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Technical Information
Deltabar PMD63B

Process pressure measurement
4-20mA analog, HART,
PROFINET over Ethernet-APL, PROFIBUS PA



Short description

Application

- Pressure measuring ranges: up to 40 bar (600 psi)
- Process temperatures: up to 250 °C (482 °F) with diaphragm seal
- Accuracy: up to ±0.025%

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. These undesired anomalies include dynamic pressure shocks or changes in the supply voltage, for example. Capillaries attenuate the pressure shocks. The patented TempC process membrane for the diaphragm seal reduces the measurement error caused by environmental and process temperature effects to a minimum.

Endress+Hauser
People for Process Automation

Table of contents

About this document 4
Symbols 4
Graphic conventions 4
List of abbreviations 5
Turn down calculation 5

Function and system design 6
Equipment architecture 6
Measuring system 7
Communication and data processing 8
Reliability for devices with HART, Bluetooth, PROFINET over Ethernet-APL , PROFIBUS PA 8

Input 9
Measured variable 9
Measuring range 9

Output 10
Output signal 10
Signal on alarm 10
Load 10
Damping 11
Ex connection data 11
Linearization 11
Protocol-specific data 11
Wireless HART data 14

Power supply 15
Terminal assignment 15
Available device plugs 15
Supply voltage 16
Electrical connection 17
Potential equalization 18
Terminals 18
Cable entries 18
Cable specification 18
Overvoltage protection 19

Performance characteristics 20
Response time 20
Reference operating conditions 20
Total performance 20
Resolution 23
Total error 23
Long-term stability 24
Response time T63 and T90 25
Warm-up time 25

Installation 26
Orientation 26
Installation instructions for devices with diaphragm seals . . 27
Sensor selection and arrangement 28
Special mounting instructions 29

Environment 31
Ambient temperature range 31
Storage temperature 31
Operating altitude 31
Climate class 31
Degree of protection 31
Vibration resistance 32
Electromagnetic compatibility (EMC) 32

Process 33
Process temperature range 33
Process temperature range (temperature at transmitter) . . 34
Diaphragm seal capillary armor 34
Process pressure range 34
Thermal insulation 35

Mechanical construction 38
Design, dimensions 38
Dimensions 39
Process connections for devices with temperature isolators 42
Process connections for devices with 2 capillaries 46
Process connections 48
Weight 55
Materials in contact with process 57
Materials not in contact with process 57
Surface roughness 59
Accessories 59

Display and user interface 60
Operating concept (not for devices with 4 to 20 mA analog) 60
Languages 60
Local operation 60
Local display 62
Remote operation 63
System integration 65
Supported operating tools 65
HistoROM 66

Certificates and approvals 67
CE mark 67
RCM-Tick marking 67
Ex approvals 67
Corrosion test 67
EAC conformity 67
Drinking water approval 67
Overfill protection system 67
Functional safety SIL/ IEC 61508 Declaration of Conformity 67
Radio approval 68
CRN approval 68
Test reports 68
Pressure Equipment Directive 2014/68/EU (PED) 68
Oxygen application (optional) 69
China RoHS symbol 69
RoHS 69
PROFINET over Ethernet-APL certification 69
Additional certification 69

Order information 70
Ordering information 70
Scope of delivery 70
Service 70
Measuring point (TAG) 70
Test reports, declarations and inspection certificates 70

Application packages 71
Heartbeat Technology 71

Accessories 72
Device-specific accessories 72
Device Viewer 72

Documentation 72

Registered trademarks 72

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

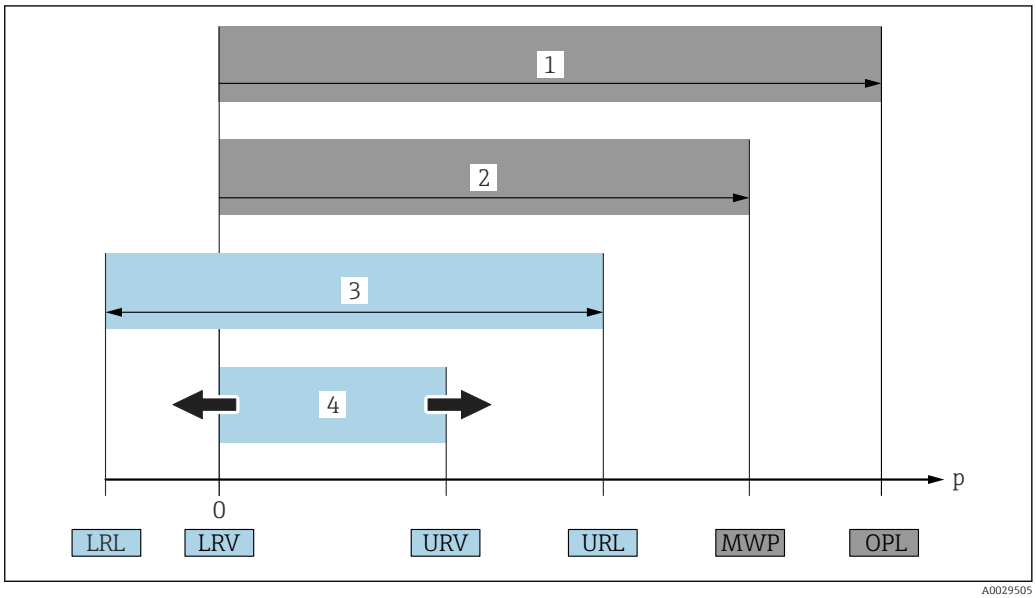
Safety instructions: ⚠ →

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

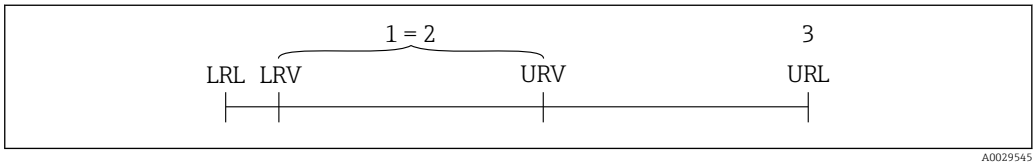
List of abbreviations



A0029505

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



A0029545

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

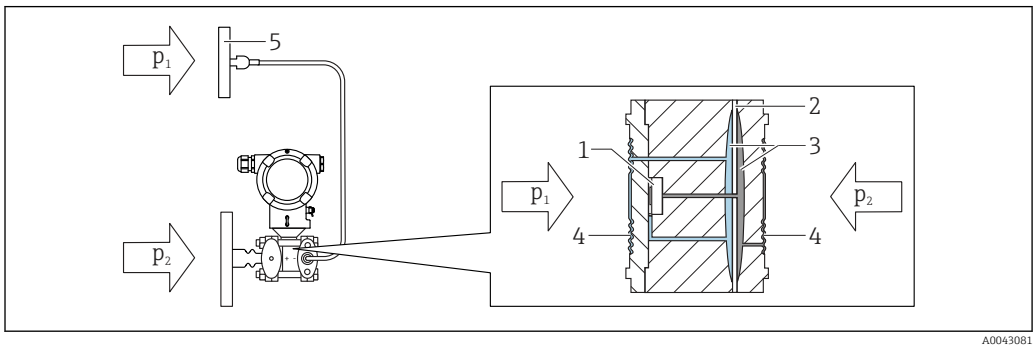
Example:
- Measuring cell: 16 bar (240 psi)
- Upper range limit (URL) = 16 bar (240 psi)
- Calibrated/adjusted span: 0 to 8 bar (0 to 120 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 8 bar (120 psi)

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

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

Function and system design

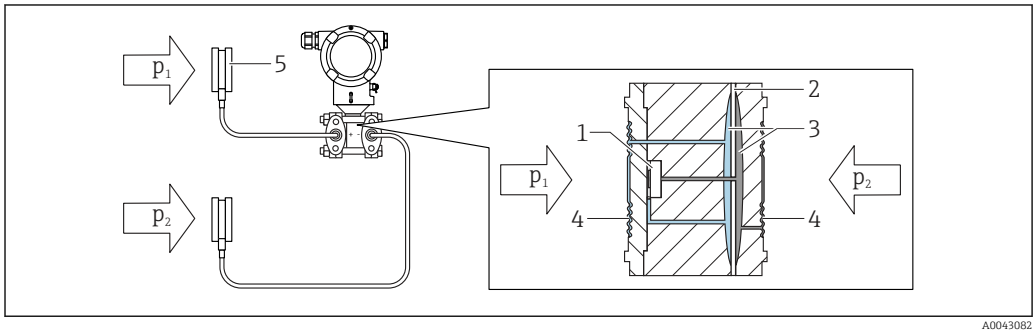
Equipment architecture



A0043081

1 *Capillary on the second side (P1) is optional*

1 *Measuring element*
2 *Middle diaphragm*
3 *Fill fluid*
4 *Internal membrane*
5 *Membrane of the diaphragm seal*
p_1 *Pressure 1*
p_2 *Pressure 2*



A0043082

1 *Measuring element*
2 *Middle diaphragm*
3 *Fill fluid*
4 *Internal membrane*
5 *Membrane of the diaphragm seal*
p_1 *Pressure 1*
p_2 *Pressure 2*

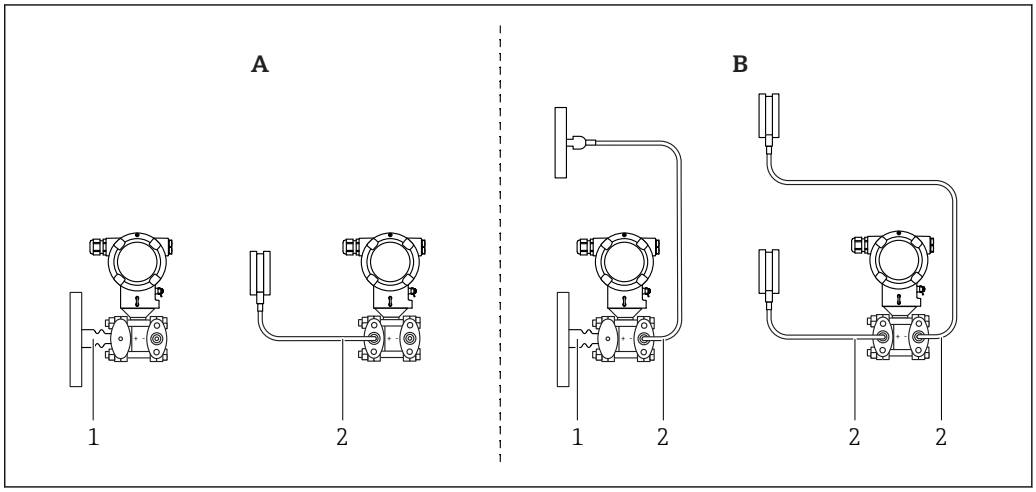
The pressures applied are transferred from the membrane of the diaphragm seal to the internal membrane of the measuring cell by means of an incompressible fill fluid. This causes a deflection of the membranes on both sides. A second fill fluid transfers the pressure to a side of the measuring element 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.

Applications for diaphragm seals

Diaphragm seal systems are used if the process and the device need to be separated. Diaphragm seal systems offer clear advantages in the following instances:
- In the case of high process temperatures - through the use of temperature isolators or capillaries
- In the case of strong vibrations - decouple the process from the device by using a capillary
- For mounting locations that are difficult to access

Measuring system

Device versions

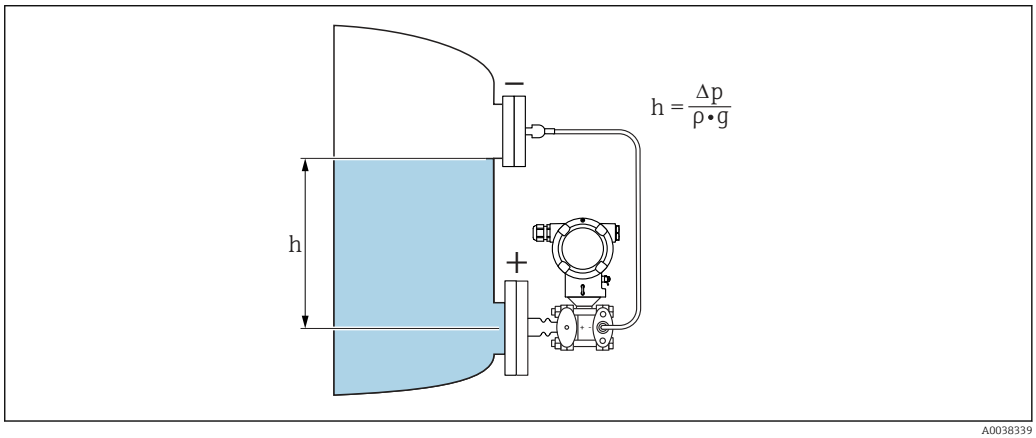


A0043595

A Diaphragm seal on one side
1 With temperature isolator on HP side
2 With capillary on HP side
B Diaphragm seal, both sides
1 With temperature isolator on HP side and with capillary on LP side
2 With capillary on HP side and with capillary on LP side

Level measurement (volume and mass):

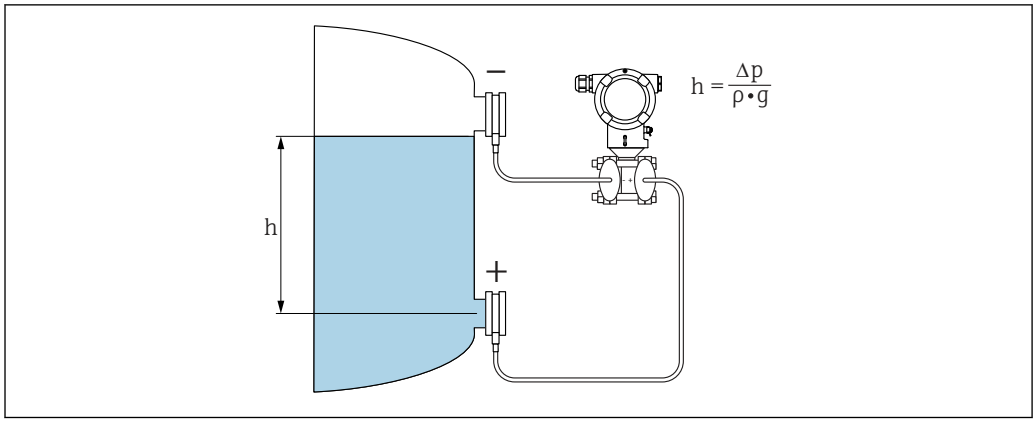
Diaphragm seal with temperature isolator on both sides



A0038339

h Height (level)
Δp Differential pressure
ρ Density of the medium
g Acceleration due to gravity

Diaphragm seal on both sides with capillary



h *Height (level)*
Δp *Differential pressure*
ρ *Density of the medium*
g *Acceleration due to gravity*

Advantages:

- Volume and mass measurements in any vessel shape with a freely programmable characteristic curve
- Has a wide range of uses, e.g.:
  - For level measurement in vessels with pressure overlay
  - For foam formation
  - In vessels with agitators or screen fittings
  - For liquid gases
  - For standard level measurement

Communication and data processing

- 4-20 mA analog (optional)
- 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

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.

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)]
100 (1.5)	−100 (-1.5)	+100 (+1.5)	5 (0.075)
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.

PN 160 / 16 MPa / 2400 psi

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

1) MWP depends on the selected process connection.
2) Applies to the process seal materials FKM, PTFE, FFKM, EPDM and for pressure applied on both sides.
3) If the side vent valves (sv) and PTFE seal option is selected, the burst pressure is 600 bar (8700 psi)
4) If pressure is applied on the negative side only, the MWP is 100 bar (1500 psi).

Minimum static pressure

- Minimum static pressure: 50 mbar (0.75 psi)$_{abs}$
  Observe the pressure and temperature application limits of the selected fill fluid
- Observe the pressure and temperature application limits of the selected fill fluid
- Vacuum applications: pay attention to the installation instructions

Output

Output signal

Current output

4 to 20 mA analog, 2-wire

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

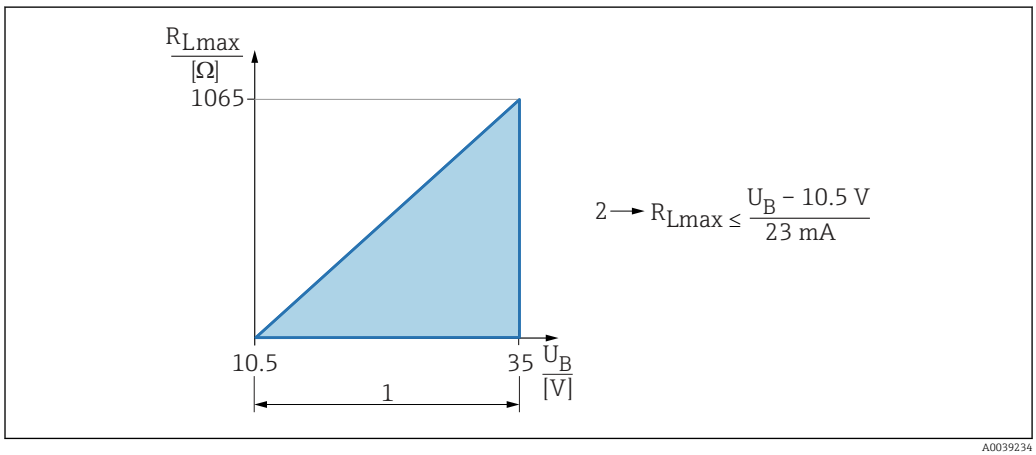
Galvanic isolation:
Yes

Signal on alarm

- 4 to 20 mA analog:
  - Signal over-range: > 20.5 mA
  - Signal under-range: < 3.8 mA
  - Min alarm (< 3.6 mA, factory setting)
- 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

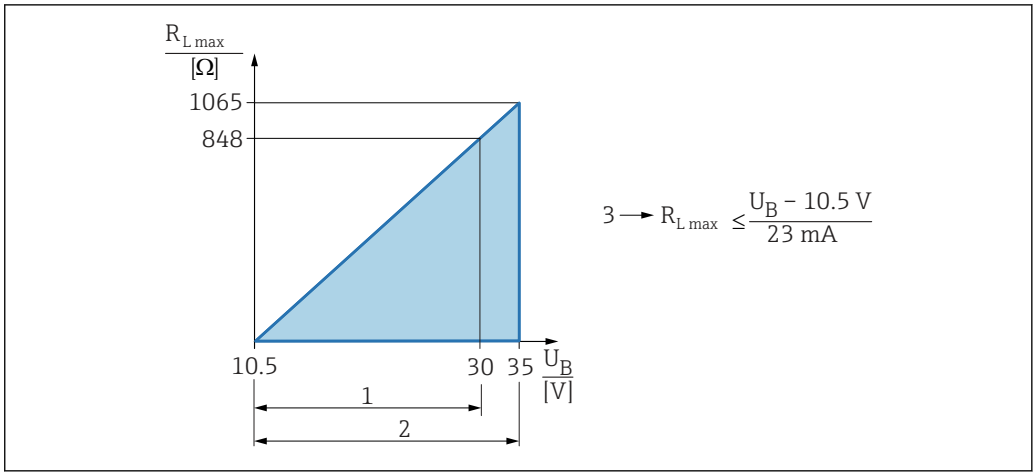
Load

4 to 20 mA analog



1 10.5 to 35 V power supply
2 R_{Lmax} maximum load resistance
U_B Supply voltage

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 DIP switch on the electronic insert (analog electronics only)
- 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.

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

Device variable	Measured value
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:
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

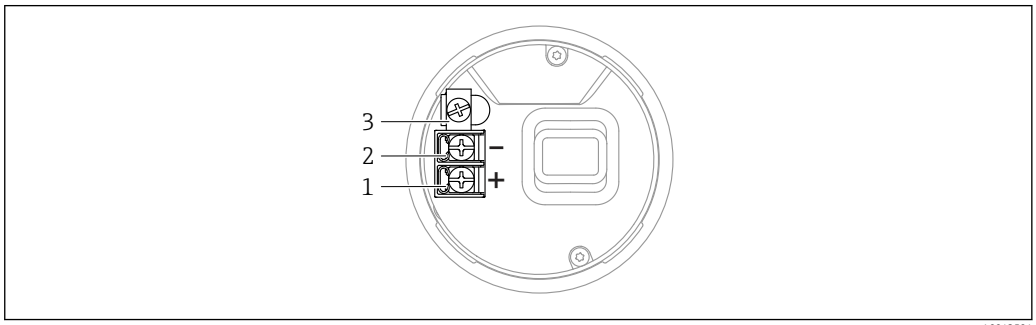
Wireless HART data

- 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

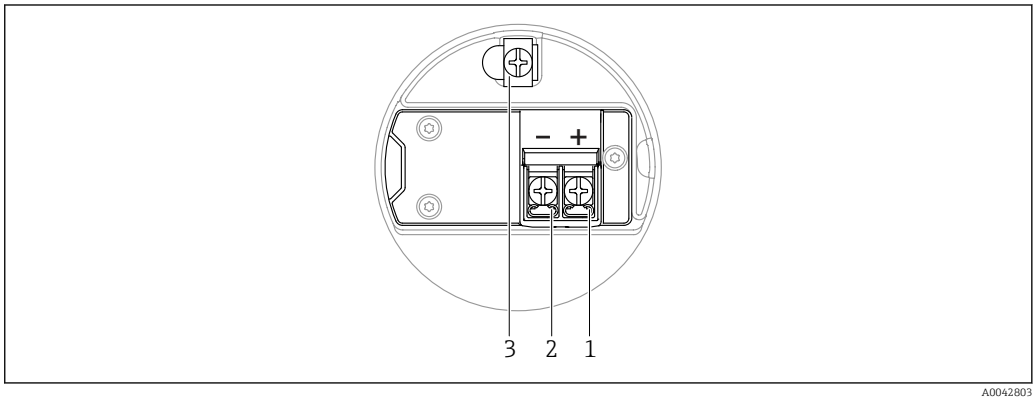
Single compartment housing



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

1 Plus terminal
2 Minus terminal
3 Internal ground terminal

Dual-compartment housing



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

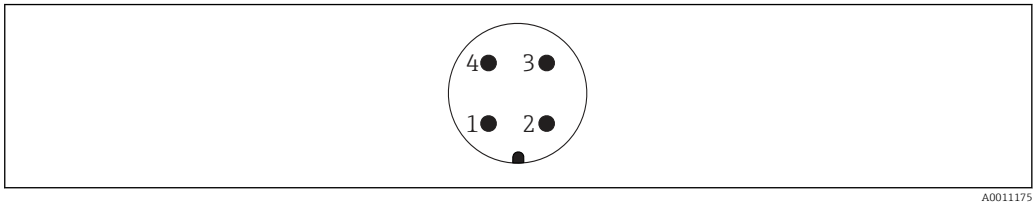
1 Plus terminal
2 Minus terminal
3 Internal ground terminal

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



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

Pin	Analog HART PROFIBUS PA
1	Signal +
2	Not used

Pin	Analog 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

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.

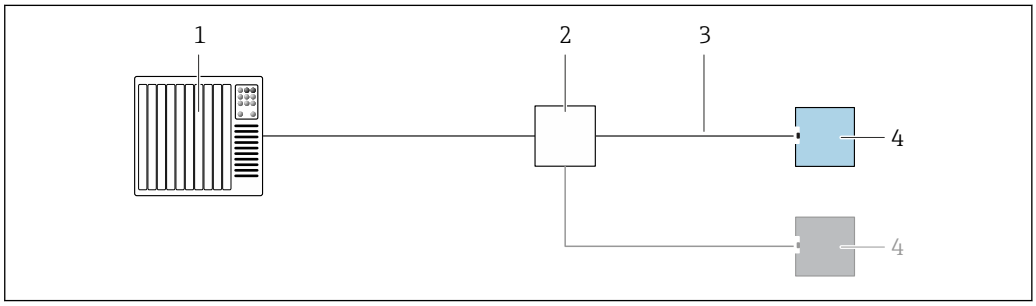
PROFINET over Ethernet-APL: The APL field switch must be tested to ensure it meets safety requirements (e.g. PELV, SELV, Class 2) and must comply with the relevant protocol specifications.

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

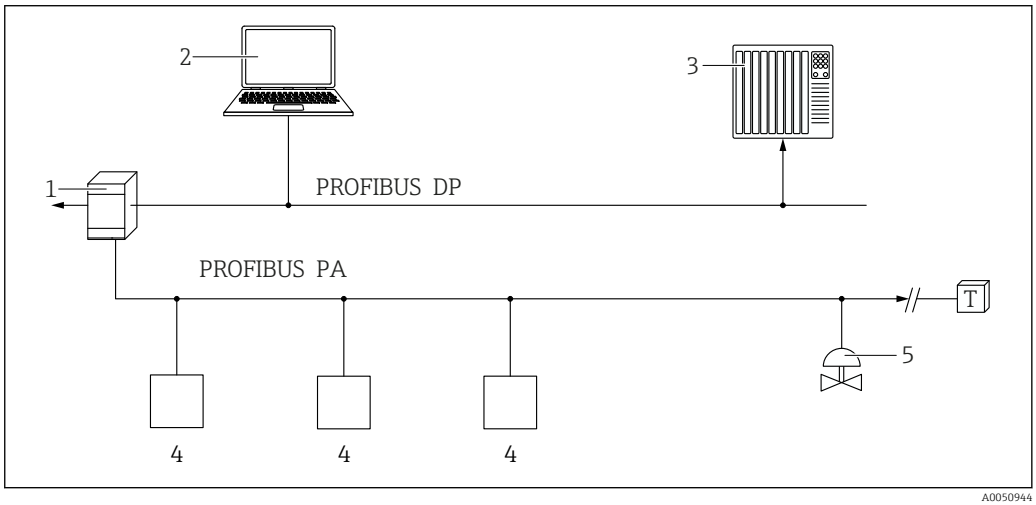
PROFINET over Ethernet-APL



5 *Connection example for PROFINET over Ethernet-APL*

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

PROFIBUS PA

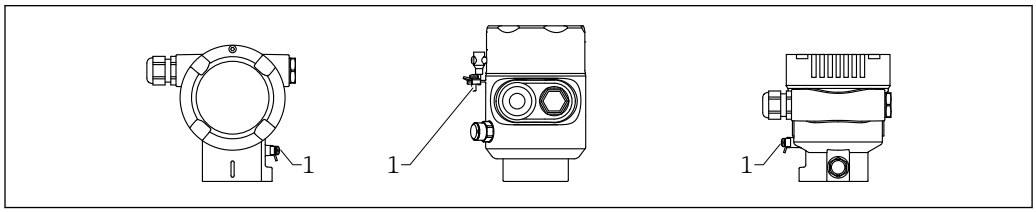


1 *Segment coupler*
2 *Computer with PROFIusb and operating tool (e.g. DeviceCare/FieldCare)*
3 *PLC (programmable logic controller)*
4 *Transmitter*
5 *Additional functions (valves etc.)*

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).



1 Ground terminal for connecting the potential matching line

Terminals

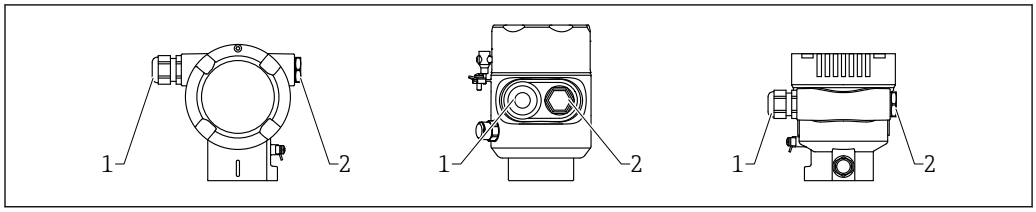
- Supply voltage and inner ground terminal
  Clamping range: 0.5 to 2.5 mm² (20 to 14 AWG)
- External ground terminal
  Clamping range: 0.5 to 4 mm² (20 to 12 AWG)

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.



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)
- 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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Calculation of the diaphragm seal error with the Endress+Hauser Applicator

Diaphragm seal errors are not taken into consideration. They are calculated separately in the Applicator "Sizing Diaphragm Seal".

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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.

Diaphragm seal on one side with temperature isolator

Measuring cell	Standard	Platinum
100 mbar (1.5 psi)	TD 1:1 to 5:1 = ±0.10 % TD > 5:1 = ±0.02 % · TD	not available
500 mbar (7.5 psi)	TD 1:1 to 15:1 = ±0.075 % TD > 15:1 = ±(0.0015 % · TD + 0.053 %)	not available
3 bar (45 psi) 16 bar (240 psi) 40 bar (600 psi)	TD 1:1 to 15:1 = ±0.075 % TD > 15:1 = ±(0.0015 % · TD + 0.053 %)	not available

Diaphragm seal on both sides with two capillaries or diaphragm seal with temperature isolator on LP side and capillary on HP side.

Measuring cell	Standard	Platinum
100 mbar (1.5 psi)	TD 1:1 to 5:1 = ±0.15 % TD > 5:1 = ±0.03 % · TD	not available
500 mbar (7.5 psi)	TD 1:1 to 5:1 = ±0.15 % TD > 5:1 = ±0.03 % · TD	not available
3 bar (45 psi) 16 bar (240 psi) 40 bar (600 psi)	TD 1:1 to 15:1 = ±0.1 % TD > 15:1 = ±(0.006 % · TD + 0.01 %)	not available

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.

100 mbar (1.5 psi) measuring cell
±(0.07 % · TD + 0.07 %)

500 mbar (7.5 psi) measuring cell
±(0.03 % · TD + 0.017 %)

3 bar (45 psi), 16 bar (240 psi) and 40 bar (600 psi) measuring cell
±(0.012 % · TD + 0.017 %)

$E2_E$ - 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).

100 mbar (1.5 psi) measuring cell
Standard
- Influence on the zero point: ±0.203 % · 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)

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)

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)

Resolution

Current output: <1 µA

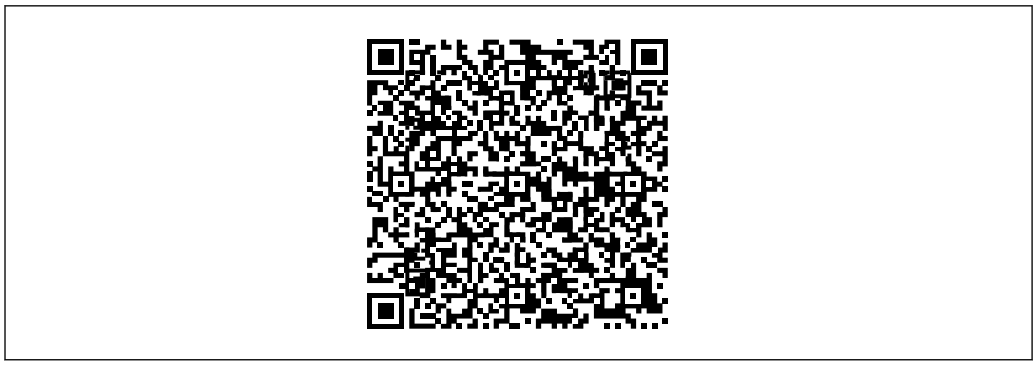
Total error

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

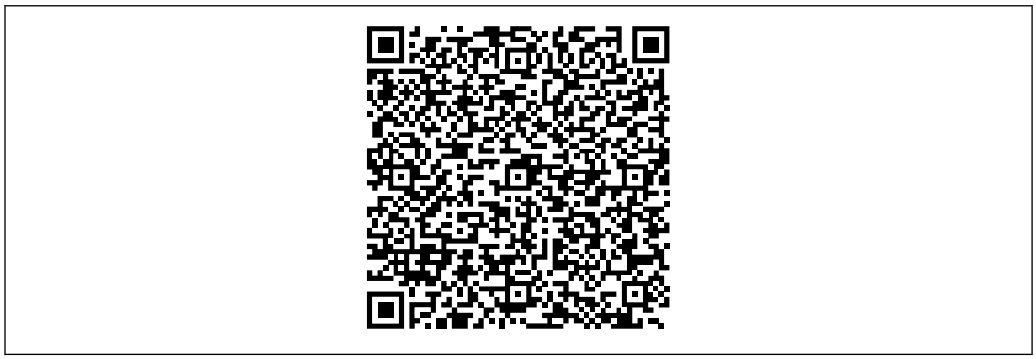
Detailed measurement errors, e.g. for other temperature ranges, can be calculated with the Applicator "Sizing Pressure Performance".



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Calculation of the diaphragm seal error with the Endress+Hauser Applicator

Diaphragm seal errors are not taken into consideration. They are calculated separately in the Applicator "Sizing Diaphragm Seal".



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Long-term stability

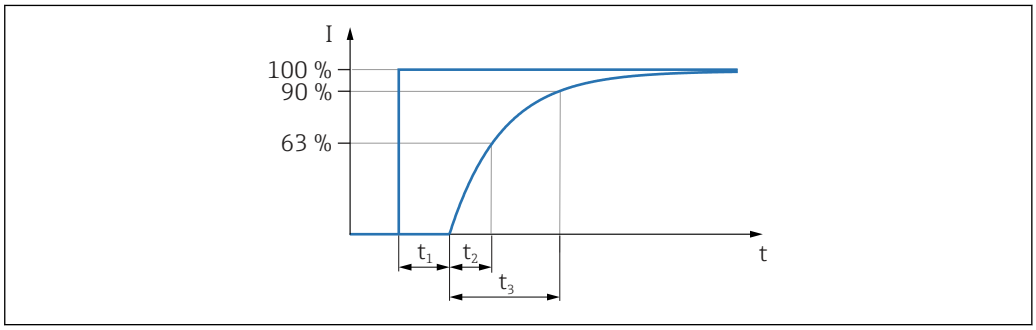
100 mbar (1.5 psi) measuring cell
- 1 year: ±0.08 %
- 5 years: ±0.12 %
- 10 years: ±0.20 %
- 15 years: ±0.28 %

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 %

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

Depends on the diaphragm seal. Calculate in the Applicator.

The "Thermal Range Expander" diaphragm seal can be used for extreme applications with high process temperatures and low ambient temperatures. The range of application is expanded by the use of two different fill fluids (fill fluid in the primary chamber for high process temperature and fill fluid in the secondary chamber for ambient temperature).

Ordering information: Product Configurator, order code for "Application package", option "Thermal Range Expander"

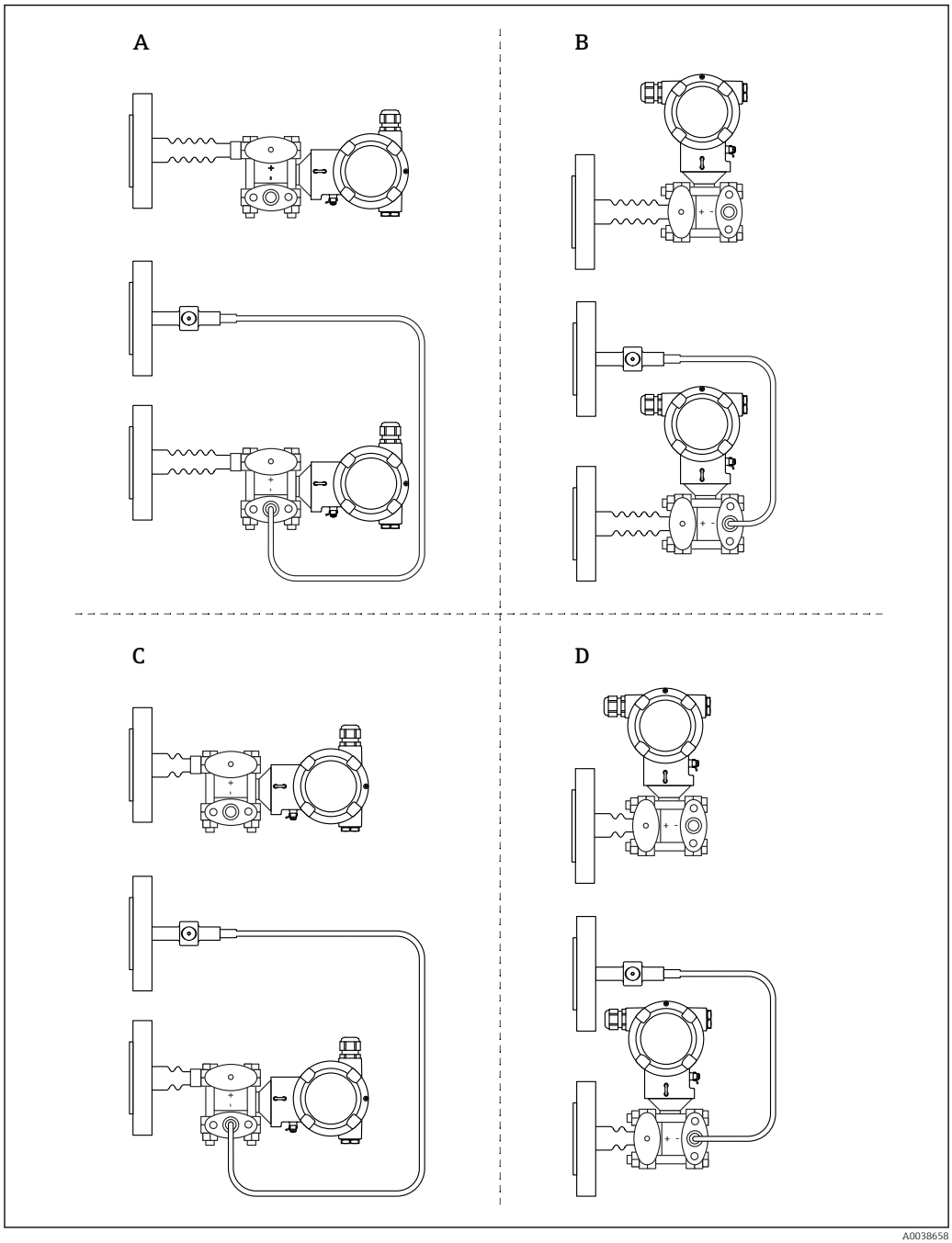
Warm-up time

As per IEC 62828-4: ≤5 s

Installation

Orientation

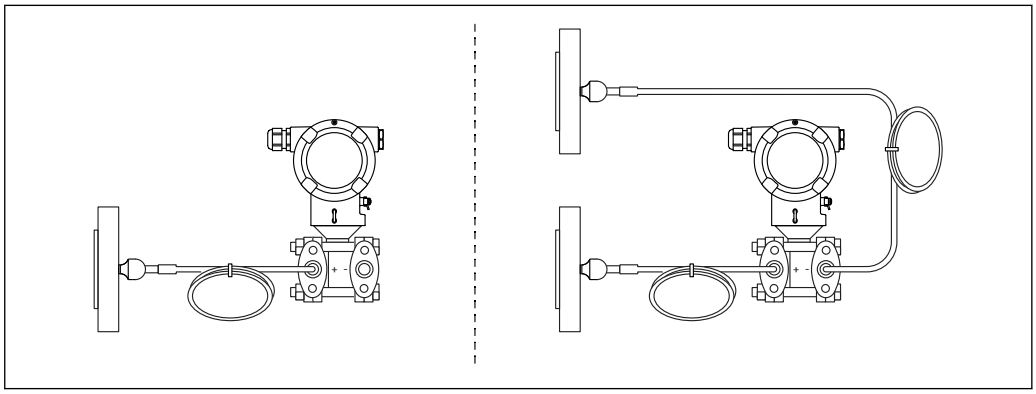
Diaphragm seal on one side or both sides with temperature isolator



A Design HP side: Transmitter horizontal, temperature isolator long
B Design HP side: Transmitter vertical, temperature isolator long
C Design HP side: Transmitter horizontal, temperature isolator short
D Design HP side: Transmitter vertical, temperature isolator short

Diaphragm seal on one side or both sides with capillary

In vacuum applications, mount the pressure transmitter below the lower diaphragm seal.



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Use "Sizing Diaphragm Seal" for the installation check.

Order options:
- ..... m capillary, 316L (standard capillary armor)
- ..... m capillary, PVC-coated capillary armor on 316L
- ..... m capillary, PTFE-jacketed capillary armor on 316L
- ..... ft capillary, 316L (standard capillary armor)
- ..... ft capillary, PVC-coated capillary armor on 316L
- ..... ft capillary, PTFE-jacketed capillary armor on 316L

Installation instructions for devices with diaphragm seals

General information

A diaphragm seal together with the transmitter form a closed, calibrated system, which is filled through openings in the diaphragm seal and in the transmitter's measurement system. These openings are sealed and must not be opened.

In the case of devices with diaphragm seals and capillaries, the zero point shift caused by the hydrostatic pressure of the filling liquid column in the capillaries must be taken into account when selecting the measuring cell. Perform zero adjustment if necessary. If a measuring cell with a small measuring range is selected, the nominal measuring cell range may be overdriven as a result of a position adjustment (position adjustment due to the zero offset caused by the installation position of the fluid column of the fill fluid).

For devices with a capillary, a suitable fastening device (mounting bracket) is recommended for installation.

During installation, ensure sufficient strain relief for the capillary to prevent it from bending (capillary bending radius ≥ 100 mm (3.94 in)).

Mount the capillary so that it is vibration-free (in order to avoid additional pressure fluctuations).

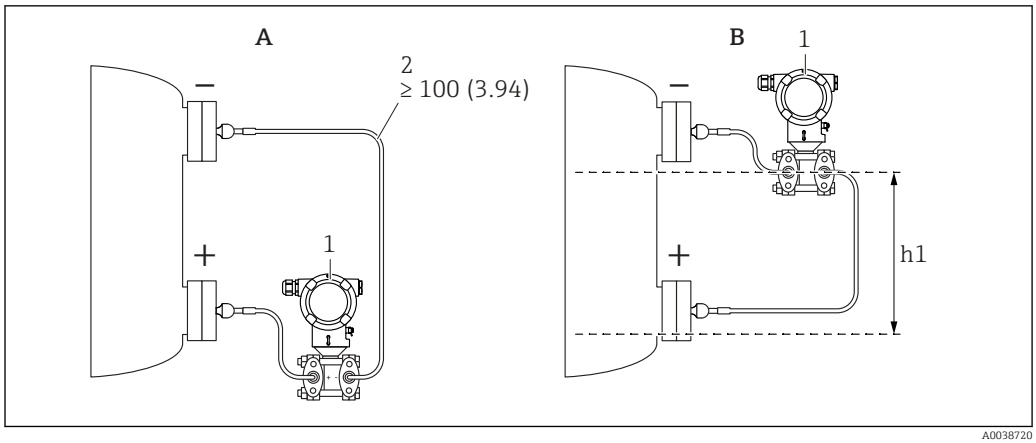
Do not mount capillaries in the vicinity of heating or cooling lines and protect them against direct sunlight.

Additional installation instructions are provided in the Applicator "Sizing Diaphragm Seal".

Vacuum applications

In vacuum applications, mount the pressure transmitter below the diaphragm seal. This prevents additional vacuum loading of the diaphragm seal caused by the presence of fill fluid in the capillary.

If the pressure transmitter is installed above the diaphragm seal, do not exceed the maximum height difference h1. The height difference h1 is shown in the Applicator "Sizing Diaphragm Seal".



Unit of measurement mm (in)

A Recommended installation in a vacuum application
B Installation above the lower diaphragm seal
h1 Height difference (is shown in the Applicator "Sizing Diaphragm Seal")
1 Device
2 Bending radius ≥ 100 mm (3.94 in). Ensure strain relief to prevent the capillary from bending.

The maximum height difference depends on the density of the fill fluid and the lowest absolute pressure that can ever occur at the diaphragm seal (empty vessel).

Sensor selection and arrangement

Level measurement

Level measurement in an open vessel, diaphragm seal on one side with temperature isolator

- Mount the device directly on the vessel
- The negative side is open to atmospheric pressure

Level measurement in a closed vessel, diaphragm seal on one side with temperature isolator

- Mount the device directly on the vessel
- Always connect the piping on the negative side above the maximum level

Level measurement in a closed vessel, diaphragm seal on one side or both sides with capillary

Mount the device below the lower diaphragm seal

Level measurement is only guaranteed between the upper edge of the lower diaphragm seal and the lower edge of the upper diaphragm seal.

Level measurement in a closed vessel with superimposed vapor, diaphragm seal on one side with temperature isolator

- Mount the device directly on the vessel
- Always connect the piping on the negative side above the maximum level
- The condensate trap ensures constant pressure on the negative side
- When measuring in media with solid parts (such as dirty liquids) installing separators and drain valves is useful for capturing and removing sediment

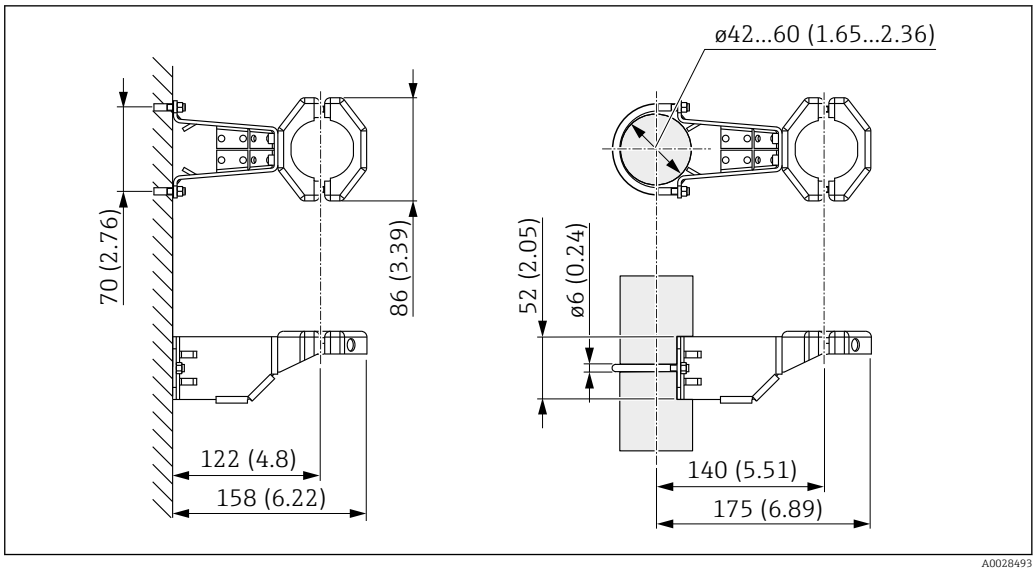
Differential pressure measurement

Differential pressure measurement in gases, vapors and liquids, diaphragm seal on one side or two sides with capillary

- Mount diaphragm seals with capillaries on pipes at the top or side
- In vacuum applications, mount the device below the measuring point

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.



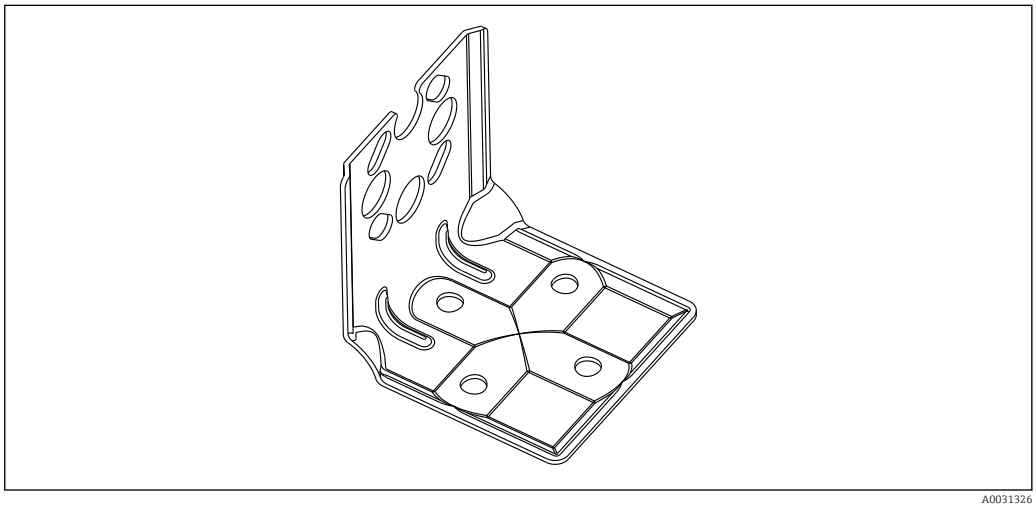
Unit of measurement mm (in)

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:



- 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

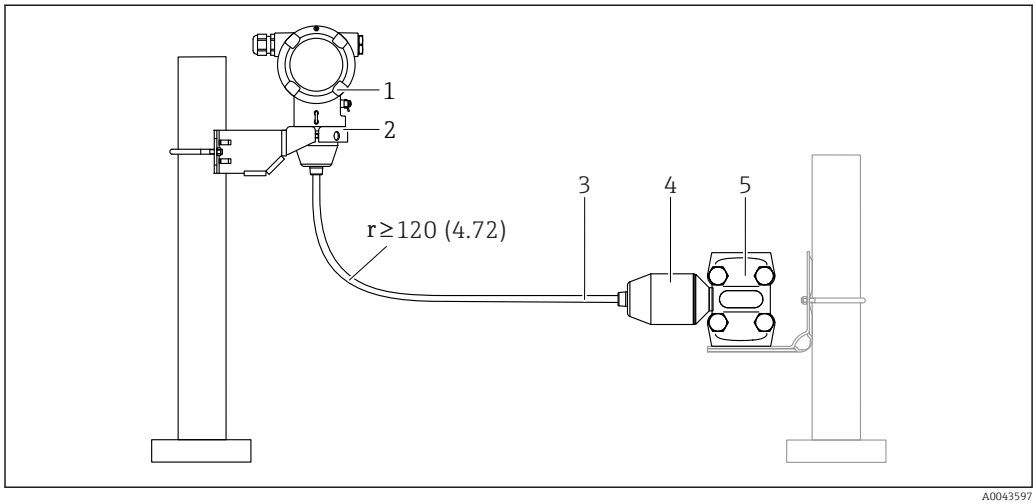
Sensor, remote (separate housing)

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)
- 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)
- Devices with PVC-coated capillary armor: –25 to +80 °C (–13 to +176 °F)
- Separate housing: –20 to +60 °C (–4 to +140 °F)

Applications with very high temperatures: use either a diaphragm seal on one side with a temperature isolator, or a diaphragm seal on one side or both sides with a capillary. Use a mounting bracket!

If vibrations additionally occur in the application: use a device with a capillary.

Hazardous area

For devices for use in hazardous areas, see the Safety Instructions, Installation Drawing or Control Drawing

Storage temperature

- Without device display:
  Standard: –40 to +90 °C (–40 to +194 °F)
- 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)

Devices with PVC-coated capillary armor: –25 to +90 °C (–13 to +194 °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.

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
- Gland M20, hygienic, IP66/68/69 NEMA 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
- 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: 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
0.1 to 40 bar (1.5 to 600 psi)	10 Hz to 60 Hz: ±0.35 mm (0.0138 in) 60 Hz to 1000 Hz: 5 g	30 g

Stainless steel single-compartment housing, hygienic

Description	Sinusoidal vibration IEC62828-1	Shock
Device with temperature isolator	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
0.1 to 40 bar (1.5 to 600 psi)	10 Hz to 60 Hz: ±0.35 mm (0.0138 in) 60 Hz to 1000 Hz: 5 g	30 g

Description	Sinusoidal vibration IEC62828-1	Shock
Device with temperature isolator	10 Hz to 60 Hz: ±0.075 mm (0.0030 in) 60 Hz to 500 Hz: 1 g	15 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.

Diaphragm seal fill fluid

Fill fluid	P_{abs} = 0.05 bar (0.725 psi) [1]	P_{abs} ≥1 bar (14.5 psi) [2]
Silicone oil	−40 to +180 °C (−40 to +356 °F)	−40 to +250 °C (−40 to +482 °F)
Vegetable oil	−10 to +160 °C (+14 to +320 °F)	−10 to +220 °C (+14 to +428 °F)

1) Permitted temperature range at p_{abs} = 0.05 bar (0.725 psi) (observe temperature limits of the device and the system!)
2) Permitted temperature range at p_{abs} ≥1 bar (14.5 psi) (observe temperature limits of the device and the system!)

Fill fluid	Density [1] kg/m³
Silicone oil	970
Vegetable oil	920

1) Density of the diaphragm seal fill fluid at 20 °C (68 °F).

The calculation of the operating temperature range of a diaphragm seal system depends on the fill fluid, capillary length and capillary internal diameter, process temperature and oil volume of the diaphragm seal. Detailed calculations, e.g. for temperature ranges, vacuum and temperature ranges, are done separately in the Applicator "Sizing Diaphragm Seal".

A0038925

Seals

Seal on the LP side (−)	Temperature	Pressure specifications
FKM	−20 to +85 °C (−4 to +185 °F)	-
FKM Cleaned of oil and grease	−10 to +85 °C (+14 to +185 °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	−40 to +85 °C (−40 to +185 °F)	-
PTFE	−40 to +85 °C (−40 to +185 °F)	PN > 160 bar (2 320 psi) Minimum process temperature: −20 °C (−4 °F)

- Diaphragm seal and capillary welded: Pay attention to the temperature application limits of the fill fluid.
- Device generally OPL on one side 160 bar (2 320 psi), on both sides 240 bar (3 480 psi)

Process temperature range (temperature at transmitter)

Diaphragm seal on one side with temperature isolator

- Dependent on design (see "Design" section)
- Dependent on diaphragm seal and fill fluid: −40 to +250 °C (−40 to +482 °F)
- Observe the temperature application limits of the fill fluid
- Observe the maximum gauge pressure and maximum temperature
- Pay attention to the process temperature range of the seal

Design:

- Transmitter horizontal, temperature isolator long: 250 °C (482 °F)
- Transmitter vertical, temperature isolator long: 250 °C (482 °F)
- Transmitter horizontal, temperature isolator short: 200 °C (392 °F)
- Transmitter vertical, temperature isolator short: 200 °C (392 °F)

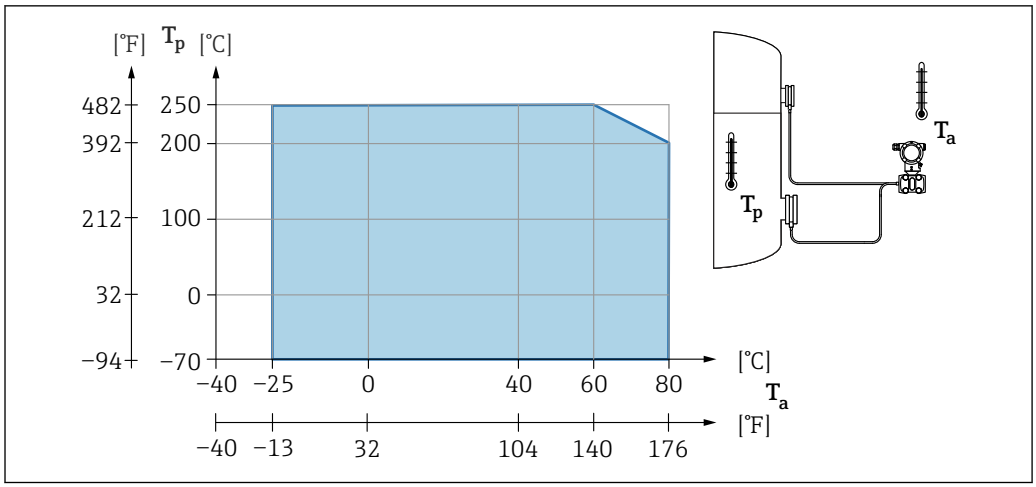
Diaphragm seal on one side or both sides with capillary

- Depending on diaphragm seal and fill fluid:−40 °C (−40 °F) up to +250 °C (+482 °F)
- Observe the maximum gauge pressure and maximum temperature

Diaphragm seal capillary armor

Process temperature depending on the ambient temperature.

- 316L: No restrictions
- PTFE: No restrictions
- PVC: See the following diagram



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).

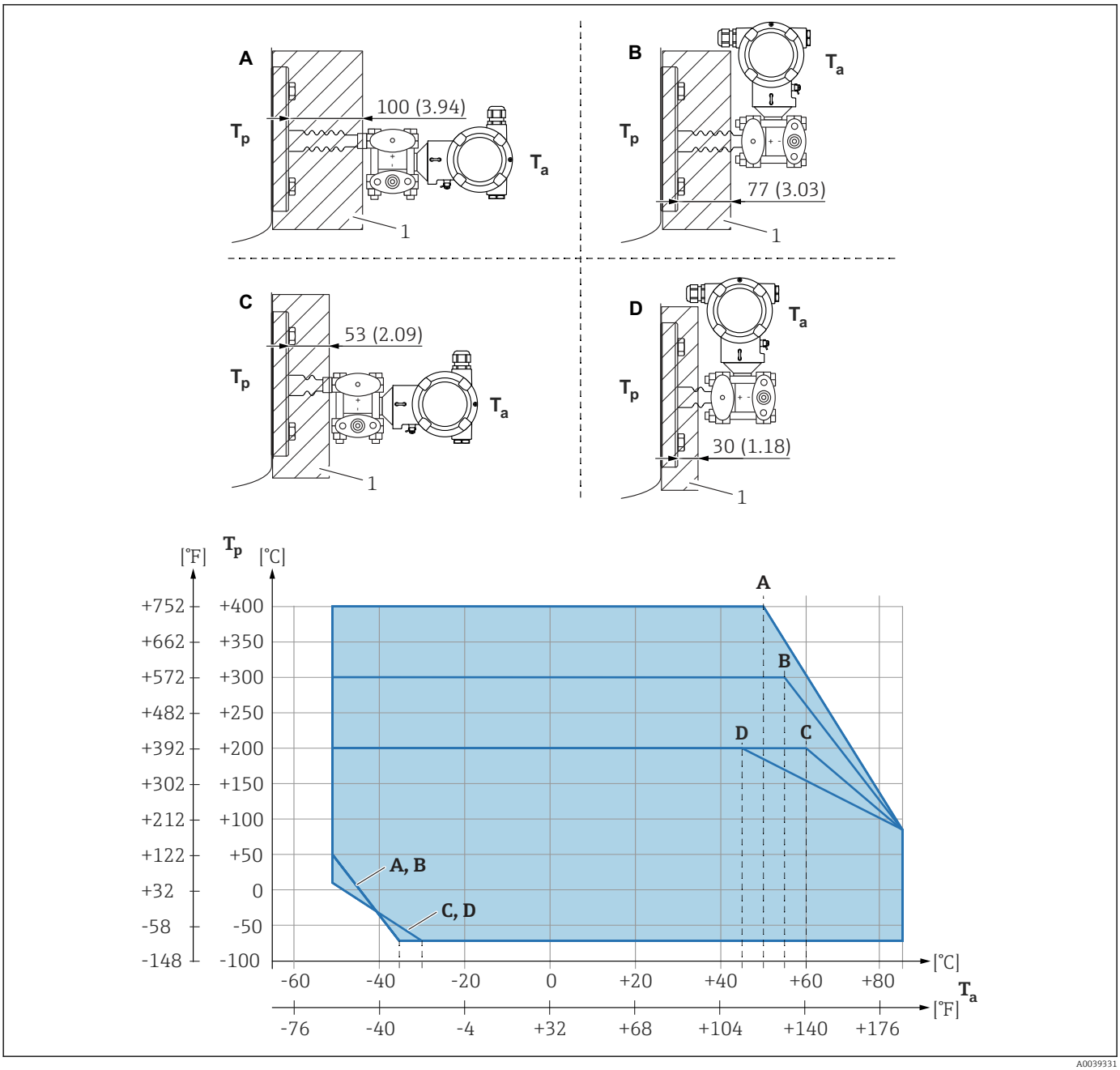
Burst pressure

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.

Thermal insulation

Thermal insulation when mounting with a temperature isolator

The device may only be insulated up to a certain height. The maximum permitted insulation height applies to an insulation material with a thermal conductivity ≤ 0.04 W/(m x K) and to the maximum permitted ambient temperature and process temperature. The data were determined under the application "quiescent air".



1 Insulation material
A Transmitter horizontal, temperature isolator long
B Transmitter vertical, temperature isolator long
C Transmitter horizontal, temperature isolator short
D Transmitter vertical, temperature isolator short

Item	T_a [1]	T_p [2) 3)]
A	50 °C (122 °F)	400 °C (752 °F)
	85 °C (185 °F)	85 °C (185 °F)
	–50 °C (–58 °F)	50 °C (122 °F)
	–35 °C (–31 °F)	–70 °C (–94 °F)
B	55 °C (131 °F)	300 °C (572 °F)
	85 °C (185 °F)	85 °C (185 °F)
	–50 °C (–58 °F)	50 °C (122 °F)
	–35 °C (–31 °F)	–70 °C (–94 °F)

Item	T_a [1]	T_p [2] [3]
C	60 °C (140 °F)	200 °C (392 °F)
	85 °C (185 °F)	85 °C (185 °F)
	−50 °C (−58 °F)	10 °C (50 °F)
	−30 °C (−22 °F)	−70 °C (−94 °F)
D	67 °C (153 °F)	200 °C (392 °F)
	85 °C (185 °F)	85 °C (185 °F)
	−50 °C (−58 °F)	10 °C (50 °F)
	−30 °C (−22 °F)	−70 °C (−94 °F)

1) Maximum ambient temperature at transmitter
2) Maximum process temperature
3) Process temperature depending on the fill fluid used.

Without insulation, the ambient temperature decreases by 5 K.

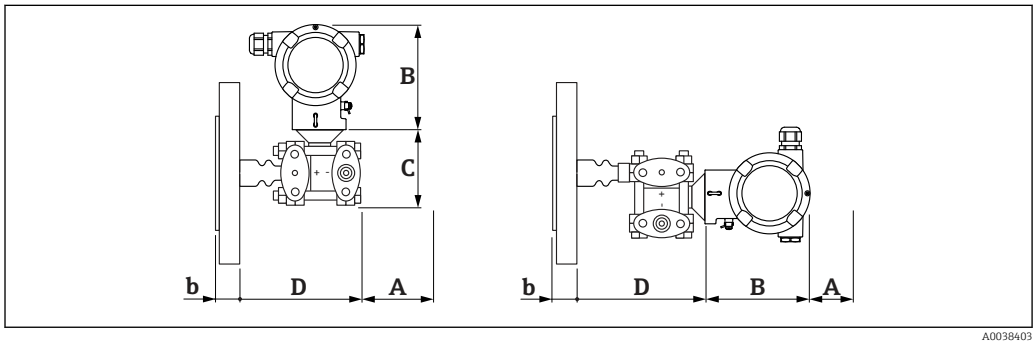
Mechanical construction

Design, dimensions

Device height

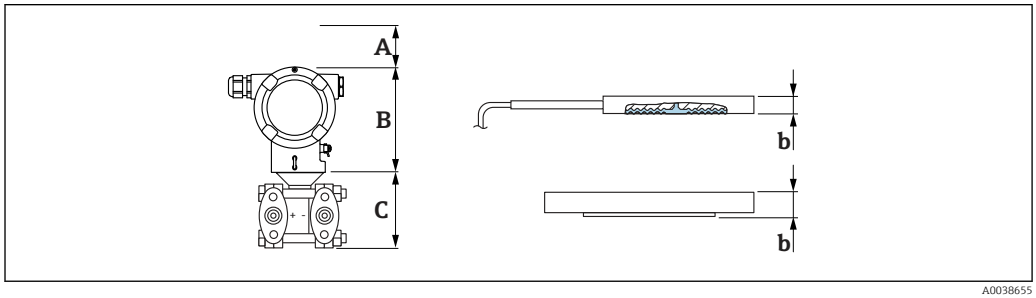
The device height is calculated from
- the height of the housing
- the height of optional mounted parts such as temperature isolators or capillaries
- the height of the individual process connection

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).



A0038403

A Installation clearance
B Height of the housing
b Height of the process connection
C Height of the sensor assembly
D Width of the mounted parts including sensor assembly

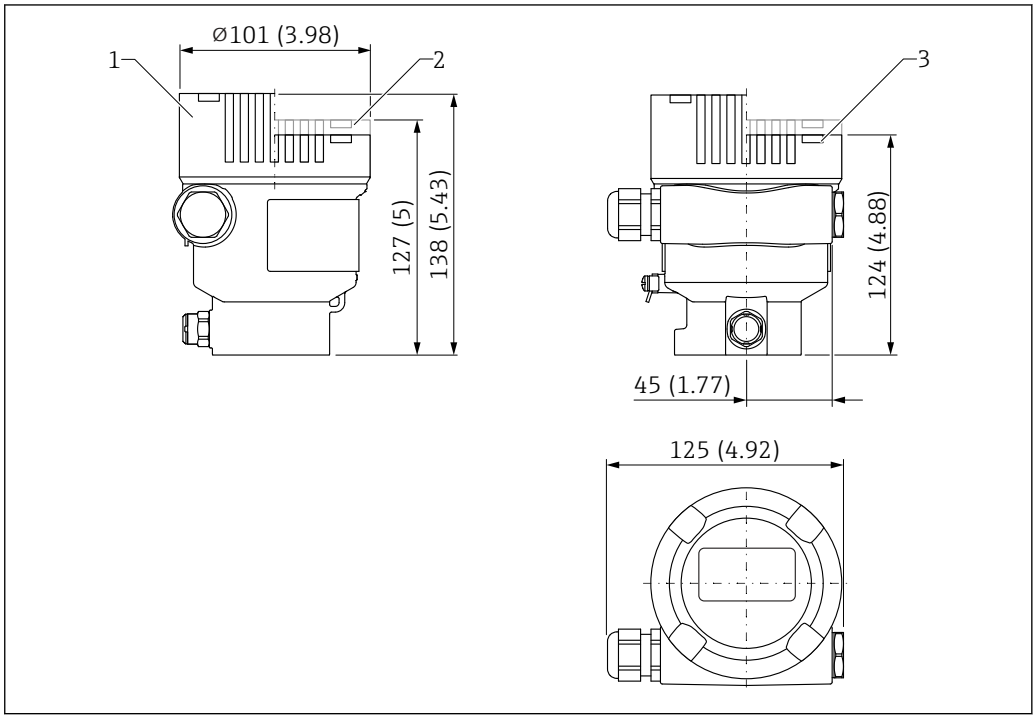


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A Installation clearance
B Housing height
C Side flanges
b Process connections

Dimensions

Single-compartment housing, aluminum

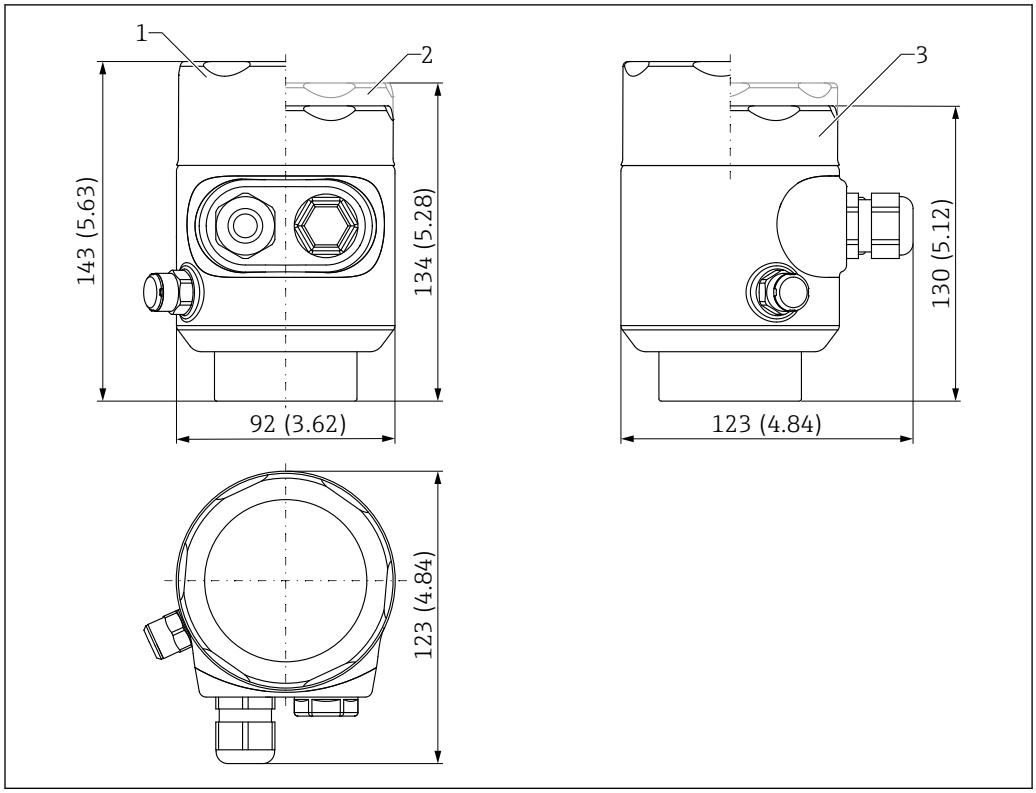


Unit of measurement mm (in)

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.

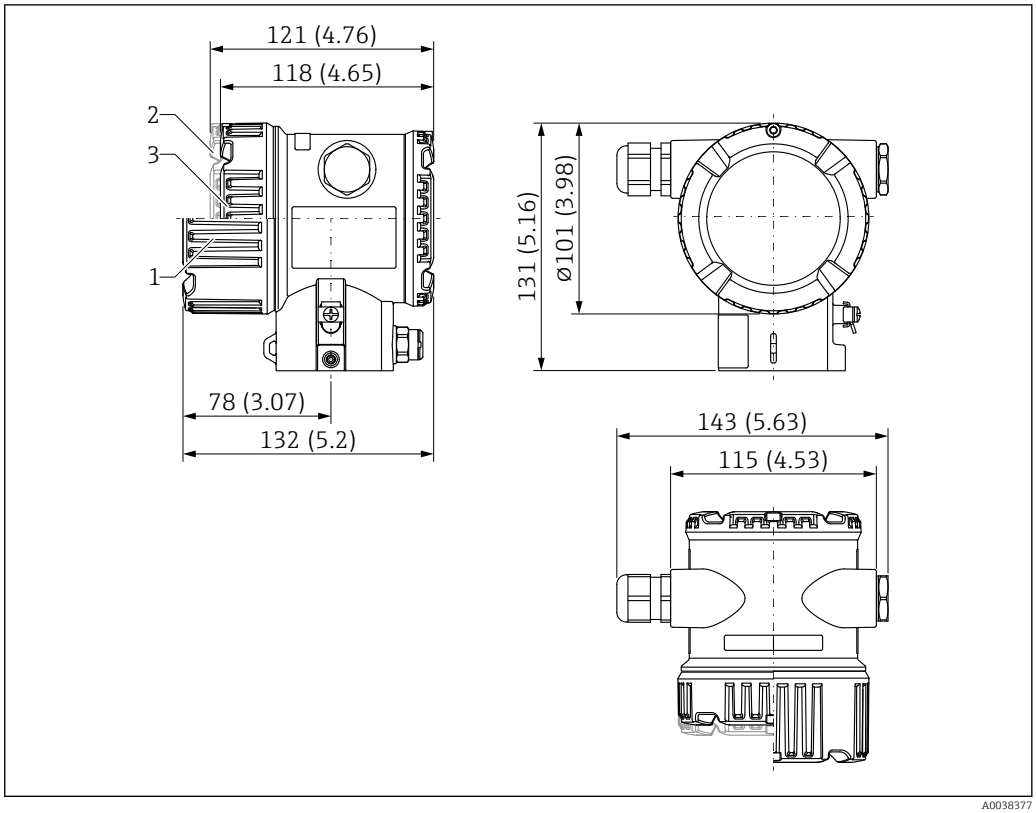
Single compartment housing, 316L, hygiene



6 Dimensions; single compartment housing, 316 L, hygiene; incl. M20 coupling and plug, plastic

1 Height with cover comprising glass sight glass (dust ignition-proof)
2 Height with cover comprising plastic sight glass
3 Cover without sight glass

Dual-compartment housing

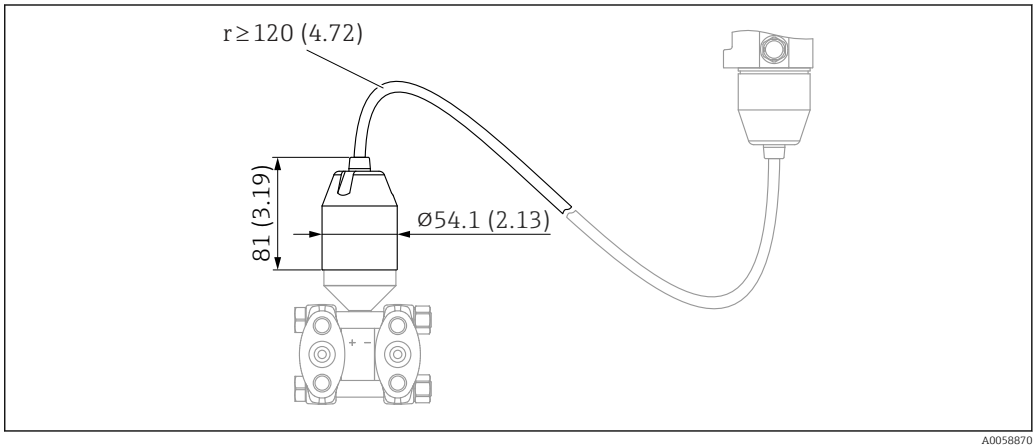


Unit of measurement mm (in)

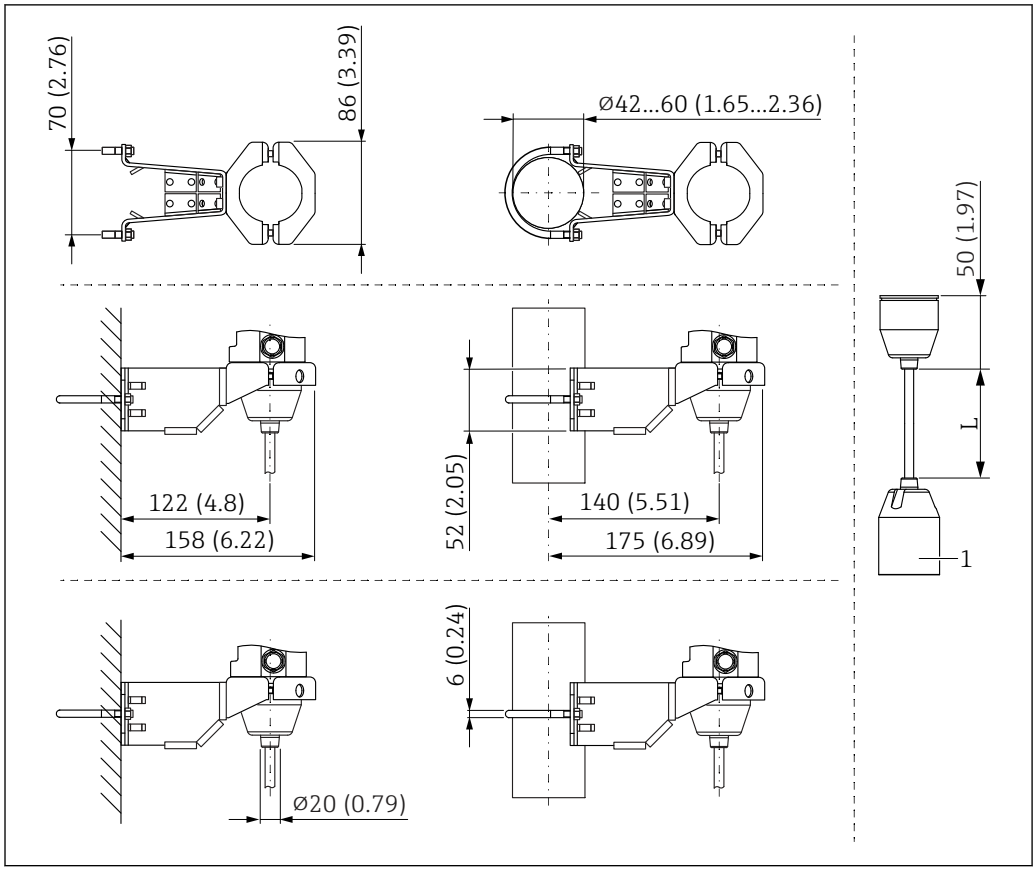
1 *Device with display, cover with sight glass made of glass (devices for Ex d/XP, dust Ex): 132 mm (5.2 in)*
2 *Device with display, cover with plastic sight glass: 121 mm (4.76 in)*
3 *Device without display, cover without sight glass: 118 mm (4.65 in)*

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

Sensor, remote (separate housing)



Bracket and cable length



Unit of measurement mm (in)

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

Process connections for devices with temperature isolators

Selecting the process connection and capillary

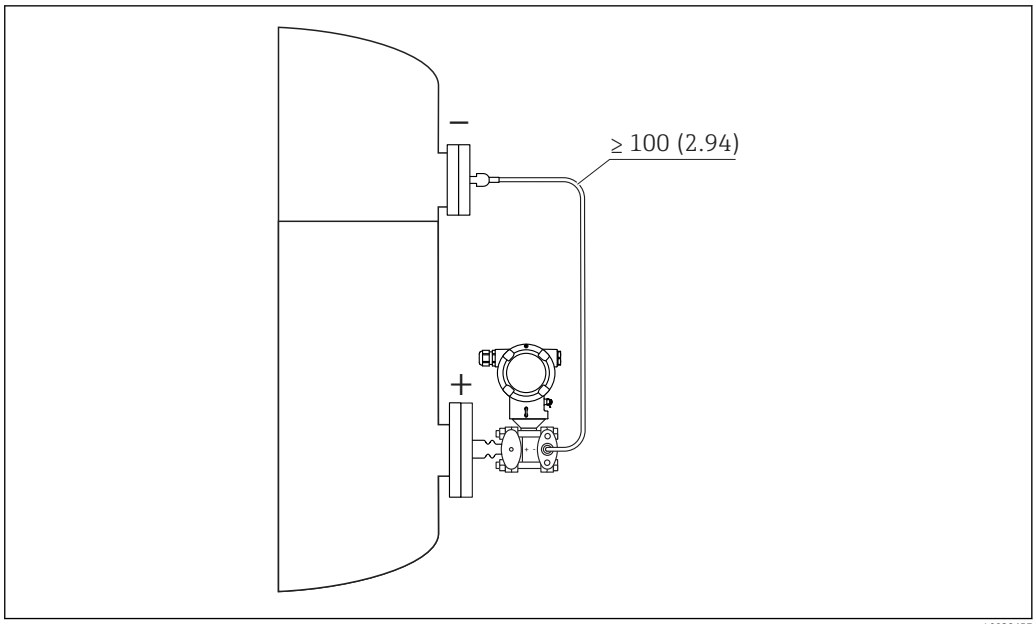
The device can be fitted with different process connections on the high-pressure side (HP) and on the low-pressure side (LP).

The device can also be fitted with capillaries on the low-pressure side (LP).

When using diaphragm seal systems with a capillary, sufficient strain relief must be provided to prevent the capillary from bending (capillary bending radius ≥ 100 mm (3.94 in)).

Example:
- Process connection on high-pressure side = DN80 flange
- Process connection on low-pressure side = DN50 flange

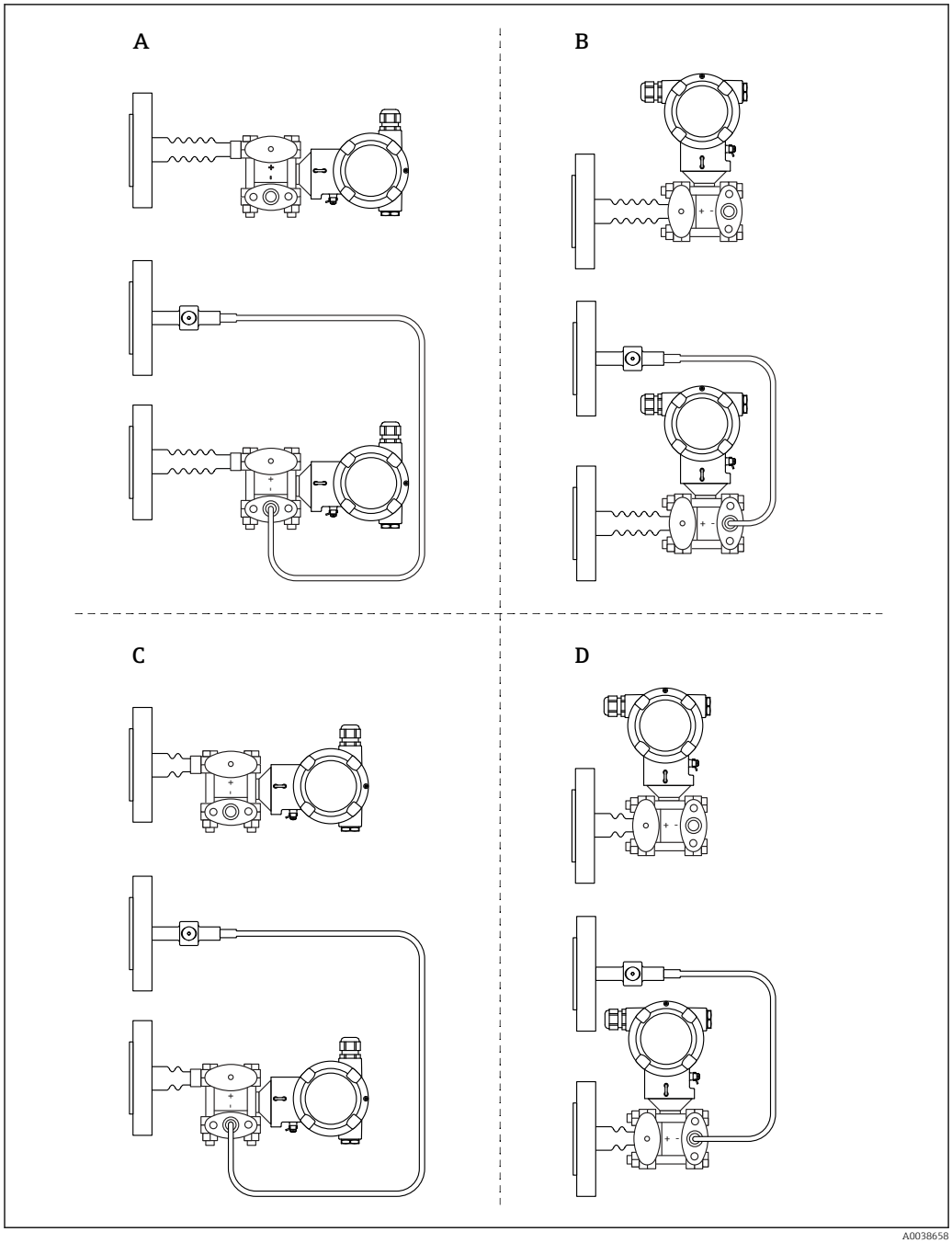
Your benefits:
- Thanks to the variety of order options, the devices can be optimally adapted to the given installation situation
- Reduced costs due to optimum system design
- Easier installation due to adjusted length of capillary line
- Easier adaptation to existing installation situations



Unit of measurement mm (in)

If different process connections and capillaries are used, it is essential to size and order the device using the free "Sizing Diaphragm Seal" selection tool.

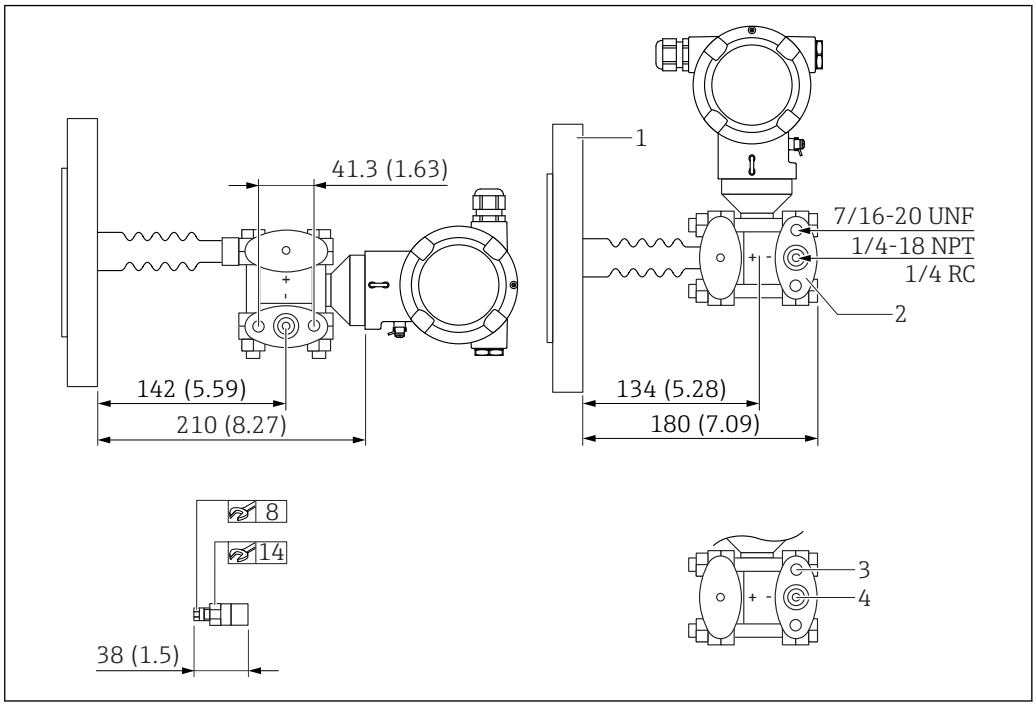
Overview: Diaphragm seal on one side or both sides with temperature isolator



A Transmitter horizontal, temperature isolator long
B Transmitter vertical, temperature isolator long
C Transmitter horizontal, temperature isolator short
D Transmitter vertical, temperature isolator short

Process connections with diaphragm seal on one side, high-pressure side

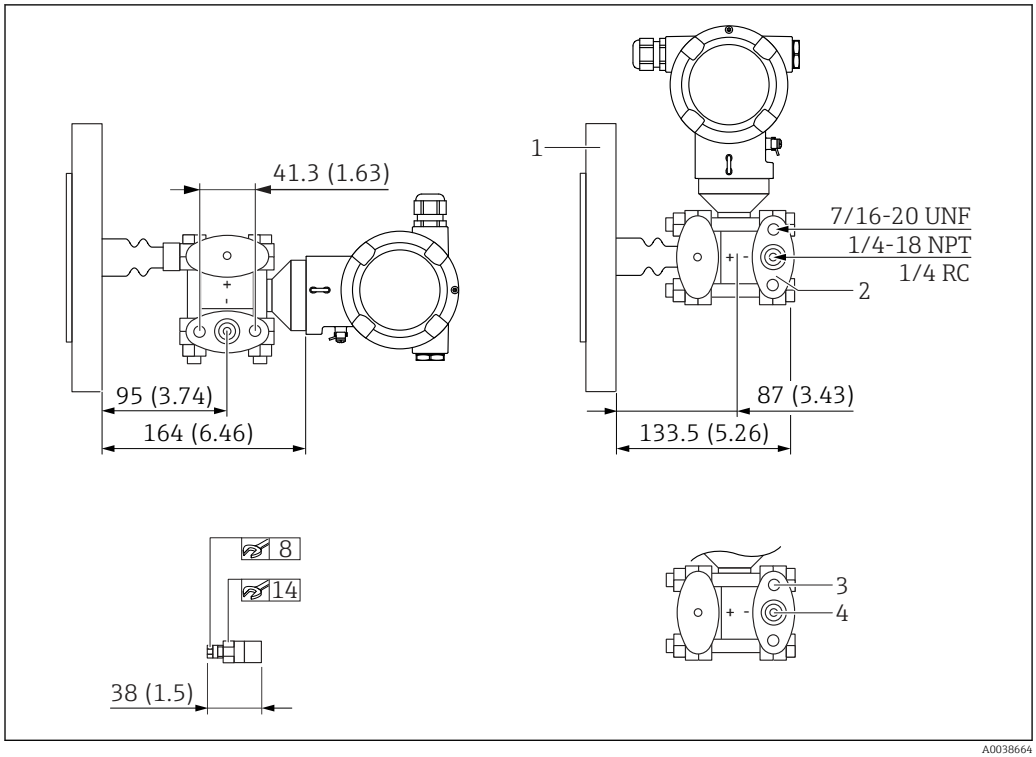
Device with long temperature isolator



Unit of measurement mm (in)

1 *High-pressure side*
2 *Low-pressure side*
3 *Thread depth: 15 mm (0.59 in)*
4 *Thread depth: 12 mm (0.47 in)(±1 mm (0.04 in))*

Device with short temperature isolator



Unit of measurement mm (in)

1 *High-pressure side*
2 *Low-pressure side*
3 *Thread depth: 15 mm (0.59 in)*
4 *Thread depth: 12 mm (0.47 in)(±1 mm (0.04 in))*

Process connections for devices with 2 capillaries

Selecting the process connection and capillary

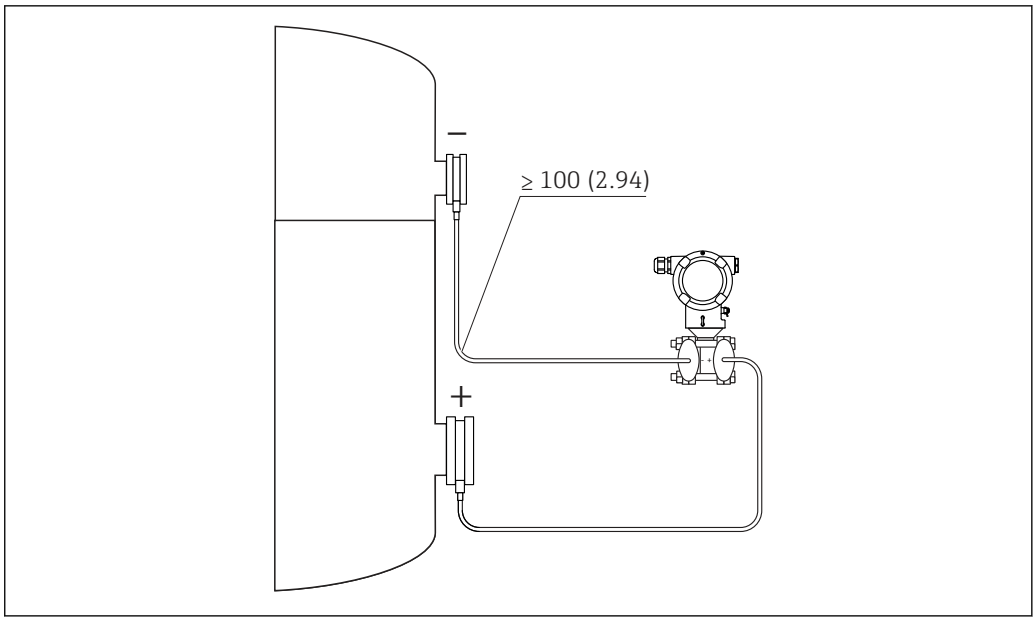
The device can be fitted with different process connections on the high-pressure side (HP) and on the low-pressure side (LP).

The device can also be fitted with different capillary lengths on the high-pressure side (HP) and on the low-pressure side (LP).

When using diaphragm seal systems with a capillary, sufficient strain relief must be provided to prevent the capillary from bending (capillary bending radius ≥ 100 mm (3.94 in)).

Example:
- Process connection on high-pressure side = DN80 flange
- Process connection on low-pressure side = DN50 flange
- Capillary length on high-pressure side = 2 m (6.6 ft)
- Capillary length on low-pressure side = 5 m (16 ft)

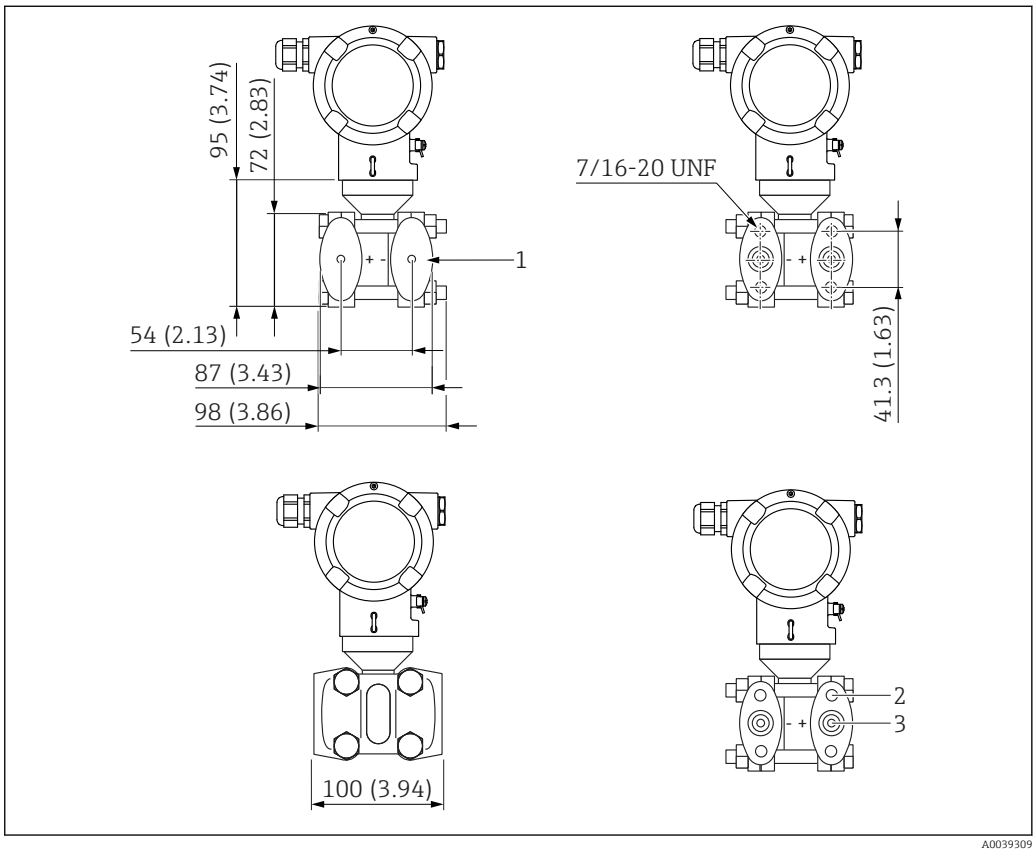
Advantages:
- Thanks to the variety of order options, the devices can be optimally adapted to the given installation situation
- Reduced costs due to optimum system design
- Easier installation due to adjusted length of capillary on low-pressure side and high-pressure side
- Easier adaptation to existing installation situations



Unit of measurement mm (in)

If different process connections and capillaries are used, it is essential to size and order the device using the free "Sizing Diaphragm Seal" selection tool.

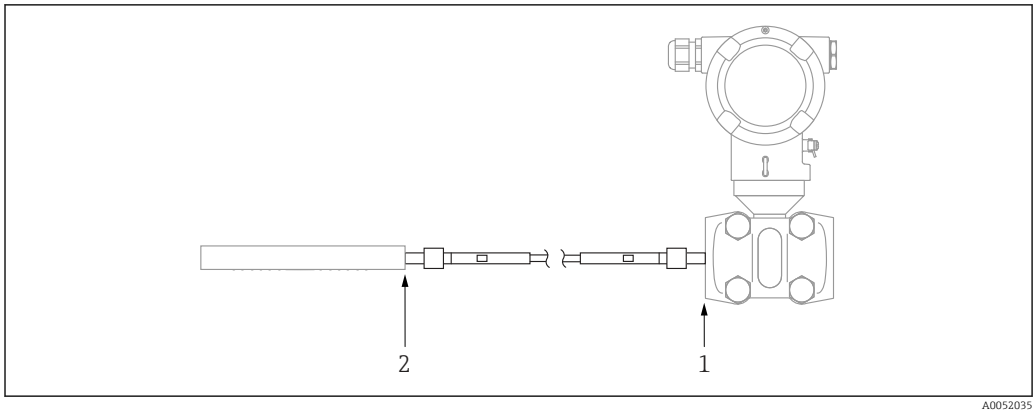
Basic unit



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

1 *Diaphragm seal mount*
2 *Thread depth: 15 mm (0.59 in)*
3 *Thread depth: 12 mm (0.47 in)(±1 mm (0.04 in))*

Capillary length;



8 The capillary length is the distance between the oval flange and the rear side of the diaphragm seal. Unit of measurement mm (in)

1 Oval flange
2 Rear side of diaphragm seal

Process connections with diaphragm seal

- The following drawings are schematic diagrams
  The dimensions of a diaphragm seal supplied may deviate from the dimensions given in this document
- For more information: contact the Endress+Hauser sales office

Process connections

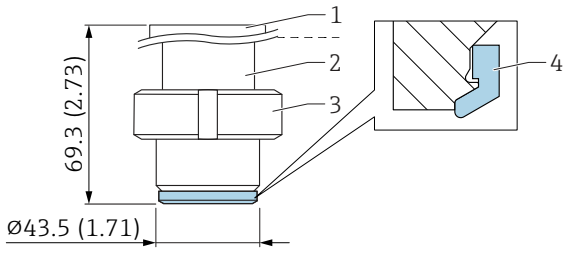
Maximum working pressure and overpressure limit

The maximum working pressure (MWP) and the overpressure limit (OPL) of the sensor can deviate from the maximum MWP and OPL of the process connection.

Explanation of terms

- DN or NPS or A = alphanumeric identifier of the flange size
- PN or Class or K = alphanumeric pressure rating of a component

Universal process adapter, diaphragm seal, TempC process membrane



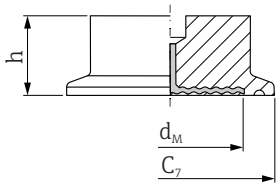
1 Top section: AISI 316L (1.4404)
2 Bottom section: AISI 316L (1.4435)
3 Slotted nut: AISI 304 (1.4301) or AISI 304L (1.4307)
4 Molded seal: silicone or EPDM

Unit mm (in)

Designation	Seal	PN	Order option [1]
Universal process adapter	Form seal made of silicon [2]	PN 10	52J
Universal process adapter	Form seal made of EPDM [3]		50J

1) Product Configurator order code for "Process connection"
2) FDA 21CFR177.2600/USP Class VI, order number: 52023572
3) FDA (177.2600), USP Class VI; 5 pcs, order number: 71100719

Tri-Clamp, diaphragm seal, TempC process membrane



A0021644

C_7 *Diameter*
h *Height*
d_M *Max. diameter of process membrane*

Unit mm (in)

Designation [1) 2)]				C_7	d_M	h	Order option [3)]
DN ISO 2852	DN DIN 32676	NPS [in]	PN [4)]	[mm]	[mm]	[mm]	
DN 38	DN 40	1 ½	PN 40	50.5	36	30	3CJ
DN 51 / 40	DN 50	2	PN 40	64	41	30	3EJ
DN 63.5	–	2 ½	PN 40	77.5	61	30	3JJ
DN 76.1	–	3	PN 40	91	61	30	3FJ

1) Material AISI 316L
2) A suitable high-pressure clamp must be used for applications with a maximum working pressure (MWP) > 40 bar (580 psi). The high-pressure clamp is not included in the scope of supply. Please note the following warning!
3) Product Configurator order code for "Process connection"
4) Use a high-pressure clamp for higher temperatures! Please note the following warning!

MWP values if high-pressure clamps are used

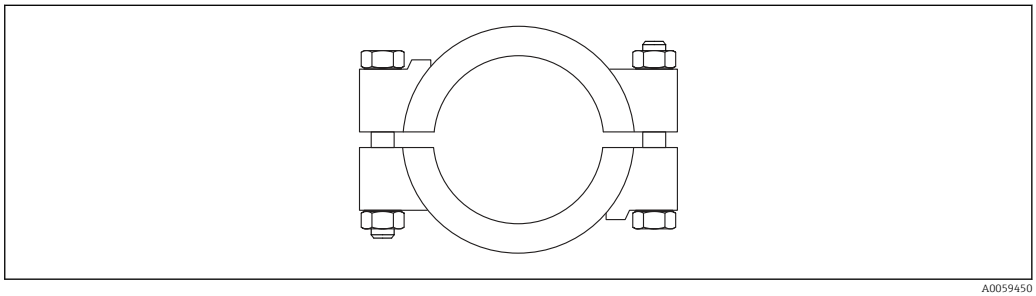
Maximum temperature	DN 38	DN 51 / 40	DN 63.5	DN 76.1
21 °C (70 °F)	103 bar (1 500 psi)	69 bar (1 000 psi)	69 bar (1 000 psi)	69 bar (1 000 psi)
121 °C (250 °F)	83 bar (1 200 psi)	55 bar (800 psi)	55 bar (800 psi)	55 bar (800 psi)

⚠ WARNING

For Tri-Clamp ISO 2852: If the high-pressure clamp and seal are not correctly specified, this can lead to leaks!

This can result in severe personal injury due to a bursting clamp.

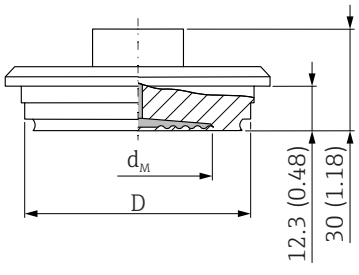
- ▶ A suitable high-pressure clamp must be used when installing diaphragm seals, e.g., the 13MHP high-pressure clamp and a suitable seal.
- ▶ The maximum working pressure of the high-pressure clamp and seal must be greater than or equal to the maximum working pressure of the diaphragm seal.



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9 *Example of a high-pressure clamp.*

Varivent, diaphragm seal, TempC process membrane



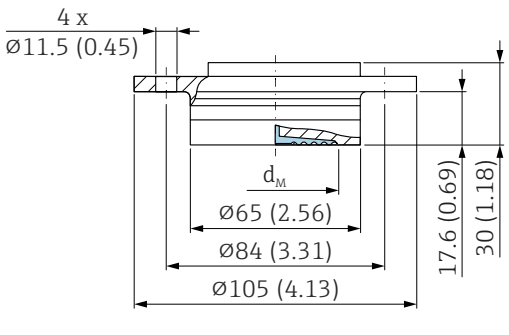
D Diameter
d_M Max. diameter of process membrane

Unit mm (in)

Designation [1]	PN	D	d_M	Order option [2]
		[mm]	[mm]	
Type F for pipes DN 25 - DN 32	PN 40	50	36	41J
Type N for pipes DN 40 - DN 162	PN 40	68	61	42J

1) Material AISI 316L
2) Product Configurator order code for "Process connection"

DRD DN50 (65 mm), diaphragm seal, TempC process membrane



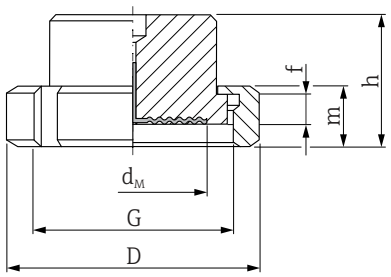
d_M Max. diameter of process membrane

Unit mm (in)

Designation [1]	PN	d_M	Order option [2]
		[mm]	
DRD DN 50 (65 mm), slip-on flange AISI 304 (1.4301)	PN 25	48	4AJ

1) Material AISI 316L (1.4435)
2) Product Configurator order code for "Process connection"

SMS nozzle with union nut, diaphragm seal, TempC process membrane



A0021674

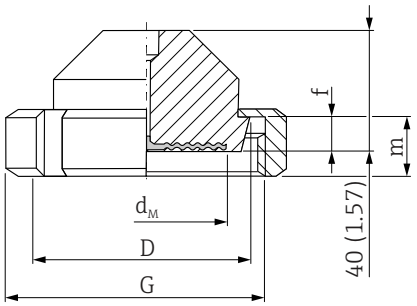
D *Diameter*
f *Nozzle height*
G *Thread*
h *Height*
m *Height*
d_M *Max. diameter of process membrane*

Unit mm (in)

Designation [1]	PN	D	f	G	m	h	d_M	Order option [2]
NPS		[mm]	[mm]		[mm]	[mm]	[mm]	
1 ½	PN 25	74	4	Rd 60 – 1/6	25	57	36	4QJ
2	PN 25	84	4	Rd 70 – 1/6	26	62	48	4RJ [3]

1) Material AISI 316L
2) Product Configurator order code for "Process connection"
3) Endress+Hauser supplies these slotted nuts in AISI 304 stainless steel (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).

Taper adapter with groove slip-on nut, DIN 11851, diaphragm seal, TempC process membrane



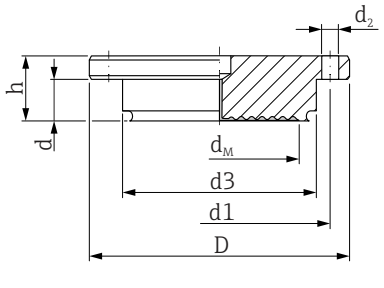
D Diameter
f Adapter height
G Thread
m Height
d_M Max. diameter of process membrane

Unit mm (in)

Taper adapter [1]							Order option [2]
DN	PN	D	f	d_M	G	m	
[in]		[mm]	[mm]	[mm]		[mm]	
DN 40	PN 40	56	10	36	Rd 65 x 1/6"	21	1JJ
DN 50	PN 25	68.5	11	48	Rd 78 x 1/6"	19	1DJ
DN 80	PN 25	100	12	61	Rd 110 x 1/4"	26	1FJ

1) Material AISI 316L
2) Product Configurator order code for "Process connection"

NEUMO BioControl, diaphragm seal, TempC process membrane



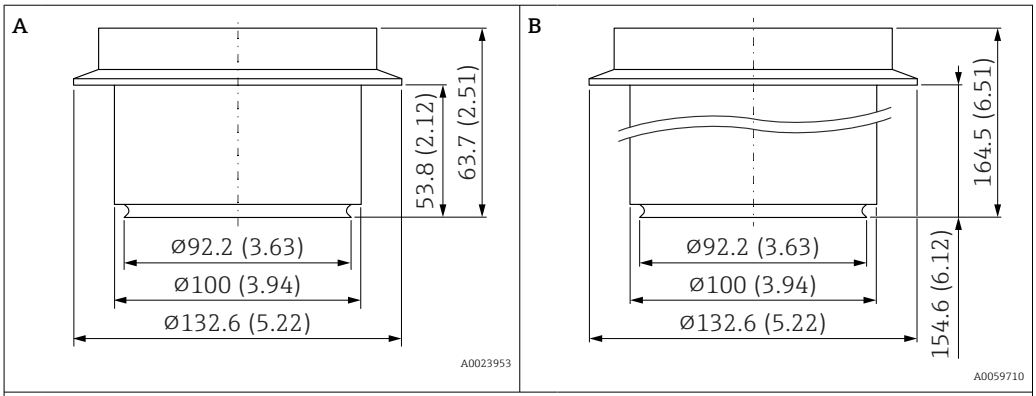
D Diameter
h/d Height
d1/ d3 diameter
d_2 Diameter of hole
d_M Max. diameter of process membrane

Unit mm (in)

NEUMO BioControl [1) 2)]									Order option [3)]
DN	PN	D	d	d_2	d_3	d_1	h	d_M	
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
DN 50	PN 16	90	17	4 x Ø9	50	70	27	36	5DJ
DN 80	PN 16	140	25	4 x Ø11	87.4	115	37	61	5FJ

1) Material AISI 316L
2) Process temperature range: −10 to +200 °C (+14 to +392 °F)
3) Product Configurator order code for "Process connection"

Sanitary Tank Spud, diaphragm seal, TempC process membrane



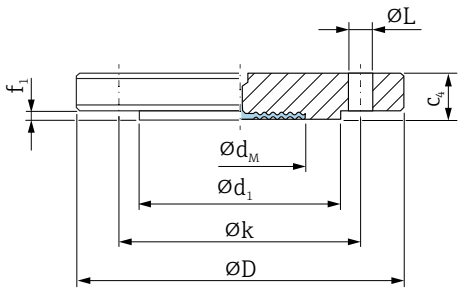
Unit mm (in)

Item	Designation [1)]	PN	Order option [2)]
A	Sanitary Tank Spud, 316L, 2" barrel	PN 40	7JJ [3)]
B	Sanitary Tank Spud, 316L, 6" barrel		7LJ [3)]

1) AISI 316L (1.4435)
2) Product Configurator order code for "Process connection"
3) EPDM seal supplied

Flange EN1092-1, flush membrane, diaphragm seal

Connection dimensions according to EN1092-1.



A0045226

ØD Diameter of flange
c_4 Thickness
Ød$_1$ Raised face
f_1 Raised face
Øk Pitch diameter
ØL Diameter of hole
Ød$_M$ Max. diameter of membrane

Unit mm

Flange [1) 2)]							Boltholes			Order option [3)]
DN	PN	Form	ØD	c_4	Ød$_1$	f_1	Number	ØL	Øk	
			mm	mm	mm	mm		mm	mm	
DN 40	PN 10-40	B1	150	18	88	3	4	18	110	H2J
DN 50	PN 10-40	B1	165	20	102	3	4	18	125	H3J
DN 80	PN 10-40	B1	200	24	138	3	8	18	160	H5J

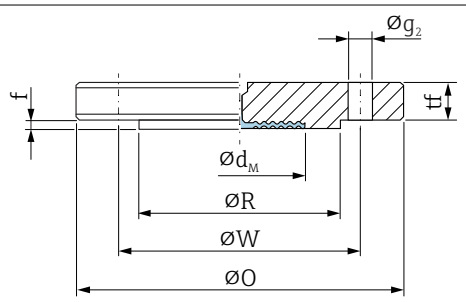
1) Material: AISI 316L
2) The flange raised face is made from the same material as the membrane.
3) Product Configurator order code for "Process connection"

Maximum diameter of membrane Ød$_M$

DN	PN	Ød$_M$ (mm)
		316L
DN 40	PN 10-40	-
DN 50	PN 10-40	61
DN 80	PN 10-40	89

Flange ASME B16.5, flush membrane, diaphragm seal

Connection dimensions in accordance with ASME B 16.5, raised face RF



A0045230

ØO Diameter of flange
tf Thickness
ØR Raised face
f Raised face
ØW Pitch diameter
Øg$_2$ Diameter of hole
Ød$_M$ Max. diameter of the membrane

Unit in

Flange [1) 2)]						Boltholes			Order option [3)]
NPS	Class	ØO	tf	ØR	f	Number	Øg$_2$	ØW	
in		in	in	in	in		in	in	
1 ½	150	5	0.62	2.88	0.06	4	5/8	3.88	ACJ
2	150	6	0.69	3.62	0.06	4	3/4	4.75	ADJ
3	150	7.5	0.88	5	0.06	4	3/4	6	AFJ

1) Material AISI 316/316L: combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)
2) The raised face of the flange is made of the same material as the membrane.
3) Product Configurator order code for "Process connection"

Maximum diameter of membrane Ød$_M$

NPS	Class	Ød$_M$ (in)
		316L
1 ½	150	-
2	150	2.40
3	150	3.50

Weight

Housing

Weight including electronics and display.

- Single-compartment housing: 1.1 kg (2.43 lb)
- Stainless steel single-chamber housing, hygienic: 1.2 kg (2.65 lb)
- Dual-compartment housing
  Aluminum: 1.4 kg (3.09 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)

Basic weight of the measuring cell including side flanges and fastening materials

3.3 kg (7.28 lb)

Temperature isolator

- Temperature isolator, short: 0.22 kg (0.49 lb)
- Temperature isolator, long: 0.40 kg (0.88 lb)

Capillary

- 316L (standard capillary armor):
  0.16 kg/m (0.35 lb/m) + 0.2 kg (0.44 lb)
  (Weight per capillary in m)
- PVC-coated capillary armor on 316 L:
  0.21 kg/m (0.46 lb/m) + 0.2 kg (0.44 lb)
  (Weight per capillary in m)
- PTFE-jacketed capillary armor on 316 L:
  0.29 kg/m (0.64 lb/m) + 0.2 kg (0.44 lb)
  (Weight per capillary in m)

Process connections

Weight [1]		Order option [2]
Standard	Diaphragm seal	
1.50 kg (3.31 lb)	1.60 kg (3.53 lb)	ACJ
2.40 kg (5.29 lb)	2.50 kg (5.51 lb)	ADJ
4.90 kg (10.80 lb)	5.10 kg (11.25 lb)	AFJ
2.35 kg (5.18 lb)	2.35 kg (5.18 lb)	H2J
3.20 kg (7.06 lb)	3.20 kg (7.06 lb)	H3J
5.54 kg (12.22 lb)	5.54 kg (12.22 lb)	H5J
0.38 kg (0.84 lb)	-	VJJ
0.41 kg (0.90 lb)	-	VJC
0.70 kg (1.54 lb)	-	VLJ
0.76 kg (1.68 lb)	-	VLC
0.35 kg (0.77 lb)	-	WLJ
0.38 kg (0.84 lb)	-	WLC
0.73 kg (1.61 lb)	-	WNJ
0.79 kg (1.74 lb)	-	WNC
1.20 kg (2.65 lb)	-	WPJ
1.30 kg (2.87 lb)	-	WPC
1.10 kg (2.43 lb)	-	VMJ

Weight [1]		Order option [2]
Standard	Diaphragm seal	
1.19 kg (2.62 lb)	-	VMC
2.30 kg (5.07 lb)	-	X4J

1) Total weight consisting of sensor assembly and process connection.
2) Product Configurator order code for "Process connection"

Accessories

Mounting bracket: 0.5 kg (1.10 lb)

Materials in contact with process

Membrane material

- 316L (1.4435)
- 316L (1.4435), TempC
  TempC Membrane stands for "Temperature Compensatory Membrane"
  This membrane reduces the process and environmental influences for diaphragm seals compared to conventional systems
- In the case of devices with a barrel, the flange raised face is made of 316L
  - 316L in the case of EN 1092-1 flanges
  - F316/316L in the case of ASME flanges

Seal

- PTFE
- FKM
- EPDM
- FFKM

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".

Single compartment housing, 316L, hygiene

- Housing: stainless steel 316L (1.4404)
- Dummy cover: stainless steel 316L (1.4404)
- Cover stainless steel 316L (1.4404) with PC Lexan 943A sight glass
  Cover stainless steel 316L (1.4404) with borosilicate sight glass; can optionally be ordered as a mounted accessory
  For dust ignition-proof applications, the sight glass is always made of borosilicate.
- Cover sealing materials: VMQ
- Plug: PBT-GF30-FR or stainless steel

- Plug sealing material: EPDM
- Nameplate: stainless steel housing labeled directly
- 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".

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

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

Fill fluid, diaphragm seal:
- Silicone oil, FDA 21 CFR 175.105
- Vegetable oil, FDA 21 CFR 172.856

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
- Measuring cell body: AISI 316L (1.4404)
- Temperature isolator: AISI 316L (1.4404)
- Side flanges: AISI 316/316L (1.4408) / CF3M (cast equivalent to material AISI 316L)
- Heat shrink tube (only available for PVC-coated capillary armor or PTFE capillary armor): polyolefin

Diaphragm seal capillary armor

AISI 316L

- Capillary: AISI 316 Ti (1.4571)
- Protective hose for capillary: AISI 316L (1.4404)

PVC-coated

- Capillary: AISI 316 Ti (1.4571)
- Protective hose for capillary: AISI 316L (1.4404)
- Coating: PVC
- Heat shrink tube at capillary junction: polyolefin

PTFE-armored

- Capillary: AISI 316 Ti (1.4571)
- Protective hose for capillary: AISI 316L (1.4404)
- Armor: PTFE
- Single-ear clamp: 1.4301

Surface roughness

- Parts in contact with process: hygienic Ra < 0.76 µm (29.9 µin) (excluding flanges and threaded process connections)
- Parts in contact with process: Hygienic Ra <0.38 µm (15 µin) electropolished

Accessories

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

Display and user interface

Operating concept (not for devices with 4 to 20 mA analog)

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.

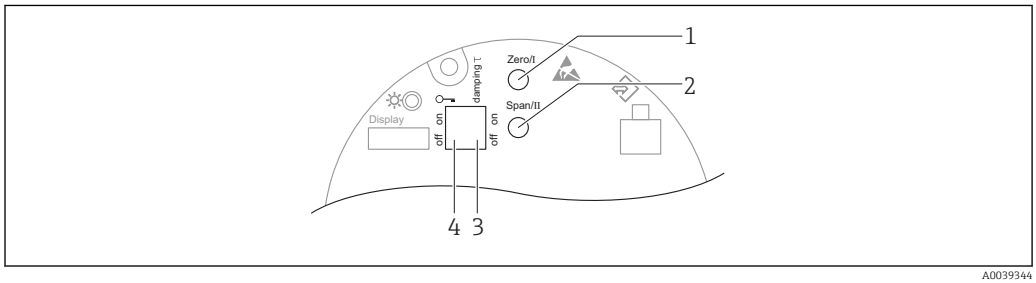
If no particular operating language has been selected, the local display is delivered from the factory with English.

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

Local operation

Operating keys and DIP switches on the electronic insert

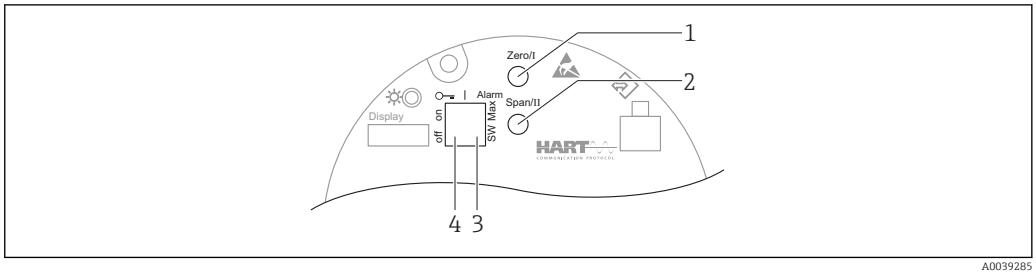
Analog 4 to 20 mA



A0039344

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

HART

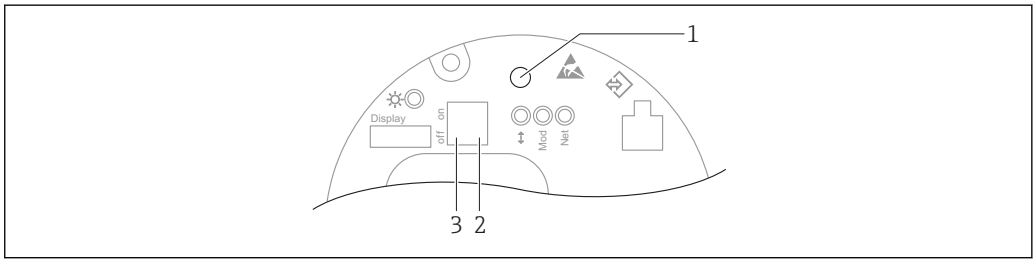


A0039285

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

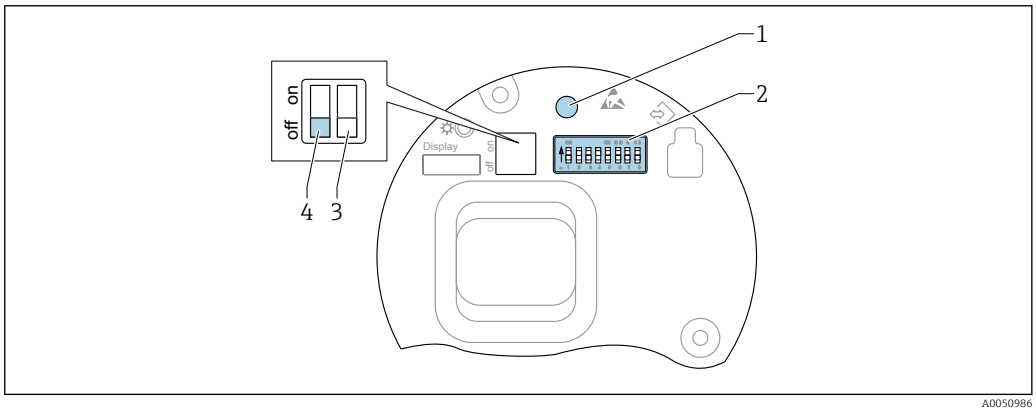


A0046061

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

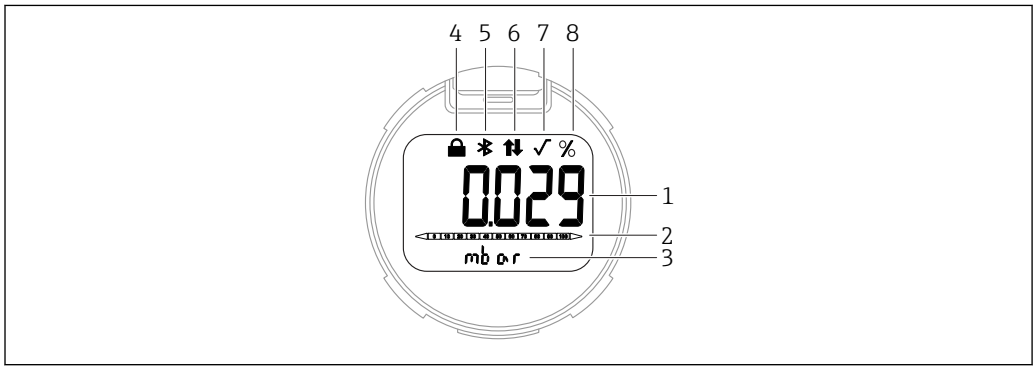
The setting of the DIP switches on the electronic insert has priority over the settings made via other operation methods (e.g. FieldCare/DeviceCare).

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

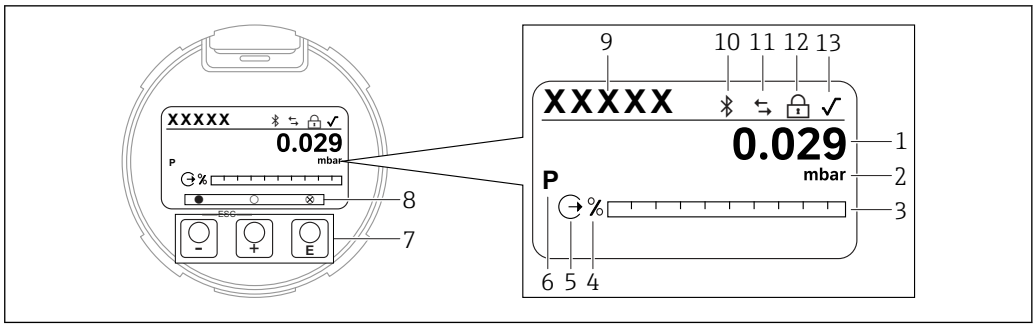
The device displays are available with the additional option of Bluetooth® wireless technology.



10 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.

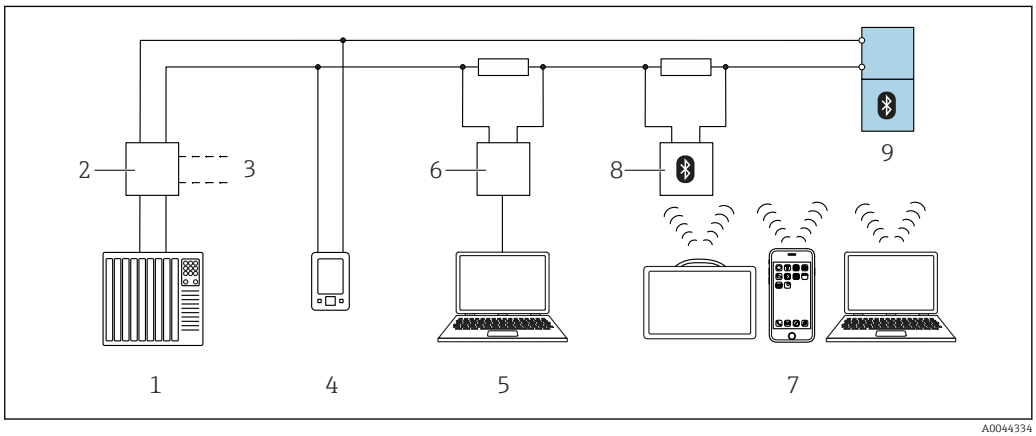


11 *Graphic display with optical operating keys.*

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

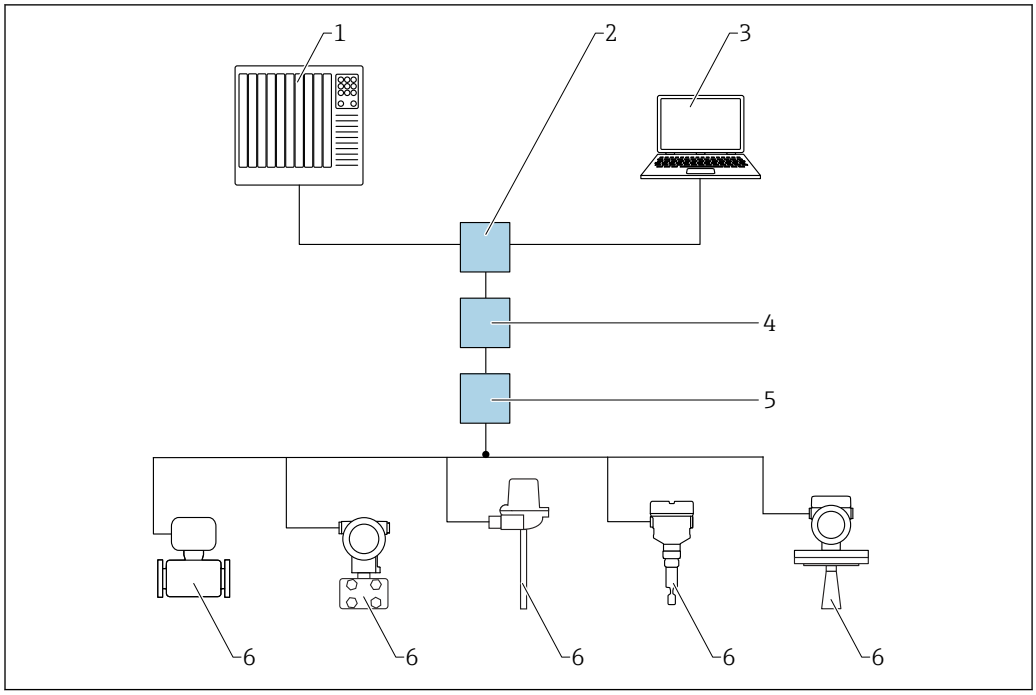
Via HART protocol or Bluetooth



12 *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



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

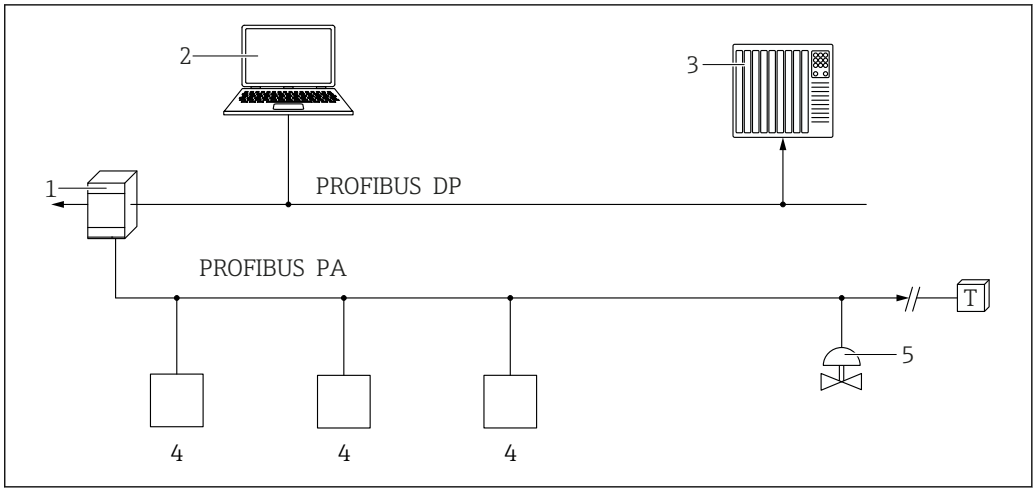
1 Automation system, e.g. Simatic S7 (Siemens)
2 Ethernet switch
3 Computer with web browser (e.g., Microsoft Edge) for accessing the integrated device web server or computer with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM) with iDTM PROFINET Communication
4 APL power switch (optional)
5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

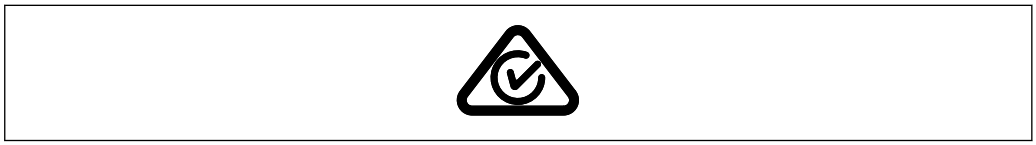
1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

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".

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 equipped with a separate plate bearing the registration number (in preparation). 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.
- CoC ASME BPE, declaration
- ASME B31.3 process piping, declaration
- EU Food Contact Materials (EC) 1935/2004, declaration
- US Food Contact Materials FDA CFR 21, Declaration
- CN Food Contact Materials GB 4806, Declaration
- Surface roughness test ISO4287/Ra, (wetted parts), test report
- Pressure test, internal procedure, test report
- Helium leak test, internal procedure, test report

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).

The following also applies:

Devices with an inline seal ≥ 1.5"/PN40: suitable for stable gases in group 1, category II, module A2

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 160 bar (2 400 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)
- 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
- Definition of tag name: to be defined in the additional specifications
- 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
- Prepared for sealing, PMO-compliant
- Weather protection covers

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

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.
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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