CoriolisMaster FCB400, FCH400

Coriolis mass flowmeter

Device firmware version: 01.08.00

Measurement made easy

CoriolisMaster FCB430 / 450
CoriolisMaster FCH430 / 450

Introduction

With no up or downstream piping requirements the compact Coriolis flowmeters can be installed in the tightest spaces, enabling applications not possible before.

CoriolisMaster FCB400
The compact Coriolis mass flowmeters from the CoriolisMaster FCB400 series offer low pressure drop, high capacity, an intuitive ABB display featuring a standardized design and cross-product compatibility, five modular inputs and outputs as well as HART communication.

CoriolisMaster FCH400
The compact Coriolis mass flowmeters for hygienic applications from the CoriolisMaster FCH400 series additionally offer EHEDG certified cleanability; all wetted materials are polished.

Additional Information

Additional documentation on CoriolisMaster FCB400, FCH400 is available for download free of charge at www.abb.com/flow.
Alternatively simply scan this code:

Table of contents

1 Safety

General information and instructions

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

Warnings

The warnings in these instructions are structured as follows:

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

Note

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

Intended use

This device is intended for the following uses:

- To convey liquids and gases (including unstable measuring media).
- To meter mass flow directly.
- To meter volumetric flow (indirectly via mass flow and density).
- To measure the density of the measuring medium.
- To measure the temperature of the measuring medium.

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

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

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

Improper use

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

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

Notes on data safety

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 Ltd 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.

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.

Manufacturer’s address

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

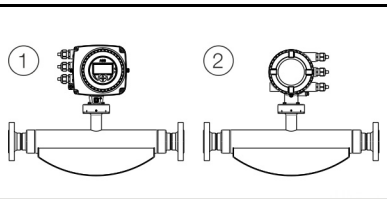
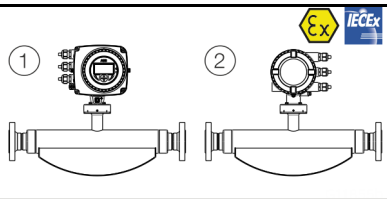
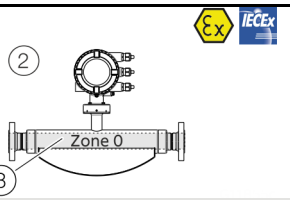
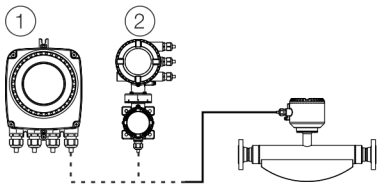
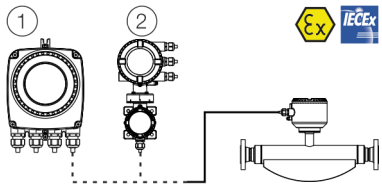
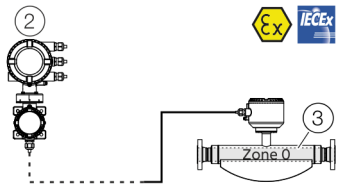
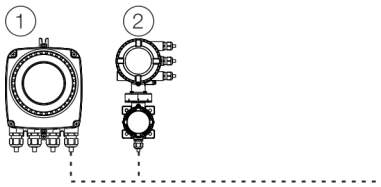
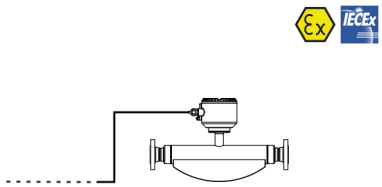
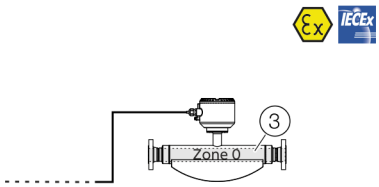
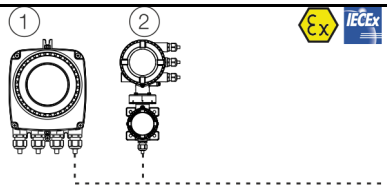
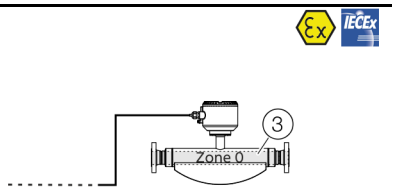
Customer service center
Tel: +49 180 5 222 580
Email: automation.service@de.abb.com

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 .

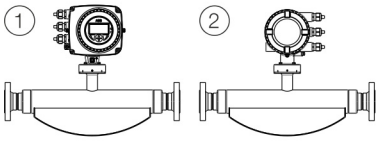
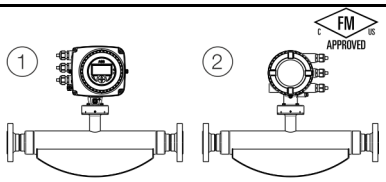
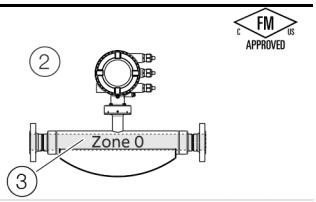
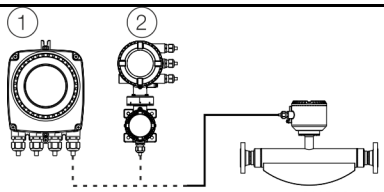
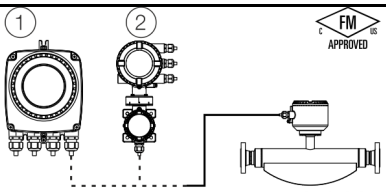
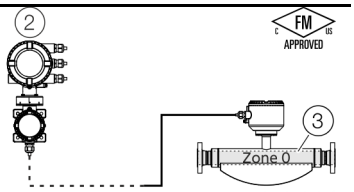
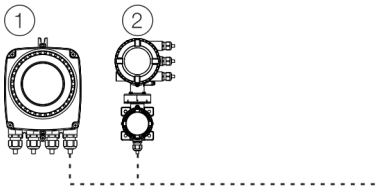
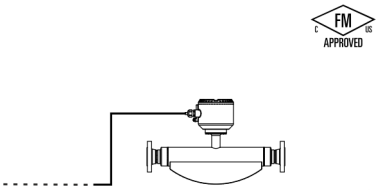
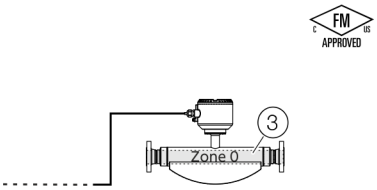
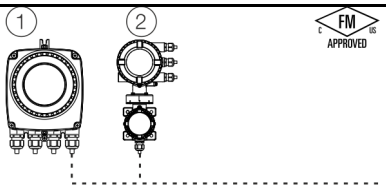
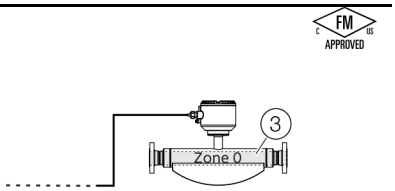
Device overview

ATEX / IECEx

	Standard / No explosion protection		Zone 2, 21, 22		Zone 1, 21 (Zone 0)	
Model number	**FCx4xx Y0**		**FCx4xx A2**		**FCx4xx A1**	
Integral mount design • Standard • Zone 2, 21, 22 • Zone 1, 21 • Zone 0						
Model number	**FCT4xx Y0**	**FCx4xx Y0**	**FCT4xx A2**	**FCx4xx A2**	**FCT4xx A1**	**FCx4xx A1**
Remote mount design Transmitter and flowmeter sensor • Standard • Zone 2, 21, 22 • Zone 1, 21 • Zone 0						
Model number	**FCT4xx Y0**		**FCT4xx A2**		**FCx4xx A1**	
Remote mount design Transmitter • Standard • Zone 2, 21, 22 Sensor • Zone 1, 21 • Zone 0						
Model number	—		**FCT4xx A2**		**FCx4xx A1**	
Remote mount design Transmitter • Zone 2, 21, 22 Sensor • Zone 1, 21	—					

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

cFMus

	Standard / No explosion protection		Class I Div. 2 / Zone 2		Class I Div. 1 / Zone 1 (Zone 0)	
Model number	**FCx4xx Y0**		**FCx4xx F2**		**FCx4xx F1**	
Integral mount design • Standard • Div. 2 / Zone 2 • Div. 1 / Zone 1 (Zone 0)						
Model number	**FCT4xx Y0**	**FCx4xx Y0**	**FCT4xx F2**	**FCx4xx F2**	**FCT4xx F1**	**FCx4xx F1**
Remote mount design Transmitter and flowmeter sensor • Div. 2 / Zone 2 • Div. 1 / Zone 1 (Zone 0)						
Model number	**FCT4xx Y0**		**FCT4xx F2**		**FCx4xx F1**	
Remote mount design Transmitter • Standard Sensor • Div. 2 / Zone 2 • Div. 1 / Zone 1 (Zone 0)						
Model number	—		**FCT4xx F2**		**FCx4xx F1**	
Remote mount design Transmitter • Div. 2 / Zone 2 Sensor • Div. 1 / Zone 1 (Zone 0)	—					

(1) Single-compartment housing

(2) Dual-compartment housing

(3) Zone 0 within the meter tube

… 2 Use in potentially explosive atmospheres

Ex marking

Description of model numbers

Each device design has a specific model number. The parts of the model number relating to explosion protection are listed in the following table. The complete key to model numbers is described in the device data sheet.

Basic model	**FCa4c**	**d**	**m**	**f**	**g**	**h**	**i**	**j**	k	l	m
Explosion protection											
Without		Y0									
ATEX / IECEx (Zone 2 / 22)		A2									
ATEX / IECEx (Zone 1 / 21)		A1									
cFMus version, Class 1, Div. 2 (Zone 2 / 21)		F2									
cFMus version, Class 1, Div. 1 (Zone 1 / 21)		F1									
NEPSI (Zone 2 / 22)		S2									
NEPSI (Zone 1 / 21)		S1									
Design / terminal box material / cable glands											
Integral mount - see transmitter housing			Y0								
Remote mount / aluminum / 1 × M20 × 1.5			U1								
Remote mount / aluminum / 1 × NPT ½ in			U2								
Remote mount / stainless steel / 1 × M20 × 1.5			A1								
Remote mount / stainless steel / 1 × NPT ½ in			A2								
Nominal diameter / nominal connection diameter				xxxxx							
Process connection					xx						
Material for wetted parts											
Stainless steel						A1					
Polished stainless steel						H1					
Nickel alloy						C1					
Flow rate calibration							x				
Density calibration								x			

Basic model	**FCa4c**	d	m	f	g	h	i	j	**k**	**l**	**m**
Design / transmitter housing / transmitter housing material / cable gland											
Integral mount / dual-compartment housing / aluminum / 3 × M20 × 1.5									D1		
Integral mount / dual-compartment housing / aluminum / 3 × NPT ½ in									D2		
Integral mount / dual-compartment housing / aluminum / 3 × M20 × 1.5 (Ex d / XP)									D5		
Integral mount / dual-compartment housing / aluminum / 3 × NPT ½ in (Ex d / XP)									D6		
Integral mount / dual-compartment housing / stainless steel / 3 × M20 × 1.5									D3		
Integral mount / dual-compartment housing / stainless steel / 3 × NPT ½ in									D4		
Integral mount / dual-compartment housing / stainless steel / 3 × M20 × 1.5 (Ex d / XP)									D7		
Integral mount / dual-compartment housing / stainless steel / 3 × NPT ½ in (Ex d / XP)									D8		
Integral mount / single-compartment housing / aluminum / 3 × M20 × 1.5									S1		
Integral mount / single-compartment housing / aluminum / 3 × NPT ½ in									S2		
Remote mount / dual-compartment housing / aluminum / 3 × M20 × 1.5									R1		
Remote mount / dual-compartment housing / aluminum / 3 × NPT ½ in									R2		
Remote mount / dual-compartment housing / aluminum / 3 × M20 × 1.5 (Ex d / XP)									R5		
Remote mount / dual-compartment housing / aluminum / 3 × NPT ½ in (Ex d / XP)									R6		
Remote mount / dual-compartment housing / stainless steel / 3 × M20 × 1.5									R3		
Remote mount / dual-compartment housing / stainless steel / 3 × NPT ½ in									R4		
Remote mount / dual-compartment housing / stainless steel / 3 × M20 × 1.5 (Ex d / XP)									R7		
Remote mount / dual-compartment housing / stainless steel / 3 × NPT ½ in (Ex d / XP)									R8		
Remote mount / single-compartment housing, wall mounting / aluminum / 4 × M20 × 1.5									W1		
Remote mount / single-compartment housing, wall mounting / aluminum / 4 × NPT ½ in									W2		
Remote mount / not specified									Y0		
Outputs											
Current output 1 (active or passive), digital output 1 & 2 (passive), HART®, PROFIBUS DP®										D1	
Current output 1 (active), digital output 1 & 2 (passive), HART®, Modbus®										M1*	
Current output 1 (active / passive), digital output 1 & 2 (passive), digital output 3 (active), HART, Modbus										M6	
Current output 1 (active / passive), digital output 1 & 2 (passive), HART®, 1 Port Ethernet										E2**	
Current output 1 (active / passive), digital output 1 & 2 (passive), HART®, 2 Port Ethernet										E3**	
Current output 1 (active / passive), digital output 1 & 2 (passive), HART®, 1 Port Ethernet + POE										E4**	
Current output 1 (active / passive), digital output 1 & 2 (passive), HART										G0	
Current output 1 (active / passive), digital output 1 & 2 (passive), 24 V DC transmitter loop power supply, HART®										G1	
Current output 1 (active / passive), digital output 1 & 2 (passive), current output 2 (passive), HART®										G2	
Current output 1 (active / passive), digital output 1 & 2 (passive), current output 2 (passive), current output 3 (passive), HART®										G3	
Current output 1 (active / passive), digital output 1 & 2 (passive), current output 2 (passive), 24 V DC transmitter loop power supply, HART®										G4	
Without										Y0	
Power supply											
100 to 230 V AC											A
11 to 30 V DC											C
Without											Y

* The M1 design is identical in construction to the M5 design, as it can also be called in other locations

** Only available with single-compartment housing, non-Ex or Zone 2, Division 2

… 2 Use in potentially explosive atmospheres

… Ex marking

Additional ordering information	**FCa4cdefghijklm**	**XXX**	**XXX**	**XX**
Option card 1				
2 port Ethernet (various protocols)		DR6*		
1 × active digital output		DRH		
Option card 2				
Power over Ethernet module / Modbus			DS8*	
1 × active digital output			DSH	
Connection type				
Without				U0
1 × M 12 plug connector for Ethernet 1 Port (4 signal lines)				UE*
2 × M 12 plug connector for Ethernet 2 Port (4 signal lines)				UF*
1 × M 12 plug connector for Ethernet 1 Port (8 signal lines)				UG*
1 × RJ45 connector with 5 m cable length attached (4 signal lines)				U5*
2 × RJ45 connector with 5 m cable length attached (4 signal lines)				UB*
1 × RJ45 connector with 5 m cable length attached (8 signal lines)				UC*
1 × RJ45 connector with 10 m cable length attached (4 signal lines)				U6*
2 × RJ45 connector with 10 m cable length attached (4 signal lines)				DU*
1 × RJ45 connector with 10 m cable length attached (8 signal lines)				UH*
1 × RJ45 connector with 15 m cable length attached (4 signal lines)				U7*
2 × RJ45 connector with 15 m cable length attached (4 signal lines)				UJ*
1 × RJ45 connector with 15 m cable length attached (8 signal lines)				UK*
1 × RJ45 connector with 20 m cable length attached (4 signal lines)				U8*
2 × RJ45 connector with 20 m cable length attached (4 signal lines)				UN*
1 × RJ45 connector with 20 m cable length attached (8 signal lines)				UP*

* Only available with single-compartment housing and Ethernet

⚠ DANGER

Risk of injury caused by live parts!

When using the outputs of the M6 option digital output or the DRH/DSH option active digital output option cards, all the option cards used and all pre-installed output circuits must use the ‘Increased safety’ (Ex-e) IP rating.

The ‘Intrinsic safety’ (Ex i) IP rating is not permitted.

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 for use in Zone 2, 21	Ex marking	Certificate
FCa4c – A2Y0fghijD Integral mount design with dual-compartment housing	II3G Ex ec IIC T6...T1 Gc II2D Ex tb IIIC T80°C...Tmedium Db	**ATEX:** FM15ATEX0014X, FM15ATEX0016X **IECEx:** IECEx FME 15.0005X
FCa4c – A2efghijY Sensor in remote mount design with dual-compartment housing		
FCT4c – A2R Transmitter in remote mount design with dual-compartment housing	II3G Ex ec IIC T6 Gc II2D Ex tb IIIC T80°C Db	

Model number for use in Zone 1, 21	Ex marking	Certificate
FCa4c – A1Y0fghijDx (x = 1 to 4) Integral mount design with dual-compartment housing	II 1/2 (1) G Ex db eb ia mb [ia Ga] IIC T6…T1 Gb II 2 (1) D Ex ia tb [ia Da] IIIC T80°C Db	**ATEX:** FM15ATEX0015X **IECEx:** IECEx FME 15.0005X
FCa4c – A1Y0fghijDx (x = 5 to 8) Integral mount design with dual-compartment housing (flameproof enclosure 'Ex d')	II 1/2 (1) G Ex db ia mb [ia Ga] IIB+H2 T6...T1 Gb II 2 (1) D Ex ia tb [ia Da] IIIC T80°C Db	
FCa4cA1Y0fghM6jDx (x=1 to 4) or DRH or DSH option card Integral mount design with dual-compartment housing and active digital output option card	II 1/2 (1) G Ex db eb ia mb IIC T6…T1 Gb II 2 (1) D Ex eb tb IIIC T80°C Db	
FCa4c – A1efghijY Sensor in remote mount design with dual-compartment housing	II 1/2 G Ex eb ia mb IIB+H2 T6…T1 Ga/Gb II 2 D Ex ia tb IIIC T80°C Db	
FCa4cA1Y0fghM6jDx (x=5 to 8) or DRH or DSH option card Integral mount design with dual-compartment housing (flameproof enclosure 'Ex d') and active digital output option card	II 1/2 (1) G Ex db ia mb IIB+H2 T6...T1 Gb II 2 (1) D Ex ia tb IIIC T80°C Db	
FCT4c – A1R (x = 1 to 4) Transmitter in remote mount design with dual-compartment housing	II 2 (1) G Ex db e ia mb [ia Ga] IIC T6…T1 Gb II 2 (1) D Ex ia mb tb [ia Da] IIIC T80°C Db	
FCT4c – A1R (x = 5 to 8) Transmitter in remote mount design with dual-compartment housing (flameproof enclosure 'Ex d')	II 2 (1) G Ex db ia mb [ia Ga] IIB+H2 T6…T1 Gb II 2 (1) D Ex ia tb [ia Da] IIIC T80°C Db	
FCT4c – A1R (x = 1 to 4) fghM6 or DRH or DSH option card Transmitter in remote mount design with dual-compartment housing and active digital output option card	II 2 (1) G Ex db eb ia mb IIC T6…T1 Gb II 2 (1) D Ex ia mb tb IIIC T80°C Db	
FCT4c – A1R (x = 5 to 8)fghM6 or DRH or DSH option card Transmitter in remote mount design with dual-compartment housing (flameproof enclosure 'Ex d') and active digital output option card	II 2 (1) G Ex db ia mb IIB+H2 T6…T1 Gb II 2 (1) D Ex ia tb IIIC T80°C Db	

… 2 Use in potentially explosive atmospheres

… Ex marking

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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 for use in Division 2	Ex marking	
FCa4c – F2Y0fghijD Integral mount design with dual-compartment housing	Certificate: FM18US0160X NI: CL I,II,III Div 2, GPS ABCDEFG, T6…T1	Certificate: FM18CA0073X DIP: CL II,III, Div 1, GPS EFG, T6
FCa4c – F2efghijY Sensor in remote mount design with dual-compartment housing	CL I, ZN 2, AEx ec IIC T6…T1 CL I, ZN 2, Ex ec IIC T6…T1	ZN 21, AEx ia tb IIIC T80°C ZN21,Ex ia tb IIIC T80°C
Design in accordance with ANSI / ISA 12.27.01 as ‘Single Seal Device’ or as ‘Dual Seal Device’ (option TE2)	See handbook for temperature class information	
FCT4c – F2R Transmitter in remote mount design with dual-compartment housing		
FCT4c – F2W Transmitter in remote mount design with single-compartment housing		

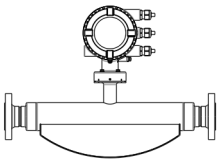
Model number for use in Division 1	Ex marking	Certificate
FCa4c – F1Y0fghijDx (x = 1 to 4) Integral mount design with dual-compartment housing	XP-IS: CL I, Div 1, GPS ABCD,T6…T1 (USA) XP-IS: CL I, Div 1, GPS BCD,T6…T1 (CAN)	**cFMus:** 3050239
FCa4c – F1Y0fghijDx (x = 5 to 8) Integral mount design with dual-compartment housing (Explosionproof ‘XP’). Design in accordance with ANSI / ISA 12.27.01 as ‘Single Seal Device’ or as ‘Dual Seal Device’ (option TE2)	DIP: CL II,III, Div 1, GPS EFG,T6 CL I, ZN 1, AEx db ia IIB+H2 T6…T1 (USA) ZN21, AEx ia tb IIIC T80°C (USA) CL I, ZN 1, Ex db ia IIB+H2 T6…T1 (CAN) ZN21, Ex ia tb IIIC T80°C (CAN) See handbook for temperature class information and installation drawing 3KXF000028G0009	
FCa4c – F1efghijY Sensor in remote mount design with dual-compartment housing Design in accordance with ANSI / ISA 12.27.01 as ‘Single Seal Device’ or as ‘Dual Seal Device’ (option TE2)	XP-IS: CL I, Div 1, GPS BCD T6…T1 (USA) DIP: CL II,III, Div 1, GPS EFG,T6 CL I, ZN 1, AEx db ia IIB+H2 T6…T1 (USA) ZN 21, AEx ia tb IIIC T80°C (USA) CL I, ZN 1, Ex db ia IIB+H2 T6…T1 (CAN) ZN21, Ex ia tb IIIC T80°C (CAN) See handbook for temperature class information and installation drawing 3KXF000028G0009	
FCT4c – F1Rx (x = 1 to 4) Transmitter in remote mount design with dual-compartment housing	XP-IS: CL I, Div 1, GPS BCD,T6…T1 (USA) XP-IS: CL I, Div 1, GPS BCD,T6…T1 (CAN)	
FCT4c – F1Rx (x = 5 to 8) Sensor in remote mount design with dual-compartment housing (Explosionproof ‘XP’).	DIP: CL II,III, Div 1, GPS EFG, T6 CL I, ZN 1, AEx db ia IIB+H2 T6…T1 (USA) ZN 21, AEx ia tb IIIC T80°C (USA) CL I, ZN 1, Ex db ia IIB+H2 T6…T1 (CAN) ZN21,Ex ia tb IIIC T80°C (CAN) See handbook for temperature class information and installation drawing 3KXF000028G0009	

Temperature data

Temperature resistance for the connecting cable

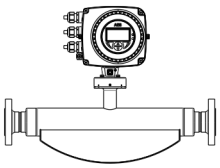
The temperature at the cable entries of the device depends on the design, the measuring medium temperature T_{medium} and the ambient temperature $T_{amb.}$.
For the electric connection of the device, use only cables with sufficient temperature resistance in accordance with the following table.

Devices in integral mount design with dual-compartment housing



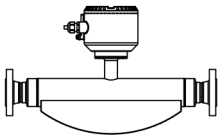
$T_{amb.}$	Temperature resistance
≤ 50 °C (≤ 122 °F)	≥ 70 °C (≥ 158 °F)
≤ 60 °C (≤ 140 °F)	≥ 80 °C (≥ 176 °F)
≤ 70 °C (≤ 158 °F)	≥ 90 °C (≥ 194 °F)

Devices in integral mount design with single-compartment housing



$T_{amb.}$	Temperature resistance
≤ 50 °C (≤ 122 °F)	≥ 75 °C (≥ 167 °F)
≤ 60 °C (≤ 140 °F)	≥ 85 °C (≥ 185 °F)
≤ 70 °C (≤ 158 °F)	≥ 95 °C (≥ 203 °F)

Sensor in remote mount design



$T_{amb.}$	Temperature resistance
≤ 50 °C (≤ 122 °F)	≥ 105 °C (≥ 221 °F)
≤ 60 °C (≤ 140 °F)	≥ 110 °C (≥ 230 °F)
≤ 70 °C (≤ 158 °F)	≥ 120 °C (≥ 248 °F)

For sensors in remote mount design, the wires in the connection box must be additionally insulated with the enclosed silicone hoses starting from ambient temperatures of $T_{amb.}$ ≥ 60 °C (≥ 140 °F).

Environmental and process conditions for model FCx4xx...

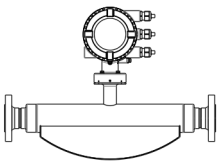
Ambient temperature $T_{amb.}$	-20 to 70 °C
	(-4 to 158 °F)
	-40 to 70 °C*
	(-40 to 158 °F)*
Measuring medium temperature	-40 to 205 °C
T_{medium}	(-40 to 400 °F)
IP rating / NEMA rating	IP 65, IP 67 /
	NEMA 4X,Type 4X

* Optional, with order code '**Ambient temperature range – TA9**'

… 2 Use in potentially explosive atmospheres

… Temperature data

Measuring medium temperature for sensors in integral mount design with dual-compartment housing



Model FCx4xx-A1… and FCx4xx-F1… in Zone 1, Division 1

The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class.

	Temperature class					
Ambient temperature $T_{amb.}$	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
≤ 30 °C (≤ 86 °F)	205 °C (400 °F)* 130 °C (266 °F)	205 °C (400 °F)* 130 °C (266 °F)	195 °C (383 °F)* 130 °C (266 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
≤ 40 °C (≤ 104 °F)	205 °C (400 °F)* 130 °C (266 °F)	205 °C (400 °F)* 130 °C (266 °F)	195 °C (383 °F)* 130 °C (266 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
≤ 50 °C (≤ 122 °F)	205 °C (400 °F)* 130 °C (266 °F)	205 °C (400 °F)* 130 °C (266 °F)	195 °C (383 °F)* 130 °C (266 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
≤ 60 °C (≤ 140 °F)	205 °C (400 °F)* 130 °C (266 °F)	205 °C (400 °F)* 130 °C (266 °F)	195 °C (383 °F)* 130 °C (266 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
≤ 70 °C (≤ 158 °F)	205 °C (400 °F)* 130 °C (266 °F)	205 °C (400 °F)* 130 °C (266 °F)	195 °C (383 °F)* 130 °C (266 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)

* Only with the '**Extended tower length – TE1, TE2 or TE3**' order option

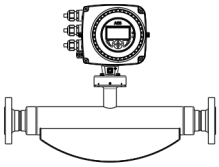
Model FCx4xx-A2… and FCx4xx-F2… in Zone 2, Division 2

The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class.

	Temperature class					
Ambient temperature $T_{amb.}$	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
≤ 30 °C (≤ 86 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)*	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)* 50 °C (122 °F)
≤ 40 °C (≤ 104 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)*	130 °C (266 °F)	95 °C (203 °F)	—
≤ 50 °C (≤ 122 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)*	130 °C (266 °F)	—	—
≤ 60 °C (≤ 140 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)*	130 °C (266 °F)	—	—
≤ 70 °C (≤ 158 °F)	205 °C (400 °F)* 130 °C (266 °F)	205 °C (400 °F)* 130 °C (266 °F)	195 °C (383 °F)* 130 °C (266 °F)	130 °C (266 °F)	—	—

* Only with the '**Extended tower length – TE1, TE2 or TE3**' order option

Measuring medium temperature for sensors in integral mount design with single-compartment housing



Model FCx4xx-A2... and FCx4xx-F2... in Zone 2, Division 2

The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class.

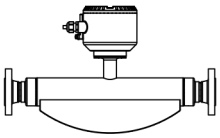
	Temperature class					
Ambient temperature $T_{amb.}$	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
≤ 30 °C (≤ 86 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
≤ 40 °C (≤ 104 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	—
≤ 50 °C (≤ 122 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	—
≤ 60 °C (≤ 140 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	—	—
≤ 70 °C (≤ 158 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	—	—

* Only with the '**Extended tower length – TE1, TE2 or TE3**' order option

… 2 Use in potentially explosive atmospheres

… Temperature data

Measuring medium temperature for sensors in remote mount design



Model FCx4xx-A1…, FCx4xx-F1… in Zone 1

The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class.

	Temperature class					
Ambient temperature $T_{amb.}$	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
≤ 30 °C (≤ 86 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
≤ 40 °C (≤ 104 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
≤ 50 °C (≤ 122 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
≤ 60 °C (≤ 140 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)
≤ 70 °C (≤ 158 °F)	205 °C (400 °F)	205 °C (400 °F)	195 °C (383 °F)	130 °C (266 °F)	95 °C (203 °F)	80 °C (176 °F)

Model FCx4xx-A2… and FCx4xx-F2… in Zone 2, Division 2

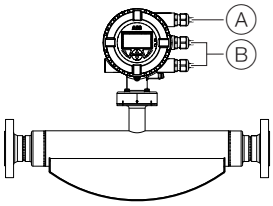
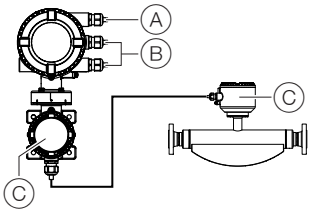
The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class.

	Temperature class					
Ambient temperature $T_{amb.}$	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
≤ 30 °C (≤ 86 °F)	205 °C (400 °F)* 195 °C (383 °F)	205 °C (400 °F)* 195 °C (383 °F)	195 °C (383 °F)* 130 °C (266 °F)	130 °C (266 °F)* 95 °C (203 °F)	95 °C (203 °F)* 80 °C (176 °F)	80 °C (176 °F)
≤ 40 °C (≤ 104 °F)	205 °C (400 °F)* 180 °C (356 °F)	205 °C (400 °F)* 180 °C (356 °F)	195 °C (383 °F)* 130 °C (266 °F)	130 °C (266 °F)* 95 °C (203 °F)	95 °C (203 °F)* 80 °C (176 °F)	—
≤ 50 °C (≤ 122 °F)	205 °C (400 °F)* 140 °C (284 °F)	205 °C (400 °F)* 140 °C (284 °F)	130 °C (266 °F)* 130 °C (266 °F)	130 °C (266 °F)* 95 °C (203 °F)	80 °C (176 °F)* 60 °C (140 °F)	—
≤ 60 °C (≤ 140 °F)	205 °C (400 °F)* 120 °C (248 °F)	205 °C (400 °F)* 120 °C (248 °F)	130 °C (266 °F)* 120 °C (248 °F)	130 °C (266 °F)* 95 °C (203 °F)	—	—
≤ 70 °C (≤ 158 °F)	180 °C (356 °F)* 80 °C (176 °F)	180 °C (356 °F)* 80 °C (176 °F)	130 °C (266 °F)* 80 °C (176 °F)	130 °C (266 °F)* 80 °C (176 °F)	—	—

* Only with the '**Extended tower length – TE1, TE2 or TE3**' order option

Electrical data

Overview

Standard / No explosion protection	Zone 2, 21 Division 2 and Zone 2, 21	Zone 1, 21 (Zone 0) Division 2 and Zone 1, 21
ATEX: – **IECEx:** –	**ATEX:** II 3 G & II 2 D **IECEx:** Gc & Db	**ATEX:** II 1/2 (1) G & II 2 (1) D II 1/2 G & II 2 D II 2 (1) G & II 2 (1) D **IECEx:** (Ga) Gb & (Da) Db Ga/Gb & Db (Ga) Gb & (Da) Db
USA: – **Canada:** –	**USA:** NI & DIP AEx ec & AEx tb **Canada:** Non-Incendive & Dust Ignition Proof Ex ec & Ex tb	**USA:** XP-IS & DIP AEx db ia & AEx ia tb **Canada:** XP-IS & DIP Ex db ia & Ex ia tb
		
(A) Power supply	(B) Inputs / outputs, communication	(C) Signal cable (remote mount design only)
• Type of protection ATEX / IECEx: Increased safety ‘Ex e’ • Type of protection USA / Canada: ‘non IS’ • Maximum 250 Vrms • Terminals: 1+, 2-, L, N, ⏚	• Type of protection ATEX / IECEx: Either increased safety ‘Ex e’ or intrinsically safe ‘Ex ia’ • Type of protection USA / Canada: Either ‘non IS’ or ‘intrinsically safe IS’. • When installing in ‘Ex ia’ or ‘IS’, suitable intrinsically safe isolation amplifiers must be used for the connection. • Terminals: 31, 32, Uco, V1, V2, V3, V4, 41, 42, 51, 52	• Terminals: A, B, UFE, GRN • Type of protection ATEX / IECEx: Increased safety ‘Ex e’ • Type of protection USA / Canada: ‘non IS’

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 26 must be observed when changing the type of protection!

… 2 Use in potentially explosive atmospheres

… Electrical data

Zone 2, 21 and Division 2 – Model: FCx4xx-A2, FCx4xx-F2

Outputs on basic device	Operating values (general)		Type of protection – 'nA' / '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	25 mA	30 V	25 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 49.

Inputs and outputs with optional plug-in cards	Operating values (general)		Type of protection – 'nA' / 'NI'	
	U_N	I_N	U_N	I_N
Current output V3 / V4, active*	30 V	30 mA	30 V	30 mA
Terminals V3 / V4 and V1 / V2*				
Current output V1 / V2, passive**	30 V	30 mA	30 V	30 mA
Current output V3 / V4, passive**				
Terminals V1 / V2** or V3 / V4**				
Digital output V3 / V4, active*	30 V	25 mA	30 V	25 mA
Terminals V3 / V4 and V1 / V2*				
Digital output V1 / V2, passive**	30 V	30 mA	30 V	30 mA
Digital output V3 / V4, passive**				
Terminals V1 / V2** or V3 / V4**				
Digital input V3 / V4, active*	30 V	3,45 mA	30 V	3,45 mA
Terminals V3 / V4 and V1 / V2				
Digital input V1 / V2, passive**	30 V	3,45 mA	30 V	3,45 mA
Digital input V3 / V4, passive**				
Terminals V1 / V2** or V3 / V4**				
Digital output V1 / V2, active*	24 V	22,5 mA	30 V	30 mA
Digital output V3 / V4, active*				
Terminals V1 / V2** or V3 / V4**				
Modbus® / PROFIBUS DP®	30 V	30 mA	30 V	30 mA
Terminals V1 / V2				
Ethernet card	57 V	417 mA	57 V	417 mA
Ethernet (various protocols)				
Port 1 / Port 2				
Ethernet card in connection with Power over Ethernet (POE card)	57 V	417 mA	57 V	417 mA
Ethernet (various protocols)				
Port 1 / Port 2				

* 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 53.

… 2 Use in potentially explosive atmospheres

… Electrical data

Zone 1 ,21 und Division 1 – Model: FCx4xx-A1, FCx4xx-F1

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

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

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

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

** Only in conjunction with current output U_{CO} / 32 in 'power mode', see **Current output Uco / 32 as loop power supply for digital output 41 / 42 or 51 / 52** on page 49.

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 output V1 / V2, active***	30	0.7	—	—	—	—	—	—	—	—	—	—	—	—
Digital output V3 / V4, active***														
Terminals V1 / V2** or V3 / V4														
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	1.5	1.5	6	6	0.14	0.14
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 53.

*** Not available as intrinsically safe version.

… 2 Use in potentially explosive atmospheres

… Electrical data

Special connection conditions

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

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

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

The output circuits are designed so that they can be connected to both intrinsically-safe and non-intrinsically-safe circuits.
- Combining intrinsically safe and non-intrinsically safe circuits is not permitted.
- On intrinsically safe circuits, potential equalization should be established along the entire length of the cable used for the signal outputs.
- The rated voltage of the non-intrinsically safe circuits is U_M = 30 V.
- Intrinsic safety is preserved If the rated voltage U_M = 30 V is not up-scaled when connections are established to non-intrinsically safe external circuits.
- The information in **Changing the type of protection** on page 26 must be observed when changing the type of protection.

Active digital output

⚠ DANGER

Risk of injury caused by live parts!
Option cards for the active digital output are intended only for use in potentially explosive atmospheres as the ‘increased safety’ (Ex-e) IP rating and therefore may not be used as an intrinsically safe circuit.

If these optional active plug-in cards are used in combination with other option cards, all the option cards used and all pre-installed output current circuits must also use the ‘Increased safety’ (Ex-e) IP rating.

The option of changing of IP rating is not permitted in connection with Active Pulse option cards.

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 17 must be observed.

Ethernet communication

⚠ DANGER

Explosion hazard due to improper installation!
Ethernet Option Cards are designed only for use in hazardous applications Zone 2 / Division 2.

The output circuits are designed so that different topologies such as daisy chain or point to point can be connected. See Installation diagram for detailed information.

- It is not permitted to combine both topologies.
- Ethernet communication is only available for installations in Zone 2/Division 2.
- The rated voltage of these non-intrinsically safe circuits are UM = 57 V.

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), 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.

Opening and closing the housing

⚠ DANGER

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

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

⚠ 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 37.

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

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

… 2 Use in potentially explosive atmospheres

… Installation instructions

Cable entries in accordance with ATEX / IECEx

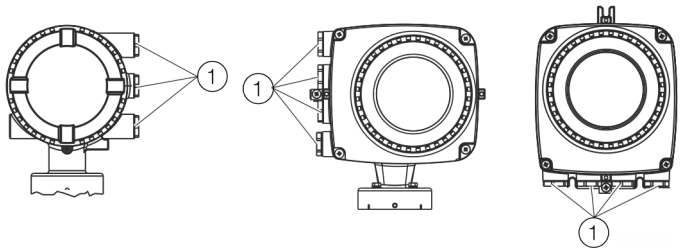
The devices are supplied with cable glands installed (certified in accordance with ATEX or IECEx).

- 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 1: Cable entry

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

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

Note

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

Electrical connections

Note

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

For the electric connection of the device, use only cables with sufficient temperature resistance in accordance with the tables at **Temperature resistance for the connecting cable** on page 13.

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 47.

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 47.

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.

Coriolis mass flowmeters are designed as 'Single Seal Devices'. With the TE2 order option, 'Extended tower length - insulation capacity with dual gasket', the devices can be used as a '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 15 to DN 150 (½ to 6 in)
Operating temperature	-50 °C to 205 °C (-58 °F to 400 °F)
Process pressure	PN 100 / Class 600

… 2 Use in potentially explosive atmospheres

Operating instructions

Protection against electrostatic discharges

⚠ DANGER

Risk of explosion!

The painted surface of the device can store electrostatic charges.

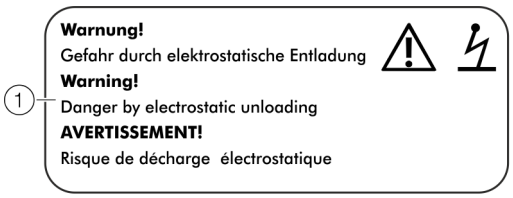
As a result, the housing can form an ignition source due to electrostatic discharges in the following conditions:

- 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 an additional warning plate.



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

Figure 2: Additional warning plate

Repair

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

Changing the type of protection

If you are installing in Zone 1 / Div. 1, the current outputs and digital outputs of models FCB430/450 and FCH430/450 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 V AC/1min or 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 Product identification

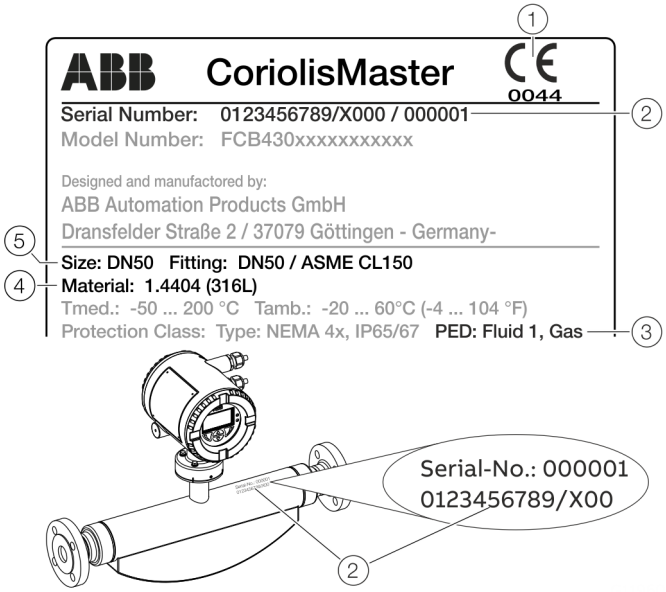
Name plate

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
3. Serial number
4. Order code
5. Manufacturer
6. Process connection / pressure rating
7. Ambient temperature range
8. PED marking
9. Maximum power consumption
10. 'Hot surface' symbol
11. 'Observe operating instruction' symbol
12. Year of manufacture (month / year)
13. Ex marking, such as ATEX / IECEx or FM / CSA
14. Maximum voltage at inputs and outputs
15. Power supply
16. IP rating
17. Measuring medium temperature range
18. Meter tube material
19. Nominal diameter

Figure 3: Name plate (example)

The marking is provided on the name plate and on the sensor itself in accordance with the Pressure Equipment Directive (PED).



1. CE mark with notified body
2. Serial number of the sensor
3. Fluid group or reason for exception
4. Material of the pressure-bearing parts (wetted parts)
5. Nominal diameter / Nominal pressure rating

Figure 4: PED marking (example)

The marking is dependent on the nominal diameter (> DN 25 or ≤ DN 25) of the sensor (also refer to Pressure Equipment Directive 2014/68/EU).

Pressure equipment within the scope of the Pressure Equipment Directive
The number of the notified body is specified underneath the CE mark to confirm that the device meets the requirements of the Pressure Equipment Directive.
The respective fluid group in accordance with the Pressure Equipment Directive is indicated under PED.
Example: Fluid Group 1 = hazardous fluids, gaseous.

Pressure equipment beyond the scope of the Pressure Equipment Directive
In PED the exception to Article 4 (3) of the Pressure Equipment Directive is specified.
The pressure equipment is classified in the SEP (= Sound Engineering Practice) 'Good Engineering Practice' category.

4 Transport and storage

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.

Inspection

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

Transporting the device

⚠ 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.

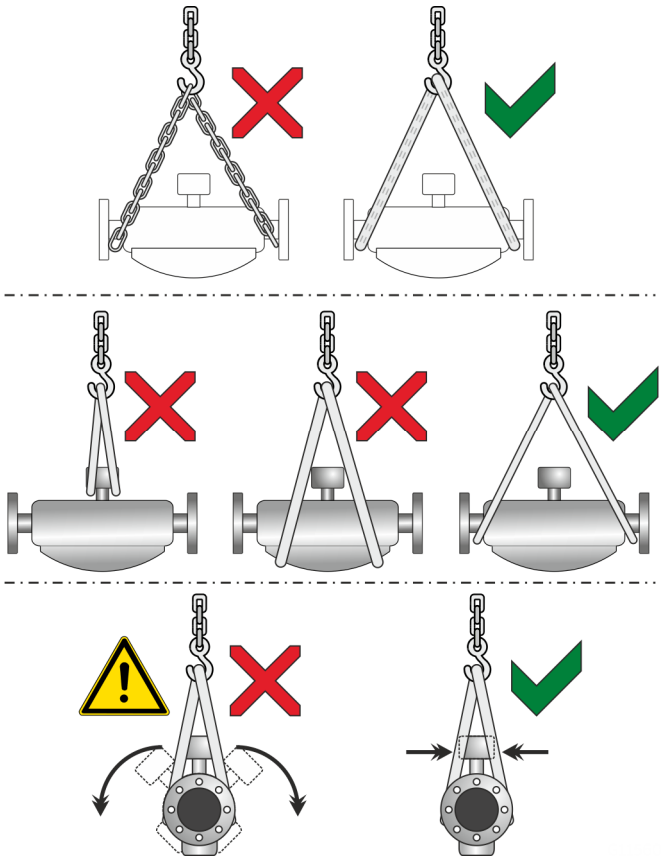


Figure 5: Transport instructions

Observe the following when transporting the device to the measuring location:

- Observe the weight details of the device in the data sheet.
- Use only approved hoisting slings for crane transport.
- Do not lift devices by the transmitter housing or terminal box.
- The center of gravity of the device may be located above the harness suspension points.

Storing the device

Bear the following points in mind when storing devices:

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

Ambient conditions

The ambient conditions for the transport and storage of the device correspond to the ambient conditions for operation of the device.
Adhere to the device data sheet!

Returning devices

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

5 Installation

General 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.

Calculating pressure loss

Pressure loss depends on the properties of the medium and the flow rate.
A good aid for pressure loss calculation is the Online ABB Product Selection Assistant (PSA) for flow at www.abb.com/flow-selector.

… 5 Installation

… General installation conditions

Brackets and supports

No special supports or damping are required for the device when the device is used and installed as intended.
In systems designed in accordance with 'Best Practice', the forces acting on the device are already sufficiently absorbed. This is also true of devices installed in series or in parallel.
For heavier devices, it is advisable to use additional supports / brackets on site. Doing this prevents damage to the process connections and piping from lateral forces.
Please observe the following points:

- Mount two supports or brackets symmetrically in the immediate vicinity of the process connections.
- Do not fasten any supports or brackets to the housing of the flowmeter sensor.

Note

For increased vibration load, such as for example on ships, the use of the 'CL1' marine design is recommended.

Inlet section

The sensor does not require any inlet section.
The devices can be installed directly before/after manifolds, valves or other equipment, provided that no cavitation is caused by this equipment.

Mounting position

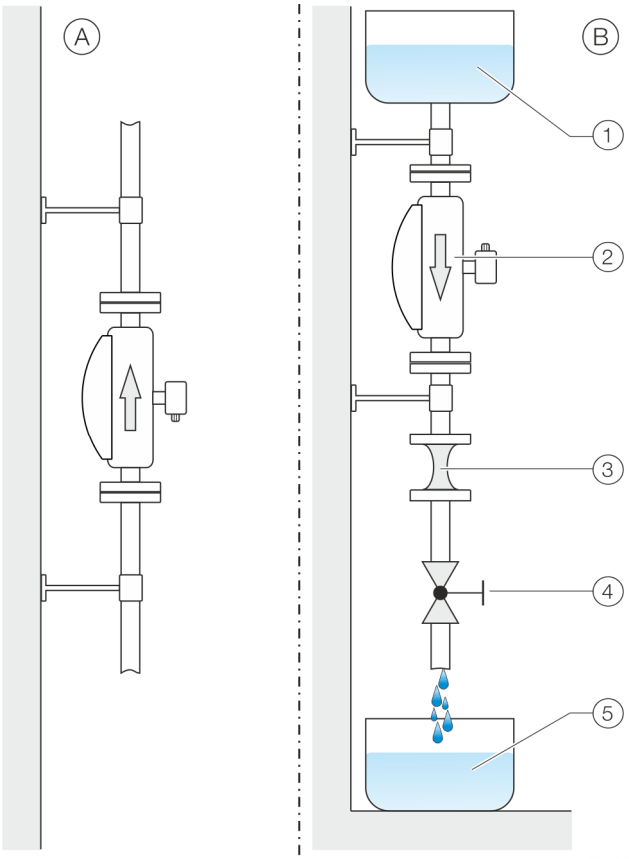
The flowmeter operates in any mounting position.
Depending on the measuring medium (liquid or gas) and the measuring medium temperature, certain mounting positions are preferable to others.For this purpose, consider the following examples.
The preferred flow direction is indicated by the arrow on the sensor.The flow will be displayed as positive.
The specified measuring accuracy can be achieved only in the calibrated flow direction (for forward flow calibration, this is only in the direction of the arrow; for the optional forward flow and reverse flow calibration, this can be in both flow directions).

Liquid measuring media

Observe the following points to avoid measuring errors:

- The meter tubes must always be completely filled with the measuring medium.
- The gases dissolved in the measuring medium must not leak out. To safeguard this, a minimum back pressure of 0.2 bar (2.9 psi) is recommended.
- The minimum vapor pressure of the measuring medium must be maintained when there is negative pressure in the meter tube or when liquids are gently simmering.
- During operation, there must be no phase transitions in the measuring medium.

Vertical installation



1 Supply tank
2 Sensor
3 Piping constriction / orifice
4 Turn-off device
5 Filling tank

Figure 6: Vertical installation

Ⓐ For vertical installation in a riser, no special measures are required.
Ⓑ For vertical installation in a downpipe, a piping constriction or an orifice must be installed below the sensor. Doing this prevents the sensor from draining during the measurement.

Horizontal installation

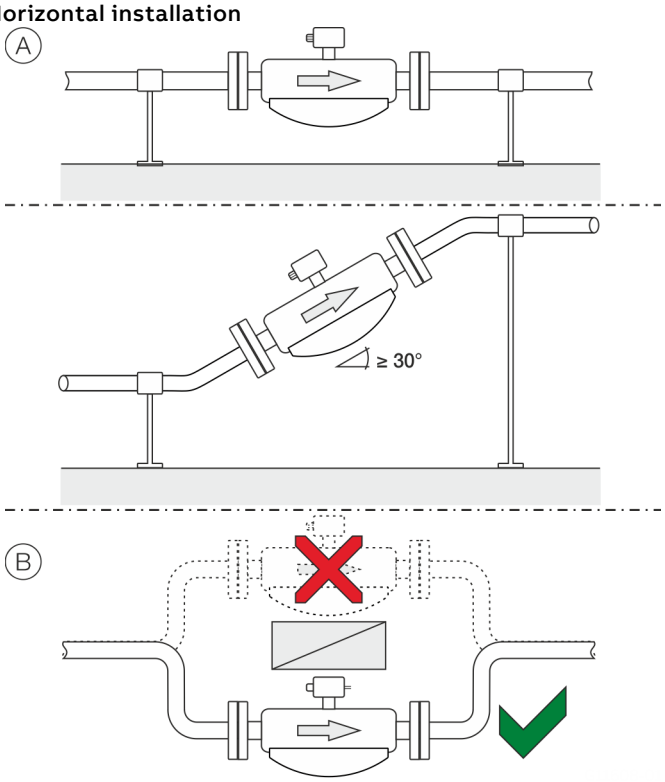


Figure 7: Horizontal installation

Ⓐ For liquid measuring media and horizontal installation, the transmitter and terminal box must point upward. If a self-draining installation is required, the sensor must be mounted at an incline of ≥ 30°.
Ⓑ Installing the sensor at the highest point of the piping leads to an increased number of measuring errors due to the accumulation of air or the formation of gas bubbles in the meter tube.

Gaseous measuring media

Observe the following points to avoid measuring errors:

- Gases must be dry and free of liquids and condensates.
- Avoid the accumulation of liquids and the formation of condensate in the meter tube.
- During operation, there must be no phase transitions in the measuring medium.

If there is a risk of condensate formation when using gaseous measuring media, note the following:
Ensure that condensates cannot accumulate in front of the sensor.
If this cannot be avoided, we recommend that the sensor is installed vertically with a downward flow direction.

Vertical installation

For vertical installation, no special measures are required.

Horizontal installation

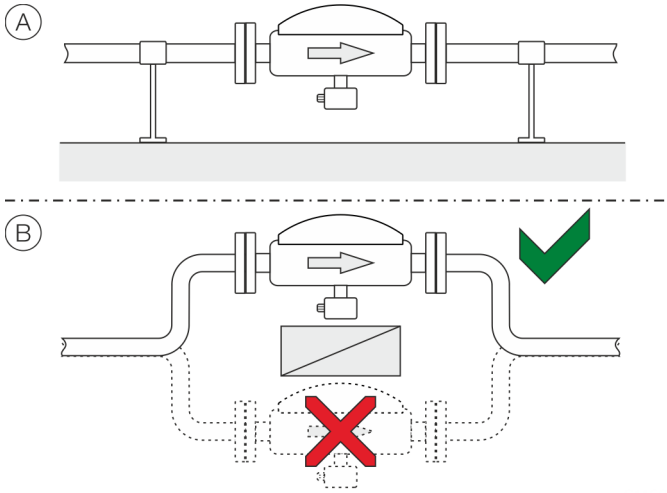


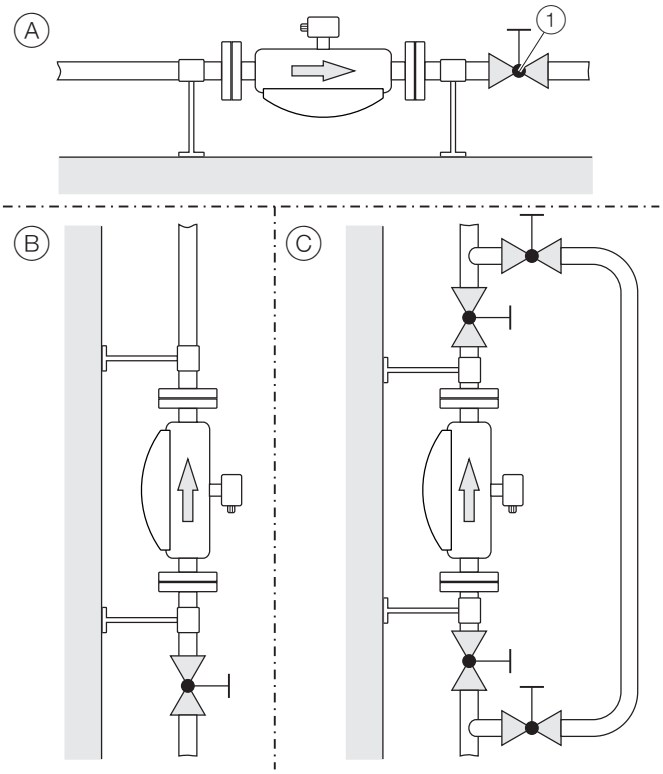
Figure 8: Horizontal installation

Ⓐ For gaseous measuring media and horizontal installation, the transmitter and terminal box must point downward.
Ⓑ Installing the sensor at the lowest point of the piping leads to an increased number of measuring errors due to the accumulation of liquid or the formation of condensates in the meter tube.

… 5 Installation

… General installation conditions

Turn-off devices for the zero point adjustment



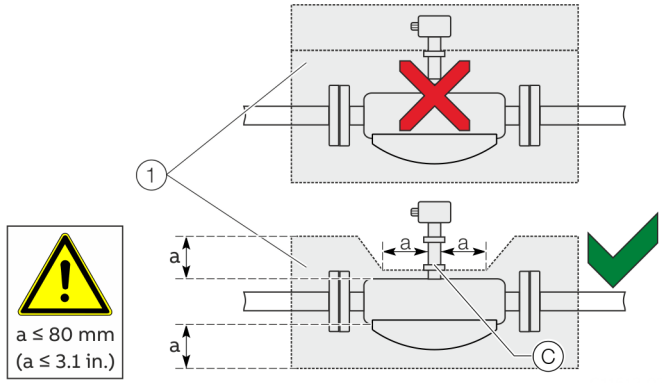
① Turn-off device

Figure 9: Mounting options for turn-off devices (example)

To guarantee the conditions for zero point balancing under operating conditions, turn-off devices are required in the piping:

- Ⓐ At least on the outlet side when the transmitter is mounted in horizontal position
- Ⓑ At least on the inlet side when the transmitter is mounted in vertical position.
- Ⓒ In order to perform balancing during an ongoing process, it is advisable to mount a bypass pipe.

Sensor insulation



① Insulation

Figure 10: Installation at T_{medium} –50°to 205 °C (–58 to 400 °F)

The sensor may only be insulated in conjunction with the option TE1 ‘Extended tower length for sensor insulation’ or TE2 ‘Extended tower length – insulation capacity with dual gasket,’ as shown in Figure 10.

Heat tracing of the sensor

When operating the sensor in conjunction with heat tracing, the temperature at point Ⓒ (Figure 10) 100 °C (212 °F) may not be exceeded at any time!

Installation in EHEDG-compliant installations

⚠ WARNING

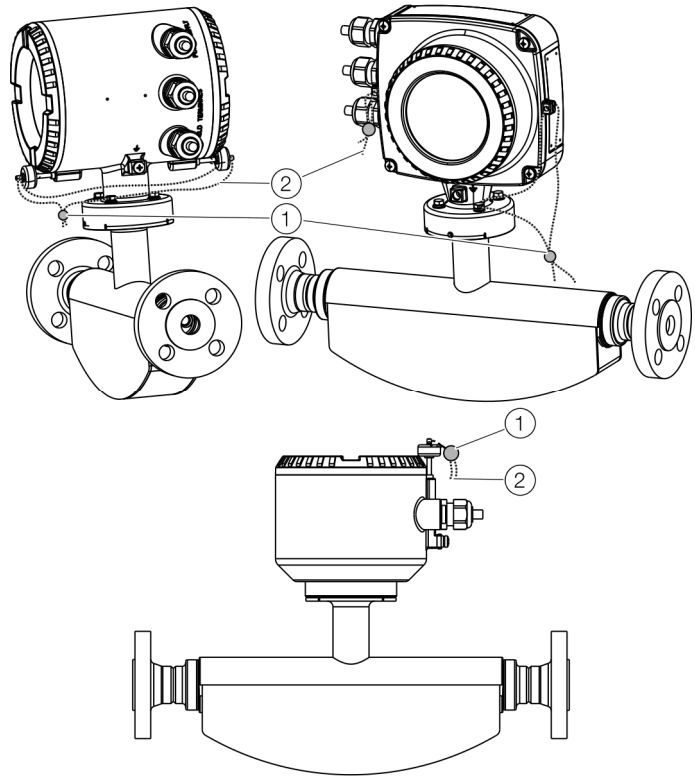
Risk of poisoning!

Bacteria and chemical substances can contaminate or pollute pipeline systems and the materials they are made of.

- In EHEDG-compliant installations, the instructions below must be observed.

- The required self-draining functionality of the sensor can only be guaranteed when the vertical mounting position or horizontal mounting position at a 30° incline is used. Refer to **Liquid measuring media** on page 30.
- The combination of process connections and gaskets selected by the operator may comprise only EHEDG-compliant components. Please note the information in the latest version of the EHEDG Position Paper: ‘Hygienic Process connections to use with hygienic components and equipment’ in this regard.
- The pipe fitting in accordance with DIN 11851 is approved for use in conjunction with an EHEDG-compliant gasket.

Devices for legal metrology



① Lead seal ② Lead seal wire

Figure 11: Sealing in accordance with MID / OIML R117 (example)

On devices for legal metrology, the hardware write protection must be activated after commissioning in many cases.
This prevents a change in the parameterization of the devices.
Hardware settings on page 71

To prevent deactivation of the hardware write protection or other manipulations during operation, the transmitter housing and the sensor housing connection box (with remote mount design) must be sealed.
For this purpose, a seal kit is available at ABB.
For the assembly of the seal, please observe the separate 'IN/FCX100/FCX400/MID/OIML-XA' instructions.

Process conditions

Temperature limits °C (°F)

Note
When using the device in potentially explosive atmospheres, note the additional temperature data in **Temperature data** on page 13!

Measuring medium temperature T_{medium}
- FCx430: −50 to 160 °C (−58 to 320 °F)
- FCx450: −50 to 205 °C (−58 to 401 °F)

In devices with order code 'Extended tower length – TE3', the measuring medium temperature must be limited to a maximum of 140 °C (284 °F) from an ambient temperature of ≥ 65 °C (149 °F).

Temperature Data

	Standard	Optional
Ambient temperature	−20 to 70 °C (−4 to 158 °F)	−40 to 70 °C (−40 to 158 °F)
Storage temperature	−20 to 70 °C (−4 to 158 °F)	—

Note
When operating below -20 °C (-4 °F), the LCD display can no longer be read and the electronics should be operated with as few vibrations as possible.
Full functionality is assured at temperatures above -20 °C (-4 °F).
Storage temperature of the devices in the 'Standard' version without cable glands is also −40 to 70 °C (−40 to 158°F).

Pressure ratings

The maximum permissible operating pressure is determined by the respective process connection, the temperature of the medium to be measured, the screws, and the gasket material.
For an overview of available pressure ratings, see Device overview in the data sheet.

… 5 Installation

… Process conditions

Housing as a protective device (optional)

Order code PR5

Maximum burst pressure 60 bar (870 psi)

Optional order code PR6 and PR7 on request

- Increased burst pressures up to 100 bar (1450 psi), possible for nominal diameters DN 15 to 100 (½ to 4 in.).
- Increased burst pressures up to 150 bar (2175 psi), possible for nominal diameters DN 15 to 80 (½ to 3 in.).
- Purge connections are available on request.

Pressure Equipment Directive

Conformity assessment in accordance with Category III, fluid group 1, gas

Note the corrosion resistance of the meter tube materials in relation to the measuring medium.

Material load for process connections

Note

You can reference the availability of the different process connections in the Online ABB Product Selection Assistant (PSA) for flow www.abb.com/flow-selector.

- Not all connections shown here are available in all the devices and designs.
- The permissible material load of the device can additionally differ from the material load of the connection. The permissible limit values (pressure rating / measuring medium temperature T_{medium}) can be found on the name plate.

Design	Nominal diameter	PS_{max}	TS_{max}	TS_{min}
Pipe fitting	DN 15 to DN 40	40 bar	140 °C	−40 °C
(DIN 11851)	(½ to 1½ in)	(580 psi)	(284 °F)	(−40 °F)
	DN 50 to DN 100	25 bar	140 °C	−40 °C
	(2 to 4 in)	(363 psi)	(284 °F)	(−40 °F)
Pipe fitting	DN 25 to DN 80	6 bar	140 °C	−40 °C
(SMS 1145)	(1 to 3 in)	(87 psi)	(284 °F)	(−40 °F)
Tri-Clamp	DN 15 to DN 50	16 bar	120 °C	−40 °C
(DIN 32676)	(½ to 2 in)	(232 psi)	(248 °F)	(−40 °F)
	DN 65 to DN 100	10 bar	120 °C	−40 °C
	(2½ to 4 in)	(145 psi)	(248 °F)	(−40 °F)
ASME BPE Clamp	< DN 80	17.1 bar	121 °C	−40 °C
	(< 3 in)	(248 psi)	(249.8 °F)	(−40 °F)
	DN 80	15.5 bar	121 °C	−40 °C
	(< 3 in)	(224.8 psi)	(249.8 °F)	(−40 °F)
	DN 100	12.9 bar	121 °C	−40 °C
	(< 4 in)	(187.1 psi)	(249.8 °F)	(−40 °F)

Material load curves for flange devices

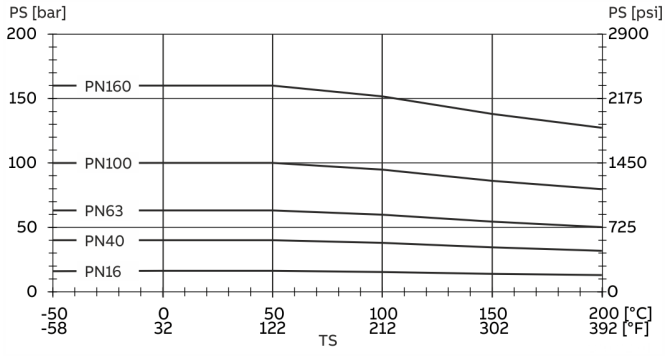


Figure 12: Stainless steel DIN flange 1.4571 / 1.4404 (316Ti / 316L) to DN 200 (8 in)

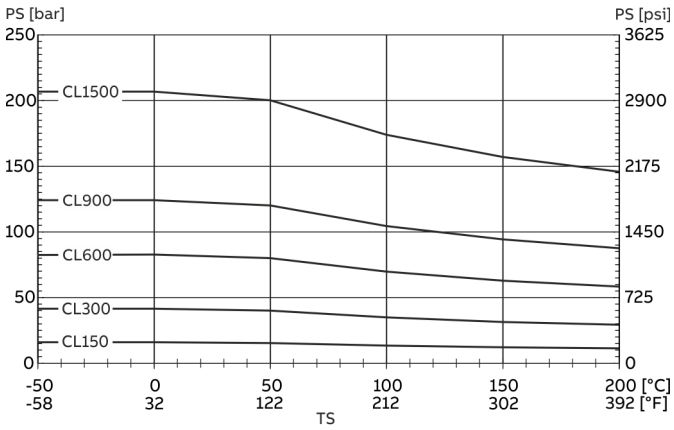


Figure 13: Stainless steel ASME flange 1.4571 / 1.4404 (316Ti / 316L) up to DN 200 (8 in.)

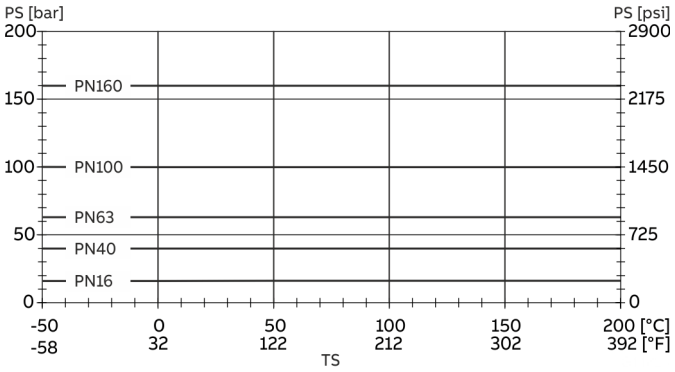


Figure 14: Nickel alloy DIN flange C4 (2.4610) or nickel alloy C22 (2.4602) up to DN 200 (8 in.)

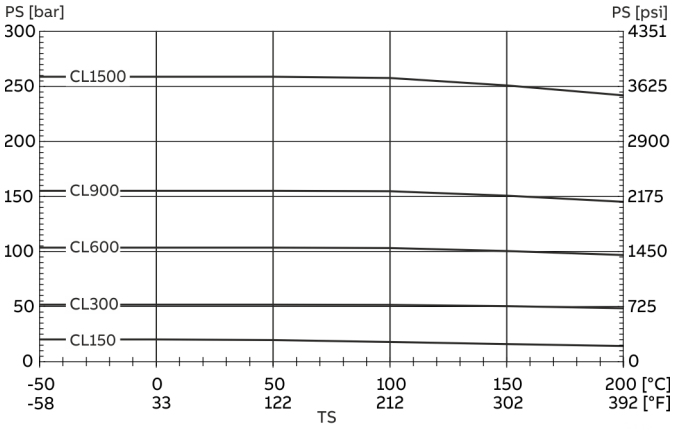


Figure 15: Nickel alloy ASME flange C4 (2.4610) or nickel alloy C22 (2.4602) up to DN 200 (in.)

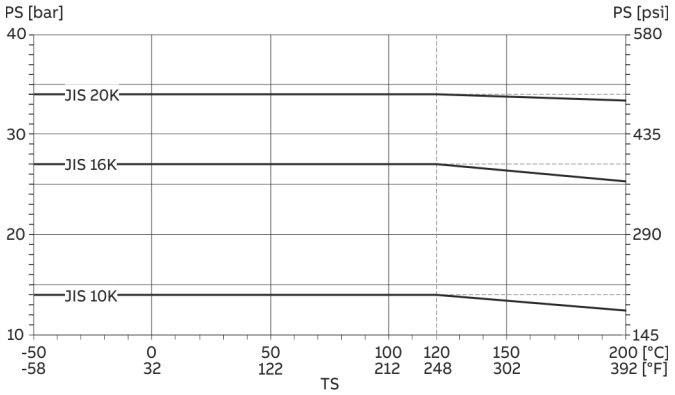


Figure 16: Stainless steel JIS B2220 flange 1.4435 or 1.4404 (AISI 316L) , nickel alloy C4 (2.4610) or nickel alloy C22 (2.4602)

Installing the sensor

Before installation in the piping, observe the installation conditions and instructions on the mounting position!

1. Insert the sensor into the piping centrally and positioned coplanar. Use suitable gaskets to seal the process connections.
2. Tighten flange screws by working on each in a crosswise manner with the maximum permissible torque.
3. Check the seal integrity of the process connections.

Installing the transmitter in the remote mount design

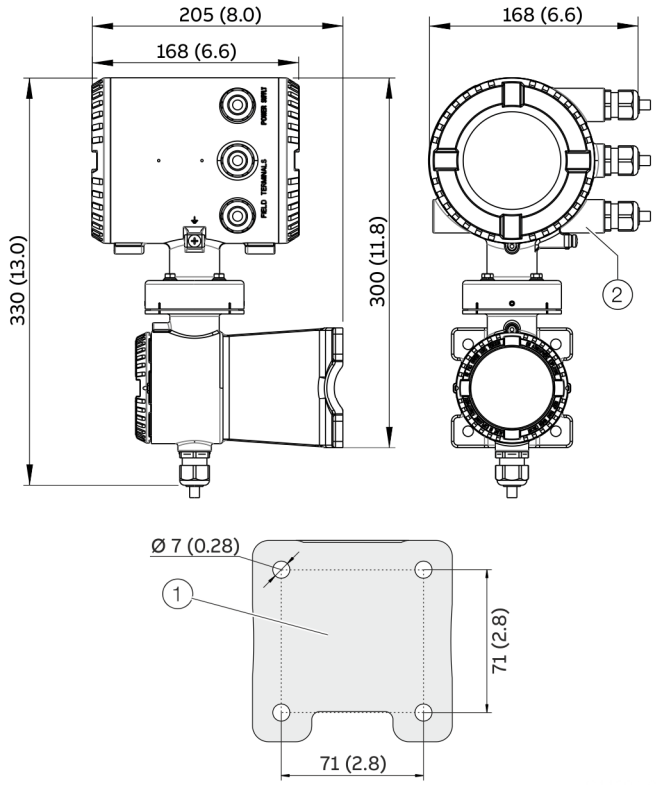
When selecting a location for the transmitter, consider the following points:

- 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.

… 5 Installation

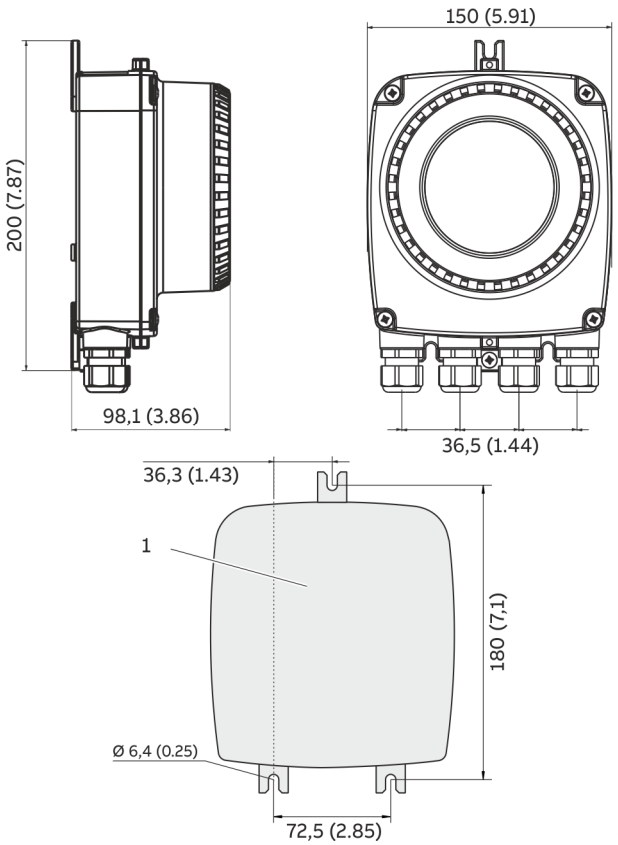
… Installing the transmitter in the remote mount design



(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 17: Mounting dimensions dual-compartment housing



(1) Hole pattern for mounting holes

Figure 18: Mounting dimensions single-compartment housing

Opening and closing the housing

⚠ DANGER

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

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

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

⚠ WARNING

Risk of injury due to live parts!

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

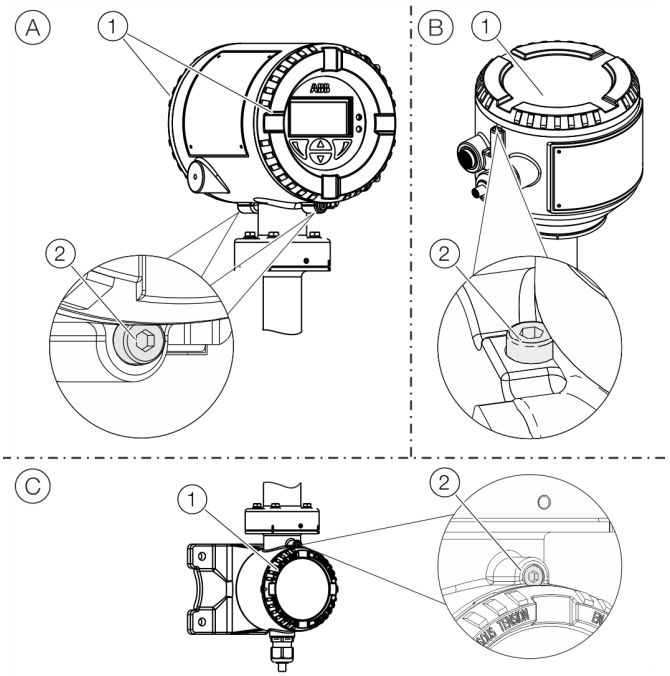
- Before opening the housing, switch off the power supply.

NOTICE

Potential adverse effect on the IP rating

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

Dual- compartment housing



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

Figure 19: Cover lock (example)

Open the housing:

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

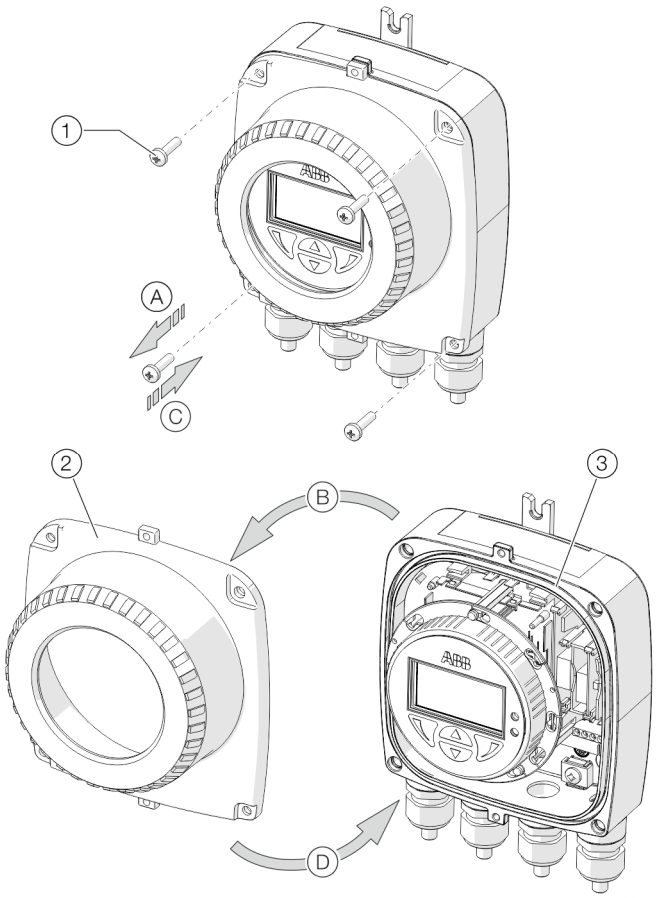
Close the housing:

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

… 5 Installation

… Opening and closing the housing

Single-compartment housing



① Cover screws
② Transmitter housing cover
③ Gasket

Figure 20: Open / close single-compartment housing

Open the housing:

- Perform steps Ⓐ and Ⓑ.

Close the housing:

- Perform steps Ⓒ and Ⓓ.

Adjusting the transmitter position

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!

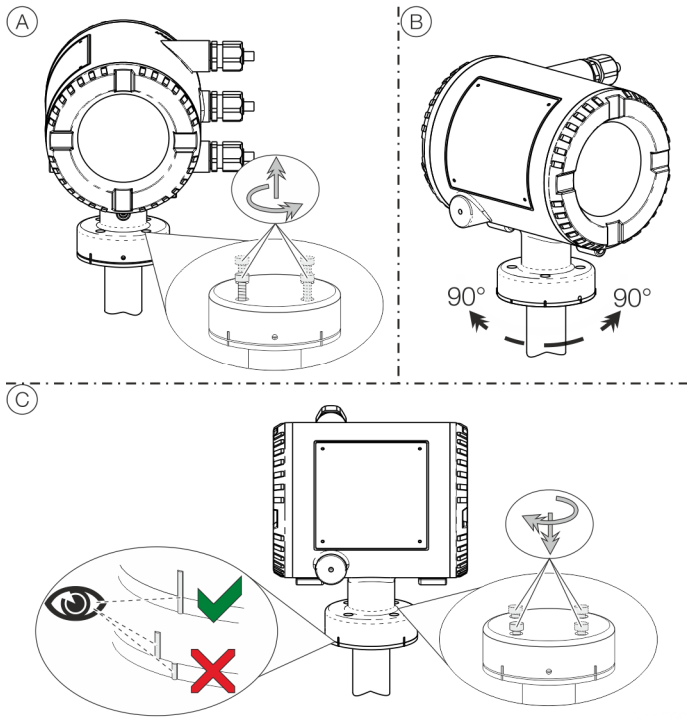


Figure 21: Rotate transmitter housing

Rotate the housing:

- Perform steps Ⓐ to Ⓒ.

Rotate LCD indicator – dual-compartment housing

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

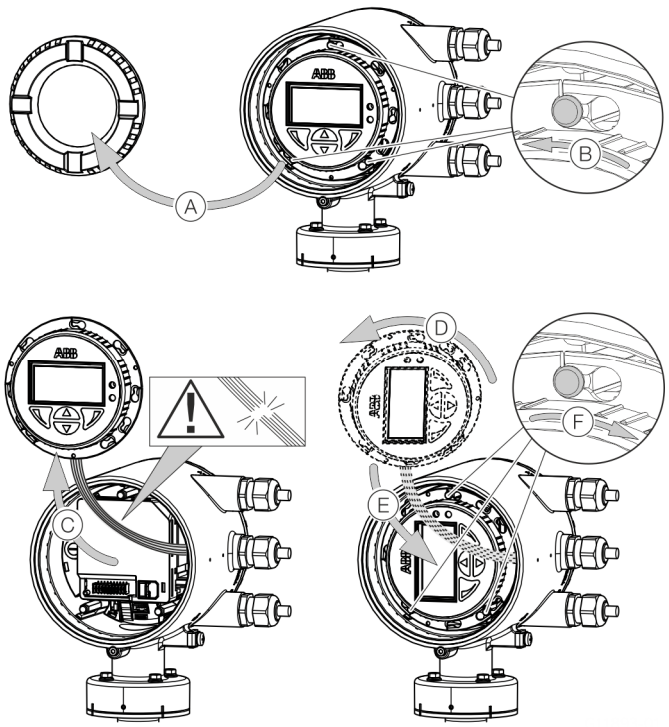


Figure 22: Rotating the LCD indicator

Turn the LCD indicator:

1. Open housing Ⓐ, see **Opening and closing the housing** on page 37.
2. Perform steps Ⓑ to Ⓕ.

Rotate LCD indicator – single-compartment housing

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

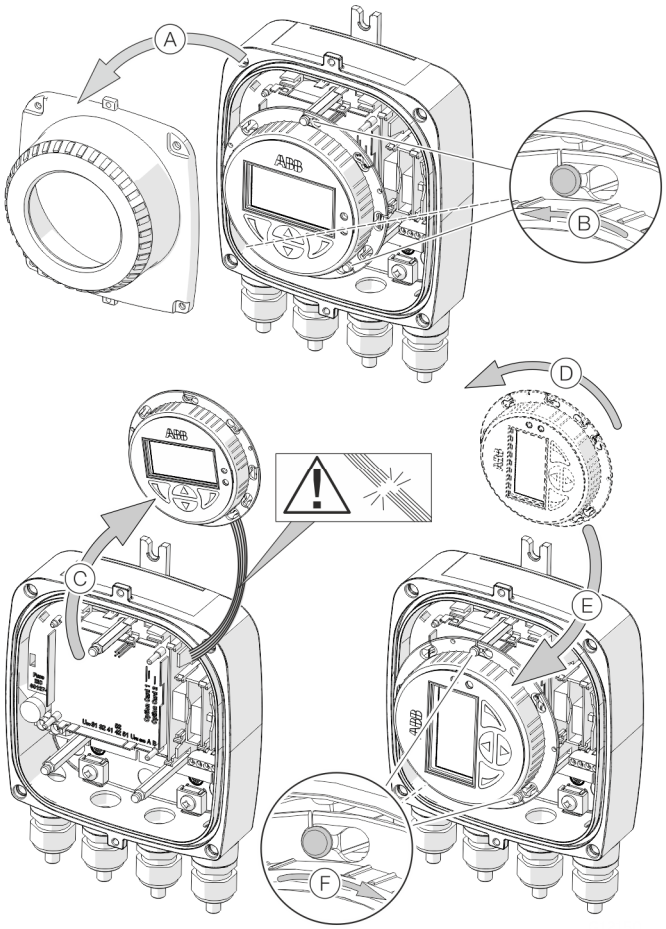


Figure 23: Rotating the LCD indicator

Turn the LCD indicator:

1. Open housing Ⓐ, see **Opening and closing the housing** on page 37.
2. Perform steps Ⓑ to Ⓕ.

… 5 Installation

Installing the plug-in cards

⚠ WARNING

Loss of Ex Approval!

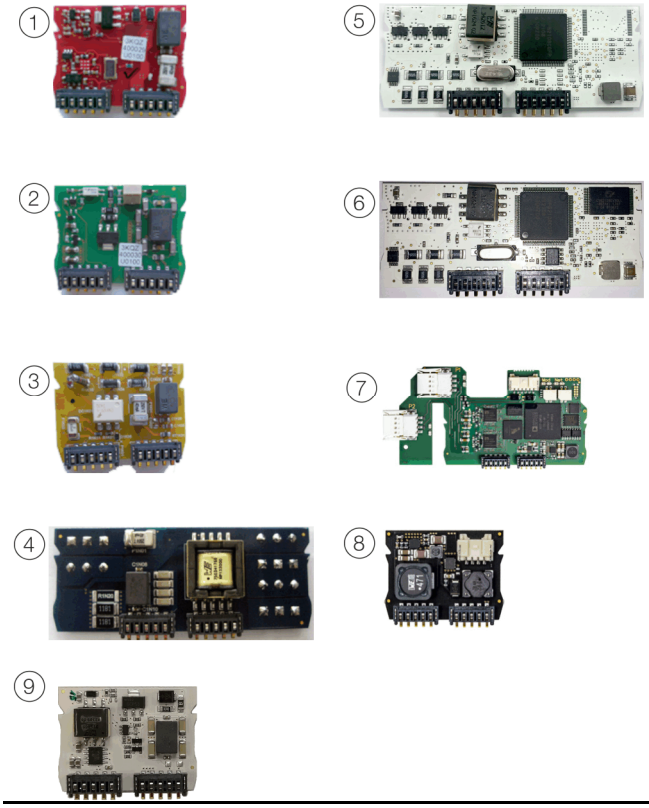
Loss of Ex Approval due to retrofitting of plug-in cards on devices for use in potentially explosive atmospheres.

- 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: 3KQZ400035U0100	2
2	Passive digital output (green) Order no.: 3KQZ400030U0100	1**
3	Passive digital input (yellow) Order no.: 3KQZ400032U0100	2
4	Loop power supply 24 V DC (blue) Order no.: 3KQZ400031U0100	1
5	Modbus RTU RS485 (white) Order no.: 3KQZ400028U0100	1
6	Profibus DP (white) Order no.: 3KQZ400027U0100	1
7	Ethernet Order no.: 3KQZ400037U0100	1
8	Power over Ethernet (POE) Order no.: 3KQZ400039U0100	1
9	Active digital output (white) Order no.: 3KQZ400056U0100	1**

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

* Only one plug-in card of the active digital output type or passive digital output type can be inserted in Pos. (2).

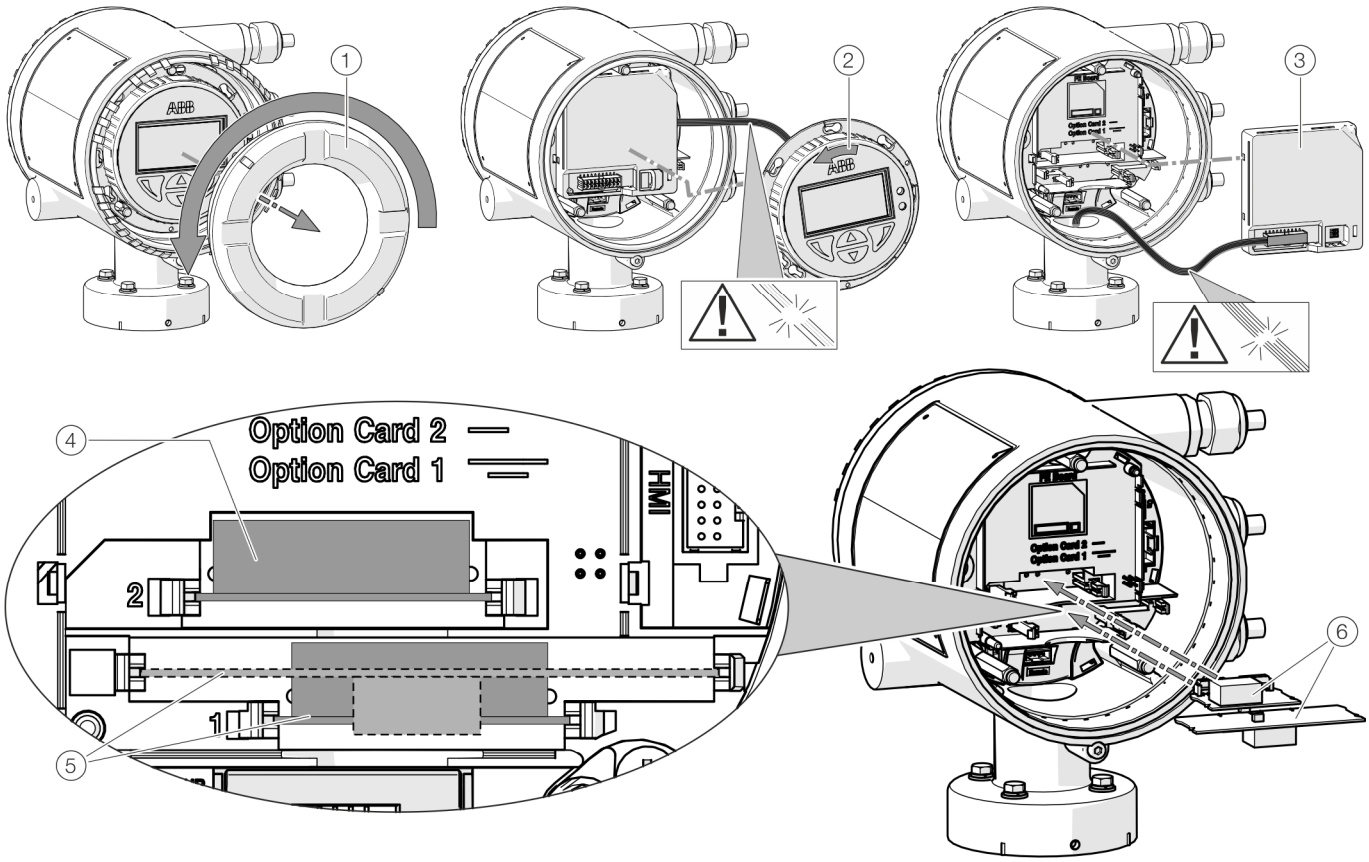
The following table provides an overview of the possible plug-in card combinations that can be selected when ordering the device. Because of the wide variety of options, not all combinations can be presented. Possible combinations are presented in our Online ABB Product Selection Assistant (PSA) for flow at www.abb.com/flow.

Main ordering	Additional ordering information		Slot OC1	Slot OC2
information (outputs)	Additional output 1	Additional output 2	Terminals V1 / V2	Terminals V3 / V4
G0	–	–	–	–
G1	–	–	Loop power supply 24 V DC (blue)	–
G2	–	–	–	Current output, 4 to 20 mA passive (red)
G3	–	–	Current output, 4 to 20 mA passive (red)	Current output, 4 to 20 mA passive (red)
G4	–	–	Loop power supply 24 V DC (blue)	Passive current output (red)
D1	–	–	Profibus DP, RS485 (white)	
M1	–	–	Modbus RTU RS485 (white)	
M6	–	–	Modbus RTU RS485 (white)	Active digital output (white)
E2	–	–	Ethernet (green)	
E3	–	–	Ethernet (green)	
E4	–	–	Ethernet (green)	Power over Ethernet (green)
G0	DRT	–	Loop power supply 24 V DC (blue)	–
G0	DRT	DSN	Loop power supply 24 V DC (blue)	Passive digital input (yellow)
G0	DRT	DSG	Loop power supply 24 V DC (blue)	Passive digital output (green)
G0	DRT	DSA	Loop power supply 24 V DC (blue)	Current output, 4 to 20 mA passive (red)
G0	DRN	–	Passive digital input (yellow)	–
G0	DRN	DSG	Passive digital input (yellow)	Passive digital output (green)
G0	DRN	DSA	Passive digital input (yellow)	Current output, 4 to 20 mA passive (red)
G0	DRG	DSN	Passive digital output (green)	Passive digital input (yellow)
G0	DRG	DSA	Passive digital output (green)	Current output, 4 to 20 mA passive (red)
G0	DRA	DSA	Current output, 4 to 20 mA passive (red)	Current output, 4 to 20 mA passive (red)
G0	DRN	DSH	Passive digital input (yellow)	Active digital output (white)
G0	DRA	DSG	Current output, 4 to 20 mA passive (red)	Passive digital output (green)
G0	DRA	DSN	Current output, 4 to 20 mA passive (red)	Passive digital input (yellow)
G0	DRM	–	Modbus RTU RS485 (white)	–
G0	DRA	DSH	Current output, 4 to 20 mA passive (red)	Active digital output (white)
G0	DRD	–	Profibus DP, RS485 (white)	–
G0	DRM	DSN	Modbus RTU RS485 (white)	Passive digital input (yellow)
G0	DRM	DSG	Modbus RTU RS485 (white)	Passive digital output (green)
G0	DRD	DSN	Profibus DP, RS485 (white)	Passive digital input (yellow)
G0	DRA	DSH	Modbus RTU RS485 (white)	Active digital output (white)
G0	DRD	DSG	Profibus DP, RS485 (white)	Passive digital output (green)
G0	DR6	–	Ethernet	–
G0	DR6	DS8	Ethernet (green)	Power over Ethernet (green)
G0	DR6	DSN	Ethernet (green)	Passive digital input (yellow)
G0	DR6	DSG	Ethernet (green)	Passive digital output (green)

… 5 Installation

… Installing the plug-in cards

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

⚠ WARNING

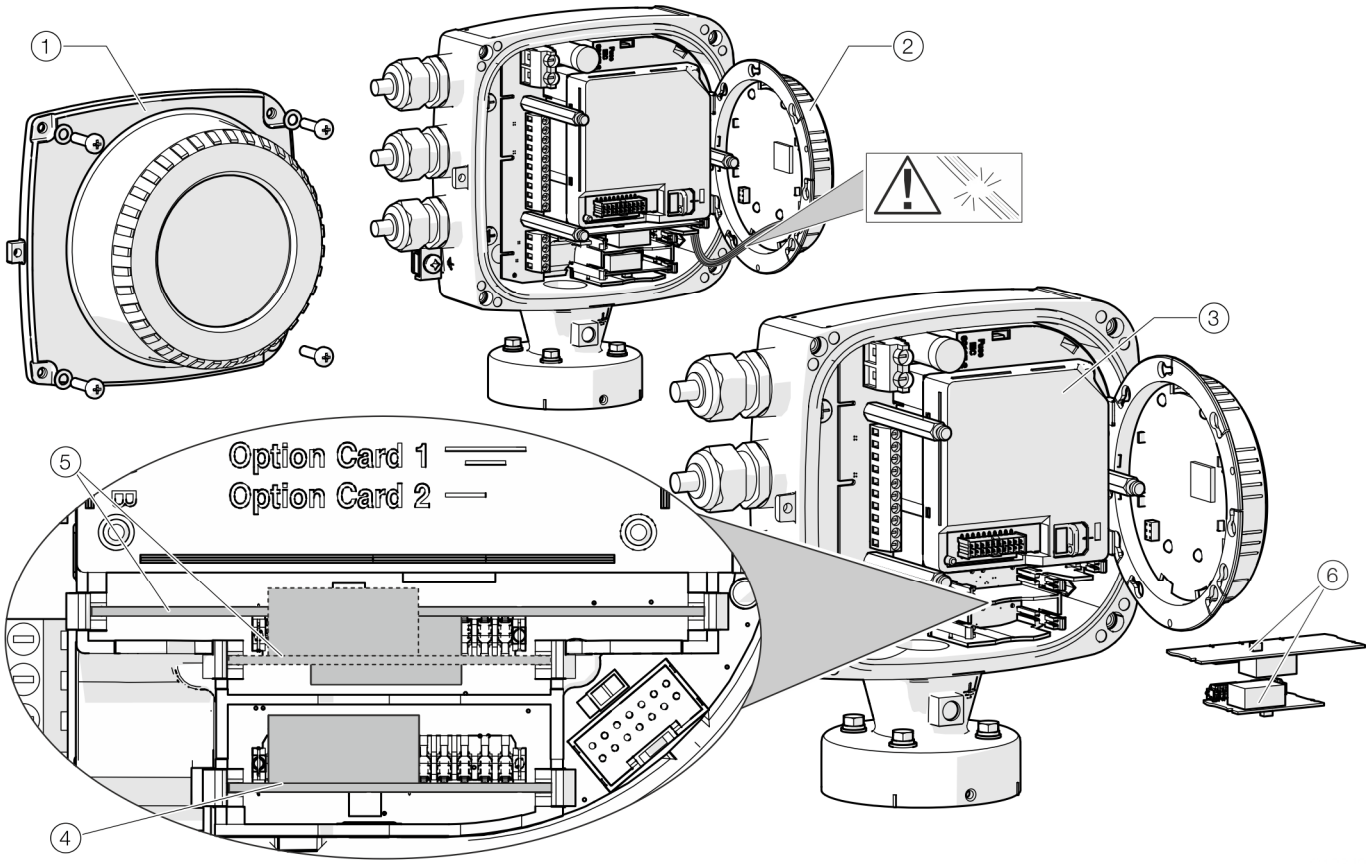
Risk of injury due to live parts!
When the housing is open, contact protection is not provided and EMC protection is limited.
- Before opening the housing, switch off the power supply.

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 45.
8. After powering up the power supply, configure the plug-in card functions.

Single-compartment housing



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

Figure 25: 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.

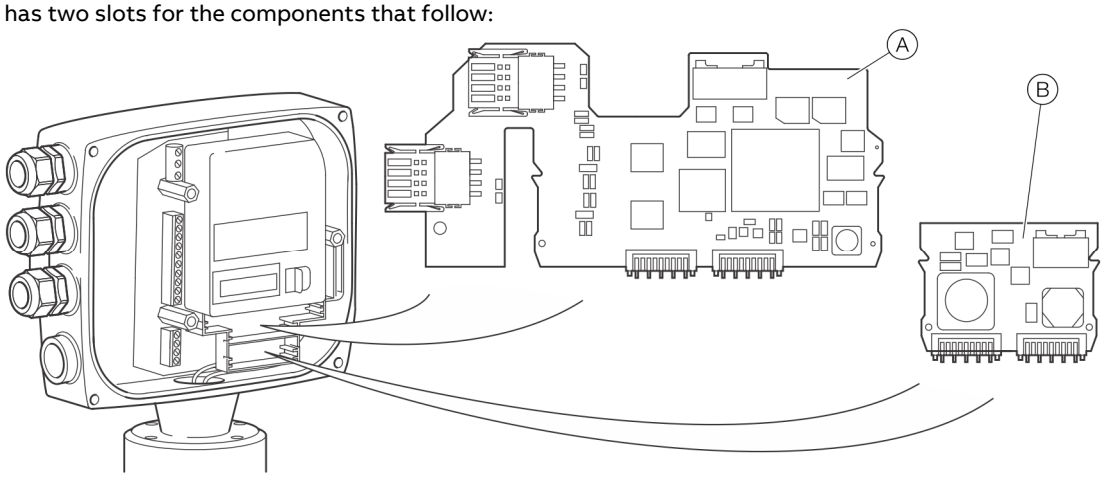
1. Switch off the power supply.
2. Unscrew / remove the cover.
3. Remove the LCD indicator. Ensure that the cable harness is not damaged.
   Insert the LCD indicator into the bracket
   (only for single-compartment housings)
4. Remove frontend board (only in integral mount design and dual-compartment 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 45.
8. After powering up the power supply, configure the plug-in card functions.

… 5 Installation

… Installing the plug-in cards

Ethernet card

The Flowmeter has two slots for the components that follow:



Ⓐ Ethernet card (part number 3KQZ400037U0100)

Ⓑ Power over Ethernet (PoE) card (part number 3KQZ400039U0100)

Figure 26: Install the plug-in cards

⚠ DANGER

Explosion hazard due to improper installation!

Ethernet Option Cards are designed only for use in hazardous applications Zone 2 / Division 2.

⚠ 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.
4. Insert the plug-in card in the corresponding slot and engage. Ensure that the contacts are aligned correctly.
5. Attach the frontend board, insert the LCD indicator and screw on / replace the cover.
6. Connect the Ethernet plug in card in accordance with **EtherNet/IP™ communication** on page 63.
7. After powering up the power supply, configure the plug-in card functions.

Note

For detailed instructions how to plug in and connect the Power over Ethernet (PoE) card, please contact ABB.

6 Electrical connections

Safety instructions

⚠ 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.

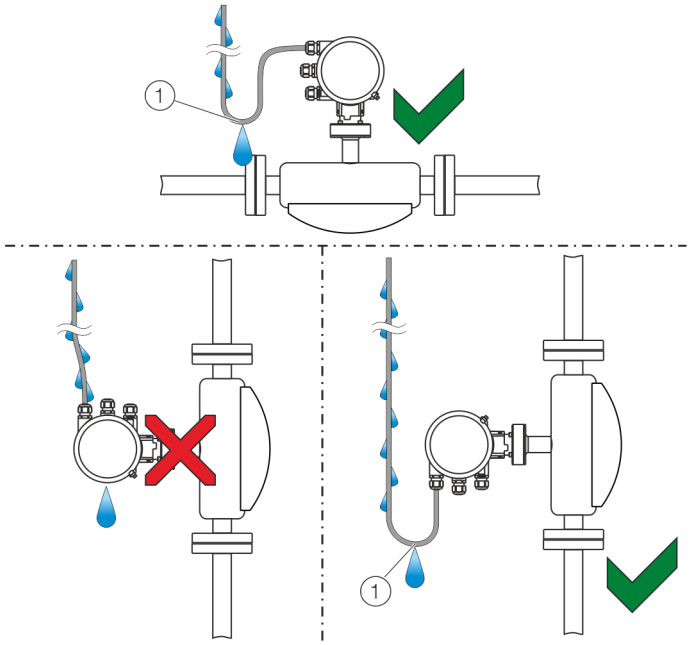
The power supply is connected to terminal L (phase), N (zero), or 1+, 2–, and PE.
A circuit breaker with a maximum rated current of 16 A must be installed in the power supply line.
The wire cross-sectional area of the power supply cable and the circuit breaker used must comply with VDE 0100 and must 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.

… 6 Electrical connections

Installing the connection cables

General information on cable installation

Ensure that a drip loop (water trap) is used when installing the connecting cables for the sensor.
When mounting the sensor vertically, position the cable entries at the bottom.
If necessary, rotate the transmitter housing accordingly.



① Drip loop

Figure 27: Laying the connection cable

Signal cable specification

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	Application-dependent, for use in potentially explosive atmospheres, observe the information in **Temperature resistance for the connecting cable** on page 13!

Maximum signal cable length	
0.25 mm^2 (AWG 24)	50 m (164 ft)
0.34 mm^2 (AWG 22)	100 m (328 ft)
0.5 mm^2 (AWG 20)	150 m (492 ft)
0.75 mm^2 (AWG 19)	200 m (656 ft)

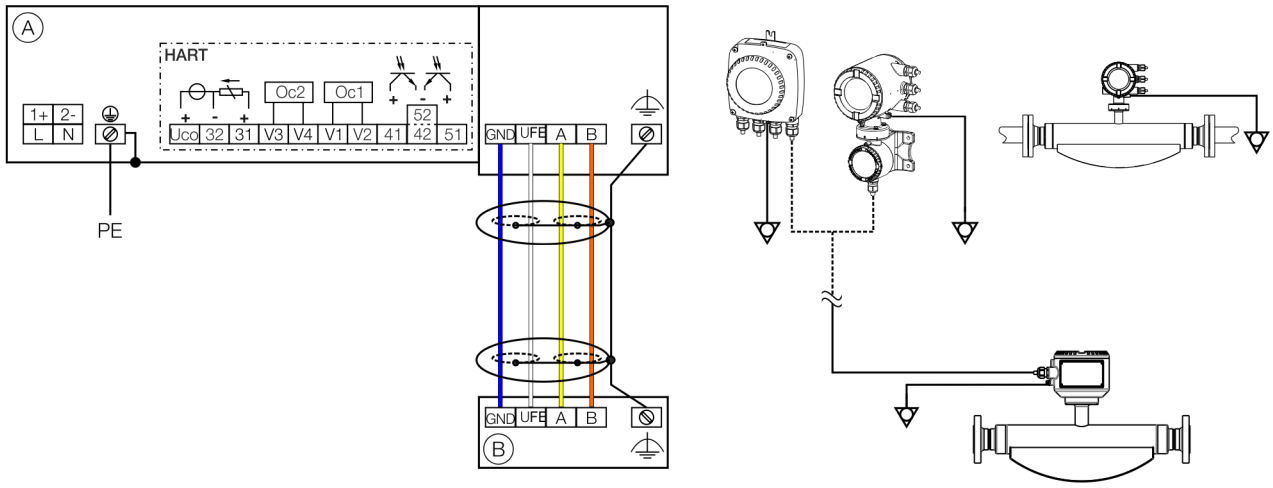
Recommended cables

It is recommended to use an ABB signal cable 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).

ABB signal cable	**Ordering number**
5 m (16 ft)	3KQZ407123U0500
10 m (33 ft)	3KQZ407123U1000
20 m (65 ft)	3KQZ407123U2000
50 m (164 ft)	3KQZ407123U5000
100 m (328 ft)	3KQZ407123U1H00
150 m (492 ft)	3KQZ407123U1F00
200 m (656 ft)	3KQZ407123U2H00

For marine applications, an appropriate certified signal cable must be used.
ABB recommends the cable HELKAMA RFE-FRHF 2×2×0,75 QUAD 250V (HELKAMA order number 20522).

Terminal assignment



Ⓐ Transmitter

Ⓑ Sensor

Figure 28: 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

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 40.

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

… 6 Electrical connections

Electrical data for inputs and outputs

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

Power supply L / N, 1+ / 2–

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

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

Requirements for inputs and outputs

For reasons of electromagnetic compatibility (EMC), shielded cables should be used in certain output configurations; this is presented in the table below.
The cable shielding must be inserted in the device, see **Connection to integral mount design** on page 56 and **Connection to remote mount design** on page 58.

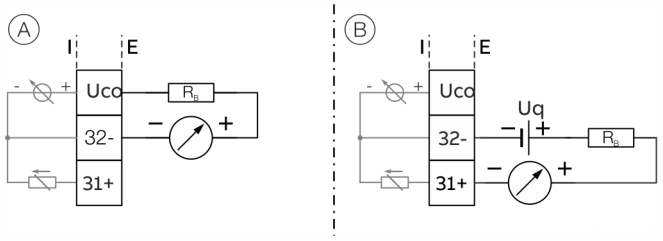
Use of shielded cables

Transmitter	**Plug-in card used**	**Terminal**				
		Uco/31/32	**41/42**	**51/52**	**V1/V2**	**V3/V4**
Dual-compartment housing	Active digital output V1/V2	—	—	—	X	—
	Active digital output V3/V4	—	—	—	—	X
	Modbus V1/V2	—	—	—	X	—
	Profibus DP V1/V2	—	—	—	X	—
Single-compartment housing	Active digital output V1/V2	X	X	X	—	X
	Active digital output V3/V4	X	X	X	X	—
	Modbus V1/V2*	—	—	—	X	—
	Profibus DP V1/V2*	—	—	—	X	—
	Ethernet V1/V2	X	X	X	X	X
	Ethernet V1/V2, POE V3/V4	X	X	X	X	X

X Use shielded cables

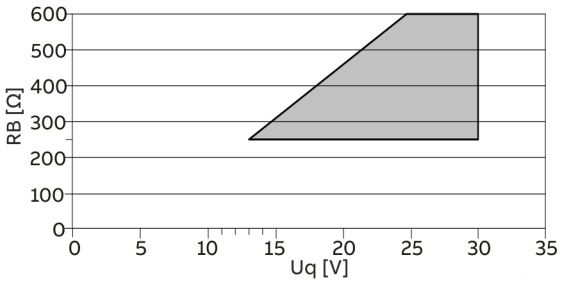
* Use in remote mount design only

Current output 32 / Uco, 31 / 32 (basic device)
Can be configured for outputting mass flow, volume flow, density and temperature via on-site software.



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

Figure 29: (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

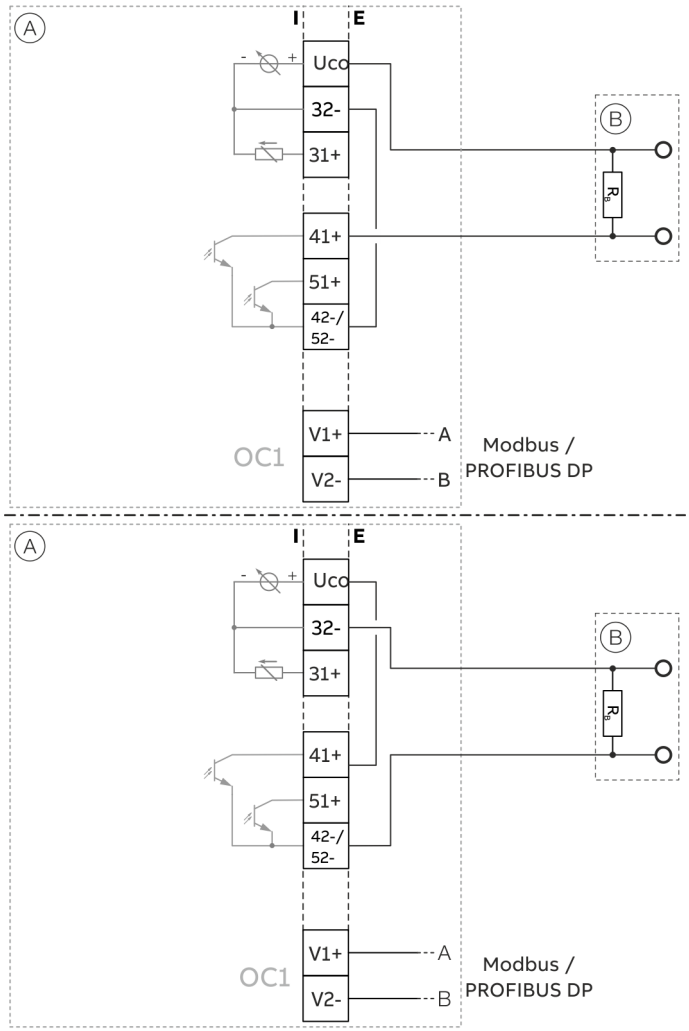
Figure 30: Source voltage for passive outputs

Current output	**Active**	**Passive**
Terminals	Uco / 32	31 / 32
Output signal	4 to 20 mA or 4 to 12 to 20 mA switchable	
Load R_B	250 Ω ≤ R_B ≤ 300 Ω	250 Ω ≤ R_B ≤ 600 Ω
Source voltage U_q*	–	13 V ≤ U_q ≤ 30 V
Measuring error	< 0.1 % of measured value	
Resolution	0.4 µA per digit	

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

For information on communication via the HART protocol, refer to **HART® Communication** on page 61.

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 31: 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 32.
Load rating I_{max}	22.6 mA, permanently short circuit-proof

Table 1: Specification current output Uco / 32 in power mode

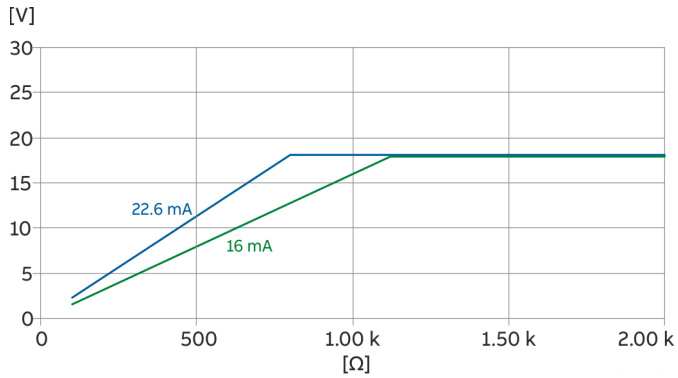
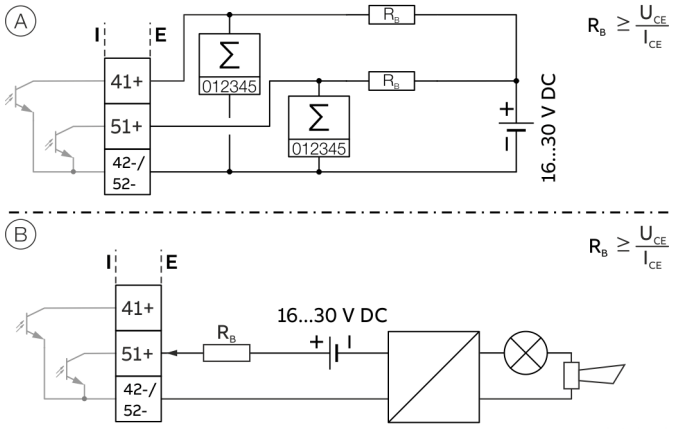


Figure 32: Output voltage dependent on load resistance

… 6 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 33: (I = internal, E = external, R_B = load)

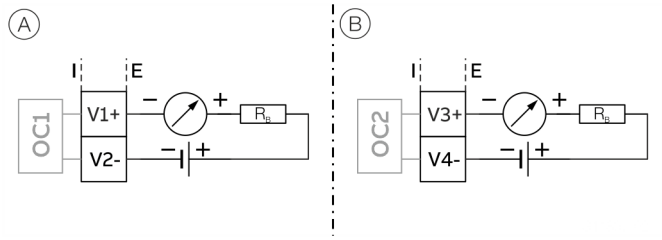
Pulse / frequency output (passive)	
Terminals	41 / 42, 51 / 52
Output ‘closed’	0 V ≤ U_{CEL} ≤ 3 V
	For f < 2.5 kHz: 2 mA < I_{CEL} < 30 mA
	For f > 2.5 kHz: 10 mA < I_{CEL} < 30 mA
Output ‘open’	16 V ≤ U_{CEH} ≤ 30 V DC
	0 mA ≤ I_{CEH} ≤ 0.2 mA
f_{max}	10.5 kHz
Pulse width	0.05 to 2000 ms

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.

Note

- Terminals 42 / 52 have common grounding. Digital outputs 41 / 42 and 51 / 52 are not electrically isolated from each other. An electrically isolated digital output can be made using a plug-in module.
- If using a mechanical counter, it is advisable to set a pulse width of ≥ 30 ms and a maximum frequency of f_{max} ≤ 3 kHz.

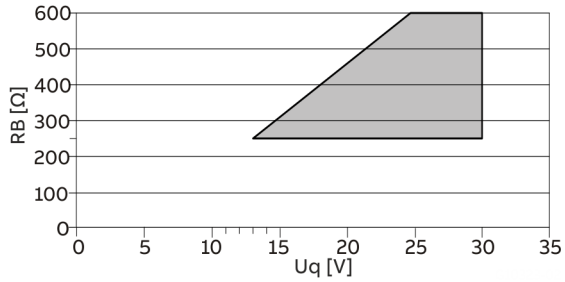
Current output V1 / V2, V3 / V4 (plug-in module)
Up to two additional plug-in modules can be implemented via the ‘Passive current output (red)’ option module.
Can be configured for outputting mass flow, volume flow, density and temperature via on-site software.



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

Figure 34: (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 35: 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 output for flow direction signaling, alarm output etc. via on-site software.

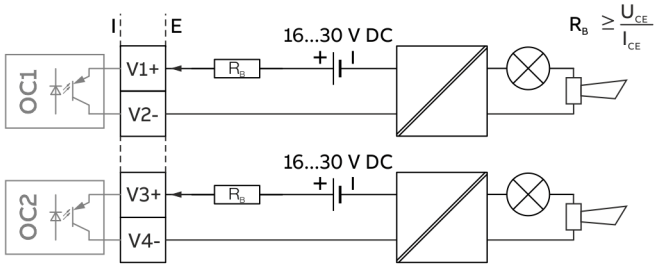
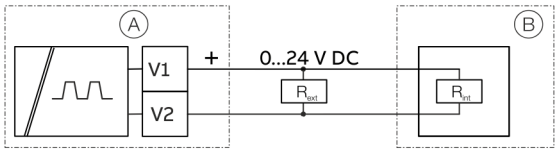


Figure 36: Plug-in card as binary output (I = internal, E = external, R_B = load)

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.

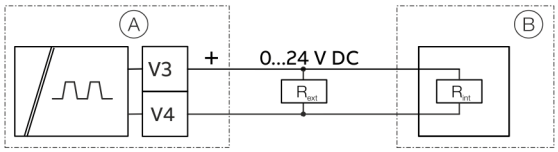
Active digital output V1 / V2, V3 / V4 (plug-in card)
An additional binary output can be implemented via the 'Active digital output (white)' plug-in card.
Can be configured on-site as a logical output for V1 / V2 (flow direction signaling, alarm output, etc.) via software.
Can be configured on-site for V3 / V4 as a frequency output, pulse output or logical output via software.



Ⓐ Transmitter Ⓑ Distributed control system, etc.

Figure 37: Plug-in card V1 / V2

or



Ⓐ Transmitter Ⓑ Distributed control system, etc.

Figure 38: Plug-in card V3 / V4

The plug-in module can be used in slot OC1 **or** OC2.
External voltage cannot be connected to the active binary output.
Only one of the two digital output plug-in cards (passive or active) will be supported at the same time.

Note
Requirements for inputs and outputs
For reasons of electromagnetic compatibility (EMC), shielded cables should be used in certain output configurations; this is presented in Table **Use of shielded cables** on page 48.

… 6 Electrical connections

… Electrical data for inputs and outputs

Dependency of the output voltage U from the load R_B.
Load R_B is the parallel connection of the internal resistance R_{int} and optional external resistance R_{ext}.

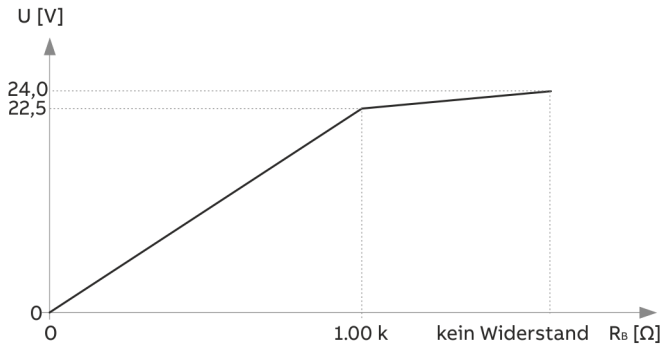
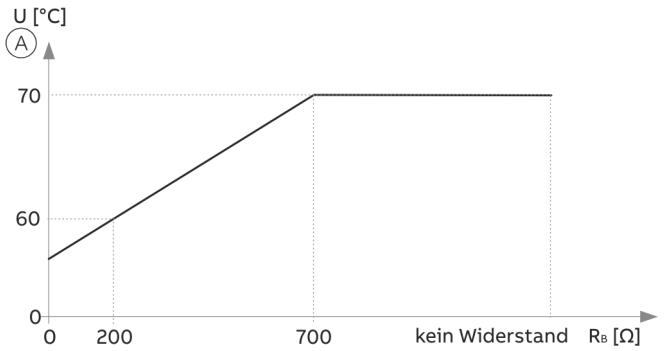


Figure 39: Dependency of the output voltage U from the load R_B.

Permissible ambient temperature single-compartment housing: 70 °C

Permissible ambient temperature dual-compartment housing dependent on the load R_B:



Ⓐ Ambient temperature (°C)

Figure 40: Permissible ambient temperature dual-compartment housing

Binary output (active)	
Terminals	V1 / V2, V3 / V4
'Off' output	$U_L \leq 200$ mV
	$I_L < 0$ mA
'On' output	$0 V \leq U_H \leq 24 V$ (dependent on R_B)
	$0 mA \leq I_H \leq 22.5 mA$ (dependent on R_B)

For pulse/frequency output	
Terminals	V3 / V4
'Off' output	$U_L \leq 200$ mV
	$I_L < 0$ mA
'On' output	$0 V \leq U_H \leq 24 V$ (dependent on R_B)
	$0 mA \leq I_H \leq 22.5 mA$ (dependent on R_B)
f_{max}	10.5 kHz
Pulse width	0.05 to 2000 ms

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

A digital input can be implemented via the 'Passive digital input (yellow)' plug-in module.
Can be configured as an input for external counter reset, external output deactivation etc. via on-site software.

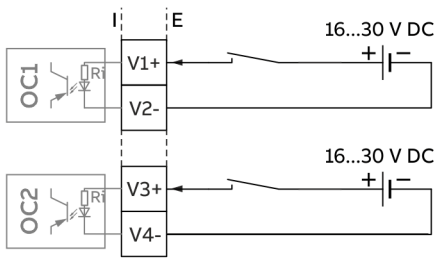


Figure 41: Plug-in card as digital input (I = internal, E = external)

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

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

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

Use of the 'loop power supply (blue)' plug-in card allows a passive output on the transmitter to be used as an active output. See also **Connection examples** on page 53.

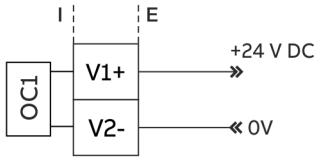


Figure 42: (I = Internal, E = External)

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

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

Note

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

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.

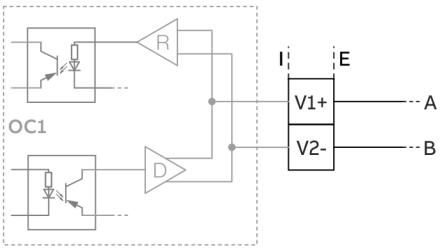


Figure 43: Plug-in card as a Modbus / PROFIBUS DP interface (I = internal, E = external)

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 61 and **PROFIBUS DP® communication** on page 62.

Connection examples

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

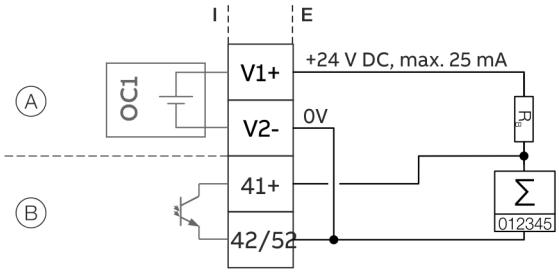
Digital output 41 / 42, 51 / 52, V3 / V4 active

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

Note

Each 'loop power supply (blue)' plug-in card must only power one output.

It must not be connected to two outputs (for example digital output 41 / 42 and 51 / 52)!

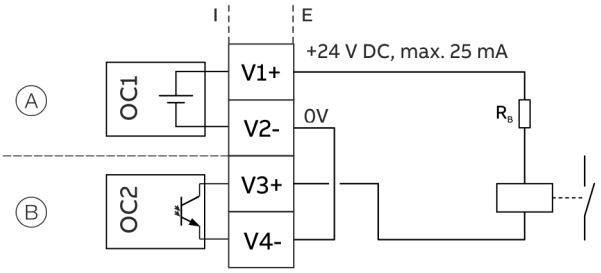


(A) 'Loop power supply (blue)' plug-in card in slot 1

(B) Digital output, digital output 41 / 42

Figure 44: 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

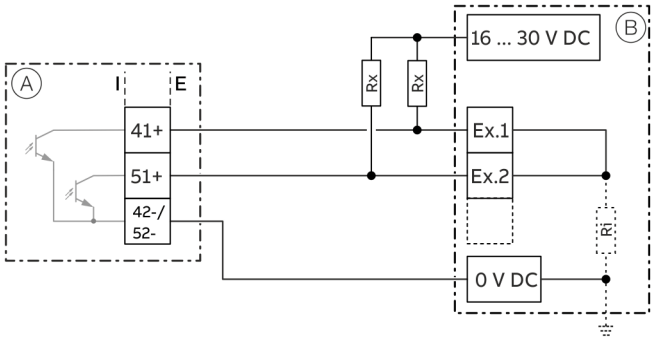
(B) 'Digital output (green)' plug-in card in slot 2

Figure 45: Active digital output V3 / V4 (example)

… 6 Electrical connections

… Electrical data for inputs and outputs

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



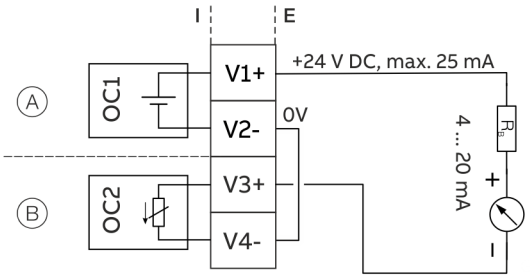
(A) Transmitter
(B) Distributed control system / Memory programmable controller
Ex. 1 Input 1
Ex. 2 Input 2
R_X Resistor for current limitation
R_I Distributed control system internal resistance

Figure 46: 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.

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.

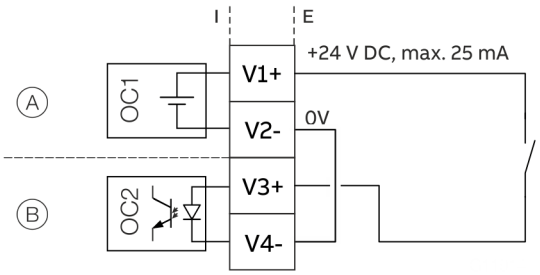


(A) 'Loop power supply (blue)' plug-in card in slot 1
(B) 'Passive current output (red)' plug-in card in slot 2

Figure 47: 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 48: 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.

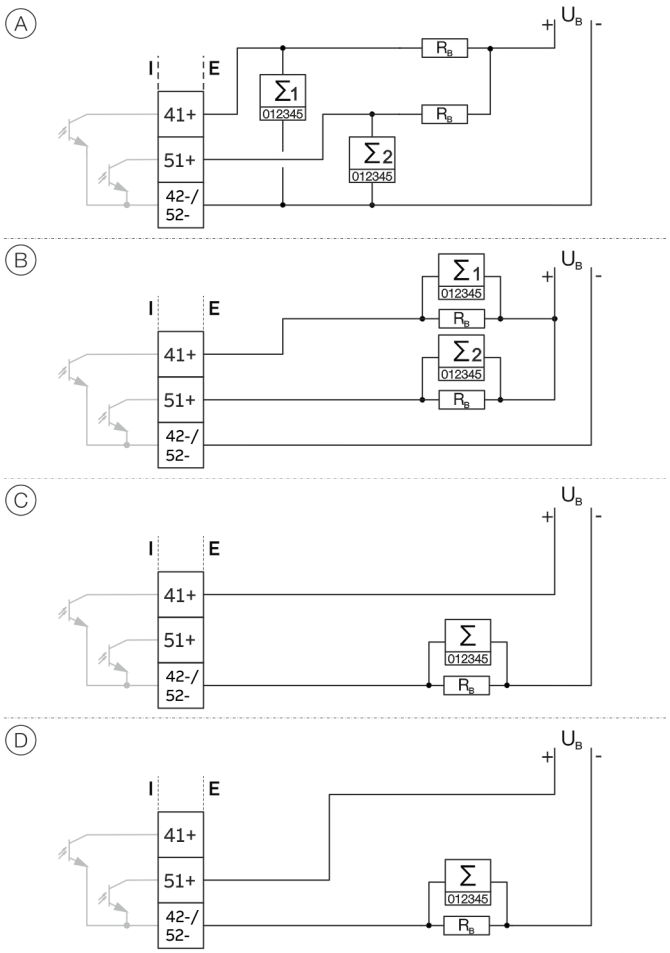


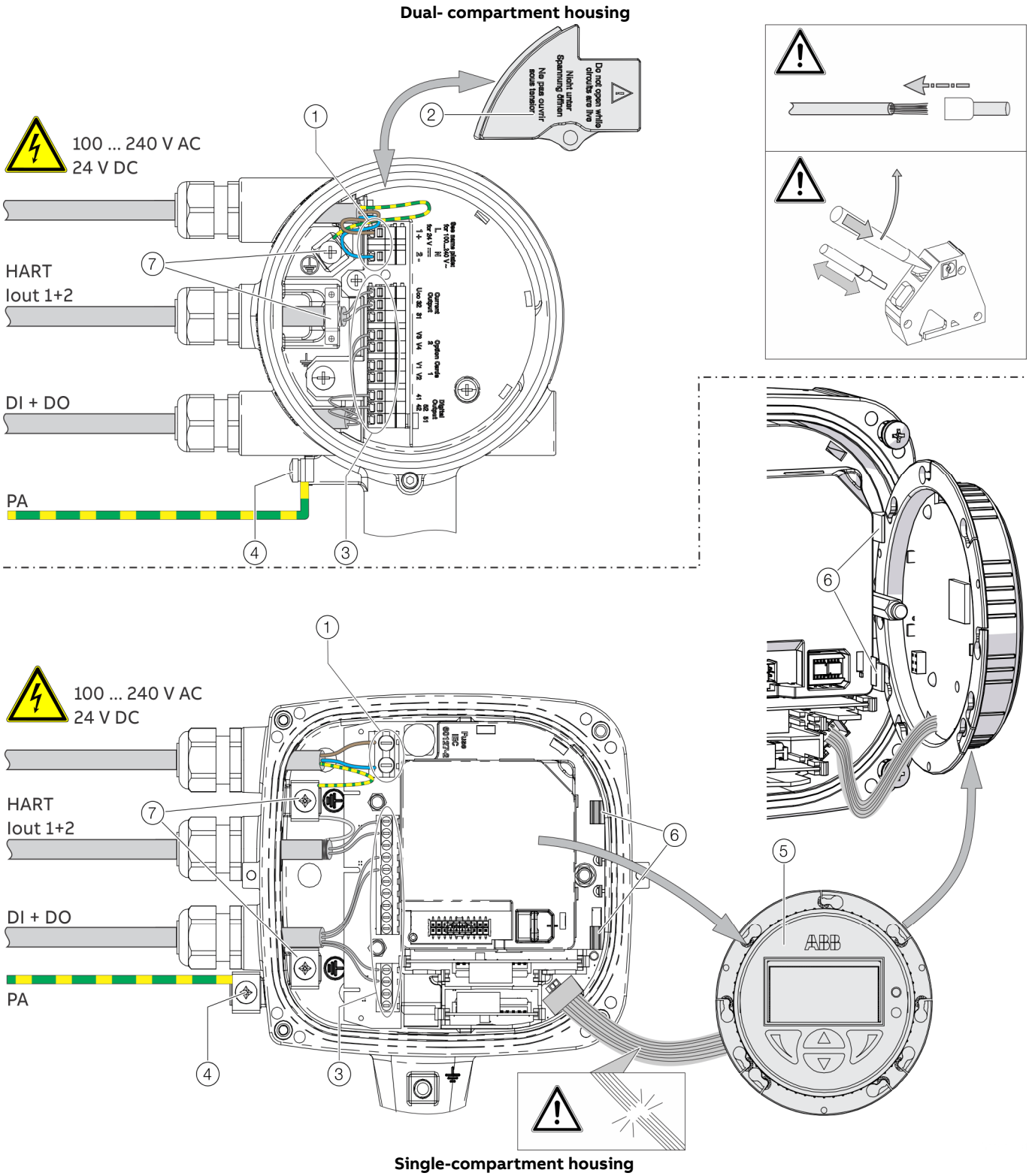
Figure 49: Connection versions digital output 41 / 42 and 51 / 52

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

Table 2: Connection versions digital output

… 6 Electrical connections

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

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 37 to open and close the housing safely.

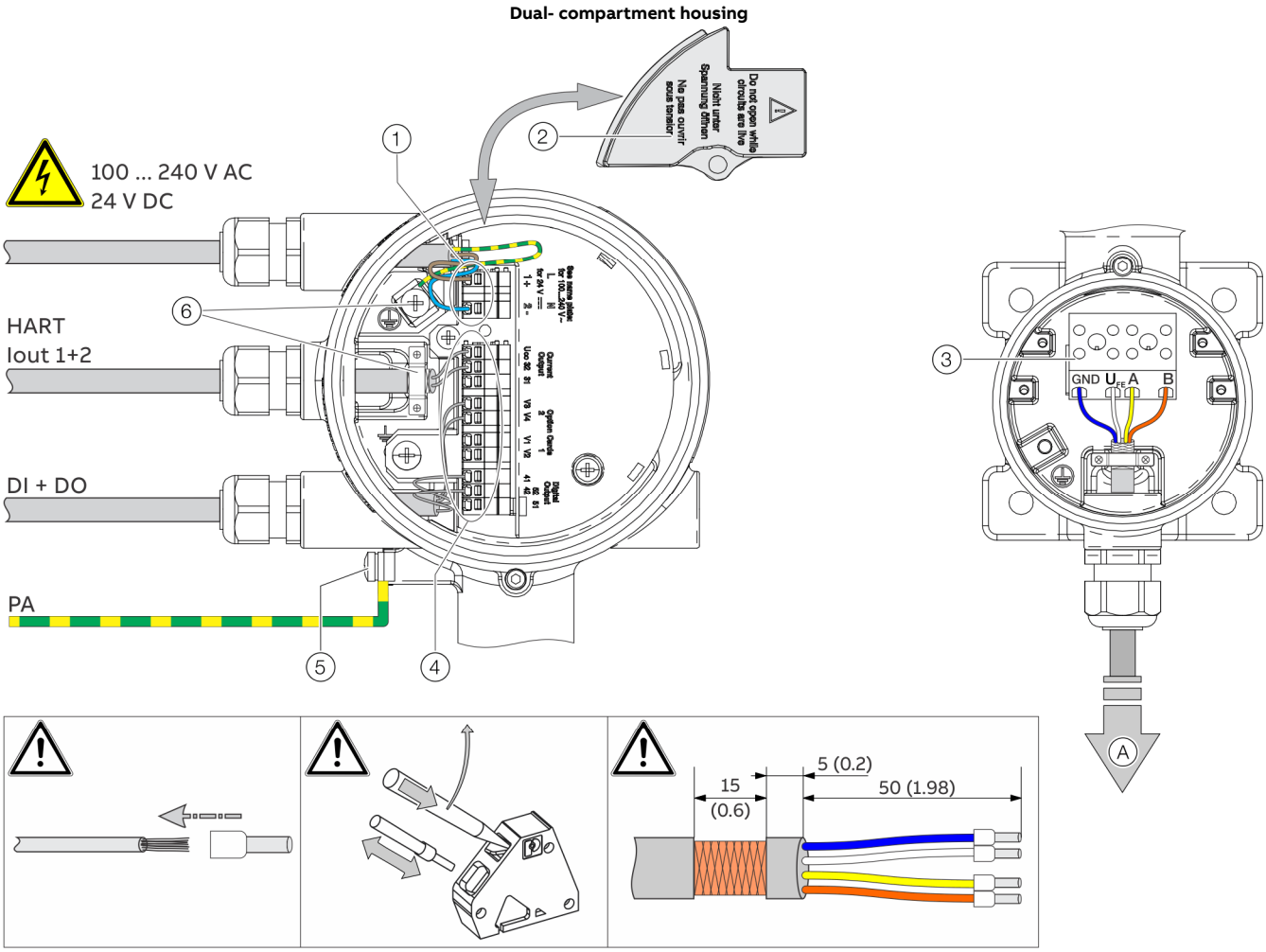
Observe the following points when connecting to an electrical supply:

- 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.

… 6 Electrical connections

Connection to remote mount design

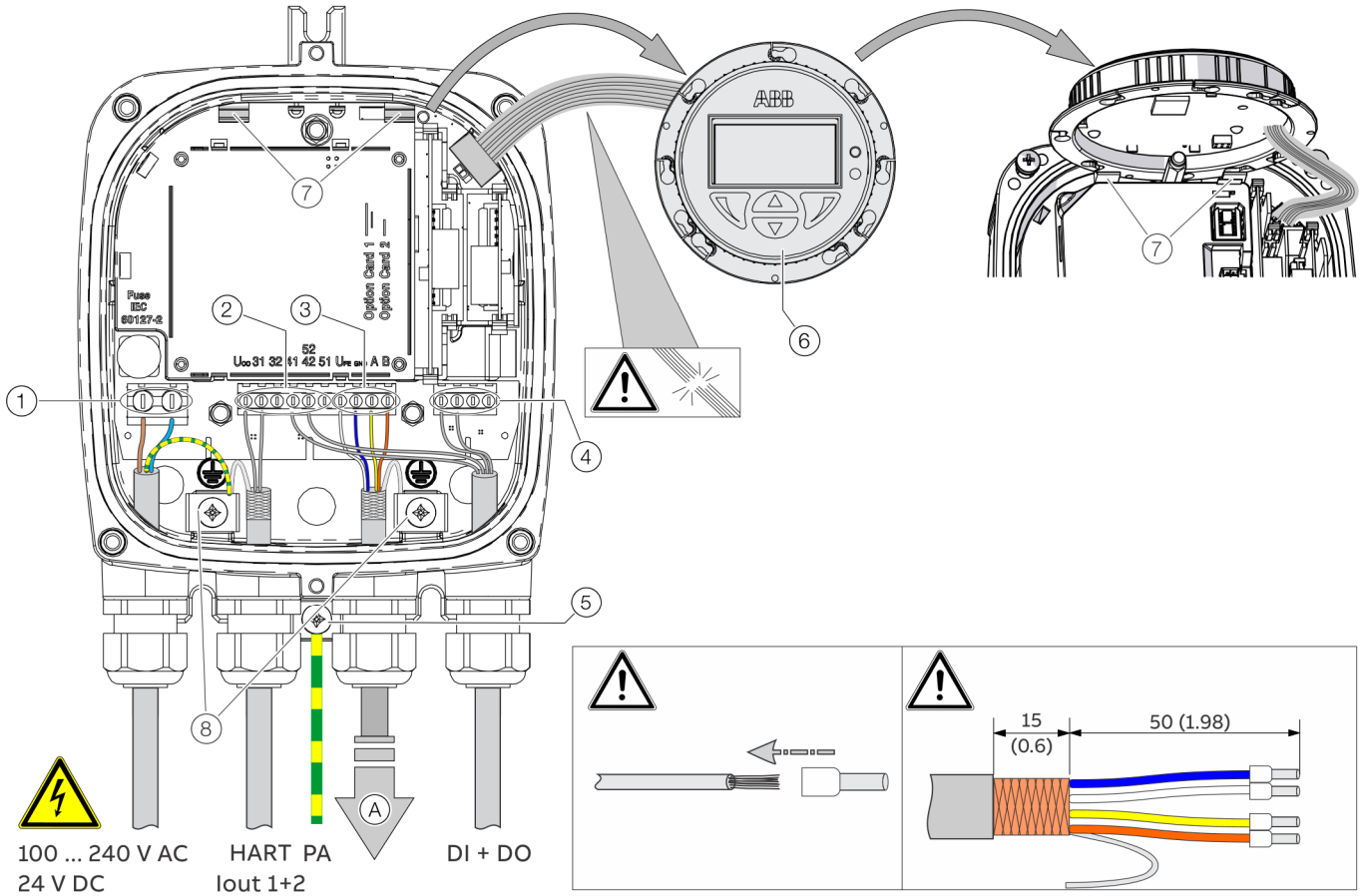
Transmitter



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

Figure 51: Electrical connection to transmitter in remote mount design [example, dimensions in mm (in)]

Single-compartment housing

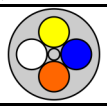
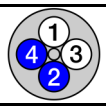


(A) Signal cable to sensor
(1) Terminals for power supply
(2) Terminals for inputs and outputs (base device)
(3) Terminals for signal cable
(4) Terminals for inputs and outputs (plug-in cards)
(5) Terminal for potential equalization
(6) LCD indicator
(7) Bracket for LCD indicator (park position)
(8)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

Figure 52: 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 37 to open and close the housing safely.

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

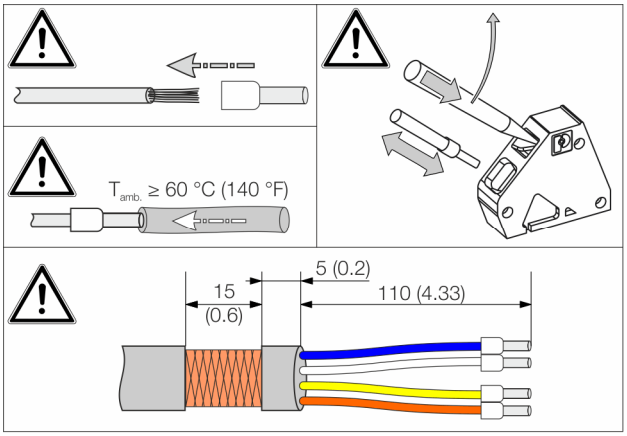
Observe the following points when connecting to an electrical supply:

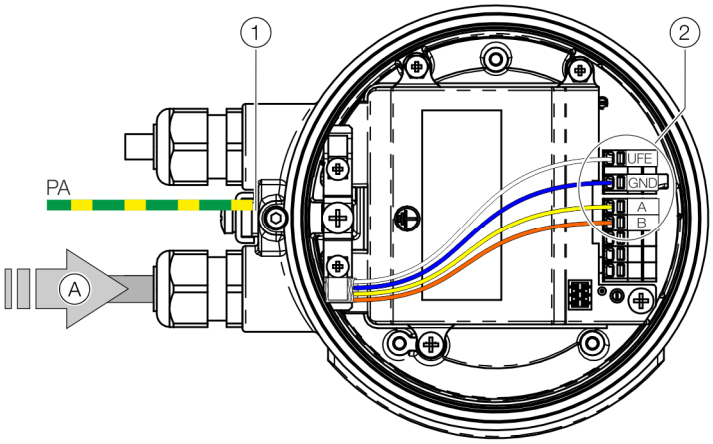
- Lead the cable for the power supply and the signal inputs and outputs into the housing as shown.
- The signal cable to the sensor is connected in the lower connection area of the transmitter.
- Connect the cables in accordance with the electrical connection diagram. If present, connect the cable shielding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

… 6 Electrical connections

… Connection to remote mount design

Flowmeter sensor





(A) Signal cable from the sensor

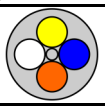
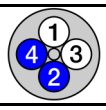
(1) Terminal for potential equalization

(2) Terminals for signal cable

Figure 53: 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 37 to open and close the housing safely.

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

Observe the following points when connecting to an electrical supply:

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

Digital communication

HART® Communication

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

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 (DSV401 R2).
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

HART process variable	**Process value**
Primary Value (PV)	Q_m – Mass flow
Secondary Value (SV)	Q_v – Volume flow rate
Tertiary Value (TV)	p – Density
Quaternary Value (QV)	T_m – Measuring medium temperature

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

Modbus® communication

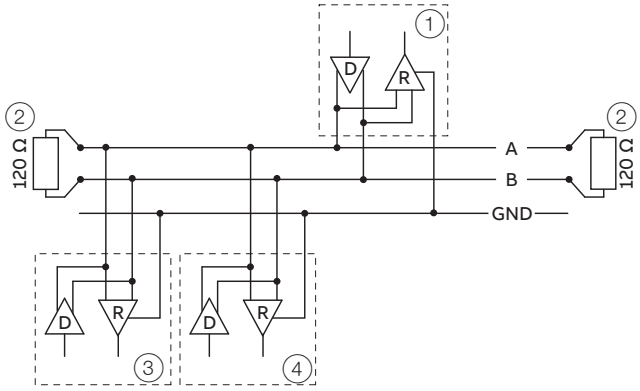
Note
The Modbus® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

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

Modbus protocol	
Terminals	V1 / V2
Configuration	Via the Modbus interface or via the local operating interface in connection with Asset Vision Basic (DAT200) and a corresponding Device Type Manager (DTM)
Transmission	Modbus RTU - RS485 serial connection
Baud rate	2400, 4800, 9600, 19200, 38400, 56000, 57600, 115200 baud Factory setting: 9600 baud
Parity	None, even, odd Factory setting: odd
Stop bit	One, two Factory setting: One
IEEE format	Little endian, big endian Factory setting: Little endian
Typical response time	< 100 ms
Response delay time	0 to 200 milliseconds Factory setting: 10 milliseconds

… 6 Electrical connections

… Digital communication



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

Figure 54: Communication with the Modbus protocol

Cable specification

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

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

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

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

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

PROFIBUS DP® communication

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

PROFIBUS DP interface	
Terminals	V1 / V2
Configuration	Via the PROFIBUS DP interface or via the local operating interface in connection with Asset Vision Basic (DAT200) and 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

For commissioning purposes, you will need a device driver in EDD (Electronic Device Description) or DTM (Device Type Manager) format plus a GSD file.

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
0x9700	PA139700.gsd	1AI
0x3432	ABB_3432.gsd	6xAI, 2xTOT, 1xAO, 1xDI, 1xDO

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.

See also **Parameter description** in the operating instruction on page 86.

Limits and rules when using ABB fieldbus accessories

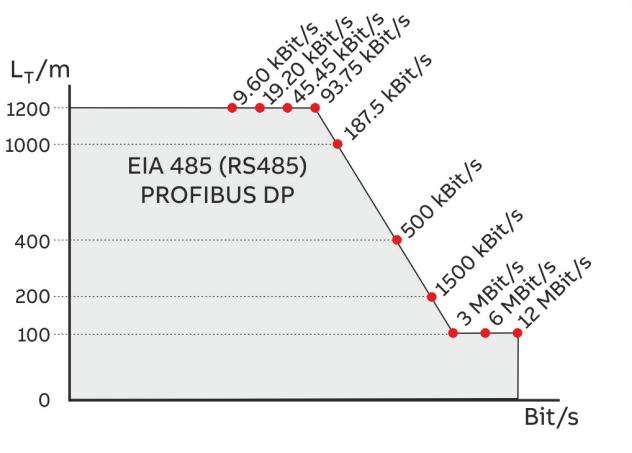


Figure 55: Bus cable length depends on the transmission rate

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))

EtherNet/IP™ communication

Note

You will find detailed information regarding the “Ethernet” in the interface description “COM/FCB400/FCH400/E/MB”.

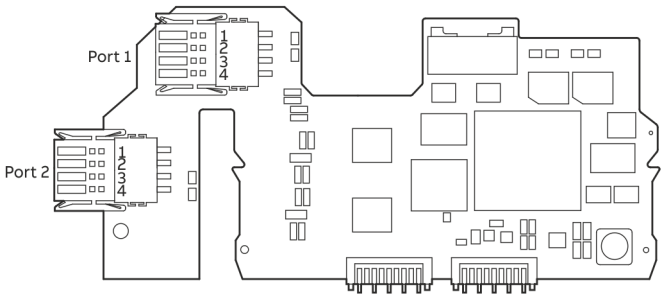


Figure 56: Ethernet communication plug-in card

One port connection without power over Ethernet

Terminal designation:

Port	Pin	Function	Color coding
1	Pin 1	RD+	White / Orange
	Pin 2	RD−	Orange
	Pin 3	TD+	White / Green
	Pin 4	TD−	Green

Standard Ethernet 10/100 BASE-T/TX (IEEE802.3) single port connection.

One port connection with power over Ethernet

Terminal designation:

Port	Pin	Function	Color coding
1	Pin 1	RD+	White / Orange
	Pin 2	RD−	Orange
	Pin 3	TD+	White / Green
	Pin 4	TD−	Green
2	Pin 1	PWR+	White / Blue
	Pin 2	PWR+	Blue
	Pin 3	PWR−	White / Brown
	Pin 4	PWR−	Brown

Standard Ethernet 10/100 BASE-T/TX (IEEE802.3) single port connection.

… 6 Electrical connections

… Digital communication

Two port connection without power over Ethernet

Terminal designation:			
Port	**Pin**	**Function**	**Color coding**
1	Pin 1	RD+	White / Orange
	Pin 2	RD−	Orange
	Pin 3	TD+	White / Green
	Pin 4	TD−	Green
2	Pin 1	RD+	White / Orange
	Pin 2	RD−	Orange
	Pin 3	TD+	White / Green
	Pin 4	TD−	Green

Ethernet communication

Equipped with an Ethernet Card, CoriolisMaster provides 2 Ethernet Ports supporting a Ring, Star and Daisy Chain Network configuration.

In addition to the Ethernet Card, a plug-in Card providing ‚Power over Ethernet' is available. This Card allows to power the 24 V DC Version of the flowmeter through Ethernet without the need for additional power supply.

EtherNet/IP™ protocol

Note

The EtherNet/IP protocol is not secure, as such. The application should be assessed before Implementation to ensure the protocol is suitable.

With implemented CoriolisMaster EtherNet/IP protocol, cyclic Communication is supported. Process Variables, Diagnostic Data and Device Status Information can be accessed cyclically.

For Device Configuration a Webserver is available providing full access to all parameter and diagnostic data.

EtherNet/IP Interface	
Configuration	Through the Webserver or the local operating Interface (Display).
EtherNet / IP ProductCode	5001
EDS file	FCB4_FCH4_01_01.eds
Device profile	Profile 0x43, Generic Device, (keyable).
Supporte standards and protocols	Common Industrial Protocol (CIP™) Vol1, Ed 3.25
	EtherNet/IP™ Adaptation of CIP™, Vol2, Ed 1.23
Cable	Cat 5

Further Ethernet communication protocols

Note

The device supports following security modes:

Secured Protocols:

Webserver https:

Security modes

Used ports by Webserver: TCP 443

Security is based on .x509 Certificates

Protocol could be deactivated via HMI.

Unsecured protocols:

EtherNet / IP and Modbus TCP

Used ports by EtherNet/IP: TCP 44818, UDP 2222

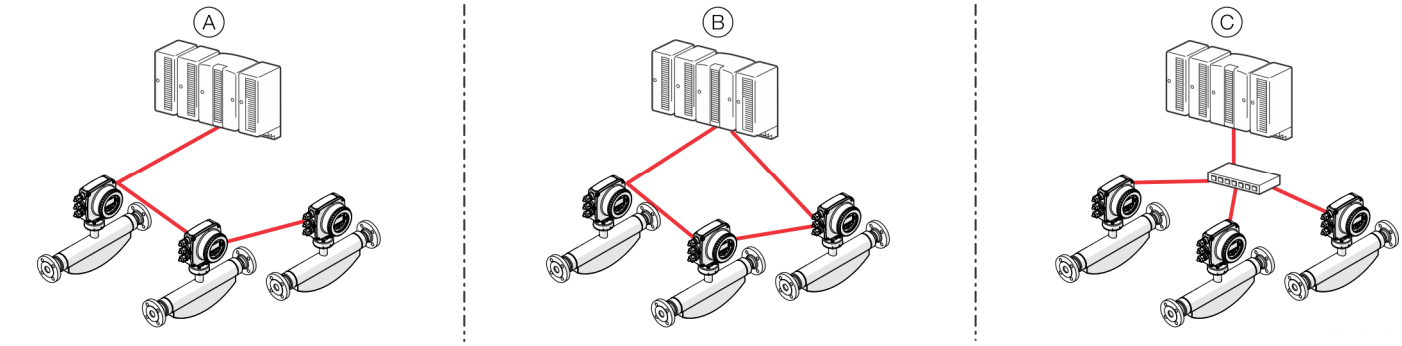
Used ports by Modbus/TCP: TCP 502

All protocols can be enabled / disabled in the HMI Menu.Ethernet

Note

For EMC reasons, if an Ethernet output and a current or digital output are used simultaneously, a shielded cable must also be used for the current or digital output. The shield of the cable must be connected in the unit., see **Connection to integral mount design** on page 56 and **Connection to remote mount design** on page 58.

Wiring with different network topologies

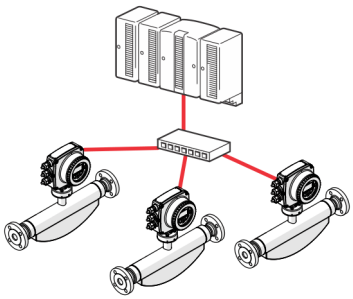


(A) Daisy-chain
(B) Ring
(C) Star

Figure 57: Connection topologies

Ethernet Option Cards are designed only for use in hazardous applications Zone 2 / Division 2 or general purpose areas.
The output circuits are designed so that different topologies such as daisy chain or point to point can be connected.
See Installation diagram for detailed information.

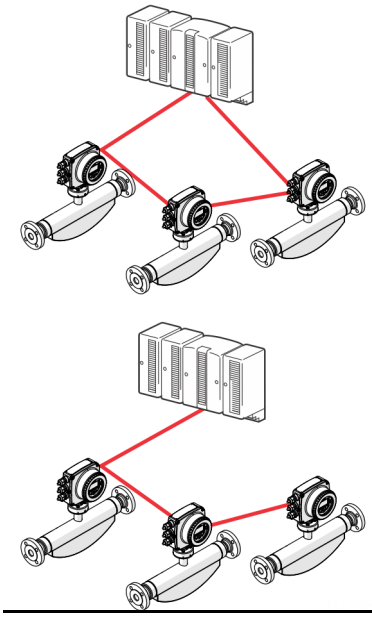
- It is not permitted to combine both topologies.
- Ethernet communication is only available for installations in Zone 2/Division 2 or general purpose
- The rated voltage of these non-intrinsically safe circuits are UM = 57 V.

Topology	No. Ethernet cables connected	No. wires in Ethernet cable	PoE	Port	Clamp	Function	Cable
Star 	1	4	No	1	1	RD+	white / orange
					1	RD–	orange
					3	TD+	white / green
					4	TD–	green
	1	8	No	1	1	RD+	white / orange
					2	RD–	orange
					3	TD+	white / green
					4	TD–	green
				2	1	Spare 1+	white / blue
					2	Spare 1–	blue
					3	Spare 2+	white / brown
					4	Spare 2–	brown
	1	4	Yes	1	1		Recommendation:
					2		Use cable with 8 wires
					3		
					4		
	1	8	Yes	1	1	RD+	white / orange
					2	RD–	orange
					3	TD+	white / green
					4	TD–	green
				2	1	Spare 1+	white / blue
					2	Spare 1–	blue
					3	Spare 2+	white / brown
					4	Spare 2–	brown

… 6 Electrical connections

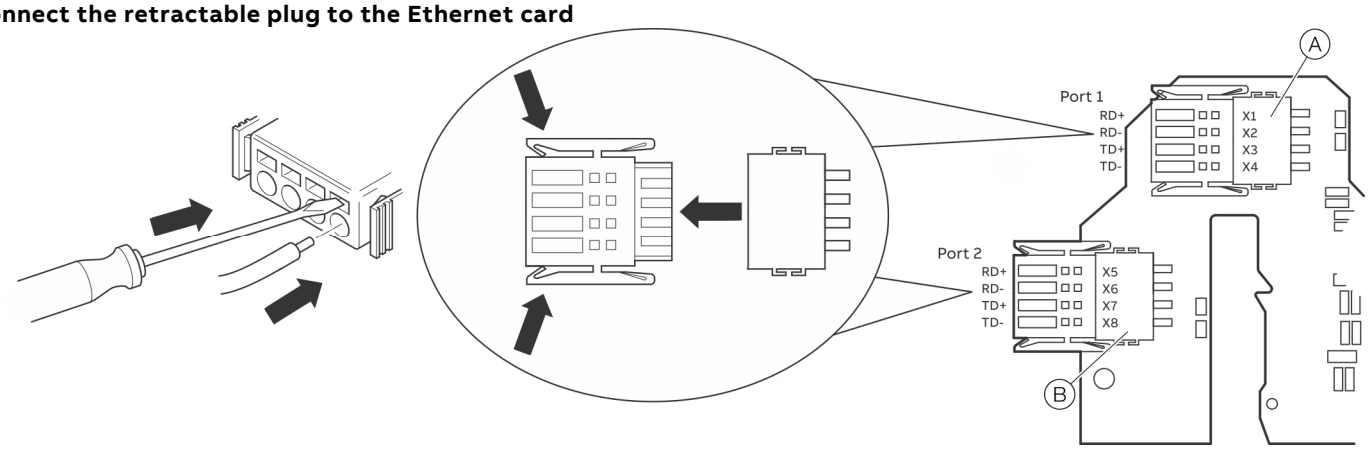
… Digital communication

Topology	No. Ethernet cables connected	No. wires in Ethernet cable	PoE	Port	Clamp	Function	Cable
Ring or daisy-chain	2	4*	No	1	1	RD+	white / orange
					2	RD−	orange
					3	TD+	white / green
					4	TD−	green
				2	1	RD+	white / orange
					2	RD−	orange
					3	TD+	white / green
					4	TD−	green



* If you use 8-wire cables, 4 wires will not be connected.

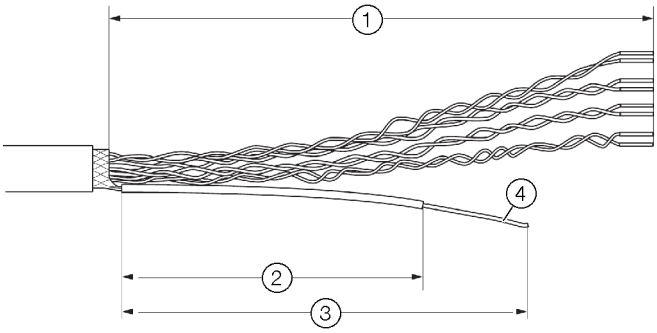
Connect the retractable plug to the Ethernet card



Ⓐ Port 1 Ⓑ Port 2

Figure 58: Ethernet card connection

Preparing the EtherNet Cat5e cable

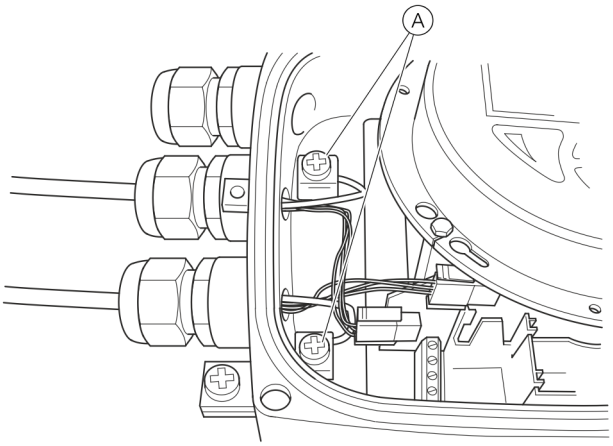


① 90 mm (3.54 in)
② 39 mm (1.54 in)
③ 60 mm (2.36 in)
④ Tin 10 mm of the end of the braided shield of the cable

Figure 59: Preparing the EtherNet Cat5e cable

Ground the Ethernet connection cable

Connect the outer shield of the Ethernet cable to the screw terminal.



Ⓐ Screw terminal

Figure 60: Ground the Ethernet connection cable

M12 plug (option)

Various options for M12 plugs are available from the model code:

- Flowmeter equipped with 1 × M12 (with 4 wires, connecting to Port 1)
- Flowmeter equipped with 2 × M12 (with 4 wires each, connecting to Port 1 & 2)
- Flowmeter equipped with 1 × M12 (with 8 wires, connecting to Port 1 & 2)

These options allow for connection to different network topologies:

Topology	**4 wires**	**4 wires**	**4 wires**	**8 wires**
				
	1 x M12 (4 wires)	2 x M12 (4 wires)		1 x M12 (8 wires)
Star	Y	Y		Y
Ring or daisy-chain	N	Y		N
PoE	N	N		Y

Electrical connections

For the internal wiring inside the transmitter and the related pinout within the M12 Plug, refer to table below:

Wiring inside the transmitter	**M12 Plug pin**	**Color**	**Ethernet card port/pin**
 **M12 plug with 4 wires**	1	Yellow	Port 1 X1
	2	Orange	Port 1 X2
	3	White	Port 1 X3
	4	Blue	Port 1 X4
 **M12 plug with 8 wires**	1	White	Port 1 X1
	2	Blue	Port 1 X2
	3	Brown	Port 1 X3
	4	Green	Port 1 X4
	5	Pink	Port 1 X5
	6	Yellow	Port 1 X6
	7	Grey	Port 1 X7
	8	Red	Port 1 X8

… 6 Electrical connections

… Digital communication

Use in hazardous areas

⚠ WARNING

There are limitations of the M12 plug in combination with a ATEX / IECEx approved flowmeter.

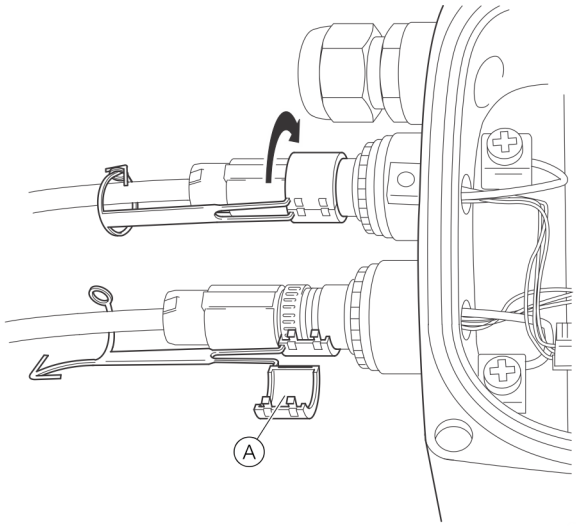
	No Ex Area	ATEX/IEX Zone 2	Div 2
Ethernet cable directly connected to Ethernet card terminals	Y	Y	Y
Ethernet cable connected to M12 plug at transmitter housing	Y	Y	N

Retaining clip

⚠ WARNING

When using the M12 Plug in combination with a ATEX / IECEx approved flowmeter, a retainer clip must be put in place.

- Use or operating the device without a M12-locking clip is not permitted.



Ⓐ Retaining clip

Figure 61: Mounting of retaining clip

⚠ DANGER

Explosion hazard

Danger of explosion by connecting or disconnecting the M12 connector when the device is energized.

- Only connect or disconnect the M12 connector when the device is de-energized.

1. Remove the metal M12 connector closing cap at transmitter enclosure from delivery state.
2. Connect the customer M12 connector cable.
3. Put the enclosed retaining clip around the M12 connector and close them until the clip clicks into space and secure the clip by closing arrow and needle eye.

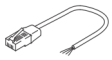
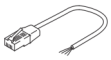
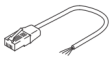
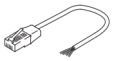
RJ45 connector (option)

Various Options for RJ45 connection are available from the Modelcode. The RJ45 connector is equipped with a certain length of Ethernet cable – as per model code.

The flowmeter is shipped with the Ethernet cable fitted to the terminals inside the transmitter:

- Flowmeter equipped with 1 × RJ45 (with 4 wires, connectingto Port 1)
- Flowmeter equipped with 2 × RJ45 (with 4 wires each,connecting to Port 1 and 2)
- Flowmeter equipped with 1 ×RJ45 (with 8 wires, connectingto Port 1 and 2)

These options allow for connection to different network topologies:

Topology	4 wires	4 wires	4 wires	8 wires
				
	1 x RJ45 (4 wires)	2 x RJ45 (4 wires)		1 x RJ45 (8 wires)
Star	Y	Y		Y
Ring or daisy-chain	N	Y		N
PoE	N	N		Y

Electrical connections

For the internal wiring inside the transmitter and the related pinout within the RJ45 connector, refer to table below:

Wiring inside the transmitter	Color	Ethernet card port/pin
RJ45 with 4 wires	Yellow	Port 1 X1
	Orange	Port 1 X2
	White	Port 1 X3
	Blue	Port 1 X4
RJ45 with 8 wires	White/orange	Port 1 X1
	Orange	Port 1 X2
	White/green	Port 1 X3
	Green	Port 1 X4
	White/blue	Port 2 X5
	Blue	Port 2 X6
	White/brown	Port 2 X7
	Brown	Port 2 X8

Use in hazardous areas

⚠ WARNING

There are limitations of the RJ45 plug in combination with a ATEX / IECEx approved flowmeter.

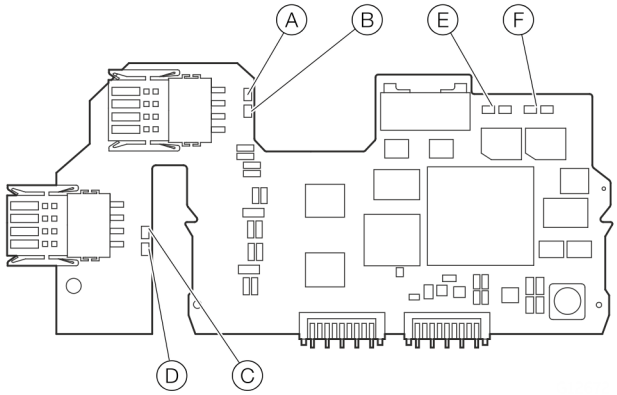
	No ExArea	ATEX/IEX Zone 2	Div 2
Ethernet cable with RJ45 connector fitted at transmitter housing	Y	Y	N

… 6 Electrical connections

… Digital communication

Ethernet card status LEDs

The 6 LEDs on the Ethernet card indicate the status of each port and the network.
To enable card status indication in the upper HMI Line, navigate to 'Display / Display Tag / Ethernet Status'.



(A) Port 1
(B) Activity 1
(C) Port 2
(D) Activity 2
(E) Module Status (Mod)
(F) Network Status (Net)

Figure 62: Ethernet card status LEDs

LED	Status	HMI display	Description
(A) Port 1	ON		Network connection (link up)
	OFF		No network
(B) Activity 1	Flashing or ON		Traffic
	OFF		No traffic
(C) Port 2	ON		Network connection (link up)
	OFF		No network
(D) Activity 2	Flashing or ON		Traffic
	OFF		No traffic
(E) Module Status (Mod)	green, ON	Mod showing <G> continously	Device ready for Operation. Working properly
	green, Flashing (1 Hz)	Mod changing between <G> and < >	Standby. Device not configured yet
	green/ red, Flashing (1Hz)		Device performs "Power-On" Test
	red, Flashing (1 Hz)	Mod changing between <R> and < >	Simple Error, which can be fixed
	red, ON	Mod showing <R> continously	Major Error. Non removable serious error
	OFF	Mod showing < > continously	No Power
(F) Network Status (Net)	green, ON	Net showing <G> continously	Connected. Device has at least one established connection
	green, Flashing (1 Hz)	Net changing between <G> and < >	No Connection. Device did not establish any connections, but was assigned an IP address
	green/ red, Flashing (1Hz)		Device performs "Power-On" Test
	red, ON	Net showing <R> continously	Dublicated IP address. Device has detected that the device IP address is already in use
	OFF	Net showing < > continously	No supply voltage or IP Address.
	red, flashing (1 Hz)	Mod changing between <R> and < >	Connection timeout

7 Commissioning

Safety instructions

⚠ DANGER

Explosion hazard

Improper installation and commissioning of the device carries a risk of explosion.

- For use in potentially explosive atmospheres, observe the information in **Use in potentially explosive atmospheres** on page 6!

⚠ CAUTION

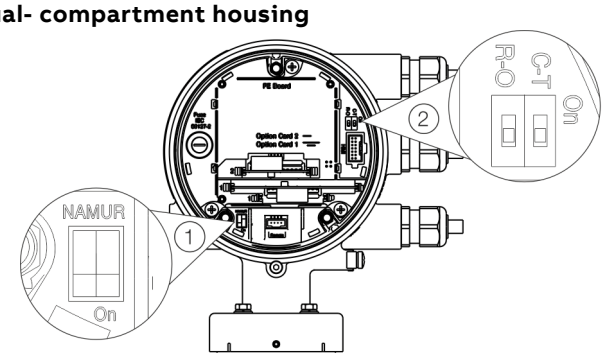
Risk of burns due to hot measuring media

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.

Hardware settings

Dual- compartment housing



① NAMUR DIP switch ② Write protection DIP switch

Figure 63: 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

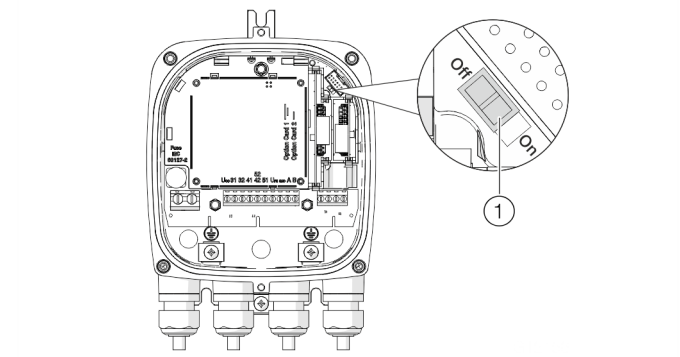
The configuration (NAMUR, optoelectronic coupler) for the digital outputs on the basic device is set via DIP switches in the transmitter.

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.

… 7 Commissioning

… Hardware settings

Single-compartment housing



(1) DIP switch, Write protection

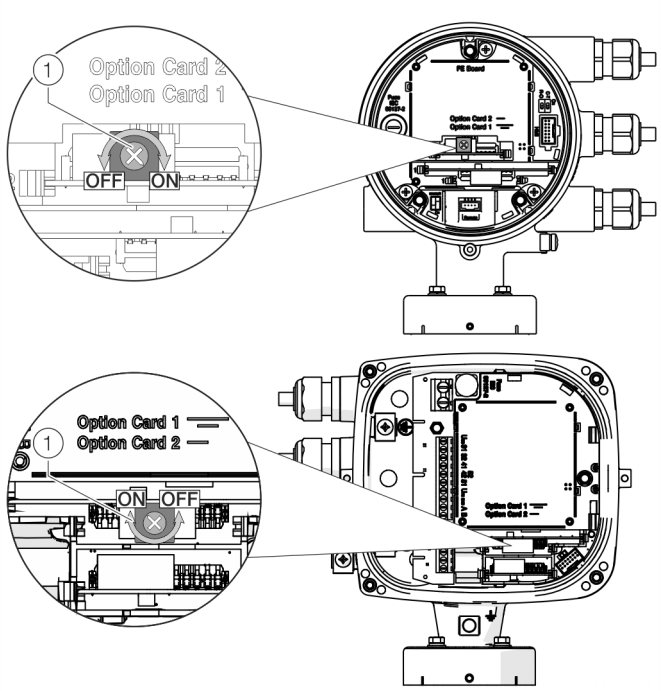
Figure 64: Position of the DIP switch

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 65: 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

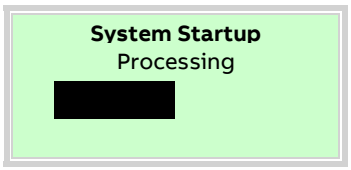
The following points must be checked before commissioning the device:

- Correct wiring in accordance with **Electrical connections** on page 45.
- 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.

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 of the device

The CoriolisMaster FCB400, FCH400 can be commissioned and operated via the integrated LCD indicator (see **Menu: Easy Setup** on page 77).

Alternatively, the CoriolisMaster FCB400, FCH400 can also be commissioned and operated via standard HART tools. These include:

- ABB HART handheld terminal DHH805 (FCB4xx EDD)
- ABB Asset Vision Basic (FCB4xx DTM)
- 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 ABB AssetVision Basic and ABB Field Information Manager (FIM)

There are two different software packages available for configuration:

- ABB AssetVision Basic combined with the ABB CoriolisMaster Device Type Manager (DTM).
- ABB Field Information Manager (FIM) combined with the ABB CoriolisMaster Field Device Information Package (FDI package).

… 7 Commissioning

… Parameterization of the device

AssetVision Basic with the ABB CoriolisMaster Device Type Manager (DTM)

The required software and drivers can be downloaded using the adjacent download link.

Installation of the software and connection to the flowmeter:

1. Unpack the downloaded archive file to the c:\temp folder.
2. AssetVision Basic (DAT200) install ‘3KXD151200S0050_Tool_DAT200_Asset_Vision_Basic’.
3. HART Communication DTM install ‘ABB DTM HART Communication ServicePort’.
4. CoriolisMaster DTM FCXxxx install ‘3KXF410100S0002_DTM_FCXxxx_HART_CoriolisMaster‘.
5. Connect the flowmeter with the PC / laptop, see chapter **Parameterization via the infrared service port adapter** on page 75 or **Parameterization via HART®** on page 76.
6. Power-up the power supply for the flowmeter and start AssetVision Basic on the PC / laptop
   - Select HART and ‘ABB HART Communication ServicePort’.
   - Select the corresponding COM port.
   - Baud rate 19200.
   - The flowmeter is detected and the CoriolisMaster DTM starts automatically.
   - Confirm the dialog field ‘Upload parameters’ by selecting ‘yes’.

Field Information Manager (FIM) with the ABB CoriolisMaster Field Device Information Package

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 75 or **Parameterization via HART®** on page 76.
4. Power-up the power supply for the flowmeter and start the ABB Field Information Manager (FIM).
5. Drag and drop the ‘ABB.FCXxxx.01.00.00.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 66.

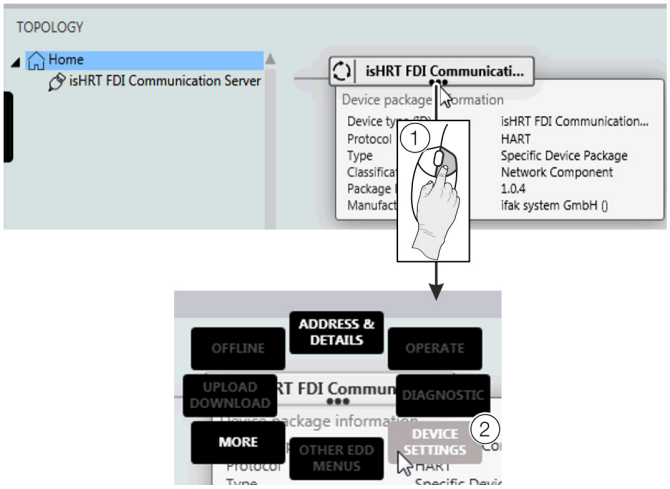


Figure 66: Select FIM – ‘Device Settings’

7. Select ‘DEVICE SETTINGS’ (2) as shown in Figure 66.

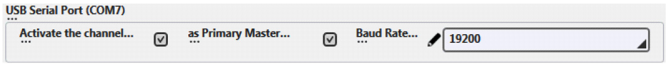


Figure 67: Select FIM – COM-Port

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’.

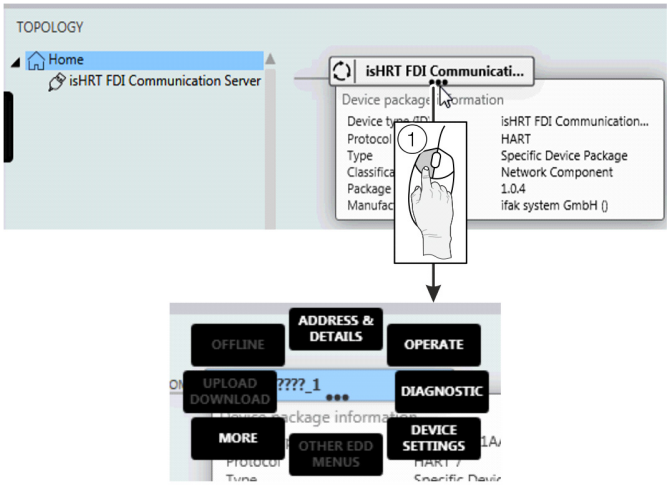


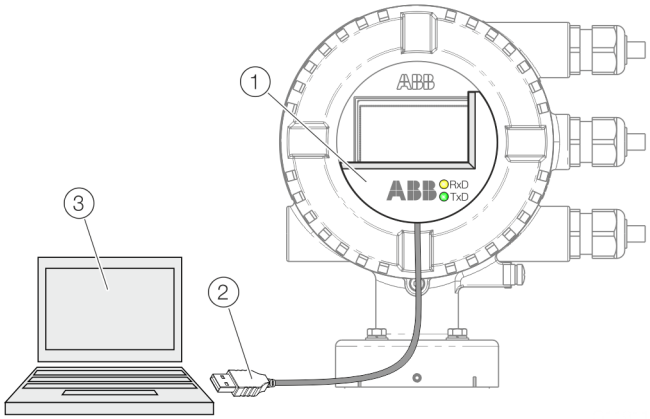
Figure 68:

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 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 HART-DTM and the software ‘ABB AssetVision’ available at www.abb.com/**flow**, all parameters can also be set without a HART connection.



(1) Infrared service port adapter
(2) USB-interface cable
(3) PC / Notebook running ABB AssetVision and HART DTM

Figure 69: 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 ABB AssetVision and perform the parameterization of the equipment.

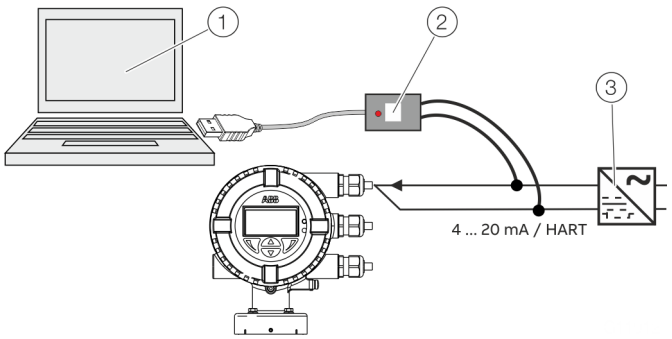
Detailed information on operating the software is available in the relevant operating instructions and the DTM online help.

… 7 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.
All parameters can also be set via the HART protocol, using the HART DTM available at www.abb.com/**flow** and the ABB AssetVision software.



① PC / Notebook running ABB AssetVision and HART DTM
② HART modem
③ Power supply unit

Figure 70: 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.

Basic Setup

The device can be factory parameterized to customer specifications upon request. If no customer information is available, the device is delivered with factory settings.
Settings for the most common parameters are summarized in the 'Easy Setup' menu.
This menu is the quickest way to perform the initial configuration of the device.
For information on navigating through the transmitter menu, see **Menu navigation** on page 81.
For a detailed description of all menus / parameters see **Parameter description** in the operating instruction on page 86.

Menu: Easy Setup

Menu / parameter	Description
Easy Setup	
Language	Selection of menu language.
Unit Massflow Qm	Selection of the unit for mass flow rate (for example for the Q_mMax / Q_mMaxDN parameters and for the corresponding process value).
Unit Volumeflow Qv	Selection of the unit for volume flow rate (for example for the Q_vMax / Q_vMaxDN parameters and for the corresponding process value).
Unit Density	Selection of the unit for the density (e.g. for the associated parameters and the corresponding process values).
Unit Temperature	Selection of unit for temperature (e.g. for the associated parameters and the corresponding process values).
Unit Mass Totalizer	Selection of the unit for the mass counters and the pulse outputs.
Unit Vol. Totalizer	Selection of the unit for the volume totalizers and the pulse outputs.
Curr.Out 31 / 32 / Uco	Selection of the process value issued via the current output.
Curr.Out V1/V2	The current outputs V1 / V2 and V3 / V4 are only available if the corresponding plug-in cards are present!
Curr.Out V3/V4	
Dig.Out 41 / 42 Mode	Selection of the operating mode for the digital output 41 / 42. • Off: Digital output 41 / 42 deactivated. • Logic: 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. The maximum frequency can be configured in accordance with the upper range value.

… 7 Commissioning

… Basic Setup

Menu / parameter	Description
Dig.Out 51 / 52 Mode	Selection of the operating mode for the digital output 51 / 52. • Off: Digital output deactivated. • Logic: Digital output functions as binary output (for function see parameter '„...Setup Logic Output'). • Frequency: Digital output 51 / 52 as a frequency output. In frequency mode, a frequency is issued that is proportional to the flow rate. The maximum frequency can be configured in accordance with the upper range value. • Follow DO 41/42: The digital output 51 / 52 follows the function of digital output 41 / 42. Depending on the setting of the parameter 'Input/Output / ...Dig.Out 41/42 / Outp. Flow Direction', digital output 51 / 52 is operated in pulse mode as follows: – No pulses are issued if 'Forward & Reverse' is selected. Only digital output 41 / 42 is active. – If 'Forward' is selected, pulses for forward flow are issued on digital output 41 / 42, while pulses for reverse flow are issued on digital output 51 / 52. – When "Reverse" is selected, pulses for reverse flow are output on digital output 41 / 42, while pulses for forward flow are output on digital output 51 / 52. • 90° Shift: Output of the same pulses as for digital output 41 / 42, phase shifted by 90°. Only if digital output 41 / 42 has been configured as a pulse or frequency output. • 180° Shift: Output of the same pulses as for digital output 41 / 42, phase shifted by 180°. Only if digital output 41 / 42 has been configured as a pulse or frequency output. • Follow DO 41/42 (Frequency): The digital output 51 / 52 follows digital output 41 / 42. Digital output 51 / 52 then also works as a frequency output, the settings under "… / Dig.Out 41 / 42 / ...Setup Freq Output" are accepted. The output of the frequency at digital output 51 / 52 is dependent on the setting of the register "Outp. Flow Direction" for digital output 41 / 42: – When "Forward" is selected, a frequency for forward flow is output at digital output 41 / 42 and a frequency for reverse flow is output at digital output 51 / 52 – When "Reverse" is selected, a frequency for reverse flow is output at digital output 41 / 42 and a frequency for forward flow is output at digital output 51 / 52 • 180° Shift (Frequency): Output of the same frequency as for digital output 41 / 42, phase shifted by 180° **Note** If digital output 41 / 42 has been configured as pulse or frequency output, digital output 51 / 52 can be configured separately as binary or frequency output. However, digital output 51 / 52 cannot be configured as a second independent pulse output.

Menu / parameter	Description
Easy Setup	
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. • Logic: Digital output V1 / V2 as a binary output (for example, as an alarm output).
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. • Logic: Digital output V3 / V4 as a binary output (for example, as an alarm output).
Dig.Out 51/52 Freq.	The operating modes are available with an APO card only. When these operating modes are selected, DO51 / 52 is mirrored to V3 / V4. • Frequency: Digital output V3 / V4 as a frequency output. In frequency mode, a frequency is issued that is proportional to the flow rate. The maximum frequency can be configured in accordance with the upper range value. • Follow DO 41/42: Digital output V3 / V4 follows the function of digital output 41 / 42. Depending on the setting of the 'Input/Output / ...Dig.Out 41/42 / Outp. Flow Direction' parameter, digital output V3 / V4 is operated in pulse mode as follows: – No pulses are issued if 'Forward & Reverse' is selected. Only digital output 41 / 42 is active. – When 'Forward' is selected, pulses for forward flow are output on digital output 41 / 42, while pulses for reverse flow are output on digital output V3 / V4. – When 'Reverse' is selected, pulses for reverse flow are output on digital output 41 / 42, while pulses for forward flow are output on digital output V3 / V4. • 90° Shift: Output of the same pulses as for digital output 41 / 42, phase shifted by 90°. Only if digital output 41 / 42 has been configured as a pulse or frequency output. • 180° Shift: Output of the same pulses as for digital output 41 / 42, phase shifted by 180°. Only if digital output 41 / 42 has been configured as a pulse or frequency output. • Follow DO 41/42 (Frequency): Digital output V3 / V4 follows digital output 41 / 42. Digital output V3 / V4 then also works as a frequency output, the settings under '… / Dig.Out 41 / 42 / ...Setup Freq Output' are accepted. The output of the frequency at digital output V3 / V4 is dependent on the setting of the register 'Outp. Flow Direction' for digital output 41 / 42: – When 'Forward' is selected, a frequency for forward flow is output at digital output 41 / 42 and a frequency for reverse flow is output at digital output V3 / V4 – When 'Reverse' is selected, a frequency for reverse flow is output at digital output 41 / 42 and a frequency for forward flow is output at digital output V3 / V4 • 180° Shift (Frequency): Output of the same frequency as for digital output 41 / 42, phase shifted by 180° **Note** Digital output V3 / V4 cannot be configured as an additional independent frequency output (operating mode 'Frequency (=51 / 52)'. Digital output V3 / V4 can be configured separately as a binary or frequency output. However, digital output V3 / V4 cannot be configured as a second independent pulse output.

… 7 Commissioning

… Basic Setup

Menu / parameter	Description
DO 41/42 Freq.	Selection of process value issued via the frequency or pulse output.
Dig.Out 41/42 Pulse	Only if digital output 41 / 42 has been configured as a frequency or pulse output.
Dig.Out 51/52 Freq.	
FrequencyV3 / V4	
Dig.Out 41 / 42 Logic	Selection of the output function for the relevant binary output. • F / R Signal: The binary output signals the flow direction. • Dual Range: The binary output is activated when measuring range 2 (QmMax 2 / QvMax 2) is selected. This selection is only available if the parameter 'Range Mode Config' has been configured to Qm or Qv. • Batch End Contact: The binary output is activated when the set fill quantity is reached (only if the FillMass function is activated).
Dig.Out 51 / 52 Logic	
Dig.Out V1 / V2 Logic	Only if the relevant digital output has been configured as a binary output.
Dig.Out V3 / V4 Logic	
Qm Max	Sets the upper range value for the mass flow for forward and reverse flow. The value is also used to calculate the corresponding percentage value.
Qv Max	Setting of the upper measuring range value 1 for the volume flow for feed flow and reverse flow. The value is also used to calculate the corresponding percentage value.
Density Max	Sets the maximum / minimum density to be measured. This value is used to calculate the percentage density value. These parameters are only available if the density output 'Density [unit]' was selected when configuring the power and digital outputs.
Density Min	
Pulses per Unit	Set pulses per volume or per mass flow unit, and the pulse width for the digital output operating mode 'Pulse'. Only available if a digital output has been configured as a pulse output, and the volume flow or mass flow has been selected as the process variable to be output.
Pulse Width	
Upper Frequency41 / 42	Sets the upper range value frequency for the digital output operating mode 'Frequency'. The entered value corresponds to 100 % flow. Only available if a digital output has been configured as a frequency output, and the volume flow or mass flow has been selected as the process variable to be output.
Upper Frequency51 / 52	
Upper FrequencyV3 / V4	
System Zero	Starts the automatic zero point balancing using  . Automatic zero point balancing takes approx. 60 seconds. **Note** Prior to starting the zero point adjustment, make sure that: • There is no flow through the sensor (close all valves, shut-off devices etc.) • The sensor must be filled completely with measuring medium for measurement.

8 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!

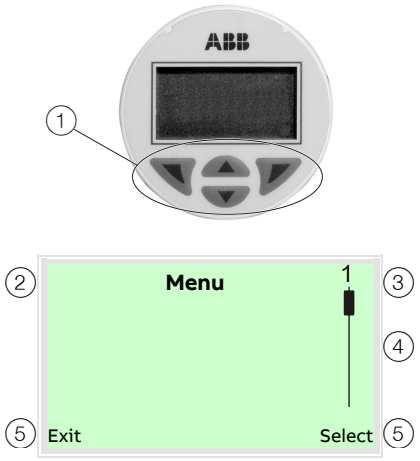
- Before starting work on the device, make sure that it has cooled sufficiently.

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

Note

For detailed information on the operation and parameterization of the device, consult the associated operating instructions (OI)!



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 71: LCD display

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

Note

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

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

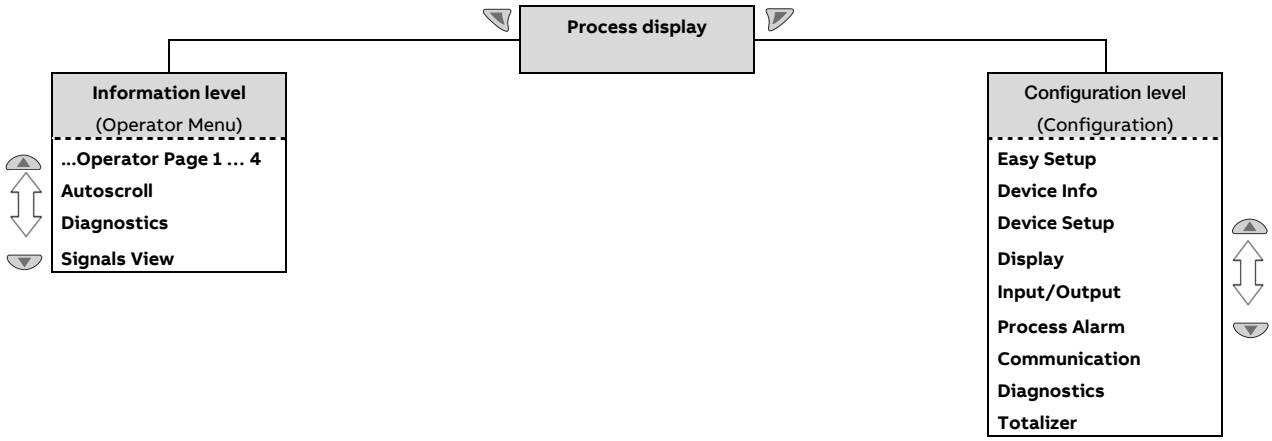
Control button functions

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

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

… 8 Operation

Menu levels



Process display
The process display shows the current process values.
From the level of the process display, you can branch out into two menu levels (information level, configuration level).

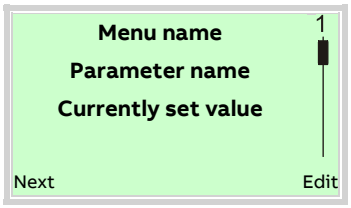
Information level (Operator Menu)
The information level contains the parameters and information that are relevant for the operator.
The device configuration cannot be changed on this level.

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 additional information on the parameters, see **Parameter description** in the operating instruction on page 86.

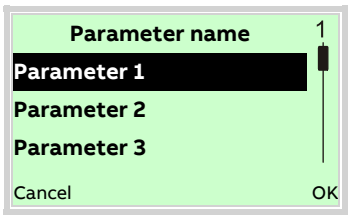
Selecting and changing parameters

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.

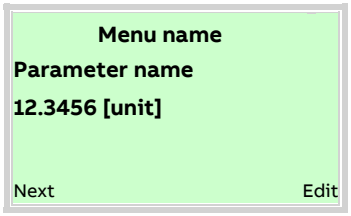


3. Select the desired value using ▲ / ▼.
4. Confirm the selection with ◤.

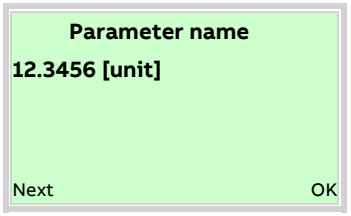
This concludes the procedure for selecting a parameter value.

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.

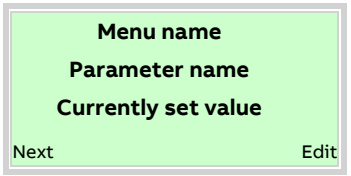


3. Use ◥ to select the decimal place to change.
4. Use ▲ / ▼ to set the desired value.
5. Use ◥ to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use ◤ to confirm your setting.

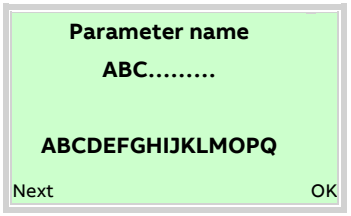
This concludes the procedure for changing a parameter value.

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.

… 8 Operation

… Selecting and changing parameters

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.

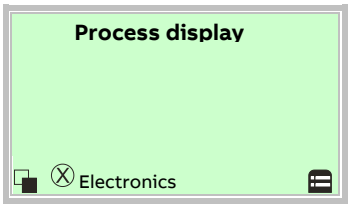
Note

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

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 information regarding troubleshooting, refer to the chapter titled "Diagnosis / Error messages" in the operating instruction.

9 Maintenance / Repair

Safety instructions

⚠ WARNING

Loss of Ex-approval!

Loss of Ex approval due to replacement of components in devices for use in potentially explosive atmospheres.

- Devices for use in potentially explosive atmospheres may be serviced and repaired by qualified ABB personnel only.
- For measuring devices for potentially explosive atmospheres, observe the relevant operator guidelines. See also **Use in potentially explosive atmospheres** on page 6.

⚠ 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.

Note

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

10 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 29.

… 10 Dismounting and disposal

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.

Parameter description **in the operating instruction**
Device overview **in the data sheet**
"Diagnosis / error messages" in the operating instruction

11 Specification

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

12 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.
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13 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

ABB Measurement & Analytics

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

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

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