

DATA SHEET

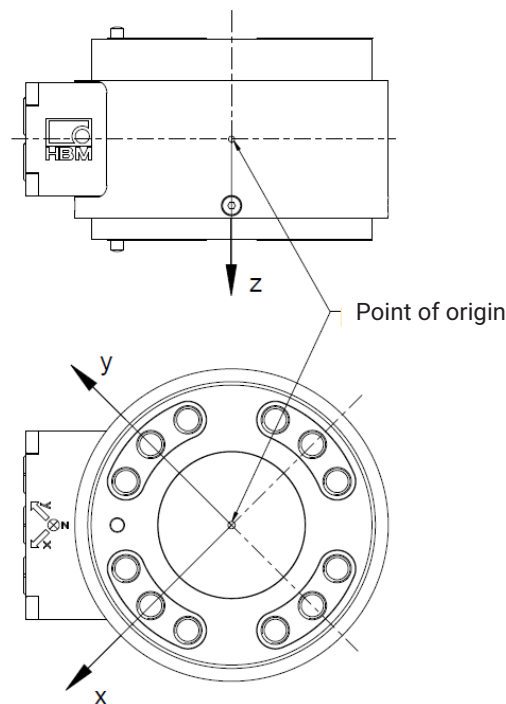
# MCS10 Multicomponent sensor

## SPECIAL FEATURES

- Compact multicomponent sensor
- Different nominal (rated) measuring ranges
- Up to 6 components; each in every direction: tension & compression, clockwise & counterclockwise
- Can be adapted to many measurement tasks by choosing the required measurement outputs
- Flange connection with centering and pin for positioning
- Degree of protection IP67
- Transducer identification TEDS, optional
- Customization possible



## SCHEMATIC DIAGRAM



## SPECIFICATIONS

Size			BG1	BG2			BG3	
Type			005	010	025	050	100	200
<b>Accuracy class</b>			0.2		0.1			0.15
<b>Nominal lateral force <math>F_x</math> &amp; <math>F_y</math></b>	$F_{x,nom}; F_{y,nom}$	kN	1	2	5	10	20	40
<b>Nominal axial force <math>F_z</math></b>	$F_{z,nom}$	kN	5	10	25	50	100	200
<b>Nominal bending moment <math>M_x</math> &amp; <math>M_y</math></b>	$M_{x,nom}; M_{y,nom}$	kN·m	0.05	0.15	0.35	0.7	2	3.5
<b>Nominal torsional moment <math>M_z</math></b>	$M_{z,nom}$	kN·m	0.05	0.15	0.25	0.5	1.5	3
<b>Nominal sensitivity <math>F_x</math> &amp; <math>F_y</math><sup>1)</sup></b>	$C_{F_x,nom}; C_{F_y,nom}$	mV/V	1.5±0.3				1.3±0.3	1.2±0.3
<b>Nominal sensitivity <math>F_z</math><sup>1)</sup></b>	$C_{F_z,nom}$	mV/V	1.4±0.3				1.3±0.3	1.2±0.3
<b>Nominal sensitivity <math>M_x</math> &amp; <math>M_y</math><sup>1)</sup></b>	$C_{M_x,nom}; C_{M_y,nom}$	mV/V	1.8±0.3					1.5±0.3
<b>Nominal sensitivity <math>M_z</math><sup>1)</sup></b>	$C_{M_z,nom}$	mV/V	1.4±0.3	1.6±0.3	1.1±0.3		0.9±0.3	
<b>Relative zero signal error, related to nominal sensitivity<sup>2)</sup></b>	$d_{S,0}$	%	±1					
<b>Temperature effect per 10K in the nominal (rated) temperature range</b> On the output signal, related to the actual value On the zero signal, related to the nominal (rated) sensitivity	$TC_C$ $TC_0$	% %	<±0.2		<±0.1			
<b>Linearity deviation, related to nominal sensitivity</b>	$d_{lin}$	%	<±0.05					
<b>Rel. reversibility error (<math>0.2F_{nom}</math> to <math>F_{nom}</math>), related to nominal sensitivity</b> Forces ( $F_x, F_y$ & $F_z$ ) Moments ( $M_x, M_y$ & $M_z$ )	$U(d_{hy})$	% %	<±0.15		<±0.1		<±0.15	
<b>Rel. creep over 30 mins.</b>	$d_{crF+E}$	%	<±0.15					
<b>Rel. standard deviation of repeatability</b> per DIN 1319, related to the variation of the output signal	$\sigma_{rel}$	%	<±0.05					
<b>Input and output resistance</b> 3-component $F_x/F_y$ $F_z$ 6-component $F_x/F_y$ $F_z$ $M_x/M_y$ $M_z$	$R_i, R_o$	$\Omega$ $\Omega$ $\Omega$ $\Omega$ $\Omega$	350±20 700±20 350±20 700±20 350±20 700±20	700±20 350±20 700±20 700±20 350±20				
<b>Insulation resistance</b>	$R_{is}$	$\Omega$	> 2x10 <sup>9</sup>					
<b>Reference excitation voltage</b>	$U_{ref}$	V	5					
<b>Operating range of the excitation voltage</b>	$B_{U,G}$	V	0.5 to 12					
<b>Nominal temperature range</b>	$B_{t,nom}$	°C	-10 to +70					
<b>Operating temperature range</b>	$B_{t,G}$	°C	-10 to +85					
<b>Storage temperature range</b>	$B_{t,s}$	°C	-30 to +85					
<b>Reference temperature</b>	$t_{ref}$	°C	+23					

1) The individual sensitivity can be found in the test certificate and, as an option, can be stored in the TEDS chip. This sensitivity has a maximum deviation of 0.5 %

2) When operating with a carrier frequency of 4.8 kHz, the relative zero signal error can be ±3 %.

**SPECIFICATIONS (CONTINUED)**

Size		BG1	BG2		BG3			
Type		005	010	025	050	100	200	
<b>Crosstalk</b>								
Determined at uniaxial load. With a smaller, interfering component, crosstalk is reduced by the same factor.								
<b>Influencing component</b>		<b>Affected component</b>						
<b>Lateral force (<math>F_{x,nom}</math>; <math>F_{y,nom}</math>)</b>	<b>Axial force (<math>F_{z,nom}</math>)</b>	$XT_{F_x \rightarrow F_z}$	%	<±1	<±0.5			
		$XT_{F_y \rightarrow F_z}$						
$XT_{M_x \rightarrow F_z}$		%		<±1				
$XT_{M_y \rightarrow F_z}$								
<b>Bending moment (<math>M_{x,nom}</math>; <math>M_{y,nom}</math>)</b>		$XT_{M_z \rightarrow F_z}$	%	<±3	<±1	<±0.5		
<b>Torsional moment (<math>M_{z,nom}</math>)</b>								
<b>Axial force (<math>F_{z,nom}</math>)</b>	<b>Lateral force (<math>F_{x,nom}</math>; <math>F_{y,nom}</math>)</b>	$XT_{F_z \rightarrow F_x}$	%	<±3	<±1.5			
		$XT_{F_z \rightarrow F_y}$						
<b>Lateral force (<math>F_{x,nom}</math>; <math>F_{y,nom}</math>)</b>		$XT_{F_x \rightarrow F_y}$	%	<±1	<±0.5	<±0.3		
		$XT_{F_y \rightarrow F_x}$						
<b>Bending moment (<math>M_{x,nom}</math>; <math>M_{y,nom}</math>)</b>	<b>Lateral force (<math>F_{x,nom}</math>; <math>F_{y,nom}</math>)</b>	$XT_{M_x \rightarrow F_x}$	%	<±2	<±1.5	<±1		
		$XT_{M_x \rightarrow F_y}$						
		$XT_{M_y \rightarrow F_x}$						
$XT_{M_y \rightarrow F_y}$								
<b>Torsional moment (<math>M_{z,nom}</math>)</b>		$XT_{M_z \rightarrow F_x}$	%	<±3		<±1		
	$XT_{M_z \rightarrow F_y}$							
<b>Axial force (<math>F_{z,nom}</math>)</b>	<b>Bending moment (<math>M_{x,nom}</math>; <math>M_{y,nom}</math>)</b>	$XT_{F_z \rightarrow M_x}$	%	<±3		<±1.5		
		$XT_{F_z \rightarrow M_y}$						
<b>Lateral force (<math>F_{x,nom}</math>; <math>F_{y,nom}</math>)</b>		<b>Bending moment (<math>M_{x,nom}</math>; <math>M_{y,nom}</math>)</b>	$XT_{F_x \rightarrow M_x}$	%	<±1.5			
			$XT_{F_x \rightarrow M_y}$					
	$XT_{F_y \rightarrow M_x}$							
$XT_{F_y \rightarrow M_y}$								
<b>Bending moment (<math>M_{x,nom}</math>; <math>M_{y,nom}</math>)</b>		$XT_{M_x \rightarrow M_y}$	%	<±1.5	<±1	<±0.5		
	$XT_{M_y \rightarrow M_x}$							
<b>Torsional moment (<math>M_{z,nom}</math>)</b>		$XT_{M_z \rightarrow M_x}$	%	<±1.5		<±1		
	$XT_{M_z \rightarrow M_y}$							
<b>Axial force (<math>F_{z,nom}</math>)</b>	<b>Torsional moment (<math>M_{z,nom}</math>)</b>	$XT_{F_z \rightarrow M_z}$	%	<±3	<±1.5			
<b>Lateral force (<math>F_{x,nom}</math>; <math>F_{y,nom}</math>)</b>		$XT_{F_x \rightarrow M_z}$	%	<±3		<±1		
		$XT_{F_y \rightarrow M_z}$						
<b>Bending moment (<math>M_{x,nom}</math>; <math>M_{y,nom}</math>)</b>		$XT_{M_x \rightarrow M_z}$	%	<±1.5		<±1		
	$XT_{M_y \rightarrow M_z}$							

**SPECIFICATIONS (CONTINUED)**

Size		BG1	BG2		BG3			
Type		005	010	025	050	100	200	
<b>Load limits</b>								
<b>Load ratio sum at multiaxial load (theoretical value for calculating load ranges)</b>								
$LRS = \left[ k_1 \cdot \frac{\sqrt{F_x^2 + F_y^2}}{F_{x,nom}} + k_2 \cdot \frac{ F_z }{F_{z,nom}} + k_3 \cdot \frac{\sqrt{M_x^2 + M_y^2}}{M_{x,nom}} + k_4 \cdot \frac{ M_z }{M_{z,nom}} \right] \cdot 100\%$								
<b>Correction factors</b>								
k <sub>1</sub>		0.7	0.7	1.3	1.6	1.2	1.4	
k <sub>2</sub>		1.0	0.9	1.8	1.4	1.2	1.4	
k <sub>3</sub>		0.6	0.6	1.1	1.1	1.1	1.1	
k <sub>4</sub>		1.2	1.0	1.4	1.4	1.3	1.5	
<b>Criterion for the nominal (rated) measuring range</b> to be met at multi-axial load (The load of each individual component must not exceed its maximum capacity)	%	LRS<265		LRS<350				
<b>Criterion for the fatigue strength range</b> to be met at multiaxial <b>pulsating</b> load (The load of each individual component must not exceed its maximum capacity)	%	LRS<250		LRS<325				
<b>Criterion for the fatigue strength range</b> to be met at multiaxial <b>alternating</b> load (The load of each individual component must not exceed its maximum capacity)	%	LRS<175		LRS<250				
<b>Criterion for the static load range</b> to be met at multiaxial load (The load of each individual component must not exceed its limit load)	%	LRS<340		LRS<450				
<b>Lateral force limit (Fx, Fy)</b> , related to F <sub>x,nom</sub> ; F <sub>y,nom</sub> <sup>3)</sup>	F <sub>x(y),L</sub>	%	250	270	190	150	200	180
<b>Axial force limit (Fz)</b> , related to F <sub>z,nom</sub> <sup>3)</sup>	F <sub>z,L</sub>	%	170	200	140	190	200	180
<b>Bending moment limit (Mx, My)</b> , related to M <sub>x,nom</sub> ; M <sub>y,nom</sub> <sup>3)</sup>	M <sub>x(y),L</sub>	%	310		240	230		
<b>Torsional moment limit (Mz)</b> , related to M <sub>z,nom</sub> <sup>3)</sup>	M <sub>z,L</sub>	%	150	180		190	170	
<b>Criterion for the (static) range without break</b> to be met at multiaxial load (The load of each individual component must not exceed its breaking load)	%	LRS<450		LRS<600				
<b>Lateral force at break (Fx, Fy)</b> , related to F <sub>x,nom</sub> ; F <sub>y,nom</sub> <sup>3)</sup>	F <sub>x(y),B</sub>	%	>490	>520	>340	>270	>370	>320
<b>Axial force at break (Fz)</b> , related to F <sub>z,nom</sub> <sup>3)</sup>	F <sub>z,B</sub>	%	>330	>400	>250	>330	>360	>320
<b>Bending moment at break (Mx, My)</b> , related to M <sub>x,nom</sub> ; M <sub>y,nom</sub> <sup>3)</sup>	M <sub>x(y),B</sub>	%	>600	>610	>430	>410		
<b>Torsional moment at break (Mz)</b> , related to M <sub>z,nom</sub> <sup>3)</sup>	M <sub>z,B</sub>	%	>280	>340	>320		>340	>300

<sup>3)</sup> At static load and uniaxial load

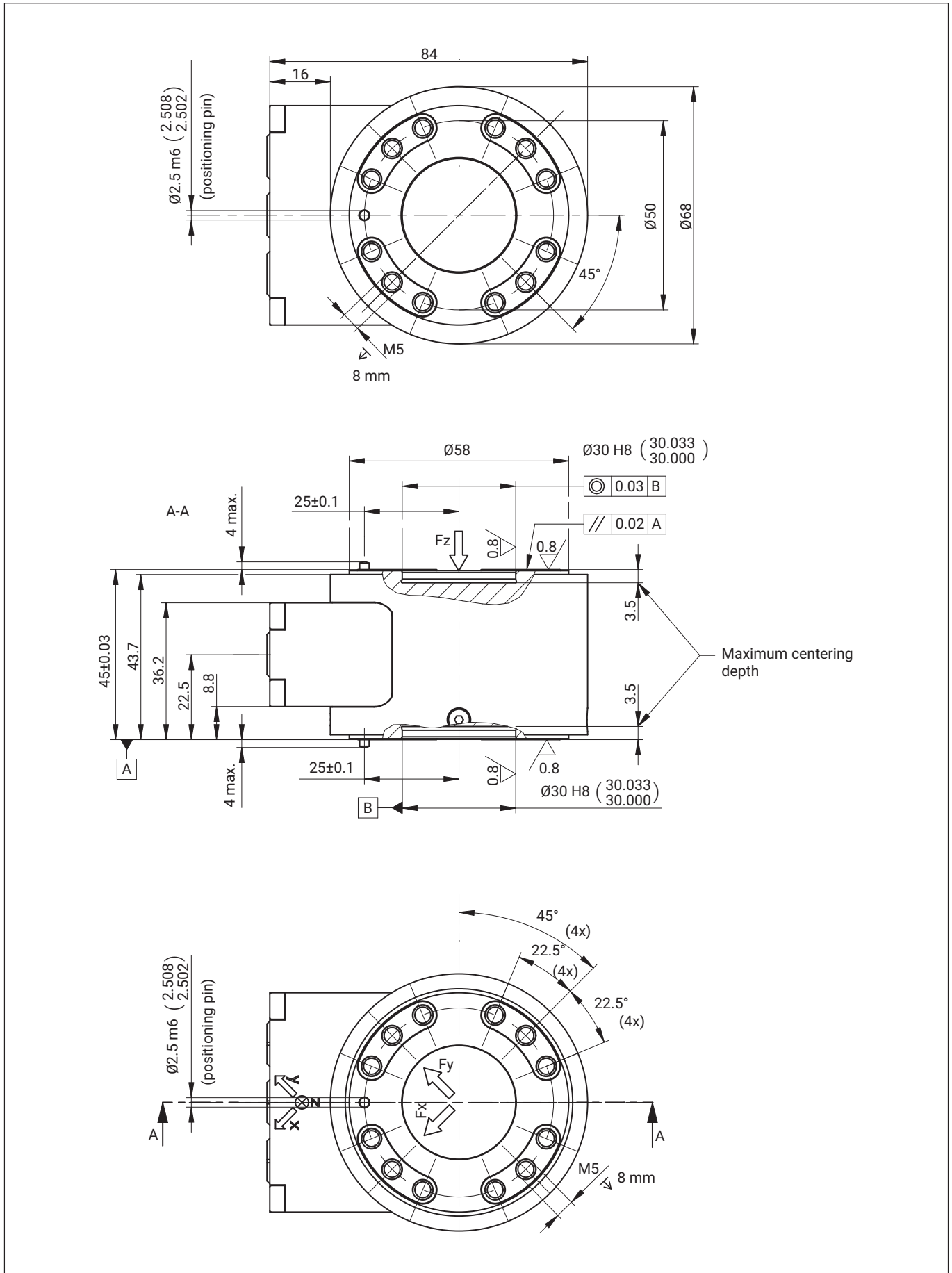
The load criteria apply to the sum of all simultaneously occurring loads, regardless of whether these are measured or parasitic.

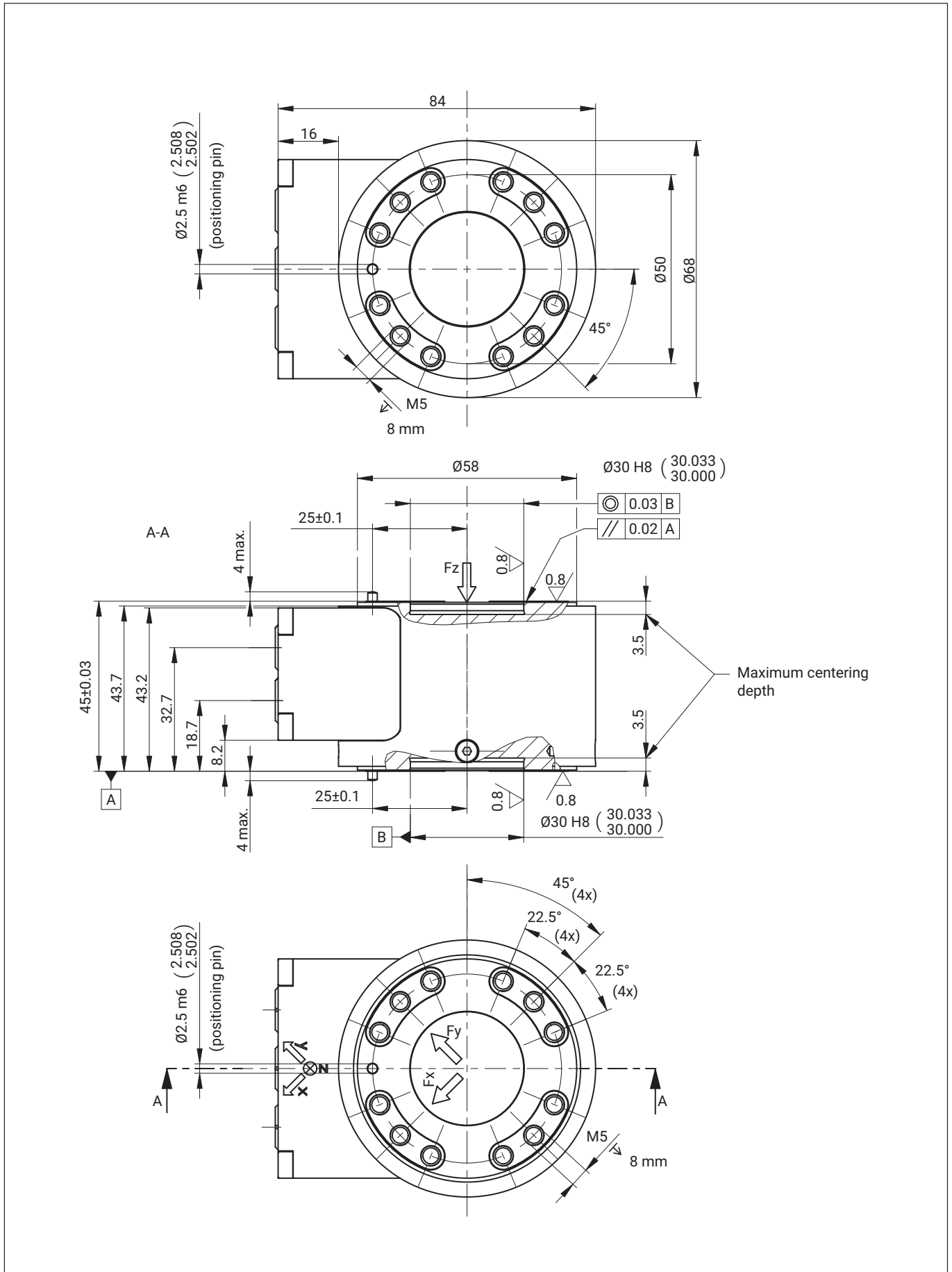
The origin of the sensor coordinates is in the geometric center (half the height of the sensor). In the application, the bending moment generated by a lateral force must be taken into account when determining the maximum bending moment that can occur. Please note that half the height of the sensor must be taken into account as an additional lever arm.

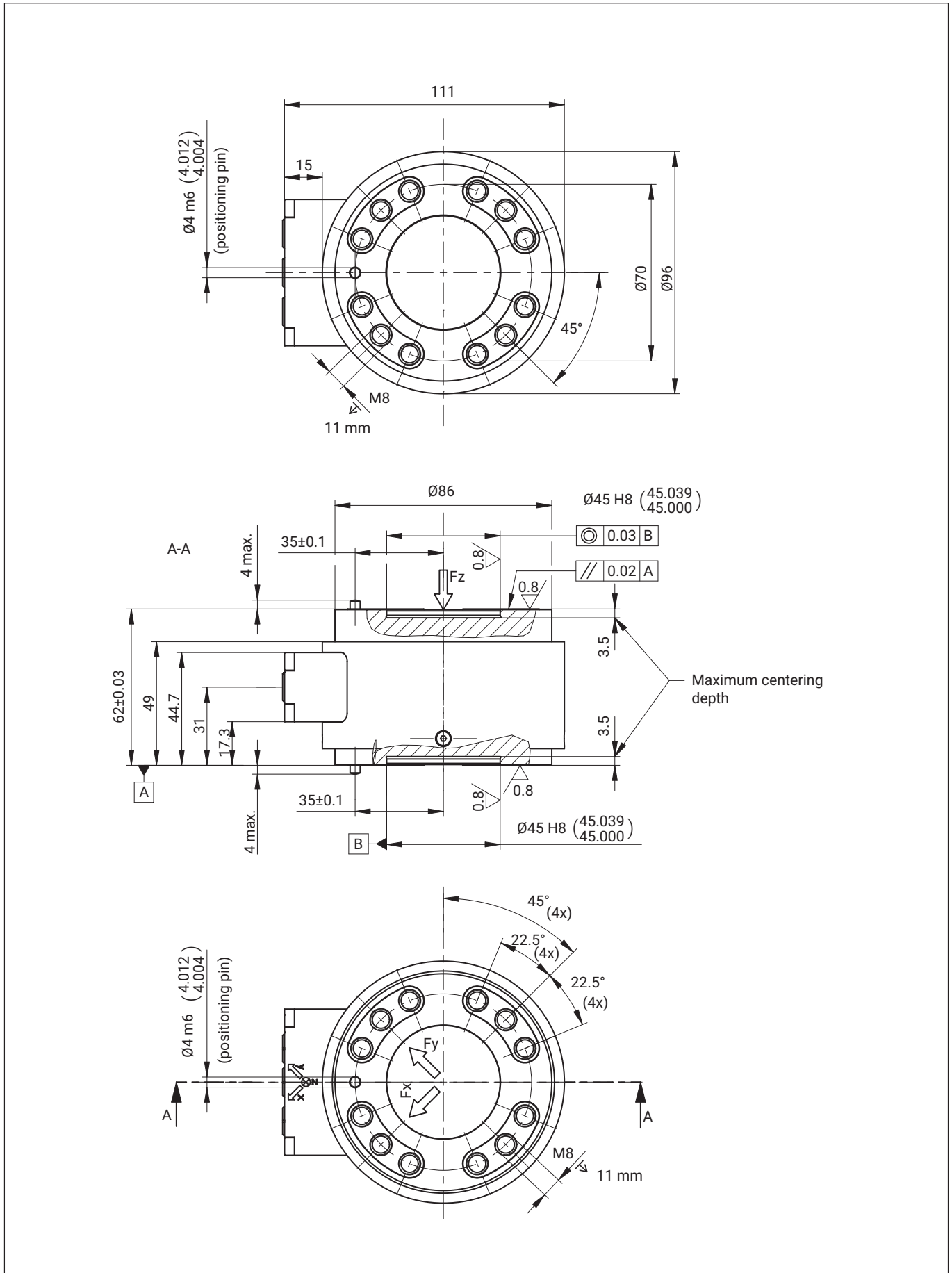
**SPECIFICATIONS (CONTINUED)**

Size		BG1	BG2		BG3		
Type		005	010	025	050	100	200
<b>Mechanical values</b>							
Nominal (rated) displacement at lateral force F <sub>x</sub> & F <sub>y</sub>	mm	<0.03	<0.04	<0.05	<0.05	<0.05	<0.07
Nominal (rated) displacement at axial force F <sub>z</sub>	mm	<0.02	<0.03	<0.03	<0.04	<0.04	<0.05
Tilt angle at M <sub>x,nom</sub> ; M <sub>y,nom</sub>	degrees	<0.04	<0.05	<0.05	<0.06	<0.05	<0.05
Torsion angle at M <sub>z,nom</sub>	degrees	<0.08	<0.08	<0.06	<0.07	<0.08	<0.07
Stiffness in the radial direction (x or y)	kN/mm	37	54	117	202	452	659
Stiffness in the axial direction (z)	kN/mm	353	471	993	1664	3018	4824
Stiffness during the bending moment round a radial axis (x or y)	kN·m/degrees	1.4	3.8	7.9	13.3	41.5	83.7
Stiffness during the torsional moment round the axial axis (z)	kN·m/degrees	0.7	2.1	4.6	7.6	27.4	44.5
Natural frequency <sup>4)</sup> in radial direction (x or y)	kHz	2.4	1.7	1.9	2.5		3.4
Natural frequency <sup>4)</sup> in axial direction (z)		7.4	5.2	5.6	7.2	6.4	7.9
Natural frequency <sup>4)</sup> around a radial axis (x or y)		8.5	6	6.5	8.4	7.8	9.9
Natural frequency <sup>4)</sup> around the axial axis (z)		3.8	2.8	3.1	4		5.1
<b>General information</b>							
Weight (approx.)	kg	0.5	1.0	1.8		3.8	
Material: Measuring body		Titanium alloy		Stainless steel			
Material: Housing		Aluminum alloy, powder coated					
Degree of protection per EN 60529		IP67					
Maximum cable length (6-wire configuration) of the standard cable for multiple components	m	50					
Transducer identification, optional		TEDS, per IEEE 1451.4					
Emission (EME) (EN 61326-1, Section 7) RFI field strength		Class B					
Immunity to interference (EN 61326-1, Table 2; EN 61326-2-3)	V/m	10					
Electromagnetic fields (AM)	A/m	100					
Power-frequency magnetic fields							
Electrostatic discharge (ESD)	kV	4					
Contact discharge	kV	8					
Air discharge	kV	1					
Fast transients (burst)	kV	1					
Impulse voltages (surge)	V	10					
Conducted interference (AM)							
Mechanical shock (EN 60068-2-27)							
Number	n	1000					
Duration	ms	3					
Acceleration (half sine)	m/s <sup>2</sup>	650					
Vibration in 3 directions (EN 60068-2-6)							
Frequency range	Hz	10...2000					
Duration	h	2.5					
Acceleration (amplitude)	m/s <sup>2</sup>	150					

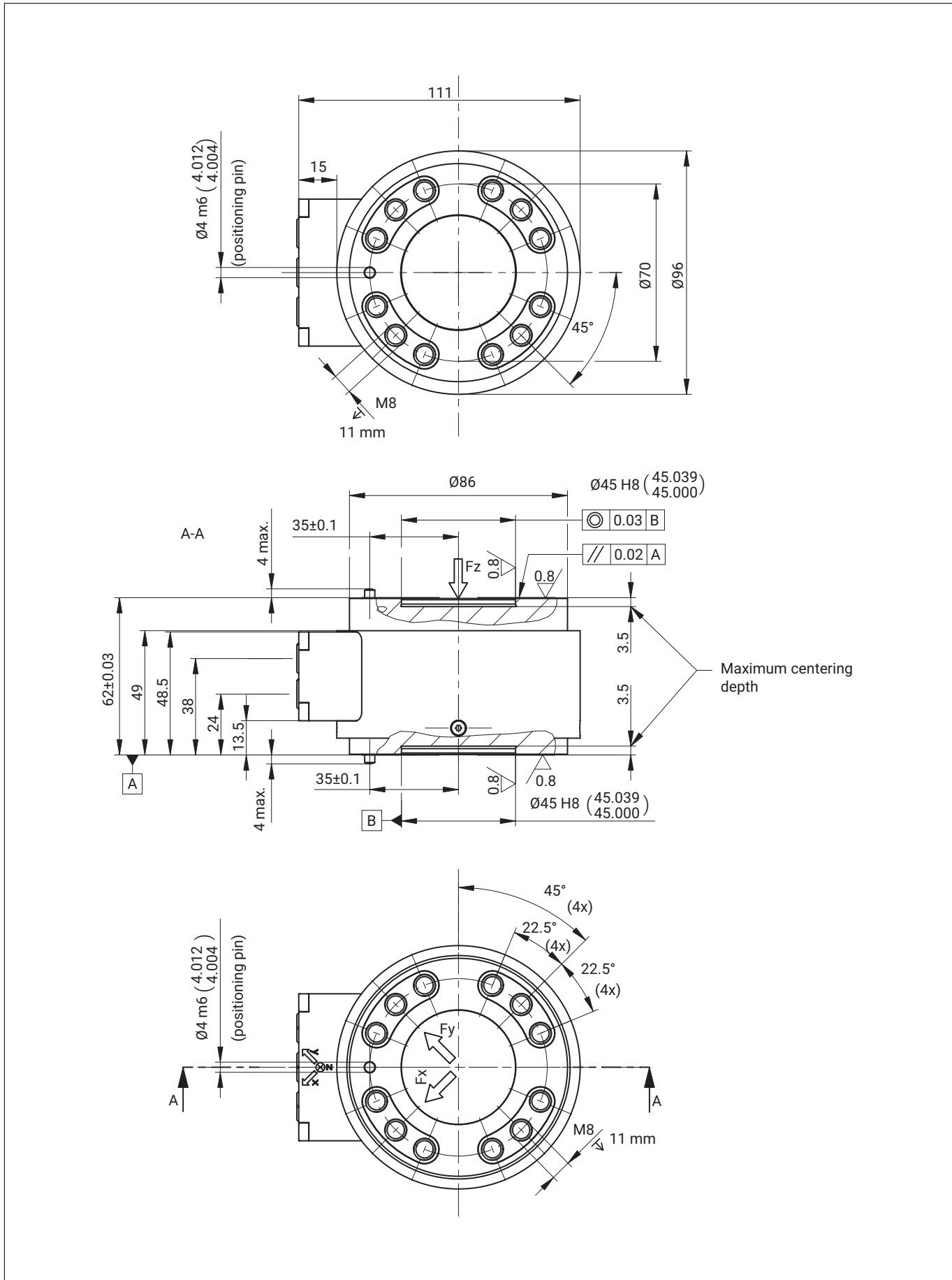
<sup>4)</sup> The natural frequency in the specifications only takes into account the transducer, not the necessary loading fittings. The relevant natural frequency of the overall setup changes naturally if additional masses are mounted on the transducer. Consequently, this is a recommended value serving as a guide, which always requires consideration of the mounting conditions for a dynamic setup.

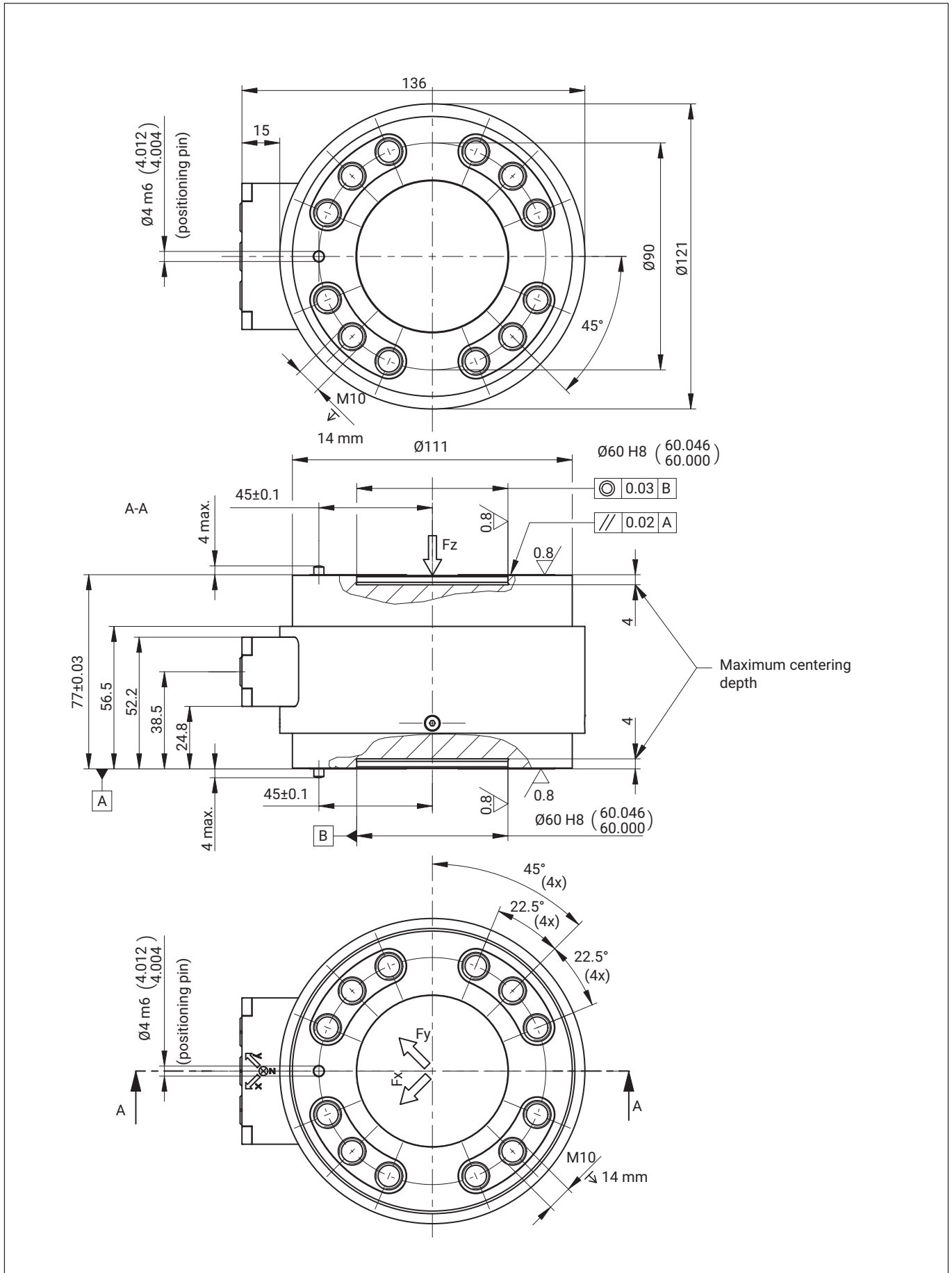


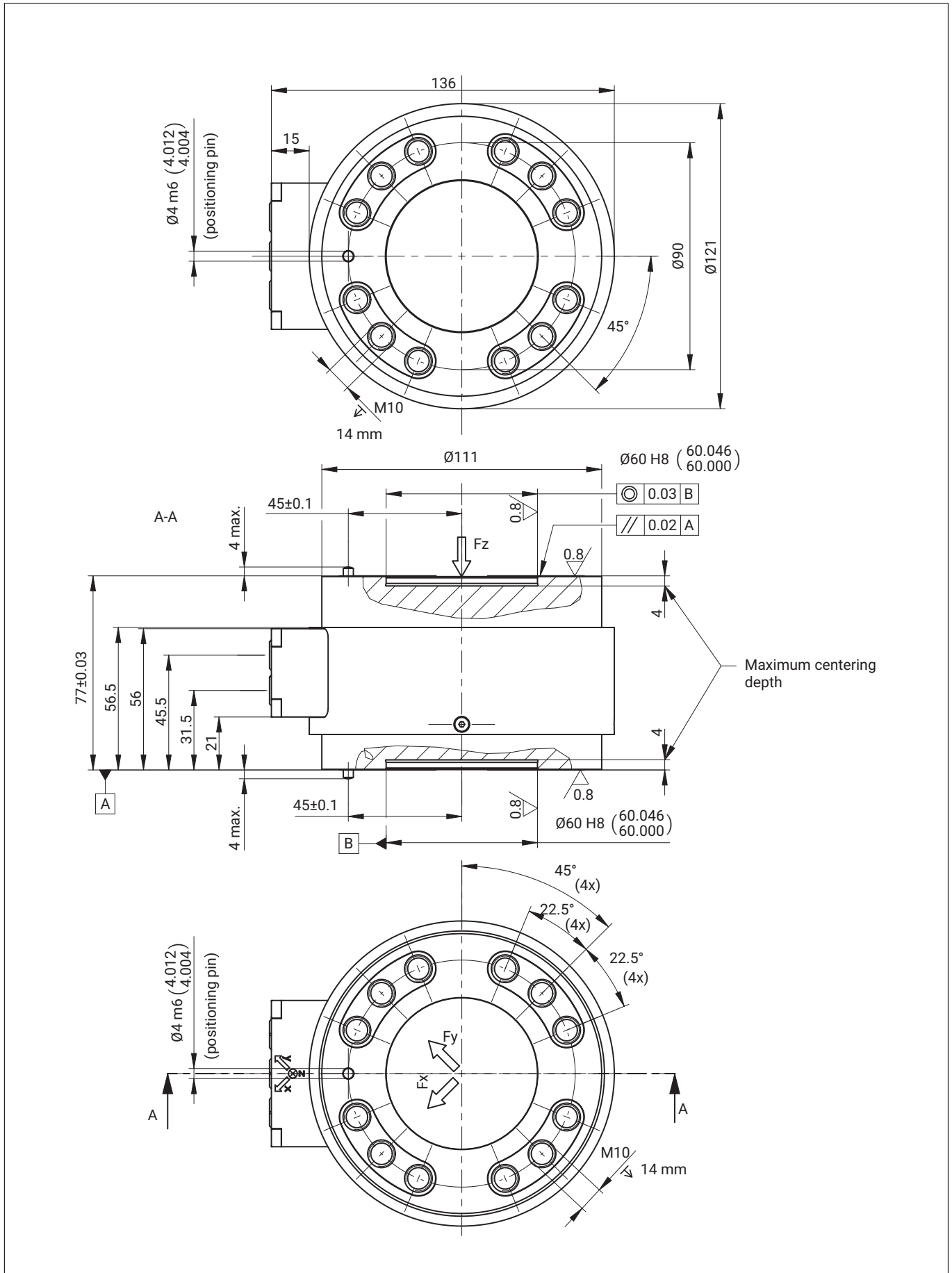


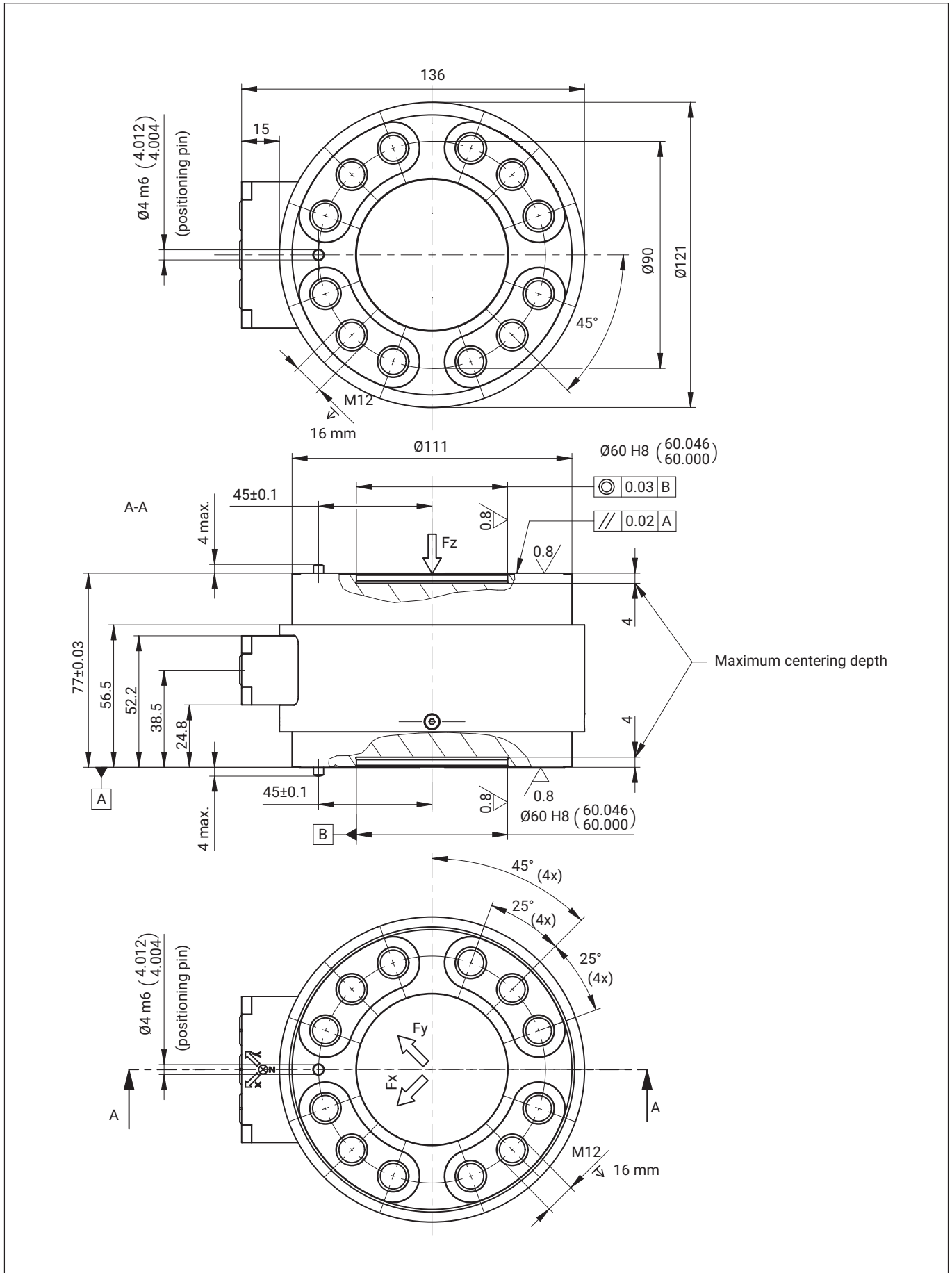


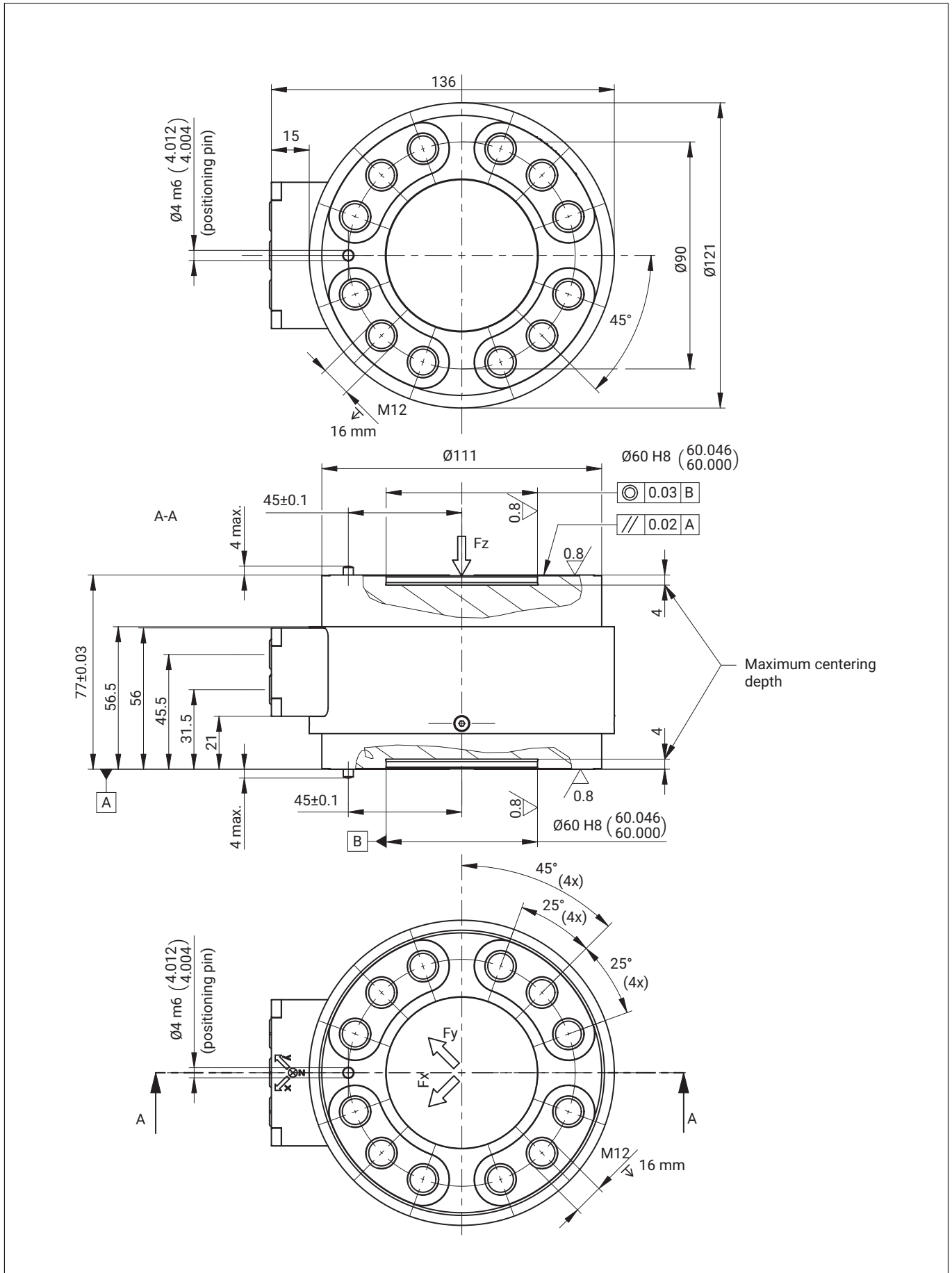




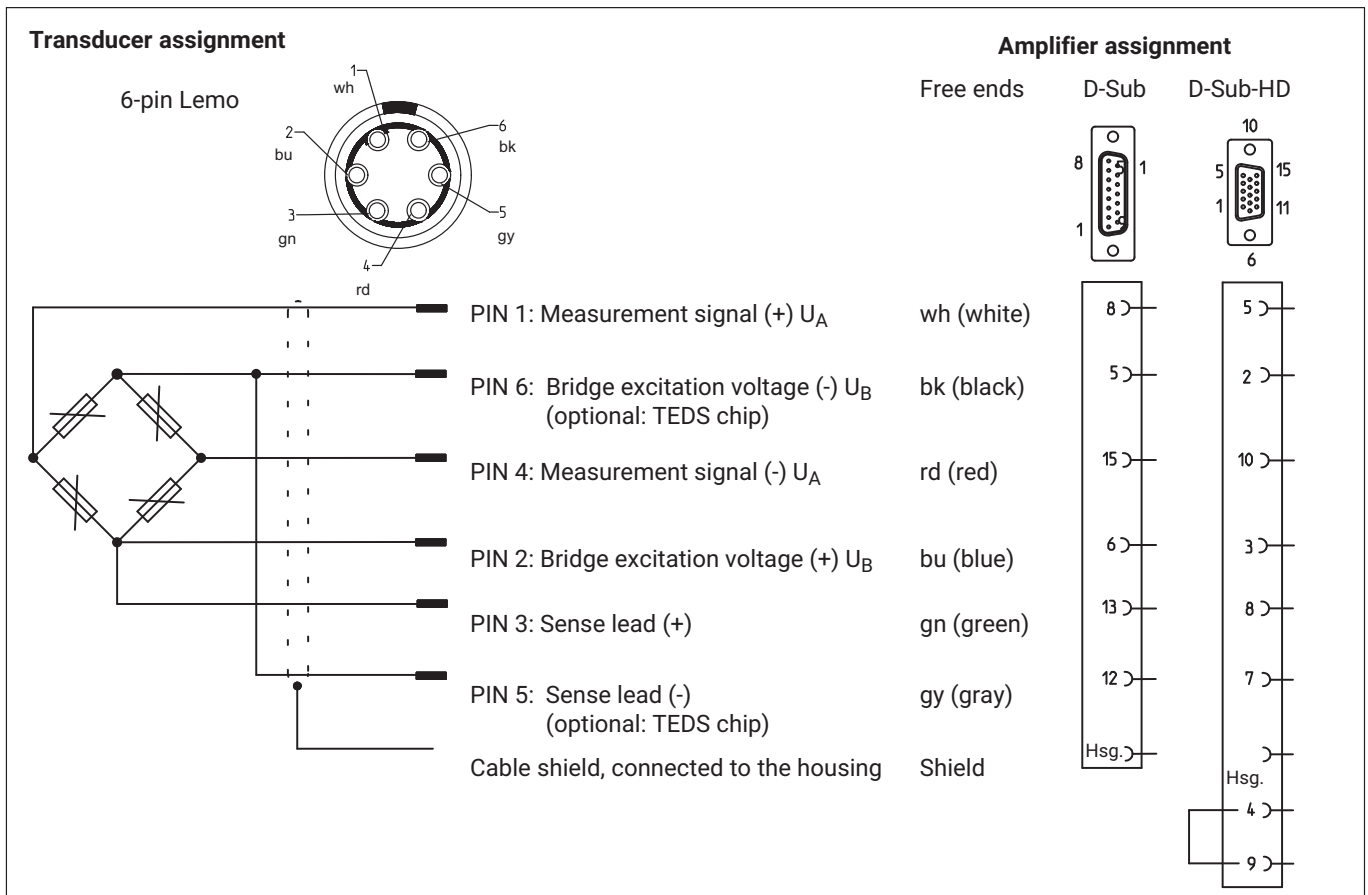




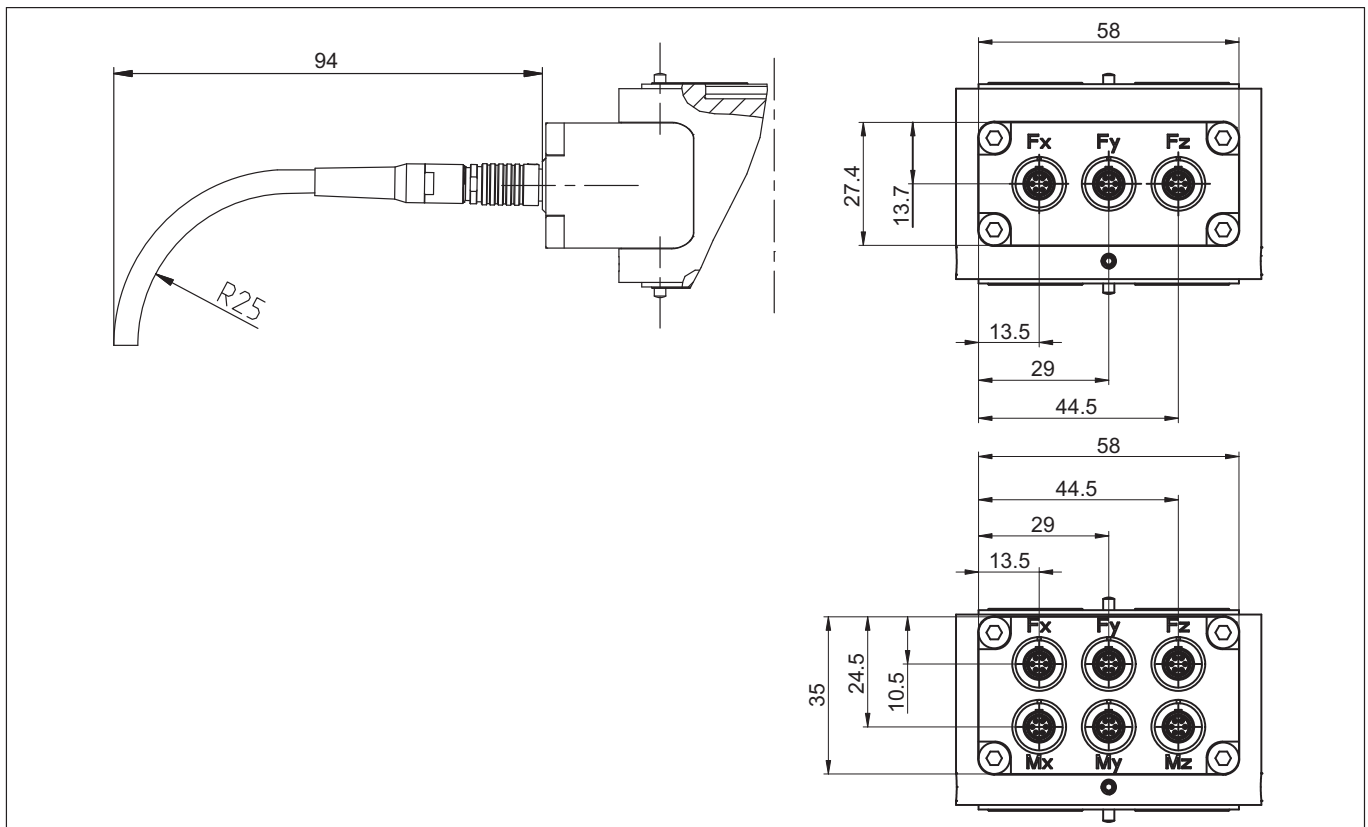




## PIN ASSIGNMENT



## CABLE



## ORDERING NUMBER MCS10

Ordering number		
<b>K-MCS10</b>		
1	Code	Measurement range
	005	$F_x=1\text{ kN}$ ; $F_y=1\text{ kN}$ ; $F_z=5\text{ kN}$ ; $M_x=0.05\text{ kNm}$ ; $M_y=0.05\text{ kNm}$ ; $M_z=0.05\text{ kNm}$
	010	$F_x=2\text{ kN}$ ; $F_y=2\text{ kN}$ ; $F_z=10\text{ kN}$ ; $M_x=0.15\text{ kNm}$ ; $M_y=0.15\text{ kNm}$ ; $M_z=0.15\text{ kNm}$
	025	$F_x=5\text{ kN}$ ; $F_y=5\text{ kN}$ ; $F_z=25\text{ kN}$ ; $M_x=0.35\text{ kNm}$ ; $M_y=0.35\text{ kNm}$ ; $M_z=0.25\text{ kNm}$
	050	$F_x=10\text{ kN}$ ; $F_y=10\text{ kN}$ ; $F_z=50\text{ kN}$ ; $M_x=0.7\text{ kNm}$ ; $M_y=0.7\text{ kNm}$ ; $M_z=0.5\text{ kNm}$
	100	$F_x=20\text{ kN}$ ; $F_y=20\text{ kN}$ ; $F_z=100\text{ kN}$ ; $M_x=2\text{ kNm}$ ; $M_y=2\text{ kNm}$ ; $M_z=1.5\text{ kNm}$
	200	$F_x=40\text{ kN}$ ; $F_y=40\text{ kN}$ ; $F_z=200\text{ kN}$ ; $M_x=3,5\text{ kNm}$ ; $M_y=3,5\text{ kNm}$ ; $M_z=3\text{ kNm}$
2	Code	Version
	3C	Option for 3 components - only forces ( $F_x$ , $F_y$ & $F_z$ )
	6C	Option for 6 components - obligatory for moments
3	Code	Component $F_x$
	FX	Measurement output $F_x$
	00	No measurement output
4	Code	Component $F_y$
	FY	Measurement output $F_y$
	00	No measurement output
5	Code	Component $F_z$
	FZ	Measurement output $F_z$
	00	No measurement output
6	Code	Component $M_x$
	MX	Measurement output $M_x$
	00	No measurement output
7	Code	Component $M_y$
	MY	Measurement output $M_y$
	00	No measurement output
8	Code	Component $M_z$
	MZ	Measurement output $M_z$
	00	No measurement output
9	Code	Transducer identification (TEDS)
	S	Without TEDS chip
	T	With TEDS chip

For example:

K-MCS10 - 0 1 0 - 6 C - F X - F Y - 0 0 - M X - 0 0 - M Z - S

1            2            3            4            5            6            7            8            9

## ACCESSORIES (TO BE ORDERED SEPARATELY)

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Article	Ordering number
Configurable connection cable	K-KAB-M
Connection cable 6 m with free ends	1-KAB146-6

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