Technical
Information
TI322P/00/en

Pressure Transmitter
cerabar M PMP 46
cerabar M PMP 48

Overload resistant pressure transmitter with diaphragm seal and analogue, Smart or PROFIBUS-PA electronics

PMP 48
Flange

PMP 46
Clamp

Applications

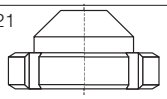
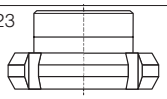
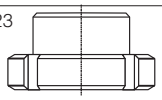
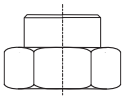
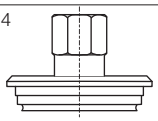
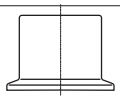
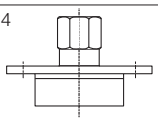
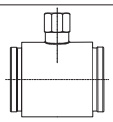
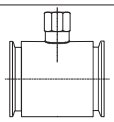
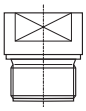
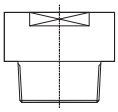
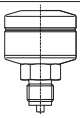
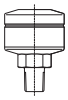
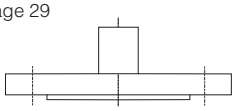
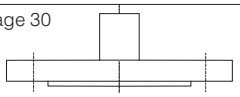
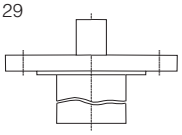
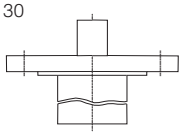
The Cerabar M transmitter measures the gauge and absolute pressure of gases, vapours and liquids and can be used in all areas of industry.
Installation and process conditions often make the use of diaphragm seals necessary. Endress+Hauser offers you the following:

- PMP 46: diaphragm seals for hygienic applications
- PMP 48: diaphragm seals with threaded boss, separator, flange or flange with extension

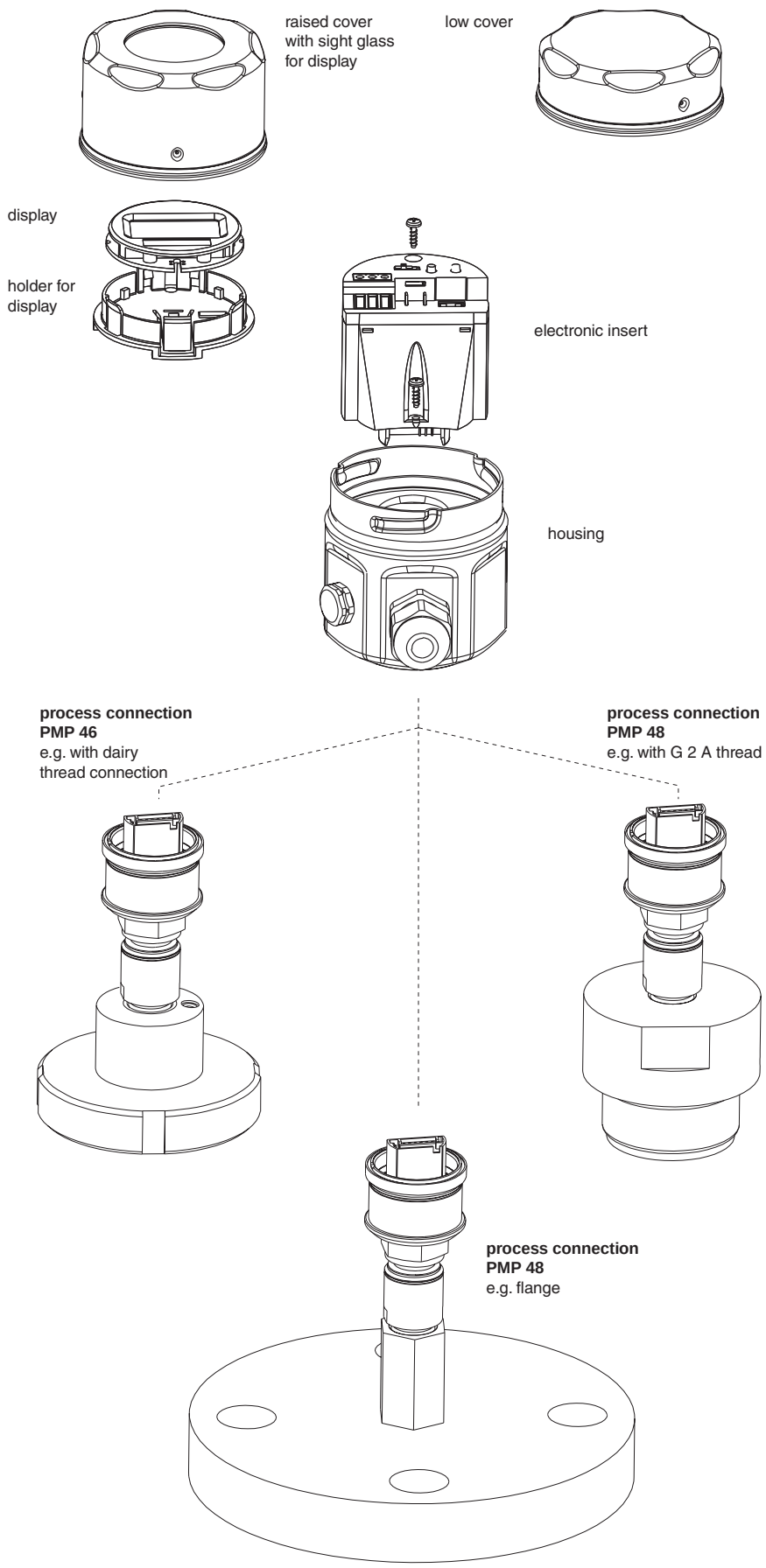
Features and Benefits

- Accuracy
  – Linearity better than 0.2% of set span
  – Adjustable measuring range with TD 10:1
  – Long-term stability better than 0.1%
- Piezoresistive metal sensor with metal diaphragm for measuring ranges up to 400 bar (6000 psi).
- Electronics
  – Analogue: cost effective version with short response time especially for fast processes
  – Smart: intelligent with versatile operating procedures via HART protocol
  – PROFIBUS-PA: tried and tested for digital communications
- Housing
  With its stainless steel housing and no dead volume, the Cerabar M fulfils all the special hygienic requirements of the food and pharmaceutical industries. The polyester-epoxy coated aluminium housing has proven itself well in the process industry.
- Process connections
  All customary thread versions, hygienic connections and flanges available.

Endress+Hauser
The Power of Know How

Construction	Diaphragm seal	Connection	Page/Version	Standard	Nominal width	Pressure range	Instrument type
Hygienic applications	Diaphragm seal	Groove nut	Page 21 	DIN 11851	DN 32, DN 40, DN 50	max. 40 bar (600 psi)	PMP 46
			Page 23 	SMS	1½", 2"		
			Page 23 	RJT	1½", 2"		
			Page 23 	ISS	1½", 2"		
		Clamping bracket	Page 24 	Varivent	Type N		
			Page 22 	Clamp	1½", 2", 3"		
		Flange	Page 24 	DRD	D = 65 mm		
	Pipe diaphragm seal	Thread adapter	Page 21 	DIN 11851	DN 25, DN 40, DN 50		
		Clamping bracket	Page 22 	Clamp	¾", 1", 1½", 2"		
Threaded boss	Diaphragm seal	G	Page 27 	DIN ISO 228/1	G 1 G 1½ G 2	max. 400 bar (6000 psi)	PMP 48
		NPT	Page 27 	ANSI B1.20.1	1 NPT 1½ NPT 2 NPT		
Threaded boss with separator	Diaphragm seal	G	Page 28 	EN 837	G ½	max. 160 bar (2300 psi)	
		NPT	Page 28 	ANSI B1.20.1	½ NPT		
Flange	Diaphragm seal	DIN flange	Page 29 	DIN 2501	DN 25 DN 50 DN 80	max. 400 bar (6000 psi)	
		ANSI flange	Page 30 	ANSI B.16.5	1", 2", 3", 4"		
Flange with extension	Diaphragm seal	DIN flange	Page 29 	DIN 2501	DN 50 DN 80		
		ANSI flange	Page 30 	ANSI B.16.5	2", 3", 4"		

Instrument Configuration of Cerabar M with Stainless Steel Housing



Housings

The stainless steel housing of Cerabar M is especially remarkable due to its chemical resistance and hygienic properties. Having no dead volume and being condensation-tight with a surface roughness of Ra ≤ 0,8 µm, it is easy to clean and thereby ideal for the food and pharmaceutical industry.
The aluminium housing has proven its ruggedness and has become a standard in many industries such as chemicals, papermaking, power generation, water and wastewater treatment.

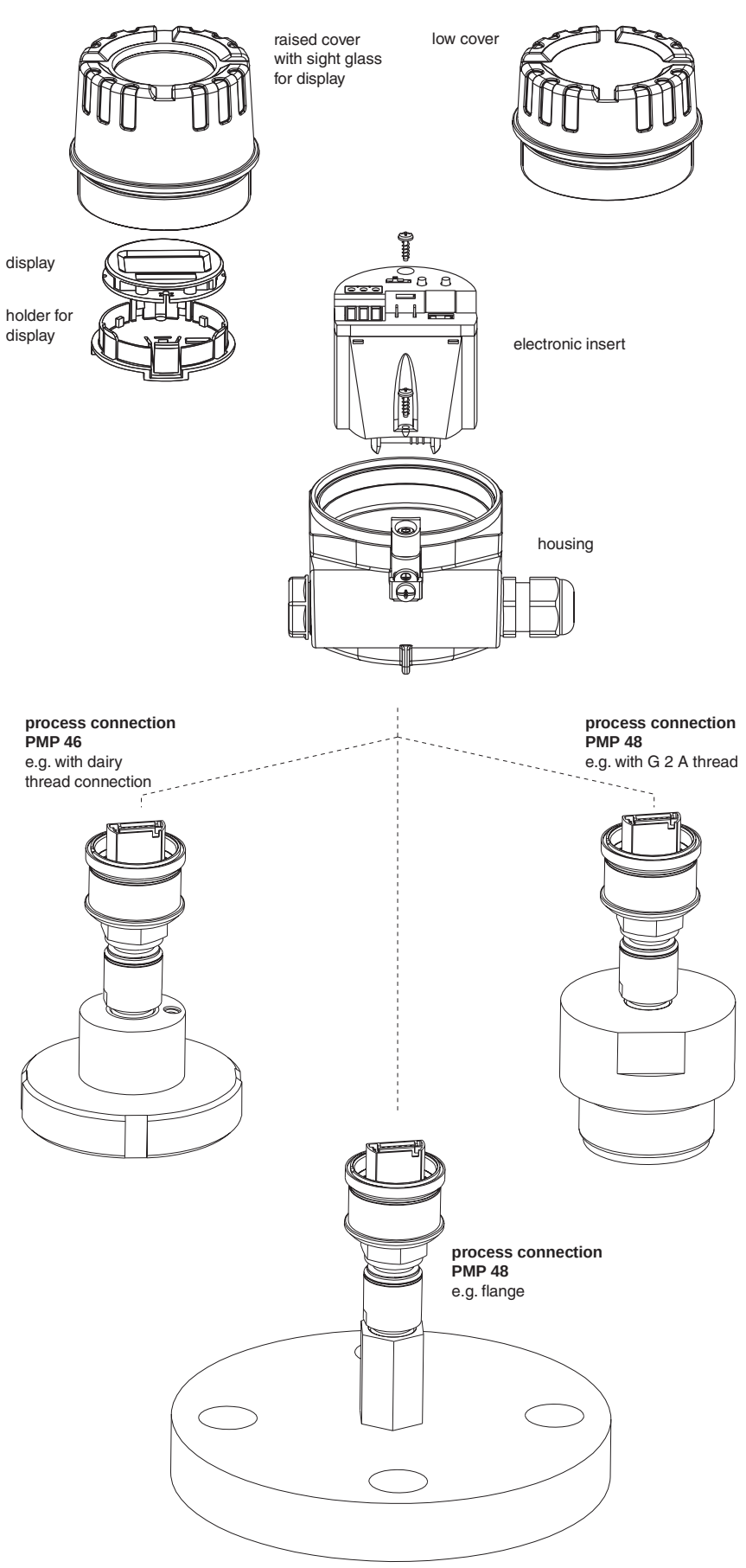
- Ingress protection
  – IP 65 with Harting plug (Han7D),
  – IP 66/Nema 4X as standard or
  – IP 68/Nema 6P with 5 m (16.4 ft) assembled cable with pressure compensation or plug M 12x1. This version is recommended for very moist applications (e.g. wet vessel walls or pipes).
- Optional connection with
  – cable gland M 20x1.5 or
  – cable entry ½ NPT or G ½,
  – Harting plug (Han7D) or plug M 12x1 or
  – with assembled cable
- A raised cover with sight glass is provided when using a display. A low cover is available for versions without a local display.

Electronic Inserts

Cerabar M has three electronics versions

- Analogue: 4…20 mA
  Operation directly at the measuring point with one potentiometer each for lower range-value and upper range-value and a three-step range switch as well as an on/off switch for damping.
- Smart: 4…20 mA with HART protocol
  Operation:
  – at the measuring point via two push buttons for lower range-value and upper range-value as well as an on/off switch for damping, or
  – via the Universal HART Communicator DXR 275 handheld terminal at any point along the 4…20 mA line, or
  – via PC e.g. with the Endress+Hauser Commuwin II operating program.
- PROFIBUS-PA:
  Operation:
  – Using a PC with an operating program, e.g. Commuwin II from Endress+Hauser, or
  – using two keys for lower range-value and upper range-value.

Instrument Configuration of Cerabar M with Aluminium Housing



Displays

A display module can be used for showing measured values and for simplifying local operation. The display is plugged onto the electronic insert using a holder.

- Analogue display for Cerabar M with analogue electronics: The analogue display gives the current pressure value related to the measuring range in the form of a bar graph.
- Digital display for Cerabar M with Smart electronics: The digital display gives the pressure in the form of a four-digit number. The appropriate current value from 4…20 mA is shown as a bar graph underneath.
- Digital display for Cerabar M with PROFIBUS-PA electronics:
  The digital display gives the pressure in the form of a four-digit number. The bar graph depicts the current pressure value related to the measuring range.

Process Connections

- Process connections are available with all common threads, flush-mounted hygienic connections and flanges (see summary, page 2).
- Chemical resistance can be guaranteed by selecting suitable materials for the process connection. This applies especially to the metal separating diaphragm of the diaphragm seal in contact with the medium.
- The diaphragm is welded to every diaphragm seal with no dead volume.

Measuring System

System Components

The complete measuring system consists of:

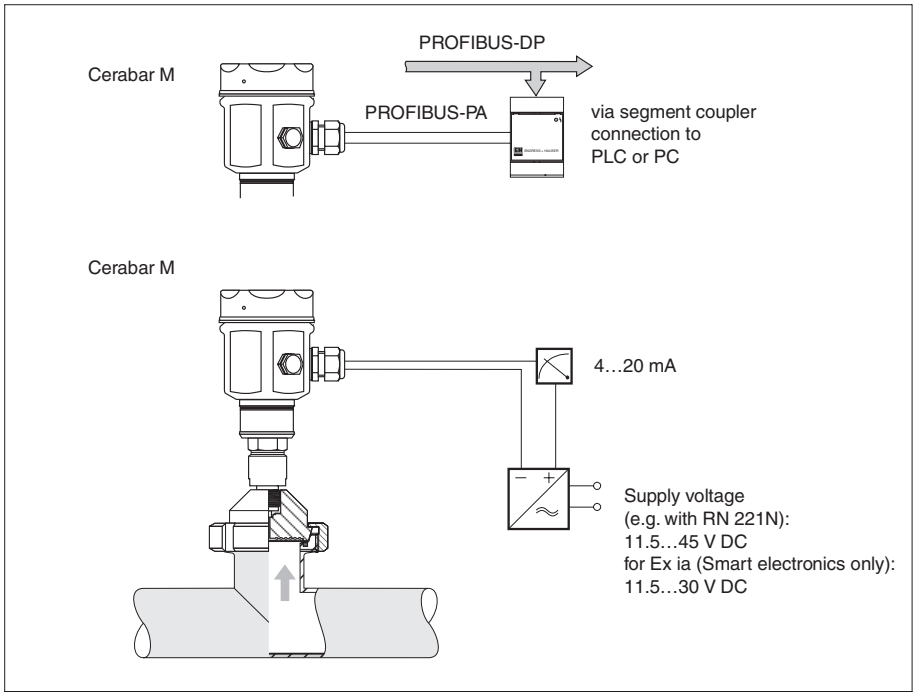
- Cerabar M pressure transmitter with
  - analogue output 4…20 mA and
  - supply voltage, e.g. with the RN 221N transmitter power supply unit from Endress+Hauser
    Supply voltage: 11.5…45 V DC

or

- Cerabar M pressure transmitter with
  - 4…20 mA signal output and HART communication signal and
  - supply voltage, e.g. RN 221N transmitter power supply unit from Endress+Hauser
    Supply voltage: 11.5…45 V DC
    or Ex ia: 11.5…30 V DC

or

- Cerabar M pressure transmitter with
  - PROFIBUS-PA digital communication signal and
  - connection via segment coupler to a PLC or PC using e.g. the Endress+Hauser Commuwin II operating program
    Supply voltage: 9…32 V DC
    or Ex ia: 9…24 V DC



Complete measuring system Cerabar M
above:
with PROFIBUS-PA electronics
below:
with Smart electronics or with analogue electronics

Operating Principle

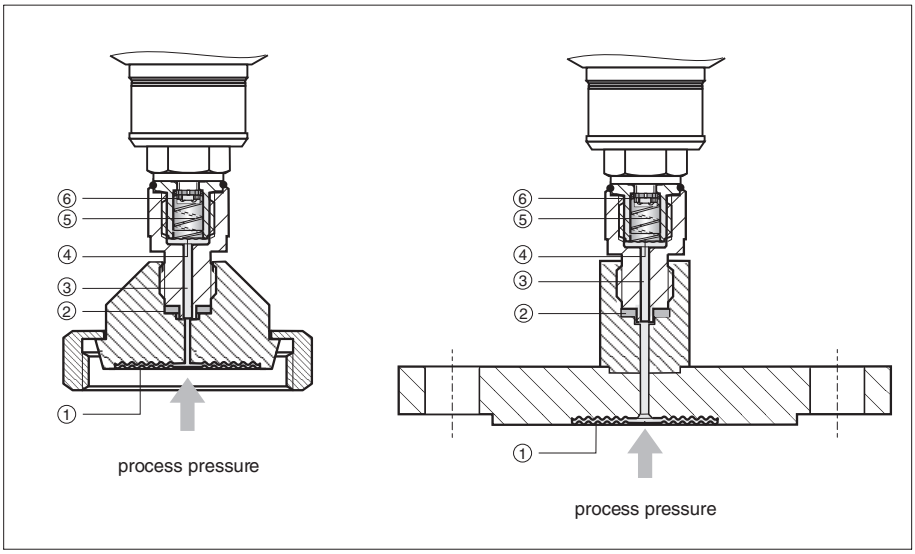
Piezoresistive Sensor with Diaphragm Seal

The process pressure acting on the diaphragm of the diaphragm seal is transmitted to the metallic separating diaphragm of the sensor by the filling fluid of the diaphragm seal. The separating diaphragm is deflected and the fluid transmits the pressure to a resistance bridge. The bridge output voltage, which is proportional to pressure, is then measured and evaluated.

Advantages:

- For process pressures up to 400 bar (6000 psi)
- Excellent long-term stability
- Guaranteed resistance to overload up to 4-times nominal pressure (max. 600 bar/9000 psi)

① Diaphragm of diaphragm seal
② Copper ring
③ Diaphragm seal filling fluid
④ Metallic separation diaphragm
⑤ Channel with filling fluid
⑥ Polysilicone measuring element



Operation

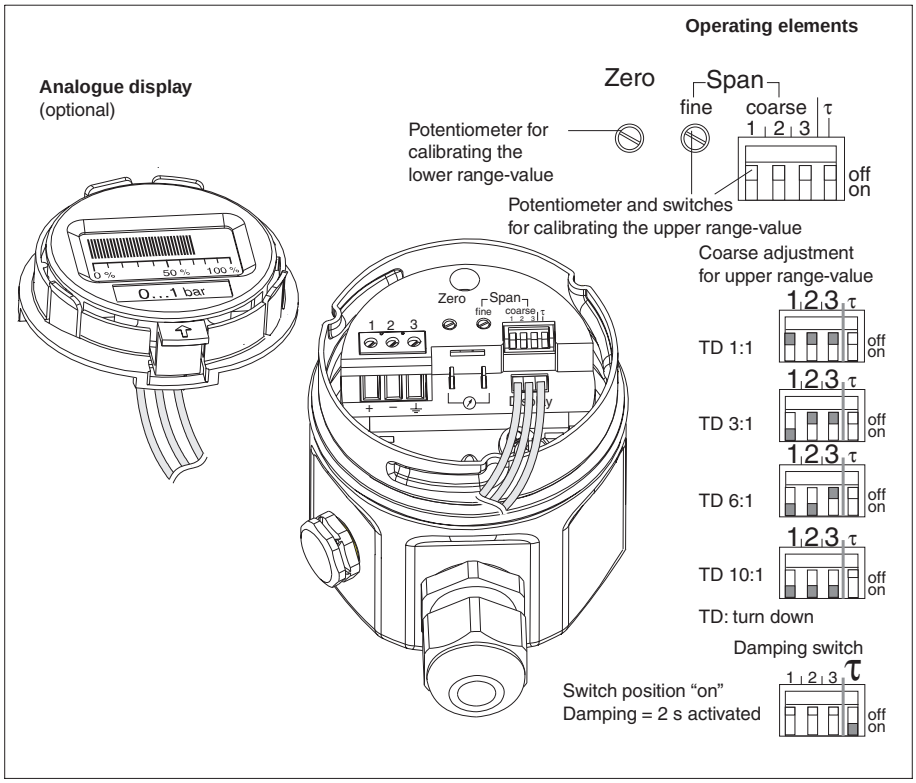
Three electronics versions are available for operating the Cerabar M.

- The analogue electronics is the simplest and most cost-effective method to operate the Cerabar M.
- Smart electronics opens up a wide range of operating and calibration routines. It can then be operated either by means of a handheld terminal or an operating program (e.g. Endress+Hauser Commuwin II).
- The PROFIBUS-PA electronics provide direct connection to the PROFIBUS-PA field bus. The PROFIBUS-PA can be easily set up and many values are retrievable from the control room.

Analogue Electronics

For the Cerabar M with analogue electronics lower range-value (Zero) and upper range-value (Span) are directly calibrated at the measuring point via two potentiometers. The required lower and upper range-values must be applied as reference pressure.

- For coarse calibration of the measuring span, a spread between TD 1:1 and TD 10:1 can be selected using DIP switches.
- A 2 s damping of the measured value can be activated using a DIP switch.
- The analogue display shows the pressure on a bar graph as a ratio to the measuring range.
- Over- or under-run of the signal can be indicated by a flashing of the bar graph.



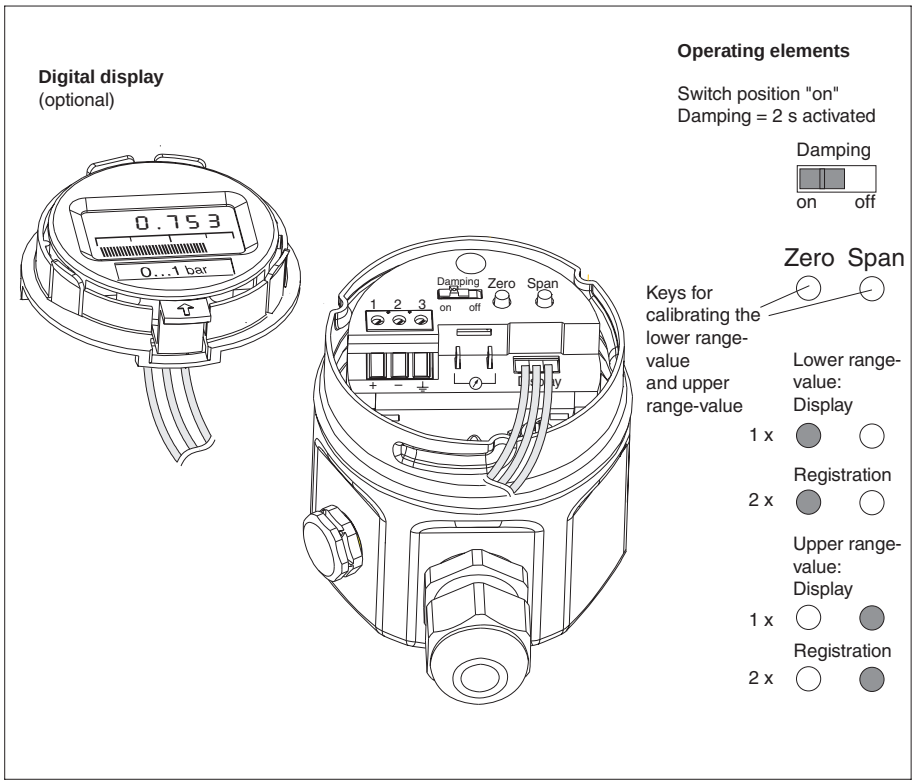
Smart Electronics

A Cerabar M with Smart electronics can be calibrated with or without reference pressure.

– When calibrating with reference pressure, the pressure for lower range-value and upper range-value must be entered and confirmed by pressing the Zero or Span key twice. Press these keys once to display saved values for lower range-value and upper range-value.

– If you calibrate without reference pressure, enter the measuring points using a handheld terminal or using an operating program.

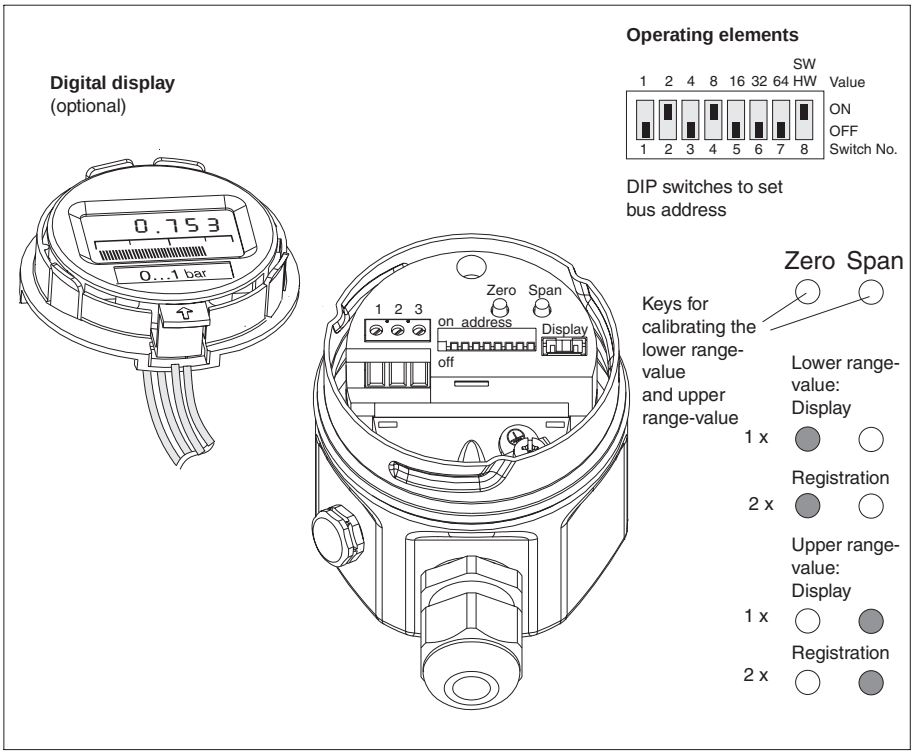
- A damping of 2 s can be set directly on the instrument. A damping value of 0...40 s can be selected using communication.
- The digital display shows the pressure as a four-character number. The appropriate 4…20 mA current is shown as a bar graph underneath.
- Error codes on the digital display and in Commuwin II simplify error diagnosis.



PROFIBUS-PA Electronics

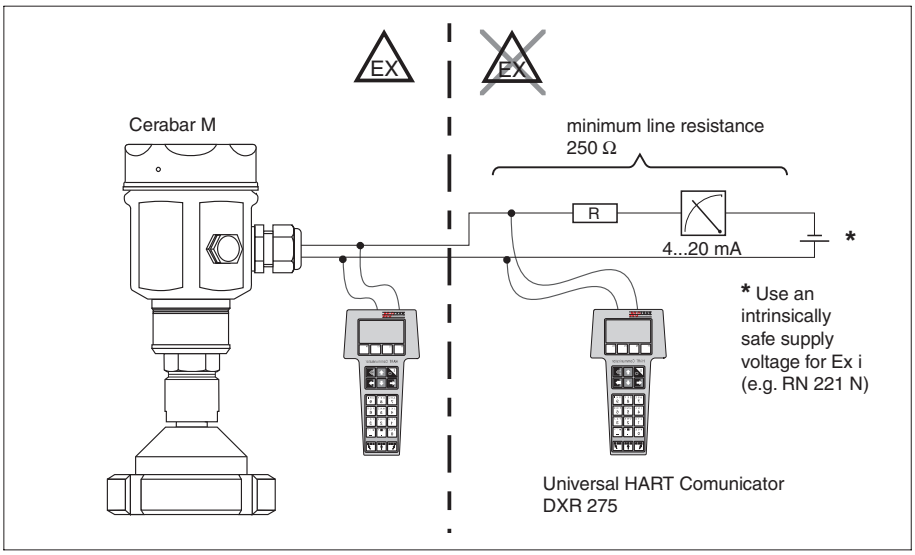
A Cerabar M with PROFIBUS-PA electronics has the following operating options.

- You can set a damping of between 0 and 40 s using communication.
- You can set instrument bus address direct in the instrument using the address switch.
- The digital display gives the pressure as a four-digit number. The bar graph depicts the current pressure value related to the measuring range. The measuring range can be set either on site using the Zero and Span keys or remotely using an operating program, such as Commuwin II.
- Error codes on the digital display and in Commuwin II simplify error diagnosis.



Smart Electronics Operation Using a Handheld Terminal

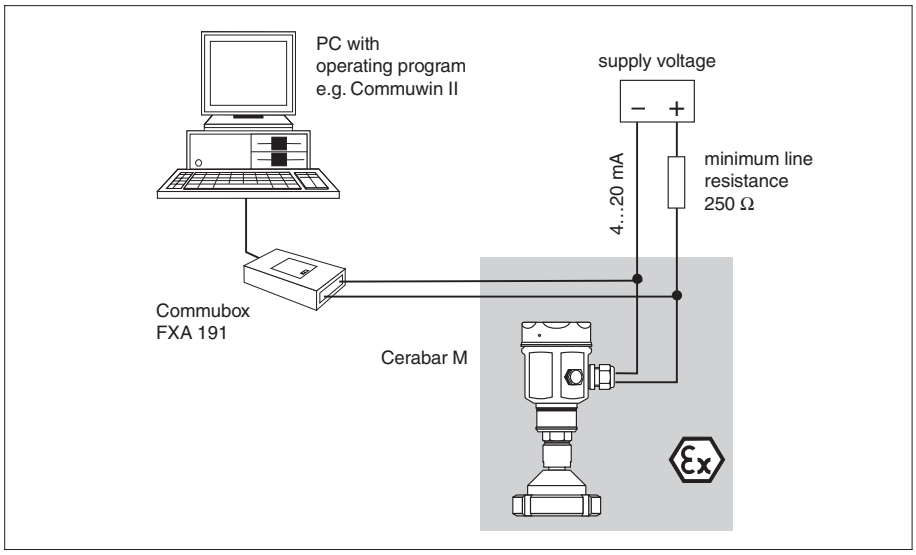
Using the Universal HART Communicator DXR 275 handheld terminal, you can set the Cerabar M, make checks and use additional functions such as "Damping" and "Calibration without reference pressure" all along the 4...20 mA line.



Cerabar M operation with Smart electronics using a handheld terminal

Smart Electronics Operation Using PC

The Commubox FXA 191 connects 4…20 mA Smart transmitters that have a HART protocol to the RS 232 C serial interface of a personal computer. This enables the transmitter to be remotely operated with the Endress+Hauser Commuwin II operating program. You can connect the Commubox FXA 191 at any point along the 4…20 mA line. It is also suited for connection to intrinsically-safe signal circuits.



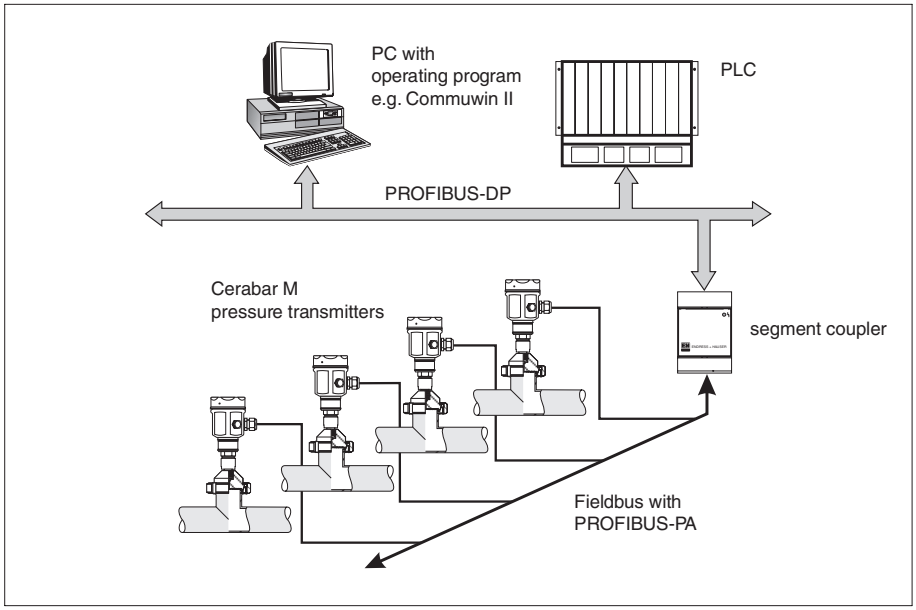
Cerabar M
operation with Smart
electronics using PC

Connecting to PROFIBUS-PA

PROFIBUS-PA is an open fieldbus standard to enable serveral sensors and actuators, including those in explosion-hazardous areas, to be connected to bus line. With PROFIBUS-PA, two-wire looped instruments can be supplied by the sensor with power and digital process information.

The number of instruments operated by one bus segment is:

- up to 10 for Ex ia applications
- up to 32 for all further applications (e.g. non-Ex, EEx nA)



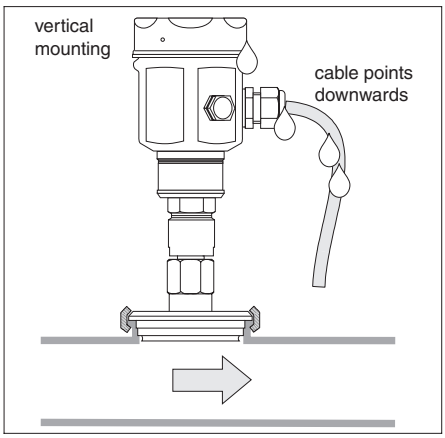
Cerabar M
operation with
PROFIBUS-PA
electronics

Installation

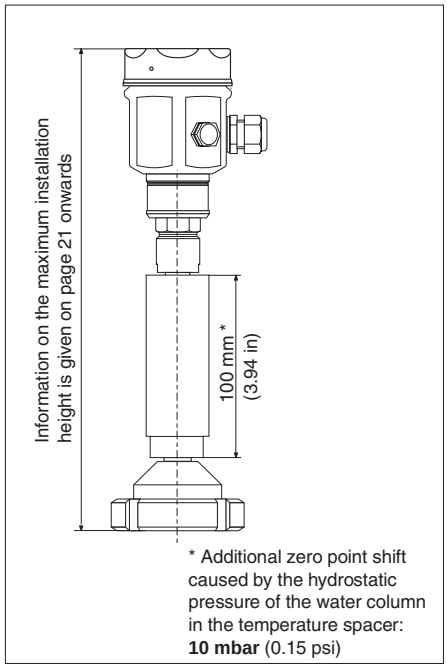
Mounting Instructions
- The protective cap of the diaphragm seal should only be removed just before mounting.
- The diaphragm seal and the pressure sensor together form a closed, oil-filled, calibrated system. The following rules should be observed:
  – The filling hole is sealed and not to be opened.
  – When mounting the Cerabar M, it should only be turned by the nut of the diaphragm seal and not by the hex nut of the Cerabar M.

Cleaning
The diaphragm of the diaphragm seal must not be pressed in or cleaned with pointed or hard objects.

Mounting
To prevent moisture from entering, the cable entry should preferably hang downwards or to the side.



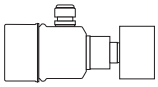
Mounting with Temperature Spacer
Endress+Hauser recommends the use of a temperature spacer when extreme media temperatures (from approx. 150°C/302°F) continually cause the ambient temperature to exceed the permissible limit of +85°C (+185°F).



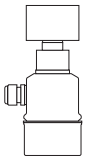
Cerabar M with temperature spacer

Shifting of the Zero Point due to Position
The Cerabar M is calibrated based on the limit point method according to DIN 16086.
Depending on the orientation of the instrument, there may be a slight shift in the measured value. Diaphragm seals also shift the zero point depending on the orientation of the instrument.

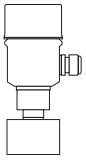
- neutral calibration position



- max. positive zero point shift



- max. negative zero point shift



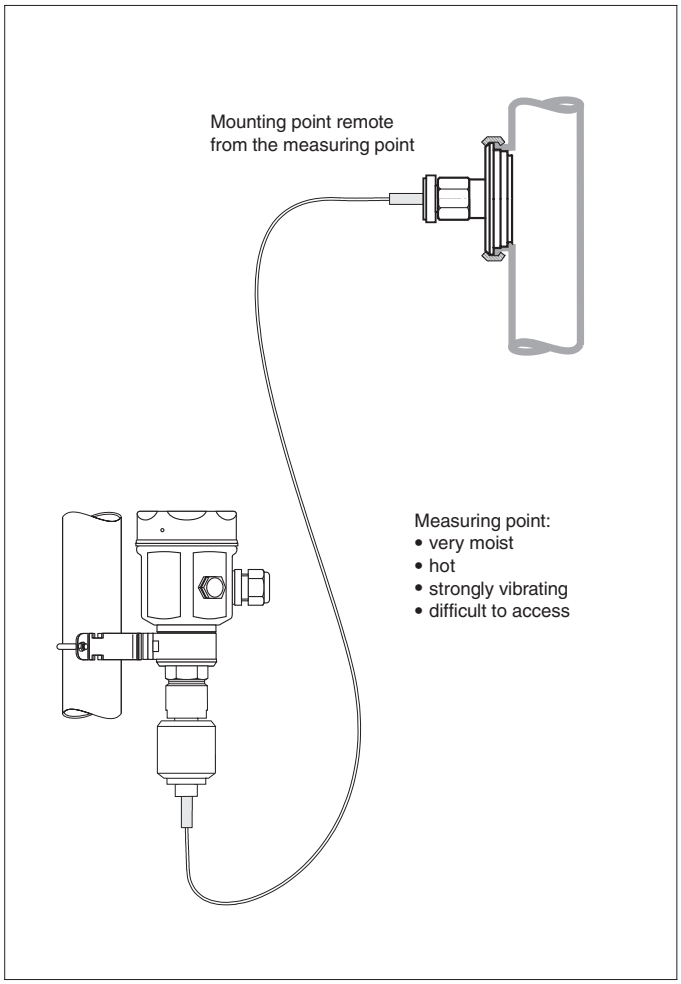
This zero point shift due to position can be corrected (refer to zero point increase and decrease, page 16).

The max. effect of position for all diaphragm seals is given in the tables on page 21 onwards. These values are for silicone oil. For other oils available, the shift in zero point due to position varies according to the density of the oil (see page 12).

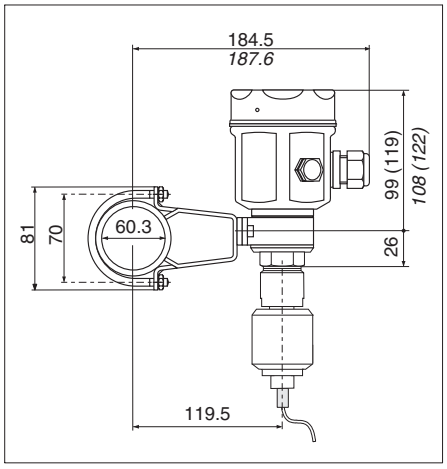
Installation (Continuation)

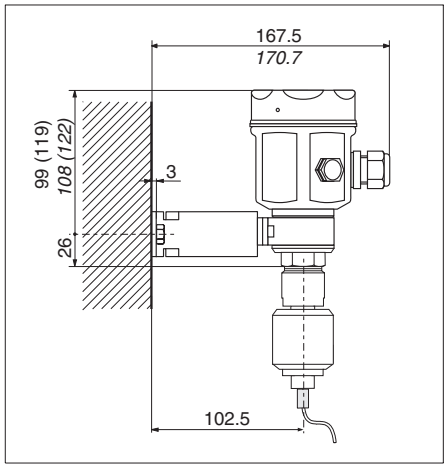
Mounting with Capillary Tubing
To protect from high temperatures (max. 350°C/+662°F media temperature), moisture, vibration, or where the mounting point is not easily accessible, the housing of the Cerabar M can be mounted with a capillary tubing away from the measuring point.
A bracket for mounting on a wall and pipe is available for this:
- Material: 1.4301 (AISI 304)
- Order No.: 52001402

(It can also be selected as an accessory in the Product Structure.)



Dimensions
- 1 mm = 0.039 in
  1 in = 25.4 mm





Values in brackets apply to instruments with raised cover.
Values in italics apply to instruments with an aluminium housing.
All dimensions are in mm.

Design Planning for the Diaphragm Seal

Diaphragm Seal Filling Fluid

The temperature and pressure of the process are of critical importance when selecting the filling fluid for the diaphragm seal.

①, ②

The suitability of the fluid to meet the requirements of the medium must also be considered. For foodstuffs applications, only physiologically safe fluids such as vegetable oil or silicone oil (AK 100) may be used in the diaphragm seal.

⑤

Guidelines for Mounting Capillary Tubes

The transmitter should generally be mounted below the tapping point. A maximum height difference between the tapping point and transmitter should not be exceeded. This will otherwise result in a break in the column of fluid in the capillary and damage the diaphragm seal.

③

- Minimum bending radius of capillary tubing: 100 mm (3.94 in).
- In the case of applications in vacuum, the instrument should be mounted below the pressure tapping point.

Smallest Recommended Measuring Span and Diaphragm Diameter

The effects of temperature cause the diaphragm seal to expand. This in turn gives rise to an additional temperature effect on the zero point. When selecting the diaphragm seal the following points are to be observed:

- The nominal diameter of the diaphragm seal determines the width of the diaphragm.
- Temperature effects vary inversely with the width of the diaphragm diameter.

The largest possible width of diaphragm should be chosen for small measuring spans and/or capillaries so that temperature effects remain within the nominal range of the application.

Temperature Effects

The temperature coefficients of the diaphragm seals as stated in the technical data and dimensions (page 21 onwards) apply to silicone oil (calibrating temperature +20°C/+68°F) and are determined by the process and ambient temperatures.

For other fluids, the T_K value is to be multiplied by the T_K correction factor.

④

For instruments with capillary tubing, the total temperature coefficient T_K can be calculated by adding the T_K of the Cerabar M to that of the diaphragm seal, together with the T_K of the capillary tubing.

The T_K of the capillary tubing is determined by the ambient temperature:

T_K per meter for silicone oil:
0.5 mbar/10 K.

		①	②	③			④	⑤
Filling fluid of diaphragm seal	**Code**	**Permissible temperature of medium at 0.05 bar ≤ p_{abs} ≤ 1 bar (0.73 psi ≤ p_{abs} ≤ 14.5 psi)**	**Permissible temperature of medium at p_{abs} ≥ 1 bar (p_{abs} ≥ 14.5 psi)**	**Maximum height difference at p_{abs} ≥ 1 bar (p_{abs} ≥ 14.5 psi)**	**Minimum permissible pressure at +20°C (+68°F)**	**Density [g/cm³]**	**T_K - Correction factor**	**Remarks**
Silicone oil (AK 100)	A, J	–40…+180°C (–40…+356°F)	–40… +250°C (–40…+482°F)	max. 7 m (max. 23 ft)	10 $mbar_{abs}$ (0.15 psi)	0,96	1	standard, foodstuffs applications
High-temperature oil (paraffin)	G, H, K	–10…+200°C (+14…+392°F)	–10… +350°C (+14…+662°F)	max. 7 m (max. 23 ft)	10 $mbar_{abs}$ (0.15 psi)	0.81	0.72	
Fluorolube FS-5 [1]	N	–40…+80°C (–40…+176°F)	–40…+175°C (–40…+347°F)	max. 7 m (max. 23 ft)	10 $mbar_{abs}$ (0.15 psi)	1.87	0.91	inert oil e.g. for oxygen or chlorine
Glycerine	E	—	+15…+200°C (+59…+392°F)	max. 4 m (max. 13.1 ft)	10 $mbar_{abs}$ (0.15 psi)	1.26	0.64	foodstuffs applications
Vegetable oil (Neobee M20)	D, F	–10…+120°C (+14…+392°F)	–10…+200°C (+14…+392°F)	max. 7 m (max. 23 ft)	10 $mbar_{abs}$ (0.15 psi)	0.94	1.05	FDA No.: 21CFR172.856

1) Observe operating limits for oxygen service for non-metallic materials.

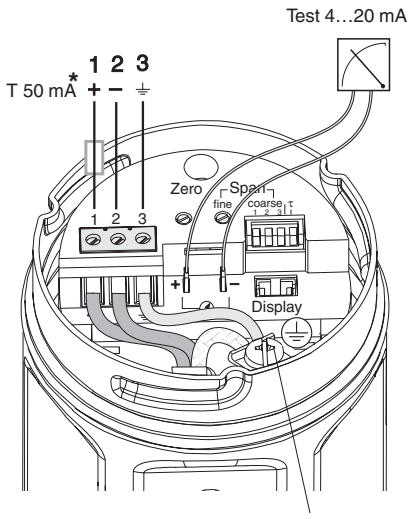
Electrical Connection

Wiring Analogue and Smart Electronics

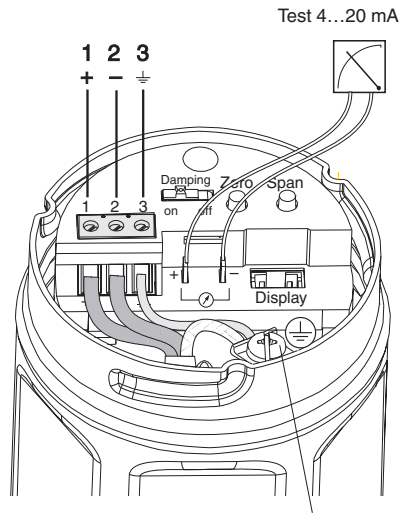
The two-wire cable is connected to screw terminals on the electronic insert.

- Supply voltage: 11.5…45 V DC; additional for Smart electronics Ex ia: 11.5…30 V DC
- Cable:
  - Analogue: two-wire instrumentation cable
  - Smart: screened, twisted-pairs
  - max. wire cross-section: 2.5 mm^2 (solid conductor)
- Internal protection circuits against reverse polarity, HF interference and overvoltage peaks.
- Test signal: The output current can be measured using the terminal plugs for this purpose on the electronic insert without interrupting the process measurement.
- Always connect the screening or ground cable (if present) to the internal ground terminal of the housing, not to terminal 3.

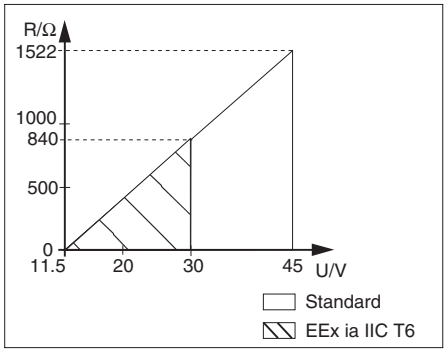
Electrical connection analogue electronics



Electrical connection Smart electronics



***** For analogue electronics versions with certificate ATEX II 1/3 D (non Ex supply voltage) the instrument must always be protected by a 50 mA (slow-blow) fuse.



Load diagram for analogue and Smart electronics

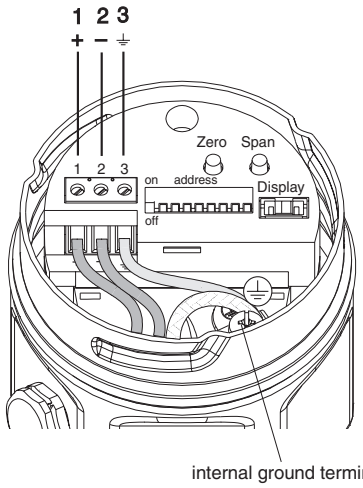
Wiring PROFIBUS-PA

The digital communication signal is transmitted to the bus using a two-wire connecting cable. The bus cable also carries the supply voltage.

- Supply voltage: 9…32 V DC
  Ex ia: 9…24 V DC
- Bus cable:
  Use a twisted, screened two-wire cable. The following specifications must be observed when using the FISCO model (explosion protection):
  – Loop resistance (DC):
  15…150 Ω/km
  – Inductance: 0.4…1 mH/km
  – Capacitance: 80…200 nF/km
- Always connect the screening or ground cable (if present) to the internal ground terminal of the housing, not to terminal 3.

Infomation on the structure and grounding of the network are given in Operating Instructions BA 198F »PROFIBUS-PA: Guidelines for planning and comissioning« and the PROFIBUS-PA specification EN 50170 (DIN 19245).

Electrical connection PROFIBUS-PA electronics



Connection: M12 Plug (PROFIBUS-PA)

Endress+Hauser also provides a Cerabar M with a M12 plug. This version can be easily connected to the PROFIBUS network using a preterminated cable.

Versions:

- PM ❑ 4❑ – ❑ L1 ❑❑ ❑ P ❑ ❑❑ ❑ (❑)
- PM ❑ 4❑ – ❑ L1 ❑❑ ❑ R ❑ ❑❑ ❑ (❑)
- PM ❑ 4❑ – ❑ L2 ❑❑ ❑ P ❑ ❑❑ ❑ (❑)
- PM ❑ 4❑ – ❑ L2 ❑❑ ❑ R ❑ ❑❑ ❑ (❑)

Connection M12 Plug

For hygienic applications or humid operating areas, Endress+Hauser also offers a Cerabar M with a M12 plug with IP 68 ingress protection. A socket for user-specific connection to this housing connector is available from Endress+Hauser, order no. 52006263.

Versions:

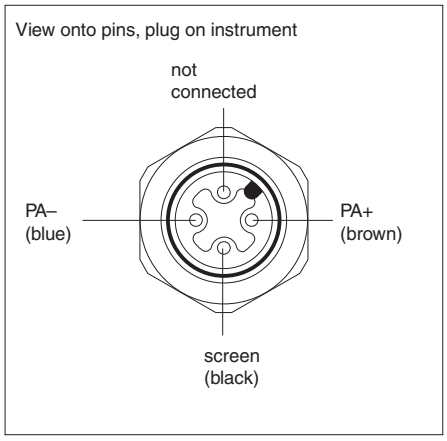
- PMP 4❑ – ❑ L1 ❑❑ ❑ H ❑ ❑❑ ❑ (❑)
- PMP 4❑ – ❑ L1 ❑❑ ❑ J ❑ ❑❑ ❑ (❑)
- PMP 4❑ – ❑ L2 ❑❑ ❑ H ❑ ❑❑ ❑ (❑)
- PMP 4❑ – ❑ L2 ❑❑ ❑ J ❑ ❑❑ ❑ (❑)
- PMP 4❑ – ❑ L1 ❑❑ ❑ A ❑ ❑❑ ❑ (❑)
- PMP 4❑ – ❑ L1 ❑❑ ❑ C ❑ ❑❑ ❑ (❑)
- PMP 4❑ – ❑ L2 ❑❑ ❑ A ❑ ❑❑ ❑ (❑)
- PMP 4❑ – ❑ L2 ❑❑ ❑ C ❑ ❑❑ ❑ (❑)

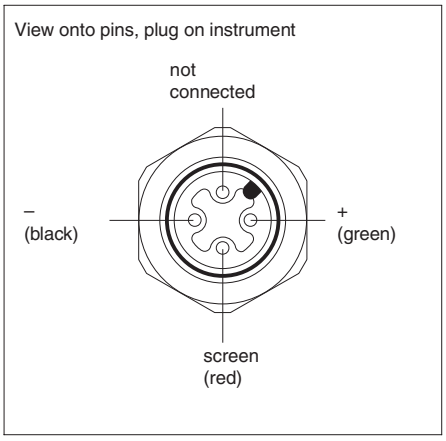
Connection Harting Plug

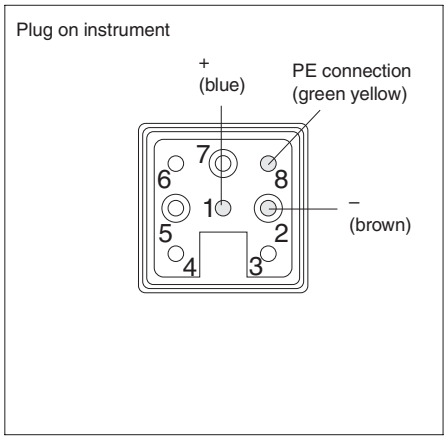
For applications in power stations, there is a Cerabar M with a Han7D Harting plug:

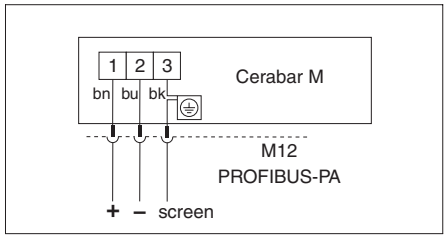
Versions:

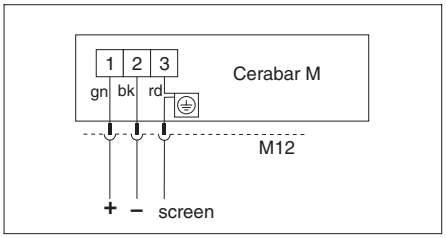
- PM ❑ 4❑ – ❑ H1 ❑❑ ❑ ❑ ❑ ❑❑ ❑ (❑)
- PM ❑ 4❑ – ❑ H2 ❑❑ ❑ ❑ ❑ ❑❑ ❑ (❑)

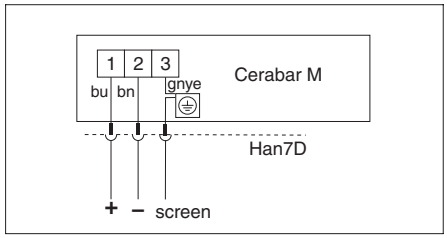












Technical Data

General Information

Manufacturer	Endress+Hauser
Instrument	Pressure transmitter
Designation	Cerabar M PMP 46, PMP 48
Technical documentation Version Technical data	TI322P/00/en 03.05 according to DIN 19259

Application

Measurement of absolute and gauge pressure in gases, vapours, liquids and dusts

Operation and System Design

Measuring principle

Piezoresistive sensor with diaphragm seal	The process pressure acting on the diaphragm of the diaphragm seal is transmitted to the metal separating diaphragm of the sensor by a filling fluid. The separating diaphragm is deflected and the resulting pressure proportional change in the output voltage of the resistance bridge is then measured and evaluated. Working volume: smaller than 1 mm^2 (0.039 in^2)

Measuring system

with analogue electronics (see page 7)	Cerabar M and supply voltage Calibration via potentiometers for lower range-value and upper range-value, optional analogue display
with Smart electronics (see page 7)	Cerabar M and supply voltage: – two keys on the instrument Universal HART Communicator DXR 275 – PC with operating program e.g. Commuwin II via Commubox FXA 191 Optional digital display.
with PROFIBUS-PA electronics (see page 8)	Connection via segment coupler to PLC or PC with an operating program e.g. Commuwin II. Optional digital display.
Construction	Stainless steel or aluminium housing, all common diaphragm seal versions see "Product Structure" and "Dimensions"
Signal transmission Analogue Smart PROFIBUS-PA	– 4…20 mA, 2-wire – 4…20 mA with superposed HART communication signal, 2-wire – digital communication signal, 2-wire

Input

Measured variables	Absolute or gauge pressure

Measuring ranges

PMP 46 (max. 40 bar), PMP 48							
Type of pressure	**Measure-ment limits**	**Min. span**	**Overload**	**Type of pressure**	**Measure-ment limits**	**Min. Span**	**Overload**
	bar	**bar**	**bar**	**bar**	**bar**	**bar**	**bar**
gauge	0…1	0.1	4	**absolute**	0…1	0.1	4
gauge	0…4	0.4	16	**absolute**	0…4	0.4	16
gauge	0…10	1	40	**absolute**	0…10	1	40
gauge	0…40*	4	160	**absolute**	0…40	4	160
gauge	0…100*	10	400	**absolute**	0…100	10	400
gauge	0…400*	40	600	**absolute**	0…400	40	600
gauge	–1…+1	0.2	4	* Absolute pressure sensors			
gauge	–1…+4	0.5	16				
gauge	–1…+10	1.1	40				

The stated overload applies to the sensor. Please also note the maximum permissible overloads for the diaphragm seals.

Input (Continuation)

Resistance to low pressures (vacuum resistance)		to 10 $mbar_{absolute}$ (0.15 psia)
Adjusting the span (turn down)		to TD 10:1 (see also this page figure 2)
Zero point increase and decrease	Analogue Smart PROFIBUS-PA	– ±10% within extended measurement limits – any within extended measurement limits – any within extended measurement limits (see also this page figure 1)

Output

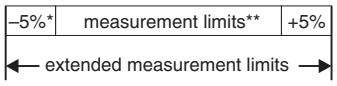
Analogue signal 4…20 mA (analogue electronics)

Output signal	4…20 mA
Signal on alarm	Signal overrun (>20.5 mA) or underrun (<3.6 mA)
Integration time (damping)	Directly on instrument using DIP switches, switch position "off": 0 s; "on": 2 s

4…20 mA with HART protocol (Smart electronics)

Output signal	4…20 mA with HART protocol
Resolution	1 µA
Signal on alarm	optional 3.6 mA, 22 mA or "continue" (last current value will be held)
Integration time (damping)	Directly on instrument using DIP switches, switch position "off": 0 s; "on": 2 s or with Universal HART Communicator DXR 275 or using operating program e.g. Commuwin II: 0…40 s

Figure 1: extended measurement limits



* not with absolute pressure sensors or with overpressure sensors with lower measurement limit of –1 bar
** measurement limits, see page 15

Examples:
0…4 bar overpressure sensor:
extended measurement limits:
–0.2…4.2 bar
0…10 bar absolute pressure sensor:
extended measurement limits:
0…10.5 bar_{abs}

PROFIBUS-PA (PROFIBUS-PA electronics)

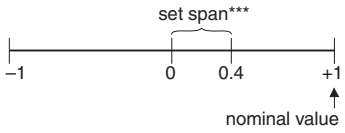
Output signal	Digital communication signal PROFIBUS-PA (Profile 3.0)
PA function	Slave
Transmission rate	31.25 kBit/s
Response time	Slave: approx. 20 ms PLC: 300…600 ms for approx. 30 transmitters (depending on segment coupler)
Integration time (damping)	0…40 ms via communication
Communication resistance	none, PROFIBUS-PA termination-resistor
Physical layer	IEC 61158-2

Accuracy

Reference conditions		DIN IEC 770 T_U=25°C (+77°F) Accuracy data adopted after entering "Low sensor calibration" and "High sensor calibration" for lower range-value and upper range-value.
Linearity including hysteresis and reproducibility (based on the limit point method to DIN IEC 770)		±0.2% of set span***
Linearity at low absolute pressure ranges (due to performance limits of currently available DKD calibration rigs)		for ≥40 $mbar_{absolute}$ to <100 $mbar_{absolute}$: ±0.3 % of set span***
Warm-up time	Analogue Smart PROFIBUS-PA	– 200 ms – 1 s – 1 s
Rise time (T90 time)	Analogue Smart PROFIBUS-PA	– 60 ms – 220 ms – 220 ms
Settling time	Analogue Smart PROFIBUS-PA	– 180 ms – 600 ms – 600 ms
Long-term drift (with reference to the set span***)		±0.1% per year ±0.25% per 3 years
Thermal effects – with reference to the set span*** – Applies to transmitters without diaphragm seals or capillary tubes, see also "Temperature Effects" page 12.		Analogue electronics: – for –10°C…+60°C (+14…+140°F): ±(0.3% x TD + 0.3%) – for –40°C…–10°C (–40…+14°F), +60°C…+85°C (+140…185°F): ±(0.5% x TD + 0.5%) Smart and PROFIBUS-PA electronics: – for –10°C…+60°C (+14…+140°F): ±(0.2% x TD + 0.2%) – for –40°C…–10°C (–40…+14°F), +60°C…+85°C (+140…185°F): ±(0.4% x TD + 0.4%)
Temperature coefficient (maximum TK) – If the temperature coefficient level exceeds the thermal change, then the thermal change automatically becomes valid. – Applies to transmitters without diaphragm seals or capillary tubes, see also "Temperature Effects" page 12.		Zero signal and span: Analogue electronics: – for –10…+60°C (+14…+140°F): ±0.15% of nominal value/10 K – for –40…–10°C (–40…+14°F), +60…+85°C (+140…185°F): ±0.2% of nominal value/10 K Smart and PROFIBUS-PA electronics: – for –10…+60°C (+14…+140°F): ±0.08% of nominal value/10 K – for –40…–10°C (–40…+14°F), +60…+85°C(+140…185°F): ±0.1% of nominal value/10 K
Vibration effects		None (4 mm in path peak-to-peak 5…15 Hz, 2 g: 15…150 Hz, 1 g: 150 Hz…2000 Hz)

Figure 2: Turn down

Explanation of terms:
Turn down (TD) =
nominal value / set span***



Example:
nominal value = 1 bar
set span*** = 0.4 bar
TD = 1 : 0.4

*** Calibrated span for instruments with PROFIBUS-PA electronics

Process conditions

Installation conditions	Any position Zero point shift due to position can be corrected, see page 16, " Zero point increase and decrease"

Ambient conditions

Ambient temperature	–40…+85°C (–40…+185°F) For instruments approved for use in hazardous areas, see Safety Instructions (XA…), Installation Drawing (CSA) or Control Drawing (FM).
Ambient temperature range (temporary)	–40…+100°C (–40…+212°F)
Storage temperature	–40…+85°C (–40…+185°F)
Climatic class	4K4H to DIN EN 60721-3
Protection	– IP 65: Instruments with Harting plug Han7D – IP 66/Nema 4X: instruments with cable gland, cable entry or M 12 plug (in combination with gauge pressure sensor) – IP 68 (1m water over 24 h) or NEMA 6P (1.8 m water over 30 min): instruments with assembled cable or M 12 plug (in combination with absolute pressure sensor)
Electromagnetic compatibility	Interference Emission to EN 61326, Electrical Equipment Class B, Interference immunity to EN 61326 Annex A (Industrial) and NAMUR Recommendation EMC (NE 21) Influence to EMC ≤0.5% Smart and PROFIBUS-PA electronics: Twisted, screened pairs must be used.

Process conditions

Process temperature	Depending on maximum permissible temperature of filling liquid of diaphragm seal and diameter of diaphragm (see also page 12) For instruments approved for use in hazardous areas, see Safety Instructions (XA…), Installation Drawing (CSA) or Control Drawing (FM).
Pressure specifications The MWP (maximum working pressure) is specified on the nameplate. The value refers to a reference temperature of 20°C (68°F) or 100°F for ANSI flanges. – Test pressure (over pressure limit OPL) = MWP (nameplate) x 1.5 – The pressure values permitted at higher temperatures can be found in the following standards: EN 1092-1: 2001 Tab. 18; ASME B 16.5a – 1998 Tab. 2-2.2 F316; ASME B 16.5a – 1998 Tab. 2.3.8 N10276; JIS B2201 The maximum pressure for the measuring device is dependent on the lowest-rated element with respect to pressure, see following sections for this: – permitted overload of the sensor, page 15, table "Measuring range" – for process connections "Product structure" and "Dimensions", from page 19 onwards	

Mechanical Construction

Design

Housing	Stainless steel (type F 15) with a surface roughness Ra ≤ 0.8 µm or aluminium (type F 18) Optional electrical connection via – M 20 x 1.5 cable gland – Cable entry G ½, ½ NPT, – Harting plug (Han7D) or M 12x1 plug – assembled cable with reference air feed
Process connections	All common diaphragm seal versions, see "Product Structure" and "Dimensions"

Materials

Housing		– Stainless steel 1.4404 (AISI 316L) or – cast aluminium housing with protective polyester based powder coating
Nameplate	Stainless steel housing Aluminium housing	– Engraved on housing with laser – 1.4301 (AISI 304)
Process connections (in contact with the medium)		1.4435 (AISI 316L)
Union nuts		1.4307 (AISI 304L)
Process diaphragm (in contact with the medium)	PMP 46 PMP 48	– 1.4435 (AISI 316L) – 1.4435 (AISI 316L), Hastelloy 2.4819 (C 276), tantalum, PTFE film 0.09 mm (0.0035 in) on 1.4435 (AISI 316L) (not for vacuum) PTFE film 0.25 mm (0.0098 in) on 1.4435 (AISI 316L) (not for vacuum)
O-Ring for cover sealing	Stainless steel housing Aluminium housing	– Silicone – NBR
Bracket for pipe and wall mounting		1.4301 (AISI 304)
Filling fluid in diaphragm seals		Silicone oil, vegetable oil (FDA listed), glycerine, high-temperature oil, Fluorolobe (see also page 12)

Display and Operating Interface

Display and Operation

Display (optional)	Analogue	– Pluggable analogue display with bar graph (Pressure display related to set measuring range as bar graph with 30 segments)
	Smart and PROFIBUS-PA	– Pluggable digital display and extra bar graph (Pressure display as four-digit number and also in relating to set measuring range as bar graph with 28 segments)
Display resolution	Analogue display	– Bar graph: 1 segment equals 3.33% of the set measuring range
	Digital display	– Digital display 0.1% bar graph: 1 segment equals 3.57% of the set measuring range
Operation	Analogue	– Lower range-value and upper range-value calibration using two potentiometers and DIP switches on the instrument
	Smart	– Lower range-value and upper range-value calibration using two keys on the instrument
	PROFIBUS-PA	– Lower range-value and upper range-value calibration for the bar graph using two keys on the instrument
For further setting options, refer to pages 7…9		

Communication Interfaces

Handheld terminal	HART protocol: Universal HART Communicator DXR 275, The HART Communicator can be connected anywhere along the 4…20 mA line, minimum line resistance: 250 Ω
PC	Connection via Commubox FXA 191 to a serial interface of a PC The commubox can be connected anywhere along the 4…20 mA line. minimum line resistance: 250 Ω Operating e.g. via Commuwin II operating program.
PROFIBUS-PA	Connection via segment coupler connection to PLC or PC with an operating program e.g. Commuwin II

Power Supply

Analogue and Smart Electronics

Supply voltage	– 11.5…45 V DC – Ex ia: 11.5…30 V DC (Smart electronics only)
Overvoltage category	II to DIN EN 61010-1
Ripple	No effect for 4…20 mA signal up to ±5% residual ripple within permissible range With HART Communicator and Commubox: max. ripple (measured on 500 Ω) 47…125 Hz: U_{PP}=200 mV max. noise (measured on 500 Ω) 500 Hz…10 kHz: U_{eff}=2.2 mV

PROFIBUS-PA Electronics

Supply voltage	– 9…32 V DC – Ex ia: 9…24 V DC, see also Safety Instructions (XA…), Installation Drawing (CSA) or Control Drawing (FM).
Current consumption	11 mA ± 1 mA
Power up current	Corresponds to table 4, IEC 61158-2

Certificates and Approvals

Ignition protection	see "Product Structure, Certificates"
CE Mark	By attaching the CE Mark, Endress+Hauser confirms that the instrument fulfils all the requirements of the relevant EC directives.

Order Code

see "Product Structure"

Supplementary Documentation

Cerabar M System Information: SI 038P/00/en
Cerabar M Technical Information: TI 321P/00/en
Cerabar M with analogue electronics Operating Instructions: BA 200P/00/en
Cerabar M with Smart electronics Operating Instructions: BA 201P/00/en
Cerabar M PROFIBUS-PA Operating Instructions: BA 222P/00/en
PROFIBUS-DP/PA, Guidelines for planning and comissioning: BA 198F/00/en
ATEX II 1/2 G EEx ia IIC T4/T6 Safety Instructions: XA 039P/00
ATEX II 1/2 G EEx ia IIC T4/T6, PROFIBUS-PA Safety Instructions: XA 096P/00
ATEX II 2 G EEx ia IIC T4/T6 Safety Instructions: XA 130P/00
ATEX II 2 G EEx ia IIC T4/T6, PROFIBUS-PA Safety Instructions: XA 149P/00
ATEX II 3 G EEx nA II T5 Safety Instructions: XA 052P/00
ATEX II 1/2 D EEx ia IIC T4/T6 Safety Instructions: XA 038P/00
ATEX II 1/2 D EEx ia IIC T4/T6, PROFIBUS-PA Safety Instructions: XA 097P/00
ATEX II 1/3 D Safety Instructions: XA 040P/00
ATEX II 1/3 D PROFIBUS-PA Safety Instructions: XA 098P/00
EMC guidelines Technical Information: TI 241F/00/en

Product Structure PMP 46

Certificates

R Standard
G ATEX II 1/2 G, EEx ia IIC T6
H ATEX II 2 G, EEx ia IIC T6
N ATEX II 3 G, EEx nA II T5
K ATEX II 1/2 D, EEx ia IIC T6
L ATEX II 1/3 D (non-Ex power supply)
C CSA General Purpose
S CSA IS (suitable for Div. 2) Cl. I, II, III, Div. 1, Groups A…G
T CSA, Cl. I, Div. 2, Groups A…D; Cl. II, III, Div. 1, Groups E…G
P FM IS (non-incendive) Cl. I, II, III, Div. 1, Groups A…G
M FM DIP, Cl. II, III, Div. 1, Groups E…G
V TIIS Ex ia IIC T6

Housing

Stainless steel 1.4404 (AISI 316L)
E1 Cable gland M 20x1.5
G1 Cable entry G ½
C1 Cable entry ½ NPT
H1 Harting plug (Han7D)
L1 Plug M 12x1
K1 5 m cable (with pressure compensation)

Aluminium
E2 Cable gland M 20x1.5
G2 Cable entry G ½
C2 Cable entry ½ NPT
H2 Harting plug (Han7D)
L2 Plug M 12x1
K2 5 m cable (with pressure compensation)

Metal Sensor: Nominal Value (Maximum Overload)

Gauge pressure					
3H	0…1 bar	(4 bar)	100 kPa	(400 kPa)	15 psig (60 psig)
3M	0…4 bar	(16 bar)	400 kPa	(1.6 MPa)	60 psig (240 psig)
3P	0…10 bar	(40 bar)	1 MPa	(4 MPa)	150 psig (600 psig)
3S	0…40 bar	(160 bar)	4 MPa	(16 MPa)	600 psig (2400 psig)
Absolute pressure					
4H	0…1 bar	(4 bar)	100 kPa	(400 kPa)	15 psia (60 psig)
4M	0…4 bar	(16 bar)	400 kPa	(1.6 MPa)	60 psia (240 psig)
4P	0…10 bar	(40 bar)	1 MPa	(4 MPa)	150 psia (600 psig)
4S	0…40 bar	(160 bar)	4 MPa	(16 MPa)	600 psia (2400 psig)
Negative gauge pressure					
7H	–1…+1 bar	(4 bar)	–100…100 kPa (400 kPa)		–15…15 psig (60 psig)
7M	–1…+4 bar	(16 bar)	–100…400 kPa (1.6 MPa)		–15…60 psig (240 psig)
7P	–1…+10 bar	(40 bar)	–0.1…1 MPa (4 MPa)		–15…150 psig (600 psig)

Calibration and Technical Units

1 Calibrated nominal value mbar/bar
2 Calibrated nominal value kPa/MPa
3 Calibrated nominal value mm H_2O/m H_2O
4 Calibrated nominal value inch H_2O
5 Calibrated nominal value kgf/cm^2
6 Calibrated nominal value psi
B Calibrated from … to … technical unit … (bar, kPa, psi …)
9 Others

Electronics, Display

A Analogue 4…20 mA, without display
H HART 4…20 mA, without display
P PROFIBUS-PA, without display
C Analogue 4…20 mA, with analogue display
J HART 4…20 mA, with digital display
R PROFIBUS-PA, with digital display

Accessories/Certification

1 None
2 Bracket for pipe and wall mounting
C 3.1.B Inspection certificate for all parts in contact with the medium made of 1.4435 (AISI 316L)
9 Others

Code for Process Connection **See Page 20**

Filling Fluid in Diaphragm Seal and Coupling of Diaphragm Seal

Notes on Code H, F, J: Capillary >1 with diaphragm seals from DN 50 or 2" only
A Silicone oil, direct coupling
D Vegetable oil (FDA listed), direct coupling
E Glycerine, direct coupling
G High-temperature oil, with temperature spacer 100 mm (3.94 in)
K 1 m (3.28 ft) capillary tubing with high-temperature oil
H …m capillary tubing with high-temperature oil
F …m capillary tubing with vegetable oil
J …m capillary tubing with silicone oil
N Fluorolube, grease-free for oxygen service, direct coupling
Y Others

PMP 46									

Product designation

in combination with diaphragm seals:
– Dairy DIN 11851,
  versions AG, AH and AL as well as
  PB, PH and PL
– Varivent, version LL

Note!
To meet the requirements of the EHEDG, these instruments should be installed in accordance with Hygienic Equipment Design Criteria.

Diaphragm and Pipe Seal for Hygienic Applications
Material 1.4435 (AISI 316L)

Diaphragm seal

AG Dairy thread DIN 11851, DN 32, PN 40
AH Dairy thread DIN 11851, DN 40, PN 40
AL Dairy thread DIN 11851, DN 50, PN 40

DG Clamp, 1½", PN 40
DL Clamp, 2", PN 40
DU Clamp, 3", PN 40

EG SMS thread,1½", PN 40
EL SMS thread, 2", PN 40

FG RJT thread, 1½", PN 40
FL RJT thread, 2", PN 40

GG ISS thread, 1½", PN 40
GL ISS thread, 2", PN 40

KL DRD flange, D=65 mm

LL Varivent, type N for pipes DN 40…125

Pipe diaphragm seal

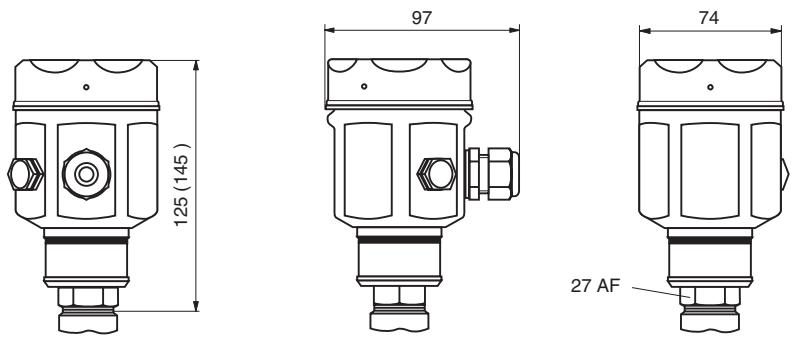
PB Dairy thread DIN 11851, DN 25, PN 40
PH Dairy thread DIN 11851, DN 40, PN 40
PL Dairy thread DIN 11851, DN 50, PN 40

SA Clamp, ¾", PN 40
SB Clamp, 1", PN 40
SG Clamp, 1½", PN 40
SL Clamp, 2", PN 40

YY Others

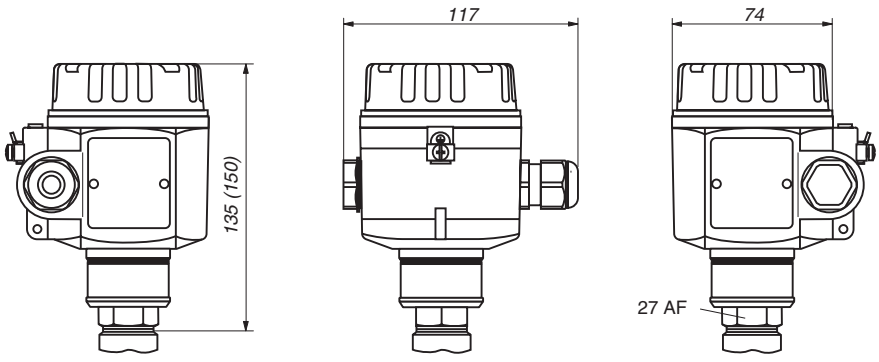
Code for process connection

Dimensions
Housing



Dimensions
- 1 mm = 0.039 in
  1 in = 25.4 mm

All dimensions are in mm.



Housing
- *above:* Stainless steel 1.4404 (AISI 316L)
  below: Aluminium
- optional cover raised (with display) or low

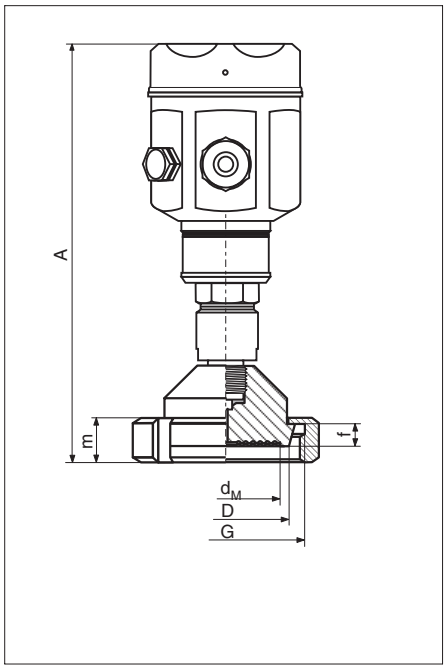
Values in brackets apply to instruments with raised cover.
Values in italics apply to instruments with an aluminium housing.

Dimensions
PMP 46

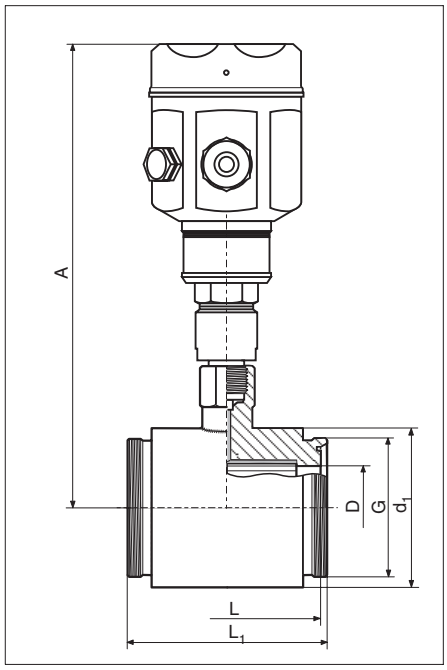
Conversion factors
- 1 mm = 0.039 in
  1 in = 25.4 mm
- 1 kg = 2.2 lbs
  1 lbs = 0.45 kg
- 1 bar = 14.5 psi
  1 psi = 0.069 bar

Process connection
- Wetted parts of diaphragm seal: 1.4435 (AISI 316L)
- Standard surface roughness of parts in contact with the medium Ra ≤ 0.8 µm. Reduced surface roughness on request.

Diaphragm Seal
Conical Sleeve with Groove Nut
DIN 11851 (Dairy Thread)



Pipe Diaphragm Seal
DIN 11851 (Dairy Thread)



Diaphragm seal
conical sleeve with groove nut, DIN 11851 (dairy thread)

Instrument	Code	Pipe	Conical sleeve			Groove nut		Diaphragm seal					Stainless steel housing		Aluminium housing	
		Nominal diameter	Nominal pressure	Diameter	Sleeve height	Thread	Height	Diaphragm diameter	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		DN	PN	D	f	G	m	d_M	Ambient	Process			max. A		max. A	
		mm	bar	mm	mm		mm	mm	mbar/10K	mbar/10K	bar	mbar	mm	kg	mm	kg
PMP 46	AG	32	40	50	10	Rd 58 x 1/6"	21	32	+3	+4	from 2.0	9	251.5	1.4	256.5	1.7
PMP 46	AH	40	40	56	10	Rd 65 x 1/6"	21	38	+2	+4	from 0.4	9	250.5	1.4	255.5	1.7
PMP 46	AL	50	40	68	11	Rd 78 x 1/6"	25	46	+1	+2	from 0.1	8	245.5	1.6	250.5	1.9

Pipe diaphragm seal DIN 11851 (dairy thread)

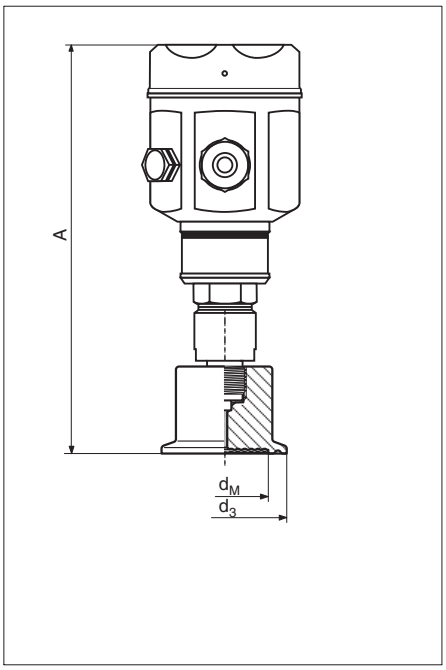
Instrument	Code	Pipe	Conical sleeve				Diaphragm seal						Stainless steel housing		Aluminium housing	
		Nominal diameter	Nominal pressure	Diameter	Diameter	Thread	Height	Total length	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		DN	PN	D	d_1	G	L	L_1	Ambient	Process			max. A		max. A	
		mm	bar	mm	mm		mm	mm	mbar/10K	mbar/10K	bar	mbar	mm	kg	mm	kg
PMP 46	PB	25	40	26,2	58	Rd 52 x 1/6"	126	140	+4	+8	from 2.0	8	273.5	3.0	278.5	3.3
PMP 46	PH	40	40	38	78	Rd 65 x 1/6"	126	140	+2	+4	from 0.4	10	283.5	3.4	292.5	3.7
PMP 46	PL	50	40	50,7	88	Rd 78 x 1/6"	100	114	+1	+2	from 0.1	11	288.5	3.8	293.5	4.1

Dimensions PMP 46

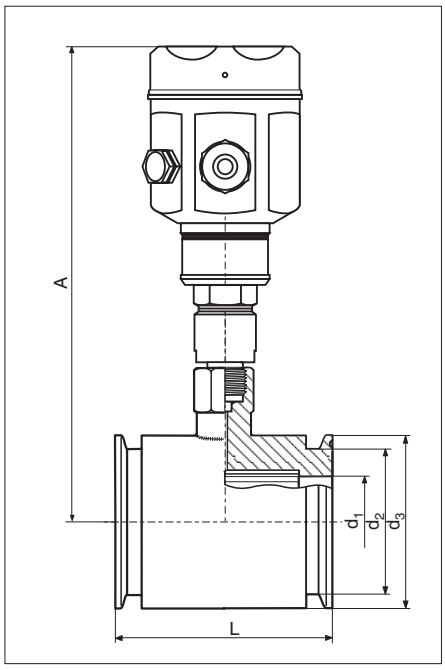
Conversion factors
- 1 mm = 0.039 in
  1 in = 25.4 mm
- 1 kg = 2.2 lbs
  1 lbs = 0.45 kg
- 1 bar = 14.5 psi
  1 psi = 0.069 bar

Process connection
- Wetted parts of diaphragm seal: 1.4435 (AISI 316L)
- Standard surface roughness of parts in contact with the medium Ra ≤ 0.8 µm. Reduced surface roughness on request.

Clamp Diaphragm Seal



Clamp Pipe Diaphragm Seal



Diaphragm seal Clamp

Instrument	Code	Clamp					Diaphragm seal					Stainless steel housing		Aluminium housing	
		Nominal diameter			Nominal pressure	Diameter	Diaphragm diameter	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		DN			PN	d_3	d_M	Ambient	Process			max. A		max. A	
		ISO 2852	DIN 32676	Triclamp											
		mm	mm	inch	bar	mm	mm	mbar/10K	mbar/10K	bar	mbar	mm	kg	mm	kg
PMP 46	DG	25/33.7/38	25/32/40	1½"	40	50.5	34	+3	+4	from 0.4	8	234.5	1.0	239.5	1.3
PMP 46	DL	40/51	50	2"	40	64	45	+1	+2	from 0.1	9	242.5	1.2	247.5	1.5
PMP 46	DU	70/76.1	65	3"	40	91	71,5	+1	+2	from 0.1	9	242.5	1.4	247.5	1.7

Pipe diaphragm seal Clamp

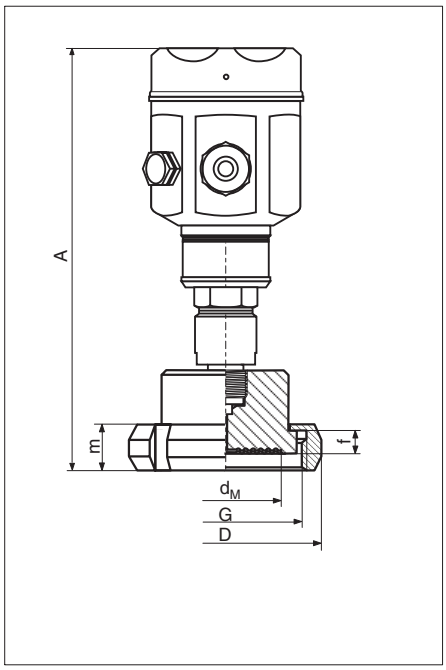
Instrument	Code	Pipe	Clamp				Diaphragm seal					Stainless steel housing		Aluminium housing	
		Nominal diameter	Nominal pressure	Diameter	Diameter	Diameter	Installation length	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		DN	PN	d_1	d_2	d_3	L	Ambient	Process			max. A		max. A	
		ISO 2852													
		mm	bar	mm	mm	mm	mm	mbar/10K	mbar/10K	bar	mbar	mm	kg	mm	kg
PMP 46	SA	15	40	10.5	18	25	140	+7	+11	from 6.0	8	220	2.6	225	2.9
PMP 46	SB	25	40	22.5	41.5	50.5	126	+4	+8	from 2.0	8	220	3.0	225	3.3
PMP 46	SG	40	40	35.5	41.5	50.5	126	+2	+4	from 0.4	9	257	3.4	262	3.7
PMP 46	SL	50	40	48.6	55	64	100	+1	+2	from 0.1	11	268	3.8	273	4.1

Dimensions PMP 46

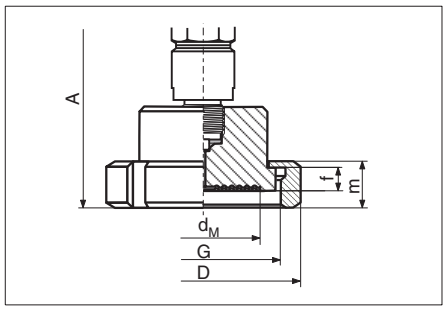
Conversion factors
- 1 mm = 0.039 in
  1 in = 25.4 mm
- 1 kg = 2.2 lbs
  1 lbs = 0.45 kg
- 1 bar = 14.5 psi
  1 psi = 0.069 bar

Process connection
- Wetted parts of diaphragm seal: 1.4435 (AISI 316L)
- Standard surface roughness of parts in contact with the medium Ra ≤ 0.8 µm. Reduced surface roughness on request.

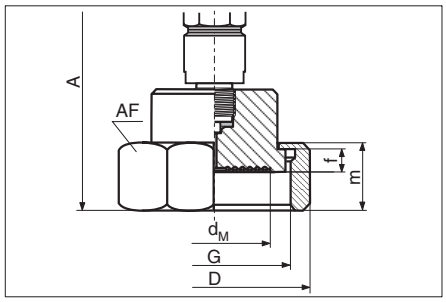
SMS Sleeve with Groove Nut



RJT Sleeve with Groove Nut



ISS Sleeve with Groove Nut



Diaphragm seal SMS sleeve with groove nut

Instrument	Code	Pipe	Conical sleeve			Groove nut		Diaphragm seal					Stainless steel housing		Aluminium housing	
		Nominal diameter	Nominal pressure	Diameter	Sleeve height	Thread	Height	Diaphragm diameter	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		DN	PN	D	f	G	m	d_M	Ambient	Process			max. A		max. A	
			bar	mm	mm		mm	mm	mbar/10K	mbar/10K	bar	mbar	mm	kg	mm	kg
PMP 46	EG	1½"	40	74	4	Rd 60 - 1/6"	25	34	+4	+4	from 0.4	8	254.5	1.4	259.5	1.7
PMP 46	EL	2"	40	84	4	Rd 70 - 1/6"	26	46	+2	+2	from 0.1	9	259.5	1.6	264.5	1.9

Diaphragm seal RJT sleeve with groove nut

Instrument	Code	Pipe	Conical sleeve			Groove nut		Diaphragm seal					Stainless steel housing		Aluminium housing	
		Nominal diameter	Nominal pressure	Diameter	Sleeve height	Thread	Height	Diaphragm diameter	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		DN	PN	D	f	G	m	d_M	Ambient	Process			max. A		max. A	
			bar	mm	mm		mm	mm	mbar/10K	mbar/10K	bar	mbar	mm	kg	mm	kg
PMP 46	FG	1½"	40	72	6.4	2 5/16" - 1/8"	21	28	+8	+8	from 0.4	8	257	1.6	262	1.9
PMP 46	FL	2"	40	86	6.4	2 7/8" - 1/8"	22	38	+3	+4	from 0.1	9	258	1.7	263	2.0

Diaphragm seal ISS sleeve with groove nut

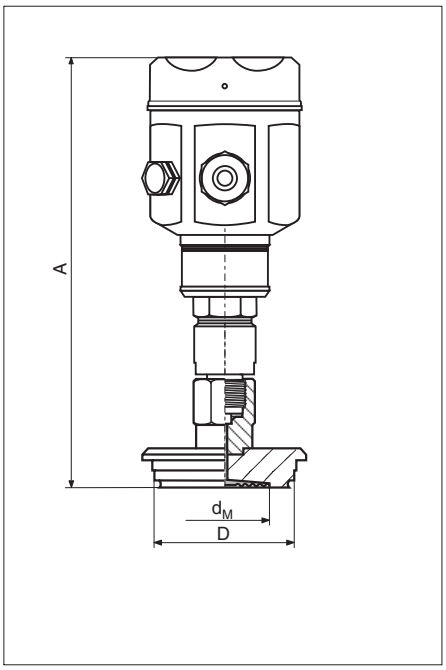
Instrument	Code	Pipe	Conical sleeve			Groove nut			Diaphragm seal					Stainl. steel housing		Aluminium housing	
		Nominal diameter	Nominal pressure	Diameter	Sleeve height	Thread	Height	Across flats	Diaphragm diameter	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		DN	PN	D	f	G	m	AF	d_M	Ambient	Process			max. A		max. A	
			bar	mm	mm		mm	mm	mm	mbar/10K	mbar/10K	bar	mbar	mm	kg	mm	kg
PMP 46	GG	1½"	40	62 AF	4	2" - 1/8"	30	62	34	+4	+4	from 0.4	8	267.5	1.4	272.5	1.7
PMP 46	GL	2"	40	77 AF	4	2 1/2" - 1/8"	30	77	45	+2	+2	from 0.1	9	267.5	1.8	272.5	2.1

Dimensions PMP 46

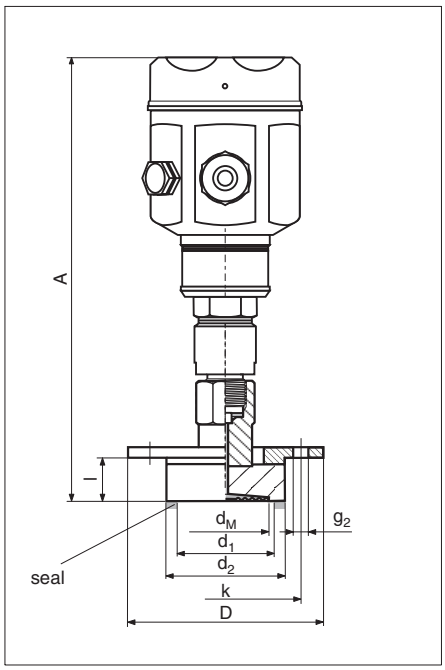
Conversion factors
- 1 mm = 0.039 in
  1 in = 25.4 mm
- 1 kg = 2.2 lbs
  1 lbs = 0.45 kg
- 1 bar = 14.5 psi
  1 psi = 0.069 bar

Process connection
- Wetted parts of diaphragm seal: 1.4435 (AISI 316L)
- Standard surface roughness of parts in contact with the medium Ra ≤ 0.8 µm. Reduced surface roughness on request.

Varivent

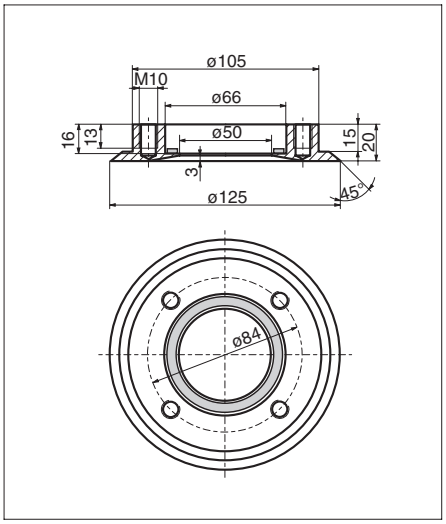


DRD Flange



Diaphragm seal Varivent Type N and DRD

Instrument	Code	Neck/Flange					Bolt holes			Diaphragm seal					Stainless steel housing		Aluminium housing	
		Nominal pressure	Extension length	Extension diameter	Internal diameter	Diameter	Number	Diameter	Pitch diameter	Diaphragm diameter	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		PN	l	d_2	d_1	D		g_2	k	d_M	Ambient	Process			max. A		max. A	
		bar	mm	mm	mm	mm		mm	mm	mm	mbar/10K	mbar/10K	bar	mbar	mm	kg	mm	kg
PMP 46	LL	40	–	–	–	68	–	–	–	46	+2	+2	from 0.1	11	235.5	1.3	252.5	1.6
PMP 46	KL	40	17	65	50	105	4	10.5	84	46	+2	+2	from 0.1	11	239.5	1.6	258.5	1.9



Welding Flange

Endress+Hauser offers a welding flange with PTFE flat packing for the flush-mounted installation of the DRD flange (version KL).

Material: 1.4435 (AISI 316L)
Order No.: 52002041
only PTFE flat seal:
Order No.: 916783-0000

Product Structure PMP 48

Certificates

R Standard
G ATEX II 1/2 G, EEx ia IIC T6
H ATEX II 2 G, EEx ia IIC T6
N ATEX II 3 G, EEx nA II T5
K ATEX II 1/2 D, EEx ia IIC T6
L ATEX II 1/3 D (non-Ex power supply)
C CSA General Purpose
S CSA IS (suitable for Div. 2) Cl. I, II, III, Div. 1, Groups A…G
T CSA Cl. I, Div. 2, Groups A…D, Cl. II, III, Div. 1, Groups E…G
P FM IS (non-incendive) Cl. I, II, III, Div. 1, Groups A…G
M FM DIP, Cl. II, III, Div. 1, Groups E…G
V TIIS Ex ia IIC T6

Housing

Stainless steel 1.4404 (AISI 316L)
E1 Cable gland M 20x1.5
G1 Cable entry G ½
C1 Cable entry ½ NPT
H1 Harting plug (Han7D)
L1 Plug M 12x1
K1 5 m cable (with pressure compensation)

Aluminium
E2 Cable gland M 20x1.5
G2 Cable entry G ½
C2 Cable entry ½ NPT
H2 Harting plug (Han7D)
L2 Plug M 12x1
K2 5 m cable (with pressure compensation)

Metal Sensor: Nominal Value (Maximum Overload)

Gauge pressure					
3H	0…1 bar	(4 bar)	100 kPa	(400 kPa)	15 psig (60 psig)
3M	0…4 bar	(16 bar)	400 kPa	(1.6 MPa)	60 psig (240 psig)
3P	0…10 bar	(40 bar)	1 MPa	(4 MPa)	150 psig (600 psig)
3S	0…40 bar	(160 bar)	4 MPa	(16 MPa)	600 psig (2400 psig)
3U	0…100 bar	(400 bar)	10 MPa	(40 MPa)	1500 psig (6000 psig)
3Z	0…400 bar	(600 bar)	40 MPa	(60 MPa)	6000 psig (9000 psig)
Absolute pressure					
4H	0…1 bar	(4 bar)	100 kPa	(400 kPa)	15 psia (60 psig)
4M	0…4 bar	(16 bar)	400 kPa	(1.6 MPa)	60 psia (240 psig)
4P	0…10 bar	(40 bar)	1 MPa	(4 MPa)	150 psia (600 psig)
4S	0…40 bar	(160 bar)	4 MPa	(16 MPa)	600 psia (2400 psig)
4U	0…100 bar	(400 bar)	10 MPa	(40 MPa)	1500 psia (6000 psig)
4Z	0…400 bar	(600 bar)	40 MPa	(60 MPa)	6000 psia (9000 psig)
Negative gauge pressure					
7H	–1…+1 bar	(4 bar)	–100…100 kPa (400 kPa)		–15…15 psig (60 psig)
7M	–1…+4 bar	(16 bar)	–100…400 kPa (1.6 MPa)		–15…60 psig (240 psig)
7P	–1…+10 bar	(40 bar)	–0.1…1 MPa (4 MPa)		–15…150 psig (600 psig)

Calibration and Technical Units

1 Calibrated nominal value mbar/bar
2 Calibrated nominal value kPa/MPa
3 Calibrated nominal value mm H_2O/m H_2O
4 Calibrated nominal value inch H_2O
5 Calibrated nominal value kgf/cm^2
6 Calibrated nominal value psi
B Calibrated from … to … technical unit … (bar, kPa, psi …)
9 Others

Electronics, Display

A Analogue 4…20 mA, without display
H HART 4…20 mA, without display
P PROFIBUS-PA, without display
C Analogue 4…20 mA, with analogue display
J HART 4…20 mA, with digital display
R PROFIBUS-PA, with digital display

Accessories/Certification

1 None
2 Bracket for pipe and wall mounting
C 3.1.B Inspection certificate for all parts in contact with the medium made of 1.4435 (AISI 316L)
9 Others

Code for Process Connection **see Page 26**

Filling Fluid in Diaphragm Seal and Coupling to Cerabar M

Notes on Code H, F, J: Capillary > 1 m with diaphragm seals from DN 50 or 2" only
A Silicone oil, direct coupling
D Vegetable oil, direct coupling
E Glycerine, direct coupling
G High-temperature oil, with temperature spacer 100 mm
N Fluorolube, grease-free for oxygen service, direct coupling
K 1 m (3.28 ft) capillary tubing with high-temperature oil
H …m capillary tubing with high-temperature oil
F …m capillary tubing with vegetable oil
J …m capillary tubing with silicone oil

Material of Diaphragm

Note: Flanges with extension as well as threaded boss in 1.4435 (AISI 316L) available only
1 1.4435 (AISI 316L)
2 Hastelloy C 276
5 Tantalum
9 Others
7 PTFE film 0.09 mm on 1.4435 (not for vacuum)
8 PTFE film 0.25 mm on 1.4435 (not for vacuum)

PMP 48										

Product designation

Product Structure
Process Connections
PMP 48

Process Connection
Material 1.4435 (AISI 316L)

Threaded boss

AF G 1, DIN ISO 228/1
AG G 1½, DIN ISO 228/1
AR G 2, DIN ISO 228/1
BF 1 NPT, ANSI B 1.201
BG 1½ NPT, ANSI B 1.201
BR 2 NPT, ANSI B 1.201
CA Separator with G ½, EN 837, Form 6kt
DA Separator with ½ NPT, ANSI B 1.201

Flanges, dimensions to DIN 2501

EB DN 25", PN 10/40
EC DN 25", PN 64/160
ED DN 25", PN 250
EF DN 25, PN 400
EK DN 50, PN 10/40
EM DN 50, PN 64
EN DN 50, PN 100/160
EP DN 50, PN 250
ER DN 50, PN 400
EU DN 80, PN 10/40

Flanges with extended diaphragm, dimensions to DIN 2501

FK DN 50, PN 10/40, extended diaphragm 50 mm
FU DN 80, PN 10/40, extended diaphragm 50 mm
GK DN 50, PN 10/40, extended diaphragm 100 mm
GU DN 80, PN 10/40, extended diaphragm 100 mm
JK DN 50, PN 10/40, extended diaphragm 200 mm
JU DN 80, PN 10/40, extended diaphragm 200 mm

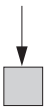
Flanges, dimensions to ANSI B 16.5 with raised face form RF

KB 1", 150 lbs
KC 1", 300 lbs
KD 1", 400/600 lbs
KE 1", 900/1500 lbs
KF 1", 2500 lbs
KJ 2", 150 lbs
KK 2", 300 lbs
KL 2", 400/600 lbs
KM 2", 900/1500 lbs
KN 2", 2500 lbs
KU 3", 150 lbs
KV 3", 300 lbs
KW 4", 150 lbs
KX 4", 300 lbs

Flanges with extended diaphragm, dimensions to ANSI B 16.5

LJ 2", 150 lbs, extended diaphragm 2"
LU 3", 150 lbs, extended diaphragm 2"
LW 4", 150 lbs, extended diaphragm 2"
MJ 2", 150 lbs, extended diaphragm 4"
MU 3", 150 lbs, extended diaphragm 4"
MW 4", 150 lbs, extended diaphragm 4"
NJ 2", 150 lbs, extended diaphragm 6"
NU 3", 150 lbs, extended diaphragm 6"
NW 4", 150 lbs, extended diaphragm 6"

YY Others



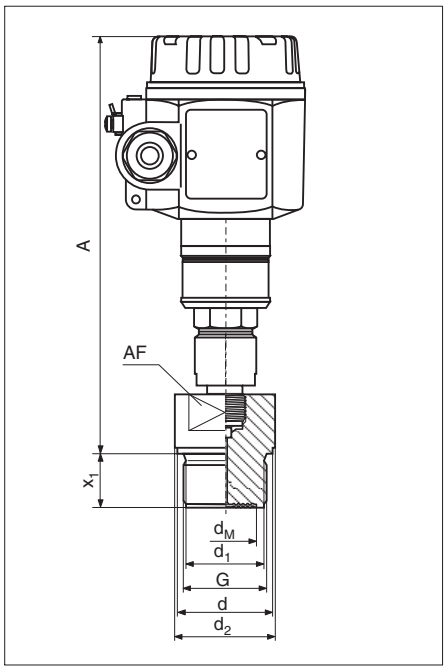
Code for process connection

Dimensions PMP 48

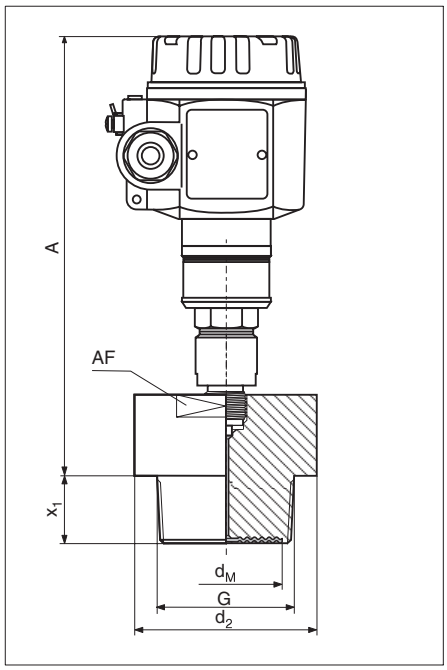
Conversion factors
- 1 mm = 0.039 in
  1 in = 25.4 mm
- 1 kg = 2.2 lbs
  1 lbs = 0.45 kg
- 1 bar = 14.5 psi
  1 psi = 0.069 bar

Process connection
- Wetted parts of diaphragm seal: 1.4435 (AISI 316L)

G Threaded Boss



NPT Threaded Boss



Threaded boss G and NPT

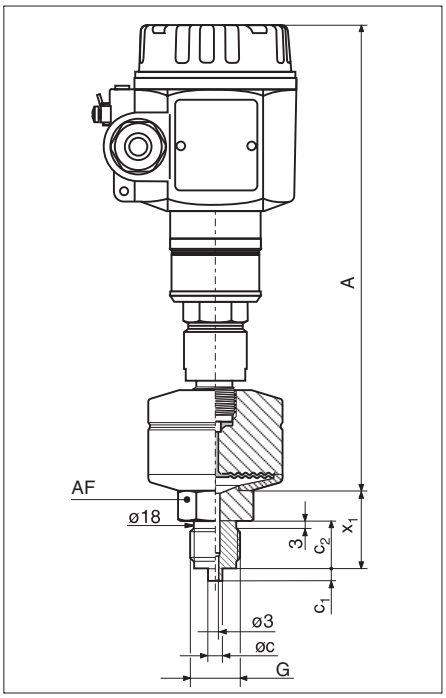
Instrument	Code	Threaded boss							Diaphragm seal					Stainless steel housing		Aluminium housing	
		Threaded boss	Nominal pressure	Diameter	Diameter	Diameter	Thread length	Across flats	Diaphragm diameter	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
			PN	d_1	d	d_2	x_1	AF	d_M	Ambient	Process			max. A		max. A	
			bar	mm	mm	mm	mm	mm	mm	mbar/10K		bar	mbar	mm	kg	mm	kg
PMP 48	AF	G 1	400	29	39	39	21	41	28	+6	+6	from 1.0	11	231.5	1.2	236.5	1.5
PMP 48	AG	G 1½	400	44	55	58	30	41	38	+2	+4	from 0.4	11	232.5	1.9	237.5	2.2
PMP 48	AR	G 2	400	56	68	78	30	60	46	+1	+2	from 0.1	11	237.5	2.9	242.5	3.2
PMP 48	BF	1 NPT	400	–	–	–	23	41	23	+9	+9	from 1.0	11	235.5	1.5	240.5	1.8
PMP 48	BG	1½ NPT	400	–	–	52	30	46	32	+5	+5	from 0.4	11	233.5	1.9	238.5	2.2
PMP 48	BR	2 NPT	400	–	–	78	30	65	36	+3	+4	from 0.4	11	233.5	2.8	238.5	3.1

Dimensions PMP 48

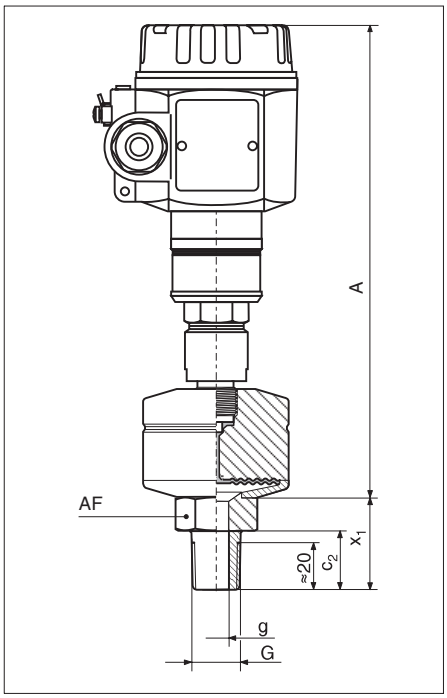
Conversion factors
- 1 mm = 0.039 in
  1 in = 25.4 mm
- 1 kg = 2.2 lbs
  1 lbs = 0.45 kg
- 1 bar = 14.5 psi
  1 psi = 0.069 bar

Process connection
- Wetted parts of diaphragm seal: 1.4435 (AISI 316L)

Separator with G ½ A; EN 837 Form B 6kt



Separator with ½ NPT, ANSI B 1.20.2



Separator G and NPT

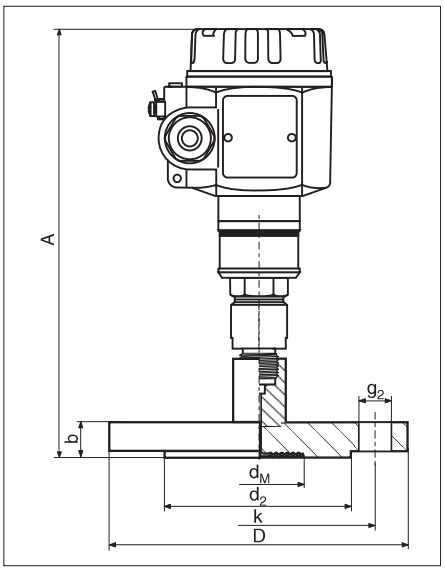
Instrument	Code	Threaded boss								Diaphragm seal				Stainless steel housing		Aluminium housing	
		Threaded boss	Nominal pressure	Diameter	Height	Thread length	Height	Diameter	Across flats	Temperature coefficient T_K, (for silicone oil, for other oils, see page 12)		Recommended minimum measuring range	Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
			PN	c	c_1	c_2	x_1	g	AF	Ambient	Process			max. A		max. A	
			bar	mm	mm	mm	mm	mm	mm	mbar/10K		bar	mbar	mm	kg	mm	kg
PMP 48	CA	G ½	160	6	5	20	34	–	22	+1	+2	ab 0,1	7	218.5	1.2	218.5	1.5
PMP 48	DA	½ NPT	160	–	–	25	39	11.4	22	+1	+2	ab 0,1	7	237.5	1.2	237.5	1.5

Dimensions PMP 48

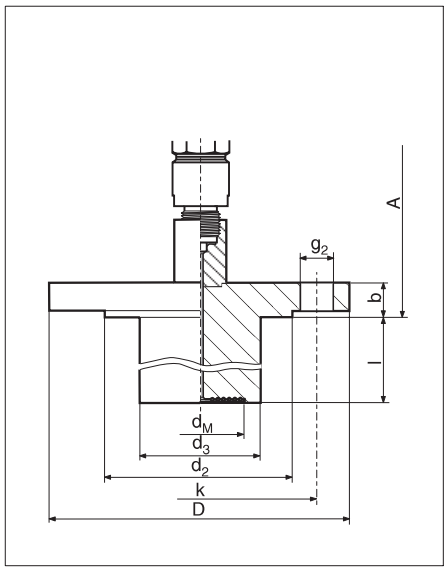
Conversion factors
- 1 mm = 0.039 in
  1 in = 25.4 mm
- 1 kg = 2.2 lbs
  1 lbs = 0.45 kg
- 1 bar = 14.5 psi
  1 psi = 0.069 bar

Flange
- Stainless steel 1.4435 (AISI 316L)
- Wetted diaphragm see Product Structure

DIN Flange



DIN Flange with Extension



Diaphragm seal: Flanges, dimensions to DIN 2501, with raised face Form D to DIN 2526

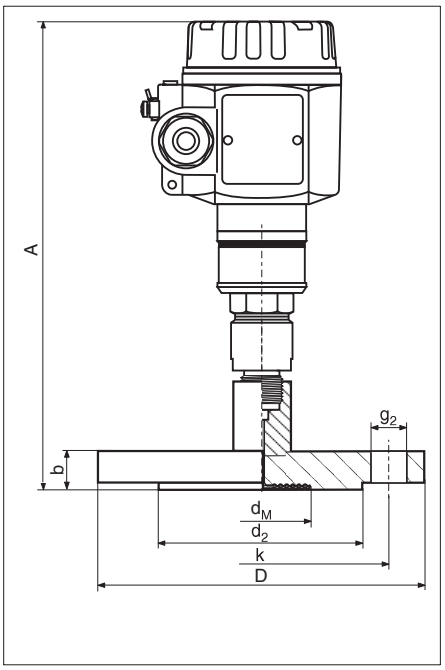
Instrument	Code	Flange							Bolt holes			Diaphragm seal				Stainless steel housing		Aluminium housing	
		Nominal diameter	Nominal pressure	Extended flange length	Diameter of extended flange	Diameter	Thickness	Raised face	Number	Diameter	Pitch diameter	Diaphragm diameter	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		DN	PN	l	d_3	D	b	d_2		g_2	k	d_M	Ambient	Process		max. A		max. A	
			bar	mm	mm	mm	mm	mm		mm	mm	mm	mbar/10K		mbar	mm	kg	mm	kg
PMP 48	EB	25	10/40	–	–	115	18	68	4	14	85	28	+8	+8	11	228	2.8	233	3.1
PMP 48	EC	25	64/160	–	–	140	24	68	4	18	100	28	+8	+8	11	234	4.4	239	4.7
PMP 48	ED	25	250	–	–	150	28	68	4	22	105	28	+8	+8	11	238	5.1	243	5.4
PMP 48	EF	25	400	–	–	180	38	68	4	26	130	28	+8	+8	11	248	7.8	253	8.1
PMP 48	EK	50	10/40	–	–	165	20	102	4	18	125	46	+1	+2	10	255	3.3	260	3.6
PMP 48	EM	50	64	–	–	180	20	102	4	22	135	46	+1	+2	11	261	5.9	266	5.9
PMP 48	EN	50	100/160	–	–	195	20	102	4	26	145	46	+1	+2	11	265	16.5	270	16.8
PMP 48	EP	50	250	–	–	200	20	102	8	26	150	46	+1	+2	11	273	2.5	278	2.8
PMP 48	ER	50	400	–	–	235	52	102	8	30	180	52	+1	+2	11	287	9.5	292	9.8
PMP 48	FK	50	10/40	50	48.3	165	20	102	4	18	125	46	+1	+2	15	255	4.1	260	4.4
PMP 48	GK	50	10/40	100	48.3	165	20	102	4	18	125	46	+1	+2	20	255	7.7	260	8.0
PMP 48	JK	50	10/40	200	48.3	165	20	102	4	18	125	46	+1	+2	30	255	3.3	260	3.6
PMP 48	EU	80	10/40	–	–	200	24	138	8	18	160	70	+1	+2	11	259	5.8	264	6.1
PMP 48	FU	80	10/40	50	76.5	200	24	138	8	18	160	70	+1	+2	16	259	5.8	264	6.1
PMP 48	GU	80	10/40	100	76.5	200	24	138	8	18	160	70	+1	+3	21	259	4.1	264	4.4
PMP 48	JU	80	10/40	200	76.5	200	24	138	8	18	160	70	+1	+3	31	259	7.7	264	8.0

Dimensions PMP 48

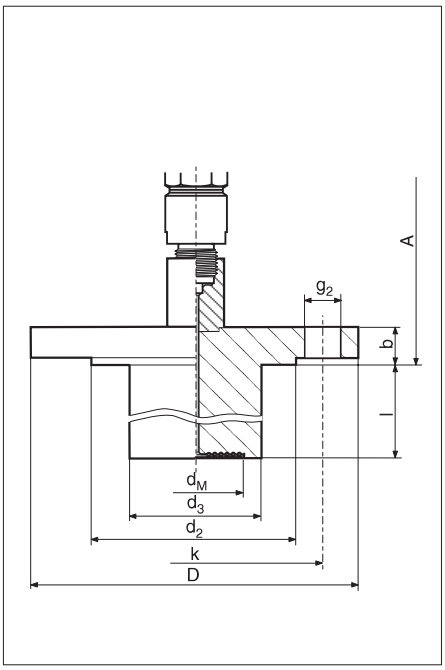
Conversion factors
- 1 mm = 0.039 in
  1 in = 25.4 mm
- 1 kg = 2.2 lbs
  1 lbs = 0.45 kg
- 1 bar = 14.5 psi
  1 psi = 0.069 bar

Flange
- Stainless steel 1.4435 (AISI 316L)
- Wetted diaphragm see Product Structure

ANSI Flange



ANSI Flange with Extension



Diaphragm seal: Flanges, dimensions to ANSI B 16.5, with raised face form RF

Instru-ment	Code	Flange							Bolt holes			Diaphragm seal				Stainl. steel housing		Aluminium housing	
		Nominal diameter	Nominal pressure	Extended flange length	Diameter of extended flange	Diameter	Thickness	Raised face	Number	Diameter	Pitch diameter	Diaphragm diameter	Temperature coefficient T_K (for silicone oil, for other oils, see page 12)		Max. effects of mounting position (see page 10)	Height of Cerabar M	Total weight	Height of Cerabar M	Total weight
		DN	PN	l	d_3	D	b	d_2		g_2	k	d_M	Ambient	Process		max. A		max. A	
			lb/sq.in		inch	inch	inch	inch		inch	inch	inch	mbar/10K		mbar	mm	kg	mm	kg
PMP 48	KB	1"	150	–	–	4.25	0.56	2.00	4	0.62	3.12	1.10	+8	+8	10	223.5	2.3	228.5	2.6
PMP 48	KC	1"	300	–	–	4.88	0.69	2.00	4	0.75	3.50	1.10	+8	+8	10	227	2.5	232	2.8
PMP 48	KD	1"	400/600	–	–	4.88	0.93	2.00	4	0.75	3.50	1.10	+8	+8	10	233.5	3.0	238.5	3.3
PMP 48	KE	1"	900/1500	–	–	1.32	1.36	2.00	4	1.00	4.00	1.10	+8	+8	10	244.5	4.8	249.5	5.1
PMP 48	KF	1"	2500	–	–	6.25	1.62	2.00	4	1.00	4.25	1.10	+8	+8	10	251	6.8	256	7.1
PMP 48	KJ	2"	150	–	–	6.00	0.75	3.62	4	0.75	4.75	2.03	+3	+1	10	254.5	3.3	259.5	3.6
PMP 48	LJ	2"	150	2"	48.3	6.00	0.75	3.62	4	0.75	4.75	1.77	+1	+2	15	254.5	4.5	259.5	4.8
PMP 48	MJ	2"	150	4"	48.3	6.00	0.75	3.62	4	0.75	4.75	1.77	+1	+2	20	254.5	4.9	259.5	5.2
PMP 48	NJ	2"	150	6"	48.3	6.00	0.75	3.62	4	0.75	4.75	1.77	+1	+2	25	254.5	5.2	259.5	5.5
PMP 48	KK	2"	300	–	–	6.50	0.88	3.62	8	0.75	5.00	2.03	+1	+2	10	257.5	4.1	262.5	4.4
PMP 48	KL	2"	400/600	–	–	6.50	1.00	3.62	8	0.75	5.00	2.03	+1	+2	10	267	5.1	272	5.4
PMP 48	KM	2"	900/1500	–	–	8.50	1.50	3.62	8	1.00	6.50	2.03	+1	+2	10	280	11.0	285	11.3
PMP 48	KN	2"	2500	–	–	9.25	2.00	3.62	8	1.12	6.75	2.03	+1	+2	10	295	16.5	300	16.8
PMP 48	KU	3"	150	–	–	7.50	0.94	5.00	4	0.75	6.00	3.14	+1	+2	11	254.5	5.8	259.5	6.1
PMP 48	LU	3"	150	2"	76	7.50	0.94	5.00	4	0.75	6.00	2.83	+1	+2	16	254.5	6.9	259.5	7.2
PMP 48	MU	3"	150	4"	76	7.50	0.94	5.00	4	0.75	6.00	2.83	+1	+3	21	254.5	7.5	259.5	7.8
PMP 48	NU	3"	150	6"	76	7.50	0.94	5.00	4	0.75	6.00	2.83	+1	+3	23	254.5	7.8	259.5	8.1
PMP 48	PU	3"	150	8"	76	7.50	0.94	5.00	4	0.75	6.00	2.83	+1	+3	31	254.5	8.3	259.5	8.6
PMP 48	KV	3"	300	–	–	8.25	1.12	5.00	8	0.88	6.62	3.14	+1	+2	11	259	7.7	264	8.0
PMP 48	MV	3"	300	4"	76	8.25	1.12	5.00	8	0.88	6.62	2.83	+1	+2	16	259	7.5	264	7,8
PMP 48	PV	3"	300	8"	76	8.25	1.12	5.00	8	0.88	6.62	2.83	+1	+3	26	259	8.3	264	8.6
PMP 48	KW	4"	150	–	–	9.00	0.94	6.19	8	0.75	7.50	3.14	+1	+2	11	259	7.9	264	8.2
PMP 48	LW	4"	150	2"	94	9.00	0.94	6.19	8	0.75	7.50	3.50	+1	+2	16	254.5	9.0	259.5	9.3
PMP 48	MW	4"	150	4"	94	9.00	0.94	6.19	8	0.75	7.50	3.50	+1	+3	21	254.5	9.6	259.5	9.9
PMP 48	NW	4"	150	6"	94	9.00	0.94	6.19	8	0.75	7.50	3.50	+1	+3	26	254.5	9.9	259.5	10.2
PMP 48	KX	4"	300	–	–	10.00	1.25	6.19	8	0.88	7.88	3.14	+1	+2	12	262.5	12.4	267.5	12.7

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