

## Press Force Sensor

Type 9313 ... 9363

–0,5 ... 5 kN to –20 ... 120 kN

These ready-to-use piezoelectric force sensors are particularly suitable for measuring rapidly changing compression forces in presses. The press force sensors are supplied calibrated and can be mounted in various ways.

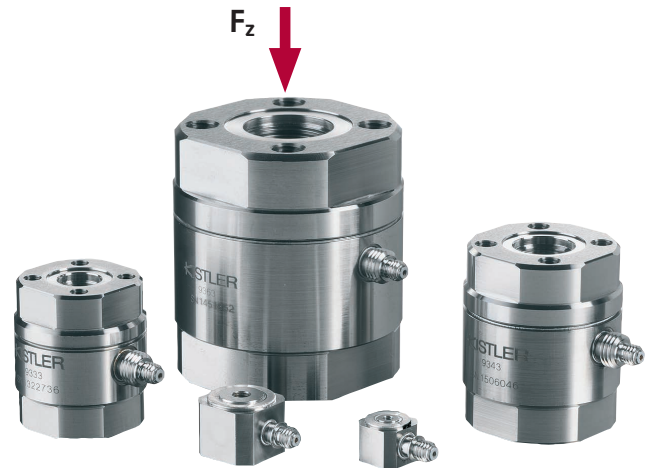
Five sizes (with maximum measuring range of 5 kN, 20 kN, 50 kN, 70 kN and 120 kN respectively) are available.

- 3 calibrated measuring ranges: 100 %, 10 %, 1 %
- Compact force sensor ready for easy mounting in connecting rods or plungers
- Double flange for maximum adaptability
- Central bore for ejection tools, etc. (not provided in 5 kN and 20 kN sensor)
- Can be used as force calibration sensor
- Suitable for monitoring joining processes
- SCS calibration (optional)
- Calibration of additional measuring range (optional)

### Description

This device is a sensor calibrated in three ranges for measuring compression forces. The compression forces acting on the sensor produce in the piezoelectric element a proportional electric charge, which is converted in the measurement or monitoring electronics into a proportional electric voltage. The side cable connector can be very easily covered with a screw-on protector included as standard. On the top and bottom of Types 9333, 9343 und 9363 are flanges that allow simple, versatile direct mounting in connecting rods or plungers. It can also be directly mounted at one end, using a fine female thread or the supplied cheese head screw with threaded bush. This minimizes the mounted height of the sensor. If direct mounting is not possible, standard (optional accessory) or customized adapters may be used. A centering seat on both ends allows very accurate coaxial mounting, for example in press-in spindles. A central bore opens up further applications, e.g. with central ejection tools.

Types 9313 and 9323 have a central tapped blind hole in each end for mounting an axial shaft adapter. If direct mounting is not possible, a standard adapter (optional accessory) or custom alternative can be used.



### Application

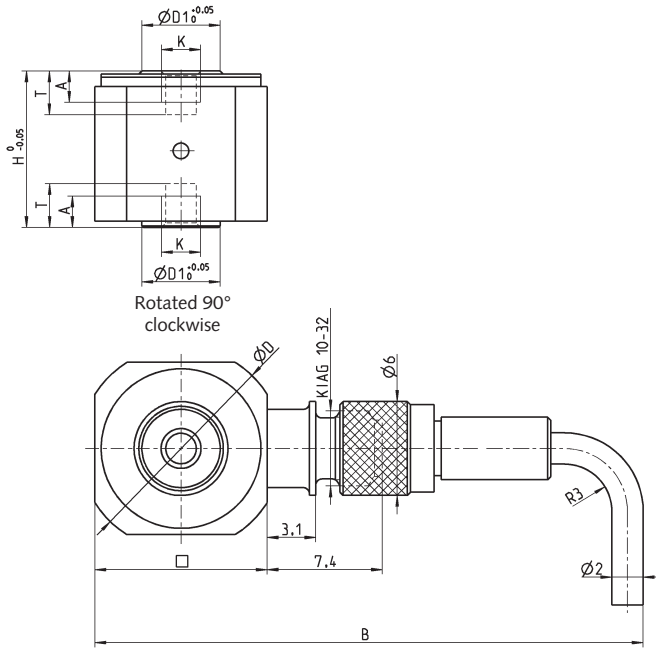
The very low profile and rigidity of the press force sensor makes it particularly suitable for measuring rapidly changing compression forces in presses, press-in forces in joining processes, or generally for simply measuring compression forces in test machinery. The elastic characteristics of the machine structure remain largely unchanged. The sensor may be fitted in the moving connecting rod, in the plunger or on the machine table (stationary).

The sensor is suitable for use as a calibration element in calibration measurement. Its compactness and high level of measuring accuracy in all three ranges allow on site calibration of force or strain sensors mounted in the structure of a machine.



Fig. 1: Calibrating element with force distribution cap, flange and cable protector

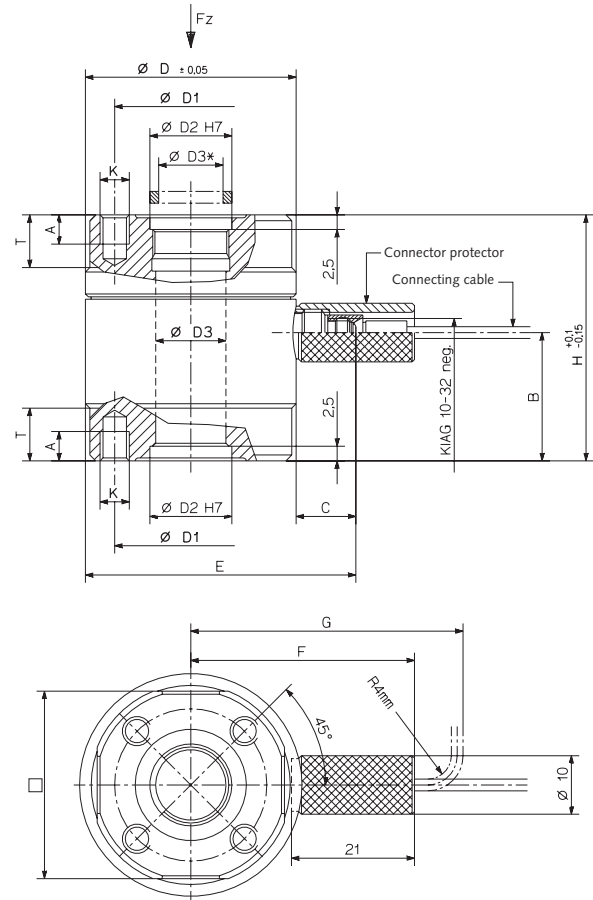
**Dimensions Type 9313 ... 9323**



**Dimensions in mm**

Type	D	D1	$\square$	H	K	T	A	B
9313	13	5	11	10	M2,5	2,8	2	35
9323	19	10	16	14	M4	4,2	3	40

**Dimensions Type 9333 ... 9363**



**Dimensions in mm**

Type	D	D1	D2	D3	D3*	$\square$	H	A
9333	30	21	10	8	8	26	34	4
9343	36	26	14	11	11	32	42	5
9363	54	40	21	17	17	48	60	8

Type	B	C	E	F	G	K	T
9333	16,6	10,1	40,1	36	43,5	M4	8
9343	21,7	10,2	46,2	39	46,5	M5	9
9363	32,5	10,4	64,4	48	56	M8	13

\* Remains clear with centering rings fitted

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## Technical Data

Press Force Sensor		Type	9313	9323	9333	9343	9363
Measuring range	$F_z$	kN	-0,5 ... 5	-2 ... 20	-5 ... 50	-10 ... 70	-20 ... 120
Overload	$F_z$	kN	-0,55/5,5	-2,2/22	-6/60	-14/84	-24/144
Calibrated measuring ranges							
100 %	$F_z$	kN	0 ... 5	0 ... 20	0 ... 50	0 ... 70	0 ... 120
10 %	$F_z$	kN	0 ... 0,5	0 ... 2	0 ... 5	0 ... 7	0 ... 12
1 %	$F_z$	kN	0 ... 0,05	0 ... 0,2	0 ... 0,5	0 ... 0,7	0 ... 1,2
Sensitivity	$F_z$	pC/N	-10	-10	-3,9	-3,9	-3,8
Threshold	$F_z$	N	0,01	0,01	0,02	0,02	0,02
Linearity, typical		% FSO	$\pm 0,3$	$\pm 0,3$	$\pm 0,5$	$\pm 0,3$	$\pm 0,3$
Hysteresis, typical		% FSO	0,4	0,4	0,3	0,2	0,1
Torque max.	( $F_{x,y} = 0, F_z = 0$ ) $M_z$	N·m	0,8	2	8	15	90
Bending moment max.							
( $F_z = 100$ %)	$M_{x,y}$	N·m	0,2	0,5	10	10	30
( $F_z = 0$ %)	$M_{x,y}$	N·m	0,8	2	60	130	280
Shear force max. <sup>1)</sup>	$F_{x,y}$ ( $F_z = 0$ )	kN	0,03	0,07	1,5	3	4,5
Crosstalk							
(typical)	$F_{x,y} \rightarrow F_z$	N/N	<0,29	<0,65	<0,03	<0,07	<0,06
	$M_{x,y} \rightarrow F_z$	N/N·m	<72,4	<98	<0,3	<0,3	<0,3
Rigidity	$c_z$ ( $F_z$ )	N/ $\mu$ m	470	1 100	1 650	2 340	3 800
Natural frequency	$f_n$ ( $F_z$ )	kHz	>38	>34,6	>55,3	>47,3	>35,3
Operating temperature		°C	-40 ... 120				
Temperature coefficient of sensitivity	$F_z$	%/°C	0,05	0,05	-0,02	-0,02	-0,02
Insulation resistance at 20 °C		$\Omega$	$\geq 5 \cdot 10^{13}$				
Capacitance	C	pF	$\approx 26$	$\approx 84$	$\approx 55$	$\approx 65$	$\approx 150$
Connector			KIAG 10-32 neg.				
Degree of protection (with cable connected)		EN60529	IP65				
Case material		DIN	1.4542				
Weight		g	8	25	137	240	800
Tightening torque max.							
M2,5	$M_A$	N·m	0,5				
M4	$M_A$	N·m		1	2		
M5	$M_A$	N·m				4	
M8	$M_A$	N·m					21

<sup>1)</sup> Application of force in plane of flange

### General Mounting Instructions

Whenever possible the force should be transferred axially. Eccentric force application, bending moments, torques and shear forces are only permissible to a limited extent.

The bearing surfaces that transmit the force to the press force sensor must be flat, rigid and clean. The centering seats on both ends of the Type 9333 ... 9363 press force sensor allow very accurate coaxial mounting using the supplied centering rings.

The sensor can be mounted directly using the adapter flange on each end, the female thread, the mounting screw with threaded bush, or the adapter module. Special adapter modules can be manufactured for mounting by the customer if required.

### Adaptation Options for Press Force Sensors

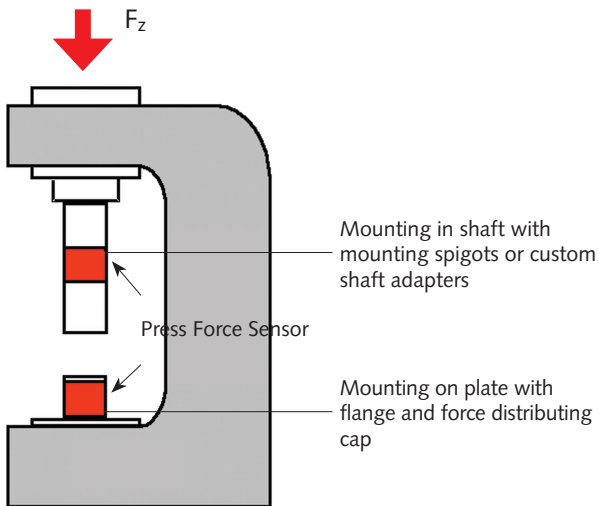


Fig. 2: Mounting principle

### Adaptation Options for Types 9313 and 9323

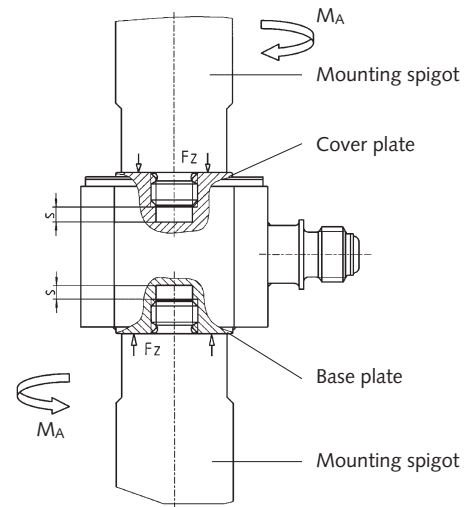


Fig. 3: Adaptation A: Mounting Types 9313 and 9323 in shaft with mounting spigots

The thread of the mounting spigot must not be longer than the maximum possible depth of the mating thread or project into the holes in the ends of the press force sensor. Preferably, sufficient play  $S$  (see mounting diagram) to ensure this should be allowed for.

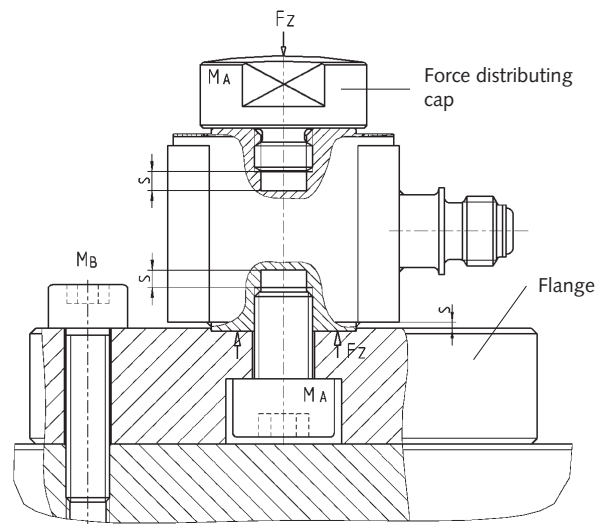
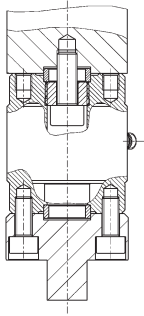


Fig. 4: Adaptation option B: Mounting Types 9313 and 9323 in shaft with flange and force distributing cap

**Overview of Adaptation Options (Types 9333 ... 9363)**

**Mounting in Plunger**

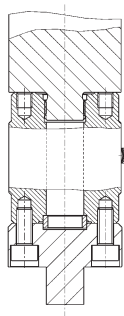
Direct mounting using integral threaded bush with mounting screw



Customized tool adapter

A

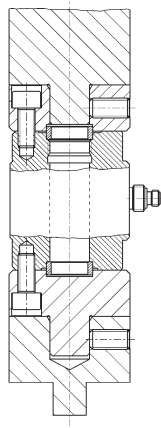
Direct mounting using fine threaded provided



Customized tool adapter

B

Straight shank holder with clamping screw

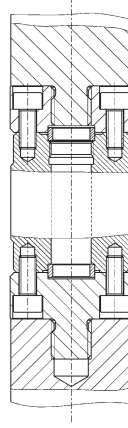


Straight shank Customized tool adapter with clamping screw

C

**Mounting in Connecting Rod**

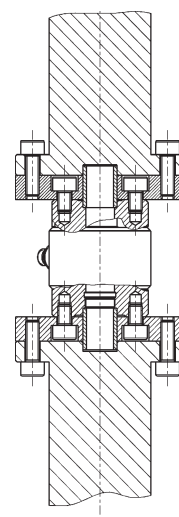
Female thread adapter



Male thread adapter

D

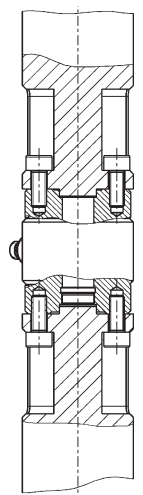
Adapter flange



Adapter flange

E

Direct mounting using integral flange

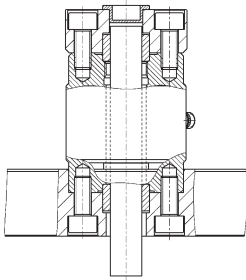


Direct mounting using integral flange

F

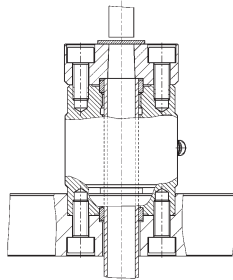
**Table Mounting**

G



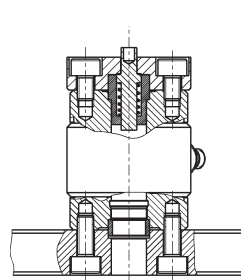
Customized adaptation of deep drawing tool with central ejection tool

H



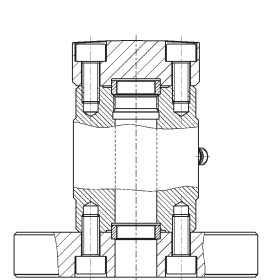
Customized adaptation of punching tool with central ejection bore

I



Customized adaptation of riveting tool

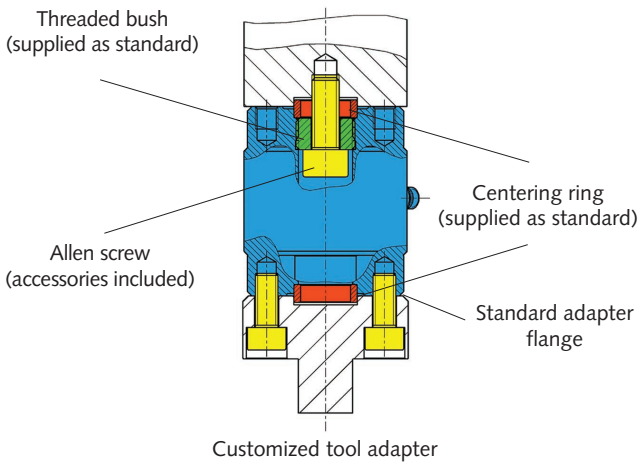
J



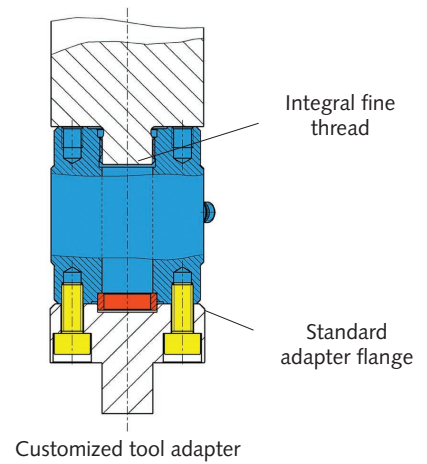
Press force sensor with force distributing cap used as calibrating element

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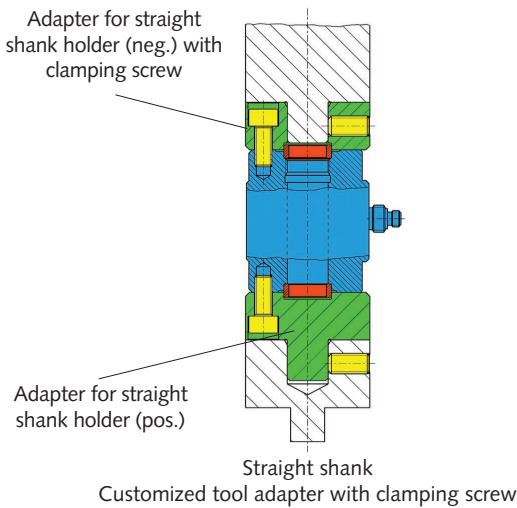
### Example A: Direct Mounting Using Integral Mounting Screw and Threaded Bush



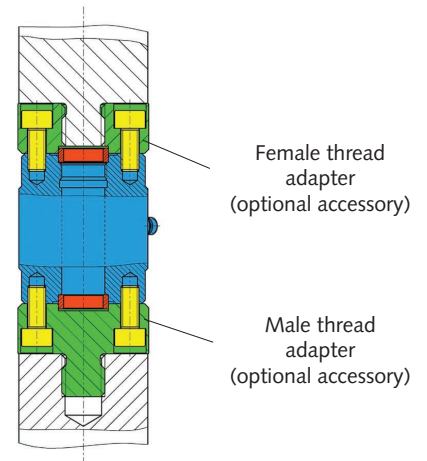
### Example B: Direct Mounting Using Integral Fine Thread



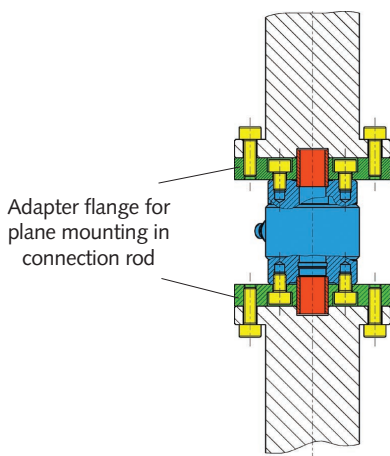
### Example C: Mounting Using Adapter with Straight Shank Holder



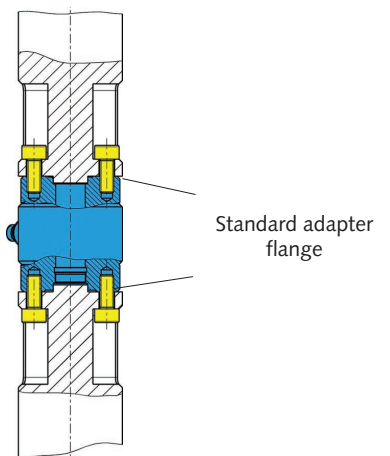
### Example D: Mounting Using Threaded Adapter



### Example E: Mounting Using Adapter Disk/Flange

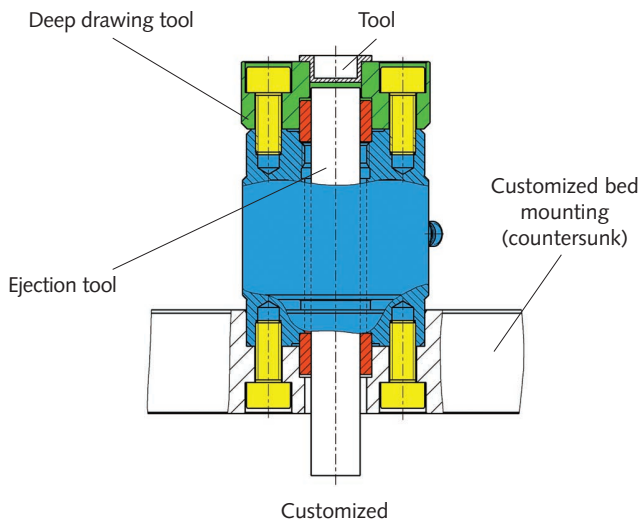


### Example F: Direct Mounting Using Integral Flange

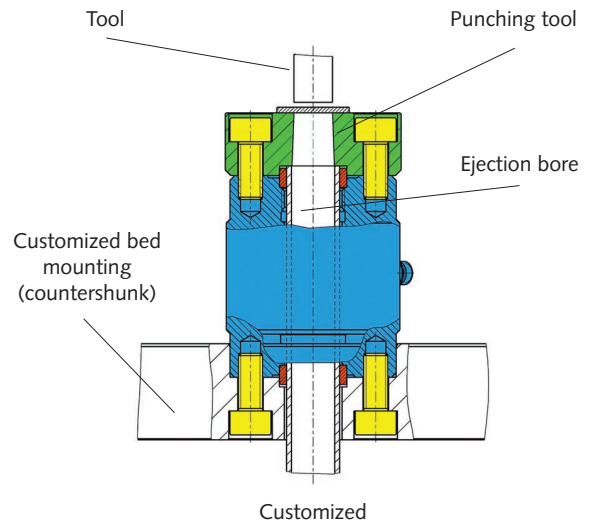


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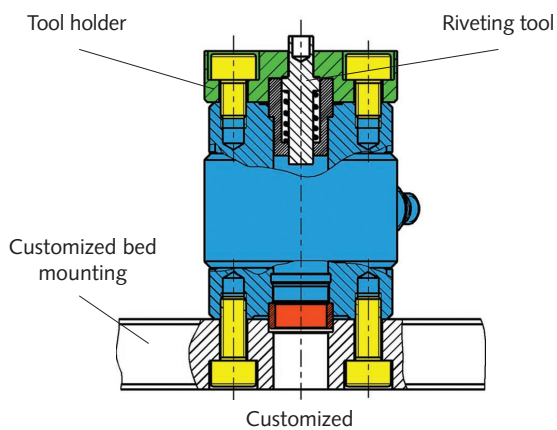
**Example G: Adaptation of Deep Drawing Toll with Central Ejection Tool**



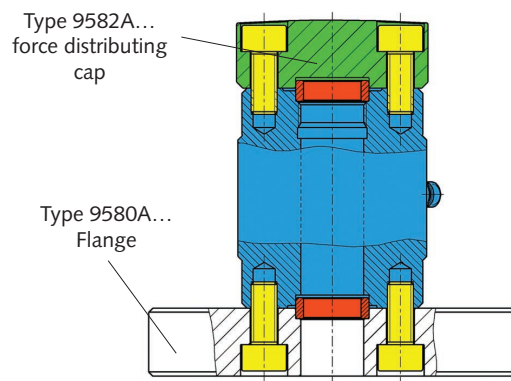
**Example H: Adaptation of Punching Tool with Central Ejection Bore**



**Example I: Adaptation of Riveting Tool**



**Example J: Calibrating Element with Force Distributing Cap and Flange**



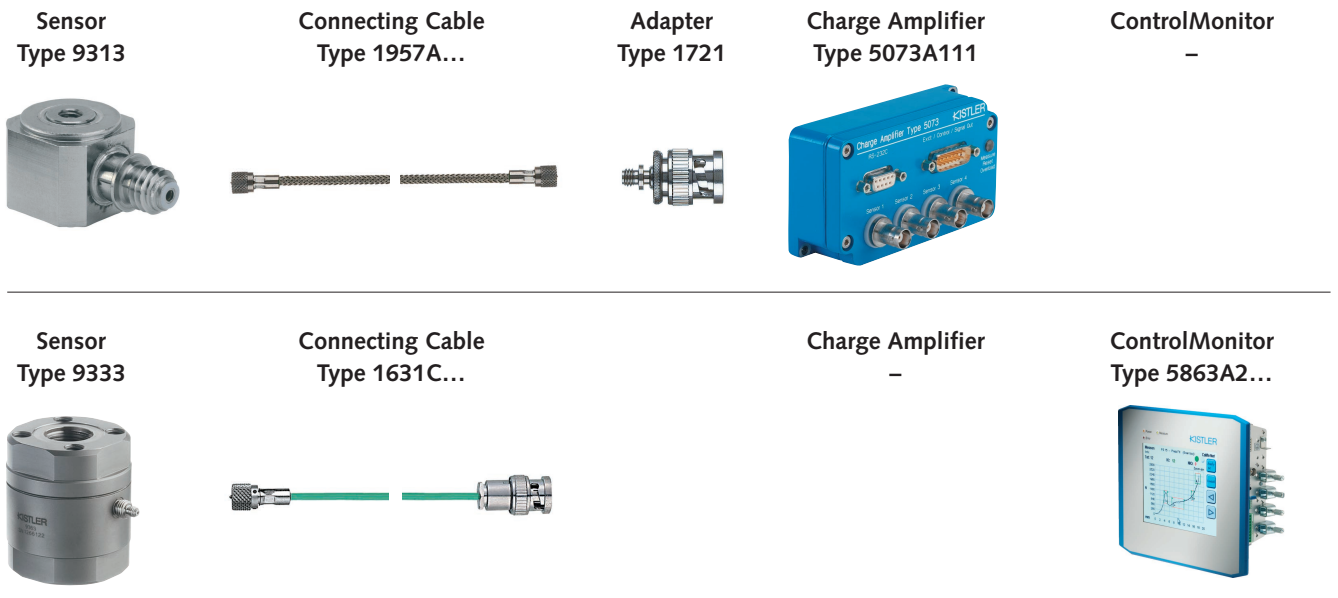
For mounting as a calibration element, the press force sensor can be directly adapted by the customer with a Type 9582A... force distributing cap (optional accessories). Alternatively, as shown, it can be fitted with an additional Type 9680A... flange (optional accessories) for easy mounting on the bed of the machine.

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## Connection

Only high insulation, low capacitance coaxial cables that only produce very little triboelectricity during movement may be used to connect piezoelectric sensors. For industrial applica-

tions we recommend using the types listed under accessories.



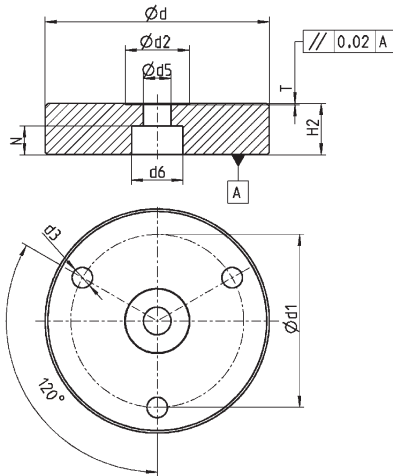
Ordering Code Scope of Delivery including Accessories	Type	Optional Accessories	Type
<b>Press Force Sensor <math>F_z</math> -0,5 ... 5 kN</b>	<b>9313</b>	<ul style="list-style-type: none"> <li>Connecting cable, KIAG 10-32 pos. – BNC pos.</li> <li>Connecting cable, KIAG 10-32 pos. – TNC pos.</li> <li>Connecting cable, KIAG 10-32 pos. – KIAG 10-32 pos.</li> </ul>	1631C... 1633C... 1635C...
<b>Press Force Sensor <math>F_z</math> -2 ... 20 kN</b>	<b>9323</b>	<ul style="list-style-type: none"> <li>Connecting cable, KIAG 10-32 pos. int. – BNC pos.</li> </ul>	1939A...
<b>Press Force Sensor <math>F_z</math> -5 ... 50 kN</b>	<b>9333</b>	<ul style="list-style-type: none"> <li>Connector protector</li> <li>Threaded bush</li> <li>M4x12 cheese head screw</li> <li>Centering ring (2x)</li> </ul>	3.414.366 3.315.053 6.120.102 3.420.179
<b>Press Force Sensor <math>F_z</math> -10 ... 70 kN</b>	<b>9343</b>	<ul style="list-style-type: none"> <li>Connector protector</li> <li>Threaded bush</li> <li>M6x18 cheese head screw</li> <li>Centering ring (2x)</li> </ul>	3.414.366 3.315.054 6.120.122 3.420.180
<b>Press Force Sensor <math>F_z</math> -20 ... 120 kN</b>	<b>9363</b>	<ul style="list-style-type: none"> <li>Connector protector</li> <li>Threaded bush</li> <li>M10x25 cheese head screw</li> <li>Centering ring (2x)</li> </ul>	3.414.366 3.315.055 6.120.066 3.420.181
		<ul style="list-style-type: none"> <li>Viton®-Connecting cable, KIAG 10-32 pos. int. – KIAG 10-32 pos. int. oil leak-proof</li> <li>Flange</li> <li>Force distribution cap</li> <li>Female thread adapter</li> <li>Male thread adapter</li> <li>Mounting spigot</li> <li>SCS calibration</li> </ul>	1941A... 9580A... 9500A.../ 9582A... 9584A... 9586A... 9590A... 9950-SCS-F-01

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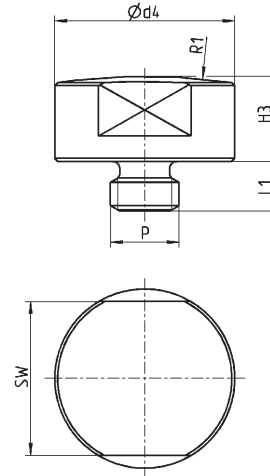


## Flange



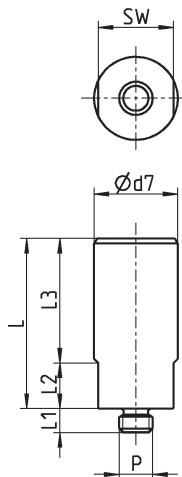
for Type	Type	d	d1	d2	d3	d5	d6	H2	N
9313	9580A7	27	20	5,4	2,7	2,7	5,5	7	2,6
9323	9580A8	35	27	10	3,2	4,3	8	8	4,5

## Force Distributing Cap



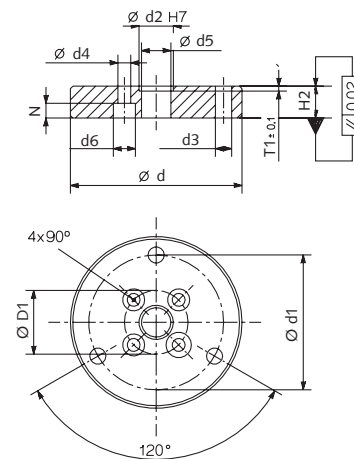
for Type	Type	d4	H3	L1	P	R1	SW
9313	9500A00	6	3	1,9	M2,5	15	5
9323	9500A01	10,5	5	2,9	M4	35	9

## Mounting Spigot



for Type	Type	d7	L	L1	L2	L3	P	SW
9313	9590A7	5	12,5	1,9	2,5	10	M2,5	4,5
9323	9590A8	10	20,5	2,9	5,5	15	M4	9

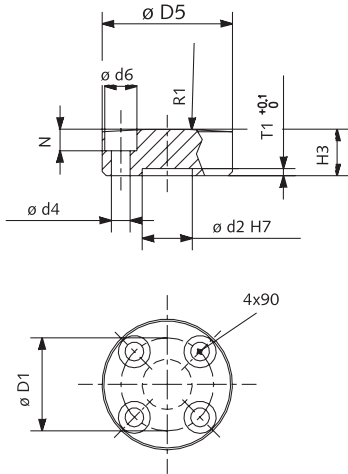
## Flange



for Type	Type	D1	d	d1	d2	d3	d4	d5	d6	H2	T1	N
9333	9580A0	21	62	50	10	5,5	4,3	8,5	7,5	11	2	5
9343	9580A1	26	70	55	14	6,6	5,3	12	9	13	2	6
9363	9580A2	40	100	78	21	13,5	8,4	18	14	22	2	9

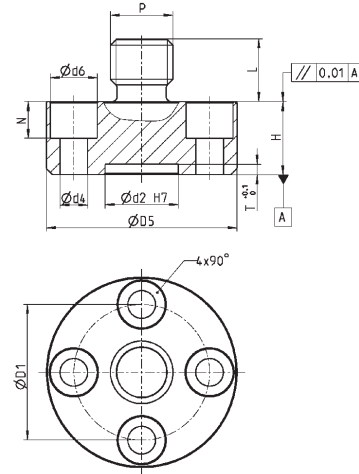
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**Force Distributing Cap**



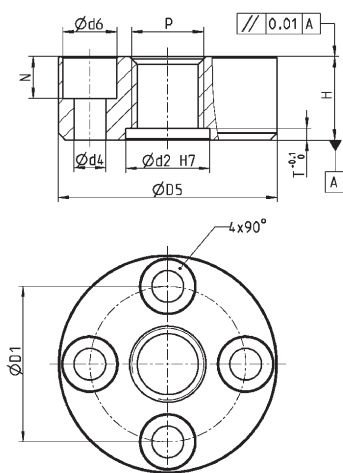
for Type	Type	D1	D5	d2	d4	d6	H3	T1	N	R1
9333	9582A0	21	30	10	4,3	7,5	11	2	5	250
9343	9582A1	26	36,5	14	5,3	9	13	2	6	300
9363	9582A2	40	56	21	8,4	14	22	2	9	350

**Male Thread Adapter**



for Type	Type	D1	D5	d2	d4	d6	H	N	P	L	T
9333	9586A0	21	30	10	4,3	7,5	11	5	M8	9	2
9343	9586A1	26	36,5	14	5,3	9	14	7	M12	12	2
9363	9586A2	40	56	21	8,4	14	21	9	M18	19	2

**Female Thread Adapter**



for Type	Type	D1	D5	d2	d4	d6	H	N	P	T
9333	9584A0	21	30	10	4,3	7,5	11	5	M8	2
9343	9584A1	26	36,5	14	5,3	9	14	7	M12	2
9363	9584A2	40	56	21	8,4	14	21	9	M18	2

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