

## SITRANS T

### Temperature transmitter SITRANS TH100/TH100Slim/TH320/ TH420/TR320/TR420/TF320/TF420 with 4 to 20 mA/HART

#### Operating Instructions

7NG0.1. / 7NG0.2. (TH/TR320/420 mA/HART)  
7NG0.4. (TF320/420 single chamber housing mA/HART)  
7NG0.5. (TF320/420 dual chamber housing mA/HART)  
7NG3211-0. / 7NG3150-0NN00 (TH100/TH100 Slim)  
7MF7902-1AD (Display)  
7NG3092-8KN (USB modem and SIPROM T)

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## Legal information

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<b>NOTICE</b>
indicates that property damage can result if proper precautions are not taken.

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.

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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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# Getting started

## 1.1 SITRANS TH100 Commissioning

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. If you want to change the factory settings, configure the device using the USB modem and the SIPROM T parameter assignment software.  
Parameter assignment with USB modem and SIPROM T (Page 143)
2. Mount or install the device depending on the application.  
Installing SITRANS TH in a connection head (Page 69)  
Mounting SITRANS TH100/320/420 on DIN rail and G rail (Page 71)
3. Connect the device.  
Connecting the TH100 (Page 83)
4. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
5. Switch on the power supply.  
Switching on the supply voltage (Page 133)
6. Wait for 10 seconds.  
After this startup time, the device is operational.
7. Wait 5 minutes to get exact measured values.

### See also

Structure (Page 34)

## 1.2 Commissioning SITRANS TH100 Slim

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. If you want to change the factory settings, configure the device using the USB modem and the SIPROM T parameter assignment software.  
Parameter assignment with USB modem and SIPROM T (Page 143)
2. Mount or install the device depending on the application.
3. Connect the device.  
Connecting TH100 Slim (Page 84)
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 10 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.

## 1.3 Commissioning SITRANS TH320 with 4 to 20 mA

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. If you want to change the factory settings, configure the device using the USB modem and the SIPROM T parameter assignment software.  
Parameter assignment with USB modem and SIPROM T (Page 143)
2. Mount or install the device depending on the application.  
Installing SITRANS TH in a connection head (Page 69)  
Mounting SITRANS TH100/320/420 on DIN rail and G rail (Page 71)
3. Connect the device.  
Connecting TH320 (Page 85)
4. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
5. Switch on the power supply.  
Switching on the supply voltage (Page 133)
6. Wait for 2 seconds.  
After this startup time, the device is operational.
7. Wait 5 minutes to get exact measured values.
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

## Result

The LED is lit green.  
Structure (Page 39)

## See also

Diagnostics and troubleshooting (Page 191)

# 1.4 Commissioning SITRANS TH320 with HART

## Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. Mount or install the device depending on the application.  
Installing SITRANS TH in a connection head (Page 69)  
Mounting SITRANS TH100/320/420 on DIN rail and G rail (Page 71)
2. Connect the device.  
Connecting TH320 (Page 85)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 2 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using remote operation.  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

## Result

The LED is lit green.  
Structure (Page 39)

## See also

Diagnostics and troubleshooting (Page 191)

# 1.5 Commissioning SITRANS TH420 with HART

## Requirement

You have read the following safety instructions:

- General safety information (Page 29)
- Basic safety information: Installing/mounting (Page 65)
- Basic safety information: Connecting (Page 81)
- Basic safety information: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. Install the device.  
Installing SITRANS TH in a connection head (Page 69)  
Mounting SITRANS TH100/320/420 on DIN rail and G rail (Page 71)
2. Connect the device.  
Connecting TH420 (Page 86)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 2 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using remote operation.  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

## Result

The LED is lit green.  
Structure (Page 39)

## See also

Diagnostics and troubleshooting (Page 191)

# 1.6 Commissioning SITRANS TR320 with 4 to 20 mA

## Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. If you want to change the factory settings, configure the device using the USB modem and the SIPROM T parameter assignment software.  
Parameter assignment with USB modem and SIPROM T (Page 143)
2. Mount the device.  
Installing SITRANS TR on DIN rail (Page 72)
3. Connect the device.  
Connecting TR320 (Page 88)
4. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
5. Switch on the power supply.  
Switching on the supply voltage (Page 133)
6. Wait for 2 seconds.  
After this startup time, the device is operational.
7. Wait 5 minutes to get exact measured values.
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

## Result

The LED is lit green.  
Structure (Page 48)

## See also

Diagnostics and troubleshooting (Page 191)

# 1.7 Commissioning SITRANS TR320 with HART

## Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. Mount the device.  
Installing SITRANS TR on DIN rail (Page 72)
2. Connect the device.  
Connecting TR320 (Page 88)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 2 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using remote operation.  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

## Result

The LED is lit green.  
Structure (Page 48)

## See also

Diagnostics and troubleshooting (Page 191)

# 1.8 Commissioning SITRANS TR420 with HART

## Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. Mount the device.  
Installing SITRANS TR on DIN rail (Page 72)
2. Connect the device.  
Connecting TR420 (Page 90)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 2 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using remote operation.  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

## Result

The LED is lit green.  
Structure (Page 48)

## See also

Diagnostics and troubleshooting (Page 191)

# 1.9 Commissioning SITRANS TF320 single chamber housing with 4 to 20 mA

## Condition

In this section, you will learn how to commission the device step-by-step.

Before you start, note the following safety notes:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. Mount the device.  
Mounting the SITRANS TF single chamber housing (Page 73)
2. Connect the device.  
Connecting the SITRANS TF320 single chamber housing (Page 93)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 10 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using the buttons (Page 109) or the USB modem and SIPROM T.  
Parameter assignment over device with display (Page 144) or  
Parameter assignment with USB modem and SIPROM T (Page 143)
8. Lock the device.  
Locking the device (Page 116)

## 1.10 Commissioning SITRANS TF320 single chamber housing with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Mounting the SITRANS TF single chamber housing (Page 73)
2. Connect the device.  
Connecting the SITRANS TF320 single chamber housing (Page 93)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)

## 1.11 Commissioning SITRANS TF420 single chamber housing with HART

5. Wait for 10 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using the buttons (Page 109) or remote operation.  
Parameter assignment over device with display (Page 144) or  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the device (Page 116)

## 1.11 Commissioning SITRANS TF420 single chamber housing with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Mounting the SITRANS TF single chamber housing (Page 73)
2. Connect the device.  
Connecting the SITRANS TF420 single chamber housing (Page 96)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 10 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using the buttons (Page 109) or remote operation.  
Parameter assignment over device with display (Page 144) or  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the device (Page 116)

## 1.12 Commissioning SITRANS TF320 dual chamber housing with 4 to 20 mA

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Mounting the SITRANS TF dual chamber housing (Page 74)
2. Connect the device.  
Connecting the SITRANS TF320 dual chamber housing (Page 100)
3. Switch on the power supply.  
Switching on the supply voltage (Page 133)
4. Wait for 2 seconds.  
After this startup time, the device is operational.
5. Wait 5 minutes to get exact measured values.
6. If you want to change the factory settings, configure the device using the buttons (Page 110) or the USB modem and SIPROM T.  
Parameter assignment over device with display (Page 144) or  
Parameter assignment with USB modem and SIPROM T (Page 143)
7. Lock the device.  
Locking the device (Page 116)

## 1.13 Commissioning SITRANS TF320 dual chamber housing with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. Mount the device.  
Mounting the SITRANS TF dual chamber housing (Page 74)
2. Connect the device.  
Connecting the SITRANS TF320 dual chamber housing (Page 100)
3. Switch on the power supply.  
Switching on the supply voltage (Page 133)
4. Wait for 2 seconds.  
After this startup time, the device is operational.
5. Wait 5 minutes to get exact measured values.
6. If you want to change the factory settings, configure the device using the buttons (Page 110) or remote operation.  
Parameter assignment over device with display (Page 144)  
Assigning parameters using remote operation (Page 165)
7. Lock the device.  
Locking the device (Page 116)

## 1.14 Commissioning SITRANS TF420 dual chamber housing with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Mounting the SITRANS TF dual chamber housing (Page 74)
2. Connect the device.  
Connecting the SITRANS TF420 dual chamber housing (Page 102)
3. Switch on the power supply.  
Switching on the supply voltage (Page 133)
4. Wait for 2 seconds.  
After this startup time, the device is operational.
5. Wait 5 minutes to get exact measured values.

6. If you want to change the factory settings, configure the device using the buttons (Page 110) or remote operation.
  - Parameter assignment over device with display (Page 144)
  - Assigning parameters using remote operation (Page 165)
7. Lock the device.
  - Locking the device (Page 116)



# Introduction

## 2.1 Purpose of this documentation

These instructions contain all information required to commission and use the device. Read the instructions carefully prior to installation and commissioning. In order to use the device correctly, first review its principle of operation.

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

Article no.	Product
7NG031..	TH320 with 4 to 20 mA/HART
7NG041..	TH420 with 4 to 20 mA/HART
7NG032..	TR320 with 4 to 20 mA/HART
7NG042..	TR420 with 4 to 20 mA/HART
7NG034..	TF320 single chamber enclosure with 4 to 20 mA/HART
7NG044..	TF420 single chamber enclosure with 4 to 20 mA/HART
7NG035..	TF320 two-chamber enclosure with 4 to 20 mA/HART
7NG045..	TF420 two-chamber enclosure with 4 to 20 mA/HART
7NG3211-0....	TH100 with 4 to 20 mA
7NG3150-0NN00	TH100 Slim
7MF7902-1AD	Local display
7NG3092-8KN	USB modem and SIPROM T

## 2.2 Functional Safety Manual

You can find instructions and additional information regarding functional safety of the SITRANS TH/TR/TF 320/420 and SITRANS TS500 transmitters in the English edition of the Functional Safety Manual Functional Safety Manual (<https://www.siemens.com/processinstrumentation/documentation>). Document number: A5E41864869

## 2.3 Document history

The following table contains the major changes in the documentation compared to the previous edition.

Edition	Comment
07/2021	SITRANS TH100 Slim adopted Certificates and approvals revised
01/2021	Revised technical data on certificates and approvals

## 2.4 Product compatibility

The following table describes the compatibility between the edition of this manual, the device version, the engineering system and the associated EDD.

Manual edition	Comments	Device version	Compatible version of device integration package	
07/2021 & 08/2020	New device features	HART 7 TH/TR320/420: 01.02.xx or higher TF320/420: 01.01.01 or higher	SIMATIC PDM V9.1	EDD: 01.00.00 or higher
			AMS Device Manager V13.3	EDD: 01.00.01 or higher
			DTM	EDD: 01.00.01 or higher
			Field Communicator FC 375/475	EDD: 01.00.01 or higher

## 2.5 USB modem: Information on industrial use

### NOTICE

#### Use in a domestic environment

This Class A Group 1 equipment is intended for use in industrial areas.

In a domestic environment this device may cause radio interference.

## 2.6 Checking the consignment

1. Check the packaging and the delivered items for visible damages.
2. Report any claims for damages immediately to the shipping company.
3. Retain damaged parts for clarification.
4. Check the scope of delivery by comparing your order to the shipping documents for correctness and completeness.



### WARNING

#### Using a damaged or incomplete device

Risk of explosion in hazardous areas.

- Do not use damaged or incomplete devices.

## 2.7 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit

<https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under

<https://www.siemens.com/industrialsecurity>.

## 2.8 Transportation and storage

To guarantee sufficient protection during transport and storage, observe the following:

- Keep the original packaging for subsequent transportation.
- Devices/replacement parts should be returned in their original packaging.
- If the original packaging is no longer available, ensure that all shipments are properly packaged to provide sufficient protection during transport. Siemens cannot assume liability for any costs associated with transportation damages.

### NOTICE

#### Insufficient protection during storage

The packaging only provides limited protection against moisture and infiltration.

- Provide additional packaging as necessary.

Special conditions for storage and transportation of the device are listed in Technical data (Page 199).

## 2.9 Notes on warranty

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. The sales contract contains all obligations on the part of Siemens as well as the complete and solely applicable warranty conditions. Any statements regarding device versions described in the manual do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of publishing. Siemens reserves the right to make technical changes in the course of further development.

## Safety notes

### 3.1 Prerequisites for safe use

This device left the factory in good working condition. In order to maintain this status and to ensure safe operation of the device, observe these instructions and all the specifications relevant to safety.

Observe the information and symbols on the device. Do not remove any information or symbols from the device. Always keep the information and symbols in a completely legible state.

#### 3.1.1 Warning symbols on the device

Symbol	Explanation
	Consult operating instructions

#### 3.1.2 Laws and directives

Observe the safety rules, 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)

Further provisions for hazardous area applications are for example:

- IEC 60079-14 (international)
- EN 60079-14 (EU)

#### 3.1.3 Conformity with European directives

The CE mark on the device is a sign of conformity with the following European directives:

Electromagnetic compatibility EMC 2014/30/EU	Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to electromagnetic compatibility
Atmosphère explosible ATEX 2014/34/EU	Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres

3.3 Use in hazardous areas

The applicable directives can be found in the EU conformity declaration of the specific device.

3.1.4 Improper device modifications

 <b>WARNING</b>
<b>Improper device modifications</b> Risk to personnel, system and environment can result from modifications to the device, particularly in hazardous areas. <ul style="list-style-type: none"><li>• Only carry out modifications that are described in the instructions for the device. Failure to observe this requirement cancels the manufacturer's warranty and the product approvals.</li></ul>

3.2 Requirements for special applications

Due to the large number of possible applications, each detail of the described device versions for each possible scenario during commissioning, operation, maintenance or operation in systems cannot be considered in the instructions. If you need additional information not covered by these instructions, contact your local Siemens office or company representative.

**Note**

**Operation under special ambient conditions**

We highly recommend that you contact your Siemens representative or our application department before you operate the device under special ambient conditions as can be encountered in nuclear power plants or when the device is used for research and development purposes.

3.3 Use in hazardous areas

**Qualified personnel for hazardous area applications**

Persons who install, connect, commission, operate, and service the device in a hazardous area must have the following specific qualifications:

- They are authorized, trained or instructed in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures, aggressive, and hazardous media.
- 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 pertinent safety regulations.

**⚠ WARNING****Use in hazardous area**

Risk of explosion.

- Only use equipment that is approved for use in the intended hazardous area and labeled accordingly.
- Do not use devices that have been operated outside the conditions specified for hazardous areas. If you have used the device outside the conditions for hazardous areas, make all Ex markings unrecognizable on the nameplate.

**⚠ WARNING****Loss of safety of device with type of protection "Intrinsic safety Ex i"**

If the device or its components have already been operated in non-intrinsically safe circuits or the electrical specifications have not been observed, the safety of the device is no longer ensured for use in hazardous areas. There is a risk of explosion.

- Connect the device with type of protection "Intrinsic safety" solely to an intrinsically safe circuit.
- Observe the specifications for the electrical data on the certificate and/or in Technical data (Page 199).

### 3.3.1 Special conditions for use of SITRANS TF

**⚠ WARNING****Special conditions for use of SITRANS TF with flameproof enclosure "Ex d" type of protection and "Ex t" dust protection**

- Observe the ambient temperature, the type of protection and the electrical data in the certificate of the SITRANS TF device and/or in the chapter Technical data (Page 199).
- The sealing plug and the thread adapter (components) can be used for installation in electrical equipment of flameproof "Ex d" type of protection of groups IIA, IIB, IIC as well as dust protection by enclosure "Ex t" type of protection.
- At ambient temperatures  $\geq 60$  °C, heat-resistant cables with a temperature rating of at least 20 K above ambient temperature must be used.
- Do not repair flameproof joints. Flameproof joints are, for example, threaded inlets for cable glands.
- Risk of explosion in hazardous areas if electrostatic charges develop, for example, when cleaning plastic surfaces with a dry cloth. Prevent electrostatic charging in hazardous areas.

#### See also

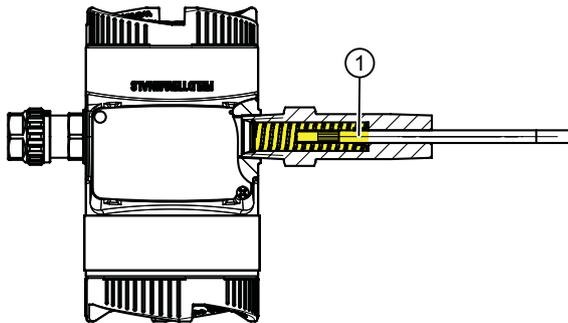
Accessory part sealing plug / thread adapter (Page 235)

**⚠ WARNING**

**Incorrect mounting of temperature sensors on SITRANS TF**

Risk of explosion in hazardous areas. If you attach a temperature sensor to an explosion-proof SITRANS TF enclosure via the cable inlet, you must observe the special conditions.

- Observe the ambient temperature, the type of protection and the electrical data in the certificate of the SITRANS TF device and/or in the chapter Technical data (Page 199).
- The medium temperature influences the ambient temperature of the SITRANS TF device. If necessary, reduce the ambient temperature for the SITRANS TF. Refer to the information on the nameplate and/or in Technical data (Page 199).
- The installation of a temperature sensor may increase the volume for the pressure-resistant enclosure.
- Arrange to have the installation of a temperature sensor on a SITRANS TF evaluated by an accredited approval body.



① Yellow area = additional volume when connecting a temperature sensor to a SITRANS TF double chamber housing

**⚠ WARNING**

**Use of incorrect device parts in potentially explosive environments**

Devices and their associated device parts are either approved for different types of protection or they do not have explosion protection. There is a risk of explosion if device parts (such as covers) are used for devices with explosion protection that are not expressly suited for this type of protection. If you do not adhere to these guidelines, the test certificates and the manufacturer warranty will become null and void.

- Use only device parts that have been approved for the respective type of protection in the potentially explosive environment. Covers that are not suited for the "explosion-proof" type of protection are identified as such by a notice label attached to the inside of the cover with "Not Ex d Not SIL".
- Do not swap device parts unless the manufacturer specifically ensures compatibility of these parts.

## Description

### 4.1 SITRANS TH100/TH100 Slim

#### 4.1.1 Application range

##### **Area of application SITRANS TH100**

The SITRANS TH100 transmitter can be used in all fields. Its compact size means that it can be installed in connection heads of type B (DIN 43729) or larger. The following sensor can be connected:

- RTD Pt100

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

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.

- Transmitter with two-wire technology
- Installation in connection head of type B (in accordance with DIN 43729) or larger, or on a DIN rail
- Programming, e.g. of sensor connection and measuring range
- Intrinsically-safe and non-sparking version for use in hazardous areas

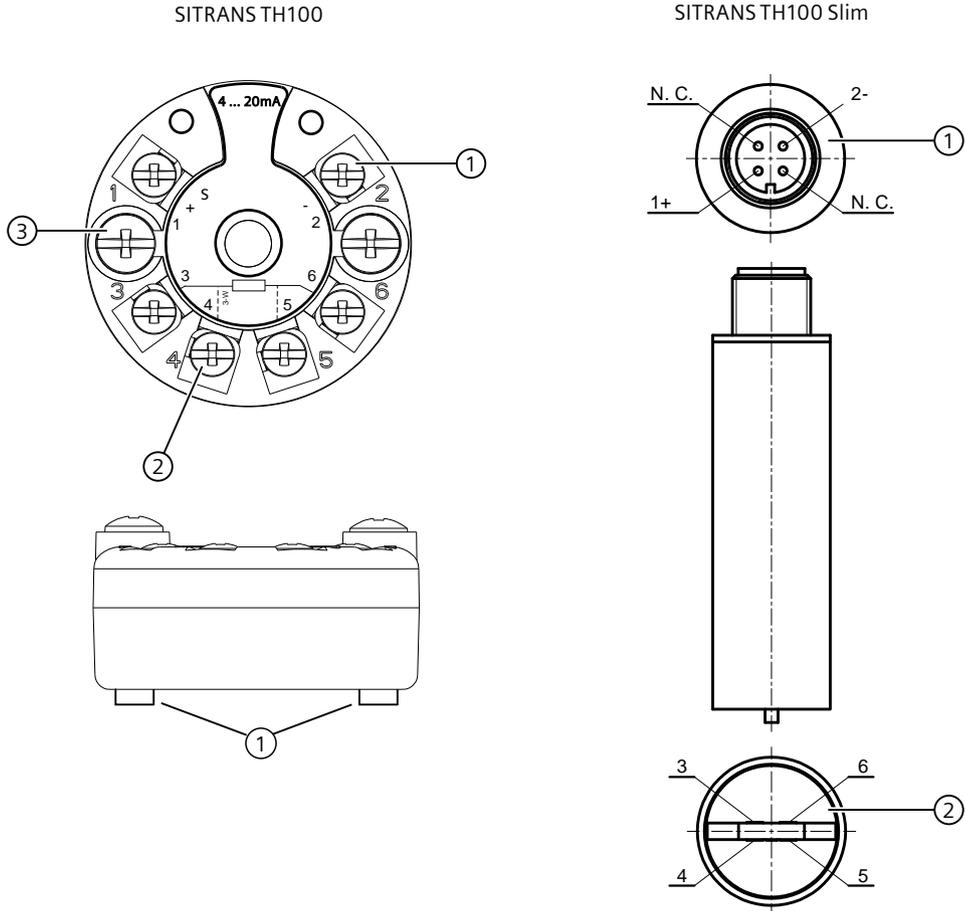
##### **Area of application SITRANS TH100 Slim**

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

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

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

4.1.2 Structure



- ① 1 (+) and 2 TH100: Output terminals: Power supply  $U_{auxr}$  output current  $I_{out}$   
(-) TH100 Slim: M12 device plug
- ② 3, 4, 5, and 6 TH100: Input terminals for Pt100  
TH100 Slim: Soldering points for Pt100
- ③ Mounting screw M4x25
- N. C. Points are not occupied.  
(not connected)

Figure 4-1 SITRANS TH100/TH100 Slim design

### 4.1.3 Nameplate layout SITRANS TH100

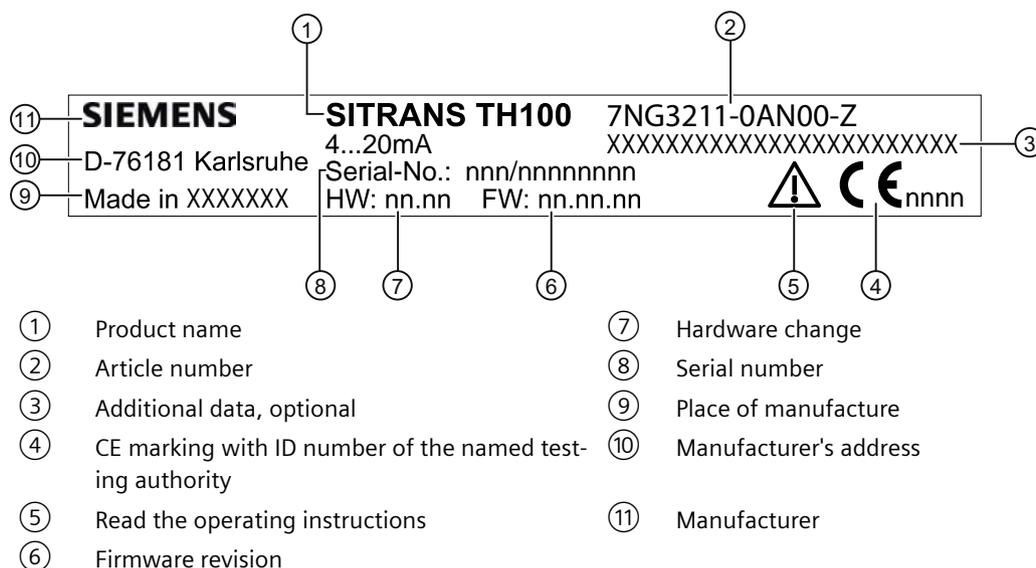


Figure 4-2 Example of nameplate with general information

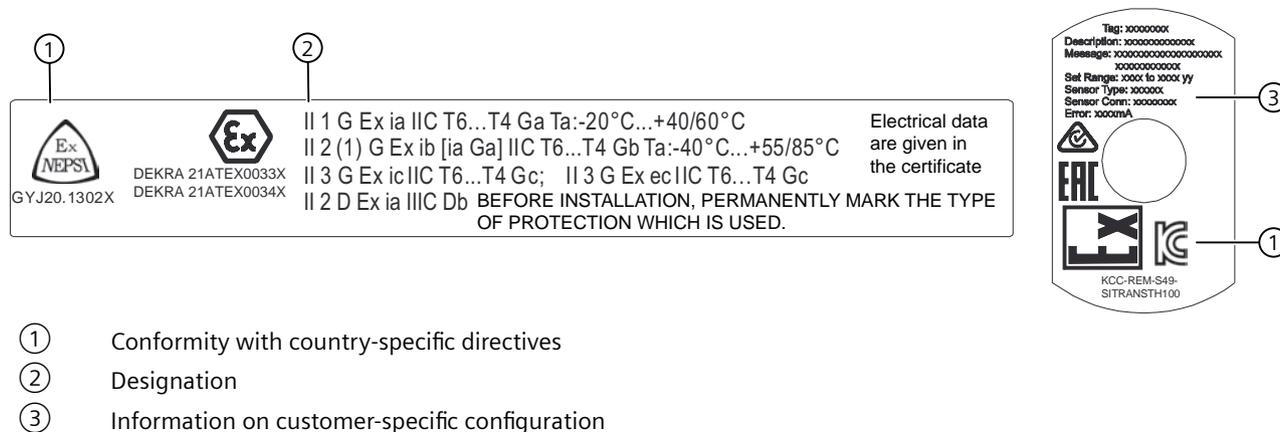


Figure 4-3 Example of nameplates with approval information

### 4.1.4 Mode of operation TH100/TH100 Slim

The following function block diagram clarifies the transmitter's mode of operation:

The signal delivered by an RTD Pt100 (two-wire, three-wire, four-wire system) is amplified in the input stage. The voltage that is proportional to the input variable is then converted into digital signals by a multiplexer in an analog-to-digital converter. These are converted in the microcontroller in accordance with the sensor characteristic and further data, e.g. measuring range or damping.

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

4.1 SITRANS TH100/TH100 Slim

The input and output circuits are each protected against electromagnetic interference through the use of EMC filters.

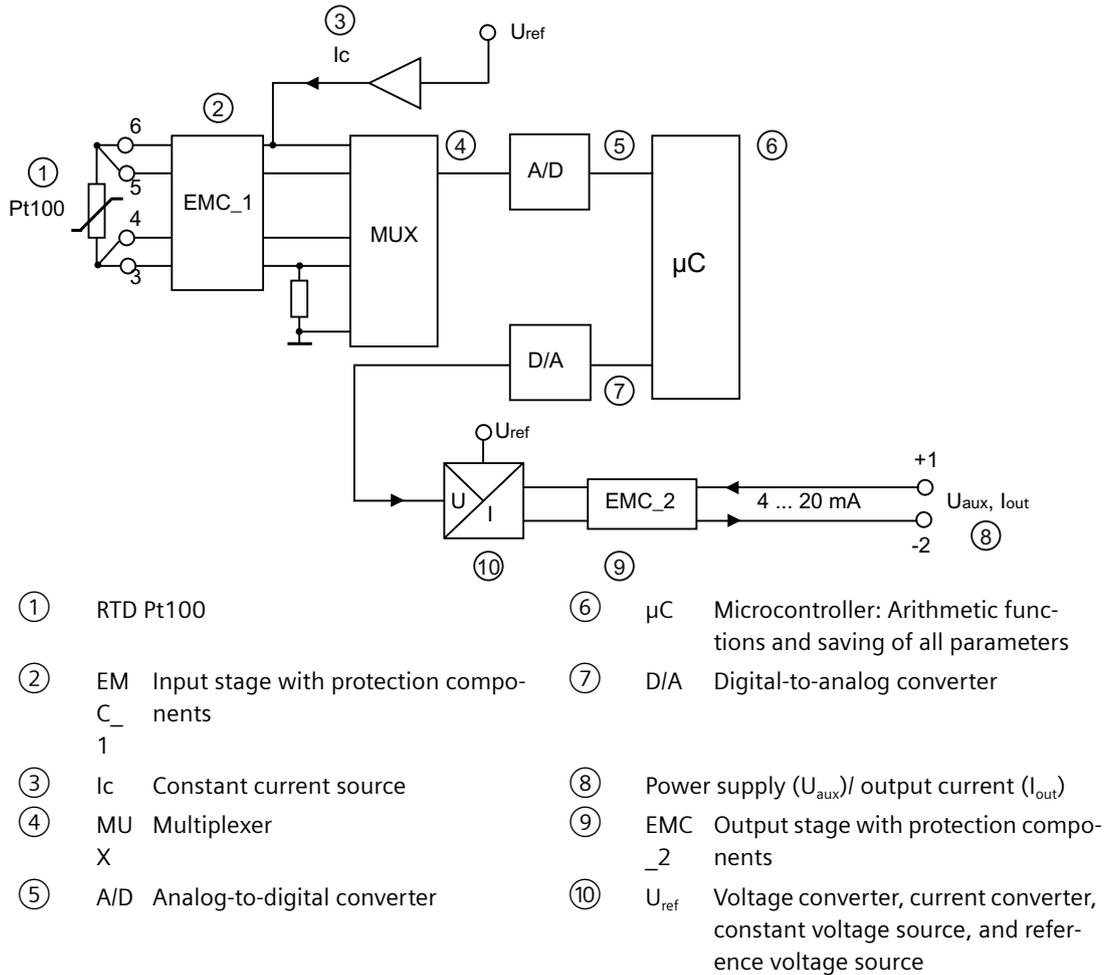


Figure 4-4 Function chart for SITRANS TH100

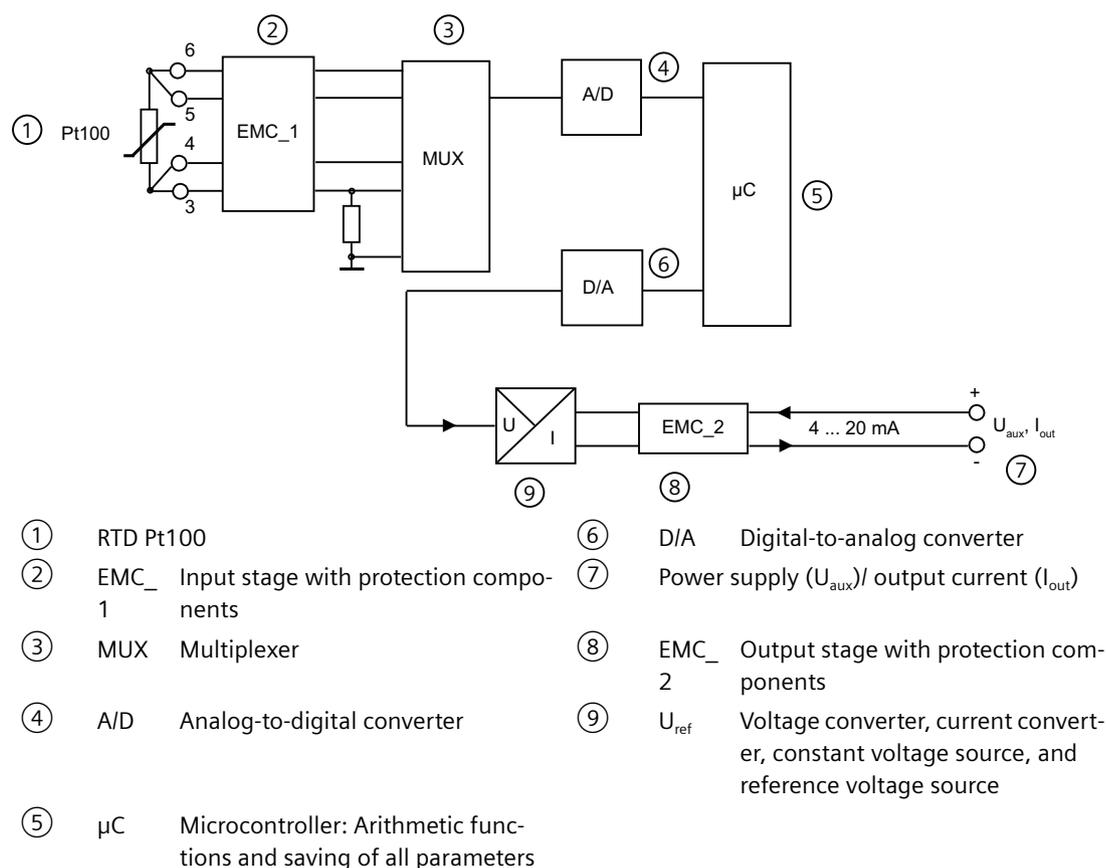


Figure 4-5 Function chart for SITRANS TH100 Slim

## 4.2 SITRANS TH320/TH420

### 4.2.1 Application

#### SITRANS TH320

The SITRANS TH320 transmitter can be used in all sectors. Its compact size means that it can be installed in connection heads of type B (DIN 43729) or larger. Due to its universal input stage, the following sensors and signal sources can be connected:

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

Without HART communication interface:

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

## 4.2 SITRANS TH320/TH420

With HART communication interface:

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

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

## SITRANS TH420

The SITRANS TH420 transmitter with two inputs can be used in all sectors. Its compact size means that it can be installed in connection heads of type B (DIN 43729) or larger. Due to its universal input module, the following sensors and signal sources can be connected in redundant operation (high input availability):

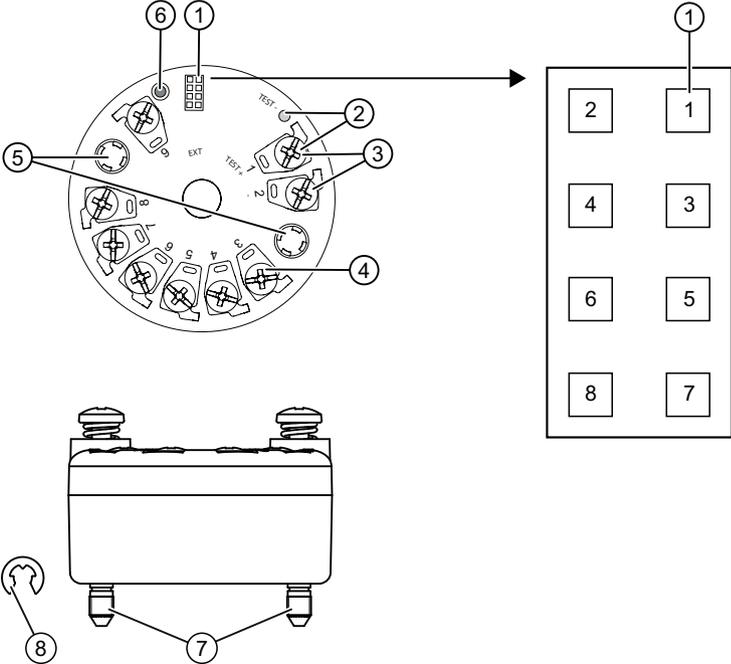
- 2 resistance thermometers (2-wire, 3-wire, 4-wire connection)
- 2 thermocouples
- 1 thermocouple and 1 resistance thermometer (2-, 3-, 4-wire connection)
- 2 linear resistors, potentiometer and DC voltage sources

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

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

Transmitters of the "Intrinsic safety or Zone 2 Increased Safety" type of protection can be installed in hazardous areas. The device meets the requirements of the EU Directive 2014/34/EU (ATEX), the FM and CSA regulations as well as other national approvals, e.g. EACEx, NEPSI, Inmetro.

4.2.2 Structure

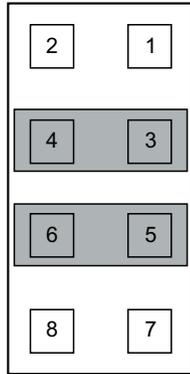


- ① Extension port terminal number 1  
Meaning of the jumper positions (Page 40)
- ② Test terminals (Page 42)
- ③ 1 (+) and 2 (-)            Output terminals
- ④ 3, 4, 5, and 6            Input terminals TH320  
3, 4, 5, 6, 7, 8 and 9    Input terminals TH420
- ⑤ Mounting holes
- ⑥ LED
- ⑦ Mounting screw M4
- ⑧ Lock washer DIN 6799 - 3.2 A2

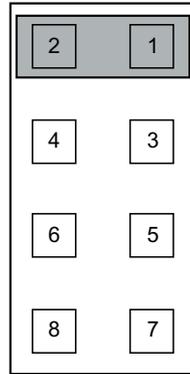
Figure 4-6 SITRANS TH320/TH420 design

### 4.2.3 Meaning of the jumper positions

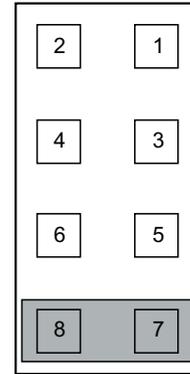
The device has two internal jumpers.



Delivery state  
(No Function)  
Fault current  $\leq 3.6$  mA  
in accordance with  
NAMUR NE43



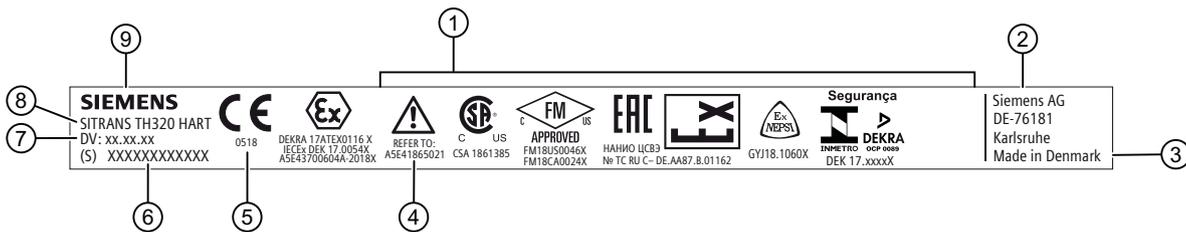
Write protection enabled  
(Write Protect)  
Introduction (Page 176)



Fault current  $\geq 21$  mA  
in accordance with  
NAMUR NE43  
(Safe State)

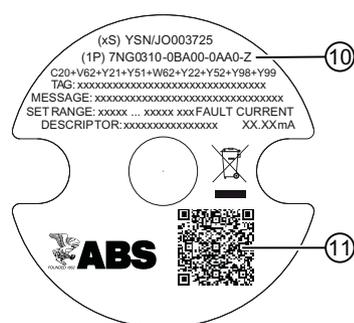
A fault current  $\geq 21$  mA is not permissible for operation of the device with functional safety. Functional safety cannot be activated with a fault current  $\geq 21$  mA.

### 4.2.4 Nameplate layout SITRANS TH320/420



- ① Conformity with country-specific guidelines
- ② Manufacturer's address
- ③ Place of manufacture
- ④ Read the compact operating instructions
- ⑤ CE marking with ID number of the named testing authority
- ⑥ Serial number  
First two digits = year of manufacture
- ⑦ Device version
- ⑧ Product name
- ⑨ Manufacturer

Figure 4-7 Example of nameplate for SITRANS TH with approval information



⑩ Article number

⑪ QR code for mobile website with device-specific information about the product

Figure 4-8 Example of nameplate on the base of the SITRANS TH with general information

## 4.2.5 LED function

### Description

The integrated LED on the transmitter indicates errors according to NAMUR NE44 and NE107.

State	LED	
	Operating state	Color
Device OK	On	Green
No power supply	Off	-
Display of faults independent of the device, e.g. wire break, sensor short circuit, violation of sensor limits	Flashing	Red
Device error	On	Red

## 4.2.6 Test terminals

### Description

The test terminals allow for direct measurement of the loop current without impairing the loop integrity. When using the test terminals, the temperature transmitter must be connected to the power supply.

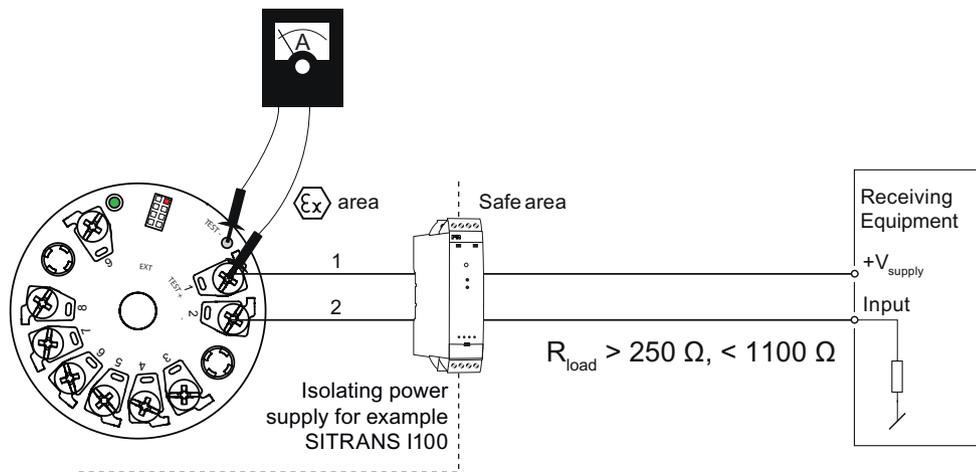


Figure 4-9 Test terminals

**Warning!** Only use certified testing devices for installation in hazardous areas.

### 4.2.7 How TH320 works

The functional principle is described below based on the function chart.

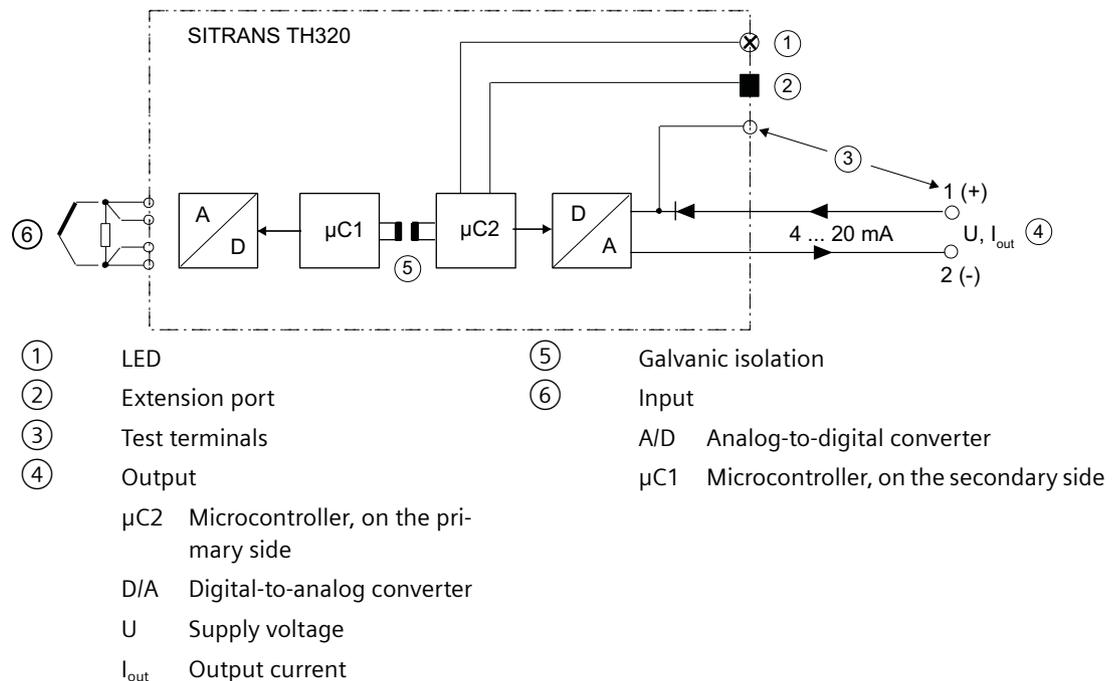


Figure 4-10 Function chart for SITRANS TH320

- Input ⑥ for connecting different signal sources. Section: Input (Page 207).
- This signal is converted to a digital signal in an analog-to-digital converter (A/D).
- The digital signal is evaluated in a microcontroller (μC1) on the secondary side and corrected to match the input characteristic.
- The digital signal is transferred via the galvanic isolation ⑤ to the microcontroller (μC2) on the primary side.
- The analog output value is calculated in the microcontroller (μC2) on the primary side. The functional status is indicated by LED ① and the communications data is prepared.
- The digital-to-analog converter (D/A) subsequently converts the signal into the output current ④ of 4 to 20 mA.

### 4.2.8 How TH420 works

The functional principle is described below based on the function chart.

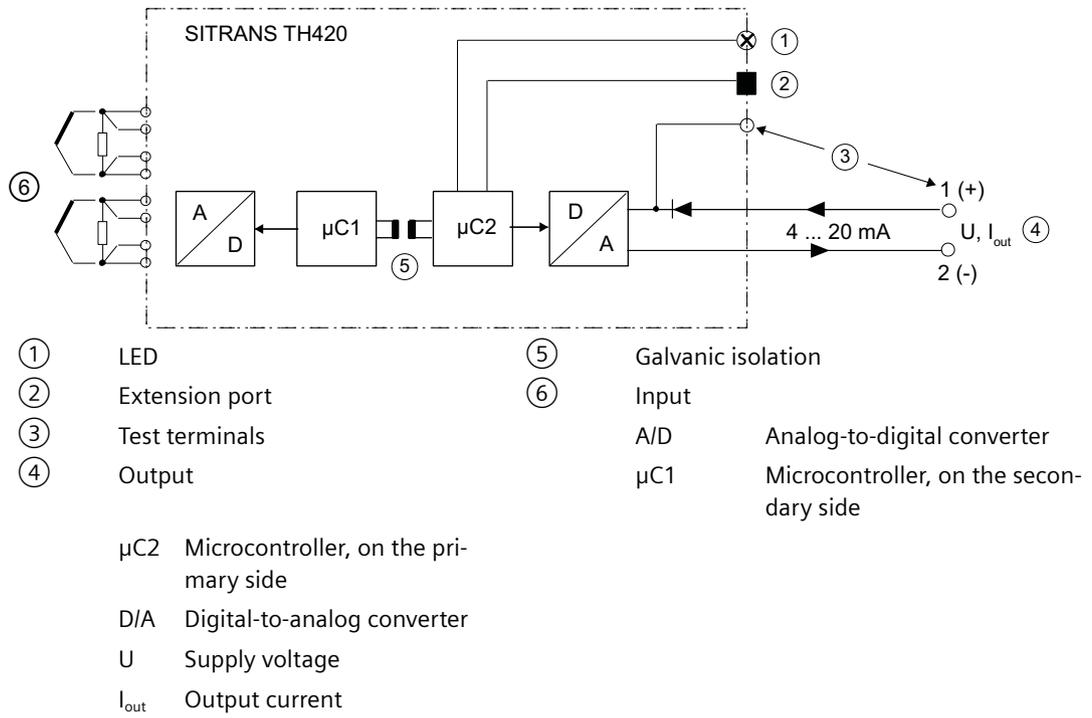


Figure 4-11 Function chart for SITRANS TH420/TR420

- Input ⑥ for connecting different signal sources. Section: Input (Page 207).
- This signal is converted to a digital signal in an analog-to-digital converter (A/D).
- The digital signal is evaluated in a microcontroller (µC1) on the secondary side and corrected to match the input characteristic.
- The digital signal is transferred via the galvanic isolation ⑤ to the microcontroller (µC2) on the primary side.
- The analog output value is calculated in the microcontroller (µC2) on the primary side. The functional status is indicated by LED ① and the communications data is prepared.
- The digital-to-analog converter (D/A) subsequently converts the signal into the output current ④ of 4 to 20 mA.

## 4.2.9 HART communication

### 4.2.9.1 HART communication with supply from voltage source

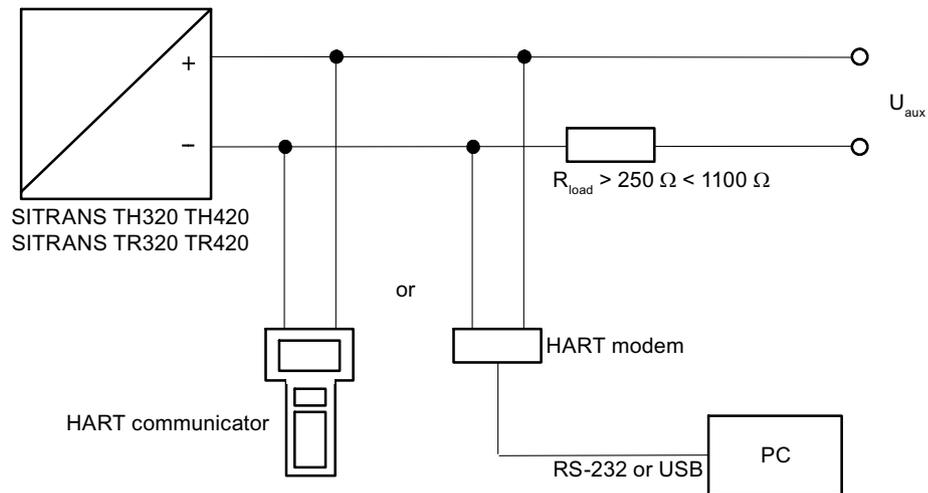
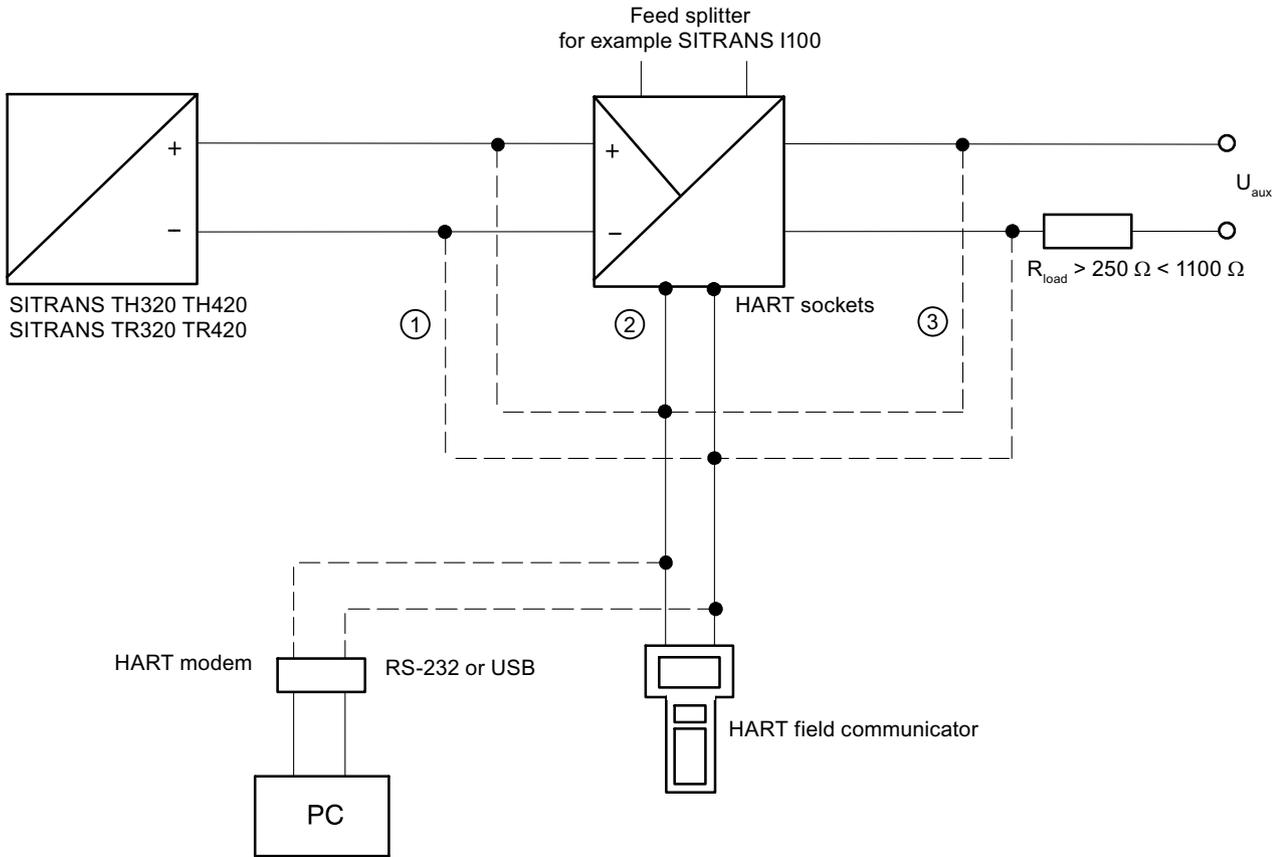


Figure 4-12 HART communication with supply from voltage source

### 4.2.9.2 HART communication with supply via isolating power supply



- ① Only intrinsically safe HART communicators or HART modems are allowed to be used with an intrinsically safe power supply.
- ② HART communication via HART jacks of isolating power supply
- ③ Load  $\geq 250 \Omega$  only relevant if HART communication takes place via this branch. Otherwise, load of 0 to 650  $\Omega$  for versions ① or ②

Figure 4-13 HART communication with supply via isolating power supply

## 4.3 SITRANS TR320/TR420

### 4.3.1 Application

#### SITRANS TR320

SITRANS TR320 transmitters can be used in all sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. Due to its universal input stage, the following sensors and signal sources can be connected:

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

Without HART communication interface:

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

With HART communication interface:

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

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

#### SITRANS TR420

SITRANS TR420 transmitters with two inputs can be used in all sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. Due to its universal input stage, the following sensors and signal sources can be connected:

- 2 resistance thermometers (2-wire, 3-wire, 4-wire connection)
- 2 thermocouples
- 1 thermocouple and 1 resistance thermometer (2-, 3-, 4-wire connection)
- 2 linear resistors, potentiometer and DC voltage sources

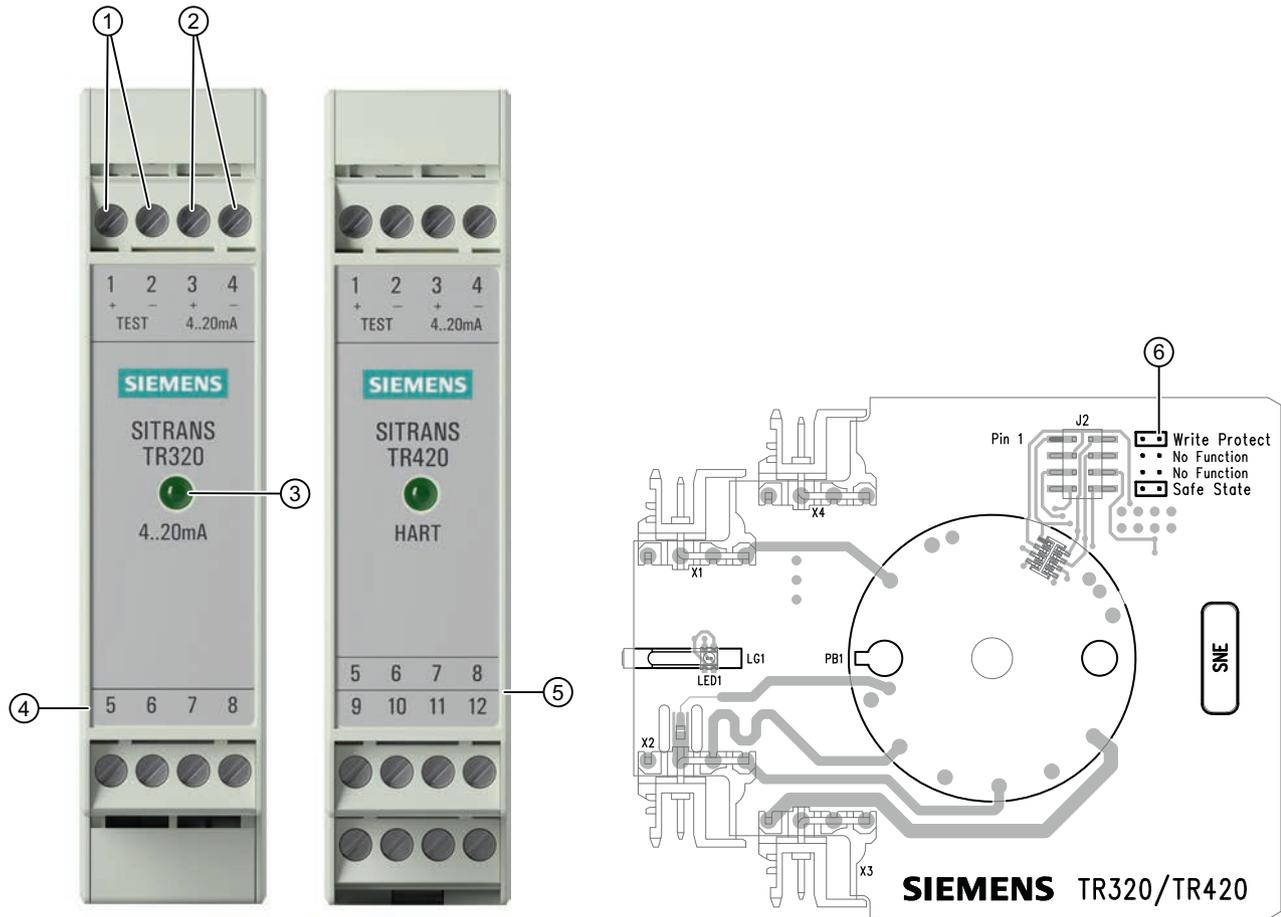
The output signal is a load-independent direct current from 4 to 20 mA in accordance with the input characteristic, superimposed by the digital HART signal.

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

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

4.3 SITRANS TR320/TR420

4.3.2 Structure

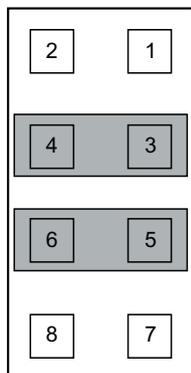


- ① 1 (+) and 2 (-) Test terminals (Page 51)
- ② 3 (+) and 4 (-) Output terminals
- ③ LED
- ④ 5, 6, 7, and 8 Input terminals TR320
- ⑤ 5, 6, 7, 8, 9, 10, 11 Input terminals TR420 and 12
- ⑥ Extension port terminal number 1  
Meaning of the jumper positions (Page 49)

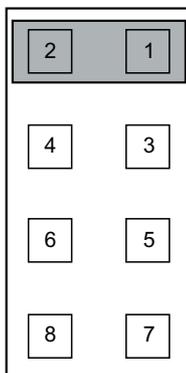
Figure 4-14 SITRANS TR320/TR420 design

### 4.3.3 Meaning of the jumper positions

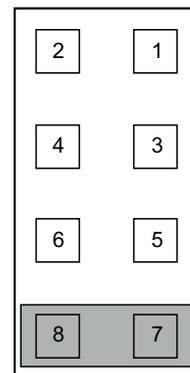
The device has two internal jumpers.



Delivery state  
(No Function)  
Fault current  $\leq 3.6$  mA  
in accordance with  
NAMUR NE43



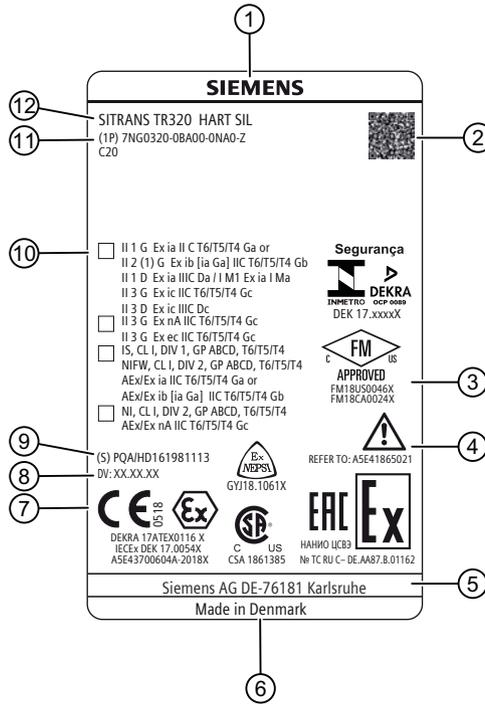
Write protection enabled  
(Write Protect)  
Introduction (Page 176)



Fault current  $\geq 21$  mA  
in accordance with  
NAMUR NE43  
(Safe State)

A fault current  $\geq 21$  mA is not permissible for operation of the device with functional safety. Functional safety cannot be activated with a fault current  $\geq 21$  mA.

### 4.3.4 Nameplate layout SITRANS TR



- |   |   |   |  |
|---|---|---|--|
| ① | Manufacturer  | ⑦ | CE marking with ID number of the named testing authority |
| ② | QR code for mobile website with device-specific information about the product | ⑧ | Device version   |
| ③ | Conformity with country-specific guidelines                                   | ⑨ | Serial number<br>First two digits = year of manufacture  |
| ④ | Read the compact operating instructions                                       | ⑩ | Ex marking   |
| ⑤ | Manufacturer's address  | ⑪ | Article number   |
| ⑥ | Place of manufacture  | ⑫ | Product name   |

Figure 4-15 Example of nameplate for SITRANS TR with approval information

### 4.3.5 LED function

#### Description

The integrated LED on the transmitter indicates errors according to NAMUR NE44 and NE107.

State	LED	
	Operating state	Color
Device OK	On	Green
No power supply	Off	-

State	LED	
	Operating state	Color
Display of faults independent of the device, e.g. wire break, sensor short circuit, violation of sensor limits	Flashing	Red
Device error	On	Red

## See also

Instructions and manuals (<http://www.siemens.com/processinstrumentation/documentation>)

## 4.3.6 Test terminals

### Description

The test terminals allow for direct measurement of the loop current without impairing the loop integrity. When using the test terminals, the temperature transmitter must be connected to the power supply.

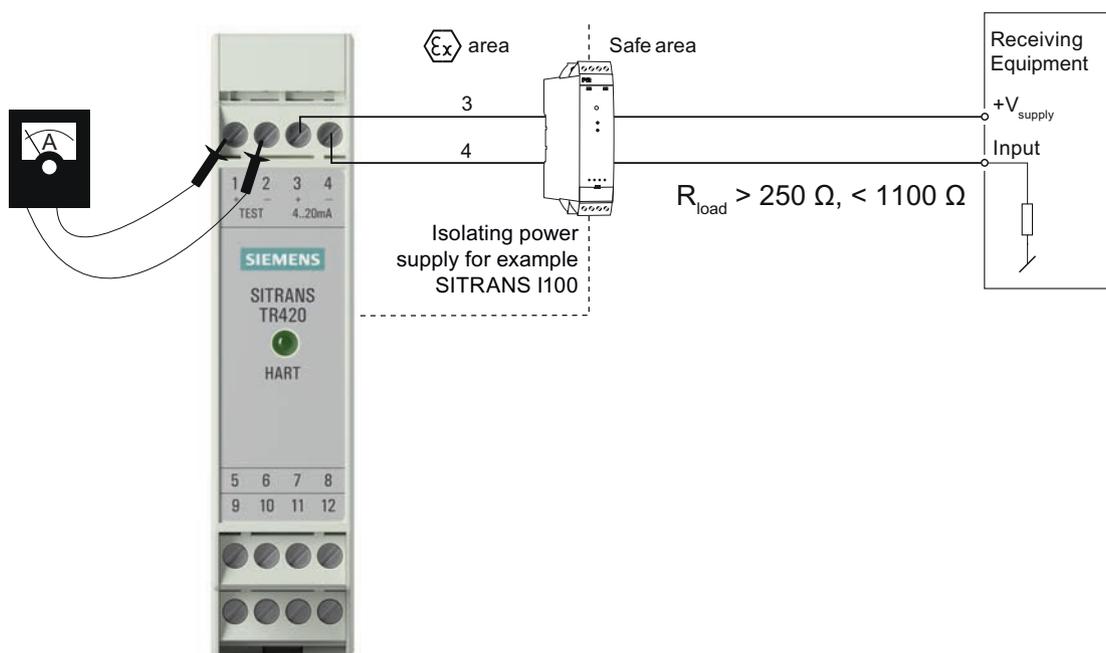


Figure 4-16 Test terminals

**Warning!** Only use certified testing devices for installation in hazardous areas.

### 4.3.7 How TR320 works

The functional principle is described below based on the function chart.

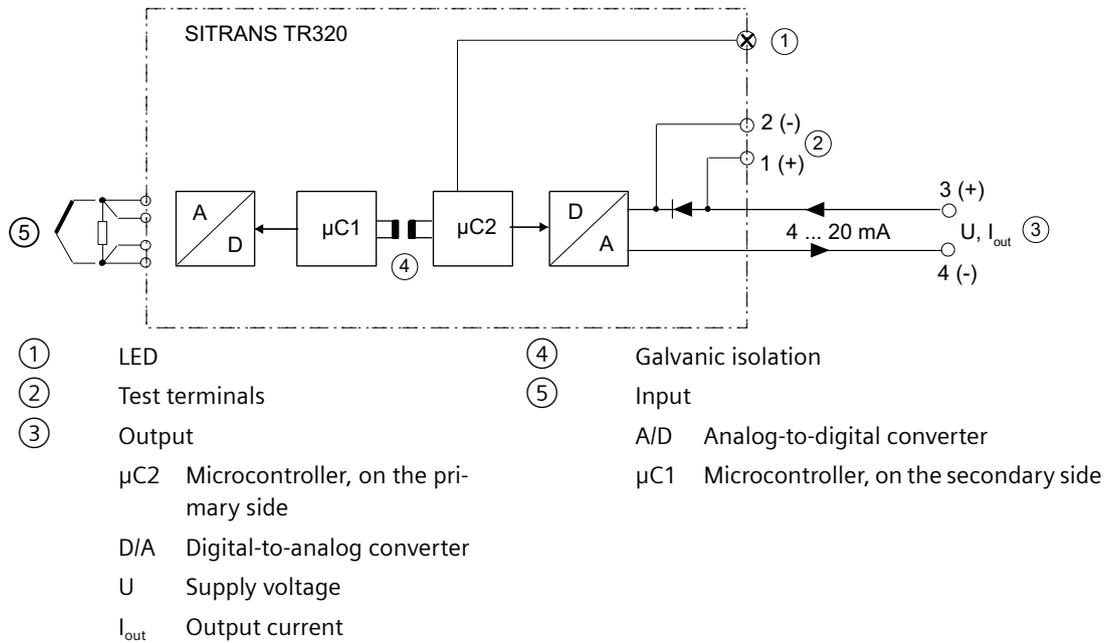


Figure 4-17 Function chart for SITRANS TR320

- Input ⑤ for connecting different signal sources. Section: Input (Page 207).
- This signal is converted to a digital signal in an analog-to-digital converter (A/D).
- The digital signal is evaluated in a microcontroller (μC1) on the secondary side and corrected to match the input characteristic.
- The digital signal is transferred via the galvanic isolation ④ to the microcontroller (μC2) on the primary side.
- The analog output value is calculated in the microcontroller (μC2) on the primary side. The functional status is indicated by LED ① and the communications data is prepared.
- The digital-to-analog converter (D/A) subsequently converts the signal into the output current ③ of 4 to 20 mA.

### 4.3.8 How TR420 works

The functional principle is described below based on the function chart.

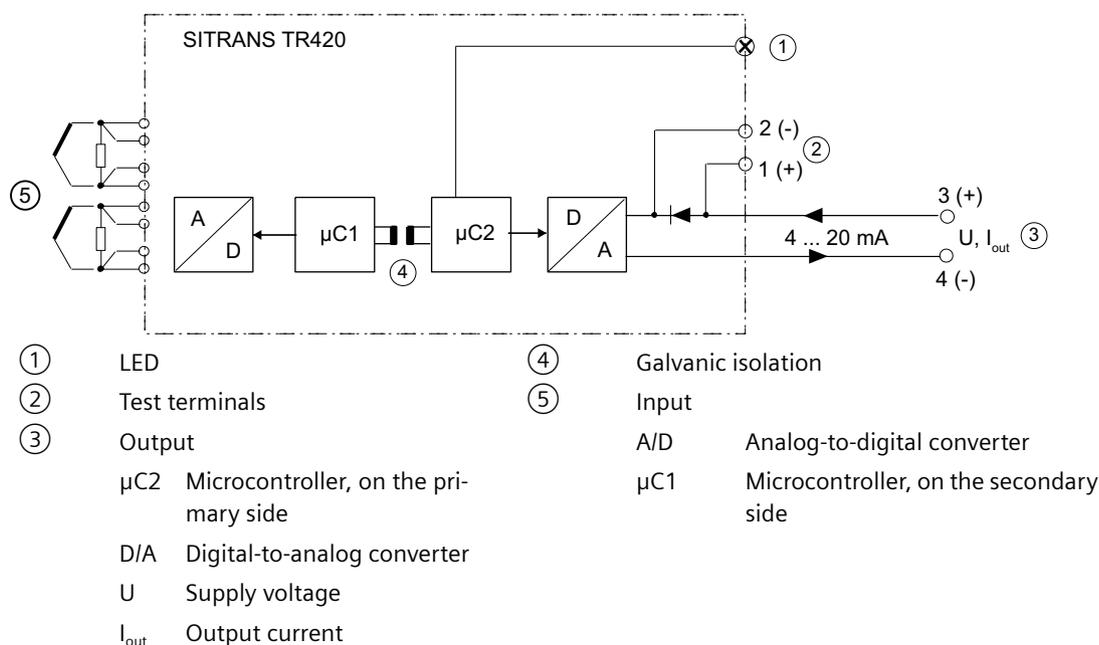


Figure 4-18 Function chart for SITRANS TH420/TR420

- Input ⑥ for connecting different signal sources. Section: Input (Page 207).
- This signal is converted to a digital signal in an analog-to-digital converter (A/D).
- The digital signal is evaluated in a microcontroller (μC1) on the secondary side and corrected to match the input characteristic.
- The digital signal is transferred via the galvanic isolation ④ to the microcontroller (μC2) on the primary side.
- The analog output value is calculated in the microcontroller (μC2) on the primary side. The functional status is indicated by LED ① and the communications data is prepared.
- The digital-to-analog converter (D/A) subsequently converts the signal into the output current ③ of 4 to 20 mA.

### 4.3.9 HART communication

#### 4.3.9.1 HART communication with supply from voltage source

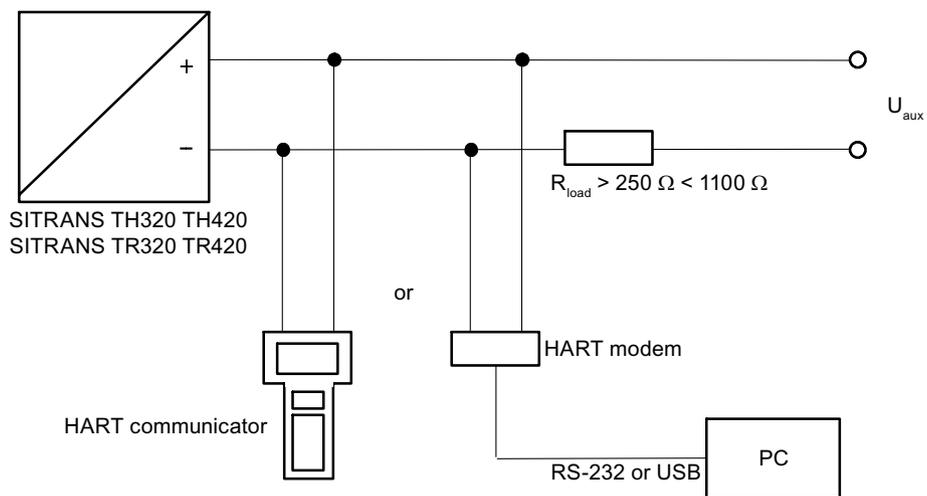
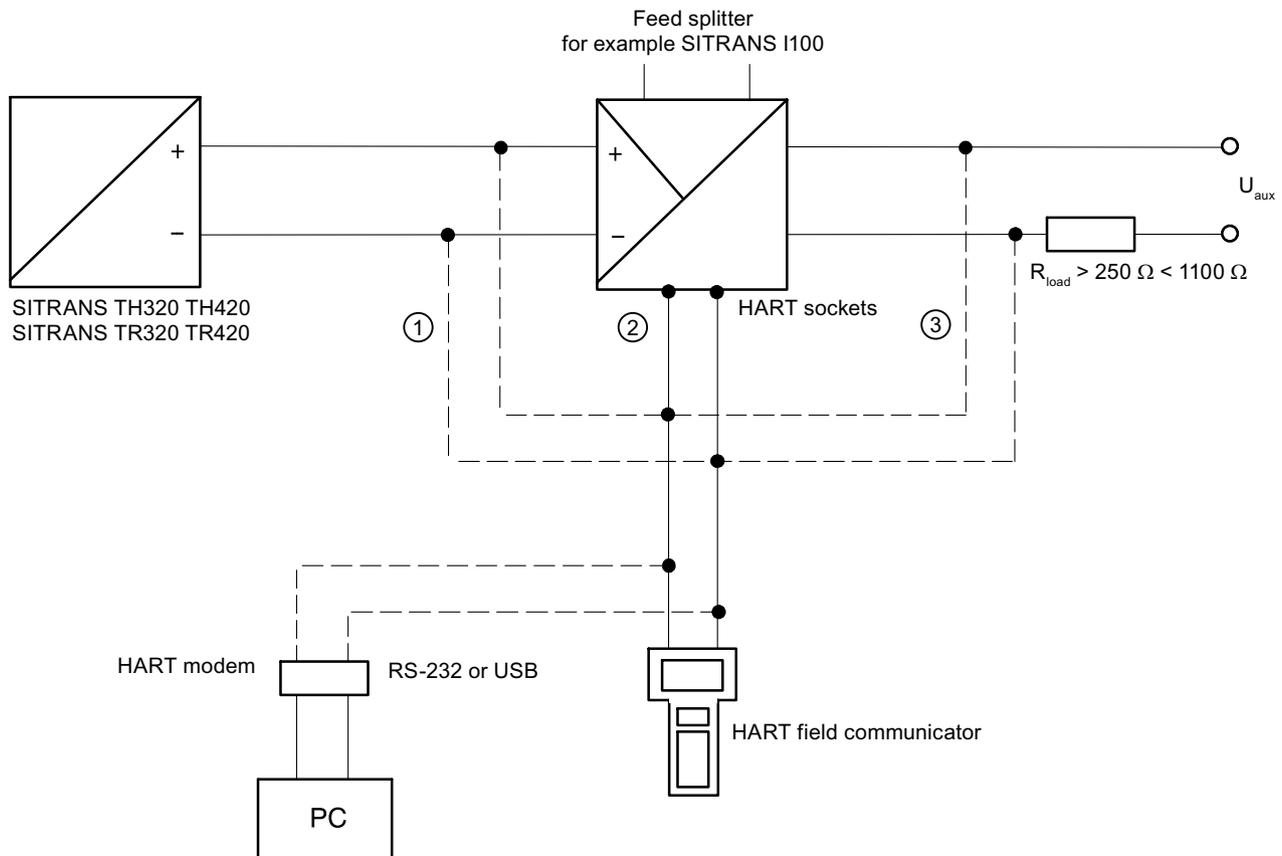


Figure 4-19 HART communication with supply from voltage source

## 4.3.9.2 HART communication with supply via isolating power supply



- ① Only intrinsically safe HART communicators or HART modems are allowed to be used with an intrinsically safe power supply.
- ② HART communication via HART jacks of isolating power supply
- ③ Load  $\geq 250 \Omega$  only relevant if HART communication takes place via this branch. Otherwise, load of 0 to  $650 \Omega$  for versions ① or ②

Figure 4-20 HART communication with supply via isolating power supply

## 4.4 SITRANS TF320/TF420

### 4.4.1 Application

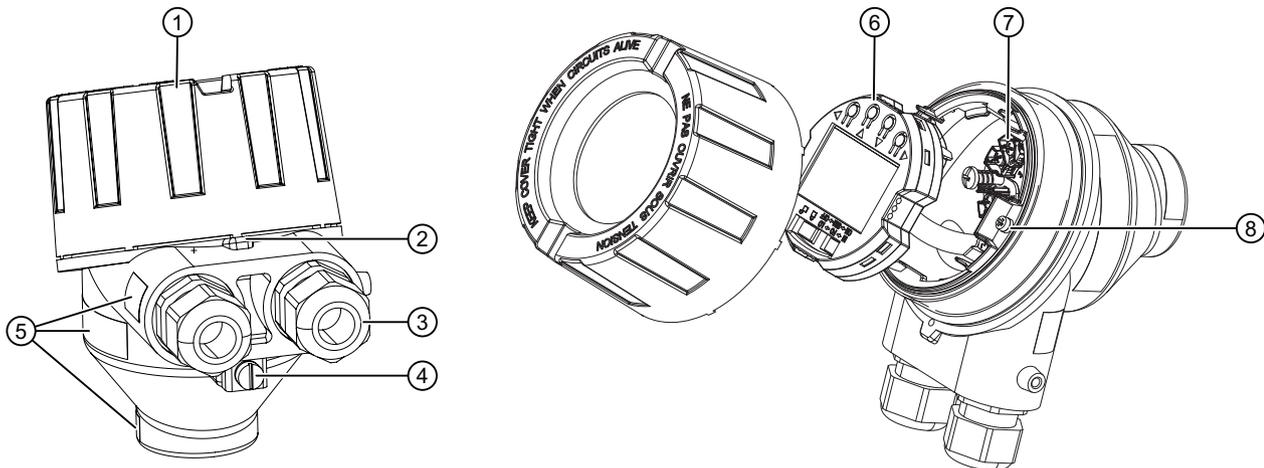
#### SITRANS TF320

SITRANS TF320 can be used everywhere where temperatures need to be measured under particularly adverse conditions and where a convenient local display is ideal. Which is why users from all industries have opted for this field device. The rugged enclosure protects the electronics. The stainless steel model is almost completely resistant to sea water and other aggressive elements. The inner workings offer high measuring accuracy, universal input and a wide range of diagnostic options.

#### SITRANS TF420

SITRANS TF420 with its two sensor inputs can be used everywhere where temperatures need to be measured without interruption under particularly adverse conditions and where a convenient local display is ideal. Which is why users from all industries have opted for this field device. The rugged enclosure protects the electronics. The stainless steel model is almost completely resistant to sea water and other aggressive elements. The inner workings offer high measuring accuracy, universal input and a wide range of diagnostic options.

### 4.4.2 Single chamber housing design



- ① Cover, optionally with an inspection window
- ② Safety catch
- ③ Cable inlet, optionally with cable gland
- ④ Ground terminal

- ⑤ Nameplates
- ⑥ Display (optional)
- ⑦ Electrical terminal compartment
- ⑧ Fixing screws for the display holder

Figure 4-21 SITRANS TF single chamber housing design

### 4.4.3 Nameplate layout SITRANS TF single chamber housing

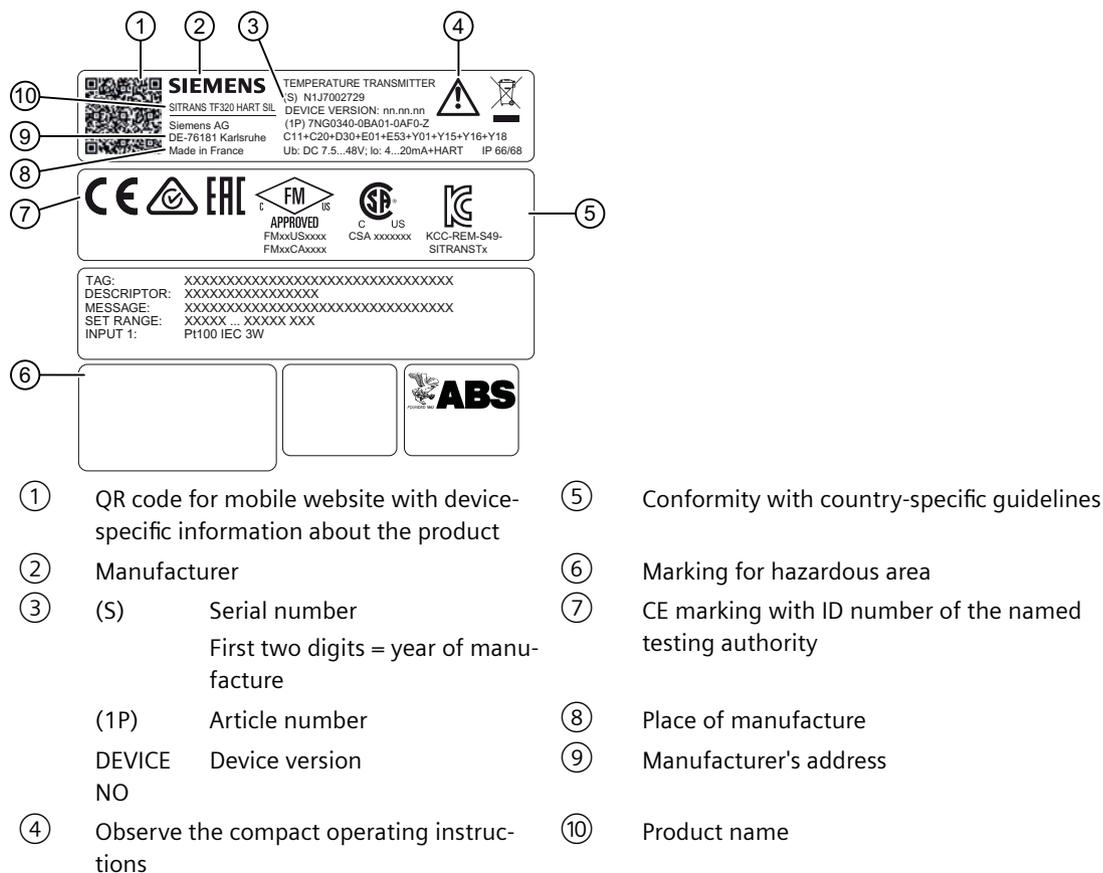
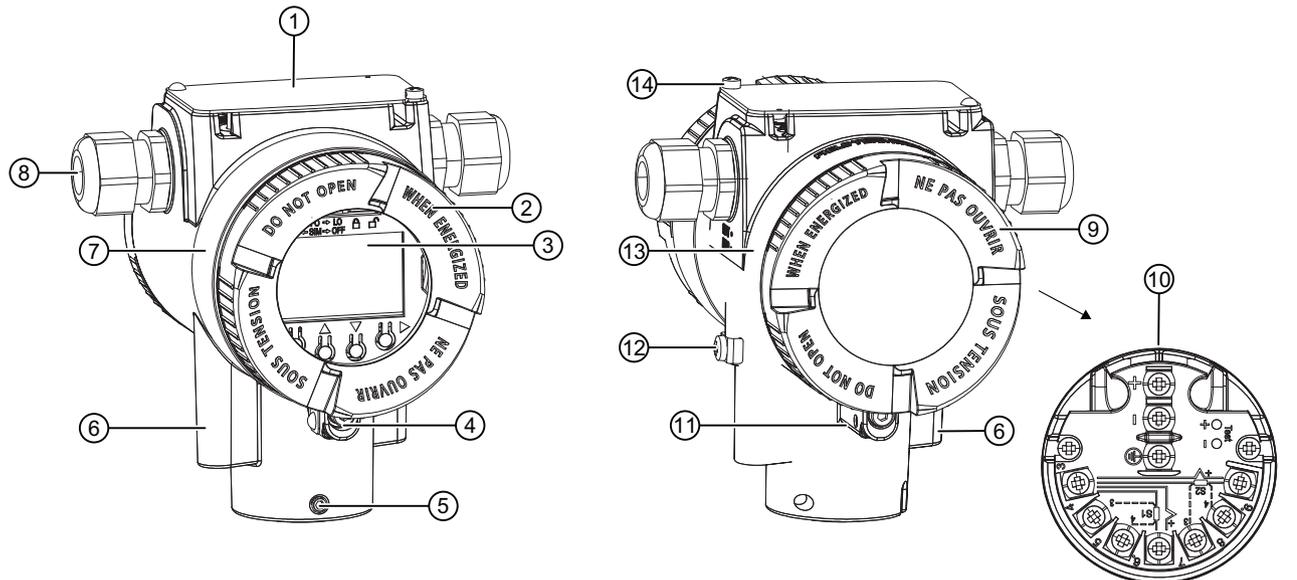


Figure 4-22 Example of nameplate for SITRANS TF single chamber housing

### 4.4.4 Dual chamber housing design



- |   |   |   |   |
|---|---|---|---|
| ① | Cover over buttons  | ⑧ | Cable inlet, optionally with cable gland                  |
| ② | Cover (front), optionally with inspection window                                | ⑨ | Cover (rear) for electrical terminal compartment          |
| ③ | Local display (optional)  | ⑩ | Electrical terminal compartment                           |
| ④ | Safety catch (front)  |   | Connecting the SITRANS TF dual chamber housing (Page 100) |
| ⑤ | Retaining screw for rotation of the enclosure<br>Rotating the display (Page 76) | ⑪ | Safety catch (back)                                       |
| ⑥ | Mounting holes on the enclosure   | ⑫ | Ground terminal   |
| ⑦ | Nameplate   | ⑬ | Nameplate   |
|   |   | ⑭ | Screw for the cover over the buttons                      |

Figure 4-23 Installation of SITRANS TF dual chamber housing

#### 4.4.5 Nameplate layout SITRANS TF dual chamber housing

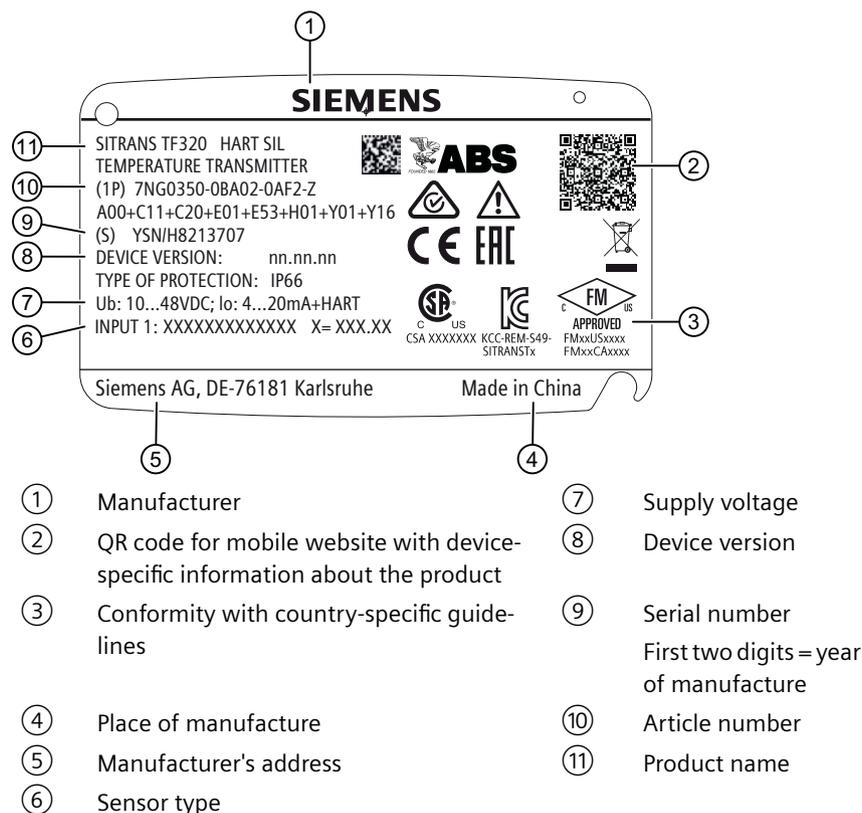
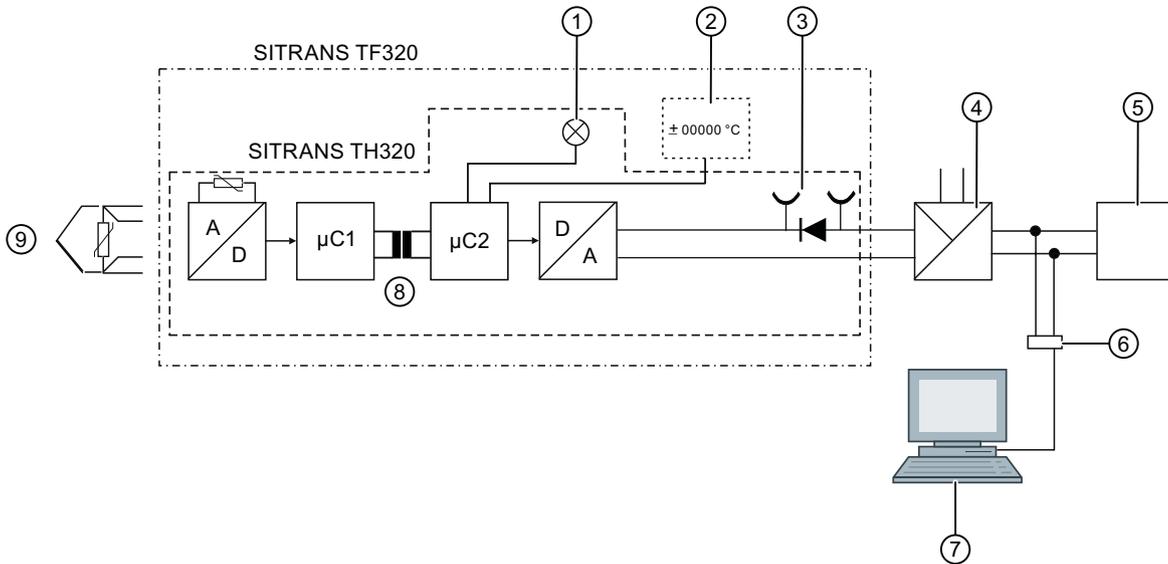


Figure 4-24 Example of nameplate for SITRANS TF dual chamber housing

### 4.4.6 How TF320 works

The functional principle is described below based on the function chart.



- |   |                                  |     |  |
|---|----------------------------------|-----|--|
| ① | LED                              | ⑥   | HART modem                             |
| ② | Local display                    | ⑦   | Computer                               |
| ③ | Test terminals                   | ⑧   | Galvanic isolation                     |
| ④ | Feed splitter, e.g. SITRANS I100 | ⑨   | Input                                  |
| ⑤ | Load                             | A/D | Analog-to-digital converter            |
|   |                                  | μC1 | Microcontroller, on the secondary side |

Figure 4-25 Function chart for SITRANS TF with SITRANS TH320

- Input ⑨ for connecting different signal sources. Section: Input (Page 207).
- This signal is converted to a digital signal in an analog-to-digital converter (A/D).
- The digital signal is evaluated in a microcontroller (μC1) on the secondary side and corrected to match the input characteristic.
- The digital signal is transferred via the galvanic isolation ⑧ to the microcontroller (μC2) on the primary side.
- The analog output value is calculated in the microcontroller (μC1) on the primary side. The functional status is indicated by LED ① and the communications data is prepared.
- The digital-to-analog converter (D/A) subsequently converts the signal into the output current of 4 to 20 mA.
- The power supply source is located in the output signal circuit.

### 4.4.7 How TF420 works

The functional principle is described below based on the function chart.

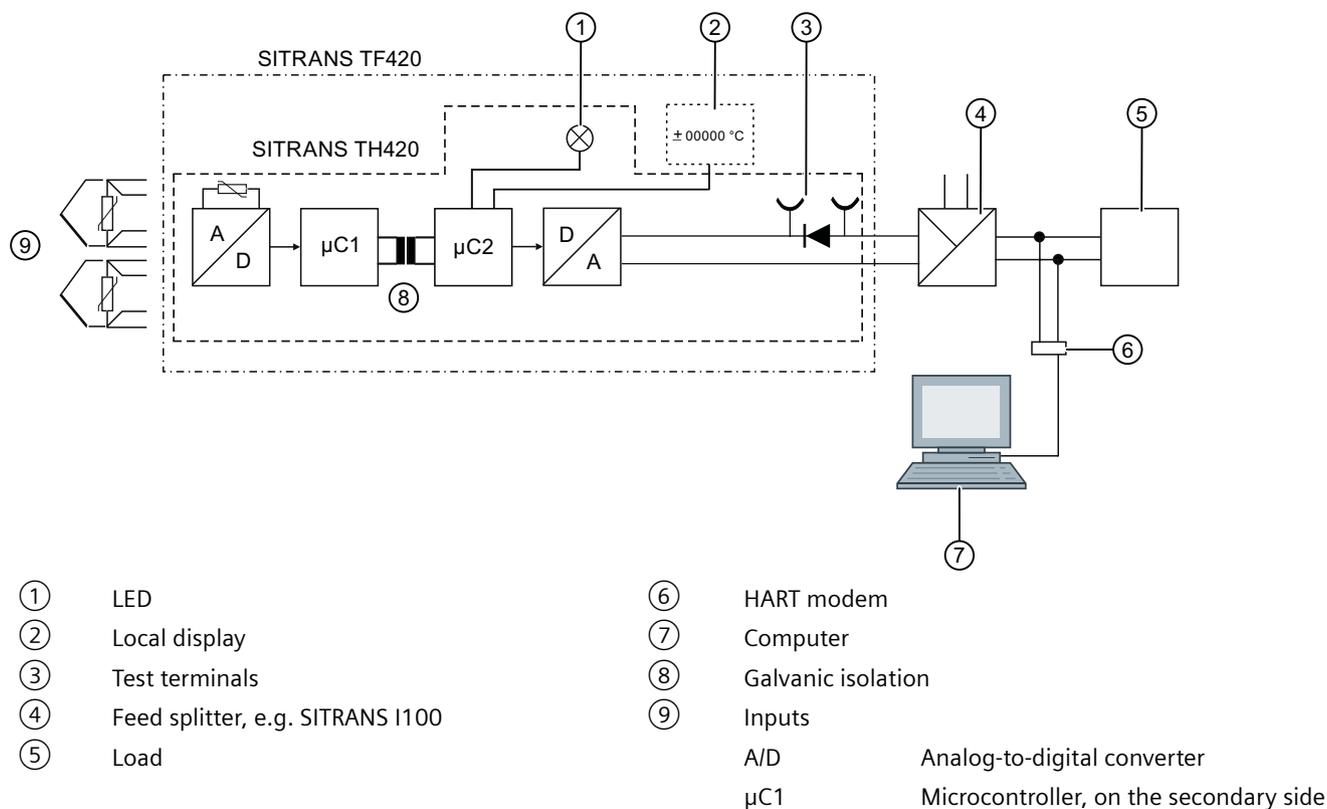


Figure 4-26 Function chart for SITRANS TF with SITRANS TH420

- Input ⑨ for connecting different signal sources. Section: Input (Page 207).
- This signal is converted to a digital signal in an analog-to-digital converter (A/D).
- The digital signal is evaluated in a microcontroller (μC1) on the secondary side and corrected to match the input characteristic.
- The digital signal is transferred via the galvanic isolation ⑧ to the microcontroller (μC2) on the primary side.
- The analog output value is calculated in the microcontroller (μC1) on the primary side. The functional status is indicated by LED ① and the communications data is prepared.
- The digital-to-analog converter (D/A) subsequently converts the signal into the output current of 4 to 20 mA.
- The power supply source is located in the output signal circuit.

## 4.5 USB modem and SIPROM T

### 4.5.1 Applications

Use the USB modem only for the purposes specified in these instructions.

The USB modem with SIPROM T parameter assignment software is used for parameter assignment and operation of the following temperature transmitters:

- SITRANS TH100Slim/TH100/TH200/TH320 with 4 to 20 mA
- SITRANS TR200/TR320 with 4 to 20 mA
- SITRANS TF with SITRANS TH200
- SITRANS TF320 with 4 to 20 mA

Connect the temperature transmitter to the PC via the USB modem. The required supply voltage of the temperature transmitter is provided via the USB modem.

NOTICE
<p><b>Improper use of the USB modem</b></p> <p>The USB modem and the connected devices can be damaged.</p> <ul style="list-style-type: none"><li>• Only use the USB modem for parameter assignment of the named Siemens temperature transmitters.</li><li>• Always use the SIPROM T parameter assignment software.</li><li>• Refer to the information in section Technical data (Page 199).</li><li>• Observe the technical data of the temperature transmitters in the associated operating instructions. You can find the operating instructions on the Internet at Instructions and manuals (<a href="http://www.siemens.com/processinstrumentation/documentation">http://www.siemens.com/processinstrumentation/documentation</a>).</li></ul>



### 4.5.2 Product features

- USB port (USB V1.1, compatible with USB 2.0)
- Galvanic isolation between the PC and the temperature transmitter with parameters to be assigned
- Adherence to the Ex requirements for the connected temperature transmitters
- Feeding of the USB modem with supply voltage directly from the USB port of the PC

### 4.5.3 Meaning of LEDs on the USB modem

LED on the USB modem	Meaning
Power LED lit green.	The USB modem is connected to the USB port of the PC. The operating system of your PC is in normal state.
Power LED flashes green.	The temperature transmitter is assigned parameters.
Power LED is not lit.	This PC is in the standby or idle state.
Comm LED is lit yellow.	The USB modem is restarted.
Comm LED flashes yellow.	Data transfer from the PC to the USB modem.
Error LED is lit red.	Modem-internal errors (RAM errors) or a short-circuit at the modem terminals to the temperature transmitter was detected during the parameter assignment operation.
All LEDs are not lit up.	The firmware of the USB modem is being updated.
All LEDs light up for 3 s.	The firmware of the USB modem was successfully updated.

#### See also

Troubleshooting of USB modem (Page 198)

*Description*

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*4.5 USB modem and SIPROM T*

# Installing/mounting

## 5.1 Basic safety notes

<b>NOTICE</b>
<p><b>Direct sunlight</b></p> <p>Damage to device.</p> <p>The device can overheat or materials become brittle due to UV exposure.</p> <ul style="list-style-type: none"> <li>• Protect the device from direct sunlight.</li> <li>• Make sure that the maximum permissible ambient temperature is not exceeded. Refer to the information in Technical data (Page 199).</li> </ul>

### 5.1.1 ATEX/IECEX and others

#### 5.1.1.1 Safety information for installation in "Intrinsic safety "ia/ib"

##### Zones 0, 1, 2, 20, 21, 22 and M1

###### General installation information

The first two digits of the serial number stand for the year of production. With aluminum enclosures, you also have to make sure during installation that ignition sources due to sparks caused by impact or friction are prevented. In the case of enclosures made of non-metallic materials or painted metal, electrostatic charging must be prevented.

The distance between terminals, including the stripped core, must be a minimum of 3 mm from each grounded metal part.

The test terminals allow for direct measurement of the loop current without impairing the loop integrity. When using the test terminals, the transmitter must be connected to the supply voltage. Only use certified testing devices for installation in hazardous areas. If the transmitter/local display is used in Ex nA or Ex ec protection type, it can no longer be used with intrinsic safety afterwards.

Intrinsically safe circuits must withstand an insulation voltage of 500 V AC. The insulation voltage is generated towards grounded enclosure parts, e.g. field housing or control cabinet. Observe the installation requirements according to IEC/EN 60079-11 Section 6.3.13. These requirements are met by the TF320 /420 temperature transmitters and the TS500 temperature sensor from Siemens.

**Note the following information for installation in a potentially explosive gas atmosphere:**

The transmitter/local display must be installed in an enclosure of form B in accordance with DIN 43729 or equivalent so that at least IP20 protection in accordance with IEC/EN 60529 is guaranteed.

The enclosure must be suitable for the application and installed to meet the applicable regulations.

**Note the following information for installation in a potentially explosive dust atmosphere:**

The transmitter/local display must be installed in a metal enclosure of form B in accordance with DIN 43729 or equivalent so that at least IP6X protection in accordance with IEC/EN 60529 is guaranteed.

The enclosure must be suitable for the application and installed to meet the applicable regulations. Cable entries and dummy elements must meet the same requirements.

With dust deposits up to 5 mm, the maximum surface temperature on the outside of the enclosure is 20 C higher than the maximum ambient temperature. Remove any dust deposits in excess of 5 mm.

**Note the following instructions for installation in mines:**

The transmitter/local display must be installed in a metal enclosure which guarantees at least IP6X protection in accordance with IEC/EN 60529.

Aluminum enclosure are not permitted in mines.

The enclosure must be suitable for the application and installed to meet the applicable regulations.

Cable entries and dummy elements must meet the same requirements.

**5.1.1.2 Safety information for installation in "Non-sparking nA/ec" and "Intrinsic safety ic"**

**Zones 2 and 22**

**General installation information**

In the case of enclosures made of non-metallic materials or painted metal, electrostatic charging must be prevented. At ambient temperatures  $\geq 60$  °C, heat-resistant cables with a temperature rating of at least 20 K above ambient temperature must be used.

The enclosure must be suitable for the application and professionally installed. With dust deposits up to 5 mm, the maximum surface temperature on the outside of the enclosure is 20 C higher than the maximum ambient temperature. Remove any dust deposits in excess of 5 mm.

The distance between terminals, including the stripped core, must be a minimum of 3 mm from each grounded metal part.

A test connection is only permissible if the area is safe or the supply/output circuit and the utilized ammeter are intrinsically safe.

**Note the following information for installation in a potentially explosive gas atmosphere:**

In "Ex ic" areas, the transmitter/local display must be installed in an enclosure that ensures at least IP20 degree of protection according to IEC 60529 and that is suitable for the application and is installed professionally.

In "Ex nA" and "Ex ec" areas, the transmitter/local display must be installed in an enclosure that ensures at least IP54 degree of protection according to IEC 60079-0. In addition, the enclosure

must have an internal Pollution degree 2 or better according to IEC 60664-1.  
Cable entries and dummy elements must meet the same requirements.

**Note the following information for installation in a potentially explosive dust atmosphere:**

If the transmitter/local display is supplied with an intrinsically safe signal "ic" and has a connection to an intrinsically safe signal "ic" (e.g. a passive device), it must be installed in a metal enclosure form B according to DIN 43729 or equivalent that ensures at least IP6X degree of protection according to IEC 60529.

Cable entries and dummy elements must meet the same requirements.

If the transmitter/local display is supplied with a non-sparking signal "nA/ec" or has a connection to a non-sparking signal, it must be installed in an enclosure that ensures at least IP6X degree of protection according to IEC 60529 and that meets the requirements of protection type EX t. Cable entries and dummy elements must meet the same requirements.

## 5.1.2 FM/CSA

### 5.1.2.1 Safety information for installation in "Intrinsic safety "ia"

#### Hazardous areas CL I, Div 1, GP ABCD CL I, Zone 0 IIC

##### General installation information

- The installation must be carried out in accordance with the regulations of the US National Electrical Code (NEC) or in Canada the Canadian Electrical Code (CEC).
- Devices with FM approval for intrinsic safety can be connected to barriers according to the ENTITY CONCEPT. This concept allows the interconnection of approved transmitters, measuring instruments and other devices in combinations that have not been specifically investigated by FM, provided that the criteria of the authority are met. This combination is intrinsically safe if the entity concept is acceptable to the authority responsible for the installation.
- The entity concept comprises the following criteria: The intrinsically safe devices, with the exception of barriers, must not be a power source. The maximum voltage  $U_i$  ( $V_{max}$ ), the maximum current  $I_i$  ( $I_{max}$ ) and the maximum power  $P_i$  ( $P_{max}$ ) that an intrinsically safe device can receive without loss of intrinsic safety must be greater than or equal to the voltage ( $U_o$  or  $U_{oc}$  or  $V_t$ ), current ( $I_o$  or  $I_{sc}$  or  $I_t$ ) and power values  $P_o$  that can be supplied from the barrier.
- The sum of the maximum unprotected capacitance ( $C_i$ ) of each intrinsically safe device and the connecting cables must be less than the capacitance ( $C_a$ ) which can be safely connected to the barrier.
- The sum of the maximum unprotected inductance ( $L_i$ ) of each intrinsically safe device and the connecting cables must be less than the inductance ( $L_a$ ) which can be safely connected to the barrier.
- The entity parameters  $U_o$ ,  $V_{oc}$  or  $V_t$  and  $I_o$ ,  $I_{sc}$  or  $I_t$ , as well as  $C_a$  and  $L_a$  for barriers are communicated by the barrier manufacturer.

## 5.1 Basic safety notes

- The transmitter/local display must be installed in a suitable enclosure that complies with the installation requirements of the Canadian Electrical Code (CEC) or, in the USA, the National Electrical Code (NEC).
- In the case of enclosures made of non-metallic materials or painted metal, electrostatic charging must be prevented.
- Supply cables with a temperature rating of at least 5 C above ambient temperature must be used.

WARNING: Intrinsic safety may be impaired when components are replaced.

### 5.1.2.2 Safety information for installation in "Non Incendive nA"

#### Hazardous areas CL I, Div 2, GP ABCD CL I, Zone 2 IIC

##### General installation information

- The transmitter/local display must be installed in an enclosure that ensures at least IP54 degree of protection according to IEC 60529 and that is suitable for the application and is installed professionally. Cable entries and dummy elements must meet the same requirements.
- In the case of enclosures made of non-metallic materials or painted metal, electrostatic charging must be prevented.
- Supply cables with a temperature rating of at least 5 C above ambient temperature must be used.

WARNING: Replacement of components may impair suitability for Class I, Division 2 areas.

WARNING: Do not perform terminal connection work on equipment if the power has not been switched off and the area has not been designated as safe.

##### Installation with "non incendive field wiring" protection type

The wiring concept for the "Non Incendive Field Wiring" type of protection allows the wiring of devices with "Non Incendive Field Wiring" type of protection with associated devices of the same type of protection or associated devices with "Intrinsic safety" type of protection or associated devices that have not been specifically tested as a combined system, with an permissible wiring procedure for unclassified installation locations,  $V_{oc} < V_{max}$ ,  $C_a \geq C_i + C_{Cable}$ ,  $L_a \geq L_i + L_{Cable}$

### 5.1.3 SITRANS TF

 <b>WARNING</b>
<b>Unsuitable cables, cable glands and/or plugs</b> Risk of explosion in hazardous areas. <ul style="list-style-type: none"><li>• Use only cable glands/plugs that comply with the requirements for the relevant type of protection.</li><li>• Tighten the cable glands in accordance with the torques specified in Technical data (Page 199).</li><li>• Close unused cable inlets for the electrical connections.</li><li>• When replacing cable glands, only use cable glands of the same type.</li><li>• After installation, check that the cables are seated firmly.</li></ul>

<b>NOTICE</b>
<b>Use of line and cable entries made of plastic in hazardous areas</b> Device damage caused by impact at temperatures below -20 °C. <ul style="list-style-type: none"><li>• Make sure that the line and cable entries are protected from impacts.</li></ul>

## 5.2 Installing SITRANS TH in a connection head

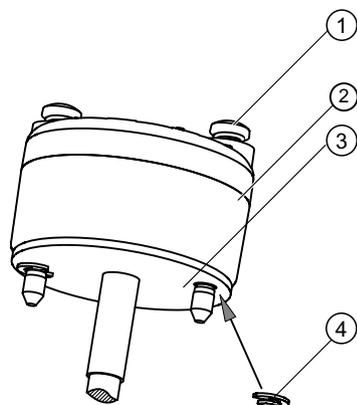
### 5.2.1 Installing SITRANS TH100/320/420 in the base of the connection head

#### Condition

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

**Procedure**

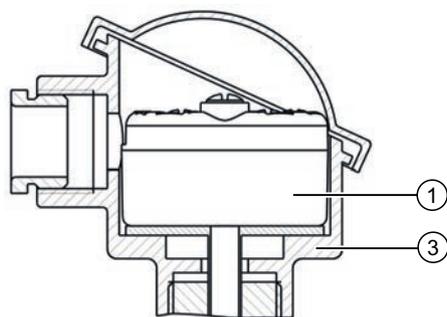
1. Place the springs on the fixing screws.
2. Secure the lock washers.



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

Figure 5-1 Securing the lock washer

3. Secure the transmitter with the fixing screws in the connection head base.



- |                   |
|-------------------|
| ① Transmitter     |
| ③ Connection head |

Figure 5-2 Securing the transmitter in the connection head base

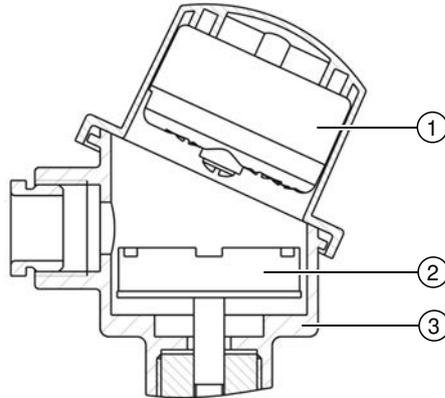
## 5.2.2 Installing SITRANS TH100/320/420 in the raised cover of the connection head

**Condition**

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

## Procedure

1. Place the springs on the fixing screws.
2. Secure the transmitter with the fixing screws in the connection head cover.



① Transmitter

② Ceramic base of the measuring element

③ Connection head

Figure 5-3 Securing the transmitter in the connection head cover

## 5.3 Mounting SITRANS TH100/320/420 on DIN rail and G rail

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### 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.

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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/G 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.

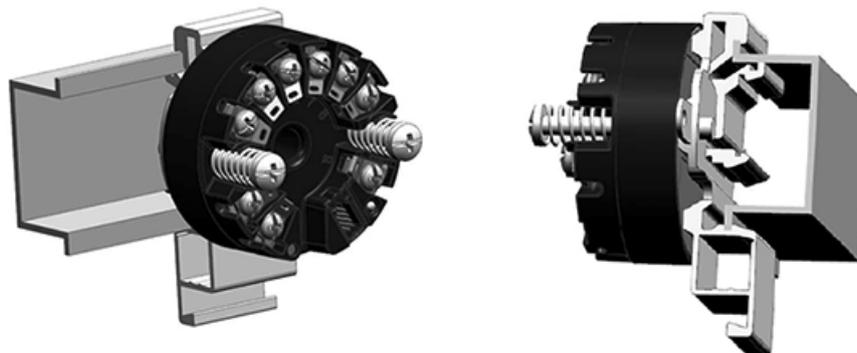


Figure 5-4 Securing the transmitter on DIN rails

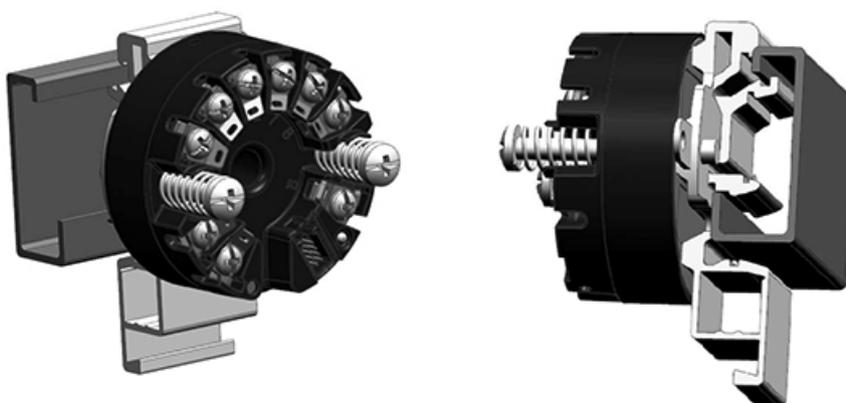


Figure 5-5 Securing the transmitter on G rails

## 5.4 Installing SITRANS TR on DIN rail

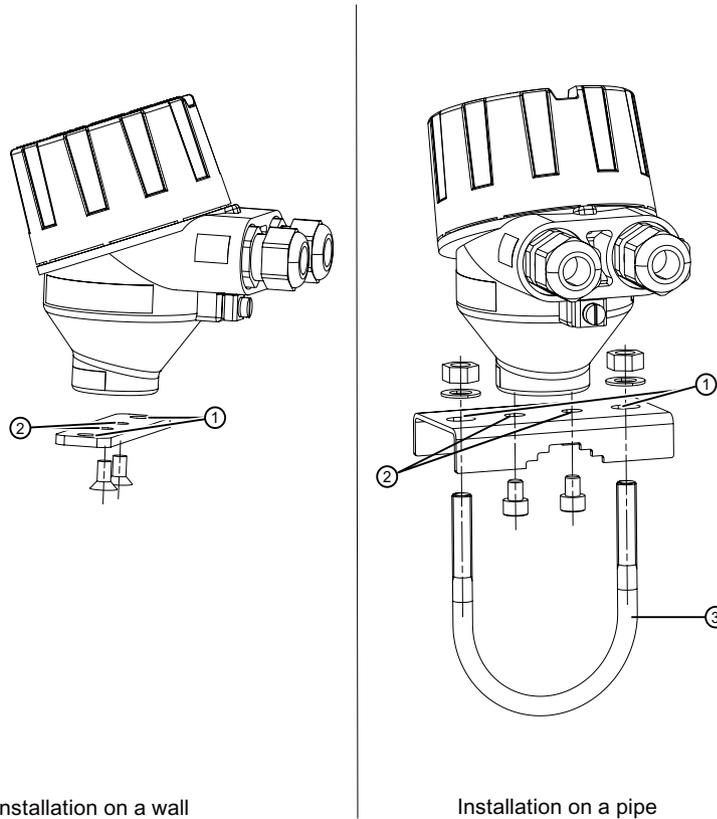
The transmitter is secured to a 35 mm DIN rail in accordance with DIN EN 60715.

Comply with the ambient conditions specified in the technical data.

## 5.5 Mounting the SITRANS TF single chamber housing

### 5.5.1 Mounting the device on the wall or pipe

#### Procedure



Installation on a wall

Installation on a pipe

- ① Fastening holes for fastening to a wall or to the pipe clamp
- ② Fastening holes for fastening the rail to the device
- ③ Pipe clamp

1. Use the fixing screws to fasten the bracket on the device.
2. Fasten the rail to the wall or to the pipe clamp.

### 5.5.2 Rotating the display

To read the display in any mounting position, you can rotate it by 360° in 90° steps.

### Procedure

1. Use a 3 mm Allen key to loosen the safety catch.
2. Unscrew the cover.
3. Remove the display from the holder.

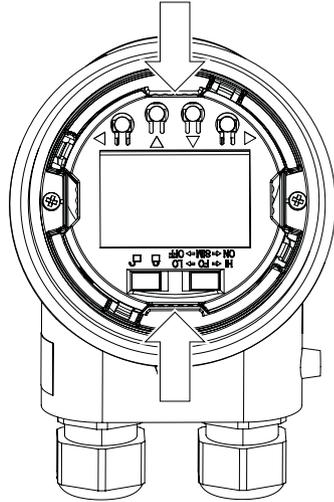


Figure 5-6 Remove the display

4. Rotate the display in 90° increments to the desired position.
5. Mount the display once again at the desired position.
6. Screw the cover back on as far as it will go.
7. Use a 3 mm Allen key to secure the safety catch.

### See also

Single chamber housing design (Page 56)  
Opening the device (Page 93)

## 5.6 Mounting the SITRANS TF dual chamber housing

### 5.6.1 Mounting device to a pole with mounting bracket

#### Introduction

The mounting holes in the bracket ② and the device enclosure ① determine the permitted mounting positions.

## Procedure

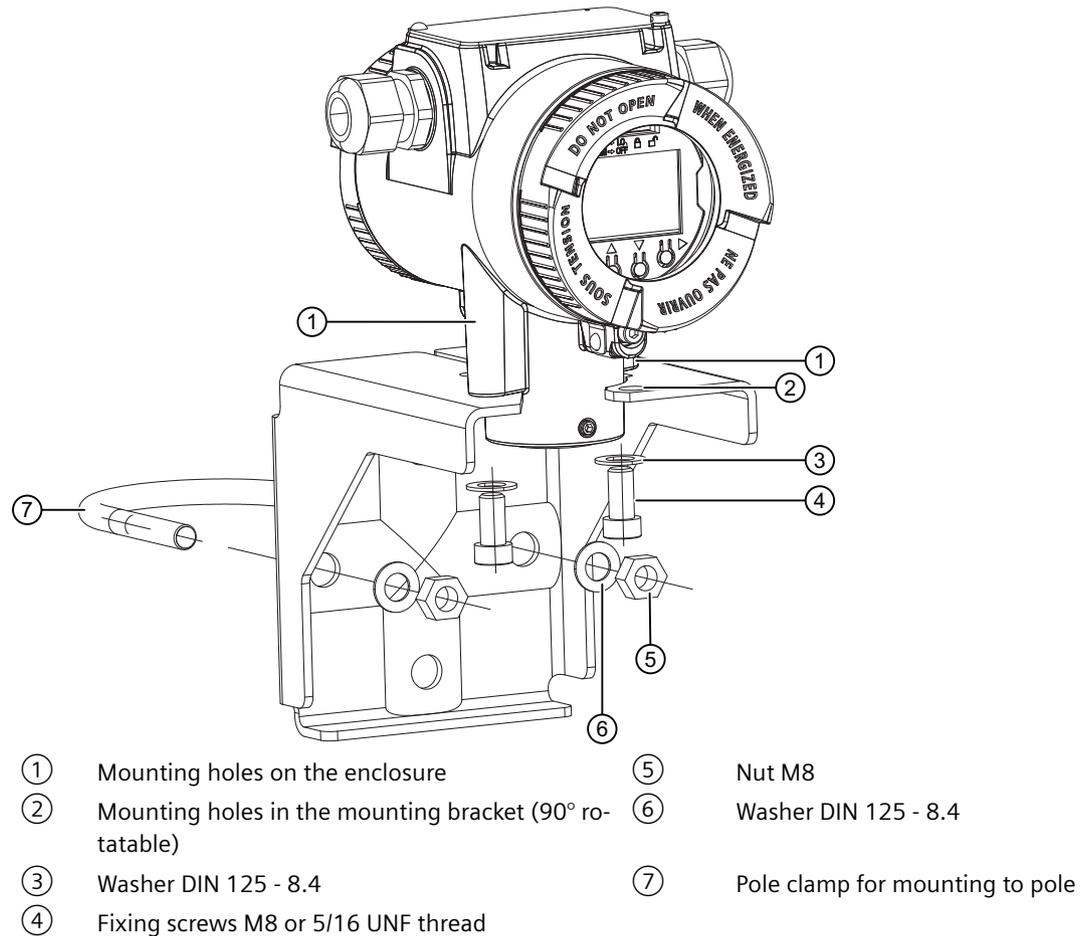


Figure 5-7 Mounting device to a pole with mounting bracket

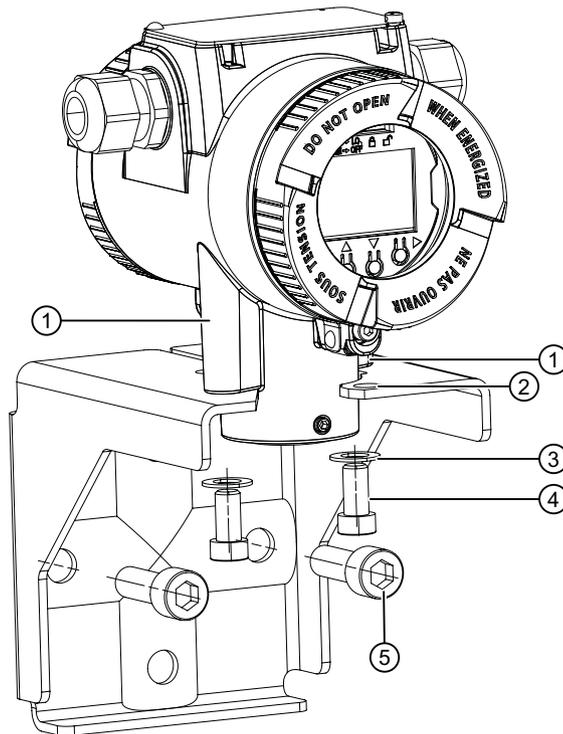
1. Push the enclosure ① onto the mounting bracket ②.
2. Secure the enclosure ① with the fixing screws ④ and washers ③ onto the mounting bracket.
3. Secure the mounting bracket with pole clamp ⑦, washers ⑥ and nuts ⑤ on the pole.

### 5.6.2 Mounting device to the wall with mounting bracket

#### Introduction

The mounting holes in the bracket ② and the device enclosure ① determine the permitted mounting positions.

**Procedure**



- |   |  |   |                                     |
|---|--|---|-------------------------------------|
| ① | Mounting holes on the enclosure                        | ④ | Fixing screws M8 or 5/16 UNF thread |
| ② | Mounting holes in the mounting bracket (90° rotatable) | ⑤ | Fixing screws                       |
| ③ | Washer DIN 125 - 8.4                                   |   |                                     |

Figure 5-8 Mounting device to the wall with mounting bracket

1. Push the enclosure ① onto the mounting bracket ②.
2. Secure the enclosure ① with the fixing screws ④ and washers ③ onto the mounting bracket.
3. Secure the mounting bracket to the wall. Use suitable fixing screws ⑤.

**5.6.3 Rotating the display**

To read the local display in any mounting position, you can rotate it incrementally 360°.

**Procedure**

1. Use a 3 mm Allen key to loosen the front safety catch.
2. Unscrew the front cover.

3. Remove the local display from the holder.

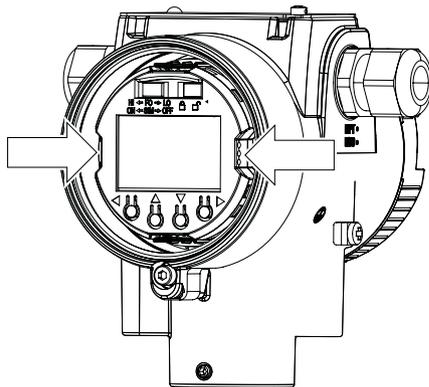


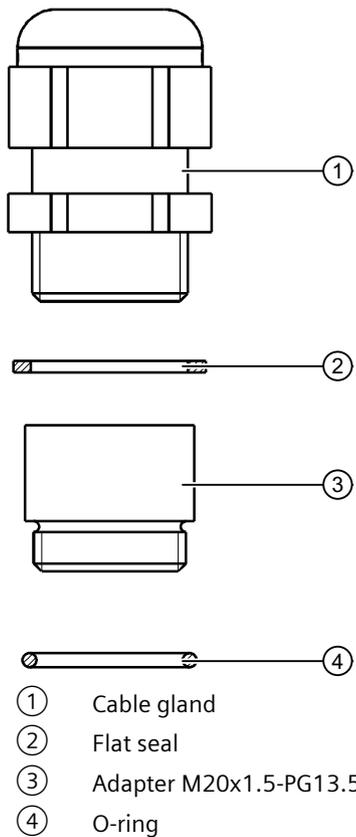
Figure 5-9 Remove the local display

4. Rotate the local display in 90° increments to the desired position.
5. Mount the local display once again at the desired position.
6. Screw the front cover on as far as it will go.

### See also

- Dual chamber housing design (Page 58)
- Opening the device (Page 100)

## 5.7 Mount adapter M20x1.5-PG13.5



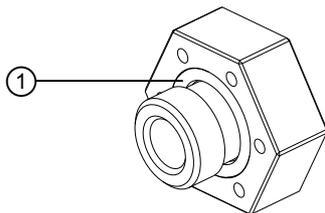
## 5.8 Mount adapter for connector socket Han7D/Han8D

### Tools

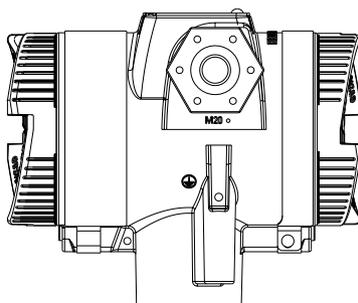
- Torque wrench 35 width A/F
- Screw retainer finish (for example, Loctite 270)

## Procedure

1. Clean the thread of the adapter and enclosure until free of dust and grease.
2. Fully insert the O-ring into the adapter.
  - Make sure that the O-ring remains in the correct position ① during installation of the adapter.



3. Apply the screw retainer finish to the thread of the adapter.
4. Turn the adapter clockwise by hand until tight.
5. Tighten the adapter with a torque of 5 Nm (+1).
6. If necessary, adjust the position of the adapter until it is mounted in the following position:



## 5.9 Removing

 **WARNING**

**Incorrect disassembly**

The following risks may result from incorrect disassembly:

- Injury through electric shock
- Risk through emerging media when connected to the process
- Risk of explosion in hazardous area

In order to disassemble correctly, observe the following:

- Before starting work, make sure that you have switched off all physical variables such as pressure, temperature, electricity etc. or that they have a harmless value.
- If the device contains hazardous media, it must be emptied prior to disassembly. Make sure that no environmentally hazardous media are released.
- Secure the remaining connections so that no damage can result if the process is started unintentionally.

# Connecting

## 6.1 Basic safety notes

 <b>WARNING</b>
<b>Connecting or disconnecting in explosive environments</b> Connecting or disconnecting a powered device in explosive environments can lead to an explosion. <ul style="list-style-type: none"><li>• Connect and disconnect in <b>non</b>-explosive environments. - or -</li><li>• Remove power to the device before connecting or disconnecting in explosive atmosphere.</li></ul>

 <b>WARNING</b>
<b>Lack of equipotential bonding</b> Risk of explosion through compensating currents or ignition currents through lack of equipotential bonding. <ul style="list-style-type: none"><li>• Ensure that the device is potentially equalized.</li></ul> <b>Exception:</b> It may be permissible to omit connection of the equipotential bonding for devices with type of protection "Intrinsic safety Ex i".

 <b>WARNING</b>
<b>Loss of safety of device with type of protection "Intrinsic safety Ex i"</b> If the device or its components have already been operated in non-intrinsically safe circuits or the electrical specifications have not been observed, the safety of the device is no longer ensured for use in hazardous areas. There is a risk of explosion. <ul style="list-style-type: none"><li>• Connect the device with type of protection "Intrinsic safety" solely to an intrinsically safe circuit.</li><li>• Observe the specifications for the electrical data on the certificate and/or in Technical data (Page 199).</li></ul>

 <b>WARNING</b>
<b>Unsuitable cables, cable glands and/or plugs</b>
Risk of explosion in hazardous areas.
<ul style="list-style-type: none"><li>• Use only cable glands/plugs that comply with the requirements for the relevant type of protection.</li><li>• Tighten the cable glands in accordance with the torques specified in Technical data (Page 199).</li><li>• Close unused cable inlets for the electrical connections.</li><li>• When replacing cable glands, only use cable glands of the same type.</li><li>• After installation, check that the cables are seated firmly.</li></ul>

 <b>WARNING</b>
<b>Improper power supply</b>
Risk of explosion in hazardous areas as result of incorrect power supply.
<ul style="list-style-type: none"><li>• Connect the device in accordance with the specified power supply and signal circuits. The relevant specifications can be found in the certificates, in Technical data (Page 199) or on the nameplate.</li></ul>

<b>NOTICE</b>
<b>Ambient temperature too high</b>
Damage to cable sheath.
<ul style="list-style-type: none"><li>• At an ambient temperature <math>\geq 60\text{ °C}</math> (140 °F), use heat-resistant cables suitable for an ambient temperature at least <math>20\text{ °C}</math> (36 °F) higher.</li></ul>

 <b>WARNING</b>
<b>Connecting device in energized state</b>
Risk of explosion in hazardous areas.
<ul style="list-style-type: none"><li>• Connect devices in hazardous areas only in a de-energized state.</li></ul>
<b>Exceptions:</b>
<ul style="list-style-type: none"><li>• Devices having the type of protection "Intrinsic safety Ex i" may also be connected in energized state in hazardous areas.</li><li>• Exceptions for type of protection "Non-sparking nA/ec" (Zone 2) are regulated in the relevant certificate.</li></ul>

**Note****Improvement of interference immunity**

- Lay signal cables separate from cables with voltages > 60 V.
- Use cables with twisted wires.
- Keep device and cables at a distance from strong electromagnetic fields.
- Take account of the conditions for communication specified in the Technical data (Page 199).
- Use shielded cables to guarantee the full specification according to HART/PA/FF/Modbus/EIA-485/Profibus DP.

## 6.2 Connecting the TH100

**Requirement**

If you use stranded wire used, you need a ferrule.

Note the maximum permissible core cross-section (Page 199).

**Procedure**

1. Connect the input or inputs to terminals 3 to 6.

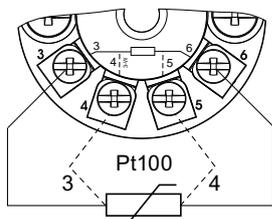
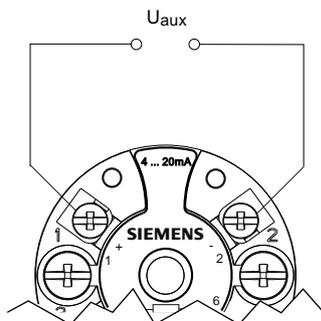


Figure 6-1 2-wire, 3-wire or 4-wire RTD

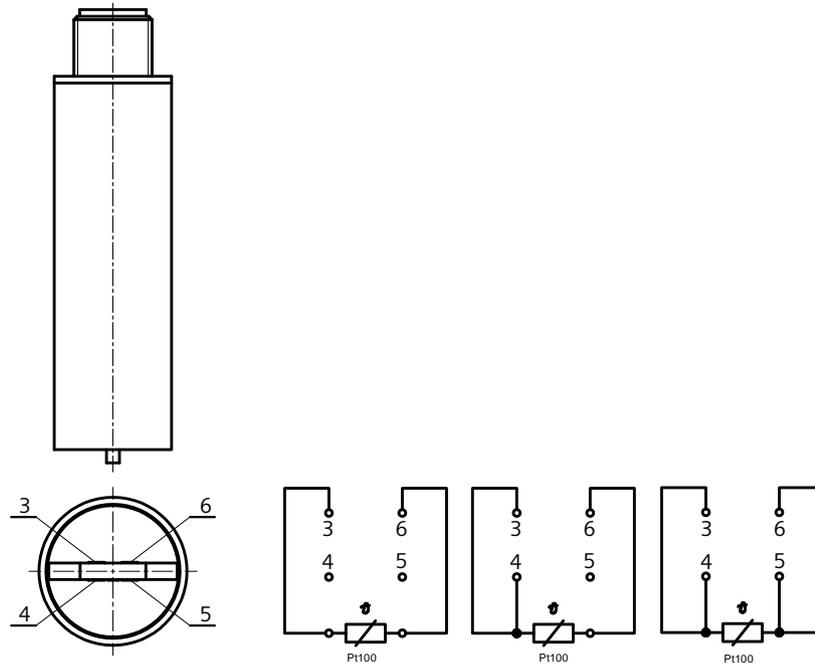
2. Connect the supply voltage to the terminals 1 (+) and 2 (-).  
Take the polarity into account. The device has reverse polarity protection.



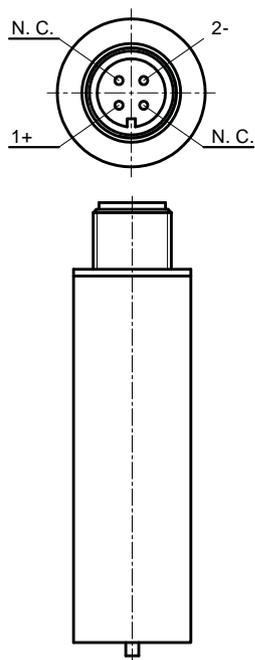
## 6.3 Connecting TH100 Slim

### Procedure

1. Solder points 3 to 6 to the Pt100.



2. Connect the M12 device plug to SITRANS TH100 Slim.  
1 (+) and 2 (-)  
Take the polarity into account. The device has reverse polarity protection.



N. C. Points are not used.  
(not  
con-  
nec-  
ted)

## 6.4 Connecting TH320

### Requirement

If you use stranded wire used, you need a ferrule.

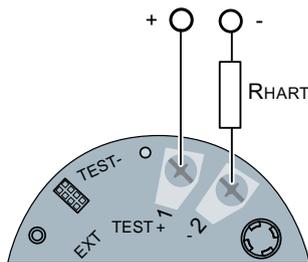
Note the maximum permissible core cross-section (Page 202).

**Procedure**

1. Connect the input or inputs to terminals 3 to 6.

2-wire, 3-wire or 4-wire RTD or linear resistance I1: Input 1	TC (internal CJC or external 2-wire or 3-wire CJC)	
Voltage input (unipolar and bipolar)	3-wire or 4-wire potentiometer	

2. Connect the supply voltage to the terminals 1 (+) and 2 (-). Take the polarity into account. The device has reverse polarity protection.



For devices with HART communication, connect a  $\geq 250 \Omega$  resistor.

## 6.5 Connecting TH420

**Requirement**

If you use stranded wire used, you need a ferrule.

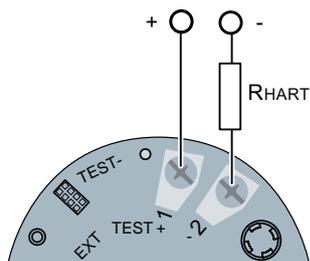
Note the maximum permissible core cross-section (Page 202).

**Procedure**

1. Connect the input or inputs to terminals 3 to 9.

<p>Input 1 (I1) and/or input 2 (I2): 2-wire, 3-wire or 4-wire RTD or linear resistance</p>	<p>Input 1 (I1) and/or input 2 (I2): TC (int. CJC or ext. 2-wire, 3-wire or 4-wire CJC)</p>	<p>Input 1 (I1) and/or input 2 (I2): voltage input (unipolar and bipolar)</p>
<p>Input 1: TC (int. CJC or ext. 2-wire or 3-wire CJC) Input 2: 2-wire, 3-wire or 4-wire RTD</p>	<p>Input 1 (I1) and/or input 2 (I2): 3-wire or 4-wire potentiometer</p>	<p>Input 1 (I1): 5-wire potentiome- ter Input 2 (I2): 3-wire potentiome- ter</p>

2. Connect the supply voltage to the terminals 1 (+) and 2 (-).  
Take the polarity into account. The device has reverse polarity protection.



For devices with HART communication, connect a  $\geq 250 \Omega$  resistor.

## 6.6 Connecting TR320

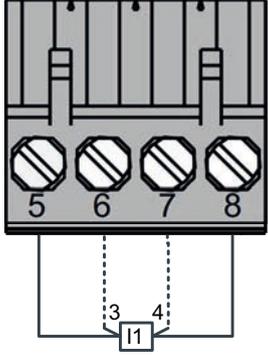
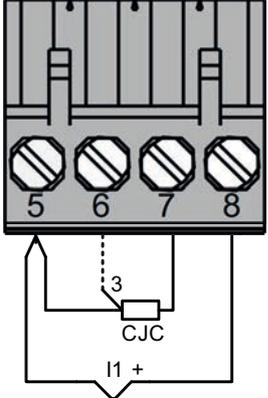
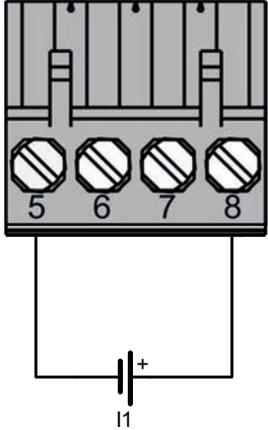
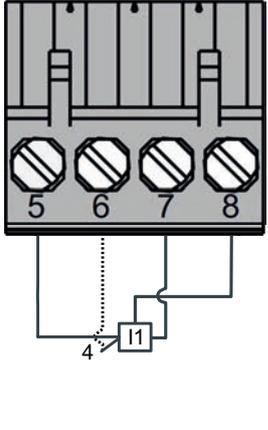
### Requirement

If you use stranded wire used, you need a ferrule.

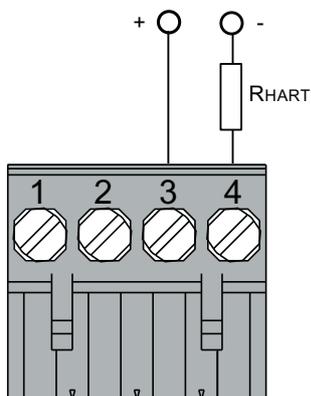
Note the maximum permissible core cross-section (Page 202).

**Procedure**

1. Connect the input or inputs to terminals 5 to 8.  
The terminals are equipped with a coding profile to ensure intrinsic safety.

		
<p>2-wire, 3-wire or 4-wire RTD or wire resistance I1: Input 1</p>	<p>TC (internal CJC or external 2-wire or 3-wire CJC)</p>	
		
<p>Voltage input (unipolar and bipolar)</p>	<p>3-wire or 4-wire potentiometer</p>	

2. Connect the supply voltage to the terminals 3 (+) and 4 (-).



For devices with HART communication, connect a  $\geq 250 \Omega$  resistor.

3. Take the polarity into account. The device has reverse polarity protection.

## 6.7 Connecting TR420

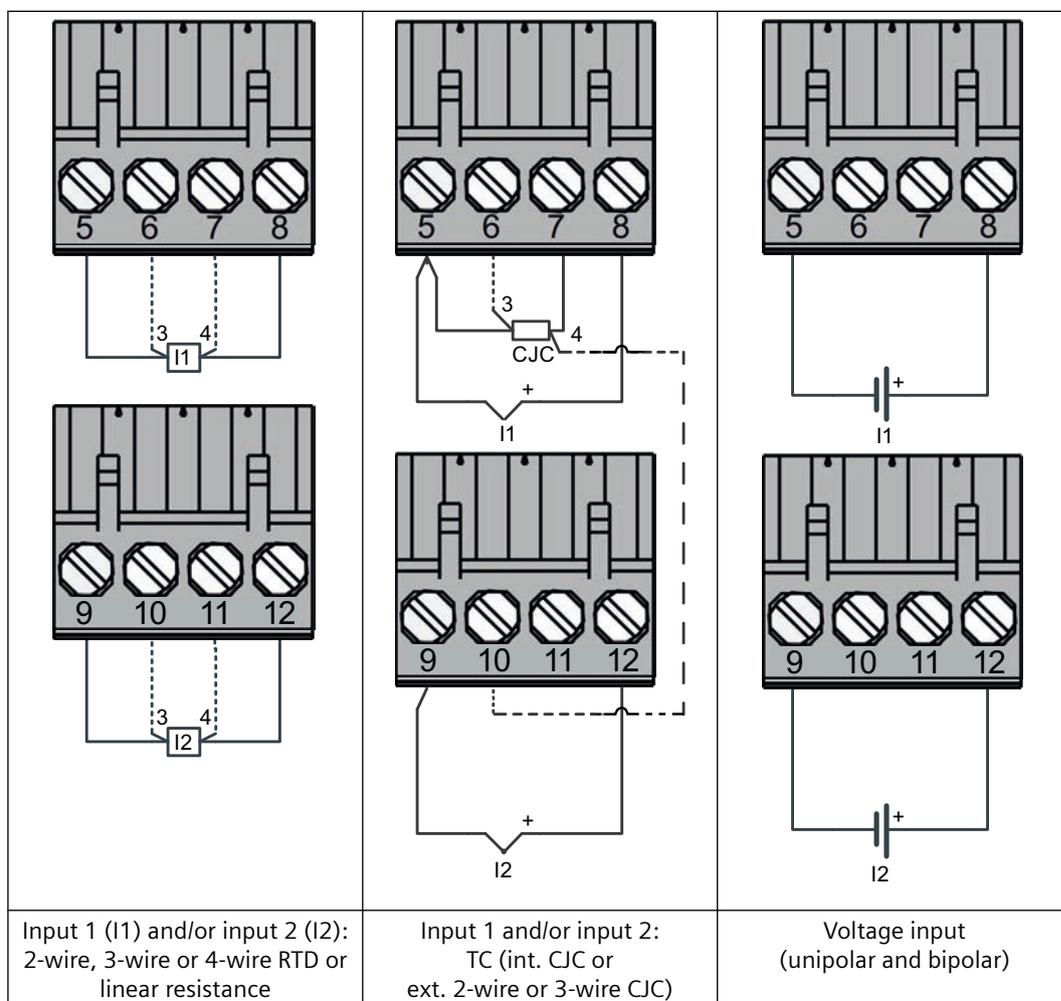
### Requirement

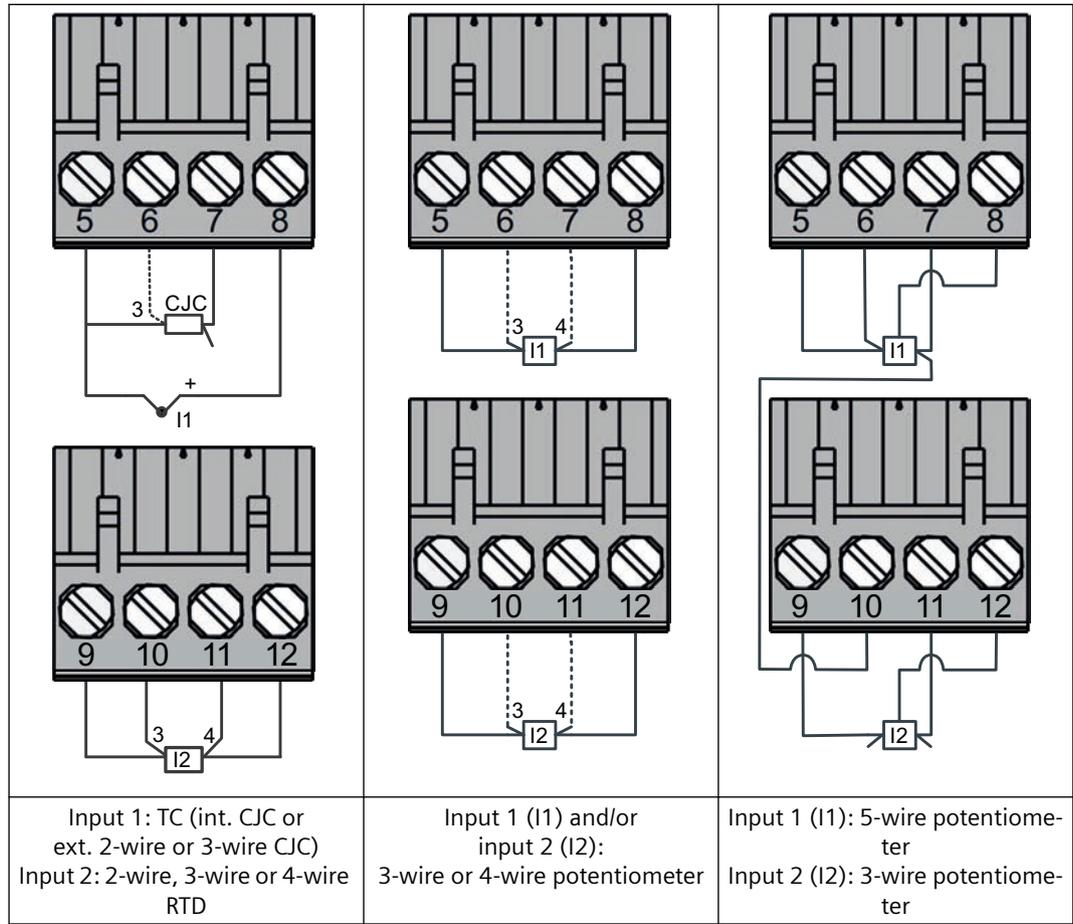
If you use stranded wire used, you need a ferrule.

Note the maximum permissible core cross-section (Page 202).

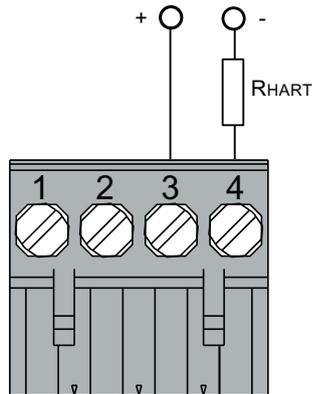
## Procedure

1. Connect the input or inputs to terminals 5 to 12.  
The terminals are equipped with a coding profile to ensure intrinsic safety.





2. Connect the supply voltage to the terminals 3 (+) and 4 (-).



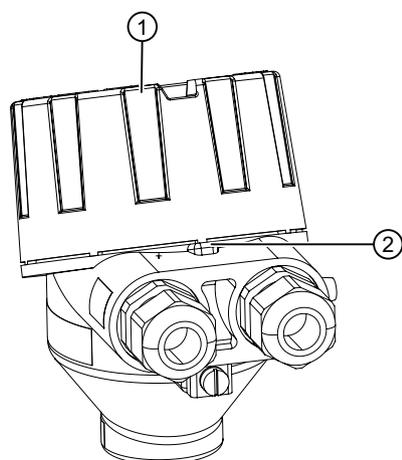
For devices with HART communication, connect a  $\geq 250 \Omega$  resistor.

3. Take the polarity into account. The device has reverse polarity protection.

## 6.8 Connecting the SITRANS TF single chamber housing

### 6.8.1 Opening the device

#### Procedure



- ① Cover of the electrical cable compartment
- ② Safety catch

Figure 6-2 Opening device with single chamber housing

1. Use a 3 mm Allen key to loosen the safety catch ②.
2. Unscrew the cover of the electrical cable compartment ①.

### 6.8.2 Connecting the SITRANS TF320 single chamber housing

#### Condition

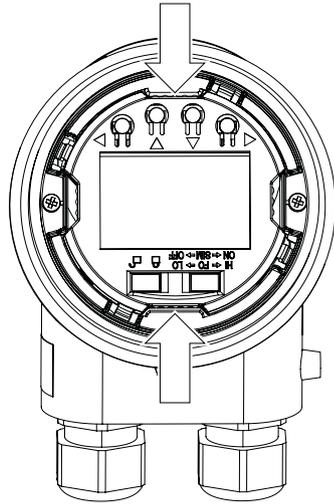
The device is opened. (Page 93)

If you use stranded wire used, you need a ferrule.

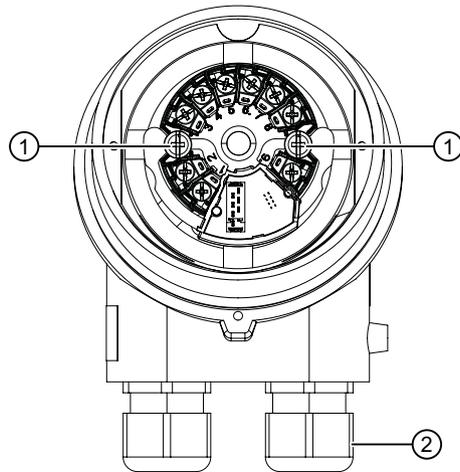
Note the maximum permissible core cross-section (Page 202).

**Procedure**

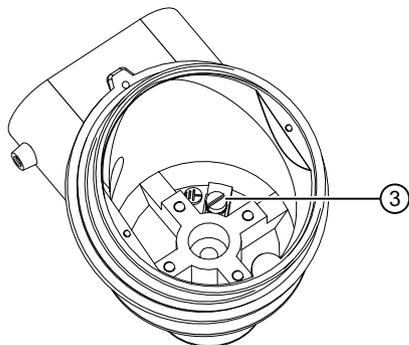
1. Remove the local display from the holder.



2. Loosen the fastening screws of the temperature transmitter ① and remove it.



3. Increase the protection from high-frequency radiation through shielded connecting cables.
  - Lead the shielded connecting cables through the EMC cable glands ②.
  - or –
  - Connect the cable shield to the screw of the ground terminal ③.



The screw of the ground terminal is electrically connected to the external protective conductor connection.

4. Connect the input terminals ④ and output terminals ⑤.  
Connecting TH320 (Page 85)

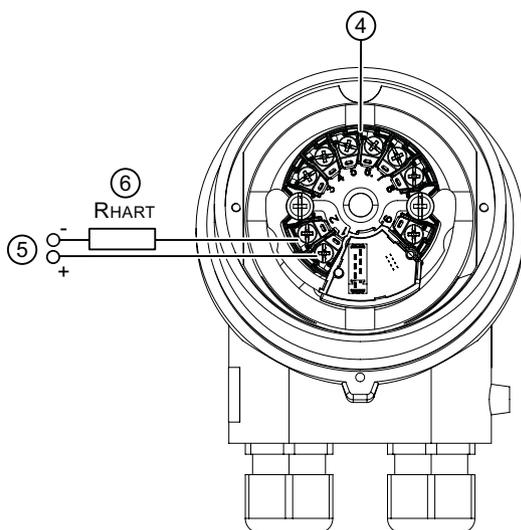
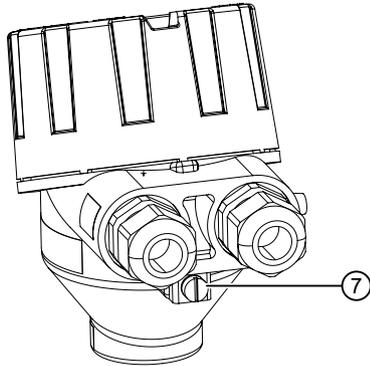


Figure 6-3 HART communication resistor ⑥ (optional)

5. Insert the temperature transmitter and screw it into place.
6. Insert the local display.

6.8 Connecting the SITRANS TF single chamber housing

7. Close the device.  
Closing the device (Page 99)
8. Connect the device to the plant with the protective conductor connection ⑦.



6.8.3 Connecting the SITRANS TF420 single chamber housing

Condition

The device is opened. (Page 93)

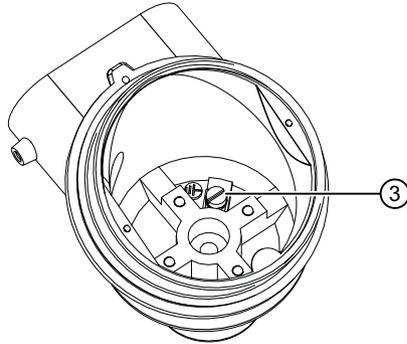
If you use stranded wire used, you need a ferrule.

Note the maximum permissible core cross-section (Page 202).



6.8 Connecting the SITRANS TF single chamber housing

3. Increase the protection from high-frequency radiation through shielded connecting cables.
  - Lead the shielded connecting cables through the cable glands ②.
  - or –
  - Connect the cable shield to the screw of the ground terminal ③.



The screw of the ground terminal is electrically connected to the external protective conductor connection.

4. Connect the input terminals ④ and output terminals ⑤.  
Connecting TH420 (Page 86)

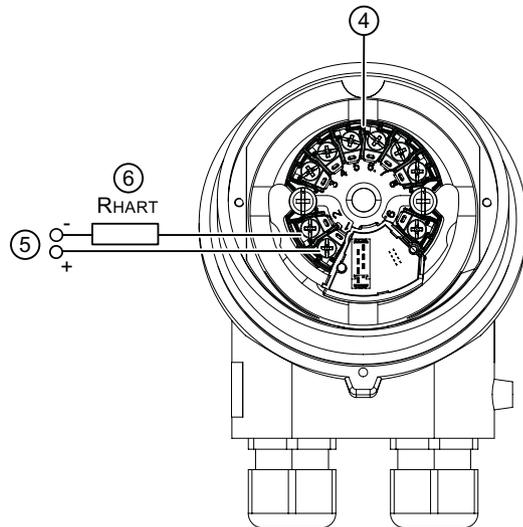
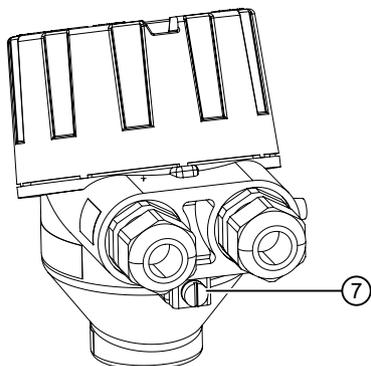


Figure 6-4 HART communication resistor ⑥ (optional)

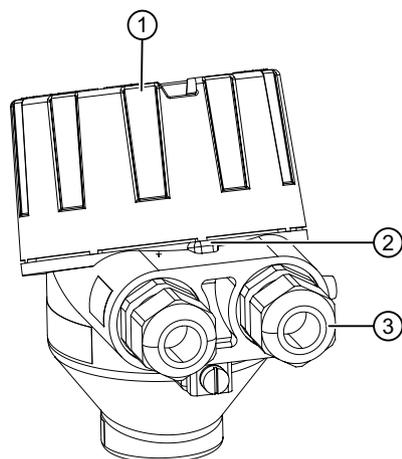
5. Insert the temperature transmitter and screw it into place.
6. Insert the local display.

7. Close the device.  
Closing the device (Page 99)
8. Connect the device to the plant with the protective conductor connection ⑦.



#### 6.8.4 Closing the device

##### Procedure



- ① Cover
- ② Safety catch
- ③ Cable gland

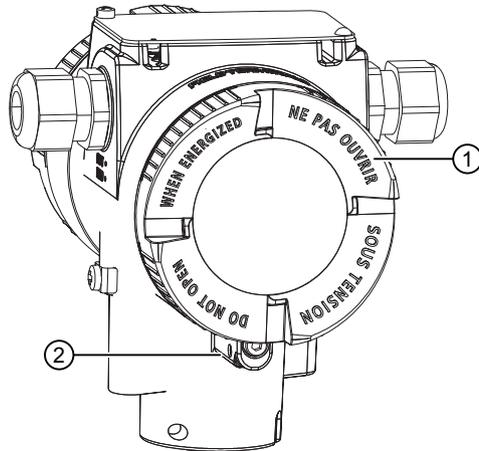
Figure 6-5 Closing device with single chamber housing

1. Screw the cover ① back on as far as it will go.
2. Use a 3 mm Allen key to secure the cover with the safety catch ②.
3. Check the tightness of the cable glands ③ in accordance with the degree of protection.

## 6.9 Connecting the SITRANS TF dual chamber housing

### 6.9.1 Opening the device

#### Procedure



- ① Cover of the electrical cable compartment
- ② Safety catch (back)

Figure 6-6 Rear view of the device

1. Use a 3-mm Allen key to loosen the safety catch (rear) ②.
2. Unscrew the cover of the electrical cable compartment ①.

### 6.9.2 Connecting the SITRANS TF320 dual chamber housing

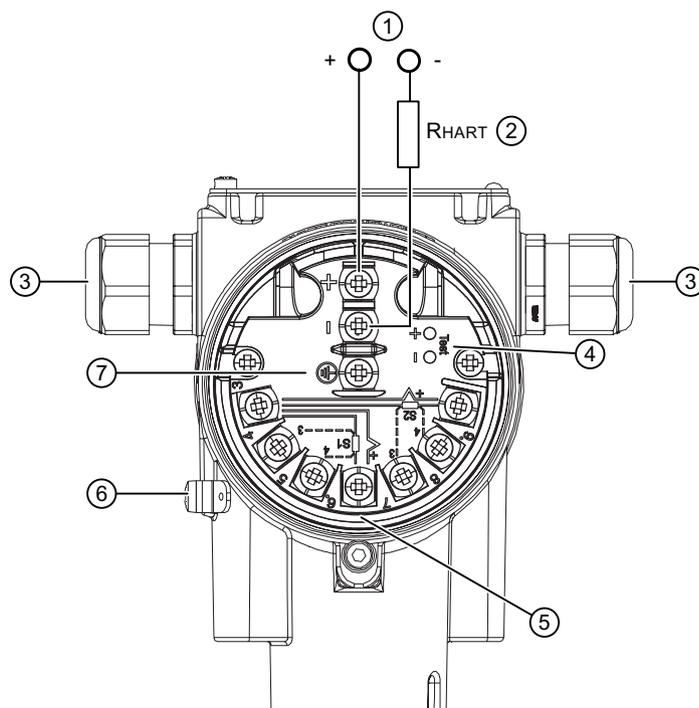
#### Requirement

The device is opened. (Page 100)

If you use stranded wire, you need a ferrule.

Note the maximum permissible core cross-section (Page 202).

## Procedure



- |   |  |   |                                |
|---|--|---|--------------------------------|
| ① | Supply voltage                         | ⑤ | Input terminals                |
| ② | HART communication resistor (optional) | ⑥ | Protective conductor connector |
| ③ | Cable gland                            | ⑦ | Ground terminal                |
| ④ | Test terminals                         |   |                                |

Figure 6-7 Connecting the device

1. Lead the shielded connecting cables through the cable glands ③.
2. Connect the device to the plant with the protective conductor connection ⑥.
3. Connect the wires of the power supply ① to the terminals (+) and (-).  
Take the polarity into account. The device has reverse polarity protection.
4. Connect the shield to the screw of the ground terminal ⑦.  
The screw of the ground terminal is electrically connected to the external protective conductor connection.
5. For devices with intrinsic safety type of protection, use an isolating power supply that corresponds to the requirements of the relevant type of protection.

6.9 Connecting the SITRANS TF dual chamber housing

6. Connect the input terminals ⑤.

<p>2-wire, 3-wire or 4-wire RTD or linear resistance I1: Input 1</p>	<p>TC (internal CJC or external 2-wire or 3-wire CJC)</p>	
<p>Voltage input (unipolar or bipolar)</p>	<p>3-wire or 4-wire potentiometer</p>	

7. Close the device.  
Closing the device (Page 105)

### 6.9.3 Connecting the SITRANS TF420 dual chamber housing

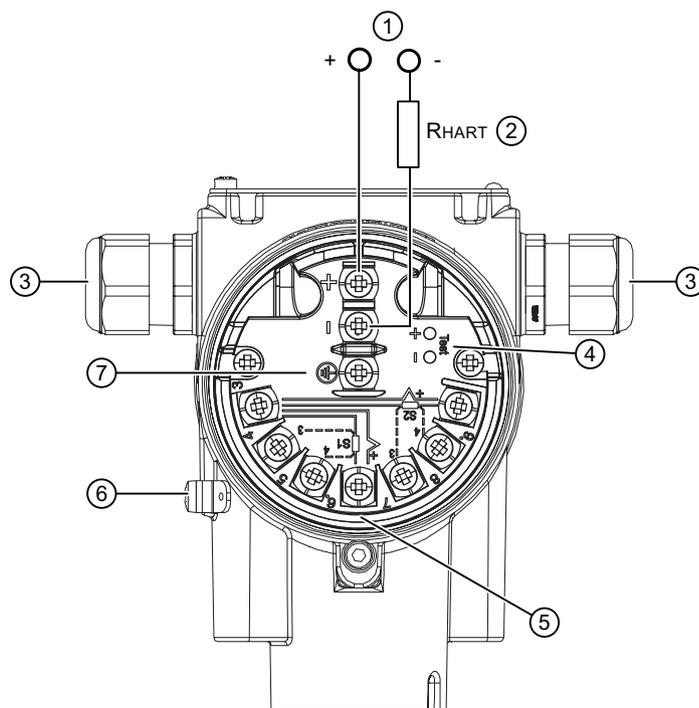
#### Requirement

The device is opened. (Page 100)

If you use stranded wire used, you need a ferrule.

Note the maximum permissible core cross-section (Page 202).

## Procedure



- |   |  |   |                                |
|---|--|---|--------------------------------|
| ① | Supply voltage                         | ⑤ | Input terminals                |
| ② | HART communication resistor (optional) | ⑥ | Protective conductor connector |
| ③ | Cable gland                            | ⑦ | Ground terminal                |
| ④ | Test terminals                         |   |                                |

Figure 6-8 Connecting the device

1. Lead the shielded connecting cables through the cable glands ③.
2. Connect the device to the plant with the protective conductor connection ⑥.
3. Connect the wires of the power supply ① to the terminals (+) and (-). Take the polarity into account. The device has reverse polarity protection.
4. Connect the shield to the screw of the ground terminal ⑦. The screw of the ground terminal is electrically connected to the external protective conductor connection.
5. For devices with intrinsic safety type of protection, use an isolating power supply that corresponds to the requirements of the relevant type of protection.

6.9 Connecting the SITRANS TF dual chamber housing

6. Connect the input terminals ⑤.

<p>Input 1 (I1) and/or input 2 (I2): 2-wire, 3-wire or 4-wire RTD or linear resistance</p>	<p>Input 1 (I1) and/or input 2 (I2): TC (int. CJC or ext. 2-wire, 3-wire or 4-wire CJC)</p>	<p>Input 1 (I1) and/or input 2 (I2): Voltage input (unipolar or bipolar)</p>
<p>Input 1: TC (int. CJC or ext. 2-wire or 3-wire CJC) Input 2: 2-wire, 3-wire or 4-wire RTD</p>	<p>Input 1 (I1) and/or input 2 (I2): 3-wire or 4-wire potentiometer</p>	<p>Input 1 (I1): 5-wire potentiometer Input 2 (I2): 3-wire potentiometer</p>

7. Close the device.  
Closing the device (Page 105)

## 6.9.4 Closing the device

### Procedure

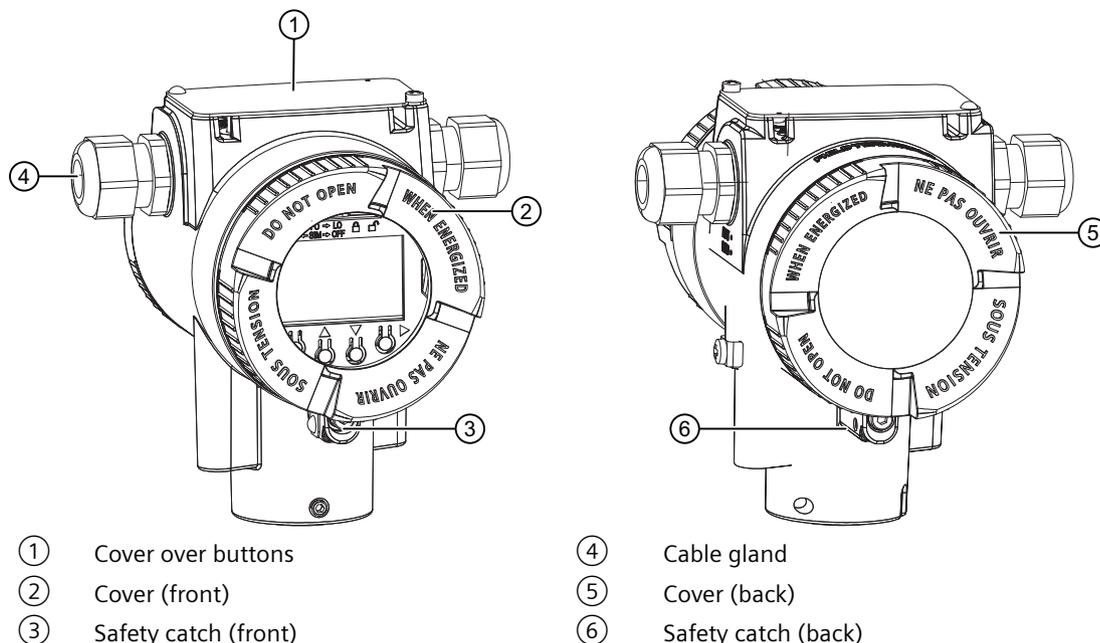


Figure 6-9 Closing the device

1. Screw on the covers ② and ⑥ as far as they will go.
2. Secure both covers with the safety catch ③ or ⑦.
3. Close the cover over the buttons ①.
4. Tighten the screw for the cover over the buttons.
5. Check the tightness of the cable glands ④ in accordance with the degree of protection.

## 6.10 Connect the Han cable socket to the cable

### **⚠ WARNING**

#### **Loss of the safety required for approval by using the Han plug**

You may only use the Han plug for non-Ex devices and for devices with intrinsic safety "Ex i"; otherwise, the safety required for the approval is not guaranteed.

### **Note**

Observe the protection class of the Han plug when defining the protection class.

The contact parts for the cable socket are supplied.

6.11 Connect M12 cable socket to the cable

For devices with a Han plug mounted on the enclosure, make the connection via the cable socket.

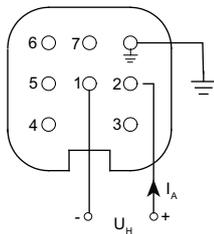
**Requirement**

- The terminal area of the cable socket is suitable for cables with diameters ranging from 6 to 12 mm.
- These cables use stranded wires with 1 mm<sup>2</sup> as single conductors ("+", "-" and ground).
- You are using a crimping tool from HARTING (article number 09 99 000 0110).

**Procedure**

1. Slide the sleeve and the screwed joint on the cable.
2. Strip approx. 8 mm of the cable ends.
3. Crimp the contact parts on the cable ends.
4. Assemble the cable socket.

**Connector pin assignment with Han 7D or Han 8D plug or cable socket**



I<sub>A</sub>    Output current  
U<sub>H</sub>    Auxiliary power

**6.11      Connect M12 cable socket to the cable**

 <b>WARNING</b>
<b>Loss of safety required for approval by using the M12 device plug.</b>
You may only use the plug for non-Ex devices; otherwise, the safety required for the approval is not guaranteed.

**Note**

A conductive connection must not exist between the shield and the connector housing.

**Note**

Observe the protection class of the M12 device plug when defining the protection class.

In devices where a plug is already mounted on the enclosure, the connection is made via a cable socket.

1. Thread the parts of the cable socket as described by the manufacturer of the cable socket.
2. Strip approximately 18 mm of the bus cable ①.
3. Twist the shield.
4. Thread the shield in the insulating sleeve.
5. Draw 8 mm of shrink sleeve over the cable, wires and shield up to the reference edge ②.
6. Screw the cable ends and the shield in the pin insert.
7. Fasten the parts of the cable socket as described by the manufacturer.

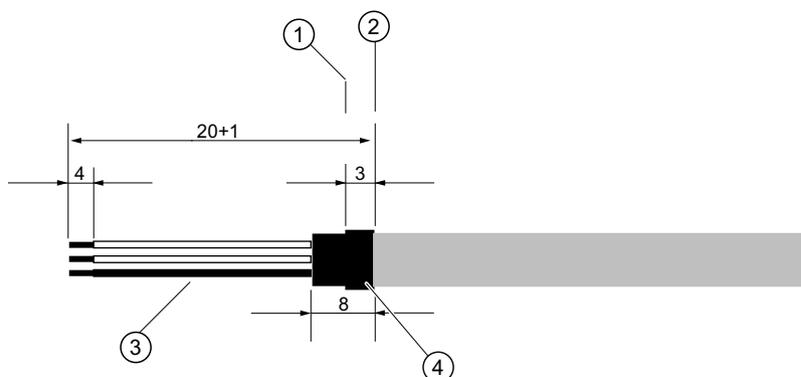
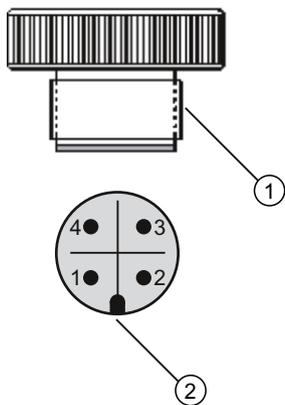


Figure 6-10 Preparing the connecting cable

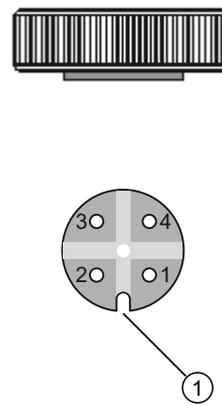
- |   |  |   |                                   |
|---|--|---|-----------------------------------|
| ① | Reference edge for stripping                                       | ③ | Insulating sleeve over the shield |
| ② | Reference edge for the dimension specifications for cable assembly | ④ | Shrink sleeve                     |

Assignment



Layout for M12 device plug

- ① M12 x 1 thread
- ② Positioning catch
- 1 +
- 2 Not connected
- 3 -
- 4 Shield



Assignment diagram M12-cable socket

- ① Positioning slot
  - 1 +
  - 2 Not connected
  - 3 -
  - 4 Shield
- Middle contact of the cable socket not connected

## Operating (SITRANS TF)

### 7.1 Local operation

#### 7.1.1 Buttons

##### 7.1.1.1 Single chamber housing buttons

The four buttons are located below the local display.

To access the buttons, remove the cover.

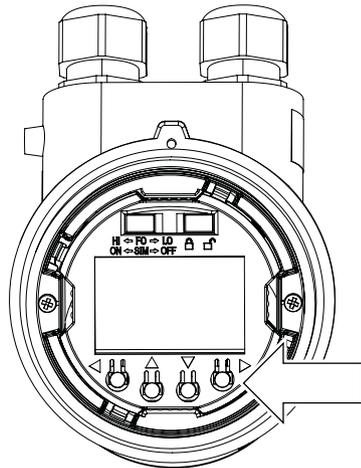


Figure 7-1 Single chamber housing with open cover

### 7.1.1.2 Dual chamber housing buttons

The four buttons are located below the cover:

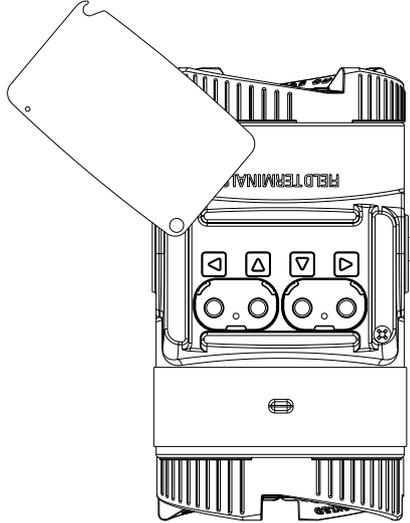


Figure 7-2 Top view

## 7.1.2 Operating the device with display

### 7.1.2.1 Navigating in the views

You navigate in the views with the buttons:

AUTOHOTPOT

Example

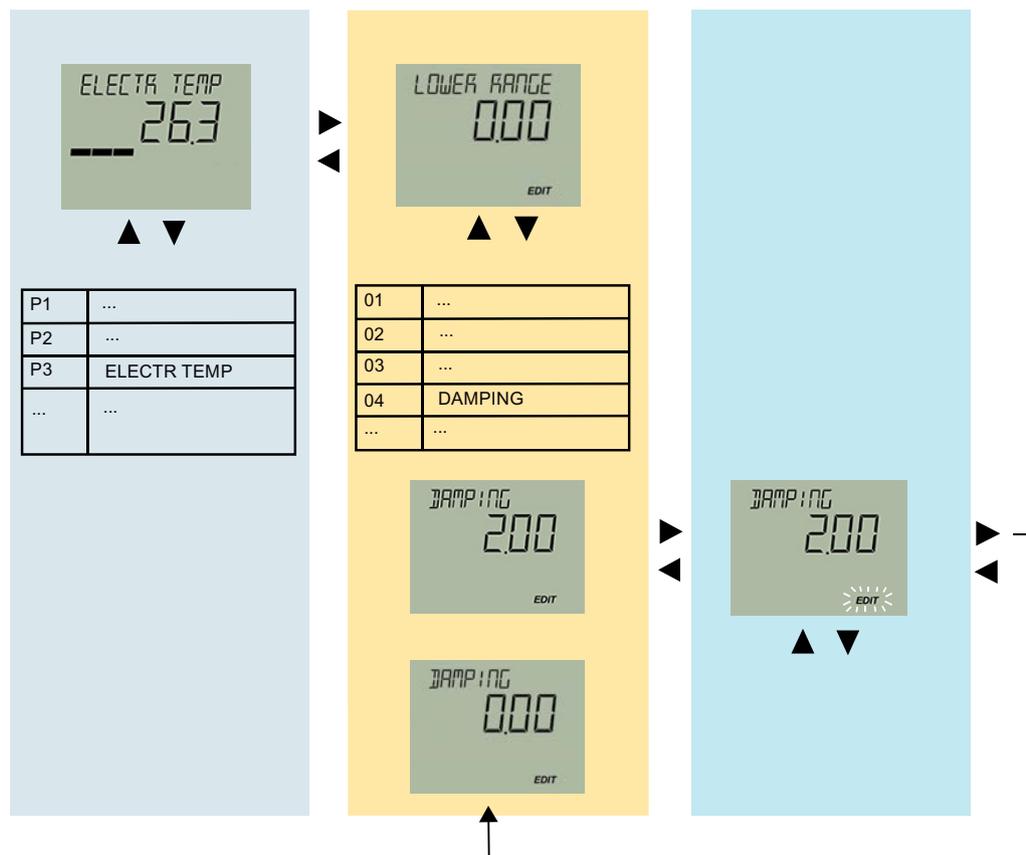


Figure 7-3 The colors represent three different views: Measured value view, parameter view and edit view

See also

Buttons (Page 109)

7.1.2.2 Measurement view

Measurement view

The measurement view shows the current measured values as well as status and diagnostic messages:



- ① Name and unit of the measured value (alternating)
- ② Measured value
- ③ Measured value ID
- ④ Bar display

Figure 7-4 Example of measurement view

① shows the name of the measured value and the set unit as alternating values.

Measured value IDs ③ start with "P".

The bar display shows the following information:

- Measured value ID P1: The position of a measured value within the set measuring span.
- Measured value ID P2 and P3: The position of the measured value within the sensor limits.

Display of measured values

The following measured values are displayed:

Measured value ID	Visualization on the display	Meaning
P1	PV	Measured value of the primary variable
P2	INPUT 1	Measured value at input 1
P3	INPUT 2	Measured value at input 2 for devices with two inputs
P4	CURRENT OUT	Analog current of the primary variable
P5	ELECTR TEMP	Electronics temperature

Navigating in the measurement view

Requirement

You have disabled the button lock.

Disabling button lock (Page 164)

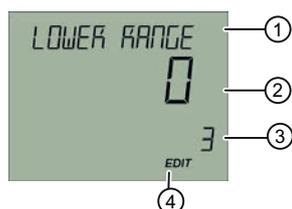
## Procedure

1. Use the ▲ and ▼ buttons to navigate in the measurement view.
2. To switch to the parameter view, press the ► button.

### 7.1.2.3 Parameter view

#### Parameter view

The parameter view shows the parameters, parameter values and the wizards of the device.



- ① Name and unit of the parameter (alternating)
- ② Parameter value
- ③ Parameter ID
- ④ "EDIT" symbol (permanently enabled)

Figure 7-5 Example of parameter view

For parameters with an associated unit, the parameter name and unit are displayed as alternating values in ①. Example: Lower range value in °C.

#### List of parameters on the display

The parameters are displayed with parameter ID and parameter name.

Depending on the parameter settings or the device version of your device, some parameters are not visible.

Parameter ID	Parameter name on the display	Meaning
01	TYPE INPUT 1	Input type 1
02	WIRING 1	Connection type for input 1
03	WIRE RES 1	Wire resistance for connecting cable at Input 1
04	TYPE INPUT 2	Input type 2
05	WIRING 2	Connection type for input 2
06	WIRE RES 2	Wire resistance for connecting cable at Input 2
07	PV MAPPING	Assignment of the primary variable
08	UNITS	Set unit of the primary variable
09	LOWER RANGE	Set the lower range value of the primary variable
10	UPPER RANGE	Set upper range value of the primary variable
11	DAMPING	Damping value
12	FUNCT SAFETY	Enable and disable Functional Safety

7.1 Local operation

Parameter ID	Parameter name on the display	Meaning
13	LOOP TEST	Loop test
14	TRIM INPUT 1	One-point calibration input 1
15	TRIM INPUT 2	One-point calibration input 2
16	CHANGE PIN	Change User PIN
17	PIN RECOVERY	PIN recovery
18	USER PIN	Enable and disable User PIN
19	MIN INPUT 1	Minimum measured peak value at Input 1
20	MAX INPUT 1	Maximum measured peak value at input 1
21	MIN INPUT 2	Minimum measured peak value at input 2
22	MAX INPUT 2	Maximum measured peak value at Input 2
23	MIN ETEMP	Minimum transmitter electronics temperature
24	MAX ETEMP	Maximum transmitter electronics temperature
25	BUTTON LOCK	Enable and disable button lock

The parameter ID is written after the parameter name in parentheses from here on out. Example: Parameter "Damping value" [11].

**Navigating in the parameter view**

**Requirement**

The button lock is disabled.  
 Disabling button lock (Page 164)

**Procedure**

1. Use the ▲ or ▼ buttons to navigate within the parameters.  
 To navigate faster, keep the ▲ or ▼ button pressed.  
 After the last parameter, you jump to the first parameter, and vice versa.
2. To switch to edit view, press the ► button.
3. To return to the measurement view, press the ◀ button.

**7.1.2.4 Edit view**

You change the parameter values in the edit view. Wizards are available for specific parameters.

**Parameter values**

There are various parameter values:

- Enumerations (e.g. unit type)
- Numerical values (e.g. damping)

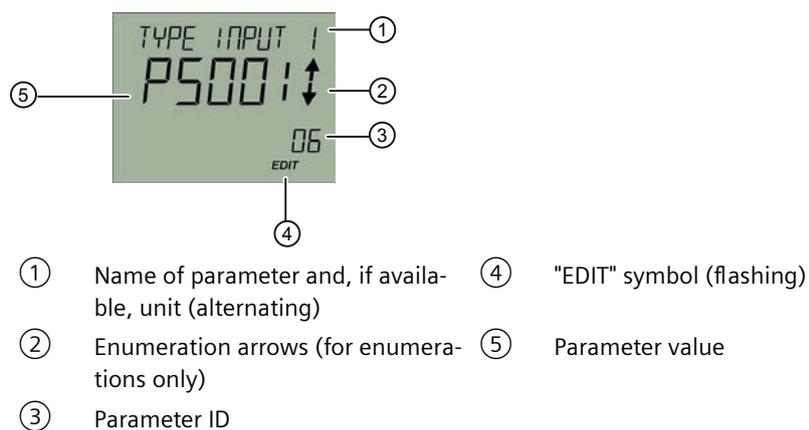


Figure 7-6 Example of edit view

For parameters with an associated unit, the parameter name and unit are displayed as alternating values in ①. Example: Lower range value in °C.

## See also

Disabling button lock (Page 164)

## Changing parameter values

### Requirement

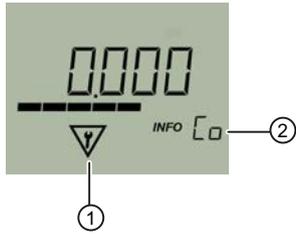
The device is not write-protected.

For information on write protection, refer to section Locking the device (Page 116).

### Procedure

1. Navigate to the parameter view (Page 110).
2. Select the desired parameter with the ▲ or ▼ button. Use the ► button to confirm. You are in the edit view.
3. Change the parameter value with the ▲ or ▼ button. To navigate faster, keep the ▲ or ▼ button pressed.
4. Save the change with the ► button. Or, cancel the change with the ◀ button.

### 7.1.2.5 Device status display



- ① Symbol - NAMUR NE 107
- ② Diagnostics ID

Figure 7-7 Example

For additional information about symbols and the diagnostic messages, refer to Diagnostics and troubleshooting (Page 191).

## 7.2 Remote operation

You can operate the device using HART communication. The following is required for this purpose:

- A handheld (e.g. FC475) or PC software such as SIMATIC PDM.
- A HART modem to connect a PC with the device or a lead to connect the handheld with the device.

### See also

SIMATIC PDM (Page 229)

## 7.3 Locking the device

### 7.3.1 Introduction

The following options are available to lock the device:

- Enable write protection using switch.
- Enable write protection using the User PIN.
- Enable write protection using the button lock.

Write protection	Sym- bol	ID	Read measured values on the display	Read parameters on the display	Change parameters via the device with display
Switch enabled	🔒	L	Yes	Yes	No
User PIN <sup>1)</sup> enabled		LP	Yes	Yes	Yes, after input of the user PIN
Button lock enabled		LL	Yes	No	No

<sup>1)</sup>The user PIN is factory set to 2457 in the device. When delivered, write protection is disabled using the user PIN.

#### Devices with functional safety

To enable functional safety, first enable the User PIN.

### 7.3.2 Enable write protection with write protection switch

#### Introduction

The write protection switch is used for enabling write protection.

#### Procedure

1. Unscrew the cover.
2. Slide the write protection switch to the closed lock position.

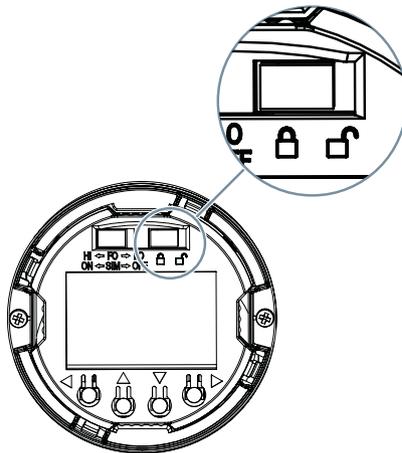


Figure 7-8 Enable write protection using the write protection switch

#### Result

When the write protection switch is set to the closed lock position, measured values and parameters can be read.

### 7.3.3 Enable the User PIN on the display

#### Requirement

The User PIN is disabled.

#### Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. Select the parameter "User PIN".
3. Use the ► button to confirm.  
The message "USER PIN ON" (User PIN enabled) appears for 2 seconds.

#### Result



### 7.3.4 Enable the button lock on the display

#### Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. In the parameter view, select the "Button lock" parameter.
3. Press the ► button.  
The "EDIT" symbol flashes.
4. Select ON with the ▲ or ▼ button.



5. Use the ► button to confirm.

## Result

- The display automatically returns to the measurement view.
- The display automatically changes between the measured values every 12 seconds.
- The symbol for button lock "LL" and the measured value ID are displayed alternately.



# Commissioning

## 8.1 Basic safety notes

 <b>WARNING</b>
<b>Improper commissioning in hazardous areas</b> Device failure or risk of explosion in hazardous areas. <ul style="list-style-type: none"><li>• Do not commission the device until it has been mounted completely and connected in accordance with the information in Technical data (Page 199).</li><li>• Before commissioning take the effect on other devices in the system into account.</li></ul>

 <b>WARNING</b>
<b>Commissioning and operation with pending error</b> If an error message appears, correct operation in the process is no longer guaranteed. <ul style="list-style-type: none"><li>• Check the gravity of the error.</li><li>• Correct the error.</li><li>• If the error still exists:<ul style="list-style-type: none"><li>– Take the device out of operation.</li><li>– Prevent renewed commissioning.</li></ul></li></ul>

## 8.2 SITRANS TH100 Commissioning

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. If you want to change the factory settings, configure the device using the USB modem and the SIPROM T parameter assignment software.  
Parameter assignment with USB modem and SIPROM T (Page 143)
2. Mount or install the device depending on the application.  
Installing SITRANS TH in a connection head (Page 69)  
Mounting SITRANS TH100/320/420 on DIN rail and G rail (Page 71)
3. Connect the device.  
Connecting the TH100 (Page 83)
4. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
5. Switch on the power supply.  
Switching on the supply voltage (Page 133)
6. Wait for 10 seconds.  
After this startup time, the device is operational.
7. Wait 5 minutes to get exact measured values.

### See also

Structure (Page 34)

## 8.3 Commissioning SITRANS TH100 Slim

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. If you want to change the factory settings, configure the device using the USB modem and the SIPROM T parameter assignment software.  
Parameter assignment with USB modem and SIPROM T (Page 143)
2. Mount or install the device depending on the application.
3. Connect the device.  
Connecting TH100 Slim (Page 84)

4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 10 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.

## 8.4 Commissioning SITRANS TH320 with 4 to 20 mA

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. If you want to change the factory settings, configure the device using the USB modem and the SIPROM T parameter assignment software.  
Parameter assignment with USB modem and SIPROM T (Page 143)
2. Mount or install the device depending on the application.  
Installing SITRANS TH100/320/420 in the base of the connection head (Page 69)  
Mounting SITRANS TH100/320/420 on DIN rail and G rail (Page 71)
3. Connect the device.  
Connecting TH320 (Page 85)
4. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
5. Switch on the power supply.  
Switching on the supply voltage (Page 133)
6. Wait for 2 seconds.  
After this startup time, the device is operational.
7. Wait 5 minutes to get exact measured values.
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

### Result

The LED is lit green.

Structure (Page 39)

## 8.5 Commissioning SITRANS TH320 with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount or install the device depending on the application.  
Installing SITRANS TH100/320/420 in the base of the connection head (Page 69)  
Mounting SITRANS TH100/320/420 on DIN rail and G rail (Page 71)
2. Connect the device.  
Connecting TH320 (Page 85)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 2 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using remote operation.  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

### Result

The LED is lit green.

Structure (Page 39)

## 8.6 Commissioning SITRANS TH420 with HART

### Requirement

You have read the following safety instructions:

- General safety information (Page 29)
- Basic safety information: Installing/mounting (Page 65)
- Basic safety information: Connecting (Page 81)
- Basic safety information: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Install the device.  
Installing SITRANS TH100/320/420 in the base of the connection head (Page 69)  
Mounting SITRANS TH100/320/420 on DIN rail and G rail (Page 71)
2. Connect the device.  
Connecting TH420 (Page 86)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 2 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using remote operation.  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

### Result

The LED is lit green.

Structure (Page 39)

## 8.7 Commissioning SITRANS TR320 with 4 to 20 mA

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. If you want to change the factory settings, configure the device using the USB modem and the SIPROM T parameter assignment software.  
Parameter assignment with USB modem and SIPROM T (Page 143)
2. Mount the device.  
Installing SITRANS TR on DIN rail (Page 72)
3. Connect the device.  
Connecting TR320 (Page 88)
4. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
5. Switch on the power supply.  
Switching on the supply voltage (Page 133)
6. Wait for 2 seconds.  
After this startup time, the device is operational.
7. Wait 5 minutes to get exact measured values.
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

### Result

The LED is lit green.

Structure (Page 48)

## 8.8 Commissioning SITRANS TR320 with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Installing SITRANS TR on DIN rail (Page 72)
2. Connect the device.  
Connecting TR320 (Page 88)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 2 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using remote operation.  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

### Result

The LED is lit green.

Structure (Page 48)

## 8.9 Commissioning SITRANS TR420 with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Installing SITRANS TR on DIN rail (Page 72)
2. Connect the device.  
Connecting TR420 (Page 90)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 2 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using remote operation.  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TH/TR device (Page 176)

### Result

The LED is lit green.

Structure (Page 48)

## 8.10 Commissioning SITRANS TF320 single chamber housing with 4 to 20 mA

### Condition

In this section, you will learn how to commission the device step-by-step.

Before you start, note the following safety notes:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. Mount the device.  
Mounting the SITRANS TF single chamber housing (Page 73)
2. Connect the device.  
Connecting the SITRANS TF320 single chamber housing (Page 93)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 10 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using the buttons (Page 109) or the USB modem and SIPROM T.  
Parameter assignment over device with display (Page 144) or  
Commissioning the USB modem and SIPROM T (Page 134)
8. Lock the device.  
Locking the SITRANS TF device (Page 179)

## 8.11 Commissioning SITRANS TF320 single chamber housing with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Mounting the SITRANS TF single chamber housing (Page 73)
2. Connect the device.  
Connecting the SITRANS TF320 single chamber housing (Page 93)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)
5. Wait for 10 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using the buttons (Page 109) or remote operation.  
Parameter assignment over device with display (Page 144) or  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TF device (Page 179)

## 8.12 Commissioning SITRANS TF420 single chamber housing with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Mounting the SITRANS TF single chamber housing (Page 73)
2. Connect the device.  
Connecting the SITRANS TF420 single chamber housing (Page 96)
3. For devices with intrinsically safe protection type, use an isolating power supply that corresponds to the requirements of the relevant type of protection.
4. Switch on the power supply.  
Switching on the supply voltage (Page 133)

5. Wait for 10 seconds.  
After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.
7. If you want to change the factory settings, configure the device using the buttons (Page 109) or remote operation.  
Parameter assignment over device with display (Page 144) or  
Assigning parameters using remote operation (Page 165)
8. Lock the device.  
Locking the SITRANS TF device (Page 179)

## 8.13 Commissioning SITRANS TF320 dual chamber housing with 4 to 20 mA

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Mounting the SITRANS TF dual chamber housing (Page 74)
2. Connect the device.  
Connecting the SITRANS TF320 dual chamber housing (Page 100)
3. Switch on the power supply.  
Switching on the supply voltage (Page 133)
4. Wait for 2 seconds.  
After this startup time, the device is operational.
5. Wait 5 minutes to get exact measured values.
6. If you want to change the factory settings, configure the device using the buttons (Page 116) or the USB modem and SIPROM T.  
Parameter assignment over device with display (Page 144) or  
Parameter assignment with USB modem and SIPROM T (Page 143)
7. Lock the device.  
Locking the SITRANS TF device (Page 179)

## 8.14 Commissioning SITRANS TF320 dual chamber housing with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

### Procedure

1. Mount the device.  
Mounting the SITRANS TF dual chamber housing (Page 74)
2. Connect the device.  
Connecting the SITRANS TF320 dual chamber housing (Page 100)
3. Switch on the power supply.  
Switching on the supply voltage (Page 133)
4. Wait for 2 seconds.  
After this startup time, the device is operational.
5. Wait 5 minutes to get exact measured values.
6. If you want to change the factory settings, configure the device using the buttons (Page 110) or remote operation.  
Parameter assignment over device with display (Page 144)  
Assigning parameters using remote operation (Page 165)
7. Lock the device.  
Locking the device (Page 116)

## 8.15 Commissioning SITRANS TF420 dual chamber housing with HART

### Condition

You have read the following safety instructions:

- General safety notes (Page 29)
- Basic safety notes: Installing/mounting (Page 65)
- Basic safety notes: Connecting (Page 81)
- Basic safety notes: Commissioning (Page 121)

Read the entire device manual in order to achieve the optimum performance of the device.

## Procedure

1. Mount the device.  
Mounting the SITRANS TF dual chamber housing (Page 74)
2. Connect the device.  
Connecting the SITRANS TF420 dual chamber housing (Page 102)
3. Switch on the power supply.  
Switching on the supply voltage (Page 133)
4. Wait for 2 seconds.  
After this startup time, the device is operational.
5. Wait 5 minutes to get exact measured values.
6. If you want to change the factory settings, configure the device using the buttons (Page 110) or remote operation.  
Parameter assignment over device with display (Page 144)  
Assigning parameters using remote operation (Page 165)
7. Lock the device.  
Locking the device (Page 116)

## 8.16 Switching on the supply voltage

### Requirement

- You have connected the device correctly. (Page 81)
- The terminal voltage on the device is correct. (Page 199)

### Procedure

Switch on the supply voltage.

- Product name and firmware version appear briefly on the display.
- The measured values are shown on the display.  
For a device without a display, you read off the current output as follows:
  - Over the remote control (e.g. SIMATIC PDM).
  - With a DC current measuring device.

## 8.17 Commissioning the USB modem and SIPROM T

### 8.17.1 Fundamental safety instructions

**NOTICE**

**Improper operating conditions**

Device damage.

- Only operate the USB modem under laboratory conditions.
- Observe the environmental requirements in section Technical data (Page 199).
- Only operate the USB modem in a controlled electromagnetic environment. Do not use radio transmitters, such as mobile phones, in the direct vicinity.
- Do not expose the modem to moisture or direct sunlight.

### 8.17.2 Installing the SIPROM T parameterization software

#### Requirement

- PC with USB port and Windows 10 operating system
- Windows Microsoft .NET Framework 4.5 or higher for Windows 10
- USB modem present

#### Procedure

1. Download the SIPROM T parameter assignment software from the Internet free of charge. (<http://www.siemens.com/processinstrumentation/downloads>)
2. Uninstall the SIPROM T installations from your PC.
3. Before you start the installation, read the information for preparation in the Readme file.
4. Double-click the "setup.exe" file in the SIPROM T software directory.
5. Follow the installation instructions.
6. Download the following USB driver from the Internet: ([http://www.ftdichip.com/Drivers/CDM/CDM20830\\_Setup.exe](http://www.ftdichip.com/Drivers/CDM/CDM20830_Setup.exe))
7. Open the USB driver file.
8. Install the downloaded USB driver.

## Procedure

1. Open the SIPROM T Software directory > USB Driver.
2. Double-click the "CDM20830\_Setup.exe" file.
3. Follow the installation instructions.
4. Open the "Device Manager" in Windows.

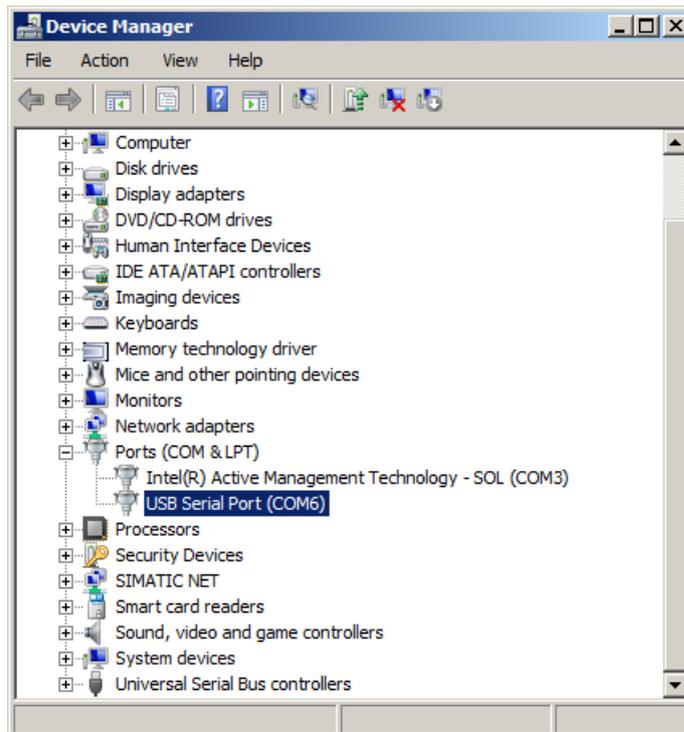


Figure 8-1 Windows Device Manager

5. Double-click "Ports (COM & LPT)".  
The newly installed USB port is named "USB Serial Port (COMx)", where x stands for the COM port number.
6. Note down the COM port number.
7. Open SIPROM T.
8. In the menu, select "Device" > "Settings".
9. Select the noted COM port number from the Windows "Device Manager".
10. Click "OK".

## See also

Uninstalling USB drivers (Page 185)

### 8.17.3 Connecting USB modem

#### Procedure

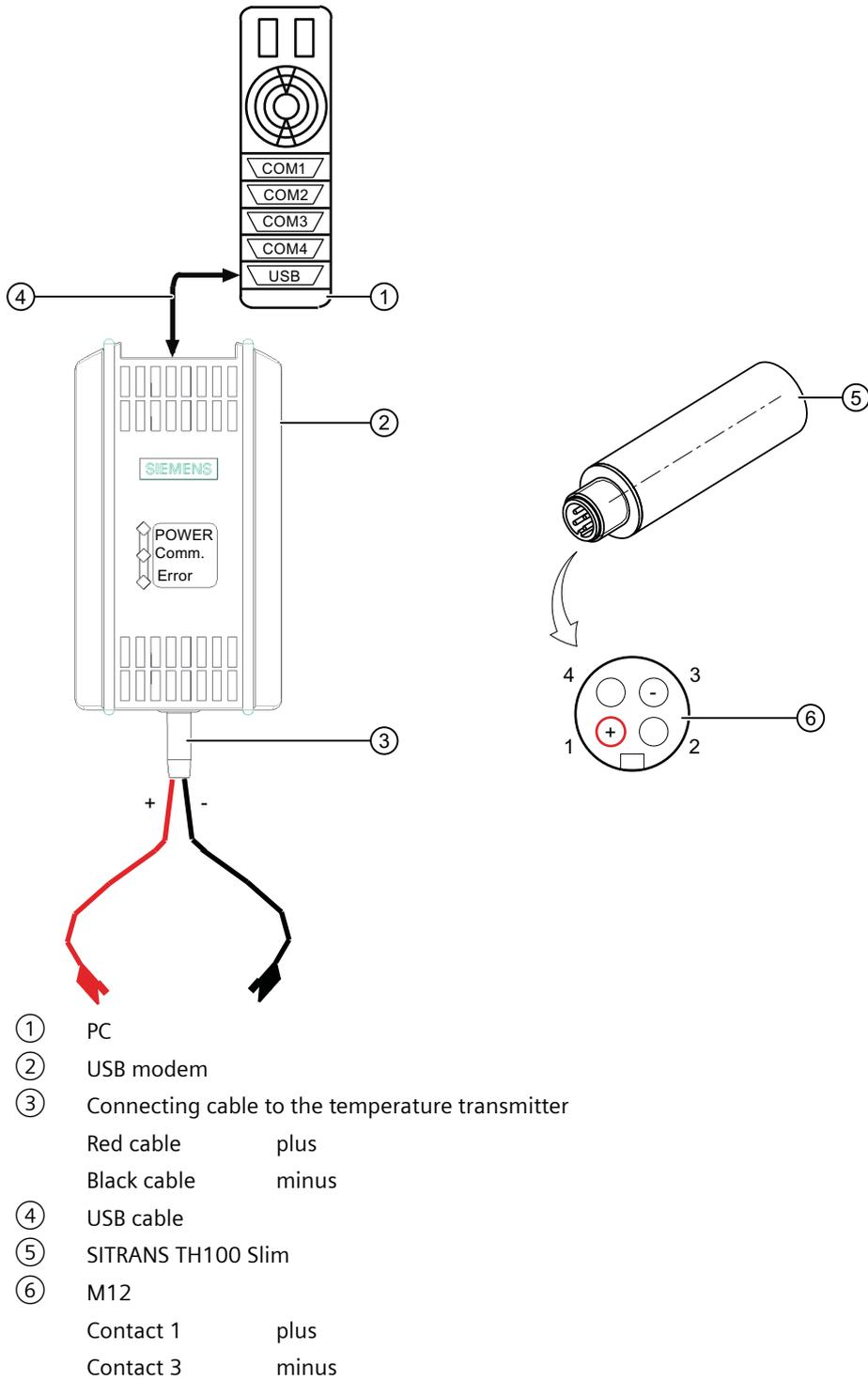


Figure 8-2 Connecting USB modem

1. Connect the USB modem ② to your PC ① using the USB cable ④.
2. Connect the USB modem to the temperature transmitter using the connecting cable ③.



## Parameter assignment

### 9.1 Overview of parameters and functions

#### Introduction

You can operate the device via local operation or remote operation (e.g. SIMATIC PDM).

- The parameters that you can reach over the device with a display are marked by the parameter ID. Hereinafter, the parameter ID is always written inside parentheses after the parameter name. Example: Parameter "Damping value" [04].
- You can access the complete number of parameters via remote operation. The device-specific parameters are available in each tool for configuration. The instructions or online help for these tools will provide you with information on how to use the different tools for parameter assignment.

#### 9.1.1 Parameters and functions

##### List of parameters and functions

The following parameters are available via the local operation and via remote operation (e.g. SIMATIC PDM).

The parameters are grouped according to their function in the following overview:

Quick start	SIMATIC PDM	Device with display (local operation)
"Quick Start" wizard	Menu command "Device > Wizard > Wizard - Quick start..."	-

Current output	SIMATIC PDM	Device with display (local operation)
Set input type	"Settings > Sensor settings" parameter group	Input type 1 [01] (Page 144) / Input type 2 [04] (Page 148)
Set wiring configuration	"Settings > Sensor settings" parameter group	Connection type for input 1 [02] (Page 148) / Connection type for input 2 [05] (Page 151)
Set lower range value Set upper range value	"Settings > Current output" parameter group	Lower range value [09]/Upper range value [10] (Page 154)
Lower range current Upper range current	"Settings > Current output" parameter group	-
Set damping value	"Settings > Sensor settings" parameter group	Damping value [11] (Page 155)

9.1 Overview of parameters and functions

Current output	SIMATIC PDM	Device with display (local operation)
Set current output	"Settings > Current output" parameter group	-
Set saturation limits	"Settings > Current output" parameter group	-
Loop test	Menu command "Device > Loop test"	Loop test [13] (Page 156)

Application	SIMATIC PDM	Device with display (local operation)
Select unit	"Settings > Sensor settings" parameter group	Unit [08] (Page 153)
Set the linearization table (60 breakpoints)	"Settings > Sensor settings" parameter group	-
Set the spline curve (40 breakpoints)	"Settings > Sensor settings" parameter group	-
Change Callendar-Van Dusen coefficients	"Settings > Sensor settings" parameter group	-

Calibration	SIMATIC PDM	Device with display (local operation)
One-point calibration	Menu command "Maintenance > Calibration"	One-point calibration input 1 [14] (Page 158) / One-point calibration input 2 [15] (Page 158)
Two-point calibration	Menu command "Maintenance > Calibration"	-

Identification	SIMATIC PDM	Device with display (local operation)
Read and configure identification data of your device	"Identification" parameter group	-

Maintenance and diagnostics	SIMATIC PDM	Device with display (local operation)
Set fault current for input and output	"Maintenance and diagnostics > Measuring range check mode" parameter group	-
Set fault current for sensor error detection	"Maintenance and diagnostics > Error detection" parameter group	-
Set fault current for drift detection	"Maintenance and diagnostics > Drift detection" parameter group	-
Display of the diagnostics	Menu command "Diagnostics > Diagnostics"	-
Limit monitoring and event counter	Menu command "Diagnostics > Device status"	-

## 9.1 Overview of parameters and functions

Maintenance and diagnostics	SIMATIC PDM	Device with display (local operation)
Calibration	Menu command "Maintenance > Calibration"	One-point calibration input 1 [14] (Page 158) / One-point calibration input 2 [15] (Page 158)
Display operating time	Menu command "Diagnostics > Operating time"	-
Display peak values Reset peak values	"Diagnostics > Peak values" parameter group	Minimum measured peak value at Input 1 [19] (Page 162) / Maximum measured peak value at Input 1 [20] (Page 162) / Minimum measured peak value at Input 2 [21] (Page 163) / Maximum measured peak value at Input 2 [22] (Page 163)

HART communication	SIMATIC PDM	Device with display (local operation)
Configure HART address	Menu command "Device > Assign address and tag"	-
Select PV selector Select SV selector Select TV selector Select QV selector	"Settings > Assignment of dynamic variables" parameter group	-

Write protection	SIMATIC PDM	Device with display (local operation)
Enable and disable user PIN	Menu command "Device > Security"	Enable user PIN (Page 161) / Disable user PIN (Page 161)
Change user PIN	Menu command "Device > Security > Change user PIN"	Change user PIN (Page 158)
PIN recovery	-	PIN recovery [17] (Page 159)
Enable and disable button lock	-	Enabling button lock (Page 164) / Disabling button lock (Page 164)

Reset	SIMATIC PDM	Device with display (local operation)
Device restart	Menu command "Device > Device restart"	-
Factory reset	Menu command "Device > Reset > Factory reset"	-
Reset to sensor calibration	Menu command "Device > Reset > Reset to sensor calibration"	-

## Functional Safety

The following additional functionality is available for devices with Functional Safety:

Functional Safety	SIMATIC PDM	Device with display (local operation)
Enable and disable Functional Safety	Menu command "Device > Functional Safety"	Functional Safety Manual (Page 25)

### 9.1.2 Advanced functions

#### Description

Function	Description
Difference	The analog output signal is proportional to the difference between the measured values of sensors 1 and 2.
Average value measurement	The analog output signal is proportional to the average value of the measured values of sensors 1 and 2.
Max.	The analog output signal is proportional to the sensor with the highest value.
Min.	The analog output signal is proportional to the sensor with the lowest value.
Sensor drift	When the difference of the measured values between sensor 1 and sensor 2 exceeds a defined limit, a sensor drift warning or sensor drift error is displayed.
Redundancy (hot backup)	The analog output signal is proportional to the primary sensor (sensor 1 or sensor 2) as long as no error is detected and the input is within the user-defined limit. If an error is detected at the primary sensor or the sensor 1 value is outside the user-specific limit, the analog output signal becomes proportional to the redundant sensor (sensor 1 or sensor 2) and a warning is generated.
User-specific linearization - Callendar-Van Dusen coefficients	Supports the change of the Callendar-Van Dusen coefficients.
Custom type - Linearization table	Supports the input of up to 60 breakpoints.
Custom type - Spline curve	Supports the input of up to 40 breakpoints.
Operating hours counter - Transmitter electronics	Recording of the internal transmitter temperatures during operation, recording time in each of 9 fixed sub-temperature ranges.
Operating hours counter - Sensors	Recording of the sensor measuring temperatures during operation, recording time in each of 9 fixed sub-temperature ranges. The subranges are specified separately for each sensor type.
Peak values - Transmitter electronics	Recording of the minimum and maximum internal transmitter temperature across the entire device lifetime.
Peak values - Sensors	The recording of the min./max. measured values of the sensor(s) is saved. When the measurement configuration is changed, the values are reset.

## 9.2 Parameter assignment with USB modem and SIPROM T

### Requirements

- SITRANS TH100Slim/TH100/TH200/TH320 with 4 to 20 mA
- SITRANS TR200/TR320 with 4 to 20 mA
- SITRANS TF with SITRANS TH200
- SITRANS TF320 with 4 to 20 mA

### Procedure

#### NOTICE

##### Disconnect USB modem

Device damage.

1. Leave the temperature transmitter connected to the USB modem and PC during the parameter assignment operation.
2. After completion of the parameter assignment, wait another 2 seconds before you disconnect the temperature transmitter.

1. Disconnect the temperature transmitter from the 4 to 20 mA current loop.
2. Install the SIPROM T parameter assignment software.  
Installing the SIPROM T parameterization software (Page 134)
3. Install the USB driver.  
Installing the SIPROM T parameterization software (Page 134)
4. Connect the USB modem and the temperature transmitter to your PC.  
Connecting USB modem (Page 136)
  - The Power LED is lit green.  
Meaning of LEDs on the USB modem (Page 63)
5. Open SIPROM T.
6. Select the menu command "Device > Read from device".
7. Assign the temperature transmitter parameters.
8. Select the menu command "Device" > "Write to device".
9. Wait at least 2 seconds before you disconnect the temperature transmitter.

### See also

Identification (Page 166)

User-specific type (Page 166)

Set the linearization table (60 breakpoints) (Page 168)

Set the spline curve (40 breakpoints) (Page 168)

9.3 Parameter assignment over device with display

- Sensor calibration (Page 168)
- Transmitter sensor matching (Page 171)
- Operating hours counter (Page 172)
- Current output (Page 173)

## 9.3 Parameter assignment over device with display

### Introduction

This section describes all parameters that you can reach over the device with a display.

You will find information on operating the device with display in the section Operating the device with display (Page 110).

You can find the list of available parameters with ID and parameter name in the section List of parameters on the display (Page 113).

### 9.3.1 Input type 1 [01]

Selects the input type 1.

	Indication on the display	Meaning
Setting range:	P100I	Pt100 - IEC 751
	P500I	Pt500 - IEC 751
	P1k I	Pt 1000 - IEC 751
	TC B	TC Type B - IEC 584
	TC E	TC Type E - IEC 584
	TC J	TC Type J - IEC 584
	TC K	TC Type K - IEC 584
	TC N	TC Type N - IEC 584
	TC R	TC Type R - IEC 584
	TC S	TC Type S - IEC 584
	TC T	TC Type T - IEC 584
	TC L	TC Type L - IEC 584
	TC U	TC Type U - DIN 43710
Factory setting:	P100I	Pt100 - IEC 751

You can select all input types via remote operation.

## 9.3 Parameter assignment over device with display

	Remote operation	Indication on the display	Meaning
Setting range:	Ohm	OHM	Ohm
	kOhm	KOHM	kiloOhms
	Calibrated RTD - Callendar-Van Dusen	CVD	Calibrated RTD - Callendar-Van Dusen coefficients
	Potentiometers	POT	Potentiometers
	RTD Pt $x$ - IEC 751, $10 \leq x \leq 10,000$	PTX I	RTD Pt $x$ <sup>1)</sup> - IEC751, $10 \leq x \leq 10,000$ <sup>1)</sup>
	RTD Pt50 - IEC 751	P50 I	RTD Pt50 - IEC 751
	RTD Pt100 - IEC 751	P100I	RTD Pt100 - IEC 751
	RTD Pt200 - IEC 751	P200I	RTD Pt200 - IEC751
	RTD Pt500 - IEC 751	P500I	RTD Pt500 - IEC 751
	RTD Pt1000 - IEC 751	P1k I	RTD Pt1000 - IEC 751
	RTD Pt $x$ - JIS C1604-81, $10 \leq x \leq 10,000$	PTX J	RTD Pt $x$ <sup>1)</sup> - JIS C1604-81, $10 \leq x \leq 10,000$ <sup>1)</sup>
	RTD Pt50 – JIS C1604-81 (R100/R0 = 1.3916)	P50 J	RTD Pt50 – JIS C1604-81 (R100/R0 = 1.3916)
	RTD Pt100 - JIS C1604-81 (R100/R0 = 1.3916)	P100J	RTD Pt100 - JIS C1604-81 (R100/R0 = 1.3916)
	RTD Pt200 - JIS C1604-81 (R100/R0 = 1.3916)	P200J	RTD Pt200 - JIS C1604-81 (R100/R0 = 1.3916)
	RTD Ni $x$ - DIN 43760, $10 \leq x \leq 10,000$	NIX D	RTD Ni $x$ <sup>1)</sup> - DIN 43760, $10 \leq x \leq 10,000$ <sup>1)</sup>
	RTD Ni50 - DIN 43760	N50 D	RTD Ni50 - DIN 43760
	RTD Ni100 - DIN 43760	N100D	RTD Ni100 - DIN 43760
	RTD Ni120 - DIN 43760	N120D	RTD Ni120 - DIN 43760
	RTD Ni1000 - DIN 43760	N1k D	RTD Ni1000 - DIN 43760
	RTD Cu $x$ - ECW No. 15, $5 \leq x \leq 1,000$	CUX E	RTD Cu $x$ <sup>1)</sup> - ECW No. 15, $5 \leq x \leq 1,000$
	RTD Cu10 - ECW No. 15 ( $\alpha = 0.00427$ )	C10 E	RTD Cu10 - ECW No. 15 ( $\alpha = 0.00427$ )
	RTD Cu100 - ECW No. 15 ( $\alpha = 0.00427$ )	C100E	RTD Cu100 - ECW No. 15 ( $\alpha = 0.00427$ )
	RTD Cu50 - GOST 6651-1994 ( $\alpha = 0.00426$ )	C50G1	RTD Cu50 - GOST 6651-1994 ( $\alpha = 0.00426$ )
	RTD Cu50 - GOST 6651-2009 ( $\alpha = 0.00428$ )	C50G2	RTD Cu50 - GOST 6651-2009 ( $\alpha = 0.00428$ )
	RTD Cu100 - GOST 6651-2009 ( $\alpha = 0.00428$ )	C1hG2	RTD Cu100 - GOST 6651-2009 ( $\alpha = 0.00428$ )
	RTD Pt50 – GOST 6651-2009 ( $\alpha = 0.00391$ )	P50 G	RTD Pt50 – GOST 6651-2009 ( $\alpha = 0.00391$ )
	RTD Pt100 – GOST 6651-2009 ( $\alpha = 0.00391$ )	P100G	RTD Pt100 – GOST 6651-2009 ( $\alpha = 0.00391$ )
	RTD Cu100 – GOST 6651-1994 ( $\alpha = 0.00426$ )	C1hG1	RTD Cu100 – GOST 6651-1994 ( $\alpha = 0.00426$ )
	RTD Cu $x$ – GOST 6651-1994 ( $\alpha = 0.00426$ )	CUX G	RTD Cu $x$ <sup>1)</sup> – GOST 6651-1994 ( $\alpha = 0.00426$ )

## 9.3 Parameter assignment over device with display

	Remote operation	Indication on the display	Meaning
	RTD Ni <sub>x</sub> – GOST 6651-2009 ( $\alpha = 0.00617$ )	NIX G	RTD Ni <sub>x</sub> <sup>1)</sup> – GOST 6651-2009 ( $\alpha = 0.00617$ )
	RTD Ni50 – GOST 6651-2009 ( $\alpha = 0.00617$ )	N50 G	RTD Ni50 – GOST 6651-2009 ( $\alpha = 0.00617$ )
	RTD Ni100 – GOST 6651-2009 ( $\alpha = 0.00617$ )	N100G	RTD Ni100 – GOST 6651-2009 ( $\alpha = 0.00617$ )
	RTD Cu <sub>x</sub> – GOST 6651-2009 ( $\alpha = 0.00428$ )	CUX G	RTD Cu <sub>x</sub> <sup>1)</sup> – GOST 6651-2009 ( $\alpha = 0.00428$ )
	RTD Pt <sub>x</sub> – GOST 6691-2009 ( $\alpha = 0.00391$ )	PTX G	RTD Pt <sub>x</sub> <sup>1)</sup> – GOST 6691-2009 ( $\alpha = 0.00391$ )
	Micro-Volts unipolar (CUSTOM SPECIFIC)	µV	Micro-Volts unipolar (CUSTOM SPECIFIC)
	Milli-Volts unipolar (CUSTOM SPECIFIC)	mV	Milli-Volts unipolar (CUSTOM SPECIFIC)
	Volts unipolar (CUSTOM SPECIFIC)	V	Volts unipolar (CUSTOM SPECIFIC)
	µV bipolar	µV±	Micro-Volts bipolar
	µV unipolar	µV±	Micro-Volts unipolar
	mV bipolar	mV±	Milli-Volts bipolar
	mV unipolar	mV±	Milli-Volts unipolar
	V bipolar	V±	Volts bipolar
	V unipolar	V±	Volts unipolar
	TC Type B - IEC 584	TC B	Thermocouple Type B - IEC 584
	TC Type E - IEC 584	TC E	Thermocouple Type E - IEC 584
	TC Type J - IEC 584	TC J	Thermocouple Type J - IEC 584
	TC Type K - IEC 584	TC K	Thermocouple Type K - IEC 584
	TC Type L - DIN 43710	TC L	Thermocouple Type L - DIN 43710
	TC Type Lr - GOST 3044-84	TC LR	Thermocouple Type Lr - GOST 3044-84
	TC Type N - IEC 584	TC N	Thermocouple Type N - IEC 584
	TC Type R - IEC 584	TC R	Thermocouple Type R - IEC 584
	TC Type S - IEC 584	TC S	Thermocouple Type S - IEC 584
	TC Type T - IEC 584	TC T	Thermocouple Type T - IEC 584
	TC Type U - DIN 43710	TC U	Thermocouple Type U - DIN 43710
	TC Type W3 - ASTM E 988	TC W3	Thermocouple Type W3 - ASTM E 988
	TC Type W5 - ASTM E 988	TC W5	Thermocouple Type W5 - ASTM E 988
	Custom type	CUSTOM	Custom type
Factory set- ting:	RTD Pt100 - IEC 751	P100I	Pt100 - IEC 751

<sup>1)</sup> Value x matches customer RTD value

### 9.3.2 Connection type for input 1 [02]

Selects the connection type for input 1 depending on the selected sensor.

Indication on the display	WIRING 1
Setting range:	2, 3, 4-wire
Factory setting:	3-wire

### 9.3.3 Wire resistance for connecting cable at Input 1 [03]

Requirement: Connection type 2-wire

Selects the wire resistance for Input 1.

Indication on the display	WIRE RES 1
Setting range:	0 to 100 $\Omega$
Factory setting:	0 $\Omega$

### 9.3.4 Input type 2 [04]

Selects the input type 2.

Setting range:	Display	Meaning
	NONE	No input type selected
	P100I	Pt100 IEC751
	P500I	Pt500 IEC751
	P1k I	Pt1000 IEC751
	TC B <sup>1)</sup>	Thermocouple Type B IEC 584
	TC E <sup>1)</sup>	Thermocouple Type E IEC 584
	TC J <sup>1)</sup>	Thermocouple Type J IEC 584
	TC K <sup>1)</sup>	Thermocouple Type K IEC 584
	TC N <sup>1)</sup>	Thermocouple Type N IEC 584
	TC R <sup>1)</sup>	Thermocouple Type R IEC 584
	TC S <sup>1)</sup>	Thermocouple Type S IEC 584
	TC T <sup>1)</sup>	Thermocouple Type T IEC 584
	TC L <sup>1)</sup>	Thermocouple Type L IEC 584
Factory setting:	NONE	No input type selected

<sup>1)</sup> Can only be selected when the input type TC was also selected for input 1.

You can select all input types via remote operation.

## Parameter assignment

### 9.3 Parameter assignment over device with display

Setting range:	Remote operation	Indication on the display	Meaning
	Ohms	OHM	Ohm
	kiloOhms	KOHM	kiloOhms
	Calibrated RTD - Cal Van Dusen	CVD	Calibrated RTD - Cal Van Dusen
	Potentiometers	POT	Potentiometers
	RTD Ptx - IEC 751, $10 \leq x \leq 10.000$	PTX I	RTD Ptx - IEC751, $10 \leq x \leq 10,000^{1)}$
	RTD Pt50 - IEC 751	P50 I	RTD Pt50 - IEC 751
	RTD Pt100 - IEC 751	P100I	RTD Pt100 - IEC 751
	RTD Pt200 - IEC 751	P200I	RTD Pt200 - IEC751
	RTD Pt500 - IEC 751	P500I	RTD Pt500 - IEC 751
	RTD Pt1000 - IEC 751	P1k I	RTD Pt1000 - IEC 751
	RTD Ptx - JIS C1604-81, $10 \leq x \leq 10,000$	PTX J	RTD Ptx - JIS C1604-81, $10 \leq x \leq 10,000^{1)}$
	RTD Pt50 – JIS C1604-81 (R100/R0 = 1.3916)	P50 J	RTD Pt50 – JIS C1604-81 (R100/R0 = 1.3916)
	RTD Pt100 - JIS C1604-81 (R100/R0 = 1.3916)	P100J	RTD Pt100 - JIS C1604-81 (R100/R0 = 1.3916)
	RTD Pt200 - JIS C1604-81 (R100/R0 = 1.3916)	P200J	RTD Pt200 - JIS C1604-81 (R100/R0 = 1.3916)
	RTD Nix - DIN 43760, $10 \leq x \leq 10,000$	NIX D	RTD Nix - DIN 43760, $10 \leq x \leq 10,000^{1)}$
	RTD Ni50 - DIN 43760	N50 D	RTD Ni50 - DIN 43760
	RTD Ni100 - DIN 43760	N100D	RTD Ni100 - DIN 43760
	RTD Ni120 - DIN 43760	N120D	RTD Ni120 - DIN 43760
	RTD Ni1000 - DIN 43760	N1k D	RTD Ni1000 - DIN 43760
	RTD Cux - ECW No. 15, $5 \leq x \leq 1,000$	CUX E	RTD Cux - ECW No. 15, $5 \leq x \leq 1,000^{1)}$
	RTD Cu10 - ECW No. 15 ( $\alpha = 0.00427$ )	C10 E	RTD Cu10 - ECW No. 15 ( $\alpha = 0.00427$ )
	RTD Cu100 - ECW No. 15 ( $\alpha = 0.00427$ )	C100E	RTD Cu100 - ECW No. 15 ( $\alpha = 0.00427$ )
	RTD Cu50 - GOST 6651-1994 ( $\alpha = 0.00426$ )	C50G1	RTD Cu50 - GOST 6651-1994 ( $\alpha = 0.00426$ )
	RTD Cu50 - GOST 6651-2009 ( $\alpha = 0.00428$ )	C50G2	RTD Cu50 - GOST 6651-2009 ( $\alpha = 0.00428$ )
	RTD Cu100 - GOST 6651-2009 ( $\alpha = 0.00428$ )	C1hG2	RTD Cu100 - GOST 6651-2009 ( $\alpha = 0.00428$ )
	RTD Pt50 – GOST 6651-2009 ( $\alpha = 0.00391$ )	P50 G	RTD Pt50 – GOST 6651-2009 ( $\alpha = 0.00391$ )
	RTD Pt100 – GOST 6651-2009 ( $\alpha = 0.00391$ )	P100G	RTD Pt100 – GOST 6651-2009 ( $\alpha = 0.00391$ )
	RTD Cu100 – GOST 6651-1994 ( $\alpha = 0.00426$ )	C1hG1	RTD Cu100 – GOST 6651-1994 ( $\alpha = 0.00426$ )
	RTD Cux – GOST 6651-1994 ( $\alpha = 0.00426$ )	CUX G	RTD Cux – GOST 6651-1994 ( $\alpha = 0.00426^{1)}$
	RTD Nix – GOST 6651-2009 ( $\alpha = 0.00617$ )	NIX G	RTD Nix – GOST 6651-2009 ( $\alpha = 0.00617^{1)}$

RTD Ni50 – GOST 6651-2009 ( $\alpha = 0.00617$ )	N50 G	RTD Ni50 – GOST 6651-2009 ( $\alpha = 0.00617$ )
RTD Ni100 – GOST 6651-2009 ( $\alpha = 0.00617$ )	N100G	RTD Ni100 – GOST 6651-2009 ( $\alpha = 0.00617$ )
Micro-Volts bipolar	$\mu\text{V}\pm$	Micro-Volts bipolar
Milli-Volts bipolar	$\text{mV}\pm$	Milli-Volts bipolar
Volts bipolar	$\text{V}\pm$	Volts bipolar
TC Type B - IEC 584	TC B	Thermocouple Type B - IEC 584
TC Type W5 - ASTM E 988	TC W5	Thermocouple Type W5 - ASTM E 988
TC Type W3 - ASTM E 988	TC W3	Thermocouple Type W3 - ASTM E 988
TC Type E - IEC 584	TC E	Thermocouple Type E - IEC 584
TC Type J - IEC 584	TC J	Thermocouple Type J - IEC 584
TC Type K - IEC 584	TC K	Thermocouple Type K - IEC 584
TC Type N - IEC 584	TC N	Thermocouple Type N - IEC 584
TC Type R - IEC 584	TC R	Thermocouple Type R - IEC 584
TC Type S - IEC 584	TC S	Thermocouple Type S - IEC 584
TC Type T - IEC 584	TC T	Thermocouple Type T - IEC 584
TC Type L - DIN 43710	TC L	Thermocouple Type L - DIN 43710
TC Type U - DIN 43710	TC U	Thermocouple Type U - DIN 43710
TC Type Lr - GOST 3044-84	TC LR	Thermocouple Type Lr - GOST 3044-84
RTD Cux – GOST 6651-2009 ( $\alpha = 0.00428$ )	CUX G	RTD Cux – GOST 6651-2009 ( $\alpha = 0.00428$ ) <sup>1)</sup>
RTD Ptx – GOST 6691-2009 ( $\alpha = 0.00391$ )	PTX G	RTD Ptx – GOST 6691-2009 ( $\alpha = 0.00391$ ) <sup>1)</sup>
Custom Linearization (CUSTOM SPECIFIC)	CUSTOM	Custom Linearization (CUSTOM SPECIFIC)
Micro-Volts unipolar (CUSTOM SPECIFIC)	$\mu\text{V}$	Micro-Volts unipolar (CUSTOM SPECIFIC)
Milli-Volts unipolar (CUSTOM SPECIFIC)	$\text{mV}$	Milli-Volts unipolar (CUSTOM SPECIFIC)
Volts unipolar (CUSTOM SPECIFIC)	$\text{V}$	Volts unipolar (CUSTOM SPECIFIC)
None	NONE	No input type selected
Factory setting:	None	NONE
		No input type selected

<sup>1)</sup> Value x matches customer RTD value

### 9.3.5 Connection type for input 2 [05]

Selects the connection type for input 2 depending on the selected sensor.

Indication on the display	WIRING 2
Setting range:	2, 3, 4-wire
Factory setting:	-

### 9.3.6 Wire resistance for connecting cable at Input 2 [06]

Requirement: Connection type 2-wire

Selects the wire resistance for Input 2.

Indication on the display	WIRE RES 2
Setting range:	0 to 100 $\Omega$
Factory setting:	-

### 9.3.7 Assignment of the primary variable [07]

#### 9.3.7.1 Introduction

#### Introduction

You select which device variable is displayed in the Measurement view (Page 112) with the "Assignment of the primary variable" parameter.

The primary variables are available for your selection:

Indication on the display	Device variable
I 1	Input 1
I 2	Input 2
CJC 1	Input 1 CJC
CJC 2	Input 2 CJC
AVG	Average input 1 and input 2
I 1-I 2	Difference input 1 - input 2
I 2-I 1	Difference input 2 - input 1
ABS	Absolute difference input 1 - input 2
MIN	Minimum input 1 or input 2
MAX	Maximum input 1 or input 2
I 1 B	Input 1 and input 2 as backup
I 2 B	Input 2 and input 1 as backup
AVG B	Average input 1 and input 2 with both as backup
MIN B	Minimum input 1 or input 2 with both as backup
MAX B	Maximum input 1 or input 2 with both as backup
ETEMP	Electronics temperature

### 9.3.7.2 Setting the assignment of the primary variable

#### Requirement

You know the parameter values for the "Assignment of the primary variable" parameter. (Page 152)

#### Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. Select the parameter "Assignment of the primary variable".
3. Press the ► button.
4. Select the desired input value with the ▲ or ▼ button.
5. Use the ► button to confirm.

#### Result

- The selected device variable is displayed in the measurement view (P1).

### 9.3.8 Unit [08]

Selects the unit for the "Sensor temperature" and "Electronics temperature" measured values that are displayed in the measurement view.

Setting range:	K
	°C
	°F
	°R
Factory setting:	°C

You can select additional units with the remote operation that are to be displayed in the measurement view.

## 9.3.9 Lower range value [09]/Upper range value [10]

### 9.3.9.1 Lower range value [09] parameter

Sets the lower range value.

Indication on the display:	LOWER RANGE
Setting range:	Within the measuring limits
Factory setting:	0 °C The lower range value (4 mA) corresponds to 0% of the measuring range.

### 9.3.9.2 Upper range value [10] parameter

Sets the upper range value.

Indication on the display:	UPPER RANGE
Setting range:	Within the measuring limits
Factory setting:	100 °C

### 9.3.9.3 Adjusting lower range value/upper range value

#### Introduction

The lower range value (4 mA) corresponds to 0% of the measuring range. The upper range value (20 mA) corresponds to 100% of the measuring range. Using remote operation you can change the relationship between the values of the lower range value/upper range value and the current output. For example, lower range value corresponds to 20 mA.

You have the following options for assigning the desired temperature measurements to the lower range value and the upper range value:

	Device with display	Remote operation
Set lower range value	"Lower range value" parameter	Settings > Current output > Lower range value
Set upper range value	"Upper range value" parameter	Settings > Current output > Upper range value

The minimum permissible measuring span of the input type must not be underpassed. You can find the minimum permissible measuring span of your input type in the section Technical data (Page 199).

#### Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. In the parameter view, select the "Set lower range value" parameter.

3. Press the ► button.
4. Enter a value within the measuring limits of the selected input type with the ▲ or ▼ button.
5. Use the ► button to confirm.  
The lower range value is set. Note that the upper range value does not move automatically.
6. Navigate to the "Set upper range value" parameter.
7. Press the ► button.
8. Enter a value within the measuring limits of the selected input type with the ▲ or ▼ button.
9. Use the ► button to confirm.  
The upper range value is set.

## Result

You have defined your measuring range.

- If the minimum permissible measuring span that is dependent on the selected input type is underpassed, the message "FAILD" appears.

## See also

Parameters and functions (Page 139)

## 9.3.10 Damping value [11]

### 9.3.10.1 Damping value parameter

Sets the damping (filtering) for smoothing of sudden process value variations.

Setting range:	0.01 s ... 60 s, in steps of 0.01 s
Factory setting:	0 s

The damping influences the response time of the device: When you increase the damping value, the response time of the temperature transmitter to changes in the pressure measurement increases.

- Reduce the damping value for faster response times. Specify a value that meets the requirements regarding signal stability and response time.

### 9.3.10.2 Set damping value

## Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. Select the "Damping value" parameter.

9.3 Parameter assignment over device with display

3. Press the ► button.
4. Set the damping with the ▲ and ▼ buttons.
5. To set the damping in steps of 0.10 s, press and hold down the buttons.
6. Use the ► button to confirm.

**9.3.11 Functional Safety [12]**

Enables Functional Safety.

The parameter is only visible for devices with Functional Safety.

**See also**

Functional Safety Manual (<https://www.siemens.com/processinstrumentation/documentation>)

**9.3.12 Loop test [13]**

Sets a constant loop current for test purposes.

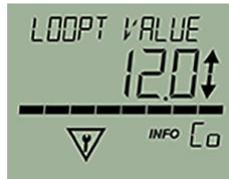
You have the option of selecting preset values or a user-defined value.

Setting range:	3.55 mA	
	4 mA	
	12 mA	
	20 mA	
	22.8 mA	
	USER	User defined
Factory setting:	12 mA	

**9.3.12.1 Loop test with preset loop current value**

1. Navigate into the parameter view.  
Navigating in the views (Page 110)
2. Select the parameter "Loop test".

- Use the ► button to confirm.

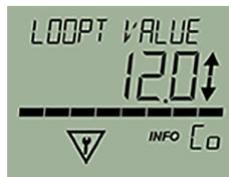


The loop test starts:

- The "EDIT" symbol flashes.
  - The "Function check" symbol is displayed.
  - The "Co" symbol (constant current mode) is displayed.
- Change the preset value with the ▲ or ▼ button.
  - Use the ► button to confirm.  
The loop test starts.
  - End the loop test with the ◀ button.

### 9.3.12.2 Loop test with user defined loop current value

- Navigate into the parameter view.  
Navigating in the views (Page 110)
- In the parameter view, select the "Loop test" parameter.
- Use the ► button to confirm.



The loop test starts:

- The "EDIT" symbol flashes.
  - The "Function check" symbol is displayed.
  - The "Co" symbol (constant current mode) is displayed.
- Change to "USER" with the ▲ or ▼ button.
  - Use the ► button to confirm.
  - Set a value between 3.6 mA and 22.8 mA using the buttons ▲ or ▼.
  - Use the ► button to confirm.  
The loop test starts.
  - End the loop test with the ◀ button.

### 9.3.13 One-point calibration input 1 [14]

Calibrates the lower calibration point at input 1. The device moves the characteristic by the difference between the original and the new calibration point. The result of the one-point calibration is saved in the TRIM INPUT 1 parameter.

Indication on the display:	TRIM INPUT 1
----------------------------	--------------

The two-point calibration via remote operation calibrates the low and high calibration point.

#### See also

Setting two-point calibration (Page 170)

Setting one-point calibration (Page 169)

### 9.3.14 One-point calibration input 2 [15]

Calibrates the lower calibration point at input 2. The device moves the characteristic by the difference between the original and the new calibration point. The result of the one-point calibration is saved in the TRIM INPUT 2 parameter.

Indication on the display:	TRIM INPUT 2
----------------------------	--------------

The two-point calibration via remote operation calibrates the low and high calibration point.

#### See also

Setting two-point calibration (Page 170)

Setting one-point calibration (Page 169)

### 9.3.15 Change User PIN [16]

#### 9.3.15.1 Change user PIN

Used to change the User PIN.

Setting range:	1 to 65535
Factory setting:	2457

#### Requirement

The "User PIN (Page 161)" parameter is enabled.

## Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. Select the parameter "Change user PIN".



3. Press the ► button.
4. Enter the old user PIN.
5. Enter the new user PIN with a value between 1 and 65535.  
Changing parameter values (Page 115)



6. Use the ► button to confirm.
7. Repeat the new user PIN and use the ► button to confirm.



## Result

- If both user PINs match, the "COMPL" message appears.  
The user PIN has been successfully changed.
- If the two user PINs do not match, the "FAILED" message appears.  
Then repeat the described procedure.

### 9.3.16 PIN recovery [17]

Used to reset the user PIN to the factory setting.

The user PIN is factory set to 2457 in the device.

### 9.3.16.1 Recovering the user PIN

#### Requirement

- You have received the PUK from Technical Support (Page 228) using the serial number of your device.
- The "User PIN (Page 161)" parameter is enabled.

#### Procedure

1. In the parameter view, select the "PIN recovery" parameter.



2. Press the ► button.  
The cursor and the "EDIT" symbol flash.
3. Enter the digits of the PUK:
  - Use the ▲ or ▼ button to change.
  - Use the ► button to confirm.
  - Use the ◀ button to delete.

The complete PUK is shown on the top line of the display.



4. When the PUK is complete, use the ► button to confirm.

#### Result

- If you have entered the correct PUK, the message "NEW PIN - 2457" appears.  
The user PIN has been reset to the factory setting 2457.
- If the PUK was not correctly entered, the message "FAILED" appears.  
Then repeat the described procedure.

## 9.3.17 User PIN [18]

### 9.3.17.1 User PIN

Used to enable or disable the user PIN.

Setting range:	ON	Enable user PIN
	OFF	Disable user PIN
Factory setting:	User PIN disabled	

When user PIN is enabled, the measured values and parameters are read-only.

- To change the parameters and use the device functions, the user PIN must be input.  
The user PIN 2457 is factory preset in the device.

### 9.3.17.2 Enable user PIN

#### Requirement

The User PIN is disabled.

#### Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. Select the parameter "User PIN".
3. Use the ► button to confirm.  
The message "USER PIN ON" (User PIN enabled) appears for 2 seconds.

#### Result

The User PIN is activated after about 10 minutes or after a device restart.



### 9.3.17.3 Disable user PIN

#### Requirement

The user PIN is enabled.

**Procedure**

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. Select the parameter "User PIN".
3. Use the ► button to confirm.
4. Select YES with the ▲ or ▼ button.



5. Use the ► button to confirm.  
The message "USER PIN OFF" appears for 2 seconds.

**Result**

The User PIN is disabled.



**9.3.18 Minimum measured peak value at Input 1 [19]**

Shows the minimum measured peak value at input 1.

Indication on the display	MIN INPUT 1
---------------------------	-------------

**9.3.19 Maximum measured peak value at Input 1 [20]**

Shows the maximum measured peak value at input 1.

Indication on the display	MAX INPUT 1
---------------------------	-------------

**9.3.20 Minimum measured peak value at Input 2 [21]**

Shows the minimum measured peak value at input 2.

Indication on the display	MIN INPUT 2
---------------------------	-------------

**9.3.21 Maximum measured peak value at Input 2 [22]**

Shows the maximum measured peak value at input 2.

Indication on the display	MAX INPUT 2
---------------------------	-------------

**9.3.22 Minimum transmitter electronics temperature [23]**

Shows the minimum measured transmitter electronics temperature.

Indication on the display	MIN ETEMP
---------------------------	-----------

**9.3.23 Maximum transmitter electronics temperature [24]**

Shows the maximum measured transmitter electronics temperature.

Indication on the display	MAX ETEMP
---------------------------	-----------

**9.3.24 Button lock [25]**

Enables the button lock. You can continue to operate the device using remote operation.

Setting range:	ON	Button lock enabled
	OFF	Button lock disabled
Factory setting:	OFF	

### 9.3.24.1 Enabling button lock

#### Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. In the parameter view, select the "Button lock" parameter.
3. Press the ► button.  
The "EDIT" symbol flashes.
4. Select ON with the ▲ or ▼ button.



5. Use the ► button to confirm.

#### Result

- The display automatically returns to the measurement view.
- The display automatically changes between the measured values every 12 seconds.
- The symbol for button lock "LL" and the measured value ID are displayed alternately.

### 9.3.24.2 Disabling button lock

#### Procedure

To disable the button lock, press and hold the ► button for 5 seconds.

#### Result

- The symbol for Button lock "LL" is hidden.
- You can operate the device using the buttons.

## 9.4 Assigning parameters using remote operation

### 9.4.1 Introduction

#### Introduction

This section describes the most important parameters and functions that are available additionally over remote operation:

- "Quick Start" wizard
- Identification (TAG)
- Custom type
- Sensor calibration
- Transmitter sensor matching
- Assignment of dynamic variables
- Current output

### 9.4.2 "Quick Start" wizard

You use the "Quick start" wizard to configure your device in five steps for the required application:

- Step 1: Identification
- Step 2: Sensor settings
- Step 3: Assignment of dynamic variables
- Step 4: Process parameters
- Step 5: Process alarms
- Step 6: Summary

The summary provides an overview of the "old" and "new" parameters.

To store the parameters in SIMATIC PDM and transfer them to the device, click the "Apply" button.

### 9.4.3 Identification

Define the data that you need to identify your device under the "Identification" parameter group. A distinction is made between data you can set yourself and values that are preset in the factory. The default values are write-protected and cannot be changed by the user. The corresponding allocation is set out below:

Designation	Adjustable	Preset	Factory setting
Short tag	X	-	
Long tag (TAG)	X	-	
Description	X	-	
Message	X	-	
Installation date	X	-	dd.mm.yyyy
Device			
Manufacturer_id	-	X	Siemens
Device type	-	X	SITRANS TH320/TH420/TR320/TR420
Product name	-	X	SITRANS TH320 <sup>1)</sup>
Serial number	-	X	in accordance with device manufacture
Final assembly number	-	-	
Hardware version	-	X	in accordance with device manufacture
Firmware version	-	X	in accordance with device manufacture
EDD version	-	X	

<sup>1)</sup> in accordance with the order

### 9.4.4 User-specific type

#### 9.4.4.1 Introduction

For special applications, a user-specific type is available. There is no internal validation check in the Engineering System. Test the expected functionality for your application.

Enter up to 60 breakpoints via SIPROM T or the remote operation.

- Set the linearization table (60 breakpoints) (Page 168)  
Enter the desired number of breakpoints. You can freely position x and y values on the linearization curve.

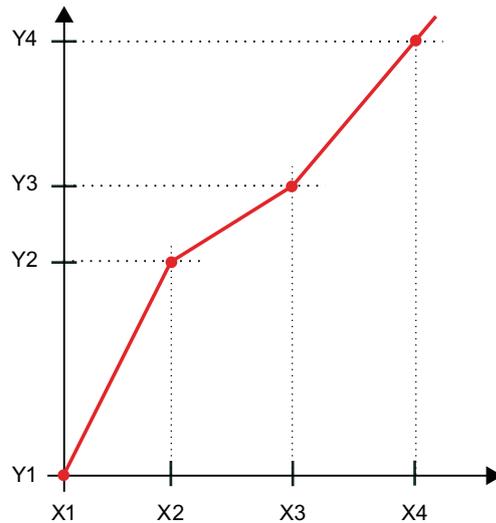


Figure 9-1 Linearization table

- Set the spline curve (40 breakpoints) (Page 168)  
Enter the minimum and maximum X-value. The x values are distributed evenly on the x axis according to the desired number of breakpoints. You can freely assign the y values.

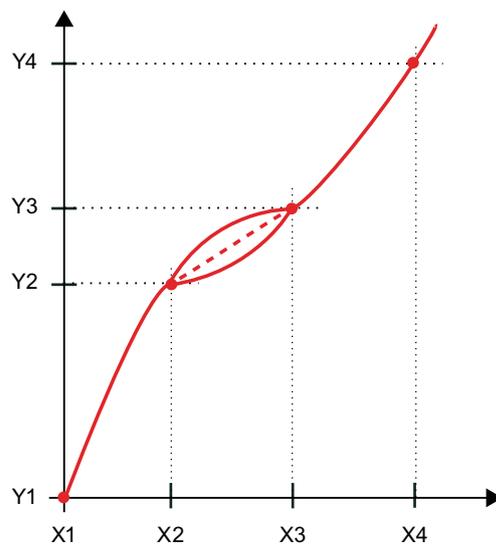


Figure 9-2 Spline curve

#### 9.4.4.2 Set the linearization table (60 breakpoints)

##### Procedure

1. Select the "Custom type" option for the "Type" parameter.
2. Select a custom type from the list, e.g. resistance.
3. Select the "Linearization table" option for the "Linearization type" parameter.
4. Enter the desired number of breakpoints.  
You can enter a minimum of 3 and up to 60 breakpoints.
5. Enter the x values and associated y values.
6. Transfer the linearization table to the device.
7. Test the expected functionality for your application.  
There is no internal validation check in the Engineering System.

#### 9.4.4.3 Set the spline curve (40 breakpoints)

##### Procedure

1. Select the "Custom type" option for the "Type" parameter.
2. Select a custom type from the list, e.g. resistance.
3. Select the "Spline curve" option for the "Linearization type" parameter.
4. Enter the minimum and maximum X value.
5. Enter the desired number of breakpoints.  
You can enter a minimum of three and up to 40 breakpoints.
6. Enter the values of the Y points.
7. Transfer the spline curve to the device.
8. Test the expected functionality for your application.  
There is no internal validation check in the Engineering System.

### 9.4.5 Sensor calibration

#### 9.4.5.1 Introduction

The sensor calibration can be a one-point calibration and a two-point calibration.

You use the one-point calibration to set the device characteristic at the low calibration point.

You use the two-point calibration to set the device characteristic at the low and high calibration point.

The results are correct measured values at the calibration points.

Enter the calibration points within the measuring range using the remote operation.

### 9.4.5.2 Setting one-point calibration

#### Requirement

- The measured value for the low calibration point is stable.
- There is no sensor error.
- The measured value is in the measuring range.

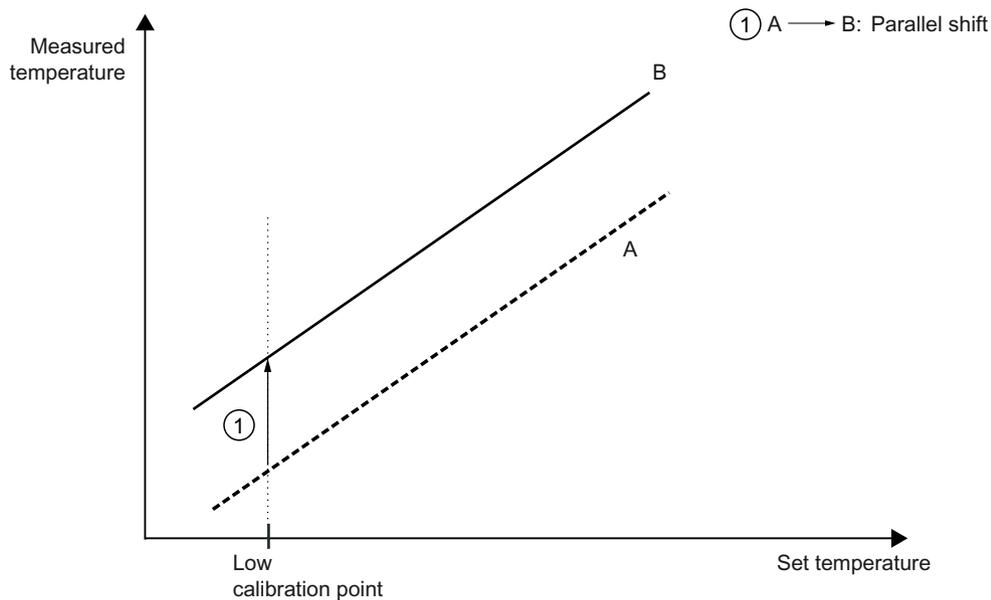
#### Procedure

1. Select the menu command "Maintenance > Calibration".
2. Select the tab input 1 or input 2.
3. Bring the sensor to a stable temperature environment. For example, 0 °C.  
The fluctuation of the measured value is within the precision requirements.  
We recommend use of a calibrator, e.g. from Beamex.
4. Click the "One-point calibration" button.
5. Confirm the warnings.
6. When your measured value is stable, assign the measured value to the low calibration point of the device.

#### Result

The device calibrates to the measured value.

The device moves the characteristic by the difference between the original and the new calibration point.



- A Original characteristic
- B Characteristic after the one-point calibration of the low calibration point

### 9.4.5.3 Setting two-point calibration

#### Requirement

- The measured values for the high and low calibration point are stable.
- There is no sensor error.
- The measured values are in the measuring range.

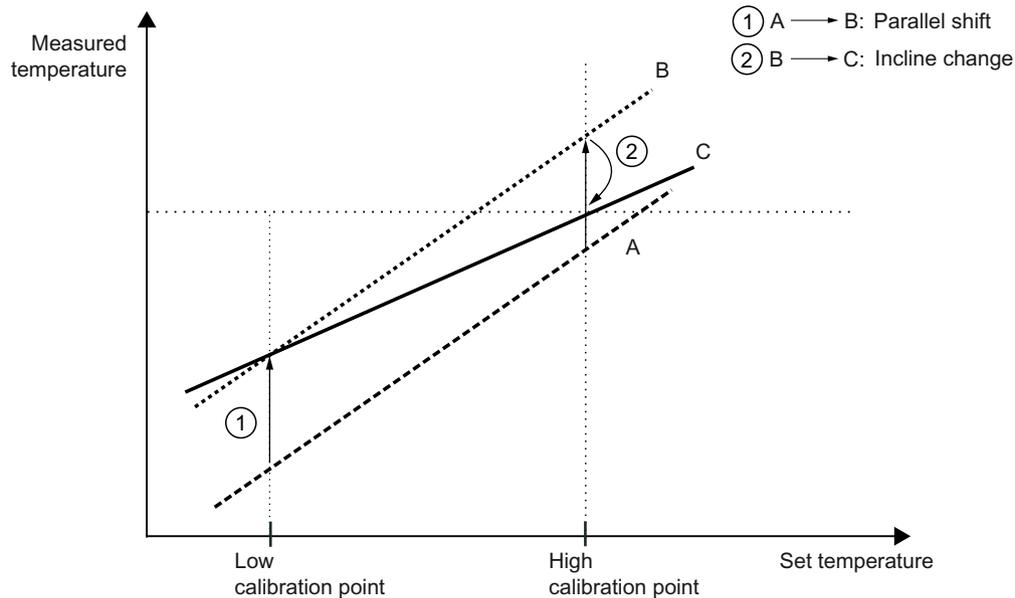
#### Procedure

1. Select the menu command "Maintenance > Calibration".
2. Select the tab input 1 or input 2.
3. Bring the sensor to a stable temperature environment. For example, 0 °C.  
The fluctuation of the measured value is within the precision requirements.
4. Click the "Two-point calibration" button.
5. Confirm the warnings.
6. When your measured value is stable, assign the measured value to the low calibration point of the device.
7. Repeat the process for the high calibration point.

## Result

The device calibrates to your measured values.

The device moves the characteristic by the difference between the original and the new calibration points.



- A Original characteristic
- B Characteristic after the two-point calibration of the low calibration point
- C Characteristic after the two-point calibration of the high calibration point

## 9.4.6 Transmitter sensor matching

### 9.4.6.1 Introduction

The Callendar-Van Dusen coefficients are used to match the temperature transmitter with the sensor. If requested, the sensor manufacturer will provide you with the Callendar-Van Dusen coefficients according to IEC 60751 with the sensor. The results are correctly measured measured values over the desired temperature range through very good approximation of the actual temperature response of the platinum resistance thermometer.

You can change the calibration points R0, A, B, C, Alpha, Beta and Delta using the remote operation.

### 9.4.6.2 Changing the Callendar-Van Dusen coefficients

**Procedure**

1. Select a sensor with Callendar-Van Dusen coefficients for the "Input type" parameter.
2. Change the values for R0, A, B and C, or R0, Alpha, Beta and Delta.
3. Transfer the values to the device.

### 9.4.7 Assignment of dynamic variables

With the remote operation you can assign any device variable for the dynamic variables PV selector, SV selector, TV selector and QV selector.

The device variable assigned to the PV selector controls the loop current.

Device variables:	Input 1
	Input 2
	Input 1 CJC
	Input 2 CJC
	Average input 1 and input 2
	Difference input 1 - input 2
	Difference input 2 - input 1
	Absolute difference input 1 - input 2
	Minimum input 1 or input 2
	Maximum input 1 or input 2
	Input 1 and input 2 as backup
	Input 2 and input 1 as backup
	Average input 1 and input 2 with both as backup
	Minimum input 1 or input 2 with both as backup
	Maximum input 1 or input 2 with both as backup
	Electronics temperature

### 9.4.8 Operating hours counter

**Operating hours counter 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 history of the transmitter is recorded in 9 ambient temperature ranges.
- Starts with the first commissioning at the factory.
- Operating hours counter and temperature ranges cannot be reset or set by the user.
- The operating hours counter is only updated as long as the device is in measuring mode. The operating hours counter is not updated in simulation mode.

**Operating hours counter for sensor measuring temperature**

- 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 operating hours counter is automatically reset when you change one of the following parameters in the device:
  - Input type
  - Wiring configuration
  - RTD factor

**Procedure**

1. Using remote operation (for example SIMATIC PDM), select the menu command "Diagnostics > Operating time".
2. Select "Input 1", "Input 2" or "Electronics temperature" in the submenu.

**9.4.9 Current output****9.4.9.1 Fault current****Introduction****Fault current of the transmitter**

The fault current is set to  $\leq 3.6$  mA at the factory.

You set the fault current of the internal transmitter from  $\leq 3.6$  mA to  $\geq 21$  mA with the switch on the display.

Setting the fault current of the internal transmitter with switch to  $\geq 21$  mA (Page 181)

A fault current  $\geq 21$  mA is not permissible for operation of the device with functional safety. Functional safety cannot be activated with a fault current  $\geq 21$  mA.

**Fault current of the sensor**

Your device is delivered with the following Factory settings (Page 217).

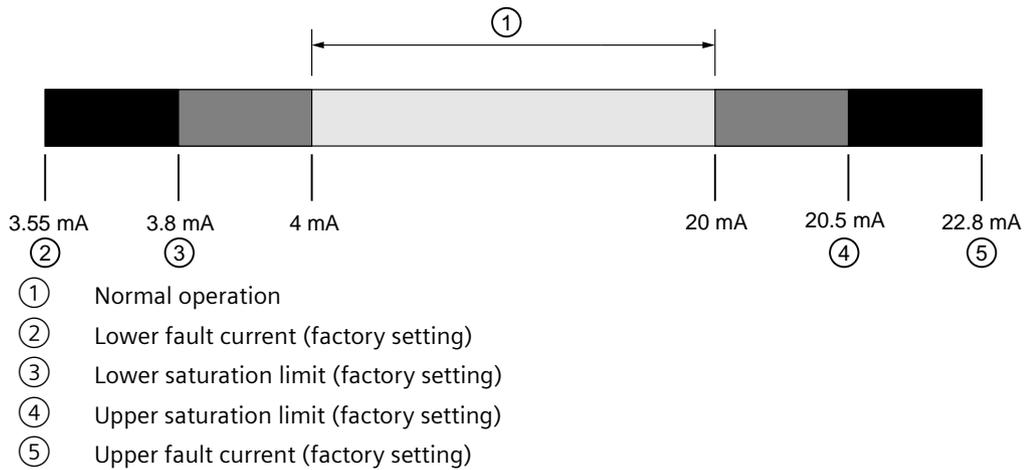
You use parameter assignment software to change the parameters for the fault current.

**Lower fault current parameter**

Adjusts the magnitude of the lower fault current ②.

Setting range:	Between 3.55 mA and lower saturation limit ③
Factory setting:	3.55 mA, or as specified in order

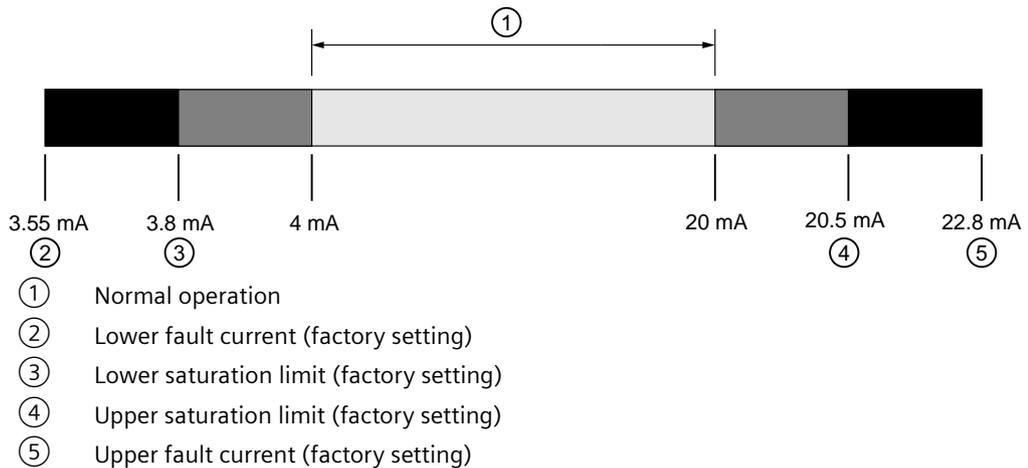
9.4 Assigning parameters using remote operation



**Upper fault current parameter**

Adjusts the magnitude of the upper fault current ⑤.

Setting range:	Between upper saturation limit ④ und 22.8 mA
Factory setting:	22.8 mA, or as specified in order



**See also**

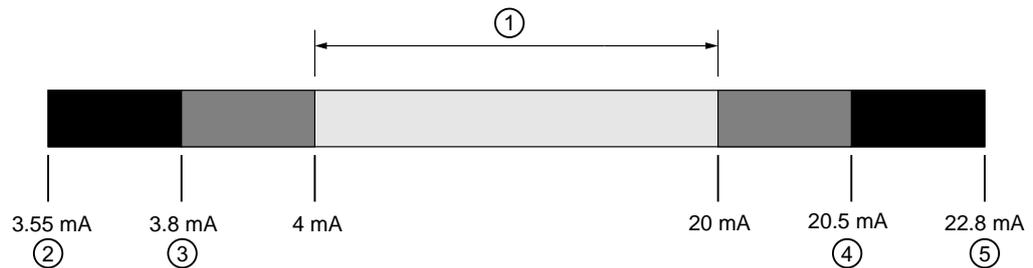
Setting the fault current of the internal transmitter with switch to  $\geq 21$  mA (Page 181)

**9.4.9.2 Lower saturation limit parameter**

Sets the lower threshold for the lower saturation limit ③.

The loop current cannot drop below the set threshold.

Setting range:	Between lower fault current <sup>②</sup> and 4 mA
Factory setting:	3.8 mA, or as specified in order



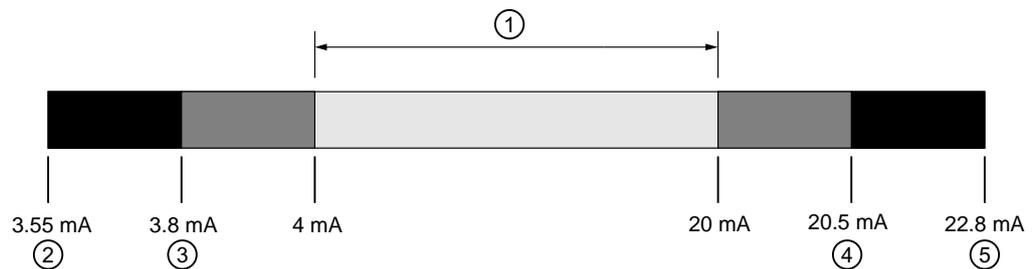
- ① Normal operation
- ② Lower fault current (factory setting)
- ③ Lower saturation limit (factory setting)
- ④ Upper saturation limit (factory setting)
- ⑤ Upper fault current (factory setting)

### 9.4.9.3

#### Upper saturation limit parameter

Sets the threshold for the upper saturation limit<sup>④</sup>.

Setting range:	Between 20 mA and the upper fault current
Factory setting:	20.5 mA, or as specified in order



- ① Normal operation
- ② Lower fault current (factory setting)
- ③ Lower saturation limit (factory setting)
- ④ Upper saturation limit (factory setting)
- ⑤ Upper fault current (factory setting)

#### See also

Technical data (Page 199)

## 9.5 Locking the device

### 9.5.1 Locking the SITRANS TH/TR device

#### 9.5.1.1 Introduction

The following options are available to lock the device:

- Enabling write protection using the jumper.

The table gives you an overview of the write protection options:

Write protection	Read measured values (measurement view)	Read parameters (parameter view)	Change parameters (edit view)
Jumper set	Yes	Yes	No
User PIN enabled	Yes	Yes	Yes, after input of the user PIN

#### Devices with functional safety

To enable functional safety, first enable the user PIN.

#### 9.5.1.2 Enable SITRANS TH write protection with jumper

##### Introduction

The jumper is used for enabling write protection.

## Procedure

1. Set the jumper as follows:

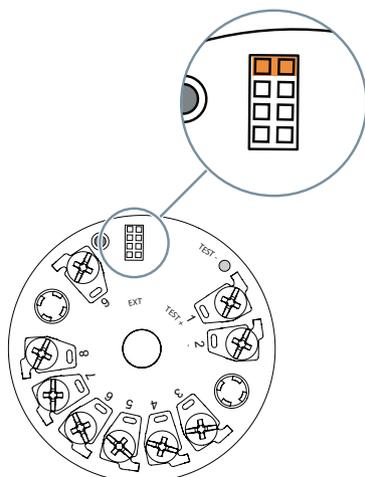


Figure 9-3 SITRANS TH: Enable write protection using the jumper

Meaning of the jumper positions (Page 40)

## Result

When the jumper is set, only the measured values and the parameters can be read.

### 9.5.1.3 Enable SITRANS TR write protection with jumper

## Introduction

The jumper is used for enabling write protection.

**Procedure**

1. Switch off the power supply.
2. Open the housing.  
Press the recesses marked in the figure with a pen.

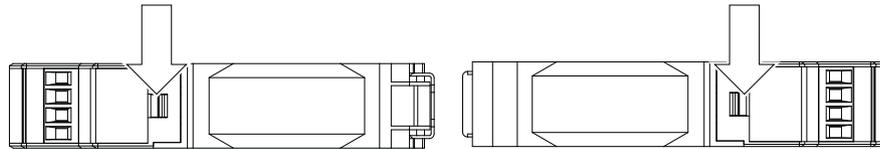


Figure 9-4 Enclosure top view: Above and below

3. Set the jumper as follows:

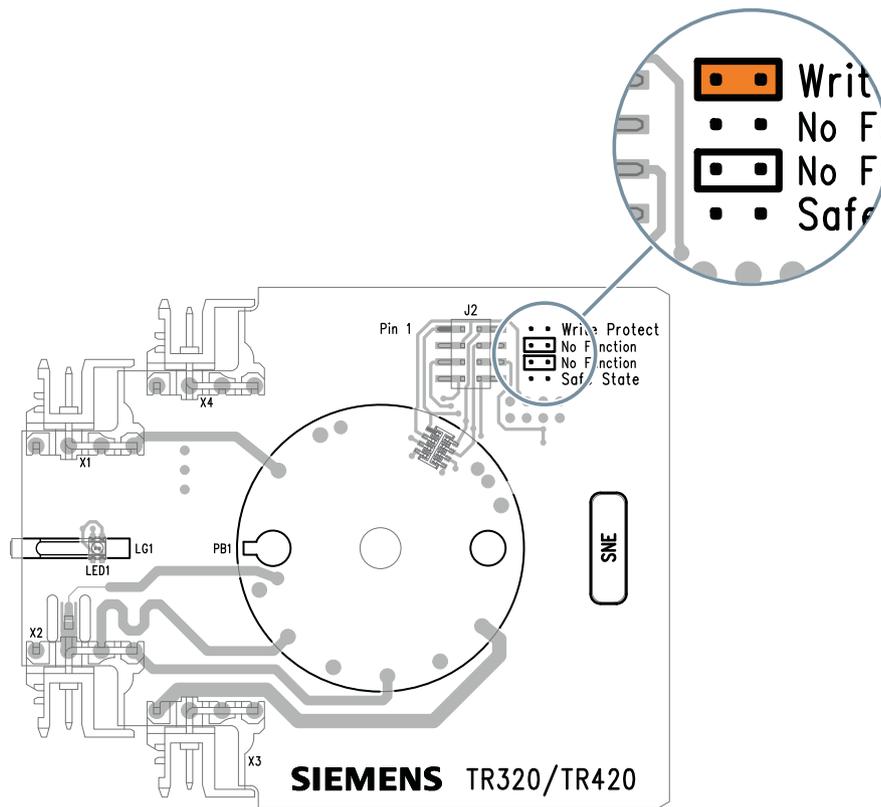


Figure 9-5 SITRANS TH: Enable write protection using the jumper

Meaning of the jumper positions (Page 49)

**Result**

When the jumper is set, only the measured values and the parameters can be read.

### 9.5.1.4 User PIN parameter

Used to change the User PIN.

Setting range:	1 to 65535
Factory setting:	2457

### See also

Parameters and functions (Page 139)

## 9.5.2 Locking the SITRANS TF device

### 9.5.2.1 Introduction

The following options are available to lock the device:

- Enable write protection using switch.
- Enable write protection using the User PIN.
- Enable write protection using the button lock.

Write protection	Sym- bol	ID	Read measured values on the display	Read parameters on the display	Change parameters via the device with display
Switch enabled		L	Yes	Yes	No
User PIN <sup>1)</sup> enabled		LP	Yes	Yes	Yes, after input of the user PIN
Button lock enabled		LL	Yes	No	No

<sup>1)</sup>The user PIN is factory set to 2457 in the device. When delivered, write protection is disabled using the user PIN.

### Devices with functional safety

To enable functional safety, first enable the User PIN.

### 9.5.2.2 Enable write protection with write protection switch

#### Introduction

The write protection switch is used for enabling write protection.

### Procedure

1. Unscrew the cover.
2. Slide the write protection switch to the closed lock position.

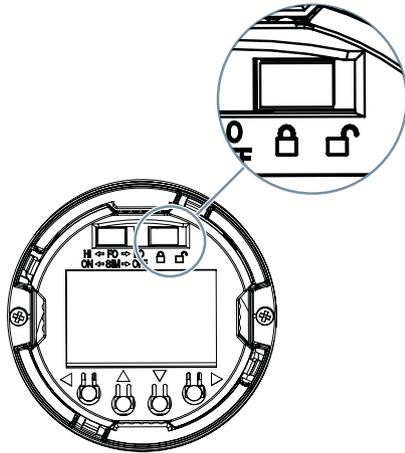


Figure 9-6 Enable write protection using the write protection switch

### Result

When the write protection switch is set to the closed lock position, measured values and parameters can be read.

#### 9.5.2.3 Enable the User PIN on the display

### Requirement

The User PIN is disabled.

### Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. Select the parameter "User PIN".
3. Use the ► button to confirm.  
The message "USER PIN ON" (User PIN enabled) appears for 2 seconds.

### Result



### 9.5.2.4 Enable the button lock on the display

#### Procedure

1. Navigate to the parameter view.  
Navigating in the views (Page 110)
2. In the parameter view, select the "Button lock" parameter.
3. Press the ► button.  
The "EDIT" symbol flashes.
4. Select ON with the ▲ or ▼ button.



5. Use the ► button to confirm.

#### Result

- The display automatically returns to the measurement view.
- The display automatically changes between the measured values every 12 seconds.
- The symbol for button lock "LL" and the measured value ID are displayed alternately.

## 9.6 Setting the fault current of the internal transmitter with switch to $\geq 21$ mA

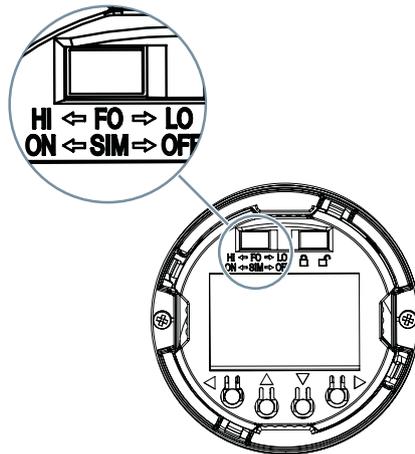
### Introduction

You set the fault current of the internal transmitter from  $\leq 3.6$  mA to  $\geq 21$  mA with the switch on the display.

A fault current  $\geq 21$  mA is not permissible for operation of the device with functional safety. Functional safety cannot be activated with a fault current  $\geq 21$  mA.

## Procedure

1. Unscrew the cover.
2. Move the left switch to the HI position.



- FO Fault current
- LO Lower fault current  $\leq 3.6$  mA
- HI Upper fault current  $\geq 21$  mA
- SIM Reserved for devices with PA (simulation mode)

Figure 9-7 Set the upper fault current using switch

## Result

When the switch is in the HI position, the upper fault current is enabled.

## See also

Current output (Page 173)

## Service and maintenance

### 10.1 Basic safety notes

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**Note**

The device is maintenance-free.

---

#### 10.1.1 Maintenance

The device is maintenance-free. However, a periodic inspection according to pertinent directives and regulations must be carried out.

An inspection can include, for example, check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover
- Reliability of power supply, lightning protection, and grounds

#### 10.1.2 SITRANS TF

** WARNING****Use of a computer in a hazardous area**

If the interface to the computer is used in the hazardous area, there is a risk of explosion.

- Ensure that the atmosphere is explosion-free (hot work permit).

** WARNING****Dust layers above 5 mm**

Risk of explosion in hazardous areas.

Device may overheat due to dust build up.

- Remove dust layers in excess of 5 mm.

 <b>CAUTION</b>
<b>Releasing button lock</b> Improper modification of parameters could influence process safety. <ul style="list-style-type: none"><li>• Make sure that only authorized personnel may cancel the button locking of devices for safety-related applications.</li></ul>

<b>NOTICE</b>
<b>Penetration of moisture into the device</b> Damage to device. <ul style="list-style-type: none"><li>• Make sure when carrying out cleaning and maintenance work that no moisture penetrates the inside of the device.</li></ul>

## 10.2 Cleaning

### Cleaning the enclosure

- Clean the outside of the enclosure with the inscriptions and the display window using a cloth moistened with water or a mild detergent.
- Do not use any aggressive cleansing agents or solvents, e.g. acetone. Plastic parts or the painted surface could be damaged. The inscriptions could become unreadable.

### See also

Cleaning (Page 184)

 <b>WARNING</b>
<b>Electrostatic charge</b> Risk of explosion in hazardous areas if electrostatic charges develop, for example, when cleaning plastic surfaces with a dry cloth. <ul style="list-style-type: none"><li>• Prevent electrostatic charging in hazardous areas.</li></ul>

## 10.3 Maintenance and repair work

** WARNING****Impermissible repair and maintenance of the device**

- Repair and maintenance must be carried out by Siemens authorized personnel only.

** WARNING****Impermissible repair of explosion protected devices**

Risk of explosion in hazardous areas

- Repair must be carried out by Siemens authorized personnel only.

** WARNING****Impermissible accessories and spare parts**

Risk of explosion in areas subject to explosion hazard.

- Only use original accessories or original spare parts.
- Observe all relevant installation and safety instructions described in the instructions for the device or enclosed with the accessory or spare part.

** WARNING****Improper connection after maintenance**

Risk of explosion in areas subject to explosion hazard.

- Connect the device correctly after maintenance.
- Close the device after maintenance work.

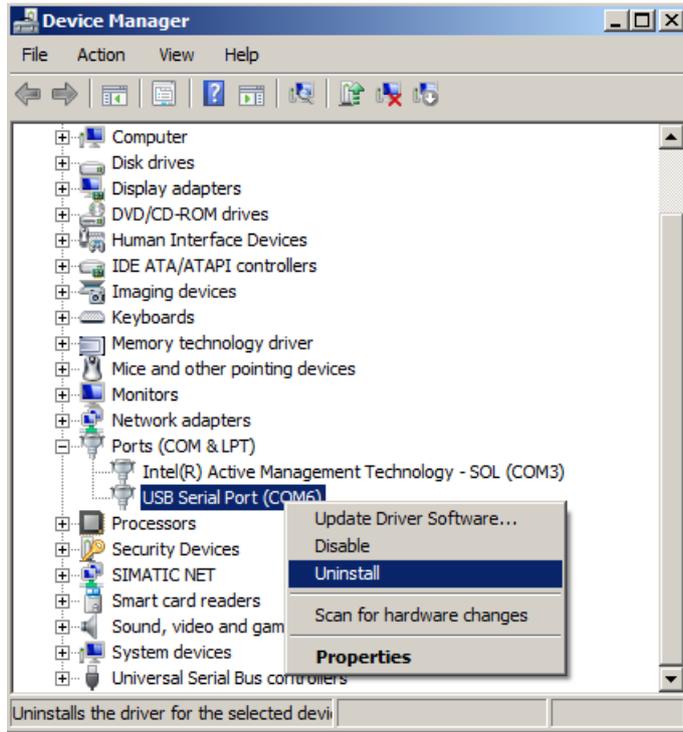
Refer to Connecting (Page 81).

### 10.3.1 Uninstalling USB drivers

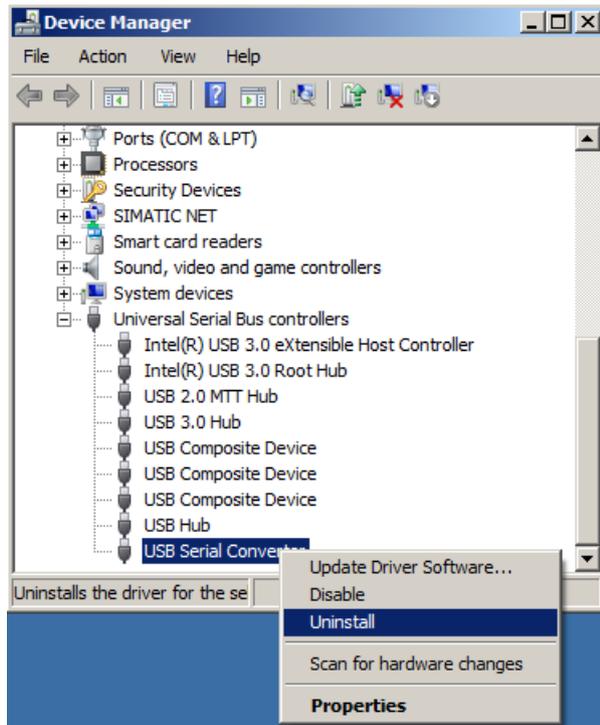
#### Procedure

1. Select "Ports (COM & LPT)" > "USB Serial Port (COMx)" in the Windows Device Manager.
2. Right-click on "USB Serial Port (COMx)".

- 3. Select "Uninstall" from the shortcut menu.



- 4. Select "USB Controller" > "USB Serial Converter" in the Windows Device Manager.
- 5. Right-click on "USB Serial Converter".
- 6. Select "Uninstall" from the shortcut menu.



**Result**

The associated registration entry for the USB modem is deleted.

**10.3.2 SITRANS TF**

 <b>WARNING</b>
<b>Impermissible repair and maintenance of the device</b>
<ul style="list-style-type: none"> <li>• Repair and maintenance must be carried out by Siemens authorized personnel only.</li> </ul>

**10.3.2.1 Impermissible repair of explosion protected devices**

 <b>WARNING</b>
<b>Impermissible repair of explosion protected devices</b>
Risk of explosion in hazardous areas.
<ul style="list-style-type: none"> <li>• Repairs may only be carried out by personnel authorized by Siemens.</li> <li>• Do not repair flameproof joints. Flameproof joints are, for example, threaded inlets for cable glands.</li> </ul>

 <b>CAUTION</b>
<b>Hot surfaces</b>
Risk of burns during maintenance work on parts having surface temperatures exceeding 70 °C (158 °F).
<ul style="list-style-type: none"> <li>• Take corresponding protective measures, for example by wearing protective gloves.</li> <li>• After carrying out maintenance, remount touch protection measures.</li> </ul>

**10.3.2.2 Checking the seals****Inspect the seals at regular intervals**

1. Clean the enclosure and seals.
2. Check the enclosure and the seals for cracks and damage.
3. If necessary, lubricate the seals or replace them. Use only original seals (<https://www.siemens.com/industrymall>).

### 10.3.2.3 Check cable glands

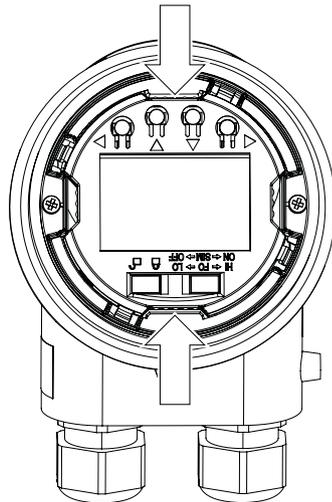
- Check the tightness of the cable glands at regular intervals.
- Tighten the cable glands if necessary.

### 10.3.3 Replace SITRANS TF single chamber housing local display

#### 10.3.3.1 Removing the display

##### Procedure

1. De-energize the device.
2. Open the device.  
Opening the device (Page 93)
3. Remove the local display from the holder.



4. Disconnect the cable from the local display.

### 10.3.3.2 Installing the display

#### Procedure

1. Connect the cable to the local display as shown in the figure.

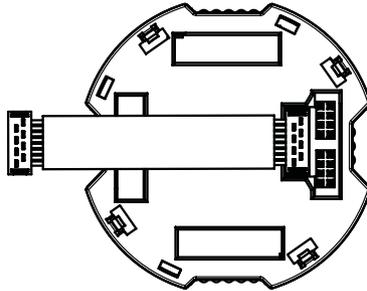


Figure 10-1 Ensure correct polarity!

2. Fasten the local display in the holder.
3. Close the device.  
Closing the device (Page 99)

## 10.4 Absence of pollutants



The product does not contain any dangerous substances above the concentration value according to GB/T 26572.

## 10.5 Return procedure

Enclose the bill of lading, return document and decontamination certificate in a clear plastic pouch and attach it firmly to the outside of the packaging.

**Required forms**

- Delivery note
- Return document (<http://www.siemens.com/processinstrumentation/returngoodsnote>) with the following information:
  - Product (item description)
  - Number of returned devices/replacement parts
  - Reason for returning the item(s)
- Decontamination declaration (<http://www.siemens.com/sc/declarationofdecontamination>)  
With this declaration you warrant "that the device/replacement part has been carefully cleaned and is free of residues. The device/replacement part does not pose a hazard for humans and the environment."  
If the returned device/replacement part has come into contact with poisonous, corrosive, flammable or water-contaminating substances, you must thoroughly clean and decontaminate the device/replacement part before returning it in order to ensure that all hollow areas are free from hazardous substances. Check the item after it has been cleaned. Any devices/replacement parts returned without a decontamination declaration will be cleaned at your expense before further processing.

**10.6 Disposal**



Devices described in this manual should be recycled. They may not be disposed of in the municipal waste disposal services according to the Directive 2012/19/EC on waste electronic and electrical equipment (WEEE).

Devices can be returned to the supplier within the EC, or to a locally approved disposal service for eco-friendly recycling. Observe the specific regulations valid in your country.

Further information about devices containing batteries can be found at: Information on battery/product return (WEEE) (<https://support.industry.siemens.com/cs/document/109479891/>)

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**Note**

**Special disposal required**

The device includes components that require special disposal.

- Dispose of the device properly and environmentally through a local waste disposal contractor.
-

## Diagnostics and troubleshooting

### 11.1 Device status symbols

Device status is shown using symbols on the local display. Additionally, the symbol and respective text message for each device status can be seen in remote engineering, asset management or process control systems.

Locally, alarms are shown as a symbol in the lower line of the display. If several diagnostic states are active at the same time, the symbol for the most critical state is shown.

#### Device status characteristics

The following table provides possible cause of device status and actions for the user or service.

The symbols used on the local display are based on NAMUR status signals, whereas symbols used in SIMATIC PDM are based on Siemens standard alarm classes.

---

#### Note

##### Device status priority conflict - Namur vs Siemens standard

When more than one diagnostic event is active simultaneously, a conflict in priorities may arise. In this case, the Namur symbol on the local display will differ from that shown in SIMATIC PDM.

- For example: if both diagnostic states "Maintenance demanded" and "Configuration error" are active,
  - Local display (using Namur symbols) will show "Configuration error" as higher priority.
  - SIMATIC PDM (using Siemens standard symbols) will show "Maintenance demanded" as higher priority.

Be aware of the priority for each device status, depending on the interface used.

---

#### Note

##### Namur device status priorities

This device uses Namur device status priorities based on HCF specification.

---

The sequence of symbols in the table corresponds to the priority of the device status, beginning with the most critical.

---

#### Note

##### Priorities of the NAMUR device status

This device uses the priorities of the NAMUR device status based on the HCF specification.

---

The order of the symbols in the table corresponds to the priority of the device status, starting with the most critical message.

## Device status symbols

Display – NAMUR NE 107		NAMUR – HCF	SIMATIC PDM/PLC		
Symbol	Device status	Priority *	Symbol	Device status	Priority *
	Failure	1		Maintenance alarm	1
<b>Cause:</b> Output signal invalid due to fault in the field device or in the peripherals. <b>Measure:</b> Maintenance is required immediately.					
	Maintenance re- quired	4		Maintenance demanded	2
<b>Cause:</b> Output signal is still valid, but wear reserve is almost exhausted and/or a function will be limited soon. <b>Measure:</b> Maintenance is strongly recommended as soon as possible.					
	Maintenance re- quired	4		Maintenance required	3
<b>Cause:</b> The output signal is still valid. No functional restrictions have been determined but the wear reserve will most likely be exhausted in the next few weeks. <b>Measure:</b> Maintenance of device should be planned.					
	Function test	2		Manual operation	4
<b>Cause:</b> Output signal temporarily invalid (e.g. frozen) due to work being performed on the device. <b>Measure:</b> Manual mode over HMI or disable the engineering system.					
	Function test	2		Simulation mode	5
<b>Cause:</b> The output signal does temporarily not reflect the process because the output is based on a simulation value. <b>Measure:</b> Simulation mode over HMI or disable the engineering system or restart device.					
	Failure	1		Out of service	6
<b>Cause:</b> The output signal does not represent the process value. The device mode is set to "Out of service". <b>Measure:</b> Disable "Out of service" and enable normal operation.					
	Failure	1	 (red)	Configuration error	7
<b>Cause:</b> Output signal invalid due to parameter setting, connection error or configuration error in the HW. <b>Measure:</b> Check hardware configuration of the device over HMI or engineering system.					

Display – NAMUR NE 107		NAMUR – HCF	SIMATIC PDM/PLC		
Symbol	Device status	Priority *	Symbol	Device status	Priority *
	Out of specification	3		Process value alarm	8
<p><b>Cause:</b> Deviations from permissible ambient or process conditions detected by the device (by means of self-monitoring or based on warnings/errors in the device) indicate that the measured value is unreliable or that deviations from the set value in the actuators are most likely greater than anticipated under normal operating conditions.</p> <p>Process or ambient conditions can damage the device or result in unreliable results.</p> <p><b>Measure:</b> Check ambient temperature or process conditions. If possible, install device at different location.</p>					
	Function test	2	 (yellow)	Configuration warning	9
<p><b>Cause:</b> Safety validation is not complete.</p> <p><b>Measure:</b> Acknowledge safety event in the Functional Safety menu and repeat safety commissioning.</p>					
	Out of specification	3		Process value warning	10
<p><b>Cause:</b> Deviations from permissible ambient or process conditions detected by the device (by means of self-monitoring or based on warnings/errors in the device) indicate that the measured value is unreliable or that deviations from the set value in the actuators are most likely greater than anticipated under normal operating conditions.</p> <p>Process or ambient conditions can damage the device or result in unreliable results.</p> <p><b>Measure:</b> Check ambient temperature or process conditions. If possible, install device at different location.</p>					
No symbol is displayed				Process value tolerance	11
<p><b>Cause:</b> At least one process value violates one of the process tolerance limits set in the device parameters.</p> <p><b>Measure:</b> Check the parameter settings for limits for this application.</p>					
No symbol is displayed			No symbol is displayed	Configuration changed	12
<p><b>Cause:</b>The device configuration has changed due to a work process.</p> <p><b>Measure:</b> Reset configuration bit memory to delete the diagnostic message.</p>					
No symbol is displayed	Good – OK		No symbol is displayed	No assignment	13
<p><b>Cause:</b> Device state ok. No errors from active diagnostics.</p> <p><b>Measure:</b> No action required.</p>					

\* The smallest number indicates the highest level of error severity.

\*\* In SIMATIC PDM, the Siemens standard symbol as well as the corresponding NAI symbol is displayed (by the device display).

## 11.2 Diagnostic messages

The following table shows the IDs of diagnostic messages and possible causes and instructions for corrective actions.

ID	Symbols	Message	Cause/Remedy
8A		Input 1 error	A sensor error (broken/shorted sensor) is detected at Input 1. Unplug and reconnect the sensor cable. If the problem persists, replace the sensor.
8B		Input 2 error	A sensor error (broken/shorted sensor) is detected at Input 2. Unplug and reconnect the sensor cable. If the problem persists, replace the sensor.
8C		Input 1 CJC error	A sensor error (broken/shorted sensor) is detected at the cold junction compensation measurement used for Input 1. Unplug and reconnect the sensor cable. If the problem persists, replace the sensor.
8D		Input 2 CJC	A sensor error (broken/shorted sensor) is detected at the cold junction compensation measurement used for Input 2. Unplug and reconnect the sensor cable. If the problem persists, replace the sensor.
8E		Drift detected	The difference of the measured results between Input 1 and Input 2 lies above the configured maximum limit. Unplug and reconnect the sensor cable. If the problem persists, replace the sensor.
8F		Backup enabled	A sensor error is detected, the backup sensor is in use. Unplug and reconnect the sensor cable. Check if the sensor is operated out of specified limits. If the problem persists, replace the sensor.
8G		Backup error	A sensor error is detected at the backup sensor, no backup is available. Unplug and reconnect the sensor cable. Check if the sensor is operated out of specified limits. If the problem persists, replace the sensor.
8H		Drift detected, reference voltage FVR	A critical measurement error was detected at the internal voltage reference. Reconnect or repair the sensor. If the problem persists, contact Technical Support.

ID	Symbols	Message	Cause/Remedy
8J		Drift detected, reference voltage VREF	A critical measurement error was detected at the internal voltage reference. Reconnect or repair the sensor. If the problem persists, contact Technical Support.
8L		Drift detected at Input 1	A critical measurement error was detected at Input 1. Reconnect or repair the sensor. If the problem persists, contact Technical Support.
8n		Drift detected at Input 2	A critical measurement error is detected at Input 2. Reconnect or repair the sensor. If the problem persists, contact Technical Support.
8o		Drift detected, ground voltage offset to terminal 3	A critical measurement error is detected on ground voltage offset to terminal 3. Reconnect or repair the sensor. If the problem persists, contact Technical Support.
bF		Configuration not supported by device	<b>Device LED flashing red:</b> The configuration is temporarily invalid for less than 3 seconds, for example during parameter download. No further action is required by the user. <b>Device LED lights permanently red:</b> The configuration is temporarily invalid for more than 3 seconds, for example if the download is paused. Correct and/or resend the configuration.
bL		Device restart due to unexpected program error	Watchdog function has detected an internal device error. Restart the device. If the problem persists, contact Technical Support.
bo		Primary variable out of limits	Process value has reached the sensor limit. Review process conditions versus product specifications.
bP		Non-primary variable out of limits	A process value that is not mapped to the primary variable has reached the sensor limit. Review process conditions versus product specifications.
CA		Simulation mode	The device is in simulation mode and one or more of its device variables are not representative of the process. Disable the simulation to return to normal operation.

11.2 Diagnostic messages

ID	Symbols	Message	Cause/Remedy
Co		Loop current fixed	The loop current is being held at a fixed value and is not responding to process variations. Disable the simulation to return to normal operation.
CP		Loop current in saturation	The loop current has reached its upper (or lower) saturation limit and cannot increase (or decrease) any further. Adjust loop current scaling.
E4		Internal RTD sensor error	Sensor error is detected at the internal temperature sensor. Reset the device or switch it off and back on. If the problem persists, contact Technical Support.
EL		Electronics temperature alarm	<b>Device LED flashing red:</b> The device is operated outside its specified temperature range. Check the operating temperature. <b>Device LED lights permanently red:</b> The device is operated outside its specified temperature range in functional safety mode. Check the operating temperature.
Fb		Minimum supply voltage not reached	<b>Device LED is off:</b> A supply voltage is probably applied but still too low. Check the power supply (at the output terminals). If the problem persists, contact Technical Support. <b>Device LED lights permanently red:</b> The device is operated below its specified supply voltage range. Check the power supply (at the output terminals). Reset the device or switch it off and back on. If the problem persists, contact Technical Support.
FL		Electronics defect	Defect of device electronics. A replacement of the device is recommended. Contact Technical Support.
Fn		Error in communication with input CPU	An unrecoverable error occurred in the internal communication to the input CPU. Reset the device or switch it off and back on. If the problem persists, contact Technical Support.
FE		Loop current read back error	The loop current does not correspond to the expected value. Check DAC trim settings. Restore to factory DAC calibration. If the problem persists, contact Technical Support.

ID	Symbols	Message	Cause/Remedy
FC	 	Maximum supply voltage exceeded	The device is operated above its specified supply voltage range. Check the power supply (at the output terminals). Reset the device or switch it off and back on. If the problem persists, contact Technical Support.
FU	 	Input CPU reconfiguration failed	An unrecoverable error occurred in the input CPU. Reset the device or switch it off and back on. If the problem persists, contact Technical Support.
L		-	The device is write-protected by a write-protection switch.
LL		-	Button lock is enabled.
LP		-	Parameters and device functions are write-protected with a user PIN.
SA	 	Error in EEPROM communication	An unrecoverable error occurred in the internal communication to the EEPROM. Reset the device or switch it off and back on. If the problem persists, contact Technical Support.
Sb	 	Volatile memory check failure Maintenance alarm	Device electronics error. Restart the device. If error continues, device electronics may have a defect. Repair is required. Contact Technical Support.
SC	 	CRC16 error in input CPU configuration	An unrecoverable error occurred in the internal input CPU. Reset the device or switch it off and back on. If the problem persists, contact Technical Support.
Sn	 	Exception error during code execution	An exception error occurred in the program execution of the main CPU. Reset the device or switch it off and back on. If the problem persists, contact Technical Support.
So	 	Stack integrity error	An exception error occurred in the program execution of the main CPU. Reset the device or switch it off and back on. If the problem persists, contact Technical Support.
SU	 	Safety critical device error	Check the error in menu "Diagnostics" in tab "Extended field device status". Validate the functional safety configuration or reselect normal operation. If the device does not display an error, repeat the safety start up.

## 11.3 Troubleshooting

Symptom	Cause of error	Remedy
Display empty or shows "INIT"	No or incorrect supply voltage	Check the voltage at the terminals, the connections and the wiring.
Display shows "#####" instead of the current measured value	Value too large to appear on the display	Adjust the unit so that a lower value can be displayed.

## 11.4 Troubleshooting of USB modem

Below you can find information on how to troubleshoot simple errors yourself.

LED on the USB modem	Cause of error	Remedy
Power LED is not lit.	The USB cable is not connected.	<ul style="list-style-type: none"> <li>Connect the USB cable. Connecting USB modem (Page 136)</li> </ul>
	Hardware fault occurred.	<ul style="list-style-type: none"> <li>Replace the device.</li> </ul>
Power LED flashes yellow during parameter assignment of the temperature transmitter.	No temperature transmitter connected.	<ol style="list-style-type: none"> <li>Check the polarity on the temperature transmitter. Connecting USB modem (Page 136)</li> <li>Check whether the loop current is at least 3.5 mA.</li> </ol>
Comm LED is not lit.	USB modem is not detected by the PC.	<ol style="list-style-type: none"> <li>Check the port settings in SIPROM T.</li> <li>Check the driver installation and reinstall SIPROM T if necessary.</li> </ol>
Error LED illuminates red during the temperature transmitter parameter assignment.	Short-circuit at the modem terminals for the temperature transmitter.	<ul style="list-style-type: none"> <li>Check the wiring of the modem terminals. Connecting USB modem (Page 136)</li> </ul>
Error LED is lit red.	Hardware fault occurred.	<ul style="list-style-type: none"> <li>If the Error LED remains continuously lit even after repeatedly switching the power supply of the modem off and on, the USB modem is defective. Replace the USB module.</li> </ul>

### See also

Meaning of LEDs on the USB modem (Page 63)

## Technical data

### 12.1 SITRANS TH100/TH100 slim

#### 12.1.1 Technical specifications

Rated conditions	SITRANS TH100/TH100 Slim
Ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	≤ 98%, condensing
Electromagnetic compatibility	As per EN 61326 and NAMUR NE21
Errors with EMC influences	
<ul style="list-style-type: none"> <li>ESD in accordance with EN 61000-4-2</li> </ul>	< 0.10% of measuring span
<ul style="list-style-type: none"> <li>HF radiation according to EN 61000-4-3</li> </ul>	< 0.8% of measuring range 0 ... 100 °C
<ul style="list-style-type: none"> <li>Burst in accordance with EN 61000-4-4</li> </ul>	< 0.1% of measuring range 0 ... 100 °C
<ul style="list-style-type: none"> <li>HF energizing according to EN 61000-4-6</li> </ul>	< 0.9% of measuring range 0 ... 100 °C

Construction	SITRANS TH100	SITRANS TH100 Slim
Core cross-section	Max. 2.5 mm <sup>2</sup> (AWG 13)	M12 device plug
Weight	50 g	42 g
Material	Molded plastic	316L stainless steel
Degree of protection	In accordance with IEC 60529	-
<ul style="list-style-type: none"> <li>Housing</li> </ul>	IP40	IP67
<ul style="list-style-type: none"> <li>Terminals</li> </ul>	IP00	-
Tightening torque for screw terminals	Nm	-

Input RTD	SITRANS TH100/TH100 Slim
Input type	Pt100 according to IEC 60751
Characteristic curve	Temperature-linear
Connection type	2-wire, 3-wire and 4-wire
Resolution	14 bit
Measuring accuracy	

12.1 SITRANS TH100/TH100 slim

Input RTD	SITRANS TH100/TH100 Slim
• Measuring span <250 °C (450 °F)	< 0.25 °C (0.45 °F)
• Measuring span >250 °C (450 °F)	< 0.1% of measuring span
Repeatability	< 0.1 °C (0.18 °F)
Measuring current	Approx. 0.4 mA
Measuring cycle	< 0.7 s
Measuring range	-200 ... 850 °C (-328 ... 1562 °F)
Measuring span	25 ... 1050 °C (77 ... 1922 °F)
Unit of measurement	°C or °F
Offset (one-point calibration)	Programmable: -100 ... +100 °C (-180 ... 180 °F)
Wire resistance	Max. 20 Ω (total of forward and return lines)
Interference frequency suppression	50 and 60 Hz

Output	SITRANS TH100	SITRANS TH100 Slim
Output signal		4 ... 20 mA, two-wire
Supply voltage		8.5 ... 36 V DC
		Up to 30 V for Ex ia and ib Up to 32 V for Ex nL/ic Up to 35 V for Ex nA
Max. load		(U <sub>aux</sub> - 8.5 V) / 0.023 A
Above the range		3.6 mA to 23 mA continuously adjustable (factory setting: 3.84 mA to 20.50 mA)
Error signal For example in the event of sensor breakage		3.6 mA to 23 mA continuously adjustable (factory setting: 3.6 mA or 22.8 mA)
Damping time		0 ... 30 s (factory setting: 0 s)
Protection		Against reversed polarity
Resolution		12 bit
Accuracy at 23 °C		< 0.1% of measuring span
Temperature influence		Max. 0.1% / 10 °C (0.1% / 18 °F)
Power supply influence		< 0.01% of measuring span / V
Effect of load impedance		< 0.025% of max. span / 100 Ω
Long-term drift		< 0.025% of max. span in the first month < 0.035% of max. span after one year < 0.05% of the max. span after 5 years

**Note**

**Measurement errors**

Greater measuring errors may occur if the transmitter is installed on a DIN rail in an environment with severe interference. Observe the applicable ESD directives.

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

**See also**

SITRANS TH100 dimension drawings (Page 221)

**12.1.2 Certificates and approvals**

Only the technical specifications listed in the certificates (<http://www.siemens.com/processinstrumentation/certificates>) apply to applications in hazardous atmospheres.

Certificates and approvals	SITRANS TH100
ATEX (Europe) DEKRA 21ATEX0033X DEKRA 21ATEX0034X	
Type of explosion protection "Intrinsically safe, gas (Ex i IIC)"	II 1 G Ex ia IIC T6...T4 Ga II 2 (1) G Ex ib [ia Ga] IIC T6...T4 Gb II 3 G Ex ic IIC T6...T4 Gc II 3 G Ex ec IIC T6...T4 Gc
Type of explosion protection "Increased safety (Ex ec)"	II 3 G Ex ec IIC T6...T4 Gc II 3 G Ex ec[ic] IIC T6...T4 Gc
Type of explosion protection "Intrinsically safe, dust (Ex i IIC)"	II 2 D Ex ia IIC Db
FM (USA) FM 3024169	IS CI I, II, III, Div 1, GP ABCDEFG T4/T5/T6 CI I, ZN 0 AEx ia IIC T4/T5/T6 NI, S CI I, II, III, Div 2, GP ABCDFG T4/T5/T6 NI IIC T4/T5/T6
FM (Canada) FM 3024169C	IS CI I, II, III, Div 1, GP ABCDEFG T4/T5/T6 CI I, ZN 0 Ex ia IIC T4/T5/T6 NI, S CI I, II, III, Div 2, GP ABCDFG T4/T5/T6 NI IIC T4/T5/T6

## 12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

### 12.2.1 Operating conditions

Operating conditions	SITRANS TH320/420	SITRANS TR	SITRANS TF
Ambient temperature	-50 ... +85 °C (-58 ... +185 °F) SITRANS TF dual chamber housing: -40 ... +85 °C (-40 ... +185 °F)		
Ambient temperature for devices with local display	-40 ... +85 °C (-40 ... +185 °F)		
Ambient temperature for devices with functional security	-40 ... +80 °C (-40 ... +176 °F)		
Storage temperature	-50 ... +85 °C (-58 ... +185 °F) SITRANS TF dual chamber housing and SITRANS TF dual chamber housing with display: -40 ... +85 °C (-40 ... +185 °F) SITRANS TF single chamber enclosure with display: -40 ... +85 °C (-40 ... +185 °F)		
Reference temperature for sensor calibration	+24 °C (77 °F) ±1.0 °C (33.8 °F)		
Relative humidity	< 99% relative humidity (no condensation)		
Degree of protection			
• Transmitter enclosure	IP68	IP20	IP66/IP67/IP68
• Terminals	IPO0	IP20	IPO0

### 12.2.2 Construction

Mechanical specifications	SITRANS TH320/420	SITRANS TR	SITRANS TF
Weight	50 g	122 g (0.27 lb)	Single chamber housing: 0.85 kg Dual chamber housing: Aluminum: 1.3 kg, stainless steel: 3.3 kg
Maximum core cross-section	1 x 1.5 mm <sup>2</sup> (AWG 16)	2.5 mm <sup>2</sup> (AWG 14)	Single chamber housing: 1.5 mm <sup>2</sup> (AWG 16) Dual chamber housing: 2.5 mm <sup>2</sup> (AWG 14)
Tightening torque for screw terminals	0.4 Nm	0.5 ... 0.6 Nm	
Vibration	IEC 60068-2-6		
2 Hz to 25 Hz	1.6 mm		
25 Hz to 100 Hz	4 g		

### 12.2.3 General specifications

General specifications	SITRANS TH320/420/TR	SITRANS TF	
Supply voltage	7.5 <sup>1)</sup> ... 48 <sup>2)</sup> V DC 7.5 <sup>1)</sup> ... 30 <sup>2)</sup> V DC (Ex i)	Single chamber housing Without display: 7.5 ... 48 V DC 7.5 ... 30 V DC (Ex i) With display: 10 ... 48 V DC 10 ... 30 V DC (Ex i)	Dual chamber housing Without display: 8.2 ... 48 V DC 8.2 ... 30 V DC (Ex i) With display: 10.7 ... 48 V DC 10.7 ... 30 V DC (Ex i)
Maximum power loss	≤ 850 mW		
Minimum load resistance at supply voltage > 37 V insulation voltage, test/operation	(Supply voltage – 37 V) / 23 mA		
Insulation voltage, test/operation	2.5 kVAC / 55 V AC 2.5 kVAC / 42 V AC(Ex i)		
Polarity protection	All inputs and outputs		
Write protection	Jumper or software		
Warming-up time	< 5 min.		
Starting time	< 2.75 s		
Programming	SIPROM T or HART		
Signal-to-noise ratio	> 60 dB		
Long-term stability, better than	± 0.05% of measuring span/year ± 0.18% of measuring span/5 years		
Response time	<ul style="list-style-type: none"> <li>• 4 to 20 mA ≤ 55 ms</li> <li>• HART ≤ 75 ms (typically 70 ms)</li> </ul>		
Damping	0 ... 60 s		
Signal dynamic, input	24 bit		
Signal dynamic, output	18 bit		
Influence of changes in supply voltage	< 0.005% of measuring span/V DC		

<sup>1)</sup> Note that the minimum supply voltage must correspond to the value measured at the terminals of the SITRANS TH320/TH420 and that all external voltage drops must be taken into consideration.

<sup>2)</sup> Protect the device from overvoltage with the help of a suitable supply voltage or suitable overvoltage protection equipment.

### 12.2.4 Input accuracy SITRANS TH320/420/TR/TF

Basic values		
Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>
Pt10	≤ ±0.8 °C	≤ ±0.020 °C/°C
Pt20	≤ ±0.4 °C	≤ ±0.010 °C/°C
Pt50	≤ ±0.16 °C	≤ ±0.004 °C/°C

12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

Basic values		
Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>
Pt100	≤ ±0.04 °C	≤ ±0.002 °C/°C
Pt200	≤ ±0.08 °C	≤ ±0.002 °C/°C
Pt500	T <sub>max.</sub> ≤ 180 °C: ≤ ±0.08 °C T <sub>max.</sub> > 180 °C: ≤ ±0.16 °C	≤ ±0.002 °C/°C
Pt1000	≤ ±0.08 °C	≤ ±0.002 °C/°C
Pt2000	T <sub>max.</sub> ≤ 300 °C: ≤ ±0.08 °C T <sub>max.</sub> > 300 °C: ≤ ±0.4 °C	≤ ±0.002 °C/°C
Pt10,000	≤ ±0.16 °C	≤ ±0.002 °C/°C
Pt x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Ni10	≤ ±1.6 °C	≤ ±0.020 °C/°C
Ni20	≤ ±0.8 °C	≤ ±0.010 °C/°C
Ni50	≤ ±0.32 °C	≤ ±0.004 °C/°C
Ni100	≤ ±0.16 °C	≤ ±0.002 °C/°C
Ni120	≤ ±0.16 °C	≤ ±0.002 °C/°C
Ni200	≤ ±0.16 °C	≤ ±0.002 °C/°C
Ni500	≤ ±0.16 °C	≤ ±0.002 °C/°C
Ni1000	≤ ±0.16 °C	≤ ±0.002 °C/°C
Ni2000	≤ ±0.16 °C	≤ ±0.002 °C/°C
Ni10000	≤ ±0.32 °C	≤ ±0.002 °C/°C
Ni x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Cu5	≤ ±1.6 °C	≤ ±0.040 °C/°C
Cu10	≤ ±0.8 °C	≤ ±0.020 °C/°C
Cu20	≤ ±0.4 °C	≤ ±0.010 °C/°C
Cu50	≤ ±0.16 °C	≤ ±0.004 °C/°C
Cu100	≤ ±0.08 °C	≤ ±0.002 °C/°C
Cu200	≤ ±0.08 °C	≤ ±0.002 °C/°C
Cu500	≤ ±0.16 °C	≤ ±0.002 °C/°C
Cu1000	≤ ±0.08 °C	≤ ±0.002 °C/°C
Cu x	Largest tolerance of neighboring points	Largest temperature coefficient of neighboring points
Linear resistance: 0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C
Linear resistance: 0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C
Potentiometers: 0 ... 100%	4-wire and 5-wire: < 0.05% 3-wire: < ±0.15% (3-wire)	< ±0.005%
mV: -20 ... 100 mV	≤ ±5 μV ≤ ± 0.01% of the value	≤ ±0.2 μV/°C
mV: -100 ... 1700 mV	≤ ±0.1 mV ≤ ± 0.01% of the value	≤ ±36 μV/°C

12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

Basic values		
Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>
mV: ±800 mV	≤ ±0.1 mV ≤ ± 0.01% of the value	≤ ±32 μV/°C
TC E	≤ ±0.2 °C ≤ ± 0.01% of the value	≤ ±0.025 °C/°C
TC J	≤ ±0.25 °C ≤ ± 0.01% of the value	≤ ±0.025 °C/°C
TC K	≤ ±0.25 °C ≤ ± 0.01% of the value	≤ ±0.025 °C/°C
TC L	≤ ±0.35 °C ≤ ± 0.01% of the value	≤ ±0.025 °C/°C
TC N	≤ ±0.4 °C ≤ ± 0.01% of the value	≤ ±0.025 °C/°C
TC T	≤ ±0.25 °C ≤ ± 0.01% of the value	≤ ±0.025 °C/°C
TC U	< 0 °C ≤ ±0.8 °C ≤ ± 0.01% of the value ≥ 0 °C ≤ ±0.4 °C ≤ ± 0.01% of the value	≤ ±0.025 °C/°C
TC Lr	≤ ±0.2 °C ≤ ± 0.01% of the value	≤ ±0.1 °C/°C
TC R	< 200 °C ≤ ±0.5 °C ≤ ± 0.01% of the value ≥ 200 °C ≤ ±1 °C ≤ ± 0.01% of the value	≤ ±0.1 °C/°C
TC S	< 200 °C ≤ ±0.5 °C ≤ ± 0.01% of the value ≥ 200 °C ≤ ±1 °C ≤ ± 0.01% of the value	≤ ±0.1 °C/°C
TC W3	≤ ±0.6 °C ≤ ± 0.01% of the value	≤ ±0.1 °C/°C
TC W5	≤ ±0.4 °C ≤ ± 0.01% of the value	≤ ±0.1 °C/°C
TC type: B <sup>2)</sup>	≤ ±1 °C ≤ ± 0.01% of the value	≤ ±0.1 °C/°C
TC type: B <sup>3)</sup>	≤ ±3 °C ≤ ± 0.01% of the value	≤ ±0.1 °C/°C
TC type: B <sup>4)</sup>	≤ ±8 °C ≤ ± 0.01% of the value	≤ ±0.8 °C/°C
TC type: B <sup>5)</sup>	Not specified	Not specified

12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

Basic values		
Input type	Basic accuracy	Temperature coefficient <sup>1)</sup>
CJC (internal)	< ± 0.5 °C SITRANS TF dual chamber housing: < +3 °C	Included in basic accuracy
CJC (external)	≤ ±0.08 °C	≤ ±0.002 °C/°C

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

See also

Accuracy calculation examples (Page 231)

12.2.5 Output accuracy SITRANS TH320/420/TR/TF

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

Electromagnetic compatibility according to IEC/EN 61326-1 and NAMUR Recommendation EMC (NE21)

Refer to the Declaration of Conformity (<http://www.siemens.com/processinstrumentation/certificates>) for details on electromagnetic compatibility.

All tests were also passed with digital HART communication. The device functions were checked before and after the EMC tests and were verified.

	SITRANS TH	SITRANS TF	
	SITRANS TR	Single chamber housing	Two chamber enclosure
Measurement accuracy based on test according to IEC/EN 61326-1	0.1 ... 1% of the measuring range		0.1 ... 0.6% of the measuring range

**See also**

Accuracy calculation examples (Page 231)

Product documentation (Page 227)

**12.2.6 Input**

**12.2.6.1 RTD for SITRANS TH320/420/TR/TF**

Input type	Standard	Min. value	Max. value	$\alpha$	Min. measuring span
Pt10 ... 10,000	IEC 60751	-200 °C	+850 °C	0.003851	10 °C
	JIS C 1604-8	-200 °C	+649 °C	0.003916	10 °C
	GOST 6651-2009	-200 °C	+850 °C	0.003910	10 °C
	Callendar-Van Dusen	-200 °C	+850 °C	-	10 °C
Ni10 ... 10,000	DIN 43760-1987	-60 °C	+250 °C	0.006180	10 °C
	GOST 6651-2009 / OIML R84:2003	-60 °C	+180 °C	0.006170	10 °C
Cu5 ... 1000	Edison Copper Winding No. 15	-200 °C	+260 °C	0.004270	100 °C
	GOST 6651-2009 / OIML R84:2003	-180 °C	+200 °C	0.004280	100 °C
	GOST 6651-94	-50 °C	+200 °C	0.004260	100 °C

Connection type	2-wire, 3-wire and 4-wire
Wire resistance per wire (max.)	50 $\Omega$
Input current	< 0.15 mA
Effect of the wire resistance (with 3-wire and 4-wire connections)	< 0.002 $\Omega$ / $\Omega$
SITRANS TF dual chamber housing: Additional cable resistance with 2-wire connection	0.0098 ohm
Cable, wire-wire capacity	Max. 30 nF (Pt1000 & Pt10000 IEC and JIS +Ni1000 & NI10000)Max. 50 nF (all other input types)
Fault detection, programmable	None, short-circuited, broken, short-circuited or broken
Note: When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.	
Detection limit for short-circuited input	15 $\Omega$
Fault detection time (RTD)	$\leq$ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	$\leq$ 2000 ms

### 12.2.6.2 Thermocouple (TC)

Input type	Min. temperature	Max. temperature	Min. measuring span	Standard
B	0 (85) °C	+1820 °C	100 °C	IEC 60584-1
E	-200 °C	+1000 °C	50 °C	IEC 60584-1
J	-100 °C	+1200 °C	50 °C	IEC 60584-1
K	-180 °C	+1372 °C	50 °C	IEC 60584-1
L	-200 °C	+900 °C	50 °C	DIN 43710
Lr	-200 °C	+800 °C	50 °C	GOST 3044-84
N	-180 °C	+1300 °C	50 °C	IEC 60584-1
R	-50 °C	+1760 °C	100 °C	IEC 60584-1
S	-50 °C	+1760 °C	100 °C	IEC 60584-1
T	-200 °C	+400 °C	50 °C	IEC 60584-1
U	-200 °C	+600 °C	50 °C	DIN 43710
W3	0 °C	+2300 °C	100 °C	ASTM E988-96
W5	0 °C	+2300 °C	100 °C	ASTM E988-96

#### Cold junction compensation (CJC)

Cold junction compensation (CJC)	Constant, internal (default) or external over Pt100 or Ni100 RTD
Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
Connection external CJC	2-wire, 3-wire or 4-wire
External CJC, wire resistance per wire (for 3-wire and 4-wire connections)	50 Ω
Effect of the wire resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Input current external CJC	< 0.15 mA
Temperature range external CJC	-50 ... +135 °C (-58 ... +275 °F)
Cable, wire-wire capacity (CJC and thermocouple)	Max. 50 nF
Total wire resistance	Max. 10 kΩ
Fault detection, programmable	None, short-circuited, broken CJC: Short-circuited or broken
Note: The short-circuited fault detection only applies to the CJC input.	
Fault detection time (TC)	≤ 75 ms (typically 70 ms)
Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2000 ms

### 12.2.6.3 Linear resistance

Linear resistance input	SITRANS TH320/TR320/TF320	SITRANS TH420/TR420/TF420
Input range	0 Ω ... 100 kΩ	
Min. measuring span	25 Ω	
Connection type	2-wire, 3-wire or 4-wire	2-wire, 3-wire or 4-wire

12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

Linear resistance input	SITRANS TH320/TR320/TF320	SITRANS TH420/TR420/TF420
Wire resistance per wire (max.)		50 Ω
Input current		< 0.15 mA
Effect of the wire resistance (with 3-wire or 4-wire connections)		< 0.002 Ω/Ω
SITRANS TF dual chamber housing: Additional cable resistance with 2-wire connection		0.0098 ohm
Cable, wire-wire capacity		Max. 30 nF (lin. R > 400 Ω) Max. 50 nF (lin. R ≤ 400 Ω)
Fault detection, programmable	None, short-circuited, broken, short-circuited or broken	

### 12.2.6.4 Potentiometer

Potentiometer input	
Resistance range	10 Ω ... 100 kΩ
Input range	0 ... 100%
Minimum measured span	10%
Connection type	3-wire, 4-wire or 5-wire 5-wire only for devices with two inputs
Wire resistance per wire (max.)	50 Ω
Input current	< 0.15 mA
Effect of the wire resistance (with 3-wire and 4-wire connections)	< 0.002 Ω/Ω
Cable, wire-wire capacity	Max. 30 nF (potentiometer > 400 Ω) Max. 50 nF (potentiometer ≤ 400 Ω)
Fault detection, programmable	None, short-circuited, broken, short-circuited or broken
Note: When the configured potentiometer size is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.	
Detection limit for short-circuited input	15 Ω
Fault detection time, wiper arm (no short-circuit detection)	≤ 75 ms (typically 70 ms)
Fault detection time, element	≤ 2000 ms
Fault detection time (for 4-wire and 5-wire)	≤ 2000 ms

### 12.2.6.5 Voltage

Voltage input	SITRANS TH320/420/TR/TF
Measuring range	-800 ... +800 mV (bipolar) -100 ... +1700 mV
Min. measuring span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacity	Max. 30 nF (input range: -100 ... 1700 mV) Max. 50 nF (input range: -20 ... 100 mV)

Voltage input	SITRANS TH320/420/TR/TF
Error detection, programmable	None, broken
Error detection time	≤ 75 ms (typically 70 ms)

## 12.2.7 Output specifications and HART

Output and HART communication	SITRANS TH320/420/TR/TF
Normal range, programmable	3.8 ... 20.5/20.5 ... 3.8 mA
Extended range (output limits), programmable	3.5 ... 23/23 ... 3.5 mA
Programmable input/output limits	
<ul style="list-style-type: none"> <li>Fault current</li> </ul>	Enable / disable
<ul style="list-style-type: none"> <li>Fault current setting</li> </ul>	3.5 to 23 mA
Update time	10 ms
Load (with current output)	≤ (V <sub>supply</sub> - 7.5)/0.023 [Ω]
Load stability	< 0.01% of measuring span/100 Ω
Input fault detection, programmable (detection of input short circuits is ignored with TC and voltage inputs)	3.5 to 23 mA
NAMUR NE43 Upscale	> 21 mA
NAMUR NE43 Downscale	< 3.6 mA
HART protocol versions	HART 7

Measuring span = currently selected range

### See also

Programmable sensor input and current output limits (Page 232)

## 12.2.8 Certificates and approvals

### 12.2.8.1 ATEX/IECEx and others

#### Certificate numbers

Only the technical specifications listed in the certificates (<http://www.siemens.com/processinstrumentation/certificates>) apply to applications in hazardous atmospheres.

ATEX/IECEx and others	SITRANS TH320/420/TR	SITRANS TF	Display
Certificate numbers	DEKRA 17 ATEX 0116 X	DEKRA 19ATEX0106X A5E50642461A-2021X	DEKRA 19ATEX0105 X

12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

ATEX/IECEx and others	SITRANS TH320/420/TR	SITRANS TF	Display
	A5E43700604A-2018X	DEKRA 19ATEX0107X DEKRA 19ATEX0108X	A5E50485541A-2020X
	IECEx DEK 17.0054X	IECEx DEK 19.0069X IECEx DEK 19.0070X	IECEx DEK19.0068X
ГОСТ 31610.0-2014 (IEC 60079-0:2011) ГОСТ 31610.11-2014 (IEC 60079-11:2011) ГОСТ 31610.15-2014/IEC 60079-15:2010	№ TC RU C-DE.AA87.B.01162 OC НАНИО «ЦСВЭ»	№ EAЭC RU C-DE.xxxx.x.xxxxx/ xx OC ВСИ «ВНИИФТРИ»	№ EAЭC RU C-DE.BH02.B.00587/20 OC ВСИ «ВНИИФТРИ»
ABNT NBR IEC60079-0 ER-RATA 2:2016 ABNT NBR IEC60079-1:2016 ABNT NBR IEC60079-31:2014	-	DEK xx.00xxX	-
ГОСТ 31610.0-2014 (IEC 60079-0:2011) ГОСТ 31610.1.1-2012 (IEC 60079-1:2002) ГОСТ xxxxx.xx-xxxx/IEC 60079-31:2013	-	№ EAЭC RU C-DE.xxxx.x.xxxxx/ xx OC ВСИ «ВНИИФТРИ»	-
DEKRA 19ATEX0106X	-	II 1 G Ex ia IIC T6 ... T4 Ga and/or II 2 (1) G Ex ib [ia Ga] IIC T6 ... T4 Gb and/or II 2 (1) D Ex ib [ia Da] II- IC T100 °C Db	-
DEKRA 19ATEX0107X	-	II 3 G Ex ec IIC T6 ... T4 Gc and/or II 3 G Ex ic IIC T6 ... T4 Gc and/or II 3 G Ex nA IIC T6 ... T4 Gc and/or II 3 D Ex ic IIIC T100 °C Dc	-
DEKRA 19ATEX0108X	-	II 2 G Ex db IIC T6 ... T4 Gb II 2 D Ex tb IIIC T100 °C Db	-
IECEx DEK 19.0069X	-	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb Ex ib [ia Da] IIIC T 100 °C Db Ex ec IIC T6 ... T4 Gc Ex ic IIIC T100 °C Dc Ex nA IIC T6 ... T4 Gc	-
IECEx DEK 19.0070X	-	Ex db IIC T6 ... T4 Gb Ex tb III T100 °C Db Ex tc IIIC T100 °C Dc	-
A5E50642461A-2021X	-	II 3 D Ex tc IIIC T100 °C Dc	-

"Intrinsic safety ia/ib" type of protection

ATEX/IECEX and others	SITRANS TH320/420/TR	SITRANS TF	Display
<ul style="list-style-type: none"> <li>"Intrinsic safety ia/ib" type of protection</li> </ul>	Zones 0, 1, 2, 20, 21, 22 and M1		
Name <ul style="list-style-type: none"> <li>ATEX</li> </ul>	II 1 G Ex ia IIC T6 ... T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb II 1 D Ex ia IIIC Da I M1 Ex ia I Ma	II 1 G Ex ia IIC T6 ... T4 Ga II 2 (1) G Ex ib [ia Ga] IIC T6 ... T4 Gb II 2 (1) D Ex ib [ia Da] II-IC T100 °C Db	II 1 G Ex ia IIC Ga
<ul style="list-style-type: none"> <li>IECEX and others</li> </ul>	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb Ex ia IIIC Da Ex ia I Ma	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb Ex ib [ia Da] IIIC T100 °C Db	Ex ia IIC Ga
<ul style="list-style-type: none"> <li>EACEX</li> </ul>	0Ex ia IIC T6 ... T4 Ga X 1Ex ib [ia Ga] IIC T6 ... T4 Gb X Ex ia IIIC T70 °C to T105 °C Da X PO Ex ia I Ma X	0Ex ia IIC T6 ... T4 Ga X 1Ex ib [ia Ga] IIC T6 ... T4 Gb X Ex ib [ia Da] IIIC T100°C Db X	Ex ia IIC Ga U
Output terminals SITRANS TH/ SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	$U_i = 30 \text{ V DC}$ , $I_i = 120 \text{ mA}$ , $L_i = 0 \mu\text{H}$ , $C_i = 1.0 \text{ nF}$	$U_i = 30 \text{ V DC}$ , $I_i = 120 \text{ mA}$ , $L_i = 0 \mu\text{H}$ , $C_i = 2.2 \text{ nF}$	$U_i = 30 \text{ V DC}$ , $I_i = 120 \text{ mA}$ , $L_i = 0 \mu\text{H}$ , $C_i = 2.2 \text{ nF}$
<ul style="list-style-type: none"> <li>Permissible ambient temperature <math>P_i = 900 \text{ mW}</math></li> </ul>	-50 °C to +85 °C (-58 °F to +185 °F) temperature class T4 -50 °C to +65 °C (-58 °F to +149 °F) temperature class T5 -50 °C to +50 °C (-58 °F to +122 °F) temperature class T6	-50 ... +75 °C (-58 ... +167 °F) T4 <sup>1)</sup> -50 ... +40 °C (-58 ... +104 °F) T6 <sup>1)</sup>	-40 ... +85 °C (-40 ... +185 °F) Temperature class T4 -40 ... +50 °C (-40 ... +122 °F) Temperature class T6
<ul style="list-style-type: none"> <li>Permissible ambient temperature <math>P_i = 750 \text{ mW}</math></li> </ul>	-50 °C to +85 °C (-58 °F to +185 °F) temperature class T4 -50 °C to +70 °C (-58 °F to +158 °F) temperature class T5 -50 °C to +55 °C (-58 °F to +131 °F) temperature class T6	-50 ... +75 °C (-58 ... +167 °F) Temperature class T4 <sup>1)</sup> -50 ... +45 °C (-58 ... +113 °F) Temperature class T6 <sup>1)</sup>	-40 ... +85 °C (-40 ... +185 °F) Temperature class T4 -40 ... +55 °C (-40 ... +131 °F) Temperature class T6
<ul style="list-style-type: none"> <li>Permissible ambient temperature <math>P_i = 610 \text{ mW}</math></li> </ul>	-50 °C to +85 °C (-58 °F to +185 °F) temperature class T4 -50 °C to +75 °C (-58 °F to +167 °F) temperature class T5 -50 °C to +60 °C (-58 °F to +140 °F) temperature class T6	-50 ... +75 °C (-58 ... +167 °F) Temperature class T4 <sup>1)</sup> -50 ... +50 °C (-58 ... +122 °F) Temperature class T6 <sup>1)</sup>	-40 ... +85 °C (-40 ... +185 °F) Temperature class T4 -40 ... +60 °C (-40 ... +140 °F) Temperature class T6

12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

ATEX/IECEx and others	SITRANS TH320/420/TR	SITRANS TF	Display
<i>Input terminals</i>	<b>TH320/420/TR/TF320</b>		-
SITRANS TH/TF: 3, 4, 5, 6, 7, 8, 9	$U_o = 7.2 \text{ V DC}$ , $I_o = 12.9 \text{ mA}$ , $P_o = 23.3 \text{ mW}$ , $L_o = 200 \text{ mH}$ , $C_o = 13.5 \mu\text{F}$		
SITRANS TR: 5, 6, 7, 8, 9, 10, 11, 12	<b>TH320/420/TR/TF420</b> (input 1 or 2)		
	$U_o = 7.2 \text{ V DC}$ , $I_o = 7.3 \text{ mA}$ , $P_o = 13.2 \text{ mW}$ , $L_o = 667 \text{ mH}$ , $C_o = 13.5 \mu\text{F}$		

1) A SITRANS TF display or a SITRANS TF in a dual chamber housing has the minimum permissible ambient temperature of -40 °C.

"Intrinsic safety ic" type of protection

ATEX/IECEx and others	SITRANS TH320/420/TR	SITRANS TF	Display
• "Intrinsic safety ic" type of protection	Zones 2 and 22		
Name	II 3 G Ex ic IIC T6 ... T4 Gc	II 3 G Ex ic IIC T6 ... T4 Gc	II 3 G Ex ic IIC Gc
• ATEX	II 3 D Ex ic IIIC Dc	II 3 D Ex ic IIIC T100 °C Dc	
• IECEx	Ex ic IIC T6 ... T4 Gc Ex ic IIIC Dc	Ex ic IIC T6 ... T4 Gc Ex ic IIIC T100 °C Dc	Ex ic IIC Gc
• EACEx	2Ex ic IIC T6 ... T4 Gc X Ex ic IIIC T70 °C to T105 °C Dc X	2Ex ic IIC T6 ... T4 Gc X Ex ic IIIC T100 °C Dc X	Ex ic IIC Gc U
<i>Output terminals</i>	$U_i = \text{DC } 37 \text{ V}$ , $L_i = 0 \mu\text{H}$ , $C_i = 1.0 \text{ nF}$	$U_i = 37 \text{ V DC}$ , $P_i = 851 \text{ mW}$ , $L_i = 0 \mu\text{H}$ , $C_i = 2.2 \text{ nF}$	$U_i = 37 \text{ V DC}$ , $L_i = 120 \text{ mA}$ , $L_i = 0 \mu\text{H}$ , $C_i = 2.2 \text{ nF}$
SITRANS TH/ SITRANS TF single chamber housing: 1, 2	For $U_i = \text{DC } 48 \text{ V}$ , $P_i = 851 \text{ mW}$ , $L_i = 0 \mu\text{H}$ , $C_i = 1.0 \text{ nF}$	For $U_i = 48 \text{ V DC}$ , $P_i = 851 \text{ mW}$ , $L_i = 0 \mu\text{H}$ , $C_i = 2.2 \text{ nF}$	
SITRANS TR: 3, 4		SITRANS TF with local display:	
SITRANS TF dual chamber housing: (+) and (-)		$U_i = 37 \text{ V DC}$ , $P_i = 851 \text{ mW}$	
• Permissible ambient temperature	-50 °C to +85 °C (-58 °F to +185 °F) temperature class T4 -50 °C to +70 °C (-58 °F to +158 °F) temperature class T5 -50 °C to +55 °C (-58 °F to +131 °F) temperature class T6	-50 ... +75 °C (-58 ... +167 °F) Temperature class T4 <sup>1)</sup> -50 ... +45 °C (-58 ... +113 °F) Temperature class T6 <sup>1)</sup>	-40 ... +85 °C (-40 ... +185 °F) Temperature class T4 -40 ... +60 °C (-40 ... +140 °F) Temperature class T6
<i>Output terminals</i>	$U_i = 30 \text{ V DC}$ , $L_i = 0 \mu\text{H}$ , $C_i = 1.0 \text{ nF}$	$U_i = 30 \text{ V DC}$ , $L_i = 0 \mu\text{H}$ , $C_i = 2.2 \text{ nF}$ -	
SITRANS TH/ SITRANS TF single chamber housing: 1, 2			
SITRANS TR: 3, 4			
SITRANS TF dual chamber housing: (+) and (-)			

12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

ATEX/IECEX and others	SITRANS TH320/420/TR	SITRANS TF	Display
<ul style="list-style-type: none"> <li>Permissible ambient temperature</li> </ul>	-50 °C to +85 °C (-58 °F to +185 °F) temperature class T4 -50 °C to +75 °C (-58 °F to +167 °F) temperature class T5 -50 °C to +60 °C (-58 °F to +140 °F) temperature class T6	-50 ... +75 °C (-58 ... +167 °F) Temperature class T4 <sup>1)</sup> -50 ... +50 °C (-58 ... +113 °F) Temperature class T6 <sup>1)</sup>	-
<i>Input terminals</i>	<b>TH320/420/TR/TF320</b>		-
SITRANS TH/TF: 3, 4, 5, 6, 7, 8, 9	U <sub>o</sub> = 7.2 V DC, I <sub>o</sub> = 12.9 mA, P <sub>o</sub> = 23.3 mW, L <sub>o</sub> = 200 mH, C <sub>o</sub> = 13.5 µF		
SITRANS TR: 5, 6, 7, 8, 9, 10, 11, 12	<b>TH320/420/TR/TF420</b> (input 1 or 2) U <sub>o</sub> = 7.2 V DC, I <sub>o</sub> = 7.3 mA, P <sub>o</sub> = 13.2 mW, L <sub>o</sub> = 667 mH, C <sub>o</sub> = 13.5 µF		

<sup>1)</sup> A SITRANS TF display or a SITRANS TF in a dual chamber housing has the minimum permissible ambient temperature of -40 °C.

"Non-sparking nA/ec" type of protection

ATEX/IECEX and others	SITRANS TH320/420/TR	SITRANS TF	Display
<ul style="list-style-type: none"> <li>"Non-sparking nA/ec" type of protection</li> </ul>	Zone 2 Take measures to ensure that the supply voltage (including transients) does not rise above 140% of the rated voltage.		
Name	II 3 G Ex nA IIC T6 ... T4 Gc	II 3 G Ex ec IIC T6 ... T4 Gc	II 3 G Ex nA IIC Gc
<ul style="list-style-type: none"> <li>ATEX</li> </ul>	II 3 G Ex ec IIC T6 ... T4 Gc	II 3 G Ex nA IIC T6 ... T4 Gc	II 3 G Ex ec IIC Gc
<ul style="list-style-type: none"> <li>IECEX</li> </ul>	Ex nA IIC T6 ... T4 Gc Ex ec IIC T6 ... T4 Gc	Ex ec IIC T6 ... T4 Gc Ex nA IIC T6 ... T4 Gc	Ex nA IIC Gc Ex ec IIC Gc
<ul style="list-style-type: none"> <li>EACEx</li> </ul>	2Ex nA IIC T6 ... T4 Gc X		Ex e II Gc U Ex nA II Gc U
<i>Output terminals</i>	U <sub>n</sub> = 37 V DC, P <sub>n</sub> = 851 mW		U <sub>n</sub> = 2.5 V
SITRANS TH/ SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)			
<ul style="list-style-type: none"> <li>Permissible ambient temperature</li> </ul>	-50 °C to +85 °C (-58 °F to +185 °F) temperature class T4 -50 °C to +70 °C (-58 °F to +158 °F) temperature class T5 -50 °C to +55 °C (-58 °F to +131 °F) temperature class T6	-50 ... +75 °C (-58 ... +167 °F) Temperature class T4 <sup>1)</sup> -50 ... +45 °C (-58 ... +113 °F) Temperature class T6 <sup>1)</sup>	-40 ... +85 °C (-40 ... +185 °F) Temperature class T4 -40 ... +55 °C (-40 ... +131 °F) Temperature class T6

12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

ATEX/IECEx and others	SITRANS TH320/420/TR	SITRANS TF	Display
	<b>U<sub>max</sub> = 30 V DC</b>		
<ul style="list-style-type: none"> <li>Permissible ambient temperature</li> </ul>	-50 °C to +85 °C (-58 °F to +185 °F) temperature class T4 -50 °C to +75 °C (-58 °F to +167 °F) temperature class T5 -50 °C to +60 °C (-58 °F to +140 °F) temperature class T6	-	-

1) A SITRANS TF display or a SITRANS TF in a dual chamber housing has the minimum permissible ambient temperature of -40 °C.

**"Flameproof enclosure Ex d/dust explosion protection by enclosure Ex tb/tc" type of protection**

ATEX/IECEx and others	SITRANS TH320/420/TR	SITRANS TF	Display
<ul style="list-style-type: none"> <li>"Flameproof enclosure Ex d/dust explosion protection by enclosure Ex tb/tc" type of protection</li> </ul>	-	Zone 1/21/22	-
Name	-	II 2 G Ex db IIC T6 ... T4 Gb	-
<ul style="list-style-type: none"> <li>ATEX</li> </ul>	-	II 2 D Ex tb IIIC T100°C Db II 3 D Ex tc IIIC T100°C Dc	-
<ul style="list-style-type: none"> <li>IECEx</li> </ul>	-	Protection against explosion db IIC T6 ... T4 Gb Protection against explosion tb IIIC T100°C Db Protection against explosion tc IIIC T100°C Dc	-
<ul style="list-style-type: none"> <li>EACEx</li> </ul>	-	1Ex d IIC T6...T4 GbX Ex tb IIC T100°C Db X	-
<i>Output terminals</i>	-	<b>U<sub>max</sub> = 37 V DC</b>	-
SITRANS TF single chamber housing: 1, 2 SITRANS TF dual chamber housing: (+) and (-)			
<ul style="list-style-type: none"> <li>Permissible ambient temperature</li> </ul>	-	-50 ... +75 °C (-58 ... +167 °F) Temperature class T4 <sup>1)</sup> -50 ... +60 °C (-58 ... +140 °F) Temperature class T6 <sup>1)</sup>	-

1) A SITRANS TF display or a SITRANS TF in a dual chamber housing has the minimum permissible ambient temperature of -40 °C.

**12.2.8.2 FM/CSA**

Only the technical specifications listed in the certificates (<http://www.siemens.com/processinstrumentation/certificates>) apply to applications in hazardous atmospheres.

FM/CSA	SITRANS TH320/420/TR	SITRANS TF	Display
Certificate number	The permissible operating values are specified in the certificate ( <a href="http://www.siemens.com/processinstrumentation/certificates">http://www.siemens.com/processinstrumentation/certificates</a> ).		
	FM18CA0024X FM18US0046X FM18NUS0002 FM18NCA0001		FM21US0044X FM21CA0030X FM21NUS0004X FM21NCA0003X
	CSA 1861385		
• "Intrinsic safety ia" or "Intrinsic safety IS" type of protection			
Labeling	IS,CL I, Div 1, GP ABCD, T6 ... T4 Ex ia IIC T6 ... T4 Ga AEx ia IIC T6 ... T4 Ga or Ex ib [ia Ga] IIC T6 ... T4 Gb AEx ib [ia Ga] IIC T6 ... T4 Gb	IS, CL I, II, III, Div 1, GP ABC-DEFG, T6 ... T4 Ex ia IIC T6 ... T4 Ga AEx ia IIC T6 ... T4 Ga or Ex ib [ia Ga] IIC T6 ... T4 Gb AEx ib [ia Ga] IIC T6 ... T4 Gb	IS,CL I, Div 1, GP ABCD, T6 ... T4 or Ex ia IIC T6 ... T4 Ga AEx ia IIC T6 ... T4 Ga
• "Non-explosive/energy limited NIFW" type of protection			
Labeling	NIFW, CL I, Div 2, GP ABCD T6 ... T4 AEx ic IIC T6 ... T4 Gc Ex ic IIC T6 ... T4 Gc		
• "Non-explosive NI" type of protection			
Labeling	Take measures to ensure that the supply voltage (including transients) does not rise above 140% of the rated voltage. NI, CL I, Div 2, GP ABCD T6...T4 CL I, Zone 2, AEx nA IIC T6 ... T4 Gc Ex nA IIC T6 ... T4 Gc CL I, Div 2, GP ABCD, T6...T4 Ex nA IIC T6 ... T4 Gc		

12.2 SITRANS TH320/TH420/TR320/TR420/TF320/TF420

FM/CSA	SITRANS TH320/420/TR	SITRANS TF	Display
<ul style="list-style-type: none"> <li>Explosion protection "Flameproof enclosure XP", "Dust ignition proof DIP"</li> </ul>			
Labeling	-	CL I, Div 1, GP ABCD T6 ... T4 Type 4X CL II/III, Div 1, GP EFG T6 ... T4 Type 4X CL II/III, Div 2, GP FG T6 ... T4 Type 4X or AEx db IIC T6 ... T4 Gb AEx tb IIIC T100°C Db AEx tc IIIC T100°C Dc CL I, Div 1, GP ABCD T6 ... T4 Type 4X CL II/III, Div 1, GP EFG T6 ... T4 Type 4X CL II/III, Div 2, GP FG T6 ... T4 Type 4X Ex db IIC T6 ... T4 Gb Ex tb IIIC T100°C Db Ex tc IIIC T100°C Dc	-

## 12.2.9 Factory settings

### 12.2.9.1 Factory setting SITRANS TH320/TR320/TF320

Factory settings	SITRANS TH320/TR320
Input	Pt100 (IEC 751) in 3-wire connection
Measuring range	+0 ... +100 °C (+32 ... +212 °F)
Fault current	
<ul style="list-style-type: none"> <li>Input circuit wire break</li> </ul>	22.8 mA
<ul style="list-style-type: none"> <li>Input circuit short circuit</li> </ul>	22.4 mA
<ul style="list-style-type: none"> <li>Input monitoring wire break and short-circuit</li> </ul>	
Sensor calibration	No sensor calibration of the input and output
Damping	0.0 s

### 12.2.9.2 Factory setting SITRANS TH420/TR420/TF420

Factory settings	SITRANS TH420/TR420
Input 1	Pt100 (IEC 751) in 3-wire connection
Input 2	not configurable (inactive)
Measuring range	+0 ... +100 °C (+32 ... +212 °F)
Fault current	
<ul style="list-style-type: none"> <li>Input circuit wire break</li> </ul>	22.8 mA
<ul style="list-style-type: none"> <li>Input circuit short circuit</li> </ul>	22.4 mA
<ul style="list-style-type: none"> <li>Input circuit drift</li> </ul>	22 mA (active when input 2 is active)
Input monitoring wire break and short-circuit	
Sensor calibration	No sensor calibration of the input and output
Damping	0.0 s

## 12.3 USB modem

Ambient conditions	
Pollution degree according to IEC 61010	1 ... 2
Ambient temperature range	0 ... 50 °C (+32 ... +122 °F)
Storage temperature range	-20 ... +65 °C (-4 ... +149 °F)
Relative humidity	5 ... 80% at 25 °C (no condensation)
USB port	
Connection	USB 1.1, compatible with USB 2.0
USB current	Standard, < 200 mA
Power supply of temperature transmitter	
Available power supply	Max. 23 mA
Available supply voltage	Max. 20 V (at 4 mA)
Construction	
Weight	Approx. 250 g
Dimensions (W x H x D)	Approx. 105 x 58 x 26 mm
Degree of protection	IP20

## 12.4 Display

<b>Ambient conditions</b>	
Ambient temperature	-20 ... +85 °C (-7 ... +185 °F) You can find the data for use in hazardous areas in the respective certificate.
Storage temperature	-40 ... +85 °C (-40 ... +185 °F) You can find the data for use in hazardous areas in the respective certificate.
Best readability	-10 ... +70 °C (14 ... +158 °F)
<b>Power supply</b>	
Power supply	Is provided by the temperature transmitter
Own power consumption	< 3 mA
Voltage drop over terminals	< 2.5 V
<b>Display</b>	
Area of application	SITRANS TF and SITRANS TS500 temperature transmitter
Measuring frequency	≥ 2 Hz
Local display	Maximum 5 decimal places
Display range	-99999 ... +99999
Decimal point change	Automatically
Error warning	According to NAMUR NE 107
<b>Mechanical construction</b>	
Dimensions	Diameter: 64.3 mm (2.53") Height: 15 ... 22.5 mm (0.6 ... 0.88")
Installation	Plug in
Enclosure material	Plastic
Wiring	Plug-in connection



## Dimension drawings

### 13.1 SITRANS TH320/TH420 dimension drawings

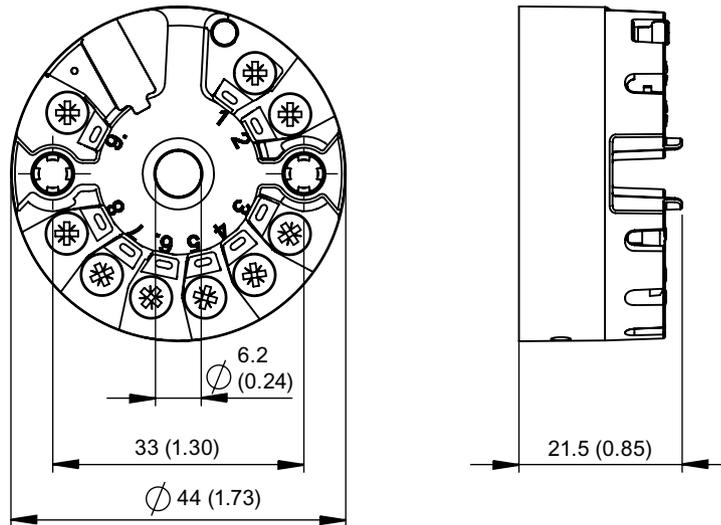


Figure 13-1 SITRANS TH320/TH420 dimension drawings, dimensions in mm (inch)

### 13.2 SITRANS TH100 dimension drawings

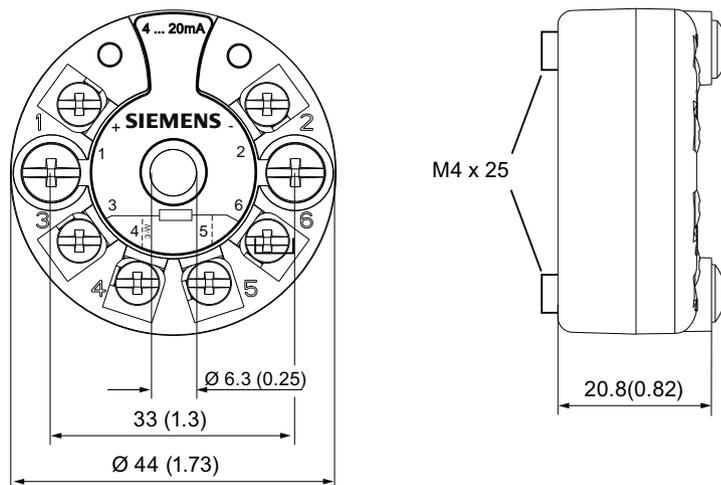


Figure 13-2 SITRANS TH100 dimension drawings, dimensions in mm (inch)

### 13.3 SITRANS TH100 Slim dimension drawings

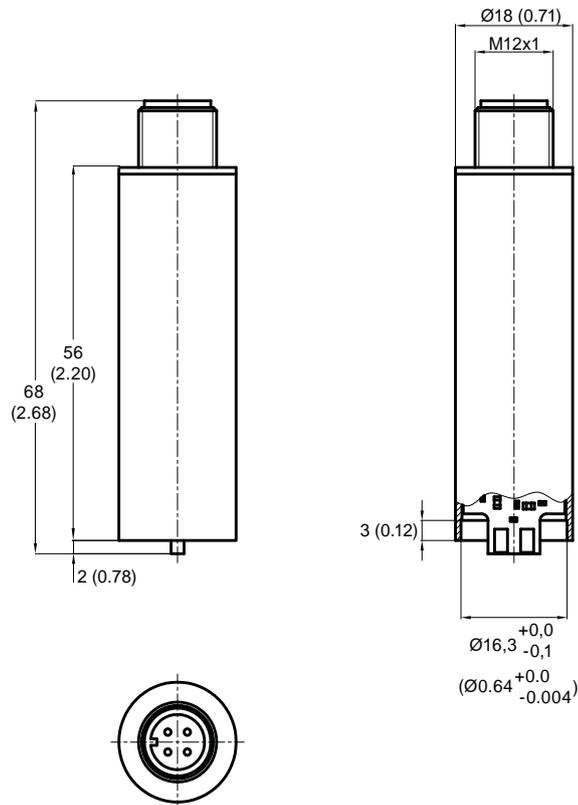


Figure 13-3 SITRANS TH100 Slim dimension drawing, dimensions in mm (inch)

### 13.4 Dimension drawings mounting rail adapter

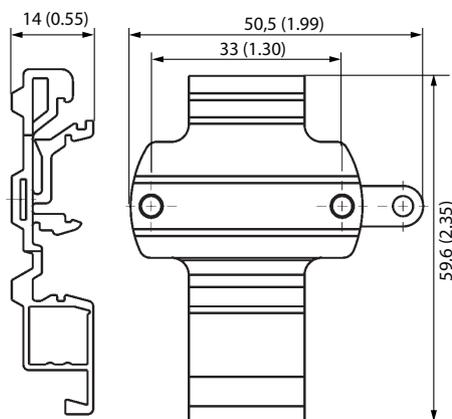


Figure 13-4 Dimension drawings mounting rail adapter (7NG3092-8KA), dimensions in mm (inch)

### 13.5 Dimension drawings SITRANS TR320/TR420

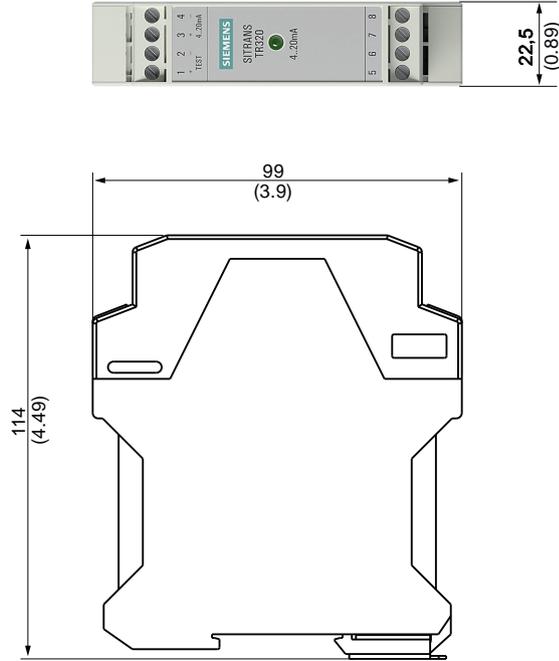


Figure 13-5 SITRANS TR320/TR420 dimension drawings, dimensions in mm (inch)

### 13.6 Dimension drawings display

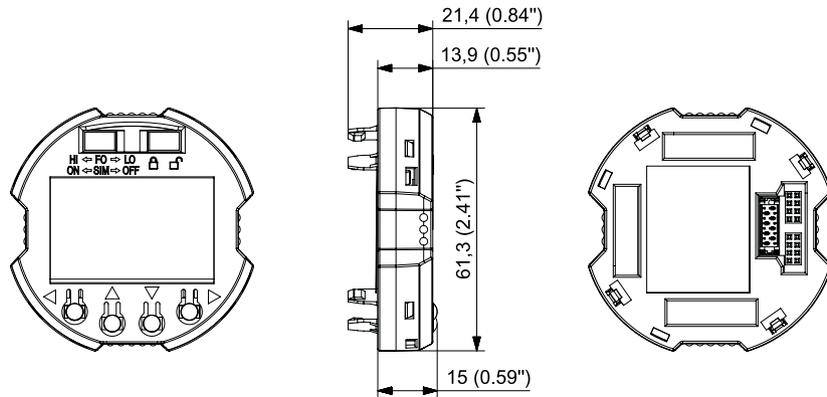


Figure 13-6 Dimension drawings display, dimensions in mm (inch)

### 13.7 Dimension drawings SITRANS TF single chamber housing

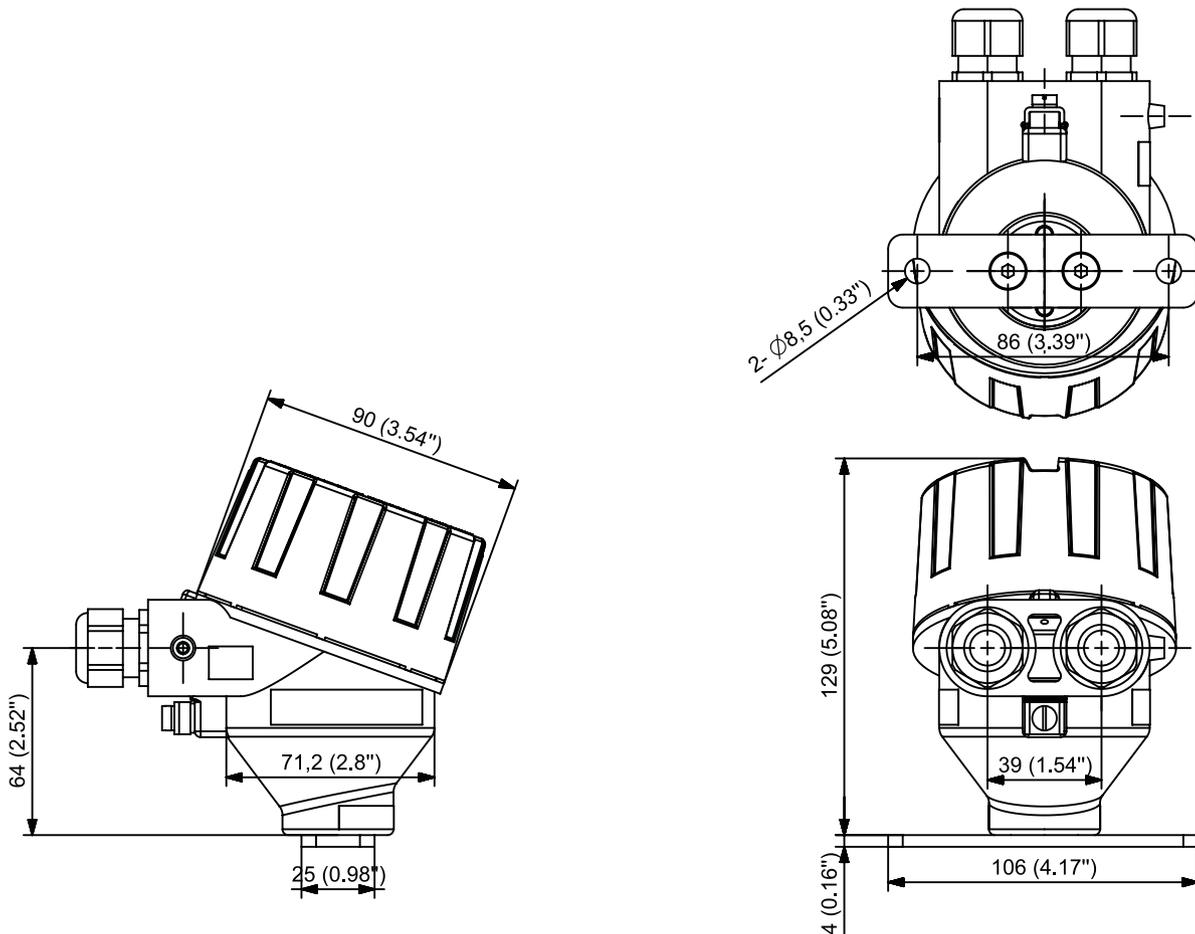


Figure 13-7 SITRANS TF Single chamber housing dimensional drawings, dimensions in mm (inch)

### 13.8 Dimension drawings SITRANS TF dual chamber housing

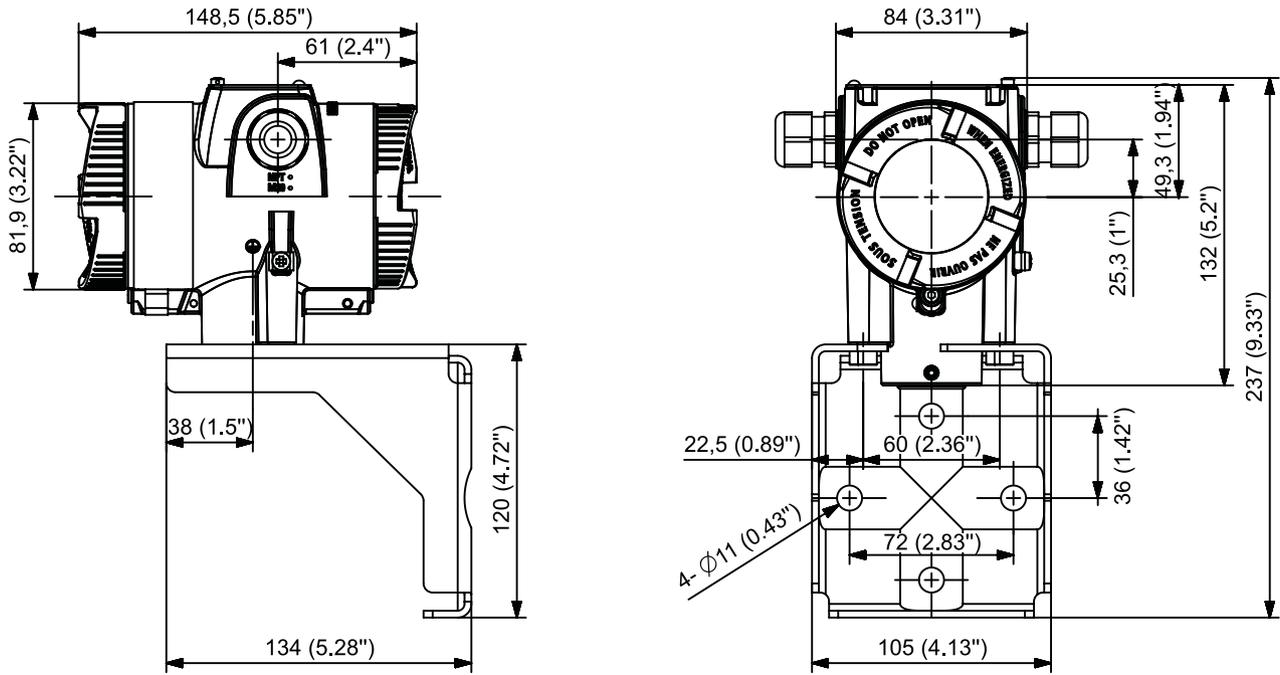


Figure 13-8 SITRANS TF Dual chamber housing dimensional drawings, dimensions in mm (inch)



# Product documentation and support

## A.1 Product documentation

Process instrumentation product documentation is available in the following formats:

- Certificates (<http://www.siemens.com/processinstrumentation/certificates>)
- Downloads (firmware, EDDs, software) (<http://www.siemens.com/processinstrumentation/downloads>)
- Catalog and catalog sheets (<http://www.siemens.com/processinstrumentation/catalogs>)
- Manuals (<http://www.siemens.com/processinstrumentation/documentation>)  
You have the option to show, open, save, or configure the manual.
  - "Display": Open the manual in HTML5 format
  - "Configure": Register and configure the documentation specific to your plant
  - "Download": Open or save the manual in PDF format
  - "Download as html5, only PC": Open or save the manual in the HTML5 view on your PC

You can also find manuals with the Mobile app at Industry Online Support (<https://support.industry.siemens.com/cs/ww/de/sc/2067>). Download the app to your mobile device and scan the device QR code.

### Product documentation by serial number

Using the PIA Life Cycle Portal, you can access the serial number-specific product information including technical specifications, spare parts, calibration data, or factory certificates.

#### Entering a serial number

1. Open the PIA Life Cycle Portal (<https://www.pia-portal.automation.siemens.com>).
2. Select the desired language.
3. Enter the serial number of your device. The product documentation relevant for your device is displayed and can be downloaded.

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

#### Scanning a QR code

1. Scan the QR code on your device with a mobile device.
2. Click "PIA Portal".

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

## A.2 Technical support

### Technical support

If this documentation does not completely answer your technical questions, you can enter a Support Request (<http://www.siemens.com/automation/support-request>).

Additional information on our technical support can be found at Technical Support (<http://www.siemens.com/automation/csi/service>).

### Service & support on the Internet

In addition to our technical support, Siemens offers comprehensive online services at Service & Support (<http://www.siemens.com/automation/serviceandsupport>).

### Contact

If you have further questions about the device, contact your local Siemens representative at Personal Contact (<http://www.automation.siemens.com/partner>).

To find the contact for your product, go to "all products and branches" and select "Products & Services > Industrial automation > Process instrumentation".

Contact address for business unit:

Siemens AG  
Digital Industries  
Process Automation  
Östliche Rheinbrückenstr. 50  
76187 Karlsruhe, Germany

## A.3 QR code label

A QR code label can be found on the device. With the use of a smart phone, the QR code provides a direct link to a website with information specific to the device, such as manuals, FAQs, certificates, etc.

# Remote operation

## B.1 SIMATIC PDM

### B.1.1 Overview SIMATIC PDM

SIMATIC PDM (Process Device Manager) is a general-purpose, manufacturer-independent tool for the configuration, parameter assignment, commissioning, diagnostics and maintenance of intelligent field devices and field components. Follow-up installations and additional information on SIMATIC PDM are available on the Internet at SIMATIC PDM ([www.siemens.com/simatic-pdm](http://www.siemens.com/simatic-pdm)).

SIMATIC PDM monitors the process values, alarms and status signals of the device. It allows you to display, compare, adjust, verify, and simulate process device data; also to set schedules for calibration and maintenance.

For information on, for example, how to install and integrate devices, commission the software, see Operating Manual 'Help for SIMATIC PDM'. The manual is delivered with SIMATIC PDM software. Once the SIMATIC PDM is installed on your computer you find the manual under: Start > All programs > Siemens Automation > SIMATIC > Documentation. Link at our website: SIMATIC PDM instructions and manuals (<https://support.industry.siemens.com/cs/products?dtp=Manual&pnid=16983&lc=en-WW>).

---

**Note****Field device parameters**

- For a list of parameters and additional information, consult section "Overview of parameters and functions (Page 139)".
  - The field device remains in measurement mode during the time you configure the field device.
- 

### B.1.2 Check SIMATIC PDM version

If problems occur while using SIMATIC PDM check the Internet at [www.siemens.com/simatic-pdm](http://www.siemens.com/simatic-pdm) to make sure you have the most recent version of SIMATIC PDM, the most recent Service Pack (SP) and the most recent hot fix (HF).

### B.1.3 Updating the Electronic Device Description (EDD)

#### Procedure

The EDD revision must match the Firmware revision in the device according to the table in section Product compatibility (Page 26). To install a new EDD:

1. Go to the support page Software downloads (<http://www.siemens.de/prozessinstrumentierung/downloads>).  
Enter the product name in the field "Enter search term...".
2. Download the most current EDD of your device.
3. Save files to your computer and extract the zipped file to an easily accessed location.
4. Launch SIMATIC PDM – Device Integration Manager. From the File menu, click "Read device descriptions from compressed source...".
5. Browse to the unzipped EDD file, select and open it.
6. Use the "Integration" function to integrate the EDD into the device catalog. The EDD is now accessible via SIMATIC Manager.

#### See also

Nameplate layout SITRANS TH320/420 (Page 40)

# Calibration examples

## C.1 Accuracy calculation examples

### Description

The ambient temperature calibrated at the factory is accepted for the sample accuracy calculations. Other potential sources of errors to be taken into consideration, such as power supply effects, fluctuations of ambient temperature, etc. were not taken into account.

**Example: Sensor Pt100, configured from –200 °C to +850 °C**

$$\text{Pt100}_{\text{Basic accuracy}} = 0.04 \text{ } ^\circ\text{C}$$

$$\text{Output}_{\text{Analog accuracy}} = 0.0016 \text{ mA}$$

$$\text{Total}_{\text{Accuracy (mA)}} = \frac{\text{Basic}_{\text{Accuracy}}}{\text{Configured\_Span}_{\text{INPUT}}} \times 16.0 \text{ mA} + \text{Output}_{\text{Analog Accuracy}}$$

$$\text{Total}_{\text{Accuracy (mA)}} = \frac{0.04 \text{ } ^\circ\text{C}}{850 \text{ } ^\circ\text{C} - (-200 \text{ } ^\circ\text{C})} \times 16.0 \text{ mA} + 0.0016 \text{ mA} = \underline{0.0022 \text{ mA}}$$

$$\text{Total}_{\text{Accuracy (\%)}} = \frac{\text{Total}_{\text{Accuracy (mA)}}}{16.0 \text{ mA}} \times 100 \%$$

$$\text{Total}_{\text{Accuracy (\%)}} = \frac{0.0022 \text{ mA}}{16.0 \text{ mA}} \times 100 \% = \underline{0.01381 \%}$$

**Example: Thermocouple type K, internal CJC, measured value at 400 °C, configured from 0 °C to 400 °C**

$$\text{Thermocouple type K}_{\text{Basic accuracy}} = 0.25 \text{ } ^\circ\text{C}$$

$$\text{Output}_{\text{Analog accuracy}} = 0.0016 \text{ mA}$$

$$\text{Total}_{\text{Accuracy (mA)}} = \frac{\text{Basic value}_{\text{Accuracy}} + \text{int. CJC (inaccuracy due to signal amplification} \times \text{measured value)}}{\text{Configured range}_{\text{INPUT}}} \times 16.0 \text{ mA} + \text{output}_{\text{Analog accuracy}}$$

$$\text{Total}_{\text{Accuracy (mA)}} = \frac{0.25 \text{ } ^\circ\text{C} + 0.5 \text{ } ^\circ\text{C} (0.0001 \times 400)}{400 \text{ } ^\circ\text{C}} \times 16.0 \text{ mA} + 0.0016 \text{ mA} = 0.0332 \text{ mA}$$

$$\text{Total}_{\text{Accuracy (\%)}} = \frac{\text{Total}_{\text{Accuracy (mA)}}}{16.0 \text{ mA}} \times 100\%$$

$$\text{Total}_{\text{Accuracy (\%)}} = \frac{0.0316 \text{ mA}}{16.0 \text{ mA}} \times 100\% = 0.2075\%$$

**Example: Thermocouple type K, external CJC Pt1000, measured value at 400 °C, configured from 0 °C to 400 °C**

$$\text{Thermocouple type K}_{\text{Basic accuracy}} = 0.25 \text{ } ^\circ\text{C}$$

C.2 Programmable sensor input and current output limits

$$\text{Output}_{\text{Analog accuracy}} = 0.0016 \text{ mA}$$

$$\text{Total}_{\text{Accuracy (mA)}} = \frac{\text{Basic value}_{\text{Accuracy}} + \text{ext. CJC (inaccuracy due to signal amplification x measured value)}}{\text{Configured range}_{\text{INPUT}}} \times 16.0 \text{ mA} + \text{output}_{\text{Analog accuracy}}$$

$$\text{Total}_{\text{Accuracy (mA)}} = \frac{0.25 \text{ }^\circ\text{C} + 0.08 \text{ }^\circ\text{C} (0.0001 \times 400)}{400 \text{ }^\circ\text{C}} \times 16.0 \text{ mA} + 0.0016 \text{ mA} = 0.0164 \text{ mA}$$

$$\text{Total}_{\text{Accuracy (\%)}} = \frac{\text{Total}_{\text{Accuracy (mA)}}}{16.0 \text{ mA}} \times 100\%$$

$$\text{Total}_{\text{Accuracy (\%)}} = \frac{0.0164 \text{ mA}}{16.0 \text{ mA}} \times 100\% = 0.1025\%$$

## C.2 Programmable sensor input and current output limits

### Description

Programmable input and output limits are available to increase system safety and integrity.

#### Input

When the input signal exceeds either of the programmable lower and upper limits, the device will output a user defined fault current. Setting input limits ensures that any out of range measurements can be uniquely identified and flagged via the transmitter output, resulting in improved asset and material protection e.g. thermal runaway of a reaction process can be mitigated.

Example:

Pt100 input ranged 100 °C to 400 °C

Input limits set to Upper = +650 °C, Lower = -150 °C

Fault current set to 3.5 mA

Output limits set to Upper = 20.5 mA, Lower = 3.8 mA

C.2 Programmable sensor input and current output limits

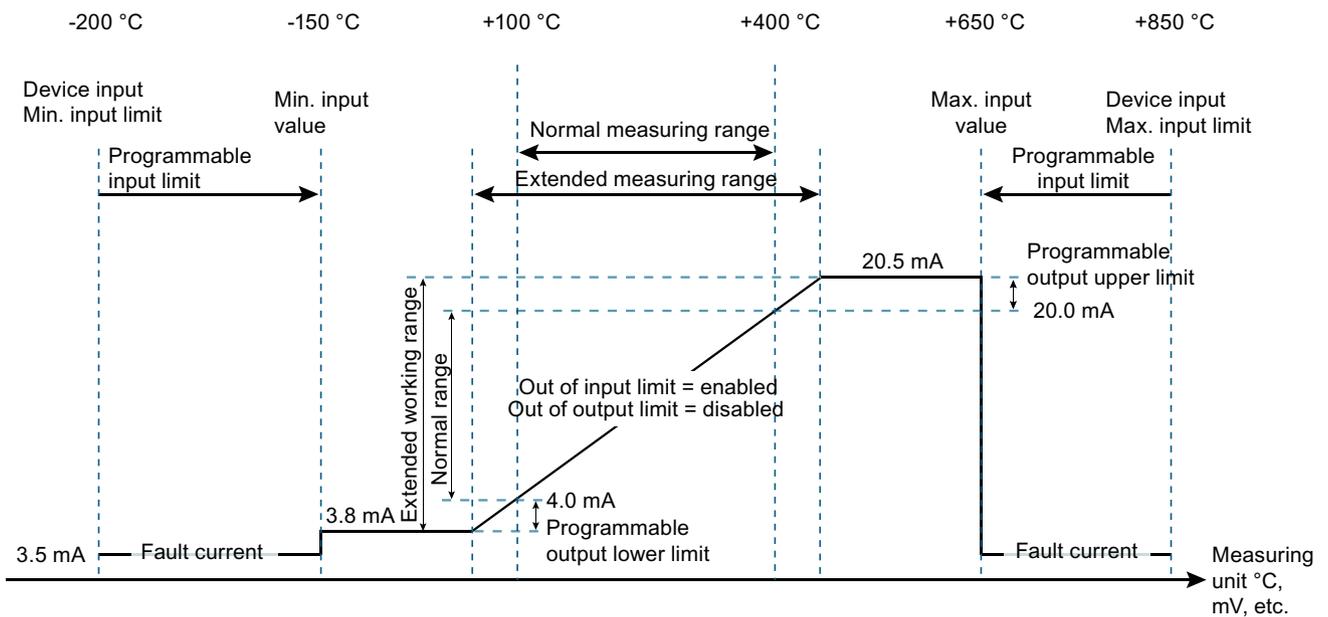


Figure C-1 Programmable input

**Output**

When the output exceeds either of the programmable upper and lower limits, the device will output a user defined fault current.

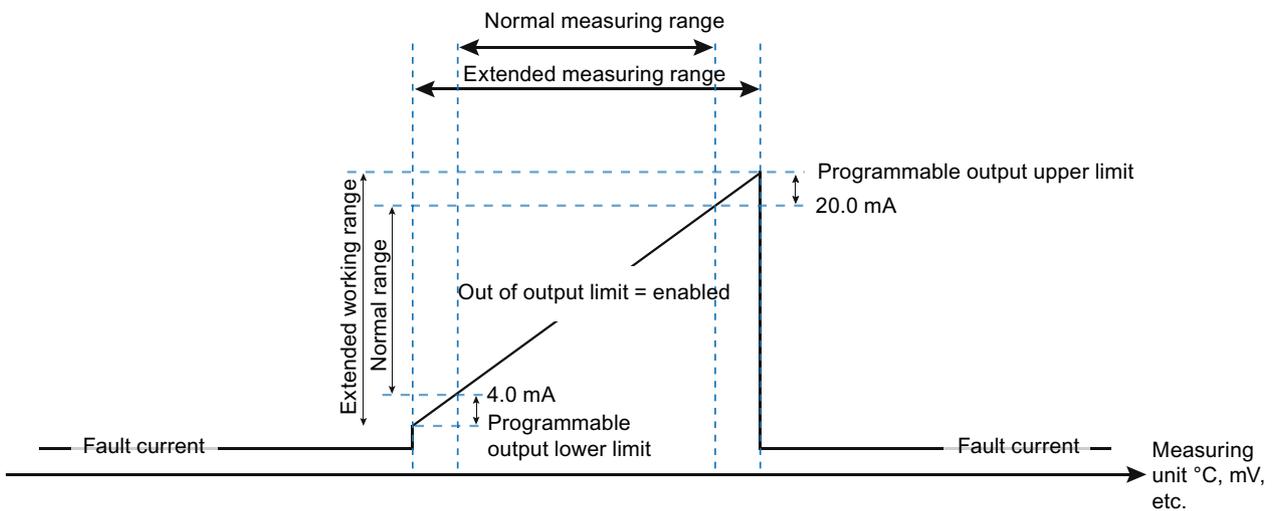


Figure C-2 Programmable output

**See also**

Technical data (Page 199)



## Accessory part sealing plug / thread adapter

### D.1 Intended use of accessory part

The sealing plug and the thread adapter (components) can be used for installation in electrical equipment of flameproof "Ex d" type of protection of groups IIA, IIB, IIC as well as dust protection by enclosure "Ex t" type of protection.

### D.2 Safety instructions for accessory part

<p> <b>WARNING</b></p> <p><b>Incorrect assembly</b></p> <ul style="list-style-type: none"> <li>• The component can be damaged or destroyed or its functionality impaired through incorrect assembly.           <ul style="list-style-type: none"> <li>– Mount the component using a suitable tool. Refer to the information in Chapter "Technical specifications of accessory part (Page 236)", for example, torques for installation.</li> </ul> </li> <li>• For "Explosion-proof Ex d" type of protection: To ensure an engagement depth of 8 mm, the enclosure must have a wall thickness of at least 10 mm.</li> </ul> <p><b>Improper modifications</b></p> <p>Danger to personnel, system and environment can result from modifications and repairs of the component, particularly in hazardous areas.</p> <ul style="list-style-type: none"> <li>• Any modification which deviates from the delivery state is not permitted.</li> </ul> <p><b>Loss of enclosure type of protection</b></p> <p>IP protection is not guaranteed without sealant.</p> <ul style="list-style-type: none"> <li>• Use a suitable thread sealant.</li> <li>• If you are using the component in type of protection dust protection by enclosure "Ex t", use the supplied sealing ring (①, figure in Chapter "Dimensional drawings of accessory part (Page 237)").</li> </ul> <p><b>Unsuitable fluids in the environment</b></p> <p>Danger of injury or damage to device.</p> <p>Aggressive media in the environment can damage the sealing ring. Type of protection and device protection may no longer be guaranteed.</p> <ul style="list-style-type: none"> <li>• Make sure that the sealing material is suitable for the area of use.</li> </ul>
--

**Note**

**Loss of type of protection**

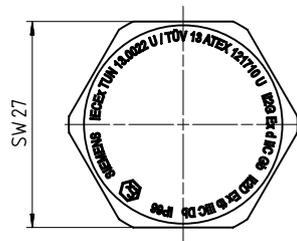
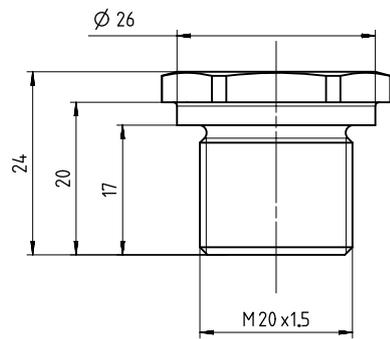
Changes in the ambient conditions can loosen the component.

- As part of the recommended maintenance intervals: Check the compression fitting for tight fit and tighten, if necessary.

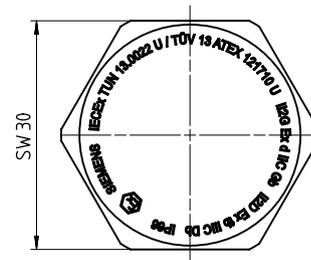
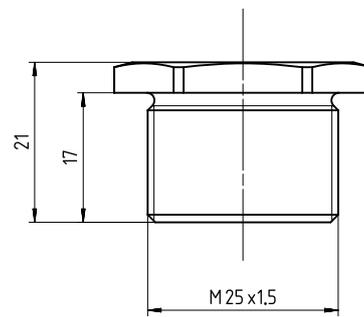
## D.3 Technical specifications of accessory part

Technical specifications sealing plug and thread adapter	
Sealing plug suitable for types of protection	Explosion-proof enclosure "d" of groups IIA, IIB, IIC Dust protection by enclosure "t"
Standard compliance	The components meet Directive 94/9. They meet the requirements of standards IEC/EN 60079-0; IEC/EN 60079-1; IEC/EN 60079-31.
Explosion protection	
• Gas explosion protection	II2G Ex d IIC
• Dust explosion protection	II1D Ex t IIIC
Certificates	IECEX TUN 13.0022 U TÜV 13 ATEX 121710 U
Material for sealing plug / thread adapter	Stainless steel
Material for seal	Vulcanized fiber or Victor Reinz AFM 30
Ambient temperature range	-40 ... +100 °C (-40 ... +212 °F)
For "Ex d" type of protection:	
Required wall thickness for tappings	10 mm
Torque	
• For thread size M20 x 1.5	65 Nm
• For thread size M25 x 1.5	95 Nm
• For thread size ½-14 NPT	65 Nm
Width A/F for thread size M20 x 1.5	27
Width A/F for thread size M25 x 1.5	30
Key size for thread size ½-14 NPT	10

## D.4 Dimensional drawings of accessory part

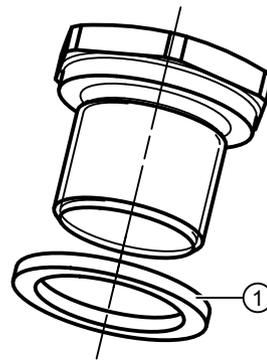
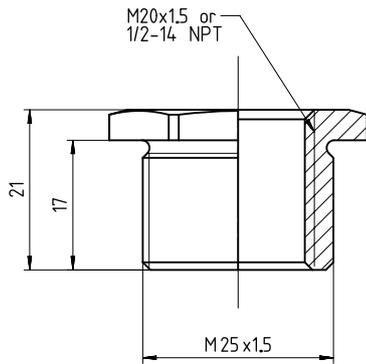


Sealing plug Ex d, M20 x 1.5, dimensions in mm

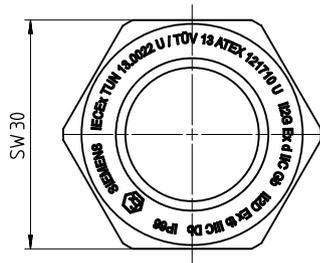


Sealing plug Ex d, M25 x 1.5, dimensions in mm

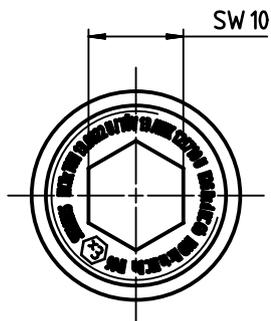
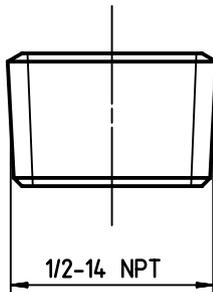
D.4 Dimensional drawings of accessory part



① Sealing ring: Use for dust protection "Ex t" type of protection.



Thread adapter Ex d, M25 x 1.5 on M20 x 1.5 and M25 x 1.5 on 1/2-14 NPT, dimensions in mm



Sealing plug Ex d 1/2 -14 NPT

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