

Pressure Transmitter *cerabar S PMC 731, PMP 731*

**Cerabar S with a ceramic or metal sensor overload
resistant with function monitoring
Communication using HART, PROFIBUS-PA and
Foundation Fieldbus**



Application

The Cerabar S transmitter accurately measures the pressure of gases, vapours and liquids and is used in all areas of chemical and process engineering.

The modular design of the Cerabar S enables it to be used in all industrial environments.

- Cerabar S PMC 731:
Capacitive pressure measurement with dry ceramic sensor up to 40 bar (600 psi)
 - resistant to overload and water hammer, vacuum-tight
 - process connections:
Threaded or flush-mounted ceramic sensor
- Cerabar S PMP 731:
– piezoresistive pressure measurement with metal sensor up to 400 bar (6000 psi)
 - process connections thread with flush-mounted metal diaphragm, e.g. for high-viscosity media or internal separating diaphragm

Features and Benefits

- High measurement accuracy
 - Non-linearity 0.1% of set span
 - Long-term drift better than 0.1% per year
 - Temperature effects on zero and span smaller than $\pm 0.1\%$
- Modular construction means less stock
 - Freely adjustable measuring range (max. TD 100:1) without process pressure
 - Simple replacement of process connection or sensor gasket
 - Electronics can be replaced without recalibrating the pressure transmitter
- Simple and easy operation via 4...20 mA, HART protocol or connection to PROFIBUS-PA or Foundation Fieldbus
- Self-monitoring from sensor to electronics

Endress+Hauser

The Power of Know How



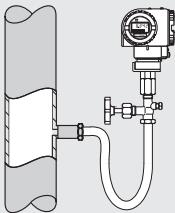
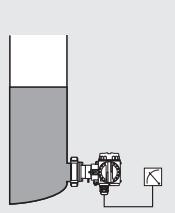
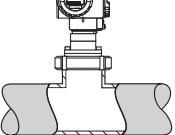
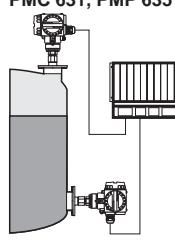
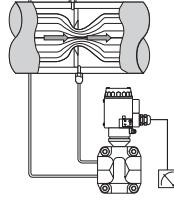
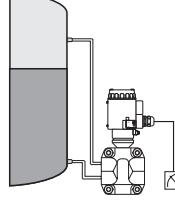
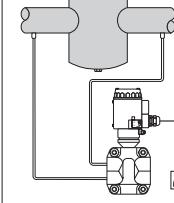
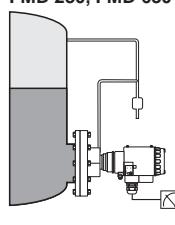
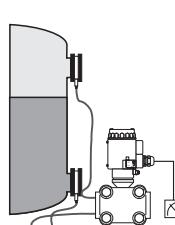
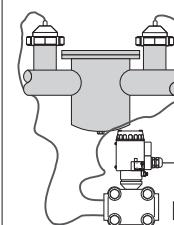
Selecting the Instrument

The Cerabar S is designed as replaceable modules and is based on the same construction principle as its »twin brother« the Deltabar S. This has the following advantages:

- Better stock management and maintenance by stocking modules instead of instruments
- Simple handling using a universal operating principle.

The table below provides a complete summary of the Cerabar S/ Deltabar S families. Further information on instruments:

- grey fields are found in this Technical Information
- white fields are found in Technical Information TI 217P and TI 256P.

	Gauge and absolute pressure	Flow	Level	Differential pressure	Ceramic sensor Gauge pressure – 5 mbar to 40 bar Absolute pressure – from 20 mbar to 40 bar	Metal sensor Gauge and absolute pressure – from 100 mbar to 400 bar
Cerabar S Threaded and flush-mounted process connections	PMC 731, PMP 731 		PMC 731 		PMC 731 including flush-mounted process connections from page 18 	PMP 731 optional flush-mounted diaphragm or internal diaphragm with adapter from page 22 
Diaphragm seal TI 217P	PMC 631, PMP 635 		PMC 631, PMP 635 		PMC 631 	PMP 635 
Deltabar S oval flange TI 256P	PMD 230, PMD 235 	PMD 230, PMD 235 	PMD 230, PMD 235 		PMD 230 metal-free connection also available 	PMD 235 
Flange TI 256P			FMD 230, FMD 630 		FMD 230 flush-mounted ceramic sensor, metal-free connection also available 	FMD 630 metallic diaphragm with optional tube 
Diaphragm seal with capillary extension TI 256P			FMD 633 	FMD 633 		FMD 633 including hygienic applications 

Mechanical Construction

Modularity

The intelligent pressure transmitters from Endress+Hauser

- Cerabar S: gauge/absolute pressure measurement
- Deltabar S: differential pressure, level and flow measurement (see TI 256P)

offer optimum modularity for future product development.

Features include:

- Interchangeable sensor module and process connections
- Interchangeable housing versions
- Universal interchangeable electronics for gauge/absolute and differential pressure
- Simple and uniform operation

Interchangeable Sensor Modules

The sensor modules are fully calibrated for pressure and temperature in the factory. These data are stored in the sensor module. After replacing the sensor module, the data is automatically loaded into the electronics from the calibrated sensor module. The transmitter is then again ready to measure without having to be recalibrated.

Display Module

A display module with the following features can be used for showing measured values and for simplifying local operation:

- Large four-character pressure display with bar graph showing current. For 4...20 mA instruments, the bar graph shows the actual current value and for fieldbus instruments, it displays the relationship between the current measured pressure value and the set measuring range.
- The housing has both an isolated electronics compartment and an isolated connection compartment.

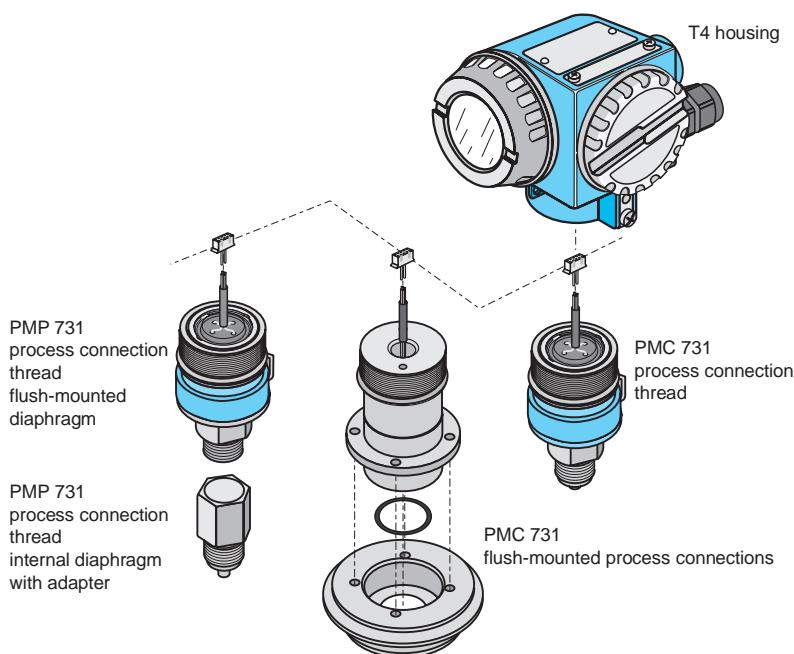
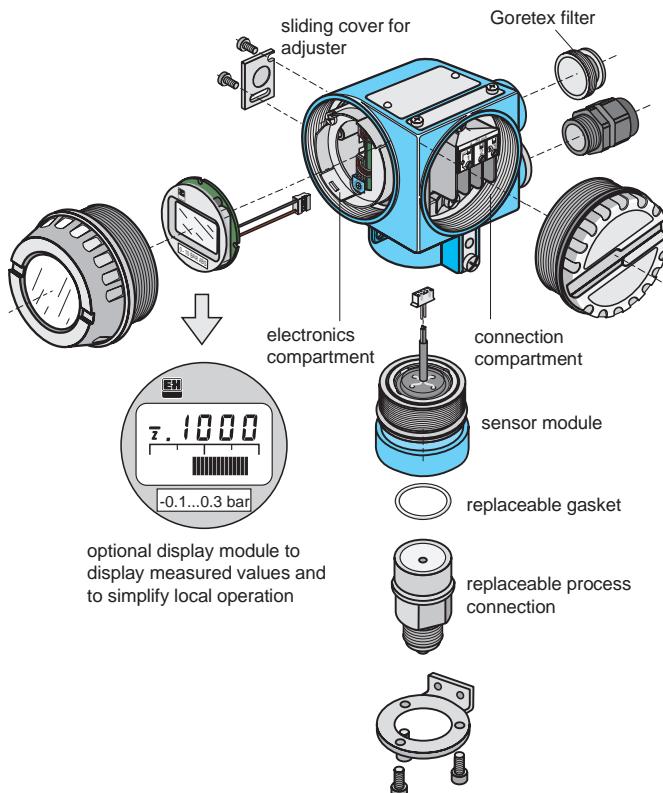
Housings

Housing T4 is used for vertical mounting of the Cerabar S:

- Protection IP 65
- Separate electronics and connection compartments
- Easily accessible operating elements on the outside of the instrument
- Optional M 20x1.5, 1/2 NPT or G 1/2 also PROFIBUS-PA M12 plug, Foundation Fieldbus 7/8" plug or Harting Han7D plug
- Housing can be rotated through 270°

Replaceable Process Connections

- The sensor gasket and process connection of the Cerabar S PMC 731 easily be replaced in just a few simple steps.
- Flush-mounted process connections for hygienic applications are also available for the PMC 731.
- Various thread versions are available for the Cerabar S PMP 731 with flush-mounted or internal separating diaphragm as required. Instruments with flush-mounted diaphragms are recommended for high viscous media.



Measuring System

System Components

The complete measuring system consists of:

- Cerabar S pressure transmitter with
 - 4...20 mA signal output and **HART** communication protocol and
 - power supply, e.g. with the RN 221N transmitter power supply unit from Endress+Hauser
 - Non-Ex: 11.5...45 V DC,
 - Ex d[ia]: 13...30 V DC,
 - Ex ia: 11.5...30 V DC

or

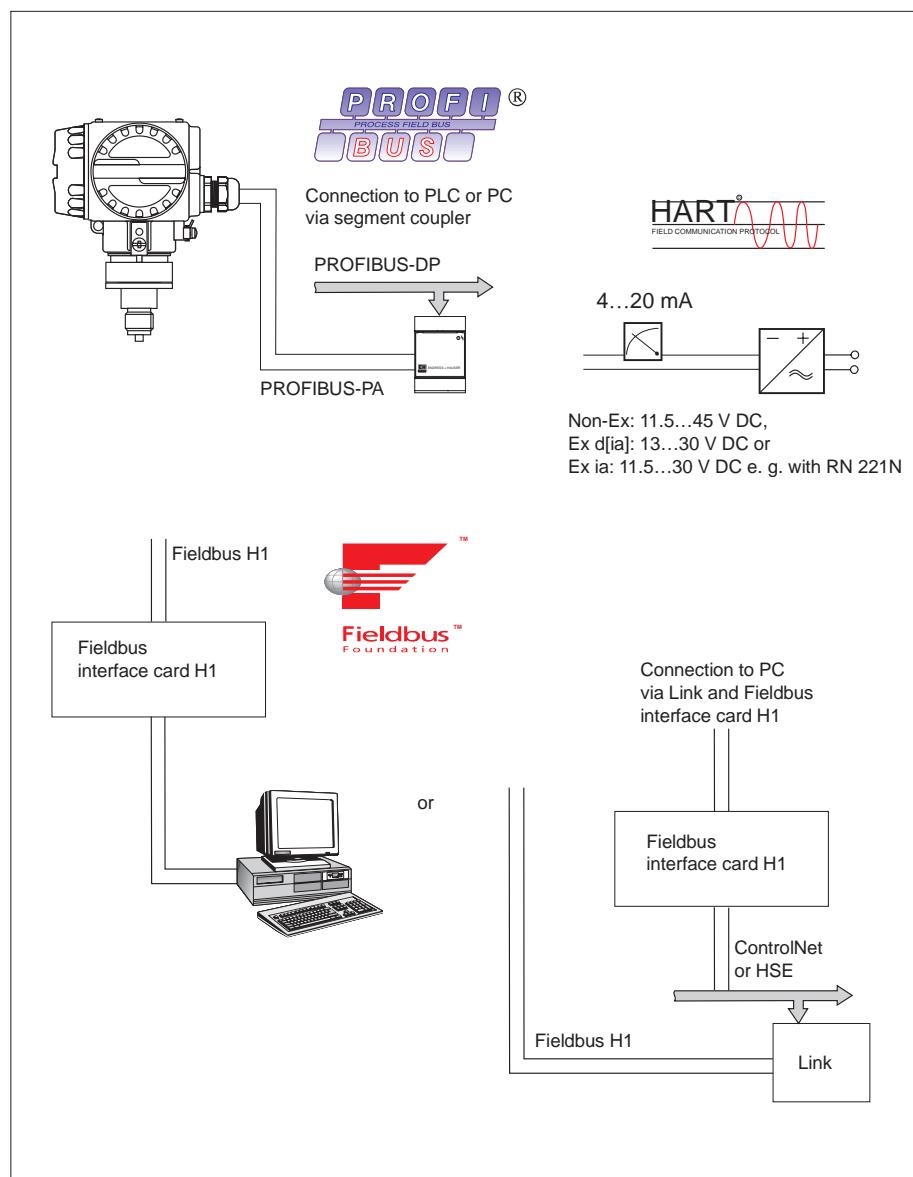
- Cerabar S pressure transmitter with
 - **PROFIBUS-PA** digital communications signal and
 - connection via segment coupler to a PLC or PC using e.g. the Endress+Hauser Commuwin II operating program

or

- Cerabar S pressure transmitter with
 - **Foundation Fieldbus** digital communications signal and
 - Fieldbus interface card H1 or Link and Fieldbus interface card H1 for connecting to a PC with the operating program

Complete measuring system Cerabar S

- left above: PROFIBUS-PA see also Operation page 7
- right above: Current output 4...20 mA with HART communications signal
- below: Foundation Fieldbus see also Operation page 8



Operating Principle

Ceramic Sensor

The ceramic sensor is a dry sensor with the process pressure acting directly on the rugged ceramic diaphragm and deflecting it by a maximum of 0.025 mm. A pressure-proportional change in the capacitance is measured by the electrodes on the ceramic substrate and diaphragm. The measuring range is determined by the thickness of the ceramic diaphragm.

Advantages:

- Guaranteed resistance to overload up to 40-times nominal pressure
- Extremely high chemical resistance, comparable to Hastelloy
- For use with vacuums

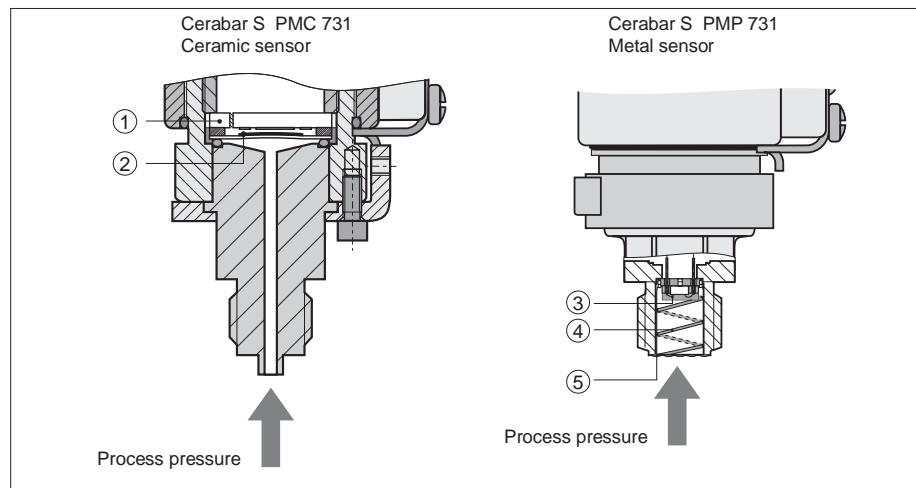
Metal Sensor

The process pressure deflects the separating diaphragm with a filling liquid transmitting the pressure to a resistance bridge. The bridge output voltage, which is proportional to pressure, is then measured and processed.

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)

The pressure sensors:
① ceramic substrate
② ceramic diaphragm
③ polysilicon measuring element
④ channel with filling fluid
⑤ welded metal flush-mounted separating diaphragm



Operation

The Cerabar S can be operated in the following ways:

- Using the four keys on the instrument directly at the mounting point for calibrating zero point and span at the touch of a button.
- or
- Operating remotely using the digital HART data protocols
 - e.g. via Commubox FXA 191 and a PC with the Endress+Hauser Commuwin II operating program or
 - using the Universal HART communicator DXR 275 handheld terminal

or

- Using segment couplers to connect the intrinsically-safe PROFIBUS-PA and PROFIBUS-DP fieldbus and operating the instrument via PC and Commuwin II operating program
- or
- Using interface card H1 or via Link and interface card H1 for connecting the intrinsically safe Foundation Fieldbus and for operating via PC and operating program.

Operation Using the Universal HART Communicator DXR 275

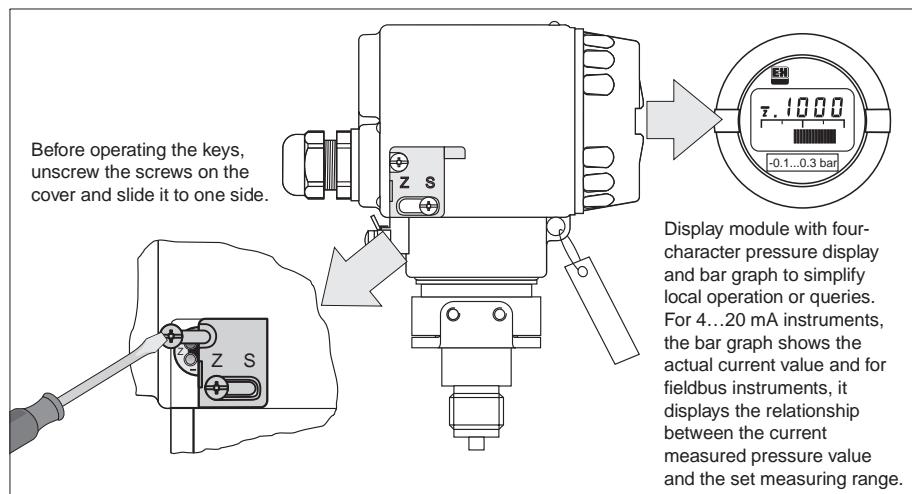
There are two possibilities for scaling the 4...20 mA output: either by directly applying the appropriate line pressures or by entering the desired range-end values via the display module.

- ZERO: +Z and -Z
- SPAN: +S and -S

A zero point shift due to the orientation of the instrument (bias pressure) can also be corrected using these keys as well as for locking and unlocking the measuring point.

Operating with keys

When operating with keys, screw the cover down securely with both screws after operation.

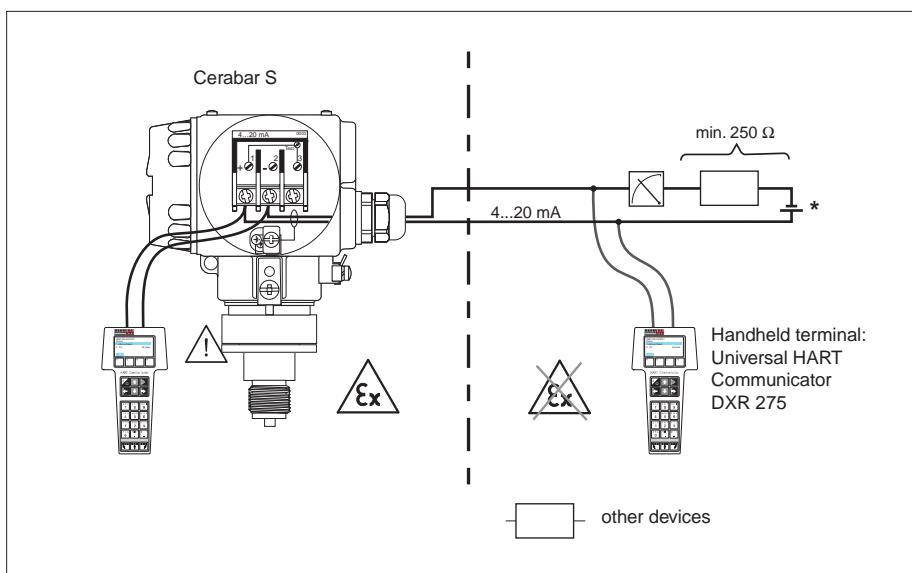


Handheld Terminal

The Hart Communication DXR 275 can be connected at any point along the 4...20 mA line to check, configure and read additional information (operating matrix, see page 7).

The HART Communicator DXR 275 can be connected anywhere along the 4...20 mA line.

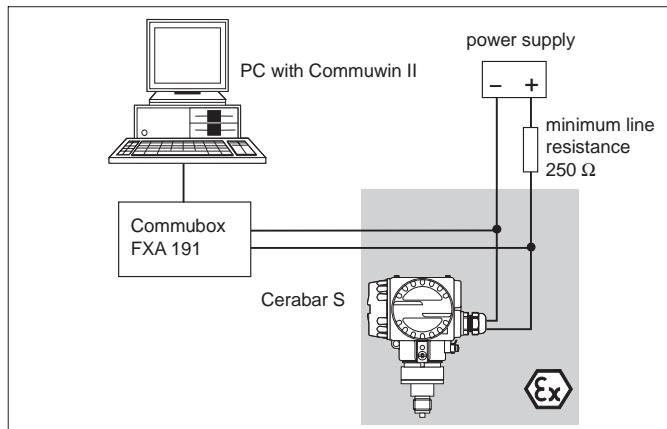
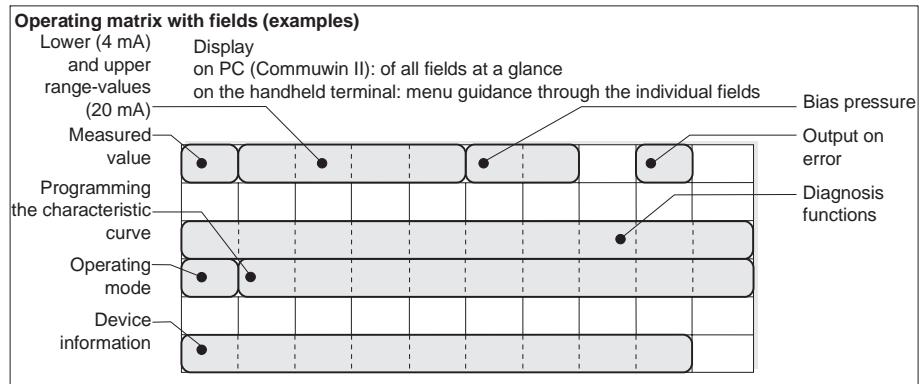
* Use an intrinsically safe power supply for Ex i (z. B. FXN 671, RN 221N).



Operation Using the Matrix

All operations and functions are identical whether the Cerabar S is calibrated using a process bus and PC or a handheld terminal.

All information can easily be accessed using the operating matrix. Calibration is just as easy.



The Commubox can be connected anywhere along the 4...20 mA line.

Operation Using the Commubox FXA 191

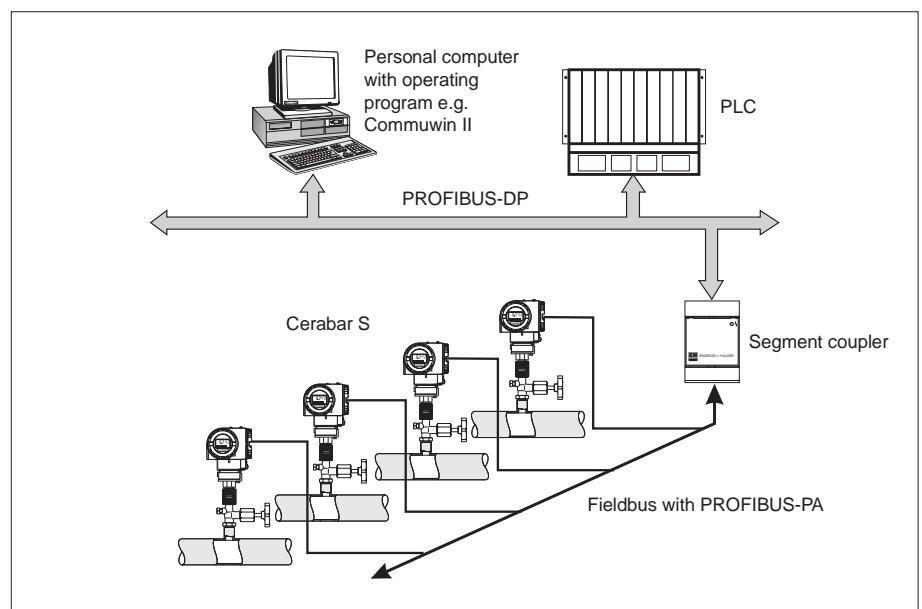
The Commubox FXA 191 connects 4...20 mA Smart transmitters that has a HART protocol to the RS 232 C serial interface of a personal computer. This enables the transmitter to be remotely operated with the Endress+Hauser Commuwin II operating program. Commuwin II shows, for example, the operating matrix above for easy programming of the transmitter. The Commubox FXA 191 is used for intrinsically safe signal circuits.

Connecting to PROFIBUS-PA

PROFIBUS-PA is an open fieldbus standard to enable several sensors and actuators, including those in explosion-hazardous areas, to be connected to a 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 EEx ia applications
- up to 32 for non-Ex applications



Cerabar S with PROFIBUS-PA

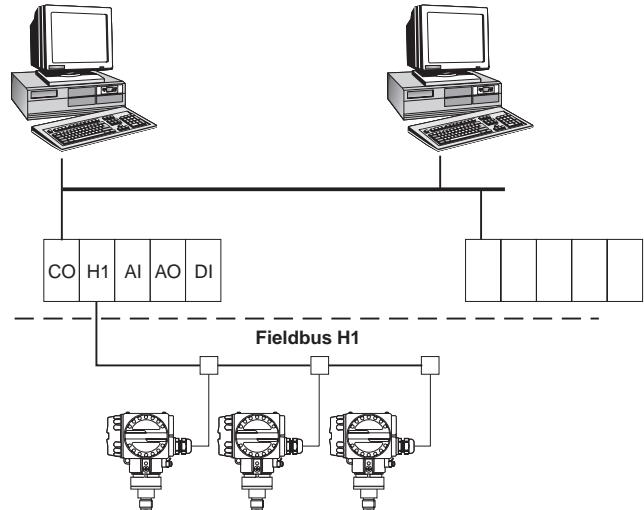
Connecting to Foundation Fieldbus

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

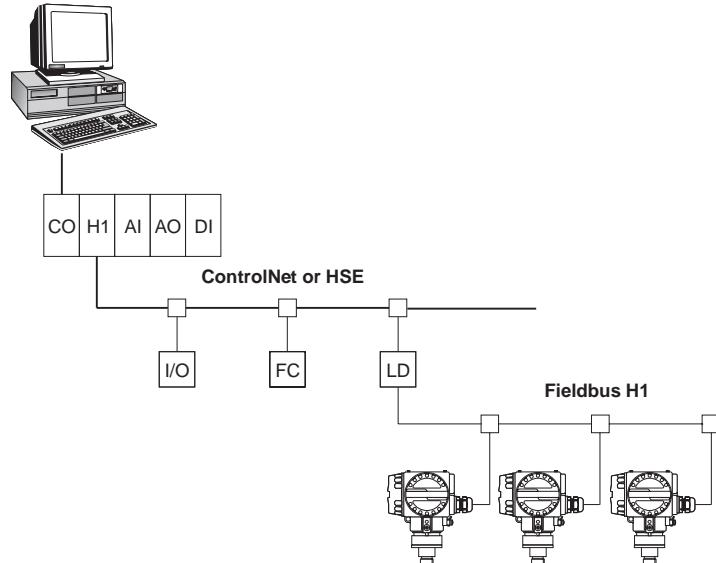
The following instruments can be operated via an interface card or via Link and an interface card:

- up to 10 instruments for Ex ia applications
- up to 32 instruments for Non-Ex applications

Direct connection via Fieldbus interface card H1



Connection via Link and Fieldbus interface card H1



Cerabar S with Foundation Fieldbus
CO: Controller
H1: H1 interface
CN: ControlNet
AI: Analogue Input
AO: Analogue Output
DI: Digital Input
I/O: Input/Output
FC: Frequency converter
LD: Link

Installation

Mounting Instructions

The Cerabar S is mounted in the same way as a manometer. Its position depends upon the application:

- **Gases:**

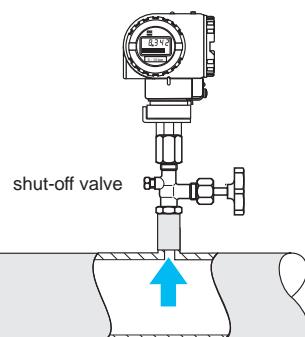
Mount above the tapping point

- **Liquids:**

Mount below or at the same level as the tapping point

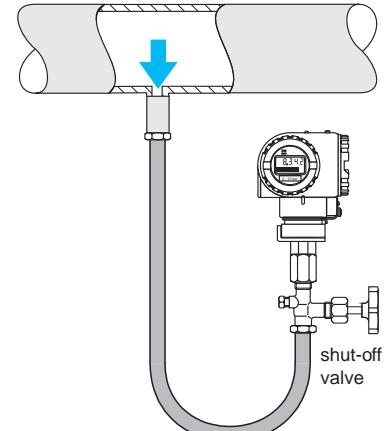
Gases

Mount above the tapping point



Liquids

Mount below the tapping point

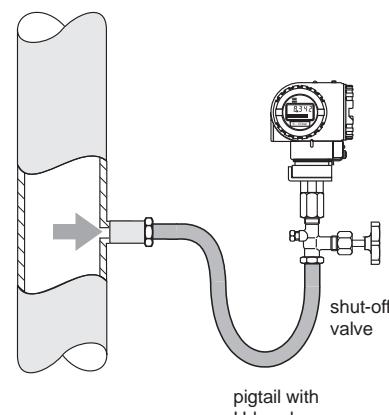


- **Steam/vapour:**

Mount with a pigtail below the tapping point

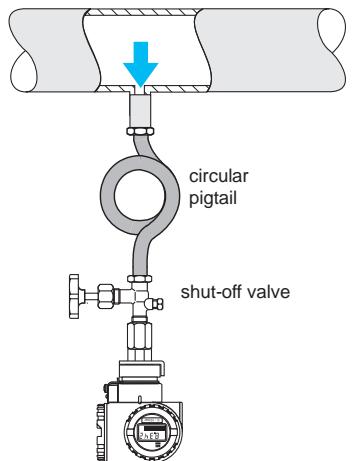
Steam/vapour

Mounted with pigtail with U-bend



Steam/vapour

Mounted with circular pigtail

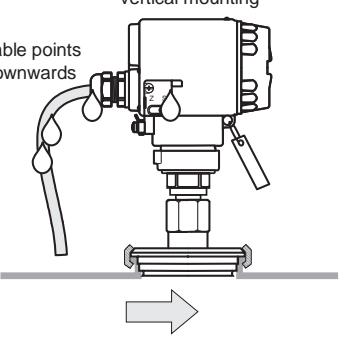


To protect against moisture:

- The cable entry should preferably be pointing downwards.
- The cover of the Z/S keys is on the side of the housing.

vertical mounting

cable points downwards

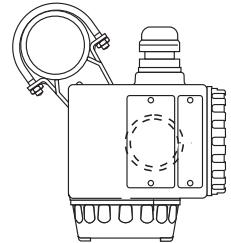
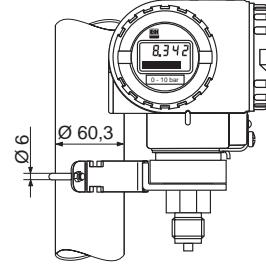


Installation (Continuation)

Wall and Pipe Mounting

A mounting set is available for mounting on a wall or a horizontal or vertical pipe.

- Material: 1.4301 (AISI 304)
- Order No: 919806-0000
- (can also be selected in the Product Structure)



Mounting on a horizontal pipe

PMC 731	19 mm
PMP 731 flush-mounted diaphragm	14 mm
PMP 731 internal diaphragm	39 mm

Mounting on a wall

PMC 731	19 mm
PMP 731 flush-mounted diaphragm	14 mm
PMP 731 internal diaphragm	39 mm

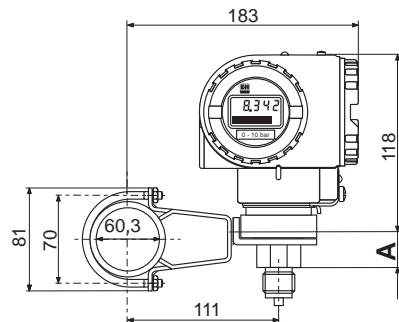
Conversion factors

1 in = 25.4 mm

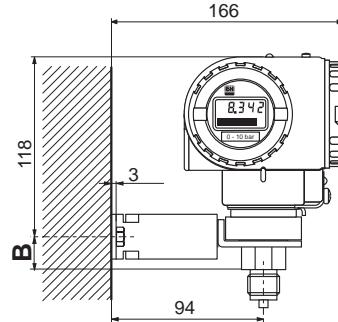
1 mm = 0.039 in

Dimensions are in mm.

Mounting on a horizontal pipe



Mounting on a wall



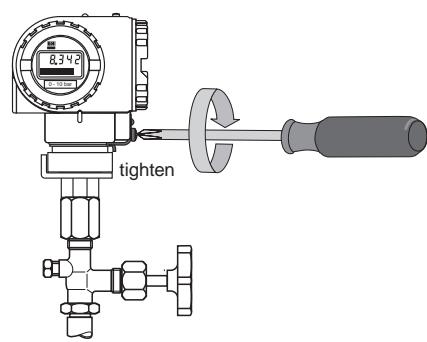
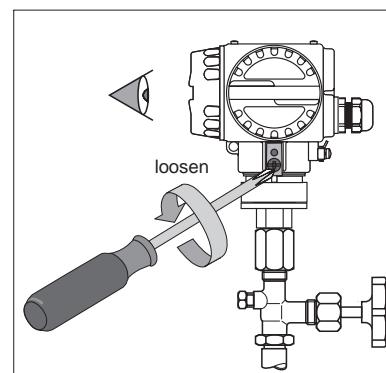
Rotating the Housing

By simply unscrewing the holding screw, the housing can be rotated max. 270° and still remain above the process connection, even when an instrument is plugged in.

Cleaning

The metal separating diaphragm of the Cerabar S PMP 731 must not be pressed in or cleaned with pointed or hard objects.

Loosen the screw underneath the connection compartment to rotate the housing.



Electrical Connection

Wiring 4...20 mA

The two-wire cable is connected to screw terminals (wire cross section 0.5...2.5 mm²/ AWG 20...13) in the connecting compartment.

- For the connecting line, we recommend you use a twisted, screened two-core cable.
- Supply voltage:
 - Non-Ex: 11.5...45 V DC
 - Ex d[ia]: 13...30 V DC
 - Ex ia: 11.5...30 V DC
- Internal protection circuits against reverse polarity, HF interference and overvoltage peaks (see Technical Information TI 241F "EMC Guidelines").
- Test signal:

The output current can be measured between terminal 1 and 3 without interrupting the process measurement.

Wiring PROFIBUS-PA

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

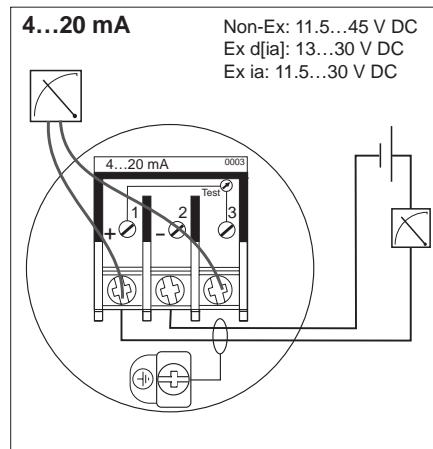
- Supply voltage:
 - Non-Ex: 9...32 V DC
 - Ex ia: 9...24 V DC

• Bus cable:

For the connecting line, we recommend you use a twisted, screened two-core 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...20 nF/km

Instructions on connecting and grounding the network are given in BA 198F "Project Instructions for PROFIBUS-PA" as well as PROFIBUS-PA specifications.



Electrical connection:
Cerabar S for all versions with 4...20 mA

Wiring Foundation Fieldbus

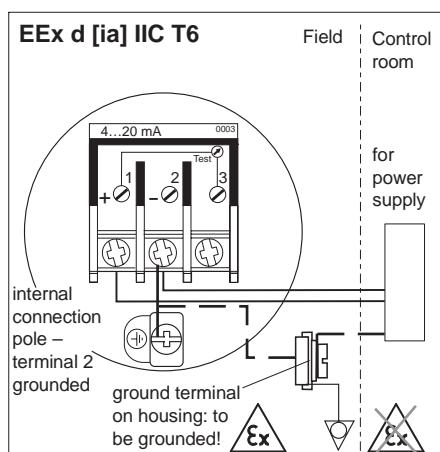
The digital communication signal is transmitted to the bus using a two-wire connecting cable. The bus cable also carries the power supply.

- Supply voltage:
 - Non-Ex: 9...32 V DC
 - Ex ia: 9...24 V DC
 - Ex d: 9...32 V DC

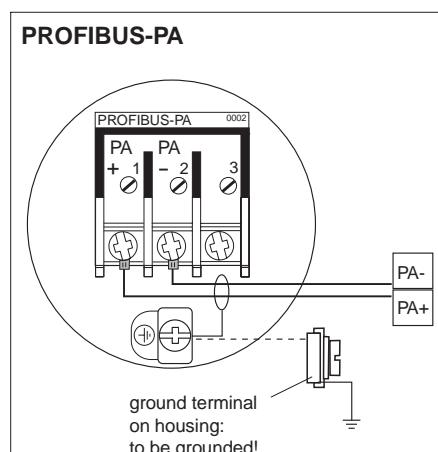
• Bus cable:

For the connecting line, we recommend you use a twisted, screened two-core cable. Further information on the type of cabling to be used can be found in the FF specification or in IEC 61158-2.

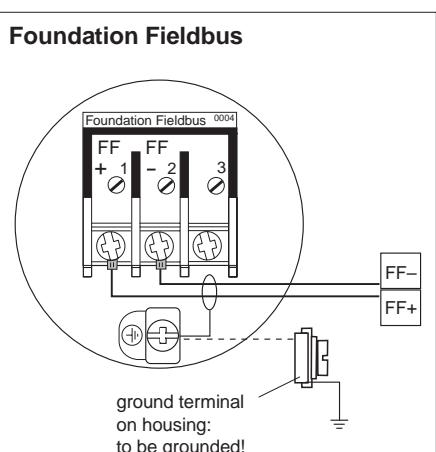
Further information on connecting and grounding the network is given at the Internet address "<http://www.fieldbus.org>".



Electrical connection:
Cerabar S for version with flameproof enclosure
PMC 731 - I □ □ □ □ □ □



Electrical connection:
Cerabar S for all versions with PROFIBUS-PA
(Reversed polarity has no effect on function.)



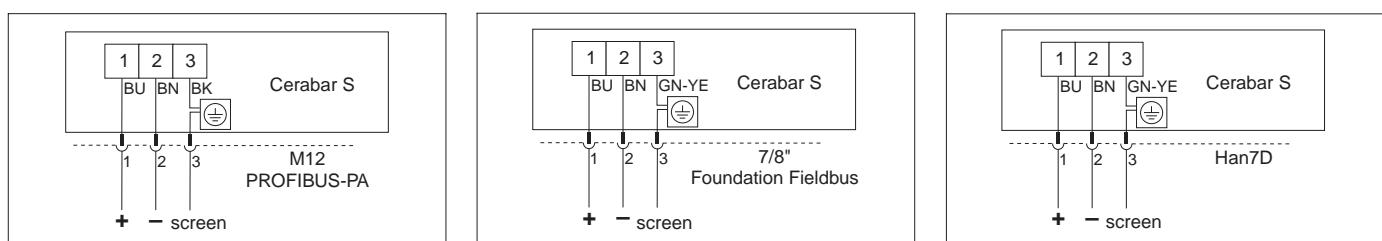
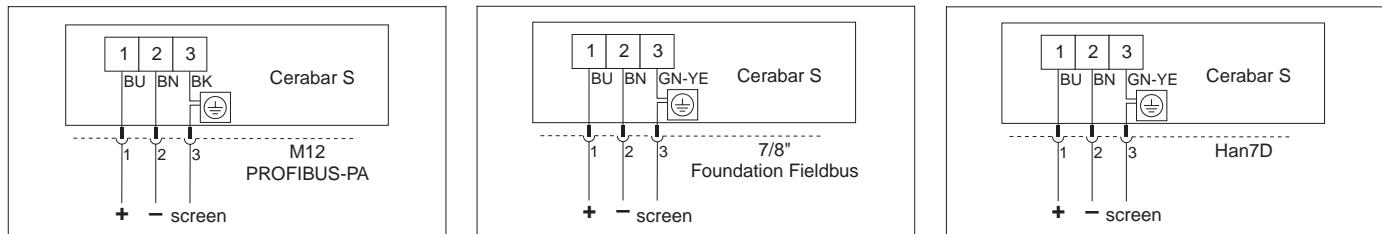
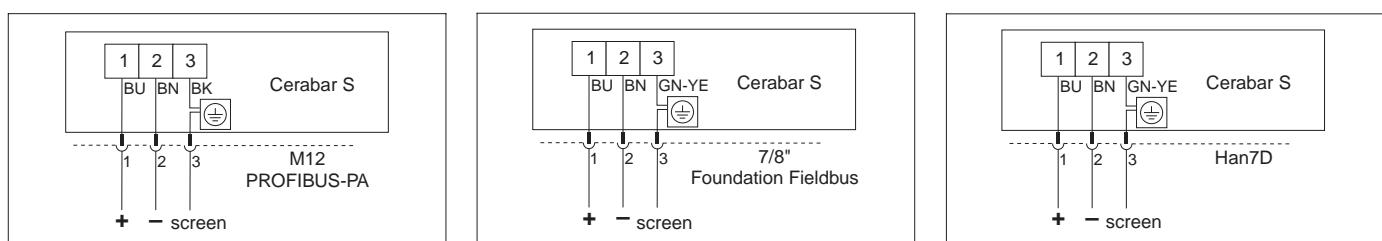
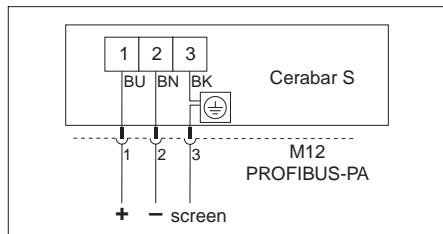
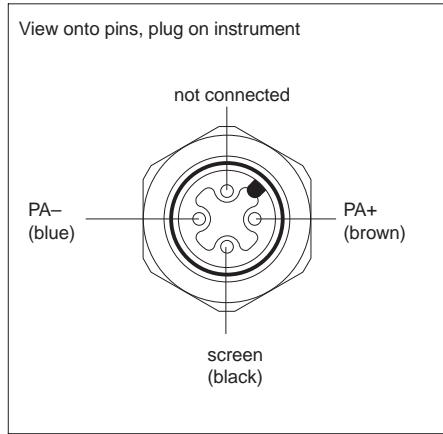
Electrical connection:
Cerabar S for all versions with Foundation Fieldbus
(Reversed polarity has no effect on function.)

Connection M12 Plug (PROFIBUS-PA)

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

Versions:

- PM □ 731 – □ M □□□□□□□□□
- PM □ 731 – □ N □□□□□□□□□
- PM □ 731 – □ U □□□□□□□□□



Connection Harting Plug

For applications in power stations, there is a Cerabar S with a Harting Han7D plug.

Versions:

- PM □ 731 – □ L □□□□□□□□□
- PM □ 731 – □ K □□□□□□□□□

Technical Data

General Information	Manufacturer	Endress+Hauser
	Instrument	Pressure transmitter
	Designation	Cerabar S PMC 731, PMP 731
	Technical documentation Version Technical data	TI 216P/00/en 08.02 according to DIN 19259

Application	Measurement of absolute and gauge pressure in gases, vapours and liquids
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Operation and System Design	Measuring Principle	
	PMC 731 with ceramic sensor	The pressure causes a slight deflection of the ceramic diaphragm of the sensor. The change in capacitance is proportional to the pressure and is measured by the electrodes of the ceramic sensor. Volume of chamber: approx. 2 mm ³ (0.078 in ³)
	PMP 731 with metal sensor	The process pressure acting on the metallic separating diaphragm of the sensor is transmitted via a filling fluid to a resistance bridge. The change in the output voltage of the bridge is proportional to the pressure and is then measured. Volume of chamber: approx. 1 mm ³ (0.039 in ³)
	with 4...20 mA current output	Cerabar S and power supply, e.g. via the RN 221N transmitter power pack and operation via: – four keys on the instrument and a plug-in display module – Universal HART Communicator DXR 275 handheld terminal – PC with Commuwin II operating program via Commubox FXA 191
	with PROFIBUS-PA	Connection via segment coupler to PLC or PC, e.g. with Commuwin II operating program
	with Foundation Fieldbus	Via interface card H1 direct connection to PC with operating program or via Link and interface card H1 connection to PC with operating program

Input	Measured variables	Absolute and gauge pressure
	Construction	Threaded process connection according to European, American or Japanese standards or flush-mounted see »Product Structure« and »Mechanical Construction«
	Signal transmission	– HART, 4...20 mA analogue signal, 2-wire – PROFIBUS-PA: digital communication signal, 2-wire – Foundation Fieldbus: digital communication signal, 2-wire

PMC 731							
Type of pressure	Measurement limits	Nominal value	Recommended min. span	Overload	Resistance to low pressure	Order code	
	bar	bar	bar	bar	bar absolut		
gauge	-0.1...0.1	0.1	0.005	4	0.7	1C	
gauge	-0.4...0.4	0.4	0.02	10	0	1F	
gauge	-1.0...2	2	0.1	20	0	1K	
gauge	-1.0...10	10	0.5	40*	0	1P	
gauge	-1.0...40	40	2	62	0	1S	
absolute	0...0.4	0.4	0.02	10	0	2F	
absolute	0...2	2	0.1	20	0	2K	
absolute	0...10	10	0.5	40*	0	2P	
absolute	0...40	40	2	62	0	2S	

* for PVDF-Connection max. 20 bar

PMP 731						
Type of pressure	Measurement limits bar	Nominal value bar	Recommended min. span bar	Overload bar	Resistance to low pressure mbar absolut	Order code
						3H
Gauge	-1...1	1*	0.05	4	10	
Gauge	-1...2.5	2.5	0.125	10	10	3L
Gauge	-1...10	10	0.5	40	10	3P
Gauge	-1...40	40**	2	160	10	3S
Gauge	-1...100	100**	5	400	10	3U
Gauge	-1...400	400**	20	600	10	3Z
Absolute	0...1	1*	0.05	4	10	4H
Absolute	0...2.5	2.5	0.125	10	10	4L
Absolute	0...10	10	0.5	40	10	4P
Absolute	0...40	40	2	160	10	4S
Absolute	0...100	100	5	400	10	4U
Absolute	0...400	400	20	600	10	4Z

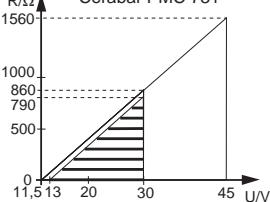
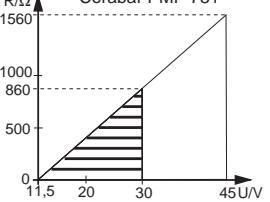
* Technical data for linearity and temperature effect are doubled.

** Absolute pressure sensors

Adjusting the span (turndown)	100:1
Zero point increase and decrease	Within measurement limits

Output signal

4...20 mA with HART protocol

Output signal	4...20 mA with superimposed communication signal for HART protocol
Load	
	
Signal on alarm for electronic Order code "M"	Standard: ≥ 21.5 mA Optionen: max: setting in the range 21...22.5 mA continue: last measured value held min: ≤ 3.6 mA
Resolution	1 μ A
Damping (Integration time)	0 to 16 s in steps via rotary switch on the instrument, 0 to 40 s infinitely adjustable with handheld terminal or PC
Communication resistance	min. 250 Ω

PROFIBUS-PA

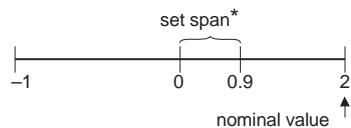
Output signal	Digital communication signal PROFIBUS-PA
PA function	Slave
Transmission rate	31.25 kBit/s
Response time	Slave: ca. 20 ms SPS: 300...600 ms (depending on system coupler) for approx. 30 transmitters
Signal on alarm	Signal: Status bit set, last measured value will be held, Display module: Error code
Communication resistance	PROFIBUS-PA termination resistor
Physical layer	IEC 1158-2

Foundation Fieldbus

Output signal	Digital communication signal, Foundation Fieldbus protocol
Foundation Fieldbus function	Publisher-Subscriber
Transmission rate	31.25 kBit/s
Signal on alarm	Signal: Status bit set, last measured value will be held, Display module: Error code
Communication resistance	Foundation Fieldbus termination resistor
Physical layer	IEC 1158-2

Accuracy

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



Example: nominal value* = 2 bar
set span = 0.9 bar
TD = 2:0.9

* for fieldbus variants, the data relates to the "calibrated span"

Reference conditions	DIN IEC 770 Tu=25°C (77°F) Accuracy data adopted after entering »Low sensor calibration« and »High sensor calibration« for zero and nominal value
Linearity including hysteresis and reproducibility based on the limit point method to IEC 770	to TD 10:1: $\pm 0.1\%$ of set span* for TD 10:1 to 20:1: $\pm 0.1\% \times [\text{nominal value}/(\text{set span}^* \times 10)]$ of set span*
Linearity at low absolute pressure ranges (due to performance limits of currently available DKD calibration rigs)	absolut: for > 30 mbar to < 100 mbar: $\pm 0.3\%$ for ≤ 30 mbar: $\pm 1\%$ of set span*
Response time	PMC 731: 500 ms, PMP 731: 400 ms
Warm-up time	2 s
Rise time (T ₉₀ -time)	150 ms
Long-term drift	$\pm 0.1\%$ of nominal value per year $\pm 0.25\%$ of nominal value per 5 years
Thermal effects (with reference to the set span*, max. TD 20:1)	for $-10 \dots +60^\circ\text{C}$ ($+14 \dots +140^\circ\text{F}$): $\pm (0.1\% \times \text{TD} + 0.1\%)$ for $-40 \dots -10^\circ\text{C}$ ($-40 \dots +14^\circ\text{F}$) and $+60 \dots +85^\circ\text{C}$ ($+140 \dots +185^\circ\text{F}$): $\pm (0.2\% \times \text{TD} + 0.2\%)$ TD = nominal value/set span*
Thermal effect for Cerabar S with PTFE gasket (PMC 731 - # # # # # # # D, max. TD 20:1)	for $-20 \dots +85^\circ\text{C}$ ($-4 \dots +185^\circ\text{F}$): $\pm (0.2\% \times \text{TD} + 0.4\%)$: 0.1 bar $\pm (0.2\% \times \text{TD} + 0.2\%)$: 0.4 bar; 2 bar $\pm (0.1\% \times \text{TD} + 0.1\%)$: 10 bar; 40 bar
Temperature coefficient (maximum TK) (If the temperature coefficient level exceeds the thermal effects, then the thermal change automatically becomes valid.)	For zero signal and span: $\pm 0.02\%$ of nominal value/10K for $-10 \dots +60^\circ\text{C}$ ($+14 \dots +140^\circ\text{F}$); $\pm 0.05\%$ of nominal value/10K for $-40 \dots -10^\circ\text{C}$ ($-40 \dots +14^\circ\text{F}$) and $+60 \dots +85^\circ\text{C}$ ($+140 \dots +185^\circ\text{F}$)
Temperature coefficient for Cerabar S with PTFE gasket (PMC 731 - # # # # # # # D)	For zero signal and span: $\pm 0.05\%$ of nominal value/10K for $-20 \dots +85^\circ\text{C}$ ($-4 \dots +185^\circ\text{F}$)
Vibration effects	None (4 mm in path peak-to-peak 5...15 Hz, 2 g: 15...150 Hz, 1 g: 150 Hz...2000 Hz)

Application conditions

Installation conditions

Position for calibration ① PMC 731, PMP 731 ② PMP 731 (100 bar and 400 bar sensors only) ③ PMC 731 (ceramic sensor flush-mounted)	
Installation conditions	Any position, zero point shift due to position can be corrected, no effect on span

Ambient conditions

Ambient temperature	$-40 \dots +85^\circ\text{C}$ ($-40 \dots +185^\circ\text{F}$) (for Ex see Safety Instructions XA...)
Ambient temperature range	$-40 \dots +100^\circ\text{C}$ ($-40 \dots +212^\circ\text{F}$) (for Ex see Safety Instructions XA...)
Storage temperature	$-40 \dots +100^\circ\text{C}$ ($-40 \dots +212^\circ\text{F}$)
Climatic class	4K4H to DIN EN 60721-3
Protection	IP 65 (IP 68 on request)
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); Interference Immunity to EN 61 000-4-3: 30 V/m

Process conditions

Process temperature (Please also note the temperature limits of the gasket used, see tables on next page)	$-40 \dots +100^\circ\text{C}$ ($-40 \dots +212^\circ\text{F}$) (for Ex see Safety Instructions XA...)
Material temperature	Cleaning temperature for Cerabar S flush-mounted with ceramic sensor: $+140^\circ\text{C}$ ($+284^\circ\text{F}$) up to 60 minutes
Process pressure	Corresponds to permissible overload, see tables on pages 13...14

Mechanical Construction

Gaskets for PMC 731		Temperature limits
1	FPM, Viton	-20...+100°C (-4...+212°F)
6	FPM, Viton cleaned for oxygen service Compound V70G3	-10...+60°C (+14...+140°F)
A	FPM, Viton oil- and grease-free Compound V70G3	-10...+100°C (+14...+212°F)
2	NBR Compound 8307	-20...+100°C (-4...+212°F)
7	FFKM, Kalrez Compound 4079	+5...+100°C (+41...+212°F)
4	EPDM Compound EPDM 13-70	-30...+100°C ¹⁾ (-40...+212°F)
D	PTFE+ Hastelloy C4	-20...+85°C (-4...+185°F)
	For constructive reasons can only be exchanged for the same gasket.	
C	Chemraz Compound Chemraz 505	-10...+100°C (+14...+212°F)

Design

Housing	Housing can be rotated, Separated electronics and connection compartments, Optional electrical connection via M 20 x 1.5 with cable gland or G 1/2, 1/2 NPT thread, also via PROFIBUS-PA M12 plug or Foundation Fieldbus 7/8" or Harting Han7D plug Terminal connection for wire cross section 0.5...2.5 mm ² (AWG 20...13)
Process connections	Weight: - Aluminium housing with process connection G 1/2: 1.3 kg - Stainless steel housing with process connection G 1/2: 2.9 kg All common thread versions and flush-mounted connections

Materials

Housing		- Cast aluminium housing with protective polyester-based powder coating RAL 5012 (blue), cover RAL 7035 (grey), saltwater spray test DIN 50021 (504 h) passed - Stainless steel 1.4435 (AISI 316L)
Nameplates		1.4301 (AISI 304)
Process connections	PMC 731 PMP 731	1.4435 (AISI 316L) or Hastelloy 2.4819 (C276) or PVDF ²⁾ 1.4435 (AISI 316L) or Hastelloy 2.4819 with Hastelloy diaphragm
Process diaphragm	PMC 731 PMP 731	Al ₂ O ₃ Aluminium oxide ceramic 1.4435 (AISI 316L) or Hastelloy 2.4819 (C276)
Gaskets	PMC 731 PMP 731	FPM Viton, FPM Viton cleaned for oxygen service ³⁾ , FPM Viton oil and grease-free, NBR, Kalrez, EPDM, PTFE+Hastelloy C4, Chemraz (see table on left side "gaskets for PMC 731") FPM Viton, PTFE+Hastelloy C4, Copper (see table on left side "gaskets for PMP 731")
O-ring for cover gasket		NBR
Mounting accessories		Bracket for pipe and wall mounting 1.4301

Measuring cell

PMC 731 PMP 731	- without filling fluid, dry cell sensor - filling fluid optional silicone oil or inert oil (Voltalef 1A) cleaned for oxygen service ²⁾
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Display and Operating Interface

Display and operating module

Display	Pluggable digital display and extra bar graph (28 segments) (Pressure display as four-digit number and also in relating to set measuring range as bar graph).
Display resolution	Digital display: 0.1% Bar graph: 1 segment equals 3.57 % of the set span
Operation	Four keys on the instrument

Communication interfaces

Gaskets for PMP 731		Temperature limits
1, 2, 4	FPM, Viton Compound YR859-V80G	-20...+100°C (-4...+212°F)
6	Copper	-40...+100°C (-40...+212°F)
P	PTFE+ Hastelloy C4	-20...+85°C (-4...+185°F)
	For constructive reasons can only be exchanged for the same gasket.	

Handheld terminal	- HART: Universal HART Communicator DXR 275 - for connecting anywhere along the 4...20 mA line - minimum line resistance: 250 Ω
PC for operating with the Commuwin II operating program	- Commubox FXA 191 for connecting to serial interface of a PC - for connecting anywhere along the 4...20 mA line - minimum line resistance: 250 Ω
PROFIBUS-PA	Segment coupler for connecting to PLC or PC, e.g. with the Commuwin II operating program
Foundation Fieldbus	Via interface card H1 direct connection to PC with operating program or via Link and interface card H1 connection to PC with operating program.

1) Gaskets for lower temperatures on request.

2) Note the Safety Instructions (XA) and electrostatic charging when using a PVDF process connection.

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

4...20 mA with HART protocol

Power Supply

Power voltage	<ul style="list-style-type: none"> - Non-Ex: 11.5...45 V DC - Ex d[ia]: 13...30 V DC - Ex ia: 11.5...30 V DC
Overvoltage category	III to DIN EN 61 010-1
Ripple	No effect for 4...20 mA signal up to $\pm 5\%$ residual ripple within permissible range
Ripple with Smart transmitters	HART: max. ripple (measured at 500Ω) 47...125 Hz: $U_{ss}=200$ mV; max. noise (measured at 500Ω) 500 Hz...10 kHz: $U_{eff}=2.2$ mV

PROFIBUS-PA

Power voltage	<ul style="list-style-type: none"> - Non-Ex: 9...32 V DC - Ex ia: 9...24 V DC
Current consumption	$10 \text{ mA} \pm 1 \text{ mA}$ (for Ex see Safety Instructions XA...)
Power up current	Corresponds to Table 4, IEC 1158-2

Foundation Fieldbus

Power voltage	<ul style="list-style-type: none"> - Non Ex: 9...32 V DC - Ex ia: 9...24 V DC
Current consumption	$11 \text{ mA} \pm 1 \text{ mA}$
Power up current	Corresponds to Table 4, IEC 1158-2

Certificates and Approvals

Protection	see »Product Structure«
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 S/Deltabar S System Information: SI 020P/00/en Cerabar S with diaphragm seal versions for all applications Technical Information: TI 217P/00/en Cerabar S HART Operating Instructions: BA 187P/00/en Cerabar S PROFIBUS-PA Operating Instructions: BA 168P/00/en Cerabar S Foundation Fieldbus Operating Instructions: BA 211P/00/en PROFIBUS-DP/PA Guidelines for planning and commissioning: BA 198F/00/en CE Ex II 1/2 G, EEx ia IIC T4/T6 Safety Instructions: XA 001P/00 CE Ex II 1/2 G or 2 G, EEx ia IIC T4/T6, PROFIBUS-PA Safety Instructions: XA 004P/00 CE Ex II 2 G, EEx d IIC T5/T6 Safety Instructions: XA 022P/00 CE Ex II 2 G, EEx d[ia] IIC T6 Safety Instructions: XA 053P/00 CE Ex II 1/2 G, EEx ia IIC T4/T6, Foundation Fieldbus Safety Instructions: XA 088P/00 CE Ex II 2 G, EEx d IIC T5/T6, Foundation Fieldbus Safety Instructions: XA 090P/00 CE Ex II 3 G, EEx nA II T6 Safety Instructions: XA 150P/00 EMC Test procedures Technical Information: TI 241F/00/en

Product Structure

PMC 731

Cerabar S PMC 731

Certificates, Approvals, Protection

- R Standard
- C ATEX II 3 G, EEx nA II T6
- G Cenelec EEx ia IIC T4/T6 and ATEX II 1/2 G
- I Cenelec EEx d [ia] IIC T61 and ATEX II 2 G (not with flush-mounted process connections, with cable entry M 20x1.5, G 1/2, 1/2 NPT)
- O FM IS (non-incendive) CL. I, II, III; Div. 1, Groups A...G¹⁾
- S CSA IS (non-incendive) CL. I, II, III; Div. 1, Groups A...G¹⁾

¹⁾ Certificate not with electronics version
PROFIBUS-PA

Housing: Aluminium

with display module		without display module	
3	Cable gland M 20x1.5	4	Cable gland M 20x1.5
5	Cable entry 1/2 NPT	6	Cable entry 1/2 NPT
7	Cable entry G 1/2	8	Cable entry G 1/2
K	Harting Han7D plug	L	Harting Han7D plug
M	PROFIBUS-PA plug M12	N	PROFIBUS-PA plug M12
P	Foundation Fieldbus plug 7/8"	Q	Foundation Fieldbus plug 7/8"

Housing: Stainless steel (AISI 316L)

with display module	
R	Cable gland M 20x1.5
S	Cable entry 1/2 NPT
T	Cable entry G 1/2
U	PROFIBUS-PA plug M12
V	Foundation Fieldbus plug 7/8"

Ceramic Sensor: Nominal Value (Maximum Overload)

Limits (see table measuring range PMC 731, page 13)

Sensors for gauge pressure

1C	100 mbar (4 bar)	10 kPa (0.4 MPa)	1.5 psig (60 psig)	40 inch H ₂ O (60 psig)
1F	400 mbar (10 bar)	40 kPa (1.0 MPa)	6 psig (150 psig)	150 inch H ₂ O (150 psig)
1K	2 bar (20 bar)	200 kPa (2.0 MPa)	30 psig (300 psig)	800 inch H ₂ O (300 psig)
1P	10 bar (40 bar)	1 MPa (4.0 MPa)	150 psig (600 psig)	
1S	40 bar (60 bar)	4 MPa (6.0 MPa)	600 psig (900 psig)	

Sensors for absolute pressure

2F	400 mbar (10 bar)	40 kPa (1.0 MPa)	6 psia (150 psia)	
2K	2 bar (20 bar)	200 kPa (2.0 MPa)	30 psia (300 psia)	
2P	10 bar (40 bar)	1 MPa (4.0 MPa)	150 psia (600 psia)	
2S	40 bar (60 bar)	4 MPa (6.0 MPa)	600 psia (900 psia)	

Calibration and Technical Units

- 1 Calibrated from 0 to nominal value in mbar/bar
- 3 Calibrated from 0 to nominal value in mm H₂O/m H₂O
- 5 Calibrated from 0 to nominal value in kgf/cm²
- 9 Adjusted from ... to ... technical unit
- B Calibrated from ... to ... technical unit, with calibration report

Electronics Version, Communication

- M 4...20 mA passive, HART with linearisation and other functions
- P PROFIBUS-PA
- F Foundation Fieldbus

Accessories

- 1 None
- 2 Bracket for pipe and wall mounting
- 3 3.1.B Inspection certificate for all parts in contact with the medium made of 1.4435 (AISI 316L)
- 4 3.1.B Inspection certificate for all parts in contact with the medium made of 1.4435 (AISI 316L) and bracket

Process Connection

Thread, Material

1M	G 1/2 (external) DIN 16 288; 1.4435 (AISI 316L)
2M	G 1/2 (external) DIN 16 288; Hastelloy C276
5M	G 1/2 (external) DIN 16 288; PVDF ²⁾ (max. 20 bar/300 psi, max. -10...+60°C/+14...+140°F)
1P	G 1/2 (external), G 1/4 (internal); 1.4435 (AISI 316L)
1R	G 1/2 (external), Ø 11.4 mm (internal); 1.4435 (AISI 316L)
1N	1/2 NPT (external), 1/4 NPT (internal); 1.4435 (AISI 316L)
2N	1/2 NPT (external), 1/4 NPT (internal); Hastelloy C276
1A	1/2 NPT (external), Ø 11.4 mm (internal); 1.4435 (AISI 316L)
1S	PF 1/2 (external) JIS B0202; 1.4435 (AISI 316L)
1K	PT 1/2 (external), Ø 11.4 mm (internal) JIS B0203; 1.4435 (AISI 316L)
1T	M 20x1.5 (external) DIN 16288; 1.4435 (AISI 316L)

²⁾ Note the Safety Instructions (XA) and electrostatic charging!

Ceramic sensor flush-mounted (not with FPM Viton gasket, cleaned for oxygen service, gasket version 6)

Hygienic Connections

AH	DN 40, DIN 11851, PN 40	EK	DN 50, PN 40, DIN 2527, Form B (without raised face)
AL	DN 50, DIN 11851, PN 40	EU	DN 80, PN 40, DIN 2527, Form B (without raised face)
KL	DRD-Flange, D=65 mm	KJ	2", 150 lbs ANSI B.16.5, raised face
LL	Varivent D=68 mm (for pipes DN 40 ... DN 125)	KK	2", 300 lbs ANSI B.16.5, raised face
		DL	ISO 2852 Clamp 2", PN 40
		RI	RF-Flange JIS 10K 50A

Threaded boss

AG	G 1 1/2	AR	G 2
BF	1 1/2 NPT	BR	2 NPT
XK	M 44x1.25	9Y	Others

Replaceable Gasket, Wetted Parts, Lower Temperature Limit

1	FPM Viton, -20°C (-4°F)	6	FPM Viton, cleaned for oxygen service
A	FPM Viton, oil and grease-free, -10°C (+14°F)	C	Chemraz, -10°C (+14°F)
7	Kalrez, +5°C (+41°F)	4	EPDM, -40°C (-40°F)
2	NBR, -20°C (-4°F)	D	PTFE+Hastelloy C4, for constructive reasons can only be exchanged for the same gasket
9	Others		



Product designation

Dimensions PMC 731

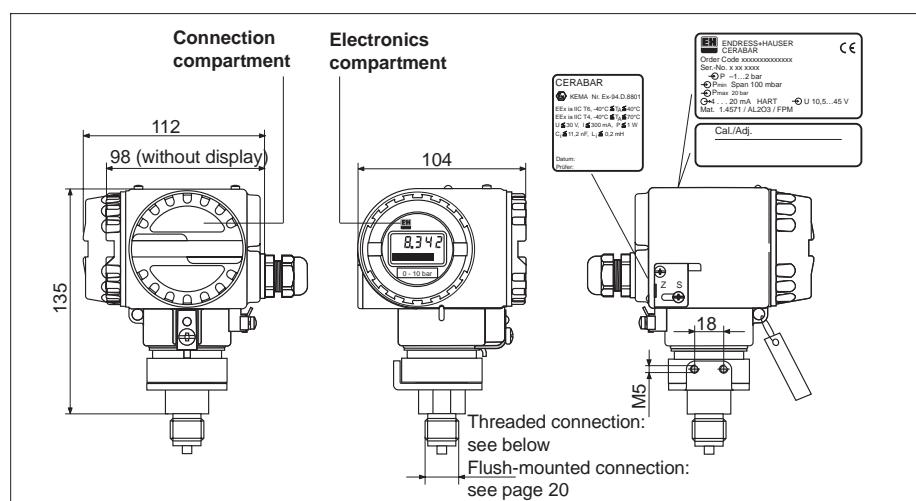
Housing:

- Electronics and connection compartment separated
- can be rotated through 270°
- Material: cast aluminium with powdered polyester coating or stainless steel 1.4435 (AISI 316L)
- Cable gland or optional cable entry, see product structure page 18

Process connections

- below: thread
- Page 20: flush-mounted

Dimensions of Housing



Process Connection Threads

Conversion factors

1 mm = 0.039 in
1 in = 25.4 mm

Dimensions are in mm.

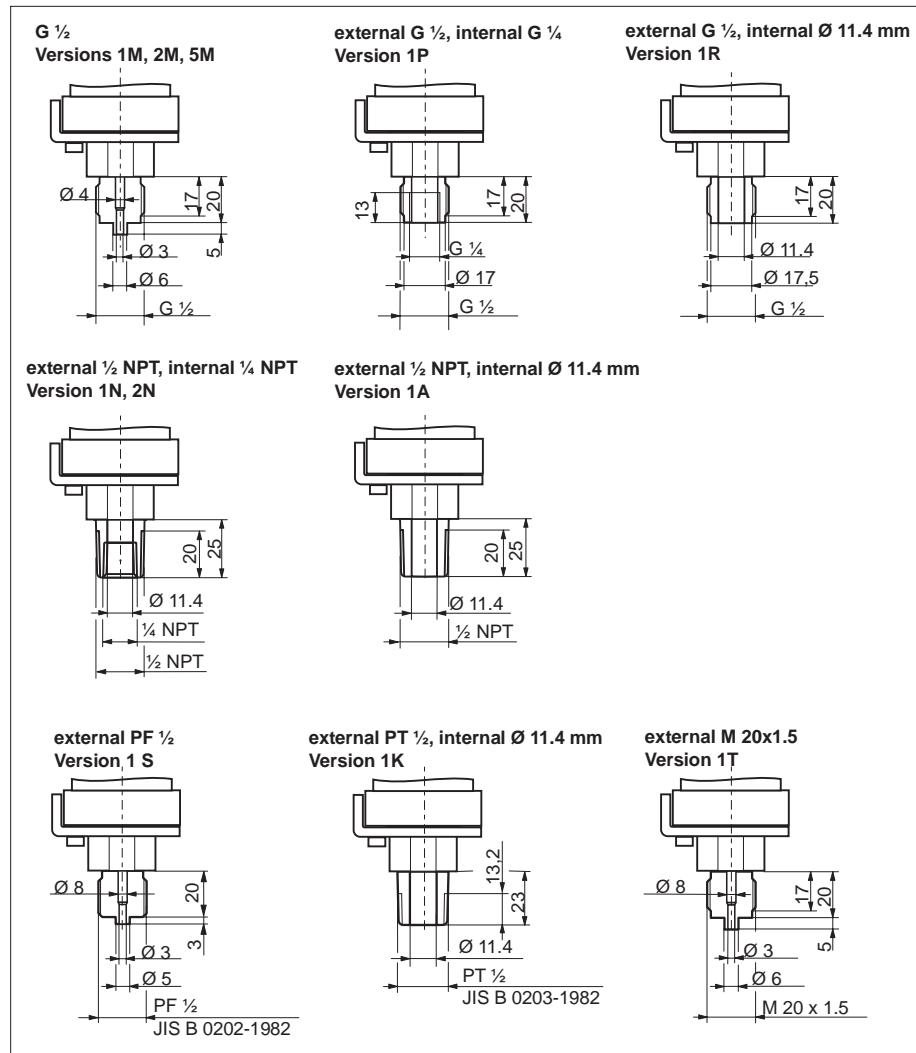
Process connections

Thread:

- Material: 1.4435 (AISI 316L) or Hastelloy 2.4819 (C276) oder PVDF
- Process gasket: FPM Viton, FPM Viton cleaned for oxygen service, FPM Viton oil and grease-free, Chemraz, NBR, Kalrez, EPDM

Note on selection

Large internal diameters are recommended for highly-viscous media.



Flush-Mounted Process Connections

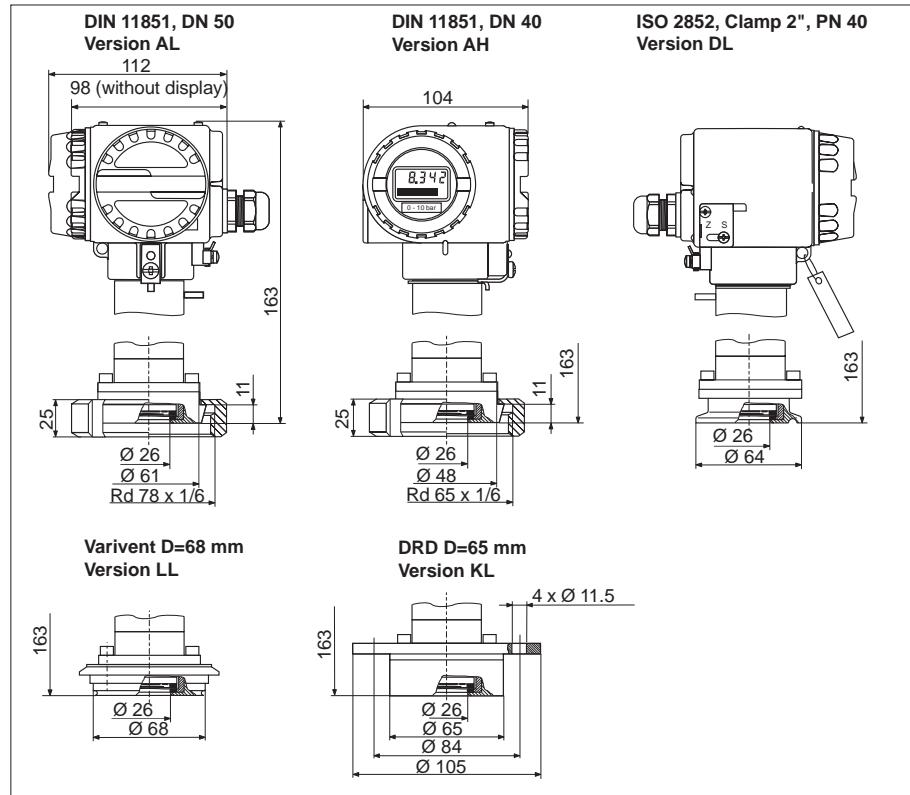
Hygienic Connections

Housing:

- Electronics and connection compartment separated
- can be rotated through 270°
- Material: cast aluminium with powdered polyester coating or stainless steel 1.4435 (AISI 316L)
- Cable gland or optional cable entry, see product structure page 18
- Surface height of parts in contact with medium Ra ≤ 0.8 µm

Material sanitary connections

- 1.4435 (AISI 316L)
- Dry measuring cell, without filling fluid



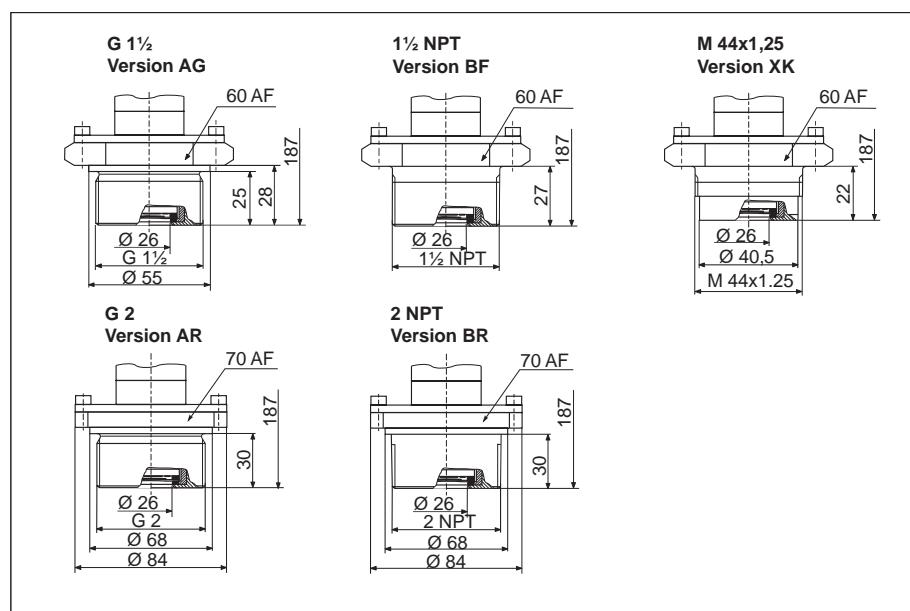
Threaded Bosses

Conversion factors

1 mm = 0.039 in
1 in = 25.4 mm

Dimensions are in mm.

Material of threaded boss
1.4435 (AISI 316L)



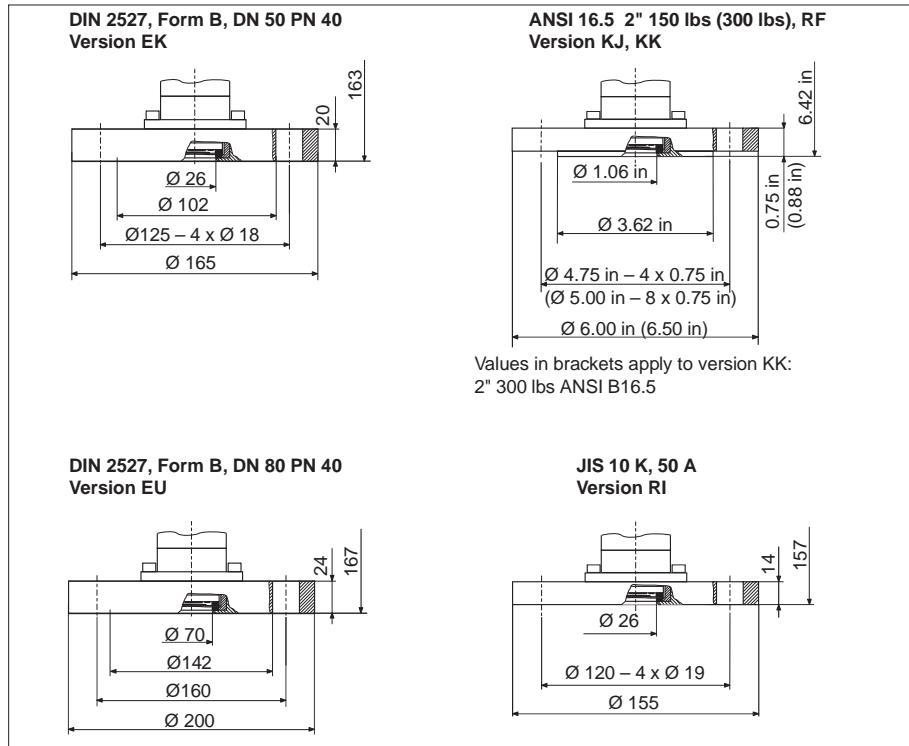
Flanges

Conversion factors

1 mm = 0.039 in

1 in = 25.4 mm

Dimensions are in mm.



Product Structure

PMP 731

Cerabar S PMP 731

Certificates, Approvals, Protection

- R Standard
- C ATEX II 3 G, EEx nA II T6
- G Cenelec EEx ia IIC T4/T6 and ATEX II 1/2 G
- I Cenelec EEx d IIC T5/T6¹⁾ and ATEX II 2 G (with cable entry M 20x1.5, G 1/2, 1/2 NPT only)
- D EEx ia IIC T4/T6, Zone 0
- Q FM explosion proof CL. I, II, III Div. 1, Groups A...G¹⁾ (with cable entry 1/2 NPT only)
- O FM IS (non-incendive) CL. I, II, III; Div. 1, Groups A...G
- U CSA explosion proof CL. I, II, III, Div. 1 Groups B...G¹⁾ (with cable entry 1/2 NPT only)
- S CSA IS (non-incendive) CL. I, II, III; Div. 1, Groups A...G

¹⁾ Certificate not with electronics version
PROFIBUS-PA

Housing: Aluminium

- with display module
- 3 Cable gland M 20x1.5
- 5 Cable entry 1/2 NPT
- 7 Cable entry G 1/2
- K Harting Han7D plug
- M PROFIBUS-PA plug M12
- P Foundation Fieldbus plug 7/8"

- without display module
- 4 Cable gland M 20x1.5
- 6 Cable entry 1/2 NPT
- 8 Cable entry G 1/2
- L Harting Han7D plug
- N PROFIBUS-PA plug M12
- Q Foundation Fieldbus plug 7/8"

Housing: Stainless steel (AISI 316L)

- with display module
- R Cable gland M 20x1.5
- S Cable entry 1/2 NPT
- T Cable entry G 1/2
- U PROFIBUS-PA plug M12
- V Foundation Fieldbus plug 7/8"

Metal Sensor: Nominal Value (Maximum Overload)

Limits (see table measuring range PMP 731, page 14)

Sensors for gauge pressure

3H	1 bar	(4 bar)	100 kPa	(400 kPa)	15 psig	(60 psig)	250 inch H ₂ O	(60 psig)
3L	2,5 bar	(10 bar)	250 kPa	(1 MPa)	38 psig	(150 psig)	1000 inch H ₂ O	(150 psig)
3P	10 bar	(40 bar)	1 MPa	(4 MPa)	150 psig	(600 psig)		
3S	40 bar	(160 bar)	4 MPa	(16 MPa)	600 psig	(2400 psig)		
3U	100 bar	(400 bar)	10 MPa	(40 MPa)	1500 psig	(6000 psig)		
3Z	400 bar	(600 bar)	40 MPa	(60 MPa)	6000 psig	(9000 psig)		

Sensors for absolute pressure

4H	1 bar	(4 bar)	100 kPa	(400 kPa)	15 psia	(60 psia)	250 inch H ₂ O	(60 psig)
4L	2,5 bar	(10 bar)	250 kPa	(1 MPa)	38 psia	(150 psia)		
4P	10 bar	(40 bar)	1 MPa	(4 MPa)	150 psia	(600 psia)		
4S	40 bar	(160 bar)	4 MPa	(16 MPa)	600 psia	(2400 psia)		
4U	100 bar	(400 bar)	10 MPa	(40 MPa)	1500 psia	(6000 psia)		
4Z	400 bar	(600 bar)	40 MPa	(60 MPa)	6000 psia	(9000 psia)		

Calibration and Technical Units

- 1 Calibrated from 0 to nominal value in mbar/bar
- 3 Calibrated from 0 to nominal value in mm H₂O/m H₂O
- 5 Calibrated from 0 to nominal value in kgf/cm²
- 9 Adjusted from ... to ... technical unit
- B Calibrated from ... to ... technical unit, with calibration report
- 2 Calibrated from 0 to nominal value in kPa/MPa
- 4 Calibrated from 0 to nominal value in inch H₂O
- 6 Calibrated from 0 to nominal value in psi

Electronics Version, Communication

- M 4...20 mA passive, HART with linearisation and other functions
- P PROFIBUS-PA
- F Foundation Fieldbus

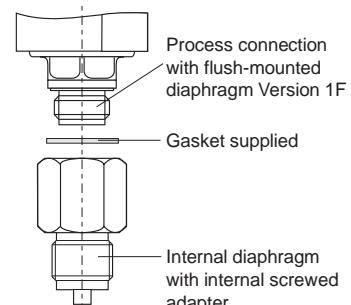
Accessories

- 1 None
- 2 Bracket for pipe and wall mounting
- 3 3.1.B Inspection certificate for all parts in contact with the medium made of 1.4435
- 4 3.1.B Inspection certificate for all parts in contact with the medium made of 1.4435 and bracket
- 5 NACE MR0175/3.1.B material, Inspection Certificate EN 10204
- 6 NACE MR0175/3.1.B material mounting bracket, Inspection Certificate EN 10204

Process Connection Thread, Material

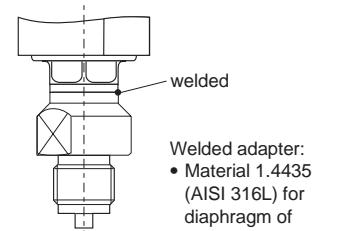
Flush-mounted diaphragm

- 1F G 1/2 (external);
Material Process Connection 1.4435 (AISI 316L) for diaphragm of 1.4435,
Material Process Connection Hastelloy for diaphragm of Hastelloy



Intral diaphragm, adapter 1.4435 (AISI 316L)

- 1M G 1/2 (external) DIN 16288
- 1G 1/2 NPT (external)
- 1S PF 1/2 (external) JISB0202
- 1K PT 1/2 (external) JISB0203
- 1T M 20x1.5 (external)
- 1X 1/2 NPT (internal)
- 9Y Others



Material of Diaphragm, Gasket, Filling Fluid

- 1 Diaphragm 1.4435 (AISI 316L), Viton, silicon oil
- 2 Diaphragm Hastelloy C276, Viton, silicon oil
- 3 Diaphragm 1.4435 (AISI 316L), Viton, Voltalef, oil and grease-free, cleaned for oxygen service
- P Diaphragm 1.4435 (AISI 316L), PTFE and Hastelloy, silicon oil
- A Diaphragm 1.4435 (AISI 316L), welded, silicon oil
- B Diaphragm Hastelloy, welded, silicon oil
- C Diaphragm 1.4435 (AISI 316L), welded, Voltalef, cleaned for oxygen service
- D Diaphragm 1.4435 (AISI 316L), welded, Voltalef, oil and grease-free

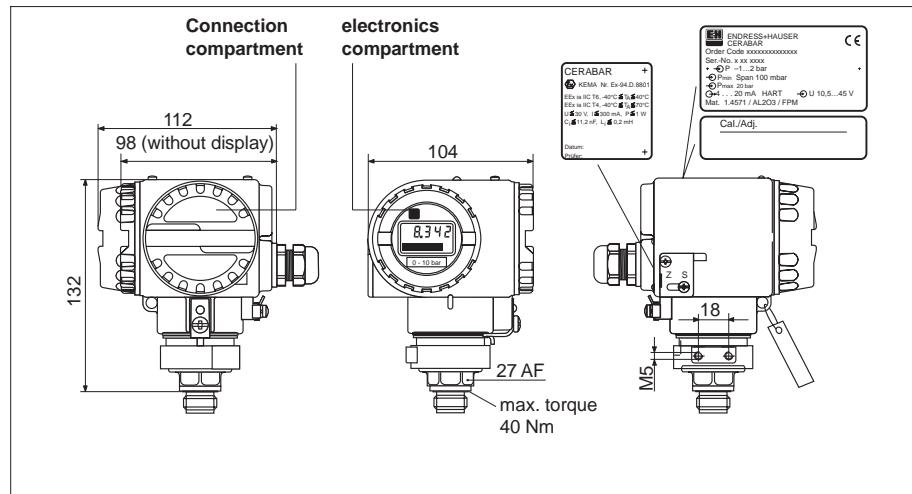
PMP 731

Product designation

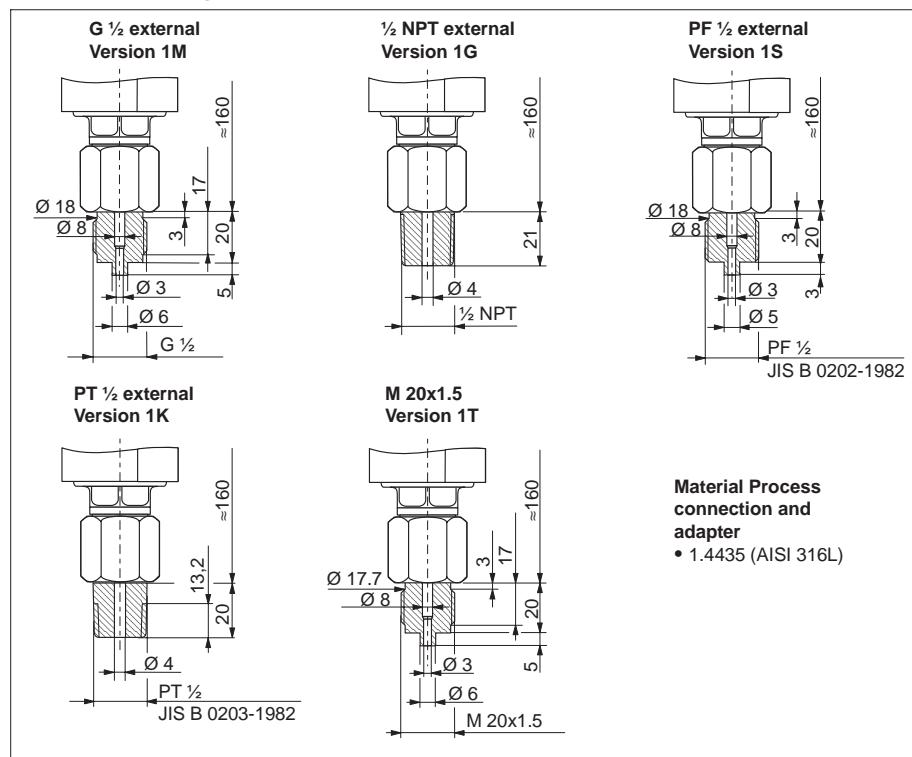
Dimensions PMP 731

- Electronics and connection compartment separated
- can be rotated through 270°
- Material: cast aluminium with powdered polyester coating or stainless steel 1.4435 (AISI 316L)
- Cable gland or optional cable entry, see product structure page 22

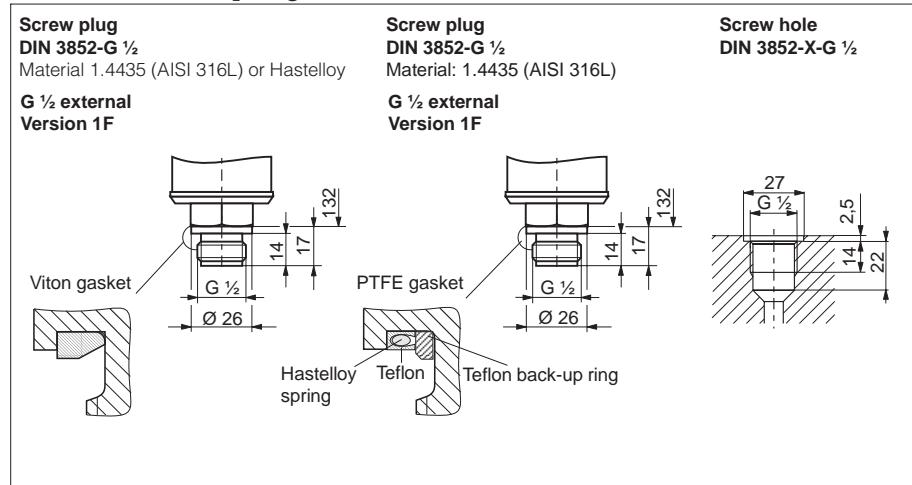
Dimensions of Housing



Threaded Process Connections: Internal diaphragm with adapter



Threaded Process Connections: Flush-mounted diaphragm



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