Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Deltabar FMD72

Electronic differential pressure measurement for level measurement
Differential pressure transmitter with metal sensors
Overload-resistant and function-monitored; Communication via HART

Application

The Deltabar FMD72 is used to measure the level, volume or mass of liquids in pressurized tanks. The system consists of two 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.

Your benefits

The electronic differential pressure measurement system eliminates the issues associated with traditional differential pressure measurements using mechanical systems (impulse lines or oil-filled capillaries):

- No measurement drift caused by changes in ambient temperature
- No condensation or evaporation in impulse lines
- No high cost of heating impulse lines to prevent freezing (installation, energy)
- No tubing or connection leaks as are often seen in installations with impulse lines
- Multivariable level measurement: HART-based differential pressure, head pressure and sensor temperatures from one system
- Continuous status monitoring of the entire system thanks to HART-based diagnostics
- Intuitive menu-driven installation
- Color-coded wiring
- Very high reproducibility and long-term stability
- High reference accuracy of individual sensors: up to ±0.075 %,
  as PLATINUM version: ±0.05 %
- Increased process availability and reliability
- The architecture and design of the new electronic differential pressure system minimizes safety hazards
- Total operating costs (total cost of ownership) are kept low thanks to shorter installation times, the reduction in downtime required for maintenance and decreased demand for spare parts

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Table of contents

Document information

Function of document and how to use

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.

Further standard device 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.

Certificate/type of protection	Documentation	Version in the order code
ATEX II 1/2G Ex ia IIC T6 Ga/Gb	XA00619P	BA
ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb	XA00620P	BC
ATEX II 3G Ex nA IIC T6 BC	XA00621P	BD
IEC Ex ia IIC T6 Ga/Gb	XA00622P	IA
IEC Ex d [ia] IIC T6 Ga/Gb	XA00623P	IB
CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00626P	CA
CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00627P	CB
CSA C/US Cl.I Div.2 Gr.A-D, Zone 2	XA00671P	CC
FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00624P	FA
FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00625P	FB
FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00669P	FD

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

Document conventions

Safety symbols

Symbol	Meaning
DANGER A0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING A0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

Symbol	Meaning
CAUTION A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE 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 (sine-wave) is applied or through which alternating 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 and notation for certain types of information

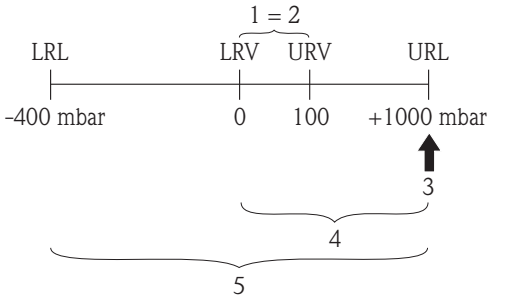
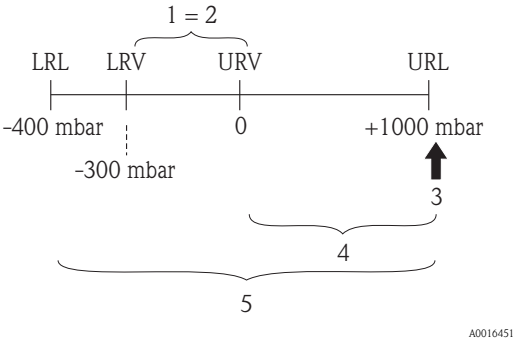
Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional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

Symbols and notation in graphics

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

Symbol	Meaning
 A0011187	**Hazardous area** Indicates a hazardous area.
 A0011188	**Safe area (non-hazardous area)** Indicates a non-hazardous location.

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 "(→ 22)" 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 "(→ 22)" section.
LRL	Lower range limit
URL	Upper range limit
LRV	Lower range value
URV	Upper range value
TD	**Turn down** Set span and zero-based span
Case 1	
|Lower range value (LRV) | ≤ | Upper range value (URV)|	
Example with measuring cell HP = 400 mbar (6 psi) and measuring cell LP = 1 000 mbar (15 psi): ■ Lower range value (LRV) = 0 mbar ■ Upper range value (URV) = 100 mbar (1.45 psi) ■ Nominal value (URL) = 1 bar (14.5 psi)	
Turn down: TD = URL + LRL / | URV - LRV | = 14:1	
Set span: URV – LRV = 100 mbar (1.45 psi) This span is based on the zero point.	
Case 2	
|Lower range value (LRV) | ≤ | Upper range value (URV)|	
Example with measuring cell HP = 400 mbar (6 psi) and measuring cell LP = 1 000 mbar (15 psi): ■ Lower range value (LRV) = 0 mbar ■ Upper range value (URV) = 100 mbar (1.45 psi) ■ Nominal value (URL) = 1 bar (14.5 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.	*1 Set span* *2 Zero-based span* *3 Nominal value ≙ Upper range limit (URL)* *4 Nominal measuring range* *5 Sensor measuring range*

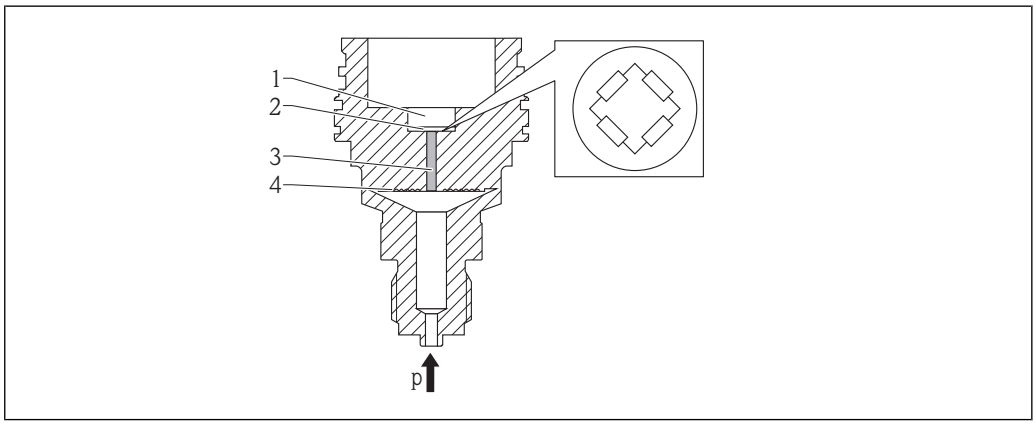
Function and system design

Measuring principle

Electronic differential pressure measurement

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 10 bar (150 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



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

Measuring system

The FMD72 consists of 2 sensor modules and one transmitter.

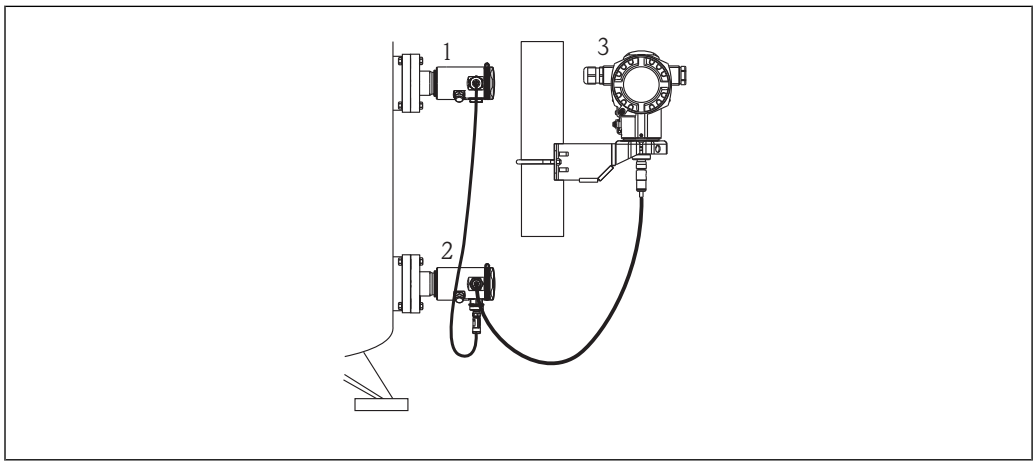
Device features

Field of application	■ Level ■ Differential pressure
Process connections	■ Thread ■ EN and ANSI flanges
Measuring ranges (differential pressure)	From –400 to +400 mbar (–6 to +6 psi) to –1 to +10 bar (–15 to +150 psi)
OPL [1)]	to 40 bar (600 psi)
Process temperature limits	–40 to +125 °C (–40 to +257 °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 preconfigurations

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

Product design

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



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1 Sensor module LP
2 Sensor module HP
3 Transmitter

The FMD72 is best suited to level measurement in tanks with pressure overlay, high distillation columns and other containers 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.

Input

Measured variable

Measured process variables

- Pressure HP and Pressure LP
- Sensor temperature

Calculated process variables

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

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 in the order code [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

1) The vacuum resistance applies for the measuring cell under reference operating conditions.
2) Version in the order code, see feature 70/75 "Sensor range"

Absolute pressure

Nominal value	Range limit		MWP	OPL	Vacuum resistance [1]	Version in the order code [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

1) The vacuum resistance applies for the measuring cell under reference operating conditions.
2) Version in the order code, see feature 70/75 "Sensor range"

Output

Output signal

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

Signal range – 4 to 20 mA HART

3.8 mA to 20.5 mA

Signal on alarm

According to NAMUR NE 43

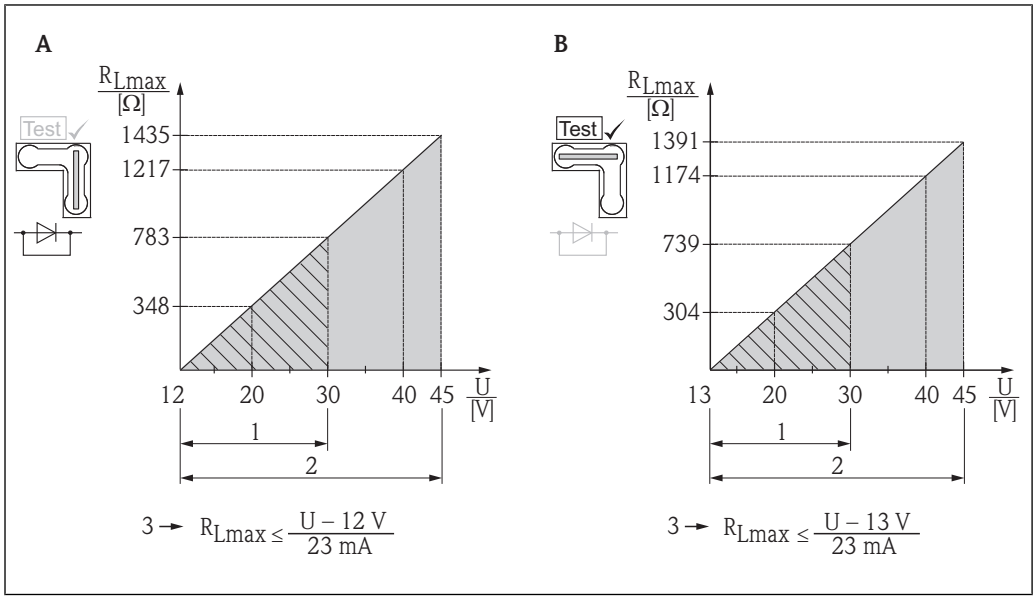
4 to 20 mA HART

- 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.

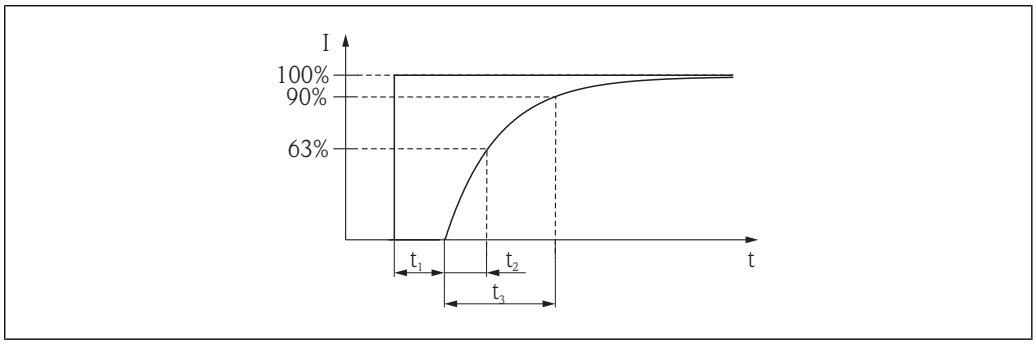
In the following load diagrams, observe the position of the jumper and the explosion protection:



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 1/2 G, 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:



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Dynamic behavior, current output

Dead time t_1	Dead time (t_1) [ms]	Time constant (T63), t_2	Time constant (T90), t_3
max.	90	90	210

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 T93 (= t_3) [ms]
min.	250	340	460
max.	1050	1140	1260

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 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).

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 ■ Electronics temperature
Supported functions	■ Burst mode ■ Additional transmitter status

Power supply

Supply voltage

WARNING

Risk of explosion.

Risk of electric shock and/or explosion!

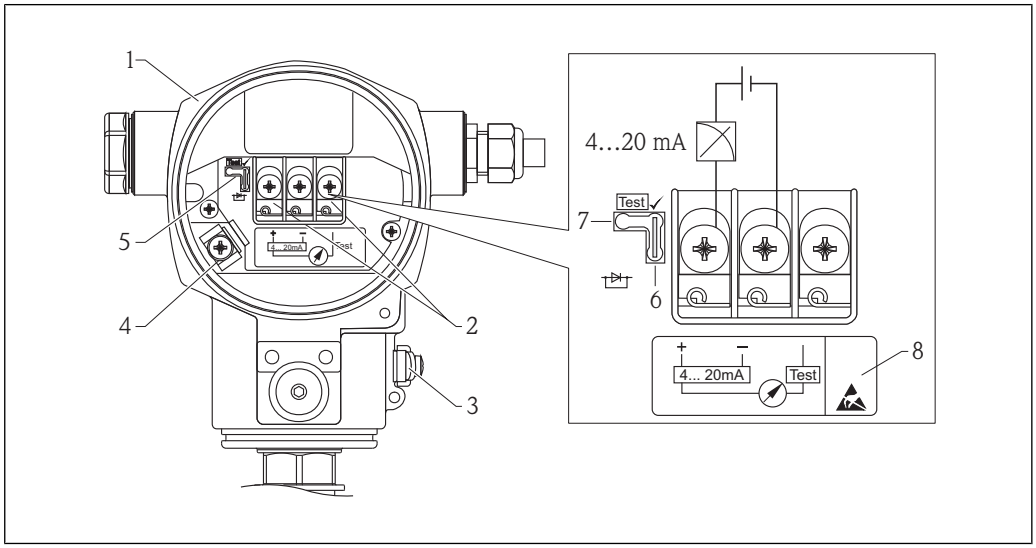
- ► When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations as well as the Safety Instructions.
- ► All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

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

Electrical connection

Wiring the transmitter

- 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.



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1 Housing
2 4 to 20 mA test signal between positive and test terminal
3 External ground terminal
4 Internal ground terminal
5 Jumper for 4 to 20 mA test signal
6 Minimum supply voltage = 12 V DC, jumper is set as illustrated in the diagram.
7 Minimum supply voltage = 13 V DC, jumper is set in "Test" position.
8 Devices with integrated overvoltage protection are labeled "OVP" (overvoltage protection) here.

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
 A0016059	■ 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
 A0016060	■ 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-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- The cable outer diameter depends on the cable gland used.

Cable glands

Type of protection	Cable gland	Permitted cable diameter	Permitted wire cross-sections
■ Standard ■ Ex ia ■ Ex ic	Plastic M20x1.5	5 to 10 mm (0.2 to 0.39 in)	0.5 to 2.5 mm² (20 to 14 AWG)
■ Ex tD ■ 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 (optional)

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

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 1 060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell = constant, in range: horizontal ±1°
- Input of Lo Trim Sensor and Hi Trim Sensor for lower range value and upper range value
- Zero based span
- Process isolating diaphragm material: AISI 316L (1.4435)
- Filling oil: silicone oil
- Supply voltage: 24 V DC ±3 V DC
- Load with HART: 250 Ω

Resolution

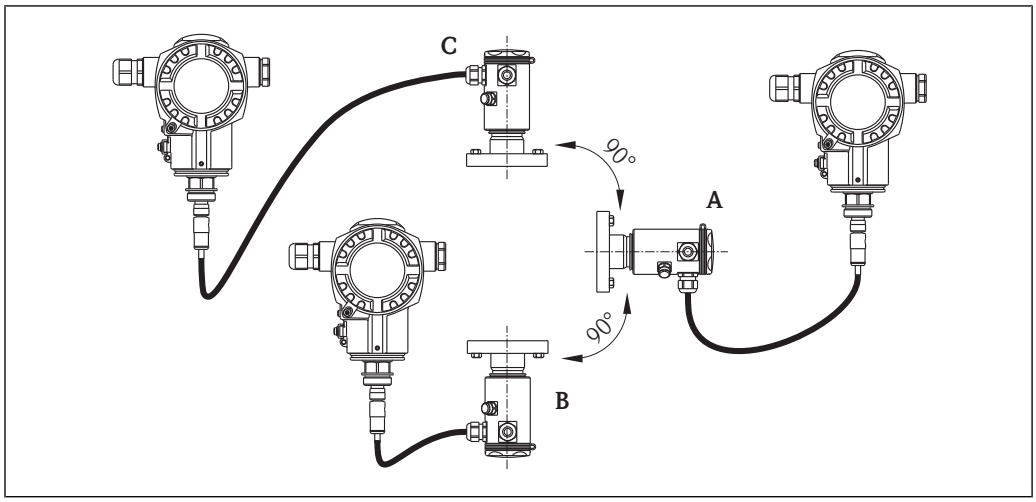
- Current output: 1 µA
- Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

Long-term stability

	1 year	5 years	10 year	Calculated long-term stability (L_P) of the differential pressure
Measuring ranges	**% of URL for every sensor**			
400 mbar (6 psi)	L_P = ±0.035	L_P = ±0.14	L_P = ±0.32	Calculation in bar: $L_{PDiff[bar]} = \sqrt{L_{P1}^2 + L_{P2}^2}$ A0016463
1 bar (15 psi)	L_P = ±0.020	L_P = ±0.08	L_P = ±0.180	
2 bar (30 psi)	L_P = ±0.025	L_P = ±0.05	L_P = ±0.075	
4 bar (60 psi)	L_P = ±0.025	L_P = ±0.05	L_P = ±0.075	
10 bar (150 psi)	L_P = ±0.025	L_P = ±0.05	L_P = ±0.075	Percentage calculation of URL dP/year: $L_{PDiff[\%]} = \frac{L_{PDiff[bar]} \cdot 100}{L_{PDiff[bar]}}$ A0016464

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.

Influence of the installation position



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	Process isolating diaphragm axis is vertical (A)	Process isolating diaphragm pointing upwards (B)	Process isolating diaphragm pointing downwards (C)
Sensor with 1/2" thread and silicone oil	Calibration position, no measurement error	< +4 mbar (+0.06 psi)	< –4 mbar (–0.06 psi)
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 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.

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 values are valid for the current output and the digital output.

Pressure reference accuracy (A_P):

$$A_P = \sqrt{\text{Nonlinearity}^2 + \text{Nonreproducability}^2 + \text{Pressurehysteresis}^2}$$

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Differential pressure reference accuracy (A_{PDiff}):

$$A_{PDiff} = \sqrt{A_{P1}^{\ 2} + A_{P2}^{\ 2}}$$

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

Measuring cell	Sensor	Reference accuracy A_p [%URL for every sensor]			Calculated reference accuracy (A_P) of the differential pressure
400 mbar (6 psi)	Absolute pressure	▪ TD 1:1 ▪ TD > 1:1	A_p = A_p =	±0.15 ±0.15 x TD	Calculation in bar: $A_{PDiff[bar]} = \sqrt{A_{P1}^{\ 2} + A_{P2}^{\ 2}}$ A0016468 Percentage calculation of URL dP: $A_{PDiff[\%]} = \frac{A_{PDiff[bar]} \cdot 100}{P_{Diff[bar]}}$ A0016469
1 bar (15 psi)	Relative pressure/ Absolute pressure	▪ TD 1:1 to TD 2.5:1 ▪ TD > 2.5:1	A_p = A_p =	±0.075 ±0.03 x TD	
2 bar (30 psi)	Relative pressure	▪ TD 1:1 to TD 5:1 ▪ TD > 5:1	A_p = A_p =	±0.075 ±0.015 x TD	
2 bar (30 psi)	Absolute pressure	▪ TD 1:1 to TD 5:1 ▪ TD > 5:1	A_p = A_p =	±0.075 ±0.015 x TD	
4 bar (60 psi)	Relative pressure/ Absolute pressure	▪ TD 1:1 to TD 10:1 ▪ TD > 10:1	A_p = A_p =	±0.075 ±0.0075 x TD	
10 bar (150 psi)	Relative pressure/ Absolute pressure	▪ TD 1:1 to TD 15:1 ▪ TD > 15:1	A_p = A_p =	±0.075 ±0.005 x TD	

Total performance

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change of the zero point.

All specifications apply to the temperature range –10 to +60 °C (+14 to +140 °F) and a turn down of 1:1.

Measuring cell	% of URL for every sensor	Calculated total performance (P_P) of the differential pressure
400 mbar (6 psi)	P_P = ±0.25	Calculation in bar: $P_{PDiff[bar]} = \sqrt{P_{P1}^{\ 2} + P_{P2}^{\ 2}}$ A0016470 Percentage calculation of URL dP: $P_{PDiff[\%]} = \frac{P_{PDiff[bar]} \cdot 100}{P_{Diff[bar]}}$ A0016471
1 bar (15 psi)	P_P = ±0.15	
2 bar (30 psi)	P_P = ±0.15	
4 bar (60 psi)	P_P = ±0.22	
10 bar (150 psi)	P_P = ±0.22	

Total error

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

All specifications apply to the temperature range –10 to +60 °C (+14 to +140 °F) and a turn down of 1:1.

Measuring cell	% of URL/year for every sensor	Calculated total error (E_P) of the differential pressure
400 mbar (6 psi)	E_P = ±0.3	Calculation in bar: $E_{PDiff[bar]} = \sqrt{E_{P1}^{\ 2} + E_{P2}^{\ 2}}$ A0016472 Percentage calculation of URL dP/year: $E_{PDiff[\%]} = \frac{E_{PDiff[bar]} \cdot 100}{P_{Diff[bar]}}$ A0016473
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi)	E_P = ±0.2	

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

Thermal change of the zero output and the output span

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 of the differential pressure
	% of the set span for every sensor		
400 mbar (6 psi)	±(0.2 x TD + 0.015)	±(0.4 x TD + 0.03)	Calculation in bar: $T_{PDiff[bar]} = \sqrt{T_{P1}^{\ 2} + T_{P2}^{\ 2}}$ A0016474 Percentage calculation of URL dP/year: $T_{PDiff[\%]} = \frac{T_{PDiff[bar]} \cdot 100}{P_{Diff[bar]}}$ A0016475
1 bar (15 psi) 2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi)	±(0.1 x TD + 0.01)	±(0.4 x TD + 0.02)	

Application limits

A high ratio between the level and head pressure can result in large measured errors. A maximum ratio of 1:6 is recommended. For calculation purposes, please use the free "Applicator" calculation tool, which is available online at "www.endress. com/applicator" or offline on a CD.

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 FMD72 is best suited to level measurement in tanks with pressure overlay, high distillation columns and other containers 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 (→ 16).
  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.

General installation instructions

Mounting the sensor modules and transmitter is very easy

- The housings of the sensor modules can be rotated up to 380°.
- The transmitter is freely rotatable in the mounting bracket.

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

Your benefits

- Easy to mount by optimally aligning the housing
- Good, accessible device operation
- Optimum readability of the onsite display (optional)
- Simple pipe installation through optional alignment of the modules

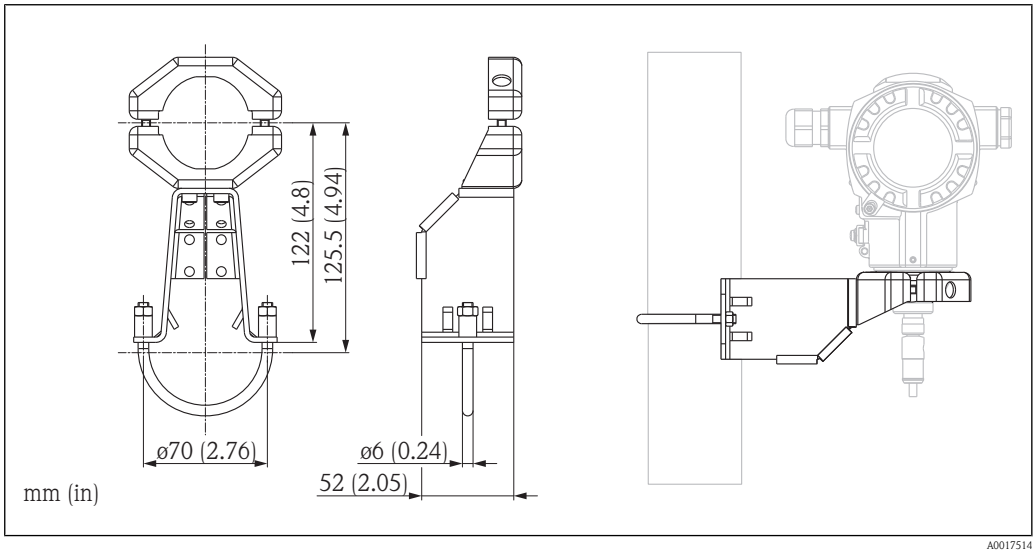
Installing the sensor modules

- Due to the orientation of the sensor modules, there may be a shift in the zero point, i.e. when the container is empty or partially full, the measured value does not display zero. You can correct this zero point shift: see "Commissioning without an operating menu" or the "Position adjustment" section .
- 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.

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.



- Feature 620, "Accessory Enclosed" in the order code.
- Dimensions (→ 27).

Sensor and transmitter cable

You can choose from different cable lengths:
- Sensor cable: PE-X: 1.82 m (6 ft), 4.57 m (15 ft), 10.67 m (35 ft) and 30.48 m (100 ft) feature 105, "Cable length between sensors:" in the order code.
- Transmitter cable: PE-X: 1.82 m (6 ft), 4.57 m (15 ft)and 10.67 m (35 ft) feature 100, "Cable length between sensor module and transmitter:" in the order code.

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, 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

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 (NE 21). For details refer to the Declaration of Conformity.
- Maximum deviation: < 0.5 % of span
- All EMC measurements were performed with a turn down (TD) = 2:1.

Process

Process temperature limits

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

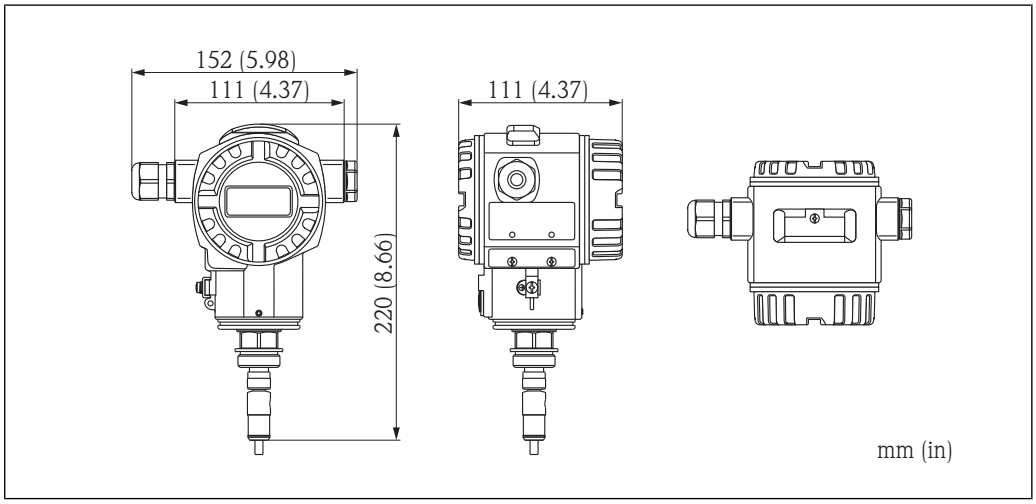
- The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure. See the following sections:
  - (→ 9), "Measuring range" section
  - The MWP (maximum working pressure) is specified on the nameplate of the individual sensor module. This value refers to a reference 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) 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).

Mechanical construction

Design, dimensions

Transmitter (optional display on the side)

Front view, left-hand side view, top view. For installation height H, see specific process connection.



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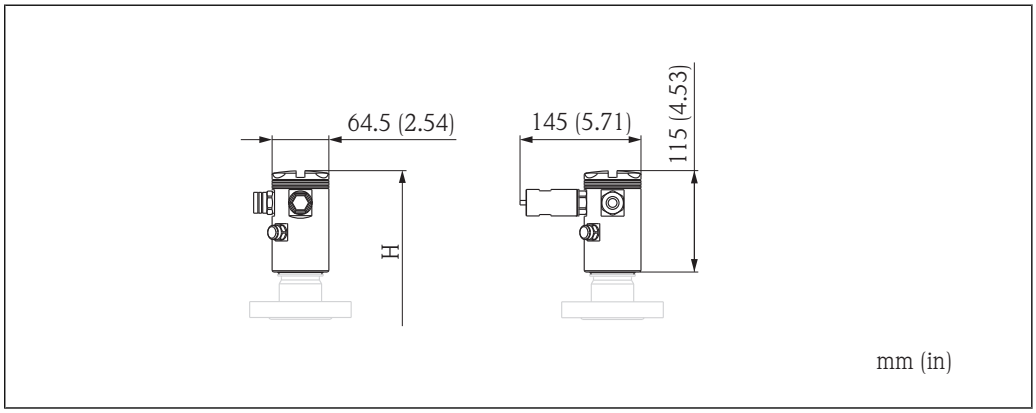
Transmitter weight (→ 27).

Sensor housing

Side view. For installation height H, see specific process connection.



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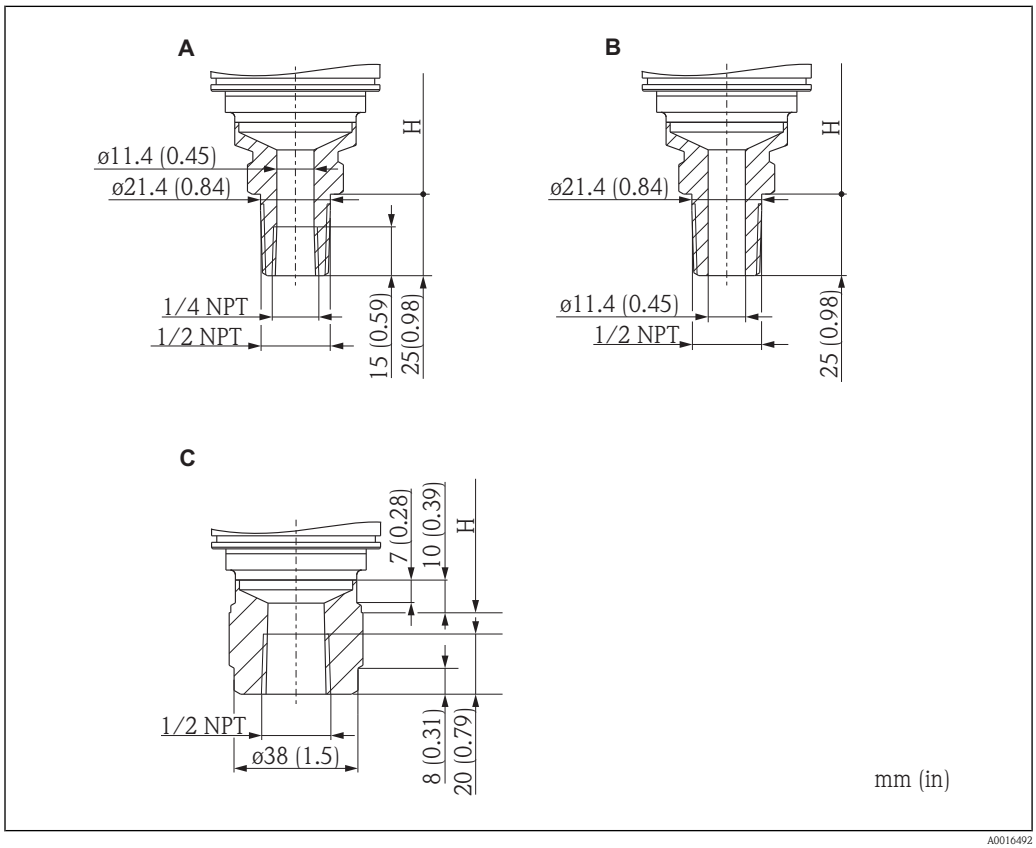
Sensor housing weight (→ 27).

Process connections: thread, internal process isolating diaphragm

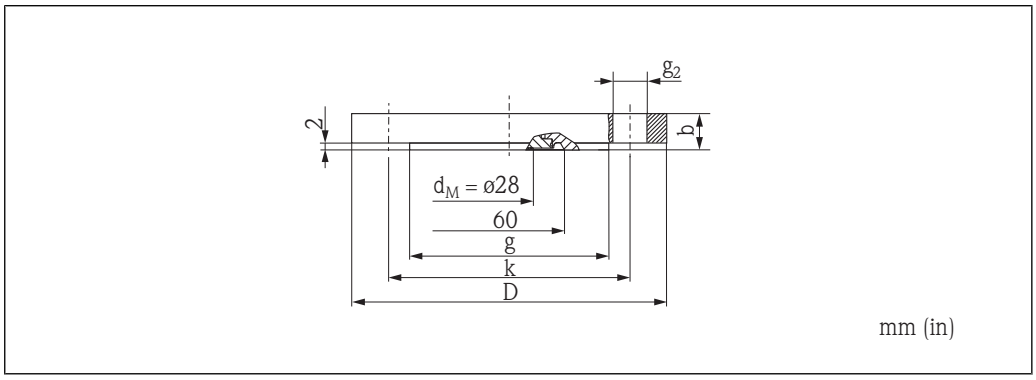
ANSI thread. Installation height H, see table.



Drawing	Thread	Version	Material	Weight	Installation height H
A	ANSI 1/2 MNPT 1/4 FNPT	RLJ	AISI 316L	0.6 kg (1.32 lbs)	149 mm (5.87 in)
B	ANSI 1/2 MNPT	RKJ		0.6 kg (1.32 lbs)	
C	ANSI 1/2 FNPT	R1J		0.7 kg (1.54 lbs)	

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

EN/DIN flange with flush-mounted process isolating diaphragm, material AISI 316L:



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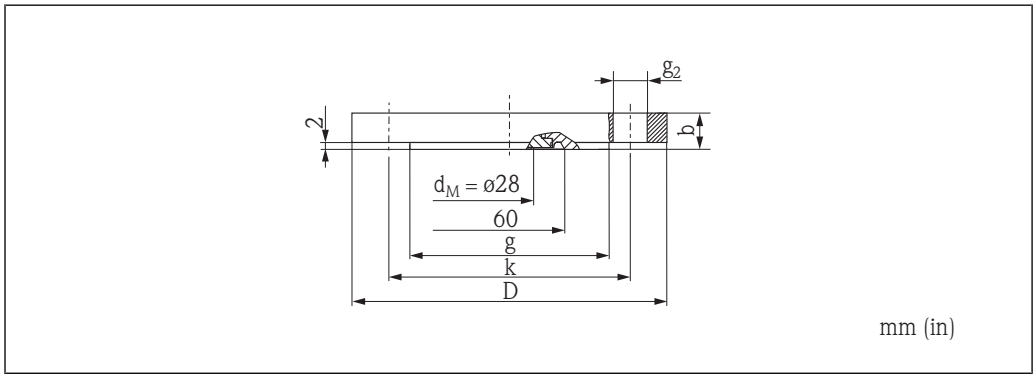
	Flange [1]							Boltholes		
Version	Nominal diameter	Nominal pressure	Shape [2]	Diameter	Thickness	Raised face	Weight	Quantity	Diameter	Hole circle
				D	b	g			g_2	k
				[mm (in)]	[mm (in)]	[mm (in)]	[kg (lbs)]		[mm (in)]	[mm (in)]
CXJ	DN 50	PN 10-40	B1 (D)	165 (6.5)	20 (0.79)	102 (4.02)	3.0 (6.62)	4	18 (0.71)	125 (4.92)
CZJ	DN 80	PN 10-40	B1 (D)	200 (7.87)	24 (0.94)	138 (5.43)	5.3 (11.69)	8	18 (0.71)	160 (6.3)

1) The roughness of the surface in contact with the medium including the raised face of the flange (all standards) is Ra 0.8 µm (31.5 µin). Lower surface roughness on request.
2) Name as per DIN 2527 provided in brackets

Weight of housing (→ 27)

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

ANSI flange, material AISI 316/316L (combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)).



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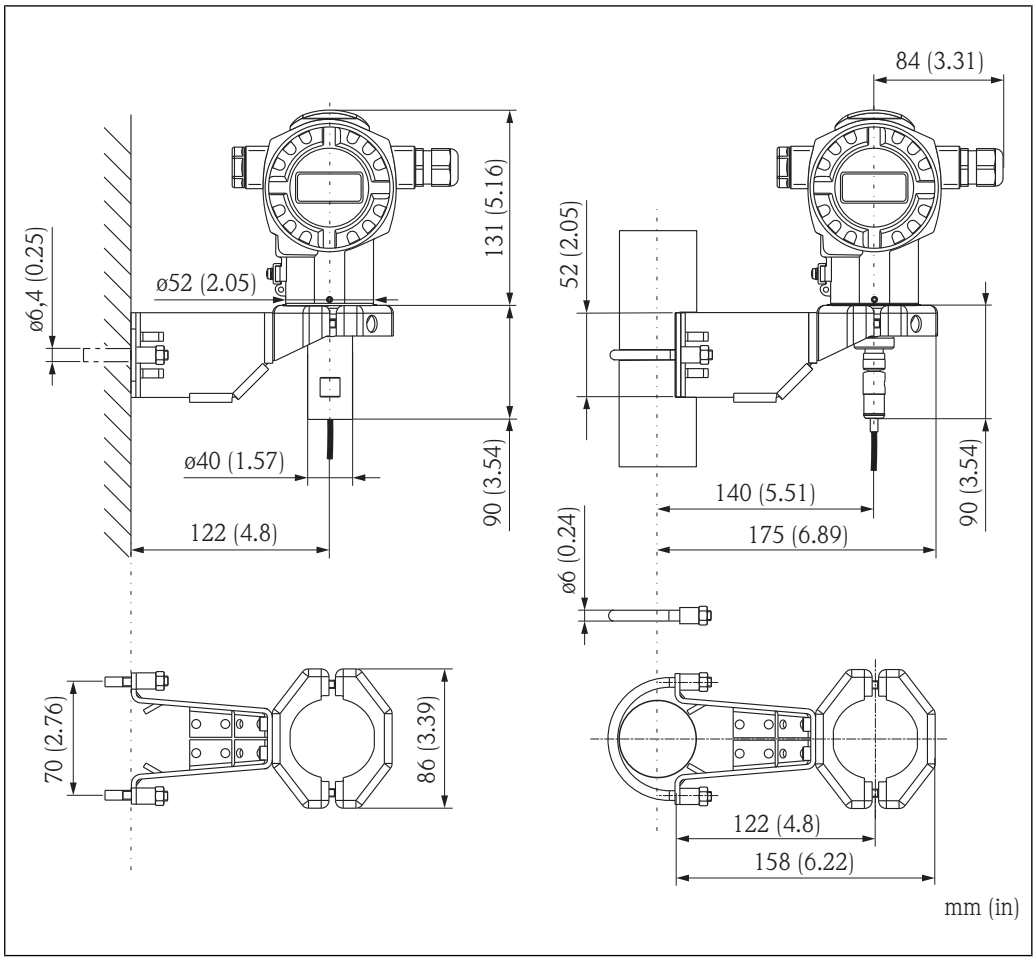
	Flange [1]						Boltholes		
Version	Nominal diameter	Class	Diameter	Thickness	Raised face	Weight	Quantity	Diameter	Hole circle
			D	b	g			g_2	k
	[in (mm)]		[in (mm)]	[in (mm)]	[in (mm)]	[kg (lbs)]		[in (mm)]	[in (mm)]
AFJ	2 (50)	150	6 (152.4)	0.75 (19.1)	3.62 (91.9)	2.4 (5.29)	4	0.75 (19.1)	4.75 (120.7)
ARJ	2 (50)	300	7.5 (190.5)	0.88 (22.4)	3.62 (91.9)	3.2 (7.06)	8	0.75 (19.1)	5 (127)
AGJ	3 (76)	150	7.5 (190.5)	0.94 (23.9)	5 (127)	4.9 (10.80)	4	0.75 (19.1)	6 (152.4)
ASJ	3 (76)	300	8.25 (209.5)	1.12 (28.4)	5 (127)	6.7 (14.77)	8	0.88 (22.4)	6.62 (168.1)

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.

Weight of housing (→ 27)

Wall and pipe mounting with mounting bracket



Weight

Transmitter

	Aluminum	AISI 316L
With electronic insert and display	1.7 kg (3.75 lbs)	2.6 kg (5.73 lbs)
With electronic insert without display	1.6 kg (3.53 lbs)	2.5 kg (5.51 lbs)

Sensor module

Aluminum	AISI 316L
0.6 kg (1.32 lbs)	1.35 kg (2.98 lbs)

Process connections

(→ 23)

Materials in contact with process

NOTICE

► Device components in contact with the process are listed in the "Mechanical construction"(→ 23) and "Ordering information"(→ 36) 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 14435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1: 2001 Tab. 18. The chemical composition of the two materials can be identical.

Process isolating diaphragm

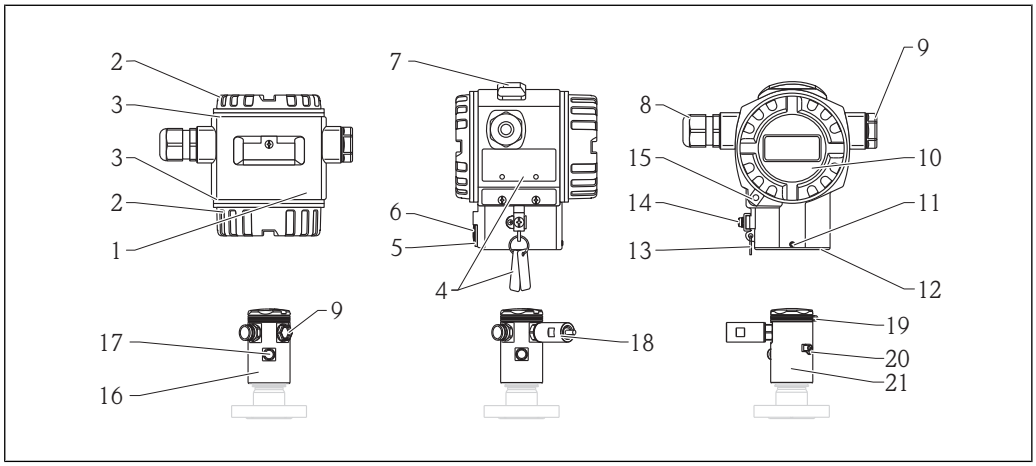
AISI 316L (DIN/EN material number 1.4435)

Filling oil

Silicone oil

Materials not in contact with process

Transmitter housing and sensor modules



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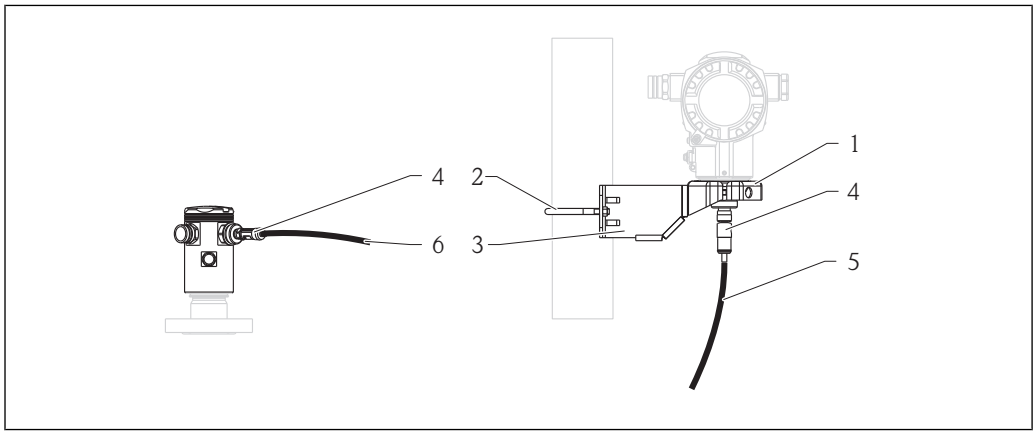
Item number	Component part	Material
1	T14 housing, RAL 5012 (blue)	Die-cast aluminum with protective powder-coating on polyester base
	T14 housing	Precision cast AISI 316L (1.4435)
2	Cover, RAL 7035 (gray)	Die-cast aluminum with protective powder-coating on polyester base
	Cover	Precision cast AISI 316L (1.4435)
3	Cover seal	EPDM
4	Nameplates	AISI 304 (1.4301)
5	Pressure compensation filter, O-ring	Silicone (VMQ)
6	Pressure compensation filter	PA6 GF10
7	External operation (keys and key cover), RAL 7035 (gray)	Polycarbonate PC-FR, screw A4
8	Cable gland	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
	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
16	Sensor module housing and cover	Die-cast aluminum with protective powder-coating on polyester base
		Precision cast AISI 316L (1.4435)
17	Pressure compensation filter	PA6 GF10 For approval Ex na: 316L (1.44.04)
18	Adapter	316L

Item number	Component part	Material
19	Snap ring for cover	PP
20	Earth connection box	316L
21	Nameplates	Plastic film

Connecting parts



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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
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
- Diagnosis
- Expert level

Quick and safe commissioning

Guided menus for applications

Reliable operation

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

Efficient diagnostics increase measurement availability

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

Local operation

Functions

Function	External operation (operating keys, optional)	Internal operation (electronic insert)	Onsite display (optional)
Position adjustment (zero point correction)	X	X	X
Setting lower-range value and upper-range value – reference pressure present at the device	X	X	X
Device reset	X	X	X
Locking and unlocking parameters relevant to the measured value	X (only if display is connected)	X	X
Value acceptance indicated by green LED	–	X	X
Switching damping on and off	–	X	X
Switch on Min. alarm	–	X	X

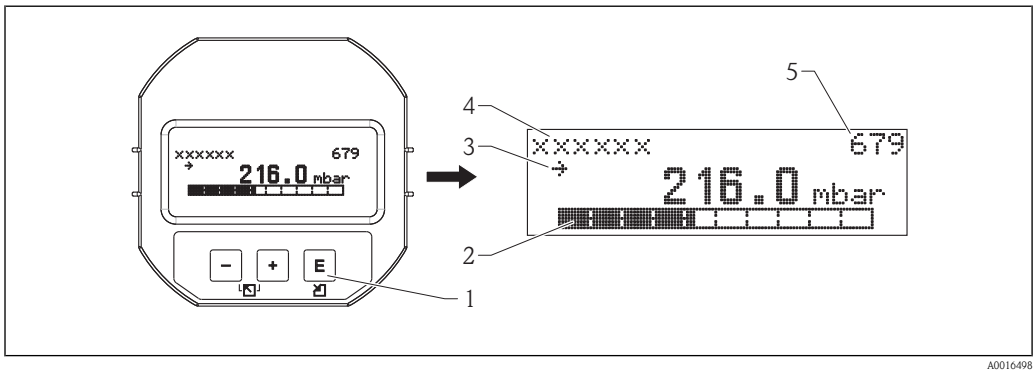
Operating the device using onsite display (optional)

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



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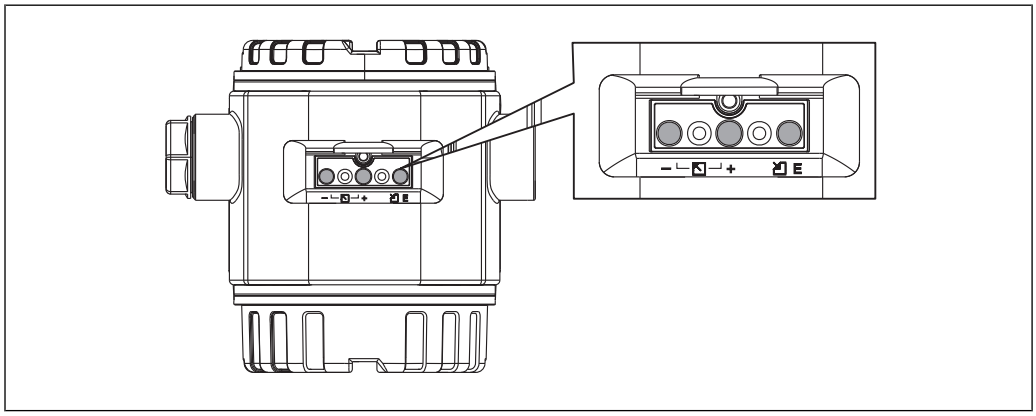
1 Operating keys
2 Bargraph
3 Symbol
4 Header
5 Parameter ID number

Operating keys on the exterior of the device

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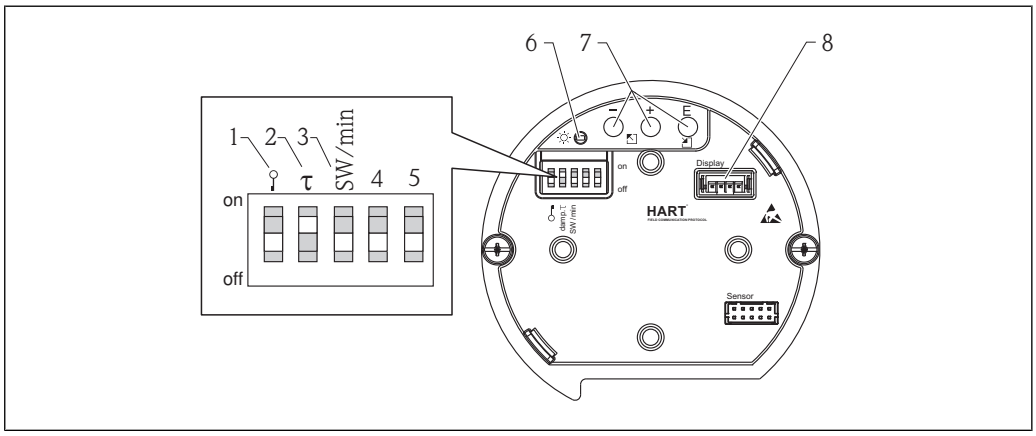
The operating keys on the outside of the device make it unnecessary to open the housing. This guarantees:

- 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



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

Remote operation

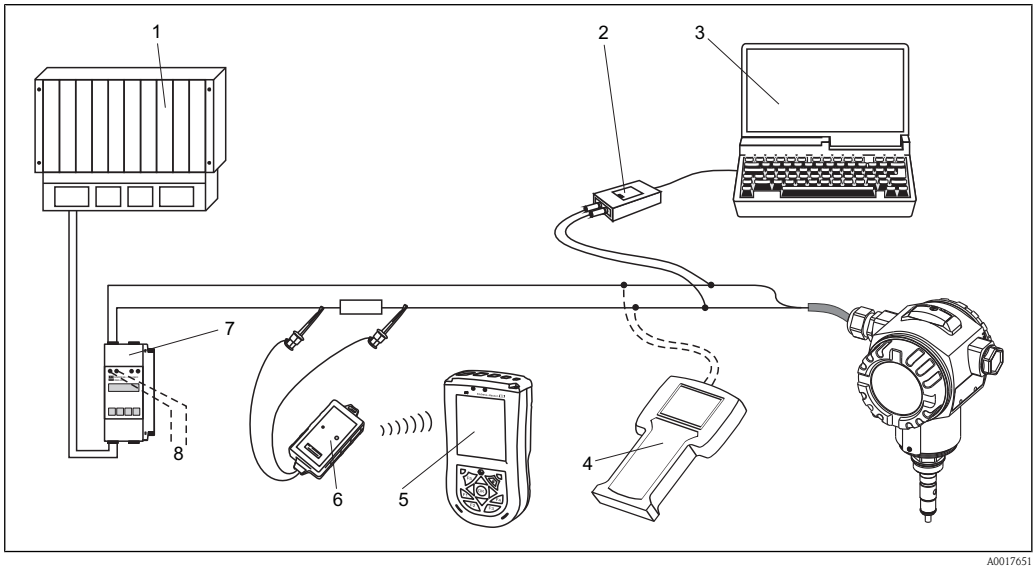
Depending on the position of the write protection switch on the device, all software parameters are accessible.

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

Remote operation is possible with the following hardware and software:

Remote operation via HART

Options for remote operation via HART:



1 PLC (programmable logic control)
2 Commubox FXA195 (USB)
3 Computer with operating tool (e.g. FieldCare, AMS, SIMATIC PDM)
4 Field Communicator 375, 475
5 Field Xpert SFX100
6 VIATOR Bluetooth modem with connecting cable
7 Transmitter power supply unit RMA422 or RN221N (with communication resistor)
8 Connection for Commubox FXA195

Only use certified operating devices in hazardous area!

FieldCare

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

FieldCare supports the following functions:

- Configuration of transmitters in offline and online mode
- Loading and saving device data (upload/download)
- Documentation of the measuring point

Connection options:

HART via Commubox FXA195 and the USB port on a computer

For further information, see www.endress.com

Commubox FXA195

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

Field Xpert

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

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.

Pressure Equipment Directive (PED)

The FMD72 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 FMD72:

DIN EN 60770 (IEC 60770):

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

DIN 16086:

Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications on data sheets

EN 61326-X:

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

EN61000-4-5:

Electromagnetic compatibility for test and measurement methods

NAMUR - User association of automation technology in process industries.

NE 21 – Electromagnetic Compatibility (EMC) of Industrial Process and Laboratory Control Equipment.

NE 43 – Standardization of the Signal Level for the Failure Information of Digital Transmitters.

NE 32 – Data Retention in the Event of a Power Failure in Field and Control Instruments with Microprocessors

NE 44 – Standardization of Status Indicators on PCT Instruments with the Help of Light Emitting Diodes

NE 53 – Software of Field Devices and Signal Processing Devices with Digital Electronics

NE 107 – Self-Monitoring and Diagnosis of Field Devices

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 FMD72	CSA, FM IS, XP, NI	40 bar (580psi)

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

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 → Instruments → Select device → 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 measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

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.

Certificate/type of protection	Documentation	Version in the order code
ATEX II 1/2G Ex ia IIC T6 Ga/Gb	XA00619P	BA
ATEX II 1/2G Ex d [ia] IIC T6 Ga/Gb	XA00620P	BC
ATEX II 3G Ex nA IIC T6 BC	XA00621P	BD
IEC Ex ia IIC T6 Ga/Gb	XA00622P	IA
IEC Ex d [ia] IIC T6 Ga/Gb	XA00623P	IB
CSA C/US IS Cl.I Div.1 Gr.A-D, Ex ia Zone 0,1,2	XA00626P	CA
CSA C/US XP Cl.I Div.1 Gr.A-D, Ex d [ia], Zone 0,1,2	XA00627P	CB
CSA C/US Cl.I Div.2 Gr.A-D, Zone 2	XA00671P	CC
FM C/US IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0,1,2	XA00624P	FA
FM C/US XP AIS Cl.I Div.1 Gr.A-D, Exd [ia] Zone 0,1,2	XA00625P	FB
FM C/US NI Cl.I Div.2 Gr.A-D, Zone 2	XA00669P	FD

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

Registered trademarks

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