TTF300

Field-mount temperature transmitter

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

Measurement made easy

Introduction

The TTF300 is available with the HART, PROFIBUS PA and FOUNDATION Fieldbus communication protocols.

The TTF300 has global approvals for explosion protection up to Zone 0.

The TTF300 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 TTF300 is available for download free of charge at www.abb.com/temperature.
Alternatively simply scan this code:

Table of contents

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 corresponding SIL-Safety Manual should be observed.

Improper use

The following are considered to be instances of especially improper use of the device:

- For use as a climbing aid, for example for mounting purposes.
- For use as a bracket for external loads, for example as a support for piping, etc.
- 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.

Cyber security disclaimer

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 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.

Software downloads

By visiting the web pages indicated below, you will find notifications about newly found software vulnerabilities and options to download the latest software. It is recommended that you visit this web pages regularly:
www.abb.com/cybersecurity

ABB Library – TTF300 – Software downloads

Manufacturer's address

ABB AG
Measurement & Analytics
Schillerstr. 72
32425 Minden
Germany
Tel: +49 571 830-0
Fax: +49 571 830-1806

Service address

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

Ex marking

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.
- A list of standards, including the output data to which the device conforms, can be found in the examination certificate or manufacturer's declaration supplied with the device.
- In devices with several types of protection, for example TTF300 -E4, observe the 'Product Identification' chapter in the operating or commissioning instruction before commissioning.

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.

Model TTF300-E1H	
To HW-Rev.: 01.07:	
Type Examination Test Certificate	PTB 05 ATEX 2017 X
From HW-Rev.: 02.00:	
Type Examination Test Certificate	PTB 20 ATEX 2008 X
Model TTF300-E1P and TTF300-E1F	
Type Examination Test Certificate	PTB 09 ATEX 2016 X
II 1 G	Ex ia IIC T6…T1 Ga
II 2 (1) G	Ex [ia IIC Ga] ib IIC T6…T1 Gb
II 2 G (1D)	Ex [ia IIIC Da] ib IIC T6…T1 Gb

ATEX increased safety and dust explosion protection

Approved for use in zone 2 and 22.

Model TTF300-E5	
TTF300-E5H to HW-Rev.: 01.07, TTF300-E5P, TTF300-E5F:	
Manufacturer's Declaration	
II 3 G	Ex ec IIC T6...T1 Gc
II 3 D	Ex tc IIIB T133°C Dc

ATEX dust explosion protection

Approved for use in Zone 21 and 22.

TTF300-D5H model to HW-Rev.: 01.07	
Type Examination Test Certificate	BVS 06 ATEX E 029
II 2D	Ex tb IIIC T135°C Db
II 3D	Ex tc IIIC T135°C Dc

ATEX dust explosion protection | intrinsic safety

Permitted for zone 21, 22 | Zone 0, 1 and 2.

The 'D6H' coding combines 'Dust explosion protection' (TTF300-D5H) and 'Intrinsic safety' (TTF300-E1H) types of protection. Devices with several types of protection may only be operated in one of the possible types of protection. For this purpose, observe the 'Product Identification' chapter in the operating or commissioning instruction before commissioning.

TTF300-D6H model to HW-Rev.: 01.07	
Type examination test certificate	BVS 06 ATEX E 029
"Dust explosion protection", (TTF300-D5H)	
Type examination certificate	PTB 05 ATEX 2017 X
"Intrinsic safety", (TTF300-E1H)	
II 1G	Ex ia IIC T6…T1 Ga
II 2D	Ex tb IIIC T135°C Db

ATEX flameproof (enclosure)

Approved for use in Zone 1 and 2.

Model TTF300-E3	
Type Examination Test Certificate	PTB 99 ATEX 1144 X
II 1/2 G	Ex db IIC T6/T4 Ga/Gb

ATEX flameproof (enclosure) | intrinsic safety

Permitted for zone 1 and 2 (flameproof enclosure) | Zone 0, 1 and 2 (intrinsic safety).

The 'E4' coding combines the following types of protection: 'Intrinsic safety' (TTF300-E1) and 'Flameproof (enclosure)' (TTF300-E3).
Devices with several types of protection may only be operated in one of the possible types of protection. For this purpose, observe the 'Product Identification' chapter in the operating or commissioning instruction before commissioning.

Model TTF300-E4	
Type Examination Test Certificate	PTB 99 ATEX 1144 X
TTF300-E4P and TTF300-E4F:	
Type Examination Test Certificate	PTB 05 ATEX 2016 X
TTF300-E4H to HW-Rev.: 01.07:	
Type Examination Test Certificate	PTB 05 ATEX 2017 X
TTF300-E4H from HW-Rev.: 02.00:	
Type Examination Test Certificate	PTB 20 ATEX 2008 X
II 1/2 G Ex db IIC T6/T4 Ga/Gb	
II 1 G Ex ia IIC T6…T1 Ga	

IECEx intrinsic safety

Approved for use in Zone 0, 1, and 2.

Model TTF300-H1H	
To HW-Rev.: 01.07:	
IECEx Certificate of Conformity	IECEx PTB 09.0014X
From HW-Rev.: 02.00:	
IECEx certificate of conformity	IECEx PTB 20.0035X
Model TTF300-H1P and TTF300-H1F	
IECEx Certificate of Conformity	IECEx PTB 11.0108X
Ex ia IIC T6...T1 Ga	
Ex [ia IIC Ga] ib IIC T6...T1 Gb	
Ex [ia IIIC Da] ib IIC T6...T1 Gb	

IECEx dust explosion protection

Approved for use in Zone 21 and 22.

TTF300-J5H model to HW-Rev.: 01.07	
IECEx certificate of conformity	IECEx BVS 17.0065X
Ex tb IIIC T135°C Db	
Ex tc IIIC T135°C Dc	

IECEx flameproof (enclosure)

Approved for use in Zone 1 and 2.

Model TTF300-H5	
IECEx Certificate of Conformity	IECEx PTB 12.0039 X
Ex db IIC T6/T4 Gb	

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 ia IIC T6…T1 Ga	

IECEx intrinsic safety

Approved for use in Zone 0, 1, and 2.

IECEx certificate of conformity	IECEx PTB 12.0028X
Ex ia IIC T6…T1 Ga	

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Temperature data

Transmitter

ATEX / IECEx intrinsic safety, ATEX increased safety as well as dust explosion protection (Zone 22)

Temperature class	Permissible ambient temperature range
T6, T5	−50 to 56 °C (−58 to 132.8 °F)
T4 to T1	−50 to 85 °C (−58 to 185.0 °F)

ATEX / IECEx flameproof (enclosure)

Temperature class	Permissible ambient temperature range on the connection head
T6	−40 to 67 °C (−40 to 152 °F)
T4 to T1	−40 to 85 °C (−40 to 185 °F)

LCD indicator

ATEX / IECEx intrinsic safety

Temperature class	Permissible ambient temperature range
T6	−50 to 56 °C (−58 to 132.8 °F)
T4 to T1	−50 to 85 °C (−58 to 185 °F)

Electrical data

Transmitter

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

Supply circuit	TTF300-E1H TTF300-H1H	TTF300-E1P/-H1P TTF300-E1F/-H1F	
		FISCO*	ENTITY
Max. voltage	U_i = 30 V	U_i ≤ 17.5 V	U_i ≤ 24.0 V
Short-circuit current	I_i = 130 mA	I_i ≤ 183 mA*	I_i ≤ 250 mA
Max. power	P_i = 0.8 W	P_i ≤ 2.56 W*	P_i ≤ 1.2 W
Internal inductance	L_i = 160 µH**	L_i ≤ 10 µH	L_i ≤ 10 µH
Internal capacitance	C_i = 0.57 nF***	C_i ≤ 5 nF	C_i ≤ 5 nF

* II B FISCO: I_i ≤ 380 mA, P_i ≤ 5.32 W

** Only applies to HART variant. From HW-Rev.: 02.00, previously 0.5 mH

*** Only applies for HART variants. From HW-Rev.: 1.07, previously 5 nF

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

TTF300-E1H, TTF300-H1H measurement current circuit model	Resistance thermometers, resistors	Thermocouples, voltages
Max. voltage	U_o = 6.5 V	U_o = 1.2 V
Short-circuit current	I_o = 17.8 mA[1]	I_o = 50 mA
Max. power	P_o = 29 mW[2]	P_o = 60 mW
Internal inductance	L_i ≈ 0 mH (negligible)	L_i ≈ 0 mH (negligible)
Internal capacitance	C_i = 49 nF	C_i = 49 nF
Maximum permissible external inductance	L_o = 5 mH	L_o = 5 mH
Maximum permissible external capacitance	C_o = 1.65 µF[3]	C_o = 1.15 µF[4]

1 From HW-Rev.: 02.00, previously 25 mA

2 From HW-Rev.: 02.00, previously 38 mW

3 From HW-Rev.: 02.00, previously 1.55 µF

4 From HW-Rev.: 02.00, previously 1.05 µF

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

TTF300-E1P, TTF300-H1P, TTF300-E1F, TTF300-H1F measurement current circuit model		
	Resistance thermometers, resistors	**Thermocouples, voltages**
Max. voltage	U_o = 6.5 V	U_o = 1.2 V
Short-circuit current	I_o = 25 mA	I_o = 50 mA
Max. power	P_o = 38 mW	P_o = 60 mW
Internal inductance	L_i ≈ 0 mH (negligible)	L_i ≈ 0 mH (negligible)
Internal capacitance	C_i = 49 nF	C_i = 49 nF
Maximum permissible external inductance	L_o = 5 mH	L_o = 5 mH
Maximum permissible external capacitance	C_o = 1.55 µF	C_o = 1.05 µF

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

LCD indicator interface	
Max. voltage	U_o = 6.2 V
Short-circuit current	I_o = 65.2 mA
Max. power	P_o = 101 mW
Internal inductance	L_i ≈ 0 mH (negligible)
Internal capacitance	C_i ≈ 0 nF (negligible)
Maximum permissible external inductance	L_o = 5 mH
Maximum permissible external capacitance	C_o = 1.4 µF

Type of protection: flameproof (enclosure) Ex db IIC

Supply circuit	
Maximum voltage	U_S = 30 V
Maximum current	I_s = 32 mA, limited by the upstream fuse (rated fuse current 32 mA)

Measurement current circuit	
Maximum voltage	U_O = 6.5 V
Maximum current	I_O = 17.8 mA
Maximum power	P_O = 39 mW

Type of protection: dust explosion protection Ex tb IIIC T135°C Db, Ex tc IIIC T135°C Dc

Non-intrinsically safe power supply

Supply circuit	
Maximum voltage	U_S = 30 V
Maximum current	I_s = 32 mA, limited by the upstream fuse (rated fuse current 32 mA)

Measurement current circuit	
Maximum permissible power dissipation in the measuring inset (sensor)	P_i = 0.5 W

Intrinsically safe power supply

If in the dust explosion protection type of protection, the transmitter is supplied with power from a power supply unit which is designed as intrinsically safe in the ‘Ex ia’ or ‘Ex ib’ type of protection, a limitation of the power supply circuit by an upstream fuse is not required.

In this case, the electric data of the transmitter for the intrinsic safety type of protection Ex ia IIC (Part 1) for TTF300-E1H and TTF300-H1H, Ex ia IIC (Part 2) as well Ex ia IIC (Part 3) should be complied with.

Refer to **Intrinsic safety type of protection Ex ia IIC (Part 1)** on page 8.

LCD indicator

Intrinsic safety type of protection Ex ia IIC

Supply circuit	
Max. voltage	U_i = 9 V
Short-circuit current	I_i = 65.2 mA
Max. power	P_i = 101 mW
Internal inductance	L_i ≈ 0 mH (negligible)
Internal capacitance	C_i ≈ 0 nF (negligible)

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Installation instructions

ATEX / IECEx / EAC-Ex

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.

Cable entries

Devices with type of protection 'Ex d' without supplied cable glands

For devices with the 'Ex d – flameproof (enclosure)' type of protection which are supplied without cable glands, observe the instructions in **Flameproof (enclosure) – Zone 1** on page 15.
For information on the cable gland used, refer to the relevant data sheet and operating instructions.

Devices with type of protection 'Ex d' with cable glands

If devices in 'Ex d – flameproof (enclosure)' type of protection with cable gland are ordered, an Ex d certified cable gland is factory-installed.

Cable gland data

- Thread: 2 × M20 × 1.5 or 2 × ½ in NPT
- Temperature range: −50 to 85 °C (−58 to 185 °F)
- External cable diameter: 3.2 to 8.7 mm (0.13 to 0.34 in)
- Material: Brass, nickel-plated

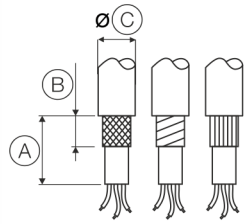
The cable entry is only suitable for fixed installations and non-reinforced cables with round and smooth plastic sleeves and suitable outside diameter. The cables must be attached appropriately in order to prevent them being pulled out or twisted.

The operating instruction and approvals supplied with the cable glands, as well as any applicable requirements in accordance with EN 60079-14 must be taken into account accordingly.

Installation instructions for cable glands

The sealing rings of the cable glands harden at low temperatures. Before installation, bring the sealing rings to a temperature of at least 20 °C for 24 hours. Before inserting the sealing rings and fixing them onto the cable gland, knead the rings to ensure they are soft and flexible.

IP rating IP66 / 67 is only achieved by installing the black neoprene sealing ring between the cable gland and the housing and by observing the tightening torque of 3.6 Nm (**Figure 2**, item ②).
Cables must be protected against extreme mechanical loads (caused by tension, torsion, crushing, and so on). Even under operating conditions, it must be ensured that the cable entry remains hermetically sealed. The customer must provide a strain relief device for the cable.



Ⓐ 40 mm
Ⓑ 12 mm
Ⓒ Ø 8.5 / 12 mm

Figure 1: Stripping the connection cables

1. Check that cable used is suitable (i.e., check the mechanical resilience, temperature range, creep resistance, resistance to chemicals, outside diameter, and so on).
2. Strip the cable in accordance with **Figure 1**.
3. Check the outer sleeve for damage and soiling.
4. Insert the cable in the cable gland.

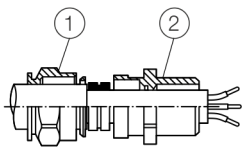


Figure 2: Tightening the cable glands

5. Tighten the cable gland until the cable is firmly enclosed by the sealing ring (**Figure 2**, item ①). Do not tighten more than 1.5--times of the specified torque on the housing (see assembly instructions for cable gland)!

Maintenance
Check the cable glands during each maintenance session. If the cable is slack, retighten the cap(s) of the cable glands.
If it is not possible to retighten them, the cable gland will need to be replaced.

M20 × 1.5 plastic cable gland for various types of protection
The optionally supplied M20 × 1.5 plastic cable gland has a limited temperature range. The permissible ambient temperature range of the cable gland is −20 to 80 °C (−4 to 176 °F). When using the cable gland, make sure that the ambient temperature is within this range.

The cable gland must be installed in the housing with a tightening torque of 3.8 Nm. On the cable side, when installing the connection of the cable gland and cable, check for integrity to ensure that the required IP rating is met.

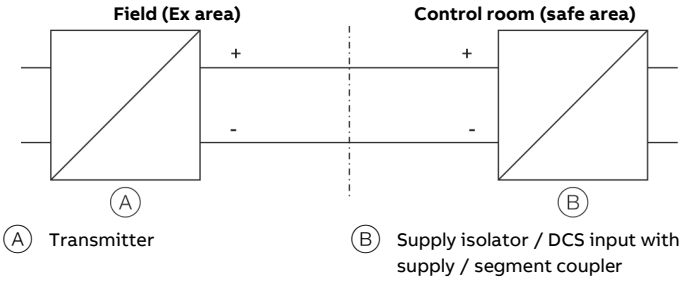
Electrical connections

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:

Transmitter (intrinsically safe equipment)		**Supply isolator / DCS input (related equipment)**
U_i	≥	U_o
I_i	≥	I_o
P_i	≥	P_o
$L_i + L_c$ (cable)	≤	L_o
$C_i + C_c$ (cable)	≤	C_o



Ⓐ Transmitter

Ⓑ Supply isolator / DCS input with supply / segment coupler

Figure 3: Intrinsic safety proof

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.

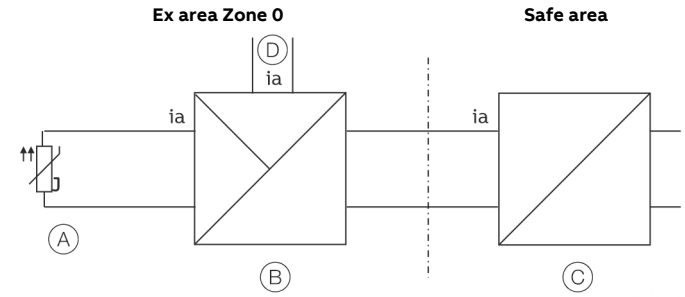
With transmitters for PROFIBUS PA and FOUNDATION Fieldbus H1 applications, FISCO interconnection methods can be used.

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

… Installation instructions

ATEX – Zone 0

Marking: II 1 G Ex ia IIC T6...T1 Ga



A Sensor
B TTF300 transmitter
C Supply isolator [Ex ia]
D Interface for LCD indicator

Figure 4: Hookup in ATEX – Zone 0

The input for the supply isolator must be designed with ‘Ex ia’ type of protection.
Please make sure to avoid impermissible electrostatic charging of the transmitter when using it in Zone 0.
As the user, it is your responsibility to ensure that the sensor instrumentation meets the requirements of applicable explosion protection standards.

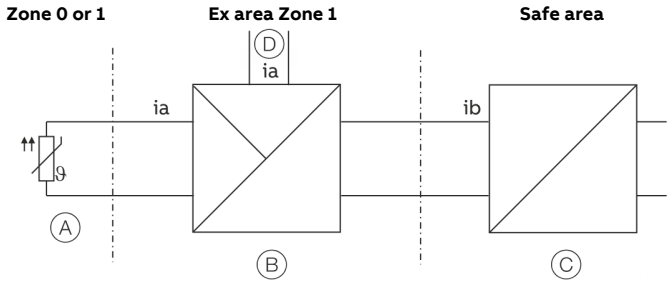
⚠ WARNING

Risk of explosion!
When using the device in areas which require the ‘Ga’ equipment protection level - EPL (Zone 0), the TTF300 types should be installed with aluminum housings to protect against mechanical impact loads or friction.

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)

ATEX – Zone 1 (0)

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



A Sensor
B TTF300 transmitter
C Supply isolator [Ex ib]
D Interface for LCD indicator

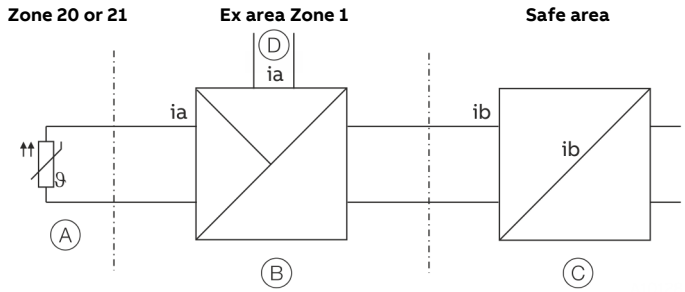
Figure 5: Hookup in ATEX - Zone 1 (0)

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, make sure that impermissible electrostatic charging of the temperature transmitter is avoided.

ATEX – Zone 1 (20)

Marking: II 2 G (1D) Ex [ia IIIC Da] ib IIC T6...T1 Gb



Ⓐ Sensor
Ⓑ TTF300 transmitter
Ⓒ Supply isolator [Ex ib]
Ⓓ Interface for LCD indicator

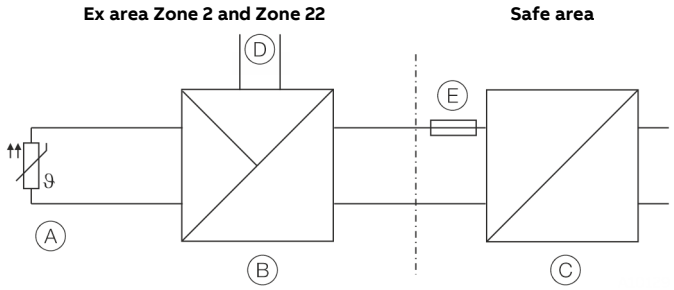
Figure 6: Hookup in ATEX - Zone 1 (20)

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.

ATEX – Zone 2 and Zone 22

Marking:
II 3 G Ex nA IIC T6...T1 Gc
II 3 G Ex ec IIC T6...T1 Gc
II 3 D Ex tc IIIB T133°C Dc



Ⓐ Sensor
Ⓑ TTF300 transmitter
Ⓒ Supply isolator with voltage limit (30 V)
Ⓓ Interface for LCD indicator
Ⓔ TTF300-E5H*

Figure 7: Hookup in ATEX - Zone 2

* from HW-Rev.: 02.00.00: Fuse, 32 mA

When using the transmitter in Zone 2 and Zone 22, observe the following:

- The temperature transmitter must be installed in accordance with IP rating IP 54 (in accordance with EN 60529). 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.
- The temperature transmitter must be installed, operated and maintained in such a way as to avoid the occurrence of electrostatic charging.
- The temperature transmitter must be integrated into the potential equalization of the system.
- The connection leads must be permanently installed and secured against tensile load.

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

… Installation instructions

In addition, the following points must be observed for TTF300 HART (TTF300-E5H) from HW-Rev.: 02.00.00:
The power supply circuit of the transmitter must be limited by an upstream fuse with a fuse current rating of 32 mA and a fuse rated voltage of ≥ 30 V. The fuse can be located in the associated supply isolator or must be separately installed upstream. The breaking capacity of the fuse must be the same or greater than the maximum assumed short-circuit current at the installation site (usually 1,500 A).
The display / service interface must not be used in type of protection 'nA' and 'ec'.

Note
Use in explosive hybrid mixtures, where explosive dusts and gases are present simultaneously, is not currently permitted in accordance with EN 60079-0 and EN 60079-31.

Dust explosion protection – Zone 21

Marking:
II 2D Ex tb IIIC T135°C Db
II 3D Ex tc IIIC T135°C Dc

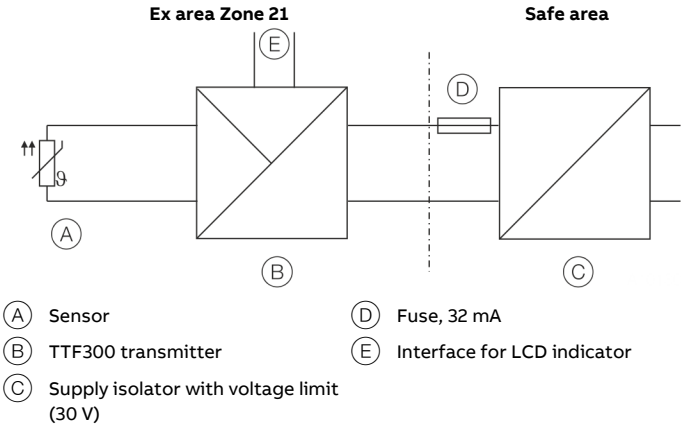
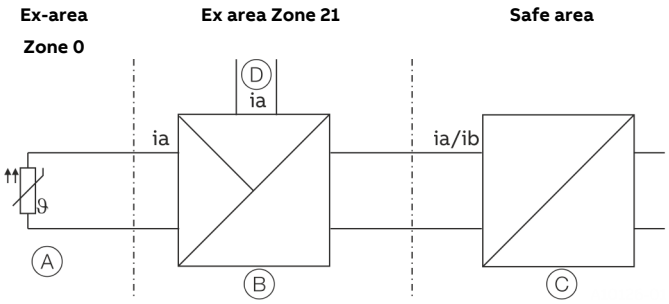


Figure 8: Hookup in Zone 21 (dust explosion protection)

The power supply circuit of the transmitter must be limited by an upstream fuse with a fuse current rating of 32 mA. This is not required if the power supply unit is designed as intrinsically safe with a 'Ex ia / Ex ib' type of protection.
Maximum input terminal voltage of the transmitter: 30 V DC.
The maximum permissible power dissipation in the measuring inset (sensor) is P_i = 0.5 W.
As the user, it is your responsibility to ensure that the sensor instrumentation meets the requirements of applicable explosion protection standards.

Dust explosion protection – Zone 0/21

Housing design: ATEX II 2D Ex tb IIIC T135°C Db
Transmitter design: ATEX II 1G Ex ia IIC T6...T1 Ga



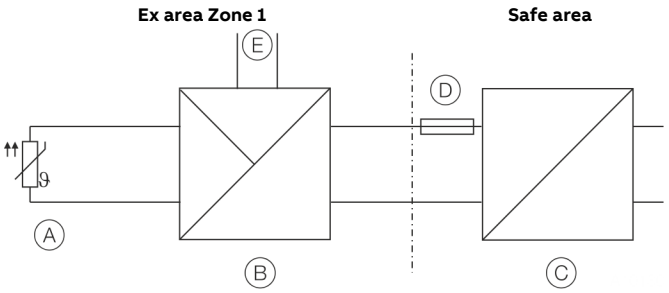
Ⓐ Sensor
Ⓑ TTF300 transmitter
Ⓒ Intrinsically safe supply isolator in ‘Ex ia’ or ‘Ex ib’ type of protection
Ⓓ Interface for LCD indicator

Figure 9: Hookup in Zone 0/21 (dust explosion protection)

When using the sensor in Zone 0 and the transmitter in Zone 21, the transmitter must be approved for Zone 21, while the sensor circuit must be designed in the ‘Ex ia’ type of protection and the supply circuit as well as the power supply unit in the ‘Ex ia’ or ‘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.

Flameproof (enclosure) – Zone 1

Housing design: ATEX II 2G Ex db IIC T6/T4 Gb



Ⓐ Sensor
Ⓑ Transmitter in Ex d-housing
Ⓒ Supply isolator with voltage limit (30 V)
Ⓓ Fuse, 32 mA
Ⓔ Interface for LCD indicator

Figure 10: Hookup in Zone 1, ‘flameproof (enclosure)’ type of protection

The power supply circuit of the transmitter must be limited by an upstream fuse with a fuse current rating of 32 mA.
Maximum input terminal voltage of the transmitter: 30 V DC.
The ‘flameproof enclosure’ type of protection is only achieved by correctly installing a specially certified cable gland with the Ex d type of protection with the corresponding marking.
The sensor instrumentation must be provided by the user in accordance with the valid Ex-standards.
As far as the installation and mounting of components is concerned (explosion-proof cable entries, connection parts), only those components are approved which at the least technically comply with the current version of the PTB 99 ATEX 1144 X type examination certificate and for which a separate examination certificate exists. At the same time, it is imperative that the operating conditions listed in the respective component certificates are complied with.

… 2 Use in potentially explosive atmospheres in accordance with ATEX and IECEx

… Installation instructions

The transmitter must be connected using suitable cable and cable entries or pipeline systems that satisfy the requirements of EN 60079-1 and for which a separate examination certificate exists. If the transmitter is connected to pipeline systems, the relevant sealing device must be affixed directly to the housing. Cable entries (PG glands) and sealing plugs of simple design must not be used.
Close unused cable entry in accordance with EN 60079.-1.
The connection lead must be routed securely and in such a way as to ensure adequate protection against damage.
If the temperature on the entry parts is over 70° C, connection leads with sufficient temperature resistance must be used.
The transmitter must be integrated into the local potential equalization of the potentially explosive area.

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

⚠ DANGER

Risk of explosion due to hot parts

Hot parts inside the device pose an explosion hazard.

- Never open the device immediately after switch-off.
- A waiting time of at least four minutes should be observed before opening the device.

⚠ DANGER

Explosion hazard when opening the device

Explosion hazard when opening the device with activated power supply.

- Before opening the device, switch off the power supply.

Damage to the 'Flameproof (enclosure)– Ex d' type of protection

The cover thread is used as a flameproof joint for the 'Flameproof (enclosure) – Ex d' type of protection.

- During assembly / disassembly of the device, make sure that the cover thread does not get damaged.
- Devices with damaged threads must no longer be used in potentially explosive atmospheres.

Protection against electrostatic discharges

The painted surface of the housing and the plastic parts inside the device can store electrostatic charges.

⚠ WARNING

Risk of explosion!

The device must not be used in areas in which process-related electrostatic charging of the housing may occur.

- The device must be installed, maintained and cleaned such that any dangerous electrostatic charge is avoided.

Repair

⚠ DANGER

Explosion hazard

Explosion hazard due to improper repair of the device. Faulty devices must not be repaired by the operator.

- The device may only be repaired by the ABB Service Department.
- Repairs on flameproof joints are not permitted.

3 Use in potentially explosive atmospheres in accordance with cFMus, 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, CSA or cFMus applies.

Transmitter Ex marking cFMus

cFMus Intrinsically Safe

Model TTF300-L1H for USA or TTF300-R1H for Canada	
From HW-Rev.: 02.00	
Control Drawing	TTF300-L1H
IS Class I,II,III, Div. 1,2 Group ABCDEFG T6,T4	
Zone 0 AEx/Ex ia IIC T6…T1 Ga	
Zone 1 AEx/Ex [ia Ga] ib IIC T6…T1 Gb	
Zone 1 AEx/Ex ib IIC T6…T1 Gb / [AEx/Ex ia Da] IIIC	

cFMus Non-Incendive

Model TTF300-L2H for USA or TTF300-R2H for Canada	
From HW-Rev.: 02.00	
Control Drawing	TTF300-L2H
NI Class I,II,III Div. 2 Group ABCDEFG T6,T4	
Zone 2 AEx/Ex nA IIC T6…T1 Gc	
Zone 2 AEx/Ex ec IIC T6…T1 Gc	

cFMus Explosion Proof

Model TTF300-L3H for USA or TTF300-R3H for Canada	
From HW-Rev.: 02.00	
Control Drawing	TTF300-L3H
XP Class I, Div 1,2 Group ABCD T6,T4 for Conduit Um ≤ 42VDC 32mA fused	
DIP Class II, Div 1,2 Group EFG T6,T4 Um ≤ 42VDC 32mA fused	
XP/IS Class I Div 1,2 GP ABCD T6,T4 with IS Output	
Entity Drawing TTF300-L3H	
XP/IS Class I, Div 1,2 Group ABCD T6,T4 with IS Output	
Entity Drawing TTF300-L3H	
Zone 1 AEx/Ex db [ia Ga] IIC T6…T1 Gb	

cFMus Explosion Proof and Intrinsically safe

Model TTF300-L7H (L1H +L3H) for USA, **Model TTF300-R7H (R1H + R3H) for Canada**	
From HW-Rev.: 02.00	
Control Drawing	TTF300-L3H, TTF300-L1H
XP Class I, Div 1,2 Group ABCD T6,T4 for Conduit Um <= 42VDC 32mA fused	
DIP Class II, Div 1,2 Group EFG T6,T4 Um <= 42VDC 32mA fused	
XP/IS Class I, Div 1,2 Group ABCD T6,T4 with IS Output	
Entity Drawing TTF300-L3H	
IS Class I,II,III Div 1,2 Group ABCDEFG T6,T4 with	
Entity Drawing TTF300-L1H	
Zone 1 AEx/Ex db [ia Ga] IIC T6…T1 Gb	

Transmitter Ex marking FM / CSA

FM Intrinsically Safe

Model TTF300-L1H	
Up to HW-Rev.: 01.07	
Control Drawing	SAP_214832
Model TTF300-L1P	
Control Drawing	TTF300-L1..P (IS)
Model TTF300-L1F	
Control Drawing	TTF300-L1..F (IS)
Class I, Div. 1 + 2, Groups A, B, C, D	
Class I, Zone 0, AEx ia IIC T6	

FM Non-Incendive

Model TTF300-L2H	
Up to HW-Rev.: 01.07	
Control Drawing	SAP_214830 (NI_PS)
	SAP_214828 (NI_AA)
Model TTF300-L2P	
Control Drawing	TTF300-L2..P (NI_PS)
	TTF300-L2..P (NI_AA)
Model TTF300-L2F	
Control Drawing	TTF300-L2..F (NI_PS)
	TTF300-L2..F (NI_AA)
Class I, Div. 2, Groups A, B, C, D	
Class I Zone 2 Group IIC T6	

FM Explosion proof

Model TTF300-L3
XP, DIP Class I, II, III, Div. 1 + 2, Groups A-G, factory sealed

CSA Intrinsically Safe

Model TTF300-R1H	
Up to HW-Rev.: 01.07	
Control Drawing	SAP_214825
Model TTF300-R1P	
Control Drawing	TTF300-R1..P (IS)
Model TTF300-R1F	
Control Drawing	TTF300-R1..F (IS)
Class I, Div. 1 + 2, Groups A, B, C, D	
Class I, Zone 0, Ex ia IIC	

CSA Non-Incendive

Model TTF300-R2H	
Up to HW-Rev.: 01.07	
Control Drawing	SAP_214827 (NI_PS)
	SAP_214895 (NI_AA)
Model TTF300-R2P	
Control Drawing	TTF300-R2..P (NI_PS)
	TTF300-R2..P (NI_AA)
Model TTF300-R2F	
Control Drawing	TTF300-R2..F (NI_PS)
	TTF300-R2..F (NI_AA)
Class I, Div. 2, Groups A, B, C, D	

CSA Explosion proof

Model TTF300-R3
XP, DIP Class I, II, III, Div. 1 + 2, Groups A-G, factory sealed

CSA Explosion Proof and Intrinsically Safe

Model TTF300-R7H (R1H + R3H)	
Up to HW-Rev.: 01.07	
Control Drawing	SAP_214825
Model TTF300-R7P (R1P + R3P)	
Control Drawing	TTF300-R1..P (IS)
Model TTF300-R7F (R1F + R3F)	
Control Drawing	TTF300-R1..F (IS)
XP, DIP Class I, II, III, Div. 1 + 2, Groups A-G, factory sealed	
Class I, Div. 1 + 2, Groups A, B, C, D	
Class I, Zone 0, Ex ia IIC	

LCD indicator Ex marking

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_{max} = 9 V, I_i / I_{max} < 65.2 mA, P_i = 101 mW, C_i = 0.4 µF, L_i = 0	

FM Non-Incendive

Control Drawing	SAP_214 751
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 V, I_i / I_{max} < 65.2 mA, P_i = 101 mW, C_i = 0.4 µF, 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_{max} = 9 V, I_i / I_{max} < 65.2 mA, P_i = 101 mW, C_i < 0.4 µF, L_i = 0	

CSA Non-Incendive

Control Drawing	SAP_214 750
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 V, I_i / I_{max} < 65.2 mA, P_i = 101 mW, C_i < 0.4 µF, L_i = 0	

* Temp. Ident: T6 T_{amb} 56 °C, T4 T_{amb} 85 °C

** Temp. Ident: T6 T_{amb} 60 °C, T4 T_{amb} 85 °C

… 3 Use in potentially explosive atmospheres in accordance with cFMus, FM and CSA

Installation instructions

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).

Warnings and instructions should be followed as per notes on the associated control drawing for installation in the associated hazardous area.

The control drawings are available for download under the following link. Just scan or click on the QR code:

ABB Library – TTF300 – control drawings

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.

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)

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!

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

⚠ DANGER

Risk of explosion due to hot parts
Hot parts inside the device pose an explosion hazard.
- Never open the device immediately after switch-off.
- A waiting time of at least four minutes should be observed before opening the device.

⚠ DANGER

Explosion hazard when opening the device
Explosion hazard when opening the device with activated power supply.
- Before opening the device, switch off the power supply.

Adverse effect on the 'Explosionproof – XP' type of protection
The cover thread is used as a flameproof joint for the 'Explosionproof – XP' type of protection.
- During assembly / disassembly of the device, make sure that the cover thread does not get damaged.
- Devices with damaged threads must no longer be used in potentially explosive atmospheres.

Protection against electrostatic discharges
The painted surface of the housing and the plastic parts inside the device can store electrostatic charges.

⚠ WARNING

Risk of explosion!
The device must not be used in areas in which process-related electrostatic charging of the housing may occur.
- The device must be installed, maintained and cleaned such that any dangerous electrostatic charge is avoided.

Repair

⚠ DANGER

Explosion hazard

Explosion hazard due to improper repair of the device. Faulty devices must not be repaired by the operator.

- The device may only be repaired by the ABB Service Department.
- Repairs on flameproof joints are not permitted.

4 Product identification

Name plate

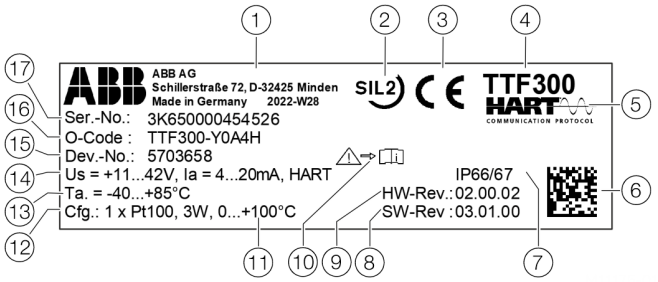
Note

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

Note

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

For devices with PROFIBUS PA® or FOUNDATION Fieldbus®, the device IDs are additionally specified.



1. Manufacturer, manufacturer address, country of manufacture, manufacturing year - week
2. Safety integrity level, SIL logo (optional)
3. CE mark (EU conformity), if not on additional plate
4. Type designation / model
5. Communication protocol of the transmitter (HART®, FF, PB)
6. 2D barcode for serial number in accordance with order
7. IP rating of housing
8. Software revision
9. Hardware version
10. 'Follow product documentation' symbol

11 and 12: HART® transmitter customer configuration:

11. Set measuring range of the transmitter
12. Set sensor type and circuit type

11 and 12: PROFIBUS PA® or FOUNDATION Fieldbus® transmitter customer configuration:

Ident_Number or DEVICE_ID

13. Ambient temperature range, on additional plate for Ex versions
14. Specification of the transmitter (supply voltage range, output current range, communication protocol)
15. Serial number of the device electronics (7 or 8-digit)
16. Device type: Coding of type of protection, housing/indicator, cable entry, and communication protocol (complies with the ordering information of the device).
17. Serial number of the device (serial number in accordance with order)

Figure 11: HART® name plate (example)

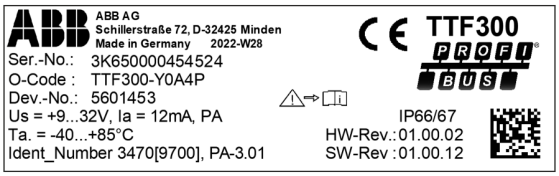


Figure 12: PROFIBUS PA® name plate (example)

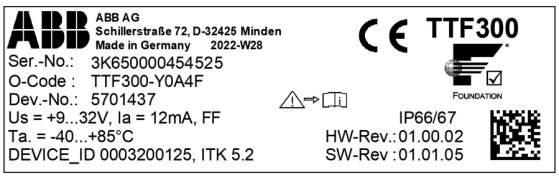


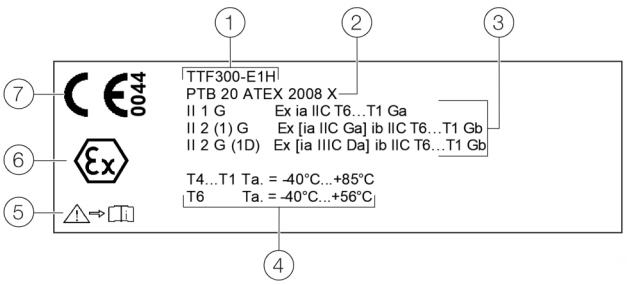
Figure 13: FOUNDATION Fieldbus® name plate (example)

Explosion protection marking for devices with one type of protection

Devices with an explosion-proof design are marked with the following additional plates.

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.



1. Type designation in accordance with approval
2. Approval number
3. Protection class of the explosion-proof design (explosion protection marking)
4. Temperature class of the explosion-proof design
5. 'Follow product documentation' symbol
6. CE mark (EU conformity) and notified body for quality assurance
7. Ex marking

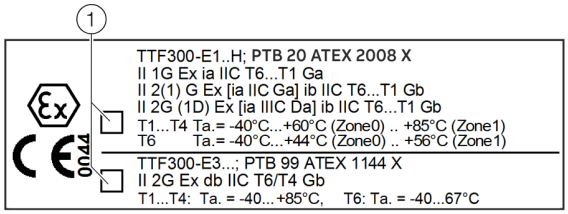
Figure 14: Additional data plate for explosion-protected devices (example)

Explosion protection marking for devices with several types of protection

Coding of the type of protection of the device in accordance with ordering information can also refer to different explosion approvals for various types of protection.

The ‘intrinsic safety’, ‘flameproof (enclosure)’ and ‘dust explosion protection’ types of protection can be possible for one device.

The following figure shows an example of explosion protection marking for the ‘intrinsic safety’ and ‘flameproof (enclosure)’ types of protection:



(1) Checkboxes for marking type of protection

Figure 15: Example of several types of protection: “Intrinsic safety” and “Flameproof (enclosure)”, coding of the type of protection: E4.

Measures required before the use of devices with several types of protection

NOTICE

Note for temperature transmitters with multiple types of protection

Before the transmitter is installed, the selected type of protection must be indelibly marked on the explosion protection certification plate.

The transmitter can then only be operated with this degree of protection throughout its entire service life.

- If two protection types are indelibly marked on the explosion protection certification plate, the transmitter must not be used in areas categorized as hazardous.

Devices with several types of protection may only be operated in one of the possible types of protection.

Before commissioning, users must decide on one of these types of protection and their corresponding approval.

- The ‘E4’ coding enables the following types of protection: ‘Intrinsic safety’, type ‘TTF300-E1’ and ‘Flameproof (enclosure)’, type ’TTF300-E3’.
- The ‘D6’ coding enables the following types of protection: ‘Intrinsic safety’, type ‘TTF300-E1’ and ‘Dust explosion protection’, type ’TTF300-D5’.

Additional combinations are generally possible.

Use in explosive hybrid mixtures (where explosive dusts and gases are present simultaneously) is not currently permitted in accordance with EN 60079-0 and EN 60079-31.

The additional plate has two checkboxes (see **Figure 15**) for marking.

It is absolutely necessary to mark one of the checkboxes on the left side indelibly in accordance with the selected type of protection of the application. This has to be done before the TTF300 is commissioned in the application.

The marking must be applied in a permanent and indelible manner, for example by using a caustic or acidic pencil or by stamping the marking on a metallic plate.

Unmarked devices must **NOT** be commissioned.

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 48) 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.).

Address for return shipment:
Please contact Customer Center Service acc. to page 5 for nearest service location.

6 Installation

Note
When using the device in potentially explosive atmospheres, note the additional data in **Use in potentially explosive atmospheres in accordance with ATEX and IECEx** on page 6 and **Use in potentially explosive atmospheres in accordance with cFMus, FM and CSA** on page 18!

Ambient conditions

Ambient temperature
- Standard: −40 to 85 °C (−40 to 185 °F)
- Optional: −50 to 85 °C (−58 to 185 °F)
- Limited temperature range for explosion-proof design: see relevant 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

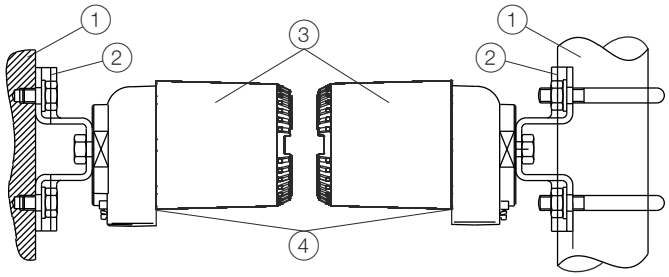
Temperature and humidity limits
In accordance with IEC 60068-2-30

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
IP 66 and IP 67

Mounting



1 Wall / Pipe
2 Bracket
3 Transmitter
4 Locking screw

Figure 16: Installation variants

⚠ CAUTION

Risk of injury!
There is a risk of injury if the transmitter falls out due to improper mounting.
- Make sure that transmitter is securely fastened.

Wall mounting:
Fasten the wall bracket to the wall using 4 screws (Ø 10 mm)

Pipe mounting:
Attach the pipe mount to the pipe using 2 pipe clamps (Ø 10 mm). The pipe mount can be fastened to a pipe with a maximum diameter of 62 mm (2.4 in)

… 6 Installation

Opening and closing the housing

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing or terminal box open!
While using the device in potentially explosive atmospheres before opening the transmitter housing or the terminal box, note the following points:

- A valid fire permit must be present.
- Make sure that no flammable or hazardous atmospheres are present.

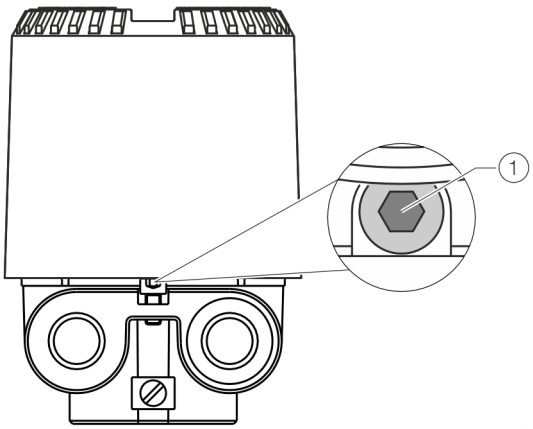


Figure 17: Cover lock (example)

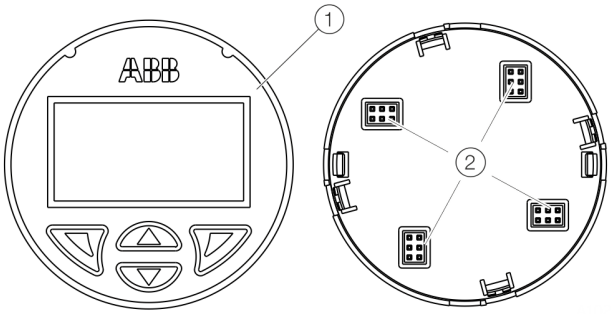
To open the housing, release the cover lock by screwing in the Allen screw (1).
After closing the housing, lock the housing cover by unscrewing the Allen screw (1).

NOTICE

Potential adverse effect on the IP rating

- Check the O-ring gasket for damage and replace it if necessary before closing the housing cover.
- Check that the O-ring gasket is properly seated when closing the housing cover.

Rotating the LCD indicator



(1) Front view

(2) Rear view of LCD indicator / plug positions

Figure 18: 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 4 positions at increments of 90°-.
To adjust the position, proceed as follows:

1. Tighten the lock screw under the housing cover.
2. Release the housing cover by turning it counterclockwise.
3. Carefully pull the LCD indicator to release it from its bracket.
4. Carefully insert the LCD indicator in the required position.
5. Screw the housing cover back on.
6. Loosen the lock screw until the housing cover is firmly in place.

NOTICE

Potential adverse effect on the IP rating

- Check the O-ring gasket for damage and replace it if necessary before closing the housing cover.
- Check that the O-ring gasket is properly seated when closing the housing cover.

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 cFMus, FM and CSA** on page 18!

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.

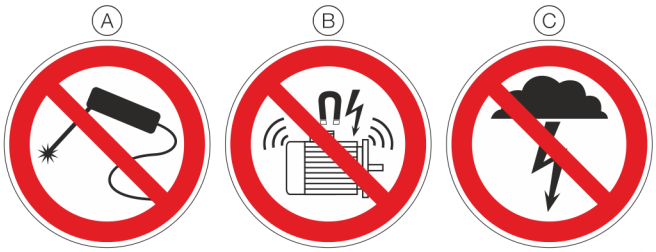
Note
The signal cable wires must be provided with wire end sleeves. The slotted screws of the connection terminals are tightened with a size 1 screwdriver (3.5 or 4 mm).

Protection of the transmitter from damage caused by highly energetic electrical 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 **Recommended shielding / grounding** on page 29.

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 19: 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)!

… 7 Electrical connections

… Protection of the transmitter from damage caused by highly energetic electrical interferences

Suitable 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

Power supply cable

Maximum cable outer diameter:

12 mm (0.47 in)

Maximum wire cross section:

2.5 mm^2 (AWG 16)

Cable glands

The cable diameter must be appropriate for the cable gland used so that IP rating IP 66 /IP 67 or NEMA 4X can be maintained. This must be checked during installation.

For delivery without cable gland (thread M20 × 1.5 or NPT ½ in), the following points must be observed:

- Use cable glands in accordance with version M20 × 1.5 or NPT ½ in.
- Observe information in the data sheet for the cable gland used.
- Check the working temperature for the cable gland used.
- Check the IP rating IP 66 / IP 67 or NEMA 4X of the cable gland used.
- Check the Ex relevant specifications for the cable gland used in accordance with the manufacturer data sheet or the Ex declaration.
- The cable gland used must be approved for the cable diameter (IP rating).
- Observe tightening torque in accordance with information in data sheet / operating instructions for the cable gland used.

Shielding of the sensor connecting cable

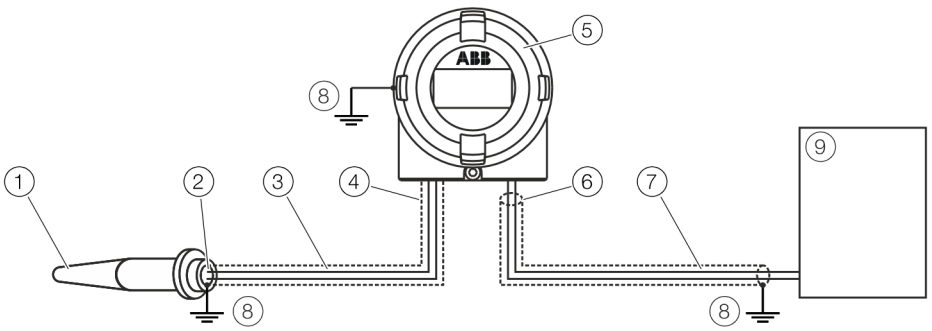
To ensure the system benefits from optimum electromagnetic interference immunity, the individual system components, and the connection cables in particular, need to be shielded.
The shield must be connected to the ground reference plane.

Note
National regulations and directives must be observed when grounding system components.

NOTICE

Damage to components!
In systems without potential equalization or with potential differences between the individual grounding points, multiple instances of shield grounding can result in transient currents at mains frequency.
These can damage the shielding, influence the measurements and have a significant impact on signal transmission, of bus signals in particular.

Recommended shielding / grounding
Grounded sensor (thermocouple, mV, RTD, Ohm), transmitter housing grounded
For ideal interference immunity, the shielding of the sensor connection cable should be connected to the sensor and transmitter housing via a conductive connection. Sensor and transmitter housing have been grounded.
The shielding of the power supply cable is grounded at the supply isolator / DCS input directly This shielding is insulated from the transmitter housing. The shielding of the power supply cable and the shielding of sensor connection cable must not be connected to one another. Make sure that the shielding is not connected to ground anywhere else.



1. Temperature sensor
2. Shielding grounded via sensor
3. Sensor connection cable
4. Shielding connected to transmitter housing via a conductive connection
5. Transmitter housing, grounded
6. Shielding insulated from transmitter housing
7. Supply voltage cable
8. Grounding point
9. Supply isolator / DCS input

Figure 20: The shielding of the sensor connection cable has been grounded on both sides via the sensor and the transmitter housing. The shielding of the supply voltage cable is separate from the sensor connection cable and housing.

Note
Make sure that no potential equalization can occur in the case of two-sided grounding. If this is to be expected, grounding must be one-sided only. The system's grounding concept as well as relevant national regulations must be complied with.

⚠ WARNING

Explosion hazard
If, for functional reasons, grounding in a potentially explosive atmosphere is required by means of a connection to the potential equalization, grounding must be on one side only.

… 7 Electrical connections

… Shielding of the sensor connecting cable

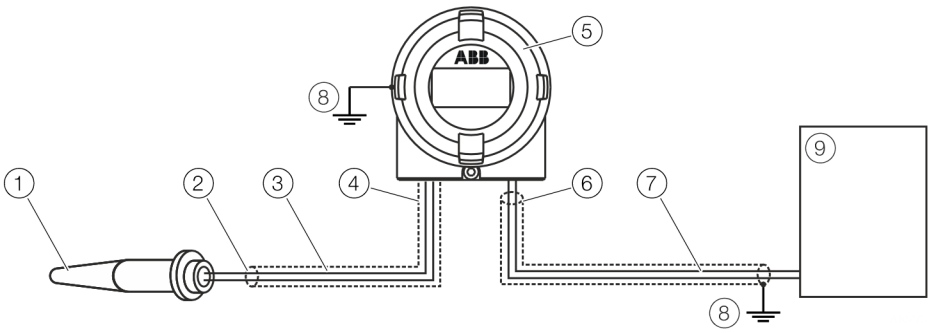
Additional examples for shielding / grounding

Insulated sensor measuring inset (thermocouple, mV, RTD, Ohm), transmitter housing grounded

The shielding of the sensor connection cable is grounded via the grounded transmitter housing. This shielding is insulated from the sensor.

The shielding of the power supply cable is grounded at the supply isolator / DCS input directly This shielding is insulated from the transmitter housing.

The shielding of the power supply cable and the shielding of sensor connection cable must not be connected to one another. Make sure that the shielding is not connected to ground anywhere else.



1. Temperature sensor
2. Shielding insulated from sensor
3. Sensor connection cable
4. Shielding grounded via transmitter housing
5. Transmitter housing, grounded
6. Shielding insulated from transmitter housing
7. Supply voltage cable
8. Grounding point
9. Supply isolator / DCS input

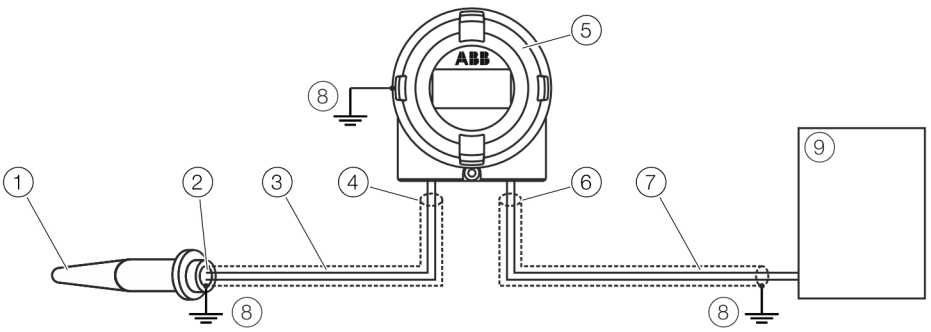
Figure 21: The shielding of the sensor connection cable and the shielding of the power supply cable are separate and each grounded at one end

Insulated sensor measuring inset (thermocouple, mV, RTD, Ohm), transmitter housing grounded

The shielding of the sensor connection cable is grounded via the grounded pressure sensor housing. This shielding of the power supply cable is insulated from the transmitter housing.

The shielding of the power supply cable is grounded at the supply isolator / DCS input directly This shielding is insulated from the transmitter housing.

The shielding of the power supply cable and the shielding of sensor connection cable must not be connected to one another. Make sure that the shielding is not connected to ground anywhere else.

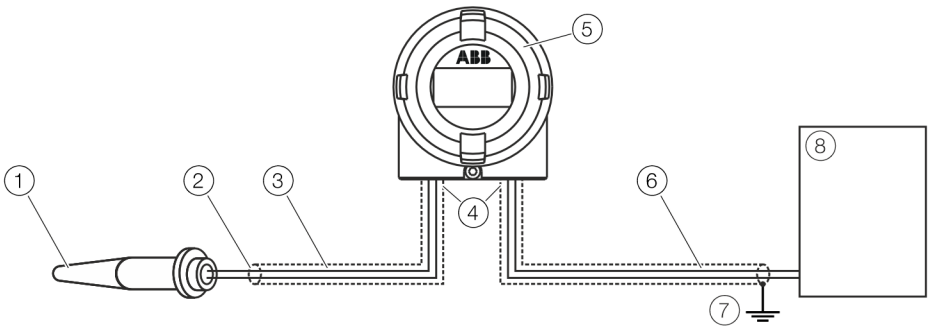


1. Temperature sensor
2. Shielding grounded via sensor
3. Sensor connection cable
4. Shielding insulated from transmitter housing
5. Transmitter housing, grounded
6. Shielding insulated from transmitter housing
7. Supply voltage cable
8. Grounding point
9. Supply isolator / DCS input

Figure 22: The shielding of the sensor connection cable and of the supply voltage cable are separate and each grounded on one side.

Insulated sensor measuring inset (thermocouple, mV, RTD, Ohm), transmitter housing not grounded

The shielding of the power supply cable and the shielding of the sensor connection cable are connected to one another via the transmitter housing. The shielding is grounded at one end of the power supply cable, directly at the supply isolator / DCS input. Make sure that the shielding is not connected to ground anywhere else.



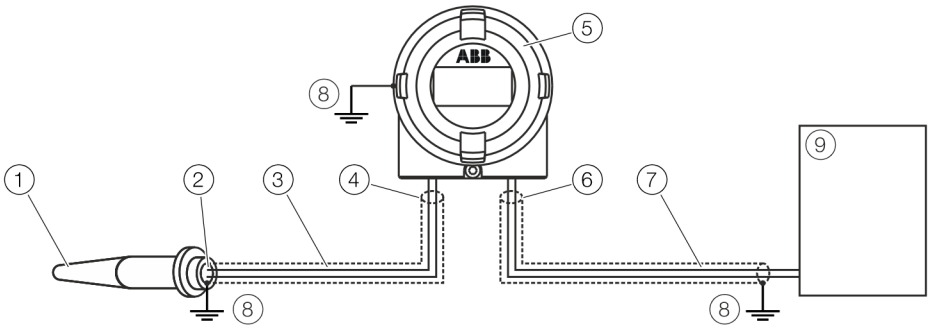
1. Temperature sensor
2. Shielding insulated from sensor
3. Sensor connection cable
4. Shielding connected electrically via transmitter housing
5. Transmitter housing, not grounded
6. Supply voltage cable
7. Grounding point
8. Supply isolator / DCS-input

Figure 23: The shielding of the sensor connection cable and the shielding of the power supply cable are connected electrically via the transmitter housing and grounded at one end

Non-insulated sensor measuring inset (thermocouple), transmitter housing grounded

The shielding of the sensor connection cable is grounded via the grounded pressure sensor housing. This shielding of the power supply cable is insulated from the transmitter housing.

The shielding of the power supply cable is grounded at the supply isolator / DCS input directly This shielding is insulated from the transmitter housing. The shielding of the power supply cable and the shielding of the sensor connection cable must not be connected to one another. Make sure that the shielding is not connected to ground anywhere else.



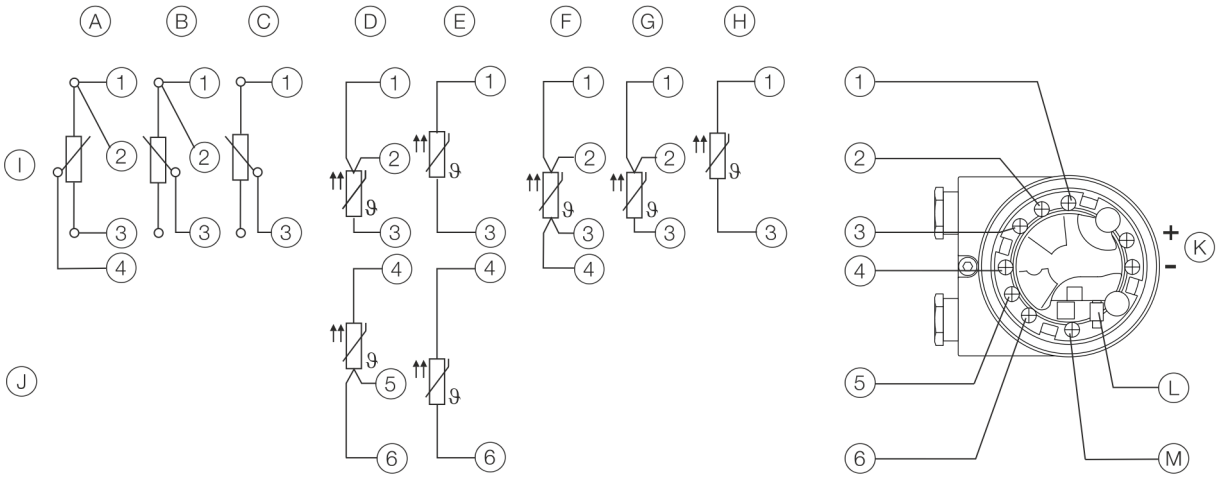
1. Temperature sensor
2. Shielding grounded via sensor
3. Sensor connection cable
4. Shielding insulated from transmitter housing
5. Transmitter housing, grounded
6. Shielding insulated from transmitter housing
7. Supply voltage cable
8. Grounding point
9. Supply isolator / DCS input

Figure 24: The shielding of the sensor connection cable and of the supply voltage cable are separate and each grounded on one side.

… 7 Electrical connections

Terminal assignment

Resistance thermometers (RTD) / resistors (potentiometer)



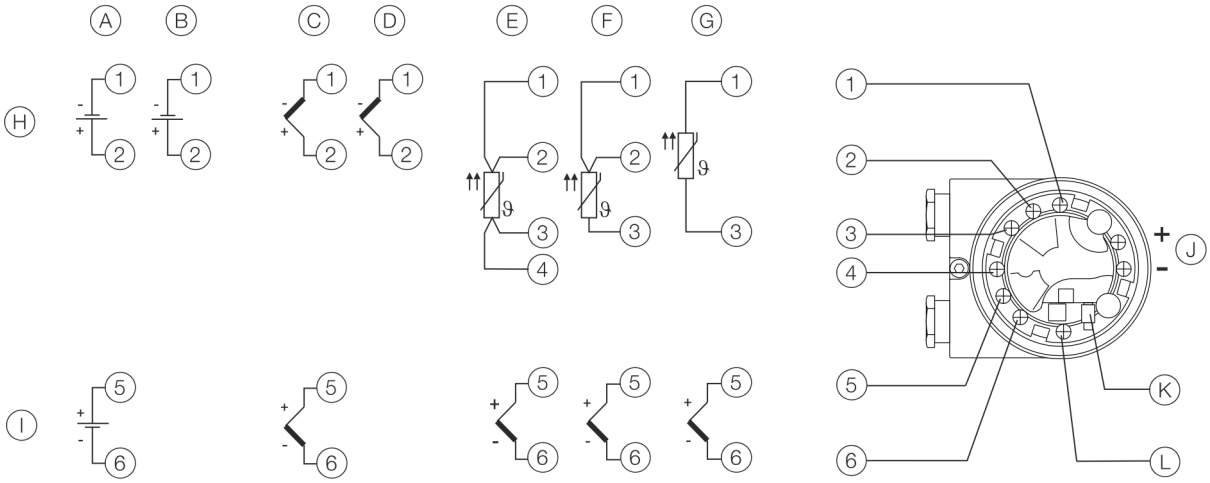
(A) Potentiometer, four-wire circuit
(B) Potentiometer, three-wire circuit
(C) Potentiometer, two-wire circuit
(D) 2 x RTD, three-wire circuit*
(E) 2 x RTD, two-wire circuit*
(F) RTD, four-wire circuit
(G) RTD, three-wire circuit
(H) RTD, two-wire circuit

(I) Sensor 1
(J) Sensor 2*
(K) 4 to 20 mA HART®, PROFIBUS PA®, FOUNDATION Fieldbus®
(L) Interface for LCD indicator and service
(M) Ground terminal for shield support for sensors and supply / signal lines
(1) – (6) Sensor connection (of measuring inset)

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

Figure 25: Terminal assignment Resistance thermometer (RTD) / resistances (potentiometer)

Thermocouples / voltages and resistance thermometers (RTD) / thermocouple combinations



(A) 2 x voltage measurement*
(B) 1 x voltage measurement
(C) 2 x thermocouple*
(D) 1 x thermocouple
(E) 1 x RTD, four-wire circuit and thermocouple*
(F) 1 x RTD, three-wire circuit and thermocouple*
(G) 1 x RTD, two-wire circuit and thermocouple*
(H) Sensor 1
(I) Sensor 2*
(J) 4 to 20 mA HART®, PROFIBUS PA®, FOUNDATION Fieldbus®
(K) Interface for LCD indicator and service
(L) Ground terminal for shield support for sensors and supply / signal lines
(1) – (6) Sensor connection (of measuring inset)

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

Figure 26: Terminal assignment: Thermocouples / voltages and resistance thermometer (RTD) / thermocouple combinations

… 7 Electrical connections

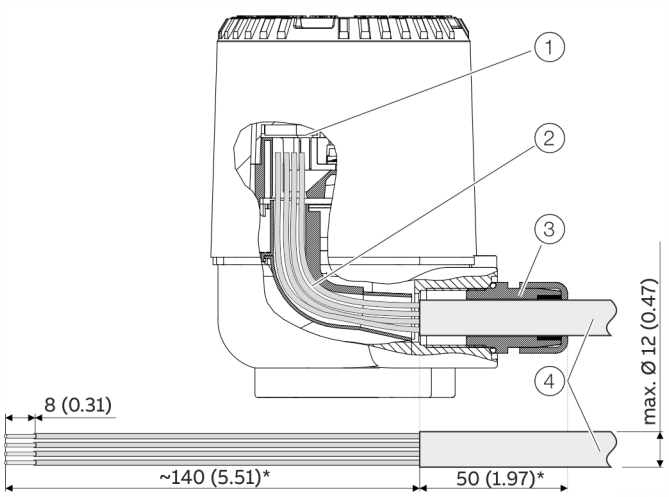
Terminal for sensor connection cable

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing or terminal box open!

While using the device in potentially explosive atmospheres before opening the transmitter housing or the terminal box, note the following points:

- A valid fire permit must be present.
- Make sure that no flammable or hazardous atmospheres are present.



① Terminal compartment
② Cable entry
③ Cable gland
④ Sensor connection cable

Figure 27: Connection to the transmitter, dimensions in mm (in.)

1. Tighten the lock screw under the housing cover.
2. Unscrew the housing cover.
3. If available, pull out the LCD indicator carefully
4. Strip the sensor connection cable as shown and attach wire end sleeves.
   A line length of 190 mm should be ensured between the cable gland entry and the terminals. 140 mm should be stripped from the cable jacket along this length*.
5. Guide the sensor connection cable through the cable glands and into the housing. Then tighten the cable glands*.
6. Connect the wires as per the connection diagram.
7. If there is one, carefully insert the LCD indicator in the previous / required position.
8. Screw the housing cover back on.
9. Loosen the lock screw until the housing cover is firmly in place.

* If an increased electromagnetic interference emission is to be expected at the installation site, for increasing the interference immunity, we recommend stripping more than 140 mm (e.g. 143 mm) from the sensor cable. After inserting the sensor connection cable in the cable gland, pull back the cable from the stop by the relevant amount, then tighten the cable gland.

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 Ω
- 0 to 5000 Ω

Sensor connection type

Two-, three-, four-wire circuit

Connection lead

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

Measurement current

< 300 µA

Sensor short circuit

< 5 Ω (for resistance thermometer)

Sensor wire break

- Measuring range: 0 to 500 Ω > 0.6 to 10 kΩ
- Measuring range: 0 to 5 Ω > 5.3 to 10 kΩ

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 kΩ, total 3 kΩ

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

Input resistance

> 10 MΩ

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 kΩ
- 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

… 7 Electrical connections

… Electrical data for inputs and outputs

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 behavior

- 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). Detailed information about this can be found in the SIL-Safety Manual.

Notice – Before SW-Rev.: 03.00

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)

Notice – From SW-Rev.: 03.00

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/TTX300/PB).

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
- 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

For detailed information, see the COM/TTX300/FF FOUNDATION Fieldbus® interface description.

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®

Supply 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 supply voltage

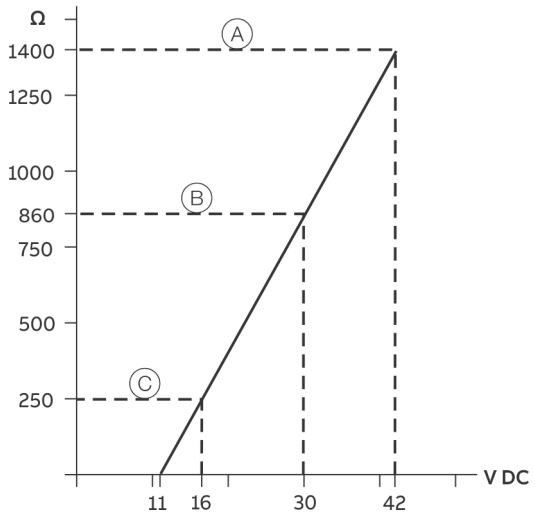
During communication this is in accordance with the HART FSK 'Physical Layer' specification.

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 = (supply voltage−11 V) / 0.022 A



Ⓐ TTF300

Ⓑ TTF300 in Ex-applications

Ⓒ HART communication resistance

Figure 28: Maximum load depending on supply voltage

Maximum power consumption

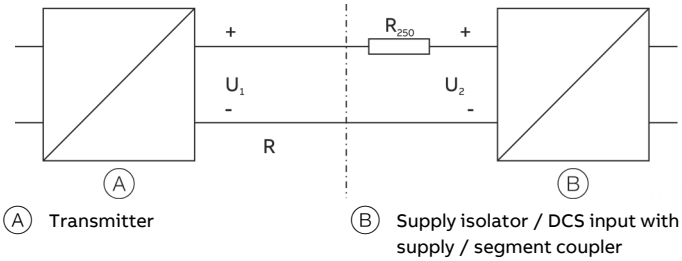
$P = U_s \times 0.022$ A

E.G. U_s = 24 V → P_{max} = 0.528 W

… 7 Electrical connections

… Electrical data for inputs and outputs

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.



A Transmitter

B Supply isolator / DCS input with supply / segment coupler

Figure 29: HART load resistance

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

Standard application with 4 to 20 mA functionality
When connecting these components, observe the following condition:
$U_{1min} \leq U_{2min}$ - 22 mA x R

Standard application with HART functionality
Adding resistance R_{250} increases the minimum supply voltage U_{2min}: $U_{1min} \leq U_{2min}$ - 22 mA x (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 ≥ 250 Ω (< 1100 Ω) 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 39 and **Hardware settings** on page 42..

Power supply – PROFIBUS / FOUNDATION Fieldbus
Supply voltage
Non-Ex application:
U_S = 9 to 32 V DC
Ex-applications with:
U_S = 9 to 17 V DC (FISCO)
U_S = 9 to 24 V DC (Fieldbus Entity model I.S.)
Current consumption:
≤ 12 mA

Standard application with PROFIBUS PA and FOUNDATION Fieldbus H1 functionality
During hookup, the following condition should be complied with:
$U_{1min} \leq U_{2min}$ – 12 mA x R

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.

Checks prior to commissioning

The following points must be checked before commissioning the device:

- Correct wiring in accordance with **Electrical connections** on page 27.
- The ambient conditions must correspond to the information given on the name plate and in the data sheet.

Communication

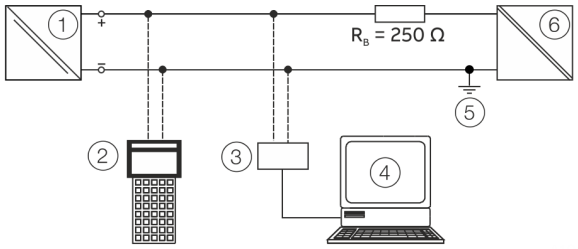
HART® Communication

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.



1. Transmitter
2. Handheld terminal
3. HART® modem
4. PC with Asset Management Tool
5. Grounding (optional)
6. Power supply unit (process interface)

R_B load resistance (if necessary)

Figure 30: Example of HART® interface connection

Manufacturer ID	0x1A
Device-ID*	HART 5: 0x004B (0x000B), HART 7: 0x1A4B (0x1A0B)
Profile	From SW-Rev.: 03.00 (corresponds to HW-Rev.: 02.00 and higher): HART 5.9 and HART 7.6, can be switched via • LCD indicator with configuration function • Tools • HART commands Default, if nothing else ordered: HART 7.6. To SW-Rev.: 01.03: HART 5.1 and HART 7, switchable via DIP switch. Default, if nothing else ordered: HART 5.1. SW-Rev.: 01.01: HART 5.1, previously HART 5.
Configuration	On device using LCD indicator DTM, EDD, FDI (FIM)
Transmission signal	BELL Standard 202

* From SW-Rev.: 03.01.00, previously see brackets

… 8 Commissioning

… Communication

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 FDI Device Package (Field Information Manager / FIM)

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

Extended from SW-Rev.: 03.00:
- Device status signaling according to NE 107
- Freely configurable diagnostic categorization with diagnostic history in accordance with NE 107

Tracking of events and configuration changes, from SW-Rev.: 03.00
The HART® device stores information on critical events and configuration changes.

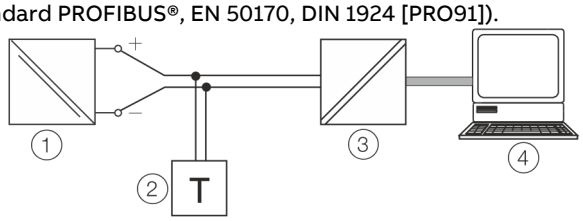
The information can be output via tools:
- Event monitor for the logging of critical events
- Configuration monitor for configuration changes

For detailed information, see HART® COM/TTX300/HART interface description.

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]).



1 Transmitter
2 Bus termination
3 Segment coupler
4 PC / DCS

Figure 31: Example of PROFIBUS PA® interface connection

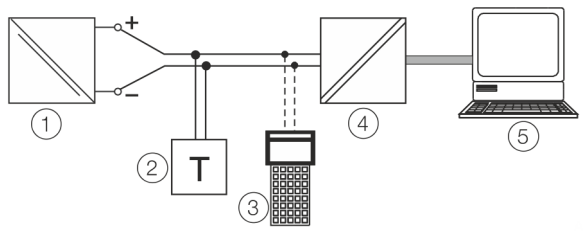
Manufacturer ID	0x1A
ID number	0x3470 [0x9700]
Profile	PA 3.01 (see PROFIBUS PA® interface description (COM/TTX300/PB))
Configuration	On device using LCD indicator DTM EDD GSD
Transmission signal	IEC 61158-2

Voltage / current consumption
- Average 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.

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.



① Transmitter
② Bus termination
③ Handheld terminal
④ Linking Device
⑤ PC / DCS

Figure 32: Example of FOUNDATION Fieldbus® interface connection

Device ID	000320001F...
ITK	5.x (see FOUNDATION Fieldbus® interface description (COM/TTX300/FF)
Configuration	On device using LCD indicator EDD
Transmission signal	IEC 61158-2

Voltage / current consumption

- Average 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.

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 TTF300 .
  The general operation and menus of the LCD indicator are described in **Menu navigation** on page 43.

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.

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.

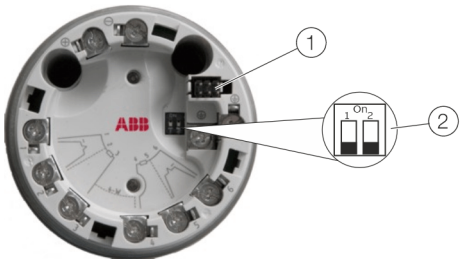
Hardware settings

Devices with HART® from HW-Rev.: 02.00 (corresponds to Software from SW-Rev.: 03.00 and higher)
HART devices from HW-Rev.: 02.00 do not have DIP switches.The desired HART profile (HART 7 or HART 5) the write protection are 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.: 01.07



(1) LCD indicator interface (2) DIP switch

Figure 33: DIP switch on the transmitter (not for HART devices from HW-Rev.: 02.00)

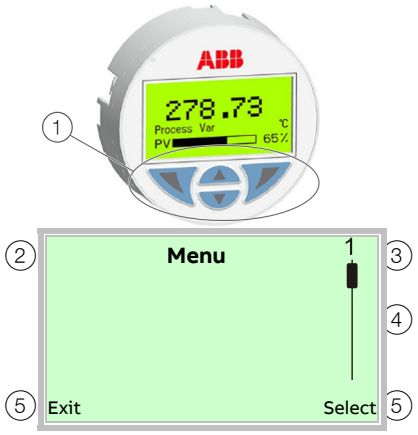
Located on the top of the transmitter next to the LCD indicator interface (1) are two DIP switches (2).
Switch 1 activates the hardware write protection.
Switch 2 supports the request of the FOUNDATION Fieldbus for a hardware release for simulation in accordance with ITK.
For transmitters that support HART 7, switch 2 allows the desired HART version to be set (HART 5 or HART 7).

DIP switch		Function
1	Local write protection	Off: Local write protection deactivated
		On: Local write protection activated
2	Release of the simulation	Off: Simulation deactivated
	(FOUNDATION Fieldbus only)	On: Simulation activated
2	HART version	Off: HART 5
		On: HART 7

Note

- Factory setting: both switches set to ‘OFF’. Local write protection deactivated and HART 5, unless explicitly ordered HART 7 (HART version) or simulation locked (FOUNDATION Fieldbus).
- In PROFIBUS PA devices, Switch 2 must always be set to the ‘OFF’ position.

Menu navigation



① Operating buttons for menu navigation
② Indication of menu designation
③ Indication of menu number
④ Marking to indicate relative position within the menu
⑤ Indication of the current function assigned to the operating buttons and

Figure 34: LCD display (example)

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 ⑤ that is currently assigned to them is shown on the LCD display.

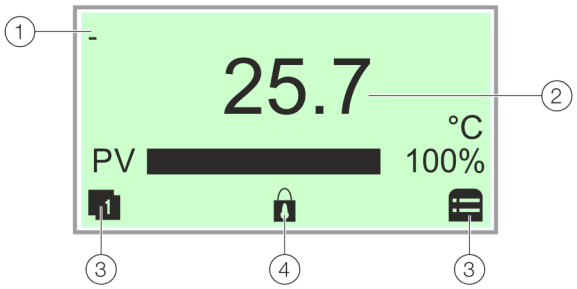
Control button functions

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

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

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

Process display



① Measuring point tagging (Device TAG)
② Current process values
③ 'Button function' symbol
④ 'Parameterization protected' symbol

Figure 35: Process display (example)

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.: 03.00, two process variables can also be optionally displayed: one is displayed above the other.

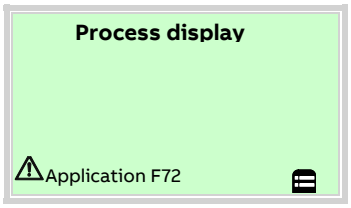
Symbol	Description
	Call up information level.
	Call up configuration level.
	The device is protected against changes in the parametrization.

… 9 Operation

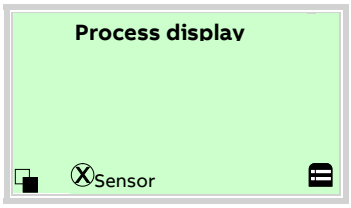
Error messages in the HART® LCD display

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

- To SW-Rev.: 01.03: A symbol or letter (device status) and a number (DIAG.NO.)
- From SW-Rev.: 03.00: The relevant device status symbol and the associated diagnosis group.



To SW-Rev.: 01.03



From SW-Rev.: 03.00

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

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

* To SW-Rev.: 01.03

** From SW-Rev.: 03.00

The error can then be read in plain text via the “Diagnosis” information level (from SW-Rev.: 03.00).

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

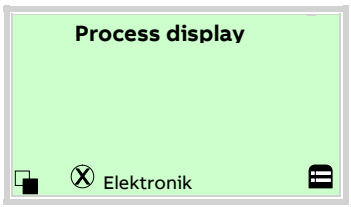
Range	Description
Electronics	Diagnosis for device hardware.
Sensor	Diagnosis for sensor elements and connection lines.
Configuration	Diagnosis of the communication interface and parameterization / configuration.
Operating conditions	Diagnosis for ambient and process conditions.
Process (from SW-Rev.: 03.00)	Notes and warnings when leaving the sensor or process temperature range.

Note

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

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

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:

Symbol	Description
	Error / failure
	Check function
	Outside of the specification
	Maintenance required

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:

Range	Description
Electronics	Diagnosis for device hardware.
Sensor	Diagnosis for sensor elements and connection lines.
Installation / Configuration	Diagnosis for communication interface and parameterization / configuration
Operating conditions	Diagnosis for ambient and process conditions.

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

… 9 Operation

Factory settings

Firmware settings

The transmitter is configured ex works.

HART® devices from SW-Rev.: 03.00

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 settings are reset to the factory settings in accordance with the following table (corresponds to default configuration BS).
- The menu item “Reset to Order” in the service menu is used to reset the settings 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 “Factory reset” and “Reset to Order”.

Devices with PROFIBUS PA®, FOUNDATION Fieldbus®, and HART® (all SW revisions)

The following table with the corresponding parameter values applies:

Menu	Designation	Parameter	Factory setting
Device Setup	Write protection	–	No
	Input Sensor 1	Sensor Type	Pt100 (IEC60751)
		R-Connection	Three-wire
		Measured Range Begin[1)]	0
		Measured Range End[1)]	100
		Engeneering Unit	Degrees °C
		Damping	Off
Process Alarm		Fault signaling[1)]	To SW-Rev.: 01.03: Overrange / high alarm 22 mA[1)] From SW-Rev.: 03.00: Underrange / low alarm 3.5 mA[1)]
	Input Sensor 2	Sensor Type	Off
	Input / output assignment	Measurement type	Sensor 1
	TAG	–	–
	HART Descriptor[1)]	–	To SW-Rev.: 01.03: TIXXX-[1)]
Display	Display Value	–	Process Variable
	Bargraph[1)]	–	Yes, output %[1)]
	Language	–	English
	Contrast	–	50 %
Communication	HART Burstmode[1)]	Status[1)]	Off[1)]
	Bus Address[2) 3)]	–	126[2)] / 30[3)]
	Simulation mode[3)]	–	Off[3)]
	HART Protocol	–	HART 5 / 7[4)]

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 all types of reset (all SW revisions).

10 Maintenance

Repair and maintenance activities may only be performed by authorized customer service personnel.
When replacing or repairing individual components, use original spare parts.

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.

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

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

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.

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

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.

Notes

Notes

ABB Measurement & Analytics

For your local ABB contact, visit:
www.abb.com/contacts

For more product information, visit:
www.abb.com/temperature

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