TTF350

EN
English

Commissioning Instructions

Field-mounted temperature transmitters
TTF350

HART®
FIELD COMMUNICATIONS PROTOCOL

ABB

Field-mounted temperature transmitters
TTF350

Commissioning Instructions - EN

CI/TTF350-EN

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Manufacturer:

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

Contents

1 Safety

1.1 General Safety Information

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

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

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

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

1.2 Intended use

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 following items are included in the intended use:

- Read and follow the instructions in this manual.
- Observe the technical ratings (refer to the section “Technical data” or data sheet).

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

1.3 Technical limits

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

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

1.4 Personnel qualification

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

1.5 Electrical installation safety information

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

Observe the electrical connection information in the manual, otherwise the electrical protection can be affected.

The secure isolation of contact-dangerous electrical circuits is only guaranteed when the connected devices fulfil the requirements of the DIN VDE 0106 T.101 (basic requirements for secure isolation).

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

1.6 Operating safety information

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

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

1.7 Returning devices

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

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

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

1.8 Disposal

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

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

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

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

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

Dispose of the product/solution directly in a specialized recycling facility and do not use the municipal garbage. Only privately used products may be disposed of in the municipal garbage according to the WEEE directive 2002/96/EC. Proper disposal prevents negative effects on people and the environment, and supports the reuse of valuable raw materials.

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

2 Use in areas requiring ignition protection

Special regulations must be observed in explosion-protection zones for the auxiliary power connection, signal inputs/outputs and ground connection. Information on ignition protection in the separate chapters must be observed.

Caution! Potential damage to parts!

All parts must be installed in accordance with manufacturer information and relevant standards and regulations.

Startup and operation must be performed in accordance with ATEX 137 or BetrSichV (EN60079-14).

2.1 Approvals

The approvals for use of the TTF350 temperature transmitter in explosion-protection areas can be found in the section "Approvals".

2.2 Ground

If for functional reasons, the intrinsically safe circuit has to be grounded by connection to the equipotential bonding system, it may only be grounded at a single location.

2.3 Interconnection

If transmitters are operated in an intrinsically safe circuit, proof that the interconnection is intrinsically safe must by provided in accordance with DIN VDE 0165/08.98 (EN 60 079-14/1997 and IEC 60 079-14/1996). In general, intrinsically safe circuits require proof of interconnection.

2.4 Configuration

TTF350 temperature transmitters can be installed in the explosion-protection area in compliance with the proof of interconnection and directly in the explosion-protection area using approved handheld HART terminals (e.g., HC275) as well as by coupling an ignition-proof modem to the circuit outside the explosion-protection area.

2.5 Explosion-protection relevant information

For additional information, refer to the section “Explosion-protection relevant information”.

3 Installation

3.1 Installation options

There are two ways to install transmitters:

- Wall installation
- Pipe installation

Important

The transmitter is equipped with an LC display as standard.

3.1.1 Wall installation

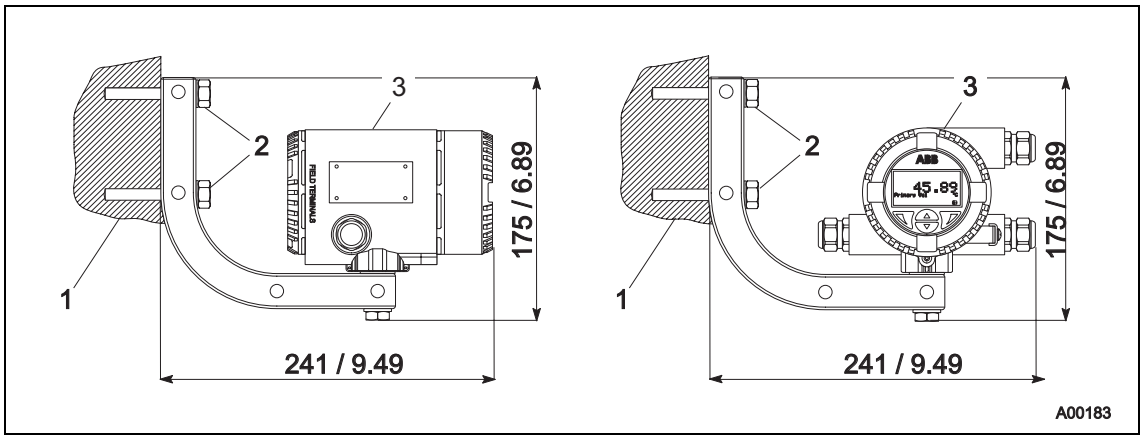

Fig. 1: Dimensions in mm/inches

1 Wall
2 Wall mount
3 Transmitter TTF350

1. Locate an installation site close to the temperature sensor head.

Warning - General hazards!

The transmitter can fall and be damaged if not firmly attached. There is also a risk that persons can be injured.

Install the wall mount on a sufficiently stable wall only.

2. Screw the transmitter to the wall mount.
3. Attach the wall mount securely with 2 screws (∅ 10 mm).

3.1.2 Pipe installation

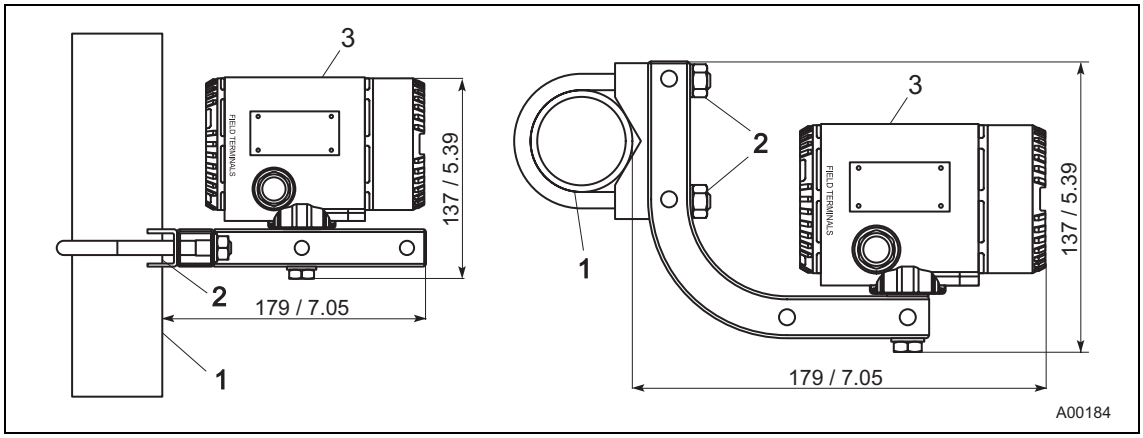

Fig. 2: Dimensions in mm/inches

1 Pipe (max. Ø 2 inches)
2 Pipe mount
3 Transmitter TTF350

1. Locate an installation site on a pipe close to the temperature sensor head.

Important
The pipe mount can be attached to a pipe with a maximum diameter of 2" (max. 60 mm).

2. Screw the transmitter to the pipe mount.

3 Attach the pipe mount securely to the pipe with 2 pipe clamps (∅ 10 mm).

Important
The wall and pipe installation set supports variable installation positions. A few examples of the different options are shown here. The mounting screw allows infinitely adjustable positioning (0° … 360°) of the housing.

3.2 Installing and aligning the optional LCD display with control buttons

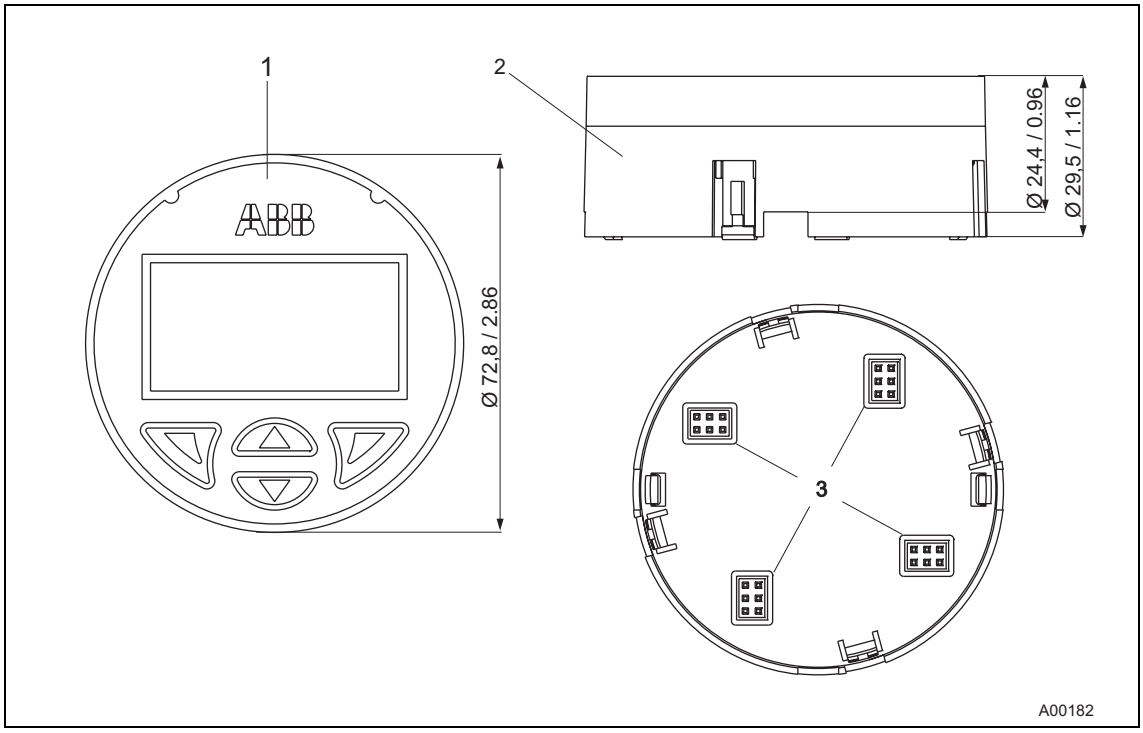

Fig. 3

1 Front view
2 Side view
3 Rear view of LCD display / plug positions

The LCD display is attached to the housing of the TTF350 transmitter.

1 Unscrew the housing cover for the transmitter.

2. Carefully remove the LCD display from the inset for the transmitter. The LCD display is held firmly in place. You might have to use the tip of a screwdriver to pry loose the LCD display. Avoid mechanical damage.
3. No tools are required to insert the LCD display, which can be mounted in 4 positions at 90° degree intervals to ensure the display is mounted properly and readable.
4. Screw on the housing cover for the transmitter.

4 Electrical connection

Warning – Electrical voltage risk!

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

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

Energy supply and signal are routed in the same line and are to be implemented as SELV or PELV circuit according to norm (standard version). In the ignition-proof version, the guidelines according to the ignition-proof norms are to be adhered to.

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

Important

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

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

The cross-head screws of the connection terminals are tightened with a size 1 screwdriver (3.5 mm or 4 mm).

4.1 Conductor material

- Standard conductor material must be used for the power supply cable.
- The maximum peripheral wire cross section is 2.5 mm^2.

Caution! Potential damage to parts!

A rigid conductor material can result in wire breaks.

The connecting cable must be flexible.

Line length

From the lower edge of the housing (no cable gland) to the hole in the clamping area, an additional 100 mm of line is needed. An overall line length (without cable gland) of approx. 200 mm is required (approx. 100 mm bared).

4.2 Cable glands

4.2.1 TTF350 without cable gland

The cable diameter for the cable gland used must comply with requirements for IP / Nema 4x protection class. This must be checked during installation.

For delivery without cable gland (threads M20x1.5 or NPT 1/2"), the following points must be observed:

- Use cable glands acc. to version M20 x 1.5 or NPT 1/2".
- Observe information in data sheet / operating instructions for cable gland used.
- Check the working temperature for the cable gland used.
- Check the IP protection class IP66 / 67 or NEMA 4X of the cable gland in used.
- Check the explosion protection relevant information for the cable gland used acc. to manufacturer's data sheet or Ex certificate.
- The cable gland used must be approved for the cable diameter (IP protection class).
- For tightening torque, observe information in data sheet / operating instructions for cable gland used.

4.2.2 TTF350 EEx d models without cable gland

For delivery of the product variants TTF350-E3... (ATEX EEx d / hermetically sealed) and TTF350-E4....(ATEX EEx d and EEx ia or hermetically sealed and intrinsically safe) without cable gland an approved ATEX EEx d cable gland must be used according to EN 50018.

The explosion protection relevant information for the cable glands (M20*1.5 6H or 1/2" NPT, clamping range, temperature range, etc.) must comply with the requirements for PTB ATEX approval in order to ensure protection type EEx d for the TTF350.

For information on the cable gland used, refer to the data sheet and operating instructions.

4.3 Connection for power supply cable

Caution - Potential damage to parts!

Connecting the power supply cable with power switched on may result in a short circuit and potential damage to the transmitter.

The power must be switched off to connect the power supply cable.

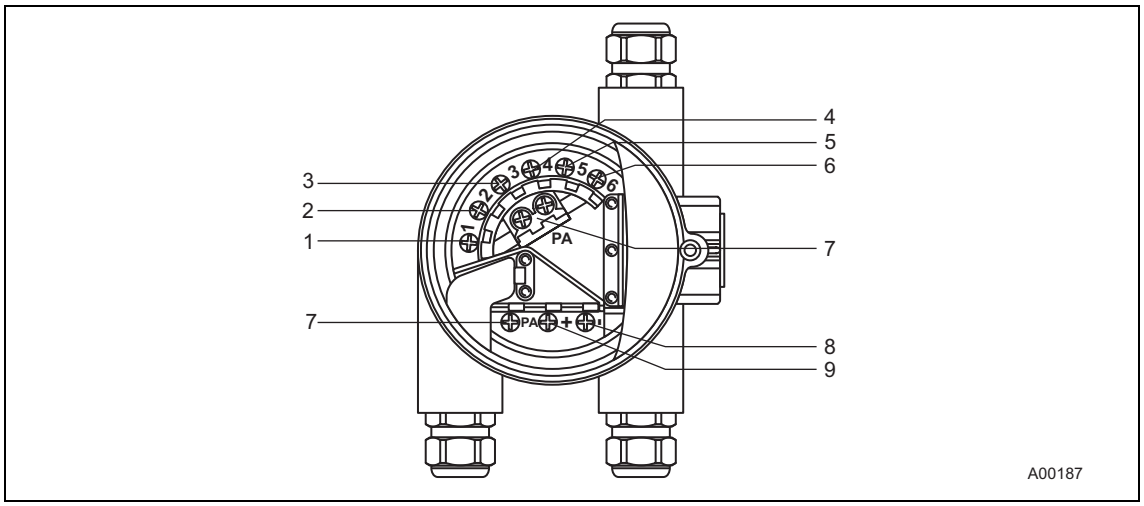

Fig. 4: Sensor and supply voltage terminal box of the TTF350 field device

1 … 6	Sensor connection	7	Shield
7 … 9	Signal/power supply connection	8	Minus
	11 ... 42 VDC / 4 … 20 mA	9	Plus
	11 … 30 VDC / 4 … 20 mA (Ex)		

1. Route the power supply cable through the cable gland into the housing of the transmitter. Then tighten the cable gland.
2. Strip the wires and attach wire end sleeves.
3. Release the clamping screws for the (+) and (-) terminals with the proper screwdriver. Make sure that the screws do not fall out.
4. Connect the (+) wire to the (+) terminal on the transmitter.
5. Connect the (-) wire to the (-) terminal on the transmitter.

The connection of the line shield is optional.

4.4 Connection for measuring element

Important

The model of the sensor connecting cable must correspond to the sensor model and configuration of the transmitter.

When connecting the transmitter and measuring inset (sensor) make sure for thermocouple sensors that the material of the sensor connecting cable corresponds to the thermocouple model.

1. Look for the connection type for the selected measuring element in the connection diagrams.
2. Release the clamping screws for terminals 1 to 6 using the proper screwdriver. Make sure that the screws do not fall out.
3. Insert the wires for the measuring element and sensor cable connection under the open terminals and carefully tighten the clamping screws for the connections.

4.5 Terminal connection diagrams

RTD resistance sensors

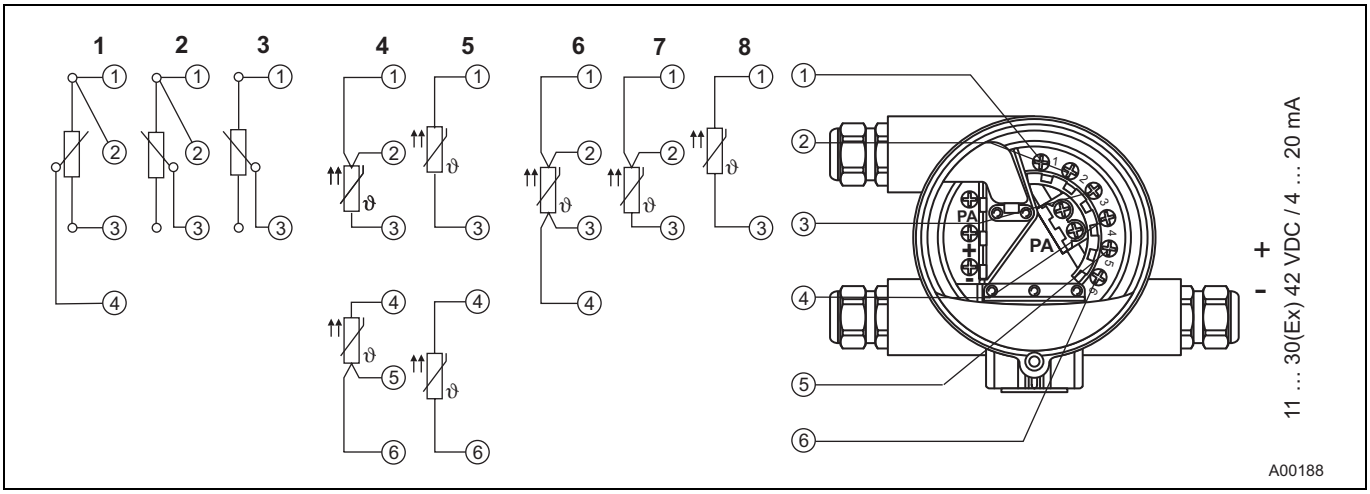

Fig. 5

Potentiometer: 0 … 500 Ω or 0 … 5000 Ω

1 Potentiometer, 4-wire circuit
2 Potentiometer, 3-wire circuit
3 Potentiometer, 2-wire circuit

4 2 x RTD, 3-wire circuit (sensor backup/redundancy, sensor drift monitoring, average value or differential temperature measurement)
5 2 x RTD, 2-wire circuit (sensor backup/redundancy, sensor drift monitoring, average value or differential temperature measurement)

6 RTD, 4-wire circuit
7 RTD, 3-wire circuit
8 RTD, 2-wire circuit

Thermocouples/Voltages

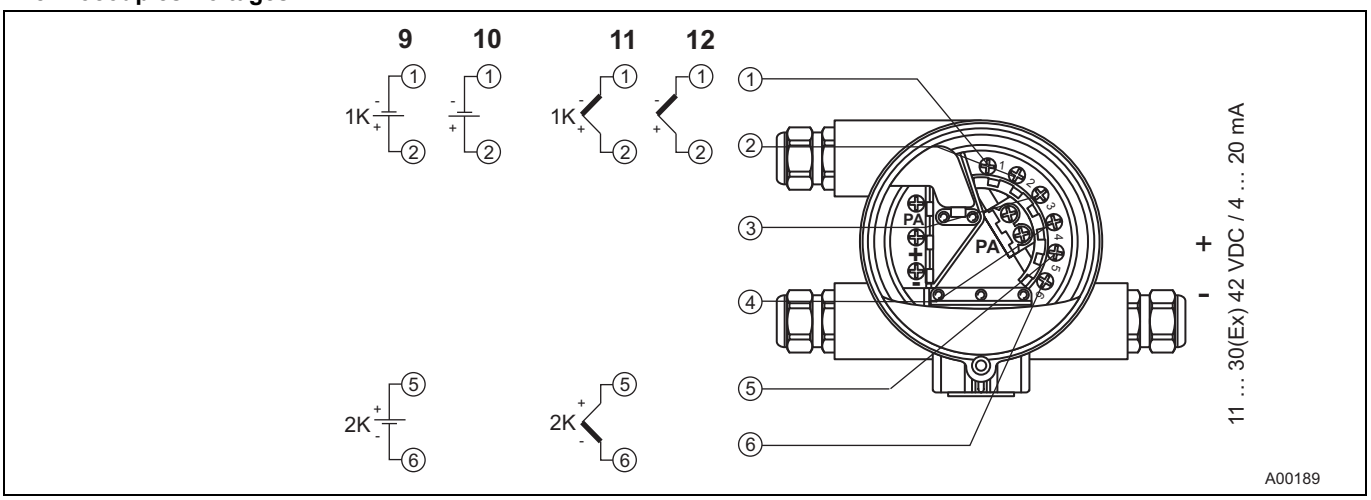

Fig. 6

9 2 x voltage measurement (sensor backup/redundancy, sensor drift monitoring, average value or differential temperature measurement)
10 Voltage measurement
11 2 x thermocouple (sensor backup/redundancy, sensor drift monitoring, average value or differential temperature measurement)
12 Thermocouple

RTD/thermocouples configuration

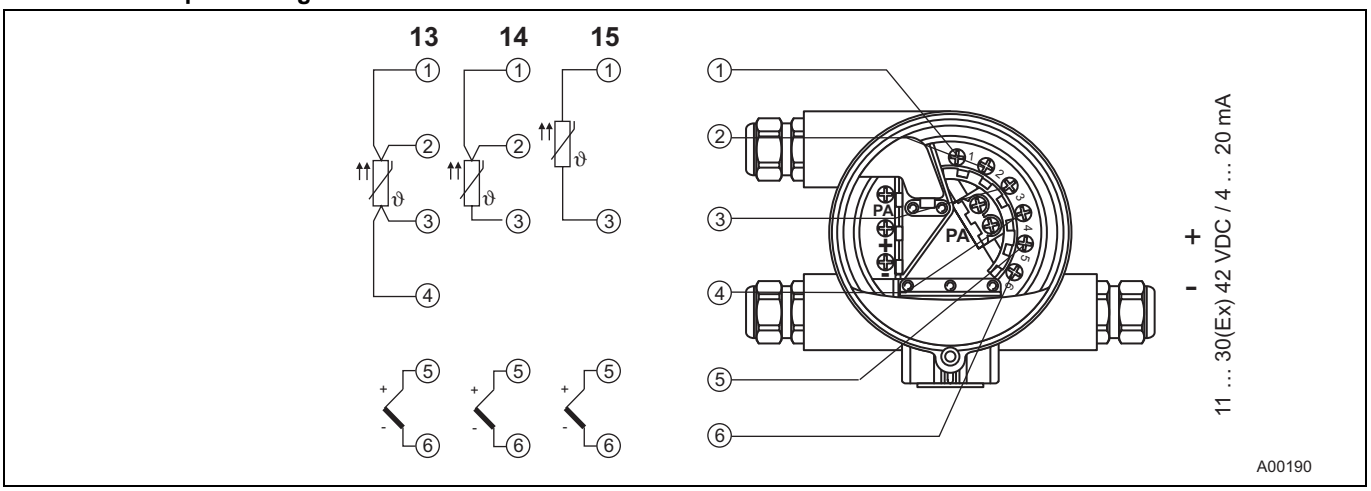

Fig. 7

13 1 x RTD, 4-wire circuit and thermocouple (sensor backup/redundancy, sensor drift monitoring, average value or differential temperature measurement)
14 1 x RTD, 3-wire circuit and thermocouple (sensor backup/redundancy, sensor drift monitoring, average value or differential temperature measurement)
15 1 x RTD, 2-wire circuit and thermocouple (sensor backup/redundancy, sensor drift monitoring, average value or differential temperature measurement)

4.5.1 Standard application

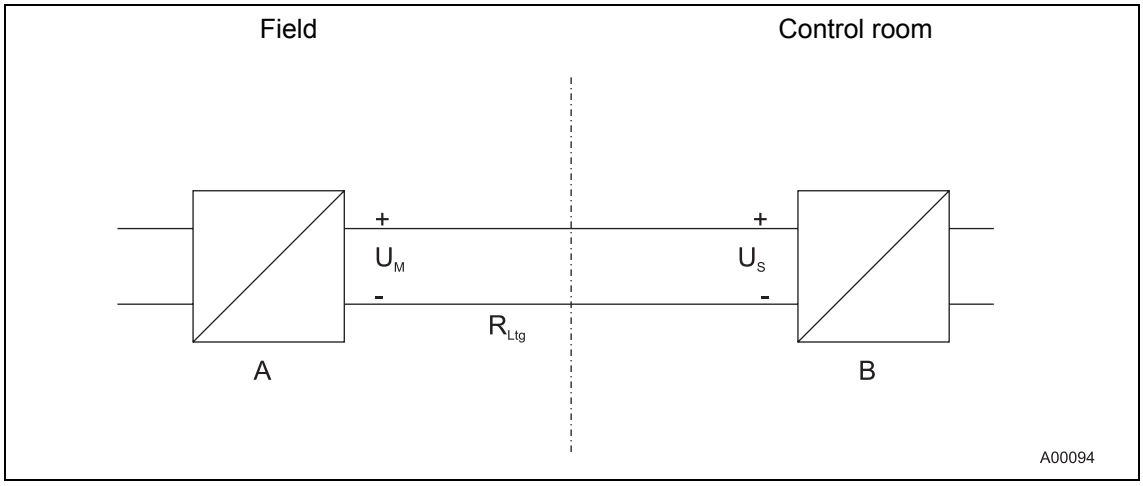

Fig. 8

A Transmitter B Power supply / SPS input with supply

When connecting transmitters and power supplies, observe the following specification:

$U_{Mmin} \leq U_{Smin} + 0.02A \times R_{Ltg}$

Where

U_{Mmin}: Minimum operating voltage of transmitter (refer to technical data for transmitter)

U_{Smin} : Minimum supply voltage of power supply / SPS input

R_{Ltg}: Line resistance between transmitter and power supply

For HART functionality, use power supplies or SPS input cards with HART mark. If this is not possible, the interconnection must have a resistance ≥ 250 Ω (< 1100 Ω).

The signal line can be connected with or without ground. When connecting the ground (minus side), make sure that only one side of the contact is connected to the equipotential bonding system.

4.5.1.1 Standard application with HART functionality

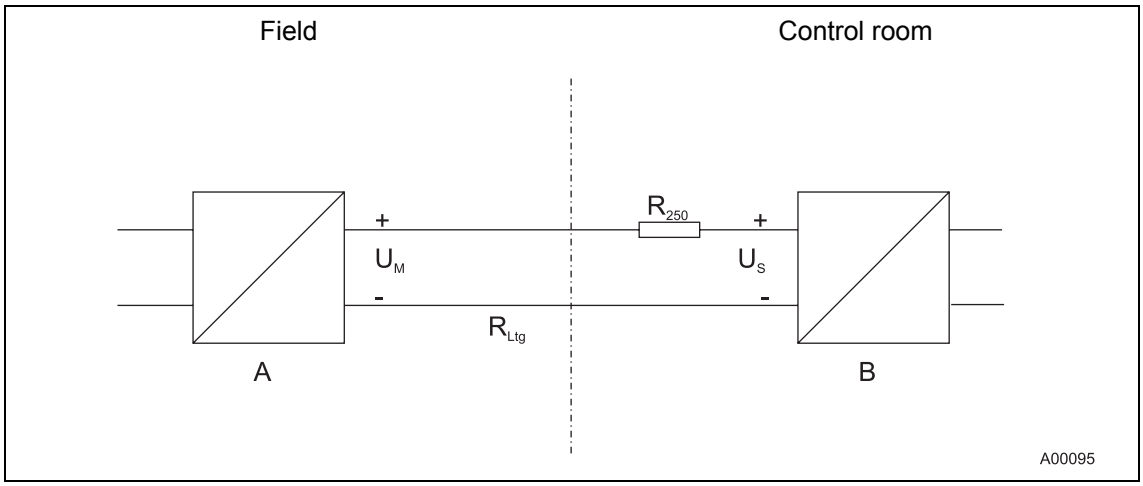

Fig. 9

A Transmitter

B Power supply / SPS input with supply

Adding resistance R250 increases the minimum supply voltage:

$U_{Mmin} \leq U_{Smin} + 0.02A \times (R_{Ltg} + R_{250})$

Where

U_{Mmin}: Minimum operating voltage of transmitter (refer to technical data for transmitter)

U_{Smin} : Minimum supply voltage of power supply / SPS input

R_{Ltg}: Line resistance between transmitter and power supply

R_{250} : Resistance for HART functionality

4.5.1.2 Electrical interconnection in explosion risk area

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

Intrinsic safety

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

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

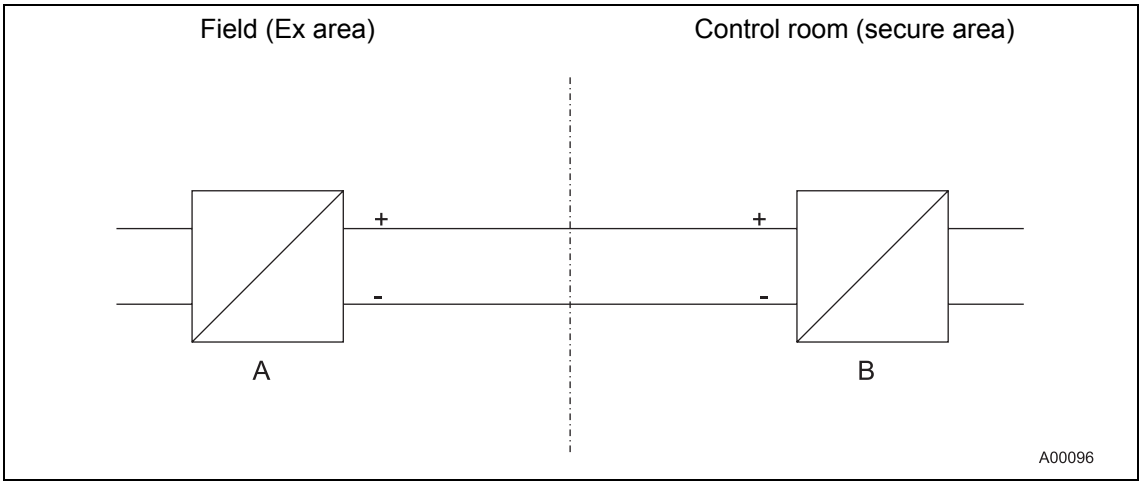

Fig. 10

A Transmitter

B Power supply SPS input

Important

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

4.5.2 Installation in ignition protection areas

Transmitters can be installed in a wide variety of industrial sectors. Systems that require ignition protection are divided into zones. As a result, different instruments are also required. For additional information, refer to the section “Explosion-protection relevant information” or the data sheet.

4.5.2.1 Zone 0

Transmitter design: II 1G EEx ia IIC T6

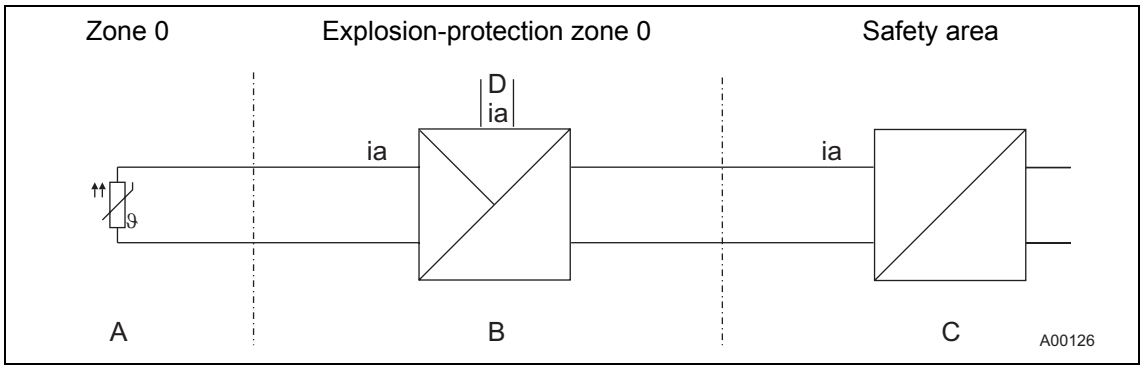

Fig. 11

A Sensor

B TTF350 transmitter

C Power supply [EEx ia]

D HMI interface for LCD display

The input for the power supply must be in EEx ia design.

When using the transmitter in zone 0, make sure you prevent electrostatic charging of the temperature transmitter (observe warnings on equipment).

The sensor must be used by the user in accordance with applicable ignition-protection standards.

4.5.3 Zone 1 (0)

Transmitter design: II 2 (1) G EEx [ia] ib IIC T6

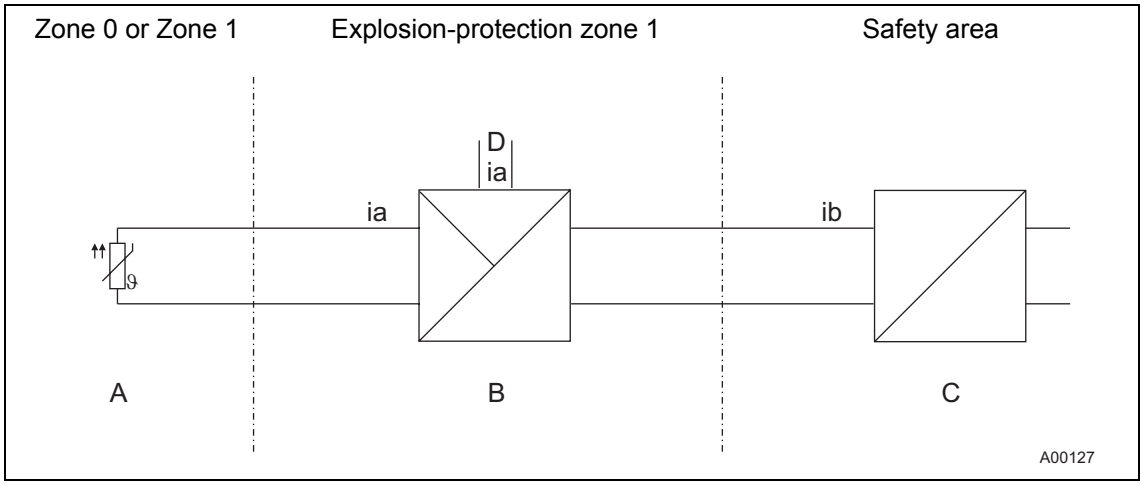

Fig. 12

A Sensor

B TTF350 transmitter

C Power supply [EEx ib]

D HMI interface for LCD display

The input for the power supply must be at a minimum in EEx ib design.

The sensor must be used by the user in accordance with applicable ignition-protection standards. It can be installed in zone 1 or zone 0. For zone 0, the circuit must be in "ia" design.

4.5.4 Zone 1 (20)

Transmitter design: II 2G (1D) EEx [iaD] ib IIC T6

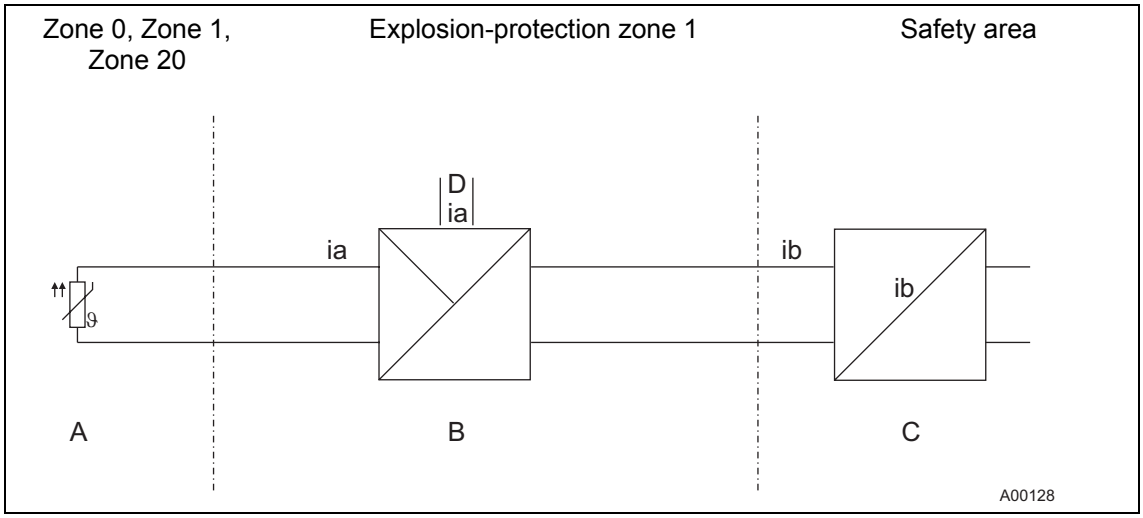

Fig. 13

A Sensor
B TTF350 transmitter
C Power supply [EEx ib]
D HMI interface for LCD display

The input for the power supply must be at a minimum in EEx ib design.

The sensor must be used by the user in accordance with applicable ignition-protection standards. It can be installed in zone 0, zone 1 or zone 20. For zone 0 and zone 20, the circuit must be in "ia" design.

4.5.5 Zone 2

Transmitter design: II 3G EEx nA II T6

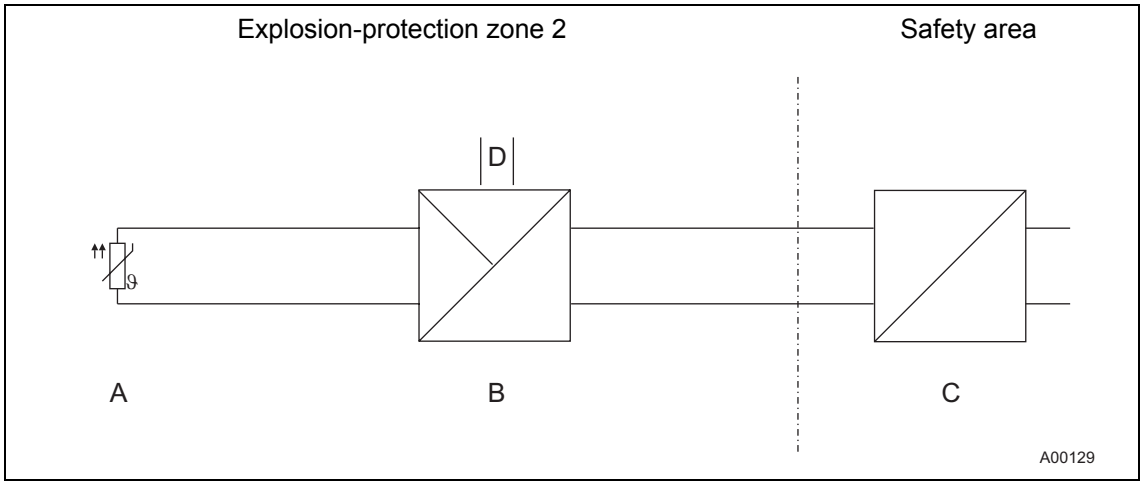

Fig. 14

A Sensor
B TTF350 transmitter
C Power supply
D HMI interface for LCD display

Ensure that in case of a disturbance the supply voltage cannot exceed 40 % of the normal voltage.

4.5.6 Dust-explosion protection Zone 20:

Transmitter design: ATEX II 1D IP 65 T135 °C

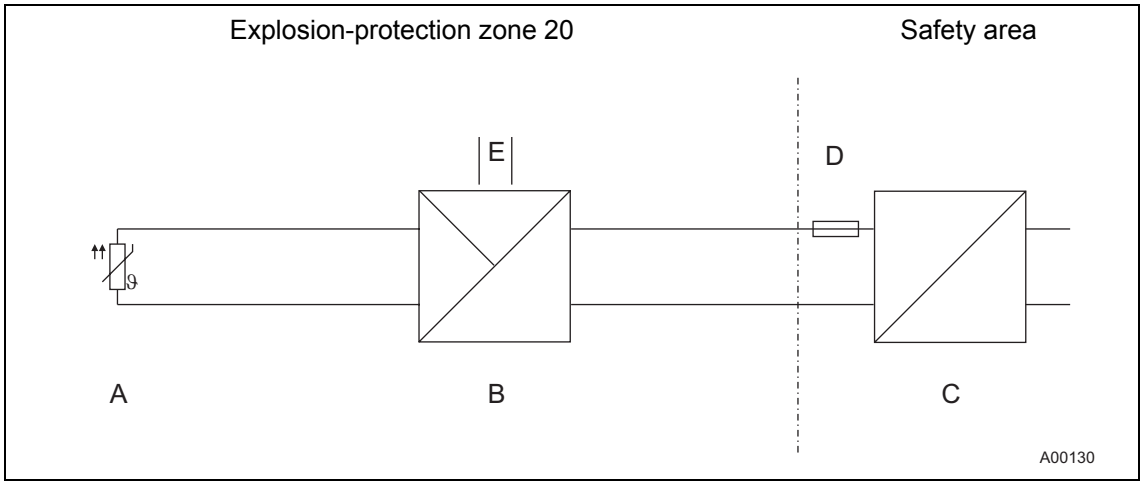

Fig. 15

A Sensor
B TTF350 transmitter
C Power supply
D Fuse, 32 mA
E HMI interface for LCD display

The electric circuit of the transmitter must be limited by an upstream fuse per IEC 127 with a fuse current rating of 32 mA. This is not required if the power supply is in intrinsically safe "ia" design.

4.5.7 Dust-explosion protection Zone 0/20

Housing design: ATEX II 1D IP 65 T135 °C

Transmitter design: ATEX II 1G EEx ia IIC T6

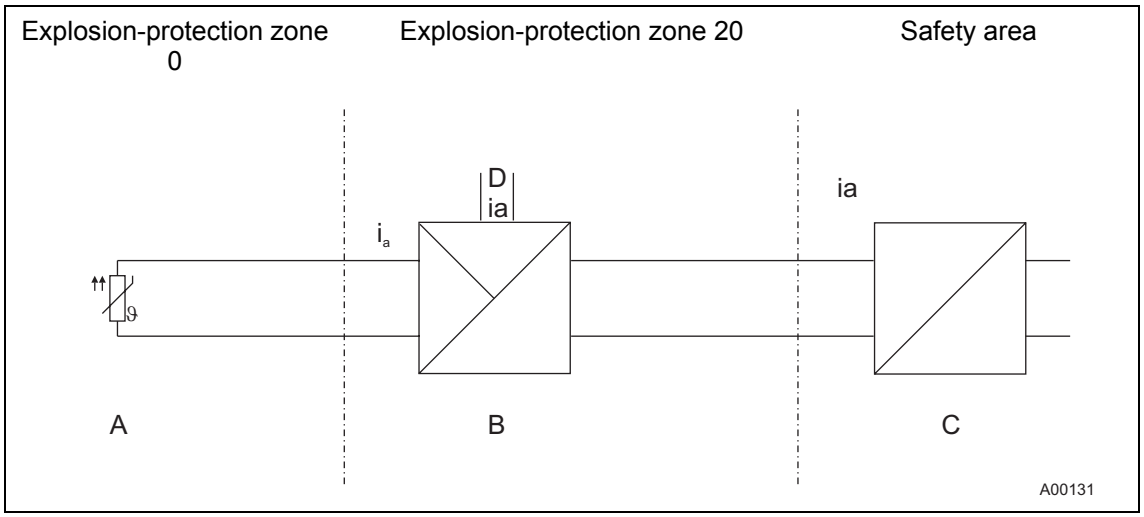

Fig. 16

A Sensor

B TTF350 transmitter

C Power supply

D HMI interface for LCD display

When using the sensor in zone 0, the transmitter must be in EEx ia (category 1G) design.

If the transmitter is designed with intrinsic safety, the power supply must provide an intrinsically safe circuit.

4.5.8 Flameproof protection Zone 1

Housing design: ATEX II 2G EEx d IIC T6

Transmitter design: No ignition protection

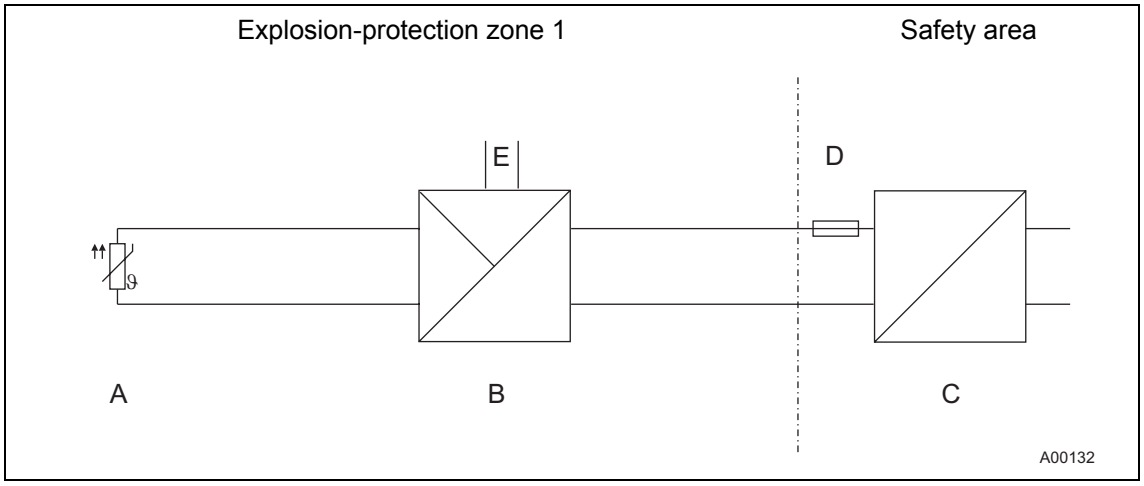

Fig. 17

A Sensor
B TTF350 transmitter in Ex d housing
C Power supply
D Fuse, 32 mA
E HMI interface for LCD display

To achieve the flameproof protection, proper mounting of a specially certified cable gland that complies with the standards and relevant Ex designation on the cover sheet of the PTB 99 ATEX 1144 certificate is required.

4.5.9 Flameproof protection Zone 0

Housing design: ATEX II 2G EEx d IIC T6

Transmitter design: ATEX II 1G EEx ia IIC T6

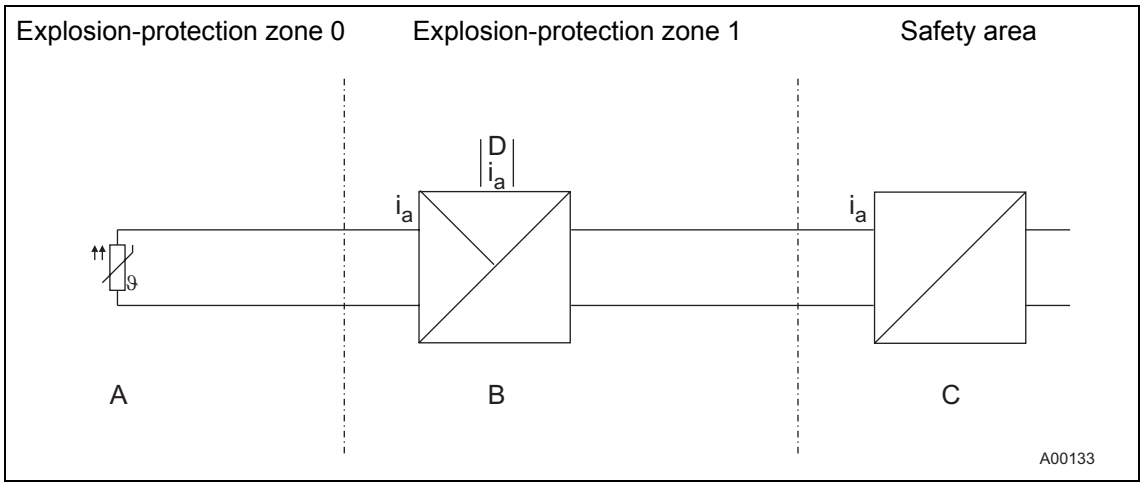

Fig. 18

A Sensor

B TTF350 transmitter in Ex d housing

C Power supply

D HMI interface for LCD display

To achieve the flameproof protection, proper mounting of a specially certified cable gland that complies with the standards and relevant Ex designation on the cover sheet of the PTB 99 ATEX 1144 certificate is required

The input for the power supply must be in EEx ia design.

The sensor must be used by the user in accordance with applicable ignition-protection standards. It can be installed in zone 1 or zone 0. For zone 0, the circuit must be in "ia" design.

5 Explosion-protection relevant information and approvals for the LC display

5.1 LCD display HMI ignition-proof type B (intrinsically safe)

Approved for use in zone 0.

Designation:

- II 1G EEx ia IIC T6

Important
The Ex or ignition-proof designation is provided on the name plate.

EC prototype test certificate: ZELM 07 ATEX 0331 U

Temperature table

Temperature class	Permissible ambient temperature range	
	Device category 1 use	Device category 2 use
T6	-40 … 40 °C	-40 … 40 °C
T5	-40 … 55 °C	-40 … 55 °C
T4	-40 … 85 °C	-40 … 85 °C

For the ambient temperature range from -50 °C to -20°C, additional mechanical protection is required.

Safety-relevant data

Intrinsically safe EEx ia IIC explosion protection

	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
Internal capacitance	C_i = 342 nF

5.2 LCD display

CE mark:

The HMI type B LCD display meets all requirements for the CE mark in accordance with IEC 61326 (2001).

Namur:

The HMI type B LCD display complies with NAMUR NE 21 (02/2004).

CSA and FM

Intrinsic Safety

FM	Class I, Div. 1, Groups A, B, C, D T6 Class I, Zone 0, AEx ia IIC T6 Control drawing: TTF350-L4
CSA	Class I, Div. 1, Groups A, B, C, D T6 Class I, Zone 0, AEx ia Group IIC T6 Control drawing: TTF350-R4

Non-incendive

FM	Class I, Div. 2, Groups A, B, C, D, T6 Control drawing: TTF350-L5
CSA	Class I, Div. 2, Groups A,B,C,D T6 Control drawing: TTF350-R5

6 Startup Operation

Important

The transmitter is immediately ready for operation after mounting and installation of the connections. The parameters are set at the factory.

The connected wires must be checked for firm seating. Only firmly seated wires ensure full functionality.

7 Appendix

Important

All documentation, declarations of conformity and certificates are available in the download area of ABB Automation Products GmbH.

www.abb.com/temperature

7.1 Additional documents

- Operating instructions (OI/TTF350)
- Data sheet (DS/TTF350)

Statement about the contamination of devices and components

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

Otherwise, the shipment can be rejected. This explanation may only be filled out and signed by authorized specialist personnel of the operator.

Customer details:

Company:	
Address:	
Contact person:	Telephone:
Fax:	E-Mail:

Device details:

Type:	Serial no.:
Reason for the return/description of the defect:	

Was this device used for working with substances which pose a threat or health risk?

☐ Yes ☐ No

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

biological	☐	corrosive/irritating	☐	combustible (highly/extremely combustible)	☐
toxic	☐	explosive	☐	other toxic substances	☐
radioactive	☐				

Which substances have had contact with the device?

1.
2.
3.

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

City, Date	Signature and company stamp

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ABB is continually improving its products. As a result, technical information in this document is subject to change.

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CI/TTF350-EN

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

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

ABB Automation Products GmbH
Borsigstr. 2
63755 Alzenau
Germany
Tel: +49 551 905-534
Fax: +49 551 905-555
CCC-support.deapr@de.abb.com