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# Temperature Sensors / Measuring insets

## SensyTemp TSP/ SensyTemp TSA101

### Operating Instruction

OI/TSP-EN

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Rev. A

#### Manufacturer:

##### **ABB Automation Products GmbH**

Borsigstraße 2

63755 Alzenau

Germany

Tel.: +49 551 905-534

Fax: +49 551 905-555

##### **Customer service center**

Phone: +49 180 5 222 580

Fax: +49 621 381 931-29031

[automation.service@de.abb.com](mailto:automation.service@de.abb.com)

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## **1 Safety**

### **1.1 General information and notes for the reader**

You must read these instructions carefully prior to installing and commissioning the device.

These instructions are an important part of the product and must be kept for future reference.

These instructions are intended as an overview and do not contain detailed information on all designs for this product or every possible aspect of installation, operation and maintenance.

For additional information or if specific problems occur that are not discussed in these instructions, contact the manufacturer.

The content of these instructions is neither part of any previous or existing agreement, promise or legal relationship nor is it intended to change the same.

This product is built based on state-of-the-art technology and is operationally safe. It has been tested and left the factory in perfect working order from a safety perspective. The information in the manual must be observed and followed in order to maintain this state throughout the period of operation.

Modifications and repairs to the product may only be performed if expressly permitted by these instructions.

Only by observing all of the safety instructions and all safety/warning symbols in these instructions can optimum protection of both personnel and the environment, as well as safe and fault-free operation of the device, be ensured.

Information and symbols directly on the product must be observed. They may not be removed and must be fully legible at all times.

### **1.2 Intended use**

The temperature sensors are used for measuring temperatures in a vast range of process applications. The resistance thermometers or thermocouples can be used with or without a thermowell.

The device is designed for use exclusively within the values stated on the name plate and in the technical specifications (see the "Specifications" chapter in the operating instructions or the data sheet).

- The maximum operating temperature must not be exceeded.
- The permissible ambient temperature must not be exceeded.
- The housing's degree of protection must be observed during operation.

### **1.3 Target groups and qualifications**

Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator to do so. The specialist personnel must have read and understood the manual and comply with its instructions.

Prior to using corrosive and abrasive materials for measurement purposes, the operator must check the level of resistance of all parts coming into contact with the materials to be measured. ABB Automation Products GmbH will gladly support you in selecting the materials, but cannot accept any liability in doing so.

The operators must strictly observe the applicable national regulations with regards to installation, function tests, repairs, and maintenance of electrical products.

### **1.4 Warranty provisions**

Using the device in a manner that does not fall within the scope of its intended use, disregarding this instruction, using underqualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

**1.5 Plates and symbols**

**1.5.1 Safety-/ warning symbols, note symbols**



**DANGER – <Serious damage to health / risk to life>**

This symbol in conjunction with the signal word "Danger" indicates an imminent danger. Failure to observe this safety information will result in death or severe injury.



**DANGER – <Serious damage to health / risk to life>**

This symbol in conjunction with the signal word "Danger" indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury.



**WARNING – <Bodily injury>**

This symbol in conjunction with the signal word "Warning" indicates a possibly dangerous situation. Failure to observe this safety information may result in death or severe injury.



**WARNING – <Bodily injury>**

This symbol in conjunction with the signal word "Warning" indicates a potential electrical hazard. Failure to observe this safety information may result in death or severe injury.



**CAUTION – <Minor injury>**

This symbol in conjunction with the signal word "Caution" indicates a possibly dangerous situation. Failure to observe this safety information may result in minor or moderate injury. This may also be used for property damage warnings.



**ATTENTION – <Property damage>!**

The symbol indicates a potentially damaging situation.

Failure to observe this safety information may result in damage to or destruction of the product and/or other system components.



**IMPORTANT (NOTICE)**

This symbol indicates operator tips, particularly useful information, or important information about the product or its further uses. It does not indicate a dangerous or damaging situation.

1.5.2 TSP1xx, TSP3xx name plate

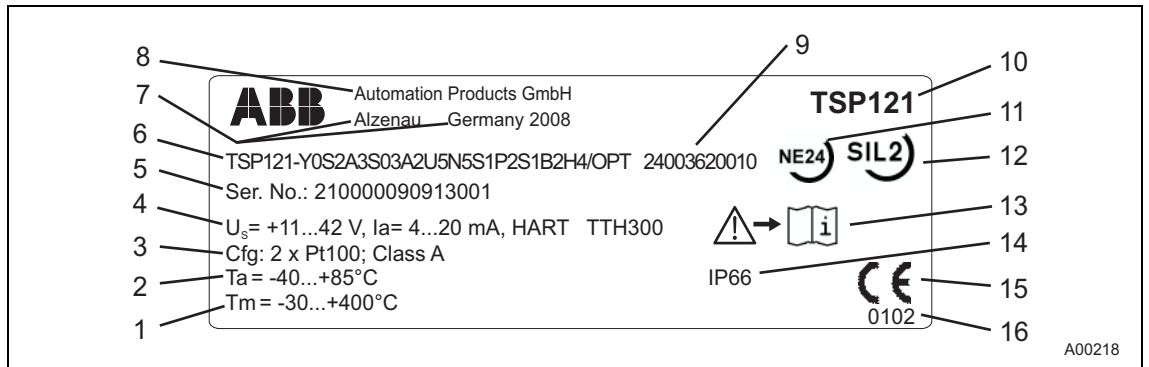


Fig. 1

- |  |   |
|--|---|
| 1 Medium temperature range (process temperature)             | 9 Order number and item, e.g., 2400362 and 0010                         |
| 2 Ambient temperature range (temperature at connection head) | 10 Model name   |
| 3 Sensor configuration                                       | 11 NE 24 conformity   |
| 4 Specifications for transmitter                             | 12 SIL 2  |
| 5 Serial number  | 13 Note: Refer to product documentation                                 |
| 6 Order code   | 14 Degree of protection   |
| 7 Country / year of manufacture                              | 15 CE mark (EC conformity)  |
| 8 Manufacturer   | 16 Number of the notified body (in the case of ATEX-certified products) |

1.5.3 TSA101 name plate

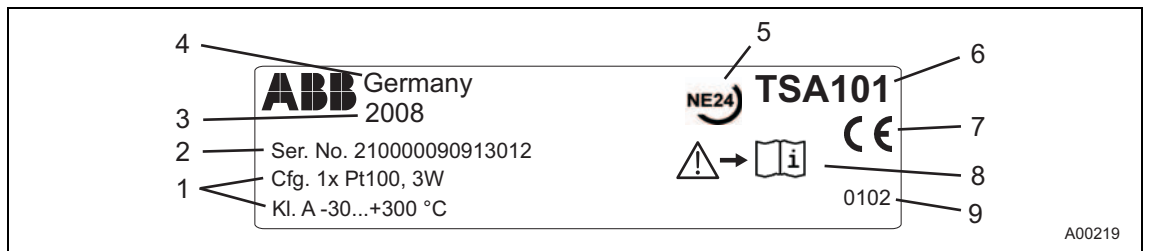


Fig. 2

- |                          |  |
|--------------------------|--|
| 1 Sensor configuration   | 6 Model name   |
| 2 Serial number          | 7 CE mark (EC conformity)  |
| 3 Year of manufacture    | 8 Note: Refer to product documentation                                 |
| 4 Country of manufacture | 9 Number of the notified body (in the case of ATEX-certified products) |
| 5 NE 24 conformity       |  |

**1.5.4 TSP1xx, TSP3xx approval plate**

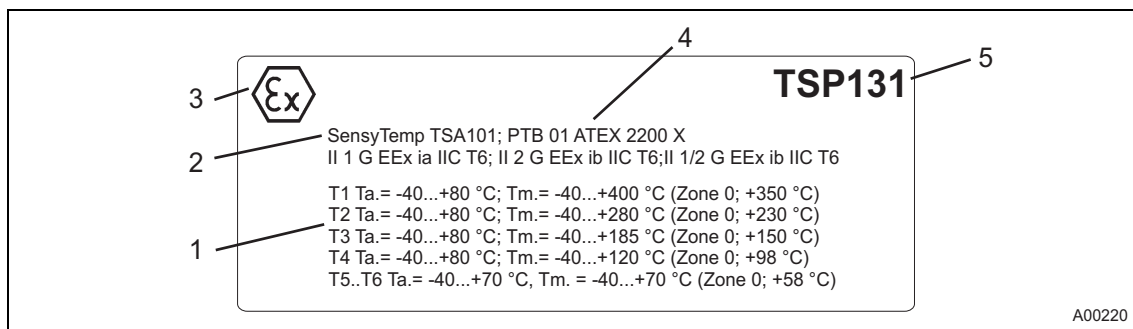


Fig. 3

- |   |                            |   |                 |
|---|----------------------------|---|-----------------|
| 1 | Temperature range          | 4 | Approval number |
| 2 | Model name as per approval | 5 | Model name      |
| 3 | Ex designation             |   |                 |

**1.5.5 TSA101 approval plate**

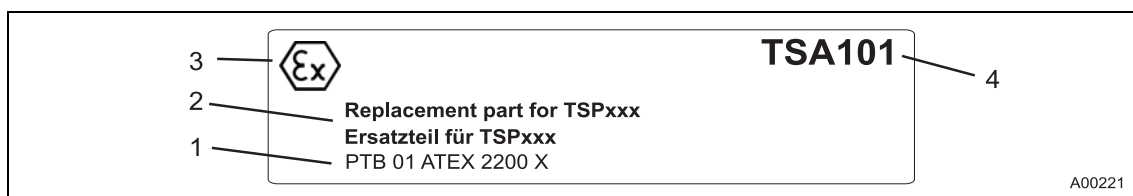


Fig. 4

- |   |   |   |                |
|---|---|---|----------------|
| 1 | Number of approval body   | 3 | Ex designation |
| 2 | Note: Measuring inset only for installation in SensyTemp TSP1xx, TSP3xx temperature sensors | 4 | Model name     |

**Note regarding process temperature**

The values specified on the name plate are maximum values and do not take process-related stress into consideration. This should be taken into consideration when working with the instruments.

**1.6 Transport safety information**

Observe the following information:

- Do not expose the device to moisture during transport. Pack the device accordingly.
- Pack the device so that it is protected from vibration during transport, e.g. through air-cushioned packaging.

### 1.7 Safety information for electrical installation

- The electrical connection may only be made by authorized specialist personnel and in accordance with the electrical circuit diagrams.
- The electrical connection information in the manual must be observed; otherwise, the type of electrical protection may be adversely affected.
- Safe isolation of electrical circuits which are dangerous if touched is only guaranteed if the connected devices satisfy the requirements of DIN EN 61140 (VDE 0140 Part 1) (basic requirements for safe isolation).
- To ensure safe isolation, install supply lines so that they are separate from electrical circuits which are dangerous if touched, or implement additional isolation measures for them.

### 1.8 Operating safety information

Before switching on, ensure that the specified environmental conditions in the “Technical Specifications” chapter and in the data sheet are complied with and that the power supply voltage corresponds with the voltage of the transmitter.

When there is a chance that safe operation is no longer possible, put the device out of operation and secure against unintended operation.

Check the devices for possible damage that may have occurred from improper transport. Damages in transit must be recorded on the transport documents. All claims for damages must be submitted to the shipper without delay and before installation.

### 1.9 Returning devices

Use the original packaging or suitably secure shipping containers if you need to return the device for repair or recalibration purposes. Fill out the return form (see the Appendix) and include this with the device.

According to EC guidelines for hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes:

All devices delivered to ABB Automation Products GmbH must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Please contact Customer Center Service acc. to page 2 for nearest service location.

## 1.10 Integrated management system

ABB Automation Products GmbH operates an integrated management system, consisting of:

- Quality management system to ISO 9001:2008
- Environmental management system to ISO 14001:2004
- Occupational health and safety management system to BS OHSAS 18001:2007 and
- Data and information protection management system

Environmental awareness is an important part of our company policy.

Our products and solutions are intended to have a minimal impact on the environment and on people during manufacturing, storage, transport, use, and disposal.

This includes the environmentally-friendly use of natural resources. We conduct an open dialog with the public through our publications.

## 1.11 Disposal

This product is manufactured from materials that can be reused by specialist recycling companies.

### 1.11.1 Information on WEEE Directive 2002/96/EC (Waste Electrical and Electronic Equipment)

This product is not subject to WEEE Directive 2002/96/EC or relevant national laws (e.g., ElektroG in Germany).

The product must be disposed of at a specialist recycling facility. Do not use municipal garbage collection points. According to the WEEE Directive 2002/96/EC, only products used in private applications may be disposed of at municipal garbage facilities. Proper disposal prevents negative effects on people and the environment, and supports the reuse of valuable raw materials.

If it is not possible to dispose of old equipment properly, ABB Service can accept and dispose of returns for a fee.

### 1.11.2 RoHS Directive 2002/95/EC

With the Electrical and Electronic Equipment Act (ElektroG) in Germany, the European Directives 2002/96/EC (WEEE) and 2002/95/EC (RoHS) are translated into national law. ElektroG defines the products that are subject to regulated collection and disposal or reuse in the event of disposal or at the end of their service life. ElektroG also prohibits the marketing of electrical and electronic equipment that contains certain amounts of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE) (also known as hazardous substances with restricted uses).

The products provided by ABB Automation Products GmbH do not fall within the current scope of the directive on waste from electrical and electronic equipment according to ElektroG. If the necessary components are available on the market at the right time, in the future these substances will no longer be used in new product development.

## 2 Use in potentially explosive atmospheres

In potentially explosive atmospheres, special regulations must be observed for the power supply, signal inputs/outputs, and ground connection. The information relating specifically to explosion protection that appears within the individual chapters must be observed.



### **Notice - Potential damage to parts!**

All parts must be installed in accordance with the manufacturer's specifications, as well as relevant standards and regulations.

Commissioning and operation must be performed in accordance with ATEX 137 or BetrSichV (German Ordinance on Industrial Safety and Health), EN 60079-14 (Electrical apparatus for explosive gas atmospheres), and EN 50281-1-2 and 2/A1 (Electrical apparatus for use in the presence of combustible dust).

### 2.1 Degree of protection

The connection parts of the temperature sensor must be installed so that a degree of protection of at least that of the type of explosion protection used can be achieved.

### 2.2 Temperature classes

The temperature sensors are marked as conforming to temperature class T6 as standard. If the existing explosive gas atmosphere is to be assigned a temperature class of T5, T4, T3, T2, or T1, the temperature sensor can be used at correspondingly higher process temperatures.

### 2.3 Electrostatic charging

Please make sure to avoid impermissible electrostatic charging of the temperature sensor when using it in potentially explosive atmospheres.

### 2.4 Grounding

If, for functional reasons, the intrinsically safe circuit needs to be grounded by means of a connection to the equipotential bonding, it may only be grounded at one point.

### 2.5 Interconnection

If the temperature sensor is operated in an intrinsically safe circuit, proof that the interconnection is intrinsically safe must be provided in accordance with DIN VDE 0165/Part 1 (EN 60079-25/2004 and IEC 60079-25/2003). An interconnection certificate must always be provided for intrinsically safe circuits.

### 2.6 Configuration

The temperature sensor can be configured in the potentially explosive atmosphere in compliance with the interconnection certificate, both directly in the potentially explosive atmosphere using approved handheld HART terminals and by coupling an Ex modem into the circuit outside the potentially explosive atmosphere.

### 2.7 Ex relevant specifications

See Chapter 10, "Ex relevant specifications" page 37.

**3 Design and function**

**3.1 Design**

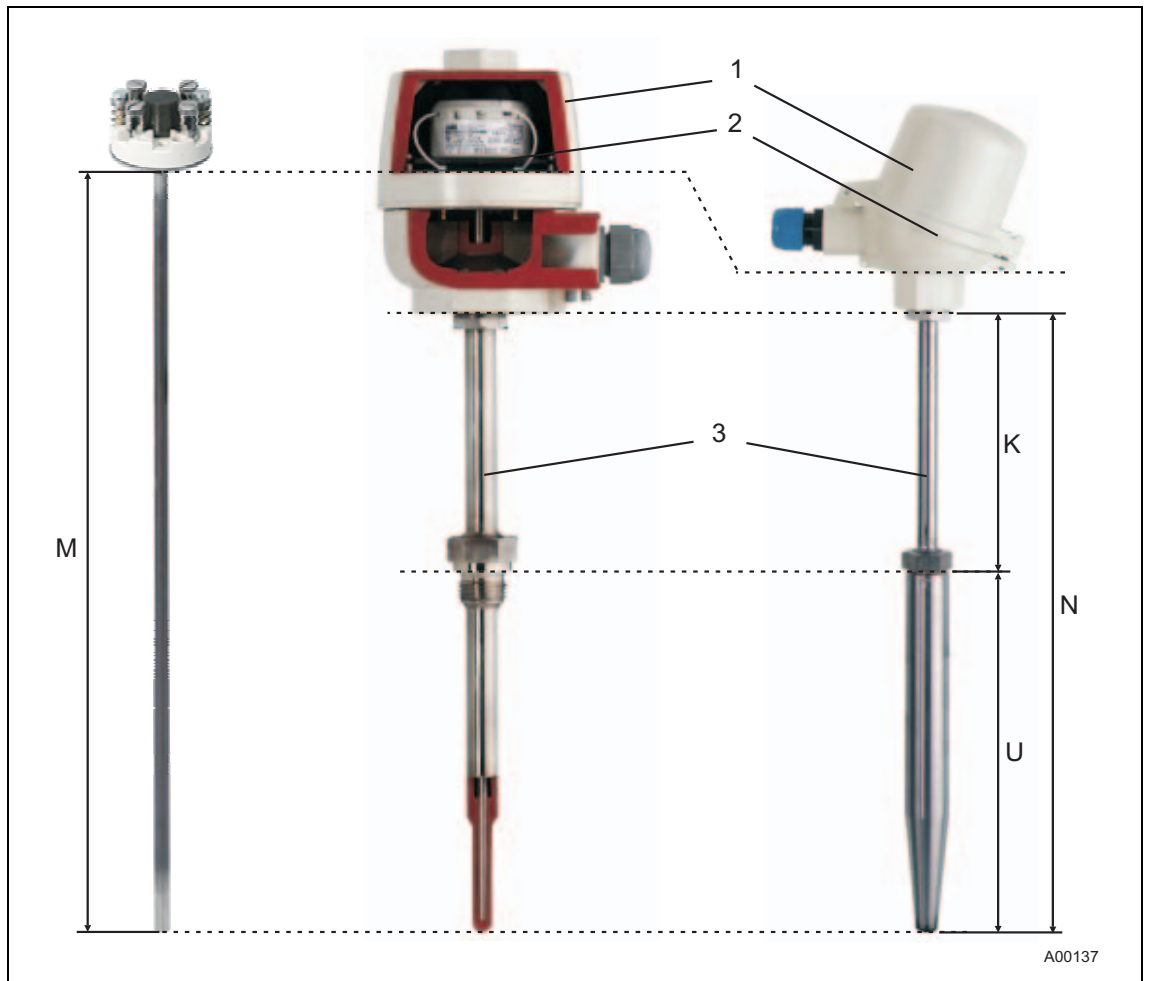


Fig. 5

- 1 Connection head
- 2 Transmitter mounted in connection head, with LCD indicator as an option
- 3 Extension tube

- M Measuring inset length
- K Ext. tube length
- N Nominal length
- U Insertion depth

### 3.2 Function

Process temperatures are measured using temperature sensors from the SensyTemp TSP1X1 and TSP3X1 series. These temperature sensors are suitable for measuring temperatures in the majority of processes.

The structure of the SensyTemp TSA101 measuring insets installed in the temperature sensors conforms to DIN 43735.

Depending on the sensor, a resistance value (in the case of resistance temperature sensors) or a millivolt signal (in the case of thermocouple sensors) is output for the process temperature in question.

In the case of measuring insets with open leads or a ceramic socket, this signal is transmitted without being converted. If a transmitter is mounted on the measuring inset, the temperature signal is converted into a scaled current or bus signal. Additional information is available for HART, PROFIBUS PA or FOUNDATION Fieldbus applications. The transmission of scaled signals for process evaluation purposes depends on the distance and ambient conditions concerned.

For the purpose of installing up to two transmitters or a combination of a transmitter and LCD indicator, covers of varying heights are available for the connection heads in accordance with DIN 43729. LCD indicators are electrically connected to the transmitter and installed in connection heads with "D" at the end of their names (e.g., BUZHD). This ensures information can be displayed directly.

Current standards allow measuring insets to be replaced without the need for interruptions in operation. This involves simply opening the cover of the connection head. The measuring inset can be removed after unscrewing two mounting screws. Any explosion protection regulations must be observed.

SensyTemp TSA101 measuring insets have been optimized for use with SensyTemp TSP1X1 and TSP3X1 temperature sensors. It is recommended to use them in this combination only.

More detailed functional descriptions and information concerning the required transmitters can be found in the relevant data sheets and operating instructions.

## 4 Mounting

### 4.1 General

- The temperature sensors (thermocouple, resistance thermometer) have to be in maximum contact with the medium to be measured.
- The Ingress Protection degree will no longer apply in the event of damage to the connection head or the threads, seals, or cable glands on the connection head.
- The connection wires must be firmly connected to the connection terminals.
- The correct polarity must be ensured if using thermocouples.
- When using resistance thermometers, take note of whether a two-, three-, or four-wire circuit is being used.
- When installing temperature sensors in existing thermowells, make sure that the measuring inset can be inserted easily. If this is not the case, the inside of the thermowell will need to be cleaned.
- The temperature sensor must be firmly and securely installed in a way that conforms to the requirements of the application process.
- Please take note of the sensor and circuit type specified.
- After clamping the connection lines using a suitable tool (screwdriver, wrench), you must ensure that the connection heads are securely closed and sealed again. When doing this, make sure that the sealing rings of the connection heads are clean and undamaged.

## 4.2 Cable glands

SensyTemp TSP1xx and TSP3xx temperature sensors are supplied with a M20 x 1.5 cable gland. Approved cable glands are used as appropriate for temperature sensors with Ex certification. If used correctly, these cable glands can help achieve a degree of protection of at least IP 66 (in the case of TSP1X1) or IP66 / 67 (in the case of SensyTemp TSP3X1).

Alternatively, the temperature sensor can be supplied without cable glands but with an M20 x 1.5 or 1/2" NPTF thread only. In this case, the user must take appropriate measures to ensure that the required degree of protection is achieved.

With this option it is also necessary to ensure that the measures taken satisfy the relevant requirements and standards concerning explosion protection (e.g., EN 50018) as well as the approvals for the relevant temperature sensors (e.g., PTB 99 ATEX 1144 for EEx d).

In practice, you may find the specified degree of protection can no longer be achieved if certain cables and lines are used in conjunction with the cable gland. Deviations from the test conditions as set out in the IEC 60529 standard must be checked. Check the cables' concentricity, transposition, external hardness, sheath, and surface roughness.

### 4.2.1 Requirements for achieving the degree of protection

- Cable glands may only be used in the specified clamping area.
- When using very soft cable types, do not use them in the lower clamping area.
- Only use round cables or cables with a slightly oval-shaped cross section.
- Frequent opening / closing is possible but may have a negative effect on the degree of protection.
- If cables are demonstrating pronounced cold flow behavior, the cable glands will need to be retightened.
- Armoured cables require special cable glands.

4.3 Insertion depth

The insertion depth of a temperature sensor affects the accuracy of measurements: Too shallow an insertion depth can result in measurement errors due to heat dissipation via the process connection and the pipeline or tank wall. (The extent of the error depends on the ambient conditions at the measuring point.)

**Recommended insertion depth (to avoid heat dissipation errors)**

Medium	Depth [mm]
Fluids	8 ... 10 x Ø thermowell tip
Gases	10 ... 15 x Ø thermowell tip

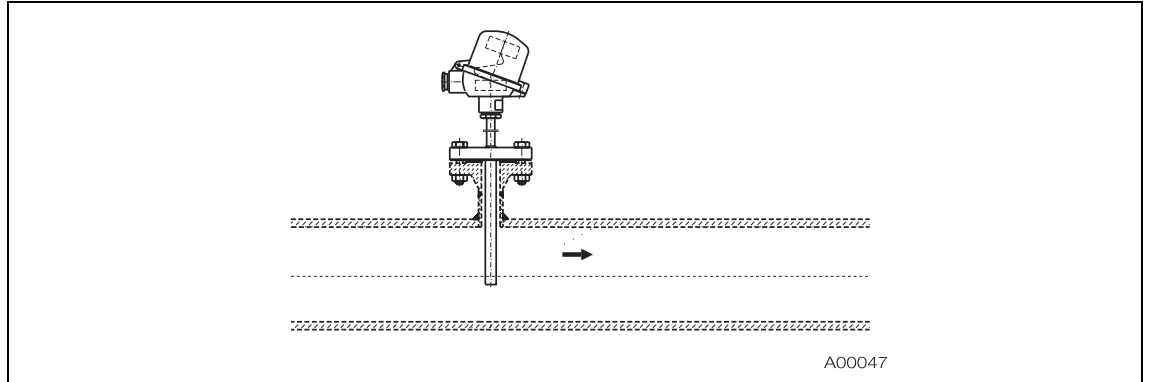


Fig. 6

4.4 Insufficient nominal diameter

In the case of pipelines with very small nominal diameters, insertion at an angle or in an elbow pipe is recommended; the thermowell tip must be positioned against the flow of the medium in this case.

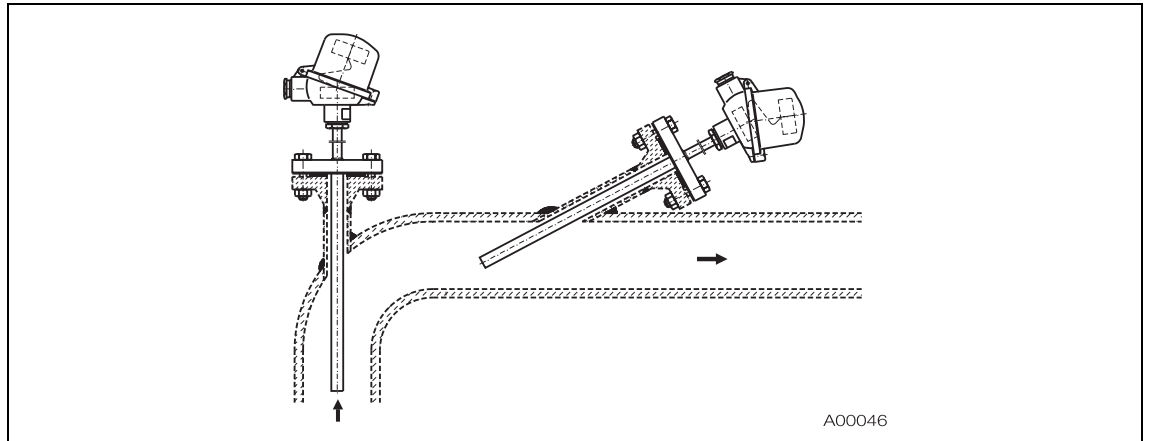


Fig. 7

## 4.5 Potentially explosive atmosphere

Avoid increases in the ambient temperature by ensuring equipment is at a sufficient distance from system components with excessively high temperatures. It must be ensured that heat dissipation can take place by means of unrestricted air circulation. You must avoid exceeding the maximum permissible ambient temperature as per the approved temperature class.

Installation and removal may only be performed by specialist personnel who have knowledge of the concept behind the relevant Ex types of protection. Compliance with the Ex temperature classes must be ensured by putting appropriate measures in place.

It is essential to ensure compliance with the EC-type-examination certificates for the equipment, including the documents associated with these.

The temperature sensors must be included in the equipotential bonding.

### 4.5.1 Intrinsic safety

#### **ATEX II 1 G EEx ia IIC T1 ... T6, Zone 0, 1, 2**

No additional specific information needs to be observed for mechanical installation.

### 4.5.2 Intrinsic safety acc. to NAMUR recommendation

#### **NE 24 and ATEX II 1 G EEx ia IIC T1 ... T6**

No additional specific information needs to be observed for mechanical installation.

### 4.5.3 Dust-ignition protection

#### **ATEX II 1 D IP6X T133 ... T400, Zone 20, 21, 22**

Installation and removal may only be performed by specialist personnel who have knowledge of the concept behind the type of protection "Electrical apparatus with protection by enclosure and with surface temperature limitation for use in areas in which combustible dust is present in sufficient quantities that it may create a risk of fire or explosion (dust-ignition protection)".

The temperature sensors are to be connected securely and tightly to the container concerned, in accordance with their mounting type (thermowell with flange, with threaded connection, with sliding connector or as welded thermowell). Choose connection elements that are suitable for the application in question (screws, seals, etc.).

Only use connection cables that satisfy the requirements of DIN EN 50281-1-2:1998 Pt. 11.

SensyTemp TSP1X1 and TSP3X1 temperature sensors must be installed in an existing thermowell.

### 4.5.4 Dust-ignition protection and intrinsic safety

#### **ATEX II 1 D IP6X T133 ... T400 and ATEX II 1 G EEx ia IIC T1 ... T6, Zone 0, 1, 2, 20, 21, 22**

Chapters 4.5.1 and 4.5.3 must be applied in respect of this.



#### **Important**

Use in explosive hybrid mixtures (where explosive dusts and gases are present simultaneously) is not currently permitted in accordance with EN 60079-0 and EN 61241-0.

#### 4.5.5 Flameproof enclosure

##### **ATEX II 1/2 G EEx d IIC T1 ... T6, Zone 1**

For Zone 0, thermowells which satisfy the following requirements must be used:

- Install suitable thermowells for zone separation. SensyTemp TSP321 and TSP331 temperature sensors are supplied with an appropriate thermowell. SensyTemp TSP311 temperature sensors must be installed in an existing thermowell.
- Suitable temperature-, pressure- and corrosion-resistant sealing elements must be used.

Use only prototype-certified ABB measuring insets whose diameter matches the corresponding hole of the connection head (ignition penetration-proof seam).

If there is surface damage in the area of the ignition penetration-proof seam of the measuring inset or the connection head base, the defective components may no longer be used.

- Observe the approval and installation information for the cable gland. In the case of cable glands supplied by ABB, operating instructions 42/10-57 XU must be observed.

#### 4.5.6 Intrinsic safety and flameproof enclosure

##### **ATEX II 1 G EEx ia IIC T1 ... T6 and ATEX II 1/2 G EEx d IIC T1 ... T6**

Chapters 4.5.1 and 4.5.5 must be applied in respect of this.

#### 4.5.7 Dust-ignition protection and flameproof enclosure

##### **ATEX II 1 D IP 6X T133 ... T400 and ATEX II 1/2 G EEx d IIC T1 ... T6, Zone 1, 2, 20, 21, 22**

Chapters 4.5.3 and 4.5.5 must be applied in respect of this.



##### **Important**

Use in explosive hybrid mixtures (where explosive dusts and gases are present simultaneously) is not permitted in accordance with EN 60079-0 and EN 61241-0.

#### 4.5.8 ATEX II 3 G EEx nA II T1 ... T6 and ATEX II 3 D IP6X T133 ... T300, Zone 2 and 22

No additional specific information needs to be observed for mechanical installation.



##### **Important**

Use in explosive hybrid mixtures (where explosive dusts and gases are present simultaneously) is not permitted in accordance with EN 60079-0 and EN 61241-0.

## 5 Electrical connections

### 5.1 General

The following applies to devices with a transmitter: The power supply and signal are routed in the same line and must be implemented as a Safety Extra Low Voltage (SELV) or Protective Extra Low Voltage (PELV) circuit in accordance with IEC 61508.

- The cable wires must be provided with end sleeves.
- When using PROFIBUS PA, the design must be in accordance with EN 50170 for PROFIBUS PA.
- When using FOUNDATION Fieldbus H1, the design must be in accordance with IEC 61158.
- The user is responsible for ensuring EMC-compliant cabling.

#### 5.1.1 Electrical interconnection in potentially explosive atmospheres

Special interconnections are required for use in hazardous areas depending on the safety requirements.

##### Intrinsic safety

The Power supply SPS inputs must have corresponding input protection circuits available in order to eliminate a hazard (spark formation). An interconnection inspection must be performed. For proof of the intrinsic safety, the electrical limit values are to be used as the basis for the prototype test certificates of the apparatuses (devices), including capacitance and inductivity values of the wires. The proof of the intrinsic safety is given if the following conditions are fulfilled with comparison of the limit values of the apparatus.

Transmitter (intrinsically safe apparatus)		Power supply / SPS input (related apparatus)
$U_i$	$\geq$	$U_o$
$I_i$	$\geq$	$I_o$
$P_i$	$\geq$	$P_o$
$L_i + L_c$ (cable)	$\leq$	$L_o$
$C_i + C_c$ (cable)	$\leq$	$C_o$

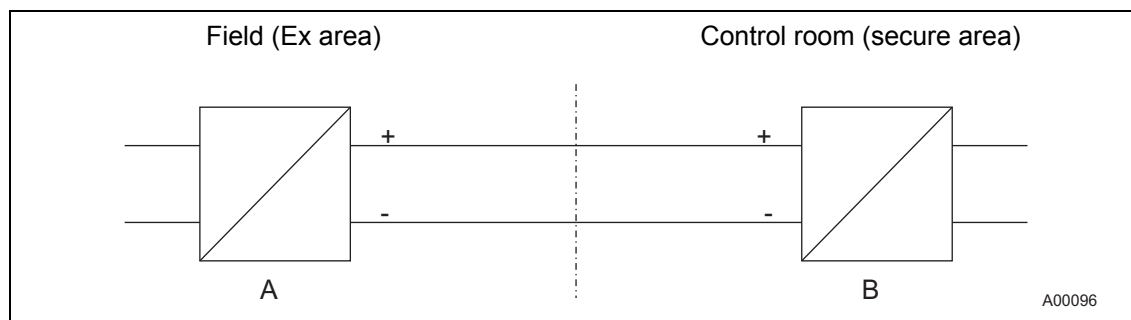


Fig. 8

A Transmitter

B Power supply / SPS input



##### Important

Observe the “Technical specifications” and “Explosion-protection technical data” chapters (see data sheet resp. operating instructions).

**Electrical connections**

**5.1.2 Measuring inset with ceramic base**

**5.1.2.1 Resistance thermometer**

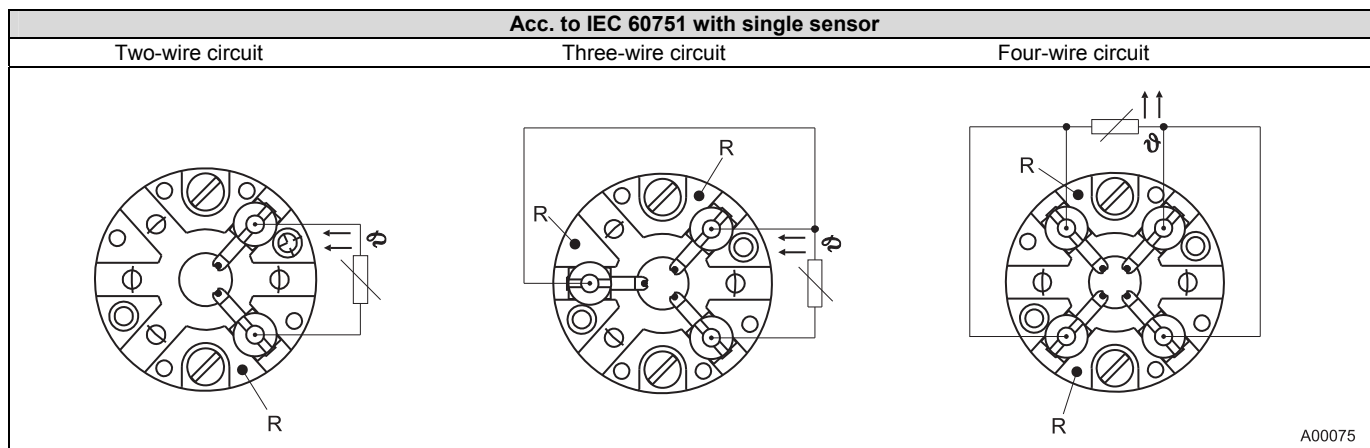


Fig. 9  
R Red

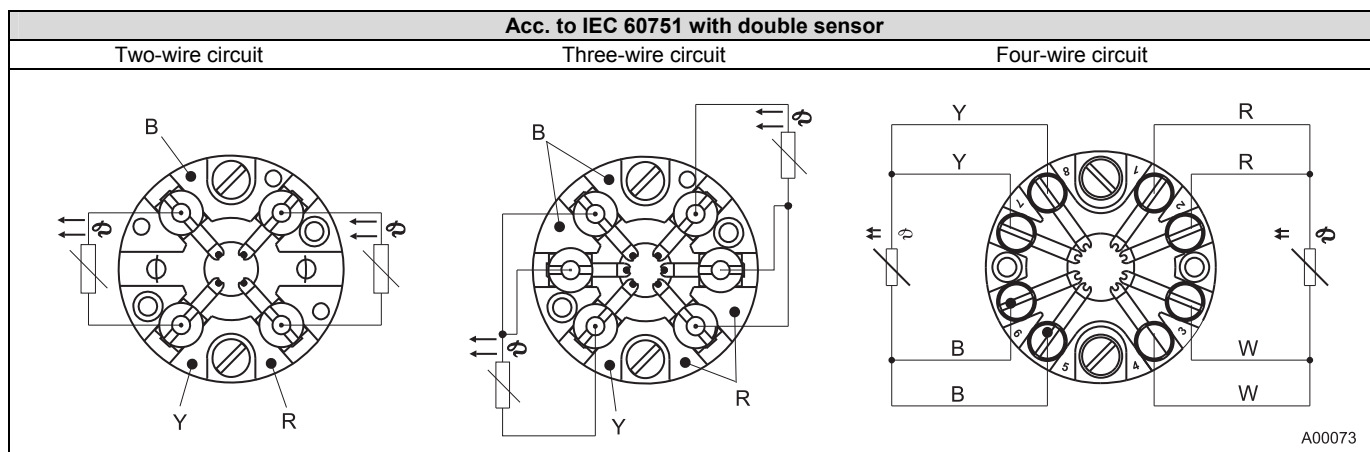


Fig. 10  
Y Yellow  
B Black  
R Red  
W White

**5.1.2.2 Thermocouple**

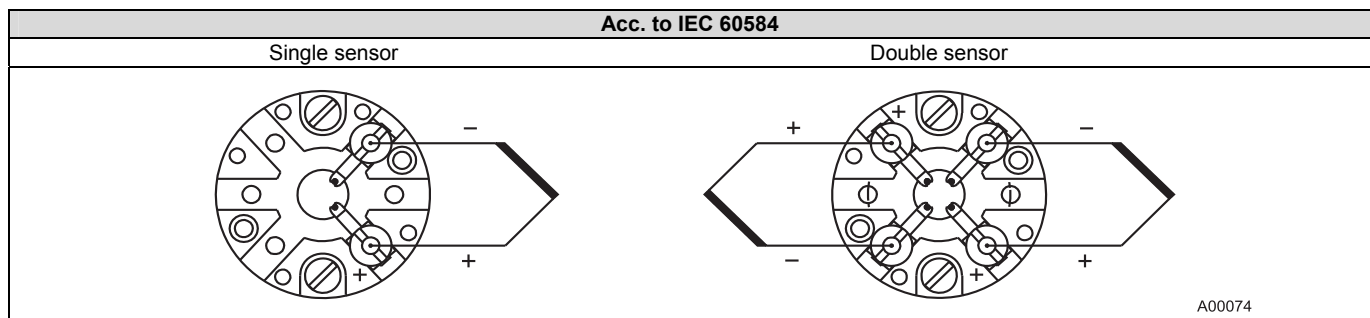


Fig. 11

**5.1.3 Harting plug connection in connection head**

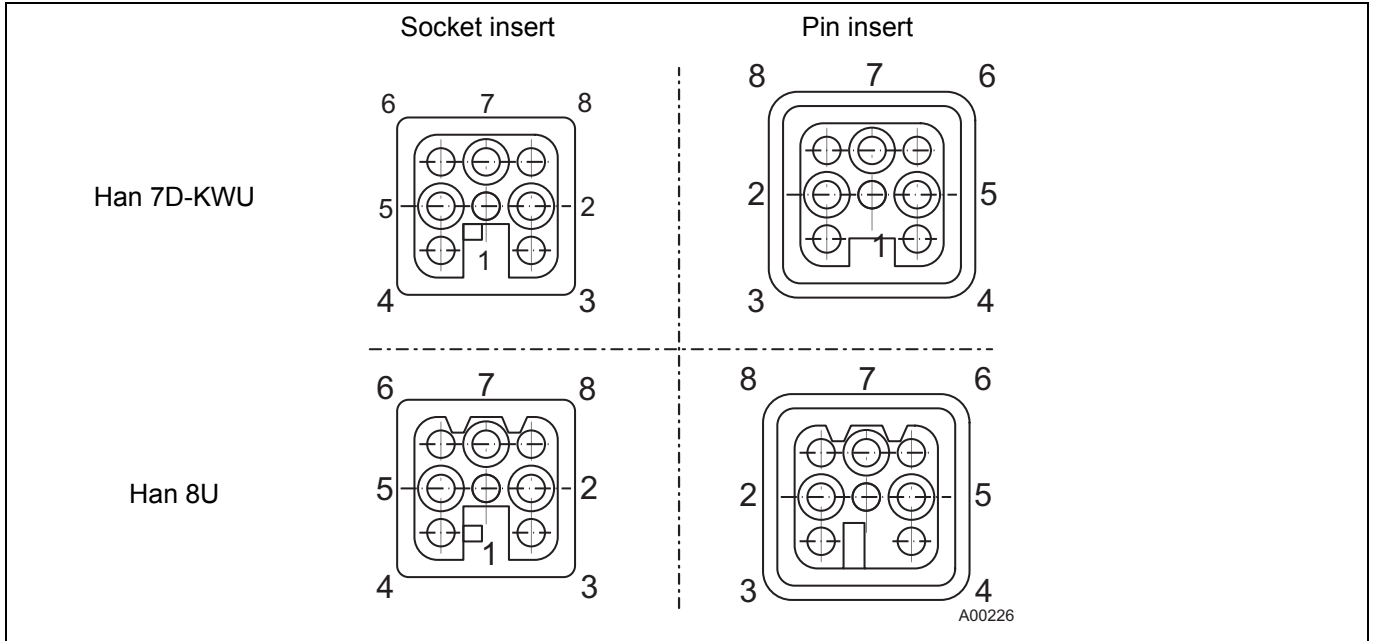


Fig. 12: External view in each case

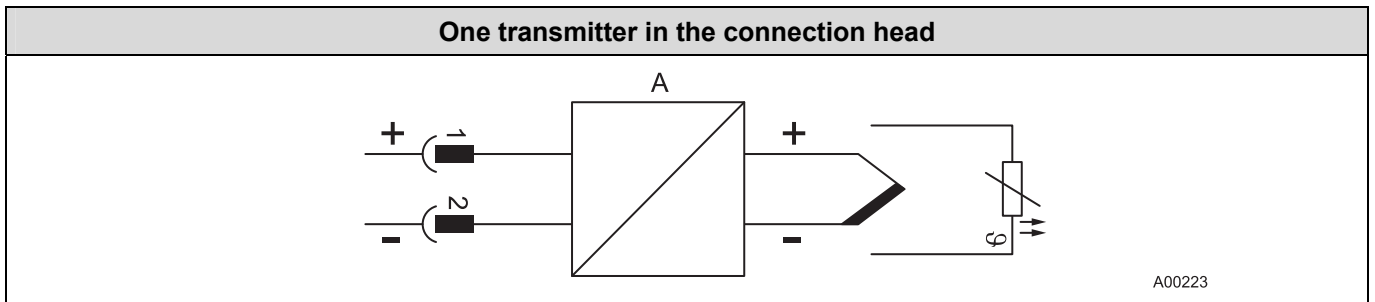


Fig. 13  
A Transmitter

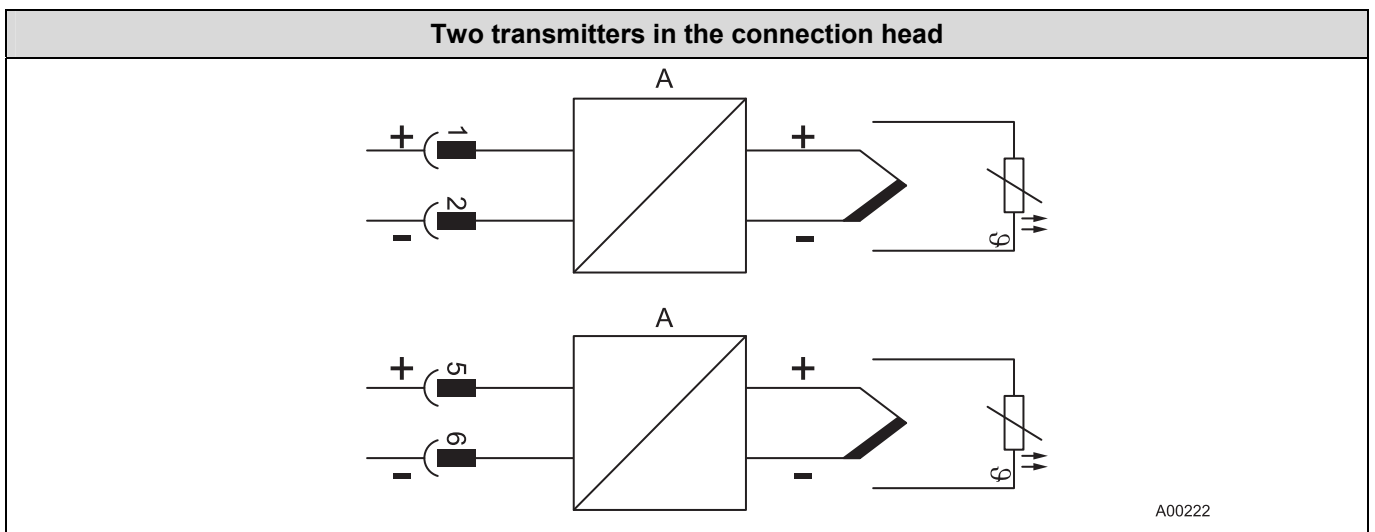


Fig. 14  
A Transmitter

5.1.3.1 Resistance thermometer

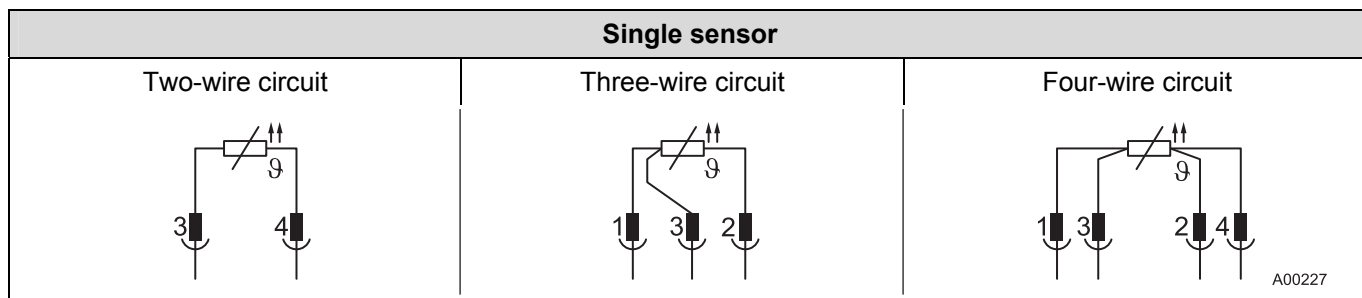


Fig. 15

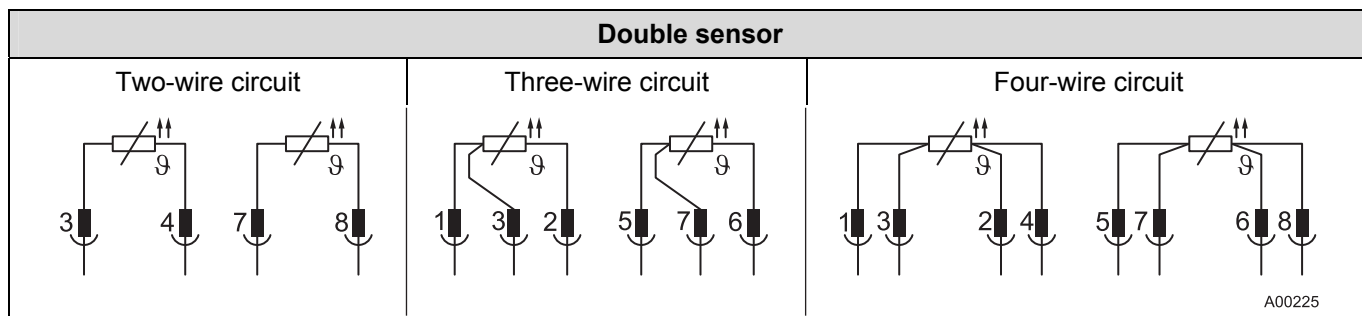


Fig. 16

5.1.3.2 Thermocouple

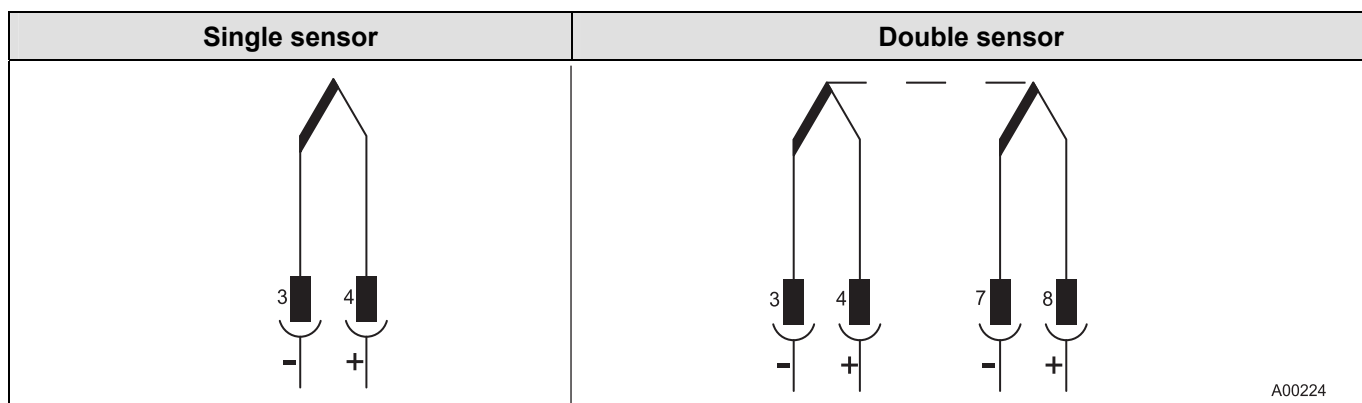


Fig. 17

**5.1.4 Installation in a potentially explosive atmosphere**

The temperature sensor can be installed in a huge variety of industrial locations. Plants with explosion protection (Ex plants) are divided into zones, meaning that they also require a wide range of instruments. Ex relevant specifications as outlined in the chapter titled "Ex relevant specifications" in the operating instructions must be observed.

The temperature sensor must be instrumented by the user in accordance with the valid Ex standards. This involves ensuring compliance with the electrical connection values in accordance with the associated EC-type-examination certificate.

**5.1.4.1 Intrinsic safety**

**ATEX II 1 G EEx ia IIC T6 ... T1, Zone 0, 1, 2**

In the case of the intrinsic safety type of protection, only one measuring element may be connected in Zone 0 if two measuring elements are being used (e.g., 2 x Pt100). The internal wiring in TTH300 transmitters enables 2 measuring elements to be connected since both elements are integrated into the same intrinsically safe sensor circuit.

Only certified transmitters with the maximum values specified in the operating instructions may be connected to the temperature sensors. If two transmitters are used for two intrinsically safe circuits, the sum of the values may not exceed the maximum values specified in the operating instructions. For the Zone 0 design, only one intrinsically safe sensor measurement circuit may be used.

The temperature sensor must feature appropriate input protection circuits in order to eliminate hazards (spark formation). The interconnection must be inspected. In order to provide proof of intrinsic safety, the electrical limit values must be used as the basis for the type-examination certificates for the equipment (devices); this includes the capacitance and inductance values for the connection cables.

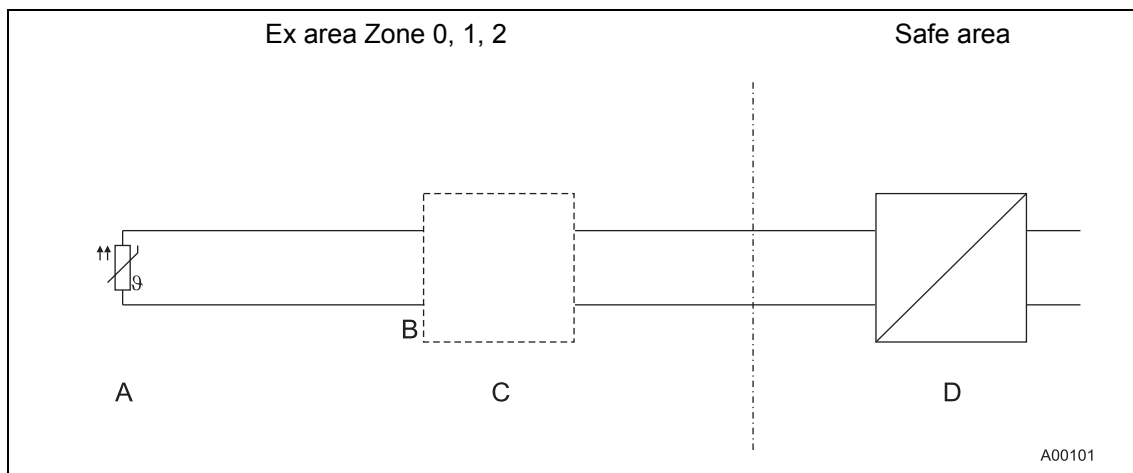


Fig. 18

- A Sensor
- B Sensor connection cables
- C Housing
- D EEx ia/ib transmitter

The transmitter must have an EEx ia (Category 1G) design to enable it to be used in Zone 0.

5.1.4.2 Intrinsic safety acc. to NAMUR recommendation

NE 24 and ATEX II 1 G EEx ia IIC T1 ... T6

See Chapter 5.1.4.1.



**Important**

Due to the geometric dimensions within the mineral insulated cable, double sensors may not satisfy the requirements of Point 2 of Namur recommendation NE 24.

5.1.4.3 Dust-ignition protection

ATEX II 1 D IP6X T133 ... T400, Zone 20, 21, 22

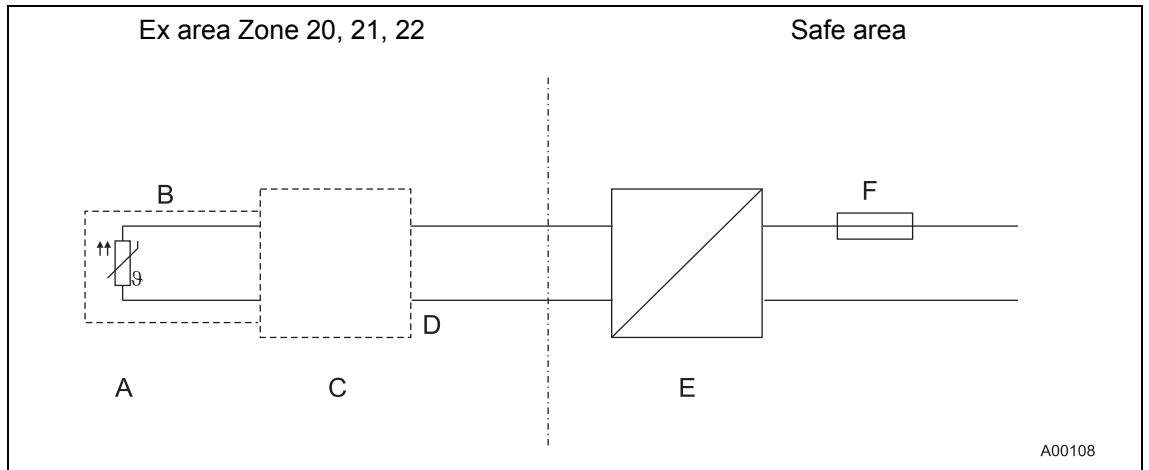


Fig. 19

- |   |                            |
|---|----------------------------|
| A Sensor  | D Sensor connection cables |
| B Thermowell  | E Transmitter              |
| C EEx D approved connection head with EEx D cable gland | F 32 mA fuse               |

The transmitter supply current must be limited by an upstream fuse conforming to IEC 127 with a fuse nominal current of 32 mA. This is not required if the transmitter has an intrinsically safe design according to Chapter 5.1.4.1.

5.1.4.4 Dust-ignition protection and intrinsic safety

ATEX II 1 D IP6X T133 ... T400 and ATEX II 1 G EEx ia IIC T1 ... T6, Zone 0, 1, 2, 20, 21, 22

See Chapters 5.1.4.1 and 5.1.4.3.

**5.1.4.5 Flameproof enclosure**

**ATEX II 1/2 G EEx d IIC T1 ... T6, Zone 1, 2**

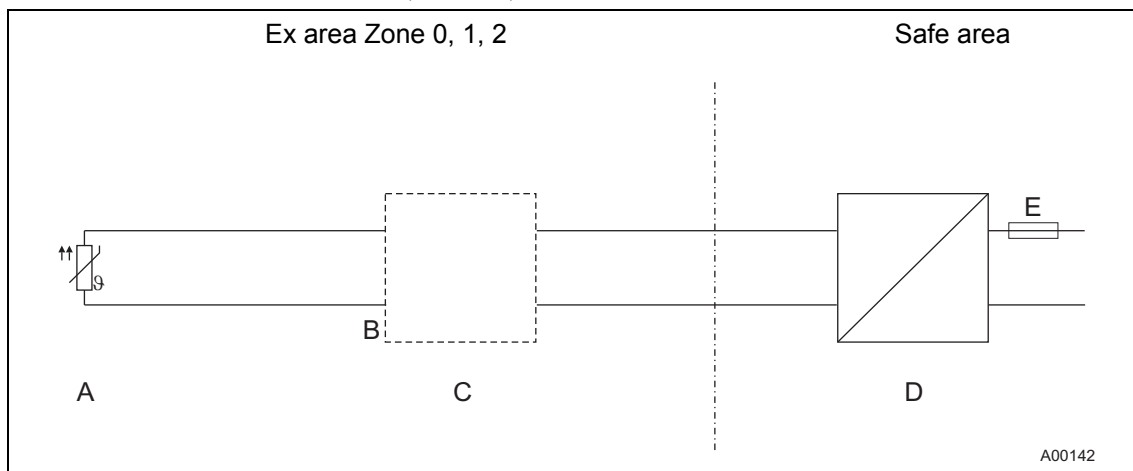


Fig. 20

- A Sensor
- B Sensor connection cables
- C EEx d housing (IP6X) with EEx d cable gland
- D EEx ia/ib transmitter
- E 32 mA fuse

The transmitter supply current must be limited by an upstream fuse conforming to IEC 127 with a fuse nominal current of 32 mA. This is not required if the transmitter has an intrinsically safe design according to Chapter 5.1.4.1.

**5.1.4.6 Intrinsic safety and flameproof enclosure**

**ATEX II 1 G EEx ia IIC T1 ... T6 and ATEX II 1/2 G EEx d IIC T1 ... T6**

See Chapters 5.1.4.1 and 5.1.4.5.

**5.1.4.7 Dust-ignition protection and flameproof enclosure**

**ATEX II 1 D IP 6X T133 ... T400 and ATEX II 1/2 G EEx d IIC T1 ... T6, Zone 1, 2, 20, 21, 22**

See Chapters 5.1.4.3 and 5.1.4.5.

**5.1.4.8 ATEX II 3 G EEx nA II T1 ... T6 and ATEX II 3 D IP6X T133 ... T300, Zone 2 and 22**

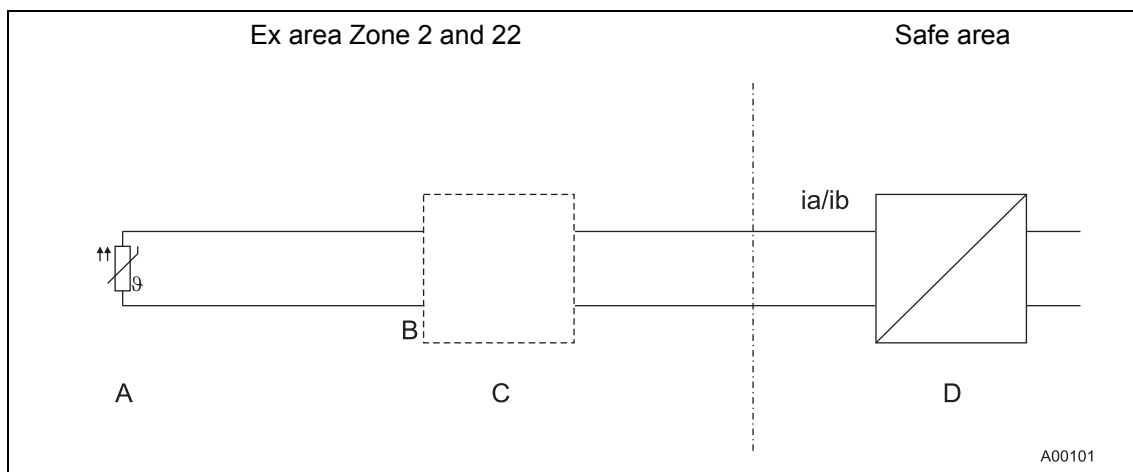


Fig. 21

- A Sensor
- B Sensor connection cables
- C Housing with IP6X
- D Transmitter

5.1.5 Installation in a potentially explosive atmosphere

5.1.5.1 Intrinsic safety

**ATEX II 1 G EEx ia IIC T1 ... T6, Zone 0, 1, 2**

With this instrumentation, it must be ensured that the power feed only comes from an approved intrinsically safe electrical circuit of the appropriate category. The electrical and thermal parameters may not be exceeded; see the chapter titled "Thermal data" in the operating instructions.

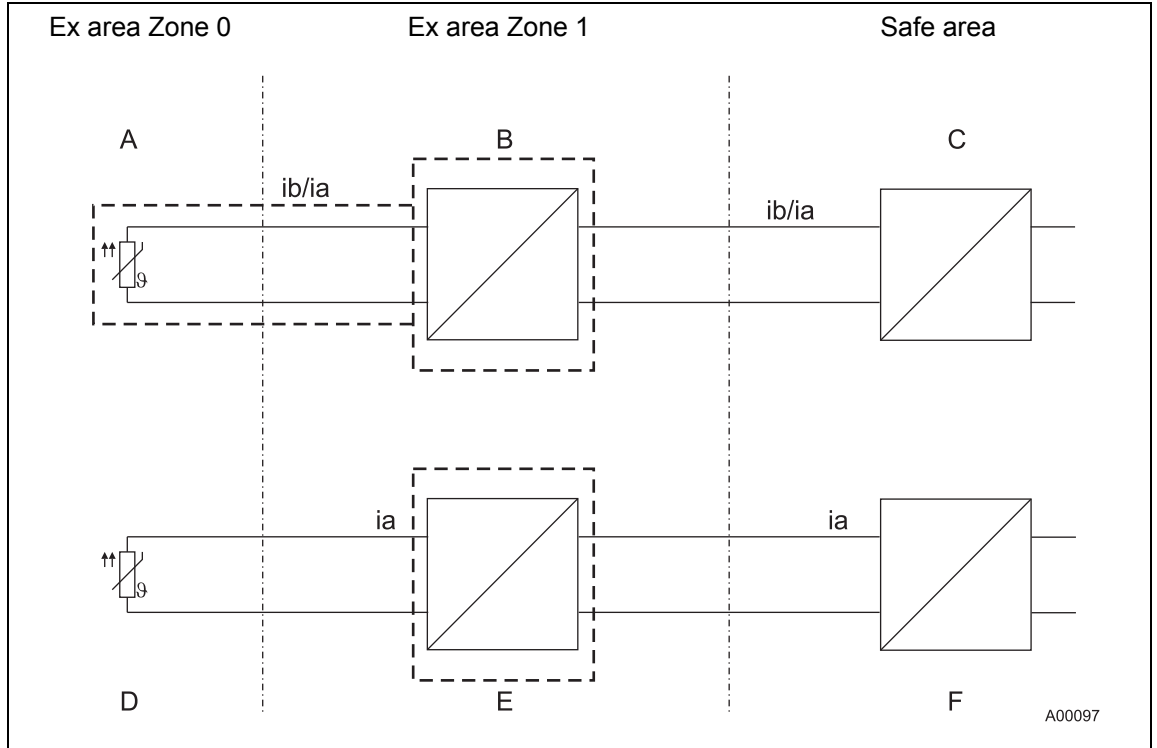


Fig. 22

- |   |   |
|---|---|
| A Measuring inset with thermowell             | D Measuring inset                       |
| B EEx ib or ia transmitter in connection head | E EEx ia transmitter in connection head |
| C Supply isolator [EEx ia/ib]                 | F Supply isolator [EEx ia]              |

5.1.5.2 Intrinsic safety acc. to NAMUR recommendation

**NE 24 and ATEX II 1 G EEx ia IIC T1 ... T6**

See Chapter 5.1.5.1.



**Important**

Due to the geometric dimensions within the plastic-sheathed cable, double sensors may not satisfy the requirements of Point 2 of Namur recommendation NE 24.

**5.1.5.3 Dust-ignition protection**

**ATEX II 1 D IP 6X T133 ... T400, Zone 20, 21, 22**

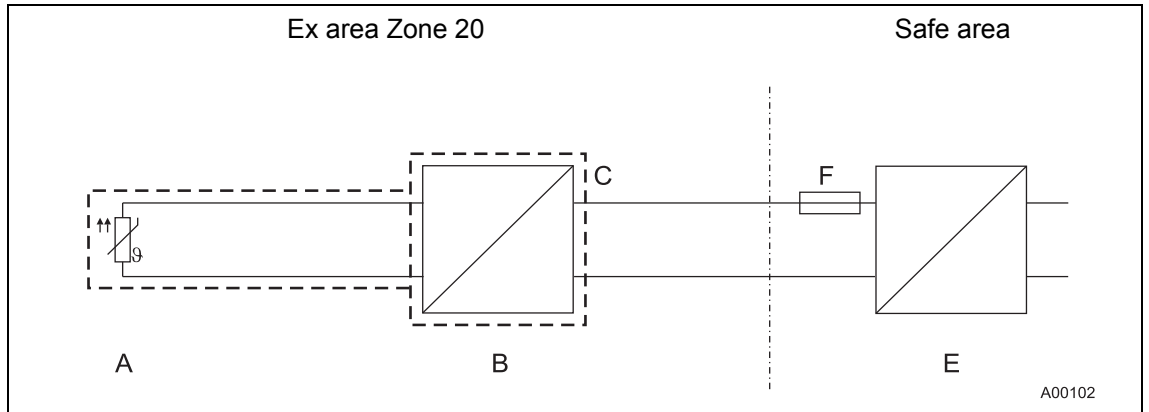


Fig. 23

- |   |                   |
|---|-------------------|
| A Measuring inset with thermowell               | D Fuse            |
| B Transmitter                                   | E Supply isolator |
| C EEx D approved housing with EEx D cable gland |                   |

The transmitter supply current must be limited by an upstream fuse conforming to IEC 127 with a fuse nominal current of 32 mA. This is not required if the transmitter has an intrinsically safe design according to Chapter 5.1.5.1.

**5.1.5.4 Dust-ignition protection and intrinsic safety**

**ATEX II 1 D IP 6X T133 ... T400 and ATEX II 1 G EEx ia IIC T1 ... T6, Zone 0, 1, 2, 20, 21, 22**

See Chapters 5.1.5.1 and 5.1.5.3.

**5.1.5.5 Flameproof enclosure**

**ATEX II 1/2 G EEx d IIC T1 ... T6, Zone 1**

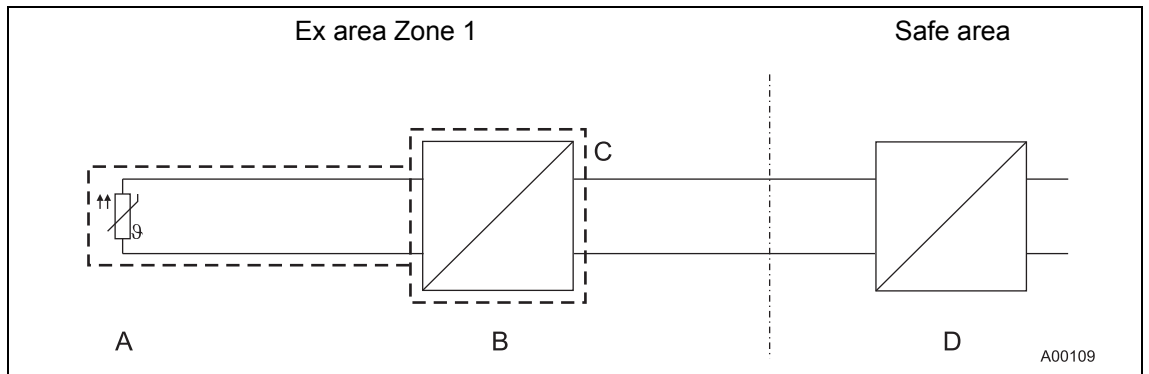


Fig. 24

- |                                   |   |
|-----------------------------------|---|
| A Measuring inset with thermowell | C EEx d housing (IP6X) with EEx d cable gland |
| B Transmitter in connection head  | D Supply isolator                             |

**5.1.5.6 Intrinsic safety and flameproof enclosure**

**ATEX II 1 G EEx ia IIC T1 ... T6 and ATEX II 1/2 G EEx d IIC T1 ... T6**

See Chapters 5.1.5.1 and 5.1.5.5.

**5.1.5.7 Dust-ignition protection and flameproof enclosure**

**ATEX II 1 D IP6X T133 ... T400 and ATEX II 1/2 G EEx d IIC T1 ... T6, Zone 1, 2, 20, 21, 22**

See Chapters 5.1.5.3 and 5.1.5.5.

**5.1.5.8 ATEX II 3 G EEx nA II T1 ... T6 and ATEX II 3 D IP6X T133 ... T300, Zone 2 and 22 (non-conducting dusts)**

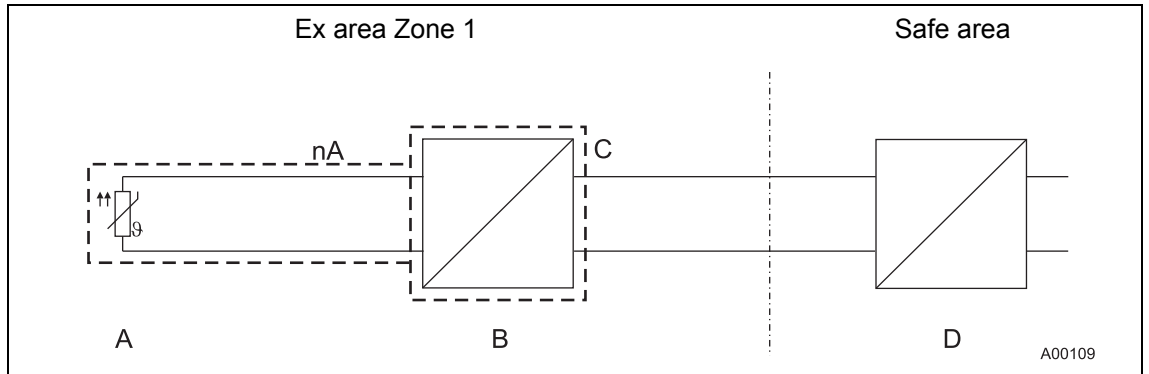


Fig. 25

- |  |                      |
|--|----------------------|
| A Measuring inset with or without thermowell | C Housing with IP 6X |
| B EEx nA transmitter in connection head      | D Supply isolator    |

**6 Commissioning**

The following must be checked before commissioning:

- Thermowells and protective sleeves have been installed correctly and form a tight seal (especially when used as a separation element for Zone 0).
- Equipotential bonding line is connected.
- The electrical specifications comply with the specified Ex relevant values.
- Electrical connection and installation has been carried out correctly in accordance with the "Installation" and "Electrical connection" chapters.

## 7 LCD-indicator

### 7.1 Configuration

During operation, the name of the measuring point and the measured value are shown on the LCD indicator.



**Important**

Configuration with an integrated LCD indicator is only provided for temperature sensors in the TSP1x1 and TSP3x1 series.

#### 7.1.1 Menu navigation

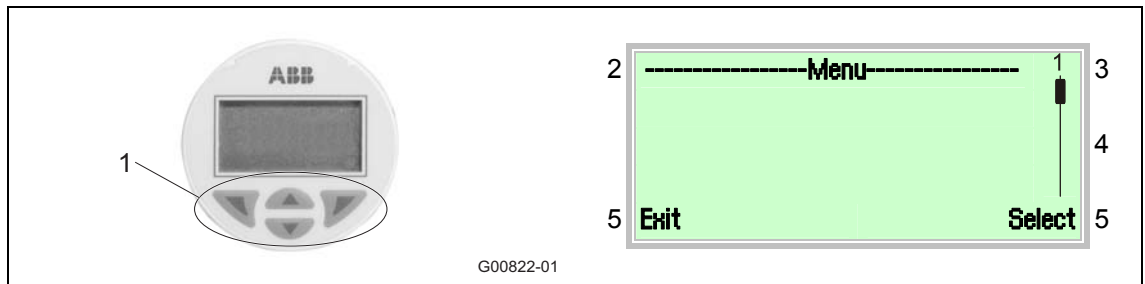


Fig. 26: LCD-indicator

- 1 Control buttons for menu navigation
- 2 Menu name
- 3 Menu number
- 4 Marker for indicating relative position within the menu
- 5 Function currently assigned to the and control buttons

You can use the or control buttons to browse through the menu or select a number or character within a parameter value.

Different functions can be assigned to the and control buttons. The function that is currently assigned to them (5) is shown on the display.

##### 7.1.1.1 Control button functions

	Meaning
Exit	Exit menu
Back	Go back one submenu
Cancel	Cancel a parameter entry
Next	Select the next position for entering numerical and alphanumeric values

	Meaning
Select	Select submenu / parameter
Edit	Edit parameter
OK	Save parameter entered

7.1.2 Process display

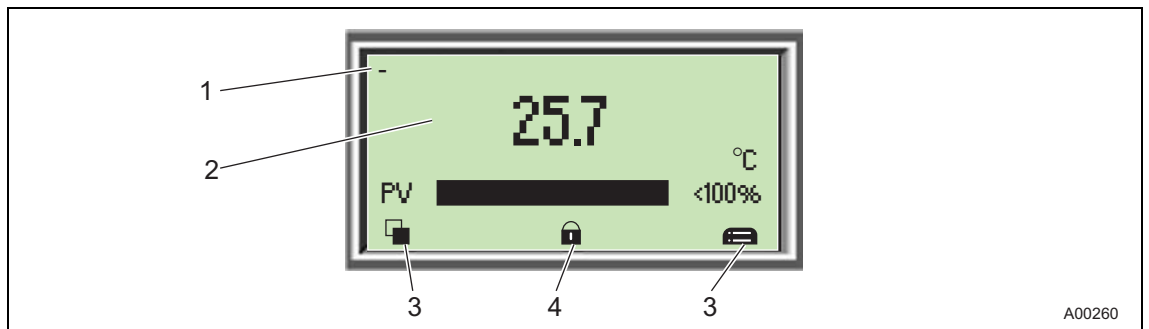


Fig. 27: Process display (example)

- |   |  |
|---|--|
| <p>1 Measuring point identifier</p> <p>2 Current process values</p> | <p>3 Symbol indicating button function</p> <p>4 Symbol indicating "Parameterization protected"</p> |
|---|--|

The process display appears on the LC display when the device is switched on. It shows information about the device and current process values.

The way in which the current process values (2) are shown can be adjusted on the configuration level.


7.1.2.1 Description of symbols

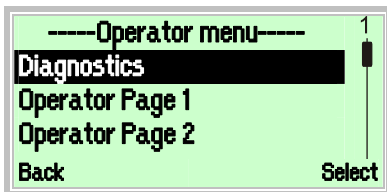
Symbol	Description
	Call up information level. When Autoscroll mode is enabled, a U symbol appears here and the operator pages are automatically displayed one after the other.
	Call up configuration level.
	The device is protected against changes to the parameter settings.




7.1.3 Switching to the information level (PROFIBUS PA and FOUNDATION Fieldbus only)

On the information level, the operator menu can be used to display diagnostic information and choose which operator pages to display.



1. Use  to switch to the information level.

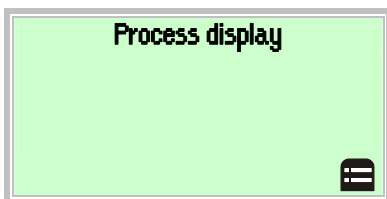



2. Use  or  to select a submenu.
3. Use  to confirm your selection.

Menu	Description
... / Operator menu	
<b>Diagnostics</b>	Selects "Diagnostics" submenu
Operator Page 1	Selects the operator page to be displayed
Operator Page 2	
Autoscroll	When Multiplex mode is enabled, this initiates automatic switching of the operator pages on the process display.
<b>Signal View</b>	Selects the "Signal View" submenu, in which all dynamic measured values are displayed

7.1.4 Switching to the configuration level (parameterization)

The device parameters can be displayed and changed on the configuration level.

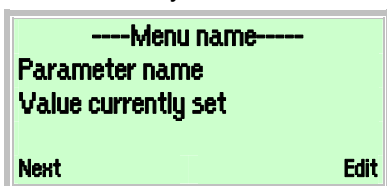


1. Use  to switch to the information level.

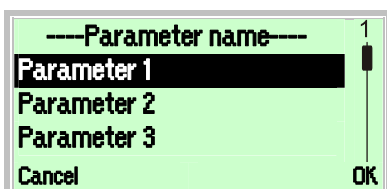
## 7.1.5 Selecting and changing parameters

### 7.1.5.1 Entry from table

When an entry is made from a table, a value is selected from a list of parameter values.



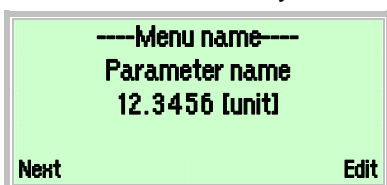
1. Select the parameters you want to set in the menu.
2. Use to call up the list of available parameter values. The parameter value that is currently set is highlighted.



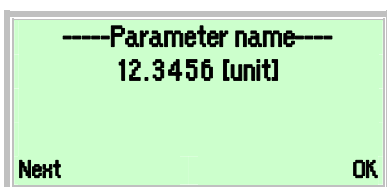
3. Use or to select the required value.
  4. Use to confirm your selection.
- This concludes the procedure for selecting a parameter value.

### 7.1.5.2 Numerical entry

When a numerical entry is made, a value is set by entering the individual decimal positions.



1. Select the parameters you want to set in the menu.
2. Use to call up the parameter for editing. The position that is currently selected is highlighted.

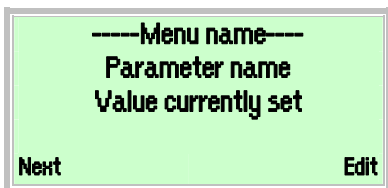



3. Use to select the decimal position to be changed.
4. Use or to set the required value.
5. Use to select the next decimal position.
6. If necessary, select and set other decimal positions using the same procedure as described in steps 3 and 4.
7. Use to confirm your setting.

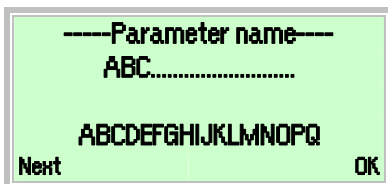
This concludes the procedure for changing a parameter value.






**7.1.5.3 Alphanumeric entry**

When an alphanumeric entry is made, a value is set by entering the individual decimal positions.



1. Select the parameters you want to set in the menu.
2. Use  to call up the parameter value for editing. The position that is currently selected is highlighted.



3. Use  to select the position to be changed.
4. Use  or  to select the required character.
5. Use  to select the next position.
6. If necessary, select and set other decimal positions using the same procedure as described in steps 3 and 4.
7. Use  to confirm your setting.

This concludes the procedure for changing a parameter value.













**7.1.6 Menu structure and diagnostic messages**

The parameters are structured in the form of a menu. The menu consists of a maximum of three levels.

For detailed information on the menu structure, a description of the parameters and a list of possible diagnostic messages, please consult the operating instructions for the transmitter.

**7.1.7 Setting the language**

The language is set to German by default in the equipment's as-delivered state. To change it to English, proceed as follows:

1. Press the  control button to call up the configuration menu.
2. Use either the  or  control button to scroll to the "Anzeige" submenu.
3. Press the  control button to call up the "Anzeige" submenu.
4. Use either the  or  control button to scroll to the "Sprache" submenu.
5. Press the  control button to call up the "Sprache" submenu.
6. Press the  control button to switch to Edit mode and use either the  or  control button to navigate to "Englisch".
7. Press the  control button to switch to the language setting for English.
8. Press the  control button three times to navigate back to the display.

## 8 Trouble shooting

### 8.1 Error table

The entire temperature measurement circuit should be tested routinely. The tables below contain details of the most important errors together with their possible causes and suggestions for how to remedy them.

Error	Cause	Remedy
Measuring signal fault	<ul style="list-style-type: none"> <li>Electrical/magnetic interspersion</li> </ul>	<ul style="list-style-type: none"> <li>Keep measuring lines that are laid in parallel at least 0.5 m apart.</li> <li>Put electrostatic shielding in place by means of foil/mesh grounded at one point.</li> <li>Twist wires (pairs) against magnetic interspersion.</li> <li>Have measuring lines intersect interfering power cables at right angles.</li> <li>Use transmitters.</li> </ul>
	<ul style="list-style-type: none"> <li>Ground loops</li> </ul>	<ul style="list-style-type: none"> <li>Only one grounding point in measurement circuit or "floating" measuring system (not grounded).</li> </ul>
	<ul style="list-style-type: none"> <li>Decrease in insulation resistance</li> </ul>	<ul style="list-style-type: none"> <li>It is possible that moisture has penetrated the thermometer or measuring inset; dry and reseal if necessary.</li> <li>Replace measuring inset.</li> <li>Check whether the thermometer is thermally overloaded.</li> </ul>
Response times too long, incorrect signals	<ul style="list-style-type: none"> <li>Incorrect installation location:                             <ul style="list-style-type: none"> <li>In the flow shadow</li> <li>Where it can be affected by a heat source</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Select an installation location that enables the medium to transfer its temperature to the thermometer undisturbed.</li> </ul>
	<ul style="list-style-type: none"> <li>Incorrect installation method:                             <ul style="list-style-type: none"> <li>Too shallow an installation depth</li> <li>Too much heat dissipation</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Installation depth approx. temperature sensitive length + 6 x d (fluids) to 10 x (gases) d (d = outer thermowell diameter).</li> <li>Ensure thermal contact by means of suitable contact surfaces and / or heat transfer medium (especially when carrying out surface measurements).</li> </ul>
	<ul style="list-style-type: none"> <li>Thermowell too thick</li> <li>Thermowell bore too large</li> </ul>	<ul style="list-style-type: none"> <li>Select the smallest thermowell possible for the process.</li> <li>Initial approximation of response time proportional to the cross section or volume of the thermometer, depending on the heat transfer values and air gaps in the structure.</li> <li>The latter with heat-conductive paste.</li> </ul>
	<ul style="list-style-type: none"> <li>Deposits on the thermowell</li> </ul>	<ul style="list-style-type: none"> <li>Remove during inspections.</li> <li>If possible, select a different thermowell or another installation location.</li> </ul>

<b>Error</b>	<b>Cause</b>	<b>Remedy</b>
Interruptions in the thermometer	<ul style="list-style-type: none"> <li>• Vibrations</li> </ul>	<ul style="list-style-type: none"> <li>• Reinforced springs on the measuring inset.</li> <li>• Reduce the insertion depth.</li> <li>• Select a different measuring point (if possible).</li> <li>• Special measuring inset and thermowell structure.</li> </ul>
Heavily corroded thermowell	<ul style="list-style-type: none"> <li>• Composition of the medium not as assumed or has changed</li> <li>• Improper thermowell material selected</li> </ul>	<ul style="list-style-type: none"> <li>• Check medium.</li> <li>• Analyze the thermowell (which may be defective) and then select a more suitable material.</li> <li>• Use additional surface protection.</li> <li>• Under certain circumstances, the thermowell may have to be replaced regularly as a wear part.</li> </ul>

**8.2 Specific errors with thermocouples**

<b>Error description</b>	<b>Cause of error</b>	<b>Remedy</b>
Fluctuating temperature indication with otherwise problem-free thermocouple measurement circuit structure	<ul style="list-style-type: none"> <li>• Reference points - temperature or voltage not constant</li> </ul>	<ul style="list-style-type: none"> <li>• Temperature or supply voltage must remain constant.               <ul style="list-style-type: none"> <li>– &lt; 0.1 % (check instruments).</li> </ul> </li> <li>• Full value incorporated into measurements for base metal thermocouples; only approx. half the value incorporated for precious metal thermocouples.</li> </ul>
Temperature display values deviate significantly from table values for thermocouples	<ul style="list-style-type: none"> <li>• Incorrect material combinations</li> <li>• Poor electrical contacts               <ul style="list-style-type: none"> <li>– Parasitic voltages (thermovoltages, electrical voltages)</li> </ul> </li> <li>• Incorrect compensating cable</li> </ul>	<ul style="list-style-type: none"> <li>• Check thermocouples and cables for:               <ul style="list-style-type: none"> <li>– Correct pairing.</li> <li>– Correct compensating cable.</li> <li>– Correct polarity.</li> </ul> </li> <li>• Permissible ambient temperature at connection head.</li> </ul>

8.3 Specific errors with resistance thermometers

Error description	Cause of error	Remedy
Too high or fluctuating temperature display despite known cross section and precision measurement resistor for resistance thermometer	<ul style="list-style-type: none"> <li>Line resistances too high, not compensated</li> <li>Temperature-related resistance change in supply line</li> </ul>	<ul style="list-style-type: none"> <li>If still possible:                             <ul style="list-style-type: none"> <li>Lay 2 lines with a larger cross section only after a more accessible location.</li> <li>Shorten the supply line.</li> <li>Line compensation.</li> <li>Switch to three- or four-wire circuit.</li> <li>Use head-mounted transmitters.</li> </ul> </li> </ul>
Fluctuating temperature display with otherwise problem-free resistance thermometer measurement circuit structure	<ul style="list-style-type: none"> <li>Voltage or power supply not constant</li> </ul>	<ul style="list-style-type: none"> <li>Must be kept constant at &lt; 0.1 %. Full value used for measurement with out-of-tune bridges and current / voltage measurement (four-wire circuit).</li> </ul>

9 Calibration

The long-term stability of TSP temperature sensors and replaceable measuring insets depends largely on the operating conditions. It is not possible to provide information on this that can be applied in a general sense.

ABB recommends to calibrate the measuring insets on a regular basis.

Guide values for a maximum constant operating temperature:

- 400 °C calibration after a maximum of 2 years
- 200 °C calibration after a maximum of 5 years

Depending on process requirements (e.g., increased accuracy, system availability, safety) and in applications with above-average stress levels (strong vibrations, frequent and rapid temperature changes, etc.), the time periods may have to be shortened significantly.

**ABB offers its customers a low-cost, high-precision calibration service at our German Calibration Service (DKD)-accredited lab in Alzenau.**

## 10 Ex relevant specifications

### 10.1 Intrinsic safety ATEX "Ex i"

For use in thermowells, the surface temperature on the thermowell is correspondingly lower.

The operator assumes responsibility for correct and proper installation when replacing the measuring inset in a thermometer. ABB requires the manufacturing number marked on the old part so that the conformity of the ordered design can be checked with the initial delivery and the valid approvals.

Max. inner inductivity:  $L_i = 15 \text{ mH/m}$

Max. inner capacitance:  $C_i = 280 \text{ pF/m}$

#### 10.1.1 Electrical power limit "EEx i"

The following electrical values must not be exceeded:

U <sub>i</sub> (input voltage)	I <sub>i</sub> (input current)
30 V	101 mA
25 V	158 mA
20 V	309 mA
P <sub>i</sub> (inner power) = according to calculation using thermal resistance R <sub>th</sub>	
L <sub>i</sub> (inner inductivity) = 15 μH per meter	
C <sub>i</sub> (inner capacitance) = 280 pF per meter	

#### 10.1.2 Thermal resistance

The following table lists thermal resistances for measuring insets with diameter 3.0 mm (0.12 inch) and 6.0 mm (0.24 inch). The values have been specified subject to the conditions "Gas with a flow velocity of 0 m/s" and "Measuring inset without or with an additional thermowell".

Thermal resistance R <sub>th</sub>	Measuring inset Ø 3 mm (0.12 inch)	Measuring inset Ø 6 mm (0.24 inch)
Without thermowell		
Resistance thermometer	200 K/W	84 K/W
Thermocouple	30 K/W	30 K/W
With thermowell		
Resistance thermometer	70 K/W	40 K/W
Thermocouple	30 K/W	30 K/W

K/W = Kelvin per watt

#### 10.1.3 Output power P<sub>o</sub>

Transmitter type	P <sub>o</sub>
TTH200 HART	≤ 38 mW
TTH300 HART	≤ 38 mW
TTH300 PA	≤ 38 mW
TTH300 FF	≤ 38 mW
TR04	≤ 383 mW

All other information required to prove intrinsic safety (U<sub>o</sub>, I<sub>o</sub>, P<sub>o</sub>, L<sub>o</sub>, C<sub>o</sub> etc.) can be taken from the EC type-examination certificates for the relevant transmitter models.

#### 10.1.4 Special requirements (temperature rise)

In the event of a fault, the temperature sensors will exhibit a temperature rise Δt as appropriate for the applied power. This temperature rise Δt must be taken into account with regard to the difference between process temperature and temperature class.

#### **i** Important

In the event of a fault (short circuit), the dynamic short-circuit current which occurs in the measurement circuit for a matter of milliseconds not relevant with regard to temperature rise. The permissible outer capacitance is based on the dynamic short-circuit current.

The temperature rise Δt can be calculated as follows:

$$\Delta t = R_{th} \times P_o \text{ [K/W} \times \text{W]}$$

Δt = Temperature rise

R<sub>th</sub> = Thermal resistance

P<sub>o</sub> = Output power

#### Example:

Resistance thermometer diameter 3 mm (0.12 inch) without thermowell

R<sub>th</sub> = 200 K/W,

TTHXXX temperature transmitter P<sub>o</sub> = 38 mW.

$$\Delta t = 200 \text{ K/W} \times 0.038 \text{ W} = 7.6 \text{ K}$$

Therefore, at a transmitter output power P<sub>o</sub> = 38 mW, the maximum temperature rise in the event of a fault is approximately 8 K.

This results in the following maximum process temperatures T<sub>medium</sub>:

#### Maximum process temperature T<sub>medium</sub> in Zone 0:

<b>T6 (85 °C)</b> 80 % = 68 °C T <sub>medium</sub> = 60 °C	<b>T5 (100 °C)</b> 80 % = 80 °C T <sub>medium</sub> = 72 °C	<b>T4 (135 °C)</b> 80 % = 108 °C T <sub>medium</sub> = 100 °C
<b>T3 (200 °C)</b> 80 % = 160 °C T <sub>medium</sub> = 152 °C	<b>T2 (300 °C)</b> 80 % = 240 °C T <sub>medium</sub> = 232 °C	<b>T1 (450 °C)</b> 80 % = 360 °C T <sub>medium</sub> = 352 °C

The surface temperature of Category 1 devices must not exceed 80 % of the ignition temperature of a flammable gas or liquid.

#### Possible process temperature T<sub>med</sub> in Zone 1:

<b>T6 (85 °C)</b> - 5 °C = 80 °C T <sub>medium</sub> = 72 °C	<b>T5 (100 °C)</b> - 5 °C = 95 °C T <sub>medium</sub> = 87 °C	<b>T4 (135 °C)</b> - 5 °C = 130 °C T <sub>medium</sub> = 122 °C
<b>T3 (200 °C)</b> - 5 °C = 195 °C T <sub>medium</sub> = 187 °C	<b>T2 (300 °C)</b> - 10 °C = 290 °C T <sub>medium</sub> = 282 °C	<b>T1 (450 °C)</b> - 10 °C = 440 °C T <sub>medium</sub> = 432 °C

To calculate the temperature classes for T6, T5, T4, and T3 deduct 5 K each; for T2 and T1, deduct 10 K each.

## Ex relevant specifications

### 10.2 Flameproof enclosure "Ex d"

The enclosures for thermometers of this design are flameproof. An explosion inside the thermometer will not ignite the explosive atmosphere in the area in which the device is located. Alongside the use of a flameproof enclosure, this is achieved by compliance with specified ignition gap lengths and widths (between enclosure and measuring inset) and "Ex d"-certified cable entries. SensyTemp TSP300 temperature sensors can be used as "Ex d" versions in the following zones provided that the corresponding requirements are met:

- With suitable thermowell and connection head in Zone 1 / 0 (separation of zones, so measuring inset in Zone 0)
- With connection head but without thermowell in Zone 1

These thermometers hold EC type-examination certificate PTB 99 ATEX 1144 with Ex designation II 1/2 G Ex d IIC T1 ... T6.

#### Temperature ranges:

Maximum permissible ambient temperature: -40 ... 60 °C

Maximum permissible temperature in connection head:

Temperature class	Without transmitter	With transmitter
T1 ... T4	125 °C	85 °C
T5	90 °C	82 °C
T6	75 °C	67 °C

#### 10.3.1 Thermal data

	Approved ambient temperature at connection head	Approved process temperature at thermowell	Maximum temperature at the process connection on the connection head side	Maximum surface temperature at the connection head	Maximum surface temperature at the thermowell
Category 1D or Category 1/2 with intrinsically-safe transmitter installed	-40 ... 85 °C (-40 ... 185 °F)	-40 ... 85 °C -40 ... 200 °C <sup>1)</sup> -40 ... 300 °C <sup>1)</sup> -40 ... 400 °C <sup>1)</sup>	85 °C 164 °C 251 °C 346 °C	120 °C	133 °C 200 °C 300 °C 400 °C
Category 1D or Category 1/2 with fuse protection of installed transmitter by means of external IEC fuse	-40 ... 85 °C (-40 ... 185 °F)	-40 ... 85 °C -40 ... 200 °C <sup>1)</sup> -40 ... 300 °C <sup>1)</sup> -40 ... 400 °C <sup>1)</sup>	85 °C 164 °C 251 °C 346 °C	133 °C <sup>2)</sup> 150 °C <sup>3)</sup>	133 °C 200 °C 300 °C 400 °C
Category 1D or Category 1/2D Measurement circuit intrinsically-safe transmitter external or non-intrinsically-safe via external IEC fuse in the power feed circuit of the external transmitter	-40 ... 85 °C -40 ... 120 °C -40 ... 120 °C -40 ... 120 °C	-40 ... 85 °C -40 ... 200 °C -40 ... 300 °C -40 ... 400 °C	85 °C 200 °C 251 °C 346 °C	85 °C 200 °C 200 °C 200 °C	133 °C 200 °C 300 °C 400 °C

1) The user must take suitable measures to ensure that the maximum permissible ambient temperature of 85 °C (185 °F) at the connection head is not exceeded.

2) Fitted with a transmitter with and without display.

3) Fitted with two transmitters.

Maximum permissible media temperature:

Temperature class	Use in Zone 0	Use in Zone 1
T1	358 °C	438 °C
T2	238 °C	288 °C
T3	158 °C	193 °C
T4	106 °C	128 °C
T5	78 °C	93 °C
T6	66 °C	78 °C

### 10.3 Dust ignition protection (enclosure)

The power feed can come from a power supply with intrinsically-safe output circuit of protection type "EEx ia IIB" or "EEx ia IIC", or can be non intrinsically safe. In the case of a non-intrinsically-safe power feed, the current is limited by an upstream fuse conforming to IEC 127 with a fuse nominal current of 32 mA.

Highest value for connection to an intrinsically-safe power supply unit of protection type "Ex ia IIB / IIC":



#### Important



When using two transmitters and / or measuring insets, the sum of the voltages, currents, and outputs must not exceed the values specified in the EC type-examination certificate.

**11 Appendix**

**11.1 Other applicable documents**

- Data sheet (DS/TSP1X1)
- Data sheet (DS/TSP3X1)
- Data sheet (DS/TSA101)
- Commissioning instructions (CI/TSP)
- SIL safety manual for SensyTemp TSP (SM/TSP/SIL)
- Safety specifications for cable glands (42/10-57-XU)
- TTH300 operating instructions (OI/TTH300)
- TTH200 operating instructions (OI/TTH200)

**11.2 Approvals and certifications**

CE mark		The version of the meter in your possession meets the requirements of the following European directives: <ul style="list-style-type: none"> <li>- EMC directive 2004/108/EC</li> <li>- ATEX directive 94/9/EC</li> </ul>
Explosion Protection		Identification for intended use in potentially explosive atmospheres according to: <ul style="list-style-type: none"> <li>- ATEX directive (marking in addition to CE marking)</li> </ul>



**Important**

All documentation, declarations of conformity, and certificates are available in ABB's download area.

[www.abb.com/temperature](http://www.abb.com/temperature)



12 - 2009

## EG-Konformitätserklärung EC-Certificate of Compliance

ABB Automation Products GmbH  
Borsigstr. 2  
D-63755 Alzenau  
Germany

Erklärt, dass die Produkte der  
Geräteart:

*Declare that the products of device type:*

Temperaturfühler SensyTemp  
Temperature Sensor SensyTemp

Modell- / Typebezeichnung:  
*Model- / type name:*

TSP111, TSP121, TSP131  
TSP311, TSP321, TSP331

Produktnummer:  
*Product number:*

TSP111-..., TSP121-..., TSP131-...,  
TSP311-..., TSP321-..., TSP331-...,

Konform zu den EG-Richtlinien ist:  
*Conform to EC-directives:*

94/9/EG ( ATEX )  
2004/108/EG ( EMV/EMC )

EG-Baumusterprüfbescheinigung:  
*EC-Type examination certificate:*

PTB 01 ATEX 2200 X  
PTB 99 ATEX 1144  
BVS 06 ATEX E 029  
PTB 99 ATEX 2053 X  
PTB 03 ATEX 2083 X  
PTB 99 ATEX 2139 X  
PTB 05 ATEX 2017 X  
PTB 09 ATEX 2016 X  
DMT 02 ATEX E 068 X  
ZELM 99 ATEX 0021  
PTB 05 ATEX 2079 X

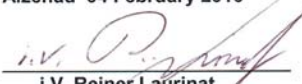
Relevante Normen:  
*Related Standards:*

EN 61326-1:2006  
EN 60079-0: 2006; EN 61241-0: 2006  
EN 60079-11: 2007, EN 61241-1: 2004  
EN 60079-1:2007

Anerkennung Qualitätssicherung  
Produktion :  
*Production Quality notification:*

PTB 99 ATEX -Q004-...

Alzenau 04 February 2010

  
i.V. Reiner Laurinat  
Leiter Qualitätsmanagement  
Quality Manager


  
i.A. Harald Müller  
Leiter Hardwareentwicklung  
R&D Manager Hardware

ABB Automation Products GmbH

**Statement on the contamination of devices and components**

Repair and / or maintenance work will only be performed on devices and components if a statement form has been completed and submitted.

Otherwise, the device / component returned may be rejected. This statement form may only be completed and signed by authorized specialist personnel employed by the operator.

**Customer details:**

Company: \_\_\_\_\_

Address: \_\_\_\_\_

Contact person: \_\_\_\_\_

Telephone: \_\_\_\_\_

Fax: \_\_\_\_\_

E-mail: \_\_\_\_\_

**Device details:**

Type: \_\_\_\_\_

Serial no.: \_\_\_\_\_

Reason for the return/description of the defect: \_\_\_\_\_

**Was this device used in conjunction with substances which pose a threat or risk to health?** Yes       No

If yes, which type of contamination (please place an X next to the applicable items)?

Biological          Corrosive / irritating          Combustible (highly / extremely combustible)    Toxic          Explosive          Other toxic substances    Radioactive    

Which substances have come into contact with the device?

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

We hereby state that the devices / components shipped have been cleaned and are free from any dangerous or poisonous substances.

\_\_\_\_\_  
Town/city, date\_\_\_\_\_  
Signature and company stamp

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**ABB Limited**

Salterbeck Trading Estate  
Workington, Cumbria  
CA14 5DS  
UK  
Tel: +44 (0)1946 830 611  
Fax: +44 (0)1946 832 661

**ABB Inc.**

125 E. County Line Road  
Warminster, PA 18974  
USA  
Tel: +1 215 674 6000  
Fax: +1 215 674 7183

**ABB Automation Products GmbH**

Borsigstr. 2  
63755 Alzenau  
Germany  
Tel: +49 551 905-534  
Fax: +49 551 905-555