Technical Information

Deltapilot S FMB70

Hydrostatic level measurement

Pressure sensor with CONTITE^{TM} measuring cell. Condensate-resistant and offering long-term stability. Communication via HART, PA or FF.

Application

The hydrostatic pressure sensor is used for the following measuring tasks:
- Hydrostatic pressure measurement in liquids and paste-like media in all areas of process engineering, process measuring technology, pharmaceuticals and the food industry
- Level, volume or mass measurements in liquids

Your benefits

- Very good reproducibility and long-term stability
- Hermetically sealed CONTITE^{TM} measuring cell:
  - Condensate-resistant and climatic-proofed
  - High reference accuracy: ±0.1 %, for PLATINUM version: ±0.075 %
  - Minimum temperature effects

- Used for process pressure monitoring up to SIL3, certified according to IEC 61508 by TÜV SÜD
- HistoROM®/M-DAT memory module
- Function-monitored from the measuring cell to the electronics
- Continuous modularity for differential pressure, hydrostatics and pressure (Deltabar S – Deltapilot S –Cerabar S), e.g.
  - replaceable display
  - universal electronics
- Quick commissioning with Quick Setup menu
- Menu-guided operation
- Extensive diagnostic functions
- Use in drinking water: NSF

Endress+Hauser [EH]

People for Process Automation

Table of contents

Document information

Document conventions

Warning symbols

Symbol	Meaning
GEFAHR A0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNUNG A0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
VORSICHT A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or moderate injury.
HINWEIS A0011192-EN	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols

Symbol	Meaning
A0018335	Direct current A terminal to which DC voltage is applied or through which direct current flows.
A0018336	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
A0018337	Direct current and alternating current • A terminal to which alternating voltage or DC voltage is applied. • A terminal through which alternating current or direct current flows.
A0018338	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
A0018339	**Protective ground connection** A terminal that must be connected to ground prior to establishing any other conections.
A0011201	**Equipotential connection** A connection that must be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Tool symbols

Symbol	Meaning
A0011219	Phillips head screwdriver
A0011220	Flat blade screwdriver
A0013442	Torx screwdriver
A0011222	Hexagon wrench
A0011221	Allen key

Symbols for certain types of information

Symbol	Meaning
A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
A0011193	**Tip** Indicates additional information.
A0015483	**Reference to documentation** Refers to the corresponding device documentation.
A0015484	**Reference to page** Refers to the corresponding page number.
A0015486	**Reference to diagrams** Refers to the corresponding graphic number and page number.
1. , 2. , ...	Series of steps
A0015488	Help in the event of a problem

Symbols in graphics

Symbol	Meaning
1, 2, 3, 4, ...	Numbering for main positions
1. , 2. , ...	Series of steps
A, B, C, D, ...	Views
A-A, B-B, ...	Sections
A0011187	**Hazardous area** Indicates a hazardous area.
A0011188	**Safe area (non-hazardous area)** Indicates a non-hazardous area.

Terms and abbreviations

Term/abbreviation	Explanation
MWP	The MWP (maximum working pressure) for the individual sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "→ 🗎 29" section.
OPL	The OPL (over pressure limit = sensor overload limit) for the sensor 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. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "→ 🗎 29" section.
LRL	Lower range limit
URL	Upper range limit
LRV	Lower range value
URV	Upper range value
TD	**Turn down**
Case 1: • ⎮Lower range value (LRV)⎮ ≤ ⎮Upper range value (URV)⎮ *Example:* • Lower range value (LRV) = 0 mbar • Upper range value (URV) = 40 mbar (0.6 psi) • Nominal value (URL) = 400 mbar (6 psi) *Turn down:* • TD = URL / ⎮URV⎮ = 10:1 *Set span:* • URV – LRV = 40 mbar (0.6 psi) This span is based on the zero point.	 *Example: 400 mbar (6 psi) measuring cell*
Case 2: • ⎮Lower range value (LRV)⎮ ≥ ⎮Upper range value (URV)⎮ *Example:* • Lower range value (LRV) = –200 mbar (-3 psi) • Upper range value (URV) = 0 bar • Nominal value (URL) = 400 mbar (6 psi) *Turn down:* • TD = URL / ⎮(LRV)⎮ = 2:1 *Set span:* • URV – LRV = 200 mbar (3 psi) This span is based on the zero point.	 *Example: 400 mbar (6 psi) measuring cell* *1 Set span* *2 Zero-based span* *3 Nominal value≙ Upper range limit (URL)* *4 Nominal measuring range* *5 Sensor measuring range*
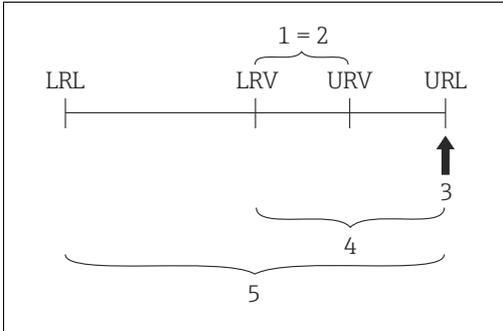
Function and system design

Device selection

Deltapilot S	FMB70
	T14 T15 T17 A0019982
Field of application	• Level measurement • Pressure measurement
Industries	Food, pharmaceutical, environment (fresh water and wastewater), chemical
Process connections	• Thread • Flange • Flush-mounted hygienic connections
Process connection material	• AISI 316L (1.4435 or 1.4404) - see "Materials" section) • Alloy C276 (2.4819)
Measuring ranges	from −100 to +100 mbar (-1.5 to +1.5 psi) to −1000 to +10000 mbar (-15 to +150 psi)
OPL	Max. 40 bar (600 psi)
Process temperature range	−10 to +100 ℃ (+14 to 212 ℉); +135 ℃ (275 ℉) for a maximum of 30 minutes
Ambient temperature range	• −40 to +85 ℃ (-40 to 185 ℉) • Separate housing: - 20 to +60 ℃ (-4 to 140 ℉)
Reference accuracy	±0.1% of the set span

Supply voltage	• Version for non-hazardous areas:
	  • 4 to 20 mA HART: 10.5 to 45 V DC
	  • PROFIBUS PA and FOUNDATION Fieldbus: 9to 32 V DC
	• Ex ia: 10.5 to 30 V DC

Output	• 4 to 20 mA with superimposed HART protocol • PROFIBUS PA or • FOUNDATION Fieldbus
Options	• Gold-rhodium coated process isolating diaphragm • 3.1 inspection certificate • 3A and EHEDG approval • HistoROM®/M-DAT memory module • Separate housing
Specialties	• Absolutely resistant to condensate thanks to hermetically sealed CONTITE™ cell • Maximum flexibility thanks to modular design • Special cleaning of the transmitter to remove paint-wetting substances, for use in paint shops

Measuring principle

$$p_{mess} = p_{ges} - p_{atm}$$

$$p_{mess} = (p_{atm} + p_{hydr.}) - p_{atm}$$

$$h \sim p$$

$$h = \frac{p}{\rho \cdot g}$$

$$p = p_{atm} + p_{hydr.}$$

$$p_{ges} = p_{atm} + p_{hydr.}$$
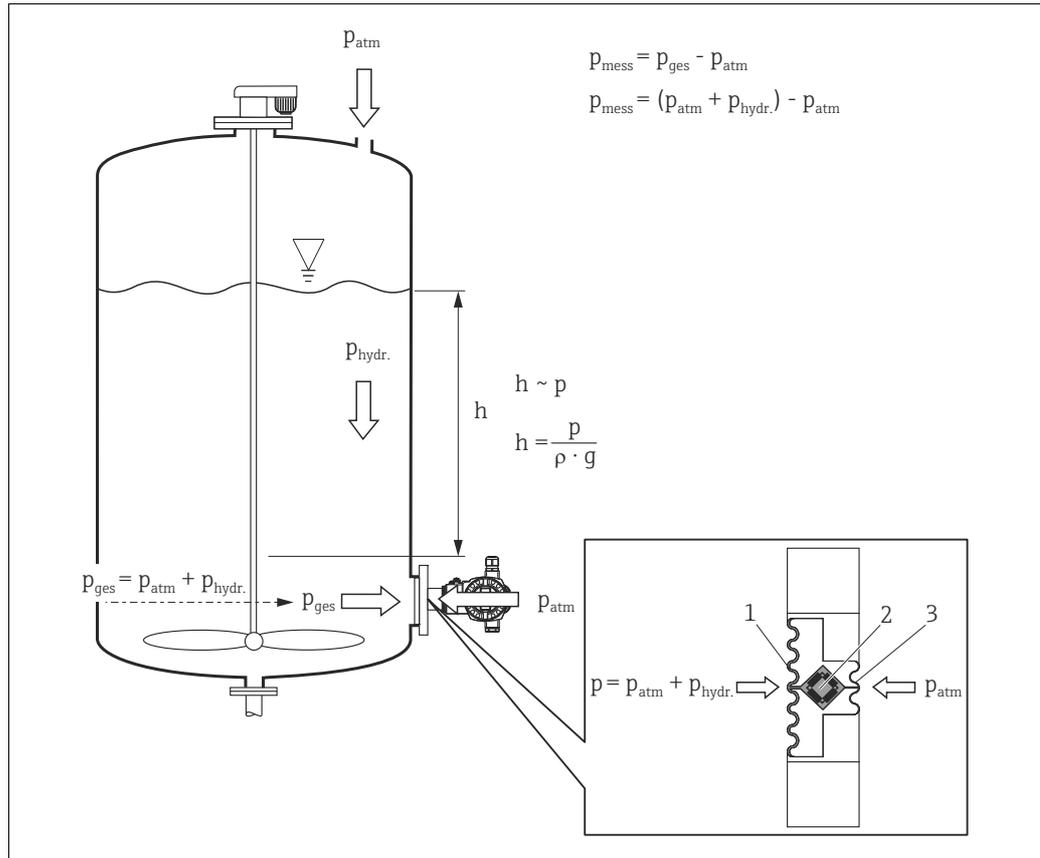
Deltapilot S hydrostatic level measurement and measuring principle

1	*Process isolating diaphragm*
2	*Sensing element*
3	*Rear isolating membrane of the CONTITE™ measuring cell*
g	*Gravitational acceleration*
h	*Level height*
p_{tot}	*Total pressure = hydrostatic pressure + atmospheric pressure*
p_{atm}	*Atmospheric pressure*
$p_{hydr.}$	*Hydrostatic pressure*
p_{meas}	*Measured pressure in the measuring cell = hydrostatic pressure*
ρ	*Density of the medium*

Due to its weight, a liquid column creates hydrostatic pressure. If the density is constant, the hydrostatic pressure depends solely on the height h of the liquid column.
The CONTITE™ measuring cell, which works according to the principle of the gauge pressure sensor, constitutes the core of the Deltapilot S. In contrast to conventional gauge pressure sensors, the precision measuring element (2) in the CONTITE™ measuring cell is absolutely protected between the process isolating diaphragm (1) and the rear isolating membrane (3). Thanks to this hermetic sealing of the measuring element, the CONTITE™ measuring cell is absolutely insensitive to condensate/condensation and aggressive gases. The pressure applied is transferred from the process isolating diaphragm to the measuring element by means of an oil without any loss in pressure.
The sensor temperature is measured by means of the resistance bridge in the measuring cell. The electronics can compensate any measuring errors resulting from fluctuations in temperature with these measured temperature values.

A linearization with max. 32 points, based on a table entered either manually or semi-automatically, can be activated locally or remotely. This function allows, for example, measurement in engineering units and provides a linear output signal for spherical and horizontal cylindrical tanks, and vessels with a conical outlet.

Level measurement in closed tanks with pressure overlay

You can determine the differential pressure in tanks with pressure overlay using two Deltapilot S devices. The measured pressure values of the two Deltapilot S devices are sent to a signal processing unit such as Endress+Hauser RMA or a PLC. The signal processing unit or PLC determines the difference in pressure and uses this to calculate the level and the density where necessary.
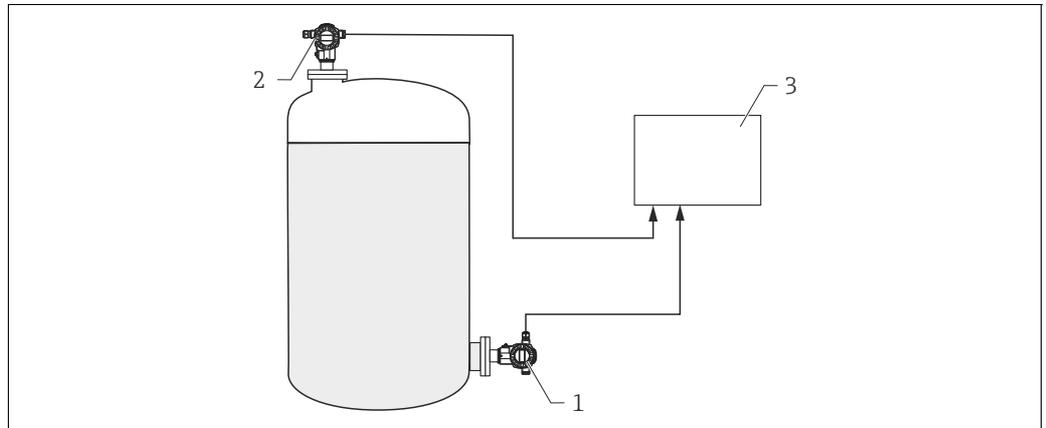
Level measurement in a closed tank with pressure overlay

1   Deltapilot 1 measures the total pressure (hydrostatic pressure and top pressure)
2   Deltapilot 2 measures the top pressure
3   The signal processing unit determines the difference in pressure and uses this to calculate the level

NOTICE

Measured errors may occur.

If the ratio of level to top pressure is >1:6, significant measured errors may occur. Reproducibility is not affected.

▸ When selecting the Deltapilot S, make sure you choose sufficiently large measuring ranges (→ see example).

Example:
- Max. hydrostatic pressure = 600 mbar (9 psi)
- Max. top pressure (Deltapilot 2) = 300 mbar (4.5 psi)
- Max. total pressure, measured with Deltapilot 1 = 300 mbar (4.5 psi) + 600 mbar (9 psi) = 900 mbar (13.5 psi) ⇒ measuring cell to be selected: 0 to 1200 mbar (0 to 18 psi)
- Max. pressure, measured with Deltapilot 2: 300 mbar (4.5 psi) ⇒ measuring cell to be selected: 0 to 400 mbar (6 psi)

NOTICE

Probe 2 may be submerged during differential pressure measurement.

Messasured errors may occur.

▸ Please ensure during installation that probe 2 cannot be submerged.

Density measurement

You can measure the density in tanks with pressure overlay using two Deltapilot S devices and a signal processing unit or a PLC. The signal processing unit or the PLC calculates the density from the known distance Δh between the two Deltapilot S devices and the two measured values p_1 and p_2.
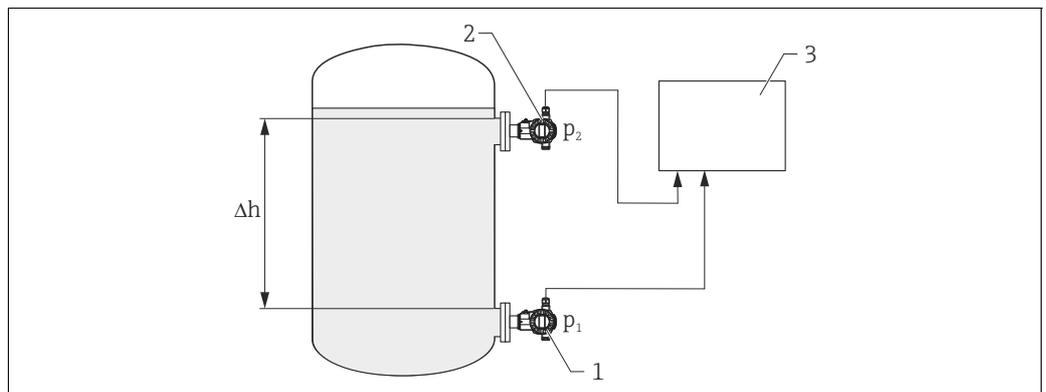
Level measurement in a closed tank with pressure overlay

1   Deltapilot 1 determines pressure measured value p_1
2   Deltapilot 2 determines pressure measured value p_2
3   Signal processing unit determines the density from the two measured values p_1 and p_2 and the distance Δh.

Communication protocol

- 4 to 20 mA with HART communication protocol
- PROFIBUS PA
  - The Endress+Hauser devices meet the requirements of the FISCO model.
  - Due to the low current consumption of 13 mA ± 1 mA, the following number of devices can be operated on one bus segment if installing as per FISCO:
    - up to 7 Deltapilot S for Ex ia, CSA IS and FM IS applications
    - up to 27 Deltapilot S for all other applications, e.g. in non-hazardous areas, Ex nA, etc.

Further information on PROFIBUS PA can be found in the Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and in the PNO Guideline.

- FOUNDATION Fieldbus
  - The Endress+Hauser devices meet the requirements of the FISCO model.
  - Due to the low current consumption of 15.5 mA ± 1 mA, the following number of devices can be operated on one bus segment if installing as per FISCO:
    - up to 6 Deltapilot S for Ex ia, CSA IS and FM IS applications
    - up to 24 Deltapilot S for all other applications, e.g. in non-hazardous areas, Ex nA, etc.

Further information on FOUNDATION Fieldbus, such as requirements for bus system components can be found in Operating Instructions BA00013S "FOUNDATION Fieldbus Overview".

Input

Measured variable   Hydrostatic pressure

Measuring range

Nominal value	Range limit		Smallest calibratable span	MWP	OPL	Vacuum resistance [1]	Order code	
	lower (LRL)[2]	upper (URL)				Synthetic oil/ Inert oil	Feature	Version
	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar$_{abs}$ (psi$_{abs}$)]		
100 mbar (1.5 psi)	−0.1 (-1.5)	+0.1 (+1.5)	0.025 (0.375)	2.7 (40.5)	4 (60)	0.01/0.04 (0.15/1)		1C
400 mbar (6 psi)	−0.4 (-6)	+0.4 (+6)	0.04 (0.6)	5.3 (79.5)	8 (120)			1F
1.2 bar (18 psi)	−1.0 (-15)	+1.2 (+18)	0.1 (1.5)	16 (240)	24 (360)		40	1H
4 bar (60 psi)	−1.0 (-15)	+4 (+60)	0.1 (1.5)	16 (240)	24 (360)			1M
10 bar (150 psi)	−1.0 (-15)	+10 (+150)	0.1 (1.5)	27 (405)	40 (600)			1P

1)   The vacuum resistance applies for the measuring cell under reference operating conditions.

2)   By default, the device is set to a lower sensor limit of 0 bar. Please specify in the order if the lower sensor limit is to be set to a different default value.

Output

Output signal

- 4 to 20 mA with superimposed digital communication protocol HART 5.0. 2-wire
- Digital communication signal PROFIBUS PA (Profile 3.0)
  - Signal coding: Manchester Bus Powered (MBP): Manchester II
  - Transmission rate: 31.25 KBit/s voltage mode
- Digital communication signal FOUNDATION Fieldbus
  - Signal coding: Manchester Bus Powered (MBP): Manchester II
  - Transmission rate: 31.25 KBit/s voltage mode

Output	Order code	Operation (→ 🕮 44 ff)		
		External + LCD	Internal + LCD	Internal
	Feature	Version		
4 to 20mA HART	30	A	B	C
4 to 20mA HART, Li=0		D	E	F
PROFIBUS PA		M	N	O
FOUNDATION Fieldbus		P	Q	R

**Signal range –
4 to 20 mA HART**

3.8 mA to 20.5 mA

Signal on alarm

As per NAMUR NE 43

- 4 to 20 mA HART
  Options:
  - Max. alarm: can be set from 21 to 23 mA (factory setting: 22 mA)
  - Hold measured value: last measured value is held
  - Min. alarm: 3.6 mA
- PROFIBUS PA: can be configured in Analog Input block,
  Options: Last Valid Out Value (factory setting), Fail Safe Value, Status bad
- FOUNDATION Fieldbus: can be configured in Analog Input block,
  Options: Last Good Value, Fail Safe Value (factory setting), Wrong Value

Load – 4 to 20 mA HART

A0019988
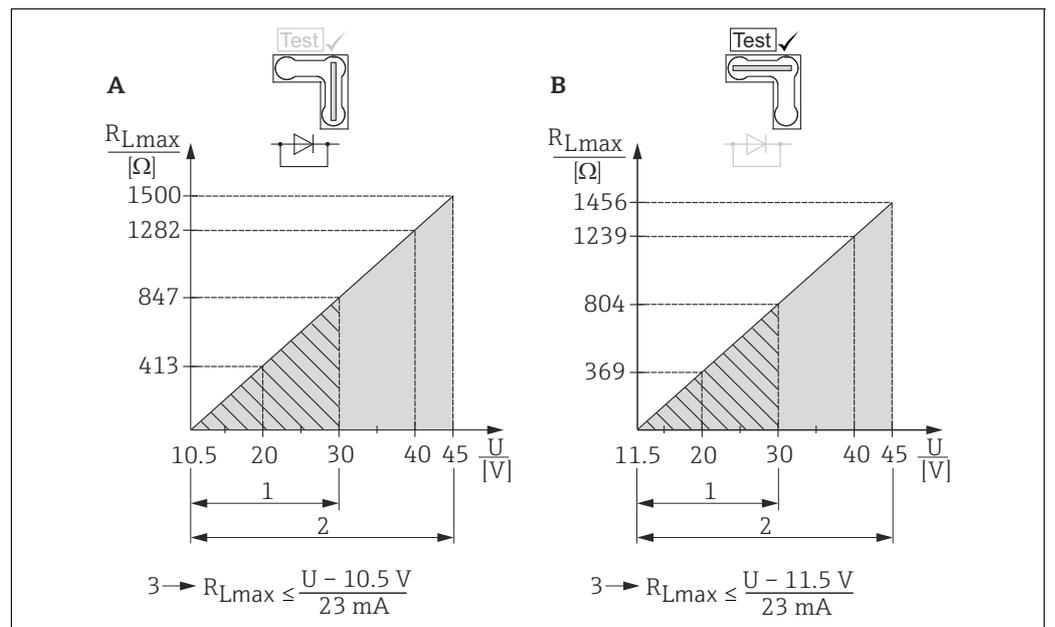
Load diagram, observe the position of the jumper and the explosion protection (→ 🕮 19, "Measuring a 4 to 20 mA test signal" section.)

A   Jumper for 4 to 20 mA test signal set to "Non-test" position
B   Jumper for 4 to 20 mA test signal set to "Test" position
1   Power supply 10.5 (11.5) to 30 V DC for 1/2 G, 1 GD, 1/2 GD, FM IS, CSA IS, NEPSI Ex ia and IEC Ex ia

2   Power supply 10.5 (11.5) to 45 V DC for devices for non-hazardous areas, 1/2 D, 1/3 D, 3 G Ex nA, FM DIP, FM NI, CSA dust ignition proof
3 R_{Lmax} = maximum load resistance
U   Supply voltage

When operating via a handheld terminal or via a PC with an operating program, a minimum communication resistance of 250 Ω must exist within the loop.

Dead time, time constant
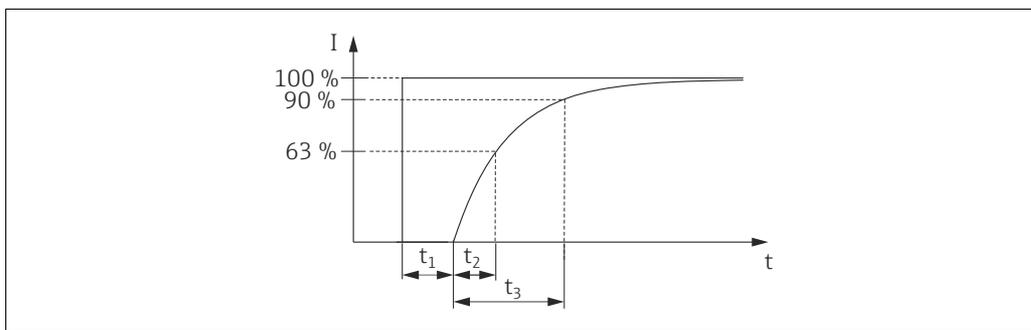
Presentation of the dead time and the time constant

Dynamic behavior, current output

	Dead time (t_1) [ms]	Time constant T63 (=t_2) [ms]	Time constant T90 (=t_3) [ms]
Max.	40	30	69

Dynamic behavior, HART

A typical burst rate of 300 ms results in the following behavior:

	Dead time (t_1) [ms]	Time constant T63 (=t_2) [ms]	Time constant T90 (=t_3) [ms]
Min.	200	230	230
Max.	1000	1030	1030

Reading cycle

- Acyclic: max. 3/s, typically 1/s (depending on command # and number of preambles)
- Cyclic (burst): max. 3/s, typically 2/s

The device commands the BURST MODE function for cyclic value transmission via the HART communication protocol.

Cycle time (update time)

Cyclic (burst): min. 300 ms.

Response time

- Acyclic: min. 330 ms, typically 590 ms (depending on command # and number of preambles)
- Cyclic (burst): min. 160 ms, typically 350 ms (depending on command # and number of preambles)

Dynamic behavior, PROFIBUS PA

A typical PLC cycle time of 1 s results in the following behavior:

	Dead time (t_1) [ms]	Time constant T63 (=t_2) [ms]	Time constant T90 (=t_3) [ms]
Min.	75	105	105
Max.	1275	1305	1305

Reading cycle (PLC)

- Cyclic: typically 30/s (depending on the number and type of the function blocks used in the closed-control loop)
- Acyclic: typically 25/s

Cycle time (update time)

Min. 200 ms
The cycle time in a bus segment in cyclic data communication depends on the number of devices, on the segment coupler used and on the internal PLC cycle time. A new value can be determined up to 5 times per second.

Response time

- Cyclic: approx. 10 to 13 ms (depending on the min. slave interval)
- Acyclic: approx. 60 ms to 70 ms (depending on the min. slave interval)

Dynamic behavior, FOUNDATION Fieldbus

A typical configuration for the macro cycle time (host system) of 1 s results in the following behavior:

	Dead time (t_1) [ms]	Time constant T63 (=t_2) [ms]	Time constant T90 (=t_3) [ms]
Min.	85	115	115
Max.	1085	1115	1115

Reading cycle

- Cyclic: max. 10/s (depending on the number and type of function blocks used in the closed-control loop)
- Acyclic: typically 10/s

Cycle time (update time)

Cyclic: min. 100 ms

Response time

- Cyclic: max. 20 ms (for standard bus parameter settings)
- Acyclic: typically 100 ms (for standard bus parameter settings)

Damping

A damping affects all outputs (output signal, display).

- Via onsite display, handheld terminal or PC with operating program, continuous from 0 to 999 s
- Additionally for HART and PROFIBUS PA: via DIP switch on the electronic insert, switch position "on" = set value and "off"
- Factory setting: 2 s

Alarm current

Designation	Order code	
	Feature	Version
Min alarm current		
HART burst mode PV	100 and 110	J
Min alarm current + HART burst mode PV		

Firmware Version

Designation	Order code	
	Feature	Version
02.11.zz, HART, DevRev21		73
04.00.zz, FF, DevRev07	850	74
04.01.zz, PROFIBUS PA, DevRev03		75
02.10.zz, HART, DevRev21		76

Designation	Order code	
	Feature	Version
03.00.zz, FF, DevRev06	850	77
04.00.zz, PROFIBUS PA		78

Protocol-specific data

HART

Manufacturer ID	17 (11 hex)
Device Type Code	26 (1A hex)
Device Revision	21 (15 hex) - SW version 02.1y.zz
HART spezification	5
DD Revision	• 4 (russian in language selection) • 3 (netherlands in language selection)
Device description files (DTM, DD)	Information and files can be found: • www.endress.com • www.hartcomm.org
HART load	Min. 250 Ω
HART device variables	The measured values can be freely assigned to the device variables: **Measured values for PV (primary variable)** • Pressure • Level • Tank content **Measured values for SV, TV (second and third variable)** • Pressure **Measured values for QV (fourth variable)** • Temperature
Supported functions	• Burst mode • Additional Transmitter Status • Device Locking • Alternative operating modes

PROFIBUS PA

Manufacturer ID	17 (11 hex)
Ident number	154F hex
Profile Version	3.0 • SW Version 03.00.zz • SW Version 04.00.zz 3.02 • SW Version 04.01.zz (Device Revision 3) Compartibility SW version 03.00.zz and higher.
GSD Revision	• 4 (SW Version 3.00.zz and 4.00.zz) • 5 (Device Revision 3)
DD Revision	• 1 (SW Version 3.00.zz and 4.00.zz) • 1 (Device Revision 3)
GSD File	Information and files can be found: • www.endress.com • www.profibus.org
DD Files	
Output values	**Measured values for PV (über Analog Input Function Block)** • Pressure • Level • Tank content **Measured values for SV** • Pressure • Temperature

Input values	Input value sent from PLC, can be shown on display

Supported features	■ Identification & Maintenance
	  Simple device identification via control system and nameplate
	■ Condensed status[1]
	■ Automatic ident number adaptation and switchable to following ident numbers[1]:
	  – 9700: Profile-specific transmitter identification number with the "Classic" or "Condensed" status.
	  – 1503: Compatibility mode for the old Deltapilot S generation (DB50, DB50L, DB51, DB52, DB53).
	  – 154F: Identification number for the new Deltapilot S generation (FMB70).
	■ Device locking: The device can be locked by hardware or software.

1)   Only with Profile Version 3.02

FOUNDATION Fieldbus

Manufacturer ID	452B48 hex
Device type	1007 hex
Device Revision	■ 6 - SW Version 03.00.zz ■ 7 - SW Version 04.00.zz (FF-912)
DD Revision	■ 3 (Device Revision 6) ■ 2 (Device Revision 7)
CFF Revision	■ 4 (Device Revision 6) ■ 1 (Device Revision 7)
DD Files	Information and files can be found: ■ www.endress.com ■ www.fieldbus.org
CFF Files	
Device Tester Version (ITK Version)	■ 5.0 (Device Revision 6) ■ 6.01 (Device Revision 7)
ITK Test Campaign Number	■ IT054800 (Device Revision 6) ■ IT085600 (Device Revision 7)
Link Master (LAS) capable	yes
Link Master / Basic Device selectable	Yes, default is Basic Device
Node Address	Default: 247 (F7 hex)
Supported features	Field Diagnostics Profile [1] Following methods are supported: ■ Restart ■ Configure error as warning or alarm ■ HistoROM ■ Peakhold ■ AlarmInfo ■ SensorTrimm
Number of VCRs	■ 44 (Device Revision 6) ■ 24 (Device Revision 7)
Number of Link Objects in VFD	50

1)   Only with FF912

Virtual communication references (VCRs)

	Device revision 6	Device revision 7
Permanent Entries	44	1
Client VCRs	0	0
Server VCRs	5	10
Source VCRs	8	43
Sink VCRs	0	0
Subscriber VCRs	12	43
Publisher VCRs	19	43

Link settings

	Device revision 6	Device revision 7
Slot time	4	4
Min. inter PDU delay	12	10
Max. response delay	10	10

Transducer Blocks

Block	Content	Output values
TRD1 Block	Contains all parameters related to the measurement	• Pressure or level (channel 1) • Process temperature (channel 2)
Service Block	Contains service information	• Pressure after damping (channel 3) • Pressure peakhold indicator (channel 4) • Counter for max. pressure transgressions (channel 5)
Diagnostic Block	Contains diagnostic information	Error code via DI channels (channel 0 to 16)
Display Block	Contains parameters to configure the onsite display	No output values

Function blocks

Block	Content	Number of blocks	Execution time		Functionality	
			Device revision 6	Device revision 7	Device revision 6	Device revision 7
Resource Block	This block contains all the data that uniquely identify the device; it is an electronic version of a nameplate for the device.	1			enhanced	
Analog Input Block 1 Analog Input Block 2	The AI Block receives the measuring data from the Sensor Block, (selectable via a channel number) and makes the data available to other function blocks at its output. Enhancement: digital outputs for process alarms, fail safe mode	2	45 ms	45 ms[1]	enhanced	
Digital Input Block	This block contains the discrete data of the Diagnose Block (selectable via a channel number 0 to 16) and provides them for other blocks at the output.	1	40 ms	30 ms	standard	enhanced
Digital Output Block	This block converts the discrete input and thus initiates an action (selectable via a channel number) in the DP Flow Block or in the Service Block. Channel 1 resets the counter for max. pressure transgressions..	1	60 ms	40 ms	standard	enhanced
PID Block	The PID Block serves as a proportional-integral-derivative controller and is used almost universally for closed-loop-control in the field including cascade and feedforward. Input IN can be indicated on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_CONTENT).	1	120 ms	70 ms	standard	enhanced
Arithmetic Block	This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be performed.	1	50 ms	40 ms	standard	enhanced
Input Selector Block	The Input Selector Block facilitates the selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI Blocks. The block performs maximum, minimum, average and 'first good' signal selection. Inputs IN1 to IN4 can be indicated on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_CONTENT).	1	35 ms	35 ms	standard	enhanced
Signal Characterizer Block	The Signal Characterizer Block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is generated by a single look-up table with 21 arbitrary x-y pairs.	1	30 ms	40 ms	standard	enhanced
Integrator Block	The Integrator Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input Block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating a binary signal when the setpoint is reached.	1	35 ms	40 ms	standard	enhanced
Analog Alarm Block	This block contains all process alarm conditions (working like a comparator) and represents them at the output.	1	35 ms	35 ms	standard	enhanced

Additional function block information:

Instantiate Function Block	YES	YES
Number of additional instantiate blocks	11	5

1)   Without trend and alarm reports

Power supply

> **NOTICE**
>
> **Electrical safety is compromised by an incorrect connection!**
>
> ▸ When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings → 📄 56 ff. All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas. → 📄 56 ff.
>
> ▸ Devices with integrated overvoltage protection must be grounded. → 📄 22
>
> ▸ Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

Terminal assignment

4 to 20 mA HART
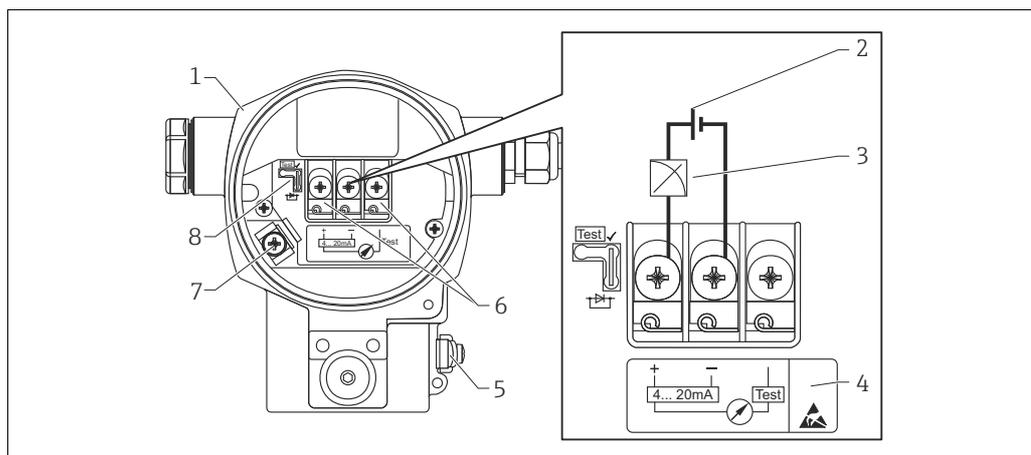
A0019989

Terminal assignment, shown here with aluminum housing (T14)

1   Housing
2   Supply voltage
3   4 to 20 mA
4   Devices with integrated overvoltage protection are labeled "OVP" (overvoltage protection) here.
5   External ground terminal
6   4 to 20 mA test signal between positive and test terminal
7   Internal ground terminal
8   Jumper for 4 to 20 mA test signal → 📄 19, "Measuring a 4 to 20 mA test signal" section.

PROFIBUS PA and FOUNDATION Fieldbus

A0020158

Terminal assignment, shown here with aluminum housing (T14)

1   Housing
3   Supply voltage
3   Devices with integrated overvoltage protection are labeled OVP (overvoltage protection) here.
4   External ground terminal
5   Internal ground terminal

Supply voltage	**4 to 20 mA HART**

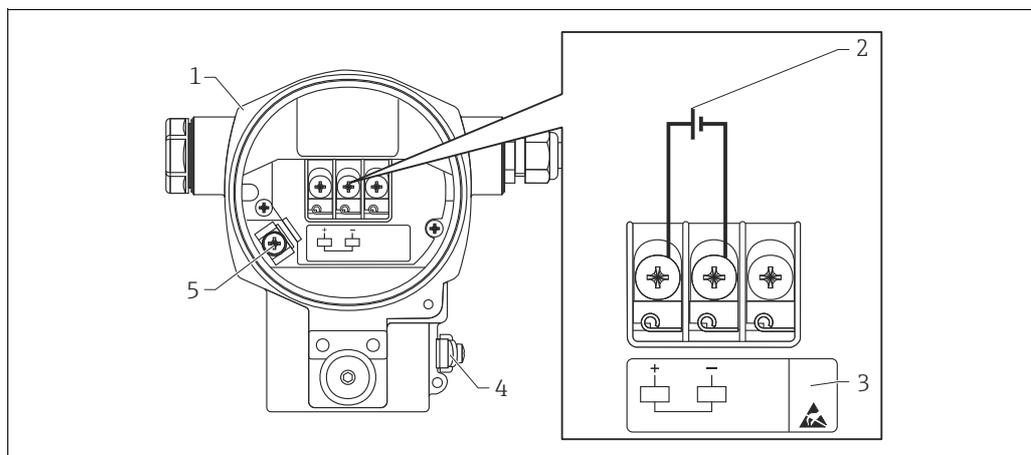| Version	Jumper for 4 to 20 mA test signal	Supply voltage
Non-hazardous area	in "Test" position	11.5 to 45 V DC
	in "Non-Test" position	10.5 to 45 V DC
Intrinsically safe	in "Test" position	11.5 to 30 V DC
	in "Non-Test" position	10.5 to 30 V DC
• Other types of protection • Uncertified devices	in "Test" position	11.5 to 45 V DC (versions with 35 V DC plug-in connection)
	in "Non-Test" position	10.5 to 45 V DC (versions with 35 V DC plug-in connection)

Measuring a 4 to 20 mA test signal

A 4 to 20 mA test signal may be measured via the positive and test terminal without interrupting the measurement. The minimum supply voltage of the device can be reduced by simply changing the position of the jumper. As a result, operation is also possible with lower voltage sources. Observe the position of the jumper in accordance with the following table.

Jumper position for test signal	Description
 A0019992	– Measurement of 4 to 20 mA test signal via positive and test terminal: possible. (Thus, the output current can be measured without interruption via the diode.) – Delivery status – Minimum supply voltage: 11.5 V DC
 A0019993	– Measurement of 4 to 20 mA test signal via positive and test terminal: not possible. – Minimum supply voltage: 10.5 V DC

PROFIBUS PA

• Version for non-hazardous areas: 9 to 32 V DC
• Ex ia: 10.5 to 30 V DC

FOUNDATION Fieldbus

• Version for non-hazardous areas: 9 to 32 V DC
• Ex ia: 10.5 to 30 V DC

Current consumption	• PROFIBUS PA: 13 mA ± 1 mA, switch-on current complies with IEC 61158-2, Clause 21 • FOUNDATION Fieldbus: 15.5 mA ± 1 mA, switch-on current complies with IEC 61158-2, Clause 21

Electrical connection	**PROFIBUS PA**
	The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the power supply. For further information on the network structure and grounding, and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and PNO Guideline
	FOUNDATION Fieldbus
	The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the power supply. For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA00013S "FOUNDATION Fieldbus Overview" and the FOUNDATION Fieldbus Guideline.

Terminals	For wire cross-sections of 0.5 to 2.5 mm² (20 to 14 AWG)

Cable entry			

Approval	Type	Clamping area
Standard, II1/2G Exia, IS	Plastic M20x1.5	5 to 10 mm (0.2 to 0.39 in)
ATEX II1/2D, II1/3D, II1/2GD Exia, II1GD Exia, II3G Ex nA	Metal M20x1.5 (Ex e)	7 to 10.5 mm (0.28 to 0.41 in)

For additional technical data, see section on housing → 🖹 30 ff".

Device plug connectors	**Devices with Harting plug Han7D**

A0019990
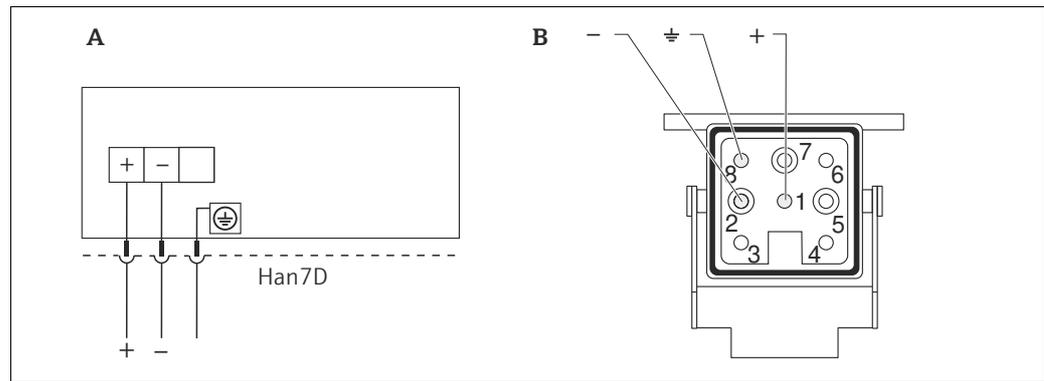
A   Electrical connection for devices with Harting plug Han7D
B   View of the plug-in connection at the device

Material: CuZn, gold-plated plug-in jack and plug

Connection of cable version

A0019991
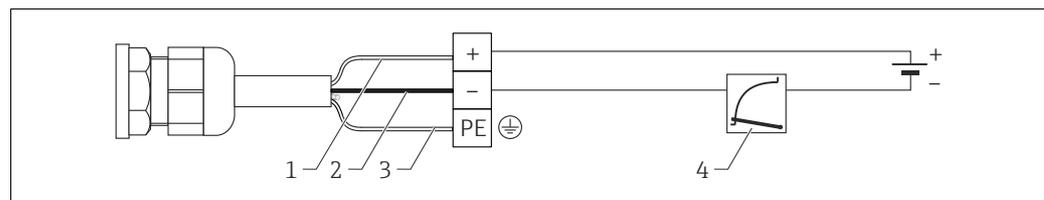
1   rd = red
2   bk = black
3   gnye = green
4   4 to 20 mA

Devices with M12 plug

PIN assignment in M12 plug	PIN	Meaning
	1	signal +
	2	not assigned
	3	signal −
	4	ground
A0011175		
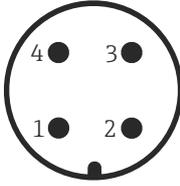
Endress+Hauser offers the following accessories for devices with an M12 plug:
Plug-in jack M 12x1, straight
- Material: Body PA; coupling nut CuZn, nickel-plated
- Degree of protection (fully locked): IP67
- Order number: 52006263

Plug-in jack M 12x1, elbowed
- Material: Body PBT/PA; coupling nut GD-Zn, nickel-plated
- Degree of protection (fully locked): IP67
- Order number: 71114212

Cable 4x0.34 mm² (20 AWG) with M12 socket, elbowed, screw plug, length 5 m (16 ft)
- Material: Body PUR; coupling nut CuSn/Ni; cable PVC
- Degree of protection (fully locked): IP67
- Order number: 52010285

Devices with 7/8" plug

PIN assignment in 7/8" plug	PIN	Meaning
	1	signal −
	2	signal +
	3	not assigned
	4	shield
A0011176		
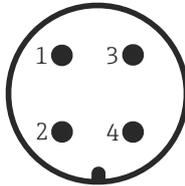
External thread: 7/8 - 16 UNC
- Material: Housing / body CuZn, nickel-plated
- Degree of protection: IP68

Cable specification	**HART**
	• Endress+Hauser recommends using shielded, twisted-pair two-wire cables.
	• Cable outer diameter: 5 to 9 mm (0.2 to 0.35 in) depending on the cable entries used (→ 🖹 20)

PROFIBUS PA

Use a twisted, shielded two-wire cable, preferably cable type A

ℹ️

For further information on the cable specifications, see Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning", the PNO Guideline 2.092 PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

FOUNDATION Fieldbus

Use a twisted, shielded two-wire cable, preferably cable type A

ℹ️

For further information on the cable specifications, see Operating Instructions BA00013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC 61158-2 (MBP).

Residual ripple	without influence on 4 to 20 mA signal up to ± 5 % residual ripple within the permitted voltage range [according to HART hardware specification HCF_SPEC-54 (DIN IEC 60381-1)]
Overvoltage protection (optional)	• Overvoltage protection:
	– Nominal functioning DC voltage: 600 V
	– Nominal discharge current: 10 kA
	• Surge current check î = 20 kA satisfied as per DIN EN 60079-14: 8/20 µs
	• Arrester AC current check I = 10 A satisfied

Ordering information:
Feature 100, version "1" and
feature 110, version "2".

> **NOTICE**
> **Device could be destroyed!**
> ▸ Devices with integrated overvoltage protection must be grounded.

Influence of power supply	≤ 0.0006 % of URL/1 V

Performance characteristics

Reference operating conditions

- As per IEC 60770
- Ambient temperature T_A = constant, in the range of: +21 to +33°C (+70 to +91°F)
- Humidity φ = constant, in the range of: 5 to 80 % RH
- Ambient pressure p_A = constant, in the range of: 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell = constant, in range: horizontal ±1°
- Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value
- Zero based span
- Process isolating diaphragm material: Alloy C276 (2.4819)
- Filling oil: synthetic oil / inert oil
- Supply voltage: 24 V DC ± 3 V DC
- Load with HART: 250 Ω

Long-term stability

Measuring cell	% of URL/1 year	% of URL/5 years
100 mbar (1.5 psi)	±0.18	±0.45
400 mbar (6 psi) 1200 mbar (18 psi)	±0.1	±0.25
4000 mbar (60 psi), 10000 mbar (150 psi)	±0.05	±0.125

Influence of the installation position

Maximum: ±2.3 mbar (0.0345 psi). The value is doubled for devices with inert oil.

Position-dependent zero shift can be corrected. See → ▤ 25, "General installation instructions" section.

Resolution

- Current output: 1 µA
- Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

Reference accuracy

The reference accuracy comprises the non-linearity according to limit point setting, hysteresis and non-reproducibility as per IEC 60770. The data refer to the calibrated span.

Measuring cell	% of the set span		
	standard		Platinum
100 mbar (1.5 psi)	• TD 1:1 to TD 2:1 = ±0.15 • TD > 2:1 to TD 4:1 = ±0.075 x TD		• TD 1:1 to TD 2:1 = ±0.1 • TD > 2:1 to TD 4:1 = ±0.05 x TD
400 mbar (6 psi)	• TD 1:1 to TD 4:1 = ±0.15 • TD > 4:1 to TD 10:1 = ±0.0375 x TD		• TD 1:1 to TD 4:1 = ±0.1 • TD > 4:1 to TD 10:1 = ±0.025 x TD
1200 mbar (18 psi)	• TD 1:1 to TD 2:1 = ±0.1 • TD > 2:1 to TD 12:1 = ±0.05 x TD		• TD 1:1 to TD 2:1 = ±0.075 • TD > 2:1 to TD 12:1 = ±0.0375 x TD
4000 mbar (60 psi)	• TD 1:1 to TD 4:1 = ±0.1 • TD > 4:1 to TD 40:1 = ±0.025 x TD		• TD 1:1 to TD 4:1 = ±0.075 • TD > 4:1 to TD 40:1 = ±0.02 x TD
10000 mbar (150 psi)	• TD 1:1 to TD 2.5:1 = ±0.1 • TD > 2.5:1 = ±0.04 x TD		• TD 1:1 to TD 2.5:1 = ±0.075 • TD > 2.5:1 = ±0.03 x TD

Total performance

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change in the zero point.
All specifications apply to the temperature range −10 to +60 °C (+14 to +140 °F) and a turn down of 1:1.

Measuring cell	% of URL	
	standard	Platinum
100 mbar (1.5 psi), 400 mbar (6 psi)	±0.35	±0.25
1200 mbar (18 psi), 4000 mbar (60 psi), 10000 mbar (150 psi)	±0.15	±0.12

Total error

The total error comprises the long-term stability and the total performance.
All specifications apply to the temperature range −10 to +60 °C (+14 to +140 °F) and a turn down of 1:1.

Measuring cell	% of URL/year	
	standard	Platinum
100 mbar (1.5 psi)	±0.53	±0.43
400 mbar (6 psi)	±0.45	±0.35
1200 mbar (18 psi)	±0.25	±0.22
4000 mbar (60 psi), 10000 mbar (150 psi)	±0.20	±0.17

Warm-up period

- 4 to 20 mA HART: 10 s
- PROFIBUS PA: 6 s
- FOUNDATION Fieldbus: 50 s

Thermal change of the zero output and the output span

Measuring cell	% of the set span			
	−10 to +60 °C (+14 to 140 °F)		+60 to +85 °C (+140 to 185 °F)	
	standard	Platinum	standard	Platinum
100 mbar (1.5 psi)	±(0.3 x TD + 0.02)	±(0.2 x TD + 0.02)	±(0.4 x TD + 0.04)	±(0.3 x TD + 0.04)
400 mbar (6 psi)	±(0.25 x TD + 0.01)	±(0.15 x TD + 0.01)	±(0.3 x TD + 0.02)	±(0.2 x TD + 0.02)
1200 mbar (18 psi), 4000 mbar (60 psi), 10000 mbar (150 psi)	±(0.1 x TD + 0.01)	±(0.075 x TD + 0.01)	±(0.15 x TD + 0.02)	±(0.1 x TD + 0.02)

These values specify the thermal change for the most unfavorable situation where the process temperature and the ambient temperature change independently of each other.

Installation

General installation instructions

- The position-dependent zero point shift can be corrected directly at the device via an operating key, and also in hazardous areas in the case of devices with external operation.
- The housing of the Deltapilot S can be rotated up to 380°. See → 🗎 27, "Turning the housing" section.
- The onsite display can be rotated in 90° stages.
- For mounting the device on pipes or walls, Endress+Hauser offers a mounting bracket → 🗎 25, "Wall and pipe-mounting" section.

Level measurement

- Always install the device below the lowest measuring point.
- Do not install the device at the following positions:
  - in the filling curtain
  - in the tank outflow
  - or at a point in the tank that can be affected by pressure pulses from the agitator
- The adjustment and functional test can be carried out more easily if you mount the device downstream of a shutoff device.
- The Deltapilot S must be included in the insulation for media than can harden when cold.

Pressure measurement in gases

Mount Deltapilot S with shutoff device above the tapping point so that any condensate can flow into the process.

Pressure measurement in steams

- Mount Deltapilot S with siphon above the tapping point.
  The siphon reduces the temperature to almost the ambient temperature.
- Fill the siphon with liquid before commissioning.

Pressure measurement in liquids

Mount Deltapilot S with shutoff device below or at the same level as the tapping point.

Wall and pipe-mounting

Endress+Hauser offers a mounting bracket for installing the device on pipes or walls.
The mounting bracket can be installed on pipes with a diameter of 1¼" to 2" or on walls.

Ordering information:
Feature 110, version "U" or
as a separate accessory (part no.: 71102216).

Dimensions → 🗎 39.

"Separate housing" version With the "separate housing" version, you are able to mount the housing with the electronics insert at a distance from the measuring point. This version facilitates trouble-free measurement:
- Under particularly difficult measuring conditions (at installation locations that are cramped or difficult to access)
- If rapid cleaning of the measuring point is required
- If the measuring point is exposed to vibrations
- For compact installations

You can choose between different cable versions:
- PE: 2 m (6.6 ft), 5 m (16 ft) and 10 m (33 ft)
- FEP: 5 m (16 ft).

Ordering information:
Feature 110, version "G".

Dimensions → 🗎 39.

A0019994
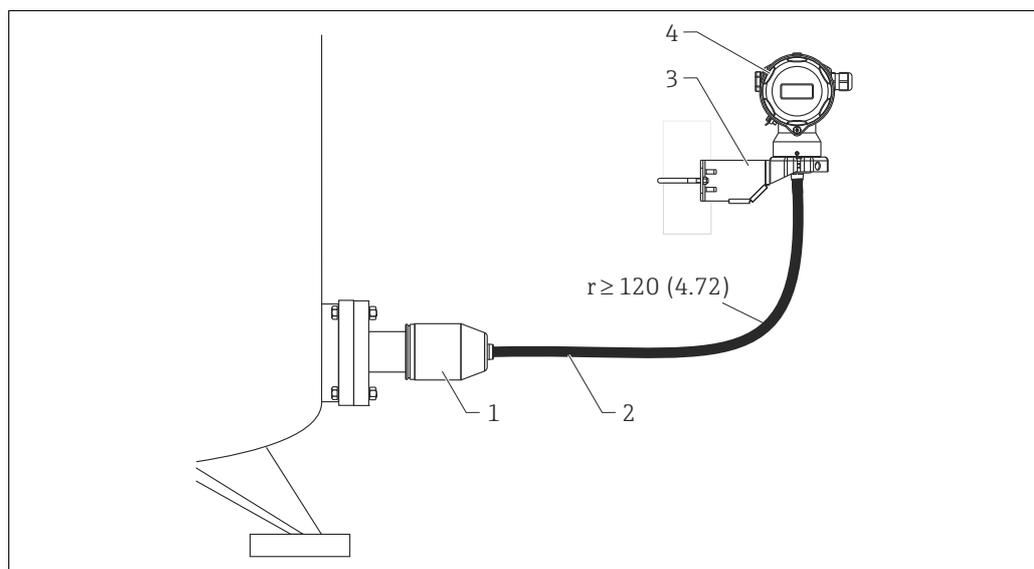
Measuring unit mm (in)

In the case of the "separate housing" version, the sensor is delivered with the process connection and cable ready mounted. The housing 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 and the sensor.

1   Process connection with sensor - For degrees of protection, see the following section
2   Cable, both ends are fitted with a socket
3   Mounting bracket provided, suitable for pipe and wall mounting
4   Housing with electronic insert - Degrees of protection → 🗎 30 ff

Degree of protection for the process connection and sensor with the use of
- FEP cable:
  - IP 69K
  - IP 66 NEMA 4/6P
  - IP 68 (1.83 mH_2O for 24 h) NEMA 4/6P
- PE cable:
  - IP 66 NEMA 4/6P
  - IP 68 (1.83 mH_2O for 24 h) NEMA 4/6P

Technical data of the PE and FEP cable:
- Minimum bending radius: 120 mm (4.72 in)
- Cable extraction force: max. 450 N
- 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 separate housing is used, the installation height of the process connection is reduced compared to the dimensions of the standard version.
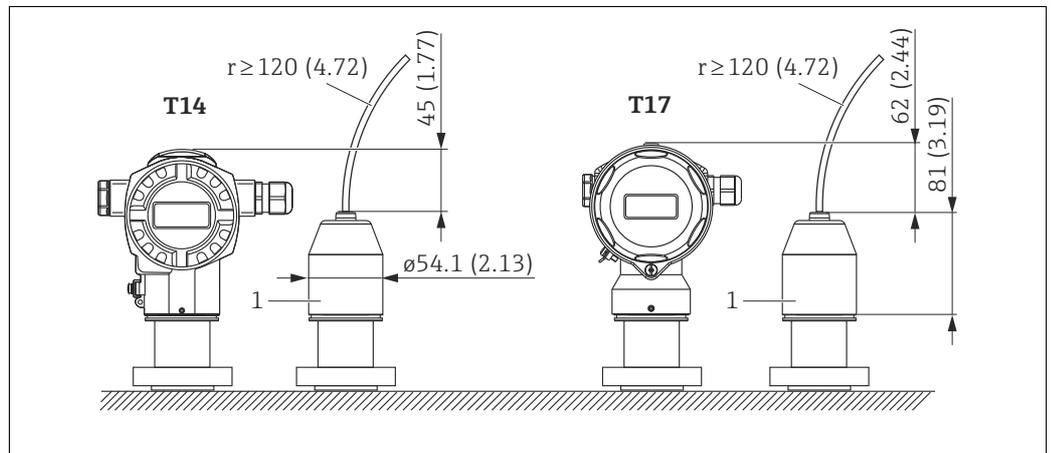
Measuring unit mm (in)

1   Process connection adapter.

Turning the housing

The housing can be rotated up to 380° by loosening the Allen screw.

Your benefits
- Simple mounting by optimally aligning the housing
- Good, accessible device operation
- Optimum readability of the onsite display (optional).
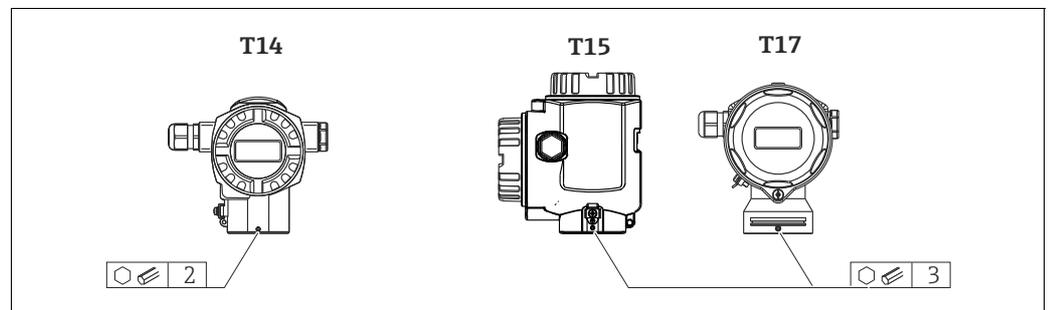
Silicone-free applications

Special cleaning of the transmitter to remove paint-wetting substances, for use in paint shops for example.

Ordering information:
Feature 90, version "L".

Applications with hydrogen

With regard to materials in which hydrogen formation takes place, hydrogen atoms can diffuse through the metals of the sensor. This can result in incorrect measurement results.
Endress+Hauser offers process isolating diaphragms with gold-rhodium coating for this application.

Ordering information:
Feature 60, version "6".

Environment

Ambient temperature range

- −40 to +85 ℃ (-40 to +185 ℉)
  lower temperatures on request
- Onsite display: −20 to +70℃ (-4 to +158 ℉)
  Extended temperature application range with restrictions in optical properties, such as display speed and contrast: −40 to +85 ℃ (-40 to +185 ℉)
- Separate housing: -20 to +60 ℃ (-4 to +140 ℉) (installation without insulation)

For devices for use in hazardous areas, see Safety Instructions, Installation or Control Drawing (→ 🖹 56 ff, "Safety Instructions" and "Installation/ Control Drawings" sections).

The device can be used in the temperatures ranges mentioned. The values of the specification, such as thermal change, may be exceeded.

Storage temperature range

- −40 to +90 ℃ (-40 to +194 ℉)
- Onsite display: −40 to +85 ℃ (-40 to +185 ℉)
- Separate housing: -40 to +60 ℃ (-40 to +140 ℉)

Degree of protection

- Housing → 🖹 30 ff
- Separate housing → 🖹 26

Climate class

Class 4K4H (air temperature: −20 to 55 ℃ (-4 to 131 ℉), relative humidity: 4 to 100 %) fulfilled as per DIN EN 60721-3-4 (condensation possible)

Vibration resistance

Device/accessory	Test standard	Vibration resistance
FMB70	GL	Guaranteed for: 3 to 25 Hz: ±1.6 mm (0.063 in); 25 to 100 Hz: 4 g in all 3 planes
FMB70 with mounting bracket	IEC 61298-3	Guaranteed for: 10 to 60 Hz: ±0.15 mm (0.0059 in); 60 to 500 Hz: 2 g in all 3 planes

Electromagnetic compatibility

- Electromagnetic compatibility to EN 61326 and NAMUR recommendation EMC (NE21). For details refer to the Declaration of Conformity.
- Maximum deviation: < 0.5 % of span
- All EMC measurements were performed with a turn down (TD) = 2:1.

Process

Process temperature limits
- −10 to +100 ℃ (+14 to 212 ℉)
- Up to +135℃ (+275℉) short-term (for 30 minutes) for cleaning purposes

Pressure specifications

> **⚠ WARNING**
>
> **The maximum pressure for the measuring device depends on the lowest rated element with regard to pressure → 🖺 10 ff, "Measuring range" and → 🖺 30 ff "Mechanical construction" section.**
>
> ‣ The measuring device must be operated only within the specified limits!
> ‣ The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of 20℃ (68℉), or 100℉ (38 ℃) for ANSI flanges, and may be applied to the device for an unlimited time. Observe pressure-temperature dependency.
> ‣ The pressure values permitted at higher temperatures can be found in the standards
> EN 1092-1: 2001 Tab. 18 [1]
> ASME B 16.5a – 1998 Tab. 2-2.2 F316
> ASME B 16.5a – 1998 Tab. 2.3.8 N10276
> JIS B 2220.
> ‣ The test pressure corresponds to the over pressure limit of the measuring device
> (OPL = 1.5 x MWP) and may only be applied temporarily so that no permanent damage develops.
> ‣ The Pressure Equipment Directive (EC Directive 97/23/EC) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
> ‣ In the case of sensor range and process connections where the over pressure limit (OPL) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value (1.5 x PN; MWP = PN).

---

[1] With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13E0 in EN 1092-1: 2001 Tab. 18. The chemical composition of the two materials can be identical.

Mechanical construction

Device height

The device height is based on

- the height of the housing and
- the height of the relevant process connection.

The individual heights of the components can be found in the following sections. You can calculate the device height easily by adding the individual heights together. If necessary, the installation space (the space used to install the device) must also be taken into account.
You can use the following table for this:

Section	Page	Height
Height of housing	→ 📄 30 ff	
Process connections	→ 📄 32 ff	
Installation space		
Height of device		

T14 housing, optional display on the side
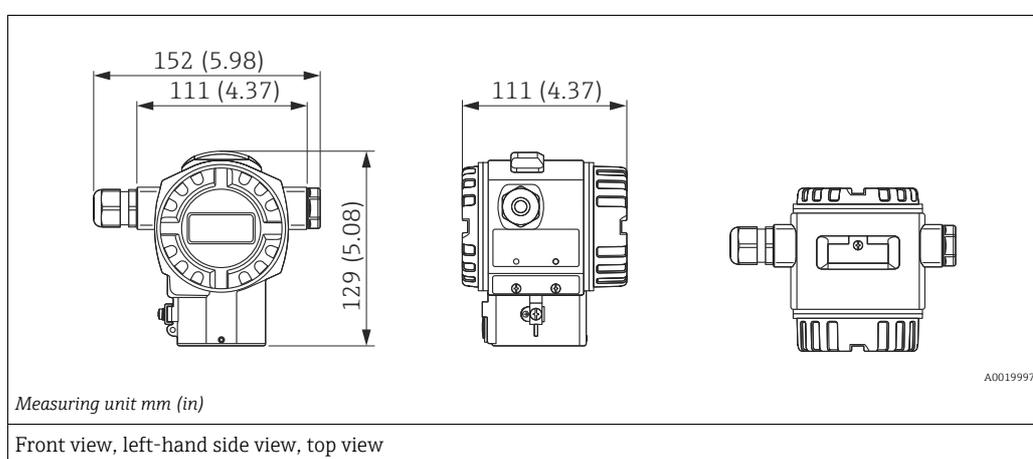
152 (5.98)
111 (4.37)
111 (4.37)
129 (5.08)

A0019997

Measuring unit mm (in)

Front view, left-hand side view, top view

Material		Degree of protection	Cable entry	Weight kg (lbs)		Order code	
Housing	Cover seal			with display	without display	Feature	Version
Aluminum	EPDM	IP66/67 NEMA 6P	M20 gland	1.2 (2.65)	1.1 (2.43)	30	A
		IP66/67 NEMA 6P	G ½" thread				B
		IP66/67 NEMA 6P	NPT ½" thread				C
		IP66/67 NEMA 6P	M12 plug				D
		IP66/67 NEMA 6P	7/8" plug				E
		IP65 NEMA 4	HAN7D plug 90 degrees				F

T15 housing, optional display on the top
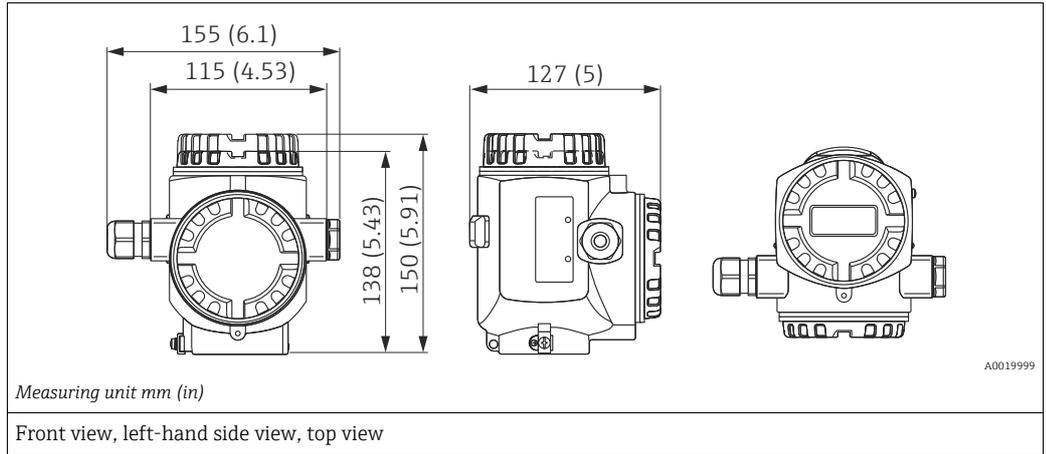
Measuring unit mm (in)

Front view, left-hand side view, top view

Material		Degree of protection	Cable entry	Weight kg (lbs)		Order code	
Housing	Cover seal			with display	without display	Feature	Version
Aluminum	EPDM	IP66/67 NEMA 6P	M20 gland	1.8 (3.97)	1.7 (3.75)	30	J
		IP66/67 NEMA 6P	G ½" thread				K
		IP66/67 NEMA 6P	NPT ½" thread				L
		IP66/67 NEMA 6P	M12 plug				M
		IP66/67 NEMA 6P	7/8" plug				N
		IP65 NEMA 4	HAN7D plug 90 degrees				P

T17 housing (hygienic), optional display on the side

Measuring unit mm (in)

Front view, left-hand side view, top view
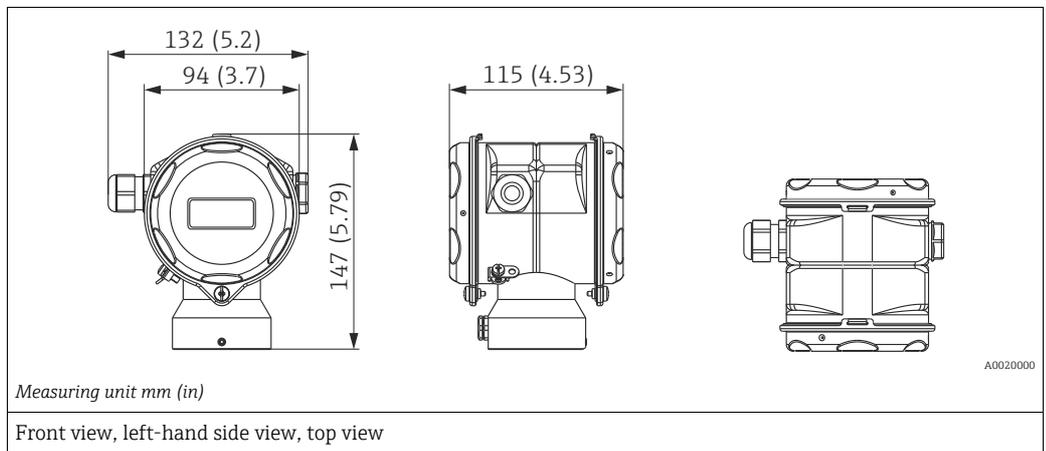
Material		Degree of protection[1]	Cable entry	Weight kg (lbs)		Order code	
Housing	Cover seal			with display	without display	Feature	Version
316L	EPDM	IP66/68 NEMA 6P	M20 gland	1.2 (2.65)	1.1 (2.43)	30	R
		IP66/68 NEMA 6P	G ½" thread				S
		IP66/68 NEMA 6P	NPT ½" thread				T
		IP66/68 NEMA 6P	M12 plug				U
		IP66/68 NEMA 6P	7/8" plug				V

1) Degree of protection IP 68: 1.83 mH$_2$O for 24 h

Process connections   **Threaded connection ISO 228 and NPT**

Measuring unit mm (in)

A0020001

Measuring unit mm (in)

A0020002

Measuring unit mm (in)

A0020003
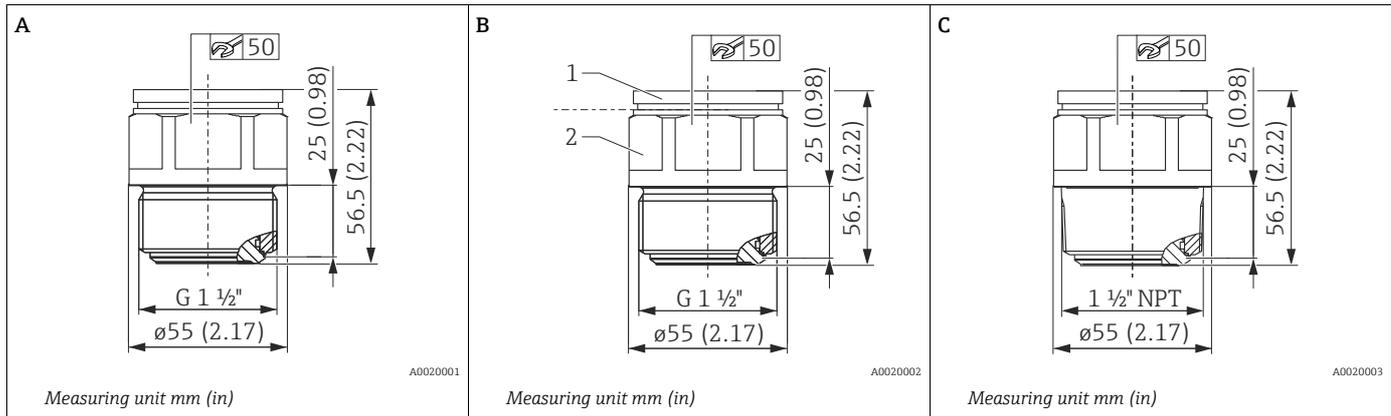
Position	Designation	Material	Weight kg (lbs)	Order code[1] Feature	Version
A	Thread ISO 228 G 1 ½" A	AISI 316L (1.4435)	0.8 (1.76)		1G
B	Thread ISO 228 G 1 ½" A	• 1: Top section AISI 316L (1.4404) • 2: Bottom section Alloy C276 (2.4819)	0.8 (1.76)	70	1H
C	Thread ANSI 1 ½" MNPT	AISI 316L (1.4435)	0.8 (1.76)		2D

1)   CSA approval: Feature 10

ℹ Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection must be ordered with a CSA approval. These devices are fitted with a separate plate bearing the registration number CRN OF1987.7C.

EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527, raised face RF
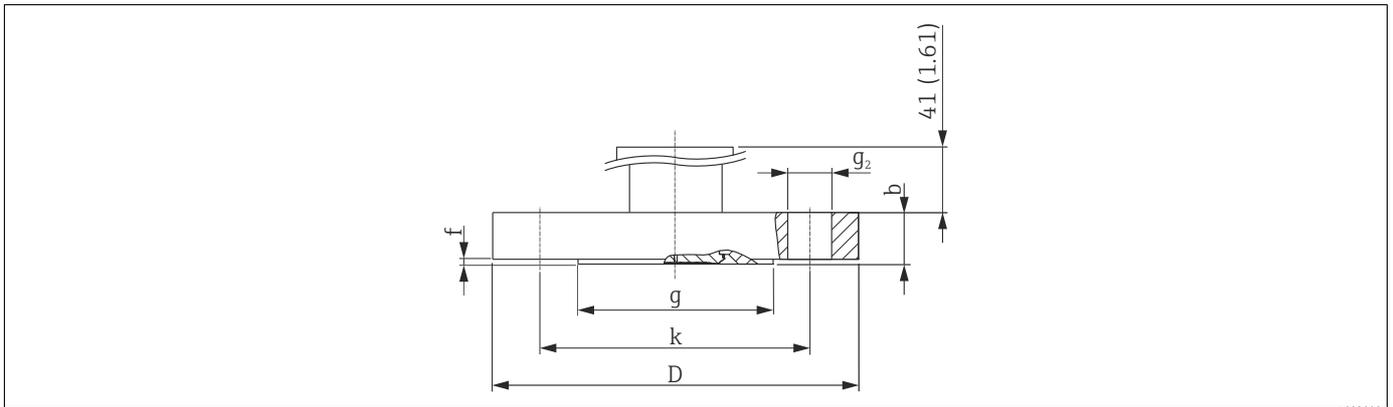
Measuring unit mm (in)

Flange [1]								Boltholes				Order code Feature 70
Nominal diameter	Nominal pressure	Shape[2]	Material[3]	Dia-meter	Thick-ness	Raised face diameter	Raised face height	Quan-tity	Dia-meter	Hole circle	Weight[4]	Version
				D	b	g	f		g_2	k		
				[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	kg (lbs)	
DN 40	PN 10/16	B1 (C)	AISI 316L	150	18	88	2	4	18	110	2.6 (5.73)	CE
DN 50	PN 10/16	B1 (C)	AISI 316L	165	18	102	2	4	18	125	3.3 (7.28)	CF
DN 80	PN 10/16	B1 (C)	AISI 316L	200	20	138	2	8	18	160	5.1 (11.25)	CG
DN 100	PN 10/16	B1 (C)	AISI 316L	220	20	158	2	8	18	180	6.3 (13.89)	CH

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards) is Ra 0.8 μm (31.5 in). Lower surface roughness on request.

2) Designation as per DIN 2526 in brackets

3) Endress+Hauser supplies DIN/EN stainless steel flanges as per AISI 316L (DIN/ EN material number 1.4404 or 14435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1: 2001 Tab. 18. The chemical composition of the two materials can be identical.

4) Weight incl. pipe and measuring cell, housing weight → 📄 30 ff

ANSI flanges, connection dimensions as per ANSI B 16.5, raised face RF
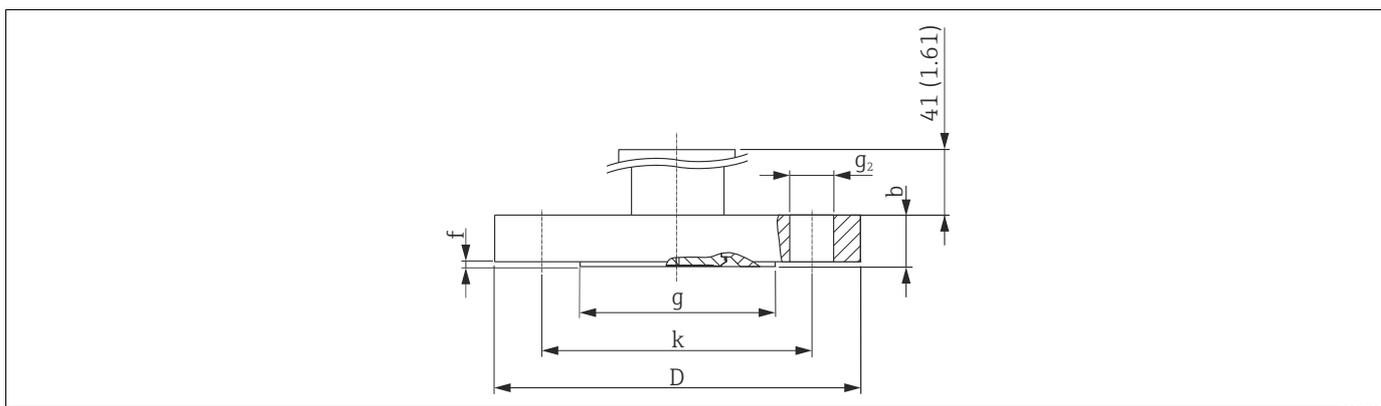
Height in mm (in)

Flange [1]							Boltholes				Order code Feature 70
Nominal diameter	Class	Material[2]	Diameter D	Thick-ness b	Diameter of raised face g	Raised face height f	Quan-tity	Dia-meter g₂	Hole circle k	Weight[3]	Version
[in]	[lb./sq in]		[in]	[in]	[in]	[in]		[in]	[in]	kg (lbs)	
1 1/2	150	AISI 316/316L	5	0.69	2.88	0.06	4	0.62	3.88	2.1 (4.63)	AE
2	150	AISI 316/316L	6	0.75	3.62	0.06	4	0.75	4.75	3.0 (6.62)	AF
3	150	AISI 316/316L	7.5	0.94	5	0.06	4	0.75	6	5.7 (12.57)	AG
4	150	AISI 316/316L	9	0.94	6.19	0.06	8	0.75	7.5	7.8 (17.2)	AH

1)   The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards) is Ra 0.8 µm (31.5 in). Lower surface roughness on request.

2)   Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)

3)   Weight incl. pipe and measuring cell, housing weight → 🖺 30 ff

JIS flanges, connection dimensions as per JIS B 2220 BL, raised face RF

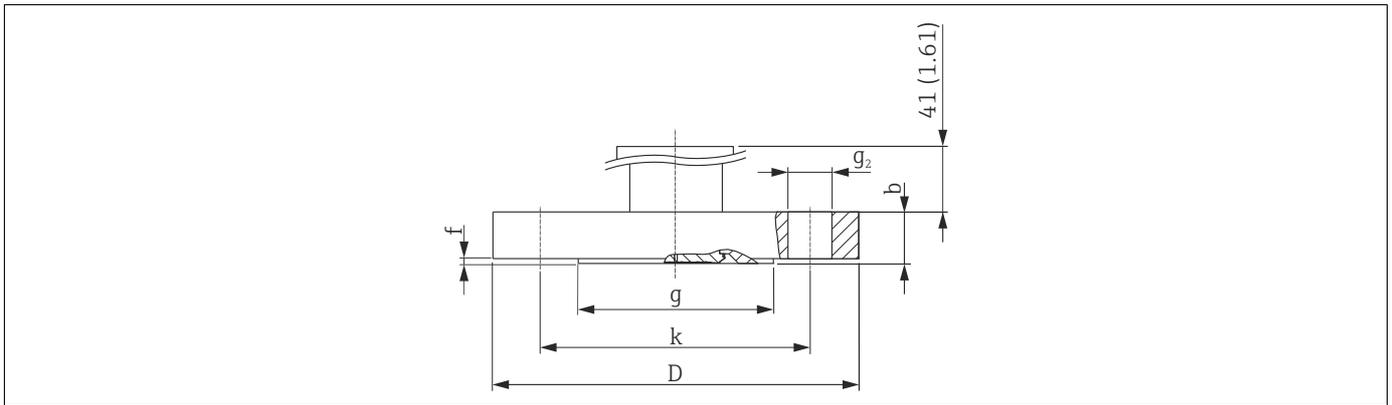
Measuring unit mm (in)

Flange [1]						Boltholes				Order code Feature 70
Nominal diameter	Nominal pressure	Diameter D	Thickness b	Diameter of raised face g	Raised face height f	Quantity	Diameter g2	Hole circle k	Flange weight [2]	Version
		[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	kg (lbs)	
40 A	10 K	140	16	81	2	4	19	105	2.1 (4.63)	KE
50 A	10 K	155	16	96	2	4	19	120	2.5 (5.51)	KF
80 A	10 K	185	18	126	2	8	19	150	3.8 (8.38)	KL
100 A	10 K	210	18	151	2	8	19	175	4.9 (10.8)	KH

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards) is Ra 0.8 µm (31.5 in). Lower surface roughness on request.

2) Weight incl. pipe and measuring cell, housing weight → 🗎 30 ff

Hygienic connections

A

ø56 (2.2)
Rd 65 x 1/6
10.2 (0.4)
59.5 (2.34)

Measuring unit mm (in)   A0020005

B

ø68.5 (2.7)
Rd 78 x 1/6
11.2 (0.44)
59.5 (2.34)

Measuring unit mm (in)   A0020006

C

ø68.5 (2.7)
Rd 78 x 1/6
20.5 (0.81)
59.5 (2.34)

Measuring unit mm (in)   A0020007

D

ø56.5 (2.22)
ø64 (2.52)
20.5 (0.81)
59.5 (2.34)

Measuring unit mm (in)   A0020008

E

4 x
ø11.5 (0.45)
ø65$_{-1.2}$ (2.56$_{-0.05}$)
ø84 (3.31)
ø105 (4.13)
23.5 (0.93)
59.5 (2.34)

Measuring unit mm (in)   A0020009
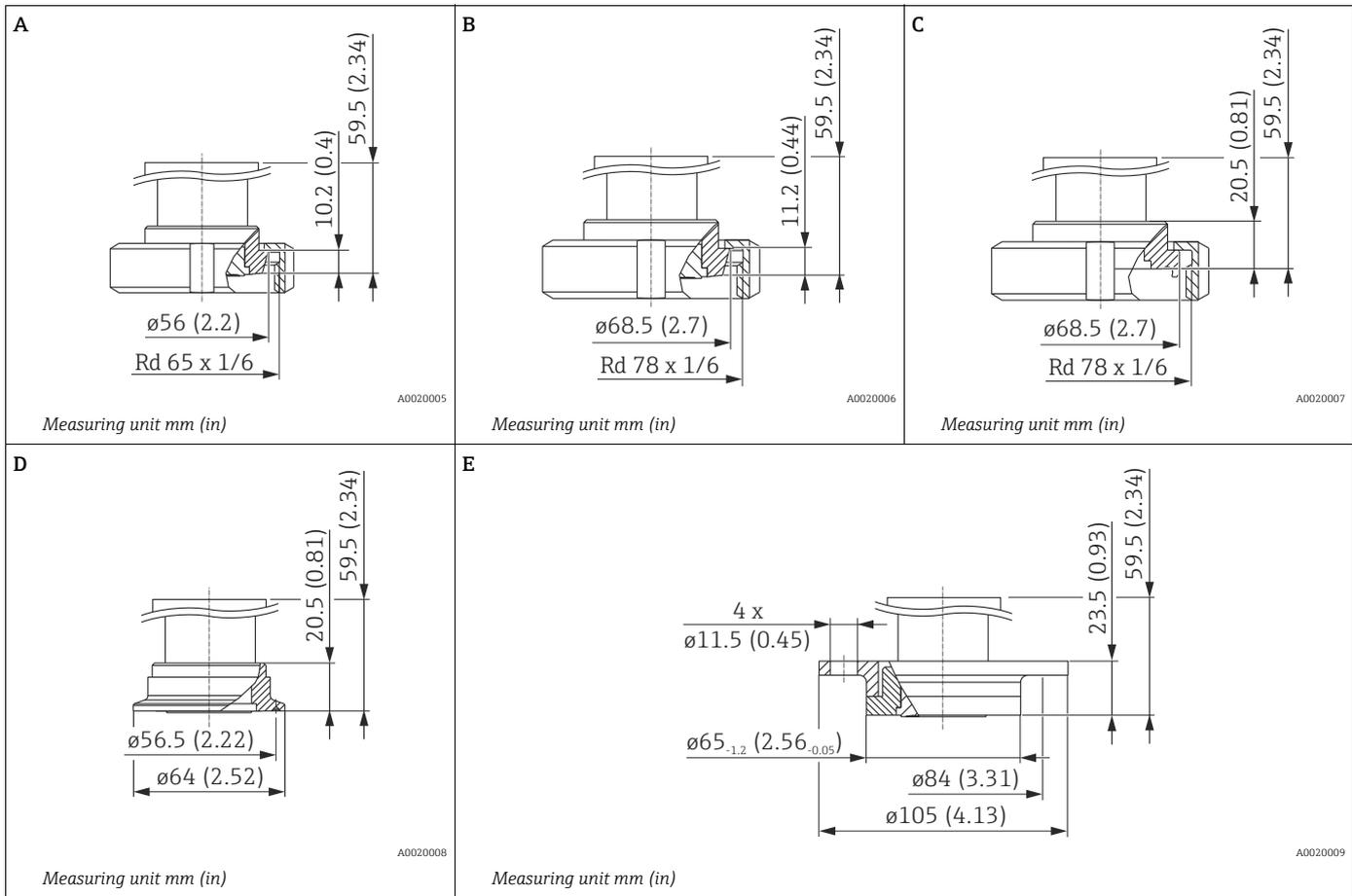
Position [1]	Designation	Material	Weight kg (lbs)	Order code Feature	Version
A	DIN 11851 DN 40 PN 25, EHEDG, 3A	AISI 316L (1.4435)	0.7 (1.54)	70	M2 [2]
B	DIN 11851 DN 50 PN 25, EHEDG, 3A		0.9 (1.98)		M3 [2]
C	DIN11864-1 A DN50 PN16 pipe DIN11866-A, slotted nut, 316L, EHEDG, 3A		1 (2.21)		ND [2]
D	Tri-Clamp ISO 2852 DN 40 – DN 51 (2"), DIN 32676DN 50, EHEDG, 3A		0.7 (1.54)		TD [2]
E	DRD DN50 (65 mm) PN 25, slotted nut AISI 304 (1.4301)		1.1 (1.98)		TK

1)   The roughness of the surface in contact with the medium is R_a ≤0.76 µm (30 µin) as standard.
Surface quality R_a<0.38µm electropolished (wetted), ordering information: Feature 100 and 110, version "C".

2)   Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).

Measuring unit mm (in)

Measuring unit mm (in)

Measuring unit mm (in)
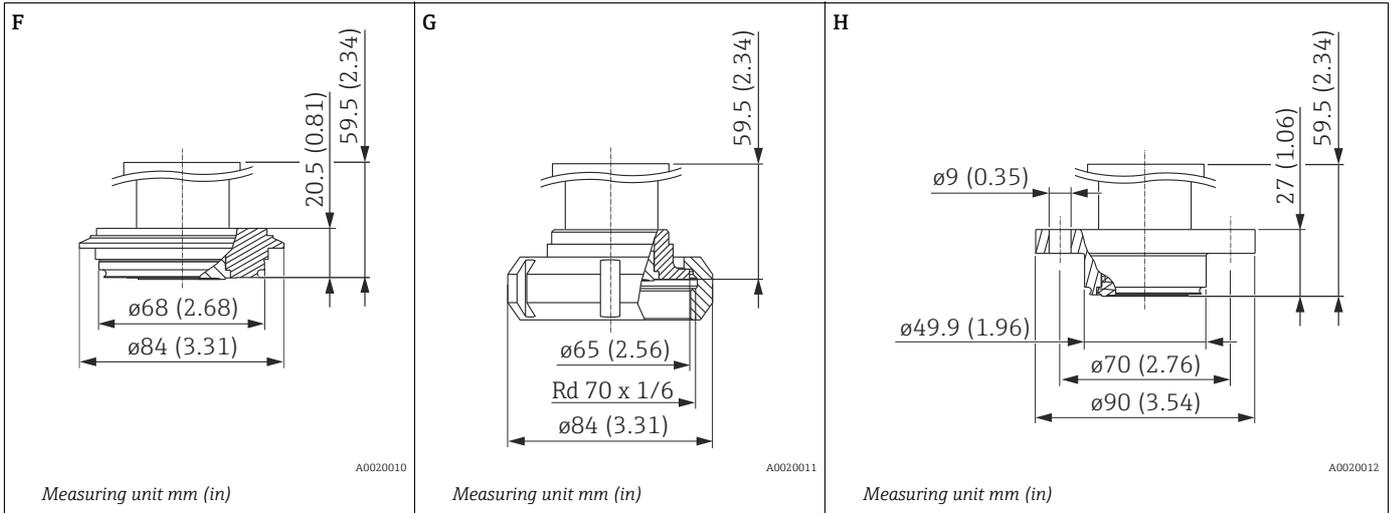
Position [1]	Designation	Material	Weight kg (lbs)	Order code Feature	Version
F	Varivent type N for pipes 40 – 162, PN 40, EHEDG, 3A	AISI 316L (1.4435)	1 (2.21)	70	TR
G	SMS 2", PN25, EHEDG		0.7 (1.54)		UE[2]
H	NEUMO, D50, PN16, 316L, 3A		0.8 (1.76)		S4

1) The roughness of the surfaces in contact with the medium is R_a ≤0.76 µm (30 µin) as standard.
   Surface quality R_a<0.38µm electropolished (wetted), ordering information: Feature 100 and 110, version "C".
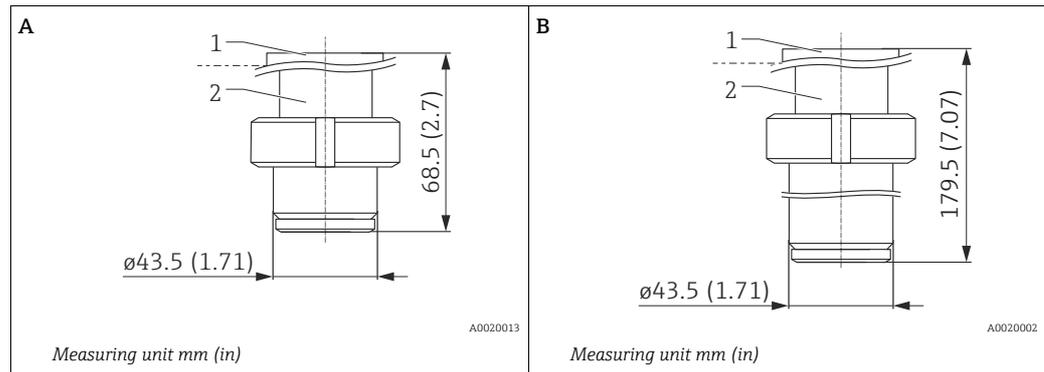
2) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).

Universal process adapter

Measuring unit mm (in)

Position [1]	Designation	Material	Weight kg (lbs)	Order code	
				Feature	Version
A	Universal process adapter incl. silicone molded seal (spare part no.: 52023572) FDA 21CFR177.2600/USP Class VI-70C, EHEDG, 3A	• 1: Top section AISI 316L (1.4404) • 2: Bottom section AISI 316L (1.4435)	0.8 (1.76)	70	0 [2]
	Universal process adapter incl. EPDM molded seal				1
B	Universal process adapter, 6 inch extension incl. silicone molded seal (spare part no.: 52023572) FDA 21CFR177.2600/USP Class VI-70C, EHEDG, 3A		1.7 (3.75)		57 [2]
	Universal process adapter, 6 inch extension incl. EPDM molded seal				58

1) The roughness of the surface in contact with the medium is $R_a \leq 0.76$ µm (30 µin) as standard.
   Surface quality $R_a < 0.38$µm electropolished (wetted), ordering information: Feature 100 and 110, version "C".

2) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).
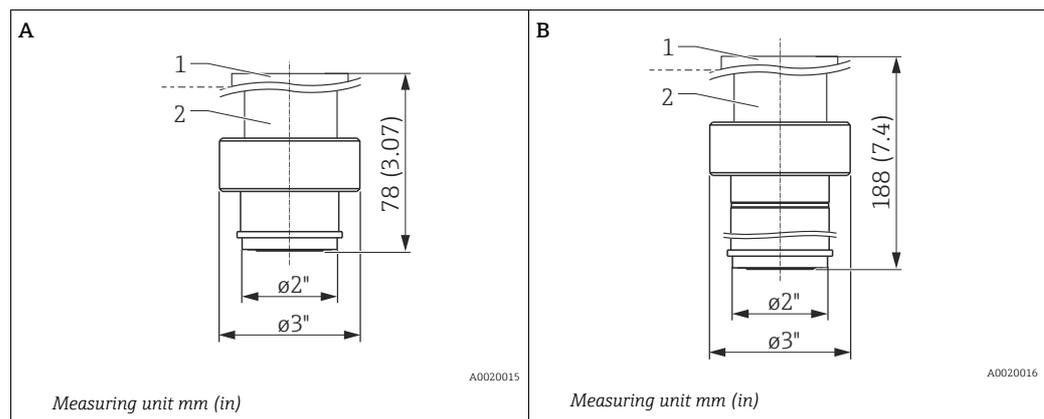
Anderson process adapter

Measuring unit mm (in)

Position [1]	Designation	Material	Weight kg (lbs)	Order code	
				Feature	Version
A	Anderson short process adapter 2-3/16", 316L, 3A, incl. silicone molded seal, 3A	• 1: Top section AISI 316L (1.4404) • 2: Bottom section AISI 316L (1.4435) • Slotted nut AISI 316L (1.4404)	0.8 (1.76)	70	60
B	Anderson long process adapter 6-1/2", 316L, 3A, incl. silicone molded seal, 3A		1.7 (3.75)		62

1) The roughness of the surface in contact with the medium is $R_a \leq 0.76$ µm (30 µin) as standard.
   Surface quality $R_a < 0.38$µm electropolished (wetted), ordering information: Feature 100 and 110, version "C".

**Separate housing:
wall and pipe mounting with
mounting bracket**
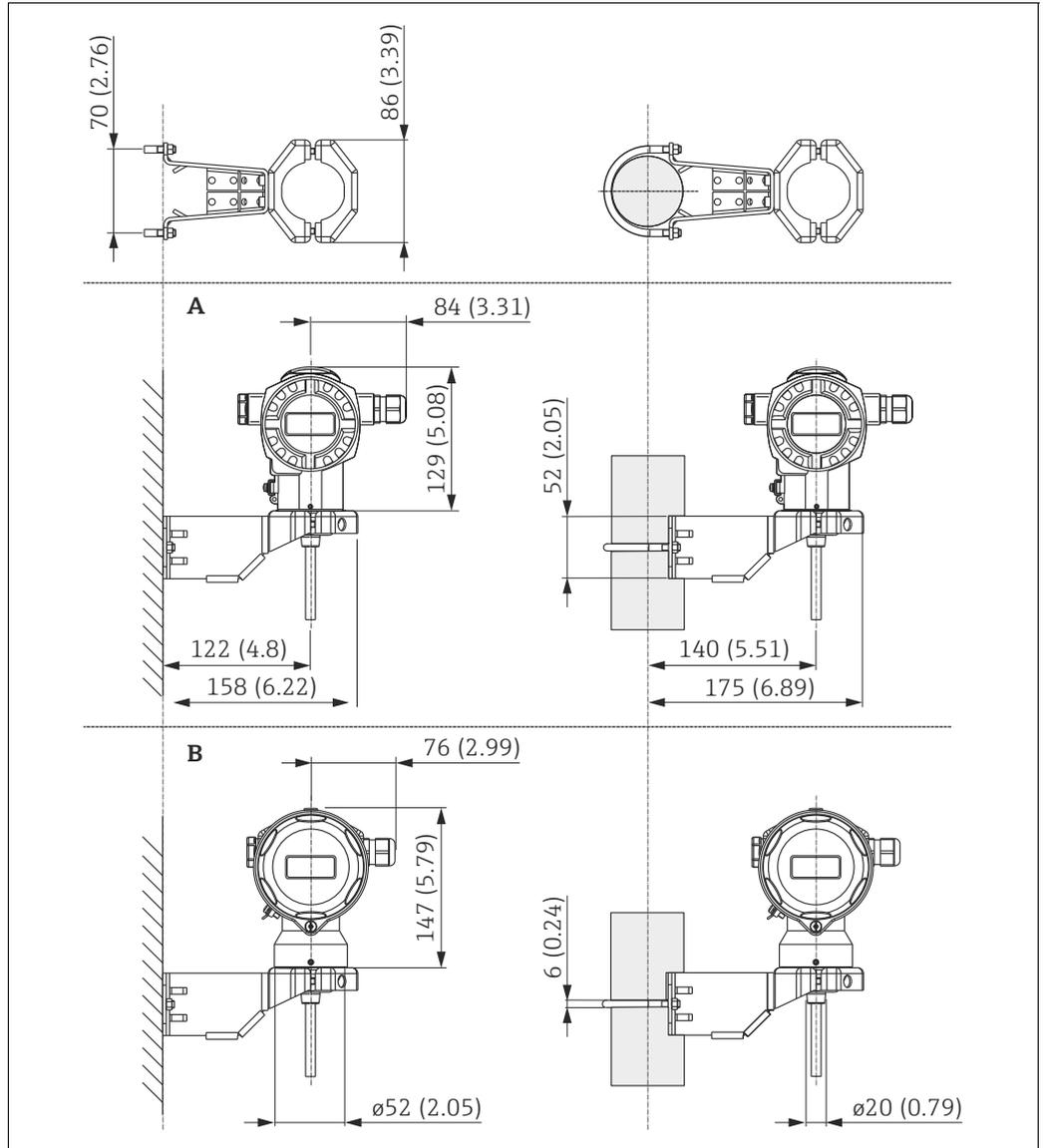
Measuring unit mm (in)

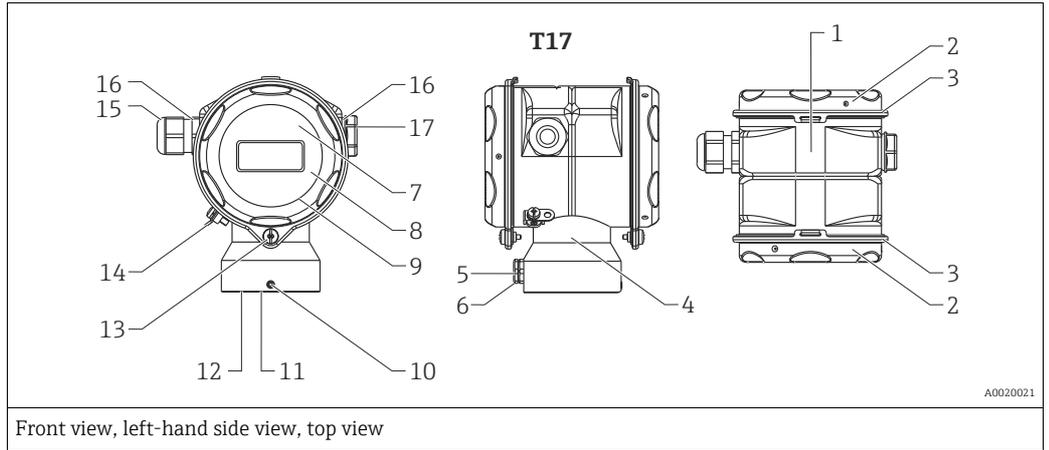| Position	Designation	Weight		Order code	
		Housing (T14 or T17)	Mounting bracket	Feature	Version
A	Dimensions with T14 housing, optional display on the side	→ 📄 30 ff	0.5 kg (1.10)	110	U
B	Dimensions with T17 housing, optional display on the side				

Can also be ordered as a separate accessory (part no.: 71102216).

Material (not wetted)   Housing

Front view, left-hand side view, top view
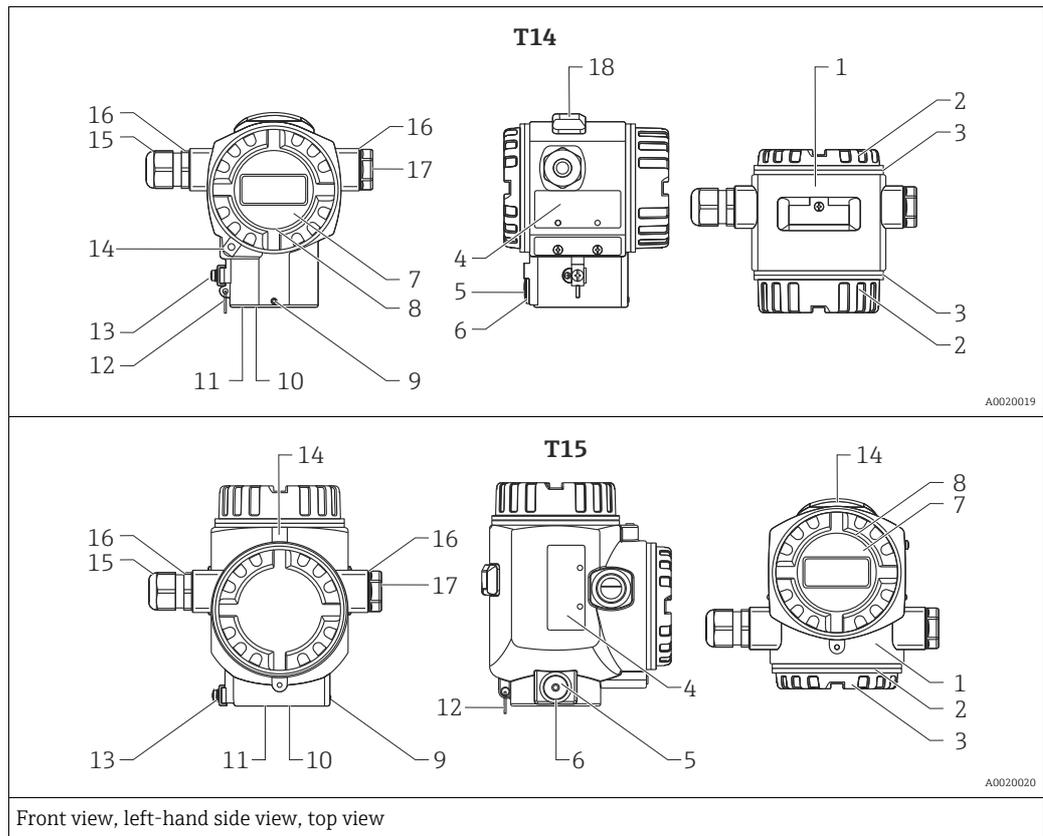
Item number	Component part	Material
1	T14 and T15 housing, RAL 5012 (blue)	Die-cast aluminum with protective powder-coating on polyester base
2	Cover, RAL 7035 (gray)	Die-cast aluminum with protective powder-coating on polyester base
3	Cover seal	EPDM
4	Nameplates	AISI 304 (1.4404)
5	Pressure compensation filter	PA6 GF10
6	Pressure compensation filter, O-ring	Silicone (VMQ)
7	Sight glass	Mineral glass
8	Sight glass seal	Silicone (VMQ)
9	Screw	A4
10	Sealing ring	EPDM
11	Snap ring	PA66-GF25
12	Snap ring for nameplates	AISI 304 (1.4301)/ AISI 316 (1.4401)
13	External ground terminal	AISI 304 (1.4301)
14	Cover clamp	Clamp AISI 316L (1.4435), screw A4
15	Cable entry	Polyamide (PA) or CuZn nickel-plated
16	Seal of cable entry and blind plug	Silicone (VMQ)
17	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)
18	External operation (keys and key cover), RAL 7035 (gray)	Polycarbonate PC-FR, screw A4

Front view, left-hand side view, top view

Item number	Component part	Material
1	T17 housing	AISI 316L (1.4404)
2	Cover	
3	Cover seal	EPDM
4	Nameplates	Lasered
5	Pressure compensation filter	PA6 GF10
6	Pressure compensation filter, O-ring	Silicone (VMQ)
7	Sight glass for non-hazardous area, ATEX Ex ia, NEPSI Zone 0/1 Ex ia, IECEx Zone 0/1 Ex ia, FM NI, FM IS, CSA IS	Polycarbonate (PC)
8	Sight glass for ATEX 1/2 D, ATEX 1/3 D, ATEX 1 GD, ATEX 1/2 GD, ATEX 3 G, FM DIP, CSA dust ignition-proof	Mineral glass
9	Sight glass seal	EPDM
10	Screw	A2-70
11	Sealing ring	EPDM
12	Snap ring	PA6
13	Screw	A4-50
14	External ground terminal	AISI 304 (1.4301)
15	Cable entry	Polyamide PA, for dust ignition-proof: CuZn nickel-plated
16	Seal of cable entry and blind plug	Silicone (VMQ)
17	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)

Connecting parts
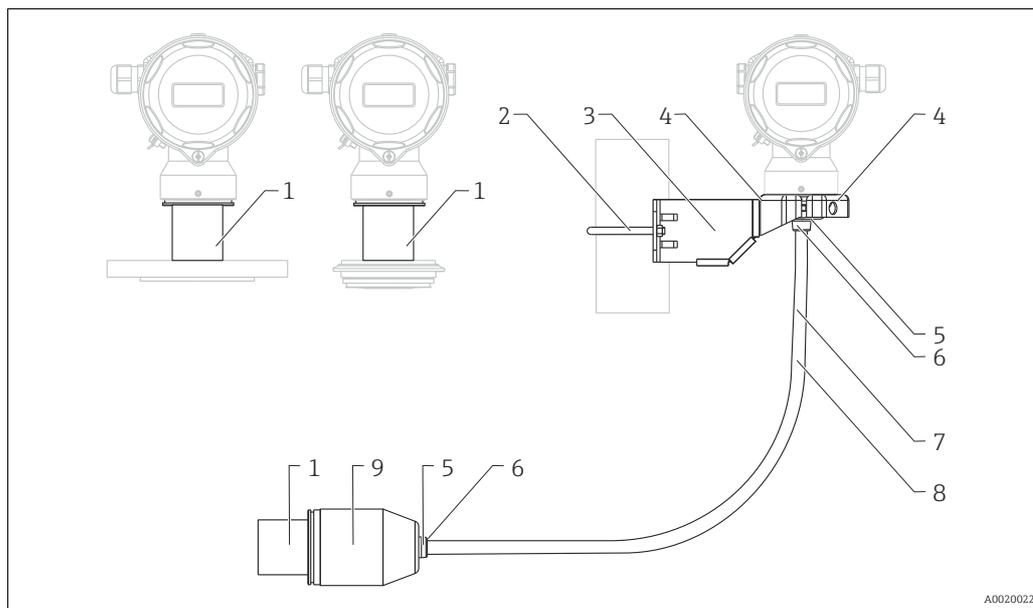
Item number	Component part	Material
1	Connection between the housing and process connection	AISI 316L (1.4404)
2	Mounting bracket	Bracket AISI 316L (1.4404)
3		Screw and nuts A4-70
4		Half-shells: AISI 316L (1.4404)
5	Seal for cable from Separate housing	EPDM
6	Gland for cable from separate housing	AISI 316L (1.4404)
7	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
8	FEP cable for separate housing	abrasion-proof cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted, UV-resistant
9	Process connection adapter for separate housing	AISI 316L (1.4404)

Fill fluid

Designation	Order code	
	Feature	Version
Synthetic oil polyalphaolefin FDA 21 CFR 178.3570, NSF H1		C
Inert oil	90	F
Inert oil, cleaned for silicone-free service		L

Material (wetted)

Process connections

Process-wetted device components are listed in the "Mechanical construction" (→ 🖺 30) and "Ordering information" (→ 🖺 52) sections.

Process isolating diaphragm

Designation	Order code	
	Feature	Version
Alloy C276 (2.4819), Ø 35.8 mm (1.41 in)	60	2
Alloy C276 (2.4819), Ø 35.8 mm (1.41 in), with gold-rhodium coating		6

TSE Certificate of Suitability (Transmissible Spongiform Encephalopathy)

The following applies to all process wetted device components:
• They do not contain any materials derived from animals.
• No additives or operating materials derived from animals are used in production or processing.

ℹ️

Process-wetted device components are listed in the "Mechanical construction" (→ 🖺 30 ff) and "Ordering information" (→ 🖺 52 ff) sections.

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnosis
- Expert level

Quick and safe commissioning

Guided menus for applications

Reliable operation

- Local operation possible in several languages
- Standardized operation at the device and in the operating tools

Efficient diagnostics increase measurement availability

- Remedial measures are integrated in plain text
- Diverse simulation options

Local operation

Function	External operation (operating keys, optional, not T17 housing)	Internal operation (electronic insert)	Display (optional)
Position adjustment (zero point correction)	✔	✔	✔
Setting lower-range value and upper-range value - reference pressure present at the device	✔ (HART only)	✔ (HART only)	✔
Device reset	✔	✔	✔
Locking and unlocking parameters relevant to the measured value	–	✔	✔
Value acceptance indicated by green LED	✔	✔	✔
Switching damping on and off	–	✔ (HART and PA only)	✔
Configuring bus address (PA)	–	✔	✔
Switching simulation mode on and off (FOUNDATION Fieldbus)	–	✔	✔

**Operating the device using onsite display (optional)**

A 4-line liquid crystal display (LCD) is used for display and operation. The onsite display shows measured values, dialog text as well as fault and notice messages in plain text, thereby supporting the user in every stage of operation. The device display can be turned in 90° steps.
Depending on the installation position of the device, this makes it easy to operate the device and read the measured value.

Functions:
- 8-digit measured value display incl. sign and decimal point, bar graph for
  - 4 to 20 mA HART as current display
  - PROFIBUS PA as graphic display of the standardized value of the AI block
  - FOUNDATION Fieldbus as graphic display of the transducer output
- Simple and complete menu guidance thanks to separation of the parameters into several levels and groups.
- Menu guidance in up to 8 languages
- Each parameter is given a 3-digit ID number for easy navigation.

- Option for configuring the display according to individual requirements and preferences, such as language, alternating display, display of other measured values such as sensor temperature, contrast setting.
- Comprehensive diagnostic functions (fault and warning message, peak-hold indicators, etc.).
- Rapid and safe commissioning with the Quick Setup menus.

Overview
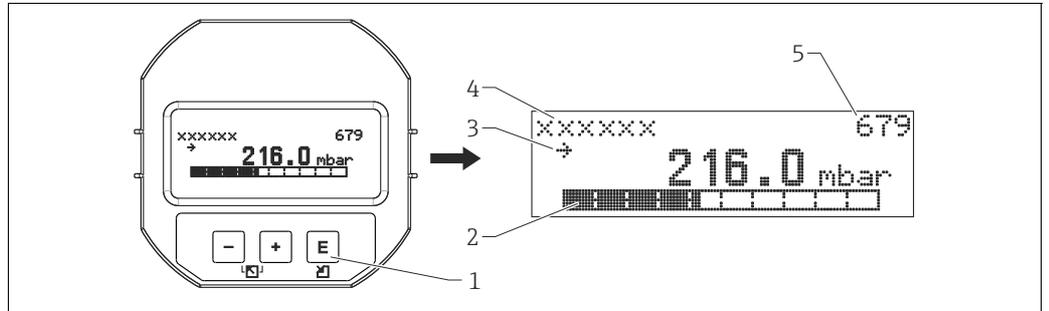
1   Operating keys
2   Bar graph
3   Symbol
4   Header line
5   Parameter identification number

Ordering information:
Feature 20

Operating keys on the exterior of the device

With the aluminum housing (T14 and T15), the operating keys are located either outside of the housing, under the protection cap or inside on the electronic insert. With the T17 housing (stainless steel), the operating keys are located inside the housing on the electronic insert.
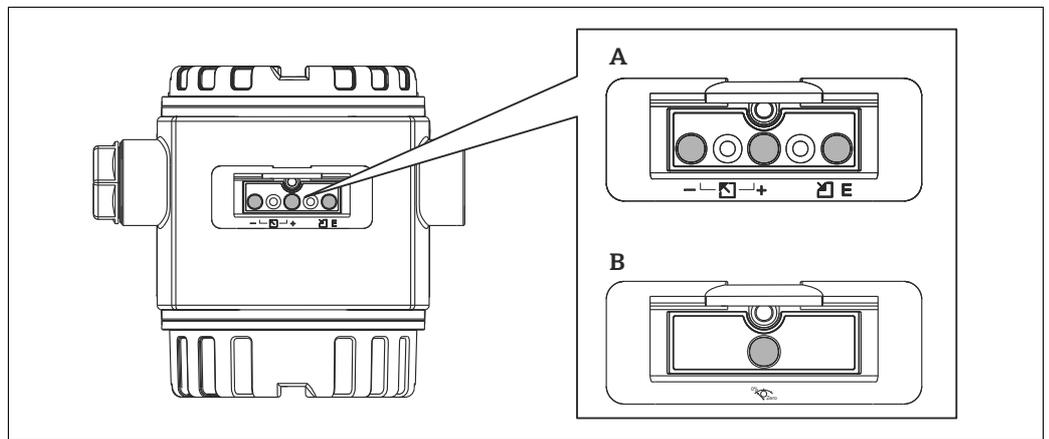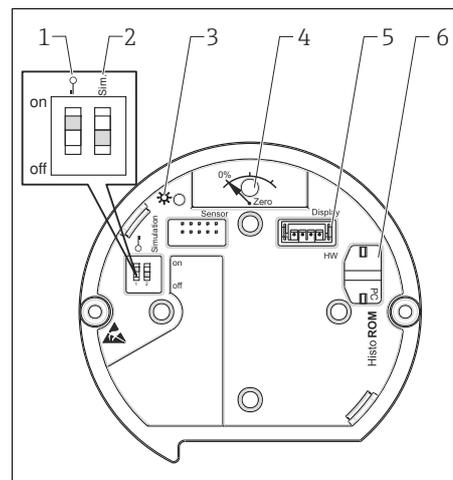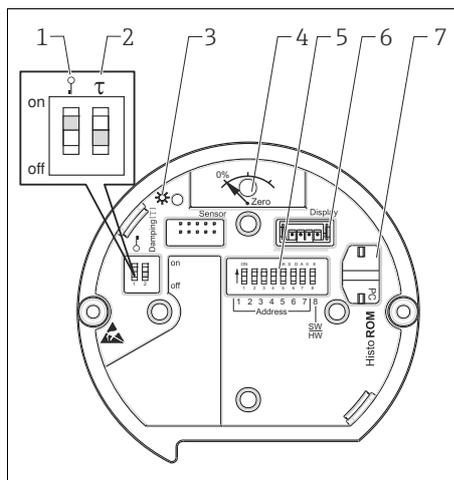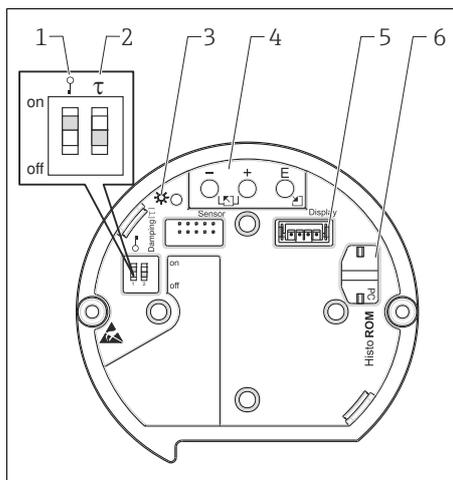

A   4 to 20 mA HART
B   PROFIBUS PA and FOUNDATION Fieldbus

The operating keys located externally on the device work on the Hall sensor principle. As a result, no additional openings are required in the device. This guarantees:
- Complete protection against environmental influences such as moisture and contamination.
- Simple operation without any tools.
- No wear.

Ordering information:
Feature 20

Operating keys and elements located internally on the electronic insert

A0020031

Electronic insert HART

1   *DIP-switch for locking/unlocking parameters relevant to the measured values*
2   *DIP-switch for damping on/off*
3   *Green LED to indicate value being accepted*
4   *Operating keys*
5   *Slot for optional display*
6   *Slot for optional HistoROM®/M-DAT*

A0020032

Electronic insert PROFIBUS PA

1   *DIP-switch for locking/unlocking parameters relevant to the measured values*
2   *DIP-switch for damping on/off*
3   *Green LED to indicate value being accepted*
4   *Key for position adjustment and device reset*
5   *DIP-switch for bus address*
6   *Slot for optional display*
7   *Slot for optional HistoROM®/M-DAT*

A0020033

Electronic insert FOUNDATION Fieldbus

1   *DIP-switch for locking/unlocking parameters relevant to the measured values*
2   *DIP-switch for simulation mode on/off*
3   *Green LED to indicate value being accepted*
4   *Key for position adjustment and device reset*
5   *Slot for optional display*
6   *Slot for optional HistoROM®/M-DAT*

Ordering information:
Feature 20

Remote operation

All software parameters are accessible depending on the position of the write protection switch on the device.

Hardware and software for remote operation	HART	PROFIBUS PA	FOUNDATION Fieldbus
FieldCare→ 🖹 46 ff	✔ [1]	✔ [2]	✔
FieldXpert SFX100 → 🖹 47 ff	✔	−	✔
NI-FBUS Configurator → 🖹 47 ff	−	−	✔
HistoROM®/M-DAT→ 🖹 48 ff	✔	✔	✔

[1]   Commubox FXA195 required → 🖹 47 ff

[2]   Profiboard or Proficard required → 🖹 47 ff

FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that support the FDT standard.

FieldCare supports the following functions:
• Configuration of transmitters in offline and online mode
• Loading and saving device data (upload/download)
• HistoROM®/M-DAT analysis
• Documentation of the measuring point

Connection options:
• HART via Commubox FXA195 and the USB port on a computer
• PROFIBUS PA via segment coupler and PROFIBUS interface card
• Service interface with Commubox FXA291 and ToF adapter FXA291 (USB).

For further information please contact your local Endress+Hauser Sales Center.

Field Xpert SFX100

Field Xpert is an industrial PDA with integrated 3.5" touchscreen from Endress+Hauser based on Windows Mobile. It offers wireless communication via the optional VIATOR Bluetooth modem or via WiFi and Endress+Hauser's Fieldgate FXA520. Field Xpert also works as a stand-alone device for asset management applications. For details, refer to BA00060S/04/EN.

Commubox FXA195

For intrinsically safe HART communication with FieldCare via the USB interface. For details refer to TI00404F/00/EN.

Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field devices with a CDI interface (=Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI00405C/07/EN.

For the following Endress+Hauser devices you need the "ToF adapter FXA291" as an additional accessory:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70

ToF adapter FXA291

The ToF adapter FXA291 connects the Commubox FXA291 with devices of the ToF platform, pressure equipment and Gammapilot via the USB interface of a personal computer or a notebook. For details refer to KA00271F.

Profiboard

For connecting a PC to PROFIBUS.

Proficard

For connecting a laptop to PROFIBUS

FF configuration program

FF configuration program, such as NI-FBUS Configurator, to
- connect devices with "FOUNDATION Fieldbus signal" into an FF network
- set FF-specific parameters

Remote operation via:
- Operation with NI-FBUS Configurator:
  The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, loops, and a schedule based on the fieldbus concepts.
  You can use the NI-FBUS Configurator to configure a fieldbus network as follows:
  – Set block and device tags
  – Set device addresses
  – Create and edit function block control strategies (function block applications)
  – Configure vendor-defined function and transducer blocks
  – Create and edit schedules
  – Read and write to function block control strategies (function block applications)
  – Invoke Device Description (DD) methods
  – Display DD menus
  – Download a configuration
  – Verify a configuration and compare it to a saved configuration
  – Monitor a downloaded configuration
  – Replace a virtual device by a real device
  – Save and print a configuration

HistoROM®/M-DAT (optional)

HistoROM®/M-DAT is a memory module which can be attached to every electronic insert. The HistoROM®/M-DAT can be retrofitted at any stage (order number: 52027785).

Your benefits

- Quick and safe commissioning of the same measuring points by copying the configuration data of one transmitter to another transmitter.
- Reliable process monitoring thanks to cyclical recording of pressure and sensor temperature measured values.
- Simple diagnosis by recording diverse events such as alarms, configuration changes, counters for measuring range undershoot and overshoot for pressure and temperature as well as user limit overshoot and undershoot for pressure and temperature etc.
- Analysis and graphic evaluation of the events and process parameters via software (contained in scope of supply).

A CD with an Endress+Hauser operating program is also included in the scope of delivery.
You can copy data from one transmitter to another transmitter when operating a FOUNDATION Fieldbus device via an FF configuration program. You need the Endress+Hauser FieldCare operating program and the Commubox FXA291 service interface and the ToF adapter FXA291 to be able to access the data and events saved in the HistoROM®/M-DAT.
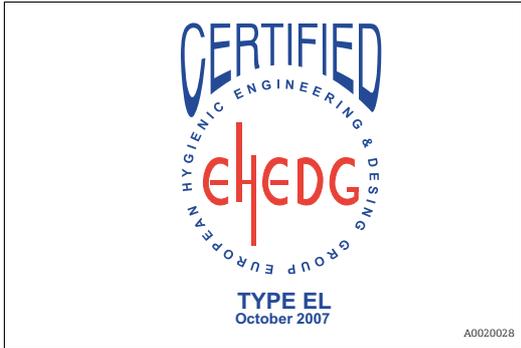
Ordering information:
Feature 100, version "N" or
as a separate accessory (part no.: 52027785).

For further information please contact your local Endress+Hauser Sales Center.

Certificates and approvals

CE mark

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

Ex approvals

- ATEX
- FM
- CSA
- NEPSI
- IECEx
- GOST on request
- TIIS

All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.
→ 🗎 56 ff, "Safety Instructions" and "Installation/ Control Drawings" sections.

Suitability for hygienic processes

The Deltapilot S is suitable for use in hygienic processes.
Overview of suitable process connections from → 🗎 30.
Many versions meet the requirements of 3A-Sanitary Standard No. 74 and are certified by the EHEDG. Suitable fittings and seals must be used to ensure hygiene-compliant design according to the specifications of 3A and EHEDG.

ℹ️

The gap-free connections can be cleaned without residue using the usual cleaning methods.

Functional safety SIL/ IEC 61508 Declaration of Conformity (optional)

The Deltapilot S devices with 4 to 20 mA output signal have been developed to 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 with Deltapilot S, settings and characteristic quantities for functional safety, please refer to the "Functional Safety Manual - Deltapilot S" SD00213P/00.

Ordering information:
Feature 100, version "1" and
Feature 110, version "E".

Overfill protection

WHG (see document ZE00266P).

Ordering information:
Feature 10, version "F".

CRN approvals

Some device versions have CRN approval. For a CRN-approved device, a CRN-approved process connection must be ordered with a CSA approval. These devices are fitted with a separate plate bearing the registration number CRN OF1987.7C.

Ordering information:
Process connection: Feature 70
CSA approval: Feature 10

Standards and guidelines	DIN EN 60770 (IEC 60770): Transmitters for use in industrial-process control systems Part 1: Methods for inspection and routine testing
	DIN 16086: Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications on data sheets
	EN 61326-X: EMC product family standard for electrical equipment for measurement, control and laboratory use.
Pressure Equipment Directive (PED)	The Deltapilot S device corresponds to Article 3 (3) of the EC directive 97/23/EC (Pressure Equipment Directive) and has been designed and manufactured according to good engineering practice.
Marine approval	GL (German Lloyd) Ordering information: Feature 100, version "S".
Drinking water approval	NSF 61 approval Ordering information: Feature 100, version "F".
Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ISA 12.27.01	Endress+Hauser devices are designed in accordance with ANSI/ISA 12.27.01. allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with the North American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids. Please refer to the following table for the seal class assigned (single seal or dual seal):

Device	Approval	Single seal MWP
FMB70	CSA C/ US IS	10 bar (150 psi)

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

Inspection certificate	

Designation	Order code	
	Feature	Version
EN10204-3.1 material (wetted) inspection certificate	100	B
EN10204-3.1 individual testing, inspection certificate	100 and 110	3
EN10204-3.1 pressure test, inspection certificate	100 and 110	4
EN10204-3.1 AD2000 pressure-bearing inspection certificate	100 and 110	5
EN10204-3.1 wetted material +Ra, Ra= surface roughness, dimension test, inspection certificate	100 and 110	6
EN10204-3.1 helium leak test, inspection certificate	100 and 110	7
EN10204-3.1 measurement Delta ferrite content, inspection certificate	100 and 110	8

Calibration

Designation	Order code	
	Feature	Version
Sensor range; %	50	A
Customer-specific; see additional specification	50	B
Factory calibration certificate, 5-point; see additional specification	50	C
DKD/DAkkS certificate; see additional specification	50	D
Customized pressure; see additional specification	50	E
Customized level; see additional specification	50	F
Customized pressure + 5-point factory calibration certificate; see additional specification	50	H
Customized level + 5-point factory calibration certificate; see additional specification	50	I
Platinum; see additional specification	50	K
Platinum + factory calibration certificate 5-point; see additional specification	50	L
Platinum + DKD/DAkkS certificate; see additional specification	50	M
Sensor range; mbar/bar	50	1
Sensor range; kPa/MPa	50	2
Sensor range; mmH2O/mH2O	50	3
Sensor range; inH2O/ftH2O	50	4
Sensor range; psi	50	6

Certificate of Compliance ASME BPE

Ordering information:
Feature 100 and 110, version "L".

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Products → Select Product → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

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

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

Configuration data sheet	**Pressure**

The following configuration data sheet must be completed and included with the order if the version "E" or "H" has been selected in feature 50 in the ordering information.

Pressure unit

❏ mbar	❏ mmH$_2$O	❏ mmHg	❏ Pascal	❏ torr
❏ bar	❏ mH$_2$O	❏ inHg	❏ hPa	
	❏ ftH$_2$O		❏ kPa	❏ g/cm^2
❏ psi	❏ inH$_2$O	❏ gf/cm^2	❏ MPa	❏ kg/cm^2
		❏ kgf/cm^2		
				❏ lb/ft^2
				❏ atm

Calibration range / Output

Lower range value (LRV):   _____   [Pressure unit]

Upper range value (URV):   _____   [Pressure unit]

Display

Display the contents of the main line [1]
- ❏ Primary value [PV] (default)
- ❏ Primary value [%]
- ❏ Pressure
- ❏ Current [mA] (HART only)
- ❏ Temperature
- ❏ Error number
- ❏ Alternating display

[1] Depending on sensor and communication variant

Damping

Damping   _____ sec (default 2 sec)

Smallest span (factory calibration)→ 📄 10

Level

The following configuration data sheet must be completed and included with the order if the version "F" or "T" has been selected in feature 50 in the ordering information.

Pressure unit					Output unit (scaled unit)				
					Mass	Lengths	Volume	Volume	Percent
❏ mbar	❏ mmH$_2$O	❏ mmHg	❏ Pascal	❏ torr	❏ kg	❏ m	❏ l	❏ USgal	❏ %
❏ bar	❏ mH$_2$O	❏ inHg	❏ hPa		❏ t	❏ dm	❏ hl	❏ impgal	
	❏ ftH$_2$O		❏ kPa	❏ g/cm^2	❏ lb	❏ cm		❏ USbblPETR	
❏ psi	❏ inH$_2$O	❏ gf/cm^2	❏ MPa	❏ kg/cm^2		❏ mm	❏ m^3		
		❏ kgf/cm^2					❏ ft^3		
				❏ lb/ft^2		❏ ft			
				❏ atm		❏ inch			

Example

Empty pressure [a]:
Low pressure value (empty) _____
[Pressure unit]

Empty calibration [a]:
Low level value (empty) _____
[Scaled unit]

Full pressure [b]:
High pressure value (full) _____
[Pressure unit]

Full calibration [b]:
High level value (full) _____
[Scaled unit]

A0020042

A   0 mbar / 0m
B   300 mbar (4.5psi) / 3 m (9.8 ft).

Display

Display the contents of the main line [1]
❏ Primary value [PV] (default)
❏ Primary value [%]
❏ Pressure
❏ Current [mA] (HART only)
❏ Temperature
❏ Level before lin.
❏ Tank content
❏ Error number
❏ Alternating display

[1] Depending on sensor and communication variant

Damping

Damping   _____ sec (default 2 sec)

Accessories

HistoROM®/M-DAT	HistoROM®/M-DAT is a memory module which can be attached to every electronic insert. Ordering information: Feature 100, version "N" or as a separate accessory (part no.: 52027785).
Wall and pipe-mounting	Endress+Hauser offers a mounting bracket for installing the device on pipes or walls. Ordering information: Feature 110, version "U" or as a separate accessory (part no.: 71102216). Dimensions → 🗎 39.
Welding flanges	For details refer to TI004426F/00/EN "Weld-in adapter and Flanges".
Welding neck for universal process adapter	For details refer to TI004426F/00/EN "Weld-in adapter and Flanges".
Welding neck for ISO G 1 ½ thread	For details refer to TI004426F/00/EN "Weld-in adapter and Flanges".

Adapter Uni

The following adapters can be used to create a connection between the customer's process connection and the Deltapilot S with a universal adapter:

A

Rd 52 x ⅙"
ø44 (1.73)

26.5 (1.04)
29.5 (1.16)
39.5 (1.56)
47.5 (1.87)

ø51.6 (2.03)
ø56 (2.2)
Rd 65 x 1
ø78 (3.07)

A0020037

Measuring unit mm (in)

B

Rd 52 x ⅙"
ø44 (1.73)

25.5 (1)
28.5 (1.12)
39.5 (1.56)
47.5 (1.87)

ø51.6 (2.03)
ø61 (2.4)
ø68 (2.68)
Rd 78 x 1
ø92 (3.62)

A0020038

Measuring unit mm (in)

C

Rd 52 x ⅙"
ø44 (1.73)

6 (0.24)
31.5 (1.24)
39.5 (1.56)

ø51.6 (2.03)
ø65 (2.56)
ø84 (3.31)
ø105 (4.13)

A0020039

Measuring unit mm (in)

D

Rd 52 x ⅙"
ø44 (1.73)

39.5 (1.56)

ø51.6 (2.03)
ø64 (2.52)

A0020040

Measuring unit mm (in)

E

Rd 52 x ⅙"
ø44 (1.73)

39.5 (1.56)

ø68 (2.68)
ø84 (3.31)

A0020041

Measuring unit mm (in)

Position	Designation	Material	Weight kg (lbs)	Order number	Order number with 3.1 inspection certificate
A	DIN11851 DN40		0.2 (0.44)	71114172	71114178
B	DIN11851 DN50		0.3 (0.66)	71114173	71114205
C	DRD DN50	AISI 316L (1.4435)	0.6 (1.32)	71114174	71114206
D	Clamp 2"		0.2 (0.44)	71114176	71114207
E	Varivent		0.5 (1.1)	71114177	71114208

Additional documentation

Field of Activities	Pressure measurement, powerful instruments for process pressure, differential pressure, level and flow: FA00004P/00/EN
Technical Information	• EMC test procedures: TI00241F/00/EN • Technical Information for Deltabar S: TI00382P/00/EN • Technical Information for Cerabar S: TI00383P/00/EN
Operating Instructions	4 to 20 mA HART: • Deltapilot S: BA00332P/00/EN • Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA00274P/00/EN PROFIBUS PA: • Deltapilot S: BA00356P/00/EN • Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA00296P/00/EN FOUNDATION Fieldbus: • Deltapilot S: BA00372P/00/EN • Description of device functions Cerabar S/Deltabar S/Deltapilot S: BA00303P/00/EN
Brief Operating Instructions	• 4 to 20 mA HART, Deltapilot S: KA01020P/00/EN • PROFIBUS PA, Deltapilot S: KA01023P/00/EN • FOUNDATION Fieldbus, Deltapilot S: KA01026P/00/EN
Functional safety manual (SIL)	Deltapilot S (4 to 20 mA): SD00213P/00/EN

Safety Instructions

Certificate/type of protection	Electronic insert	Documentation	Order code	
			Feature	**Version**
ATEX II 1/2 G Ex ia IIC T6	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00283P	10	1
ATEX II 1/2 G Ex ia IIC T6, WHG	– 4 to 20 mA HART	– XA00283P and ZE00266P		6
ATEX II 1/2 D	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00284P		2
ATEX II 1/3 D	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00285P		4
ATEX II 1 GD Ex ia IIC T6	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00287P		8
ATEX II 1/2 GD Ex ia IIC T6	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00286P		3
ATEX II 3 G Ex nA II T6	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00288P		7
ATEX II Ex ia + FM IS + CSA IS ATEX II 1/2G Ex ia IIC T6+ FM/CSA IS CL.I,II,III Div.1 Gr.A-G	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00252P		E

Certificate/type of protection	Electronic insert	Documentation	Order code	
			Feature	Version
IECEx Zone 0/1 Ex ia IIC T6	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XB00010P	10	I

Certificate/type of protection	Electronic insert	Documentation	Order code	
			Feature	Version
NEPSI Ex ia IIC T4/T6	– 4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	– XA00435P	10	H

Certificate/type of protection	Electronic insert	Order code	
		Feature	Version
TIIS Ex ia IIC T4	4 to 20 mA HART	10	K

Installation/ Control Drawings

Certificate/type of protection	Electronic insert	Documentation	Order code	
			Feature	Version
FM DIP Cl.II,III Div.1 Gr.E-G, Zone 21,22	–	–		Q
FM NI Cl.I Div.2 Gr.A-D, Zone 2	–	– XA01065P		R
FM IS Class I, II, III, Division 1, Groups A – G; NI, Class I Division 2, Groups A – D; AEx ia	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD00214P – ZD00216P	10	S
CSA IS Class I, II, III, Division 1, Groups A – G; Class I Division 2, Groups A – G	– 4 to 20 mA HART – PROFIBUS PA, FOUNDATION Fieldbus	– ZD00215P – ZD00217P		U
CSA C/US Cl.II, III Div.1 Gr.E-G	–	–		W

Overfill protection   WHG: ZE00266P/00/DE

Registered trademarks

HART®	Registered trademark of the HART Communication Foundation, Austin, USA
PROFIBUS®	Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany
FOUNDATION™ Fieldbus	Registered trademark of Fieldbus Foundation, Austin, Texas, USA

Patents

This product is protected by at least one of the patents listed below.
Additional patents are under development.

US patents	EP patents	DE patents
US 6,427,129 B1	EP 0 892 249 B1	DE 203 13 744.2 U1
US 6,703,943 A1		

71229042

www.addresses.endress.com

Endress+Hauser

People for Process Automation