



Straight thermocouples

SensyTemp TSH200

Operating Instructions

OI/TSH200-EN

11.2007

Manufacturer:

ABB Automation Products GmbH

Borsigstraße 2
63755 Alzenau
Germany
Tel.: +49 551 905-534
Fax: +49 551 905-555
CCC-support.deapr@de.abb.com

© Copyright 2007 by ABB Automation Products GmbH
Subject to change without notice

This document is protected by copyright. It assists the user with the safe and efficient operation of the device. The contents may not be copied or reproduced in whole or in excerpts without prior approval of the copyright holder.

1	Safety	5
1.1	General Safety Information	5
1.2	Intended use	5
1.3	Technical limits	6
1.4	Warranty provision	6
1.5	Labels and symbols	6
1.5.1	Symbols and warnings	6
1.5.2	Device label / Name plate	7
1.6	Operator liability	8
1.7	Personnel qualification	8
1.8	Information on unpacking the units	8
1.9	Storage conditions	8
1.10	Installation safety information	9
1.11	Electrical installation safety information	9
1.12	Operating safety information	9
1.13	Safety information on deinstallation	9
1.13.1	RoHS directive 2002/95/EC	10
1.14	Returning devices	10
1.15	Disposal	10
1.15.1	Information on WEEE directive 2002/96/EC (Waste Electrical and Electronic Equipment)	10
1.16	Transport safety information	11
1.17	Safety information for maintenance and inspection	11
2	Design and function	12
2.1	Temperature sensor design	12
2.2	Function	12
3	Use in safety-related systems acc. to IEC61508 / IEC61511 (SIL)	13
4	Installation / Deinstallation	13
4.1	General	13
4.2	Installation of ceramic protective fittings in equipment under operating temperature	14
4.3	Gas-tightness	14
4.4	Cable glands	14
4.4.1	Requirements for achieving the protection class	14
4.5	Disassembly	15
5	Electrical connection	16
5.1	General	16
5.1.1	Cables and wires	16
5.1.2	EMC suitable cabling	16
5.1.3	Terminal connection	17
5.1.4	Connection types	17

Contents

5.2	Operation in intrinsically safe circuits	17
5.3	Connection diagrams for thermocouples	18
5.3.1	SensyTemp TSH210 temperature sensor	18
5.3.2	SensyTemp TSH220 temperature sensor	19
5.3.3	SensyTemp TSH250 temperature sensor	20
5.4	Temperature sensor connection with transmitter	21
6	Startup Operation	21
7	Maintenance / Repair	22
7.1	Long-term stability / Recalibration	22
8	Troubleshooting	22
8.1	Quick test	22
8.2	Error table	23
8.3	Specific errors with thermocouples	25
9	Technical data	26
9.1	Vibration resistance	26
9.2	Ambient temperature at connection head	26
10	Appendix	27
10.1	Permits and certifications	27
10.2	Additional documents	28
10.3	Supplementary documents	28
11	Index	30

1 Safety

Read these operating instructions carefully prior to installing and commissioning the device.

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 in case specific problems occur that are not discussed adequately in these instructions, contact the manufacturer. In addition, we declare that the contents of these instructions are not part of any prior or existing agreements, commitments or legal relationships or are intended to amend these.

All obligations of ABB Automation Products GmbH are created by the relevant sales agreement, which contains the complete and solely binding warranty regulations. These contractual warranty provisions are neither extended nor limited by compliance with this manual.

1.1 General Safety Information

The “Safety” chapter provides an overview of the safety aspects to be observed for the operation of the device.

The device is built based on state-of-the-art technology and is operationally safe. It was tested and left the factory in a proper state. The requirements in the manual as well as the documentation and certificates must be observed and followed in order to maintain this state for the period of operation.

The general safety requirements must be complied with completely during operation of the device. In addition to the general information, the individual chapters of the manual contain descriptions about processes or procedural instructions with specific safety information.

Only the observance of all safety information enables the optimal protection of personnel as well as the environment from hazards and the safe and trouble-free operation of the device.

1.2 Intended use

The temperature sensors are used for measuring tactile temperature in high-temperature applications.

Repairs, alterations and enhancements or the installation of replacement parts is only permissible as far as described in the manual. Further actions must be verified with ABB Automation Products GmbH. Excluded from this are repairs performed by ABB-authorized specialist shops.

1.3 Technical limits

The device is designed for use exclusively within the stated values on the name plate and in the technical specifications (see "Technical Specifications" chapter and data sheet). These must be complied with accordingly, e.g.:

- The maximum operating temperature may not be exceeded.
- The permitted operating temperature may not be exceeded.
- The housing protection system must be observed.

1.4 Warranty provision

A use contrary to the device's stipulated use, disregarding of this manual, the use of under-qualified personnel as well as unauthorized alterations excludes the manufacturer of liability from any resulting damages. The manufacturer's warranty expires.

1.5 Labels and symbols

1.5.1 Symbols and warnings

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

One of these symbols in conjunction with the "Danger" warning indicates an imminent danger. If it is not avoided, death or serious injury will result.

**Warning – <Bodily injury>**

The symbol in conjunction with the "Warning" message indicates a possibly dangerous situation. If it is not avoided, death or serious injury could result.

**Caution – <Slight injuries>**

The symbol in conjunction with the "Caution" message indicates a possibly dangerous situation. If it is not avoided, slight or minor injury can result. May also be used for property damage warnings.

**Notice – <Property damage>!**

The symbol indicates a possibly damaging situation. If it is not avoided, the product or something in its area can be damaged.

**Important**

The symbol indicates operator tips or especially useful information. This is not a message for a dangerous or damaging situation.

1.5.2 Device label / Name plate

Temperature sensors in the TSH series are labeled with the following plates:

- 1. Name plate: Contains information about the model, manufacturer, order code, serial number, year and country of manufacture.
- 2. Approval plate (optional): Contains the most important information for the relevant approval, e.g., approval number, model per approval and, if necessary, the number of the manufacturer's declaration.
- 3. Special data plate (if necessary): Contains customer-specific information.



Information about the approval plate

When a product name changes, the model name on the approval plate might not match the name on the model plate; the approval also has to be updated based on the new model name. The design of the devices does not change with respect to the approval. When the approval is renewed or modified, the new name is added.

The tag number plates for temperature sensors in the TSH series are typically located on the underside of the connection head.

1.5.2.1 TSH name plate

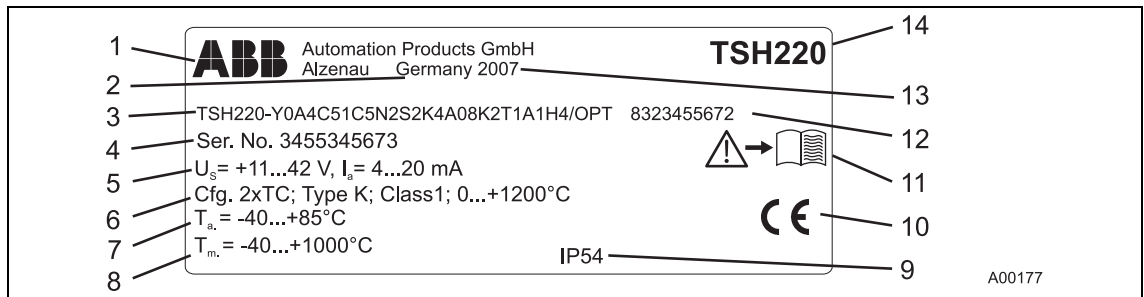


Fig. 1

- | | |
|------------------------|-----------------------------------------|
| 1 Manufacturer | 8 Max. operating temperature |
| 2 Country | 9 Protection class |
| 3 Order code | 10 CE mark (EC conformity) |
| 4 Serial number | 11 Note: Refer to product documentation |
| 5 Technical data | 12 ABB Order number |
| 6 Sensor configuration | 13 Year of manufacture |
| 7 Temperature range | 14 Model name |

1.6 Operator liability

Before the use of corrosive and abrasive measuring medium, the operator must clarify the resistance of all parts that come into contact with the medium to be measured. ABB will gladly support you with the selection, however, cannot accept any liability.

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

1.7 Personnel qualification

The installation, commissioning and maintenance of the device may only be carried out through trained specialist personell authorized by the plant operator. The specialist personnel must have read and understood the manual and comply with its instructions.

1.8 Information on unpacking the units

To prevent damage use the utmost care when unpacking the devices.

Check the package and packing material for accessories.

Check the devices immediately after unpacking 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 claimed without delay against the shipper and before the installation. Damaged devices may not be put into operation.

Ceramic thermowells are very fragile. Use the utmost care when unpacking and handling them. Avoid any impact or pulses. For thermometers with flanges, remove the transport lock according to the accompanying unpacking instructions.

1.9 Storage conditions

The units must be stored in dry and dust-free conditions.

The storage temperature should be between -20°C (-4°F) and 70°C (158°F).

The storage time is basically indefinite, however, the warranty conditions stipulated in the order confirmation of the supplier are valid.

After longer periods of storage, check the seals and replace, if necessary, prior to use.

1.10 Installation safety information

Observe the following information:

- Comply with the maximum torque for all flange connections.
- Install the devices without mechanical tension (torsion, bending).
- Install flange devices with coplanar counter flanges.
- Only install devices for the intended operating conditions and with suitable seals.
- Secure the flange bolts and nuts for pipeline vibrations.

1.11 Electrical installation safety information

The electrical connection may only be performed by authorized specialist personnel according to the electrical plans.

Comply with electrical connection information in the manual. Otherwise, the electrical protection class can be affected.

The secure separation of contact-dangerous electrical circuits is only guaranteed when the connected devices fulfill the requirements of the DIN EN 61140 (VDE 0140 Part 1) (basic requirements for secure separation).

For secure separation, run the supply lines separated from contact-dangerous electrical circuits or additionally insulate them.

1.12 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.

1.13 Safety information on deinstallation



Warning - General hazards!

Prior to deinstalling or disassembling the device, check for hazardous process conditions such as pressure, high temperatures, aggressive or toxic media, etc.

Read the instructions in the sections “Safety information” and “Electrical connection,” and perform the specified steps in reverse order.

1.13.1 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 to 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 a specific amount 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 to you 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, these substances will no longer be used in new product development.

1.14 Returning devices

Use the original packaging or a suitably secure packaging for returning the device for repair or for recalibration. Include the properly filled out return form (see attachment) 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 its shipping:

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

1.15 Disposal

ABB Automation Products GmbH actively promotes environmental consciousness and has an operational management system in accordance with DIN EN ISO 9001:2000, EN ISO 14001:2004 and OHSAS 18001. Our products and solutions should have minimum impact on the environment and persons during manufacture, storage, transport, use and disposal.

This includes the environmentally friendly use of natural resources. Through its publications ABB conducts an open dialog with the public.

This product/solution is manufactured from materials that can be reused by specialized recycling companies.

1.15.1 Information on WEEE directive 2002/96/EC (Waste Electrical and Electronic Equipment)

This product/solution is not subject to the WEEE directive 2002/96/EC and relevant national laws (e.g., ElektroG in Germany).

Dispose of the product/solution directly in a specialized recycling facility and do not use the municipal garbage. Only privately used products may be disposed of in the municipal garbage according to the WEEE directive 2002/96/EC. 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.

1.16 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.
- Ceramic thermowells are very fragile and require the utmost care during handling, transport and packaging.

1.17 Safety information for maintenance and inspection

**Warning – Risk to persons!**

When the housing cover is open, EMC and protection against contact are suspended. There are electric circuits within the housing which pose a contact risk. The auxiliary power must be switched off before opening the housing cover.

**Warning – Risk to persons!**

The inspection screw (for draining condensate fluid) for devices \geq DN 450 can be under pressure. The fluid that squirts out can cause severe injuries. Depressurize pipes before opening the inspection screw.

Corrective maintenance work may only be performed by trained personnel.

- Depressurize the device and adjoining lines or containers before removing the device.
- Check whether hazardous materials are used as materials to be measured before opening the device. Residual amounts of hazardous material may still be present in the device and could escape when the device is opened.
- As far as provided in the scope of the operational responsibility, check the following items through a regular inspection:
 - the pressure-carrying walls / lining of the pressure device
 - the measurement-related function
 - the leak tightness
 - the wear (corrosion)

2 Design and function

2.1 Temperature sensor design

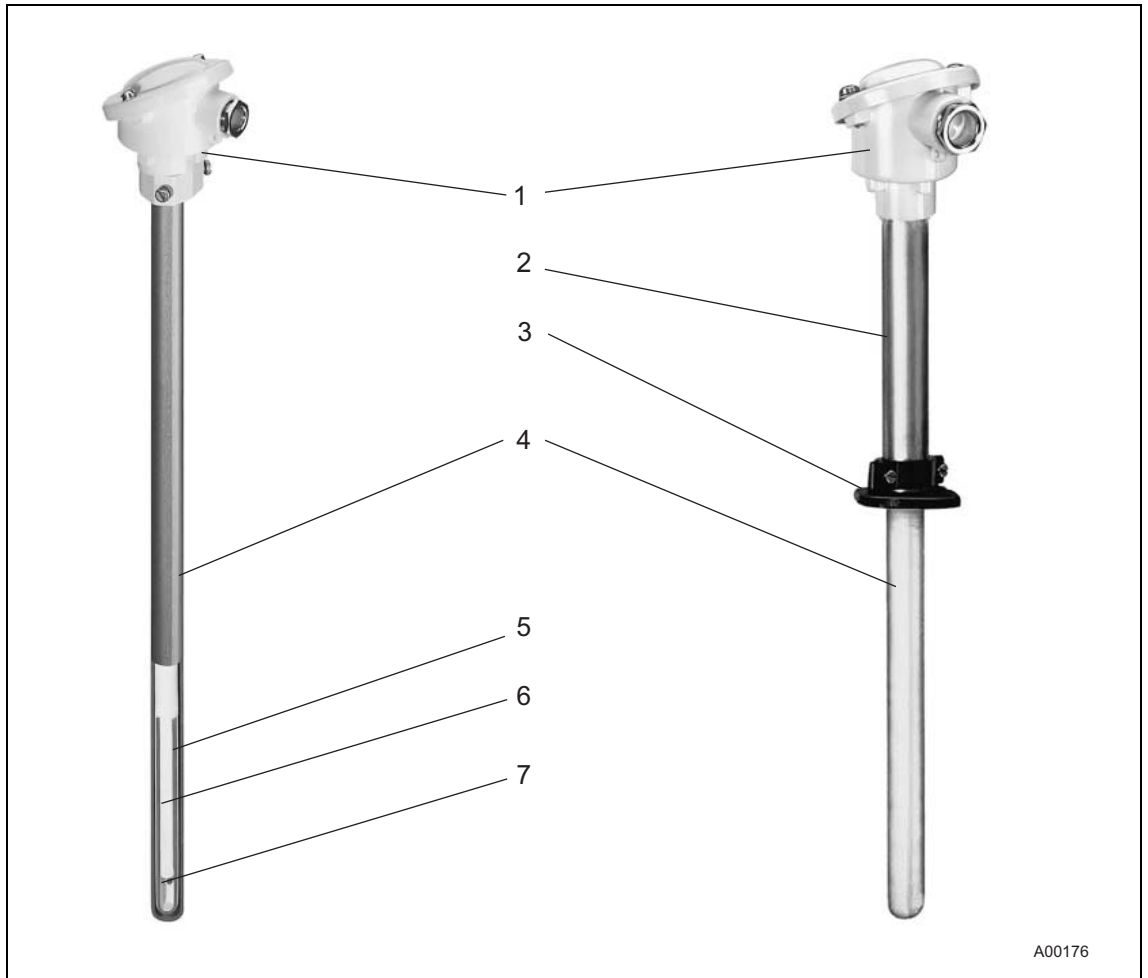


Fig. 2

- | | |
|-----------------------------------------------------------|------------------|
| 1 Connection head, if necessary, with mounted transmitter | 4 Thermowell |
| 2 Support tube (TSH220 / TSH250 only) | 5 Inner tube |
| 3 Process connection | 6 Insulation rod |
| | 7 Thermocouple |

2.2 Function

Temperature sensors in the SensyTemp TSH series are used to measure temperatures in high-temperature applications (e.g., flue gases).

Temperature sensors are available with or without integrated transmitter. The transmitter built into the connection head measures the thermovoltage of the measuring unit and converts it into an output signal (4 ... 20 mA, HART, PROFIBUS or FOUNDATION fieldbus). This signal is conducted via the connection cable to the process control.

For functional descriptions of the various transmitters, refer to the relevant data sheets and operating instructions.

3 Use in safety-related systems acc. to IEC61508 / IEC61511 (SIL)

Temperature sensors in the SensyTemp TSH series can be used with integrated SIL-certified transmitters acc. to IEC61508 / IEC61511 in safety-related systems. Before commissioning the device read the SIL safety information for the relevant transmitter.

4 Installation / Deinstallation

4.1 General



Caution – Cancellation of the IP protection class!

Damage to components such as housing, threads, cable glands or seals, cancels the IP protection class of the temperature sensor.

Install connection lines, terminal block and connection points properly. When replacing cable glands, make sure the replacement parts correspond to the IP protection class.

- The temperature sensors must be brought into the best possible contact with the medium to be measured.
- The connection lines must be firmly connected with the connection terminals.
- Observe the correct polarity for thermocouples.
- When installing temperature sensors in existing thermowells, make sure that the temperature sensor can be moved slightly. If this is not the case, the inside of the thermowell must be cleaned.
- This also applies to the installation of interchangeable measuring units. Only ABB original parts may be installed in ABB temperature sensors.
- The temperature sensor must be firmly and securely installed according to the application process.
- Observe the specified circuit type.
- After clamping the connection lines using a suitable tool (screwdriver, wrench), ensure that the connection heads are securely closed and sealed. Be sure to observe here that the sealing rings of the connection head are clean and undamaged.
- The seals selected must meet the requirements. Make sure the seals are fitted properly.
- Tighten flange screws in a crosswise manner.



Important

At high temperatures, we recommend installing temperature sensors in vertical position to protect against bending and mechanical damage to the thermowell.

If the sensor has to be installed in a horizontal position, ensure that the thermowell is supported.

4.2 Installation of ceramic protective fittings in equipment under operating temperature

Ceramics are characterized by their hardness and brittleness. When ceramic material is exposed to temperature shocks, it can crack due to internal stresses in its grain structure. For this reason, temperature sensors with ceramic protective fittings may only be introduced gradually into the process:

Process temperature 1600 °C -> Slide-in rate 1-2 cm/min

Process temperature 1200 °C -> Slide-in rate 10-20 cm/min

4.3 Gas-tightness

Gas-tight ceramic materials are typically only resistant to temperature changes on a limited basis. To reduce the risk of temperature shock and prevent the thermowell from subsequently bursting, temperature sensors with gas-tight ceramic thermowells must be heated before installation.

High temperature sensors are generally designed for use in pressureless processes.

When mounting the temperature sensor using stop flanges and counter flanges, a pressure of up to approx. 1 bar (14.50 psi) of gas-tightness can be expected with proper installation. Refer to EN 50446:2006.

4.4 Cable glands

In practice the protection class might not actually be achieved due to the interaction of the cable gland with specific cables and wires. In such cases, the deviations from the inspection conditions are too far beyond the standard (e.g., cable is not circular, cable is twisted, cable is too soft overall and does not provide sufficiently high and long-lasting elastic resistance, cable has a different surface roughness, etc.).

4.4.1 Requirements for achieving the protection class

- Cable glands may only be used in the specified clamping area (cable diameter must match the cable gland).
- When using very soft cable types do not use them in the low clamping area.
- Use only round cables (if necessary, slightly oval cross-section).
- Frequent opening/closing is possible but may have a negative effect on the protection class.
- For cables with pronounced cold flow behavior, the cable gland has to be retightened.



Important

The protection class is not guaranteed for armored cable (wire mesh).

4.5 Disassembly

**Warning - Risk of burns!**

Risk of burns caused by leaking dangerous media when disassembling.

Before disassembling the complete temperature sensor, switch off the process and allow the pipe (containers, etc.) with the temperature sensor to cool off. This also applies when disassembling the measuring inset (insulation rod), if the inset is integrated in the process without a thermowell.

- The feed lines must be separated before deinstallation of the temperature sensor. Implement appropriate measures to protect against an unintentional switching on of opened apparatuses.
- The part or apparatus of the system in which the deinstallation is to take place must be shut down. Ensure that no dangerous media can leak out and that no pressure is present.
- Comply with the relevant safety and accident prevention regulations. In the area of the Federal Republic of Germany, the operational safety regulations (BetrSichV) must be observed.
- When deinstalling measuring insets (insulation rods), make sure that you pull these gently from the protective fitting.

**Caution - Potential damage to parts!**

The connecting cable and housing must not be damaged during deinstallation.
Replace damaged parts.

5 Electrical connection

5.1 General

Observe the corresponding instructions for the electrical installation. Only connect in dead-voltage state!

Since the sensor and transmitter have no switch-off elements, overvoltage protection devices, lightning protection or voltage separation capacity must be provided on the plant side.

The following applies to devices with a transmitter: Energy supply and signal are routed in the same line and are to be implemented as SELV or PELV circuit according to norm (standard version).

It must be checked whether the existing power supply corresponds with the specifications on the model plate and in the technical specifications (see "Technical Specifications" chapter or data sheet).



Important

The electrical connection is carried out with the temperature sensor/transmitter in the installed state.

The signal cable wires must be provided with wire end sleeves.

The maximum connectable conductor cross-section amounts to 1.5 mm² (AWG15). The cross-head screws of the connection terminals are tightened with a size 1 screwdriver (3.5 mm or 4 mm). Observe the diameter of the selected cable fitting. (See the "Installation" chapter).

5.1.1 Cables and wires

- Only use insulated cables and wires whose tested voltage between wire - ground, wire - shielding, and shielding - ground amounts to at least 500 V AC.
- Fit cables and wires with end sleeves.
- The cables used must fulfill the valid requirements with regards to strength and temperature for the particular application case.
- The electrical connection wires must be run so that mechanical damage is impossible.
- For the use of PROFIBUS, the running of the wires is performed according to EN 50 170 for PROFIBUS PA.
- For the use of FOUNDATION Fieldbus the running of the wires is performed according to IEC61158.

5.1.2 EMC suitable cabling

The power supply of the transmitter occurs via the signal cable. A shielding of the cable is not mandatory for analog transmitters, however, shielded and twisted wires achieve the best results. Unshielded cables may not be run in the area of strong electrical fields.

For fieldbus applications (PROFIBUS PA, FOUNDATION Fieldbus), the corresponding instrumentation guidelines for an EMC suitable cabling must be taken into account (e.g., PROFIBUS PA instrumentation guidelines from the PNO).

5.1.3 Terminal connection

1. The power supply should be securely switched off when making electrical connections.
2. Open the connection head. Observe the cool down time!
3. Connect the positive wire with the terminal on the transmitter labeled with the "+" and the negative wire with the terminal labeled with the "-". The use of terminal ends (lugs) is recommended.
4. Establish a ground connection, if necessary.
5. The screws must be tight and a good contact must be ensured.
6. The connection head must be tightly closed (see the "Installation" chapter).

5.1.4 Connection types

Thermocouples can be used as single or double thermocouples.

Only certified transmitters with the maximum values specified in the operating instructions may be connected to the temperature sensors.

5.2 Operation in intrinsically safe circuits



Danger – Serious damage to health / risk to life

Use of temperature sensors without explosion protection in an explosive area can result in an explosion.

Temperature sensors in the SensyTemp TSH series may not be used in explosion-protection areas.

When operating a temperature sensor from the SensyTemp TSH series in an EEx ia/ib intrinsically safe circuit, the operators must comply with all regulations and technical data according to DIN EN 60079-14 (VDE 0165-1) para. 12.

Proof that the interconnection is intrinsically safe must be provided in accordance with DIN VDE 0165/08.98 (EN 60 079-14/1997 and IEC 60 079-14/1996). In general, intrinsically safe circuits require proof of interconnection. For proof of the intrinsic safety, the electrical limit values are to be used as the basis for the EC-Type-Examination Certificate and manufacturer's declarations for the apparatuses (devices), including capacitance and inductivity values of the wires. These requirements ensure that operation of a temperature sensor in the SensyTemp TSH series does not cancel the intrinsic safety of a circuit.

Temperature sensors in the SensyTemp TSH series that are intended for use in intrinsically safe circuits are delivered with a manufacturer's declaration. 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.



Important

Refer to the technical data for the transmitter used and the manufacturer's declaration for the sensor.



Important

When temperature sensors from the SensyTemp TSH series are used in with doubled measuring units in intrinsically safe circuits (2x thermocouples), only one measurement circuit can be connected.

Electrical connection

5.3 Connection diagrams for thermocouples

5.3.1 SensyTemp TSH210 temperature sensor

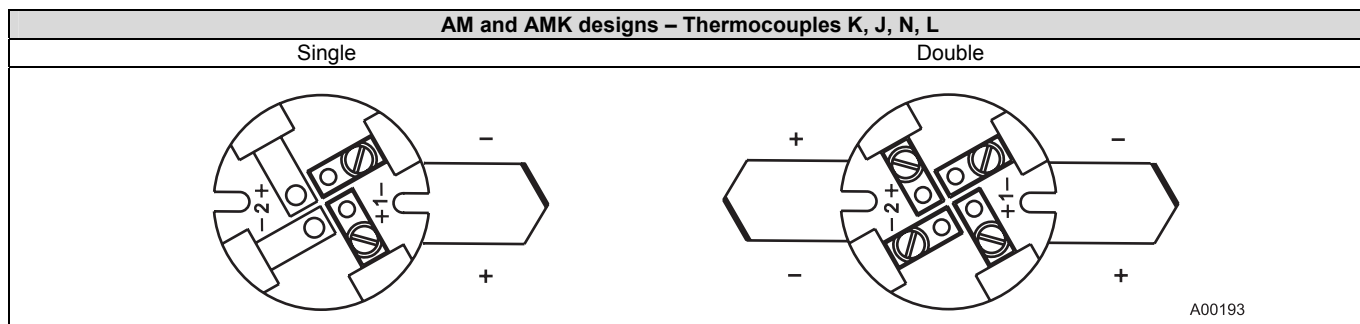


Fig. 3

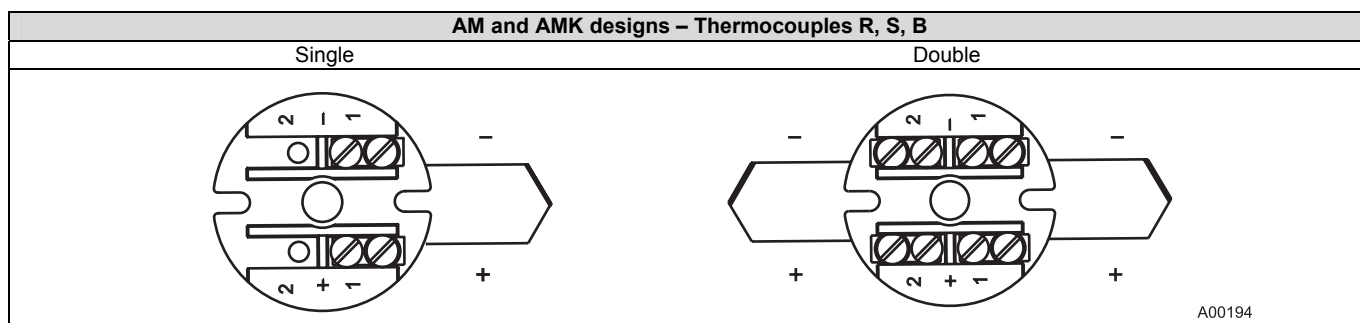


Fig. 4

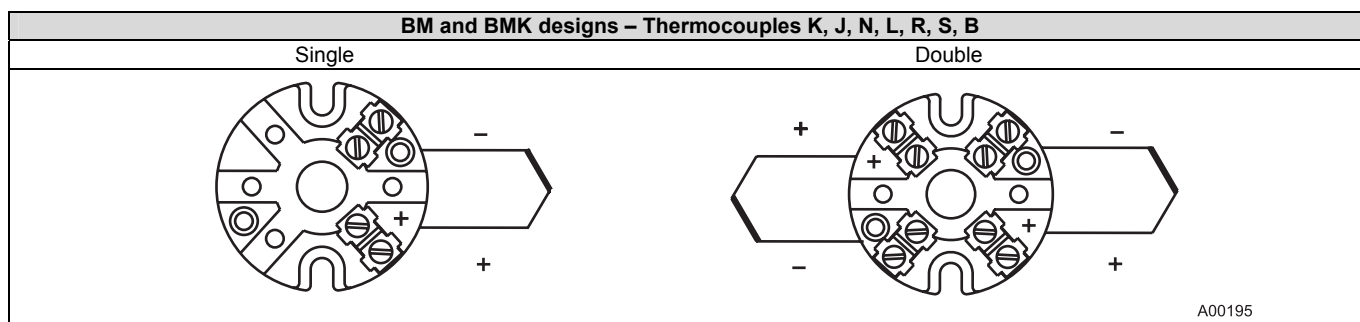


Fig. 5

5.3.2 SensyTemp TSH220 temperature sensor

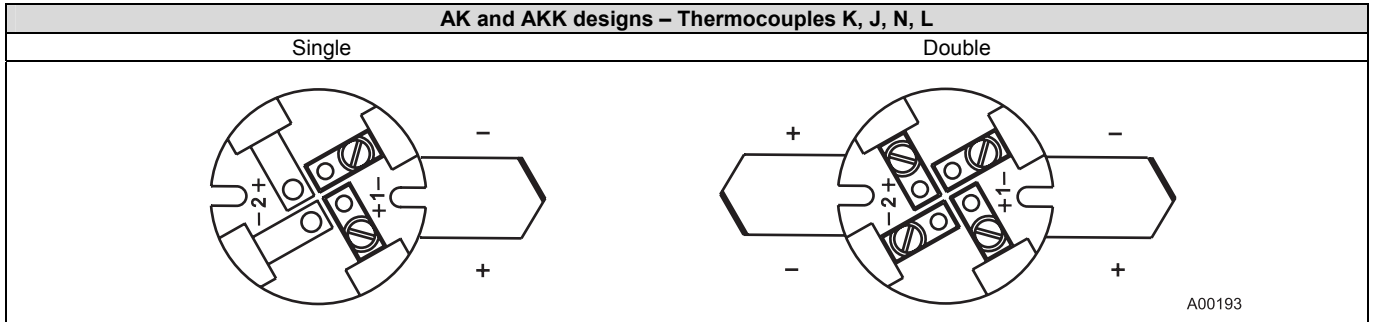


Fig. 6

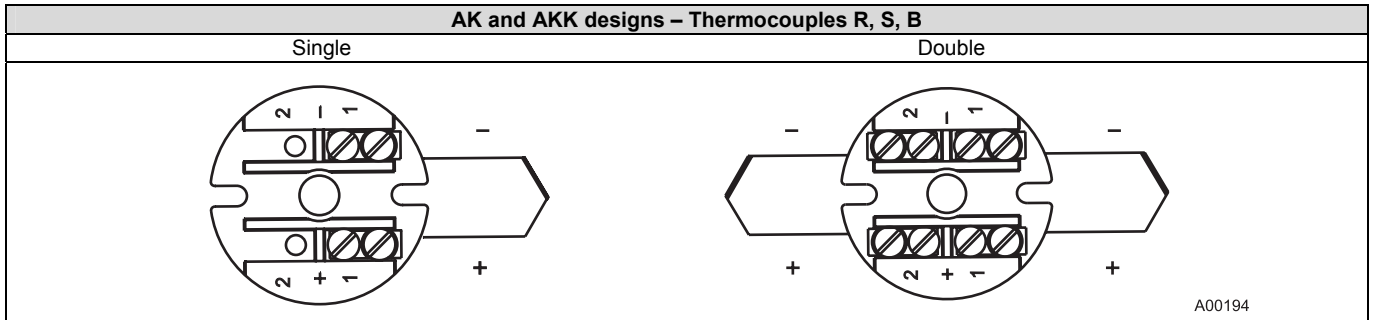


Fig. 7

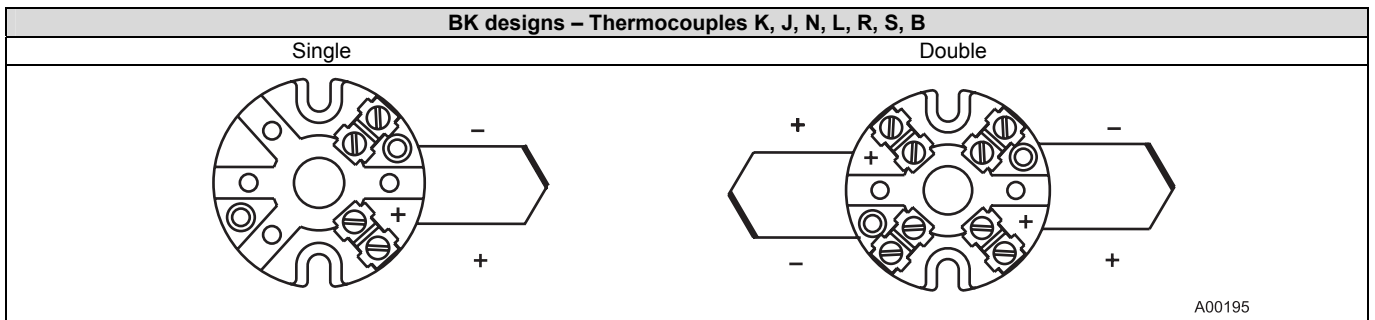


Fig. 8

Electrical connection

5.3.3 SensyTemp TSH250 temperature sensor

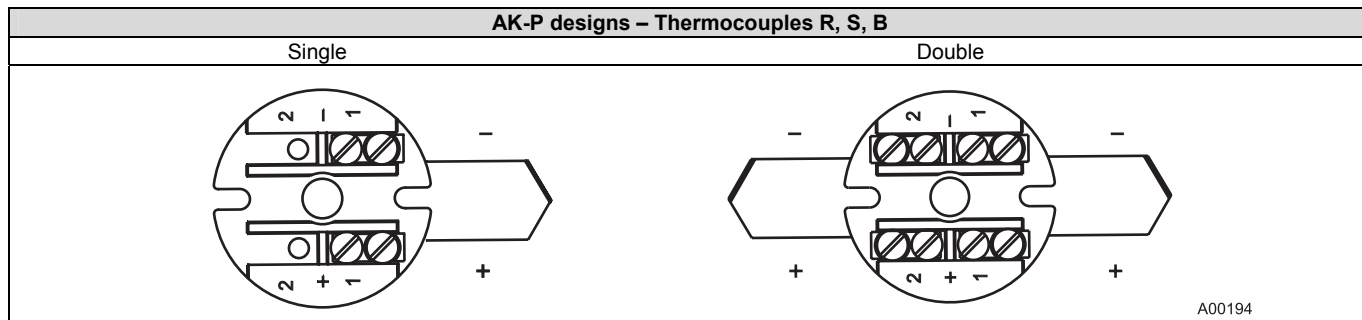


Fig. 9

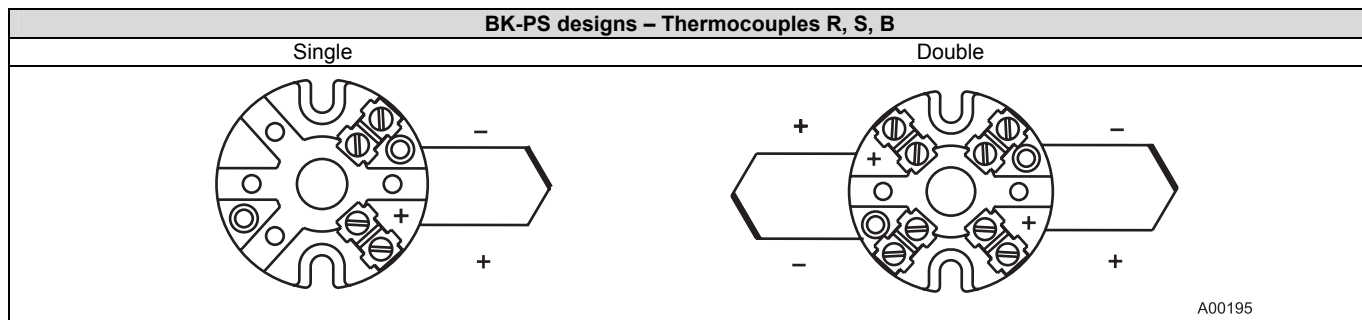


Fig. 10

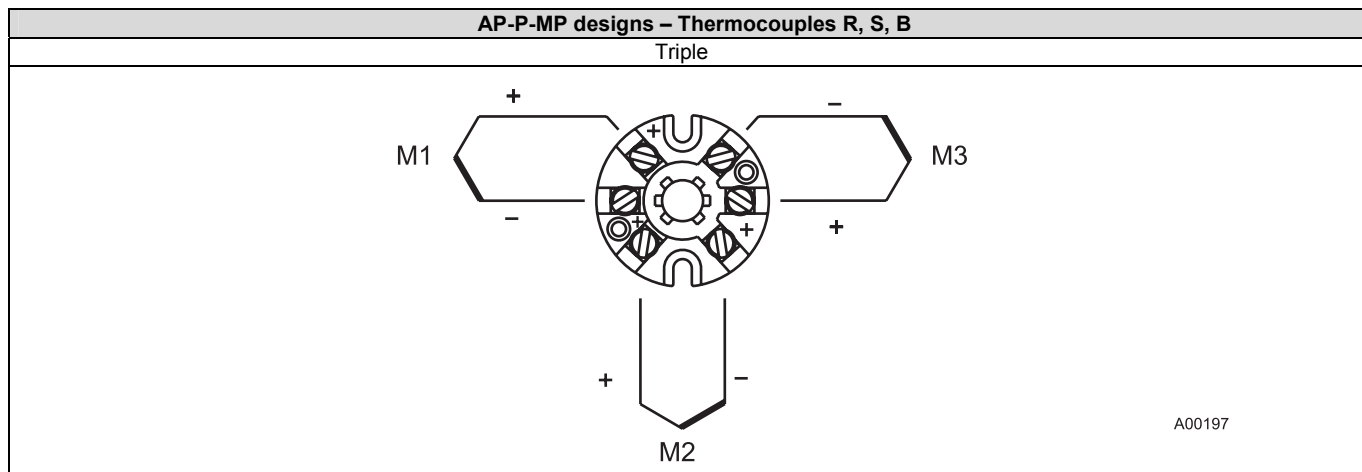


Fig. 11

5.4 Temperature sensor connection with transmitter

Observe the corresponding documents for the interconnection of transmitters and feed separators (Example, see TTH300 operating instructions; document name OI/TTH300).

Suggested installation PROFIBUS PA	See ABB documentation 10/63-0.40.
Suggested installation FOUNDATION Fieldbus	See ABB documentation 10/63-0.50.

The operating instructions for the selected transmitter are included in the delivery by ABB. This information is additionally available for download on the Internet at www.abb.com/temperature. The technical data of the selected transmitter must be complied with.

6 Startup Operation

The following must be checked before commissioning:

- The proper mounting and sealing of thermowells or protective sleeves
- The connection for the ground wire.
- The compliance of the electrical specifications with the specified values.
- The electrical connection and the installation must be performed according to the “Installation” and “Electrical connection” chapters.



Warning - General hazards!

The relevant safety and accident prevention regulations must be complied with.

- The associated technical documentation for the operation of transmitters and display units is to be observed. The technical documentation is also available on the Internet at www.abb.com/temperature.

7 Maintenance / Repair

The function of the temperature sensor must be regularly tested according to the process requirements, e.g., to check whether recalibration is required. Only ABB original parts may be used when replacing parts.

Service and maintenance activities may only be performed by qualified personnel. ABB service personnel can assist in maintenance and repair for a free.

7.1 Long-term stability / Recalibration

The long-term stability of the SensyTemp TSH temperature sensor and interchangeable measuring insets (insulation rods) depends largely on the operating conditions. It is not possible to make a general statement that applies to all use cases.

We recommend that you regularly recalibrate the measuring insets (insulation rods).

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

ABB offers its customers cost-effective and high-precision recalibration in our German Calibration Service (DKD) accredited lab in Alzenau.

8 Troubleshooting

8.1 Quick test

Perform quick tests of thermocouples as well as the associated measuring circuits in the uninstalled state.

Instruments required:

- Millivolt meter
- Resistance meter or resistance bridge
- Resistance meter with 60 ... 100 V voltage (all measurements at room temperature)

The following tests can be performed:

- Insulation at room temperature.
- Locate wire breaks by “knocking”.

A thermocouple is regarded as functioning correctly when $R < 20 \Omega$ (wire $> 0.5 \text{ mm } \emptyset$). The value depends on the wire cross section and the length. $R_{\text{isol}} = 100 \text{ M } \Omega$ (for insulated thermocouple).

- The heating of the thermocouples to approx. 200 °C to 400 °C (without temperature controls) allows for further conclusions to be drawn about interruptions, reversed polarity, too little insulation resistance, etc.



Important

The accuracy of temperature sensors according to the ISO 9000 requirements can only be checked by comparison with a reference element. In most cases, deinstallation and test in a test oven are necessary.

8.2 Error table

The complete temperature measurement circuit should be routinely tested. The following tables contain the most important errors with the possible causes and suggestions for their remedy.

Error	Source of Error	Error correction
Measurement signal fault	<ul style="list-style-type: none"> Electrical/magnetic interspersion 	<ul style="list-style-type: none"> Keep at least 0.5 m distance between the measurement wires and power cables, routed in parallel. Electrostatic shielding via on one point grounded foil/netting. Twisting of the wires (pairs) against magnetic interspersion. Right angle intersecting of measurement wires with interfering power cables. Use of transmitters.
	<ul style="list-style-type: none"> Ground loops 	<ul style="list-style-type: none"> Only one grounding point in measurement circuit or measurement system "floating" (not grounded).
	<ul style="list-style-type: none"> Decreasing of the insulation resistance 	<ul style="list-style-type: none"> Moisture has possibly penetrated into the thermometer or the measuring inset; dry if necessary and seal again. Replace measuring inset. Check whether the thermometer is thermally overloaded.

Error	Source of Error	Error correction
<p>Response times too long, faulty signals</p>	<ul style="list-style-type: none"> • Incorrect installation location: <ul style="list-style-type: none"> – In the flow shadow – In the influence of a heat source 	<ul style="list-style-type: none"> • Select installation location so that the medium can transfer its temperature undisturbed.
	<ul style="list-style-type: none"> • Improper installation method: <ul style="list-style-type: none"> – Insufficient installation depth – Too much heat dissipation 	<ul style="list-style-type: none"> • Installation depth approx. temperature sensitive length + 6 x d (fluids) to 10 x (gases) d (d = outer thermowell diameter). • Ensure thermal contacts, above all with surface measurements, through appropriate contact surfaces and/or thermal conducting material.
	<ul style="list-style-type: none"> • Thermowell too thick • Thermowell hole too large 	<ul style="list-style-type: none"> • Select the smallest thermowell possible for the process. • Response time as a first approximation proportional to the cross section or volume of the thermometer, depending on the thermal transition values and air gaps in the installation. The latter with contact agent.
	<ul style="list-style-type: none"> • Deposits on the thermowell 	<ul style="list-style-type: none"> • Remove during inspections. • If possible, select a different thermowell or another installation location.
<p>Interruptions in the thermometer</p>	<ul style="list-style-type: none"> • Vibrations 	<ul style="list-style-type: none"> • Enforced springs on the measuring inset. • Shortening of the installation length. • Relocation of the measuring location (if possible). • Special construction of measuring inset and thermowell.
<p>Heavily corroded thermowell</p>	<ul style="list-style-type: none"> • Composition of the medium not as assumed or has changed • Improper thermowell material selected 	<ul style="list-style-type: none"> • Check medium • Possibly analyze the defective thermowell and then select a more suitable material. • Use an additional surface protectant. • Under certain circumstances, the thermowell may have to be replaced regularly as a wear part.

8.3 Specific errors with thermocouples

Error description	Source of Error	Error correction
<p>Fluctuating temperature indication with otherwise trouble-free measurement circuit assembly of the thermocouple</p>	<ul style="list-style-type: none"> • Reference junctions - temperature or voltage not constant 	<ul style="list-style-type: none"> • Temperature or supply voltage must remain constant. <ul style="list-style-type: none"> – < 0.1% (check instruments). • With base metal thermocouples, taken with the entire value into the measurement, precious metal thermocouples with only approx. half of the value.
<p>Strong deviations of the temperature indicator from table values for thermocouples</p>	<ul style="list-style-type: none"> • Incorrect material combinations • Poor electrical contacts <ul style="list-style-type: none"> – Parasitic voltages (thermovoltages, galvanic voltages) • Incorrect compensating cable 	<ul style="list-style-type: none"> • Check thermocouples and cables for: <ul style="list-style-type: none"> – Correct pairing. – Correct compensating cable. – Correct polarity. • Approved ambient temperature at connection head.

9 Technical data



Important

For general technical data, refer to the data sheet.

9.1 Vibration resistance

Due to their high degree of hardness and associated brittleness, ceramic materials are very sensitive to pulse and impact loads. For this reason, avoid shocks during installation, storage, transport, etc.

9.2 Ambient temperature at connection head

Connection head without transmitter	-40 ... 150 °C (-40 ... 302 °F)
Connection head with transmitter	-40 ... 85 °C (-40 ... 185 °F)

In specific applications, high temperature sensors are frequently subjected to higher temperatures at the connection head. For this reason, ABB high temperature sensors in the SensyTemp TSH200 series are equipped with a silicon clamping ring instead of a rubber clamping ring at the cable entry (M20 x 1.5 thread) on the connection heads. This increases the permissible ambient temperature from 80 °C (176 °F) to 150 °C (302 °F).

10 Appendix

10.1 Permits and certifications

- EC declaration of conformity (CE):
- Manufacturer's declaration regarding intrinsically safe power supplies for TSH temperature sensors

In addition, observe the EC-Type-Examination Test Certificate of the installed transmitters.

ABB has a DKD-certified test laboratory for measuring:

- Quality characteristics
- Properties
- Specific values
- Specific requirements

Certificates and credentials according to EN 10204

- Calibration in the temperature range of $-35\text{ °C} \dots 1200\text{ °C}$ ($-31 \dots 2192\text{ °F}$)
- Calibration of temperature sensors also with connected transmitters
- Creation of individual basic value series and calculation of thermometer constants
- Securing and returning of the calibrated temperature measuring devices to national measurement standards according to EN 29000 (DIN ISO 9000)

The thermometers are subject to standard final check before shipping in order to ensure contract conformity.

The standard final checks contain the following tests:

- Insulation and thermocouple resistance test
- Visual inspection
- Dimension check
- Identification check



Important

All declarations of conformity and certificates are available as a separate document in the download area of ABB Automation Products GmbH.

www.abb.com/temperature

10.2 Additional documents

- Commissioning instructions (CI/TSH200)
- Data sheet SensyTemp TSH (DS/TSH200)
- Operating instructions of the installed transmitter (if ordered with transmitter)
- SIL safety handbook of the installed transmitter (if ordered with SIL-transmitter)

10.3 Supplementary documents

Temperature transmitter for sensor head mounting

- Data sheet TH01, TH01-Ex; 3KDE115080R10xx
- Data sheet TH02, TH02-Ex; 10/11-8.19
- Data sheet TF12, TF12-Ex; 10/11-8.26
- Data sheet TF02, TF02-Ex; 10/11-8.25
- Data sheet TTH300; DS/TTH300

Statement about the contamination of devices and components

The repair and/or maintenance of devices and components will only be performed when a completely filled out explanation is present.

Otherwise, the shipment can be rejected. This explanation may only be filled out and signed by authorized specialist personnel of 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 for working with substances which pose a threat or health risk?** 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 harmful substances radioactive

Which substances have had contact with the device?

1. _____

2. _____

3. _____

We hereby certify that the devices/parts shipped were cleaned and are free from any dangerous or poisonous materials.

City, Date_____
Signature and company stamp

11 Index

A	
Additional documents	29
Appendix	28
C	
Cable glands	14
Cables and wires	16
Connection diagrams for thermocouples	19
Connection types	17
D	
Design and function	12
Disassembly	15
Disposal	10
E	
Electrical installation safety information	9
EMC suitable cabling	16
F	
Functional safety (SIL)	13
G	
Gas-tightness	14
General Safety Information	5
I	
Information on unpacking the units	8
Installation / Deinstallation	13
Installation of ceramic protective fittings in systems under operating temperature	14
Installation safety information	9
Intended use	5
L	
Labels and symbols	6
Long-term stability / Recalibration	22
M	
Maintenance / Repair	22
Maintenance safety information	11
N	
Name plate	7
O	
Operating safety information	9
Operation in intrinsically safe circuits	17
Operator liability	8
P	
Permits and certifications	28
Personnel qualification	8
R	
Requirements for achieving the protection class	14
Returning devices	10
S	
Safety	5
Safety information on deinstallation	9
SIL (Functional safety)	13
Startup Operation	22
Storage conditions	8
Supplementary documents	29
Symbols and warnings	6
T	
Technical data	27
Technical limits	6
Temperature sensor connection	22
Temperature sensor design	12
Terminal connection	17
Transport safety information	11
Troubleshooting SIL (Functional safety)	23
U	
Use in safety-related systems acc. to IEC61508 / IEC61511 (SIL)	13
W	
Warranty provision	6
WEEE directive	10

ABB has Sales & Customer Support
expertise in over 100 countries worldwide.

www.abb.com/temperature

The Company's policy is one of continuous product
improvement and the right is reserved to modify the
information contained herein without notice.

Printed in the Fed. Rep. of Germany (11.2007)

© ABB 2007

3KXT141001R4201



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
CCC-support.deapr@de.abb.com