

Piezoelectric Force Sensor Type 6411B



- Small dimension
- Easy installation
- Separable sensor cable
- Secure ground connection even without shielding from the mold
- No single-wire cable
- For indirect pressure measuring behind the ejector pin
- Overworked version for high temperature applications up to a permanent mold temperature of 200 °C

Description and Application

The piezoelectric force sensor type 6411B stands out in its small dimension and its ability to be equipped with a separable sensor cable. The separable cable give the advantage of allowing the sensor to still be used, even if the cable is damaged.

Furthermore the force sensor can be permanently operated at a maximum temperature range of 200 °C. This corresponds with mold temperatures, which can be found in injection molding processes. Comparable force sensors however are usually limited to 120 °C.

The sensor is not only suitable for injection molding process but can also be used for general industrial force measurement.

Engineering - Suggestion for Sensor Positioning

Piezoelectric force sensors are generally installed behind the ejector pin and measure the cavity pressure indirectly. Therefore the sensors themselves do not come directly into contact with the plastic melt. For this reason, the mounting place depends on the position of the ejector pin and thus cannot be chosen freely. Alternatively, a specific „measuring pin“ can be used for the indirect measuring of the cavity pressure. The locations for measurement can be based off the following information in the table below.

We gladly offer assistance in determining the best sensor location.

Application	Mounting place suggestion
- Process optimization - General monitoring	- near the gate respectively at critical position - on a thick wall - before first baffle
Consistency monitoring	on the relevant position
Monitoring and control of viscosity and compression	previous of the cavity temperature sensor
Monitoring and control of shrinkage	around the cavity temperature sensor
Mold filling control („Short Shots“)	at the end of the flow path

Mounting

The force sensors are mounted directly behind the ejector pin, without additional fastening elements behind the ejector pin in the pocket created for the sensor. Thus the bearing surface of the pin-head should be finely polished and machined so that it contours (plain and parallel) on the sensor surface. For the clean installation into a blind bore (pocket) a hardened pressure disk is included in the scope of delivery.

By mounting a force sensor behind the ejector pin, the sensor cable is passed through freely and can move. A single wire cable could not be used in an application like this. This is due to the fact that single wire cable must be protected by the metal of the mold to provide shielding. PRIAMUS sensor cables always have their own shielding available.

The sensor cable should be displaced in the ejector plate, which should be covered by a thin plate to avoid damages. The angles in the cable channel must be added with a phase ($3 \times 45^\circ$) or a radius (R2), therewith the cable will not be damaged.

The protecting cap should be fixed on the mounting plate of the connector.

Handling

The contact plug must be kept clean and dry to avoid false signals.

In the not connected status the protecting cap for the sensor must be plugged on. In the connected status the protecting cap will be connected with the cap of the connecting cable, therewith defilement in the cap will be avoided.

Technical Data

Properties	Unit	Specifications
Measuring range	N	0 ... 2500
Overload	N	max. 3000
Nominal force sensitivity ¹⁾	pC/N	-4.4
Maximum mold temperature ²⁾	°C °F	0 ... 200 32 ... 392
Deviation of linearity	%	< +/-1
Natural frequency	kHz	≈ 200
Insulation resistance	Ω	> 10 ¹³ (room temperature) > 10 ¹² (bei 200 °C)

¹⁾ The exact sensitivity is provided on a separate calibration sheet.

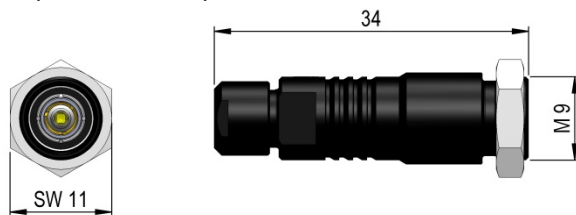
²⁾ Parts, which surround the sensor directly, must not pass the stated temperature. Parts, which are further away, can have > 200 °C.

Variants

Type	Connector	Cable length in [m]	Sensor cable	Connection to
6411B	-	-	-	Multi Channel Connecting Box 1195A-8p or Connecting cable 1041Ax 1049Bx
6411Bx.x-102	Fischer KBE 102 fem., TRIAX	x.x = 0.2 / 0.4 / 0.6 / 0.8 / 1.0 / 1.2	1006C Bending radius: 5mm	Multi-Pin Connecting Cable 1045Bx 1047Ax 1054Bx

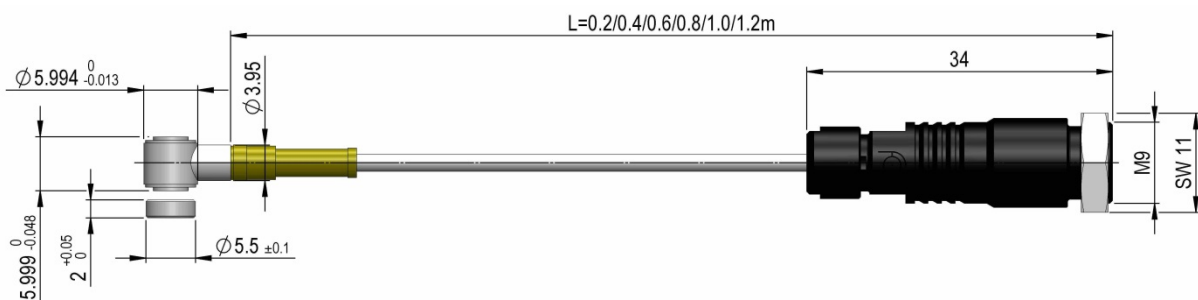
One Pin TRIAX Connector

Easy connection by TRIAX format



Fischer Type KBE 102 female TRIAX

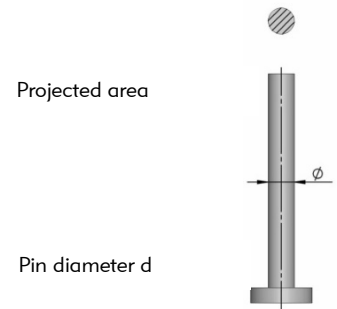
Dimensions Piezoelectric Force Sensor type 6411Bx.x-102 with cable and connector



Calculation of the Pressure Sensitivity

The effective cavity pressure results from the diameter of the ejector pin and the correspondent projected area on the pin front. Therefore the stated force sensitivity in the calibration certificate has to be converted depending on the pin diameter into a pressure sensitivity.

$$E_p[\text{pC/bar}] = \frac{d^2[\text{mm}^2] \cdot \pi \cdot 0.1}{4} E_f[\text{pC/N}]$$



Nominal force sensitivity E_f : -4.4 pC/N¹⁾

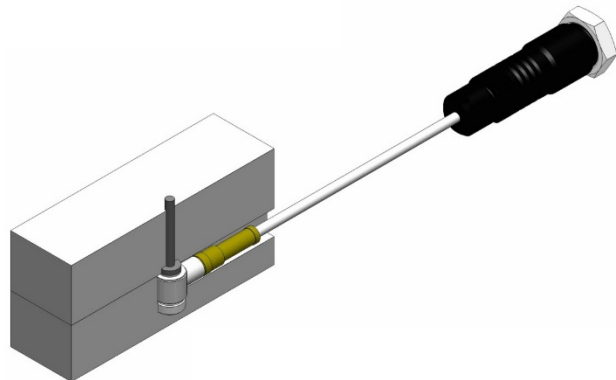
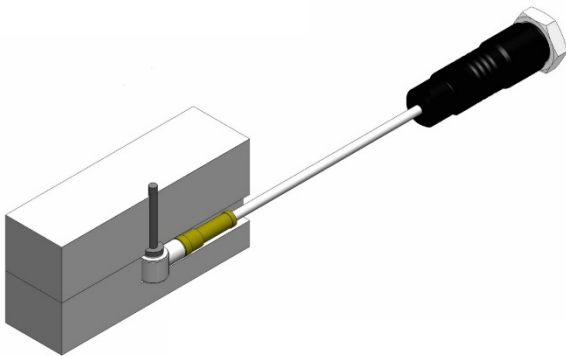
Pin diameter d [mm]	Pressure sensitivity E_p [pC/bar]	Maximum pressure [bar]
1.6	-0.88	> 3.000
2	-1.38	
2.5	-2.16	
3	-3.11	
4	-5.53	2.000
5	-8.64	1.250

¹⁾ The exact sensitivity is provided on a separate calibration sheet.

Examples for Installation Situation

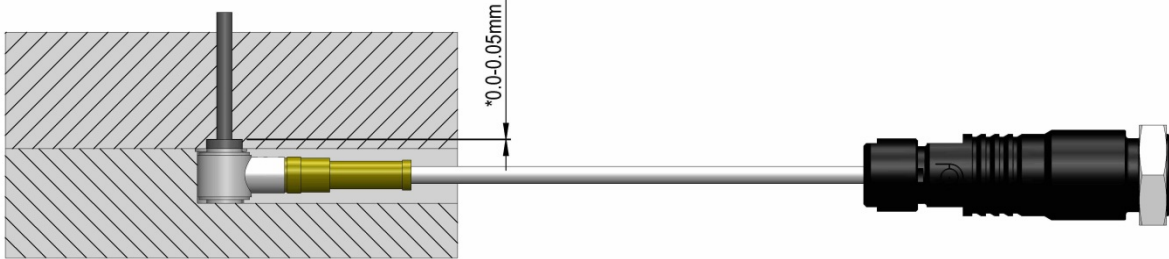
Standard: Without pressure disk

Alternative: With pressure disk



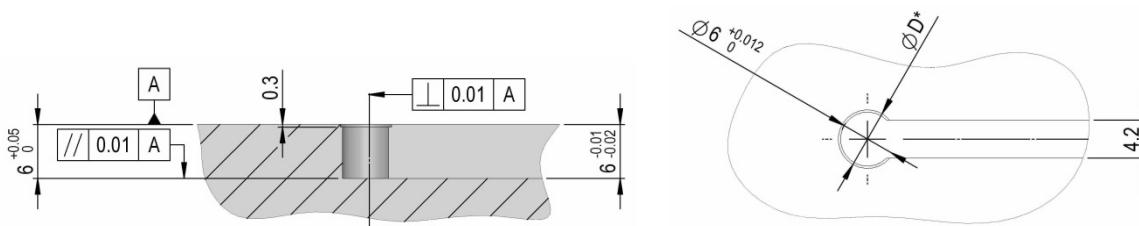
Example:

Force sensor type 6411B for indirect measuring mountes behind the ejector pin in the ejector set.

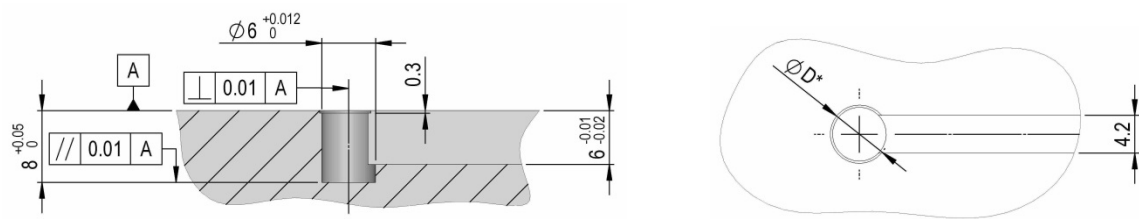


* = The sensor must not be preloaded. Check slackness before mounting the sensor.

Mounting Hole Standard

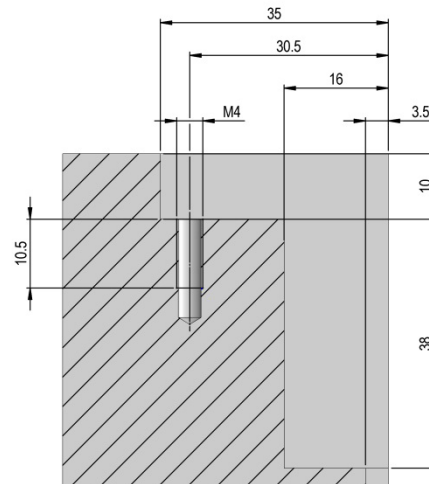
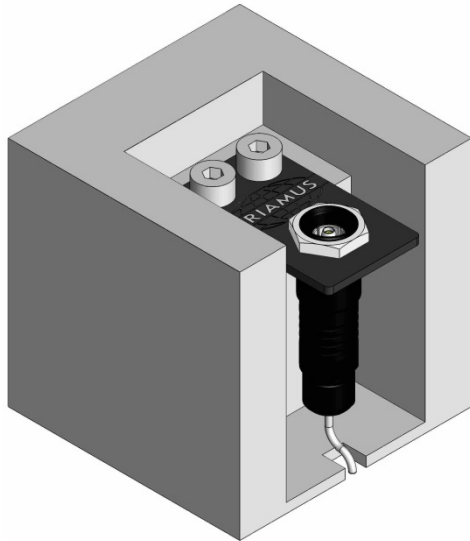


Mounting Hole Alternative with Pressure Disk



* = Recess 0.5 mm bigger than the diameter of the ejector head

Installation Situation – Connector with Mounting Plate

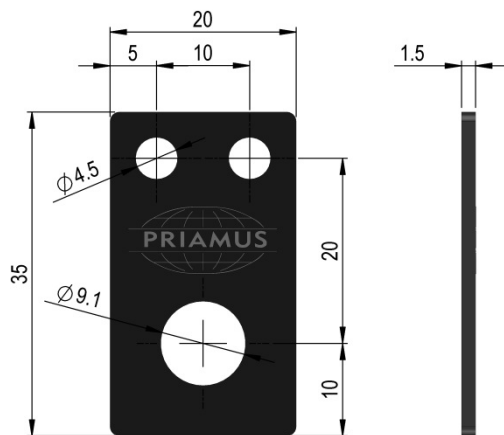


Scope of Delivery

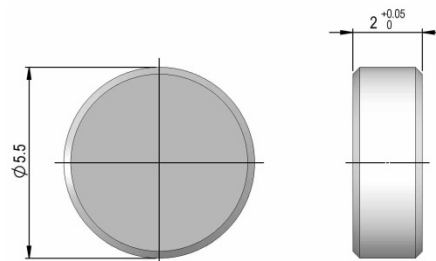
Article	Type
Mounting plate	6581B
Sensor cable for 6411Bx.x-102	1006C

Article	Type
Pressure disk	6412A
Identification plate	-

Mounting plate type 6581B



Pressure disk type 6412A



Accessories (Optional)

Connecting and extension cables

Type	Coat	Bending radius [mm]	Connector ¹⁾ TRIAx / ²⁾ Code 1
Connecting cables:			
1041Ax	Plastic	12	Fischer Type S 102 male ¹⁾ Fischer Type S 102 male ¹⁾
1049Bx	Metal hose	20	Fischer Type S 102 male ¹⁾ Fischer Type S 102 male ¹⁾
Multi pin connecting cables:			
1045Bx	Plastic	12 (bundled: 25)	Fischer Type S 104 fem. 16-pin ²⁾ 4 x Fischer Type S 102 male ¹⁾
1047Ax	Plastic	12	Fischer Type S 104 fem. 16-pin ²⁾ 1 x Fischer Type S 102 male ¹⁾
1054Bx	Plastic	50	Fischer Type S 104 fem. 16-pin ²⁾ Fischer Type S 104 fem. 16-pin ²⁾
Extension cable:			
1043Bx	Metal hose	20	Fischer Type S 102 male ¹⁾ Fischer Type KBE 102 fem. ¹⁾

Article	Type
Multi channel connecting box	1195A-8p
BlueLine charge and temperature amplifier	5070A-2p2T

Article	Type
BlueLine charge amplifier	5080A-xp