

Press Force Sensor

0 ... 5 N to 0 ... 700 kN

Type 9323A ... 9393A,
Type 9383AU0109
Type 9393AU0109

The sensors of the Press Force series are ideal for measuring both dynamic and quasistatic forces. The factory preloading and adaptability of these practical designs ensure readiness for immediate use. They come in five different sizes which are divided in seven measuring ranges.

- Compression forces from 0 ... 5 N to 0 ... 700 kN
- Each individual sensor offers an extremely wide measuring range
- Calibration certificate for 3 measuring ranges: 100 %, 10 %, 1 % and 0,1 % (Type 9323AAA only)
- SCS calibration optional
- Simple mechanical adaptation with flanges on both ends
- Easily mounted in connecting rods or press plungers
- Factor of safety against overload of up to 100 when using lowest ranges

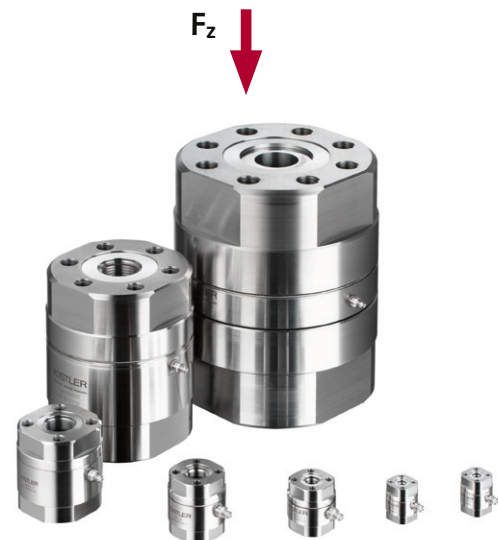
Description

These press force sensors are based on the piezoelectric measuring principle. The force acting on the quartz element generates at the output of the sensor a proportional electric charge, which is converted by the series-connected measuring amplifier (such as ICAM Type 5073A...) into a process signal suitable for evaluation (typically 0 ...10 V). Depending on the utilized type of sensor, tension forces of up to 16 % of the compression force range can also be measured. Although uncalibrated, these ranges are often used for detecting tool withdrawal forces, for example after press-fit processes.

Applications

The flange connections at both ends allow flexible mechanical adaptation of the sensor to suit the particular machine environment. The included centering rings also facilitate axial adjustment. The rotationally symmetrical shape of the press force sensor makes it ideal for mounting in or on the end of connecting rods or press plungers.

The piezoelectric element's special characteristic of approximately constant measuring accuracy over a substantial range allows the same press force sensor to be used for a wide spectrum of forces. The feasibility of switching measuring range when using suitable amplifiers (such as the ICAM Type 5073A...) bolsters this advantage while accommodating



the general trend towards production and measuring stations handling a greater variety of parts. However, the wide-range measuring chain also offers critical advantages in laboratory applications, where frequent changes of sensor are the order of the day. And the extremely high degree of overload protection obviates involved protective measures when using the lowest measuring ranges.



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

Technical data

Press Force Sensor	Type	9323AAA	9323AA	9323A	9333A	9343A	9363A	9383A	9393A
Measuring range F_z	kN	0 ... 5	0 ... 10	0 ... 20	0 ... 50	0 ... 70	0 ... 120	0 ... 300	0 ... 700
Overload F_z	kN	5.5	12	24	60	84	144	360	840
Measuring ranges, calibrated F_z 100 %	kN	0 ... 5	0 ... 10	0 ... 20	0 ... 50	0 ... 70	0 ... 120	0 ... 300	0 ... 700
10 %	kN	0 ... 0.5	0 ... 1	0 ... 2	0 ... 5	0 ... 7	0 ... 12	0 ... 30	0 ... 70
1 %	kN	0 ... 0.05	0 ... 0.1	0 ... 0.2	0 ... 0.5	0 ... 0.7	0 ... 1.2	0 ... 3	0 ... 7
0.1 %	kN	0 ... 0.005							
Max. tension force	kN	0 ... -1	0 ... -1	0 ... -2	0 ... -5	0 ... -10	0 ... -20	0 ... -50	0 ... -140
Sensitivity, F_z	pC/N	-33	-9.6	-3.9	-3.9	-3.9	-3.8	-1.9	-1.9
Linearity incl. Hysteresis ¹⁾	%FSO	$\leq \pm 0.5$ ²⁾							
Repeatability	%FSO	0.02	0.03	0.02	0.03	0.01	0.01		
Preload force F_v	kN	8.5	8.5	8.5	15	25	80	250	450
Torque max. ($F_{x,y} = 0, F_z = 0$), M_z	N·m	5	5	5	14	31	145	783	1 980
Bending moment max. $M_{x,y}$ $F_z = 100\%$	N·m	0.9	0.9	0.9	10	10	232	972	1 100
$F_z = 0\%$	N·m	14	23	23	65	135	638	3.407	9 940
Shear force max. ³⁾ $F_{x,y}$ ($F_z = 0$)	kN	0.48	0.62	0.62	1	1.8	5.8	16.9	31.4
Crosstalk (typical) $F_{x,y} \rightarrow F_z$	N/N	$\leq \pm 0.05$ ⁴⁾	$\leq \pm 0.05$	$\leq \pm 0.03$	$\leq \pm 0.03$	$\leq \pm 0.07$	$\leq \pm 0.06$	$\leq \pm 0.02$	$\leq \pm 0.02$
$M_{x,y} \rightarrow F_z$	N/N·m	$\leq \pm 0.5$ ⁴⁾	$\leq \pm 0.5$	$\leq \pm 0.5$	$\leq \pm 0.3$	$\leq \pm 0.3$	$\leq \pm 0.3$	$\leq \pm 0.3$	$\leq \pm 0.3$
Rigidity c_z (F_z)	kN/ μ m	≈ 1.0 ⁴⁾	≈ 1.3	≈ 1.2	≈ 2.3	≈ 2.6	≈ 4.4	≈ 7.9	≈ 10.0
Natural frequency, f_n (F_z)	kHz	> 70 ⁴⁾	> 74.5	> 72	> 55	> 47	> 35	> 17	> 11.3
Operating temperature	°C	-40 ... 80	-40 ... 120						
Temperature coefficient of sensitivity, F_z	%/°C	0.02	0.05	-0.02					
Insulation resistance at 23°C	Ω	$\geq 1 \cdot 10^{13}$	$\geq 5 \cdot 10^{13}$						$\geq 10^{13}$
Capacity C	pF	≈ 202	≈ 68	≈ 29	≈ 55	≈ 65	≈ 150	≈ 790	≈ 890
Connector		KIAG 10-32 neg.							
Protection class EN60529 with connected cable	IP	65							
with cable Type 1983AD... and welded sensor	IP	67							
Case material	DIN	1.4542							
Weight	g	48	50	47	137	240	800	6.490	1.8663

¹⁾ Referring to FSO of the calibrated (!) measuring range

²⁾ For sub-range 0.1% determined only for ascending curve, without hysteresis

³⁾ Corresponds to lateral force at the flange

⁴⁾ Calculated value

General mounting instructions

- The flange bearing surfaces that transmit the force to the sensor must be kept flat and free from dirt and grease
- The centering seats on both ends of the sensor allow very accurate coaxial mounting using the supplied centering rings.
- The sensor can be mounted using the central female thread or tapped holes of the pitch circle.
- Do not exceed the bending moments, torques and shear force specified in the table.
- Whenever possible the force should be transferred axially rather than laterally.
- See pages 4 and 5 for other mounting options.

Customized measuring range

Types 9383A and 9393A can also be customized prestressed. The measuring range can thus be designed for a specific tension-/pressure range. The type designation for the customer specific sensors will be extended with U0109.

Technical data

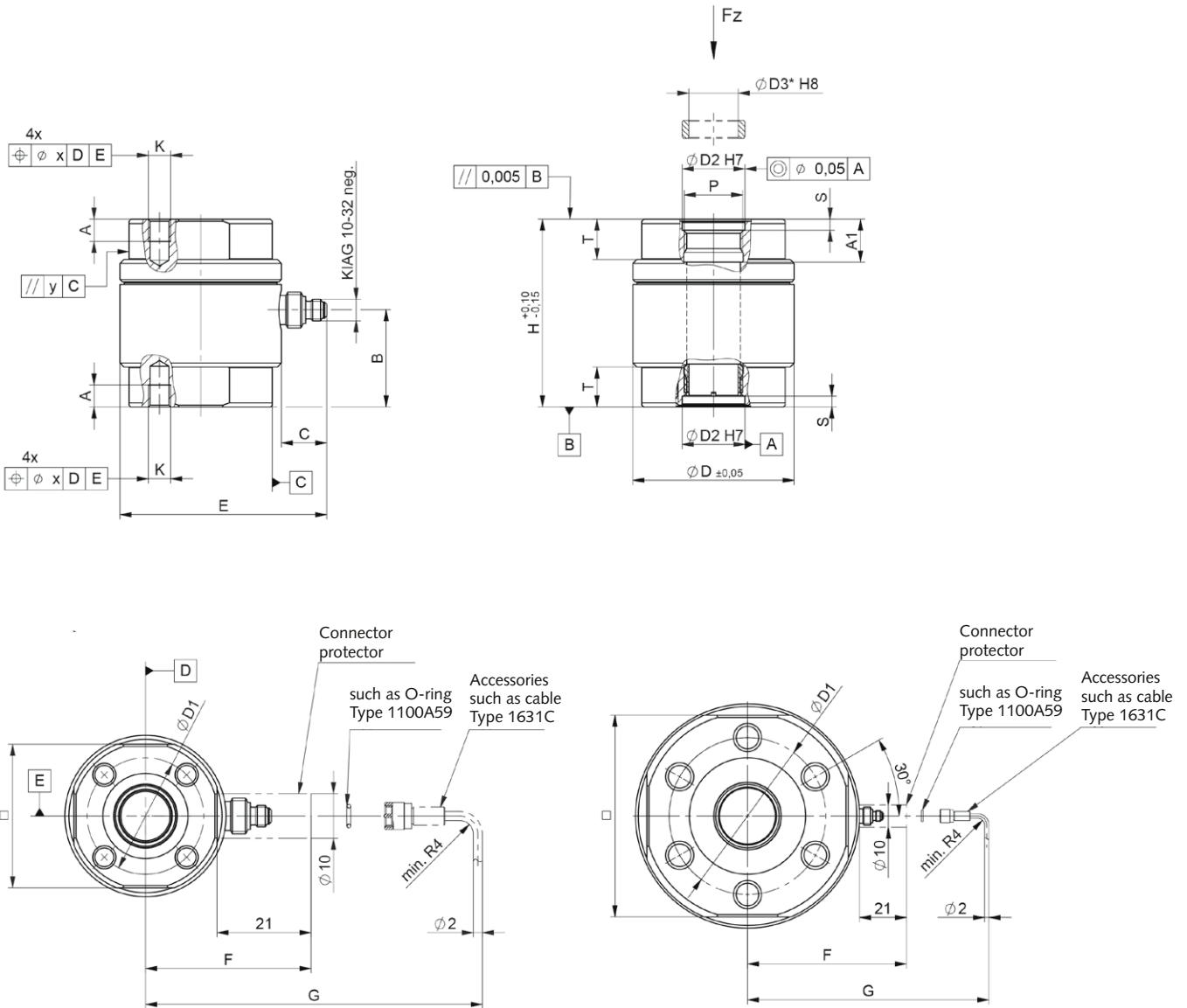
Press Force Sensor	Type	9383AU0109	9393AU0109
Compression force:			
Measuring range Fz, max	kN	-50 ... 500 a)	-100 ... 950 b)
Overload Fz, max.	kN	-55/550	-110/1 045
Calibrated Range Fz	kN	customized	customized
Linearity incl. Hysteresis	%FSO	≤±1	≤±1

a) Minimal pretension: $F_{v1} = 100$ kN at max. compression force of $F_z = 500$ kN

b) Minimal pretension: $F_{v1} = 200$ kN at max. compression force of $F_z = 950$ kN

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Dimensions Type 9323A/AA/AAA ... 9383A

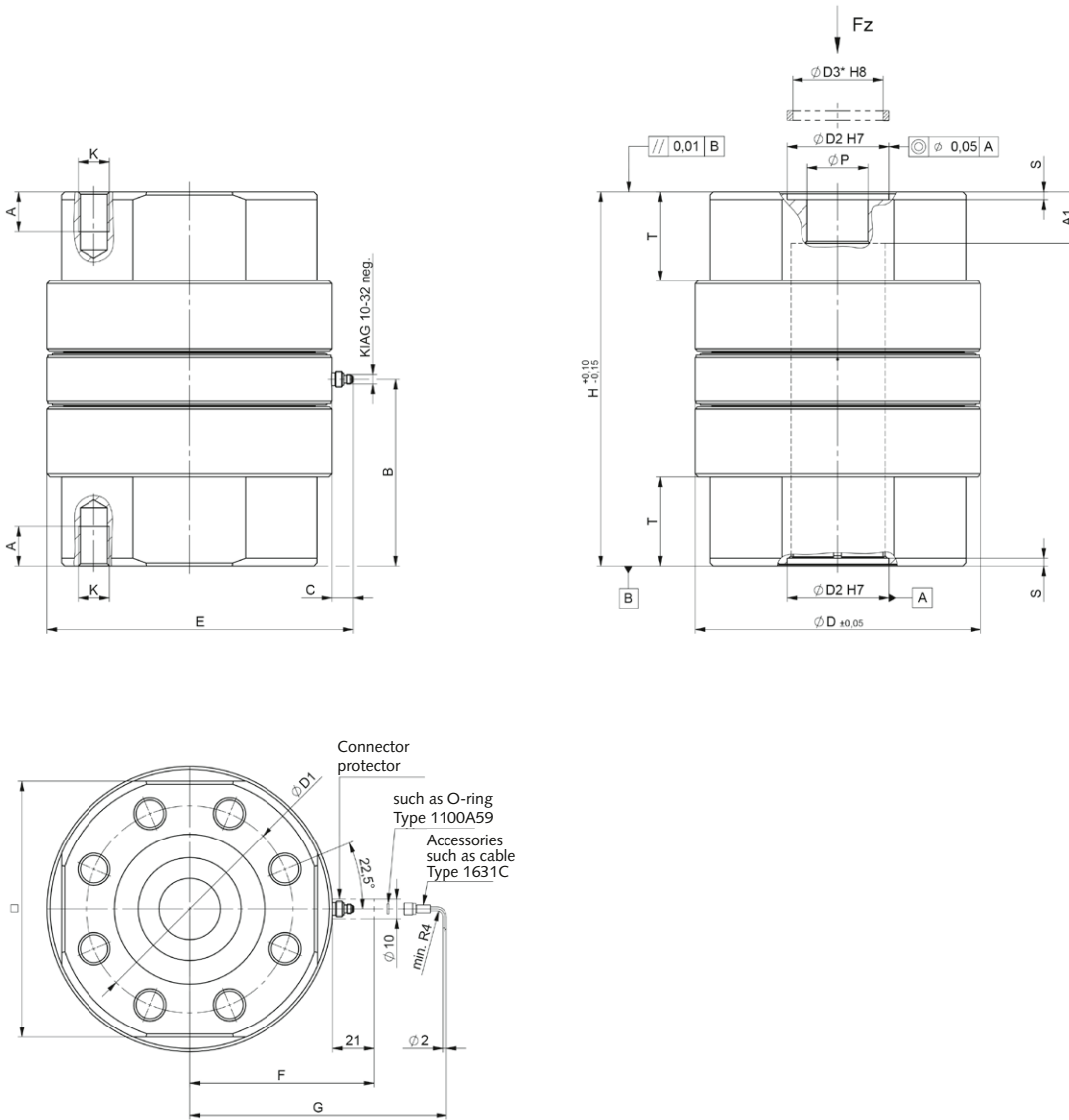


Type 9323A/9333A/9343A/9363A

Type 9383A

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Dimensions Type 9393A



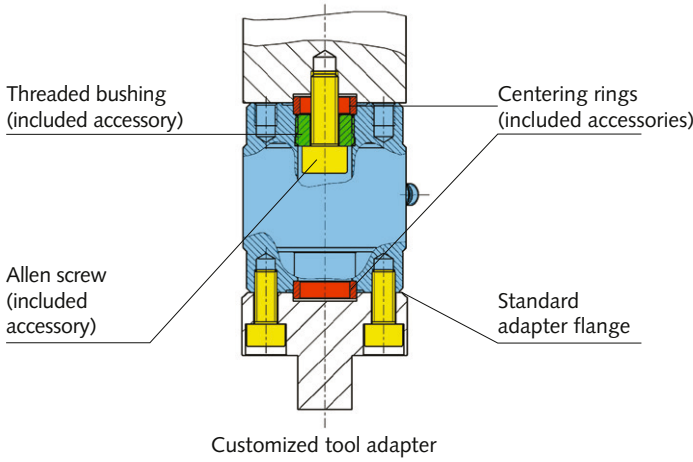
Dimensions in mm

Type	D	D1	D2	D3*	□	H	A	A1	B	C	E	F	G	K	P	T	S	x	y
9323A/AA/AAA	20	14	6	4	17	26	4	7.6	13.3	7.4	27.4	–	36	M3	M5x0.5	6	2.5	0.2	0.1
9333A	30	21	10	8	26	34	4	7.1	16.6	10.2	40.2	36	43.5	M4	M9x0.5	8	2.5	0.3	0.12
9343A	36	26	14	11	32	42	5	9.6	21.7	10.2	46.2	39	46.5	M5	M13x1	9	2.5	0.35	0.15
9363A	54	40	21	17	48	60	8	13.3	32.5	10.4	64.4	48	56	M8	M20x1.5	13	2.5	0.5	0.15
9383A	100	70	30	23.5	90	130	14	24.5	68.6	10.7	110.7	70.7	77.7	M12	S28x2	30	3	–	–
9393A	145	105	52	45.5	130	190	20	26	94.9	10.8	155.8	93.3	131.2	M16	Ø31	45	3	–	–

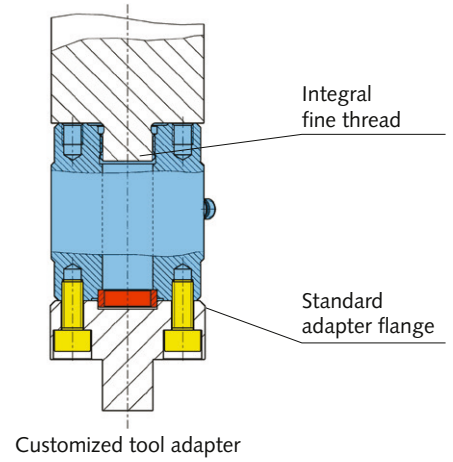
* Free passage with mounted centering rings

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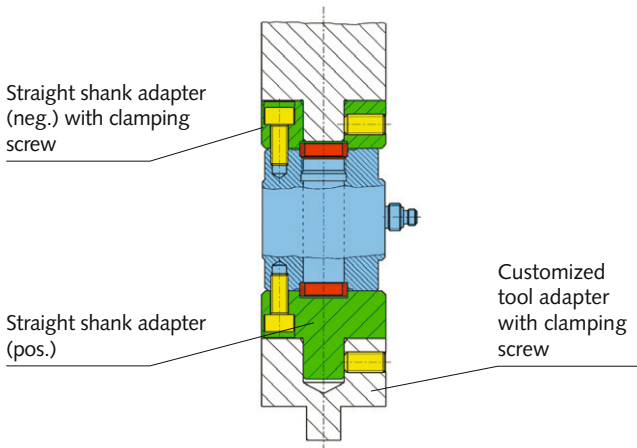
A: Direct mounting using integral mounting screw and threaded bushing



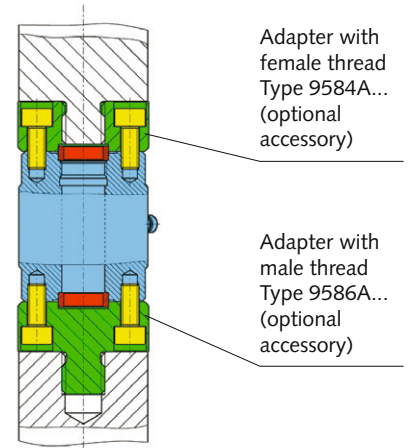
B: Direct mounting using integral fine thread



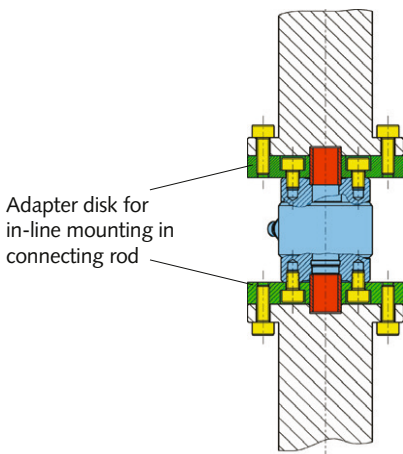
C: Mounting using straight shank adapter



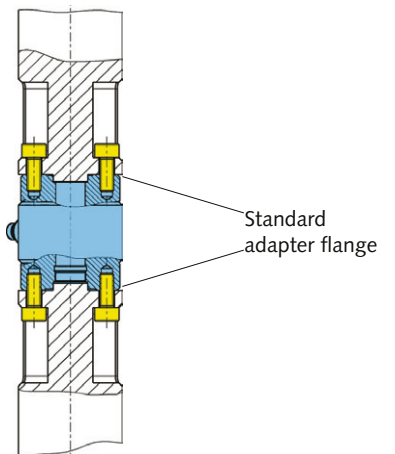
D: Mounting using threaded adapter



E: Mounting using adapter disk/flange

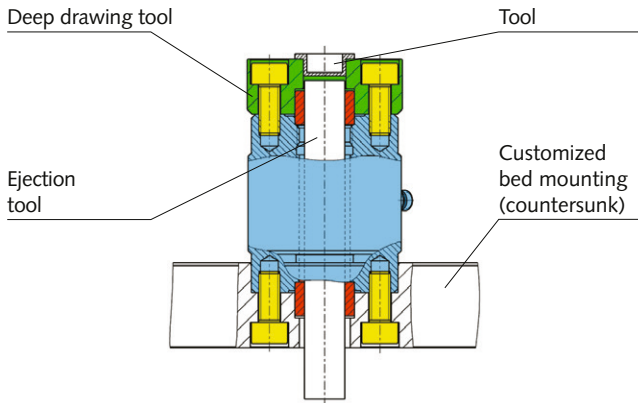


F: Direct mounting using integral flange

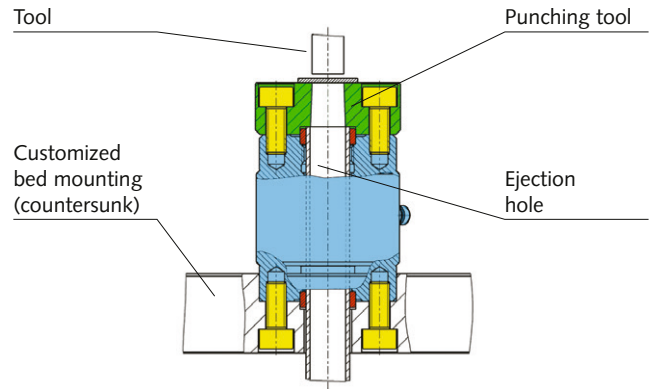


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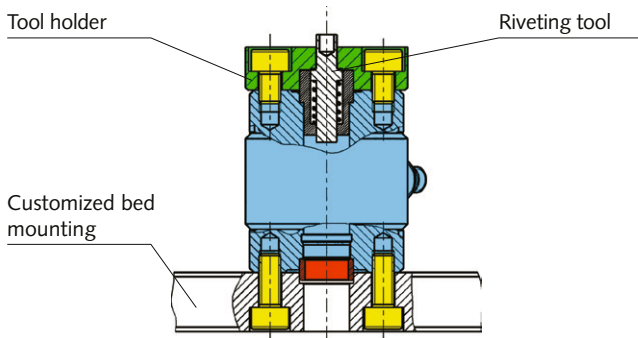
G: Adapter for deep drawing tool with central ejection tool



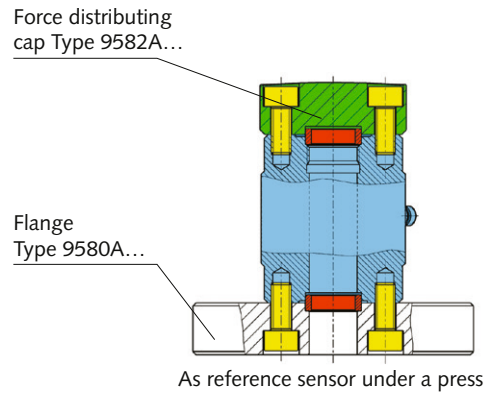
H: Adapter for punching tool with central ejection bore



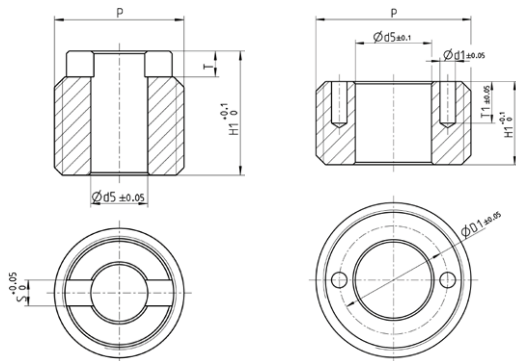
I: Adapter riveting tool



J: Calibrating element with force distributing cap and flange



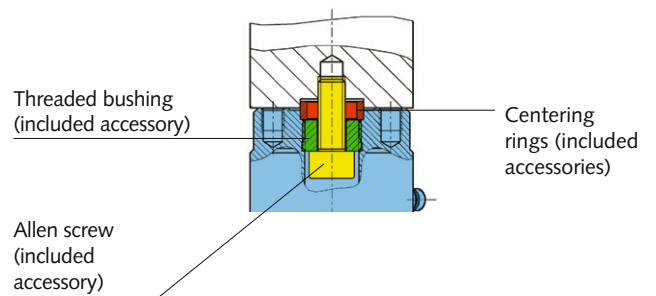
Drawings of mechanical accessories (scope of delivery)
Threaded bushing



Art. No. 3.315.076

Art. No. 3.315.053/054/055/087

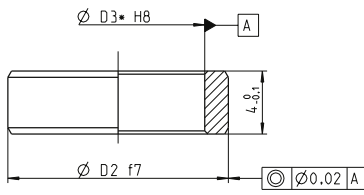
Hexagon socket screw



Sensor Type	Art. No	D1	d1	d5	H1	P	T	T1	S
9323A/AA/AAA	3.315.076	-	-	2,2	4,8	M5x0,5	1	-	1
9333A	3.315.053	6,5	1,1	4,3	4,5	M9x0,5	-	3	-
9343A	3.315.054	9,1	1,3	6,4	7	M13x1	-	3,5	-
9363A	3.315.055	14,5	1,6	10,5	10,5	M20x1,5	-	5	-
9383A	3.315.087	21	2,5	16,5	24,5	S28x2-8e	-	5	-
9393A	-	-	-	-	-	-	-	-	-

Sensor Type	Art. No	D1
9323A/AA/AAA	6.120.235	M2x12
9333A	6.120.102	M4x12
9343A	6.120.122	M6x18
9363A	6.120.066	M10x25
9383A	55075248	M16x50
9393A	6.120.136	M30x60

Centering ring

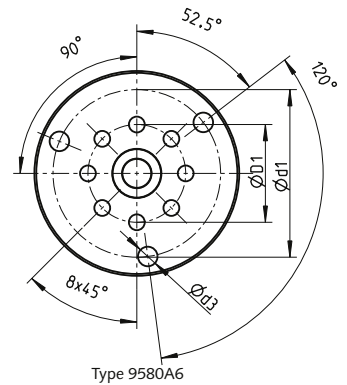
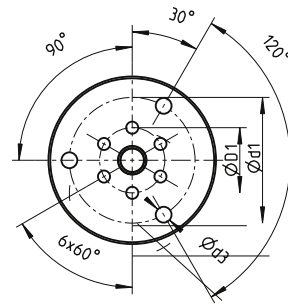
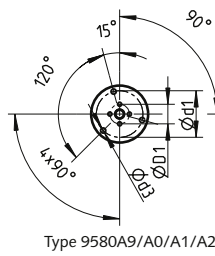
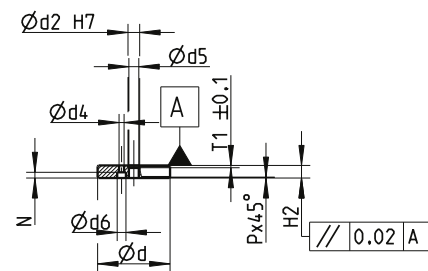


Sensor Type	Art. No.	D2	D3*
9323A/AA AAA	3.420.196	6	4
9333A	3.420.179	10	8
9343A	3.420.180	14	11
9363A	3.420.181	21	17
9383A	3.420.197	30	23,5
9393A	3.420.280	52	45,5

* Free passage with mounted centering rings

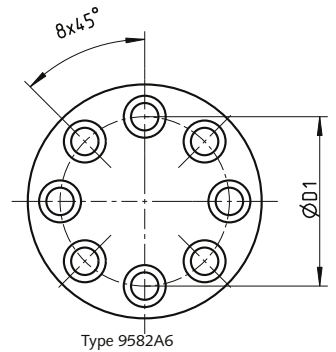
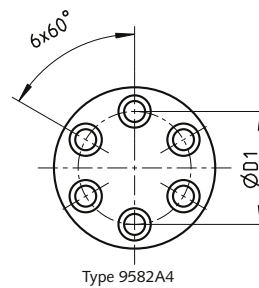
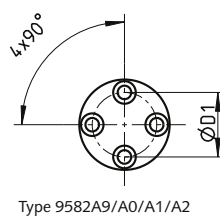
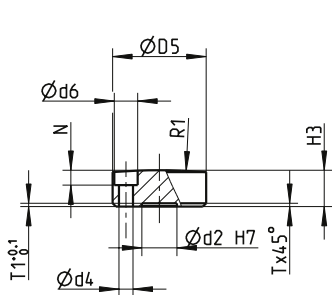
Drawings of mechanical accessories (optional)

Flange



Sensor Type	Flange Type	D1	d	d1	d2	d3	d4	d5	d6	H2	T1	N
9323A/AA/AAA	9580A9	14	40	30	6	4,5	3,2	4,5	5,6	8	2	3
9333A	9580A0	21	62	50	10	5,5	4,3	8,5	7,5	11	2	5
9343A	9580A1	26	70	55	14	6,6	5,3	12	9	13	2	6
9363A	9580A2	40	100	78	21	13,5	8,4	18	14	22	2	9
9383A	9580A4	70	180	135	30	17	13	25	20	30	2,5	13
9393A	9580A6	105	220	180	52	21	17	31	26	48	2,5	17

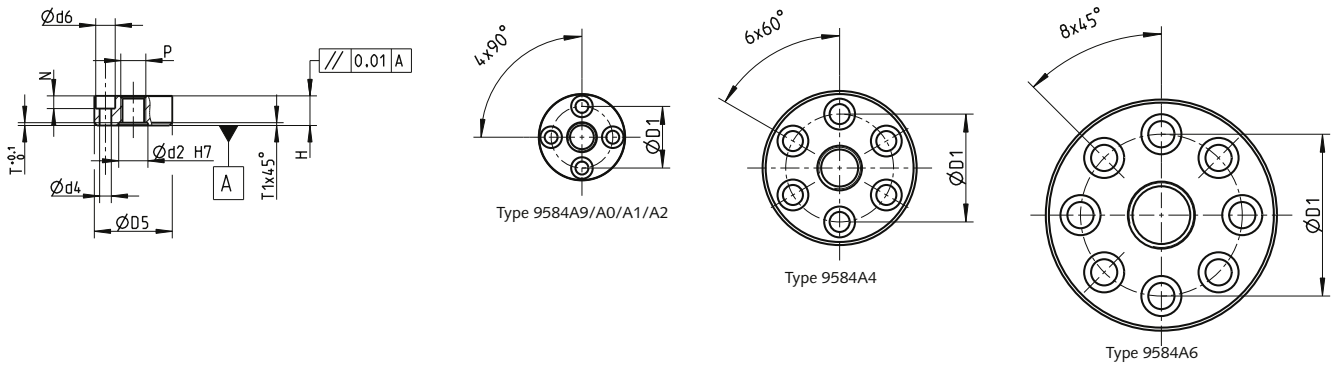
Force distributing cap



Sensor Type	Force Distr. Cap Type	D1	D5	d2	d4	d6	H3	T1	N	R1
9323A/AA/AAA	9582A9	14	20	6	3,2	5,6	8,5	2	3,5	200
9333A	9582A0	21	30	10	4,3	7,5	11	2	5	250
9343A	9582A1	26	36,5	14	5,3	9	13	2	6	300
9363A	9582A2	40	56	21	8,4	14	22	2	9	350
9383A	9582A4	70	100	30	13	20	50	2,5	13,5	550
9393A	9582A6	105	145	52	17	26	80	2,5	19	850

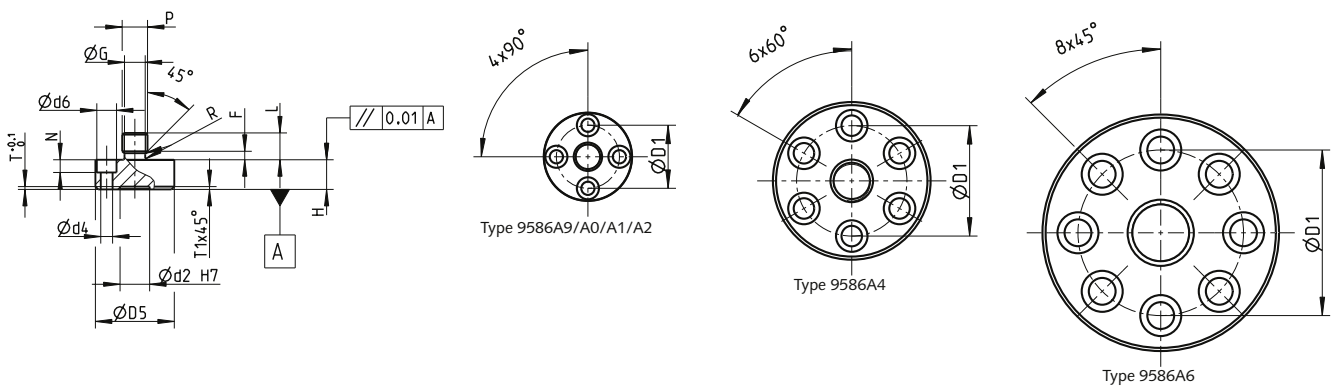
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Adapter with female thread



Sensor Type	Adapter Type	D1	D5	d2	d4	d6	H	N	P	T
9323A/AA/AAA	9584A9	14	20	6	3,2	5,6	8	3	M4	2
9333A	9584A0	21	30	10	4,3	7,5	11	5	M8	2
9343A	9584A1	26	36,5	14	5,3	9	14	7	M12	2
9363A	9584A2	40	56	21	8,4	14	21	9	M18	2
9383A	9584A4	70	100	30	13	20	30	13,5	M27	2,5
9393A	9584A6	105	150	52	17	26	48	17	M42	2,5

Adapter with male thread



Sensor Type	Adapter Type	D1	D5	d2	d4	d6	H	N	P	L	T
9323A/AA/AAA	9586A9	14	20	6	3,2	5,6	8	3	M4	5	2
9333A	9586A0	21	30	10	4,3	7,5	11	5	M8	9	2
9343A	9586A1	26	36,5	14	5,3	9	14	7	M12	12	2
9363A	9586A2	40	56	21	8,4	14	21	9	M18	19	2
9383A	9586A4	70	100	30	13	20	30	13,5	M27	26	2,5
9393A	9586A6	105	150	52	17	26	48	17	M42	43	2,5

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