

# Technical Information

## Proline t-mass I 300

Thermal mass flowmeter



Insertion flowmeter with long-term stability and compact, easily accessible transmitter

### Application

- Measuring principle is characterized by a high operable flow range and direct mass flow measurement
- Measurement of utility and process gases as well as gas mixtures in circular piping or rectangular ducts

### Device properties

- Insertion version for DN 80 to 1500 (3 to 60")
- Bidirectional measurement; high measuring performance
- Patented drift-free sensor with SIL 2
- Compact dual-compartment housing with up to 3 I/Os
- Backlit display with touch control and WLAN access
- Remote display available

### Your benefits

- Flexible, convenient programming based on 21 standard gases or freely definable gas mixtures thereof
- High level of process control – premium measurement accuracy and repeatability
- Reliable monitoring – detection of process disturbances and reverse flow
- Flexible installation – suitable for large dimensional range and circular pipes or rectangular ducts
- Full access to process and diagnostic information – numerous, freely combinable I/Os and fieldbuses
- Reduced complexity and variety – freely configurable I/O functionality
- Integrated verification – Heartbeat Technology



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

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## About this document

### Symbols









#### Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	<b>Ground connection</b> A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	<b>Protective Earth (PE)</b> A terminal which must be connected to ground prior to establishing any other connections.  The ground terminals are situated inside and outside the device: <ul style="list-style-type: none"> <li>■ Inner ground terminal: Connects the protective earth to the mains supply.</li> <li>■ Outer ground terminal: Connects the device to the plant grounding system.</li> </ul>

#### Communication symbols




Symbol	Meaning
	<b>Wireless Local Area Network (WLAN)</b> Communication via a wireless, local network.
	<b>LED</b> Light emitting diode is off.
	<b>LED</b> Light emitting diode is on.
	<b>LED</b> Light emitting diode is flashing.

#### Symbols for certain types of information

Symbol	Meaning
	<b>Permitted</b> Procedures, processes or actions that are permitted.
	<b>Preferred</b> Procedures, processes or actions that are preferred.
	<b>Forbidden</b> Procedures, processes or actions that are forbidden.
	<b>Tip</b> Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection



Symbols in graphics

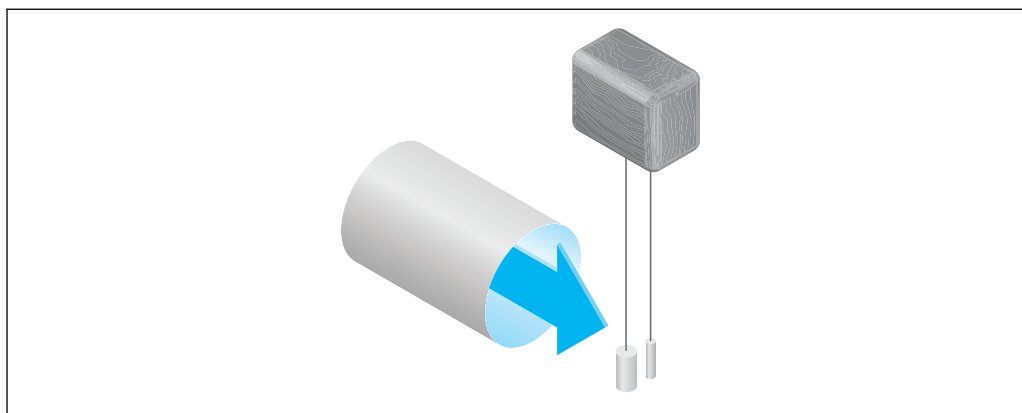
Symbol	Meaning
1, 2, 3, ...	Item numbers
1, 2, 3, ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
	Hazardous area
	Safe area (non-hazardous area)
	Flow direction



## Function and system design

### Measuring principle

The thermal measuring principle is based on the cooling of a heated resistance thermometer (PT100) from which heat is extracted by the passing medium.



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The medium passes two PT100 resistance thermometers in the measurement section. One of these is used in the conventional way as a temperature sensor, while the other serves as a heating element. The temperature sensor monitors and records the effective process temperature while the heated resistance thermometer is kept at a constant differential temperature (compared to the measured process temperature) by controlling the electrical current used by the heating element. The greater the mass flow passing over the heated resistance thermometer, the greater the extent to which cooling takes place and therefore the stronger the current required to maintain a constant differential temperature. This means that the heat current measured is an indicator of the mass flow rate of the medium.

### Gas Engine

The integrated Gas Engine functionality ensures maximum measuring performance for flow measurement. The Gas Engine developed by Endress+Hauser is a software-based database of typical standard gases and their specific properties. The Gas Engine calculates the properties of gas mixtures based on the percentage shares of up to 8 gas components.

The Gas Engine functionality enables:

- Calibration with air; no need for expensive and complex calibration with real gas
- Precise conversion of air to other gases; no recalibration required
- Exact measurement of single gases and also of gas mixtures
- Dynamic correction of pressure and temperature changes

The device can be configured for 21 freely selectable gases and water vapor.

Gases available for selection:

- |                     |                   |                       |
|---------------------|-------------------|-----------------------|
| ■ Ammonia           | ■ Helium          | ■ Ozone <sup>1)</sup> |
| ■ Argon             | ■ Carbon dioxide  | ■ Propane             |
| ■ Butane            | ■ Carbon monoxide | ■ Oxygen              |
| ■ Chlorine          | ■ Krypton         | ■ Hydrogen sulfide    |
| ■ Hydrogen chloride | ■ Air             | ■ Nitrogen            |
| ■ Ethane            | ■ Methane         | ■ Hydrogen            |
| ■ Ethylene          | ■ Neon            | ■ Xenon               |

1) Can only be selected as an individual gas or as a gas mixture with oxygen.

Mixtures of these gases, e.g. natural gas, can be programmed easily and quickly on the basis of the percentage shares.



For other gases, contact the Endress+Hauser sales organization responsible for your area.



**Bidirectional measurement and reverse flow detection**

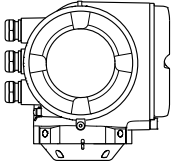
Conventional thermal mass flowmeters cannot distinguish between forward and reverse flows. They always record flow in both directions with the same algebraic sign. Endress+Hauser's thermal flowmeter is available in this conventional unidirectional design, or as a bidirectional flowmeter. Both versions feature sensors that are protected in stainless steel. The bidirectional version can distinguish between the two flow directions and measure and totalize the flow in both directions with the same degree of accuracy.

The version to detect reverse flow only measures flow in the positive direction. The reverse flow is detected by the device but is not totalized.


**Measuring system**

The device consists of a transmitter and a sensor.  
The device is available as a compact version:  
The transmitter and sensor form a mechanical unit.

**Transmitter**

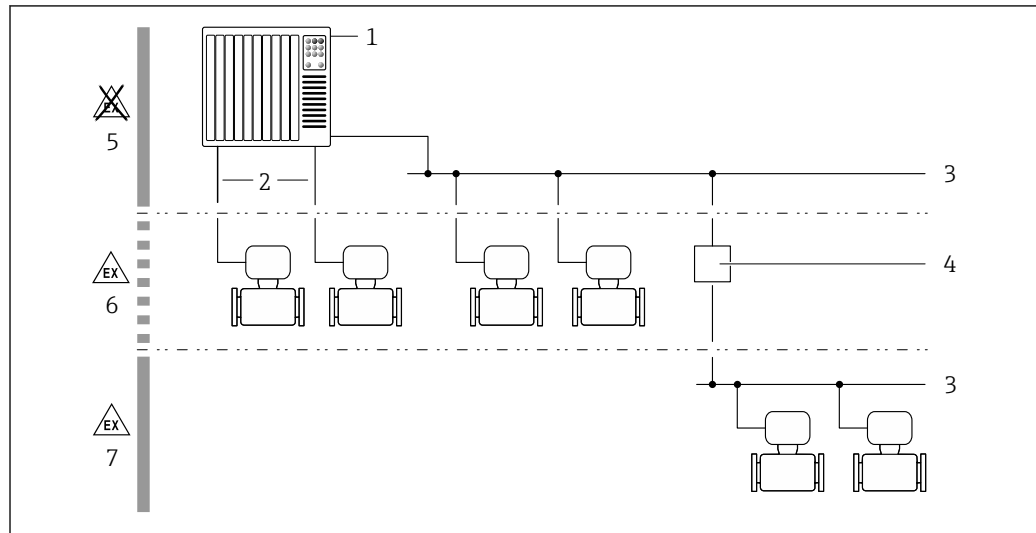
<p><b>Proline 300</b></p> 	<p>Device versions and materials:</p> <ul style="list-style-type: none"><li>■ Transmitter housing Aluminum, coated: aluminum, AlSi10Mg, coated</li><li>■ Material of window in transmitter housing: Aluminum, coated: glass</li></ul> <p>Configuration:</p> <ul style="list-style-type: none"><li>■ External operation via 4-line, backlit, graphic local display with touch control and guided menus ("Make-it-run" wizards) for application-specific commissioning.</li><li>■ Via service interface or WLAN interface:<ul style="list-style-type: none"><li>■ Operating tools (e.g. FieldCare, DeviceCare)</li><li>■ Web server (access via Web browser, e.g. Microsoft Internet Explorer, Microsoft Edge)</li></ul></li></ul>
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**Sensor**

<p><b>t-mass I</b></p> 	<p>Insertion version:</p> <ul style="list-style-type: none"><li>■ Sensor lengths: 235 mm (9 ")/335 mm (13 ")/435 mm (17 ")/608 mm (24 ") for DN 80 to 1500 (3 to 60")</li><li>■ Materials (in contact with medium):<ul style="list-style-type: none"><li>■ Insertion tube: stainless steel 1.4404 (316/316L)</li><li>■ Sensing element: Stainless steel 1.4404 (316/316L) Alloy C22, 2.4602 as version for corrosive gases</li></ul></li><li>■ Exception: connecting part to transmitter (not in contact with medium): 1.4301 (304)</li></ul>
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## Equipment architecture



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 1 Possibilities for integrating measuring devices into a system

- 1 Control system (e.g. PLC)
- 2 Connecting cable (0/4 to 20 mA HART etc.)
- 3 Fieldbus
- 4 Coupler
- 5 Non-hazardous area
- 6 Hazardous area: Zone 2; Class I, Division 2
- 7 Hazardous area: Zone 1; Class I, Division 1

## Dependability






## IT security

Our warranty is valid only if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the device and associated data transfer, must be implemented by the operators themselves in line with their security standards.

## Device-specific IT security

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section.

Function/interface	Factory setting	Recommendation
Write protection via hardware write protection switch →  9	Not enabled.	On an individual basis following risk assessment.
Access code (also applies for Web server login or FieldCare connection) →  9	Not enabled (0000).	Assign a customized access code during commissioning.
WLAN (order option in display module)	Enabled.	On an individual basis following risk assessment.
WLAN security mode	Enabled (WPA2-PSK)	Do not change.
WLAN passphrase (password) →  9	Serial number	Assign an individual WLAN passphrase during commissioning.
WLAN mode	Access point	On an individual basis following risk assessment.
Web server →  9	Enabled.	On an individual basis following risk assessment.
CDI-RJ45 service interface →  9	–	On an individual basis following risk assessment.



#### *Protecting access via hardware write protection*

Write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be disabled via a write protection switch (DIP switch on the motherboard). When hardware write protection is enabled, only read access to the parameters is possible.

Hardware write protection is disabled when the device is delivered.

#### *Protecting access via a password*

Different passwords are available to protect write access to the device parameters or access to the device via the WLAN interface.

- **User-specific access code**  
Protect write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare). Access authorization is clearly regulated through the use of a user-specific access code.
- **WLAN passphrase**  
The network key protects a connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface which can be ordered as an option.
- **Infrastructure mode**  
When the device is operated in infrastructure mode, the WLAN passphrase corresponds to the WLAN passphrase configured on the operator side.

#### *User-specific access code*

Write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code.

#### *WLAN passphrase: Operation as WLAN access point*

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface, which can be ordered as an optional extra, is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter.

#### *Infrastructure mode*

A connection between the device and WLAN access point is protected by means of an SSID and passphrase on the system side. Please contact the relevant system administrator for access.

#### *General notes on the use of passwords*

- The access code and network key supplied with the device should be changed during commissioning.
- Follow the general rules for generating a secure password when defining and managing the access code or network key.
- The user is responsible for the management and careful handling of the access code and network key.

#### *Access via Web server*

The device can be operated and configured via a Web browser with the integrated Web server. The connection is via the service interface (CDI-RJ45) or the WLAN interface.

The Web server is enabled when the device is delivered. The Web server can be disabled if necessary (e.g. after commissioning) via the **Web server functionality** parameter.

The device and status information can be hidden on the login page. This prevents unauthorized access to the information.



For detailed information on device parameters, see:  
The "Description of Device Parameters" document

#### *Access via service interface (CDI-RJ45)*

The device can be connected to a network via the service interface (CDI-RJ45). Device-specific functions guarantee the secure operation of the device in a network.



The use of relevant industrial standards and guidelines that have been defined by national and international safety committees, such as IEC/ISA62443 or the IEEE, is recommended. This includes organizational security measures such as the assignment of access authorization as well as technical measures such as network segmentation.



Transmitters with an Ex de approval may not be connected via the service interface (CDI-RJ45)!

Order code for "Approval", options (Ex de): BB, C2, GB, MB, NB



## Input

### Measured variable

#### Measured process variables

- Mass flow
- Temperature

#### Calculated process variables

- Corrected volume flow
- Volume flow
- FAD volume flow
- Flow velocity
- Calorific value
- 2nd temperature heat difference
- Heat flow
- Energy flow
- Density

#### Process variables available for order


Order code for "Sensor version":

- Option SB "Bidirectional" measures the flow in both directions (»positive« and »negative« flow) and totalizes the flow in both directions. The device is calibrated in both directions.
- Option SC "Reverse flow detection" only measures the flow in the positive direction. The reverse flow is detected by the device but is not totalized. The device is only calibrated in the positive forward flow direction.

Order code for "Application package":

Option EV "Second gas group" enables the configuration of two different standard gases/gas mixtures in the device and allows the user to switch from one gas group to another using the status input or (if available) via bus communication.

### Measuring range

The available measuring range depends on the choice of gas and size of the pipe. Each measuring device is calibrated individually with air under reference operating conditions. No recalibration is required in the case of customer-specific gases, as the device's Gas Engine →  6 functionality converts from air to these gases.

The measuring ranges calibrated for air are indicated in the following section. For information on other gases and process conditions, contact your sales organization or use the Applicator selection software.

#### SI units

- Order code for "Sensor version; sensor; insertion tube", option SA "Unidirectional; stainless steel; stainless steel"
- Order code for "Sensor version; sensor; insertion tube", option HA "Unidirectional; Alloy; stainless steel"

DN [mm]	Full scale value [kg/h] (Air, 20°C, 1.013 bar a)		Full scale value [Nm <sup>3</sup> /h] (Air, 0°C, 1.013 bar a)	
	Minimum	Maximum	Minimum	Maximum
80	21	2 086	16	1 613
100	33	3 260	25	2 521
150	73	7 335	57	5 672
200	130	13 040	101	10 084
250	204	20 375	158	15 757
300	293	29 340	227	22 689
400	522	52 160	403	40 337
500	815	81 500	630	63 026
600	1 174	117 360	908	90 758
700	1 597	159 740	1 235	123 531



DN [mm]	Full scale value [kg/h] (Air, 20°C, 1.013 bar a)		Full scale value [Nm <sup>3</sup> /h] (Air, 0°C, 1.013 bar a)	
	Minimum	Maximum	Minimum	Maximum
1 000	3 260	326 000	2 521	252 105
1 500	7 335	733 501	5 672	567 236

- Order code for "Sensor version; sensor; insertion tube:", option SB "Bidirectional; stainless steel; stainless steel"
- Order code for "Sensor version; sensor; insertion tube:", option SC "Reverse flow detection; stainless steel; stainless steel"

DN [mm]	Full scale value [kg/h] (Air, 20°C, 1.013 bar a)		Full scale value [Nm <sup>3</sup> /h] (Air, 0°C, 1.013 bar a)	
	Minimum	Maximum	Minimum	Maximum
80	13	1 310	10	1 012
100	23	2 310	17	1 786
150	47	4 750	36	3 673
200	84	8 475	65	6 553
250	132	13 250	102	10 246
300	190	19 000	146	14 692
400	337	33 750	260	26 099
500	530	53 000	409	40 986
600	762	76 250	589	58 966
700	1 038	103 820	802	80 286
1 000	2 119	211 900	1 638	163 868
1 500	4 767	476 750	3 686	368 683

#### US units

- Order code for "Sensor version; sensor; insertion tube", option SA "Unidirectional; stainless steel; stainless steel"
- Order code for "Sensor version; sensor; insertion tube", option HA "Unidirectional; Alloy; stainless steel"

DN [in]	Full scale value [lb/h] (Air, 68°F, 14.7 psi a)		Full scale value [SCFM] (Air, 59°F, 14.7 psi a)	
	Minimum	Maximum	Minimum	Maximum
3	42	4 173	9	909
4	74	7 419	16	1 616
6	167	16 693	36	3 636
8	297	29 677	65	6 464
10	464	46 371	101	10 100
12	668	66 774	145	14 544
16	1 187	118 709	259	25 856
20	1 855	185 482	404	40 400
24	2 671	267 094	582	58 176
28	3 635	363 545	792	79 184
40	7 419	741 929	1 616	161 600
60	16 693	1 669 340	3 636	363 600



- Order code for "Sensor version; sensor; insertion tube:", option SB "Bidirectional; stainless steel; stainless steel"
- Order code for "Sensor version; sensor; insertion tube:", option SC "Reverse flow detection; stainless steel; stainless steel"

DN [in]	Full scale value [lb/h] (Air, 68°F, 14.7 psi a)		Full scale value [SCFM] (Air, 59°F, 14.7 psi a)	
	Minimum	Maximum	Minimum	Maximum
3	29	2 981	6	648
4	52	5 257	11	1 144
6	108	10 810	23	2 354
8	192	19 287	42	4 200
10	301	30 155	65	6 567
12	432	43 241	94	9 417
16	768	76 810	167	16 729
20	1 206	120 620	262	26 272
24	1 735	173 533	377	37 797
28	2 362	236 279	514	51 463
40	4 822	482 253	1 050	105 039
60	10 850	1 085 012	2 363	236 326


The flow rates listed are only representative for the calibrated conditions and do not necessarily reflect the measuring capacity of the measuring device under operating conditions and the actual pipe internal diameters present on site. To make sure that the correct device version and sizing is selected to suit the application, contact the sales organization or use the Applicator selection software.

### Special applications

#### High gas flow velocities (>70 m/s)

In the case of high gas flow velocities, it is advisable to read in the process pressure dynamically or to enter the pressure as accurately as possible, as a velocity-dependent correction is performed.

#### Light gases (hydrogen, helium)

- The reliable measurement of light gases can be difficult due to their very high thermal conductivity. Depending on the application, the flow rates of light gases are often particularly slow and the flow profiles are not sufficiently developed. The flows are frequently in the laminar flow range, while turbulent flow would actually be needed for optimum measurement.
- Despite loss of accuracy and linearity in applications with light gases and low flow rates, the device measures with a good degree of repeatability and is therefore suitable for monitoring flow conditions (e.g. leak detection).
- The recommended inlet runs must be doubled for light gases. →  38


### Operable flow range

- 200:1 with factory calibration
- Up to 1000:1 with application-specific adjustment

### Input signal

#### Output and input variants → 15

#### External values

The measuring device provides interfaces which allow values measured externally →  14 to be transmitted to the measuring device:

- Analog inputs 4-20 mA
- Digital inputs

Pressure values can be transmitted as absolute or gauge pressure. For gauge pressure, the atmospheric pressure must be known or specified by the customer.




*HART protocol*

The measured values are written from the automation system to the measuring device via the HART protocol. The pressure transmitter must support the following protocol-specific functions:

- HART protocol
- Burst mode

*Current input*

The measured values are written from the automation system to the measuring device via the current input →  14.

*Digital communication*

The measured values can be written from the automation system to the measuring via:  
Modbus RS485

**Current input 0/4 to 20 mA**

<b>Current input</b>	0/4 to 20 mA (active/passive)
<b>Current span</b>	<ul style="list-style-type: none"> <li>■ 4 to 20 mA (active)</li> <li>■ 0/4 to 20 mA (passive)</li> </ul>
<b>Resolution</b>	1 µA
<b>Voltage drop</b>	Typically: 0.6 to 2 V for 3.6 to 22 mA (passive)
<b>Maximum input voltage</b>	≤ 30 V (passive)
<b>Open-circuit voltage</b>	≤ 28.8 V (active)
<b>Possible input variables</b>	<ul style="list-style-type: none"> <li>■ Pressure</li> <li>■ Temperature</li> <li>■ Mol-% (gas analyzer)</li> <li>■ External reference flow rate (in-situ adjustment)</li> </ul>

**Status input**

<b>Maximum input values</b>	<ul style="list-style-type: none"> <li>■ DC -3 to 30 V</li> <li>■ If status input is active (ON): <math>R_i &gt; 3 \text{ k}\Omega</math></li> </ul>
<b>Response time</b>	Configurable: 5 to 200 ms
<b>Input signal level</b>	<ul style="list-style-type: none"> <li>■ Low signal: DC -3 to +5 V</li> <li>■ High signal: DC 12 to 30 V</li> </ul>
<b>Assignable functions</b>	<ul style="list-style-type: none"> <li>■ Off</li> <li>■ Reset the individual totalizers separately</li> <li>■ Reset all totalizers</li> <li>■ Flow override</li> <li>■ Second gas group</li> <li>■ Zero point adjustment</li> </ul>



## Output

### Output and input variants

Depending on the option selected for output/input 1, different options are available for the other outputs and inputs. Only one option can be selected for each output/input 1 to 3. The following tables must be read vertically (↓).

Example: If the option BA "4–20 mA HART" was selected for output/input 1, one of the options A, B, D, E, , H, I or J is available for output 2 and one of the options A, B, D, E, , H, I or J is available for output 3.

### Output/input 1 and options for output/input 2



Options for output/input 3 → 16

Order code for "Output; input 1" (020) →	Possible options														
Current output 4 to 20 mA HART	BA														
Current output 4 to 20 mA HART Ex i passive	↓	CA													
Current output 4 to 20 mA HART Ex i active		↓	CC												
Modbus RS485								↓	MA						
Order code for "Output; input 2" (021) →	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Not assigned	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Current output 4 to 20 mA	B			B		B	B			B		B	B	B	
Current output 4 to 20 mA Ex i passive		C	C		C			C			C				C
User-configurable input/output <sup>1)</sup>	D			D		D	D			D		D	D	D	
Pulse/frequency/switch output	E			E		E	E			E		E	E	E	
Pulse/frequency/switch output Ex i passive		G	G		G			G			G				G
Relay output	H			H		H	H			H		H	H	H	
Current input 0/4 to 20 mA	I			I		I	I			I		I	I	I	
Status input	J			J		J	J			J		J	J	J	

1) A specific input or output → 20 can be assigned to a user-configurable input/output.



## Output/input 1 and options for output/input 3

 Options for output/input 2 →  15

Order code for "Output; input 1" (020) →	Possible options														
Current output 4 to 20 mA HART	BA														
Current output 4 to 20 mA HART Ex i passive	↓	CA													
Current output 4 to 20 mA HART Ex i active		↓	CC												
Modbus RS485								↓	MA						
Order code for "Output; input 3" (022) →	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Not assigned	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Current output 4 to 20 mA	B					B			B	B	B	B	B	B	
Current output 4 to 20 mA Ex i passive		C	C												
User-configurable input/output	D					D			D	D	D	D	D	D	
Pulse/frequency/switch output	E					E			E	E	E	E	E	E	
Pulse/frequency/switch output Ex i passive		G	G												
Relay output	H					H			H	H	H	H	H	H	
Current input 0/4 to 20 mA	I					I			I	I	I	I	I	I	
Status input	J					J			J	J	J	J	J	J	



## Output signal

## Current output 4 to 20 mA HART

Order code	"Output; input 1" (20): Option BA: current output 4 to 20 mA HART
Signal mode	Can be set to: <ul style="list-style-type: none"> <li>■ Active</li> <li>■ Passive</li> </ul>
Current range	Can be set to: <ul style="list-style-type: none"> <li>■ 4 to 20 mA NAMUR</li> <li>■ 4 to 20 mA US</li> <li>■ 4 to 20 mA</li> <li>■ 0 to 20 mA (only if the signal mode is active)</li> <li>■ Fixed current</li> </ul>
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	250 to 700 $\Omega$
Resolution	0.38 $\mu$ A
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	<ul style="list-style-type: none"> <li>■ Mass flow</li> <li>■ Volume flow</li> <li>■ Corrected volume flow</li> <li>■ FAD volume flow</li> <li>■ Flow velocity</li> <li>■ Temperature</li> <li>■ Energy flow</li> <li>■ Pressure</li> <li>■ Density</li> <li>■ Heat flow</li> <li>■ Electronics temperature</li> <li>■ 2nd temperature heat difference</li> </ul> <p>For SIL (application package), only mass flow</p>

## Current output 4 to 20 mA HART Ex i

Order code	"Output; input 1" (20) choose from: <ul style="list-style-type: none"> <li>■ Option CA: current output 4 to 20 mA HART Ex i passive</li> <li>■ Option CC: current output 4 to 20 mA HART Ex i active</li> </ul>
Signal mode	Depends on the selected order version.
Current range	Can be set to: <ul style="list-style-type: none"> <li>■ 4 to 20 mA NAMUR</li> <li>■ 4 to 20 mA US</li> <li>■ 4 to 20 mA</li> <li>■ 0 to 20 mA (only if the signal mode is active)</li> <li>■ Fixed current</li> </ul>
Open-circuit voltage	DC 21.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	<ul style="list-style-type: none"> <li>■ 250 to 400 <math>\Omega</math> (active)</li> <li>■ 250 to 700 <math>\Omega</math> (passive)</li> </ul>
Resolution	0.38 $\mu$ A



<b>Damping</b>	Configurable: 0 to 999.9 s
<b>Assignable measured variables</b>	<ul style="list-style-type: none"> <li>■ Mass flow</li> <li>■ Volume flow</li> <li>■ Corrected volume flow</li> <li>■ FAD volume flow</li> <li>■ Flow velocity</li> <li>■ Temperature</li> <li>■ Energy flow</li> <li>■ Pressure</li> <li>■ Density</li> <li>■ Heat flow</li> <li>■ Electronics temperature</li> <li>■ 2nd temperature heat difference</li> </ul> <p>For SIL (application package), only mass flow</p>

**Modbus RS485**

<b>Physical interface</b>	RS485 in accordance with EIA/TIA-485 standard
<b>Terminating resistor</b>	Integrated, can be activated via DIP switches

**Current output 4 to 20 mA**

<b>Order code</b>	"Output; input 2" (21), "Output; input 3" (022): Option B: current output 4 to 20 mA
<b>Signal mode</b>	Can be set to: <ul style="list-style-type: none"> <li>■ Active</li> <li>■ Passive</li> </ul>
<b>Current span</b>	Can be set to: <ul style="list-style-type: none"> <li>■ 4 to 20 mA NAMUR</li> <li>■ 4 to 20 mA US</li> <li>■ 4 to 20 mA</li> <li>■ 0 to 20 mA (only if the signal mode is active)</li> <li>■ Fixed current</li> </ul>
<b>Maximum output values</b>	22.5 mA
<b>Open-circuit voltage</b>	DC 28.8 V (active)
<b>Maximum input voltage</b>	DC 30 V (passive)
<b>Load</b>	0 to 700 $\Omega$
<b>Resolution</b>	0.38 $\mu$ A
<b>Damping</b>	Configurable: 0 to 999.9 s
<b>Assignable measured variables</b>	<ul style="list-style-type: none"> <li>■ Mass flow</li> <li>■ Volume flow</li> <li>■ Corrected volume flow</li> <li>■ FAD volume flow</li> <li>■ Flow velocity</li> <li>■ Temperature</li> <li>■ Energy flow</li> <li>■ Pressure</li> <li>■ Density</li> <li>■ Heat flow</li> <li>■ Electronics temperature</li> <li>■ 2nd temperature heat difference</li> </ul> <p>For SIL (application package), only mass flow</p>



**Pulse/frequency/switch output**

<b>Function</b>	Can be set to pulse, frequency or switch output
<b>Version</b>	Open collector Can be set to: <ul style="list-style-type: none"> <li>■ Active</li> <li>■ Passive</li> <li>■ Passive NAMUR</li> </ul>
<b>Maximum input values</b>	DC 30 V, 250 mA (passive)
<b>Open-circuit voltage</b>	DC 28.8 V (active)
<b>Voltage drop</b>	For 22.5 mA: ≤ DC 2 V
<b>Pulse output</b>	
<b>Maximum input values</b>	DC 30 V, 250 mA (passive)
<b>Maximum output current</b>	22.5 mA (active)
<b>Open-circuit voltage</b>	DC 28.8 V (active)
<b>Pulse width</b>	Configurable: 0.05 to 2 000 ms
<b>Maximum pulse rate</b>	10 000 Impulse/s
<b>Pulse value</b>	Adjustable
<b>Assignable measured variables</b>	<ul style="list-style-type: none"> <li>■ Mass flow</li> <li>■ Volume flow</li> <li>■ Corrected volume flow</li> <li>■ FAD volume flow</li> <li>■ Energy flow</li> <li>■ Heat flow</li> </ul> For SIL (application package), only mass flow
<b>Frequency output</b>	
<b>Maximum input values</b>	DC 30 V, 250 mA (passive)
<b>Maximum output current</b>	22.5 mA (active)
<b>Open-circuit voltage</b>	DC 28.8 V (active)
<b>Output frequency</b>	Adjustable: end value frequency 2 to 10 000 Hz ( $f_{\max} = 12\,500$ Hz)
<b>Damping</b>	Configurable: 0 to 999.9 s
<b>Pulse/pause ratio</b>	1:1
<b>Assignable measured variables</b>	<ul style="list-style-type: none"> <li>■ Mass flow</li> <li>■ Volume flow</li> <li>■ Corrected volume flow</li> <li>■ FAD volume flow</li> <li>■ Flow velocity</li> <li>■ Temperature</li> <li>■ Energy flow</li> <li>■ Pressure</li> <li>■ Density</li> <li>■ Heat flow</li> <li>■ Electronics temperature</li> <li>■ 2nd temperature heat difference</li> </ul> For SIL (application package), only mass flow
<b>Switch output</b>	
<b>Maximum input values</b>	DC 30 V, 250 mA (passive)
<b>Open-circuit voltage</b>	DC 28.8 V (active)
<b>Switching behavior</b>	Binary, conductive or non-conductive
<b>Switching delay</b>	Configurable: 0 to 100 s



<b>Number of switching cycles</b>	Unlimited
<b>Assignable functions</b>	<ul style="list-style-type: none"> <li>■ Off</li> <li>■ On</li> <li>■ Diagnostic behavior</li> <li>■ Limit value <ul style="list-style-type: none"> <li>■ Off</li> <li>■ Mass flow</li> <li>■ Volume flow</li> <li>■ Corrected volume flow</li> <li>■ FAD volume flow</li> <li>■ Heat flow</li> <li>■ Energy flow</li> <li>■ Flow velocity</li> <li>■ Density</li> <li>■ Calorific value</li> <li>■ Temperature</li> <li>■ 2nd temperature heat difference</li> <li>■ Totalizer 1-3</li> <li>■ Electronics temperature</li> </ul> </li> <li>■ Flow direction monitoring</li> <li>■ Status <ul style="list-style-type: none"> <li>Low flow cut off</li> </ul> </li> </ul>

### Relay output

<b>Function</b>	Switch output
<b>Version</b>	Relay output, galvanically isolated
<b>Switching behavior</b>	Can be set to: <ul style="list-style-type: none"> <li>■ NO (normally open), factory setting</li> <li>■ NC (normally closed)</li> </ul>
<b>Maximum switching capacity (passive)</b>	<ul style="list-style-type: none"> <li>■ DC 30 V, 0.1 A</li> <li>■ AC 30 V, 0.5 A</li> </ul>
<b>Assignable functions</b>	<ul style="list-style-type: none"> <li>■ Off</li> <li>■ On</li> <li>■ Diagnostic behavior</li> <li>■ Limit value <ul style="list-style-type: none"> <li>■ Off</li> <li>■ Mass flow</li> <li>■ Volume flow</li> <li>■ Corrected volume flow</li> <li>■ FAD volume flow</li> <li>■ Heat flow</li> <li>■ Energy flow</li> <li>■ Flow velocity</li> <li>■ Density</li> <li>■ Temperature</li> <li>■ 2nd temperature heat difference</li> <li>■ Totalizer 1-3</li> <li>■ Electronics temperature</li> </ul> </li> <li>■ Flow direction monitoring</li> <li>■ Status <ul style="list-style-type: none"> <li>Low flow cut off</li> </ul> </li> </ul>

### User-configurable input/output

**One** specific input or output is assigned to a user-configurable input/output (configurable I/O) during device commissioning.

The following inputs and outputs are available for assignment:

- Choice of current output: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Pulse/frequency/switch output
- Choice of current input: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Status input



The technical values correspond to those of the inputs and outputs described in this section.

## Signal on alarm

Depending on the interface, failure information is displayed as follows:

### HART current output

Device diagnostics	Device condition can be read out via HART Command 48
--------------------	--

### Modbus RS485

Failure mode	Choose from: <ul style="list-style-type: none"> <li>■ NaN value instead of current value</li> <li>■ Last valid value</li> </ul>
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### Current output 0/4 to 20 mA

*4 to 20 mA*

Failure mode	Choose from: <ul style="list-style-type: none"> <li>■ 4 to 20 mA in accordance with NAMUR recommendation NE 43</li> <li>■ 4 to 20 mA in accordance with US</li> <li>■ Min. value: 3.59 mA</li> <li>■ Max. value: 22.5 mA</li> <li>■ Freely definable value between: 3.59 to 22.5 mA</li> <li>■ Actual value</li> <li>■ Last valid value</li> </ul>
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*0 to 20 mA*

Failure mode	Choose from: <ul style="list-style-type: none"> <li>■ Maximum alarm: 22 mA</li> <li>■ Freely definable value between: 0 to 20.5 mA</li> </ul>
--------------	---

### Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: <ul style="list-style-type: none"> <li>■ Actual value</li> <li>■ No pulses</li> </ul>
Frequency output	
Failure mode	Choose from: <ul style="list-style-type: none"> <li>■ Actual value</li> <li>■ 0 Hz</li> <li>■ Defined value (<math>f_{\max}</math> 2 to 12 500 Hz)</li> </ul>
Switch output	
Failure mode	Choose from: <ul style="list-style-type: none"> <li>■ Current status</li> <li>■ Open</li> <li>■ Closed</li> </ul>

### Relay output

Failure mode	Choose from: <ul style="list-style-type: none"> <li>■ Current status</li> <li>■ Open</li> <li>■ Closed</li> </ul>
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**Local display**

<b>Plain text display</b>	With information on cause and remedial measures
<b>Backlight</b>	Red backlighting indicates a device error.



Status signal as per NAMUR recommendation NE 107

**Interface/protocol**

- Via digital communication:
  - HART protocol
  - Modbus RS485
- Via service interface
  - CDI-RJ45 service interface
  - WLAN interface

<b>Plain text display</b>	With information on cause and remedial measures
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Additional information on remote operation → 66

**Web browser**

<b>Plain text display</b>	With information on cause and remedial measures
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**Light emitting diodes (LED)**

<b>Status information</b>	Status indicated by various light emitting diodes The following information is displayed depending on the device version: <ul style="list-style-type: none"> <li>■ Supply voltage active</li> <li>■ Data transmission active</li> <li>■ Device alarm/error has occurred</li> </ul>
---------------------------	---

**Load**

Output signal → 17

**Ex connection data****Safety-related values**

Order code "Output; input 1"	Output type	Safety-related values "Output; input 1"	
		26 (+)	27 (-)
Option <b>BA</b>	Current output 4 to 20 mA HART	$U_N = 30 \text{ V}_{DC}$ $U_M = 250 \text{ V}_{AC}$	
Option <b>MA</b>	Modbus RS485	$U_N = 30 \text{ V}_{DC}$ $U_M = 250 \text{ V}_{AC}$	

Order code "Output; input 2"; "Output; input 3"	Output type	Safety-related values			
		Output; input 2		Output; input 3	
		24 (+)	25 (-)	22 (+)	23 (-)
Option <b>B</b>	Current output 4 to 20 mA	$U_N = 30 \text{ V}_{DC}$ $U_M = 250 \text{ V}_{AC}$			
Option <b>D</b>	User-configurable input/ output	$U_N = 30 \text{ V}_{DC}$ $U_M = 250 \text{ V}_{AC}$			
Option <b>E</b>	Pulse/frequency/switch output	$U_N = 30 \text{ V}_{DC}$ $U_M = 250 \text{ V}_{AC}$			



Order code "Output; input 2"; "Output; input 3"	Output type	Safety-related values			
		Output; input 2		Output; input 3	
		24 (+)	25 (-)	22 (+)	23 (-)
Option <b>H</b>	Relay output	$U_N = 30 \text{ V}_{DC}$ $I_N = 100 \text{ mA}_{DC}/500 \text{ mA}_{AC}$ $U_M = 250 \text{ V}_{AC}$			
Option <b>I</b>	Current input 4 to 20 mA	$U_N = 30 \text{ V}_{DC}$ $U_M = 250 \text{ V}_{AC}$			
Option <b>J</b>	Status input	$U_N = 30 \text{ V}_{DC}$ $U_M = 250 \text{ V}_{AC}$			

## Intrinsically safe values

Order code "Output; input 1"	Output type	Intrinsically safe values "Output; input 1"	
		26 (+)	27 (-)
Option <b>CA</b>	Current output 4 to 20 mA HART Ex i passive	$U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1.25 \text{ W}$ $L_i = 0 \text{ } \mu\text{H}$ $C_i = 6 \text{ nF}$	
Option <b>CC</b>	Current output 4 to 20 mA HART Ex i active	<b>Ex ia</b> <sup>1)</sup> $U_0 = 21.8 \text{ V}$ $I_0 = 90 \text{ mA}$ $P_0 = 491 \text{ mW}$ $L_0 = 4.1 \text{ mH(IIC)}/$ $15 \text{ mH(IIB)}$ $C_0 = 160 \text{ nF(IIC)}/$ $1160 \text{ nF(IIB)}$  $U_i = 30 \text{ V}$ $I_i = 10 \text{ mA}$ $P_i = 0.3 \text{ W}$ $L_i = 5 \text{ } \mu\text{H}$ $C_i = 6 \text{ nF}$	<b>Ex ic</b> <sup>2)</sup> $U_0 = 21.8 \text{ V}$ $I_0 = 90 \text{ mA}$ $P_i = 491 \text{ mW}$ $L_0 = 9 \text{ mH(IIC)}/$ $39 \text{ mH(IIB)}$ $C_0 = 600 \text{ nF(IIC)}/$ $4000 \text{ nF(IIB)}$

1) Only available for the Zone 1; Class I, Division 1 version

2) Only available for the Zone 2; Class I, Division 2 version

Order code for "Output; input 2"; "Output; input 3"	Output type	Intrinsically safe values or NIFW values			
		Output; input 2		Output; input 3	
		24 (+)	25 (-)	22 (+)	23 (-)
Option <b>C</b>	Current output 4 to 20 mA Ex i passive	$U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1.25 \text{ W}$ $L_i = 0$ $C_i = 0$			
Option <b>G</b>	Pulse/frequency/switch output Ex i passive	$U_i = 30 \text{ V}$ $I_i = 100 \text{ mA}$ $P_i = 1.25 \text{ W}$ $L_i = 0$ $C_i = 0$			

## Low flow cut off

The switch points for low flow cut off are user-selectable.

## Galvanic isolation

The outputs are galvanically isolated from one another and from earth (PE).




## Protocol-specific data

## HART

Manufacturer ID	0x11
Device type ID	0x1160
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: <a href="http://www.endress.com">www.endress.com</a>
HART load	Min. 250 Ω
System integration	Information on system integration: Operating Instructions . <ul style="list-style-type: none"> <li>▪ Measured variables via HART protocol</li> <li>▪ Burst Mode functionality</li> </ul>

## Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
Response times	<ul style="list-style-type: none"> <li>▪ Direct data access: typically 25 to 50 ms</li> <li>▪ Auto-scan buffer (data range): typically 3 to 5 ms</li> </ul>
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	<ul style="list-style-type: none"> <li>▪ 03: Read holding register</li> <li>▪ 04: Read input register</li> <li>▪ 06: Write single registers</li> <li>▪ 08: Diagnostics</li> <li>▪ 16: Write multiple registers</li> <li>▪ 23: Read/write multiple registers</li> </ul>
Broadcast messages	Supported by the following function codes: <ul style="list-style-type: none"> <li>▪ 06: Write single registers</li> <li>▪ 16: Write multiple registers</li> <li>▪ 23: Read/write multiple registers</li> </ul>
Supported baud rate	<ul style="list-style-type: none"> <li>▪ 1 200 BAUD</li> <li>▪ 2 400 BAUD</li> <li>▪ 4 800 BAUD</li> <li>▪ 9 600 BAUD</li> <li>▪ 19 200 BAUD</li> <li>▪ 38 400 BAUD</li> <li>▪ 57 600 BAUD</li> <li>▪ 115 200 BAUD</li> </ul>
Data transfer mode	<ul style="list-style-type: none"> <li>▪ ASCII</li> <li>▪ RTU</li> </ul>
Data access	Each device parameter can be accessed via Modbus RS485.  For Modbus register information
System integration	Information on system integration: Operating Instructions . <ul style="list-style-type: none"> <li>▪ Modbus RS485 information</li> <li>▪ Function codes</li> <li>▪ Register information</li> <li>▪ Response time</li> <li>▪ Modbus data map</li> </ul>



## Power supply

### Terminal assignment

#### Transmitter: supply voltage, input/outputs

##### HART

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (-)	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)
The terminal assignment depends on the specific device version ordered → 15.							

##### Modbus RS485

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (-)	26 (B)	27 (A)	24 (+)	25 (-)	22 (+)	23 (-)
The terminal assignment depends on the specific device version ordered → 15.							



Terminal assignment of the remote display and operating module → 26.

### Available device plugs



Device plugs may not be used in hazardous areas!

#### Device plug for connecting to the service interface:

Order code for "Accessory mounted"

Option **NB**, adapter RJ45 M12 (service interface) → 31

#### Order code for "Accessory mounted", option NB "Adapter RJ45 M12 (service interface)"

Order code "Accessory mounted"	Cable entry/coupling → 26	
	Cable entry 2	Cable entry 3
NB	Plug M12 × 1	–

### Supply voltage

Order code for "Power supply"	Terminal voltage		Frequency range
Option <b>D</b>	DC 24 V	±20%	–
Option <b>E</b>	AC 100 to 240 V	–15 to +10%	50/60 Hz, ±4 Hz
Option <b>I</b>	DC 24 V	±20%	–
	AC 100 to 240 V	–15 to +10%	50/60 Hz, ±4 Hz

### Power consumption

#### Transmitter

Max. 10 W (active power)

switch-on current	Max. 36 A (<5 ms) as per NAMUR Recommendation NE 21
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### Current consumption

#### Transmitter

- Max. 400 mA (24 V)
- Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)

### Power supply failure

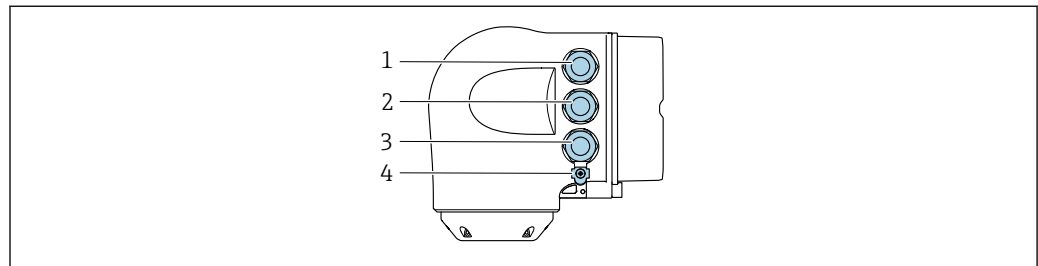
- Totalizers stop at the last value measured.
- Depending on the device version, the configuration is retained in the device memory or in the pluggable data memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.



## Electrical connection

## Connecting the transmitter

- i** ■ Terminal assignment → 25
- Device plugs available → 25



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- 1 Terminal connection for supply voltage
- 2 Terminal connection for signal transmission, input/output
- 3 Terminal connection for signal transmission, input/output or terminal for network connection via service interface (CDI-RJ45); Optional: terminal connection for external WLAN antenna or connection for remote display and operating module DKX001
- 4 Protective ground (PE)

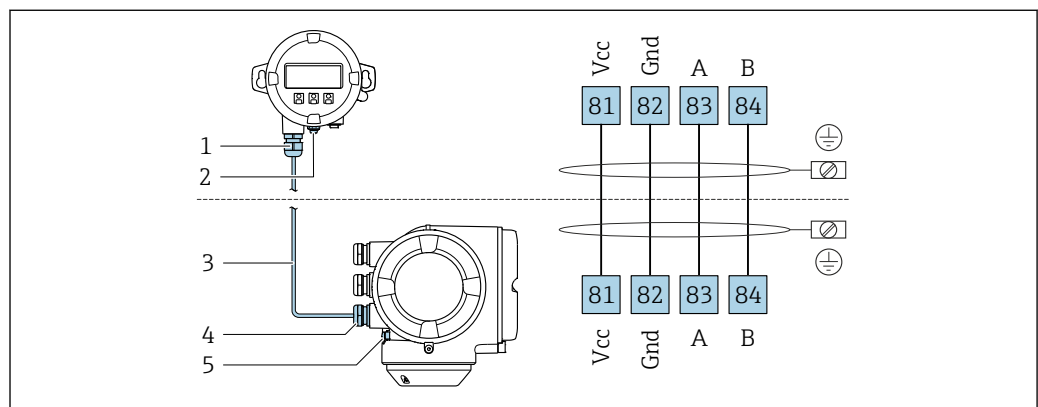
- i** An adapter for RJ45 and the M12 connector is optionally available:  
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

The adapter connects the service interface (CDI-RJ45) to an M12 connector mounted in the cable entry. Therefore the connection to the service interface can be established via an M12 connector without opening the device.

- i** Network connection via service interface (CDI-RJ45) → 68

## Connecting the remote display and operating module DKX001

- i** The remote display and operating module DKX001 is available as an optional extra → 77.
  - The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
  - If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



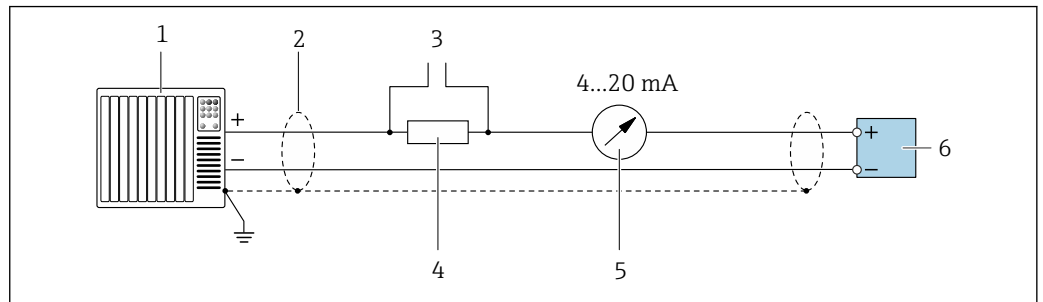
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- 1 Remote display and operating module DKX001
- 2 Protective earth (PE)
- 3 Connecting cable
- 4 Measuring device
- 5 Protective earth (PE)



## Connection examples

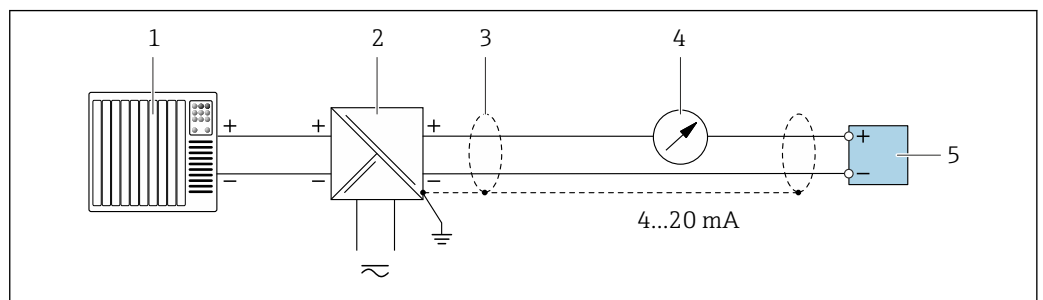
### Current output 4 to 20 mA HART



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**2** Connection example for 4 to 20 mA HART current output (active)

- 1 Automation system with current input (e.g. PLC)
- 2 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 31
- 3 Connection for HART operating devices → 66
- 4 Resistor for HART communication ( $\geq 250 \Omega$ ); observe maximum load → 17
- 5 Analog display unit: observe maximum load → 17
- 6 Transmitter



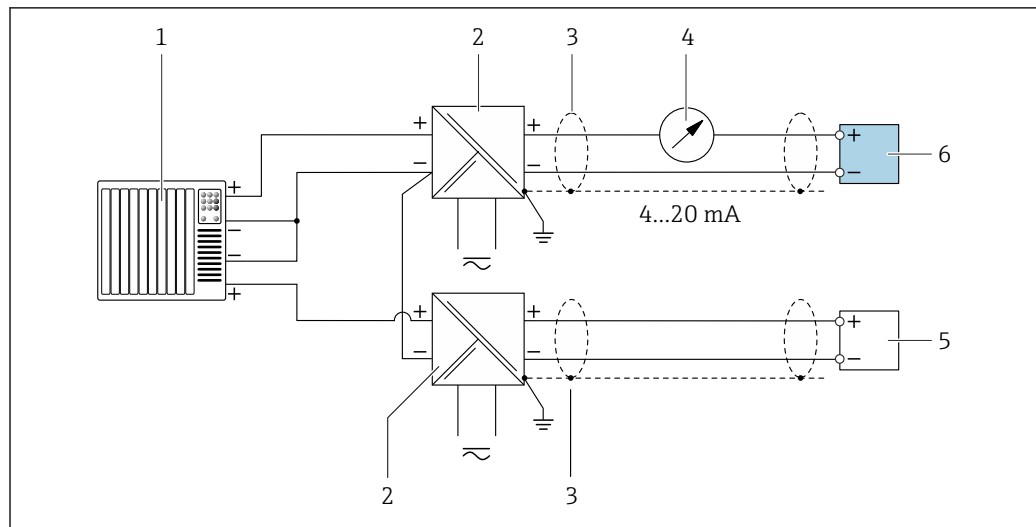
A0028762

**3** Connection example for 4 to 20 mA HART current output (passive)

- 1 Automation system with current input (e.g. PLC)
- 2 Power supply
- 3 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 31
- 4 Analog display unit: observe maximum load → 17
- 5 Transmitter



## HART input

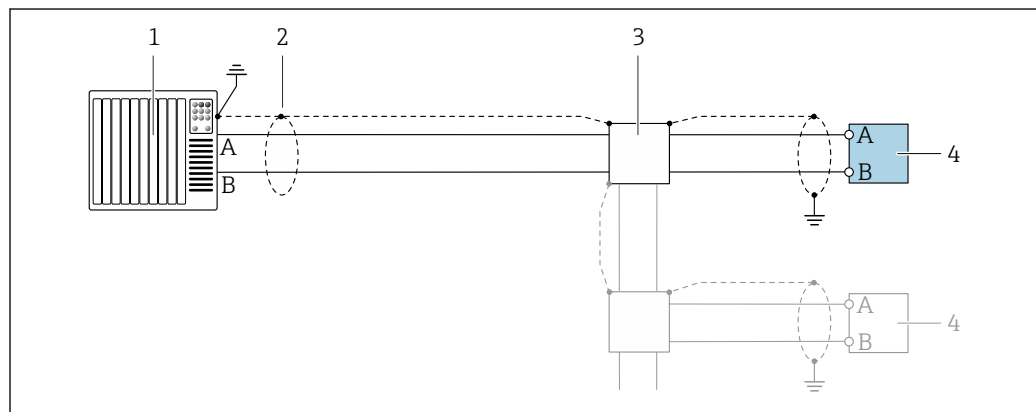


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4 Connection example for HART input with a common negative (passive)

- 1 Automation system with HART output (e.g. PLC)
- 2 Active barrier for power supply (e.g. RN221N)
- 3 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
- 4 Analog display unit: observe maximum load → 17
- 5 Pressure measuring device (e.g. Cerabar M, Cerabar S): see requirements
- 6 Transmitter

## Modbus RS485



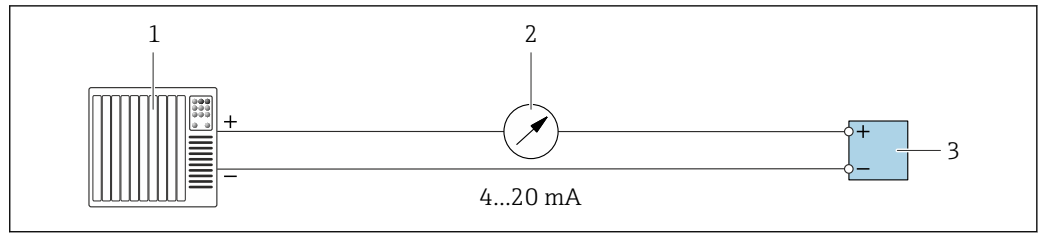
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5 Connection example for Modbus RS485, non-hazardous area and Zone 2; Class I, Division 2

- 1 Control system (e.g. PLC)
- 2 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
- 3 Distribution box
- 4 Transmitter



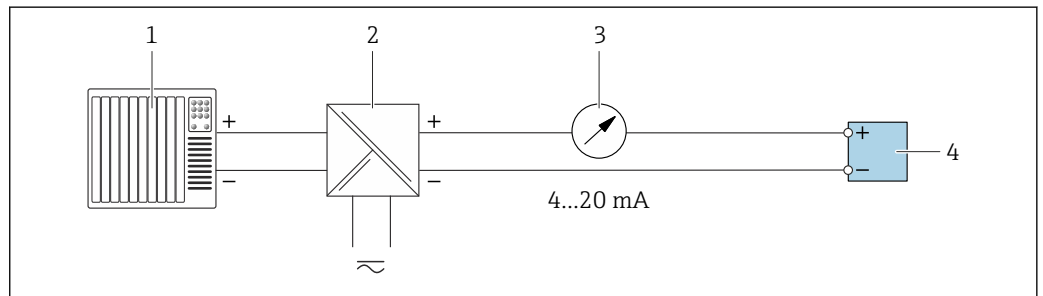
### Current output 4-20 mA



A0028758

6 Connection example for 4-20 mA current output (active)

- 1 Automation system with current input (e.g. PLC)
- 2 Analog display unit: observe maximum load → 17
- 3 Transmitter

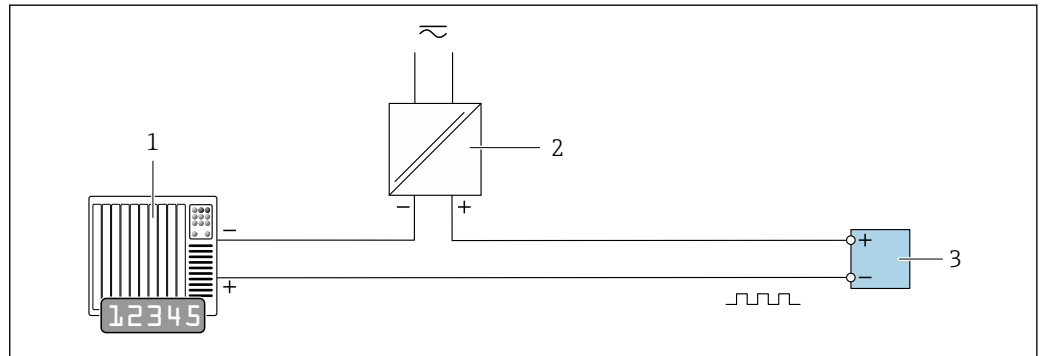


A0028759

7 Connection example for 4-20 mA current output (passive)

- 1 Automation system with current input (e.g. PLC)
- 2 Active barrier for power supply (e.g. RN221N)
- 3 Analog display unit: observe maximum load → 17
- 4 Transmitter

### Pulse/frequency output



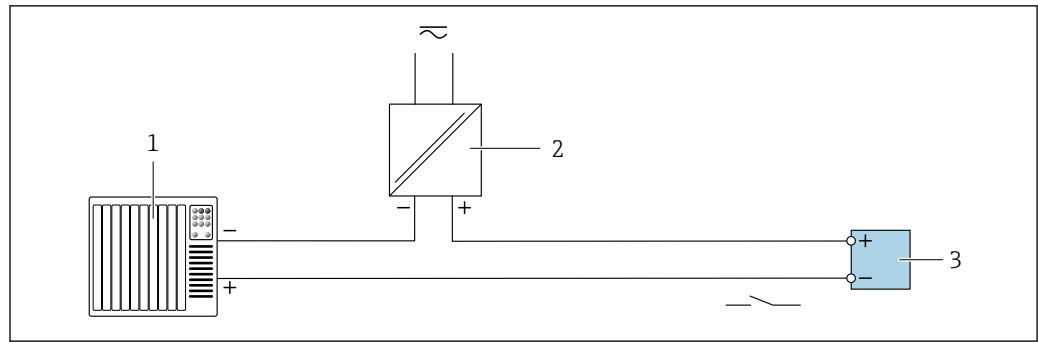
A0028761

8 Connection example for pulse/frequency output (passive)

- 1 Automation system with pulse/frequency input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 19



## Switch output

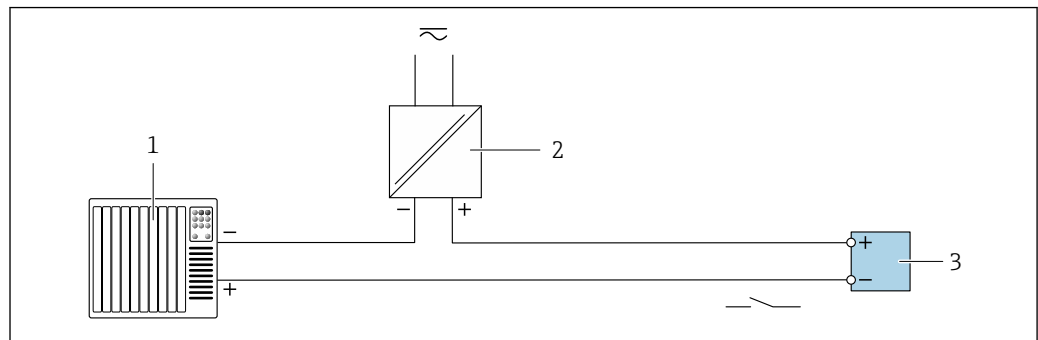


A0028760

9 Connection example for switch output (passive)

- 1 Automation system with switch input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 19

## Relay output

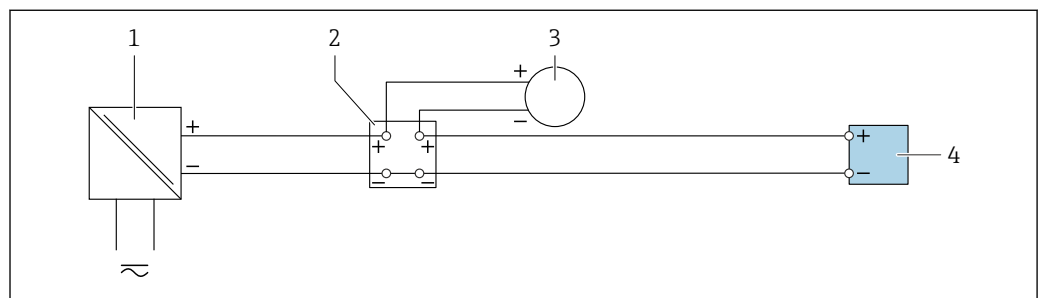


A0028760

10 Connection example for relay output (passive)

- 1 Automation system with relay input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 20

## Current input



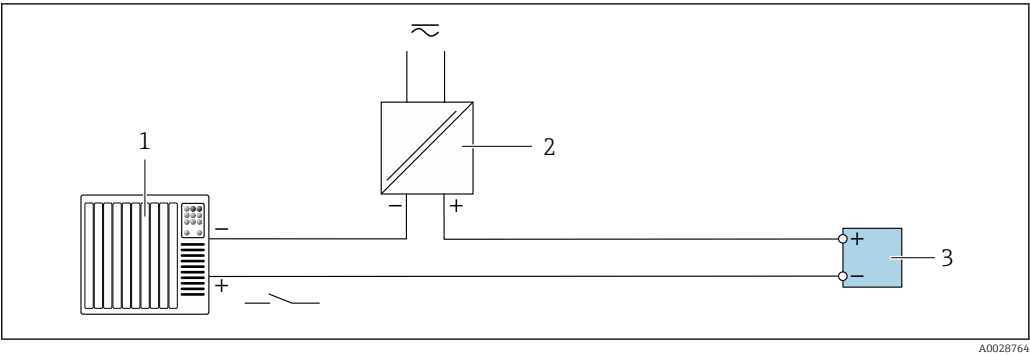
A0028915

11 Connection example for 4 to 20 mA current input

- 1 Power supply
- 2 Terminal box
- 3 External measuring device (to read in pressure or temperature, for instance)
- 4 Transmitter



Status input



12 Connection example for status input

- 1 Automation system with status output (e.g. PLC)
- 2 Power supply
- 3 Transmitter

Potential equalization

Requirements

- For potential equalization:
- Pay attention to in-house grounding concepts
  - Take account of operating conditions like the pipe material and grounding
  - Connect the medium, sensor and transmitter to the same electrical potential
  - Use a ground cable with a minimum cross-section of 6 mm<sup>2</sup> (0.0093 in<sup>2</sup>) for potential matching connections

Terminals

Spring-loaded terminals: Suitable for strands and strands with ferrules.  
Conductor cross-section 0.2 to 2.5 mm<sup>2</sup> (24 to 12 AWG).

Cable entries

- Cable gland: M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - NPT ½"
  - G ½"
  - M20

Pin assignment, device plug

Service interface

Order code for "Accessories mounted", option **NB**: Adapter RJ45 M12 (service interface)

<p>A0032047</p>	Pin			Assignment
	1	+		Tx
	2	+		Rx
	3	-		Tx
	4	-		Rx
	Coding		Plug/socket	
		D	Socket	

- Recommended plug:
- Binder, series 763, part no. 99 3729 810 04
  - Phoenix, part no. 1543223 SACC-M12MSD-4Q

Cable specification

Permitted temperature range

- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.

Power supply cable (incl. conductor for the inner ground terminal)

Standard installation cable is sufficient.



**Signal cable***Current output 4 to 20 mA HART*

A shielded cable is recommended. Observe grounding concept of the plant.

*Modbus RS485*

The EIA/TIA-485 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

<b>Cable type</b>	A
<b>Characteristic impedance</b>	135 to 165 $\Omega$ at a measuring frequency of 3 to 20 MHz
<b>Cable capacitance</b>	< 30 pF/m
<b>Wire cross-section</b>	> 0.34 mm <sup>2</sup> (22 AWG)
<b>Cable type</b>	Twisted pairs
<b>Loop resistance</b>	$\leq 110 \Omega/\text{km}$
<b>Signal damping</b>	Max. 9 dB over the entire length of the cable cross-section
<b>Shield</b>	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

*Current output 0/4 to 20 mA*

Standard installation cable is sufficient.

*Pulse/frequency/switch output*

Standard installation cable is sufficient.

*Relay output*

Standard installation cable is sufficient.

*Current input 0/4 to 20 mA*

Standard installation cable is sufficient.

*Status input*

Standard installation cable is sufficient.

**Connecting cable for transmitter - remote display and operating module DKX001***Standard cable*

A standard cable can be used as the connecting cable.

<b>Standard cable</b>	4 cores (2 pairs); pair-stranded with common shield
<b>Shielding</b>	Tin-plated copper-braid, optical cover $\geq 85\%$
<b>Capacitance: core/shield</b>	Maximum 1 000 nF for Zone 1; Class I, Division 1
<b>L/R</b>	Maximum 24 $\mu\text{H}/\Omega$ for Zone 1; Class I, Division 1
<b>Cable length</b>	Maximum 300 m (1 000 ft), see the following table

<b>Cross-section</b>	<b>Cable length for use in:</b> <ul style="list-style-type: none"> <li>■ Non-hazardous area</li> <li>■ Hazardous area: Zone 2; Class I, Division 2</li> <li>■ Hazardous area: Zone 1; Class I, Division 1</li> </ul>
0.34 mm <sup>2</sup> (22 AWG)	80 m (270 ft)
0.50 mm <sup>2</sup> (20 AWG)	120 m (400 ft)
0.75 mm <sup>2</sup> (18 AWG)	180 m (600 ft)



Cross-section	Cable length for use in: <ul style="list-style-type: none"> <li>■ Non-hazardous area</li> <li>■ Hazardous area: Zone 2; Class I, Division 2</li> <li>■ Hazardous area: Zone 1; Class I, Division 1</li> </ul>
1.00 mm <sup>2</sup> (17 AWG)	240 m (800 ft)
1.50 mm <sup>2</sup> (15 AWG)	300 m (1 000 ft)

*Optionally available connecting cable*

<b>Standard cable</b>	2 × 2 × 0.34 mm <sup>2</sup> (22 AWG) PVC cable <sup>1)</sup> with common shield (2 pairs, pair-stranded)
<b>Flame resistance</b>	According to DIN EN 60332-1-2
<b>Oil-resistance</b>	According to DIN EN 60811-2-1
<b>Shielding</b>	Tin-plated copper-braid, optical cover ≥ 85 %
<b>Capacitance: core/shield</b>	≤200 pF/m
<b>L/R</b>	≤24 μH/Ω
<b>Available cable length</b>	10 m (35 ft)
<b>Operating temperature</b>	When mounted in a fixed position: -50 to +105 °C (-58 to +221 °F); when cable can move freely: -25 to +105 °C (-13 to +221 °F)

- 1) UV radiation can impair the cable outer sheath. Protect the cable from direct sunshine where possible.



## Performance characteristics

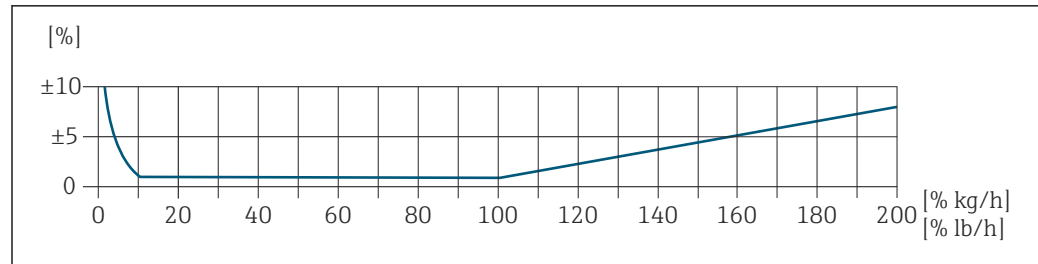
### Reference operating conditions

- Error limits based on ISO 11631
- Dry air with +20 to +30 °C (+68 to +86 °F) at 0.8 to 1.5 bar (12 to 22 psi)
- Specifications as per calibration protocol
- Accuracy based on accredited calibration rigs that are traced to ISO 17025.



To obtain measured errors, use the *Applicator* sizing tool → 79

### Maximum measured error



A0042739

### Calibrated measuring range

The measuring accuracy is specified in relation to the mass flow and divided into two ranges:

- ±1.0 % of the current measured value for 100% to 10% of the calibrated measuring range (under reference operating conditions)
- ±0.10 % of the calibrated full scale value for 10% to 1% of the calibrated measuring range (under reference operating conditions)

The measuring device is calibrated and adjusted on an accredited and traceable calibration rig and its accuracy is certified in a calibration report <sup>1)</sup> (5 control points).

Order code for "Calibration flow":

- Option G "Factory calibration": calibration report (5 control points)
- Option K "Traceable ISO/IEC17025": Swiss Calibration Services (SCS) calibration report (5 control points) which confirms traceability to the national calibration standard



For information on calibrated measuring ranges and maximum full scale values → 11

### Extended measuring range

The device has an extended measuring range that goes beyond the maximum calibrated value (100%). Here, the last measured values in the calibrated range are taken and then extrapolated. The end of the extrapolated range is only reached once the productive energy of the sensor is exceeded and/or the Mach number is greater than listed below.

Mach number	Order code
0.2	<ul style="list-style-type: none"> <li>■ Order code for "Sensor version; sensor; insertion tube:", option SB "Bidirectional; stainless steel; stainless steel"</li> <li>■ Order code for "Sensor version; sensor; insertion tube:", option SC "Reverse flow detection; stainless steel; stainless steel"</li> </ul>
0.4	<ul style="list-style-type: none"> <li>■ Order code for "Sensor version; sensor; insertion tube:", option SA "Unidirectional; stainless steel; stainless steel"</li> <li>■ Order code for "Sensor version; sensor; insertion tube:", option HA "Unidirectional; Alloy; stainless steel"</li> </ul>

The accuracy is specified in relation to the mass flow.

$\pm 1.0\% \pm (\text{current measured value in \%} - 100\%) \times 0.07$  for 100% to 200% of the calibrated measuring range (under reference operating conditions)

1) Two calibration reports for the order code for "Sensor version; sensor; insertion tube:", option SB "Bidirectional; stainless steel; stainless steel"



**Accuracy of outputs**

The outputs have the following base accuracy specifications.

*Current output*

<b>Accuracy</b>	$\pm 5 \mu\text{A}$
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*Pulse/frequency output*

o.r. = of reading

<b>Accuracy</b>	Max. $\pm 50$ ppm o.r. (over the entire ambient temperature range)
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<b>Repeatability</b>	$\pm 0.25$ % of the display value for velocities above 1.0 m/s (3.3 ft/s)
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<b>Response time</b>	Typically < 3 s for 63 % of a step change (in both directions)
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**Influence of ambient temperature****Current output**

<b>Temperature coefficient</b>	Max. $1 \mu\text{A}/^{\circ}\text{C}$
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**Pulse/frequency output**

<b>Temperature coefficient</b>	No additional effect. Included in accuracy.
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**Influence of medium temperature**

Air: 0.02 % per  $^{\circ}\text{C}$  (0.036 % per  $^{\circ}\text{F}$ ) of the process temperature change in relation to the reference temperature

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**Influence of medium pressure**

Air: 0.3 % per bar (0.02 % per psi) of the process pressure change (from the set process pressure)

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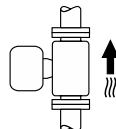
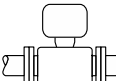
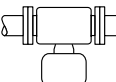
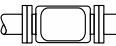
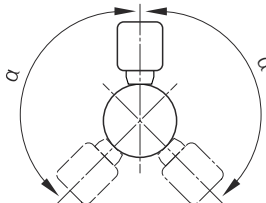
## Installation

As a prerequisite for correct flow measurement, thermal measuring devices require a fully developed flow profile. For this reason, please pay attention to the following points and document sections when installing the device:

- Avoid flow disturbances, as the thermal measuring principle reacts sensitively to them.
- Give priority to dry gases.
- Take measures to avoid or remove condensation (e.g. condensation trap, thermal insulation etc.).

### Orientation

The direction of flow must match the direction of the arrow on the sensor. In the case of the bidirectional sensor, the arrow points in the positive direction. When performing bidirectional measurement, the sensing element must be installed with an accuracy of 3°.

Orientation		Recommendation
Vertical orientation	 A0015591	✓ <sup>1)</sup>
Horizontal orientation, transmitter head up	 A0015589	✓✓
Horizontal orientation, transmitter head down	 A0015590	✓ <sup>2)</sup>
Horizontal orientation, transmitter head at side	 A0015592	✓
Inclined orientation, transmitter head down	 A0015773	✓ <sup>2)</sup>

- 1) In the case of saturated or impure gases, vertical orientation is preferred in order to minimize condensation or contamination. For bidirectional sensors, select horizontal orientation.
- 2) Select inclined orientation ( $\alpha = \text{approx. } 135^\circ$ ) for very wet or water-saturated gas (e.g. digester gas, undried compressed air), or if deposits or condensate are constantly present.

### Installation instructions

For mechanical reasons and to protect the pipe, support is recommended for heavy sensors (e.g. when installing a hot tap).

### Pipes

**The measuring device must be professionally installed, and the following points must be observed:**

- Weld pipes professionally.
- Use seals of the correct size.
- Align flanges and seals correctly.
- Remove protection cap from sensing element.
- Following installation, the pipe must be free from dirt and particles in order to avoid damage to the sensors.
- For further information → ISO standard 14511.

### Insertion depth

The minimum length of the insertion version can be determined using the Endress+Hauser Applicator program or with the calculation formula below. The calculated necessary insertion depth must be within the adjusting range of the selected insertion version.

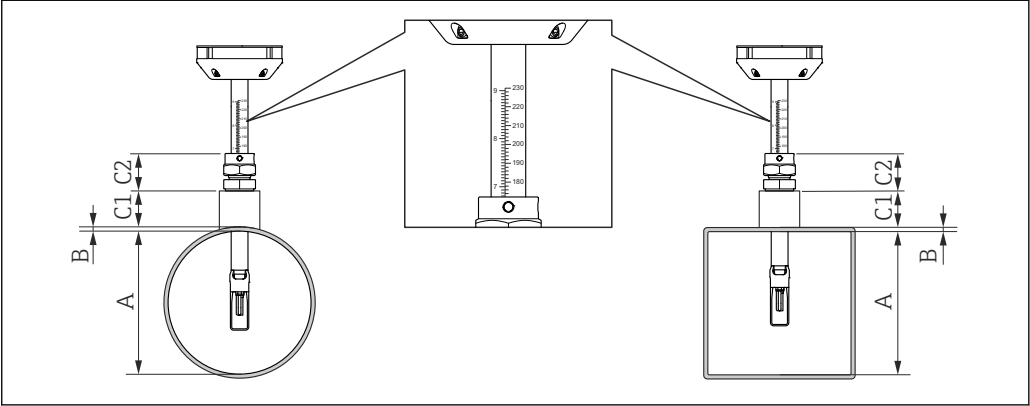


**NOTICE**

**Metal ferrules undergo plastic deformation during the initial installation.**

As a result the insertion depth is fixed after initial installation and the ferrules can no longer be replaced.

- Pay attention to information on preconditions and on determining the insertion depth.
- Check the insertion depth closely before tightening the ferrules.



A0039548

13 Determine the dimensions A, B, C1 and C2

A In the case of a circular pipe: the pipe internal diameter (DN); in the case of a duct: the inner dimension

B Thickness of pipe wall or of duct wall

C1 Mounting kit

C2 Sensor's compression fitting

**Calculating the insertion depth**

$$\text{Insertion depth} = (0.3 \cdot A) + B + (C1 + C2)$$



The insertion depth must be at least 100mm.

**Determining dimensions C1 and C2**

*If only Endress+Hauser mounting bosses are used*

Mounting boss 1" NPT	C1 + C2 = 112 mm (4.409 in)
Mounting boss G1"	C1 + C2 = 106 mm (4.173 in)
Mounting boss ¾" NPT	C1 + C2 = 108 mm (4.252 in)
Mounting boss G¾"	C1 + C2 = 105 mm (4.134 in)



If a cold/hot tap is used, use dimension "L" → 51 instead of "C1".



Use Applicator to determine dimensions C1 and C2 if using other E+H mounting kits (e.g. cold/hot taps).

*If not exclusively using Endress+Hauser mounting bosses*

C1	Length of pipe connection used
C2 (compression fitting with 1" NPT thread)	52 mm (2.047 in)
C2 (compression fitting with G1" thread)	46 mm (1.811 in)
C2 (compression fitting with ¾" NPT thread)	48 mm (1.889 in)
C2 (compression fitting with G¾" thread)	45 mm (1.772 in)



### Selecting the length of the insertion version

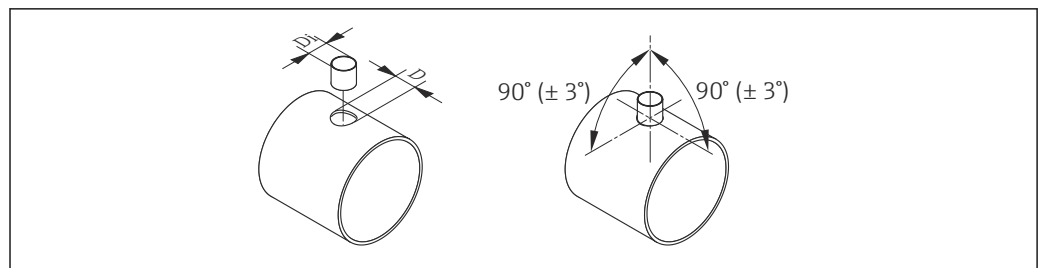
Select the length of the insertion version using the calculated insertion depth and the following table. The insertion depth must be within the adjusting range of the insertion version.

Length of insertion tube		Adjusting range (insertion depth)	
[mm]	[in]	[mm]	[in]
235	9	100 to 235	3.9 to 9.3
335	13	100 to 335	3.9 to 13.2
435	17	100 to 435	3.9 to 17.1
608	24	100 to 608	3.9 to 23.9

### Installation conditions for nipples



Suitable support brackets must be used if installing in rectangular air ducts (or pipes with thin walls).



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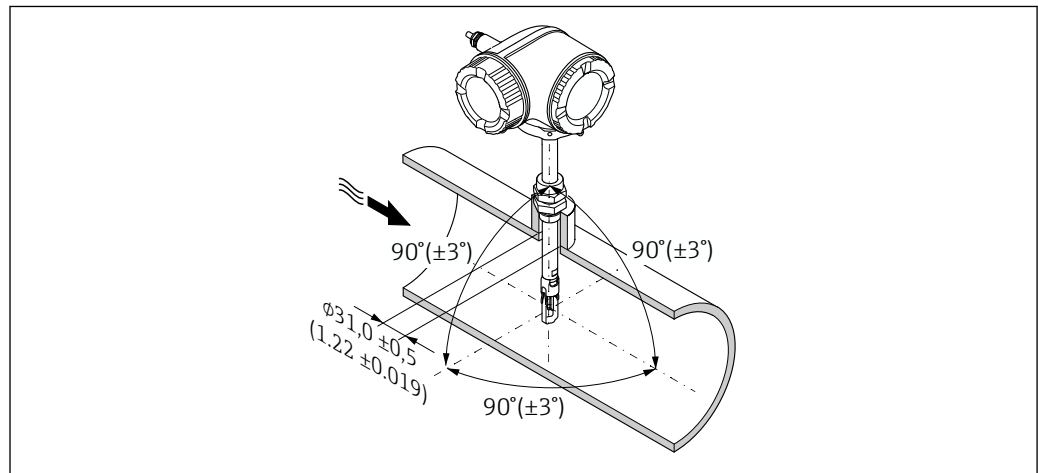
$D \quad \varnothing 31.0 \pm 0.5 \text{ mm } (1.22 \pm 0.019 \text{ in})$

$D_i \quad \varnothing 23.0 \pm 0.5 \text{ mm } (0.91 \pm 0.019 \text{ in})$

### Aligning to the flow direction

The following criteria must be met for optimum flow measurement:

- The sensor is aligned at a  $90^\circ$  angle to the flow direction.
- The arrow engraved on the sensor shaft matches the positive flow direction.
- The scale on the sensor shaft is aligned with the pipe axis.



A0039511

14 Engineering unit: mm (in)

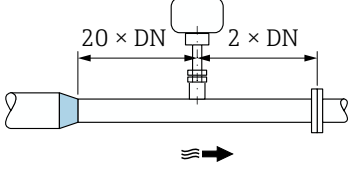
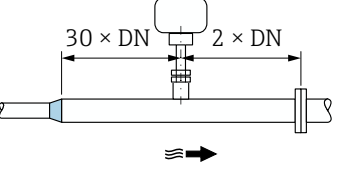
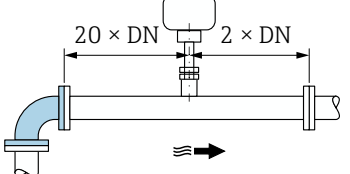
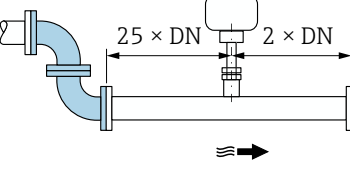
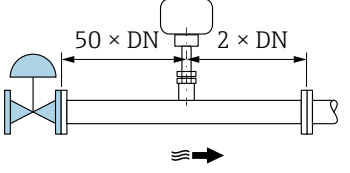
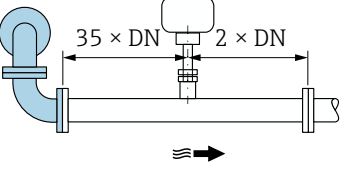
### Inlet and outlet runs

A fully developed flow profile is a requirement for optimal thermal flow measurement.

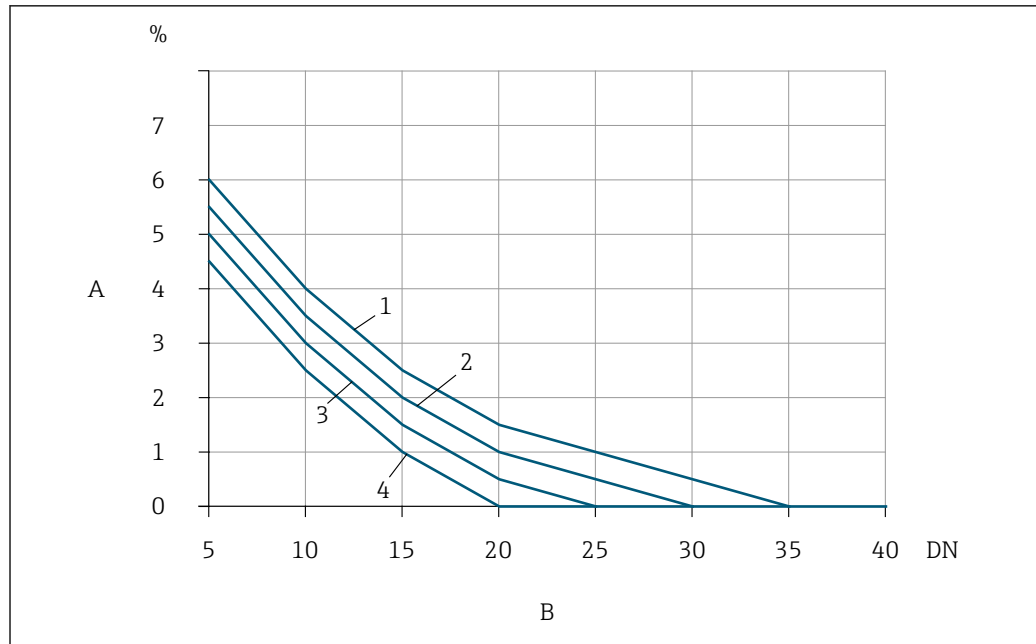
To achieve the best possible measuring performance, observe the following inlet and outlet runs at the very minimum.



- In the case of bidirectional sensors, also observe the recommended inlet run in the opposite direction.
- If several flow disturbances are present, use flow conditioners.
- Use flow conditioners if it is not possible to observe the required inlet runs.
- In the case of control valves, the amount of disturbance depends on the valve type and opening degree. The recommended inlet run for control valves is  $50 \times \text{DN}$ .
- In the case of very light gases (helium, hydrogen), the recommended inlet run must be doubled.

 <p><b>15</b> Reduction</p> <p>A0040193</p>	 <p><b>16</b> Expansion</p> <p>A0040192</p>
 <p><b>17</b> 90° elbow</p> <p>A0039440</p>	 <p><b>18</b> 2 x 90° elbow</p> <p>A0039441</p>
 <p><b>19</b> Control valve</p> <p>A0039445</p>	 <p><b>20</b> 2 x 90° elbow, 3-dimensional</p> <p>A0039442</p>





A0045846

21 The additional measured error to be expected without flow conditioners depending on the disturbance type and inlet run

- A Additional measured error (%)  
 B Inlet run (DN)  
 1 2 × 90° elbow, 3-dimensional  
 2 Expansion  
 3 2 × 90° elbow  
 4 Reduction or 90° elbow

### Flow conditioner

Use flow conditioners if it is not possible to observe the required inlet runs. Flow conditioners improve the flow profile and therefore reduce the necessary inlet runs.

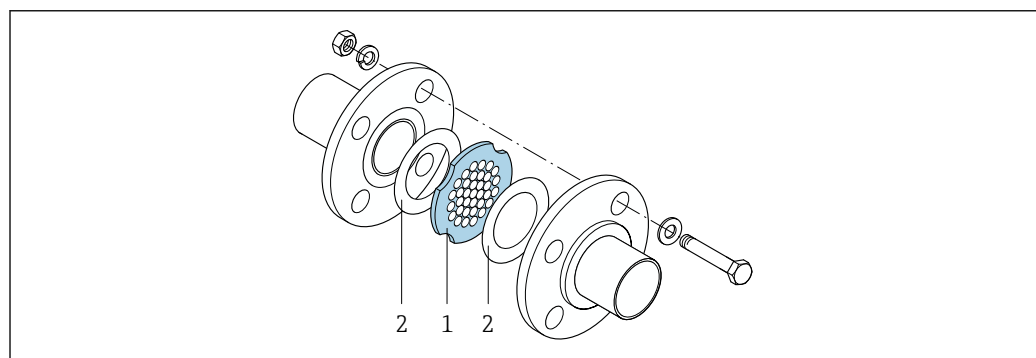
Mount the flow conditioner in flow direction in front of the measuring device.

Available in the following flange standards:

- ASME B16.5 Cl. 150/Cl. 300
- EN 1092-1 PN10/PN16/PN25/PN40
- JIS B2220 10K/20K

Available in the following line sizes:

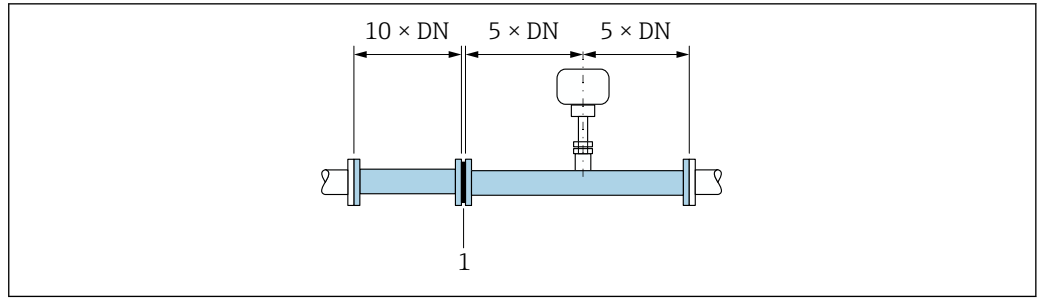
- DN 80 (3")
- DN 100 (4")
- DN 150 (6")
- DN 200 (8")
- DN 250 (10")
- DN 300 (12")



A0039538

- 1 Flow conditioner  
 2 Seal



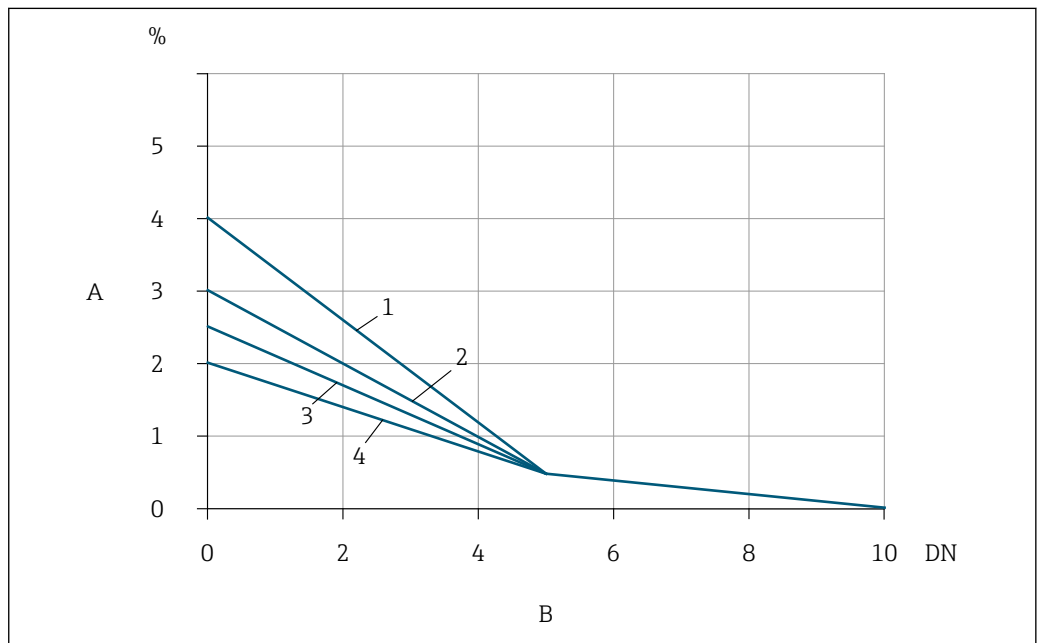


A0039424

22 Recommended inlet and outlet runs when using a flow conditioner

1 Flow conditioner

**i** In the case of bidirectional sensors, also observe the inlet run in the opposite direction.



A0039508

23 The additional measured error to be expected with flow conditioners depending on the disturbance type and inlet run

- A Additional measured error (%)  
 B Inlet runs upstream of the flow conditioner (DN)  
 1  $2 \times 90^\circ$  elbow, 3-dimensional  
 2 Expansion  
 3  $2 \times 90^\circ$  elbow  
 4 Reduction or  $90^\circ$  elbow

The pressure loss for flow conditioners is calculated as follows:  $\Delta p \text{ [mbar]} = 0.0085 \cdot \rho \text{ [kg/m}^3] \cdot v^2 \text{ [m/s]}$

Example of air

$p = 10 \text{ bar abs.}$

$t = 25^\circ\text{C} \rightarrow \rho = 11.71 \text{ kg/m}^3$

$v = 10 \text{ m/s}$

$\Delta p = 0.0085 \cdot 11.71 \cdot 10^2 = 9.95 \text{ mbar}$

$\rho$  : density of the process medium

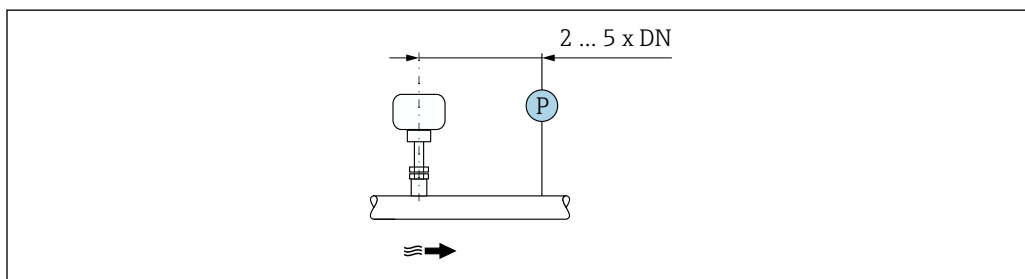
$v$ : average flow velocity

abs. = absolute



**Outlet runs with pressure measuring points**

Install the pressure measuring point downstream of the measuring system. This prevents the pressure transmitter from potentially affecting the flow in the measuring point.



A0039447

24 Installation of a pressure measuring point (P = pressure transmitter)



## Environment

<b>Ambient temperature range</b>	<b>Measuring device</b>	<ul style="list-style-type: none"> <li>■ -40 to +60 °C (-40 to +140 °F)</li> <li>■ Order code for "Test, certificate", option JP: -50 to +60 °C (-58 to +140 °F)</li> </ul>
	<b>Readability of the local display</b>	-20 to +60 °C (-4 to +140 °F) The readability of the display may be impaired at temperatures outside the temperature range.

### NOTICE


#### Danger of overheating

- ▶ Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 °C (176 °F).
- ▶ Ensure that sufficient convection takes place at the transmitter neck.
- ▶ When using in potentially explosive atmospheres, observe the information in the device-specific Ex documentation. For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.
- ▶ Ensure that a sufficiently large area of the transmitter neck remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.
- ▶ If operating outdoors:  
Avoid direct sunlight, particularly in warm climatic regions.

 You can order a weather protection cover from Endress+Hauser →  77.

<b>Storage temperature</b>	-50 to +80 °C (-58 to +176 °F), preferably at +20 °C (+68 °F)
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<b>Atmosphere</b>	If a plastic transmitter housing is permanently exposed to certain steam and air mixtures, this can damage the housing.
-------------------	---

 In cases of doubt, please contact the Sales Center.

<b>Degree of protection</b>	<b>Measuring device</b>
	<ul style="list-style-type: none"> <li>■ As standard: IP66/67, type 4X enclosure</li> <li>■ When housing is open: IP20, type 1 enclosure</li> <li>■ Display module: IP20, type 1 enclosure</li> </ul> <b>External WLAN antenna</b> IP67

<b>Vibration- and shock-resistance</b>	<b>Vibration sinusoidal, in accordance with IEC 60068-2-6</b>
	<ul style="list-style-type: none"> <li>■ 2 to 8.4 Hz, 3.5 mm peak</li> <li>■ 8.4 to 2 000 Hz, 1 g peak</li> </ul>
	<b>Vibration broad-band random, according to IEC 60068-2-64</b>
	<ul style="list-style-type: none"> <li>■ 10 to 200 Hz, 0.003 g<sup>2</sup>/Hz</li> <li>■ 200 to 2 000 Hz, 0.001 g<sup>2</sup>/Hz</li> <li>■ Total: 1.54 g rms</li> </ul>
	<b>Shock half-sine, according to IEC 60068-2-27</b>
	6 ms 30 g
	<b>Rough handling shocks according to IEC 60068-2-31</b>

<b>Interior cleaning</b>	Suitable for cleaning-in-place (CIP) and sterilization-in-place (SIP).
--------------------------	--



**Manufacturer options for delivery of parts**

- Oil- and grease-free wetted parts, no declaration. Order code for "Service", option HA.
- Oil- and grease-free wetted parts as per IEC/TR 60877-2.0 and BOC 50000810-4, with declaration. Order code for "Service", option HB. The plant operator must ensure that the measuring device meets the requirements of the operator's oxygen application.

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**Electromagnetic compatibility (EMC)**




As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)



Details are provided in the Declaration of Conformity.

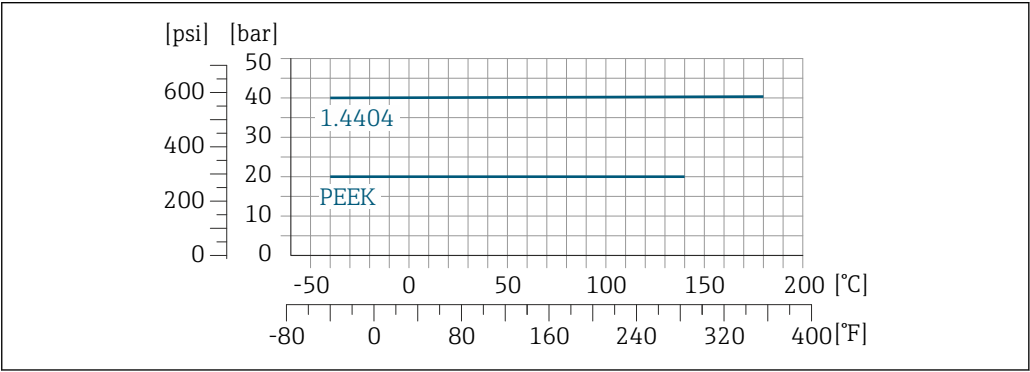


## Process

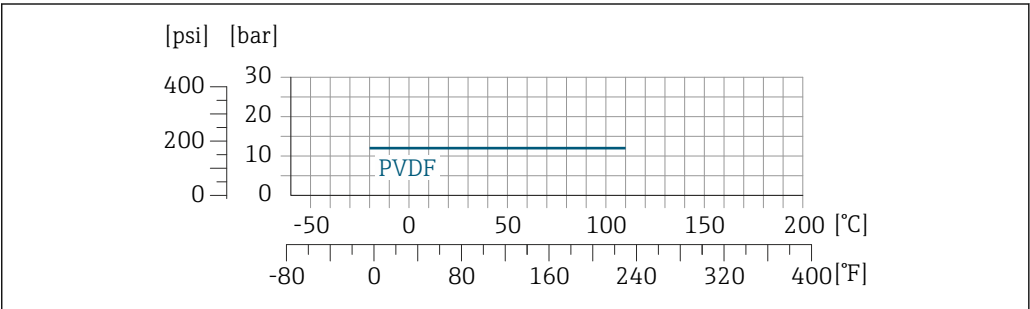
Medium temperature range	<div>Sensor -40 to +180 °C (-40 to +356 °F)</div> <div>Seals</div> <div><div>■ Sealing rings:</div><div><div>■ EPDM -40 to +140 °C (-40 to +284 °F)</div><div>■ FKM -40 to +180 °C (-40 to +356 °F)</div></div><div>■ Ferrule:</div><div><div>■ PEEK -40 to +140 °C (-40 to +284 °F)</div><div>■ PVDF -20 to +110 °C (-4 to +230 °F)</div><div>■ 1.4404 -40 to +180 °C (-40 to +356 °F)</div></div></div> <div><div> Ferrule in 1.4404: ferrule has a fixed position on the shaft. Restriction for repeat calibrations (observe minimum insertion depth →  36)</div></div>
Medium pressure range	Minimum 0.5 bar absolute. Maximum permitted medium pressure →  45

Pressure/temperature ratings	The following pressure/temperature diagrams apply to all pressure-bearing parts of the device and not just the process connection. The diagrams show the maximum permissible medium pressure depending on the specific medium temperature.
------------------------------	--

### Ferrule



 25 With compression fitting material 1.4404/F316L/F316



 26 With compression fitting material 1.4404/F316L/F316

Flow limit	<div> Measuring range →  11</div>
------------	---



The maximum flow depends on the gas type and the pipe nominal diameter used. The end of the measuring range is reached when the Mach number listed below is reached.

Mach number	Order code
0.2	<ul style="list-style-type: none"> <li>Order code for "Sensor version; sensor; insertion tube.", option SB "Bidirectional; stainless steel; stainless steel"</li> <li>Order code for "Sensor version; sensor; insertion tube.", option SC "Reverse flow detection; stainless steel; stainless steel"</li> </ul>
0.4	<ul style="list-style-type: none"> <li>Order code for "Sensor version; sensor; insertion tube.", option SA "Unidirectional; stainless steel; stainless steel"</li> <li>Order code for "Sensor version; sensor; insertion tube.", option HA "Unidirectional; Alloy; stainless steel"</li> </ul>



Use the Applicator to size the device.

## Pressure loss



Use the Applicator for precise calculations.

## Thermal insulation

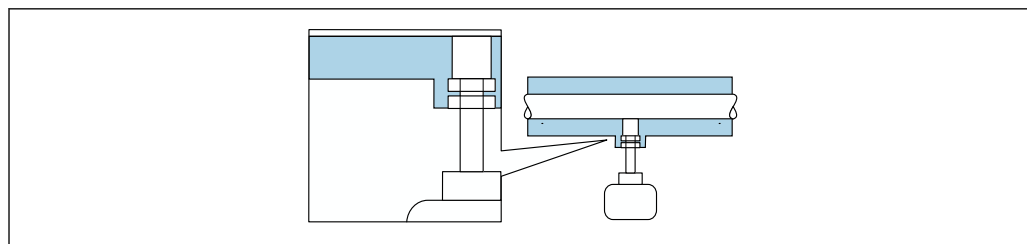
In the case of some fluids, it is important to keep the heat radiated from the sensor to the transmitter to a low level. A wide range of materials can be used for the required insulation.

If the gas is very wet or saturated with water (e.g. digester gas), the pipe and the sensor housing should be insulated, and heated where necessary, to prevent water droplets condensing on the sensing element.

### NOTICE

#### Electronics overheating on account of thermal insulation!

- Recommended orientation: horizontal orientation, transmitter housing pointing downwards.
- Do not insulate the transmitter housing .
- Maximum permissible temperature at the lower end of the transmitter housing: 80 °C (176 °F)
- Thermal insulation with not isolated extended neck: We recommend that you do not insulate the extended neck in order to ensure optimum dissipation of heat.



A0039420

27 Thermal insulation with not isolated extended neck

## Heating

Some fluids require suitable measures to avoid loss of heat at the sensor.

### Heating options

- Electrical heating, e.g. with electric band heaters
- Via pipes carrying hot water or steam

### NOTICE

#### Electronics overheating on account of thermal insulation!

- Recommended orientation: horizontal orientation, transmitter housing pointing downwards.
- Do not insulate the transmitter housing .
- Maximum permissible temperature at the lower end of the transmitter housing: 80 °C (176 °F)
- Thermal insulation with extended neck free: We recommend that you do not insulate the extended neck in order to ensure optimum dissipation of heat.



**NOTICE****Danger of overheating when heating**

- ▶ Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 °C (176 °F).
- ▶ Ensure that sufficient convection takes place at the transmitter neck.
- ▶ When using in potentially explosive atmospheres, observe the information in the device-specific Ex documentation. For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.
- ▶ Ensure that a sufficiently large area of the transmitter neck remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

---

**Hot tap, process pressure**

Only use the hot tap for mounting and removal at process pressure for non-toxic, innocuous gases.

Medium pressure version

- Max. process pressure: 20 bar (290 psi)
- Max. extraction pressure: 16 bar (230 psi)
- Max. extraction temperature: +50 °C (+122 °F)
- Min. insertion sensor length: 435mm (17")

Low pressure version

- Max. process pressure: 20 bar (290 psi)
- Max. extraction pressure: 4.5 bar (65 psi)
- Max. extraction temperature: +50 °C (+122 °F)
- Min. insertion sensor length: 335mm (13")

---

**Cold tap, ambient pressure**

Cold tap for mounting and removal at ambient pressure.

- Max. process pressure: 20 bar (290 psi)
- Max. extraction pressure: 1 bar (14.5 psi)
- Max. extraction temperature: +50 °C (+122 °F)
- Min. insertion sensor length: 335mm (13")

---

**Mounting boss**

To mount the device directly on the process pipe.

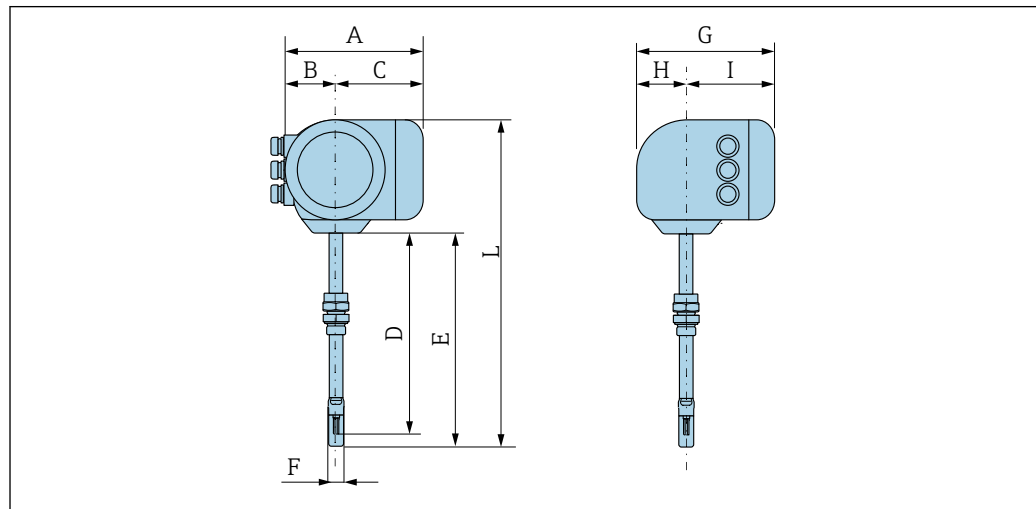
Max. process pressure: 40 bar (580 psi)



## Mechanical construction

Dimensions in SI units

Compact version



A0041075

Order code for "Housing", option A "Aluminum, coated"

A <sup>1)</sup> [mm]	B <sup>1)</sup> [mm]	C [mm]	G <sup>2)</sup> [mm]	H [mm]	I <sup>2)</sup> [mm]
169	68	101	200	59	141

- 1) Depending on the cable gland used: values up to + 30 mm  
 2) For version without local display: values – 30 mm

Order code for "Housing", option A "Aluminum, coated"; Ex d or XP

A <sup>1)</sup> [mm]	B [mm]	C [mm]	G <sup>2)</sup> [mm]	H [mm]	I [mm]
188	85	103	217	58	148

- 1) Depending on the cable gland used: values up to + 30 mm  
 2) For version without local display: values – 49 mm

Sensor with order code for "Housing", option A "Aluminum, coated"

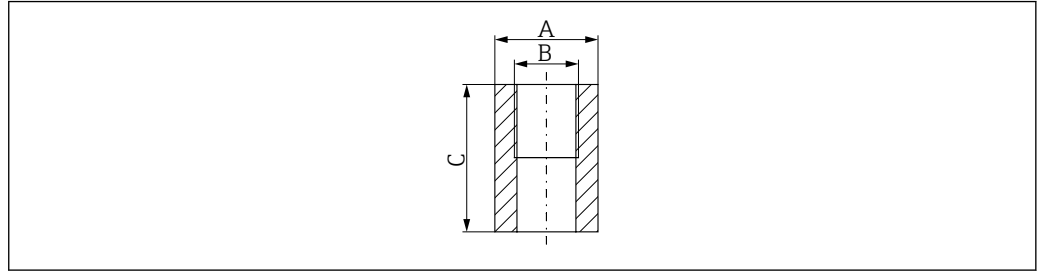
Installed length [mm]	D [mm]	E [mm]	F [mm]	L <sup>1)</sup> [mm]
235	281	298	22.4	483
335	381	398	22.4	583
435	481	498	22.4	683
608	652	669	22.4	854

- 1) For Ex d or XP versions: values + 4 mm



## Accessories

### Welding socket



A0041333

A 45 mm

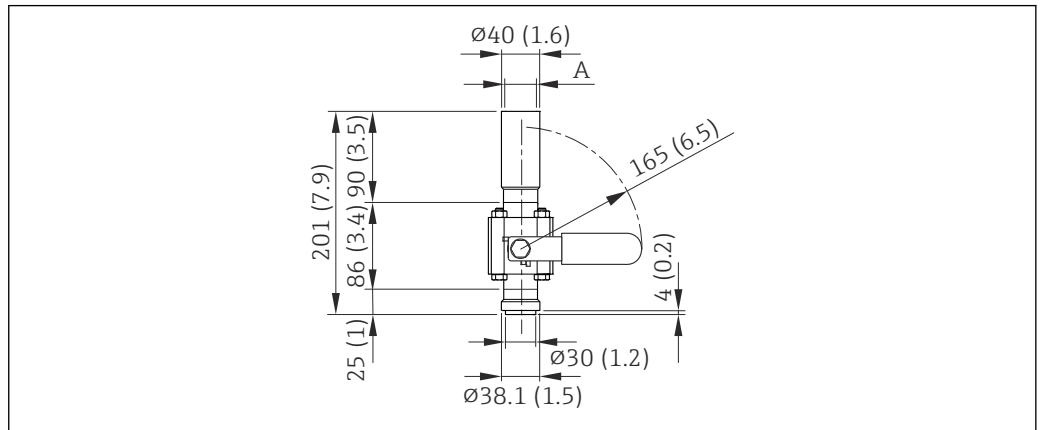
B Order code for "Accessory enclosed", option "Welding socket"

C 60 mm

Order code for "Accessory enclosed":

- Option PC "Welding socket G 1"
- Option PD "Welding socket 1" NPT"
- Option PE "Welding socket G 3/4"
- Option PF "Welding socket 3/4" NPT"

### Cold tap, ambient pressure



A0042224

28 Dimensions: mm (in)

A Order code for "Accessory enclosed", option "Welding socket"

Order code for "Accessory enclosed":

- Option PR "Cold tap G 1", ambient pressure"
- Option PS "Cold tap 1" NPT, ambient pressure"
- Option PT "Cold tap G 3/4", ambient pressure"
- Option PU "Cold tap 3/4" NPT, ambient pressure"



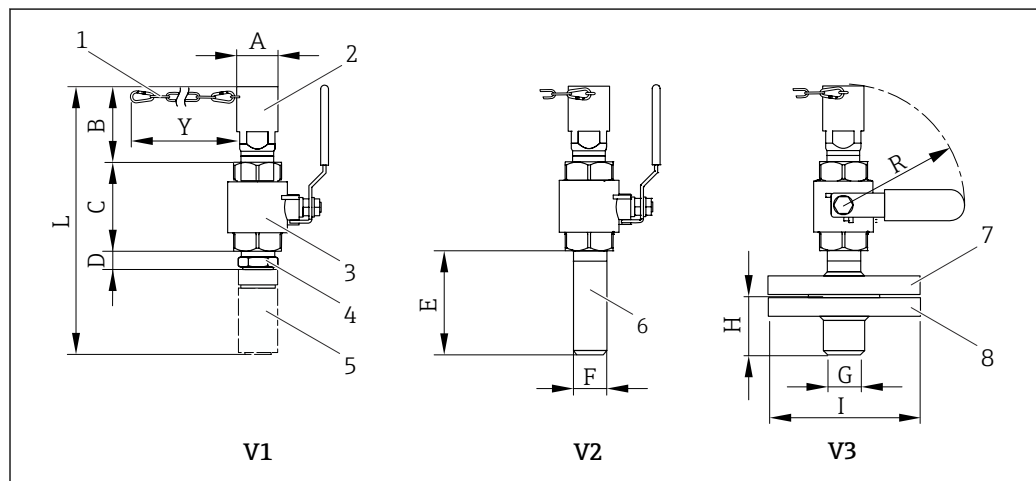
*Hot tap, process pressure**Low-pressure version*

Available for order as:

- Order code for "Accessory enclosed"
    - Option PG "Hot tap G 1", low pressure = 4.5 bar/65 psig"
    - Option PH "Hot tap 1" NPT, low pressure = 4.5 bar/65 psig"
    - Option PK "Hot tap G 3/4", low pressure = 4.5 bar/65 psig"
    - Option PL "Hot tap 3/4" NPT, low pressure = 4.5 bar/65 psig"
    - The low-pressure version as "Accessory enclosed" comprises: V2 → 29, 50
  - Can be ordered separately as an "Accessory": DK6003 → 78
- Versions V1, V2 and V3 can be ordered via DK6003



- Can only be used with the following installed lengths:
  - Order code for "Installed length", option L2 "335mm (13)"
  - Order code for "Installed length", option L3 "435mm (17)"
  - Order code for "Installed length", option L4 "608mm (24)"
- Cannot be used with 1.4404 clamping ring. Maximum temperature is limited (140°C for PEEK and 110°C for PVDF)



29 Versions available for order

- 1 Safety chain for low-pressure version  
 2 Sensor connection  
 3 Ball valve  
 4 Retrofit adapter (for subsequent installation with existing welding socket (DK6MB))  
 5 Welding socket (DK6MB) only G1" / 1" NPT  
 6 Process connection welding socket  
 7 Flange adapter  
 8 Process connection flange  
 V1 Version with retrofit adapter  
 V2 Version with welding socket  
 V3 Version with flange








A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	L [mm]	R [mm]	Y <sup>1)</sup> [mm]
42.4	~85	88	~60	123	33.4	33.4	54	123.9	~252.5	165	620

1) Safety chain (for  $p \leq 4.5$  bar) only in conjunction with low-pressure version

Weight [kg]		
V1	V2	V3
2.8	2.4	4.9



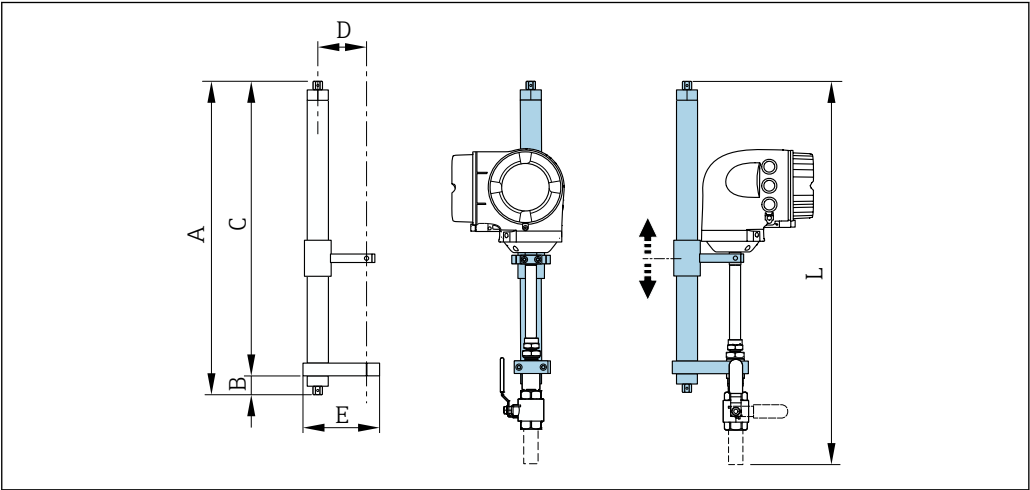
Medium-pressure version


- i** Available for order as:
- Order code for "Accessory enclosed"
    - Option PI "Hot tap G 1", medium pressure = 16 bar/230 psig
    - Option PJ "Hot tap 1" NPT, medium pressure = 16 bar/230 psig
    - Option PM "Hot tap G ¾", medium pressure = 16 bar/230 psig
    - Option PN "Hot tap ¾" NPT, medium pressure = 16 bar/230 psig
    - The medium-pressure version comprises: V2 →  29,  50 and extractor assembly →  30,  51
  - Can be ordered separately as an "Accessory": DK6003 →  78
  - Versions V1, V2 and V3 →  29,  50 can be ordered via DK6003

- i**
- Can only be used with the following installed lengths:
    - Order code for "Installed length", option L3 "435mm (17")"
    - Order code for "Installed length", option L4 "608mm (24")"
  - Cannot be used with 1.4404 clamping ring. Maximum temperature is limited (140°C for PEEK and 110°C for PVDF)

Extractor assembly for medium-pressure version

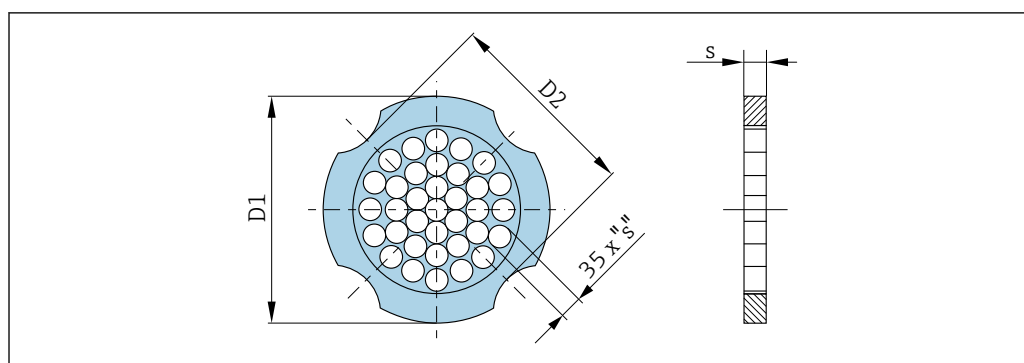
- i** Order code for "Accessory enclosed":
- Option PI "Hot tap G 1", medium pressure maximum 16 bar/230 psig"
  - Option PJ "Hot tap 1" NPT, medium pressure maximum 16 bar/230 psig"
  - Option PM "Hot tap G ¾", medium pressure maximum 16 bar/230 psig"
  - Option PN "Hot tap ¾" NPT, medium pressure maximum 16 bar/230 psig"



 30 Extractor assembly

L [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	Weight [kg]
930	740	40	700	120	180	8.4



*Flow conditioner*

A0033504

Used in combination with flanges according to DIN EN 1092-1: PN 10

1.4404 (316, 316L)

Can be ordered separately as an "Accessory": DK6004

DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
80	145.3	D2	10.1
100	165.3	D2	13.3
150	221.0	D2	20.0
200	274.0	D1	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.

2) The flow conditioner is fitted at the indentations between the bolts.

Used in combination with flanges according to DIN EN 1092-1: PN 16

1.4404 (316, 316L)

Can be ordered separately as an "Accessory": DK6004

DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
80	145.3	D2	10.1
100	165.3	D2	13.3
150	221.0	D2	20.0
200	274.0	D2	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.

2) The flow conditioner is fitted at the indentations between the bolts.

Used in combination with flanges according to DIN EN 1092-1: PN 25

1.4404 (316, 316L)

Can be ordered separately as an "Accessory": DK6004

DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
80	145.3	D2	10.1
100	171.3	D1	13.3
150	227.0	D2	20.0



Used in combination with flanges according to DIN EN 1092-1: PN 25

1.4404 (316, 316L)

Can be ordered separately as an "Accessory": DK6004

DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
200	280.0	D1	26.3
250	340.0	D1	33.0
300	404.0	D1	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.

2) The flow conditioner is fitted at the indentations between the bolts.

Used in combination with flanges according to DIN EN 1092-1: PN 40

1.4404 (316, 316L)

Can be ordered separately as an "Accessory": DK6004

DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
80	145.3	D2	10.1
100	171.3	D1	13.3
150	227.0	D2	20.0
200	294.0	D2	26.3
250	355.0	D2	33.0
300	420.0	D1	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.

2) The flow conditioner is fitted at the indentations between the bolts.

Used in combination with flanges according to ASME B16.5: Class 150

1.4404 (316, 316L)

Can be ordered separately as an "Accessory": DK6004

DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
80	138.4	D1	10.1
100	176.5	D2	13.3
150	223.5	D1	20.0
200	274.0	D2	26.3
250	340.0	D1	33.0
300	404.0	D1	39.6

1) The flow conditioner is fitted at the outer diameter between the bolts.

2) The flow conditioner is fitted at the indentations between the bolts.

Used in combination with flanges according to ASME B16.5: Class 300

1.4404 (316, 316L)

Can be ordered separately as an "Accessory": DK6004

DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
80	151.3	D1	10.1
100	182.6	D1	13.3
150	252.0	D1	20.0
200	309.0	D1	26.3



Used in combination with flanges according to ASME B16.5: Class 300 1.4404 (316, 316L) Can be ordered separately as an "Accessory": DK6004			
DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
250	363.0	D1	33.0
300	402.0	D1	39.6

- 1) The flow conditioner is fitted at the outer diameter between the bolts.  
2) The flow conditioner is fitted at the indentations between the bolts.

Used in combination with flanges according to JIS B2220: 10K 1.4404 (316, 316L) Can be ordered separately as an "Accessory": DK6004			
DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
80	136.3	D2	10.1
100	161.3	D2	13.3
150	221.0	D2	20.0
200	271.0	D2	26.3
250	330.0	D2	33.0
300	380.0	D2	39.6

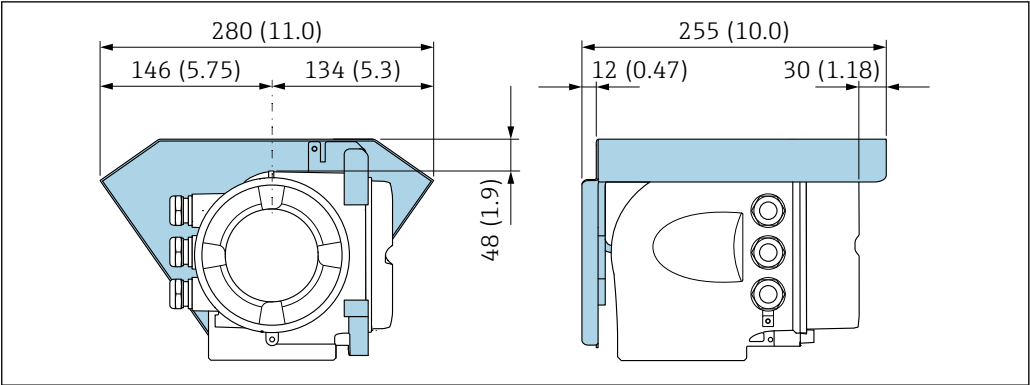
- 1) The flow conditioner is fitted at the outer diameter between the bolts.  
2) The flow conditioner is fitted at the indentations between the bolts.

Used in combination with flanges according to JIS B2220: 20K 1.4404 (316, 316L) Can be ordered separately as an "Accessory": DK6004			
DN [mm]	Centering diameter [mm]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [mm]
80	142.3	D1	10.1
100	167.3	D1	13.3
150	240.0	D1	20.0
200	284.0	D1	26.3
250	355.0	D2	33.0
300	404.0	D1	39.6

- 1) The flow conditioner is fitted at the outer diameter between the bolts.  
2) The flow conditioner is fitted at the indentations between the bolts.



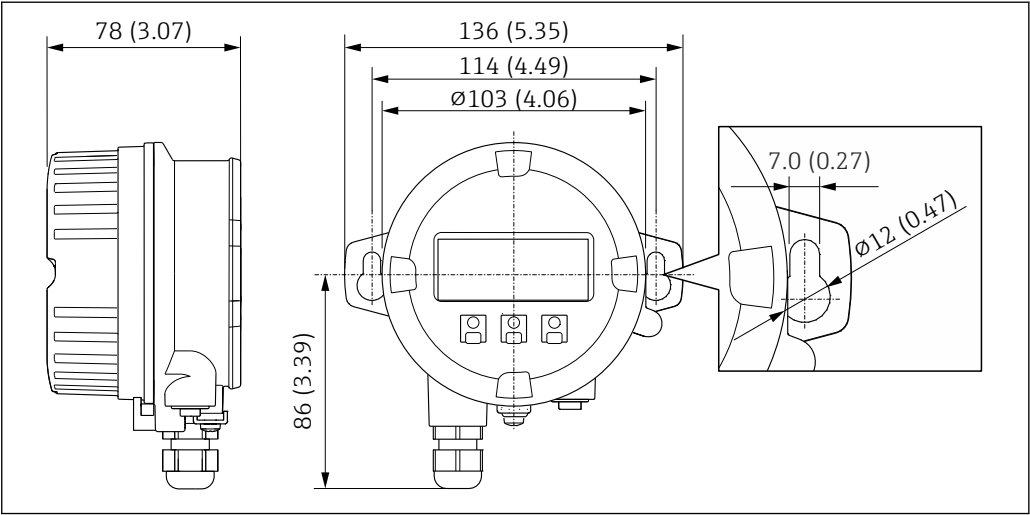
Weather protection cover



A0029553

31 Engineering unit mm (in)

Remote display and operating module DKX001

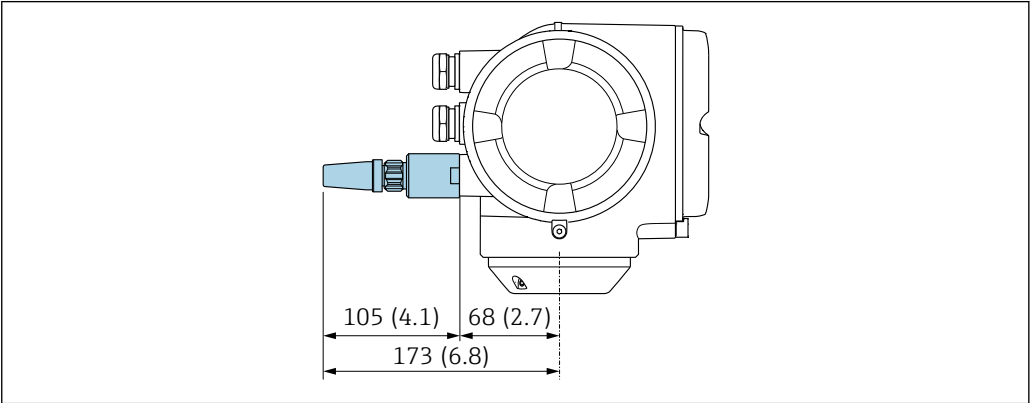


A0028921

32 Engineering unit mm (in)

External WLAN antenna

External WLAN antenna mounted on device



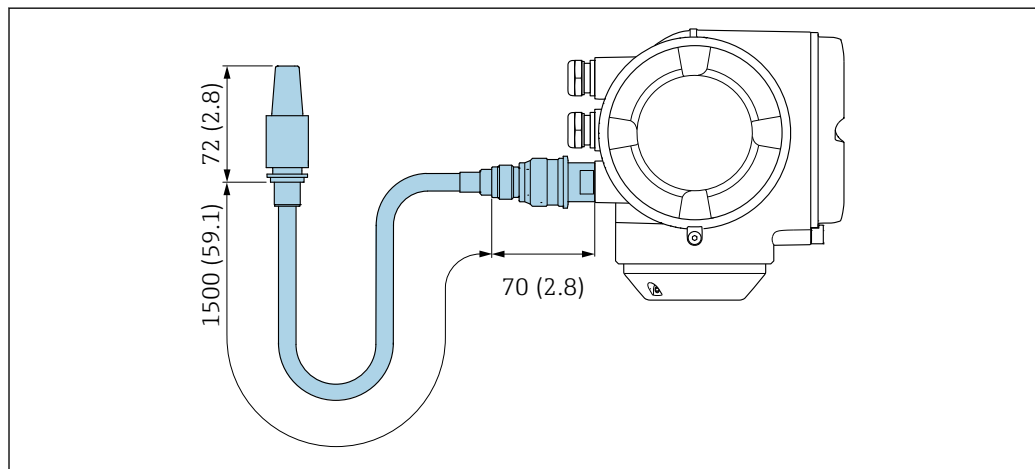
A0028923

33 Engineering unit mm (in)



*External WLAN antenna mounted with cable*

The external WLAN antenna can be mounted separately from the transmitter if the transmission/reception conditions at the transmitter mounting location are poor.

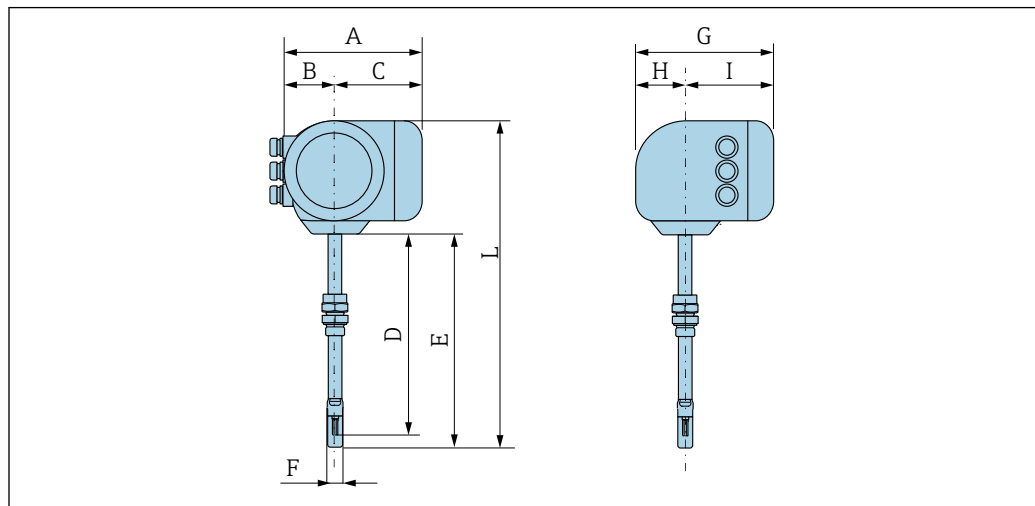


A0033597

34 Engineering unit mm (in)

## Dimensions in US units

## Compact version



A0041075

*Order code for "Housing", option A "Aluminum, coated"*

A <sup>1)</sup> [in]	B <sup>1)</sup> [in]	C [in]	G <sup>2)</sup> [in]	H [in]	I <sup>2)</sup> [in]
6.65	2.68	3.98	7.87	2.32	5.55

1) Depending on the cable gland used: values up to + 1.18 in

2) For version without local display: values – 1.18 in

*Order code for "Housing", option A "Aluminum, coated"; Ex d or XP*

A <sup>1)</sup> [in]	B <sup>1)</sup> [in]	C [in]	G <sup>2)</sup> [in]	H [in]	I <sup>2)</sup> [in]
7.4	3.35	4.06	8.54	2.28	5.83

1) Depending on the cable gland used: values up to + 1.18 in

2) For version without local display: values – 1.93 in



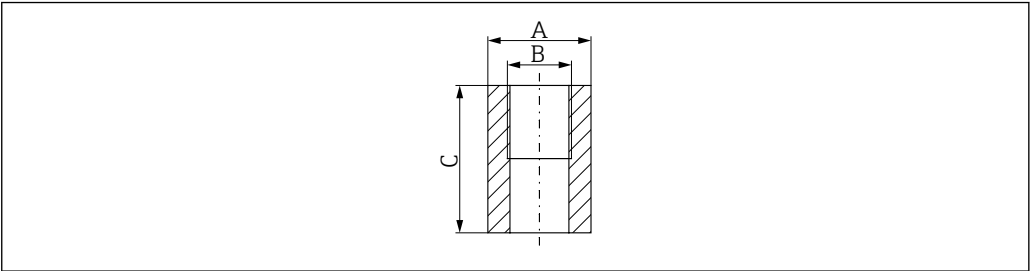
Sensor with order code for "Housing", option A "Aluminum, coated"

Installed length [in]	D [in]	E [in]	F [in]	L <sup>1)</sup> [in]
9	11.06	11.73	0.88	19.02
13	15	15.67	0.88	22.95
17	18.94	19.61	0.88	26.89
24	25.67	26.34	0.88	33.62

1) For Ex d or XP versions: values + 0.16 in

Accessories

Welding socket



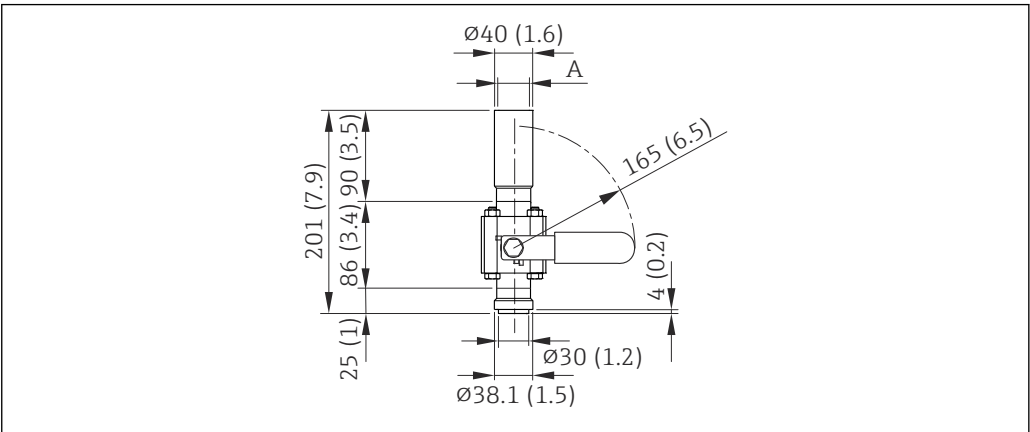
A0041333

- A 1.77 in  
B Order code for "Accessory enclosed", option "Welding socket"  
C 2.36 in

Order code for "Accessory enclosed":

- Option PC "Welding socket G 1"
- Option PD "Welding socket 1" NPT"
- Option PE "Welding socket G ¾"
- Option PF "Welding socket ¾" NPT"

Cold tap, ambient pressure



A0042224

35 Dimensions: mm (in)

A Order code for "Accessory enclosed", option "Welding socket"

Order code for "Accessory enclosed":

- Option PR "Cold tap G 1", ambient pressure"
- Option PS "Cold tap 1" NPT, ambient pressure"
- Option PT "Cold tap G ¾", ambient pressure"
- Option PU "Cold tap ¾" NPT, ambient pressure"



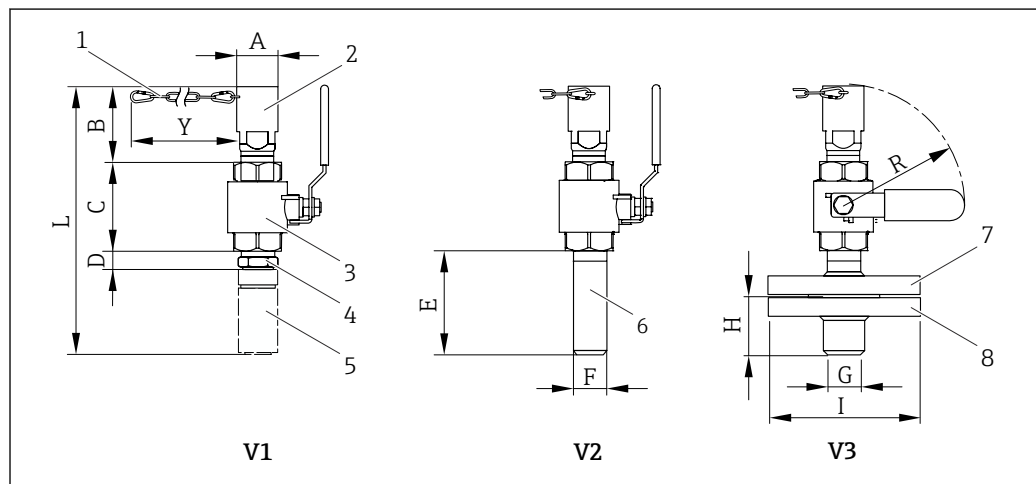
*Hot tap, process pressure**Low-pressure version*

Available for order as:

- Order code for "Accessory enclosed"
    - Option PG "Hot tap G 1", low pressure = 4.5 bar/65 psig"
    - Option PH "Hot tap 1" NPT, low pressure = 4.5 bar/65 psig"
    - Option PK "Hot tap G ¾", low pressure = 4.5 bar/65 psig"
    - Option PL "Hot tap ¾" NPT, low pressure = 4.5 bar/65 psig"
    - The low-pressure version as "Accessory enclosed" comprises: V2 → 36, 58
  - Can be ordered separately as an "Accessory": DK6003 → 78
- Versions V1, V2 and V3 can be ordered via DK6003



- Can only be used with the following installed lengths:
  - Order code for "Installed length", option L2 "335mm (13)"
  - Order code for "Installed length", option L3 "435mm (17)"
  - Order code for "Installed length", option L4 "608mm (24)"
- Cannot be used with 1.4404 clamping ring. Maximum temperature is limited (284°F for PEEK and 230°F for PVDF)



36 Versions available for order

- 1 Safety chain for low-pressure version  
 2 Sensor connection  
 3 Ball valve  
 4 Retrofit adapter (for subsequent installation with existing welding socket (DK6MB))  
 5 Welding socket (DK6MB) only G1" / 1" NPT  
 6 Process connection welding socket  
 7 Flange adapter  
 8 Process connection flange  
 V1 Version with retrofit adapter  
 V2 Version with welding socket  
 V3 Version with flange








A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	I [in]	L [in]	R [in]	Y <sup>1)</sup> [in]
1.67	~3.35	3.46	~2.36	4.84	1.31	1.31	2.13	4.88	~9.94	6.50	24.41

1) Safety chain (for p ≤ 65 psi g) only in conjunction with low-pressure version

Weight [lbs]		
V1	V2	V3
6	5	11



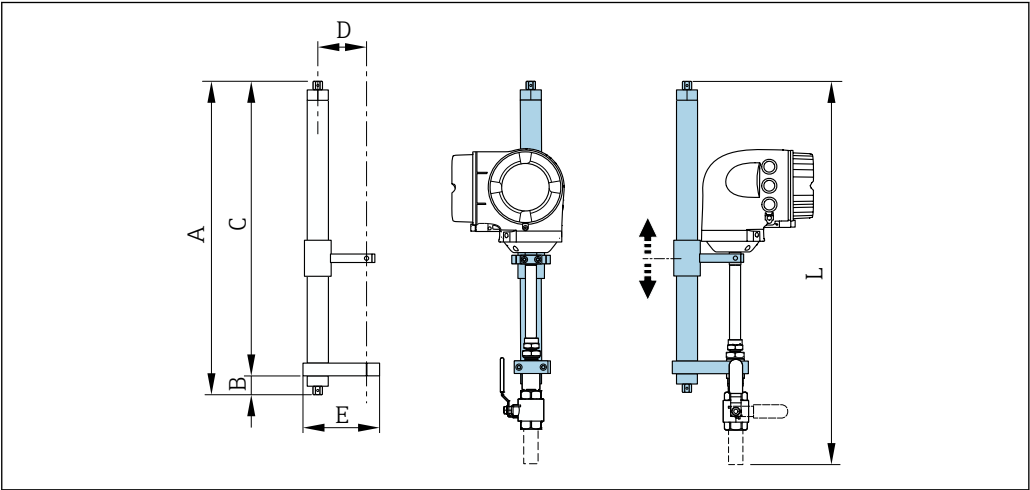
Medium-pressure version


- i** Available for order as:
- Order code for "Accessory enclosed"
    - Option PI "Hot tap G 1", medium pressure = 16 bar/230 psig
    - Option PJ "Hot tap 1" NPT, medium pressure = 16 bar/230 psig
    - Option PM "Hot tap G ¾", medium pressure = 16 bar/230 psig
    - Option PN "Hot tap ¾" NPT, medium pressure = 16 bar/230 psig
    - The medium-pressure version comprises: V2 →  36,  58 and extractor assembly →  37,  59
  - Can be ordered separately as an "Accessory": DK6003 →  78
  - Versions V1, V2 and V3 →  36,  58 can be ordered via DK6003

- i**
- Can only be used with the following installed lengths:
    - Order code for "Installed length", option L3 "435mm (17)"
    - Order code for "Installed length", option L4 "608mm (24)"
  - Cannot be used with 1.4404 clamping ring. Maximum temperature is limited (140°C for PEEK and 110°C for PVDF)

Extractor assembly for medium-pressure version

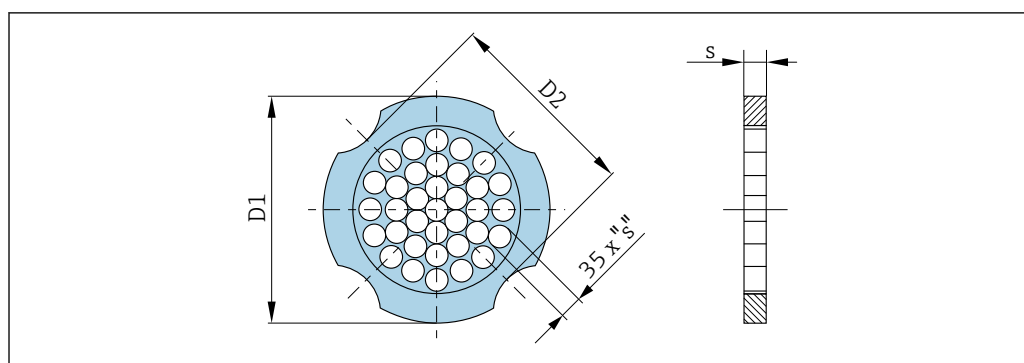
- i** Order code for "Accessory enclosed":
- Option PI "Hot tap G 1", medium pressure maximum 16 bar/230 psig
  - Option PJ "Hot tap 1" NPT, medium pressure maximum 16 bar/230 psig
  - Option PM "Hot tap G ¾", medium pressure maximum 16 bar/230 psig
  - Option PN "Hot tap ¾" NPT, medium pressure maximum 16 bar/230 psig



 37 Extractor assembly

L [in]	A [in]	B [in]	C [in]	D [in]	E [in]	Weight [lbs]
36.61	29.13	1.57	27.56	4.72	7.09	18.5



*Flow conditioner*

A0033504

Used in combination with flanges according to ASME B16.5: Class 150

1.4404 (316, 316L)

Can be ordered separately as an "Accessory": DK6004

DN [in]	Centering diameter [in]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [in]
3	5.45	D1	0.40
4	6.95	D2	0.52
6	8.81	D1	0.79
8	10.80	D2	1.04
10	13.40	D1	1.30
12	15.90	D1	1.56

1) The flow conditioner is fitted at the outer diameter between the bolts.

2) The flow conditioner is fitted at the indentations between the bolts.

Used in combination with flanges according to ASME B16.5: Class 300

1.4404 (316, 316L)

Can be ordered separately as an "Accessory": DK6004

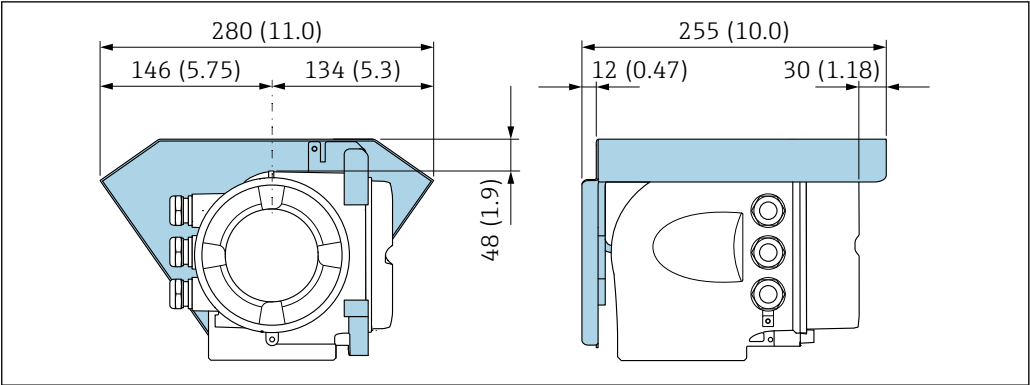
DN [in]	Centering diameter [in]	D1 <sup>1)</sup> / D2 <sup>2)</sup>	s [in]
3	5.96	D1	0.40
4	7.19	D1	0.52
6	9.92	D1	0.79
8	12.20	D1	1.04
10	14.30	D1	1.30
12	15.80	D1	1.56

1) The flow conditioner is fitted at the outer diameter between the bolts.

2) The flow conditioner is fitted at the indentations between the bolts.



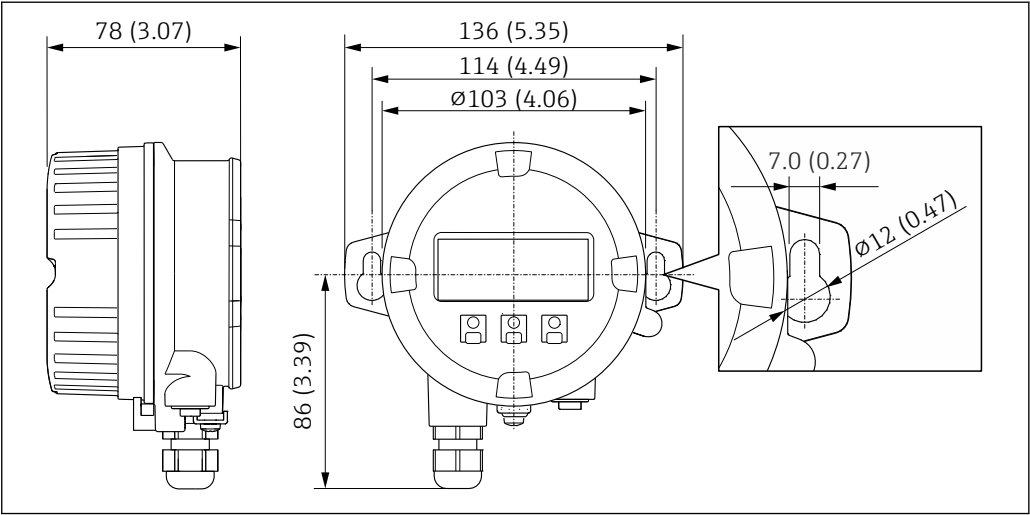
Weather protection cover



A0029553

38 Engineering unit mm (in)

Remote display and operating module DKX001

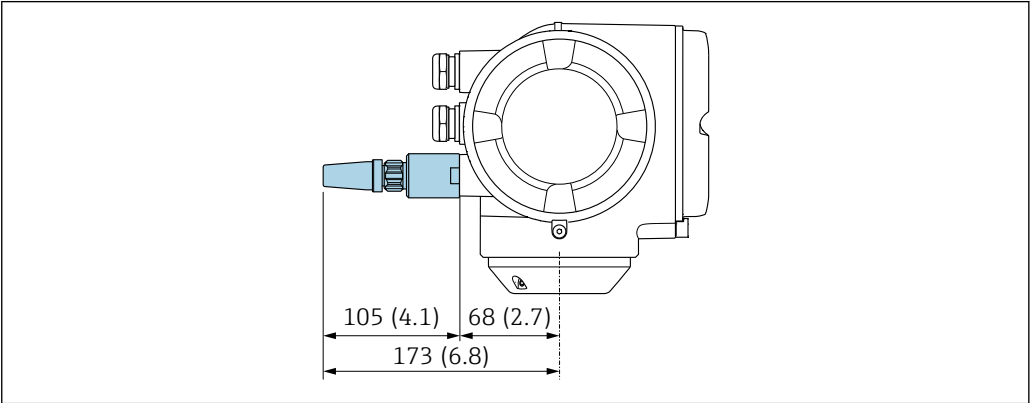


A0028921

39 Engineering unit mm (in)

External WLAN antenna

External WLAN antenna mounted on device



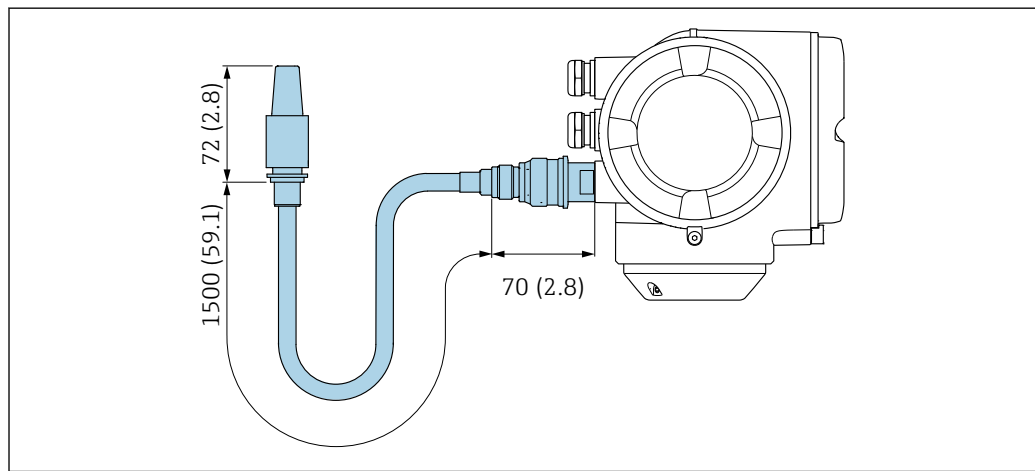
A0028923

40 Engineering unit mm (in)



*External WLAN antenna mounted with cable*

The external WLAN antenna can be mounted separately from the transmitter if the transmission/reception conditions at the transmitter mounting location are poor.



A0033597

41 Engineering unit mm (in)

**Materials****Transmitter housing**

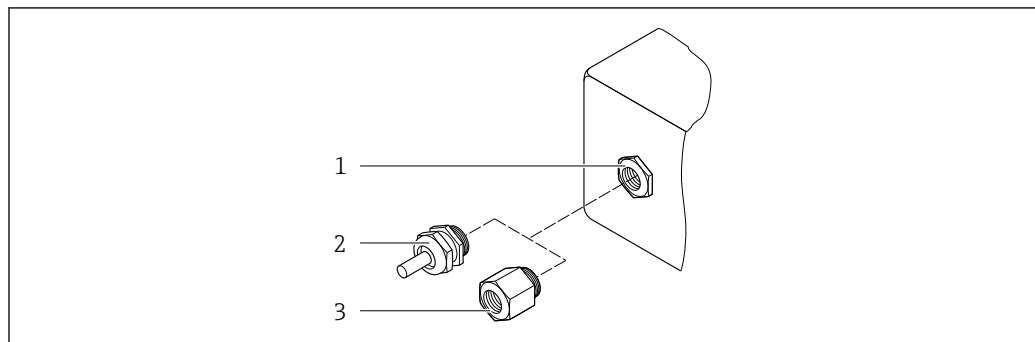
Order code for "Housing":

Option A "Aluminum, coated": aluminum, AlSi10Mg, coated

*Window material*

Order code for "Housing":

Option A "Aluminum, coated": glass

**Cable entries/cable glands**

A0020640

42 Possible cable entries/cable glands

1 Female thread M20 × 1.5

2 Cable gland M20 × 1.5

3 Adapter for cable entry with female thread G ½" or NPT ½"

Order code for "Housing", option A "Aluminum, coated"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Compression fitting M20 × 1.5	Non-Ex: plastic
	Z2, D2, Ex d/de: brass with plastic
Adapter for cable entry with female thread G ½"	Nickel-plated brass
Adapter for cable entry with female thread NPT ½"	



**Materials for insertion tube**

Stainless steel, 1.4404 (316/316L)

**Process connections, process coupling**

Stainless steel, 1.4404 (316/316L)

**Sensing element****Unidirectional**

- Stainless steel, 1.4404 (316/316L)
- Alloy C22, 2.4602 (UNS N06022);

**Bidirectional**

Stainless steel, 1.4404 (316/316L)

**Reverse flow detection**

Stainless steel, 1.4404 (316/316L)

**Ferrules**

- PEEK
- PVDF
- 1.4404 (316/316L)

**Flat ring seal**

- EPDM
- FKM



For aggressive media (e.g. chlorine or ozone), we recommend special materials (Alloy for sensing element, PVDF or 1.4404 for ferrules and FKM for flat seal). For any requests, please contact the Endress+Hauser sales organization responsible for your area.

**Sensor guard**

Stainless steel, 1.4404 (316/316L)

**Accessories***Protective cover*

Stainless steel, 1.4404 (316L)

*External WLAN antenna*

- Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass
- Adapter: Stainless steel and nickel-plated brass
- Cable: Polyethylene
- Plug: Nickel-plated brass
- Angle bracket: Stainless steel

*Mounting boss (DK6MB)*

Stainless steel, 1.4404 (316/316L)

*Hot tap, low and medium pressure**Mounting boss*

Stainless cast steel 1.4404 (316L)

*Ball valve*

- Stainless cast steel CF3M or CF8M
- Seal: PTFE

*Sensor connection*

Stainless steel, 1.4404 (316/316L)



*Cold tap, atmospheric pressure*

- Stainless steel, 1.4404 (316/316L)
- Stainless cast steel CF3M or CF8M
- Seal: PTFE

## Weight

All values (weight exclusive of packaging material) refer to devices with EN/DIN PN 40 flanges. Weight specifications including transmitter as per order code for "Housing", option A "Aluminum, coated".

Different values due to different transmitter versions:

Transmitter version for the hazardous area

(Order code for "Housing", option A "Aluminum, coated"; Ex d): +2 kg (+4.4 lbs)

### Weight in SI units

Installed length [mm]	Weight [kg]
235	4.8
335	4.9
435	5
608	5.1

### Weight in US units

Installed length [in]	Weight [lbs]
9	10.6
13	10.8
17	11
24	11.2

## Process connections

- G $\frac{3}{4}$ ", ISO 228/1 compression fitting
- G1", ISO 228/1, compression fitting
- $\frac{3}{4}$ " NPT, compression fitting
- 1" NPT, compression fitting



For information on the different materials used in the process connections → 63



## Human interface

### Operating concept

#### Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

#### Fast and safe commissioning

- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief descriptions of the individual parameter functions
- Access to the device via Web server
- WLAN access to the device via mobile handheld terminal, tablet or smart phone

#### Reliable operation

- Operation in local language
- Uniform operating philosophy applied to device and operating tools
- If replacing electronic modules, transfer the device configuration via the integrated memory (HistoROM backup) which contains the process and measuring device data and the event logbook. No need to reconfigure.

#### Efficient diagnostic behavior increases measurement availability

- Troubleshooting measures can be called up via the device and in the operating tools
- Diverse simulation options, logbook for events that occur and optional line recorder functions

### Languages

Can be operated in the following languages:

- Via local operation  
English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via Web browser  
English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese

### Local operation

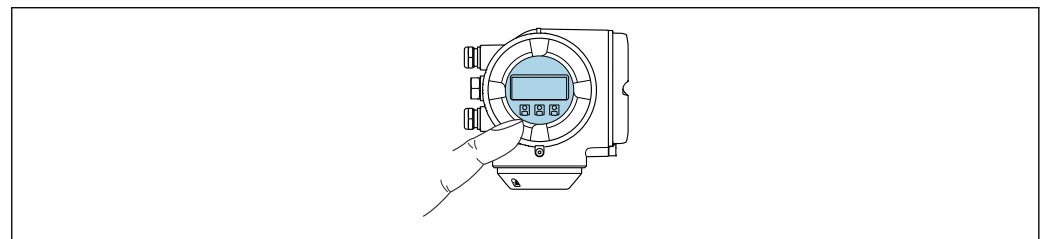
#### Via display module

Equipment:

- Order code for "Display; operation", option F "4-line, illuminated, graphic display; touch control"
- Order code for "Display; operation", option G "4-line, illuminated, graphic display; touch control + WLAN"



Information about WLAN interface → 68



A0026785

43 Operation with touch control

#### Display elements

- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for the display: -20 to +60 °C (-4 to +140 °F)  
The readability of the display may be impaired at temperatures outside the temperature range.

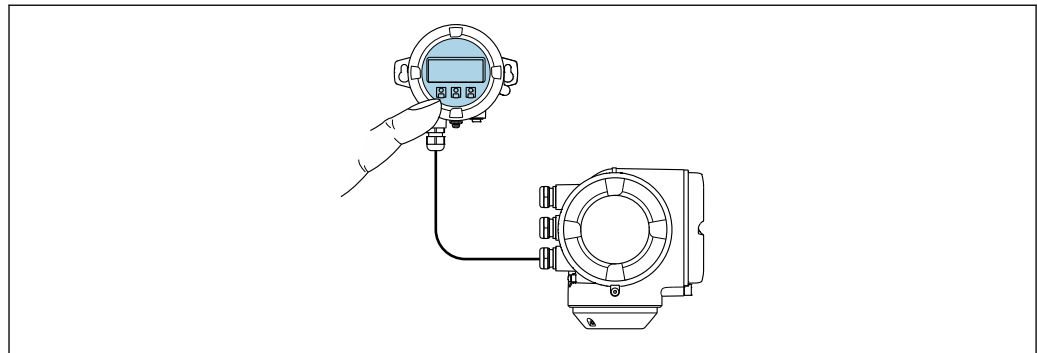


### Operating elements

- External operation via touch control (3 optical keys) without opening the housing: ☒, ☐, ☒
- Operating elements also accessible in the various zones of the hazardous area

### Via remote display and operating module DKX001

- i** The remote display and operating module DKX001 is available as an optional extra → 77.
- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
  - If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



A0026786

44 Operation via remote display and operating module DKX001

### Display and operating elements

The display and operating elements correspond to those of the display module → 65.

### Housing material

Transmitter housing		Remote display and operating module
Order code for "Housing"	Material	Material
Option A "Aluminum, coated"	AlSi10Mg, coated	AlSi10Mg, coated

### Cable entry

Corresponds to the choice of transmitter housing, order code for "Electrical connection".

### Connecting cable

→ 32

### Dimensions

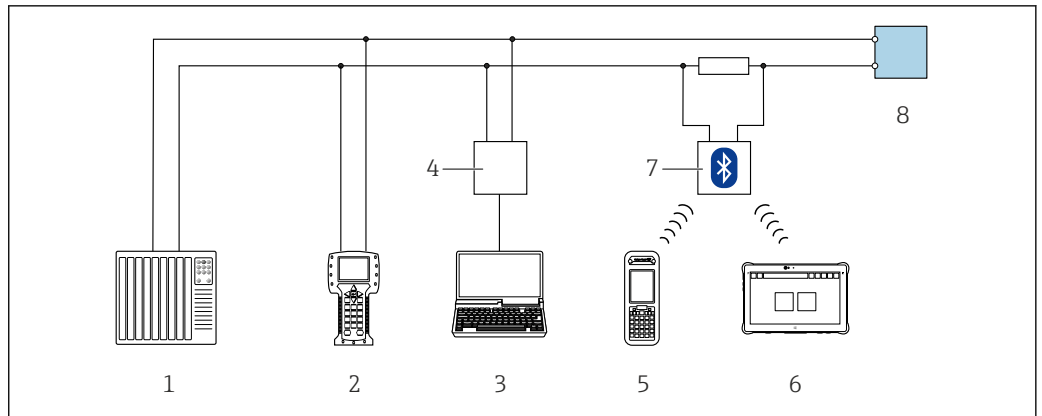
→ 55

## Remote operation

### Via HART protocol

This communication interface is available in device versions with a HART output.

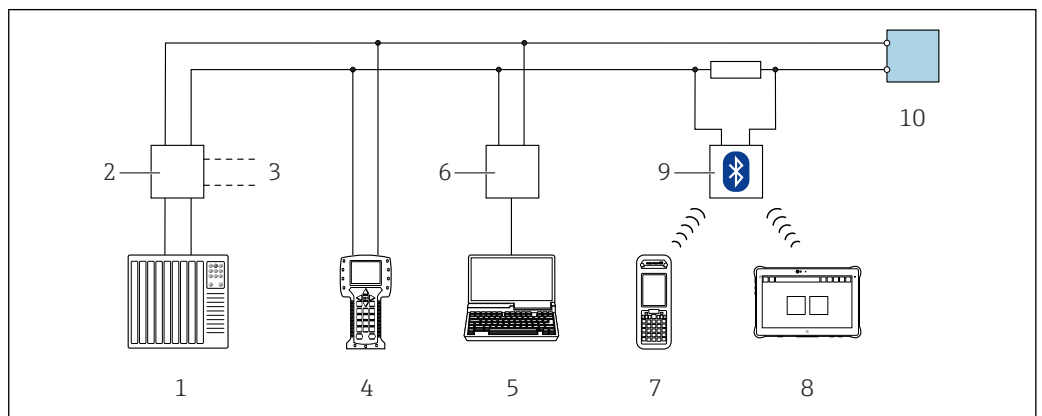




A0028747

45 Options for remote operation via HART protocol (active)

- 1 Control system (e.g. PLC)
- 2 Field Communicator 475
- 3 Computer with Web browser (e.g. Internet Explorer) for access to the integrated device Web server or computer with an operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"
- 4 Commubox FXA195 (USB)
- 5 Field Xpert SFX350 or SFX370
- 6 Field Xpert SMT70
- 7 VIATOR Bluetooth modem with connecting cable
- 8 Transmitter



A0028746

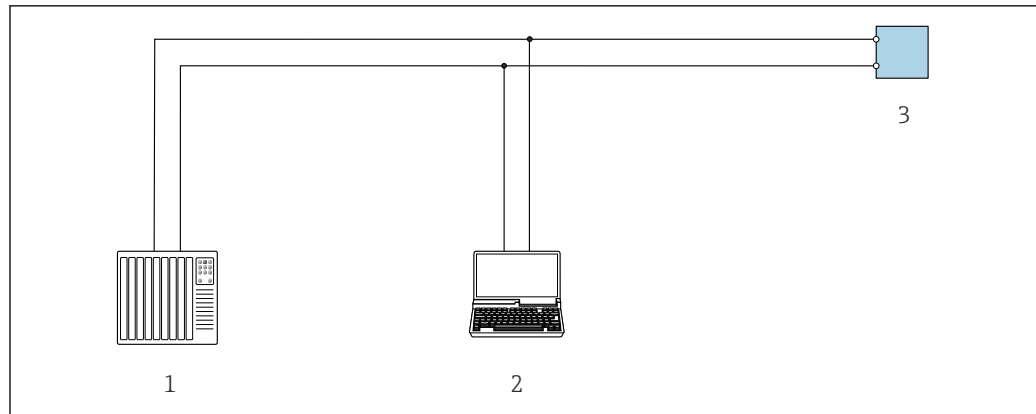
46 Options for remote operation via HART protocol (passive)

- 1 Control system (e.g. PLC)
- 2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
- 3 Connection for Commubox FXA195 and Field Communicator 475
- 4 Field Communicator 475
- 5 Computer with Web browser (e.g. Internet Explorer) for access to the integrated device Web server or computer with an operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"
- 6 Commubox FXA195 (USB)
- 7 Field Xpert SFX350 or SFX370
- 8 Field Xpert SMT70
- 9 VIATOR Bluetooth modem with connecting cable
- 10 Transmitter

### Via Modbus RS485 protocol

This communication interface is available in device versions with a Modbus-RS485 output.





A0029437

47 Options for remote operation via Modbus-RS485 protocol (active)

- 1 Control system (e.g. PLC)
- 2 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP" or Modbus DTM
- 3 Transmitter

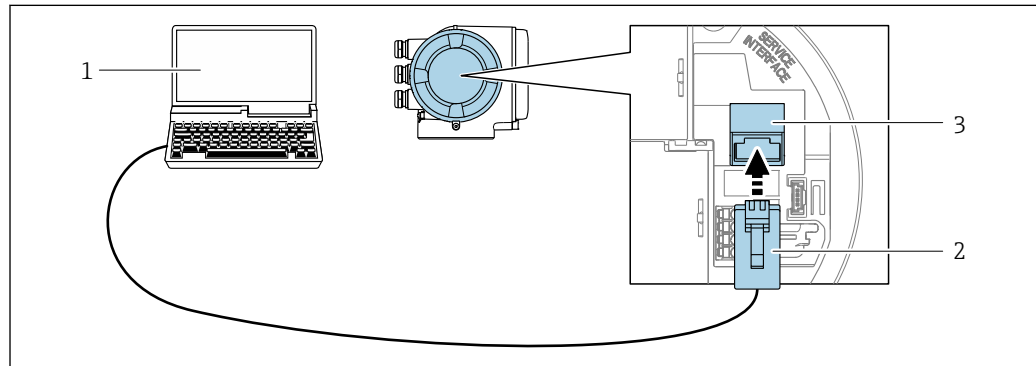
## Service interface

### Via service interface (CDI-RJ45)

A point-to-point connection can be established to configure the device onsite. With the housing open, the connection is established directly via the service interface (CDI-RJ45) of the device.

**i** An adapter for RJ45 and the M12 connector is optionally available:  
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

The adapter connects the service interface (CDI-RJ45) to an M12 connector mounted in the cable entry. Therefore the connection to the service interface can be established via an M12 connector without opening the device.



A0027563

48 Connection via service interface (CDI-RJ45)

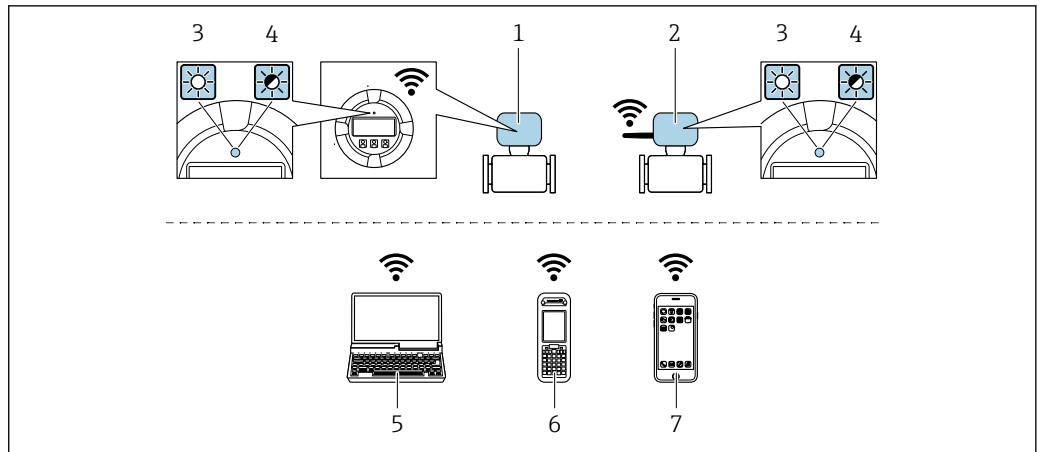
- 1 Computer with Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with "FieldCare", "DeviceCare" operating tool with COM DTM "CDI Communication TCP/IP" or Modbus DTM
- 2 Standard Ethernet connecting cable with RJ45 connector
- 3 Service interface (CDI-RJ45) of the measuring device with access to the integrated Web server

### Via WLAN interface

The optional WLAN interface is available on the following device version:


Order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN"






A0034570

- 1 Transmitter with integrated WLAN antenna
- 2 Transmitter with external WLAN antenna
- 3 LED lit constantly: WLAN reception is enabled on measuring device
- 4 LED flashing: WLAN connection established between operating unit and measuring device
- 5 Computer with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare)
- 6 Mobile handheld terminal with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or operating tool (e.g. FieldCare, DeviceCare)
- 7 Smart phone or tablet (e.g. Field Xpert SMT70)


Function	WLAN: IEEE 802.11 b/g (2.4 GHz) <ul style="list-style-type: none"> <li>Access point with DHCP server (default setting)</li> <li>Network</li> </ul>
Encryption	WPA2-PSK AES-128 (in accordance with IEEE 802.11i)
Configurable WLAN channels	1 to 11
Degree of protection	IP67
Available antennas	<ul style="list-style-type: none"> <li>Internal antenna</li> <li>External antenna (optional)</li> </ul> <p>In the event of poor transmission/reception conditions at the place of installation. Available as an accessory .</p> <p> Only one antenna active in each case!</p>
Range	<ul style="list-style-type: none"> <li>Internal antenna: typically 10 m (32 ft)</li> <li>External antenna: typically 50 m (164 ft)</li> </ul>
Materials (external antenna)	<ul style="list-style-type: none"> <li>Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass</li> <li>Adapter: Stainless steel and nickel-plated brass</li> <li>Cable: Polyethylene</li> <li>Connector: Nickel-plated brass</li> <li>Angle bracket: Stainless steel</li> </ul>


### Supported operating tools

Different operating tools can be used for local or remote access to the measuring device. Depending on the operating tool used, access is possible with different operating units and via a variety of interfaces.

Supported operating tools	Operating unit	Interface	Additional information
Web browser	Notebook, PC or tablet with Web browser	<ul style="list-style-type: none"> <li>CDI-RJ45 service interface</li> <li>WLAN interface</li> </ul>	Special Documentation for device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	<ul style="list-style-type: none"> <li>CDI-RJ45 service interface</li> <li>WLAN interface</li> <li>Fieldbus protocol</li> </ul>	→  79



Supported operating tools	Operating unit	Interface	Additional information
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	<ul style="list-style-type: none"> <li>■ CDI-RJ45 service interface</li> <li>■ WLAN interface</li> <li>■ Fieldbus protocol</li> </ul>	→  79
Device Xpert	Field Xpert SFX 100/350/370	HART fieldbus protocol	Operating Instructions BA01202S  Device description files: Use update function of handheld terminal

 Other operating tools based on FDT technology with a device driver such as DTM/iDTM or DD/EDD can be used for device operation. These operating tools are available from the individual manufacturers. Integration into the following operating tools, among others, is supported:

- FactoryTalk AssetCentre (FTAC) from Rockwell Automation → [www.rockwellautomation.com](http://www.rockwellautomation.com)
- Process Device Manager (PDM) from Siemens → [www.siemens.com](http://www.siemens.com)
- Asset Management Solutions (AMS) from Emerson → [www.emersonprocess.com](http://www.emersonprocess.com)
- FieldCommunicator 375/475 from Emerson → [www.emersonprocess.com](http://www.emersonprocess.com)
- Field Device Manager (FDM) from Honeywell → [www.honeywellprocess.com](http://www.honeywellprocess.com)
- FieldMate from Yokogawa → [www.yokogawa.com](http://www.yokogawa.com)
- PACTWare → [www.pactware.com](http://www.pactware.com)

The related device description files are available: [www.endress.com](http://www.endress.com) → Downloads


### Web server

Thanks to the integrated Web server, the device can be operated and configured via a Web browser and via a service interface (CDI-RJ45) or via a WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, device status information is also displayed, allowing users to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN". The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

### Supported functions

Data exchange between the operating unit (such as a notebook for example) and the measuring device:


- Upload the configuration from the measuring device (XML format, configuration backup)
- Save the configuration to the measuring device (XML format, restore configuration)
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
- Flash firmware version for device firmware upgrade, for instance
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package →  76)



Web server special documentation

### HistoROM data management

The measuring device features HistoROM data management. HistoROM data management comprises both the storage and import/export of key device and process data, making operation and servicing far more reliable, secure and efficient.

 When the device is delivered, the factory settings of the configuration data are stored as a backup in the device memory. This memory can be overwritten with an updated data record, for example after commissioning.



### Additional information on the data storage concept

There are different types of data storage units in which device data are stored and used by the device:

	HistoROM backup	T-DAT	S-DAT
<b>Available data</b>	<ul style="list-style-type: none"> <li>■ Event logbook such as diagnostic events for example</li> <li>■ Parameter data record backup</li> <li>■ Device firmware package</li> </ul>	<ul style="list-style-type: none"> <li>■ Measured value logging ("Extended HistoROM" order option)</li> <li>■ Current parameter data record (used by firmware at run time)</li> <li>■ Peakhold indicator (min/max values)</li> <li>■ Totalizer values</li> </ul>	<ul style="list-style-type: none"> <li>■ Sensor data: nominal diameter etc.</li> <li>■ Serial number</li> <li>■ Calibration data</li> <li>■ Device configuration (e.g. SW options, fixed I/O or multi I/O)</li> </ul>
<b>Storage location</b>	Fixed on the user interface board in the connection compartment	Attachable to the user interface board in the connection compartment	In the sensor plug in the transmitter neck part

### Data backup

#### Automatic

- The most important device data (sensor and transmitter) are automatically saved in the DAT modules
- If the transmitter or measuring device is replaced: once the T-DAT containing the previous device data has been exchanged, the new measuring device is ready for operation again immediately without any errors
- If the sensor is replaced: once the sensor has been replaced, new sensor data are transferred from the S-DAT in the measuring device and the measuring device is ready for operation again immediately without any errors
- If exchanging the electronics module (e.g. I/O electronics module): Once the electronics module has been replaced, the software of the module is compared against the current device firmware. The module software is upgraded or downgraded where necessary. The electronics module is available for use immediately afterwards and no compatibility problems occur.

#### Manual

Additional parameter data record (complete parameter settings) in the integrated device memory HistoROM backup for:

- Data backup function  
Backup and subsequent restoration of a device configuration in the device memory HistoROM backup
- Data comparison function  
Comparison of the current device configuration with the device configuration saved in the device memory HistoROM backup

### Data transfer

#### Manually

Transfer of a device configuration to another device using the export function of the specific operating tool, e.g. with FieldCare, DeviceCare or Web server: to duplicate the configuration or to store in an archive (e.g. for backup purposes)

### Event list

#### Automatic

- Chronological display of up to 20 event messages in the events list
- If the **Extended HistoROM** application package (order option) is enabled: up to 100 event messages are displayed in the events list along with a time stamp, plain text description and remedial measures
- The events list can be exported and displayed via a variety of interfaces and operating tools e.g. DeviceCare, FieldCare or Web server

### Data logging

#### Manual

If the **Extended HistoROM** application package (order option) is enabled:

- Record up to 1 000 measured values via 1 to 4 channels
- User configurable recording interval
- Record up to 250 measured values via each of the 4 memory channels
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server




## Certificates and approvals

Current certificates and approvals for the product are available via the Product Configurator at [www.endress.com](http://www.endress.com).

1. Select the product using the filters and search field.
2. Open the product page.

The **Configuration** button opens the Product Configurator.

<b>CE mark</b>	<p>The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.</p> <p>Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.</p>
<b>RCM-tick symbol</b>	<p>The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".</p>
<b>Ex approval</b>	<p>The measuring device is certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.</p> <p>Devices with the order code for "Approval", option BB or BD have equipment protection level (EPL) Ga/Gb (Zone 0 in the measuring tube).</p> <p> The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.</p>

### ATEX, IECEX

Currently, the following versions for use in hazardous areas are available:

#### Ex db eb

Category	Type of protection
II1/2G	Ex db eb ia IIC T4...T1 Ga/Gb
II2G	Ex db eb ia IIC T4...T1 Gb

#### Ex db

Category	Type of protection
II1/2G	Ex db ia IIC T4...T1 Ga/Gb
II2G	Ex db ia IIC T4...T1 Gb

#### Ex ec

Category	Type of protection
II3G	Ex ec IIC T4...T1 Gc

#### Ex tb

Category	Type of protection
II2D	Ex tb IIIC T** °C Db

### cCSA<sub>US</sub>

Currently, the following versions for use in hazardous areas are available:

#### XP (Ex d)

Class I, II, III Division 1 Groups A-G

#### NI (Ex ec)

Class I Division 2 Groups A - D



**Ex de**

- Class I, Zone 1 AEx/ Ex de ia IIC T4...T1 Ga/Gb
- Class I, Zone 1 AEx/ Ex de ia IIC T4...T1 Gb

**Ex db**

- Class I, Zone 1 AEx/ Ex db ia IIC T4...T1 Ga/Gb
- Class I, Zone 1 AEx/ Ex db ia IIC T4...T1 Gb

**Ex ec**

Class I, Zone 2 AEx/ Ex ec IIC T4...T1 Gc

**Ex tb**

Zone 2 I AEx/ Ex tb IIIC T\*\* °C Db

**Functional safety**

The measuring device can be used for flow monitoring systems (min., max., range) up to SIL 2 (single-channel architecture; order code for "Additional approval", option LA) and SIL 3 (multi-channel architecture with homogeneous redundancy) and is independently evaluated and certified in accordance with IEC 61508.

The following types of monitoring in safety equipment are possible:  
Mass flow



Functional Safety Manual with information on the SIL device

**HART certification****HART interface**

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:

- Certified according to HART 7
- The device can also be operated with certified devices of other manufacturers (interoperability)

**Radio approval**

The measuring device has radio approval.



For detailed information regarding radio approval, see the Special Documentation

**Additional certification****CRN approval**

Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device.

**Other standards and guidelines**

- EN 60529  
Degrees of protection provided by enclosures (IP code)
- EN 61010-1  
Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326-3-2  
Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- NAMUR NE 21  
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32  
Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43  
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53  
Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 105  
Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107  
Self-monitoring and diagnosis of field devices



- NAMUR NE 131  
Requirements for field devices for standard applications
- ETSI EN 300 328  
Guidelines for 2.4 GHz radio components.
- EN 301489  
Electromagnetic compatibility and radio spectrum matters (ERM).

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**Classification of process  
sealing between electrical  
systems and (flammable or  
combustible) process fluids  
in accordance with ANSI/ISA  
12.27.01**

Endress+Hauser devices are designed in accordance with ANSI/ISA 12.27.01, allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These devices comply with the North American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids.  
Further information can be found in the control drawings of the relevant devices.



## Ordering information

Detailed ordering information is available as follows:

- In the Product Configurator on the Endress+Hauser website: [www.endress.com](http://www.endress.com) -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: [www.addresses.endress.com](http://www.addresses.endress.com)



### **Product Configurator - the tool for individual product configuration**

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop



## Application packages

Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements.

The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: [www.endress.com](http://www.endress.com).



Detailed information on the application packages:  
Special Documentation for the device → 81

### Diagnostics functions

Package	Description
Extended HistoROM	<p>Comprises extended functions concerning the event log and the activation of the measured value memory.</p> <p>Event log: Memory volume is extended from 20 message entries (standard version) to up to 100 entries.</p> <p>Data logging (line recorder):</p> <ul style="list-style-type: none"> <li>Memory capacity for up to 1000 measured values is activated.</li> <li>250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user.</li> <li>Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.</li> </ul>

### Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	<p><b>Heartbeat Verification</b> Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment".</p> <ul style="list-style-type: none"> <li>Functional testing in the installed state without interrupting the process.</li> <li>Traceable verification results on request, including a report.</li> <li>Simple testing process via local operation or other operating interfaces.</li> <li>Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications.</li> <li>Extension of calibration intervals according to operator's risk assessment.</li> </ul> <p><b>Heartbeat Monitoring</b> Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to:</p> <ul style="list-style-type: none"> <li>Draw conclusions - using these data and other information - about the impact on the measuring performance over time.</li> <li>Schedule servicing in time.</li> <li>Monitor the process or product quality, e.g. process stability.</li> </ul>

### Second gas group

Package	Description
Second gas group	This application package enables the configuration of two different standard gases/gas mixtures in the device and allows the user to switch from one gas group to another using the status input or (if available) via bus communication.














## Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: [www.endress.com](http://www.endress.com).









### Device-specific accessories

### For the transmitter


Accessories	Description
Proline 300 transmitter	<p>Transmitter for replacement or storage. Use the order code to define the following specifications:</p> <ul style="list-style-type: none"> <li>▪ Approvals</li> <li>▪ Output</li> <li>▪ Input</li> <li>▪ Display/operation</li> <li>▪ Housing</li> <li>▪ Software</li> </ul> <p> Order code: 6X3BXX</p> <p> Installation Instructions EA01286D</p>
Remote display and operating module DKX001	<ul style="list-style-type: none"> <li>▪ If ordered directly with the measuring device: Order code for "Display; operation", option O "Remote display 4-line illum.; 10 m (30 ft) Cable; touch control"</li> <li>▪ If ordered separately: <ul style="list-style-type: none"> <li>▪ Measuring device: order code for "Display; operation", option M "W/o, prepared for remote display"</li> <li>▪ DKX001: Via the separate product structure DKX001</li> </ul> </li> <li>▪ If ordered subsequently: DKX001: Via the separate product structure DKX001</li> </ul> <p><b>Mounting bracket for DKX001</b></p> <ul style="list-style-type: none"> <li>▪ If ordered directly: order code for "Accessory enclosed", option RA "Mounting bracket, pipe 1/2"</li> <li>▪ If ordered subsequently: order number: 71340960</li> </ul> <p><b>Connecting cable (replacement cable)</b> Via the separate product structure: DKX002</p> <p> Further information on display and operating module DKX001 →  66.</p> <p> Special Documentation SD01763D</p>
External WLAN antenna	<p>External WLAN antenna with 1.5 m (59.1 in) connecting cable and two angle brackets. Order code for "Accessory enclosed", option P8 "Wireless antenna wide area".</p> <p> <ul style="list-style-type: none"> <li>▪ The external WLAN antenna is not suitable for use in hygienic applications.</li> <li>▪ Further information on the WLAN interface →  68.</li> </ul></p> <p> Order number: 71351317</p> <p> Installation Instructions EA01238D</p>
Protective cover	<p>Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight.</p> <p> Order number: 71343505</p> <p> Installation Instructions EA01160D</p>







## For the sensor

Accessories	Description
Mounting boss	<b>Order code for "Accessory enclosed"</b> <ul style="list-style-type: none"> <li>Option PC "Mounting boss, G1"</li> <li>Option PD "Mounting boss, 1" NPT"</li> <li>Option PE "Mounting boss, G<math>\frac{3}{4}</math>"</li> <li>Option PF "Mounting boss, <math>\frac{3}{4}</math>" NPT"</li> </ul>  Can be ordered separately: order code DK6MB
Cold tap (ambient pressure)	<b>Order code for "Accessory enclosed"</b> <ul style="list-style-type: none"> <li>Option PR "Cold tap G1", ambient pressure"</li> <li>Option PS "Cold tap 1" NPT, ambient pressure"</li> <li>Option PT "Cold tap G<math>\frac{3}{4}</math>", ambient pressure"</li> <li>Option PU "Cold tap <math>\frac{3}{4}</math>" NPT, ambient pressure"</li> </ul>  Can be ordered separately: order code DK6ML
Hot tap (low pressure)	<b>Order code for "Accessory enclosed"</b> <ul style="list-style-type: none"> <li>Option PG "Hot tap G1", low pressure max. 4.5 bar/65 psig"</li> <li>Option PH "Hot tap 1" NPT, low pressure max. 4.5 bar/65 psig"</li> <li>Option PK "Hot tap G<math>\frac{3}{4}</math>", low pressure max. 4.5 bar/65 psig"</li> <li>Option PL "Hot tap <math>\frac{3}{4}</math>" NPT, low pressure max. 4.5 bar/65 psig"</li> </ul>  Mounting set contains mounting boss (process connection), sensor connection with safety chain and ball valve. To insert or remove the sensor at process pressures up to max. 4.5 barg (65 psi).  If the accessory is ordered separately, individual combinations can be selected. Order code DK6003
Hot tap (medium pressure)	<b>Order code for "Accessory enclosed"</b> <ul style="list-style-type: none"> <li>Option PI "Hot tap G1", medium pressure max. 16 bar/230 psig"</li> <li>Option PJ "Hot tap 1" NPT, medium pressure max. 16 bar/230 psig"</li> <li>Option PM "Hot tap G<math>\frac{3}{4}</math>", medium pressure max. 16 bar/230 psig"</li> <li>Option PN "Hot tap <math>\frac{3}{4}</math>" NPT, medium pressure max. 16 bar/230 psig"</li> </ul>  Mounting set contains mounting boss (process connection), sensor connection, ball valve and extractor assembly. To insert or remove the sensor at process pressures up to max. 16 barg (230 psi).  If the accessory is ordered separately, individual combinations can be selected. Order code DK6003
Flow conditioner	 Can be ordered separately: order code DK6004 <p><b>Available for the following pipe diameters:</b></p> <ul style="list-style-type: none"> <li>DN 80 (3")</li> <li>DN 100 (4")</li> <li>DN 150 (6")</li> <li>DN 200 (8")</li> <li>DN 250 (10")</li> <li>DN 300 (12")</li> </ul> <p><b>Available for the following process connections:</b></p> <ul style="list-style-type: none"> <li>PN10, EN1092-1</li> <li>PN16, EN1092-1</li> <li>PN25, EN1092-1</li> <li>PN40, EN1092-1</li> <li>Cl.150, ASME B16.5</li> <li>Cl.300, ASME B16.5</li> <li>10K, JIS B2220</li> <li>20K, JIS B2220</li> </ul>  Screws and seals are not included in the delivery.



## Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface.  Technical Information TI00404F



HART Loop Converter HMX50	<p>Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.</p> <p> <ul style="list-style-type: none"> <li>■ Technical Information TI00429F</li> <li>■ Operating Instructions BA00371F</li> </ul> </p>
Fieldgate FXA42	<p>Is used to transmit the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices</p> <p> <ul style="list-style-type: none"> <li>■ Technical Information TI01297S</li> <li>■ Operating Instructions BA01778S</li> <li>■ Product page: <a href="http://www.endress.com/fxa42">www.endress.com/fxa42</a></li> </ul> </p>
Field Xpert SMT70	<p>The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress.</p> <p>This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle.</p> <p> <ul style="list-style-type: none"> <li>■ Technical Information TI01342S</li> <li>■ Operating Instructions BA01709S</li> <li>■ Product page: <a href="http://www.endress.com/smt70">www.endress.com/smt70</a></li> </ul> </p>
Field Xpert SMT77	<p>The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1.</p> <p> <ul style="list-style-type: none"> <li>■ Technical Information TI01418S</li> <li>■ Operating Instructions BA01923S</li> <li>■ Product page: <a href="http://www.endress.com/smt77">www.endress.com/smt77</a></li> </ul> </p>

## Service-specific accessories

Accessories	Description
Applicator	<p>Software for selecting and sizing Endress+Hauser measuring devices:</p> <ul style="list-style-type: none"> <li>■ Choice of measuring devices with industrial requirements</li> <li>■ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy.</li> <li>■ Graphic illustration of the calculation results</li> <li>■ Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.</li> </ul> <p>Applicator is available:</p> <ul style="list-style-type: none"> <li>■ Via the Internet: <a href="https://portal.endress.com/webapp/applicator">https://portal.endress.com/webapp/applicator</a></li> <li>■ As a downloadable DVD for local PC installation.</li> </ul>
W@M	<p>W@M Life Cycle Management</p> <p>Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle.</p> <p>W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime.</p> <p>Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, see: <a href="http://www.endress.com/lifecyclemanagement">www.endress.com/lifecyclemanagement</a></p>
FieldCare	<p>FDT-based plant asset management tool from Endress+Hauser.</p> <p>It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.</p> <p> Operating Instructions BA00027S and BA00059S</p>
DeviceCare	<p>Tool to connect and configure Endress+Hauser field devices.</p> <p> Innovation brochure IN01047S</p>



## System components

Accessories	Description
Memograph M graphic data manager	<p>The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.</p> <ul style="list-style-type: none"> <li>■ Technical Information TI00133R</li> <li>■ Operating Instructions BA00247R</li> </ul>
Ceraphant PTC31B	<p>The pressure transmitter for measuring the absolute and gauge pressure in gases, steam, liquids and dusts. It can be used to read in the operating pressure value.</p> <ul style="list-style-type: none"> <li>■ Technical Information TI01130P</li> <li>■ Operating Instructions BA01270P</li> </ul>
Cerabar PMC21	<p>The pressure transmitter for measuring the absolute and gauge pressure in gases, steam, liquids and dusts. It can be used to read in the operating pressure value.</p> <ul style="list-style-type: none"> <li>■ Technical Information TI01133P</li> <li>■ Operating Instructions BA01271P</li> </ul>
Cerabar S PMC71	<p>The pressure transmitter for measuring the absolute and gauge pressure of gases, steam and liquids. It can be used to read in the operating pressure value.</p> <ul style="list-style-type: none"> <li>■ Technical Information TI00383P</li> <li>■ Operating Instructions BA00271P</li> </ul>



## Supplementary documentation



For an overview of the scope of the associated Technical Documentation, refer to the following:

- *W@M Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

### Standard documentation

### Brief Operating Instructions

*Brief Operating Instructions for the sensor*

Measuring device	Documentation code
Proline t-mass I	KA01443D

*Brief Operating Instructions for transmitter*

Measuring device	Documentation code	
	HART	Modbus RS485
Proline 300	KA01444D	KA01445D

### Operating Instructions

Measuring device	Documentation code	
	HART	Modbus RS485
t-mass I 300	BA01993D	BA01995D

### Description of Device Parameters

Measuring device	Documentation code	
	HART	Modbus RS485
t-mass 300	GP01143D	GP01144D

### Device-dependent additional documentation

### Safety instructions

Safety instructions for electrical equipment for hazardous areas.

Contents	Documentation code
ATEX/IECEX Ex d/Ex de	XA01965D
ATEX/IECEX Ex ec	XA01966D
cCSAus XP	XA01969D
cCSAus Ex d/ Ex de	XA01967D
cCSAus Ex nA	XA01968D

*Remote display and operating module DKX001*

Contents	Documentation code
ATEX/IECEX Ex i	XA01494D
ATEX/IECEX Ex ec	XA01498D
cCSAus IS	XA01499D
cCSAus Ex nA	XA01513D
INMETRO Ex i	XA01500D



Contents	Documentation code
INMETRO Ex ec	XA01501D
NEPSI Ex i	XA01502D
NEPSI Ex nA	XA01503D

### Functional Safety Manual

Contents	Documentation code
Proline t-mass 300	SD02483D

### Special documentation

Contents	Documentation code	
	HART	Modbus RS485
Functional Safety Manual	SD02483D	–
Heartbeat Technology	SD02478D	SD02478D
Web server	SD02485D	SD02486D

### Installation Instructions

Content	Comment
Installation instructions for spare part sets and accessories	Documentation code: specified for each individual accessory .

## Registered trademarks

#### **HART®**

Registered trademark of the FieldComm Group, Austin, USA

#### **Modbus®**

Registered trademark of SCHNEIDER AUTOMATION, INC.



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