TTH300
Field-mount temperature transmitter

Temperature transmitter for all communications protocols. Redundancy thanks to two inputs.

Measurement made easy

Introduction
The TTH300 is available with the HART, PROFIBUS PA and FOUNDATION Fieldbus communications protocols.

The transmitter has global approvals for explosion protection up to zone 0.

The TTH300 implements various NAMUR recommendations, including NE 89 and NE 107.

Safety-relevant applications up to SIL 3 (redundant) are supported in accordance with IEC 61508.

Additional Information
Additional documentation on TTH300 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.
**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**

ABB Automation Products GmbH
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 TTH300-E1H</th>
<th>To HW-Rev. 1.07:</th>
<th>PTB 05 ATEX 2017 X</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From HW Rev. 02.00.00:</td>
<td>PTB 20 ATEX 2008 X</td>
</tr>
<tr>
<td>Model TTH300-E1P and TTH300-E1F</td>
<td>Type Examination Test Certificate</td>
<td>PTB 09 ATEX 2016 X</td>
</tr>
<tr>
<td>II 1 G</td>
<td>Ex ia IIC T6...T1 Ga</td>
<td></td>
</tr>
<tr>
<td>II 2 (1) G</td>
<td>Ex [ia IIC Ga] Ib IIC T6...T1 Gb</td>
<td></td>
</tr>
<tr>
<td>II 2 (1D)</td>
<td>Ex [ia IIC Da] Ib IIC T6...T1 Gb</td>
<td></td>
</tr>
</tbody>
</table>

ATEX non-sparking and increased safety
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 TTH300-E2</th>
<th>Declaration of conformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 3 G Ex nA IIC T6...T1 Gc</td>
<td></td>
</tr>
<tr>
<td>II 3 G Ex ec IIC T6...T1 Gc</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Model TTH300-H1H</th>
<th>To HW-Rev. 1.07:</th>
<th>IECEx certificate of conformity</th>
<th>IECEx PTB 09.0014X</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From HW Rev. 02.00.00:</td>
<td>IECEx certificate of conformity</td>
<td>IECEx PTB 20.0035X</td>
</tr>
<tr>
<td>Model TTH300-H1P and TTH300-H1F</td>
<td>IECEx certificate of conformity</td>
<td>IECEx PTB 11.0108X</td>
<td></td>
</tr>
<tr>
<td>Ex ia IIC T6...T1 Ga</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex [ia IIC Ga] Ib IIC T6...T1 Gb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex [ia IIC Da] Ib IIC T6...T1 Gb</td>
<td></td>
<td></td>
<td></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.

<table>
<thead>
<tr>
<th>Model TTH300-E1H</th>
<th>Type Examination Test Certificate</th>
<th>PTB 05 ATEX 2079 X</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1G Ex ia IIC T6…T1 Ga</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ATEX non-sparking and increased safety
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>Declaration of conformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 3 G Ex nA IIC T6...T1 Gc</td>
</tr>
<tr>
<td>II 3 G Ex ec IIC T6...T1 Gc</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>IECEx certificate of conformity</th>
<th>IECEx PTB 12.0028X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex ia IIC T6...T1 Ga</td>
<td></td>
</tr>
</tbody>
</table>
## Temperature data

**Transmitter**

ATEX / IECEx intrinsic safety, ATEX non-sparking and increased safety

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>−50 to 56 °C (−58 to 132.8 °F)</td>
</tr>
<tr>
<td>T4-T1</td>
<td>−50 to 85 °C (−58 to 185.0 °F)</td>
</tr>
</tbody>
</table>

**LCD indicator**

ATEX / IECEx intrinsic safety, ATEX non-sparking and increased safety

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>−50 to 56 °C</td>
</tr>
<tr>
<td>T4-T1</td>
<td>−50 to 85 °C</td>
</tr>
</tbody>
</table>

## Electrical data

**Transmitter**

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

**Power supply circuit**

<table>
<thead>
<tr>
<th></th>
<th>TTH300-E1H</th>
<th>TTH300-E1H/-H1H</th>
<th>TTH300-E1F/-H1F</th>
</tr>
</thead>
<tbody>
<tr>
<td>FISCO¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. voltage</td>
<td>U_i = 30 V</td>
<td>U_i ≤ 17.5 V</td>
<td>U_i ≤ 24.0 V</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>I_o = 130 mA</td>
<td>I_o ≤ 183 mA²</td>
<td>I_o ≤ 250 mA</td>
</tr>
<tr>
<td>Max. power</td>
<td>P_i = 0.8 W</td>
<td>P_i ≤ 2.56 W²</td>
<td>P_i ≤ 1.2 W</td>
</tr>
<tr>
<td>Internal inductance</td>
<td>L_i = 160 μH¹</td>
<td>L_i ≤ 10 μH</td>
<td>L_i ≤ 10 μH</td>
</tr>
<tr>
<td>Internal capacitance</td>
<td>C_i = 0.57 nF⁴</td>
<td>C_i ≤ 5 nF</td>
<td>C_i ≤ 5 nF</td>
</tr>
</tbody>
</table>

¹ FISCO according to 60079-27
² For HART variant only. From Hardware Rev. 02.00.00, previously 0.5 mH
³ For HART variant only. From hardware revision 1.07, previously 5 nF

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

**TTH300-E1H, TTH300-H1H**

**Measurement current circuit**

<table>
<thead>
<tr>
<th></th>
<th>Resistance Thermocouples, voltages thermometers, resistors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. voltage</td>
<td>U_o = 6.5 V</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>I_o = 17.8 mA*</td>
</tr>
<tr>
<td>Max. power</td>
<td>P_o = 29 mW**</td>
</tr>
<tr>
<td>Internal inductance</td>
<td>L_i ≤ 0 mH (negligible)</td>
</tr>
<tr>
<td>Internal capacitance</td>
<td>C_i = 49 nF</td>
</tr>
<tr>
<td>Maximum permissible</td>
<td>L_o = 5 mH</td>
</tr>
<tr>
<td>Maximum permissible</td>
<td>C_o = 1.55 μF</td>
</tr>
</tbody>
</table>

* From Hardware Rev. 02.00.00, previously 25 mA
** From Hardware Rev. 02.00.00, previously 38 mW

**TTH300-E1P, TTH300-H1P, TTH300-E1F, TTH300-H1F**

**Measurement current circuit**

<table>
<thead>
<tr>
<th></th>
<th>Resistance Thermocouples, voltages thermometers, resistors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. voltage</td>
<td>U_o = 6.5 V</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>I_o = 25 mA</td>
</tr>
<tr>
<td>Max. power</td>
<td>P_o = 38 mW</td>
</tr>
<tr>
<td>Internal inductance</td>
<td>L_i ≤ 0 mH (negligible)</td>
</tr>
<tr>
<td>Internal capacitance</td>
<td>C_i = 49 nF</td>
</tr>
<tr>
<td>Maximum permissible</td>
<td>L_o = 5 mH</td>
</tr>
<tr>
<td>Maximum permissible</td>
<td>C_o = 1.55 μF</td>
</tr>
</tbody>
</table>

¹ FISCO according to 60079-27
² For HART variant only. From Hardware Rev. 02.00.00, previously 0.5 mH
³ For HART variant only. From hardware revision 1.07, previously 5 nF
⁴ For HART variant only. From Hardware Rev. 02.00.00, previously 5 nF
... 2  Use in potentially explosive atmospheres in accordance with ATEX and IECEx

**Electrical data**

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

<table>
<thead>
<tr>
<th>LCD indicator interface</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. voltage</td>
<td>$U_o = 6.2 \text{ V}$</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>$I_o = 65.2 \text{ mA}$</td>
</tr>
<tr>
<td>Max. power</td>
<td>$P_o = 101 \text{ mW}$</td>
</tr>
<tr>
<td>Internal inductance</td>
<td>$L_i \approx 0 \text{ mH (negligible)}$</td>
</tr>
<tr>
<td>Internal capacitance</td>
<td>$C_i \approx 0 \text{ nF (negligible)}$</td>
</tr>
<tr>
<td>Maximum permissible internal inductance</td>
<td>$L_i \leq 5 \text{ mH}$</td>
</tr>
<tr>
<td>Maximum permissible internal capacitance</td>
<td>$C_i \leq 1.4 \text{ μF}$</td>
</tr>
</tbody>
</table>

**Supply circuit**

<table>
<thead>
<tr>
<th>LCD indicator</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic safety type of protection</td>
<td>Ex ia IIC</td>
</tr>
<tr>
<td>Max. voltage</td>
<td>$U_i = 9 \text{ V}$</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>$I_i = 65.2 \text{ mA}$</td>
</tr>
<tr>
<td>Max. power</td>
<td>$P_i = 101 \text{ mW}$</td>
</tr>
<tr>
<td>Internal inductance</td>
<td>$L_i \approx 0 \text{ mH (negligible)}$</td>
</tr>
<tr>
<td>Internal capacitance</td>
<td>$C_i \approx 0 \text{ nF (negligible)}$</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 appropriate competences for the type of work to be conducted. When operating with combustible dusts, comply with EN 60079-31.

The safety instructions for electrical apparatus in potentially explosive areas must be in accordance with Directive 2014/34/EU (ATEX) and IEC 60079-14 (Installation of electrical equipment in potentially explosive areas). Comply with the applicable regulations for the protection of employees to ensure safe operation.

**IP protection rating of housing**

The temperature transmitter and LCD indicator Type AS must be installed according to the ‘intrinsic safety’ IP rating such that an IP rating of at least IP 20 is achieved in accordance with IEC 60529.

Perform installation according to the ‘non-sparking’ (nA) IP rating or the ‘increased safety’ (ec) IP rating such that an IP rating of at least IP 54 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 (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>$L_i + L_c$ (cable) $\leq L_o$</td>
<td></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.

With transmitters for PROFIBUS PA and FOUNDATION Fieldbus H1 applications, FISCO interconnection methods can be used.

ATEX – Zone 0
Marking: II 1 G Ex ia IIC T6...T1 Ga

![Figure 1: Intrinsic safety installation check](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.

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 ensured.

Encapsulation material used for the transmitter:
Polyurethane (PUR), WEVO PU-417
... 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

... Installation instructions

ATEX – Zone 1 (0)
Marking: II 2 (1) G Ex [ia IIC Ga] ib IIC T6...T1 Gb

Zone 0 or 1
Ex area Zone 1
Safe area

A  Sensor
B  Transmitter in housing with IP rating IP 20
C  Supply isolator [Ex ib]
D  Interface for LCD indicator

Figure 3: Hookup in ATEX - Zone 1 (0)

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 1 or Zone 0.

When using the transmitter in Zone 1, you must ensure that impermissible electrostatic charging of the temperature transmitter is prevented (observe the warnings on the device).

ATEX – Zone 1 (20)
Marking: II 2 G (1D) Ex [ia III C Da] ib IIC T6...T1 Gb

Zone 20 or 21
Ex area Zone 1
Safe area

A  Sensor
B  Transmitter in housing with IP rating IP 20
C  Supply isolator [Ex ib]
D  Interface for LCD indicator

Figure 4: Hookup in ATEX - Zone 1 (20)

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
Marking:
II 3 G Ex nA IIC T6...T1 Gc
II 3 G Ex ec IIC T6...T1 Gc

Figure 5: Hookup in ATEX – Zone 2

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). Suitable cable glands must be used for this purpose.
- 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](http://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 TTH300-L1H**
  - To HW-Rev. 1.07:  
  - Control Drawing: SAP_214829
  - From HW Rev. 02.00.00:  
  - Control Drawing: See attached information

- **Model TTH300-L1P**
  - Control Drawing: TTH300-L1P (IS)

- **Model TTH300-L1F**
  - Control Drawing: TTH300-L1F (IS)
  - Class I, Div. 1 + 2, Groups A, B, C, D
  - Class I, Zone 0, AEx la IIC T6

**FM Non-Incendive**

- **Model TTH300-L2H**
  - To HW-Rev. 1.07:  
  - Control Drawing: 214831 (Non-Incendive)
  - From HW Rev. 02.00.00:  
  - Control Drawing: See attached information

- **Model TTH300-L2P**
  - Control Drawing: TTH300-L2P (NI_PS)
  - TTH300-L2P (NI_AA)

- **Model TTH300-L2F**
  - Control Drawing: TTH300-L2F (NI_PS)
  - TTH300-L2F (NI_AA)
  - Class I, Div. 2, Groups A, B, C, D

**CSA Intrinsically Safe**

- **Model TTH300-R1H**
  - To HW-Rev. 1.07:  
  - Control Drawing: 214826
  - From HW Rev. 02.00.00:  
  - Control Drawing: See attached information

- **Model TTH300-R1P**
  - Control Drawing: TTH300-R1P (IS)

- **Model TTH300-R1F**
  - Control Drawing: TTH300-R1F (IS)
  - Class I, Div. 1 + 2, Groups A, B, C, D
  - Class I, Zone 0, Ex ia IIC T6

**CSA Non-Incendive**

- **Model TTH300-R2H**
  - To HW-Rev. 1.07:  
  - Control Drawing: SAP_214824 (Non-Incendive)

- **Model TTH300-R2P**
  - Control Drawing: TTH300-R2P (NI_PS)
  - TTH300-R2P (NI_AA)

**LCD indicator**

**FM Intrinsically Safe**

- **Control Drawing**: SAP_214748
  - I.S. Class I Div 1 and Div 2, Group: A, B, C, D or I.S. Class I Zone 0 AEx la IIC T*
  - \( U_i / V_{max} = 9 \text{ V}, I_i / I_{max} < 65.2 \text{ mA}, P_i = 101 \text{ mW}, C_i = 0.4 \mu \text{F}, L_i = 0 \)

**FM Non-Incendive**

- **Control Drawing**: SAP_214751
  - N.I. Class I Div 2, Group: A, B, C, D or Ex nL IIC T**, Class I Zone 2
  - \( U_i / V_{max} = 9 \text{ V}, I_i / I_{max} < 65.2 \text{ mA}, P_i = 101 \text{ mW}, C_i = 0.4 \mu \text{F}, L_i = 0 \)

**CSA Intrinsically Safe**

- **Control Drawing**: SAP_214749
  - I.S. Class I Div 1 and Div 2, Group: A, B, C, D or I.S. Zone 0 Ex ia IIC T*
  - \( U_i / V_{max} = 9 \text{ V}, I_i / I_{max} < 65.2 \text{ mA}, P_i = 101 \text{ mW}, C_i < 0.4 \mu \text{F}, L_i = 0 \)

**CSA Non-Incendive**

- **Control Drawing**: SAP_214750
  - N.I. Class I Div 2, Group: A, B, C, D or Ex nL IIC T**, Class I Zone 2
  - \( U_i / V_{max} = 9 \text{ V}, I_i / I_{max} < 65.2 \text{ mA}, P_i = 101 \text{ mW}, C_i < 0.4 \mu \text{F}, L_i = 0 \)
  - * Temp. Ident: T6 Twto 56 °C, T4 Tmin 85 °C
  - ** Temp. Ident: T6 Twto 60 °C, T4 Tmin 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 indicator Type A and Type AS must be installed such that an IP rating of at least IP 20 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.

Note
When operating the transmitter in Zone 0, the compatibility of the device materials with the surrounding atmosphere must be guaranteed.

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

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>$L_i + L_c$ (cable) $\leq L_o$</td>
<td></td>
</tr>
<tr>
<td>$C_i + C_c$ (cable) $\leq C_o$</td>
<td></td>
</tr>
</tbody>
</table>

![Figure 6: Intrinsic safety installation check](image)

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.

With transmitters for PROFIBUS PA and FOUNDATION Fieldbus H1 applications, FISCO interconnection methods can be used.

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 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 insert.

For devices with PROFIBUS PA or FOUNDATION Fieldbus, the device-ID is also specified.

| 1 | Manufacturer, manufacturer address, manufacturing year - week |
| 2 | Safety integrity level, SIL logo (optional with HART transmitter) |
| 3 | CE mark (EU conformity), if not on additional plate |
| 4 | Type designation / model |
| 5 | Transmitter communications protocol (HART, FF, PA) |
| 6 | 2D barcode for serial number in accordance with order |
| 7 | Serial number of the device electronics (7 or 8 digits) |
| 8 | Software revision |
| 9 | Hardware version |
| 10 | ‘Follow product documentation’ symbol |
| 11 | HART transmitter: |
| 12 | Set measuring range of the transmitter |
| 13 | Measuring point tag (TAG) in accordance with order (optional) |
| 14 | Set sensor type and circuit type |
| 15 | Transmitter FOUNDATION Fieldbus or PROFIBUS PA: |
| 16 | Measuring point tag (TAG) in accordance with order (optional) |
| 17 | DEVICE_ID or Ident_Number |
| 18 | Ambient temperature range, on additional plate for Ex versions |
| 19 | Transmitter specification (supply voltage range, output current range, communications protocol) |
| 20 | Coding of the type of protection of the device (in accordance with ordering information) |
| 21 | Serial number of the device (serial number in accordance with order) |

Figure 7: HART name plate (example)

Figure 8: PROFIBUS PA name plate (example)

Figure 9: FOUNDATION Fieldbus name plate (example)

Figure 10: 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.
5 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
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 35) 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 5 for nearest service location.
6 Installation

**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 6 and Use in potentially explosive atmospheres in accordance with FM and CSA on page 12!

## Ambient conditions

### Ambient temperature

- **Default:** −40 to 85 °C (−40 to 185 °F)
- **Optional:** −50 to 85 °C (−58 to 185 °F)
- **Restricted range during operation with LCD-indicator:** −20 to 70 °C (−4 to 158 °F)
- **Restricted range during operation with explosion-proof design:** see corresponding certificate

### Transport- / Storage temperature

−50 to 85 °C (−58 to 185 °F)

### Climate class in accordance with DIN EN 60654-1

Cx −40 to 85 °C (−40 to 185 °F) at 5 to 95 % relative air humidity

### Max. permissible humidity in accordance with IEC 60068-2-30

100 % relative air humidity

### Vibration resistance in accordance with IEC 60068-2-6

10 to 2000 Hz at 5 g, during operation and transport

### Shock resistance in accordance with IEC 60068-2-27

gn = 30, during operation and transport

### IP rating

- Power supply circuit: IP 20
- Measurement current circuit: IP 00 or IP-rating of installation housing

### 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 on the measuring inset

#### Figure 11: Installation example

**Note**

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

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)

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.
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:

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.

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.
7 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 6 and Use in potentially explosive atmospheres in accordance with FM and CSA on page 12!

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).

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 Terminal assignment on page 20.

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.

Figure 14: Warning signs

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

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.
... 7 Electrical connections

Terminal assignment

Resistance thermometers (RTD) / resistors (potentiometer)

A  Potentiometer, four-wire circuit
B  Potentiometer, three-wire circuit
C  Potentiometer, two-wire circuit
D  2 × RTD, three-wire circuit*
E  2 × RTD, two-wire circuit*
F  RTD, four-wire circuit
G  RTD, three-wire circuit
H  RTD, two-wire circuit
I  Sensor 1
J  Sensor 2*
K  Interface for LCD indicators and service
1 – 6  Sensor connection (of measuring inset)
7 – 8  4 to 20 mA HART®, PROFIBUS PA®, FOUNDATION Fieldbus®

* Sensor backup / sensor redundancy, sensor drift monitoring, mean measurement, or differential measurement

Figure 15: Terminal assignment resistance thermometers (RTD) / resistors (potentiometer)
Thermocouples / voltages and resistance thermometer (RTD) / thermocouple combinations

- **A**: 2 × voltage measurement*
- **B**: 1 × voltage measurement
- **C**: 2 × thermocouple*
- **D**: 1 × thermocouple
- **E**: 1 × RTD, four-wire circuit and 1 x thermocouple*
- **F**: 1 × RTD, three-wire circuit and 1 x thermocouple*
- **G**: 1 × RTD, two-wire circuit and 1 x thermocouple*
- **H**: Sensor 1
- **I**: Sensor 2*
- **J**: Interface for LCD indicators and service

* Sensor backup / sensor redundancy, sensor drift monitoring, mean measurement, or differential measurement

Figure 16 Terminal assignment thermocouples / voltages and resistance thermometer (RTD) / thermocouple combinations
... 7 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\(\Omega\)

Detection of sensor wire break in accordance with NE 89 in all lines

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 in accordance with IEC 60584 / ASTM E988
- D in accordance with ASTM E988

Voltages
- −125 to 125 mV
- −125 to 1100 mV

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

Detection of sensor wire break in accordance with NE 89 in all lines

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

Functionality input
Freestyle characteristic / 32-points-sampling point table
- Resistance measurement up to a maximum of 5 k\(\Omega\)
- Voltages up to maximum 1.1 V

Sensor error adjustment
- Through Callendar-Van Dusen coefficients
- Through value table, 32 support points
- Through single-point adjustment (offset adjustment)
- Through two-point adjustment

Input functionality
- 1 Sensor
- 2 Sensors:
  mean measurement,
  differential measurement,
  sensor redundancy,
  Sensor drift monitoring
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
Note
Regardless of the alarm setting (underrange or overrange), a high alarm or low alarm is always generated for some internal device errors (e.g. hardware errors). More detailed information can be found in the SIL Safety Manual.

Before SW-Rev. 3.00
Note
The default factory setting for the error current signal is high alarm 22 mA.

- Overrange / high alarm 22 mA (20.0 to 23.6 mA)
- Underrange / low alarm 3.6 mA (3.5 to 4.0 mA)

From SW-Rev. 3.00
Note
The default factory setting for the error current signal is low alarm 3.5 mA, in accordance with NAMUR recommendations NE 93, NE 107 and NE 131.

- Overrange / high alarm 22 mA (20.0 to 23.6 mA)
- Underrange / low alarm 3.5 mA (3.5 to 4.0 mA)

Output – PROFIBUS PA®

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

Output signal
- PROFIBUS – MBP (IEC 61158-2)
- Baud rate 31.25 kBit/s
- PA-Profile 3.01
- FISCO compliant (IEC 60079-27)
- ID-Number: 0x3470 [0x9700]

Error current signal
- FDE (Fault Disconnection Electronic)

Block structure
- Physical Block
- Transducer Block 1 – Temperature
- Transducer Block 2 – HMI (LCD indicator)
- Transducer Block 3 – enhanced diagnosis
- Analog Input 1 – Primary Value (Calculated Value*)
- Analog Input 2 – SECONDARY VALUE_1 (Sensor 1)
- Analog Input 3 – SECONDARY VALUE_2 (Sensor 2)
- Analog Input 4 – SECONDARY VALUE_3 (reference junction temperature)
- Analog Output – optional HMI display (Transducer Block 2)
- Discrete Input 1 – extended diagnosis 1 (Transducer Block 3)
- Discrete Input 2 – extended diagnosis 2 (Transducer Block 3)

* Sensor 1, Sensor 2 or difference or mean

For detailed information see the PROFIBUS PA® interface description (COM/TTH300/PB).
... 7 Electrical connections

... Electrical data for inputs and outputs

Output – FOUNDATION Fieldbus®

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

Output signal
- FOUNDATION Fieldbus H1 (IEC 611582-2)
- Baud rate 31.25 kBit/s, ITK 5.x
- ITK 6.x from SW-Rev. 1.02.00 (see interface description FOUNDATION Fieldbus, COM/TTX300/FF)
- FISCO compliant (IEC 60079-27)
- Device ID: 000320001F...

Error current signal
- FDE (Fault Disconnection Electronic)

Block structure*
- Resource Block
- Transducer Block 1 – Temperature
- Transducer Block 2 – HMI (LCD indicator)
- Transducer Block 3 – enhanced diagnosis
- Analog Input 1 – PRIMARY_VALUE_1 (Sensor 1)
- Analog Input 2 – PRIMARY_VALUE_2 (Sensor 2)
- Analog Input 3 – PRIMARY_VALUE_3 (Calculated Value**)
- Analog Input 4 – SECONDARY_VALUE (reference junction temperature)
- Analog Output – optional HMI display
  (Transducer Block 2)
- Discrete Input 1 – extended diagnosis 1
  (Transducer Block 3)
- Discrete Input 2 – extended diagnosis 2
  (Transducer Block 3)
- PID – PID controller

LAS (Link Active Scheduler) link master functionality

* For the block description, block index, execution times, and block class, refer to the interface description
** Sensor 1, Sensor 2 or difference or mean

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.

Power supply – HART®

Input terminal voltage
Non-Ex application:
\[ U_S = 11 \text{ to } 42 \text{ V DC} \]
Ex applications:
\[ U_S = 11 \text{ to } 30 \text{ V DC} \]

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 \( I_a \leq 3.6 \text{ mA} \).

Maximum load
\[ R_B = \frac{(\text{supply voltage} - 11 \text{ V})}{0.022 \text{ A}} \]

Maximum power
\[ P = U_S \times 0.022 \text{ A} \]
E.G. \( U_S = 24 \text{ V} \rightarrow P_{\text{max}} = 0.528 \text{ W} \)

Figure 17: Maximum load depending on input terminal voltage

Maximum power
\[ P = U_S \times 0.022 \text{ A} \]
E.G. \( U_S = 24 \text{ V} \rightarrow P_{\text{max}} = 0.528 \text{ W} \)
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.

**Figure 18: HART load resistance**

- **A** Transmitter
- **B** Supply isolator / DCS input with supply / segment coupler

- $U_{1\text{min}}$: 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.

For further information on the revision of the standard HART protocol and on switching options, see **HART® Communication** on page 26 and **Hardware settings** on page 29.
8 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.

Hardware settings on page 29

Checks prior to commissioning

The following points must be checked before commissioning the device:

- Correct wiring in accordance with Electrical connections on page 18.
- The ambient conditions must correspond to the information given on the name plate and in the data sheet.

Communication

HART® 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.

<table>
<thead>
<tr>
<th>Manufacturer ID</th>
<th>0x1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device ID</td>
<td>HART 5: 0x000B, HART 7: 0x1A0B</td>
</tr>
</tbody>
</table>
| Profile         | From SW-Rev. 3.00 (corresponds to HW-Rev. 2.00 and higher):
|                 | HART 5.9 and HART 7.6, switchable via
|                 | • HMI LCD indicator with configuration function
|                 | • Tools
|                 | • HART commands
|                 | Default, if nothing else ordered: HART 7.6. |
| SW-Rev. 1.03:   | HART 5.1 and HART 7, switchable via DIP switch.
|                 | Default, if nothing else ordered: HART 5.1. |
| SW-Rev. 1.01.08:| HART 5.1, previously HART 5. |
| Configuration   | On device using LCD indicator
|                 | DTM, EDD, FDI (FIM) |
| Transmission signal | BELL Standard 202 |

Operating modes

- Point-to-point communication mode – standard (general address 0)
- HART 5: Multidrop mode (addressing 1 to 15)
- HART 7: Addressing 0 to 63, independent of current loop mode
- Burst Mode
Configuration options / tools

Driver-independent:
- HMI LCD indicator with configuration function

Driver-dependent:
- Device management / Asset management tools
- FDT technology – via TTX300-DTM driver (Asset Vision Basic / DAT200)
- EDD – via TTX300 EDD driver (Handheld terminal, Field Information Manager / FIM)
- FDI technology – via TTX300 package (Field Information Manager / FIM)

Diagnosis notice
- Overrange-/ underrange in accordance with NE 43
- HART® diagnosis

Extended from SW-Rev. 3.00
- Device status signaling according to NE 107
- Freely configurable diagnostic categorization with diagnostic history according to NE 107

Tracking of events and configuration changes, from SW-Rev. 3.00

The HART® device stores information on critical events and configuration changes.

The information can be output via tools:
- Event monitor for logging critical events
- Configuration monitor for configuration changes

See the interface description HART® (COM/TTX300/HART) for details.

PROFIBUS® Communication

Note

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

The interface conforms to Profile 3.01 (standard PROFIBUS®, EN 50170, DIN 1924 [PRO91]).

![Example for PROFIBUS PA® connection](image)

<table>
<thead>
<tr>
<th>Manufacturer ID</th>
<th>0x1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID number</td>
<td>0x3470 [0x9700]</td>
</tr>
<tr>
<td>Profile</td>
<td>PA 3.01 (see interface description PROFIBUS PA® (COM/TTX300/PB))</td>
</tr>
<tr>
<td>Configuration</td>
<td>On device using LCD indicator</td>
</tr>
<tr>
<td></td>
<td>DTM</td>
</tr>
<tr>
<td></td>
<td>EDD</td>
</tr>
<tr>
<td></td>
<td>GSD</td>
</tr>
<tr>
<td>Transmission signal</td>
<td>IEC 61158-2</td>
</tr>
</tbody>
</table>

Voltage / current consumption

- Mean current consumption: 12 mA.

In the event of an error, the FDE function (= Fault Disconnection Electronic) integrated in the device makes sure that the current consumption cannot exceed a maximum of 20 mA.


8 Commissioning

Communication

FOUNDATION Fieldbus® Communication

Note

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

![Diagram of FOUNDATION Fieldbus® connection]

- Transmitter
- Bus termination
- Handheld terminal
- Linking Device
- PC / DCS

Figure 21: Example for FOUNDATION Fieldbus® connection

<table>
<thead>
<tr>
<th>Device ID</th>
<th>000320001F...</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITK</td>
<td>5.x</td>
</tr>
<tr>
<td>ITC from SW-Rev. 1.02.00</td>
<td>6.x (see FOUNDATION Fieldbus® interface description (COM/TTX300/FF))</td>
</tr>
<tr>
<td>Configuration</td>
<td>On device using LCD indicator</td>
</tr>
<tr>
<td>Transmission signal</td>
<td>IEC 61158-2</td>
</tr>
</tbody>
</table>

Basic Setup

Note

The communication and configuration of the transmitter via HART, PROFIBUS PA and FOUNDATION Fieldbus H1 are described in the separate documentation “Interface Description” for the relevant protocol (COM/TTX300/...).

The following configuration types are available for the transmitter:

- With DTM:
  Configuration can be performed within an FDT frame application that is approved for use with the DTM.

- With EDD:
  Configuration can be performed within an EDD frame application that is approved for use with the EDD.

- With FDI-Package (FIM):
  Configuration is possible within an FDI frame applications (Field Information Manager / FIM) for which the FDI packages are released.

- With LCD Indicator Type A with operating buttons
  Commissioning via the LCD indicator does not require any tools to be connected to the device and is therefore the simplest way of configuring the TTH300.

Note

Unlike configuration using the DTM, EDD or FDI-Package (FIM) the functionality of the transmitter can only be changed to a limited extent with the LCD indicator.

Voltage / current consumption

- Mean current consumption: 12 mA.
  In the event of an error, the FDE function (= Fault Disconnection Electronic) integrated in the device makes sure that the current consumption cannot exceed a maximum of 20 mA.
9 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.

Hardware settings

Devices with HART® from HW-Rev. 2.00 (corresponds to SW-Rev. 3.00 and higher)
HART devices from HW-Rev. 2.00 do not have DIP switches. The desired HART profile (HART 7 or HART 5) and the write protection is set via the operating buttons of the LCD display (optional), tools or HART commands.

Note
Factory setting, unless explicitly ordered otherwise:
• HART 7
• Write protection OFF

Devices with PROFIBUS PA®, FOUNDATION Fieldbus® and HART® to HW-Rev. 1.07

The transmitter has two DIP switches that can be accessed via a hinged cover.
• Switch 1 activates the hardware write protection.
• Switch 2 supports the FOUNDATION Fieldbus requirement for a hardware enable for simulation in accordance with ITK.

For transmitters that support HART 7, switch 2 allows the desired HART version to be set (HART 5 or HART 7).

<table>
<thead>
<tr>
<th>DIP switch</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Local write protection</td>
</tr>
<tr>
<td></td>
<td>Off: Local write protection deactivated</td>
</tr>
<tr>
<td></td>
<td>On: Local write protection activated</td>
</tr>
<tr>
<td>2</td>
<td>Enabling the simulation (only with FOUNDATION Fieldbus)</td>
</tr>
<tr>
<td></td>
<td>Off: Simulation blocked</td>
</tr>
<tr>
<td></td>
<td>On: Simulation enabled</td>
</tr>
<tr>
<td></td>
<td>Selecting the HART version (only with HART protocol)</td>
</tr>
<tr>
<td></td>
<td>Off: HART 5</td>
</tr>
<tr>
<td></td>
<td>On: HART 7</td>
</tr>
</tbody>
</table>

Note (not for HART devices from HW-Rev. 2.00)
• Factory settings: Both switches ‘OFF’. Local write protection deactivated and HART 5, unless explicitly ordered HART 7 (HART version) or simulation locked (FOUNDATION Fieldbus).
• With PROFIBUS PA devices, Switch 2 must always be in the ‘OFF’ position.
... 9 Operation

Menu navigation

You can use the [ ] or [ ] operating buttons to browse through the menu or select a number or character within a parameter value. Different functions can be assigned to the [ ] and [ ] operating buttons. The function [ ] that is currently assigned to them is shown on the LCD display.

Control button functions

<table>
<thead>
<tr>
<th>Meanings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit</td>
<td>Exit menu</td>
</tr>
<tr>
<td>Back</td>
<td>Go back one submenu</td>
</tr>
<tr>
<td>Cancel</td>
<td>Cancel a parameter entry</td>
</tr>
<tr>
<td>Next</td>
<td>Select the next position for entering numerical and alphanumeric values</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Meanings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select</td>
<td>Select submenu / parameter</td>
</tr>
<tr>
<td>Edit</td>
<td>Edit parameter</td>
</tr>
<tr>
<td>OK</td>
<td>Save parameter entered</td>
</tr>
</tbody>
</table>

Note

For detailed information on the parameterization of the device, consult the associated operating instructions.

Process display

The process display appears on the LCD display when the device is powered on. It shows information about the device and current process values. The way in which the current process values are shown can be adjusted on the configuration level. The symbols at the bottom of the process display are used to indicate the functions of the operating buttons [ ] and [ ], in addition to other information.

From SW-Rev. 3.00, two process variables can also be optionally displayed: one is displayed on top of the other.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Call up information level.</td>
</tr>
<tr>
<td>2</td>
<td>Call up configuration level.</td>
</tr>
<tr>
<td>3</td>
<td>The device is protected against changes in the parametrization.</td>
</tr>
</tbody>
</table>
Error messages in the HART® LCD display

In the event of an error, different information appears depending on the revision:

- To SW-Rev. 1.03: A symbol or letter (Device Status) and a number (DIAG.NO.)
- As of SW-Rev. 3.00: Corresponding device status symbol and associated diagnostics group.

The error can then be read in plain text via the information level “Diagnosis” (from SW-Rev. 3.00).

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>Configuration</td>
<td>Diagnosis of the communication interface and parameterization / configuration.</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>Diagnosis for ambient and process conditions.</td>
</tr>
<tr>
<td>Process</td>
<td>Notes and warnings when leaving the sensor or process temperature range.</td>
</tr>
<tr>
<td>(from SW-Rev. 3.00)</td>
<td></td>
</tr>
</tbody>
</table>

Note

For a detailed description of the errors and notices on troubleshooting, see “Diagnosis / error messages” in the operating instruction.

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

<table>
<thead>
<tr>
<th>Symbol letter*</th>
<th>Status symbols according to NAMUR NE 107**</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>not applicable</td>
<td>OK or Information Device is functioning or information is available</td>
</tr>
<tr>
<td>C</td>
<td>Check Function</td>
<td>Device is undergoing maintenance (for example simulation)</td>
</tr>
<tr>
<td>S</td>
<td>Off Specification</td>
<td>Device or measuring point is being operated outside of the specifications</td>
</tr>
<tr>
<td>M</td>
<td>Maintenance Required</td>
<td>Request service to prevent the measuring point from failing</td>
</tr>
<tr>
<td>F</td>
<td>Failure</td>
<td>Error, measuring point has failed</td>
</tr>
</tbody>
</table>

* To SW-Rev. 1.03

** From SW-Rev. 3.00
... 9 Operation

... Process display

Error messages in the LCD display PROFIBUS PA® and FOUNDATION Fieldbus®

In the event of an error, a message consisting of a symbol and text appears at the bottom of the process screen (e.g. electronics) The text displayed provides information about the area in which the error has occurred.

The error messages are divided into four groups in accordance with the NAMUR classification scheme. The group assignment can only be changed using a DTM or EDD:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✗</td>
<td>Error / failure</td>
</tr>
<tr>
<td>⬇</td>
<td>Function check</td>
</tr>
<tr>
<td>🎓</td>
<td>Outside of the specification</td>
</tr>
<tr>
<td>🔄</td>
<td>Maintenance required</td>
</tr>
</tbody>
</table>

The error can then be read in plain-text format on the ‘Diagnosis’ information level.

The error messages are also 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 the errors and notices on troubleshooting, see “Diagnosis / error messages” in the operating instruction.
Factory settings

Firmware settings
The transmitter is configured ex works.

HART® devices from SW-Rev. 3.00
These devices can be reset to the factory setting, as well as to the setting according to the customer order. With the menu item “Factory reset” in the service menu, the factory settings are reset to the factory settings according to the following table (corresponds to standard configuration BS).
The menu item “Reset to Order” in the service menu is used to reset to the configuration ordered by the customer (default configuration BS, customer-specific configuration without special user characteristic BF or customer-specific configuration with special user characteristic BG).
The currently set HART protocol remains unchanged during a factory reset and a reset to order.

Devices with PROFIBUS PA®, FOUNDATION Fieldbus® and HART® (all SW revisions)
The following table with the corresponding parameter values applies.

<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></td>
<td>Input Sensor 1</td>
<td>Sensor Type</td>
<td>Pt100 (IEC60751)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R-Connection</td>
<td>Three-wire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measured Range Begin¹</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measured Range End¹</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Unit</td>
<td>Degrees °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Damping</td>
<td>Off</td>
</tr>
<tr>
<td>Process Alarm</td>
<td></td>
<td>Fault signaling¹</td>
<td>To SW-Rev. 1.03: Overrange / high alarm 22 mA¹ From SW-Rev. 3.00: Underrange / low alarm 3.5 mA¹</td>
</tr>
<tr>
<td></td>
<td>Input Sensor 2</td>
<td>Sensor Type</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Input / output assignment</td>
<td>Measurement type</td>
<td>Sensor 1</td>
</tr>
<tr>
<td></td>
<td>TAG</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>HART Descriptor¹</td>
<td>–</td>
<td>To SW-Rev. 1.03: TIXXX-¹</td>
</tr>
<tr>
<td>Display</td>
<td>Display Value</td>
<td>–</td>
<td>Process Variable</td>
</tr>
<tr>
<td></td>
<td>Bargraph¹</td>
<td>–</td>
<td>Yes, output %¹</td>
</tr>
<tr>
<td></td>
<td>Language</td>
<td>–</td>
<td>English</td>
</tr>
<tr>
<td></td>
<td>Contrast</td>
<td>–</td>
<td>50 %</td>
</tr>
<tr>
<td>Communication</td>
<td>HART Burstmode¹</td>
<td>Status¹</td>
<td>Off¹</td>
</tr>
<tr>
<td></td>
<td>Bus Address²³</td>
<td>–</td>
<td>126³ / 30³</td>
</tr>
<tr>
<td></td>
<td>Simulation mode³</td>
<td>–</td>
<td>Off³</td>
</tr>
<tr>
<td></td>
<td>HART Protocol</td>
<td>–</td>
<td>HART 5 / 7⁴</td>
</tr>
</tbody>
</table>

1 Only applies to HART transmitters
2 Only applies to PROFIBUS PA transmitters
3 Only applies to FOUNDATION Fieldbus transmitters
4 The currently set HART protocol remains unchanged during any type of reset (all SW revisions).
10 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.

Note
For detailed information on the maintenance of the device,
consult the associated operating instructions (OI)!

11 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.

12 Specification

Note
The device data sheet is available in the ABB download area at
www.abb.com/temperature.

13 Additional documents

Note
Declarations of conformity of the device are available in the
download area of ABB at 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
PROFIBUS and PROFIBUS PA are registered trademarks of PROFIBUS &
PROFINET International (PI)
FOUNDATION Fieldbus is a registered trademark of FieldComm Group, Austin,
Texas, USA.
14 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
The TTH300 is available with the HART, PROFIBUS PA and FOUNDATION Fieldbus communications protocols. The transmitter has global approvals for explosion protection up to Ex d IIC T5 and Ex a IIB T3 Gb. Safety-relevant applications up to SIL 3 (redundant) are supported in accordance with IEC 61508.

Additional Information
Additional documentation on TTH300 is available for download free of charge at www.abb.com/temperature. Alternatively simply scan this code.

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