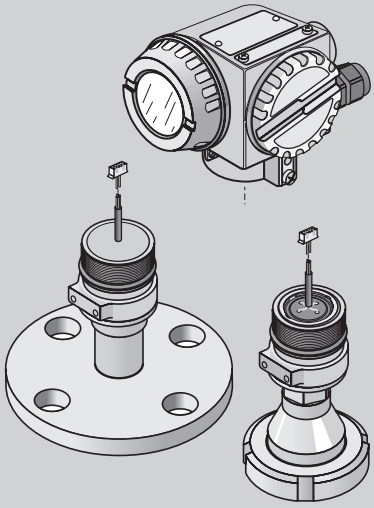


Transmitter-PM4DM
with isolating diaphragm

Selfmonitoring

Local display and adjustment

Wide variety of process couplings

Also for hygienc conditions

Explosion protected EEx ia IIC

SMART function and communication

PROFILE

The pressure transmitter PM4DM works on the two wire principle and, depending on the measuring range, it features a ceramic or polysilicon measuring element. Gauge pressures from 5* mbar up to 400 bar, and absolute pressures from 20* mbar up to 400 bar are converted into a standard pressure proportional 4...20 mA signal. The pressure itself is transferred from the isolating diapragm via the internal filling liquid onto the measuring cell, ensuring that the process coupling is performing its function according to the process conditions.
Microprocessor technology ensures reliable and simple operation. Remote operation via the supply leads is possible for FSK protocol HART

DESCRIPTION

Transmitter PM4DM comprises the measuring cell, the process flange with isolating diaphragm and the electronics housing. The connecting terminals are in a separate compartment. An ASIC in the sensor module stores all the sensor-specific data, so that exchange or replacement of the electronics becomes quite simple. The flat sealing diapragm is welded or brazed into a ring carrier. Depending on the respective positions of sealing diaphragm it can be supplied also with a capillary tube.

Pressure transfere is achieved by different types of oil, which are sealed under vacuum into the system.

Process flanges, wetted by the process media are made of

– Stainless steel 316 L

Material of diapghragm is available in

– Stainless steel 316 L
  PTFE foil on Stainless steel
  Hastelloy C
  Tantalum

Process flanges itself are also available for hygineic condictions according to

– DIN 11851
  Clamp
  SMS
  Others

for standard flanges according to

– DIN 2501 raised face type D
  ANSI B 16.5 with raised face

for threaded flanges

– G thread
  NPT thread

An optional LCD indicator with integrated bargraph is very useful for on-site adjustment and display.

If the mounting position makes access to the terminal compartment difficult, or the display cannot be viewed easily, the entire transmitter can be rotated up to 320 degree.

Microprocessor controlled electronics convert the pressure signal into a high precision output signal, and provides comprehensive monitoring functions. The self monitoring feature of the measuring cell ensures exceptional operating safety and reliability for industrial processes.

Electronics and connecting terminals are housed in separate hermetic compartments. This ensures that the electronics are protected from aggressive environments when the terminal compartment is opened.

Span start (zero) and span are adjustable on-site by means of four push buttons. Remote adjustment is possible by using the „HART“ protocol.

A turn-down ratio of 100 : 1 is possible within the range of each measuring cell*).

If an internal fault is detected, the self-monitoring function generates an alarm which drives the output signal into a pre-defined condition (upscale, downscale or no effect)

*) depending from flange and isolating diapgragm

TECHNICAL DATA

INPUT

CERAMICAL CELL UP TO 40 BAR

Gauge pressure

Cell type	Measuring limits [bar]	Smallest span	Max. Overload
0.4 bar	-1/+04	depending	10 bar
2 bar	-1/+2	from	20 bar
10 bar	-1/+10	flange	40 bar
40 bar	-1/+40	dimensions	60 bar

Absolute pressure

Cell type	Measuring limits [bar]	Smallest span	Max. Overload
0.4 bar	0/+04	depending	10 bar
2 bar	0/+2	from	20 bar
10 bar	0/+10	flange	40 bar
40 bar	0/+40	dimensions	60 bar

POLYSILICON CELL FROM 40 BAR UP TO 400 BAR

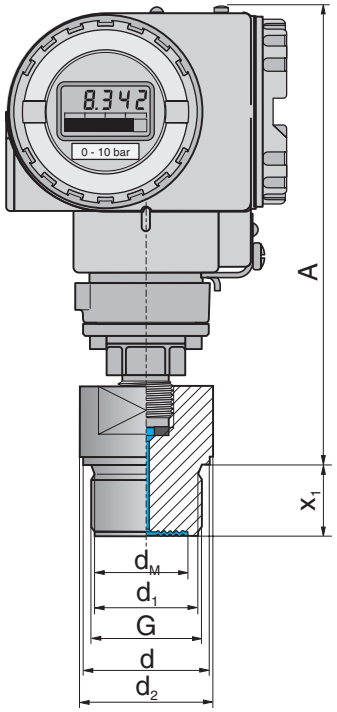
Gauge pressure

Cell type	Measuring limits [bar]	Smallest span	Max. Overload
100 bar	-1/+100	1bar	400 bar
400 bar	-1/+400	4bar	600 bar

Absolute pressure

Cell type	Measuring limits [bar]	Smallest span	Max. Overload
100 bar	0/+100	1 bar	400 bar
400 bar	0/+400	4 bar	600 bar

Fig. 1 Threaded coupling



Filling media

Filling media	Medium temperature at $50\ m_{bar} \leq p_{abs} \leq 1$ bar	Medium temperature at $p_{abs} \geq 1$ bar	Remarks
Silicone oil	- 40 up to + 180 °C	- 10 up to + 200 °C	Standard
High-temperature oil	- 10 up to + 200 °C	- 10 up to + 350 °C	
Halocarbon	- 40 up to + 80 °C	- 40 up to + 175 °C	For Oxygen, inert
Fluorolube	- 40 up to + 80 °C	- 40 up to + 175 °C	For Oxygen, inert
Voltalef	- 40 up to + 80 °C	- 40 up to + 175 °C	For Oxygen, inert
Glycerine	----------	+ 15 up to + 200 °C	Food & beverages
Vegetable oil	- 10 up to + 120 °C	- 10 up to + 200 °C	Food & beverages

FILLING MEDIA FOR SEALING DIAPHRAGM

Selecting the filling liquid for the isolating diaphragm depends from pressure and temperature conditions of the process. Second criteria is the immunity of the filling liquid with the process.
Details see list above.

Minimum pressure 10 mbar absolute

PROCESS MEDIA

Liquids and gases (aggressive or corrosive with suitable material selection)

MATERIALS

Diaphragm

- Stainless steel 316 L
- PTFE foil on stainless steel
- Hastelloy C
- Tantalum

Process coupling

- Stainless steel 316 L

SMALLEST SPAN

Based upon the thermal expansion of the filling liquid, isolating diaphragms cause an additional temperature effect with the measurement.
Following points should be considered for selection:

- The nominal width of the diaphragm seal is determed by the diameter of the diaphragm.
- Large diameter of diaphragm results in smaller temperature effect.
- Small spans require large diameter to minimize temperature effects.
- The larger the diameter of the diaphragm, the larger permissable process temperature range.

TEMPERATURE EFFECTS

Main temperature effect depends mainly from the process temperature adjacent to the sealing diaphragm.

- The temperature coefficient given in the technical specification applies to glycerine calibrated at 20 °C.
- These values are to be doubled for other filling fluids.
- The total temperature coefficient Tk is the result of adding Tk of the transmitter to that of the isolating diaphragm.

Table 1 Threaded coupling with isolating diaphragm

Threaded process coupling							**Isolating diaphragm**				
Thread		∅	∅	∅	Depth	Spanner width	∅ diaphragm	Temp. coeff.	Min. span	Total height	Total weight
	PN	d1	d	d2	x1	SW	dM	Tk		A	
	bar	mm	mm	mm	mm	mm	mm	mbar/10K	bar	mm	kg
G 1 A	400	29	39	SW	21	41	27	20	≥ 10	175	1.6
G 1 ½ A	400	42	54.5	58	30	41	38	6	≥ 0.4	177	2.3
G 2 A	400	56	68	78	30	60	44	3	≥ 0.1	182	3.3
NPT 1in	400			SW	28	41	23	20	≥ 10	180	1.9
NPT 1 ½in	400			52	30	46	32	12	≥ 0.4	178	2.3
NPT 2 in	400			78	30	65	36	6	≥ 0.1	178	3.2

Fig.2 DIN flanged isolating diaphragm

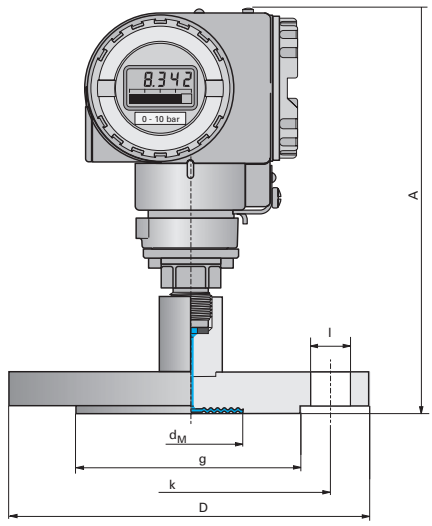


Table 2 DIN flanged isolating diaphragm

DIN flanged process coupling							**Bolt holes**				
Flange		∅	Thick-ness	Raised face ∅	∅ diaphragm	Temp. coeff.	Number	∅	Pitch ∅	Total height	Total weight
DN	PN	D	b	g	dM	Tk		l	k	A	
	bar	mm	mm	mm	mm	mbar/10K		mm	mm	mm	kg
50	10/40	165	20	102	46	3	4	18	125	200	3.72
80	10/40	20	20	138	70	2	8	18	160	204	6.23
25	64/160	140	-	68	28	20	4	18	100	204	2.9
25	250	150	-	68	28	20	4	22	105	204	5.45
25	400	180	-	68	28	20	4	26	130	204	11.4
50	64	180	20	102	46	3	4	22	135	204	6.26
50	100/160	195	20	102	46	3	4	26	145	204	16.9
50	250	200	20	102	46	3	8	26	150	204	12.9

Fig. 3 ANSI flanged isolating diaphragm

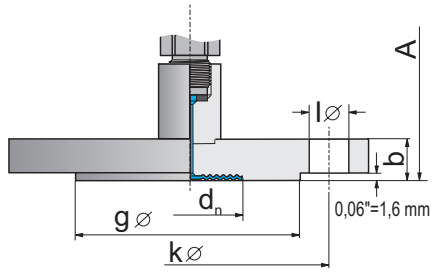


Table 3 ANSI flanged isolating diaphragm

ANSI flanged process coupling							**Bolt holes**				
Pipe		∅	Thick-ness	Raised face ∅	∅ diaphragm	Temp. coeff.	Number	∅	Pitch ∅	Total height	Total weight
DN	PN	D	b	g	dM	Tk		l	k	A	
in	lb/sq.in	in	in	in	in	psi/10°F		in	in	in	pounds
2	150	6	¾	3.62	1.81	0.008	4	¾	4 ¾	7.87	9.2
2	300	6 ½	0.88	3.62	1.81	0.008	8	¾	5	7.87	9.9
3	150	7 ½	0.94	5	-	0.005	4	¾	6	7.87	13.8
3	300	8 ¼	1.12	5	-	0.005	8	0.88	6,62	7.87	17.9
1	400/600	4.88	0.69	2	1.1	0.05	4	¾	3 ½	7.87	6.4
1	900/1500	5.88	1.12	2	1.1	0.05	4	¾	4	7.87	10.8
1	2500	6 ¼	1.38	2	1.1	0.05	4	¾	4 ¼	7.87	13.8
2	400/600	6 ½	1	3.62	1.81	0.008	8	¾	5	7.87	12
2	900/1500	8 ½	1.5	3.62	1.81	0.008	8	1	6 ½	7.87	25.1
2	2500	9 ¼	2	3.62	1.81	0.008	8	1.12	6 ¾	7.87	37.3

Fig. 4 Flange to DIN 11851 (hygienic)

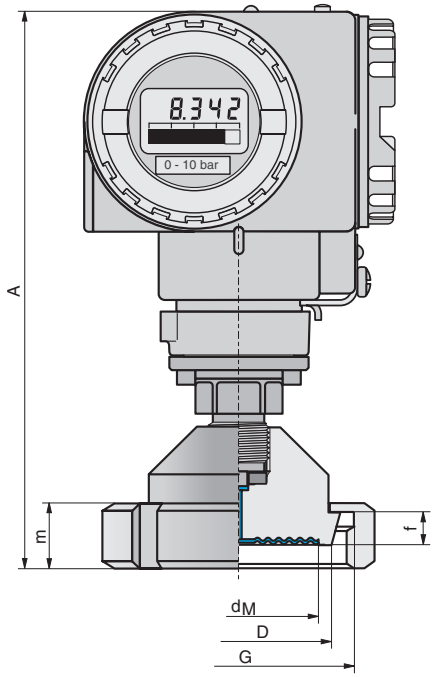


Table 4 Flange to DIN 11851 with isolating diaphragm (hygienic)

DIN 11851 flanged process coupling							**Isolating diaphragm**				
		∅	Cone-height	Thread	Height	Height	∅ diaphragm	Temp. coeff.	Min. span	Total height	Total weight
DN	PN	D	f	G	k	m	dM	Tk	k	A	
	bar	mm	mm	Rd	mm	mm	mm	mbar/10K	bar	mm	kg
25	40	44	10	52 x 1/6	21	21	26	20	≥ 6	175	1.6
32	40	50	10	58 x 1/6	30	21	32	12	≥ 2	177	2.3
40	40	56	11	65 x 1/6	30	21	38	6	≥ 0.4	182	3.3
50	40	68	11	78 x 1/6	28	25	46	3	≥ 0.1	180	3.9

OUTPUT

Standard signal: 4...20 mA

max. output current: 20.5 mA

Ripple: ≤ 0.25 % fsd

Characteristic: pressure proportional

CONFORMITY

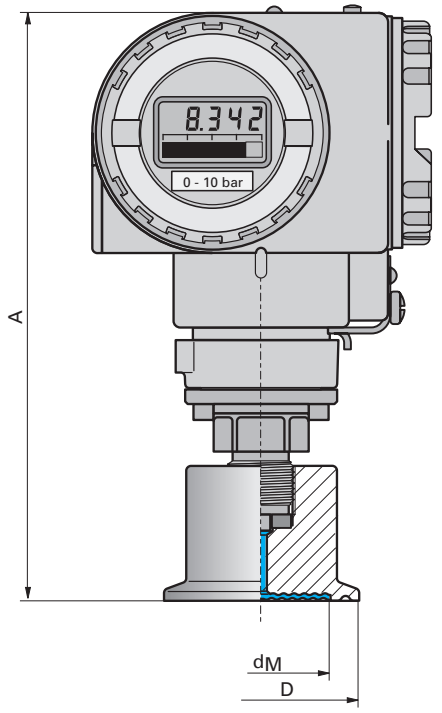
(zero based to DIN 16 084)

≤ 0.1 % of set span up to TD 10:1

For TD 100:1 Conformity error

$$= \pm 0{,}1\,\% \times \frac{0{,}1 \times no\,\min al \circ value}{set \circ span}$$

Fig 5 Hygienic flange, Tri-clamp



Max. load

$$R_{Load} = \frac{U_{Supply} - 11.5[V]}{0.02[V]} - R_{Lead}[\Omega]$$

Load effect: ≤ 0.01 % per 100 Ω

Table 5 Tri-clamp hygienic flange with isolating diaphragm

Tri-clamp flanged process coupling			**Isolating diaphragm**				
		∅	∅ diaphragm	Temp. coeff.	Min. span	Total height	Total weight
DN	PN	D	dM	Tk	k	A	
in	bar	mm	mm	mbar/10K	bar	mm	kg
1 ½	40	50.5	32	12	≥ 0.4	177	1.4
2	40	64	46	3	≥ 0.1	187	1.6

DISPLAY

4 digit LDC display of pressure, and LCD bargraph with 28 segments for output signal.

OPERATION

Local operation is performed by means of four keys protected by a cover plate for adjustment of zero and span and for balancing any offset due to the mounting position. Damping can be set with the rotary switch accessable after removing the lid for the electronic compartment. Remote operation is possible by using the HART protocol facilities.

EXPLOSION PROTECTION

Protection type: EEx ia IIC T4, zone 1

Certificate of conformity

KEMA Nr. Ex 95.C.3881

Installation

Transmitter in zone 1 hazarded area

ENVIRONMENTAL CONDITIONS

Permissible temperatures

For operation: -40... + 85 °C
For storage: -40.... +100 °C

Fig 6 Hygienic flange SMS

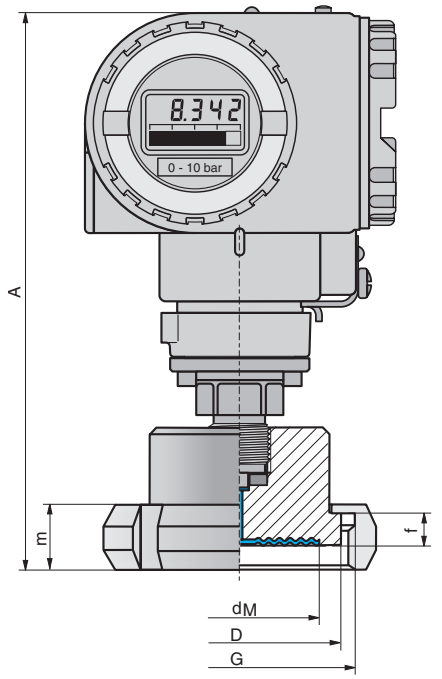


Table 6 Hygienic flange with isolating diaphragm to SMS

SMS flanged process coupling							**Isolating diaphragm**				
		∅	Insert-height	Thread	Height	Height	∅ diaphragm	Temp. coeff.	Min. span	Total height	Total weight
DN	PN	D	f	G	k	m	dM	Tk	k	A	
in	bar	mm	mm	Rd	mm	mm	mm	mbar/10K	bar	mm	kg
1	40	35.5	3.5	40 x 1/6	20	15.5	23	30	≥ 6	204	1.4
1 ½	40	55	4	60 x 1/6	25	21	32	12	≥ 0.4	204	1.8
2	40	65	4	70 x 1/6	260	21	46	3	≥ 0.1	204	2.0

POWER SUPPLY

Supply voltage

11.5 ... 45 VDC
11.5...30 VDC for intrinsic safety

Voltage effect

≤ 0.1 % between 12 and 36 VDC

Ripple

no effect for U_{PP} ≤ 0.5 % at 24 VDC

Temperature effects [1,2)]

Temperature Coefficient Tk in % / 10 K		
Span start	Span	Ambient temperature
±0,02 %	±0,02 %	-10 … + 60 °C
±0,05 %	±0,05 %	-40 . . . -10 °C
±0,05 %	±0,05 %	+60 . . . +85 °C

MAX. PROCESS TEMPERATURE

without temperature isolator: ≤130 °C, limited to heating-up of electronics.

with temperature isolator: ≥ 130 °C
for Ex limited to + 70 °C = T4

DAMPING

Adjustable 0..16 s
(settling time for 63 % of final value)

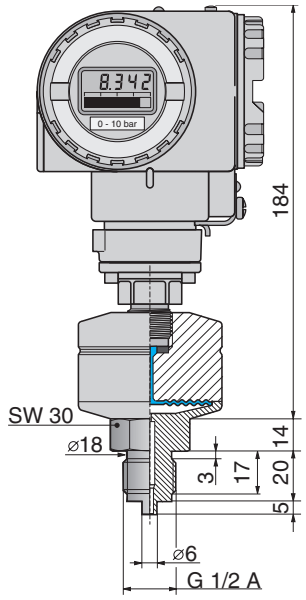
Undamped delay for T_{90}: 150 ms

[1)] referred to nominal span of the cell.
Referred to adjusted span:
-10...+60 °C: ±0,1 %*TD +0,1 %,

Wheras $TD = \frac{definedCellSpan}{adjustedSpan}$

[2)] add Tk for isolating diaphragm

Fig. 6 Thermal isolator



RELATIVE HUMIDITY

100 %, no condensation

CLIMATIC CATEGORY

Class GPC to DIN 40 040

VIBRATION EFFECT

(For electronics only) No effect from mechanical vibrations with 4 mm stroke at 5...15 Hz, or 2g at 15...150 Hz, or 1 g at 150...2000 Hz

ELECTROMAGNETIC COMPATIBILITY

Meets EN 50 082-2 and EN 50 011.
Tests according to IEC 801-1 to 801-6

GENERAL

Electronic housing

Die-cast aluminium AlSi12 with fully chromated surface, epoxy polyester coated

Housing protection type

IP 65 to IEC 529

Electrical connections

Screw terminals for 0.5...2.5 mm² via cable entry gland

Mounting position: not critical

Weight: depending from process coupling, see tables

Accessories: operating instructions 9499-040-43501

ACCESSORY

Mounting set, for version with capillary 9404-290-01201

ORDERING STRUCTURE

See next page!
Please use clear text for the specification. Final order numbers will be given in effect of orders.

Fig.7 connections

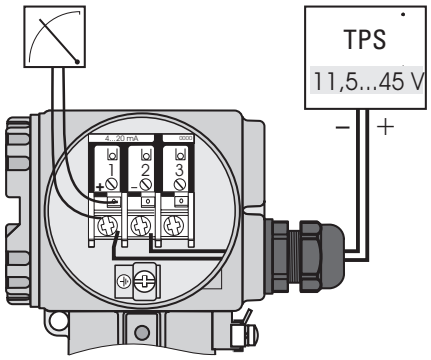
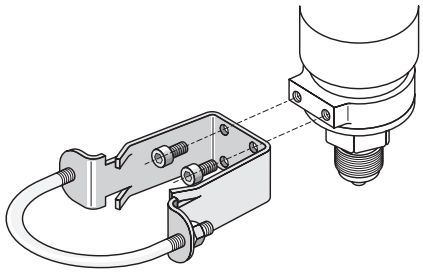


Fig.8 Mounting bracket



ORDERING STRUCTURE

9404	219	·	·	·	·	1

Version with HART protocol

no display, non EEx	4
EEx ia IIC T4/T6	5
with LCD display, non EEx	6
with LCD display, EEx ia IIC T4/T6	7

Missing codes wil be given in effect of orders, please select and use clear text

Sensor, ceramic, gauge pressure
400 mbar, 2 bar, 10 bar, 40 bar .....
Sensor, Silicon, gauge pressure
100 bar, 400 bar

Sensor, ceramic, absolute pressure
400 mbar, 2 bar, 10 bar, 40 bar .....
Sensor, Silicon, absolute pressure
100 bar, 400 bar

Calibration / unit . .....
Calibrated from 0...nominal value of cell
in mbar/bar, linear
in kPa/Mpa, linear
in mm H_2O, linear
in inch H_2O, linear
in kgf/cm^2, linear
in psi, linear
Span start, span, technical units in clear text

Filling liquid / temperature isolator . .....
Silicon oil, none
Vegetable oil, none
Glycerine, none
High temperature oil, 100 mm isolator
High temperature oil, 1 m capillary
Silicone oil, 1 m capillary
Inert oil, for oxygene duty

Diaphragm material . ....
SS 1.4435 (SS 316 L) or 1.4571 (SS 316 Ti)
Hastelloy C 276
Tantalum
PTFE laminate on 1.4435

Process flanges to .....
DIN 2501, ANSI B 16.5
Thread G / NPT
Hygienic DIN, clamp, SMS

Material flanges
DIN / ANSI flange, hygienic flange:
Stainless steel *1.4435 (SS 316 L)*

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Printed in Germany - Edition 0302 - Subject to change without notice - 9498 737 34913