Technical Information
Deltabar FMD71, FMD72

Level measurement with electronic differential pressure



Electronic differential pressure transmitter with ceramic and metal sensors

Application

The Deltabar FMD71/FMD72 is used to measure the level, volume or mass of liquids in pressurized and vacuum vessels.

Your benefits

The electronic differential pressure system eliminates traditional mechanical issues resulting in greater process availability and reliability

- Safety risks are minimized with the electronic differential pressure system architecture and design
- Lowest total cost of ownership due to reduced installation time, maintenance, downtime and spare requirements, downtime and spare requirements.
- Multivariable level measurement: HART-based differential pressure, head pressure and sensor temperatures from one system
- Continuous health indication of the entire system via HART-based diagnostic
- High reproducibility and long-term stability
- Overload-resistant and function-monitored

Endress+Hauser
People for Process Automation

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Document information

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

Electrical symbols

Symbol	Meaning
A0011197	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
 A0011198	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
 A0017381	**Direct current and alternating current** ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0011200	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Symbols for certain types of information

Symbol	Meaning
 A0011182	**Permitted** Indicates procedures, processes or actions that are permitted.
 A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.

Symbol	Meaning
 A0011194	**Reference to documentation** Refers to the corresponding device documentation.
 A0011195	**Reference to page** Refers to the corresponding page number.
 A0011196	**Reference to graphic** Refers to the corresponding graphic number and page number.
 A0015502	**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
 A0011187	**Hazardous area** Indicates a hazardous area.
 A0011188	**Safe area (non-hazardous area)** Indicates the non-hazardous area.

Documentation

The document types listed are available:
- On the CD supplied with the device
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Brief Operating Instructions KA01105P: getting the 1st measured value quickly

The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

Operating Instructions BA01044P: your comprehensive reference

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

Description of Device Parameters GP01013P: reference for your parameters

The document provides a detailed explanation of each individual parameter in the operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Safety Instructions (XA)

Safety Instructions (XA) are supplied with the device depending on the approval. These instructions are an integral part of the Operating Instructions.

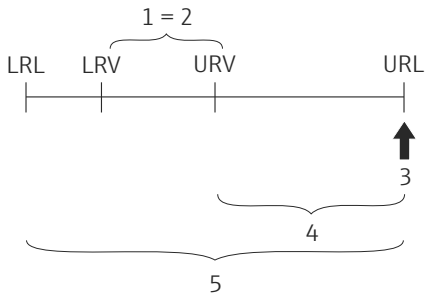
Device	Certificate/type of protection	Documentation	Version [1)]
FMD71, FMD72	ATEX II 1/2G Ex ia IIC T6 Ga/Gb	XA00619P	BA
FMD71, FMD72	ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb	XA00620P	BC
FMD71, FMD72	ATEX II 3G Ex nA IIC T6 GC	XA00621P	BD
FMD71, FMD72	IEC Ex ia IIC T6 Ga/Gb	XA00622P	IA
FMD71, FMD72	IEC Ex d [ia] IIC T6 Ga/Gb	XA00623P	IB
FMD71, FMD72	CSA General Purpose	-	CD

Device	Certificate/type of protection	Documentation	Version [1]
FMD71	FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00628P	FA
FMD71	FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00629P	FB
FMD71	CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00631P	CB
FMD71	FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00668P	FD
FMD71	CSA C/US NI, Cl.I Div. 2, Gr.A-D Cl.I, Zone 2, IIC	XA00670P	CC
FMD71	CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00630P	CA
FMD72	CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00626P	CA
FMD72	CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00627P	CB
FMD72	CSA C/US NI, Cl.I Div.2 Gr.A-D, Zone 2	XA00671P	CC
FMD72	FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00624P	FA
FMD72	FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00625P	FB
FMD72	FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00669P	FD

1) Product Configurator, "Approval" section

The nameplate provides information on the Safety Instructions (XA) that are relevant for the device.

Terms and abbreviations

Term/abbreviation	Explanation
MWP	The MWP (maximum working pressure) for the individual sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "(→ 30)" section.
OPL	The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "(→ 30)" section.
LRL	Lower range limit
URL	Upper range limit
LRV	Lower range value
URV	Upper range value
TD |Lower range value (LRV)| < |Upper range value (URV)| Example with measuring cell HP = 1 000 mbar (15 psi) and measuring cell LP = 400 mbar (6 psi): LRL = 400 mbar (6 psi): ▪ Lower range value (LRV) =−300 mbar (−4.35 psi) ▪ Upper range value (URV) = 0 mbar ▪ Nominal value (URL) =1 000 mbar (15 psi) Turn down: TD = URL + |LRL| / | URV - LRV | 4.66:1 Set span: URV − LRV =300 mbar (4.35 psi) This span is based on the zero point.	**Turn down** Set span and zero-based span  *1 Set span* *2 Zero-based span* *3 Nominal value ≙Upper range limit (URL)* *4 Nominal measuring range* *5 Sensor measuring range*

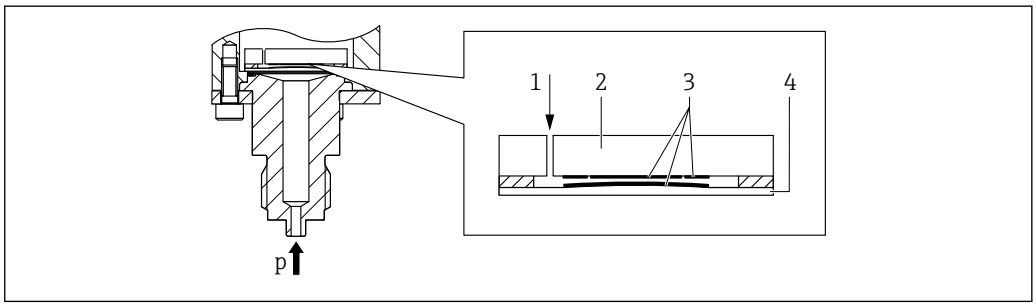
Function and system design

Measuring principle - electronic differential pressure measurement

FMD71 with ceramic process isolating diaphragm (Ceraphire®)

The ceramic sensor is a dry sensor, i.e. the process pressure acts directly on the robust ceramic process isolating diaphragm and causes it to deflect. A pressure-dependent change in capacitance is measured at the electrodes of the ceramic support and the process isolating diaphragm. The measuring range is determined by the thickness of the ceramic process isolating diaphragm.

Advantages:
- Guaranteed overload resistance up to 40 times the nominal pressure
- The ultrapure 99.9 % ceramic (Ceraphire®, see also "www.endress.com/ceraphire") ensures:
  - Excellent chemical resistance properties, comparable with Alloy C
  - Less relaxation
  - High mechanical stability
- Can be used in absolute vacuum
- Outstanding surface finish, $R_a \leq 0.3$ µm (11.8 µin)



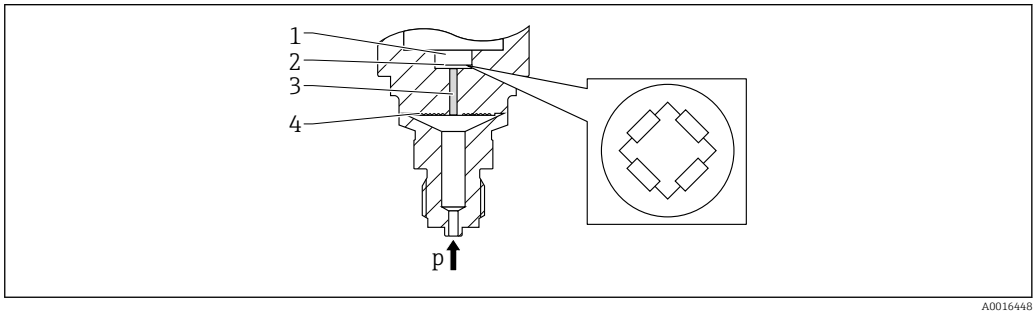
A0020465

1 Air pressure (relative pressure sensors)
2 Ceramic support
3 Electrodes
4 Ceramic process isolating diaphragm

FMD72 with metal process isolating diaphragm

The process pressure deflects the metal process isolating diaphragm of the individual sensors and a fill fluid transfers the pressure to a resistance bridge (semiconductor technology) within the compact sensor. The pressure-dependent change in the bridge output voltage is measured and evaluated.

Advantages:
- Can be used for process pressures up to 40 bar (600 psi).
- High long-term stability
- Guaranteed overload resistance up to 10 times the nominal pressure
- Significantly less thermal effect compared to diaphragm seal systems with capillaries



A0016448

1 Silicon measuring element, substrate
2 Wheatstone bridge
3 Channel with fill fluid
4 Metal process isolating diaphragm

Measuring system

The FMD71/FMD72 consists of 2 sensor modules and one transmitter. One sensor module measures the hydrostatic pressure (high pressure) and the other one the head pressure (low pressure). The level (electronic differential pressure) is calculated in the transmitter using these two digital values.

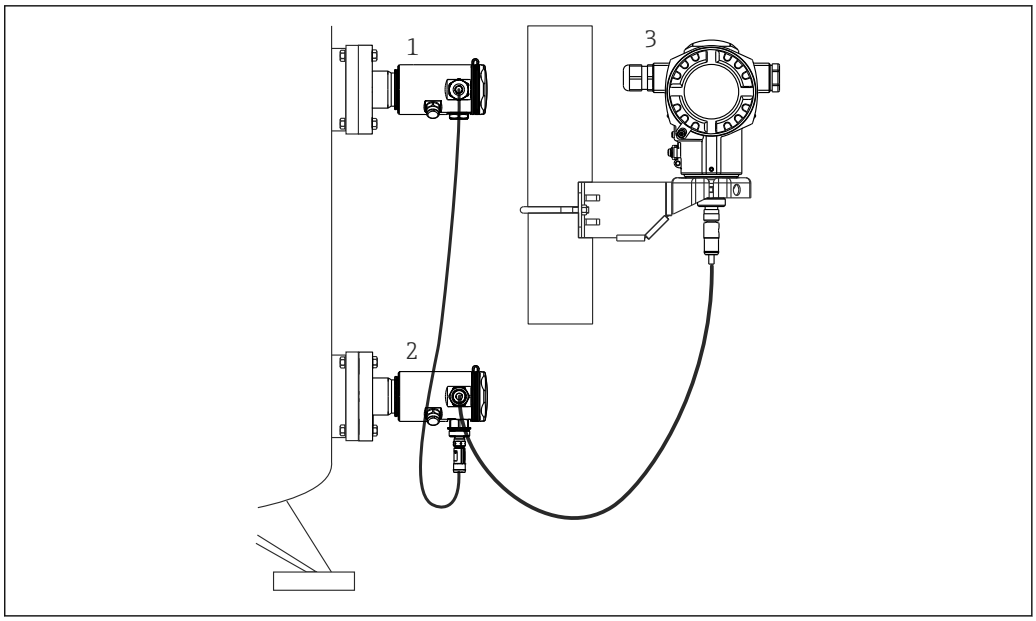
Device features

	FMD71	FMD72
Field of application	▪ Level ▪ Differential pressure	
Process connections	▪ Thread ▪ EN and ANSI flanges ▪ Flush-mounted hygienic connections	▪ Thread ▪ EN and ANSI flanges ▪ Flush-mounted hygienic connections
Measuring ranges (differential pressure)	from −100 to +100 mbar (−1.5 to +1.5 psi) to−1 to +40 bar (−15 to +600 psi)	from −400 to +400 mbar (−6 to +6 psi) to−1 to +40 bar (−15 to +600 psi)
MWP [1]	to60 bar (900 psi)	to160 bar (2 400 psi)
Process temperature limits	−25 to +150 °C (−13 to +302 °F)	−40 to +125 °C (−40 to +257 °F) Higher process temperature limits available on request (up to +250 °C (480 °F))
Ambient temperature range	−40 to +80 °C (−40 to +176 °F)	
Reference accuracy of the individual sensors	▪ Up to ±0.075 % of the set span ▪ PLATINUM version: up to ±0.05 % of the set span	
Supply voltage	▪ Version for non-hazardous areas: 12 (13) to 45 V DC ▪ Ex ia: 12 (13) to 30 V DC	
Output	4 to 20 mA with superimposed HART protocol	
Options	▪ NACE-compliant materials ▪ Software pre-configurations	

1) MWP: depends on the lowest-rated element, with regard to pressure, of the selected component

Product design

Level measurement (level, volume and mass) with Deltabar:



A0016449

1 Sensor module LP
2 Sensor module HP
3 Transmitter

The FMD71/FMD72 is best suited to level measurement in tanks with pressure overlay or vacuum vessels and tanks, high distillation columns and other vessels with changing ambient temperatures.

The sensor module HP is mounted on the lower measuring connection and the sensor module LP is mounted above the maximum level. The transmitter can be mounted on pipes or walls with the mounting bracket.

The sensor signal is transmitted digitally. In addition, sensor temperatures and the individual process pressures present at the respective sensor modules can be individually evaluated and transmitted.

System integration

The device can be given a tag name (max. 32 alphanumeric characters).

Designation	Version [1]
Measuring point (TAG), see additional specifications	Z1

1) Product Configurator, "Identification" section

Input

Measured variable

Measured process variables

- Pressure HP and Pressure LP
- Sensor temperature

Calculated process variables

- Differential pressure
- Level (level, volume or mass)

FMD71: measuring range of individual sensors

The URL of the differential pressure corresponds to the nominal value of the HP sensor.

Relative pressure

Nominal value	Range limit		MWP	OPL	Vacuum resistance [1]	Version [2]
	lower (LRL)	upper (URL)				
	[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)	2.7 (40.5)	4 (60)	0.7 (10.5)	1C
250 mbar (4 psi)	−0.25 (−4)	+0.25 (+4)	3.3 (49.5)	5 (75)	0.5 (7.5)	1E
400 mbar (6 psi)	−0.4 (−6)	+0.4 (+6)	5.3 (79.5)	8 (120)	0	1F
1 bar (15 psi)	−1 (−15)	+1 (+15)	6.7 (100.5)	10 (150)		1H
2 bar (30 psi)	−1 (−15)	+2 (+30)	12 (180)	18 (270)		1K
4 bar (60 psi)	−1 (−15)	+4 (+60)	16.7 (250.5)	25 (375)		1M
10 bar (150 psi)	−1 (−15)	+10 (+150)	26.7 (400.5)	40 (600)		1P
40 bar (600 psi)	−1 (−15)	+40 (+600)	40 (600)	60 (900)		1S

1) The vacuum resistance applies for the measuring cell under reference operating conditions. (see "Reference operating conditions" section)
2) Product Configurator, "Sensor range" section

Absolute pressure

Nominal value	Range limit		MWP	OPL	Vacuum resistance [1]	Version [2]
	lower (LRL)	upper (URL)				
	[bar_{abs} (psi_{abs})]	[bar_{abs} (psi_{abs})]	[bar_{abs} (psi_{abs})]	[bar_{abs} (psi_{abs})]	[bar_{abs} (psi_{abs})]	
100 mbar (1.5 psi)	0	+0.1 (+1.5)	2.7 (40.5)	4 (60)	0	2C
250 mbar (4 psi)	0	+0.25 (+4)	3.3 (49.5)	5 (75)		2E
400 mbar (6 psi)	0	+0.4 (+6)	5.3 (79.5)	8 (120)		2F
1 bar (15 psi)	0	+1 (+15)	6.7 (100.5)	10 (150)		2H
2 bar (30 psi)	0	+2 (+30)	12 (180)	18 (270)		2K
4 bar (60 psi)	0	+4 (+60)	16.7 (250.5)	25 (375)		2M
10 bar (150 psi)	0	+10 (+150)	26.7 (400.5)	40 (600)		2P
40 bar (600 psi)	0	+40 (+600)	40 (600)	60 (900)		2S

1) The vacuum resistance applies for the measuring cell under reference operating conditions. (see "Reference operating conditions" section)
2) Product Configurator, "Sensor range" section

FMD72: measuring range of individual sensors

The URL of the differential pressure corresponds to the nominal value of the HP sensor.

Relative pressure

Nominal value	Range limit		MWP	OPL	Vacuum resistance [1]	Version [2]
	lower (LRL)	upper (URL)			Silicone oil	
	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar_{abs} (psi_{abs})]	
400 mbar (6 psi)	−0.4 (−6)	+0.4 (+6)	4 (60)	6 (90)	0.01 (0.15)	1F
1 bar (15 psi)	−1 (−15)	+1 (+15)	6.7 (100)	10 (150)		1H
2 bar (30 psi)	−1 (−15)	+2 (+30)	13.3 (200)	20 (300)		1K
4 bar (60 psi)	−1 (−15)	+4 (+60)	18.7 (280.5)	28 (420)		1M
10 bar (150 psi)	−1 (−15)	+10 (+150)	26.7 (400.5)	40 (600)		1P
40 bar (600 psi)	−1 (−15)	+40 (+600)	100 (1500)	160 (2400)		1S

1) The vacuum resistance applies for the measuring cell under reference operating conditions. (see "Reference operating conditions" section)
2) Product Configurator, "Sensor range" section

Absolute pressure

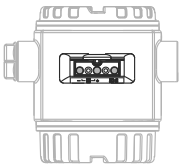
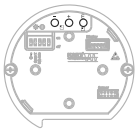
Nominal value	Range limit		MWP	OPL	Vacuum resistance [1]	Version [2]
	lower (LRL)	upper (URL)			Silicone oil	
	[bar_{abs} (psi_{abs})]	[bar_{abs} (psi_{abs})]	[bar_{abs} (psi_{abs})]	[bar_{abs} (psi_{abs})]	[bar_{abs} (psi_{abs})]	
1 bar (15 psi)	0	+1 (+15)	6.7 (100)	10 (150)	0.01 (0.15)	2H
2 bar (30 psi)	0	+2 (+30)	13.3 (200)	20 (300)		2K
4 bar (60 psi)	0	+4 (+60)	18.7 (280.5)	28 (420)		2M
10 bar (150 psi)	0	+10 (+150)	26.7 (400.5)	40 (600)		2P
40 bar (600 psi)	−1 (−15)	+40 (+600)	100 (1500)	160 (2400)		2S

1) The vacuum resistance applies for the measuring cell under reference operating conditions. (see "Reference operating conditions" section)
2) Product Configurator, "Sensor range" section

Output

Output signal

4 to 20 mA with superimposed digital communication protocol HART 6.0, 2-wire

Operation		
External (A) [1] + LCD (C)	Internal (B) + LCD (C)	Internal (B)
A  B  C  A0021280		
Order code version [2]		
5	4	8

1) In the case of the T17 transmitter housing, the operating keys are always arranged internally on the electronic insert.
2) Product Configurator, "Display, operation:" section

Signal range – 4 to 20 mA HART

3.8 mA to 20.5 mA

Signal on alarm

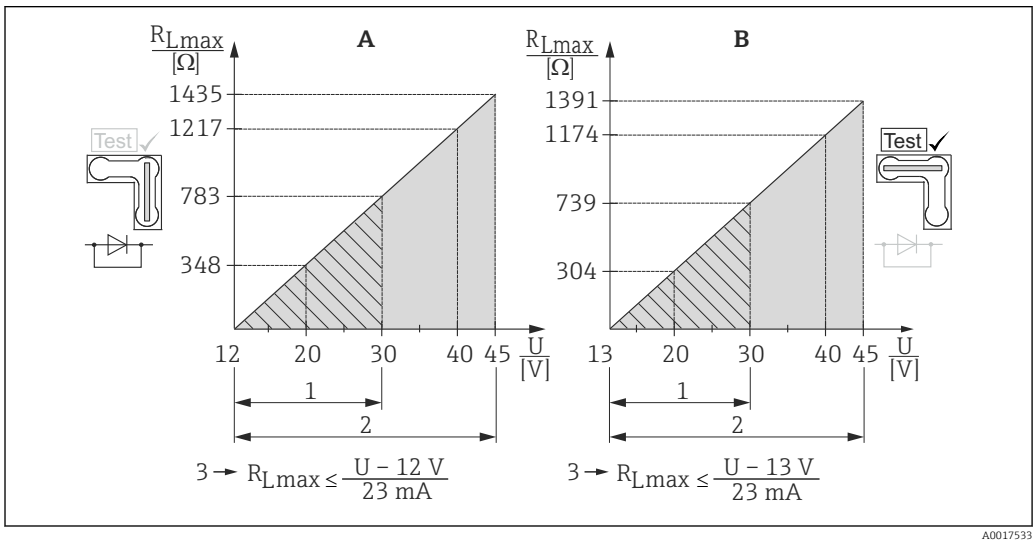
According to NAMUR NE43

- Max. alarm: (factory setting: 22 mA) can be set from 21 to 23 mA
- Hold measured value: last measured value is held
- Min. alarm: 3.6 mA

Maximum load

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.

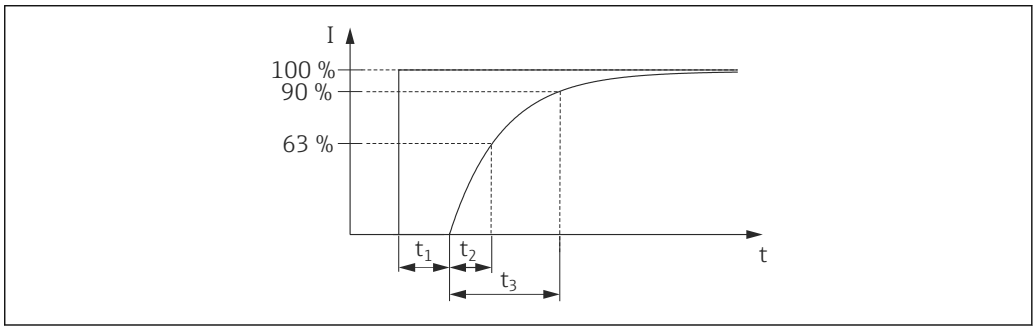
In the following load diagrams, observe the position of the jumper and the explosion protection:



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 for II 1/2 G Ex ia, FM IS, CSA IS
2 Power supply for devices for the non-hazardous area, 2 G Ex d, 3 G Ex nA, FM XP, FM NI, CSA XP, CSA dust ignition-proof
3 R_{Lmax} maximum load resistance
U Supply voltage

Dead time, time constant

Presentation of the dead time and the time constant:



A0019786

Dynamic behavior, current output

	Dead time (t_1) [ms]	Time constant (T63), t_2	Time constant (T90), t_3
max.	120	120	280

Dynamic behavior, HART

	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.	280	400	560
max.	1100	1220	1380

Reading cycle

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

The Deltabar FMD71/FMD72 offers BURST MODE functionality for cyclical 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)

Damping

A damping affects all outputs (output signal, display):
- Via onsite display, handheld terminal or PC with operating program, continuous from 0 to 999 s
- Via DIP switch on the electronic insert, switch position "on" = set value and "off"
- Factory setting: 2 s

Damping can be switched on or off using a switch on the electronic insert. If the switch is on, the time constant can be set via a parameter in the menu and if the switch is off, the output signal is not damped (time constant = 0.0).

Alarm current

Designation	Version [1]
Configured min alarm current	IA

1) Product Configurator, "Service" section

Firmware Version

Designation	Version [1]
01.00.zz, HART, DevRev01	78

1) Product Configurator, "Firmware Version" section

Protocol-specific data

Manufacturer ID	17 (0x11)
Device type ID	39 (0x27)
HART specification	6.0
Device description files (DTM, DD)	Information and files under: ▪ www.endress.com ▪ www.hartcomm.org
HART device variables	**Measured values for PV (primary variable)** ▪ Differential pressure ▪ Level linear (before lin.) ▪ Level after linearization table **Measured values for SV, TV, QV (second, third and fourth variable)** ▪ Measured differential pressure ▪ Corrected pressure ▪ Measured pressure HP ▪ Sensor press. HP ▪ Sensor temperature HP ▪ Measured pressure LP ▪ Sensor press. LP ▪ Sensor temperature LP ▪ Level before linearization ▪ Tank content ▪ Electronic temperature
Supported functions	▪ Burst mode ▪ Additional transmitter status

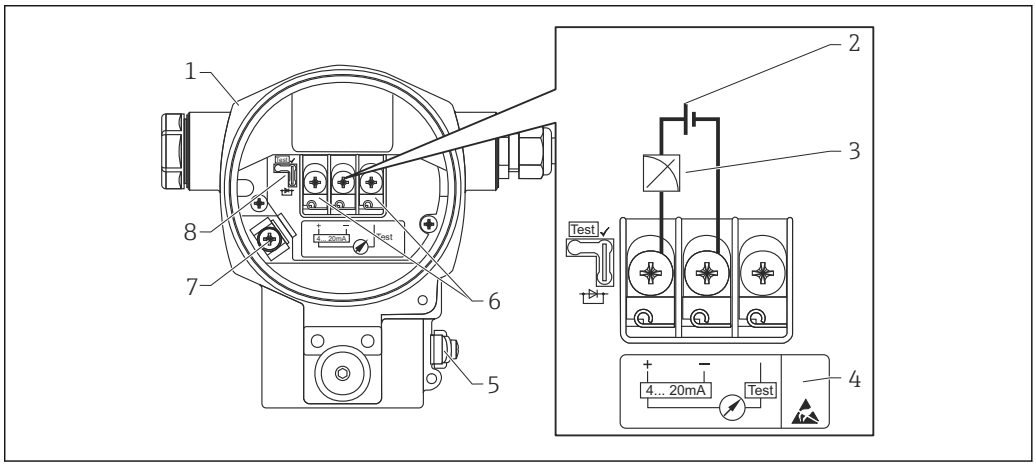
Power supply

NOTICE

Limitation of electrical safety due to incorrect connection!

- In accordance with IEC/EN61010 a separate circuit breaker must be provided for the device .
- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- 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.
- Devices with integrated overvoltage protection must be grounded.
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are integrated.

Terminal assignment



A0019989

1 *Housing*
2 *Supply voltage (see the following section on "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*

Supply voltage

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
4 to 20 mA HART, version for non-hazardous areas	13 to 45 V DC	12 to 45 V DC

Measuring a 4 to 20 mA test signal

A 4 to 20 mA test signal may be measured via the positive and test terminal without interrupting the measurement. The minimum supply voltage of the device can be reduced by simply changing the position of the jumper. As a result, operation is also possible with a lower supply voltage. To keep the corresponding measured error below 0.1 %, the current measuring device should exhibit an internal resistance of <0.7Ω. Observe the position of the jumper in accordance with the following table.

Jumper position for test signal	Description
 A0019992	▪ Measurement of 4 to 20 mA test signal via the positive and test terminal: possible. (Thus, the output current can be measured without interruption via the diode.) ▪ Delivery status ▪ Minimum supply voltage: 13 V DC
 A0019993	▪ Measurement of 4 to 20 mA test signal via positive and test terminal: not possible. ▪ Minimum supply voltage: 12 V DC

Cable specification for transmitter connection

- Endress+Hauser recommends using twisted, shielded two-wire cables.
- Terminals for core cross-sections0.5 to 2.5 mm² (20 to 14 AWG)
- The cable outer diameter depends on the cable entry used.

Cable entries

Explosion protection	Type	Permitted cable diameter	Permitted wire cross-sections
▪ Standard ▪ Ex ia	Plastic M20x1.5	5 to 10 mm (0.2 to 0.39 in)	0.5 to 2.5 mm² (20 to 14 AWG)
▪ Ex nA ▪ FM approval ▪ CSA approval	Metal M20 x 1.5	7 to 10.5 mm (0.28 to 0.41 in)	

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)]

Influence of power supply

≤0.0006 % of URL/1 V

Overvoltage protection

Standard version

The standard version of the pressure instruments does not contain any special elements to protect against overvoltage ("wire to ground"). Nevertheless the requirements of the applicable EMC standard EN 61000-4-5 (testing voltage 1kV EMC wire/ground) are met.

Optional overvoltage protection

Devices showing version "NA" in feature 610 "Accessory Mounted" in the order code are equipped with 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

NOTICE

Device could be destroyed!

▶ Devices with integrated overvoltage protection must be grounded.

Performance characteristics - general

Reference operating conditions

- As per IEC 60770
- Ambient temperature T_A = constant, in the range of:+21 to +33 °C (+70 to +91 °F)
- Humidityφ= constant, in the range of: 5 to 80 % rH
- Ambient pressure p_A = constant, in the range of:860 to 1060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell = constant, in range: horizontal ±1° (see also "Influence of the installation position" section (→ 17))
- Input of Lo Trim Sensor and Hi Trim Sensor for lower range value and upper range value
- Zero based span
- Material of process isolating diaphragm FMD71: Al_2O_3 (aluminum oxide ceramic, Ceraphire®)
- Material of process isolating diaphragm FMD72: AISI 316L (1.4435)
- Filling oil: silicone oil
- Supply voltage: 24 V DC ±3 V DC
- Load with HART: 250 Ω

Measuring uncertainty for small absolute pressure measuring ranges

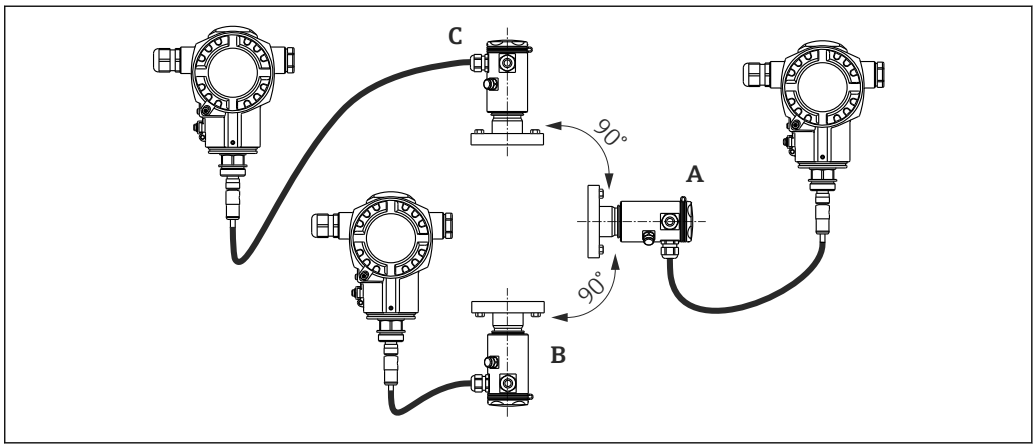
The smallest extended uncertainty of measurement that can delivered by our standards is:

- in range 1 to 30 mbar (0.0145 to 0.435 psi): 0.4 % of reading
- in range < 1 mbar (0.0145 psi): 1 % of reading.

Resolution

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

Influence of the installation position



A0016465

	Process isolating diaphragm axis is horizontal (A)	Process isolating diaphragm pointing upwards (B)	Process isolating diaphragm pointing downwards (C)
FMD71	Calibration position, no measurement error	< +0.2 mbar (+0.003 psi)	< −0.2 mbar (−0.003 psi)
FMD72 sensor with 1/2" thread and silicone oil		< +4 mbar (+0.06 psi)	< −4 mbar (−0.06 psi)
FMD72 sensor with thread > 1/2" and flanges		< +10 mbar (+0.145 psi) The value is doubled for inert oil.	< −10 mbar (−0.145 psi) The value is doubled for inert oil.

If the sensors are mounted at 180° to one another, this doubles the effect of the deviation which influences the differential pressure or the level signal.

This effect can be corrected using the function to adjust the position (position adjustment) for the differential pressure. Additional position adjustments for individual pressure signals are not available.

A position-dependent zero shift can be corrected on the device .

Warm-up period

4 to 20 mA HART : < 10 s

Vibration effects

Test standard	Vibration effects
IEC 61298-3	≤ Reference accuracy up to 10 to 60 Hz: ±0.35 mm (±0.01 in); 60 to 500 Hz: 2 g

Application limits

A high ratio between the level and head pressure can result in large measured errors. A maximum ratio of 1:10 is recommended. For calculation purposes, please use the free "Applicator" calculation tool, which is available online at "www.endress.com/applicator" or on CD-ROM.

Performance characteristics - devices with ceramic process isolating diaphragm

FMD71 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 span.

Measuring cell	Sensor	Reference accuracy (A) [%URL for every sensor]		Calculated reference accuracy (A_{Diff}) of the differential pressure
		Standard	Platinum	
100 mbar (1.5 psi)	Relative pressure	A = ±0.075	-	Calculation (mbar, bar or psi): $A_{Diff} = \sqrt{\left(\frac{A_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{A_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016468 Percentage calculation of URL dP: $A_{Diff}[\%] = \frac{A_{Diff} \cdot 100}{P_{Diff}}$ A0016469
250 mbar (3.75 psi)	Relative pressure	A = ±0.075	-	
400 mbar (6 psi)	Relative pressure	A = ±0.075	-	
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	Relative pressure/ Absolute pressure	A = ±0.075	A = ±0.05	

Ordering information

Designation	Version [1]
Platinum	D
Standard	G

1) Product Configurator, "Reference accuracy" section

Thermal change of the zero output and the output span for FMD71

Standard version

Measuring cell	−10 to +60 °C (+14 to +140 °F)	−20 to −10 °C (−4 to +14 °F) +60 to +125 °C (+140 to +257 °F)	Calculated thermal change (T_{Diff}) of the differential pressure
	% of the set span for every sensor		
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	T_{total} = ±0.176	T_{total} = ±0.276	Calculation (mbar, bar or psi): $T_{Diff} = \sqrt{\left(\frac{T_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{T_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016474 Percentage calculation of URL dP: $T_{Diff}[\%] = \frac{T_{Diff} \cdot 100}{P_{Diff}}$ A0016475
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	T_{total} = ±0.092	T_{total} = ±0.250	

High-temperature version

Measuring cell	Sensor	−10 to +60 °C (+14 to +140 °F)	+60 to +150 °C (140 to +302 °F)	Calculated thermal change (T_{Diff}) of the differential pressure
		% of the set span for every sensor		
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	Relative pressure	T_{total} = ±0.176	T = ±0.75	Calculation (mbar, bar or psi): $T_{Diff} = \sqrt{\left(\frac{T_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{T_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016474 Percentage calculation of URL dP: $T_{Diff}[\%] = \frac{T_{Diff} \cdot 100}{P_{Diff}}$ A0016475
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	Relative pressure	T_{total} = ±0.092	T = ±0.5	
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi)	Absolute pressure	T_{total} = ±0.092	T = ±0.75	
40 bar (600 psi)	Absolute pressure	T_{total} = ±0.092	T = ±0.5	

Hygienic version

Measuring cell	Sensor	−10 to +60 °C (+14 to +140 °F)	−0 to +150 °C (0 to +302 °F)	Calculated thermal change (T_{Diff}) of the differential pressure
		% of the set span for every sensor		
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	Relative pressure	T_{total} = ±0.352	T = ±1.25	Calculation (mbar, bar or psi): $T_{Diff} = \sqrt{\left(\frac{T_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{T_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016474 Percentage calculation of URL dP: $T_{Diff}[\%] = \frac{T_{Diff} \cdot 100}{P_{Diff}}$ A0016475
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	Relative pressure	T_{total} = ±0.184	T = ±0.75	
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi)	Absolute pressure	T_{total} = ±0.184	T = ±1.25	
40 bar (600 psi)	Absolute pressure	T_{total} = ±0.184	T = ±0.75	

FMD71 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).

Measuring cell	% of URL for every sensor - standard version	% of URL for every sensor - high-temperature version	% of URL for every sensor - hygienic version	Calculated total performance (TP_{Diff}) of the differential pressure
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	TP = ±0.2	TP = ±0.46	TP = ±0.575	Calculation (mbar, bar or psi): $TP_{Diff} = \sqrt{\left(\frac{TP_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{TP_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016470 Percentage calculation of URL dP: $TP_{Diff}[\%] = \frac{TP_{Diff} \cdot 100}{P_{Diff}}$ A0016471
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	TP = ±0.15	TP = ±0.46	TP = ±0.5	

The "Applicator Sizing Electronic dp" selection tool, available free of charge on the Endress +Hauser web site (www.endress. com/applicator), enables detailed calculations for your respective applications.

FMD71 long-term stability

Measuring ranges	Sensor	Standard version		Hygienic version		Calculated long-term stability (L_{Diff}) of the differential pressure
		1 year	10 years	1 year	10 years	
		% of URL for every sensor		% of URL for every sensor		
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	Relative pressure	L = ±0.1	L = ±0.2	L = ±0.25	L = ±0.45	Calculation (mbar, bar or psi): $L_{Diff} = \sqrt{\left(\frac{L_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{L_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016463 Percentage calculation of URL dP/year: $L_{Diff}\ [\%] = \frac{L_{Diff} \cdot 100}{P_{Diff}}$ A0016464
	Absolute pressure		L = ±0.3		L = ±0.55	
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	Relative pressure	L = ±0.05	L = ±0.2	L = ±0.1	L = ±0.2	
	Absolute pressure		L = ±0.3		L = ±0.3	

FMD71 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).

Measuring cell	% of URL for every sensor - standard version	% of URL for every sensor - high-temperature version	% of URL for every sensor - hygienic version	Calculated total error (TE_{Diff}) of the differential pressure
100 mbar (1.5 psi) 250 mbar (4 psi) 400 mbar (6 psi)	TE = ±0.25	TE = ±0.51	TE = ±0.925	Calculation (mbar, bar or psi): $TE_{Diff} = \sqrt{\left(\frac{TE_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{TE_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016472 Percentage calculation of URL dP: $TE_{Diff}\ [\%] = \frac{TE_{Diff} \cdot 100}{P_{Diff}}$ A0016473
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	TE = ±0.2	TE = ±0.51	TE = ±0.7	

Performance characteristics - devices with metal process isolating diaphragm

FMD72 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 span.

Measuring cell	Sensor	Reference accuracy (A) [%URL for every sensor]		Calculated reference accuracy (A_{Diff}) of the differential pressure
		Standard	Platinum	
400 mbar (6 psi)	Absolute pressure	A = ±0.15	-	Calculation (mbar, bar or psi): $A_{Diff} = \sqrt{\left(\frac{A_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{A_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016468 Percentage calculation of URL dP: $A_{Diff}[\%] = \frac{A_{Diff} \cdot 100}{P_{Diff}}$ A0016469
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	Relative pressure/ Absolute pressure	A = ±0.075	A = ±0.05	

Ordering information

Designation	Version [1]
Platinum	D
Standard	G

1) Product Configurator, "Reference accuracy" section

Thermal change of the zero output and the output span for FMD72

Measuring cell	−10 to +60 °C (+14 to +140 °F)	−40 to −10 °C (−40 to +14 °F) +60 to +80 °C (+140 to +176 °F)	Calculated thermal change (T_{Diff}) of the differential pressure
	% of the set span for every sensor		
400 mbar (6 psi)	T_{total} = ±0.215 T_{span} = ±0.2 $T_{zero\ point}$ = ±0.015	T_{total} = ±0.43 T_{span} = ±0.4 $T_{zero\ point}$ = ±0.03	Calculation (mbar, bar or psi): $T_{Diff} = \sqrt{\left(\frac{T_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{T_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016474 Percentage calculation of URL dP: $T_{Diff}[\%] = \frac{T_{Diff} \cdot 100}{P_{Diff}}$ A0016475
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	T_{total} = ±0.101 T_{span} = ±0.1 $T_{zero\ point}$ = ±0.01	T_{total} = ±0.42 T_{span} = ±0.4 $T_{zero\ point}$ = ±0.02	

FMD72 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).

Measuring cell	% of URL for every sensor	Calculated total performance (TP_{Diff}) of the differential pressure
400 mbar (6 psi)	TP = ±0.25	Calculation (mbar, bar or psi): $TP_{Diff} = \sqrt{\left(\frac{TP_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{TP_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016470 Percentage calculation of URL dP: $TP_{Diff}\,[\%] = \frac{TP_{Diff} \cdot 100}{P_{Diff}}$ A0016471
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	TP = ±0.15	

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FMD72 long-term stability

	1 year	5 years	10 years	Calculated long-term stability (L_{Diff}) of the differential pressure
Measuring ranges	% of URL for every sensor			
400 mbar (6 psi)	L = ±0.035	L = ±0.14	L = ±0.32	Calculation (mbar, bar or psi): $L_{Diff} = \sqrt{\left(\frac{L_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{L_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016463 Percentage calculation of URL dP/year: $L_{Diff}\,[\%] = \frac{L_{Diff} \cdot 100}{P_{Diff}}$ A0016464
1 bar (15 psi)	L = ±0.020	L = ±0.08	L = ±0.180	
2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi)	L = ±0.025	L = ±0.05	L = ±0.075	
40 bar (600 psi)	L = ±0.025	L = ±0.075	L = ±0.100	

FMD72 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).

Measuring cell	% of URL/year for every sensor	Calculated total error (TE_{Diff}) of the differential pressure
400 mbar (6 psi)	TE = ±0.30	Calculation (mbar, bar or psi): $TE_{Diff} = \sqrt{\left(\frac{TE_{HP}}{100} \cdot URL_{HP}\right)^2 + \left(\frac{TE_{LP}}{100} \cdot URL_{LP}\right)^2}$ A0016472 Percentage calculation of URL dP: $TE_{Diff}\,[\%] = \frac{TE_{Diff} \cdot 100}{P_{Diff}}$ A0016473
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 40 bar (600 psi)	TE = ±0.20	

Installation

When measuring in media containing solids, such as dirty liquids, installing separators and drain valves is useful for capturing and removing sediment.

Mounting location

The FMD71/FMD72 is best suited to level measurement in vessels with pressure overlay or vacuum tanks, high distillation columns and other vessels with changing ambient temperatures.

The sensor module HP is mounted on the lower measuring connection and the sensor module LP is mounted above the maximum level. The transmitter can be mounted on pipes or walls with the mounting bracket.

Orientation

- Transmitter: Any orientation.
- Sensor modules: The orientation can cause a zero point shift (→ 17).
  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).

General installation instructions

Mounting the sensor modules and transmitter is very easy
- The housings of the sensor modules can be rotated up to 480°.
- The transmitter is freely rotatable in the mounting bracket.

The sensor modules and transmitter can be easily aligned when mounted.

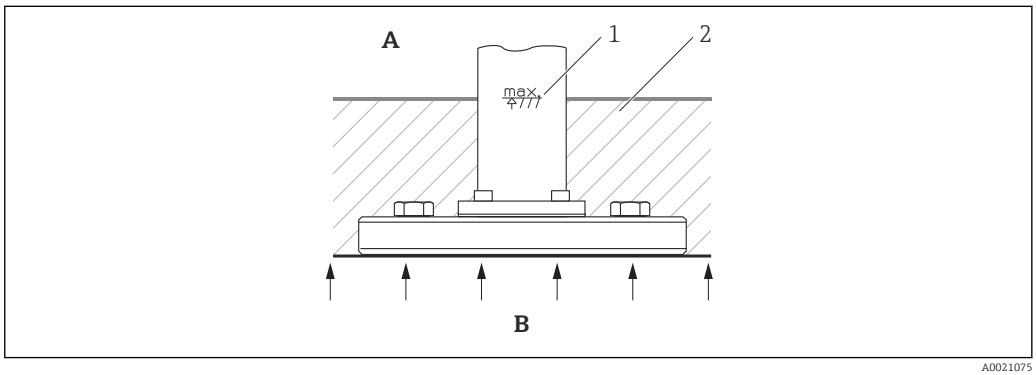
Your benefits
- Easy mounting due to optimum alignment of housing
- Easily accessible device operation
- Optimum readability of the onsite display (optional)
- Easy pipe installation due to optional alignment of the modules.

Thermal insulation - FMD71 high-temperature version

The FMD71 high-temperature version may only be insulated up to a certain height. The maximum permitted insulation height is indicated on the devices and applies to an insulation material with a heat conductivity ≤ 0.04 W/(m x K) and to the maximum permitted ambient and process temperature. The insulation height is not indicated on hygienic connections.

- Ambient temperature (T_A): ≤ 70 °C (158 °F)
- Process temperature (T_P): ≤ 150 °C (302 °F)

The data were determined under the most critical application "quiescent air".



A0021075

A Ambient temperature
B Process temperature
1 Insulation height
2 Insulation material

Installing the sensor modules

General installation instructions

- Due to the orientation of the sensor modules, there may be a shift in the zero point, i.e. when the vessel is empty or partially full, the measured value does not display zero.
- Always install the sensor module HP below the lowest measuring point.
- Always install the sensor module LP above the highest measuring point.
- Do not mount the sensor modules in the filling curtain or at a point in the tank which could be affected by pressure pulses from an agitator.
- Do not mount the sensor modules in the suction area of a pump.
- The adjustment and functional test can be carried out more easily if you mount the sensor modules downstream of a shutoff device.

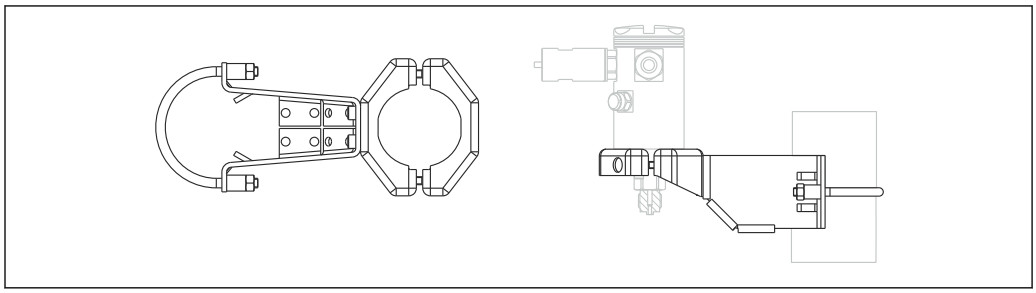
Mounting sensor modules with PVDF process connections

⚠ WARNING

Risk of damage to process connection!
Risk of injury!

▶ Sensor modules with PVDF process connections must be installed with the mounting bracket supplied!

The mounting bracket can be installed on pipes with a diameter of 1¼" to 2" or on walls.

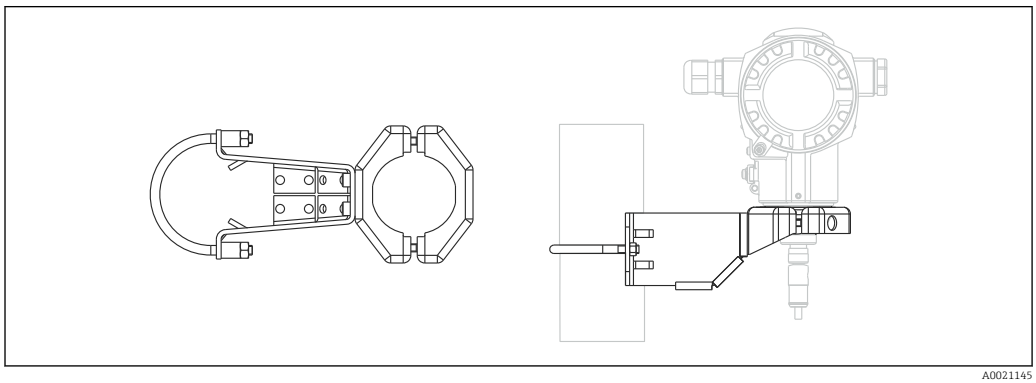


A0017514

- The mounting bracket is included in the delivery.
- Ordering information:
  Product Configurator, "Enclosed accessories" section, "PA" version or as separate accessory (Part No.: 71102216).
- Dimensions (→ 🖹 53).

Installing the transmitter

The transmitter is installed with the mounting bracket supplied. The mounting bracket can be installed on pipes with a diameter of 1¼" to 2" or on walls.



A0021145

- The mounting bracket is included in the delivery.
- If an additional mounting bracket is required (e.g. for a PVDF process connection), it can be ordered as follows:
  Product Configurator, "Enclosed accessories" section, "PA" version or as separate accessory (Part No.: 71102216).
- Dimensions (→ 🖹 53).

Sensor and transmitter cable

Designation	Length	Version [1]
Sensor cable PE-X	1.82 m (6 ft)	BC
	4.57 m (15 ft)	CC
	10.67 m (35 ft)	DC
	30.48 m (100 ft)	FC
	45.72 m (150 ft)	GC
Transmitter cable PE-X	1.82 m (6 ft)	BC
	4.57 m (15 ft)	CC
	10.67 m (35 ft)	DC

1) Product Configurator, "Cable length" section

Technical data for PE-X cable:
- Temperature resistance:–40 to +80 °C (–40 to +176 °F)
- Flame resistance: to DIN 60332-1-2 and DIN EN 50266-2-5
- Halogen-free: to DIN VDE 0472 part 815
- Oil-resistant: to DIN EN 60811-2-1
- Other: UV-resistant to DIN VDE 0276-605
- Bending radius: min. 34 mm (1.34 in), permanently installed

Environment

Ambient temperature range

- Without onsite display: −40 to +80 °C (−40 to +176 °F)
- With onsite display: −20 to +70 °C (−4 to +158 °F)
  Extended temperature operation range with limitations in optical properties, such as display speed and contrast, for example: −40 to +80 °C (−40 to +176 °F).

For devices for use in hazardous areas, see Safety Instructions .

The device can be used in this temperature range. The values of the specification, such as thermal change, may be exceeded.

Storage temperature range

−40 to +80 °C (−40 to +176 °F)

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)

Degree of protection

IP66/68 NEMA 4x/6P

IP 68 degree of protection for T17 housing: 1.83 mH2O for 24 h

Vibration resistance

Housing	Test standard	Vibration resistance
Aluminum and steel housing	IEC 61298-3	Guaranteed for: 10 to 60 Hz: ±0.15 mm (±0.0059 in); 60 to 500 Hz: 2 g in all 3 planes

Electromagnetic compatibility

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

Process

FMD71 process temperature limits

- −25 to +125 °C (−13 to +257 °F)
- High-temperature version: −15 to +150 °C (+5 to +302 °F); see ordering information for feature 610, version "NB".
- For saturated steam applications, use a Deltabar FMD72 with a metal process isolating diaphragm or provide a siphon for temperature isolation when installing.
- Pay attention to the process temperature range of the seal. See also the following table.

Seal	Notes	Process temperature range		Version [1]
		Threaded connection or flange	Hygienic process connections	
FKM Viton	-	−25 to +125 °C (−13 to +257 °F)	-	A
FKM Viton	FDA [3], 3A Class I, USP Class VI	−5 to +125 °C (+23 to +257 °F)	−5 to +150 °C (+23 to +302 °F)	B
Kalrez, Compound 4079	-	+5 to +125 °C (+41 to +257 °F) +5 to +150 °C (+41 to +302 °F) [2]	-	D
NBR	FDA [3]	−10 to +100 °C (+14 to +212 °F)	-	F
NBR, low temperature	-	−40 to +100 °C (−40 to +212 °F)	-	H
HNBR [4]	FDA [3], 3A Class II, KTW, AFNOR, BAM	−25 to +125 °C (−13 to +257 °F)	−20 to +125 °C (−4 to +257 °F)	G
EPDM 70	FDA [3]	−40 to +125 °C (−40 to +257 °F)	-	J
EPDM 291 [4]	FDA [3], 3A Class II, USP Class VI, DVGW, KTW, W270, WRAS, ACS, NSF61	-	−15 to +150 °C (+5 to +302 °F)	K
FFKM Kalrez 6375	-	+5 to +125 °C (+41 to +257 °F)	-	L
FFKM Kalrez 7075	-	+5 to +125 °C (+41 to +257 °F)	-	M
FFKM Kalrez 6221	FDA [3], USP Class VI	−5 to +125 °C (+23 to +257 °F)	−5 to +150 °C (+23 to +302 °F)	N
Fluoroprene XP40	FDA [3], USP Class VI, 3A Class I	+5 to +125 °C (+41 to +257 °F)	+5 to +150 °C (+41 to +302 °F)	P
VMQ silicone	FDA [3]	−35 to +85 °C (−31 to +185 °F)	−20 to +85 °C (−4 to +185 °F)	S
The process temperature ranges indicated here refer to the permanent operation of the FMD71. For cleaning purposes, a higher temperature (max. 150 °C (302 °F)) may be applied for a short period (max. 30 min.).				

1) Product Configurator, "Seal" section
2) 150 °C (302 °F) for high-temperature version
3) Food-safe FDA 21 CFR 177.2600
4) These seals are used for devices with 3A-approved process connections.

Applications with changes in temperature

Frequent extreme changes in temperatures can temporarily cause measuring errors. Temperature compensation takes place after a few minutes. Internal temperature compensation is faster the smaller the change in temperature and the longer the time interval.

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

FMD72 process temperature limits

Device	Limits
Process connections with internal process isolating diaphragm	−40 to +125 °C (−40 to +257 °F)
Process connections with flush-mounted process isolating diaphragm (flange)	−40 to +100 °C (−40 to +212 °F)

Pressure specifications

⚠ WARNING

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

► (→ 🖹 11), "Measuring range" section and (→ 🖹 31) "Mechanical construction" section

- (→ 🖹 11), "Measuring range" section
  The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure. See the following sections:
  The MWP (maximum working pressure) is specified on the nameplate of the individual sensor module. This value refers to a reference temperature of +20 °C (+68 °F), or +38 °C (+100 °F)for ANSI flanges, and can be present at the device for an unlimited period. Observe pressure-temperature dependency.
- Please refer to the following standards for the pressure values permitted at higher temperatures:
  - EN 1092-1: 2001 Tab. 18. With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
  - ASME B 16.5a – 1998 Tab. 2-2.2 F316
  - ASME B 16.5a – 1998 Tab. 2.3.8 N10276
  - JIS B 2220
- The test pressure corresponds to the over pressure limit of the individual sensor modules (OPL = 1.5 x MWP [1]) and may only be applied temporarily so that no permanent damage develops.
- The Pressure Equipment Directive (EC Directive 97/23/EC) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
- In the case of sensor range and process connections where the over pressure limit (OPL) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value (1.5 x PN; MWP = PN).

1) Formula does not apply to the FMD72 with a 40 bar (600 psi) measuring cell.

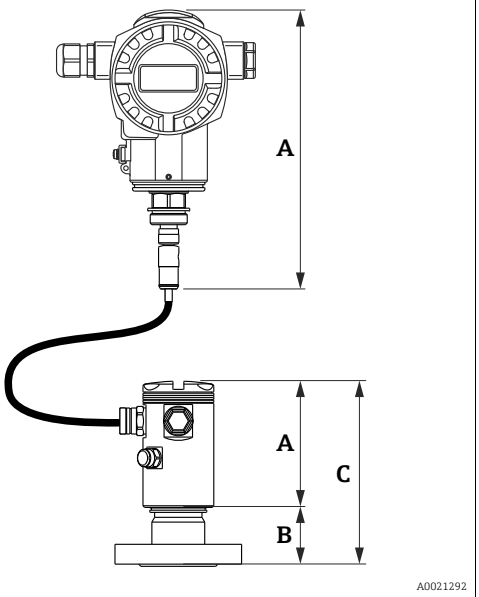
Mechanical construction

Device height

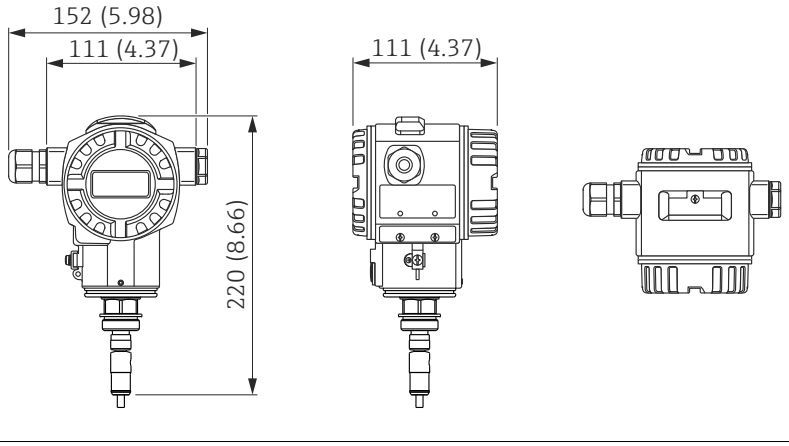
The device height is calculated from

- the height of the housing and
- the height of the individual 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. Where applicable also take into consideration the installation distance (space that is used to install the device). You can use the following table for this purpose:

Section	Page	Height	Example
Housing height	(→ 32) ff.	(A)	
Process connections	(→ 34)	(B)	
Installation distance	-	(C)	
Device height			

T14 transmitter housing (optional display on the side)

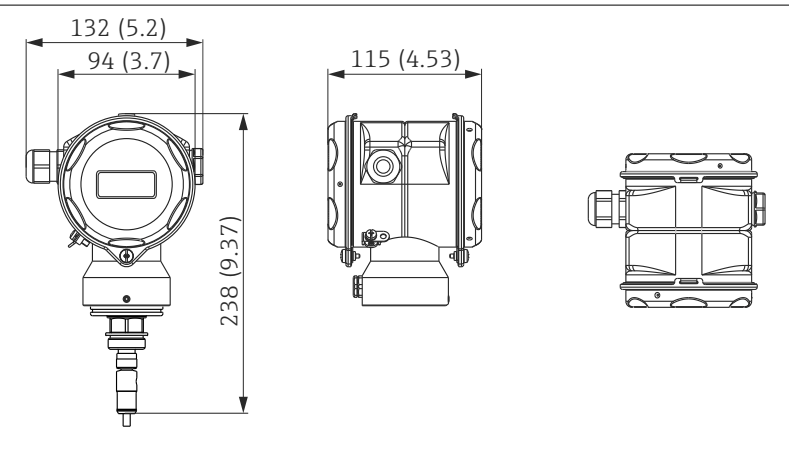


Engineering unit mm (in)

Material	Degree of protection	Cable entry	Weight kg (lbs)		Version [1]
			With display	Without display	
Aluminum	IP66/68 NEMA 4x/6P	▪ M20 ▪ G ½ (on request) ▪ NPT ½	1.7 (3.75)	1.6 (3.53)	A
Stainless steel	IP66/68 NEMA 4x/6P	▪ M20 ▪ G ½ (on request) ▪ NPT ½	2.6 (5.73)	2.5 (5.51)	B

1) Product Configurator, "Transmitter housing" section

In preparation - T17 transmitter housing (optional display on the side)

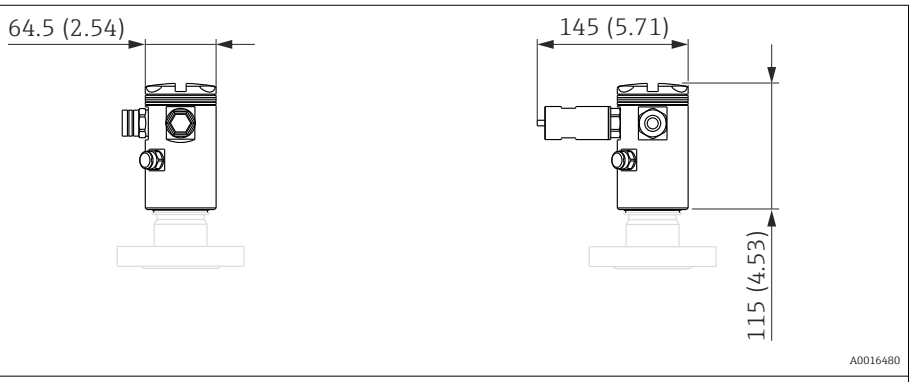


Engineering unit mm (in)

Material	Degree of protection	Cable entry	Weight kg (lbs)		Version [1]
			With display	Without display	
316L	IP66/68 NEMA 6P	▪ M20 ▪ G ½ (on request) ▪ NPT ½	2.6 (5.73)	2.5 (5.51)	C

1) Product Configurator, "Transmitter housing" section

Sensor housing



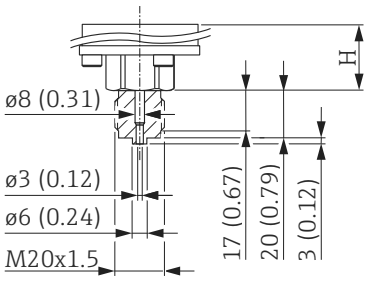
Engineering unit mm (in)

Material	Degree of protection	Cable entry	Weight kg (lbs)	Version [1]
Aluminum	IP66/68 NEMA 4x/6P	▪ M20 ▪ G ½ (on request) ▪ NPT ½	0.6 (1.32)	A
Stainless steel	IP66/68 NEMA 4x/6P	▪ M20 ▪ G ½ (on request) ▪ NPT ½	1.35 (2.98)	B

1) Product Configurator, "Sensor module housing" section

FMD71 process connections, internal process isolating diaphragm

Thread DIN 13



Engineering unit mm (in)

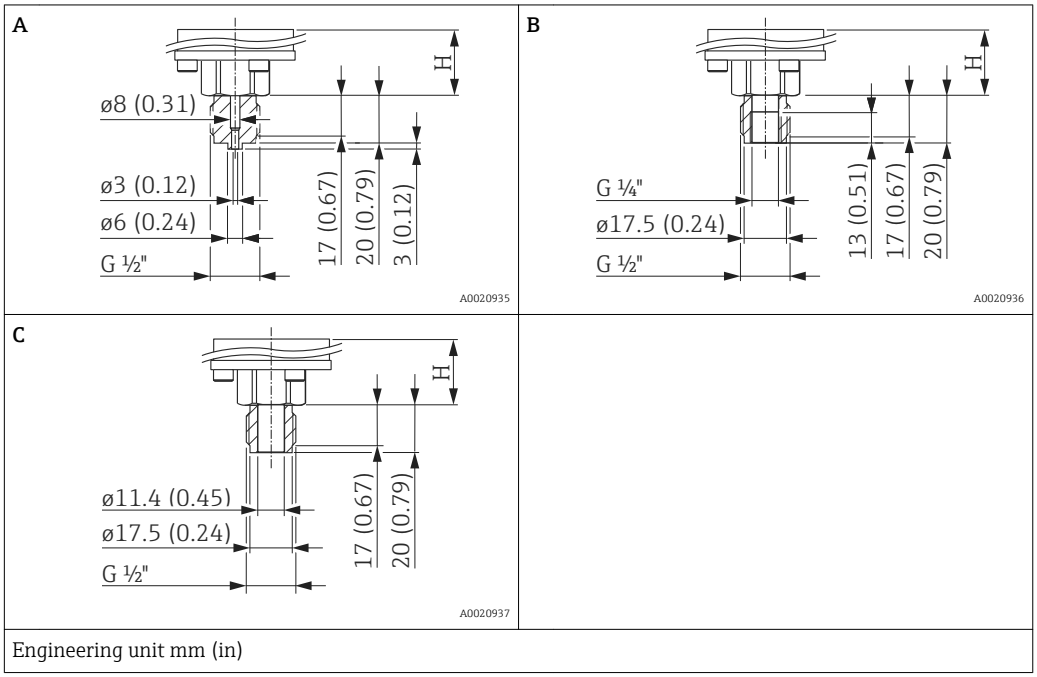
Designation	Material	Weight kg (lbs)	Version [1]
DIN 13 M20 x 1.5, EN 837 3 mm (0.12 in)	AISI 316L	0.63 (1.39)	G1J
	Alloy C276 (2.4819)		G2C

1) Product Configurator, "Process connection" section

Description	Height H
Standard height	26 mm (1.02 in)
Device with Ex d[ia], CSA XP or FM XP	96 mm (3.78 in)
High-temperature version	106 mm (4.17 in)
High-temperature version with Ex d[ia], CSA XP or FM XP	176 mm (6.93 in)

FMD71 process connections, internal process isolating diaphragm

Thread ISO 228 G



Engineering unit mm (in)

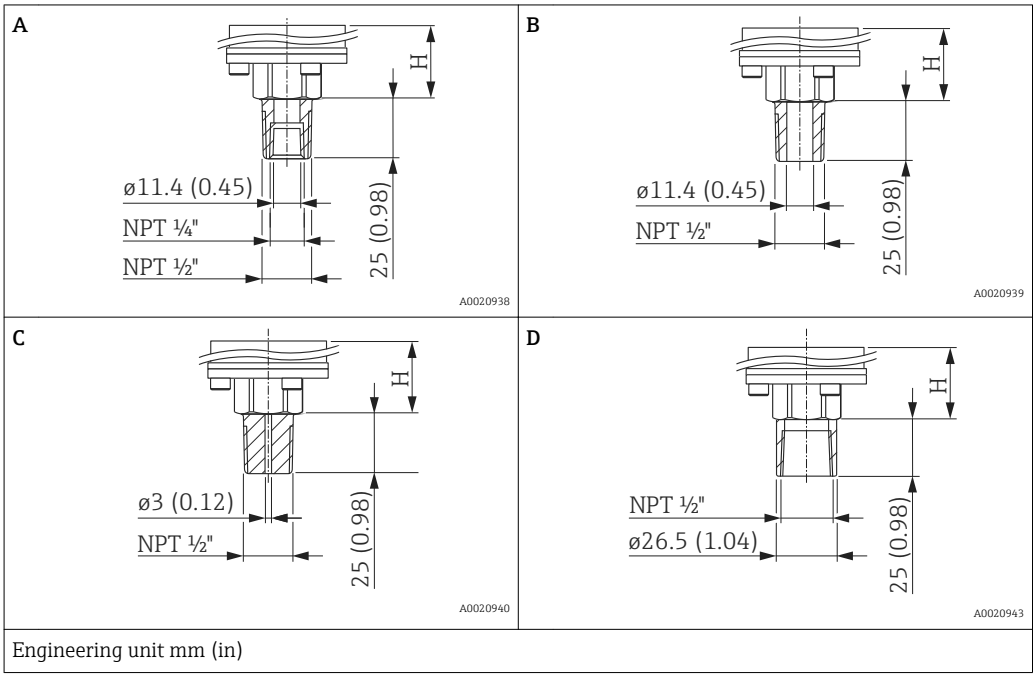
Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
A	Thread ISO 228 G ½" A EN 837	AISI 316L (CRN)	0.63 (1.39)	GCJ
		Alloy C276 (2.4819) (CRN)		GCC
		Monel (2.4360)		GCD
		PVDF ▪ Mount only with mounting bracket ▪ MWP 10 bar (150 psi), OPL max. 15 bar (225 psi) ▪ Process temperature range: +10 to +60 °C (+14 to +140 °F)		GCF
B	Thread ISO 228 G ½" A, G ¼" (female) EN 837	AISI 316L (CRN)		GLJ
		Alloy C276 (2.4819) (CRN)		GLC
		Monel (2.4360)		GLD
C	Thread ISO 228 G ½" A EN 837, bore 11.4 mm (0.45 in)	AISI 316L (CRN)		GMJ
		Alloy C276 (2.4819) (CRN)		GMC
		Monel (2.4360)		GMD

1) Product Configurator, "Process connection" section

Description	Height H
Standard height	26 mm (1.02 in)
Device with Ex d[ia], CSA XP or FM XP	96 mm (3.78 in)
High-temperature version	106 mm (4.17 in)
High-temperature version with Ex d[ia], CSA XP or FM XP	176 mm (6.93 in)

FMD71 process connections, internal process isolating diaphragm

Thread ANSI



Engineering unit mm (in)

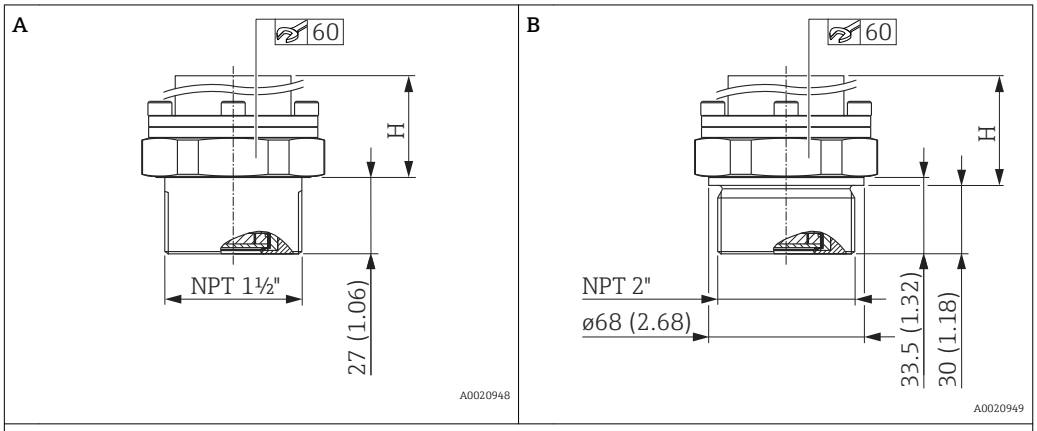
Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
A	ANSI ½" MNPT, ¼" FNPT	AISI 316L (CRN)	0.63 (1.39)	RLJ
		Alloy C276 (2.4819) (CRN)		RLC
		Monel (2.4360)		RLD
B	ANSI ½" MNPT, bore 11.4 mm (0.45 in)	AISI 316L (CRN)		RKJ
		Alloy C276 (2.4819) (CRN)		RKC
		Monel (2.4360)		RKD
C	ANSI ½" MNPT, bore 3 mm (0.12 in)	**PVDF** ▪ Mount only with mounting bracket ▪ MWP 10 bar (150 psi), OPL max. 15 bar (225 psi) ▪ Process temperature range: +10 to +60 °C (+14 to +140 °F)		RJF
D	ANSI ½" FNPT 11.4 mm (0.45 in)	AISI 316L (CRN)		R1J
		Alloy C276 (2.4819) (CRN)		R1C
		Monel (2.4360)		R1D

1) Product Configurator, "Process connection" section

Description	Height H
High-temperature version	86 mm (3.39 in)
High-temperature version with Ex d[ia], CSA XP or FM XP	151 mm (5.94 in)

FMD71 process connections, flush-mounted process isolating diaphragm

Thread ANSI



Engineering unit mm (in)

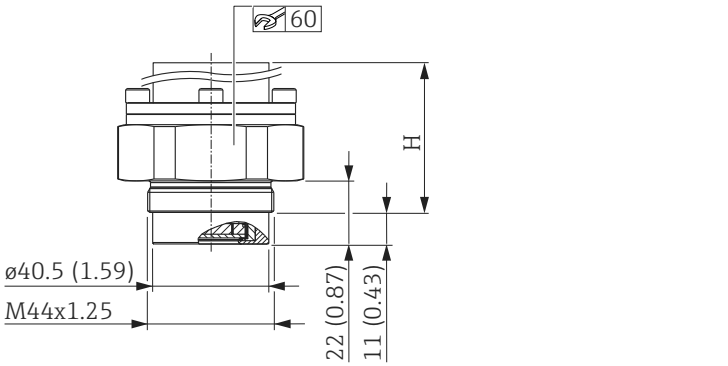
Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
A	ANSI 1 ½" MNPT	AISI 316L (CRN)	0.63 (1.39)	U7J
		Alloy C276 (2.4819) (CRN)		U7C
		Monel (2.4360)		U7D
B	ANSI 2" MNPT	AISI 316L (CRN)		U8J
		Alloy C276 (2.4819) (CRN)		U8C
		Monel (2.4360)		U8D

1) Product Configurator, "Process connection" section

Description	Height H
High-temperature version	86 mm (3.39 in)
High-temperature version with Ex d[ia], CSA XP or FM XP	151 mm (5.94 in)

FMD71 process connections, flush-mounted process isolating diaphragm

Thread DIN 13



Engineering unit mm (in)

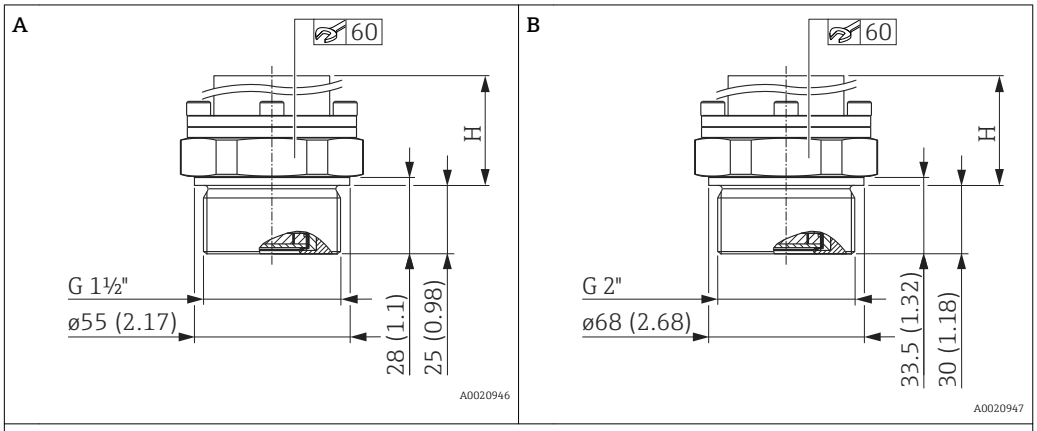
Designation	Material	Weight	Version [1]
		kg (lbs)	
DIN 13 M44 x 1.25	AISI 316L	0.63 (1.39)	G4J
	Alloy C276 (2.4819)		G4C

1) Product Configurator, "Process connection" section

Description	Height H
High-temperature version	86 mm (3.39 in)
High-temperature version with Ex d[ia], CSA XP or FM XP	151 mm (5.94 in)

FMD71 process connections, flush-mounted process isolating diaphragm

Thread ISO 228 G



Engineering unit mm (in)

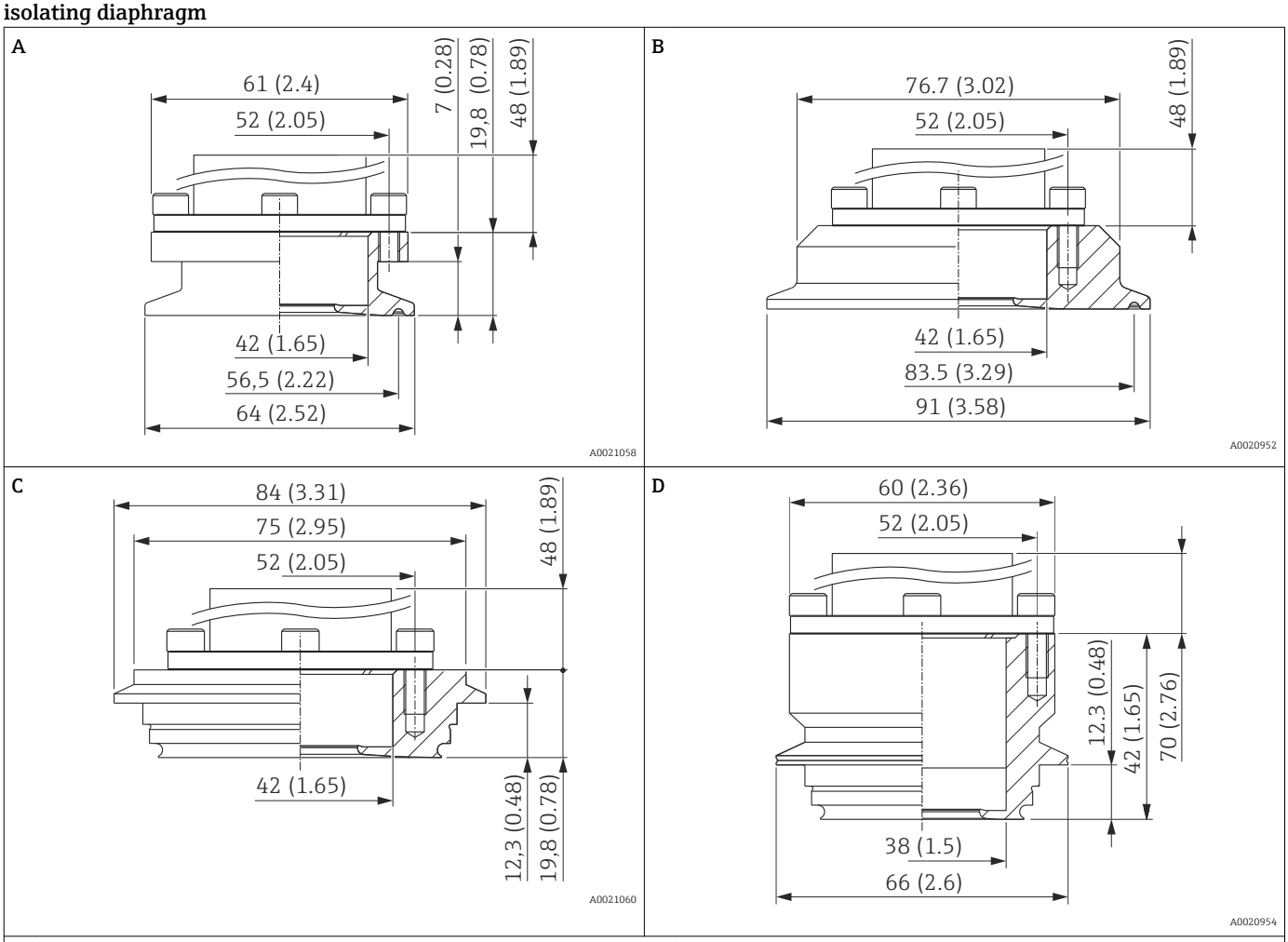
Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
A	Thread ISO 228 G 1 ½" A	AISI 316L	0.63 (1.39)	GVJ
		Alloy C276 (2.4819)		GVC
		Monel (2.4360)		GVD
B	Thread ISO 228 G 2" A	AISI 316L		GWJ
		Alloy C276 (2.4819)		GWC
		Monel (2.4360)		GWD

1) Product Configurator, "Process connection" section

Description	Height H
High-temperature version	86 mm (3.39 in)
High-temperature version with Ex d[ia], CSA XP or FM XP	151 mm (5.94 in)

FMD71 process connections, flush-mounted process isolating diaphragm

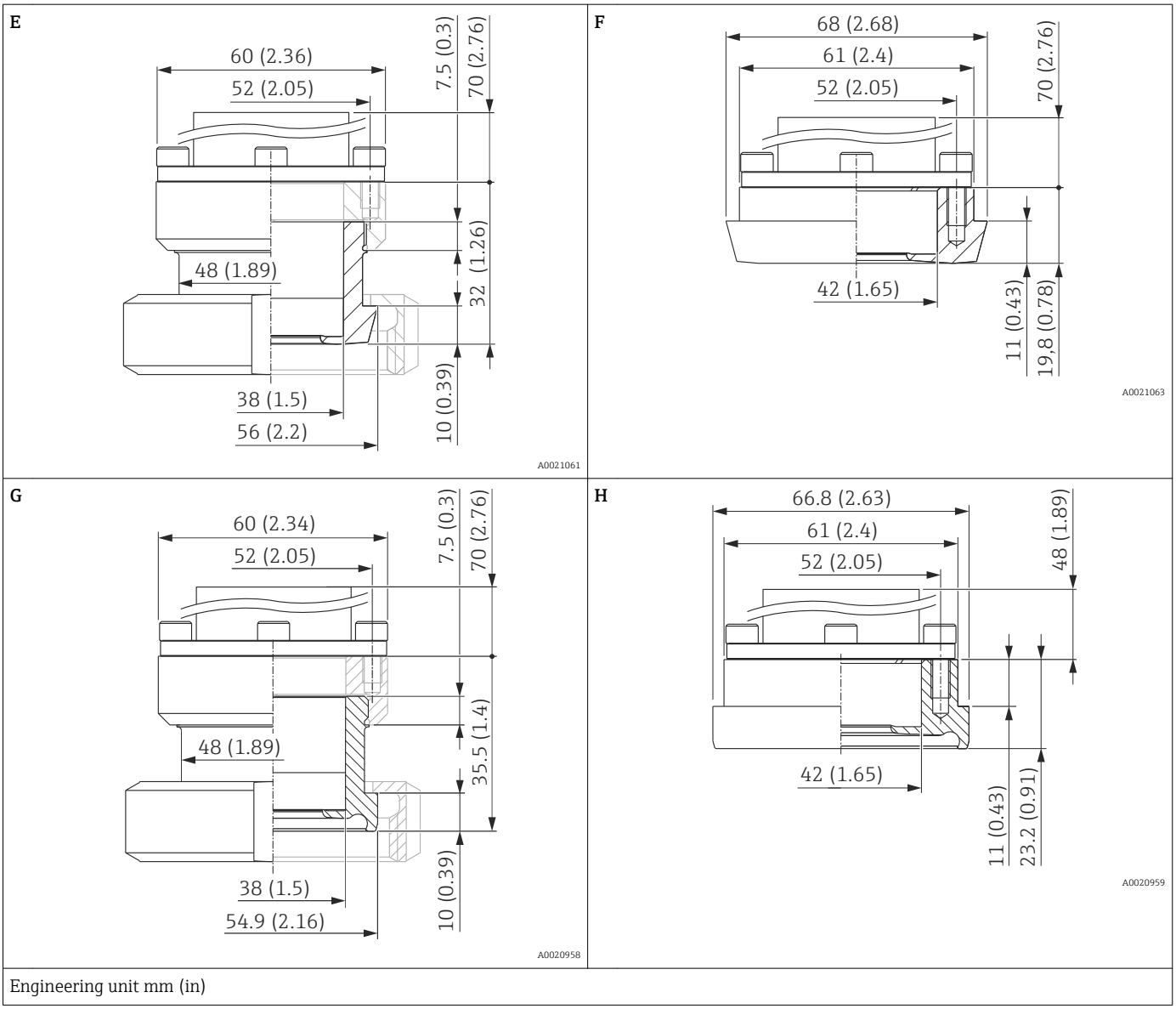
Hygienic connections



Engineering unit mm (in)

Item	Designation	Material	Weight kg (lbs)	Version [1]
A [2]	Tri-Clamp ISO 2852 DN 40 – DN 51 (2"), DIN 32676DN 50, EHEDG, 3A (CRN)	AISI 316L (1.4435)	0.7 (1.54)	TDJ [3]
B	Tri-Clamp ISO 2852 DN 76.1 (3"), EHEDG, 3A, with FDA seal		0.9 (1.98)	TFJ [3]
C [2]	Varivent Type N for pipes 40 – 162, PN 40, EHEDG, 3A (CRN)		1 (2.21)	TRJ
D	Varivent Type F for pipes DN25-32 PN 40, 316L, EHEDG, 3A, with FDA seal		0.46 (1)	TQJ

1) Product Configurator, "Process connection" section
2) Roughness of wetted surfaces R_a < 0.76 µm (30 µin) as standard. Surface quality R_a < 0.38 µm (15 µin) electropolished (wetted) available on request.
3) 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).

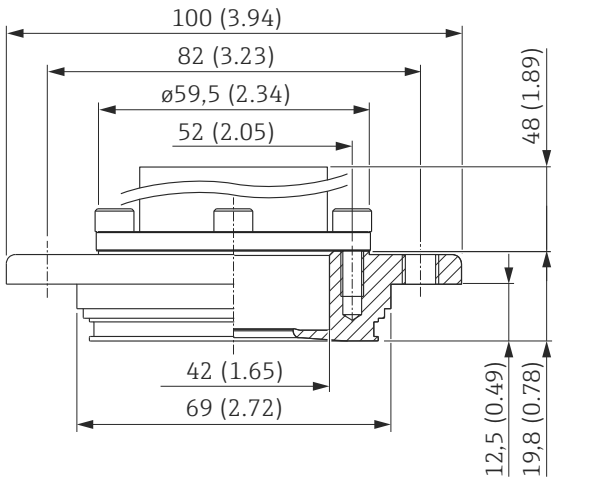


Engineering unit mm (in)

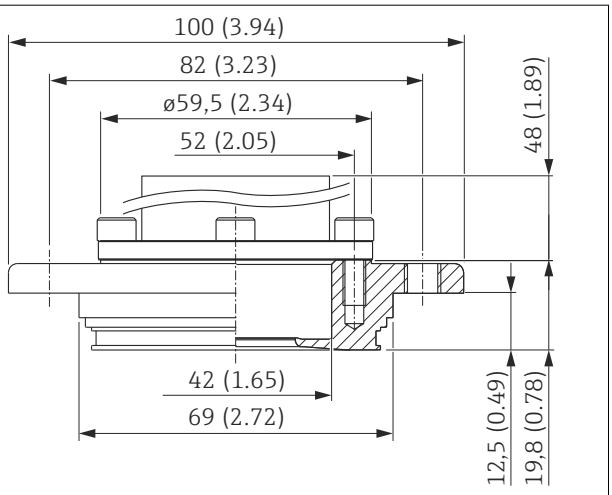
Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
E	DIN 11851 DN 40 PN 25, EHEDG, 3A (CRN)	AISI 316L (1.4435)	0.7 (1.54)	MZJ [2]
F	DIN 11851 DN 50 PN 25, EHEDG, 3A (CRN)		0.9 (1.98)	MRJ [2]
G	DIN11864-1 A DN40 PN16 pipe DIN11866-A, slotted nut, 316L, EHEDG, 3A		1 (2.21)	NCJ [2]
H	DIN11864-1 A DN50 PN40 pipe DIN11866-A, slotted nut, 316L, EHEDG, 3A		1 (2.21)	NDJ [2]

1) Product Configurator, "Process connection" section
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).

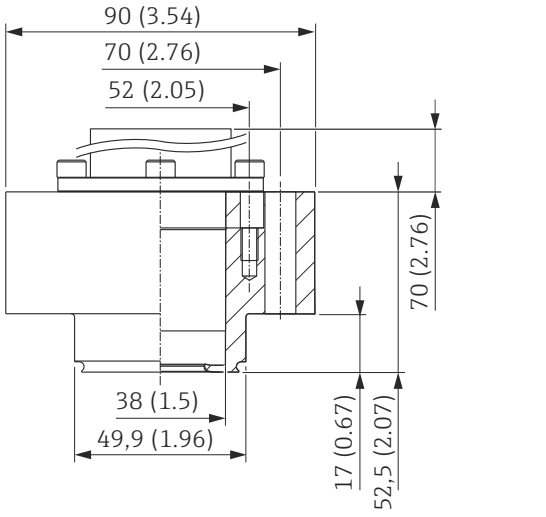
I



J



K



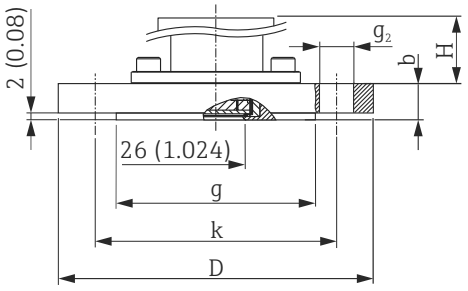
Engineering unit mm (in)

Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
I	APV inline DN50 PN40, 316L, 3A, with FDA seal	AISI 316L (1.4435)	1.2 (2.65)	TMJ
J	DRD DN50 (65 mm) PN 25, slotted nut AISI 304 (1.4301)		0.9 (1.98)	TIJ
K	NEUMO BioControl, D50, PN16, 316L, 3A		0.8 (1.76)	S2J

1) Product Configurator, "Process connection" section

FMD71 process connections, flush-mounted process isolating diaphragm

EN/DIN flanges, connection dimensions in accordance with EN 1092-1/DIN 2527



Engineering unit mm (in)

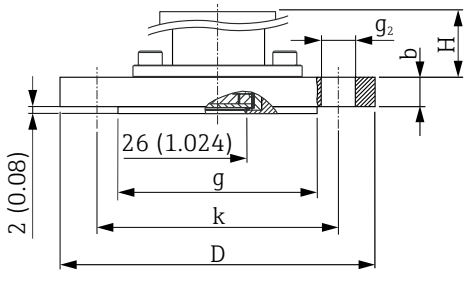
Flange							Boltholes			Weight	Version [1]
Nominal diameter	Nominal pressure	Shape [2]	Material	Diameter	Thickness	Raised face	Quantity	Diameter	Hole circle		
				D	b	g		g_2	k		
				mm	mm	mm		mm	mm	kg (lbs)	
DN 25	PN 10-40	B1 (D)	AISI 316L	115	18	68	4	14	85	1.4 (3.09)	CNJ
DN 32	PN 10-40	B1 (D)	AISI 316L	140	18	78	4	18	100	2 (4.41)	CPJ
DN 40	PN 10-40	B1 (D)	AISI 316L	150	18	88	4	18	110	2.4 (5.29)	CQJ
DN 40	PN 10-40	B1 (D)	ECTFE [3]	150	21	88	4	18	110	2.6 (5.73)	CQP
DN 50	PN 10-40	B1 (D)	AISI 316L	165	20	102	4	18	125	3.2 (7.06)	CXJ
DN 50	PN 10-16	B1 (D)	PVDF [4]	165	18	102	4	18	125	2.9 (6.39)	CFF
DN 50	PN 25-40	B1 (D)	ECTFE [3]	165	20	102	4	18	125	3.2 (7.06)	CRP
DN 50	PN 63 (64)	B2 (D)	AISI 316L	180	26	102	4	22	135	4.6 (10.14)	PDJ
DN 80	PN 10-16	B1 (D)	PVDF [4]	200	21.4	138	8	18	160	1 (2.21)	CGF
DN 80	PN 10-40	B1 (D)	AISI 316L	200	24	138	8	18	160	5.5 (12.13)	CZJ
DN 80	PN 25-40	B1 (D)	ECTFE [3]	200	24	138	8	18	160	5.5 (12.13)	CSP

1) Product Configurator, "Process connection" section
2) Name as per DIN 2527 provided in brackets
3) ECTFE coating on AISI 316L (1.4404). When using in hazardous areas: avoid electrostatic charge on the plastic surfaces.
4) Mount only with mounting bracket. MWP 10 bar (150 psi), OPL max . 15 bar (225 psi) process temperature range: −10 to +60 °C (+14 to +140 °F)

Description	Height H
Standard height	26 mm (1.02 in)
Device with Ex d[ia], CSA XP or FM XP	96 mm (3.78 in)

FMD71 process connections, flush-mounted process isolating diaphragm

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



Engineering unit mm (in)

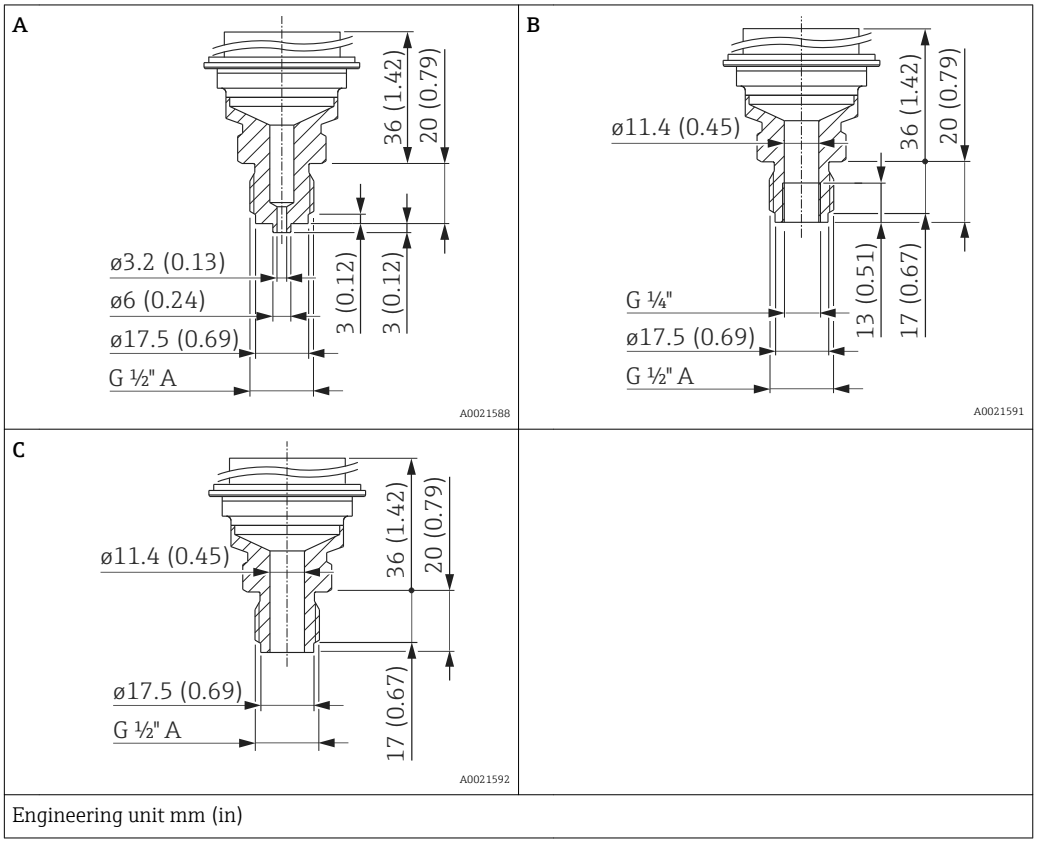
Flange [1]						Boltholes			Weight	Version [2]
Nominal diameter	Class	Material	Diameter	Thickness	Raised face	Quantity	Diameter	Hole circle		
			D	b	g		g_2	k		
in	in		in	in	in		in	in	kg (lbs)	
1	150	AISI 316/316L [3]	4.25	1.18	2	4	0.62	3.12	0.9 (1.98)	ACJ
1	300	AISI 316/316L [3]	4.88	1.18	2	4	0.75	3.5	1.4 (3.09)	ANJ
1 ½	150	AISI 316/316L [3]	5	0.69	2.88	4	0.62	3.88	2.1 (4.63)	AEJ (CRN)
1 ½	300	AISI 316/316L [3]	6.12	0.81	2.88	4	0.88	4.5	2.6 (5.73)	AQJ (CRN)
2	150	AISI 316/316L [3]	6	0.75	3.62	4	0.75	4.75	3.0 (6.62)	AFJ (CRN)
2	150	ECTFE [4]	6	0.75	3.62	4	0.75	4.75	2.4 (5.29)	AFN
2	150	PVDF [5]	6	0.75	3.62	4	0.75	4.75	0.5 (1.10)	AFF
2	300	AISI 316/316L [3]	6.5	0.88	3.62	8	0.75	5	3.2 (7.06)	ARJ (CRN)
3	150	AISI 316/316L [3]	7.5	0.94	5	4	0.75	6	5.7 (12.57)	AGJ (CRN)
3	150	ECTFE [4]	7.5	0.94	5	4	0.75	6	4.9 (10.80)	AGN
3	150	PVDF [5]	7.5	0.94	5	4	0.75	6	0.9 (1.98)	AGF
3	300	AISI 316/316L 3)	8.25	1.12	5	8	0.88	6.62	6.8 (14.99)	ASJ (CRN)
4	150	AISI 316/316L [3]	9	0.94	6.19	8	0.75	7.5	7.8 (17.2)	AHJ (CRN)
4	150	ECTFE [4]	9	0.94	6.19	8	0.75	7.5	7.1 (15.66)	AHN
4	300	AISI 316/316L [3]	10	1.25	6.19	8	0.88	7.88	11.6 (25.58)	ATJ (CRN)

1) AISI 316L
2) Product Configurator, "Process connection" section
3) Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)
4) ECTFE coating on AISI 316/316L. When using in hazardous areas: avoid electrostatic charge on the plastic surfaces.
5) max.: 15 bar (225 psi), −10 to +60 °C (+14 to +140 °F)

Description	Height H
Standard height	26 mm (1.02 in)
Device with Ex d[ia], CSA XP or FM XP	96 mm (3.78 in)

FMD72 process connections, internal process isolating diaphragm

Thread ISO 228 G



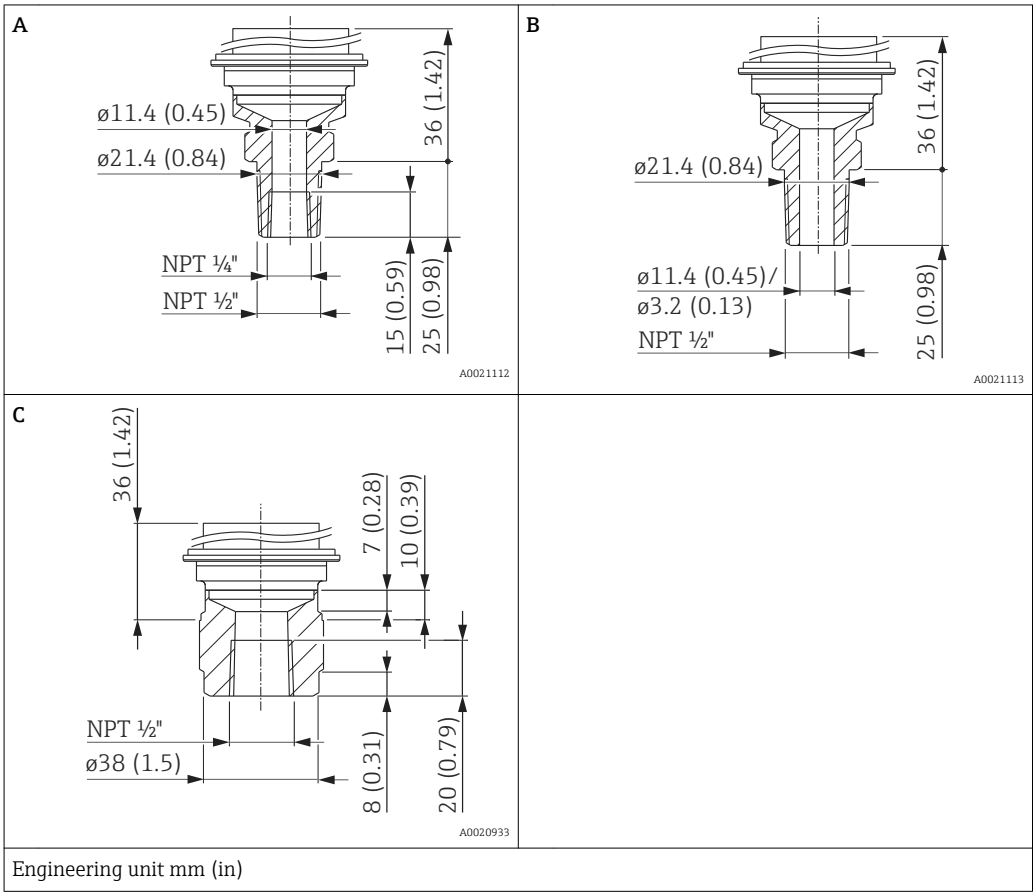
Engineering unit mm (in)

Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
A	Thread ISO 228 G ½" A EN 837	AISI 316L (CRN)	0.63 (1.39)	GCJ
		Alloy C276 (2.4819) (CRN)		GCC
B	Thread ISO 228 G ½" A, G ¼" (female) EN 837	AISI 316L (CRN)		GLJ
		Alloy C276 (2.4819) (CRN)		GLC
C	Thread ISO 228 G ½" A EN 837, bore 11.4 mm (0.45 in)	AISI 316L (CRN)		GMJ
		Alloy C276 (2.4819) (CRN)		GMC

1) Product Configurator, "Process connection" section

FMD72 process connections, internal process isolating diaphragm

Thread ANSI



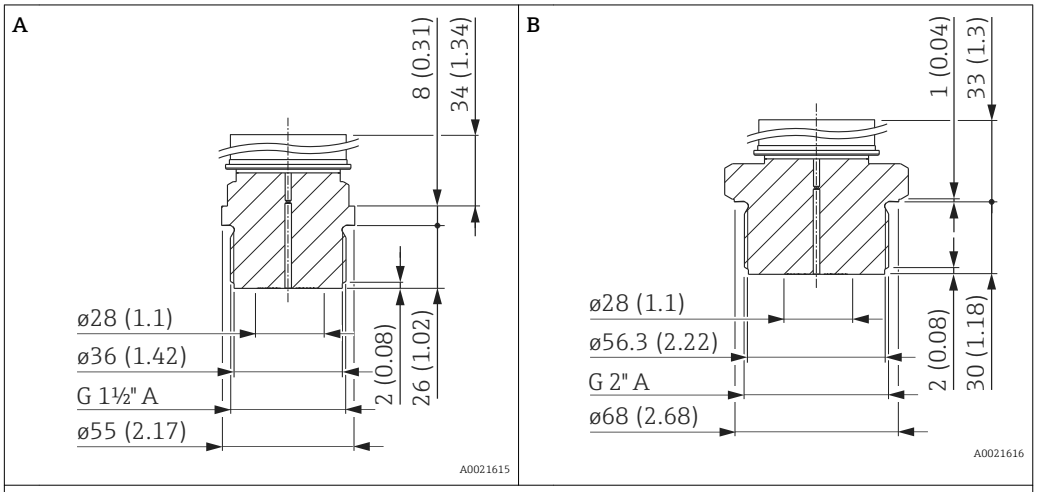
Engineering unit mm (in)

Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
A	ANSI ½" MNPT, ¼" FNPT	AISI 316L (CRN)	0.63 (1.39)	RLJ
		Alloy C276 (2.4819) (CRN)		RLC
B	ANSI ½" MNPT, bore 11.4 mm (0.45 in)	AISI 316L (CRN)		RKJ
		Alloy C276 (2.4819) (CRN)		RKC
D	ANSI ½" FNPT 11.4 mm (0.45 in)	AISI 316L (CRN)		R1J
		Alloy C276 (2.4819) (CRN)		R1C

1) Product Configurator, "Process connection" section

FMD72 process connections, flush-mounted process isolating diaphragm

Thread ISO 228 G



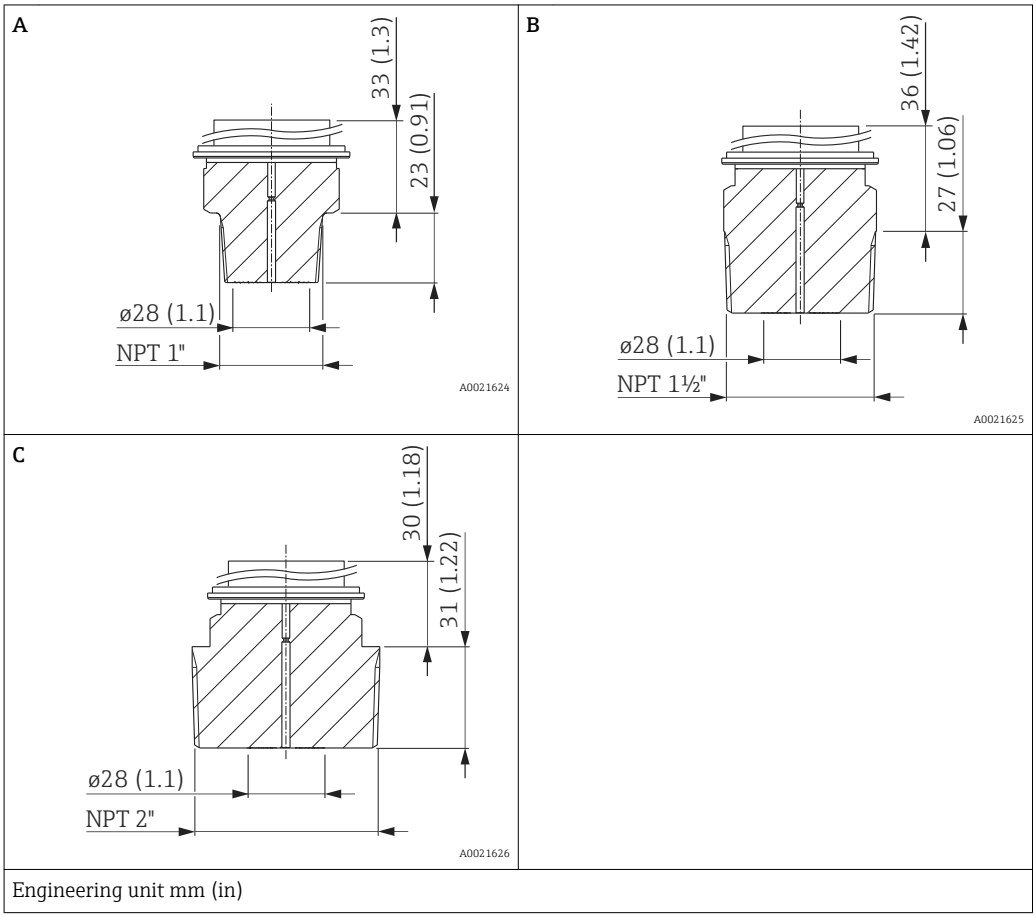
Engineering unit mm (in)

Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
A	Thread ISO 228 G 1 ½" A	AISI 316L	1.1 (2.43)	GVJ
B	Thread ISO 228 G 2" A	AISI 316L	1.5 (3.31)	GWJ

1) Product Configurator, "Process connection" section

FMD72 process connections, flush-mounted process isolating diaphragm

Thread ANSI



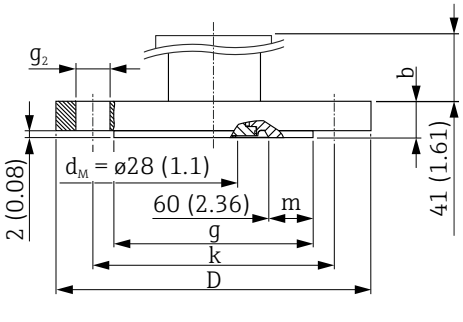
Engineering unit mm (in)

Item	Designation	Material	Weight	Version [1]
			kg (lbs)	
A	ANSI 1" MNPT	AISI 316L (CRN)	0.7 (1.54)	U5J
B	ANSI 1 ½" MNPT	AISI 316L (CRN)	1 (2.21)	U7J
C	ANSI 2" MNPT	AISI 316L (CRN)	1.3 (2.87)	U8J

1) Product Configurator, "Process connection" section

FMD72 process connections, flush-mounted process isolating diaphragm

EN/DIN flanges, connection dimensions in accordance with EN 1092-1/DIN 2527



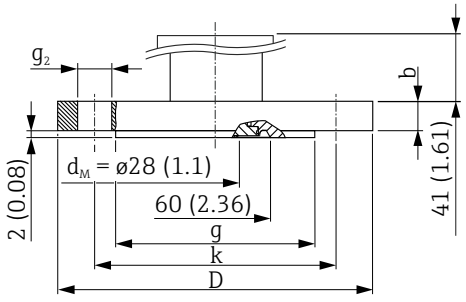
Engineering unit mm (in)

Flange [1) 2)]							Boltholes			Version [3)]
Nominal diameter	Nominal pressure	Shape [4)]	Diameter	Thickness	Raised face	Weight	Quantity	Diameter	Hole circle	
			D	b	g			g_2	k	
			[mm]	[mm]	[mm]	[kg (lbs)]		[mm]	[mm]	
DN 25	PN 10-40	B1 (D)	115	18	68 [5)]	1.2 (2.65)	4	14	85	CNJ
DN 32	PN 10-40	B1 (D)	140	18	78 [5)]	1.9 (4.19)	4	18	100	CPJ
DN 40	PN 10-40	B1 (D)	150	18	88 [5)]	2.2 (4.85)	4	18	110	CQJ
DN 40	PN 10-40	B1 (D)	165	20	102	3.0 (6.62)	4	18	125	CXJ
DN 80	PN 10-40	B1 (D)	200	24	138	5.3 (11.69)	8	18	160	CZJ

1) The roughness of the surface in contact with the medium including the raised face of the flange (all standards) is $<R_a$ 0.8 µm (31.5 µin). Lower surface roughness on request.
2) AISI 316L
3) Product Configurator, "Process connection" section
4) Name as per DIN 2527 provided in brackets
5) The sealing surface in these process connections is smaller than what is specified in the standard. Due to the smaller sealing surface, a special seal must be used. For further information, please contact a seal manufacturer or your local Endress+Hauser Sales Center.

FMD72 process connections, flush-mounted process isolating diaphragm

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



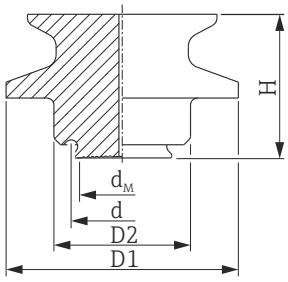
Engineering unit mm (in)

Flange [1) 2)]						Boltholes			Version [3)]
Nominal diameter	Class	Diameter	Thickness	Raised face	Weight	Qty.	Diameter	Hole circle	
		D	b	g			g_2	k	
[in]		[in]	[in]	[in]	[kg (lbs)]		[in]	[in]	
1 ½"	150	5	069	2.88 [4)]	1.5 (3.31)	4	0.62	3.88	AEJ (CRN)
1 ½"	300	6.12	0.81	2.88 [4)]	2.6 (5.73)	4	0.88	4.5	AQJ (CRN)
2	150	6	0.75	3.62	2.4 (5.29)	4	0.75	4.75	AFJ (CRN)
2	300	7.5	0.88	3.62	3.2 (7.06)	8	0.75	5	ARJ (CRN)
3	150	7.5	0.94	5	4.9 (10.80)	4	0.75	6	AGJ (CRN)
3	300	8.25	1.12	5	6.7 (14.77)	8	0.88	6.62	ASJ (CRN)
4	150	9	0.94	6.19	7.1 (15.66)	8	0.75	7.5	AHJ (CRN)
4	300	10	1.25	6.19	11.6 (25.88)	8	0.88	7.88	ATJ (CRN)

1) The roughness of the surface in contact with the medium is $<R_a$ 0.8 µm (31.5 µin). Lower surface roughness 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, "Process connection" section
4) The sealing surface in these process connections is smaller than what is specified in the standard. Due to the smaller sealing surface, a special seal must be used. For further information, please contact a seal manufacturer or your local Endress+Hauser Sales Center.

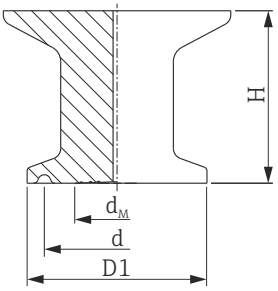
FMD72 process connections, flush-mounted process isolating diaphragm **Hygienic connections**

A



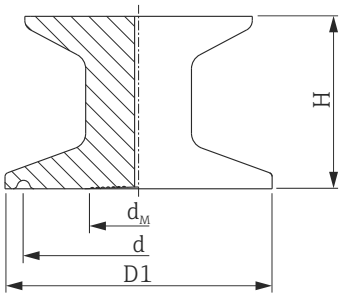
A0021800

B



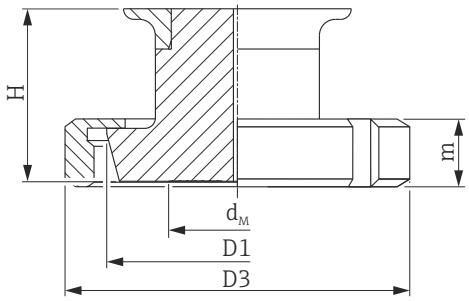
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C



A0021802

D



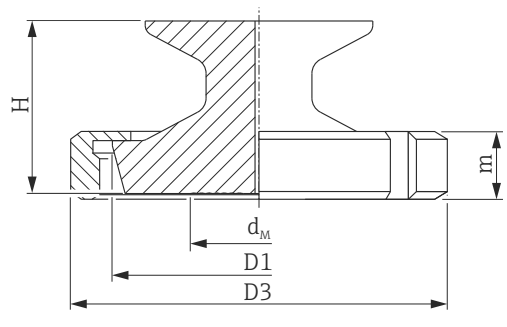
A0021803

Engineering unit mm (in)

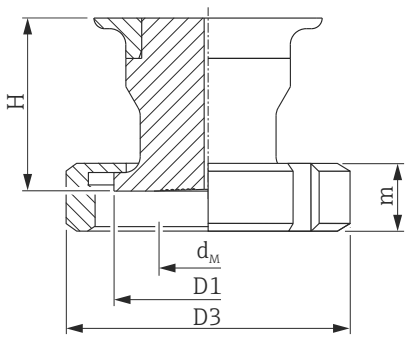
Item	Designation	Nominal pressure	External ϕ	External ϕ	Seal ϕ	Process isolating diaphragmϕ	Height	Height	Material	Weight	Version [1]
		PN	D1	D3	d	dM	H	m		kg (lbs)	
A	Clamp DN18-22	40	34 (1.34)	-	27.5 (1.08)	17.2 (0.68)	max. 40 (1.57)	-	AISI 316L (1.4435) [2]	0.5 (1.10)	TBJ
B	Clamp 1"	40	50.5 (1.99)	-	43.5 (1.71)	21.65 (0.85)		-		0.6 (1.32)	TCJ
	Clamp 1½"	40	50.5 (1.99)	-	43.5 (1.71)	28 (1.10)		-		0.6 (1.32)	TJJ
	Clamp 2"	40	64 (2.52)	-	56.5 (2.22)	28 (1.10)		-		0.7 (1.54)	TDJ
C	DIN11851 B25	40	43.4 (1.71)	63 (2.48)	-	28 (1.10)		21 (0.83)		0.7 (1.54)	MXJ
	DIN11851 B32	40	49.4 (1.94)	70 (2.76)	-	28 (1.10)		21 (0.83)		0.8 (1.76)	MIJ
D	DIN11851 B40	40	55.4 (2.18)	78 (3.07)	-	28 (1.10)		21 (0.83)		0.9 (1.98)	MZJ
	DIN11851 B50	40	67.4 (2.65)	92 (3.62)	-	28 (1.10)		22 (0.87)		1.1 (2.43)	MRJ

1) The roughness of the surface in contact with the medium is R_a 0.76 µm (30 µin).
2) Delta ferrite content <1 %

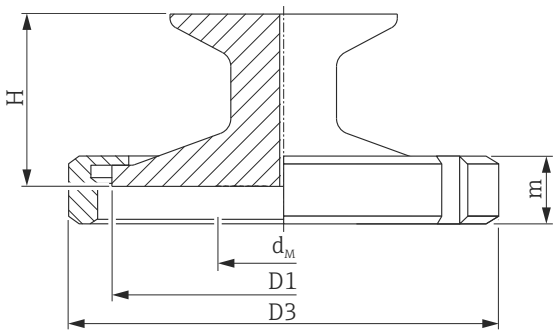
E
E



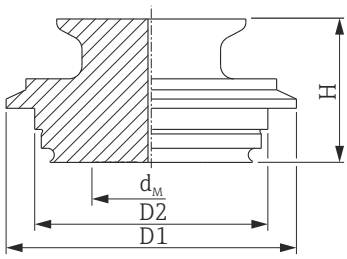
F



G



H

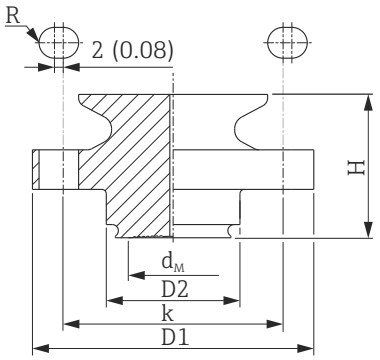


Engineering unit mm (in)

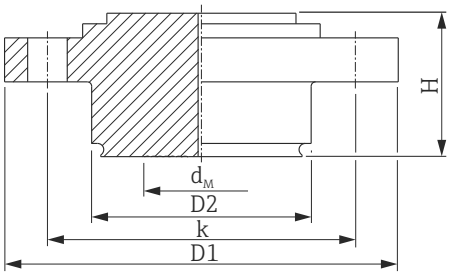
Item	Designation	Nominal pressure	External ϕ	External ϕ	External ϕ	Process isolating diaphragm ϕ	Height	Height	Material	Weight	Version [1]
		PN	D1	D2	D3	dM	H	m		kg (lbs)	
E	SMS 1"	25	35.5 (1.4)	-	51 (2.01)	21.65 (0.85)	max. 40 (1.57)	20 (0.79)	AISI 316L (1.4435) [2]	0.7 (1.54)	T6J
F	SMS 1½"	25	55 (2.17)	-	74 (2.91)	28 (1.10)		25 (0.98)		0.8 (1.76)	T7J
	SMS 2"	25	65 (2.56)	-	84 (3.31)	28 (1.10)		26 (1.02)		0.9 (1.98)	TXJ
G	Varivent B	40	52.7 (2.07)	31 (1.22)	-	21.65 (0.85)		-		0.7 (1.54)	TPJ
H	Varivent F	40	66 (2.6)	53 (2.09)	-	28 (1.10)		-		0.9 (1.98)	TQJ
	Varivent N	40	84 (3.31)	68 (2.68)	-	28 (1.10)		-		1.1 (2.43)	TRJ

1) The roughness of the surface in contact with the medium is R_a 0.76 µm (30 µin).
2) Delta ferrite content <1 %

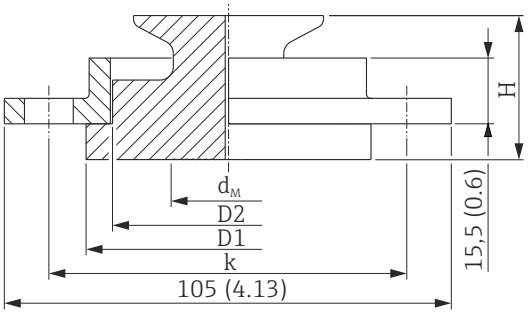
I



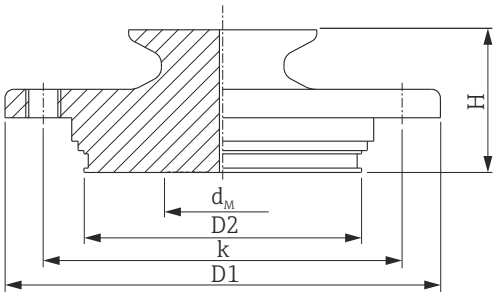
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K



L

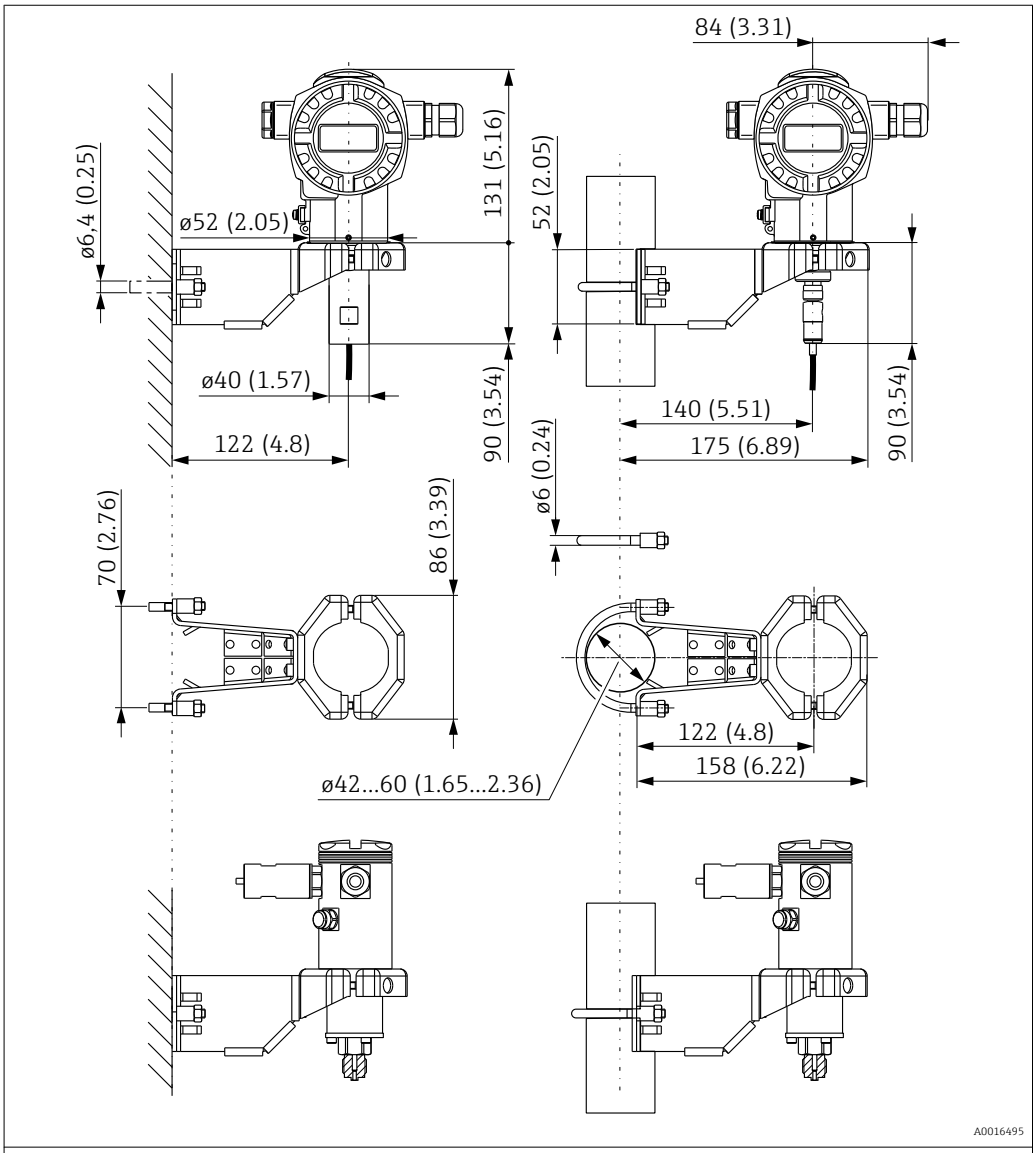


Engineering unit mm (in)

Item	Designation	Nominal pressure	External ϕ	External ϕ	Hole circle-ϕ	Process isolating diaphragm ϕ	Height	Material	Weight	Version [1]
		PN	D1	D2	k	dM	H		kg (lbs)	
I	Neumo D25	16	64 (2.52)	30.4 (1.2)	50 (1.97); 4 x, R 3.5 mm (0.14 in)	21.65 (0.85)	max. 40 (1.57)	AISI 316L (1.4435) [2]	0.8 (1.76)	S1J
J	Neumo D50	16	89.5 (3.52)	49.9 (1.96)	70 (2.76); 4 x ø 9 mm (0.35 in)	28 (1.10)			1.2 (2.65)	S4J
K	DRD	25	64.5 (2.54)	52.5 (2.07)	84 (3.31); 4 x ø 11.5 mm (0.45 in)	28 (1.10)			1.0 (2.21)	TIJ
L	APV Inline	10	99.5 (3.92)	69 (2.72)	82 (3.23); 6 x ø 8.6 mm (0.34 in) + 2 x M8	28 (1.10)			1.2 (2.65)	TMJ

1) The roughness of the surface in contact with the medium is R_a 0.76 µm (30 µin).
2) Delta ferrite content <1 %

Wall and pipe mounting with mounting bracket



Engineering unit mm (in)

Weight kg (lbs)		Version [1]
Housing	Mounting bracket	
(→ 32)	0.5 (1.1)	PA

1) Product Configurator, "Process connection" section

Also available for order as a separate accessory: part number 71102216

Materials in contact with process

NOTICE

- Device components in contact with the process are listed in the "Mechanical construction" (→ 31) and "Ordering information" sections.

TSE Certificate of Suitability

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 connections

- Endress+Hauser supplies DIN/EN flanges and threaded connection in stainless steel as per AISI 316L (DIN/ EN material number 1.4404 or 1.4435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1: 2001 Tab. 18. The chemical composition of the two materials can be identical.
- "Clamp connections" and "Hygienic process connections": AISI 316L (DIN/EN material number 1.4435)
- Some process connections are also available in Alloy C276 (DIN/EN material number 2.4819). For this purpose see the information in the "Mechanical construction" section.

Process isolating diaphragm

Sensor	Designation	Version [1]
FMD71	Al_2O_3 aluminum oxide ceramic, Ceraphire® (FDA 21 CFR 186.1256, USP Class VI), ultrapure 99.9 % (see also www.endress.com/ceraphire)	-
FMD72	AISI 316L (DIN/EN material number 1.4435)	A
FMD72	AlloyC (on request)	B

1) Product Configurator, "Process connection" section

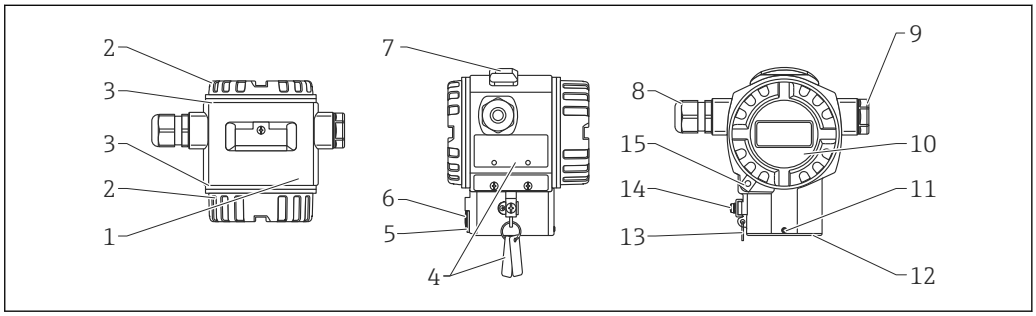
Filling oil

Designation	Version [1]
Silicone oil	1
Inert oil (on request)	2

1) Product Configurator, "Process connection" section

Materials not in contact with process

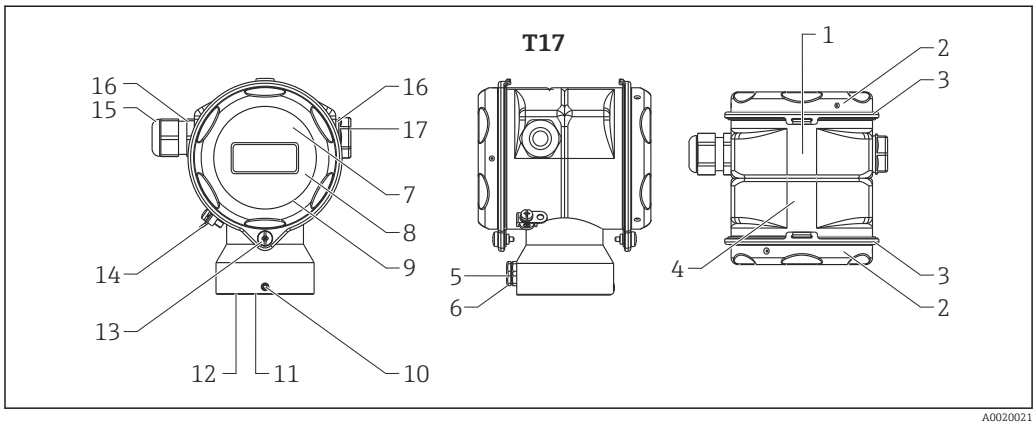
T14 transmitter housing



A0016496

Item number	Component part	Material
1	T14 housing, RAL 5012 (blue)	Die-cast aluminum with protective powder-coating on polyester base
	T14 housing	Precision cast AISI 316L (1.4435)
2	Cover, RAL 7035 (gray)	▪ Die-cast aluminum with protective powder-coating on polyester base ▪ Coating on thread: Heat-curing lubricant varnish
	Cover	▪ Precision cast AISI 316L (1.4435) ▪ Coating on thread: Heat-curing lubricant varnish
3	Cover seal	EPDM
4	Nameplates	AISI 304 (1.4404)
5	Pressure compensation filter, O-ring	VMQ or EPDM
6	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
7	External operation (keys and key cover), RAL 7035 (gray)	Polycarbonate PC-FR, screw A4
8	Cable entry	Polyamide (PA)
	Seal	Silicone (VMQ)
9	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)
	Seal	Silicone (VMQ)
10	Sight glass	Mineral glass (polycarbonate on request)
	Sight glass seal	Silicone (VMQ)
11	Screw	A4
12	Sealing ring	EPDM
	Snap ring	PA66-GF25
13	Round strand rope for nameplates	AISI 304 (1.4301)/ AISI 316 (1.4401)
14	External ground terminal	AISI 304 (1.4301)
15	Cover clamp	Clamp AISI 316L (1.4435), screw A4

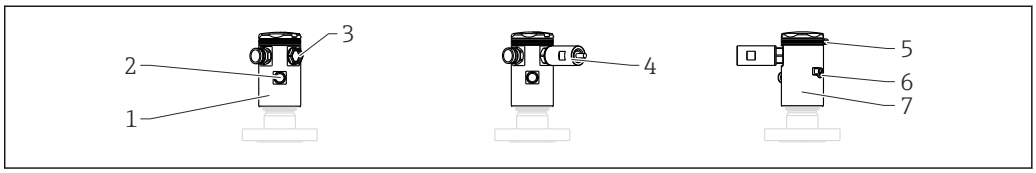
T17 transmitter housing



A0020021

Item number	Component part	Material
1	T17 housing	AISI 316L (1.4404)
	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		
9	Sight glass seal	EPDM
10	Screw	A2-70
11	Sealing ring	EPDM
12	Snap ring	PA6
13	Screw	A4-50 Coating on thread: Heat-curing lubricant varnish
14	External ground terminal	AISI 304 (1.4301)
15	Cable entry	Polyamide PA, for dust ignition-proof: CuZn nickel-plated
16	Seal of cable entry and plug	Silicone (VMQ)
17	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)

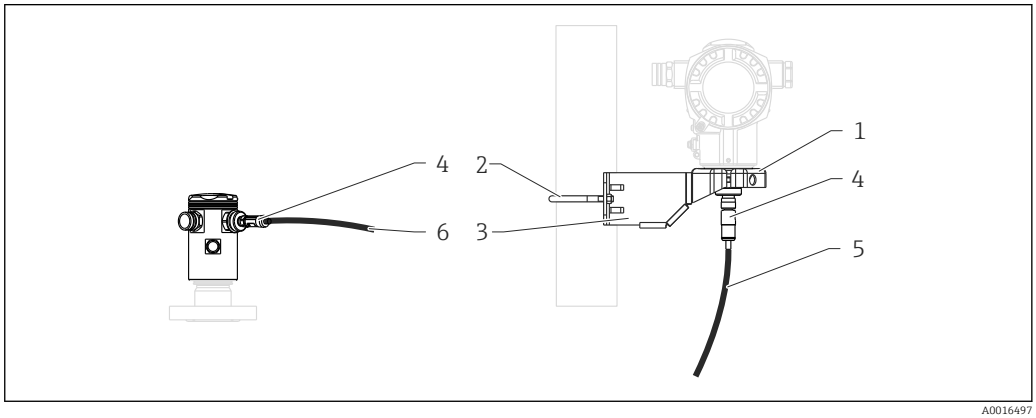
Sensor modules



A0021295

Item number	Component part	Material
1	Sensor module housing and cover	Aluminum with protective powder-coating on polyester base
		Precision cast AISI 316L (1.4404)
2	Pressure compensation filter	PA6 GF10 or 316L (1.4404)
3	Blind plug	PBT-GF30 FR, for dust ignition-proof: AISI 316L (1.4435)
	Seal	Silicone (VMQ)
4	Adapter	316L
5	Snap ring for cover	PP
6	Earth connection box	316L
7	Nameplates	Plastic film

Connecting parts



A0016497

Item number	Component part	Material
1	Mounting bracket	Bracket AISI 316L (1.4404)
2		Screw and nuts A4-70
3		Half-shells: AISI 316L (1.4404)
4	M12 plug	PP and stainless steel
5	Cable for transmitter connection	PE-X halogen-free
6	Cable for sensor connection	PE-X halogen-free

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

Quick and safe commissioning

Guided menus for applications

Reliable operation

- Local operation possible in up to two 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 control.

Efficient diagnostics increase measurement availability

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

Local operation

Functions

Function	External operation (operating keys, optional)	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	☑	☑	☑
Device reset	☑	☑	☑
Locking and unlocking parameters relevant to the measured value	☑ (only if display is connected)	☑	☑
Value acceptance indicated by green LED	—	☑	☑
Switching damping on and off	☑ (only if display is connected)	☑	☑
Switch on Min. alarm	☑ (only if display is connected)	☑	☑

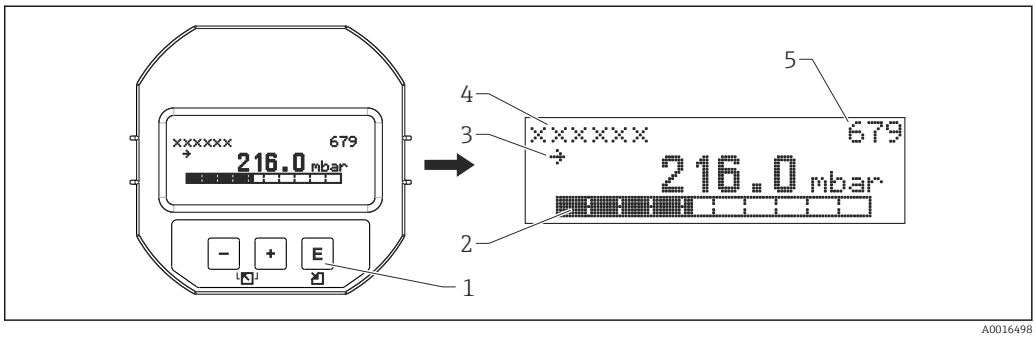
Operating the device using onsite display (optional)

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

Functions:

- 8-digit measured value display incl. sign and decimal point, bargraph for 4 to 20 mA HART as current display.
- Simple and complete menu guidance thanks to separation of the parameters into several levels.
- 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.).
- Quick and safe commissioning

Overview

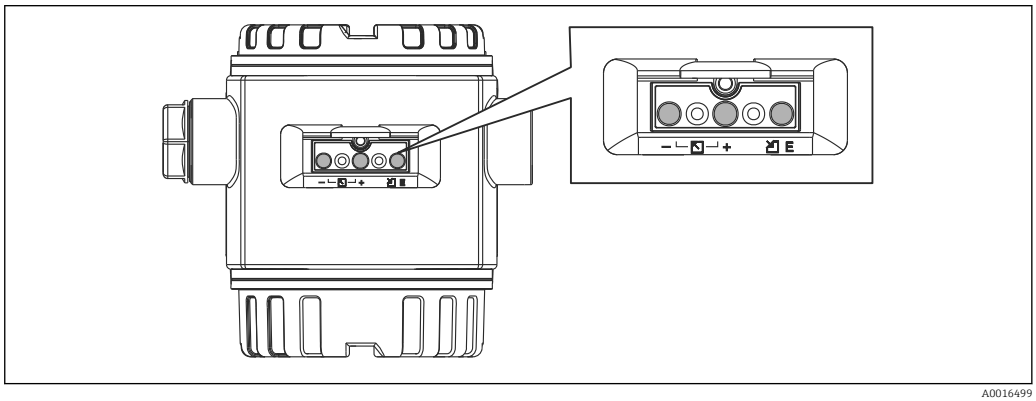


A0016498

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

Operating keys on the exterior of the device

With the T14 housing (aluminum or stainless steel), the operating keys are located either outside of the housing, under the protection cap or inside on the electronic insert. In addition, devices with an onsite display and a 4 to 20 mA HART electronic insert have operating keys on the onsite display.

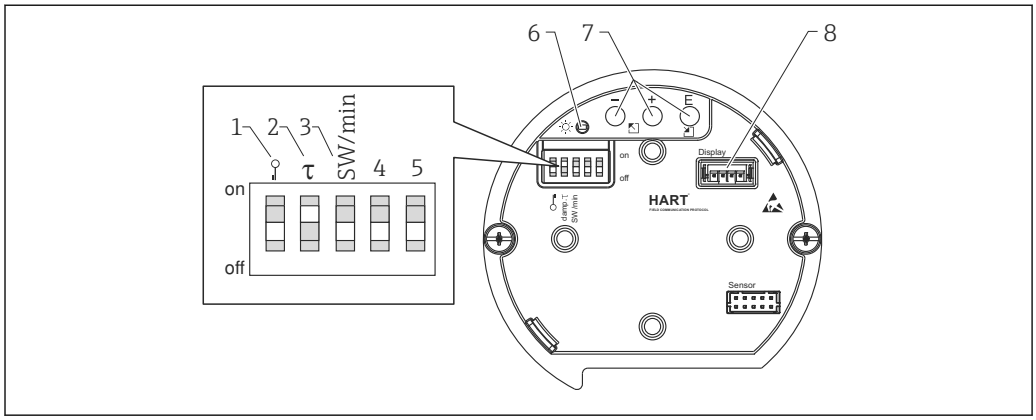


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The operating keys on the outside of the device make it unnecessary to open the housing. This guarantees:

- Complete protection against environmental influences such as moisture and contamination.
- Simple operation without any tools.
- No wear.

Operating keys and elements located internally on the electronic insert



A0016500

1 DIP switch for locking/unlocking parameters relevant to the measured value
2 DIP switch for switching damping on/off
3 DIP switch for alarm current SW/Alarm min (3.6 mA)
4…5 Not assigned
6 Green LED to indicate value being accepted
7 Operating keys
8 Slot for optional display

Operating languages

You can also choose another language in addition to the standard language "English":

Designation	Version [1]
English (standard)	AA
German	AB
French	AC
Spanish	AD
Italian	AE
Portuguese	AG
Chinese, simplified characters	AK
Japanese	AL

1) Product Configurator, "Additional operating language" section

Certificates and approvals

CE mark

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

Ex approvals

- ATEX
- FM
- CSA
- IECEx

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 .

Suitability for hygienic processes (in preparation)

The Deltabar is suitable for use in hygienic processes. An overview of suitable process connections is provided from Page 36 onwards. Many versions meet the requirements of 3A Sanitary Standard No. 74 and are certified by the EHEDG. Suitable fittings and seals must be used to ensure hygiene-compliant design according to 3A and EHEDG specifications.

The seamless connections can be cleaned of all residue using any of the typical cleaning methods within this industry.

Materials in contact with food meet Regulation (EC) No. 1935/2004.

Pressure Equipment Directive (PED)

The Deltabar corresponds to Article 3 (3) of the EC directive 97/23/EC (Pressure Equipment Directive) and has been designed and manufactured in accordance with good engineering practice.

Other standards and guidelines

The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity. In addition, the following applies to the Deltabar:

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 61000-4-5:

Electromagnetic compatibility for test and measurement methods

EN 61326-X:

EMC product family standard for electrical equipment for measurement, control, regulation and laboratory procedures.

NAMUR - User association of automation technology in process industries.

NE21 - Electromagnetic Compatibility (EMC) of Industrial Process and Laboratory Control Equipment.

NE43 - Standardization of the Signal Level for the Failure Information of Digital Transmitters.

NE32 - Data Retention in the Event of a Power Failure in Field and Control Instruments with Microprocessors

NE44 - Standardization of Status Indicators on PCT Instruments with the Help of Light Emitting Diodes

NE53 - Software of Field Devices and Signal-processing Devices with Digital Electronics

NE107 - Self-monitoring and Diagnosis of Field Devices

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. CRN-approved devices are fitted with a separate plate bearing the registration number 0F10525.5C.

Product Configurator:
- "Process connection" section (the CRN process connections are indicated appropriately in the "Mechanical construction" section.)
- "Approval" section, "CSA approval" version

Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ISA 12.27.01

Endress+Hauser devices are designed in accordance with ANSI/ISA 12.27.01. allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with the North American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids. Please refer to the following table for the seal class assigned (single seal or dual seal):

Device	Approval	Single seal MWP
Deltabar FMD71/FMD72	CSA, FM IS, XP, NI	40 bar (580psi)

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

Calibration unit

Designation	Version [1]
Level range; %	A
Differential pressure range; mbar/bar	B
Differential pressure range; kPa/MPa	C
Differential pressure range; mm/mH2O	D
Differential pressure range; inH2O/ftH2O	E
Differential pressure range; psi	F
Customer-specific level; see additional spec	K

1) Product Configurator, "Calibration; Unit" section

Calibration

Designation	Version [1]
Factory calibration certificate, 5-point	F1

1) Product Configurator, "Calibration" section

Test, certificate

Designation	Version [1]
3.1 Material documentation, wetted metal parts, EN10204-3.1 inspection certificate	JA
Declaration of Conformity NACE MR0175, wetted metal parts	JB
Helium leak test, internal procedure, inspection certificate	KD
Pressure test, internal procedure, inspection certificate	KE

1) Product Configurator, "Test, certificate" section

Ordering information

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

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: Direct input of information specific to measuring point, 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 from the Endress+Hauser Online Shop

Documentation

Field of Activities

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

FA00004P/00/EN

Technical Information

EMC test procedures TI00241F/00/EN

Operating Instructions

BA01044P/00/EN

Description of device parameters

GP01013P/00/EN

Brief Operating Instructions

- KA01105P/00/EN - Brief Operating Instructions for devices
- SD00354P/00/A2 - Screening with Cable Shield

Safety Instructions (XA)

Safety Instructions (XA) are supplied with the device depending on the approval. These instructions are an integral part of the Operating Instructions.

Device	Certificate/type of protection	Documentation	Version [1]
FMD71, FMD72	ATEX II 1/2G Ex ia IIC T6 Ga/Gb	XA00619P	BA
FMD71, FMD72	ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb	XA00620P	BC
FMD71, FMD72	ATEX II 3G Ex nA IIC T6 GC	XA00621P	BD
FMD71, FMD72	IEC Ex ia IIC T6 Ga/Gb	XA00622P	IA
FMD71, FMD72	IEC Ex d [ia] IIC T6 Ga/Gb	XA00623P	IB
FMD71, FMD72	CSA General Purpose	-	CD
FMD71	FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00628P	FA
FMD71	FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00629P	FB
FMD71	CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00631P	CB
FMD71	FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00668P	FD
FMD71	CSA C/US NI, Cl.I Div. 2, Gr.A-D Cl.I, Zone 2, IIC	XA00670P	CC
FMD71	CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00630P	CA
FMD72	CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00626P	CA
FMD72	CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00627P	CB
FMD72	CSA C/US NI, Cl.I Div.2 Gr.A-D, Zone 2	XA00671P	CC
FMD72	FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00624P	FA

Device	Certificate/type of protection	Documentation	Version [1]
FMD72	FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00625P	FB
FMD72	FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00669P	FD

1) Product Configurator, "Approval" section

The nameplate provides information on the Safety Instructions (XA) that are relevant for the device.

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