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Technical Information
Deltapilot S FMB70

Hydrostatic level measurement





Pressure sensor with CONTITE™ measuring cell
Condensate-resistant

Applications

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

Your benefits

- Very good reproducibility and long-term stability
- Maximum plant safety provided by one-of-a-kind, condensate-resistant CONTITE measuring cell
- High reference accuracy up to 0.075 %
- Used for process level and pressure monitoring up to SIL3, certified according to IEC 61508 by TÜV SÜD
- High level of safety during operation thanks to function monitoring from the measuring cell to the electronics
- Electronics easily replaced using HistoROM®/M-DAT
- For use in drinking water

Endress+Hauser
People for Process Automation

Table of contents

About this document 4
Document function 4
Symbols used 4
Documentation 5
List of abbreviations 5
Turn down calculation 6
Registered trademarks 6

Function and system design 7
Device selection 7
Measuring principle 8
Communication protocol 10

Input 11
Measured variable 11
Measuring range 11

Output 12
Output signal 12
Signal range 12
Failure signal 12
Load 12
Dead time, time constant 13
Dynamic behavior, current output 13
Dynamic behavior, digital output (HART electronics) 13
Dynamic behavior PROFIBUS PA 14
Dynamic behavior FOUNDATION Fieldbus 14
Damping 15
Alarm current 15
Firmware version 15
Protocol-specific data, HART 15
Protocol-specific data, PROFIBUS PA 16
Protocol-specific data, FOUNDATION Fieldbus 16

Power supply 19
Terminal assignment 19
Supply voltage 20
Current consumption 20
Electrical connection 20
Terminals 21
Cable entries 21
Device plug 21
Cable specification 22
Start current 22
Residual ripple 22
Overvoltage protection 22
Influence of power supply 23

Performance characteristics of metal process membrane 24
Reference operating conditions 24
Influence of the installation position 24
Resolution 24
Reference accuracy 24
Thermal change of the zero output and the output span . . . 24
Total performance 25
Long-term stability 25
Total error 25
Warm-up time 25

Installation 26
General installation instructions 26
Measuring arrangement 26
Orientation 26
Wall and pipe mounting 26
"Separate housing" version 27
Turning the housing 28

Environment 29
Ambient temperature range 29
Storage temperature range 29
Degree of protection 29
Climate class 29
Electromagnetic compatibility 29
Vibration resistance 29
Oxygen applications 29
PWIS-free applications 30
Hydrogen applications 30

Process 31
Process temperature limits 31
Pressure specifications 31

Mechanical construction 32
Device height 32
T14 housing, optional display on the side 33
T15 housing, optional display on the top 34
T17 housing (hygienic), optional display on the side 34
Explanation of terms 34
Process connections 35
Process connections 36
Hygienic connections 39
Separate housing: Wall and pipe mounting with mounting bracket 43
Materials not in contact with process 44
Weight 46
Materials in contact with process 46
Fill fluid 47

Operability 48
Operating concept 48
Local operation 48
Remote operation 51
HistoROM®/M-DAT (optional) 52
System integration 53

Certificates and approvals 54
CE approval 54
RCM-tick symbol 54
Ex approvals 54
EAC conformity 54
Suitable for hygiene applications 54
Certificate of current Good Manufacturing Practices (cGMP) 54

Functional safety SIL/ IEC 61508 Declaration of Conformity (optional) 54
Overspill protection 54
CRN approval 54
Other standards and guidelines 55
Pressure Equipment Directive 2014/68/EU (PED) 55
Manufacturer declarations 55
Marine approval 55
Drinking water approval 55
Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ISA 12.27.01 56
Inspection certificate 56
Calibration 56
Service 57
Certificate of Compliance ASME BPE 2012 57

Ordering information 58
Special device versions 58
Scope of delivery 58
Measuring point (TAG) 58
Configuration data sheet 59

Accessories 61
HistoROM®/M-DAT 61
Welding flanges and weld-in adapters 61
Adapter Uni 61
Additional mechanical accessories 61
Service-specific accessories 61

Supplementary documentation 62
Field of Activities 62
Technical Information 62
Special Documentation 62
Operating Instructions 62
Brief Operating Instructions 62
Functional safety manual (SIL) 62
Overfill prevention 62
Safety Instructions (XA) 62
Installation/Control Drawings 63

About this document

Document function

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.

Symbols used

Safety symbols

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation may result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation may result in minor or moderate injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other circumstances that do not result in personal injury.

Electrical symbols

Symbol	Meaning	Symbol	Meaning
	**Protective ground connection** A terminal that must be connected to ground prior to establishing any other connections.		**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

Symbols for certain types of Information

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

Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1. , 2. , 3. ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections

Documentation

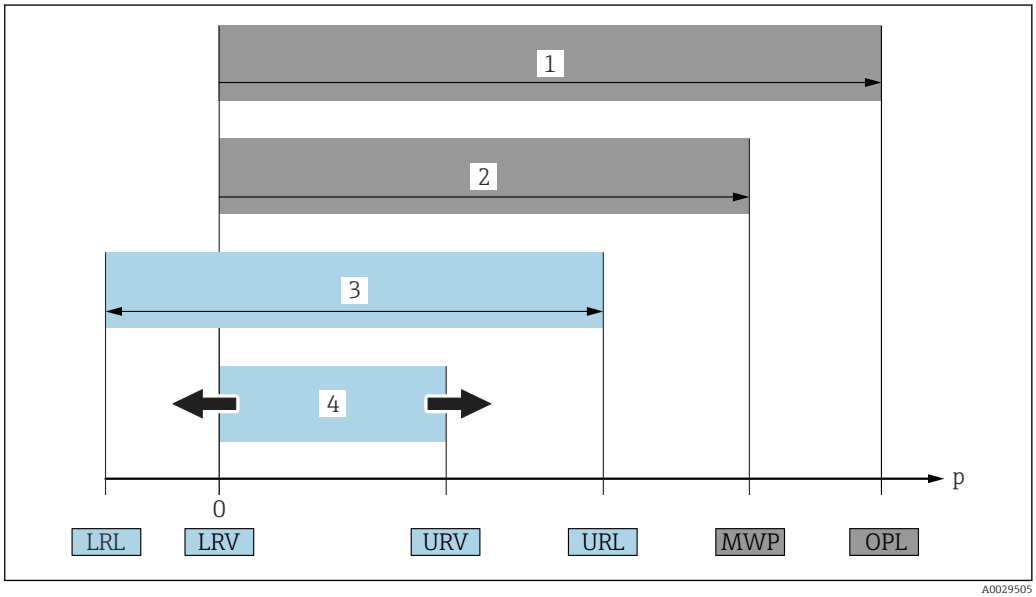
See the "Supplementary documentation" section → 62

The document types listed are available:
In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Safety Instructions (XA)

See the "Safety instructions" section → 62

List of abbreviations



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

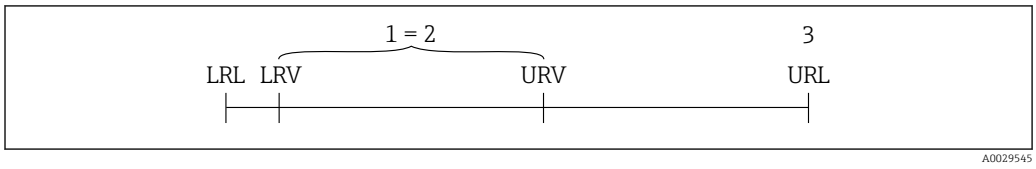
2 MWP: The MWP (maximum working pressure) for the measuring cells depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection also has to be taken into consideration besides the measuring cell. Pay attention to the pressure/temperature dependency. The maximum working pressure may be applied to 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 lower range limit and upper range limit. This measuring range is equivalent to the maximum measuring span that can be calibrated/adjusted.

4 The calibrated/adjusted measuring span corresponds to the span between the lower range limit and upper range limit. Factory setting: 0 to upper range limit. Other calibrated spans can be ordered as customized measuring spans.

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

Turn down calculation



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

Example:
- Measuring cell: 10 bar (150 psi)
- Upper range limit (URL) = 10 bar (150 psi)
- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)

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

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

Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, USA

PROFIBUS®

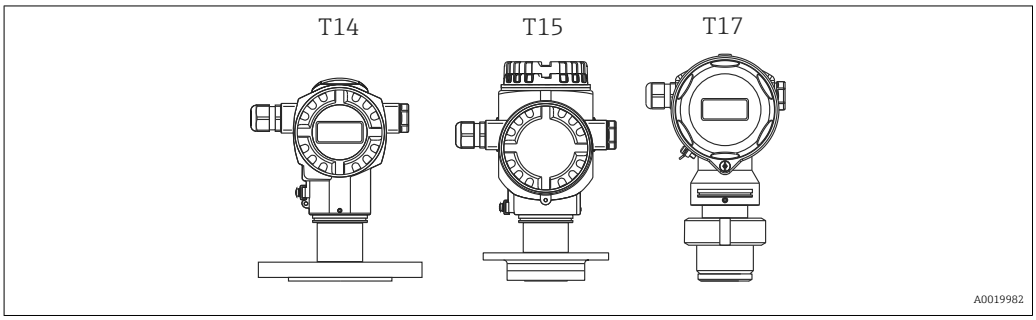
Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

FOUNDATION™Fieldbus

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

Function and system design

Device selection



Field of application

- Level measurement
- Pressure measurement

Industries

Food, pharmaceutical, environment (fresh water and wastewater), chemical

Process connections

- Thread
- Flanges
- 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 −1 000 to +10 000 mbar (−15 to +150 psi)

OPL

max. 40 bar (600 psi)

Process temperature range(temperature at process connection)

−10 to +100 °C (+14 to +212 °F); +135 °C (275 °F) for maximum 30 minutes

Ambient temperature range

- Without LCD display: −40 to +85 °C (−40 to +185 °F) lower temperatures on request
- With LCD display: −20 to +70 °C (−4 to +158 °F)
  (extended temperature application range−40 to +85 °C (−40 to +185 °F) with limitations in optical properties, such as display speed and contrast)
- Separate housing:−20 to +60 °C (−4 to +140 °F)

Reference accuracy

±0.1 % of the set span (0.075 % platinum)

Supply voltage

Supply voltage non-Ex
- 4 to 20 mA HART: 10.5 to 45 V DC
- PROFIBUS PA and FOUNDATION Fieldbus: 9 to 32 V DC

Supply voltage Ex ia
10.5 to 30 V DC

Output

4 to 20 mA with superimposed HART protocol, PROFIBUS PA or FOUNDATION Fieldbus

Options

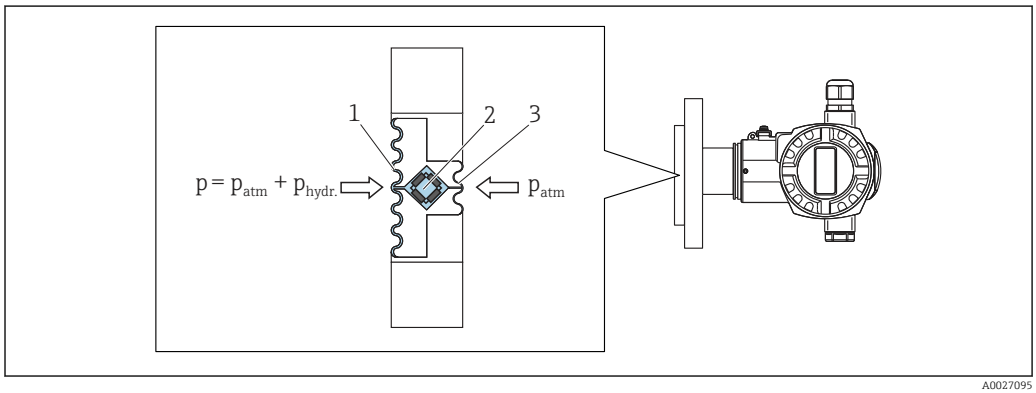
- Gold/rhodium-coated process isolating diaphragm
- Inspection certificate 3.1
- 3A and EHEDG approval
- HistoROM®/M-DAT memory chip
- Separate housing

Specialties

- Absolute resistance 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

CONTITE™ measuring cell



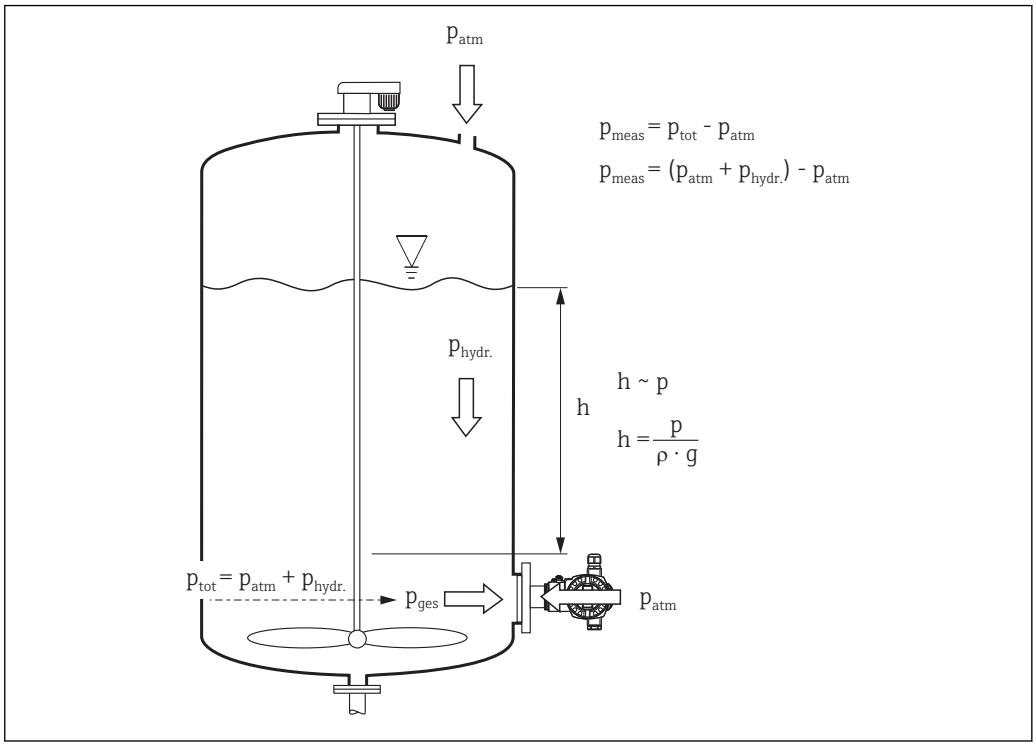
1 Process isolating diaphragm
2 Measuring element
3 Rear isolating membrane of the CONTITE™ measuring cell
P_{atm} *Atmospheric pressure*
$P_{hydr.}$ *Hydrostatic pressure*

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).

Advantages:
- 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 containers with a conical outlet.

Product design

Hydrostatic level measurement

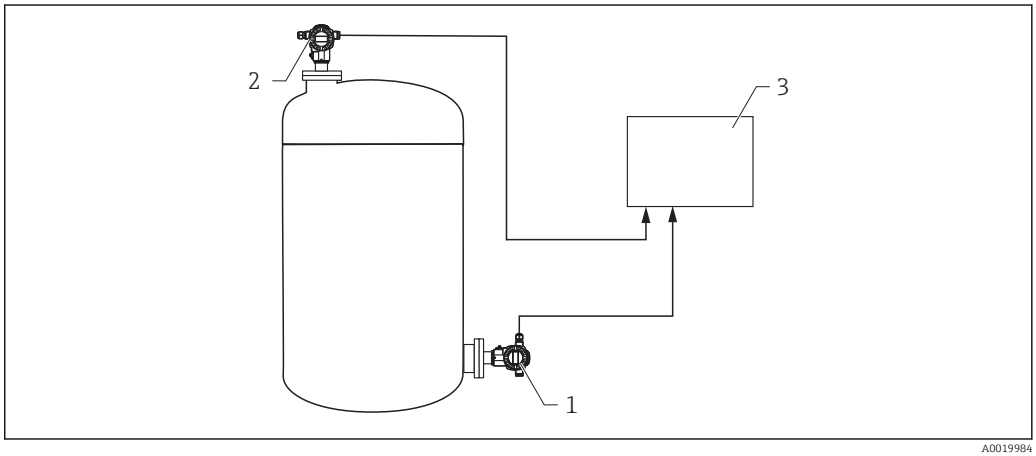


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g *Gravitational acceleration*
h *Level height*
P_{tot} *Total pressure = hydrostatic pressure + atmospheric pressure*
P_{atm} *Atmospheric pressure*
$P_{hydr.}$ *Hydrostatic pressure*
P_{meas} *Measured pressure in the measuring cell = hydrostatic pressure*
ρ *Density of the medium*

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.



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

NOTICE

Measured errors may occur

Large measured errors can occur if the ratio of the level to the top pressure is >1:6. This does not affect reproducibility.

- ► When selecting the Deltapilot S, make sure you choose sufficiently large measuring ranges (see the following example).
- ► Specific applications can be simulated with the Endress + Hauser Applicator (https://portal.endress.com/webapp/applicator10).

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 1 200 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 (0 to 6 psi)

NOTICE

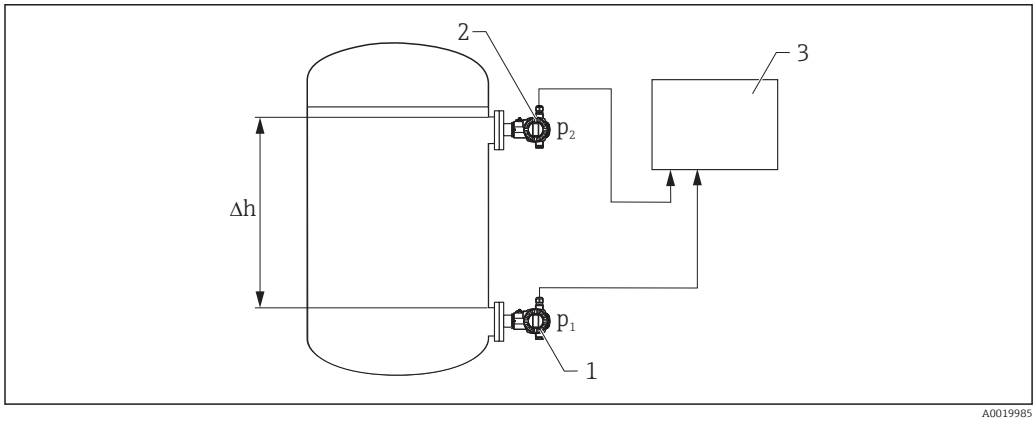
Possibility of probe 2 flooding during differential pressure measurement.

Measured errors can occur.

- ► When installing, make sure that probe 2 cannot be flooded.

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.



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
  - Endress+Hauser devices meet the requirements specified by the FISCO model.
  - Due to a 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 devices for Ex ia, CSA IS and FM IS applications or up to 27 devices for all other applications e.g. in non-hazardous areas, Ex nA etc. Further information on PROFIBUS PA can be found in Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and in the PNO Guideline.
- FOUNDATION Fieldbus
  - Endress+Hauser devices meet the requirements specified by the FISCO model.
  - Due to a 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 devices for Ex ia, CSA IS and FM IS applications or up to 24 devices 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

Measured process variables

Pressure

Measuring range

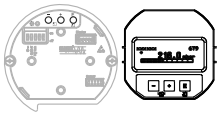
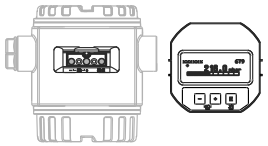
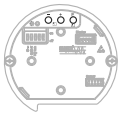
Sensor	Maximum sensor measuring range		Lowest calibratable span	MWP	OPL	Vacuum resistance [1]	Option [2]
	lower (LRL)	upper (URL)				Synthetic oil/ Inert oil	
	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar_{abs} (psi_{abs})]	
100 mbar (1.5 psi)	−0.1 (-1.5)	+0.1 (+1.5)	0.025 (0.375)	2.7 (40.5)	4 (60)	0.01/0.04 (0.15/0.6)	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)		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) Product Configurator, order code for "Sensor range; sensor over pressure limit"

Output

Output signal

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

Output	Internal + LCD	External + LCD	Internal
	   A0021280		
	Option [1]		
4 to 20mA HART	B	A	C
4 to 20mA HART, Li=0	E	D	F
PROFIBUS PA	N	M	O
FOUNDATION Fieldbus	Q	P	R

1) Product Configurator, order code for "Display, operation: "

Signal range

4 to 20 mA

3.8 mA to 20.5 mA

Failure signal

4 to 20 mA HART

As per NAMUR NE 43.

- 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

As per NAMUR NE 43.

Can be set in the Analog Input Block.

Options:
- Last Valid Out Value (factory setting)
- Fail Safe Value
- Status bad

FOUNDATION Fieldbus

As per NAMUR NE 43.

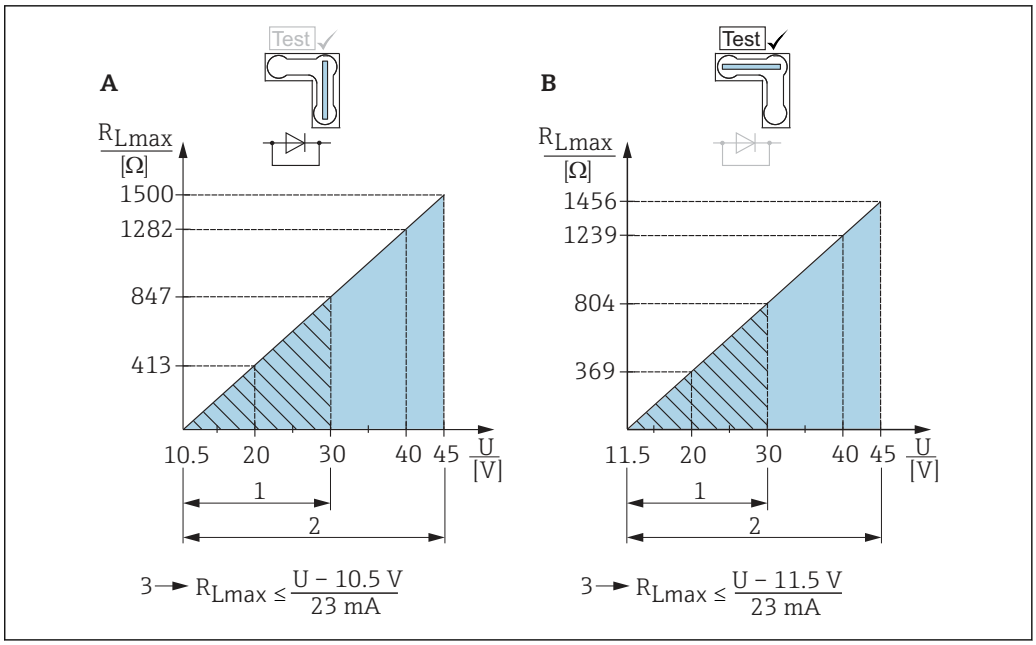
Can be set in the Analog Input Block.

Options:
- Last Good Value
- Fail Safe Value (factory setting)
- Wrong Value

Load

4 to 20 mA HART

In order to guarantee sufficient terminal voltage in two-wire devices, a maximum load resistance R (including line resistance) must not be exceeded depending on the supply voltage U_0 of the supply unit. In the following load diagrams, observe the position of the jumper and the explosion protection:



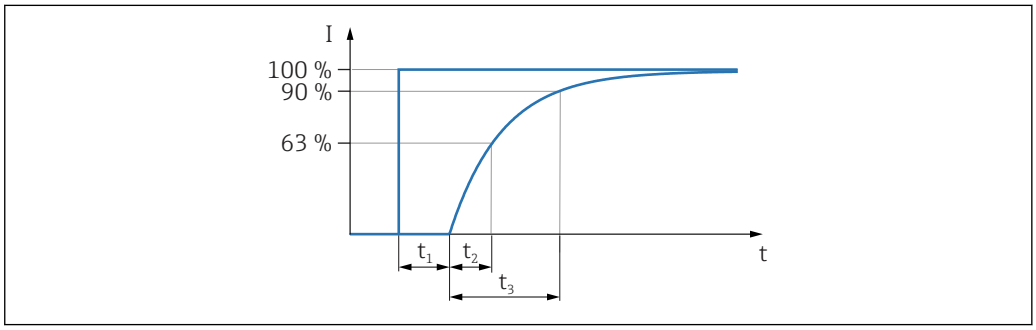
A0019988

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 and 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 be taken into account.

Dead time, time constant

Presentation of the dead time and the time constant:



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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, digital output (HART electronics)

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

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

Read cycle

- Acyclic: max. 3/s, typically 1/s (depends 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]	Dead time (t_1) [ms] + Time constant T63 (t_2) [ms]	Dead time (t_1) [ms] + Time constant T90 (t_3) [ms]
Min.	75	105	105
Max.	1275	1305	1305

Read cycle (PLC)

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

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 measured value can be determined up to five times a second.

Response time

- Acyclic: approx. 60 ms to 70 ms (depending on Min. Slave Interval)
- Cyclic: approx. 10 ms to 13 ms (depending on 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]	Dead time (t_1) [ms] + Time constant T63 (t_2) [ms]	Dead time (t_1) [ms] + Time constant T90 (t_3) [ms]
Min.	85	115	115
Max.	1085	1115	1115

Read cycle

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

Cycle time (update time)

Cyclic: min. 100 ms

Response time

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

Damping

A damping affects all outputs (output signal, display):
- Via local display, handheld terminal or PC with operating program, continuously from 0 to 999 s
- Also 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	Option [1]
Min alarm current	J
HART burst mode PV	J
Min alarm current + HART burst mode PV	J

1) Product Configurator, order code for "Additional options 1" and "Additional options 2"

Firmware version

Designation	Option [1]
02.20.zz, HART 7, DevRev22	72
02.11.zz, HART 5, DevRev21	73
04.00.zz, FF, DevRev07	74
04.01.zz, PROFIBUS PA, DevRev03	75
02.10.zz, HART 5, DevRev21	76
03.00.zz, FF, DevRev06	77
04.00.zz, PROFIBUS PA	78
02.30.zz, HART 7	71

1) Product Configurator, order code for "Firmware version"

Protocol-specific data, HART

Manufacturer ID	17 (11 hex)
Device type ID	26 (1A hex)
Device revision	▪ 21 (15 hex) - SW version 02.1y.zz - HART specification 5 ▪ 22 (16 hex) - SW version 02.2y.zz - HART specification 7
HART specification	▪ 5 ▪ 7
DD revision	▪ 4 (Russian in language selection) for device revision 21 ▪ 3 (Dutch in language selection) for device revision 21 ▪ 1 for device revision 22
Device description files (DTM, DD)	Information and files at: ▪ www.endress.com ▪ www.fieldcommgroup.org/registered-products
HART load	Min. 250 Ω
HART device variables	The measured values are assigned to the device variables as follows: **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 measuring modes

Protocol-specific data, PROFIBUS PA

Manufacturer ID	17 (11 hex)
Identification 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) Compatibility with 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 at: ▪ www.endress.com ▪ www.profibus.org
DD files	
Output values	**Measured values for PV (via Analog Input Function Block)** ▪ Pressure ▪ Level ▪ Tank content **Measured value for SV** ▪ Pressure ▪ Temperature
Input values	Input value sent from PLC, can be shown on display

Supported functions	▪ Identification & maintenance, simplest device identification on the control system and nameplate
	▪ Condensed status (only with Profile Version 3.02)
	▪ Automatic ID number adjustment and switchable to the following ID numbers (only with Profile Version 3.02):
	  ▪ 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.

Protocol-specific data, FOUNDATION Fieldbus

Manufacturer ID	452B48 hex
Device type	100B 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 at: ▪ www.endress.com ▪ www.fieldcommgroup.org/registered-products
CFF files	
Device tester version (ITK version)	▪ 5.0 (device revision 6) ▪ 6.01 (device revision 7)
Number of ITK test campaign	▪ IT054800 (device revision 6) ▪ IT085600 (device revision 7)
Link Master (LAS) capability	Yes
Choice of "Link Master" and "Basic Device"	Yes; factory setting: Basic Device
Node address	Factory setting: 247 (F7 hex)

Supported functions	Field diagnostics profile (only with FF912) The following methods are supported: ▪ Restart ▪ Configure error as warning or alarm ▪ HistoROM ▪ Peakhold ▪ Alarm info ▪ Sensor trim
Number of VCRs	▪ 44 (device revision 6) ▪ 24 (device revision 7)
Number of link objects in VFD	50

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	Contents	Output values
TRD1 Block	Contains all parameters related to the measurement	Process temperature (channel 2)
Service Block	Contains service information	▪ Pressure after damping (channel 3) ▪ Pressure drag pointer (channel 4) ▪ Counter for max. pressure transgressions (channel 5)
Diagnostic block	Contains diagnostic information	Diagnostic number via DI channels (channel 0 to 16)
Display block	Contains parameters to configure the on-site display	No output values

Function blocks

Block	Contents	Quantity Blocks	Execution time		Functionality	
			Device Revision 6	Device Revision 7	Device Revision 6	Device Revision 7
Resource Block	The Resource Block contains all the data that uniquely identify the device. It is an electronic version of a nameplate of the device.	1			Extended	Extended
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 (without trend and alarm reports)	Extended	Extended
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	Extended
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	Extended
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	Extended
Arithmetic Block	This block is designed to enable the simple use of common mathematical functions in measuring technology. 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	Extended
Input Selector Block	This block facilitates the selection of up to four inputs and generates an output value based on the configured action. This block normally receives its inputs from AI Blocks. The block enables the selection of maximum, minimum, average and 'first good' values. Inputs IN1 to IN4 can be shown on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_CONTENT).	1	35 ms	35 ms	Standard	Extended
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	Extended
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	Extended
Analog Alarm Block	This block contains all process alarm conditions (working like a comparator) and presents them at the output.	1	35 ms	35 ms	Standard	Extended

Additional function block information:

Instantiable function blocks	Yes	Yes
Number of additional instantiable function blocks	11	5

Power supply

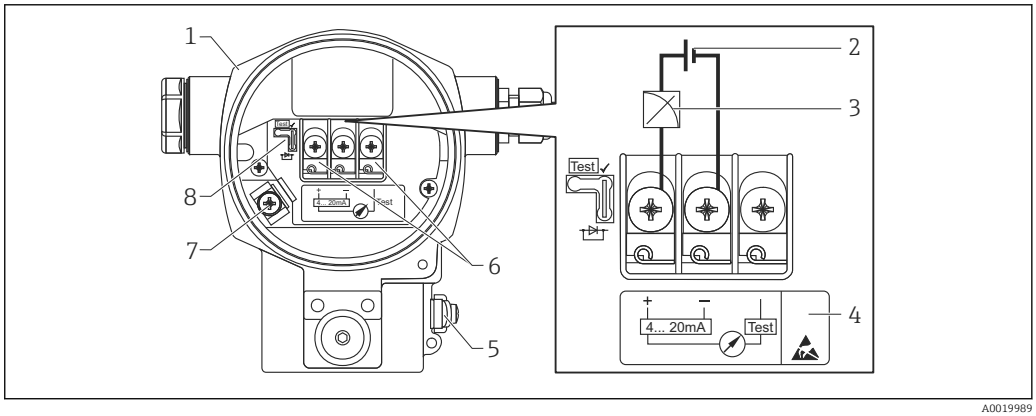
⚠ WARNING

Reduced electrical safety due to incorrect connection!

- When using the measuring instrument in hazardous areas, installation must also comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings → 62.
- All explosion protection data are provided in separate Ex documentation, which is available on request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas → 62.
- Devices with integrated overvoltage protection must be grounded → 22.
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

Terminal assignment

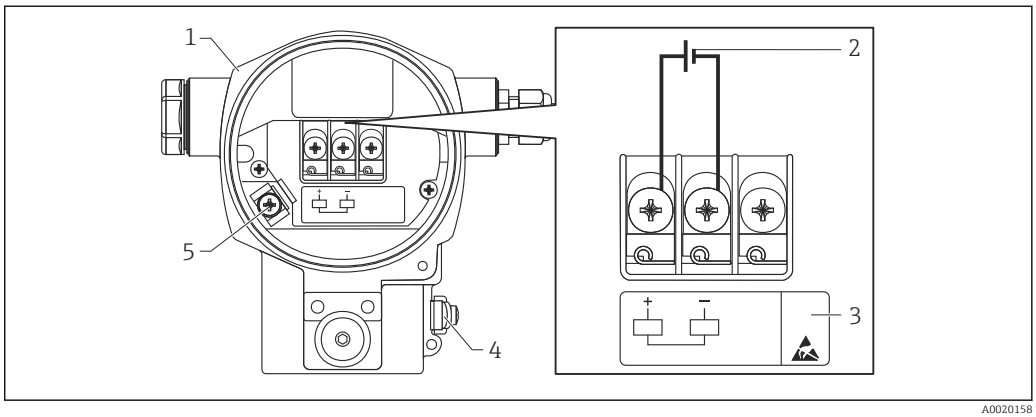
4 to 20 mA HART



A0019989

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 → 20*

PROFIBUS PA and FOUNDATION Fieldbus



A0020158

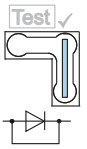
1 *Housing*
2 *Supply voltage*
3 *Devices with integrated overvoltage protection are labeled "OVP" (overvoltage protection) here.*
4 *External ground terminal*
5 *Internal ground terminal*

Supply voltage

4 to 20 mA HART

Electronic version	Jumper for 4 to 20 mA test signal in "Test" position (delivery status)	Jumper for 4 to 20 mA test signal in "Non-test" position
Version for non-hazardous area	11.5 to 45 V DC	10.5 to 45 V DC
Intrinsically safe	11.5 to 30 V DC	10.5 to 30 V DC
▪ Other types of protection ▪ Devices without a certificate	11.5 to 45 V DC (Versions with 35 V DC plug-in connection)	10.5 to 45 V DC (Versions with 35 V DC plug-in connection)

Measuring a 4 to 20 mA test signal

Jumper position for test signal	Description
 A0019992	▪ Measurement of 4 to 20 mA test signal via the positive and test terminal: possible. (Thus, the output current can be measured without interruption via the diode.) ▪ As-delivered state ▪ Minimum supply voltage: 11.5 V DC
 A0019993	▪ Measurement of 4 to 20 mA test signal via the 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:
  - Installation in bus system according to FISCO model: Ui=17.5 V DC
  - Point-to-point installation: Ui = 24 V DC

FOUNDATION Fieldbus

- Version for non-hazardous areas: 9 to 32 V DC
- Ex ia:
  - Installation in bus system according to FISCO model: Ui=17.5 V DC
  - Point-to-point installation: Ui = 24 V DC

Current consumption

- PROFIBUS PA: 13 mA ±1 mA, switch-on current corresponds to IEC 61158-2, Clause 21
- FOUNDATION Fieldbus: 15.5 mA ±1 mA, switch-on current corresponds to IEC 61158-2, Clause 21

Electrical connection

PROFIBUS PA

The digital communication signal is transmitted to the bus via a twin-core connecting cable. The bus line 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 the PNO Guideline.

FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a twin-core connecting cable. 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

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

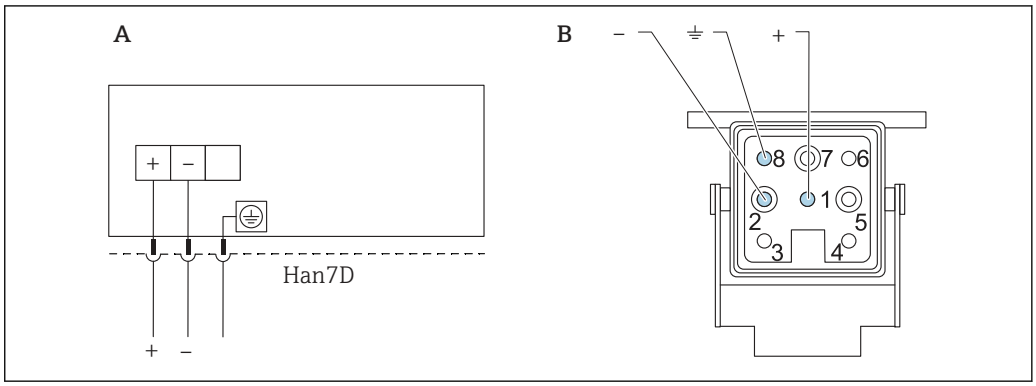
Cable entries

Approval	Cable gland	Clamping range
Standard, II 1/2 G Ex ia, IS	Plastic M20x1.5	5 to 10 mm (0.2 to 0.39 in)
ATEX II 1/2 D, II 1/3 D, II 1/2 GD Ex ia, II 1 GD Ex ia, II 3 G 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 → 33

Device plug

Connection of devices with Harting plug Han7D

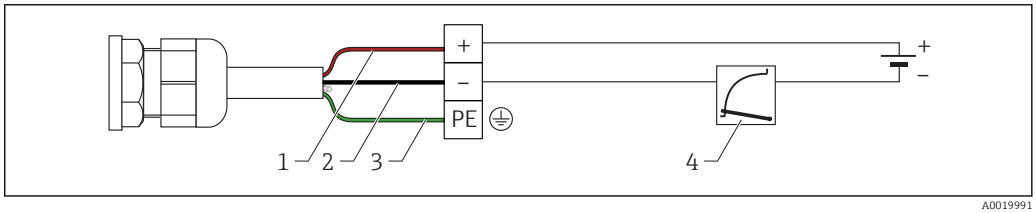


A0019990

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

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

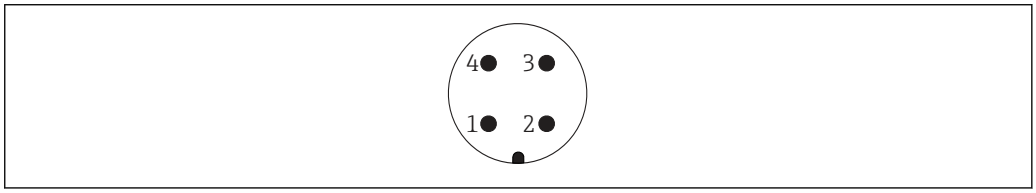
Connection of cable version



A0019991

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

Connection of devices with M12 plug



A0011175

1 Signal +
2 Not used
3 Signal –
4 Ground

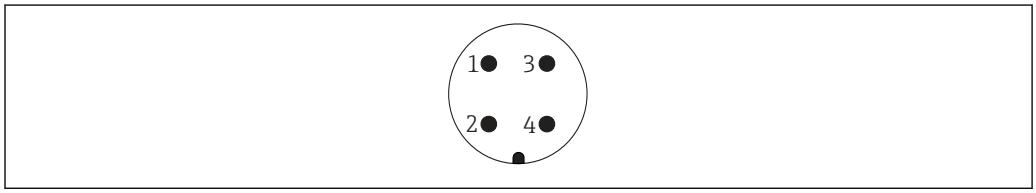
Endress+Hauser offers the following accessories for devices with an M12 plug:

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 elbowed socket, 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

Connection of devices with 7/8" plug



A0011176

1 Signal -
2 Signal +
3 Shielding
4 Not used

External thread: 7/8 - 16 UNC
- Material: 316L (1.4401)
- 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 entry used → 📄 21

PROFIBUS PA

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

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.

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

Start current

12 mA

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

- 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: Product Configurator, order code for "Additional options 1" or "Additional options 2", option "M"

NOTICE

Device could be destroyed!

- Devices with integrated overvoltage protection must be grounded.

Influence of power supply ≤0.0006 % of upper range limit/1 V

Performance characteristics of metal process membrane

Reference operating conditions

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

Influence of the installation position

Maximum: ±2.3 mbar (0.0345 psi).

The value is doubled for devices with inert oil.

A position-dependent zero shift can be corrected .

Resolution

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

Reference accuracy

The reference accuracy contains the non-linearity [DIN EN 61298-2 3.11] including the pressure hysteresis [DIN EN 61298-23.13] and non-repeatability [DIN EN 61298-2 3.11] in accordance with the limit point method as per [DIN EN 60770]. The specifications refer to the calibrated measuring 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
1.2 bar (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
4 bar (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
10 bar (150 psi)	▪ TD 1:1 to TD 2.5:1 = ±0.1 ▪ TD > 2.5:1 to TD 40:1 = ±0.04 x TD	▪ TD 1:1 to TD 2.5:1 = ±0.075 ▪ TD > 2.5:1 to TD 40:1 = ±0.03 x TD

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)
1.2 bar (18 psi), 4 bar (60 psi), 10 bar (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.

Total performance

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change of 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
1.2 bar (18 psi), 4 bar (60 psi), 10 bar (150 psi)	±0.15	±0.12

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), 1.2 bar (18 psi)	±0.1	±0.25
4 bar (60 psi), 10 bar (150 psi)	±0.05	±0.125

Total error

The total error comprises the total performance and long-term stability.

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
1.2 bar (18 psi)	±0.25	±0.22
4 bar (60 psi), 10 bar (150 psi)	±0.20	±0.17

Warm-up time

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

Installation

General installation instructions

- A position-dependent zero point shift can be corrected directly at the device via operating keys, and also in hazardous areas in the case of devices with external operation.
- The device housing can be rotated up to 380° .
- When measuring in media containing solids, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.
- Point the cable and plug downwards where possible to prevent moisture from entering (e.g., rain or condensation water).

Measuring arrangement

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 outlet
  - Or at a point in the tank which could be affected by pressure pulses from the agitator.
- The calibration and functional test can be carried out more easily if you mount the device downstream from a shutoff device.
- The Deltapilot S must also be insulated in the case of media that 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 steam

Use siphons for pressure measurement in steam. The siphon reduces the temperature to almost ambient temperature. Fill the siphon with liquid before commissioning. Preferably mount the Deltapilot S with the siphon below the tapping point.

Advantages:
- defined water column only causes minimal/negligible measured errors
- only minimal/negligible thermal effects on the device

Mounting above the tapping point is also possible. Observe the max. permitted ambient temperature of the transmitter!

Pressure measurement in liquids

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

Orientation

The orientation may cause a zero point shift, see → 24.

This position-dependent zero point shift can be corrected directly at the device via the operating key, and also in hazardous areas in the case of devices with external operation (position adjustment).

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:
- Product Configurator, order code for "Additional options 2", option "U" or Product Configurator, order code for "Accessory enclosed", option "PA" or
- as a separate accessory (part no.: 71102216).

Dimensions → 43.

"Separate housing" version

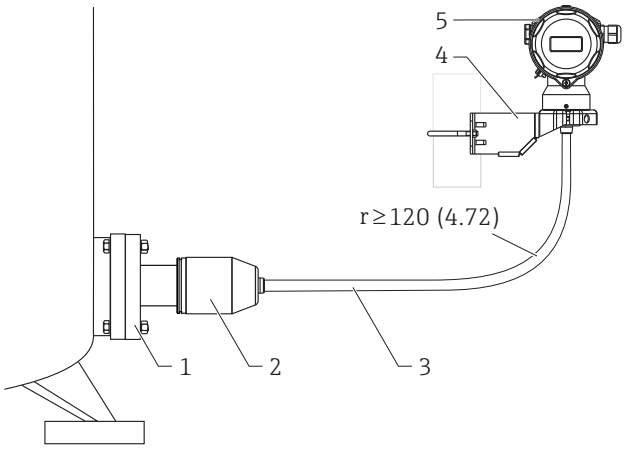
With the "separate housing" version, you are able to mount the housing with the electronics insert at a distance from the measuring point. This version facilitates trouble-free measurement
- Under particularly difficult measuring conditions (at installation locations that are cramped or difficult to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

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: Product Configurator, order code for "Additional options 2", option "G".

Dimensions → 🖹 32

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 Process connection adapter (weight: 0.93 kg (2.05 lb))
3 Cable (weight: 0.05 kg/meter (0.11 lb)), both ends are fitted with a socket
4 Mounting bracket provided, suitable for pipe and wall mounting
5 Housing with electronic insert - degrees of protection → 🖹 33

Unit mm (in)

Degree of protection for the process connection and sensor with the use of
- FEP cable:
  - IP 69 [1)]
  - 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

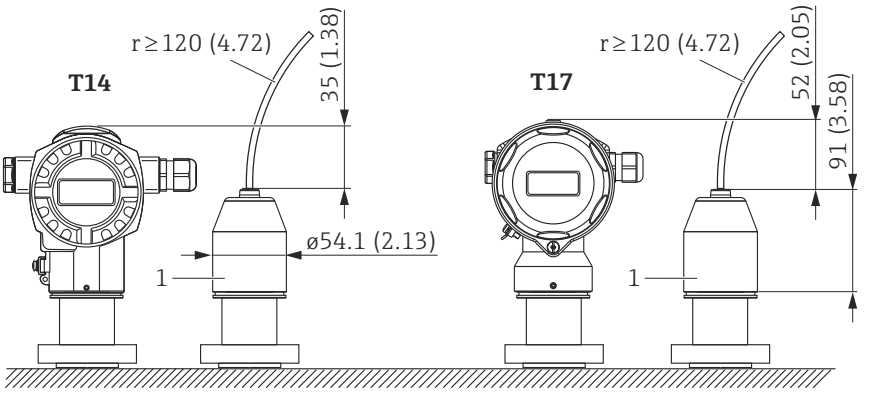
Technical data of the PE and FEP cable:
- Minimum bending radius: 120 mm (4.72 in)
- Cable extraction force: max. 450 N (101.16 lbf)
- Resistance to UV light

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

1) Designation of the IP protection class according to DIN EN 60529. Previous designation "IP69K" according to DIN 40050 Part 9 is no longer valid (standard withdrawn on November 1, 2012). The tests required by both standards are identical.

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.



1 Process connection adapter

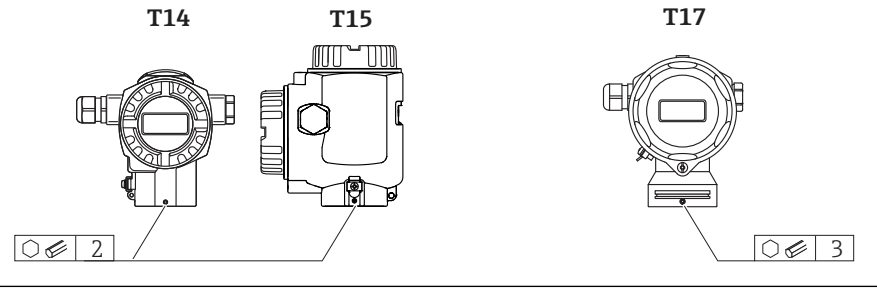
Unit mm (in)

Turning the housing

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

Your benefits

- Easy installation due to optimum alignment of housing
- Good, accessible device operation
- Optimum readability of the onsite display (optional).



Environment

Ambient temperature range

- −40 to +85 °C (−40 to +185 °F). Devices for lower temperatures available on request.
- Local display: −20 to +70 °C (−4 to +158 °F). Extended temperature application range with restrictions in optical properties, such as display speed and contrast: −40 to +85 °C (−40 to +185 °F)
- Separate housing: -20 to +60 °C (-4 to +140 °F) (installation without insulation)

Hazardous area

- For devices for use in hazardous areas, see Safety Instructions, Installation or Control Drawing → 62.
- Pressure measuring instruments that have the usual explosion protection certificates (e.g., ATEX/CSA/FM/IEC Ex, etc) can be used in hazardous areas at ambient temperatures down to −50 °C (−58 °F) (order code for "Test, Certificate" option "JN"). The functionality of the explosion protection is also guaranteed for ambient temperatures down to −50 °C (−58 °F).

Storage temperature range

- Local display: −40 to +85 °C (−40 to +185 °F)
- Separate housing: −40 to +60 °C (−40 to +140 °F)

Degree of protection

Depends on the deployed
- Housing: → 33
- Separate housing: → 27

Climate class

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

Electromagnetic compatibility

- Electromagnetic compatibility as per EN 61326 and NAMUR recommendation EMC (NE 21).
- Maximum deviation: < 0.5 % of span
- All EMC measurements were performed with a turn down (TD) = 2:1.

For further details, refer to the Declaration of Conformity.

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 axes
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 axes

Oxygen applications

Oxygen and other gases can react explosively to oils, grease and plastics, such that, among other things, the following precautions must be taken:
- All components of the system, such as measuring instruments, must be cleaned in accordance with the BAM (DIN 19247) requirements.
- Depending on the materials used, a certain maximum temperature and a maximum pressure must not be exceeded for oxygen applications.
  The maximum temperature T_{max} for oxygen applications is 60 °C (140 °F).

The devices that are suitable for gaseous oxygen applications are indicated by p_{max} in the following table.

Order code for devices [1], cleaned for oxygen applications	p_{max} for oxygen applications
FMB70 [2]	▪ Depends on the lowest-rated element, with regard to pressure, of the selected components: overpressure limit of the sensor or process connection (1.5 x PN) ▪ Depends on the fill fluid [3]

1) Device only, not accessory or enclosed accessory
2) Product Configurator, order code for "Service", option "HB"
3) Oxygen applications possible with FKM seal and inert oil.

PWIS-free applications

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

Ordering information:

Product Configurator, order code for "Fill fluid", option "L".

Hydrogen applications

A **gold-coated** metal process membrane offers universal protection against hydrogen diffusion, both in gas applications and in applications with aqueous solutions.

Applications with hydrogen in aqueous solutions

A **gold/rhodium-coated** metal process membrane (AU/Rh) offers effective protection against hydrogen diffusion.

Process

Process temperature limits

- −10 to +100 °C (+14 to +212 °F)
- up to +135 °C (275 °F) short-term (maximum 30 minutes) for cleaning purposes

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 present at the device for an unlimited time. Observe the temperature dependency of the maximum working pressure. 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). MWP data that deviate from this is 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 (overpressure limit) of the device.
- ▶ In the case of measuring cell range and process connection combinations where the overpressure limit 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 overpressure limit 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).

Mechanical construction

For the dimensions, see the Product Configurator: www.endress.com

Search for product → click "Configuration" to the right of the product image → after configuration click "CAD"

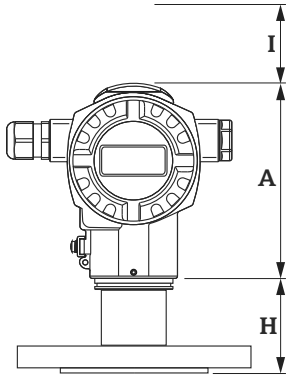
The following dimensions are rounded values. For this reason, they may deviate slightly from the dimensions given on www.endress.com.

Device height

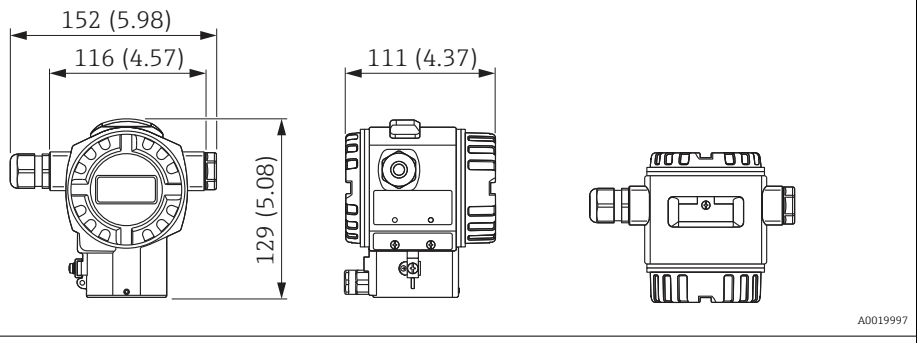
The device height is calculated from

- the height of the housing
- the height of optional mounted parts such as temperature isolators or capillaries
- the height of the relevant process connection.

The individual heights of the components are listed in the following sections. To calculate the device height, simply add up the individual heights of the components. If necessary, the installation clearance (the space used to install the device) must also be taken into account. You can use the following table for this:

Section	Page	Height	Example
Housing height	→ 33	(A)	 A0027101
Process connections	→ 35	(H)	
Installation clearance	-	(I)	
Device height			

T14 housing, optional display on the side

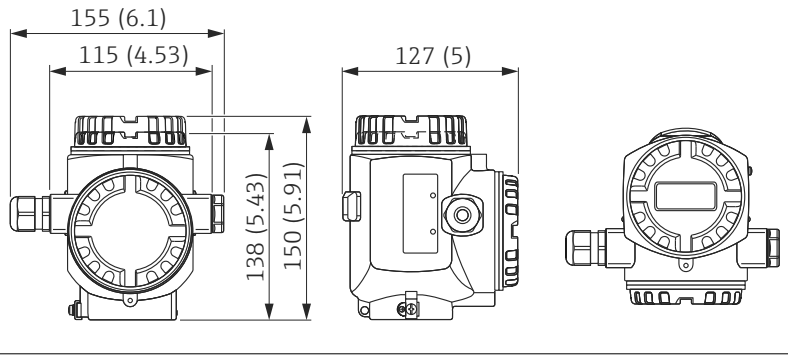


Engineering unit mm (in). Front view, left-hand side view, top view

Material		Degree of protection	Cable entry	Weight in kg (lb)		Option [1]
Housing	Cover seal			with display	without display	
Aluminum	EPDM	IP66/67 NEMA 6P	M20 gland	1.2 (2.65)	1.1 (2.43)	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

1) Product Configurator, order code for "Housing, cover seal, cable entry, degree of protection"

T15 housing, optional display on the top

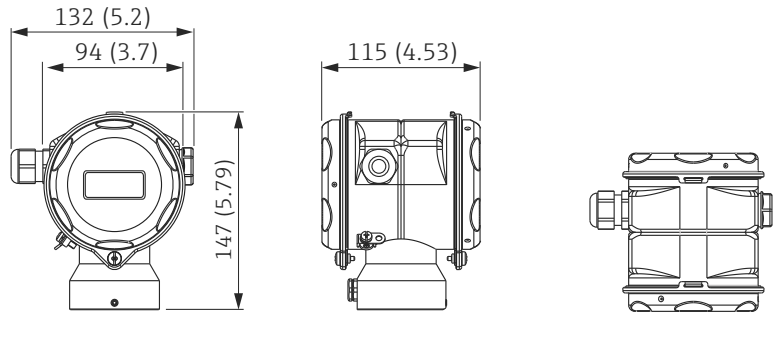


Engineering unit mm (in). Front view, left-hand side view, top view

Material		Degree of protection	Cable entry	Weight in kg (lb)		Option [1]
Housing	Cover seal			with display	without display	
Aluminum	EPDM	IP66/67 NEMA 6P	M20 gland	1.8 (3.97)	1.7 (3.75)	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

1) Product Configurator, order code for "Housing, cover seal, cable entry, degree of protection"

T17 housing (hygienic), optional display on the side



Engineering unit mm (in). Front view, left-hand side view, top view

Material		Degree of protection [1]	Cable entry	Weight in kg (lb)		Option [2]
Housing	Cover seal			with display	without display	
316L	EPDM	IP66/68 NEMA 6P	M20 gland	1.2 (2.65)	1.1 (2.43)	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_2O for 24 h
2) Product Configurator, order code for "Housing, cover seal, cable entry, degree of protection"

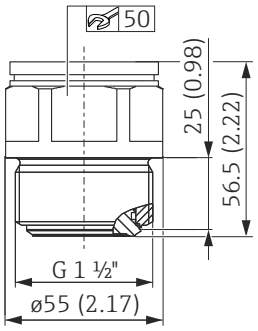
Explanation of terms

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

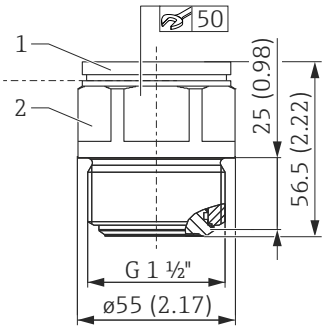
Process connections

Threaded connection ISO 228 G

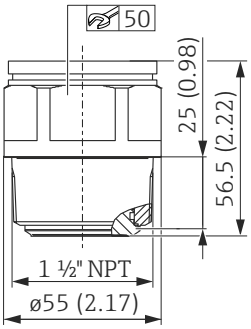
A



B



C



D

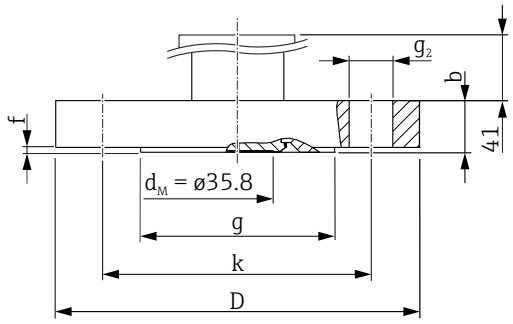
Unit mm (in)

Item	Designation	Material	Weight	Option [1]
			kg (lb)	
A	Thread ISO 228 G 1½" A	AISI 316L (1.4435)	0.8 (1.76)	1G
B	Thread ISO 228 G 1½" A	▪ 1: top section AISI 316L (1.4404) ▪ 2: bottom section Alloy C276 (2.4819)	0.8 (1.76)	1H
C	Thread ANSI 1 ½" MNPT	AISI 316L (1.4435)	0.8 (1.76)	2D

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

Process connections

EN flanges, connection dimensions in accordance with EN 1092-1, raised face RF



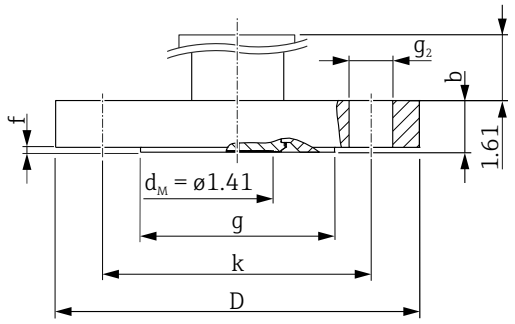
D *Diameter of flange*
b *Thickness*
g *Raised face*
f *Height of raised face*
k *Pitch diameter*
g_2 *Diameter of hole*

Unit mm

Flange [1] [2]							Boltholes			Weight	Option [3]
DN	PN	Form	D	b	g	f	Quantity	g_2	k		
			[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[kg (lb)]	
DN 40	PN 10-40	B1	150	18	88	2	4	18	110	2.6 (5.73)	CE
DN 50	PN 10-40	B1	165	20	102	2	4	18	125	3.3 (7.28)	CF
DN 80	PN 10-40	B1	200	24	138	2	8	18	160	5.1 (11.25)	CG
DN 100	PN 10-16	B1	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 R_a10 to 12.5 µm (394 to 492 µin). Lower surface roughness available on request.
2) Material AISI 316L: 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 13EO in EN 1092-1: 2001 Tab. 18. The chemical composition of the two materials can be identical.
3) Product Configurator, order code for "Process connection"

ASME flanges, connection dimensions as per ASME B 16.5, raised face RF



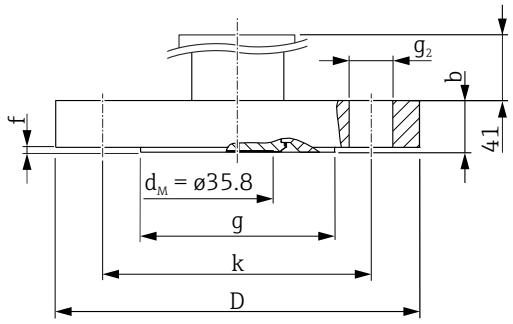
D *Diameter of flange*
b *Thickness*
g *Raised face*
f *Height of raised face*
k *Pitch diameter*
g_2 *Diameter of hole*

Unit mm

Flange [1] [2]						Boltholes			Weight	Option [3]
NPS	Class	D	b	g	f	Quantity	g_2	k		
[in]	[lb./sq in]	[in]	[in]	[in]	[in]		[in]	[in]	[kg (lb)]	
1.5	150	5	0.69	2.88	0.06	4	0.62	3.88	2.1 (4.63)	AE
2	150	6	0.75	3.62	0.06	4	0.75	4.75	3.0 (6.62)	AF
3	150	7.5	0.94	5	0.06	4	0.75	6	5.7 (12.57)	AG
4	150	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 R_a3.2 to 6.3 µm (125 to 250 µin). Lower surface roughness available on request.
2) Material AISI 316/316L: Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated).
3) Product Configurator, order code for "Process connection"

JIS flanges, connection dimensions in accordance with JIS B 2220 BL, raised face RF



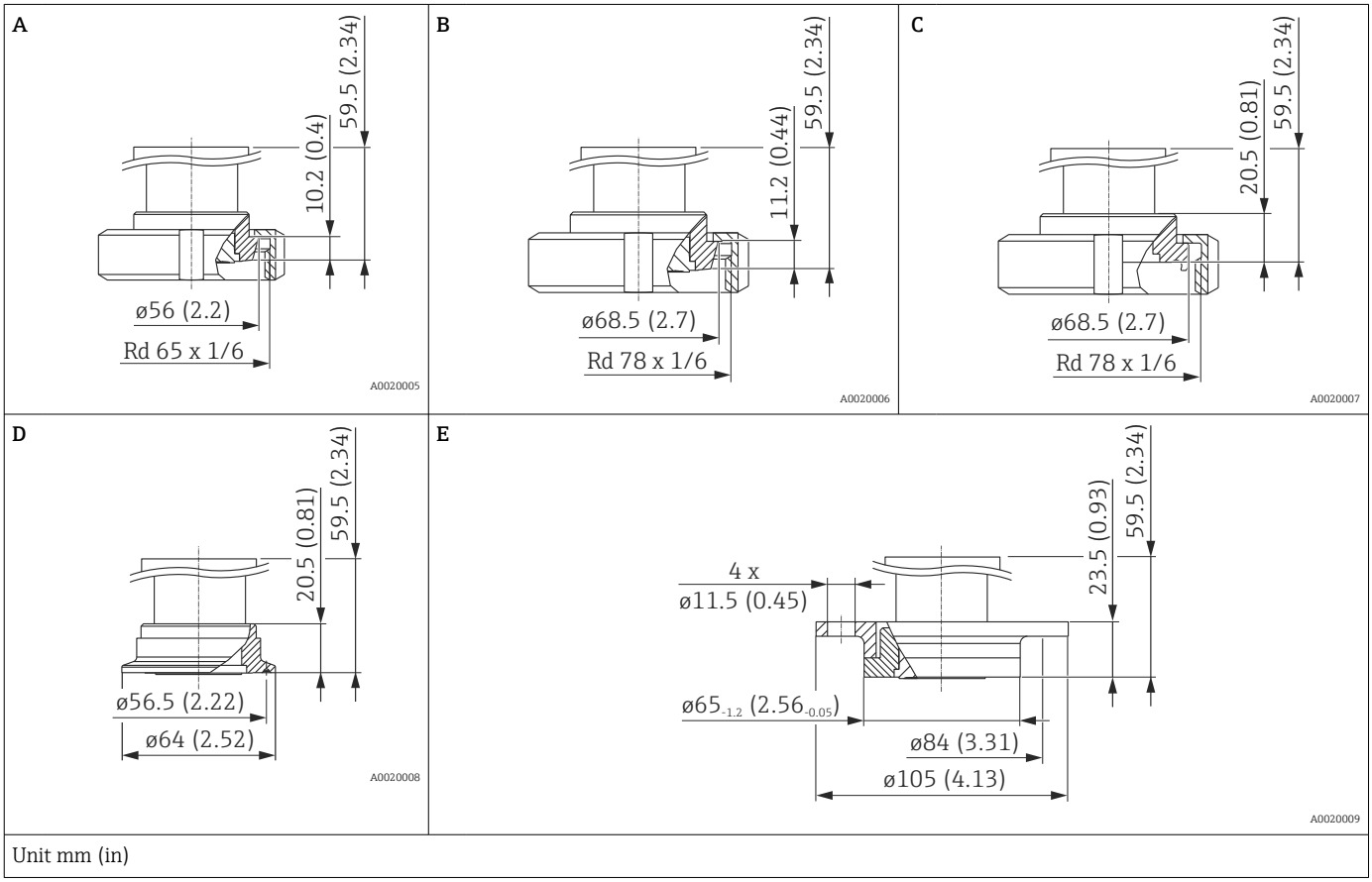
D Diameter of flange
b Thickness
g Raised face
f Height of raised face
k Pitch diameter
g_2 Diameter of hole

Unit mm

Flange [1] [2]						Boltholes			Weight	Option [3]
A	K	D	b	g	f	Quantity	g_2	k		
		[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[kg (lb)]	
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 R_a3.2 to 6.3 µm (125 to 250 µin). Lower surface roughness available on request.
2) Material AISI 316L
3) Product Configurator, order code for "Process connection"

Hygienic connections

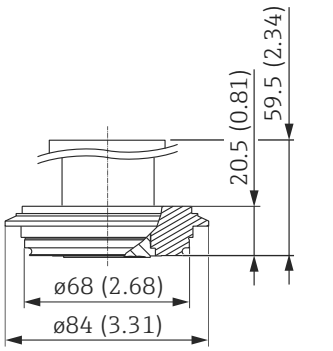


Unit mm (in)

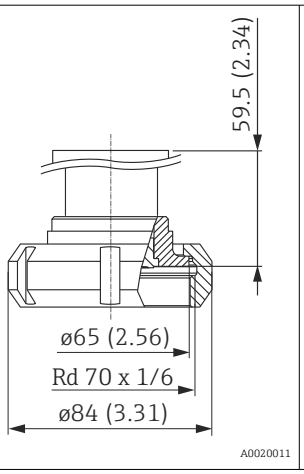
Item	Designation	Nominal pressure	Material	Weight	Option [1]
				kg (lb)	
A	DIN 11851 DN 40	PN 25	AISI 316L (1.4435)	0.7 (1.54)	M2 [2]
B	DIN 11851 DN 50	PN 25		0.9 (1.98)	M3 [2]
C	DIN 11864-1 A DN 50 Pipe DIN 11866-A, slotted nut	PN 16		1 (2.21)	ND [2]
D	Tri-Clamp ISO 2852 DN 40 – DN 51 (2"), DIN 32676 DN 50	-		0.7 (1.54)	TD
E	DRD DN 50 (65 mm), slip-on flange AISI 304 (1.4301)	PN 25		1.1 (1.98)	TK

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

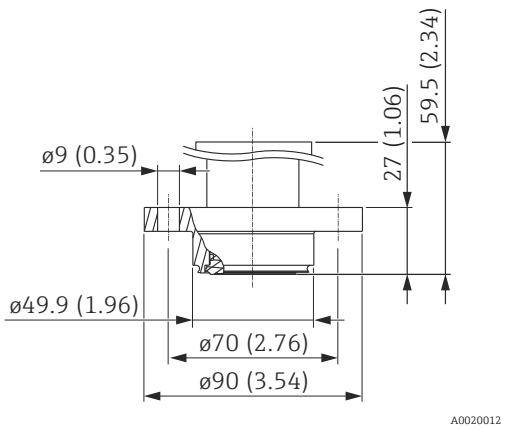
F



G



H



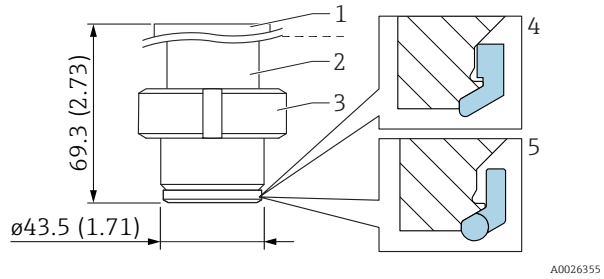
Unit mm (in)

Item	Designation	Nominal pressure	Material	Weight	Option [1]
				kg (lb)	
F	Varivent type N for 40 – 162 pipes	PN 40	AISI 316L (1.4435)	1 (2.21)	TR
G	SMS 2"	PN 25		0.7 (1.54)	UE [2]
H	NEUMO, D50	PN 16		0.8 (1.76)	S4

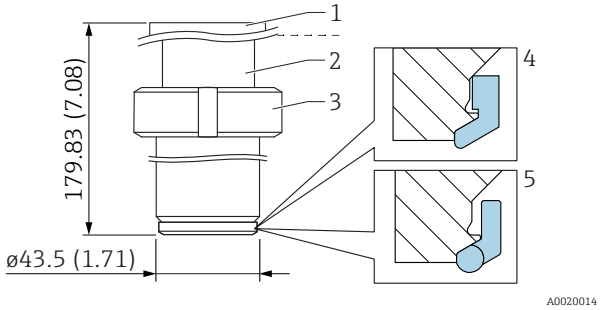
1) Product Configurator, order code for "Process connection"
2) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).

Universal process adapter

A



B



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 Form seal: silicone or EPDM
5 EPDM O-ring with backup ring AISI 316L (1.4404)

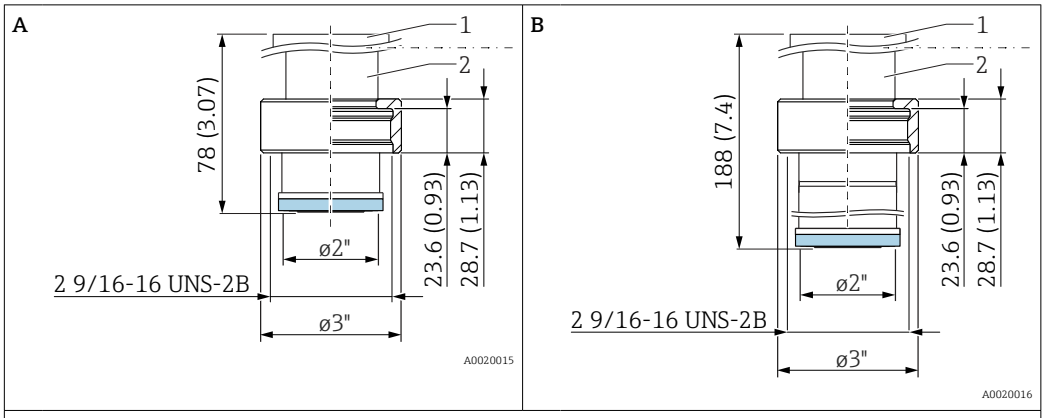
Unit mm (in)

- Roughness of the surface in contact with the medium is R_a <0.76 µm (30 µin) as standard. Surface roughness R_a< 0.38 µm (15 µin) electropolished (wetted). Ordering information: Product Configurator, order code for "Additional options" option "C"
- Silicone form seal: FDA 21CFR177.2600/USP Class VI, order number: 52023572
- EPDM form seal: FDA, USP Class VI; 5 pcs, order number: 71100719
- EPDM O-ring with backup ring AISI 316L (1.4404): FDA, USP Class VI; 1 pc, order number: 71431380

Item	Designation	Nominal pressure	Weight	Option [1]
		bar (psi)	kg (lb)	
A	Universal process adapter Form seal made of silicone (4)	10 (145)	0.8 (1.76)	00
	Universal process adapter EPDM form seal (4)			02
	Universal process adapter EPDM O-ring with backup ring (5) [2]			01
B	Universal process adapter 6 inch extension, form seal made of silicone (4)		1.7 (3.75)	57
	Universal process adapter 6 inch extension, EPDM O-ring with backup ring (5) [2]			58

1) Product Configurator, order code for "Process connection"
2) With EHEDG approval.

Anderson process adapter

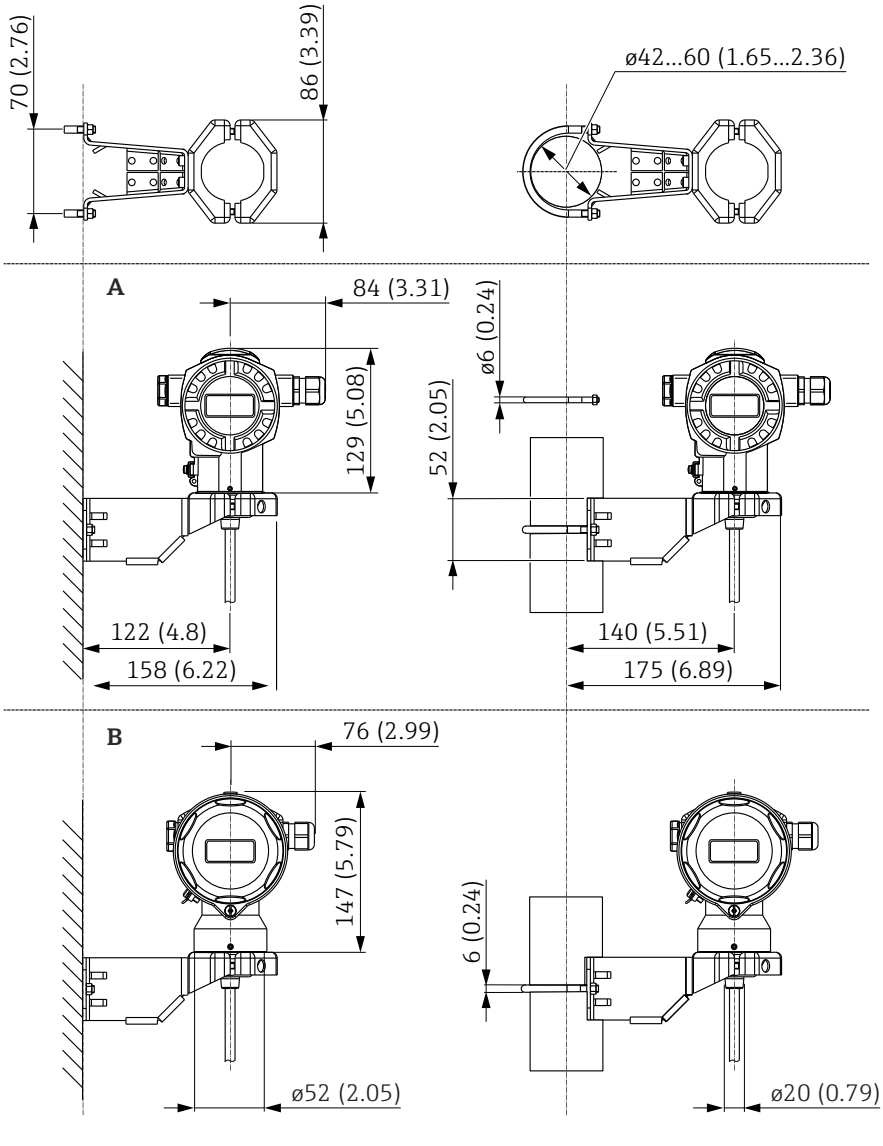


Unit mm (in)

Item	Designation	Nominal pressure	Material	Weight	Option [1]
		bar (psi)		kg (lb)	
A	Anderson process adapter, short 2-3/16", incl. silicone form seal	3.5 (50)	▪ 1: top section AISI 316L (1.4404) ▪ 2: bottom section AISI 316L (1.4435) ▪ Slotted nut AISI 316L (1.4404)	0.8 (1.76)	60
B	Anderson process adapter, long 6-1/2", incl. silicone molded seal			1.7 (3.75)	62

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

Separate housing: Wall and pipe mounting with mounting bracket



Unit mm (in)

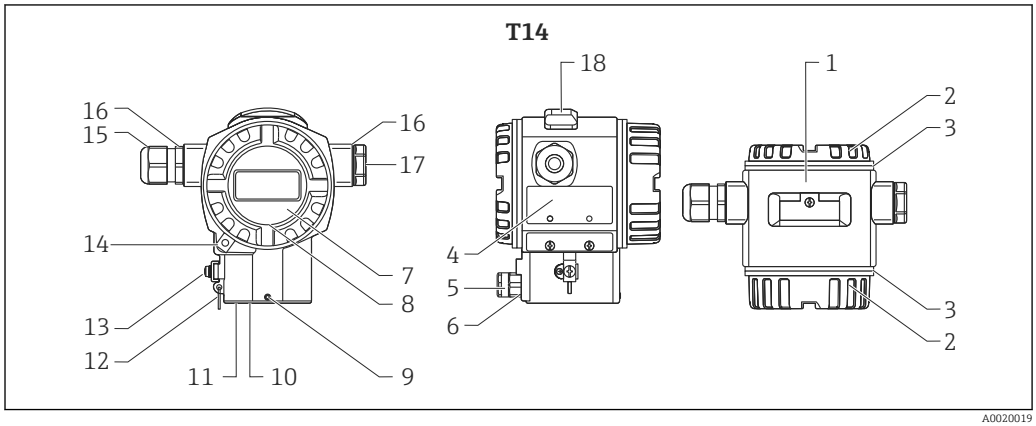
Item	Designation	Weight (kg (lb))		Option [1]
		Housing (T14 or T17)	Mounting bracket	
A	Dimensions with T14 housing, optional side display	→ 🖹 33	0.5 (1.10)	U
B	Dimensions with T17 housing, optional side display			

1) Product Configurator, order code for "Additional options 2", option "G"

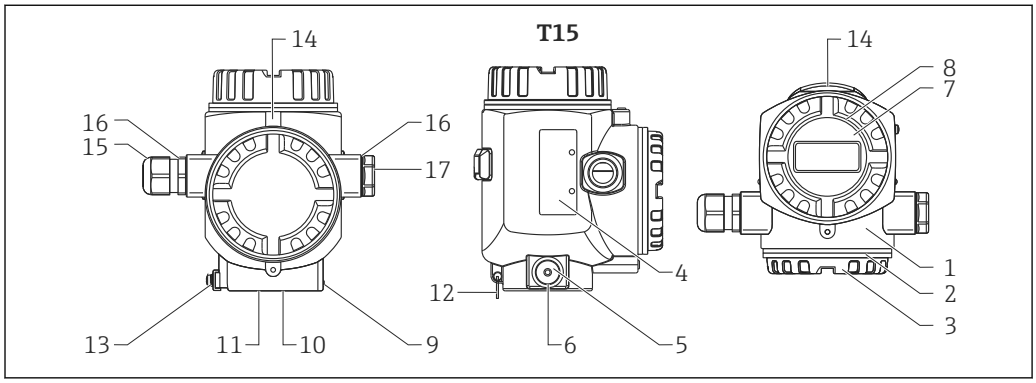
Can also be ordered as a separate accessory: part number 71102216

Materials not in contact with process

Transmitter housing



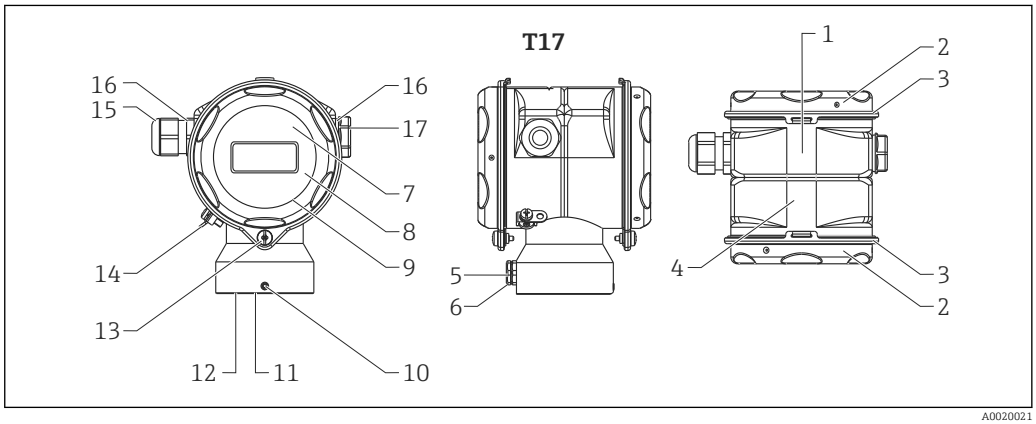
A0020019



A0020020

Item number	Component	Material
1	T14 and T15 housing, RAL 5012 (blue)	▪ Polyester powder coating on aluminum as per EN1706 AC43400 (reduced copper content ≤ 0.1 % to prevent corrosion) ▪ Coating on thread: Heat-curing lubricant varnish
2	Cover, RAL 7035 (gray)	Die-cast aluminum with protective powder-coating on polyester base
		Precision cast AISI 316L (1.4435) (cover made of 316L if T14 housing made of 316L)
4	Nameplates	▪ AISI 316L (1.4404), if T14 housing is precision-cast ▪ Anodized aluminum, if housing T14/T15 of die-cast aluminum
5	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
6	Pressure compensation filter, O-ring	VMQ or EPDM
7	Sight glass	Mineral glass
8	Sight glass seal	Silicone (VMQ)
9	Screw	A4
10	Sealing ring	EPDM
11	Retaining ring	PA66-GF25
12	Rope for nameplates	AISI 316 (1.4401)
13	External ground terminal	AISI 316L (1.4404)
14	Cover clamp	AISI 316L (1.4435) clamp, A4 screw
15	Cable entry	Polyamide (PA) or CuZn nickel-plated

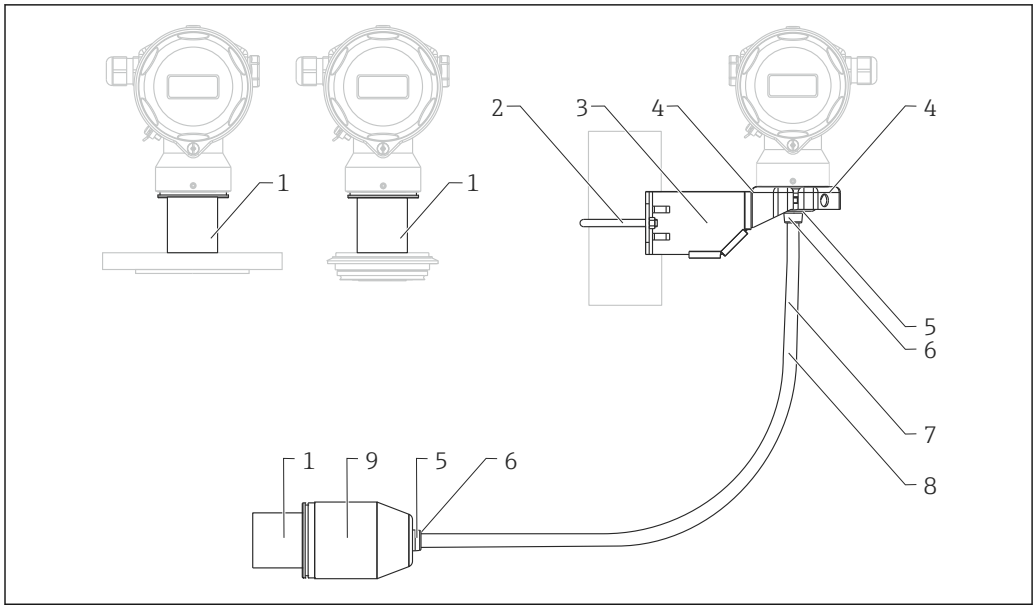
Item number	Component	Material
16	Seal of cable entry and plug	Silicone (VMQ)
17	Plug	PBT-GF30 FR, for dust ignition-proof and Exd: AISI 316L (1.4435)
18	External operation (keys and key cover), RAL 7035 (gray)	Polycarbonate PC-FR, screw A4



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Item number	Component	Material
1	T17 housing	AISI 316L (1.4404)
2	Cover	
3	Cover seal	EPDM
4	Nameplates	Lasered on
5	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
6	Pressure compensation filter, O-ring	VMQ or EPDM
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	Retaining ring	PA6
13	Screw	A4-50 Coating on thread: Heat-curing lubricant varnish
14	External ground terminal	AISI 316L (1.4404)
15	Cable entry	Polyamide PA, for dust ignition-proof: CuZn nickel-plated
16	Seal of cable entry and plug	Silicone (VMQ)
17	Plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)

Connecting parts



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Item number	Component	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 of separate housing	EPDM
6	Gland for cable from separate housing	AISI 316L (1.4404)
7	PE cable for separate housing	Abrasion-resistant cable with Dynema strain-relief members; shielded with aluminum-coated film; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV-resistant
8	FEP cable for separate housing	Abrasion-resistant cable; shielded with 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)

Weight

Component	Weight
Housing	See "Housing" section
Process connection	See "Process connections" section

Materials in contact with process

NOTICE

- Device components in contact with the process are listed in the "Mechanical construction" → 32 and "Ordering information" → 58 sections.

Delta ferrite content

A delta-ferrite content of ≤ 3% can be guaranteed and certified for the wetted parts if option "8" is selected in the "Additional options 1" or "Additional options 2" order code in the Product Configurator.

TSE Certificate of Suitability (Transmissible Spongiform Encephalopathy)

The following applies to all device components in contact with the process:

- They do not contain any materials derived from animals.
- No additives or operating materials derived from animals are used in production or processing.

Process membrane

Designation	Option [1]
Alloy C276 (2.4819), Ø 35.8 mm (1.41 in)	2
Alloy C276 (2.4819), Ø 35.8 mm (1.41 in), with gold-rhodium coating	6

1) Product Configurator, order code for "Material of process membrane; Seal:"

Fill fluid

Designation	Option [1]
Synthetic oil polyalphaolefin FDA 21 CFR 178.3620, NSF H1	C
Inert oil	F
Inert oil, cleaned for PWIS-free applications	L

1) Product Configurator, order code for "Fill fluid"

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnosis

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
- Parameters relating to measured values can be locked/unlocked using the device's write protection switch, using the device software or via remote operation

Efficient diagnostics increase measurement availability

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

Local operation

Functions

Function	External operation (operating keys, optional, not T17 housing)	Internal operation (electronic insert)	Onsite 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 the green LED	✔	✔	✔
Switching damping on and off	✔ (only if display is connected)	✔ (HART and PA only)	✔
Configuring the bus address of the device (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.

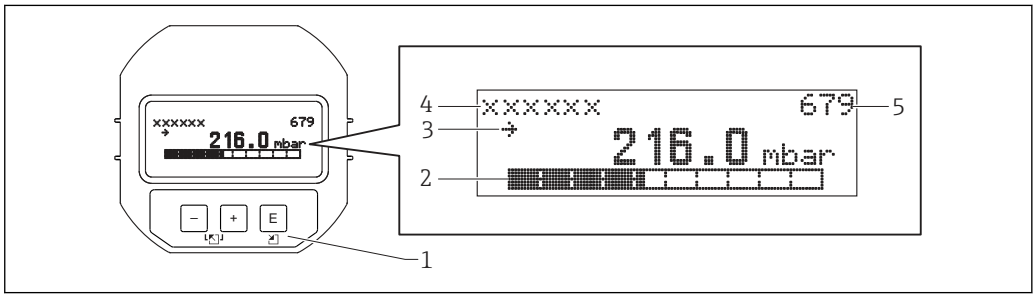
The display can be removed for easy operation.

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 including sign and decimal point and bar graph for
  - 4 to 20 mA HART (bar graph from 4 to 20 mA)
  - PROFIBUS PA (bar graph as graphic display of standardized value of AI block)
  - FOUNDATION Fieldbus (bar graph as graphic display of transducer output).
-
- Simple and complete menu guidance due to breakdown of 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

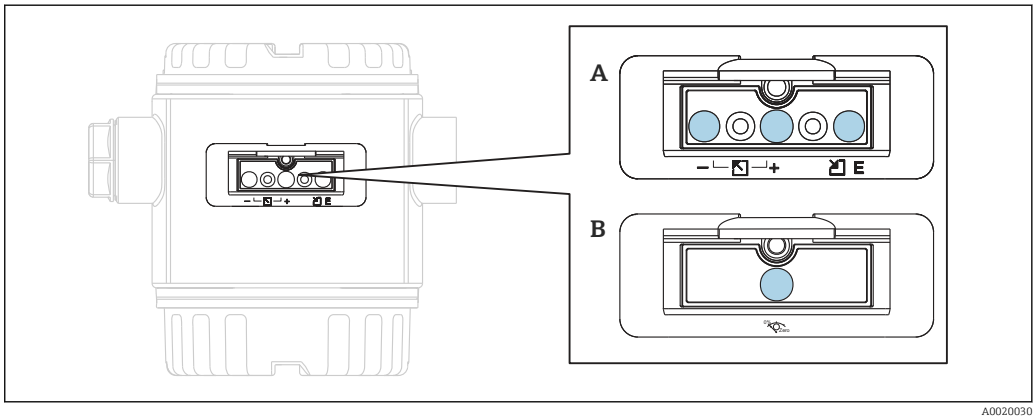


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1 Operating keys
2 Bargraph
3 Symbol
4 Header
5 Parameter ID number

Operating keys on the exterior of the device

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



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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:

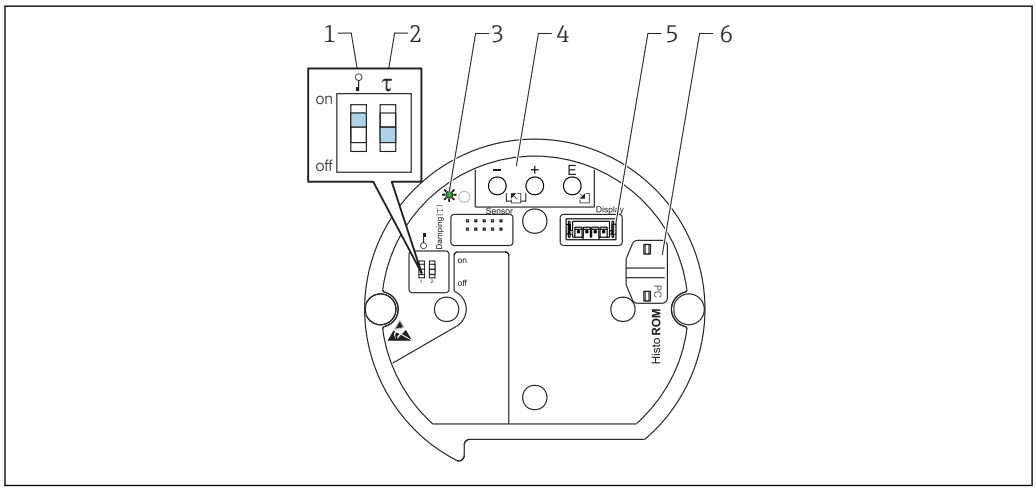
Product Configurator, order code for "Output, operation"

Operating keys and elements located internally on the electronic insert

Ordering information:

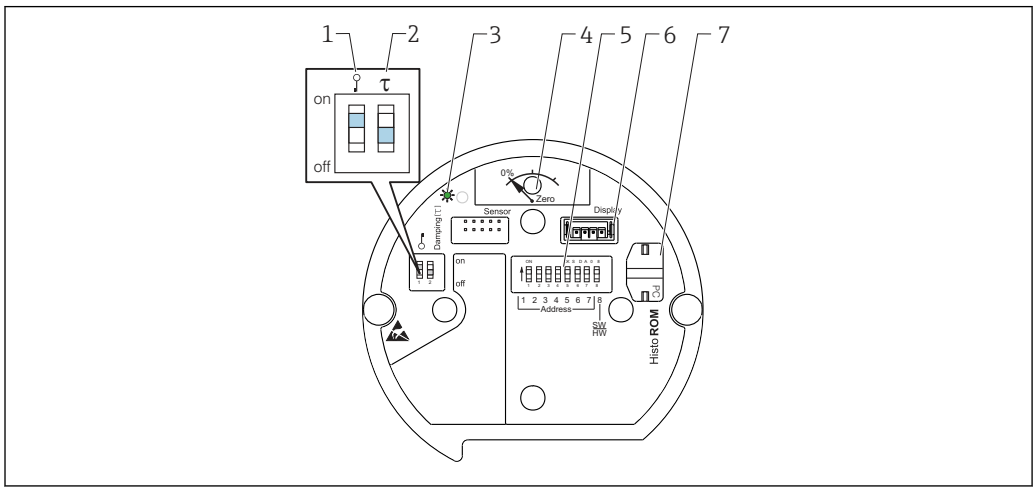
Product Configurator, order code for "Output, operation"

HART



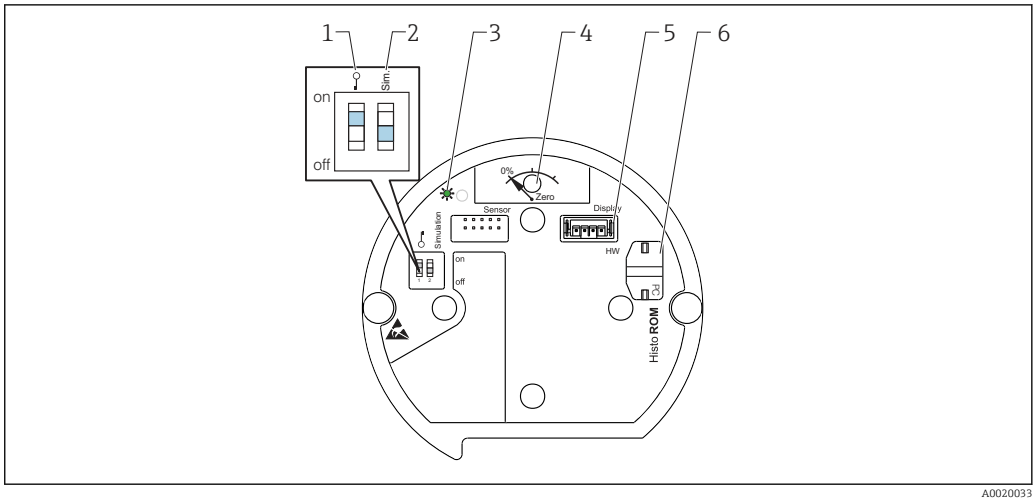
1 DIP switch for locking/unlocking parameters relevant to the measured value
2 DIP switch for switching damping on/off
3 Green LED to indicate value being accepted
4 Operating keys
5 Slot for optional display
6 Slot for optional HistoROM®/M-DAT

PROFIBUS PA



1 DIP switch for locking/unlocking parameters relevant to the measured value
2 DIP switch for switching 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

FOUNDATION Fieldbus



A0020033

1 *DIP switch for locking/unlocking parameters relevant to the measured value*
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*

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	✔	✔	✔
FieldXpert SFX100	✔	–	✔
NI-FBUS Configurator	–	–	✔
HistoROM®/M-DAT	✔	✔	✔

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 USB interface of 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 from Endress+Hauser. 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 the PROFIBUS.

Proficard

For connecting a laptop to the 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

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 methods specified in the manufacturer-specific DD (e.g. basic device settings)
- Display DD menus (e.g. tab for calibration data)
- Download a configuration
- Verify a configuration and compare it to a saved configuration
- Monitor a downloaded configuration
- Replace devices
- Save and print a configuration

HistoROM®/M-DAT (optional)

HistoROM®/M-DAT is a memory module which can be attached to every electronic insert. 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).

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, 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:

Product Configurator, order code for "Additional options:", option "N" or

Product Configurator, order code for "Application package:", option "EN" or

as a separate accessory (part no.: 52027785).

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

System integration

The device can be given a tag name (max. 8 alphanumeric characters).

Designation	Option [1]
Measuring point (TAG), see additional specifications	Z1
Bus address, see additional spec.	Z2

1) Product Configurator, order code for "Marking"

Certificates and approvals

CE approval

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

RCM-tick symbol

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 symbol on the nameplate.



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Ex approvals

- ATEX
- FM
- CSA
- NEPSI
- IECEx
- TIIS
- Also combinations of different approvals

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.

EAC conformity

The measuring system meets the legal requirements of the applicable EAC guidelines. 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.

Suitable for hygiene applications

For information on installation and approvals, see documentation SD02503F "Hygiene approvals".

For information on 3-A and EHEDG-tested adapters, see documentation TI00426F "Weld-in adapter, process adapter and flanges".

Certificate of current Good Manufacturing Practices (cGMP)

Product Configurator, order code for "Test, Certificate" option "JG"

- The certificate is only available in English
- Materials of construction of product wetted parts
- TSE compliance
- Polishing and surface finish
- Material/ compound compliance table (USP Class VI, FDA conformity)

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

The Deltapilot S devices with a 4 to 20 mA output signal have been developed in accordance with 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 with Deltapilot S, settings and functional safety data, see the "Functional safety manual - Deltapilot S" SD00213P/00.

For devices up to SIL 3 / IEC 61508 Declarations of Conformity see:

Ordering information:

Product Configurator, order code for "Additional options 1" and "Additional options 2" option "E" .

Overspill protection

WHG (see document ZE00266P/00/EN)

Ordering information:

Product Configurator, order code for "Approval" option "6".

CRN approval

A CRN approval is available for some device versions. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device. These devices are fitted with a separate plate bearing the registration number CRN OF1987.7C.

Ordering information:

Product Configurator, order code for "Process connection; Material" and

Product Configurator, order code for "Approval" (only in conjunction with an approved process connection)

Other standards and guidelines

The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity. The following standards were also applied:

DIN EN 60770 (IEC 60770):

Transmitters for use in industrial-process control systems. Part 1: Methods for performance evaluation

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.

EN 60529:

Degrees of protection provided by enclosures (IP code)

Pressure Equipment Directive 2014/68/EU (PED)

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

Pressure equipment (maximum allowable pressure (MWP) PS ≤ 200 bar (2 900 psi)) can be classified as pressure accessories in accordance with Pressure Equipment Directive 2014/68/EU. If the maximum allowable 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 (PED) 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 partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (safety accessory in accordance with Pressure Equipment Directive 2014/68/EU Article 2, point 4).

Manufacturer declarations

Depending on the desired configuration, the following documents can be ordered additionally with the device:

- FDA conformity
- TSE-free: materials free from animal origin
- Regulation (EC) No. 2023/2006 (GMP)
- Regulation (EC) No. 1935/2004 on materials and articles intended to come into contact with food

Downloading the Declaration of Conformity

www.endress.com → Download

Marine approval

GL (German Lloyd)

Ordering information:

Product Configurator, order code for "Additional options 1" or "Additional options 2" option "S" .

Drinking water approval

NSF 61 approval

Ordering information:

Product Configurator, order code for "Additional options 1" or "Additional options 2" option "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 of - 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	Option
3.1 Material documentation, wetted metal parts, EN10204-3.1 inspection certificate	B [1) 3)]
Individual test, test report	3 [1)]
Pressure test, internal procedure, test report	4 [1)]
EN10204-3.1 material wetted parts +Ra, Ra= surface roughness, dimensional check, inspection certificate	6 [1)]
Delta-ferrite measurement, internal procedure, wetted metal parts, inspection certificate	8 [1)]
3.1 Material documentation, wetted metal parts, EN10204-3.1 inspection certificate	JA [2) 3)]
PMI test (XRF), internal procedure, metal parts in contact with the medium	KG [2)]
Surface finish measurement ISO4287/Ra, wetted metal parts, inspection certificate	KB [2)]
Helium leak test, internal procedure, inspection certificate	KD [2)]
Pressure test, internal procedure, inspection certificate	KE [2)]
Delta-ferrite measurement, internal procedure, wetted metal parts, inspection certificate	KF [2)]

1) Product Configurator, order code for "Additional options 1" and "Additional options 2"
2) Product Configurator, order code for "Test, Certificate"
3) The choice of this feature for coated process membranes/process connections refers to the metal base material.

Calibration

Designation	Option [1)]
Sensor range; %	A
Factory calibration certificate, 5-point; see additional specification	C
DKD/DAkkS certificate; see additional specification	D
Customized pressure; see additional specification	E
Customized level; see additional specification	F
Customized pressure + 5-point factory calibration certificate; see additional specification	H
Customized level + 5-point factory calibration certificate; see additional specification	I
Platinum; see additional specification	K
Platinum + factory calibration certificate 5-point; see additional specification	L
Platinum + DKD/DAkkS certificate; see additional specification	M
Sensor range; mbar/bar	1
Sensor range; kPa/MPa	2
Sensor range; mmH2O/mH2O	3

Designation	Option [1]
Sensor range; inH2O/ftH2O	4
Sensor range; psi	6

1) Product Configurator, order code for "Calibration; Unit"

Service

Designation	Option [1]
Cleaned of oil+grease [2]	HA
Cleaned for oxygen service [2]	HB
Cleaned of PWIS (paint-wetting impairment substances) [2]	HC

1) Product Configurator, order code for "Service"
2) Device only, not accessories or enclosed accessories.

Certificate of Compliance ASME BPE 2012

Ordering information: Product Configurator, order code for "Additional approval" option "LW".

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.addresses.endress.com

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

Special device versions

Endress+Hauser offers special device versions as **T**echnical **S**pecial **P**roducts (TSP).

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

Scope of delivery

- Measuring device
- Optional accessories
- Brief Operating Instructions
- Calibration certificates
- Optional certificates

Measuring point (TAG)

Order code	895: Marking
Option	Z1: Tagging (TAG), see additional spec.
Position of the tag marking	To be selected in the additional specifications: ▪ Tag plate, stainless steel ▪ Self-adhesive paper label ▪ Supplied label/plate ▪ RFID TAG ▪ RFID TAG + tag plate stainless steel ▪ RFID TAG + self-adhesive paper label ▪ RFID TAG + supplied label/plate
Definition of the tag name	To be defined in the additional specifications: 3 lines containing up to 18 characters each The measuring point designation appears on the selected label and/or the RFID TAG.
Identification on electronic nameplate (ENP)	32 characters
Identification on display module	10 characters

Configuration data sheet

Pressure

The following configuration data sheet must be completed and included with the order if the option "E" or "H" has been selected in the Product Configurator, order code for "Calibration; Unit".

Pressure unit

❑ mbar	❑ mmH_2O [1]	❑ mmHg [2]	❑ Pascal	❑ torr
❑ bar	❑ mH_2O [1]	❑ inHg [2]	❑ hPa	❑ g/cm^2
❑ psi	❑ ftH_2O [1]	❑ gf/cm^2	❑ kPa	❑ kg/cm^2
	❑ inH_2O [1]	❑ kgf/cm^2	❑ MPa	❑ lb/ft^2
				❑ atm

1) The conversion factor for the pressure unit is based on a reference temperature of 4 °C (39.2 °F).
2) The conversion factor of the pressure unit refers to a reference temperature of 0 °C (32 °F).

Calibration Range / Output

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

Display

Display of the content of the main line (option depends on sensor and communication variant)

- ❑ Primary value [PV] (default)
- ❑ Main Value [%]
- ❑ Pressure
- ❑ Current [mA] (HART only)
- ❑ Temperature
- ❑ Error number
- ❑ Alternating display

Damping

Damping: _____ sec (Default 2 sec)

Lowest calibratable span (preset at factory) → 🖹 11

Level

The following configuration data sheet must be completed and included with the order if the option "F" or "T" has been selected in the Product Configurator, order code for "Calibration; Unit".

Pressure unit

- ❑ mbar
- ❑ bar
- ❑ psi
- ❑ mmH_2O [1)]
- ❑ mH_2O [1)]
- ❑ ftH_2O [1)]
- ❑ inH_2O [1)]
- ❑ mmHg [2)]
- ❑ inHg [2)]
- ❑ gf/cm^2
- ❑ kgf/cm^2
- ❑ Pascal
- ❑ hPa
- ❑ kPa
- ❑ MPa
- ❑ torr
- ❑ g/cm^2
- ❑ kg/cm^2
- ❑ lb/ft^2
- ❑ atm

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

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

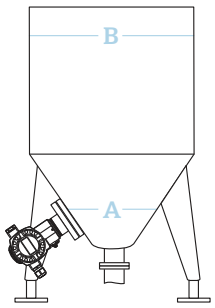
Output unit (scaled unit)

Mass	Lengths	Volume	Volume	Percent
❑ kg	❑ m	❑ l	❑ USgal	❑ %
❑ t	❑ dm	❑ hl	❑ impgal	
❑ lb	❑ cm	❑ m^3	❑ USbblPE TR	
	❑ mm	❑ ft^3		
	❑ ft			
	❑ inch			

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

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

Example



A0020042

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

1) The conversion factor for the pressure unit is based on a reference temperature of 4 °C (39.2 °F).
2) The conversion factor of the pressure unit refers to a reference temperature of 0 °C (32 °F).

Display

Display of the content of the main line (option depends on sensor and communication variant)

- ❑ Primary value [PV] (default)
- ❑ Main Value [%]
- ❑ Pressure
- ❑ Current [mA] (HART only)
- ❑ Temperature
- ❑ Level before Lin.
- ❑ Tank content
- ❑ Error number
- ❑ Alternating display

Damping

Damping: _____ sec (Default 2 sec)

Accessories

HistoROM®/M-DAT

The HistoROM®/M-DAT is a memory module that can be attached to any electronic insert.

Ordering information:

Product Configurator, order code for "Additional options 1" or Additional options 2", version "N" or as a separate accessory (part no.: 52027785).

Welding flanges and weld-in adapters

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

For dimensions and technical data, see Technical Information TI00426F.

Designation	Material	Order number	Order number with 3.1 inspection certificate
DIN 11851 DN 40	AISI 316L (1.4435)	71114172	71114178
DIN 11851 DN 50		71114173	71114205
DRD DN50		71114174	71114206
Clamp 2"		71114176	71114207
Varivent		71114177	71114208

Additional mechanical accessories

Cable shortening kits, test adapters, mounting brackets, flushing rings and protective roofs.

For details, see SD01553P/00/EN "Mechanical accessories for pressure measuring devices".

Service-specific accessories

Accessories	Description
DeviceCare SFE100	Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices Technical Information TI01134S DeviceCare is available for download at www.software-products.endress.com. You need to register in the Endress+Hauser software portal to download the application.
FieldCare SFE500	FDT-based plant asset management tool FieldCare can configure all smart field units in your plant and helps you manage them. By using the status information, FieldCare is also a simple but effective way of checking the status and condition of the field devices. Technical Information TI00028S
Field Xpert SMT70, SMT77	The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous (Ex Zone 2) and non-hazardous areas. It is suitable for commissioning and maintenance staff. It manages Endress+Hauser and third-party field instruments with a digital communication interface and documents the progress of the work. The SMT70 is designed as a complete solution. It comes with a pre-installed driver library and is an easy-to-use, touch-enabled tool for managing field devices throughout their entire life cycle. The Field Xpert SMT77 for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. It is suitable for commissioning and maintenance staff for easy management of field instruments with a digital communication interface. The touch-enabled tablet PC is designed as a complete solution. It comes with comprehensive pre-installed driver libraries and offers users a modern software user interface to manage field instruments throughout the entire life cycle.

Supplementary documentation

Field of Activities

Pressure measurement, powerful instruments for process pressure, differential pressure, level and flow:

FA00004P/00/EN

Technical Information

- Cerabar S: TI00383P/00/EN
- Deltabar S: TI00382P/00/EN
- EMC test procedures: TI00241F/00/EN
- Weld-in adapter, adapter and flanges: TI00426F/00/EN

Special Documentation

Mechanical accessories for pressure measuring devices: SD01553P/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 CerabarS/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

Overfill prevention

WHG: ZE00266P/00/EN

Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

Directive	Electronic insert	Documentation	Option [1]
ATEX II 1/2 G Ex ia IIC T6	4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA00283P	1
ATEX II 1/2 G Ex ia IIC T6, WHG (German Water Resources Act)	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

1) Product Configurator, order code for "Approval"

Directive	Electronic insert	Documentation	Option [1]
IECEx Zone 0/1 Ex ia IIC T6	4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XB00010P	I

1) Product Configurator, order code for "Approval"

Directive	Electronic insert	Documentation	Option [1]
NEPSI Ex ia IIC T4/T6	4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA00435P	H

1) Product Configurator, order code for "Approval"

Directive	Electronic insert	Option [1]
JPN Ex ia IIC T4	4 to 20 mA HART	K

1) Product Configurator, order code for "Approval"

Directive	Electronic insert	Documentation	Option [1]
INMETRO Ex ia IIC T6 Ga/Gb	4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA01320P/00	J
INMETRO Ex ta IIIC Da/Db	4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA01319P/00	Z

1) Product Configurator, order code for "Approval"

Installation/Control Drawings

Directive	Electronics	Documentation	Option [1]
FM DIP Cl.II,III Div.1 Gr.E-G, Zone 21,22	-	▪ XA01059P ▪ XA01060P	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	▪ XA01061P ▪ XA01062P	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
CSA C/US General Purpose	4 to 20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	-	X

1) Product Configurator, order code for "Approval"



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