TTH200
Head-mount temperature transmitter

Temperature transmitter for HART protocol.
Suitable for all standard requirements

Measurement made easy

Introduction
The TTH200 with the 4 to 20 mA output and HART communications protocol has global approvals for explosion protection up to Zone 0. Safety-relevant applications up to SIL 3 (redundant) are supported in accordance with IEC 61508.
The TTH200 features a universal sensor input for resistance thermometer, thermocouples, resistance and voltage measurement.

Additional Information
Additional documentation on TTH200 is available for download free of charge at www.abb.com/temperature.
Alternatively simply scan this code:
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1 Safety

General information and instructions

These instructions are an important part of the product and must be retained for future reference. Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly. The specialist personnel must have read and understood the manual and must comply with its instructions.

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 nor an amendment to any previous or existing agreement, promise or legal relationship.

Modifications and repairs to the product may only be performed if expressly permitted by these instructions. Information and symbols on the product must be observed. These may not be removed and must be fully legible at all times. The operating company must strictly observe the applicable national regulations relating to the installation, function testing, repair and maintenance of electrical products.

Warnings

The warnings in these instructions are structured as follows:

⚠️ DANGER

The signal word ‘DANGER’ indicates an imminent danger. Failure to observe this information will result in death or severe injury.

⚠️ WARNING

The signal word ‘WARNING’ indicates an imminent danger. Failure to observe this information may result in death or severe injury.

⚠️ CAUTION

The signal word ‘CAUTION’ indicates an imminent danger. Failure to observe this information may result in minor or moderate injury.

NOTICE

The signal word ‘NOTICE’ indicates possible material damage.

Note

‘Note’ indicates useful or important information about the product.
... 1 Safety

Intended use
This device is intended for the following uses:
• To measure the temperature of fluid, pulpy or pasty substances and gases or resistance/voltage values.
The device has been designed for use exclusively within the technical limit values indicated on the name plate and in the data sheets.
• The maximum ambient temperature must not be exceeded.
• The IP rating of the housing must be observed during operation.
• For use in potentially explosive atmospheres, follow the associated guidelines.
• When using as a SIL-device in safety-relevant applications, the SIL Safety Manual should be observed.

Improper use
The following are considered to be instances of especially improper use of the device:
• Material application, for example by painting over the housing, name plate or welding/soldering on parts.
• Material removal, for example by spot drilling the housing.

Warranty provisions
Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, 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.

Notes on data safety
This product is designed to be connected to and to communicate information and data via a network interface. It is operator's sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be). Operator shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and / or theft of data or information.
ABB Automation Products GmbH and its affiliates are not liable for damages and / or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and / or theft of data or information.

Manufacturer's address
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Measurement & Analytics
Schillerstr. 72
32425 Minden
Germany
Tel: +49 571 830-0
Fax: +49 571 830-1806

Customer service center
Tel: +49 180 5 222 580
Email: automation.service@de.abb.com
2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Note
- Further information on the approval of devices for use in potentially explosive atmospheres can be found in the explosion protection test certificates (at www.abb.com/temperature).
- Depending on the design, a specific marking in accordance with ATEX or IECEx applies.

Ex marking

Transmitter
ATEX intrinsic safety
The device fulfills the requirements of Directive 2014/34/EU in case of corresponding purchase orders and is approved for use in Zone 0, 1 and 2.

<table>
<thead>
<tr>
<th>Model TTH200-E1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type Examination Test Certificate PTB 05 ATEX 2017 X</td>
</tr>
<tr>
<td>II 1 G Ex la IIC T6 Ga</td>
</tr>
<tr>
<td>II 2 (1) G Ex [la IIC Ga] lb IIC T6 Gb</td>
</tr>
<tr>
<td>II 2 G (1D) Ex [la III C Da] lb IIC T6 Gb</td>
</tr>
</tbody>
</table>

Non-sparking ATEX
The device fulfills the requirements of Directive 2014/34/EU in case of corresponding purchase orders and is approved for use in Zone 2.

<table>
<thead>
<tr>
<th>Model TTH200-E2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declaration of conformity</td>
</tr>
<tr>
<td>II 3 G Ex nA IIC T1-T6 Gc</td>
</tr>
</tbody>
</table>

IECEx intrinsic safety
Approved for use in Zone 0, 1, and 2.

<table>
<thead>
<tr>
<th>Model TTH200-H1</th>
</tr>
</thead>
<tbody>
<tr>
<td>IECEx certificate of conformity IECEx PTB 09.0014X</td>
</tr>
<tr>
<td>Ex la IIC T6...T1 Ga</td>
</tr>
<tr>
<td>Ex [la IIC Ga] lb IIC T6...T1 Gb</td>
</tr>
<tr>
<td>Ex [la III C Da] lb IIC T6...T1 Gb</td>
</tr>
</tbody>
</table>

LCD indicator
ATEX intrinsic safety
The device fulfills the requirements of Directive 2014/34/EU in case of corresponding purchase orders and is approved for use in Zone 0, 1 and 2.

| Type Examination Test Certificate PTB 05 ATEX 2079 X |
| II 1G Ex la IIC T6 Ga |

Non-sparking ATEX
The device fulfills the requirements of Directive 2014/34/EU in case of corresponding purchase orders and is approved for use in Zone 2.

| Declaration of conformity |
| II 3 G Ex nA IIC T1-T6 Gc |

IECEx intrinsic safety
Approved for use in Zone 0, 1, and 2.

| IECEx certificate of conformity IECEx PTB 12.0028X |
| Ex la IIC T6 |
... 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Temperature data

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>ATEX / IECEx intrinsic safety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Device category 1 use</td>
<td>Device category 2 / 3 use</td>
</tr>
<tr>
<td>T6</td>
<td>−40 to 44 °C (−40 to 111.2 °F)</td>
<td>−40 to 56 °C (−40 to 132.8 °F)</td>
</tr>
<tr>
<td>T4-T1</td>
<td>−40 to 60 °C (−40 to 140.0 °F)</td>
<td>−40 to 85 °C (−40 to 185.0 °F)</td>
</tr>
</tbody>
</table>

ATEX Non-sparking

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Device category 3 use</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>−40 to 56 °C (−40 to 132.8 °F)</td>
</tr>
<tr>
<td>T5</td>
<td>−40 to 71 °C (−40 to 159.8 °F)</td>
</tr>
<tr>
<td>T4</td>
<td>−40 to 85 °C (−40 to 185.0 °F)</td>
</tr>
</tbody>
</table>

LCD indicator

ATEX / IECEx intrinsic safety, ATEX non-sparking

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
<th>LCD indicator interface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Device category 1 use</td>
<td>Device category 2 / 3 use</td>
</tr>
<tr>
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<td>−40 to 44 °C (−40 to 111.2 °F)</td>
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</tr>
<tr>
<td>T4-T1</td>
<td>−40 to 60 °C (−40 to 140.0 °F)</td>
<td>−40 to 85 °C (−40 to 185.0 °F)</td>
</tr>
</tbody>
</table>

Electrical data

Transmitter

Intrinsic safety type of protection Ex ia IIC (part 1)

<table>
<thead>
<tr>
<th>Supply circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. voltage ( U_i )</td>
</tr>
<tr>
<td>Short-circuit current ( I_i )</td>
</tr>
<tr>
<td>Max. power ( P_i )</td>
</tr>
<tr>
<td>Internal inductance ( L_i )</td>
</tr>
<tr>
<td>Internal capacitance ( C_i )</td>
</tr>
</tbody>
</table>

* From HW-Rev. 1.12, previously \( L_i \) = 0.5 mA.
** From HW-Rev. 1.07, previously \( C_i \) = 5 nF.

Intrinsic safety type of protection Ex ia IIC (part 2)

Thermocouples, voltages

<table>
<thead>
<tr>
<th>Measurement circuit: resistance thermometer, thermocouples, voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. voltage ( U_o )</td>
</tr>
<tr>
<td>Short-circuit current ( I_o )</td>
</tr>
<tr>
<td>Max. power ( P_o )</td>
</tr>
<tr>
<td>Internal inductance ( L_o )</td>
</tr>
<tr>
<td>Internal capacitance ( C_o )</td>
</tr>
</tbody>
</table>

* From HW-Rev. 1.12, previously \( I_o \) = 25 mA.
** From HW-Rev. 1.12, previously \( P_o \) = 38 mW.
*** From HW-Rev. 1.12, previously \( C_o \) = 49 nF.

Intrinsic safety type of protection Ex ia IIC (part 3)

<table>
<thead>
<tr>
<th>LCD indicator interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. voltage ( U_o )</td>
</tr>
<tr>
<td>Short-circuit current ( I_o )</td>
</tr>
<tr>
<td>Max. power ( P_o )</td>
</tr>
<tr>
<td>Internal inductance ( L_i )</td>
</tr>
<tr>
<td>Internal capacitance ( C_i )</td>
</tr>
<tr>
<td>Maximum permissible external inductance ( L_o )</td>
</tr>
<tr>
<td>Maximum permissible external capacitance ( C_o )</td>
</tr>
</tbody>
</table>

* From HW-Rev. 1.12, previously \( I_o \) = 25 mA.
** From HW-Rev. 1.12, previously \( P_o \) = 38 mW.
*** From HW-Rev. 1.12, previously \( C_o \) = 49 nF.
**LCD indicator**

Intrinsic safety type of protection Ex ia IIC

<table>
<thead>
<tr>
<th>Supply circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. voltage</td>
</tr>
<tr>
<td>Short-circuit current</td>
</tr>
<tr>
<td>Max. power</td>
</tr>
<tr>
<td>Internal inductance</td>
</tr>
<tr>
<td>Internal capacitance</td>
</tr>
</tbody>
</table>

**Installation instructions**

**ATEX / IECEx**

The installation, commissioning, maintenance and repair of devices in potentially explosive atmospheres must only be carried out by appropriately trained personnel. Works may be carried out only by persons, whose training has included instructions on different types of protection and installation techniques, concerned rules and regulations as well as general principles of zoning. The person must possess the relevant expertise for the type of works to be executed.

When operating with combustible dusts, EN 60079-31 must be complied with.

The safety instructions for electrical apparatus in potentially explosive areas must be complied with, in accordance with the directive 2014/34/EU (ATEX) and e.g. IEC 60079-14 (Installation of equipment in potentially explosive atmospheres).

To ensure safe operation, the respectively applicable requirements must be met for the protection of workers.

**IP protection rating of housing**

The temperature transmitter and LCD display type AS must be installed such that the IP rating of at least IP20 is achieved in accordance with IEC 60529.

**Electrical connections**

**Grounding**

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

**Intrinsic safety installation check**

If transmitters are operated in an intrinsically safe circuit, proof that the interconnection is intrinsically safe must be provided in accordance with IEC/EN 60079-14 as well as IEC/EN 60079-25. The supply isolators / DCS inputs must feature intrinsically safe input protection circuits in order to eliminate hazards (spark formation).

In order to prove safety of intrinsic safety, the electrical limit value must be used as the basis for the EC-type examination certificates for the equipment (devices); this includes the capacitance and inductance values of the cables.

Proof of intrinsic safety is said to have been provided if the following conditions are fulfilled when a comparison is carried out in relation to the limit values of the equipment:

<table>
<thead>
<tr>
<th>Transmitter (intrinsically safe equipment)</th>
<th>Supply isolator / DCS input (related equipment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_i \geq U_o$</td>
<td></td>
</tr>
<tr>
<td>$I_i \geq I_o$</td>
<td></td>
</tr>
<tr>
<td>$P_i \geq P_o$</td>
<td></td>
</tr>
<tr>
<td>$L_i + L_c \text{ (cable)} \leq L_o$</td>
<td></td>
</tr>
<tr>
<td>$C_i + C_c \text{ (cable)} \leq C_o$</td>
<td></td>
</tr>
</tbody>
</table>

**Field (Ex area)**

+ Field (Ex area)

- Control room (safe area)

A Transmitter

B Supply isolator / DCS input with supply / Segment coupler

**Figure 1:** Intrinsic safety installation check

**Installation in a potentially explosive atmosphere**

Transmitters can be installed in all kinds of industrial sectors. Potentially explosive systems are divided into zones, meaning that a wide range of different instruments are also required. For this, pay attention to the country-specific guidelines and certificates!

**Note**

Ex relevant specifications must be taken from the EC-type examination certificates and other relevant certificates that apply in each case.
... 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

... Installation instructions

ATEX - Zone 0
Designation: II 1 G Ex ia IIC T6 Ga

![Figure 2: Hookup in ATEX - Zone 0](image)

When using the transmitter in Zone 0, it must be installed in a suitable housing with IP rating IP 20.
The input for the supply isolator must be designed with ‘Ex ia’ type of protection.
When using the transmitter in Zone 0, make sure that impermissible electrostatic charging of the transmitter is avoided (observe the warnings on the device).
As the user, it is your responsibility to ensure that the sensor instrumentation meets the requirements of applicable explosion protection standards.

**Note**
When operating the transmitter in Zone 0 (EPL ‘Ga’), the compatibility of the device materials with the surrounding atmosphere must be guaranteed.

Encapsulation material used for the transmitter:
Polyurethane (PUR), WEVO PU-417

ATEX - Zone 1 (0)
Marking: II 2 (1) G Ex [ia IIC Ga] ib IIC T6 Gb

![Figure 3: Hookup in ATEX - Zone 1 (0)](image)

When using the transmitter in Zone 1, it must be installed in a suited housing with IP rating IP 20.
The input of the supply isolator must be designed with ‘Ex ib’ type of protection.
As the user, it is your responsibility to ensure that the sensor instrumentation meets the requirements of applicable explosion protection standards. The sensor can be installed in Zone 1 or Zone 0.
When using the transmitter in Zone 1, make sure that impermissible electrostatic charging of the temperature transmitter is avoided (observe the warnings on the device).
ATEX - Zone 1 (20)
Marking: II 2 G (1D) Ex [ia IIIC Da] ib IIC T6 Gb

When using the transmitter in Zone 1, it must be installed in a suitable housing with IP rating IP 20. The input for the supply isolator must be designed with ‘Ex ib’ type of protection. As the user, it is your responsibility to ensure that the sensor instrumentation meets the requirements of applicable explosion protection standards. The sensor can be installed in Zone 20 or Zone 21.

When using the transmitter in Zone 1, make sure that impermissible electrostatic charging of the temperature transmitter is avoided (observe the warnings on the device).

ATEX - Zone 2
Designation: II 3 G Ex na IIC T1-T6 Gc

When using the transmitter in Zone 2, observe the following:
- The temperature transmitter must be installed in its own housing. This housing must at least meet IP rating IP 54 (in accordance with EN 60529) and other requirements for potentially explosive atmosphere (e.g. a certified housing).
- External measures must be made for the power supply circuit in order to prevent the rated voltage from being up-scaled by more than 40% in the event of transient disturbances.
- The electrical connections must only be opened or closed when there is no hazardous atmosphere.
- When using the transmitter in Zone 2, make sure that impermissible electrostatic charging of the temperature transmitter is prevented (observe the warnings on the device).

Commissioning
The commissioning and parameterization of the device may also be carried out in potentially explosive atmospheres using a handheld terminal that has been approved accordingly under consideration of an intrinsic safety installation check. Alternatively, an Ex modem can be connected to the circuit outside the potentially explosive atmosphere.

Operating instructions
Protection against electrostatic discharges
The plastic parts inside the device can store electrostatic charges. Make sure that no electrostatic charges can accumulate when handling the device.
3 Use in potentially explosive atmospheres in accordance with FM and CSA

Note
- Further information on the approval of devices for use in potentially explosive atmospheres can be found in the explosion protection test certificates (at www.abb.com/temperature).
- Depending on the design, a specific marking in accordance with FM or CSA applies.

Ex marking
Transmitter
FM Intrinsically Safe

Model TTH200-L1
Control Drawing TTH200-L1H (I.S.)
Class I, Div. 1 + 2, Groups A, B, C, D
Class I, Zone 0, AEx ia IIC T6

FM Non-Incendive

Model TTH200-L2
Control Drawing TTH200-L2H (N.I.)
Class I, Div. 2, Groups A, B, C, D

CSA Intrinsically Safe

Model TTH200-R1
Control Drawing TTH200-R1H (I.S.)
Class I, Div. 1 + 2, Groups A, B, C, D
Class I, Zone 0, Ex ia Group IIC T6

CSA Non-Incendive

Model TTH200-R2
Control Drawing TTH200-R2H (I) (N.I.)
TTH200-R2H (2, no conduit) (N.I.)
Class I, Div. 2, Groups A, B, C, D

LCD indicator
FM Intrinsically Safe

Control Drawing SAP_214 748
I.S. Class I Div 1 and Div 2, Group: A, B, C, D or
I.S. Class I Zone 0 AEx ia IIC T*
\[ U_{i} / V_{\text{max}} = 9 \text{ V}, I_{i} / I_{\text{max}} < 65.2 \text{ mA}, P_{i} = 101 \text{ mW}, C_{i} = 0.4 \ \mu \text{F}, L_{i} = 0 \]

FM Non-Incendive

Control Drawing SAP_214 751
N.I. Class I Div 2, Group: A, B, C, D oder Ex nL IIC T**, Class I Zone 2
\[ U_{i} / V_{\text{max}} = 9 \text{ V}, I_{i} / I_{\text{max}} < 65.2 \text{ mA}, P_{i} = 101 \text{ mW}, C_{i} = 0.4 \ \mu \text{F}, L_{i} = 0 \]

CSA Intrinsically Safe

Control Drawing SAP_214 749
I.S. Class I Div 1 and Div 2; Group: A, B, C, D or
I.S. Zone 0 Ex ia IIC T*
\[ U_{i} / V_{\text{max}} = 9 \text{ V}, I_{i} / I_{\text{max}} < 65.2 \text{ mA}, P_{i} = 101 \text{ mW}, C_{i} < 0.4 \ \mu \text{F}, L_{i} = 0 \]

CSA Non-Incendive

Control Drawing SAP_214 750
N.I. Class I Div 2, Group: A, B, C, D oder Ex nL IIC T**, Class I Zone 2
\[ U_{i} / V_{\text{max}} = 9 \text{ V}, I_{i} / I_{\text{max}} < 65.2 \text{ mA}, P_{i} = 101 \text{ mW}, C_{i} < 0.4 \ \mu \text{F}, L_{i} = 0 \]

* Temp. Ident: T6 T\text{amb} 56 °C, T4 T\text{amb} 85 °C
** Temp. Ident: T6 T\text{amb} 60 °C, T4 T\text{amb} 85 °C

Installation instructions
FM / CSA
The installation, commissioning, maintenance and repair of devices in areas with explosion hazard must only be carried out by appropriately trained personnel.
The operator must strictly observe the applicable national regulations with regard to installation, function tests, repairs, and maintenance of electrical devices. (e. g. NEC, CEC).

IP protection rating of housing
The temperature transmitter and LCD display type AS must be installed such that the IP rating of at least IP20 is achieved in accordance with IEC 60529.
**Electrical connections**

**Grounding**

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

**Intrinsic safety installation check**

If transmitters are operated in an intrinsically safe circuit, proof that the interconnection is intrinsically safe must be provided in accordance with IEC/EN 60079-14 as well as IEC/EN 60079-25. The supply isolators / DCS inputs must feature intrinsically safe input protection circuits in order to eliminate hazards (spark formation).

In order to provide proof of intrinsic safety, the electrical limit value must be used as the basis for the EC-type examination certificates for the equipment (devices); this includes the capacitance and inductance values of the cables.

Proof of intrinsic safety is said to have been provided if the following conditions are fulfilled when a comparison is carried out in relation to the limit values of the equipment:

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>Supply isolator / DCS input</th>
</tr>
</thead>
<tbody>
<tr>
<td>(intrinsically safe equipment)</td>
<td>(related equipment)</td>
</tr>
<tr>
<td>$U_i \geq U_o$</td>
<td>$I_i \geq I_o$</td>
</tr>
<tr>
<td>$P_i \geq P_o$</td>
<td>$L_i + L_c$ (cable) $\leq L_o$</td>
</tr>
<tr>
<td>$C_i + C_c$ (cable) $\leq C_o$</td>
<td></td>
</tr>
</tbody>
</table>

**Installation in a potentially explosive atmosphere**

Transmitters can be installed in all kinds of industrial sectors. Potentially explosive systems are divided into zones, meaning that a wide range of different instruments are also required. For this, pay attention to the country-specific guidelines and certificates!

**Note**

Ex relevant specifications must be taken from the EC-type examination certificates and other relevant certificates that apply in each case.

**Commissioning**

The commissioning and parameterization of the device may also be carried out in potentially explosive atmospheres using a handheld terminal that has been approved accordingly under consideration of an intrinsic safety installation check. Alternatively, an Ex modem can be connected to the circuit outside the potentially explosive atmosphere.

**Operating instructions**

**Protection against electrostatic discharges**

The plastic parts inside the device can store electrostatic charges. Make sure that no electrostatic charges can accumulate when handling the device.
4 Design and function

General
Digital transmitters are communication-ready devices with microprocessor-controlled electronics. They conform to the requirements of IP rating IP 20 and are suited for integration into DIN A and DIN B sensor heads.
In the HART® transmitter, an FSK signal is superimposed on the 4 to 20 mA output signal in accordance with the HART standard to facilitate bidirectional communication.
The transmitters can be configured, polled, and tested using a DTM, an EDD or using the Field Information Manager (FIM). Handheld terminals can also be used for communication purposes.
As an option, the transmitter can be fitted with a type AS LCD display. The LCD display is used exclusively for visualizing current process values. The electrical connection between the LCD display and transmitter is provided by a 6-pin flat ribbon cable with a plug connector. The LCD display can only be operated when connected to transmitters that have an LCD display interface.

Note
The HMI type A LCD indicator with configuration function optionally used with the TTH300 is not compatible with the TTH200.

5 Product identification

Name plate

Note
Products that are marked with the adjacent symbol may not be disposed of as unsorted municipal waste (domestic waste).
They should be disposed of through separate collection of electric and electronic devices.

Note
The ambient temperature range provided on the name plate refers only to the transmitter itself and not to the sensor element used in the measuring inset.

Figure 7: Name plate (example)
Devices with an explosion-proof design are marked with the following special data plate.

1. Type designation in accordance with approval
2. Type designation
3. Temperature class of the explosion-proof design
4. CE mark (EU conformity) and notified body for quality assurance
5. Ex marking
6. IP rating explosion-proof design

Figure 8: Additional plate for explosion-protected apparatus (example)

Note
The name plates displayed are examples. The device identification plates affixed to the device can differ from this representation.

6 Transport and storage

Inspection
Check the devices immediately after unpacking for possible damage that may have occurred from improper transport. Details of any damage that has occurred in transit must be recorded on the transport documents. All claims for damages must be submitted to the shipper without delay and before installation.

Transporting the device
Observe the following instructions:
- Do not expose the device to humidity during transport. Pack the device accordingly.
- Pack the device so that it is protected against vibrations during transport, for example, by using air-cushioned packing.

Storing the device
Bear the following points in mind when storing devices:
- Store the device in its original packaging in a dry and dust-free location.
- Observe the permitted ambient conditions for transport and storage.
- Avoid storing the device in direct sunlight.
- In principle, the devices may be stored for an unlimited period. However, the warranty conditions stipulated in the order confirmation of the supplier apply.

Ambient conditions
The ambient conditions for the transport and storage of the device correspond to the ambient conditions for operation of the device. Adhere to the device data sheet!

Returning devices
For the return of devices, follow the instructions in Repair on page 29.
7 Installation

Installation options

There are three options for installing the transmitter:

- Installation in the cover of the connection head (without springs)
- Direct installation on the measuring inset (with springs)
- Installation on a top-hat rail

Installation in the cover of the connection head

![Figure 9: Installation example](image)

1. Release the screw plug 3 for the cover of the connection head.
2. Open the cover 1.
3. Secure the transmitter 2 at the proper position on the cover, using the captive screws found in the transmitter.

Installation on the measuring inset

![Figure 10: Installation example](image)

1. Remove the ceramic block from the measuring inset 3.
2. Remove the screws from the transmitter 2. Remove the sleeves from the screw holes and then remove the screws.
3. Insert new fixing screws 1 from above in the fixing holes of the transmitter.
4. Place the cambered toothed discs 4 with curve facing upward on the downward protruding screw thread.
5. Connect the power supply cable to the transmitter according to connection diagram.
6. Place the transmitter in the housing on the measuring inset and secure it.

Note
Before mounting the transmitter on the measuring inset, remove the ceramic block on the measuring inset and the captive screws in the transmitter.

To install the transmitter on the measuring inset, cambered toothed discs and the corresponding mounting screws are required; these must be ordered as separate accessories:
- Measuring inset installation set (2 fixing screws, 2 springs, 2 toothed discs) order number: 263750

1. Remove the ceramic block from the measuring inset 3.
2. Remove the screws from the transmitter 2. Remove the sleeves from the screw holes and then remove the screws.
3. Insert new fixing screws 1 from above in the fixing holes of the transmitter.
4. Place the cambered toothed discs 4 with curve facing upward on the downward protruding screw thread.
5. Connect the power supply cable to the transmitter according to connection diagram.
6. Place the transmitter in the housing on the measuring inset and secure it.

Note
The toothed discs between measuring inset and transmitter are straightened when the screws are tightened. This enables them to grip the mounting screws.

Installation on the top-hat rail

![Figure 11: Installation example](image)

When mounted on a top-hat rail, the transmitter can be placed at a distance from the sensor in a housing that is suitable for the ambient conditions.
Installing / removing the optional LCD indicator

The transmitter can be optionally equipped with an LCD indicator.

**NOTICE**

Damage to the LCD indicator caused by incorrect installation / disassembly

The flat ribbon cable of the LCD indicator can become damaged due to incorrect installation / disassembly.

- Make sure the flat ribbon cable does not get twisted or torn when installing / disassembling or rotating the LCD indicator.

Disassembling the LCD indicator

The indicator must be removed to enable connection of the sensor line or supply line:

1. Carefully remove the LCD indicator from the transmitter inset. The LCD indicator is held firmly in place, meaning that you may have to use the tip of a screwdriver to pry it loose.
2. Take care to avoid any mechanical damage.

Installing the LCD indicator

No tools are required to install the LCD indicator.

1. Carefully insert the guide pins for the LCD indicator in the guide holes of the transmitter inset. Make sure the black connection socket fits into the terminal on the transmitter inset.
2. Then press the LCD indicator in as far as it will go. Make sure that the guide pins and connection socket are fully inserted.

Rotating the LCD indicator

The position of the LCD indicator can be adjusted to suit the mounting position of the transmitter, to ensure that the display is as clearly legible as possible.

There are twelve positions at increments of 30°.

1. Carefully turn the LCD indicator to the left to release it from its holder.
2. Carefully turn the LCD indicator until the required position is reached.
3. Insert the LCD indicator into its holder again and turn it to the right into the required position until it snaps into place.

8 Electrical connections

Safety instructions

**DANGER**

Improper installation and commissioning of the device carries a risk of explosion.

For use in potentially explosive atmospheres, observe the information in Use in potentially explosive atmospheres in accordance with ATEX and IECEx on page 5 and Use in potentially explosive atmospheres in accordance with FM and CSA on page 10!

Observe the following instructions:

- The electrical connection may only be established by authorized specialist personnel and in accordance with the connection diagrams.
- The relevant regulations must be observed during electric installation.
- The electrical connection information in the instruction must be observed; otherwise, the electric IP rating may be adversely affected.
- Safe isolation of electric circuits which are dangerous if touched is ensured only 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 connection leads separate from electric circuits which are dangerous if touched, or implement additional insulation measures.
- Connections must only be established in a dead-voltage state!
- The transmitter has no switch-off elements. Therefore, overcurrent protective devices, lightning protection, or voltage disconnection options must be provided with the installation.
- The power supply and signal are routed in the same conductor and should be implemented as a SELV or PELV circuit in accordance with the relevant standard (standard version). For the explosion-proof design, the guidelines in accordance with the Ex standard must be adhered to.
- You need to check that the available power supply corresponds to the information on the name plate.

Note

The signal cable wires must be provided with wire end sleeves. The slotted screws of the connection terminals are tightened with a size 1 screwdriver (3.5 or 4 mm).
... 8 Electrical connections

Protection of the transmitter from damage caused by highly energetic electric interferences

The transmitter has no switch-off elements. Therefore, overcurrent protective devices, lightning protection, or voltage disconnection options must be provided at the plant. For the shielding and grounding of the device and the connection cable, observe Pin assignment on page 17.

NOTICE

Temperature transmitter damage!
Overvoltage, overcurrent and high-frequency interference signals on the supply connection as well as sensor connection side of the device can damage the temperature transmitter.

A Do not weld
B No high-frequency interference signals / switching operations of large consumers
C No overvoltage due to lightning

Figure 12: Warning signs

Overcurrent and overvoltage can occur through for example welding operations, switching operations of large electric consumers, or lightning in the vicinity of the transmitter, sensor, as well as connector cables. Temperature transmitters are sensitive devices on the sensor side as well. Long connector cables to the sensor can encourage damaging interference. This can already happen if temperature sensors are connected to the transmitter during installation, but are not yet integrated into the system (no connection to the supply isolator / DCS)!

Suited protective measures
The following items should be observed to protect the transmitter from sensor-side damage:
- In the vicinity of the transmitter, sensor and sensor connector cable in case of a connected sensor, high-energy overvoltage, overcurrent and high-frequency interference signals due to welding operations, lightning, circuit breakers or large consumers of electricity among others should be absolutely avoided.
- The connection cable of the sensor on the transmitter should be disconnected when performing welding work in the vicinity of the installed transmitter, sensor, as well as supply lines from the sensor to the transmitter.
- This correspondingly also applies to the supply side, if there is a connection there.

Conductor material

NOTICE

Danger of wire break!
The use of stiff cable material can lead to wire breaks in the cables.
- Only use cable material with stranded wires.

Supply voltage
Power supply cable:
Flexible standard cable material

Maximum wire cross section:
1.5 mm² (AWG 16)

Sensor connection
Depending on the type of sensor, a variety of cable materials can be used for connections.
The integrated internal reference junction makes it possible to directly connect thermal compensating cables.
Pin assignment

A  Potentiometer, four-wire circuit
B  Potentiometer, three-wire circuit
C  Potentiometer, two-wire circuit
D  RTD, four-wire circuit
E  RTD, three-wire circuit
F  RTD, two-wire circuit
G  Voltage measurement
H  Thermocouple
I  Interface for type AS LCD indicator
1 to 4  Sensor connection (of measuring inset)
5 to 6  4 to 20 mA HART

Figure 13: TTH200 connections
... 8 Electrical connections

Electrical data for inputs and outputs

Input - resistance thermometer / resistances

Resistance thermometer
- Pt100 in accordance with IEC 60751, JIS C1604, MIL-T-24388
- Ni in accordance with DIN 43760
- Cu in accordance with recommendation OIML R 84

Resistance measurement
- 0 to 500 \( \Omega \)
- 0 to 5000 \( \Omega \)

Sensor connection type
Two-, three-, four-wire circuit

Connection lead
- Maximum sensor line resistance:
  per line 50 \( \Omega \) in accordance with NE 89
- Three-wire circuit:
  Symmetrical sensor line resistances
- Two-wire circuit:
  Compensation up to 100 \( \Omega \) total lead resistance

Measurement current
< 300 \( \mu A \)

Sensor short circuit
< 5 \( \Omega \) (for resistance thermometer)

Sensor wire break
- Measuring range: 0 to 500 \( \Omega \) > 0.6 to 10 k\( \Omega \)
- Measuring range: 0 to 5 \( \Omega \) > 5.3 to 10 k\( \Omega \)

Corrosion detection in accordance with NE 89
- Three-wire resistance measurement > 50 \( \Omega \)
- Four-wire resistance measurement > 50 \( \Omega \)

Sensor error signaling
- Resistance thermometer:
  Sensor short circuit and sensor wire break
- Linear resistance measurement:
  Sensor wire break

Input - thermocouples / voltages

Types
- B, E, J, K, N, R, S, T in accordance with IEC 60584
- U, L in accordance with DIN 43710
- C, D in accordance with ASTM E-988

Voltages
- \(-125\) to \(125\) mV
- \(-125\) to \(1100\) mV

Connection lead
- Maximum sensor line resistance:
  per line 1.5 k\( \Omega \), total 3 k\( \Omega \)

Sensor wire break monitoring in accordance with NE 89
- Pulsed with 1 \( \mu A \) outside measurement interval
- Thermocouple measurement 5.3 to 10 k\( \Omega \)
- Voltage measurement 5.3 to 10 k\( \Omega \)

Input resistance
> 10 M\( \Omega \)

Internal reference junction Pt1000, IEC 60751 Cl. B
(no additional jumpers necessary)

Sensor error signaling
- Thermocouple:
  Sensor wire break
- Linear voltage measurement:
  Sensor wire break
Output – HART®

Note
The HART® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

Transmission characteristics
- Temperature linear
- Resistance linear
- Voltage linear

Output signal
- Configurable 4 to 20 mA (standard)
- Configurable 20 to 4 mA
  (Dynamic range: 3.8 to 20.5 mA in accordance with NE 43)

Simulation mode
3.5 to 23.6 mA

Induced current consumption
< 3.5 mA

Maximum output current
23.6 mA

Configurable error current signal
- Overrange 22 mA (20.0 to 23.6 mA)
- Underrange 3.6 mA (3.5 to 4.0 mA)

Power supply
Two-wire technology, polarity safe; power supply lines = signal lines

Note
Following calculations apply for standard applications. This should be taken into consideration when working with a higher maximum current.

Input terminal voltage
Non-Ex application:
U_s = 11 to 42 V DC
Ex applications:
U_s = 11 to 30 V DC

Maximum permissible residual ripple for input terminal voltage
During communication, this is in accordance with the HART® FSK ‘Physical Layer’ specification.

Undervoltage detection on the transmitter
If the terminal voltage on the transmitter down-scales a value of 10 V, this may lead to an output current of I_a \leq 3.6 mA.

Maximum load
R_B = (U_s - 11 V) / 0.022 A

\[ P = U_s \times 0.022 \text{ A} \]

Example: \( U_s = 24 \text{ V} \rightarrow P_{\text{max}} = 0.528 \text{ W} \)
8 Electrical connections

Power supply

Voltage drop on the signal line

When connecting the devices, note the voltage drop on the signal line. The minimum supply voltage on the transmitter must not be undershot.

![Diagram of HART load resistance](image)

Figure 15: HART load resistance

- $U_{1\text{min}}$: Minimum supply voltage on the transmitter
- $U_{2\text{min}}$: Minimum supply voltage of the supply isolator / DCS input
- $R$: Line resistance between transmitter and supply isolator
- $R_{250}$: Resistance (250 $\Omega$) for HART functionality

**Standard application with 4 to 20 mA functionality**

When connecting these components, observe the following condition:

$$U_{1\text{min}} \leq U_{2\text{min}} - 22 \text{ mA} \times R$$

**Standard application with HART functionality**

Adding resistance $R_{250}$ increases the minimum supply voltage

$$U_{2\text{min}}: U_{1\text{min}} \leq U_{2\text{min}} - 22 \text{ mA} \times (R + R_{250})$$

For HART functionality, use supply isolators or DCS input cards with a HART mark. If this is not possible, a resistance of $\geq 250 \Omega$ ($< 1100 \Omega$) must be added to the interconnection.

The signal line can be operated with / without grounding. When establishing a ground connection (minus side), make sure that only one side of the terminal is connected to the equipotential bonding.

9 Commissioning

General

In case of corresponding order the transmitter is ready for operation after mounting and installation of the connections. The parameters are set at the factory. The connected lines must be checked for firm seating. Only firmly seated lines ensure full functionality.

Checks prior to commissioning

The following points must be checked before commissioning the device:

- Correct wiring in accordance with Electrical connections on page 15.
- The ambient conditions must correspond to the information given on the name plate and in the data sheet.

Communication

**Note**

The HART® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

Communication with the transmitter takes place using the HART protocol. The communication signal is modulated onto both wires of the signal line in accordance with the HART FSK 'Physical Layer' specification.

The HART modem is connected at the signal line of the current output via which power is also supplied via the power supply unit.
The device is listed with the FieldComm Group.

Parameterization of the device

Note
The device does not have operating elements for parameterization on site. Parameterization takes place via the HART interface.

Parameterization of the device takes place via standard HART® tools. These include:

- ABB Handheld HART® Communicator DHH805 (TTX200 EDD)
- ABB Asset Vision Basic (TTX200 DTM)
- ABB 800xA Control system (TTX200 DTM)
- ABB Field Information Manager / FIM (TTX200 EDD, TTX200 Package)
- Other tools supporting standard HART® EDDs or DTMs (FDT1.2)

Note
Not all tools and frame applications support DTMs or EDDs at the same level. In particular, optional or advanced EDD / DTM functions may potentially not be available on all tools. ABB provides frame applications supporting the full range of functions and performance.

Operating modes

- Point-to-point communication mode – standard (general address 0)
- Multidrop mode (addressing 1 to 15)
- Burst Mode

Diagnosis notice

- Overrange / underrange in accordance with NE 43
- HART® diagnosis
... 9 Commissioning

... Parameterization of the device

Parameter descriptions

<table>
<thead>
<tr>
<th>DTM menu path, parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Device&gt; / &lt;Extras&gt;</td>
<td></td>
</tr>
<tr>
<td>&lt;Write Protection&gt;</td>
<td>Activates write protection for the entire device</td>
</tr>
<tr>
<td>• Yes: locked, entry combination:</td>
<td>≠</td>
</tr>
<tr>
<td>• No: unlocked, entry combination:</td>
<td>0110</td>
</tr>
<tr>
<td>&lt;Device reset&gt;</td>
<td>Configuration data is reset to factory settings (see Factory settings on page 24).</td>
</tr>
<tr>
<td>&lt;Factory reset&gt;</td>
<td>Configuration data is reset to factory settings (see Factory settings on page 24). In addition, the adjustment data and DAC adjustment values are also reset to factory settings.</td>
</tr>
<tr>
<td>• Yes / OK</td>
<td></td>
</tr>
<tr>
<td>&lt;Device&gt; / &lt;Configuration&gt;</td>
<td></td>
</tr>
<tr>
<td>&lt;Sensor / Sensor type&gt;</td>
<td>Selects sensor type:</td>
</tr>
<tr>
<td>• Pt100 (IEC751)</td>
<td>Pt10 (IEC751)</td>
</tr>
<tr>
<td>• Pt1000 (IEC751)</td>
<td>Pt50 (IEC751)</td>
</tr>
<tr>
<td>• Thermocouple type K (IEC584)</td>
<td>Pt200 (IEC751)</td>
</tr>
<tr>
<td>• Thermocouple type B (IEC584)</td>
<td>Pt500 (IEC751)</td>
</tr>
<tr>
<td>• Thermocouple type C (ASTME988)</td>
<td>Pt10 (JIS1604)</td>
</tr>
<tr>
<td>• Thermocouple type D (ASTME988)</td>
<td>Pt50 (JIS1604)</td>
</tr>
<tr>
<td>• Thermocouple type E (IEC584)</td>
<td>Pt100 (JIS1604)</td>
</tr>
<tr>
<td>• Thermocouple type J (IEC584)</td>
<td>Pt200 (JIS1604)</td>
</tr>
<tr>
<td>• Thermocouple type N (IEC584)</td>
<td>Pt10 (JIS1604)</td>
</tr>
<tr>
<td>• Thermocouple type R (IEC584)</td>
<td>Pt50 (JIS1604)</td>
</tr>
<tr>
<td>• Thermocouple type S (IEC584)</td>
<td>Pt100 (MIL24388)</td>
</tr>
<tr>
<td>• Thermocouple type T (IEC584)</td>
<td>Pt200 (MIL24388)</td>
</tr>
<tr>
<td>• Thermocouple type L (DIN43710)</td>
<td>Pt1000 (MIL24388)</td>
</tr>
<tr>
<td>• Thermocouple type U (DIN43710)</td>
<td>Ni50 (DIN43760)</td>
</tr>
<tr>
<td>• Thermal voltage -125 to 125 mV</td>
<td>Ni100 (DIN43760)</td>
</tr>
<tr>
<td>• Thermal voltage -125 to 1100 mV</td>
<td>Ni120 (DIN43760)</td>
</tr>
<tr>
<td>• Resistance 0 to 500 Ω</td>
<td>Ni1000 (DIN43760)</td>
</tr>
<tr>
<td>• Resistance 0 to 5000 Ω</td>
<td>Cu10 (OIML R 84), a=4270</td>
</tr>
<tr>
<td></td>
<td>Cu100 (OIML R 84), a=4270</td>
</tr>
<tr>
<td>&lt;Sensor / Connection&gt;</td>
<td>Sensor connection type relevant for all Pt, Ni, Cu resistance thermometers</td>
</tr>
<tr>
<td>• Two-wire: sensor connection type in two-wire technology</td>
<td></td>
</tr>
<tr>
<td>• Three-wire: sensor connection type in three-wire technology</td>
<td></td>
</tr>
<tr>
<td>• Four-wire: sensor connection type in four-wire technology</td>
<td></td>
</tr>
<tr>
<td>&lt;Sensor / Line resistance&gt;</td>
<td>Sensor line resistance relevant for all Pt, Ni, Cu resistance thermometers with a two-wire circuit</td>
</tr>
<tr>
<td></td>
<td>Value range: 0 to 100 Ω</td>
</tr>
<tr>
<td>DTM menu path, parameters</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>&lt;Device&gt; / &lt;Configuration&gt;</strong></td>
<td></td>
</tr>
<tr>
<td><strong>&lt;Sensor / Reference junction&gt;</strong></td>
<td>• Internal: use of the internal reference junction of the transmitter when using a thermocouple / compensating cable (relevant for all thermocouples except for type B)</td>
</tr>
<tr>
<td></td>
<td>• External - fixed: transfer of thermal cable / compensating cable via copper material at constant thermostat temperature</td>
</tr>
<tr>
<td></td>
<td>• Without: no reference junction</td>
</tr>
<tr>
<td><strong>&lt;Sensor / Reference junction temperature&gt;</strong></td>
<td>Relevant for external reference junction, specification of constant external reference junction temperature</td>
</tr>
<tr>
<td></td>
<td>Value range: −50 to 100 °C</td>
</tr>
<tr>
<td><strong>&lt;Device&gt; / &lt;Parameterize&gt;</strong></td>
<td></td>
</tr>
<tr>
<td><strong>&lt;Measuring range of PV / unit&gt;</strong></td>
<td>Selects the physical unit for the sensor measuring signal</td>
</tr>
<tr>
<td></td>
<td>Units: °C, °F, °R, K, mV, Ω, mA</td>
</tr>
<tr>
<td><strong>&lt;Measuring range of PV / lower range value&gt;</strong></td>
<td>Defines the value for 4 mA (adjustable)</td>
</tr>
<tr>
<td><strong>&lt;Measuring range of PV / upper range value&gt;</strong></td>
<td>Defines the value for 20 mA (adjustable)</td>
</tr>
<tr>
<td><strong>&lt;Current output / damping&gt;</strong></td>
<td>Configurable τ 63% output signal damping value</td>
</tr>
<tr>
<td></td>
<td>Value range: 0 to 100 s</td>
</tr>
<tr>
<td><strong>&lt;Current output / output upon error &gt;</strong></td>
<td>Generates a high alarm signal in the event of a sensor or device error; can be configured 20 to 23.6 mA (overrange)</td>
</tr>
<tr>
<td></td>
<td>• Standard 22 mA</td>
</tr>
<tr>
<td><strong>&lt;Current output / output upon error &gt;</strong></td>
<td>Generates a low alarm signal in the event of a sensor or device error; can be configured 3.5 to 4 mA (underrange)</td>
</tr>
<tr>
<td><strong>&lt;Device&gt; / &lt;Maintenance&gt;</strong></td>
<td></td>
</tr>
<tr>
<td><strong>&lt;Poll address / TAG&gt; (HART TAG)</strong></td>
<td>Defines the HART TAG name.</td>
</tr>
<tr>
<td></td>
<td>• 8 characters, alphanumeric</td>
</tr>
<tr>
<td><strong>&lt;Poll address / TAG&gt; (Address (Multidrop))</strong></td>
<td>Specifies the communication type</td>
</tr>
<tr>
<td></td>
<td>• Address = 0 conforms to HART operating mode: point-to-point communication, 4 to 20 mA output signal</td>
</tr>
<tr>
<td></td>
<td>• Address = 1 to 15 conforms to HART multidrop operating mode output signal 3.6 mA, only the digital HART measured values are available</td>
</tr>
<tr>
<td><strong>&lt;Adjustment&gt; (Set lower range value)</strong></td>
<td>Temperature correction for specified / simulated sensor lower range value to target lower range temperature value</td>
</tr>
<tr>
<td></td>
<td>• Set Trim low or lower range value &gt; OK</td>
</tr>
<tr>
<td><strong>&lt;Adjustment /DAC adjustment fixed for zero at 4 mA&gt;</strong></td>
<td>Output signal correction for specified / simulated sensor LRV value to 4.000 mA set point</td>
</tr>
<tr>
<td></td>
<td>• Analog current measurement value input 3.5 to 4.5 mA</td>
</tr>
<tr>
<td><strong>&lt;Adjustment /DAC adjustment fixed for amplification at 20 mA&gt;</strong></td>
<td>Output signal correction for specified / simulated sensor URV value to 20.000 mA set point</td>
</tr>
<tr>
<td></td>
<td>• Analog current measurement value input 19.5 to 20.5 mA</td>
</tr>
<tr>
<td><strong>&lt;Device&gt; &lt;Simulation&gt;</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output signal simulation corresponding to the value specified</td>
</tr>
<tr>
<td></td>
<td>• Value range: 3.5 to 23.6 mA</td>
</tr>
</tbody>
</table>
... 9 Commissioning

... Parameterization of the device

Factory settings
The transmitter is configured at the factory. The table below contains the relevant parameter values.

<table>
<thead>
<tr>
<th>Menu</th>
<th>Designation</th>
<th>Parameter</th>
<th>Factory setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Setup</td>
<td>Write protection</td>
<td>-</td>
<td>No</td>
</tr>
<tr>
<td>Input</td>
<td>Sensor Type</td>
<td>Pt100 (IEC60751)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R-Connection</td>
<td>Three-wire circuit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measured Range Begin</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measured Range End</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engineering Unit</td>
<td>Degrees C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Damping</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>Process Alarm</td>
<td>Fault signaling</td>
<td>Overrange 22 mA</td>
<td></td>
</tr>
</tbody>
</table>
Basic Setup

Sensor error adjustment (DTM adjustment function)
Sensor error adjustment can be performed in the DTM by navigating to the menu path Device / Calibration. For sensor error adjustment, the sensor connected to the transmitter must be brought to the lower range value temperature / Trim low using a water quench or oven. It is important to make sure the temperature is balanced and stable.

In the DTM, check that the proper adjustment temperature has been entered for the sensor before adjusting it. Based on the comparison of the adjustment temperature entered (setpoints) with the digital temperature measured by the transmitter, which is available after linearization in the form of HART temperature information, the transmitter calculates the temperature deviation resulting from the sensor error.

During sensor adjustment (single-point adjustment), the temperature deviation calculated results in an offset shift of the linear characteristic output by the linearization module; the values of this characteristic correspond to the HART signal or are sent to the current output.

A pure sensor offset error can be corrected via the calibration function ‘Set lower range value’ or the adjustment function ‘Trim low’. By contrast, if the error is not a pure sensor offset error, it can only be corrected using two-point adjustment or two-point calibration.

D / A analog output adjustment (4 mA- and 20 mA-Trim)
D/A analog output adjustment is used to compensate for errors in the current input of the higher-level system. D/A analog output adjustment for the transmitter can be used to modify the loop current so that the desired value is displayed in the higher-level system.

Error compensation for the higher-level system is possible at the lower range value with 4 mA and / or 20 mA (single-point error correction: offset or two-point error correction: offset + linear gradient).

The D / A analog output adjustment can be accessed in the DTM via the menu path Device / Calibration. Prior to analog adjustment, it is necessary to determine the loop current values based on iterative entry of current values in simulation mode; the higher-level I/O system displays exactly 4.000 mA or the lower range limit temperature, and 20.000 mA or the upper range limit temperature. The current loop values must be measured using an ammeter and recorded.

The lower range limit value or 4.000 mA should then be simulated in D / A analog output compensation mode using sensor simulation. Following this, the iteratively calculated current value at which the higher-level system displays exactly 4.000 mA or the lower range limit value must be entered as an adjustment value. Proceed in a similar manner for the upper range value or 20.000 mA.

After this correction, the AD converter error of the higher-level system is corrected by the DA converter of the transmitter. For the higher-level system, the value of the analog 4 to 20 mA output signal and the digital HART signal now match.

The adjustment should be repeated when connecting the transmitter to another input of a higher-level system.
... 9 Commissioning

... Basic Setup

HART variables
The transmitter provides three HART variables. The HART variables are assigned the following values:
- Primary HART variable: process value
  The primary HART variable is assigned permanently to the analog output and is accordingly mapped to the 4 to 20 mA signal.
- Secondary HART variable: electronic unit temperature
- Third-level HART variable: electric input

Communication / HART TAG / device addressing
For ease of identification, each HART device features a configurable 8-digit HART TAG. All devices are supplied with the HART TAG ‘TI XXX’ as standard. When storing HART TAG measuring point tags with more than 8 digits in the device, use the ‘Report’ parameter, which supports up to 32 characters.

In addition to the HART TAG, each device has a HART address. This address is set to 0 by default, which means that the device operates in HART standard communication mode (point-to-point operation).

When an address in the range 1 to 15 is used, the device switches to the ‘HART Multidrop mode’.
This operating mode enables users to connect up to 15 devices to a power supply unit in parallel.
In multidrop mode, an analog output signal that matches the process temperature is not available.
The output signal in multidrop mode is a constant 3.6 mA and is used exclusively for the power supply. In multidrop mode, sensor or process data information is available only as a HART signal.

10 Operation

Safety instructions
If there is a chance that safe operation is no longer possible, take the device out of operation and secure it against unintended startup.

Process display

Note
The device does not have operating elements for parameterization on site.
Parameterization takes place via the HART interface.

The process display appears on the LCD display when the device is powered on. It shows information about the device and current process values.
Error messages on the LCD display
If an error occurs, a message consisting of a symbol or letter (device status) and a number (DIAG NO.) will appear at the bottom of the process display.

The diagnostic messages are divided into the following groups in accordance with the NAMUR classification scheme:

<table>
<thead>
<tr>
<th>ID code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>OK or Information</td>
</tr>
<tr>
<td>C</td>
<td>Check Function</td>
</tr>
<tr>
<td>S</td>
<td>Off Specification</td>
</tr>
<tr>
<td>M</td>
<td>Maintenance Required</td>
</tr>
<tr>
<td>F</td>
<td>Failure</td>
</tr>
</tbody>
</table>

Additionally, the diagnostic messages are divided into the following areas:

<table>
<thead>
<tr>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics</td>
<td>Diagnosis for device hardware.</td>
</tr>
<tr>
<td>Sensor</td>
<td>Diagnosis for sensor elements and connection lines.</td>
</tr>
<tr>
<td>Installation / Configuration</td>
<td>Diagnosis for communication interface and parameterization / configuration</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>Diagnosis for ambient and process conditions.</td>
</tr>
</tbody>
</table>

Note
For a detailed description of errors and troubleshooting instructions, please see Diagnosis / error messages on page 27.

11 Diagnosis / error messages
The transmitter signals messages and errors in different ways.

Messages via the HART interface
The transmitter signals changed configuration or parameter setting by setting the HART flag ‘Configuration-changed’ (Configuration-changed).

Error message on the LCD display
In the event of an error, a message appears at the bottom of the process display, consisting of a symbol or letters (Device Status) and a number (DIAG.NO.). See Error messages on the LCD display on page 27.

Error message on the current output
Sensor or device errors can be indicated by underranging or overranging of the current output.

Configuration is made via the DTM parameter ‘<Current output / output with error>’.
### 11 Diagnosis / error messages

#### Possible error messages – HART®

<table>
<thead>
<tr>
<th>Range</th>
<th>Displays the device status</th>
<th>Displays the DIAG. NO.</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics</td>
<td>F</td>
<td>1</td>
<td>Device defective</td>
<td>Replace the device</td>
</tr>
<tr>
<td>Electronics</td>
<td>S</td>
<td>2</td>
<td>Ambient temperature overshot / undershot</td>
<td>Check environment; reposition measuring point if required</td>
</tr>
<tr>
<td>Electronics</td>
<td>F</td>
<td>3</td>
<td>EEPROM defective</td>
<td>Replace the device</td>
</tr>
<tr>
<td>Electronics</td>
<td>M</td>
<td>4</td>
<td>Electronics overload</td>
<td>Factory reset</td>
</tr>
<tr>
<td>Electronics</td>
<td>F</td>
<td>5</td>
<td>Memory error</td>
<td>Factory reset</td>
</tr>
<tr>
<td>Electronics</td>
<td>I</td>
<td>7</td>
<td>LCD indicator connected</td>
<td>Status info; not an error</td>
</tr>
<tr>
<td>Installation / Configuration</td>
<td>I</td>
<td>8</td>
<td>Device write-protected</td>
<td>Status info; not an error</td>
</tr>
<tr>
<td>Electronics</td>
<td>I</td>
<td>9</td>
<td>EEPROM busy</td>
<td>Status info; not an error</td>
</tr>
<tr>
<td>Electronics</td>
<td>F</td>
<td>12</td>
<td>Sensor input defective (communication)</td>
<td>Replace the device</td>
</tr>
<tr>
<td>Electronics</td>
<td>F</td>
<td>13</td>
<td>Sensor input defective (error)</td>
<td>Replace the device</td>
</tr>
<tr>
<td>Electronics</td>
<td>F</td>
<td>14</td>
<td>Sensor input defective (ADC error)</td>
<td>Replace the device</td>
</tr>
<tr>
<td>Installation / Configuration</td>
<td>C</td>
<td>32</td>
<td>Diagnostics simulation mode</td>
<td>Not an error, diagnostic info, measurement OK</td>
</tr>
<tr>
<td>Sensor</td>
<td>F</td>
<td>34</td>
<td>Measuring error, sensor</td>
<td>Check sensor connection</td>
</tr>
<tr>
<td>Sensor</td>
<td>F</td>
<td>35</td>
<td>Short-circuit, sensor</td>
<td>Check sensor connection</td>
</tr>
<tr>
<td>Sensor</td>
<td>F</td>
<td>36</td>
<td>Wire break, sensor</td>
<td>Check sensor connection</td>
</tr>
<tr>
<td>Sensor</td>
<td>F</td>
<td>37</td>
<td>Range overshot, sensor</td>
<td>Check measuring limits</td>
</tr>
<tr>
<td>Sensor</td>
<td>F</td>
<td>38</td>
<td>Range undershot, sensor</td>
<td>Check measuring limits</td>
</tr>
<tr>
<td>Installation / Configuration</td>
<td>I</td>
<td>41</td>
<td>Single-point adjustment active, sensor</td>
<td>Status info; not an error</td>
</tr>
<tr>
<td>Installation / Configuration</td>
<td>I</td>
<td>42</td>
<td>Two-point adjustment active, sensor</td>
<td>Status info; not an error</td>
</tr>
<tr>
<td>Installation / Configuration</td>
<td>F</td>
<td>65</td>
<td>Configuration defective</td>
<td>Check configuration:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Incorrect device</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Measuring span is too small</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Incorrect configuration data</td>
</tr>
<tr>
<td>Installation / Configuration</td>
<td>C</td>
<td>71</td>
<td>Reconfiguration is running</td>
<td>Status info; not an error</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>F</td>
<td>72</td>
<td>Error in the application</td>
<td>Check configuration, connections; reset to factory settings</td>
</tr>
<tr>
<td>Installation / Configuration</td>
<td>I</td>
<td>74</td>
<td>Analog output adjustment active</td>
<td>Status info; not an error</td>
</tr>
<tr>
<td>Installation / Configuration</td>
<td>C</td>
<td>75</td>
<td>Analog output in simulation</td>
<td>Status info; not an error</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>S</td>
<td>76</td>
<td>Values overshot</td>
<td>Check parameters:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Sensor limits up-scaled</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Measuring span is too small</td>
</tr>
</tbody>
</table>

**Note**

If the remedial measures listed for the error message do not improve the status of the device, please consult ABB Service.
12 Maintenance

Safety instructions

⚠️ CAUTION

Risk of burns due to hot measuring media
The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!
• Before starting work on the device, make sure that it has cooled sufficiently.

If transmitters are used as intended under normal operating conditions, no maintenance is required.

Cleaning

When cleaning the exterior of meters, make sure that the cleaning agent used does not corrode the housing surface and the gaskets.

When using the device in potentially explosive atmospheres, observe the notice on cleaning in Protection against electrostatic discharges on page 9.

13 Repair

Safety instructions

⚠️ DANGER

Explosion hazard
Explosion hazard due to improper repair of the device.
• Faulty devices may not be repaired by the operator.
• The device may only be repaired by the ABB Service Department.

On-site repair of the transmitter or exchange of electronic components is not permissible.

Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes.
Fill out the return form (see Return form on page 31) and include this with the device.

In accordance with the EU Directive governing 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 must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Please contact Customer Center Service acc. to page 4 for nearest service location.
14 Recycling and disposal

Note

Products that are marked with the adjacent symbol may **not** be disposed of as unsorted municipal waste (domestic waste).

They should be disposed of through separate collection of electric and electronic devices.

This product and its packaging are manufactured from materials that can be recycled by specialist recycling companies.

Bear the following points in mind when disposing of them:

- As of 8/15/2018, this product will be under the open scope of the WEEE Directive 2012/19/EU and relevant national laws (for example, ElektroG - Electrical Equipment Act - in Germany).
- The product must be supplied to a specialist recycling company. Do not use municipal waste collection points. These may be used for privately used products only in accordance with WEEE Directive 2012/19/EU.
- If there is no possibility to dispose of the old equipment properly, our Service can take care of its pick-up and disposal for a fee.

15 Specification

Note

The device data sheet is available in the ABB download area at [www.abb.com/temperature](http://www.abb.com/temperature).

16 Additional documents

Note

Declarations of conformity of the device are available in the download area of ABB at [www.abb.com/temperature](http://www.abb.com/temperature). In addition, these are also included with the device in case of ATEX-certified devices.

Trademarks

**HART** is a registered trademark of FieldComm Group, Austin, Texas, USA
17 Appendix

Return form

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: Email:

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
**Introduction**

The TTH200 with the 4 to 20 mA output and HART communications protocol has global approvals for explosion protection up to Zone 0. Safety-relevant applications up to SIL 3 (redundant) are supported in accordance with IEC 61508. The TTH200 features a universal sensor input for resistance thermometer, thermocouples, resistance and voltage measurement.

**Additional Information**

Additional documentation on TTH200 is available for download free of charge at www.abb.com/temperature. Alternatively simply scan this code:

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