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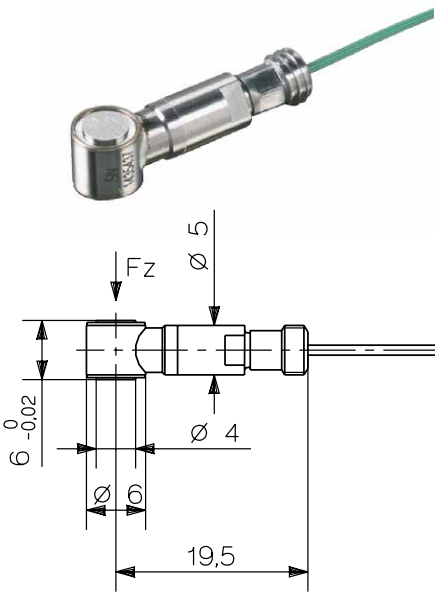
Miniature Force Sensor

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
- Available with single-wire technology



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, including the single-wire version. With single-wire 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 9211B... is used without the single-wire connector Typ 1839. For 4-channel applications the Sensor Type 9211B... 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	$\geq 10^{13}$
at 120 °C	Ω	$\geq 10^{12}$

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.

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Force Sensor Type 9211BE
Indirect measuring sensor with replaceable single-wire cable. Suitable for mounting as complete module in the ejector plate.

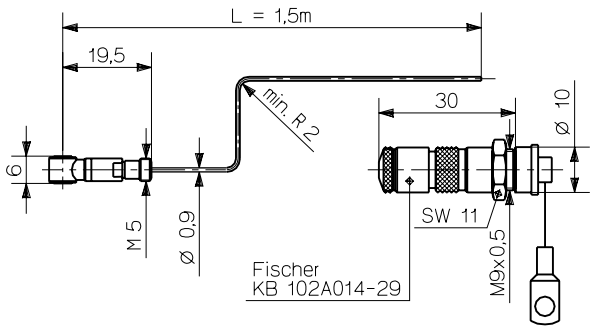


Fig. 1: Force Sensor Type 9211BE with cable and connector

Force Sensor Type 9211B... with standard lengths 0,2 ... 3,0 m (see ordering key)
Indirect measuring sensor with replaceable coaxial connecting cable in lengths of 0,2 ... 3,0 m or special lengths.

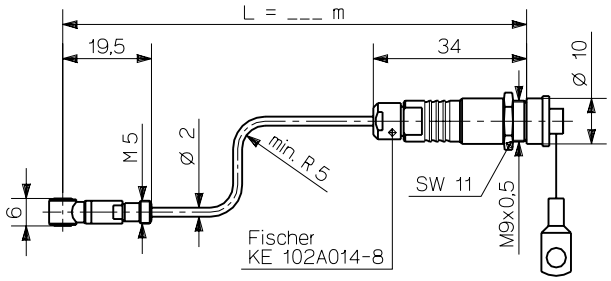


Fig. 2: Force Sensor Type 9211B... with cable and connector standard length: 0,2 ... 3,0 m (see ordering key)

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.

Calculated pressure sensitivity [pC/bar] =
Nominal force sensitivity [pC/N] · area of ejector pin [mm²] · 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.

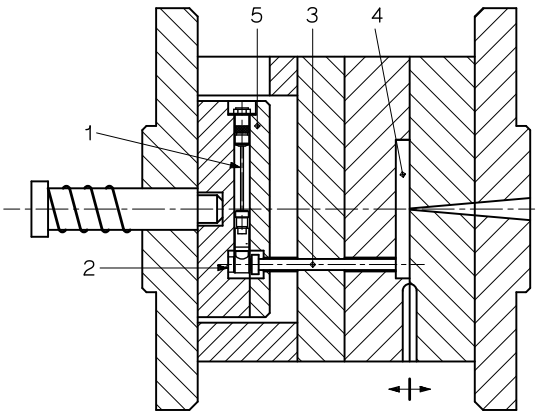
The following table shows the calculated sensitivity with the nominal sensitivity of the Type 9211B... and the maximum pressure for a selection of ejector pins.

Diameter ejector pin [mm]	Sensivity [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. Once mounted the sensor must not have any preload. A clearance of 0,03mm is recommended.

When using the single-wire 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 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.

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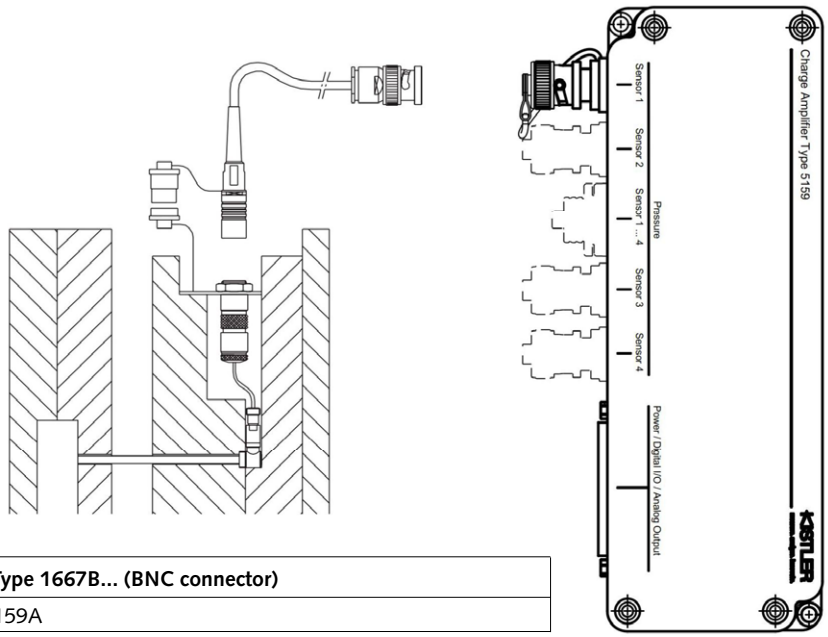
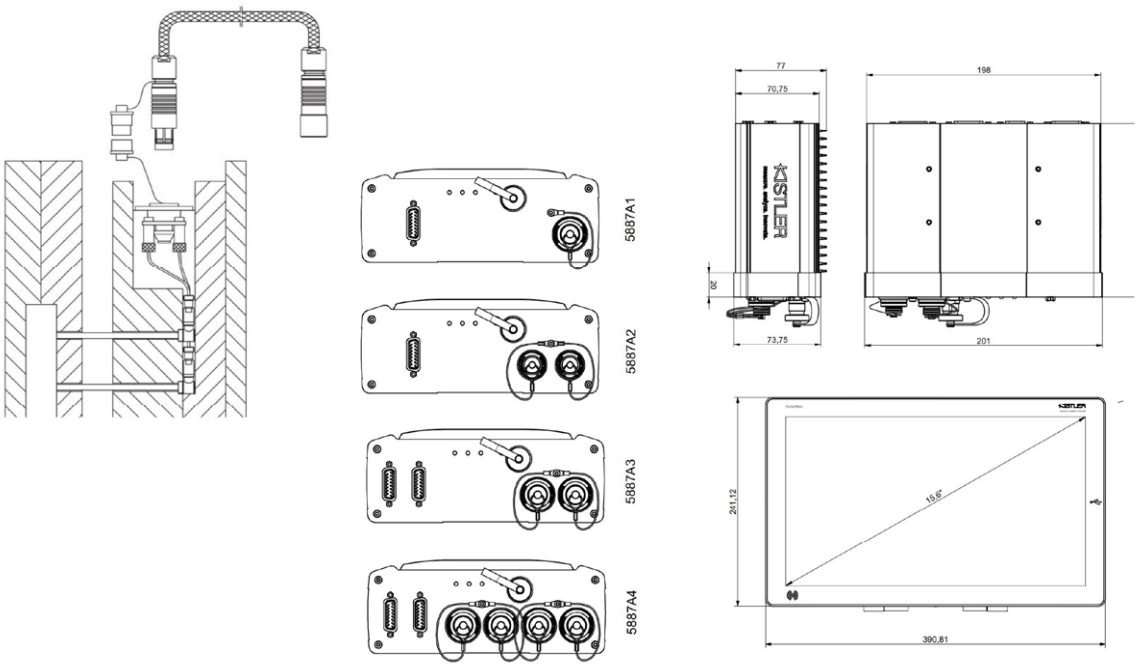
Cable and amplifier for measuring chains with sensor Type 9211B...



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

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



4-Channel cable Type 1995A... to connector Type 17022A4...	8-Channel cable Type 1997A... to connector Type 1722A8...
Type 5887A1	Type 5887A2
	Typ 5887A3
	Type 5887A4

Fig 5: Sensor Type 9211B... with monitoring system ComoNeo Type 25887...

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Mounting examples

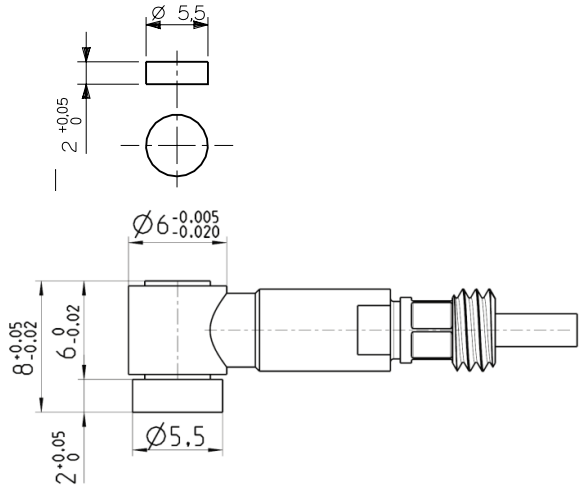


Fig. 6: Sensor Type 9211 with thrust washer Type 9411

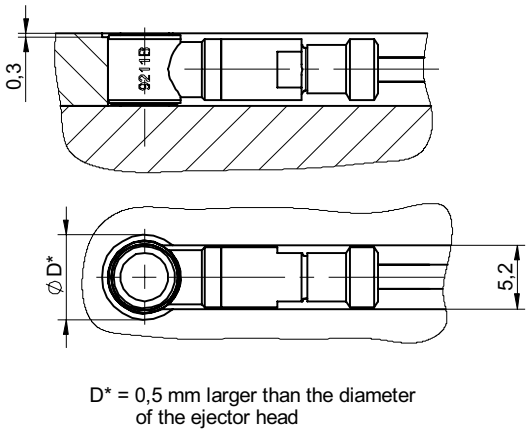


Fig. 7 : Mounting in retaining plate

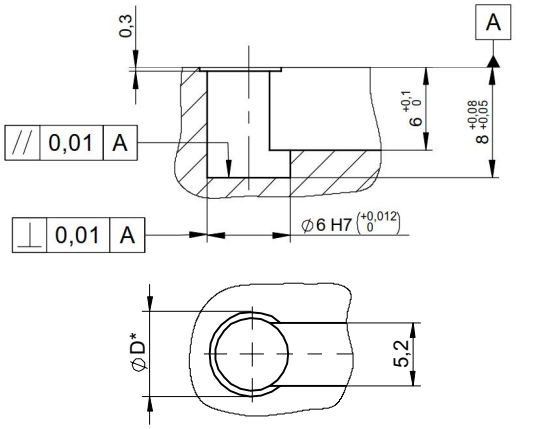


Fig. 8: Mounting bore with thrust washer Type 9411

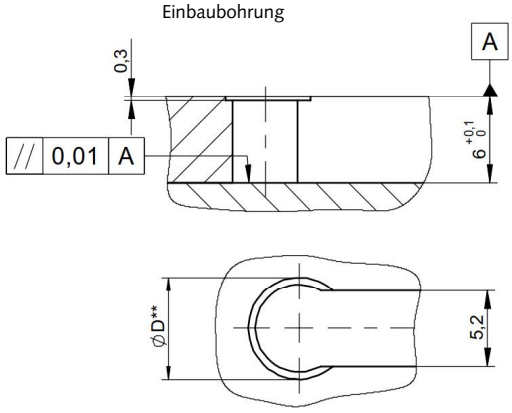
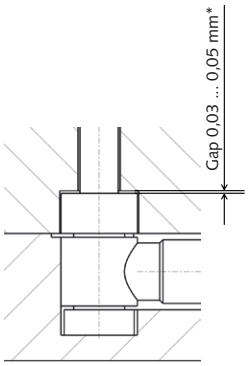


Abb. 9: Mounting bore without thrust washer



* 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

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Accessories included

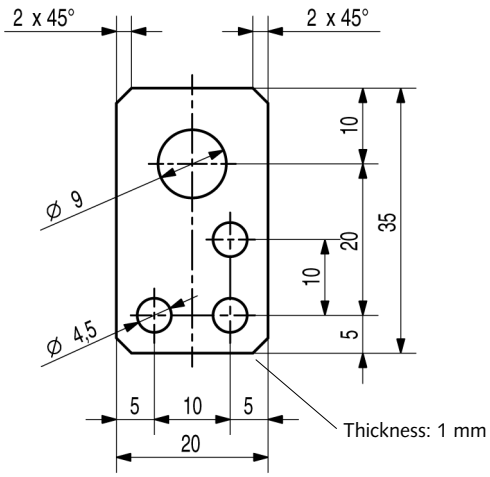

Fig. 10: Mounting plate Mat. No. 65005208

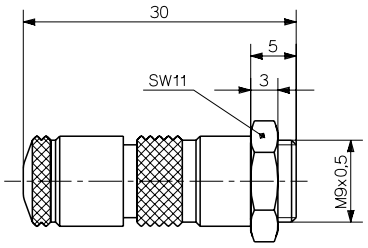

Fig. 11: Single-wire connector Type 1839

Accessories included	**Mat. No./Type**
• Sensor	9211B...
• Thrust washer	9411
• Identification plate	

Accessories depending on the selected variant

Cable type and plug

• Single-wire cable with M4 connector L = 1,5 m	1666A2
• Connector (for single-wire variants with connector) only Type 9211BE)	1839
• Coaxial cable 0 ... 200 °C with M4 connector with Fischer connector	1645C...
• Mounting plate for connector Type 1839 or coaxial cable with Fischer connector	65005208
• Short circuit cover (only Type 9211BE)	65015932

Accessories (optionally orderable)

• Fischer cable SE102 - BNC pos. (only Type 9211B...)	1667B...
• Single-wire cable with M4 connector L = 5 m	1666A4
• Single-wire cable with M4 connector with crimp pin Type 65003747 pre-installed L = min 0,04 m bis max = 1,5 m	1674AZSP
• Crimp pin for single-wire cable (for connection to Types 1712... and 1714...)	65003747
• Coaxial cable 0 ... 200 °C with M4 connector and MiniCoax plug	1650A4P...

Multichannel connectors and contact elements

• 4-channel connector up to 120 °C (for MiniCoax and single-wire cable)	1722A4...
• 8-channel connector up to 120 °C (for MiniCoax and single-wire cable)	1722A8...
• 4-channel connector up to 200 °C (for single-wire cable)	1708
• 8-channel connector up to 200 °C (for single-wire cable)	1710
• Contact elements 1-channel for single-wire types	1712…
• Contact elements 4-channel for single-wire types	1714…
• Crimpset with tools (Mounting of crimp pin 65003747 for connection to Types 1712... and 1714...)	1381A0

Ordering key

Type 9211B □

without PFA-cable D2 (only sensor)	**0,0**
with PFA cable D2, L=0,2 m	**0,2**
with PFA cable D2, L=0,4 m	**0,4**
with PFA cable D2, L=0,6 m	**0,6**
with PFA cable D2, L=0,8 m	**0,8**
with PFA cable D2, L=1,0 m	**1,0**
with PFA cable D2, L=1,2 m	**1,2**
with PFA cable D2, L=1,5 m	**1,5**
with PFA cable D2, L=1,6 m	**1,6**
with PFA cable D2, L=2,0 m	**2,0**
with PFA cable D2, L=2,5 m	**2,5**
with PFA cable D2, L=3,0 m	**3,0**
with PFA cable D2, L= ... m	**-sp**
with PTFE single-wire cable, L=1,5 m (with Stecker Typ 1839 included)	**E**
with PTFE single-wire cable, L=1,5 m (without connector Type 1839 included)	**G**

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