SensyMaster FMT430, FMT450
Thermal mass flowmeter

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

Measurement made easy

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

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

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

General information and instructions

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

Warnings

The warnings in these instructions are structured as follows:

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

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

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

NOTICE
The signal word ‘NOTICE’ indicates possible material damage.

Note
‘Note’ indicates useful or important information about the product.

Intended use

This device can be used in the following applications:

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

This device is intended for the following uses:

• for direct mass flow measurement of gases and gas mixtures in closed pipelines.
• for indirect measurement of volume flows (through standard density and mass current).
• for measuring the temperature of the measuring medium.
The device has been designed for use exclusively within the technical limit values indicated on the identification plate and in the data sheets.

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

- Measuring media may only be used if, based on the state of the art or the operating experience of the user, it can be assured that the chemical and physical properties necessary for operational security of the materials of the wetted parts of the temperature 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 Automation Products GmbH 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

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

Service address

Customer service center
Tel:  +49 180 5 222 580
Email:  automation.service@de.abb.com
2 Use in potentially explosive atmospheres

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

Device overview
ATEX / IECEx

<table>
<thead>
<tr>
<th>Model number</th>
<th>Standard / No explosion protection</th>
<th>Zones 2, 22</th>
<th>Zone 1, 21 (Zone 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integral mount design</td>
<td>FMT4x0 Y0</td>
<td>FMT4x0 A2</td>
<td>FMT4x0 A1</td>
</tr>
<tr>
<td>• Standard</td>
<td>• Zone 2, 22</td>
<td>• Zone 1, 21</td>
<td>• Zone 0</td>
</tr>
<tr>
<td>Remote mount design</td>
<td>FMT4x2 Y0</td>
<td>FCx4x0 Y0</td>
<td>FMT4x2 A2</td>
</tr>
<tr>
<td>Transmitter and flowmeter sensor</td>
<td>• Standard</td>
<td>• Zone 2, 22</td>
<td>• Zone 1, 21</td>
</tr>
<tr>
<td>Remote mount design</td>
<td>FMT4x2 Y0</td>
<td>FMT4x0 A2</td>
<td>FCx4x0 A1</td>
</tr>
<tr>
<td>Transmitter</td>
<td>• Standard</td>
<td>• Zone 2, 22</td>
<td>• Zone 1, 21</td>
</tr>
<tr>
<td>Sensor</td>
<td>• Zone 1, 21</td>
<td>• Zone 0</td>
<td></td>
</tr>
</tbody>
</table>

1 Single-compartment housing
2 Dual-compartment housing
3 Zone 0 within the meter tube
## cFMus

<table>
<thead>
<tr>
<th>Model number</th>
<th>Standard / No explosion protection</th>
<th>Class I Div. 2 / Zone 2</th>
<th>Class I Div. 1 / Zone 1 (Zone 0)</th>
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</thead>
<tbody>
<tr>
<td>Integral mount design</td>
<td>FMT4x0 Y0</td>
<td>FMT4x0 F2</td>
<td>FMT4x0 F1</td>
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<td></td>
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<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
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<tr>
<td></td>
<td>1 Single-compartment housing</td>
<td>2 Dual-compartment housing</td>
<td></td>
</tr>
<tr>
<td>Remote mount design</td>
<td>FMT4x2 Y0</td>
<td>FMT4x0 Y0</td>
<td>FMT4x2 F2</td>
</tr>
<tr>
<td></td>
<td><img src="image4.png" alt="Diagram" /></td>
<td><img src="image5.png" alt="Diagram" /></td>
<td><img src="image6.png" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>1 Single-compartment housing</td>
<td>2 Dual-compartment housing</td>
<td></td>
</tr>
<tr>
<td>Remote mount design</td>
<td>FCT4x2 Y0</td>
<td>FCT4x0 F2</td>
<td>FMT4x0 F1</td>
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<td><img src="image10.png" alt="Diagram" /></td>
<td><img src="image11.png" alt="Diagram" /></td>
<td><img src="image12.png" alt="Diagram" /></td>
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<tr>
<td></td>
<td>1 Single-compartment housing</td>
<td>2 Dual-compartment housing</td>
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<tr>
<td>Remote mount design</td>
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<td>FMT4x2 F2</td>
<td>FMT4x0 F1</td>
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<td><img src="image13.png" alt="Diagram" /></td>
<td><img src="image14.png" alt="Diagram" /></td>
<td><img src="image15.png" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>1 Single-compartment housing</td>
<td>2 Dual-compartment housing</td>
<td></td>
</tr>
</tbody>
</table>
... 2 Use in potentially explosive atmospheres

Ex marking

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

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

<table>
<thead>
<tr>
<th>Model number for use in Zone 2, 22</th>
<th>Ex marking</th>
<th>Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMT4x0 – A2 (i=D..,Y..,S..)</td>
<td>II 3G Ex ec IIC T6...T1 Gc</td>
<td>ATEX: FM19ATEX0178X</td>
</tr>
<tr>
<td>Sensor in integral mount design or remote mount design with single-compartment or dual-compartment housing</td>
<td>II 3D Ex tc IIIC T80°C...Tmedium Dc</td>
<td>IECEx: IECEx FMG 19.0025X</td>
</tr>
<tr>
<td>FMT4x2 – A2 (i=W..,R..)</td>
<td>II 3G Ex ec IIC T6 Gc</td>
<td></td>
</tr>
<tr>
<td>Sensor in remote mount design with single-compartment housing</td>
<td>II 3D Ex tc IIIC T80°C Dc</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model number for use in Zone 0/1, 21</th>
<th>Ex marking</th>
<th>Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMT4x0 – A1 (i=D1...D8)</td>
<td>II 2 G Ex db eb ib mb IIC T6...T1 Gb</td>
<td>ATEX: FM19ATEX0177X</td>
</tr>
<tr>
<td>Sensor in integral mount design with dual-compartment housing</td>
<td>II 2 G Ex la IIC T6...T1 Ga</td>
<td>IECEx: IECEx FMG 19.0025X</td>
</tr>
<tr>
<td>FMT4x0 – A3 (i=D1...D8)</td>
<td>II 1/2 G Ex db eb ib mb IIC T6...T1 Gb/Ga</td>
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</tr>
<tr>
<td>Sensor in integral mount design with dual-compartment housing (Zone 0 in meter tube)</td>
<td>II 1 G Ex la IIC T6...T1 Ga</td>
<td></td>
</tr>
<tr>
<td>FMT4x0 – A1 (i=Y0)</td>
<td>II 2 G Ex eb ib mb IIC T6...T1 Gb</td>
<td></td>
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<tr>
<td>Sensor in remote mount design with dual-compartment housing</td>
<td>II 2 G Ex la IIC T6...T1 Ga</td>
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<tr>
<td>FMT4x0 – A3 (i=Y0)</td>
<td>II 1/2 G Ex eb la lb mb IIC T6...T1 Gb/Ga</td>
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</tr>
<tr>
<td>Sensor in remote mount design with dual-compartment housing (Zone 0 in meter tube)</td>
<td>II 1 G Ex la IIC T6...T1 Ga</td>
<td></td>
</tr>
<tr>
<td>FMT4x0 – A1 (i=R1...R4)</td>
<td>II 2 G Ex db eb la mb IIB+H2 T6 Gb</td>
<td></td>
</tr>
<tr>
<td>Transmitter in remote mount design with dual-compartment housing</td>
<td>II 2 G Ex la IIB+H2 T80°C Db</td>
<td></td>
</tr>
<tr>
<td>FMT4x0 – A1 (i=R5...R8)</td>
<td>II 2 G Ex db la IIB+H2 T6 Gb</td>
<td></td>
</tr>
<tr>
<td>Transmitter in remote mount design with dual-compartment housing (flameproof enclosure ‘Ex d’)</td>
<td>II 2 G Ex la IIB+H2 T80°C Db</td>
<td></td>
</tr>
</tbody>
</table>
**cFMus**

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

**Model number design**: FMTabcdefgijkl.m.n.o.p
- For detailed information on the design of the model number, see the ordering information in the data sheet

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<td>FMT4x0 - F2 (i=D..Y..,S..)</td>
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<td></td>
<td></td>
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<tr>
<td>Sensor in integral mount design with single-compartment or dual-compartment housing.</td>
<td></td>
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<tr>
<td>Design in accordance with ANSI / ISA 12.27.01 as 'Dual Seal Device'.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CL I, ZN 2, AEX ec IIC T6...T1 Gc</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ZN 21, AEX tb IIIc T80°C...T165°C Db</td>
<td></td>
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<tr>
<td>See handbook for temperature class information</td>
<td>Certificate: FM19US0110X</td>
<td>NI: CL I, Div 2, GPS ABCD T6...T1</td>
<td>NI: CL I, Div 2, GPS ABCD T6...T1</td>
</tr>
<tr>
<td>DIP: CL II,III, Div 2, GPS EFG T6...T3B</td>
<td>DIP: CL II,III, Div 2, GPS EFG T6...T3B</td>
<td>CL I, ZN 2, Ex ec IIC T6...T1 Gc</td>
<td>CL I, ZN 2, Ex ec IIC T6...T1 Gc</td>
</tr>
</tbody>
</table>

| FMT4x2 - F2 (i=W..,R..) |            |      |         |
| Transmitter in remote mount design with single-compartment or dual-compartment housing. |            |      |         |
| USA: |            |      |         |
| DIP: CL II,III, Div 2, GPS EFG T6 | DIP: CL II,III, Div 2, GPS EFG T6 |
| CL I, ZN 2, AEX ec IIC T6 Gc | CL I, ZN 2, Ex ec IIC T6 Gc |
| ZN 21, AEX tb IIIc T80°C Db | Ex tb IIIc T80°C...T165°C Db |
| See handbook for temperature class information | ANSI/ISA 12.27.01: Dual Seal |

<table>
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<th>Model number for use in Division 1</th>
<th>Ex marking</th>
<th>USA:</th>
<th>Canada:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMT4x0 - F1 (i=D1...D8)</td>
<td></td>
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<tr>
<td>Sensor in integral mount design or remote mount design with dual-compartment housing.</td>
<td></td>
<td></td>
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<tr>
<td>Design in accordance with ANSI / ISA 12.27.01 as 'Dual Seal Device'.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>CL I, ZN 1, AEX db eb la mb IIB+H2 T6...T1 Gb</td>
<td>CL I, ZN 1, AEX db eb la mb IIB+H2 T6...T1 Gb</td>
<td></td>
<td></td>
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<tr>
<td>ZN 21, AEX la tb IIIc T80°C...T165°C Db</td>
<td>Ex ia tb IIIc T80°C...T165°C Db</td>
<td></td>
<td></td>
</tr>
<tr>
<td>See handbook for temperature class information and installation drawing 3kxf000094G0009</td>
<td>Certificate: FM19US0110X</td>
<td>S-XP-IS: CL I, Div 1, GPS BCD T6...T1</td>
<td></td>
</tr>
<tr>
<td>DIP: CL II,III, Div 1, GPS EFG T6...T3B</td>
<td>DIP: CL II,III, Div 1, GPS EFG T6...T3B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| FMT4x0 - F1 (i=Y0) |            |      |         |
| Sensor in remote mount design. |            |      |         |
| Design in accordance with ANSI / ISA 12.27.01 as 'Dual S-XP Seal Device'. |            |      |         |
| CL I, ZN 1, AEX db eb mb IIB+H2 T6...T1 Gb | CL I, ZN 1, AEX db eb mb IIB+H2 T6...T1 Gb |
| ZN 21, AEX tb IIIc T80°C...T165°C Db | Ex tb IIIc T80°C...T165°C Db |
| See handbook for temperature class information and installation drawing 3kxf000094G0009 | Certificate: FM19US0110X | S-XP: CL I, Div 1, GPS BCD T6...T1 |
| DIP: CL II,III, Div 1, GPS EFG T6...T3B | DIP: CL II,III, Div 1, GPS EFG T6...T3B |

| FMT4x0 - F1 (i=R1...R8) |            |      |         |
| Transmitter in remote mount design with dual-compartment housing. |            |      |         |
| XP-IS: CL I, Div 1, GPS BCD T6 | XP-IS: CL I, Div 1, GPS BCD T6 |
| DIP: CL II,III, Div 1, GPS EFG T6 | DIP: CL II,III, Div 1, GPS EFG T6 |
| CL I, ZN 1, AEX db la IIB+H2 T6 Gb | CL I, ZN 1, Ex db la IIB+H2 T6 Gb |
| ZN 21, AEX la tb IIIc T80°C Db | Ex ia tb IIIc T80°C Db |
| See handbook for temperature class information and installation drawing 3kxf000094G0009 | ANSI/ISA 12.27.01: Dual Seal | IN-/OUTPUTS: Urated=30V |

- ANSI/ISA 12.27.01: Dual Seal
... 2 Use in potentially explosive atmospheres

Temperature data

Temperature resistance for the connecting cable
The temperature at the cable entries of the device is dependent on the measuring medium temperature $T_{\text{medium}}$ and the ambient temperature $T_{\text{amb}}$.

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

<table>
<thead>
<tr>
<th>$T_{\text{amb}}$</th>
<th>Temperature resistance for the connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\leq 50 ^\circ C$ ($\leq 122 ^\circ F$)</td>
<td>$\geq 70 ^\circ C$ ($\geq 158 ^\circ F$)</td>
</tr>
<tr>
<td>$\leq 60 ^\circ C$ ($\leq 140 ^\circ F$)</td>
<td>$\geq 80 ^\circ C$ ($\geq 176 ^\circ F$)</td>
</tr>
<tr>
<td>$\leq 70 ^\circ C$ ($\leq 158 ^\circ F$)</td>
<td>$\geq 90 ^\circ C$ ($\geq 194 ^\circ F$)</td>
</tr>
</tbody>
</table>

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

Note
The signal cable supplied by ABB can be used without restrictions up to an ambient temperature of $\leq 80 ^\circ C$ ($\leq 176 ^\circ F$).

Environmental and process conditions for model FMT4xx...

<table>
<thead>
<tr>
<th>Ambient temperature $T_{\text{amb}}$</th>
<th>$-20$ to $70 ^\circ C$ ($-4$ to $158 ^\circ F$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring medium temperature $T_{\text{medium}}$</td>
<td>$-20$ to $150 ^\circ C$ ($-4$ to $302 ^\circ F$)</td>
</tr>
<tr>
<td>IP rating / NEMA rating</td>
<td>IP 65, IP 67 / NEMA 4X, Type 4X</td>
</tr>
</tbody>
</table>
Measuring medium temperature (Ex data) for model FMT4x0-A1… in Zone 1, Zone 21
The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class. The permissible measuring medium temperature specified in Environmental and process conditions for model FMT4xx… on page 10 must not be up-scaled!

<table>
<thead>
<tr>
<th>Ambient temperature $T_{amb.}$</th>
<th>Temperature class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>$-40 ^\circ C$ to $50 ^\circ C$</td>
<td>280 °C (536 °F)</td>
</tr>
<tr>
<td>($-40 ^\circ F$ to $122 ^\circ F$)</td>
<td></td>
</tr>
<tr>
<td>$-40 ^\circ C$ to $60 ^\circ C$</td>
<td>280 °C (536 °F)</td>
</tr>
<tr>
<td>($-40 ^\circ F$ to $140 ^\circ F$)</td>
<td></td>
</tr>
<tr>
<td>$-40 ^\circ C$ to $70 ^\circ C$</td>
<td>280 °C (536 °F)</td>
</tr>
<tr>
<td>($-40 ^\circ F$ to $158 ^\circ F$)</td>
<td></td>
</tr>
</tbody>
</table>

Measuring medium temperature (Ex data) for model FMT4x0-A2… in Zone 2, Zone 22
The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class. The permissible measuring medium temperature specified in Environmental and process conditions for model FMT4xx… on page 10 must not be up-scaled!

<table>
<thead>
<tr>
<th>Ambient temperature $T_{amb.}$</th>
<th>Temperature class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>$-40 ^\circ C$ to $40 ^\circ C$</td>
<td>300 °C (572 °F)</td>
</tr>
<tr>
<td>($-40 ^\circ F$ to $104 ^\circ F$)</td>
<td></td>
</tr>
<tr>
<td>$-40 ^\circ C$ to $50 ^\circ C$</td>
<td>300 °C (572 °F)</td>
</tr>
<tr>
<td>($-40 ^\circ F$ to $122 ^\circ F$)</td>
<td></td>
</tr>
<tr>
<td>$-40 ^\circ C$ to $60 ^\circ C$</td>
<td>300 °C (572 °F)</td>
</tr>
<tr>
<td>($-40 ^\circ F$ to $140 ^\circ F$)</td>
<td></td>
</tr>
<tr>
<td>$-40 ^\circ C$ to $70 ^\circ C$</td>
<td>300 °C (572 °F)</td>
</tr>
<tr>
<td>($-40 ^\circ F$ to $158 ^\circ F$)</td>
<td></td>
</tr>
</tbody>
</table>
... 2 Use in potentially explosive atmospheres

... Temperature data

Measuring medium temperature (Ex data) for model FMT4x0-F1... in Class I Division 1 and Class II Division 1
The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class. The permissible measuring medium temperature specified in Environmental and process conditions for model FMT4xx... on page 10 must not be up-scaled!

<table>
<thead>
<tr>
<th>Ambient temperature $T_{amb}$</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
</tr>
</thead>
<tbody>
<tr>
<td>−40 °C to 50 °C (−40 °F to 122 °F)</td>
<td>280 °C (536 °F)</td>
<td>185 °C (365 °F)</td>
<td>90 °C (194 °F)</td>
<td>90 °C (194 °F)</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Measuring medium temperature (Ex data) for model FMT4x0-F1... in Class I Division 2 and Class II Division 2
The table shows the maximum permissible measuring medium temperature as a function of ambient temperature and temperature class. The permissible measuring medium temperature specified in Environmental and process conditions for model FMT4xx... on page 10 must not be up-scaled!

<table>
<thead>
<tr>
<th>Ambient temperature $T_{amb}$</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
</tr>
</thead>
<tbody>
<tr>
<td>−40 °C to 40 °C (−40 °F to 104 °F)</td>
<td>300 °C (572 °F)</td>
<td>290 °C (554 °F)</td>
<td>195 °C (383 °F)</td>
<td>130 °C (266 °F)</td>
<td>95 °C (203 °F)</td>
<td>80 °C (176 °F)</td>
</tr>
</tbody>
</table>

Notice on dust-ignition protection for USA and Canada in accordance with NEC
The surface temperature of the device must not under any circumstances up-scale 85 °C (185 °F) if there is there carbonaceous dust or dust which can carbonate.

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

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

Overview

Figure 1: Electrical connections overview

<table>
<thead>
<tr>
<th>Zones 2, 22</th>
<th>Division 2 and Zone 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATEX / IECEx:</td>
<td>USA:</td>
</tr>
<tr>
<td>II 3 G &amp; II 3 D</td>
<td>DIV2 &amp; ZN2</td>
</tr>
<tr>
<td>Canada:</td>
<td>DIV2 &amp; ZN2</td>
</tr>
</tbody>
</table>

Activating the inputs and outputs

- Power supply
- Inputs / outputs, communication
- Signal cable (remote mount design only)

<table>
<thead>
<tr>
<th>Zones 1, 21</th>
<th>Division 1 and Zone 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATEX / IECEx:</td>
<td>USA:</td>
</tr>
<tr>
<td>II 2 G &amp; II 2 D</td>
<td>DIV1 &amp; ZN1</td>
</tr>
<tr>
<td>II 1/2 G &amp; II 1 G &amp; II 2 D</td>
<td>DIV1 &amp; ZN1</td>
</tr>
</tbody>
</table>

Activating the inputs and outputs

- Power supply
- Inputs / outputs, communication
- Signal cable (remote mount design only)

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 21 must be observed when changing the type of protection!
### ... Use in potentially explosive atmospheres

### ... Electrical data

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

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>'e' / 'XP'</th>
<th>'la' / 'IS'</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outputs on basic device</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current / HART output 31 / $U_{CO}$, active</td>
<td>$U_M$ [V]</td>
<td>$I_M$ [A]</td>
</tr>
<tr>
<td>Terminals 31 / $U_{CO}$</td>
<td>30</td>
<td>0.2</td>
</tr>
<tr>
<td>Current / HART output 31 / 32, passive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals 31 / 32</td>
<td>30</td>
<td>0.2</td>
</tr>
<tr>
<td>Digital output 41 / 42, active*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals 41 / 42 and V1 / V2*</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Digital output 41 / 42, active**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals 41 / 42 and $U_{CO}$ / 32**</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Digital output 41 / 42, passive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals 41 / 42</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Digital output 51 / 52, active*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals 51 / 52 and V1 / V2*</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Digital output 51 / 52, passive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals 51 / 52</td>
<td>30</td>
<td>0.1</td>
</tr>
</tbody>
</table>

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 $U_{CO}$ / 32 as loop power supply for digital output 41 / 42 or 51 / 52 on page 54.

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>'e' / 'XP'</th>
<th>'la' / 'IS'</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inputs and outputs with optional plug-in cards</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals V3 / V4 and V1 / V2*</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Current output V1 / V2, passive**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals V1 / V2** or V3 / V4**</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Current output V3 / V4, passive**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals V1 / V2** or V3 / V4**</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Digital output V3 / V4, active*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals V3 / V4 and V1 / V2*</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Digital output V1 / V2, passive**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals V1 / V2** or V3 / V4**</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Digital output V3 / V4, passive**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals V1 / V2** or V3 / V4**</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Digital input V3 / V4, active*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals V3 / V4 and V1 / V2</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Digital input V1 / V2, passive*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital input V3 / V4, passive*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals V1 / V2** or V3 / V4**</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Modbus® / PROFIBUS DP®</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals V1 / V2</td>
<td>30</td>
<td>0.1</td>
</tr>
</tbody>
</table>

* 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 58.
Zone 2, 22 and Division 2 – Model: FMT4xx-A2, FMT4xx-F2

<table>
<thead>
<tr>
<th>Outputs on basic device</th>
<th>Operating values (general)</th>
<th>Type of protection ‘ec’ / ‘NI’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$U_N$</td>
<td>$I_N$</td>
</tr>
<tr>
<td><strong>Current / HART output 31 / $U_CO$, active</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals 31 / $U_CO$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current / HART output 31 / 32, passive</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals 31 / 32</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digital output 41 / 42, active</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals 41 / 42 and V1 / V2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digital output 41 / 42, active</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals 41 / 42 and $U_CO / 32$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digital output 41 / 42, passive</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals 41 / 42</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digital output 51 / 52, active</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals 51 / 52 and V1 / V2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digital output 51 / 52, passive</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals 51 / 52</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 54.

<table>
<thead>
<tr>
<th>Inputs and outputs with optional plug-in cards</th>
<th>Operating values (general)</th>
<th>Type of protection ‘ec’ / ‘NI’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$U_N$</td>
<td>$I_N$</td>
</tr>
<tr>
<td><strong>Current output V3 / V4, active</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals V3 / V4 and V1 / V2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current output V1 / V2, passive</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals V1 / V2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digital output V3 / V4, active</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals V3 / V4 and V1 / V2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digital output V1 / V2, active</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals V1 / V2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digital input V3 / V4, active</strong></td>
<td>30 V</td>
<td>3,45 mA</td>
</tr>
<tr>
<td>Terminals V3 / V4 and V1 / V2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digital input V1 / V2, active</strong></td>
<td>30 V</td>
<td>3,45 mA</td>
</tr>
<tr>
<td>Terminals V1 / V2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Modbus® / PROFIBUS DP®</strong></td>
<td>30 V</td>
<td>30 mA</td>
</tr>
<tr>
<td>Terminals V1 / V2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 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 58.
... 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 \( U_M = 30 \text{ V} \).
- Intrinsic safety is preserved if the rated voltage \( U_M = 30 \text{ V} \) is not up-scaled when connections are established to non-intrinsically safe external circuits.
- The information in Changing the type of protection on page 21 must be observed when changing the type of protection.

Devices connected to the relevant equipment must not be operated at over 250 V\(_{\text{rms}}\) 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 13 must be observed.
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. When operating with combustible dusts, comply with EN 60079-31.
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!
Before opening the transmitter housing or the terminal box, note the following points:
- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Switch off the power supply and wait for t > 20 minutes before opening.

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

See also Opening and closing the housing on page 43.

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

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

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
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 $T_{\text{medium}}$ and the ambient temperature $T_{\text{amb}}$.
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 10.

**Grounding**
The sensor must be grounded in accordance with the applicable international standards.
Perform grounding of the device in accordance with **Pin assignment** on page 52.

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 **Pin assignment** on page 52.

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

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

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

Connecting devices with cable (conduits) to the electric installation makes it possible for measuring media to reach the electric system.
To prevent measuring media from seeping into the electric installation, the devices are equipped with process gaskets which meet requirements in accordance with ANSI / ISA 12.27.01.

SensyMaster flowmeters are designed as ‘Dual Seal Devices’.

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

<table>
<thead>
<tr>
<th>Limit values</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange or pipe material</td>
<td>No limitations</td>
</tr>
<tr>
<td>Nominal sizes</td>
<td>DN 25 to DN 2000 (1 to 78 in)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>−20 °C to 280 °C (~−4 °F to 536 °F)</td>
</tr>
<tr>
<td>Process pressure</td>
<td>PN 40 / Class 300</td>
</tr>
</tbody>
</table>
... 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.

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

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

NOTICE

Special conditions for safe use!
For devices with dual-compartment housing with type of protection Ex ‘d’, the following instructions must be observed:
• The mounting screws ① used to connect the dual-compartment housing to the sensor shall be M5 × 20 A2 gemäß according DIN 7964.
• The mounting screws shall have a yield stress of at least 210 N/m².

Repair
Devices of type of protection ‘d’ are equipped with flameproof joints in the housing. Contact ABB before commencing repair work.
Changing the type of protection
If you are installing in Zone 1 / Div. 1, the current outputs and digital outputs of models FMT430/450 can be operated with different types of protection:

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

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

<table>
<thead>
<tr>
<th>Original installation</th>
<th>New installation</th>
<th>Necessary test steps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zone 1 / Div. 1:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current outputs and</td>
<td>Current outputs</td>
<td>• 500 × 1.414 = 710 V DC/1min</td>
</tr>
<tr>
<td>digital outputs in</td>
<td>and digital</td>
<td>Test between</td>
</tr>
<tr>
<td>non-intrinsically</td>
<td>outputs in</td>
<td>terminals A / B, UFE,</td>
</tr>
<tr>
<td>safe design</td>
<td>intrinsically</td>
<td>/GND, UCO / 32, 31, 41 / 42, 51 / 52,</td>
</tr>
<tr>
<td></td>
<td>safe ia / IS</td>
<td>V1 / V2 and V3 / V4, and terminals A, B, UFE, GND, UCO, 31, 32, 41, 42, 51, 52,</td>
</tr>
<tr>
<td></td>
<td>design</td>
<td>V1, V2, V3, V4 and the housing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When this test is performed, no voltage flashover is permitted in or on the device.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Optical evaluation particularly of the electronic circuit boards, no visible damage or evidence of explosion.</td>
</tr>
</tbody>
</table>

| **Zone 1 / Div. 1:**  |                  |                     |
| Current outputs and   | Current outputs  | • Visual inspection, no damage visible on the threads (cover, ½ in NPT cable |
| digital outputs in    | and digital      | glands).            |
| intrinsically safe ia | outputs in       |                     |
| (ib) / IS design      | non-intrinsically |                     |
|                       | safe design      |                     |
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.

Plates and symbols

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

Figure 6: Warning signs on the device

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.
4 Transport and storage

Inspection

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

Transport

⚠️ DANGER
Life-threatening danger due to suspended loads.
In the case of suspended loads, a danger of the load falling exists.
  • Standing under suspended loads is prohibited.

⚠️ WARNING
Risk of injury due to device slipping.
The device's center of gravity may be higher than the harness suspension points.
  • Make sure that the device does not slip or turn during transport.
  • Support the device laterally during transport.

Storing the device

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

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

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

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

Ambient conditions

Storage temperature range
-20 to 85 °C (−4 to 185 °F)

Relative humidity
Maximum 85 % RH, annual average ≤ 65 % RH

Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes. Fill out the return form (see Return form on page 86) and include this with the device.

In accordance with the EU Directive governing hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes:
All devices delivered to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

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

Safety instructions

⚠️ DANGER

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

⚠️ WARNING

Risk of injury due to process conditions.
The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when working on the device.
• Before working on the device, make sure that the process conditions do not pose any hazards.
• If necessary, wear suited personal protective equipment when working on the device.
• Depressurize and empty the device / piping, allow to cool and purge if necessary.

Installation conditions

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

Maintain a suitable distance from electromagnetic fields and interference that extend beyond the usual dimensions.

Seals
Users are responsible for selecting and mounting suitable gaskets (material, shape).
Note the following points when selecting and mounting gaskets:
• Use gaskets made from a material that is compatible with the measuring medium and measuring medium temperature.
• Gaskets must not extend into the flow area, since possible turbulence may influence the accuracy of the device.
Inlet and outlet sections
The figures below show the recommended inlet and outlet sections for various installations.

To achieve the specified measuring accuracy, the indicated inlet and outlet sections are required.
In case of combinations of several inlet-side errors, e.g. valve and reduction, a longer inlet section must always be taken into account.
In case of confined spaces at the installation site, the outlet section can be shortened to 3 × DN. However, reducing the specified inlet section will reduce the achievable level of accuracy.
A high repeatability of the measured value is maintained.
In case of insufficient inlet and outlet sections, a special calibration may be possible. To do this, a detailed alignment is necessary for individual cases.
The specified inlet and outlet sections must be doubled for gases with a very low density (hydrogen, helium).

---

**Figure 7: Inlet and outlet sections**

<table>
<thead>
<tr>
<th>Installation</th>
<th>Inlet section</th>
<th>Outlet section</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>min. 15 × DN</td>
<td>min. 5 × DN</td>
</tr>
<tr>
<td>B</td>
<td>min. 15 × DN</td>
<td>min. 5 × DN</td>
</tr>
<tr>
<td>C</td>
<td>min. 20 × DN</td>
<td>min. 5 × DN</td>
</tr>
<tr>
<td>D</td>
<td>min. 25 × DN</td>
<td>min. 5 × DN</td>
</tr>
<tr>
<td>E</td>
<td>min. 40 × DN</td>
<td>min. 5 × DN</td>
</tr>
<tr>
<td>F</td>
<td>min. 50 × DN</td>
<td>min. 5 × DN</td>
</tr>
</tbody>
</table>
... 5 Installation

... Installation conditions

Installation at high ambient temperatures

Figure 8: Mounting position at high ambient temperatures

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

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

Sensor insulation

The sensor may be insulated as shown in Figure 9.

Ambient conditions

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

Relative humidity
Maximum 85 % RH, annual average ≤ 65 % RH

IP rating
In accordance with EN 60529: IP 65 / IP 67

NEMA IP rating
NEMA 4X

Process conditions

Measured medium temperature

Note
When using the device in potentially explosive atmospheres, note the additional temperature data in Temperature data on page 10!

Devices with ceramic element and flange connection
- Standard and explosion-proof design: −20 to 150 °C (−4 to 302 °F)
- High temperature design: −20 to 300 °C (−4 to 572 °F)
- DVGW design: 0 to 70°C (32 to 158 °F)

The approved measuring medium temperature $T_{\text{medium}}$ also depends on the selected sensor connection and the design of the pipe components.

The following temperature specifications apply:

<table>
<thead>
<tr>
<th>Sensor connection</th>
<th>$T_{\text{medium}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threaded connection DIN 11851</td>
<td>−20 to 150 °C (−4 to 302 °F)</td>
</tr>
<tr>
<td>Clamp ring fitting</td>
<td>−20 to 150 °C (−4 to 302 °F)</td>
</tr>
<tr>
<td>Pipe components with ball valve</td>
<td>Maximum 150 °C (302 °F)</td>
</tr>
<tr>
<td>Integrated hot tap fitting</td>
<td>See Material loads for process connections on page 27</td>
</tr>
</tbody>
</table>
Maximum operating pressure

<table>
<thead>
<tr>
<th>Sensor connection</th>
<th>Maximum measuring medium pressure $P_{\text{medium}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange in accordance with</td>
<td>4 MPa, 40 bar (580 psi)</td>
</tr>
<tr>
<td>DIN EN 1092, PN 40</td>
<td></td>
</tr>
<tr>
<td>Threaded connection DIN 11851</td>
<td>1.6 MPa, 16 bar (232 psi)</td>
</tr>
<tr>
<td>Clamp ring fitting</td>
<td>2 MPa, 20 bar (290 psi)</td>
</tr>
<tr>
<td>Integrated hot tap fitting</td>
<td>See Material loads for process connections on page 27</td>
</tr>
</tbody>
</table>

Pressure loss

Figure 10: Pressure loss in logarithmic representation

Material loads for process connections

Figure 11: DIN flange process connection

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

Figure 12: ASME flange process connection
5 Installation

Assembly of the pipe component

When installing the pipe components, observe the following points:

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

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

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

Note

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

- The inside diameter of the pipe and flange must precisely match in the wafer type design. Any differences in levels or edges, or untidy weld seams, will reduce the measuring accuracy.
- To guarantee that the flow profile is not distorted, the gaskets must not protrude into the piping.
3. Use the appropriate screws for the holes.
4. Slightly grease the threaded nuts.
5. Tighten the nuts in a crosswise manner in accordance with the figure. First tighten the nuts to approx. 50% of the maximum torque, then to 80%, and finally a third time to the maximum torque.

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

![Figure 14: Tightening sequence for the flange screws](image-url)
... 5 Installation

Assembly of the welding adapter with flange or threaded connector

Welding adapter with flange connector
Dimensions in mm (in)

![Diagram of welding adapter with flange connector]

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

Figure 15: Dimensions in mm (in)

<table>
<thead>
<tr>
<th>$h$ – sensor length</th>
<th>$\varnothing , D$ – outer pipe diameter (min. / max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>263 (10.35)</td>
<td>100 to 350 (3.94 to 13.78)</td>
</tr>
<tr>
<td>425 (16.73)</td>
<td>&gt; 350 to 700 (&gt; 13.78 to 27.56)</td>
</tr>
<tr>
<td>775 (30.51)</td>
<td>&gt; 700 to 1400 (&gt; 27.56 to 55.12)*</td>
</tr>
</tbody>
</table>

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

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

Figure 16: Dimensions in mm (in)

<table>
<thead>
<tr>
<th>h – sensor length</th>
<th>Ø D – outer pipe diameter (min. / max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>263 (10.35)</td>
<td>100 to 150 (3.94 to 5.91)</td>
</tr>
<tr>
<td>425 (16.73)</td>
<td>&gt; 150 to 500 (&gt; 5.91 to 19.69)</td>
</tr>
<tr>
<td>775 (30.51)</td>
<td>&gt; 500 to 1150 (&gt; 19.69 to 45.28)*</td>
</tr>
</tbody>
</table>

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

... Assembly of the welding adapter with flange or threaded connector

Welding adapter with threaded connection in accordance with DIN 11851

Dimensions in mm (in)

Figure 17: Dimensions in mm (in)
Mounting
Consider the following points when installing the welding dater in the piping:

- After welding, the welding adapter must have a length of \( L \) (see chapter Figure 15 on page 30 and Welding adapter with threaded connection in accordance with DIN 11851 on page 32).

\[
L = h - \left( \frac{1}{2} \times D \right)
\]

- Length of the welding adapter
- Installation length of the sensor
- Outside diameter of the pipeline

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

Additional instructions for welding adapter with ball valve

**DANGER**

Danger to life due to improper installation!
During welding, the gaskets in the ball valve may overheat. This can lead to the measuring medium escaping in an uncontrolled manner. This can result in severe injuries or death.
- Remove the ball valve before welding.

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

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

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

**NOTE**

Damage to the sensor.
Closing the ball valve before you remove the sensor can seriously damage the protective cage or the sensor elements.
- Do not close the ball valve until the sensor has been removed.
... 5 Installation

Assembly of the welding adapter with compression ring fitting

All dimensions in mm (in)

![Diagram of welding adapter with compression fitting]

1. Compression fitting
2. Welding tube for the compression fitting

Figure 18: Welding adapter with compression fitting

<table>
<thead>
<tr>
<th>h – sensor length</th>
<th>h3 – installation length</th>
<th>L = h3 − (½ × ØD)</th>
<th>Ø D – outer pipe diameter*(min. / max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>263 (10.35)</td>
<td>244 (9.61)</td>
<td>to be calculated</td>
<td>&gt; 100 to 350 (&gt; 3.94 to 13.78)</td>
</tr>
<tr>
<td>425 (16.73)</td>
<td>406 (15.98)</td>
<td></td>
<td>&gt; 350 to 700 (&gt; 13.78 to 27.56)</td>
</tr>
<tr>
<td>775 (30.51)</td>
<td>756 (29.76)</td>
<td></td>
<td>&gt; 700 to 1400 (&gt; 27.56 to 55.12)</td>
</tr>
</tbody>
</table>

Table 1: Dimensions of welding adapter with compression fitting

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

<table>
<thead>
<tr>
<th>L</th>
<th>Length of the welding adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>Height dependent on nominal diameter</td>
</tr>
<tr>
<td>h3</td>
<td>Installation length of the sensor</td>
</tr>
<tr>
<td>ØD</td>
<td>Outside diameter of the piping</td>
</tr>
</tbody>
</table>

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

Calculations (mm)

\[
L = h3 - \left(\frac{1}{2} \times ØD\right)
\]

\[
Z = (h3 + 137 \text{ mm}) - \left(\frac{1}{2} \times ØD\right)
\]

Calculations (in)

\[
L = h3 - \left(\frac{1}{2} \times ØD\right)
\]

\[
Z = (h3 + 5.39 \text{ in}) - \left(\frac{1}{2} \times ØD\right)
\]

Preparing the sensor

**DANGER**
Fire hazard in oxygen applications
Fire hazard in oxygen applications due to the use of unapproved thread sealing compound.
- Use only approved thread sealing compound for oxygen applications!

**WARNING**
Risk of injury
Risk of injury due to the sensor ejecting because of a missing safety ring.
- Mount the sensor with compression fitting only with the safety ring in place.

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

... Assembly of the welding adapter with compression ring fitting

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


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

Description of first installation
1. Carefully insert the prepared sensor into the welding adapter.

**NOTICE**

Damage to the device
Mechanical damage to the sensor element can occur due to improper installation.
- When inserting into the welding adapter, the sensor protection frame must not hit the bottom of the piping.

2. Screw in the compression fitting (with thread sealing compound) into the welding adapter, first by hand and then tighten with 1.5 to 2.5 turns.
3. Move the sensor to the correct height for the calculated ‘Z’ dimension (see Figure 19) and secure the compression fitting against shifting by tightening the union nut by hand.
4. Align the sensor such that the lateral flow arrow on the upper sensor protection tube end points in the exact direction of the flow.
5. Using a suited marker pen, mark the orientation and height of the sensor on the sensor protection tube, compression fitting and the welding adapter (see Figure 20, pos. 3). The marking on the union nut is also used as a starting position (6 o’clock position, see Figure 21) for the tightening of the compression fitting.

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

**Note**
Before commissioning, the tightness and compressive strength of the measuring point must be guaranteed!
- In addition, check the fittings using a suited leak detection spray.

![Figure 21: Tighten sensor](image-url)
Disassembly and reinstallation of the sensor

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


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

Disassembly of the sensor

**WARNING**

Risk of injury due to process conditions
The process conditions, for example high pressures and temperatures, toxic and aggressive measuring media, can give rise to hazards when working on the device.
- Before working on the device, make sure that the process conditions do not pose any hazards.
- If necessary, wear suited personal protective equipment when working on the device.
- Depressurize and empty the device / piping, allow to cool and purge if necessary.

1. Depressurize and empty the device / piping, allow to cool and purge if necessary.
2. Switch off the power supply of the sensor and remove the connection cable.
3. Using a suited marker pen, mark the orientation and height of the sensor on the sensor protection tube, compression fitting and the welding adapter (see Figure 20, pos. 3).
4. Carefully loosen the union nut of the compression fitting and hold the sensor while doing so to prevent the sensor protection frame from hitting the bottom of the piping.

**NOTICE**

Damage to the device
Mechanical damage to the sensor element can occur due to improper disassembly.
- The sensor protection frame must not hit the bottom of the piping.

Note
Very high clamping forces are exerted on the clamp ring when the compression fitting is tightened. As a result, the clamp ring is lightly pressed into the sensor protection tube. The compression fitting can no longer be shifted onto the sensor protection tube and the ‘Z’ dimension can be readjusted once again.

Reinstallation of the sensor

**WARNING**

Risk of injury
Risk of injury due to the sensor ejecting because of a missing safety ring.
- Mount the sensor with compression fitting only with the safety ring in place.

1. Make sure that the safety snap ring is inserted in the provided snap ring groove (see Figure 20, pos. 2).
2. Apply sealing compound to the pipe thread of the fitting body.
3. Carefully insert the sensor into the welding adapter.

**NOTICE**

Damage to the device
Mechanical damage to the sensor element can occur due to improper installation.
- When inserting into the welding adapter, sensor protection frame must not hit the bottom of the piping.

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

Assembly of the welding adapter with hot tap fitting

**DANGER**

Explosion hazard
Explosion hazard during installation or operation of the integrated hot tap fitting in potentially explosive atmospheres.
- The integrated hot tap fitting must not be installed or operated in potentially explosive atmospheres.

**Welding design**

Danger to life due to improper installation!
Do not shorten hot tap fitting components or interfere with the design. This can lead to the measuring medium escaping in an uncontrolled manner. This can result in severe injuries or death.

**Wafer type design**
Installation of the wafer type design is performed as explained in Wafer type design (FMT091) and partial measuring section (FMT092) on page 28.

The welding version of the integrated changing device is available in two installation lengths:
- for nominal diameters DN 100 to 125 (4 to 5 in) and
- for nominal diameters DN 150 to 300 (6 to 12 in).

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

![Diagram of integrated hot tap fitting]

Figure 22: Integrated hot tap fitting in measurement position, dimensions in mm (in)
Calculation of the installation length $X$ and installation depth $Y$

$X = h - \left( \frac{D}{2} \right)$

$Y = \left( \frac{D}{2} \right) - 28 \text{ mm (1.1 inch)}$

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

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

$X = 425 \text{ mm} - (210 \text{ mm} / 2) = 320$ mm

$Y = (210 \text{ mm} / 2) - 28 \text{ mm} = 77$ mm

Consider the following points when installing the welding version in the piping:
- Maintain a right angle to the pipe axis (max. tolerance 2°).
- The adapter centering pin must be aligned with the pipe axis in the flow direction (outflow side, behind the measuring point).

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

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

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

Installing the sensor

Wafer type design and welding adapter

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

Installation / Disassembly in connection with the hot tap fitting

DANGER

Danger to life due to piping under pressure!
If the changing device is in the measurement position during disassembly of the sensor, this may pose a danger to life due to the possibility of the sensor being ejected.
- Disassemble the sensor only if the hot tap fitting is in the disassemble position.

DANGER

Danger to life due to leaking measuring medium!
If the changing device is in the measurement position during disassembly of the sensor or gaskets in the changing device are damaged, leaking measuring medium may pose a danger to life.
- Make sure that the hot tap fitting is in the disassemble position.
- If measuring medium should start to leak in spite of this, immediately stop disassembly of the sensor and tighten the fixing screws.
- Drain and rinse the piping before disassembling the sensor, check and repair the hot tap fitting.

CAUTION

Risk of injury due to leaking measuring medium!
When you disassemble the transmitter, small quantities of measuring medium may leak due to the nature of the design.
- Make sure that sufficient ventilation is guaranteed during disassembly of the sensor.

NOTE

Damage to the changing device
Using tools or other devices to operate the lock nut can damage the hot tap fitting.
- Operate the union nut by hand only.
Installation of the sensor during operation

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

**Installing the sensor:**
1. Place the supplied O-ring in the groove of the sensor connection.
2. Carefully slide the sensor into the changing device. Observe correct alignment to the centering pin in the process.
3. Fasten the sensor to the sensor connection using screws. Use the supplied M12 screws, as well as two extended special screws for this.
4. Place the protection caps onto the special screws and tighten using two nuts.
5. Twist the transmitter with the union nut into the measuring position. The lower edge of the union nut indicates the position of the sensor. Only when the measuring position is reached 50 - OPEN - MESSEN (the lower limit stop of the union nut) will the sensor be in the middle of the piping and precise values can be provided.
6. Carry out the electrical connection

**Disassembly of the sensor during operation**

**Disassembly of the sensor:**
1. Twist the transmitter with the union nut into the disassemble position. The lower edge of the union nut indicates the position of the sensor. Only when the disassemble position is reached 0 - CLOSE - ZU (the upper limit stop of the union nut) will the sensor be in the disassemble position and the hot tap fitting sealed off from the process.
2. Disconnect electrical connections.
3. Remove protection caps.
4. Remove flange screws.
5. Carefully pull the sensor out of the changing device (do not tip to the side).
5 Installation

Installing the transmitter in the remote mount design

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

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

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

---

Figure 26: Mounting dimensions dual-compartment housing

---

Figure 27: Mounting dimensions single-compartment housing
Opening and closing the 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.

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.

Open the housing:
- Perform steps A and B.

Close the housing:
- Perform steps C and D.
... 5 Installation

... Opening and closing the housing

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

Transmitter housing

⚠️ DANGER

Damaging the device carries a risk of explosion!
When the screws for the transmitter housing are loosened, the explosion protection is suspended.
- Tighten all screws prior to commissioning.
- Never disconnect the transmitter housing from the sensor.
- Loosen only the screws indicated when rotating the transmitter housing!

Figure 30: Rotate transmitter housing

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

Figure 31: Rotating the LCD indicator

Turn the LCD indicator:
1. Open housing A, see Opening and closing the housing on page 43.
2. Perform steps B to F.

Rotate the housing:
- Perform steps A to C.
Rotate LCD indicator – single-compartment housing
The LCD indicator can be rotated in three increments of 90° each.

Figure 32: Rotating the LCD indicator

Turn the LCD indicator:
1. Open housing A, see Opening and closing the housing on page 43.
2. Perform steps B to F.
## 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.

<table>
<thead>
<tr>
<th>Plug-in cards</th>
<th>Pos.</th>
<th>Description</th>
<th>Quantity*</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="plug-in card 1" /></td>
<td>1</td>
<td>Current output, 4 to 20 mA passive (red)</td>
<td>2</td>
</tr>
<tr>
<td><img src="image2.png" alt="plug-in card 2" /></td>
<td>2</td>
<td>Passive digital output (green)</td>
<td>1</td>
</tr>
<tr>
<td><img src="image3.png" alt="plug-in card 3" /></td>
<td>3</td>
<td>Passive digital input (yellow)</td>
<td>2</td>
</tr>
<tr>
<td><img src="image4.png" alt="plug-in card 4" /></td>
<td>4</td>
<td>Loop power supply 24 V DC (blue)</td>
<td>1</td>
</tr>
<tr>
<td><img src="image5.png" alt="plug-in card 5" /></td>
<td>5</td>
<td>Modbus RTU RS485 (white)</td>
<td>1</td>
</tr>
<tr>
<td><img src="image6.png" alt="plug-in card 6" /></td>
<td>6</td>
<td>Profibus DP (white)</td>
<td>1</td>
</tr>
</tbody>
</table>

* The ‘Number’ column indicates the maximum number of plug-in cards of the same type that can be used.
The following table provides an overview of the possible plug-in card combinations that can be selected when ordering the device.

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

... Installing the plug-in cards

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 33: 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 50.
8. After powering up the power supply, configure the plug-in card functions.
6 Electrical connections

Safety instructions

⚠️ DANGER

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

⚠️ WARNING

Risk of injury due to live parts.
Improper work on the electrical connections can result in electric shock.
• Connect the device only with the power supply switched off.
• Observe the applicable standards and regulations for the electrical connection.

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.

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.
## Cable entries

The electrical connection is made via cable entries with a ½ in-NPT or M20 × 1.5 thread. Devices with a M20 × 1.5 or ½ in-NPT thread are equipped with protective plugs.

The black protective plugs in the cable glands are intended to provide protection during transport. Any unused cable entries must be sealed with sealing plugs before commissioning in accordance with the applicable national standards.

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

### Installing the connection cables

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

![Drip loop](image)

Figure 35: Laying the connection cable

## Signal cable

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

### Cable specification

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

### Maximum signal cable length

<table>
<thead>
<tr>
<th>Cable Cross Section</th>
<th>Maximum Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25 mm² (AWG 24)</td>
<td>25 m (82 ft)</td>
</tr>
<tr>
<td>0.34 mm² (AWG 22)</td>
<td>40 m (131 ft)</td>
</tr>
<tr>
<td>0.5 mm² (AWG 20)</td>
<td>65 m (213 ft)</td>
</tr>
<tr>
<td>0.75 mm² (AWG 19)</td>
<td>100 m (328 ft)</td>
</tr>
</tbody>
</table>

### Recommended cables

It is recommended to use an ABB signal cable with the order number 3KQZ407123U0100 for standard applications. The ABB signal cable fulfills the above-mentioned cable specification and can be utilized unrestrictedly up to an ambient temperature of T<sub>amb</sub> = 80 °C (176 °F).
6 Electrical connections

Pin assignment

![Electrical connection diagram]

Connections for the power supply

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Function / comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Phase</td>
</tr>
<tr>
<td>N</td>
<td>Neutral conductor</td>
</tr>
<tr>
<td>PE / 🌱</td>
<td>Protective earth (PE)</td>
</tr>
</tbody>
</table>

Potential equalization

DC voltage

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Function / comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+</td>
<td>+</td>
</tr>
<tr>
<td>2-</td>
<td>−</td>
</tr>
<tr>
<td>PE / 🌱</td>
<td>Protective earth (PE)</td>
</tr>
</tbody>
</table>

Potential equalization

Connecting the signal cable

Only for remote mount design.
The sensor housing and transmitter housing must be connected to potential equalization.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Function / comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>FE</td>
<td>Sensor power supply</td>
</tr>
<tr>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>A</td>
<td>Data line</td>
</tr>
<tr>
<td>B</td>
<td>Data line</td>
</tr>
<tr>
<td>🌱</td>
<td>Functional earth / Shielding</td>
</tr>
</tbody>
</table>

Connections for inputs and outputs

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Function / comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uco / 32</td>
<td>Current output 4 to 20 mA- / HART® output, active or</td>
</tr>
<tr>
<td>31 / 32</td>
<td>Current output 4 to 20 mA- / HART® output, passive</td>
</tr>
<tr>
<td>41 / 42</td>
<td>Passive digital output DO1</td>
</tr>
<tr>
<td>51 / 52</td>
<td>Passive digital output DO2</td>
</tr>
<tr>
<td>V1 / V2</td>
<td>Plug-in card, slot OC1</td>
</tr>
<tr>
<td>V3 / V4</td>
<td>Plug-in card, slot OC2</td>
</tr>
</tbody>
</table>

For details, see Optional plug-in cards on page 46.
Electrical data for inputs and outputs

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

Power supply L / N, 1+ / 2−

<table>
<thead>
<tr>
<th>AC voltage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminals</td>
<td>L / N</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>100 to 240 V AC, 50 / 60 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>&lt; 20 VA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminals</td>
</tr>
<tr>
<td>Operating voltage</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
</tbody>
</table>

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

Current output 31 / Uco, active

Current output 31 / 32, passive

Figure 37: (l = 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.

Figure 38: Source voltage for passive outputs

<table>
<thead>
<tr>
<th>Current output</th>
<th>Active</th>
<th>Passive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminals</td>
<td>Uco / 32</td>
<td>31 / 32</td>
</tr>
<tr>
<td>Output signal</td>
<td>4 to 20 mA or 4 to 20 mA switchable</td>
<td></td>
</tr>
<tr>
<td>Source voltage U_q *</td>
<td>250 Ω ≤ R_B ≤ 300 Ω</td>
<td>250 Ω ≤ R_B ≤ 600 Ω</td>
</tr>
<tr>
<td>Load R_B</td>
<td>250 Ω ≤ R_B ≤ 300 Ω</td>
<td>250 Ω ≤ R_B ≤ 600 Ω</td>
</tr>
<tr>
<td>Source voltage U_q *</td>
<td>13 V ≤ U_q ≤ 30 V</td>
<td></td>
</tr>
<tr>
<td>Measuring error</td>
<td>&lt; 0.1 % of measured value</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.4 µA per digit</td>
<td></td>
</tr>
</tbody>
</table>

* 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 65.
... 6 Electrical connections

... Electrical data for inputs and outputs

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

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.

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Uco / 32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>For active connection of passive outputs</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>Load dependent, see Figure 40.</td>
</tr>
<tr>
<td>Load rating I_{max}</td>
<td>22.6 mA, permanently short circuit-proof</td>
</tr>
</tbody>
</table>

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

![Figure 40: Output voltage dependent on load resistance](image-url)
Digital output 41 / 42, 51 / 52 (basic device)
Can be configured as pulse, frequency or binary output via on-site software.

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.

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 65 and PROFIBUS DP® communication on page 66.

---

**Pulse / frequency output (passive)**

<table>
<thead>
<tr>
<th>Terminals</th>
<th>41 / 42, 51 / 52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output ‘closed’</td>
<td>$0 \leq U_{CEL} \leq 3$ V</td>
</tr>
<tr>
<td></td>
<td>For $f &lt; 2.5$ kHz: $2$ mA $&lt; I_{CEL} &lt; 30$ mA</td>
</tr>
<tr>
<td></td>
<td>For $f &gt; 2.5$ kHz: $10$ mA $&lt; I_{CEL} &lt; 30$ mA</td>
</tr>
<tr>
<td>Output ‘open’</td>
<td>$16 \leq U_{CEH} \leq 30$ V DC</td>
</tr>
<tr>
<td></td>
<td>$0$ mA $\leq I_{CEH} \leq 0.2$ mA</td>
</tr>
<tr>
<td>$f_{\text{max}}$</td>
<td>$10.5$ kHz</td>
</tr>
<tr>
<td>Pulse width</td>
<td>$0.1$ to $2000$ ms</td>
</tr>
</tbody>
</table>

**Binary output (passive)**

<table>
<thead>
<tr>
<th>Terminals</th>
<th>41 / 42, 51 / 52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output ‘closed’</td>
<td>$0 \leq U_{CEL} \leq 3$ V</td>
</tr>
<tr>
<td></td>
<td>$2$ mA $\leq I_{CEL} \leq 30$ mA</td>
</tr>
<tr>
<td>Output ‘open’</td>
<td>$16 \leq U_{CEH} \leq 3$ V DC</td>
</tr>
<tr>
<td></td>
<td>$0$ mA $\leq I_{CEH} \leq 0.2$ mA</td>
</tr>
</tbody>
</table>

Switching function Can be configured using software.

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

---
6 Electrical connections

Electrical data for inputs and outputs

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.

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

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 $I_{\text{max}} = 22 \, \text{mA}$. $\Box = \text{Permissible range}$

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

<table>
<thead>
<tr>
<th>Binary output (passive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminals</td>
</tr>
<tr>
<td>Output 'closed'</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Output 'open'</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Switching function</td>
</tr>
</tbody>
</table>

Passive current output

<table>
<thead>
<tr>
<th>Terminals</th>
<th>V1 / V2, V3 / V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signal</td>
<td>4 to 20 mA</td>
</tr>
<tr>
<td>Load $R_B$</td>
<td>$250 , \Omega \leq R_B \leq 600 , \Omega$</td>
</tr>
<tr>
<td>Source voltage $U_q$</td>
<td>$13 , \text{V} \leq U_q \leq 30 , \text{V}$</td>
</tr>
<tr>
<td>Measuring error</td>
<td>$&lt; 0.1 %$ of measured value</td>
</tr>
<tr>
<td>Resolution</td>
<td>$0.4 , \mu\text{A}$ per digit</td>
</tr>
</tbody>
</table>

* The source voltage $U_q$ is dependent of the load $R_B$ and must be placed in an additional area.
Digital input V1 / V2, V3 / V4 (plug-in module)
Up to two additional digital inputs can be implemented via the 'Passive digital input (yellow)' plug-in card. Can be configured as an input for external counter reset, external output deactivation etc. via on-site software.

![Figure 46: Plug-in card as digital input (I = internal, E = external)](image)

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

### Digital input

<table>
<thead>
<tr>
<th>Terminal</th>
<th>V1 / V2, V3 / V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input 'On'</td>
<td>16 V ≤ U_{KL} ≤ 30 V</td>
</tr>
<tr>
<td>Input 'Off'</td>
<td>0 V ≤ U_{KL} ≤ 3 V</td>
</tr>
<tr>
<td>Internal resistance Rᵢ</td>
<td>6.5 kΩ</td>
</tr>
</tbody>
</table>

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 58.

![Figure 47: (I = Internal, E = External)](image)

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

### Loop power supply 24 V DC

<table>
<thead>
<tr>
<th>Terminals</th>
<th>V1 / V2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>For active connection of passive outputs</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>24 V DC at 0 mA, 17 V DC at 25 mA</td>
</tr>
<tr>
<td>Load rating</td>
<td>25 mA, permanently short circuit-proof</td>
</tr>
</tbody>
</table>

**Note**

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

Electrical data for inputs and outputs

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

Digital output 41 / 42, 51 / 52, V3 / V4 active
When the 'loop power supply 24 V DC (blue)' plug-in card is used, the digital outputs on the basic device and on the option modules can also be wired as active digital outputs.

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

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

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

The RX resistors limit the maximum current through the optoelectronic coupler of the digital outputs in the transmitter.
The maximum permissible current is 25 mA. An RX 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.

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.

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.
... 6 Electrical connections

Connection to integral mount design

Dual-compartment housing

100 ... 240 V AC
24 V DC

HART
Iout 1+2

DI + DO

PA

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)

Figure 54: 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 43 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.
62 FMT430, FMT450 THERMAL MASS FLOWMETER | CI/FMT430/450-EN REV. B

... 6 Electrical connections

Connection to remote mount design

Transmitter

![Diagram of electrical connections]

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

Figure 55: 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 43 to open and close the housing safely.

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.

### Table: Signal Cables

<table>
<thead>
<tr>
<th>Terminal</th>
<th>ABB signal cable</th>
<th>HELKAMA signal cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>Blue</td>
<td>Blue (4)</td>
</tr>
<tr>
<td>(V_{FE})</td>
<td>White</td>
<td>white (3)</td>
</tr>
<tr>
<td>A</td>
<td>Yellow</td>
<td>Blue (2)</td>
</tr>
<tr>
<td>B</td>
<td>Orange</td>
<td>white (1)</td>
</tr>
</tbody>
</table>

---

**Figure 56:** Electrical connection to transmitter in remote mount design (example, dimensions in mm (in))
... 6 Electrical connections

... Connection to remote mount design

Flowmeter sensor

Figure 57: Connection to sensor in remote mount design (example)

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 $T_{\text{amb}} \geq 60 ^\circ C (\geq 140 ^\circ F)$ 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 DTM and other files can be downloaded from [www.abb.com/flow](http://www.abb.com/flow).

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

**Factory setting of the HART® process variables**

<table>
<thead>
<tr>
<th>Process variable</th>
<th>Process value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Value (PV)</td>
<td>Mass flow</td>
</tr>
<tr>
<td>Secondary Value (SV)</td>
<td>Temperature</td>
</tr>
<tr>
<td>Tertiary Value (TV)</td>
<td>Mass (counter)</td>
</tr>
<tr>
<td>Quaternary Value (QV)</td>
<td>Standard flow rate</td>
</tr>
</tbody>
</table>

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](http://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.

<table>
<thead>
<tr>
<th>Modbus protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminals</td>
</tr>
<tr>
<td>Configuration</td>
</tr>
<tr>
<td>Transmission</td>
</tr>
<tr>
<td>Baud rate</td>
</tr>
<tr>
<td>Factory setting: 9600 baud</td>
</tr>
<tr>
<td>Parity</td>
</tr>
<tr>
<td>Factory setting: odd</td>
</tr>
<tr>
<td>Stop bit</td>
</tr>
<tr>
<td>Factory setting: One</td>
</tr>
<tr>
<td>IEEE format</td>
</tr>
<tr>
<td>Factory setting: Little endian</td>
</tr>
<tr>
<td>Typical response time</td>
</tr>
<tr>
<td>Response delay time</td>
</tr>
<tr>
<td>Factory setting: 10 milliseconds</td>
</tr>
</tbody>
</table>
6 Electrical connections

Digital communication

![Diagram](image)

**Figure 58: 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 mm² (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**

<table>
<thead>
<tr>
<th>Terminals</th>
<th>V1 / V2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>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)</td>
</tr>
<tr>
<td>Transmission</td>
<td>In accordance with IEC 61158-2</td>
</tr>
<tr>
<td>Baud rate</td>
<td>9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5 Mbps</td>
</tr>
<tr>
<td>The baud rate is automatically detected and does not need to be configured manually</td>
<td></td>
</tr>
<tr>
<td>Device profile</td>
<td>PA Profile 3.02</td>
</tr>
<tr>
<td>Bus address</td>
<td>Address range 0 to 126</td>
</tr>
<tr>
<td>Factory setting: 126</td>
<td></td>
</tr>
</tbody>
</table>

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

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

You can download EDD, DTM and GSD from [www.abb.com/flow](http://www.abb.com/flow).

The files required for operation can also be downloaded from [www.profibus.com](http://www.profibus.com).

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

<table>
<thead>
<tr>
<th>ID number</th>
<th>GSD file name</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x9740</td>
<td>PA139740.gsd</td>
</tr>
<tr>
<td>0x3435</td>
<td>ABB_3435.gsd</td>
</tr>
<tr>
<td>0x9700</td>
<td>PA139700.gsd</td>
</tr>
</tbody>
</table>

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

Refer to **Parameter description** in the operating instruction.
Limits and rules when using ABB fieldbus accessories

![Diagram of bus cable length versus transmission rate](image)

**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 $\geq 1500$ kBit/s!
- Spur cable length ($L_S$), at $\leq 1500$ kBit/s: $LS \leq 0.25$ 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 ($\sum L_S$) $\leq 6.60$ m, trunk cable length ($L_T$) $> 6.60$ m,
    total length $= L_T + (\sum L_S) \leq 200$ m,
    maximum 22 DP nodes ($= 6.60$ m / (0.25 m + 0.05 m spare))
7 Commissioning

Safety instructions

⚠️ DANGER

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

⚠️ CAUTION

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

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

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

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

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

Hardware settings

Dual-compartment housing

![Diagram of dual-compartment housing]

Figure 60: 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.

<table>
<thead>
<tr>
<th>Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
<td>Write protection active</td>
</tr>
<tr>
<td>Off</td>
<td>Write protection deactivated</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
<td>Digital output 41 / 42 and 51 / 52 as NAMUR output.</td>
</tr>
<tr>
<td>Off</td>
<td>Digital output 41 / 42 and 51 / 52 as optoelectronic coupler output.</td>
</tr>
</tbody>
</table>
Single-compartment housing

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-protection 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.

<table>
<thead>
<tr>
<th>Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
<td>Write protection active</td>
</tr>
<tr>
<td>Off</td>
<td>Write protection deactivated.</td>
</tr>
</tbody>
</table>

Configuration of digital outputs V1 / V2 or V3 / V4

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.

<table>
<thead>
<tr>
<th>Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
<td>Digital output V1 / V2 or V3 / V4 as NAMUR output.</td>
</tr>
<tr>
<td>Off</td>
<td>Digital output V1 / V2 or V3 / V4 as optoelectronic coupler output.</td>
</tr>
</tbody>
</table>
... 7 Commissioning

Checks prior to commissioning

The following points must be checked before commissioning the device:

- Correct wiring in accordance with Electrical connections on page 50.
- Correct grounding of the device.
- The ambient conditions must meet the requirements set out in the specification.
- The power supply must meet the requirements set out on the name plate.

Parameterization of the device

The CI_FMT430_450_EN_B can be commissioned and operated via the integrated LCD indicator (option, see Parameterization via the menu function Easy Setup on page 72).

Alternatively, the CI_FMT430_450_EN_B can also be commissioned and operated via ABB Asset Vision Basic (FEP6xx DTM).

Parameterization with the optional LCD indicator

A PC / Notebook and the USB interface cable are needed to configure the device via the device local operating interface. By combining the HART-DTM and the softwareflow available at www.abb.com/ABB AssetVision, all parameters can also be set without a fieldbus connection.

Parameterization via the local operating interface

**DANGER**

Explosion hazard

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

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

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

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

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. 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.

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

Switching on the power supply
- Switch on the power supply.
The LCD display shows the following display during the startup process:

The process display is displayed after the startup process.
... 7 Commissioning

Parameterization via the menu function Easy Setup

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

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

1. Switch to the configuration level with .

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

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

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

Selection of the menu language

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

Configuration of the current output

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

Only if an appropriate plug-in card is present!

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

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

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

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

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

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

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

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

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

... Parameterization via the menu function Easy Setup

40. Use \( \text{} \) to call up the edit mode.
41. Using \( \text{} / \text{} \), select the desired process value for frequency output 51 / 52.
42. Confirm the selection with \( \text{} \).

43. Use \( \text{} \) to call up the edit mode.
44. Using \( \text{} / \text{} \) set the frequency for 100 % of the flow rate.
45. Confirm the selection with \( \text{} \).

46. Use \( \text{} \) to call up the edit mode.
47. Using \( \text{} / \text{} \) set the frequency for 0 % of the flow rate.
48. Confirm the selection with \( \text{} \).

49. Use \( \text{} \) to call up the edit mode.
50. Using \( \text{} / \text{} \), select the desired function for binary output 51 / 52.
51. Confirm the selection with \( \text{} \).
Select the application using the digital inputs

**Easy Setup**

Dig.In 0 Application

Application 1

Next  Edit

**Easy Setup**

Dig.In 1 Application

Application 2

Next  Edit

**Easy Setup**

Dig.In1+2Application

Application 3

Next  Edit

61. Use 
62. Use 
63. Confirm the selection with .

Select measuring ranges and units

**Easy Setup**

Unit Massflow Qm

Next  Edit

64. Use 
65. Use 
66. Confirm the selection with .

Easy Setup

Qm Max

Next  Edit

Only if an appropriate plug-in card is present!

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

Easy Setup

Volume flow Qv

m3/h

Next  Edit

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

Easy Setup

Std. Conditions Vol@

20°C 1 ATM

Next  Edit

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

Easy Setup

Qv@ Max

Next  Edit

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

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


... 7 Commissioning

... Parameterization via the menu function Easy Setup

79. Use \( \text{Edit} \) to call up the edit mode.
80. Use \( \text{Up} / \text{Down} \) to select the desired temperature unit.
81. Confirm the selection with \( \text{OK} \).

82. Use \( \text{Edit} \) to call up the edit mode.
83. Use \( \text{Up} / \text{Down} \) to set the desired measuring range for temperature measurement.
84. Confirm the selection with \( \text{OK} \).

85. Use \( \text{Edit} \) to call up the edit mode.
86. Use \( \text{Up} / \text{Down} \) to set the desired low flow (\% of \( Q_{m\text{Max}} \) / \( Q_{V\text{Max}} \)).
87. Confirm the selection with \( \text{OK} \).

Once all parameter have been set, the main menu appears again.
The most important parameters are now set.
88. Use \( \text{Exit} \) to switch to the process display.
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.

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

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

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

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

Menu navigation

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

<table>
<thead>
<tr>
<th></th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>◀</td>
<td>Exit menu</td>
</tr>
<tr>
<td>◀</td>
<td>Go back one submenu</td>
</tr>
<tr>
<td>◀</td>
<td>Cancel a parameter entry</td>
</tr>
<tr>
<td>◀</td>
<td>Select the next position for entering numerical and alphanumeric values</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select</td>
<td>Select submenu / parameter</td>
</tr>
<tr>
<td>Edit</td>
<td>Edit parameter</td>
</tr>
<tr>
<td>OK</td>
<td>Save parameter entered</td>
</tr>
</tbody>
</table>

Figure 67: LCD display
8 Operation

Menu levels

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

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

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

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

Switching to the information level

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

1. Open the using Operator Menu.
2. Select the desired submenu using / .
3. Confirm the selection with .

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/ /</td>
<td>Call up information level. When Autoscroll mode is activated, the icon appears here and the operator pages are automatically displayed one after the other.</td>
</tr>
<tr>
<td>/</td>
<td>Call up configuration level.</td>
</tr>
<tr>
<td>/</td>
<td>The device is protected against changes in the parametrization.</td>
</tr>
</tbody>
</table>
... 8 Operation

... Switching to the information level

Error messages on the LCD display

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

![Process display](image)

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:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✗</td>
<td>Error / failure</td>
</tr>
<tr>
<td>🛠</td>
<td>Function check</td>
</tr>
<tr>
<td>🔍</td>
<td>Outside of the specification</td>
</tr>
<tr>
<td>🔔</td>
<td>Maintenance required</td>
</tr>
</tbody>
</table>

The error messages are also divided into the following areas:

<table>
<thead>
<tr>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>Error / alarm due to the current operating conditions.</td>
</tr>
<tr>
<td>Sensor</td>
<td>Error / alarm of the flowmeter sensor.</td>
</tr>
<tr>
<td>Electronics</td>
<td>Error / alarm of the electronics.</td>
</tr>
<tr>
<td>Configuration</td>
<td>Error / alarm due to device configuration.</td>
</tr>
</tbody>
</table>

**Note**

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

Switching to the configuration level (parameterization)

**Note**

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

**Note**

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

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

![Process display](image)

1. Switch to the configuration level with 📈.

![Access Level](image)

2. Select the desired level of access using ⬅️ / ⬆️.

3. Confirm the selection with ✅.

**Note**

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

- There is no factory default password. For security reasons it is recommended to set a password.
- The password prevents access to the parameterization via the buttons on the device. For further access protection via DTM or EDD (HART®, PROFIBUS®, Modbus®) the hardware write protection switch must be set (see Write-protect switch on page 68).

<table>
<thead>
<tr>
<th>Access Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read Only</td>
<td>All parameters are locked. Parameters are read only and cannot be modified.</td>
</tr>
<tr>
<td>Standard</td>
<td>All the parameters can be changed.</td>
</tr>
<tr>
<td>Service</td>
<td>Only ABB Customer Service has access to the Service menu.</td>
</tr>
</tbody>
</table>
Once you have logged on to the corresponding access level, you can edit or reset the password. Reset (status 'no password defined') by selecting ‘ ’ as a password.

Enter Password
**********
QRSTUVWXYZ 0123456

4. Enter the appropriate password. No password is preset in the factory settings. Users can switch to the configuration level without entering a password.

The selected access level remains active for 3 minutes. Within this time period you can toggle between the process display and the configuration level without re-entering the password.

5. Use to confirm the password.

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

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

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

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.

Parameter name
Parameter 1
Parameter 2
Parameter 3
Cancel OK

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.
... 8 Operation

... Switching to the configuration level (parameterization)

3. Use \( \rightarrow \) to select the decimal place to change.
4. Use \( \uparrow \) / \( \downarrow \) to set the desired value.
5. Use \( \rightarrow \) to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use \( \rightarrow \) 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 \( \rightarrow \) to call up the parameter for editing. The decimal place that is currently selected is highlighted.
3. Use \( \rightarrow \) to select the decimal place to change.
4. Use \( \uparrow \) / \( \downarrow \) to set the desired value.
5. Use \( \rightarrow \) to select the next decimal place.
6. If necessary select and set additional decimal places in accordance with steps 3 to 4.
7. Use \( \rightarrow \) to confirm your setting.
This concludes the procedure for changing a parameter value.

Exiting the setup
For some menu items, values must be entered. If you don’t want to change the parameter, you can exit the menu as described below.
1. Pressing \( \rightarrow \) (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. \( \rightarrow \) terminates editing and exits the menu item. Use \( \rightarrow \) to return to the start.

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

Safety instructions

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

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

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

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

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

---

**NOTICE**
Damage to components!
The electronic components of the printed circuit board can be damaged by static electricity (observe ESD guidelines).
- Make sure that the static electricity in your body is discharged before touching electronic components.

**Note**
For detailed information on the maintenance of the device, consult the associated operating instructions (OI)!
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 23.

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.
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.
PROFIBUS and PROFIBUS DP are registered trademarks of PROFIBUS & PROFINET International (PI)
Swagelok is a registered trademark of the Swagelok Company
Kalrez and Kalrez Spectrum are registered trademarks of DuPont Performance Elastomers.
Viton is a DuPont de Nemours trademark
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
### Appendix

#### FMT400 Installation diagram 3kxf000094G0009

<table>
<thead>
<tr>
<th>Notes: US and Canadian application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ATEX &amp; IECEx application</td>
</tr>
<tr>
<td>2. The intrinsic safety concept allows the intrinsic safety of equipment not specially examined or tested when installed in classified locations.</td>
</tr>
<tr>
<td>3. Control equipment must be used when installed in hazardous locations.</td>
</tr>
<tr>
<td>4. Installation should be in accordance with U.S. or Canadian regulations.</td>
</tr>
<tr>
<td>5. The configuration of the associated apparatus must be followed when installing this equipment.</td>
</tr>
<tr>
<td>6. Associated apparatus must be installed in accordance with the associated apparatus installation diagram.</td>
</tr>
</tbody>
</table>

#### Diagram

![Installation diagram](3kxf000094G0009)
## Zone 2/22 & Division 2

### Model code
- FMT4bcY0
- FMT4bcA2
- FMT4bcF2
- HART Communication

### Indication

<table>
<thead>
<tr>
<th>Indication</th>
<th>Abbr.</th>
<th>Status</th>
<th>Option</th>
<th>Terminal</th>
<th>Operating Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Active or Passive</td>
<td>Chosen Option depending on Model Number (MN)</td>
<td>If &quot;or&quot; occurs Terminal depends on MN</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On board</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Output 1</td>
<td>CO1</td>
<td>A</td>
<td>On board Power Supply</td>
<td>31/U_{CO}</td>
<td></td>
</tr>
<tr>
<td>Current Output 1</td>
<td>CO1</td>
<td>P</td>
<td></td>
<td>31/32</td>
<td></td>
</tr>
<tr>
<td>Digital Output 1</td>
<td>DO1</td>
<td>A</td>
<td>With OC Active Supply</td>
<td>41/42 and V1/V2</td>
<td></td>
</tr>
<tr>
<td>Digital Output 1</td>
<td>DO1</td>
<td>P</td>
<td></td>
<td>41/42</td>
<td></td>
</tr>
<tr>
<td>Digital Output 2</td>
<td>DO2</td>
<td>A</td>
<td>With OC Active Supply</td>
<td>51/52 and V1/V2</td>
<td></td>
</tr>
<tr>
<td>Digital Output 2</td>
<td>DO2</td>
<td>P</td>
<td></td>
<td>51/52</td>
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<tr>
<td>Option Cards (OC)</td>
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</tr>
<tr>
<td>Current Output 2</td>
<td>CO2</td>
<td>A</td>
<td>With OC Active Supply</td>
<td>V1/V2 and V3/V4</td>
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</tr>
<tr>
<td>Current Output 2</td>
<td>CO2</td>
<td>P</td>
<td></td>
<td>V1/V2 or V3/V4</td>
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<tr>
<td>Current Output 3</td>
<td>CO3</td>
<td>P</td>
<td></td>
<td>V1/V2 or V3/V4</td>
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</tr>
<tr>
<td>Digital Output 3</td>
<td>DO3</td>
<td>A</td>
<td>With OC Active Supply</td>
<td>V1/V2 and V3/V4</td>
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<td>Digital Output 3</td>
<td>DO3</td>
<td>P</td>
<td></td>
<td>V1/V2 or V3/V4</td>
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<tr>
<td>Digital Input 1</td>
<td>DI1</td>
<td>A</td>
<td>With OC Active Supply</td>
<td>V1/V2 and V3/V4</td>
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<td>Digital Input 1</td>
<td>DI1</td>
<td>P</td>
<td></td>
<td>V1/V2 or V3/V4</td>
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<tr>
<td>Modbus / Profibus DP</td>
<td>- - -</td>
<td>A</td>
<td></td>
<td>V1/V2</td>
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</table>
## Zone 0/1/21 & Division 1

Model code | FMT4bcA1, FMT4bcA3  
FMT4bcF1

**HART Communication**

<table>
<thead>
<tr>
<th>Indication</th>
<th>Abbr.</th>
<th>Status</th>
<th>Option</th>
<th>Terminal</th>
<th>Ex e / XP</th>
<th>Ex i a / IS</th>
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<tbody>
<tr>
<td>Current Output 1</td>
<td>CO1</td>
<td>A</td>
<td>On board Power Supply</td>
<td>31/UI0</td>
<td>30 0,2</td>
<td>30 0,2</td>
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<td>Current Output 1</td>
<td>CO1</td>
<td>P</td>
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<tr>
<td>Digital Output 1</td>
<td>DO1</td>
<td>A</td>
<td>With OC Active Supply</td>
<td>41/42 and V1/V2</td>
<td>30 0,1</td>
<td>27 -</td>
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<tr>
<td>Digital Output 1</td>
<td>DO1</td>
<td>P</td>
<td></td>
<td></td>
<td>30 0,1</td>
<td>27 -</td>
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<tr>
<td>Digital Output 2</td>
<td>DO2</td>
<td>A</td>
<td>With OC Active Supply</td>
<td>51/52 and V1/V2</td>
<td>30 0,1</td>
<td>27 -</td>
</tr>
<tr>
<td>Digital Output 2</td>
<td>DO2</td>
<td>P</td>
<td></td>
<td></td>
<td>30 0,1</td>
<td>27 -</td>
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</tbody>
</table>

**Option Cards (OC)**

| Current Output 2| CO2   | A      | With OC Active Supply   | V1/V2 and V3/V4           | 30 0,1    | 27 -        |
| Current Output 2| CO2   | P      |                          |                           | 30 0,1    | 27 -        |
| Digital Output 3| DO3   | A      | With OC Active Supply   | V1/V2 and V3/V4           | 30 0,1    | 27 -        |
| Digital Output 3| DO3   | P      |                          |                           | 30 0,1    | 27 -        |
| Digital Input 1 | DI1   | A      | With OC Active Supply   | V1/V2 and V3/V4           | 30 0,1    | 27 -        |
| Digital Input 1 | DI1   | P      |                          |                           | 30 0,1    | 27 -        |
| Digital Input 2 | DI2   | P      |                          |                           | 30 0,1    | 27 -        |
| Modbus / Profinet | DP | - -  | A                        | V1/V2                     | 30 0,1    | 27 -        |

For more information, please refer to the Installation diagram 3kxf00004G0009.
<table>
<thead>
<tr>
<th>Model number</th>
<th>On Board Input/Output</th>
<th>Slot1</th>
<th>Slot2</th>
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<tbody>
<tr>
<td>G8</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
</tr>
<tr>
<td>G1</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
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<td>G2</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
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<tr>
<td>G3</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
</tr>
<tr>
<td>G4</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
</tr>
<tr>
<td>G5</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
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<tr>
<td>G6</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
</tr>
<tr>
<td>G7</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
</tr>
<tr>
<td>G8</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
</tr>
<tr>
<td>G9</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
</tr>
<tr>
<td>G10</td>
<td>31 32 Uso</td>
<td>41 42</td>
<td>V1 V2</td>
</tr>
</tbody>
</table>

Safety Warning: The option card AS (Active Supply) is only suitable for use with internal option cards. The use of external circuits is not allowed.

Sicherheitshinweis: Die Optionskarte AS (Active Supply) ist nur für die Verwendung mit internen Optionskarten geeignet. Der Einsatz mit externen Schaltkreisen ist nicht erlaubt.

Summary of model numbers, option cards and the corresponding customer connections / terminals
Allowed I/O connections and OPTION CARD handling:

- CO1 passive
  - Current OUT 1 (on Board)
- CO1 active
  - Current OUT 1 (on Board)
- DO1 passive
  - Digital OUT 1 (on Board)
- DO2 passive
  - Digital OUT 2 (on Board)

ABB (passive)
- U01
  - 32 -
  - 31 -
- A (passive)
  - 41 -
  - 42/32 -
  - 51 -
- A (active)
  - LOAD
- CUSTOMER (active)
  - LOAD

WARNING: A should only be used for "OH Board" Current Out!
Allowed I/O connections and OPTION CARD handling:
Allowed I/O connections and OPTION CARD handling:
Allowed I/O connections and OPTION CARD handling:
... 13 Appendix

... FMT400 Installation diagram 3kxf000094G0009

Allowed I/O connections and OPTION CARD handling:

![Diagram](image.png)
Allowed I/O connections and OPTION CARD handling:

- CI2 passive
- CO3 passive

- Digital IN 2 (Option Card) (8 digital 2 in/3/4) or (8 digital 1 in/3/4)
- Current OUT 3 (Option Card) (8 digital 2 in/3/4) or (8 digital 1 in/3/4)

- ABB (active)
- CUSTOMER (active)
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... FMT400 Installation diagram 3kxf000094G0009

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Introduction

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

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

Additional Information

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

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