

Force

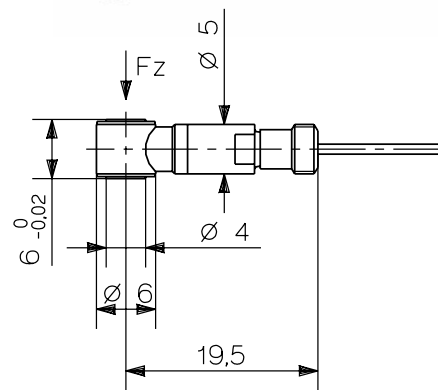
Miniature Force Sensor Head

Type 9211B...

for mold cavity pressure with diameter 6 mm

Quartz force sensor for the measuring range from 0 ... 2 500 N or for measuring mold cavity pressure of up to 3 000 bar during injection molding of plastics.

- Extremely compact
- Replaceable cable



Description

The 9211B... miniature sensor offers high resolution and has extremely small dimensions and a rugged, welded case. The charge signal (pC = pico coulombs) output by the force sensor is converted in the Kistler charge amplifier or in a monitoring unit into a proportional output voltage that is largely independent of the length of the sensor cable. The maximum possible output voltage from the standard amplifier is 10 V. In the most sensitive range this gives 1 N/V. The replaceable cables allow a wide choice of connecting cables.

Application

Thanks to its compactness the miniature force sensor is suitable for dynamic and quasistatic force measurements. This is particularly useful for an application like injection molding, where space is critical and forces are high. Indirect pressure measurement is particularly suitable for molds with small cavities or a large number of ejectors. The sensor is positioned under the ejector pin in the ejector plate, and measures the force curve by means of the ejector. This allows calculation of the actual mold cavity pressure.

Technical data

Measuring range	N	0 ... 2 500
Calibrated partial range	N	0 ... 250
Overload	N	3 000
Threshold	mN	10
Sensitivity	pC/N	-4,4
Linearity, all ranges	%FSO	±1
Operating temperature range	°C	-40 ... 200
Insulation resistance		
at 20 °C	Ω	≥10 ¹³
at 120 °C	Ω	≥10 ¹²

Miniature Force Sensor – for mold cavity pressure with diameter 6 mm, Type 9211B...

Force Sensor Type 9211B... with standard lengths
Indirect measuring sensor with replaceable coaxial connecting cable in lengths of 0,4 or 1.0 m lengths.

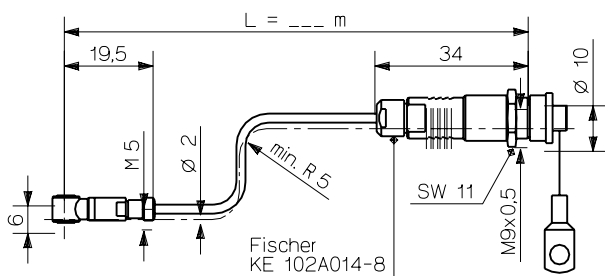


Fig. 2: Force Sensor Type 9211B... with cable and connector
standard length: 0,4... 1.0 m (see ordering key)

Computation of sensitivity for the pressure measurement

The front face of the ejector pin must be taken into account when mounting the force sensor for pressure measurement. The nominal sensor sensitivity (pC/N) is converted into a corresponding pressure sensitivity using the following formula.

$$\text{Calculated pressure sensitivity [pC/bar]} = \text{Nominal force sensitivity [pC/N]} \cdot \text{area of ejector pin [mm}^2\text{]} \cdot 0,1$$

The measuring range of the sensor must be taken into account when choosing the ejector pins. The larger the ejector pin area the higher the force on the sensor.

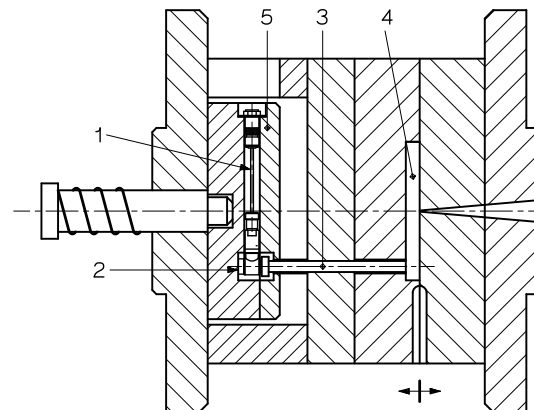
The following table shows the calculated sensitivity with the nominal sensitivity of the Type 9211B... and the maximum pressure for a selection of ejector pins.

Diameter ejector pin [mm]	Sensitivity [pC/bar]	Maximum pressure [bar]
1,6	-0,88	3 000
2	-1,38	
2,5	-2,16	
3	-3,11	2 000
4	-5,53	
5	-8,64	1 250

Mounting

The miniature force sensor has a precision ground face. The bearing surface of the ejector pin must also be finely machined, flat, rigid and exactly parallel. A hardened thrust washer must be used when mounting in a blind hole. Once mounted the sensor must not have any preload. A clearance of 0,03mm is recommended.

Principle of function



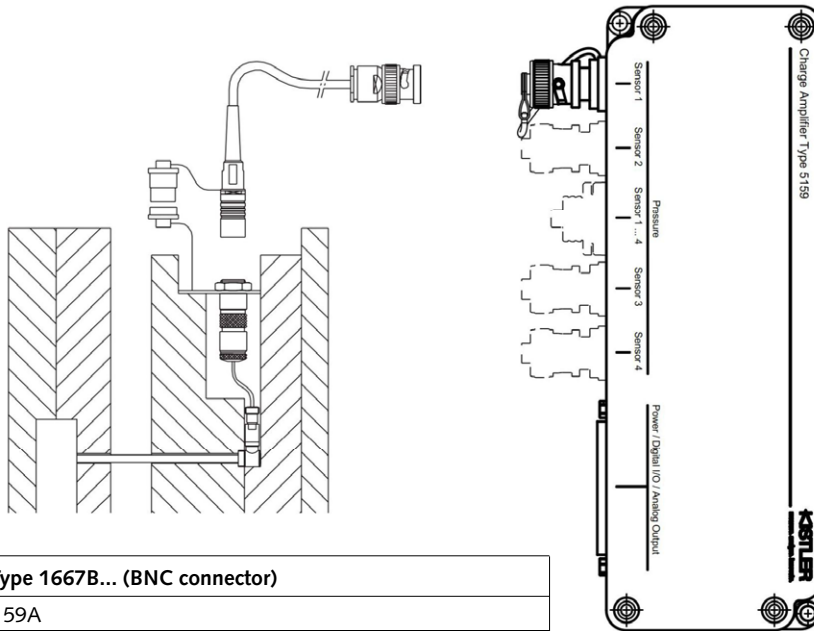
- 1 Force sensor
- 2 Thrust washer
- 3 Ejector pin
- 4 Cavity
- 5 Ejector plate

Fig. 3: Force sensor for indirect measurement of mold cavity pressure behind an ejector pin in the mold.

9211B_000-555e-03:19

This information corresponds to the current state of knowledge. Kistler reserves the right to make technical changes. Liability for consequential damage resulting from the use of Kistler products is excluded.

Cable and amplifier for measuring chains with sensor Type 9211B...



Cabel Type 1667B... (BNC connector)
Type 5159A

Fig. 4: Sensor Type 9211B... with charge amplifier Typ 5159A

9211B_000-555e-03:19

This information corresponds to the current state of knowledge. Kistler reserves the right to make technical changes. Liability for consequential damage resulting from the use of Kistler products is excluded.

Mounting examples

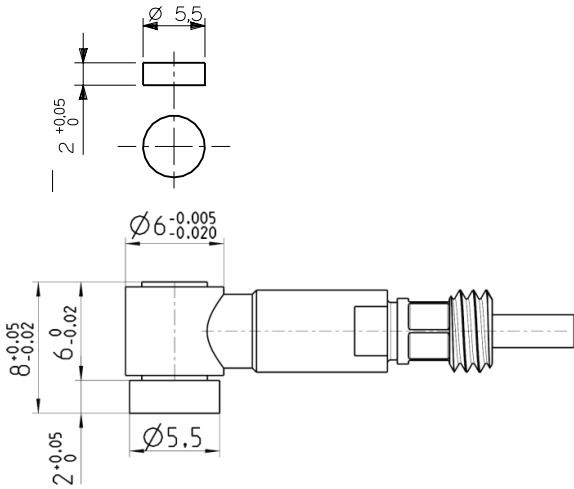
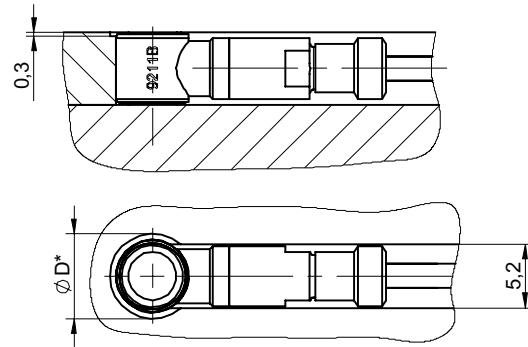
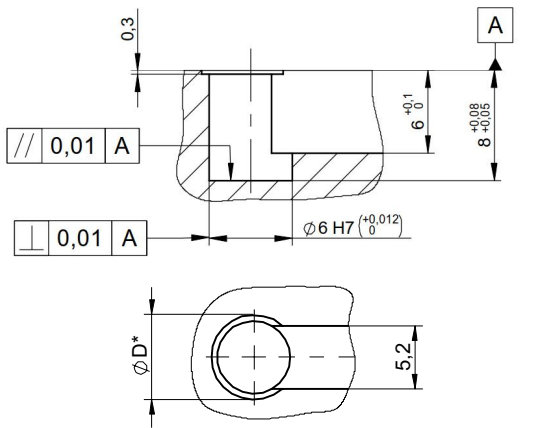


Fig. 6: Sensor Type 9211 with thrust washer Type 9411



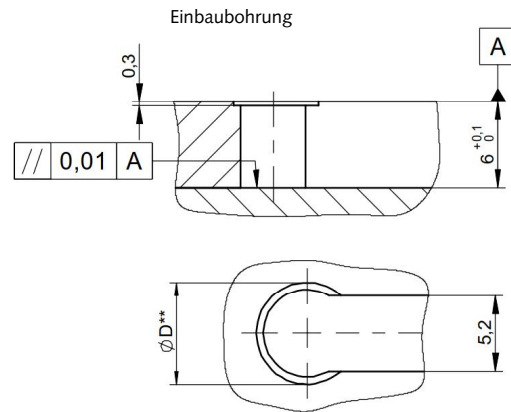
D* = 0,5 mm larger than the diameter of the ejector head

Fig. 7: Mounting in retaining plate



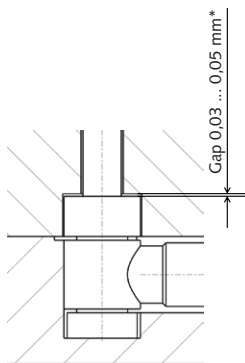
D* = 0,5 mm larger than the diameter of the ejector head

Fig. 8: Mounting bore with thrust washer Type 9411



D** = 0,5 mm larger than the diameter of the ejector head

Abb. 9: Mounting bore without thrust washer



* Sensor should not be preloaded. Consider this value as a minimum during construction and realisation of the mold. Depending on deformation, it could be necessary to have a bigger gap. Check clearance before mounting the sensor.

Fig. 10: Mounting sensor with ejector pin

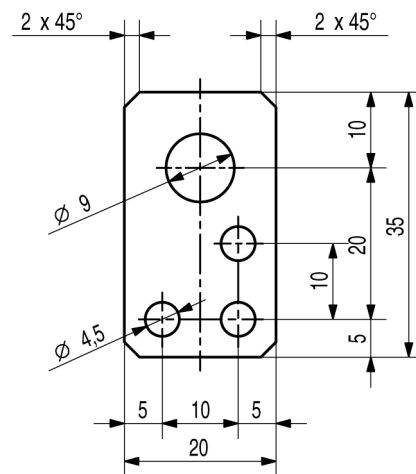


Fig. 10: Mounting plate Mat. No. 65005208 Thickness: 1 mm

9211B_000-555e-03:19