

Miniature Force Sensor

Type 9213B...

for Mold Cavity Pressure with diameter 6 mm and M2,5 thread

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.

- Case with M2,5 mounting thread
- Replaceable cable
- Available with singlewire technology

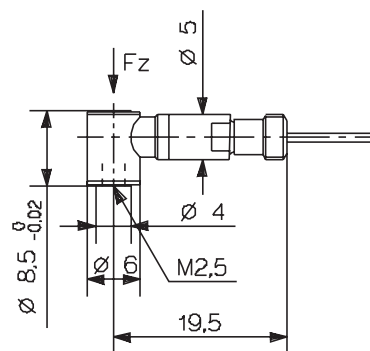
Description

The Type 9213B... 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, including the singlewire version. With singlewire technology an individual cable is shortened to the required length and connected to the connector using the proven cut and grip technique. With this arrangement the mold serves as a shield for signal transmission.

For multi cavity applications the sensor Type 9213B... is used without the singlewire connector Typ 1839. For 4-channel applications the Sensor Type 9213B... is mounted with the Multi-Channel Connector Type 1708... and for 8-channel applications with the Multi-Channel Connector Type 1710...

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

Force Sensor Type 9213BE

Indirect measuring sensor with replaceable singlewire cable.
Suitable for mounting as complete module in the ejector plate.

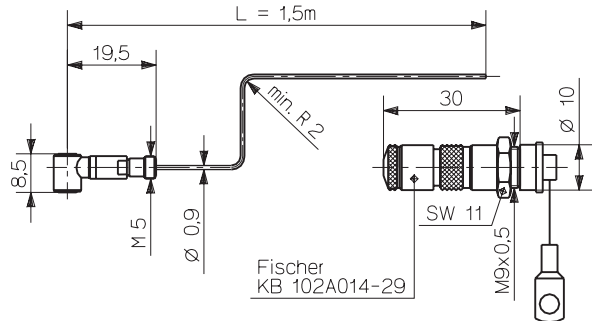


Fig. 1: Force Sensor Type 9213BE with cable and connector

Force Sensor Type 9213Bsp with standard lengths 0,2/0,4/0,6/0,8/1,2 m

Indirect measuring sensor with replaceable coaxial connecting cable in lengths of 0,2/0,4/0,6/0,8/1,2 m or special lengths.

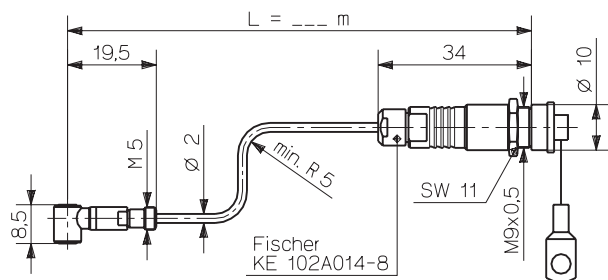


Fig. 2: Force Sensor Type 9213Bsp with cable and connector (standard length: 0,2/0,4/0,6/0,8/1,2 m)

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 9213B... and the maximum pressure for a selection of ejector pins.

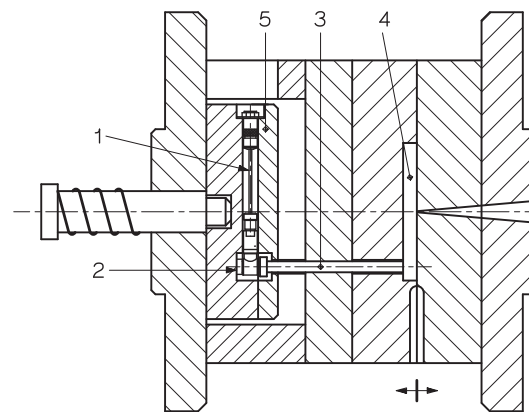
Diameter ejector pin [mm]	Sensitivity [pC/bar]	Maximum pressure [bar]
1,6	-0,88	>3 000
2	-1,38	
2,5	-2,16	
3	-3,11	
4	-5,53	2 000
5	-8,64	1 250

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. The sensor can be mounted from below with an M2,5 screw. Once mounted the sensor must not have any preload. A clearance of 0.03mm is recommended.

When using the singlewire technology, it must be ensured that the single-wire cable is kept in the ejector plate and that the Type 1839 connector is also mounted in this plate. When installing the connector in a different plate, electrical shielding by the mold must be ensured.

Principle of Mounting



- 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.

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Cable and Amplifier for Measuring Chains with Sensor Type 9213B...

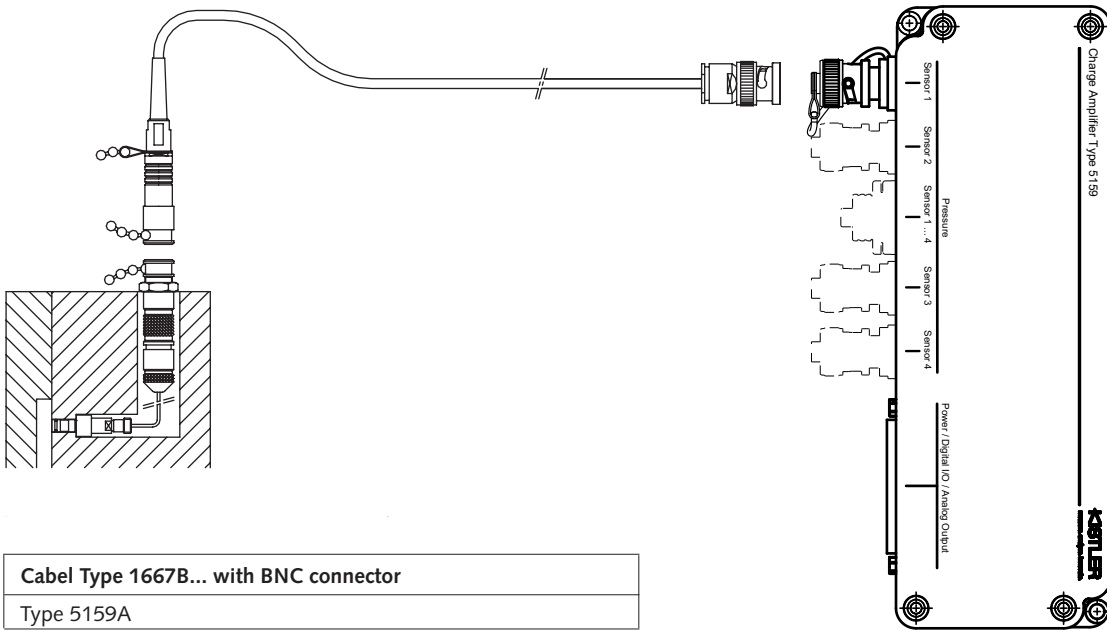


Fig. 4: Sensor Type 9213B... with charge amplifier Type 5159A...

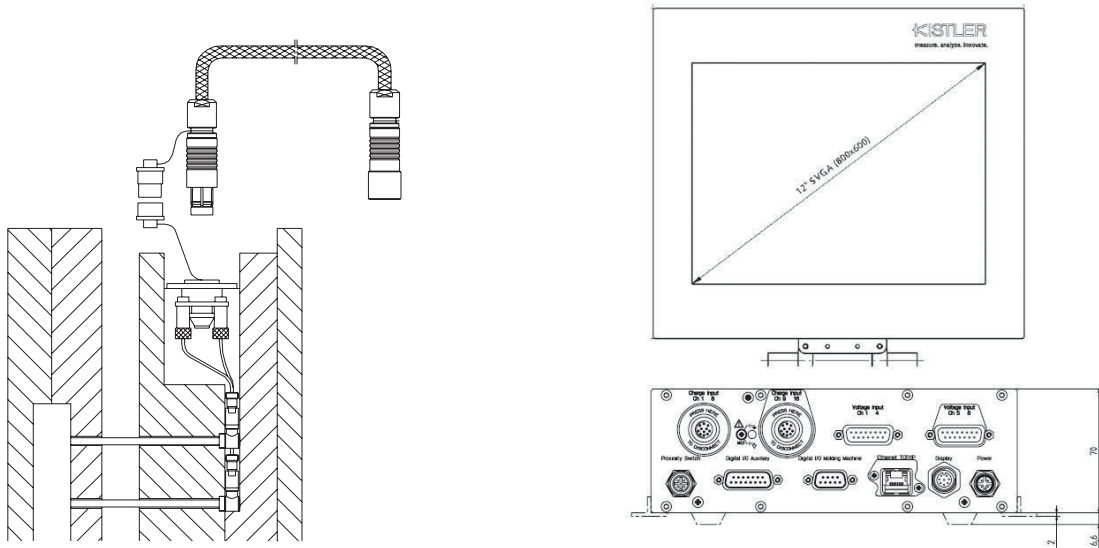


Fig 5: Sensor Type 9213B... with monitoring system CoMo® Injection Type 2869B...

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Mounting Examples

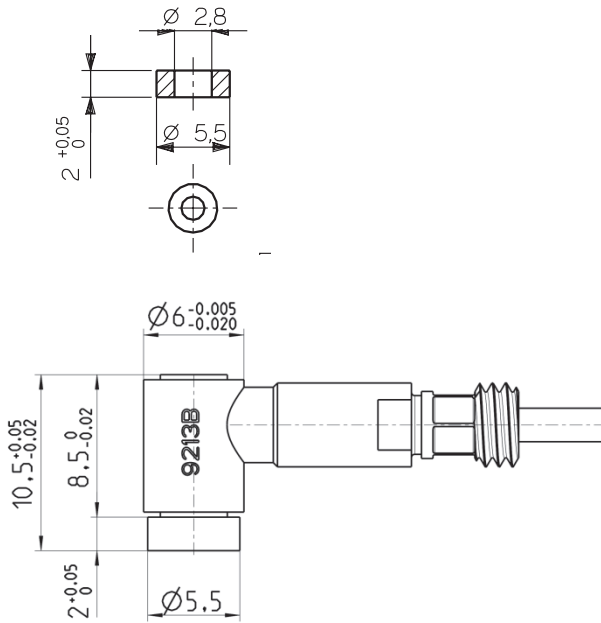


Fig. 6: Sensor Type 9213 with thrust washer Type 9413

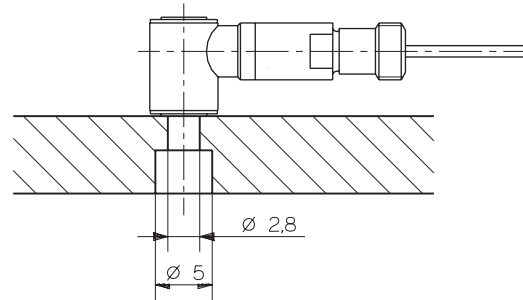


Fig. 7: Mounting in retaining plate

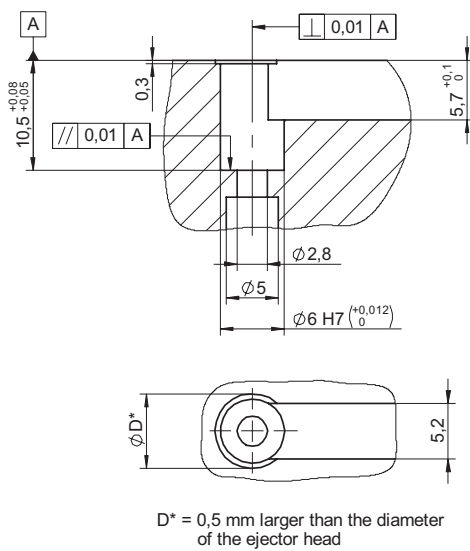
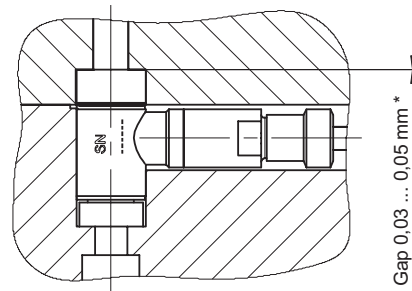


Fig. 8: Mounting bore with thrust washer Type 9413



* 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. 9: Mounting sensor Type 9213 with ejector pin

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Accessories Included

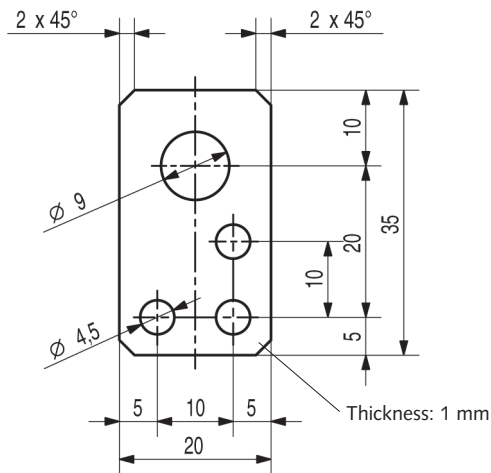


Fig. 10: Mounting plate Art. No. 3.520.328

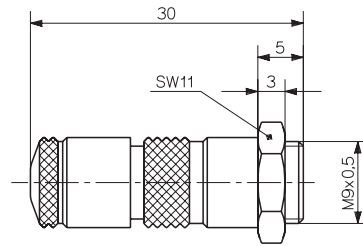


Fig. 11: Singlewire connector Type 1839

Accessories Included

Miniature force sensor Type 9213BE with singlewire cable

- Connector
- Mounting plate
- Thrust washer
- Identification plate

Type/Art. No.

- 1839
- 3.520.328
- 9413
- 3.520.235

High temperature extension cable with metal tubing and BNC connection

- Length 2 m 1661A2
- Length 5 m 1661A5
- Length 10 m 1661A10
- Special length (between 0,5 m and 8 m) 1661A sp
- 4-channel connector 1708
- 8-channel connector 1710

Miniature force sensor Type 9213Bsp (standard lengths: 0,2/0,4/0,6/0,8/1,2 m) with coaxial cable and connector

- Mounting plate
- Thrust washer
- Identification plate

- 3.520.328
- 9411
- 3.520.235

Optional Accessories

High temperature extension cable Fluoropolymer with BNC connection

- Length 2 m
- Length 5 m
- Length 10 m
- Special length (between 0,5 m and 8 m)

Type/Art. No.

- 1667B2
- 1667B5
- 1667B10
- 1667Bsp

Ordering Key

Singlewire cable, L = 1,5 m	E
Coaxial cable with special length, specify cable length L in m (L _{min} = 0,1 m / L _{max} = 5 m*)	sp
Sensor Type 9213BE without connector	G

* Standard lengths: 0,2/0,4/0,6/0,8/1,2 m

Type 9213B



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