TI01511P/00/EN/09.25-00
71726766
2025-10-17

Technical Information
Deltabar PMD75B

Differential pressure, level and flow measurement in liquids or gases
4-20mA HART, PROFINET over Ethernet-APL, PROFIBUS PA



Digital differential pressure transmitter with metallic process membrane

Application

- Pressure measuring ranges: up to 250 bar (3 750 psi) (gauge pressure and absolute pressure) and 40 bar (600 psi) (differential pressure)
- Static pressure: up to 420 bar (6 300 psi)
- Accuracy: up to ±0.035%

Advantages

The new Deltabar generation introduces a robust pressure transmitter that combines numerous benefits: Easiest local or remote operation, allows condition-based maintenance and offers smart safety in processes. The firmware is designed to ensure extremely easy handling. Intuitive and clear wizard navigation guides the user through the commissioning and verification of the device. The Bluetooth connectivity provides safe and remote operation. The large display with backlight guarantees excellent readability. The Heartbeat Technology software package offers an on-demand verification and monitoring function to detect undesired anomalies. including plugged impulse lines or changes in the supply voltage, for example.

Endress+Hauser
People for Process Automation

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About this document

Symbols

Warning symbols

DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

WARNING

This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

CAUTION

This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

Electrical symbols

Ground connection: ⏚

Terminal for connection to the grounding system.

Symbols for certain types of Information

Permitted: ✓

Procedures, processes or actions that are permitted.

Forbidden: ✗

Procedures, processes or actions that are forbidden.

Additional information: ℹ

Reference to documentation:

Reference to page:

Series of steps: 1., 2., 3.

Result of an individual step: ↳

Symbols in graphics

Item numbers: 1, 2, 3 ...

Series of steps: 1., 2., 3.

Views: A, B, C, ...

Symbols on the device

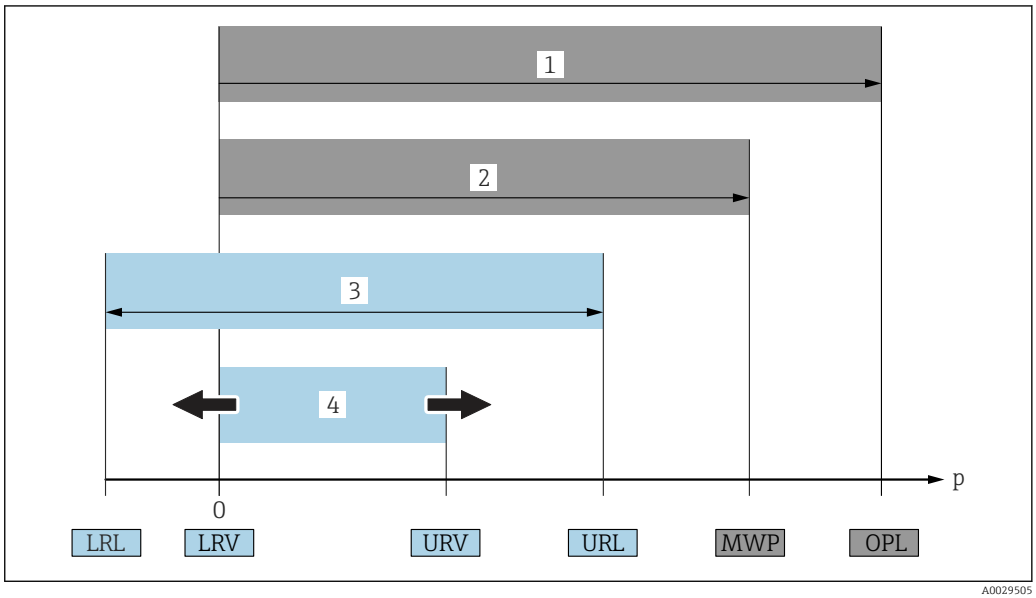
Safety instructions: ⚠ →

Observe the safety instructions contained in the associated Operating Instructions.

Graphic conventions

- Installation, explosion and electrical connection drawings are presented in simplified format
- Devices, assemblies, components and dimensional drawings are presented in reduced-line format
- Dimensional drawings are not to-scale representations; the dimensions indicated are rounded off to 2 decimal places

List of abbreviations



1 *OPL: The OPL (over pressure limit = measuring cell overpressure limit) for the device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection must be taken into consideration in addition to the measuring cell. Observe pressure-temperature dependency. OPL (Over Pressure Limit) is a test pressure.*

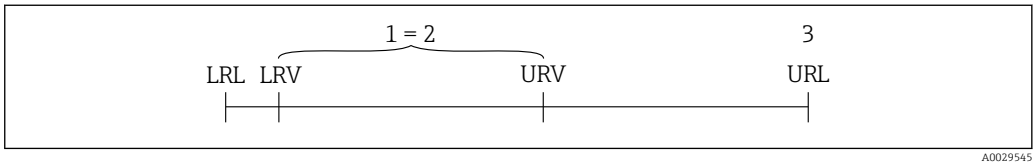
2 *MWP: The MWP (maximum working pressure) for the measuring cells depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection also has to be taken into consideration besides the measuring cell. Observe pressure-temperature dependency. The maximum working pressure may be applied at the device for an unlimited period of time. The maximum working pressure can be found on the nameplate.*

3 *The maximum measuring range corresponds to the span between the LRL and URL. This measuring range is equivalent to the maximum span that can be calibrated/adjusted.*

4 *The calibrated/adjusted span corresponds to the span between the LRV and URV. Factory setting: 0 to URL. Other calibrated spans can be ordered as customized spans.*

p Pressure
LRL Lower range limit
URL Upper range limit
LRV Lower range value
URV Upper range value
TD Turn down Example - see the following section.

Turn down calculation



1 *Calibrated/adjusted span*
2 *Zero point-based span*
3 *Upper range limit*

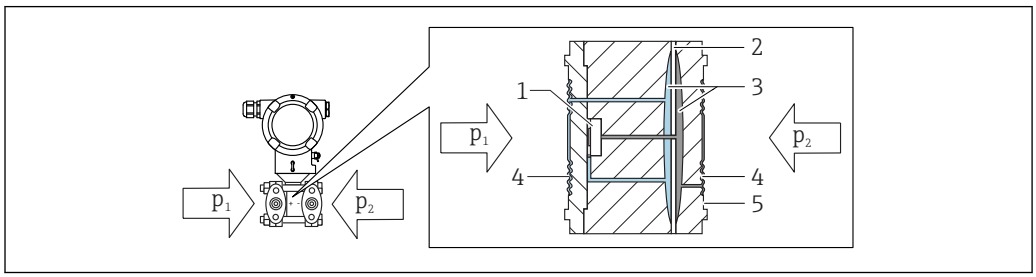
Example:
- Measuring cell: 16 bar (240 psi)
- Upper range limit (URL) = 16 bar (240 psi)
- Calibrated/adjusted span: 0 to 8 bar (0 to 120 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 8 bar (120 psi)

$$TD = \frac{URL}{|URV - LRV|}$$

In this example, the TD is therefore 2:1. This measuring span is based on the zero point.

Function and system design

Equipment architecture



A0043083

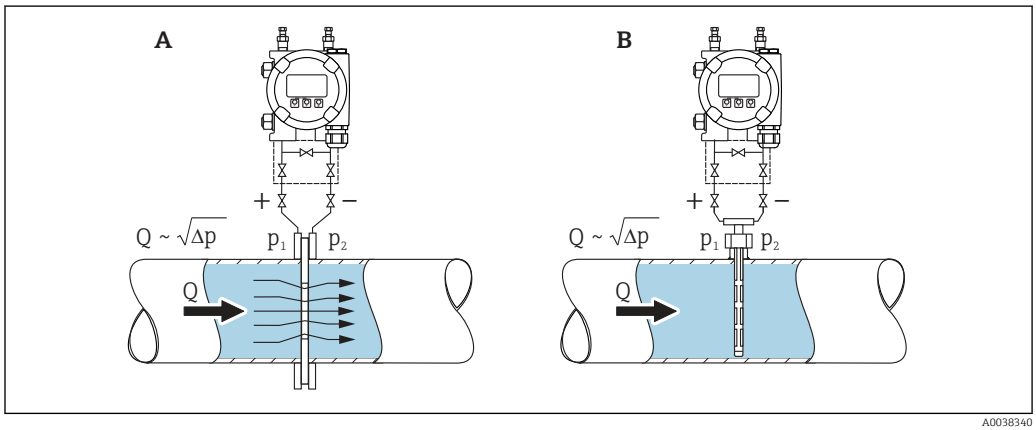
1 Measuring element
2 Middle diaphragm
3 Fill fluid
4 Membrane
5 Seal
p_1 Pressure 1
p_2 Pressure 2

The membrane is deflected on both sides by the pressures that are applied. A fill fluid transfers the pressure to a side of the measuring element where a resistance bridge is located (semiconductor technology). The change in the bridge output voltage, which depends on the differential pressure, is measured and processed further.

Measuring system

Flow measurement

Flow measurement with Deltabar and differential pressure sensor:



A0038340

A Orifice plate
B Pitot tube
Q Flow
Δp Differential pressure, $\Delta p = p_1 - p_2$

Advantages:

- A specific unit is defined
- With the **Low flow cut off** parameter, positive zero return can be configured in the lower measuring range.

Communication and data processing

- 4 to 20 mA with HART communication protocol (optional)
- Bluetooth (optional)
- PROFIBUS PA (optional)
- PROFINET over Ethernet-APL (optional): 10BASE-T1L communication protocol

Reliability for devices with HART, Bluetooth, PROFINET over Ethernet-APL , PROFIBUS PA

IT security

Endress+Hauser can 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.

Input

Measured variable

Measured process variables

- Differential pressure
- Absolute pressure
- Gauge pressure

Measuring range

Depending on the device configuration, the maximum working pressure (MWP) and the overpressure limit (OPL) can deviate from the values in the tables.

Standard: PN 160 / 16 MPa / 2400 psi

Measuring cell	Maximum measuring range		Smallest calibratable span (preset at factory) [1) 2)]
	lower (LRL)	upper (URL)	
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]
10 (0.15)	−10 (-0.15)	+10 (+0.15)	0.25 (0.00375)
30 (0.45)	−30 (-0.45)	+30 (+0.45)	0.3 (0.0045)
100 (1.5)	−100 (-1.5)	+100 (+1.5)	1 (0.015)
500 (7.5)	−500 (-7.5)	+500 (+7.5)	5 (0.075)
3000 (45)	−3000 (-45)	+3000 (+45)	30 (0.45)
16000 (240)	−16000 (-240)	+16000 (+240)	160 (2.4)
40000 (600)	−40000 (-600)	+40000 (+600)	400 (6)

1) Turn down > 100:1 on request or can be configured at the device
2) The maximum TD is 5:1 in the case of platinum.

Standard: PN 160 / 16 MPa / 2400 psi

Measuring cell	MWP	OPL		Burst pressure [1) 2)].
		on one side	on both sides	
[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
10 (0.15)	100 (1500)	150 (2250)	150 (2250)	690 (10005)
30 (0.45)	100 (1500)	150 (2250)	150 (2250)	690 (10005)
100 (1.5)	160 (2400) [3)]	160 (2400)	240 (3600)	690 (10005)
500 (7.5)	160 (2400) [3)]	160 (2400)	240 (3600)	690 (10005)
3000 (45)	160 (2400) [3)]	160 (2400)	240 (3600)	690 (10005)
16000 (240)	160 (2400) [3)]	160 (2400)	240 (3600)	690 (10005)
40000 (600)	160 (2400) [3) 4)]	"+" side: 160 (2400) "–" side: 100 (1500)	240 (3600)	690 (10005)

1) Applies to the process seal materials FKM, PTFE, FFKM, EPDM and for pressure applied on both sides.
2) If the side vent valves (sv) and PTFE seal option is selected, the burst pressure is 600 bar (8 700 psi)
3) If CRN approval is selected, the following limited MWP values apply: with copper seals: 124 bar (1 798.5 psi)
4) If pressure is applied on the negative side only, the MWP is 100 bar (1 500 psi).

Standard: PN 250 / 25 MPa / 3626 psi

Measuring cell	Maximum measuring range		Smallest calibratable span (preset at factory) [1) 2)]
	Lower (LRL)	Upper (URL)	
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]
100 (1.5)	−100 (-1.5)	+100 (+1.5)	1 (0.015)
500 (7.5)	−500 (-7.5)	+500 (+7.5)	5 (0.075)

Measuring cell	Maximum measuring range		Smallest calibratable span (preset at factory) [1) 2)]
	Lower (LRL)	Upper (URL)	
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]
3000 (45)	−3000 (-45)	+3000 (+45)	30 (0.45)
16000 (240)	−16000 (-240)	+16000 (+240)	160 (2.4)
40000 (600)	−40000 (-600)	+40000 (+600)	400 (6)

1) Turn down > 100:1 on request or can be configured at the device
2) The maximum TD is 5:1 in the case of platinum.

Standard: PN 250 / 25 MPa / 3626 psi

Measuring cell	MWP [1)]	OPL		Burst pressure [2) 3) 4)]
		on one side	on both sides	
[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
100 (1.5)	250 (3626) [5)]	250 (3626)	375 (5625)	1320 (19140)
500 (7.5)	250 (3626) [5)]	250 (3626)	375 (5625)	1320 (19140)
3000 (45)	250 (3626) [5)]	250 (3626)	375 (5625)	1320 (19140)
16000 (240)	250 (3626) [5)]	250 (3626)	375 (5625)	1320 (19140)
40000 (600)	250 (3626) [5) 6)]	"+" side: 250 (3626) "–" side: 100 (1500)	375 (5625)	1320 (19140)

1) MWP only on both sides.
2) Applies to the process seal materials FKM, FFKM, EPDM and for pressure applied on both sides.
3) If the side vent valves (sv) option is selected, the burst pressure is 690 bar (10 005 psi).
4) For the process seal material PTFE, the burst pressure is 1 250 bar (18 125 psi).
5) If a CRN approval is selected, the following limited MWPs apply: with side venting: 179 bar (2 596.2 psi); with copper seals: 124 bar (1 798.5 psi)
6) If pressure is applied on the negative side only, the MWP is 100 bar (1 500 psi).

Option PN 320 / 32 MPa / 4641 psi

Measuring cell	Maximum measuring range		Smallest calibratable span (preset at factory) [1) 2)]
	lower (LRL)	upper (URL)	
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]
100 (1.5)	−100 (-1.5)	+100 (+1.5)	1 (0.015)
500 (7.5)	−500 (-7.5)	+500 (+7.5)	5 (0.075)
3000 (45)	−3000 (-45)	+3000 (+45)	30 (0.45)
16000 (240)	−16000 (-240)	+16000 (+240)	160 (2.4)
40000 (600)	−40000 (-600)	+40000 (+600)	400 (6)

1) Turn down > 100:1 on request
2) The maximum TD is 5:1 in the case of platinum.

Option PN 320 / 32 MPa / 4641 psi

Measuring cell	MWP [1)]	OPL		Burst pressure [2) 3) 4)]
		on one side	on both sides	
[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
100 (1.5)	320 (4641) [5)]	320 (4641)	480 (7200)	1320 (19140)
500 (7.5)	320 (4641) [5)]	320 (4641)	480 (7200)	1320 (19140)
3000 (45)	320 (4641) [5)]	320 (4641)	480 (7200)	1320 (19140)

Measuring cell	MWP [1]	OPL		Burst pressure [2] [3] [4]
		on one side	on both sides	
[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
16000 (240)	320 (4641) [5]	320 (4641)	480 (7200)	1320 (19140)
40000 (600)	320 (4641) [5] [6]	"+" side: 320 (4641) "–" side: 100 (1500)	480 (7200)	1320 (19140)

1) MWP only on both sides.
2) Applies for the process seal materials FKM, FFKM, EPDM and for pressure applied at both sides.
3) If the side vent valves (sv) option is selected, the burst pressure is 690 bar (10005 psi).
4) For the process seal material PTFE (PN250), the burst pressure is 1250 bar (18125 psi).
5) If CRN approval is selected, the following limited MWP values apply: without side vent valves: 262 bar (3800 psi); with side vent: 179 bar (2596.2 psi); with copper seals: 124 bar (1798.5 psi)
6) If pressure is applied on the negative side only, the MWP is 100 bar (1500 psi).

Option PN 420 / 42 MPa / 6092 psi

Measuring cell	Maximum measuring range		Smallest calibratable span (preset at factory) [1] [2]
	lower (LRL)	upper (URL)	
[mbar (psi)]	[mbar (psi)]	[mbar (psi)]	[mbar (psi)]
100 (1.5)	–100 (-1.5)	+100 (+1.5)	1 (0.015)
500 (7.5)	–500 (-7.5)	+500 (+7.5)	5 (0.075)
3000 (45)	–3000 (-45)	+3000 (+45)	30 (0.45)
16000 (240)	–16000 (-240)	+16000 (+240)	160 (2.4)
40000 (600)	–40000 (-600)	+40000 (+600)	400 (6)

1) Turn down > 100:1 on request
2) The maximum TD is 5:1 in the case of platinum.

Option PN 420 / 42 MPa / 6092 psi

Measuring cell	MWP [1]	OPL		Burst pressure [2] [3] [4]
		on one side	on both sides	
[mbar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]
100 (1.5)	420 (6092) [5]	420 (6092)	630 (9450)	1320 (19140)
500 (7.5)	420 (6092) [5]	420 (6092)	630 (9450)	1320 (19140)
3000 (45)	420 (6092) [5]	420 (6092)	630 (9450)	1320 (19140)
16000 (240)	420 (6092) [5]	420 (6092)	630 (9450)	1320 (19140)
40000 (600)	420 (6092) [5] [6]	"+" side: 420 (6092) "–" side: 100 (1500)	630 (9450)	1320 (19140)

1) MWP only on both sides.
2) Applies for the process seal materials FKM, FFKM, EPDM and for pressure applied at both sides.
3) If the side vent valves (sv) option is selected, the burst pressure is 690 bar (10005 psi).
4) For the process seal material PTFE (PN250), the burst pressure is 1250 bar (18125 psi).
5) If CRN approval is selected, the following limited MWP values apply: without side vent valves: 262 bar (3800 psi); with side vent: 179 bar (2596.2 psi); with copper seals: 124 bar (1798.5 psi)
6) If pressure is applied on the negative side only, the MWP is 100 bar (1500 psi).

PMD75B: optionally available as a gauge or absolute pressure measuring cell

Measuring cell	Maximum measuring range		Smallest calibratable span (preset at factory) [1]
	lower (LRL)	upper (URL)	
bar (psi)	bar (psi)	bar (psi)	bar (psi)
160 (2400) gauge	-1 (-15)	160 (2400)	40 (600)
160 (2400) abs	0	160 (2400)	4 (60)
250 (3750) gauge [2]	-1 (-15)	250 (3750)	40 (600)
250 (3750) abs [2]	0	250 (3750)	4 (60)

1) The maximum TD is 5:1 in the case of platinum.
2) The 250 bar measuring cell can be used over the entire measuring range with up to 100,000 load changes without specification restrictions.

PMD75B: optionally available as a gauge or absolute pressure measuring cell

Measuring cell	MWP	OPL		Burst pressure [1] [2] [3]
		on one side	on both sides	
bar (psi)	bar (psi)	bar (psi)		[bar (psi)]
160 (2400) gauge	160 (2400) [4]	240 (3600)	- [5]	1320 (19140)
160 (2400) abs	160 (2400) [4]	240 (3600)	- [5]	1320 (19140)
250 (3750) gauge [6]	250 (3750) [4]	375 (5625)	- [5]	1320 (19140)
250 (3750) abs [6]	250 (3750) [4]	375 (5625)	- [5]	1320 (19140)

1) Applies for the process seal materials FKM, FFKM, EPDM and for pressure applied at both sides.
2) If the side vent valves (sv) option is selected, the burst pressure is 690 bar (10 005 psi).
3) For the process seal material PTFE (PN250), the burst pressure is 1 250 bar (18 125 psi).
4) If CRN approval is selected, the following limited MWP values apply: without side vent valves: 262 bar (3 800 psi); with side vent: 179 bar (2 596.2 psi); with copper seals: 124 bar (1 798.5 psi)
5) Available only with blind flange on LP side.
6) The 250 bar measuring cell can be used over the entire measuring range with up to 100,000 load changes without specification restrictions.

Minimum static pressure

- Minimum static pressure at reference operating conditions for silicone oil:25 mbar (0.0375 psi)$_{abs}$
- Minimum static pressure for 85 °C (185 °F) silicone oil: to 250 mbar (4 psi) $_{abs}$

Optionally available as a gauge or absolute pressure sensor (all measuring cells)
- Minimum static pressure at reference operating conditions for silicone oil:10 mbar (0.15 psi)$_{abs}$
- Minimum static pressure for 85 °C (185 °F) silicone oil: to 10 mbar (0.15 psi) $_{abs}$

Output

Output signal

Current output

4 to 20 mA with superimposed digital communication protocol HART, 2-wire

The current output offers a choice of three different operating modes:
- 4.0 to 20.5 mA
- NAMUR NE 43: 3.8 to 20.5 mA (factory setting)
- US mode: 3.9 to 20.8 mA

PROFINET with Ethernet-APL

10BASE-T1L, 2-wire 10 Mbit

PROFIBUS PA

According to EN 50170 Volume 2, IEC 61158-2

Signal coding:
Manchester Bus Powered (MBP) type 1

Data transmission rate:
31.25 kBit/s, voltage mode

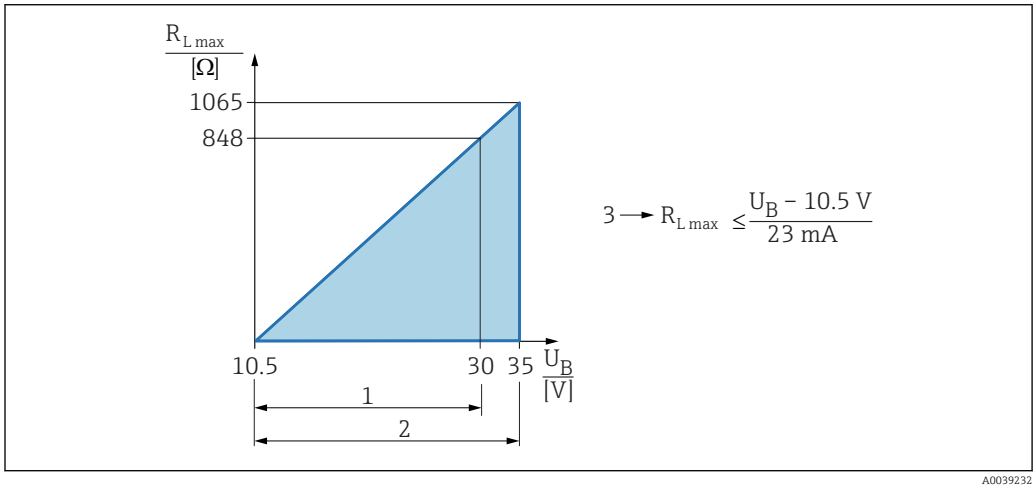
Galvanic isolation:
Yes

Signal on alarm

- 4 to 20 mA HART:
  Options:
  - Max alarm: can be set from 21.5 to 23 mA
  - Min. alarm: < 3.6 mA (factory setting)
  - Signal on alarm in accordance with NAMUR recommendation NE 43.
- PROFINET over Ethernet-APL:
  - According to "Application layer protocol for decentralized periphery", Version 2.4
  - Diagnostics according to PROFINET PA Profile 4.02
- PROFIBUS PA
  - Diagnostics in accordance with PROFIBUS PA Profile 3.02
  - Status signal (as per NAMUR recommendation NE 107) plain text display

Load

4 to 20 mA HART



A0039232

1 Power supply 10.5 to 30 VDC Ex i
2 Power supply 10.5 to 35 VDC, for other types of protection and non-certified device versions
3 R_{Lmax} maximum load resistance
U_B Supply voltage

Operation via handheld terminal or PC with operating program: take minimum communication resistance of 250 Ω into consideration.

Damping

A damping affects all outputs (output signal, display). Damping can be enabled as follows:
- Via the onsite display, Bluetooth, handheld terminal or PC with operating program, continuous from 0 to 999 seconds
- Factory setting: 1 s

Ex connection data

See the separate technical documentation (Safety Instructions (XA)) on www.endress.com/download.

Linearization

The device's linearization function allows the user to convert the measured value to any units of height or volume. User-defined linearization tables of up to 32 value pairs can be entered if necessary.

Flow measurement with Deltabar and differential pressure sensor

Low flow cut off parameter: When the **Low flow cut off** parameter is activated, small flows which can lead to large fluctuations in the measured value are suppressed.

The **Low flow cut off** parameter is set to 5% by default when the **Output current transfer function** parameter is set to **Square root** option.

Protocol-specific data

HART

- Manufacturer ID: 17 (0x11{hex})
- Device type ID: 0x1131
- Device revision: 1
- HART specification: 7
- DD revision: 1
- Device description files (DTM, DD) information and files at:
  - www.endress.com
  - www.fieldcommgroup.org
- HART load: min. 250 Ohm

HART device variables (preset at the factory)

The following measured values are assigned to the device variables at the factory:

Device variable	Measured value
Primary variable (PV) [1]	Pressure [2]
Secondary variable (SV)	Sensor temperature
Tertiary variable (TV)	Electronic temperature
Quaternary variable (QV)	Sensor pressure [3]

1) The PV is always applied to the current output.
2) The pressure is the calculated signal after damping and position adjustment.
3) The Sensor pressure is the raw signal of the measuring cell before damping and position adjustment.

Choice of HART device variables

- **Pressure** option (after position correction and damping)
- Scaled variable
- Sensor temperature
- Sensor pressure
  Sensor Pressure is the raw signal from sensor before damping and position adjustment.
- Electronics temperature
- Terminal current
  The terminal current is the read-back current on terminal block.
- Terminal voltage 1
  Visibility depends on order options or device settings
- **Noise of pressure signal** option and **Median of pressure signal** option
  Visible if Heartbeat Technology ordered
- Percent of range
- Loop current
  The loop current is the output current set by the applied pressure.

Supported functions

- Burst mode
- Additional transmitter status
- Device locking

PROFINET over Ethernet-APL

Protocol	Application layer protocol for decentral device periphery and distributed automation, Version 2.4
Communication type	Ethernet Advanced Physical Layer 10BASE-T1L
Conformity class	Conformance Class B
Netload Class	Netload Class II
Baud rates	Automatic 10 Mbit/s with full-duplex detection
Periods	From 32 ms
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs
Media Redundancy Protocol (MRP)	Yes
System redundancy support	System redundancy S2 (2 AR with 1 NAP)
Device profile	Application interface identifier 0xB310 Generic device
Manufacturer ID	0x11
Device type ID	A231
Device description files (GSD, FDI, DTM, DD)	Information and files at: - www.endress.com On the product page for the device: Documents/Software → Device drivers - www.profibus.org
Supported connections	- 2 x AR (IO Controller AR) - 1 x AR (IO-Supervisor Device AR connection allowed) - 1 x Input CR (Communication Relation) - 1 x Output CR (Communication Relation) - 1 x Alarm CR (Communication Relation)
Configuration options for device	- Manufacturer-specific software (FieldCare, DeviceCare) - Web browser - Device master file (GSD), can be read out via the integrated web server of the device - DIP switch for setting the service IP address
Configuration of the device name	- DCP protocol - Process Device Manager (PDM) - Integrated web server

Supported functions	- Identification & maintenance
	Simple device identification via:
	  - Control system
	  - Nameplate
	- Measured value status
	The process variables are communicated with a measured value status
	- Blinking feature via the local display for simple device identification and assignment
	- Device operation via operating tools (e.g. FieldCare, DeviceCare, SIMATIC PDM)

System integration	For information on system integration, see Operating Instructions - Cyclic data transmission - Overview and description of the modules - Status coding - Startup parameterization - Factory setting

PROFIBUS PA

Manufacturer ID:
17 (0x11)

Ident number:
0x1574 or 0x9700

Profile version:
3.02

GSD file and version
Information and files at:
- www.endress.com
  On the product page for the device: Documents/Software → Device drivers
- www.profibus.com

Output values

Analog Input:
- Pressure
- Scaled variable
- Sensor temperature
- Sensor pressure
- Electronics temperature
- **Median of pressure signal** option (only available if the "Heartbeat Verification + Monitoring" application package was selected).
- **Noise of pressure signal** option (only available if the "Heartbeat Verification + Monitoring" application package was selected).

Digital Input:
ℹ Only available if the "Heartbeat Verification + Monitoring" application package was selected

Heartbeat Technology → SSD: Statistical Sensor Diagostics

Heartbeat Technology → Process Window

Input values

Analog Output:
Analog value from PLC to be indicated on the display

Supported functions

- Identification & maintenance
  Simple device identification via control system and nameplate
- Automatic Ident Number Adoption
  GSD compatibility mode for generic profile 0x9700 "Transmitter with 1 Analog Input"
- Physical Layer Diagnostics
  Installation check of the PROFIBUS segment and device using terminal voltage and message monitoring
- PROFIBUS upload/download
  Reading and writing parameters is up to ten times faster with PROFIBUS upload/download
- Condensed status
  Straightforward and self-explanatory diagnostic information through categorization of occurring diagnostic messages

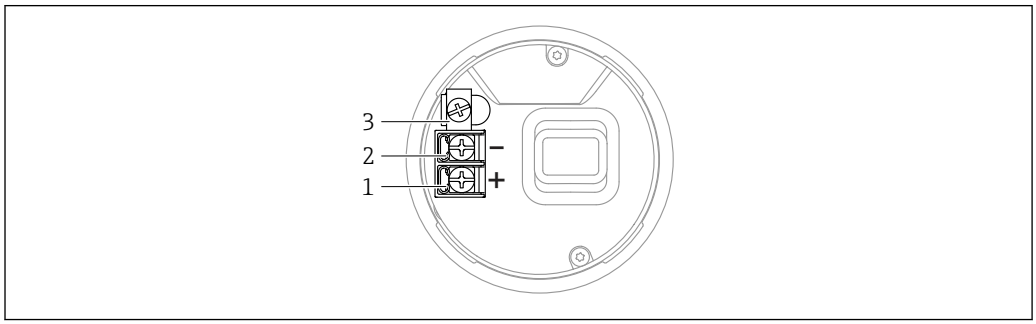
Wireless HART data

- Minimum starting voltage: 10.5 V
- Start-up current: 3.6 mA
- Start-up time: <5 s
- Minimum operating voltage: 10.5 V
- Multidrop current: 4 mA

Power supply

Terminal assignment

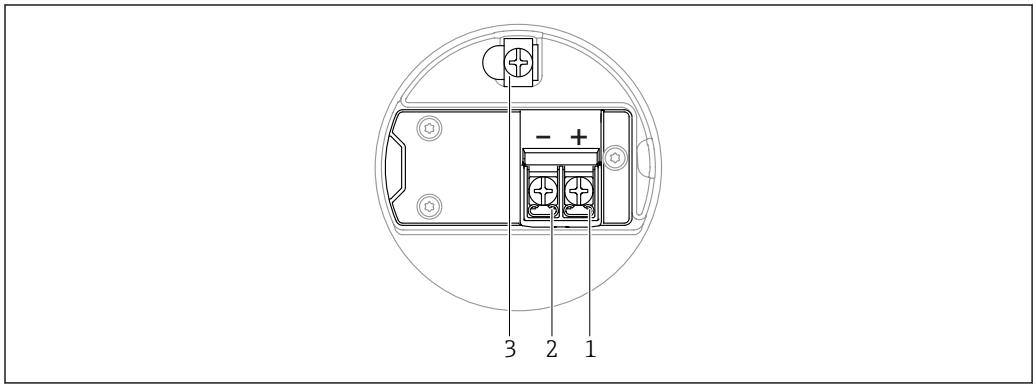
Single compartment housing



1 *Connection terminals and ground terminal in the connection compartment*

1 *Plus terminal*
2 *Minus terminal*
3 *Internal ground terminal*

Dual-compartment housing



2 *Connection terminals and ground terminal in the connection compartment*

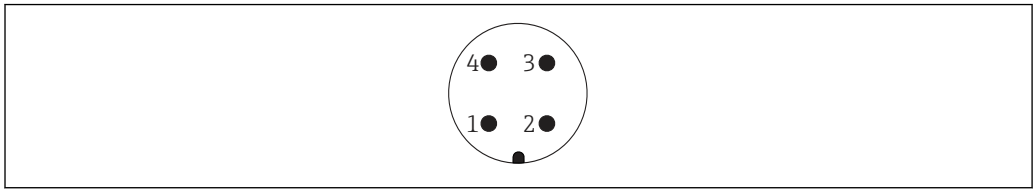
1 *Plus terminal*
2 *Minus terminal*
3 *Internal ground terminal*

Available device plugs

In the case of devices with a plug, it is not necessary to open the housing for connection purposes.

Use the enclosed seals to prevent the penetration of moisture into the device.

Devices with M12 plug



3 *View of the plug-in connection on the device*

Pin	HART PROFIBUS PA
1	Signal +
2	Not used

Pin	HART PROFIBUS PA
3	Signal –
4	Earth

Pin	PROFINET over Ethernet-APL
1	APL signal -
2	APL signal +
3	Shielding
4	Not used

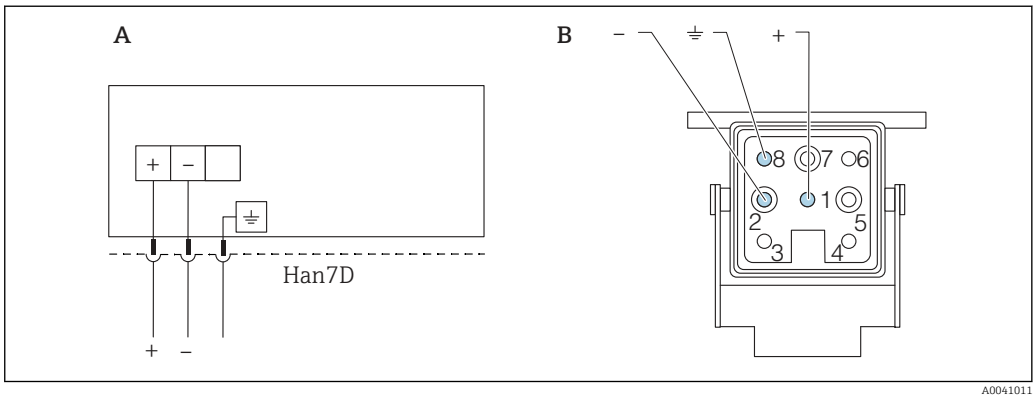
Endress+Hauser offers the following accessories for devices with an M12 plug:

Plug-in jack M 12x1, straight
- Material:
  Body: PBT; union nut: nickel-plated die-cast zinc; seal: NBR
- Degree of protection (fully locked): IP67
- Order number: 52006263

Plug-in jack M 12x1, angled (not for PROFINET over Ethernet-APL)
- Material:
  Body: PBT; union nut: nickel-plated die-cast zinc; seal: NBR
- Degree of protection (fully locked): IP67
- Order number: 71114212

Cable 4x0.34 mm^2 (20 AWG) with M12 plug-in jack, elbowed, screw plug, length 5 m (16 ft)
- Material: body: TPU; union nut: nickel-plated die-cast zinc; cable: PVC
- Degree of protection (fully locked): IP67/68
- Order number: 52010285
- Cable colors
  - 1 = BN = brown
  - 2 = WT = white
  - 3 = BU = blue
  - 4 = BK = black

Devices with a Harting plug Han7D



A Electrical connection for devices with Harting plug Han7D
B View of the plug-in connection on the device
- Brown
⏚ Green/yellow
+ Blue

Material: CuZn, gold-plated contacts of the plug-in jack and plug

Supply voltage

- Analog/HART: Ex d, Ex e, non-Ex: supply voltage: 10.5 to 35 V_{DC}
- Analog/HART: Ex i: supply voltage: 10.5 to 30 V_{DC}
- HART: Nominal current: 4 to 20 mA HART
- PROFINET over Ethernet-APL: APL power class A (9.6 to 15 V_{DC} 540 mW)
- PROFIBUS PA
  - Non-hazardous, Ex d, Ex e: 9 to 32 V_{DC}
  - Ex i FISCO principle: 9 to 17.5 V_{DC}
  - Ex i entity concept: 9 to 24 V_{DC}
  - Nominal current: 14 mA
  - Failure current FDE (Fault Disconnection Electronic): 0 mA

A suitable circuit breaker should be provided for the device in accordance with IEC/EN 61010.

HART: Depending on the supply voltage at the time the device is powered on
- the background lighting is deactivated (supply voltage <15 V)
- the Bluetooth function (order option) is also deactivated (supply voltage <12 V)

PROFIBUS PA: Depending on the supply voltage at the time the device is powered on
- the background lighting is deactivated (supply voltage <12 V)
- the Bluetooth function (order option) is also deactivated (supply voltage <10 V)

Analog/HART: The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV, Class 2) and must comply with the relevant protocol specifications. For 4 to 20 mA, the same requirements apply as for HART.

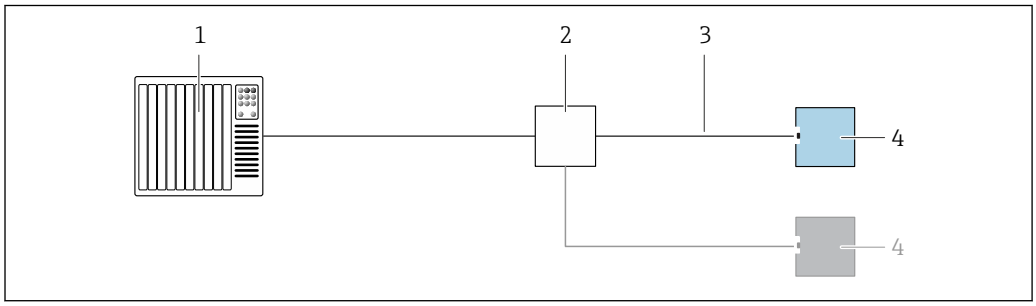
PROFINET over Ethernet-APL: The APL field switch must be tested to ensure it meets safety requirements (e.g. PELV, SELV, Class 2) and must comply with the relevant protocol specifications.

PROFIBUS PA:
- Use only suitable and certified PROFIBUS PA components (e.g. DP/PA segment coupler) for the power supply
- FISCO/FNICO-compliant according to IEC 60079-27
- The supply is not polarity-dependent

Electrical connection

Connection examples

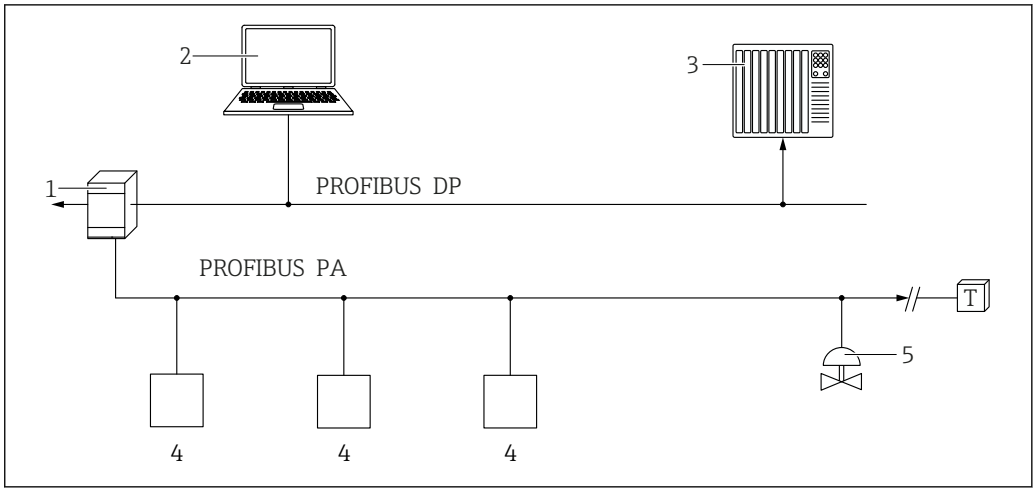
PROFINET over Ethernet-APL



4 *Connection example for PROFINET over Ethernet-APL*

1 Automation system
2 APL field switch
3 Observe cable specifications
4 Transmitter

PROFIBUS PA



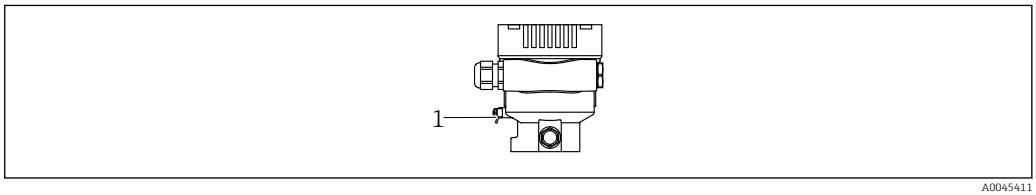
1 Segment coupler
2 Computer with PROFIusb and operating tool (e.g. DeviceCare/FieldCare)
3 PLC (programmable logic controller)
4 Transmitter
5 Additional functions (valves etc.)

Potential equalization

If necessary, the potential matching line can be connected to the outer ground terminal of the device before the device is connected.

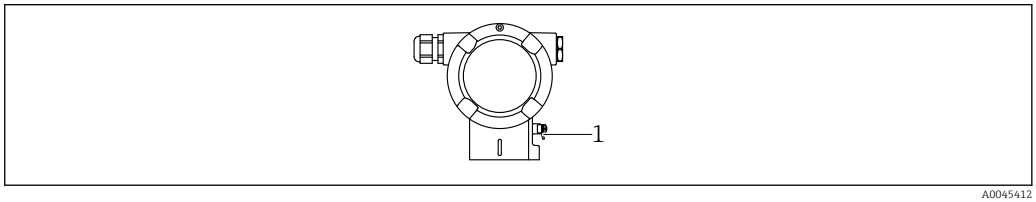
For optimum electromagnetic compatibility:
- Use the shortest possible potential matching line.
- Ensure a cross-section of at least 2.5 mm² (14 AWG).

Single-compartment housing



1 Ground terminal for connecting the potential matching line

Dual-compartment housing



1 Ground terminal for connecting the potential matching line

Terminals

- Supply voltage and inner ground terminal
  Clamping range: 0.5 to 2.5 mm² (20 to 14 AWG)
- External ground terminal
  Clamping range: 0.5 to 4 mm² (20 to 12 AWG)

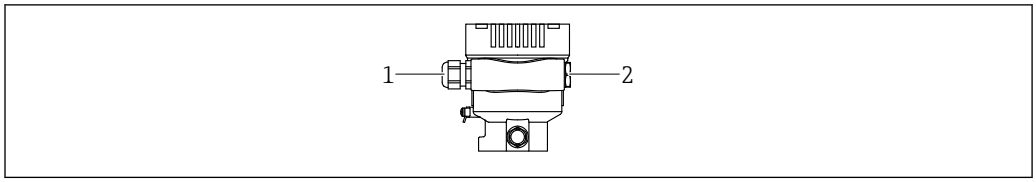
Cable entries

The type of cable entry depends on the device version ordered.

Always route connecting cables downwards so that moisture cannot penetrate the connection compartment.

If necessary, create a drip loop or use a weather protection cover.

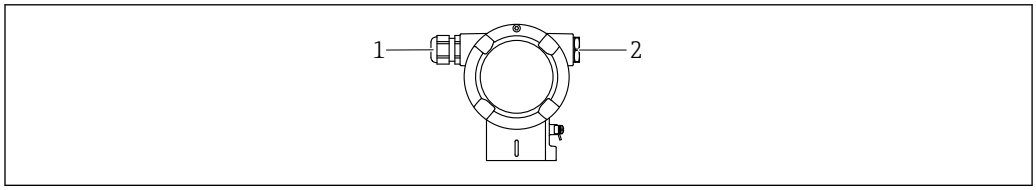
Single-compartment housing



A0045413

1 Cable entry
2 Blind plug

Dual-compartment housing



A0045414

1 Cable entry
2 Blind plug

Cable specification

- The cable outer diameter depends on the cable entry used
- Cable outer diameter
  - Plastic: Ø5 to 10 mm (0.2 to 0.38 in)
  - Nickel-plated brass: Ø7 to 10.5 mm (0.28 to 0.41 in)
  - Stainless steel: Ø7 to 12 mm (0.28 to 0.47 in)

PROFIBUS PA: Use a twisted, shielded twin-core cable, preferably cable type A.

For further information on the cable specification:
- Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning"
- PROFIBUS Assembling Guideline 8.022
- IEC 61158-2 (MBP).

PROFINET with Ethernet-APL

The reference cable type for APL segments is fieldbus cable type A, MAU type 1 and 3 (specified in IEC 61158-2). This cable meets the requirements for intrinsically safe applications according to IEC TS 60079-47 and can also be used in non-intrinsically safe applications.

Cable type	A
Cable capacitance	45 to 200 nF/km
Loop resistance	15 to 150 Ω/km
Cable inductance	0.4 to 1 mH/km

Further details are provided in the Ethernet-APL Engineering Guideline (https://www.ethernet-apl.org).

Overvoltage protection

Devices without optional overvoltage protection

Equipment from Endress+Hauser fulfills the requirements of the product standard IEC/DIN EN 61326-1 (Table 2 Industrial Environment).

Depending on the type of port (DC power supply, input/output port) different testing levels according to IEC/DIN EN against transient overvoltages are applied (IEC/DIN EN 61000-4-5 Surge):
Test level on DC power ports and input/output ports is 1 000 V line to earth

Devices with optional overvoltage protection

- Spark-over voltage: min. 400 V_{DC}
- Tested according to IEC/DIN EN 60079-14 sub chapter 12.3 (IEC/DIN EN 60060-1 chapter 7)
- Nominal discharge current: 10 kA

NOTICE

The device may be damaged by excessively high electrical voltages.

- ▶ Always ground the device with integrated overvoltage protection.

Overvoltage category

Overvoltage category II

Performance characteristics

Response time

- HART:
  - Acyclic: min. 330 ms, typically 590 ms (depends on commands and number of preambles)
  - Cyclic (burst): min. 160 ms, typically 350 ms (depends on commands and number of preambles)
- PROFINET with Ethernet-APL: cyclic: min. 32 ms
- PROFIBUS PA:
  - Acyclic: approx. 60 ms to 70 ms (depending on Min. Slave Interval)
  - Cyclic: approx. 10 ms to 13 ms (depending on Min. Slave Interval)

Reference operating conditions

- As per IEC 62828-2
- Ambient temperature T_A = constant, in the range +22 to +28 °C (+72 to +82 °F)
- Humidity φ = constant, in the range: 5 to 80 % rF ± 5 %
- Atmospheric pressure p_U = constant, in the range: 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell: horizontal ±1°
- Membrane material: AISI 316L (1.4435), Alloy C276 , Monel
- Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value
- Supply voltage: 24 V DC ±3 V DC
- Load with HART: 250 Ω
- Turn Down TD= URL/ | URV - LRV |
- Zero point-based span

Total performance

The performance characteristics refer to the accuracy of the device. The factors influencing accuracy can be divided into two groups.

- Total performance of device
- Installation factors

All of the performance characteristics meet the requirement of ≥ ± 3 sigma.

The total performance of the device comprises the reference accuracy and the ambient temperature effect and is calculated using the following formula:

Total performance = $\pm \sqrt{ (E1)^2 + (E2)^2 + (E3)^2 }$

E1 = Reference accuracy

E2 = Ambient temperature effect

E3 = Static pressure effect

Calculation of E2:

Ambient temperature effect per ±28 °C (50 °F)

(corresponds to a range of −3 to +53 °C (+27 to +127 °F))

$E2 = E2_M + E2_E$

$E2_M$ = Main temperature error

$E2_E$ = Electronics error

- The values apply to process membranes made of 316L (1.4435)
- The values refer to the calibrated span.

Calculation of the total performance with the Endress+Hauser Applicator

Detailed inaccuracies, e.g. for other temperature ranges, can be calculated with the Applicator "Sizing Pressure Performance".

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Reference accuracy [E1]

The reference accuracy comprises the non-linearity according to the limit point method, pressure hysteresis and non-repeatability in accordance with [IEC62828-1]. Reference accuracy for standard up to TD 100:1, for platinum up to TD 5:1.

Measuring cell	Standard	Platinum
10 mbar (0.15 psi)	TD 1:1 = ±0.075 % TD > 1:1 = ±0.075 % · TD	TD 1:1 = ±0.05 % TD > 1:1 to TD 5:1 = ±0.075 % · TD
30 mbar (0.45 psi)	TD 1:1 to 3:1 = ±0.075 % TD > 3:1 = ±0.025 % · TD	TD 1:1 = ±0.05 % TD > 1:1 to TD 1:1 to 3:1 = ±0.075 % TD > 3:1 to TD 5:1 = ±0.025 % · TD
100 mbar (1.5 psi)	TD 1:1 to 5:1 = ±0.05 % TD > 5:1 = ±(0.009 % · TD + 0.005 %)	TD ≥ 1:1 to 5:1 = ±0.04 %
500 mbar (7.5 psi) 3 bar (45 psi) 16 bar (240 psi) 40 bar (600 psi)	TD 1:1 to 15:1 = ±0.05 % TD > 15:1 = ±0.0015 % · TD + 0.0275	TD ≥ 1:1 to 5:1 = ±0.035 %
160 bar (2 400 psi) [1] 250 bar (3 750 psi) [1]	TD 1:1 to 5:1 = ±0.10 % TD > 5:1 = ±0.02 % · TD	not available

1) Gauge pressure measuring cell and absolute pressure measuring cell

Temperature effect [E2]

$E2_M$ - Main temperature error

The output changes due to the effect of the ambient temperature [IEC 62828-1] with respect to the reference temperature [IEC 62828-1]. The values specify the maximum error due to min./max. ambient or process temperature conditions.

10 mbar (0.15 psi) and 30 mbar (0.45 psi) measuring cell
- Standard: ±(0.14 % · TD + 0.04 %)
- Platinum: ±(0.14 % · TD + 0.04 %)

100 mbar (1.5 psi) measuring cell
- Standard: ±(0.07 % · TD + 0.07 %)
- Platinum: ±(0.07 % · TD + 0.07 %)

500 mbar (7.5 psi), 3 bar (45 psi), 16 bar (240 psi) and 40 bar (600 psi) measuring cell
- Standard: ±(0.012 % · TD + 0.017 %)
- Platinum: ±(0.012 % · TD + 0.017 %)

160 bar (2 400 psi) gauge pressure measuring cell and absolute pressure measuring cell
- Standard: ±(0.042 % · TD + 0.04 %)
- Platinum: ±(0.042 % · TD + 0.04 %)

250 bar (3 750 psi) gauge pressure measuring cell and absolute pressure measuring cell
- Standard: ±(0.022 % · TD + 0.04 %)
- Platinum: ±(0.022 % · TD + 0.04 %)

$E2_E$ - Electronics error

- 4 to 20 mA: 0.05 %
- Digital output HART: 0 %
- Digital output PROFINET: 0 %
- Digital output PROFIBUS PA: 0%

$E3_M$ - Main static pressure error

The static pressure effect refers to the effect on the output due to changes in the static pressure of the process (difference between the output at each static pressure and the output at atmospheric pressure [IEC 62828-2 / IEC 61298-3] and therefore the combination of the influence of the operating pressure on the zero point and the span).

10 mbar (0.15 psi) measuring cell
- Standard
  - Influence on the zero point: ±0.23 · TD % per 7 bar (105 psi)
  - Influence on the span: ±0.035 % per 7 bar (105 psi)
- Platinum
  - Influence on the zero point: ±0.07 % · TD per 7 bar (105 psi)
  - Influence on the span: ±0.035 % per 7 bar (105 psi)

30 mbar (0.45 psi) measuring cell
- Standard
  - Influence on the zero point: ±0.70 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.14 % per 70 bar (1 050 psi)
- Platinum
  - Influence on the zero point: ±0.25 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.14 % per 70 bar (1 050 psi)

100 mbar (1.5 psi) measuring cell
- Standard
  - Influence on the zero point: ±0.29 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.15 % per 70 bar (1 050 psi)
- Platinum
  - Influence on the zero point: ±0.077 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.15 % per 70 bar (1 050 psi)

500 mbar (7.5 psi) measuring cell
- Standard
  - Influence on the zero point: ±0.07 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.10 % per 70 bar (1 050 psi)
- Platinum
  - Influence on the zero point: ±0.028 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.10 % per 70 bar (1 050 psi)

3 bar (45 psi) measuring cell
- Standard
  - Influence on the zero point: ±0.049 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.05 % per 70 bar (1 050 psi)
- Platinum
  - Influence on the zero point: ±0.021 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.05 % per 70 bar (1 050 psi)

16 bar (240 psi) and 40 bar (600 psi) measuring cell
- Standard
  - Influence on the zero point: ±0.049 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.02 % per 70 bar (1 050 psi)
- Platinum
  - Influence on the zero point: ±0.021 % · TD per 70 bar (1 050 psi)
  - Influence on the span: ±0.02 % per 70 bar (1 050 psi)

Resolution

Current output: <1 µA

Total error

The total error of the device comprises the total performance and the long-term stability effect and is calculated using the following formula:

Total error = total performance + long-term stability

Calculation of the total error with the Endress+Hauser Applicator

Detailed measurement errors, e.g. for other temperature ranges, can be calculated with the Applicator "Sizing Pressure Performance".

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Long-term stability

10 mbar (0.15 psi) and 30 mbar (0.45 psi) measuring cell
- 1 year: ±0.20 %
- 5 years: ±0.28 %
- 10 years: ±0.31 %
- 15 years: ±0.34 %

100 mbar (1.5 psi) measuring cell
- 1 year: ±0.08 %
- 5 years: ±0.12 %
- 10 years: ±0.20 %
- 15 years: ±0.28 %

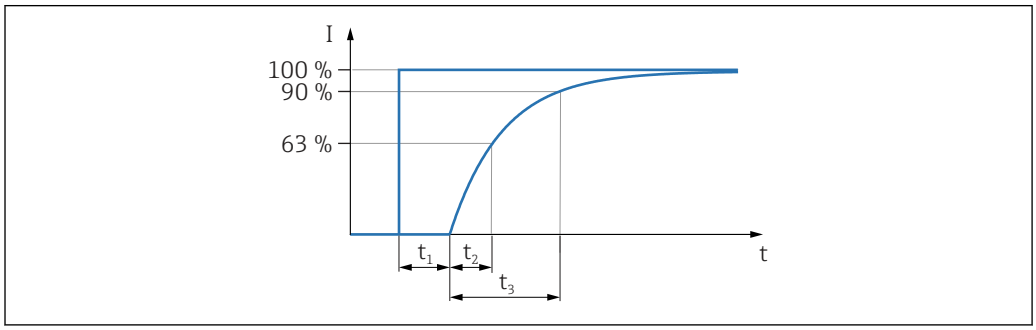
500 mbar (7.5 psi), 3 bar (45 psi), 16 bar (240 psi) and 40 bar (600 psi) measuring cell
- 1 year: ±0.025 %
- 5 years: ±0.05 %
- 10 years: ±0.10 %
- 15 years: ±0.15 %

160 bar (2 400 psi) and 250 bar (3 750 psi) gauge pressure measuring cell and absolute pressure measuring cell
- 1 year: ±0.05 %
- 5 years: ±0.07 %
- 10 years: ±0.10 %
- 15 years: ±0.15 %

Response time T63 and T90

Dead time, time constant

Representation of dead time and time constant as per IEC62828-1:



A0019786

Step response time = dead time (t_1) + time constant T90 (t_3) according to IEC62828-1

Dynamic behavior, current output (HART electronics)

10 mbar (0.15 psi) and 30 mbar (0.45 psi) sensor:
- Dead time (t_1): maximum 50 ms
- Time constant T63 (t_2): maximum 450 ms
- Time constant T90 (t_3): maximum 1100 ms

100 mbar (1.5 psi) sensor:
- Dead time (t_1): maximum 50 ms
- Time constant T63 (t_2): maximum 120 ms
- Time constant T90 (t_3): maximum 200 ms

All other sensors:
- Dead time (t_1): maximum 50 ms
- Time constant T63 (t_2): maximum 85 ms
- Time constant T90 (t_3): maximum 200 ms

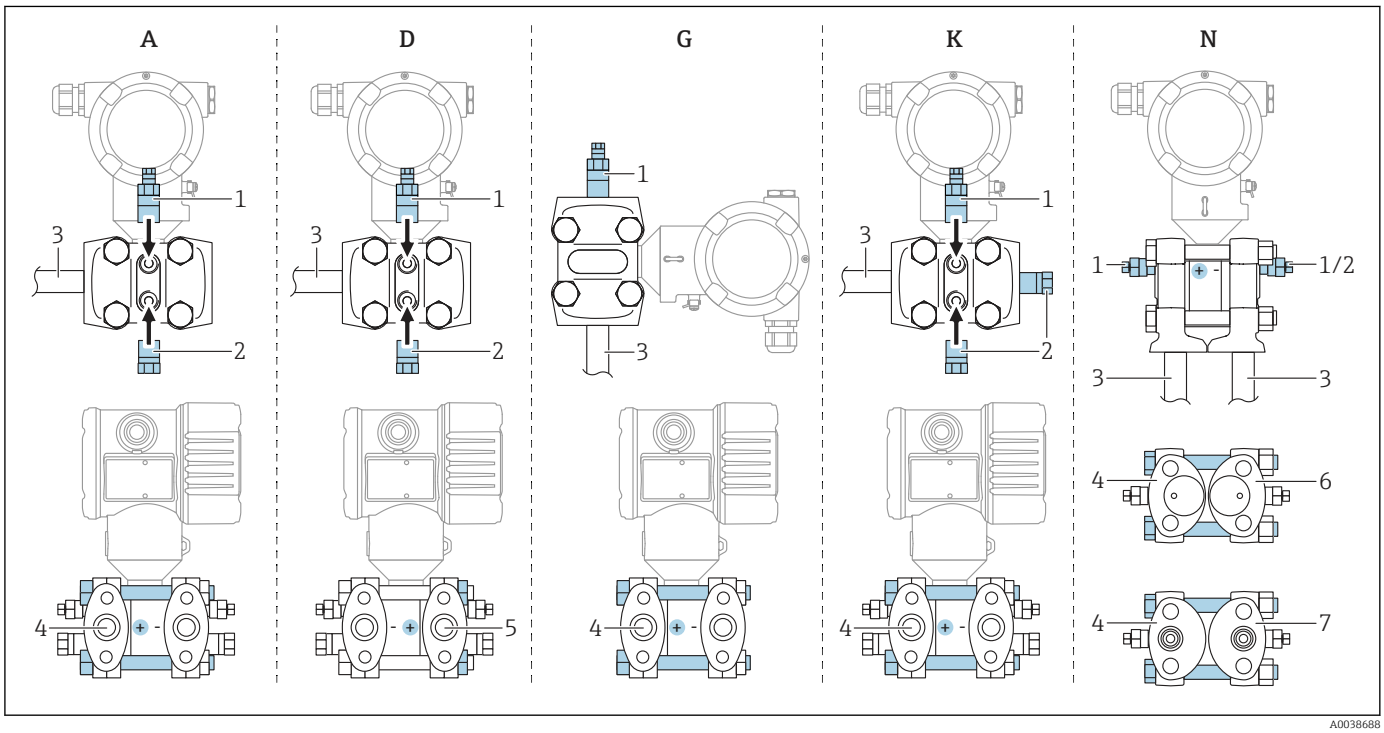
Warm-up time

As per IEC 62828-4: ≤5 s

Installation

Orientation

The installation depends on how the pressure piping is connected.



5 *A, D, G, K, N: order options*

A Horizontal pressure piping, left side high pressure (screw head side), with side vent. Thread on one side and lateral thread for horizontal pressure piping.
D Horizontal pressure piping, right side high pressure (screw nuts side), with side vent. Thread on one side and lateral thread for horizontal pressure piping.
G Vertical pressure piping, left or right side high pressure (screw head side), with vent. Thread on each side for vertical pressure piping.
K Universal side flange, left or right side high pressure (screw head side), with vent. Thread on each side and lateral thread for universal mounting.
N Process connection at bottom, left side high pressure (screw head side), vent. Thread on each side and lateral thread for mounting on existing manifolds.
1 Vent valve
2 Drain plug
3 Pressure piping
4 High pressure side (screw head side)
5 High pressure side (screw nuts side)
6 Coplanar-compatible, view from below
7 IEC upright, view from below

Sensor selection and arrangement

Flow measurement

Flow measurement in gases

Mount the device above the measuring point so that condensate can drain into the process pipe.

Flow measurement in vapors

- Mount the device below the measuring point
- Mount the condensate traps at the same height as the tapping points and at the same distance to the device
- Prior to commissioning, fill the piping to the height of the condensate traps

Flow measurement in liquids

- Mount the device below the measuring point so that the piping is always filled with liquid and gas bubbles can run back into the process pipe
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment

Level measurement

Level measurement in open vessels

- Mount the device below the lower measuring connection so that the piping is always filled with liquid
- The low-pressure side is open to atmospheric pressure
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment

Level measurement in a closed vessel

- Mount the device below the lower measuring connection so that the piping is always filled with liquid
- Always connect the low-pressure side above the maximum level
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment

Level measurement in a closed vessel with superimposed vapor

- Mount the device below the lower measuring connection so that the piping is always filled with liquid
- Always connect the low-pressure side above the maximum level
- The condensate trap ensures constant pressure on the low-pressure side
- When measuring in media with solid parts, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment

Pressure measurement

Pressure measurement with 160 bar (2 400 psi) and 250 bar (3 750 psi) measuring cell

Mount the device above the measuring point so that the condensate can drain into the process pipe

Differential pressure measurement

Differential pressure measurement in gases and vapors

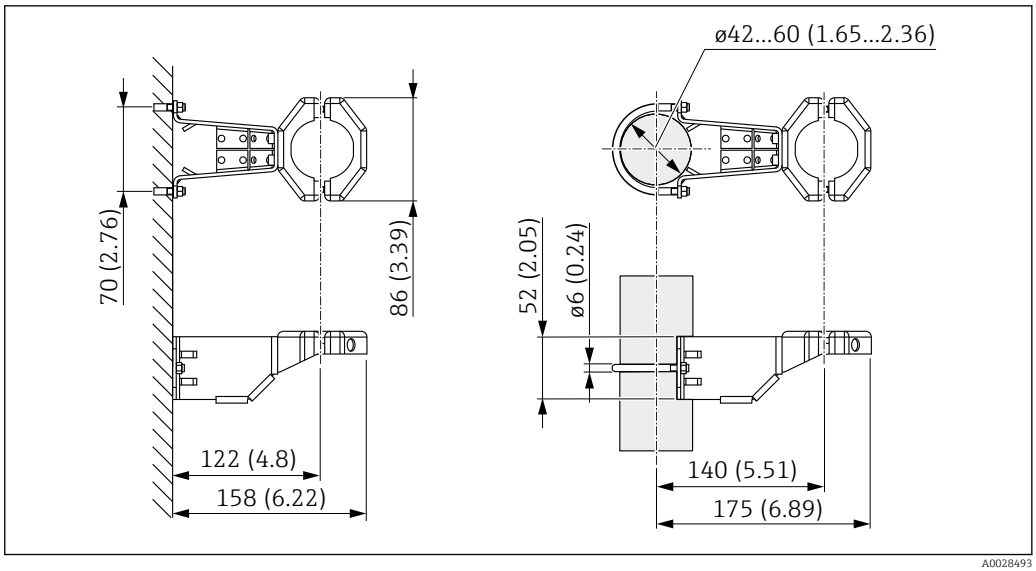
Mount the device above the measuring point so that condensate can drain into the process pipe.

Differential pressure measurement in liquids

Mount the device below the measuring point so that the piping is always filled with liquid and gas bubbles can run back into the process pipe

Mounting bracket for separate housing

The separate housing can be mounted on walls or pipes (for pipes with a diameter of 1 ¼" to 2") using the mounting bracket.



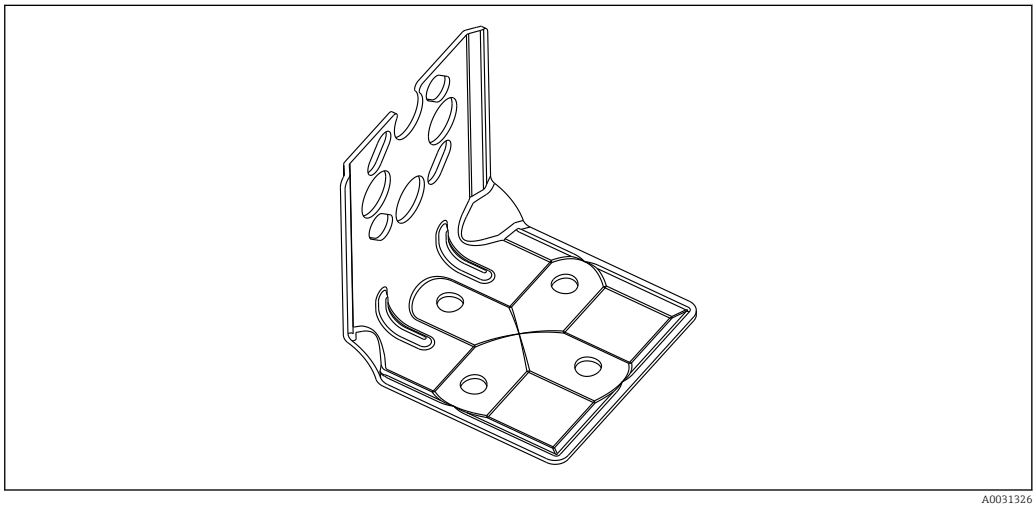
Unit of measurement mm (in)

Ordering information:
Can be ordered as a separate accessory, part number 71102216

The mounting bracket is included in the delivery if you order the device with a separate housing.

Wall and pipe mounting

Endress+Hauser offers the following mounting bracket for installing the device on pipes or walls:



- If a manifold is used, its dimensions should also be taken into consideration.
- Bracket for wall and pipe mounting including retaining bracket for pipe mounting and two nuts
- The material of the screws used to secure the device depends on the order code.

For technical data (e.g. materials, dimensions or order numbers), see the accessory document SD01553P.

Special mounting instructions

Wall and pipe mounting with a manifold (optional)

If the device is mounted on a shutoff device (e.g. manifold or shutoff valve), then use the bracket provided for this purpose. This makes it easier to disassemble the device.

For technical data, see the SD01553P accessory document.

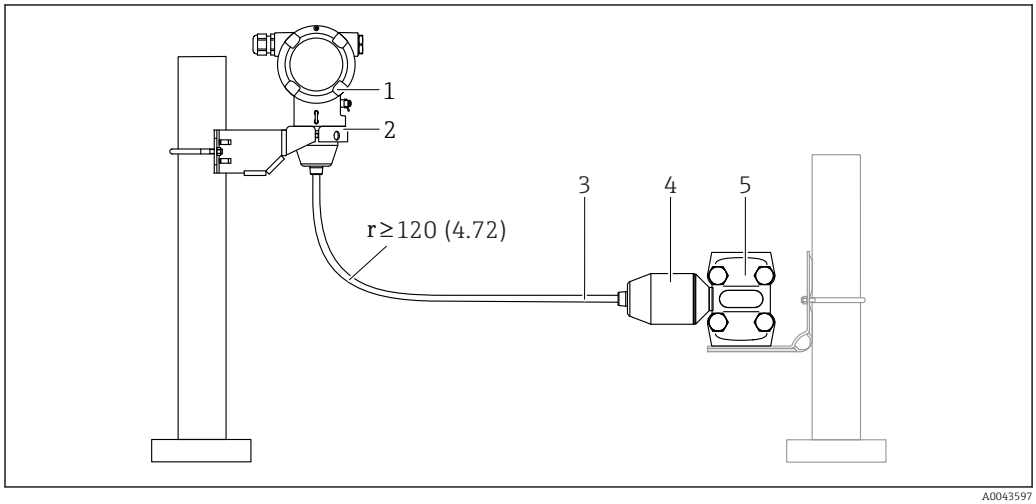
Sensor, remote (separate housing)

The housing of the device (including electronic insert) is mounted away from the measuring point.

This version thus facilitates trouble-free measurement
- Under particularly difficult measuring conditions (at installation locations that are cramped or difficult to access)
- If the measuring point is exposed to vibrations

Cable versions:
- PE: 2 m (6.6 ft), 5 m (16 ft) and 10 m (33 ft)
- FEP: 5 m (16 ft).

The sensor is supplied with the process connection and cable fitted. The housing (including electronic insert) and a mounting bracket are enclosed as separate units. The cable is provided with a socket at both ends. These sockets are simply connected to the housing (including electronic insert) and the sensor.



1 Sensor, remote (including electronic insert)
2 Mounting bracket provided, suitable for wall mounting or pipe mounting
3 Cable, both ends are fitted with a socket
4 Process connection adapter
5 Process connection with sensor

Ordering information:
- Sensor, remote (including electronic insert), and mounting bracket can be ordered via the Product Configurator
- Mounting bracket can also be ordered as a separate accessory, part number 71102216

Technical data for cable:
- Minimum bending radius: 120 mm (4.72 in)
- Cable extraction force: max. 450 N (101.16 lbf)
- Resistance to UV light

Use in hazardous area:
- Intrinsically safe installations (Ex ia/IS)
- FM/CSA IS: for Div.1 installation only

Reduction of the installation height

If the "Remote sensor" version is used, the installation height of the process connection is reduced compared to the dimensions of the standard version. For dimensions, see "Mechanical construction" section.

Environment

Ambient temperature range

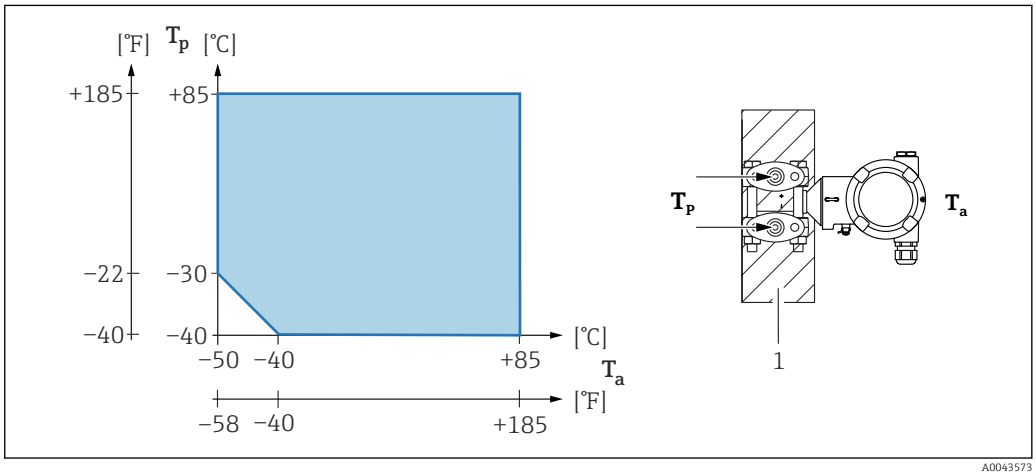
The following values apply up to a process temperature of +85 °C (+185 °F). The permitted ambient temperature is reduced at higher process temperatures.

- Without segment display or graphic display:
  - Standard:–40 to +85 °C (–40 to +185 °F)
  - Optionally available: –50 to +85 °C (–58 to +185 °F)with restricted operating life and performance
  - Optionally available: –54 to +85 °C (–65 to +185 °F); below –50 °C (–58 °F): devices can be permanently damaged
- With segment display or graphic display: –40 to +85 °C (–40 to +185 °F) with limitations in optical properties such as display speed and contrast for example. Can be used without limitations up to –20 to +60 °C (–4 to +140 °F)
  Segment display: up to –50 to +85 °C (–58 to +185 °F) with restricted operating life and performance
- Separate housing: –20 to +60 °C (–4 to +140 °F)

Devices with inert oil: minimum process and ambient temperature –20 °C (–4 °F)

Ambient temperature T_a depending on the process temperature T_p

The process connection must be fully insulated for ambient temperatures below –40 °C (–40 °F).



1 Insulation material

Hazardous area

- For devices for use in hazardous areas, see the Safety Instructions, Installation Drawing or Control Drawing
- Devices that have the most common explosion protection certificates (e.g. ATEX/ IEC Ex, etc.) can be used in explosive atmospheres with an ambient temperature of –54 to +85 °C (–65 to +185 °F) (optionally available). The functionality of the explosion protection Ex ia is guaranteed for ambient temperatures to –50 °C (–58 °F) (optionally available).
  At temperatures ≤ –50 °C (–58 °F), explosion protection is guaranteed by the housing in the case of flameproof enclosure (Ex d) type of protection. The functionality of the transmitter cannot be fully guaranteed. The Ex ia capability can no longer be guaranteed.

Storage temperature

- Without device display:
  - Standard: –40 to +90 °C (–40 to +194 °F)
  - Optionally available: –50 to +90 °C (–58 to +194 °F)with restricted operating life and performance
  - Optionally available: –54 to +90 °C (–65 to +194 °F); below –50 °C (–58 °F): Ex d devices can be permanently damaged
- With device display: –40 to +85 °C (–40 to +185 °F)
- Separate housing: –40 to +60 °C (–40 to +140 °F)

With M12 plug, elbowed: –25 to +85 °C (–13 to +185 °F)

Operating altitude

Up to 5 000 m (16 404 ft) above sea level.

Climate class

Class 4K26 (air temperature: –20 to +50 °C (–4 to +122 °F), relative air humidity: 4 to 100 %) in accordance with IEC/EN 60721-3-4.

Condensation is possible.

Atmosphere

Operation in very corrosive environment

Anodic corrosion protection can be ordered as a "mounted accessory".

Degree of protection

Test as per IEC 60529 and NEMA 250-2014

Housing and process connection

IP66/68, TYPE 4X/6P

(IP68: (1.83 mH_2O for 24 h))

Cable entries

- Gland M20, plastic, IP66/68 TYPE 4X/6P
- Gland M20, brass nickel plated, IP66/68 TYPE 4X/6P
- Gland M20, 316L, IP66/68 TYPE 4X/6P
- Thread M20, IP66/68 TYPE 4X/6P
- Thread G1/2, IP66/68 TYPE 4X/6P
  If the G1/2 thread is selected, the device is delivered with an M20 thread as standard and a G1/2 adapter is included with the delivery, along with the corresponding documentation
- Thread NPT1/2, IP66/68 TYPE 4X/6P
- Dummy plug transport protection: IP22, TYPE 2
- HAN7D plug, 90 degrees, IP65 NEMA Type 4X
- M12 plug
  When housing is closed and connecting cable is plugged in: IP66/67 NEMA Type 4X
  When housing is open or connecting cable is not plugged in: IP20, NEMA Type 1

NOTICE

M12 plug and HAN7D plug: incorrect installation can invalidate the IP protection class!

- ▶ The degree of protection only applies if the connecting cable used is plugged in and screwed tight.
- ▶ The degree of protection only applies if the connecting cable used is specified according to IP67 NEMA Type 4X.
- ▶ The IP protection classes are only maintained if the dummy cap is used or the cable is connected.

Process connection and process adapter when using the separate housing

FEP cable

- IP69 (on sensor side)
- IP66 TYPE 4/6P
- IP68 (1.83 mH_2O for 24 h) TYPE 4/6P

PE cable

- IP66 TYPE 4/6P
- IP68 (1.83 mH_2O for 24 h) TYPE 4/6P

Vibration resistance

Aluminum single-compartment housing

Measuring range	Sinusoidal vibration IEC62828-1	Shock
10 mbar (0.15 psi) and 30 mbar (0.45 psi) (only up to PN100)	10 Hz to 60 Hz: ±0.21 mm (0.0083 in) 60 Hz to 2000 Hz: 3 g	30 g
0.1 to 250 bar (1.5 to 3750 psi)	10 Hz to 60 Hz: ±0.35 mm (0.0138 in) 60 Hz to 1000 Hz: 5 g	30 g

Aluminum dual-compartment housing

Measuring range	Sinusoidal vibration IEC62828-1	Shock
10 mbar (0.15 psi) and 30 mbar (0.45 psi)	10 Hz to 60 Hz: ±0.21 mm (0.0083 in) 60 Hz to 2000 Hz: 3 g	30 g
0.1 to 250 bar (1.5 to 3 750 psi)	10 Hz to 60 Hz: ±0.35 mm (0.0138 in) 60 Hz to 1000 Hz: 5 g	30 g

Stainless steel dual-compartment housing and stainless steel precision-cast dual-compartment housing

Measuring range	Sinusoidal vibration IEC62828-1	Shock
10 mbar (0.15 psi) and 30 mbar (0.45 psi) (only up to PN63)	10 Hz to 60 Hz: ±0.075 mm (0.0030 in) 60 Hz to 500 Hz: 1 g	15 g
0.1 to 250 bar (1.5 to 3 750 psi)	10 Hz to 60 Hz: ±0.15 mm (0.0059 in) 60 Hz to 500 Hz: 2 g	15 g

Dual-compartment housing, L-form

Sinusoidal vibration IEC62828-1	Shock
10 Hz to 60 Hz: ±0.21 mm (0.0083 in) 60 Hz to 2000 Hz: 3 g	30 g

Electromagnetic compatibility (EMC)

- Electromagnetic compatibility as per IEC 61326 series and NAMUR recommendation EMC (NE21)
- With regard to the safety function (SIL), the requirements of IEC 61326-3-x are satisfied.
- Maximum deviation with interference influence: < 0.5% of span with full measuring range (TD 1:1)

For more details refer to the EU Declaration of Conformity.

Process

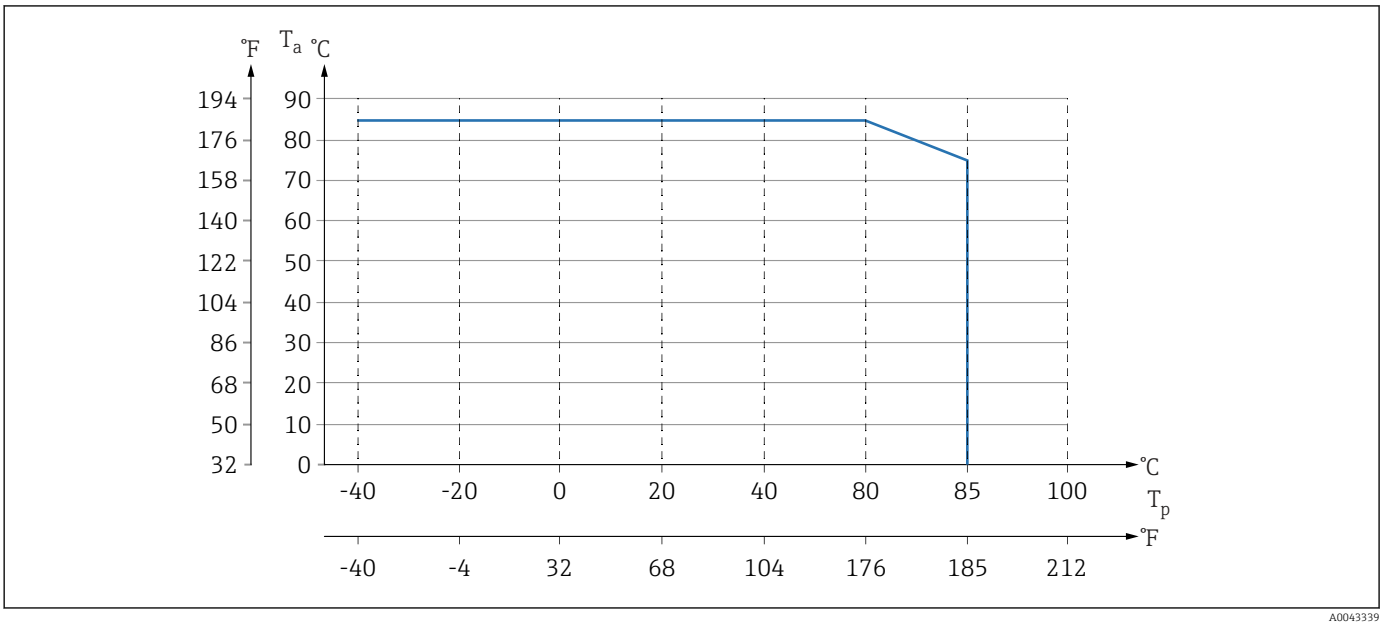
Process temperature range

NOTICE

The permitted process temperature depends on the process connection, the ambient temperature and the type of approval.

- ► All the temperature data in this document must be taken into consideration when selecting the device.

Devices without a manifold



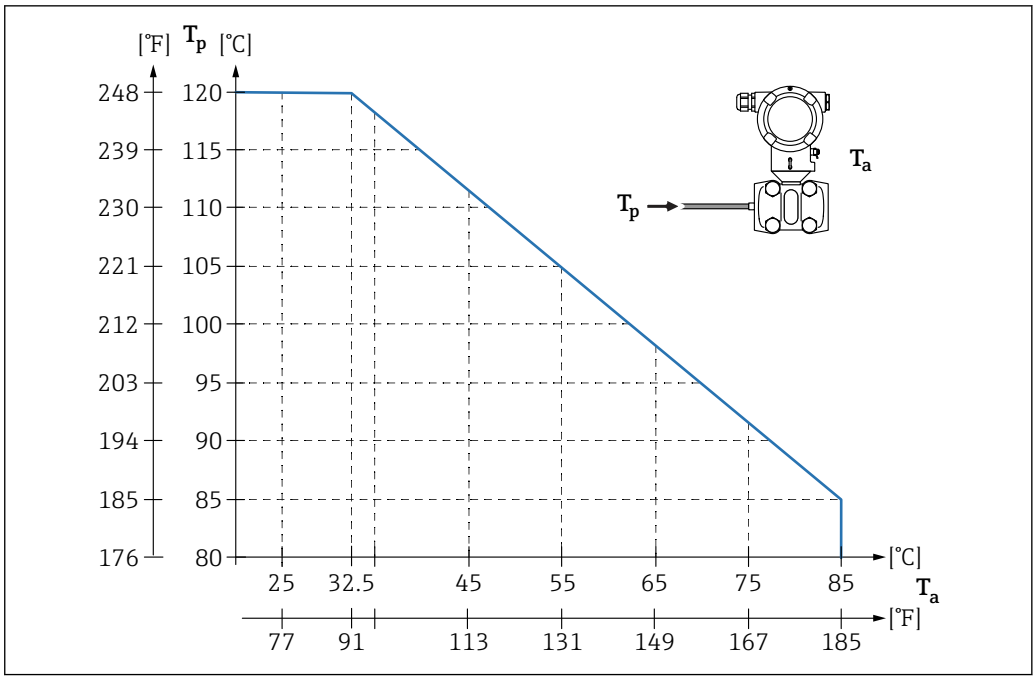
6 *Values apply for vertical mounting without insulation.*

T_p *Process temperature*
T_a *Ambient temperature*

Devices with a manifold

The maximum permitted process temperature at the manifold is 110 °C (230 °F).

For process temperatures >85 °C (185 °F)C where non-insulated side flanges are installed horizontally on a valve manifold, a reduced ambient temperature applies (see the following graphic).



T_a *Maximum ambient temperature at the manifold*
T_p *Maximum process temperature at the manifold*

Oxygen applications (gaseous)

Oxygen and other gases can react explosively to oils, grease and plastics. The following precautions must be taken:

- All components of the system, such as devices, must be cleaned in accordance with national requirements.
- Depending on the materials used, a certain maximum temperature and a maximum pressure must not be exceeded for oxygen applications.

The cleaning of the device (not accessories) is provided as an optional service.

T_{max}	P_{max}
80 °C (176 °F)	80 bar (1 200 psi)
> 80 to 120 °C (176 to 248 °F)	70 bar (1 050 psi)

Seals

Seal	Temperature	Pressure specifications
FKM	–20 to +85 °C (–4 to +185 °F)	PN > 160 bar (2 320 psi): T_{min} –15 °C (+5 °F)
FKM Cleaned of oil and grease	–10 to +85 °C (+14 to +185 °F)	-
FKM Cleaned for oxygen service	–10 to +60 °C (+14 to +140 °F)	-
FFKM	–10 to +85 °C (+14 to +185 °F)	MWP: 160 bar (2 320 psi)
	–25 to +85 °C (–13 to +185 °F)	MWP: 100 bar (1 450 psi)
EPDM [1)]	–40 to +85 °C (–40 to +185 °F)	-

Seal	Temperature	Pressure specifications
PTFE [2]	−40 to +85 °C (−40 to +185 °F)	PN > 160 bar (2 320 psi) Minimum process temperature: −20 °C (−4 °F)
PTFE [2] Cleaned for oxygen applications	−20 to +60 °C (−4 to +140 °F)	-

1) Deviations outside of the reference accuracy are possible for temperatures <−20 °C (−4 °F).
2) For 10 mbar (0.15 psi) and 30 mbar (0.45 psi) measuring cells: in the case of constantly high pressure (≥ 63 bar (913.5 psi)) and simultaneously low process temperature time (<−10 °C (+14 °F) use FKM, EPDM or FFKM seals.

Process temperature range (temperature at transmitter)

Device without a manifold

- −40 to +85 °C (−40 to +185 °F)
  Lower temperatures are optionally available.
- Pay attention to the process temperature range of the seal

Device with a manifold

The maximum permitted process temperature at the manifold is 110 °C (230 °F) (restricted by IEC standard).

For process temperatures >85 °C (185 °F) where non-insulated side flanges are installed horizontally on a manifold, a reduced ambient temperature applies up to a maximum ambient temperature, calculated according to the following formula:

$T_{Ambient_Temperature_max} = 85\ °C - 2.8 \cdot (T_{Process_Temperature} - 85\ °C)$

$T_{Ambient_Temperature_max} = 185\ °F - 2.8 \cdot (T_{Process_Temperature} - 185\ °F)$

$T_{Ambient_Temperature_max}$ = maximum ambient temperature in °C or °F

$T_{Process_Temperature}$ = process temperature at a manifold in °C or °F

Process pressure range

Pressure specifications

The maximum pressure for the device depends on the lowest-rated element with regard to pressure.

Components are: process connection, optional mounting parts, or accessories.

⚠ WARNING

Incorrect design or use of the device may cause injury due to bursting parts!

- Only operate the device within the specified limits for the components!
- MWP (maximum working pressure): The maximum working pressure is specified on the nameplate. This value refers to a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited time. Note temperature dependence of MWP. For flanges, refer to the following standards for the permitted pressure values at higher temperatures: EN 1092-1 (with regard to their stability/temperature property, the materials 1.4435 and 1.4404 are grouped together under EN 1092-1; the chemical composition of the two materials can be identical.), ASME B 16.5a, JIS B 2220 (the latest version of the standard applies in each case). Maximum working pressure data that deviate from this are provided in the relevant sections of the Technical Information.
- The overpressure limit is the maximum pressure that a device may be subjected to during a test. The overpressure limit exceeds the maximum working pressure by a certain factor. This value refers to a reference temperature of +20 °C (+68 °F).
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the device.
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PT". The abbreviation "PT" corresponds to the OPL (Over Pressure Limit) of the device. OPL (Over Pressure Limit) is a test pressure.
- In the case of measuring cell range and process connection combinations where the overpressure limit (OPL) of the process connection is less than the nominal value of the measuring cell, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If the entire measuring cell range must be used, select a process connection with a higher OPL value (1.5 x PN; MWP = PN).
- Oxygen applications: do not exceed values for P_{max} and T_{max}.
- The measuring cells have been designed for high pressure ratings with load change. Check the zero point regularly in the event of very frequent load changes up to the nominal pressure 0 to 320 bar (0 to 4 641 psi) and 0 to 420 bar (0 to 6 092 psi).
- For the 10 mbar (0.15 psi) and 30 mbar (0.45 psi) measuring cells: Check the zero point regularly at pressures ≥ 63 bar (913.5 psi).

Burst pressure

As of the specified burst pressure, the complete destruction of the pressure-bearing parts and/or a device leak must be expected. It is therefore imperative to avoid such operating conditions by carefully planning and sizing your facility.

Ultrapure gas applications

Endress+Hauser also offers devices for special applications, such as for ultrapure gas, that are cleaned of oil and grease. No special restrictions regarding the process conditions apply to these devices.

Hydrogen applications

A **gold-coated** metallic membrane offers universal protection against hydrogen diffusion, both in gas applications and in applications with water-based solutions.

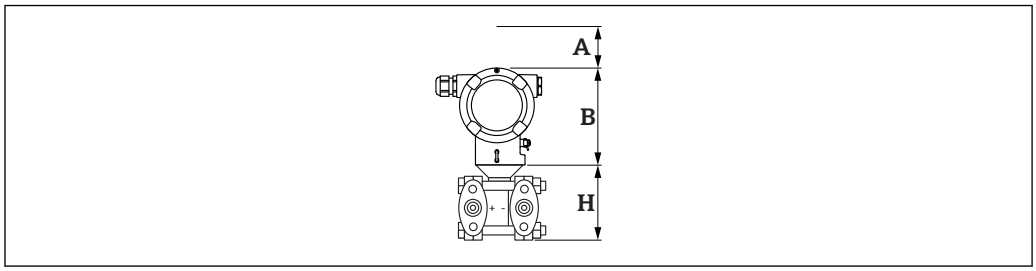
Mechanical construction

Design, dimensions

Device height

The device height is calculated from
- the height of the housing
- the height of the individual process connection

The individual heights of the components are listed in the following sections. To calculate the device height, add the individual heights of the components. Take the installation clearance into consideration (space that is used to install the device).

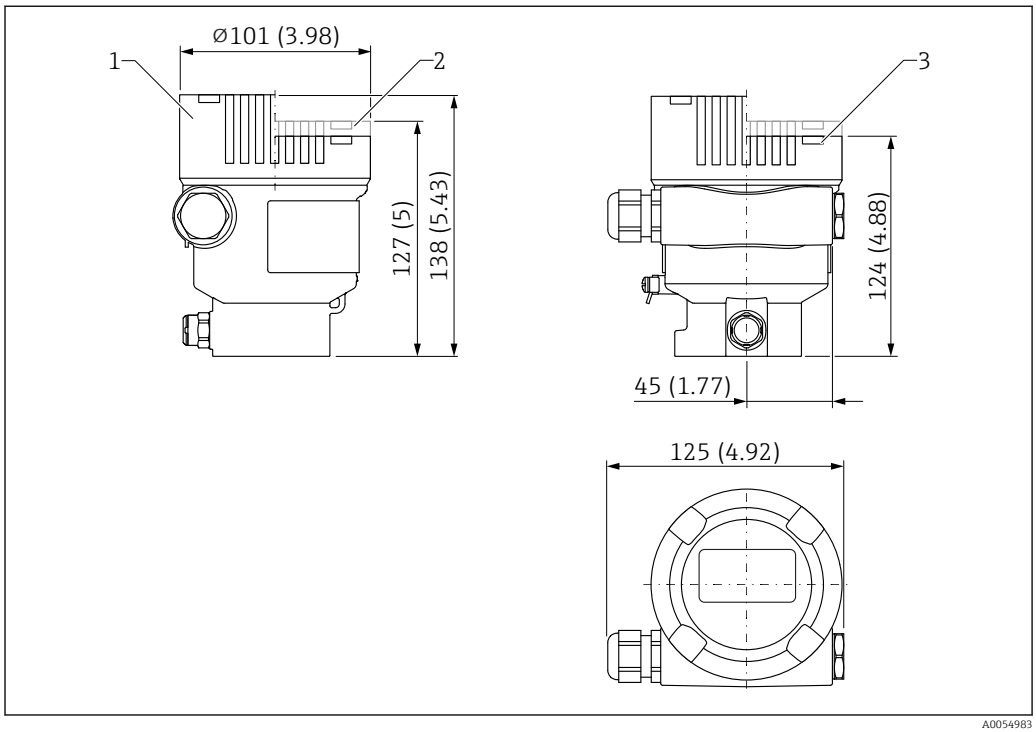


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A Installation clearance
B Height of the housing
H Height of the sensor assembly

Dimensions

Single-compartment housing



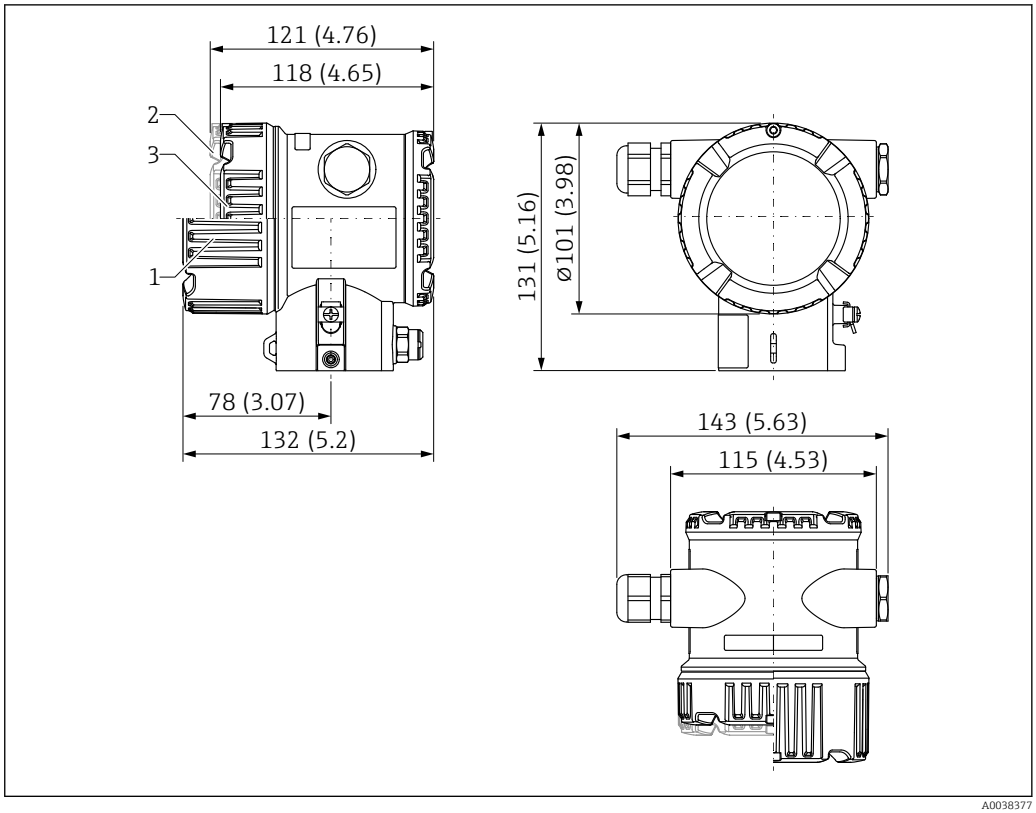
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Unit of measurement mm (in)

1 Device with display, cover with sight glass made of glass (devices for Ex d/XP, dust Ex): 138 mm (5.43 in)
2 Device with display, cover with plastic sight glass: 127 mm (5 in)
3 Device without display, cover without sight glass: 124 mm (4.88 in)

Cover optionally with ANSI Safety Red (color RAL3002) coating.

Dual-compartment housing

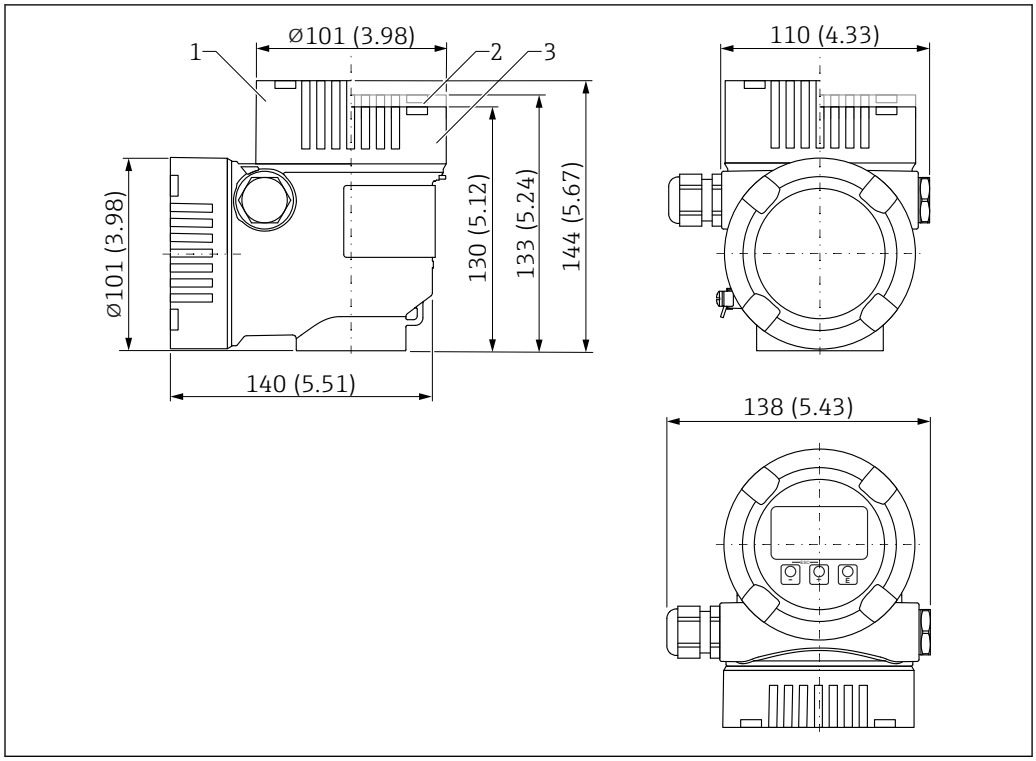


Unit of measurement mm (in)

1 Device with display, cover with sight glass made of glass (devices for Ex d/XP, dust Ex): 132 mm (5.2 in)
2 Device with display, cover with plastic sight glass: 121 mm (4.76 in)
3 Device without display, cover without sight glass: 118 mm (4.65 in)

Cover optionally with ANSI Safety Red (color RAL3002) coating.

Dual-compartment housing, L-form



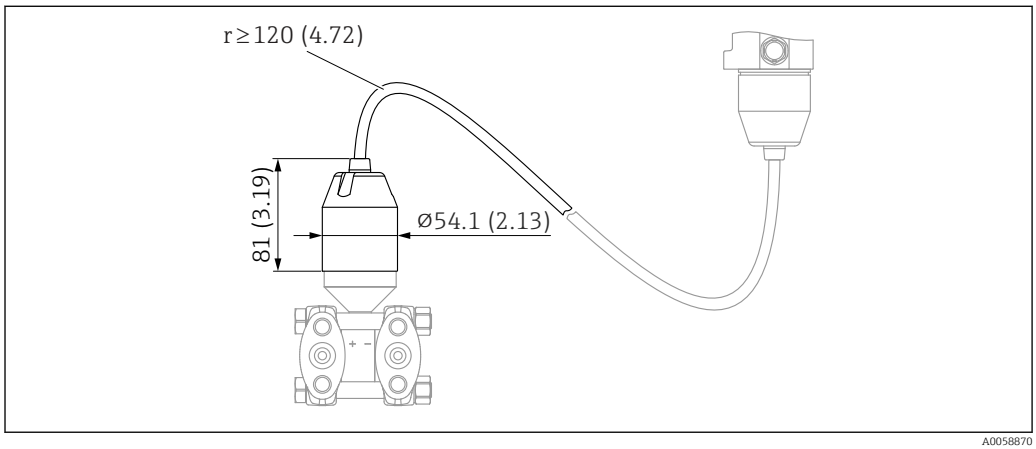
Unit of measurement mm (in)

1 144 mm (5.67 in) Height with cover comprising glass sight glass (devices for Ex d/XP, dust Ex)
2 133 mm (5.24 in) Height with cover comprising plastic sight glass
3 Cover without sight glass

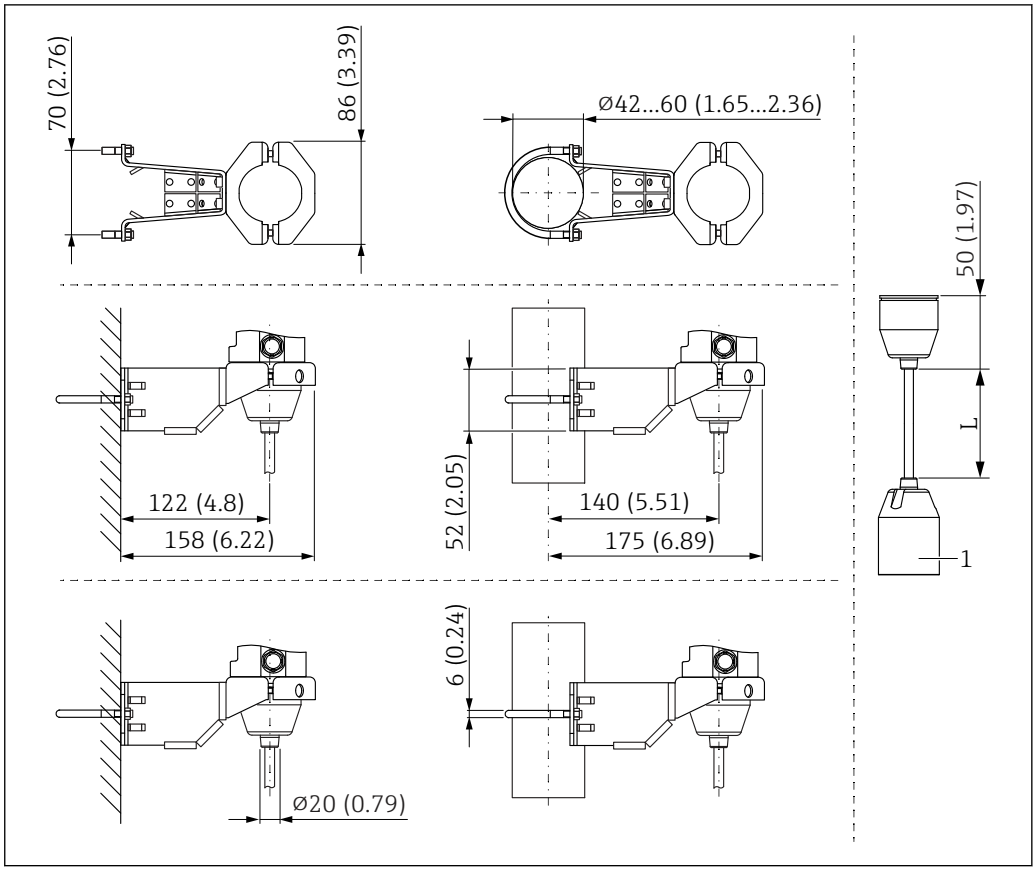
Cover optionally with ANSI Safety Red (color RAL3002) coating.

The device display fits into both housing parts (top and side) of the L-form dual-compartment housing.

Sensor, remote (separate housing)



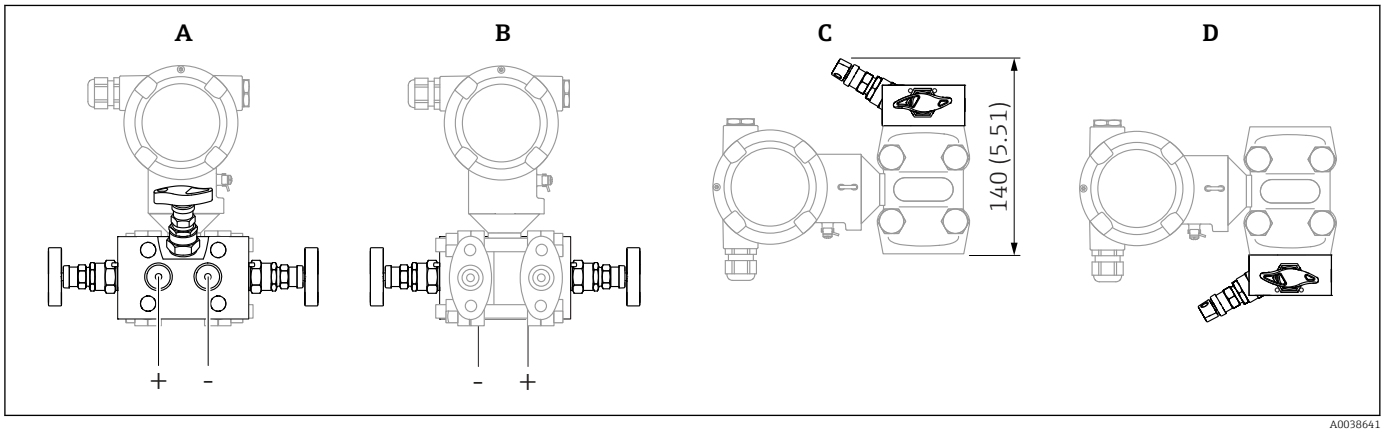
Bracket and cable length



Unit of measurement mm (in)

1 81 mm (3.19 in)
L Length of cable versions

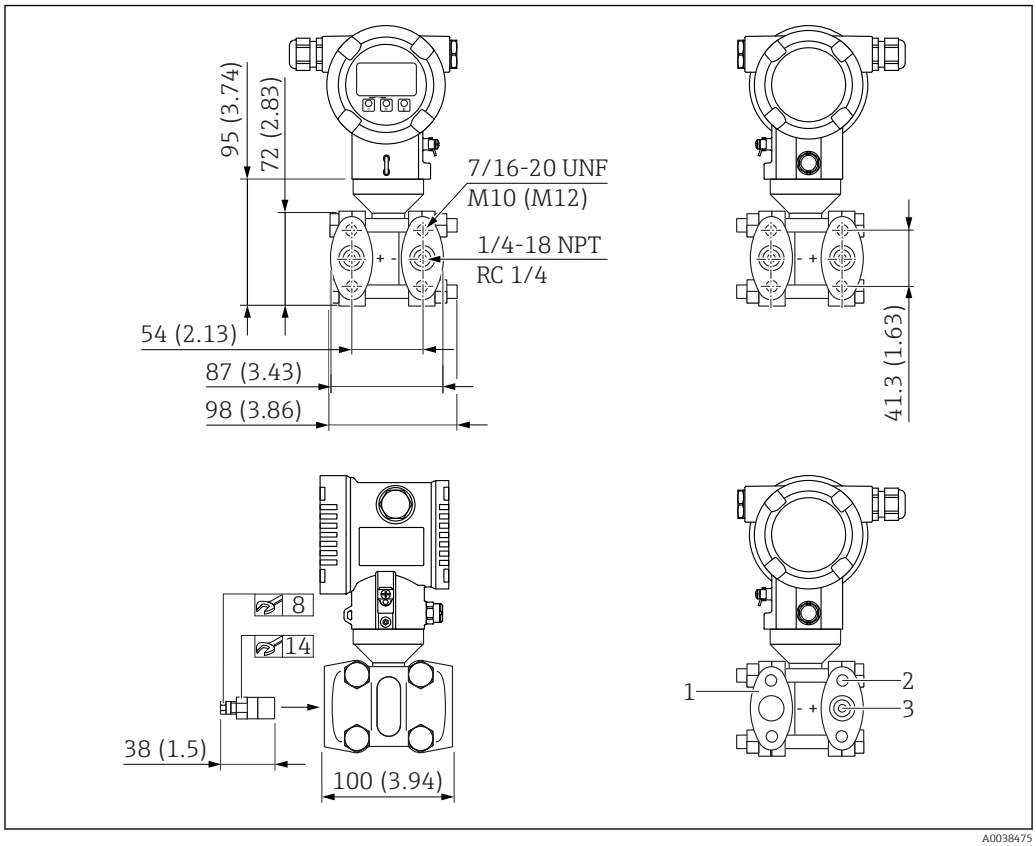
Mounting on manifold



Unit of measurement mm (in)

A Mounted backside of manifold
B Mounted front side of manifold
C Mounting from below on manifold
D Mounting from above on manifold

Oval flange, connection 1/4-18 NPT or RC 1/4



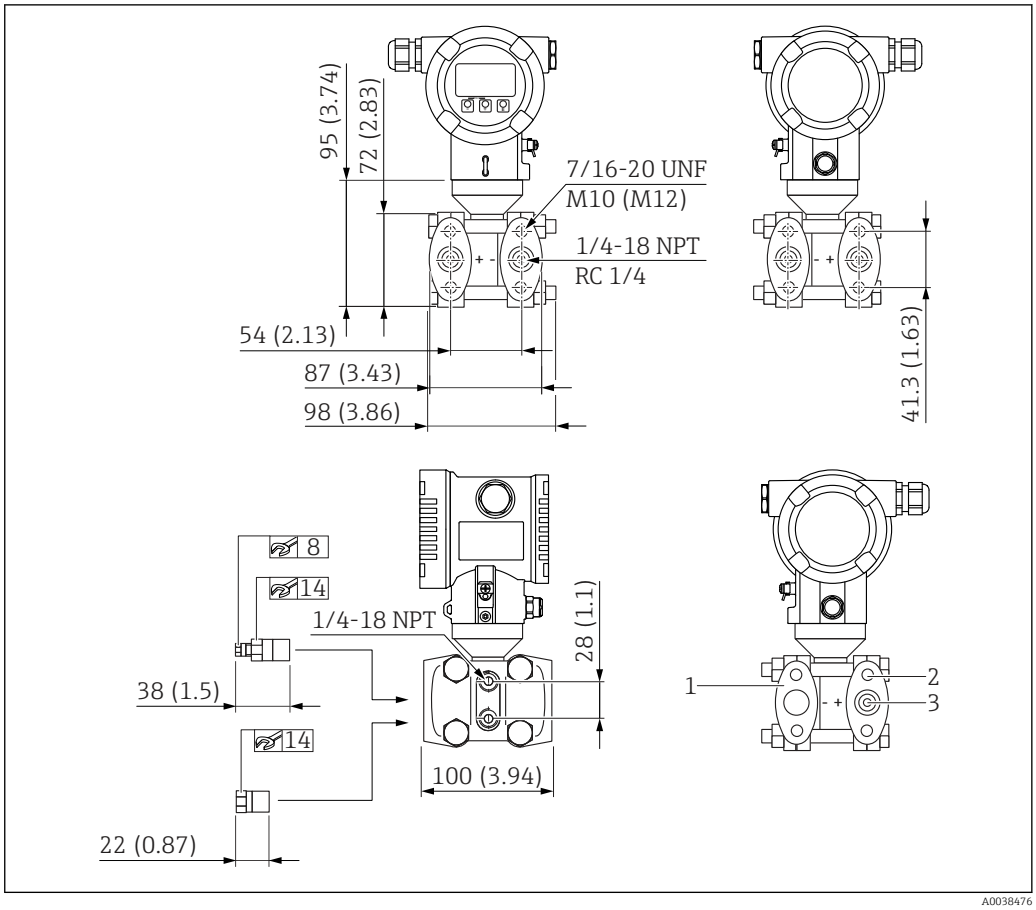
7 Front view, left-hand side view, right-hand side view. Unit of measurement mm (in)

1 blind flange
2 Thread depth: 15 mm (0.59 in)
3 Thread depth: 12 mm (0.47 in)(±1 mm (0.04 in))

Connection	Attachment	Equipment	Option [1]
NPT1/4-18 IEC61518 UNF7/16-20	7/16-20 UNF screws (PN160 - PN420) Alternatively ▪ M10 (PN160) ▪ M12 (PN420)	Includes 2 vent valves	SAJ
NPT1/4-18 IEC61518 UNF7/16-20 with blind flange on LP side (Version with absolute pressure measuring cell or gauge pressure measuring cell)	7/16-20 UNF screws (PN160 - PN420)	Includes 1 vent valve	SAJ
RC1/4" mounting UNF7/16-20	7/16-20 UNF screws (PN160 - PN420)	Includes 2 vent valves	SKJ

1) Product Configurator, order code for "Process connection"

Oval flange, connection 1/4-18 NPT or RC 1/4, with side vent



8 Front view, left-hand side view, right-hand side view. Nuts are always located on the minus side. Unit of measurement mm (in)

1 blind flange
2 Thread depth: 15 mm (0.59 in)
3 Thread depth: 12 mm (0.47 in)(±1 mm (0.04 in))

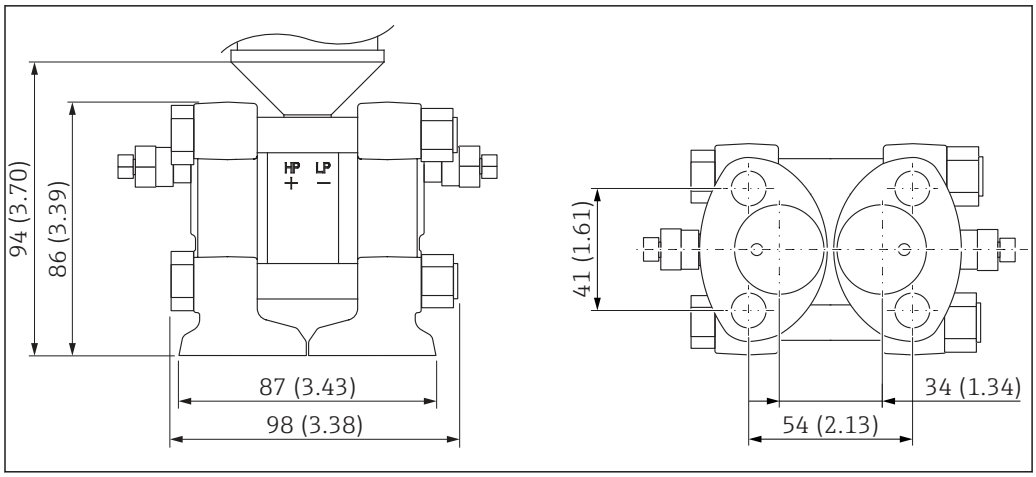
Connection	Attachment	Equipment	Option [1]
NPT1/4-18 IEC61518 UNF7/16-20	7/16-20 UNF screws (PN160 - PN420)	Includes 4 locking screws 2 vent valves	SAJ
NPT1/4-18 IEC61518 UNF7/16-20 with blind flange on LP side (Version with absolute pressure measuring cell or gauge pressure measuring cell)	7/16-20 UNF screws (PN160 - PN420)	Includes 2 locking screws 1 vent valve	SAJ
RC1/4" mounting UNF7/16-20	7/16-20 UNF screws (PN160 - PN420)	Includes 4 locking screws 2 vent valves	SKJ

1) Product Configurator, order code for "Process connection"

Bottom process connection, coplanar-compatible, Super Duplex

For mounting on existing coplanar manifolds.

Seal is supplied, as per selected seal material.

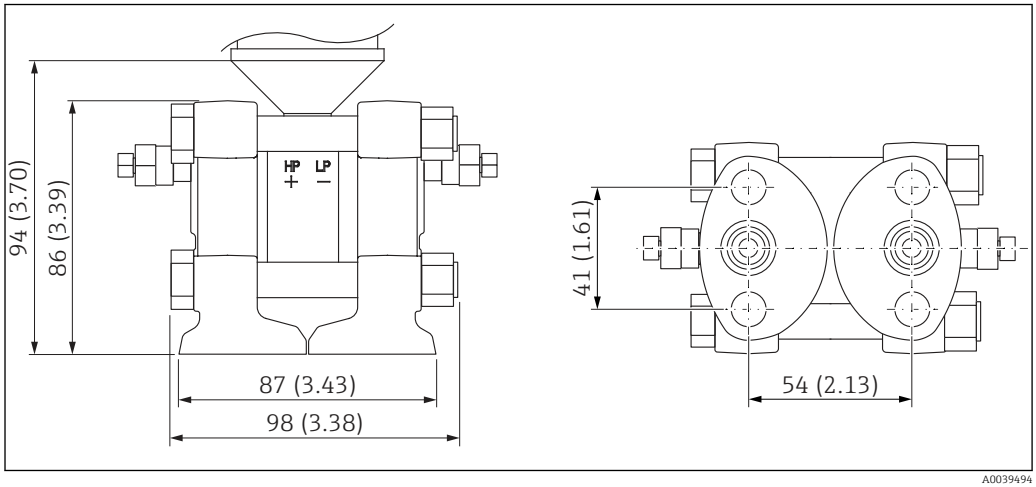


Connection	Seal for sensor flange	Seal for coplanar process connection [1]	Option [2]
Coplanar-compatible, Super Duplex	PTFE	PTFE	S7X
	FKM	FKM	
	EPDM		
	FFKM		

1) Flanged manifold: cannot be selected.
2) Product Configurator, order code for "Process connection"

Bottom process connection, NPT1/4-18 IEC61518 UNF7/16-20

For mounting on IEC manifolds in an upright position.



Connection	Option [1]
NPT1/4-18 IEC61518 UNF7/16-20, Super Duplex	SAX

1) Product Configurator, order code for "Process connection"

Weight

Housing

Weight including electronics and display.

- Single-compartment housing: 1.1 kg (2.43 lb)
- Dual-compartment housing
  - Aluminum: 1.4 kg (3.09 lb)
  - Stainless steel: 3.3 kg (7.28 lb)
- Dual-compartment housing, L-form: 1.7 kg (3.75 lb)

Sensor, remote (separate housing)

- Housing: see the Housing section
- Housing adapter: 0.55 kg (1.21 lb)
- Process connection adapter: 0.36 kg (0.79 lb))
- Cable:
  - PE cable, 2 meters: 0.18 kg (0.40 lb)
  - PE cable, 5 meters: 0.35 kg (0.77 lb)
  - PE cable, 10 meters: 0.64 kg (1.41 lb)
  - FEP cable, 5 meters: 0.62 kg (1.37 lb)
- Mounting bracket: 0.46 kg (1.01 lb)

Process connections

- Process connections made of 316L: 3.2 kg (7.06 lb)
- Process connections made of Alloy C276: 3.5 kg (7.72 lb)
- NPT1/4-18 coplanar-compatible, Super Duplex: 3.14 kg (6.92 lb)

Ex d version: 0.63 kg (1.39 lb)

Accessories

Mounting bracket: 0.5 kg (1.10 lb)

Materials in contact with process

Membrane material

- 316L (1.4435)
- Alloy C276
  The flange raised face is made from the same material as the membrane
- Tantalum
  The flange raised face is made from the same material as the membrane
- Monel (Alloy 400)
  The flange raised face is made from the same material as the membrane

Membrane coating

Gold, 25 µm

Seal

- PTFE
- FKM (FDA 21 CFR 177.2600)
- EPDM
- FFKM

Process connections

- NPT1/4-18 IEC61518 UNF7/16-20
  Side flange: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L) or Alloy C276 (2.4819)
- NPT1/4-18 DIN19213 M10
  Side flange: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L) or Alloy C276 (2.4819)
- NPT1/4-18 DIN19213 M12
  Side flange: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L) or Alloy C276 (2.4819)
- RC 1/4" installation UNF7/16-20
  Side flange: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L)
- NPT1/4-18 coplanar-compatible
  Side flange: Super Duplex (1.4469) (resistant to sea water, Super Duplex cast)
- NPT1/4-18 coplanar IEC
  Side flange: Super Duplex (1.4469) (resistant to sea water, Super Duplex cast)

Vent valves

Depending on process connection ordered:
- AISI 316L (1.4404)
- Alloy C22 (2.4602)

For Alloy C276 process connections, vent valves are not included but must/can be ordered separately as an enclosed accessory.

Locking screws

Depending on process connection ordered:
- AISI 316 L (1.4404 or 1.4435)
- Alloy C22 (2.4602)

For Alloy C276 process connections, locking screws are not included but must/can be ordered separately as an enclosed accessory.

Accessories

For technical data (e.g. materials, dimensions or order numbers), see the accessory document SD01553P.

Materials not in contact with process

Single-compartment housing, aluminum, coated

- Housing: EN AC 43400 aluminum (Cu max. 0.1%)
- Housing coating, cover: polyester
- EN AC 43400 aluminum cover (Cu max. 0.1%) with Lexan 943A PC sight glass
  EN AC 43400 aluminum cover (Cu max. 0.1%) with borosilicate sight glass; for Ex d/XP, dust Ex
- Dummy cover: EN AC 43400 aluminum (Cu max. 0.1%)
- Cover sealing materials: HNBR
- Cover sealing materials: FVMQ (in low temperature version only)
- Plug: PBT-GF30-FR or aluminum
- Plug sealing material: EPDM
- Nameplate: plastic foil
- TAG plate: plastic foil, stainless steel or provided by the customer

The cable entry with material specification can be ordered via the product structure "Electrical connection".

Dual-compartment housing, aluminum, coated

- Housing: EN AC 43400 aluminum (Cu max. 0.1%)
- Housing coating, cover: polyester
- EN AC 43400 aluminum cover (Cu max. 0.1%) with Lexan 943A PC sight glass
  EN AC 43400 aluminum cover (Cu max. 0.1%) with borosilicate sight glass; for Ex d/XP, dust Ex
- Dummy cover: EN AC 43400 aluminum (Cu max. 0.1%)
- Cover sealing materials: HNBR
- Cover sealing materials: FVMQ (in low temperature version only)
- Plug: PBT-GF30-FR or aluminum
- Plug sealing material: EPDM
- Nameplate: plastic foil
- TAG plate: plastic foil, stainless steel or provided by the customer

The cable entry with material specification can be ordered via the product structure "Electrical connection".

Dual compartment housing; 316L

- Housing: stainless steel AISI 316L (1.4409)
  Stainless steel (ASTM A351 : CF3M (cast equivalent to AISI 316L material)/DIN EN 10213 : 1.4409)
- Dummy cover: stainless steel AISI 316L (1.4409)
- Cover: stainless steel AISI 316L (1.4409) with borosilicate sight glass
- Cover sealing materials: HNBR
- Cover sealing materials: FVMQ (in low temperature version only)
- Plug: stainless steel

- Plug sealing material: EPDM
- Nameplate: stainless steel
- TAG plate: plastic foil, stainless steel or provided by the customer

The cable entry with material specification can be ordered via the product structure "Electrical connection".

Dual-compartment housing, L-shaped, aluminum, coated

- Housing: EN AC 43400 aluminum (Cu max. 0.1%)
- Housing coating, cover: polyester
- EN AC 43400 aluminum cover (Cu max. 0.1%) with Lexan 943A PC sight glass
  EN AC 43400 aluminum cover (Cu max. 0.1%) with borosilicate sight glass; for Ex d/XP, dust Ex
- Dummy cover: EN AC 43400 aluminum (Cu max. 0.1%)
- Cover sealing materials: HNBR
- Cover sealing materials: FVMQ (in low temperature version only)
- Plug: PBT-GF30-FR or aluminum
- Plug sealing material: EPDM
- Nameplate: plastic foil
- TAG plate: plastic foil, stainless steel or provided by the customer

The cable entry with material specification can be ordered via the product structure "Electrical connection".

Electrical connection

Coupling M20, plastic
- Material: PA
- Seal on cable gland: EPDM
- Dummy plug: plastic

Coupling M20, nickel-plated brass
- Material: nickel-plated brass
- Seal on cable gland: EPDM
- Dummy plug: plastic

Coupling M20, 316L
- Material: 316L
- Seal on cable gland: EPDM
- Dummy plug: plastic

M20 coupling, 316 L, hygiene
- Material: 316L
- Seal on cable gland: EPDM

M20 thread
The device is supplied with M20 thread as standard.
Transport plug: LD-PE

Thread G ½
The device is supplied as standard with an M20 thread and an enclosed adapter to G ½ including documentation (aluminum housing, 316L housing, hygienic housing) or with a mounted adapter to G ½ (plastic housing).
- Adapter made of PA66-GF or aluminum or 316L (depends on housing version ordered)
- Transport plug: LD-PE

NPT ½ thread
The device is supplied as standard with an NPT ½ thread (aluminum housing, 316L housing) or with a mounted adapter to NPT ½ (plastic housing, hygienic housing).
- Adapter made of PA66-GF or 316L (depends on housing version ordered)
- Transport plug: LD-PE

Thread NPT ¾
The device is supplied with NPT ¾ thread as standard.
Transport plug: LD-PE

M20 coupling, blue plastic
- Material: PA, blue
- Seal on cable gland: EPDM
- Dummy plug: plastic

M12 plug
- Material: nickel-plated CuZn or 316L (depends on housing version ordered)
- Transport cap: LD-PE

HAN7D plug
Material: aluminum, die-cast zinc, steel

Valve plug ISO44000 M16
- Material: PA6
- Transport plug: LD-PE

Separate housing

- Mounting bracket
  - Bracket: AISI 316L (1.4404)
  - Screw and nuts: A4-70
  - Half-shells: AISI 316L (1.4404)
- Seal for cable from separate housing: EPDM
- Gland for cable of separate housing: AISI 316L (1.4404)
- PE cable for separate housing: abrasion-proof cable with strain-relief Dynema members; shielded using aluminum-coated foil; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV-resistant
- FEP cable for separate housing: abrasion-proof cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper cores, twisted, UV-resistant
- Process connection adapter for separate housing: AISI 316L (1.4404)

Fill fluid

- Silicone oil
- Inert oil

Connecting parts

- Connection between housing and process connection: AISI 316L (1.4404)
- Screws and nuts
  - PN 160: hex.-headed bolt DIN 931-M12x90-A4-70
  - PN 160: hex.-headed nut DIN 934-M12-A4-70
  - PN 250, PN 320 and PN 420: hex.-headed bolt ISO 4014-M12x90-A4
  - PN 250, PN 320 and PN 420: hex.-headed nut ISO 4032-M12-A4-bs
- Measuring cell body: AISI 316L (1.4404)
- Side flanges: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L)

Accessories

For technical data (e.g. materials, dimensions or order numbers), see the accessory document SD01553P.

Display and user interface

Operating concept

Operator-oriented menu structure for user-specific tasks
- Guidance
- Diagnostics
- Application
- System

Quick and safe commissioning
- Interactive wizard with graphical user interface for guided commissioning in FieldCare, DeviceCare or DTM, AMS and PDM-based third-party tools or SmartBlue
- Menu guidance with brief explanations of the individual parameter functions
- Standardized operation at the device and in the operating tools
- PROFINET over Ethernet-APL: access to the device via web server

Integrated HistoROM data memory
- Adoption of data configuration when electronics modules are replaced
- Up to 100 event messages recorded in the device

Efficient diagnostic behavior increases measurement reliability
- Remedial action is integrated in plain text
- Various simulation options

Bluetooth module (optionally integrated in local display)
- Quick and easy setup with SmartBlue app or PC with DeviceCare, version 1.07.00 and higher, or FieldXpert SMT70
- No additional tools or adapters needed
- Encrypted single point-to-point data transmission (tested by Fraunhofer Institute) and password-protected communication via *Bluetooth*® wireless technology

Languages

The operating language of the local display (optional) can be selected via the Product Configurator.

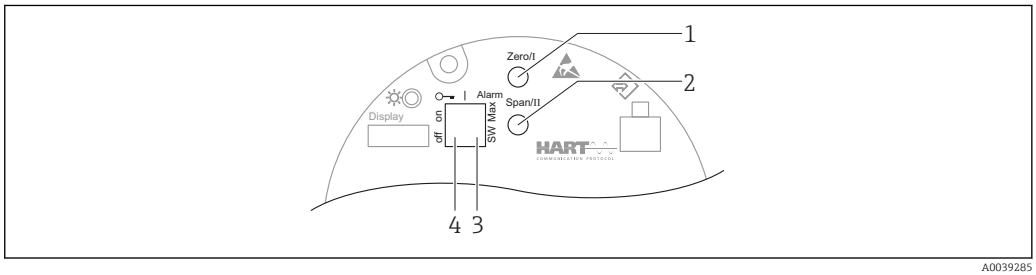
If no particular operating language has been selected, the local display is delivered from the factory with English.

The operating language can be changed subsequently via the **Language** parameter.

Local operation

Operating keys and DIP switches on the electronic insert

HART

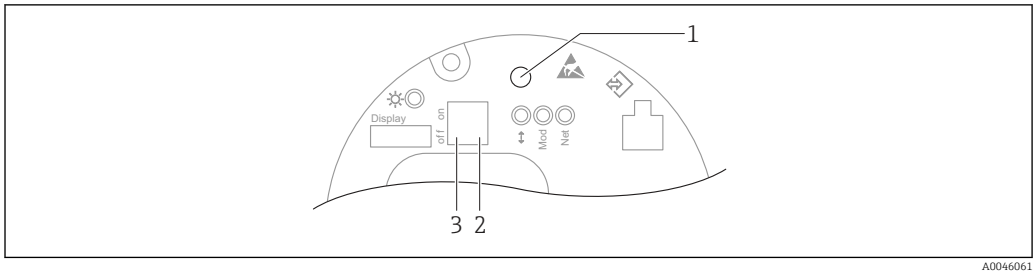


A0039285

1 Operating key for lower range value (Zero)
2 Operating key for upper range value (Span)
3 DIP switch for alarm current
4 DIP switch for locking and unlocking the device

The setting of the DIP switches has priority over the settings made via other operation methods (e.g. FieldCare/DeviceCare).

PROFINET with Ethernet-APL

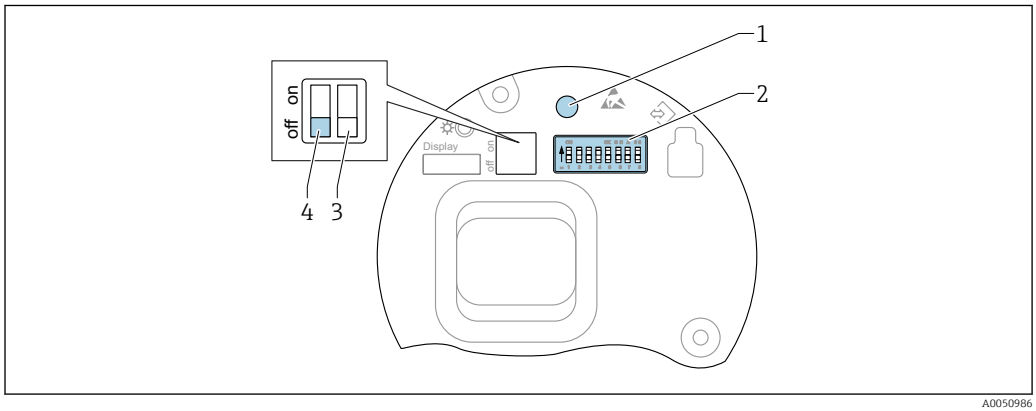


A0046061

1 *Operating key for position adjustment (zero point correction) and device reset*
2 *DIP switch for setting the service IP address*
3 *DIP switch for locking and unlocking the device*

The setting of the DIP switches has priority over the settings made via other operation methods (e.g. FieldCare/DeviceCare).

PROFIBUS PA



A0050986

1 *Operating key for position adjustment (zero point correction), reset device (reset) and password (for Bluetooth login and user role)*
2 *DIP switch for address configuration*
3 *DIP switch with no function*
4 *DIP switch for locking and unlocking the device*

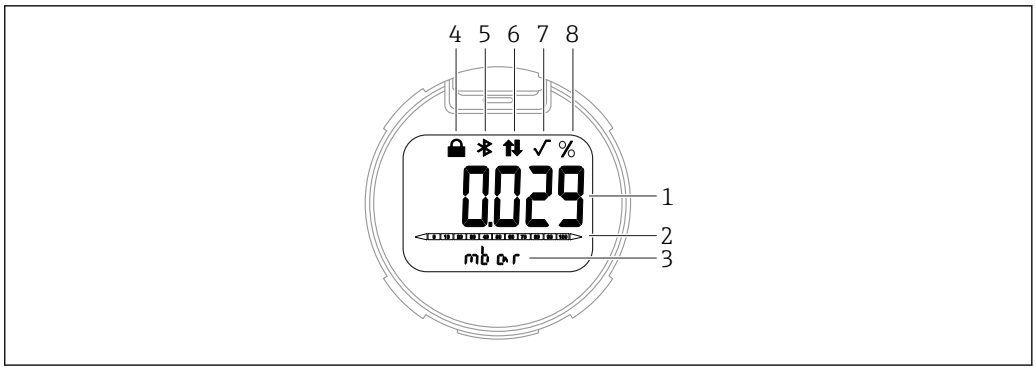
The setting of the DIP switches on the electronic insert has priority over the settings made via other operation methods (e.g. FieldCare/DeviceCare).

Local display

Device display (optional)

Functions:
- Display measured values and fault and notice messages
- Background lighting, which switches from green to red in the event of an error
- The device display can be removed for easier operation
- The device display fits into both housing parts (top and side) of the L-form dual-compartment housing.

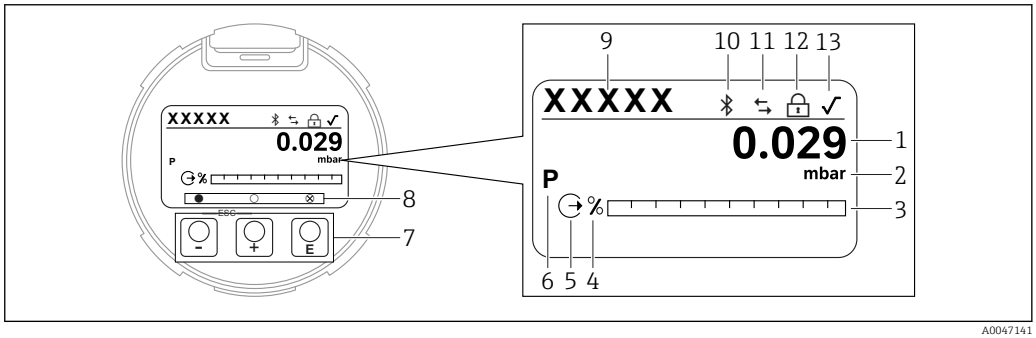
The device displays are available with the additional option of Bluetooth® wireless technology.



9 Segment display

1 *Measured value (up to 5 digits)*
2 *Bar graph (refers to the specified pressure range) proportional to the current output (not for PROFINET over Ethernet-APL or PROFIBUS PA)*
3 *Unit of measured value*
4 *Locking (symbol appears when device is locked)*
5 *Bluetooth (symbol flashes if Bluetooth connection is active)*
6 *HART communication, PROFINET over Ethernet-APL communication or PROFIBUS PA communication (symbol appears when communication is enabled)*
7 *Square root extraction (appears if the measured value is output using square root extraction) Not supported for PROFINET over Ethernet-APL or PROFIBUS PA*
8 *Measured value output in %*

The following graphics are examples. The display depends on the display settings.

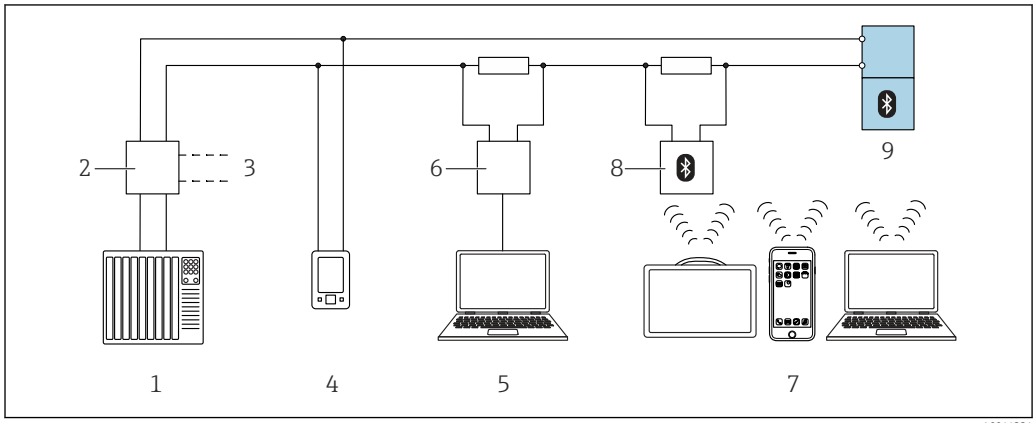


10 Graphic display with optical operating keys.

1 *Measured value (up to 12 digits)*
2 *Unit of measured value*
3 *Bar graph (refers to the specified pressure range) proportional to the current output (not for PROFINET over Ethernet-APL or PROFIBUS PA)*
4 *Bar graph unit*
5 *Symbol for current output (not for PROFINET over Ethernet-APL or PROFIBUS PA)*
6 *Symbol for displayed measured value (e.g. p = pressure)*
7 *Optical operating keys*
8 *Symbols for key feedback. Different display symbols are possible: circle (not filled in) = key pressed briefly; circle (filled in) = key pressed for longer; circle (with X) = no operation possible due to Bluetooth connection*
9 *Device Tag*
10 *Bluetooth (symbol flashes if Bluetooth connection is active)*
11 *HART communication, PROFINET over Ethernet-APL communication or PROFIBUS PA communication (symbol appears when communication is enabled)*
12 *Locking (symbol appears when device is locked)*
13 *Square root extraction (appears if the measured value is output using square root extraction) Not supported for PROFINET over Ethernet-APL or PROFIBUS PA*

Remote operation

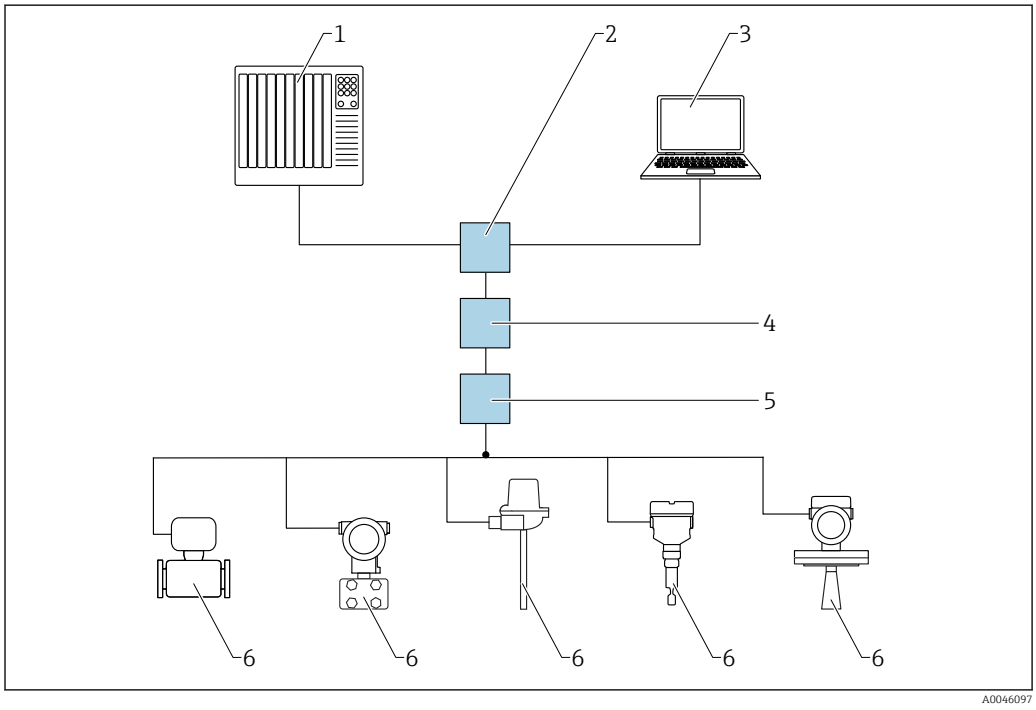
Via HART protocol or Bluetooth



11 *Options for remote operation via HART protocol*

1 *PLC (programmable logic controller)*
2 *Transmitter power supply unit, e.g. RN221N (with communication resistor)*
3 *Connection for Commubox FXA195 and AMS Trex™ device communicator*
4 *AMS Trex™ device communicator*
5 *Computer with operating tool (e.g. DeviceCare/FieldCare , AMS Device View, SIMATIC PDM)*
6 *Commubox FXA195 (USB)*
7 *Field Xpert SMT70/SMT77, smartphone or computer with operating tool (e.g. DeviceCare/FieldCare, AMS Device View, SIMATIC PDM)*
8 *Bluetooth modem with connecting cable (e.g. VIATOR)*
9 *Transmitter*

Via PROFINET over Ethernet-APL network



12 *Options for remote operation via PROFINET over Ethernet-APL network: star topology*

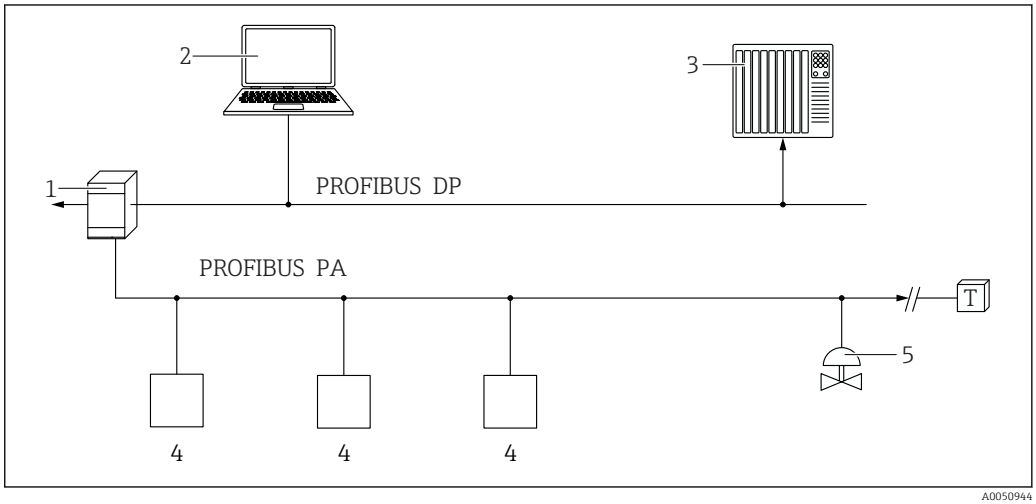
1 *Automation system, e.g. Simatic S7 (Siemens)*
2 *Ethernet switch*
3 *Computer with web browser (e.g., Microsoft Edge) for accessing the integrated device web server or computer with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM) with iDTM PROFINET Communication*
4 *APL power switch (optional)*
5 *APL field switch*
6 *APL field device*

Call up the website via the computer in the network. The IP address of the device must be known.

The IP address can be assigned to the device in a variety of ways:
- Dynamic Configuration Protocol (DCP), factory setting
  The IP address is automatically assigned to the device by the automation system (e.g. Siemens S7)
- Software addressing
  The IP address is entered via the **IP address** parameter
- DIP switch for service
  The device then has the fixed assigned IP address IP address 192.168.1.212
  The IP address is only adopted after a restart.
  The IP address can now be used to establish the network connection

The default setting is that the device uses the Dynamic Configuration Protocol (DCP). The device's IP address is automatically assigned by the automation system (e.g. Siemens S7).

Via PROFIBUS PA protocol



1 Segment coupler
2 Computer with PROFIusb and operating tool (e.g. DeviceCare/FieldCare)
3 PLC (programmable logic controller)
4 Transmitter
5 Additional functions (valves etc.)

Via Web browser (for devices with PROFINET)

Function scope

Thanks to the integrated Web server the device can be operated and configured via a Web browser. The structure of the operating menu is the same as for the local display. In addition to the measured values, device status information is also displayed and allows users to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

Via service interface (CDI)

With the Commubox FXA291, a CDI connection is established with the device interface and a Windows PC/notebook with a USB port.

Operation via Bluetooth® wireless technology (optional)

Prerequisite
- Device with Bluetooth display
- Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.00 or FieldXpert SMT70

The connection has a range of up to 25 m (82 ft). The range can vary depending on environmental conditions such as attachments, walls or ceilings.

The operating keys on the display are locked as soon as the device is connected via Bluetooth.

System integration	**HART** Version 7 **PROFINET over Ethernet-APL** PROFINET Profile 4.02 **PROFIBUS PA** PROFIBUS PA Profile Version 3.02
Supported operating tools	Smartphone or tablet with Endress+Hauser SmartBlue (app), DeviceCare, version 1.07.00 and higher, FieldCare, DTM, AMS and PDM. PC with Web server via fieldbus protocol.
HistoROM	When replacing the electronic insert, the stored data is transferred by reconnecting the HistoROM. The device does not work without HistoROM. The device serial number is saved in the HistoROM. The electronics serial number is saved in the electronics.

Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

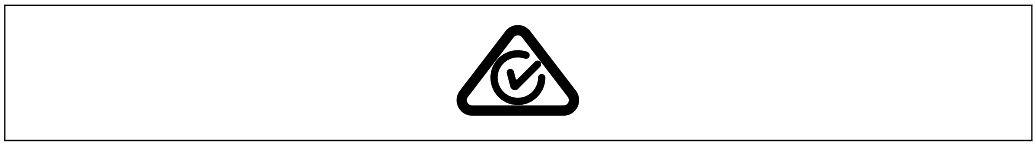
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

CE mark

The device meets the legal requirements of the relevant EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

RCM-Tick marking

The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products bear the RCM-Tick marking on the nameplate.



A0029561

Ex approvals

- ATEX
- CSA
- NEPSI
- UKCA
- INMETRO
- KC
- EAC
- JPN
- Combinations of different approvals also

All the data related to explosion protection is provided in separate Ex documentation which is also available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

Additional approvals in preparation.

Explosion-protected smartphones and tablets

If used in hazardous areas, mobile end devices with an Ex approval must be used.

Corrosion test

Standards and test methods:
- 316L: ASTM A262 Practice E and ISO 3651-2 Method A
- Alloy C22 and Alloy C276: ASTM G28 Practice A and ISO 3651-2 Method C
- 22Cr duplex, 25Cr duplex: ASTM G48 Practice A or ISO 17781 and ISO 3651-2 Method C

The corrosion test is confirmed for all wetted and pressure-bearing parts.

A 3.1 material certificate must be ordered as confirmation of the test.

EAC conformity

The device meets the legal requirements of the applicable EAC Directives. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.

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

Drinking water approval

- NSF/ANSI 61 drinking water approval
- KTW drinking water approval W 270

Overfill protection system

The device is tested in accordance with the approval guidelines for overfill protection units (ZG-ÜS:2012-07) as overfill protection as per Section 63 of the German Water Resources Act (WHG).

Functional safety SIL/ IEC 61508 Declaration of Conformity

The devices with a 4-20 mA output signal have been developed according to the IEC 61508 standard. These devices can be used to monitor the process level and pressure up to SIL 3. For a

detailed description of the safety functions, settings and functional safety data, see the "Functional Safety Manual".

Marine approval

- ABS (American Bureau of Shipping)
- LR (Lloyd's Register)
- BV (Bureau Veritas)
- DNV GL (Det Norske Veritas / German Lloyd)

Radio approval

Displays with Bluetooth LE have radio licenses according to CE and FCC. The relevant certification information and labels are provided on display.

CRN approval

A CRN approval (Canadian Registration Number) is available for some device versions. These devices are fitted with a separate plate bearing the registration number CRN 0F20813.5C. In order to obtain a CRN-approved device, a CRN-approved process connection must be ordered along with the option "CRN" in the order code for "Additional approvals".

Test reports

Test, certificate, declarations

- Inspection certificate 3.1, EN10204 (material certificate, wetted metallic parts)
  The selection of this feature for coated process membranes/process connections refers to the metallic base material.
- NACE MR0175 / ISO 15156 (wetted metallic parts), declaration
- NACE MR0103 / ISO 17945 (wetted metallic parts), declaration
- AD 2000 (wetted metal parts), declaration, excluding membrane
- ASME B31.3 process piping, declaration
- ASME B31.1 power piping, declaration
- Ambient temperature for transmitter (−50 to +85 °C (−58 to +185 °F)); for sensor, see specification
- Ambient temperature for transmitter (−54 to +85 °C (−65 to +185 °F)); for sensor, see specification
- Pressure test, internal procedure, test report
- Helium leak test, internal procedure, test report
- PMI test, internal procedure (wetted metallic parts), test report
- Welding documentation, wetted/pressurized seams, declaration

All test reports, declarations and inspection certificates are provided electronically in the Device Viewer: Enter the serial number of the nameplate (https://www.endress.com/de/pages/supporting-tools/device-viewer).

Applicable for the order codes "Calibration" and "Test, certificate" .

Product documentation on paper

Test reports, declarations and inspection certificates in hard copy can optionally be ordered with the order option "Product documentation on paper". These documents are supplied with the ordered product.

Calibration

5-point calibration certificate

10-point calibration certificate, traceable to ISO/IEC 17025

Manufacturer declarations

Various manufacturer declarations can be downloaded from the Endress+Hauser website. Other manufacturer declarations can be ordered from the Endress+Hauser sales office.

Downloading the Declaration of Conformity

www.endress.com → Download

Pressure Equipment Directive 2014/68/EU (PED)

Pressure equipment with permitted pressure ≤ 200 bar (2 900 psi)

Pressure equipment (maximum working pressure PS ≤ 200 bar (2 900 psi)) can be classified as pressure accessories in accordance with Pressure Equipment Directive 2014/68/EU. If the maximum working pressure is ≤ 200 bar (2 900 psi) and the pressurized volume of the pressure equipment is ≤ 0.1 l, the pressure equipment is subject to the Pressure Equipment Directive (see Pressure Equipment Directive 2014/68/EU, Article 4, point 3). The Pressure Equipment Directive only requires that the

pressure equipment shall be designed and manufactured in accordance with the “sound engineering practice of a Member State”.

Reasons:

- Pressure Equipment Directive 2014/68/EU Article 4, point 3
- Pressure Equipment Directive 2014/68/EU, Commission's Working Group "Pressure", Guideline A-05 + A-06

Note:

A separate assessment must be performed for pressure equipment that is part of a safety instrumented system intended to protect a pipe or vessel from exceeding allowable limits (equipment with safety function in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

Pressure equipment with allowable pressure > 200 bar (2 900 psi)

Pressure equipment designated for application in every process fluid having a pressurized volume of < 0.1 l and a maximum allowable pressure PS > 200 bar (2 900 psi) shall satisfy the essential safety requirements set out in Annex I of the Pressure Equipment Directive 2014/68/EU. According to Article 13, pressure equipment must be classified into categories in accordance with Annex II. Taking into account the small volume specified above, the pressure equipment can be categorized into Category I. They must then bear a CE mark.

Reasons:

- Pressure Equipment Directive 2014/68/EU, Article 13, Annex II
- Pressure Equipment Directive 2014/68/EU, Commission´s Working Group "Pressure", Guideline A-05

Note:

A separate assessment must be performed for pressure equipment that is part of a safety instrumented system intended to protect a pipe or vessel from exceeding allowable limits (equipment with safety function in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

The following also applies:

Devices, PN 420
Suitable for stable gases in group 1, category I, module A

Oxygen application (optional)

Verified cleaned, suitable for O2 service (wetted parts)

China RoHS symbol

The device is visibly identified according to SJ/T 11363-2006 (China-RoHS).

RoHS

The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).

PROFINET over Ethernet-APL certification

PROFINET interface

The device is certified and registered by the PNO (PROFIBUS Nutzerorganisation e. V.). The measuring system meets all the requirements of the following specifications:

- Certified according to:
  - Test specification for PROFINET devices
  - PROFINET PA Profile 4.02
  - PROFINET Netload Robustness Class 2 10 Mbit/s
  - APL conformance test
- The device can also be operated with certified devices of other manufacturers (interoperability)
- The device supports PROFINET S2 system redundancy.

Additional certification

Classification of process sealing between electrical systems and (flammable or combustible) process fluids according to UL 122701 (formerly ANSI/ISA 12.27.01)

Endress+Hauser devices are designed in compliance with UL 122701 (formerly ANSI/ISA 12.27.01), allowing users to eliminate the need for external secondary process seals in the piping, as specified

in the process seal sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC), thereby saving on costs. These devices comply with North American installation practices and provide a highly secure and cost-effective installation solution for pressure-bearing applications involving hazardous media. The devices are assigned to "single seal" as follows:

CSA C/US IS, XP, NI:

Up to 420 bar (6 300 psi).

Further information can be found in the control drawings of the relevant devices.

Metrological approval

If you select the "China" order option, the device is delivered with a Chinese nameplate according to the Chinese Quality Act.

Order information

Ordering information

Detailed ordering information is available from the nearest sales organization www.addresses.endress.com or in the Product Configurator under www.endress.com:

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

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

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the 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

Scope of delivery

The scope of delivery comprises:
- Device
- Optional accessories

Accompanying documentation:
- Brief Operating Instructions
- Final inspection report
- Additional Safety Instructions for devices with approvals (e.g. ATEX, IECEx, NEPSI, etc.)
- Optional: factory calibration form, test certificates

The Operating Instructions are available on the Internet at:

www.endress.com → Download

Service

The following services, among others, can be selected using the Product Configurator.

- Cleaned of oil+grease (wetted)
- Verified cleaned, suitable for O2 applic. (wetted)
- PWIS-free (paint-wetting impairment substances)
  (The plastic protective cover is excluded from the PWIS cleaning)
- ANSI Safety Red coating, coated housing cover
- Set HART burst mode PV
- Set max. alarm current
- Bluetooth communication is disabled on delivery
- Product documentation on paper
  A printed (hard copy) version of test reports, declarations and inspection certificates can optionally be ordered via the **Service**, Version, **Product documentation on paper** option. The required documents can be selected under the feature **Test, certificate, declaration** and are then included with the device on delivery.

Measuring point (TAG)

- Order code: marking
- Option: Z1, tagging (TAG), see additional specification
- Location of tag identifier: to be selected in the additional specifications
  - Stainless steel wired-on tag plate
  - Paper adhesive label
  - Plate provided
  - RFID tag
  - RFID tag + stainless steel wired-on tag plate
  - RFID tag + paper adhesive label
  - RFID tag + supplied label/plate
- Definition of tag name: to be defined in the additional specifications
  3 lines of maximum 18 characters each
  The specified tag name appears on the selected label and/or the RFID TAG
- Identification on electronic nameplate (ENP): 32 digits

Test reports, declarations and inspection certificates

All test reports, declarations and inspection certificates are provided electronically in the *Device Viewer*:
Enter the serial number from the nameplate
(https://www.endress.com/de/pages/supporting-tools/device-viewer)

Product documentation on paper
Test reports, declarations and inspection certificates in hard copy can optionally be ordered with feature 570 "Service", Version I7 "Product documentation on paper". The documents are then provided with the device upon delivery.

Application packages

Heartbeat Technology

Availability

Available in all device versions.

Heartbeat Verification + Monitoring, optional.

Heartbeat Diagnostics

- Continuous self-monitoring of the device
- Diagnostic messages output to
  - the local display
  - an asset management system (e.g. FieldCare or DeviceCare)
  - an automation system (e.g. PLC)
  - web server

Heartbeat Verification

- Monitoring of the installed device without interrupting the process, including a verification report
- Clear measuring point assessment (pass/fail) with high total test coverage as part of the manufacturer's specification
- Can be used to document normative requirements
- Meets the requirements for measurement traceability in accordance with ISO 9001 (ISO9001:2015 Section 7.1) ((HART: As of firmware 01.01.xx) (PROFIBUS PA: As of firmware 01.00.xx)). The verification report can be generated via Bluetooth and digital communication interface.

Heartbeat Monitoring

- Statistical Sensor Diagnostics: statistical analysis and evaluation of the pressure signal, including signal noise, to detect process anomalies (e.g. blocked impulse lines)
- Loop Diagnostics: detection of elevated measuring circuit resistance values or declining power supply (only with current output)
- Process Window: user-definable pressure and temperature limits to detect dynamic pressure surges or faulty trace heating systems or insulation
- Continuously supplies additional monitoring data to an external condition monitoring system for the purpose of predictive maintenance or process monitoring

Detailed description

See Special Documentation for SD Heartbeat Technology.

Accessories

Device-specific accessories

Mechanical accessories

- Mounting bracket for housing
- Mounting bracket for manifolds
- Prepared for sealing
- Manifolds:
  - Manifolds can be ordered as an **enclosed** accessory (screws and seals for mounting are enclosed)
  - Manifolds can be ordered as a **mounted** accessory (mounted manifolds are supplied with a documented leak test)
  - Certificates (e.g. 3.1 material certificate and NACE) and tests (e.g. PMI and pressure test) that are ordered with the device apply to the transmitter and the manifold
  - During the operating life of the valves, it may be necessary to re-tighten the pack
- Oval flange adapter
- Calibration adapter 5/16"-24 UNF, to screw into vent valves
- Weather protection covers

For technical data (e.g. materials, dimensions or order numbers), see the accessory document SD01553P.

Plug connectors

- Plug connector M12 90 deg, IP67 5m cable, union nut, Cu Sn/Ni
- Plug connector M12, IP67 union nut, Cu Sn/Ni
- Plug connector M12, 90 deg IP67 union nut, Cu Sn/Ni

The IP protection classes are only maintained if the dummy cap is used or the cable is connected.

Weld-in accessory

For details, refer to TI00426F/00/EN "Weld-in adapters, process adapters and flanges".

Device Viewer

All the spare parts for the device, along with the order code, are listed in the *Device Viewer* (https://www.endress.com/de/pages/supporting-tools/device-viewer).

Documentation

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Document type	Purpose and content of the document
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

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