SensyMaster FMT430, FMT450

Thermal mass flowmeter

Precise and dynamic direct mass flow measurement of gas in industrial applications

Device firmware version: 01.02.00

Measurement made easy

SensyMaster FMT430
SensyMaster FMT450

Introduction

The SensyMaster FMT430 is a top-quality cost-effective solution for the precise and direct dynamic mass flow measurement of gases at low and medium operating pressure levels, which fulfills the requirements of any industrial application.

In addition, the FMT450 offers the highest level of accuracy and extended functionality for demanding industrial applications.

Additional Information

Additional documentation on SensyMaster FMT430, FMT450 is available for download free of charge at www.abb.com/flow.
Alternatively simply scan this code:

Table of contents

1 Safety

General information and instructions

These instructions are an important part of the product and must be retained for future reference.
Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly. The specialist personnel must have read and understood the manual and must comply with its instructions.
For additional information or if specific problems occur that are not discussed in these instructions, contact the manufacturer.
The content of these instructions is neither part of nor an amendment to any previous or existing agreement, promise or legal relationship.
Modifications and repairs to the product may only be performed if expressly permitted by these instructions.
Information and symbols on the product must be observed. These may not be removed and must be fully legible at all times.
The operating company must strictly observe the applicable national regulations relating to the installation, function testing, repair and maintenance of electrical products.

Warnings

The warnings in these instructions are structured as follows:

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

The signal word *'**NOTICE**'* indicates possible material damage.

Note
'**Note**' indicates useful or important information about the product.

Intended use

This device can be used in the following applications:

- As an insertion sensor for flange mounting pipe component in piping with nominal diameters DN 25 to 200 (1 to 8 in).
- Through a welding adapter directly in piping of nominal diameter DN 100 (4 in) and above, as well as for non-circular cross-sections.

This device is intended for the following uses:

- for direct mass flow measurement of gases and gas mixtures in closed pipelines.
- for indirect measurement of volume flows (through standard density and mass flow).
- for measuring the temperature of the measuring medium.

The device has been designed for use exclusively within the technical limit values indicated on the identification plate and in the data sheets.

When using measuring media, the following points must be observed:

- Measuring media may only be used if, based on the state of the art or the operating experience of the user, it can be assured that the chemical and physical properties necessary for operational security of the materials of the wetted parts of the flowmeter sensor will not be adversely affected during the operating time.
- Media containing chloride in particular can cause corrosion damage to stainless steels which, although not visible externally, can damage wetted parts beyond repair and lead to the measuring medium escaping. It is the operator's responsibility to check the suitability of these materials for the respective application.
- Measuring media with unknown properties or abrasive measuring media may only be used if the operator is able to perform regular and suitable tests to ensure the safe condition of the device

Improper use

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

- Operation as a flexible compensating adapter in piping, for example for compensating pipe offsets, pipe vibrations, pipe expansions, etc.
- For use as a climbing aid, for example for mounting purposes.
- For use as a bracket for external loads, for example as a support for piping, etc.
- Material application, for example by painting over the housing, name plate or welding/soldering on parts.
- Material removal, for example by spot drilling the housing.

Warranty provisions

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using underqualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

Cyber security disclaimer

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

Software downloads

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

ABB-Library – SensyMaster FMT400 – Software Downloads

Manufacturer's address

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

Service address

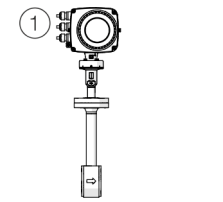
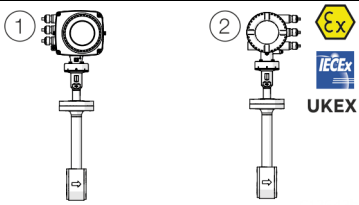
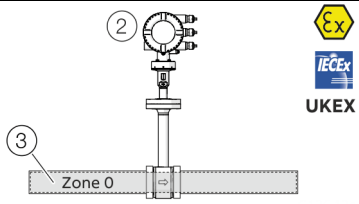
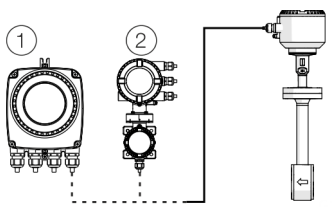
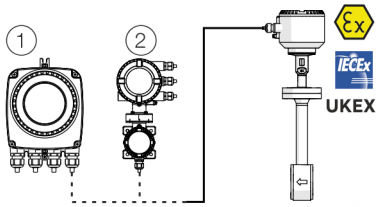
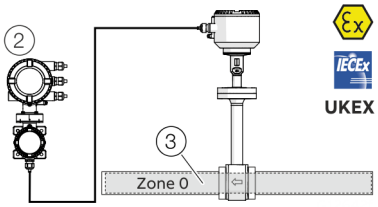
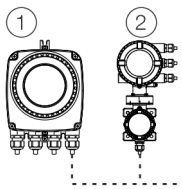
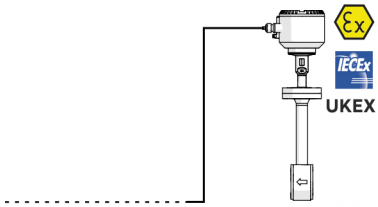
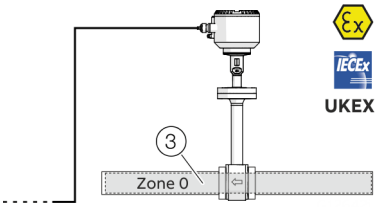
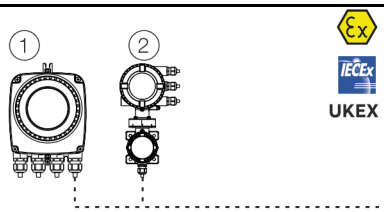
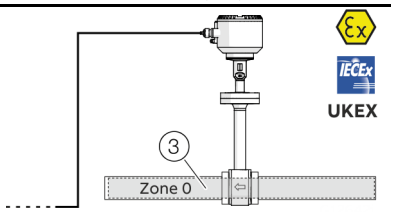
Customer service center
Tel: +49 180 5 222 580
Email: automation.service@de.abb.com

2 Use in potentially explosive atmospheres

Note
Further information on the Ex-Approval of devices can be found in the type examination certificates or the relevant certificates at www.abb.com/flow .

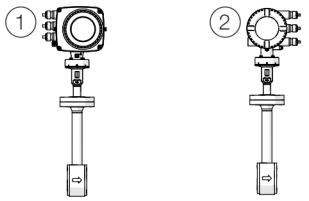
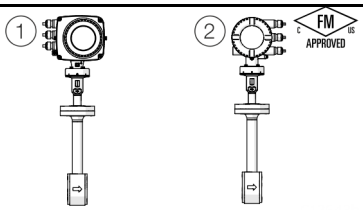
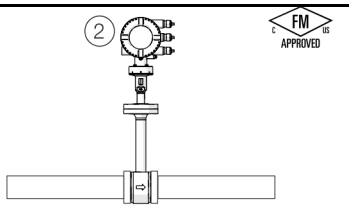
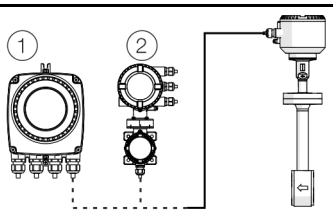
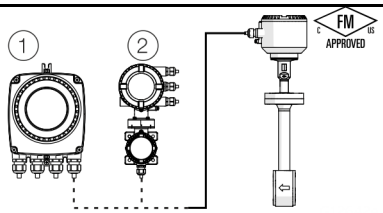
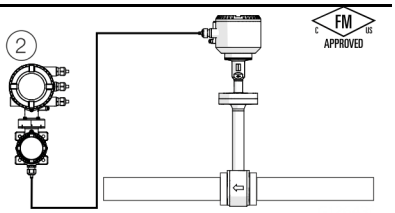
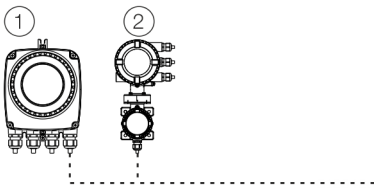
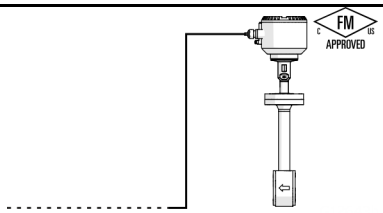
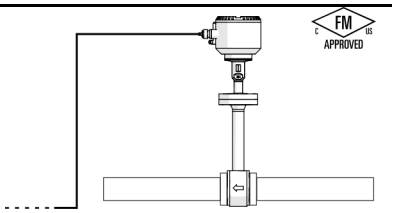
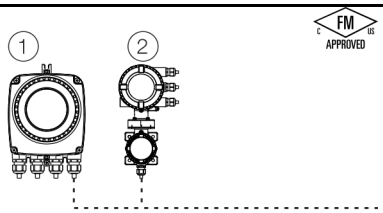
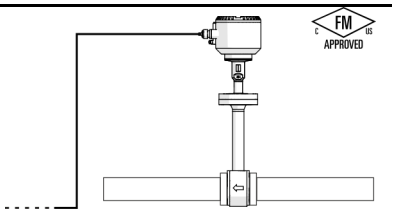
Device overview

ATEX, IECEx and UKEX

	Standard / No explosion protection	Zones 2, 22	Zone 1, 21 (Zone 0)
Model number	**FMT4x0 Y0**	**FMT4x0 A2, U2**	**FMT4x0 A1, U1, U4**
Integral mount design • Standard • Zone 2, 22 • Zone 1, 21 • Zone 0			
Model number	**FMT4x2 Y0** / **FCx4x0 Y0**	**FMT4x2 A2, U2** / **FCx4x0 A2, U2**	**FMT4x2 A1, U1, U4** / **FCx4x0 A1, U1, U4**
Remote mount design Transmitter and flowmeter sensor • Standard • Zone 2, 22 • Zone 1, 21 • Zone 0			
Model number	**FMT4x2 Y0**	**FMT4x0 A2, U2**	**FCx4x0 A1, U1, U4**
Remote mount design Transmitter • Standard • Zone 2, 22 Sensor • Zone 1, 21 • Zone 0			
Model number	—	**FMT4x2 A2, U2**	**FCx4x0 A1, U1, U4**
Remote mount design Transmitter • Zone 2, 22 Sensor • Zone 1, 21 • Zone 0	—		

(1) Single-compartment housing
(2) Dual-compartment housing
(3) Zone 0 within the meter tube

cFMus

	Standard / No explosion protection		Class I Div. 2 / Zone 2		Class I Div. 1 / Zone 1 (Zone 0)	
Model number	**FMT4x0 Y0**		**FMT4x0 F2**		**FMT4x0 F1**	
Integral mount design • Standard • Div. 2 / Zone 2 • Div. 1 / Zone 1						
Model number	**FMT4x2 Y0**	**FMT4x0 Y0**	**FMT4x2 F2**	**FMT4x0 F2**	**FMT4x2 F1**	**FMT4x0 F1**
Remote mount design Transmitter and flowmeter sensor • Div. 2 / Zone 2 • Div. 1 / Zone 1						
Model number	**FCT4x2 Y0**		**FCT4x0 F2**		**FMT4x0 F1**	
Remote mount design Transmitter • Standard Sensor • Div. 2 / Zone 2 • Div. 1 / Zone 1						
Model number	**—**		**FMT4x2 F2**		**FMT4x0 F1**	
Remote mount design Transmitter • Div. 2 / Zone 2 Sensor • Div. 1 / Zone 1	—					

(1) Single-compartment housing

(2) Dual-compartment housing

… 2 Use in potentially explosive atmospheres

Ex marking sensor and transmitter

ATEX, IECEx and UKEX

Note

- A specific marking applies, depending on the design.
- ABB reserves the right to modify the Ex-marking. Refer to the name plate for the exact marking.

Model number design*: FMTabcdefghijkl.m.n.o.p

* For detailed information on the design of the model number, see the ordering information in the data sheet

Model number for use in Zone 2, 22	Ex marking	Certificate
FMT4x0 – A2, U2 (i=D..,Y..,S..)	II 3G Ex ec IIC T6...T1 Gc	**ATEX:**
Sensor in integral mount design or remote mount design with single-compartment or dual-compartment housing	II 3D Ex tc IIIC T80°C...T_{medium} Dc	FM19ATEX0178X **IECEx:** IECEx FMG 19.0025X
FMT4x2 – A2, U2 (i=W..,R..)	II 3G Ex ec IIC T6 Gc	**UKEX:**
Sensor in remote mount design with single-compartment housing	II 3D Ex tc IIIC T80°C Dc	FM21UKEX0136X

Model number for use in Zone 0/1, 21	Ex marking	Certificate
FMT4x0 – A1, U1 (i=D1...D8)	II 2 G Ex db eb ib mb IIC T6...T1 Gb	**ATEX:**
Sensor in integral mount design with dual-compartment housing	II 2 G Ex ia IIC T6...T1 Gb II 2 D Ex ia tb IIIC T80°C...T_{medium} Db IN-/OUTPUTS: Urated=30V	FM19ATEX0177X **IECEx:** IECEx FMG 19.0025X
FMT4x0 – A3, U4 (i=D1...D8)	II 1/2 G Ex db eb ia mb IIC T6...T1 Gb/Ga	**UKEX:**
Sensor in integral mount design with dual-compartment housing (Zone 0 in meter tube)	II 1 G Ex ia IIC T6...T1 Ga II 2 D Ex ia tb IIIC T80°C...T_{medium} Db IN-/OUTPUTS: Urated=30V	FM21UKEX0135X
FMT4x0 – A1, U1 (i=Y0)	II 2 G Ex eb ib mb IIC T6...T1 Gb	
Sensor in remote mount design with dual-compartment housing	II 2 G Ex ia IIC T6...T1 Gb II 2 D Ex tb IIIC T80°C...T_{medium} Db IN-/OUTPUTS: Urated=30V	
FMT4x0 – A3, U4 (i=Y0)	II 1/2 G Ex eb ia ib mb IIC T6...T1 Gb/Ga	
Sensor in remote mount design with dual-compartment housing (Zone 0 in meter tube)	II 1 G Ex ia IIC T6...T1 Ga II 2 D Ex tb IIIC T80°C...T_{medium} Db IN-/OUTPUTS: Urated=30V	
FMT4x0 – A1, U1 (i=R1...R4)	II 2 G Ex db eb ia mb IIB+H2 T6 Gb	
Transmitter in remote mount design with dual-compartment housing	II 2 D Ex ia tb IIIC T80°C Db IN-/OUTPUTS: Urated=30V	
FMT4x0 – A1, U1 (i=R5...R8)	II 2 G Ex db ia IIB+H2 T6 Gb	
Transmitter in remote mount design with dual-compartment housing (flameproof enclosure ‘Ex d’)	II 2 D Ex ia tb IIIC T80°C Db IN-/OUTPUTS: Urated=30V	

cFMus

Note

- A specific marking applies, depending on the design.
- ABB reserves the right to modify the Ex-marking. Refer to the name plate for the exact marking.

Model number design*: FMTabcdefghijkl.m.n.o.p

* For detailed information on the design of the model number, see the ordering information in the data sheet

Model number for use in Division 2	Ex marking	
FMT4x0 - F2 (i=D..,Y..,S..)	**USA:**	**Canada:**
Sensor in integral mount design with single-compartment or dual-compartment housing. Design in accordance with ANSI / ISA 12.27.01 as 'Dual Seal Device'.	Certificate: FM19US0110X NI: CL I, Div 2, GPS ABCD T6...T1 DIP: CL II,III, Div 2, GPS EFG T6...T3B CL I, ZN 2, AEx ec IIC T6...T1 Gc ZN 21, AEx tb IIIC T80°C...T165°C Db See handbook for temperature class information	Certificate: FM19CA0055X NI: CL I, Div 2, GPS ABCD T6...T1 DIP: CL II,III, Div 2, GPS EFG T6...T3B CL I, ZN 2, Ex ec IIC T6...T1 Gc Ex tb IIIC T80°C...T165°C Db ANSI/ISA 12.27.01: Dual Seal
FMT4x2 - F2 (i=W..,R..)	**USA:**	**Canada:**
Transmitter in remote mount design with single-compartment or dual-compartment housing.	Certificate: FM19US0110X NI: CL I, Div 2, GPS ABCD T6 DIP: CL II,III, Div 2, GPS EFG T6 CL I, ZN 2, AEx ec IIC T6 Gc ZN 21, AEx tb IIIC T80°C Db See handbook for temperature class information	Certificate: FM19CA0055X NI: CL I, Div 2, GPS ABCD T6 DIP: CL II,III, Div 2, GPS EFG T6 CL I, ZN 2, Ex ec IIC T6 Gc Ex tb IIIC T80°C Db

Model number for use in Division 1	Ex marking	
FMT4x0 – F1 (i=D1...D8)	**USA:**	**Canada:**
Sensor in integral mount design or remote mount design with dual-compartment housing. Design in accordance with ANSI / ISA 12.27.01 as 'Dual Seal Device'.	Certificate: FM19US0110X S-XP-IS: CL I, Div 1, GPS ABCD T6...T1 DIP: CL II,III, Div 1, GPS EFG T6...T3B CL I, ZN 1, AEx db eb ia mb IIB+H2 T6...T1 Gb ZN 21, AEx ia tb IIIC T80°C...T165°C Db See handbook for temperature class information and installation drawing 3kxf000094G0009	Certificate: FM19CA0055X S-XP-IS: CL I, Div 1, GPS BCD T6...T1 DIP: CL II,III, Div 1, GPS EFG T6...T3B CL I, ZN 1, AEx db eb ia mb IIB+H2 T6...T1 Gb Ex ia tb IIIC T80°C...T165°C Db IN-/OUTPUTS: Urated=30V ANSI/ISA 12.27.01: Dual Seal
FMT4x0 – F1 (i=Y0)	**USA:**	**Canada:**
Sensor in remote mount design. Design in accordance with ANSI / ISA 12.27.01 as 'Dual Seal Device'.	Certificate: FM19US0110X S-XP: CL I, Div 1, GPS ABCD T6...T1 DIP: CL II,III, Div 1, GPS EFG T6...T3B CL I, ZN 1, AEx db eb mb IIB+H2 T6...T1 Gb ZN 21, AEx tb IIIC T80°C...T165°C Db See handbook for temperature class information and installation drawing 3kxf000094G0009	Certificate: FM19CA0055X S-XP: CL I, Div 1, GPS BCD T6...T1 DIP: CL II,III, Div 1, GPS EFG T6...T3B CL I, ZN 1, Ex db eb mb IIB+H2 T6...T1 Gb Ex tb IIIC T80°C...T165°C Db ANSI/ISA 12.27.01: Dual Seal
FMT4x2 – F1 (i=R1...R8)	**USA:**	**Canada:**
Transmitter in remote mount design with dual-compartment housing	Certificate: FM19US0110X XP-IS: CL I, Div 1, GPS BCD T6 DIP: CL II,III, Div 1, GPS EFG T6 CL I, ZN 1, AEx db ia IIB+H2 T6 Gb ZN 21, AEx ia tb IIIC T80°C Db See handbook for temperature class information and installation drawing 3kxf000094G0009	Certificate: FM19CA0055X XP-IS: CL I, Div 1, GPS BCD T6 DIP: CL II,III, Div 1, GPS EFG T6 CL I, ZN 1, Ex db ia IIB+H2 T6 Gb Ex ia tb IIIC T80°C Db IN-/OUTPUTS: Urated=30V

… 2 Use in potentially explosive atmospheres

Ex marking pipe components and integrated hot tap fitting

Note

- A specific marking applies, depending on the design.
- ABB reserves the right to modify the Ex-marking. Refer to the name plate for the exact marking.

ATEX, IECEx and UKEX

Model number for use in Zone 2, 22	Ex marking	Certificate
FMT091_ (j=SCA, SCB, SCC) SensyMaster FMT091 pipe component type 1, wafer type Optional with ball valve or integrated hot tap fitting	II 3 G Ex h IIC T6…T3 Gc II 3 D Ex h IIIC T85°C … T150°C Dc	**ATEX:** FM19ATEX0178X **IECEx:** IECEx FMG 19.0025X **UKEX:** FM21UKEX0136X
FMT092_ (j=SCA, SCB, SCC) SensyMaster FMT092 pipe component type 2, partial measuring section Optional with ball valve or integrated hot tap fitting		
FMT094_ (j=SCA, SCD) SensyMaster FMT094 pipe component type 4, partial measuring section Optional with ball valve or integrated hot tap fitting		

Model number for use in Zone 0/1, 21	Ex marking	Certificate
FMT091_ (j=SCA, SCB, SCC) SensyMaster FMT091 pipe component type 1, wafer type	II 2 G Ex h IIC T6…T3 Gb II 2 D Ex h IIIC T85°C … T150°C Db	**ATEX:** FM19ATEX0177X **IECEx:** IECEx FMG 19.0025X **UKEX:** FM21UKEX0135X
FMT092_ (j=SCA, SCB, SCC) SensyMaster FMT092 pipe component type 2, partial measuring section		
FMT094_ (j=SCA, SCD) SensyMaster FMT094 pipe component type 4, partial measuring section Optional with ball valve or integrated hot tap fitting		

Notice regarding the integrated hot tap fitting

The integrated hot tap fitting has been designed in accordance with the DIN EN 80079-36 and DIN EN 80079-37 standards and the ‘c – constructional safety’ type of protection.

cFMus

The pipe components do not have any marking in accordance with cFMus. The pipe components can be used in accordance with cFMus in the following areas:

- Div. 1
- Div. 2, Zone 1, 2, 21

Temperature data

Temperature resistance for the connecting cable

The temperature at the cable entries of the device is dependent on the measuring medium temperature T_{medium} and the ambient temperature $T_{amb.}$.

For the electrical connection of the device, use only cables with sufficient temperature resistance in accordance with the following table.

$T_{amb.}$	Temperature resistance for the connecting cable
≤ 50 °C (≤ 122 °F)	≥ 70 °C (≥ 158 °F)
≤ 60 °C (≤ 140 °F)	≥ 80 °C (≥ 176 °F)
≤ 70 °C (≤ 158 °F)	≥ 90 °C (≥ 194 °F)

From an ambient temperature of $T_{amb.}$ ≥ 60 °C (≥ 140 °F), the wires in the connection boxes with the enclosed silicone hoses need to be additionally insulated.

Note

The signal cable supplied by ABB can be used without restrictions up to an ambient temperature of ≤ 80 °C (≤ 176 °F).

Environmental and process conditions for model FMT4xx...

Ambient temperature $T_{amb.}$	−20 to 70 °C (−4 to 158 °F)
	−40 to 70 °C (−40 to 158 °F)*
Measuring medium temperature T_{medium}	−20 to 150 °C (−4 to 302 °F)
	−40 to 150 °C (−40 to 302 °F)*
IP rating / NEMA rating	IP 65, IP 67 / NEMA 4X,Type 4X

* Low temperature design (optional)

… 2 Use in potentially explosive atmospheres

… Temperature data

Measuring medium temperature (Ex data) for model FMT4x0-A1… in Zone 1, Zone 21

The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class. The permissible measuring medium temperature specified in **Environmental and process conditions for model FMT4xx…** on page 11 must not be up-scaled!

	Temperature class					
Ambient temperature $T_{amb.}$	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
−40 °C to 50 °C (−40 °F to 122 °F)	280 °C (536 °F)	185 °C (365 °F)	90 °C (194 °F)	90 °C (194 °F)	—	—
−40 °C to 60 °C (−40 °F to 140 °F)	280 °C (536 °F)	185 °C (365 °F)	90 °C (194 °F)	90 °C (194 °F)	—	—
−40 °C to 70 °C (−40 °F to 158 °F)	280 °C (536 °F)	185 °C (365 °F)	90 °C (194 °F)	90 °C (194 °F)	—	—

Measuring medium temperature (Ex data) for model FMT4x0-A2… in Zone 2, Zone 22

The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class. The permissible measuring medium temperature specified in **Environmental and process conditions for model FMT4xx…** on page 11 must not be up-scaled!

	Temperature class					
Ambient temperature $T_{amb.}$	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
−40 °C to 40 °C (−40 °F to 104 °F)	300 °C (572 °F)	290 °C (554 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
−40 °C to 50 °C (−40 °F to 122 °F)	300 °C (572 °F)	290 °C (554 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	—
−40 °C to 60 °C (−40 °F to 140 °F)	300 °C (572 °F)	290 °C (554 °F)	195 °C (383 °F)	130 °C (266 °F)	—	—
−40 °C to 70 °C (−40 °F to 158 °F)	300 °C (572 °F)	290 °C (554 °F)	195 °C (383 °F)	130 °C (266 °F)	—	—

Measuring medium temperature (Ex data) for model FMT4x0-F1... in Class I Division 1 and Class II Division 1

The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class. The permissible measuring medium temperature specified in **Environmental and process conditions for model FMT4xx...** on page 11 must not be up-scaled!

	Temperature class					
Ambient temperature $T_{amb.}$	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
−40 °C to 50 °C (−40 °F to 122 °F)	280 °C (536 °F)	185 °C (365 °F)	90 °C (194 °F)	90 °C (194 °F)	—	—
−40 °C to 60 °C (−40 °F to 140 °F)	280 °C (536 °F)	185 °C (365 °F)	90 °C (194 °F)	90 °C (194 °F)	—	—
−40 °C to 70 °C (−40 °F to 158 °F)	280 °C (536 °F)	185 °C (365 °F)	90 °C (194 °F)	90 °C (194 °F)	—	—

Measuring medium temperature (Ex data) for model FMT4x0-F1... in Class I Division 2 and Class II Division 2

The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class. The permissible measuring medium temperature specified in **Environmental and process conditions for model FMT4xx...** on page 11 must not be up-scaled!

	Temperature class					
Ambient temperature $T_{amb.}$	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
−40 °C to 40 °C (−40 °F to 104 °F)	300 °C (572 °F)	290 °C (554 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
−40 °C to 50 °C (−40 °F to 122 °F)	300 °C (572 °F)	290 °C (554 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	—
−40 °C to 60 °C (−40 °F to 140 °F)	300 °C (572 °F)	290 °C (554 °F)	195 °C (383 °F)	130 °C (266 °F)	—	—
−40 °C to 70 °C (−40 °F to 158 °F)	300 °C (572 °F)	290 °C (554 °F)	195 °C (383 °F)	130 °C (266 °F)	—	—

Notice on dust-ignition protection for USA and Canada in accordance with NEC

The surface temperature of the device must not under any circumstances up-scale 85 °C (185 °F) if there is there carbonaceous dust or dust which can carbonate.

Attention, T-Class for Dust US and Canada information according NEC/CEC:
The maximum temperature cannot exceed 165 °C under any circumstances where a carbonaceous dust or dust likely to carbonize is present.

- For combustible dusts, less than the lower of either the layer or cloud ignition temperature of the specific combustible dust. For organic dusts that may dehydrate or carbonize, the temperature marking shall not exceed the lower of either the ignition temperature or 165 °C (329 °F).
- For ignitible fibers/flyings, less than 165 °C (329 °F) for equipment that is not subject to overloading, or 120°C (248°F) for equipment (such as motors or power transformers) that may be overloaded.

… 2 Use in potentially explosive atmospheres

… Temperature data

Ambient and process conditions for pipe components and integrated hot tap fitting

Measuring medium temperature T_{medium}	Standard: −20 to 150 °C (−4 to 302 °F)
Ambient temperature $T_{amb.}$ for pipe components **without** ball valve or integrated hot tap fitting.	Standard: −20 to 70 °C (−4 to 158 °F), optional: −40 to 70 °C (−40 to 158 °F) Depending on the selected **ambient temperature range (TA3/TA9)** of the sensor and O-ring design.
Ambient temperature $T_{amb.}$ for pipe components with ball valve or integrated hot tap fitting (**Sensor connection options: SCA, SCB, SCD**)	Standard: −20 to 70 °C (−4 to 158 °F)

Measuring medium temperature (Ex data) for pipe components and integrated hot tap fitting

The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class. The permissible measuring medium temperature specified in the table above must not be up-scaled!

		Temperature class			
Ambient temperature $T_{amb.}$	**Options**	**T3**	**T4**	**T5**	**T6**
−20 °C to 70 °C (−4 °F to 158 °F)	Pipe component **without** ball valve or integrated hot tap fitting	150 °C (302 °F)	135 °C (275 °F)	100 °C (212 °F)	85 °C (185 °F)
−40 °C to 70 °C (−40 °F to 158 °F)	Pipe component **without** ball valve or integrated hot tap fitting	150 °C (302 °F)	135 °C (275 °F)	100 °C (212 °F)	85 °C (185 °F)
−20 °C to 70 °C (−4 °F to 158 °F)	Pipe component **with** ball valve or integrated hot tap fitting	150 °C (302 °F)	135 °C (275 °F)	100 °C (212 °F)	85 °C (185 °F)

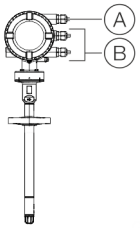
Integrated hot tap fitting – maximum surface temperature

The maximum surface temperature of the integrated hot tap fitting is 85 °C to 150 °C (185 °F to 302 °F) depending on the measuring medium temperature.

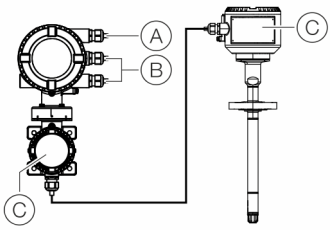
Electrical data

Overview

Integral mount design



Remote mount design



Ⓐ Power supply

Ⓑ Inputs / outputs, communication

Ⓒ Signal cable (remote mount design only)

Figure 1: Electrical connections overview

Zones 2, 22	**Division 2 and Zone 2**
ATEX/IECEx/UKEX: II 3 G & II 3 D	**USA:** DIV2 & ZN2 **Canada:** DIV2 & ZN2

Activating the inputs and outputs

Ⓐ Power supply	Ⓑ Inputs / outputs, communication	Ⓒ Signal cable (remote mount design only)
• ATEX/IECEx/UKEX type of protection: non-sparking 'Ex ec' • Type of protection USA / Canada: 'non IS' • Maximum 250 Vrms • Terminals: 1+, 2-, L, N, ⏚	• ATEX/IECEx/UKEX type of protection: non-sparking 'Ex ec' • Type of protection USA / Canada: Non-Incendive 'NI' • Terminals: 31, 32, Uco, V1, V2, V3, V4, 41, 42, 51, 52	• ATEX/IECEx/UKEX type of protection: non-sparking 'Ex ec' • Type of protection USA / Canada: Non-Incendive 'NI' • Terminals: A, B, UFE, GRN

Zones 1, 21	**Division 1 and Zone 1**
ATEX/IECEx/UKEX: II 2 G & II 2 D II 1/2 G & II 1 G & II 2 D	**USA:** DIV1 & ZN1 **Canada:** DIV1 & ZN1

Activating the inputs and outputs

Ⓐ Power supply	Ⓑ Inputs / outputs, communication	Ⓒ Signal cable (remote mount design only)
• ATEX/IECEx/UKEX type of protection: non-sparking 'Ex eb' • Type of protection USA / Canada: 'non IS' • Maximum 250 Vrms • Terminals: 1+, 2-, L, N, ⏚	• ATEX/IECEx/UKEX type of protection: non-sparking 'Ex ec' • Type of protection USA / Canada: Non-Incendive 'NI' • When installing in 'Ex ia', suited intrinsically safe isolation amplifiers must be used for the connection. • Terminals: 31, 32, Uco, V1, V2, V3, V4, 41, 42, 51, 52	• ATEX/IECEx/UKEX type of protection: non-sparking 'Ex eb' • Type of protection USA / Canada: explosionproof 'XP' • Terminals: A, B, UFE, GRN

Note

When installing in 'Ex ia' or 'IS' type of protection, the type of protection is determined by the type of electrical connection. The information in **Changing the type of protection** on page 23 must be observed when changing the type of protection!

… 2 Use in potentially explosive atmospheres

… Electrical data

Zone 0, 1, 21 and Division 1 – Model: FMT4xx-A1, FMT4xx-F1

Type of protection	**'e' / 'XP'**		**'ia' / 'IS'**											
Outputs on basic device	**U_M [V]**	**I_M [A]**	**U_O [V]**	**U_I [V]**	**I_O [mA]**	**I_I [mA]**	**P_O [mW]**	**P_I [mW]**	**C_O [nF]**	**C_I [nF]**	**C_{OPA} [nF]**	**C_{IPA} [nF]**	**L_O [mH]**	**L_I [mH]**
Current / HART output 31 / U_{CO}, active Terminals 31 / U_{CO}	30	0.2	30	30	115	115	815	815	10	10	5	5	0.08	0.08
Current / HART output 31 / 32, passive Terminals 31 / 32	30	0.2	—	30	—	115	—	815	—	27	—	5	0.08	0.08
Digital output 41 / 42, active* Terminals 41 / 42 and V1 / V2*	30	0.1	27.8	30	119	30	826	225	20	20	29	29	0.22	0.22
Digital output 41 / 42, active** Terminals 41 / 42 and U_{CO} / 32**	30	0.1	30	30	115	115	826	225	16	16	10	10	0.08	0.08
Digital output 41 / 42, passive Terminals 41 / 42	30	0.1	—	30	—	30	—	225	—	27	—	5	—	0.08
Digital output 51 / 52, active* Terminals 51 / 52 and V1 / V2*	30	0.1	27.8	30	119	30	826	225	20	20	29	29	0.22	0.22
Digital output 51 / 52, passive Terminals 51 / 52	30	0.1	—	30	—	30	—	225	—	27	—	5	—	0.08

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

Digital outputs 41 / 42 and 51 / 52 are not electrically isolated from each other. Terminals 42 / 52 have the same potential.

* Only in conjunction with additional '24 V DC loop power supply (blue)' plug-in card in slot OC1.

** Only in conjunction with current output U_{CO} / 32 in 'power mode', see **Current output Uco / 32 as loop power supply for digital output 41 / 42 or 51 / 52** on page 59.

Type of protection	**'e' / 'XP'**		**'ia' / 'IS'**											
Inputs and outputs with optional plug-in cards	**U_M [V]**	**I_M [A]**	**U_O [V]**	**U_I [V]**	**I_O [mA]**	**I_I [mA]**	**P_O [mW]**	**P_I [mW]**	**C_O [nF]**	**C_I [nF]**	**C_{OPA} [nF]**	**C_{IPA} [nF]**	**L_O [mH]**	**L_I [mH]**
Current output V3 / V4, active* Terminals V3 / V4 and V1 / V2*	30	0.1	27.8	30	119	30	826	225	29	29	117	117	0.4	0.4
Current output V1 / V2, passive** **Current output V3 / V4, passive**** Terminals V1 / V2** or V3 / V4**	30	0.1	—	30	—	68	—	510	—	45	—	59	—	0.27
Digital output V3 / V4, active* Terminals V3 / V4 and V1 / V2*	30	0.1	27.8	30	119	68	826	225	17	17	31	31	0.4	0.4
Digital output V1 / V2, passive** **Digital output V3 / V4, passive**** Terminals V1 / V2** or V3 / V4**	30	0.1	—	30	—	30	—	225	—	13	—	16	—	0.27
Digital input V3 / V4, active* Terminals V3 / V4 and V1 / V2	30	0.1	27.8	30	119	3.45	826	25.8	17	17	31	31	0.4	0.4
Digital input V1 / V2, passive* **Digital input V3 / V4, passive*** Terminals V1 / V2** or V3 / V4**	30	0.1	—	30	—	3.45	—	25.8	—	13	—	16	—	0.27
Modbus® / PROFIBUS DP® Terminals V1 / V2	30	0.1	4.2	4.2	150	150	150	150	5300	5300	0.06	0.06	0.09	0.09

* Only in conjunction with additional '24 V DC loop power supply (blue)' plug-in card in slot OC1.

** The terminal assignment depends on the model number or the slot assignments. For connection examples, see **Connection examples** on page 63.

Zone 2, 22 and Division 2 – Model: FMT4xx-A2, FMT4xx-F2

Outputs on basic device	Operating values (general)		Type of protection 'ec' / 'NI'	
	U_N	I_N	U_N	I_N
Current / HART output 31 / U_{CO}, active Terminals 31 / U_{CO}	30 V	30 mA	30 V	30 mA
Current / HART output 31 / 32, passive Terminals 31 / 32	30 V	30 mA	30 V	30 mA
Digital output 41 / 42, active* Terminals 41 / 42 and V1 / V2*	30 V	30 mA	30 V	30 mA
Digital output 41 / 42, active** Terminals 41 / 42 and U_{CO} / 32**	30 V	30 mA	30 V	30 mA
Digital output 41 / 42, passive Terminals 41 / 42	30 V	30 mA	30 V	30 mA
Digital output 51 / 52, active* Terminals 51 / 52 and V1 / V2*	30 V	30 mA	30 V	30 mA
Digital output 51 / 52, passive Terminals 51 / 52	30 V	30 mA	30 V	30 mA

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

Digital outputs 41 / 42 and 51 / 52 are not electrically isolated from each other. Terminals 42 / 52 have the same potential.

* Only in conjunction with additional '24 V DC loop power supply (blue)' plug-in card in slot OC1.

** Only in conjunction with current output U_{CO} / 32 in 'Powermode', see **Current output Uco / 32 as loop power supply for digital output 41 / 42 or 51 / 52** on page 59.

Inputs and outputs with optional plug-in cards	Operating values (general)		Type of protection 'ec' / 'NI'	
	U_N	I_N	U_N	I_N
Current output V3 / V4, active* Terminals V3 / V4 and V1 / V2*	30 V	30 mA	30 V	30 mA
Current output V1 / V2, passive** **Current output V3 / V4, passive**** Terminals V1 / V2** or V3 / V4**	30 V	30 mA	30 V	30 mA
Digital output V3 / V4, active* Terminals V3 / V4 and V1 / V2*	30 V	30 mA	30 V	30 mA
Digital output V1 / V2, passive** **Digital output V3 / V4, passive**** Terminals V1 / V2** or V3 / V4**	30 V	30 mA	30 V	30 mA
Digital input V3 / V4, active* Terminals V3 / V4 and V1 / V2	30 V	3,45 mA	30 V	3,45 mA
Digital input V1 / V2, passive* **Digital input V3 / V4, passive*** Terminals V1 / V2** or V3 / V4**	30 V	3,45 mA	30 V	3,45 mA
Modbus® / PROFIBUS DP® Terminals V1 / V2	30 V	30 mA	30 V	30 mA

* Only in conjunction with additional '24 V DC loop power supply (blue)' plug-in card in slot OC1.

** The terminal assignment depends on the model number or the slot assignments. For connection examples, see **Connection examples** on page 63.

… 2 Use in potentially explosive atmospheres

… Electrical data

Special connection conditions

Note
The AS plug-in card (24 V DC loop power supply) may only be used to power the internal inputs and outputs on the device. It must not be used to power external circuits!

Note
If the protective earth (PE) is connected in the flowmeter's terminal box, you must ensure that no dangerous potential difference can arise between the protective earth (PE) and the potential equalization (PA) in areas with explosion risk.

Note
- For devices with a power supply of 11 to 30 V DC, on-site external overvoltage protection must be provided.
- You must make sure that the overvoltage is limited to 140 % (= 42 V DC) of the maximum operating voltage.

Note
The safety requirements for intrinsically safe circuits in the EC type examination certificate of the device must be complied with.

The output circuits are designed so that they can be connected to both intrinsically-safe and non-intrinsically-safe circuits.
- Combining intrinsically safe and non-intrinsically safe circuits is not permitted.
- On intrinsically safe circuits, potential equalization should be established along the entire length of the cable used for the signal outputs.
- The rated voltage of the non-intrinsically safe circuits is U_M = 30 V.
- Intrinsic safety is preserved If the rated voltage U_M = 30 V is not up-scaled when connections are established to non-intrinsically safe external circuits.
- The information in **Changing the type of protection** on page 23 must be observed when changing the type of protection.

Devices connected to the relevant equipment must not be operated at over 250 V_{rms} AC or 250 V DC to ground.

Installation in accordance with ATEX/IECEx or UKEX must comply with the applicable national and international standards and directives.

Installation in the USA or Canada must comply with ANSI / ISA RP 12.6, 'Installation of intrinsically safe systems for hazardous (classified) locations', the 'National Electrical Code (ANSI / NFPA 70), sections 504, 505' and the 'Canadian electrical code (C22.1-02)'.

Apparatus connected to the flowmeter must have appropriate explosion protection approval in accordance with the Entity concept.
The apparatus must have intrinsically safe circuits.
The apparatus must be installed and connected in accordance with the relevant manufacturer documentation.
The electrical specifications in **Electrical data** on page 15 must be observed.

Installation instructions

ATEX, IECEx and UKEX

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

When operating with combustible dusts, comply with EN 60079-31.

Observe the safety instructions for electric apparatus for potentially explosive atmospheres in accordance with Directive 2014/34/EU (ATEX) or British Regulations (UKEX) and for example IEC 60079-14 (installation of electric equipment in potentially explosive atmospheres).
Comply with the applicable regulations for the protection of employees to ensure safe operation.

cFMus

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

Use in areas exposed to combustible dust

When using the device in areas exposed to combustible dusts (dust ignition), EN 60079-31 as well as the following points must be observed:

- The maximum surface temperature of the device may not up-scale 85 °C (185 °F).
- The process temperature of the attached piping may up-scale 85 °C (185 °F).

- Approved dust-proof cable glands must be used when operating in Zone 21, 22 or in Class II, Class III.

Sensor insulation

Observe the notes in **Sensor insulation** on page 28 if the sensor should be insulated.
Observe the information in **Temperature data** on page 11 regarding temperature class and cable specification.

Opening and closing the housing

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing or terminal box open!
Before opening the transmitter housing or the terminal box, note the following points:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 20 minutes before opening.

⚠ WARNING

Risk of injury due to live parts!
When the housing is open, contact protection is not provided and EMC protection is limited.

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

See also **Opening and closing the housing** on page 48.

Only original spare parts must be used to seal the housing.

Note
Spare parts can be ordered from ABB Service.
www.abb.com/contacts

… 2 Use in potentially explosive atmospheres

… Installation instructions

Cable entries in accordance with ATEX/IECEx and UKEX

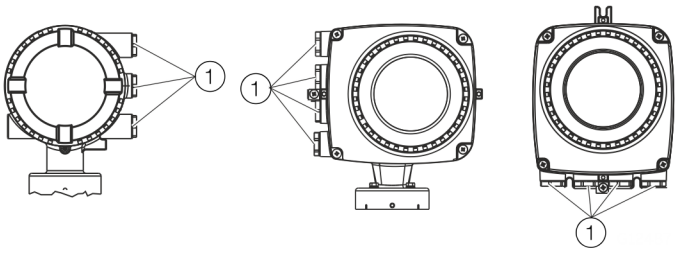
The devices are supplied with cable glands installed (certified in accordance with ATEX or IECEx).

- The use of standard cable glands and closures is prohibited.
- The black plugs in the cable glands are intended to provide protection during transport.
- The outside diameter of the connection cable must measure between 6 mm (0.24 in) and 12 mm (0.47 in) to guarantee the required tightness.
- Black cable glands are installed by default when the device is supplied. If signal outputs are connected to intrinsically safe circuits, replace the black cap on the corresponding cable gland with the blue one supplied.
- Any unused cable entries must be sealed before commissioning in accordance with the applicable standards.

Note

Low-temperature version devices (optional, up to −40 °C (−40 °F) ambient temperature) are supplied with metal cable glands due to the required temperature resistance.

Cable entries in accordance with cFMus



(1) Transport protection plugs

Figure 2: Cable entry

The devices are delivered with ½ in NPT threads with transport protection plugs.

- Unused cable entries must be sealed off prior to commissioning using either approved pipe fittings or cable glands in accordance with national regulations (NEC, CEC).
- Make sure that the pipe fittings, cable glands and, if applicable, sealing plugs are installed properly and are leak-tight.
- If the device is to be operated in areas with combustible dusts, a threaded pipe connection or cable gland with suitable approval must be used.
- The use of standard cable glands and closures is prohibited.

Note

Devices which are certified for use in North America are supplied with a ½ in. NPT thread only and without cable glands.

Electrical connections

Note

The temperature at the cable entries of the device depends on the design, the measuring medium temperature T_{medium} and the ambient temperature $T_{amb.}$.

For the electric connection of the device, use only cables with sufficient temperature resistance in accordance with the tables at **Temperature resistance for the connecting cable** on page 11.

Grounding

The sensor must be grounded in accordance with the applicable international standards.

Perform grounding of the device in accordance with **Terminal assignment** on page 57.

In accordance with NEC standards, an internal ground connection is present in the device between the sensor and the transmitter.

Perform grounding of the device in accordance with **Terminal assignment** on page 57.

Power supply terminal cover

Make sure that the power supply terminal cover is closed tightly, see also **Electrical connections** on page 55.

Process sealing

In accordance with ‘North American Requirements for Process Sealing between Electrical Systems and Flammable or Combustible Process Fluids’.

Note

The device is suitable for use in Canada.

- For use in Class II, Groups E, F and G, a maximum surface temperature of 165 °C (329 °F) may not be up-scaled.
- All cable (conduits) should be sealed from the device within a distance of 18 in (457 mm).

ABB flowmeters are designed for the worldwide industrial market and are suitable for functions such as the measurement of flammable and combustible liquids and can be installed in process pipes.

Connecting devices with cable (conduits) to the electric installation makes it possible for measuring media to reach the electric system.

To prevent measuring media from seeping into the electric installation, the devices are equipped with process gaskets which meet requirements in accordance with ANSI / ISA 12.27.01.

SensyMaster flowmeters are designed as ‘Dual Seal Devices’.

In accordance with the requirements of standard ANSI / ISA 12.27.01, the existing operating limits of temperature, pressure and pressure bearing parts must be reduced to the following limit values:

Limit values	
Flange or pipe material	No limitations
Nominal sizes	DN 25 to 2000 (1 to 78 in)
Operating temperature	
– Standard design	−20 °C to 150 °C (−4 °F to 302 °F)
– Low temperature design	−40 °C to 150 °C (−40 °F to 302 °F)
Process pressure	PN 40 / Class 300

… 2 Use in potentially explosive atmospheres

Operating instructions

Protection against electrostatic discharges

⚠ DANGER

Explosion hazard due to electrostatic charging!

The painted surface of the device can store electrostatic charges.

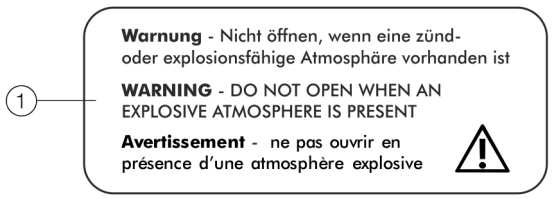
As a result, the housing can form an ignition source due to electrostatic discharges in the following conditions:

- The device is operated in environments with a relative humidity of ≤ 30 %.
- The painted surface of the device is thereby relatively free from impurities such as dirt, dust or oil.
- Instructions on avoiding ignition in potentially explosive environments due to electrostatic discharges in accordance with PD CLC/TR 60079-32-1 and IEC TS 60079-32-1 must be complied with!

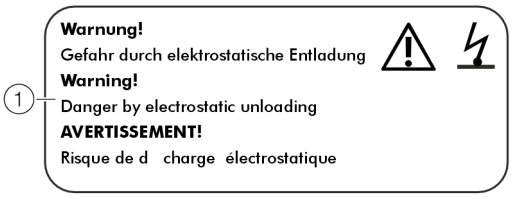
Instructions on cleaning

The painted surface of the device must be cleaned only using a moist cloth.

Devices which are approved for use in potentially explosive atmospheres have additional warning plates.



(1) **Warning** – Do not open in a flammable or potentially explosive atmosphere.



(1) **WARNING!** – Danger due to electrostatic discharge.

Figure 3: Warning signs on the device

Devices with dual-compartment housing with type of protection Ex 'd' flameproof (enclosure)

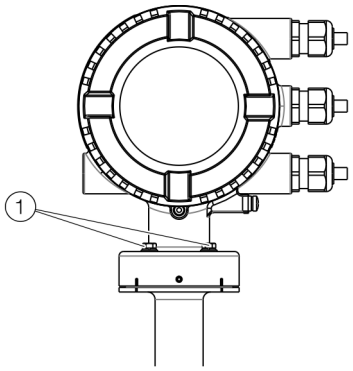


Figure 4: Mounting screws on the dual-compartment transmitter housing

NOTICE

Special conditions for safe use!

For devices with dual-compartment housing with type of protection Ex 'd', the following instructions must be observed:

- The mounting screws (1) used to connect the dual-compartment housing to the sensor shall be M5 × 20 A2 gemäß according DIN 7964.
- The mounting screws shall have a yield stress of at least 210 N/m^2.

Repair

Devices of type of protection 'd' are equipped with flameproof joints in the housing. Contact ABB before commencing repair work.

Changing the type of protection

If you are installing in Zone 1 / Div. 1, the current outputs and digital outputs of models FMT430/450 can be operated with different types of protection:

- Current output and digital output in the 'intrinsically safe ia / IS' design
- Current output and digital output in non-intrinsically safe design

If a device that is already operational is operated with a different type of protection, the following measures must be implemented/insulation checks performed in accordance with applicable standards.

Original installation	New installation	Necessary test steps
Zone 1 / Div. 1: Current outputs and digital outputs in non-intrinsically safe design	**Zone 1 / Div. 1:** Current outputs and digital outputs in intrinsically safe ia / IS design	• 500 × 1.414 = 710 V DC/1min Test between terminals A / B, U_{FE}, /GND, U_{CO} / 32, 31 / 32, 41 / 42, 51 / 52, V1 / V2 and V3 / V4, and terminals A, B, U_{FE}, GND, U_{CO}, 31, 32, 41, 42, 51, 52, V1, V2, V3, V4 and the housing. When this test is performed, no voltage flashover is permitted in or on the device. • Optical evaluation particularly of the electronic circuit boards, no visible damage or evidence of explosion.
Zone 1 / Div. 1: Current outputs and digital outputs in intrinsically safe ia(ib) / IS design	**Zone 1 / Div. 1:** Current outputs and digital outputs in non-intrinsically safe design	• Visual inspection, no damage visible on the threads (cover, ½ in NPT cable glands).

3 Use in hazardous areas in accordance with EAC TR-CU-012

Note

- An additional document with information on EAC-Ex certification is available for measuring systems that are used in potentially explosive atmospheres in accordance with EAC TR-CU-012.
- The information on EAC-Ex certification is an integral part of this instruction. As a result, it is crucial that the installation guidelines and connection values it lists are also observed.
  The icon on the name plate indicates the following:

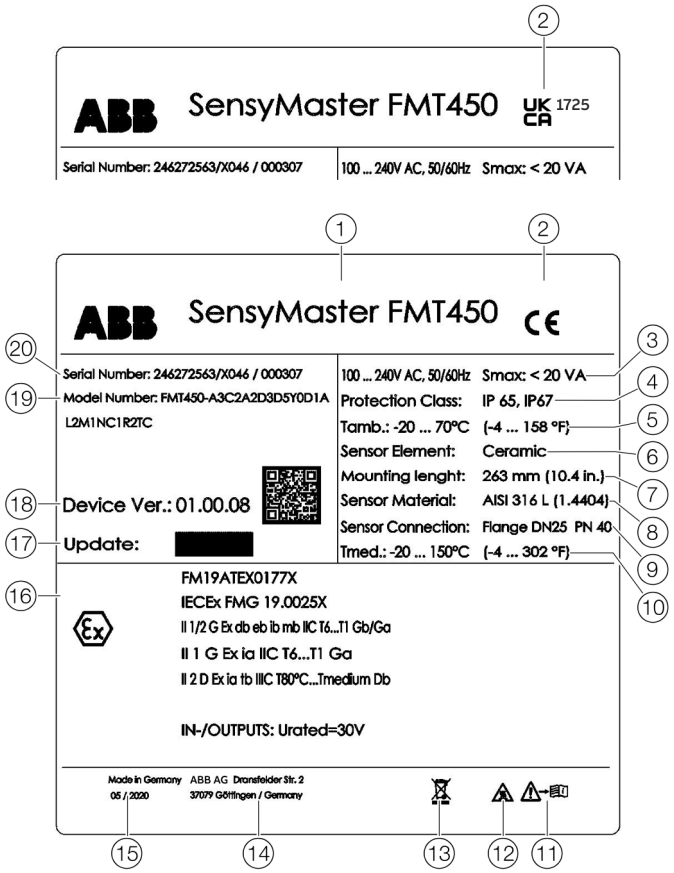
Information on EAC-Ex certification is available for free download at the following link. Alternatively simply scan the QR code.

INF/FMT200/FMT400/EAC-Ex-X8

4 Product identification

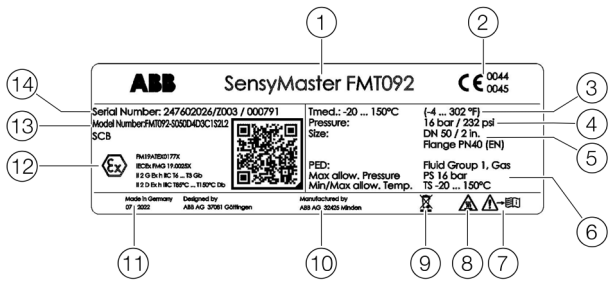
Name plate

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



1. Type designation
2. CE mark/UKCA mark with notified body
3. Power supply
4. IP- / NEMA IP rating
5. Ambient temperature range (T_{amb})
6. Sensor element design
7. Sensor installation length
8. Wetted material
9. Sensor connection
10. Measuring medium temperature range (T_{medium})
11. 'Read operating instruction' symbol
10. 'Hot surface' symbol
13. 'Disposal' symbol
14. Manufacturer's address
15. Manufacturing date (month/year)
16. Ex marking
17. Device firmware update field
18. Device firmware revision
19. Order code
20. Serial number

Figure 5: Name plate (example)



1. Type designation
2. CE mark/UKCA mark with notified body
3. Measuring medium temperature range (T_{medium})
4. Maximum operating pressure
5. Nominal diameter
6. Information on pressure equipment directive
7. 'Read operating instruction' symbol
8. 'Hot surface' symbol
9. 'Disposal' symbol
10. Manufacturer address
11. Manufacturing date (month / year)
12. Ex marking
13. Order code
14. Serial number

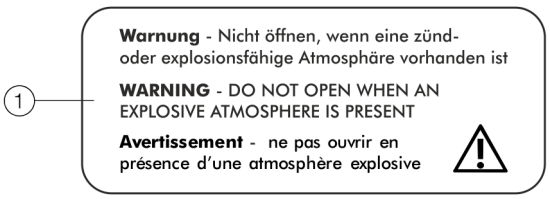
Figure 6: Pipe component name plate

Note

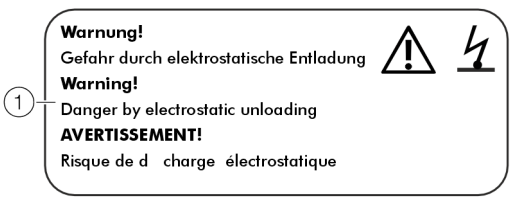
Products that are marked with the adjacent symbol may **not** be disposed of as unsorted municipal waste (domestic waste).
They should be disposed of through separate collection of electric and electronic devices.

Plates and symbols

Devices which are approved for use in potentially explosive atmospheres have additional warning plates.



1. **Warning** – Do not open in a flammable or potentially explosive atmosphere.



1. **WARNING!** – Danger due to electrostatic discharge.

Figure 7: Warning signs on the device

5 Transport and storage

Inspection

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

Transport

⚠ DANGER

Life-threatening danger due to suspended loads.
In the case of suspended loads, a danger of the load falling exists.

- Standing under suspended loads is prohibited.

⚠ WARNING

Risk of injury due to device slipping.
The device's center of gravity may be higher than the harness suspension points.

- Make sure that the device does not slip or turn during transport.
- Support the device laterally during transport.

Storing the device

Bear the following points in mind when storing devices:

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

Observe the following instructions:

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

If the original packaging material is no longer available, wrap the device in bubble wrap or corrugated cardboard and place it in a box of sufficient size lined with a shock-absorbing material (e.g., foam rubber). The thickness of the padding should be appropriate for the device weight and type of shipment. The box must be labeled as “fragile”.

For overseas shipment, always add a desiccant (e.g., silica gel) and hermetically seal the device plus desiccant in a layer of polythene that is 0.2 mm thick. Use an amount of desiccant that is appropriate for the packing volume and the expected transport time (at least for three months). You should also line the box with a layer of union paper.

Ambient conditions

Storage temperature range

Standard design:
−20 to 85 °C (−4 to 185 °F),
Low temperature design:
−40 to 85 °C (−40 to 185 °F)

Relative humidity

Maximum 85 % RH, annual average ≤ 65 % RH

Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes.
Fill out the return form (see **Return form** on page 91) and include this with the device.
In accordance with the EU Directive governing hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes:
All devices delivered to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Address for returns:
Please contact Customer Center Service according to page 5 for nearest service location.

6 Installation

Safety instructions

⚠ DANGER

Danger to life due to piping under pressure!

Sensors which may eject during installation or removal in piping remaining under pressure may pose a danger to life.

- Install or remove a sensor only if the piping is depressurized.
- As an alternative, use a pipe component with an integrated hop tap fitting.

⚠ WARNING

Risk of injury due to process conditions.

The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when working on the device.

- Before working on the device, make sure that the process conditions do not pose any hazards.
- If necessary, wear suited personal protective equipment when working on the device.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

Installation conditions

Installation location and assembly

Note the following points when selecting the installation location and when mounting the sensor:

- The ambient conditions (IP rating, ambient temperature range $T_{ambient}$) of the device must be adhered to at the installation location.
- Sensors and transmitters must not be exposed to direct sunlight. If necessary, provide a suitable means of sun protection on site. The limit values for ambient temperature $T_{ambient}$ must be adhered to.
- On flange devices, ensure that the counterflanges of the piping are aligned plane parallel. Only install flange devices with suitable gaskets.
- Prevent the sensor from coming into contact with other objects.
- The device is designed for industrial applications.
  No special EMC protective measures are required if the electromagnetic fields and interference at the installation location of the device comply with 'Best Practice' (in accordance with the standards listed in the declaration of conformity).
  Maintain a suitable distance from electromagnetic fields and interference that extend beyond the usual dimensions.

Seals

Users are responsible for selecting and mounting suitable gaskets (material, shape).

Note the following points when selecting and mounting gaskets:

- Use gaskets made from a material that is compatible with the measuring medium and measuring medium temperature.
- Gaskets must not extend into the flow area, since possible turbulence may influence the accuracy of the device.

Inlet and outlet sections

The figures below show the recommended inlet and outlet sections for various installations.

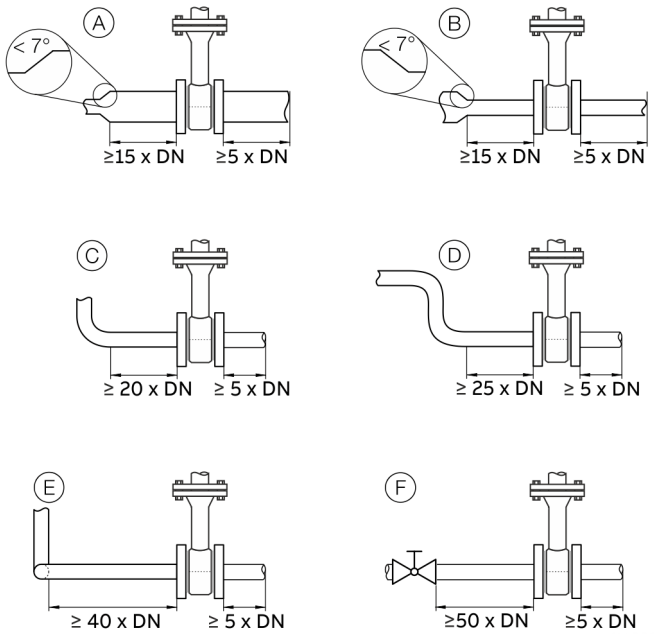


Figure 8: Inlet and outlet sections

Installation	Inlet section	Outlet section
(A) Pipe extension	min. 15 × DN	min. 5 x DN
(B) Pipe reduction	min. 15 × DN	
(C) 90° Pipe elbow	min. 20 × DN	
(D) 2 × 90° pipe elbow in one level	min. 25 × DN	
(E) 2 × 90° pipe elbow in two levels	min. 40 × DN	
(F) Control Valve	min. 50 × DN	

To achieve the specified measuring accuracy, the indicated inlet and outlet sections are required.
In case of combinations of several inlet-side effects, e.g. valve and reduction, the longer inlet section must be taken into account.

In case of confined spaces at the installation site, the outlet section can be shortened to 3 × DN. However, reducing the specified inlet section will reduce the achievable level of accuracy.
A high repeatability of the measured value is maintained.

In case of insufficient inlet and outlet sections, a special calibration may be possible. To do this, a detailed reconciliation is necessary for individual cases.
The specified inlet and outlet sections must be doubled for gases with a very low density (hydrogen, helium).

… 6 Installation

… Installation conditions

Installation at high ambient temperatures

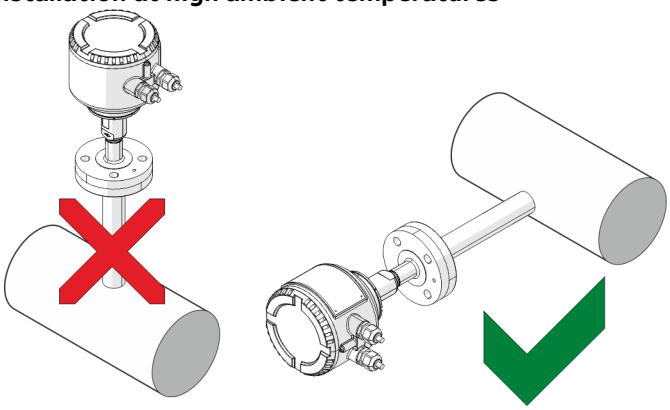
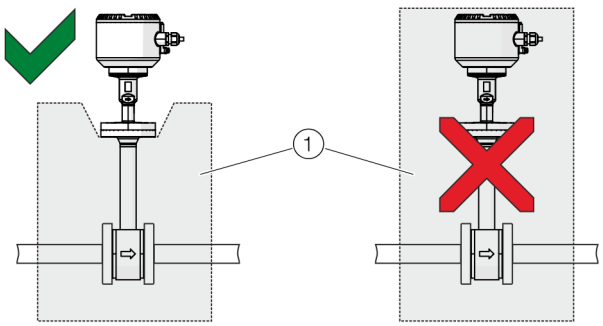


Figure 9: Mounting position at high ambient temperatures

Under high but permissible ambient temperatures, avoid additional thermal stress from heat convection or radiation, since these sources of heat may exceed the permissible ambient temperature on the equipment surface.

If the device needs to be installed directly on a hot, horizontal piping, we recommend installing it on the side. In such cases, you should avoid installing it in the 12 o'clock position, otherwise the warm air that rises up will cause additional heating of the electronics.

Sensor insulation



① Insulation

Figure 10: Isolation of the sensor

The sensor may be insulated as shown in **Figure 10**.

Ambient conditions

Ambient temperature

- Standard: −20 to 70 °C (−4 to 158 °F)
- Optional: −40 to 70 °C (−40 to 158 °F)

Relative humidity

Maximum 85 % RH, annual average ≤ 65 % RH

IP rating

In accordance with EN 60529: IP 65 / IP 67

NEMA IP rating

NEMA 4X

Process conditions

Measured medium temperature

Note

When using the device in potentially explosive atmospheres, note the additional temperature data in **Temperature data** on page 11!

Devices with ceramic sensor element and flanged connection:

Design	T_{medium}
Standard and explosion-proof design	−20 to 150 °C (−4 to 302 °F)
High temperature design*	−20 to 300 °C (−4 to 572 °F)
Low temperature design	−40 to 150 °C (−40 to 302 °F)
DVGW Version	−20 to 100°C (−4 to 212 °F)

* Not in connection with explosion-proof design.

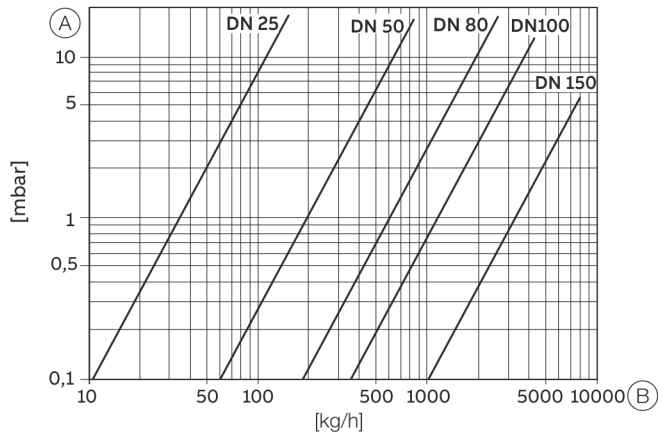
The approved measuring medium temperature T_{medium} also depends on the selected sensor connection and the design of the pipe components.
The following temperature specifications apply:

Sensor connection	T_{medium}
Flange DN25	−40 to maximum 300 °C (−40 to maximum 508 °F)
Threaded connection DIN 11851	−20 to 140 °C (−4 to 284 °F)
Clamp ring fitting	−40 to 150 °C (−40 to 302 °F)
Pipe components with ball valve	Maximum 150 °C (302 °F)
Integrated hot tap fitting	−20 to 150 °C (−4 to 302 °F)

Maximum operating pressure

Sensor connection	Maximum measuring medium pressure P_{medium}
Flange in accordance with DIN EN 1092, PN 40	4 MPa, 40 bar (580 psi)
Threaded connection DIN 11851	1.6 MPa, 16 bar (232 psi)
Clamp ring fitting	2 MPa, 20 bar (290 psi)
Integrated hot tap fitting	See **Material loads for process connections** on page 29

Pressure loss



Ⓐ Pressure loss Ⓑ Mass flow

Figure 11: Pressure loss in logarithmic representation

Material loads for process connections

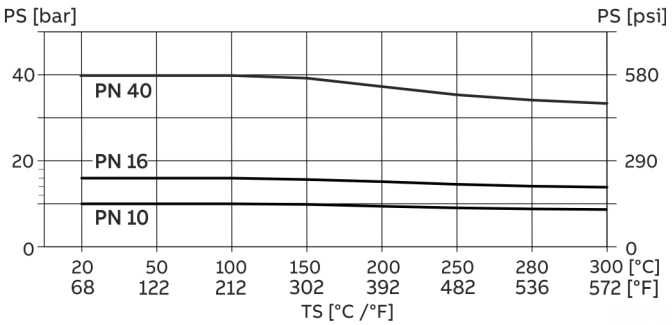


Figure 12: DIN flange process connection

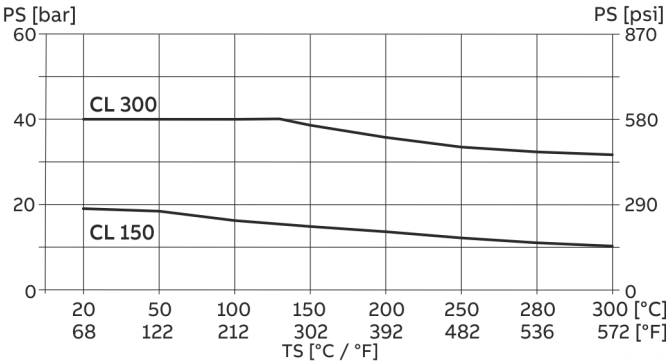


Figure 13: ASME flange process connection

The maximum approved operating pressure for CL 300 is limited to 40 bar (580 psi).

… 6 Installation

Assembly of the pipe component

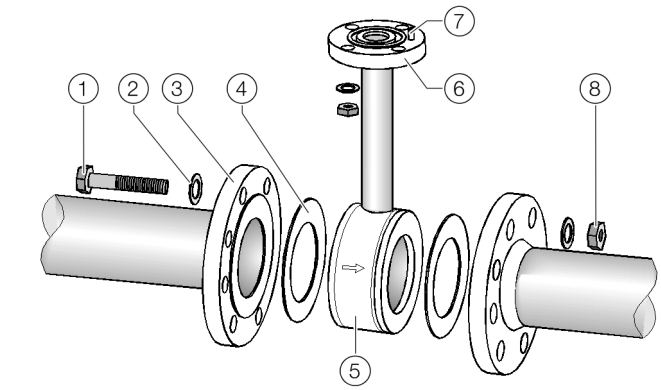
When installing the pipe components, observe the following points:

- During installation, it is important to ensure that the flow direction corresponds to the attached label.
- When welding the welding adapter, remember to observe the relevant welding instructions. The amount of heat introduced must be kept to an absolute minimum to prevent warping of the mounting flange's sealing surface.
- In the case of flanged connections, install gaskets which are in perfect condition and resistant to measuring media.
  ABB recommends the use of spiral gaskets in accordance with DIN EN 1514-2 or ASME B16.20
- Before installing pipe components or sensors, check all components and gaskets for damage.
- Pipe components must not be installed under tension, otherwise the piping may exert impermissible forces on the device.
- When assembling the flanged connections, use screws that have the required strength and dimensions, quality class A2-70 or A4-70.
- The screws must be tightened evenly and to the required torque.
- Once the pipe components have been installed, the insertion connection must be sealed by means of a blind flange plus gasket or by closing a shut-off device (if present).

Material fatigue in pipe components

Pipe components may only be used in such a way that they are not subject to fatigue stress.
A maximum of 1000 load changes at Δp = PS (40 bar [580 psi]) and any number of load changes at Δp = PS/10 (4 bar [58 psi]) are permissible.

Wafer type design (FMT091) and partial measuring section (FMT092)



1. Flange screw
2. Washer
3. Flange
4. Flange gasket
5. Pipe component
6. Sensor connection
7. Centering pin, outflow side
8. Nut

Figure 14: Installing a pipe component (example, wafer type design)

1. Position the pipe component coplanar and centered between the piping. The flow direction must correspond to the arrow indicated on the pipe component. The centering pin on the pipe component must be located on the outflow side (behind the measuring point).
2. Install gaskets between the sealing surfaces.

Note

For achieve the best measurement results, make sure the gaskets fit concentrically with the pipe component.

- The inside diameter of the pipe and flange must precisely match in the wafer type design. Any differences in levels or edges, or untidy weld seams, will reduce the measuring accuracy.
- To guarantee that the flow profile is not distorted, the gaskets must not protrude into the piping.

3. Use the appropriate screws for the holes.
4. Slightly grease the threaded nuts.
5. Tighten the nuts in a crosswise manner in accordance with the figure. First tighten the nuts to approx. 50 % of the maximum torque, then to 80 %, and finally a third time to the maximum torque.

Note

Torques for screws depend on temperature, pressure, screw and gasket materials. The relevant applicable regulations must be taken into consideration.

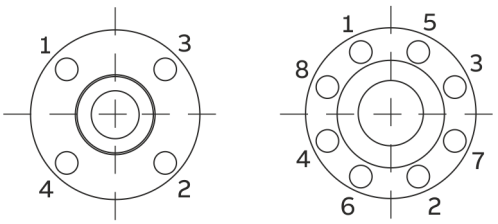


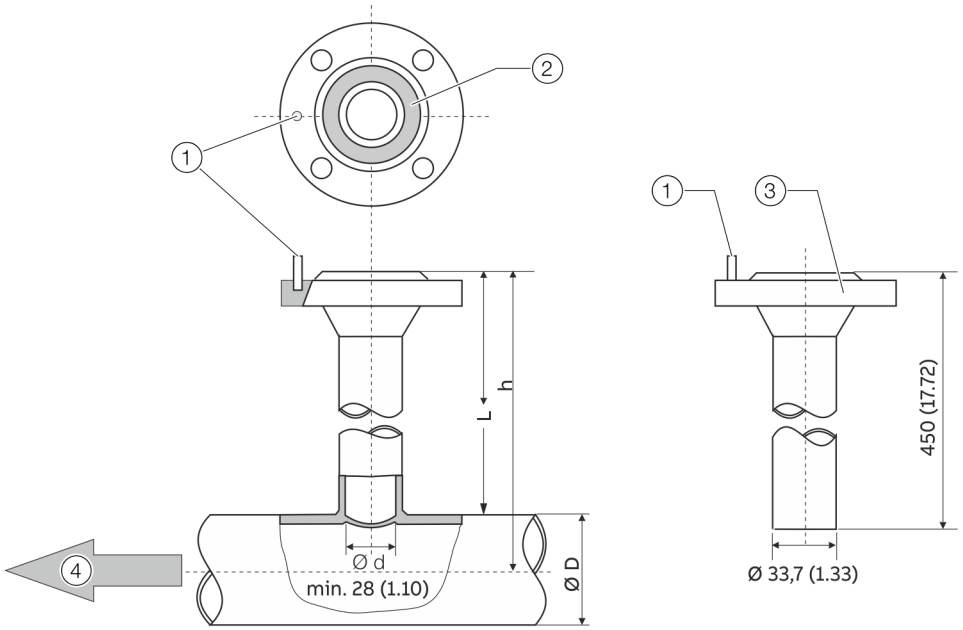
Figure 15: Tightening sequence for the flange screws

… 6 Installation

Assembly of the welding adapter with flange or threaded connector

Welding adapter with flange connector

Dimensions in mm (in)



1 Centering pin
2 Groove for O-ring
3 Connection flange DN 25 (1 in)
4 Flow direction

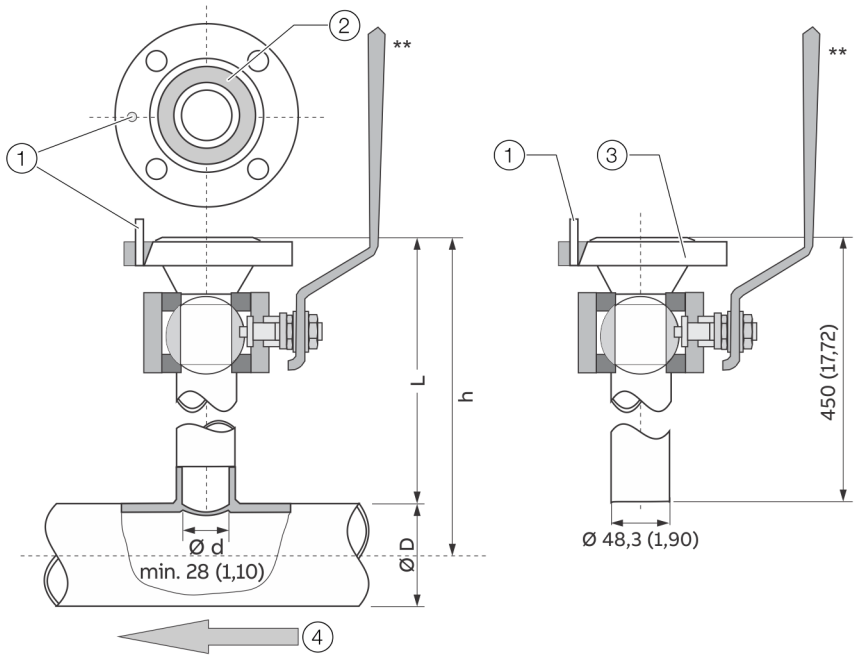
Figure 16: Dimensions in mm (in)

h – sensor length	Ø D – outer pipe diameter
263 (10.35)	80 to 350 (3.24 to 13.78)
425 (16.73)	> 350 to 700 (> 13.78 to 27.56)
775 (30.51)	> 700 to 1400 (> 27.56 to 55.12)*

* The limitation of the maximum pipe diameter only applies for installations with a sensor element in the middle of the pipe. In case of larger or non-round cross-sections, a non-centered position of the measuring element in the piping is considered in the calibration.

Weld-on adapter with ball valve

Dimensions in mm (in)



1. Centering pin
2. Groove for O-ring
3. Connection flange DN 25 (1 in)
4. Flow direction

Figure 17: Dimensions in mm (in)

h – sensor length	Ø D - outer pipe diameter
263 (10.35)	80 to 150 (3.24 to 5.91)
425 (16.73)	> 150 to 500 (> 5.91 to 19.69)
775 (30.51)	> 500 to 1150 (> 19.69 to 45.28)*

* The limitation of the maximum pipe diameter only applies for installations with a sensor element in the middle of the pipe. In case of larger or non-round cross-sections, a non-centered position of the measuring element in the piping is considered in the calibration.

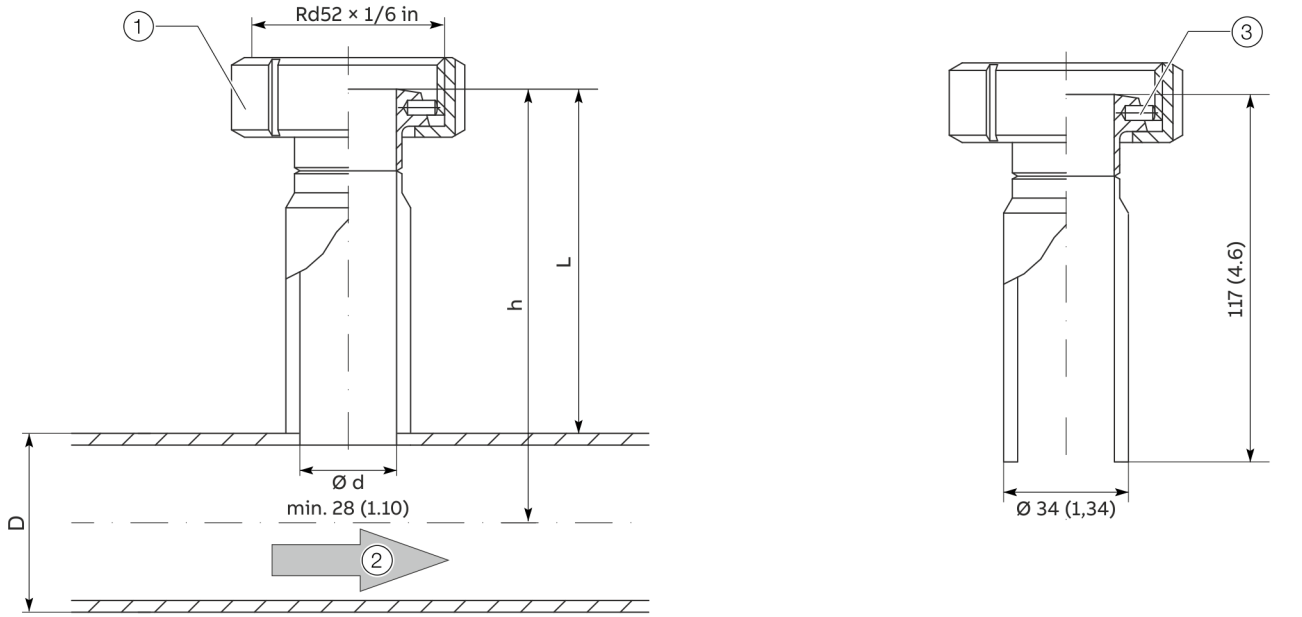
** Ball valve T_{medium}: maximum 150 °C (302 °F), explosion protection approval for use in ATEX/IECEx/UKEX Zone 2 or cFMus Div. 2.

… 6 Installation

… Assembly of the welding adapter with flange or threaded connector

Welding adapter with threaded connection in accordance with DIN 11851

Dimensions in mm (in)



1 Union nut

2 Flow direction

3 Centering pin

Figure 18: Dimensions in mm (in)

Mounting

Consider the following points when installing the welding dater in the piping:

- After welding, the welding adapter must have a length of L (see chapter **Figure 16** on page 32 and **Welding adapter with threaded connection in accordance with DIN 11851** on page 34).

$$L = h - (1/2 \times D)$$

L	Length of the welding adapter
h	Installation length of the sensor
D	Outside diameter of the pipeline

- Shorten the length of the welding adapter as needed before welding it on. After welding, the welding adapter may protrude into the piping no more than 10 mm (0.39 in).
- Observe thickness of pipeline wall and degree of shrinkage when welding!
- The distance h from the upper edge of the adapter flange to the pipe central axis must be within a tolerance of ±2 mm (0.08 in).
- Maintain a right angle to the pipe axis (max. tolerance 2°).
- The adapter centering pin must be aligned with the pipe axis in the flow direction (outflow side, behind the measuring point).
- Once welding is complete, there must be free clearance of at least 28 mm (1.10 in) to install the sensor; drill to create clearance as needed.

Additional instructions for welding adapter with ball valve

⚠ DANGER

Danger to life due to improper installation!

During welding, the gaskets in the ball valve may overheat. This can lead to the measuring medium escaping in an uncontrolled manner. This can result in severe injuries or death.

- Remove the ball valve before welding.

Versions featuring a ball valve enable the flowmeter sensor to be installed and disassembled at low gauge pressures in the pipeline with minimal gas leakage.

The design with ball valve is installed as described above, but the following indications must be observed in addition:

- To install the sensor, the ball valve must be opened completely. Then, the flowmeter sensor can be installed along with the appropriate gasket and screwed into place.
- Before disassembling the sensor, make sure that the pipeline has been depressurized. Then, you can release the screws on the flange, remove the flowmeter sensor and close the ball valve.

NOTE

Damage to the sensor.

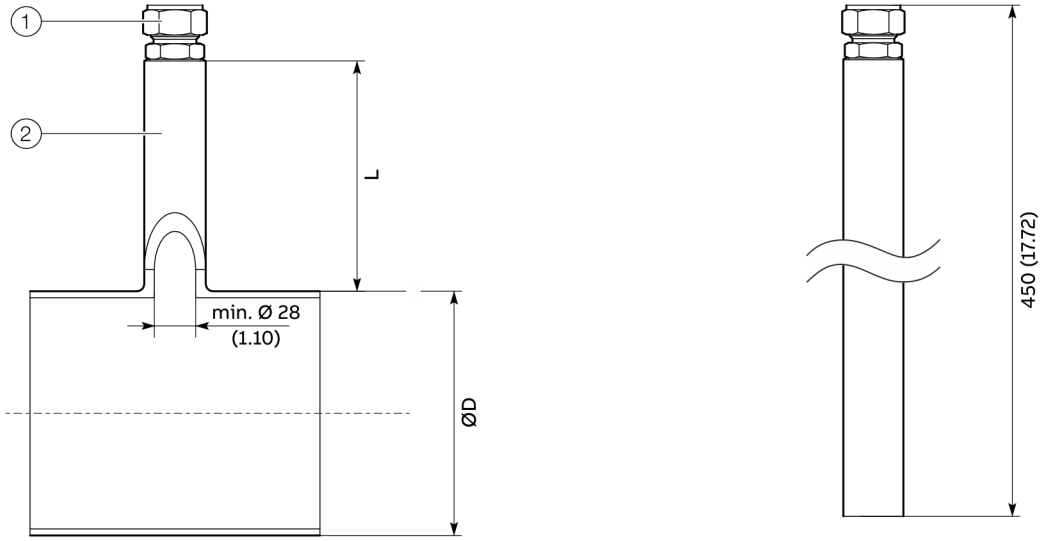
Closing the ball valve before you remove the sensor can seriously damage the protective cage or the sensor elements.

- Do not close the ball valve until the sensor has been removed.

… 6 Installation

Assembly of the welding adapter with compression ring fitting

All dimensions in mm (in)



① Compression fitting

② Welding tube for the compression fitting

Figure 19: Welding adapter with compression fitting

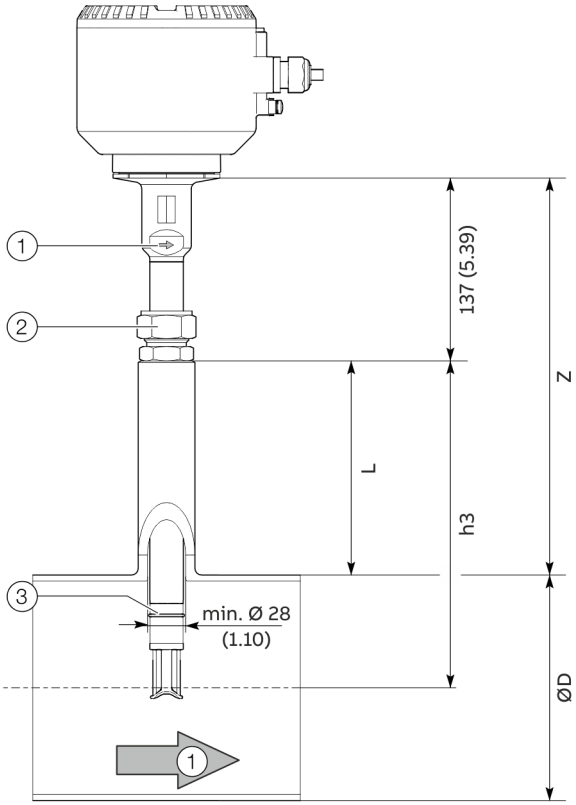
h – sensor length	h3 – installation length	L = h3 –(½ × ØD)	ø D – outer pipe diameter*
263 (10.35)	244 (9.61)	to be calculated	≥ 80 to 350 (≥ 3.24 to 13.78)
425 (16.73)	406 (15.98)		> 350 to 700 (> 13.78 to 27.56)
775 (30.51)	756 (29.76)		> 700 to 1400 (> 27.56 to 55.12)

Table 1: Dimensions of welding adapter with compression fitting

* The limitation of the maximum pipe diameter only applies for installations with thermal sensor elements in the middle of the pipe. In case of larger or non-round cross-sections, a non-centered position of the thermal sensor elements in the piping is considered in the calibration.

Mounting

Calculation of mounting dimensions



L	Length of the welding adapter	h3	Installation length of the sensor
Z	Height dependent on nominal diameter	ØD	Outside diameter of the piping

(1) Flow direction (arrow marker on the protection tube)
(2) Compression fitting
(3) Safety snap ring

Figure 20: Calculating mounting dimensions

Calculations (mm)

L = h3−(½×ØD)
Z = (h3+137 mm)−(½×ØD)

Calculations (in)

L = h3−(½×ØD)
Z = (h3+5.39 in)−(½×ØD)

Preparing the sensor

⚠ DANGER

Fire hazard in oxygen applications

Fire hazard in oxygen applications due to the use of unapproved thread sealing compound.

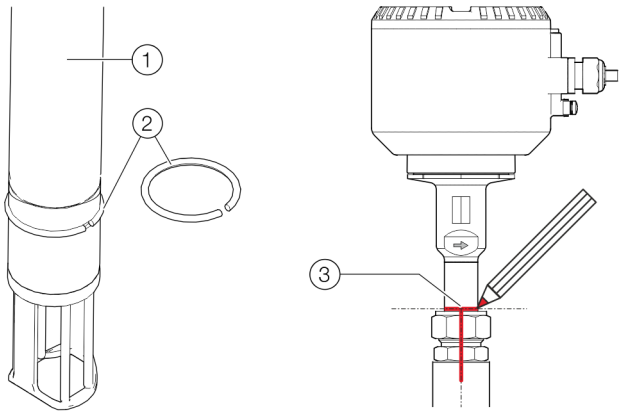
- Use only approved thread sealing compound for oxygen applications!

⚠ WARNING

Risk of injury

Risk of injury due to the sensor ejecting because of a missing safety ring.

- Mount the sensor with compression fitting only with the safety ring in place.



(1) Sensor protection tube
(2) Safety snap ring
(3) Marking for reinstallation

Figure 21: Snap ring and marking

1. Slide the compression fitting onto the sensor and tighten by hand so that the compression fitting can still be moved.
2. Insert the safety snap ring using mounting pliers (see Figure 21, Pos. (2)).

Note

For gas-tight sealing of the NPT thread of the compression fitting, you can for example use special thread sealing compounds by Swagelok such as SWAK™, Silver Goop™, PTFE-Free, etc., or PTFE thread sealing tape.

… 6 Installation

… Assembly of the welding adapter with compression ring fitting

First installation of the sensor

When mounting the sensor, a distinction is made between **first installation** and reinstallation. We will address **first installation** below.

Please also follow the 'An Installer's Pocket Guide for Swagelok® Tube Fittings – MS-13-151.pdf' available at www.swagelok.de/en.

Required tools

- Open-end wrench, width across flats 35 mm (1⅜ in)
- Open-end wrench, width across flats 38 mm (1½ in)
- Caliper gage or comparable measurement tool
- Marker pen (permanent marker) for marking

Description of first installation

1. Carefully insert the prepared sensor into the welding adapter.

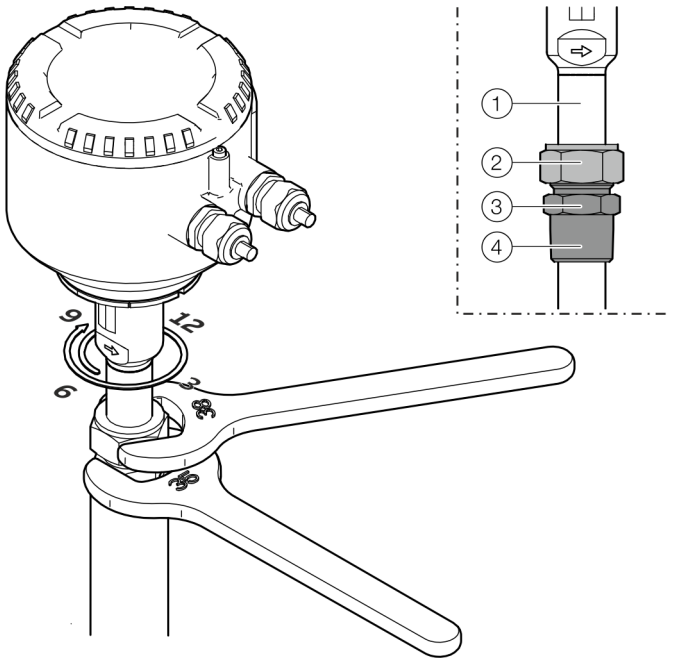
NOTICE

Damage to the device

Mechanical damage to the sensor element can occur due to improper installation.

- When inserting into the welding adapter, the sensor protection frame must not hit the bottom of the piping.

2. Screw in the compression fitting (with thread sealing compound) into the welding adapter, first by hand and then tighten with 1.5 to 2.5 turns.
3. Move the sensor to the correct height for the calculated 'Z' dimension (see Figure 20) and secure the compression fitting against shifting by tightening the union nut by hand.
4. Align the sensor such that the lateral flow arrow on the upper sensor protection tube end points in the exact direction of the flow.
5. Using a suited marker pen, mark the orientation and height of the sensor on the sensor protection tube, compression fitting and the welding adapter (see Figure 21, pos. ③). The marking on the union nut is also used as a starting position (6 o'clock position, see Figure 22) for the tightening of the compression fitting



① Sensor protection tube
② Union nut
③ Fitting body
④ Thread

Figure 22: Tighten sensor

6. Using an open-end wrench, hold the fitting body in position and with another open-end wrench, tighten the union nut by 1¼ turns clockwise to the 9 o'clock position.
   In the process, check the orientation of the sensor with the help of the markings and correct as needed.
   To achieve maximum measuring accuracy, the 'Z' dimension must be set with a tolerance of ±2 mm (±0.08 in) during installation of the sensor.

Note

Before commissioning, the tightness and compressive strength of the measuring point must be guaranteed!

- In addition, check the fittings using a suited leak detection spray.

Disassembly and reinstallation of the sensor
When mounting the sensor, a distinction is made between first installation and **reinstallation**. We will address **reinstallation** below.

Please also follow the 'An Installer's Pocket Guide for Swagelok® Tube Fittings – MS-13-151.pdf' available at www.swagelok.de/en.

Required tools

- Open-end wrench, width across flats 35 mm (1⅜ in)
- Open-end wrench, width across flats 38 mm (1½ in)
- Marker pen (permanent marker) for marking

Disassembly of the sensor

⚠ WARNING

Risk of injury due to process conditions
The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when working on the device.

- Before working on the device, make sure that the process conditions do not pose any hazards.
- If necessary, wear suited personal protective equipment when working on the device.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

1. Depressurize and empty the device / piping, allow to cool and purge if necessary.
2. Switch off the power supply of the sensor and remove the connection cable.
3. Using a suited marker pen, mark the orientation and height of the sensor on the sensor protection tube, compression fitting and the welding adapter (see Figure 21, pos. ③).
4. Carefully loosen the union nut of the compression fitting and hold the sensor while doing so to prevent the sensor protection frame from hitting the bottom of the piping.

NOTICE

Damage to the device
Mechanical damage to the sensor element can occur due to improper disassembly.

- The sensor protection frame must not hit the bottom of the piping.

5. Loosen the fitting body of the compression fitting on the welding adapter and pull out together with the sensor.

Note
Very high clamping forces are exerted on the clamp ring when the compression fitting is tightened. As a result, the clamp ring is slightly pressed into the sensor protection tube. The compression fitting can no longer be moved on the sensor protection tube and the 'Z' dimension can be easily adjusted again.

Reinstallation of the sensor

⚠ WARNING

Risk of injury
Risk of injury due to the sensor ejecting because of a missing safety ring.

- Mount the sensor with compression fitting only with the safety ring in place.

1. Make sure that the safety snap ring is inserted in the provided snap ring groove (see Figure 21, pos. ②).
2. Apply sealing compound to the pipe thread of the fitting body.
3. Carefully insert the sensor into the welding adapter.

NOTICE

Damage to the device
Mechanical damage to the sensor element can occur due to improper installation.

- When inserting into the welding adapter, sensor protection frame must not hit the bottom of the piping.

4. Screw in the compression fitting (with thread sealing compound) into the welding adapter, first by hand and then tighten with 1.5 to 2.5 turns.
5. Align the sensor in accordance with the marking (height and direction of flow) and tighten the union nut up to the marked position.

… 6 Installation

Assembly of the welding adapter with hot tap fitting

⚠ DANGER

Explosion hazard

Explosion hazard during installation or operation of the integrated hot tap fitting in potentially explosive atmospheres of Zone 0.

- Install and operate the integrated hot tap fitting only outside of potentially explosive atmospheres or in Zone 2 / Div.2 or Zone 1 / Div. 1.

Wafer type design

Installation of the wafer type design is performed as explained in **Wafer type design (FMT091) and partial measuring section (FMT092)** on page 31.

Explosion protection approval

The integrated hot tap fitting is approved for use in potentially explosive atmospheres of ATEX/IECEx/UKEX Zone 1 and Zone 2 or cFMus Div. 1 and Div. 2.

Use in Zone 0 is not permitted!

Measured medium temperature

Refer to **Measured medium temperature** on page 28.

Welding design

⚠ DANGER

Danger to life!

Danger to life caused by changes to the hot tap fitting. This can lead to the measuring medium escaping in an uncontrolled manner.

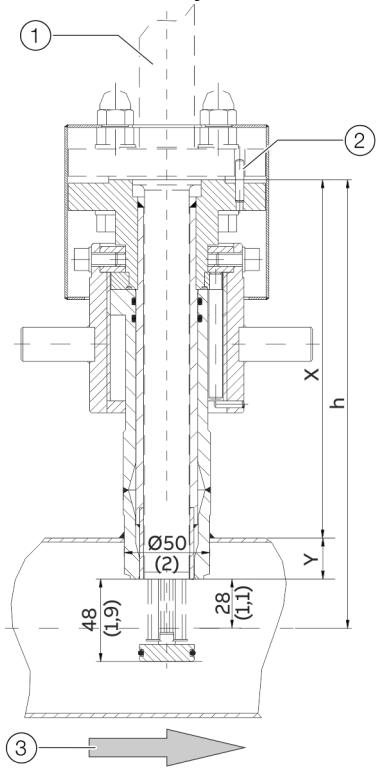
- Do not shorten hot tap fitting components or interfere with the design.

The welding version of the integrated changing device is available in two installation lengths:

- for nominal diameters DN 100 to 125 (4 to 5 in) and
- for nominal diameters DN 150 to 300 (6 to 12 in).

Note

- The sensor length **h** is 425 mm (16.73 in) respectively.
- The installation depth **Y** depends on the pipe diameter and must be calculated individually.



1 Sensor
2 Centering pin
3 Flow direction

Figure 23: Integrated hot tap fitting in measurement position, dimensions in mm (in)

Calculation of the installation length X and installation depth Y

$$X = h - \left(D / 2\right)$$

$$Y = \left(D / 2\right) - 28\ mm\ (1.1\ inch)$$

X Outside length of the integrated changing device
Y Installation depth of the integrated changing device
h Sensor length
D Outside diameter of the pipeline

Example

- Sensor length h = 425 mm (16.73 in)
- Pipe with outside diameter of 210 mm (8.27 in)
- The hot tap fitting is in measurement position

X = 425 mm – (210 mm / 2) = 320 mm
Y = (210 mm / 2) – 28 mm = 77 mm

Consider the following points when installing the welding version in the piping:

- Maintain a right angle to the pipe axis (max. tolerance 2°).
- The adapter centering pin must be aligned with the pipe axis in the flow direction (outflow side, behind the measuring point).

NOTE

Damage to components
If the welded joints become hot, warping of the sealing surfaces and / or damage to the O-rings can occur.

- Pause occasionally to allow the fitting to cool.

NOTE

Impact on measuring accuracy
Deviations from the stated dimension and position tolerances have an impact on measuring accuracy.

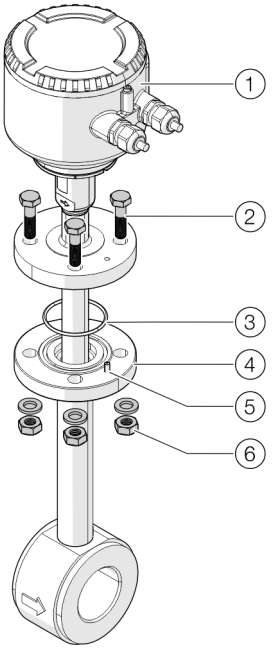
… 6 Installation

Installing the sensor

When installing the sensor, observe the following points:

- Installation in the pipe component or welding adapter is only possible if the sensor data matches the measuring point specifications.
- The sensor may be sealed only by using the O-ring supplied in the scope of delivery. The O-ring must be placed in the designated groove on the sensor connection.
- The sensor elements may not be damaged when inserting the sensor into the pipe component.
- If you are using an integrated hot tap fitting, you must check that the hot tap fitting is in the disassembly position before releasing the fixing screws.

Wafer type design and welding adapter



1	Sensor	4	Sensor connection
2	Flange screws	5	Centering pin
3	O-ring	6	Washers and nuts

Figure 24: Installing a sensor (example)

Installing the sensor:

1. Place the supplied O-ring in the groove of the sensor connection.
2. Carefully slide the sensor into the pipe component. Observe correct alignment to the centering pin in the process
3. Fasten the sensor to the sensor connection using screws. Tighten the flange screws simultaneously by applying the required
   torque (torque for supplied screws, non-lubricated, without use of spring washers: 87 Nm).

Installation / Disassembly of the sensor in connection with the hot tap fitting

Safety instructions

⚠ DANGER

Danger to life due to piping under pressure!

If the hot tap fitting is in the measurement position during disassembly of the sensor, this may pose a danger to life due to the possibility of the sensor being ejected.

- Disassemble the sensor only if the hot tap fitting is in the disassemble position.

⚠ DANGER

Danger to life due to leaking measuring medium!

If the changing device is in the measurement position during disassembly of the sensor or gaskets in the changing device are damaged, leaking measuring medium may pose a danger to life.

- Make sure that the hot tap fitting is in the disassemble position.
- If measuring medium should start to leak in spite of this, immediately stop disassembly of the sensor and tighten the fixing screws.
- Drain and rinse the piping before disassembling the sensor, check and repair the hot tap fitting.

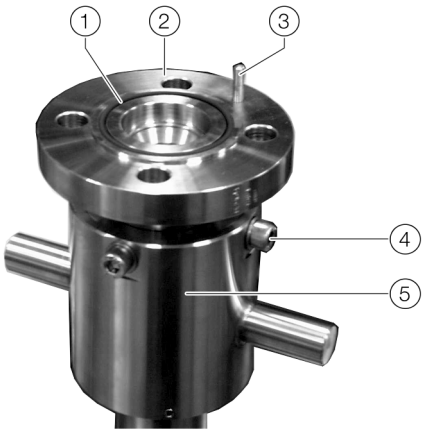
NOTICE

Damage to the changing device

Using tools or other devices to operate the lock nut can damage the hot tap fitting.

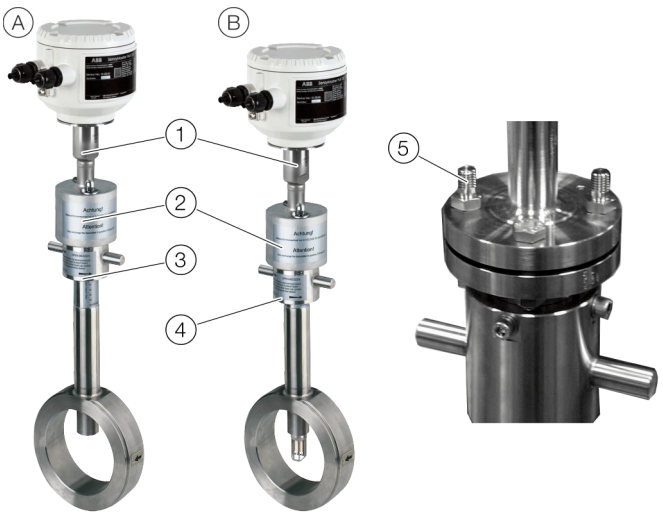
- Operate the union nut by hand only.

Overview



1. O-ring
2. Sensor connection
3. Centering pin
4. Screws for securing the guide tube
5. Union nut

Figure 25: Sensor connection on the hot tap fitting



A. Integrated hot tap fitting in disassembly position
B. Integrated hot tap fitting in measurement position
1. Sensor
2. Protection cap
3. Union nut in disassembly position
4. Union nut in measurement position
5. Special screws for protection cap

Figure 26: Sensor installation and disassembly

… 6 Installation

… Installation / Disassembly of the sensor in connection with the hot tap fitting

Disassembly of the sensor

⚠ DANGER

Danger to life due to leaking measuring medium!
Depending on the pressure in the piping, up to one liter of measuring medium can escape during disassembly of the sensor.

- Make sure that no hazardous atmosphere results from the escaping medium.
- Use safety equipment appropriate to the medium (poisonous, explosive, flammable, corrosive, toxic, etc.)

⚠ DANGER

Danger to life!
Danger to life due to leaking measuring medium from the disassembled sensor and the piping in operation.

- Secure the hot tap fitting against unintended use with a blind flange.
- Attach a warning label.

Initial position

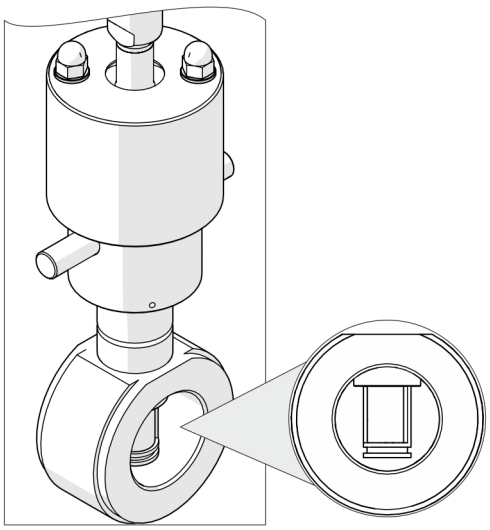


Figure 27: Integrated hot tap fitting in measurement position

The integrated hot tap fitting is in the measurement position, the sensor element fully protrudes in the piping cross-section.

Disassembly of the sensor

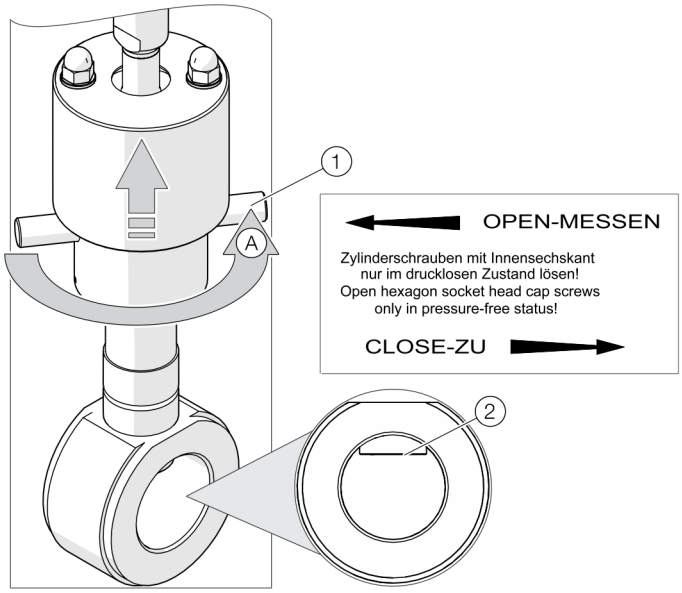


Figure 28: Setting the integrated hot tap fitting in disassembly position

1. Disconnect the electrical connections on the sensor.
2. Turn the sensor with the union nut (1) in the disassembly position. The lower edge of the union nut indicates the position of the sensor. The sensor will not be in the disassemble position **0 - CLOSE - ZU**and the hot tap fitting will not be gasketed from the process (2) until the disassembly position is reached (the upper limit stop of the union nut).

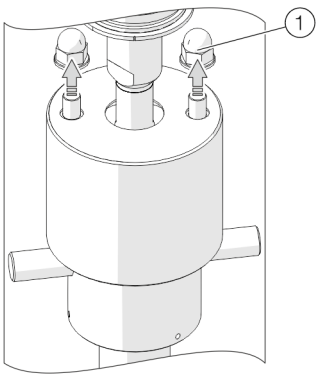


Figure 29: Loosening the cap nuts of the protection cap

3. Screw off the cap nuts (1) and washers of the protection cap.

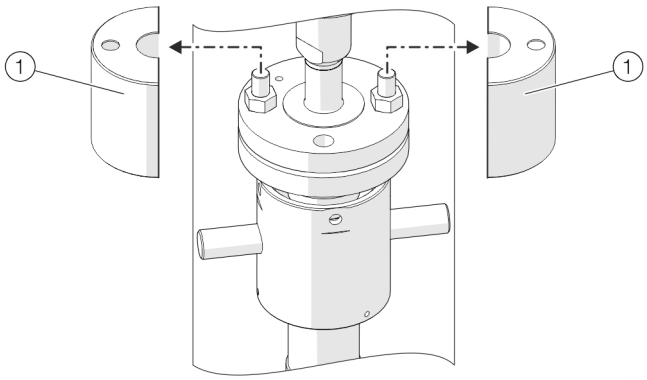


Figure 30: Removing the protection caps

4. Remove the protection caps (1).

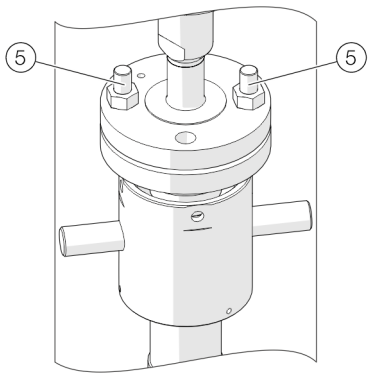


Figure 31: Removing the flange screws

5. Remove the flange screws (5).

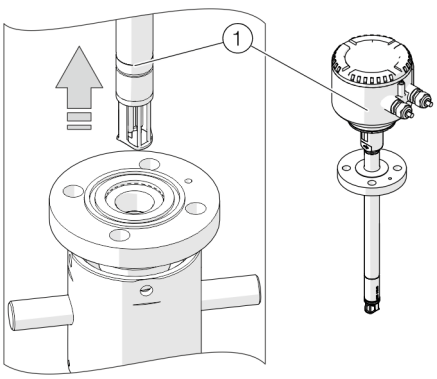


Figure 32: Removing the sensor

6. Carefully pull the sensor (1) out of the hot tap fitting (do not tip to the side).
7. Secure the hot tap fitting against unintended use with a blind flange. Additionally, attach a warning label.

Installing the sensor

Note

The changing device must be in the disassembly position before disassembling the sensor, the sensor connection is sealed.

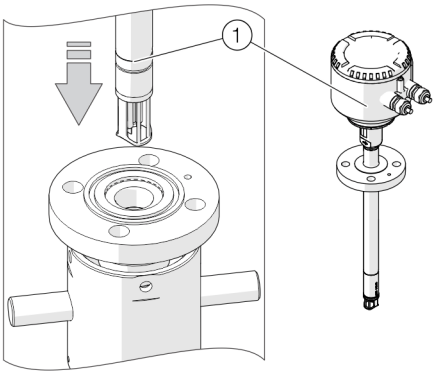


Figure 33: Inserting the sensor

1. Place the supplied O-ring in the groove of the sensor connection.
2. Carefully slide the sensor into the changing device. Observe correct alignment to the centering pin in the process.

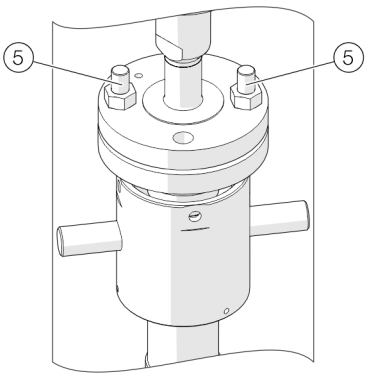


Figure 34: Screwing in the flange screws

3. Fasten the sensor to the sensor connection using screws. Use the supplied M12 screws, as well as two extended special screws (5).

… 6 Installation

… Installation / Disassembly of the sensor in connection with the hot tap fitting

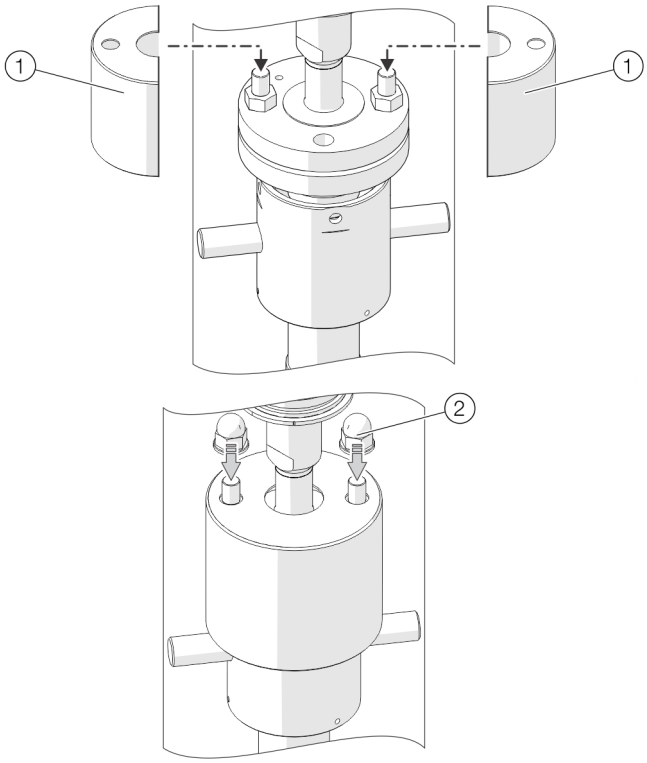


Figure 35: Placing the protection caps

4. Place the protection caps (1) onto the special screws and tighten using cap nuts (2) with washers.

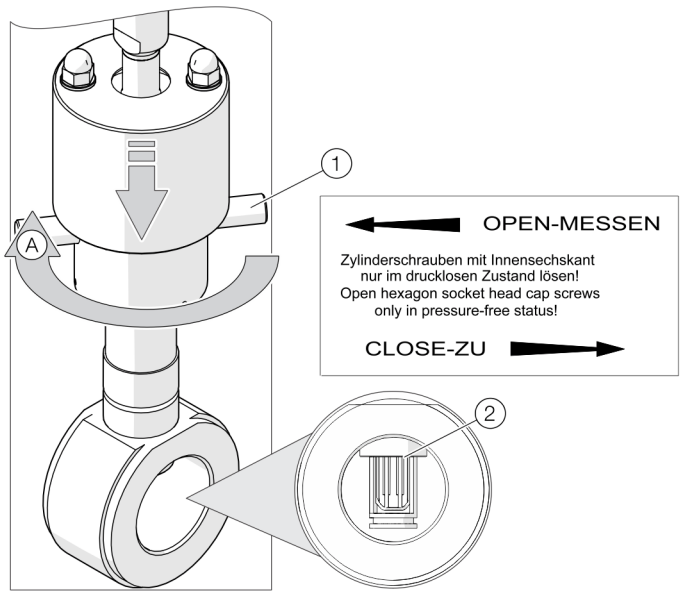


Figure 36: Setting the integrated hot tap fitting in measurement position

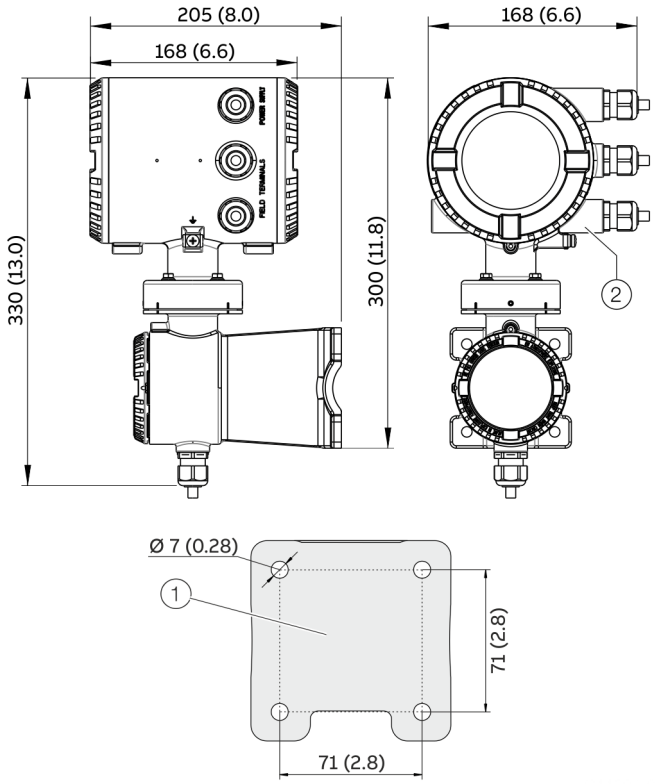
5. Turn the transmitter with the union nut (1) into the measurement position (2). The lower edge of the union nut indicates the position of the sensor. Only when the measuring position is reached **50 - OPEN - MESSEN** (the lower limit stop of the union nut) will the sensor be in the middle of the piping and precise values can be provided.
6. Carry out the electrical connection

Installing the transmitter in the remote mount design

When selecting a location for the transmitter, consider the following points:

- Observe the information concerning maximum ambient temperature and IP rating on the name plate
- The location must be mostly free from vibration.
- The location must not be exposed to direct sunlight. If necessary provide a sun screen on site.
- Do not up-scale the maximum signal cable length between the transmitter and the sensor.

1. Drill mounting holes at mounting location.
2. Attach transmitter securely to the mounting location using suited fasteners for the base material.



(1) Hole pattern for mounting holes

(2) Female thread (either ½ in NPT or M20 × 1.5), see model coding. In the case of a ½ in NPT, there is a plug instead of a cable gland.

Figure 37: Mounting dimensions dual-compartment housing

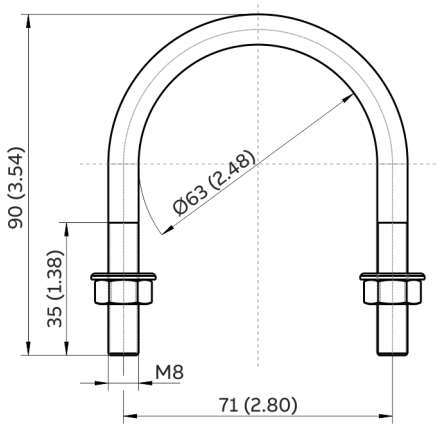
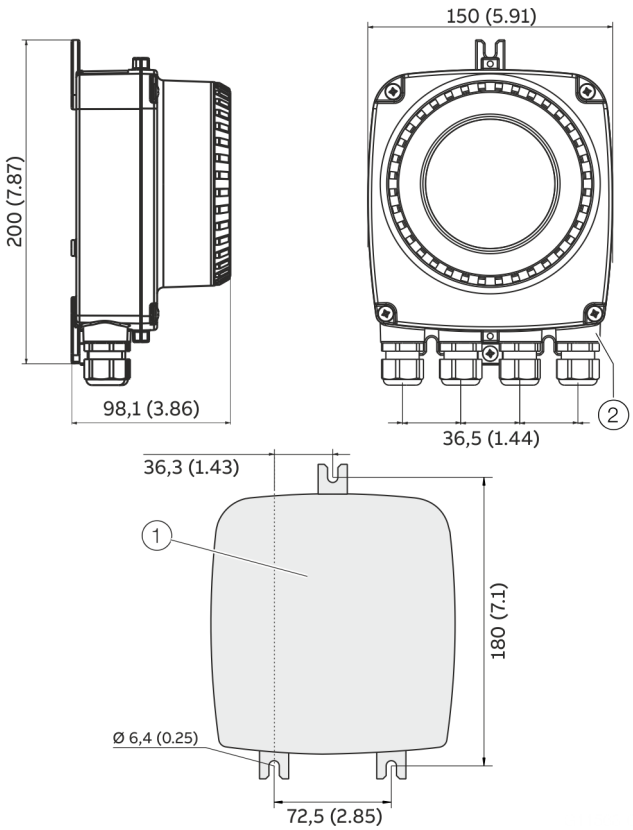


Figure 38: Assembly set for 2" pipe mounting



(1) Hole pattern for mounting holes

(2) Female thread (either ½ in NPT or M20 × 1.5), see model coding. In the case of a ½ in NPT, there is a plug instead of a cable gland.

Figure 39: Mounting dimensions single-compartment housing

… 6 Installation

Opening and closing the housing

⚠ DANGER

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

Before opening the transmitter housing or the terminal box, note the following points:

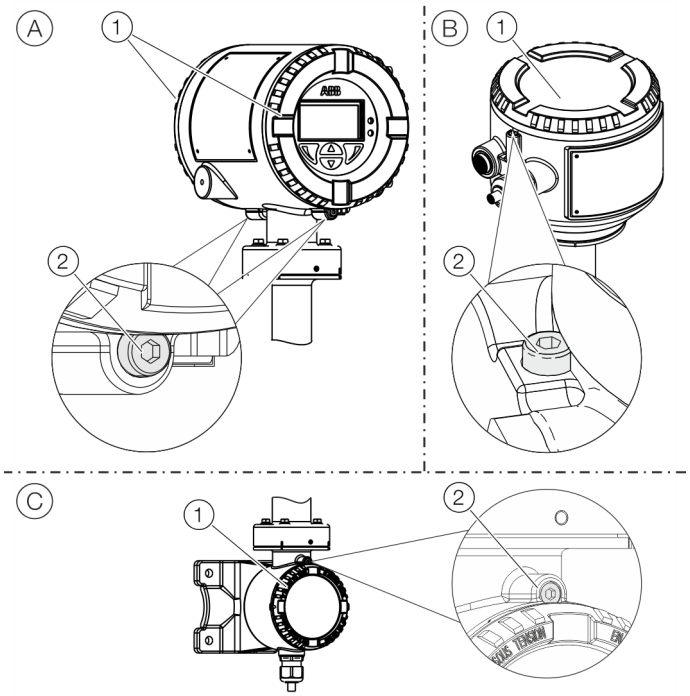
- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 20 minutes before opening.

⚠ WARNING

Risk of injury due to live parts!

When the housing is open, contact protection is not provided and EMC protection is limited.

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



(A) Integral mount design
(B) Remote mount design
(C) Transmitter, terminal space, signal cable

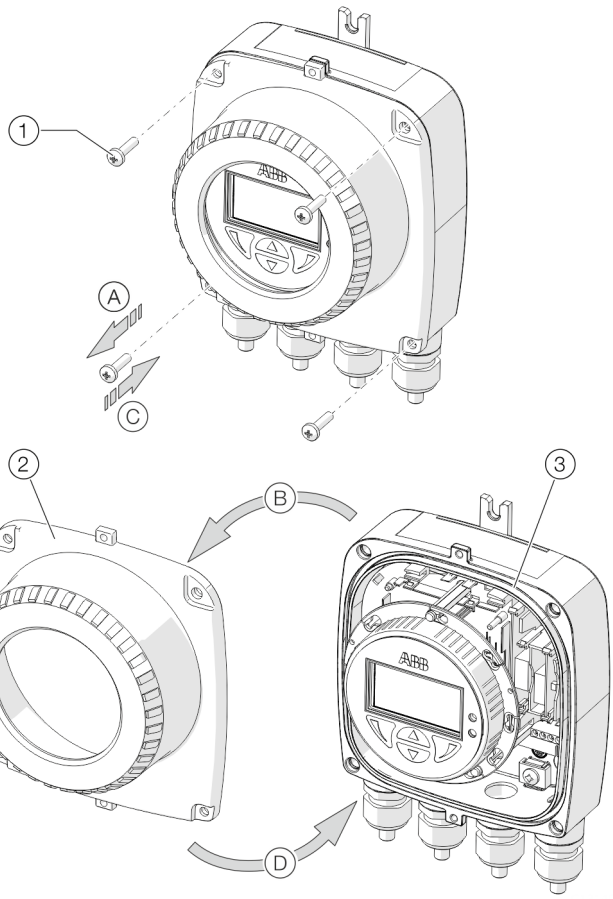
Figure 40: Cover lock (example)

Open the housing:

1. Release the cover lock by screwing in the Allen screw (2).
2. Unscrew cover (1).

Close the housing:

1. Screw on the cover (1).
2. After closing the housing, lock the cover by unscrewing the Allen screw (2).



(1) Cover screws
(2) Transmitter housing cover
(3) Gasket

Figure 41: Open / close single-compartment housing

Open the housing:

- Perform steps (A) and (B).

Close the housing:

- Perform steps (C) and (D).

Rotating the transmitter housing and LCD display

Depending on the installation position, the transmitter housing or LCD display can be rotated to enable horizontal readings.

Transmitter housing

⚠ DANGER

Damaging the device carries a risk of explosion!

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

- Tighten all screws prior to commissioning.
- Never disconnect the transmitter housing from the sensor.
- Loosen only the screws indicated when rotating the transmitter housing!

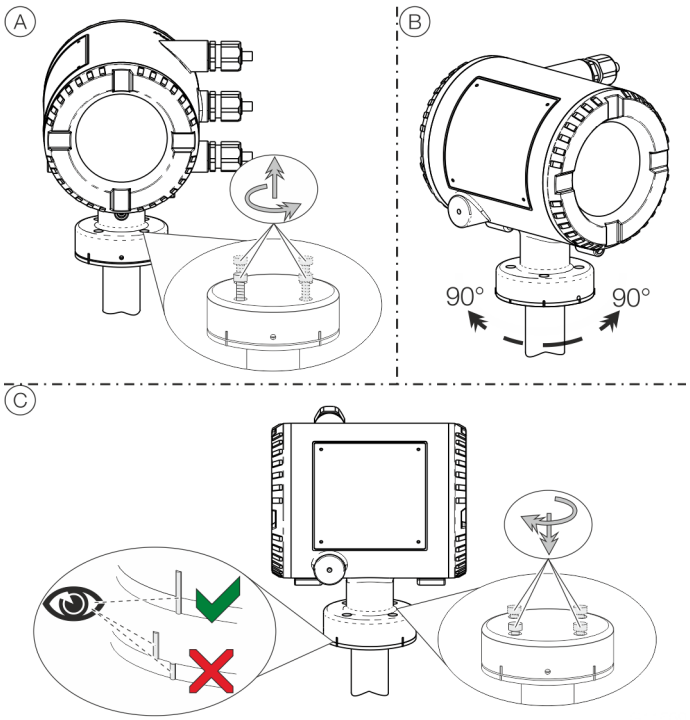


Figure 42: Rotate transmitter housing

Rotate the housing:

- Perform steps Ⓐ to Ⓒ.

Rotate LCD indicator – dual-compartment housing

The LCD indicator can be rotated in three increments of 90° each.

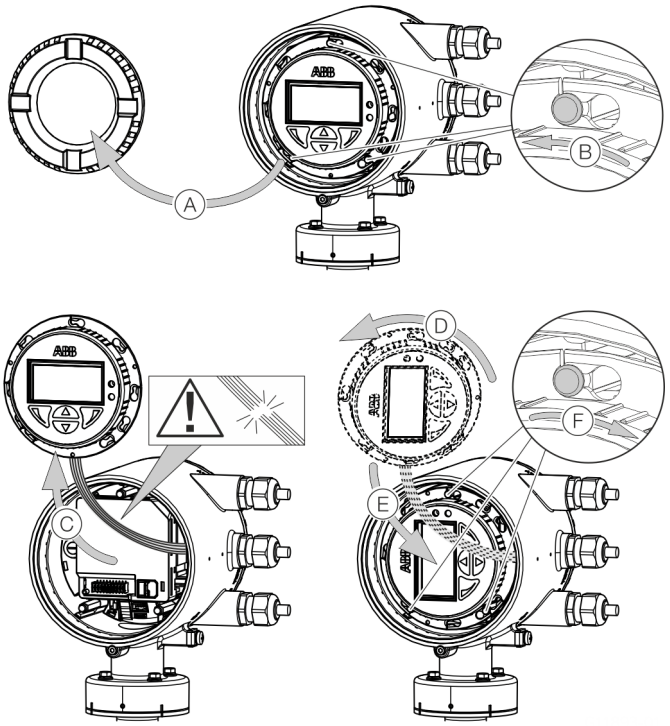


Figure 43: Rotating the LCD indicator

Turn the LCD indicator:

1. Open housing Ⓐ, see **Opening and closing the housing** on page 48.
2. Perform steps Ⓑ to Ⓕ.

… 6 Installation

… Opening and closing the housing

Rotate LCD indicator – single-compartment housing
The LCD indicator can be rotated in three increments of 90° each.

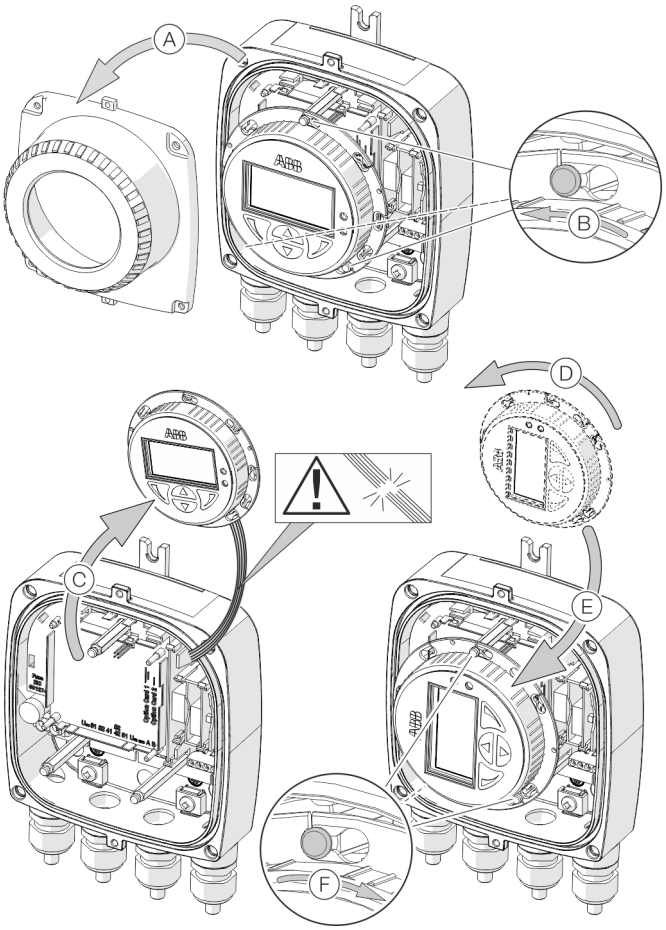


Figure 44: Rotating the LCD indicator

Turn the LCD indicator:

1. Open housing Ⓐ, see **Opening and closing the housing** on page 48.
2. Perform steps Ⓑ to Ⓕ.

Installing the plug-in cards

⚠ WARNING

Loss of Ex Approval!

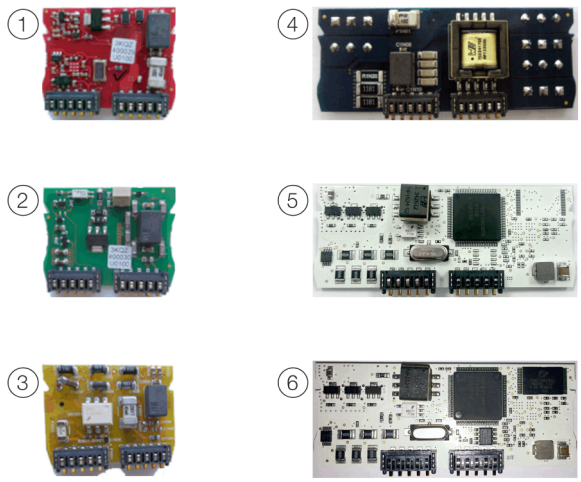
Loss of Ex Approval due to retrofitting of plug-in cards on devices for use in potentially explosive atmospheres.

- Devices for use in potentially explosive atmospheres may not be retrofitted with plug-in cards.
- If devices are to be used in potentially explosive atmospheres, the required plug-in cards must be specified when the order is placed.

Optional plug-in cards

The transmitter has two slots (OC1, OC2) into which plug-in cards can be inserted to extend inputs and outputs. The slots are located on the transmitter motherboard and can be accessed after removing the front housing cover.

Plug-in cards



Pos.	Description	Quantity*
1	Current output, 4 to 20 mA passive (red) Order no.: 3KQZ400029U0100	2
2	Passive digital output (green) Order no.: 3KQZ400030U0100	1
3	Passive digital input (yellow) Order no.: 3KQZ400032U0100	1
4	Loop power supply 24 V DC (blue) Order no.: 3KQZ400031U0100	1
5	Modbus RTU RS485 (white) Order no.: 3KQZ400028U0100	1
6	Profibus DP (white) Order no.: 3KQZ400027U0100	1

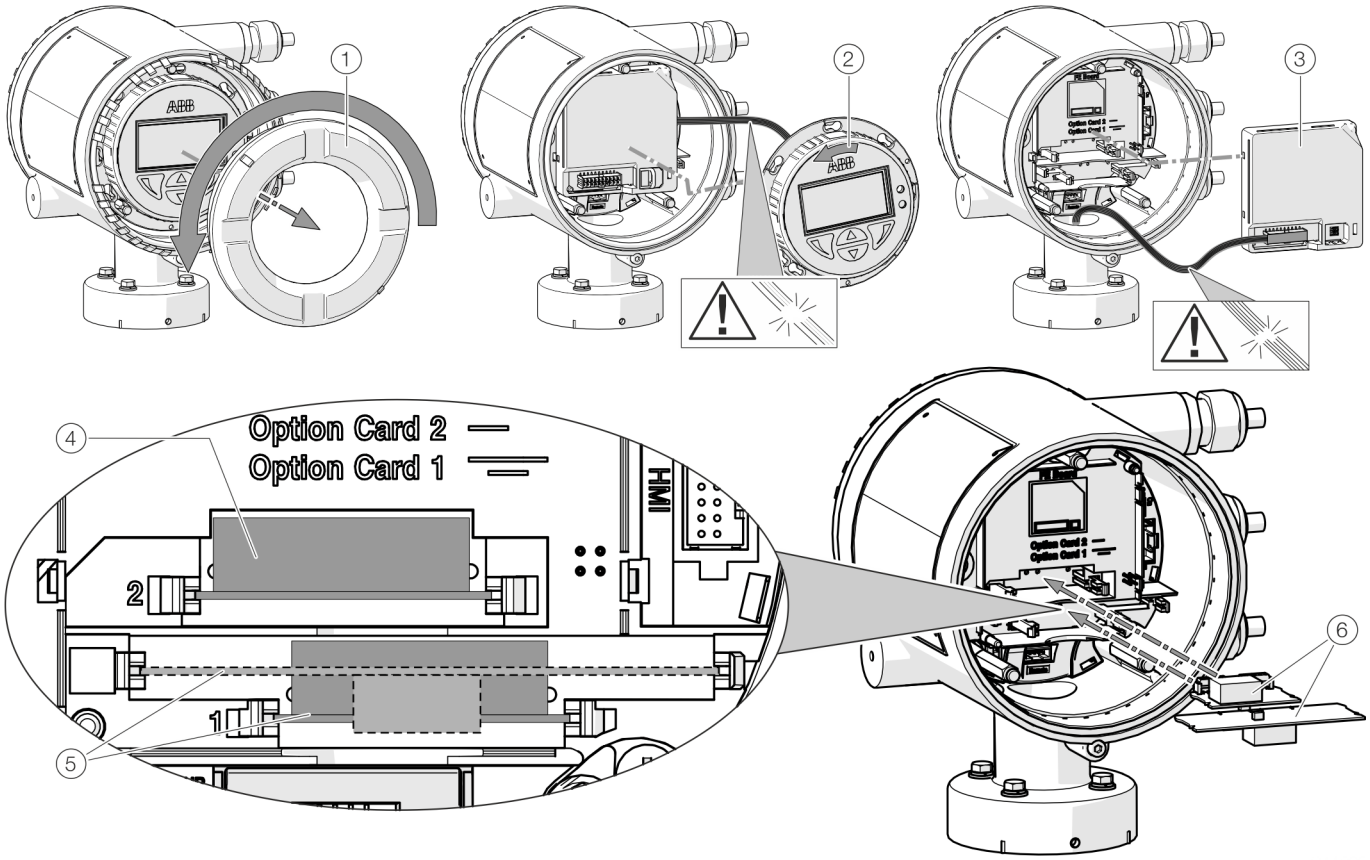
* The ‘Number’ column indicates the maximum number of plug-in cards of the same type that can be used.

… 6 Installation

… Installing the plug-in cards

The following table provides an overview of the possible plug-in card combinations that can be selected when ordering the device.

Main ordering	Additional ordering information		Slot OC1	Slot OC2
information (outputs)	Additional output 1	Additional output 2	Terminals V1 / V2	Terminals V3 / V4
G0	–	–	–	–
G1	–	–	Loop power supply 24 V DC (blue)	–
G2	–	–	–	Passive current output (red)
G3	–	–	Current output, 4 to 20 mA passive (red)	Current output, 4 to 20 mA passive (red)
G4	–	–	Loop power supply 24 V DC (blue)	Passive current output (red)
G0	DRT	–	Loop power supply 24 V DC (blue)	–
G0	DRT	DSN	Loop power supply 24 V DC (blue)	Passive digital input (yellow)
G0	DRT	DSG	Loop power supply 24 V DC (blue)	Passive digital output (green)
G0	DRT	DSA	Loop power supply 24 V DC (blue)	Current output, 4 to 20 mA passive (red)
G0	DRN	–	Passive digital input (yellow)	–
G0	DRN	DSG	Passive digital input (yellow)	Passive digital output (green)
G0	DRN	DSA	Passive digital input (yellow)	Current output, 4 to 20 mA passive (red)
G0	DRG	DSN	Passive digital output (green)	Passive digital input (yellow)
G0	DRG	DSA	Passive digital output (green)	Current output, 4 to 20 mA passive (red)
G0	DRA	DSA	Current output, 4 to 20 mA passive (red)	Current output, 4 to 20 mA passive (red)
G0	DRA	DSG	Current output, 4 to 20 mA passive (red)	Passive digital output (green)
G0	DRA	DSN	Current output, 4 to 20 mA passive (red)	Passive digital input (yellow)
G0	DRM	–	Modbus RTU RS485 (white)	–
G0	DRD	–	Profibus DP, RS485 (white)	–
G0	DRM	DSN	Modbus RTU RS485 (white)	Passive digital input (yellow)
G0	DRM	DSG	Modbus RTU RS485 (white)	Passive digital output (green)
G0	DRD	DSN	Profibus DP, RS485 (white)	Passive digital input (yellow)
G0	DRD	DSG	Profibus DP, RS485 (white)	Passive digital output (green)

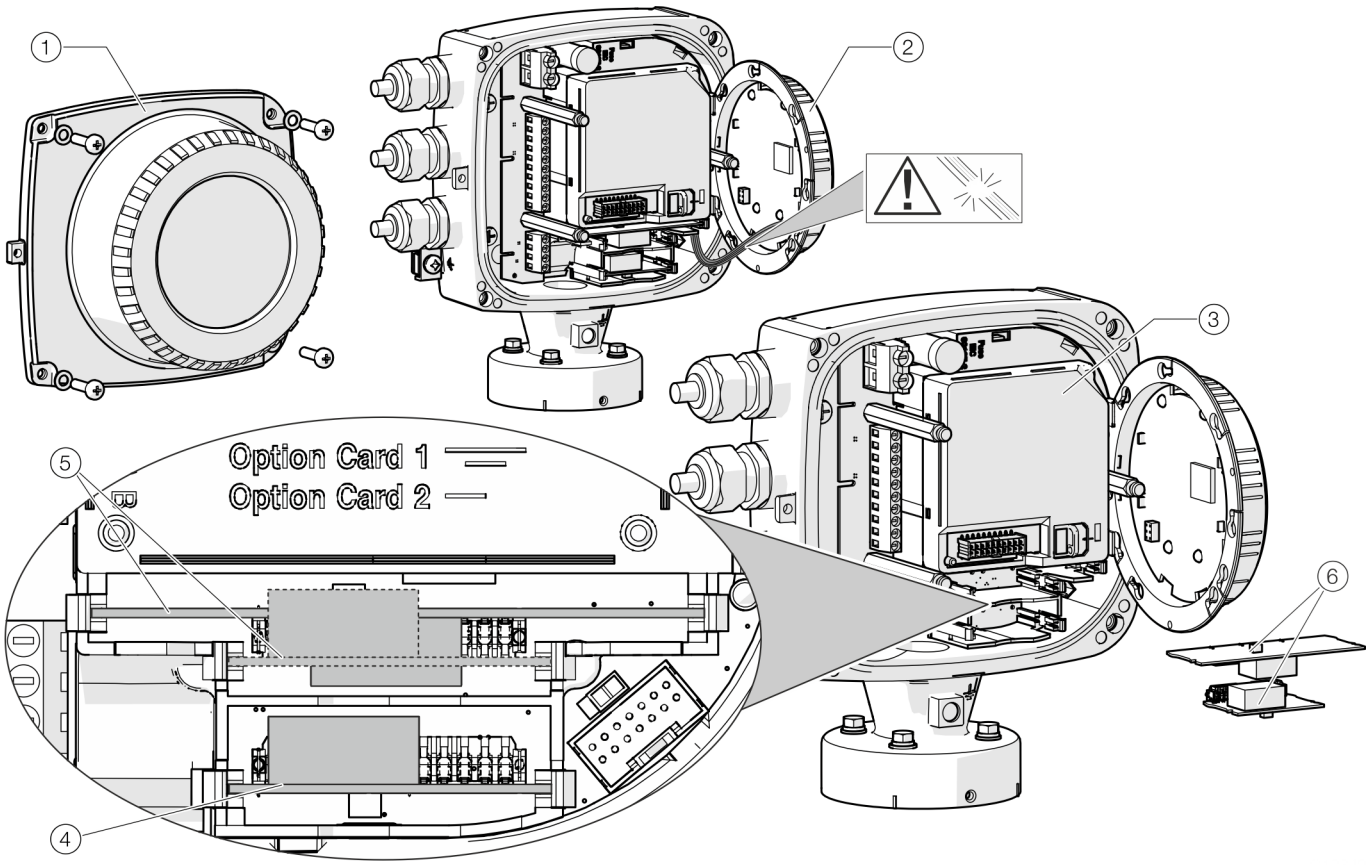


1. Cover
2. LCD indicator
3. Frontend board (FEB, with integral mount design only)
4. Slot OC2
5. Slot OC1
6. Plug-in cards

Figure 45: Installation of plug-in cards (example, dual-compartment housing)

… 6 Installation

… Installing the plug-in cards



1. Cover
2. LCD indicator
3. Slot OC1
4. Slot OC2
5. Plug-in cards

Figure 46: Installation of plug-in cards (example, single-compartment housing)

⚠ WARNING

Risk of injury due to live parts!

When the housing is open, contact protection is not provided and EMC protection is limited.

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

NOTICE

Damage to components!

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.

1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Remove the LCD indicator. Ensure that the cable harness is not damaged.
   Insert the LCD indicator into the bracket
   (only for single-compartment housings)
4. Remove frontend board (only in integral mount design and dual-compartment housing). Ensure that the cable harness is not damaged.
5. Insert the plug-in card in the corresponding slot and engage. Ensure that the contacts are aligned correctly.
6. Attach the frontend board, insert the LCD indicator and screw on / replace the cover.
7. Connect outputs V1 / V2 and V3 / V4 in accordance with **Electrical connections** on page 55.
8. After powering up the power supply, configure the plug-in card functions.

7 Electrical connections

Safety instructions

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing or terminal box open!
Before opening the transmitter housing or the terminal box, note the following points:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 20 minutes before opening.

⚠ WARNING

Risk of injury due to live parts.
Improper work on the electrical connections can result in electric shock.

- Connect the device only with the power supply switched off.
- Observe the applicable standards and regulations for the electrical connection.

The electrical connection may only be established by authorized specialist personnel and in accordance with the connection diagrams.

The electrical connection information in this manual must be observed; otherwise, the IP rating may be adversely affected. Ground the measurement system according to requirements.

Power supply

Note

- Adhere to the limit values of the power supply in accordance with the information on the name plate.
- Observe the voltage drop for large cable lengths and small conductor cross-sections. The voltage at the terminals of the device may not down-scale the minimum value required in accordance with the information on the name plate.

The power supply is connected to terminal L (phase), N (zero), or 1+, 2−, and PE.
A circuit breaker with a maximum rated current of 16 A must be installed in the power supply line.
The wire cross-sectional area of the power supply cable and the circuit breaker used must comply with VDE 0100 and must be dimensioned in accordance with the current consumption of the flowmeter measuring system. The cables must comply with IEC 227 and/or IEC 245.
The circuit breaker must be located near the device and marked as being associated with the device.
Connect the transmitter and sensor to functional earth.

… 7 Electrical connections

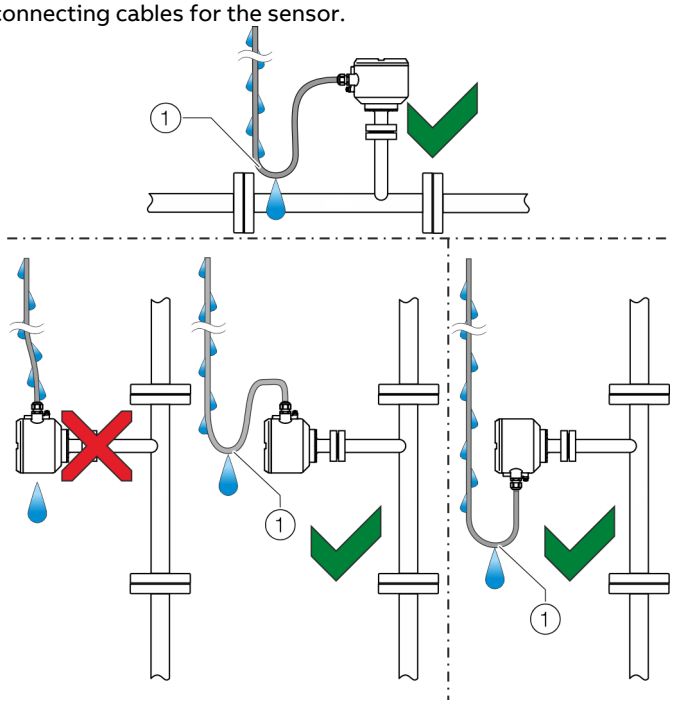
Cable entries

The electrical connection is made via cable entries with a ½ in-NPT or M20 × 1.5 thread.
Devices with a M20 × 1.5 or ½ in-NPT thread are equipped with protective plugs.
The black protective plugs in the cable glands are intended to provide protection during transport.
Any unused cable entries must be sealed with sealing plugs before commissioning in accordance with the applicable national standards.

- Observe maximum torque of 4.5 Nm (3.3 ft lb) when tightening the M20 cable gland.
- Make sure that the cable outer dimension used will fit the clamping range of the cable gland.

Installing the connection cables

Ensure that a drip loop (water trap) is used when installing the connecting cables for the sensor.



(1) Drip loop

Figure 47: Laying the connection cable

Signal cable

The signal cable used for the connection of the transmitter and sensor must fulfill at least the following technical specifications.

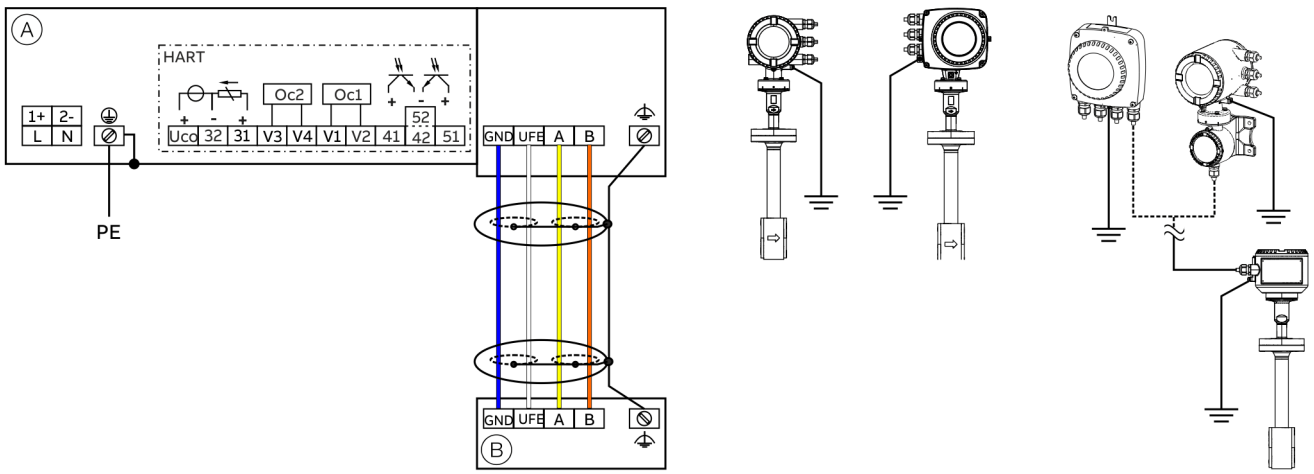
Cable specification	
Impedance	100 to 120 Ω
Withstand voltage	120 V
Outer diameter	6 to 12 mm (0.24 to 0.47 in)
Cable design	Two wire pairs as a star-quad cable
Conductor cross-section	Length-dependent
Shield	Copper braid with approximately 85 % coverage
Temperature range	Depends on application.

Maximum signal cable length	
0.25 mm^2 (AWG 24)	25 m (82 ft)
0.34 mm^2 (AWG 22)	40 m (131 ft)
0.5 mm^2 (AWG 20)	65 m (213 ft)
0.75 mm^2 (AWG 19)	100 m (328 ft)

Recommended cables

It is recommended to use an ABB signal cable with the order number 3KQZ407123U0100 for standard applications.
The ABB signal cable fulfills the above-mentioned cable specification and can be utilized unrestrictedly up to an ambient temperature of $T_{amb.}$ = 80 °C (176 °F).

Terminal assignment



Ⓐ Transmitter

Ⓑ Sensor

Figure 48: Electrical connection

Connections for the power supply

AC voltage	
Terminal	**Function/comments**
L	Phase
N	Neutral conductor
PE / ⏚	Protective earth (PE)
⏚	Potential equalization

DC voltage	
Terminal	**Function/comments**
1+	+
2-	–
PE / ⏚	Protective earth (PE)
⏚	Potential equalization

Connecting the signal cable

Only for remote mount design.

The sensor housing and transmitter housing must be connected to potential equalization.

Terminal	**Function / comments**
U_{FE}	Sensor power supply
GND	Ground
A	Data line
B	Data line
⏚	Functional earth / Shielding

Connections for inputs and outputs

Terminal	**Function / comments**
Uco / 32	**Current output 4 to 20 mA- / HART® output, active**
	or
31 / 32	**Current output 4 to 20 mA- / HART® output, passive**
41 / 42	**Passive digital output DO1**
51 / 52	**Passive digital output DO2**
V1 / V2	**Plug-in card, slot OC1**
V3 / V4	**Plug-in card, slot OC2**
	For details, see **Optional plug-in cards** on page 51.

… 7 Electrical connections

Electrical data for inputs and outputs

Note
When using the device in potentially explosive atmospheres, note the additional connection data in **Use in potentially explosive atmospheres** on page 6!

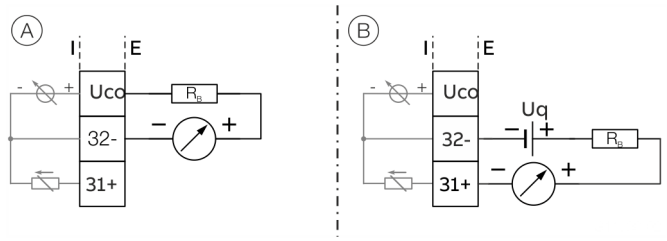
Power supply L / N, 1+ / 2–

AC voltage	
Terminals	L / N
Operating voltage	100 to 240 V AC, 50 / 60 Hz
Power consumption	< 20 VA

DC voltage	
Terminals	1+ / 2–
Operating voltage	19 to 30 V DC
Power consumption	< 20 W

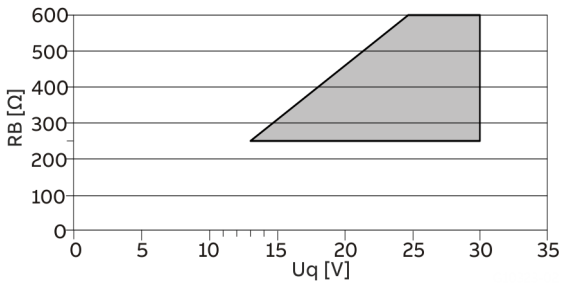
Current output 32 / Uco, 31 / 32 (basic device)

Can be configured for outputting mass flow, volume flow, density and temperature via on-site software.



Ⓐ Current output 31 / Uco, active Ⓑ Current output 31 / 32, passive

Figure 49: (I = internal, E = external, R_B = load)



Permissible source voltage U_q for passive outputs in relation to load resistance R_B where I_{max} = 22 mA. ▒▒▒ = Permissible range

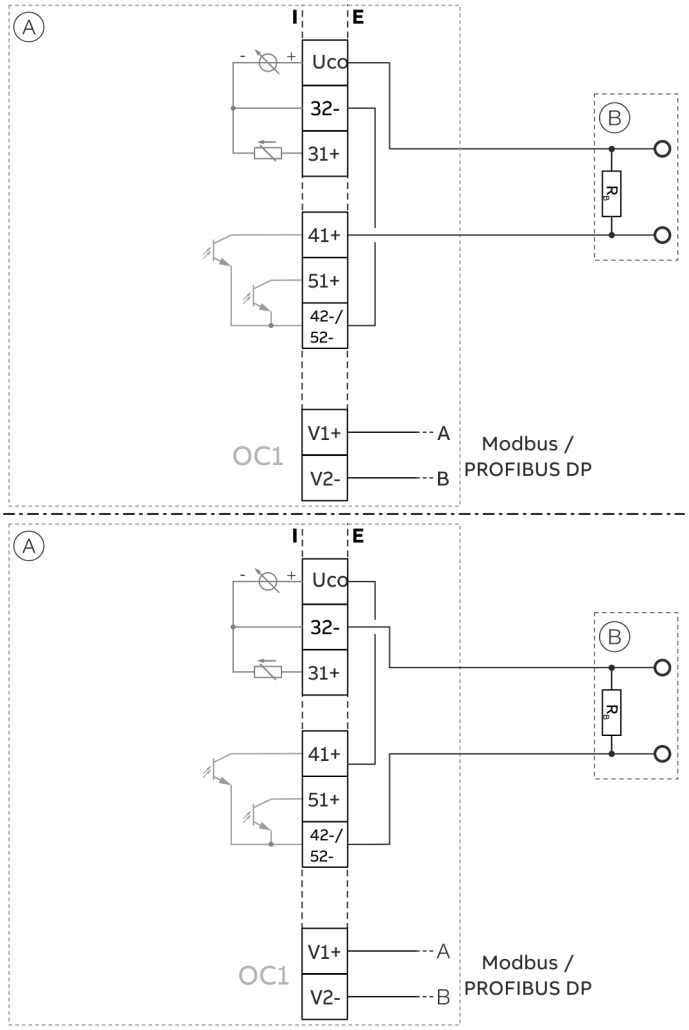
Figure 50: Source voltage for passive outputs

Current output	**Active**	**Passive**
Terminals	Uco / 32	31 / 32
Output signal	4 to 20 mA	
Load R_B	250 Ω ≤ R_B ≤ 300 Ω	250 Ω ≤ R_B ≤ 600 Ω
Source voltage U_q*	—	13 V ≤ U_q ≤ 30 V
Measuring error	< 0.1 % of measured value	
Resolution	0.4 µA per digit	

* The source voltage U_q is dependent of the load R_B and must be placed in an additional area.

For information on communication via the HART protocol, refer to **HART® Communication** on page 70.

Current output Uco / 32 as loop power supply for digital output 41 / 42 or 51 / 52



(A) Transmitter FCx400
(B) Customer wiring
OC1 Modbus / PROFIBUS DP plug-in card
R_B Load resistance

Figure 51: Current output Uco / 32 in power mode

In the case of digital communication via Modbus / PROFIBUS DP, the current output Uco / 32 can be switched to the 'Power Mode' operating mode through the software.
The current output 31/32/Uco is set permanently to 22.6 mA and no longer follows the selected process variable. HART communication is deactivated.
As a result, the passive digital outputs 41 / 42 or 51 / 52 can also be operated as active digital outputs.

The load resistance R_B needs to be integrated by the customer outside of the transmitter housing.

Loop power supply 24 V DC pperating mode	
Terminals	Uco / 32
Function	For active connection of passive outputs
Output Voltage	Load dependent, see Figure 52.
Load rating I_{max}	22.6 mA, permanently short circuit-proof

Table 2: Specification current output Uco / 32 in power mode

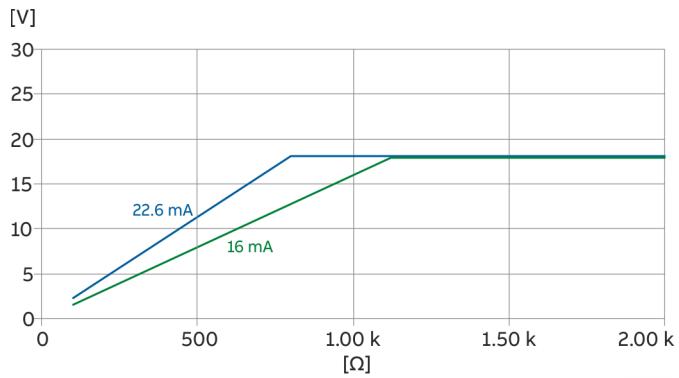


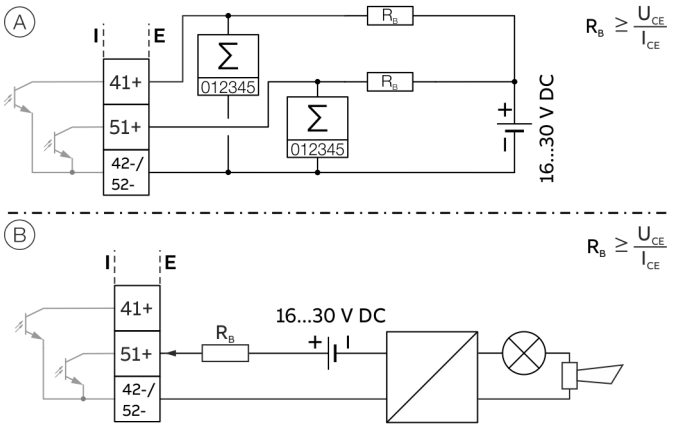
Figure 52: Output voltage dependent on load resistance

… 7 Electrical connections

… Electrical data for inputs and outputs

Digital output 41 / 42, 51 / 52 (basic device)

Can be configured as pulse, frequency or binary output via on-site software.



(A) Digital output 41 / 42, 51 / 52 passive as a pulse or frequency output

(B) Passive digital output 51 / 52 as binary output

Figure 53: (I = internal, E = external, R_B = load)

Pulse / frequency output (passive)	
Terminals	41 / 42, 51 / 52
Output ‘closed’	$0 V \leq U_{CEL} \leq 3 V$
	For f < 2.5 kHz: $2 mA < I_{CEL} < 30 mA$
	For f > 2.5 kHz: $10 mA < I_{CEL} < 30 mA$
Output ‘open’	$16 V \leq U_{CEH} \leq 30 V DC$
	$0 mA \leq I_{CEH} \leq 0.2 mA$
f_{max}	10.5 kHz
Pulse width	0.05 to 2000 ms

Binary output (passive)	
Terminals	41 / 42, 51 / 52
Output ‘closed’	$0 V \leq U_{CEL} \leq 3 V$
	$2 mA \leq I_{CEL} \leq 30 mA$
Output ‘open’	$16 V \leq U_{CEH} \leq 3 V DC$
	$0 mA \leq I_{CEH} \leq 0.2 mA$
Switching function	Can be configured using software.

Note

- Terminals 42 / 52 have the same potential. Digital outputs DO 41 / 42 and DO 51 / 52 are not electrically isolated from each other. If an additional electrically isolated digital output is required, a corresponding plug-in module must be used.
- If you are using a mechanical counter, we recommend setting a pulse width of ≥ 30 ms and a maximum frequency of $f_{max} \leq 30$ Hz.

Modbus® / PROFIBUS DP® interface V1 / V2 (plug-in card)

A Modbus or PROFIBUS DP interface can be implemented by using the ‘Modbus RTU, RS485 (white)’ or ‘PROFIBUS DP, RS485 (white)’ plug-in cards.

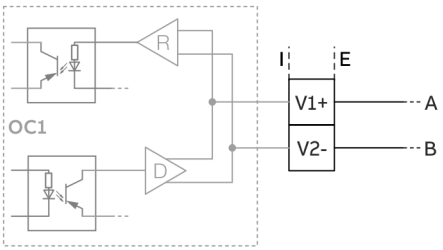


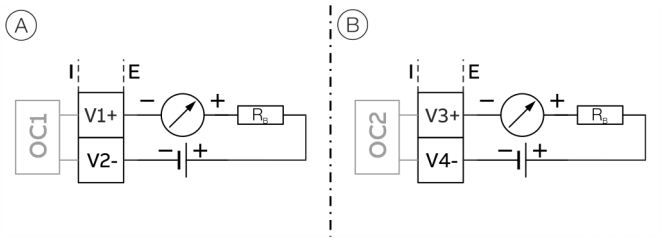
Figure 54: Plug-in card as a Modbus / PROFIBUS DP interface (I = internal, E = external)

The corresponding plug-in card can only be used in slot OC1.

For information on communication through the Modbus or PROFIBUS DP protocols, refer to chapters **Modbus® communication** on page 70 and **PROFIBUS DP® communication** on page 71.

Current output V1 / V2, V3 / V4 (plug-in module)

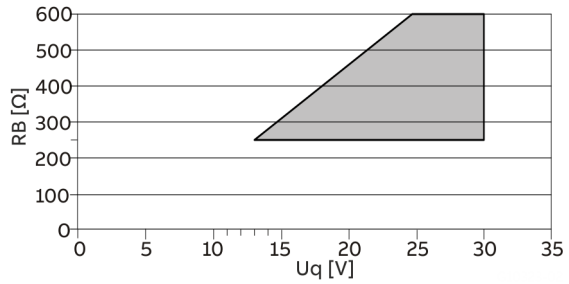
Up to two additional plug-in modules can be implemented via the 'Passive current output (red)' option module.
Can be configured for outputting mass flow, volume flow, density and temperature via on-site software.



(A) Current output V1 / V2, passive (B) Current output V3 / V4, passive

Figure 55: (I = internal, E = external, R_B = load)

The plug-in module can be used in slot OC1 **and** OC2.



Permissible source voltage U_q for passive outputs in relation to load resistance R_B where Imax = 22 mA. = Permissible range

Figure 56: Source voltage for passive outputs

Passive current output	
Terminals	V1 / V2, V3 / V4
Output signal	4 to 20 mA
Load R_B	250 Ω ≤ R_B ≤ 600 Ω
Source voltage U_q*	13 V ≤ U_q ≤ 30 V
Measuring error	< 0.1 % of measured value
Resolution	0.4 µA per digit

* The source voltage U_q is dependent of the load R_B and must be placed in an additional area.

Passive digital output V1 / V2, V3 / V4 (plug-in card)

An additional binary output can be implemented via the 'Passive digital output (green)' plug-in module.
Can be configured as an alarm output, etc. via on-site software.

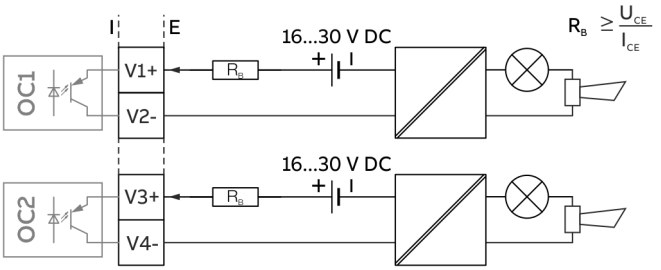


Figure 57: Plug-in card as binary output (I = internal, E = external, R_B = load)

The plug-in module can be used in slot OC1 **or** OC2.

Binary output (passive)	
Terminals	V1 / V2, V3 / V4
Output 'closed'	0 V ≤ U_{CEL} ≤ 3 V 2 mA < I_{CEL} < 30 mA
Output 'open'	16 V ≤ U_{CEH} ≤ 30 V DC 0 mA ≤ I_{CEH} ≤ 0.2 mA
Switching function	Can be configured using software.

… 7 Electrical connections

… Electrical data for inputs and outputs

Digital input V1 / V2, V3 / V4 (plug-in module)

Up to two additional digital inputs can be implemented via the ‘Passive digital input (yellow)’ plug-in card.
Can be configured as an input for external counter reset, external output deactivation etc. via on-site software.

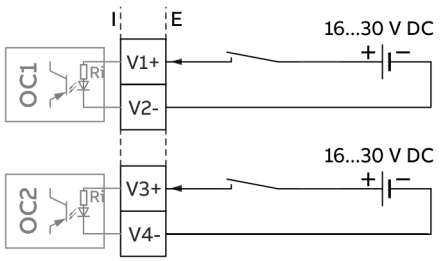


Figure 58: Plug-in card as digital input (I = internal, E = external)

The plug-in module can be used in slot OC1 **and** OC2.

Digital input	
Terminals	V1 / V2, V3 / V4
Input ‘On’	16 V ≤ U_{KL} ≤ 30 V
Input ‘Off’	0 V ≤ U_{KL} ≤ 3 V
Internal resistance R_i	6.5 kΩ
Function	Can be configured using software.

24 V DC loop power supply (plug-in module)

Use of the ‘loop power supply (blue)’ plug-in card allows a passive output on the transmitter to be used as an active output. See also **Connection examples** on page 63.

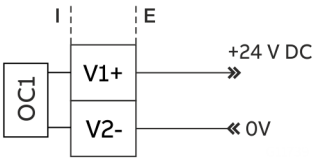


Figure 59: (I = Internal, E = External)

The plug-in module can only be used in slot OC1.

Loop power supply 24 V DC	
Terminals	V1 / V2
Function	For active connection of passive outputs
Output Voltage	24 V DC at 0 mA,
	17 V DC at 25 mA
Load rating I_{max}	25 mA, permanently short circuit-proof

Note

If the device is used in potentially explosive atmospheres, the plug-in card for the power supply may only be used to supply a passive output. It is not allowed, to connect it to multiple passive outputs!

Connection examples

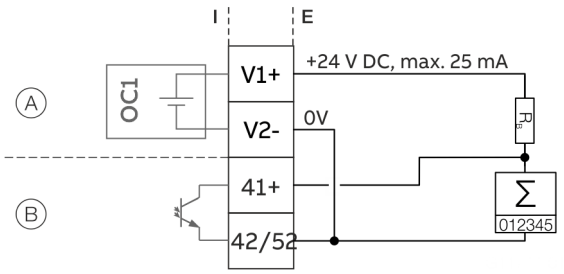
Input and output functions are configured via the device software in accordance with the desired application.

Digital output 41 / 42, 51 / 52, V3 / V4 active

When the 'loop power supply 24 V DC (blue)' plug-in card is used, the digital outputs on the basic device and on the option modules can also be wired as active digital outputs.

Note

Each 'loop power supply (blue)' plug-in card must only power one output.
It must not be connected to two outputs (for example digital output 41 / 42 and 51 / 52)!

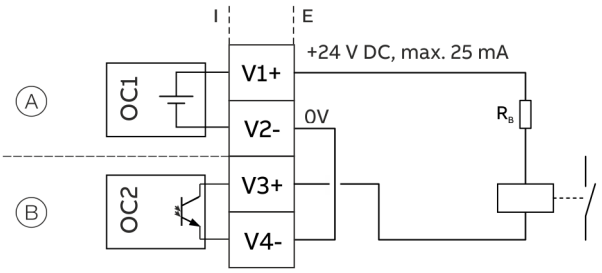


(A) 'Loop power supply (blue)' plug-in card in slot 1

(B) Digital output, digital output 41 / 42

Figure 60: Active digital output 41 / 42 (example)

The connection example shows usage for digital output 41 / 42; the same applies to usage for digital output 51 / 52.

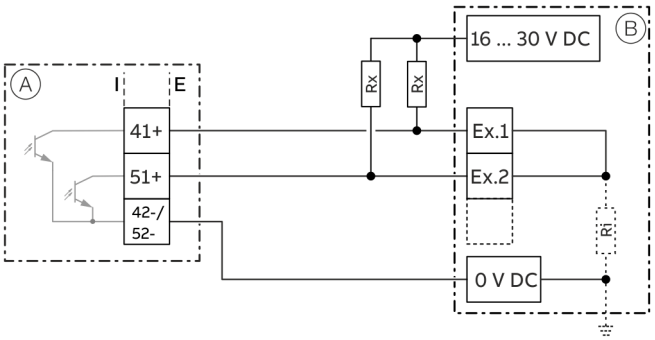


(A) 'Loop power supply (blue)' plug-in card in slot 1

(B) 'Digital output (green)' plug-in card in slot 2

Figure 61: Active digital output V3 / V4 (example)

Digital output 41 / 42, 51 / 52 passive on distributed control system



(A) Transmitter

(B) Distributed control system / Memory programmable controller

Ex. 1 Input 1

Ex. 2 Input 2

R_X Resistor for current limitation

R_I Distributed control system internal resistance

Figure 62: Digital output 41 / 42 on distributed control system (example)

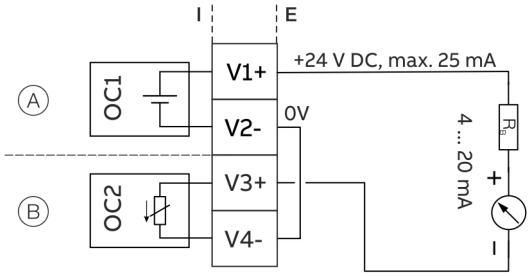
The R_X resistors limit the maximum current through the optoelectronic coupler of the digital outputs in the transmitter. The maximum permissible current is 25 mA. An R_X value of 1000 Ω / 1 W is recommended at a voltage level of 24 V DC. The input on the distributed control system is reduced from 24 V DC to 0 V DC (falling edge) with '1' at the digital output.

… 7 Electrical connections

… Electrical data for inputs and outputs

Current output V3 / V4 active

When the 'loop power supply 24 V DC, blue' plug-in card is used, the current output on the plug-in card can also be wired as the active current output.



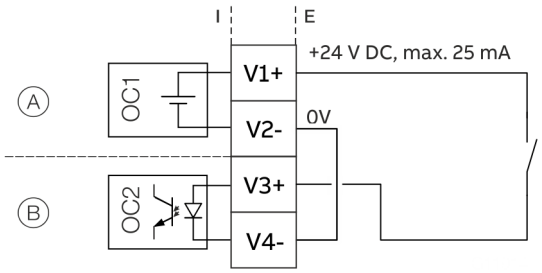
(A) 'Loop power supply (blue)' plug-in card in slot 1

(B) 'Passive current output (red)' plug-in card in slot 2

Figure 63: Active current output V3 / V4 (example)

Digital input V3 / V4 active

When the 'loop power supply 24 V DC, blue' plug-in card is used, the current output on the plug-in card can also be wired as the active current output.



(A) 'Loop power supply (blue)' plug-in card in slot 1

(B) 'Passive digital input (yellow)' plug-in card in slot 2

Figure 64: Active digital output V3 / V4 (example)

Connection versions digital output 41 / 42, 51 / 52

Depending on the wiring of digital outputs DO 41 / 42 and 51 / 52, they can be used parallel or only individually. The electrical isolation between the digital outputs also depends on the wiring.

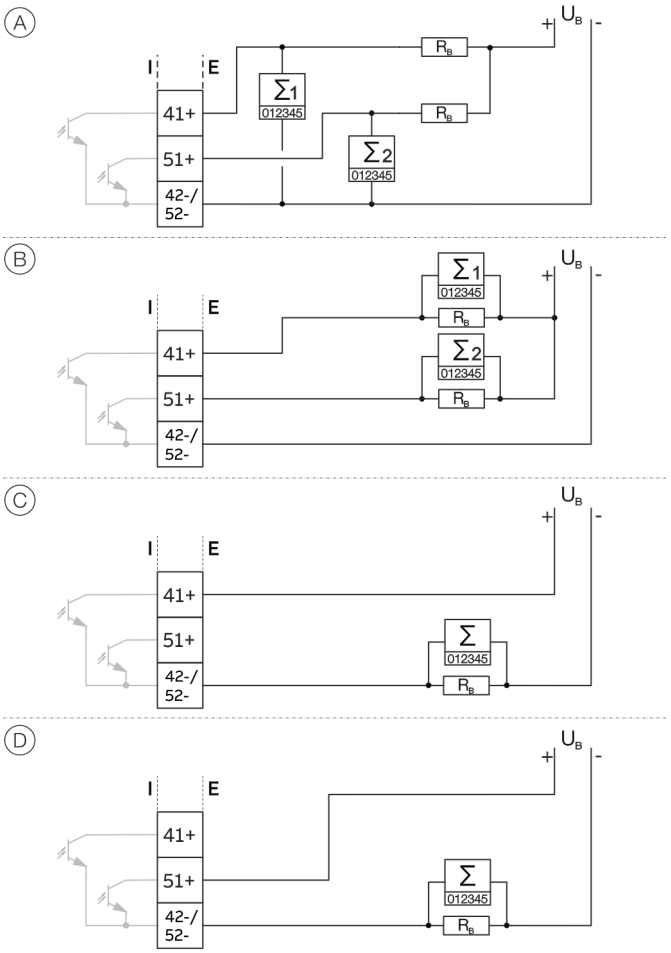
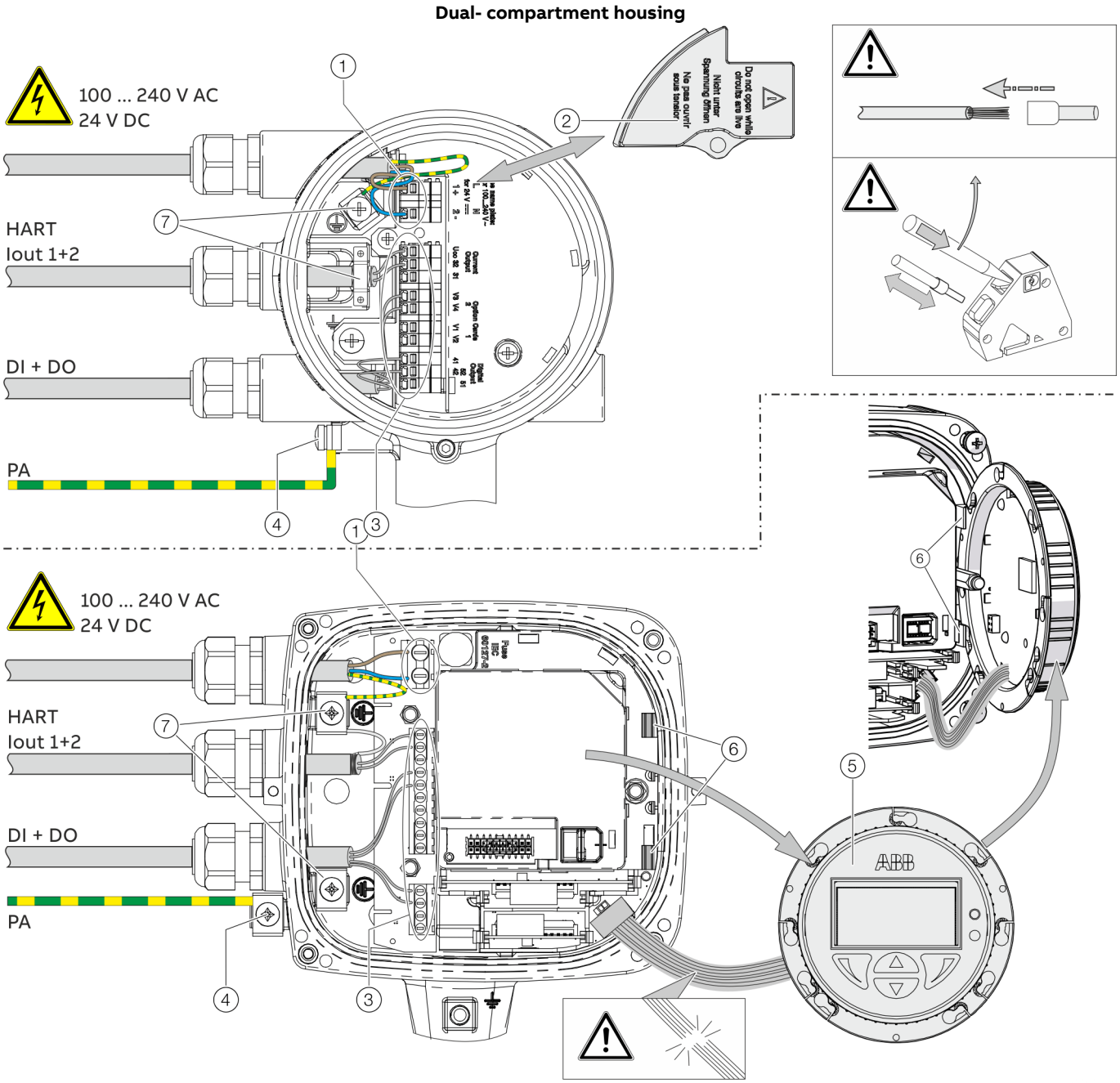


Figure 65: Connection versions digital output 41 / 42 and 51 / 52

	DO 41 / 42 and 51 / 52 can be used parallel	DO 41 / 42 and 51 / 52 electrically isolated
(A)	Yes	No
(B)	Yes	Yes
(C)	No, only DO 41 / 42 can be used	No
(D)	No, only DO 51 / 52 can be used	No

Table 3: Connection versions digital output

Connection to integral mount design



1. Terminals for power supply
2. Cover for power supply terminals
3. Terminals for inputs and outputs
4. Terminal for potential equalization
5. LCD indicator
6. Bracket for LCD indicator (park position)
7. Terminal for protective earth / cable shields

Figure 66: Connection to device (example), PA = potential equalization

… 7 Electrical connections

… Connection to integral mount design

NOTICE

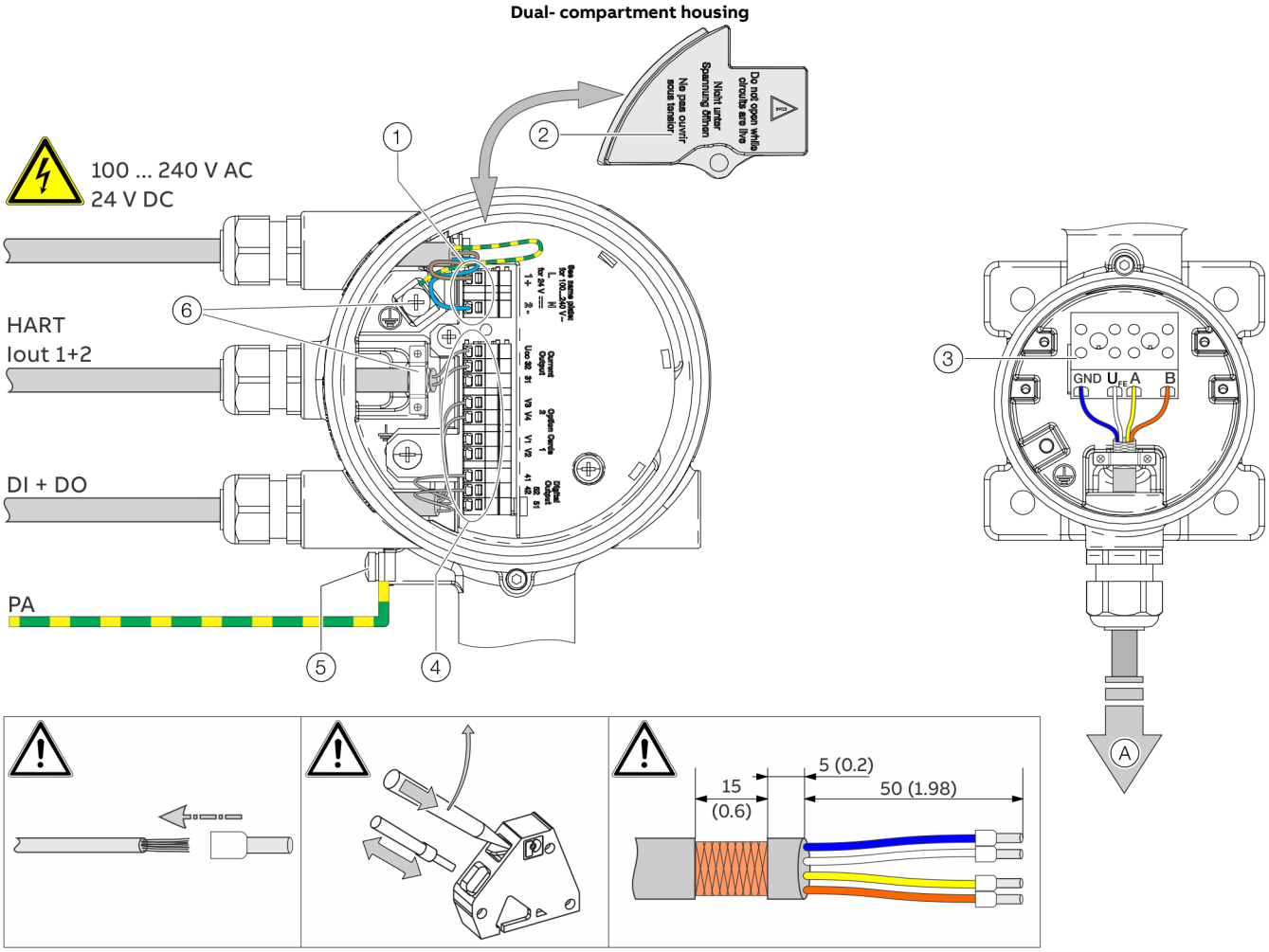
If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 48 to open and close the housing safely.

Observe the following points when connecting to an electrical supply:

- Lead the power supply cable into the housing through the top cable entry.
- Lead the cables for signal inputs and signal outputs into the housing through the middle and, where necessary, bottom cable entries.
- Connect the cables in accordance with the electrical connection. If present, connect the cable shielding to the earthing clamp provided.
- Use wire end ferrules when connecting.
- After connecting the power supply to the dual-compartment housing, terminal cover ② must be installed.
- Close unused cable entries using suited plugs.

Connection to remote mount design

Transmitter

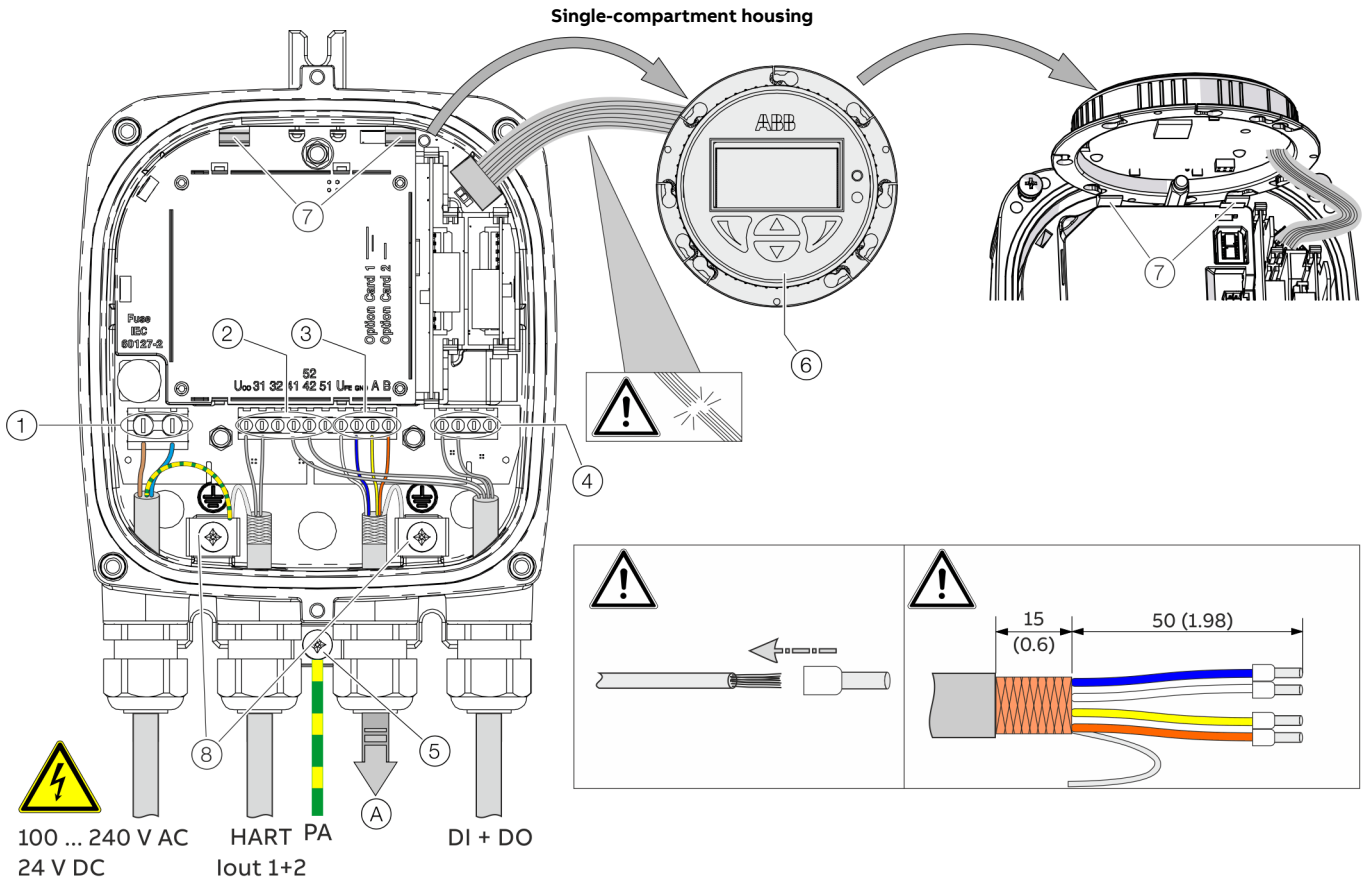


Ⓐ Upper terminal box (back side)
Ⓑ Lower terminal box
Ⓒ Signal cable to sensor
① Terminals for power supply
② Cover for power supply terminals
③ Terminals for signal cable
④ Terminals for inputs and outputs
⑤ Terminal for potential equalization
⑥ Terminal for protective earth / cable shields

Figure 67: Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

… 7 Electrical connections

… Connection to remote mount design

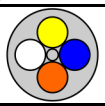
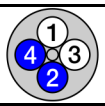


(A) Signal cable to sensor
(1) Terminals for power supply
(2) Terminals for inputs and outputs (base device)
(3) Terminals for signal cable
(4) Terminals for inputs and outputs (plug-in cards)
(5) Terminal for potential equalization
(6) LCD indicator
(7) Bracket for LCD indicator (park position)
(8) Terminal for protective earth / cable shields

Figure 68: Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

NOTICE

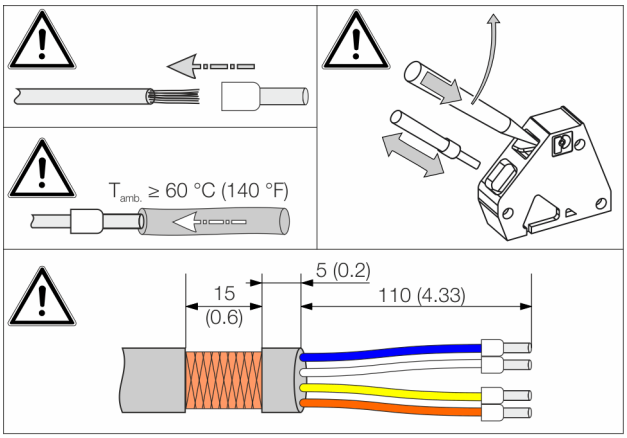
If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class. Follow the instructions in **Opening and closing the housing** on page 48 to open and close the housing safely.

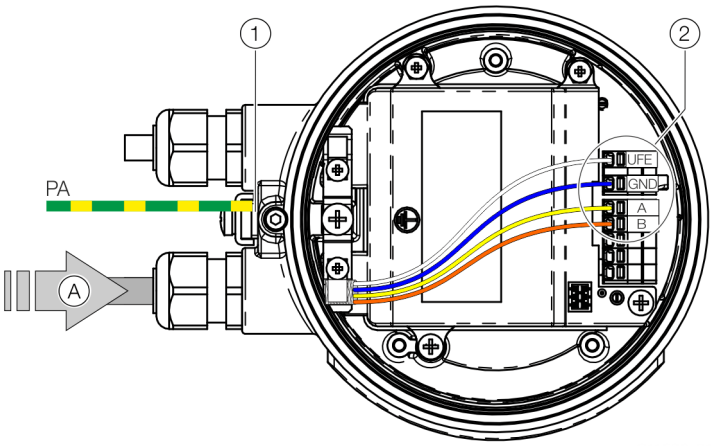
Terminal	ABB signal cable 3KQZ407123U0100	HELKAMA signal cable 20522
		
GND	Blue	Blue (4)
U_{FE}	White	white (3)
A	Yellow	Blue (2)
B	Orange	white (1)

Observe the following points when connecting to an electrical supply:

- Lead the cable for the power supply and the signal inputs and outputs into the housing as shown.
- The signal cable to the sensor is connected in the lower connection area of the transmitter.
- Connect the cables in accordance with the electrical connection diagram. If present, connect the cable shielding to the earthing clamp provided.
- Use wire end ferrules when connecting.
- After connecting the power supply, terminal cover (2) must be installed.
- Close unused cable entries using suitable plugs.

Flowmeter sensor





(A) Signal cable from the sensor

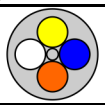
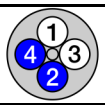
(1) Terminal for potential equalization

(2) Terminals for signal cable

Figure 69: Connection to sensor in remote mount design (example)

NOTICE

If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class. Follow the instructions in **Opening and closing the housing** on page 48 to open and close the housing safely.

Terminal	ABB signal cable 3KQZ407123U0100	HELKAMA signal cable 20522
		
GND	Blue	Blue (4)
U_{FE}	White	white (3)
A	Yellow	Blue (2)
B	Orange	white (1)

Observe the following points when connecting to an electrical supply:

- Lead the signal cable into the housing as shown.
- Connect the cables in accordance with the electrical connection. If present, connect the cable shielding to the earthing clamp provided.
- Use wire end ferrules when connecting.
- From an ambient temperature of $T_{amb.} \geq 60$ °C (≥ 140 °F) additionally insulate the wires with the enclosed silicone hoses.
- Close unused cable entries using suited plugs.

… 7 Electrical connections

Digital communication

FDI – Field Device Integration

The Device Type Driver for the SensyMaster flowmeter is based on FDI technology and can either be integrated in a control system or loaded onto a PC with the ABB Ability™ Field Information Manager (FIM).

This allows you to work with the same user interface in the commissioning phase, during operation, and for service tasks involving monitoring the device, parameterization, and reading out data.

HART® Communication

Note

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

In connection with the DTM (Device Type Manager) available to the device, communication (configuration, parameterization) can be carried out FDT 0.98 or 1.2.
Other tool or system integrations (e.g. Emerson AMS / Siemens PCS7) on request.

The necessary DTMs and other files can be downloaded from www.abb.com/flow.

HART output	
Terminals	Active: Uco / 32 Passive: 31 / 32
Protocol	HART 7.1
Transmission	FSK modulation on current output 4 to 20 mA in accordance with the Bell 202 standard
Baud rate	1200 baud
Signal amplitude	Maximum 1.2 mAss

Factory setting of the HART® process variables	
Process variable	**Process value**
Primary Value (PV)	Mass flow
Secondary Value (SV)	Temperature
Tertiary Value (TV)	Mass (counter)
Quaternary Value (QV)	Standard flow rate

The process values of the HART® variables can be set in the device menu.

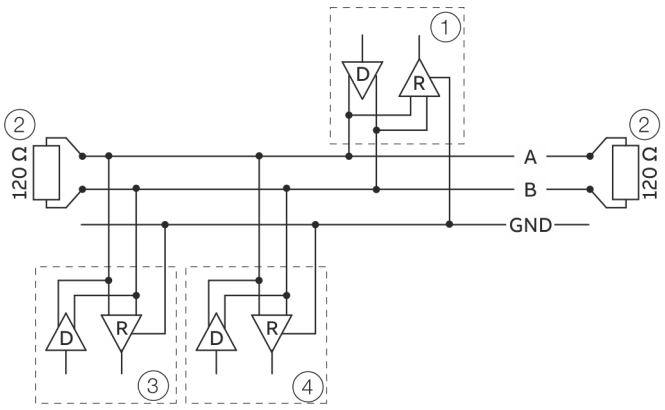
Modbus® communication

Note

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

Modbus is an open standard owned and administrated by an independent group of device manufacturers styled the Modbus Organization (www.modbus.org/).
Using the Modbus protocol allows devices made by different manufacturers to exchange information via the same communication bus, without the need for any special interface devices to be used.

Modbus protocol	
Terminals	V1 / V2
Configuration	Via the Modbus interface or via the local operating interface in connection with a corresponding Device Type Manager (DTM)
Transmission	Modbus RTU - RS485 serial connection
Baud rate	2400, 4800, 9600, 19200, 38400, 56000, 57600, 115200 baud Factory setting: 9600 baud
Parity	None, even, odd Factory setting: odd
Stop bit	One, two Factory setting: One
IEEE format	Little endian, big endian Factory setting: Little endian
Typical response time	< 100 ms
Response delay time	0 to 200 milliseconds Factory setting: 10 milliseconds



1 Modbus master
2 Terminating resistor
3 Modbus slave 1
4 Modbus slave n to 32

Figure 70: Communication with the Modbus protocol

Cable specification

The maximum permissible length is dependent on the baud rate, the cable (diameter, capacity and surge impedance), the number of loads in the device chain, and the network configuration (2-core or 4-core).

- At a baud rate of 9600 and with a conductor cross-section of at least 0.14 mm^2 (AWG 26), the maximum length is 1000 m (3280 ft).
- When using a 4-core cable as a 2-wire wiring system, the maximum length must be halved.
- The spur lines must be short, a maximum of 20 m (66 ft).
- When using a distributor with 'n' connections, each branch must have a maximum length of 40 m (131 ft) divided by 'n.'

The maximum cable length depends on the type of cable used. The following standard values apply:

- Up to 6 m (20 ft):
  cable with standard shielding or twisted-pair cable.
- Up to 300 m (984 ft):
  double twisted-pair cable with overall foil shielding and integrated earth cable.
- Up to 1200 m (3937 ft):
  double twisted-pair cable with individual foil shielding and integrated earth cables. Example: Belden 9729 or equivalent cable.

A category 5 cable can be used for Modbus RS485 up to a maximum length of 600 m (1968 ft). For the symmetrical pairs in RS485 systems, a surge impedance of more than 100 Ω is preferred, especially at a baud rate of 19200 and above.

PROFIBUS DP® communication

Note

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

PROFIBUS DP interface	
Terminals	V1 / V2
Configuration	Via the PROFIBUS DP interface or via the local operating interface in connection with a corresponding Device Type Manager (DTM)
Transmission	In accordance with IEC 61158-2
Baud rate	9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5 Mbps The baud rate is automatically detected and does not need to be configured manually
Device profile	PA Profile 3.02
Bus address	Address range 0 to 126 Factory setting: 126

Only one of the three different GSD files provided by ABB is needed for commissioning.

Parameterization of the device can be performed via the display, or through a device driver in the form of an FDI, EDD (Electronic Device Description) or DTM (Device Type Manager).

FDI, You can download EDD, DTM and GSD from www.abb.com/flow.

The files required for operation can also be downloaded from www.profibus.com.

ABB provides three different GSD files which can be integrated in the system.

ID number	**GSD file name**	
0x9740	PA139740.gsd	1xAI, 1xTOT
0x3435	ABB_3435.gsd	6xAI, 2xTOT, 1xDI, 2xDO
0x9700	PA139700.gsd	1xAI

Users decide at system integration whether to install the full range of functions or only part. Switching is made using the 'Ident Nr. Selector' parameter.

Refer to **Parameter description** in the operating instruction.

… 7 Electrical connections

… Digital communication

Limits and rules when using ABB fieldbus accessories

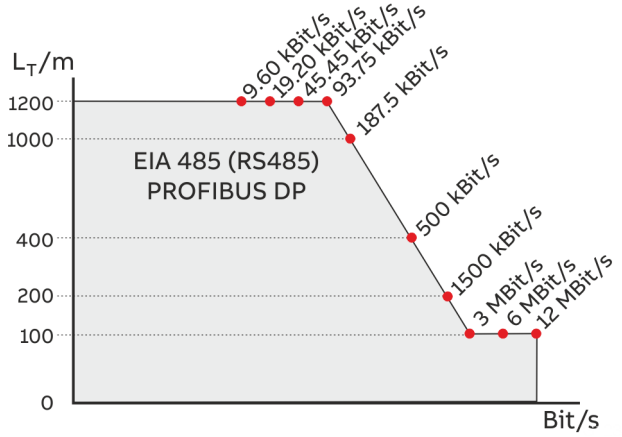


Figure 71: Bus cable length depends on the transmission rate

Pro PROFIBUS Line

(Line = Starts at DP Master and goes to last DP/PA Slave)

- Approximately 4 to 8 DP segments through the repeater (see repeater data sheets)
- Recommended DP transfer rate 500 to 1500 kBit/s
- The slowest DP node determines the transfer rate of the DP line
- Number of PROFIBUS DP and PA nodes ≤ 126 (addresses 0 to 125)

Per PROFIBUS DP segment

- Number of DP nodes ≤ 32
  (Node = Devices with / without PROFIBUS address)
- Bus termination required at the beginning and end of each DP segment!
- Trunk cable length (L_T) see diagram
  (length dependent on transfer rate)
- Cable length of at least 1 m between two DP nodes at ≥ 1500 kBit/s!
- Spur cable length (L_S), at ≤ 1500 kBit/s: LS ≤ 0.25 m, at > 1500 kBit/s: LS = 0.00 m!
- At 1500 kBit/s and ABB DP cable type A:
  - Sum of all spur cable lengths (L_S) ≤ 6.60 m, trunk cable length (L_T) > 6.60 m,
    total length = L_T+ (Σ L_S) ≤ 200 m,
    maximum 22 DP nodes
    (= 6.60 m / (0.25 m + 0.05 m spare))

8 Commissioning

Safety instructions

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing or terminal box open!
Before opening the transmitter housing or the terminal box, note the following points:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 20 minutes before opening.

⚠ CAUTION

Risk of burns due to hot measuring media
The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

Aggressive or corrosive media may lead to the damage of wetted parts of the sensor. As a result, measuring medium under pressure can leak out.

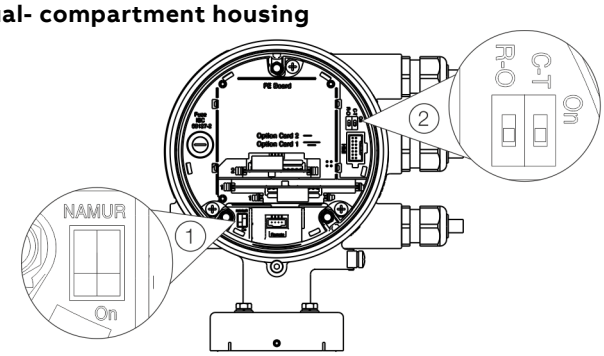
Wear to the flange gasket or process connection gaskets (e.g. flange fitting or pipe fitting) may cause a pressurized measuring medium to escape.

If pressure surges above the permissible nominal pressure of the device occur permanently during operation, this may affect the service life of the device.

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

Hardware settings

Dual- compartment housing



① NAMUR DIP switch ② Write protection DIP switch

Figure 72: Position of the DIP switches

DIP switches are located behind the front housing cover. The DIP switches are used to configure specific hardware functions. The power supply to the transmitter must be briefly interrupted in order for the modified setting to take effect.

Write-protect switch
When write protection is activated, device parameterization cannot be changed via the LCD indicator. Activating and sealing the write protection switch protects the device against tampering

Number	Function
On	Write protection active
Off	Write protection deactivated.

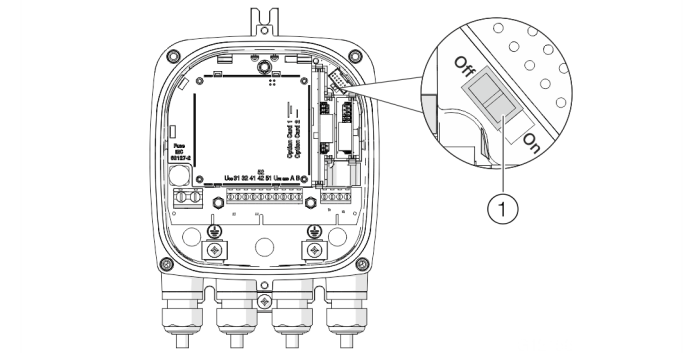
Configuration of digital outputs 41 / 42 and 51 / 52
The configuration (NAMUR, optoelectronic coupler) for the digital outputs on the basic device is set via DIP switches in the transmitter.

Number	Function
On	Digital output 41 / 42 and 51 / 52 as NAMUR output.
Off	Digital output 41 / 42 and 51 / 52 as optoelectronic coupler output.

… 8 Commissioning

… Hardware settings

Single-compartment housing



(1) DIP switch, Write protection

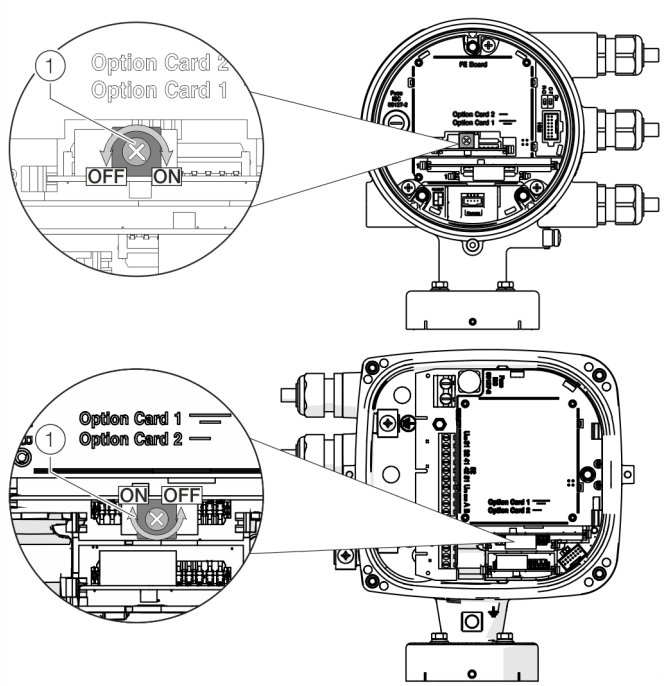
Figure 73: Position of the DIP switch

The DIP switches are used to configure specific hardware functions. The power supply to the transmitter must be briefly interrupted or the device reset in order for the modified setting to take effect.

Write-protect switch
When write protection is activated, device parameterization cannot be changed via the LCD indicator. Activating and sealing the write protection switch protects the device against tampering.

Number	Function
On	Write protection active
Off	Write protection deactivated.

Configuration of digital outputs V1 / V2 or V3 / V4



(1) NAMUR rotary switch

Figure 74: Position of rotary switch on the plug-in card

The configuration (NAMUR, optoelectronic coupler) for the digital output on the plug-in card is set via a rotary switch on the plug-in card.

Number	Function
On	Digital output V1 / V2 or V3 / V4 as NAMUR output.
Off	Digital output V1 / V2 or V3 / V4 as optoelectronic coupler output.

Checks prior to commissioning

The following points must be checked before commissioning the device:

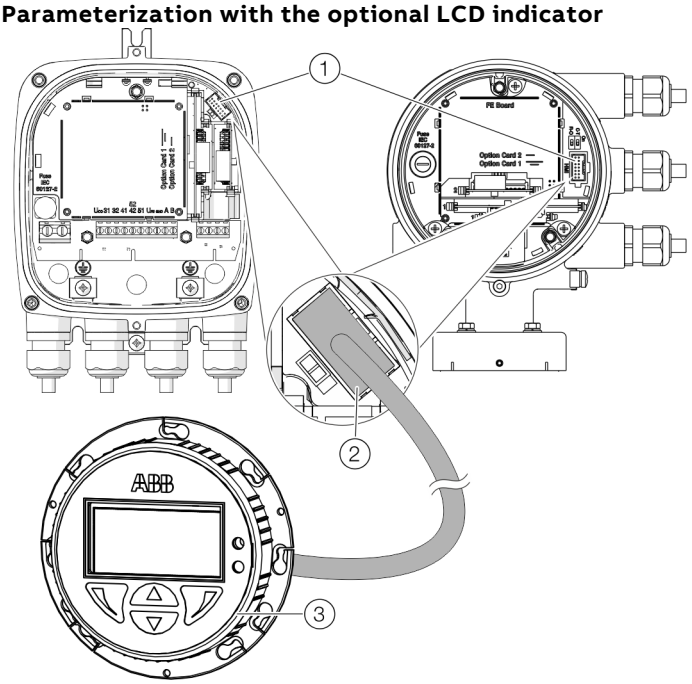
- Correct wiring in accordance with **Electrical connections** on page 55.
- Correct grounding of the device.
- The ambient conditions must meet the requirements set out in the specification.
- The power supply must meet the requirements set out on the name plate.

Parameterization of the device

The SensyMaster FMT430, FMT450 can be commissioned and operated via the integrated LCD indicator (option, see **Parameterization via the menu function Easy Setup** on page 77).

Alternatively, the CI_FMT430_450_EN_E can also be commissioned and operated via ABB Asset Vision Basic (FEP6xx DTM).

Parameterization with the optional LCD indicator



① Local operating interface
② Coupler connectors for LCD indicator
③ LCD indicator

Figure 75: Optional LCD indicator

For devices without LCD indicator, an optional LCD indicator for parameterization can be connected.

Parameterization via the local operating interface

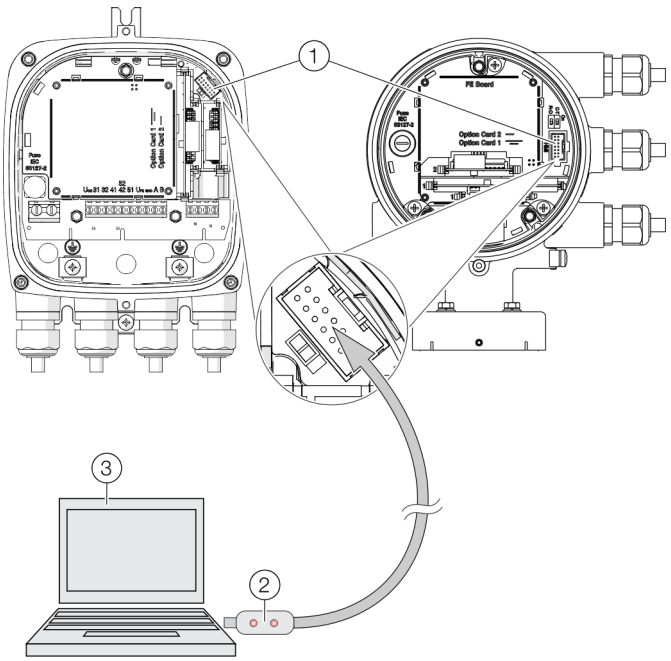
DANGER

Explosion hazard

Risk of explosion during operation of the device with open terminal box!

- Only perform parameterization of the device via the local operating interface outside potentially explosive atmospheres!

A PC / Notebook and the USB interface cable are needed to configure the device via the device local operating interface. By combining the FDI package available at www.abb.com/flow and the ABB Field Information Manager (FIM), all parameters can be set even without a fieldbus connection.



① Local operating interface
② USB-interface cable
③ PC / Notebook

Figure 76: Connection to the local operating interface

1. Open device terminal box.
2. Connect programming plug to the local operating interface of the device.
3. Insert USB interface cable into a free USB female connector on the PC / notebook.
4. Switch on the device power supply.
5. Start ABB Field Information Manager (FIM) and perform parameterization of the device.

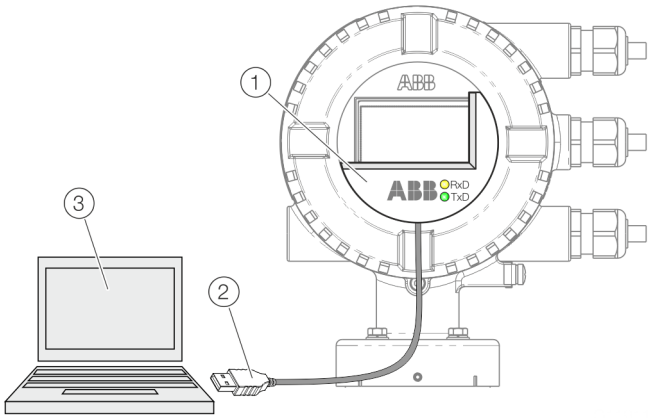
… 8 Commissioning

… Parameterization of the device

Parameterization via the infrared service port adapter

Configuration via the infrared service port adapter on the device requires a PC / notebook and the FZA100 infrared service port adapter.

By combining the FDI package available at www.abb.com/**flow** and the ABB Field Information Manager (FIM), all parameters can be set even without a HART connection.



① Infrared service port adapter ③ PC / notebook with HART DTM
② USB-interface cable

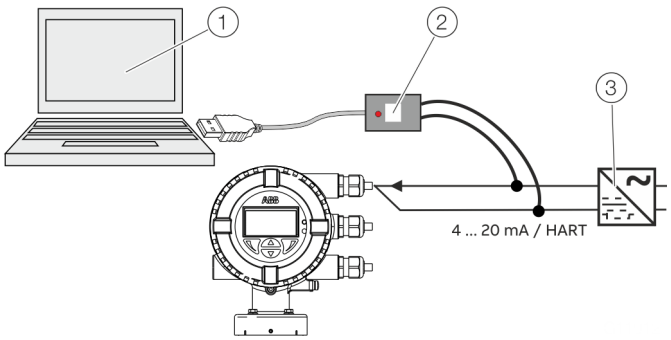
Figure 77: Infrared service port adapter on the transmitter (example)

1. Position the infrared service port adapter on the front plate of the transmitter as shown
2. Insert USB interface cable into a free USB female connector on the PC / notebook.
3. Switch on the device power supply.
4. Start the ABB Field Information Manager (FIM) and perform parameterization of the device.

Parameterization via HART®

Configuration via the HART interface of the device requires a PC / Notebook and a suited HART® Modem.

By combining the HART DTM available at www.abb.com/**flow** and the ABB Field Information Manager (FIM) , all parameters can also be set via the HART protocol.



① PC / notebook with HART DTM ③ Power supply unit
② HART modem

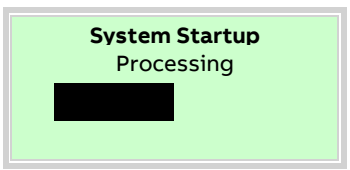
Figure 78: HART Modem on the transmitter (example)

For more detailed information on operating the software and the HART modem, please refer to the relevant operating instructions and the DTM online help.

Switching on the power supply

- Switch on the power supply.

The LCD display shows the following display during the startup process:

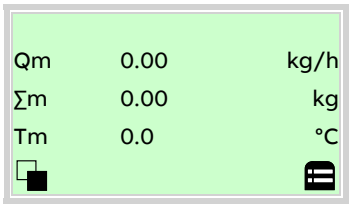


The process display is displayed after the startup process.

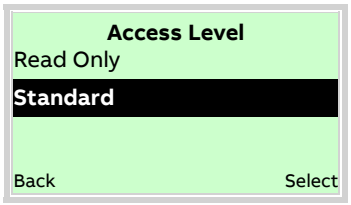
Parameterization via the menu function Easy Setup

Settings for the most common parameters are summarized in the 'Easy Setup' menu. This menu provides the fastest way to configure the device.

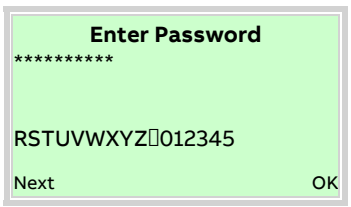
The following section describes parameterization via the 'Easy Setup' menu function.



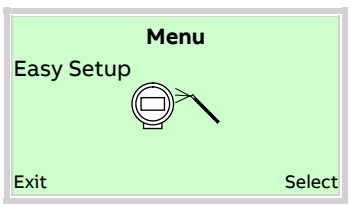
1. Switch to the configuration level with .



2. Use / to select 'Standard'.
3. Confirm the selection with .

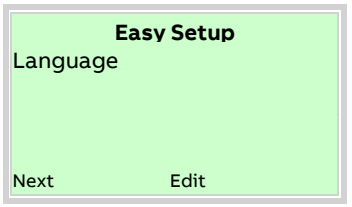


4. Use to confirm the password. A password is not available as factory default; you can continue without entering a password.



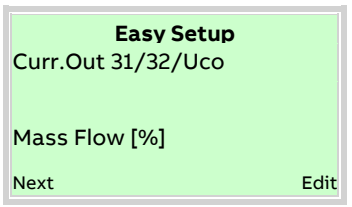
5. Use / to select 'Easy Setup'.
6. Confirm the selection with .

Selection of the menu language

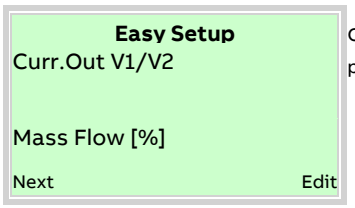


7. Use to call up the edit mode.
8. Use / to select the desired language.
9. Confirm the selection with .

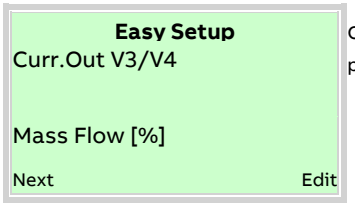
Configuration of the current output



10. Use to call up the edit mode.
11. Using / , select the desired process value for current output 31 / 32 / Uco.
12. Confirm the selection with .



Only if an appropriate plug-in card is present!



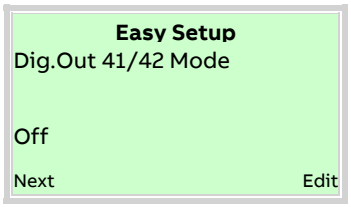
Only if an appropriate plug-in card is present!

13. Use to call up the edit mode.
14. Use / to select the desired process value for current output V1 / V2 or V3 / V4.
15. Confirm the selection with .

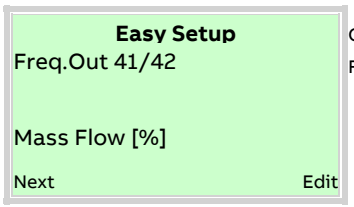
… 8 Commissioning

… Parameterization via the menu function Easy Setup

Configuring the digital outputs

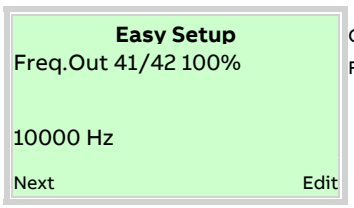


16. Use to call up the edit mode.
17. Use / to select the desired operating modeOff, Binary, Pulse, Frequencyfor the digital output.
18. Confirm the selection with .



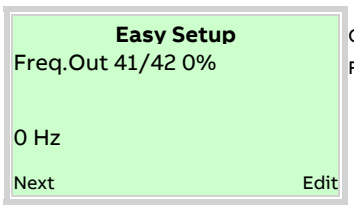
Only available if "Dig.Out 41/42 Mode" Frequency has been selected.

19. Use to call up the edit mode.
20. Using / , select the desired process value for frequency output 41 / 42.
21. Confirm the selection with .



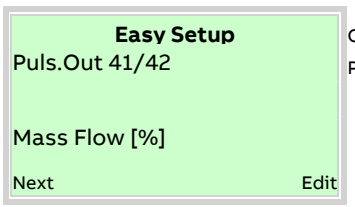
Only available if "Dig.Out 41/42 Mode" Frequency has been selected.

22. Use to call up the edit mode.
23. Using / set the frequency for 100 % of the flow rate.
24. Confirm the selection with .



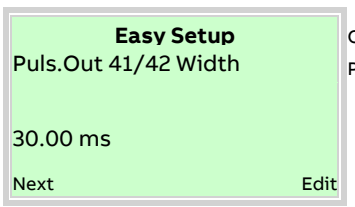
Only available if "Dig.Out 41/42 Mode" Frequency has been selected.

25. Use to call up the edit mode.
26. Using / set the frequency for 0 % of the flow rate.
27. Confirm the selection with .



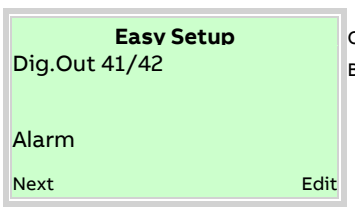
Only available if "Dig.Out 41/42 Mode" Pulse has been selected.

28. Use to call up the edit mode.
29. Using / , select the desired process value for pulse output 41 / 42.
30. Confirm the selection with .



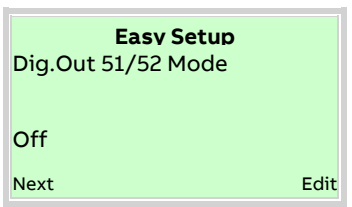
Only available if "Dig.Out 41/42 Mode" Pulse has been selected.

31. Use to call up the edit mode.
32. Use / to select the desired pulse width for the pulse output..
33. Confirm the selection with .

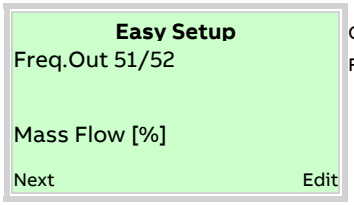


Only available if "Dig.Out 41/42 Mode" Binary has been selected.

34. Use to call up the edit mode.
35. Using / , select the desired function for binary output 41 / 42.
36. Confirm the selection with .

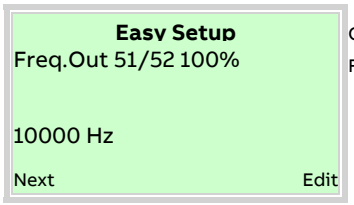


37. Use to call up the edit mode.
38. Use / to select the desired operating modeOff, Binary, Frequency, Pulse 41/42 <)90°, Pulse 41/42 <)180°for the digital output.
39. Confirm the selection with .



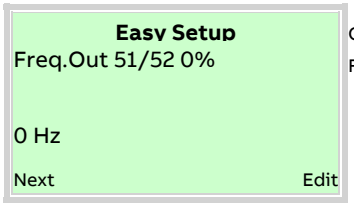
Only available if "Dig.Out 51/52 Mode" Frequency has been selected.

40. Use to call up the edit mode.
41. Using / , select the desired process value for frequency output 51 / 52.
42. Confirm the selection with .



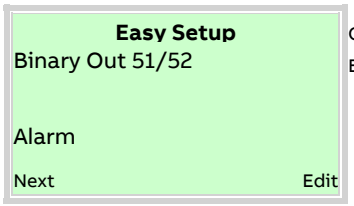
Only available if "Dig.Out 51/52 Mode" Frequency has been selected.

43. Use to call up the edit mode.
44. Using / set the frequency for 100 % of the flow rate.
45. Confirm the selection with .



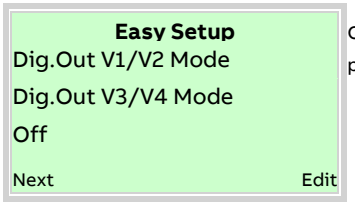
Only available if "Dig.Out 51/52 Mode" Frequency has been selected.

46. Use to call up the edit mode.
47. Using / set the frequency for 0 % of the flow rate.
48. Confirm the selection with .



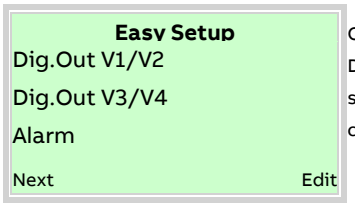
Only available if "Dig.Out 51/52 Mode" Binary has been selected.

49. Use to call up the edit mode.
50. Using / , select the desired function for binary output 51 / 52.
51. Confirm the selection with .



Only if an appropriate plug-in card is present!

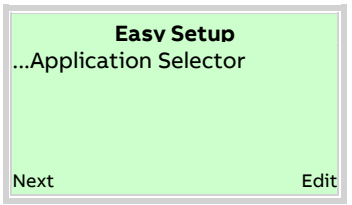
52. Use to call up the edit mode.
53. Use / to select the desired operating mode (Off, Binary) for digital output V1 / V2 or V3 / V4.
54. Confirm the selection with .



Only if for Dig.Out V1/V2 Mode or Dig.Out V3/V4 Mode Binary has been selected and an appropriate plug-in card is present!

55. Use to call up the edit mode.
56. Use / to select the desired function for binary output V1 / V2 or V3 / V4.
57. Confirm the selection with .

Select the application

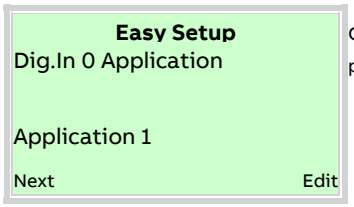


58. Use to call up the edit mode.
59. Use / to select the desired application.
60. Confirm the selection with .

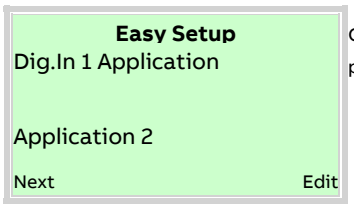
… 8 Commissioning

… Parameterization via the menu function Easy Setup

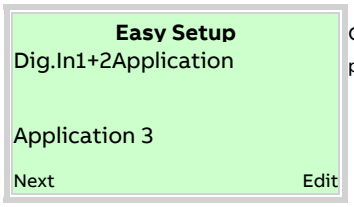
Select the application using the digital inputs



Only if an appropriate plug-in card is present!



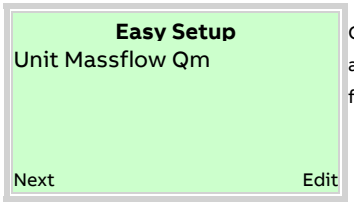
Only if an appropriate plug-in card is present!



Only if an appropriate plug-in card is present!

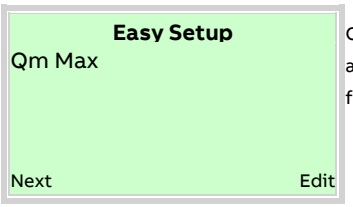
61. Use to call up the edit mode.
62. Use / to assign the applications to the respective digital inputs.
63. Confirm the selection with .

Select measuring ranges and units



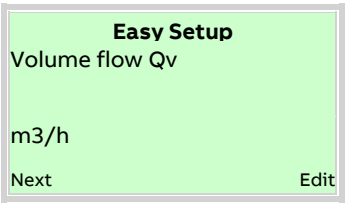
Only if Mass Flow [%] has been selected as the process value for a current, frequency or pulse output.

64. Use to call up the edit mode.
65. Use / to select the unit for mass flow measurement.
66. Confirm the selection with .

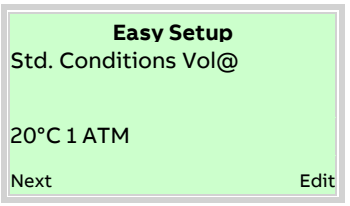


Only if Mass Flow [%] has been selected as the process value for a current, frequency or pulse output.

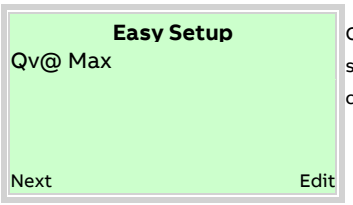
67. Use to call up the edit mode.
68. Use / to set the desired measuring range for mass flow measurement.
69. Confirm the selection with .



70. Use to call up the edit mode.
71. Use / to select the desired unit for volume flow measurement.
72. Confirm the selection with .

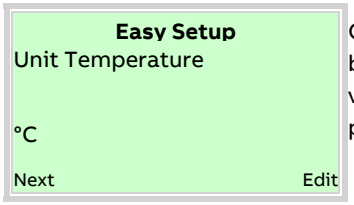


73. Use to call up the edit mode.
74. Use / to select the desired standard state for volume flow measurement.
75. Confirm the selection with .



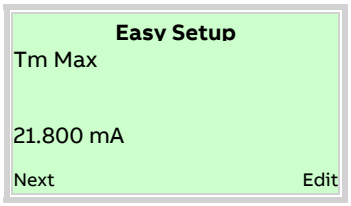
Only if Volume Flow [%] has been selected as the process value for a current, frequency or pulse output.

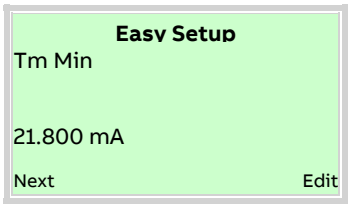
76. Use to call up the edit mode.
77. Use / to set the desired measuring range for volume flow measurement.
78. Confirm the selection with .



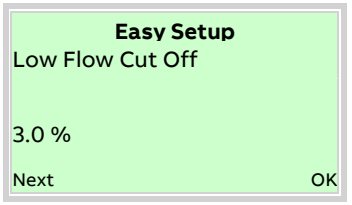
Only if Temperature [%] has been selected as the process value for a current, frequency or pulse output.

79. Use to call up the edit mode.
80. Use / to select the desired temperature unit.
81. Confirm the selection with .

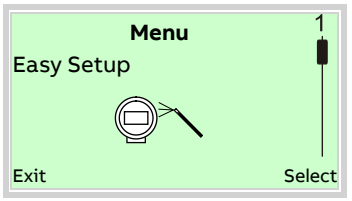




82. Use to call up the edit mode.
83. Use / to set the desired measuring range for temperature measurement.
84. Confirm the selection with .



85. Use to call up the edit mode.
86. Use / to set the desired low flow (% of Q_{mMax} / Q_{VMax}).
87. Confirm the selection with .



Once all parameter have been set, the main menu appears again. The most important parameters are now set.

88. Use to switch to the process display.

… 8 Commissioning

Software history

In accordance with NAMUR recommendation NE53, ABB offers a transparent and traceable software history.

Device software package FMT430 / FMT450 (device firmware package)

Type	Issue date	Type of change	Description	Ordering number
01.00.07	28.08.2017	First publication	—	3KXF002045U0100_01.00.07
01.00.08	06.11.2018	Change	Minor debugging	3KXF002045U0100_01.00.08
01.01.00	04.2020	Change	Function extension and minor debugging	3KXF002045U0100_01.01.00
01.02.00	07.2022	Change	Optimization of Modbus communication and and minor debugging	3KXF002045U0100_01.02.00

9 Operation

Safety instructions

⚠ CAUTION

Risk of burns due to hot measuring media

The device surface temperature may exceed 70 °C (158 °F), depending on the measuring medium temperature!

- Before starting work on the device, make sure that it has cooled sufficiently.

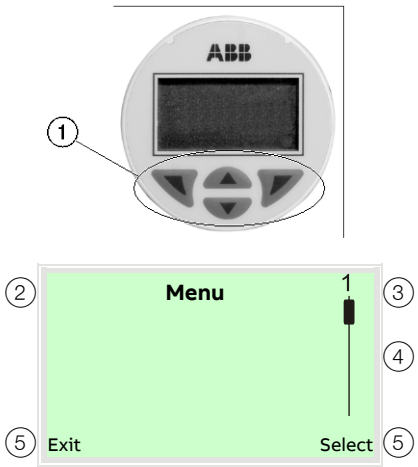
Aggressive or corrosive media may lead to the damage of wetted parts of the sensor. As a result, measuring medium under pressure can leak out.

Wear to the flange gasket or process connection gaskets (e.g. flange fitting or pipe fitting) may cause a pressurized measuring medium to escape.

If pressure surges above the permissible nominal pressure of the device occur permanently during operation, this may affect the service life of the device.

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

Menu navigation



1. Operating buttons for menu navigation
2. Menu name display
3. Menu number display
4. Marker for indicating relative position within the menu
5. Display showing the current functions of the ◥ and ◢ operating buttons

Figure 79: LCD display

The LCD indicator has capacitive operating buttons. These enable you to control the device through the closed housing cover.

Note

The transmitter automatically calibrates the capacitive buttons on a regular basis. If the cover is opened during operation, the sensitivity of the buttons is firstly increased to enable operating errors to occur. The button sensitivity will return to normal during the next automatic calibration.

You can use the ▲ or ▼ operating buttons to browse through the menu or select a number or character within a parameter value.
Different functions can be assigned to the ◥ and ◢ operating buttons. The function (5) that is currently assigned to them is shown on the LCD display.

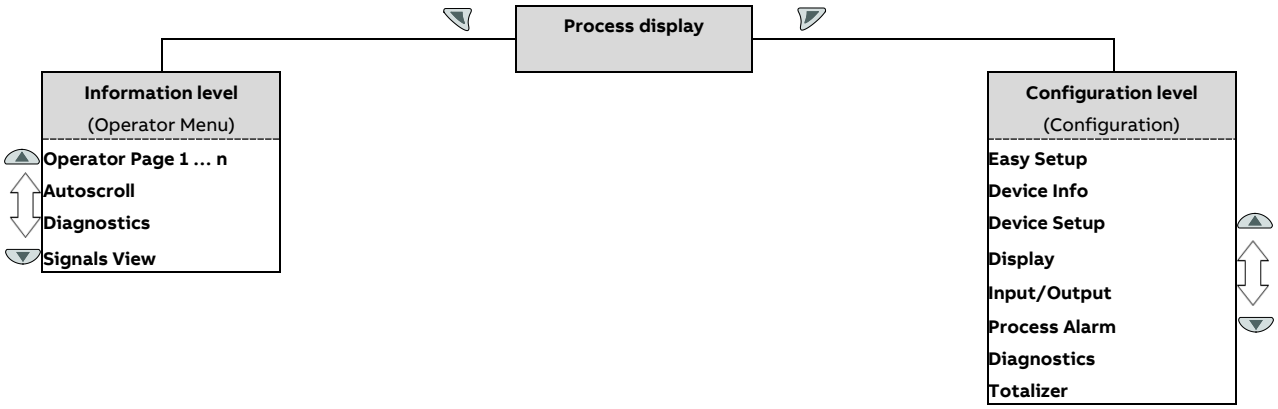
Control button functions

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

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

… 9 Operation

Menu levels

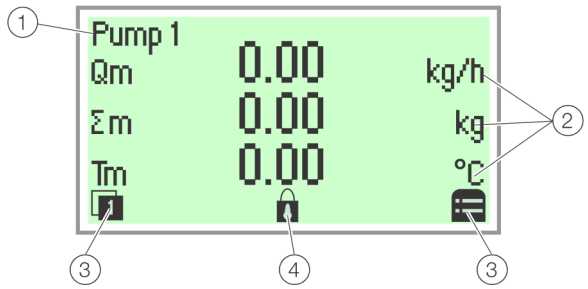


Process display
The process display shows the current process values.
There are two menu levels under the process display.

Information level (Operator Menu)
The information level contains the parameters and information that are relevant for the operator.
The device configuration cannot be changed on this level.

Configuration level (Configuration)
The configuration level contains all the parameters required for device commissioning and configuration. The device configuration can be changed on this level.
For detailed information on the parameters, refer to **Parameter description** in the operating instruction.

Process display



1. Measuring point tagging
2. Current process values
3. 'Button function' symbol
4. 'Parameterization protected' symbol

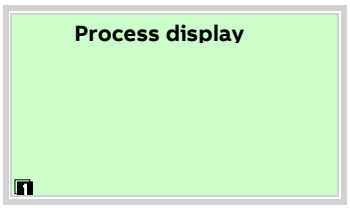
Figure 80: Process display (example)

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

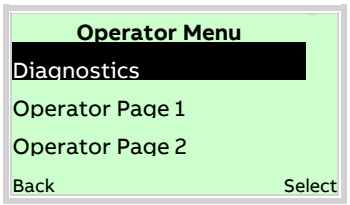
Symbol	Description
/	Call up information level. When Autoscroll mode is activated, the icon appears here and the operator pages are automatically displayed one after the other.
	Call up configuration level.
	The device is protected against changes in the parametrization.

Switching to the information level

On the information level, the operator menu can be used to display diagnostic information and choose which operator pages to display.



1. Open the using Operator Menu.



2. Select the desired submenu using / .
3. Confirm the selection with .

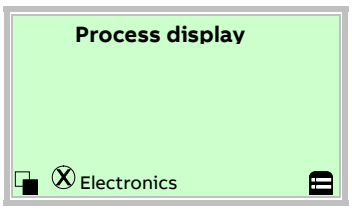
Menu	Description
... / Operator Menu	
Diagnostics	Selection of sub-menu 'Diagnostics'; see also **Error messages on the LCD display** on page 86.
Operator Page 1 to n	Selection of operator page to be displayed.
Autoscroll	When 'Autoscroll' is activated, automatic switching of the operator pages is initiated on the process screen.
Signals View	Selection of submenu 'Signals View' (only for service purposes).

… 9 Operation

… Switching to the information level

Error messages on the LCD display

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



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

Symbol	Description
	Error / failure
	Function check
	Outside of the specification
	Maintenance required

The error messages are also divided into the following areas:

Range	Description
Operation	Error / alarm due to the current operating conditions.
Sensor	Error / alarm of the flowmeter sensor.
Electronics	Error / alarm of the electronics.
Configuration	Error / alarm due to device configuration.

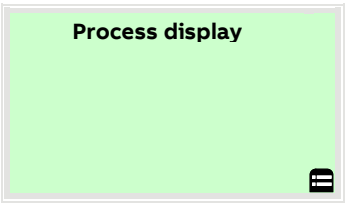
Note
For a detailed description of errors and troubleshooting instructions, please see **"Diagnosis / error messages" in the operating instruction**.

Switching to the configuration level (parameterization)

Note
For a detailed description of the individual parameters and menus on the configuration level, please refer to the **Parameter description** in the operating instruction.

Note
For security reasons it is recommended, to set a password.

The device parameters can be displayed and changed on the configuration level.



1. Switch to the configuration level with .

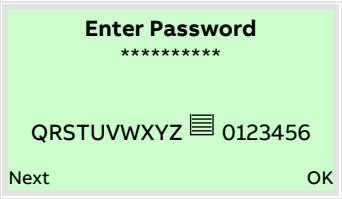
2. Select the desired level of access using / .
3. Confirm the selection with .

Note
There are three levels of access. A password can be defined for level ‘Standard’.

- There is no factory default password. For security reasons it is recommended to set a password.
- The password prevents access to the parameterization via the buttons on the device. For further access protection via DTM or EDD (HART®, PROFIBUS®, Modbus®) the hardware write protection switch must be set (see **Write-protect switch** on page 73).

Access Level	Description
Read Only	All parameters are locked. Parameters are read only and cannot be modified.
Standard	All the parameters can be changed.
Service	Only ABB Customer Service has access to the Service menu.

Once you have logged on to the corresponding access level, you can edit or reset the password. Reset (status 'no password defined') by
selecting '▤' as a password.



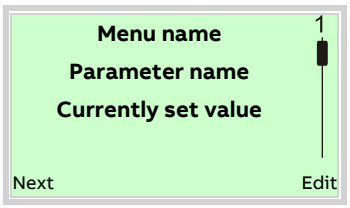
4. Enter the appropriate password. No password is preset in the factory settings. Users can switch to the configuration level without entering a password.
   The selected access level remains active for 3 minutes. Within this time period you can toggle between the process display and the configuration level without re-entering the password.
5. Use ◤ to confirm the password.

The LCD display now indicates the first menu item on the configuration level.

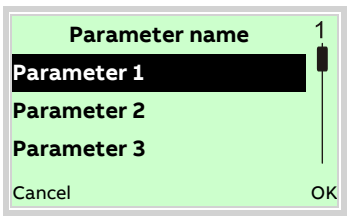
6. Select a menu using ▲ / ▼.
7. Confirm the selection with ◤.

Selecting and changing parameters

Entry from table
When an entry is made from a table, a value is selected from a list of parameter values.



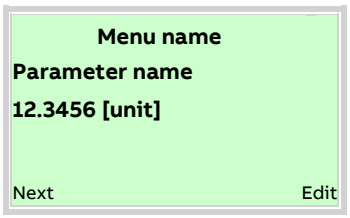
1. Select the parameters you want to set in the menu.
2. Use ◤ to call up the list of available parameter values. The parameter value that is currently set is highlighted.



3. Select the desired value using ▲ / ▼.
4. Confirm the selection with ◤.

This concludes the procedure for selecting a parameter value.

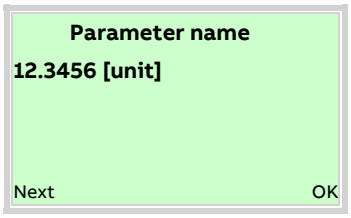
Numerical entry
When a numerical entry is made, a value is set by entering the individual decimal positions.



1. Select the parameters you want to set in the menu.
2. Use ◤ to call up the parameter for editing. The decimal place that is currently selected is highlighted.

… 9 Operation

… Selecting and changing parameters

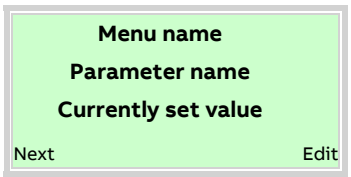


3. Use ◥ to select the decimal place to change.
4. Use ▲ / ▼ to set the desired value.
5. Use ◥ to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use ◢ to confirm your setting.

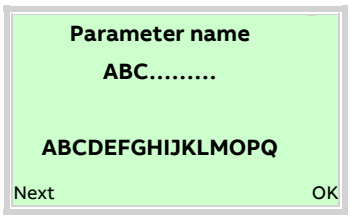
This concludes the procedure for changing a parameter value.

Alphanumeric entry

When an alphanumeric entry is made, a value is set by entering the individual decimal positions.



1. Select the parameters you want to set in the menu.
2. Use ◢ to call up the parameter for editing. The decimal place that is currently selected is highlighted.



3. Use ◥ to select the decimal place to change.
4. Use ▲ / ▼ to set the desired value.
5. Use ◥ to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use ◢ to confirm your setting.

This concludes the procedure for changing a parameter value.

Exiting the setup

For some menu items, values must be entered. If you don't want to change the parameter, you can exit the menu as described below.

1. Pressing ◥ (Next) repeatedly moves the cursor to the right. Once the cursor reaches the end position, ‘Cancel’ is displayed in the lower right of the screen.
2. ◢ terminates editing and exits the menu item. Use ◥ to return to the start.

Note

The LCD display automatically returns to the process display three minutes after the last button has been actuated.

10 Maintenance

Safety instructions

⚠ DANGER

Danger of explosion if the device is operated with the transmitter housing or terminal box open!
Before opening the transmitter housing or the terminal box, note the following points:
- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 20 minutes before opening.

⚠ DANGER

Danger to life due to piping under pressure!
Sensors which may eject during installation or removal in piping remaining under pressure may pose a danger to life.
- Install or remove a sensor only if the piping is depressurized.
- As an alternative, use a pipe component with an integrated hop tap fitting.

⚠ WARNING

Loss of Ex-approval!
Loss of Ex approval due to replacement of components in devices for use in potentially explosive atmospheres.
- Devices for use in potentially explosive atmospheres may be serviced and repaired by qualified ABB personnel only.
- For measuring devices for potentially explosive atmospheres, observe the relevant operator guidelines. See also **Use in potentially explosive atmospheres** on page 6.

⚠ WARNING

Risk of injury due to live parts!
When the housing is open, contact protection is not provided and EMC protection is limited.
- Before opening the housing, switch off the power supply.

⚠ CAUTION

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

NOTICE

Damage to components!
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.

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

11 Dismounting and disposal

Dismounting

⚠ WARNING

Risk of injury due to process conditions.
The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when dismantling the device.

- If necessary, wear suited personal protective equipment during disassembly.
- Before disassembly, make sure that the process conditions do not pose any safety risks.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

Bear the following points in mind when dismantling the device:

- Switch off the power supply.
- Disconnect electrical connections.
- Allow the device / piping to cool and depressurize and empty. Collect any escaping medium and dispose of it in accordance with environmental guidelines.
- Use suited tools to disassemble the device, taking the weight of the device into consideration.
- If the device is to be used at another location, the device should preferably be packaged in its original packing so that it cannot be damaged.
- Observe the notices in **Returning devices** on page 25.

Disposal

Note

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

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

Bear the following points in mind when disposing of them:

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

12 Specification

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

13 Additional documents

Note
All documentation, declarations of conformity, approvals, certificates and additional documentation are available in the ABB download area.
www.abb.com/flow

Trademarks

14 Appendix

Return form

Statement on the contamination of devices and components
Repair and/or maintenance work will only be performed on devices and components if a statement form has been completed and submitted.
Otherwise, the device/component returned may be rejected. This statement form may only be completed and signed by authorized specialist personnel employed by the operator.

Customer details:

Company:	
Address:	
Contact person:	Telephone:
Fax:	Email:

Device details:

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

Was this device used in conjunction with substances which pose a threat or risk to health?

☐ Yes ☐ No

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

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

Which substances have come into contact with the device?

1.
2.
3.

We hereby state that the devices/components shipped have been cleaned and are free from any dangerous or poisonous substances.

Town/city, date Signature and company stamp

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FMT400 Installation diagram 3kxf000094G0009

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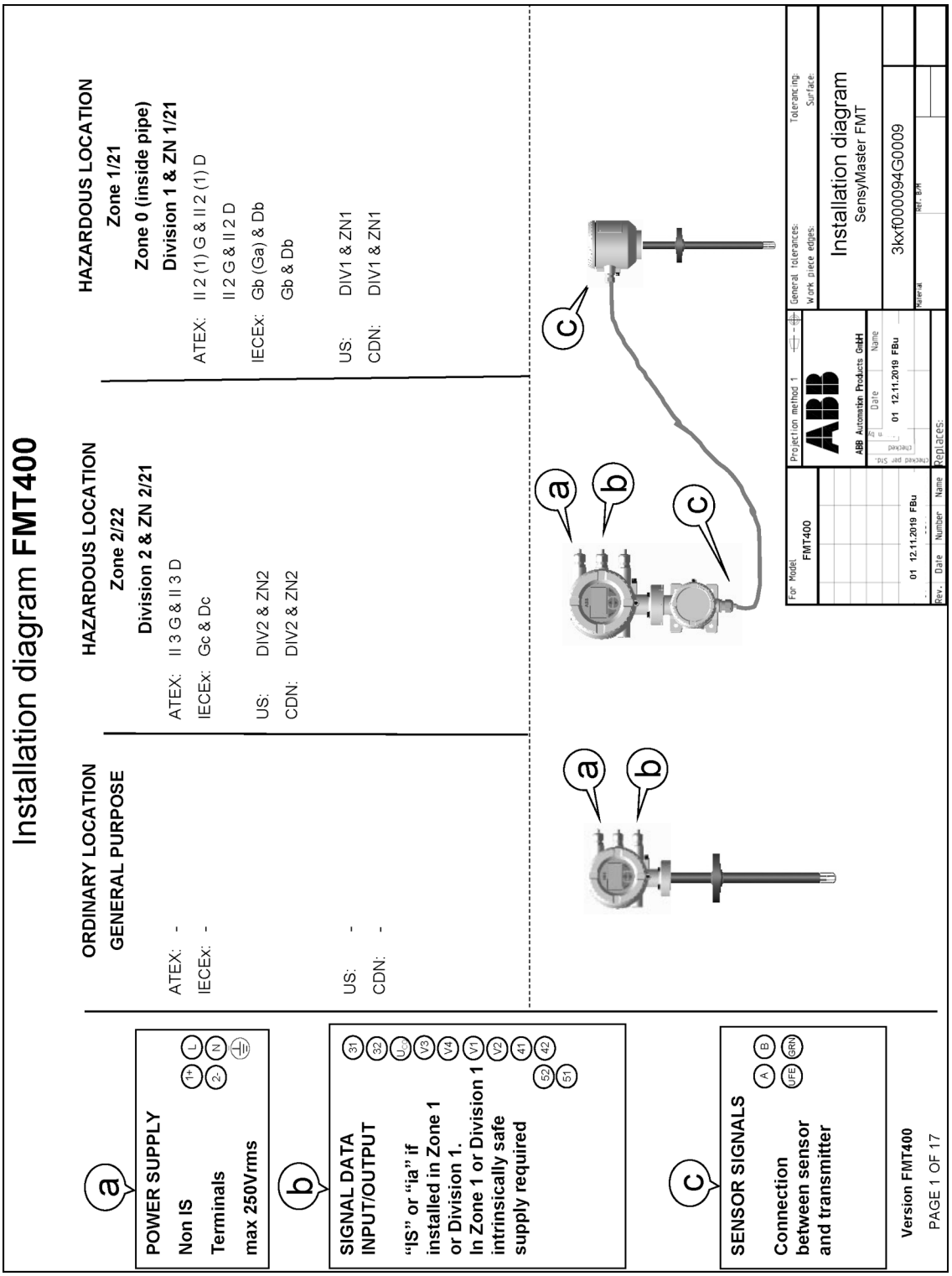

Notes: ATEX & IECEx application

1. THE INTRINSIC SAFETY ENTITY CONCEPT ALLOWS THE INTERCONNECTION OF TWO ATEX/IECEx APPROVED INTRINSICALLY SAFE DEVICES WITH ENTITY PARAMETERS NOT SPECICALLY EXAMINED IN COMBINATION AS A SYSTEM WHEN: Uo OR Voc OR Vt < V MAX, Io OR Ioc OR It < I MAX; Ca OR Co > Ci + Ccable; La OR Lo > Li + Lcable; Po < Pi.
2. DUST-TIGHT CONDUIT SEAL MUST BE USED WHEN INSTALLED IN Zone 21/22 ENVIROMENTS.
3. CONTROL EQUIPMENT CONNECTED TO THE ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 Vrms OR Vdc WITH RESPECT TO EARTH.
4. INSTALLATION SHOULD BE IN ACCORDANCE WITH THE RELEVANT INTERNATIONAL OR NATIONAL REGULATIONS „INSTALLATION OF INTRINSICALLY SAFE FOR HAZARDOUS LOCATIONS“ REGULATIONS.
5. THE CONFIGURATION OF ASSOCIATED APPARATUS MUST BE ATEX or IECEx APPROVED UNDER ENTITY CONCEPT.
6. ASSOCIATED APPARATUS MANUFACTURER´S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
7. THE ASSOCIATED APPARATUS MUST BE INSTALLED IN ACCORDANCE WITH BARRIER MANUFACTURE´S INSTALLATION DIAGRAM
8. SELECTED ASSOCIATED APPARATUS MUST BE THIRD PARTY LISTED AS PROVIDING INTRINSICALLY SAFE CIRCUITS FOR THE APPLICATION. IT MUST MEET THE REQUIREMENTS LISTED IN TABLE OF THIS INSTALLATION DIAGRAM:

Notes: US and Canadian application

1. THE INTRINSIC SAFETY ENTITY CONCEPT ALLOWS THE INTERCONNECTION OF TWO FM AND/OR CSA APPROVED INTRINSICALLY SAFE DEVICES WITH ENTITY PARAMETERS NOT SPECICALLY EXAMINED IN COMBINATION AS A SYSTEM WHEN: Uo OR Voc OR Vt < V MAX, Io OR Ioc OR It < I MAX; Ca OR Co > Ci + Ccable; La OR Lo > Li + Lcable; Po < Pi.
2. DUST-TIGHT CONDUIT SEAL MUST BE USED WHEN INSTALLED IN CLASS II AND III ENVIROMENTS.
3. CONTROL EQUIPMENT CONNECTED TO THE ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 Vrms OR Vdc WITH RESPECT TO EARTH.
4. INSTALLATION FOR U.S. AND CANADIAN APPROVED EQUIPMENT SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP12.6 „INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS“, THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70) SECTIONS 504, 505 AND THE CANADIAN ELECTRICAL CODE (C22.1-02).
5. THE CONFIGURATION OF ASSOCIATED APPARATUS MUST BE FM AND/OR CSA APPROVED UNDER ENTITY CONCEPT.
6. ASSOCIATED APPARATUS MANUFACTURER´S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
7. THE ASSOCIATED APPARATUS MUST BE INSTALLED IN ACCORDANCE WITH BARRIER MANUFACTURE´S INSTALLATION DIAGRAM
8. SELECTED ASSOCIATED APPARATUS MUST BE THIRD PARTY LISTED AS PROVIDING INTRINSICALLY SAFE CIRCUITS FOR THE APPLICATION. IT MUST MEET THE REQUIREMENTS LISTED IN TABLE OF THIS INSTALLATION DIAGRAM:

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For Model	Projection method 1	General tolerances:	Tolerancing:
FMT400	ABB Automation Products GmbH	Work piece edges:	Surface:
	Date Name	Installation diagram	
01 12.11.2019 FBu	checked per Std. checked 01 12.11.2019 FBu	SensyMaster FMT	
		3kxf000094G0009	
Rev. Date Number Name	Replaces:	Material: Ref. B/M	

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Zone 2/22 & Division 2

Model code FMT4bcY0
FMT4bcA2
FMT4bcF2
HART Communication

Indication	Abbr.	Status	Option	Terminal	Operating Value			
		Active or Passive	Choosen Option depending on Model Number (MN)	If "or" occurs Terminal depends on MN	GP		Ex ec / NI	
					U_{nom} [V]	I_{nom} [mA]	U_{nom} [V]	I_{nom} [mA]
On board								
Current Ouput 1	CO1	A	On board Power Supply	31/U_{CO}	30	30	30	30
Current Ouput 1	CO1	P		31/32	30	30	30	30
Digital Output 1	DO1	A	With OC Active Supply	41/42 and V1/V2	30	30	30	30
Digital Output 1	DO1	P		41/42	30	30	30	30
Digital Output 2	DO2	A	With OC Active Supply	51/52 and V1/V2	30	30	30	30
Digital Output 2	DO2	P		51/52	30	30	30	30
Option Cards (OC)								
Current Ouput 2	CO2	A	With OC Active Supply	V1/V2 and V3/V4	30	30	30	30
Current Ouput 2	CO2	P		V1/V2 or V3/V4	30	30	30	30
Current Ouput 3	CO3	P		V1/V2 or V3/V4	30	30	30	30
Digital Output 3	DO3	A	With OC Active Supply	V1/V2 and V3/V4	30	30	30	30
Digital Output 3	DO3	P		V1/V2 or V3/V4	30	30	30	30
Digital Input 1	DI1	A	With OC Active Supply	V1/V2 and V3/V4	30	3,45	30	3,45
Digital Input 1	DI1	P		V1/V2 or V3/V4	30	3,45	30	3,45
Modbu / Profibus DP	- - -	A		V1/V2	30	30	30	30

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For Model FMT400
01 12.11.2019 FBu
Rev. Date Number Name

Projection method 1
ABB
ABB Automation Products GmbH
Date Name
01 12.11.2019 FBu
Replaces:

General tolerances: Tolerancing:
Work piece edges: Surface:
Installation diagram
SensyMaster FMT
3kxf000094G0009
Material Ref. B/M

Zone 0/1/21 & Division 1

Model code FMT4bcA1, FMT4bcA3
FMT4bcF1

HART Communication

Indication	Abbr.	Status	Option	Terminal	Operating Value													
					Ex e / XP		Ex ia / IS											
		Active or Passive	Choosen Option depending on Model Number (MN)	If "or" occurs Terminal depends on MN	U_M [V]	I_M [A]	U_O [V]	U_I [V]	I_O [mA]	I_I [mA]	P_O [mW]	P_I [mW]	C_O [nF]	C_I [nF]	C_{OPA} [nF]	C_{IPA} [nF]	L_O [mH]	L_I [mH]
On board																		
Current Ouput 1	CO1	A	On board Power Supply	$31/U_{CO}$	30	0,2	30	30	115	115	815	815	10	10	5	5	0,08	0,08
Current Ouput 1	CO1	P		31/32	30	0,2	-	30	-	115	-	815	-	27	-	5	0,08	0,08
Digital Output 1	DO1	A	With OC Active Supply	41/42 and V1/V2	30	0,1	27,8	30	119	30	826	225	20	20	29	29	0,22	0,22
Digital Output 1	DO1	P		41/42	30	0,1	-	30	-	30	-	225		27	-	5	-	0,08
Digital Output 2	DO2	A	With OC Active Supply	51/52 and V1/V2	30	0,1	27,8	30	119	30	826	225	20	20	29	29	0,22	0,22
Digital Output 2	DO2	P		51/52	30	0,1	-	30	-	30	-	225		27	-	5	-	0,08
Option Cards (OC)																		
Current Ouput 2	CO2	A	With OC Active Supply	V1/V2 and V3/V4	30	0,1	27,8	30	119	30	826	225	29	29	117	117	0,4	0,4
Current Ouput 2	CO2	P		V1/V2 or V3/V4	30	0,1	-	30	-	68	-	510	-	45	-	59	-	0,27
Current Ouput 3	CO3	P		V1/V2 or V3/V4	30	0,1	-	30	-	68	-	510	-	45	-	59	-	0,27
Digital Output 3	DO3	A	With OC Active Supply	V1/V2 and V3/V4	30	0,1	27,8	30	119	68	826	225	17	17	31	31	0,4	0,4
Digital Output 3	DO3	P		V1/V2 or V3/V4	30	0,1	-	30	-	30	-	225	-	13	-	16	-	0,27
Digital Input 1	DI1	A	With OC Active Supply	V1/V2 and V3/V4	30	0,1	27,8	30	119	3,45	826	25,8	17	17	31	31	0,4	0,4
Digital Input 1	DI1	P		V1/V2 or V3/V4	30	0,1	-	30	-	3,45	-	25,8	-	13	-	16	-	0,27
Digital Input 2	DI2	P		V1/V2 or V3/V4	30	0,1	-	30	-	3,45	-	25,8	-	13	-	16	-	0,27
Modbus / Profibus DP	- - -	A		V1/V2	30	0,1	4,2	4,2	150	150	150	150	5300	5300	0,06	0,06	0,09	0,09

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For Model: FMT400

Projection method 1

ABB Automation Products GmbH

Rev.	Date	Number	Name
	01 12.11.2019		FBu

Replaces:

General tolerances: Tolerancing:
Work piece edges: Surface:

Installation diagram
SensyMaster FMT

3kxf000094G0009

Material: Ref. B/M

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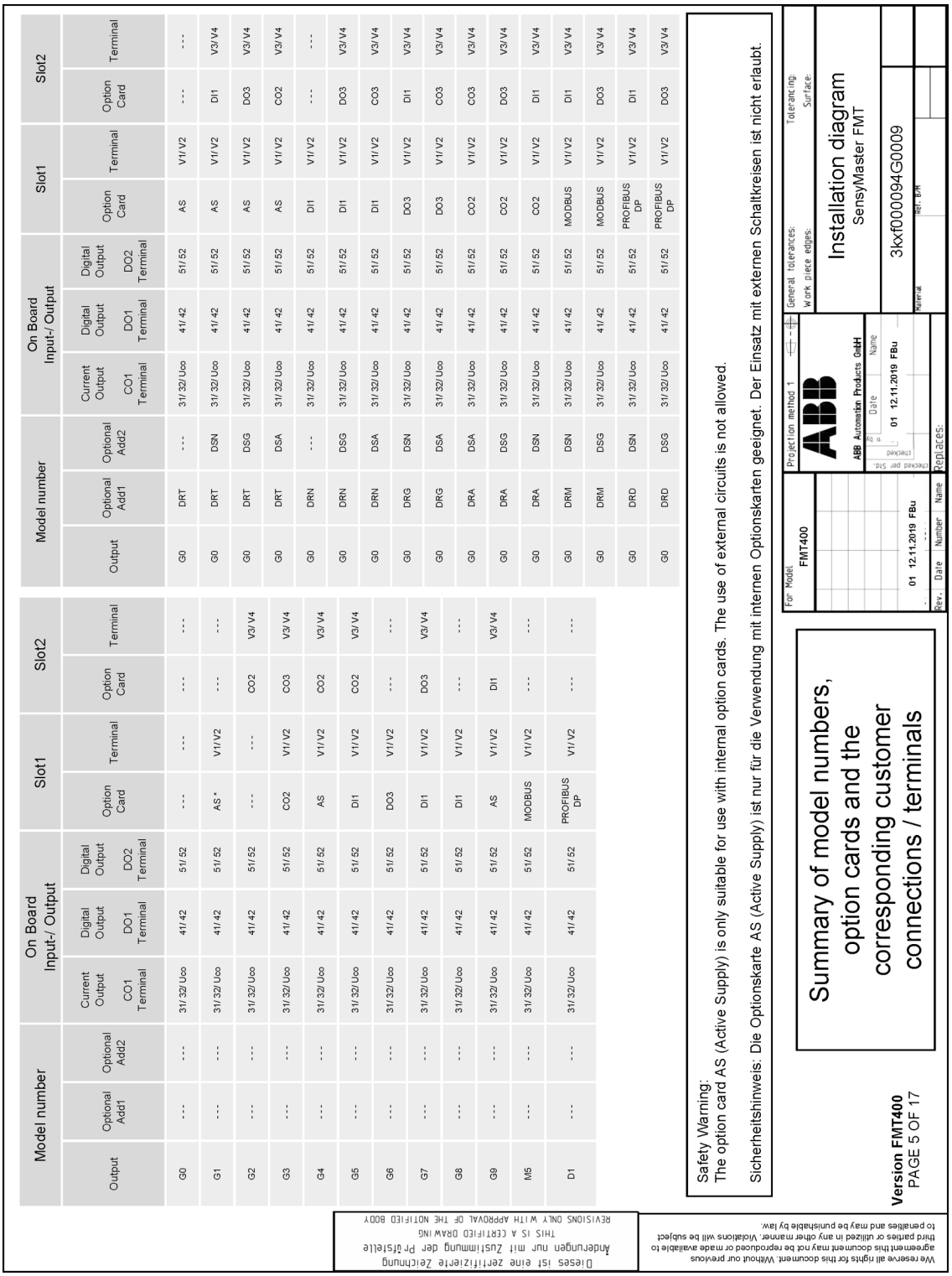

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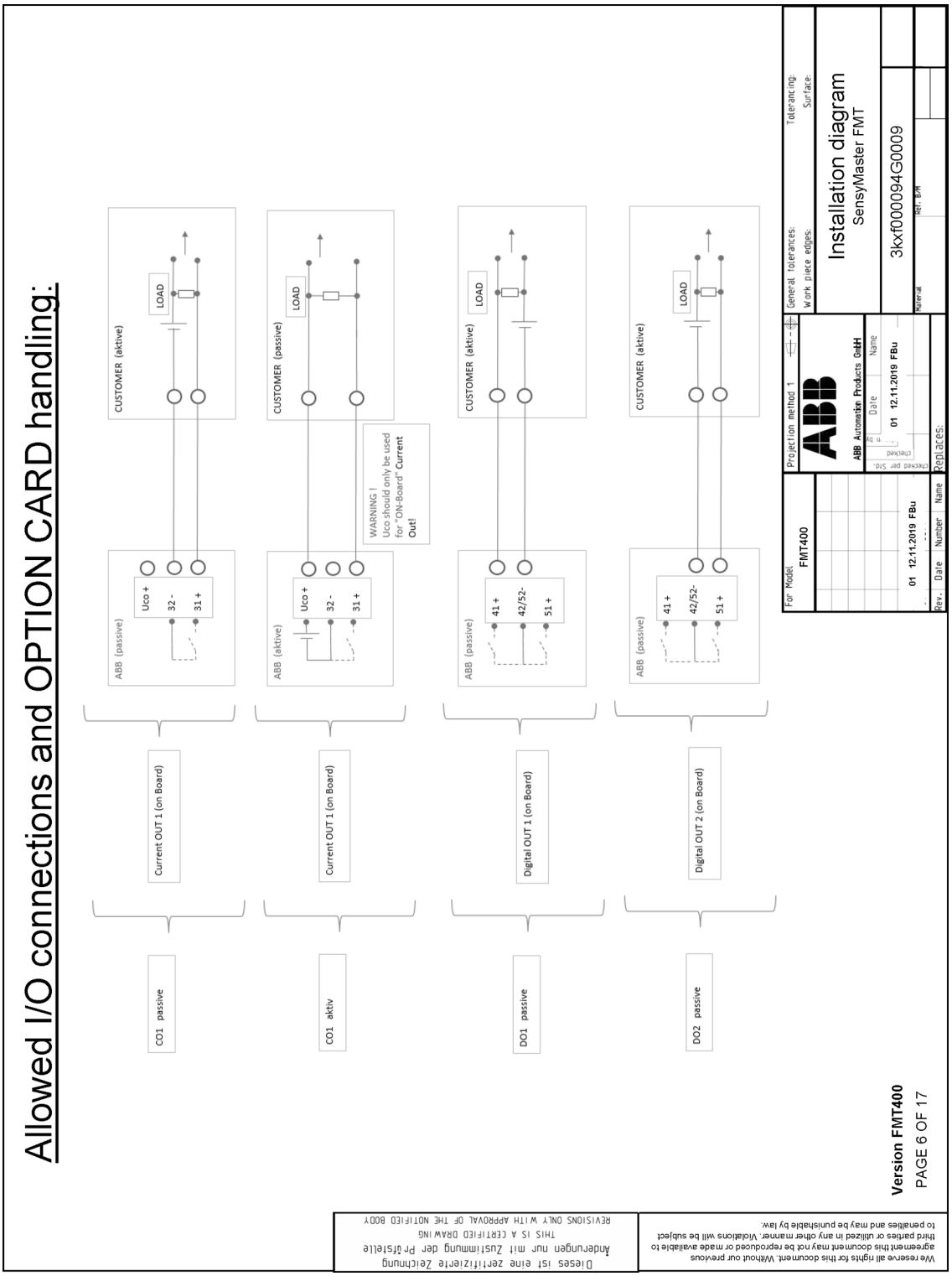
Allowed I/O connections and OPTION CARD handling:
CO1 passive
CO1 aktiv
DO1 passive
DO2 passive
Current OUT 1 (on Board)
Current OUT 1 (on Board)
Digital OUT 1 (on Board)
Digital OUT 2 (on Board)
ABB (passive)
Uco +
32 -
31 +
CUSTOMER (aktive)
LOAD
ABB (aktive)
WARNING !
Uco should only be used
for "ON-Board" Current
Out!
CUSTOMER (passive)
41 +
42/52-
51 +
Version FMT400
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For Model:
FMT400
Projection method 1
ABB Automation Products GmbH
Checked
Date
Name
01 12.11.2019 FBu
Checked per Std.
General tolerances:
Work piece edges:
Tolerancing:
Surface:
Installation diagram
SensyMaster FMT
3kxf000094G0009
Material
Ref. B/M
Rev.
Date
Number
Name
Replaces:
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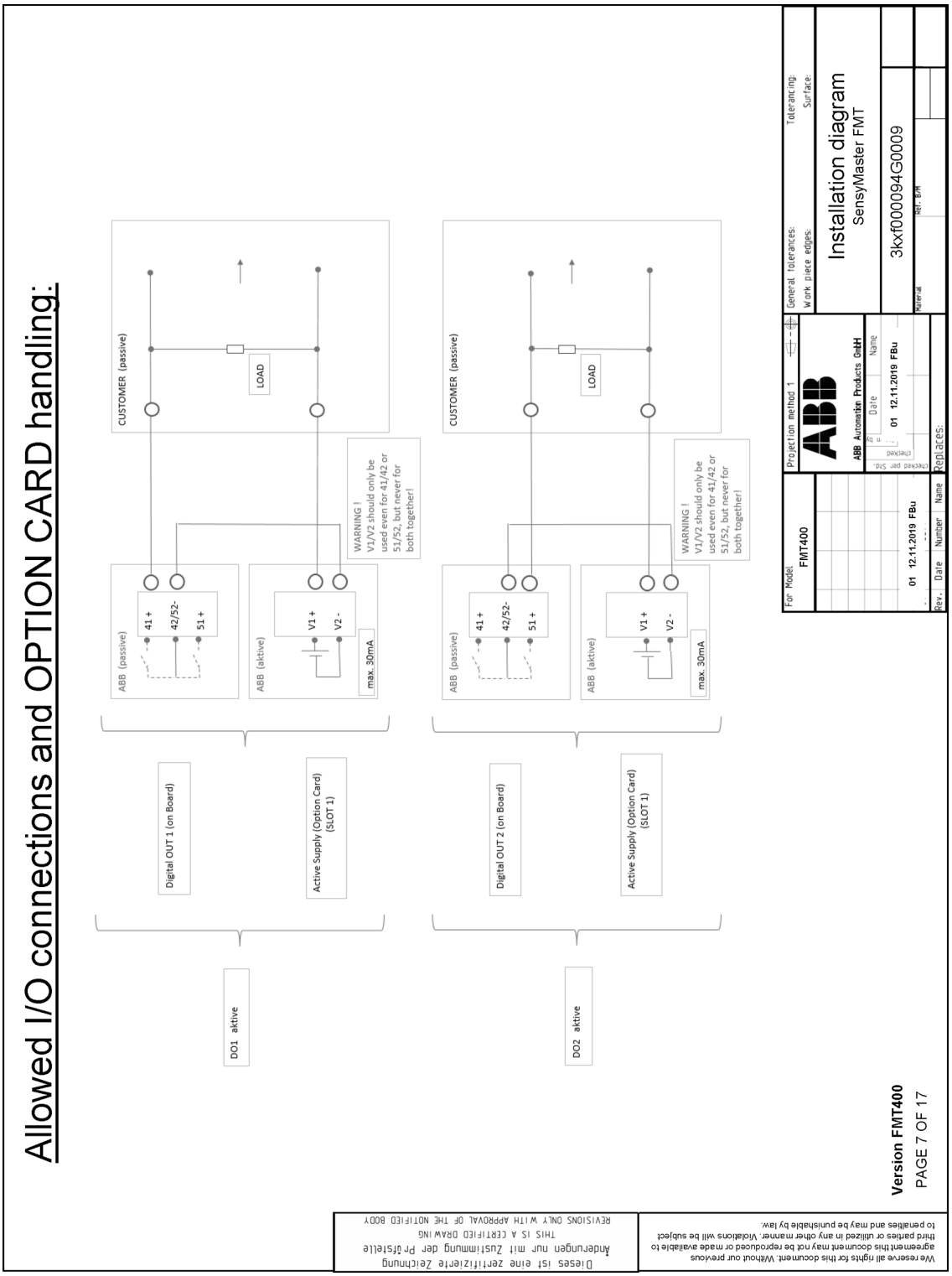

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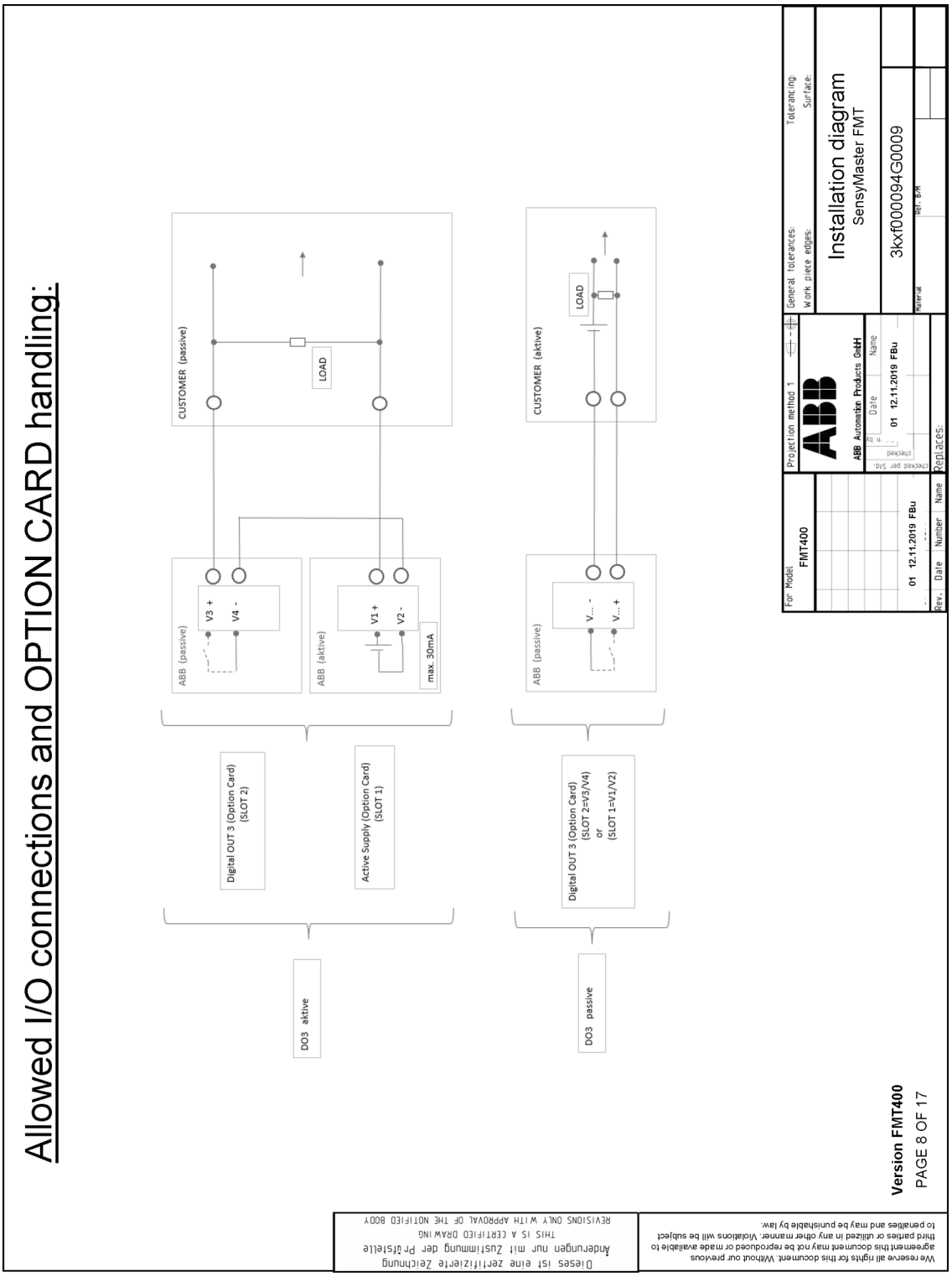
Allowed I/O connections and OPTION CARD handling:
CUSTOMER (passive)
LOAD
ABB (passive)
V3 +
V4 -
ABB (aktive)
V1 +
V2 -
max. 30mA
Digital OUT 3 (Option Card)
(SLOT 2)
Active Supply (Option Card)
(SLOT 1)
DO3 aktive
CUSTOMER (aktive)
LOAD
ABB (passive)
V... -
V... +
Digital OUT 3 (Option Card)
(SLOT 2=V3/V4)
or
(SLOT 1=V1/V2)
DO3 passive
Version FMT400
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For Model:
FMT400
Projection method 1
ABB
ABB Automation Products GmbH
Date
Name
01 12.11.2019 FBu
General tolerances:
Work piece edges:
Tolerancing:
Surface:
Installation diagram
SensyMaster FMT
3kxf000094G0009
Material
Rev. B/M
Rev.
Date
Number
Name
Replaces:
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… 14 Appendix

… FMT400 Installation diagram 3kxf000094G0009

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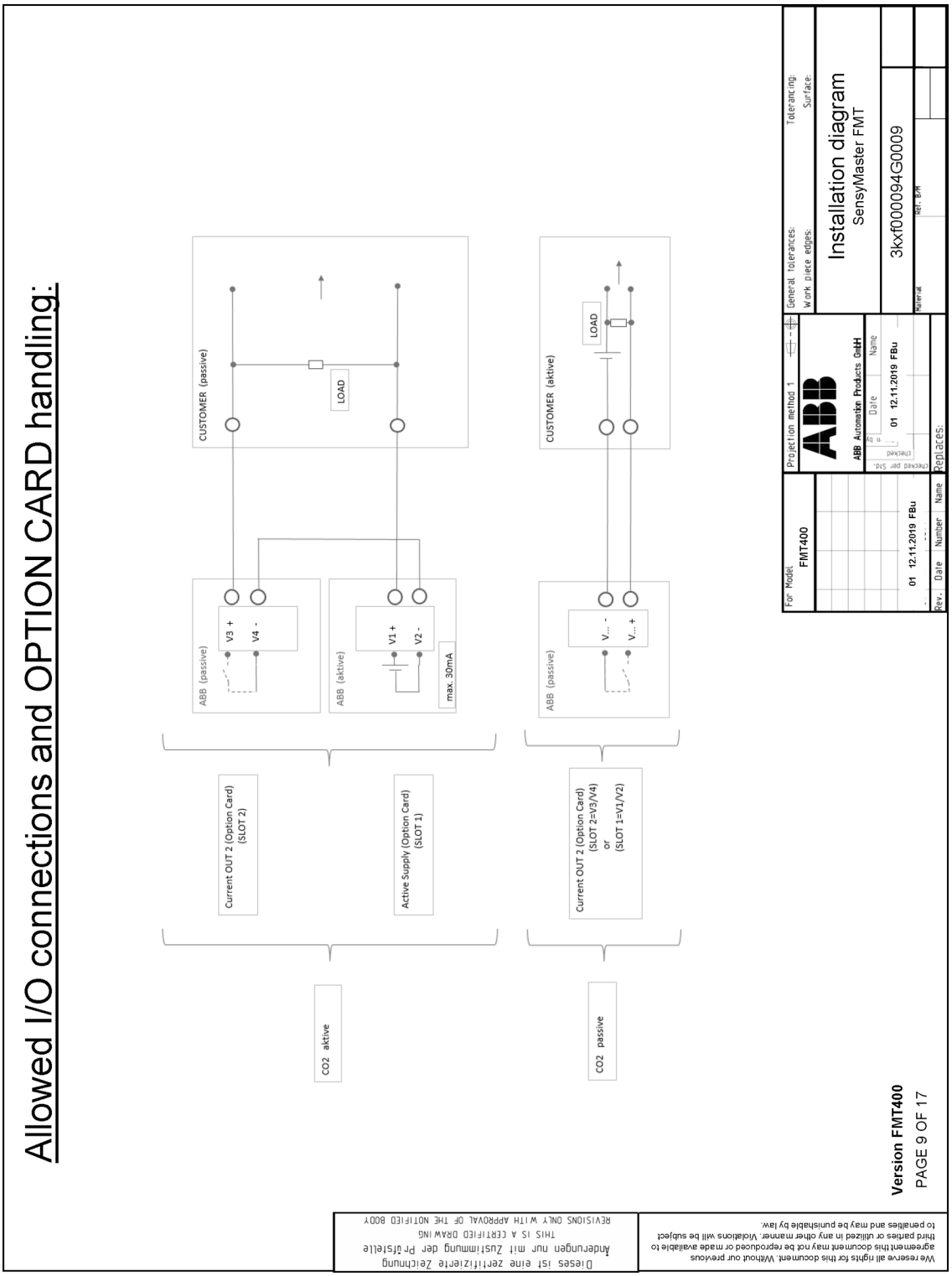

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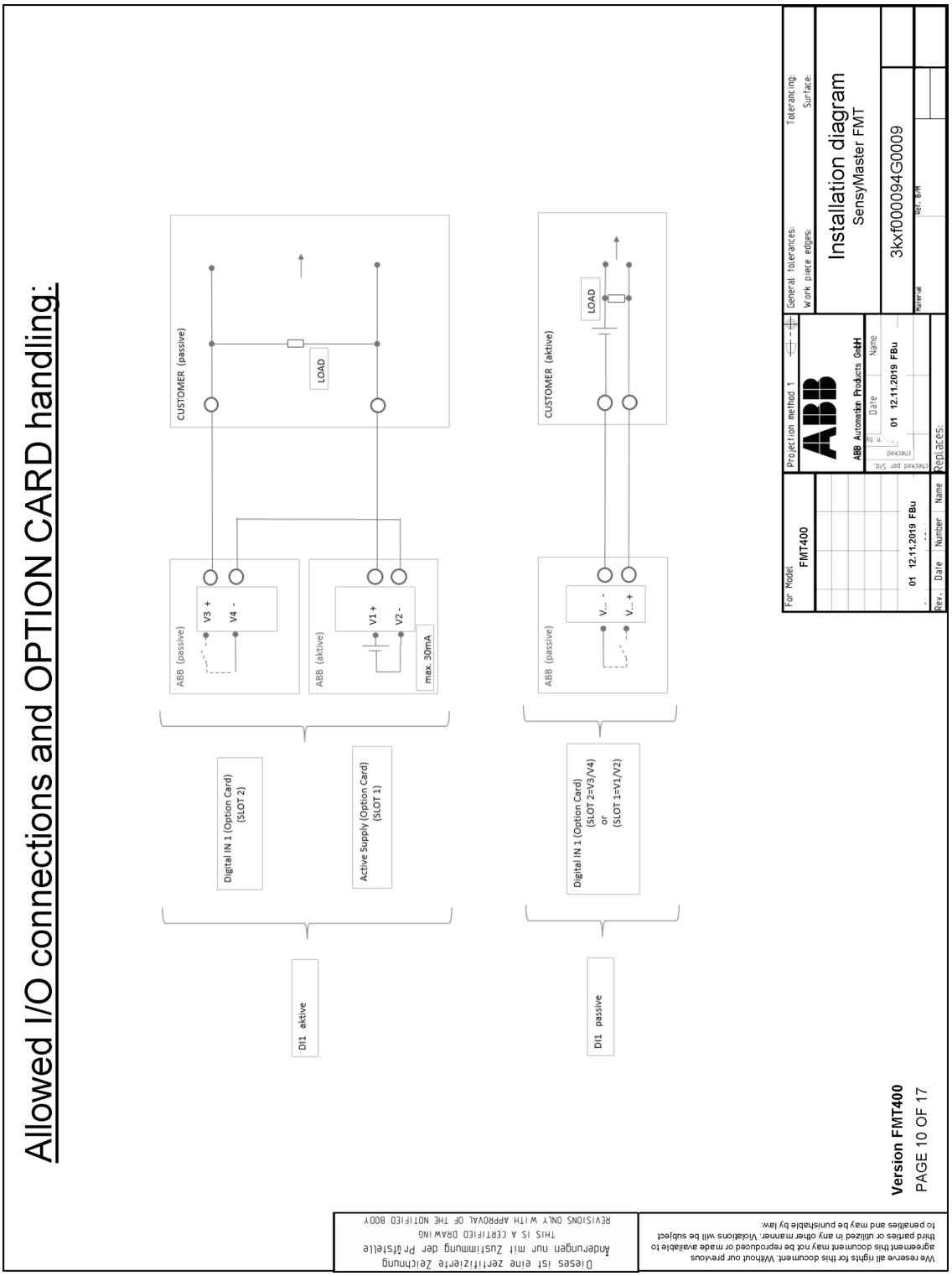
Allowed I/O connections and OPTION CARD handling:
CUSTOMER (passive)
LOAD
ABB (passive)
V3 +
V4 -
ABB (aktive)
V1 +
V2 -
max. 30mA
Digital IN 1 (Option Card) (SLOT 2)
Active Supply (Option Card) (SLOT 1)
DI1 aktive
CUSTOMER (aktive)
LOAD
ABB (passive)
V... -
V... +
Digital IN 1 (Option Card) (SLOT 2=V3/V4) or (SLOT 1=V1/V2)
DI1 passive
For Model: FMT400
Projection method 1
ABB Automation Products GmbH
General tolerances:
Work piece edges:
Tolerancing:
Surface:
Installation diagram
SensyMaster FMT
3kxf000094G0009
Material
Rev. B/M
Checked
Date
Name
01 12.11.2019 FBu
Rev. Date Number Name
Replaces:
Version FMT400
PAGE 10 OF 17
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… 14 Appendix

… FMT400 Installation diagram 3kxf000094G0009

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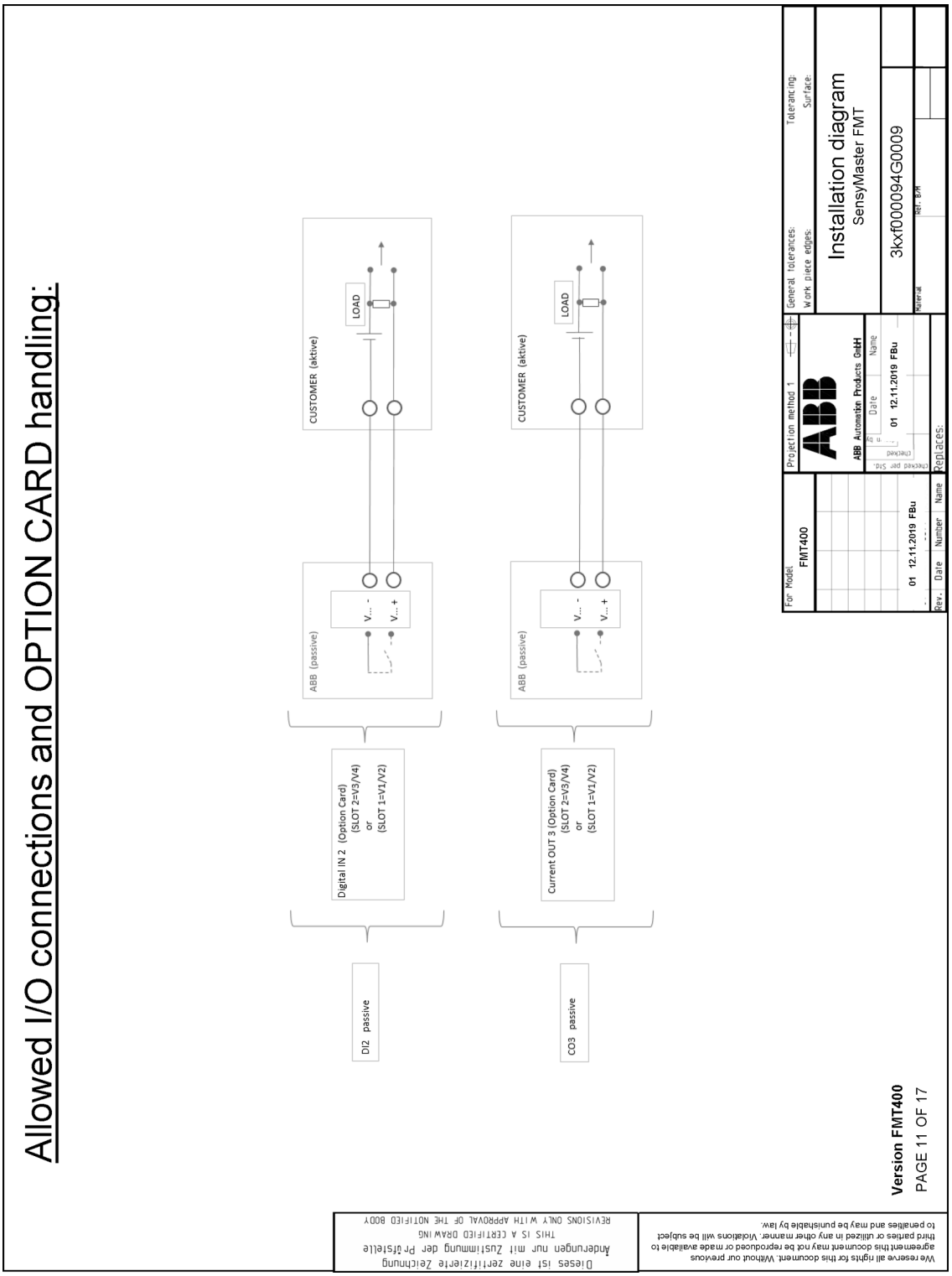

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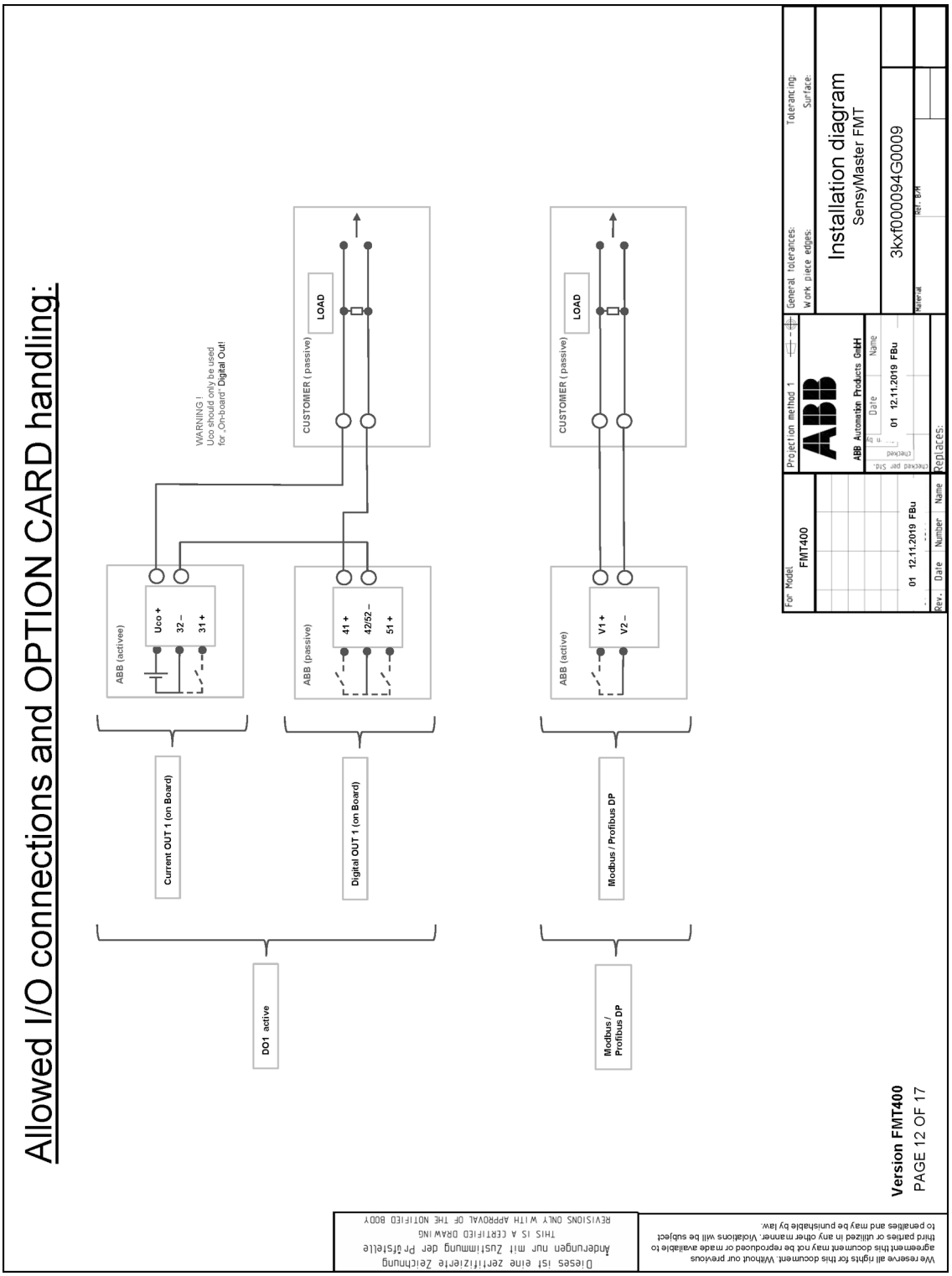
Allowed I/O connections and OPTION CARD handling:
DO1 active
Modbus / Profibus DP
Current OUT 1 (on Board)
Digital OUT 1 (on Board)
Modbus / Profibus DP
ABB (activee)
Uco +
32 –
31 +
ABB (passive)
41 +
42/52 –
51 +
ABB (active)
V1 +
V2 –
WARNING !
Uco should only be used
for „On-board" Digital Out!
CUSTOMER (passive)
LOAD
CUSTOMER (passive)
LOAD
Version FMT400
PAGE 12 OF 17
For Model:
FMT400
Projection method 1
ABB Automation Products GmbH
Name
Date
01 12.11.2019 FBu
Rev. Date Number Name
01 12.11.2019 FBu
Replaces:
General tolerances:
Work piece edges:
Tolerancing:
Surface:
Installation diagram
SensyMaster FMT
3kxf000094G0009
Material
Ref. B/M
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3KXF421015R4401

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