SIEMENS

SITRANS

Temperature sensors SITRANS TSinsert/TS100/TS200/ TS500

Operating Instructions

Introduction 1

Safety information 2

Description 3

Installation 4

Connection 5

Commissioning 6

Service and maintenance 7

Troubleshooting/FAQs 8

Technical data 9

Dimension drawings 10

Appendix A

7MC71.. SITRANS TS100
7MC72.. SITRANS TS200
7MC75.. SITRANS TS500

03/2013
A5E03920348-03

Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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.

Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG
GERMANY

Order number: A5E03920348
℗ 03/2013 Technical data subject to change

Table of contents

1 Introduction 7

1.1 History of operating instructions 7

1.2 Checking the consignment 7

1.3 Transportation and storage 8

1.4 Notes on warranty 8

2 Safety information 9

2.1 Requirements for safe use 9

2.1.1 Laws and directives 9

2.1.2 Conformity with European directives 9

2.2 Requirements for special applications 10

2.3 Use in hazardous areas 11

2.3.1 Qualified personnel for hazardous area applications 11

3 Description 13

3.1 Overview 13

3.2 Application 14

3.3 Functional principles 14

3.4 Nameplate structure 14

3.5 Temperature transmitter for SITRANS TS500 15

3.6 Measuring inserts for SITRANS TS500 16

3.7 Connection heads for SITRANS TS500 17

4 Installation 19

4.1 Basic safety instructions 19

4.1.1 Installation and location requirements 21

4.1.2 Proper mounting 21

4.2 Uninstalling 22

4.3 Install 22

5 Connection 25

5.1 Basic safety instructions 25

5.1.1 For SITRANS TSinsert/TS200/TS500 28

5.1.2 For SITRANS TS500 28

5.1.3 For SITRANS TS100/TS200 28

5.2 Electric connection 29

5.3 Electrical connection of resistance thermometers 29

5.4 Electrical connection of thermocouples 30

6 Commissioning....31
6.1 Basic safety instructions....31
6.2 Commissioning....32
7 Service and maintenance....33
7.1 Service and maintenance....33
7.2 Cleaning....33
7.3 Return procedure....34
7.4 Disposal....34
8 Troubleshooting/FAQs....35
8.1 Troubleshooting for temperature measurement....35
8.2 Troubleshooting for resistance thermometers....36
8.3 Troubleshooting for thermocouples (TC)....37
9 Technical data....39
9.1 Rated conditions....39
9.1.1 Maximum permitted ambient temperatures in the connection area of the sensor....39
9.1.1.1 SITRANS TS100....39
9.1.1.2 SITRANS TS500....39
9.1.2 Maximum permitted sample temperatures within the process....42
9.1.3 Measuring range....43
9.2 Construction....43
9.3 Electrical data....43
9.4 Measuring tolerances for resistance thermometers....44
9.5 Measuring accuracy for thermocouples....45
10 Dimension drawings....47
10.1 Overview....47
10.2 SITRANS TS100....49
10.3 SITRANS TS200....50
10.4 SITRANS TS500....51
10.4.1 SITRANS TS500, types 2 and 2N....51
10.4.2 SITRANS TS500, types 2G and 2F....53
10.4.3 SITRANS TS500, type 3....54
10.4.4 SITRANS TS500, types 3G and 3F....55
10.4.5 SITRANS TS500, types 4 and 4F....56
10.4.6 SITRANS TS500 for installation in existing protective tubes....57
10.5 SITRANS TSinsert - measuring inserts for SITRANS TS500....58
A Appendix....59
A.1 Certificate....59
A.2 Technical support....59

Index.....**61**

Introduction

1

These instructions contain all information required to commission and use the device. It is your responsibility to 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.

See also

Technical support (Page 59)

1.1 History of operating instructions

The following table contains important changes to the previous version of the documentation:

Edition	Remark
01	Edition was never published
02 10/2012	First edition of instructions
03 03/2013	Added warning notes and updated electrical data

1.2 Checking the consignment

1. Check the packaging and the device for visible damage caused by inappropriate handling during shipping.
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

Danger of explosion in hazardous areas.

- Do not use damaged or incomplete devices.

1.3 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.

CAUTION

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".

1.4 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.

See also

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

SITRANS T product information (http://www.siemens.com/sitranst)

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

Safety information 2

2.1 Requirements 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.

Symbol	Description
	Pay attention to the operating instructions

2.1.1 Laws and directives

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

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

Further provisions for hazardous area applications are for example:

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

2.1.2 Conformity with European directives

The CE marking on the device symbolizes the conformity with the following European directives:

Electromagnetic compatibility EMC 2004/108/EC	Directive of the European Parliament and of the Council on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC.
Atmosphère explosible ATEX 94/9/EC	Directive of the European Parliament and the Council on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.

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

See also

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

WARNING

Improper device modifications

Danger 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.

2.2 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.

2.3 Use in hazardous areas

2.3.1 Qualified personnel for hazardous area applications

Qualified personnel for hazardous area applications

Persons who install, assemble, 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

Unsuitable device for the hazardous area

Danger of explosion.

- Only use equipment that is approved for use in the intended hazardous area and labelled accordingly.

See also

Technical data (Page 39)

⚠ 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 danger of explosion.

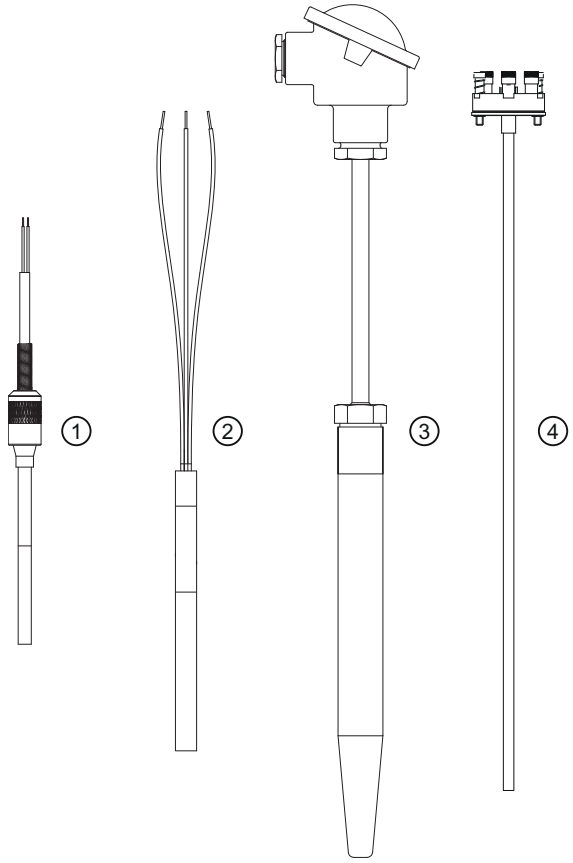
- Connect the device with type of protection "Intrinsic safety" solely to an intrinsically safe circuit.
- Observe the specifications for the electrical data on the certificate and in Chapter "Technical data (Page 39)".

Description

3

3.1 Overview

SITRANS TS product family



① SITRANS TS100 7MC71..
general use, compact design with connecting cable

② SITRANS TS200 7MC72..
general use, compact design

③ SITRANS TS500 7MC75..
general use, modular design with connection head

④ SITRANS TSinsert measuring insert for use in the SITRANS TS500 series

Elementary sensors

Resistance thermometers or thermocouples can be used for temperature measurement.

3.2 Application

The temperature sensors of the SITRANS TS product family are used for measuring temperatures in industrial plants.

Depending on the specifications, sensors can be combined with different connection heads, extension tubes, and process connections. This makes the sensors suitable for a variety of process engineering applications, e.g. in the following sectors:

- Petrochemical industry
- Pharmaceuticals industry
- Biotechnology
- Foodstuffs

3.3 Functional principles

Two different measuring principles are used for measuring temperatures.

- With resistance thermometers, the temperature is measured as a change in resistance. Resistance thermometers contain Pt100 sensor elements in accordance with IEC 60751.
- With thermocouples, the temperature is the change in voltage (Seebeck effect). The thermocouples are in accordance with IEC 584/DIN EN 60584.

3.4 Nameplate structure

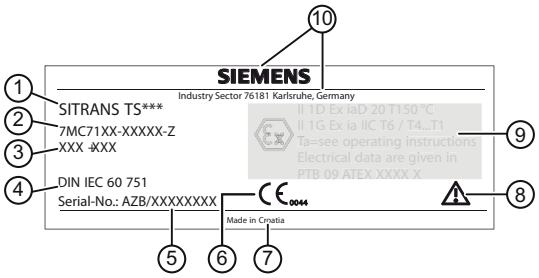
Positioning of nameplate

Note
SITRANS TS100/TS200 nameplate

Before commissioning, make sure the nameplate is securely fastened to the temperature sensor in a visible location

Device	Positioning of the nameplate
SITRANS TSinsert 7MC701.	On the bottom of the connecting plate or at the outer periphery of the ANSI adapter.
SITRANS TS100 7MC71..	On the sensor cable
SITRANS TS200 7MC72..	On the connector or on the sensor
SITRANS TS500 7MC75..	On the connection head

Example of nameplate



① Product name
② Order number (machine-readable product code)
③ Additional information on the type
④ Valid standard for the device
⑤ Serial number
⑥ CE marking
⑦ Place of manufacture
⑧ Consult the operating instructions.
⑨ Type-specific information Explosion protection/electrical data
⑩ Manufacturer´s specifications

3.5 Temperature transmitter for SITRANS TS500

The following head-mounted transmitters can be combined with the temperature sensors SITRANS TS500:

Transmitter	Features	Sensor
TH100	• Base device • Output 4 ... 20 mA • Can be configured using simple software • P_o: 12.5 mW	only [1]
TH200	• Universal device • Output 4 ... 20 mA • Can be configured using simple software • P_o: 37 mW	[1] or [2]
TH300	• Universal • Output 4 ... 20 mA / HART • Diagnostic functions • P_o: 37 mW	[1] or [2]
TH400	• Output: PROFIBUS PA or FOUNDATION Fieldbus. • Sensor redundancy • Diagnostics • P_o: 12.5 mW	[1] or [2]

[1] Resistance thermometers
[2] Thermocouple

3.6 Measuring inserts for SITRANS TS500

Measuring inserts for SITRANS TS500 temperature sensors are available in three variants:

- Variant 1:
  DIN mounting disk for accommodating a transmitter or ceramic socket.
- Variant 2:
  Fixed connection of the ends of the mineral insulated cable with a DIN ceramic socket.
- Variant 3:
  Measuring insert in a spring-loaded adapter (ANSI)

3.7 Connection heads for SITRANS TS500

The transmitters can be mounted in connection heads of type B and bigger. The following mounting types are possible:

- Measuring insert mounting
  - Standard type with compact design
  - Measuring insert (sensor) and transmitter form one unit

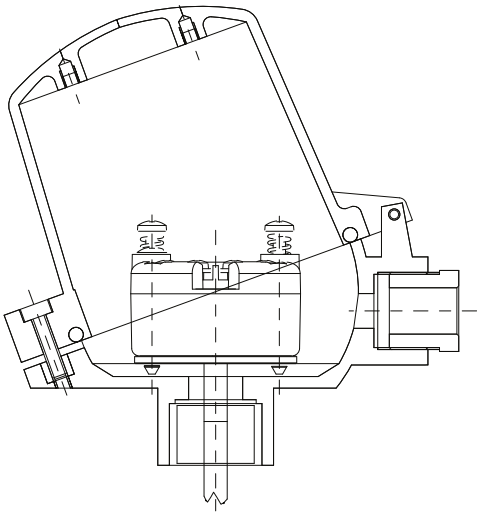


Figure 3-1 Measuring insert mounting of transmitter

- Hinged cover mounting
  - Standard type for connection heads of type BC0: B head with high hinged cover
  - Separate maintenance of the measuring insert and the transmitter is possible.

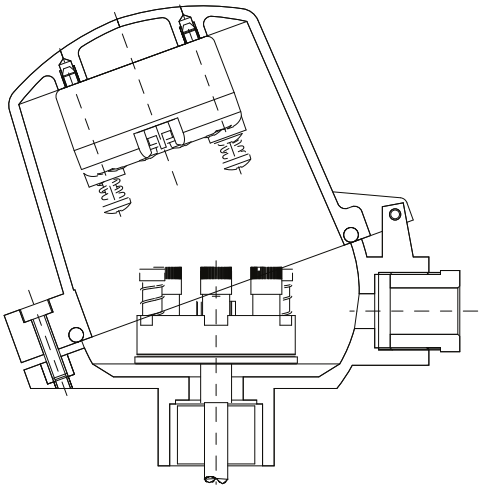


Figure 3-2 Hinged cover mounting of transmitter

Installation

4

4.1 Basic safety instructions

⚠ CAUTION

Hot surfaces resulting from hot process media

Danger of burns resulting from surface temperatures above 70 °C (155 °F).

- Take appropriate protective measures, for example contact protection.
- Make sure that protective measures do not cause the maximum permissible ambient temperature to be exceeded. Refer to the information in Chapter "Technical data (Page 39)".

⚠ WARNING

Unsuitable connecting parts

Danger of injury or poisoning.

In case of improper mounting hot, toxic and corrosive process media could be released at the connections.

- Ensure that connecting parts (such as flange gaskets and bolts) are suitable for connection and process media.

See also

Technical data (Page 39)

⚠ WARNING

Exceeded maximum ambient or process media temperature

Danger of explosion in hazardous areas.

Device damage.

- Make sure that the maximum permissible ambient and process media temperatures of the device are not exceeded. Refer to the information in Chapter "Technical data (Page 39)".

WARNING

Open cable inlet or incorrect cable gland

Danger of explosion in hazardous areas.

- Close the cable inlets for the electrical connections. Only use cable glands or plugs which are approved for the relevant type of protection.

WARNING

Incorrect mounting at Zone 0

Danger of explosion in hazardous areas.

- Ensure sufficient tightness at the process connection.
- Observe the standard IEC/EN 60079-14.

CAUTION

External stresses and loads

Damage to device by severe external stresses and loads (e.g. thermal expansion or pipe tension). Process media can be released.

- Prevent severe external stresses and loads from acting on the device.

CAUTION

High vibration area

Especially with the stainless steel housing version, use short extension lengths or external supports when used in a high vibration area.

4.1.1 Installation and location requirements

⚠ CAUTION

Direct sunlight

Device damage.

The device can overheat or materials become brittle due to UV exposure.

- Protect the device from direct sunlight.
- Make sure that the maximum permissible ambient temperature is not exceeded. Refer to the information in Chapter "Technical data (Page 39)".

4.1.2 Proper mounting

NOTICE

Incorrect mounting

The device can be damaged, destroyed, or its functionality impaired through improper mounting.

- Before installing ensure there is no visible damage to the device.
- Make sure that process connectors are clean, and suitable gaskets and glands are used.
- Mount the device using suitable tools. Refer to the information in Chapter "Technical data (Page 39)", for example installation torques requirements.

Note

Loss of degree of protection

Damage to device if the enclosure is open or not properly closed. The degree of protection specified on the nameplate is no longer guaranteed.

⚠ CAUTION

Loss of IP protection

Do not unscrew the device housing from the mounted parts with NPT threaded connection

4.2 Uninstalling

⚠ WARNING

Incorrect disassembly

The following dangers may result through incorrect disassembly:

- Injury through electric shock
- Danger through emerging media when connected to the process
- Danger 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 dangerous 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.

4.3 Install

Process connection

⚠ DANGER

Protective tube ruptures

Protective tubes that are not suitable for the process or application in question can rupture and result in serious damage to property and personal injuries

Make sure that the protective tube is suitable for the respective mounting method and application. If necessary, check the selection and order data of your protective tube.

The devices are delivered with different connection heads and different process connections depending on the specifications. The following guidelines apply:

- Assemble the process prior to the electrical installation.
- Make sure prior to mounting that the device is appropriate with regard to the process connection, media compatibility, temperature resistance and measuring range.
- The gaskets used must be suitable for the process connection and resistant to the measured media.

Rule of thumb for installation

Prevent faults caused by heat dissipation by observing the following rules:

- Select the largest possible immersion depth. Estimate the immersion depth using the formulas specified below.
- Select a measuring location with a high flow rate.
- Ensure that there is sufficient thermal insulation of the external components of the thermometer.
- Ensure that external parts have as small surfaces as possible.
- Select the optimum mounting position for the process in question.

Estimation of immersion depth

Medium	Immersion depth (calculation) [1]
Water	Immersion depth ≥ TSL + (5 x $\varnothing_{\text{protective tube}}$)
Air	Immersion depth ≥ TSL + (10 bis 15 x $\varnothing_{\text{protective tube}}$)

[1] TSL = Temperature Sensitive Length

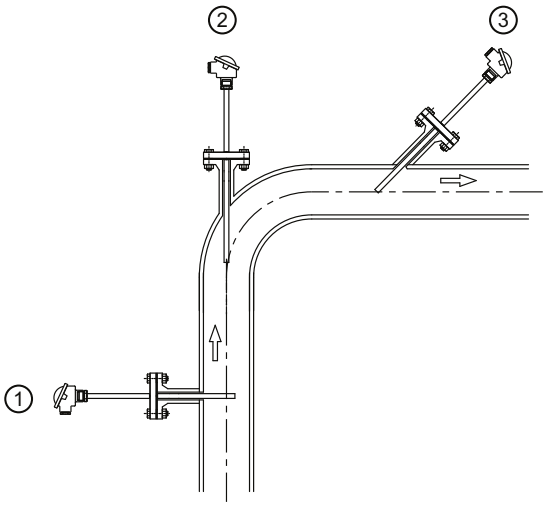
Mounting positions

Note

Mounting positions for small pipe diameters

With small pipe diameters, mount the sensors upstream at an angle or in an elbow, see ② and ③ in the diagram "Mounting positions".

The following diagram shows the possible mounting positions of the sensors:



① At a right angle to the flow
② In a bend upstream
③ In a narrow cable at an angle upstream

Figure 4-1 Mounting positions

Connection 5

5.1 Basic safety instructions

⚠ WARNING

Unsuitable cables and/or cable glands

Danger of explosion in hazardous areas.

- Only use suitable cables and cable glands complying with the requirements specified in Chapter "Technical data (Page 39)".
- Tighten the cable glands in accordance with the torques specified in Chapter "Technical data (Page 39)".
- When replacing cable glands use only cable glands of the same type.
- After installation check that the cables are seated firmly.

See also

Construction (Page 43)

⚠ WARNING

Improper power supply

Danger 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 Chapter "Electrical data (Page 43)" or on the nameplate.

⚠ WARNING

Unsafe extra-low voltage

Danger of explosion in hazardous areas due to voltage flashover.

- Connect the device to an extra-low voltage with safe isolation (SELV).

WARNING

Lack of equipotential bonding

Danger of explosion through compensating currents or ignition currents through lack of equipotential bonding.

- Ensure that the device is potentially equalized.

Exception: It may be permissible to omit connection of the equipotential bonding for devices with type of protection "Intrinsic safety Ex i".

WARNING

Unprotected cable ends

Danger of explosion through unprotected cable ends in hazardous areas.

- Protect unused cable ends in accordance with IEC/EN 60079-14.

WARNING

Loss of degree of protection

When connecting the SITRANS TS100 or TS200 with type protection "Intrinsically safe", ensure the following:

- Adhere to the requirements for electrical connection seperation
- Use IP54 rated enclosure

WARNING

Lemo plug in hazardous areas

For Lemo plug version (7MC7xxx-xxxx2-xxx) make sure the cable ends are in an environment free from dust, water, or shock

WARNING

Improper laying of shielded cables

Danger of explosion through compensating currents between hazardous area and the non-hazardous area.

- Only ground shielded cables that run into the hazardous area at one end.
- If grounding is required at both ends, use an equipotential bonding conductor.

⚠ WARNING

Connecting device in energized state

Danger of explosion in hazardous areas.

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

Exceptions:

- Circuits of limited energy may also be connected in the energized state in hazardous areas.
- Exceptions for type of protection "Non-sparking nA" (Zone 2) are regulated in the relevant certificate

Note

Electromagnetic compatibility (EMC)

You can use this device in industrial environments, households and small businesses.

For metal housings there is an increased electromagnetic compatibility compared to high-frequency radiation. This protection can be increased by grounding the housing, see Chapter "Electric connection (Page 29)".

Note

Improvement of interference immunity

- Lay signal cables separate from cables with voltages > 60 V.
- Use cables with twisted wires.
- Keep device and cables in distance to strong electromagnetic fields.
- Use shielded cables to guarantee the full specification according to HART.
- Refer to HART communication information in Chapter "Technical data (Page 39)".

5.1.1 For SITRANS TSinsert/TS200/TS500

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 (68 °F) higher.

5.1.2 For SITRANS TS500

NOTICE

Condensation in the device

Damage to device through formation of condensation if the temperature difference between transportation or storage and the mounting location exceeds 20 °C (68°F).

- Before taking the device into operation let the device adapt for several hours in the new environment.

5.1.3 For SITRANS TS100/TS200

⚠ WARNING

Use of plug connectors in explosive dust atmosphere

Danger of explosion.

Temperature sensors of the SITRANS TS100 and SITRANS TS200 series must not be used together with plug connectors in atmospheres with combustible dust.

- Do not use plug connectors in areas with combustible dust.

5.2 Electric connection

Procedure

Note
Connection sequence

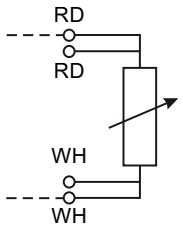
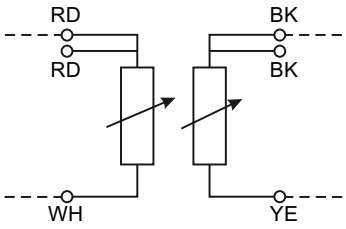
Install the temperature transmitter before connecting the temperature sensor electrically.

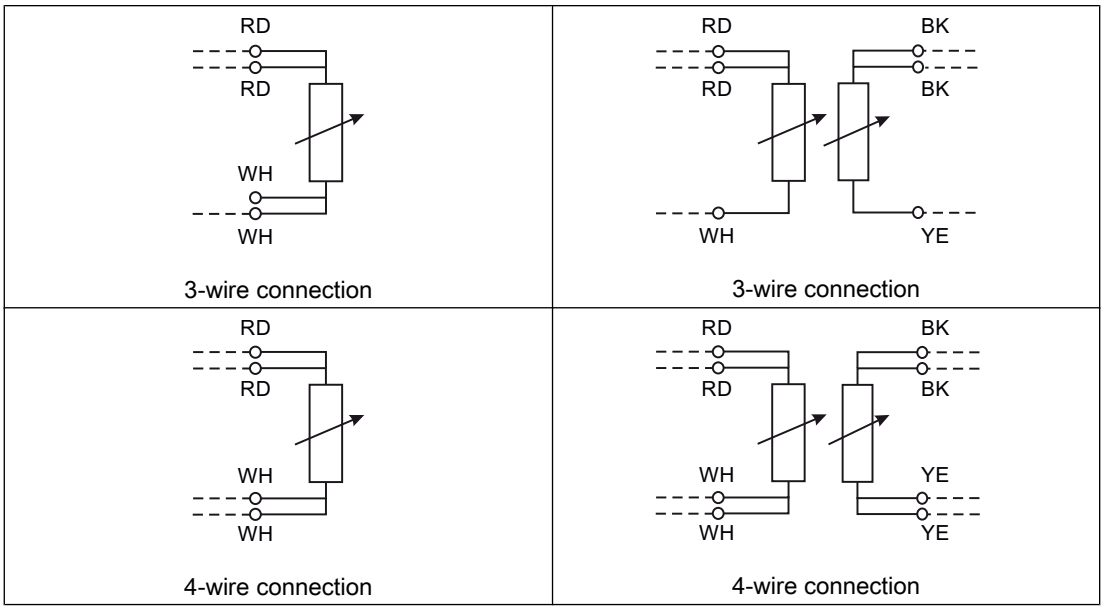
1. Release the fixing screws on the enclosure cover and remove the enclosure cover.
2. Insert the connecting cable through the cable gland.
3. Connect the wires to the relevant connecting terminals. Observe the terminal assignment.
   - Electrical connection of resistance thermometers (Page 29)
   - Electrical connection of thermocouples (Page 30)

See also

Electrical data (Page 43)

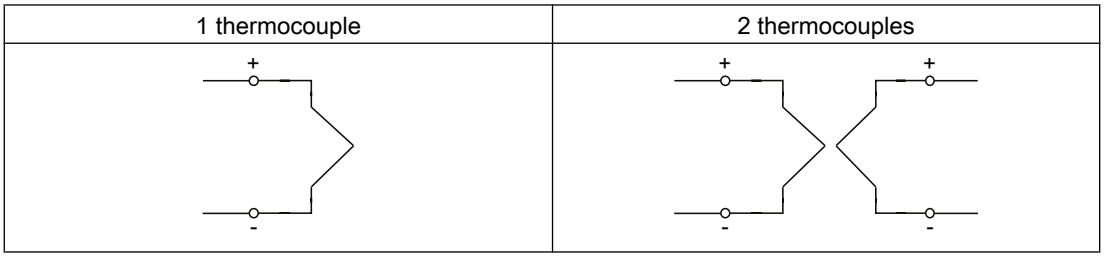
5.3 Electrical connection of resistance thermometers

1 x Pt100	2 x Pt100
	
2-wire connection	2-wire connection



Abbreviation of color: RD = red; WH = white; YE = yellow; BK = black

5.4 Electrical connection of thermocouples



Thermocouples	Cable colors	
Type	+	-
J	Black	White
K	Green	White
N	Pink	White
E	Brown	White
L	Red	Blue
T	Red	White

Commissioning 6

6.1 Basic safety instructions

⚠ WARNING

Improper commissioning in hazardous areas

Device failure or danger of explosion in hazardous areas.

- Do not commission the device until it has been mounted completely and connected in accordance with the information in Chapter "Technical data (Page 39)".
- Before commissioning take the effect on other devices in the system into account.

⚠ WARNING

Hot surfaces

Danger of burns resulting from hot surfaces.

- Take corresponding protective measures, for example by wearing protective gloves.

Note

Loss of degree of protection

Damage to device if the enclosure is open or not properly closed. The degree of protection specified on the nameplate is no longer guaranteed.

⚠ WARNING

Loss of explosion protection

Danger of explosion in hazardous areas if the device is open or not properly closed.

⚠ WARNING

Opening device in energized state

Danger of explosion in areas subject to explosion hazard.

- Only open the device in a de-energized state.
- Check prior to commissioning that the cover, cover locks, and cable inlets are assembled in accordance with the directives.

Exception: Devices having the type of protection "Intrinsic safety Ex i" may also be opened in energized state in hazardous areas.

6.2 Commissioning

Requirements

Verify that the following commissioning conditions are satisfied:

- You have connected the sensors correctly. For further details, see:
  - Electrical connection of resistance thermometers (Page 29)
  - Electrical connection of thermocouples (Page 30)
- Verify that the electrical connections are firmly tightened to the suitable torque.
- The following applies in particular with device versions with explosion protection:
  - Verify whether the cable glands are appropriate for the process and are correctly tightened.
  - The electrical data must match the specified ex-relevant values.
- All seals must be present, placed correctly and undamaged.

Procedure

1. Close the connection head. Fully screw on the cover for device versions with flameproof enclosures.
2. Connect the sensor integrated in the process to the power supply.

Service and maintenance 7

7.1 Service and maintenance

Recalibration

The temperature sensors are essentially maintenance-free. We recommend recalibration under the following conditions, however:

- The temperature sensors are used in processes with strong vibrations or changes in temperature.
- Particularly high demands on measuring accuracy and safety.

Note

Recalibration intervals

Define the recalibration intervals for the specific process or plant. With constant operating temperatures and a low load, the reference values are as follows:

- < < 2 years at temperatures up to 400 °C
- < 5 years at temperatures up to 200 °C

7.2 Cleaning

Cleaning the enclosure

- Clean the outside of the enclosure and the display window using a cloth moistened with water or a mild detergent.
- Do not use aggressive cleaning agents or solvents. Plastic components or painted surfaces could be damaged.

⚠ WARNING

Electrostatic charge

Danger of explosion in hazardous areas if electrostatic charges develop, for example, when cleaning plastic enclosures with a dry cloth.

- Prevent electrostatic charging in hazardous areas.

7.3 Return procedure

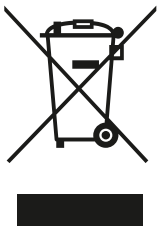
Enclose the bill of lading, return document and decontamination certificate in a clear plastic pouch and attach it firmly to the outside of the packaging.

Required forms

- Delivery note
- Return goods delivery note (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.

The forms can be found on the Internet as well as in the documentation which comes with the device.

7.4 Disposal



Devices identified by this symbol may not be disposed of in the municipal waste disposal services under observance of the Directive 2002/96/EC on waste electronic and electrical equipment (WEEE).

They can be returned to the supplier within the EC or to a locally approved disposal service. Observe the specific regulations valid in your country.

Troubleshooting/FAQs

8

8.1 Troubleshooting for temperature measurement

Table 8-1 With interruption in measured signal

State	Possible cause	Elimination
Interruption of measurement signal	Vibration and shock as a result of the ambient and working conditions.	Use a vibration-resistant measuring insert.
		Relocate measurement point.
		Select shorter insert lengths.
		Additional mechanical support
		Select a special design of the protective tube

Table 8-2 With measured signal interferences

State	Possible cause	Elimination
Short-circuit	Vibration, shock or incorrect installation	Eliminate the short-circuit, ensure insulation, if necessary, replace the defective component.
Faulty insulation	At low temperature: Ingress of water or oil due to inadequate maintenance or installation	Dry and seal all components. After verification if necessary, replace the measuring insert.
	At low temperature: Ingress of moisture due to faulty measuring insert encapsulation	Replace the measuring insert.
	At high temperatures: Change insulation due to excessively high temperature	Check the thermometer for thermal suitability and if necessary, replace it.
Measured value fluctuates	Electromagnetic influence, radio interference	Use transmitter with galvanic isolation.
		If laid in parallel, keep a minimum distance of 0.5 m between the measuring cable and the power supply line.
		Cross the channels of the power supply cables at right angles.
		Use cable with twisted wires.
		Use shielded cable and enclosure.
	Ground loops	Revise the grounding design: One-sided, feed-side grounding usually results in better shielding. Other option: Ungrounded, grounded on both sides. Refer to the warning information in section "Basic safety instructions (Page 25)".
	Faulty insulation	See above, state "Faulty insulation"

Table 8-3 With implausible measured values

State	Possible cause	Elimination
Long response time	Incorrect installation Insufficient immersion depth	For rules for immersion depths, see section "Install (Page 22)"
	Incorrect installation insufficient thermal contact	Check for a small gap between the thermometer and the measured media, especially for surface measurements. Reduce the gap by sanding or using a heat-conducting paste.
	Incorrect installation / installation site Heat dissipation, heat sources	Shielding of external heat sources, insulation of extension and the process connection. If necessary, choose a different installation site.
	Protective tube too solid, borehole too big for insert.	Optimize the protective tube for the process. Minimize the diameter, gap. Fill in the gap with thermal contact agent (oil, grease).
	Adhesions to protective tube	Remove any adhesions when checking the protective tube. If possible, replace the protective tube or choose a different installation point.
Protective tube heavily corroded or worn away by the medium	• The medium is not as expected or has changed. • Unsuitable material selected	Use suitable material for the medium. Provide the protective tube with structural enhancements, e.g. wear-resistant layer. If there is no better solution available, define replacement intervals for the protective tube as a wear and tear part.

8.2 Troubleshooting for resistance thermometers

Table 8-4 With measured signal interferences

Category / state	Possible cause	Elimination
Signal fluctuates with ambient temperature	Temperature-dependent line resistances with a 2-wire system	Use a 3-wire or 4-wire system.

Table 8-5 With implausible measured values

State	Possible cause	Elimination
Measured value too high	Uncompensated line resistance	Options: • Use a 3-wire or 4-wire system. • Adjust the measurement. • Use a head-mounted transmitter. • Shorten the lead. • Use larger lead cross sections.
	Intrinsic heat due to excessively high measuring current	• Use a head-mounted transmitter. • Work with measuring currents < 1 mA.

State	Possible cause	Elimination
	Developing increase of line resistance, e.g. due to corrosion	Clean the corroded components or if necessary, replace them, dry them and reseal them.
Measured signal too low, the fault becomes greater as the temperature increases.	Temperature dependency of the thermometer outside DIN EN 60721: • <220 °C R_{iso} > 20 MΩ • <450 °C R_{iso} > 2 MΩ • <650 °C R_{iso} > 0.5 MΩ • <850 °C R_{iso} > 0.2 MΩ	Replace the measuring insert.
	Formation of parasitic voltage sources due to line connections at a different temperature level	Bring the connections to the same temperature level: Thermal insulation.
	Formation of parasitic voltage sources due to: Terminal corrosion or bad connection (material, dirt, moisture)	Check, dry, clean, seal or if necessary, replace the connection.

8.3 Troubleshooting for thermocouples (TC)

Table 8-6 With measured signal interferences

State	Possible cause	Elimination
Measured value fluctuates	External reference junction defective or "forgotten" or its existence overlooked and additionally internal reference junction selected in the transmitter.	Check the correct functioning and installation of the external reference junction: • Constant temperature or simulation • If necessary, replace the device or change the installation to the internal reference junction of a transmitter.

Table 8-7 With implausible measured values

State	Possible cause	Elimination
Major measuring error	Wrong compensating cable or incorrect polarity (negative temperature display).	Check the type and polarity and if necessary, replace them. Always use the suitable cable type for the installed TC type.
	Incorrect linearization	Check whether the linearization corresponds to the TC type.
	Weak contacts	Check, clean or replace them.
	Secondary voltages (galvanic, thermal)	Check the thermocouple and the compensating cable. Bring the connections to the same temperature level (thermal insulation).

State	Possible cause	Elimination
Error becomes bigger at a high temperature	Temperature dependence of the thermometer recommended: <220 °C R_{iso} > 20 MΩ <450 °C R_{iso} > 2 MΩ <650 °C R_{iso} > 0.5 MΩ <850 °C R_{iso} > 0.2 MΩ ⇒ Shunt for thermocouple	Replace the measuring insert.
	Specific property of magnesium oxide insulation: Risk is lowered at higher temperatures.	Use a galvanically isolated transmitter

Table 8-8 With interferences in measurement

State	Possible cause	Elimination
Device with an internal reference junction outputs the ambient temperature	Wire broken	Check the passage, if necessary, change the parts.
The measured value changes if the temperature remains the same over a long period. Mostly lower values.	Thermally related ageing	Regularly check and recalibrate the thermocouple.

Technical data

9

9.1 Rated conditions

Storage	-40 ... +80 °C (-40 ... +176 °F)

9.1.1 Maximum permitted ambient temperatures in the connection area of the sensor

9.1.1.1 SITRANS TS100

Note

Application SITRANS TS100

SITRANS TS100 temperature sensors are only approved for the temperature classes T4 and T6. Pay attention to the temperature resistance of the connection cables.

See also

Potentially explosive gases - temperature classes T6, T4, T3 (Page 39)

Flammable dusts (Page 41)

9.1.1.2 SITRANS TS500

Potentially explosive gases - temperature classes T6, T4, T3

Calculation of the maximum permissible ambient temperatures for the electronics

The maximum permissible ambient temperature T_{amb} for the certified electronics used is calculated from the value present in the respective certificate minus the thermal value ΔT2 from the following table.

Calculation of the maximum permissible ambient temperatures for the connection head

The maximum ambient temperatures T_{amb} for the respective connection head without electronics can be obtained from the cells in the following table while taking into account the corresponding temperature of the medium.

Tables

The following table contains the maximum permissible ambient temperatures in potentially explosive gas atmospheres in the connection area of a SITRANS TS500 temperature sensor.

Maximum ambient temperatures for connection head													
				Connection head Tmax=120°C Type: AU0		Connection head Tmax=85°C Type: AV0, SITRANS TF		Connection head Tmax. (100°C) Type: BA0; BB0; BC0; BD0; AA0, AB0, AC0, KJ0, BS0, AG0		Connection head Tmax. (80°C) Type: BT0, AH0	Connection head Tmax. (100°C) Type BMO; BP0	
Temperatu medium (°C)	Temperature increase ΔT2		Neck tube length (mm)	T4	T6	T4	T6	T4	T6	T6	T4	T6
440°C	23	43	40	97	57	62	57	77	57	57	57	37
	12	23	80	108	68	73	68	88	68	68	77	57
	6	11	150	114	74	79	74	94	74	74	89	69
	3		300	117	77	82	77	97	77	77	97	77
290°C	22		40	98	58	63	58	78	58	58	78	58
	11		80	109	69	74	69	89	69	69	89	69
	5		150	115	75	80	75	95	75	75	95	75
	2		300	118	78	83	78	98	78	78	98	78
200°C	16		40	104	64	69	64	84	64	64	84	64
	8		80	112	72	77	72	92	72	72	92	72
	4		150	116	76	81	76	96	76	76	96	76
	2		300	118	78	83	78	98	78	78	98	78
130°C	9		40	111	71	76	71	91	71	71	91	71
	5		80	115	75	80	75	95	75	75	95	75
	3		150	117	77	82	77	97	77	77	97	77
	1		300	119	79	84	79	99	79	79	99	79
80°C	5		40	115	75	80	75	95	75	75	95	75
	3		80	117	77	82	77	97	77	77	97	77
	1		150	119	79	84	79	99	79	79	99	79
	0		300	120	80	85	80	100	80	80	100	80

Flammable dusts

The following table contains the maximum permissible ambient temperatures in areas with combustible dust in the connection area of a SITRANS TS500 temperature sensor.

Temperature entry for medium ΔT2	Temperature of medium (°C)	Neck tube length (mm)	ΔT2 (K)	Connection head Type: AH0, AV0, SITRANS TF (T85°C)		Connection head Type: AG0 (T100°C) Tamb. max. (°C)		Connection head Type: AU0 (T150°C) Tamb. max. (°C)		
Power entry for electronics (W)				0	1 [1]	0	1 [1]	0	1 [1]	
Temperature entry for electronics ΔT1 (K)				0	22	0	22	0	22	
440°C		40	36K	49		64		114		II ½ D Ex tD A21 IP65 T85,100,150°C [2] II½ D Ex ia/ib IIIC T200 °C Da/Db
		80	18K	67	45	82	45	132	45	
		150	8K	77	55	92	55	142	55	
		300	4K	81	59	96	59	146	59	
250°C		40	22K	63		78		128		
		80	11K	74	52	89	52	139	52	
		150	5K	80	58	95	58	145	58	
		300	1K	84	62	99	62	149	62	
120°C		40	10K	75	53	90	53	110	53	
		80	5K	80	58	95	58	115	58	
		150	3K	82	60	97	60	117	60	
		300	0K	85	63	100	63	120	63	

[1] Due to the electronics used, a maximum enclosure temperature of 85 °C is used as the basis for determining the ambient temperature.

[2] In accordance with EC type examination certificate PTB 10 ATEX 1005 X or IECEx Certificate of Conformity IECEx PTB 10.0018X issue No.: 0.

9.1.2 Maximum permitted sample temperatures within the process

Note

Permissible ambient temperature at sensor

The maximum permissible ambient temperature at the sensor simultaneously corresponds to the highest permissible sample temperature.

The minimum permissible sample temperatures are up to -200 °C depending on the version of the temperature sensor.

See also

Maximum permitted sample temperatures within the process (Page 42)

Resistance thermometers

Table 9-1 Pt 100 temperature sensor (R_{th} max=120 K/W)

1 x Pt100 TF/3 mm/6 mm 2 x Pt100 TF/3 mm/6 mm 1 x Pt100 WW/3 mm/6 mm 2 x Pt100 WW/3 mm/6 mm	Max. permissible sample temperature (°C)			
	Certified transmitter in Zone 0 with type of protection "Intrinsically safe"		Certified transmitter in Zone 1, 2 with type of protection "Intrinsically safe"	
	P0: 0 … ≤37 mW [1]	P0: ≥37 … ≤100 mW	P0: 0 … ≤37 mW [1]	P0: ≥37 … ≤100 mW
T1 = 450 °C -10K	348	340	436	428
T2 = 300 °C -10K	228	220	286	278
T3 = 200 °C - 5K	152	144	191	183
T4 = 135 °C - 5K	100	92	126	118
T6 = 85 °C - 5K	60	52	76	68

[1] e.g. SIEMENS SITRANS TH100/TH200/TH300/TH400

Thermocouples

Table 9-2 Thermocouple temperature sensor (R_{th} max=15 K/W)

1 x TC type J, K, N /3 mm 2 x TC type J, K, N /3 mm 1 x TC type J, K, N /6 mm 2 x TC type J, K, N /6 mm	Max. permissible sample temperature (°C)	
	Certified transmitter in Zone 0 with type of protection "Intrinsically safe"	Certified transmitter in Zone 1, 2 with type of protection "Intrinsically safe"
	P0: 0 … 100 mW	
T1 = 450 °C -10K	351	439
T2 = 300 °C -10K	231	289
T3 = 200 °C -5K	155	194

1 x TC type J, K, N /3 mm 2 x TC type J, K, N /3 mm 1 x TC type J, K, N /6 mm 2 x TC type J, K, N /6 mm	Max. permissible sample temperature (°C)	
	Certified transmitter in Zone 0 with type of protection "Intrinsically safe"	Certified transmitter in Zone 1, 2 with type of protection "Intrinsically safe"
	P0: 0 … 100 mW	
T4 = 135 °C -5K	103	129
T6 = 85 °C -5K	63	79

9.1.3 Measuring range

The measuring range refers to the temperature limits in which the thermometer can be used practically for measuring purposes. Depending on the loads at the place if use and the required accuracies, the actual measuring range may decrease.

Note

Measuring ranges

The application or possible operating temperatures depend on the configuration of the temperature sensor.

9.2 Construction

Torque for cable gland union nut made of	Plastic	Metal	Stainless steel
	2.5 Nm (1.8 ft lb)	4.2 Nm (3.1 ft lb)	4.2 Nm (3.1 ft lb)

9.3 Electrical data

Devices for general use

Measured current	
$I_{Measuring}$	0,3 ... 1.0 mA

Devices in explosion-protected version

Equipment protection by means of intrinsic safety	
SITRANS TSInsert/TS100/TS200	
Type of protection "Intrinsically safe", Zone 20	II 1D Ex ia IIIC T 200°C Da
Type of protection "Intrinsically safe", Zone 0	II 1G Ex ia IIC T6 / T4...T1 Ga
Type of protection "Intrinsically safe", Zone 2	II 3G Ex ic IIC T6 / T4...T1 Gc
SITRANS TS500	
Type of protection "Intrinsically safe", Zone 20/21/22	II 1/2D Ex ia/ib IIIC T 200°C Da/Db
Type of protection "Intrinsically safe", Zone 0/1	II 1/2G Ex ia/ib IIC T6 / T4...T1 Ga/Gb
Type of protection "Intrinsically safe", Zone 2	II 3G Ex ic IIC T6 / T4...T1 Gc
For connecting to circuits with the following peak values	$U_i \leq 30$ V $I_i \leq 100$ mA $P_i = P_o$ (transmitter) $C_i = 700$ pF/m $L_i = 15$ µH/m

Device protection through type of protection "nA"	
Type of protection "Non-incendive", Zone 2	II 3G Ex nA IIC T6 / T4…T1 Gc
For connecting to circuits with the following peak values	$U_n = 30$ V $U_{max} = 32$ V [1]

[1] Maximum safety voltage

Device protection through flame-proof enclosure	
	II 1/2 G Ex d IIC T6, T4, T3 Ga/Gb II 1/2 D Ex tb IIIC T85 °C,100°C , or 150°C
For connecting to circuits with the following peak values	$U_{max} = 45$ V P = 25/37/50/100 mW

9.4 Measuring tolerances for resistance thermometers

Tolerance classes

The tolerance classes of the resistance thermometers are defined as follows in accordance with IEC 60751:

Tolerance class	Precision	Δt
Class B	Basic accuracy	±(0.30 °C +0.0050|t[°C]|) ±1.8x0.30 °F +0.0050x|t[°F]-32|
Class A	Increased accuracy	±(0.15 °C +0.0020|t[°C]|) ±1.8x0.15 °F +0.0020x|t[°F]-32|
Class AA (1/3 B)	High accuracy	±(0.10 °C +0.0017|t[°C]|) ±1.8x0.10 °F +0.0017x|t[°F]-32|

Tolerances

The following tables provide an overview of the validity ranges of these tolerances. When you use a thermometer above the specified limits, the values of the next lower accuracy class apply.

Action	Tolerance	Precision	Range [°C (°F)]
Basic version	Class B	Basic accuracy	-50 ...400 (-58 ... +752)
	Class A	Increased accuracy	-30°... 300 (-58 ... +572)
	Class AA (1/3 B)	High accuracy	0°... 150 (32 ... 302)
With increased vibration resistance	Class B	Basic accuracy	-50°... 400 (-58 ... +752)
	Class A	Increased accuracy	-30°... 300 (-58 ... +662)
	Class AA (1/3 B)	High accuracy	0°... 150 (32 ... 302)
With extended measuring range	Class B	Basic accuracy	-196 ... 600 (392 ... 1112)
	Class A	Increased accuracy	-196 ... 600 (392 ... 1112)

9.5 Measuring accuracy for thermocouples

Tolerance classes

The tolerance classes of the thermocouples are defined in the following table in accordance with IEC 584/DIN EN 60584:

Catalog versions

Type	Basic accuracy, Class 2	Increased accuracy, Class 1
N	-40 °C ... +333 °C ±2.5 °C (-40 °F ... +631 °F ±4.5 °F) 333 °C ... 1100 °C ±0.0075x|t[°C]| (631 °F ... 2012 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F ... +707 °F ±2.7 °F) 375 °C ... 1000 °C ±0.004x|t[°C]| (707 °F ... 1832 °F ±0.004x|t[°F]-32|)
K	-40 °C ... +333 °C ±2.5°C (-40 °F... +631 °F ±4.5 °F) 333 °C ... 1000 °C ±0.0075x|t[°C]| (631 °F ... 1832 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F... +707 °F ±2.7 °F) 375 °C ... 1000 °C ±0.004x|t[°C]| (707 °F ... 1832 °F ±0.004x|t[°F]-32|)
J	-40 °C ... +333 °C ±2.5 °C (-40 °F ... +631 °F ±4.5 °F) 333 °C ... 750 °C ±0.0075x|t[°C]| (631 °F ... 1382 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F ... +707 °F ±2.7 °F) 375 °C ... 750 °C ±0.004x|t[°C]| (707 °F ... 1382 °F ±0.004x|t[°F]-32|)

Further base thermocouples

Type	Basic accuracy, Class 2	Increased accuracy, Class 1
T	-40 °C ... +133 °C ±1 °C (-40 °F ... +271 °F ±1.8 °F) 133 °C ... 350 °C ±0.0075x|t[°C]| (271 °F ... 662 °F ±0.0075x|t[°F]-32|)	-40 °C ... +125 °C ±0.5 °C (-40 °F ... +257 °F ±0.9 °F) 125 °C ... 350 °C ±0.004x|t[°C]| (257 °F ... 662 °F ±0.004x|t[°F]-32|)
E	-40 °C ... +333 °C ±2.5°C (-40 °F... +631 °F ±4.5 °F) 333 °C ... 900 °C ±0.0075x|t[°C]| (631 °F ... 1652 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F... +707 °F ±2.7 °F) 375 °C ... 800 °C ±0.004x|t[°C]| (707 °F ... 1472 °F ±0.004x|t[°F]-32|)

Further noble thermocouples

Type	Basic accuracy, Class 2	Increased accuracy, Class 1
R,S	0 °C ... 600 °C ±1.5 °C (32 °F ... +1112 °F ±2.7 °F) 600 °C ... 1600 °C ±0.0025x|t[°C]| (1112 °F ... 2912 °F ±0.0025x|t[°F]-32|)	0 °C ... 1100 °C ±1 °C (32 °F ... +2012 °F ±1.8 °F) 1100 °C ... 1600 °C ±[1 + 0.003 x(t -1100)] °C (2012 °F ... 2912 °F ±1,8+0,003x(t[°F]-2012)
B	600 °C ... 1700 °C ±0.0025x|t[°C]| (1112 °F ... 3092 °F ±0.0025x|t[°F]-32|)	-

Dimension drawings

10

10.1 Overview

The following tables contain brief descriptions of the temperature sensors as well as references to the corresponding dimensional drawings.

Table 10-1 Overview of SITRANS TS100 dimensional drawings

Versions	Description
Basic version	• Temperature sensors in cable design, for universal use, plastic-insulated version, for unfavorable space conditions. • SITRANS TS100 (Page 49)
Mineral-insulated cable	• Temperature sensors in cable design, for universal use, mineral-insulated version, for unfavorable space conditions. • SITRANS TS100 (Page 49)

Table 10-2 Overview of SITRANS TS200 dimensional drawings

Versions	Description
Basic sensor, flying leads, LEMO 1S coupling, M12, thermocouple coupling, mini connection head	• Temperature sensors in cable design, for universal use, mineral-insulated version, for unfavorable space conditions. • SITRANS TS200 (Page 50)

Table 10-3 Overview of SITRANS TS500 dimensional drawings

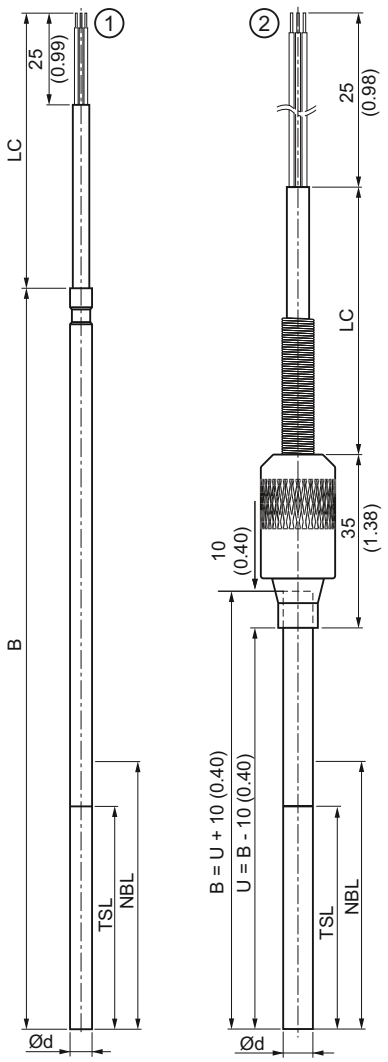
Versions	Description
Type 2, pipe version without process connection	• Temperature sensors for containers and pipelines, pipe version for low to medium stress, without process connection, without extension, for plugging-in or use with sliding compression joints • SITRANS TS500, types 2 and 2N (Page 51)
Type 2N, pipe version with screw-in nipple	• Temperature sensors for containers and pipelines, pipe version for low to medium stress, protective tube type 2N similar to DIN 43772, for screwing-in, without extension, for process temperatures up to 100 °C (212°F) • SITRANS TS500, types 2 and 2N (Page 51)
Type 2G, pipe version with screw-in nipple and extension	• Temperature sensors for containers and pipelines, pipe version for low to medium stress, protective tube in accordance with DIN 43772, type 2G, for screwing-in, with extension • SITRANS TS500, types 2G and 2F (Page 53)
Type 2F, pipe version with flange and extension	• Temperature sensors for containers and pipelines, pipe version for low to medium stress, protective tube in accordance with DIN 43772, type 2F, with flange, with extension • SITRANS TS500, types 2G and 2F (Page 53)

Versions	Description
Type 3, fast pipe version without process connection	• Temperature sensors for containers and pipelines, pipe version for low to medium stress, without process connection, without extension, for plugging-in or use with sliding compression joints • SITRANS TS500, type 3 (Page 54)
Type 3G, fast pipe version with screw-in nipple and extension	• Temperature sensors for containers and pipelines, pipe version for low to medium stress, protective tube in accordance with DIN 43772, type 3G, for screwing-in, without process connection, with extension • SITRANS TS500, types 3G and 3F (Page 55)
Type 3F, fast pipe version with flange and extension	• Temperature sensors for containers and pipelines, pipe version for low to medium stress, protective tube in accordance with DIN 43772, type 3F, with flange, with extension • SITRANS TS500, types 3G and 3F (Page 55)
Types 4 and 4F, full material version, with extension	• Temperature sensors for containers and pipelines, full material version for medium to very high stress, protective tube in accordance with DIN 43772, type 4, for welding-in, with extension • Protective tube type 4F, with flange, with extension • SITRANS TS500, types 4 and 4F (Page 56)
SITRANS TS500 for installation in existing protective tubes	• Temperature sensors for containers and pipelines, temperature sensors for installation in existing protective sleeves, suitable for sleeves in accordance with DIN 43772 and ASME B40.9-2001, with extension of European or American design • SITRANS TS500 for installation in existing protective tubes (Page 57)

Table 10-4 Overview of SITRANS TSinsert dimensional drawings: measuring inserts for retrofitting and upgrading

Versions	Description
European design	• Measuring inserts for temperature sensors, replaceable, mineral-insulated version, European design (DIN ceramic base), spring approx. 8 mm (0.31 inch) • SITRANS TSinsert - measuring inserts for SITRANS TS500 (Page 58)
American design	• Measuring inserts for temperature sensors, replaceable, mineral-insulated version, American design, spring approx. 25 mm (0.98 inch) • SITRANS TSinsert - measuring inserts for SITRANS TS500 (Page 58)

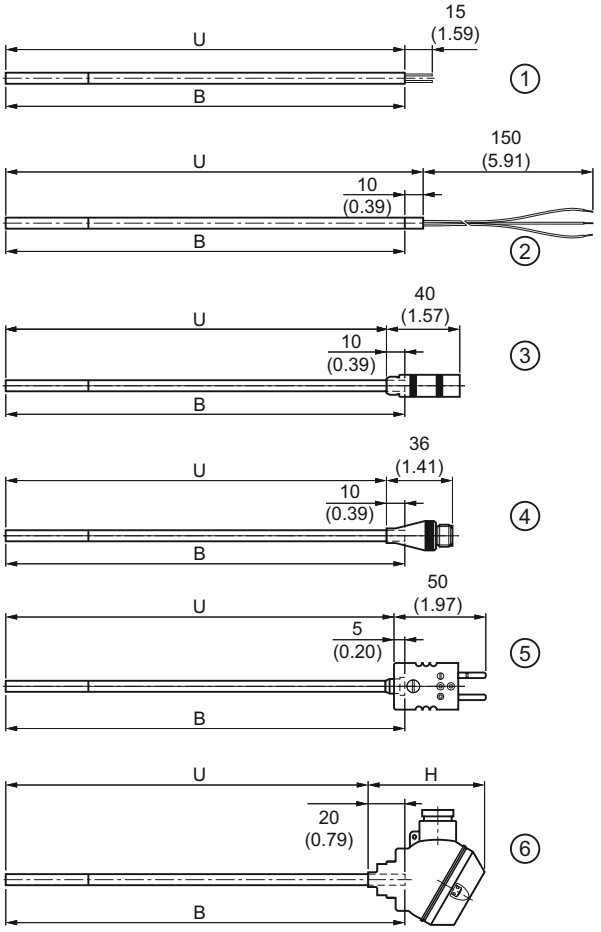
10.2 SITRANS TS100



Dimensional drawings SITRANS TS100 - dimensions in mm (inch)

①	TS100 basic version
②	TS100 mineral-insulated version
∅d	External diameter of measuring insert (6 (0.24))
B	Length of measuring insert
LC	Cable length
NBL	Non bendable length
TSL	Temperature sensitive length
U	Mounting length

10.3 SITRANS TS200

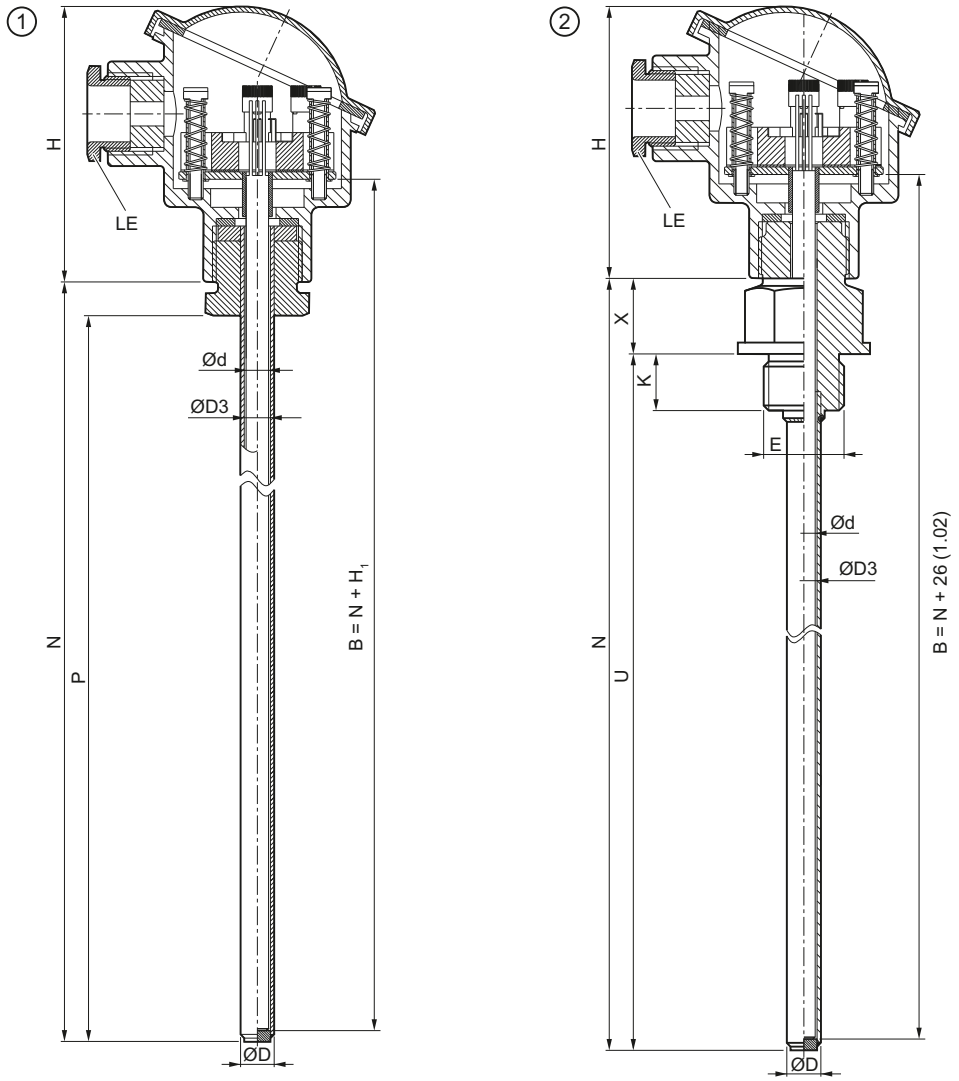


B	Length of measuring insert	U	Mounting length
H	Height of head		
①	Basic sensor	U = B	
②	Flying Leads	U = B + 10 (0.39)	
③	Coupling LEMO 1S	U = B - 10 (0.39)	
④	M12 connector	U = B - 10 (0.39)	
⑤	Thermocouple coupling	U = B - 5 (0.20)	
⑥	Miniature connection head	U = B - 20 (0.79)	

Figure 10-1 Dimensional drawings SITRANS TS200 - dimensions in mm (inch)

10.4 SITRANS TS500

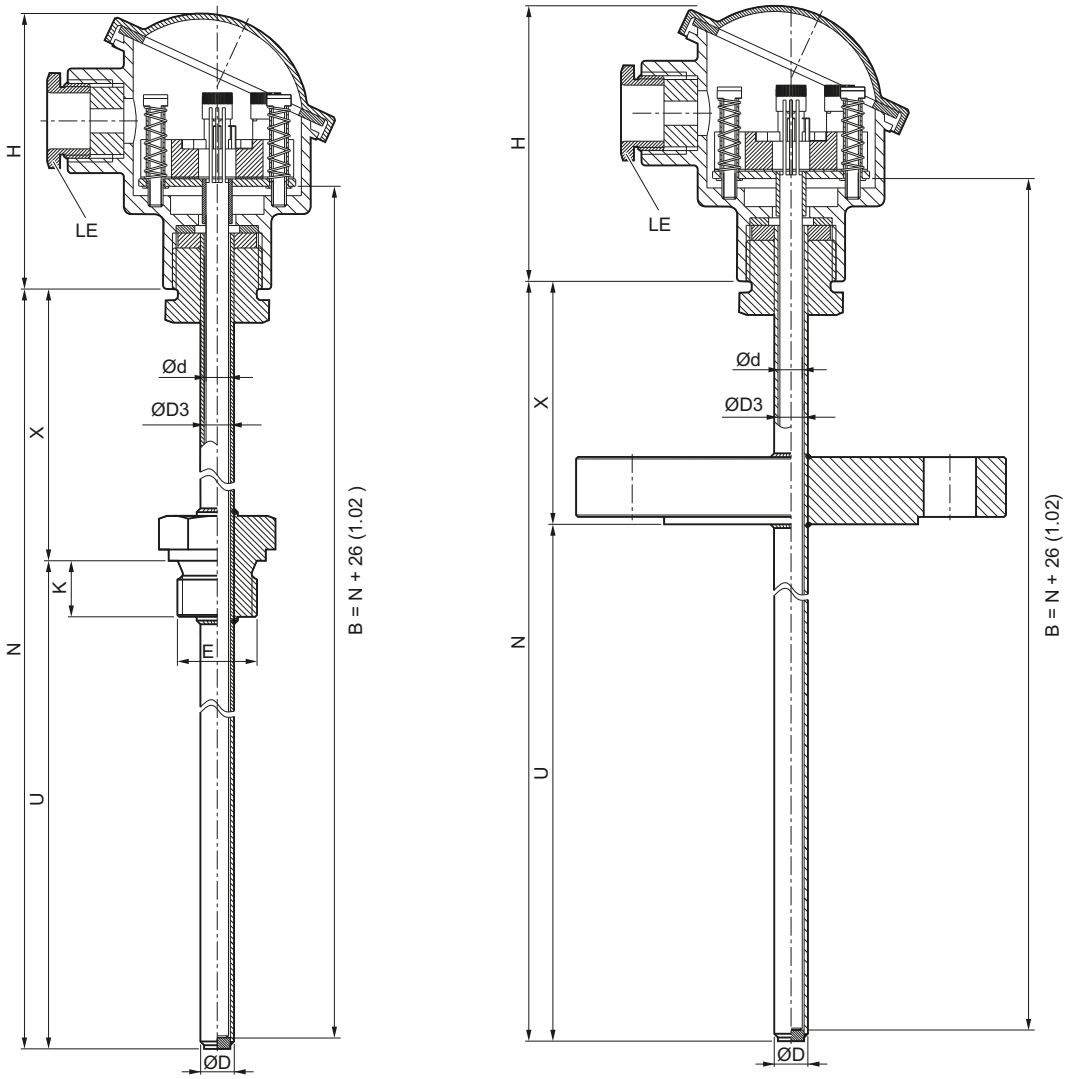
10.4.1 SITRANS TS500, types 2 and 2N



①	Type 2, pipe version without process connection		
②	Type 2N, pipe version with screw-in nipple		
B	Length of measuring insert	H_1	Type Axx: 41 (1.61) Type Bxx: 26 (1.02)
∅d	External diameter of measuring insert	K	Penetration depth
∅D	To ①: External diameter of fixing point (6 (0.24))	LE	Cable inlet
∅D	To ②: External diameter of process connection	N	Nominal length
∅D3	Internal diameter of protective tube	P	Space for process connection
E	Thread dimension of process connection	U	Mounting length
H	Height of head	X	Extension

Figure 10-2 Dimensional drawings SITRANS TS500, types 2 and 2N - dimensions in mm (inch)

10.4.2 SITRANS TS500, types 2G and 2F

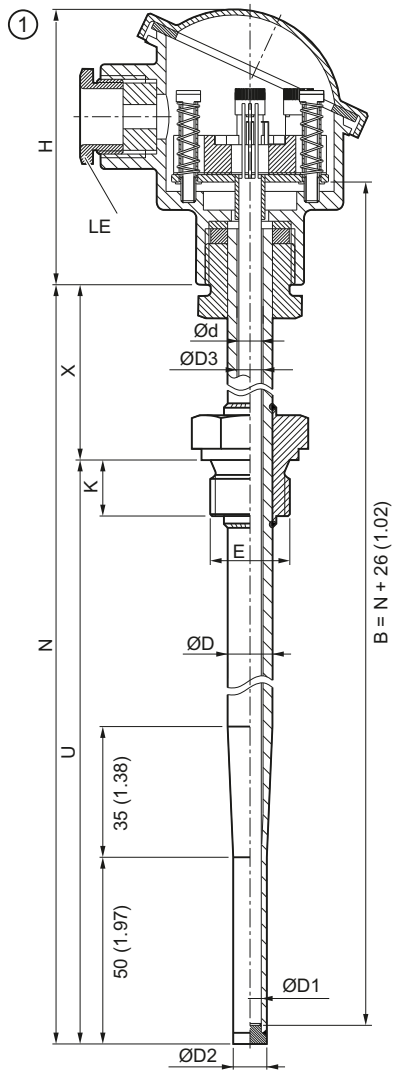


①	Type 2G, pipe version with screw-in nipple and extension
②	Type 2F, pipe version with flange and extension

B	Length of measuring insert	K	Penetration depth
∅d	External diameter of measuring insert (6 (0.24))	LE	Cable inlet
∅D	External diameter of process connection	N	Nominal length
∅D3	Internal diameter of protective tube	U	Mounting length
E	Thread dimension of process connection	X	Extension
H	Height of head		

Figure 10-3 Dimensional drawings SITRANS TS500, types 2G and 2F - dimensions in mm (inch)

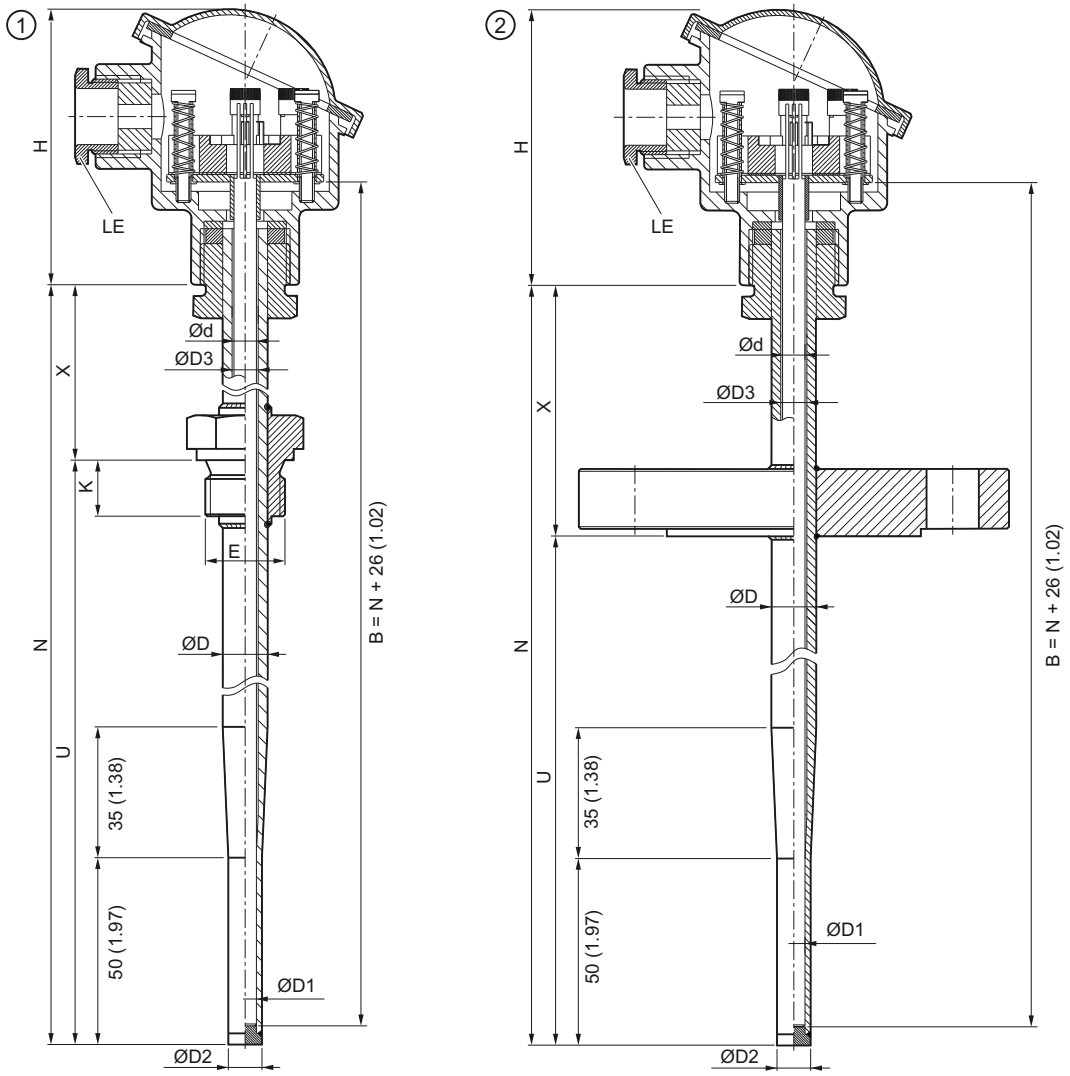
10.4.3 SITRANS TS500, type 3



①	Type 3, fast pipe version without process connection		
B	Length of measuring insert	H	Height of head
∅d	External diameter of measuring insert (6 (0.24))	H_1	Type Axx: 41 (1.61) Type Bxx: 26 (1.02)
∅D	External diameter of fixing point	LE	Cable inlet
∅D1	Internal diameter of tip	N	Nominal length
∅D2	External diameter of tip	P	Space for process connection
∅D3	Internal diameter of protective tube		

Figure 10-4 Dimensional drawing SITRANS TS500, type 3 - dimensions in mm (inch)

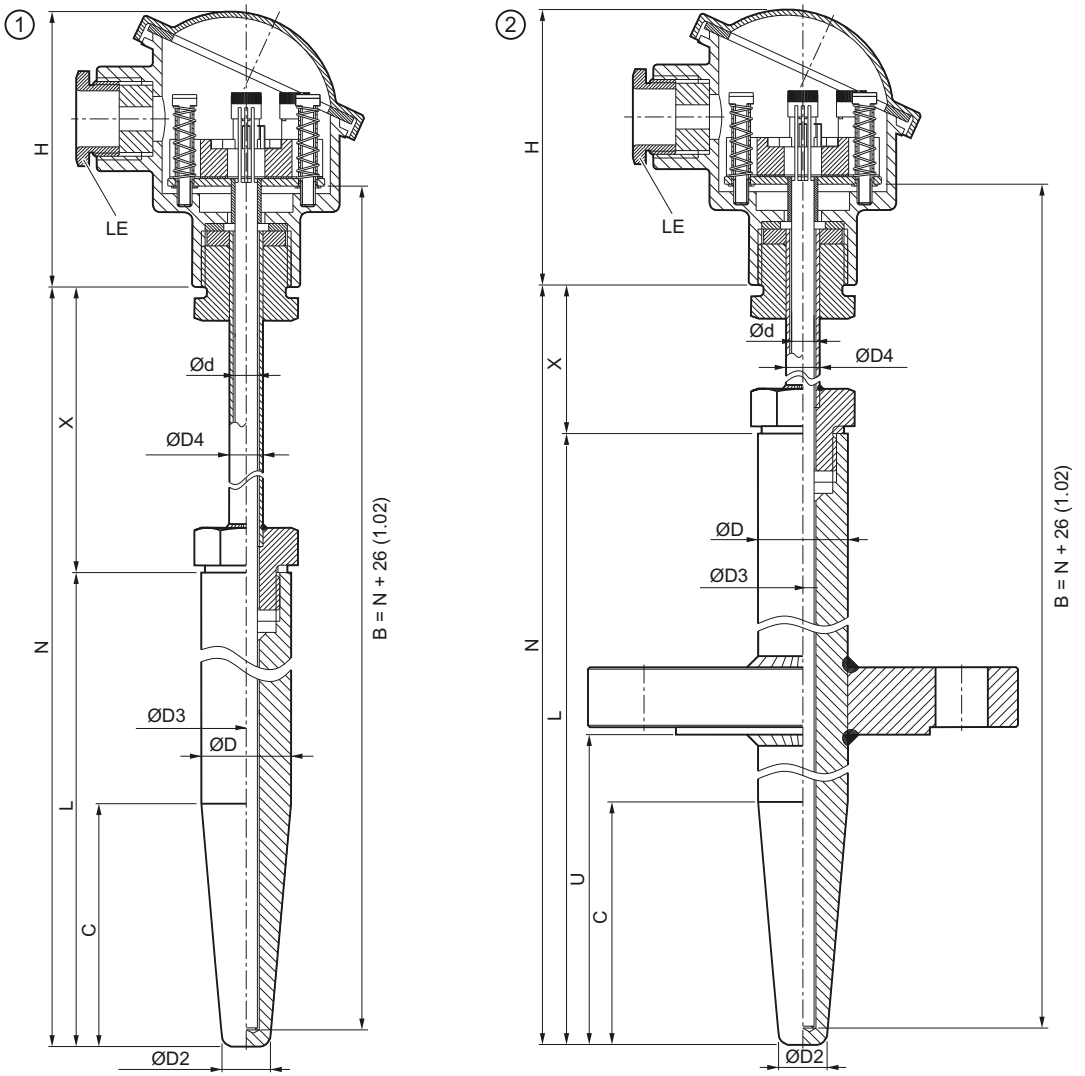
10.4.4 SITRANS TS500, types 3G and 3F



①	Type 3G, fast pipe version with screw-in nipple and extension		
②	Type 3F, fast pipe version with flange and extension		
B	Length of measuring insert	H	Height of head
∅d	External diameter of measuring insert (6 (0.24))	K	Penetration depth
∅D	External diameter of process connection	LE	Cable inlet
∅D1	Internal diameter of tip	N	Nominal length
∅D2	External diameter of tip	U	Mounting length
∅D3	Internal diameter of protective tube	X	Extension
E	Thread dimension of process connection		

Figure 10-5 Dimensional drawings SITRANS TS500, types 3G and 3F

10.4.5 SITRANS TS500, types 4 and 4F

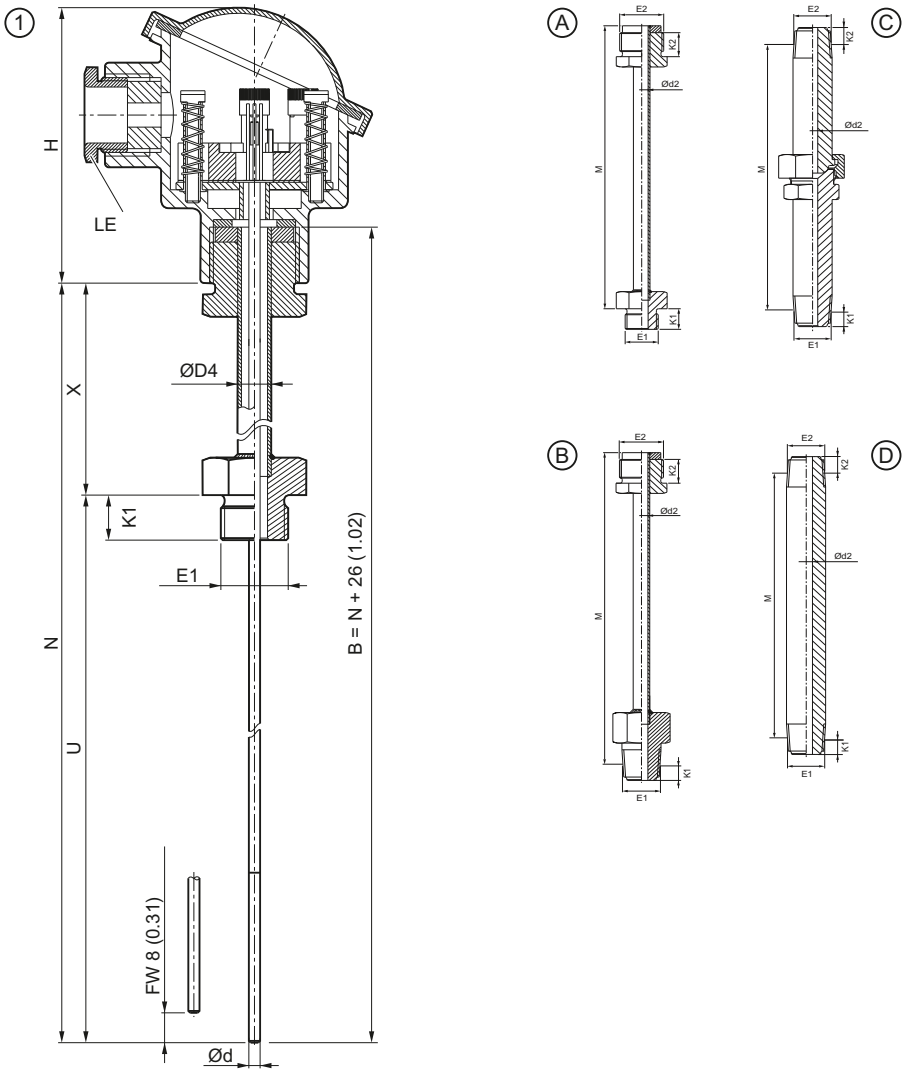


①	Type 4, full material version, with extension
②	Type 4F, full material version, with flange and extension

B	Length of measuring insert	E	Thread dimension of process connection
C	Cone length = U_{min}	H	Height of head
∅d	External diameter of measuring insert (6 (0.24))	K	Penetration depth
∅D	External diameter of process connection	L	Length of protective sleeve
∅D1	Internal diameter of tip	LE	Cable inlet
∅D2	External diameter of tip	N	Nominal length
∅D3	Internal diameter of protective tube	U	Mounting length
∅D4	External diameter of extension	X	Extension

Figure 10-6 Dimensional drawings SITRANS TS500, types 4 and 4F - dimensions in mm (inch)

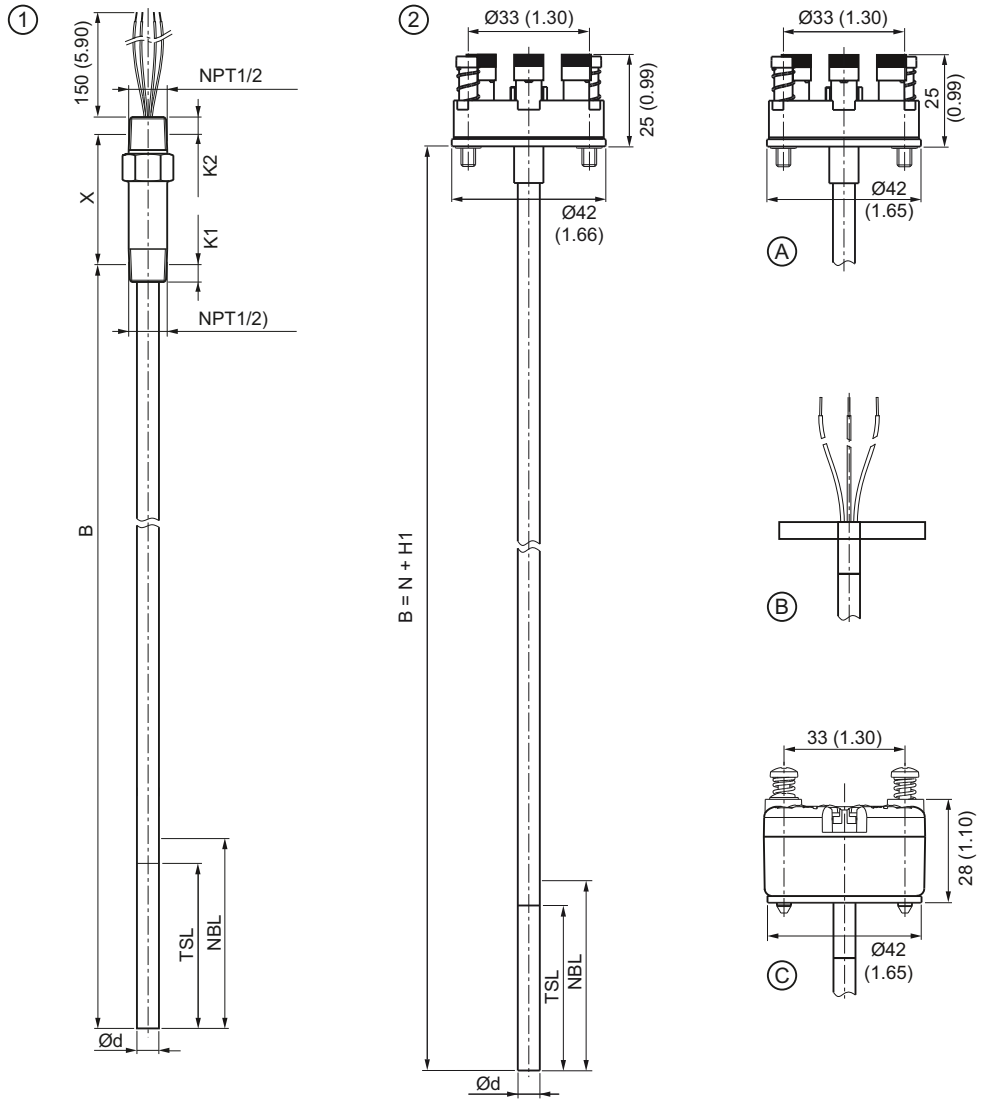
10.4.6 SITRANS TS500 for installation in existing protective tubes



①	SITRANS TS500 for installation in existing protective tubes		
Ⓐ	Extension tube, DIN G	Ⓑ	Extension tube, NPT
Ⓒ	Extension tube, NUN	Ⓓ	Extension tube, nipple
B	Length of measuring insert	K1	Penetration depth
∅d	External diameter of measuring insert	LE	Cable inlet
∅D4	External diameter of extension	N	Nominal length
E1	Thread dimension of process connection	U	Mounting length
FW	Spring excursion	X	Extension
H	Height of head		

Figure 10-7 Dimensional drawings SITRANS TS500 for installation in existing protective tubes - dimensions in mm (inch)

10.5 SITRANS TSinsert - measuring inserts for SITRANS TS500



①	American version	Ød	External diameter of measuring insert
②	European version	K1, 2	Penetration depth
Ⓐ	To ②, cold end: Ceramic base	N	Nominal length
Ⓑ	To ②, cold end: Free wire ends	NBL	Non bendable length
Ⓒ	To ②, cold end: Mounted transmitter	TSL	Temperature sensitive length
B	Length of measuring insert	X	Extension

Figure 10-8 Dimensional drawings SITRANS TSinsert - measuring inserts for SITRANS TS500 - dimensions in mm (inch)

Appendix A

A.1 Certificate

The certificates can be found on the enclosed CD and on the Internet under:

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

A.2 Technical support

Technical Support

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

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

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

Service & Support on the Internet

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

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

There you will find:

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

Additional Support

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

Find your contact partner at:

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

Documentation for various products and systems is available at:

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

See also

SITRANS T product information (http://www.siemens.com/sitranst)

Process instrumentation catalog (http://www.siemens.com/processinstrumentation/catalogs)

Index

A

Additional Support, 59
Ambient temperature of connection head
  Calculation, 39
Ambient temperature of electronics
  Calculation, 39
Ambient temperature range
  Connection head, 39
  Electronics, 39

C

Cable colors for thermocouple, 30
Calculation
  Ambient temperature of connection head, 39
  Ambient temperature of electronics, 39
Certificate, 59
Certificates, 9
Certification, 59
Connection heads for SITRANS TS500, 17
Correct usage, (See improper device modifications)
Customer Support Hotline, 59

D

Documentation
  Edition, 7
Dust, 41

F

Fault in temperature measurement
  Elimination, 35
Fault with resistance thermometer
  Elimination, 36
Fault with thermocouple
  Elimination, 37

H

Hazardous area
  Laws and directives, 9
Head-mounted transmitters for SITRANS TS500, 15
Hotline, 59

I

Immersion depth, 23
Improper device modifications, 10
Interference in measurement, 38
Internet, 59

M

Measured signal interference, 35, 36, 37
Measuring insert for SITRANS TS500, 16
Measuring principle, 14
Mounting position
  Sensor, 23

N

Nameplate, 15

P

Process connection, 22

Q

Qualified personnel, 11

R

Recalibration, 33
Resistance thermometers
  Connecting, 30
  Functional principle, 14

S

Scope of delivery, 7
Service, 59
SITRANS TS product family, 13
Support, 59

T

Temperature measurement
    Measuring principle, 14
Test certificates, 9
Thermocouple
    Cable colors, 30
    Connecting, 30
    Functional principle, 14