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

Technical Information

Deltabar S PMD70/75, FMD76/77/78

Differential pressure transmitter with ceramic and monosilicon sensors for flow, level and differential measurement
High accuracy with excellent long-term stability
HART®, PROFIBUS® PA or FOUNDATION™ Fieldbus protocols

Application

The Deltabar S differential pressure transmitter are suitable for:
- Flow measurement (volume or mass flow) in conjunction with primary elements in gase, steam and liquids
- Level, volume or mass measurement in liquids
- Differential pressure monitoring, e.g. across filters and pumps
- Corrosive or abrasive applications using unique ceramic sensor technology (PMD70). For example, DP measurement across a filter with abrasive product
- High temperatures up to 662°F (350°C) with remote diaphragm seals (FMD78)

Your benefits

- Excellent reproducibility and long-term stability
- High accuracy: up to ±0.075%, (<15:1 turndown), with optional PLATINUM version: ±0.05% span
- Turn down 100:1, higher on request

Designed with safety in mind to keep your plant, equipment and personnel safe:
- Used for flow and differential pressure monitoring up to SIL3, certified to IEC 61508 by TÜV SÜD
- Meets PED (Pressure Equipment Directive)
- Secondary seals standard in every transmitter
- Built-in diagnostic software functionality (e.g. user-defined max. / min. operating window)
- Function-monitored from the measuring cell to the electronics
- Modularity for easy, cost-effective repair
  - replaceable display
  - universal electronics for pressure and differential pressure
- Easy setup with menu-driven interface, quick setup menu for standard application modes including pressure, level and flow

HistoROM®/M-DAT memory module enables:
- Quick commissioning thanks to quick setup menu
- Process monitoring via periodic recording of pressure and temaperature values
- Monitoring of events and configuration changes

Flexible commissioning via multiple modes:
- On-board push buttons (external or inside housing)
- Easy and safe menu-guided operation on-site, via 4 to 20 mA with HART, PROFIBUS PA or FOUNDATION Fieldbus
- Extensive diagnostic functions

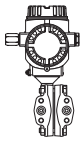
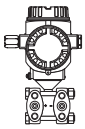
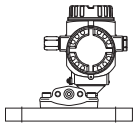
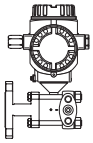
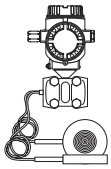
TI382P/24/ae/01.09

Endress+Hauser

People for Process Automation

Function and system design

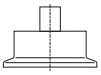
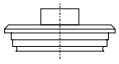
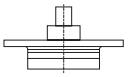
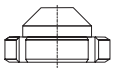
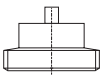
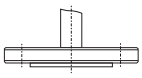
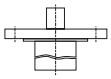
Device selection

Deltabar S – product family	**PMD70**  P01-PMD70xxx-16-xx-xx-xx-000 **With ceramic measuring diaphragms**	**PMD75**  P01-PMD75xxx-16-xx-xx-xx-000 **With metallic measuring diaphragms**	**FMD76**  P01-FMD76xxx-16-xx-xx-xx-000 **With ceramic measuring diaphragms**	**FMD77**  P01-FMD77xxx-16-xx-xx-xx-000 **With metallic measuring diaphragms and diaphragm seal mounted on one side**	**FMD78**  P01-FMD78xxx-16-xx-xx-xx-003 **With metallic measuring diaphragms and capillary diaphragm seals**
Field of application	– Flow – Level – Differential pressure	– Flow – Level – Differential pressure	– Level	– Level	– Level – Differential pressure
Process connections	– 1/4 – 18 NPT – RC 1/4	– 1/4 – 18 NPT – RC 1/4	Low-pressure side (–): – 1/4 – 18 NPT – RC 1/4 High-pressure side (+): – DN 80 – DN 100 – ANSI 3" – 4" – JIS 80A – 100A	Low-pressure side (–): – 1/4 – 18 NPT – RC 1/4 High-pressure side (+): – DN 50 – DN 100 – ANSI 2" – 4" – JIS 80A – 100A	– Wide range of diaphragm seals, → page 5, section "Overview of diaphragm seal FMD78"
Measuring ranges	from –25 to +25 mbar (–10 to +10 inH_2O) to –3 to +3 bar (-45 to +45 psi)	from –10 to +10 mbar (-4 to +4 inH_2O) to –40 to +40 bar (-600 to +600 psi)	from –100 to +100 mbar (-40 to +40 inH_2O) to –3 to +3 bar (-45 to +45 psi)	from –100 to +100 mbar (–40 to +40 inH_2O) to –16 bar to +16 bar (-230 to +230 psi)	from –100 to +100 mbar (–40 to +40 inH_2O) to –40 to +40 bar (-600 to +600 psi)
Overload [1]	on one side: max. 100 bar (1450 psi) on both sides: max. 150 bar (2175 psi)	on one side: max. 420 bar (6100 psi) on both sides: max. 630 bar (8700 psi)	on one side: max. 100 bar (1450 psi)	on one side: max. 160 bar (2320 psi)	on one side: max. 160 bar (2320 psi) on both sides: max. 240 bar (3480 psi)
Process temperature range	–20 to +85°C (–4 to +185°F)	–40 to +120°C (–40 to +248°F)	–20 to +85°C (–4 to +185°F)	up to + 400°C (+752°F)	up to +400°C (+752°F)
Ambient temperature range	–20 to +85°C (–4 to +185°F)	–40 to +85°C (–40 to +185°F) [2]	–20 to +85°C (–4 to +185°F)	–40 to +85°C (–40 to +185°F) [2]	–40 to +85°C (–40 to +185°F) [2]
Ambient temp. range separate housing	–40 to +60°C (–40 to +140°F)				
Reference Accuracy	– Up to ±0.075% of the set span – PLATINUM version: up to ±0.05% of the set span			– Up to ±0.075 % of the set span	
Supply voltage	– For non-hazardous areas: 10.5 to 45 V DC; EEx ia (intrinsically safe): 10.5 to 30 V DC				
Output	4 to 20 mA with superimposed HART protocol, PROFIBUS PA or FOUNDATION Fieldbus				
Options	– High-pressure version up to p_{stat} 700 bar (10,100 psi) – PMD75, FMD77, FMD78: Gold-Rhodium-coated diaphragm, NACE-compliant materials – Remote housing				
Specialities (options)	– Metal-free measurement with PVDF flange – Available with Deltatop as flow compact device	– p_{stat} up to 420 bar (6100 psi) – Diaphragm: tantalum – Available with Deltatop as flow compact device	– Abrasion-resistant and corrosion-resistant – No diaphragm-seal temperature effects – Metal-free measurement possible with ECTFE-coated process connection	– For high media temperatures	– Wide range of diaphragm seals
	– HistoROM®/M-DAT memory module				

1) dependent on the lowest-rated element, with regard to pressure, of the selected components

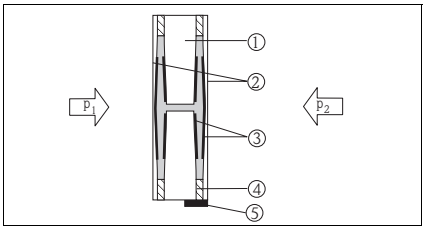
2) lower temperature on request

Overview of diaphragm seal
FMD78

Design	Diaphr. seal	Connection	Version	Standard	Nominal diameter	Nom. press./Class
Pancake	Membrane diaphragm seal	DIN cell	 P01-FMD78xxx-04-xx-xx-xx-000	DIN 2501	– DN 50 – DN 80 – DN 100	PN 16 – 400
		ANSI cell		ANSI B 16.5	– 2" – 3" – 4"	150 – 2500 lbs
Threaded connection with separator	Membrane diaphragm seal	G	 P01-FMD78xxx-03-xx-xx-xx-010	ISO 228	G 1/2 B	PN 40
		NPT	 P01-FMD78xxx-03-xx-xx-xx-011	ANSI	1/2 NPT	PN 40
Tri-Clamp	Membrane diaphragm seal	Clamp	 P01-FMD78xxx-03-xx-xx-xx-005	ISO 2852	– DN 25 (1") – DN 38 (1 1/2") – DN 51 (2") – DN 76.1 (3")	Dependent on the clamp used
	Pipe diaphragm seal	Clamp	 P01-FMD78xxx-03-xx-xx-xx-009	ISO 2852	– DN 25 (1") – DN 38 (1 1/2") – DN 51 (2")	Dependent on the clamp used
Hygienic connections	Membrane diaphragm seal	Varivent	 P01-FMD78xxx-03-xx-xx-xx-007		Type N for pipes DN 40 – DN 162	PN 40
		DRD	 P01-FMD78xxx-03-xx-xx-xx-006		DN50 (65 mm)	25 bar
		Sanitary tank spud with 2" extended diaphragm seal	 P01-FMD78xxx-03-xx-xx-xx-008		d = 100 mm	Dependent on the clamp used
		Taper adapter with coupling nut	 P01-FMD78xxx-03-xx-xx-xx-003	DIN 11851	– DN 50 – DN 65 – DN 80	PN 25
		Threaded adapter	 P01-FMD78xxx-03-xx-xx-xx-004	DIN 11851	– DN 50 – DN 65 – DN 80	PN 25
Flange	Membrane diaphragm seal	EN/DIN flange	 P01-FMD78xxx-03-xx-xx-xx-001	EN 1092-1/ DIN 2527	– DN 50 – DN 80 – DN 100	Up to 40 bar
		ANSI flange		ANSI B 16.5	– 2" – 3" – 4"	150 lbs and 300 lbs
		JIS flange		B 2220 BL	– 50 A – 80 A – 100 A	10 K
Flange with extended diaphragm seal	Membrane diaphragm seal	ANSI flange	 P01-FMD78xxx-03-xx-xx-xx-002	ANSI B 16.5	– 3" with 2"/4"/6"/ 8" extended diaphragm seal – 4" with 2"/4"/6"/ 8" ext. diaphr. seal	150 lbs

Measuring principle

Ceramic measuring diaphragms used for PMD70 and FMD76

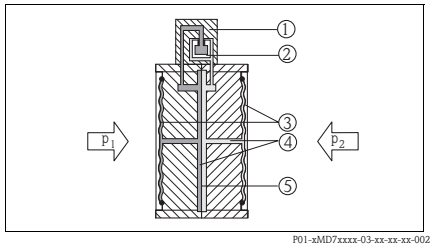


P01-xMD7xxxx-03-xx-xx-xx-000

Ceramic measuring cell PMD70 and FMD76

1 Meter body
2 Diaphragm
3 Electrodes
4 Glass frit fixes the diaphragm onto the meter body
5 Temperature sensor

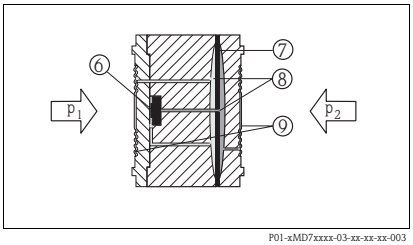
Metallic measuring diaphragms used for PMD75, FMD77 and FMD78



P01-xMD7xxxx-03-xx-xx-xx-002

Metal measuring cell 10 and 30 mbar (2 and 12 inH_2O)

1 Sensing element
2 Silicon diaphragm
3 Separating diaphragm
4 Filling oil
5 Integrated overload protection



P01-xMD7xxxx-03-xx-xx-xx-003

Metal measuring cell as of 100 mbar (40 inH_2O)

6 Sensing element
7 Overload diaphragm/Middle diaphragm
8 Filling oil
9 Separating diaphragm

Ceramic measuring diaphragms used for PMD70 and FMD76

The ceramic measuring cell is based on the principle of a plate capacitor with an electrode on (1) and a movable electrode on the interior of the diaphragm (3). Standard silicone oil or mineral oil filling oils for this measuring cell.
A differential pressure ($p_1 \neq p_2$) causes a corresponding deflection of both diaphragms. Both capacitance values are converted and are fed to the microprocessor of the transmitter as a digital signal.

Advantages:
- Self-monitoring for diaphragm break or oil loss (constant comparison of the measured temperature with a temperature calculated from the capacitance values)
- Extremely high resistance to aggressive media
- Suitable for vacuums up to 1 $mbar_{abs}$ (0.4 inH_2O)
- Metal-free versions available
- Second process barrier (Secondary Containment) for enhanced integrity

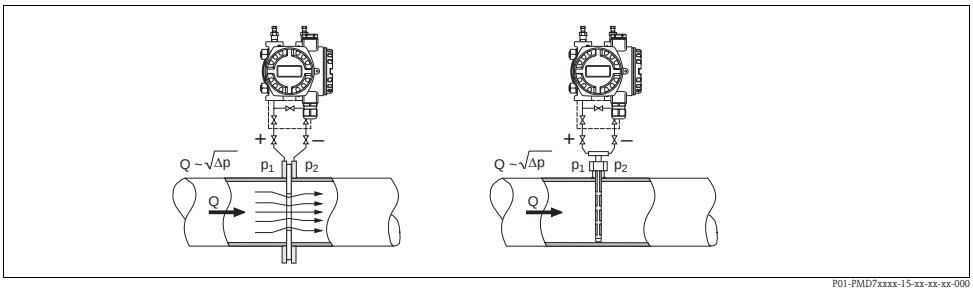
Metallic measuring diaphragms used for PMD75, FMD77 and FMD78

The separating diaphragms (3/9) are deflected on both sides by the acting pressures. A filling oil (4/8) transfers the pressure to a resistance circuit bridge (semi-conductor technology). The differential-pressure-dependent change of the bridge output voltage is measured and further processed.

Advantages:
- Standard operating pressures: 160 bar (2320 psi) and 420 bar (6090 psi)
- High long-term stability
- Very high single-sided overload resistance
- Second process barrier (Secondary Containment) for enhanced integrity

Flow measurement

Design and operation mode



P01-PMD7xxxx-15-xx-xx-xx-000

Flow measurement with Deltabar S and primary element, left: Orifice plate and right: Pitot tube

Q Flow
Δp Differential pressure, $\Delta p = p_1 - p_2$

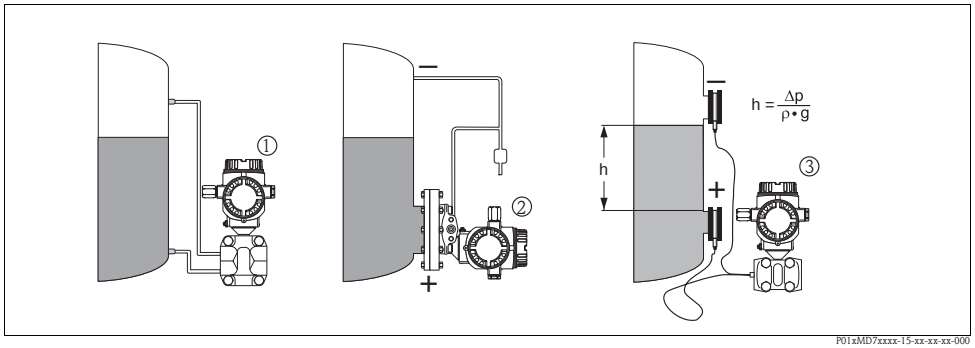
Your benefits

- Choice of four flow modes of operation: volume flow, norm volume flow (European norm conditions), standard volume flow (American standard conditions) and mass flow.
- Choice of diverse flow units with automatic unit conversion.
- A customised unit can be specified
- Low flow cut off: when activated, this function suppresses small flows which can lead to large fluctuations in the measured value.
- Contains two totalizers as standard. One totalizer can be reset to zero.
- The totalizing mode and unit can be individually set for each totalizer. This allows independent daily and annual quantity totalizing.
- With the product family Deltatop, Endress+Hauser is offering a universal and reliable solutions for flow measurement:
  - Deltatop, the compact, ready-to-use flow measuring unit including differential pressure transmitter Deltabar S

Note!
For more information about flow measurement with the Deltabar S differential pressure transmitter
- Deltabar S with orifice plate (TI422P, Deltatop DO6x)
- Deltabar S with pitot tube (TI425P, Deltatop DP6x)

Level measurement (level, volume and mass)

Design and operation mode



Level measurement with Deltabar S

1 Level measurement via impulse piping and PMD70
2 Level measurement with FMD76
3 Level measurement with FMD78
h Height (level)
Δp Differential pressure
ρ Density of the medium
g Gravitation constant

Your benefits

- Choice of three level operating modes
- Volume and mass measurements in any tank shapes by means of a freely programmable characteristic curve
- Choice of diverse level units with automatic unit conversion
- A customised unit can be specified
- Has a wide range of uses, e.g.
  - for level measurement in tanks with superimposed pressure
  - in the event of foam formation
  - in tanks with agitators of screen fittings
  - in the event of liquid gases
  - for standard level measurement

Communication protocol

- 4 to 20 mA with HART communication protocol
- PROFIBUS PA
  - The Endress+Hauser devices meet the requirements as per the FISCO model.
  - Due to the low current consumption of 13 mA ± 1 mA
    - up to 7 Deltabar S for EEx ia, CSA IS and FM IS applications
    - up to 27 Deltabar S for all other applications, e.g. in non-hazardous areas, EEx nA, etc.

    can be operated at one bus segment with installation as per FISCO.

Further information on PROFIBUS PA, such as requirements for bus system components, can be found in the Operating Instructions BA034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and in the PNO guideline.

- FOUNDATION Fieldbus
  - The Endress+Hauser devices meet the requirements as per the FISCO model.
  - Due to the low current consumption of 15 mA ± 1 mA
    - up to 6 Deltabar S for EEx ia, CSA IS and FM IS applications
    - up to 24 Deltabar S for all other applications, e.g. in non-hazardous areas, EEx nA, etc.

    can be operated at one bus segment with installation as per FISCO.

  Further information on FOUNDATION Fieldbus, such as requirements for bus system components can be found in the Operating Instructions BA013S "FOUNDATION Fieldbus Overview".

Input

Measured variable

Differential pressure, from which flow (volume or mass current) and level (level, volume or mass) are derived

Measuring range

PMD75, FMD77, FMD78 (with metallic measuring diaphragms)

Nominal value	Measurement limit		Smallest calibratable span [5]	MWP [1]	Overload [2]		Min. operating pressure [3]	Order code version [4]	
	lower (LRL)	upper (URL)			on one side	on both sides		PN 160 [6] (2320 psi)	PN 420 [6] (6100 psi)
mbar	mbar	mbar	mbar (inH_20)	mbar (inH_20)	mbar (inH_20)	mbar (inH_20)	$mbar_{abs}$ (psia)		
10 (4 inH_20) [7]	–10 (-4 inH_20)	+10 (+4 inH_20)	0.25 (0.10)	160 (2320)	160 (2320)	240 (3480)	0.1 (0.001)	7B	–
30 (12 inH_20) [7]	–30 (-12 inH_20)	+30 (+12 inH_20)	0.3 (0.12)	160 (2320)	160 (2320)	240 (3480)	0.1 (0.001)	7C	–
100 (40 inH_20)	–100 (-40 inH_20)	+100 (+40 inH_20)	1/5 (0.4/2) [8]	160 (2320)	160 (2320)	240 (3480)	0.1 (0.001)	7D	–
500 (200 inH_20)	–500 (-200 inH_20)	+500 (+200 inH_20)	5 (2)	160/420 [9] (2320/6100)	160/420 (2320/6100)	240/630 (3480/9140)	0.1 (0.001)	7F	8F
3000 (45 psi)	–3000 (-45 psi)	+3000 (+45 psi)	30 (12)	160/420 [9] (2320/6100)	160/420 (2320/6100)	240/630 (3480/9140)	0.1 (0.001)	7H	8H
16000 (240 psi)	–16000 _240 psi)	+16000 (+240 psi)	160 (65)	160/420 [9] (2320/6100)	160/420 (2320/6100)	240/630 (3480/9140)	0.1 (0.001)	7L	8L
40000 (600 psi)	–40000 (-600 psi)	+40000 (+600 psi)	400 (160)	160/420 [9] (2320/6100)	"+"side: 160/420 [10] (2320/6100)	240/630 (3480/9140)	0.1 (0.001)	7M	8M

PMD70, FMD76 (with ceramic measuring diaphragms)

Nominal value	Measurement limit		Smallest calibratable span [5]	MWP [1]	Overload [2]		Min. operating pressure [3]	Order code version [4]
	lower (LRL)	upper (URL)			on one side	on both sides		
mbar (inH_2O)	mbar (inH_2O)	mbar (inH_2O)	mbar (inH_2O)	bar (psi)	bar (psi)	bar (psi)	$mbar_{abs}$ (psia)	
25 (10)	–25 (-10)	+25 (+10)	0.25 (0.10)	10 (145)	10 (145)	15 (217)	1 (0.015)	7B
100 (40)	–100 (-40)	+100 (+40)	1 (0.4)	16 (240)	16 (240)	24 (348)	1 (0.015)	7D
500 (200)	–500 (-200)	+500 (+200)	5 (2)	100 (1450)	100 (1450)	150 (2175)	1 (0.015)	7F
3000 (1200)	–3000 (-1200)	+3000 (+1200)	30 (12)	100 (1450)	100 (1450)	150 (2175)	1 (0.015)	7H

1) The MWP (maximum working pressure; MWP = PN) for the measuring device depends on the weakest element of the components selected with regard to pressure, i.e. the process connection (see page 30 ff) has to be taken into consideration in addition to the measuring cell (see table above). Also observe pressure-temperature dependency. For the appropriate standards and further information, see page 29, "Pressure specifications" section.
2) The maximum pressure for the measuring device is dependent on the lowest-rated element, with regard to pressure, of the selected components. See also page 29, section "Pressure specifications".
3) The minimum operating pressure indicated in the table applies to silicone oil under reference operating conditions.
Min. operating pressure at 85°C (185°F) for silicone oil: 10 $mbar_{abs}$ (4 inH_2O).
FMD77 and FMD78: Min. operating pressure: 50 $mbar_{abs}$ (20 inH_2O); observe also the pressure and temperature application limits of the selected filling oil on page 56.
For vacuum applications, please observe the installation instructions on page 62 ff.
4) Versions in the order code Page 65 ff, feature 40 "Nominal range; PN"
5) Turn down > 100:1 on request
6) PN 160 versions with stainless steel A2 screws, PN 420 versions with stainless steel A4 M12 screws. PN 420 versions for PMD75 only.
7) PMD75 only
8) Minimum span that can be calibrated for PMD75: 1 mbar (0.015 psi); minimum span that can be calibrated for FMD77 and FMD78: 5 mbar (0.07 psi)
9) For PMD75 with CRN-approved process connections, the MWP is 315 bar (4570 psi).
10) "–" side: 100 bar (1450 psi)

Explanation of terms

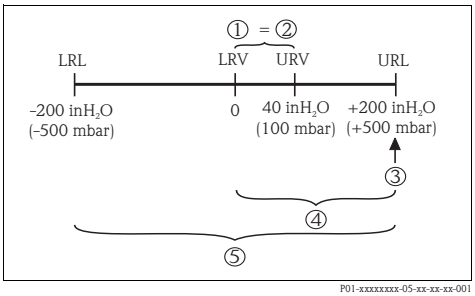
Explanation of the terms: Turn down (TD), set span and zero based span

Case 1:
- $|\text{Lower range value}| \leq |\text{Upper range value}|$

Example:
- Lower range value (LRV) = 0 mbar
- Upper range value (URV) = 100 mbar (40 inH_2O)
- Nominal value (URL) = 500 mbar (200 inH_2O)

Turn down:
- TD = URL / |URV| = 5:1

set span:
- URV – LRV = 100 mbar (40 inH_2O)
  This span is based on the zero point.



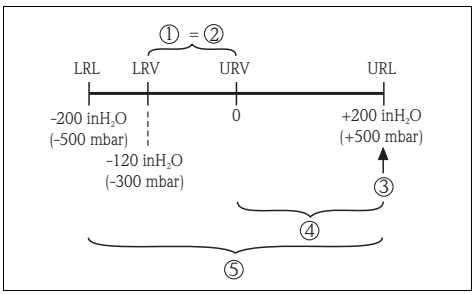
Example: 500 mbar sensor

Case 2:
- $|\text{Lower range value}| \geq |\text{Upper range value}|$

Example:
- Lower range value (LRV) = –300 mbar (-120 inH_2O)
- Upper range value (URV) = 0 bar
- Nominal value (URL) = 500 mbar (200 inH_2O)

Turn down:
- TD = URL / |(LRV)| = 1,67:1

set span:
- URV – LRV = 300 mbar (120 inH_2O)
  This span is based on the zero point.



Example: 500 mbar (200 inH_2O) sensor

1 Set span
2 Zero based span
3 Nominal value ≙ Upper range limit (URL)
4 Nominal measuring range
5 Sensor measuring range
LRL Lower range limit
URL Upper range limit
LRV Lower range value
URV Upper range value

Output

Output signal

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

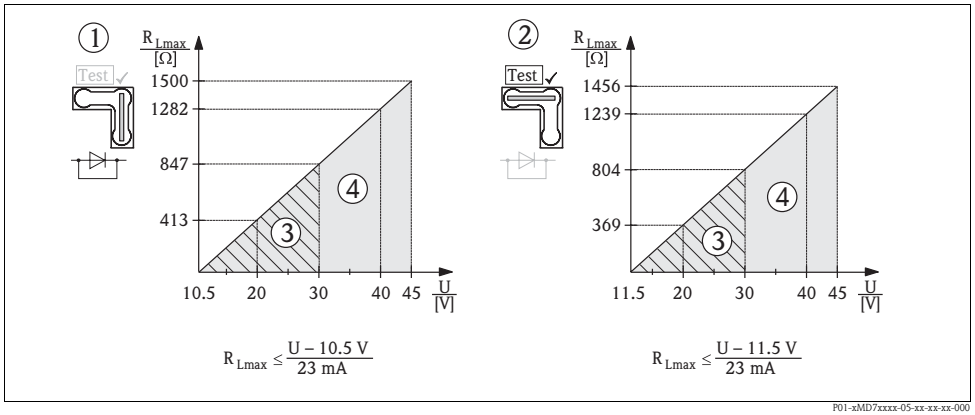
Signal range – 4 to 20 mA HART

3.8 mA to 20.5 mA

Signal on alarm

- 4 to 20 mA HART
  Options:
  – Max. alarm*: can be set from 21 to 23 mA
  – Keep measured value: last measured value is kept
  – Min. alarm: 3.6 mA
  * Factory setting: 22 mA
- PROFIBUS PA: can be set in the Analog Input block,
  options: Last Valid Out Value, Fsafe Value (factory setting), Status bad
- FOUNDATION Fieldbus: can be set in the Analog Input Block,
  options: Last Good Value, Fail Safe Value (factory setting), Wrong Value

Load – 4 to 20 mA HART



Load diagram, observe the position of the jumper and the explosion protection (page 18, section "Measuring the 4 to 20 mA test signal".)

1 Jumper for 4 to 20 mA test signal inserted in "Non-test" position
2 Jumper for 4 to 20 mA test signal inserted in "Test" position
3 Supply voltage 10.5 (11.5) to 30 V DC for 1/2 D, 1 GD, 1/2 GD, FM IS, CSA IS, IECEx ia, NEPSI Ex ia
4 Supply voltage 10.5 (11.5) to 45 V DC for device for non-hazardous areas, 1/2 D, 1/3 D, 2 G EEx d, 3 G EEx nA, FM XP, FM DIP, FM NI, CSA XP, CSA Dust-Ex, NEPSI Ex d
R_{Lmax} Maximum load resistance
U Supply voltage

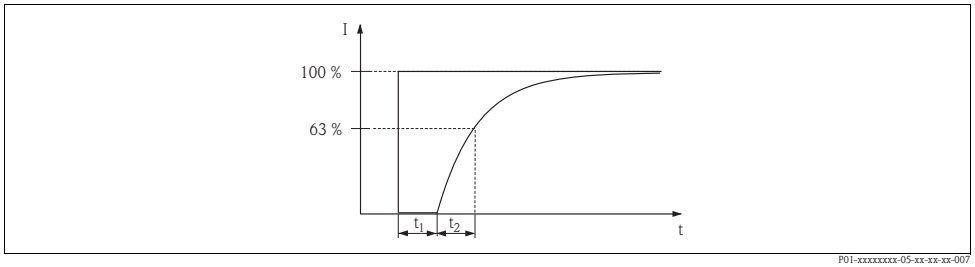
Note!
When operating via a handheld terminal or via PC with an operating program, a minimum communication resistance of 250 Ω must exist within the loop.

Resolution

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

Dynamic behavior current output

Dead time, Time constant (T63)



Presentation of the dead time and the time constant

Type	Dead time t_1	Time constant (T63), t_2
PMD75	45 ms	■ 10 and 30 mbar (2 and 12 inH_2O) measuring cell: 200 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 60 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 45 ms ■ 3 bar (43 psi) measuring cell: 40 ms ■ 16 and 40 bar (232 and 600 psi) measuring cell: 60 ms
FMD77, FMD78	dependent on the diaphragm seal	
PMD70, FMD76	90 ms	■ 25 mbar (10 12 inH_2O) measuring cell: 4700 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 280 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 210 ms ■ 3 bar (43 psi) measuring cell: 110 ms

Dynamic behavior HART

Dead time, Time constant (T63)

A typical parametrization for the PLC of 3 to 4 values per second results in the following total dead time:

Type	Dead time t_1	Time constant (T63), t_2
PMD75	295 ms	■ 10 and 30 mbar (2 and 12 inH_2O) measuring cell: 200 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 60 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 45 ms ■ 3 bar (43 psi) measuring cell: 40 ms ■ 16 and 40 bar (232 and 600 psi) measuring cell: 60 ms
FMD77, FMD78	dependent on the diaphragm seal	
PMD70, FMD76	340 ms	■ 25 mbar (10 12 inH_2O) measuring cell: 4700 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 280 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 210 ms ■ 3 bar (43 psi) measuring cell: 110 ms

Reading cycle

■ HART commands: on average 3 to 4 per second.
The Deltabar S commands the BURST MODE function for cyclic value transmission via the HART communication protocol.

Response time

≤ 250 ms

Cycle time (Update time)

On average 250 to 330 ms.

Dynamic behavior PROFIBUS PA

Dead time, Time constant (T63)

A typical cyclic parametrization for the PLC of 20 values per second results in the following total dead time:

Type	Dead time t_1	Time constant (T63), t_2
PMD75	295 ms	■ 10 and 30 mbar (2 and 12 inH_2O) measuring cell: 200 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 60 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 45 ms ■ 3 bar (43 psi) measuring cell: 40 ms ■ 16 and 40 bar (232 and 600 psi) measuring cell: 60 ms
FMD77, FMD78	dependent on the diaphragm seal	
PMD70, FMD76	340 ms	■ 25 mbar (10 12 inH_2O) measuring cell: 4700 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 280 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 210 ms ■ 3 bar (43 psi) measuring cell: 110 ms

Response time

■ cyclic: approx. 10 ms per request
■ acyclic: < 50 ms

All values are typical values.

Cycle time (Update time)

The cycle time in a bus segment in cyclic data communication depends on the number of devices, on the segment coupler used and on the internal PLC cycle time.

Dynamic behavior FOUNDATION Fieldbus

Dead time, Time constant (T63)

If the macro cycle time (Hostsystem) is set to a typical value of 250 ms, the following total dead time results:

Type	Dead time t_1	Time constant (T63), t_2
PMD75	295 ms	■ 10 and 30 mbar (2 and 12 inH_2O) measuring cell: 200 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 60 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 45 ms ■ 3 bar (43 psi) measuring cell: 40 ms ■ 16 and 40 bar (232 and 600 psi) measuring cell: 60 ms
FMD77, FMD78	dependent on the diaphragm seal	
PMD70, FMD76	340 ms	■ 25 mbar (10 12 inH_2O) measuring cell: 4700 ms ■ 100 mbar (40 12 inH_2O) measuring cell: 280 ms ■ 500 mbar (200 12 inH_2O) measuring cell: 210 ms ■ 3 bar (43 psi) measuring cell: 110 ms

Reading cycle

- cyclic: up to 5/s, dependent on the number and type of function blocks used in a closed-control loop
- acyclic: 10/s

Response time

- cyclic: < 80 ms
- acyclic: < 40 ms

All values are typical values.

Cycle time (Update time)

250 ms

Damping

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

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

Data of the FOUNDATION Fieldbus interface

Basic Data

Device Type	1009F (hex)
Device Revision	06 (hex)
DD Revision	01 (hex)
CFF Revision	01 (hex)
ITK Version	5.0
ITK-Certification Driver-No.	IT054700
Link-Master (LAS) cabable	yes
Link Master / Basic Device selectable	yes; Default: Basic Devce
Number VCRs	44
Number of Link-Objects in VFD	50

Virtual communication references (VCRs)

Permanent Entries	44
Client VCRs	0
Server VCRs	5
Source VCRs	8
Sink VCRs	0
Subscriber VCRs	12
Publisher VCRs	19

Link Settings

Slot time	4
Min. Inter PDU delay	12
Max. response delay	10

Transducer Blocks

Block	Content	Output values
TRD1 Block	contains all parameters related to the measurement	■ Pressure, Flow or Level (Channel 1) ■ Process temperatur (Channel 2)
Service Block	contains service information	■ Pressure after damping (Channel 3) ■ Pressure drag indicator (Channel 4) ■ Counter for max. pressure transgressions (Channel 5)
Dp Flow Block	contains flow and totalizer parameter	Totalizer 1 (Channel 6)
Diagnsotic Block	contains diagnostic information	Error code via DI channels (channel 0 to 6)
Display Block	contains parameters to configure the local display	No output values

Function Blocks

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

Additional Function Block Information:

Segmented Function Block	YES
Number of segmented blocks	15

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