SIEMENS

SITRANS

Temperature transmitter SITRANS TH320/TH420/TR320/ TR420 (mA/HART)

Operating Instructions

7NG031.. (TH320 mA)
7NG041.. (TH420 mA/HART)
7NG032.. (TR320 mA)
7NG042.. (TR420 mA/HART)

03/2018
A5E41864807-AA

Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

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.

Qualified Personnel

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

Proper use of Siemens products

Note the following:

⚠ WARNING

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

Trademarks

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

Disclaimer of Liability

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

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Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 of device with USB modem and SIPROM T (Page 67)
2. Install the device.
   Installing SITRANS TH in a connection head (Page 44)
   Installing SITRANS TH on DIN rail and G rail (Page 46)
3. Connect the device.
   Connecting TH320 (Page 51)
4. Switch on the power supply.
   Switching on the supply voltage (Page 62)
5. Wait for 2 seconds.
   After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.

Result

The LED is lit green.

Structure (Page 22)

See also

Diagnostics and troubleshooting (Page 77)

1.2 Commissioning SITRANS TH320 (HART)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 44)
   Installing SITRANS TH on DIN rail and G rail (Page 46)
2. Connect the device.
   Connecting TH320 (Page 51)
3. Switch on the power supply.
   Switching on the supply voltage (Page 62)
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 remote operation.
   Parameter assignment over remote operation (Page 68)

Result

The LED is lit green.

Structure (Page 22)

See also

Diagnostics and troubleshooting (Page 77)

1.3 Commissioning SITRANS TH420 (HART)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 44)
   Installing SITRANS TH on DIN rail and G rail (Page 46)
2. Connect the device.
   Connecting TH420 (Page 52)
3. Switch on the power supply.
   Switching on the supply voltage (Page 62)
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 remote operation.
   Parameter assignment over remote operation (Page 68)

Result

The LED is lit green.

Structure (Page 22)

See also

Diagnostics and troubleshooting (Page 77)

1.4 Commissioning SITRANS TR320 (mA)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)

- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 of device with USB modem and SIPROM T (Page 67)
2. Mount the device.
   Installing SITRANS TR on DIN rail (Page 46)
3. Connect the device.
   Connecting TR320 (Page 53)
4. Switch on the power supply.
   Switching on the supply voltage (Page 62)
5. Wait for 2 seconds.
   After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.

Result

The LED is lit green.

Structure (Page 31)

See also

Diagnostics and troubleshooting (Page 77)

1.5 Commissioning SITRANS TR320 (HART)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 46)
2. Connect the device.
   Connecting TR320 (Page 53)
3. Switch on the power supply.
   Switching on the supply voltage (Page 62)
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 remote operation.
   Parameter assignment over remote operation (Page 68)

Result

The LED is lit green.

Structure (Page 31)

See also

Diagnostics and troubleshooting (Page 77)

1.6 Commissioning SITRANS TR420 (HART)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 46)
2. Connect the device.
   Connecting TR420 (Page 55)

3. Switch on the power supply.
   Switching on the supply voltage (Page 62)
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 remote operation.
   Parameter assignment over remote operation (Page 68)

Result

The LED is lit green.

Structure (Page 31)

See also

Diagnostics and troubleshooting (Page 77)

Introduction

2

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.

2.2 Functional Safety Manual

For instructions and further information for functional safety of SITRANS TH and SITRANS TR temperaure transmitters refer to the English version of the Functional Safety Manual Instructions and manuals (http://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
03/2018	First edition

2.4 Product compatibility

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

Manual edition	Comments	Device revision	Compatible version of device integration package	
03/2018	First edition	HART 7 01.00.00 or higher	SIMATIC PDM V9.1	EDD: 01.00.00 or higher
			AMS Device Manager V13.3	EDD: 01.00.00 or higher
			SITRANS DTM V4.1	EDD: 01.00.00 or higher
			Field Communicator FC 375/475	EDD: 01.00.00 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 79).

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

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 USB modem: Laws and directives

Observe the safety regulations, provisions and laws applicable in your country during connection, installation and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC) (Canada)

3.1.4 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

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

3.1.5 USB modem: 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

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

⚠ WARNING

Improper device modifications

Risk to personnel, system and environment can result from modifications to the device, particularly in hazardous areas.

- 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.

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 labelled accordingly.
- Don't use devices that have been operated outside the conditions secified for hazardous areas. If you have used the device outside the conditions for hazardous areas permanently 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 has 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 79).

Description

4

4.1 SITRANS TH

4.1.1 Area of 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.

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, KCs, 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):

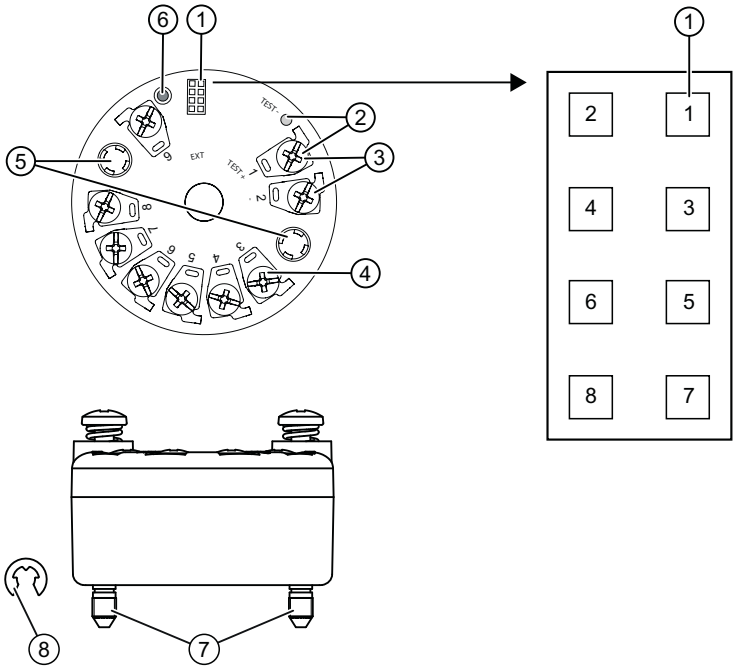
- 2 resistance thermometers (2-wire, 3-wire, 4-wire connection)
- 2 thermocouples
- 2 linear resistors, potentiometer and DC voltage sources

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, KCs, Inmetro.

4.1.2 Structure

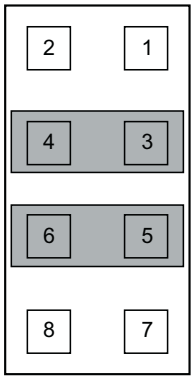


① Extension port terminal number 1
Meaning of the jumper positions (Page 23)
② Test terminals (Page 25)
③ 1 (+) and 2 (-) Output terminals
④ 3, 4, 5, and 6 Input terminals TH320
3, 4, 5, 6, 7, 8 and 9 Input terminals TH420
⑤ Mounting holes
⑥ LED
⑦ Mounting screw M4
⑧ Lock washer DIN 6799 - 3.2 A2

Figure 4-1 SITRANS TH320/TH420 design

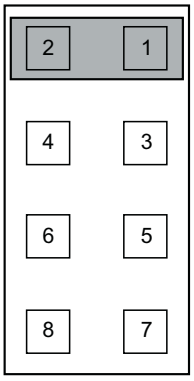
4.1.3 Meaning of the jumper positions

The device has two internal jumpers.



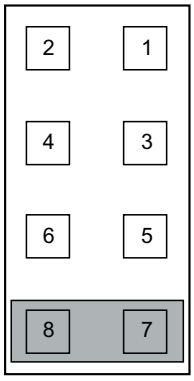
Delivery state
(No Function)

Fault current ≤ 3.6 mA
in accordance with
NAMUR NE43



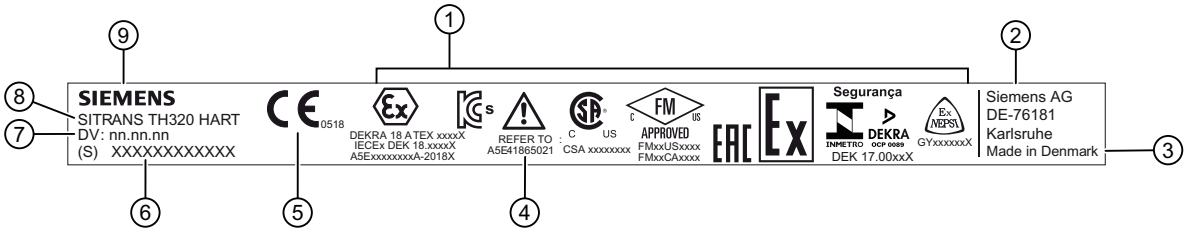
Write protection enabled
(Write Protect)

Write protection (Page 70)



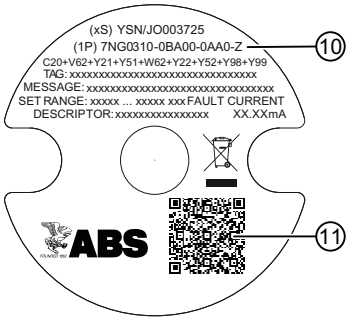
Fault current ≤ 21 mA
in accordance with
NAMUR NE43
(Safe State)

4.1.4 Nameplate layout SITRANS TH



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
⑦ Device version
⑧ Product name
⑨ Manufacturer

Figure 4-2 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 4-3 Example of nameplate on the base of the SITRANS TH with general information

4.1.5 LED function

Description

The integrated LED shows errors in accordance with NAMUR NE44 and NE107.

	LED	
State	**Operating state**	**Color**
Device OK	Constant	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	Constant	Red

4.1.6 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.

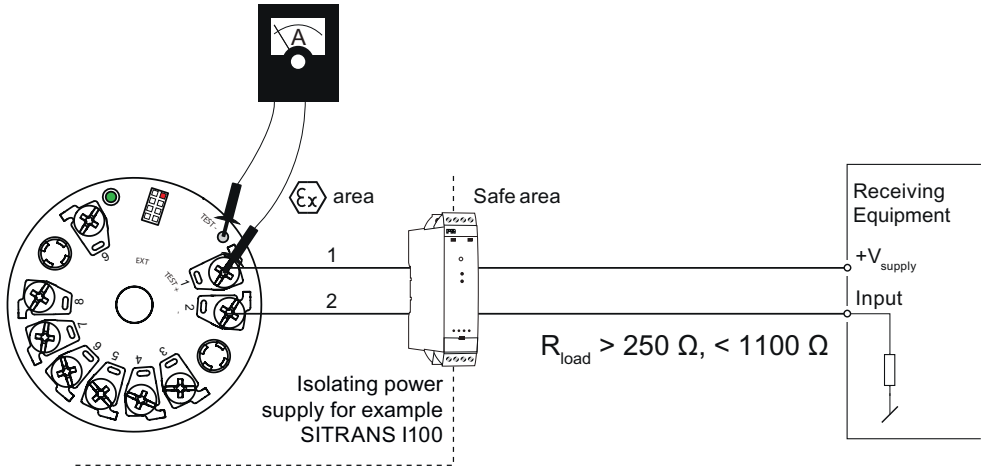
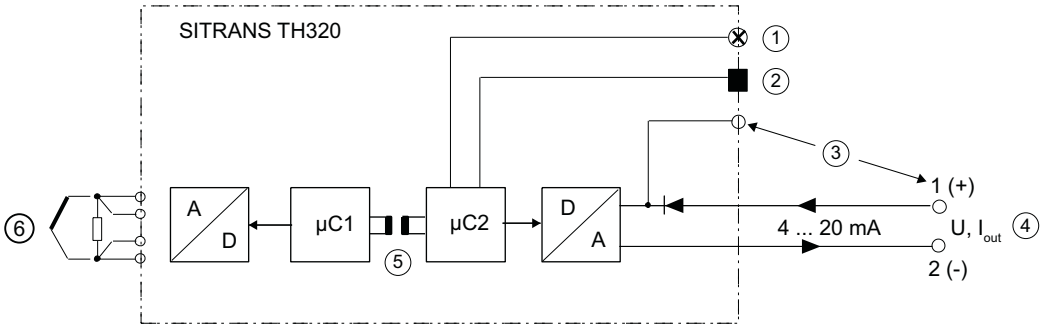


Figure 4-4 Test terminals

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

4.1.7 How TH320 works

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



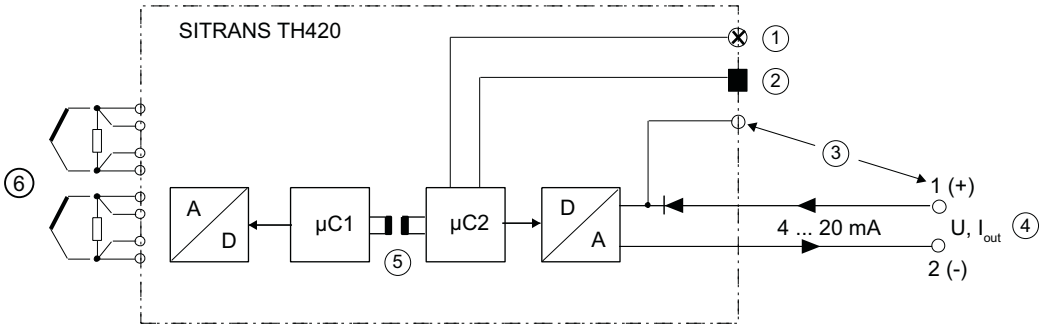
①	LED	⑤	Galvanic isolation
②	Extension port	⑥	Input
③	Test terminals	A/D	Analog-to-digital converter
④	Output	µC1	Microcontroller, on the secondary side
µC2	Microcontroller, on the primary side		
D/A	Digital-to-analog converter		
U	Supply voltage		
I_{out}	Output current		

Figure 4-5 Function chart for SITRANS TH320

- Input ⑥ for connecting different signal sources. Section: Input (Page 83).
- 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.

4.1.8 How TH420 works

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



①	LED	⑤	Galvanic isolation
②	Extension port	⑥	Input
③	Test terminals	A/D	Analog-to-digital converter
④	Output	µC 1	Microcontroller, on the secondary side
µC2	Microcontroller, on the primary side		
D/A	Digital-to-analog converter		
U	Supply voltage		
I_{out}	Output current		

Figure 4-6 Function chart for SITRANS TH420/TR420

- Input ⑥ for connecting different signal sources. Section: Input (Page 83).
- 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.

4.1.9 HART communication

4.1.9.1 HART communication with supply from voltage source

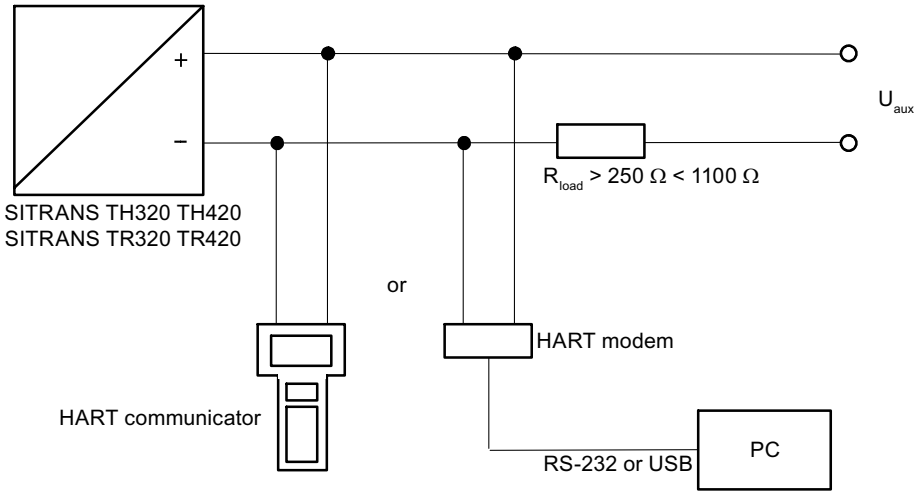
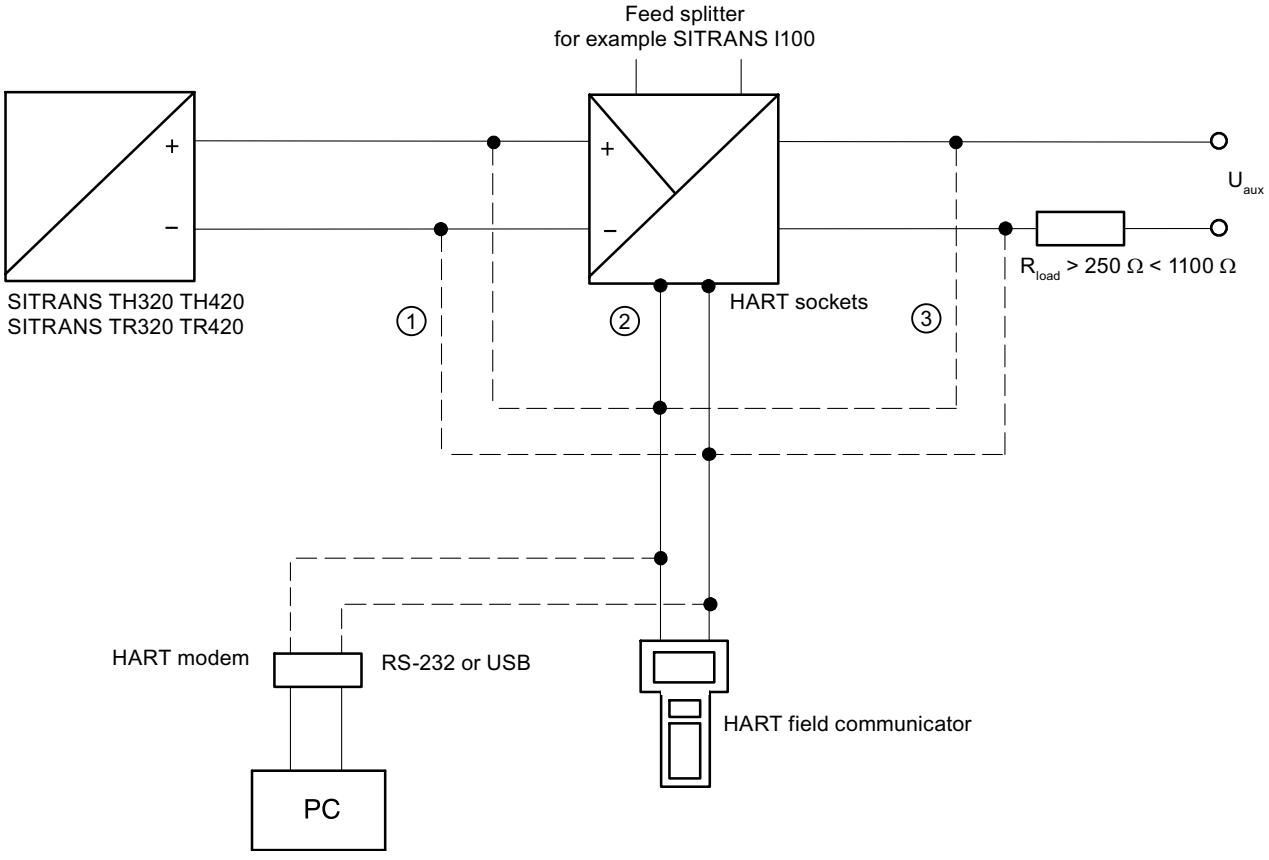


Figure 4-7 HART communication with supply from voltage source

4.1.9.2 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 ≥ 250 Ω only relevant if HART communication takes place via this branch. Otherwise, load of 0 to 650 Ω for versions ① or ②

Figure 4-8 HART communication with supply via isolating power supply

4.2 SITRANS TR

4.2.1 Area of 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, KCs, Inmetro.

SITRANS TR320

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

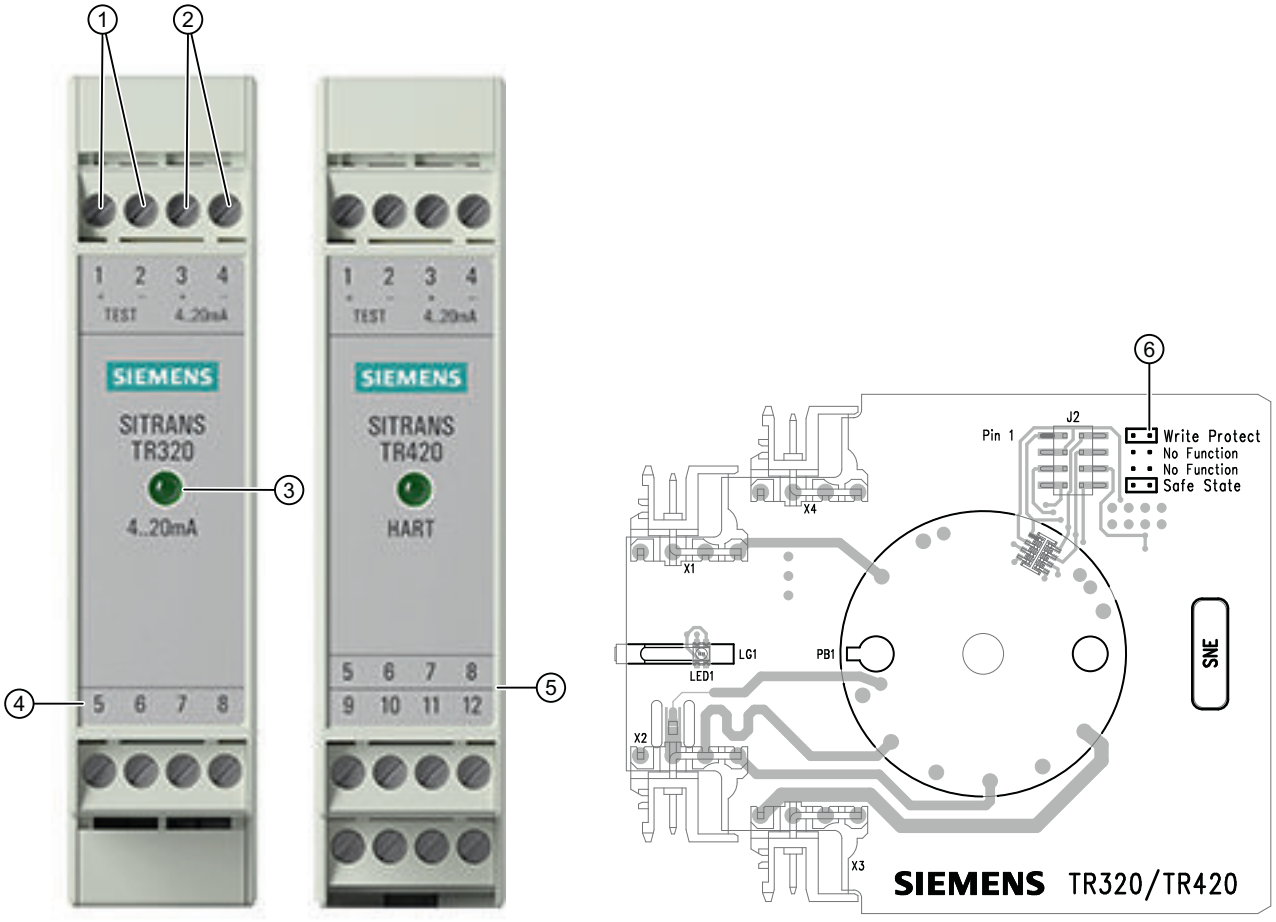
- 2 resistance thermometers (2-wire, 3-wire, 4-wire connection)
- 2 thermocouples
- 2 linear resistors, potentiometer and DC voltage sources

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

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

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

4.2.2 Structure

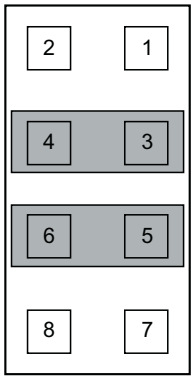


①	1 (+) and 2 (-)	Test terminals (Page 34)
②	3 (+) and 4 (-)	Output terminals
③	LED	
④	5, 6, 7, and 8	Input terminals TR320
⑤	5, 6, 7, 8, 9, 10, 11 and 12	Input terminals TR420
⑥	Extension port terminal number 1 Meaning of the jumper positions (Page 32)	

Figure 4-9 SITRANS TR320/TR420 design

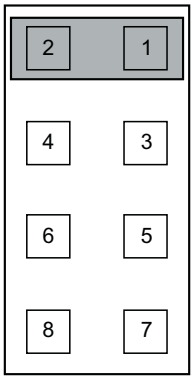
4.2.3 Meaning of the jumper positions

The device has two internal jumpers.



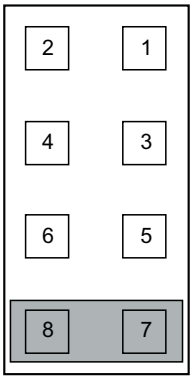
Delivery state
(No Function)

Fault current ≤ 3.6 mA
in accordance with
NAMUR NE43



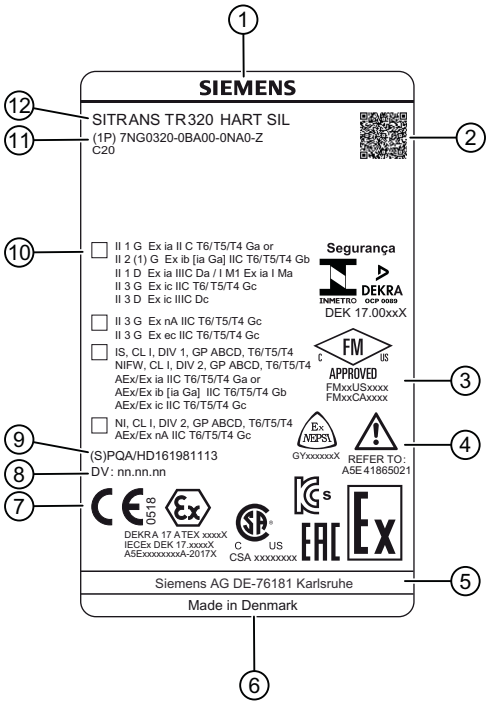
Write protection enabled
(Write Protect)

Write protection (Page 70)



Fault current ≤ 21 mA
in accordance with
NAMUR NE43
(Safe State)

4.2.4 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
④	Read the compact operating instructions	⑩	Ex marking
⑤	Manufacturer's address	⑪	Article number
⑥	Place of manufacture	⑫	Product name

Figure 4-10 Example of nameplate for SITRANS TR with approval information

4.2.5 LED function

Description

The integrated LED shows errors in accordance with NAMUR NE44 and NE107.

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

	LED	
State	**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	Constant	Red

See also

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

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.

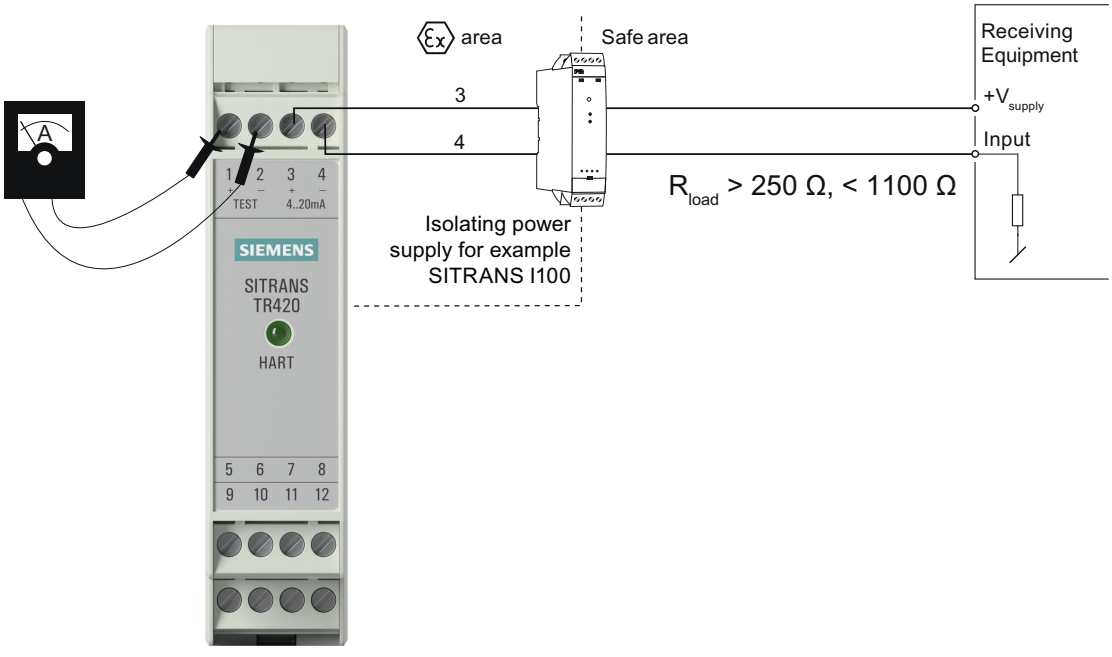
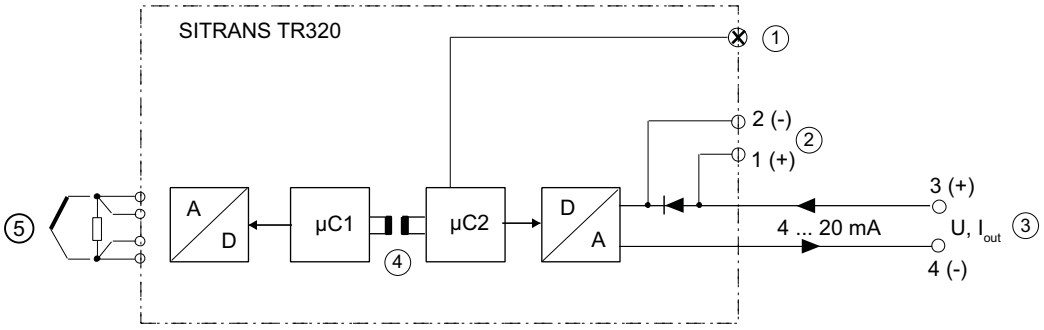


Figure 4-11 Test terminals

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

4.2.7 How TR320 works

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



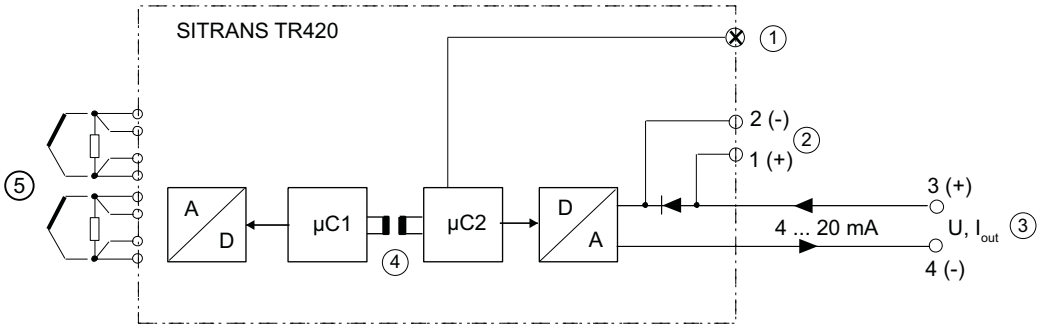
①	LED	④	Galvanic isolation
②	Test terminals	⑤	Input
③	Output	A/D	Analog-to-digital converter
µC2	Microcontroller, on the primary side	µC1	Microcontroller, on the secondary side
D/A	Digital-to-analog converter		
U	Supply voltage		
I_{out}	Output current		

Figure 4-12 Function chart for SITRANS TR320

- Input ⑥ for connecting different signal sources. Section: Input (Page 83).
- 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.

4.2.8 How TR420 works

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



①	LED	④	Galvanic isolation
②	Test terminals	⑤	Input
③	Output	A/D	Analog-to-digital converter
µC2	Microcontroller, on the primary side	µC 1	Microcontroller, on the secondary side
D/A	Digital-to-analog converter		
U	Supply voltage		
I_{out}	Output current		

Figure 4-13 Function chart for SITRANS TH420/TR420

- Input ⑥ for connecting different signal sources. Section: Input (Page 83).
- 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.

4.2.9 HART communication

4.2.9.1 HART communication with supply from voltage source

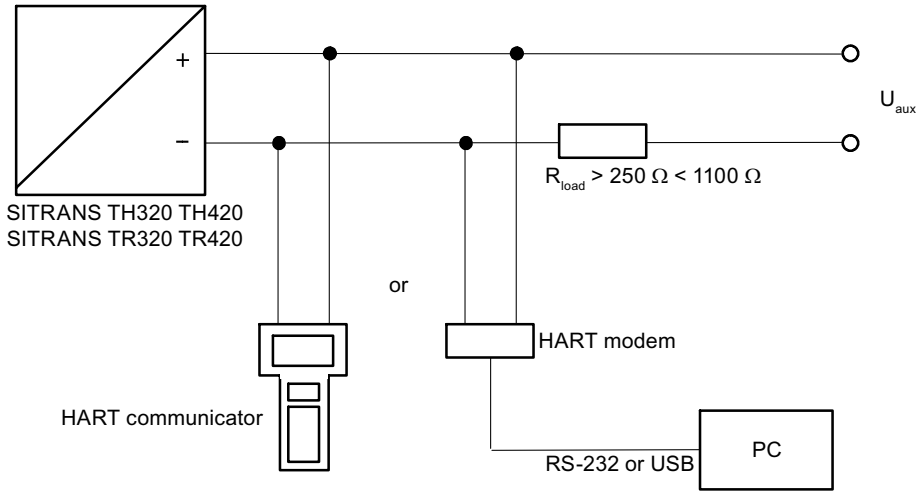
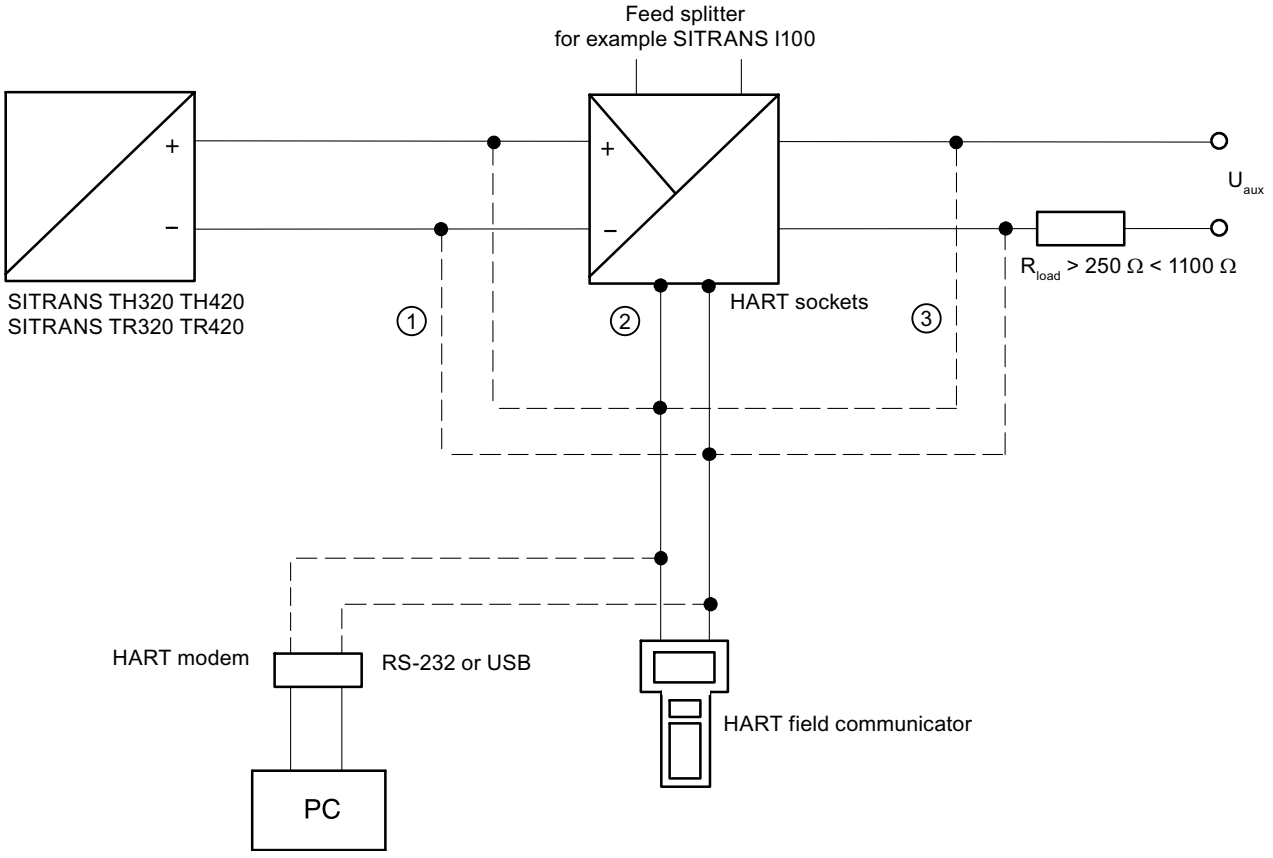


Figure 4-14 HART communication with supply from voltage source

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

Figure 4-15 HART communication with supply via isolating power supply

4.3 USB modem and SIPROM T

4.3.1 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 4 ... 20 mA
- SITRANS TR200/TR320 4 ... 20 mA

- SITRANS TF with SITRANS TH200 4 ... 20 mA
- SITRANS TF320 4 ... 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
Improper use of the USB modem The USB modem and the connected devices can be damaged. • Only use the USB modem for parameter assignment of the named Siemens temperature transmitters. • Always use the SIPROM T parameter assignment software. • Refer to the information in section Technical data (Page 79). • 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 (http://www.siemens.com/processinstrumentation/documentation).

4.3.2 Product features

- Universal modem for parameter assignment of the following temperature transmitters using the SIPROM T parameter assignment software:
  - SITRANS TH100Slim/TH100/TH200/TH320 4 ... 20 mA
  - SITRANS TR200/TR320 4 ... 20 mA
  - SITRANS TF with SITRANS TH200 4 ... 20 mA
  - SITRANS TF320 4 ... 20 mA
- 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

4.3.3 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.

LED on the USB modem	Meaning
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 transformer 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 77)

Installing/mounting 5

5.1 Basic safety notes

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. With enclosures made of non-metallic materials or painted metal, prevent an electrostatic charge from forming.

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 temperature transmitter must be connected to the power supply. Only use certified testing devices for installation in hazardous areas. If the temperature transmitter is used in Ex nA or Ex ec type of protection, it can no longer be used with intrinsic safety afterwards.

Note the following instructions for installation in a hazardous gas atmosphere:

The temperature transmitter 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 instructions for installation in a hazardous dust atmosphere:

The temperature transmitter 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.
The maximum surface temperature on the outside of the enclosure is 20 K higher than the maximum ambient temperature.

Note the following instructions for installation in mines:

The temperature transmitter 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"

Zone 2 and 22

General installation instructions

If the enclosure is made of non-metallic materials or of painted metal, electrostatic charging shall be avoided. For an ambient temperature ≥ 60 °C, heat resistant cables shall be used with a rating of at least 20 K above the ambient temperature.

The enclosure shall be suitable for the application and correctly installed The maximum surface temperature of the outer enclosure is 20 K hotter than the maximum ambient temperature.

The distance between terminals, inclusive the wires bare part, shall be at least 3 mm separated from any earthed metal.

'TEST' connection, may only be applied when the area is safe, or if supply / output circuit and the applied current meter are intrinsically safe.

For installation in a potentially explosive gas atmosphere, the following instructions apply:

For "Ex ic" the transmitter must be installed in an enclosure providing a degree of protection of at least IP20 according to IEC/EN 60529 that is suitable for the application and is correctly installed.

For “Ex nA” and “Ex ec” the transmitter must be installed in an enclosure providing a degree of protection of at least IP54 in accordance with IEC/EN 60079-0. In addition, the enclosure shall provide an internal pollution degree 2 or better as defined in IEC/EN 60664-1.
Cable entry devices and blanking elements shall fulfill the same requirements.

For installation in a potentially explosive dust atmosphere, the following instructions apply:

If the transmitter is supplied with an intrinsically safe signal "ic" and interfaces an intrinsically safe signal "ic" (e.g. a passive device) , the transmitter shall be mounted in a metal enclosure form B according to DIN 43729 or equivalent that provides a degree of protection of at least IP6X according to IEC/EN 60529.
Cable entry devices and blanking elements shall fulfill the same requirements.

If the transmitter is supplied with an non-sparking signal "nA/ec", or interfaces a non sparking signal, the transmitter shall be mounted in an enclosure, providing a degree of protection of at least IP6X according to IEC/ EN 60529, and in conformance with type of protection Ex t.
Cable entry devices and blanking elements shall fulfill the same requirements.

5.1.2 FM/CSA

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

Hazardous Area CL I, Div 1, GP ABCD CL I, Zone 0 IIC

General installation instructions

- Install in accordance with the US the National Electrical Code (NEC) or for Canada the Canadian Electrical Code (CEC).
- Equipment that is FM-approved for intrinsic safety may be connected to barriers based on the ENTITY CONCEPT. This concept permits interconnection of approved transmitters, meters and other devices in combinations which have not been specifically examined by FM, provided that the agency's criteria are met. The combination is then intrinsically safe, if the entity concept is acceptable to the authority having jurisdiction over the installation.
- The entity concept criteria are as follows: The intrinsically safe devices, other than barriers, must not be a source of power. The maximum voltage Ui (Vmax) and current Ii (Imax), and maximum power Pi (Pmax), which the device can receive and remain intrinsically safe, must be equal to or greater than the voltage (Uo or Voc or Vt) and current (Io or Isc or It) and the power Po which can be delivered by the barrier.
- The sum of the maximum unprotected capacitance (Ci) for each intrinsically device and the interconnect-ing wiring must be less than the capacitance (Ca) which can be safely connected to the barrier.
- The sum of the maximum unprotected inductance (Li) for each intrinsically device and the interconnecting wiring must be less than the inductance (La) which can be safely connected to the barrier.
- The entity parameters Uo,Voc or Vt and Io,Isc or It, and Ca and La for barriers are provided by the barrier manufacturer.
- The transmitter must be installed in a suitable enclosure to meet installation codes stipulated in the Canadian Electrical Code (CEC) or for US the National Electrical Code (NEC).
- If the enclosure is made of non-metallic materials or of painted metal, electrostatic charging shall be avoided.
- Use supply wires with a rating of at least 5 K above the ambient temperature.

WARNING: Substitution of components may impair intrinsic safety.

5.1.2.2 Safety information for installation in "Non Incendive nA"

Hazardous Area CL I, Div 2, GP ABCD CL I, Zone 2 IIC

General installation instructions

- The transmitter must be installed in an enclosure providing a degree of protection of at least IP54 according to IEC 60529 that is suitable for the application and is correctly installed.Cable entry devices and blanking elements shall fulfill the same requirements.
- If the enclosure is made of non-metallic materials or of painted metal, electrostatic charging shall be avoided.
- Use supply wires with a rating of at least 5 K above the ambient temperature.

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

WARNING: Do not disconnect equipment unless power has been switched off or the area is known to be safe.

Non Incendive field wiring installation

The non incendive field Wiring Circuit concept allows interconnection of Nonincendive Field wiring Apparatus with Associated Nonincendive Field Wiring Apparatus or Assosicated Intrinsically Safe Apparatus or Associated Apparatus not specially examined in combination as a syatem using any of the wiring methods permitted for unclassified locations, Voc < V_{max}, Ca ≥ Ci + C_{cable}, La ≥ Li + L_{cable}

5.2 Installing SITRANS TH in a connection head

Note

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

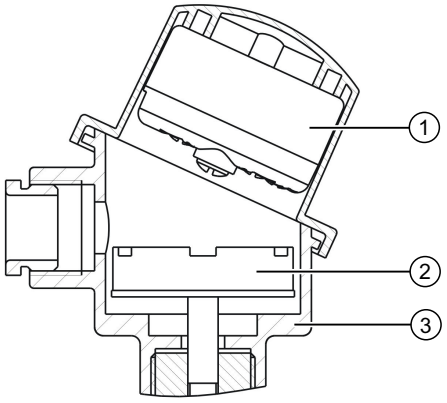
The transmitter is either secured in the base of the connection head or in the raised cover of the connection head.

The scope of the delivery of the transmitter includes:

- Springs
- Fixing screws
- Lock washers for installation on the round plate (SITRANS TH)

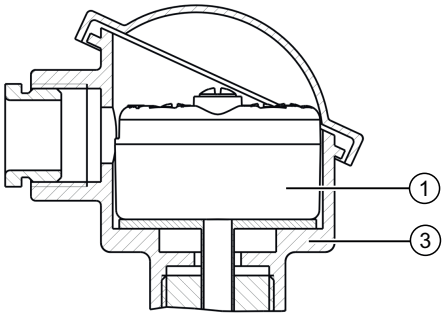
Fastening the transmitter:

In the cover of the connection head



① Transmitter
③ Connection head

In the base of the connection head

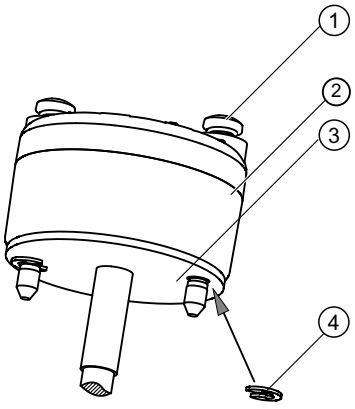


② Ceramic base of the measuring element

Note

Using the lock washers (SITRANS TH)

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



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

5.3 Installing SITRANS TH on DIN rail and G rail

Note

Fixing rings

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

You can either install the transmitter on a 35 mm DIN rail or on a 32 mm G rail. DIN EN 60715 applies to DIN rails and G rails in this context. The DIN/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.

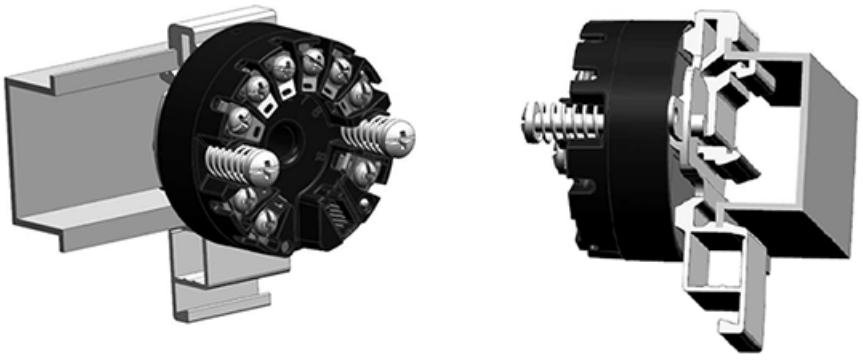


Figure 5-1 Securing the transmitter on DIN rails

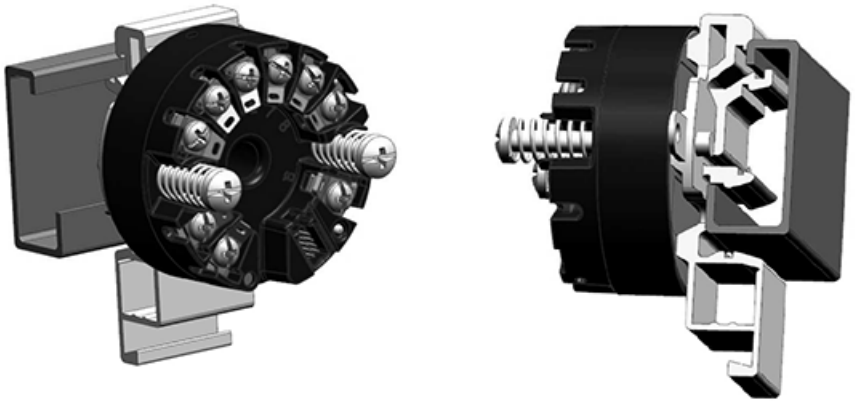


Figure 5-2 Securing the transmitter on G rails

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 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

6.1 Basic safety notes

⚠ WARNING

Unsuitable cables, cable glands and/or plugs

Risk of explosion in hazardous areas.

- Use only cable glands/plugs that comply with the requirements for the relevant type of protection.
- Tighten the cable glands in accordance with the torques specified in Technical data (Page 79).
- Close unused cable inlets for the electrical connections.
- When replacing cable, glands use only cable glands of the same type.
- After installation, check that the cables are seated firmly.

⚠ WARNING

Improper power supply

Risk of explosion in hazardous areas as result of incorrect power supply, e.g. using direct current instead of alternating current.

- 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 79) or on the nameplate.

NOTICE

Ambient temperature too high

Damage to cable sheath.

- At an ambient temperature ≥ 60 °C (140 °F), use heat-resistant cables suitable for an ambient temperature at least 20 °C (36 °F) higher.

⚠ WARNING

Connecting device in energized state

Risk of explosion in hazardous areas.

- Connect devices in hazardous areas only in a de-energized state.

Exceptions:

- Devices having the type of protection "Intrinsic safety Ex i" may also be connected in energized state in hazardous areas.
- Exceptions for type of protection "Non-sparking nA/ec" (Zone 2) are regulated in the relevant certificate.

Note

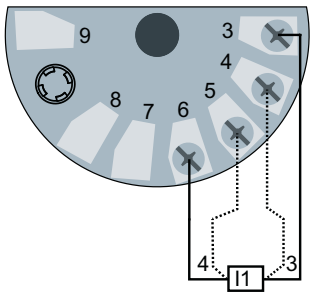
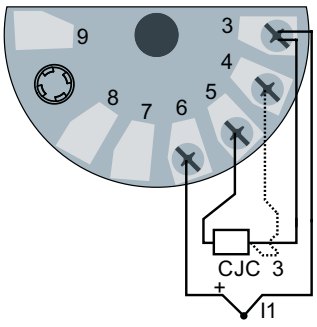
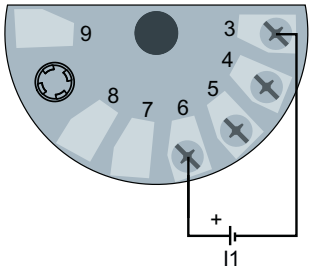
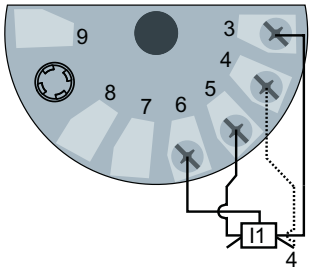
Improvement of interference immunity

- 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 79).
- Use shielded cables to guarantee the full specification according to HART/PA/FF.

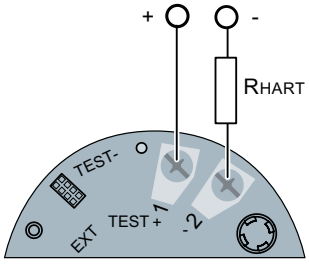
6.2 Connecting TH320

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 (single-pole or two-pole)	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.

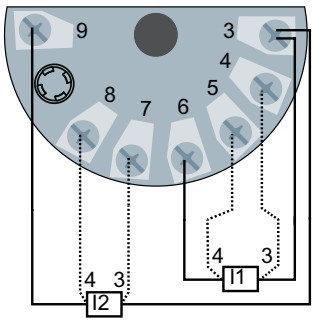
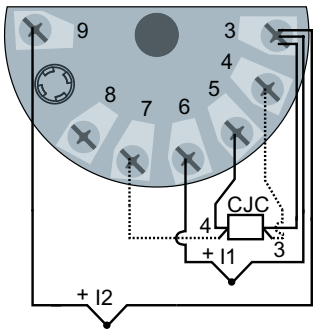
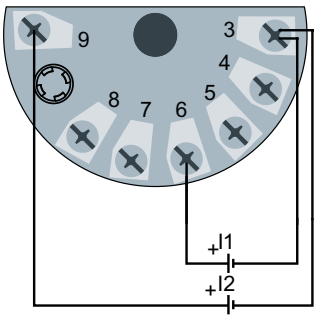
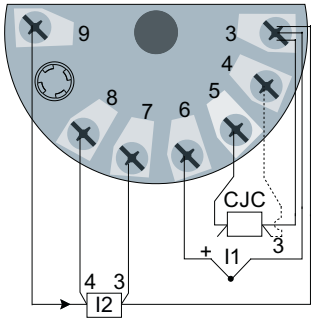
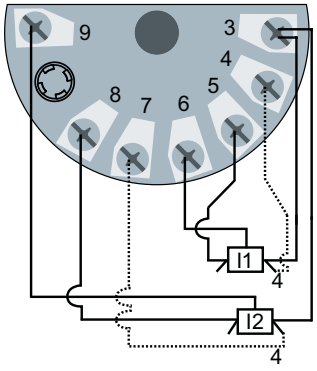
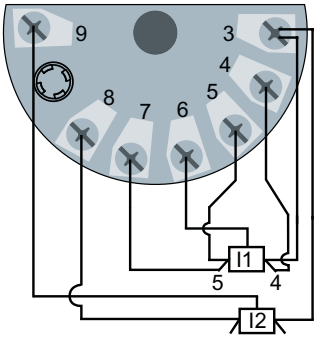


   For devices with HART communication, connect a ≥ 250 Ω resistor.

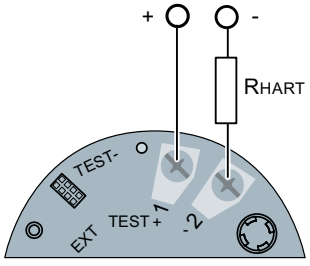
6.3 Connecting TH420

Procedure

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

		
Input 1 (I1) and/or input 2 (I2): 2-wire, 3-wire or 4-wire RTD or linear resistance	Input 1 (I1) and/or input 2 (I2): TC (int. CJC or ext. 2-wire, 3-wire or 4-wire CJC)	Input 1 (I1) and/or input 2 (I2): Voltage input (single-pole or two-pole)
		
Input 1: TC (int. CJC or ext. 2-wire or 3-wire CJC) Input 2: 2-wire, 3-wire or 4-wire RTD	Input 1 (I1) and/or input 2 (I2): 3-wire or 4-wire potentiometer	Input 1 (I1): 5-wire potentiometer Input 2 (I2): 3-wire potentiometer

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

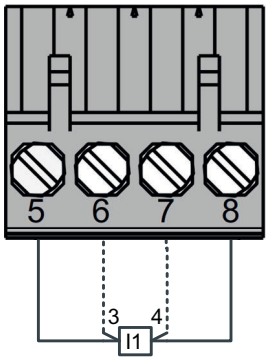
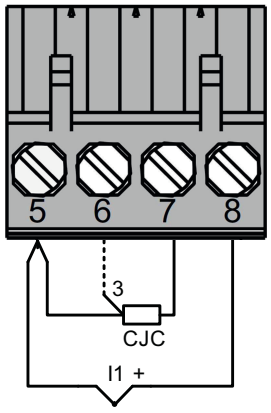
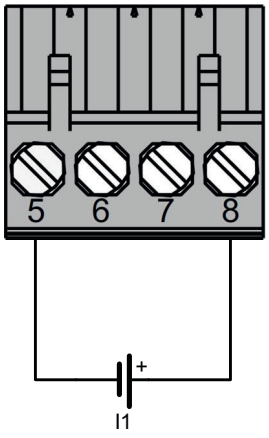
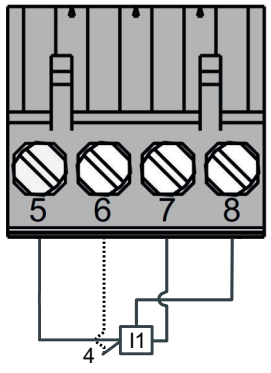


For devices with HART communication, connect a ≥ 250 Ω resistor.

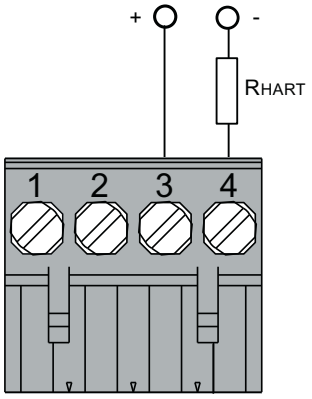
6.4 Connecting TR320

Procedure

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

		
2-wire, 3-wire or 4-wire RTD or wire resistance I1: Input 1	TC (internal CJC or external 2-wire or 3-wire CJC)	
		
Voltage input (single-pole or two-pole)	3-wire or 4-wire potentiometer	

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



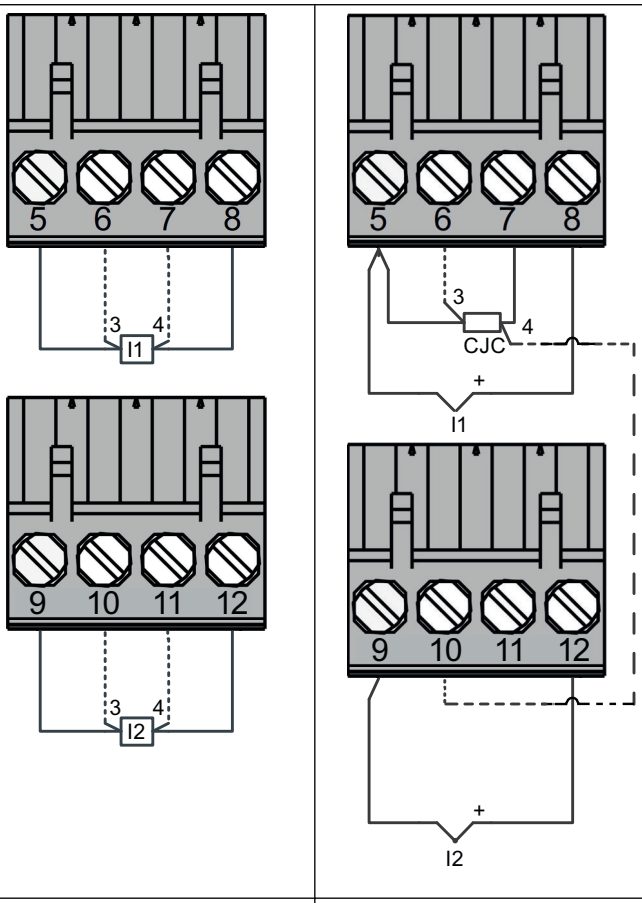
For devices with HART communication, connect a ≥ 250 Ω resistor.

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

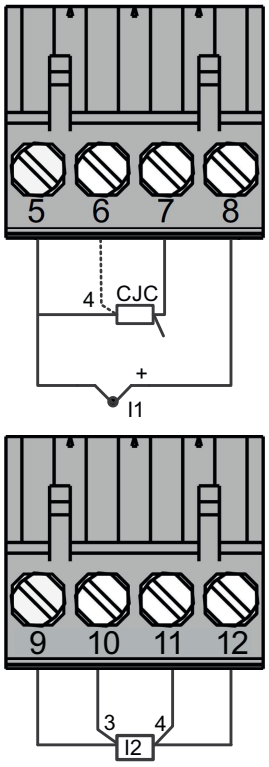
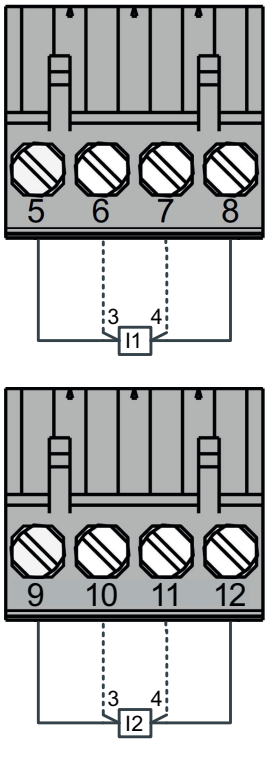
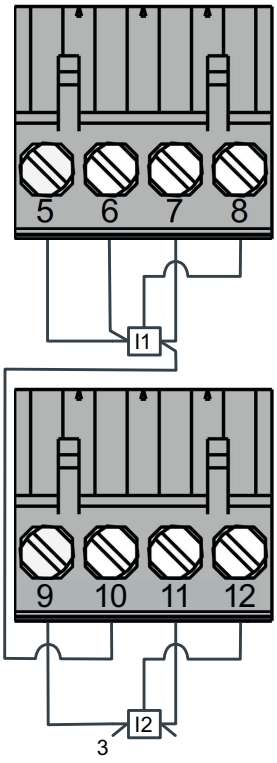
6.5 Connecting TR420

Procedure

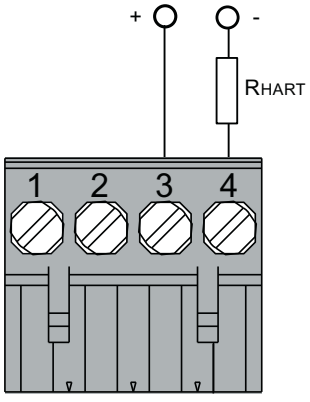
1. Connect the input or inputs to terminals 5 to 12.
   The terminals are equipped with a coding profile to ensure intrinsic safety.



Input 1 (I1) and/or input 2 (I2): 2-wire, 3-wire or 4-wire RTD or linear resistance	Input 1 and/or input 2: TC (int. CJC or ext. 2-wire or 3-wire CJC)	Voltage input (single-pole or two-pole)

		
Input 1: TC (int. CJC or ext. 2-wire or 3-wire CJC) Input 2: 2-wire, 3-wire or 4-wire RTD	Input 1 (I1) and/or input 2 (I2): 3-wire or 4-wire potentiometer	Input 1 (I1): 5-wire potentiometer Input 2 (I2): 3-wire potentiometer

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



For devices with HART communication, connect a ≥ 250 Ω resistor.

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

Commissioning 7

7.1 Basic safety notes

⚠ WARNING

Improper commissioning in hazardous areas

Device failure or risk of explosion in hazardous areas.

- Do not commission the device until it has been mounted completely and connected in accordance with the information in Technical data (Page 79).
- Before commissioning take the effect on other devices in the system into account.

⚠ WARNING

Commissioning and operation with pending error

If an error message appears, correct operation in the process is no longer guaranteed.

- Check the gravity of the error.
- Correct the error.
- If the error still exists:
  - Take the device out of operation.
  - Prevent renewed commissioning.

7.2 Commissioning SITRANS TH320 (mA)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 of device with USB modem and SIPROM T (Page 67)
2. Install the device.
   Installing SITRANS TH in a connection head (Page 44)
   Installing SITRANS TH on DIN rail and G rail (Page 46)
3. Connect the device.
   Connecting TH320 (Page 51)
4. Switch on the power supply.
   Switching on the supply voltage (Page 62)
5. Wait for 2 seconds.
   After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.

Result

The LED is lit green.

Structure (Page 22)

7.3 Commissioning SITRANS TH320 (HART)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 44)
   Installing SITRANS TH on DIN rail and G rail (Page 46)
2. Connect the device.
   Connecting TH320 (Page 51)
3. Switch on the power supply.
   Switching on the supply voltage (Page 62)

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 remote operation.
   Parameter assignment over remote operation (Page 68)

Result

The LED is lit green.

Structure (Page 22)

7.4 Commissioning SITRANS TH420 (HART)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 44)
   Installing SITRANS TH on DIN rail and G rail (Page 46)
2. Connect the device.
   Connecting TH420 (Page 52)
3. Switch on the power supply.
   Switching on the supply voltage (Page 62)
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 remote operation.
   Parameter assignment over remote operation (Page 68)

Result

The LED is lit green.

Structure (Page 22)

7.5 Commissioning SITRANS TR320 (mA)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 of device with USB modem and SIPROM T (Page 67)
2. Mount the device.
   Installing SITRANS TR on DIN rail (Page 46)
3. Connect the device.
   Connecting TR320 (Page 53)
4. Switch on the power supply.
   Switching on the supply voltage (Page 62)
5. Wait for 2 seconds.
   After this startup time, the device is operational.
6. Wait 5 minutes to get exact measured values.

Result

The LED is lit green.

Structure (Page 31)

7.6 Commissioning SITRANS TR320 (HART)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 46)
2. Connect the device.
   Connecting TR320 (Page 53)
3. Switch on the power supply.
   Switching on the supply voltage (Page 62)
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 remote operation.
   Parameter assignment over remote operation (Page 68)

Result

The LED is lit green.

Structure (Page 31)

7.7 Commissioning SITRANS TR420 (HART)

Introduction

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

Before you start, please read the following safety notes:

- General safety notes (Page 17)
- Basic safety notes: Installing/mounting (Page 41)
- Basic safety notes: Connecting (Page 49)
- Basic safety notes: Commissioning (Page 57)

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 46)
2. Connect the device.
   Connecting TR420 (Page 55)
3. Switch on the power supply.
   Switching on the supply voltage (Page 62)
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 remote operation.
   Parameter assignment over remote operation (Page 68)

Result

The LED is lit green.

Structure (Page 31)

7.8 Switching on the supply voltage

Requirement

- You have connected the device correctly. (Page 49)
- The terminal voltage on the device is correct. (Page 79)

Procedure

Switch on the power supply.

- 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.
    AUTOHOTSPOT

Result

The device is now ready for operation.

7.9 Commissioning the USB modem and SIPROM T

7.9.1 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 79). • 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.

7.9.2 Installing the SIPROM T parameterization software

Requirement

- PC with USB port and Windows 7 operating system or higher
- Windows Microsoft .NET Framework 3.5 or higher
- USB modem present
- SIPROM T parameter assignment software with USB driver installed

Procedure

1. Download the SIPROM T parameter assignment software from the Internet free of charge. Download SIPROM T parameter assignment software from the Internet (http://www.siemens.com/processinstrumentation/downloads)
2. Double-click the "setup.exe" file in the SIPROM T software directory.
3. Follow the installation instructions.

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.

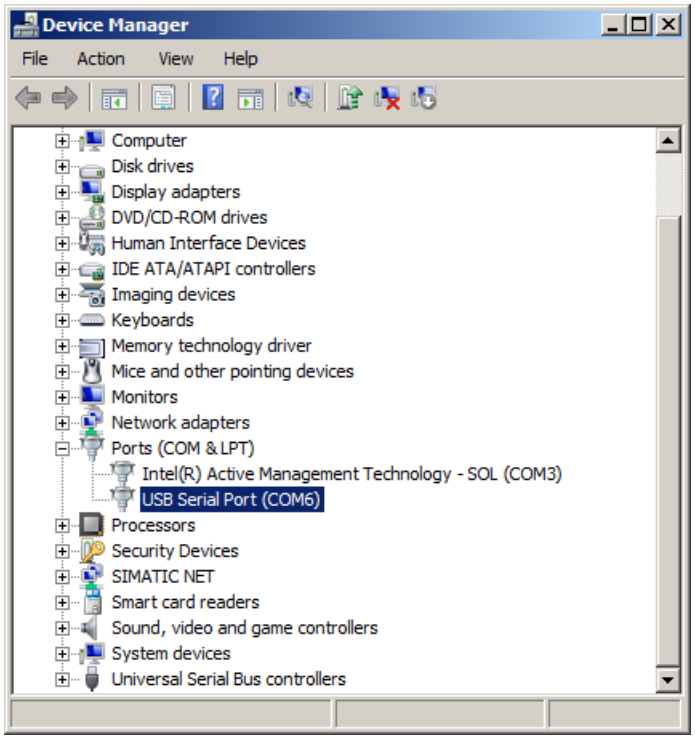


Figure 7-1 Windows Device Manager

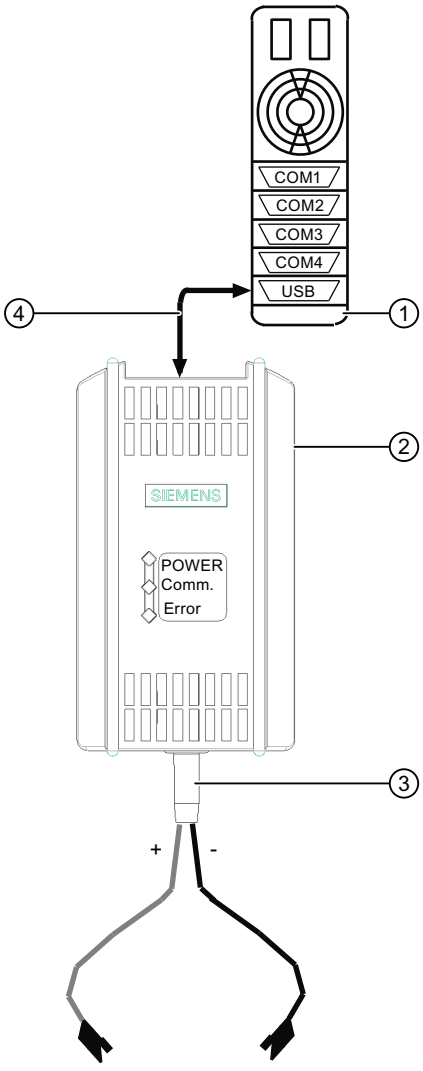
5. Double-click "Ports (COM & LPT)".
   The newly installed USB port is named "USB Serial Port (COMx)", where x stands for the COM port number.
6. Note down the COM port number.
7. Open SIPROM T.
8. In the menu, select "Device" > "Settings".
9. Select the noted COM port number from the Windows "Device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

See also

Uninstalling USB drivers (Page 72)

7.9.3 Connecting USB modem

Procedure



① PC
② USB modem
③ Connecting cable to the temperature transmitter
Black cable minus
Red cable plus
④ USB cable

Figure 7-2 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 8

8.1 Parameter assignment of device with USB modem and SIPROM T

Requirements

- SITRANS TH100Slim/TH100/TH200/TH320 4 ... 20 mA
- SITRANS TR200/TR320 4 ... 20 mA
- SITRANS TF with SITRANS TH200 4 ... 20 mA
- SITRANS TF320 4 ... 20 mA
- PC with USB port and the 32-bit or 64-bit versions of the Windows 7 operating system or higher.
- USB modem present
- SIPROM T parameter assignment software with USB driver installed

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 63)
3. Install the USB driver.
   Installing the SIPROM T parameterization software (Page 63)
4. Connect the USB modem and the temperature transmitter to your PC.
   Connecting USB modem (Page 65)
   – The Power LED is lit green.
   Meaning of LEDs on the USB modem (Page 39)
5. Open SIPROM T.
6. In the menu, select "Device" > "Download to device".
7. Assign the temperature transmitter parameters.

8. In the menu, select "Device" > "Upload from device".
9. Wait at least 2 seconds before you disconnect the temperature transmitter.

8.2 Parameter assignment over remote operation

8.2.1 SIMATIC PDM

SIMATIC PDM is a software package for configuring, parameter assignment, commissioning, diagnostics and maintenance of this device and other process devices.

SIMATIC PDM offers simple monitoring of process values, alarms, and device status information.

SIMATIC PDM allows the process device data to be:

- displayed
- set
- modified
- saved
- diagnosed
- checked for plausibility
- managed
- simulated

Additional information on SIMATIC PDM can be found at SIMATIC PDM instructions and manuals (https://support.industry.siemens.com/cs/products?dtp=Manual&pnid=16983&lc=en-WW).

8.2.2 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 error is displayed.

Function	Description
Redundancy (hot backup)	The analog output signal is proportional to sensor 1 as long as no error is detected. If an error is detected at sensor 1, the analog output signal becomes proportional to sensor 2 and a warning is generated.
User-specific linearization - Polynomial	Supports the polynomial linearization for up to 5 segments, each with polynomials up to the 4th degree.
User-specific linearization - Callendar-Van Dusen	Supports the direct input of CVD constants.
User-specific linearization - Table	Supports the table linearization with up to 60 input/output values.
User-specific linearization - Spline linearization second order	Supports the spline linearization of the second order with up to 40 output values.
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.

8.2.3 Dynamic variable mapping

Description

Four dynamic variables are supported: PV, SV, TV and QV.

If HART commands are used, any of these device variables (DV 0 - 15) can be assigned in any combination. The device variable assigned to PV controls the loop current.

Device variables	
DV0	Input 1
DV1	Input 2
DV2	Input 1 CJC
DV3	Input 2 CJC
DV4	Average input 1 and input 2
DV5	Difference input 1 - input 2
DV6	Difference input 2 - input 1
DV7	Absolute difference input 1 - input 2
DV8	Minimum input 1 or input 2
DV9	Maximum input 1 or input 2
DV10	Input 1 and input 2 as backup
DV11	Input 2 and input 1 as backup
DV12	Average input 1 and input 2 with both as backup
DV13	Minimum input 1 or input 2 with both as backup

Device variables	
DV14	Maximum input 1 or input 2 with both as backup
DV15	Electronics temperature

See also

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

8.3 Locking the device

8.3.1 Write protection

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	No	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.

8.3.2 Change user PIN

Used to change the user PIN.

Setting range:	1 to 65535
Factory setting:	00002457

Service and maintenance

9

9.1 Basic safety notes

Note

The device is maintenance-free.

9.1.1 Maintenance

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

An inspection can include check of:

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

9.2 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 71)

⚠ WARNING

Electrostatic charge

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.

9.3 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.

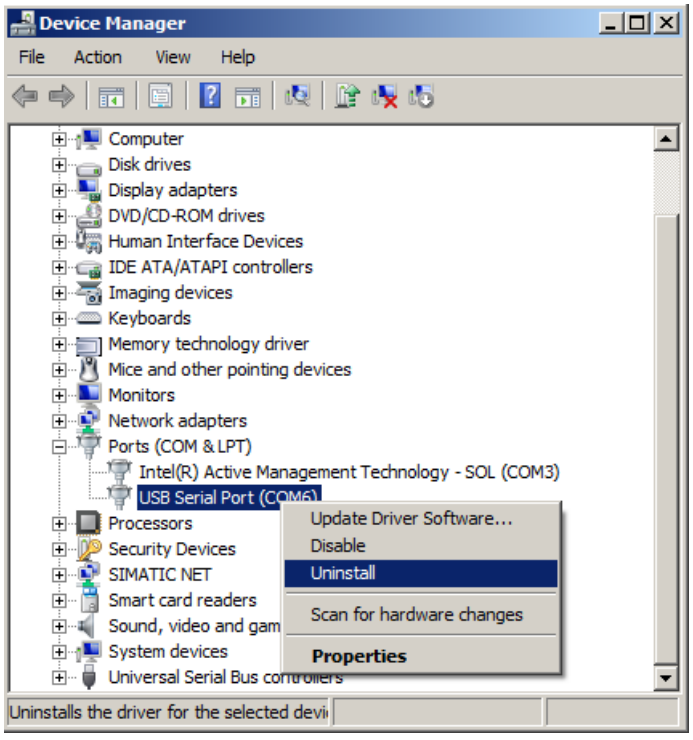
Refer to Connecting (Page 49).

9.3.1 Uninstalling USB drivers

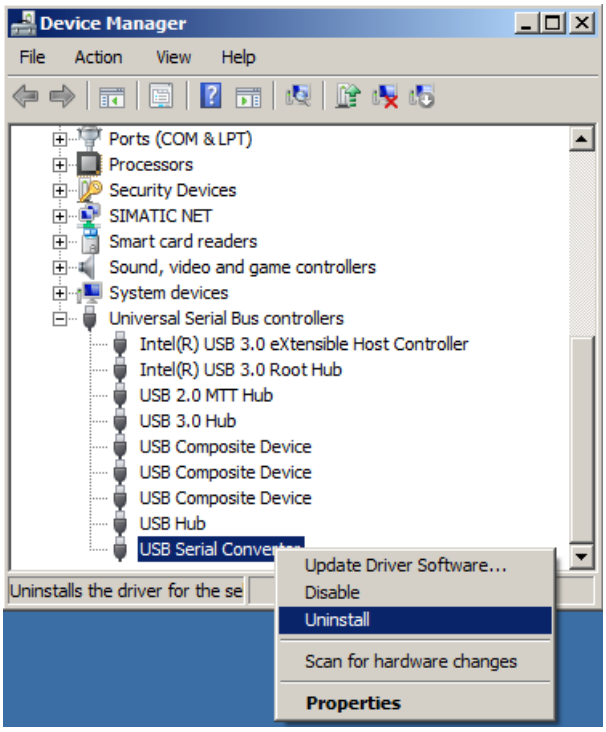
Procedure

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.

9.4 Absence of pollutants

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

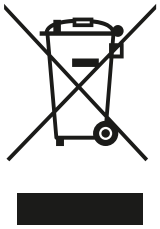
9.5 Return procedure

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.

9.6 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/)

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 10

10.1 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.	• Connect the USB cable. Connecting USB modem (Page 65)
	Hardware fault occurred.	• Replace the device.
Power LED flashes yellow during parameter assignment of the temperature transmitter.	No temperature transmitter connected.	1. Check the polarity on the temperature transmitter. Connecting USB modem (Page 65) 2. Check whether the loop current is at least 3.5 mA.
Comm LED is not lit.	USB modem is not detected by the PC.	1. Check the port settings in SIPROM T. 2. Check the driver installation and reinstall SIPROM T if necessary.
Error LED illuminates red during the temperature transmitter parameter assignment.	Short-circuit at the modem terminals for the temperature transmitter.	• Check the wiring of the modem terminals. Connecting USB modem (Page 65)
Error LED is lit red.	Hardware fault occurred.	• 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.

See also

Meaning of LEDs on the USB modem (Page 39)

Technical data

11

11.1 Ambient conditions

Ambient conditions	SITRANS TH	SITRANS TR	SITRANS TF
Ambient temperature range			
Standard		-50 ... +85 °C (-58 ... +185 °F)	
SIL		-40 ... +80 °C (-40 ... +176 °F)	
Storage temperature		-50 ... +85 °C (-58 ... +185 °F)	
Calibration temperature		+24 °C (77 °F) ±1.0 °C (33.8 °F)	
Moisture		< 99% relative humidity (no condensation)	
Type of protection, enclosure/terminals			
• Transmitter enclosure	IP68	IP20	IP66/IP67/IP68
• Terminal	IP00	IP20	IP00

11.2 Construction

Mechanical specifications	SITRANS TH	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 wire thickness	1 x 1.5 mm^2 stranded wire	2.5 mm^2 (AWG 13)	
Screw terminals tightening torque	0.4 Nm	0.5 ... 0.6 Nm	
Vibration		IEC 60068-2-6	
2 … 25 Hz		1.6 mm	
25 … 100 Hz		4 g	

11.3 Common specifications

General specifications	SITRANS TH/TR	SITRANS TF	
Supply voltage	7.5[1] ... 48[2] V DC 7.5[1] ... 30[2] V DC (Ex i)	Single chamber housing	Dual 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)	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)
Additional minimum supply voltage when using test terminals	0.8 V		
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			
• 4 to 20 mA	≤ 55 ms		
• HART	≤ 75 ms (typically 70 ms)		
Programmable attenuation	0 to 6 s		
Signal dynamic, input	24 bit		
Signal dynamic, output	18 bit		
Influence of changes in supply voltage	< 0.005% of measuring span/V DC		

[1] 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.

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

11.4 Input accuracies

	Basic values	
Input type	**Basic accuracy**	**Temperature coefficient[1)]**
Pt10	≤ ±0.8 °C	≤ ±0.020 °C/°C
Pt20	≤ ±0.4 °C	≤ ±0.010 °C/°C
Pt50	≤ ±0.16 °C	≤ ±0.004 °C/°C
Pt100	≤ ±0.04 °C	≤ ±0.002 °C/°C
Pt200	≤ ±0.08 °C	≤ ±0.002 °C/°C
Pt500	T < 180 °C = ≤ ±0.08 °C max. T > 180 °C = ≤ ±0.16 °C max.	≤ ±0.002 °C/°C
Pt1000	≤ ±0.08 °C	≤ ±0.002 °C/°C
Pt2000	T < 300 °C = ≤ ±0.08 °C max. T > 300 °C = ≤ ±0.4 °C max.	≤ ±0.002 °C/°C
Pt10.000	≤ ±0.16 °C	≤ ±0.002 °C/°C
Pt x	The highest tolerance of the adjacent points	The highest coefficient of the adjacent 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	The highest tolerance of the adjacent points	The highest coefficient of the adjacent 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	The highest tolerance of the adjacent points	The highest coefficient of the adjacent points

Basic values		
Input type	**Basic accuracy**	**Temperature coefficient[1)]**
Linear resistance: 0 ... 400 Ω	≤ ±40 mΩ	≤ ±2 mΩ/°C
Linear resistance: 0 ... 100 kΩ	≤ ±4 Ω	≤ ±0.2 Ω/°C
Potentiometer: 0 ... 100 %	< 0.05 %	< ±0.005 %
mV: -20 ... 100 mV	≤ ±5 µV	≤ ±0.2 µV/°C
mV: -100 ... 1700 mV	≤ ±0.1 mV	≤ ±36 µV/°C
mV: ±800 mV	≤ ±0.1 mV	≤ ±32 µV/°C
TC E	≤ ±0.2 °C	≤ ±0.025 °C/°C
TC J	≤ ±0.25 °C	≤ ±0.025 °C/°C
TJ K	≤ ±0.25 °C	≤ ±0.025 °C/°C
TC L	≤ ±0.35 °C	≤ ±0.025 °C/°C
TC N	≤ ±0.4 °C	≤ ±0.025 °C/°C
TC T	≤ ±0.25 °C	≤ ±0.025 °C/°C
TC U	< 0 °C ≤ ±0.8 °C ≥ 0 °C ≤ ±0.4 °C	≤ ±0.025 °C/°C
TC Lr	≤ ±0.2 °C	≤ ±0.1 °C/°C
TC R	< 200 °C ≤ ±0.5 °C ≥ 200 °C ≤ ±1 °C	≤ ±0.1 °C/°C
TC S	< 200 °C ≤ ±0.5 °C ≥ 200 °C ≤ ±1 °C	≤ ±0.1 °C/°C
TC W3	≤ ±0,6 °C	≤ ±0.1 °C/°C
TC W5	≤ ±0,4 °C	≤ ±0.1 °C/°C
TC type: B[2)]	≤ ±1 °C	≤ ±0.1 °C/°C
TC type:B[3)]	≤ ±3 °C	≤ ±0.1 °C/°C
TC type:B[4)]	≤ ±8 °C	≤ ±0.8 °C/°C
TC type:B[5)]	Not specified	Not specified
CJC (internal)	< ±0,5 °C	Included in basic accuracy
CJC (external)	≤ ±0.08 °C	≤ ±0.002 °C/°C

1) Input temperature coefficients are the listed values or 0.002 % of input span, whichever is greater.
2) Accuracy specification range > 400 °C
3) Accuracy specification range > 160 °C < 400 °C
4) Accuracy specification range > 85 °C < 160 °C
5) Accuracy specification range < 85 °C

See also

Accuracy calculation examples (Page 100)

11.5 Output accuracies

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)

EMC	
EMC interference immunity	< ±0.1 % of span
Extended EMC noise immunity NAMUR NE 21, criterion A, Burst	< ±1 % of span

See also

Accuracy calculation examples (Page 100)

11.6 Input

11.6.1 RTD

Input type	Standard	Min. value	Max. value	∝	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 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 (Pt1000 & Pt10000 IEC and JIS +Ni1000 & NI10000)Max. 50 nF (all other input types)
Fault detection, programmable	None, short-circuited, defective, short-circuited or defective
Note: When the low limit for the configured input type is below the constant detection limit for short-circuited inputs, the detection of short circuits is disabled regardless of the configuration of the fault detection.	
Detection limit for short-circuited input	15 Ω
Fault detection time (RTD)	≤ 75 ms (typically 70 ms)
Fault detection time (for 3-wire and 4-wire)	≤ 2000 ms

11.6.2 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
LR	-200 °C	+800 °C	50 °C	GOST 3044-84

Cold junction compensation (CJC)	
Cold junction compensation (CJC)	Constant, internal or external over Pt100 or Ni100 RTD
Temperature range internal CJC	-50 ... +100 °C (-58 ... +212 °F)
Connection external CJC	2-wire, 3-wire or 4-wire
External CJC, wire resistance per wire (for 3-wire and 4-wire connections)	50 Ω

Cold junction compensation (CJC)	
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	Max. 50 nF
Total wire resistance	Max. 10 kΩ
Fault detection, programmable	None, short-circuited, defective CJC: short-circuited or defective
Note: The short-circuited fault detection only applies to the CJC input.	
Fault detection time (TC)	≤ 75 ms (typically 70 ms)
Fault detection time, external CJC (for 3-wire and 4-wire)	≤ 2000 ms

11.6.3 Linear resistance

Linear resistance input	
Input range	0 Ω ... 100 kΩ
Min. span	25 Ω
Connection type	2-, 3- or 4-wire
Wire resistance per wire (max.)	50 Ω
Input current	< 0.15 mA
Effect of sensor wire resistance (3- or 4-wire)	< 0.002 Ω/Ω
Cable, wire-wire capacitance	Max. 30 nF (Lin. R > 400 Ω) Max. 50 nF (Lin. R ≤400 Ω)
Error detection, programmable	None, Broken

11.6.4 Potentiometer

Potentiometer input	
Input range	0 Ω ... 100 kΩ
Min. span	25 Ω
Connection type	2-, 3- or 4-wire
Wire resistance per wire (max.)	50 Ω
Input current	< 0.15 mA
Effect of sensor cable resistance (3- / 4-wire)	< 0.002 Ω/Ω
Cable, wire-wire capacitance	Max. 30 nF (Lin. R > 400 Ω) Max. 50 nF (Lin. R ≤ 400 Ω)
Error detection, programmable	None, Shorted, Broken, Shorted or Broken
Note: Regardless of the error detection configuration, shorted input error detection will be disabled if the configured potentiometer size is lower than the constant detection limit for shorted input.	

Potentiometer input	
Detection limit for shorted input	15 Ω
Error detection time, wiper arm (no shorted input detection)	≤ 75 ms (typical 70 ms)
Error detection time, element	≤ 2000 ms
Error detection time (4th and 5th wire)	≤ 2000 ms

11.6.5 Voltage

Voltage input	
Measurement range	-800 ... +800 mV (bipolar) -100 ... 1700 mV
Min. span	2.5 mV
Input resistance	10 MΩ
Cable, wire-wire capacitance	Max. 30 nF (input range: -100 ... 1700 mV) Max. 50 nF (input range: -20 ... 100 mV)
Error detection, programmable	None, Broken
Error detection time	≤ 75 ms (typical 70 ms)

11.7 Output specifications and HART

Output and HART communication	
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	
• Fault current	Enable / disable
• Fault current setting	3.5 to 23 mA
Update time	10 ms
Load (with current output)	≤ (V_{Supply} - 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 101)

11.8 Certificates and approvals

11.8.1 ATEX/IECEx and related

ATEX/IECEx and others	SITRANS TH/TR	SITRANS TF	Display
Certificate number			
EN 60079-0:2012, A11:2013, EN60079-11:2012	DEKRA 17 ATEX 0116 X	DEKRA xx ATEX xxxx X	DEKRA xx ATEX xxxx U
EN60079-15:2010, EN60079-7:2015	A5E43700604A-2018X	A5ExxxxxxxA-2018X	A5ExxxxxxxA-2018U
IEC60079-0:2011, IEC60079-11:2011, IEC60079-15:2010, IEC60079-7:2015	IECEx DEK 17.0054X	IECEx DEK xx.xxxxX	IECEx DEK xx.xxxxU
ABNT NBR IEC60079-0:2013, ABNT NBR IEC60079-11:2013 ABNT NBR IEC60079-15:2012, ABNT NBR IEC60079-7:2013	DEK 17.00xxX	DEK xx.00xxX	DEK xx.00xxU
ГОСТ 31610.0-2014 (IEC 60079-0:2011) ГОСТ 31610.7-2012/ IEC 60079-7:2006) ГОСТ 31610.11-2014 (IEC 60079-11:2011) ГОСТ 31610.15-2014/ IEC 60079-15:2010	№ ТС RU C–DE.xxxx.x.xxxxx ОС НАНИО «ЦСВЭ»	№ ТС RU C–DE.xxxx.x.xxxxx ОС НАНИО «ЦСВЭ»	
EN 60079-0:2012, A11:2013 EN 60079-1:2014 EN 60079-31:2014	-	DEKRA xx ATEX xxxx X	-
IEC60079-0:2017 IEC60079-1:2014 IEC60079-31:2013	-	IECEx DEK xx.xxxxX	-
ABNT NBR IEC60079 -0 ERRATA 2:2016 ABNT NBR IEC60079 -1:2016 ABNT NBR IEC60079 -31:2014	-	DEK xx.00xxX	-

ATEX/IECEx and others	SITRANS TH/TR	SITRANS TF	Display
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	-	№ ТС RU C–DE.xxxx.x.xxxxxОС НАНИО «ЦСВЭ»	-
• "Intrinsic safety ia/ib" type of protection	Zones 0, 1, 2, 20, 21, 22 and M1		
Name • ATEX	II 1 G Ex ia IIC T6 ... T4 Ga II 2(1) G Ex ib [ia Ga] IIC T6 ... T4 Gb II 1 D Ex ia IIIC Da I M1 Ex ia I Ma		II 1 G Ex ia IIC T6 ... T4 Ga II 1 D Ex ia IIIC Da I M1 Ex ia I Ma
• IECEx and others	Ex ia IIC T6 ... T4 Ga Ex ib [ia Ga] IIC T6 ... T4 Gb Ex ia IIIC Da Ex ia I Ma		Ex ia IIC T6 ... T4 Ga Ex ia IIIC Da Ex ia I Ma
• EACEx	0Ex ia IIC T6 ... T4 Ga X 1Ex ib [ia Ga] IIC T6 ... T4 Gb X Ex ia IIIC Da X PO Ex ia I Ma X		0Ex ia IIC T6 ... T4 Ga X Ex ia IIIC Da X PO Ex ia I Ma X
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_i = 30 V DC, I_i = 120 mA, L_i = 0 µH, C_i = 1.0 nF	U_i = 30 V DC, I_i = 120 mA, L_i = ? µH, C_i = ? nF	U_i = 30 V DC, I_i = 120 mA, L_i = ? µH, C_i = ? nF
• Permissible ambient temperature P_i = 900 mW	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +65 °C (-58 … +149 °F) temperature class T5 -50 … +50 °C (-58 … +122 °F) temperature class T6	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +65 °C (-58 … +149 °F) temperature class T5 -50 … +50 °C (-58 … +122 °F) temperature class T6	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +65 °C (-58 … +149 °F) temperature class T5 -50 … +50 °C (-58 … +122 °F) temperature class T6
• Permissible ambient temperature P_i = 750 mW	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +70 °C (-58 … +158 °F) temperature class T5 -50 … +55 °C (-58 … +131 °F) temperature class T6	-50 … +85 °C (-58 … +185 °F) temperature class T4-50 … +70 °C (-58 … +158 °F) temperature class T5-50 … +55 °C (-58 … +131 °F) temperature class T6	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +70 °C (-58 … +158 °F) temperature class T5 -50 … +55 °C (-58 … +131 °F) temperature class T6
• Permissible ambient temperature P_i = 610 mW	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +75 °C (-58 … +167 °F) temperature class T5 -50 … +60 °C (-58 … +140 °F) temperature class T6	-50 … +85 °C (-58 … +185 °F) temperature class T4-50 … +75 °C (-58 … +167 °F) temperature class T5 -50 … +60 °C (-58 … +140 °F) temperature class T6	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +75 °C (-58 … +167 °F) temperature class T5 -50 … +60 °C (-58 … +140 °F) temperature class T6

ATEX/IECEx and others	SITRANS TH/TR	SITRANS TF	Display
Input terminals SITRANS TH/TF: 3, 4, 5, 6, 7, 8, 9 SITRANS TR: 5, 6, 7, 8, 9, 10, 11, 12	U_o = 7.2 V DC, I_o = 12.9 mA, P_o = 23.3 mW, L_o = 200 mH, C_o = 13.5 µF		-
• "Intrinsic safety ic" type of protection	Zones 2 and 22		
Name • ATEX	II 2 G Ex ic IIC T6 ... T4 Gc II 2 D Ex ic IIIC Dc		
• IECEx	Ex ic IIC T6 ... T4 Gc Ex ic IIIC Dc		
• EACEx	2Ex ic IIC T6 ... T4 Gc X Ex ic IIIC T***°C Dc X		
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_i = 37 V DC, L_i = 0 µH, C_i = 1.0 nF For U_i = 48 V DC, P_i = 851 mW, L_i = 0 µH, C_i = 1.0 nF	U_i = 37 V DC, L_i = 0 µH, C_i = 1.0 nF For U_i = 48 V DC, P_i = 851 mW, L_i = ? µH, C_i = ? nF	U_i = 37 V DC, L_i = 0 µH, C_i = 1.0 nF For U_i = 48 V DC, P_i = 851 mW, L_i = ? µH, C_i = ? nF
• Permissible ambient temperature	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +70 °C (-58 … +158 °F) temperature class T5 -50 … +55 °C (-58 … +131 °F) temperature class T6	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +70 °C (-58 … +158 °F) temperature class T5 -50 … +55 °C (-58 … +131 °F) temperature class T6	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +70 °C (-58 … +158 °F) temperature class T5 -50 … +55 °C (-58 … +131 °F) temperature class T6
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_i = 30 V DC, L_i = 0 µH, C_i = 1.0 nF	U_i = 30 V DC, L_i = 0 µH, C_i = 1.0 nF	Ui = 30 V DC, Li = 0 µH, Ci = 1.0 nF
• Permissible ambient temperature	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +75 °C (-58 … +167 °F) temperature class T5 -50 … +60 °C (-58 … +140 °F) temperature class T6		
Input terminals SITRANS TH/TF: 3, 4, 5, 6, 7, 8, 9 SITRANS TR: 5, 6, 7, 8, 9, 10, 11, 12	U_o = 7.2 V DC, I_o = 12.9 mA, P_o = 23.3 mW, L_o = 200 mH, C_o = 13.5 µF		

ATEX/IECEx and others	SITRANS TH/TR	SITRANS TF	Display
• "Non-sparking nA/ec" type of protection	Zones 2 and 22 Take measures to ensure that the supply voltage (including transients) does not rise above 140% of the rated voltage.		
Name • ATEX	II 2 G Ex nA IIC T6 ... T4 Gc II 2 G Ex ec IIC T6 ... T4 Gc		
• IECEx	Ex nA IIC T6 ... T4 Gc Ex ec IIC T6 ... T4 Gc		
• EACEx	2Ex nA IIC T6 ... T4 Gc X		
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_{max} = 37 V DC		
• Permissible ambient temperature	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +70 °C (-58 … +158 °F) temperature class T5 -50 … +55 °C (-58 … +131 °F) temperature class T6		
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_{max} = 30 V DC		
• Permissible ambient temperature	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +75 °C (-58 … +167 °F) temperature class T5 -50 … +60 °C (-58 … +140 °F) temperature class T6		
Input terminals SITRANS TH/TF: 3, 4, 5, 6, 7, 8, 9 SITRANS TR: 5, 6, 7, 8, 9, 10, 11, 12	U_{max} = 7.2 V DC		-
• "Flameproof enclosure Ex d/ Protection by enclosure Ex tb" type of protection	-	Zone 1/21	-

ATEX/IECEx and others	SITRANS TH/TR	SITRANS TF	Display
Name • ATEX	-	II 2 G Ex db IIC T6 ... T4 Gb II 2 D Ex tb IIIC T100 °C Db	-
• IECEx	-	Ex db IIC T6 ... T4 Gb Ex tb IIIC T6 ... T4 Gb	-
Output terminals SITRANS TF single chamber housing: 1, 2 SITRANS TF dual chamber housing: (+) and (-)	-	Umax = 30 V DC, Imax ≤ 23 mA	-
• Permissible ambient temperature		-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +75 °C (-58 … +167 °F) temperature class T5 -50 … +60 °C (-58 … +140 °F) temperature class T6	
Input terminals SITRANS TF: 3, 4, 5, 6, 7, 8, 9 SITRANS TR: 5, 6, 7, 8, 9, 10, 11, 12		U_o = 7.2 V DC, I_o = 12.9 mA, P_o = 23.3 mW, L_o = 200 mH, C_o = 13.5 µF	

11.8.2 FM/CSA

FM/CSA	SITRANS TH/TR	SITRANS TF	Display
Certificate number			
FM-c CAN C22.2 No. 157-92: (affirmed 2012): CAN C22.2 No. 213-M1987: (affirmed 2008): C22.2 No.30-M1986: (affirmed 2012) C22.2 No. 1010.1:2004; CAN/CSA-E60079-0:2011: CAN/CSA-E60079-11:2011: CAN/CSA-E60079-15 2012 FM-us FM Class 3600:2011 FM Class 3610:2010 FM Class 3611:2004 FM Class 3810:2005 ANSI/ISA 60079-0:2009 ANSI/ISA 60079-11:2009 ANSI/ISA 60079-15:2009	FMxxCAxxxx FMxxUSxxxx		
CSA-c CSA Std C22.2 No. 157-92 (R2012) CAN/CSA C22.2 No. 60079-0:11 CAN/CSA C22.2 No. 60079-11:11 CAN/CSA C22.2 No. 60079-15:12 CSA 61010-1-12 CSA-us UL Std No. 913, Ed. 8 UL 60079-0, Ed 5 UL 60079-11, Ed. 6 UL 60079-15, Ed. 4 UL 61010-1 Ed. 3	CSA 1861385		
• "Intrinsic safety ia" type of protection			

FM/CSA	SITRANS TH/TR	SITRANS TF	Display
Name	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		
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_i = 30 V DC, I_i = 120 mA, P_i = 900 mW, L_i = 0 µH, C_i = 1.0 nF		
• Permissible ambient temperature	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +70 °C (-58 … +158 °F) temperature class T5 -50 … +55 °C (-58 … +131 °F) temperature class T6		
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_i = 30 V DC, I_i = 100 mA, P_i = 750 mW, L_i = 0 µH, C_i = 1.0 nF		
• Permissible ambient temperature	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +75 °C (-58 … +167 °F) temperature class T5 -50 … +60 °C (-58 … +140 °F) temperature class T6		
Input terminals SITRANS TH/TF: 3, 4, 5, 5, 7, 8, 9 SITRANS TR: 5, 6, 7, 8, 9, 10, 11, 12	U_o = 7.2 V DC, I_o = 12.9 mA, P_o = 23.3 mW, L_o = 200 mH, C_o = 13.5 µF		
• "Non incendive field wiring NIFW" type of protection			
Name	NIFW, CL I, Div 2, GP ABCD T6 ... T4		

FM/CSA	SITRANS TH/TR	SITRANS TF	Display
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_i = 30 V DC, L_i = 0 µH, C_i = 1.0 nF		
• Permissible ambient temperature	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +75 °C (-58 … +176 °F) temperature class T5 -50 … +60 °C (-58 … +140 °F) temperature class T6		
Input terminals SITRANS TH/TF: 3, 4, 5, 5, 7, 8, 9 SITRANS TR: 5, 6, 7, 8, 9, 10, 11, 12	U_o = 7.2 V DC, I_o = 12.9 mA, P_o = 23.3 mW, L_o = 200 mH, C_o = 13.5 µF		
• "Non incendive NI" type of protection	Take measures to ensure that the supply voltage (including transients) does not rise above 140% of the rated voltage.		
Name	NI, CL I, Div 2, GP ABCD T6...T4 Ex nA IIC T6 ... T4 Gc AEx nA IIC T6 ... T4 Gc		
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_{max} = 37 V DC		
• Permissible ambient temperature	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +70 °C (-58 … +158 °F) temperature class T5 -50 … +55 °C (-58 … +131 °F) temperature class T6		
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_{max} = 30 V DC		

FM/CSA	SITRANS TH/TR	SITRANS TF	Display
• Permissible ambient temperature	-50 … +85 °C (-58 … +185 °F) temperature class T4 -50 … +75 °C (-58 … +167 °F) temperature class T5 -50 … +60 °C (-58 … +140 °F) temperature class T6		
Input terminals SITRANS TH/TF: 3, 4, 5, 5, 7, 8, 9 SITRANS TR: 5, 6, 7, 8, 9, 10, 11, 12	U_{max} = 7.2 V DC		
• Non-hazardous areas			
Output terminals SITRANS TH/SITRANS TF single chamber housing: 1, 2 SITRANS TR: 3, 4 SITRANS TF dual chamber housing: (+) and (-)	U_{max} = 30 V DC, I_{max} ≤ 23 mA		

11.9 Factory settings

11.9.1 Factory setting SITRANS TH320/TR320

Factory settings	SITRANS TH320/TR320
Input	Pt100 (IEC 751) with 3-wire circuit
Measuring range	+0 ... +100 °C (+32 ... +212 °F)
Fault current	
• Brocken sensor value	22.8 mA
• Short circuit sensor value	22.4 mA
Trim	No trim of input and output
Damping	0.0 s

11.9.2 Factory setting SITRANS TH420/TR420

Factory settings	SITRANS TH420/TR420
Input 1	Pt100 (IEC 751) with 3-wire circuit
Input 2	not configurable (inactiv)
Measuring range	+0 ... +100 °C (+32 ... +212 °F)
Fault current	
• Brocken sensor value	22.8 mA
• Short circuit sensor value	22.4 mA
• Input drift	22 mA
Trim	No trim of input and output
Damping	0.0 s

11.10 USB modem

Ambient conditions	
Pollution degree according to IEC 61010	1 ... 2
Ambient temperature range	0 ... 30 °C (+32 ... +86 °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, < 100 mA

Power supply of temperature transmitter	
Available power supply	Max. 18 mA
Available supply voltage	Max. 15 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

Dimension drawings

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12.1 Dimension drawings SITRANS TH320/TH420

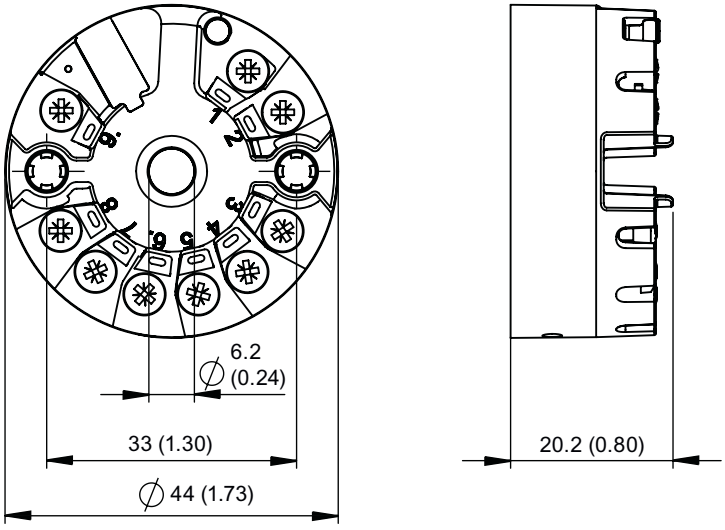

Figure 12-1 **Dimension drawings SITRANS TH320/TH420**

12.2 Dimension drawings SITRANS TR320/TR420

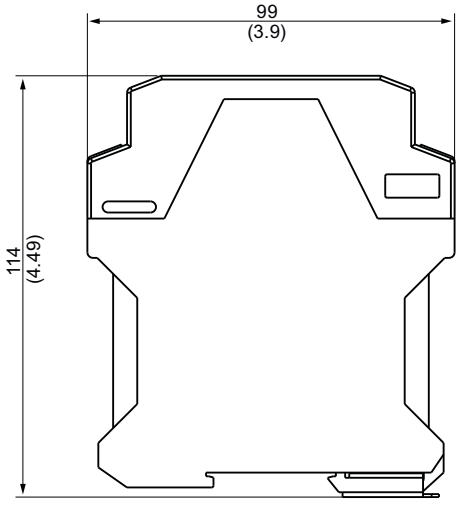

Figure 12-2 **Dimension drawings SITRANS TH320/TH420**

Appendix A

A.1 Technical support

Technical Support

If this documentation does not provide complete answers to any technical questions you may have, contact Technical Support at:

- Support request (http://www.siemens.com/automation/support-request)
- More information about our Technical Support is available at Technical support (http://www.siemens.com/automation/csi/service)

Internet Service & Support

In addition to our documentation, Siemens provides a comprehensive support solution at:

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

Personal contact

If you have additional questions about the device, please contact your Siemens personal contact at:

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

To find the personal contact for your product, go to "All Products and Branches" and select "Products & Services > Industrial Automation > Process Instrumentation".

Documentation

You can find documentation on various products and systems at:

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

A.2 Certificates

You can find certificates on the Internet at Certificates (http://www.siemens.com/processinstrumentation/certificates) or on an included DVD.

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.

A.4 Accuracy calculation examples

Description

Example: Pt100 sensor, configured from –200 °C to +850 °C

$Pt100_{Basic\ Accuracy}$ = 0.04 °C

$Output_{Analog\ Accuracy}$ = 0.0016 mA

$$Total_{Accuracy\ (mA)} = \frac{Basic_{Accuracy}}{Configured\_Span_{INPUT}} \times 16.0\ mA + Output_{Analog\ Accuracy}$$

$$Total_{Accuracy\ (mA)} = \frac{0.04\ °C}{850\ °C\text{-}(-200\ °C)} \times 16.0\ mA + 0.0016\ mA = \underline{0.0022\ mA}$$

$$Total_{Accuracy\ (\%)} = \frac{Total_{Accuracy\ (mA)}}{16.0\ mA} \times 100\ \%$$

$$Total_{Accuracy\ (\%)} = \frac{0.0022\ mA}{16.0\ mA} \times 100\ \% = \underline{0.01381\ \%}$$

Example: Type K TC, internal CJC, configured from 0 °C to 400 °C

Type K $TC_{Basic\ Accuracy}$ = 0.25 °C

$Output_{Analog\ Accuracy}$ = 0.0016 mA

$$Total_{Accuracy\ (mA)} = \frac{Basic_{Accuracy} + Int.\ CJC}{Configured\_Span_{INPUT}} \times 16.0\ mA + Output_{Analog\ Accuracy}$$

$$Total_{Accuracy\ (mA)} = \frac{0.25\ °C + 0.5\ °C}{400\ °C} \times 16.0\ mA + 0.0016\ mA = \underline{0.0316\ mA}$$

$$Total_{Accuracy\ (\%)} = \frac{Total_{Accuracy\ (mA)}}{16.0\ mA} \times 100\ \%$$

$$Total_{Accuracy\ (\%)} = \frac{0.0316\ mA}{16.0\ mA} \times 100\ \% = \underline{0.1975\ \%}$$

Example: Type K TC, external CJC Pt1000, configured from 0 °C to 400 °C

Type K $TC_{Basic\ Accuracy}$ = 0.25 °C

$Output_{Analog\ Accuracy}$ = 0.0016 mA

$$Total_{Accuracy\ (mA)} = \frac{Basic_{Accuracy} + Ext.\ CJC}{Configured\_Span_{INPUT}} \times 16.0\ mA + Output_{Analog\ Accuracy}$$

$$Total_{Accuracy\ (mA)} = \frac{0.25\ °C + 0.08\ °C}{400\ °C} \times 16.0\ mA + 0.0016\ mA = \underline{0.0148\ mA}$$

$$Total_{Accuracy\ (\%)} = \frac{Total_{Accuracy\ (mA)}}{16.0\ mA} \times 100\ \%$$

$$Total_{Accuracy\ (\%)} = \frac{0.0148\ mA}{16.0\ mA} \times 100\ \% = \underline{0.0925\ \%}$$

A.5 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

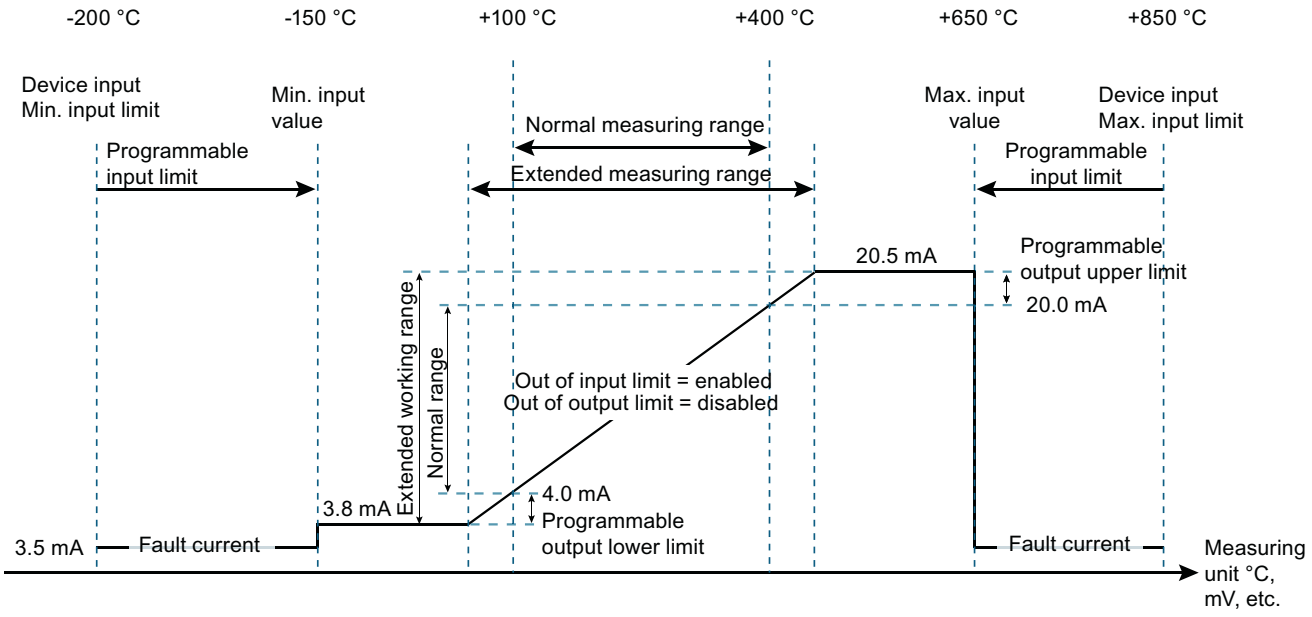

Figure A-1 Programmable input

Output

When the output exceeds either of the programmable upper and lower limits, the device will output a user defined fault current.

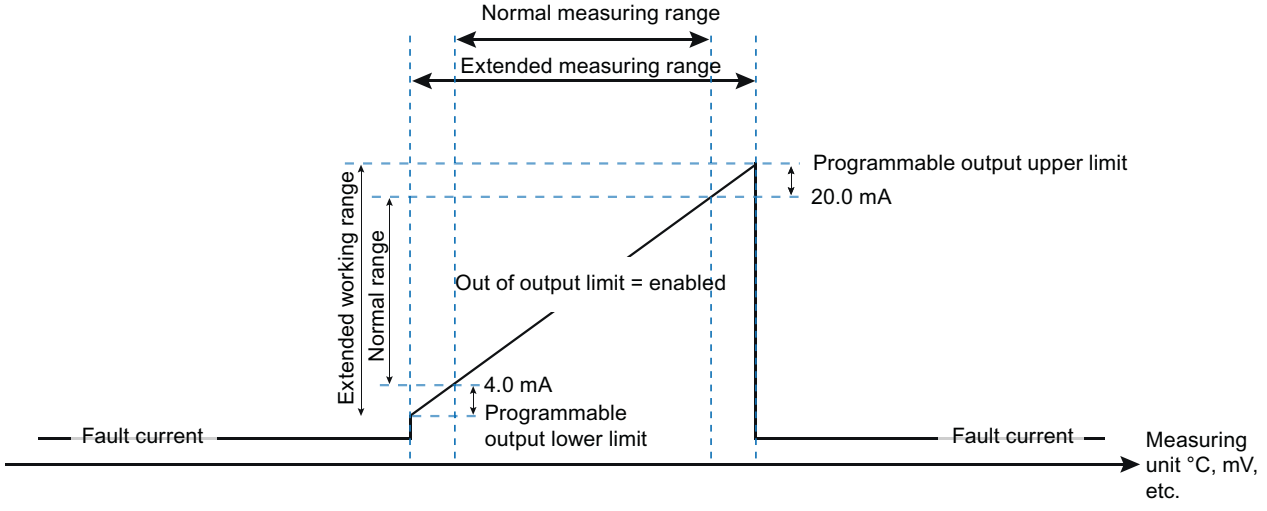

Figure A-2 Programmable output

See also

Technical data (Page 79)

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