SensyMaster FMT430, FMT450

Thermal mass flowmeter



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

Device firmware version: 01.04.00

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:

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1 Safety

General information and instructions

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

Warnings

The warnings in these instructions are structured as follows:

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

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

Intended use

This device 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

… 1 Safety

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.

On www.abb.com/cybersecurity under 'Additional resources', 'Alerts and notifications' you will find notifications about newly discovered software vulnerabilities. It is recommended that you visit this website regularly and activate 'Subscribe to email alerts' to receive email notifications about 'ABB cyber security alerts and notifications'.

Software downloads

By visiting the web page indicated below, you will find options to download the latest software. It is recommended that you visit this web page regularly:

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

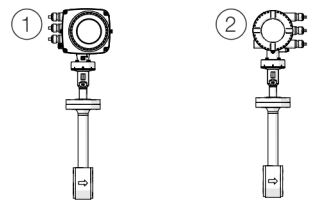
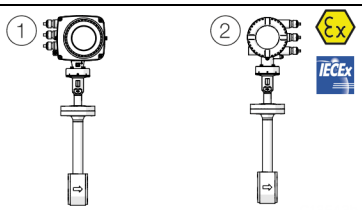
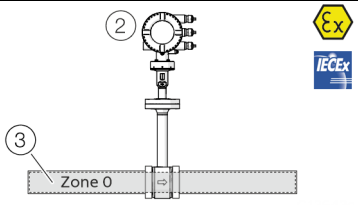
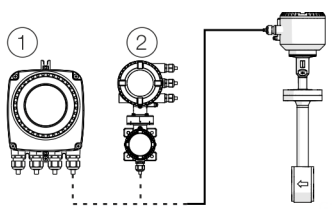
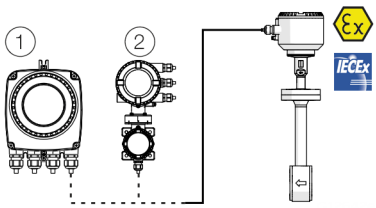
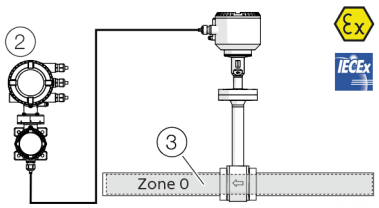
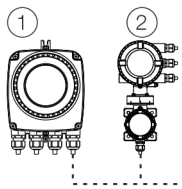
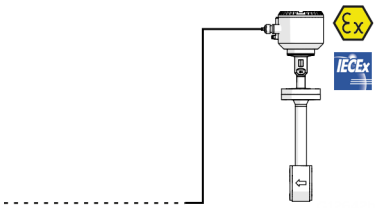
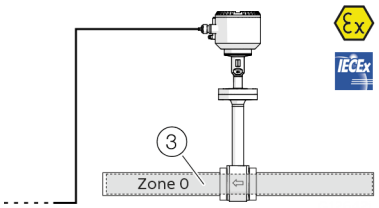
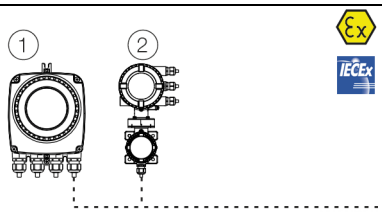
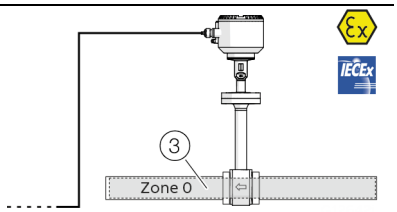
2 Use in potentially explosive atmospheres

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

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

(1) Single-compartment housing

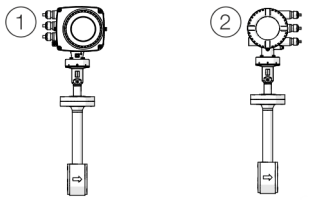
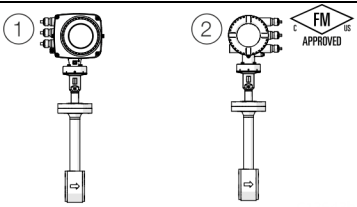
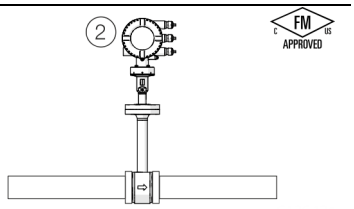
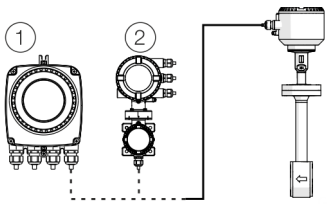
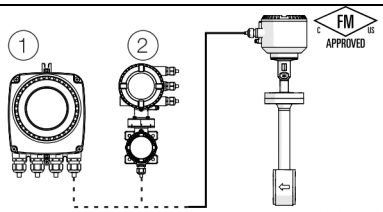
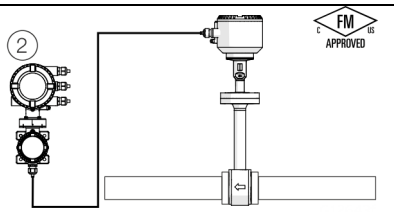
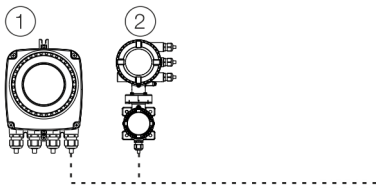
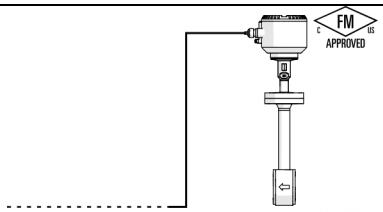
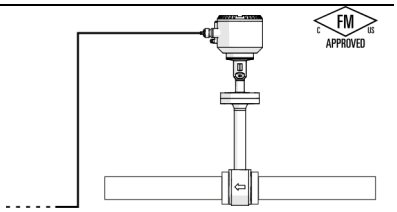
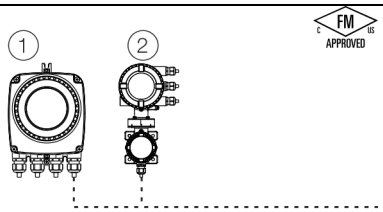
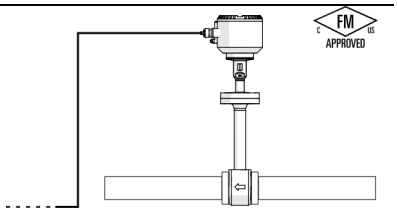
(2) Dual-compartment housing

(3) Zone 0 within the meter tube

… 2 Use in potentially explosive atmospheres

… Device overview

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	**FMT4x2 Y0**	**FMT4x0 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

Ex marking sensor and transmitter

ATEX / IECEx

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 structure*: 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 (i=D..,Y..,S..) Sensor in integral mount design or remote mount design with single-compartment or dual-compartment housing	II 3G Ex ec IIC T6...T1 Gc II 3D Ex tc IIIC T80°C...T_{medium} Dc	**ATEX:** FM19ATEX0178X **IECEx:** IECEx FMG 19.0025X
FMT4x2 – A2 (i=W..,R..) Sensor in remote mount design with single-compartment housing	II 3G Ex ec IIC T6 Gc II 3D Ex tc IIIC T80°C Dc	

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

… 2 Use in potentially explosive atmospheres

… Ex marking sensor and transmitter

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

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

Model number for use in Zone 2, 22	Ex marking	Certificate
FMT091_ (j=SCA, SCB, SCC)	II 3 G Ex h IIC T6…T3 Gc	**ATEX:**
SensyMaster FMT091 pipe component type 1, wafer type	II 3 D Ex h IIIC T85°C … T150°C Dc	FM19ATEX0178X
Optional with ball valve or integrated hot tap fitting		**IECEx:**
FMT092_ (j=SCA, SCB, SCC)		IECEx FMG 19.0025X
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)	II 2 G Ex h IIC T6…T3 Gb	**ATEX:**
SensyMaster FMT091 pipe component type 1, wafer type	II 2 D Ex h IIIC T85°C … T150°C Db	FM19ATEX0177X
FMT092_ (j=SCA, SCB, SCC)		**IECEx:**
SensyMaster FMT092 pipe component type 2, partial measuring section		IECEx FMG 19.0025X
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

… 2 Use in potentially explosive atmospheres

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	IP65, IP67 / NEMA 4X,Type 4X

* Cryogenic temperature design (optional)

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 12 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 12 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)	—	—

… 2 Use in potentially explosive atmospheres

… Temperature data

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 12 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 12 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.

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

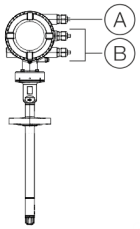
The maximum surface temperature of the integrated hot tap fitting is 85 °C to 150 °C (185 °F to 302 °F) depending on the measuring medium temperature.

… 2 Use in potentially explosive atmospheres

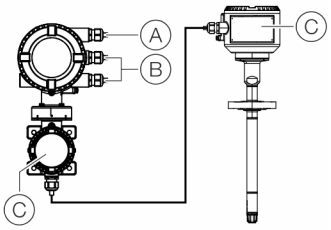
Electrical data

Overview

Integral mount design



Remote mount design



Ⓐ Power supply

Ⓑ Inputs / outputs, communication

Ⓒ Signal cable (remote mount design only)

Figure 1: Overview of electrical connections

Zones 2, 22	**Division 2 and Zone 2**
ATEX/IECEx: 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)
• Type of ignition protection ATEX/IECEx: Non-sparking “Ex ec” • Flameproof enclosure type of protection USA / Canada: ‘non IS’ • Maximum 250 Vrms • Terminals: 1+, 2-, L, N, ⏚	• Type of ignition protection ATEX/IECEx: Non-sparking “Ex ec” • Flameproof enclosure type of protection USA / Canada: Non-incendive “NI” • Terminals: 31, 32, Uco, V1, V2, V3, V4, 41, 42, 51, 52	• Type of ignition protection ATEX/IECEx: Non-sparking “Ex ec” • Flameproof enclosure type of protection USA / Canada: Non-incendive “NI” • Terminals: A, B, UFE, GRN

Zones 1, 21	**Division 1 and Zone 1**
ATEX/IECEx: 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)
• Type of ignition protection ATEX/IECEx: Non-sparking “Ex eb” • Flameproof enclosure type of protection USA / Canada: ‘non IS’ • Maximum 250 Vrms • Terminals: 1+, 2-, L, N, ⏚	• Type of ignition protection ATEX/IECEx: Non-sparking “Ex ec” • Flameproof enclosure 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	• Type of ignition protection ATEX/IECEx: Non-sparking “Ex eb” • Flameproof enclosure type of protection USA / Canada: Explosion-proof “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 24 must be observed when changing the type of protection!

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	30	0.2	30	30	115	115	815	815	10	10	5	5	0.08	0.08
Terminals 31 / U_{CO}														
Current / HART output 31 / 32, passive	30	0.2	—	30	—	115	—	815	—	27	—	5	0.08	0.08
Terminals 31 / 32														
Digital output 41 / 42, active*	30	0.1	27.8	30	119	30	826	225	20	20	29	29	0.22	0.22
Terminals 41 / 42 and V1 / V2*														
Digital output 41 / 42, active**	30	0.1	30	30	115	115	826	225	16	16	10	10	0.08	0.08
Terminals 41 / 42 and U_{CO} / 32**														
Digital output 41 / 42, passive	30	0.1	—	30	—	30	—	225	—	27	—	5	—	0.08
Terminals 41 / 42														
Digital output 51 / 52, active*	30	0.1	27.8	30	119	30	826	225	20	20	29	29	0.22	0.22
Terminals 51 / 52 and V1 / V2*														
Digital output 51 / 52, passive	30	0.1	—	30	—	30	—	225	—	27	—	5	—	0.08
Terminals 51 / 52														

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 65.

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*	30	0.1	27.8	30	119	30	826	225	29	29	117	117	0.4	0.4
Terminals V3 / V4 and V1 / V2*														
Current output V1 / V2, passive**	30	0.1	—	30	—	68	—	510	—	45	—	59	—	0.27
Current output V3 / V4, passive**														
Terminals V1 / V2** or V3 / V4**														
Digital output V3 / V4, active*	30	0.1	27.8	30	119	68	826	225	17	17	31	31	0.4	0.4
Terminals V3 / V4 and V1 / V2*														
Digital output V1 / V2, passive**	30	0.1	—	30	—	30	—	225	—	13	—	16	—	0.27
Digital output V3 / V4, passive**														
Terminals V1 / V2** or V3 / V4**														
Digital input V3 / V4, active*	30	0.1	27.8	30	119	3.45	826	25.8	17	17	31	31	0.4	0.4
Terminals V3 / V4 and V1 / V2														
Digital input V1 / V2, passive*	30	0.1	—	30	—	3.45	—	25.8	—	13	—	16	—	0.27
Digital input V3 / V4, passive*														
Terminals V1 / V2** or V3 / V4**														
Modbus® / PROFIBUS DP®	30	0.1	4.2	4.2	150	150	150	150	5300	5300	0.06	0.06	0.09	0.09
Terminals V1 / V2														

* 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 69.

… 2 Use in potentially explosive atmospheres

… Electrical data

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 65.

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 69.

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.
- Once output circuits are connected and have been operated for a while, a change of the protection (instrinsically safe and vice versa) is not permitted.

- The information in **Changing the type of protection** on page 24 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 or IECEx 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 16 must be observed.

… 2 Use in potentially explosive atmospheres

Installation instructions

ATEX / IECEx

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

The safety instructions for electrical apparatus in potentially explosive areas must be in accordance with Directive 2014/34/EU (ATEX) and IEC 60079-14 (Installation of electrical equipment in potentially explosive areas).

Comply with the applicable regulations for the protection of employees to ensure safe operation.

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 34 if the sensor should be insulated.
Comply with the information concerning the temperature classes and cable specification in Section **Temperature data** from page 12 onwards and **Temperature resistance for the connecting cable** on page 12.

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 54.

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

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

Cable entries in accordance with ATEX / IECEx

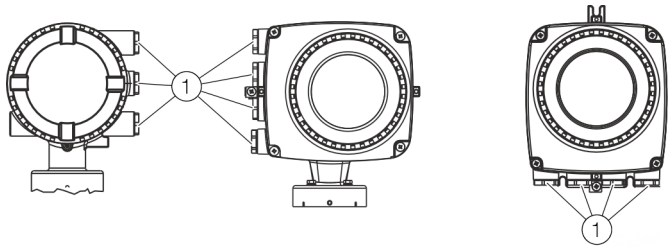
The devices are supplied with cable glands installed (certified in accordance with ATEX or IECEx).

- 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.

… 2 Use in potentially explosive atmospheres

… Installation instructions

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 12.

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 63.

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 63.

Power supply terminal cover

Make sure that the power supply terminal cover is closed tightly, see also **Electrical connections** on page 61.

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

Operating instructions

Protection against electrostatic discharges

⚠ DANGER

Explosion hazard due to electrostatic charging!

The painted surface of the device can store electrostatic charges.

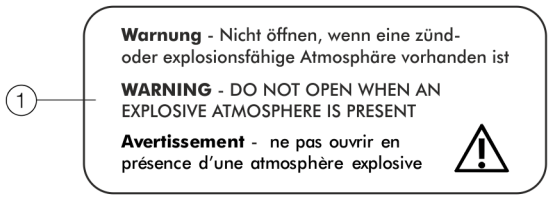
As a result, the housing can form an ignition source due to electrostatic discharges in the following conditions:

- 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!

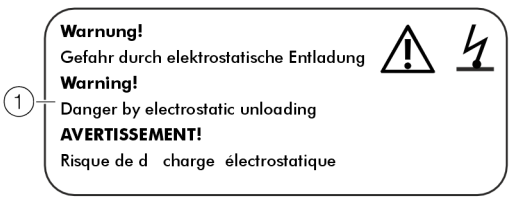
Instructions on cleaning

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)

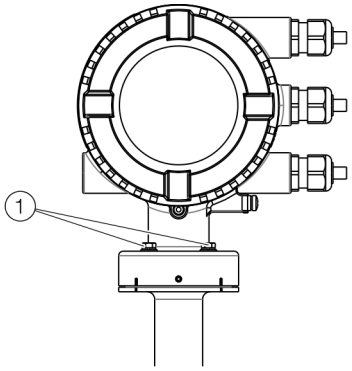


Figure 4: Mounting screws on the dual-compartment transmitter housing

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 / XP' are equipped with flameproof joints in the housing. Contact ABB before commencing repair work.

… 2 Use in potentially explosive atmospheres

… Operating instructions

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

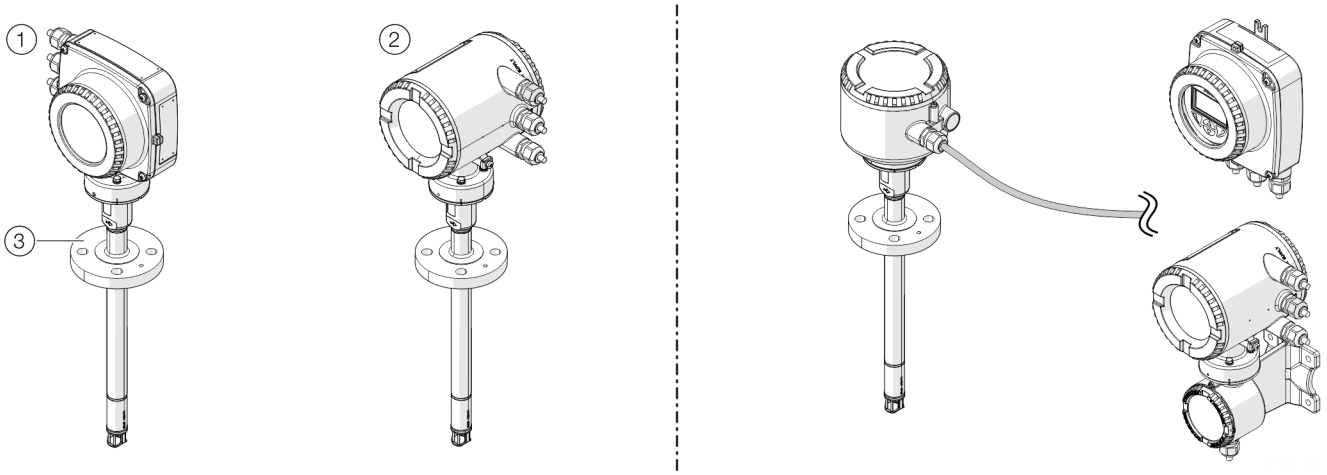
If a device that is already operational is operated with a different type of protection, the following measures must be implemented/insulation checks performed in accordance with applicable standards.

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 Design and function

Overview

Sensor



Integral mount design **Remote mount design**

Figure 5: Sensor FMT430, FMT450 (example)

Model	FMT430	FMT450
Design	Integral mount design, remote mount design; transmitter optionally in single-compartment housing (1) or dual-compartment housing (2)	
Measuring media	Gas and gas mixtures with known composition, see table	**Table: Gas types for the ApplicationSelector** on page 107
Measuring accuracy for gases* Air	±1.2 % of Qm in the range of 10 to 100 % of the standard measuring range; ±0.12 % of the Q_{max}DN possible in the nominal diameter in the range of 0 to 10 % of the measuring range	±0.6 % of the measured value, ± 0.05 % of the Q_{max}DN possible in the nominal diameter
Other gases (with optional operating gas calibration)	—	±1.6 % of the measured value, ±0.1 % of the Q_{max}DN possible in the nominal diameter
Extended measuring range	Yes, optional (depending on the gas type, with limited measuring accuracy as needed)	Yes, optional (depending on the gas type, with limited measuring accuracy as needed)
Measuring medium temperature T_{medium}	Standard design: −20 to 150 °C (−4 to 302 °F)	Standard design: −20 to 150 °C (−4 to 302 °F)
	Temperature information for high temperature**, cryogenic temperature and DVGW design, see **Measured medium temperature** on page 35.	
Ambient temperature $T_{ambient}$	Standard: −20 to 70 °C (−4 to 158 °F) Optional: −40 to 70 °C (−40 to 158 °F)	
Sensor connection (3)	Flange DN 25 – PN 40, threaded connection DIN 11851, compression fitting	
Wetted materials	Stainless steel, ceramic sensor element	
IP rating	According to EN 60529: IP65 / IP67	
NEMA rating	In accordance with NEMA 4X	

Approvals and certificates	
Explosion protection ATEX/IECEx	Zone 0, 1, 2, 21, 22
Explosion protection conforming to cFMus	Class I Div. 1, Class I Div. 2, Zone 1, 2, 21
Additional approvals	Available on our website www.abb.com/flow or by request

* The stated measuring accuracy only applies under the reference conditions in the stated standard measuring range.

** Not in connection with explosion-proof design.

… 3 Design and function

… Overview

Process connections

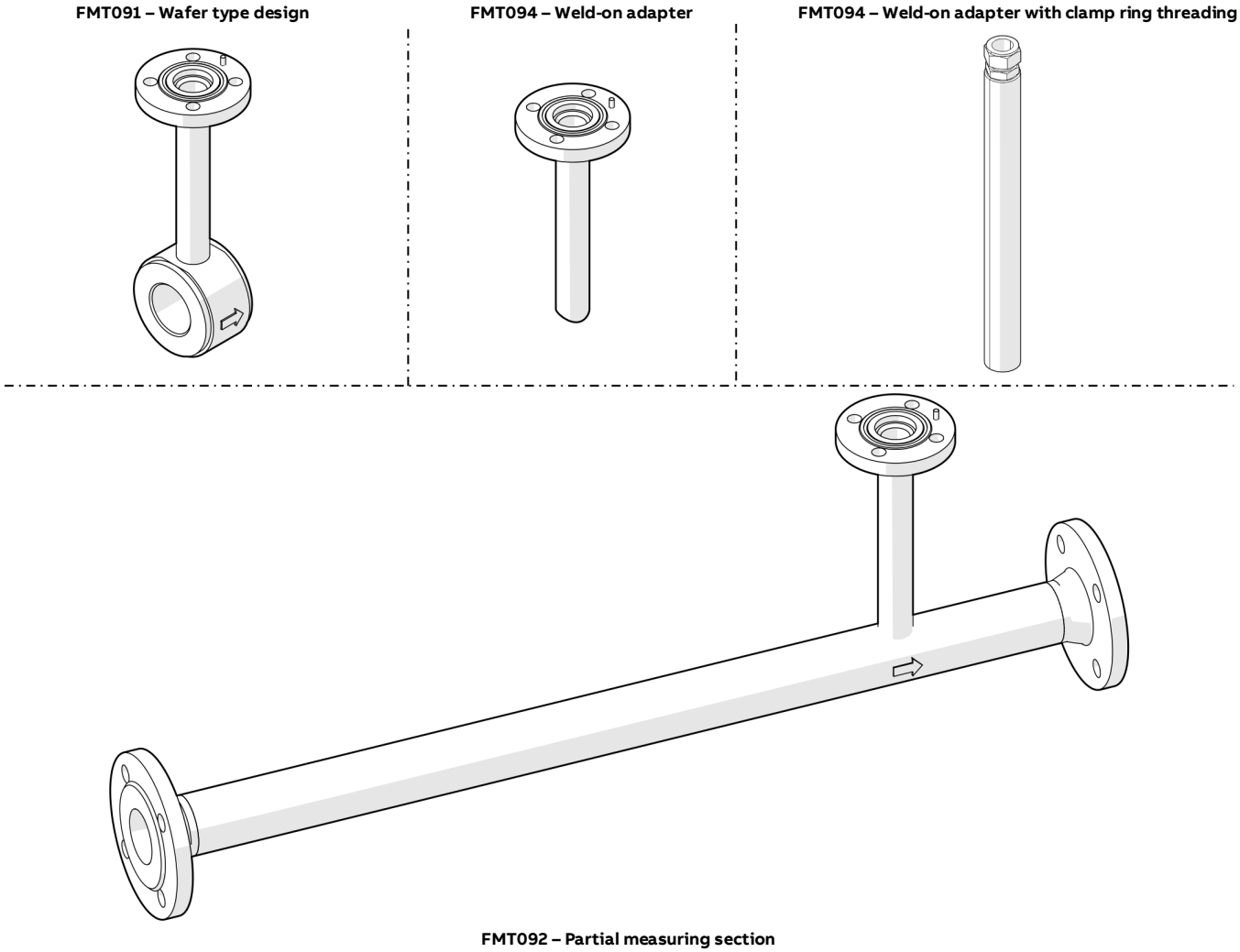


Figure 6: Pipe components (examples)

Pipe components	
FMT091 – Wafer type design	According to EN 1092-1: DN 40 to 200, PN 40
	According to ASME B16.5: 1½ to 8 in, CL 150 to 300
FMT092 – Partial measuring section	Flange according to EN 1092-1: DN 25 to 100 (larger nominal widths available by request), PN 10 to 40
	Flange according to ASME B16.5: 1½ to 8 in, CL 150 to 300
	Male thread DN 25 to 80, R1 to 3 in
FMT094 – Weld-on adapter	For rectangular ducts or pipe diameters ≥ DN 80 (3 in), PN 16 to 40
Options	With ball valve (order code SCA) or integrated hot tap fitting (order code SCB, SCC, SCD)
Explosion protection ATEX/IECEx	Zone 1, 2, 21, 22
Explosion protection conforming to cFMus	Can be used in Div. 1, Div. 2, Zone 1, 2, 21

Wetted materials for pipe components
Stainless steel, galvanized

Temperature data for pipe components	
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 (**Options for sensor connection: SCA, SCB, SCD**)	Standard: –20 to 70 °C (–4 to 158 °F)

… 3 Design and function

Transmitter

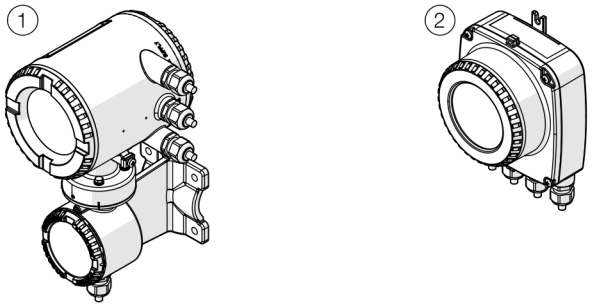


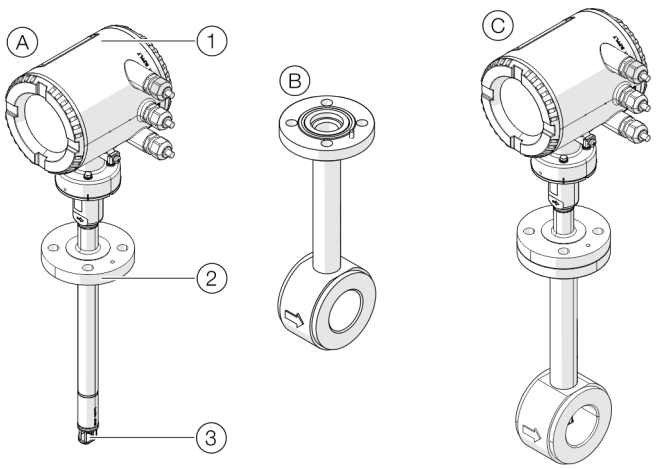
Figure 7: Transmitter with remote mount design

Model	**FMT432**	**FMT452**
Design	Integral mount design (see **Figure 5** on page 25), remote mount design; transmitter optionally in single-compartment housing (2) or dual-compartment housing (1)	
IP rating	According to EN 60529: IP65 / IP67	
NEMA rating	In accordance with NEMA 4X	
Signal cable length	Maximum 100 m (328 ft), with remote mount design only	
Power supply	24 V DC, ±20 %; 100 to 240 V AC (−15 % / +10 %, 47 to 64 Hz)	
Outputs in basic version	Current output: 4 to 20 mA active or passive Digital output 1: passive, configurable as pulse, frequency or switch output Digital output 2: passive, configurable as pulse, frequency or switch output	
Additional optional outputs	The transmitter has two slots in which plug-in cards can be inserted to provide additional inputs and outputs. The following plug-in cards are available: • Current output (maximum two expansion cards simultaneously) • Digital output (maximum one expansion card) • Digital input (maximum two expansion cards) • 24 V DC power supply for active outputs (maximum one expansion card)	
Communication	Standard: HART® 7.1; Optional: PROFIBUS DP® / Modbus®	
External output zero return	Yes	
External totalizer reset	Yes	
Counter	Yes	
ApplicationSelector	Yes, up to 2 applications	Yes, up to 8 applications
Preconfigured applications	Yes, up to 2 applications	Yes, up to 4 applications
Freely configurable applications	No	Yes, up to 4 applications
Selectable nominal diameters	Yes	Yes
Selectable gas type	No	Yes
Filling function	No	Yes, optional
"VeriMass" diagnosis function	Yes, optional	Yes, optional

Approvals and certificates	
Additional approvals	Available on our website www.abb.com/flow or by request

Device description

The SensyMaster FMT430, FMT450 works in accordance with the measuring principle of a hot-film anemometer. This measurement method allows for direct measurement of the gas mass flow.
Taking into account the standard density, the norm volume flow can be displayed without the need for additional pressure and temperature compensation.
The transmitter is equipped with an analog / HART® output (4 to 20 mA) and two fast digital outputs that can be configured as pulse, frequency or binary outputs.
Optionally, the transmitter can be extended using plug-in cards with further inputs and outputs as well as a Modbus® or PROFIBUS DP® interface.
The SensyMaster FMT430, FMT450is used in the process industry for the flow measurement of gases and gas mixtures.



(A) Sensor
(B) Pipe component
(C) Sensor with pipe component
(1) Transmitter
(2) Sensor connection
(3) Thermal sensor elements

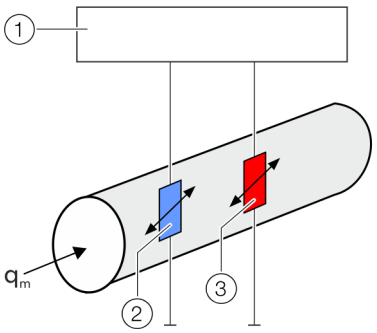
Figure 8: Sensor (example, wafer type design)

The SensyMaster FMT430, FMT450 is composed of the components sensor and pipe component (process connection). The pipe component can be delivered in various designs. In addition, a weld-on adapter makes it possible to install the flowmeter sensor in rectangular ducts or pipelines with any diameter.

Measuring principle

Thermal flow metering procedures use different ways to evaluate the flow dependent cooling of a heated resistor as measuring signal.
In a hotfilm anemometer with constant temperature difference control, the heated platinum resistor is maintained at a constant overtemperature in relation to an unheated platinum sensor inside the gas flow.

The heating power required for maintaining the overtemperature depends directly on the flow rate and the material properties of the gas. With a known (and constant) gas composition the mass-flow can be determined by electronically evaluating the heater current / mass-flow curve without additional pressure and temperature compensation.
Together with the standard density of the gas this results directly in the standard volume flow.
Considering the high measuring range dynamics up to 1:100, an accuracy smaller than 1 % of the measuring value is achieved.



(1) Transmitter
(2) Gas temperature measurement resistor
(3) Heating resistor

Figure 9: Measuring principle (simplified)

The transmitter has three signals available. In addition to the heating power, the temperatures of the measuring medium and the heater resistance are included herein, which can be used to compensate the temperature dependency of gas parameters.

By storing the gas data in the transmitter the optimal tailoring can be calculated and performed at any operating point.

4 Product identification

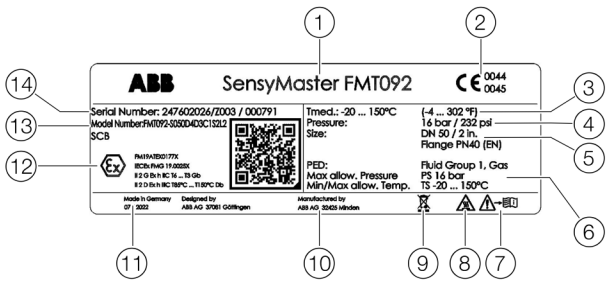
Name plate

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 with notified body
3. Power supply
4. IP- / NEMA IP rating
5. Ambient temperature range (T_{amb})
6. Sensor element design
7. Sensor mounting length
8. Wetted material
9. Sensor connection
10. Measuring medium temperature range (T_{medium})
11. 'Read operating instruction' symbol
12. '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 10: Name plate (sample)



1. Type designation
2. CE 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 11: Type plate for pipe components

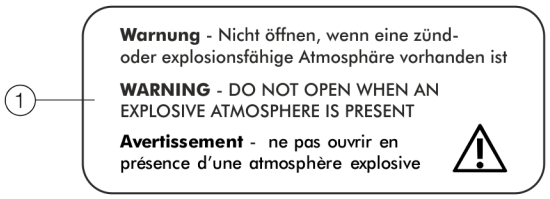
Note



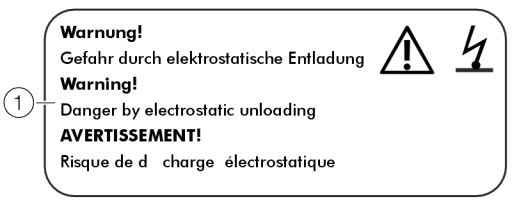
Products that are marked with the adjacent symbol may **not** be disposed of as unsorted municipal waste (domestic waste).
They should be disposed of through separate collection of electric and electronic devices.

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 12: 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

For the return of devices, follow the instructions in **Repair** on page 151.

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.

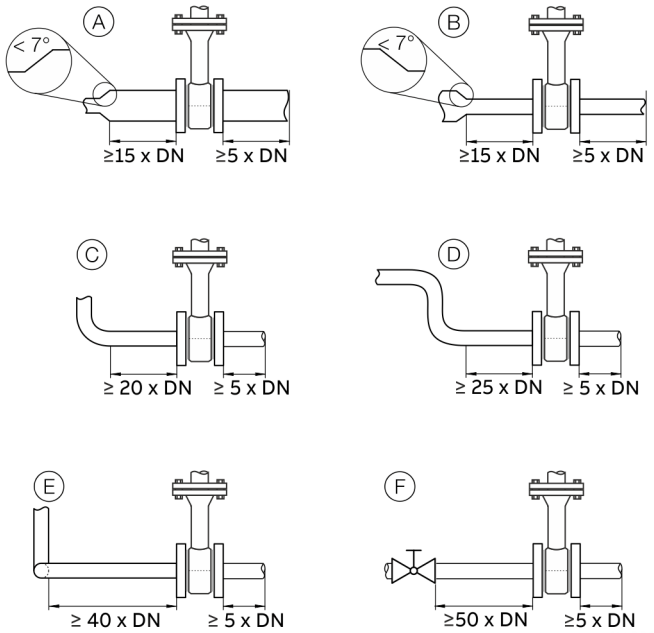


Figure 13: Inlet and outlet sections

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 errors, e.g. valve and reduction, a longer inlet section must always 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 alignment is necessary for individual cases.
The specified inlet and outlet sections must be doubled for gases with a very low density (hydrogen, helium) and a flow straightener should be used.

… 6 Installation

… Installation conditions

Installation at high ambient temperatures

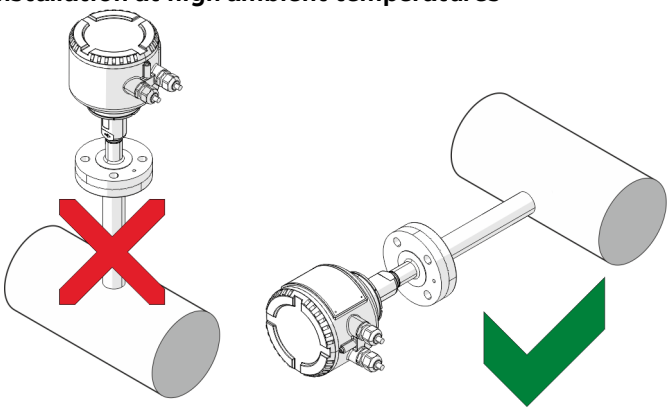
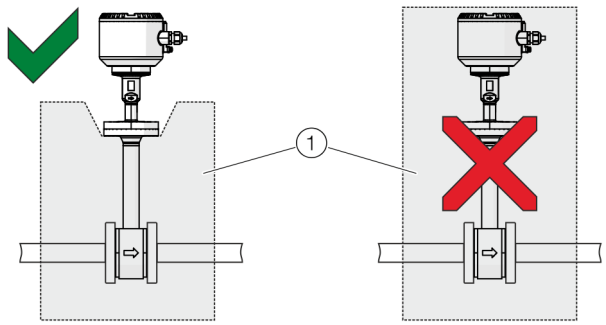


Figure 14: Mounting position at high ambient temperatures

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 15: Isolation of the sensor

The sensor may be insulated as shown in **Figure 15**.

Ambient conditions

Note

When using the device in potentially explosive atmospheres, note the additional temperature data in **Use in potentially explosive atmospheres** on page 7!

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

According to EN 60529: IP65/IP67

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 **Use in potentially explosive atmospheres** on page 7!

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.

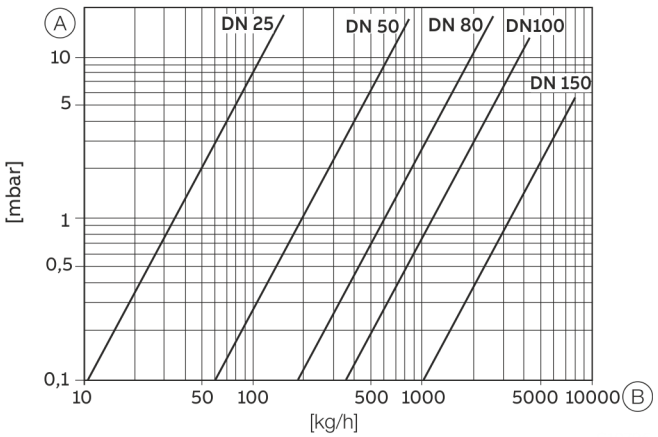
The approved measuring medium temperature T_{medium} also depends on the selected sensor connection and the design of the pipe components.
The following temperature specifications apply:

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 36

Pressure loss



Ⓐ Pressure loss Ⓑ Mass flow

Figure 16: Pressure loss in logarithmic representation

… 6 Installation

… Process conditions

Material loads for process connections

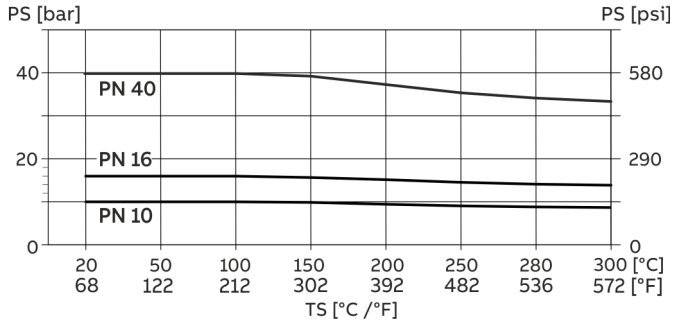


Figure 17: DIN flange process connection

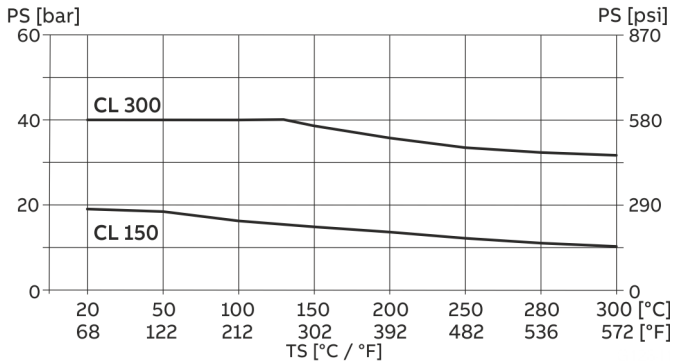


Figure 18: ASME flange process connection

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

Assembly of the pipe component

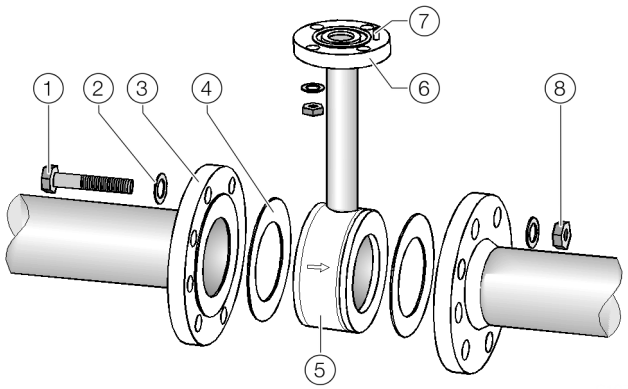
When installing the pipe components, observe the following points:

- 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 19: 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.

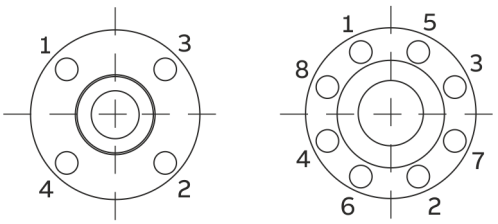


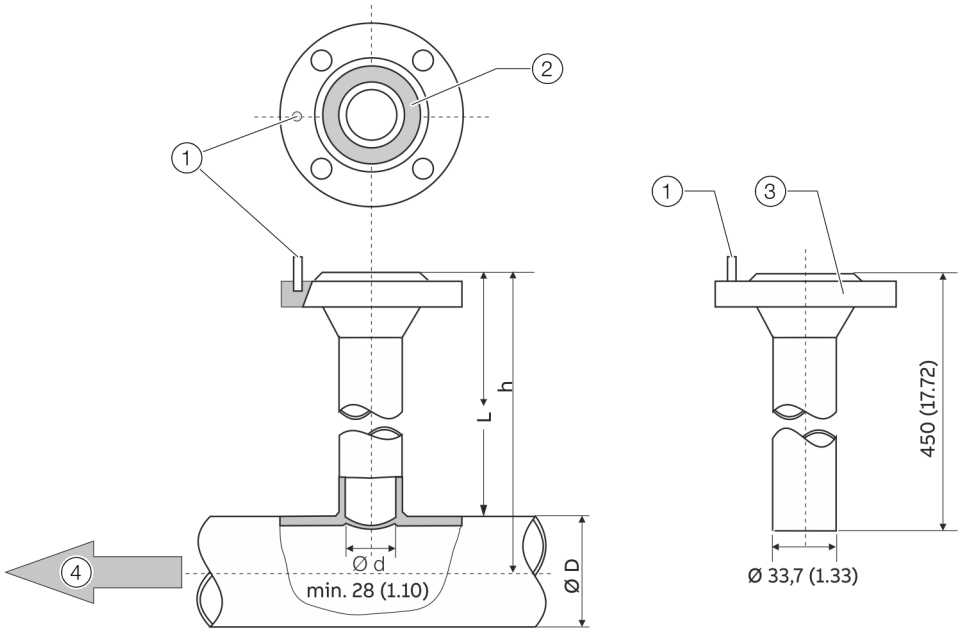
Figure 20: Tightening sequence for the flange screws

… 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

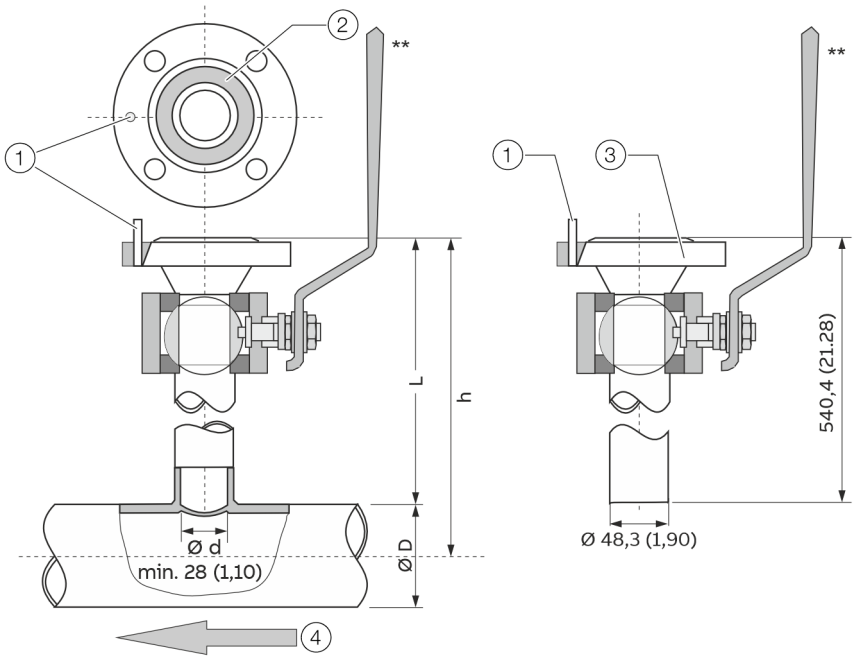
Figure 21: Dimensions in mm (in)

h (sensor mounting length)	Ø D (pipe outer 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 22: Dimensions in mm (in)

h (sensor mounting length)	Ø D (pipe outer 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.

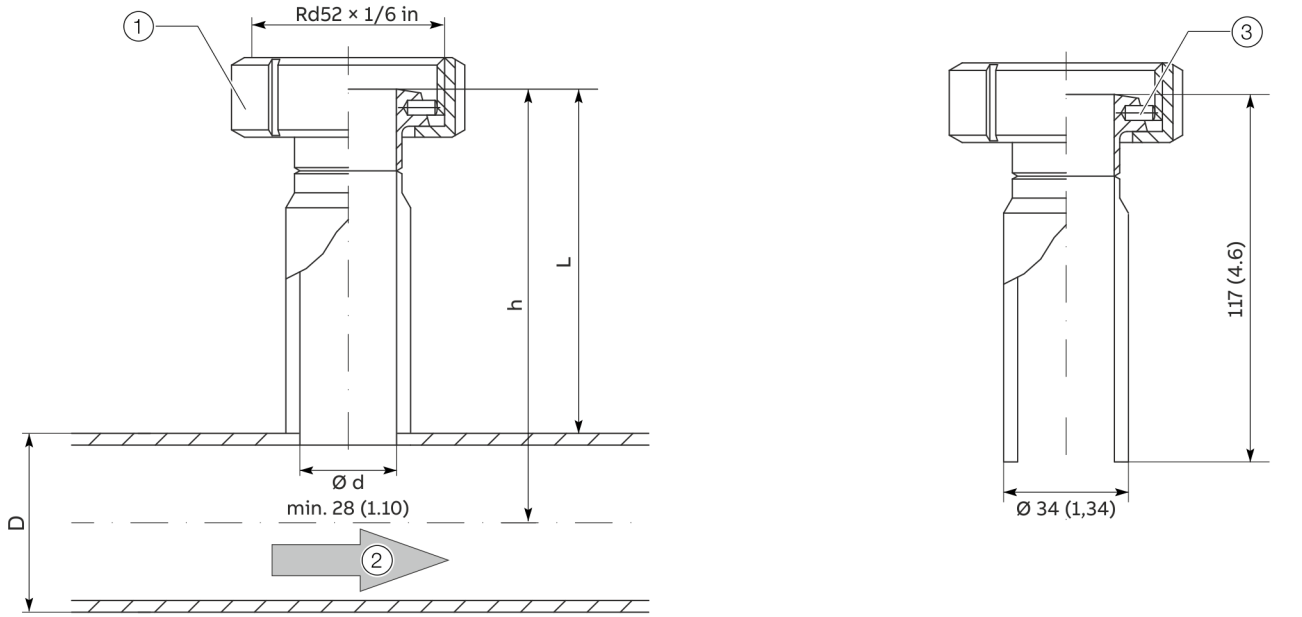
** Ball valve T_{medium}: max. 150 °C (302 °F), Explosion protection approval for use in ATEX/IECEx Zone 2 or cFMus Div. 2 respectively.

… 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 23: Dimensions in mm (in)

Mounting

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

- After welding, the welding adapter must have a length of L (see **Figure 21** on page 38 and **Figure 23** on page 40).

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

L	Length of the welding adapter
h	Sensor mounting length
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 top edge of the flange of the adapter to the pipe center axis must be within a tolerance of ±2 mm (0.08 in).
- Perpendicularity to the pipe axis must be maintained (maximum tolerance: 2°).
- The adapter centering pin must be aligned with the pipe axis in the flow direction (outflow side, behind the measuring point).
- After welding, the free clearance for installing the sensor must be at least 28 mm (1.10 in). Drill it clear if necessary.

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.

NOTICE

Damage to the sensor.

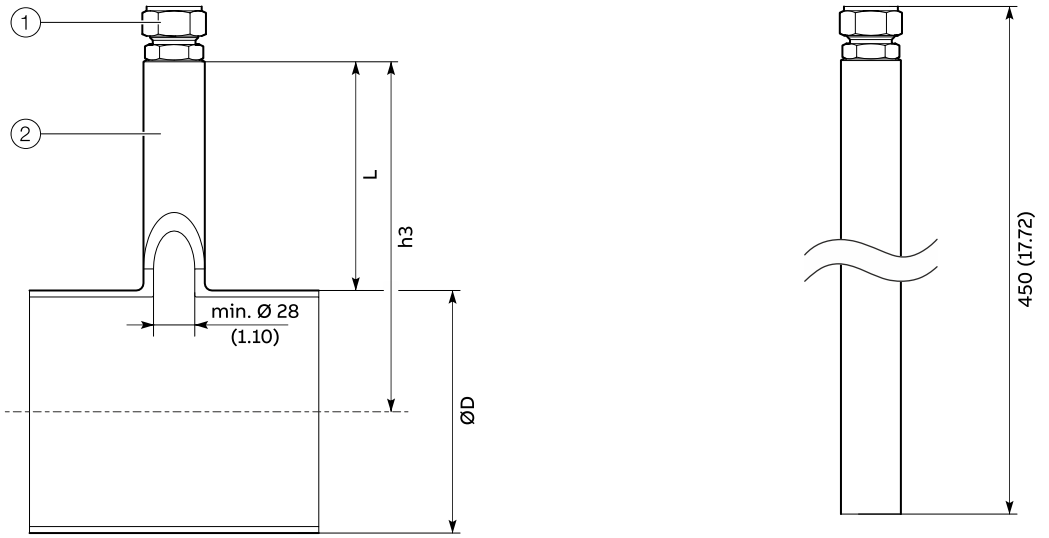
Closing the ball valve before you remove the sensor can seriously damage the protective cage or the sensor elements.

- 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 24: Welding adapter with compression fitting

h (sensor mounting length)	h3*	L = h3 –(½ × ØD)	ø D (pipe outer 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 the weld-on adapter with clamp ring threading

* The dimension **h3** is related to the sensor installation length **h** and is used to calculate the length **L** the weld-on adapter.

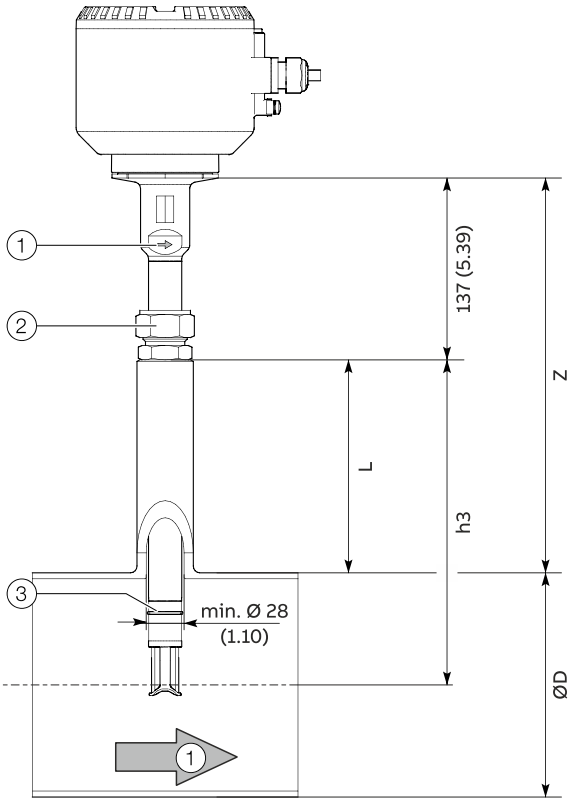
** The limitation of the maximum pipe diameter only applies to installations with the thermal measuring element in the middle of the pipe. In case of larger or non-round cross-sections, a non-centered position of the thermal sensor elements in the piping is considered in the calibration.

Mounting

When installing the weld-on adapter in the piping, observe the following points:

- The weld-on adapter must have the length **L** after being welded on (see Figure 25).
- Shorten the length of the welding adapter as needed before welding it on. After being welded on, a maximum of 10 mm (0.39 in) of the weld-on adapter may protrude into the piping.
- Observe thickness of pipeline wall and degree of shrinkage when welding!
- The distance **h3** from the top edge of the adapter to the pipe center axis must be within a tolerance of ±2 mm (0.08 in).
- Perpendicularity to the pipe axis must be maintained (maximum tolerance: 2°).
- After welding, the free clearance for installing the sensor must be at least 28 mm (1.10 in). Drill it clear if necessary.

Calculation of mounting dimensions



L	Length of the welding adapter	h3	See **Dimensions of the weld-on adapter with clamp ring threading** on page 42.
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 split ring

Figure 25: Calculating mounting dimensions

Calculations (mm)

$$L = h3-(½\times ØD)$$
$$Z = h3+137\ mm-(½\times ØD)$$

Calculations (in)

$$L = h3-(½\times ØD)$$
$$Z = h3+5.39\ in-(½\times ØD)$$

… 6 Installation

… Assembly of the welding adapter with compression ring fitting

Preparing the sensor

⚠ DANGER

Fire hazard in oxygen applications

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

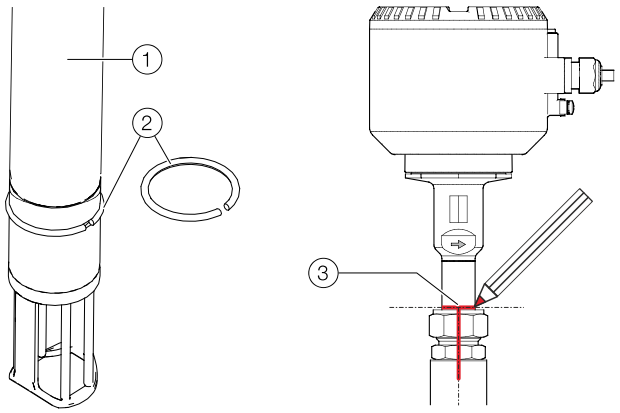
- Use only approved thread sealing compound for oxygen applications!

⚠ 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 split ring
③ Marking for reinstallation

Figure 26: 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 into the snap ring groove using mounting pliers (see Figure 26, item 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.

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 https://www.swagelok.com.

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.

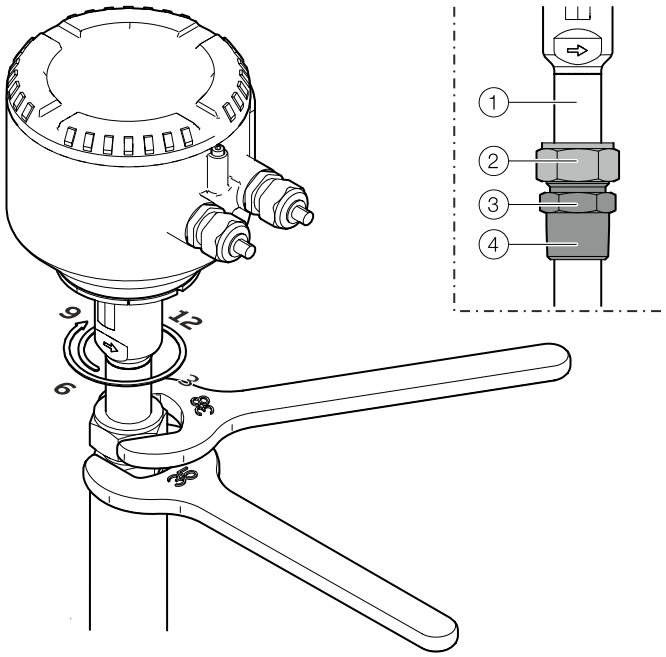
NOTICE

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 25) 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 thermowell 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 26, Item ③). The marking on the union nut is also used as a starting position (6 o'clock position, see Figure 27) for the tightening of the compression fitting



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

Figure 27: Tighten the 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.

Removal 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.com.

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 26, Item 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.

… 6 Installation

… Assembly of the welding adapter with compression ring fitting

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 lightly pressed into the sensor protection tube. The compression fitting can no longer be shifted onto the sensor protection tube and the 'Z' dimension can be readjusted once 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 26, item 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, the 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.

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 and welding adapter** on page 48.

Explosion protection approval

The integrated hot top fitting is approved for use in potentially explosive areas of ATEX/IECEx Zone 1 and Zone 2 or cFMus Div. 1 and Div. 2 respectively.

Use in Zone 0 is not permitted!

Measured medium temperature

See **Measured medium temperature** on page 35.

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.

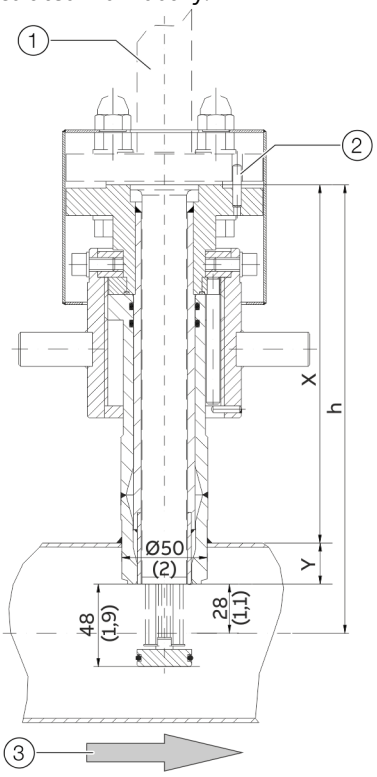
- Do not shorten hot tap fitting components or interfere with the design.

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



1 Sensor
2 Centering pin
3 Flow direction

Figure 28: Integrated hot tap fitting in a measurement position; dimensions in mm (in)

Calculation of the outer length X and installation depth Y

$$X = h - (D/2)$$

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

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

Example

- Sensor mounting 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:

- Perpendicularity to the pipe axis must be maintained (maximum tolerance: 2°).
- The adapter centering pin must be aligned with the pipe axis in the flow direction (outflow side, behind the measuring point).

NOTICE

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.

NOTICE

Impact on measuring accuracy

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

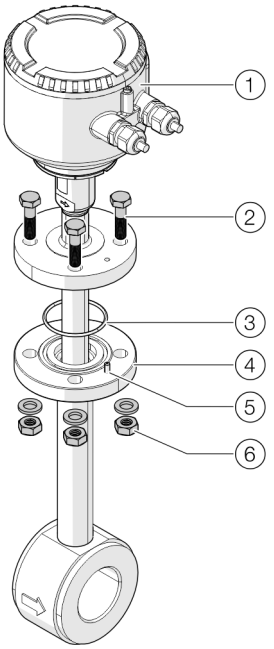
… 6 Installation

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 29: 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.

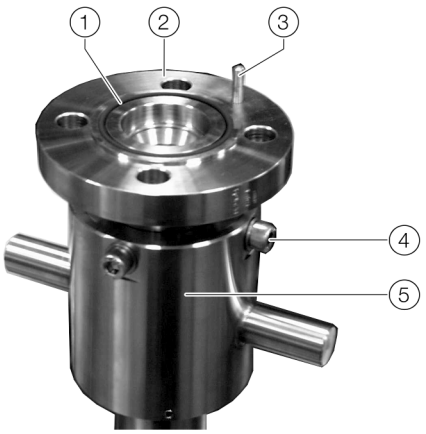
NOTICE

Damage to the changing device

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

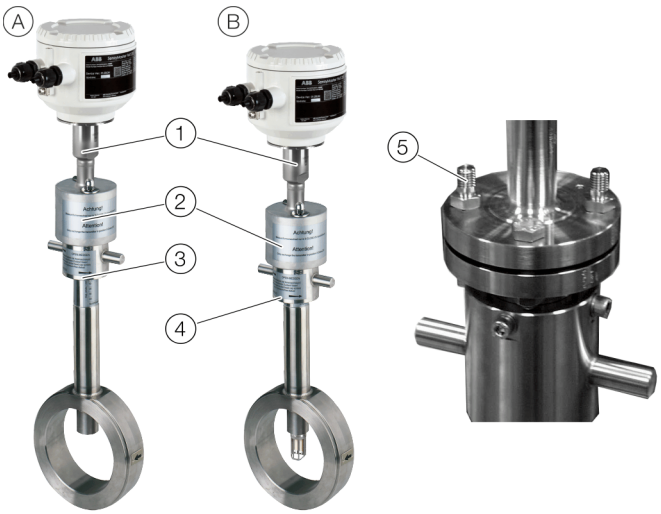
- Operate the union nut by hand only.

Overview



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

Figure 30: 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 31: 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

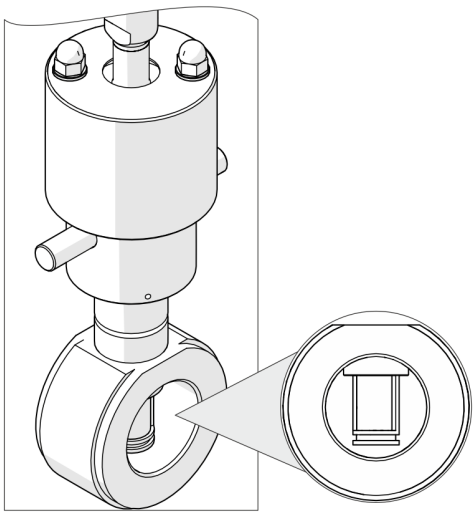


Figure 32: Integrated hot tap fitting in measurement position

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

Disassembly of the sensor

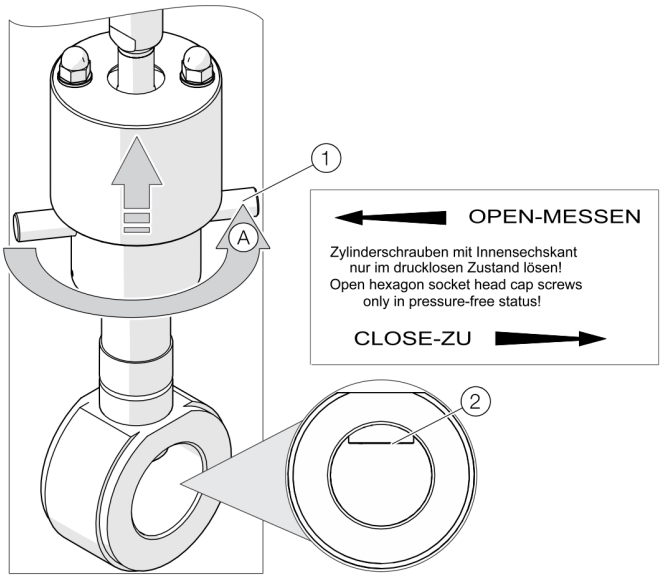


Figure 33: Setting the integrated hot tap fitting in disassembly position

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).

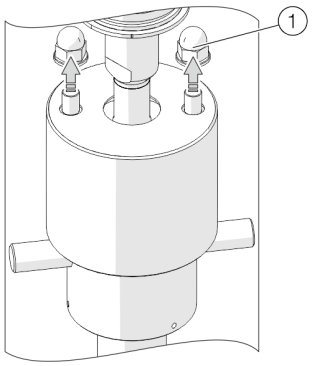


Figure 34: Loosening the cap nuts of the protection cap

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

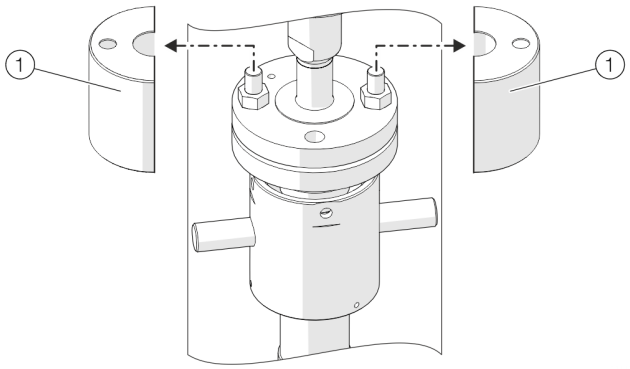


Figure 35: Removing the protection caps

4. Remove the protection caps (1).

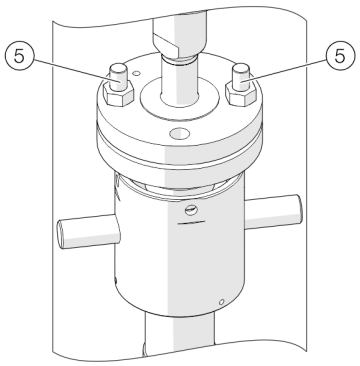


Figure 36: Removing the flange screws

5. Remove the flange screws (5).

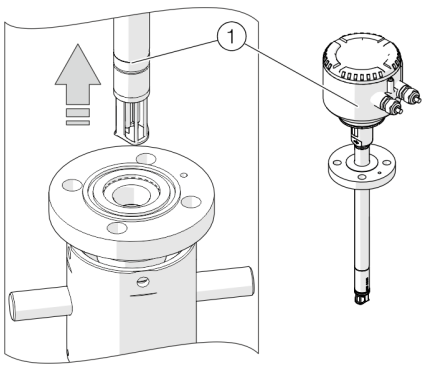


Figure 37: Removing the sensor

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.

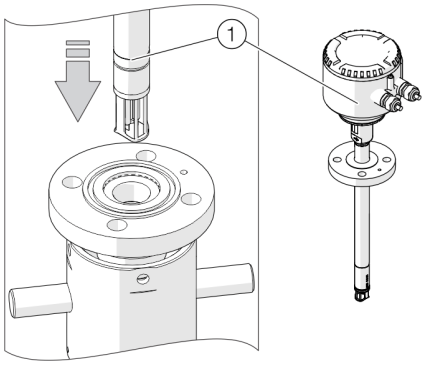


Figure 38: Inserting the sensor

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.

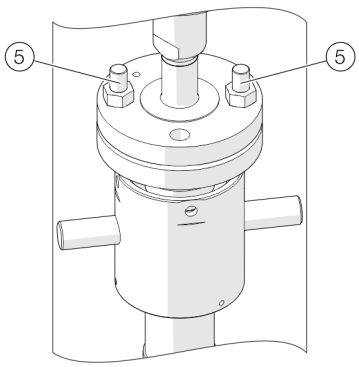


Figure 39: Screwing in the flange screws

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

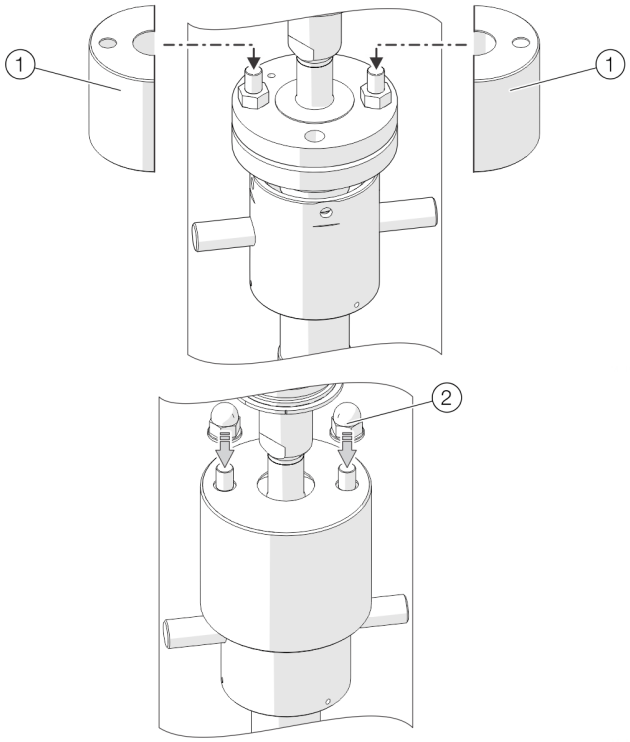


Figure 40: Placing the protection caps

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

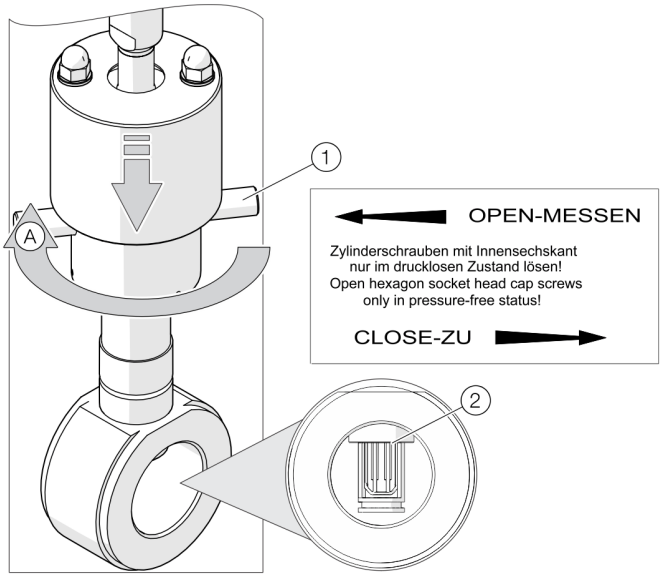


Figure 41: Setting the integrated hot tap fitting in measurement position

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.

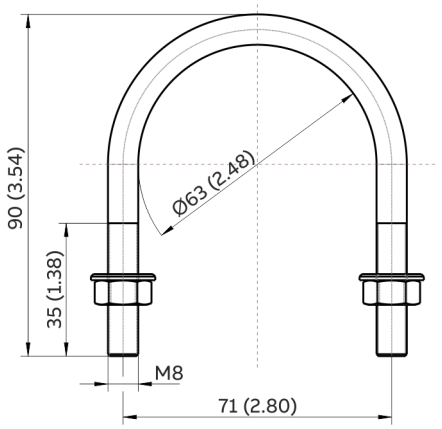
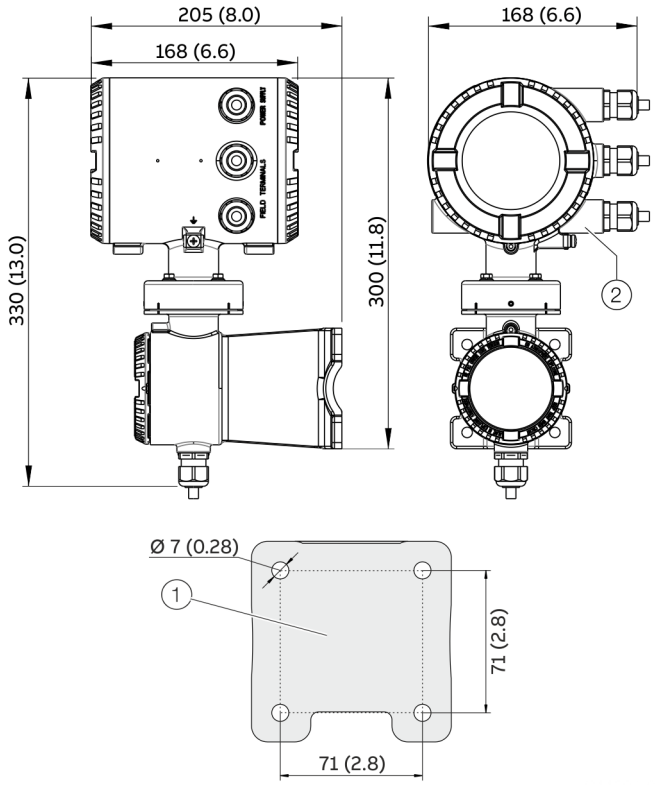


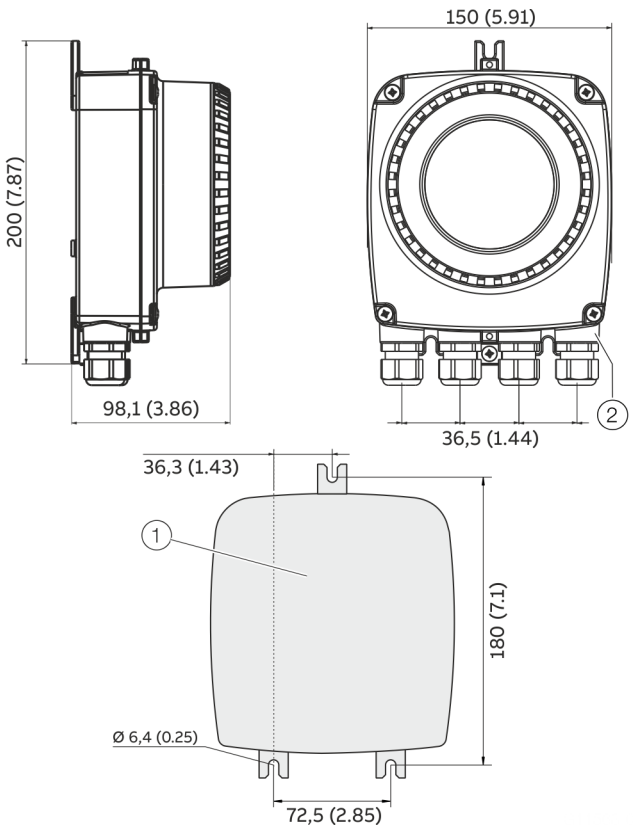
Figure 43: Assembly set for 2 in pipe mounting



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 42: Mounting dimensions dual-compartment housing



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 44: 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:

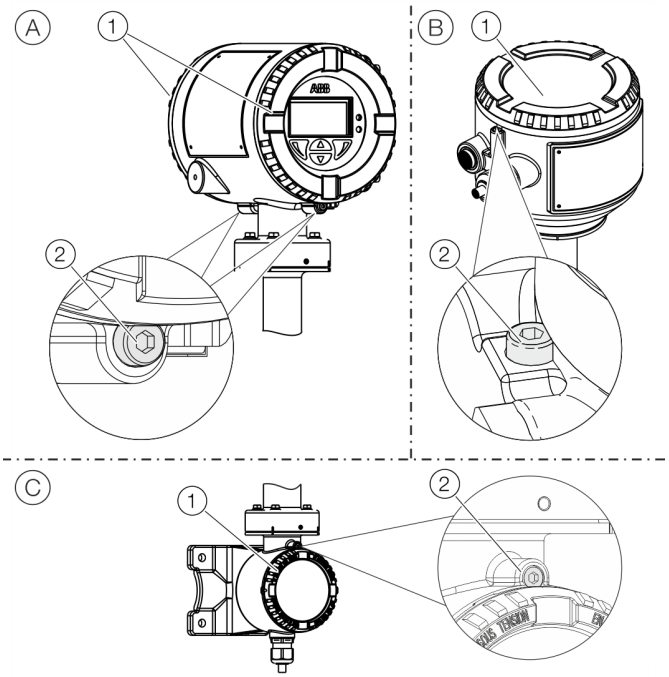
- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 20 minutes before opening.

⚠ 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

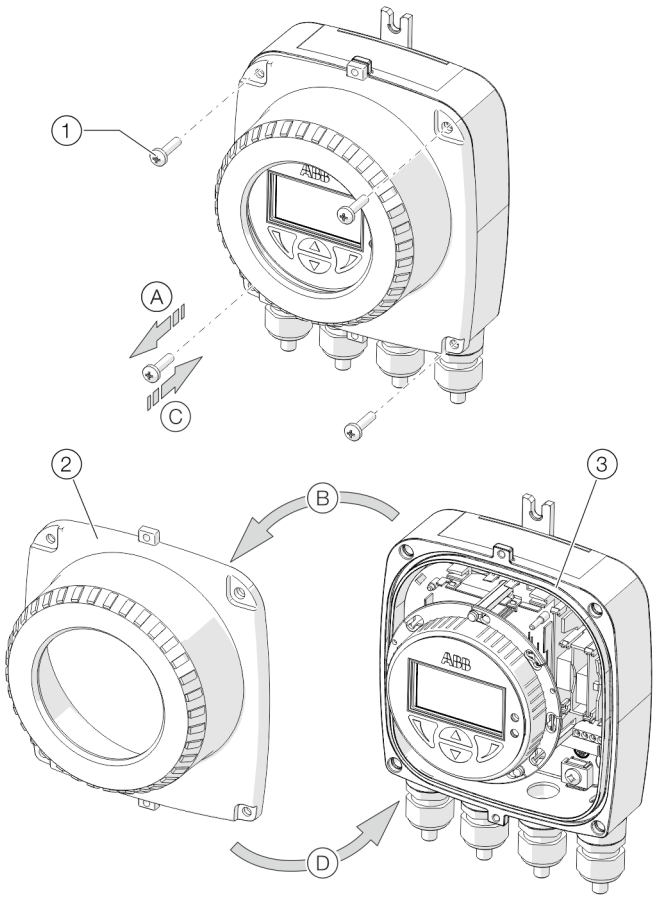
Figure 45: Cover lock (example)

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 46: 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!

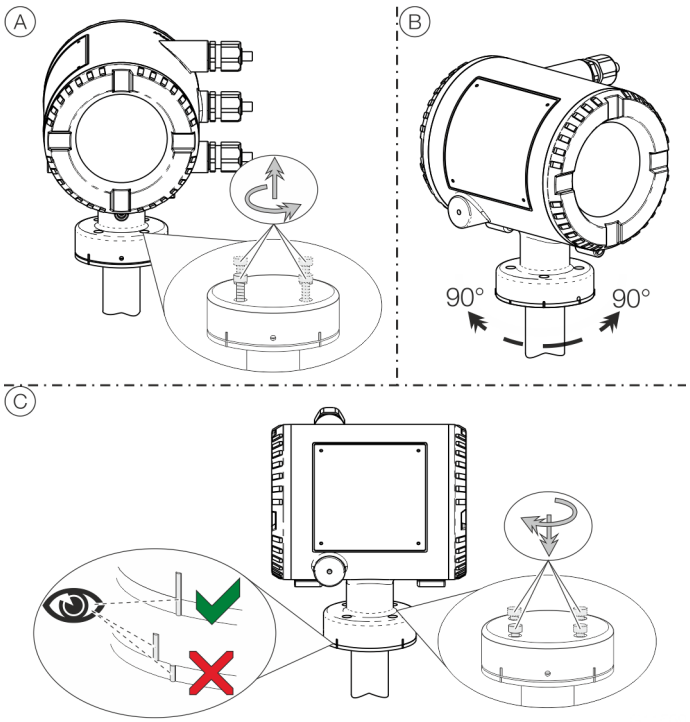


Figure 47: Rotate transmitter housing

Rotate the housing:

- Perform steps Ⓐ to Ⓒ.

Rotate LCD indicator – dual-compartment housing

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

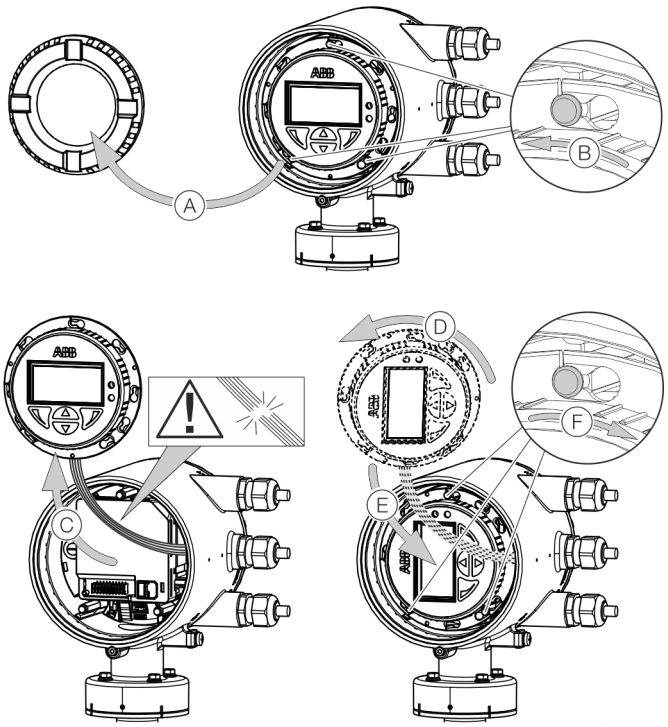


Figure 48: Rotating the LCD indicator

Turn the LCD indicator:

1. Open housing Ⓐ, see **Opening and closing the housing** on page 54.
2. Perform steps Ⓑ to Ⓕ.

… 6 Installation

… Opening and closing the housing

Rotate LCD indicator – single-compartment housing

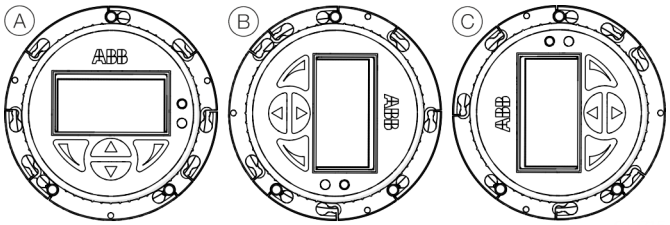


Figure 49: Possible positions of LCD indicator

The LCD indicator can be rotated to the Ⓐ, Ⓑ and Ⓒ positions. The ‘upside down’ position is not possible.
To correct the display for the ‘upside down’ position, use the menu ‘Display / Display Rotation’. This allows the display to be rotated 180° by software.

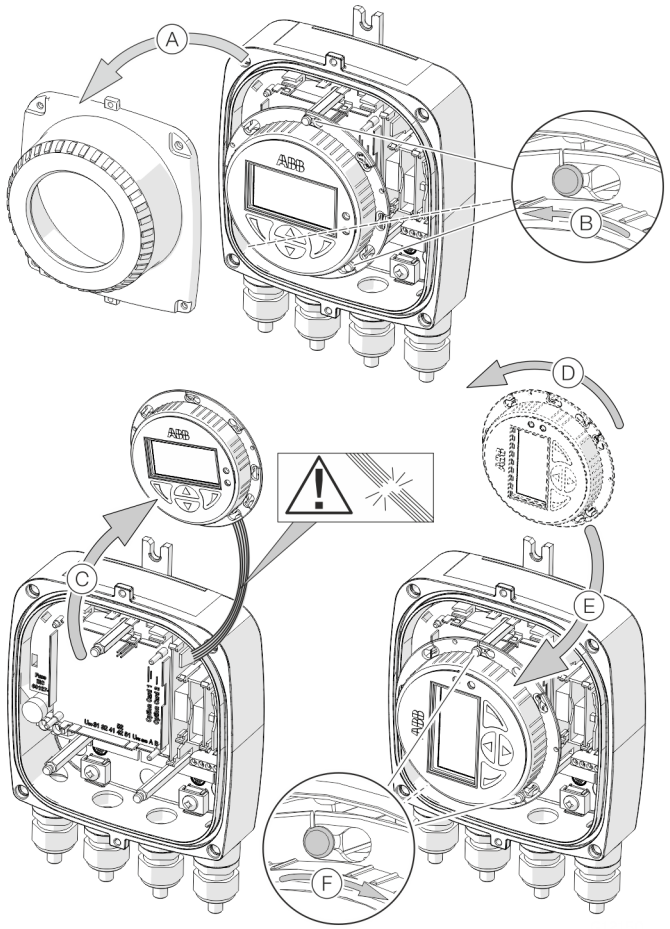


Figure 50: Rotating the LCD indicator

Turn the LCD indicator:

1. Open housing Ⓐ, see **Opening and closing the housing** on page 54.
2. Perform steps Ⓑ to Ⓕ.

Installing the plug-in cards

⚠ WARNING

Loss of Ex Approval!

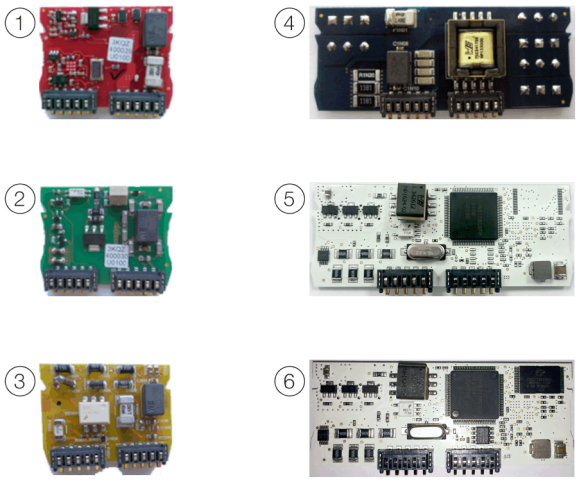
Loss of Ex Approval due to retrofitting of plug-in cards on devices for use in potentially explosive atmospheres.

- 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 number: 3KQZ400029U0100	2
2	Passive digital output (green) Order number: 3KQZ400030U0100	1
3	Passive digital input (yellow) Order number: 3KQZ400032U0100	2
4	24 V DC voltage supply (blue) Order number: 3KQZ400031U0100	1
5	Modbus RTU® RS485 (white) Order number: 3KQZ400028U0100	1
6	PROFIBUS DP® (white) Order number: 3KQZ400027U0100	1

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

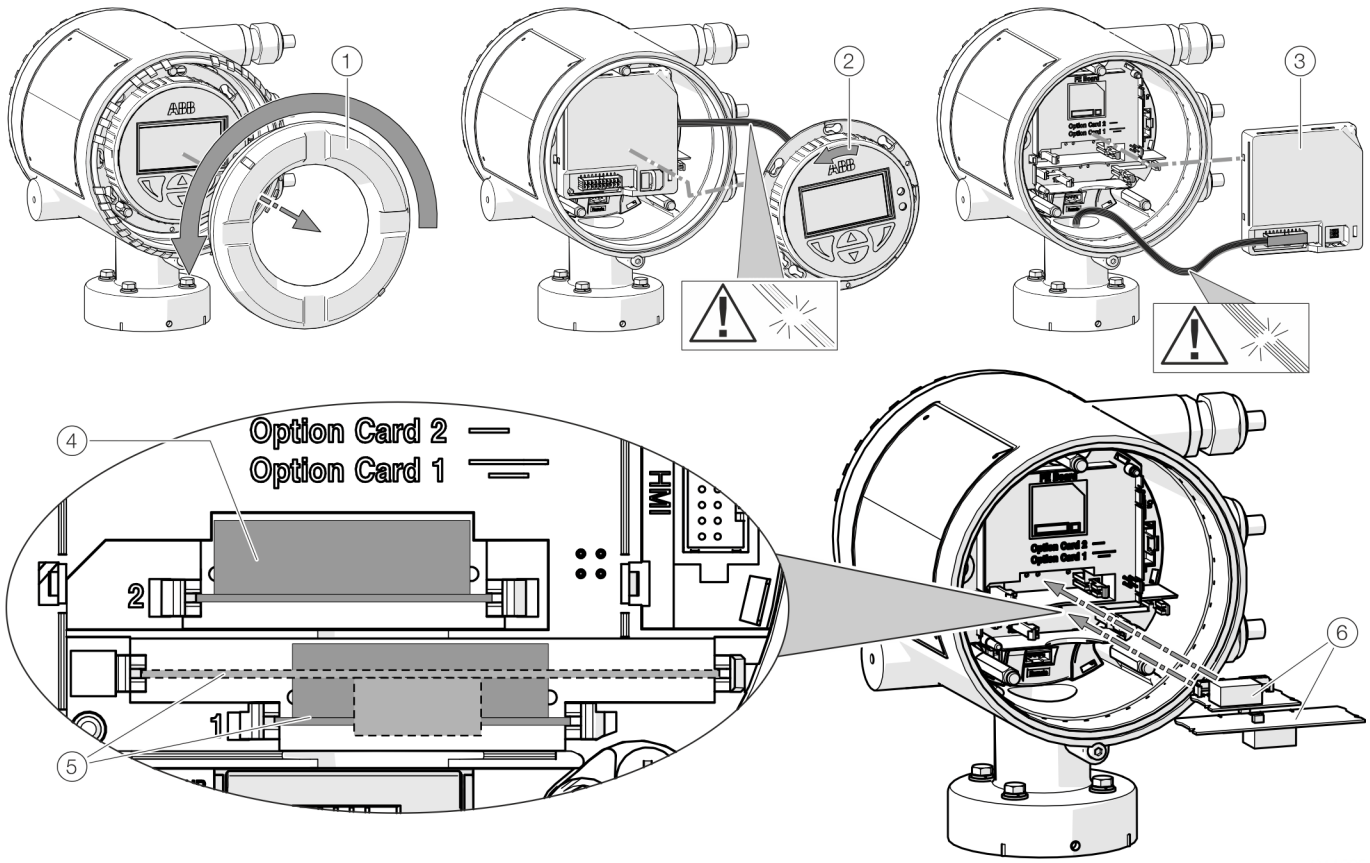
… 6 Installation

… Installing the plug-in cards

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

Main ordering information (outputs)	Additional ordering information		Slot OC1	Slot OC2
	Additional output 1	Additional output 2	Terminals V1 / V2	Terminals V3 / V4
G0	—	—	—	—
G1	—	—	24 V DC power supply (blue)	—
G2	—	—	—	Passive current output (red)
G3	—	—	Passive current output, 4 … 20 mA (red)	Passive current output, 4 … 20 mA (red)
G4	—	—	24 V DC power supply (blue)	Passive current output (red)
G0	DRT	—	24 V DC power supply (blue)	—
G0	DRT	DSN	24 V DC power supply (blue)	Passive digital input (yellow)
G0	DRT	DSG	24 V DC power supply (blue)	Passive digital output (green)
G0	DRT	DSA	24 V DC power supply (blue)	Passive current output, 4 … 20 mA (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)	Passive current output, 4 … 20 mA (red)
G0	DRG	DSN	Passive digital output (green)	Passive digital input (yellow)
G0	DRG	DSA	Passive digital output (green)	Passive current output, 4 … 20 mA (red)
G0	DRA	DSA	Passive current output, 4 … 20 mA (red)	Passive current output, 4 … 20 mA (red)
G0	DRA	DSG	Passive current output, 4 … 20 mA (red)	Passive digital output (green)
G0	DRA	DSN	Passive current output, 4 … 20 mA (red)	Passive digital input (yellow)

Dual-compartment housing



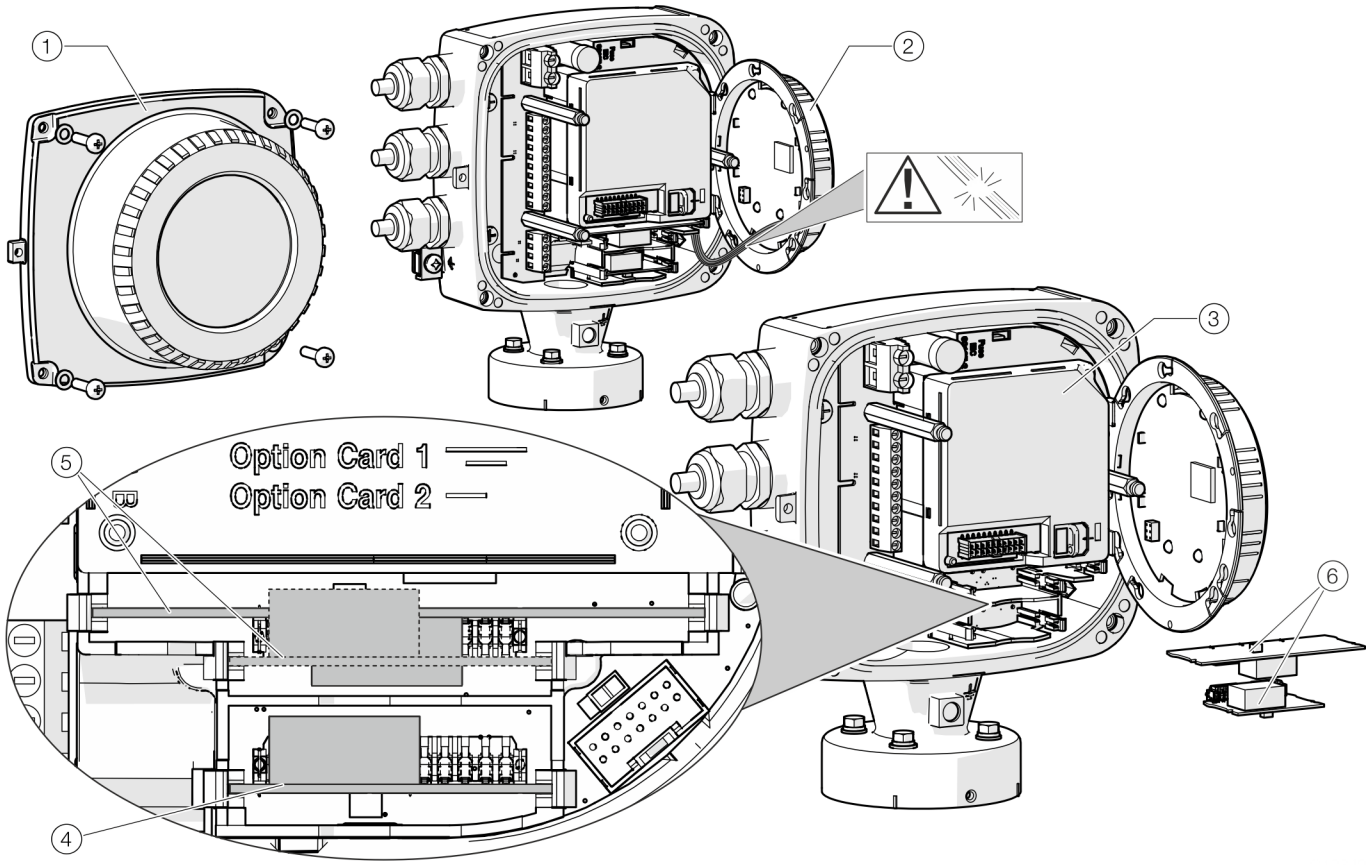
① Cover
② LCD indicator
③ Frontend board (FEB, with integral mount design only)
④ Slot OC2
⑤ Slot OC1
⑥ Plug-in cards

Figure 51: Installation of plug-in cards (example, dual-compartment housing)

… 6 Installation

… Installing the plug-in cards

Single-compartment housing



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

Figure 52: 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 61.
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

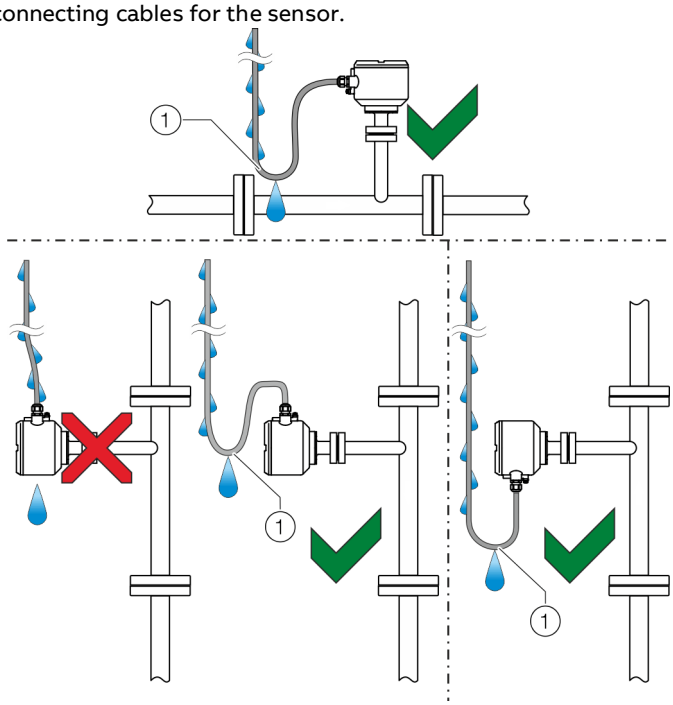
Cable entries

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 53: 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.

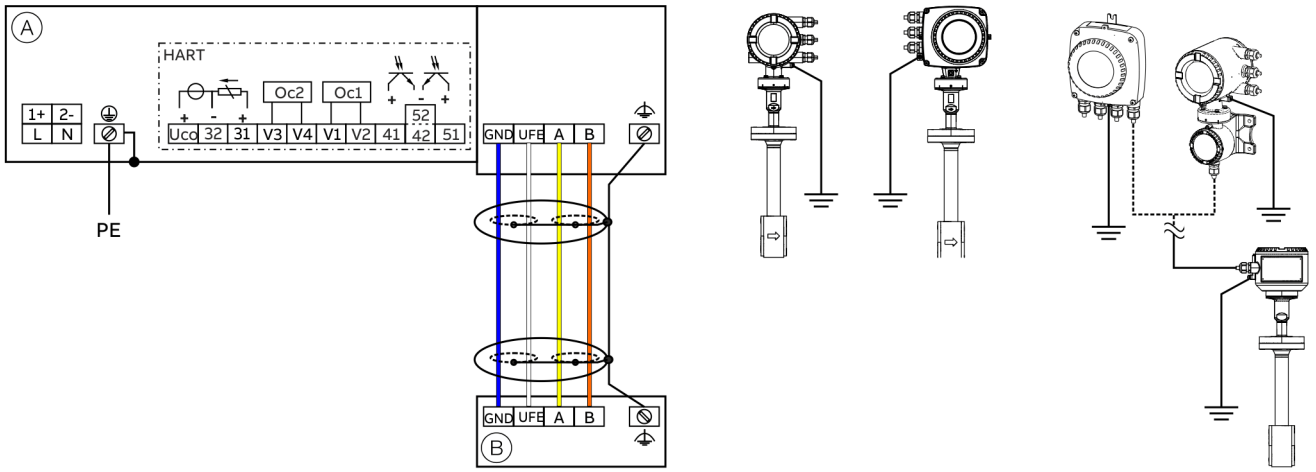
Cable specification	
Impedance	100 to 120 Ω
Withstand voltage	120 V
Outer diameter	6 to 12 mm (0.24 to 0.47 in)
Cable design	Two wire pairs as a star-quad cable
Conductor cross-section	Length-dependent
Shield	Copper braid with approximately 85 % coverage
Temperature range	Depends on application.

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 54: 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 57.

… 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 7!

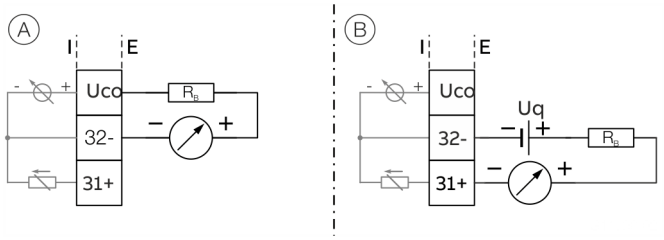
Power supply L / N, 1+ / 2–

AC voltage	
Terminals	L / N
Operating voltage	100 to 240 V AC, –15 % / +10 %, 50 / 60 Hz
Power consumption	< 20 VA

DC voltage	
Terminals	1+ / 2–
Operating voltage	11 to 30 V DC
Power consumption	< 20 W

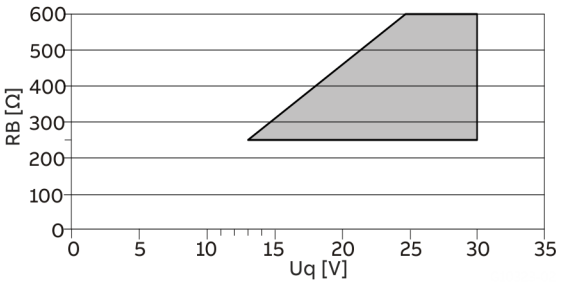
Current output 32 / Uco, 31 / 32 (basic device)

Can be configured via software on-site for the output of mass flow, volume flow and temperature.



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

Figure 55: (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

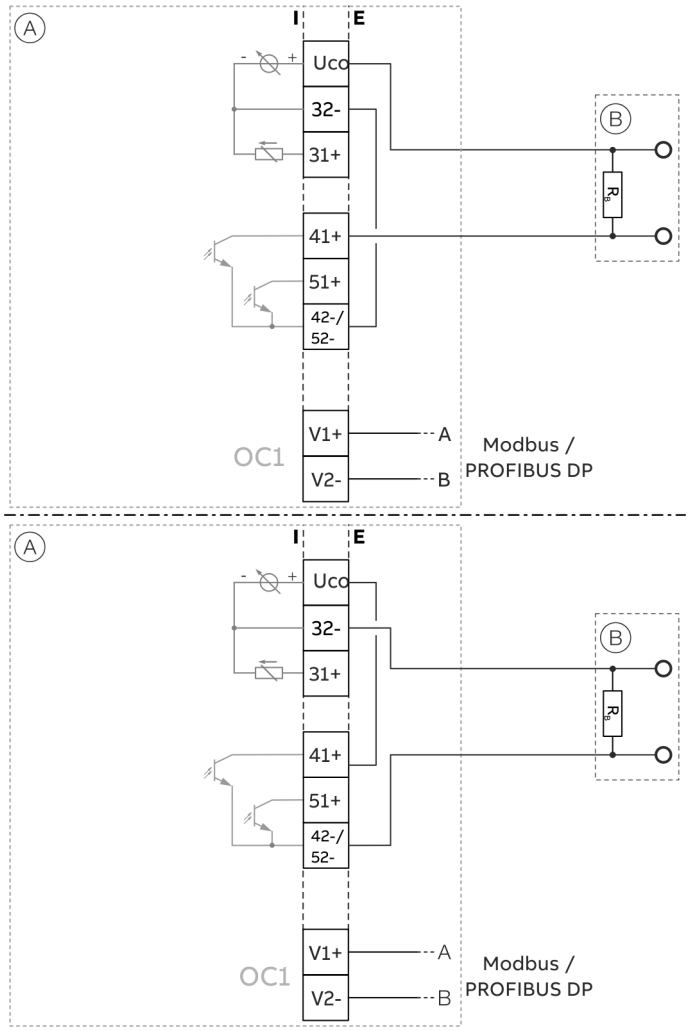
Figure 56: Source voltage for passive outputs

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 .

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 57: 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 58.
Load rating I_{max}	22.6 mA, permanently short circuit-proof

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

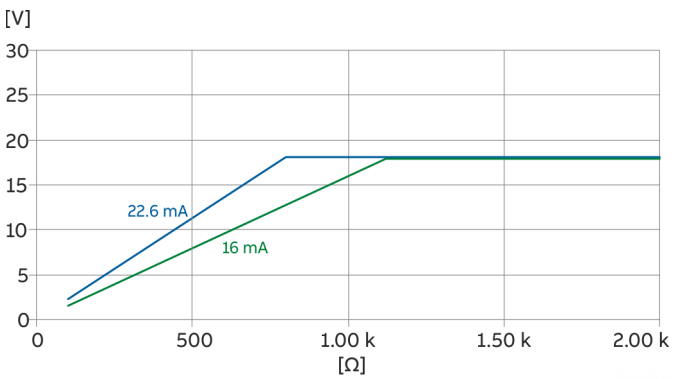


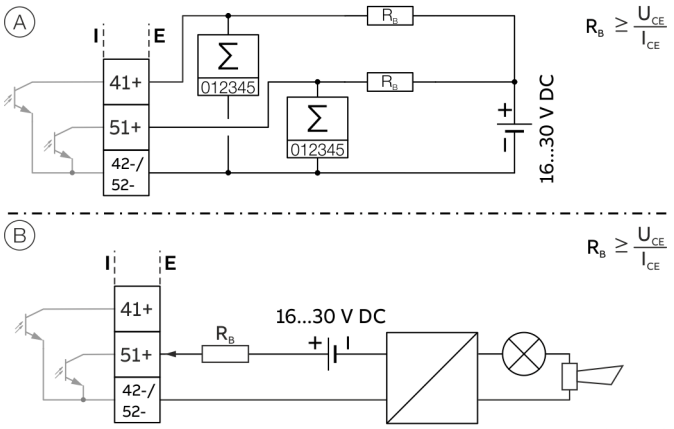
Figure 58: Output voltage dependent on load resistance

… 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 59: (I = internal, E = external, R_B = load)

Pulse / frequency output (passive)	
Terminals	41 / 42, 51 / 52
Output 'closed'	0 V ≤ U_{CEL} ≤ 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 ≤ U_{CEH} ≤ 30 V DC 0 mA ≤ I_{CEH} ≤ 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 ≤ U_{CEL} ≤ 3 V 2 mA ≤ I_{CEL} ≤ 30 mA
Output 'open'	16 V ≤ U_{CEH} ≤ 3 V DC 0 mA ≤ I_{CEH} ≤ 0.2 mA
Switching function	Can be configured using software. **Menu: Input/Output** on page 126

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} ≤ 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.

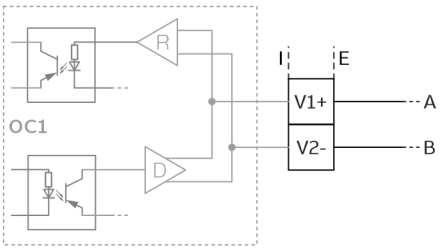


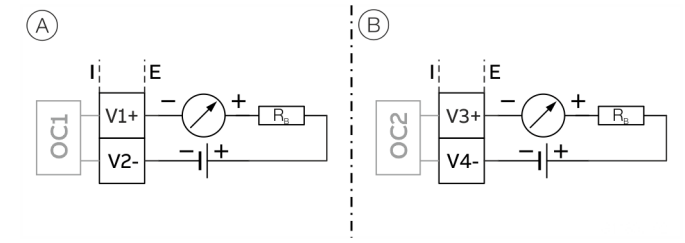
Figure 60: Plug-in card as a Modbus / PROFIBUS DP interface (I = internal, E = external)

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 76 and **PROFIBUS DP® communication** on page 77.

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

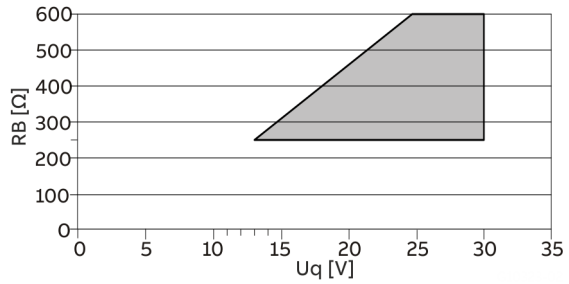
Up to two additional plug-in modules can be implemented via the 'Passive current output (red)' option module.
Can be configured for outputting mass flow, volume flow, density and temperature via on-site software.



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

Figure 61: (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 62: 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.

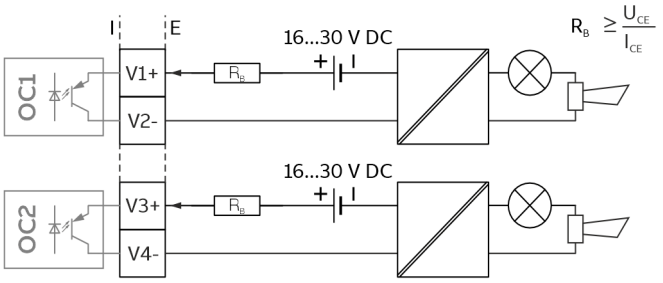


Figure 63: Plug-in card as binary output (I = internal, E = external, R_B = load)

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. **Menu: Input/Output** on page 126

… 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.

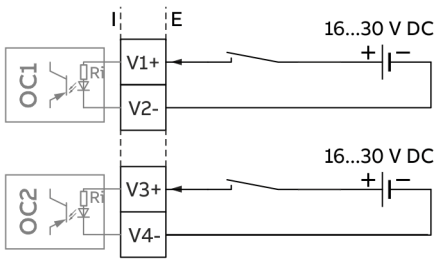


Figure 64: Plug-in card as digital input (I = internal, E = external)

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. **Menu: Input/Output** on page 126

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

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 69.

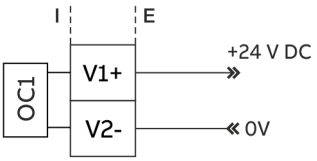


Figure 65: (I = Internal, E = External)

The plug-in card 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

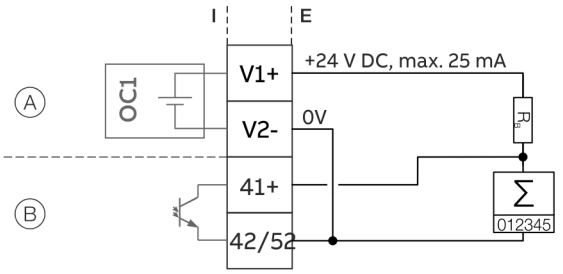
Input and output functions are configured via the device software in accordance with the desired application.
Parameter descriptions on page 106

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)!

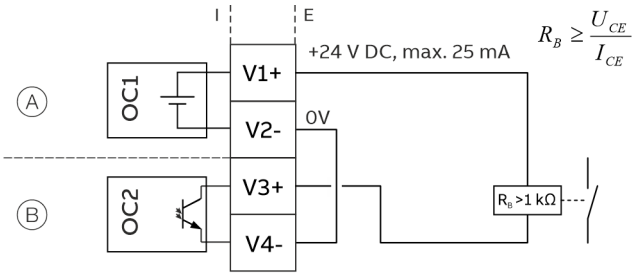


(A) 'Loop power supply (blue)' plug-in card in slot 1

(B) Digital output, digital output 41 / 42

Figure 66: 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.

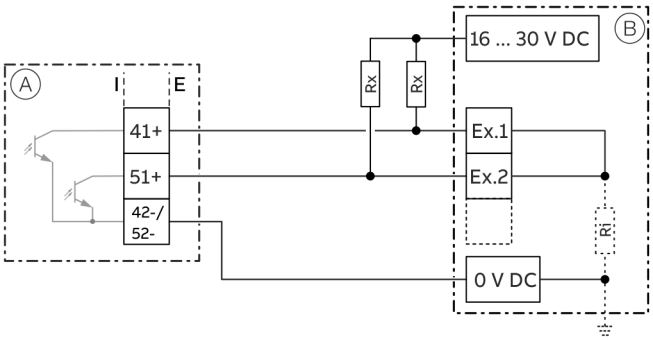


(A) 'Loop power supply (blue)' plug-in card in slot 1

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

Figure 67: 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 68: Digital output 41 / 42 on distributed control system (example)

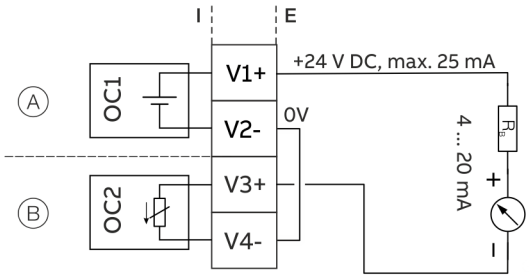
The R_X resistors limit the maximum current through the optoelectronic coupler of the digital outputs in the transmitter. The maximum permissible current is 25 mA. An R_X value of 1000 Ω / 1 W is recommended at a voltage level of 24 V DC. The input on the distributed control system is reduced from 24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



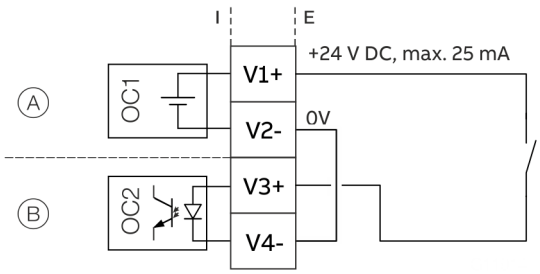
(A) 'Loop power supply (blue)' plug-in card in slot 1

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

Figure 69: 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 70: 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.

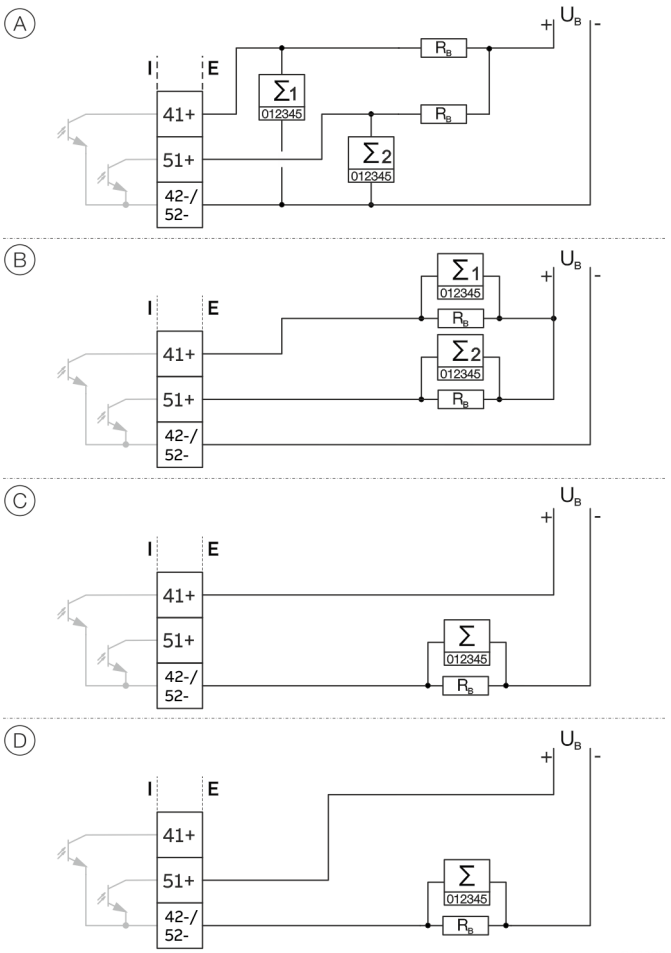
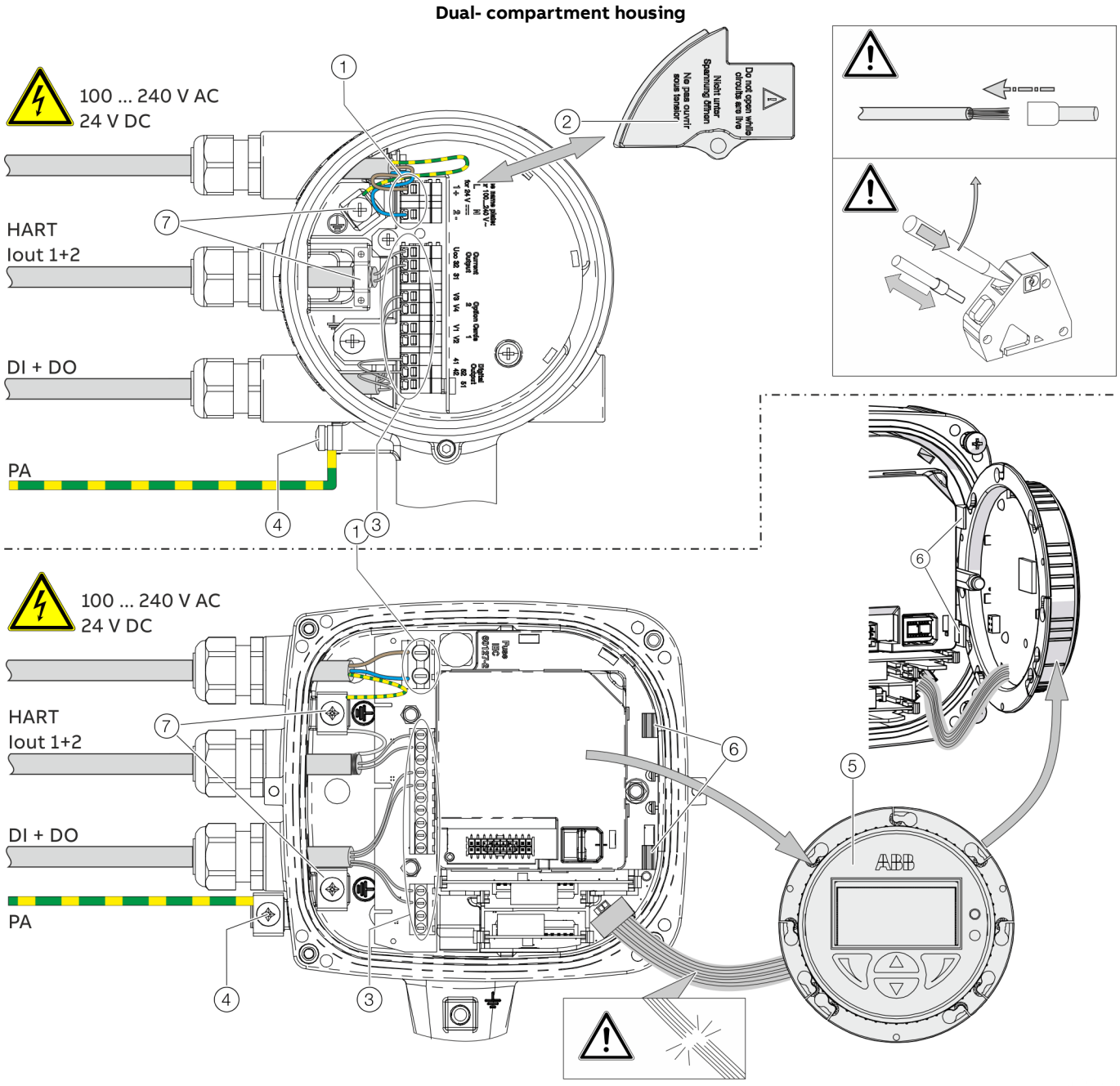


Figure 71: Connection versions digital output 41 / 42 and 51 / 52

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

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

… 7 Electrical connections

… Connection to integral mount design

NOTICE

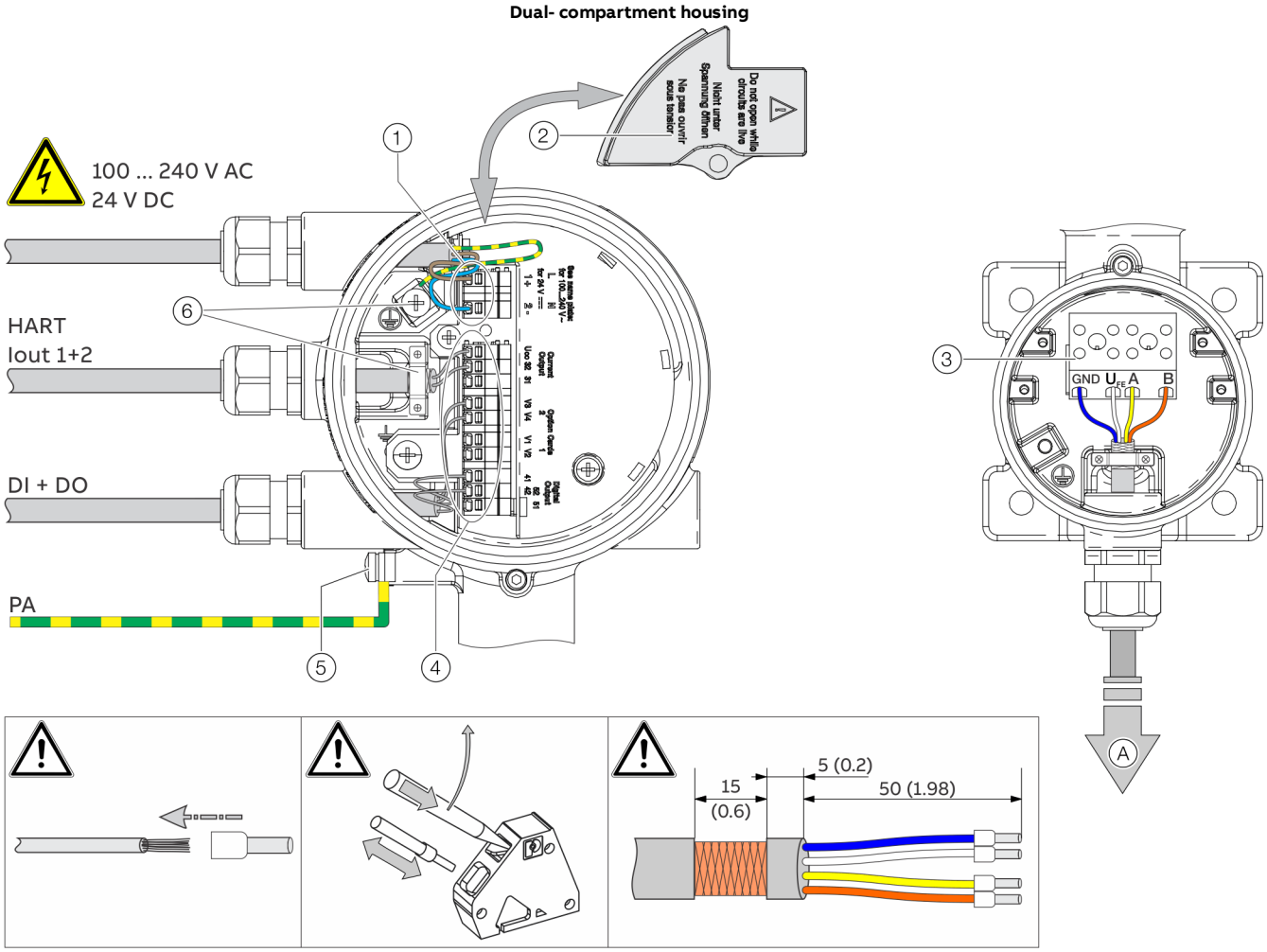
If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class.
Follow the instructions in **Opening and closing the housing** on page 54 to open and close the housing safely.

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

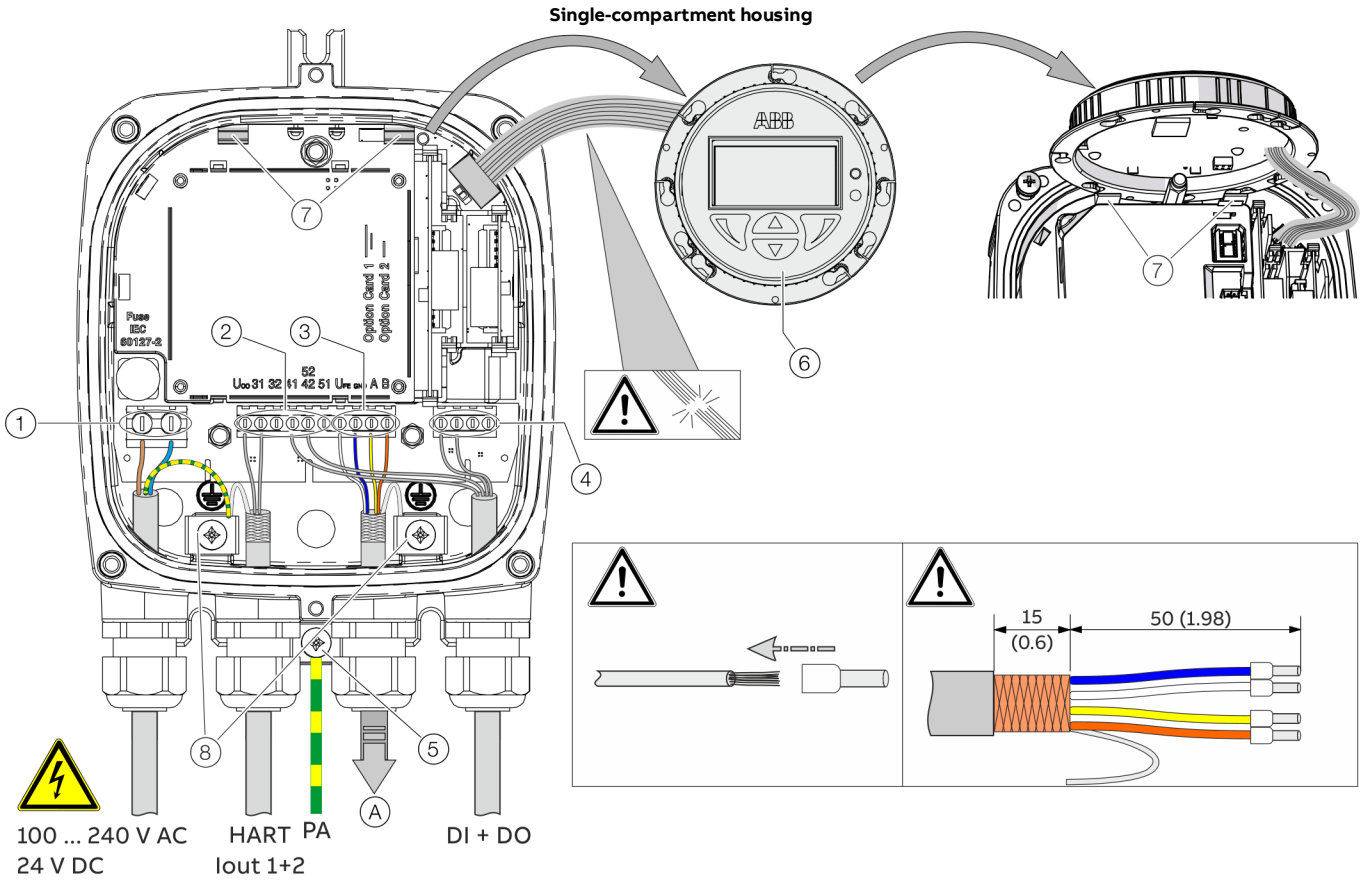


(A) Upper terminal box (back side)
(B) Lower terminal box
(C) Signal cable to sensor
(1) Terminals for power supply
(2) Cover for power supply terminals
(3) Terminals for signal cable
(4) Terminals for inputs and outputs
(5) Terminal for potential equalization
(6) Terminal for protective earth / cable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

Figure 73: Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

… 7 Electrical connections

… Connection to remote mount design

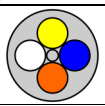
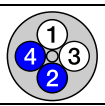


(A) Signal cable to sensor
(1) Terminals for power supply
(2) Terminals for inputs and outputs (base device)
(3) Terminals for signal cable
(4) Terminals for inputs and outputs (plug-in cards)
(5) Terminal for potential equalization
(6) LCD indicator
(7) Bracket for LCD indicator (park position)
(8)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

Figure 74: Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

NOTICE

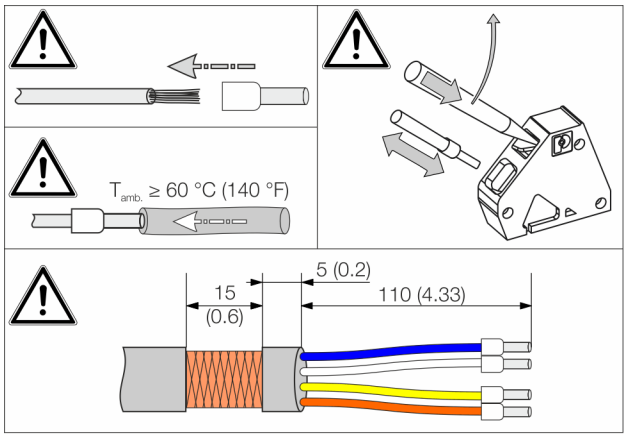
If the O-ring gasket is seated incorrectly or damaged, this may have an adverse effect on the housing protection class. Follow the instructions in **Opening and closing the housing** on page 54 to open and close the housing safely.

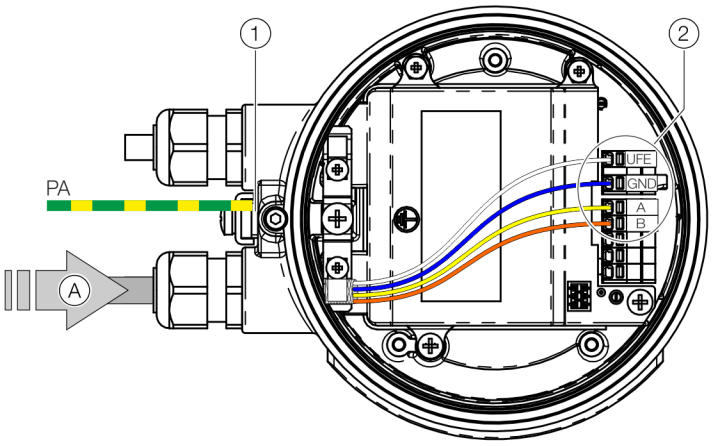
Terminal	ABB signal cable 3KQZ407123U0100	HELKAMA signal cable RFE-FRHF 250 V – 20522
		
GND	Blue	Blue (4)
U_{FE}	White	white (3)
A	Yellow	Blue (2)
B	Orange	white (1)

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

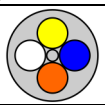
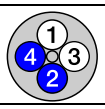
(1) Terminal for potential equalization

(2) Terminals for signal cable

Figure 75: 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 54 to open and close the housing safely.

Terminal	ABB signal cable 3KQZ407123U0100	HELKAMA signal cable RFE-FRHF 250 V – 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 $T_{amb.}$ ≥ 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 (in terms of IT and cyber security), as such the intended application should be assessed to ensure that this protocol is 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.

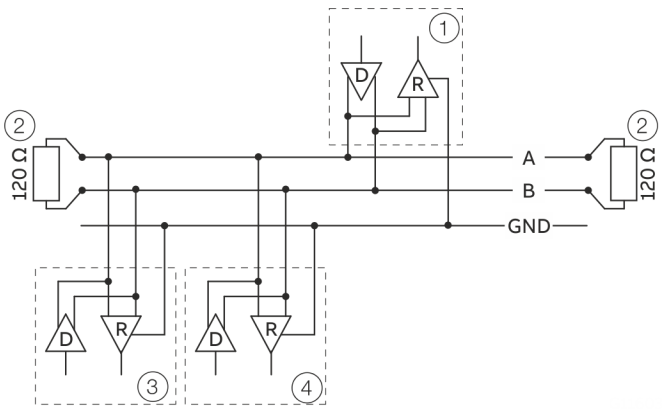
Modbus® communication

Note

The Modbus® protocol is an unsecured protocol (in terms of IT and cyber security), as such the intended application should be assessed to ensure that this protocol is 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 (LSB first), Big endian (MSB first) Factory setting: Big endian Big Endian -> MSB first (default) Little Endian -> LSB first
Typical response time	< 100 ms
Response delay time	0 to 200 ms Factory setting: 10 ms



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

Figure 76: Communication via 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 (in terms of IT and cyber security), as such the intended application should be assessed to ensure that this protocol is 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 **Ident Nr. Selector** on page 134.

… 7 Electrical connections

… Digital communication

Limits and rules when using ABB fieldbus accessories

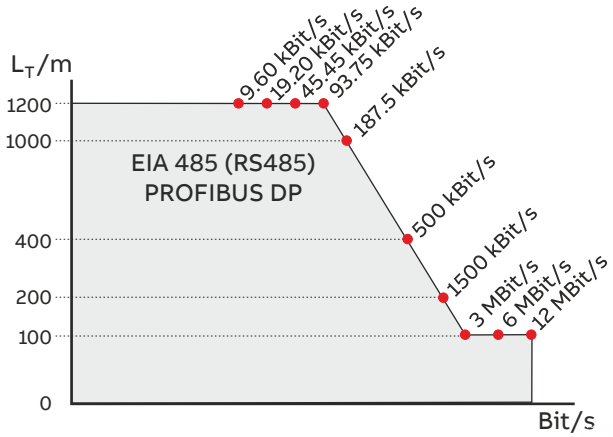


Figure 77: Bus cable length depends on the transmission rate

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.

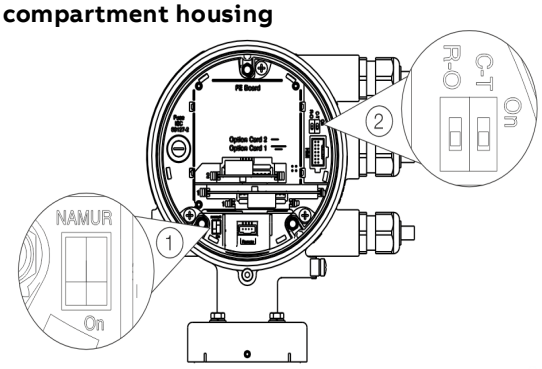
Wear to the flange gasket or process connection gaskets (e.g. flange fitting or pipe fitting) may cause a pressurized measuring medium to escape.

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 78: 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

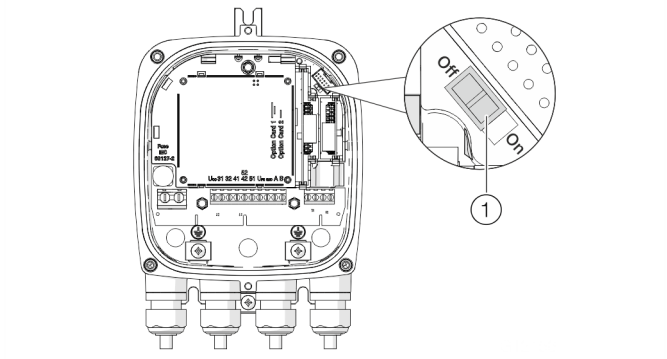
The configuration (NAMUR, optoelectronic coupler) for the digital outputs on the basic device is set via DIP switches in the transmitter.

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

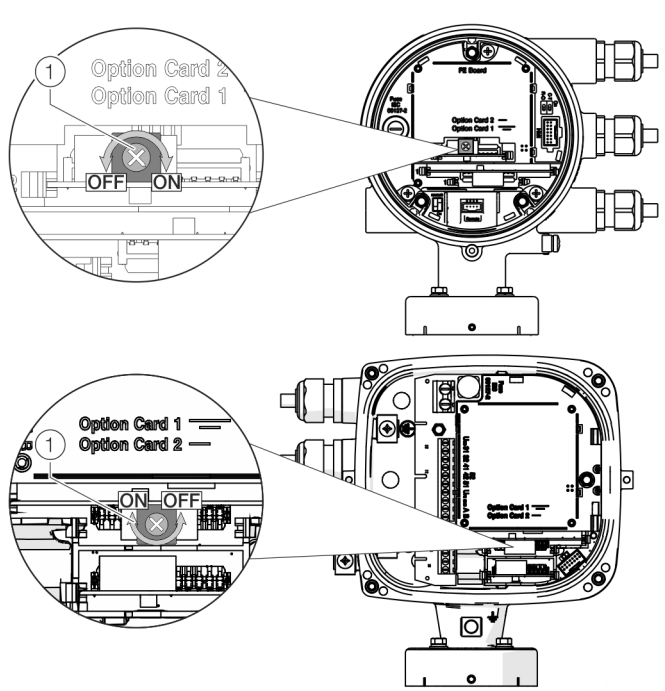
Figure 79: Position of the DIP switch

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 80: 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 61.
- 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 integral LCD display (see **Parameterization via the menu function Easy Setup** on page 84).

Alternatively, the SensyMaster FMT430, FMT450 can also be commissioned and operated via standard HART tools. These include:

- ABB HART handheld terminal DHH805 (FCB4xx EDD)
- ABB Field Information Manager (FIM) combined with the ABB CoriolisMaster Field Device Information Package (FDI package).
- ABB 800xA control system (FCB4xx DTM)
- Other tools supporting standard HART EDDs or DTMs (FDT1.2)

Note

Not all tools and frame applications support DTMs or EDDs at the same level. In particular, optional or advanced EDD / DTM functions may not be available on all tools. ABB provides frame applications supporting the full range of functions and performance.

Installation of the ABB Field Information Manager (FIM)

Download the ABB Field Information Manager (FIM) using the adjacent download link.

Download the ABB FDI package using the adjacent download link.

Installation of the software and connection to the flowmeter:

1. Install ABB Field Information Manager (FIM).
2. Unpack the ABB FDI package into the c:\temp folder.
3. Connect the flowmeter with the PC / laptop, see chapter **Parameterization via the infrared service port adapter** on page 83 or **Parameterization via HART®** on page 84.
4. Power-up the power supply for the flowmeter and start the ABB Field Information Manager (FIM).
5. Drag and drop the 'ABB.FMT2xx_FMT4xx.01.05.00.HART.fdix' file to the ABB Field Information Manager (FIM). No special view is needed for this.
6. Right-click ① as shown in Figure 81.

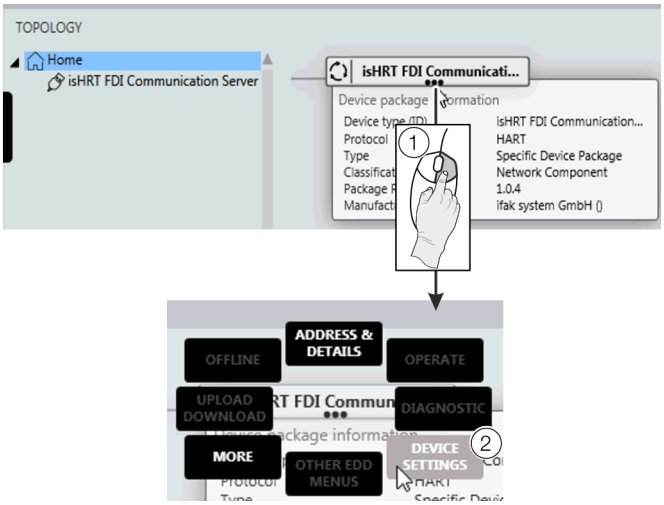


Figure 81: Select FIM – 'Device Settings'

7. Select 'DEVICE SETTINGS' ② as shown in Figure 81.

… 8 Commissioning

… Parameterization of the device

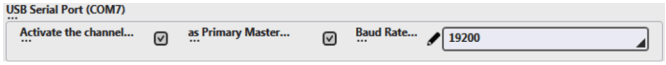


Figure 82: Select FIM – COM-Port

8. Select the corresponding COM port. Close the menu by clicking on ‘send’.
9. By using the  menu button on the left side, the flowmeter is displayed under ‘TOPOLOGY’.

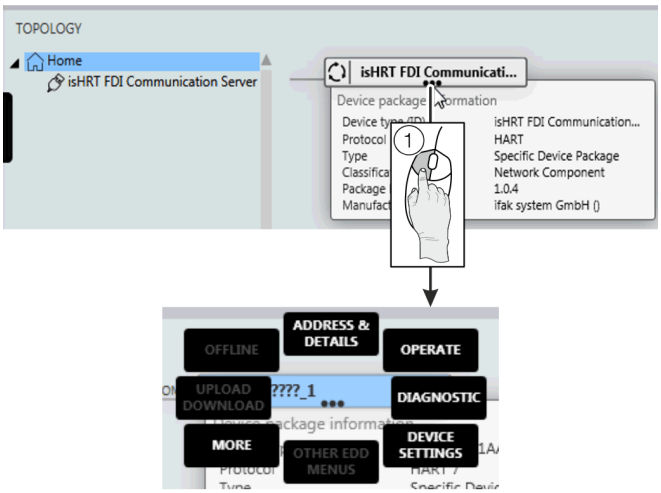
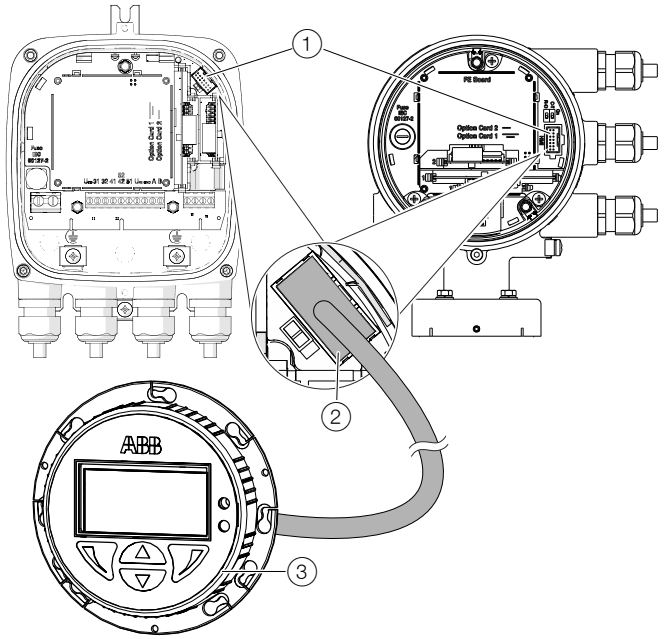


Figure 83:

All the submenus can be accessed by clicking the three points below the tag name of the flowmeter with the left mouse button ①.

Parameterization with the optional LCD indicator



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

Figure 84: Optional LCD indicator

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

Parameterization via the local operating interface

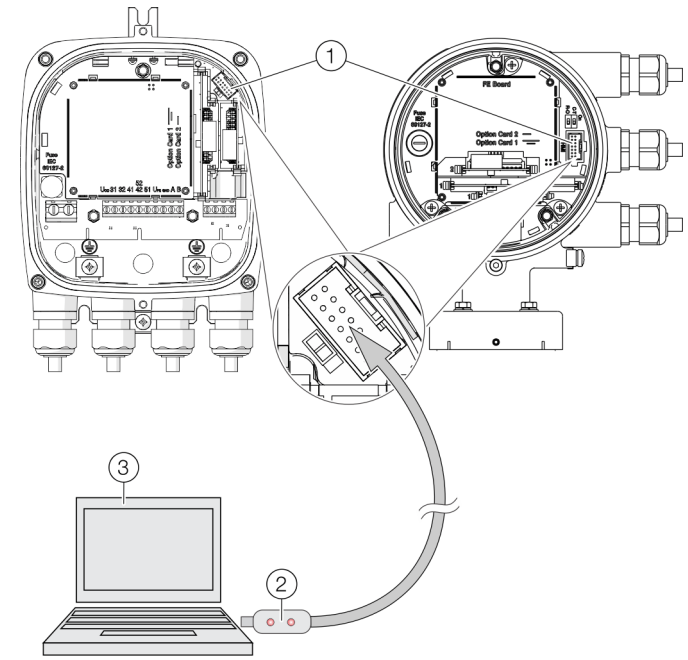
⚠ DANGER

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.



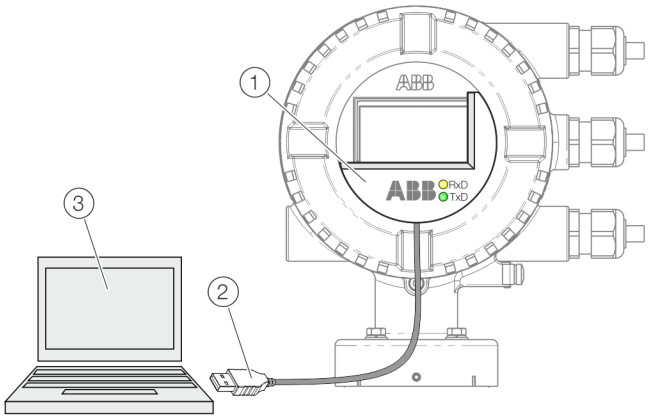
① Local operating interface ③ PC / Notebook
② USB-interface cable

Figure 85: 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.

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 86: Infrared service port adapter on the transmitter (example)

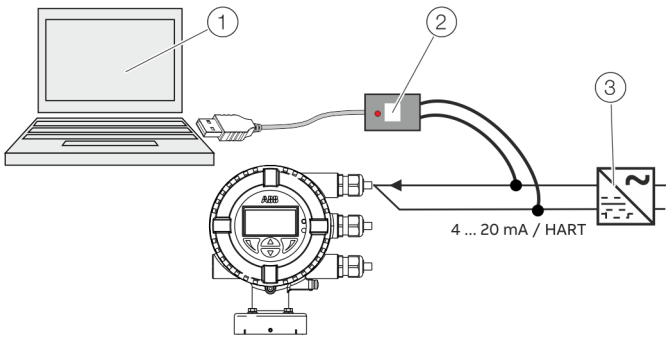
1. Position the infrared service port adapter on the front plate of the transmitter as shown
2. Insert USB interface cable into a free USB female connector on the PC / notebook.
3. Switch on the device power supply.
4. Start the ABB Field Information Manager (FIM) and perform parameterization of the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

… 8 Commissioning

… 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

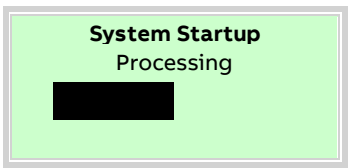
Figure 87: HART Modem on the transmitter (example)

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:

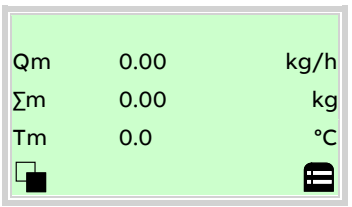


The process display is displayed after the startup process.

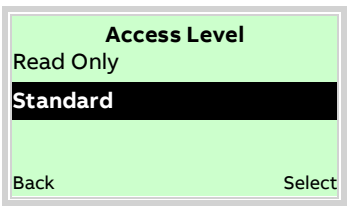
Parameterization via the menu function Easy Setup

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

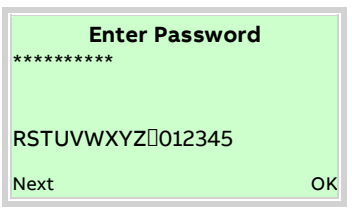
The following section describes parameterization via the ‘Easy Setup’ menu function.



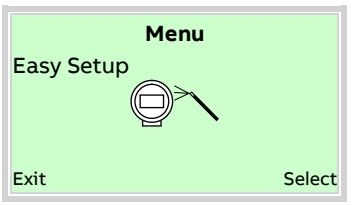
1. Switch to the configuration level with .



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

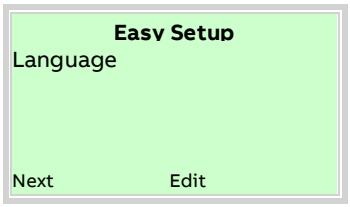


4. Use to confirm the password. A password is not available as factory default; you can continue without entering a password.



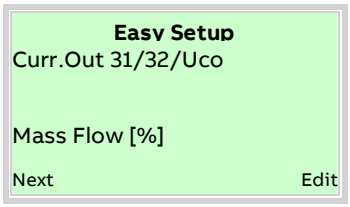
5. Use / to select ‘Easy Setup’.
6. Confirm the selection with .

Selection of the menu language

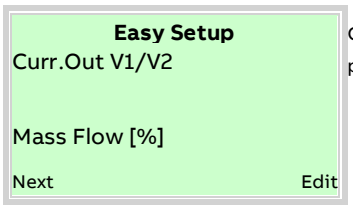


7. Use to call up the edit mode.
8. Use / to select the desired language.
9. Confirm the selection with .

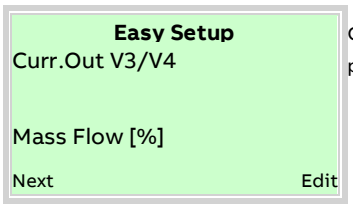
Configuration of the current output



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 .



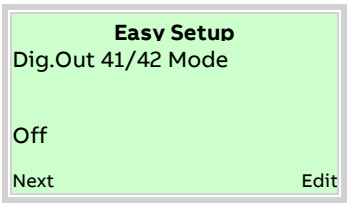
Only if an appropriate plug-in card is present!



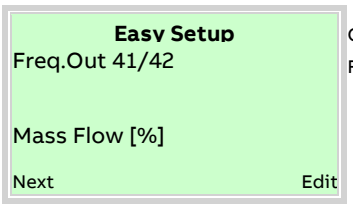
Only if an appropriate plug-in card is present!

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 .

Configuring the digital outputs

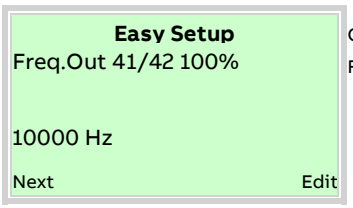


16. Use to call up the edit mode.
17. Use / to select the desired operating modeOff, Binary, Pulse, Frequencyfor the digital output.
18. Confirm the selection with .



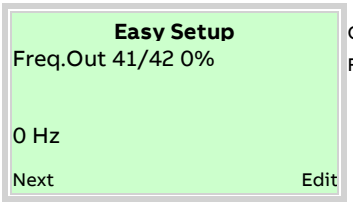
Only available if "Dig.Out 41/42 Mode" Frequency has been selected.

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 .

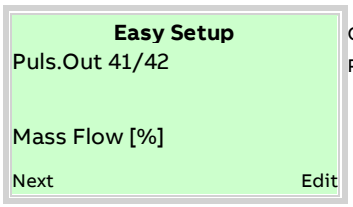


Only available if "Dig.Out 41/42 Mode" Frequency has been selected.

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

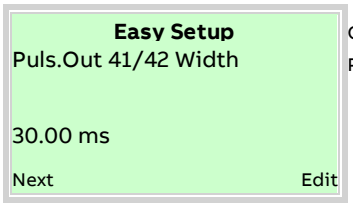
… 8 Commissioning

… Parameterization via the menu function Easy Setup



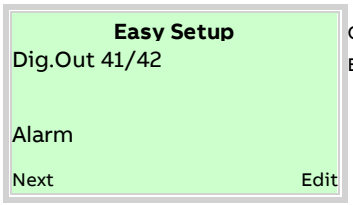
Only available if "Dig.Out 41/42 Mode" Pulse has been selected.

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 .



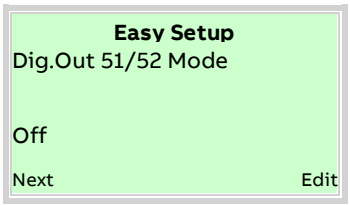
Only available if "Dig.Out 41/42 Mode" Pulse has been selected.

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 .

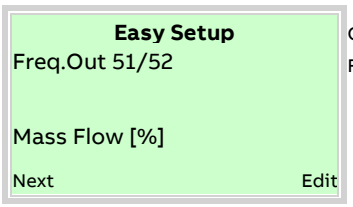


Only available if "Dig.Out 41/42 Mode" Binary has been selected.

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

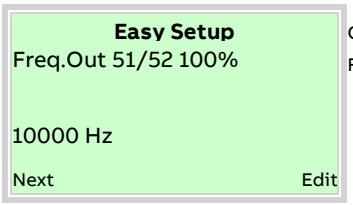


37. Use to call up the edit mode.
38. Use / to select the desired operating modeOff, Binary, Frequency, Pulse 41/42 <)90°, Pulse 41/42 <)180°for the digital output.
39. Confirm the selection with .



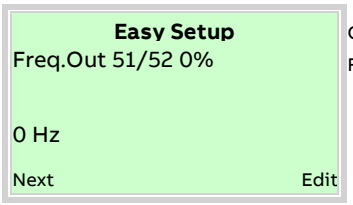
Only available if "Dig.Out 51/52 Mode" Frequency has been selected.

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 .



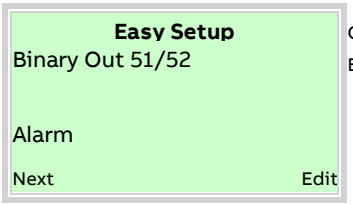
Only available if "Dig.Out 51/52 Mode" Frequency has been selected.

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



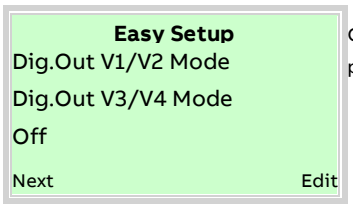
Only available if "Dig.Out 51/52 Mode" Frequency has been selected.

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



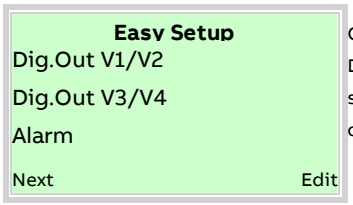
Only available if "Dig.Out 51/52 Mode" Binary has been selected.

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!

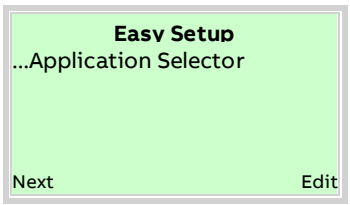
52. Use to call up the edit mode.
53. Use / to select the desired operating mode (Off, Binary) for digital output V1 / V2 or V3 / V4.
54. Confirm the selection with .



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!

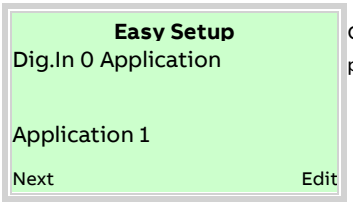
55. Use to call up the edit mode.
56. Use / to select the desired function for binary output V1 / V2 or V3 / V4.
57. Confirm the selection with .

Select the application

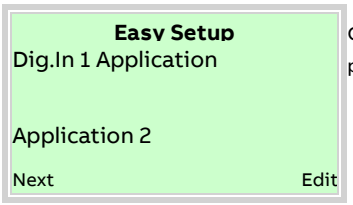


58. Use to call up the edit mode.
59. Use / to select the desired application.
60. Confirm the selection with .

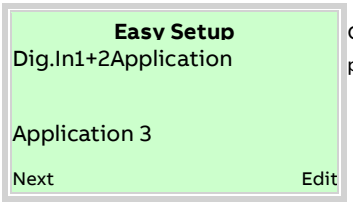
Select the application using the digital inputs



Only if an appropriate plug-in card is present!



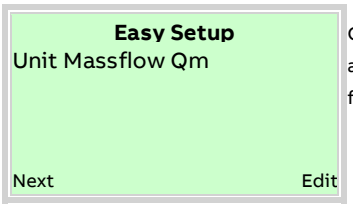
Only if an appropriate plug-in card is present!



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

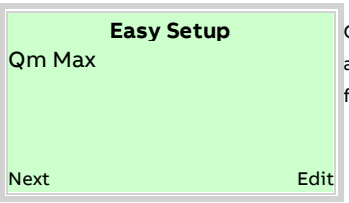


Only if Mass Flow [%] has been selected as the process value for a current, frequency or pulse output.

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

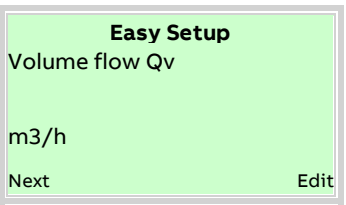
… 8 Commissioning

… Parameterization via the menu function Easy Setup

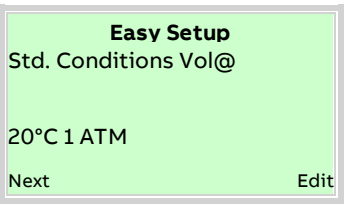


Only if Mass Flow [%] has been selected as the process value for a current, frequency or pulse output.

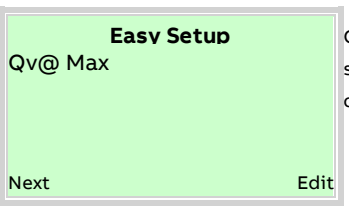
67. Use to call up the edit mode.
68. Use / to set the desired measuring range for mass flow measurement.
69. Confirm the selection with .



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

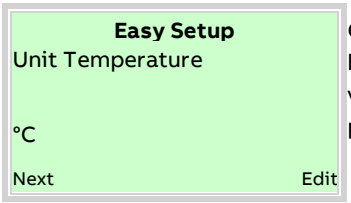


73. Use to call up the edit mode.
74. Use / to select the desired standard state for volume flow measurement.
75. Confirm the selection with .



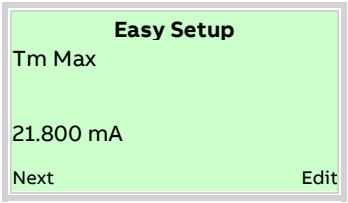
Only if Volume Flow [%] has been selected as the process value for a current, frequency or pulse output.

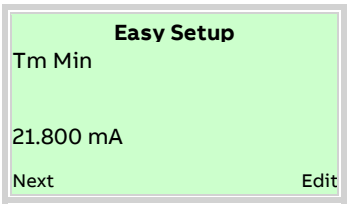
76. Use to call up the edit mode.
77. Use / to set the desired measuring range for volume flow measurement.
78. Confirm the selection with .



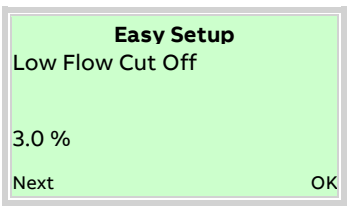
Only if Temperature [%] has been selected as the process value for a current, frequency or pulse output.

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

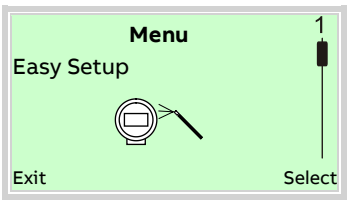




82. Use to call up the edit mode.
83. Use / to set the desired measuring range for temperature measurement.
84. Confirm the selection with .



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.

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.

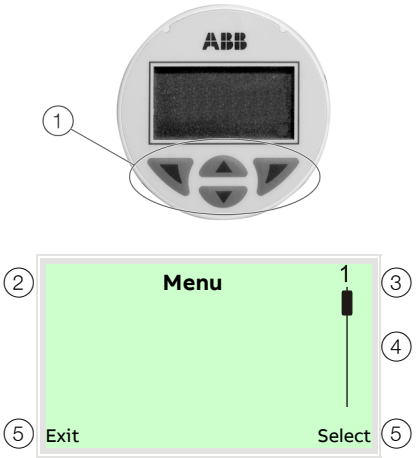
Aggressive or corrosive media may lead to the damage of wetted parts of the sensor. As a result, measuring medium under pressure can leak out.

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 88: 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 indicator.

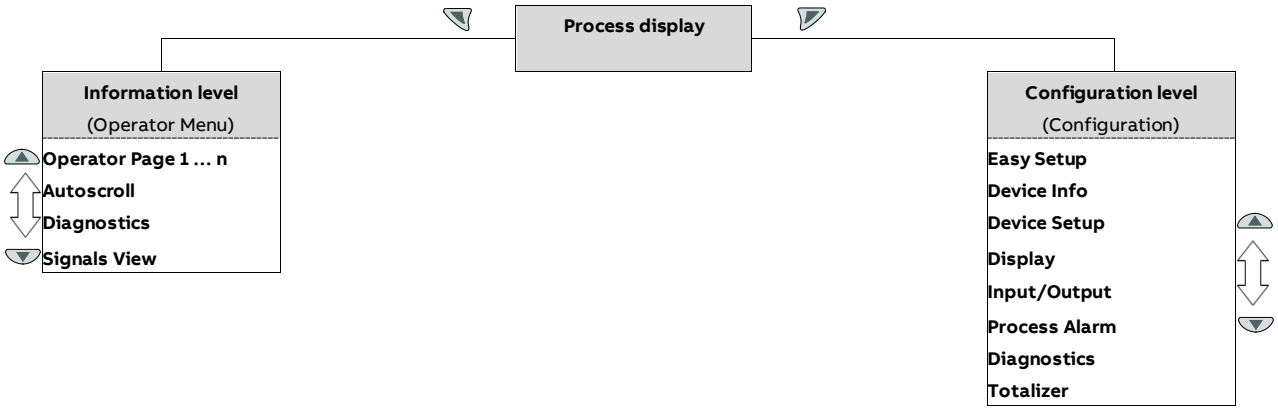
Control button functions

	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

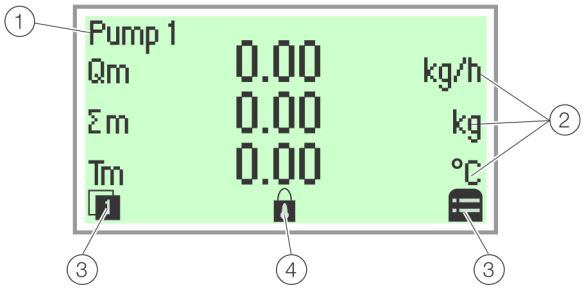


Process display
The process display shows the current process values.
There are two menu levels under the process display.

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 descriptions** on page 106.

Process display



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

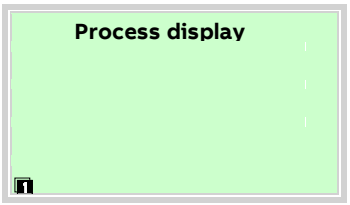
Figure 89: Process display (example)

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.

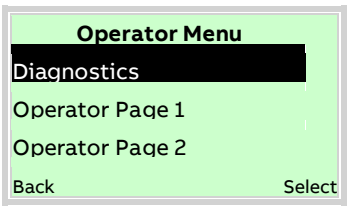
Symbol	Description
/	Call up information level. When Autoscroll mode is activated, the icon appears here and the operator pages are automatically displayed one after the other.
	Call up configuration level.
	The device is protected against changes in the parametrization.

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 .

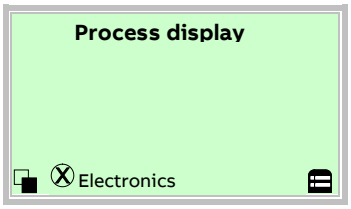
Menu	Description
... / Operator Menu	
Diagnostics	Selection of sub-menu 'Diagnostics'; see also **Error messages on the LCD display** on page 92.
Operator Page 1 to n	Selection of operator page to be displayed.
Autoscroll	When 'Autoscroll' is activated, automatic switching of the operator pages is initiated 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:

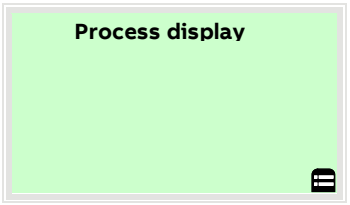
Range	Description
Operation	Error / alarm due to the current operating conditions.
Sensor	Error / alarm of the flowmeter sensor.
Electronics	Error / alarm of the electronics.
Configuration	Error / alarm due to device configuration.

Note
For a detailed description of errors and troubleshooting instructions, please see **Diagnosis / error messages** on page 141.

Switching to the configuration level (parameterization)

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 .



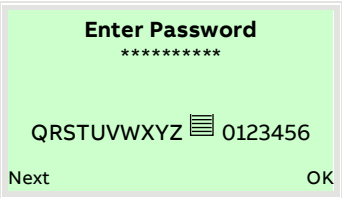
2. Select the desired level of access using / .
3. Confirm the selection with .

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 79).

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.

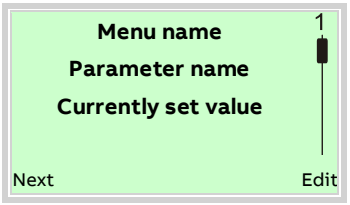
The LCD display now indicates the first menu item on the configuration level.

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

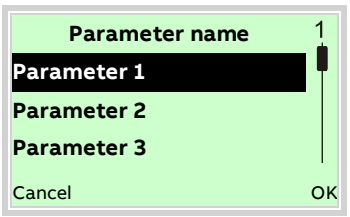
Selecting and changing parameters

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.

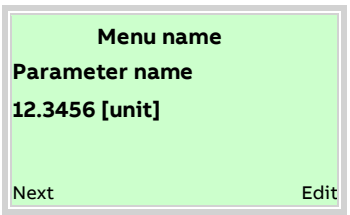


3. Select the desired value using ▲ / ▼.
4. Confirm the selection with ◤.

This concludes the procedure for selecting a parameter value.

Numerical entry

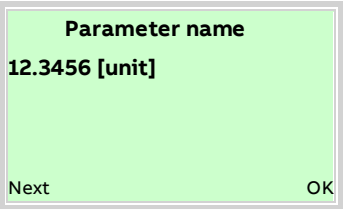
When a numerical entry is made, a value is set by entering the individual decimal positions.



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

… Switching to the configuration level (parameterization)

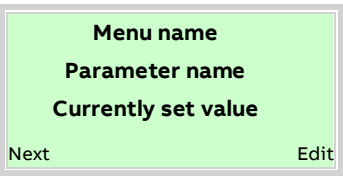


3. Use to select the decimal place to change.
4. Use / to set the desired value.
5. Use to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use to confirm your setting.

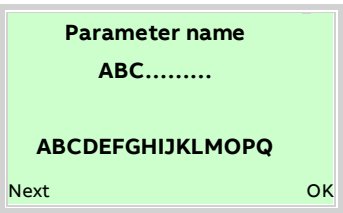
This concludes the procedure for changing a parameter value.

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.

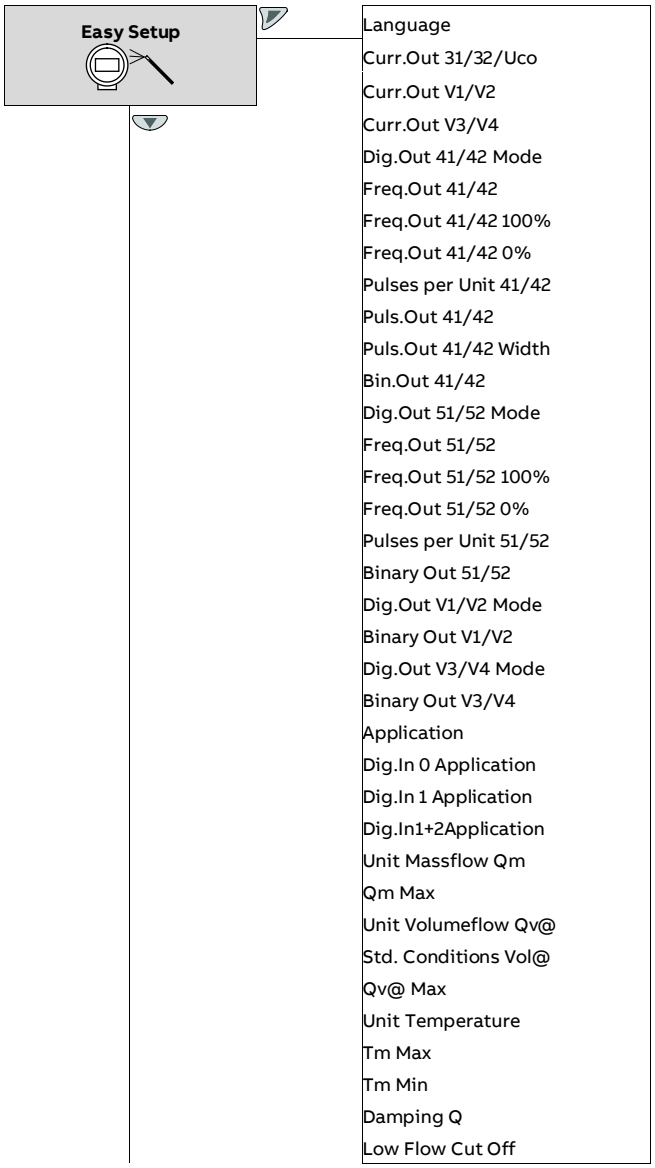
Note

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

Parameter overview

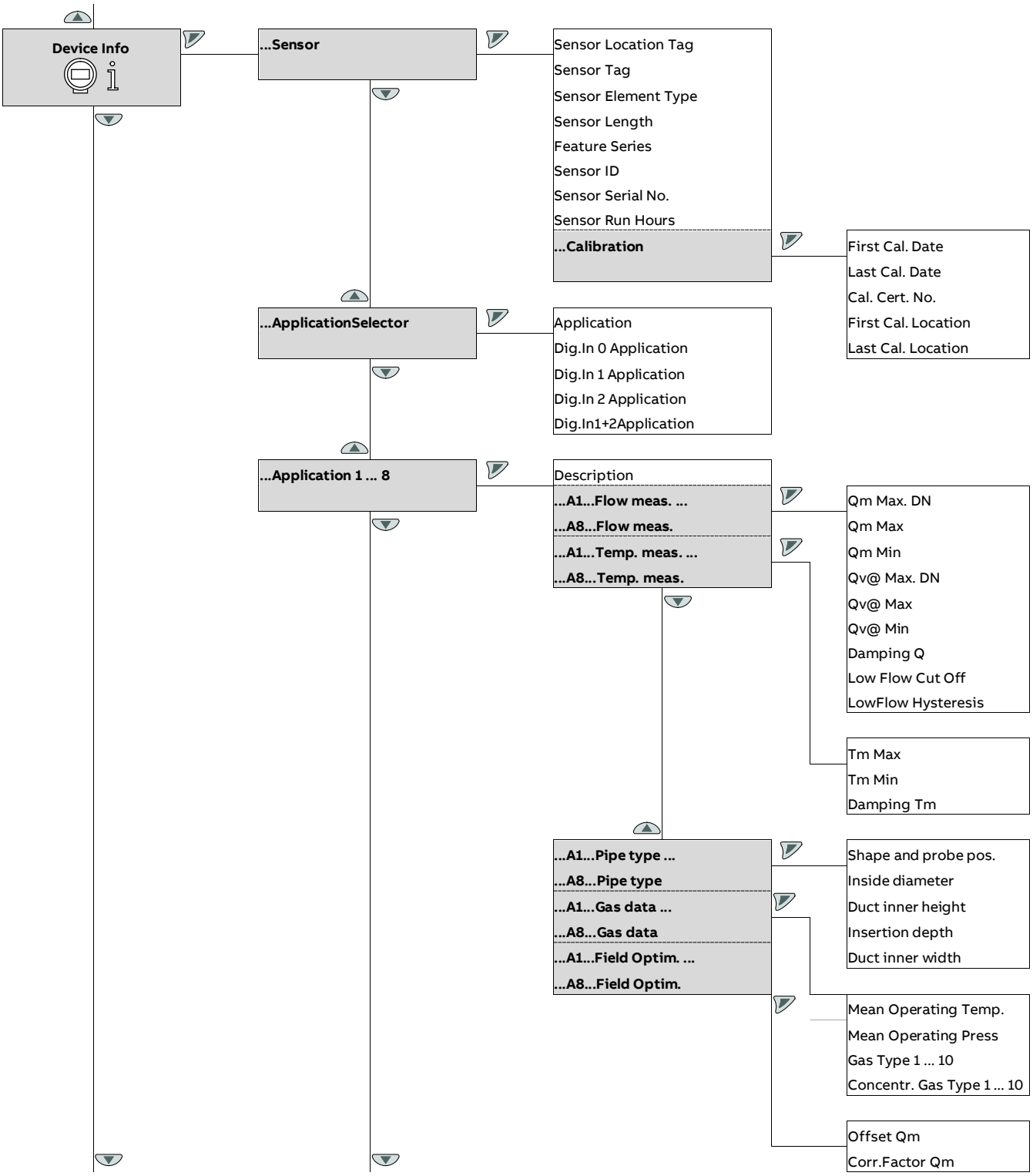
Note

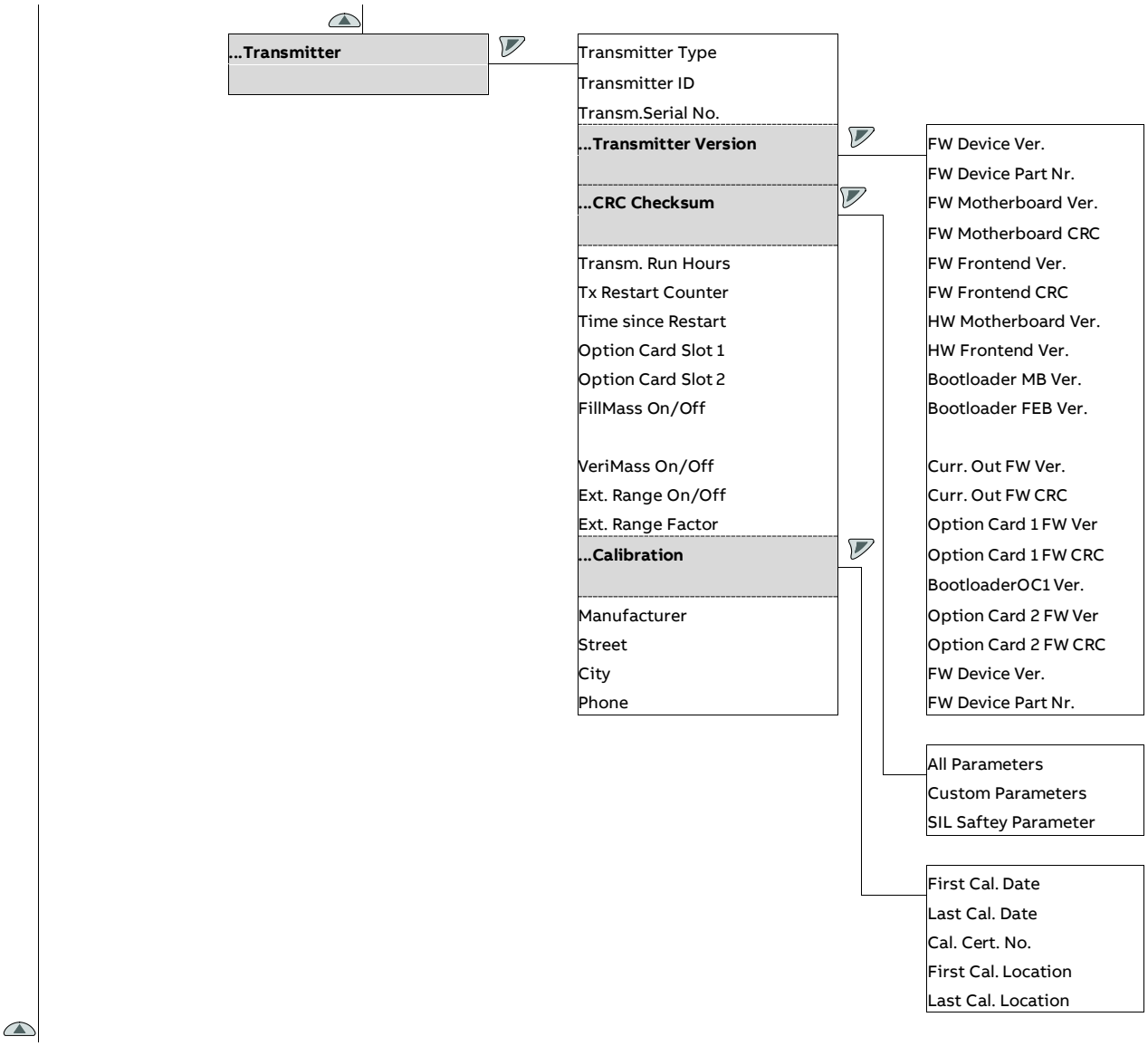
This overview of parameters shows all the menus and parameters available on the device. Depending on the version and configuration of the device, not all of the menus and parameters may be visible in it.



… 9 Operation

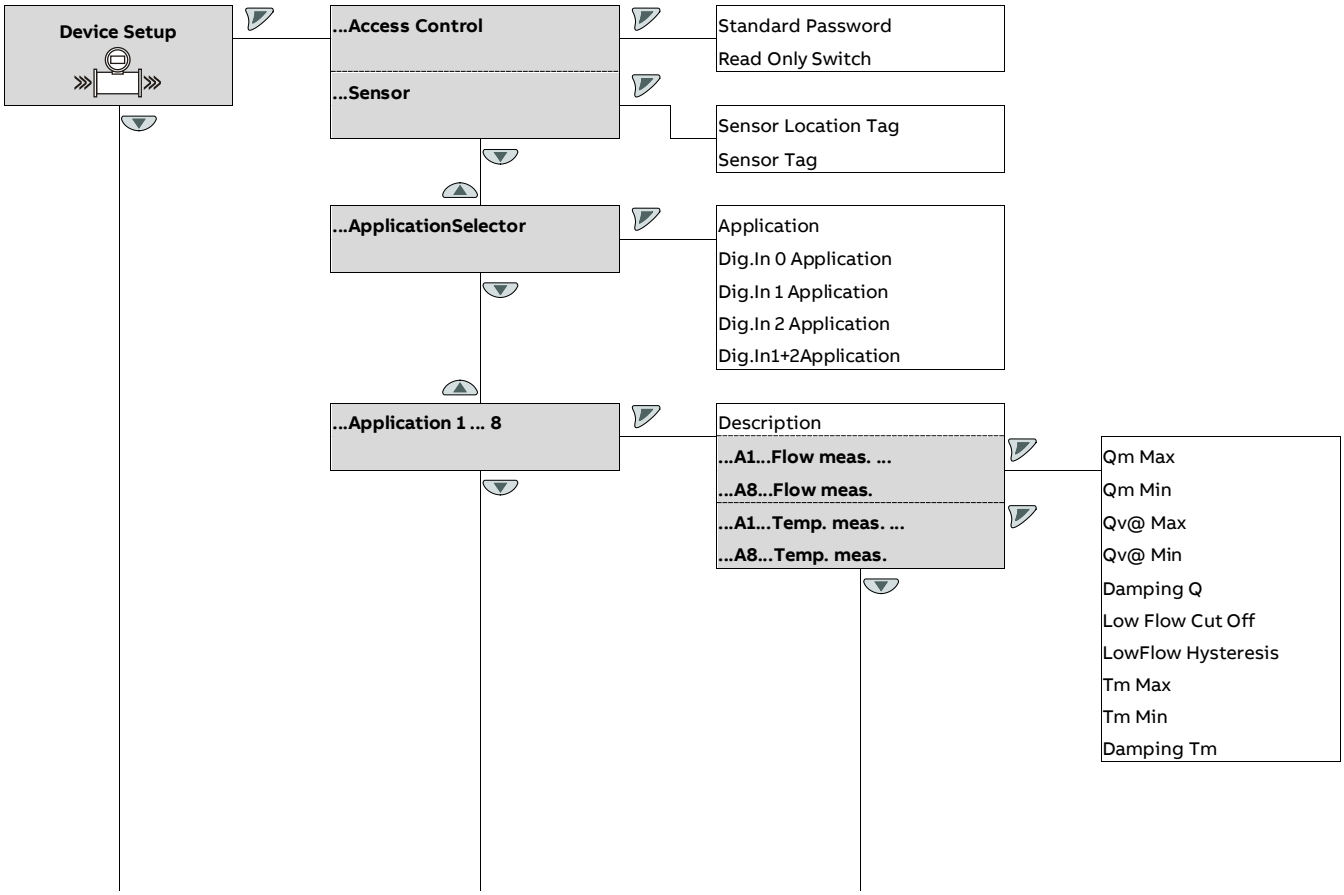
… Parameter overview

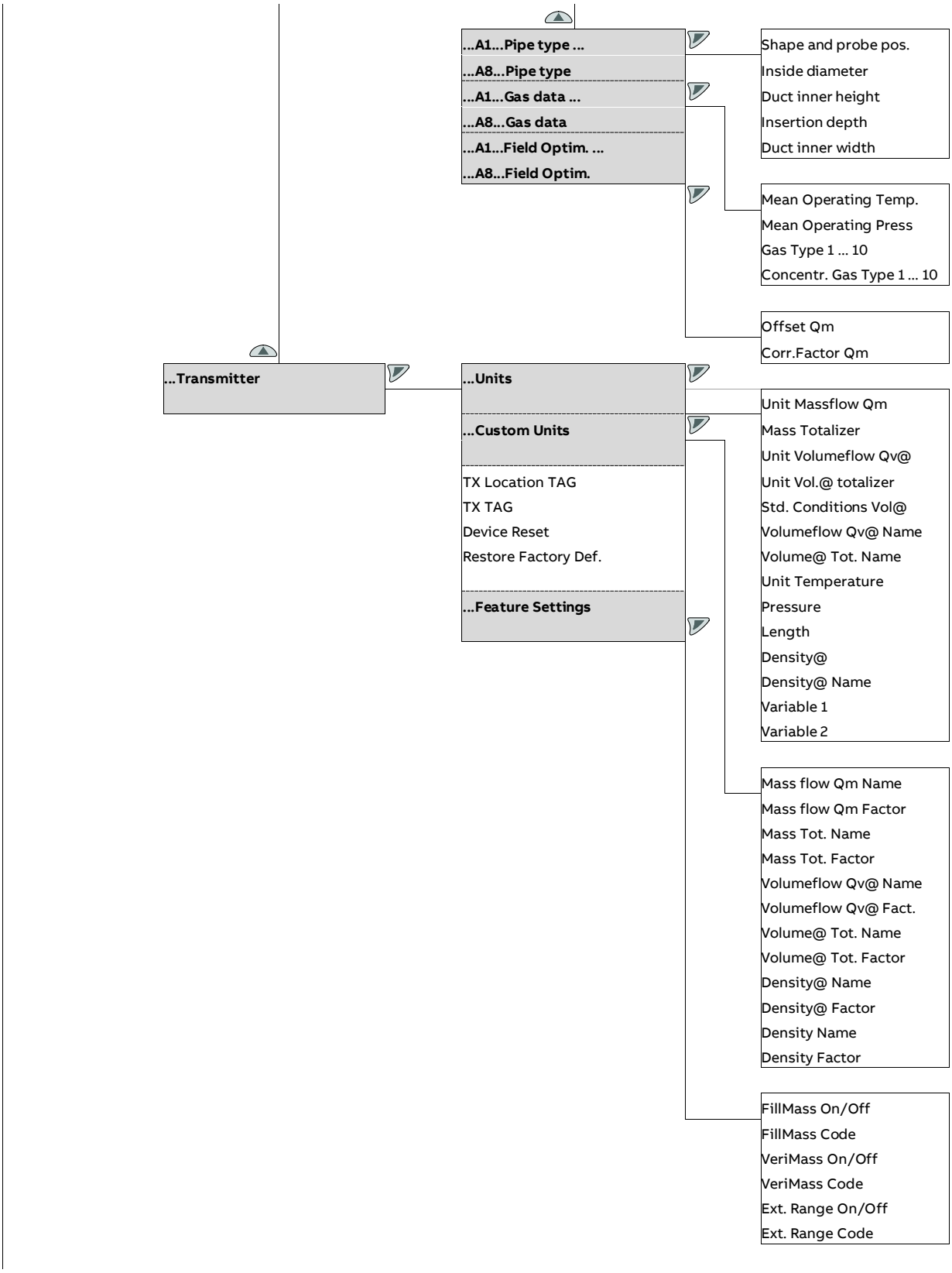



...Transmitter
Transmitter Type
Transmitter ID
Transm.Serial No.
...Transmitter Version
...CRC Checksum
Transm. Run Hours
Tx Restart Counter
Time since Restart
Option Card Slot 1
Option Card Slot 2
FillMass On/Off
VeriMass On/Off
Ext. Range On/Off
Ext. Range Factor
...Calibration
Manufacturer
Street
City
Phone
FW Device Ver.
FW Device Part Nr.
FW Motherboard Ver.
FW Motherboard CRC
FW Frontend Ver.
FW Frontend CRC
HW Motherboard Ver.
HW Frontend Ver.
Bootloader MB Ver.
Bootloader FEB Ver.
Curr. Out FW Ver.
Curr. Out FW CRC
Option Card 1 FW Ver
Option Card 1 FW CRC
BootloaderOC1 Ver.
Option Card 2 FW Ver
Option Card 2 FW CRC
FW Device Ver.
FW Device Part Nr.
All Parameters
Custom Parameters
SIL Saftey Parameter
First Cal. Date
Last Cal. Date
Cal. Cert. No.
First Cal. Location
Last Cal. Location

… 9 Operation

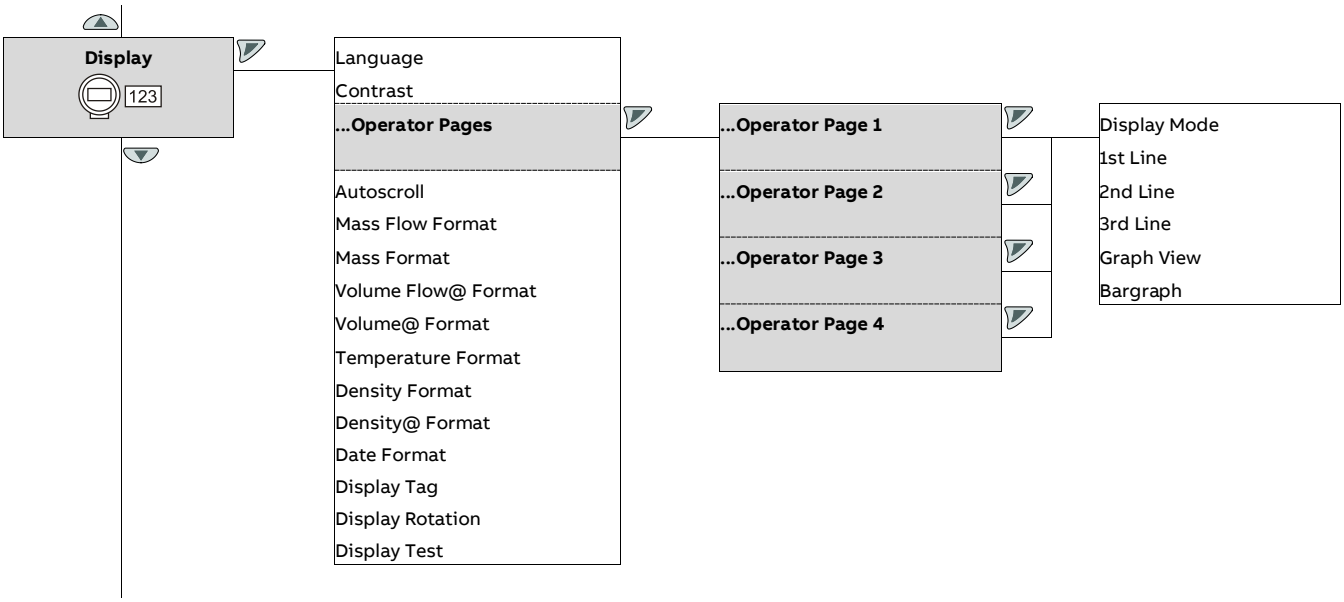
… Parameter overview

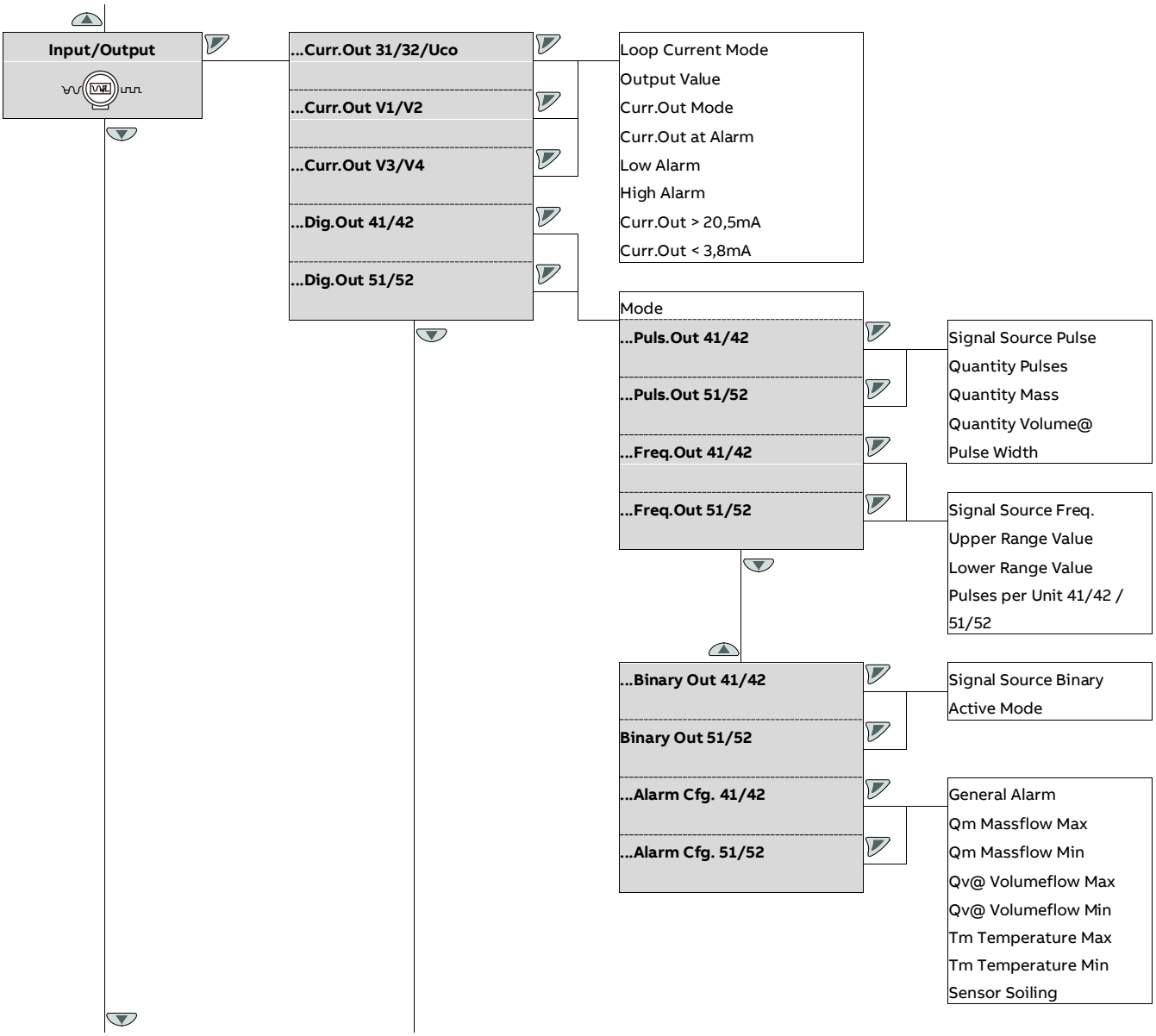



...A1...Pipe type ...
...A8...Pipe type
...A1...Gas data ...
...A8...Gas data
...A1...Field Optim. ...
...A8...Field Optim.
Shape and probe pos.
Inside diameter
Duct inner height
Insertion depth
Duct inner width
Mean Operating Temp.
Mean Operating Press
Gas Type 1 ... 10
Concentr. Gas Type 1 ... 10
Offset Qm
Corr.Factor Qm
...Transmitter
...Units
...Custom Units
TX Location TAG
TX TAG
Device Reset
Restore Factory Def.
...Feature Settings
Unit Massflow Qm
Mass Totalizer
Unit Volumeflow Qv@
Unit Vol.@ totalizer
Std. Conditions Vol@
Volumeflow Qv@ Name
Volume@ Tot. Name
Unit Temperature
Pressure
Length
Density@
Density@ Name
Variable 1
Variable 2
Mass flow Qm Name
Mass flow Qm Factor
Mass Tot. Name
Mass Tot. Factor
Volumeflow Qv@ Name
Volumeflow Qv@ Fact.
Volume@ Tot. Name
Volume@ Tot. Factor
Density@ Name
Density@ Factor
Density Name
Density Factor
FillMass On/Off
FillMass Code
VeriMass On/Off
VeriMass Code
Ext. Range On/Off
Ext. Range Code

… 9 Operation

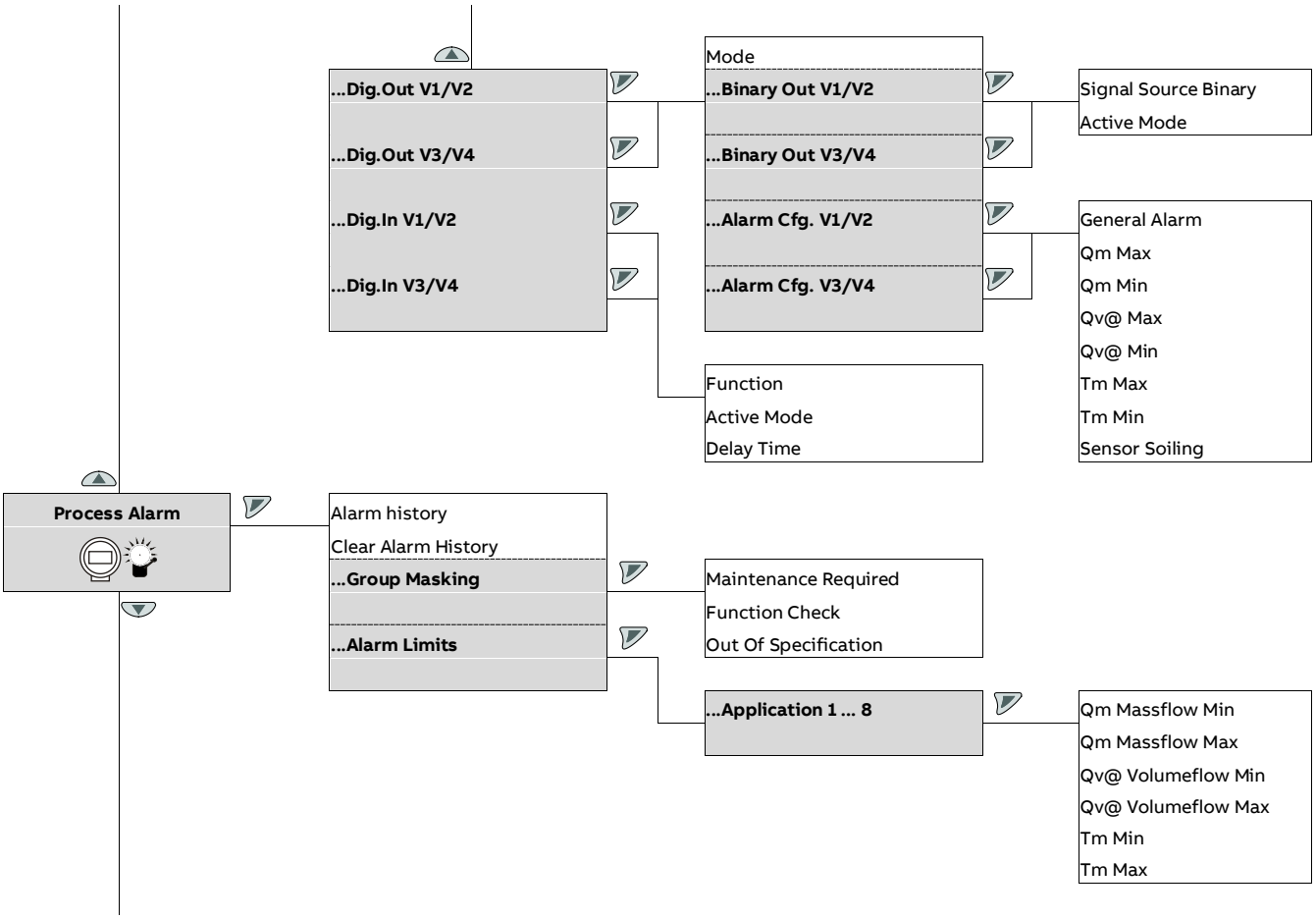
… Parameter overview

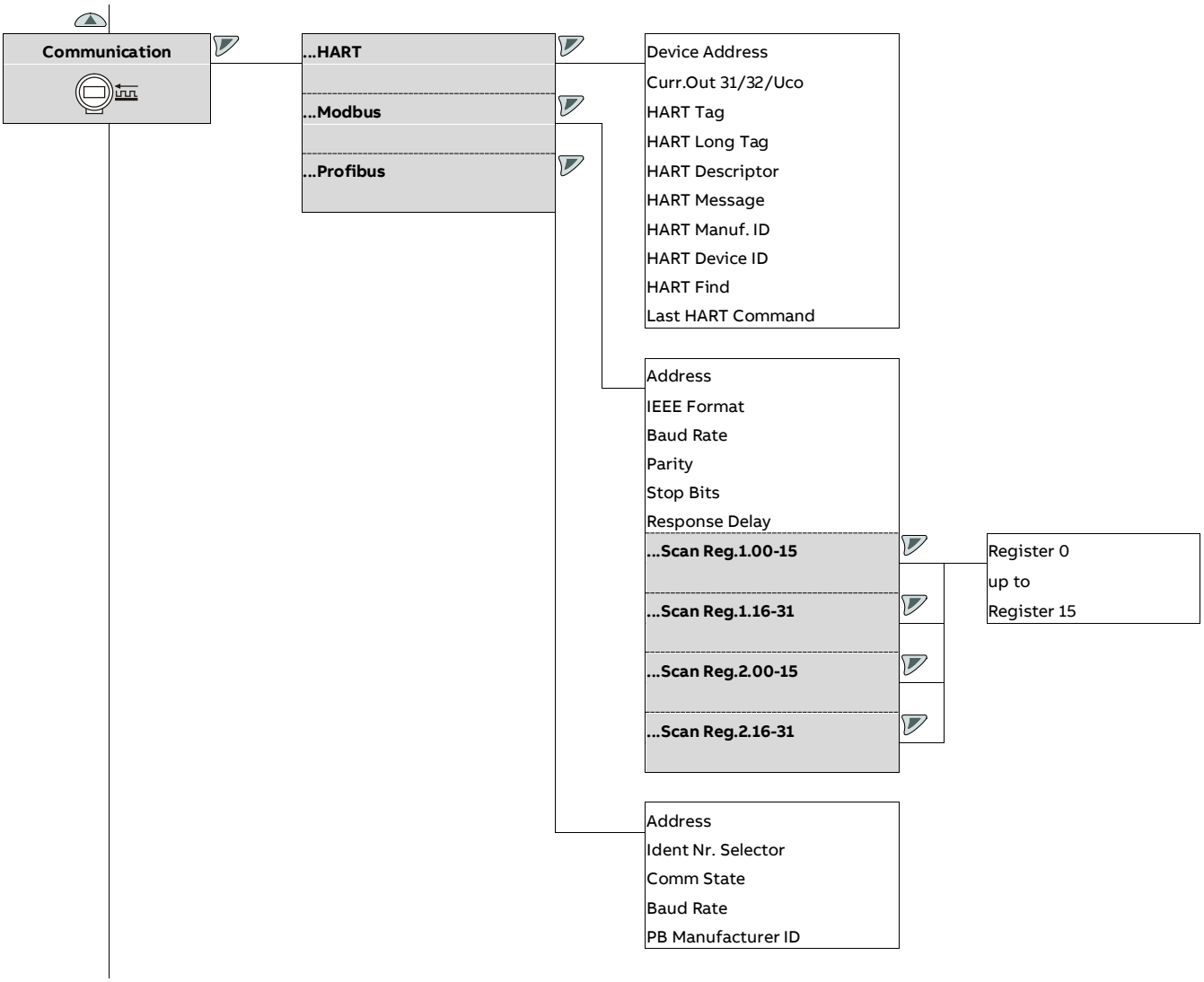



Input/Output
...Curr.Out 31/32/Uco
...Curr.Out V1/V2
...Curr.Out V3/V4
...Dig.Out 41/42
...Dig.Out 51/52
Loop Current Mode
Output Value
Curr.Out Mode
Curr.Out at Alarm
Low Alarm
High Alarm
Curr.Out > 20,5mA
Curr.Out < 3,8mA
Mode
...Puls.Out 41/42
...Puls.Out 51/52
...Freq.Out 41/42
...Freq.Out 51/52
Signal Source Pulse
Quantity Pulses
Quantity Mass
Quantity Volume@
Pulse Width
Signal Source Freq.
Upper Range Value
Lower Range Value
Pulses per Unit 41/42 / 51/52
...Binary Out 41/42
Binary Out 51/52
Signal Source Binary
Active Mode
...Alarm Cfg. 41/42
...Alarm Cfg. 51/52
General Alarm
Qm Massflow Max
Qm Massflow Min
Qv@ Volumeflow Max
Qv@ Volumeflow Min
Tm Temperature Max
Tm Temperature Min
Sensor Soiling

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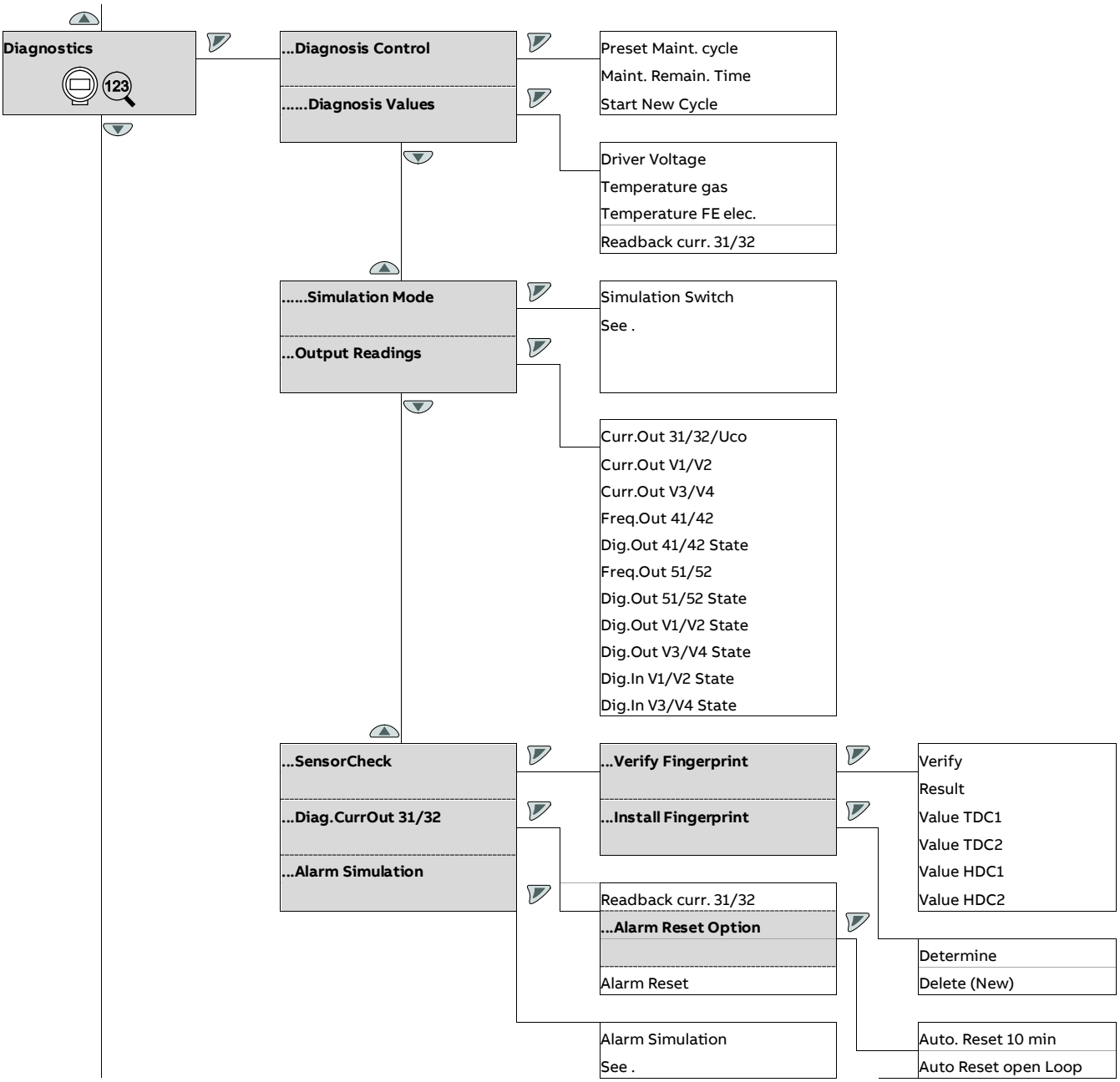
… Parameter overview

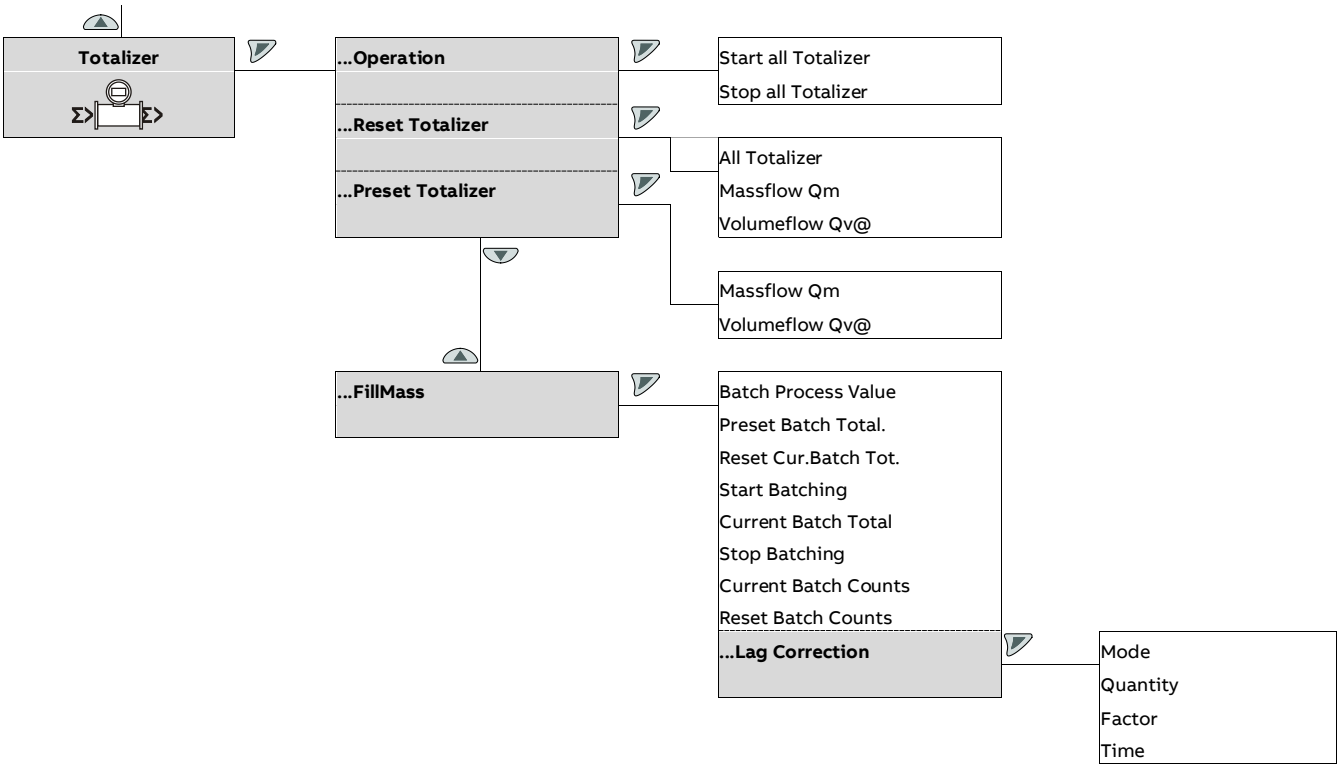



Communication
...HART
...Modbus
...Profibus
Device Address
Curr.Out 31/32/Uco
HART Tag
HART Long Tag
HART Descriptor
HART Message
HART Manuf. ID
HART Device ID
HART Find
Last HART Command
Address
IEEE Format
Baud Rate
Parity
Stop Bits
Response Delay
...Scan Reg.1.00-15
...Scan Reg.1.16-31
...Scan Reg.2.00-15
...Scan Reg.2.16-31
Register 0
up to
Register 15
Address
Ident Nr. Selector
Comm State
Baud Rate
PB Manufacturer ID

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Totalizer
...Operation
Start all Totalizer
Stop all Totalizer
...Reset Totalizer
All Totalizer
Massflow Qm
Volumeflow Qv@
...Preset Totalizer
Massflow Qm
Volumeflow Qv@
...FillMass
Batch Process Value
Preset Batch Total.
Reset Cur.Batch Tot.
Start Batching
Current Batch Total
Stop Batching
Current Batch Counts
Reset Batch Counts
...Lag Correction
Mode
Quantity
Factor
Time

… 9 Operation

Parameter descriptions

Available units

For certain parameters it is possible to choose among the following units.

Note

The 'Code' column indicates the value to which the corresponding parameter must be set, e.g. using the communications interface.

Table 1: Units for the standard volume flow

Selection	Code	Description
m^3/s	13	Cubic meters per second
m^3/min	14	Cubic meters per minute
m^3/h	15	Cubic meters per hour
m^3/d	16	Cubic meters per day
ft^3/s	29	Cubic feet per second
ft^3/min	30	Cubic feet per minute
ft^3/h	31	Cubic feet per hour
ft^3/d	32	Cubic feet per day
l/s	48	Liters per second
l/min	49	Liters per minute
l/h	50	Liters per hour
l/d	51	Liters per day
SCFS	144	Standard cubic feet per second
SCFM	145	Standard cubic feet per minute
SCFH	146	Standard cubic feet per hour
SCFD	147	Standard cubic feet per day
MSCFM	149	One thousand standard cubic feet per minute
MSCFH	150	One thousand standard cubic feet per hour
MSCFD	151	One thousand standard cubic feet per day
MMSCFH	154	One million standard cubic feet per hour
MMSCFD	155	One million standard cubic feet per day
xx/yy	254	User-defined unit

Table 2: Units for the mass flow

Selection	Code	Description
g/s	1	Grams per second
g/min	2	Grams per minute
g/h	3	Grams per hour
kg/s	5	Kilograms per second
kg/min	6	Kilograms per minute
kg/h	7	Kilograms per hour
kg/d	8	Kilograms per day
lb/s	9	Pounds (avdp) per second
lb/min	10	Pounds (avdp) per minute
lb/h	11	Pounds (avdp) per hour
lb/d	12	Pounds (avdp) per day
t/s	29	Metric tons per second
t/min	30	Metric tons per minute
t/h	31	Metric tons per hour
t/d	32	Metric tons per day
xx/yy	254	User-definable unit

Table 3: Standard density units

Selection	Code	Description
g/cm^3	1	Grams per cubic centimeter
g/m^3	3	Grams per cubic meter
kg/m^3	4	Kilograms per cubic meter
g/l	10	Grams per liter
kg/l	11	Kilograms per liter
lb/ft^3	13	Pounds (avdp) per cubic foot
xx/yy	254	User-definable unit

Table 4: Standard conditions

Code	Description
1	Temperature = 0 °C, pressure = 1.01325 bar
2	Temperature = 20 °C, pressure = 1.01325 bar
3	Temperature = 60°F, pressure = 1.01325 bar
4	Temperature = 70°F, pressure = 1.01325 bar
5	Temperature = 15°C, pressure = 1.01325 bar
6	Temperature = 20°C, pressure = 1.00000 bar
7	Temperature = 25°C, pressure = 1.00000 bar
8	Temperature = 25°C, pressure = 1.01325 bar
9	Temperature = 15°C, pressure = 1.00000 bar
254	User-defined standard conditions

Table 5: Temperature units

Selection	Code	Description
K	1	Kelvin
°C	2	Celsius
°F	3	Fahrenheit

Table 6: Units of length

Selection	Code	Description
mm	4	Millimeters
inch	13	in.

Table 7: Units for the mass counter

Selection	Code	Description
kg	2	Kilograms
g	3	Grams
t	5	Tons (metric)
lb	8	Pounds (advp)
xx	254	User-definable unit

Table 8: Units for the standard volume totalizer

Selection	Code	Description
m^3	4	Cubic meters
ft^3	7	Cubic feet
SCF	32	Standard cubic feet
MSCF	33	One thousand standard cubic feet
MMSCF	34	One million standard cubic feet
l	13	Liters
xx	254	User-definable unit

Table 9: Pressure units

Selection	Code	Description
Pa	1	Pascals
kPa	4	Kilopascals
Bar	8	Bar
mBar	9	Millibar
inH^2O@4C	51	Inches water column at 4 °C
mmH^2O@4C	54	mm water column at 4 °C
atm	64	Atmospheric gauge pressure
psi	65	Pounds per square inch
kp/cm^2	69	Kilogram-force per cm^2

Available gas types

For certain parameters it is possible to choose among the following gas types.

Note

The ‘Code’ column indicates the value to which the corresponding parameter must be set, e.g. using the communications interface.

Table: Gas types for the ApplicationSelector

Name / Formula		Code	
		HEX	DEZ
No selection	—	0	0
Air		1	1
Acetylene	C_2H_2	1E	30
Acetone	C_3H_6O	24	36
Ammonia	NH_3	27	39
Argon	Ar	2A	42
Biogas Type 1	—	30	48
1.2 Butadiene	C_4H_6	3C	60
1.3 Butadiene	C_4H_6	3F	63
1 Butene	C_4H_8	42	66
Butane	C_4H_{10}	45	69
Carbon dioxide	CO_2	48	72
Carbon monoxide	CO	4B	75

Table: Gas types for the ApplicationSelector

Name / Formula		Code	
		HEX	DEZ
Diketene	$C_4H_4O_2$	66	102
Ethane	C_2H_6	6C	108
Ethanol	C_2H_5OH	6F	111
Ethylene	C_2H_4	72	114
Formaldehyde	CH_2O	75	117
Helium	He	78	120
Hexane	C_6H_{14}	7B	123
Hydrogen	H_2	84	132
Hydrogen sulfide	H_2S	87	135
Methane	CH_4	90	144
Methanol	CH_3OH	93	147
MethylEthylKetone		96	150
Natural gas Type 1	—	99	153
Neon	Ne	AF	175
Nitrogen monoxide	NO	B2	178
Nitrogen	N_2	B5	181
Oxygen	O_2	BB	187
Ozone	O_3	BE	190
Pentane	C_5H_{12}	C1	193
Propadiene	C_3H_4	CA	202
Propane	C_3H_8	CD	205
Propene/Propylene	C_3H_6	D0	208
Water vapor	H_2O	E8	232

Note

In the case of hydrogen and helium gas types as pure gas or as a component of a gas mixture with a concentration of over 10 %, an optional process gas calibration should always be additionally ordered. That way, additional measuring errors due to the special characteristics of gases are avoided.

Under certain process conditions, the measuring range may be restricted at the lower and upper limits. Typically, the measuring range then starts at 10 % of the upper measuring range limit.

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Available process variables

The process variables available in the software are listed in the table.
Process variables can be assigned to the display (HMI), the current outputs (CO), the frequency outputs (DO [f]), and the pulse outputs (DO [pulse]).

Process variable	Short form	Description	HMI	CO	DO 41 / 52, DO 51 / 52	
					Frequency output	Pulse output
Mass Flow [unit]	Qm	Mass flow in the selected mass flow unit	X	–	–	X
Mass Flow [%]	Qm	Mass flow in percent	X	X	X	–
Qv@ [Unit]	Qv@	Standard volume flow in the selected volume unit	X	–	–	X
Qv@ [%]	Qv@	Standard volume flow in percent	X	X	X	–
Temperature [unit]	Tm	Temperature in the selected temperature unit.	X	–	–	–
Temperature [%]	Tm	Temperature in percent	X	X	X	–
Density@ [unit]	p@	Standard density in the selected density unit	X	–	–	–
Zähler Qm	∑m	Mass flow counter reading in the selected unit.	X	–	–	–
Zähler Qv@	∑v@	Standard volume flow counter reading in the selected unit.	X	–	–	–
Current Batch Total*	CBT	Current fill quantity	X	–	–	–
Current Batch Counts*	CBC	Number of fill operations	X	–	–	–
Variable 1	Va1	External fieldbus variable 1	X	–	–	–
Variable 2	Va2	External fieldbus variable 2	X	–	–	–

* Process variable is only available if the FillMass function is activated.

X = process variable available, – = process variable not available.

Menu: Easy Setup

Menu / parameter	Description
Easy Setup	
Language	Selection of menu language.
Curr.Out 31/32/Uco	Selection of the process value issued via the current output.
Curr.Out V1/V2 Curr.Out V3/V4	The current outputs V1 / V2 and V3 / V4 are only available if the corresponding plug-in cards are present! • Mass Flow [%]: Mass flow in % • Volume Flow@ [%]: Standard volume flow in % • Temperature [%]: Temperature in %
Dig.Out 41/42 Mode	Selection of the operating mode for the digital output 41 / 42. • Off: Digital output deactivated. • Binary: Digital output as a binary output (e.g. as an alarm output). • Pulse: Digital output configured as a pulse output. In pulse mode, pulses per unit are output (e.g. 1 pulse per m^3). • Frequency: Digital output configured as a frequency output. In frequency mode, a frequency is issued that is proportional to the flow rate.
Freq.Out 41/42	Selection of the process value issued via the frequency output. • Mass Flow [%]: Mass flow in % • Volume Flow@ [%]: Standard volume flow in % • Temperature [%]: Temperature in %
Freq.Out 41/42 0% Freq.Out 41/42 100%	Set the frequency range for output of the selected process variables. • Freq.Out 41/42 100%: Set the frequency for 100 % of the process variable. • Freq.Out 41/42 0%: Set the frequency for 0 % of the process variable.
Puls.Out 41/42	Selection of the process value issued via the pulse output. • Mass Flow [%]: Mass flow in % • Volume Flow@ [%]: Standard volume flow in %
Puls.Out 41/42 Width	Set the pulse width for the pulse output.
Bin.Out 41/42	Selection of binary output function. • Alarm: The binary output indicates an active alarm. The alarm is selected in the '„...Alarm Cfg. 41/42' menu. • Batch End: The binary output is activated when the set fill quantity is reached (only if the FillMass function is activated).
Dig.Out 51/52 Mode	Selection of the operating mode for the digital output 51 / 52. • Off: Digital output deactivated. • Binary: Digital output configured as a binary output. • Frequency: Digital output configured as a frequency output. In frequency mode, a frequency is issued that is proportional to the flow rate. • Pulse 41/42 <)90°: Output of the same pulses as for digital output 41 / 42, phase shifted by 90°. • Pulse 41/42 <)180°: Output of the same pulses as for digital output 41 / 42, phase shifted by 180°
Freq.Out 51/52	Selection of the process value issued via the frequency output. • Mass Flow [%]: Mass flow in % • Volume Flow@ [%]: Standard volume flow in % • Temperature [%]: Temperature in %
Freq.Out 51/52 0% Freq.Out 51/52 100%	Set the frequency range for output of the selected process variables. • Freq.Out 41/42 100%: Set the frequency for 100 % of the process variable. • Freq.Out 41/42 0%: Set the frequency for 0 % of the process variable.

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Menu / parameter	Description
Easy Setup	
Binary Out 51/52	Selection of binary output function. • Alarm: The binary output indicates an active alarm. The alarm is selected in the '„…Alarm Cfg. 51/52' menu. • Batch End: The binary output is activated when the set fill quantity is reached (only if the FillMass function is activated).
Dig.Out V1/V2 Mode	Selection of the operating mode for digital output V1 / V2. Digital output V1 / V2 is only available if the corresponding plug-in card is present! • Off: Digital output V1 / V2 deactivated. • Binary: Digital output V1 / V2 as a binary output (for example, as an alarm output).
Binary Out V1/V2	Selection of binary output function. • Alarm: The binary output indicates an active alarm. The alarm is selected in the '„…Alarm Cfg. 51/52' menu. • Batch End: The binary output is activated when the set fill quantity is reached (only if the FillMass function is activated).
Dig.Out V3/V4 Mode	Selection of the operating mode for digital output V3 / V4. Digital output V3 / V4 is only available if the corresponding plug-in card is present! • Off: Digital output V3 / V4 deactivated. • Binary: Digital output V3 / V4 as a binary output (for example, as an alarm output).
Binary Out V3/V4	Selection of binary output function. • Alarm: The binary output indicates an active alarm. The alarm is selected in the '„…Alarm Cfg. 51/52' menu. • Batch End: The binary output is activated when the set fill quantity is reached (only if the FillMass function is activated).
Application	Application selection (type of measuring medium) • Air: Using the device with factory calibration for air. • Application 1 … 8: Selection of the appropriate application. The individual applications are configured in the 'Device Setup / …Sensor / …Application 1 … 8' menu.
Dig.In 0 Application Dig.In 1 Application Dig.In 2 Application Dig.In1+2Application	Use of optional digital inputs for application switching. You can switch between four applications by wiring the digital inputs. • Dig.In 0 Application: Assignment of the application if no digital inputs are active. • Dig.In 1 Application: Assignment of the application if only digital input V1 / V2 is active. • Dig.In 2 Application: Assignment of the application if only digital input V3 / V4 is active. • Dig.In1+2Application: Assignment of the application if only digital input V1 / V2 and V3 / V4 are active. Note The function is available only with the corresponding plug-in cards in place! The digital inputs must be configured in the "Input/Output / …Dig.In V1/V2" or "Input/Output / …Dig.In V1/V2" menu using the "Act. App.Selector1|3" function or "Act. App.Selector2|3" function.

Menu / parameter	Description
Unit Massflow Qm	Selection of unit for mass flow. Refer to **Table 3: Standard density units** on page 106. The selection applies to the display of the current mass flow, and for the parameters related to mass flow such as Qm_{Max} and $Qm_{Max}DN$.
Qm Max	Set the upper range value for the mass flow.
Unit Volumeflow Qv@	Selection of unit for the standard volume flow. Refer to **Table 2: Units for the mass flow** on page 106. The selection applies to the display of the current standard volume flow and for the parameters related to standard volume flow such as Qv@ Max and Qv@ Max. DN.
Std. Conditions Vol@	Selection of the standard state for standard volume flow. • 0°C 1atm: Standard state 0 °C at 1 bar • 15°C 1bar: Standard state 15 °C at 1 bar • 20°C 1bar: Standard state 20 °C at 1 bar • 25°C 1bar: Standard state 25 °C at 1 bar
Qv@ Max	Set the upper range value for standard volume flow.
Unit Temperature	Selection of unit for temperature (e.g. for the associated parameters and the corresponding process values). See **Table 6: Units of length** on page 106.
Tm Max	Set the upper range value for the measuring medium temperature.
Tm Min	Set the lower range value for the measuring medium temperature.
Mass Totalizer	Selection of the unit for the mass counters and the pulse outputs. See **Table 8: Units for the standard volume totalizer** on page 107.
Volume Totalizer	Selection of the unit for the volume totalizers and the pulse outputs. See **Table 9: Pressure units** on page 107.
Damping Q	Select the damping for flow measurement. The value set here relates to 1 τ (Tau). The value refers to the response time for a step flowrate change. It affects the instantaneous value in the display and at the current output. Default setting: 1 second
Low Flow Cut Off	Set the switching threshold (0 to 10 %) for the low flow cut-off. If the flow rate is below the switching threshold, there is no flow measurement. The setting of 0 % deactivates the low flow cut-off. Default setting: 1.0 %

… 9 Operation

… Parameter descriptions

Menu: Device Info

This menu is only used to display the device parameters. The parameters are displayed independently of the configured access level, but cannot be changed.

Menu / parameter	Description
Device Info	
…Sensor	Selection of submenu '**…Sensor**' using .
…Application Selector	Selection of submenu '**…Application Selector**' using .
…Application 1	Selection of submenu '**…Application 1**' … '**…Application 8**' with .
…	
…Application 8	
…Transmitter	Selection of submenu '**…Transmitter**' using .

Device Info / **…Sensor**	
Sensor Location Tag	Display of the measuring point tagging for the sensor.
Sensor Tag	Display of the tag number for the sensor.
Sensor Element Type	Display of the design of the thermal measuring element.
Sensor Length	Display of the insertion length of the sensor.
Feature Series	Display of the device family.
Sensor ID	Display of the sensor ID.
Sensor Serial No.	Display of the sensor serial number.
Sensor Run Hours	Display of the operating hours of the sensor.
…Calibration	Selection of submenu '**…Calibration**' using .

Device Info / …Sensor / **…Calibration**	
First Cal. Date	Display of the calibration data of the sensor.
Last Cal. Date	
Cal. Cert. No.	
First Cal. Location	
Last Cal. Location	

Device Info / **…ApplicationSelector**	
Application	Display of the selected application (type of measuring medium).
Dig.In 0 Application	Display of the application assignment to the optional digital inputs.
Dig.In 1 Application	
Dig.In 2 Application	
Dig.In1+2Application	

Menu / parameter	Description
Device Info / ...Sensor / **...Application 1**	
...	
Device Info / ...Sensor / **...Application 8**	
Description	Display of the name of the application 1 ... 8.
...A1...Flow meas.	Selection of submenu '**...A1...Flow meas.**' ... '**...A8...Flow meas.**' with .
...	
...A8...Flow meas.	
...A1...Temp. meas.	Selection of submenu '**...A1...Temp. meas.**' ... '**...A8...Temp. meas.**' with .
...	
...A8...Temp. meas.	
...A1...Pipe type	Selection of submenu '**...A1...Pipe type**' ... '**...A8...Pipe type**' with .
...	
...A8...Pipe type	
...A1...Gas data	Selection of submenu '**...A1...Gas data**' ... '**...A8...Gas data**' with .
...	
...A8...Gas data	
...A1...Field Optim.	Selection of submenu '**...A1...Field Optim.**' ... '**...A8...Field Optim.**' with .
...	
...A1...Field Optim.	

Device Info / ...Sensor / ...Application 1 / **...A1...Flow meas.**	
...	
Device Info / ...Sensor / ...Application 8 / **...A8...Flow meas.**	
Qm Max. DN	Display of the maximum mass flow for the selected nominal diameter.
Qm Max	Display of the upper range value for the mass flow.
Qm Min	Display of the lower range value for the mass flow.
Qv@ Max. DN	Display of the maximum standard volume flow for the selected nominal diameter.
Qv@ Max	Display of the upper range value for the standard volume flow.
Qv@ Min	Display of the lower range value for the standard volume flow.
Damping Q	Display of the damping for flow measurement.
Low Flow Cut Off	Display of the switching threshold (0 to 10 %) for the low flow cut-off.
LowFlow Hysteresis	Display of the hysteresis (0 to 50 %) for the low flow cut-off.

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Menu / parameter	Description
Device Info / …Sensor / …Application 1 / **…A1…Temp. meas.**	
…	
Device Info / …Sensor / …Application 8 / **…A8…Temp. meas.**	
Tm Max	Display of the upper range value for the measuring medium temperature.
Tm Min	Display of the lower range value for the measuring medium temperature.
Damping Tm	Display of the damping for temperature measurement.

Device Info / …Sensor / …Application 1 / **…A1…Pipe type**	
…	
Device Info / …Sensor / …Application 8 / **…A8…Pipe type**	
Shape and probe pos.	Display of the piping form and sensor position.
Inside diameter	Display of the inside diameter of the piping.
Duct inner height	Display of the inside height of the channel with rectangular cross-section.
Insertion depth	Display of the insertion depth of the sensor.
Duct inner width	Display of the inside width of the channel with rectangular cross-section.

Device Info / …Sensor / …Application 1 / **…A1…Gas data**	
…	
Device Info / …Sensor / …Application 8 / **…A8…Gas data**	
Mean Operating Temp.	Display of the average measuring medium temperature.
Mean Operating Press	Display of the average measuring medium pressure.
Gas Type 1	Display of gas type for gas components 1 to 10 of a gas mix.
…	See table **Table: Gas types for the ApplicationSelector** on page 107.
Gas Type 10	
Concentr. Gas Type 1	Display of concentration in % for gas components 1 to 10 of a gas mix.
…	
Concentr.Gas Type 10	

Device Info / …Sensor / …Application 1 / **…A1…Field Optim.**	
…	
Device Info / …Sensor / …Application 8 / **…A8…Field Optim.**	
Offset Qm	Offset correction of the flow rate measured value.
Corr.Factor Qm	Correction factor for the flow measured value.

Menu / parameter	Description
Device Info / **...Transmitter**	
Transmitter Type	Display of the transmitter design.
Transmitter ID	Display of the transmitter ID.
Transm.Serial No.	Display of the transmitter serial number.
...Transmitter Version	Selection of submenu '**...Transmitter Version**' using .
...CRC Checksum	Selection of submenu '**...CRC Checksum**' using .
Transm. Run Hours	Display of the operating hours of the transmitter.
Tx Restart Counter	Number of device restarts (switching the power supply off and on).
Time since Restart	Device operating hours since the last restart.
Option Card Slot 1	Display of the type of plug-in card in slot 1 / 2.
Option Card Slot 2	
FillMass On/Off	FillMass function active?
VeriMass On/Off	VeriMass function active?
Ext. Range On/Off	Extended measuring range active? (Only for operation outside potentially explosive atmospheres or in Ex zone 2, Division 2)
Ext. Range Factor	Display of the ratio of the extended measuring range to the standard measuring range.
...Calibration	Selection of submenu '**...Calibration**' using .
Manufacturer	Display of the manufacturer address and telephone number.
Street	
City	
Phone	

Device Info / ...Transmitter / **...Transmitter Version**	
FW Device Ver.	Version and item number of device software package.
FW Device Part Nr.	
FW Motherboard Ver.	Version and checksum (CRC) of motherboard (MB) software in transmitter.
FW Motherboard CRC	
FW Frontend Ver.	Version and checksum (CRC) of frontend board (FEB) software in sensor.
FW Frontend CRC	
HW Motherboard Ver.	Hardware version of motherboard (MB) in transmitter.
HW Frontend Ver.	Hardware version of frontend board (FEB) in sensor.
Bootloader MB Ver.	Version of motherboard (MB) bootloader in transmitter.
Bootloader FEB Ver.	Version of frontend board (FEB) bootloader in sensor.
Curr. Out FW Ver.	Current output module software version and checksum (CRC).
Curr. Out FW CRC	
Option Card 1 FW Ver	Version and test number (CRC) of the software of the optional plug-in cards.
Option Card 1 FW CRC	
BootloaderOC1 Ver.	
Option Card 2 FW Ver	
Option Card 2 FW CRC	

… 9 Operation

… Parameter descriptions

Device Info / …Transmitter / **…CRC Checksum**	
All Parameters	CRC 16 checksum of all device parameters
Custom Parameters	CRC 16 checksum of all customer parameters
SIL Saftey Parameter	CRC 16 checksum of all SIL-relevant safety parameters

Device Info / …Transmitter / **…Calibration**	
First Cal. Date	Display of the calibration data of the transmitter.
Last Cal. Date	
Cal. Cert. No.	
First Cal. Location	
Last Cal. Location	

Menu: Device Setup

Menu / parameter	Description
Device Setup	
...Access Control	Selection of submenu '**...Access Control**' using .
...Sensor	Selection of submenu '**...Sensor**' using .
...ApplicationSelector	Selection of submenu '**...ApplicationSelector**' using .
...Application 1 **...** **...Application 8**	Selection of submenu '**...Application 1**' ... '**...Application 8**' with .
...Transmitter	Selection of submenu '**...Transmitter**' using .

Device Setup **/ ...Access Control**	
Standard Password	Entry / change of the password for the 'Standard' access level.
Read Only Switch	Indicator of the position of the write protection switch. For further information, see chapter **Hardware settings** on page 79.

Device Setup / **...Sensor**	
Sensor Location Tag	Enter the measuring point tagging for the sensor. Alphanumeric, max. 20 characters
Sensor Tag	Enter the tag number for the sensor. Alphanumeric, max. 20 characters

Device Setup / **...ApplicationSelector**	
Application	Application selection (type of measuring medium) • Air: Using the device with factory calibration for air. • Application 1 ... 8: Selection of the appropriate application. The individual applications are configured in the 'Device Setup / ...Application 1 ... 8' menu.
Dig.In 0 Application Dig.In 1 Application Dig.In 2 Application Dig.In1+2Application	Use of optional digital inputs for application switching. You can switch between four applications by wiring the digital inputs. • Dig.In 0 Application: Assignment of the application if no digital input is active. • Dig.In 1 Application: Assignment of the application if only digital input V1 / V2 is active. • Dig.In 2 Application: Assignment of the application if only digital input V3 / V4 is active. • Dig.In1+2Application: Assignment of the application if only digital input V1 / V2 and V3 / V4 are active. **Note** The function is available only with the corresponding plug-in cards in place! The digital inputs must be configured in the "Input/Output / ...Dig.In V1/V2" or "Input/Output / ...Dig.In V1/V2" menu using the "Act. App.Selector1|3" function or "Act. App.Selector2|3" function.

… 9 Operation

… Parameter descriptions

Menu / parameter	Description
Device Setup / **…Application 1**	
…	
Device Setup / **…Application 8**	
Description	Enter the name of the application 1 … 8. Alphanumeric, max. 20 characters
…A1…Flow meas.	Selection of submenu '**…A1…Flow meas.**' … '**…A8…Flow meas.**' with .
…	
…A8…Flow meas.	
…A1…Temp. meas.	Selection of submenu '**…A1…Temp. meas.**' … '**…A8…Temp. meas.**' with .
…	
…A8…Temp. meas.	
…A1…Pipe type	Selection of submenu '**…A1…Pipe type**' … '**…A8…Pipe type**' with .
…	
…A8…Pipe type	
…A1…Gas data	Selection of submenu '**…A1…Gas data**' … '**…A8…Gas data**' with .
…	
…A8…Gas data	
…A1…Field Optim.	Selection of submenu '**…A1…Field Optim.**' … '**…A8…Field Optim.**' with .
…	
…A1…Field Optim.	

Device Setup / …Application 1 / **…A1…Flow meas.**	
…	
Device Setup / …Application 8 / **…A8…Flow meas.**	
Qm Max	Qm Max set the upper range value for the mass flow.
Qm Min	Set the lower range value for the mass flow.
Qv@ Max	Set the upper range value for standard volume flow.
Qv@ Min	Set the lower range value for standard volume flow.
Damping Q	Select the damping for flow measurement. The value set here relates to 1 τ (Tau). The value refers to the response time for a step flowrate change. It affects the instantaneous value in the display and at the current output. Default setting: 0.2 seconds
Low Flow Cut Off	Set the switching threshold (0 to 10 %) for the low flow cut-off. If the flow rate is below the switching threshold, there is no flow measurement. The setting of 0 % deactivates the low flow cut-off. Default setting: 1.0 %
LowFlow Hysteresis	Set the hysteresis (0 to 50 %) for the low flow cut-off as it is defined in the parameter 'Low Flow Cut Off'. Default setting: 20 %

Menu / parameter	Description
Device Setup / ...Application 1 / **...A1...Temp. meas.**	
...	
Device Setup / ...Application 8 / **...A8...Temp. meas.**	
Tm Max	Set the maximum measuring medium temperature.
Tm Min	Set the minimum measuring medium temperature.
Damping Tm	Select the damping for temperature measurement. The value set here relates to 1 τ (Tau). The data refers to the response time for an abrupt change in temperature. It affects the instantaneous value in the display and at the current output. Default setting: 0.2 seconds

Device Setup / ...Application 1 / **...A1...Pipe type**	
...	
Device Setup / ...Application 8 / **...A8...Pipe type**	
Shape and probe pos.	Select the piping form and sensor position. • A: Circular centric • B: Circular • C: Rectangular
Inside diameter	Set the inside diameter of the piping. Visible only when A and B selected.
Duct inner height	Set the inside height of the channel with rectangular cross-section. Visible only when C selected.
Insertion depth	Set the insertion depth of the sensor. Visible only when B and C selected.
Duct inner width	Set the inside width of the channel with rectangular cross-section. Visible only when C selected.

… 9 Operation

… Parameter descriptions

Menu / parameter	Description
Device Setup / …Application 1 / **…A1…**	**Gas data**
…	
Device Setup / …Application 8 / **…A8…**	**Gas data**
Mean Operating Temp.	Set the average measuring medium temperature.
Mean Operating Press	Set the average measuring medium pressure.
Gas Type 1	Select gas type for gas components 1 to 10 of a gas mix.
…	See table **Table: Gas types for the ApplicationSelector** on page 107.
Gas Type 10	
Concentr. Gas Type 1	Set concentration in % for gas components 1 to 10 of a gas mix.
…	
Concentr.Gas Type 10	

Note

Make sure that the gas type with the highest concentration is entered first, followed by the gas type with the second highest concentration and so on. Input via the display guarantees that this rule is not violated. For example, it is not possible to enter a higher concentration for gas type 2 than for gas type 1.
The gas type and the corresponding concentration can be configured via various communication interfaces. The procedure mentioned above must be taken into account. Modbus RTU also provides an alternative input option that differs from the procedure described above. Further information can be found in the interface description.

Device Setup / …Application 1 / **…A1…**	**Field Optim.**
…	
Device Setup / …Application 8 / **…A8…**	**Field Optim.**
Offset Qm	Offset correction of the flow rate measured value. Causes a parallel shift of the application.
Corr.Factor Qm	Correction factor for the flow measured value. Causes a change in gradient over the measuring range of an application.

Device Setup / **…Transmitter**	
…Units	Selection of submenu '**…Units**' using .
…Custom Units	Selection of submenu '**…Custom Units**' using .
TX Location TAG	Enter the measuring point tagging for the transmitter. Alphanumeric, max. 20 characters
TX TAG	Entry of the TAG number for the transmitter. Alphanumeric, max. 20 characters
Perform Device Reset	For service purposes only. Restart the device without having to switch the power supply on and off.
Factory Defaults	All user-accessible parameters will be reset to the factory default settings.
…Feature Settings	Selection of submenu '**…Feature Settings**' using .

Menu / parameter	Description
Device Setup / ...Transmitter / **...Units**	
Unit Massflow Qm	Selection of unit for mass flow. Refer to **Table 3: Standard density units** on page 106. The selection applies to the display of the current mass flow, and for the parameters related to mass flow such as Qm_{Max} and $Qm_{Max}DN$.
Mass Totalizer	Select the unit for the mass totalizer. Refer to **Table 8: Units for the standard volume totalizer** on page 107.
Unit Volumeflow Qv@	Selection of unit for the standard volume flow. Refer to **Table 2: Units for the mass flow** on page 106. The selection applies to the display of the current standard volume flow and for the parameters related to standard volume flow such as Qv@ Max and Qv@ Max. DN.
Unit Vol.@ totalizer	Select the unit for the standard volume totalizer. Refer to **Table 9: Pressure units** on page 107.
Std. Conditions Vol@	Selection of the standard state for standard volume flow. Refer to **Table 5: Temperature units** on page 106.
Special Cond. fact.	Enter the factor by which the standard state 0°C 1atm is multiplied to define an individual standard state.
Volumeflow Qv@ Name	Enter the name of the unit for the standard volume flow. If the first character **is not a** space, the name entered also affects the display of the standard units in the process display. This allows you to show a separate text for each standard unit in the process display, e.g. SCF/h instead of $ft^3/h@$. Alphanumeric, maximum 7 characters.
Volume@ Tot. Name	Enter the name of the unit for the standard volume totalizer. If the first character **is not a** space, the name entered also affects the display of the standard units in the process display. This allows you to show a separate text for each standard unit in the process display, e.g. SCF instead of $ft^3@$. Alphanumeric, maximum 7 characters.
Temperature	Selection of unit for temperature. Refer to **Table 6: Units of length** on page 106.
Pressure	Select a unit for pressure. Refer to Fehler! Verweisquelle konnte nicht gefunden werden. on page **Fehler! Textmarke nicht definiert.**.
Length	Select a unit for length information. Refer to **Table 7: Units for the mass counter** on page 106.
Density@	Select a unit for standard density. Refer to **Table 4: Standard conditions** on page 106.
Density@ Name	Enter the name of the unit for standard density. If the first character **is not a** space, the name entered also affects the display of the standard units in the process display. This allows you to show a separate text for each standard unit in the process display, e.g. XXX instead of YYY. Alphanumeric, maximum 7 characters.

… 9 Operation

… Parameter descriptions

Menu / parameter	Description
Device Setup / …Transmitter / **…Units**	
Variable 1 Name	Selection of the unit for external process variables.
Variable 2 Name	The transmitter can show two external process variables in the display. The process variables can be transferred from a fieldbus master to the transmitter via the HART®, Modbus® oder PROFIBUS DP® protocol. You can configure the indicator through the 'Display' menu.

Device Setup / …Transmitter / **…Custom Units**	
Mass flow Qm Name	Enter the name of the user-defined unit for mass flow. Alphanumeric, maximum 7 characters.
Mass flow Qm Factor	Enter the factor for the user-defined unit for mass flow. Setting range: 0.0001 … 100000 kg/h
Mass Tot. Name	Enter the name of the user-defined totalizer unit for mass flow. Alphanumeric, maximum 7 characters.
Mass Tot. Factor	Enter the factor for a user-defined totalizer unit. Setting range: 0.0001 … 100000 kg
Volumeflow Qv@ Name	Enter the name of the user-defined unit for standard volume flow. Alphanumeric, maximum 7 characters.
Volumeflow Qv@ Fact.	Enter the factor for the user-defined unit for standard volume flow. Setting range: 0.0001 … 100000 m^3/h under standard conditions.
Volume@ Tot. Name	Enter the name of the user-defined totalizer unit for standard volume flow. Alphanumeric, maximum 7 characters.
Volume@ Tot. Factor	Enter the factor for the user-defined totalizer unit for standard volume flow. Setting range: 0.0001 … 100000 m^3 under standard conditions.
Density@ Name	Enter the name of the user-defined unit for standard density. If the first character is a space, a @ sign will be appended to the unit (standard setting). Alphanumeric, maximum 7 characters.
Density@ Factor	Enter the factor for a user-defined standard density. Setting range 0.0001 … 100000 kg/m^3

Menu / parameter	Description
Device Setup / ...Transmitter / **...Feature Settings**	
FillMass On/Off	FillMass function active? Off: FillMass function deactivated. On: FillMass function activated.
FillMass Code	Enter the device-specific code to activate the FillMass function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (by for example using the parameter 'Perform Device Reset', or by briefly switching off the power supply).
VeriMass On/Off	VeriMass function active? Off: VeriMass function deactivated. On: VeriMass function activated.
VeriMass Code	Enter the device-specific code to activate the VeriMass function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (by for example using the parameter 'Perform Device Reset', or by briefly switching off the power supply).
Ext. Range On/Off	Extended measuring range active? Off: Extended measuring range deactivated. On: Extended measuring range activated. **Note** The extended measuring range may only be activated for devices outside potentially explosive atmospheres or for devices in Zone 2 or Division2 explosion protection zones!
Ext. Range Code	Enter the device-specific code for activating the advanced measuring range. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (by for example using the parameter 'Perform Device Reset', or by briefly switching off the power supply).

… 9 Operation

… Parameter descriptions

Menu: Display

Menu / parameter	Description
Display	
Language	Selection of menu language.
Contrast	Contrast setting for the LCD display.
…Operator Pages	Selection of submenu '**…Operator Pages**' using . Up to four user-specific operator pages (layouts) can be configured for the process display. If multiple operator pages have been configured, these can be scrolled through manually on the information level. In the factory setting only Operator Page 1 is enabled.
Autoscroll	If Autoscroll is enabled, the 'Autoscroll' function can also be activated on the information level of the operator menu. In this function, operator pages are automatically displayed in succession on the process screen, changing every 10 seconds. Manual scrolling through pre-configured operator pages as described above is no longer necessary. When Auto scroll mode is enabled, the icon is displayed in the lower left corner of the screen. Default setting: Disabled.
Mass Flow Format	Selection of number of decimal places (maximum 12) used to display the corresponding process variables.
Mass Format	
Volume Flow@ Format	
Volume@ Format	
Volume Flow Format	
Volume Format	
Temperature Format	
Density@ Format	
Density Format	
Date Format	Set the display format for the date and time.
Display Tag	Configuration of the top line in the display. Off, Sensor Location Tag, Bus Address, HART Address, Appl. Description
Display Rotation	The display on the display can be rotated through software by 180°.
Display Test	Start the test of the LCD display with ''. The display test lasts approx. 10 seconds. Various patterns are shown on the LCD display to check the display.

Display / **…Operator Pages**	
…Operator Page 1	Selection of submenu '**…Operator Page 1**' using .
…Operator Page 2	Selection of submenu '**…Operator Page 2**' using .
…Operator Page 3	Selection of submenu '**…Operator Page 3**' using .
…Operator Page 4	Selection of submenu '**…Operator Page 4**' using .

Display / ...Operator Pages / **...Operator Page 1 (n)**	
Display Mode	Configure each operator page. The following versions can be selected: Off, Graph View, 1x4, 1x6A, 1x6A bar, 1x9, 1x9 bar, 2x9, 2x9 bar, 3x9. Selecting 'Off' deactivates the corresponding operator page.
1st Line	Selection of process variable displayed in the respective row.
2nd Line	See table **Available process variables** on page 108.
3rd Line	
4th Line	
Bargraph	Select the process variable displayed as a bar graph (only in display modules with "Bar" bar graph). • Mass Flow [%]: Mass flow in % • Volume Flow [%]: Volume flow in %
Graph View	Select the process variable displayed as a graphic view (available only for user page 1).

… 9 Operation

… Parameter descriptions

Menu: Input/Output

Menu / parameter	Description
Input/Output	
…Curr.Out 31/32/Uco	Selection of submenu '**…Curr.Out 31/32/Uco**' using .
…Curr.Out V1/V2	Selection of submenu '**…Curr.Out V1/V2**' using .
…Curr.Out V3/V4	Selection of submenu '**…Curr.Out V3/V4**' using .
…Dig.Out 41/42	Selection of submenu '**…Dig.Out 41/42**' using .
…Dig.Out 51/52	Selection of submenu '**…Dig.Out 51/52**' using .
…Dig.Out V1/V2	Selection of submenu '**…Dig.Out V1/V2**' using .
…Dig.Out V3/V4	Selection of submenu '**…Dig.Out V3/V4**' using .
…Dig.In V1/V2	Selection of submenu '**…Dig.In V1/V2**' using .
…Dig.In V3/V4	Selection of submenu '**…Dig.In V3/V4**' using .

Input/Output / **…Curr.Out 31/32/Uco**	
Input/Output / **…Curr.Out V1/V2**	
Input/Output / **…Curr.Out V3/V4**	
Loop Current Mode	Display of the operating mode (only for 31 / 32 Uco current output). • Multidrop Fixed: The current output is in HART multi-drop mode, the current output is fixed to 3.6 mA and no longer follows the selected process variable. The process value is still transmitted through the HART protocol. • Normal Signaling: The current output transmits the selected process value, and the process value is additionally transmitted through the HART protocol. • Power Mode: 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. The current output 31/32/Uco works as a power supply unit for the operation of the digital output 41 / 42 as an active output. See chapter **Current output Uco / 32 as loop power supply for digital output 41 / 42 or 51 / 52** on page 65.
Output Value	Selection of process variable issued at the corresponding current output. Refer to **Available process variables** on page 108.
Curr.Out Mode	Select the operating mode for the current output. • '4-20mA FWD': Flow output in forward flow direction: 4 mA = no flow, 20 mA = maximum flow).
Curr.Out at Alarm	Selection of status of the current output in error condition. The output 'low' or 'high' current is set in the subsequent menu.
Low Alarm	Sets the current for Low Alarm.
High Alarm	Sets the current for High Alarm.
Curr.Out > 20,5mA	Behavior of current output if 20.5 mA is exceeded. • Hold Last Value: The last measured value is retained and issued. • High Alarm: The high alarm current is issued. • Low Alarm: The low alarm current is issued.
Curr.Out < 3,8mA	Behavior of the current output if 3.8 mA is not reached. • Hold Last Value: The last measured value is retained and issued. • High Alarm: The high alarm current is issued. • Low Alarm: The low alarm current is issued.

Menu / parameter	Description
Input/Output / **...Dig.Out 41/42**	
Mode	Selection of the operating mode for the digital output 41 / 42. • Off: Digital output 41 / 42 deactivated. • Binary: Digital output 41 / 42 as a binary output (e.g. as an alarm output). • Pulse: Digital output 41 / 42 as a pulse output. In pulse mode, pulses per unit are output (e.g. 1 pulse per m^3). • Frequency: Digital output 41 / 42 as a frequency output. In frequency mode, a frequency is issued that is proportional to the flow rate.
...Puls.Out 41/42	Selection of submenu '**...Puls.Out 41/42**' using . Only available if 'Mode' Pulse has been selected.
...Freq.Out 41/42	Selection of submenu '**...Freq.Out 41/42**' using . Only available if 'Mode' Frequency has been selected.
...Binary Out 41/42	Selection of submenu '**...Binary Out 41/42**' using . Only available if 'Mode' Binary has been selected.
...Alarm Cfg. 41/42	Selection of submenu '**...Alarm Cfg. 41/42**' using . Only available when 'Mode' Binary is selected in the '...Binary Out 41/42 / Signal Source Binary' Alarm menu.

Input/Output / ...Dig.Out 41/42 / **...Puls.Out 41/42**	
Signal Source Pulse	Select process variable that is issued via the pulse output. Refer to **Available process variables** on page 108.
Quantity Pulses Quantity Mass Quantity Volume@	Set the pulses per mass unit or volume unit (see table **Table 1: Units for the standard volume flow** on page 106) for the pulse output.
Pulse Width	Set the pulse width (low signal) for the pulse output. The parameter directly limits the maximum possible output rate of pulses, for example max. 500 pulses/sec at 1 ms. If the calculation of the current output rate leads to an up-scale, the pulses are buffered and output with a delay. Setting range: 0.05 to 2000 ms

Input/Output / ...Dig.Out 41/42 / **...Freq.Out 41/42**	
Signal Source Freq.	Selection of process variable that is issued via the frequency output. Refer to **Available process variables** on page 108.
Upper Range Value Lower Range Value	Set the frequency range for output of the selected process variables. • Upper Range Value: Set the frequency for 100 % of the process variable. • Lower Range Value: Set the frequency for 0 % of the process variable.
Pulses per Unit 41/42	Set the pulse per flow unit. The value (in 1/unit) is calculated dynamically from the parameter "Lower Range Value", the mass or volume flow and Q_{max}. **Note** • The value can be changed within the limits indicated. The measuring range start is also adjusted automatically when doing this. • The parameter is only available for the following process variables: Qm [%], Qn [%] • The parameter is only available if the parameter 'Lower Range Value' is set to 0 Hz.

… 9 Operation

… Parameter descriptions

Menu / parameter	Description
Input/Output / …Dig.Out 41/42 / **…Binary Out 41/42**	
Signal Source Binary	Selection of binary output function. • Alarm: The binary output indicates an active alarm. The alarm is selected in the '„…Alarm Cfg. 41/42' menu. • Batch End: The binary output is activated when the set fill quantity is reached (only if the FillMass function is activated).
Active Mode	Select switching properties for the binary output. • Active High: Normally open • Active Low: Opener

Input/Output / …Dig.Out 41/42 / **…Alarm Cfg. 41/42**	
General Alarm	Selection of error messages signaled via the binary output 41 / 42.
Qm Massflow Max	Only if the parameter "Signal Source Binary" has been set to "Alarm".
Qm Massflow Min	
Qv@ Volumeflow Max	
Qv@ Volumeflow Min	
Tm Temperature Max	
Tm Temperature Min	
Sensor Soiling	In preparation

Input/Output / **…Dig.Out 51/52**	
Mode	Selection of the operating mode for the digital output 51 / 52. The following operating mode Pulse 41/42 <)90°, Pulse 41/42 <)180°" is only available if the digital output 41 / 42 has been configured as a pulse output. • Off: Digital output deactivated. • Binary: Digital output configured as a binary output (for function see parameter '…Binary Out 51/52'). • Frequency: Digital output 51 / 52 as a frequency output. In frequency mode, a frequency is issued that is proportional to the flow rate. • Pulse 41/42 <)90°: Output of the same pulses as for digital output 41 / 42, phase shifted by 90°. • Pulse 41/42 <)180°: Output of the same pulses as for digital output 41 / 42, phase shifted by 180°
…Puls.Out 51/52	Selection of submenu '**…Puls.Out 51/52**' using .
…Freq.Out 51/52	Selection of submenu '**…Freq.Out 51/52**' using . Only available if 'Mode' Frequency has been selected.
…Binary Out 51/52	Selection of submenu '**…Binary Out 51/52**' using . Only available if 'Mode' Binary has been selected.
…Alarm Cfg. 51/52	Selection of submenu '**…Alarm Cfg. 51/52**' using . Only available if 'Mode' Binary has been selected.

Menu / parameter	Description
Input/Output / ...Dig.Out 51/52 / **...Puls.Out 51/52**	
Signal Source Pulse	Display of parameters that have been set in the '...Puls.Out 41/42' menu.
Quantity Pulses	
Quantity Mass	
Quantity Volume@	
Pulse Width	

Input/Output / ...Dig.Out 51/52 / **...Freq.Out 51/52**	
Signal Source Freq.	Selection of process variable that is issued via the frequency output. Refer to **Available process variables** on page 108.
Upper Range Value	Set the frequency range for output of the selected process variables.
Lower Range Value	• Upper Range Value: Set the frequency for 100 % of the process variable. • Lower Range Value: Set the frequency for 0 % of the process variable.
Pulses per Unit 51/52	Set the pulse per flow unit. The value (in 1/unit) is calculated dynamically from the parameter 'Lower Range Value', the mass or volume flow and Q. **Note** • The value can be changed within the limits indicated. The measuring range start is also adjusted automatically when doing this. • The parameter is only available for the following process variables: Qm [%], Qn [%] • The parameter is only available if the parameter 'Lower Range Value' is set to 0 Hz.

Input/Output / ...Dig.Out 51/52 / **...Binary Out 51/52**	
Signal Source Binary	Selection of binary output function. • Alarm: The binary output indicates an active alarm. The alarm is selected in the '„...Alarm Cfg. 51/52' menu. • Batch End: The binary output is activated when the set fill quantity is reached (only if the FillMass function is activated).
Active Mode	Select switching properties for the binary output. • Active High: Normally open • Active Low: Opener

Input/Output / ...Dig.Out 51/52 / **...Alarm Cfg. 51/52**	
General Alarm	Selection of error messages signaled via the binary output 51 / 52.
Qm Massflow Max	Only if the parameter "Signal Source Binary" has been set to "Alarm".
Qm Massflow Min	
Qv@ Volumeflow Max	
Qv@ Volumeflow Min	
Tm Temperature Max	
Tm Temperature Min	
Sensor Soiling	In preparation

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… Parameter descriptions

Menu / parameter	Description
Input/Output / **…Dig.Out V1/V2**	
Input/Output / **…Dig.Out V3/V4**	
Mode	Selection of operating mode for the digital output V1 / V2 or V3 / V4. • Off: Digital output deactivated. • Binary: Digital output functions as binary output (for function see parameter '„…Binary Out V1/V2 / V3/V4'). The digital outputs V1 / V2 and V3 / V4 are only available if the corresponding plug-in cards are present!
…Binary Out V1/V2 / V3/V4	Selection of submenu '**…Binary Out V1/V2 / V3/V4**' using . Only available if 'Mode' Binary has been selected.
…Alarm Cfg. V1/V2 / V3/V4	Selection of submenu '**…Alarm Cfg. V1/V2 / V3/V4**' using . Only available if 'Mode' Binary has been selected.

Input/Output / …Dig.Out V1/V2 / **…Binary Out V1/V2**	
Input/Output / …Dig.Out V3/V4 / **…Binary Out V3/V4**	
Signal Source Binary	Selection of binary output function. See description '„Input/Output / …Dig.Out 41/42 / …Binary Out 41/42'.
Active Mode	Select switching properties for the binary output. • Active High: Normally open • Active Low: Opener

Input/Output / …Dig.Out V1/V2 / **…Alarm Cfg. V1/V2**	
Input/Output / …Dig.Out V3/V4 / **…Alarm Cfg. V3/V4**	
General Alarm	Select error messages signaled via the binary output V1 / V2 or V3 / V4.
Qm Massflow Max	Only if the parameter "Signal Source Binary" has been set to "Alarm".
Qm Massflow Min	
Qv@ Volumeflow Max	
Qv@ Volumeflow Min	
Tm Temperature Max	
Tm Temperature Min	
Sensor Soiling	In preparation

Input/Output / **…Dig.In V1/V2**	
Input/Output / **…Dig.In V3/V4**	
Function	Select a function for the digital input. • Off: No function. • Reset all Totalizer: Counter reset for all counters • Stop all Totalizer: External counter stop for all counters • Set Flowrate to zero: Sets flow measurement to 0. Heating of the thermal measuring element is also switched off here • Start/Stop Batching: Start / stop fill operation (only when FillMass function is activated). • Act. App.Selector1|3: Application selection via the digital input (with digital input V1 / V2 only). • Act. App.Selector2|3: Application selection via the digital input (with digital input V3 / V4 only).
Active Mode	Select switching properties for the digital input. • Active High: Normally open • Active Low: Opener
Delay Time	Selection of delay time for suppressing EMC faults on the digital input.

Menu: Process Alarm

Menu / parameter	Description
Process Alarm	
Clear Alarm History	Reset of the alarm history.
...Group Masking	Selection of submenu '**...Group Masking**' using .
...Alarm Limits	Selection of submenu '**...Alarm Limits**' using .

Process Alarm / **...Group Masking**	
Maintenance Required	Alarm messages are divided into groups.
Function Check	If masking is activated for a group (On), no alarm is issued.
Out Of Specification	For more detailed information, see **Diagnosis / error messages** on page 141.

Process Alarm / **...Alarm Limits**	
...Application 1	Selection of submenu '**...Application 1...8**' using .
...	The alarm thresholds can be set separately for each application.
Application 8	

Process Alarm / ...Alarm Limits / **...Application 1...8**	
Qm Massflow Min	Sets the minimum / maximum limit value for mass measurement. If the process value 'Mass Flow [unit]' exceeds or falls
Qm Massflow Max	below the limit value, an alarm is triggered.
Qv@ Volumeflow Min	Set the minimum / maximum limit value for standard volume measurement. If the process value 'Qv@ [Unit]' exceeds or
Qv@ Volumeflow Max	falls below the limit value, an alarm is triggered.
Tm Min	Sets the minimum / maximum limit value for sensor temperature. If the process value 'Temperature [unit]' exceeds or falls
Tm Max	below the limit value, an alarm is triggered.

… 9 Operation

… Parameter descriptions

Menu: Communication

Menu / parameter	Description
Communication	
…HART	Selection of submenu '**…HART**' using .
…Modbus	Selection of submenu '**…Modbus**' using .
…Profibus	Selection of submenu '**…Profibus**' using .

Communication / **…HART**	
Device Address	Selection of HART® device address. **Note** • The HART 5® protocol has provisions for creating a bus with up to 15 devices (1 to 15). If an address greater than 0 is set via HART Command 6, the device operates in multidrop mode. Current loop node cannot be changed using Command 6 in HART 5. The current output 31 / 32 / Uco is fixed to 3.6 mA. HART communication takes place through current output 31 / 32 / Uco. • The HART 7® protocol has provisions for creating a bus with up to 63 devices (1 to 63). The address and the current loop mode can be changed via HART Command 6 independently of each other. Here it is not mandatory to also have the current output fixed to 3.6 mA with an address greater than 0. If an address greater than 0 is set via the menu, the device will **NOT** switch automatically to multi-drop mode. The current loop mode is switched independently.
Curr.Out 31/32/Uco	Selection of the operating mode for current output 31/32/Uco. • Multidrop Fixed: The current output 31/32/Uco supports the HART multi-drop mode, the current output is fixed to 3.6 mA and no longer follows the selected process variable. The process variables can be transferred via the HART protocol. • Normal Signaling: The current output 31/32/Uco transfers the selected process variables. In addition, the process variables can be transferred via the HART protocol. • Power Mode: 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. The current output 31/32/Uco works as a power supply unit for the operation of the digital output 41 / 42 as an active output.
HART Tag	Entry of a unique HART® TAG number for device identification. Alphanumeric, a maximum of 8 characters, upper case only, no special characters.
HART Long Tag	Entry of a unique HART® TAG number for device identification. Alphanumeric, maximum of 32 characters, ASCII
HART Descriptor	Entry of a HART® descriptor. Alphanumeric, a maximum of 16 characters, upper case only, no special characters.
HART Message	Display of the alphanumeric measuring point tagging.
HART Manuf. ID	Display of the HART® manufacturer ID. ABB = 26
HART Device ID	Display of the HART® device ID.
HART Find	Select whether the transmitter should respond to the HART® command 73 (Find Device). • Off: The transmitter does not respond to command 73. • Once: The transmitter responds once to command 73. • Continuous: The transmitter always responds to command 73.
Last HART Command	Display of the most recently sent HART® command.

Menu / parameter	Description
Communication / ...Modbus	
Address	Setting the Modbus® device address (1 to 127).
IEEE Format	Selection of the byte order for the Modbus communication. • Enabled: If the IEEE format is activated, the data words are sent in the 'little endian' format with the lowest value word first. • Disabled: If the IEEE format is deactivated, the data words are sent in the standard Modbus® 'bigendian' format. Factory setting: Enabled.
Baud Rate	Selection of the transmission speed (baud rate) for the Modbus® communication. Factory setting: 9600 baud.
Parity	Selection of the parity for the Modbus® communication. Factory setting: Odd.
Stop Bits	Selection of the stop bits for the Modbus® communication. Factory setting: One stop bit
Response Delay	Setting of the pause time in milliseconds after receiving a Modbus® command. The device sends a response no earlier than expiration of the set pause time. Factory setting: 10 ms
...Scan Reg.1.00-15	Selection of submenu '**...Scan Reg.1.00-15**' using .
...Scan Reg.1.16-31	Selection of submenu '**...Scan Reg.1.16-31**' using .
...Scan Reg.2.00-15	Selection of submenu '**...Scan Reg.2.00-15**' using .
...Scan Reg.2.16-31	Selection of submenu '**...Scan Reg.2.16-31**' using .

Communication / ...Modbus / **...Scan Reg.1.00-15**	
Communication / ...Modbus / **...Scan Reg.2.00-15**	
Register 0 Register 1	Mass flow in the selected mass flow unit (data type float, register length 2)
Register 2 Register 3	Volume flow in the selected volume unit (data type float, register length 2)
Register 4 Register 5	Mass flow counter reading in forward flow direction (data type float, register length 2)
Register 6 Register 7	Volume flow counter reading in forward flow direction (data type float, register length 2)
Register 8 Register 9	Diagnosis state 0 (data type Usign 16, register length 1)
Register 10 Register 11	Diagnosis state 1 (data type Usign 16, register length 1)
Register 12 Register 13	Diagnosis state 2 (data type Usign 16, register length 1)
Register 14 Register 15	Mass flow unit Qm (data type Usign 8, register length 1)

Communication / ...Modbus / **...Scan Reg.1.16-31**	
Communication / ...Modbus / **...Scan Reg.2.16-31**	
Register 0	Non-configured register spaces must be filled with FFF.
...	
Register 15	

… 9 Operation

… Parameter descriptions

Menu / parameter	Description
Communication / …Profibus	
Address	Set the PROFIBUS DP® device address (1 to 126).
Ident Nr. Selector	Display the PROFIBUS DP® identification number • 0x9740 -PA 1AI+1TOT • 0x3435 -ID Specific • Adaptation Mode • 0x9700 -PA 1AI
Comm State	Display the PROFIBUS communication status. • Offline: No PROFIBUS® communication. • Stop: Bus active, device not active. • Clear: Device is being initialized. • Operate: Cyclic communication is active.
Baud Rate	Display the transmission speed (baud rate) for the PROFIBUS® communication. The baud rate is automatically detected and does not need to be configured manually.
PB Manufacturer ID	Display the PROFIBUS DP® manufacturer ID • 26: ABB

Menu: Diagnostics

Menu / parameter	Description
Diagnostics	
...Diagnosis Control	Selection of submenu '**...Diagnosis Control**' using .
...Diagnosis Values	Selection of submenu '**...Diagnosis Values**' using .
...Simulation Mode	Selection of submenu '**...Simulation Mode**' using .
...Output Readings	Selection of submenu '**...Output Readings**' using .
...SensorCheck	Selection of submenu '**...SensorCheck**' using .
...Diag.CurrOut 31/32	Selection of submenu '**...Diag.CurrOut 31/32**' using .
...Alarm Simulation	Selection of submenu '**...Alarm Simulation**' using .

Diagnostics / **...Diagnosis Control**	
Preset Maint. cycle	Sets the service interval. After the maintenance interval has expired, the corresponding error message 'Flowrate to zero' is set. The setting '0' deactivates the maintenance interval.
Maint. Remain. Time	Time remaining in the maintenance interval until the error message 'Flowrate to zero' is set.
Start New Cycle	Resetting of the maintenance interval. The service interval is reset to the value set in 'Preset Maint. cycle'.

Diagnostics / .....**Diagnosis Values**	
Temperature gas	Display of the current measuring medium temperature in °C.
Temperature FE elec.	Display of the current temperature of the frontend board electronic unit in °C.

Diagnostics / .....**Simulation Mode**	
Simulation Switch	Manual simulation of measured values. After selecting the value to be simulated, a corresponding parameter is displayed in the menu 'Diagnostics / .....Simulation Mode'. The simulation value can be set here. The output values correspond to the simulated flowrate entered. Information 'Configuration' appears in the lower line of the display. Only one measured value / output can be selected for simulation. After power-up / restart of the device, the simulation is switched off.
Off	
Curr.Out 31/32/Uco	
Curr.Out V1/V2*	
Curr.Out V3/V4*	
Dig.Out 41/42 State	
Dig.Out 41/42 Freq.	
Dig.Out 41/42 Pulse	
Dig.Out 51/52 State	
Dig.Out 51/52 Pulse	
Dig.Out V1/V2 State*	
Dig.Out V3/V4 State*	
Dig.In V1/V2 State*	
Dig.In V3/V4 State*	
Mass Flow [unit]	
Mass Flow [%]	
Qv@ Vol.flow [unit]	
Qv@ Vol.flow [%]	
Temperature [unit]	
Temperature [%]	

* Only with plug-in card present.

… 9 Operation

… Parameter descriptions

Menu / parameter	Description
Diagnostics / **…Output Readings**	
Curr.Out 31/32/Uco	Display the current values and statuses of the listed inputs and outputs.
Curr.Out V1/V2*	
Curr.Out V3/V4*	
Dig.Out 41/42 Freq.	
Dig.Out 41/42 State	
Dig.Out 51/52 Freq.	
Dig.Out 51/52 State	
Dig.Out V1/V2 State*	
Dig.Out V3/V4 State*	
Dig.In V1/V2 State*	
Dig.In V3/V4 State*	

* Only with plug-in card present.

Diagnostics / **…SensorCheck**	
…Verify Fingerprint	Selection of submenu '**…Verify Fingerprint**' using .
…Install Fingerprint	Selection of submenu '**…Install Fingerprint**' using .

Diagnostics / …SensorCheck / **…Verify Fingerprint**	
Verify	Fingerprint testing manual start using . The process takes approx. 12 minutes. Make sure that during this time there is no flow through the sensor (e.g. by shutting or sealing it off).
Result	Read fingerprint status
Value TDC1 Value TDC2 Value HDC1 Value HDC2	Read VeriMass parameters. See **'SensorCheck' diagnosis function** on page 147 for additional information on assessing the results. • Value TDC1: Temperature change TDC1 • Value TDC2: Temperature change TDC2 • Value HDC1: Heat emission change HDC1 • Value HDC2: Heat emission change HDC2

Diagnostics / …SensorCheck / **…Install Fingerprint**	
Determine	Create new commissioning fingerprint using . The process takes approx. 12 minutes. Make sure that during this time there is no flow through the sensor (e.g. by shutting or sealing it off).
Delete (New)	Delete existing commissioning fingerprint using .

Menu / parameter	Description
Diagnostics / **...Diag.CurrOut 31/32**	
Readback curr. 31/32	Activate the monitoring function for current output 31 / 32. Activate the monitoring function for current output 31 / 32. The transmitter measures the actual current and compares the measured value to the set point for the current output. If the measured value deviates from the set point by more than ±2 %, the current output on the alarm current of 3.3 mA is set and the 'Communicat. card not responding' error message is generated. Factory setting: Off.
...Alarm Reset Option	Selection of submenu '**...Alarm Reset Option**' using .
Reset Alarm	Manually resetting the 'Communicat. card not responding' error message using .

Diagnostics / ...Diag.CurrOut 31/32 / **...Alarm Reset Option**	
Auto. Reset 10 min	Automatic reset of the 'Communicat. card not responding' error message. • Off: The error is permanently saved and must be reset manually. After the reset, the current output 31 / 32 is retested. • On: The error is automatically reset after 10 minutes. After the reset, the current output 31 / 32 is retested. Factory setting: On.
Auto Reset open Loop	Behavior in the case of an open current output 31 / 32 (interruption of the current loop). • Off: If the current loop is interrupted, the 'Communicat. card not responding' is generated. The reset of the error then depends on the setting of the 'Auto. Reset 10 min' parameter. • On: If the current loop is closed again, the error will be automatically reset. Factory setting: On.

Diagnostics / **...Alarm Simulation**
Manual simulation of alarms / error messages. The simulated alarm is selected by setting the parameter to the corresponding error. See also chapter **Diagnosis / error messages** on page 141. The following error messages can be simulated:
Off, Flow Mass Reached, Flow Volume Reached, Simulation Alarm, Flowrate to Zero, Maint. Cycle Time, Totalizer Stop, Totalizer Reset, Totalizer Rollover, Dev. not calibrated, NV defect on FEB, NV data defect, FEB not detected, FEB comm. error, Incompatible FEB, NV defect on MB, DO 41/42 Saturated, CO 31/32 Saturated, CO Vx/Vy Saturated, CO 31/32 Comm. Error, Option 1 Comm. Error, Option 2 Comm. Error, CO 31/32 Safety, CO 31/32 Not Calibr., CO V1/V2 Not Calibr., CO V3/V4 Not Calibr., Volt. Monitoring MB, ADC Failure FE, Elec. defect FE, Sensor Temp. Max., Elec.Temp.Max.FE, Sensor Meas. Failure, Flow Normvolume Max., Gas Temperature Max., Configuration Error, Volume@ overflow, Sensor Soiling, Volt. Monitor FEB

… 9 Operation

… Parameter descriptions

Menu: Totalizer

Menu / parameter	Description
Totalizer	
…Operation	Selection of submenu '**…Operation**' using .
…Reset Totalizer	Selection of submenu '**…Reset Totalizer**' using .
…Preset Totalizer	Selection of submenu '**…Preset Totalizer**' using .
…FillMass	Selection of submenu '**…FillMass**' using .

Totalizer / **…Operation**	
Start all Totalizer	Starts all counters.
Stop all Totalizer	Stops all counters.

Totalizer / **…Reset Totalizer**	
All Totalizer	Resets all totalizers to zero.
Massflow Qm	Reset all mass totalizers to zero.
Volumeflow Qv@	Reset all standard volume totalizers to zero.

Totalizer / **…Preset Totalizer**	
Massflow Qm	Input from meter readings (e.g. when replacing the transmitter).
Volumeflow Qv@	

Totalizer / **…FillMass**	
Batch Process Value	Selection of process variable used during the filling process. • Off: Filler deactivated. • VolumeFlow@: Standard flow rate. • Mass Flow: Mass flow.
Preset Batch Total.	Sets the fill quantity using the selected unit. When the defined fill quantity is reached, the configured binary output is activated. **Note** Before setting the fill quantity, the corresponding process value must be selected with the parameter 'Batch Process Value'.
Reset Cur.Batch Tot.	Resets the current fill quantity.
Start Batching	Manual start of the filling function. Alternatively, the digital input can be configured for starting / stopping the fill operation.
Current Batch Total	Display of the current fill quantity. Once a fill operation has been started, the quantity already filled is shown here. The counter restarts at zero for each fill operation initiated and then counts up to the set fill quantity.
Stop Batching	Manual stop of the filling function. Alternatively, the digital input can be configured for starting / stopping the fill operation.
Current Batch Counts	Display of the number of fill operations since the last reset.
Reset Batch Counts	Sets the parameter 'Current Batch Counts' to zero.
…Quantity	Select the '**…Quantity**' submenu.

Menu / parameter	Description
Totalizer / ...FillMass / **...Quantity**	
Mode	Selection of overrun correction. Closing the fill valve takes some time and as a consequence more liquid is added, even though the fill quantity is reached and the contact for closing the valve is actuated. —Auto: The overrun quantity is calculated by the transmitter automatically. —Manual: The overrun quantity must be determined manually and entered in the selected unit via the parameter 'Quantity'.
Quantity	Manual input of the overrun quantity / display of the overrun quantity detected automatically by the transmitter.
Factor	Sets the weighting of the last filling process during automatic calculation of the overrun quantity. The calculation is based on the following formula: New correction value = last correction value + (Factor x correction value during the last fill operation) — 0.0: No change to correction value. — 1.0: The correction value is immediately adjusted to the overrun quantity calculated during the last fill operation.
Time	Sets the time for the overrun quantity correction after the fill valve is closed.

Software history

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

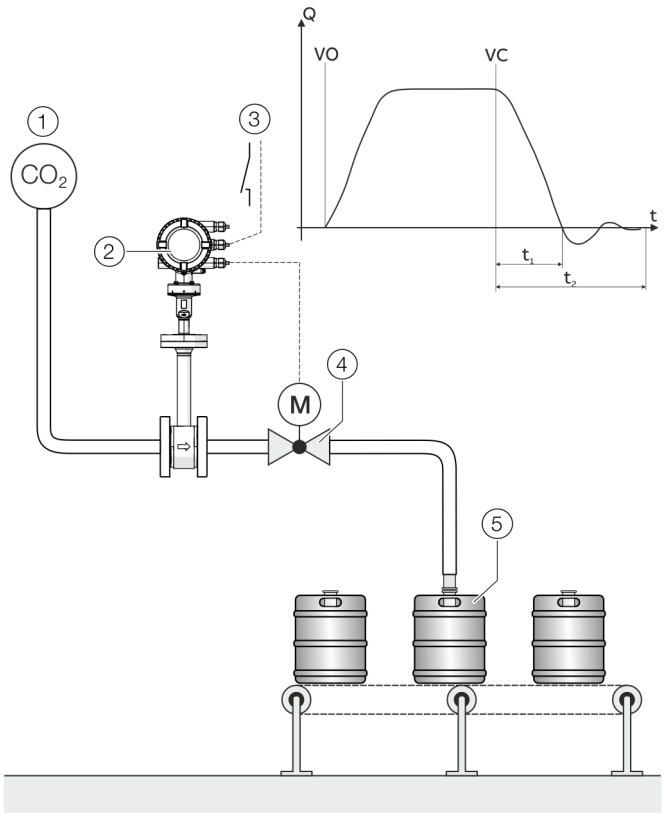
Device software package FMT430 / FMT450 (device firmware package)

Design	Issue date	Type of change	Description	Order 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 minor troubleshooting	3KXF002045U0100_01.02.00
01.03.00	05.2024	Change	Function extension and minor debugging	3KXF002045U0100_01.03.00
01.04.00	04.2026	Change	SIL2 functionality added and minor bug fixes	3KXF002045U0100_01.04.00

… 9 Operation

FillMass batch function

Only for FMT450



1. Gas pipeline (CO_2)
2. Sensor
3. Start / stop fill operation (via digital input)
4. Fill valve
5. Filling tank

Figure 90: FillMass filling function (example CO2 fill)

Diagram legend	
VO	Valve open (filling started)
VC	Valve closed (fill quantity reached)
t_1	Valve closing time
t_2	Overrun time

The integrated FillMass fill function allows filling operations with filling times of > 3 s.
For this purpose, the filling quantity is given via an adjustable totalizer.
The Modbus interface is used to configure and control the fill function.
The valve is triggered via one of the digital outputs and closed again once the preset filling quantity is reached.
The transmitter measures the overrun quantity and calculates the overrun correction from this.
Additionally, the low flow cut-off can be activated if required.

Setup

For the configuration of the fill mass function, the following steps must be performed:

1. The FillMass function must be active. See also the ‘Device Setup / …Transmitter / …Feature Settings / …’ menu.
2. One digital output must be configured as a binary output with the function ‘Batch End’. See also the ‘Input/Output / …’ menu. As an option, one digital input (plug-in card) can be configured with the function ‘Start/Stop Batching’ at the start of the filling process.
3. The parameters for the fill mass function must be configured. See also the ‘Totalizer / …FillMass / …’ menu.

Note

During fast filling processes, the damping should be set to the minimum value to ensure the greatest possible accuracy of the fill quantity.
See also the ‘Device Setup / …Transmitter / …’ menu.

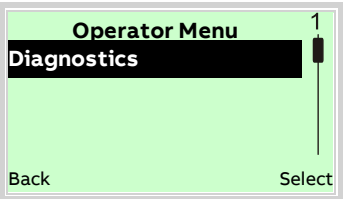
10 Diagnosis / error messages

Calling up the error description

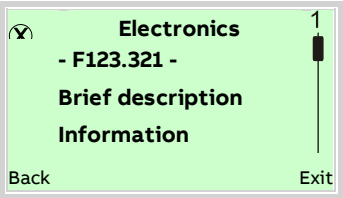
Additional details about the error that has occurred can be called up on the information level.



1. Use ◥ to switch to the information level (Operator Menu).



2. Use ▲ / ▼ to select the submenu ‘Diagnostics’.
3. Confirm the selection with ◢.



The error message is shown on the display according to priority.
The first line shows the area in which the error has occurred.
The second line shows the unique error number. It is made up of the priority (Fxxx) and the error position (.xxx)
The next lines show a brief description of the error and information on how to remedy it.
You absolutely need to scroll the display further to read the error message in more detail.

Note
For a detailed description of the error messages and information on troubleshooting, see the following pages.

General

Errors encountered are itemized in tabular form on the following pages. The response of the transmitter on error detection is described therein.
The table lists all possible errors together with a description of their impact on the value of measurement variables, the properties of current outputs and the alarm output.

If no entry is indicated in the table field, there is no effect on the measurement variable or no alarm signal for the particular output. The sequence of the errors in the table corresponds to the error priorities.
The first entry has the highest priority and the last has the lowest.

If multiple errors are detected simultaneously, the error with the highest priority determines the alarm condition of the measurement variable and the current output. If an error with a higher priority does not affect the measurement variable or the output status, the error with the next highest priority determines the status of the measurement variable and the output.

… 10 Diagnosis / error messages

Overview

The counter readings and the states of the current outputs and the alarm output are represented by symbols; please see the table below.

Symbol	Description
STOP	Counter stop
—	No change, current value
1)	When the error occurs, the corresponding measurement variable is calculated with the temperature 20 °C.
2)	When the error occurs, the corresponding measurement variable is set to the value with density = 1.
HOLD	The last 'good' measured value is retained.
⚠	Alarm (general)
⚠↑	High alarm
⚠↓	Low alarm

		Process values								Counter	Current output
Priority	Error text	Qm [%, unit]	Qv [%, unit]	Density [g/cm³]	Temperature [°C]	Concentration [%]	Net mass flow	Standard density g/cm³]	Standard volume [20 °C]	All counters	
98	No Frontend Board detected. Wrong connection. Defect Frontend.	0	0	1	–	0	0	1	0	–	⚠
96	ADC Failure on Frontend Board.	0	0	0	0	0	0	0	0	–	⚠
94	Safety Alarm Curr.Out 31/32	–	–	–	–	–	–	–	–	–	⚠
93	Sensor failure or disconnected.	0	1)	1)	20	1)	1)	1)	1)	–	⚠
92	Electronics failFrontend Board.	0	0	1	20	0	0	1	0	–	⚠
91	MB voltages outside range.	–	–	–	–	–	–	–	–	–	Current output 31 /32 /U_{CO}: ⚠↓ only
90	Frontend temp. out of range.	1)	0	1	20	0	0	1	0	–	⚠
88	FEB communication error.	0	0	1	20	0	0	1	0	–	⚠
86	Curr.Out 31/32 com error.	–	0	1	–	0	0	1	0	–	⚠
84	NV data defect. Data storage irreparable.	0	0	–	–	–	0	–	0	–	0
82	Incompatible Frontend Board.	0	–	–	–	–	–	–	–	STOP	–
80	Electronics failFrontend Board.	0	–	–	–	–	–	–	–	0	–
78	Flowrate to zero	0	0	1	–	0	0	1	0	–	⚠

		Process values								Counter	Current output
Priority	Error text	Qm [%, unit]	Qv [%, unit]	Density [g/cm³]	Temperature [°C]	Concentration [%]	Net mass flow	Standard density g/cm³]	Standard volume [20 °C]	All counters	
76	All totalizer stopp.	–	0	0	0	0	0	0	0	–	⚠
74	Totalizer reset. Reset of one or more Totalizers.	–	–	–	–	–	–	–	–	–	⚠
72	Simulation is on! Simulating process/output value	–	–	–	–	–	–	–	–	–	–
70	An alarm is simulated.	–	–	–	–	–	–	–	–	–	–
65	CO31/32 readbackcurrent deviates	–	–	–	–	–	–	–	–	–	–
60	Sensor heat emission limit.	–	–	–	–	–	–	–	–	–	–
59	Reserved 36	0	0	–	–	–	0	–	0	–	–
58	Invalid Sensor configuration	–	2)	1	–	2)	2)	2)	2)	–	–
57	Sensor temperature out of range.	1)	1)	1)	20	1)	1)	1)	1)	–	–
52	Curr.Out 31/32 is saturated.	–	–	–	–	–	–	–	–	–	Current output 31 /32 /U_{CO} only: **HOLD**, ⚠↓, ⚠↑
51	Curr.Out V1/V2, V3/V4 saturated	–	–	–	–	–	–	–	–	–	Current output V1 / V2, V3 / V4: **HOLD**, ⚠↓, ⚠↑
49	Option Card 1 com error.	–	–	–	–	–	–	–	–	–	Only with current output V1 / V2 ⚠↓,
48	Option Card 2 com error.	–	–	–	–	–	–	–	–	–	Only with current output V3 / V4: ⚠↓,
47	Dig.Out 41/42 is saturated.	–	–	–	–	–	–	–	–	–	–
46	Mass flowrate exceeds limits.	–	–	–	–	–	–	–	–	–	–
44	Volume flowrate exceeds limits.	–	–	–	–	–	–	–	–	–	–
43	Reserved 37	–	–	–	–	–	–	–	–	–	–
42	Medium temperat exceeds limits.	–	–	–	–	–	–	–	–	–	–
41	Std.Volume flow exceeds limits.	–	–	–	–	–	–	–	–	–	–
40	Sensor soiling detected.	–	–	–	–	–	–	–	–	–	–
38	Sensor memory defective.	–	–	–	–	–	–	–	–	–	–
37	NV chips defect on Motherboard.	–	–	–	–	–	–	–	–	–	–
32	Curr.Out 31/32 not calibrated.	–	–	–	–	–	–	–	–	–	–
31	Curr.Out V1/V2 not calibrated.	–	–	–	–	–	–	–	–	–	–
30	Curr.Out V3/V4 not calibrated.	–	–	–	–	–	–	–	–	–	–
28	Display value is<1600h at Qmax.	–	–	–	–	–	–	–	–	–	–
26	Maintenance interval is reached	–	–	–	–	–	–	–	–	–	–
24	Device not calibrated.	–	–	–	–	–	–	–	–	–	⚠
20	Communicat. card not responding	–	–	–	–	–	–	–	–	–	–

… 10 Diagnosis / error messages

Error messages

Error number	Error text	Description	NAMUR classification
F098.011	No Frontend Board detected. Wrong connection. Defect Frontend.	Communication error to frontend board (FEB) of the sensor. No frontend board found, frontend board defective. • For remote mount design: check signal cable connection between sensor and transmitter. • Restart the device • Replace frontend board • Contact ABB Service	Failure
F096.029	ADC Failure on Frontend Board.	AD-converter error in frontend board (FEB) of the sensor. EMC defects, frontend board defective • Check installation • Restart the device • Replace frontend board • Contact ABB Service	Failure
F094.021	Safety Alarm Curr.Out 31/32	Error in current output 31 / 32 / Uco • Check electrical connection current output 31 / 32 / Uco • Contact ABB Service	Failure
F093.033	Sensor failure or disconnected.	Electrical connection of the sensor or the thermal measuring element is defective. Sensor not connected, signal cable defective, sensor element defective. • For remote mount design: check signal cable connection between sensor and transmitter. • Check thermal measuring element • Contact ABB Service	Failure
F092.030	Electronics failFrontend Board.	Electronics error in frontend board (FEB) of the sensor. EMC defects, frontend board defective • Check installation • Restart the device • Replace frontend board • Contact ABB Service	Failure
F088.012	FEB communication error.	Communication error to frontend board (FEB) of the sensor. Electro magnetic interference. • For remote mount design: check signal cable connection between sensor and transmitter. • Restart the device • Contact ABB Service	Failure
F086.018	Curr.Out 31/32 com error.	Communication error to current output 31 / 32 / Uco. Electro magnetic interference, faulty motherboard in transmitter. • Contact ABB Service	Failure
F084.010	NV data defect. Data storage irreparable.	Error in SensorMemory. Memory module defective • Contact ABB Service	Failure
F082.013	Incompatible Frontend Board.	Incompatible frontend board. The frontend board is not compatible with the motherboard in the transmitter. • Contact ABB Service	Failure
F081.041	FEB voltages outside range.	Frontend board power supply defective. Frontend board defective. • Check power supply • Replace frontend board • Contact ABB Service	Failure
F080.025	MB voltages outside range.	Motherboard power supply defective Faulty motherboard. • Contact ABB Service.	Failure

Error number	Error text	Description	NAMUR classification
C078.003	Flowrate to zero	External switch-off active via digital input. • Check status of digital input. • Check parameterization.	Functional check
C076.005	All totalizer stopp.	External totalizer switch-off active via digital input. • Check status of digital input. • Check parameterization.	Functional check
C074.006	Totalizer reset. Reset of one or more Totalizers.	Reset of one or more counters. • Check status of digital input. • Check parameterization.	Functional check
C072.002	Simulation is on! Simulating process/output value	Simulation mode is active. • Deactivate simulation mode in the 'Diagnostics / .....Simulation Mode' menu.	Functional check
C070.026	An alarm is simulated.	The alarm simulation is active. • Deactivate alarm simulation in the 'Diagnostics / ...Alarm Simulation' menu.	Functional check
S090.031	Sensor temperature out of range.	The temperature of the thermal measuring element is outside the permissible limits. Measuring medium temperature outside of the set alarm threshold or permissible limit values. • Check parameterization, see menu **Menu: Process Alarm** on page 131 • Check process conditions, see chapter **Process conditions** on page 35	Out of specification
S065.028	CO31/32 readbackcurrent deviates	Current loop error current output 31 / 32. • Check current loop current output 31 / 32 (short-circuit / interruption). • Check load current output 31 / 32. • Check the power supply (voltage) of the transmitter.	Out of specification
S055.032	Frontend temp. out of range.	Device temperature outside of permissible limit values. • Check ambient temperature (see **Ambient conditions** on page 31)	Out of specification
S052.016	Curr.Out 31/32 is saturated.	Current output 31 / 32 overshot. The flow has exceeded the set upper measuring range value. • Check the upper range value Qv@ Max, Qm Max in the 'Device Setup / ...Sensor' menu and correct if necessary.	Out of specification
S051.017	Curr.Out V1/V2, V3/V4 saturated	Current output V1 / V2, V3 / V4 (plug-in card) overshot. The flow has exceeded the set upper measuring range value. • Check the upper range value Qv@ Max, Qm Max in the 'Device Setup / ...Sensor' menu and correct if necessary.	Out of specification
S049.019	Option Card 1 com error.	Communication error to plug-in card. • Check that the plug-in card is installed correctly. • Replace plug-in card if necessary. • Contact ABB Service.	Out of specification
S048.020	Option Card 2 com error.		
S047.015	Dig.Out 41/42 is saturated.	The pulse rate or the frequency at the pulse output 41 / 42 is outside the permissible limits. • Check configuration of the parameters for the pulse output.	Out of specification
S046.042	Dig.Out 51/52 is saturated.	The pulse rate or the frequency at the pulse output 51 / 52 is outside the permissible limits. • Check configuration of the parameters for the pulse output.	Out of specification

… 10 Diagnosis / error messages

… Error messages

Error number	Error text	Description	NAMUR classification
S045.034	Sensor heat emission limit.	Heat emission limits of the measuring element up-scaled. Flow rate too high, incorrect measuring medium • Check the process conditions	Out of specification
S044.000	Mass flowrate exceeds limits.	The mass flow is below or above the configured limit values 'Qm Massflow Min' and 'Qm Massflow Max'. • Check the settings of the parameters in the 'Process Alarm / …Alarm Limits' menu and adjust if necessary. • Check mass flow.	Out of specification
S042.037	Medium temperat exceeds limits.	The measuring medium temperature is below or above the configured limit values 'Tm Temperature Min' and 'Tm Temperature Max'. • Check the settings of the parameters in the 'Process Alarm / …Alarm Limits' menu and adjust if necessary. • Check measuring medium temperature.	Out of specification
S041.039	Std.Volume flow exceeds limits.	The standard volume flow is below or above the parameterized limit values "Qv@ Volumeflow Min" and "Qv@ Volumeflow Max". • Check the settings of the parameters in the 'Process Alarm / …Alarm Limits' menu and adjust if necessary. • Check volume flow rate.	Out of specification
M059.038	Invalid Sensor configuration	Parameterization (configuration) of the device is incorrect. • Check parameterization (configuration) • Contact ABB Service	Maintenance required
M058.040	Sensor soiling detected.	Thermal measuring element contaminated. • Check thermal sensor elements and clean as needed **Maintenance** on page 148)	Maintenance required
M038.009	Sensor memory defective.	SensorMemory missing or defective • Check SensorMemory • Replace SensorMemory • Contact ABB Service	Maintenance required
M037.014	NV chips defect on Motherboard.	Memory module on the motherboard defective. • Contact ABB Service	Maintenance required
M032.022	Curr.Out 31/32 not calibrated.	Current output 31 / 32, Uco not calibrated. • Contact ABB Service.	Maintenance required
M031.023	Curr.Out V1/V2 not calibrated.	Current output (plug-in card) V1 / V2 or V3 / V4 not calibrated. • Check plug-in card and replace if necessary.	Maintenance required
M030.024	Curr.Out V3/V4 not calibrated.	• Contact ABB Service.	
M028.007	Display value is<1600h at Qmax.	The current counter reading has exceeded the display resolution. • Check the unit setting for the mass counters / volume totalizers and adjust if necessary.	Maintenance required
M026.004	Maintenance interval is reached	Maintenance interval reached. • Perform maintenance work. • Start new maintenance interval in the 'Diagnostics / …Diagnosis Control' menu.	Maintenance required
M024.008	Device not calibrated.	Have device calibrated. • Contact ABB Service.	Maintenance required
M020.027	Communicat. card not responding	Fieldbus plug-in is not reacting. • Plug-in card is defective. • Contact ABB Service.	Maintenance required

‘SensorCheck’ diagnosis function

SensorCheck compares the characteristic values of the installation fingerprint with those of the current device fingerprint. As a result, changes to the sensor element such as contamination or damage, for example, can be detected early on and the integrity of the measurement can be guaranteed.

Note
The SensorCheck lasts approx. 12 min. Make sure that during the test there is no flow through the sensor (e.g. by shutting or sealing it off).

Menu / parameter	Description
Diagnostics / ...SensorCheck / **...Verify Fingerprint**	
Verify	Fingerprint testing manual start using .
Result	Read fingerprint status • in progress: SensorCheck is running. • incomplete: SensorCheck has been aborted. • done: SensorCheck has successfully completed. If an error of the SensorCheck should occur, restart it at a later time. If the SensorCheck still cannot be completed successfully, contact ABB Service.
Value TDC1	Read VeriMass parameters.
Value TDC2	• Value TDC1: Temperature change TDC1
Value HDC1	• Value TDC2: Temperature change TDC2
Value HDC2	• Value HDC1: Heat emission change HDC1 • Value HDC2: Heat emission change HDC2

Assessment of the result

Assessment of the results of the VeriMass parameters TDC1, TDC2, HDC1, HDC2 must be conducted individually and depending on the application. The following table provides values for a rough estimation.

Parameters	Description / recommended measures
Value TDC1	A deviation of **> ±2 K** indicates a defect of the sensor elements, the HDC characteristic values are not longer certain. • Disassemble the sensor, check the sensor element. • Contact ABB Service, if necessary.
Value TDC2	A deviation of **> ±10 %** indicates a defect of the sensor elements, the HDC characteristic values are not longer certain. • Disassemble the sensor, check the sensor element. • Contact ABB Service, if necessary.
Value HDC1	A deviation of **> ±100 %** indicates contamination of the sensor element, but the effect on the measured values is minimal in a normal situation. • Check the sensor element and clean as needed.
Value TDC2	A deviation of **> ±100 %** indicates contamination of the sensor element, the effect on the measured values is **large** in this case. • Check the sensor element and clean as needed.

11 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 7.

⚠ 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.

Corrective maintenance work may only be performed by trained personnel.
- Before removing the device, depressurize it along with any adjacent lines or vessels.
- Check whether hazardous materials have been used as measuring medium before opening the device. Residual amounts of hazardous material may still be present in the device and could escape when it is opened.

Within the scope of operator responsibility, check the following as part of a regular inspection:
- pressure-carrying walls / pressure equipment liner
- the measurement-related function
- the leak tightness
- the wear (corrosion)

Sensor

The flowmeter essentially requires no maintenance.
The following items should be checked annually:

- Ambient conditions (air circulation, humidity),
- Tightness of the process connections,
- Cable entries and cover screws,
- Operational reliability of the power supply, lightning protection, and station ground.

Repairs to the flowmeter

If repairs to the flowmeter are required, observe **Repair** on page 151.

Cleaning

When cleaning the exterior of meters, make sure that the cleaning agent used does not corrode the housing surface and the seals.
To avoid static charge, a damp cloth must be used for cleaning.

Cleaning the sensor element

It can be necessary to clean the thermal measuring element when measuring gases with damp contamination.
The cleaning interval depends on the degree of contamination of the measuring element and must be individually defined.

NOTE

Damage to the sensor due to improper cleaning!

- Do not clean the sensor element with hard objects (screwdrivers, tweezers or wire brushes).
- Do not clean the sensor element in an ultrasonic bath.
- Do not clean or dry the measuring element with pressurized air.

1. Switch off the power supply.
2. Disconnect electrical connections.
3. Disassemble the sensor from the pipe component or hot tap fitting, as described in **Assembly of the pipe component** on page 36 and **Installation / Disassembly of the sensor in connection with the hot tap fitting** on page 49.
4. Carefully clean the measuring element with warm water or an alcohol solution using a soft brush or cotton swab.
5. Allow the sensor to dry or carefully dry with warm air.
6. Check that the gasket between the sensor and pipe component or welding adapter is clean and in good condition; if necessary replace it with a new gasket (O-Ring Ø 55 mm × 3 mm (2.16 in × 0.12 in).
7. Install the sensor in the pipe component or hot tap fitting, as described in chapter **Assembly of the pipe component** on page 36 and **Installation / Disassembly of the sensor in connection with the hot tap fitting** on page 49.
8. Perform electrical connection (see **Electrical connections** on page 61).
9. Perform commissioning (see **Commissioning** on page 79).

Integrated hot tap fitting

Replace the O-ring gaskets

⚠ DANGER

Danger of injury due to improper maintenance!
Danger of injury due to leaking measuring medium during disassembly of the changing device with piping under pressure.

- Before starting maintenance, depressurize the piping and rinse.

⚠ DANGER

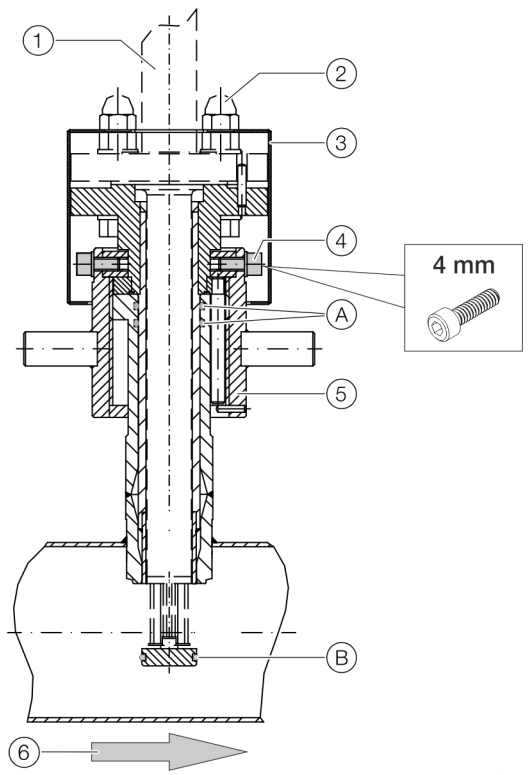
Risk of fire!
Risk of fire due to the use of non-permissible grease for oxygen applications.

- Only use permissible fitting grease for oxygen applications (e.g. Krytox GPL-226).

After approx. 100 sensor installation and disassembly procedures, the O-ring gaskets on the changing device must be replaced. If you are working with dusty, abrasive or aggressive measuring media, it may be necessary to replace these more frequently.
O-ring gaskets may only be replaced by the manufacturer's service department or by qualified personnel employed by the operator.

… 11 Maintenance

… Integrated hot tap fitting



1. Sensor
2. Special screws
3. Protection cap
4. Fixing screws for union nuts (4×)
5. Union nut
6. Flow direction

Figure 91: Gaskets on the hot tap fitting

O-ring seals		
Pos.	**Quantity**	**Design**
A	2	O-ring Ø 36 × 3 mm (1.42 × 0.12 in), Viton
B	1	O-ring Ø 26 × 3 mm (1.02 × 0.12 in), Viton

1. Disassemble the sensor (see **Installation / Disassembly of the sensor in connection with the hot tap fitting** on page 49).
2. Loosen the fixing screws of the union nut and pull the guide tube out of the changing device. Clean the guide tube if necessary.
3. Replace both inside O-rings on the changing device and the O-ring of the guide tube. Lightly lubricate the O-rings as well as the threads of the union nut and slip ring of the guide tube.
4. Insert the guide tube in the changing device and tighten the fixing screws of the union nut as far as the limit stop in exactly the same position as during disassembly.
5. Verify correct installation by rotating the lock nut into measuring and disassembly positions.
6. Install the sensor (see chapter **Installation / Disassembly of the sensor in connection with the hot tap fitting** on page 49).

12 Repair

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

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 7.

⚠ 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.

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 54 to open and close the housing safely.

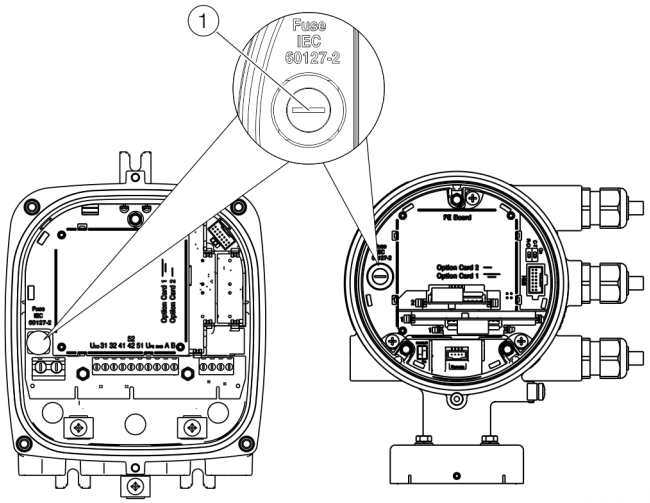
Spare parts

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

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

… 12 Repair

Replacing the fuse



① Fuse holder

Figure 92: Fuse holder position

There is a fuse in the transmitter housing.

Power supply transmitter	**11 to 30 V DC**	**100 to 240 V AC**
Rated current of fuse	1.25 A	0.8 A
Nominal voltage of fuse	250 V AC	250 V AC
Design	Device fuse 5 x 20 mm	
Breaking capacity	1500 A at 250 V AC	
Ordering number	3KQR000757U0100	3KQR000757U0200

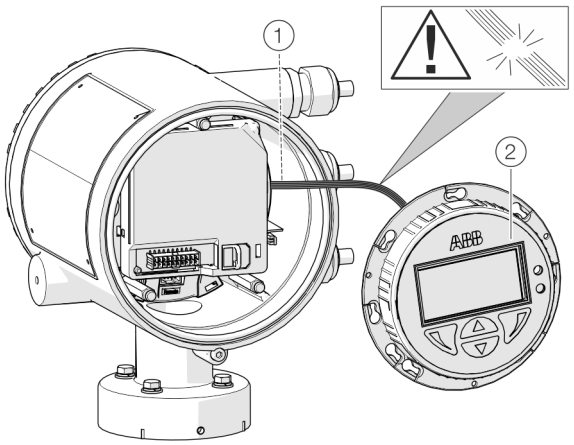
Perform the following steps to replace the fuse:

1. Switch off the power supply.
2. Open the transmitter housing.
3. Pull out the defective fuse and insert a new fuse.
4. Closing the transmitter housing.
5. Switch on the power supply.
6. Check that the device is working correctly.

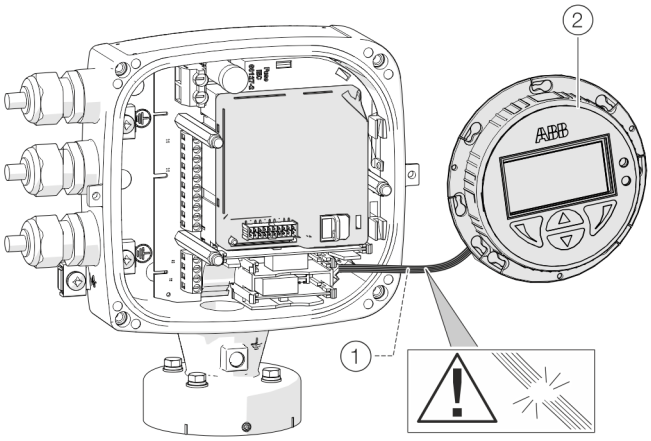
If the fuse blows again on activation, the device is defective and must be replaced.

Replacing the LCD indicator

Dual-compartment housing



Single-compartment housing



① LCD indicator cable harness

② LCD indicator

Figure 93: Replacing the LCD Indicator (example)

The LCD indicator can be replaced in the event of a malfunction.

Component	Ordering number
LCD indicator (HMI) For integral mount and remote mount design	3KQZ407125U0100

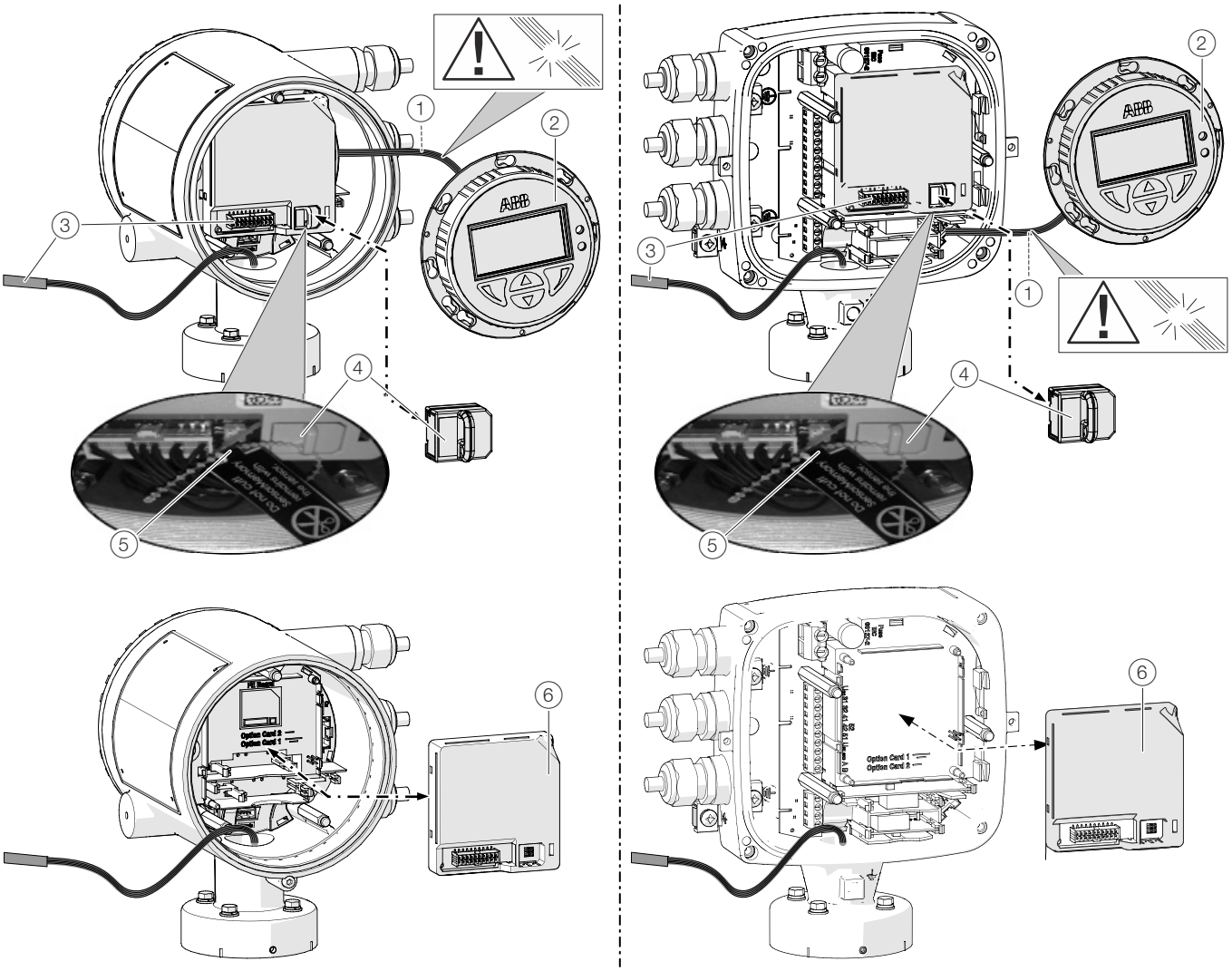
Replace the LCD indicator by following the steps below:

1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Loosen fixing screws for LCD indicator (only in integral mount design).
4. Remove the LCD indicator.
5. Pull the connector out of the motherboard.
6. Attach the connector on the new LCD indicator. Ensure that the cable harness is not damaged.
7. Insert the LCD indicator and tighten if necessary.
8. Unscrew / set down the cover once again
9. Switch on the power supply.

… 12 Repair

Replacing the slide-in

Integral mount design



① LCD indicator cable harness
② LCD indicator
③ Sensor cable harness
④ SensorMemory
⑤ Cable retainer
⑥ Frontend board

Figure 94: Replacing LCD indicator and frontend board (example)

In the event of a fault, the frontend board can be replaced on flowmeters with an integral mount design.

Component	Ordering number
Frontend board (FEB)	3KXF002810U0100

Replace the frontend board as follows:

1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Remove the LCD indicator. Ensure that the cable harness is not damaged.
4. Pull the connector out of the sensor cable harness.
5. Pull out the SensorMemory.

Note

The SensorMemory is assigned to the sensor. The SensorMemory is therefore fastened to the sensor cable harness with a cable retainer.

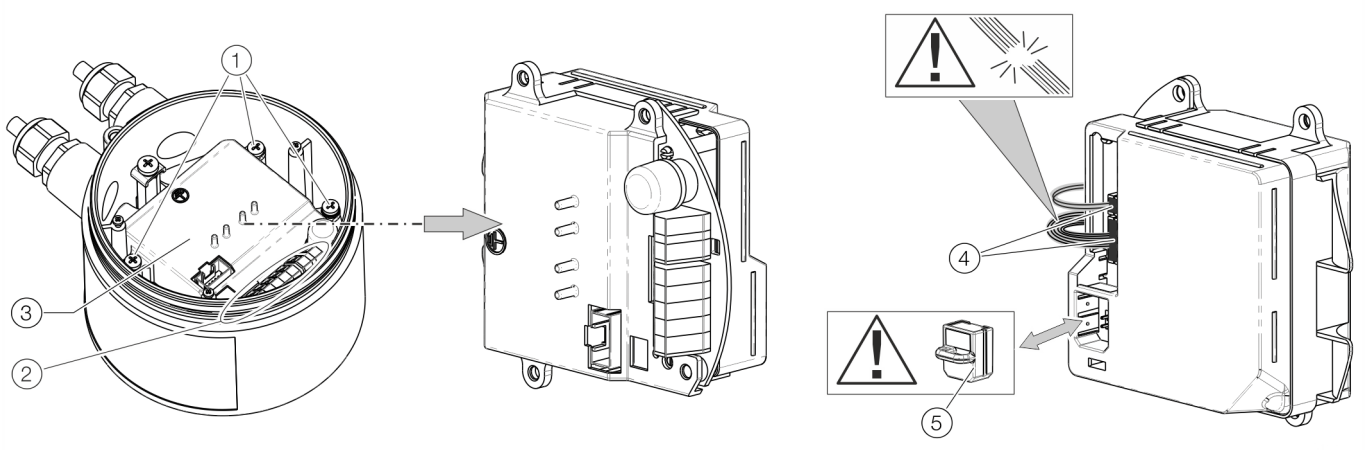
- Make sure that the SensorMemory remains with the sensor and cannot be lost!

6. Pull the faulty frontend board out forwards.
7. Insert new frontend board.
8. Attach connector from the sensor cable harness.
9. Attach the SensorMemory.
10. Insert the LCD indicator and screw on /replace the cover.

… 12 Repair

… Replacing the slide-in

Remote mount design



1. Frontend board fixing screw
2. Terminals
3. Frontend board
4. Connections for flowmeter sensor
5. SensorMemory

Figure 95: Replacing the frontend board (flowmeter sensor)

The sensor electronic unit (slide-in module) can be replaced in the event of a malfunction.

Component / version	Order no.
Sensor electronic unit (slide-in module) (non-Ex, Ex Zone 2, Division 2)	3KXF002812U1100
Sensor electronic unit (slide-in module) (Ex Zone 1)	3KXF002812U1200
Sensor electronic unit (slide-in module) (Division 1)	3KXF002812U1300

Perform the following steps to replace the sensor electronic unit:

1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Loosen the fixing screws (3×) on the sensor electronic unit.
4. Disassemble the defective sensor electronic unit.
5. Pull the connector out of the sensor cable harness. Ensure that the cable harness is not damaged.
6. Pull out the SensorMemory.

Note
The SensorMemory is assigned to the sensor. Ensure that the SensorMemory remains with the sensor and cannot be lost!

7. Insert the SensorMemory into the new sensor electronic unit.
8. Connect the plug of the sensor cable harness.
9. Insert the new sensor electronic unit and secure it with the fixing screws (3×).
10. After powering up the power supply, the transmitter automatically replicates the system data from the SensorMemory.

Replacing 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.

Note
The frontend board of the replacement sensor has a SensorMemory module.
The calibration and system data of the sensor is stored in the SensorMemory.
After powering-up the power supply, the transmitter automatically replicates the system data from the SensorMemory.

Replace the sensor as described below:

1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Disconnect the signal cable (if necessary, remove the potting compound).
4. Install the new sensor in accordance with **Installation** on page 32.
5. Complete the electrical connection in accordance with **Electrical connections** on page 61.
6. Unscrew / set down the cover once again
7. After powering-up the power supply, the transmitter automatically replicates the system data from the SensorMemory.

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 159) 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 acc. to page 6 for nearest service location.

13 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 157.

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.

14 Specification

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

15 Additional documents

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

Trademarks

HART is a registered trademark of FieldComm Group, Austin, Texas, USA

Modbus is a registered trademark of Schneider Automation Inc.

PROFIBUS and PROFIBUS DP are registered trademarks of PROFIBUS & PROFINET International (PI)

Swagelok is a registered trademark of the Swagelok Company

Kalrez and Kalrez Spectrum are registered trademarks of DuPont Performance Elastomers.

Viton is a DuPont de Nemours trademark

16 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.

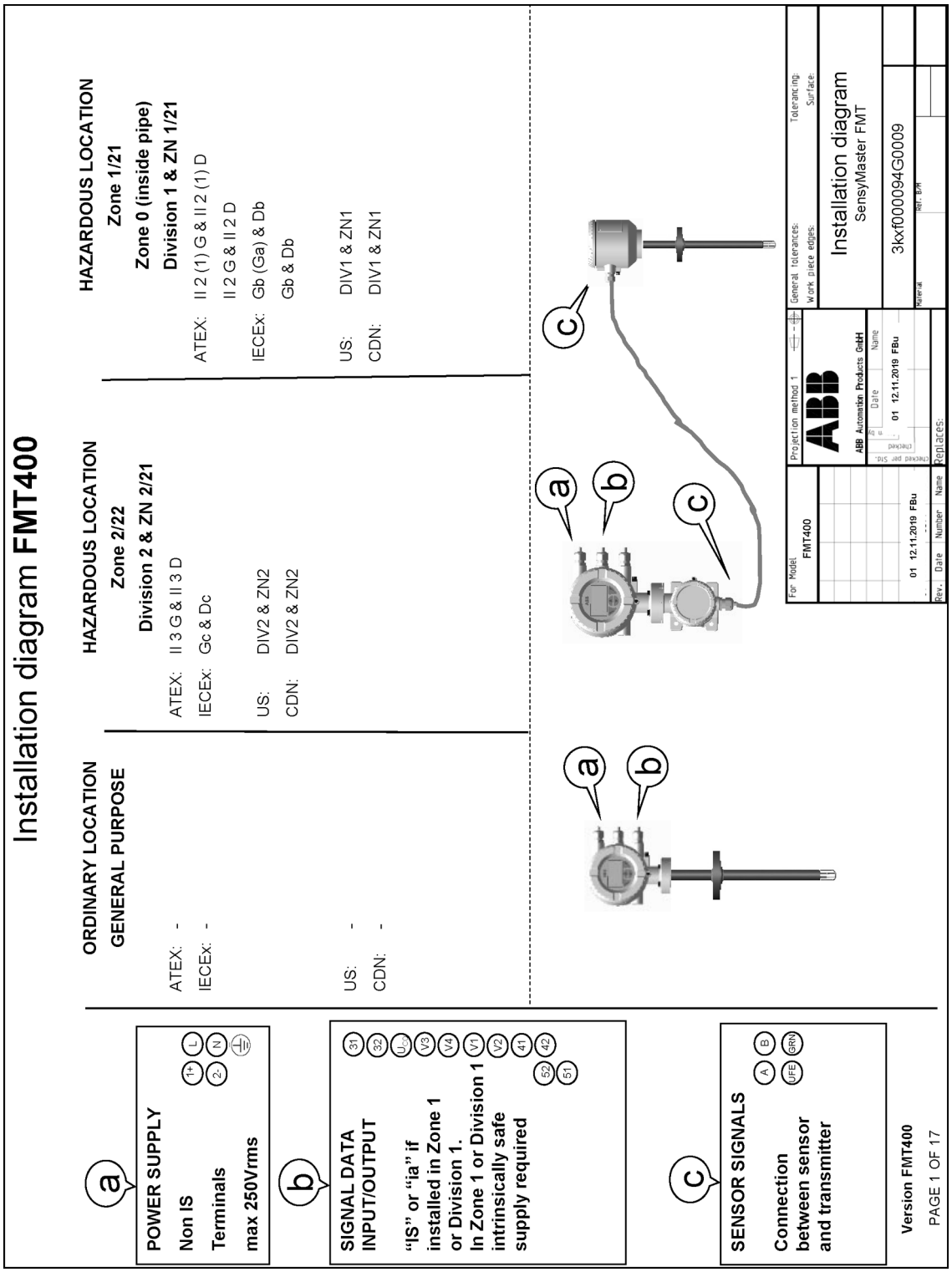
We hereby state that the devices/components shipped have been cleaned and are free from any dangerous or poisonous substances.

Town/city, date Signature and company stamp

… 16Appendix

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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Version FMT400

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

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… FMT400 Installation diagram 3kxf000094G0009

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Zone 2/22 & Division 2

Model code
FMT4bcY0
FMT4bcA2
FMT4bcF2
HART Communication

Indication	Abbr.	Status	Option	Terminal	Operating Value			
					GP		Ex ec / NI	
		Active or Passive	Choosen Option depending on Model Number (MN)	If "or" occurs Terminal depends on MN	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

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

Version FMT400
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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

General tolerances: Tolerancing:
Work piece edges: Surface:

ABB Automation Products GmbH

Installation diagram
SensyMaster FMT

Rev.	Date	Number	Name
	01 12.11.2019		FBu

Date Name
01 12.11.2019 FBu
checked per Std.
checked

Replaces:

3kxf000094G0009

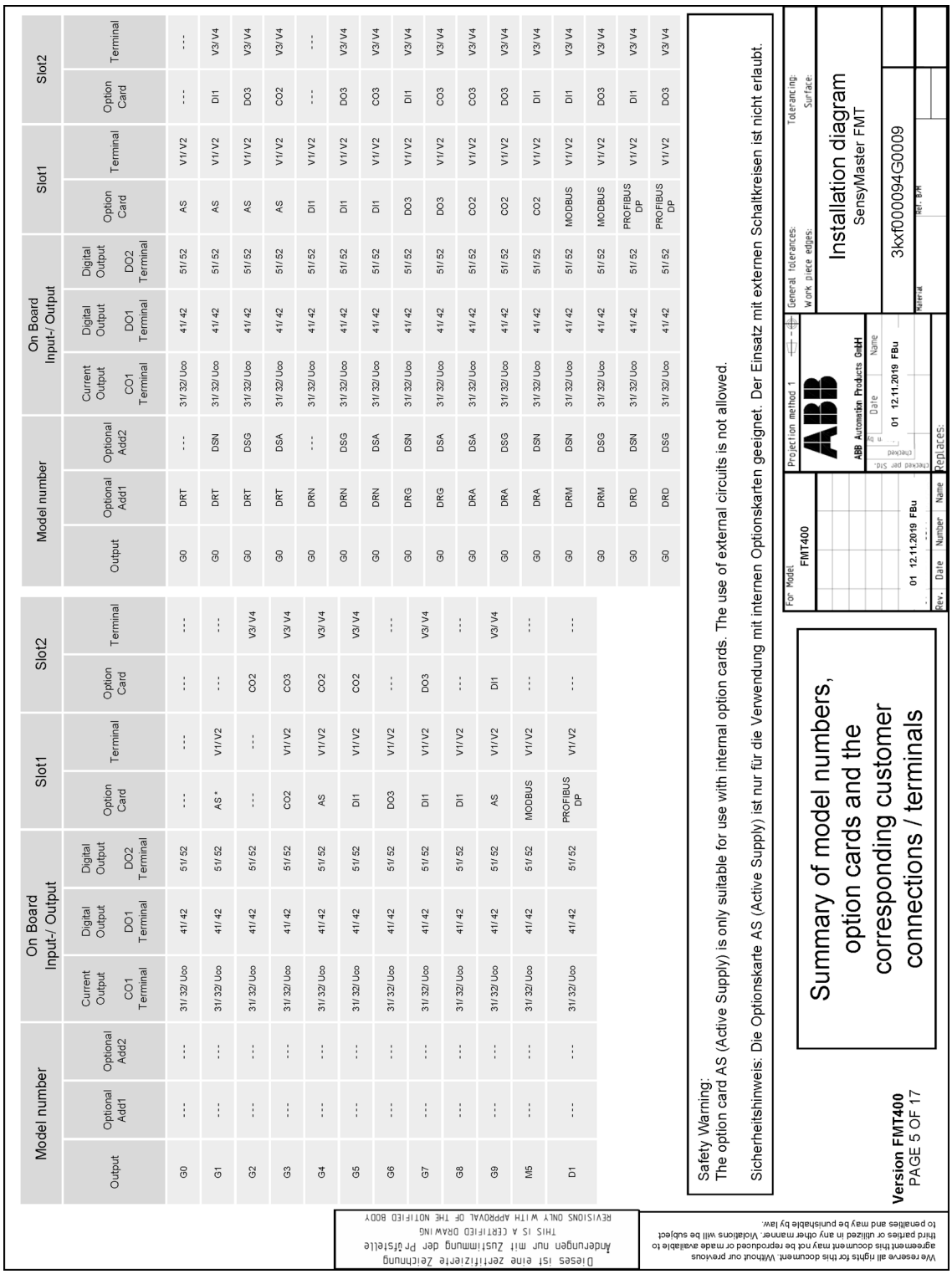
Material: Ref. B/M

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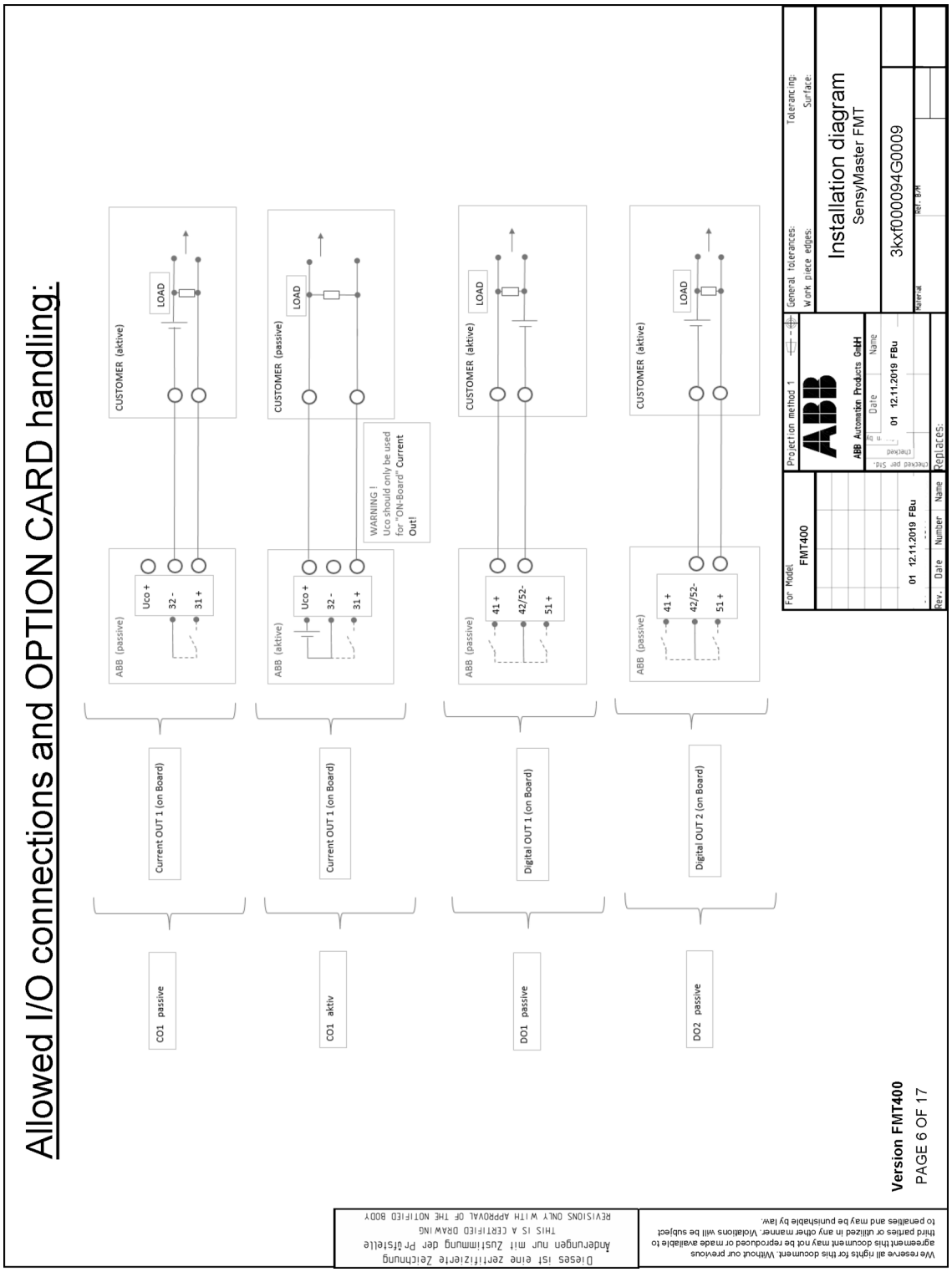
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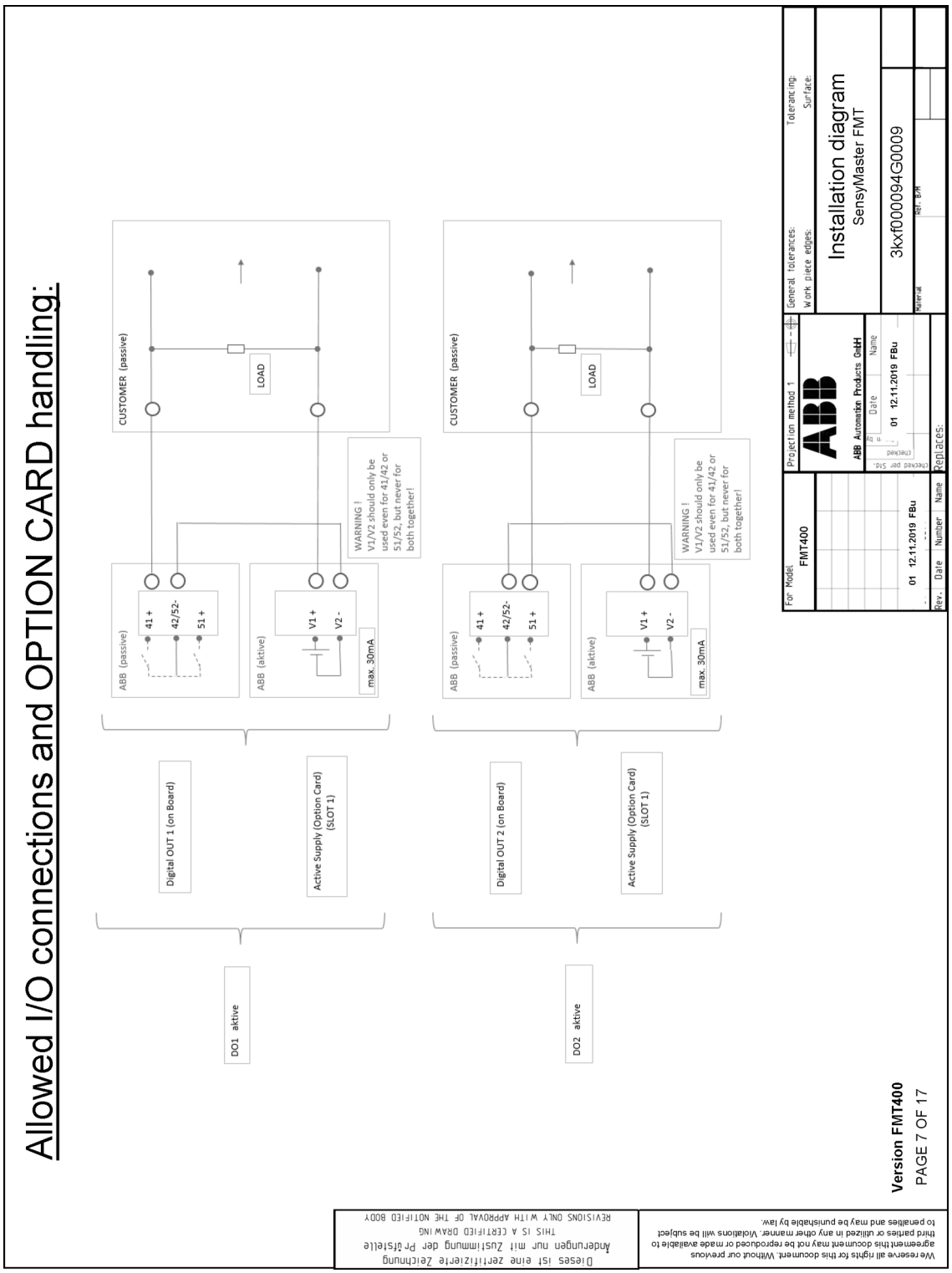
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Allowed I/O connections and OPTION CARD handling:
CO1 passive
CO1 aktiv
DO1 passive
DO2 passive
Current OUT 1 (on Board)
Current OUT 1 (on Board)
Digital OUT 1 (on Board)
Digital OUT 2 (on Board)
ABB (passive)
ABB (aktive)
ABB (passive)
ABB (passive)
Uco +
32 -
31 +
41 +
42/52-
51 +
CUSTOMER (aktive)
CUSTOMER (passive)
CUSTOMER (aktive)
CUSTOMER (aktive)
LOAD
WARNING !
Uco should only be used
for "ON-Board" Current
Out!
Version FMT400
PAGE 6 OF 17
For Model
FMT400
Projection method 1
ABB Automation Products GmbH
Drawn
Date
Name
01 12.11.2019 FBu
Checked
Checked per Std.
General tolerances:
Work piece edges:
Tolerancing:
Surface:
Installation diagram
SensyMaster FMT
3kxf000094G0009
Material
Ref. BOM
Rev.
Date
Number
Name
Replaces:
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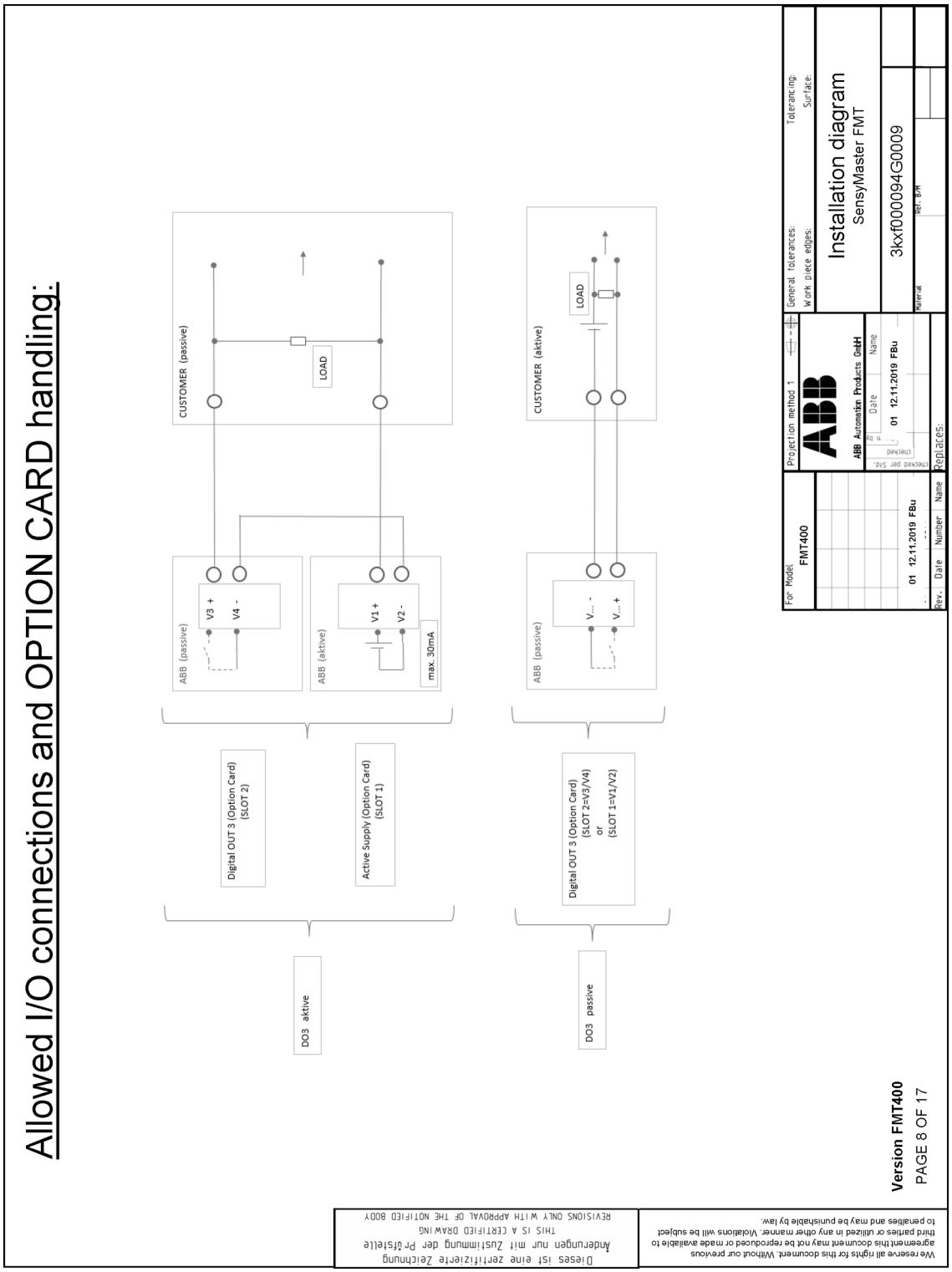
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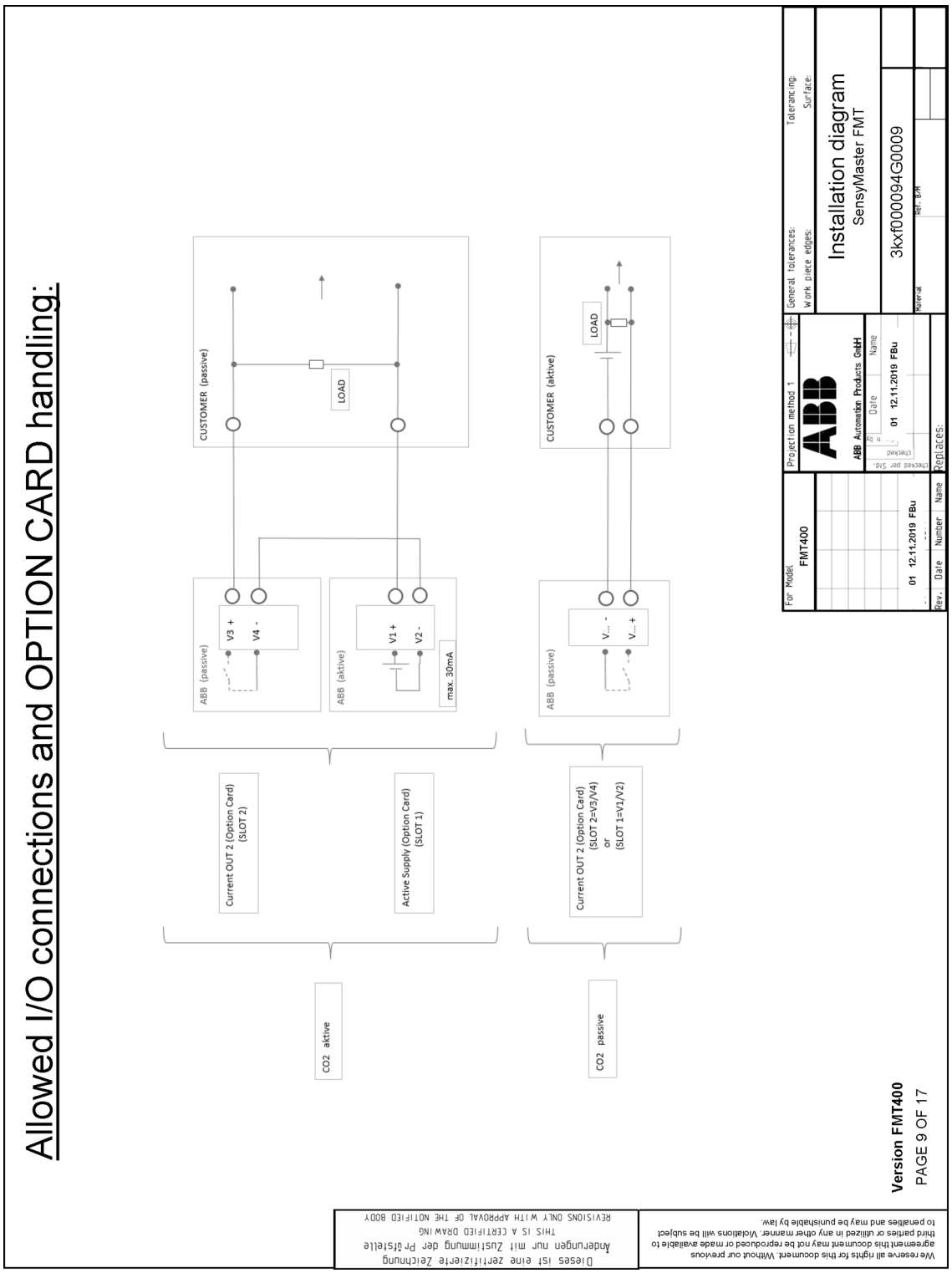
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Allowed I/O connections and OPTION CARD handling:
CUSTOMER (passive)
LOAD
ABB (passive)
V3 +
V4 -
ABB (aktive)
V1 +
V2 -
max. 30mA
Digital OUT 3 (Option Card)
(SLOT 2)
Active Supply (Option Card)
(SLOT 1)
DO3 aktive
CUSTOMER (aktive)
LOAD
ABB (passive)
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 Automation Products GmbH
Date
Name
01 12.11.2019 FBu
Checked
Checked per Std
General tolerances:
Work piece edges:
Tolerancing:
Surface:
Installation diagram
SensyMaster FMT
3kxf000094G0009
Material
Rev. Date Number Name
Replaces:
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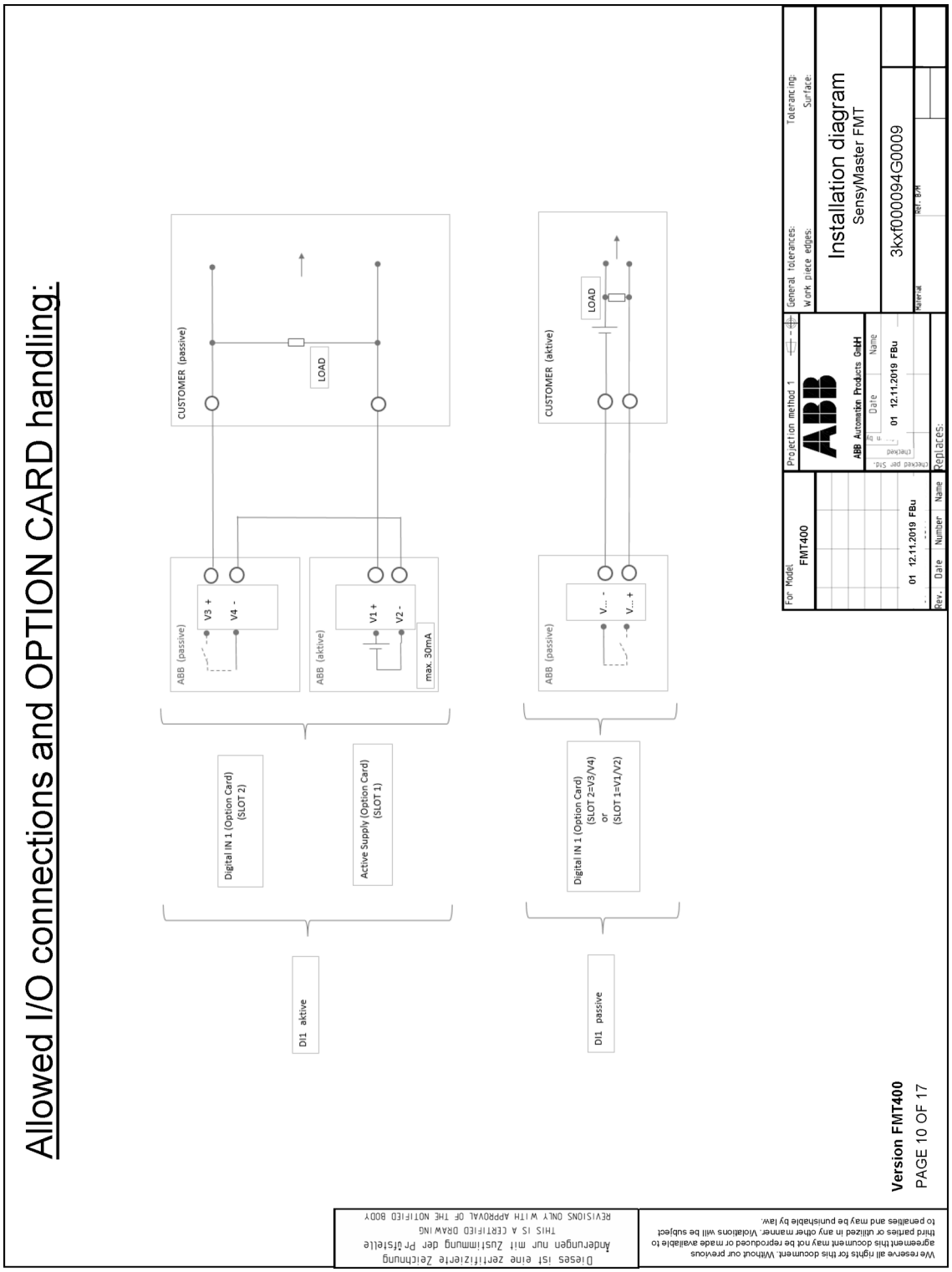
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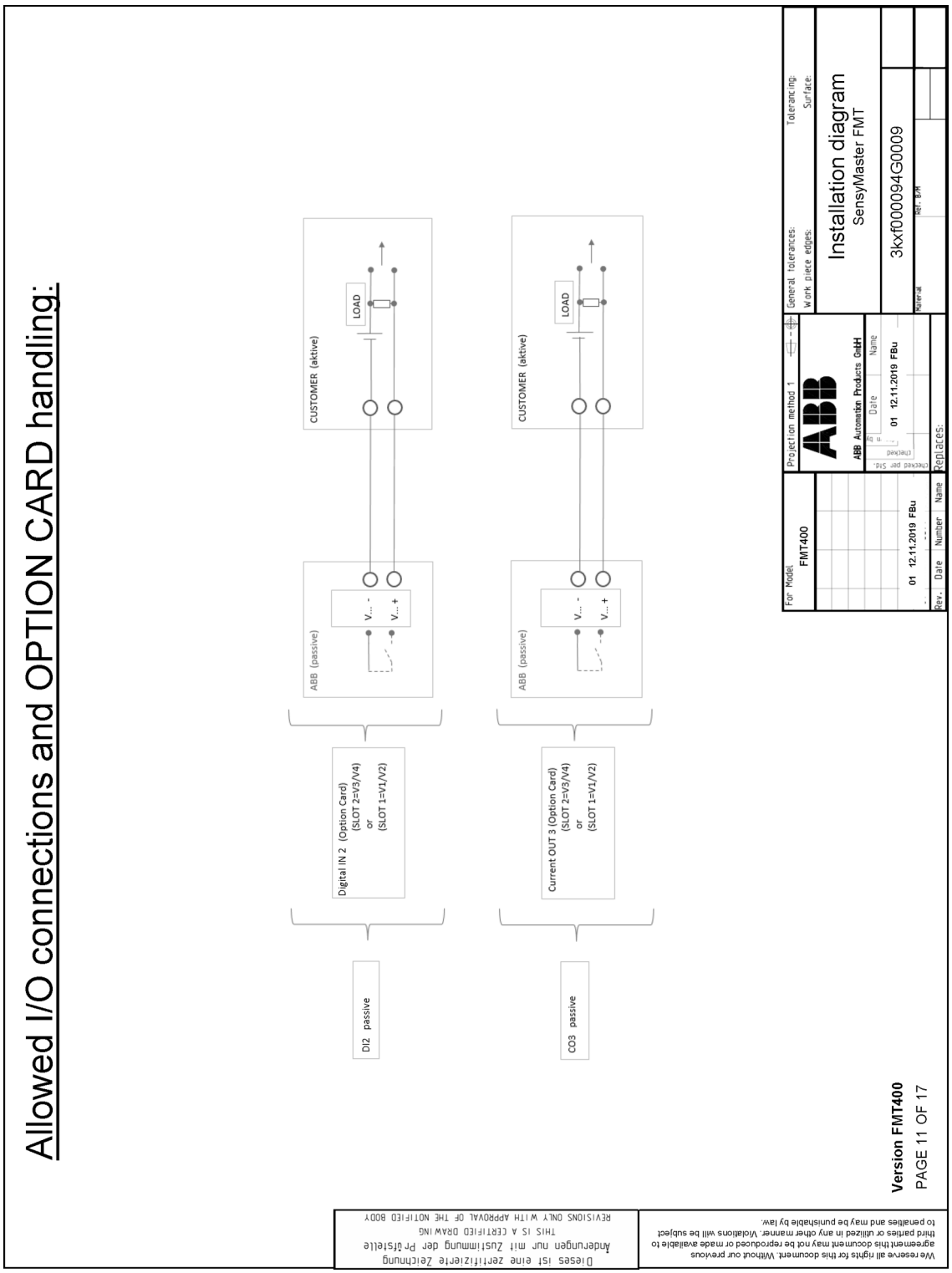
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Allowed I/O connections and OPTION CARD handling:
CUSTOMER (passive)
LOAD
ABB (passive)
V3 +
V4 -
ABB (aktive)
V1 +
V2 -
max. 30mA
Digital IN 1 (Option Card)
(SLOT 2)
Active Supply (Option Card)
(SLOT 1)
DI1 aktive
CUSTOMER (aktive)
LOAD
ABB (passive)
V... -
V... +
Digital IN 1 (Option Card)
(SLOT 2=V3/V4)
or
(SLOT 1=V1/V2)
DI1 passive
Version FMT400
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For Model:
FMT400
Projection method 1
ABB
ABB Automation Products GmbH
Checked
Date
Name
01 12.11.2019 FBu
Checked per Std
Rev. Date Number Name
01 12.11.2019 FBu
Replaces:
General tolerances:
Work piece edges:
Tolerancing:
Surface:
Installation diagram
SensyMaster FMT
3kxf000094G0009
Material
Ref. BOM
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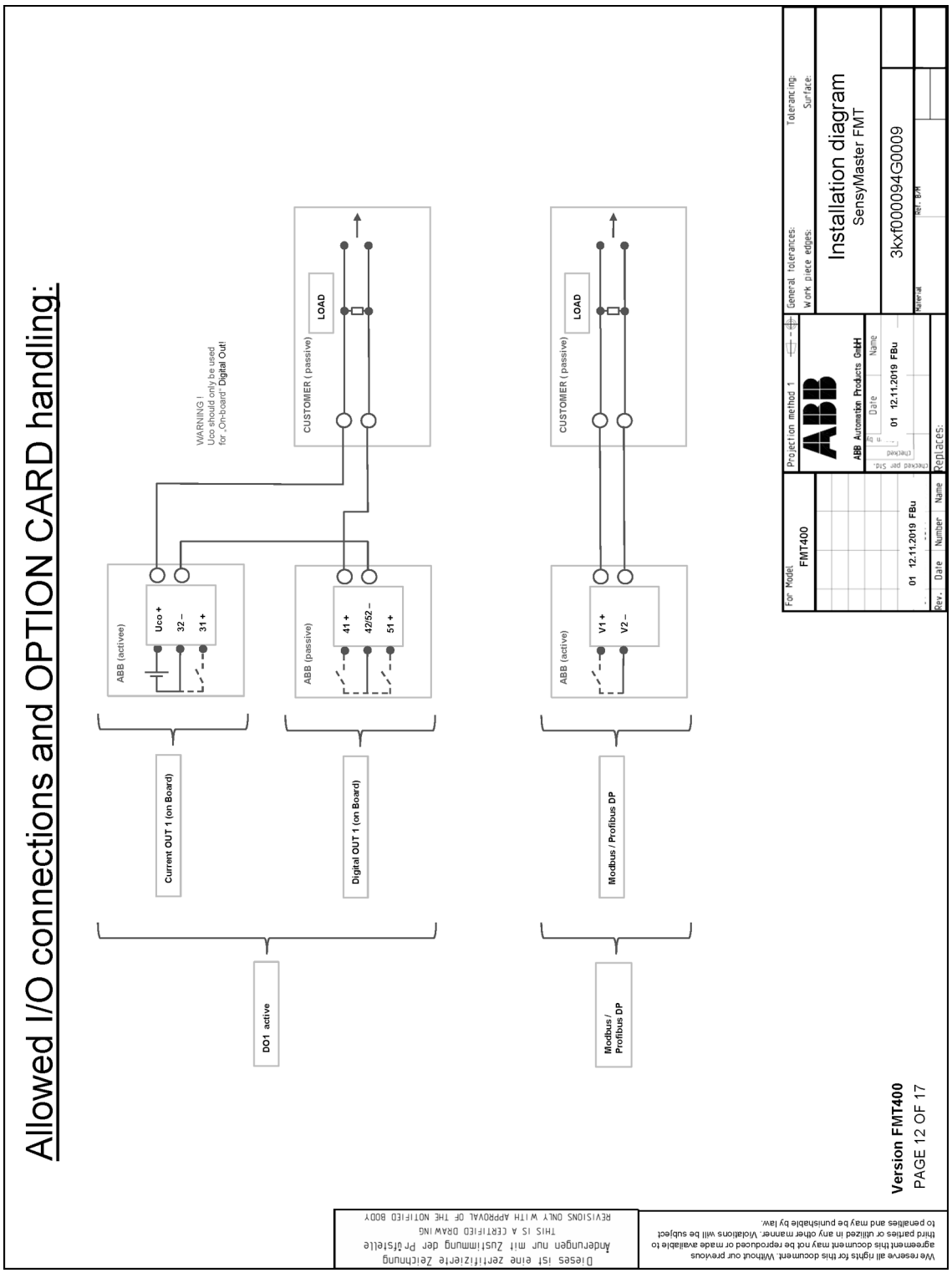
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Allowed I/O connections and OPTION CARD handling:
DO1 active
Modbus / Profibus DP
Current OUT 1 (on Board)
Digital OUT 1 (on Board)
Modbus / Profibus DP
ABB (activ)
Uco +
32 –
31 +
ABB (passive)
41 +
42/52 –
51 +
ABB (active)
V1 +
V2 –
WARNING !
Uco 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
ABB Automation Products GmbH
Name
Date
01 12.11.2019 FBu
General tolerances:
Work piece edges:
Tolerancing:
Surface:
Installation diagram
SensyMaster FMT
3kxf000094G0009
Material
Repl. EPM
Replaces:
Rev. Date Number Name
01 12.11.2019 FBu
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