

# Mounting instructions

## High Pressure Transducer

### **P3MBP** *BlueLine* Ultra high pressure transducers



A0906-31 en





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## Safety instructions

### Use in accordance with the regulations

The P3MB pressure transducer is to be used exclusively for pressure measurement and directly related control tasks. Any other use is deemed to be not as prescribed.

To ensure safe operation, the transducer must only be used in accordance with the specifications in the User Manual. It is also essential to comply with the statutory and safety regulations relevant to the particular application. This also applies to the use of accessories.

We declare that the transducer is in conformity with the requirements of the European Pressure Equipment Directive 97/23/EC, directive of the European Parliament and Council of 29 May 1997 on the approximation of the laws of the member states concerning pressure equipment.

The pressure transducer is not a safety device as defined in the regulations for use. The perfectly safe operation of this pressure transducer requires suitable transport as well as technically correct storage, installation and assembly coupled with careful operation.

Use as a "component with a safety function" does not come under appropriate use and the user must assess this himself (in the sense of the Pressure Equipment Directive 97/23/EC).

### General dangers in non-observance of the safety instructions

The pressure transducer corresponds to the state of the art and is safe to operate. The pressure transducer can give rise to residual danger if improperly installed and operated by untrained personnel.

All personnel involved in the installation, commissioning, maintenance or repair of the pressure transducer must have read and understood the User Manual and in particular the technical safety instructions.

### Accident prevention

Care must be taken to ensure that when the pressure transducer is being installed or removed, there is no pressure in the circuit.

### Residual dangers

The scope of the capabilities and components provided with the transducer covers only a part of pressure measurement technology. Equipment planners, installers and operators must plan, carry out and accept responsibility for the safety engineering aspects of pressure measurement technology in such a way that residual dangers are kept to a minimum.

All existing regulations must be complied with. There must be reference to the residual dangers connected with pressure measurement technology.

Even though the P3MB is designed to be as safe as possible, safety regulations demand that burst protection is provided all round the transducer.

The transducer must be protected against mechanical stress or shock.

The resistance of the steel used in the measuring body is only as stated if the temperatures never rise above or fall below the limits specified in the data sheet.

If the temperature limits are exceeded – for example, because there is a fire – the device is rendered unusable.

The end of service life is reached, if the zero signal has changed significantly.

Residual dangers are highlighted in this operating manual with the following symbols :



Symbol: **DANGER**

Meaning: **Maximum danger level**

Warns of an **imminently** dangerous situation in which failure to comply with safety requirements **will result in** death or serious physical injury.



Symbol: **WARNING**

Meaning: **Potentially dangerous situation**

Warns of a **potentially** dangerous situation in which failure to comply with safety requirements **can result in** death or serious physical injury.



Symbol: **CAUTION**

Meaning: **Potentially dangerous situation**

Warns of a **potentially** dangerous situation in which failure to comply with safety requirements **could result in** damage to property or some form of physical injury.



Symbol:

## **NOTE**

Means that important information about the product or its handling is being given.



Symbol:

*Meaning:* **CE mark**

The CE mark enables the manufacturer to guarantee that the product complies with the requirements of the relevant EC directives (see Declaration of Conformity at the end of this document).

## **Conversions and modifications**

The pressure transducer must not be modified from the design or safety-engineering point of view without our express agreement. Any modification precludes liability on our part for any damage resulting therefrom.

## **Qualified personnel**

The pressure transducer must only be installed and operated by qualified personnel strictly in accordance with the technical data relating to the safety requirements and safety rules and regulations listed. It is also essential to comply with the statutory and safety regulations relevant to the particular application. This also applies to the use of accessories.

"Qualified personnel" means persons familiar with the installation, assembly, commissioning and operation of the product who possess the qualifications appropriate to their function.

## **Recalibration and repair**

When you send the transducer for calibration or repair to HBM, please specify the pressure medium used. Traces of the medium can always remain in the measuring bore. We need this information to act adequately and, if required, select the appropriate cleaning agent. If no medium has been specified, we must possibly refuse to perform calibration or repair.

## 1 List of components supplied

Pressure transducer 1–P3MBP/5000 bar/10000 bar/15000 bar

Seal with packing

Order no. 5.000 bar: 2–9289.5512

Order no. 10.000 bar: 2–9289.5515

User manual

Cable made of polyurethane with Lemos connector (male) 2–9268.0835

## 2 Construction and operating mode

BlueLine series pressure transducers (5000 bar, 10,000 bar, 15,000 bar) have been designed to measure static and dynamic pressures of fluids.

The development of the P3MB BlueLine was based on HBM's years of experience in high pressure technology.

Since 1970, devices in accordance with the P3M principle have been working successfully with a nominal (rated) measuring range up to 3600 bar.

A large number of devices have proved themselves in dynamic applications.

We are now adding to this type series in the high-pressure direction with the nominal (rated) measuring range 5000 bar and also adding devices with a range of 10,000 bar and 15,000 bar

The P3MB BlueLine is suitable for dynamic applications:

- The measuring body is made of field-tested, ductile steel
- P3MB measuring bodies for higher pressures with their threaded connector are made of a single piece of rolled steel – there is no weld or any other sort of sealing or jointing point.
- The size of the chosen output signal is big enough to enable measured value adjustments to be made without too much extra work. On the other hand, the choice of output signal – or the stresses and strains – should be small enough for dynamic loading to be possible (without the premature signs of material fatigue).
- Any fluid or gas (vapour) that does not attack these steels is a suitable measurement medium. The pressure transducer and its threaded connector are strengthened for the purpose of the pressure connector and can be installed anywhere. In particular cases there are specific instructions in Chapter 3 "Mounting" which must be followed!

The stated properties are protected by FEM calculations and dynamic loading tests.

The stated measuring body design, chosen for all devices of the P3MB type series of measuring ranges 500 bar and above, enables the P3MB to meet a higher safety standard.

Years of reliable use under dynamic load and in rough operating conditions provide practical proof that the P3MB has a safe and robust design.

Strain gages (S.G.) are attached directly above the measurement hole. They are coupled to a Wheatstone bridge and to protect them from harsh ambient conditions, are located in a hermetically sealed reference chamber. This is made of stainless steel. In this way, the reliability and precision of the transducers is assured, even if operating conditions are persistently rough.

### 3 Mounting



#### CAUTION

- Before installing the P3MB, check that the threaded connector and the thread in its counterpart are sound and free of burrs. The parts must fit together easily.
- Use only the seals provided for this purpose by HBM.
- Devices must never be installed in a counterpart without a relief aperture.

The diameter of the relief aperture should not be less than 2mm. Its purpose is to safely protect the volume at the root between the two parts, the P3M and the container or pipework, against an increase in pressure. Even if the seal leaks, this will prevent destructively high forces ever building up.

P3MB BlueLine transducers are sealed at the pressure connection by a tapered gasket of 58 ° in a beveled run-in to the hole of 60° – as is usual and successful in ultrahigh pressure technology.

The seal is made from corrosion-resistant material – the 5000 bar version from 1.4301, the 10.000 bar and 15.000 bar versions from 1.4542.

To minimize the volume in the measurement hole ("dead volume") packing is used for these measuring ranges. This forms a unit with the sealing plug. This makes it very easy to install as well.

The pressure connection thread is M 20 x 1.5.

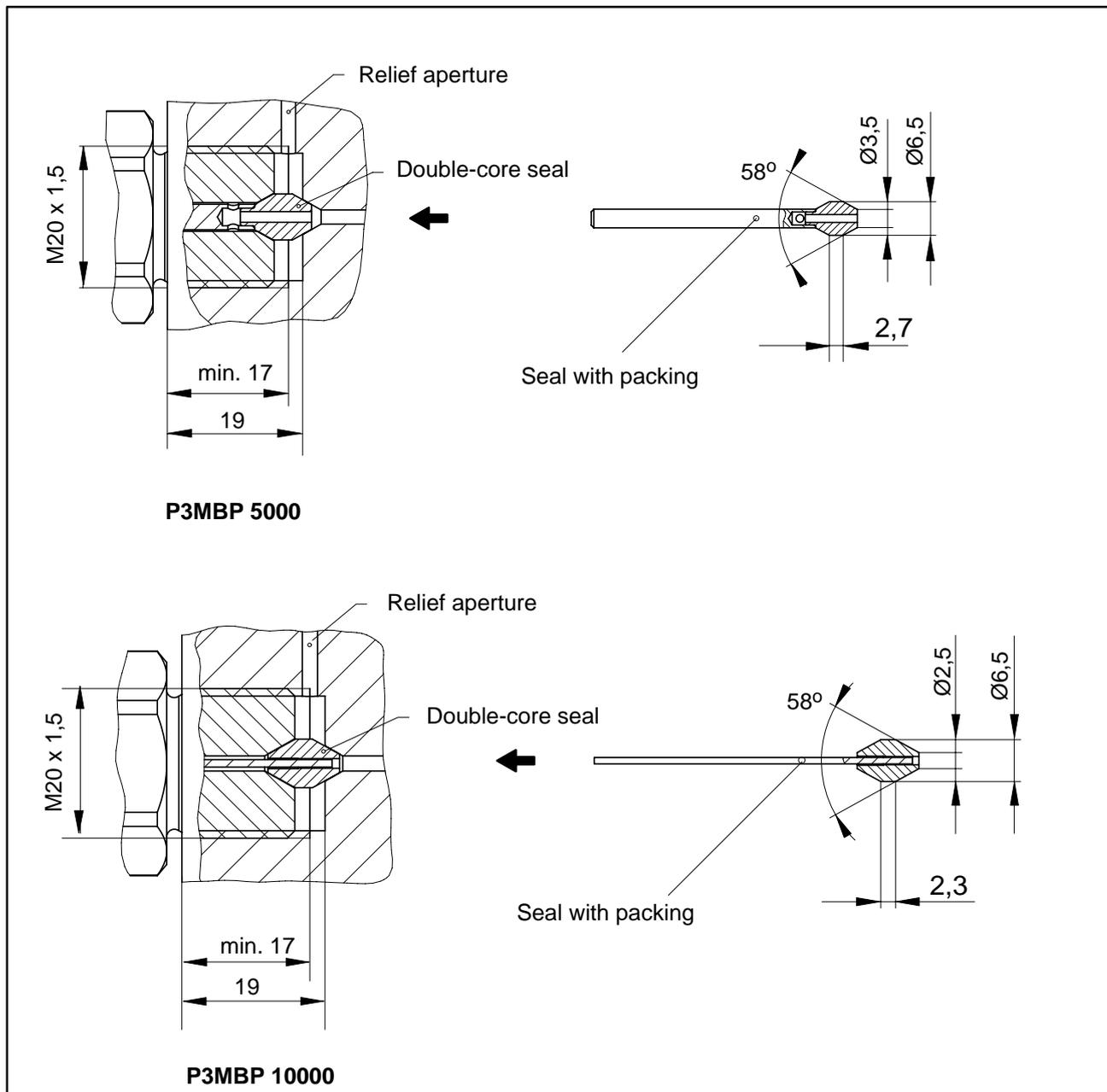
Pressure transducers can be fitted in any position.

But if the transducer is to be used to measure dynamic pressure characteristics in liquids, it is advisable to install it with the pressure connection upward. In this way you stop gas accumulating in the measurement hole, where continually changing compression and release can lead to sizable rises in temperature.



## CAUTION

When tightening, the wrench (size 27) must only be applied to the clamping area of the mounting flange, and not to the housing or cable entry. The permitted tightening torque is 30Nm.

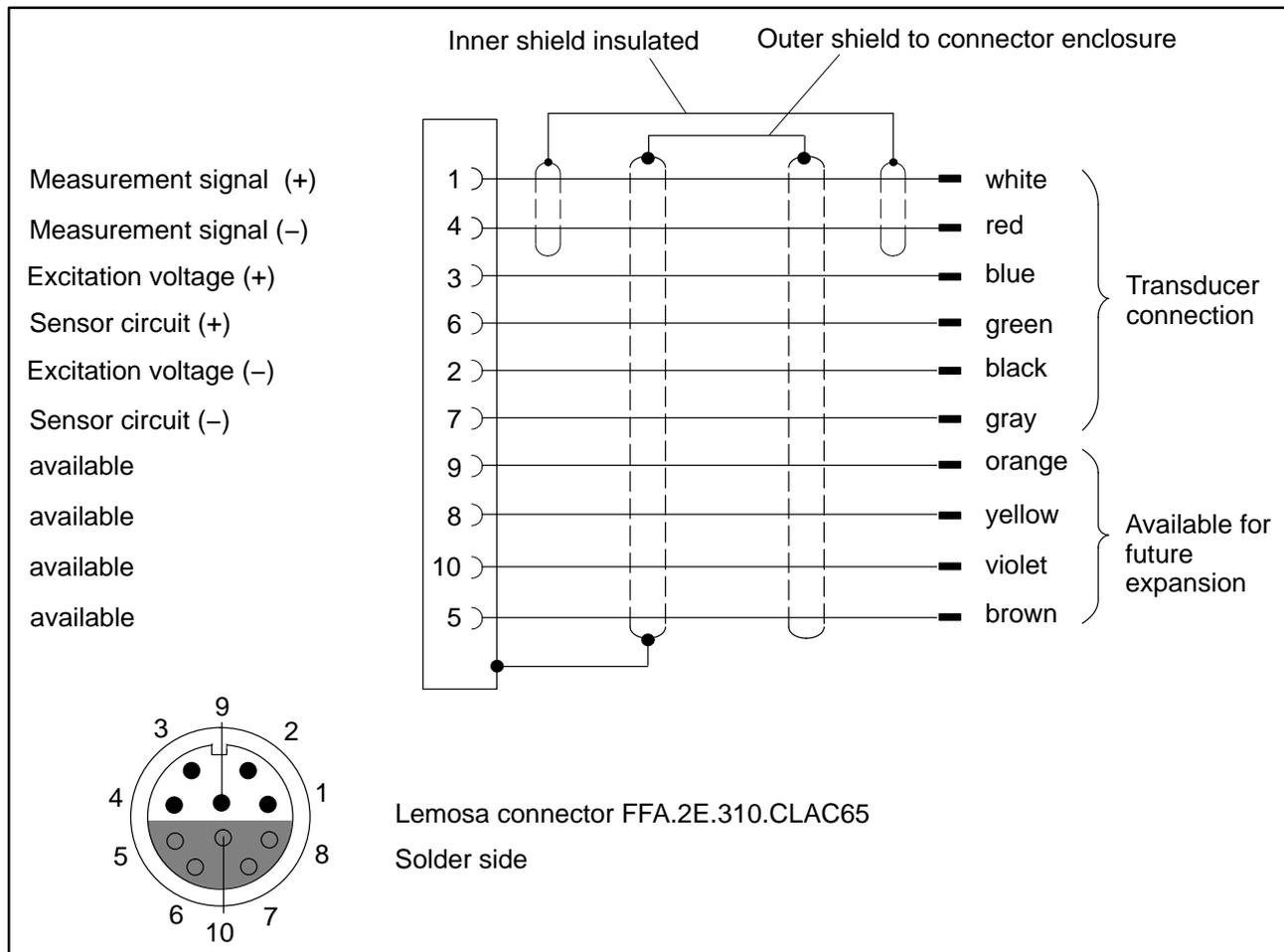


**Fig. 3.1:** Installing the pressure transducer

## 4 Electrical connection

Pressure transducers can be connected to carrier-frequency and DC voltage amplifiers.

In the standard version, pressure transducers are supplied with a 3m long unterminated connector cable.



**Abb. 4.1:** Electrical connection of the P3MBP pressure transducer

The cable shield is connected to the transducer housing (see HBM-”Greenline Shielding Concept”, G36.35.0)

## 4.1 Cable extension

Use shielded, low-capacitance extension cable. Above all the excitation circuits must have large cross-sections. HBM supplies its recommended extension cable and measuring cable by the metre.

When extending cable, ensure perfect connection with lowest possible contact resistance and good insulation between the circuits and ground. For this reason all connections must be soldered, or at least made with safe, stable terminals, and installed so that they are watertight. In the open air and/or in a damp environment, terminal boxes must be sealed.

When extending the six cores of the standard measuring cable and using a six-wire circuit amplifier, the cable length does not affect the measuring signal.

Measuring cables should not be laid parallel to high-tension and control circuits (e.g. in common cable shafts). If this cannot be arranged, protect the measuring cable with steel conduit and keep it at least 50 cm away from other cables. Stray fields from transformers, motors and protective contacts are to be avoided.

## 5 Measuring

At nominal (rated) load, the devices have an output signal of 1 mV/V.

The transducers have been designed to withstand these loads, however, the actual conditions resulting from the operating load and the variation of the individual transducers require appropriate measures to be taken to prevent bursting of the transducer.

The devices are hermetically sealed against the environment – so these are absolute pressure transducers. If it interferes at all, it is easy to take away the display of ambient pressure, e.g. 1 bar of 5000 bar, at the amplifier by taring.

The devices have reached the end of their service life if the zero signal has changed by more than 5% or if there is clearly visible and unscheduled deformation and damage to the device.

### 5.1 Measuring dynamic pressures

When there is dynamic loading, maximum pressure must not exceed the rated pressure. The oscillation bandwidth (peak-to-peak) of the permitted pressure fluctuation must not exceed 70% of the final scale value.

The P3MB/5000 bar is designed for  $10^7$  alternating loads at approx. 4000 bar and HBM is aiming to further increase the dynamic strength.

Calibration by reference to static pressures also applies when measuring dynamic pressures. Please note that in the case of measurement frequencies in the natural frequency range, amplitude reinforcements have to be taken into account.

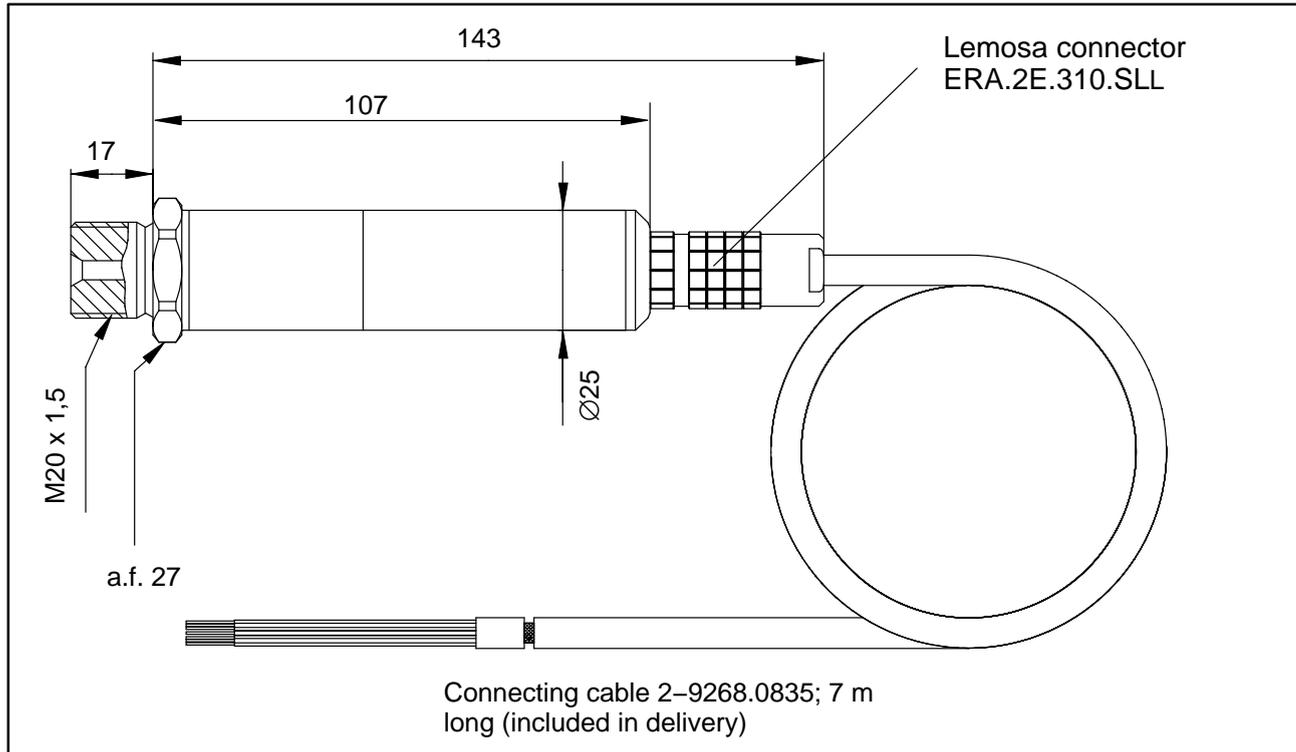
## 6 Specifications (in accordance with DIN 16 086)

Type		P3MBP BlueLine		
<b>Mechanical input quantities</b>				
<b>Pressure type</b>		Absolute pressure		
<b>Principle of measurement</b>		Foil strain gage		
<b>Measuring range, 0 bar...</b>	bar	5000	10000	15000 <sup>1)</sup>
<b>Input characteristics</b>				
<b>Accuracy class</b>		0.2	0.4	0.5
<b>Initial value</b>	bar	0		
<b>Operating range</b> at reference temperature	%	120		
<b>Overload limit</b> at reference temperature	%	120		
<b>Test pressure</b>	%	200	130	100
<b>During dynamic loading</b>				
<b>Permissible pressure</b>	%	100		
<b>Permissible vibration amplitude</b> according to DIN 50 100	bar	3500	5000	6000
<b>Dead volume</b> (with supplied HBM sealing)	mm <sup>3</sup>	210	120	
<b>Control volume</b>	mm <sup>3</sup>	approx. 1		
<b>Output characteristics</b>				
<b>Nominal (rated) sensitivity</b>	mV/V	1		
<b>Sensitivity tolerance</b>	%	< ±0.2	< ±0.4	< ±0.5
<b>Effect of temperature on the zero signal</b> in the nominal (rated) range of the excitation voltage per 10K, by reference to the nominal (rated) sensitivity				
in the nominal (rated) temperature range	%	±0.1	±0.2	±0.2
in the operating temperature range	%	±0.15	±0.25	±0.25
<b>Effect of temperature on sensitivity</b> in the nominal (rated) range of the excitation voltage per 10K, by reference to the actual value				
in the nominal (rated) temperature range	%	±0.1	±0.2	±0.2
in the operating temperature range	%	±0.3	±0.4	±0.4
<b>Characteristic curve deviation</b> (start setting)	%	0.2	0.4	0.5
<b>Repeatability</b> according to DIN 1319	%	< ±0.05		
<b>Fundamental resonance frequency</b>	kHz	> 100		
<b>Input resistance</b> at reference temperature	Ω	350 ± 5		
<b>Output resistance</b> at reference temperature	Ω	350 ± 1.5		
<b>Isolation resistance at 100V AC</b>	MΩ	5000		
<b>Excitation voltage</b>				
Nominal (rated) excitation voltage	V	2.5		
Operating range	V	0.5 ... 10		

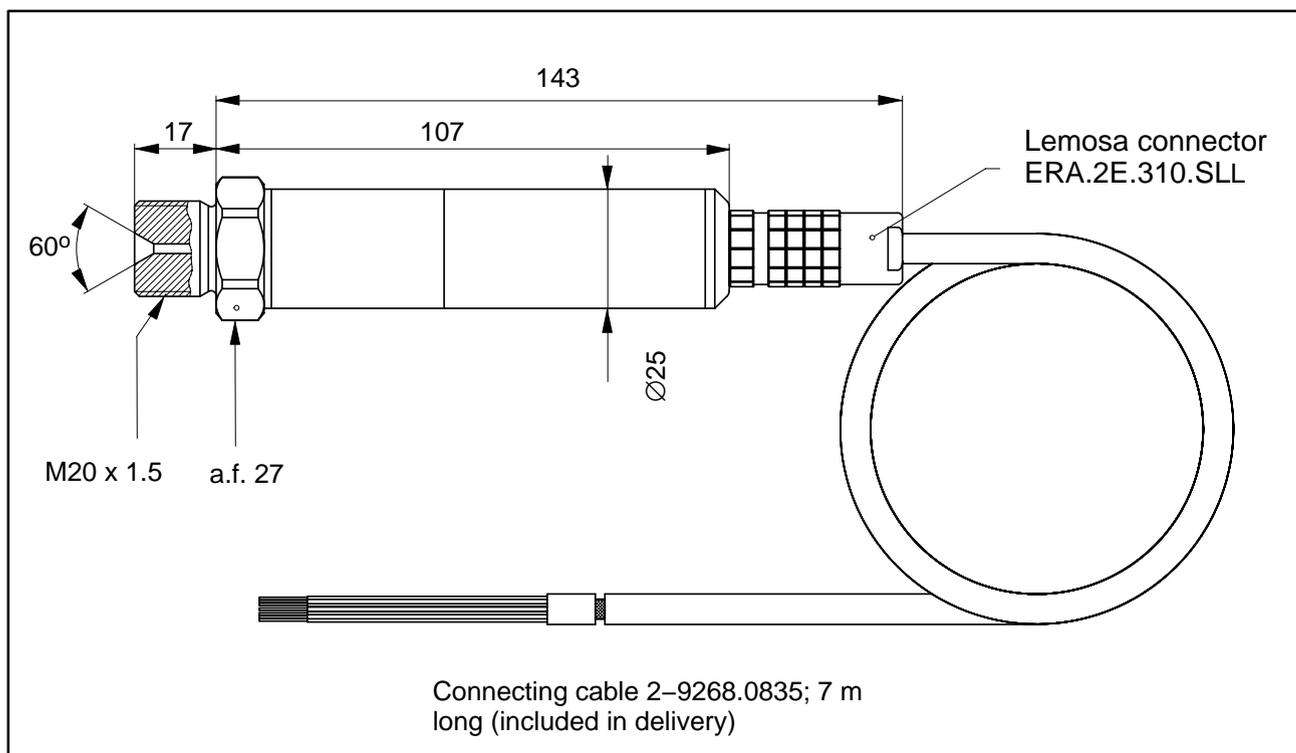
<sup>1)</sup> available in 4rd quarter of 2003

<b>Ambient conditions</b>		
<b>Reference temperature</b>	°C	+23
<b>Nominal (rated) temperature range</b>	°C	-10...+80
<b>Operating temperature range</b>	°C	-40...+100
<b>Storage temperature range</b>	°C	-50...+100
<b>Impact resistance (tested under DIN 40 046)</b>		
<b>Impact acceleration</b>	m/s <sup>2</sup>	1000
<b>Impact duration</b>	ms	4
<b>Impact form</b>		Half sine wave
<b>Mechanical specifications</b>		
<b>Pressure connection 1-P3MB</b>		M20 x 1.5 with sealing cone 58° in unit with packing for the measurement hole
<b>Electrical connection</b>		Lemosa connector ERA.2E.310.SLL
<b>Bending radius</b>		
static	mm	35
dynamic	mm	75
<b>Mounting position</b>		any
<b>Dimensions</b>	mm	Ø25 x 123
<b>Weight without cable approx.</b>	g	approx. 200
<b>Protection system</b>		IP67

## 7 Dimensions (in mm)



**Abb. 7.1:** P3MBP-5000 bar



**Abb. 7.2:** P3MBP-10000 bar







Modifications reserved.  
All details describe our products in general form only. They are not to be understood as express warranty and do not constitute any liability whatsoever.

**Hottinger Baldwin Messtechnik GmbH**

Postfach 10 01 51, D-64201 Darmstadt  
Im Tiefen See 45, D-64293 Darmstadt  
Tel.: +49/61 51/ 8 03-0; Fax: +49/61 51/ 8039100  
E-mail: [support@hbm.com](mailto:support@hbm.com) [www.hbm.com](http://www.hbm.com)



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