Technical Information
Proline Promass A 300

Coriolis flowmeter

The single-tube flowmeter for smallest flow quantities with a compact, easily accessible transmitter

Application

- Measuring principle operates independently of physical fluid properties such as viscosity or density
- Accurate measurement of smallest quantities of liquids and gases for continuous process control

Device properties

- Nominal diameter: DN 1 to 4 (1/24 to 1/8")
- Process pressure up to 400 bar (5 800 psi)
- Medium temperature up to +205 °C (+401 °F)
- Compact dual-compartment housing with up to 3 I/Os
- Backlit display with touch control and WLAN access
- Remote display available

Your benefits

- Highest process safety – self-drainable measuring tube design
- Fewer process measuring points – multivariable measurement (flow, density, temperature)
- Space-saving installation – no inlet/outlet run needs
- 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

Endress+Hauser
People for Process Automation

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Document information

Symbols used

Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Communication symbols

Symbol	Meaning
	**Wireless Local Area Network (WLAN)** Communication via a wireless, local network.
	**Bluetooth** Wireless data transmission between devices over a short distance.
	**LED** Light emitting diode is off.
	**LED** Light emitting diode is on.
	**LED** Light emitting diode is flashing.

Symbols for certain types of information

Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted.
	**Preferred** Procedures, processes or actions that are preferred.
	**Forbidden** Procedures, processes or actions that are forbidden.
	**Tip** 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 measuring principle is based on the controlled generation of Coriolis forces. These forces are always present in a system when both translational and rotational movements are superimposed.

$F_c = 2 \cdot \Delta m\ (v \cdot \omega)$

F_c = Coriolis force

Δm = moving mass

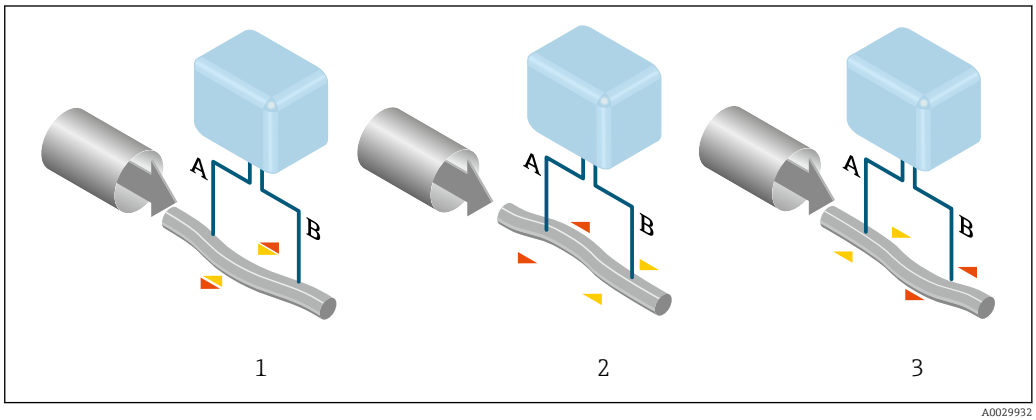
ω = rotational velocity

v = radial velocity in rotating or oscillating system

The amplitude of the Coriolis force depends on the moving mass Δm, its velocity v in the system and thus on the mass flow. Instead of a constant rotational velocity ω, the sensor uses oscillation.

In the sensor, an oscillation is produced in the measuring tube. The Coriolis forces produced at the measuring tube cause a phase shift in the tube oscillations (see illustration):

- If there is zero flow (i.e. when the fluid stands still), the oscillation measured at points A and B has the same phase (no phase difference) (1).
- Mass flow causes deceleration of the oscillation at the inlet of the tubes (2) and acceleration at the outlet (3).



A0029932

The phase difference (A-B) increases with increasing mass flow. Electrodynamic sensors register the tube oscillations at the inlet and outlet. System balance is created by exciting an eccentrically arranged swinging mass to antiphase oscillation. The measuring principle operates independently of temperature, pressure, viscosity, conductivity and flow profile.

Density measurement
The measuring tube is continuously excited at its resonance frequency. A change in the mass and thus the density of the oscillating system (comprising measuring tube and fluid) results in a corresponding, automatic adjustment in the oscillation frequency. Resonance frequency is thus a function of medium density. The microprocessor utilizes this relationship to obtain a density signal.

Volume measurement
Together with the measured mass flow, this is used to calculate the volume flow.

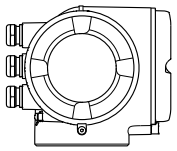
Temperature measurement
The temperature of the measuring tube is determined in order to calculate the compensation factor due to temperature effects. This signal corresponds to the process temperature and is also available as an output signal.

Measuring system

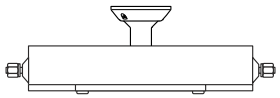
The device consists of a transmitter and a sensor.

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

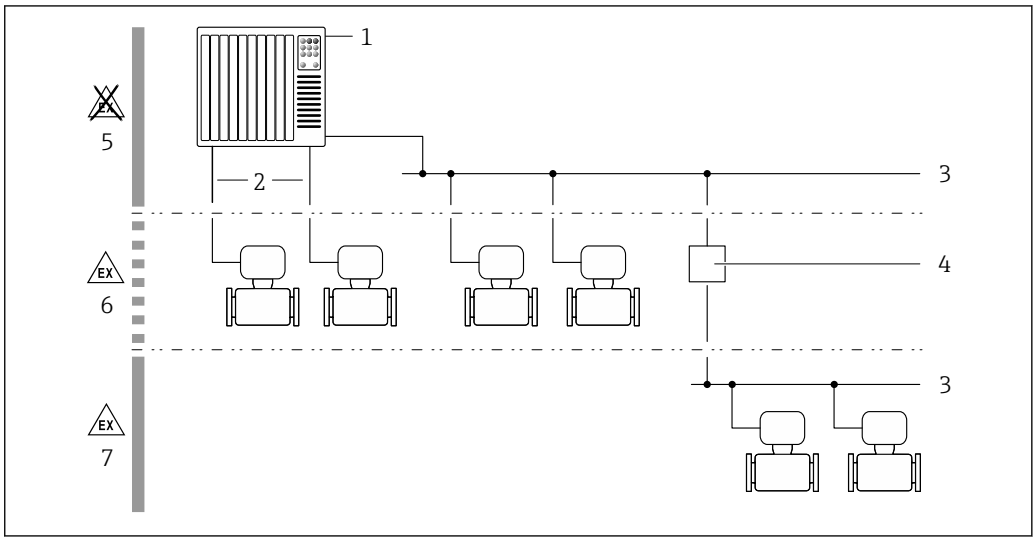
Transmitter

Promass 300  A0026708	Device versions and materials: ▪ Transmitter housing Aluminum, coated: aluminum, AlSi10Mg, coated ▪ Material of window in transmitter housing: Aluminum, coated: glass Configuration: ▪ External operation via 4-line, backlit, graphic local display with touch control and guided menus ("Make-it-run" wizards) for application-specific commissioning. ▪ Via service interface or WLAN interface: – Operating tools (e.g. FieldCare, DeviceCare) – Web server (access via Web browser, e.g. Microsoft Internet Explorer, Microsoft Edge)

Sensor

Promass A  A0026711	▪ Single-tube system for high-precision measurement of minimum flow rates ▪ Simultaneous measurement of flow, volume flow, density and temperature (multivariable) ▪ Immune to process influences ▪ Nominal diameter range: DN 1 to 4 (1/24 to 1/8 ") ▪ Materials: – Sensor: stainless steel, 1.4301 (304) – Measuring tube: stainless steel, 1.4539 (904L); Alloy C22, 2.4602 (UNS N06022) – Process connections: stainless steel, 1.4404 (316/316L); stainless steel, 1.4539 (904L); Alloy C22, 2.4602 (UNS N06022)

Equipment architecture



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 *Segment coupler*
5 *Non-hazardous area*
6 *Non-hazardous area and Zone 2/Div. 2*
7 *Hazardous area and Zone 1/Div. 1*

Safety

IT security

We only provide a warranty 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 device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

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.

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). Is equivalent to hardware write protection in terms of functionality.
- 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.

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.

When the device is delivered, the device does not have an access code and is equivalent to *0000* (open).

WLAN passphrase

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 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.

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 fieldbus

When communicating via fieldbus, access to the device parameters can be restricted to *"Read only"* access. The option can be changed in the **Fieldbus writing access** parameter.

This does not affect cyclic measured value transmission to the higher-order system, which is always guaranteed.

Additional information: "Description of Device Parameters" document pertaining to the device → 86.

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.

Additional information: "Description of Device Parameters" document pertaining to the device → 86.

Input

Measured variable

Direct measured variables

- Mass flow
- Density
- Temperature

Calculated measured variables

- Volume flow
- Corrected volume flow
- Reference density

Measuring range

Measuring ranges for liquids

DN		Measuring range full scale values $\dot{m}_{min(F)}$ to $\dot{m}_{max(F)}$	
[mm]	[in]	[kg/h]	[lb/min]
1	1/24	0 to 20	0 to 0.735
2	1/12	0 to 100	0 to 3.675
4	1/8	0 to 450	0 to 16.54

Measuring ranges for gases

The full scale values depend on the density of the gas and can be calculated with the formula below:
$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_G : x$

$\dot{m}_{max(G)}$	Maximum full scale value for gas [kg/h]
$\dot{m}_{max(F)}$	Maximum full scale value for liquid [kg/h]
$\dot{m}_{max(G)} < \dot{m}_{max(F)}$	$\dot{m}_{max(G)}$ can never be greater than $\dot{m}_{max(F)}$
ρ_G	Gas density in [kg/m³] at operating conditions
x	Constant dependent on nominal diameter

DN		x
[mm]	[in]	[kg/m³]
1	1/24	32
2	1/12	32
4	1/8	32

To calculate the measuring range, use the *Applicator* sizing tool → 84

Calculation example for gas

- Sensor: Promass A, DN 2
- Gas: Air with a density of 11.9 kg/m³ (at 20 °C and 10 bar)
- Measuring range (liquid): 100 kg/h
- x = 32 kg/m³ (for Promass A DN 2)

Maximum possible full scale value:
$\dot{m}_{max(G)} = \dot{m}_{max(F)} \cdot \rho_G : x = 100 \text{ kg/h} \cdot 11.9 \text{ kg/m}^3 : 32 \text{ kg/m}^3 = 37.2 \text{ kg/h}$

Recommended measuring range

"Flow limit" section → 48

Operable flow range

Over 1000 : 1.

Flow rates above the preset full scale value do not override the electronics unit, with the result that the totalizer values are registered correctly.

Input signal

Input and output versions

→ 🖹 12

External measured values

To increase the accuracy of certain measured variables or to calculate the corrected volume flow for gases, the automation system can continuously write different measured values to the measuring device:
- Operating pressure to increase accuracy (Endress+Hauser recommends the use of a pressure measuring device for absolute pressure, e.g. Cerabar M or Cerabar S)
- Fluid temperature to increase accuracy (e.g. iTEMP)
- Reference density for calculating the corrected volume flow for gases

Various pressure transmitters and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section → 🖹 85

It is recommended to read in external measured values to calculate the following measured variables for gases:
- Mass flow
- Corrected volume flow

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 → 🖹 10.

Digital communication

The measured values can be written from the automation system to the measuring via:
- FOUNDATION Fieldbus
- PROFIBUS PA
- Modbus RS485

Current input 0/4 to 20 mA

Current input	0/4 to 20 mA (active/passive)
Current span	▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
Resolution	1 µA
Voltage drop	Typically: 0.6 to 2 V for 3.6 to 22 mA (passive)
Maximum input voltage	≤ 30 V (passive)
Open-circuit voltage	≤ 28.8 V (active)
Possible input variables	▪ Pressure ▪ Temperature ▪ Density

Status input

Maximum input values	▪ DC −3 to 30 V ▪ If status input is active (ON): R_i >3 kΩ
Response time	Adjustable: 5 to 200 ms

Input signal level	▪ Low signal: DC −3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	▪ Off ▪ Reset the individual totalizers separately ▪ Reset all totalizers ▪ Flow override

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 table must be read vertically (↓).

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

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	↓	**CA**					
FOUNDATION Fieldbus		↓	**SA**				
FOUNDATION Fieldbus Ex i			↓	**TA**			
PROFIBUS PA				↓	**GA**		
PROFIBUS PA Ex i					↓	**HA**	
Modbus RS485						↓	**MA**
Order code for "Output; input 2" (021) →	↓	↓	↓	↓	↓	↓	↓
Not assigned	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Current output 0/4 to 20 mA	**B**		**B**		**B**		**B**
Current output 0/4 to 20 mA (Ex i)		**C**		**C**		**C**	
User configurable input/output [1]	**D**		**D**		**D**		**D**
Pulse/frequency/switch output	**E**		**E**		**E**		**E**
Double pulse output [2]	**F**						**F**
Pulse/frequency/switch output (Ex i)		**G**		**G**		**G**	
Relay output	**H**		**H**		**H**		**H**
Current input 0/4 to 20 mA	**I**		**I**		**I**		**I**
Status input	**J**		**J**		**J**		**J**
Order code for "Output; input 3" (022) →	↓	↓	↓	↓	↓	↓	↓
Not assigned	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Current output 0/4 to 20 mA	**B**						**B**
Current output 0/4 to 20 mA (Ex i)		**C**					
User configurable input/output	**D**						**D**
Pulse/frequency/switch output	**E**						**E**
Double pulse output (slave) [2]	**F**						**F**
Pulse/frequency/switch output (Ex i)		**G**					
Relay output	**H**						**H**
Current input 0/4 to 20 mA	**I**						**I**
Status input	**J**						**J**

1) A specific input or output can be assigned to a user configurable input/output → 16.
2) If double pulse output (F) is selected for output/input 2 (021), only the double pulse output (F) option is available for selection for output/input 3 (022).

Output signal

HART current output

Current output	4 to 20 mA HART
Current span	Can be set to: 4 to 20 mA (active/passive)
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	250 to 700 Ω
Resolution	0.38 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature The range of options increases if the measuring device has one or more application packages.

PROFIBUS PA

PROFIBUS PA	In accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
Data transfer	31.25 KBit/s
Current consumption	10 mA
Permitted supply voltage	9 to 32 V
Bus connection	With integrated reverse polarity protection

FOUNDATION Fieldbus

FOUNDATION Fieldbus	H1, IEC 61158-2, galvanically isolated
Data transfer	31.25 KBit/s
Current consumption	10 mA
Permitted supply voltage	9 to 32 V
Bus connection	With integrated reverse polarity protection

Modbus RS485

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

Current output 0/4 to 20 mA

Current output	0/4 to 20 mA
Maximum output values	22.5 mA
Current span	Can be set to: ▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)

Load	0 to 700 Ω
Resolution	0.38 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature The range of options increases if the measuring device has one or more application packages.

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Open collector Can be set to: ▪ Active ▪ Passive
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: ≤ DC 2 V
Pulse output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Pulse width	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature
Frequency output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Output frequency	Adjustable: end value frequency 2 to 10 000 Hz (f_{max} = 12 500 Hz)
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature The range of options increases if the measuring device has one or more application packages.
Switch output	
Maximum input values	DC 30 V, 250 mA (passive)

Open-circuit voltage	DC 28.8 V (active)
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value – Mass flow – Volume flow – Corrected volume flow – Density – Reference density – Temperature – Totalizer 1-3 ▪ Flow direction monitoring ▪ Status – Partially filled pipe detection – Low flow cut off The range of options increases if the measuring device has one or more application packages.

Double pulse output

Function	Double pulse
Version	Open collector Can be set to: ▪ Active ▪ Passive
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: ≤ DC 2 V
Output frequency	Adjustable: 0 to 1 000 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature The range of options increases if the measuring device has one or more application packages.

Relay output

Function	Switch output
Version	Relay output, galvanically isolated
Switching behavior	Can be set to: ▪ NO (normally open), factory setting ▪ NC (normally closed)

Maximum switching capacity (passive)	▪ DC 30 V, 0.1 A ▪ AC 30 V, 0.5 A
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value – Mass flow – Volume flow – Corrected volume flow – Density – Reference density – Temperature – Totalizer 1-3 ▪ Flow direction monitoring ▪ Status – Partially filled pipe detection – Low flow cut off The range of options increases if the measuring device has one or more application packages.

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

PROFIBUS PA

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02
Error current FDE (Fault Disconnection Electronic)	0 mA

FOUNDATION Fieldbus

Status and alarm messages	Diagnostics in accordance with FF-891
Error current FDE (Fault Disconnection Electronic)	0 mA

Modbus RS485

Failure mode	Choose from: ▪ NaN value instead of current value ▪ Last valid value

Current output 0/4 to 20 mA

4 to 20 mA

Failure mode	Choose from: ▪ 4 to 20 mA in accordance with NAMUR recommendation NE 43 ▪ 4 to 20 mA in accordance with US ▪ Min. value: 3.59 mA ▪ Max. value: 22.5 mA ▪ Freely definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

0 to 20 mA

Failure mode	Choose from: ▪ Maximum alarm: 22 mA ▪ Freely definable value between: 0 to 20.5 mA

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Defined value (f_{max} 2 to 12 500 Hz)
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Relay output

Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Local display

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

Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication:
  - HART protocol
  - FOUNDATION Fieldbus
  - PROFIBUS PA
  - Modbus RS485
- Via service interface

Plain text display	With information on cause and remedial measures

Additional information on remote operation → 73

Web server

Plain text display	With information on cause and remedial measures

Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes The following information is displayed depending on the device version: ▪ Supply voltage active ▪ Data transmission active ▪ Device alarm/error has occurred

Ex connection data

Safety-related values

Order code for "Output; input 1"	Output type	Safety-related values "Output; input 1"	
		26 (+)	27 (–)
Option **BA**	Current output 4 to 20 mA HART	U_{nom} = 30 V U_{max} = 250 V	
Option **GA**	PROFIBUS PA	U_{nom} = 32 V U_{max} = 250 V	
Option **MA**	Modbus RS485	U_{nom} = 30 V U_{max} = 250 V	
Option **SA**	FOUNDATION Fieldbus	U_{nom} = 32 V U_{max} = 250 V	

Order code for "Output; input 2"; "Output; input 3"	Output type	Safety-related values			
		Output; input 2		Output; input 3	
		24 (+)	25 (–)	22 (+)	23 (–)
Option **B**	Current output 4 to 20 mA	U_{nom} = 30 V U_{max} = 250 V			
Option **D**	User configurable input/ output	U_{nom} = 30 V U_{max} = 250 V			
Option **E**	Pulse/frequency/switch output	U_{nom} = 30 V U_{max} = 250 V			
Option **F**	Double pulse output	U_{nom} = 30 V U_{max} = 250 V			
Option **H**	Relay output	U_{nom} = 30 V I_{nom} = 100 mA DC/500 mA AC U_{max} = 250 V			
Option **I**	Current input 4 to 20 mA	U_{nom} = 30 V U_{max} = 250 V			
Option **J**	Status input	U_{nom} = 30 V U_{max} = 250 V			

Intrinsically safe values

Order code for "Output; input 1"	Output type	Intrinsically safe values "Output; input 1"	
		26 (+)	27 (–)
Option **CA**	Current output 4 to 20 mA HART Ex i	U_i = 30 V I_i = 100 mA P_i = 1.25 W L_i = 0 C_i = 0	
Option **HA**	PROFIBUS PA Ex i	**Ex ia** [1] U_i = 30 V I_i = 570 mA P_i = 8.5 W L_i = 10 µH C_i = 5 nF	**Ex ic** [2] U_i = 32 V I_i = 570 mA P_i = 8.5 W L_i = 10 µH C_i = 5 nF
Option **TA**	FOUNDATION Fieldbus Ex i	**Ex ia** [1] U_i = 30 V I_i = 570 mA P_i = 8.5 W L_i = 10 µH C_i = 5 nF	**Ex ic** [2] U_i = 32 V I_i = 570 mA P_i = 8.5 W L_i = 10 µH C_i = 5 nF

1) Only available for the Zone 1, Class I, Division 1 version
2) Only available for the Zone 2, Class I, Division 2 version transmitter

Order code for "Output; input 2"; "Output; input 3"	Output type	Intrinsically safe values			
		Output; input 2		Output; input 3	
		24 (+)	25 (–)	22 (+)	23 (–)
Option **C**	Current output 4 to 20 mA Ex i	U_i = 30 V I_i = 100 mA P_i = 1.25 W L_i = 0 C_i = 0			
Option **G**	Pulse/frequency/switch output Ex i	U_i = 30 V I_i = 100 mA P_i = 1.25 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	0x3B
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	Min. 250 Ω

Dynamic variables	Read out the dynamic variables: HART command 3 The measured variables can be freely assigned to the dynamic variables. **Measured variables for PV (primary dynamic variable)** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Density ▪ Reference density ▪ Temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 The range of options increases if the measuring device has one or more application packages. **Heartbeat Technology Application Package** Additional measured variables are available with the Heartbeat Technology application package: Oscillation amplitude 0 Heartbeat Technology Special Documentation → 86
Device variables	Read out the device variables: HART command 9 The device variables are permanently assigned. A maximum of 8 device variables can be transmitted: ▪ 0 = mass flow ▪ 1 = volume flow ▪ 2 = corrected volume flow ▪ 3 = density ▪ 4 = reference density ▪ 5 = temperature ▪ 6 = totalizer 1 ▪ 7 = totalizer 2 ▪ 8 = totalizer 3 ▪ 13 = target mass flow ▪ 14 = carrier mass flow ▪ 15 = concentration

PROFIBUS PA

Manufacturer ID	0x11
Ident number	0x156D
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ www.endress.com ▪ www.profibus.org

Output values (from measuring device to automation system)	**Analog input 1 to 8** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Carrier mass flow ▪ Target mass flow ▪ Density ▪ Reference density ▪ Concentration ▪ Temperature ▪ Carrier pipe temperature ▪ Electronic temperature ▪ Current input The range of options increases if the measuring device has one or more application packages. **Heartbeat Technology Application Package** Additional measured variables are available with the Heartbeat Technology application package: ▪ Oscillation frequency 0 ▪ Frequency fluctuation 0 ▪ Oscillation amplitude 0 ▪ Oscillation damping 0 ▪ Oscillation damping fluctuation 0 ▪ Exciter current 0 Heartbeat Technology Special Documentation → 86 **Digital input 1 to 2** ▪ Empty pipe detection ▪ Low flow cut off ▪ Status verification **Totalizer 1 to 3** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow ▪ Carrier mass flow
Input values (from automation system to measuring device)	**Analog output 1 to 3 (fixed assignment)** ▪ Analog output 1: external pressure ▪ Analog output 2: external temperature ▪ Analog output 3: external reference density **Digital output 1 to 4: (fixed assignment)** ▪ Digital output 1: switch positive zero return on/off ▪ Digital output 2: switch zero point adjustment on/off ▪ Digital output 3: start verification ▪ Digital output 4: relay output non-conductive/conductive **Totalizer 1 to 3** ▪ Totalize ▪ Reset and hold ▪ Preset and hold ▪ Operating mode configuration: – Net flow total – Forward flow total – Reverse flow total – Last valid value
Supported functions	▪ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ▪ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ▪ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur

Configuration of the device address	▪ DIP switches on the I/O electronics module ▪ Local display ▪ Via operating tools (e.g. FieldCare)
Compatibility with earlier model	If the device is replaced, the Promass 300 measuring device supports the compatibility of the cyclic data with earlier models. It is not necessary to adjust the engineering parameters of the PROFIBUS network with the Promass 300 GSD file. Earlier models: ▪ Promass 80 PROFIBUS PA – ID No.: 1528 (hex) – Extended GSD file: EH3x1528.gsd – Standard GSD file: EH3_1528.gsd ▪ Promass 83 PROFIBUS PA – ID No.: 152A (hex) – Extended GSD file: EH3x152A.gsd – Standard GSD file: EH3_152A.gsd Description of the function scope of compatibility: Operating Instructions → 86.

FOUNDATION Fieldbus

Manufacturer ID	0x452B48
Ident number	0x103B
Device revision	1
DD revision	Information and files under: ▪ www.endress.com ▪ www.fieldbus.org
CFF revision	
Interoperability Test Kit (ITK)	Version 6.1.2
ITK Test Campaign Number	Information: ▪ www.endress.com ▪ www.fieldbus.org
Link Master capability (LAS)	Yes
Choice of "Link Master" and "Basic Device"	Yes Factory setting: Basic Device
Node address	Factory setting: 247 (0xF7)
Supported functions	The following methods are supported: ▪ Restart ▪ ENP Restart ▪ Diagnostic
Virtual Communication Relationships (VCRs)	
Number of VCRs	44
Number of link objects in VFD	50
Permanent entries	1
Client VCRs	0
Server VCRs	10
Source VCRs	43
Sink VCRs	0
Subscriber VCRs	43
Publisher VCRs	43
Device Link Capabilities	
Slot time	4
Min. delay between PDU	8
Max. response delay	20

Transducer Blocks

Block	Contents	Output values
Setup Transducer Block (TRDSUP)	All parameters for standard commissioning.	No output values
Advanced Setup Transducer Block (TRDASUP)	All parameters for more accurate measurement configuration.	No output values
Display Transducer Block (TRDDISP)	Parameters for configuring the local display.	No output values
HistoROM Transducer Block (TRDHROM)	Parameters for using the HistoROM function.	No output values
Diagnostic Transducer Block (TRDDIAG)	Diagnostics information.	Process variables (AI Channel) ▪ Temperature (7) ▪ Volume flow (9) ▪ Concentration (10) ▪ Mass flow (11) ▪ Corrected volume flow (13) ▪ Density (14) ▪ Reference density (15) ▪ Carrier pipe temperature (51) ▪ Carrier mass flow (57) ▪ Target mass flow (58) ▪ Electronic temperature (65) ▪ Current input 1 (99)
Expert Configuration Transducer Block (TRDEXP)	Parameters that require the user to have in-depth knowledge of the operation of the device in order to configure the parameters appropriately.	No output values
Expert Information Transducer Block (TRDEXPIN)	Parameters that provide information about the state of the device.	No output values
Service Sensor Transducer Block (TRDSRVS)	Parameters that can only be accessed by Endress +Hauser Service.	No output values
Service Information Transducer Block (TRDSRVIF)	Parameters that provide Endress+Hauser Service with information about the state of the device.	No output values
Total Inventory Counter Transducer Block (TRDTIC)	Parameters for configuring all the totalizers and the inventory counter.	Process variables (AI Channel) ▪ Totalizer 1 (16) ▪ Totalizer 2 (17) ▪ Totalizer 3 (18)
Heartbeat Technology Transducer Block (TRDHBT)	Parameters for the configuration and comprehensive information about the results of the verification.	No output values
Heartbeat Results 1 Transducer Block (TRDHBTR1)	Information about the results of the verification.	No output values
Heartbeat Results 2 Transducer Block (TRDHBTR2)	Information about the results of the verification.	No output values
Heartbeat Results 3 Transducer Block (TRDHBTR3)	Information about the results of the verification.	No output values
Heartbeat Results 4 Transducer Block (TRDHBTR4)	Information about the results of the verification.	No output values

Function blocks

Block	Number blocks	Execution times	Process variables (Channel)
Resource Block (RB)	1	This Block (extended functionality) contains all the data that uniquely identify the device; it is the equivalent of an electronic nameplate for the device.	–
Analog Input Block (AI)	8	7 ms	Process variables (AI Channel) ▪ Temperature (7) ▪ Volume flow (9) ▪ Concentration (10) ▪ Mass flow (11) ▪ Corrected volume flow (13) ▪ Density (14) ▪ Reference density (15) ▪ Totalizer 1 (16) ▪ Totalizer 2 (17) ▪ Totalizer 3 (18) ▪ Carrier pipe temperature (51) ▪ Carrier mass flow (57) ▪ Target mass flow (58) ▪ Electronic temperature (65) ▪ Current input 1 (99)
Discrete Input Block (DI)	2	5 ms	▪ Switch output state (101) ▪ Low flow cut off (103) ▪ Empty pipe detection (104) ▪ Status verification (105)
PID Block (PID)	1	6 ms	–
Multiple Analog Output Block (MAO)	1	5 ms	Channel_0 (121) ▪ Value 1: External compensation variable, pressure ▪ Value 2: External compensation variable, temperature ▪ Value 3: External compensation variable, reference density The compensation variables must be transmitted to the device in the SI basic units.
Multiple Digital Output Block (MDO)	1	5 ms	Channel_DO (122) ▪ Value 1: Reset totalizer 1 ▪ Value 2: Reset totalizer 2 ▪ Value 3: Reset totalizer 3 ▪ Value 4: Flow override ▪ Value 5: Start heartbeat verification ▪ Value 6: Status switch output ▪ Value 7: Start zero point adjustment ▪ Value 8: Not assigned
Integrator Block (IT)	1	6 ms	–

Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
Response times	▪ Direct data access: typically 25 to 50 ms ▪ Auto-scan buffer (data range): typically 3 to 5 ms
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 08: Diagnostics ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	▪ 1 200 BAUD ▪ 2 400 BAUD ▪ 4 800 BAUD ▪ 9 600 BAUD ▪ 19 200 BAUD ▪ 38 400 BAUD ▪ 57 600 BAUD ▪ 115 200 BAUD
Data transfer mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information
Compatibility with earlier model	If the device is replaced, the Promass 300 measuring device supports the compatibility of the Modbus registers for process variables and diagnostic information with the earlier Promass 83 model. It is not necessary to change the engineering parameters in the automation system. Description of the function scope of compatibility: Operating Instructions → 86.

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 → 12.					

FOUNDATION Fieldbus

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (–)	26 (A)	27 (B)	24 (+)	25 (–)	22 (+)	23 (–)
		The terminal assignment depends on the specific device version ordered → 12.					

PROFIBUS PA

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 → 12.					

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 → 12.					

Terminal assignment of the remote display and operating module: → 28

Device plugs available

Device plugs may not be used in hazardous areas!

Device plugs are only available for the following device versions:
Order code for "Input; output 1"
- Option GA "PROFIBUS PA" → 26
- Option SA "FOUNDATION Fieldbus" → 26

Order code for "Input; output 1", option GA "PROFIBUS PA"

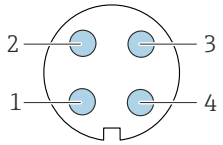
Order code for "Electrical connection"	Cable entry 2	Cable entry 3
L, N, P, U	Plug M12 × 1	–

Order code for "Input; output 1", option SA "FOUNDATION Fieldbus"

Order code for "Electrical connection"	Cable entry 2	Cable entry 3
M, 3, 4, 5	7/8" plug	–

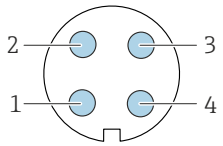
Pin assignment, device plug

PROFIBUS PA



Pin	Assignment		Coding	Plug/socket
1	+	PROFIBUS PA +	A	Plug
2		Grounding		
3	-	PROFIBUS PA –		
4		Not assigned		

FOUNDATION Fieldbus



Pin	Assignment		Coding	Plug/socket
1	+	Signal +	A	Plug
2	-	Signal –		
3		Grounding		
4		Not assigned		

Supply voltage

Order code for "Power supply"	terminal voltage		Frequency range
Option **D**	DC 24 V	±20%	–
Option **E**	AC100 to 240 V	−15…+10%	50/60 Hz
Option **I**	DC 24 V	±20%	–
	AC100 to 240 V	−15…+10%	50/60 Hz

Power consumption

Transmitter

Max. 10 W (active power)

Current consumption

Transmitter

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

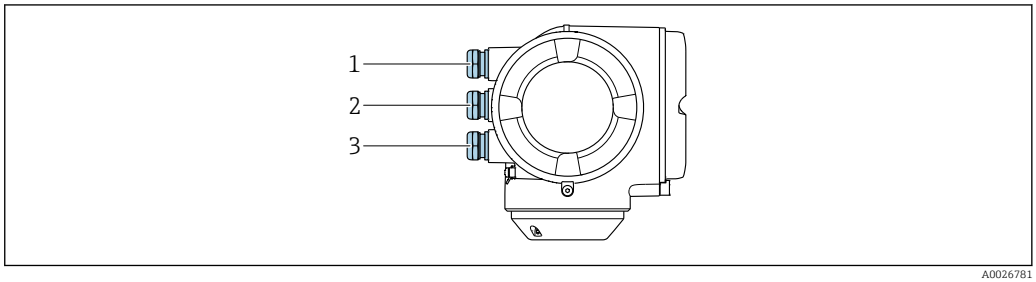
Power supply failure

- Totalizers stop at the last value measured.
- Configuration is retained in the plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection

Connecting the transmitter

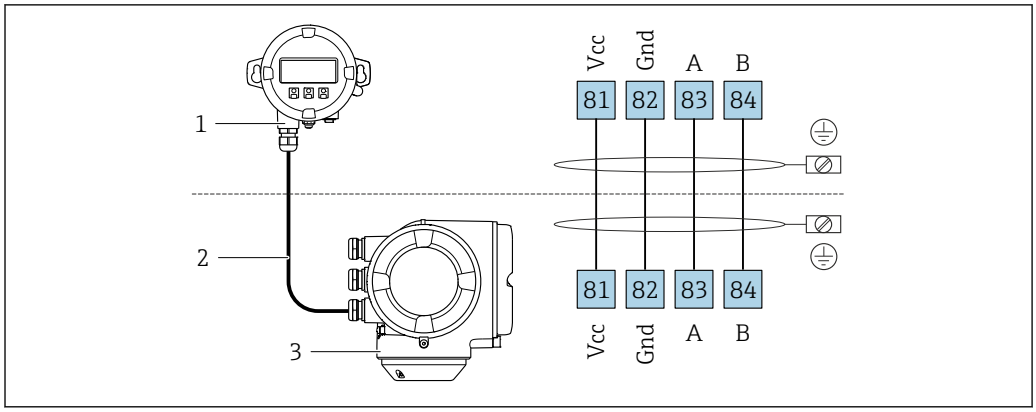
- Terminal assignment→ 25
- Device plugs available→ 26



A0026781

1 Cable entry for supply voltage
2 Cable entry for input/output signal transmission
3 Cable entry for input/output signal transmission; Optional: connection of external WLAN antenna, connection of remote display and operating module DKX001 or service plug

Connection of remote display and operating module DKX001

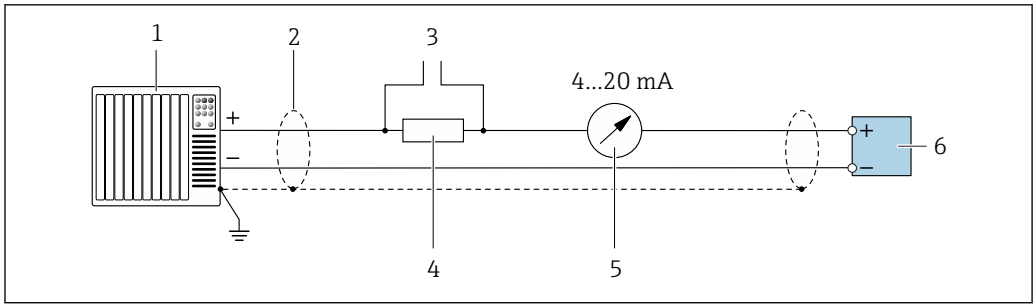


1 Remote display and operating module DKX001
2 Connecting cable
3 Measuring device

Remote display and operating module DKX001 → 🖹 83

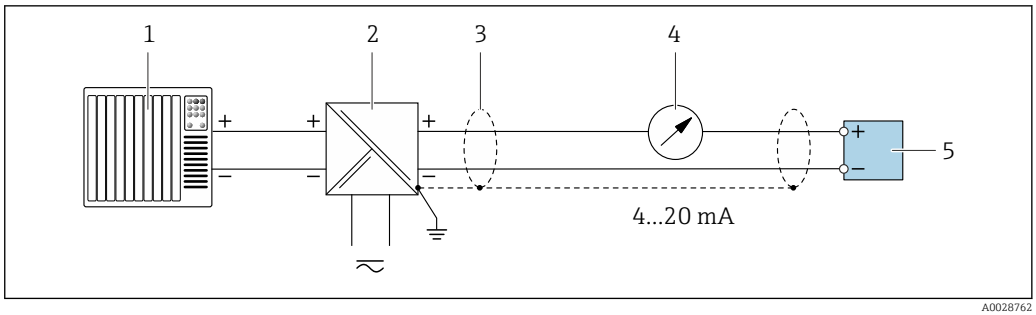
Connection examples

Current output 4 to 20 mA HART



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

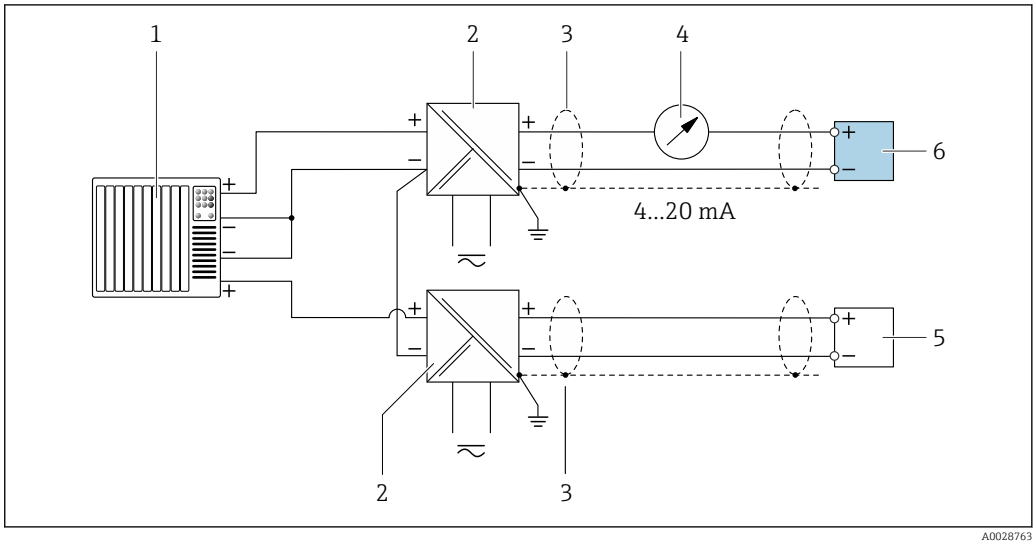
1 Automation system with current input (e.g. PLC)
2 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 🖹 35
3 Connection for HART operating devices → 🖹 73
4 Resistor for HART communication (≥ 250 Ω): observe maximum load → 🖹 13
5 Analog display unit: observe maximum load → 🖹 13
6 Transmitter



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: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 35*
4 *Analog display unit: observe maximum load → 13*
5 *Transmitter*

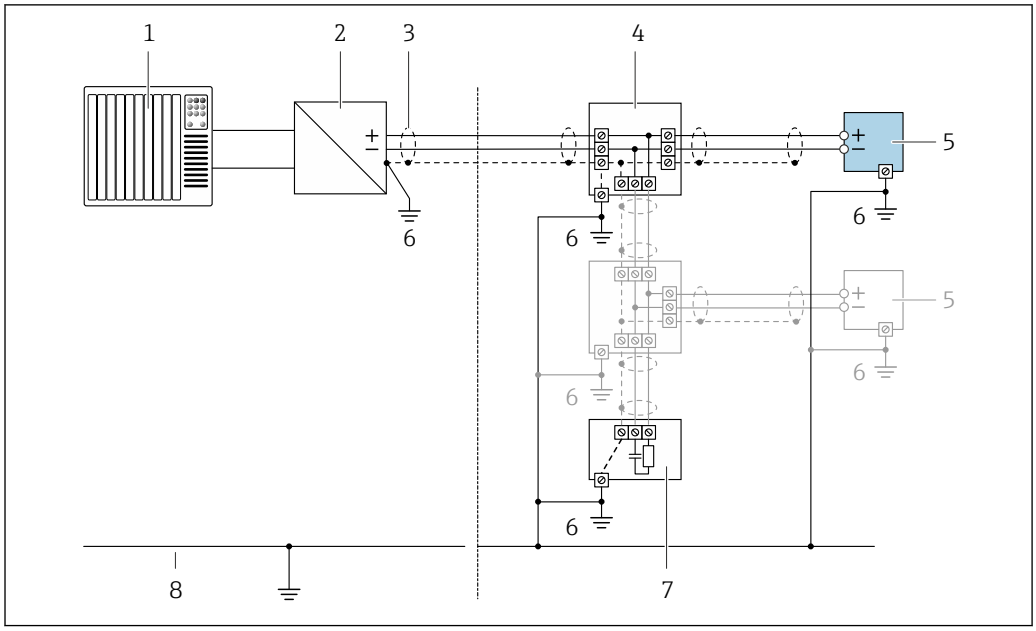
HART input



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: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load*
5 *Pressure transmitter (e.g. Cerabar M, Cerabar S): see requirements*
6 *Transmitter*

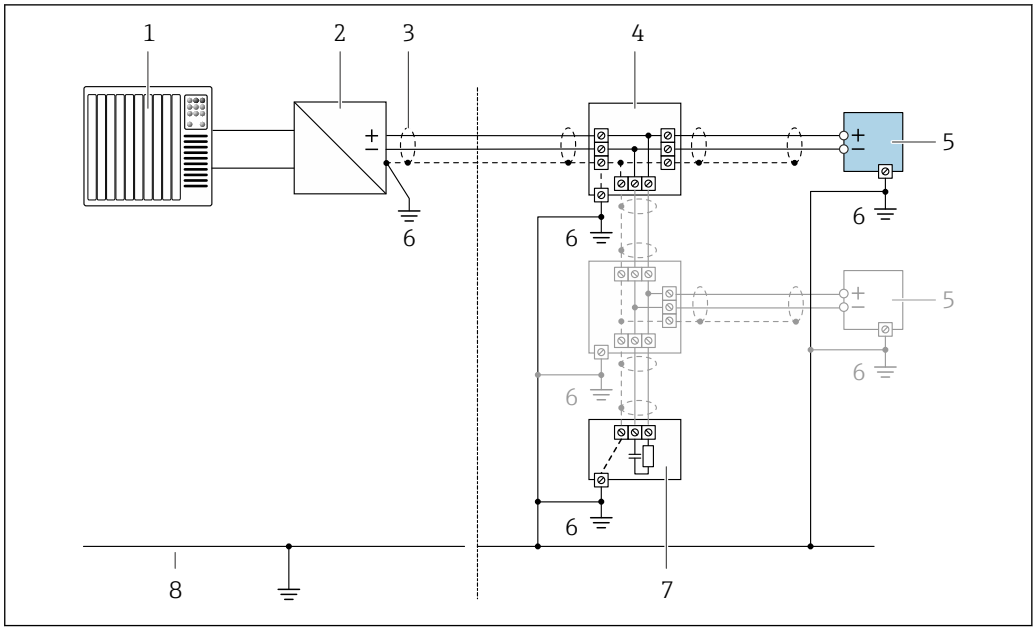
PROFIBUS-PA



5 Connection example for PROFIBUS-PA

1 *Control system (e.g. PLC)*
2 *PROFIBUS PA segment coupler*
3 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *T-box*
5 *Measuring device*
6 *Local grounding*
7 *Bus terminator*
8 *Potential matching line*

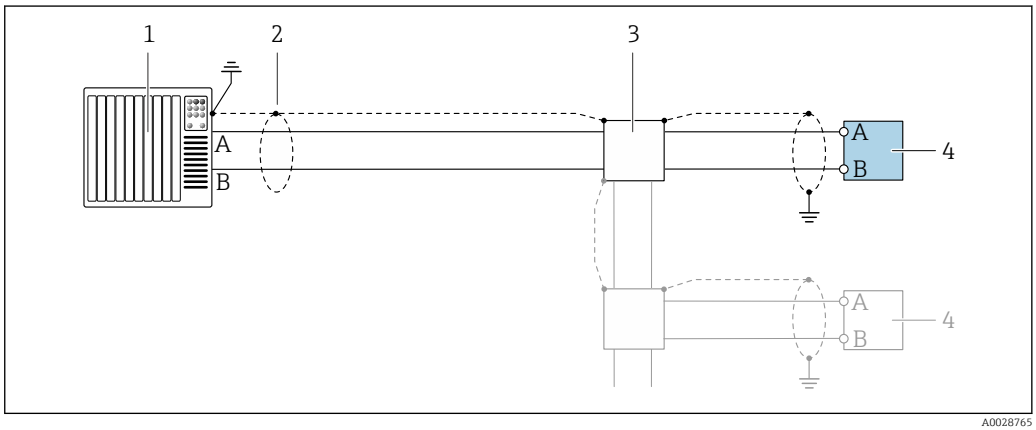
FOUNDATION Fieldbus



6 *Connection example for FOUNDATION Fieldbus*

1 *Control system (e.g. PLC)*
2 *Power Conditioner (FOUNDATION Fieldbus)*
3 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *T-box*
5 *Measuring device*
6 *Local grounding*
7 *Bus terminator*
8 *Potential matching line*

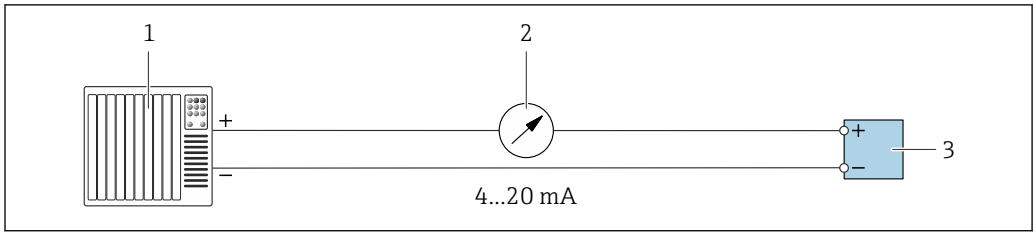
Modbus RS485



7 *Connection example for Modbus RS485, non-hazardous area and Zone 2/Div. 2*

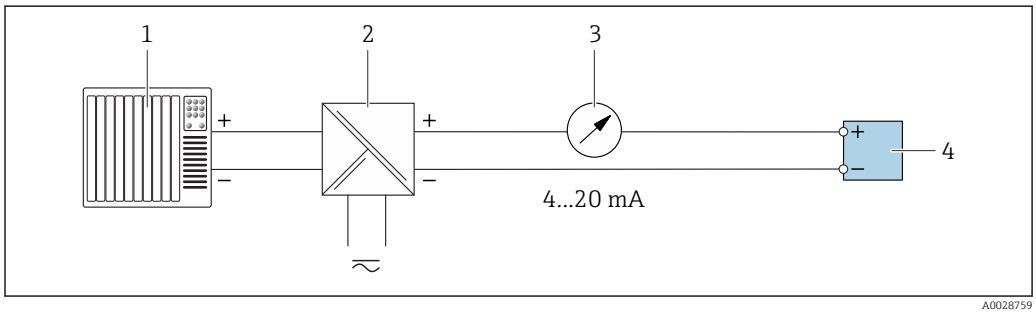
1 *Control system (e.g. PLC)*
2 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
3 *Distribution box*
4 *Transmitter*

Current output 4-20 mA



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

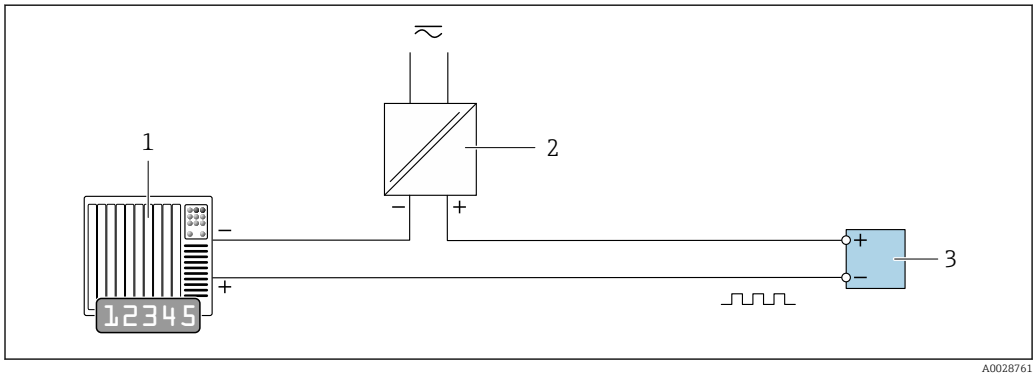
1 Automation system with current input (e.g. PLC)
2 Analog display unit: observe maximum load
3 Transmitter



9 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
4 Transmitter

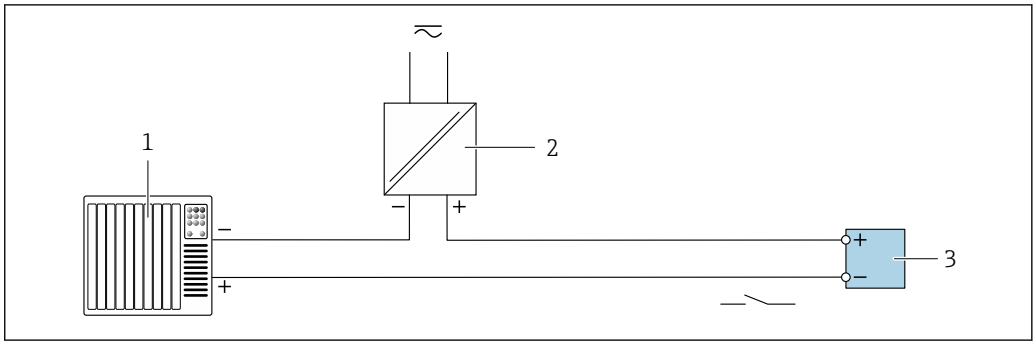
Pulse/frequency output



10 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 → 14

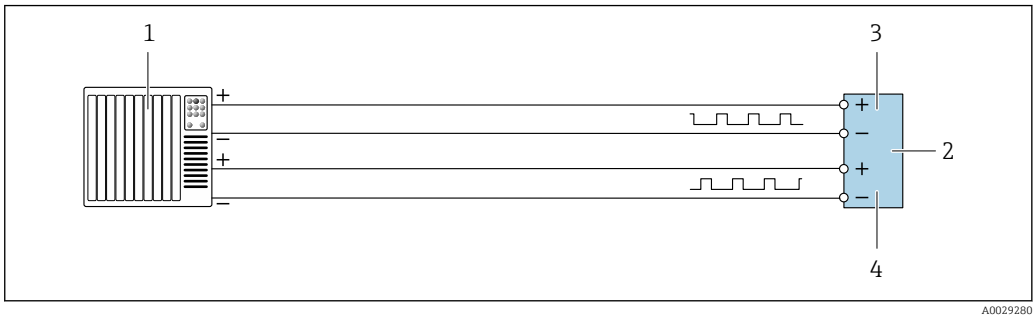
Switch output



11 Connection example for switch output (passive)

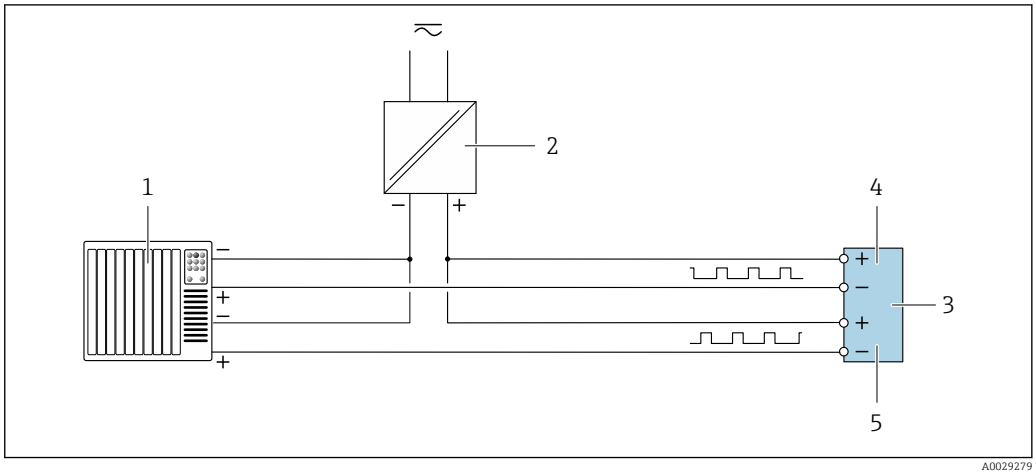
1 Automation system with switch input (e.g. PLC)
2 Power supply
3 Transmitter: Observe input values → 14

Double pulse output



12 Connection example for double pulse output (active)

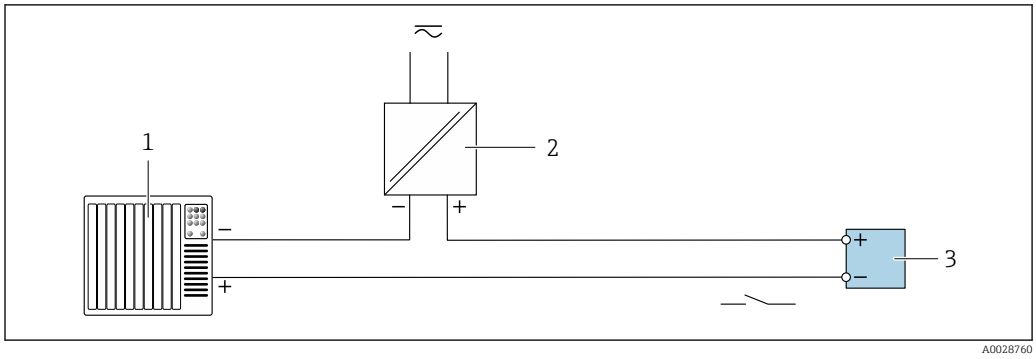
1 Automation system with double pulse input (e.g. PLC)
2 Transmitter: Observe input values → 15
3 Double pulse output
4 Double pulse output (slave), phase-shifted



13 Connection example for double pulse output (passive)

1 Automation system with double pulse input (e.g. PLC)
2 Power supply
3 Transmitter: Observe input values → 15
4 Double pulse output
5 Double pulse output (slave), phase-shifted

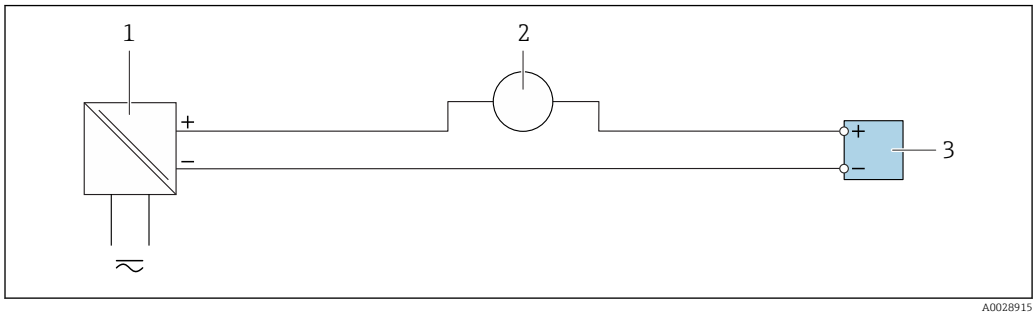
Relay output



14 Connection example for relay output (passive)

1 Automation system with relay input (e.g. PLC)
2 Power supply
3 Transmitter: Observe input values → 15

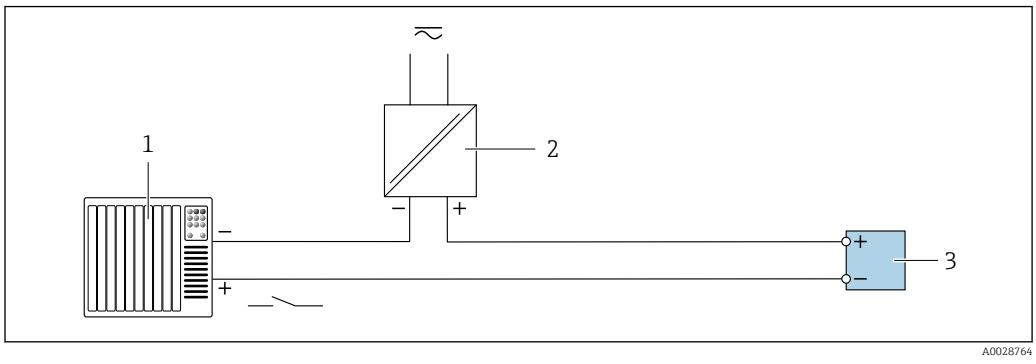
Current input



15 Connection example for 4 to 20 mA current input

1 Power supply
2 External measuring device (for reading in pressure or temperature, for instance)
3 Transmitter: Observe input values

Status input



16 Connection example for status input

1 Automation system with status output (e.g. PLC)
2 Power supply
3 Transmitter: Observe input values

Potential equalization

Requirements

No special measures for potential equalization are required.

Terminals

Transmitter

Spring terminals for conductor cross-section 0.2 to 2.5 mm² (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
- Device plug for digital communication: M12
  Only available for certain device versions → 📄 26.

Cable specification

Permitted temperature range

Minimum requirement: cable temperature range ≥ ambient temperature +20 K

Power supply cable

Standard installation cable is sufficient.

Protective ground cable

Cable: 2.1 mm² (14 AWG)

The grounding impedance must be less than 1 Ω.

Signal cable

Current output 4 to 20 mA HART

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

PROFIBUS PA

Twisted, shielded two-wire cable. Cable type A is recommended .

For further information on planning and installing PROFIBUS PA networks see:

- Operating Instructions "PROFIBUS DP/PA: Guidelines for planning and commissioning" (BA00034S)
- PNO Directive 2.092 "PROFIBUS PA User and Installation Guideline"
- IEC 61158-2 (MBP)

FOUNDATION Fieldbus

Twisted, shielded two-wire cable.

For further information on planning and installing FOUNDATION Fieldbus networks see:

- Operating Instructions for "FOUNDATION Fieldbus Overview" (BA00013S)
- FOUNDATION Fieldbus Guideline
- IEC 61158-2 (MBP)

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.

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm² (22 AWG)
Cable type	Twisted pairs
Loop resistance	≤110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	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.

Double pulse 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.

Standard cable	4 cores (2 pairs); pair-stranded with common shield
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Capacitance: core/shield	Maximum 1 000 nF for Zone 1, Class I, Division 1
L/R	Maximum 24 µH/Ω for Zone 1, Class I, Division 1
Cable length	Maximum 300 m (1 000 ft), see the following table

Cross-section	**Cable length for use in non-hazardous area, Ex Zone 2, Class I, Division 2 Ex Zone 1, Class I, Division 1**
0.34 mm^2 (22 AWG)	80 m (270 ft)
0.50 mm^2 (20 AWG)	120 m (400 ft)
0.75 mm^2 (18 AWG)	180 m (600 ft)
1.00 mm^2 (17 AWG)	240 m (800 ft)
1.50 mm^2 (15 AWG)	300 m (1 000 ft)

Optionally available connecting cable

Standard cable	2 × 2 × 0.34 mm^2 (22 AWG) PVC cable with common shield (2 pairs, pair-stranded)
Flame resistance	According to DIN EN 60332-1-2
Oil-resistance	According to DIN EN 60811-2-1
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Capacitance: core/shield	≤200 pF/m
L/R	≤24 µH/Ω
Available cable length	10 m (35 ft)
Operating temperature	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)

Performance characteristics

reference operating conditions

- Error limits based on ISO 11631
- Water with +15 to +45 °C (+59 to +113 °F) at2 to 6 bar (29 to 87 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 → 🖹 84

Maximum measured error

o.r. = of reading; 1 g/cm³ = 1 kg/l; T = medium temperature

Base accuracy

Design fundamentals → 🖹 39

Mass flow and volume flow (liquids)

±0.10 % o.r.

Mass flow (gases)

±0.50 % o.r.

Density (liquids)

Under reference operating conditions [g/cm³]	Standard density calibration [1] [g/cm³]	Wide-range Density specification [2] [3] [g/cm³]
±0.0005	±0.02	±0.002

1) Valid over the entire temperature and density range
2) Valid range for special density calibration: 0 to 2 g/cm³, +5 to +80 °C (+41 to +176 °F)
3) Order code for "Application package", option EF "Special density"

Temperature

±0.5 °C ± 0.005 · T °C (±0.9 °F ± 0.003 · (T − 32) °F)

Zero point stability

DN		Zero point stability	
[mm]	[in]	[kg/h]	[lb/min]
1	1/24	0.0010	0.000036
2	1/12	0.0050	0.00018
4	1/8	0.0225	0.0008

Flow values

Flow values as turndown parameter depending on nominal diameter.

SI units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[mm]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]	[kg/h]
1	20	2	1	0.4	0.2	0.04
2	100	10	5	2	1	0.2
4	450	45	22.5	9	4.5	0.9

US units

DN	1:1	1:10	1:20	1:50	1:100	1:500
[inch]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]	[lb/min]
1/24	0.735	0.074	0.037	0.015	0.007	0.001
1/12	3.675	0.368	0.184	0.074	0.037	0.007
1/8	16.54	1.654	0.827	0.331	0.165	0.033

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±5 µA

Pulse/frequency output

o.r. = of reading

Accuracy	Max. ±50 ppm o.r. (across the entire ambient temperature range)

Repeatability

o.r. = of reading; 1 g/cm³ = 1 kg/l; T = medium temperature

Base repeatability

Mass flow and volume flow (liquids)
±0.05 % o.r.

Mass flow (gases)
±0.25 % o.r.

Design fundamentals → 39

Density (liquids)
±0.00025 g/cm³

Temperature
±0.25 °C ± 0.0025 · T °C (±0.45 °F ± 0.0015 · (T–32) °F)

Response time

The response time depends on the configuration (damping).

Influence of ambient temperature

Current output

o.r. = of reading

Temperature coefficient	Typically 1 µA/°C

Pulse/frequency output

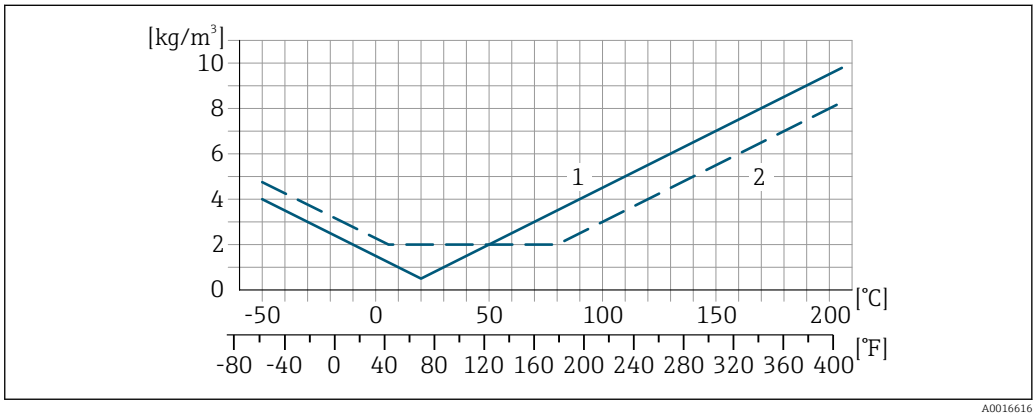
Temperature coefficient	No additional effect. Included in accuracy.

Influence of medium temperature

Mass flow and volume flow
When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is ±0.0002 % of the full scale value/°C (±0.0001 % of the full scale value/°F).

Density
When there is a difference between the density calibration temperature and the process temperature, the typical measured error of the sensor is ±0.00005 g/cm³ /°C (±0.000025 g/cm³ /°F). Field density calibration is possible.

Wide-range density specification (special density calibration)
If the process temperature is outside the valid range (→ 37) the measured error is ±0.00005 g/cm³ /°C (±0.000025 g/cm³ /°F)



1 Field density calibration, for example at +20 °C (+68 °F)
2 Special density calibration

Temperature
±0.005 · T °C (± 0.005 · (T − 32) °F)

Influence of medium pressure

A difference between the calibration pressure and process pressure does not affect accuracy.

Design fundamentals

o.r. = of reading, o.f.s. = of full scale value

BaseAccu = base accuracy in % o.r., BaseRepeat = base repeatability in % o.r.

MeasValue = measured value; ZeroPoint = zero point stability

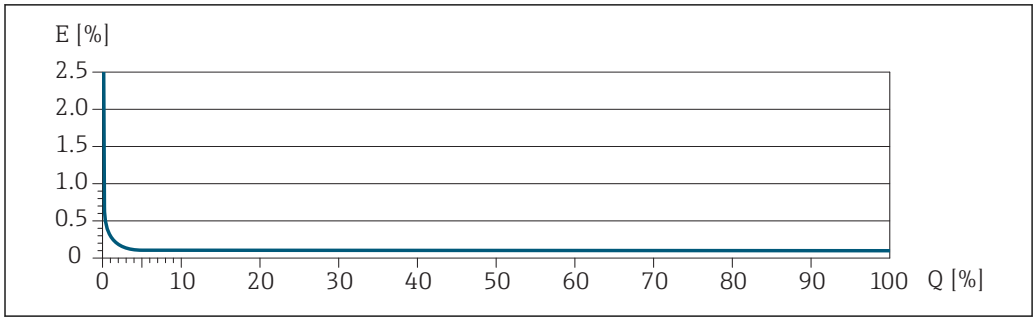
Calculation of the maximum measured error as a function of the flow rate

Flow rate	Maximum measured error in % o.r.
$\geq \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A0021332	$\pm$ BaseAccu A0021339
$< \frac{\text{ZeroPoint}}{\text{BaseAccu}} \cdot 100$ A0021333	$\pm \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021334

Calculation of the maximum repeatability as a function of the flow rate

Flow rate	Maximum repeatability in % o.r.
$\geq \frac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021335	$\pm$ BaseRepeat A0021340
$< \frac{½ \cdot \text{ZeroPoint}}{\text{BaseRepeat}} \cdot 100$ A0021336	$\pm ½ \cdot \frac{\text{ZeroPoint}}{\text{MeasValue}} \cdot 100$ A0021337

Example for max. measured error

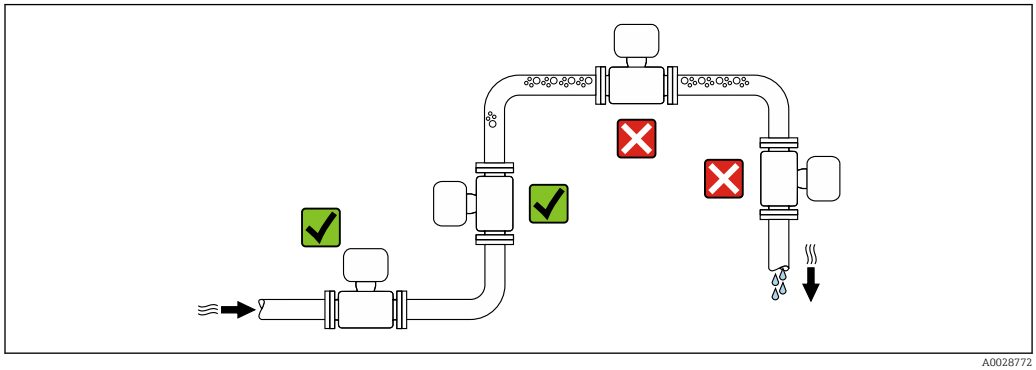


E *Error: Maximum measured error as % o.r. (example)*
Q *Flow rate as %*

Installation

No special measures such as supports etc. are necessary. External forces are absorbed by the construction of the device.

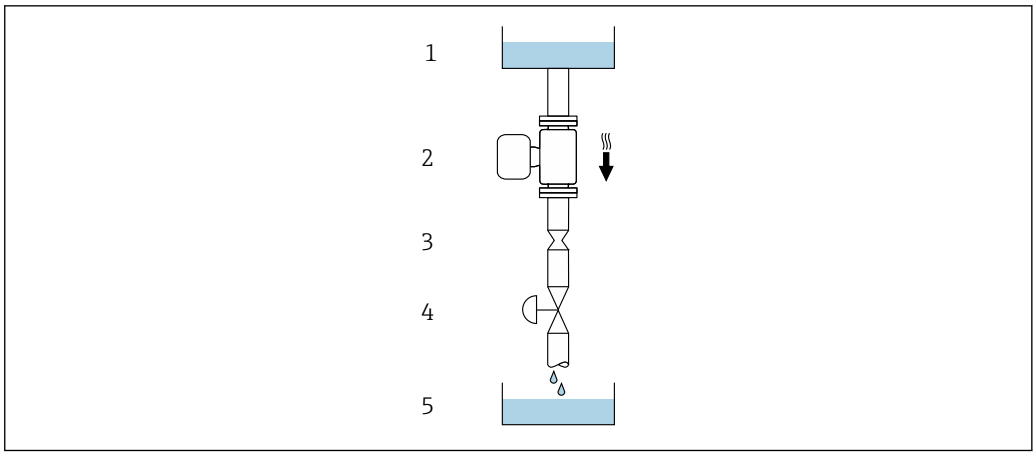
Mounting location



To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Installation in down pipes

However, the following installation suggestion allows for installation in an open vertical pipeline. Pipe restrictions or the use of an orifice with a smaller cross-section than the nominal diameter prevent the sensor running empty while measurement is in progress.



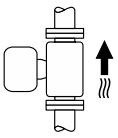
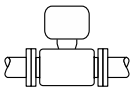
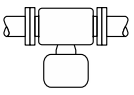
17 *Installation in a down pipe (e.g. for batching applications)*

1 *Supply tank*
2 *Sensor*
3 *Orifice plate, pipe restriction*
4 *Valve*
5 *Batching tank*

DN		Ø orifice plate, pipe restriction	
[mm]	[in]	[mm]	[in]
1	1/24	0.8	0.03
2	1/12	1.5	0.06
4	1/8	3.0	0.12

Orientation

The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

Orientation			Recommendation
A	Vertical orientation	 A0015591	✓✓
B	Horizontal orientation, transmitter head up	 A0015589	✓✓ [1] Exceptions:
C	Horizontal orientation, transmitter head down	 A0015590	✓✓ [2] Exceptions:
D	Horizontal orientation, transmitter head at side	 A0015592	✗

1) Applications with low process temperatures may decrease the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
2) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.

Inlet and outlet runs

No special precautions need to be taken for fittings which create turbulence, such as valves, elbows or T-pieces, as long as no cavitation occurs → 48.

Special mounting instructions

Rupture disk

Make sure that the function and operation of the rupture disk is not impeded through the installation of the device. The position of the rupture disk is indicated on a sticker beside it.

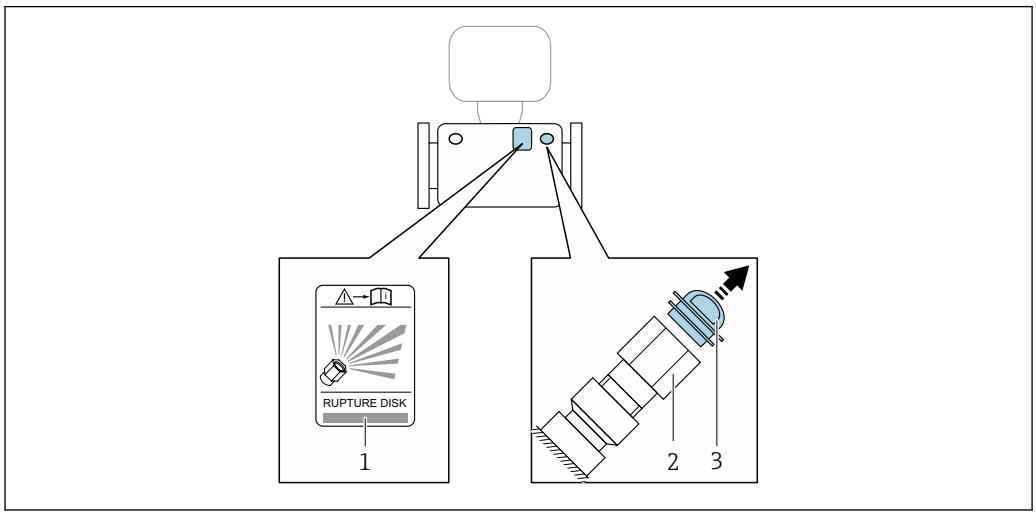
The transportation guard must be removed.

Information that is relevant to the process: → 48.

For information on the dimensions: see the "Mechanical construction -> Accessories" section

The existing connecting nozzles are not intended for the purpose of rinsing or pressure monitoring, but instead serve as the mounting location for the rupture disk.

In the event of a failure of the rupture disk, a discharge device can be screwed onto the internal thread of the rupture disk in order to drain off any escaping medium.



A0030346

1 *Rupture disk label*
2 *Rupture disk with 1/2" NPT internal thread with 1" width across flat*
3 *Transport protection*

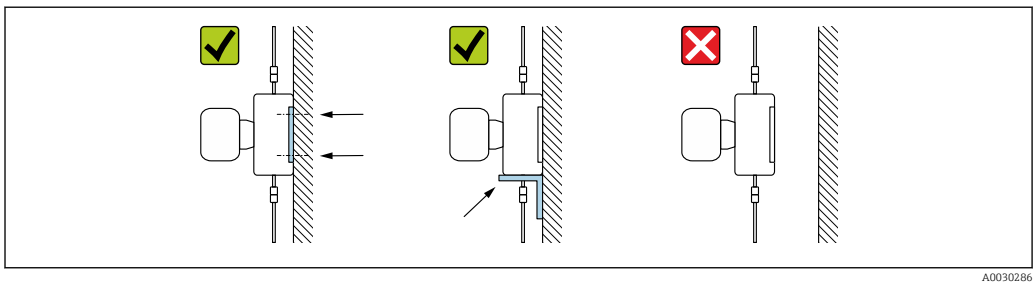
Wall mounting

WARNING

Incorrect sensor mounting
Risk of injury if measuring tube breaks
- The sensor should never be installed in a pipe in a way that it is freely suspended
- Using the base plate, mount the sensor directly on the floor, wall or ceiling.
- Support the sensor on a securely mounted support base (e.g. angle bracket).

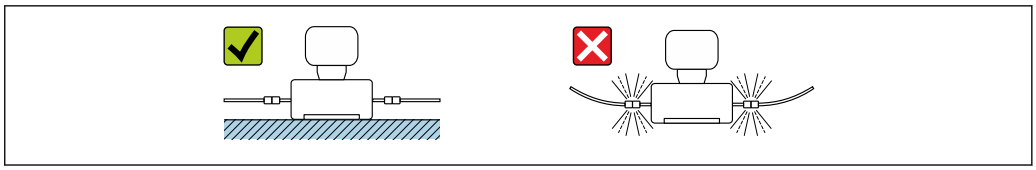
The following mounting versions are recommended for the installation.

Vertical
- Mounted directly on a wall using the base plate, or
- Device supported on an angle bracket mounted on the wall



A0030286

Horizontal
Device standing on a solid support base



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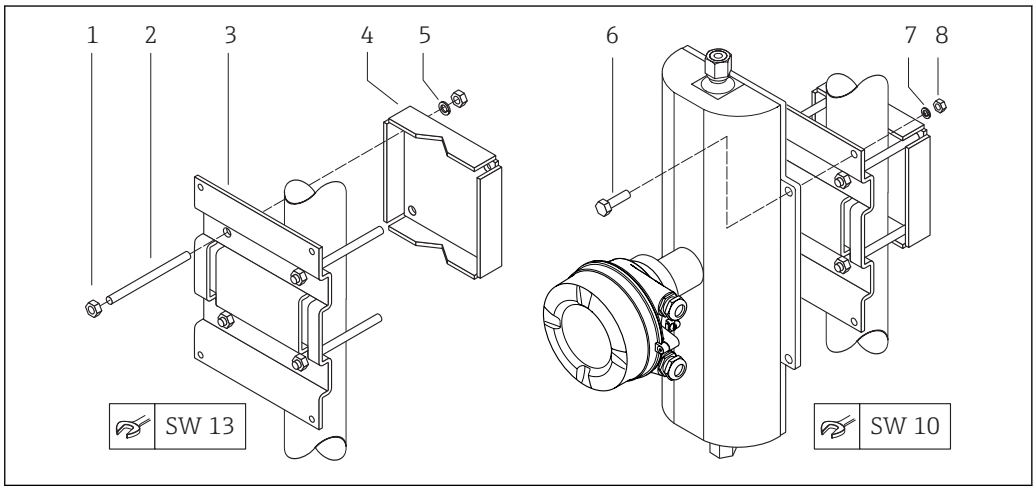
Post retainer

The post retainer mounting kit is used to secure the device to a pipe or post (order code for "Accessories", option PR).



A0019746

18 *Post retainer mounting kit*

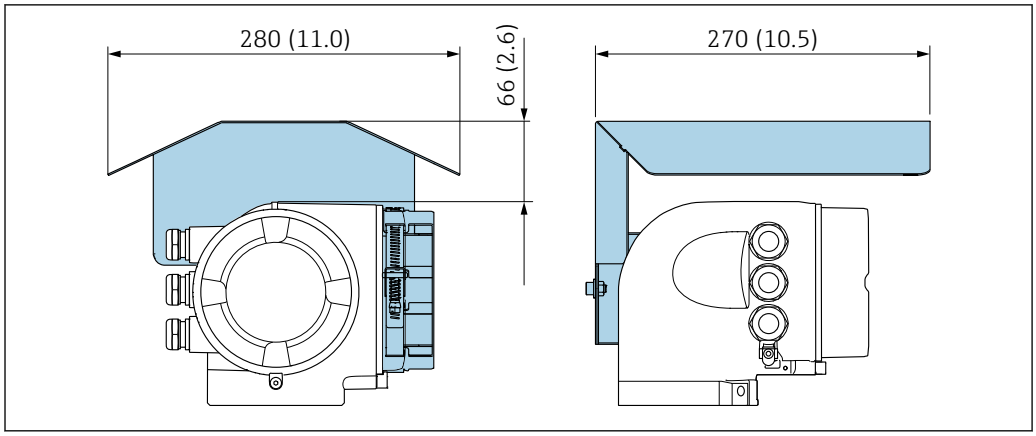
1 *8 x hexagonal nut M8 × 0.8*
2 *4 x threaded bolt M8 × 150*
3 *1 x post retaining plate*
4 *1 x post securing plate*
5 *4 x spring washer for M8*
6 *4 x hexagon bolt M6 × 20*
7 *4 x spring washer for M6*
8 *4 x hexagonal nut M6 × 0.8*

Zero point adjustment

All measuring devices are calibrated in accordance with state-of-the-art technology. Calibration takes place under reference conditions → 37. Therefore, a zero point adjustment in the field is generally not required.

Experience shows that zero point adjustment is advisable only in special cases:
- To achieve maximum measuring accuracy even with low flow rates
- Under extreme process or operating conditions (e.g. very high process temperatures or very high-viscosity fluids).

Protective cover



Environment

Ambient temperature range

Measuring device	Non-Ex	−40 to +60 °C (−40 to +140 °F)
	Ex ec, NI version	−40 to +60 °C (−40 to +140 °F)
	Ex ia, IS version	▪ −40 to +60 °C (−40 to +140 °F) ▪ Order code for "Test, certificate", option **JP** −50 to +60 °C (−58 to +140 °F)
Readability of the local display		−20 to +60 °C (−4 to +140 °F) The readability of the display may be impaired at temperatures outside the temperature range.

▶ If operating outdoors:
Avoid direct sunlight, particularly in warm climatic regions.

You can order a weather protection cover from Endress+Hauser : → 83

Storage temperature

−50 to +80 °C (−58 to +176 °F)

Climate class

DIN EN 60068-2-38 (test Z/AD)

Degree of protection

Transmitter and sensor
- As standard: IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

External WLAN antenna
IP67

Vibration resistance

- Vibration, sinusoidal according to IEC 60068-2-6
  - 2 to 8.4 Hz, 3.5 mm peak
  - 8.4 to 2 000 Hz, 1 g peak
- Vibration broad-band random, according to IEC 60068-2-64
  - 10 to 200 Hz, 0.003 g^2/Hz
  - 200 to 2 000 Hz, 0.001 g^2/Hz
  - Total: 1.54 g rms

Shock resistance

Shock, half-sine according to IEC 60068-2-27
6 ms 30 g

Impact resistance

Rough handling shocks according to IEC 60068-2-31

Interior cleaning

- Cleaning in place (CIP)
- Sterilization in place (SIP)

Options
Oil- and grease-free version for wetted parts, without inspection certificate
Order code for "Service", option **HA**

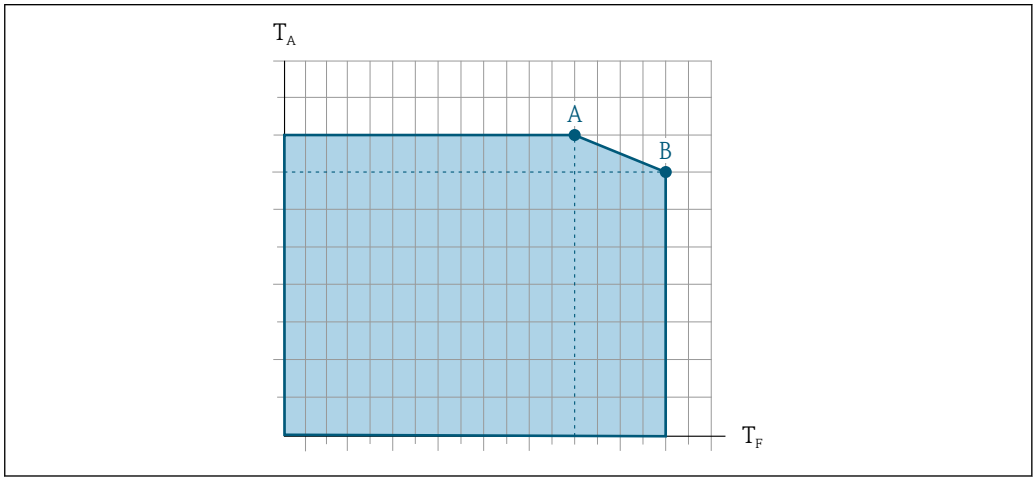
Electromagnetic compatibility (EMC)

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

For details, refer to the Declaration of Conformity.

Process

Medium temperature range



T_A Ambient temperature
T_F Medium temperature
A Maximum permitted medium temperature at $T_{A\,max}$ = 60 °C (140 °F); higher medium temperatures require a reduction in the ambient temperature T_F (derating)
B Maximum permitted ambient temperature at the maximum specified medium temperature of the sensor

Sensor	Noninsulated				Insulated			
	A		B		A		B	
	T_A	T_F	T_A	T_F	T_A	T_F	T_A	T_F
Promass A 300	60 °C (140 °F)	205 °C (401 °F)	–	–	60 °C (140 °F)	120 °C (248 °F)	55 °C (131 °F)	205 °C (401 °F)

Seals
- No internal seals
- For mounting sets with screwed-on connections:
  - Viton: −15 to +200 °C (−5 to +392 °F)
  - EPDM: −40 to +160 °C (−40 to +320 °F)
  - Silicon: −60 to +200 °C (−76 to +392 °F)
  - Kalrez: −20 to +275 °C (−4 to +527 °F)

Density

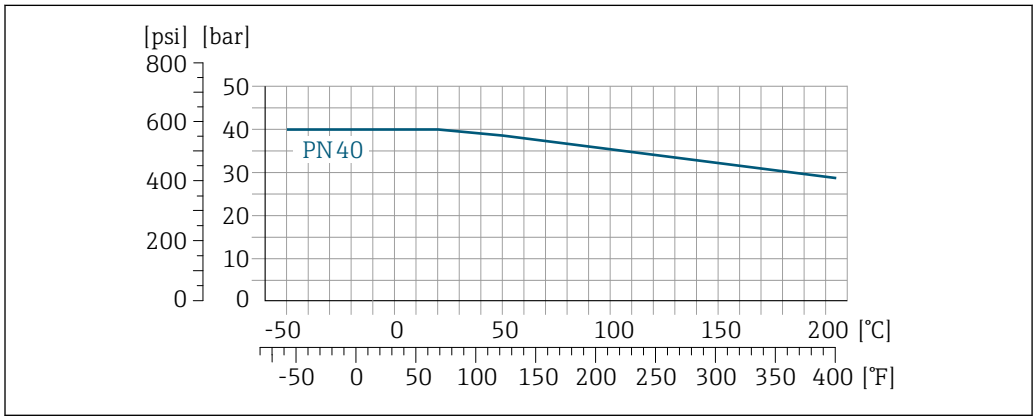
0 to 5 000 kg/m³ (0 to 312 lb/cf)

Pressure-temperature ratings

The following pressure/temperature diagrams apply to all pressure-bearing parts of the device and not just the process connection.

Flange connection according to EN 1092-1 (DIN 2501)

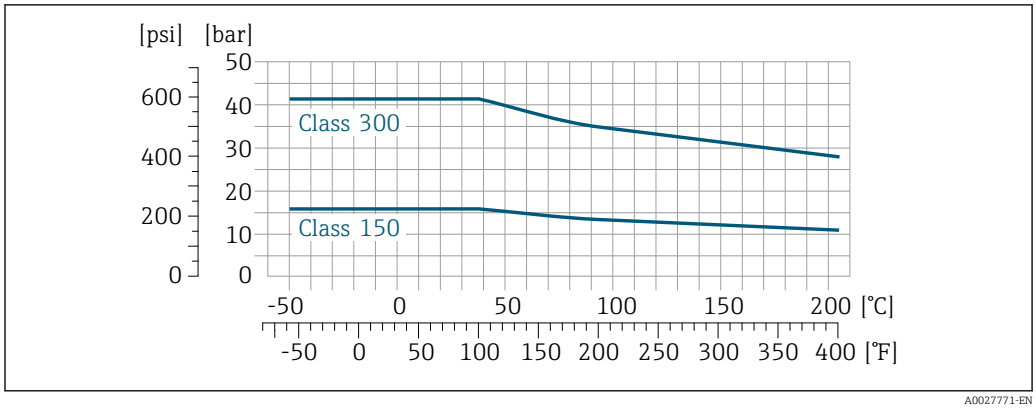
Order code for "Mounting kit", option PE, PM, PN, PO



19 With flange material: 1.4539 (904L), Alloy C22; lap joint flanges (not wetted): 1.4404 (F316/F316L)

Flange connection according to ASME B16.5

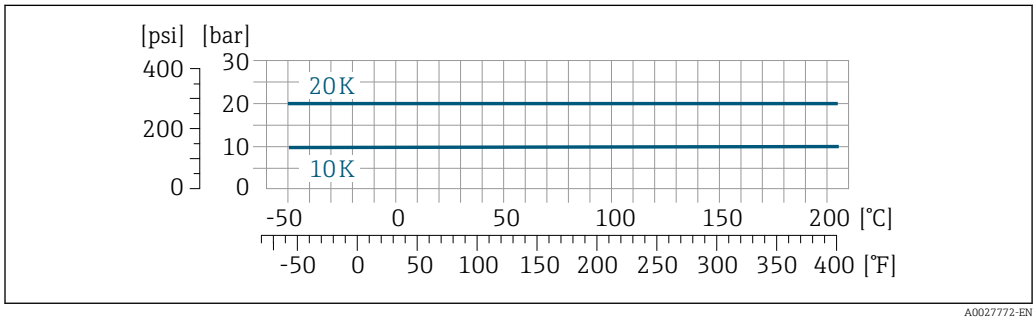
Order code for "Mounting kit", option PF, PP, PG, PQ



20 With flange material: 1.4539 (904L), Alloy C22; lap joint flanges (not wetted): 1.4404 (F316/F316L)

Flange connection according to JIS B2220

Order code for "Mounting kit", option PH, PS, PT, PU

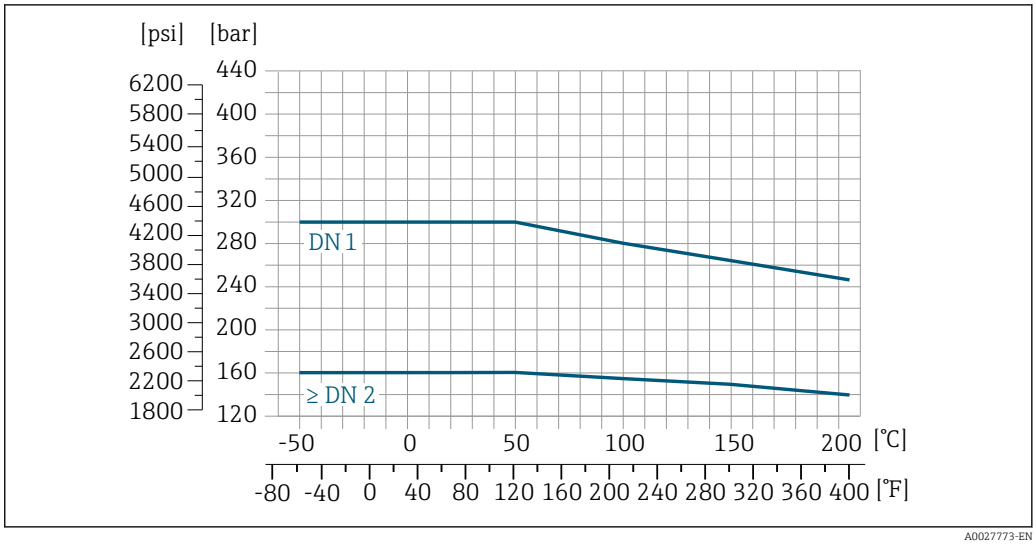


21 With flange material: 1.4539 (904L), Alloy C22; lap joint flanges (not wetted): 1.4404 (SUS F316L)

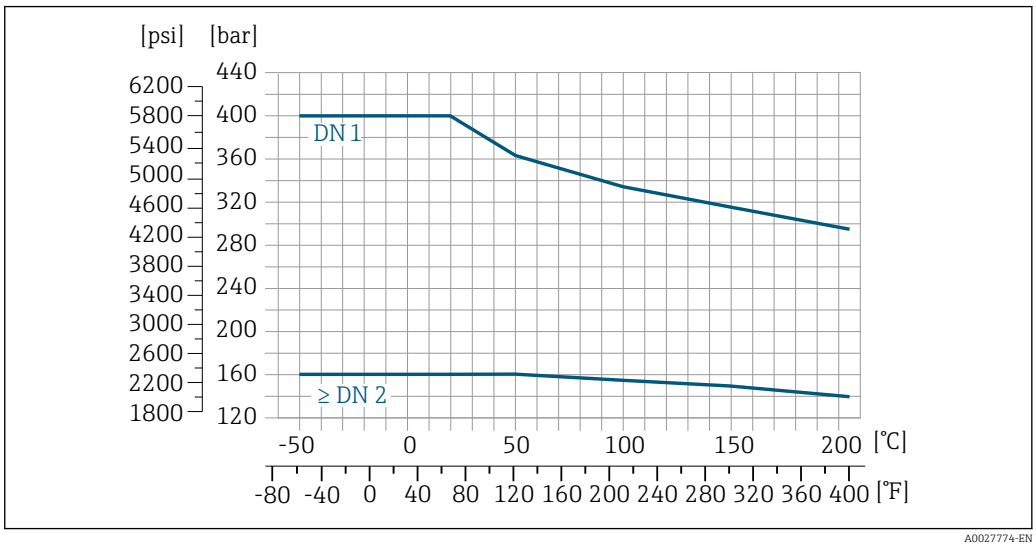
Tri-Clamp process connection

The clamp connections are suitable up to a maximum pressure of 16 bar (232 psi). Please observe the operating limits of the clamp and seal used as they could be under 16 bar (232 psi). The clamp and seal are not included in the scope of supply.

Process connection 4-VCO-4, ¼ NPTF, SWAGELOK

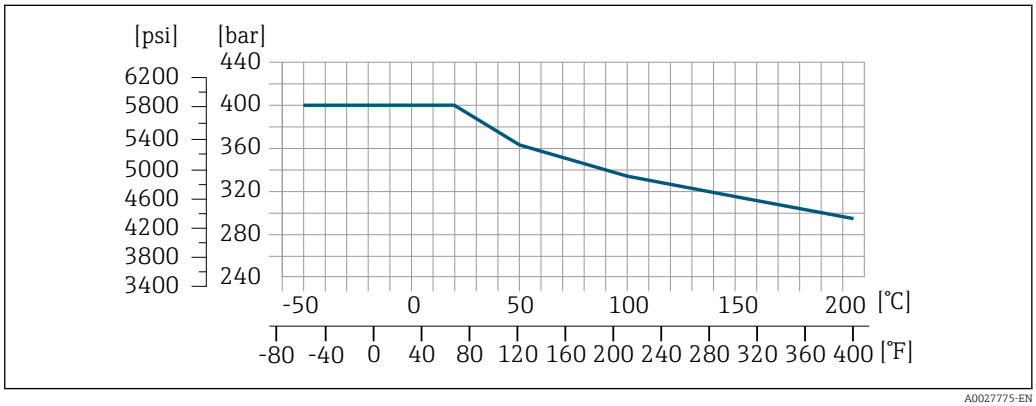


22 *With flange connection 4-VCO-4 coupling: 1.4539 (904L); ¼ NPTF threaded adapter: 1.4539 (904L); ¼" or ⅛ " SWAGELOK coupling: 1.4539 (904L)*



23 *With flange connection 4-VCO-4 coupling: Alloy C22; ¼ NPTF threaded adapter: Alloy C22; ¼" or ⅛ " SWAGELOK coupling: 1.4539 (904L)*

Process connections for high-pressure version (DN 2, 4)



24 *With flange connection 4-VCO-4 coupling: 1.4539 (904L); ¼ NPT threaded adapter: 1.4539 (904L); ¼" or ⅛ " SWAGELOK coupling: 1.4539 (904L)*

Secondary containment pressure rating

The sensor housing is filled with dry inert gas and protects the electronics and mechanics inside.

The following secondary containment pressure rating is only valid for a fully welded sensor housing and/or a device equipped with closed purge connections (never opened/as delivered).

DN		Secondary containment pressure rating (designed with a safety factor ≥ 4)		Secondary containment burst pressure	
[mm]	[in]	[bar]	[psi]	[bar]	[psi]
1	1/24	25	362	175	2538
2	1/12	25	362	155	2248
4	1/8	25	362	130	1885

If there is a risk of the measuring tube breaking due to process characteristics, e.g. in the case of corrosive fluids, we recommend the use of sensors whose secondary containment is equipped with special "pressure monitoring connections" (order code for "Sensor option", option **CH** "purge connection").

With the help of these connections, the fluid collected in the secondary containment can be bled off in the event of tube failure. This is especially important in high-pressure gas applications. These connections can also be used for gas purging (gas detection).

Do not open the purge connections unless the containment can be filled immediately with a dry, inert gas. Use only low gauge pressure to purge. Maximum pressure: 5 bar (72.5 psi).

If a device fitted with purge connections is connected to the purge system, the maximum nominal pressure is determined by the purge system itself or by the device, depending on which component has the lower nominal pressure.

If, on the other hand, the device is fitted with a rupture disk, the rupture disk is decisive for the maximum nominal pressure → 48.

For information on the dimensions: see the "Mechanical construction -> Accessories" section

Rupture disk

To increase the level of safety, a device version with a rupture disk with a trigger pressure of 10 to 15 bar (145 to 217.5 psi) can be used (order code for "Sensor option", option **CA** "rupture disk").

Rupture disks cannot be combined with the separately available heating jacket .

Special mounting instructions: → 42

For information on the dimensions: see the "Mechanical construction -> Accessories" section

Flow limit

Select the nominal diameter by optimizing between the required flow range and permissible pressure loss.

For an overview of the full scale values for the measuring range, see the "Measuring range" section

- The minimum recommended full scale value is approx. 1/20 of the maximum full scale value
- In most applications, 20 to 50 % of the maximum full scale value can be considered ideal
- A low full scale value must be selected for abrasive media (such as liquids with entrained solids): flow velocity < 1 m/s (< 3 ft/s).
- For gas measurement the following rules apply:
  - The flow velocity in the measuring tubes should not exceed half the sound velocity (0.5 Mach).
  - The maximum mass flow depends on the density of the gas: formula → 9

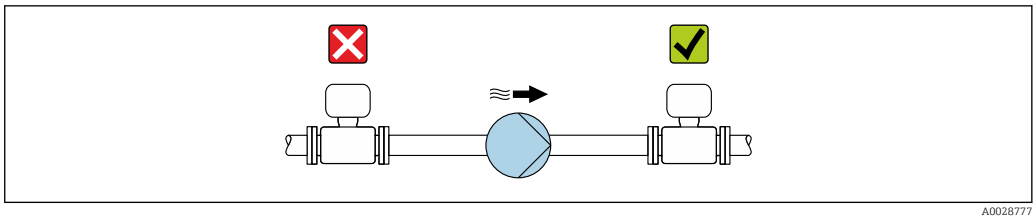
Pressure loss

To calculate the pressure loss, use the *Applicator* sizing tool → 84

System pressure

It is important that cavitation does not occur, or that gases entrained in the liquids do not outgas. This is prevented by means of a sufficiently high system pressure.

For this reason, the following mounting locations are recommended:
- At the lowest point in a vertical pipe
- Downstream from pumps (no danger of vacuum)



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Thermal insulation

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

NOTICE

Danger of overheating with insulation

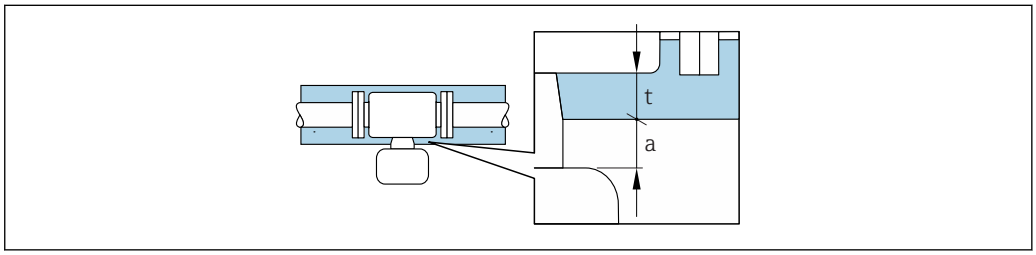
- Ensure that the temperature at the lower end of the transmitter housing does not exceed 80 °C (176 °F)

NOTICE

The insulation can also be thicker than the maximum recommended insulation thickness.

Prerequisite:

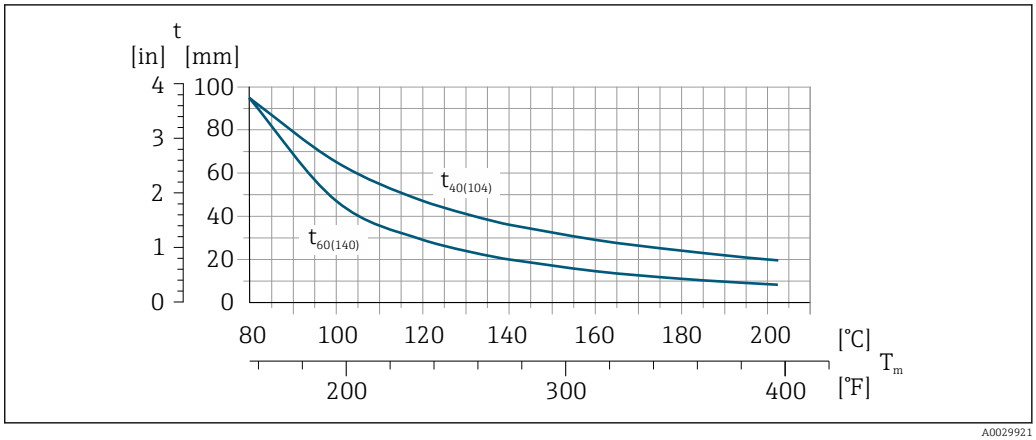
- Ensure that convection takes place on a sufficiently large scale at the transmitter neck.
- Ensure that a sufficiently large area of the housing support remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.



A0028853

a *Minimum distance to insulation*
t *maximum Insulation thickness*

The minimum distance a between the transmitter and the insulation is 10 mm (0.39 in). This is to ensure that the transmitter remains completely exposed.



A0029921

t	Insulation thickness
T_m	Medium temperature
$t40_{(104)}$	Maximum recommended insulation thickness at an ambient temperature of T_a = 40 °C (104 °F)
$t60_{(140)}$	Maximum recommended insulation thickness at an ambient temperature of T_a = 60 °C (140 °F)

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
- Via heating jackets

Heating jackets for the sensors can be ordered as accessories from Endress+Hauser → 83.

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 convection takes place on a sufficiently large scale at the transmitter neck.
- ▶ Ensure that a sufficiently large area of the housing support remains exposed. The uncovered part serves as a radiator and protects the electronics from overheating and excessive cooling.

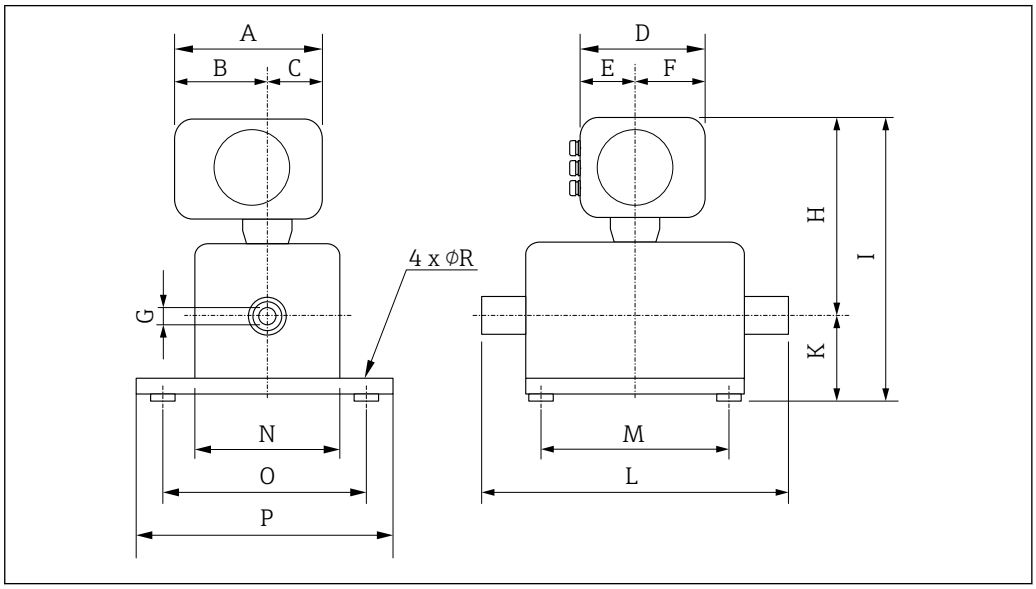
Vibrations

The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by plant vibrations.

Mechanical construction

Dimensions in SI units

Compact version



A0023830

DN [mm]	G [mm]	G [1] [mm]	K [mm]	M [mm]	N [mm]	O [mm]	P [mm]	R [mm]	L [mm]
1	1.1	–	32	160	120	145	165	4 × Ø6.5	[2]
2	1.8	1.41	32	160	120	145	165	4 × Ø6.5	[2]
4	3.5	3.02	32	220	150	175	195	4 × Ø6.5	[2]

1) High-pressure version: order code for "Measuring tube material", option SG, SH, SI
2) Dependent on the respective process connection

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

DN [mm]	A [1] [mm]	B [1] [mm]	C [mm]	D [2] [mm]	E [2] [mm]	F [mm]	H [mm]	I [mm]
1	200	141	59	169	68	101	259	291
2	200	141	59	169	68	101	259	291
4	200	141	59	169	68	101	269	301

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

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

DN [mm]	A [1] [mm]	B [1] [mm]	C [mm]	D [2] [mm]	E [mm]	F [mm]	H [mm]	I [mm]
1	217	159	58	188	85	103	289	321
2	217	159	58	188	85	103	289	321
4	217	159	58	188	85	103	299	331

1) For version without local display: values - 38 mm
2) Depending on the cable gland used: values up to + 30 mm

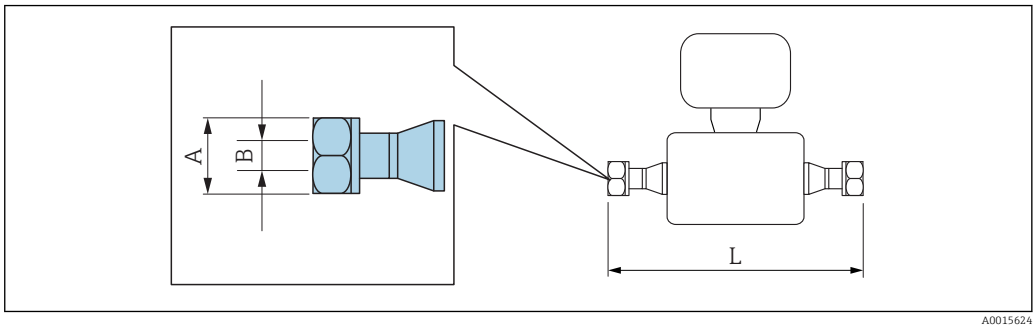
Order code for "Housing", option B "Stainless, hygienic"

DN [mm]	A [1] [mm]	B [1] [mm]	C [mm]	D [2] [mm]	E [mm]	F [mm]	H [mm]	I [mm]
1	196	135	61	176	71	105	254	286
2	196	135	61	176	71	105	254	286
4	196	135	61	176	71	105	264	296

1) For version without local display: values - 13 mm
2) Depending on the cable gland used: values up to + 30 mm

Cable glands

VCO coupling



A0015624

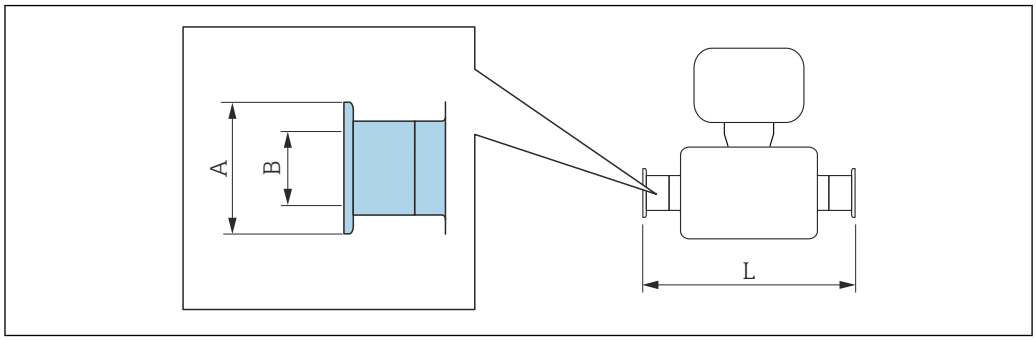
Length tolerance for dimension L in mm:
+1.5 / −2.0

4-VCO-4 **1.4404 (316/316L):** *order code for "Process connection", option* **HAW** **Alloy C22:** *order code for "Measuring tube material", option* **HA**				
DN [mm]	**A [in]**	**B [mm]**		**L [mm]**
1	SW 11/16	1.1	–	290
2	SW 11/16	1.8	1.4 [1)]	372
4	SW 11/16	3.5	3.0 [1)]	497
3A version available (Ra ≤ 0.8 µm/150 grit, Ra ≤ 0.4 µm/240 grit) for order code for "Process connection", option **HAW** (1.4539 (904L)): Order code for "Measuring tube material", option **SE, SF, SH, SI** in combination with order code for "Additional approval" , option **LP**				

1) High-pressure version: order code for "Measuring tube material", option SG, SH, SI

Clamp connections

Tri-Clamp

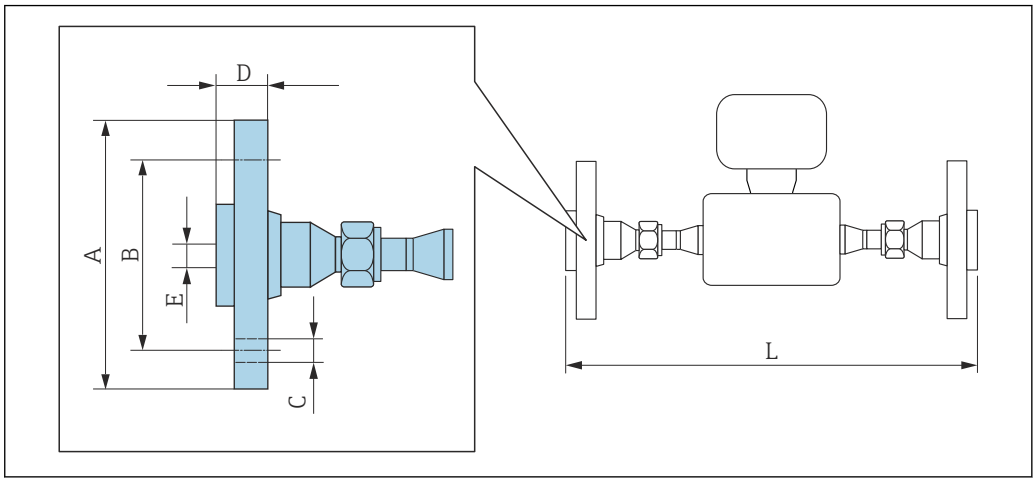


Length tolerance for dimension L in mm:
+1.5 / −2.0

½" Tri-Clamp **1.4539 (904L)** *Order code for "Process connection", option* **FBW**			
DN **[mm]**	**A** **[mm]**	**B** **[mm]**	**L** **[mm]**
1	25	9.5	296
2	25	9.5	378
4	25	9.5	503
3A version available (Ra ≤ 0.8 µm/150 grit, Ra ≤ 0.4 µm/240 grit): Order code for "Measuring tube material", option **SE, SF, SH, SI** in combination with order code for "Additional approval" , option **LP**			

Adapter

Adapter, DN 15 flange to 4-VCO-4



Length tolerance for dimension L in mm:
+1.5 / −2.0

Flange according to EN 1092-1 (DIN 2501): PN 40
1.4539 (904L): *order code for "Accessories", option* **PE**
Alloy C22: *order code for "Accessories", option* **PM**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
1	95	65	4 × Ø14	28	17.3	393
2	95	65	4 × Ø14	28	17.3	475
4	95	65	4 × Ø14	28	17.3	600

Lap joint flanges (not wetted) made of stainless steel 1.4404 (316/316L)
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)

Flange according to ASME B16.5: Class 150
1.4539 (904L): *order code for "Accessories", option* **PF**
Alloy C22: *order code for "Accessories", option* **PP**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
1	90.0	60.3	4 × Ø15.7	17.7	15.7	393
2	90.0	60.3	4 × Ø15.7	17.7	15.7	475
4	90.0	60.3	4 × Ø15.7	17.7	15.7	600

Lap joint flanges (not wetted) made of stainless steel 1.4404 (316/316L)
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)

Flange according to ASME B16.5: Class 300
1.4539 (904L): *order code for "Accessories, option* **PG**
Alloy C22: *order code for "Accessories", option* **PQ**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
1	95.0	60.3	4 × Ø15.7	20.7	15.7	393
2	95.0	60.3	4 × Ø15.7	20.7	15.7	475

Flange according to ASME B16.5: Class 300
1.4539 (904L): *order code for "Accessories, option* **PG**
Alloy C22: *order code for "Accessories", option* **PQ**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
4	95.0	60.3	4 × Ø15.7	20.7	15.7	600

Lap joint flanges (not wetted) made of stainless steel 1.4404 (316/316L)
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)

Flange JIS B2220: 10K
1.4539 (904L): *order code for "Accessories", option* **PH**
Alloy C22 :*order code for "Accessories", option* **PS**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
1	95	70	4 × Ø15	28	15.0	393
2	95	70	4 × Ø15	28	15.0	475
4	95	70	4 × Ø15	28	15.0	600

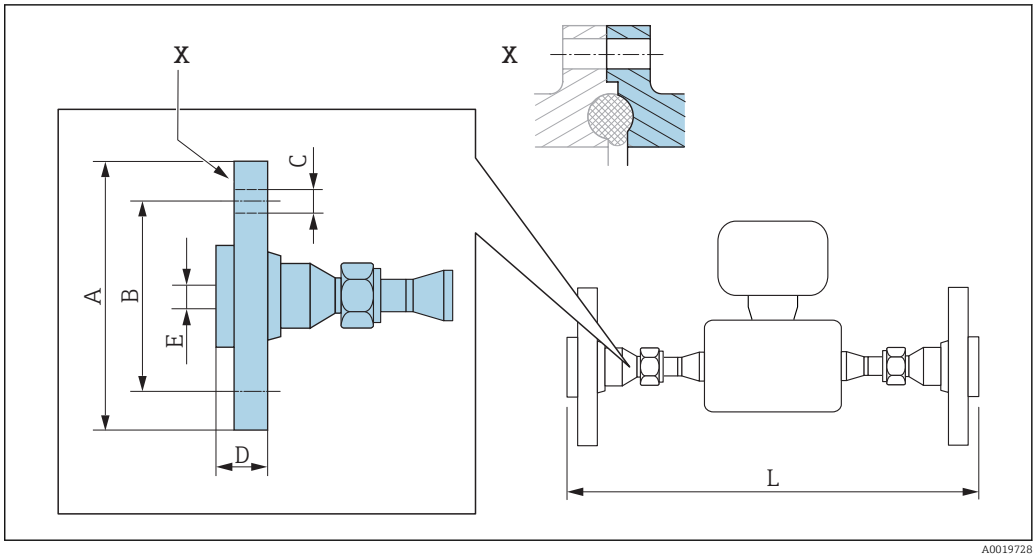
Lap joint flanges (not wetted) made of stainless steel 1.4404 (316/316L)
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)

Flange JIS B2220: 20K
1.4539 (904L): *order code for "Accessories", option* **PT**
Alloy C22: *order code for "Accessories", option* **PU**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
1	95	70	4 × Ø15	14	15.0	393
2	95	70	4 × Ø15	14	15.0	475
4	95	70	4 × Ø15	14	15.0	600

Lap joint flanges (not wetted) made of stainless steel 1.4404 (316/316L)
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)

Adapter, DN 15 grooved flange to 4-VCO-4

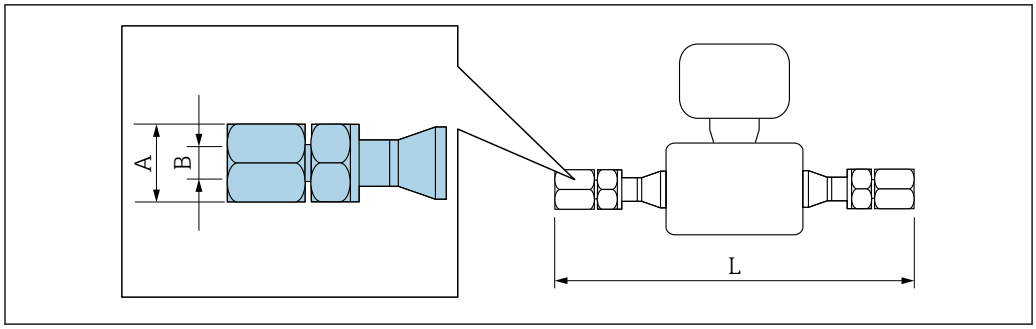


25 *Detail X: Asymmetrical process connection; the part shown in blue is provided by the supplier.*

Length tolerance for dimension L in mm:
+1.5 / −2.0

Grooved flange according to EN 1092-1 (DIN 2501): PN 40 **1.4539 (904L):** *order code for "Accessories", option* **PN** **Alloy C22:** *order code for "Accessories", option* **PO**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
1	95	65	4 × Ø14	28	17.3	393
2	95	65	4 × Ø14	28	17.3	475
4	95	65	4 × Ø14	28	17.3	600
Lap joint flanges (not wetted) made of stainless steel 1.4404 (316/316L) Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)						

Adapter, NPTF to 4-VCO-4

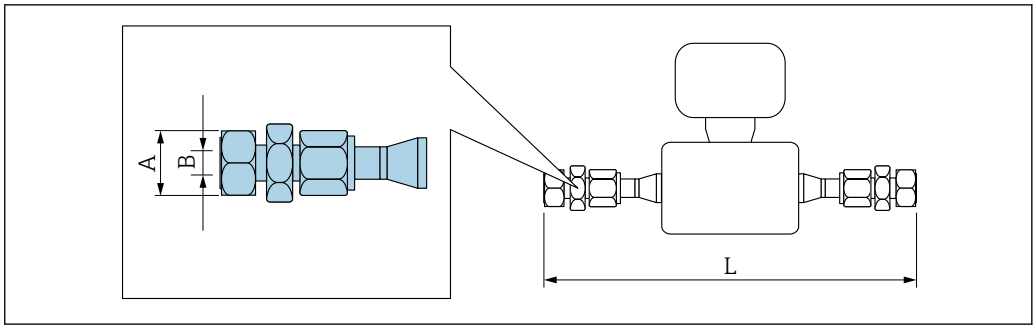


Length tolerance for dimension L in mm:
+1.5 / −2.0

¼" NPTF **1.4539 (904L):** *order code for "Accessories", option* **PI** **Alloy C22** [1]**:** *Order code for "Accessories", option* **PJ**			
DN [mm]	**A [in]**	**B [in]**	**L [mm]**
1	AF ¾	¼ NPTF	361
2	AF ¾	¼ NPTF	443
4	AF ¾	¼ NPTF	568
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)			

1) Not available as high-pressure version

Adapter, Swagelok to 4-VCO-4



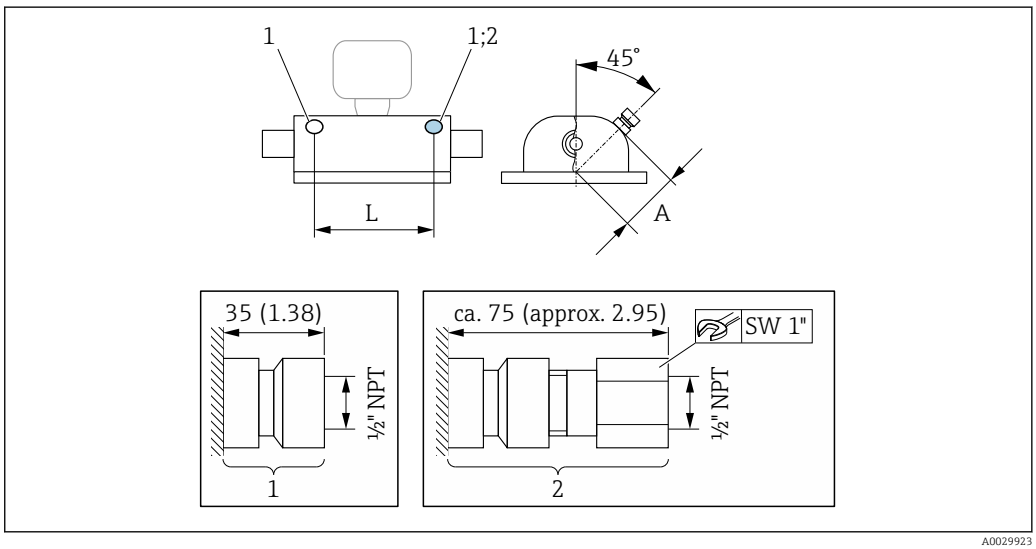
Length tolerance for dimension L in mm:
+1.5 / −2.0

Adapter, Swagelok **1.4539 (904L)** *Order code for "Accessories", ⅛" option* **PK** *Order code for "Accessories", ¼" option* **PL**			
DN [mm]	**A [in]**	**B [in]**	**L [mm]**
1	SW 7/16	⅛ NPT	361
1	SW 9/16	¼ NPT	364.6
2 [1)]	SW 7/16	⅛ NPT	441.6
2 [1)]	SW 9/16	¼ NPT	446.6
4 [1)]	SW 9/16	¼ NPT	571.6
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)			

1) Also available as high-pressure version

Accessories

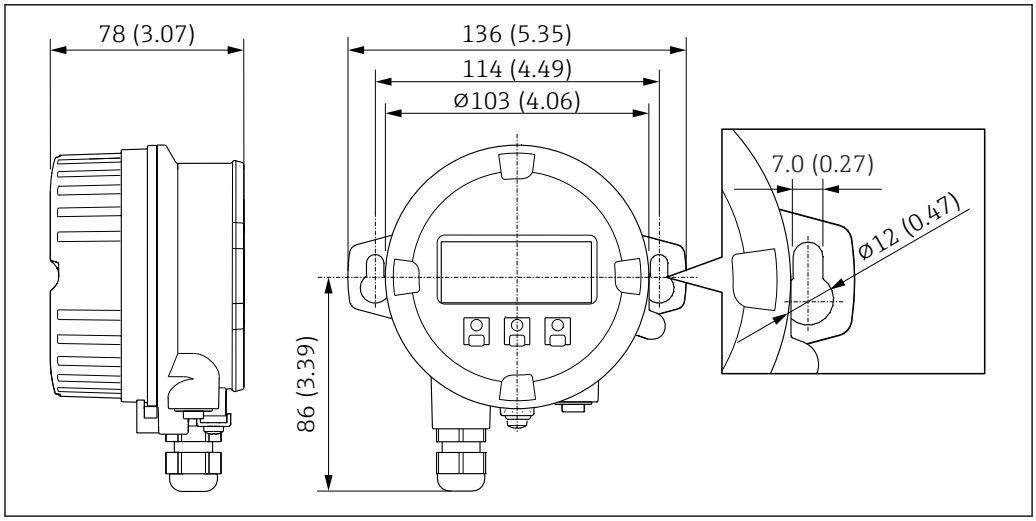
Purge connections / secondary containment monitoring



1 Connection nipple for purge connections/pressure vessel monitoring: order code for "Sensor options", option CH "Purge connection"
2 Connection nipple with rupture disk: order code for "Sensor option", option CA "Rupture disk"

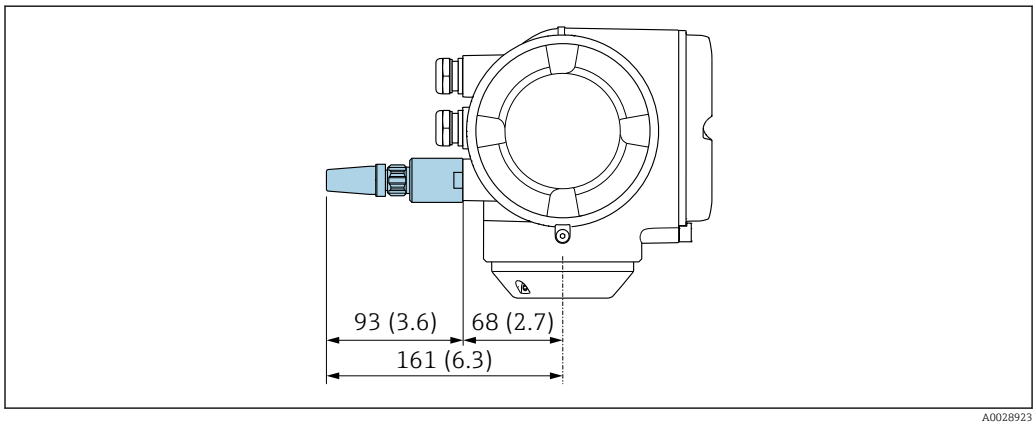
DN [mm]	A [mm]	L [mm]
1	47.0	178
2	47.0	260
4	59.5	385

Remote display and operating module DKX001



26 *Engineering unit mm (in)*

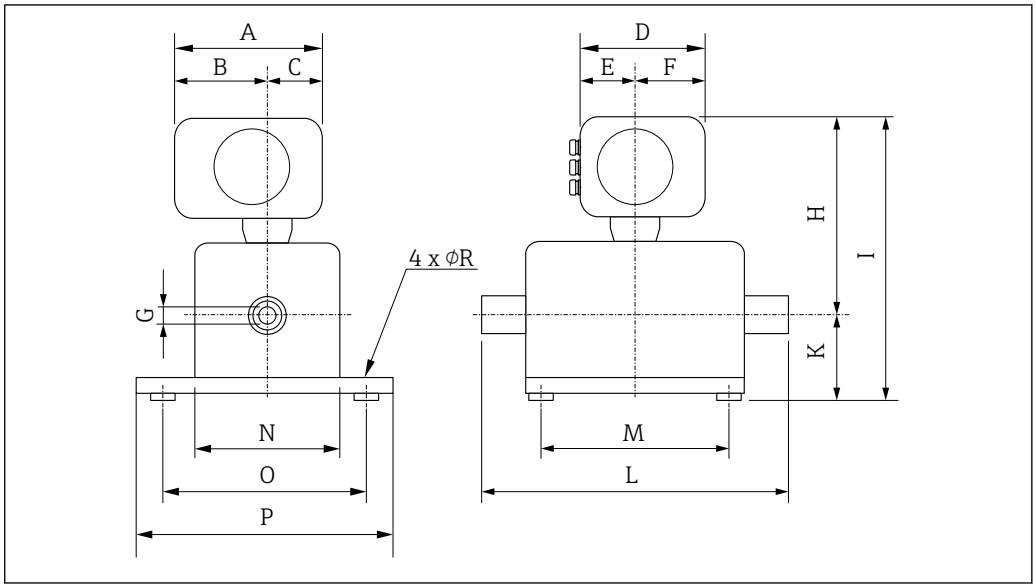
External WLAN antenna



27 *Engineering unit mm (in)*

Dimensions in US units

Compact version



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DN [in]	G [in]	G [1] [in]	K [in]	M [in]	N [in]	O [in]	P [in]	R [in]	L [in]
1/24	0.04	–	1.26	6.3	4.72	5.71	6.5	4 × Ø0.26	2)
1/12	0.07	0.056	1.26	6.3	4.72	5.71	6.5	4 × Ø0.26	2)
1/8	0.14	0.119	1.26	8.66	5.91	6.89	7.68	4 × Ø0.26	2)

1) High-pressure version: order code for "Measuring tube material", option SG, SH, SI
2) Dependent on the respective process connection

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

DN [in]	A [1] [in]	B [1] [in]	C [in]	D [2] [in]	E [2] [in]	F [in]	H [in]	I [in]
1/24	7.87	5.55	2.32	6.65	2.68	3.98	10.2	11.46
1/12	7.87	5.55	2.32	6.65	2.68	3.98	10.2	11.46
1/8	7.87	5.55	2.32	6.65	2.68	3.98	10.59	11.85

1) For version without local display: values - 1.18 in
2) Depending on the cable gland used: values up to + 1.18 in

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

DN [in]	A [1] [in]	B [in]	C [in]	D [2] [in]	E [2] [in]	F [in]	H [in]	I [in]
1/24	8.54	6.26	2.28	7.4	3.35	4.06	11.38	12.64
1/12	8.54	6.26	2.28	7.4	3.35	4.06	11.38	12.64
1/8	8.54	6.26	2.28	7.4	3.35	4.06	11.77	13.03

1) For version without local display: values - 1.49 in
2) Depending on the cable gland used: values up to + 1.18 in

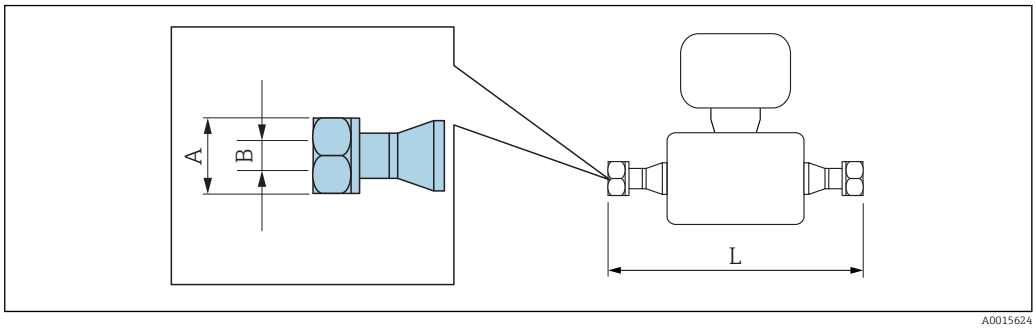
Order code for "Housing", option B "Stainless, hygienic"

DN [in]	A [1] [in]	B [in]	C [in]	D [2] [in]	E [2] [in]	F [in]	H [in]	I [in]
1	7.72	5.31	2.4	6.93	2.8	4.13	10	11.26
2	7.72	5.31	2.4	6.93	2.8	4.13	10	11.26
4	7.72	5.31	2.4	6.93	2.8	4.13	10.39	11.65

1) For version without local display: values - 0.51 in
2) Depending on the cable gland used: values up to + 1.18 in

Cable glands

VCO coupling



A0015624

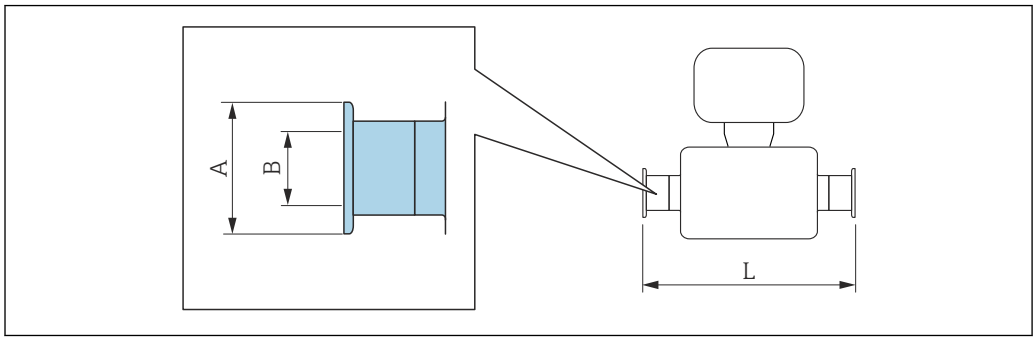
Length tolerance for dimension L in inch:
+0.06 / −0.08

4-VCO-4 **1.4404 (316/316L):** *order code for "Process connection", option* **HAW** **Alloy C22:** *order code for "Measuring tube material", option* **HA**				
DN [in]	**A [in]**	**B [in]**		**L [in]**
1/24	SW 11/16	0.043	–	11.4
1/12	SW 11/16	0.071	0.055 [1)]	14.6
1/8	SW 11/16	0.14	0.12 [1)]	19.6
3A version available (Ra ≤ 32 µin/150 grit, Ra ≤ 16 µin/240 grit) for order code for "Process connection", option **HAW** (1.4539 (904L)): Order code for "Measuring tube material", option **SE, SF, SH, SI** in combination with order code for "Additional approval" , option **LP**				

1) High-pressure version: order code for "Measuring tube material", option SG, SH, SI

Clamp connections

Tri-Clamp



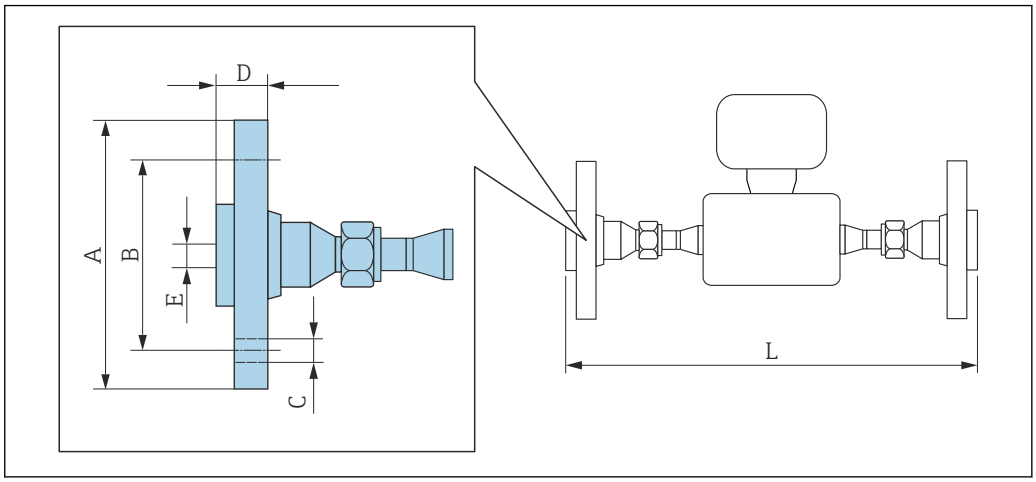
A0015625

Length tolerance for dimension L in inch:
+0.06 / −0.08

½" Tri-Clamp **1.4539 (904L)** *Order code for "Process connection", option* **FBW**			
DN **[in]**	**A** **[in]**	**B** **[in]**	**L** **[in]**
1/24	0.98	0.37	11.7
1/12	0.98	0.37	14.9
1/8	0.98	0.37	19.8
3A version available (Ra ≤ 32 µin/150 grit, Ra ≤ 16 µin/240 grit): Order code for "Measuring tube material", option **SE, SF, SH, SI** in combination with order code for "Additional approval" , option **LP**			

Adapter

Adapter, DN 15 flange to 4-VCO-4



Length tolerance for dimension L in inch:
+0.06 / −0.08

Flange according to ASME B16.5: Class 150
1.4539 (904L): *order code for "Accessories", option* **PF**
Alloy C22: *order code for "Accessories", option* **PP**

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
1/24	3.54	2.37	4 × Ø0.62	0.7	0.62	15.5
1/12	3.54	2.37	4 × Ø0.62	0.7	0.62	18.7
1/8	3.54	2.37	4 × Ø0.62	0.7	0.62	23.6

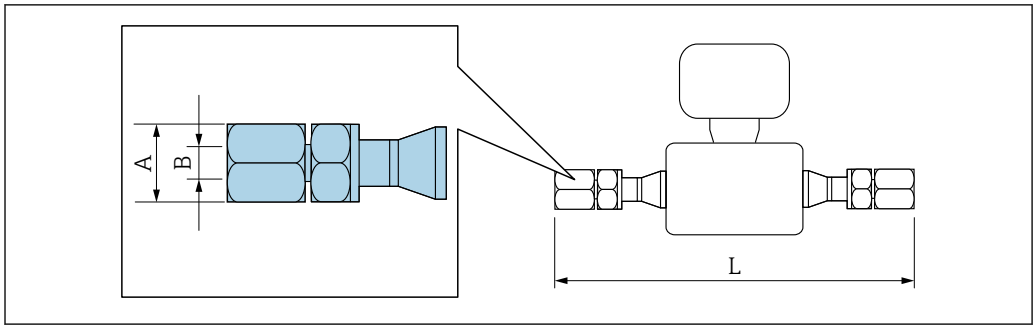
Lap joint flanges (not wetted) made of stainless steel 1.4404 (316/316L)
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)

Flange according to ASME B16.5: Class 300
1.4539 (904L): *order code for "Accessories, option* **PG**
Alloy C22: *order code for "Accessories", option* **PQ**

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	L [in]
1/24	3.74	2.37	4 × Ø0.62	0.81	0.62	15.5
1/12	3.74	2.37	4 × Ø0.62	0.81	0.62	18.7
1/8	3.74	2.37	4 × Ø0.62	0.81	0.62	23.6

Lap joint flanges (not wetted) made of stainless steel 1.4404 (316/316L)
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)

Adapter, NPTF to 4-VCO-4 coupling

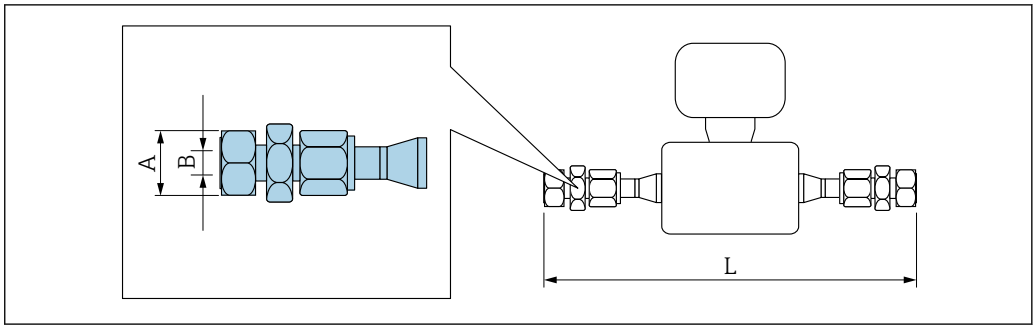


Length tolerance for dimension L in inch:
+0.06 / −0.08

¼" NPTF **1.4539 (904L):** *order code for "Accessories", option* **PI** **Alloy C22** [1]**:** *Order code for "Accessories", option* **PJ**			
DN [in]	**A [in]**	**B [in]**	**L [in]**
1/24	AF ¾	¼ NPT	14.2
1/12	AF ¾	¼ NPT	17.4
⅛	AF ¾	¼ NPT	22.4
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)			

1) Not available as high-pressure version

Adapter, Swagelok to 4-VCO-4 coupling



Length tolerance for dimension L in inch:
+0.06 / −0.08

Swagelok
1.4539 (904L)
Order code for "Accessories", ⅛" option **PK**
Order code for "Accessories", ¼" option **PL**

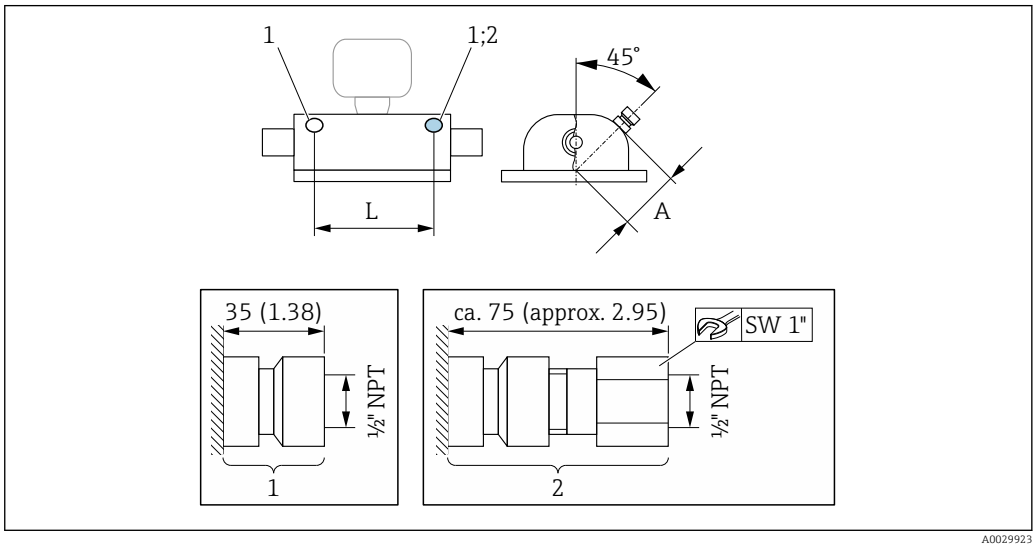
DN [in]	A [in]	B [in]	L [in]
1/24	SW 7/16	1/8 NPT	14.2
1/24	SW 9/16	1/4 NPT	14.4
1/12 1)	SW 7/16	1/8 NPT	17.4
1/12 1)	SW 9/16	1/4 NPT	17.6
1/8 1)	SW 9/16	1/4 NPT	22.5
Sealing sets: order code for "Accessories enclosed", option **P1** (Viton), **P2** (EPDM), **P3** (silicone), **P4** (Kalrez)			

1) Also available as high-pressure version

Accessories

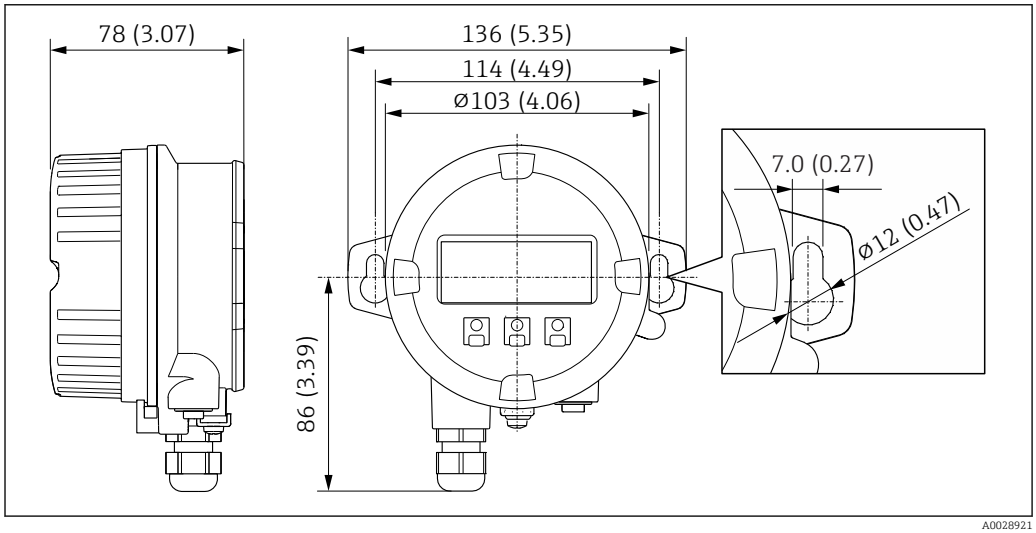
Purge connections / secondary containment monitoring

Order code for "Sensor options", option **CH**



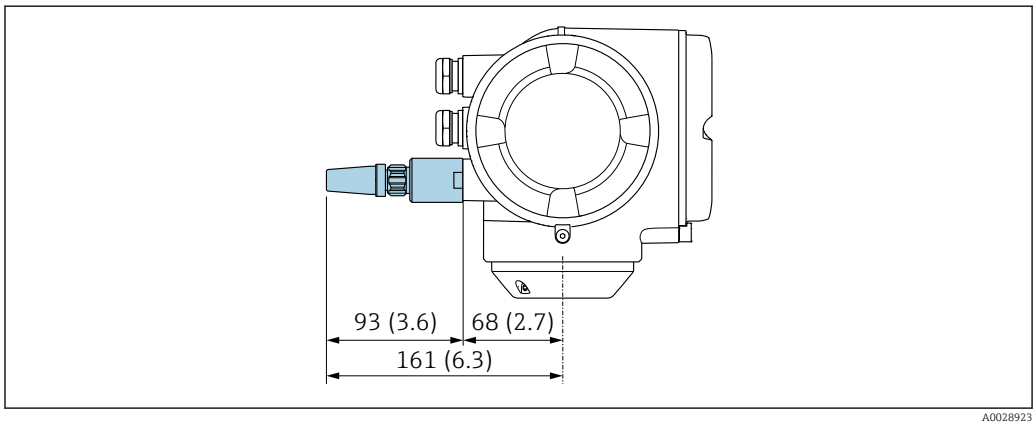
DN [in]	A [in]	L [in]
1/24	1.85	7.01
1/12	1.85	10.24
1/8	2.34	15.16

Remote display and operating module DKX001



28 *Engineering unit mm (in)*

External WLAN antenna



29 *Engineering unit mm (in)*

Weight

Transmitter version for the hazardous area: +2 kg (+4.4 lbs)

All values (weight) refer to devices with EN/DIN PN 40 flanges.

Weight in SI units

DN [mm]	Weight [kg]
1	8
2	9
4	13

Weight in US units

DN [in]	Weight [lbs]
1/24	18
1/12	20
1/8	29

Materials

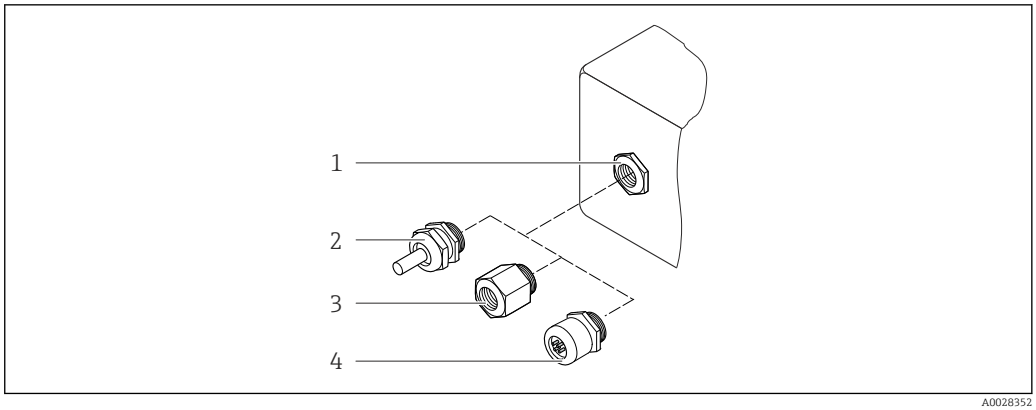
Transmitter housing

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



30 Possible cable entries/cable glands

1 Cable entry with M20 × 1.5 internal thread
2 Cable gland M20 × 1.5
3 Adapter for cable entry with internal thread G ½" or NPT ½"
4 Device plug coupling

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
Cable gland M20 × 1.5	Plastic/nickel-plated brass
Adapter for cable entry with internal thread G ½"	Nickel-plated brass
Adapter for cable entry with internal thread NPT ½"	
Device plug coupling	Plug M12 × 1 ▪ Socket: Stainless steel, 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Device plug

Electrical connection	Material
Plug M12x1	▪ Socket: Stainless steel, 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Sensor housing

- Acid and alkali-resistant outer surface
- Stainless steel 1.4301 (304)

Measuring tubes

Stainless steel, 1.4539 (904L); Alloy C22, 2.4602 (UNS N06022)

Process connections

VCO coupling
Stainless steel, 1.4404 (316/316L)

Tri-Clamp
Stainless steel, 1.4539 (904L)

Adapter, flanges as per EN 1092-1 (DIN 2501), ASME B16.5, JIS B2220
Stainless steel, 1.4539 (904L)

Adapter, lap joint flanges as per EN 1092-1 (DIN 2501), ASME B16.5, JIS B2220
Stainless steel, 1.4404 (316/316L)

SWAGELOK adapter
Stainless steel, 1.4539 (904L)

Adapter, NPTF
Stainless steel, 1.4539 (904L)

List of all available process connections → 70

Seals

Welded process connections without internal seals

Seals for mounting kit
- Viton
- EPDM
- Silicone
- Kalrez

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

External WLAN antenna

- WLAN antenna:
  ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass
- Adapter:
  Stainless steel and copper

Process connections

- Fixed flange connections:
  - EN 1092-1 (DIN 2501) flange
  - EN 1092-1 (DIN 2512N) flange
  - ASME B16.5 flange
  - JIS B2220 flange
- Clamp connections
  Tri-Clamp (OD tubes), DIN 11866 series C
- VCO connections
  4-VCO-4
- Adapter for VCO connections
  - Flange EN 1092-1 (DIN 2501)
  - Flange ASME B16.5
  - Flange JIS B2220
  - SWAGELOK
  - NPTF

For information on the different materials used in the process connections → 70

Surface roughness

All data relate to parts in contact with fluid.
- Not polished
- Ra_{max} = 0.8 µm (32 µin)
- Ra_{max} = 0.4 µm (16 µin)

Operability

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 explanations of the individual parameter functions
- Device access via Web server
- Optional: WLAN access to device via mobile handheld terminal

Reliable operation
- Operation in local language → 71
- Uniform operating philosophy applied to device and operating tools
- If replacing electronic modules, transfer the device configuration via the integrated memory (integrated HistoROM) which contains the process and measuring device data and the event logbook. No need to reconfigure.

Efficient diagnostics increase 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

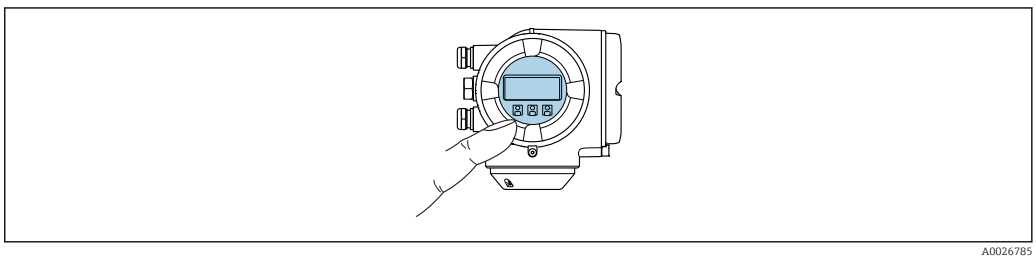
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Arabic, Bahasa (Indonesian), Thai, Vietnamese, Czech, Swedish
- Via Web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Arabic, Bahasa (Indonesian), Thai, Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese

Local operation

Via display module

Two display modules are available:
- Order code for "Display; operation", option **F** "4-line, backlit, graphic display; touch control"
- Order code for "Display; operation", option **G** "4-line, backlit, graphic display; touch control + WLAN"

Information about WLAN interface → 75



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31 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.

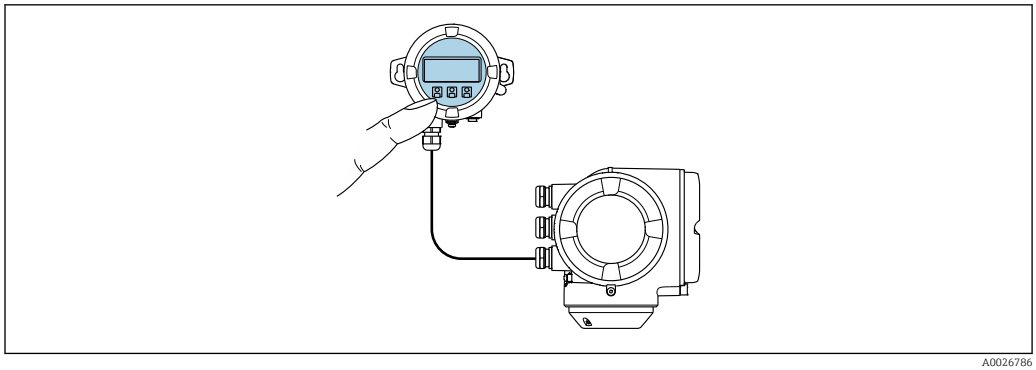
Operating elements

- External operation via touch control (3 optical keys) without opening the housing: ⊞, ⊟, Ⓔ
- Operating elements also accessible in various hazardous areas

Via remote display and operating module DKX001

The remote display and operating module DKX001 is available as an optional extra:
Order code for "Display; operation", option **O** "Separate backlit, 4-line display; 10 m (30 ft) Cable; touch control"

Another device version, e.g. other housing material, other cable length etc., can be ordered via the separate product structure DKX001. The measuring device is ordered with:
Order code for "Display; operation", option **M** "None, prepared for remote display"



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32 *Operation via remote display and operating module DKX001*

Display and operating elements

The display and operating elements correspond to those of the display module → 72.

- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is used. Display or operation at the transmitter is not possible in this case.
- The remote display and operating module DKX001 can also be ordered separately and subsequently as an accessory without a measuring device → 83.
- If ordered subsequently: The remote display and operating module DKX001 cannot be connected at the same time as the existing display or operation unit. Only one display or operation unit may be connected to the transmitter at any one time.

Material

The housing material of the display and operating module DKX001 depends on the choice of transmitter 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

→ 36

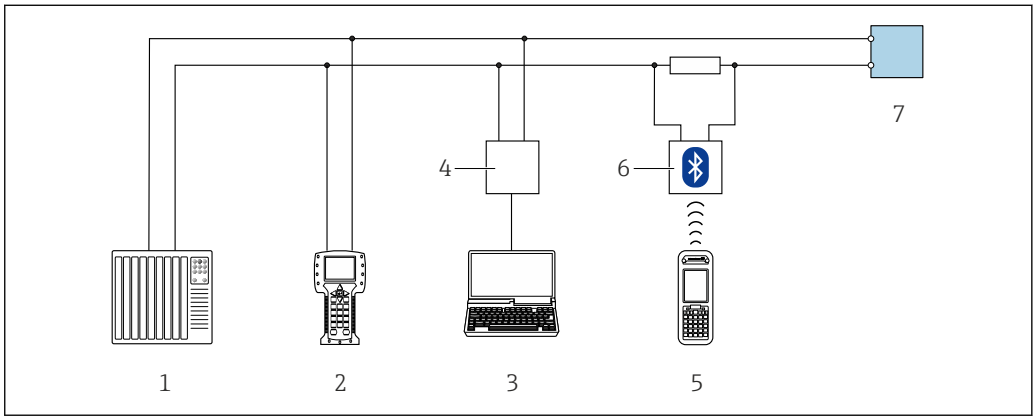
Dimensions

→ 60

Remote operation

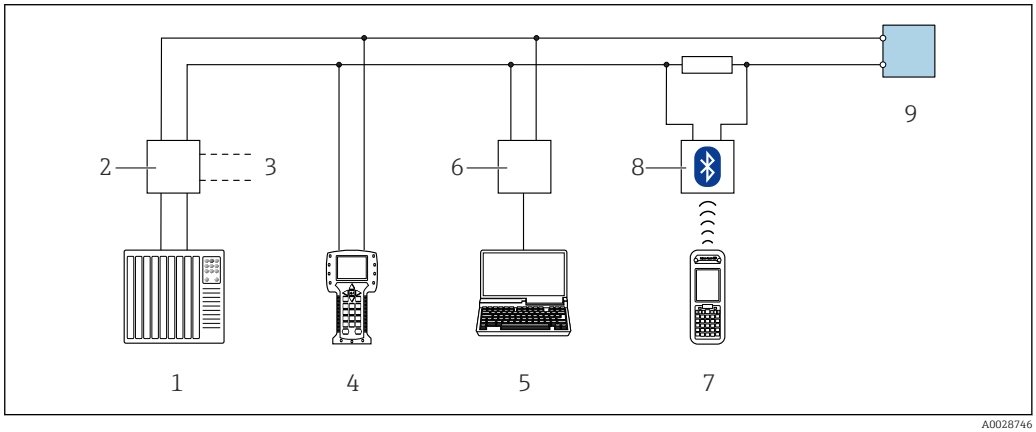
Via HART protocol

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



33 *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 accessing the integrated device Web server or computer with 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 *VIATOR Bluetooth modem with connecting cable*
7 *Transmitter*

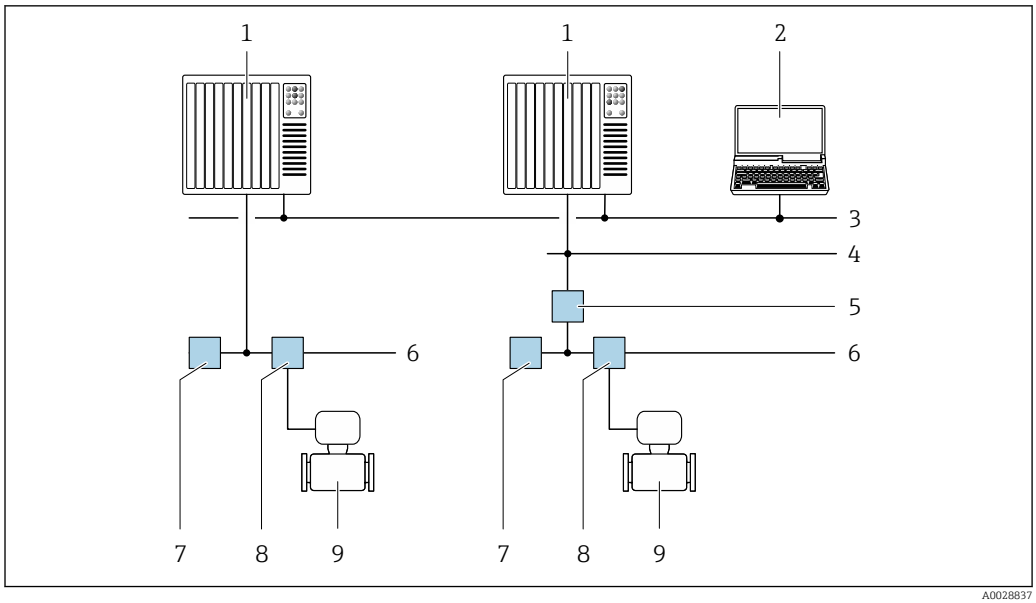


34 *Options for remote operation via HART protocol (passive)*

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 accessing the integrated device Web server or computer with 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 *VIATOR Bluetooth modem with connecting cable*
9 *Transmitter*

Via FOUNDATION Fieldbus network

This communication interface is available in device versions with FOUNDATION Fieldbus.

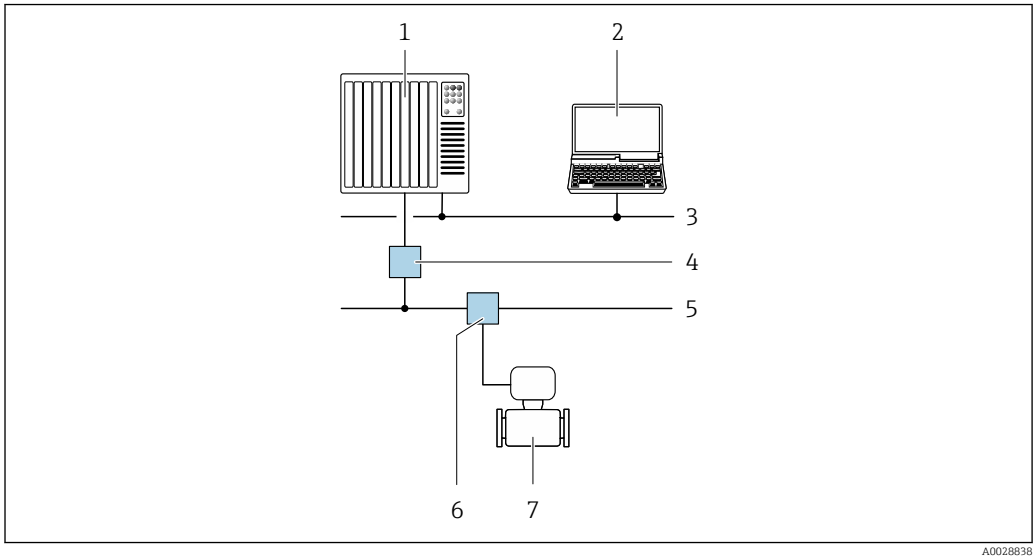


35 *Options for remote operation via FOUNDATION Fieldbus network*

1 *Automation system*
2 *Computer with FOUNDATION Fieldbus network card*
3 *Industry network*
4 *High Speed Ethernet FF-HSE network*
5 *Segment coupler FF-HSE/FF-H1*
6 *FOUNDATION Fieldbus FF-H1 network*
7 *Power supply FF-H1 network*
8 *T-box*
9 *Measuring device*

Via PROFIBUS PA network

This communication interface is available in device versions with PROFIBUS PA.

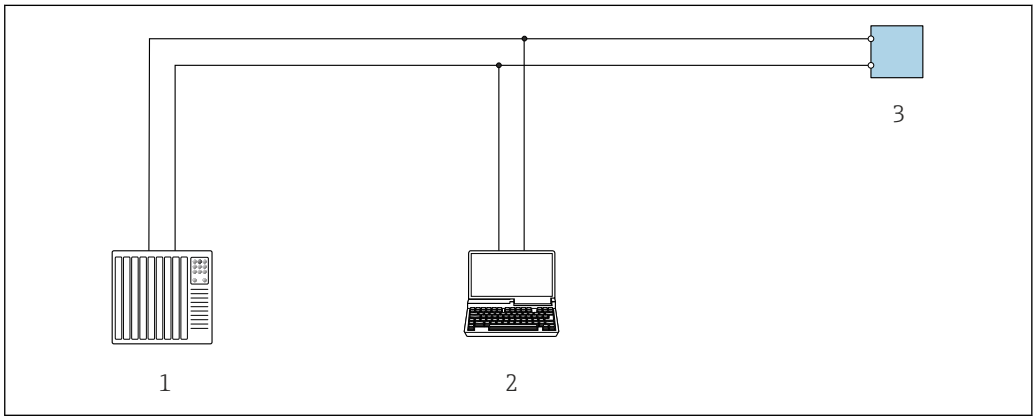


36 *Options for remote operation via PROFIBUS PA network*

1 *Automation system*
2 *Computer with PROFIBUS network card*
3 *PROFIBUS DP network*
4 *Segment coupler PROFIBUS DP/PA*
5 *PROFIBUS PA network*
6 *T-box*
7 *Measuring device*

Via Modbus RS485 protocol

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

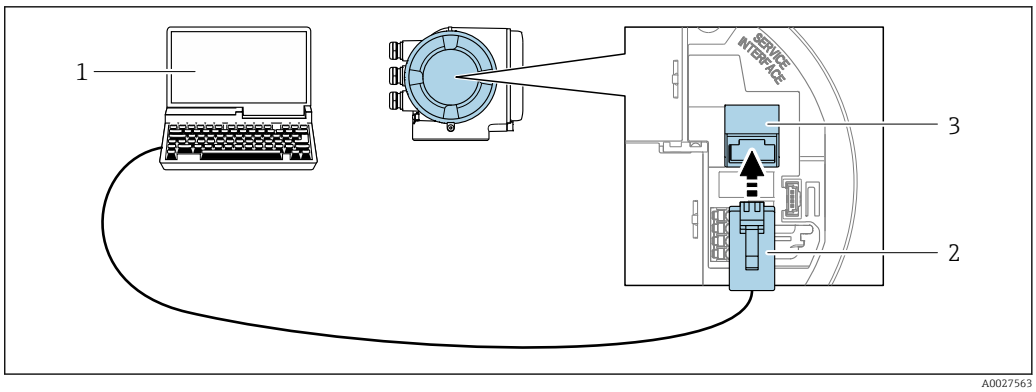


37 *Options for remote operation via Modbus-RS485 protocol (active)*

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)

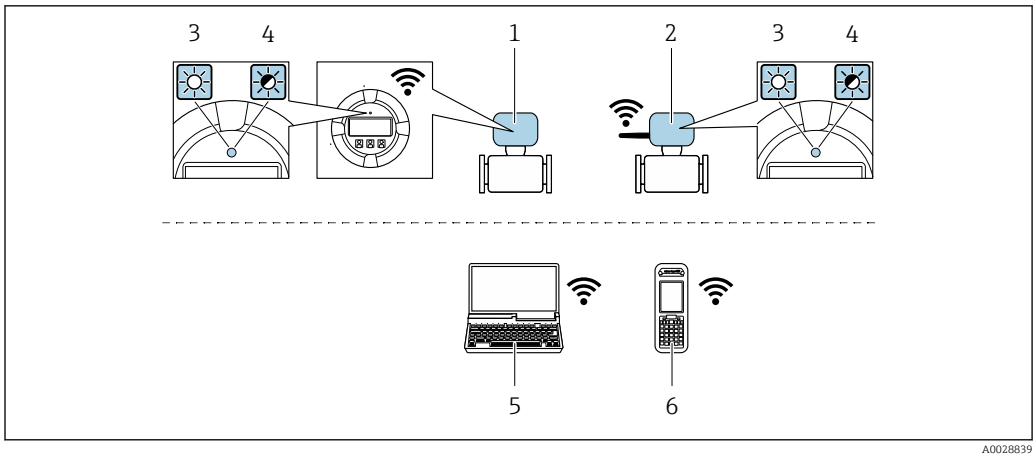


38 *Connection via service interface (CDI-RJ45)*

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, backlit, graphic display; touch control + WLAN"



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)*

Wireless LAN	IEEE 802.11 b/g (2.4 GHz) WLAN
Encryption	WPA2 PSK/TKIP AES-128
Configurable channels	1 to 11
Function	Access point with DHCP
Range with integrated antenna	Max. 10 m (32 ft)
Range with external antenna	Max. 50 m (164 ft)

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	▪ CDI-RJ45 service interface ▪ WLAN interface	Special Documentation for the device → 🖹 86
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 🖹 84

Supported operating tools	Operating unit	Interface	Additional information
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 🖹 84
Device Xpert	Field Xpert SFX 100/350/370	HART and FOUNDATION Fieldbus 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:

- Process Device Manager (PDM) by Siemens → www.siemens.com
- Asset Management Solutions (AMS) by Emerson → www.emersonprocess.com
- FieldCommunicator 375/475 by Emerson → www.emersonprocess.com
- Field Device Manager (FDM) by Honeywell → www.honeywellprocess.com
- FieldMate by Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

The associated device description files are available at: 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 a WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, status information on the device is also displayed and allows the user to monitor the status of the device. Furthermore the measuring device data can be managed and the network parameters can be configured. The WLAN connection requires a device that acts as an access point to enable communication via a computer or mobile handheld terminal.

Supported functions
Data exchange between the operating unit (such as a notebook for example) and the measuring device:
- Uploading 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, create documentation of 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

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:

	Device memory	T-DAT	S-DAT
Available data	▪ Event history, such as diagnostic events ▪ Parameter data record backup ▪ Device firmware package ▪ Driver for system integration e.g.: – DD for HART – GSD for PROFIBUS PA – DD for FOUNDATION Fieldbus	▪ Measured value memory ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Maximum indicators (min/max values) ▪ Totalizer values	▪ Sensor data: diameter etc. ▪ Serial number ▪ User-specific access code (to use the "Maintenance" user role) ▪ Calibration data ▪ Device configuration (e.g. SW options, fixed I/O or multi I/O)
Storage location	Fixed on the user interface board in the connection compartment	Can be plugged into 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

Manual
Additional parameter data record (complete parameter settings) in the integrated device memory for:
- Data backup function
  Backup and subsequent restoration of a device configuration in the device memory
- Data comparison function
  Comparison of the current device configuration with the device configuration saved in the device memory

Data transfer

Manual
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
- Use the recorded measured value data in the integrated device simulation function in the **Diagnostics** submenu.

Service logbook

Manual
- Create up to 20 user-specific events with a date and customized text in a separate logbook for documentation of the measuring point
- Use for calibration or service operations, for example, or for maintenance or revision work that has been performed

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-Tick symbol

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex approval

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.

The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.

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 T6...T1 Ga/Gb [1]
II2G	Ex db eb ia IIC T6...T1 Gb

1) The following applies for sensors with nominal diameter DN 01: Ex db eb ia IIC T6...T1 Gb

Ex db

Category	Type of protection
II1/2G	Ex db ia IIC T6...T1 Ga/Gb [1]
II2G	Ex db ia IIC T6...T1 Gb

1) The following applies for sensors with nominal diameter DN 01: Ex db eb ia IIC T6...T1 Gb

Ex ec

Category	Type of protection
II3G	Ex ec IIC T5...T1 Gc

Ex tb

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

$_{C}CSA_{US}$

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

IS (Ex i) and XP (Ex d)
Class I, III, III Division 1 Groups A-G

NI (Ex nA)
Class I Division 2 Groups A - D

Ex de
- Class I, Zone 1 AEx/ Ex de ia IIC T6...T1 Ga/Gb
  (The following applies for sensors with nominal diameter DN 01: Class I, Zone 1 AEx/ Ex de ia IIC T6...T1 Gb)
- Class I, Zone 1 AEx/ Ex de ia IIC T6...T1 Gb

Ex d
- Class I, Zone 1 AEx/ Ex d ia IIC T6...T1 Ga/Gb
  (The following applies for sensors with nominal diameter DN 01: Class I, Zone 1 AEx/ Ex d ia IIC T6...T1 Gb)
- Class I, Zone 1 AEx/ Ex d ia IIC T6...T1 Gb

Ex nA
Class I, Zone 2 AEx/ Ex nA IIC T5...T1 Gc

Ex tb
Zone 21 AEx/ Ex tb IIIC T** °C Db

Sanitary compatibility
- 3-A approval
- EHEDG-tested

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 (multichannel architecture with homogeneous redundancy) and is independently evaluated and certified by the TÜV in accordance with IEC 61508.

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

Functional Safety Manual with information on the SIL device → 86

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)

FOUNDATION Fieldbus certification
FOUNDATION Fieldbus interface

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:
- Certified in accordance with FOUNDATION Fieldbus H1
- Interoperability Test Kit (ITK), revision version 6.1.2 (certificate available on request)
- Physical Layer Conformance Test
- The device can also be operated with certified devices of other manufacturers (interoperability)

Certification PROFIBUS
PROFIBUS interface

The measuring device is certified and registered by the PROFIBUS User Organization (PNO). The measuring system meets all the requirements of the following specifications:
- Certified in accordance with PROFIBUS PA Profile 3.02
- The device can also be operated with certified devices of other manufacturers (interoperability)

Modbus RS485 certification
The measuring device meets all the requirements of the MODBUS/TCP conformity test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out.

Radio approval
Europe:
RED 2014/53/EU

United States of America:
CFR Title 47, FCC Part 15.247

Canada:
RSS-247 Issue 1

Japan:
Article 2 clause 1 item 19

Additional country-specific approvals on request.

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.

Tests and certificates

- Pressure test, internal procedure, inspection certificate
- 3.1 Material certificate, wetted parts and secondary containment, EN10204-3.1 inspection certificate
- PMI test (XRF), internal procedure, wetted parts, EN10204-3.1 inspection certificate
- EN10204-2.1 confirmation of compliance with the order and EN10204-2.2 test report

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- IEC/EN 60068-2-6
  Environmental influences: Test procedure - Test Fc: vibrate (sinusoidal).
- IEC/EN 60068-2-31
  Environmental influences: Test procedure - Test Ec: shocks due to rough handling, primarily for devices.
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326
  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
- NAMUR NE 132
  Coriolis mass meter
- ETSI EN 300 328
  Guidelines for 2.4 GHz radio components.
- EN 301489
  Electromagnetic compatibility and radio spectrum matters (ERM).

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: 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

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.

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

Diagnostics functions

Package	Description
Extended HistoROM	Comprises extended functions concerning the event log and the activation of the measured value memory. Event log: Memory volume is extended from 20 message entries (standard version) to up to 100 entries. Data logging (line recorder): ▪ Memory capacity for up to 1000 measured values is activated. ▪ 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user. ▪ Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.

Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	**Heartbeat Monitoring** 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: ▪ Draw conclusions - using these data and other information - about the impact process influences (such as corrosion, abrasion, buildup etc.) have on the measuring performance over time. ▪ Schedule servicing in time. ▪ Monitor the process or product quality, e.g. gas pockets. **Heartbeat Verification** Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment". ▪ Functional testing in the installed state without interrupting the process. ▪ Traceable verification results on request, including a report. ▪ Simple testing process via local operation or other operating interfaces. ▪ Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications. ▪ Extension of calibration intervals according to operator's risk assessment.

Concentration

Package	Description
Concentration measurement and special density	**Calculation and outputting of fluid concentrations** Many applications use density as a key measured value for monitoring quality or controlling processes. The device measures the density of the fluid as standard and makes this value available to the control system. The "Special Density" application package offers high-precision density measurement over a wide density and temperature range particularly for applications subject to varying process conditions. With the help of the "Concentration Measurement" application package, the measured density is used to calculate other process parameters: ▪ Temperature-compensated density (reference density). ▪ Percentage mass of the individual substances in a two-phase fluid. (Concentration in %). ▪ Fluid concentration is output with special units (°Brix, °Baumé, °API, etc.) for standard applications.

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.

Device-specific accessories

For the transmitter

Accessories	Description
Promass 300 transmitter	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output ▪ Input ▪ Display / operation ▪ Housing ▪ Software For details, see Installation Instructions EA01150
Remote display and operating module DKX001	The remote display and operating module DKX001 is available as an optional extra: Order code for "Display; operation", option **O** "Separate backlit, 4-line display; 10 m (30 ft) Cable; touch control" The remote display and operating module DKX001 can also be ordered separately and subsequently as an accessory without a measuring device . Further information on display and operating module DKX001→ 72. For details, see Special Documentation SD01763D
WLAN antenna Wide range	External WLAN antenna for a range of up to 50 m (165 ft). Further information on the WLAN interface → 75.
Protective cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. For details, see Installation Instructions EA01160

For the sensor

Accessories	Description
Heating jacket	Is used to stabilize the temperature of the fluids in the sensor. Water, water vapor and other non-corrosive liquids are permitted for use as fluids. If using oil as a heating medium, please consult with Endress+Hauser. Heating jackets cannot be used with sensors fitted with a rupture disk. For details, see Operating Instructions BA00099D

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Fieldgate FXA320	Gateway for the remote monitoring of connected 4 to 20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**. For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area** and the **Ex area**. For details, see Operating Instructions BA01202S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Choice of measuring devices for industrial requirements ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. ▪ Graphic illustration of the calculation results ▪ 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. Applicator is available: ▪ Via the Internet: https://wapps.endress.com/applicator ▪ As a downloadable DVD for local PC installation.
W@M	W@M Life Cycle Management 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. 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. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement

FieldCare	FDT-based plant asset management tool from Endress+Hauser. 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. For details, see Operating Instructions BA00027S and BA00059S
DeviceCare	Tool for connecting and configuring Endress+Hauser field devices. For details, see Innovation brochure IN01047S

System components

Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all 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. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R
Cerabar M	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. For details, see "Technical Information" TI00426P, TI00436P and Operating Instructions BA00200P, BA00382P
Cerabar S	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. For details, see "Technical Information" TI00383P and Operating Instructions BA00271P
iTEMP	The temperature transmitters can be used in all applications and are suitable for the measurement of gases, steam and liquids. They can be used to read in the fluid temperature. For details, see "Fields of Activity", FA00006T

Supplementary documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The *W@M Device Viewer* : Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

Standard documentation

Brief Operating Instructions

Part 1 of 2: Sensor

Measuring device	Documentation code
Proline Promass	KA01212D

Part 2 of 2: Transmitter

Measuring device	Documentation code			
	HART	FOUNDATION Fieldbus	PROFIBUS PA	Modbus RS485
Proline 300	KA01226D	KA01229D	KA01227D	KA01228D

Operating Instructions

Measuring device	Documentation			
	HART	FOUNDATION Fieldbus	PROFIBUS PA	Modbus RS485
Promass A 300	BA01482D	BA01515D	BA01504D	BA01493D

Description of device parameters

Measuring device	Documentation code			
	HART	FOUNDATION Fieldbus	PROFIBUS PA	Modbus RS485
Promass 300	GP01057D	GP01094D	GP01058D	GP01059D

Supplementary device-dependent documentation

Safety Instructions

Contents	Documentation code
ATEX/IECEx Ex d/Ex de	XA01405D
ATEX/IECEx Ex ec	XA01439D
cCSAus XP	XA01373D
cCSAus Ex d/ Ex de	XA01372D
cCSAus Ex nA	XA01507D
INMETRO Ex d/Ex de	XA01468D
INMETRO Ex ec	XA01470D
NEPSI Ex d/Ex de	XA01469D
NEPSI Ex nA	XA01471D

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
INMETRO Ex ec	XA01501D
NEPSI Ex i	XA01502D
NEPSI Ex nA	XA01503D

Special documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Functional Safety Manual	SD01727D
Remote display and operating module DKX001	SD01763D

Contents	Documentation			
	HART	FOUNDATION Fieldbus	PROFIBUS PA	Modbus RS485
Web server	SD01662D	SD01665D	SD01664D	SD01663D
Heartbeat Technology	SD01642D	SD01696D	SD01698D	SD01697D
Concentration measurement	SD01644D	SD01706D	SD01708D	SD01707D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Specified for each individual accessory

Registered trademarks

HART®
Registered trademark of the FieldComm Group, Austin, Texas, USA

PROFIBUS®
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FOUNDATION™ Fieldbus
Registration-pending trademark of the FieldComm Group, Austin, Texas, USA

Modbus®
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TRI-CLAMP®
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SWAGELOK®
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