

ProcessMaster, HygienicMaster FEX300, FEX500

ATEX / IECEx Zone 1, 2, 21, 22

EN

English

**Safety instructions for electrical
apparatus in potentially explosive areas,
in accordance with Directive 2014/34/EU
(ATEX) and IEC60079-0 (IECEx)**
Electromagnetic Flowmeter



ABB

Electromagnetic Flowmeter ProcessMaster, HygienicMaster FEX300, FEX500

Safety instructions for electrical apparatus in potentially explosive areas, in accordance with Directive 2014/34/EU (ATEX) and IEC60079-0 (IECEX) - EN

SM/FEX300/FEX500/ATEX/IECEX-EN

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**IMPORTANT (NOTE)**

This document forms an integral part of the following manuals:

- Operating Instruction OI/FEX300/FEX500
- Commissioning instruction CI/FEX300/FEX500

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1 Safety

1.1 Operator liability

The operator must strictly observe the applicable national regulations with regard to installation, function tests, repairs, and maintenance of electrical devices.

When operating the meter with combustible dusts, it is essential to comply with IEC 61241ff.

The safety instructions for electrical apparatus in potentially explosive areas must be complied with, in accordance with Directive 2014/34/EU (ATEX) and IEC60079-14 (Installation of equipment in potentially explosive atmospheres).

To ensure safe operation, the requirements of EU Directive ATEX 118a (minimum requirements concerning the protection of workers) must be met.

1.2 Technical limit values

Particular attention must be paid to the limit values listed in the sections relating to "ex relevant specifications":

- The data for the signal inputs and outputs of the transmitter
- The permissible temperature data and limit values

1.3 Safety information for electrical installation

Never attempt electrical connection unless the power supply is switched off.

Ground the flowmeter sensor and transmitter housing. Make sure there is no risk of explosion.

1.4 Symbols and warnings

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

This symbol in conjunction with the signal word "Danger" indicates an imminent danger. Failure to observe this safety information will result in death or severe injury.

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

This symbol in conjunction with the signal word "Danger" indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury.

**WARNING – <Bodily injury>**

This symbol in conjunction with the signal word "Warning" indicates a possibly dangerous situation. Failure to observe this safety information may result in death or severe injury.

**WARNING – <Bodily injury>**

This symbol in conjunction with the signal word "Warning" indicates a potential electrical hazard. Failure to observe this safety information may result in death or severe injury.

**CAUTION – <Minor injury>**

This symbol in conjunction with the signal word "Caution" indicates a possibly dangerous situation. Failure to observe this safety information may result in minor or moderate injury. This may also be used for property damage warnings.

**NOTICE – <Property damage>!**

The symbol indicates a potentially damaging situation.

Failure to observe this safety information may result in damage to or destruction of the product and/or other system components.

**IMPORTANT (NOTE)**

This symbol indicates operator tips, particularly useful information, or important information about the product or its further uses. It does not indicate a dangerous or damaging situation.

2 Device designs

The devices are available in two series. ProcessMaster 300 / HygienicMaster 300 with basic functions and ProcessMaster 500 / HygienicMaster 500 with extended functions and options.

The series is identified by the fourth digit of the model number:

Model number / device series			
FEP3...	ProcessMaster 300	FEP5...	ProcessMaster 500
FEH3...	HygienicMaster 300	FEH5...	HygienicMaster 500

Devices suitable for use in potentially explosive atmospheres feature the corresponding Ex mark on their name plates.

The design intended for use in Ex Zones 2, 21, and 22 is identified by the letter "M" in the model number, while the design intended for use in Zones 1 and 21 is identified by the letter "L".

Example:

FEP315-100A1S1D2B0A1A0M1A1C1, FEP325-100A1S1D2B0A1A1M1A0Y1,
FET325-1A0M1A1C1

2.1 Model with compact design



The transmitter and the flowmeter sensor form a single mechanical entity.




IMPORTANT (NOTE)

For further information about the instruments' explosion protection approval please refer to the Ex test certificates (available on the product CD or under www.abb.com/flow).

2.1.1 ATEX/IEC Zone 1

ProcessMaster 300 / ProcessMaster 500 FEP315.....L..... / FEP515.....L..... Zone 1, 21	HygienicMaster 300 / HygienicMaster 500 FEH315.....L..... / FEH515.....L..... Zone 1, 21
 G00886	 G00883
ATEX Certificate: FM08ATEX0080 DN3-300: II 2G Ex d e ia ma IIC T6 ... T2 >DN300 : II 2G Ex d e ia IIC T6 ... T2 II 2 D Ex tD iaD A21 IP6X T70°C ... T _{medium}	ATEX Certificate: FM08ATEX0080 II 2G Ex d e ia ma IIC T6 ... T2 II 2 D Ex tD iaD A21 IP6X T70°C ... T _{medium}
IEC Certificate: FME08.0004 DN3-300: Ex d e ia ma IIC T6 ... T2 Gb >DN300 : Ex d e ia IIC T6 ... T2 Gb Ex tD iaD A21 IP6X T70°C ... T _{medium}	IEC Certificate: FME08.0004 Ex d e ia ma IIC T6 ... T2 Gb Ex tD iaD A21 IP6X T70°C ... T _{medium}

2.1.2 ATEX/IEC Zone 2

ProcessMaster 300 / ProcessMaster 500 FEP315.....M.... / FEP515.....M.... Zones 2, 21, 22	HygienicMaster 300 / HygienicMaster 500 FEH315.....M.... / FEH515.....M.... Zones 2, 21, 22
<div> <div>1)</div>  </div> <div> <div>2)</div>  </div> <p>G01082-01</p>	<div> <div>1)</div>  </div> <div> <div>2)</div>  </div> <p>G01330</p>
<p>ATEX</p> <p>Certificate: FM08ATEX0038, FM08ATEX0080</p> <p>II 3 G Ex nA nC IIC T4 ... T3</p> <p>II 2 D Ex tD A21 IP6X T70 °C ... T_{medium}</p>	<p>ATEX</p> <p>Certificate: FM08ATEX0038, FM08ATEX0080</p> <p>II 3 G Ex nA nC IIC T4 ... T3</p> <p>II 2 D Ex tD A21 IP6X T70 °C ... T_{medium}</p>
<p>IEC</p> <p>Certificate: FME08.0004</p> <p>Ex nA nC IIC T4 ... T3</p> <p>Ex tD A21 IP6X T70 °C ... T_{medium}</p>	<p>IEC</p> <p>Certificate: FME08.0004</p> <p>Ex nA nC IIC T4 ... T3</p> <p>Ex tD A21 IP6X T70 °C ... T_{medium}</p>

- 1) Single-compartment housing
2) Dual-compartment housing

2.2 Model with remount mount design

The transmitter is mounted in a separate location from the flowmeter sensor. The electrical connection between the transmitter and flowmeter sensor may only be established using the signal cable supplied.

Application	Signal cable	
	D173D031U01	D173D027U01
Non-Ex. (< DN15)	✗	✓
Non-Ex. (≥ DN15)	✓	✓
Zone 2 / Div. 2 (< DN15)	✗	✓
Zone 2 / Div. 2 (≥ DN15)	✓	✓
Zone 1 / Div. 1 (all nominal diameter)	✗	✓

- ✗ Application not permissible
✓ Application permissible

■ Standard on delivery

i

IMPORTANT (NOTE)

For further information about the instruments' explosion protection approval please refer to the Ex test certificates (available on the product CD or under www.abb.com/flow).

2.2.1 ATEX/IEC Zone 1









DANGER - Risk of explosion caused by incorrect transmitter installation

The FET321 / FET521 transmitter is not approved for hazardous areas.

The FET321 / FET521 transmitter must not be installed or operated in potentially explosive atmospheres.

If the FEP325 flowmeter sensor is combined with the FET321 or FET325 transmitter (Zone 2), the maximum permissible signal cable length is 50 m (164 ft) with a minimum conductivity of 5 μ S/cm, without a pre-amplifier. The same is valid for the FEP525 flowmeter sensor with FET521 or FET525 (Zone 2) transmitter.

If the FEP325 flowmeter sensor is combined with the FET325 transmitter (Zone 1), 10 m (32.8 ft) signal cables are permanently connected to the transmitter. The same is valid for the FEP525 flowmeter sensor with FET525 (Zone 1) transmitter.

Flowmeter sensor ProcessMaster 300 / ProcessMaster 500 FEP325.....L.... / FEP525.....L.... In Ex area, Zone 1, 21, 22		
 G00862		
ATEX Certificate: FM08ATEX0080 DN3-300: II 2G Ex e ia ma IIC T6 ... T2 >DN300: II 2G Ex e ia IIC T6 ... T2 II 2 D Ex tD iaD A21 IP6X T85 °C ... T _{medium}		
IEC Certificate: FME08.0004 DN3-300: Ex e ia ma IIC T6 ... T2 Gb >DN300 : Ex e ia IIC T6 ... T2 Gb Ex tD A21 IP6X T85 °C ... T _{medium} Gb		
In Ex area, Zone 1, 21, 22 FET325.....L.... / FET525.....L....	Transmitter In Ex area, Zone 2, 21, 22 FET325.....M.... / FET525.....M....	Outside the Ex area FET321 / FET521
 G00863	1)  2)  G01331	1)  2)  G01331
ATEX Certificate: FM08ATEX0080 II 2 (2) G Ex d e [ia] IIC T6 II 2 (2) D Ex tD [iaD] A21 IP6X T70°C	ATEX Certificate: FM08ATEX0038, FM08ATEX0080 II 3 G Ex nA nC T4 II 2 D Ex tD A21 IP6X T70°C	No Ex approval!
IEC Certificate: FME08.0004 Ex d e [ia Gb] IIC T6 Gb Ex tD [iaD] A21 IP6X T70°C	IEC Certificate: FME08.0004 Ex nA nC T4 Ex tD A21 IP6X T70°C	

1) Single-compartment housing

2) Dual-compartment housing

2.2.2 ATEX/IEC Zone 2



DANGER - Risk of explosion caused by incorrect transmitter installation

The FET321 / FET521 transmitter is not approved for hazardous areas.

The FET321 / FET521 transmitter must not be installed or operated in potentially explosive atmospheres.

Without a pre-amplifier, the maximum permissible signal cable length is 50 m (164 ft) with a minimum conductivity of 5 $\mu\text{S}/\text{cm}$.

With a pre-amplifier, the maximum permissible signal cable length is 200 m (656 ft).

Flowmeter sensor	
ProcessMaster 300 / ProcessMaster 500 FEP325.....M.... / FEP525.....M....	HygienicMaster 300 / HygienicMaster 500 FEH325.....M.... / FEH525.....M....
In Ex area, Zone 2, 21, 22	In Ex area, Zone 2, 21, 22
 G00489	 G00576
ATEX Certificate: FM08ATEX0038, FM08ATEX0080 II 3 G Ex nA IIC T6 ... T3 II 2 D Ex tD A21 IP6X T85 °C ... T _{medium}	ATEX Certificate: FM08ATEX0038, FM08ATEX0080 II 3 G Ex nA IIC T6 ... T3 II 2 D Ex tD A21 IP6X T85 °C ... T _{medium}
IEC Certificate: FME08.0004 Ex nA IIC T6 ... T3 Ex tD A21 IP6X T85 °C ... T _{medium}	IEC Certificate: FME08.0004 Ex nA IIC T6 ... T3 Ex tD A21 IP6X T85 °C ... T _{medium}
Transmitter	
(The flowmeter sensors illustrated above can be combined with the transmitters described below)	
In Ex area, Zone 2, 21, 22 FET325.....M.... / FET525.....M....	Outside the Ex area FET321 / FET521
 G01331	 G01331
ATEX Certificate: FM08ATEX0038, FM08ATEX0080 II 3 G Ex nA nC T4 II 2 D Ex tD A21 IP6X T70°C	No Ex approval!
IEC Certificate: FME08.0004 Ex nA nC T4 Ex tD A21 IP6X T70°C	

- 1) Single-compartment housing
2) Dual-compartment housing

2.3 Overview: The fast track to the device data

These safety instructions related to explosion protection are valid in conjunction with the following certificates:

Validity area	Certificates
ATEX	FM08ATEX0038, FM08ATEX0080
IEC	FME08.0004
NEPSI	Cert No. GYJ091345
GOST Russia Kazakhstan Ukraine White Russia	Ex certificate No. 8468478, GOST-R certificate No. 0634300 Ex certificate No. 001032, GOST-K certificate No. 0025653 Ex certificate No. 1093, DVSC certificate No. 1771 Ex certificate No. 05-687-2009, GGTN certificate No. 05-687-2009

Model		Operation in zone	Electrical connection	Ex data
			Chapter	
ProcessMaster 300 / ProcessMaster 500	FEP315 or FEP515	Zone1, 21	4.1.1	4.2 and 4.3
		Zones 2, 21, 22	5.1.1	5.2 and 5.3
	FEP325 + FET325 or FEP525 + FET525	Zone1, 21	4.1.1	4.2 and 4.3
		Zones 2, 21, 22	5.1.1	5.2 and 5.3
	FEP325 + FET321 or FEP525 + FET521	Zone1, 21	4.1.1	4.2 and 4.3
		Zones 2, 21, 22	5.1.1	5.2 and 5.3
HygienicMaster 300 / HygienicMaster 500	FEH315 or FEH515	Zone1, 21	4.1.1	4.2 and 4.3
		Zones 2, 21, 22	5.1.1	5.2 and 5.3
	FEH325 + FET325 or FEH525 + FET525	Zone1, 21	4.1.1	4.2 and 4.3
		Zones 2, 21, 22	5.1.1	5.2 and 5.3
	FEH325 + FET321 or FEH525 + FET521	Zone1, 21	4.1.1	4.2 and 4.3
		Zones 2, 21, 22	5.1.1	5.2 and 5.3



IMPORTANT (NOTE)

All documentation, declarations of conformity and certificates are available in ABB's download area.

www.abb.com/flow

2.4 Name plate

2.4.1 Name plate for model with integral mount design (dual-compartment housing)

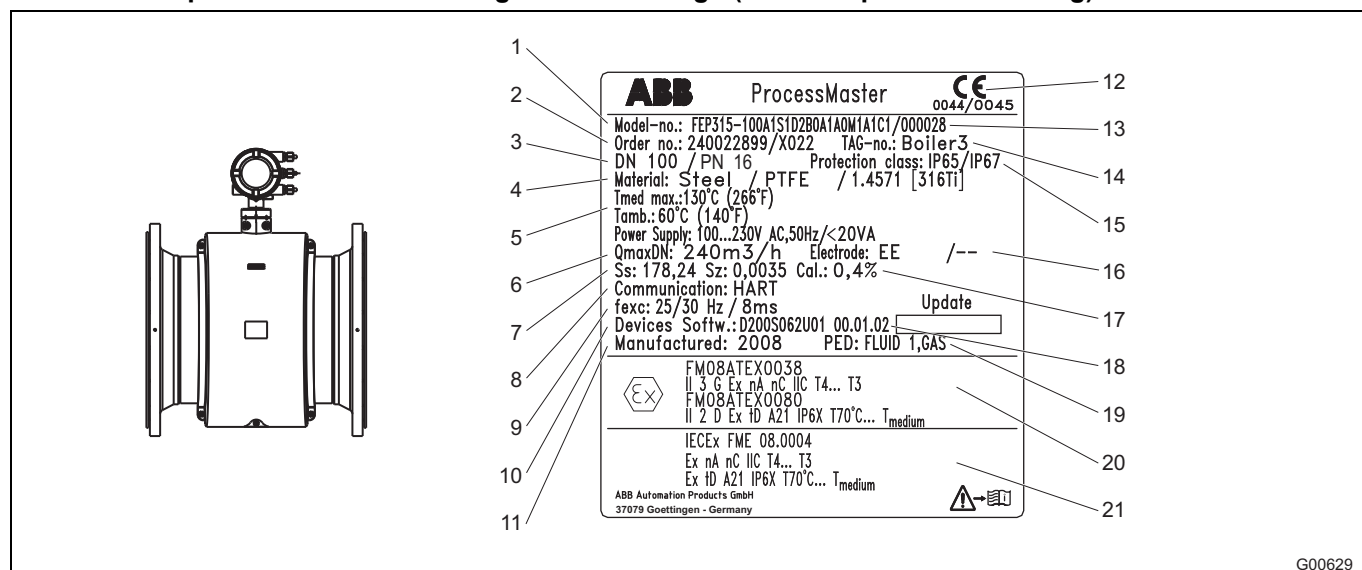


Fig. 1

- | | |
|--|---|
| <p>1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)</p> <p>2 Order no.</p> <p>3 Meter size and nominal pressure rating</p> <p>4 Material: Flange/lining/electrode</p> <p>5 Tmed = maximum permissible fluid temperature
Tamb = maximum permissible ambient temperature</p> <p>6 Calibration value Qmax DN</p> <p>7 Calibration value Ss (span)
Calibration value Sz (zero point)</p> <p>8 Communications protocol of transmitter</p> <p>9 Excitation frequency of sensor coils</p> <p>10 Software version</p> <p>11 Year of manufacture</p> <p>12 CE mark</p> <p>13 Serial number for identification by the manufacturer</p> <p>14 Client-specific TAG number (if specified)</p> <p>15 Protection type according to EN 60529</p> <p>16 Supplementary information: EE = grounding electrodes, TFE = partial filling electrode</p> | <p>17 Accuracy to which the unit was calibrated (e.g., 0.2% of rate)</p> <p>18 Version level (xx.xx.xx)</p> <p>19 Label indicating whether the unit is subject to the Pressure Equipment Directive (PED).
Information on the relevant fluid group.
Fluid group 1 = hazardous fluids, liquid, gaseous. (Pressure Equipment Directive = PED).
If the pressure equipment is not subject to the Pressure Equipment Directive 2014/68/EU, it is classified in accordance with SEP (= sound engineering practice) as per Art. 3 Para. 3 of the PED. If no such information is present, it means that the device does not claim to comply with the requirements of the Pressure Equipment Directive 2014/68/EU. Water supplies and connected equipment accessories are classed as an exception in accordance with guideline 1/16 of Art. 1 Para. 3.2 of the Pressure Equipment Directive.</p> <p>20 Ex mark according to ATEX (example)</p> <p>21 Ex mark according to IECEx (example)</p> |
|--|---|



IMPORTANT (NOTE)

Meters with 3A approval are labeled with an additional plate.

Device designs

2.4.2 Name plate for model with integral mount design (single-compartment housing)

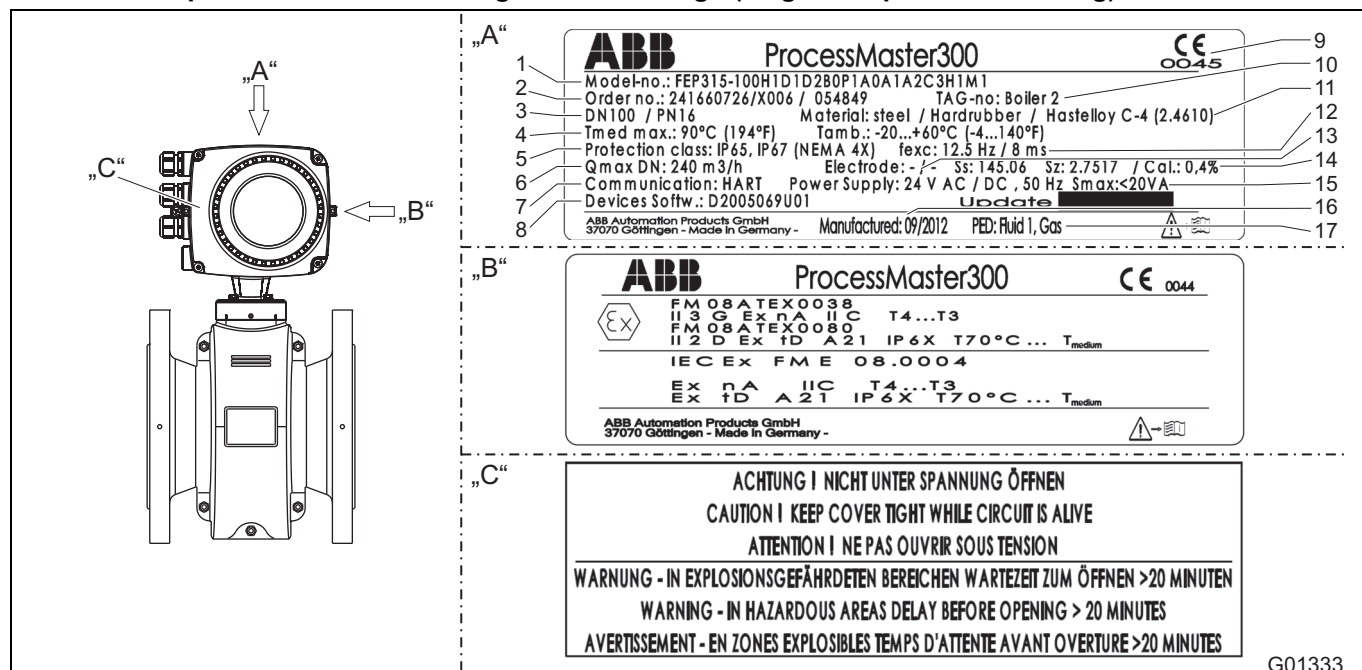


Fig. 2

„A“ Name plate

- 1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)
- 2 Order no.
- 3 Meter size and nominal pressure rating
- 4 T_{med} = maximum permissible fluid temperature
T_{amb} = maximum permissible ambient temperature
- 5 Protection type according to EN 60529
- 6 Calibration value Q_{max} DN
- 7 Communications protocol of transmitter
- 8 Software version
- 9 CE mark
- 10 Client-specific TAG number (if specified)
- 11 Material: Flange/lining/electrode
- 12 Excitation frequency of sensor coils
- 13 Supplementary information: EE = grounding electrodes, TFE = partial filling electrode
- 14 Calibration value Ss (span)
Calibration value Sz (zero point)
Accuracy to which the unit was calibrated (e.g., 0.4% of rate)

„B“ Ex mark according to ATEX and IECEx (example)

15 Supply voltage

16 Year of manufacture

17 Label indicating whether the unit is subject to the Pressure Equipment Directive (PED).

Information on the relevant fluid group.

Fluid group 1 = hazardous fluids, liquid, gaseous. (Pressure Equipment Directive = PED).

If the pressure equipment is not subject to the Pressure Equipment Directive 2014/68/EU, it is classified in accordance with SEP (= sound engineering practice) as per Art. 3 Para. 3 of the PED.

If no such information is present, it means that the device does not claim to comply with the requirements of the Pressure Equipment Directive 2014/68/EU. Water supplies and connected equipment accessories are classed as an exception in accordance with guideline 1/16 of Art. 1 Para. 3.2 of the Pressure Equipment Directive.

„C“ Safety mark



IMPORTANT (NOTE)

Meters with 3A approval are labeled with an additional plate.

2.4.3 Name plate for model with remote mount design

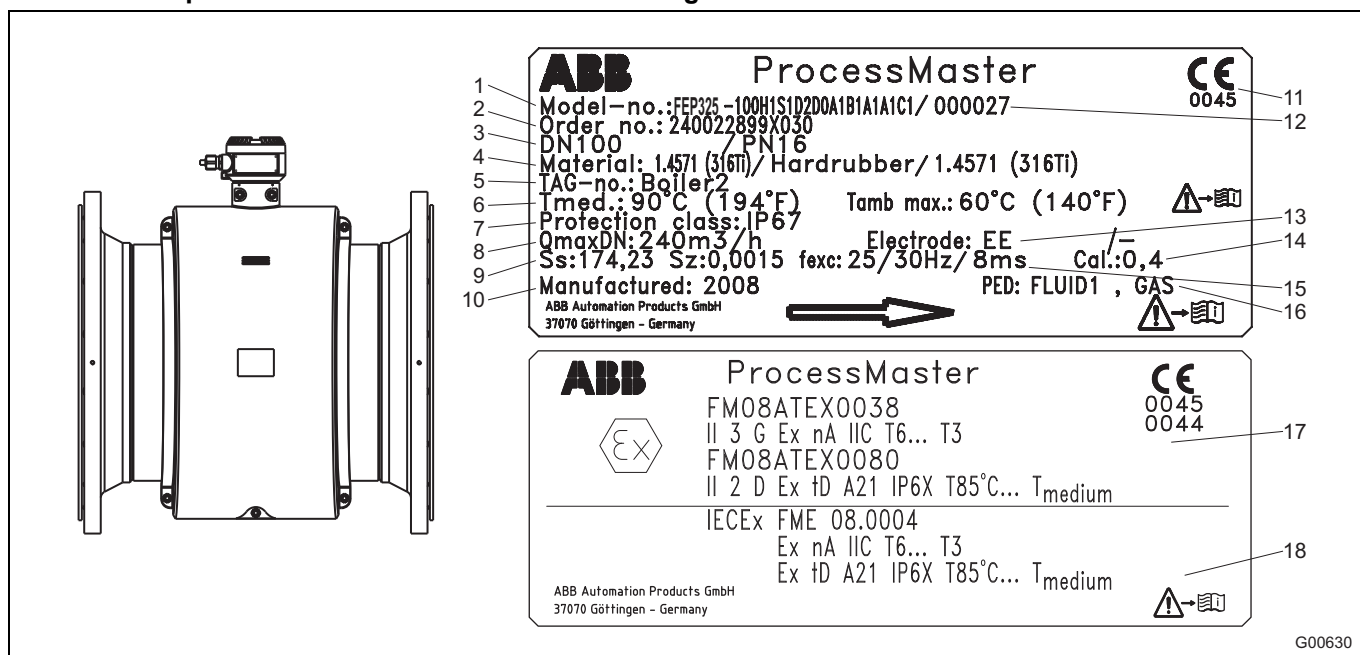


Fig. 3: Remote mount design (external transmitter)

- | | |
|---|--|
| <p>1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)</p> <p>2 Order no.</p> <p>3 Meter size and nominal pressure rating</p> <p>4 Material: Flange/lining/electrode</p> <p>5 Client-specific TAG number (if specified)</p> <p>6 T_{med} = maximum permissible fluid temperature
T_{amb} = maximum permissible ambient temperature</p> <p>7 Protection type according to EN 60529</p> <p>8 Calibration value Q_{max} DN</p> <p>9 Calibration value Ss (span)
Calibration value Sz (zero point)</p> <p>10 Year of manufacture</p> <p>11 CE mark</p> <p>12 Serial number for identification by the manufacturer</p> <p>13 Supplementary information: EE = grounding electrodes, TFE = partial filling electrode</p> <p>14 Accuracy to which the unit was calibrated (e.g., 0.4% of rate)</p> | <p>15 Excitation frequency of sensor coils</p> <p>16 Label indicating whether the unit is subject to the Pressure Equipment Directive (PED). Information on the relevant fluid group. Fluid group 1 = hazardous fluids, liquid, gaseous. (Pressure Equipment Directive = PED). If the pressure equipment is not subject to the Pressure Equipment Directive 2014/68/EU, it is classified in accordance with SEP (= sound engineering practice) as per Art. 3 Para. 3 of the PED. If no such information is present, it means that the device does not claim to comply with the requirements of the Pressure Equipment Directive 2014/68/EU. Water supplies and connected equipment accessories are classed as an exception in accordance with guideline 1/16 of Art. 1 Para. 3.2 of the Pressure Equipment Directive.</p> <p>17 Ex mark according to ATEX (example)</p> <p>18 Ex mark according to IECEx (example)</p> |
|---|--|



IMPORTANT (NOTE)

Meters with 3A approval are labeled with an additional plate.

Device designs

2.4.4 Name plate for transmitter

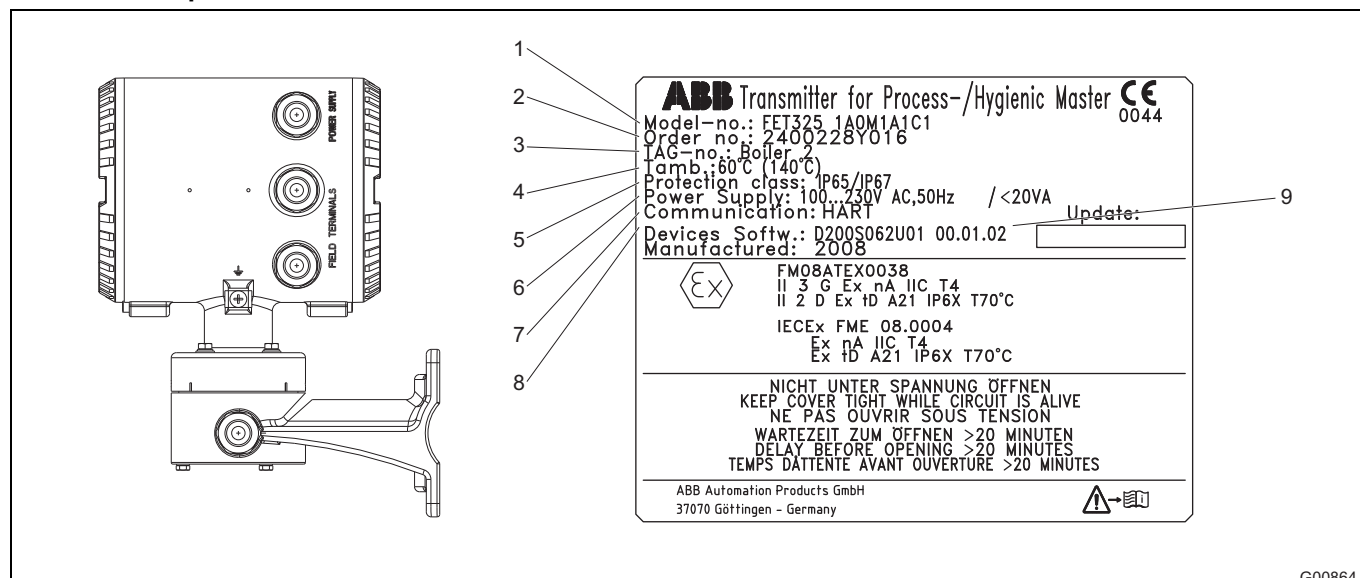


Fig. 4: External transmitter, model: FET325 / FET525 for Zone 1 (dual-compartment housing)

- | | |
|--|--|
| 1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation) | 5 Protection type according to EN 60529 |
| 2 Order no. | 6 Supply voltage |
| 3 Client-specific TAG number (if specified) | 7 Communications protocol of transmitter |
| 4 T_{amb} = maximum permissible ambient temperature | 8 Software version |
| | 9 Version level (xx.xx.xx) |
| | 10 Ex mark according to ATEX (example) |

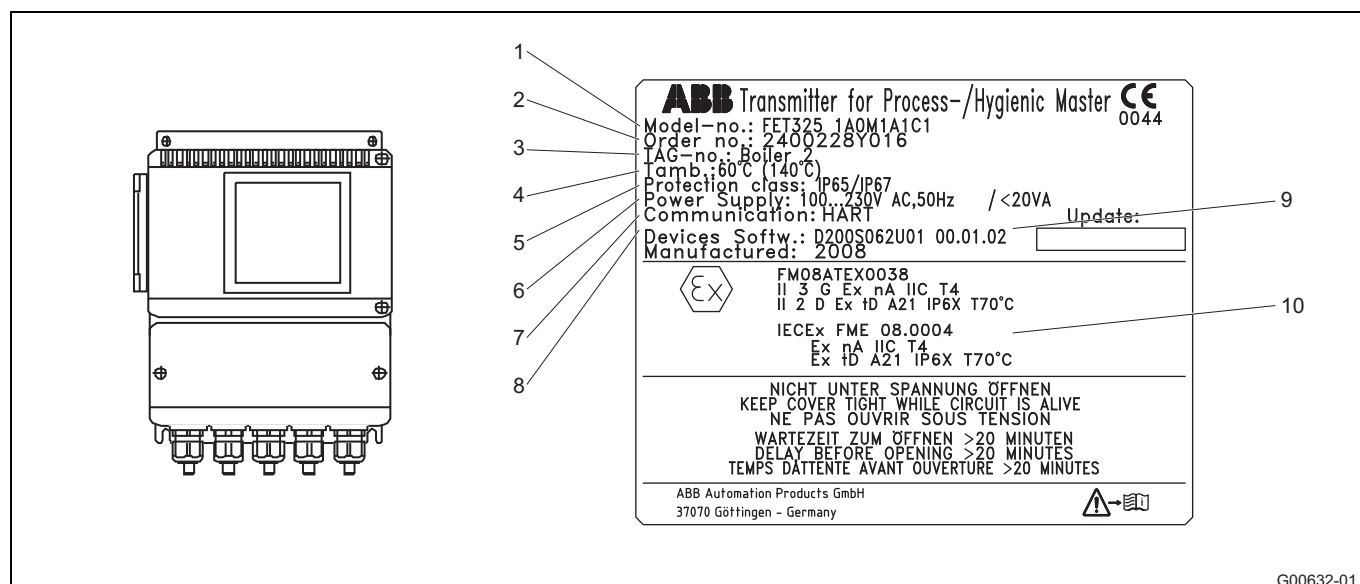


Fig. 5: External transmitter, model FET325 / FET525 for Zone 2 (dual-compartment housing)

- | | |
|--|--|
| 1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation) | 5 Protection type according to EN 60529 |
| 2 Order no. | 6 Supply voltage |
| 3 Client-specific TAG number (if specified) | 7 Communications protocol of transmitter |
| 4 T_{amb} = maximum permissible ambient temperature | 8 Software version |
| | 9 Version level (xx.xx.xx) |
| | 10 Ex mark according to ATEX (example) |

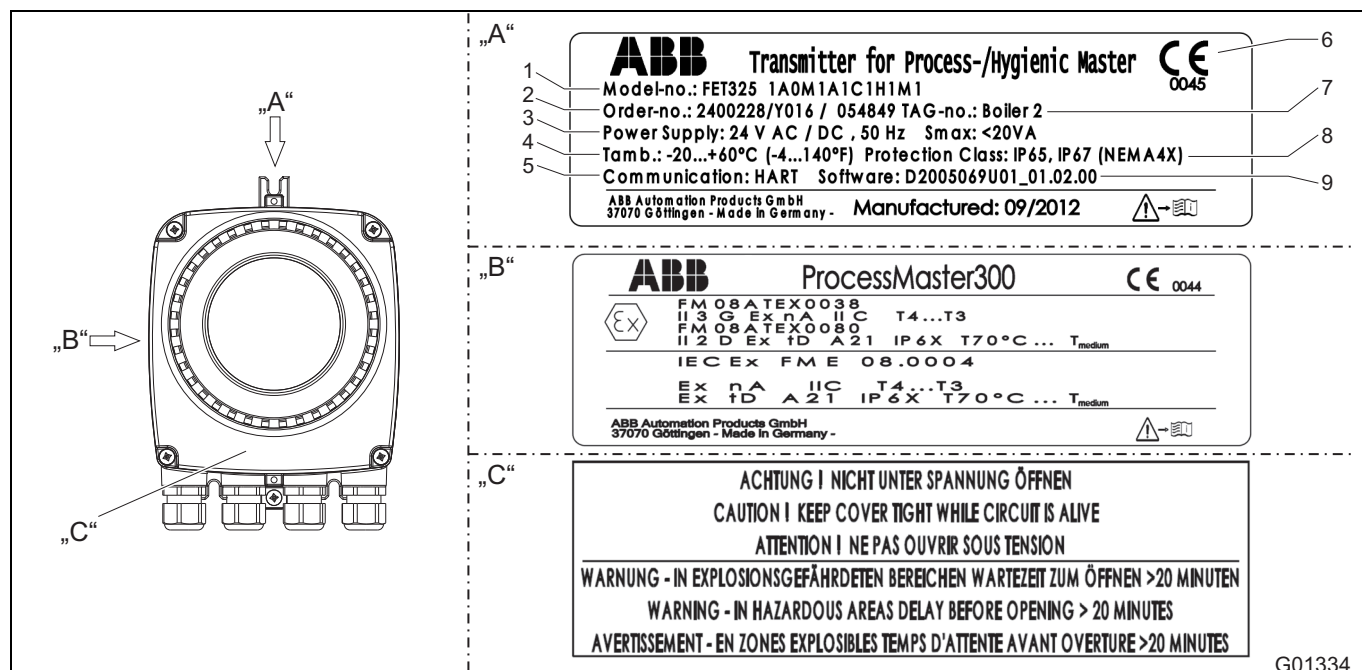


Fig. 6: External transmitter, model FET325 / FET525 for Zone 2 (single-compartment housing)

„A“ Name plate

- 1 Model number (for more detailed information about the technical design, refer to the data sheet or the order confirmation)
- 2 Order no.
- 3 Supply voltage

4 T_{amb} = maximum permissible ambient temperature

5 Communications protocol of transmitter

6 CE mark

7 Client-specific TAG number (if specified)

8 Protection type according to EN 60529

9 Software version

„B“ Ex mark according to ATEX and IECEx (example)

„C“ Safety mark

Mounting

3 Mounting

3.1 Information about opening and closing the housing

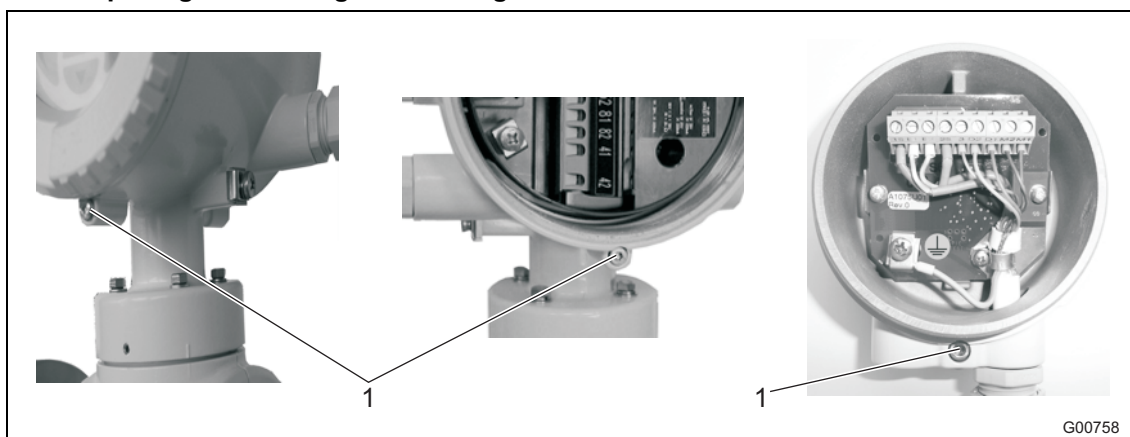


Fig. 7: Dual compartment housing - Cover safety device

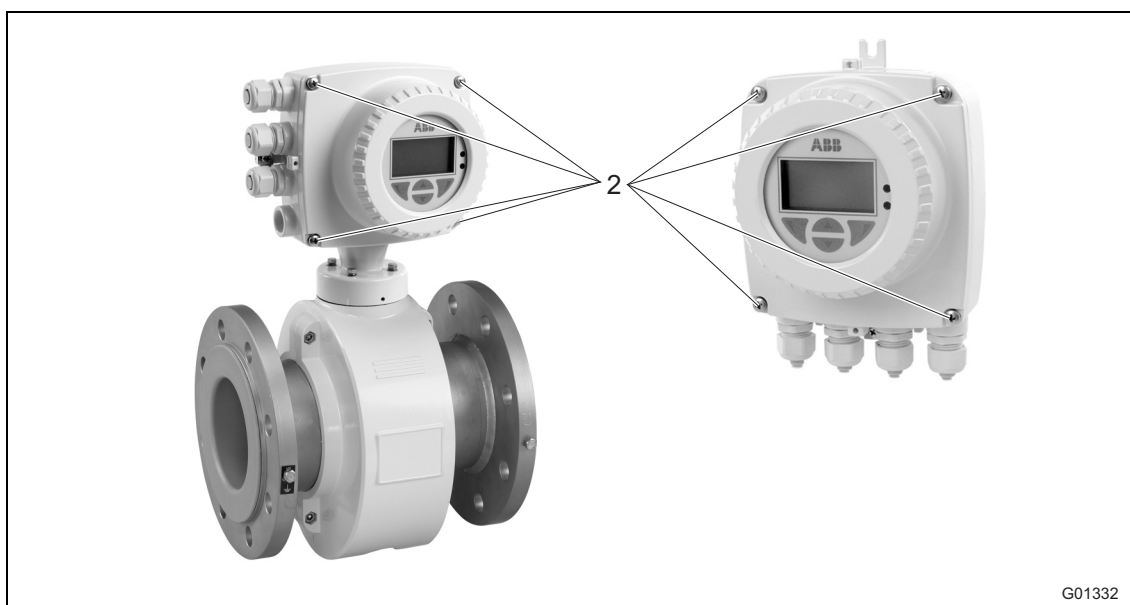


Fig. 8: Single compartment housing



DANGER - Risk of explosion!

When the housing cover is open, the explosion protection is suspended.

Before opening the housing switch off the power to all connection lines and wait at least 20 minutes.

Dual compartment housing (Fig. 7)

Release the cover safety device by screwing in the Allen screw (1).

Before closing the housing make sure that the gasket (O-ring) for the housing cover is seated correctly.

After closing the housing, lock the housing cover by unscrewing the Allen screw (1) to prevent opening the cover accidentally.

Single compartment housing (Fig. 8)

Unscrew the Phillips-head screws (2) and remove the housing cover.

3.2 Cable entries

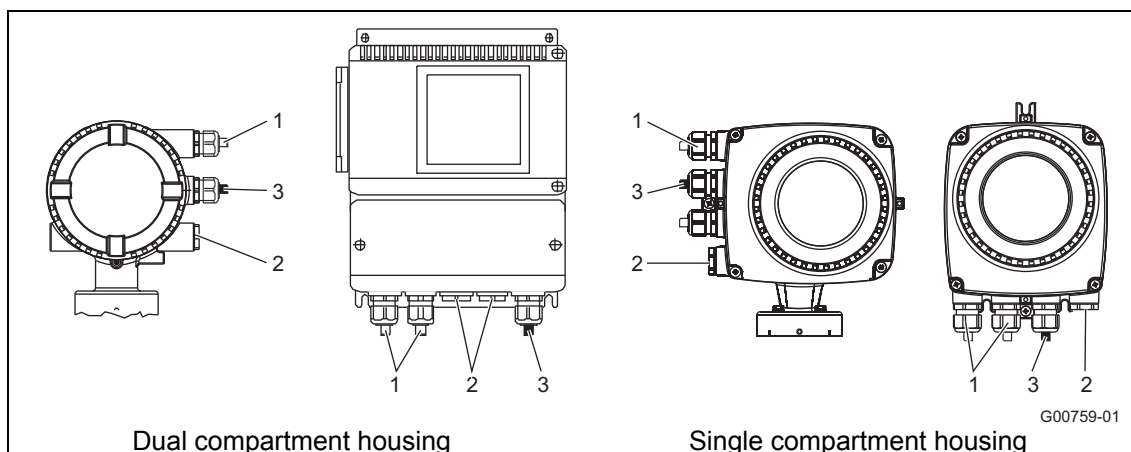


Fig. 9

The cable glands (1) supplied are ATEX-/IECEX-certified.

The black plugs (3) in the cable fittings are intended to provide protection during transport.

Any unused cable entry points must be sealed prior to commissioning, using the seals (2) supplied; these can be found in the terminal box.

The use of standard cable fittings and seals is prohibited.

The outer diameter of the connecting cable must measure between 6 mm (0.24 in) and 12 mm (0.47 in) to ensure the necessary seal integrity.

Make sure that the cable fittings and seals are correctly and tightly installed.

Black cable fittings are installed by default when the device is supplied. If signal outputs are connected to intrinsically safe circuits, we recommend that you replace the black caps on the corresponding cable fittings with the blue ones supplied.

i

IMPORTANT (NOTE)

In order to provide for the required temperature resistance, devices in low-temperature design (optional, ambient temperature down to -40 °C (-40 °F)) are delivered with a cable gland made from metal.

When operating these devices on intrinsically safe current circuits, remove the metal cable glands.

3.3 High temperature version

The high temperature design allows for complete thermal insulation of the sensor, up to the maximum illustrated device height.

The pipeline and sensor must be insulated after installing the unit according to the following illustration.

The thermal resistance of the insulation must not exceed $\lambda = 0.036 \text{ W/(mK)}$; if it does, the thickness of the insulation must be reduced accordingly.

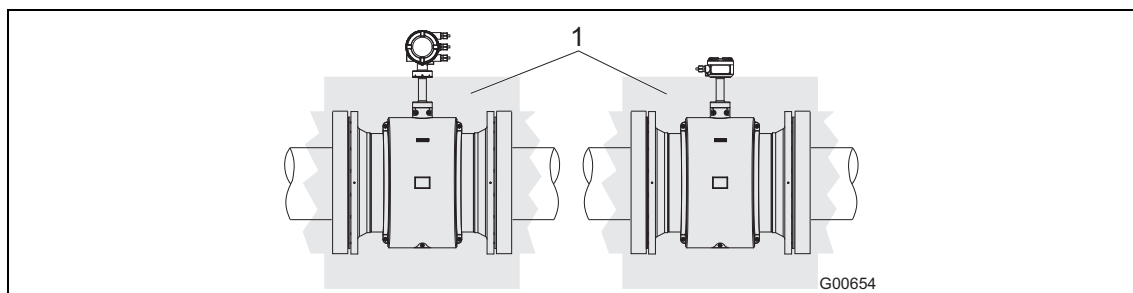


Fig. 10

1 Insulation

The surface temperature depends on the fluid temperature.

Model name	Maximum surface temperature
FEP325 / FEH325 FEP525 / FEH525	T 85 °C (185 °F) ... T _{medium}
FEP315 / FEH315 FEP515 / FEH515	T 70 °C (158 °F) ... T _{medium}

3.4 Protection class IP 68

For installation, see the commissioning instruction.

3.5 Rotating the transmitter housing

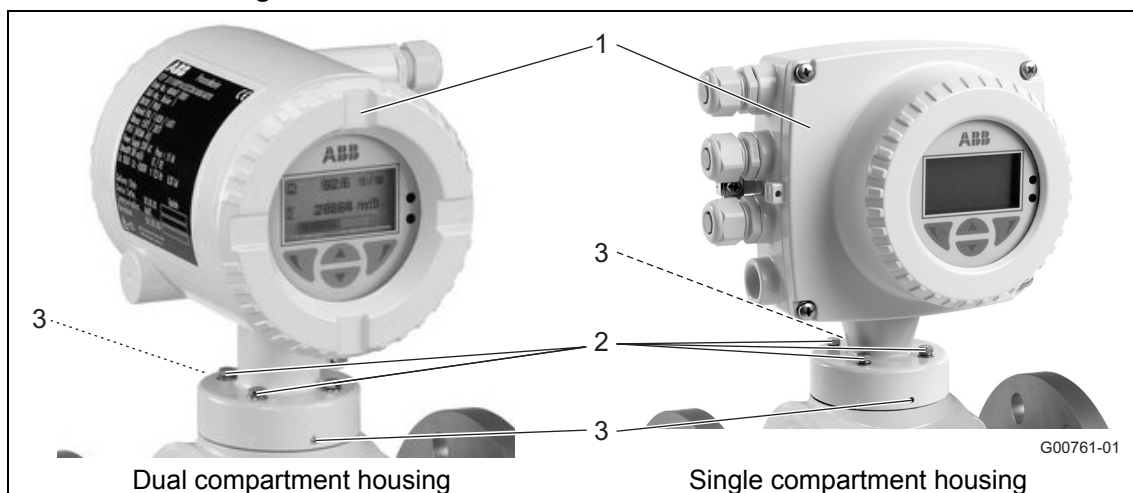


Fig. 11

1. Loosen the Allen screws (3) on the front and back sides, but do not remove entirely.
2. Loosen screws (2) and rotate the transmitter housing (1) by 90° to the left or right.
3. Retighten screws (2) and Allen screws (3).



DANGER - Risk of explosion!

When the screws for the transmitter housing are loosened, the explosion protection is suspended.

Tighten all screws (2, 3) for the transmitter housing prior to commissioning.

3.6 Information about using the device in areas with combustible dust

The device with dual-compartment transmitter housing is approved for use in potentially explosive areas (gas and dust).

The Ex certification is provided on the name plate.



DANGER - Risk of explosion!

The dust explosion protection is also provided by the housing.

Modifications to the housing are not allowed (e.g., removing or omitting parts).

3.6.1 Maximum Allowable Surface Temperature

Model name	Maximum surface temperature
FEP325 / FEH325 FEP525 / FEH525	T 85 °C (185 °F) ... T _{medium}
FEP315 / FEH315 FEP515 / FEH515	T 70 °C (158 °F) ... T _{medium}
FET325 / FET525	T 70 °C (158 °F)

The maximum surface temperature is applicable to dust layers of up to 5 mm (0.20 inch) in thickness. The minimum permissible ignition and smoldering temperatures of the dust atmosphere should be calculated in accordance with IEC61241ff.

With thicker dust layers, the maximum permissible surface temperature must be reduced. The dust can be conductive or non-conductive. IEC61241ff must be observed.

3.6.2 Minimum signal cable length

In explosion protection areas, the signal cable cannot be shorter than 5 m (16.4 ft).

4 Ex relevant specifications for operation in Zones 1, 21, and 22

4.1 Electrical connection

4.1.1 Flowmeter sensor and transmitter in zone 1 / Div. 1

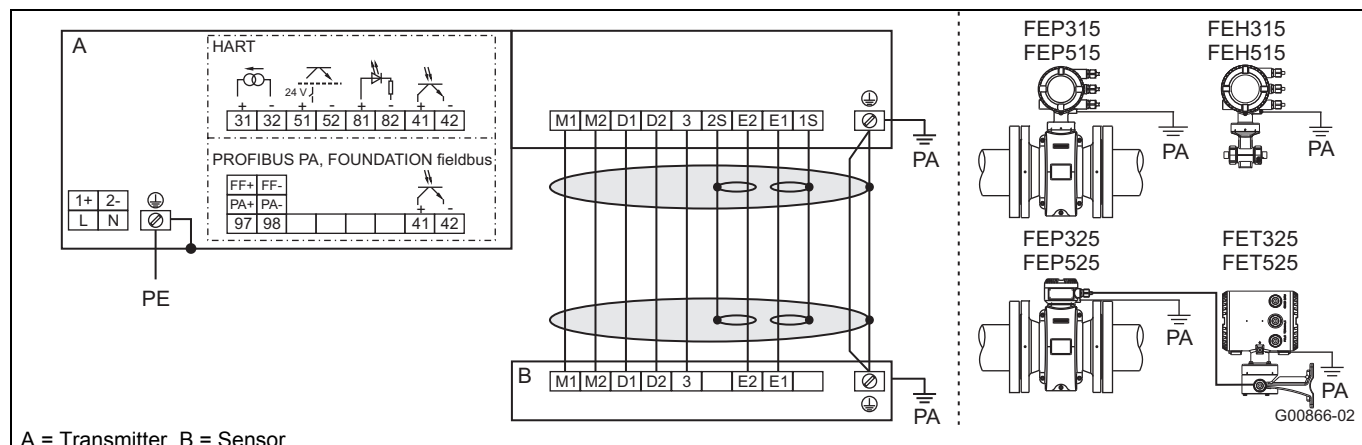


Fig. 12: HART, PROFIBUS PA and FOUNDATION fieldbus protocol

Power supply connections

AC power supply	
Terminal	Function / Notes
L	Live / Phase
N	Neutral
PE / ⊕	Protective earth (PE)

DC power supply	
Terminal	Function / Notes
1+	+
2-	-
PE / ⊕	Protective earth (PE)

Sensor cable terminal connections

Only on remote mount design.

Terminal	Function / Notes	Wire color
M1	Magnet coil	Brown
M2	Magnet coil	Red
D1	Data line	Orange
D2	Data line	Yellow
⊕ / SE	Shield	-
E1	Signal line	Violet
1S	Shield for E1	-
E2	Signal line	Blue
2S	Shield for E2	-
3	Measurement potential	Green

Output connections

Terminal	Function / Notes
31 / 32	Current / HART output The current output is available in "active" or "passive" mode. The configuration must be specified ordering the meter, because it is not possible to change the configuration on site.
97 / 98	Digital communication PROFIBUS PA (PA+ / PA-) or FOUNDATION fieldbus (FF+ / FF-) in acc. with IEC 61158-2.
51 / 52	Digital output DO1 passive Function can be configured locally as „Pulse Output" or „Digital Output". Factory setting is „Pulse Output".
81 / 82	Digital input / contact input Function can be configured locally as „External output switch-off", „external totalizer reset", „external totalizer stop" or „other". Only available in conjunction with current output „passive".
41 / 42	Digital output DO2 passive Function can be configured locally as „Pulse Output" or „Digital Output". Factory setting is „Digital Output", flow direction signaling.
PA	Potential Equalization (PA)

Note

The housing for the transmitter and flowmeter sensor must be connected to the potential equalization PA. The operator must ensure that when connecting the protective conductor (PE) no potential differences can occur between protective conductor and potential equalization (PA).

A temperature of 70 °C (158 °F) at the cable entry is assumed for the Ex calculations. Therefore, the cables used for the supply power and the signal inputs and outputs must have a minimum specification of 70 °C (158 °F).

4.1.2 Flowmeter sensor in zone 1 and transmitter in zone 2 or outside the hazardous area

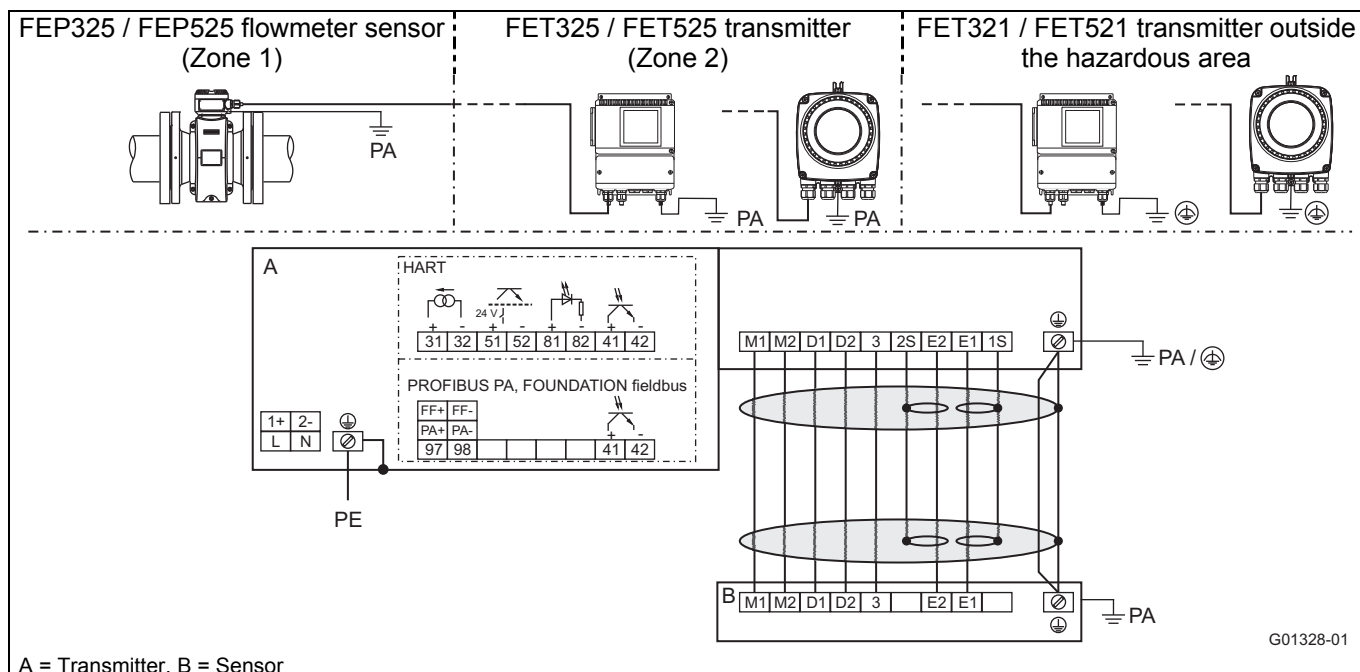


Fig. 13 HART, PROFIBUS PA and FOUNDATION fieldbus protocol

Power supply connections

AC power supply	
Terminal	Function / Notes
L	Live / Phase
N	Neutral
PE / ⊕	Protective earth (PE)

DC power supply	
Terminal	Function / Notes
1+	+
2-	-
PE / ⊕	Protective earth (PE)

Sensor cable terminal connections

Only on remote mount design.

Terminal	Function / Notes	Wire color
M1	Magnet coil	Brown
M2	Magnet coil	Red
D1	Data line	Orange
D2	Data line	Yellow
⊕ / SE	Shield	-
E1	Signal line	Violet
1S	Shield for E1	-
E2	Signal line	Blue
2S	Shield for E2	-
3	Measurement potential	Green

Output connections

Terminal	Function / Notes
31 / 32	Current / HART output The current output is available in "active" or "passive" mode.
97 / 98	Digital communication PROFIBUS PA (PA+ / PA-) or FOUNDATION fieldbus (FF+ / FF-) in acc. with IEC 61158-2.
51 / 52	Digital output DO1 active / passive Function can be configured locally as „Pulse Output" or „Digital Output". Factory setting is „Pulse Output".
81 / 82	Digital input / contact input Function can be configured locally as „External output switch-off", „external totalizer reset", „external totalizer stop" or „other".
41 / 42	Digital output DO2 passive Function can be configured locally as „Pulse Output" or „Digital Output". Factory setting is „Digital Output", flow direction signaling.
PA	Potential Equalization (PA)
⊕	Functional ground (only with transmitter outside the hazardous area)

Note

The housing for the transmitter and flowmeter sensor must be connected to the potential equalization PA. The operator must ensure that when connecting the protective conductor (PE) no potential differences can occur between protective conductor and potential equalization (PA).

A temperature of 70 °C (158 °F) at the cable entry is assumed for the Ex calculations. Therefore, the cables used for the supply power and the signal inputs and outputs must have a minimum specification of 70 °C (158 °F).

4.2 Electrical data for operation in zones 1, 21, 22 / Div. 1

4.2.1 Devices with HART protocol

When operating in potentially explosive areas, observe the following electrical data for the signal inputs and outputs of the transmitter. For the correct current output design (active/passive), see the marking contained in the device's terminal box.

Dependent upon the device design, an "active" or a "passive" output will be available. For devices designed for use in Ex Zone 1, the current output cannot be reconfigured locally. The configuration required for the current output (active/passive) must be specified when the order is placed.

Model: FEP315, FEH315 / FEP515, FEH515 or FET325 / FET525

Inputs and outputs	Operating values		Type of protection Ex i, IS					
	U_N [V]	I_N [mA]	U_O [V]	I_O [mA]	P_O [mW]	C_O [nF]	C_{OPA} [nF]	L_O [mH]
Active current / HART output (Terminals 31 / 32) Load: $250 \Omega \leq R \leq 300 \Omega$	30	30	20	100	500	210	195	6
			U_I [V]	I_I [mA]	P_I [mW]	C_I [nF]	C_{IPA} [nF]	L_I [mH]
			60	425 ⁴⁾	2000 ⁴⁾	8,4	24	0,065
Passive current / HART output (Terminals 31 / 32) Load: $250 \Omega \leq R \leq 650 \Omega$	30	30	U_I [V]	I_I [mA]	P_I [mW]	C_I [nF]	C_{IPA} [nF]	L_I [mH]
			60	500 ⁴⁾	2000 ⁴⁾	8,4	24	170
Passive digital output DO2 (Terminals 41 / 42)	30	220	U_I [V]	I_I [mA]	P_I [mW]	C_I [nF]	C_{IPA} [nF]	L_I [mH]
			60	425 ^{1) 4)} 500 ^{2) 4)}	2000 ⁴⁾	3,6	3,6	170
Passive digital output DO1 (Terminals 51 / 52)	30	220	60	425 ^{1) 4)} 500 ^{2) 4)}	2000 ⁴⁾	3,6	3,6	170
Passive digital input DI (Terminals 81/82) ³⁾	30	10	60	500 ⁴⁾	2000 ⁴⁾	3,6	3,6	170

1) For "active" current output

2) For "passive" current output

3) Only available in conjunction with passive current output

4) Intrinsically safe single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

All inputs and outputs are electrically isolated from each other and from the power supply.

Note

The output circuits are designed in such a way that they can be connected to both intrinsically-safe and non-intrinsically-safe circuits. It is not permitted to combine intrinsically safe and non-intrinsically safe circuits. In the case of intrinsically safe circuits, potential equalization is required.

The rated voltage of the non-intrinsically safe circuits is $U_M = 60 \text{ V}$.

Provided that rated voltage $U_M = 60 \text{ V}$ is not exceeded if connections are established to non-intrinsically safe external circuits, intrinsic safety is still guaranteed.

If the installation is changed from type of protection "e" to "i" or vice versa, the device must be checked in accordance with the instructions contained in section 6.4 "Changing the type of protection".

Ex relevant specifications for operation in Zones 1, 21, and 22

4.2.2 Devices with PROFIBUS PA or FOUNDATION fieldbus

When operating in potentially explosive areas, observe the following electrical data for the signal inputs and outputs of the transmitter. For the correct design (PROFIBUS PA or FOUNDATION fieldbus), see the marking contained in the device's terminal box.

For devices in Zone 1 / Div. 1 the bus termination must conform to the FISCO model or the explosion protection regulations, respectively.
For devices in Zone 2 / Div. 2 the bus termination must conform to the FNICO model or the explosion protection regulations, respectively.

Model: FEP315, FEH315 / FEP515, FEH515 or FET325 / FET525

The fieldbus and the digital output can be connected in zone 1 / Div. 1 in three different variants.

Variant 1: Intrinsically safe fieldbus connection in acc. with FISCO, intrinsically safe connection of the digital output

Inputs and outputs	Operating values		Type of protection Ex i, IS and FISCO					
	U_N [V]	I_N [mA]	U_i [V]	I_i [mA]	P_i [mW]	C_i [nF]	C_{iPA} [nF]	L_i [μH]
Passive digital output DO2 (terminals 41 / 42)	30	220	60	200 ¹⁾	5000 ¹⁾	3,6	3,6	0,17
Fieldbus (terminals 97 / 98)	32	30	17	380	5320	1	1	5

1) Intrinsically safe single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

Variant 2: Intrinsically safe fieldbus connection (not in acc. with FISCO!), intrinsically safe connection of the digital output

Inputs and outputs	Operating values		Type of protection Ex i, IS					
	U_N [V]	I_N [mA]	U_i [V]	I_i [mA]	P_i [mW]	C_i [nF]	C_{iPA} [nF]	L_i [μH]
Passive digital output DO2 (terminals 41 / 42)	30	220	60	200 ¹⁾	5000 ¹⁾	3,6	3,6	0,17
Fieldbus (terminals 97 / 98)	32	30	60	500	5000	1	1	5

1) Intrinsically safe single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

Variant 3: Fieldbus connection in acc. with FNICO (Zone 2, Div. 2), connection of digital output (Zone 2, Div. 2)

Inputs and outputs	Operating values		Type of protection Ex n, NI and FNICO					
	U_N [V]	I_N [mA]	U_i [V]	I_i [mA]	P_i [mW]	C_i [nF]	C_{iPA} [nF]	L_i [μH]
Passive digital output DO2 (terminals 41 / 42)	30	220	-	-	-	-	-	-
Fieldbus (terminals 97 / 98)	32	30	60	500 ¹⁾	5000 ¹⁾	1	1	5

1) Single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

All inputs and outputs are electrically isolated from each other and from the supply power.

Note

The output circuits are designed in such a way that they can be connected to both intrinsically-safe and non-intrinsically-safe circuits. It is not permitted to combine intrinsically safe and non-intrinsically safe circuits. In the case of intrinsically safe circuits, potential equalization is required.

The rated voltage of the non-intrinsically safe circuits is $U_M = 60$ V. Provided that rated voltage $U_M = 60$ V is not exceeded if connections are established to non-intrinsically safe external circuits, intrinsic safety is still given.

If the installation is changed from type of protection "e" to "i" or vice versa, the device must be checked in accordance with the instructions contained in section 6.4 "Changing the type of protection".

4.3 Temperature data for operation in Zone 1 / Div. 1

Model name	Surface temperature
FEP315 / FEH315 FEP515 / FEH515	70 °C (158 °F)
FEP325 / FEP525	85 °C (185 °F)
FET325 / FET525	70 °C (158 °F)

The surface temperature depends on the fluid temperature.

With increasing fluid temperature > 70 °C (158 °F) or > 85 °C (185 °F) the surface temperature also increases to the level of the fluid temperature.

Note

The maximum permissible fluid temperature depends on the lining and flange material, and is limited by the operating values in Table 1 and the explosion protection specifications in Tables 2 ... n.

Table 1: Fluid temperature as a function of lining and flange material

Models FEP315 / FEP325, FEP515 / FEP525

Materials		Fluid temperature (operating values)	
Lining	Flange	Minimum	Maximum
Hard rubber	Steel	-10 °C (14 °F) -5 °C (23 °F) ¹⁾	90 °C (194 °F) 80 °C (176 °F) ¹⁾
Hard rubber	Stainless steel	-15 °C (5 °F) -5 °C (23 °F) ¹⁾	90 °C (194 °F) 80 °C (176 °F) ¹⁾
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)
Soft rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
PTFE	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)
PFA	Steel	-10 °C (14 °F)	180 °C (356 °F)
PFA	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
Thick PTFE	Steel	-10 °C (14 °F)	180 °C (356 °F)
Thick PTFE	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
ETFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
ETFE	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)

¹⁾ Only China production site

Models FEH315, FEH515

Lining	Process connection	Material	Fluid temperature (operating values)	
			Minimum	Maximum
PFA	Flange	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
PFA	Wafer type	-	-25 °C (-13 °F)	130 °C (266 °F)
PFA	Variable process connection	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)

Table 2: Fluid temperature (Ex data) for ProcessMaster models FEP315, FEP515

Nominal diameter	Design	Temperature class	Ambient temperature											
			(- 40 °C) ¹⁾ - 20 °C ... + 40 °C				(- 40 °C) ¹⁾ - 20 °C ... + 50 °C				(- 40 °C) ¹⁾ - 20 °C ... + 60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust
DN 3 ... DN 100	NT	T1	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T2	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T3	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T4	120 °C								90 °C	30 °C	80 °C	40 °C
	HT		120 °C								120 °C	20 °C	120 °C	20 °C
	NT	T5	85 °C								70 °C	30 °C	80 °C	40 °C
	HT		85 °C								85 °C	20 °C	85 °C	20 °C
	NT	T6	70 °C								70 °C	30 °C	70 °C	40 °C
	HT		70 °C								70 °C	20 °C	70 °C	20 °C
DN 125 ... DN 2000	NT	T1	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T2	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T3	130 °C								90 °C	30 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T4	125 °C								90 °C	30 °C	80 °C	40 °C
	HT		125 °C								120 °C	20 °C	120 °C	20 °C
	NT	T5	90 °C								90 °C	30 °C	80 °C	40 °C
	HT		90 °C								90 °C	20 °C	90 °C	20 °C
	NT	T6	75 °C								75 °C	30 °C	75 °C	40 °C
	HT		75 °C								75 °C	20 °C	75 °C	20 °C

1) Low-temperature version (option)

NT: standard sensor design, T_{medium} maximum 130 °C (266 °F),

HT: high-temperature sensor design, T_{medium} maximum 180 °C (356 °F)

Not thermally insulated: The flowmeter sensor is not surrounded by pipe insulation material.

Thermally insulated: The flowmeter sensor is surrounded by pipe insulation material.

Note

The standard version includes explosion protection for gases and dust. Explosion protection for dust is only available for devices featuring a transmitter in a dual-compartment housing.

- If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.
- If the installation location for the device is classified as a potentially explosive area for gases only, the temperature data in the "Gas" column in the table must be taken into consideration.

Table 3: Fluid temperature (Ex data) for ProcessMaster models FEP325, FEP525

Nominal diameter	Design	Temperature class	Ambient temperature											
			(- 40 °C) ¹⁾ - 20 °C ... + 40 °C				(- 40 °C) ¹⁾ - 20 °C ... + 50 °C				(- 40 °C) ¹⁾ - 20 °C ... + 60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust
DN 3 ... DN 100	NT	T1	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T2	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T3	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T4	120 °C								110 °C	110 °C	110 °C	110 °C
	HT		120 °C								120 °C	120 °C	120 °C	120 °C
	NT	T5	85 °C								85 °C	85 °C	85 °C	85 °C
	HT		85 °C								85 °C	85 °C	85 °C	85 °C
	NT	T6	70 °C								70 °C	70 °C	70 °C	70 °C
	HT		70 °C								70 °C	70 °C	70 °C	70 °C
DN 125 ... DN 2000	NT	T1	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T2	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T3	130 °C								110 °C	110 °C	110 °C	110 °C
	HT		180 °C								160 °C	150 °C	160 °C	150 °C
	NT	T4	125 °C								110 °C	110 °C	110 °C	110 °C
	HT		125 °C								125 °C	125 °C	125 °C	125 °C
	NT	T5	90 °C								90 °C	90 °C	90 °C	90 °C
	HT		90 °C								90 °C	90 °C	90 °C	90 °C
	NT	T6	75 °C								75 °C	75 °C	75 °C	75 °C
	HT		75 °C								75 °C	75 °C	75 °C	75 °C

1) Low-temperature version (option)

NT: standard sensor design, T_{medium} maximum 130 °C (266 °F).

HT: high-temperature sensor design, T_{medium} maximum 180 °C (356 °F).

Not thermally insulated: The flowmeter sensor is not surrounded by pipe insulation material.

Thermally insulated: The flowmeter sensor is surrounded by pipe insulation material.

Note

The standard version includes explosion protection for gases and dust.

- If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.
- If the installation location for the device is classified as a potentially explosive area for gases only, the temperature data in the "Gas" columns in the table must be taken into consideration.

Table 4: Fluid temperature (Ex data) for HygienicMaster models FEH315, FEH515

Nominal diameter	Design	Temperature class	Ambient temperature											
			(- 40 °C) ¹⁾ - 20 °C ... + 40 °C				(- 40 °C) ¹⁾ - 20 °C ... + 50 °C				(- 40 °C) ¹⁾ - 20 °C ... + 60 °C			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust
DN 3 ... DN 100	NT	T1	130 °C								110 °C	20 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T2	130 °C								110 °C	20 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T3	130 °C								110 °C	20 °C	80 °C	40 °C
	HT		180 °C								120 °C	20 °C	120 °C	20 °C
	NT	T4	120 °C								110 °C	20 °C	80 °C	40 °C
	HT		120 °C								120 °C	20 °C	120 °C	20 °C
	NT	T5	85 °C								85 °C	20 °C	80 °C	40 °C
	HT		85 °C								85 °C	20 °C	85 °C	20 °C
	NT	T6	70 °C								70 °C	20 °C	70 °C	40 °C
	HT		70 °C								70 °C	20 °C	70 °C	20 °C

1) Low-temperature version (option)

NT standard version, T_{medium} maximum 130 °C (266 °F).

HT high temperature version, T_{medium} maximum 180 °C (356 °F).

Not thermally insulated: The flowmeter sensor is not surrounded by pipe insulation material.

Thermally insulated: The flowmeter sensor is surrounded by pipe insulation material.

Note

The standard version includes explosion protection for gases and dust. Explosion protection for dust is only available for devices featuring a transmitter in a dual-compartment housing.

- If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.
- If the installation location for the device is classified as a potentially explosive area for gases only, the temperature data in the "Gas" column in the table must be taken into consideration.

5 Ex relevant specifications for operation in zones 2, 21 and 22

5.1 Electrical connection

5.1.1 Flowmeter sensor and transmitter in zone 2, or transmitter outside the hazardous area

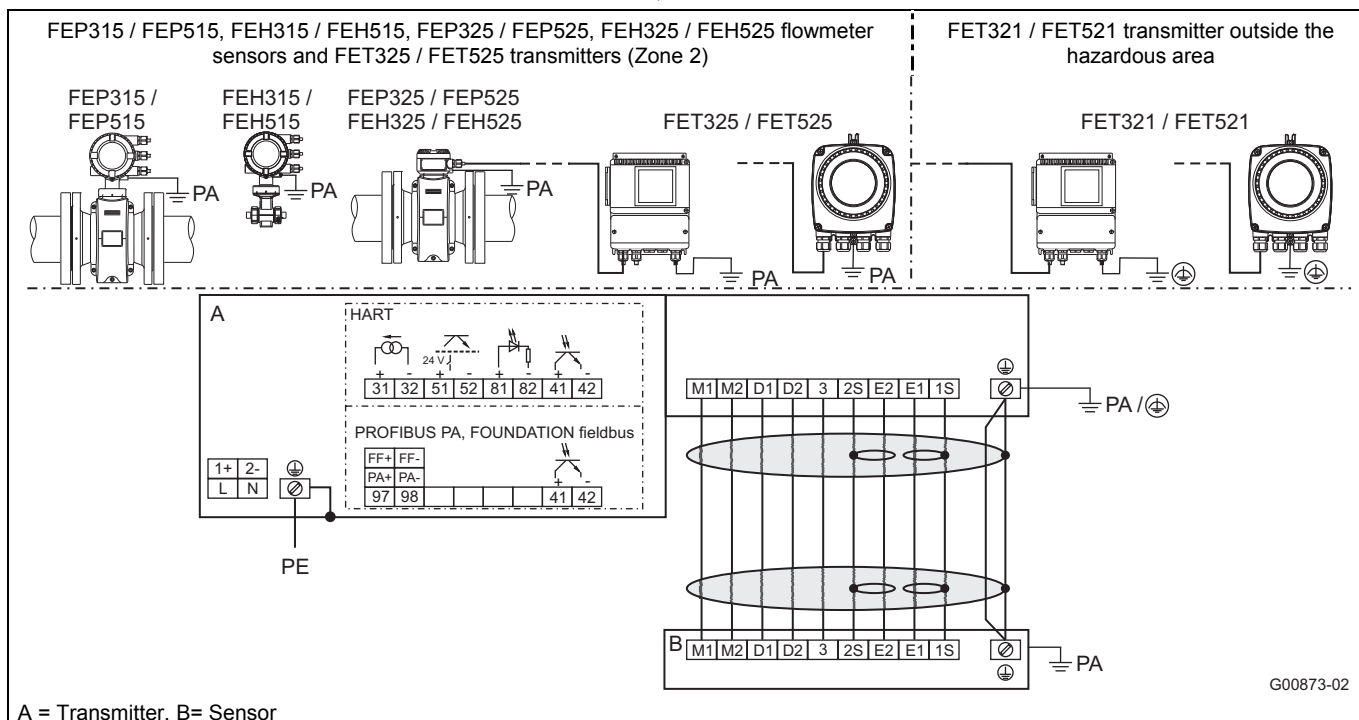


Fig. 14: HART, PROFIBUS PA and FOUNDATION fieldbus protocol

Power supply connections

AC power supply	
Terminal	Function / Notes
L	Live / Phase
N	Neutral
PE / ⊕	Protective earth (PE)

DC power supply	
Terminal	Function / Notes
1+	+
2-	-
PE / ⊕	Protective earth (PE)

Sensor cable terminal connections

Only on remote mount design.

Terminal	Function / Notes	Wire color
M1	Magnet coil	Brown
M2	Magnet coil	Red
D1	Data line	Orange
D2	Data line	Yellow
⊕ / SE	Shield	-
E1	Signal line	Violet
1S	Shield for E1	-
E2	Signal line	Blue
2S	Shield for E2	-
3	Measurement potential	Green

Output connections

Terminal	Function / Notes
31 / 32	Current / HART output The current output is available in "active" or "passive" mode.
97 / 98	Digital communication PROFIBUS PA (PA+ / PA-) or FOUNDATION fieldbus (FF+ / FF-) in acc. with IEC 61158-2.
51 / 52	Digital output DO1 active / passive Function can be configured locally as „Pulse Output" or „Digital Output". Factory setting is „Pulse Output".
81 / 82	Digital input / contact input Function can be configured locally as „External output switch-off", „external totalizer reset", „external totalizer stop" or „other".
41 / 42	Digital output DO2 passive Function can be configured locally as „Pulse Output" or „Digital Output". Factory setting is „Digital Output", flow direction signaling.
PA	Potential Equalization (PA)
⊕	Functional ground (only for transmitter outside the hazardous area)

Note

The housing for the transmitter and flowmeter sensor must be connected to the potential equalization PA. The operator must ensure that when connecting the protective conductor (PE) no potential differences can occur between protective conductor and potential equalization (PA).

A temperature of 70 °C (158 °F) at the cable entry is assumed for the Ex calculations. Therefore, the cables used for the supply power and the signal inputs and outputs must have a minimum specification of 70 °C (158 °F).

5.2 Electrical data for operation in zones 2, 21, 22 / Div. 2

5.2.1 Devices with HART protocol

When operating in potentially explosive areas, observe the following electrical data for the signal inputs and outputs of the transmitter. For the correct current output design (active/passive), see the marking contained in the device's terminal box.

Model: FEP315, FEH315 / FEP515, FEH515 or FET325 / FET525

Signal inputs and outputs	Operating values		Type of protection Ex n/NI	
	U _i [V]	I _i [mA]	U _i [V]	I _i [mA]
Current / HART output, active/passive (terminals 31/32) Load: 250 Ω ≤ R ≤ 650 Ω	30	30	30	30
Digital output DO1, active/passive (terminals 51/52)	30	220	30	220
Digital output DO2, passive (terminals 41/42)	30	220	30	220
Digital input DI (terminals 81/82)	30	10	30	10

All inputs and outputs are electrically isolated from each other and from the supply power.

5.2.2 Devices with PROFIBUS PA or FOUNDATION fieldbus

When operating in potentially explosive areas, observe the following electrical data for the signal inputs and outputs of the transmitter. For the correct design (PROFIBUS PA or FOUNDATION fieldbus), see the marking contained in the device's terminal box.

For devices in Zone 2 / Div. 2 the bus termination must conform to the FNICO model or the explosion protection regulations, respectively.

Model: FEP315, FEH315 / FEP515, FEH515 or FET325 / FET525

Inputs and outputs	Operating values		Type of protection Ex n, NI and FNICO					
	U _N [V]	I _N [mA]	U _i [V]	I _i [mA]	P _i [mW]	C _i [nF]	C _{iPA} [nF]	L _i [μH]
Digital output DO2, passive (terminals 41/42)	30	220	-	-	-	-	-	-
Fieldbus (terminals 97/98)	32	30	32	500 ¹⁾	7000 ¹⁾	1	1	5

¹⁾ Single-channel or multi-channel barriers (supply isolators) with resistance characteristic must be used.

5.3 Temperature data for operation in Zone 2 / Div. 2

Model name	Surface temperature
FEP315 / FEH315 FEP515 / FEH515	70 °C (158 °F)
FEP325 / FEH325 FEP525 / FEH525	85 °C (185 °F)
FET325 / FET525	70 °C (158 °F)

The surface temperature depends on the fluid temperature.

With increasing fluid temperature > 70 °C (> 158 °F) or > 85 °C (> 185 °F) the surface temperature also increases to the level of the fluid temperature.

Note

The maximum permissible fluid temperature depends on the lining and flange material, and is limited by the operating values in Table 1 and the explosion protection specifications in Tables 2 ... n.

Table 1: Fluid temperature as a function of lining and flange material

Models FEP315 / FEP325, FEP515 / FEP525

Materials		Fluid temperature (operating values)	
Lining	Flange	Minimum	Maximum
Hard rubber	Steel	-10 °C (14 °F) -5 °C (23 °F) ¹⁾	90 °C (194 °F) 80 °C (176 °F) ¹⁾
Hard rubber	Stainless steel	-15 °C (5 °F) -5 °C (23 °F) ¹⁾	90 °C (194 °F) 80 °C (176 °F) ¹⁾
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)
Soft rubber	Stainless steel	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
PTFE	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)
PFA	Steel	-10 °C (14 °F)	180 °C (356 °F)
PFA	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
Thick PTFE	Steel	-10 °C (14 °F)	180 °C (356 °F)
Thick PTFE	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
ETFE	Steel	-10 °C (14 °F)	130 °C (266 °F)
ETFE	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)

1) Only China production site

Models FEH315 / FEH325, FEH515 / FEH525

Lining	Process connection	Material	Fluid temperature (operating values)	
			Minimum	Maximum
PFA	Flange	Stainless steel	-25 °C (-13 °F)	180 °C (356 °F)
PFA	Wafer type	-	-25 °C (-13 °F)	130 °C (266 °F)
PFA	Variable process connection	Stainless steel	-25 °C (-13 °F)	130 °C (266 °F)

Table 2: Fluid temperature (Ex data) for ProcessMaster models FEP315, FEP515 and HygienicMaster models FEH315, FEH515

Nominal diameter	Design	Temperature class	Ambient temperature											
			- 20 °C ... + 40 °C				- 20 °C ... + 50 °C				- 20 °C ... + 60 °C			
			- 40 °C ... + 40 °C ¹⁾				- 40 °C ... + 50 °C ¹⁾				- 40 °C ... + 60 °C ¹⁾			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust
ProcessMaster DN 3 ... DN 2000 HygienicMaster DN 3 ... DN 100	NT	T1	130 °C	130 °C	---	---	130 °C	100 °C ²⁾ 110 °C ³⁾	---	---	80 °C	40 °C	---	---
	HT	T1	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	40 °C	180 °C	40 °C
	NT	T2	130 °C	130 °C	---	---	130 °C	100 °C ²⁾ 110 °C ³⁾	---	---	80 °C	40 °C	---	---
	HT	T2	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	40 °C	180 °C	40 °C
	NT	T3	130 °C	130 °C	---	---	130 °C	100 °C ²⁾ 110 °C ³⁾	---	---	80 °C	40 °C	---	---
	HT	T3	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	40 °C	180 °C	40 °C
	NT	T4	130 °C	130 °C	---	---	130 °C	100 °C ²⁾ 110 °C ³⁾	---	---	80 °C	40 °C	---	---
	HT	T4	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	40 °C	130 °C	40 °C

- 1) Low-temperature version (option)
2) Temperature values for ProcessMaster
3) Temperature values for HygienicMaster

NT: standard sensor design, T_{medium} maximum 130 °C (266 °F)

HT: high-temperature sensor design, T_{medium} maximum 180 °C (356 °F)

Not thermally insulated: The flowmeter sensor is not surrounded by pipe insulation material.

Thermally insulated: The flowmeter sensor is surrounded by pipe insulation material.

Note

The standard version includes explosion protection for gases and dust. Explosion protection for dust is only available for devices featuring a transmitter in a dual-compartment housing.

- If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.
- If the installation location for the device is classified as a potentially explosive area for gases only, the temperature data in the "Gas" column in the table must be taken into consideration.

Ex relevant specifications for operation in zones 2, 21 and 22

Table 3: Fluid temperature (Ex data) for ProcessMaster models FEP325, FEP525 and HygienicMaster models FEH325, FEH525

Nominal diameter	Design	Temperature class	Ambient temperature											
			- 20 °C ... + 40 °C				- 20 °C ... + 50 °C				- 20 °C ... + 60 °C			
			- 40 °C ... + 40 °C ¹⁾				- 40 °C ... + 50 °C ¹⁾				- 40 °C ... + 60 °C ¹⁾			
			Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated		Not thermally insulated		Thermally insulated	
			Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust	Gas	Gas & dust
ProcessMaster DN 3 ... DN 2000 HygienicMaster DN 3 ... DN 100	NT	T1	130 °C	130 °C	---	---	130 °C	130 °C	---	---	110 °C ²⁾ 120 °C ³⁾	110 °C	---	---
	HT	T1	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C
	NT	T2	130 °C	130 °C	---	---	130 °C	130 °C	---	---	110 °C ²⁾ 120 °C ³⁾	110 °C	---	---
	HT	T2	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C
	NT	T3	130 °C	130 °C	---	---	130 °C	130 °C	---	---	110 °C ²⁾ 120 °C ³⁾	110 °C	---	---
	HT	T3	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C	180 °C
	NT	T4	130 °C	130 °C	---	---	130 °C	130 °C	---	---	110 °C ²⁾ 120 °C ³⁾	110 °C	---	---
	HT	T4	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C	130 °C
	NT	T5	95 °C	95 °C	---	---	95 °C	95 °C	---	---	95 °C	95 °C	---	---
	HT	T5	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C	95 °C
	NT	T6	80 °C	80 °C	---	---	80 °C	80 °C	---	---	80 °C	80 °C	---	---
	HT	T6	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C	80 °C

- 1) Low-temperature version (option)
2) Temperature values for ProcessMaster
3) Temperature values for HygienicMaster

NT: standard sensor design, T_{medium} maximum 130 °C (266 °F)

HT: high-temperature sensor design, T_{medium} maximum 180 °C (356 °F)

Not thermally insulated: The flowmeter sensor is not surrounded by pipe insulation material.

Thermally insulated: The flowmeter sensor is surrounded by pipe insulation material.

Note

The standard version includes explosion protection for gases and dust.

- If the installation location for the device is classified as a potentially explosive area for gases and dust, the temperature data in the "Gas & dust" columns in the table must be taken into consideration.
- If the installation location for the device is classified as a potentially explosive area for gases only, the temperature data in the "Gas" columns in the table must be taken into consideration.

6 Commissioning

6.1 Preliminary checks prior to start-up

The following points must be checked before commissioning:

- The supply power must be switched off.
- The supply power must match information on the name plate.
- The pin assignment must correspond to the connection diagram.
- Sensor and transmitter must be grounded properly.
- The temperature limits must be observed.
- The sensor must be installed at a largely vibration-free location.
- The housing cover and its safety locking device must be sealed before switching on the supply power.
- For devices with remote mount design and an accuracy of 0.2 % of rate make sure that the flowmeter sensor and the transmitter match correctly.
For this purpose, the final characters X1, X2, etc. are printed on the name plates of the flowmeter sensors, whereas the transmitters are identified by the final characters Y1, Y2, etc.
Devices with the end characters X1 / Y1 or X2 / Y2, etc. fit with each other.

- Any unused connections must be sealed in accordance with IEC 60079 prior to commissioning using the plugs supplied.

i

IMPORTANT (NOTE)

Commissioning and operation must be performed in accordance with ATEX 137 or BetrSichV (EN60079-14). Only properly trained personnel are authorized to carry out commissioning in Ex areas.

6.2 Notes on combining the FEP325 flowmeter sensor with the FET325 transmitter or the FEP525 flowmeter sensor with the FET525 transmitter

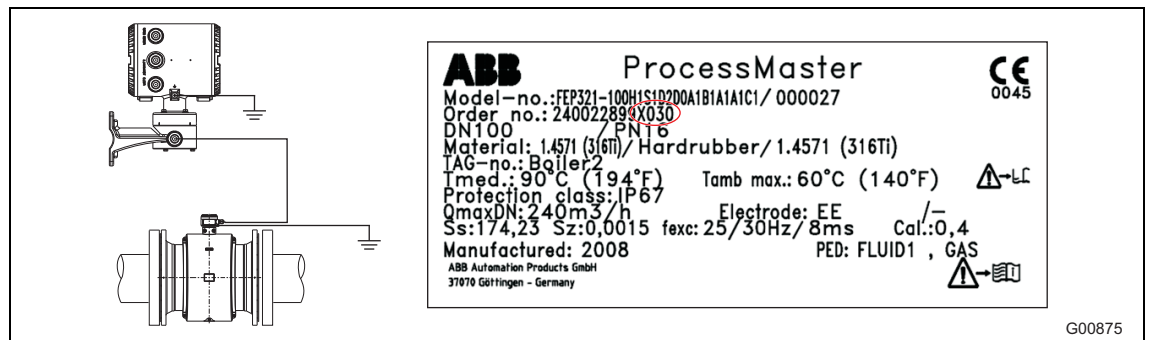


Fig. 15:

When combining the FEP325 flowmeter sensor with the FET325 transmitter, you must ensure that the flowmeter sensor is assigned to the transmitter correctly.

The same is valid for combining the FEP525 flowmeter sensor with the FET525 transmitter.

The flowmeter sensor is identified by means of the suffix (X01, X02, etc.) that forms part of the order number on the name plate.

The associated transmitter is identified by means of the suffix (Y01, Y02, etc.) that forms part of the order number on the name plate.

6.3 Special features of version designed for operation in Ex zone 1 / Div. 1

6.3.1 Configuring the current output

For devices designed for use in Ex Zone 1 / Div.1, the current output cannot be reconfigured subsequently.

The configuration required for the current output (active/passive) must be specified when the order is placed.

For the correct current output design (active/passive), see the marking contained in the device's terminal box.

6.3.2 Configuration of the digital outputs

For version designed for operation in Ex zone 1 / Div. 1, the digital outputs DO1 (51/52) and DO2 (41/42) can be configured on a NAMUR switching amplifier. On leaving the factory, the device is configured with the standard wiring (non-NAMUR).

Devices with PROFIBUS PA or FOUNDATION fieldbus only have the digital output DO2 (41 / 42).



Important (Note)

The outputs' type of protection remains unaffected by this. The devices connected to these outputs must conform to the applicable regulations for explosion protection.

The jumpers are located on the backplane in the transmitter housing.

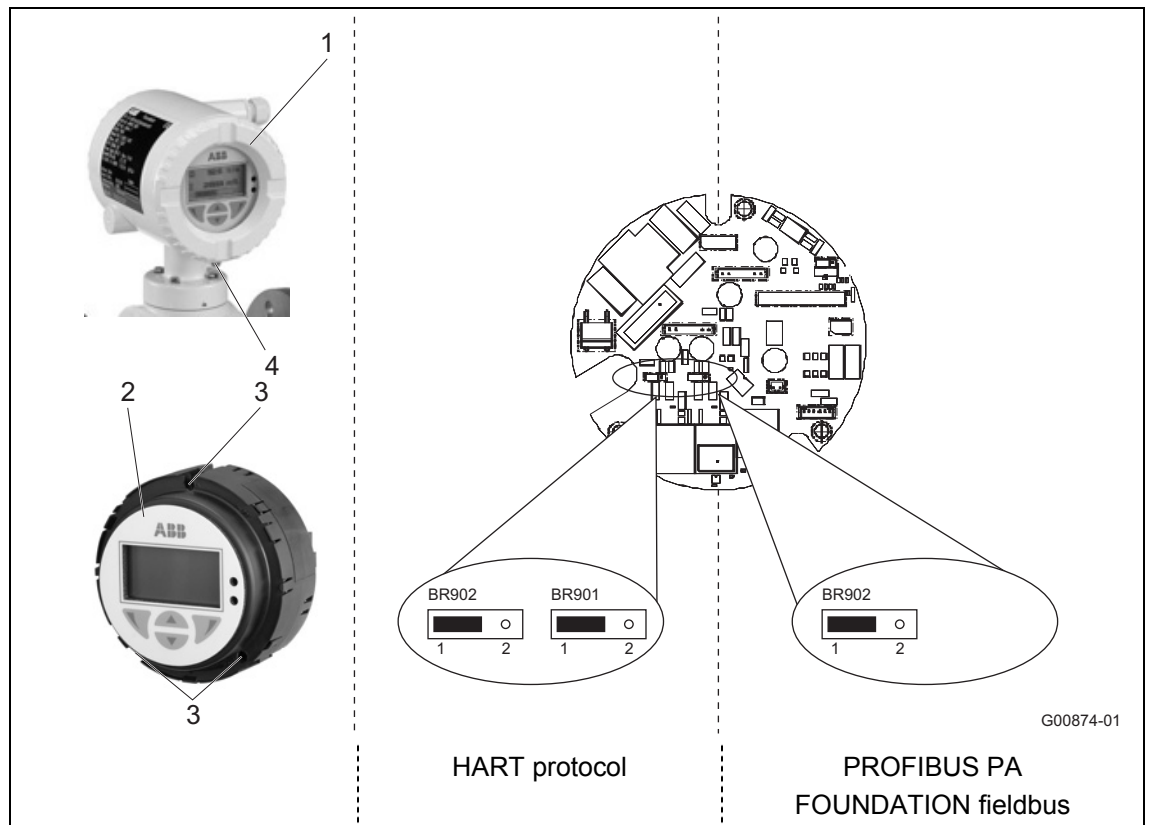


Fig. 16

BR902 for digital output DO1	BR901 for digital output DO2
BR902 in position 1: Standard (non-NAMUR) BR902 in position 2: NAMUR	BR901 in position 1: Standard (non-NAMUR) BR901 in position 2: NAMUR

Configure the digital outputs as described:

1. Switch off the supply power and wait at least 20 minutes before the next step.
2. Open the cover safety device (4) and housing cover (1).
3. Loosen screws (3) and pull out transmitter plug-in (2).
4. Insert the jumpers in the required positions.
5. Put the transmitter plug-in (2) back into the housing and retighten the screws (3).
6. Close the housing cover (1) and lock the cover by unscrewing the screw (4).

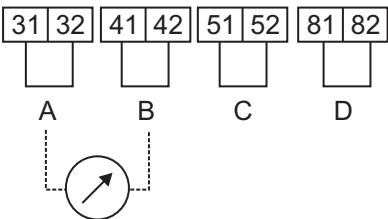
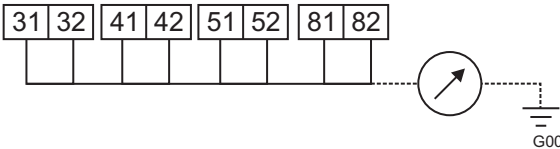
6.4 Changing the type of protection

Models FEP315 / FEP515, FEH315 / FEH515, FEP325 / FEP525, FET325 / FET525 can provide various types of protection during operation:

- When connected to an intrinsically safe circuit in Zone 1, operated as an intrinsically safe device (Ex ia)
- When connected to a non-intrinsically safe circuit in Zone 1, operated as a device with a flameproof enclosure (Ex d)
- When connected to a non-intrinsically safe circuit in Zone 2, operated as a non-sparking device (Ex nA)

If a device which is already operational is required to provide a different type of protection, the following measures must be implemented/insulation checks must be performed in accordance with IEC 60079-ff.

A subsequent change of the type of protection is the sole responsibility of the operator.

No.	1. Type of protection	2. Type of protection	Required step/check
1	Zone 1: Ex d, non-intrinsically safe circuits	Zone 1: Intrinsically safe circuits	<ul style="list-style-type: none"> • Switch off supply power. Use 500 VAC or 710 VDC to take the following measurements for one minute: Jumper terminals 31/32, 41/42, 51/52, 81/82. Then measure all jumpers (A,B,C,D) against one another.  <p style="text-align: right;">G00884</p>
			<ul style="list-style-type: none"> • Switch off supply power. Use 500 VAC or 710 VDC to take the following measurements for one minute: Jumper terminals 31/32, 41/42, 51/52, 81/82. Then measure against the housing.  <p style="text-align: right;">G00885</p>
		Zone 2: Non-sparking (nA)	<ul style="list-style-type: none"> • Visual inspection • Special precautions/checks are not necessary.
2	Zone 1: Intrinsically safe circuits	Zone 1: Ex d, non-intrinsically safe circuits	<ul style="list-style-type: none"> • Visual inspection (no damage to the threads of the cover or the cable fittings)
		Zone 2: Non-sparking (nA)	<ul style="list-style-type: none"> • Special precautions/checks are not necessary.
3	Zone 2: Non-sparking (nA)	Zone 1: Intrinsically safe circuits	<ul style="list-style-type: none"> • Perform the checks described under No. 1.
		Zone 1: Ex d, non-intrinsically safe circuits	<ul style="list-style-type: none"> • Visual inspection (no damage to the threads of the cover or the cable fittings)

7 Maintenance

7.1 General information

Repair and maintenance activities may only be performed by authorized customer service personnel.

When replacing or repairing individual components, original spare parts must be used.

**DANGER - Risk of explosion!**

When the housing cover is open, the explosion protection is suspended.

Before opening the housing switch off the power to all connection lines and wait at least 20 minutes.

**WARNING – Electrical voltage risk!**

When the housing is open, EMC protection is impaired and protection against contact is suspended.

Before opening the housing, switch off power to all connecting cables for the device.

**NOTICE - Potential damage to parts**

The electronic components of the printed circuit board can be damaged by static electricity (observe ESD guidelines).

Make sure that the static electricity in your body is discharged before touching electronic components.

**IMPORTANT (NOTE)**

Users must also observe the information in the operating and commissioning instruction for the device.

7.2 Replacing the transmitter or sensor

**IMPORTANT (NOTE)**

- When replacing the transmitter or flowmeter sensor make sure that they are assigned correctly. It is not possible to operate a flowmeter sensor of the 300 series with a transmitter of the 500 series. The series (e.g., ProcessMaster 300 or ProcessMaster 500) is shown on the name plate of the transmitter or flowmeter sensor.
- After replacing the transmitter, the system data must be reimplemented according to information in the operating instruction (see the chapter "Downloading the system data").

7.2.1 Transmitter

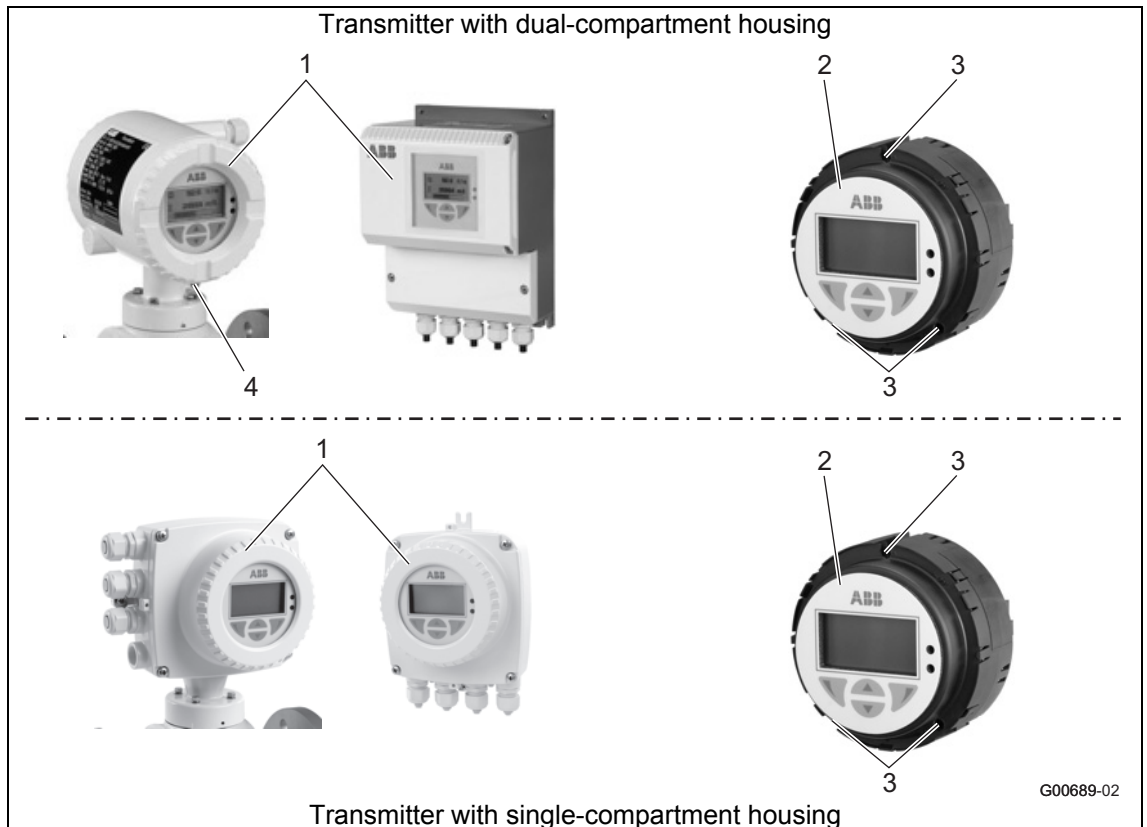


Fig. 17

Replace the transmitter plug-in as follows:

1. Switch off the supply power and wait at least 20 minutes before the next step.
2. Release the cover safety device (4) and housing cover (1).
3. Loosen screws (3) and pull out transmitter plug-in (2).
4. Replace transmitter plug-in and retighten screws (3).
5. Close the housing cover (1) and lock the cover by unscrewing the screw (4).

7.2.2 Flowmeter sensor

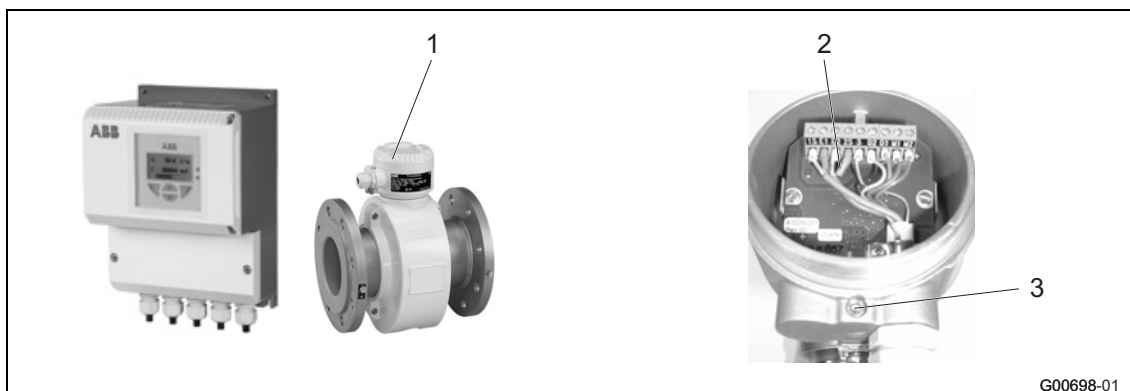


Fig. 18










Replace the flowmeter sensor as follows:

1. Switch off the supply power and wait at least 20 minutes before the next step.
2. Open the cover safety device (4) and housing cover (1).
3. Disconnect the signal cable (if necessary, remove the sealing compound).
4. Install the new sensor according to the installation instructions.
5. Complete the electrical connection according to the connection diagram.
6. Close the housing cover (1) and lock the cover by unscrewing the screw (3).

Appendix

8 Appendix

8.1 Approvals and certifications

CE mark		<p>The version of the meter in your possession meets the requirements of the following European directives:</p> <ul style="list-style-type: none"> - EMC directive 2014/30/EU - Low voltage directive 2014/35/EU - RoHS Directive 2011/65/EU - Pressure equipment directive (PED) 2014/68/EU - ATEX directive 2014/34/EU
Explosion Protection	       	<p>Identification for intended use in potentially explosive atmospheres according to:</p> <ul style="list-style-type: none"> - ATEX directive (marking in addition to CE marking) - IEC standards - FM Approvals (US) - cFM Approvals (Canada) - NEPSI (China) - GOST



IMPORTANT (NOTE)

All documentation, declarations of conformity and certificates are available in ABB's download area.

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