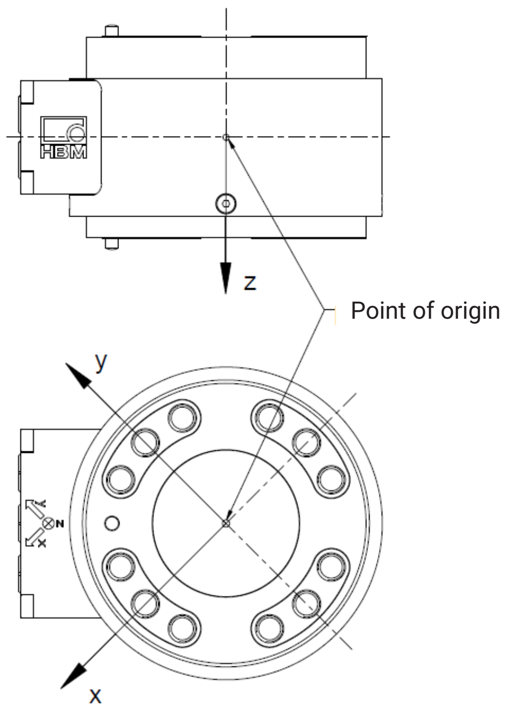
DATA SHEET

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**
Accuracy class			0.2		0.1			0.15
Nominal lateral force F_x & F_y	$F_{x,nom}$; $F_{y,nom}$	kN	1	2	5	10	20	40
Nominal axial force F_z	$F_{z,nom}$	kN	5	10	25	50	100	200
Nominal bending moment M_x & M_y	$M_{x,nom}$; $M_{y,nom}$	kN·m	0.05	0.15	0.35	0.7	2	3.5
Nominal torsional moment M_z	$M_{z,nom}$	kN·m	0.05	0.15	0.25	0.5	1.5	3
Nominal sensitivity F_x & F_y[1)]	$C_{Fx,nom}$; $C_{Fy,nom}$	mV/V	1.5±0.3				1.3±0.3	1.2±0.3
Nominal sensitivity F_z[1)]	$C_{Fz,nom}$	mV/V	1.4±0.3				1.3±0.3	1.2±0.3
Nominal sensitivity M_x & M_y[1)]	$C_{Mx,nom}$; $C_{My,nom}$	mV/V	1.8±0.3					1.5±0.3
Nominal sensitivity M_z[1)]	$C_{Mz,nom}$	mV/V	1.4±0.3	1.6±0.3	1.1±0.3			0.9±0.3
Relative zero signal error, related to nominal sensitivity[2)]	$d_{S,0}$	%	±1					
Temperature effect per 10K in the nominal (rated) temperature range								
On the output signal, related to the actual value	TC_C	%	<±0.2		<±0.1			
On the zero signal, related to the nominal (rated) sensitivity	TC_0	%	<±0.1					
Linearity deviation, related to nominal sensitivity	d_{lin}	%	<±0.05					
Rel. reversibility error ($0.2F_{nom}$ to F_{nom}), related to nominal sensitivity								
Forces (F_x, F_y & F_z)	$U(d_{hy})$	%	<±0.1					
Moments (M_x, M_y & M_z)	$U(d_{hy})$	%	<±0.15		<±0.1			<±0.15
Rel. creep over 30 mins.	d_{crF+E}	%	<±0.15					
Rel. standard deviation of repeatability per DIN 1319, related to the variation of the output signal	σ_{rel}	%	<±0.05					
Input and output resistance	R_i; R_o							
3-component Fx/Fy		Ω	350±20	700±20				
3-component Fz		Ω	700±20	350±20				
6-component Fx/Fy		Ω	350±20	700±20				
6-component Fz		Ω	700±20	700±20				
6-component Mx/My		Ω	350±20	700±20				
6-component Mz		Ω	700±20	350±20				
Insulation resistance	R_{is}	Ω	> $2x10^9$					
Reference excitation voltage	U_{ref}	V	5					
Operating range of the excitation voltage	$B_{U,G}$	V	0.5 to 12					
Nominal temperature range	$B_{t,nom}$	°C	-10 to +70					
Operating temperature range	$B_{t,G}$	°C	-10 to +85					
Storage temperature range	$B_{t,s}$	°C	-30 to +85					
Reference temperature	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**
Crosstalk Determined at uniaxial load. With a smaller, interfering component, crosstalk is reduced by the same factor.									
Influencing component	**Affected component**								
Lateral force ($F_{x,nom}$; $F_{y,nom}$)	**Axial force ($F_{z,nom}$)**	$XT_{Fx->Fz}$ $XT_{Fy->Fz}$	%	<±1	<±0.5				
Bending moment ($M_{x,nom}$; $M_{y,nom}$)		$XT_{Mx->Fz}$ $XT_{My->Fz}$	%	<±1					
Torsional moment ($M_{z,nom}$)		$XT_{Mz->Fz}$	%	<±3	<±1	<±0.5			
Axial force ($F_{z,nom}$)	**Lateral force ($F_{x,nom}$; $F_{y,nom}$)**	$XT_{Fz->Fx}$ $XT_{Fz->Fy}$	%	<±3	<±1.5				
Lateral force ($F_{x,nom}$; $F_{y,nom}$)		$XT_{Fx->Fy}$ $XT_{Fy->Fx}$	%	<±1	<±0.5	<±0.3			
Bending moment ($M_{x,nom}$; $M_{y,nom}$)		$XT_{Mx->Fx}$ $XT_{Mx->Fy}$ $XT_{My->Fx}$ $XT_{My->Fy}$	%	<±2	<±1.5	<±1			
Torsional moment ($M_{z,nom}$)		$XT_{Mz->Fx}$ $XT_{Mz->Fy}$	%	<±3		<±1			
Axial force ($F_{z,nom}$)	**Bending moment ($M_{x,nom}$; $M_{y,nom}$)**	$XT_{Fz->Mx}$ $XT_{Fz->My}$	%	<±3		<±1.5			
Lateral force ($F_{x,nom}$; $F_{y,nom}$)		$XT_{Fx->Mx}$ $XT_{Fx->My}$ $XT_{Fy->Mx}$ $XT_{Fy->My}$	%	<±1.5					
Bending moment ($M_{x,nom}$; $M_{y,nom}$)		$XT_{Mx->My}$ $XT_{My->Mx}$	%	<±1.5	<±1	<±0.5			
Torsional moment ($M_{z,nom}$)		$XT_{Mz->Mx}$ $XT_{Mz->My}$	%	<±1.5	<±1				
Axial force ($F_{z,nom}$)	**Torsional moment ($M_{z,nom}$)**	$XT_{Fz->Mz}$	%	<±3	<±1.5				
Lateral force ($F_{x,nom}$; $F_{y,nom}$)		$XT_{Fx->Mz}$ $XT_{Fy->Mz}$	%	<±3	<±1				
Bending moment ($M_{x,nom}$; $M_{y,nom}$)		$XT_{Mx->Mz}$ $XT_{My->Mz}$	%	<±1.5	<±1				

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

3) At static load and uniaxial load

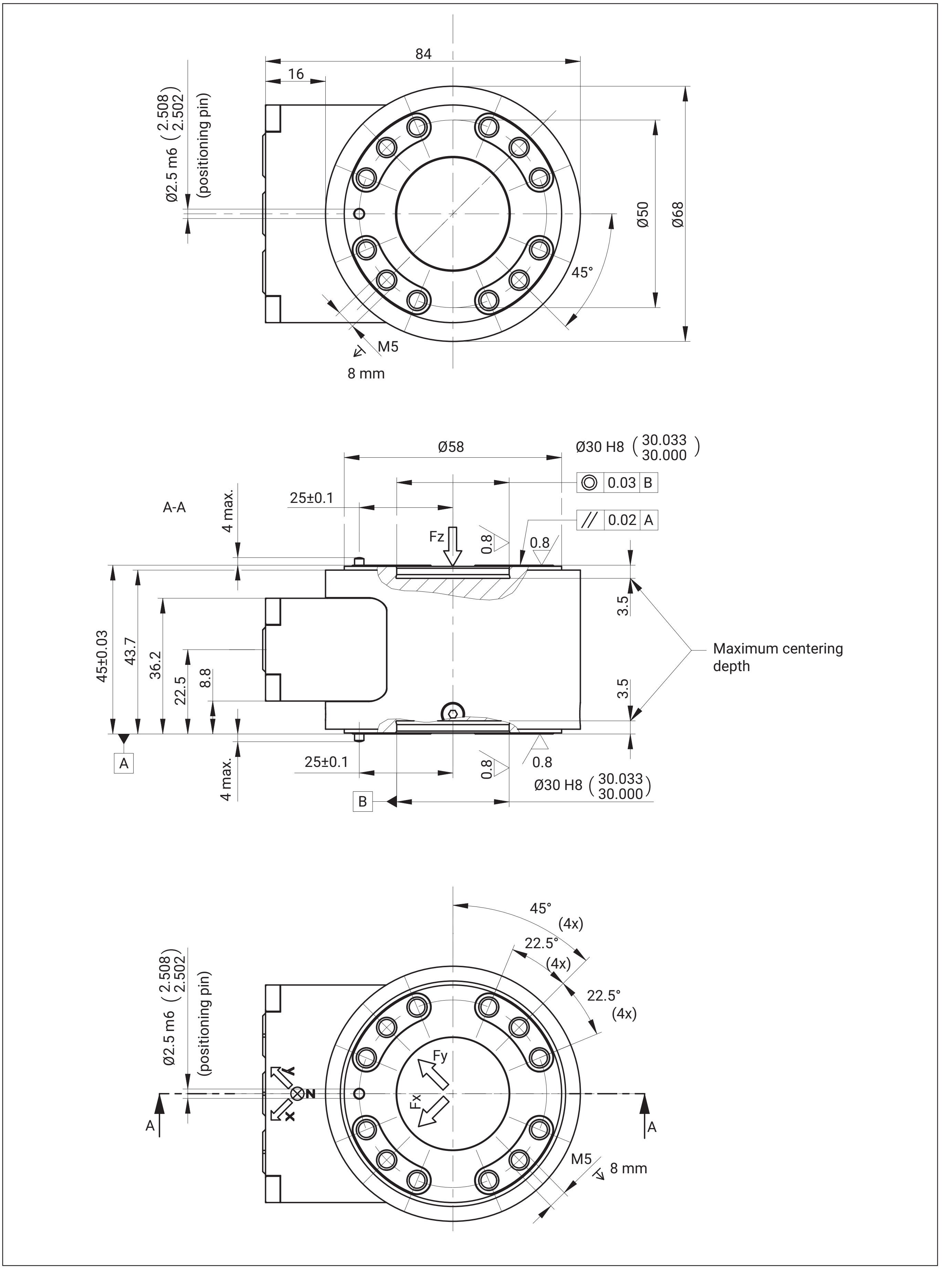
The load criteria apply to the sum of all simultaneously occurring loads, regardless of whether these are measured or parasitic.

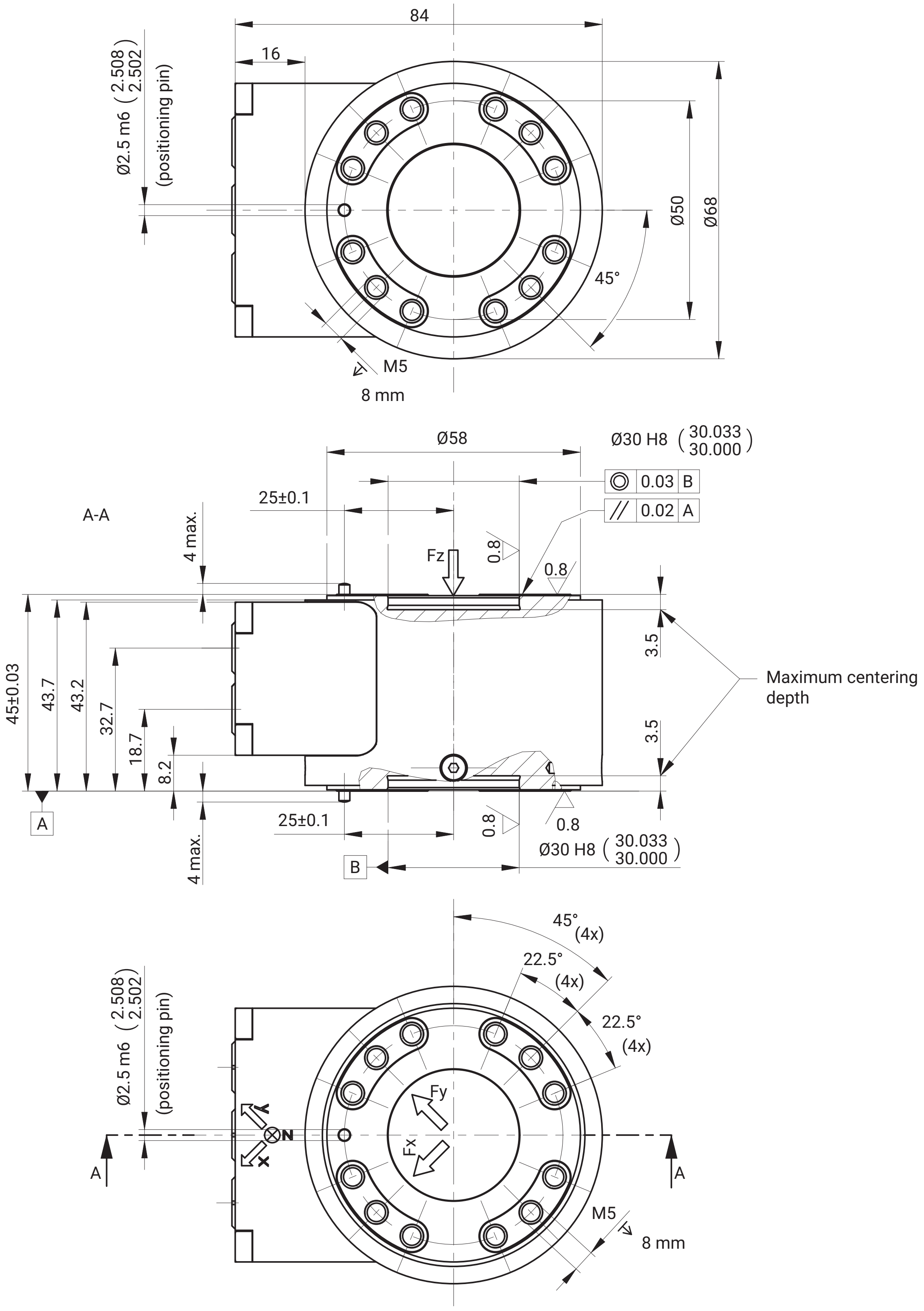
The origin of the sensor coordinates is in the geometric center (half the height of the sensor). In the application, the bending moment generated by a lateral force must be taken into account when determining the maximum bending moment that can occur. Please note that half the height of the sensor must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

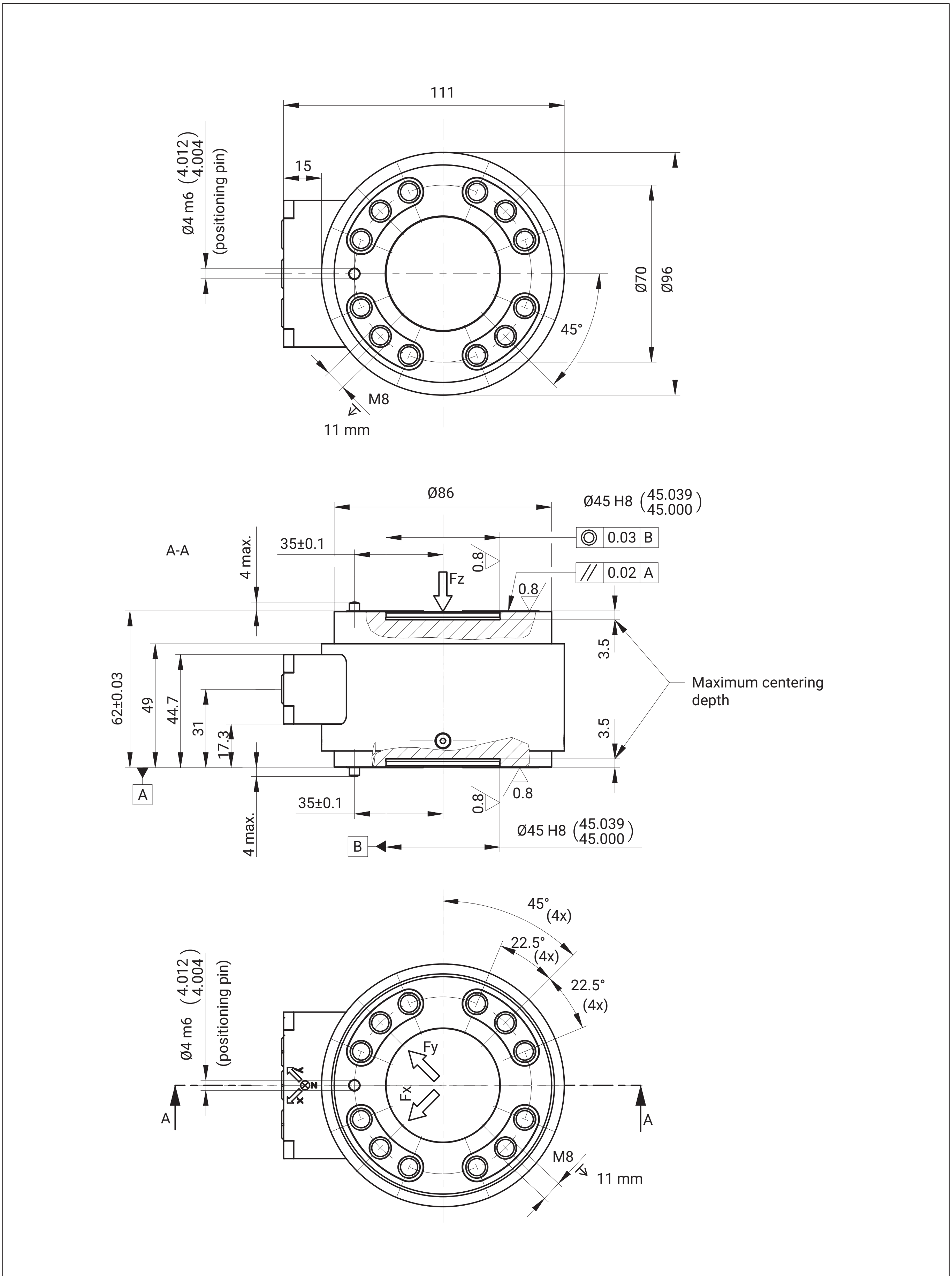
SPECIFICATIONS (CONTINUED)

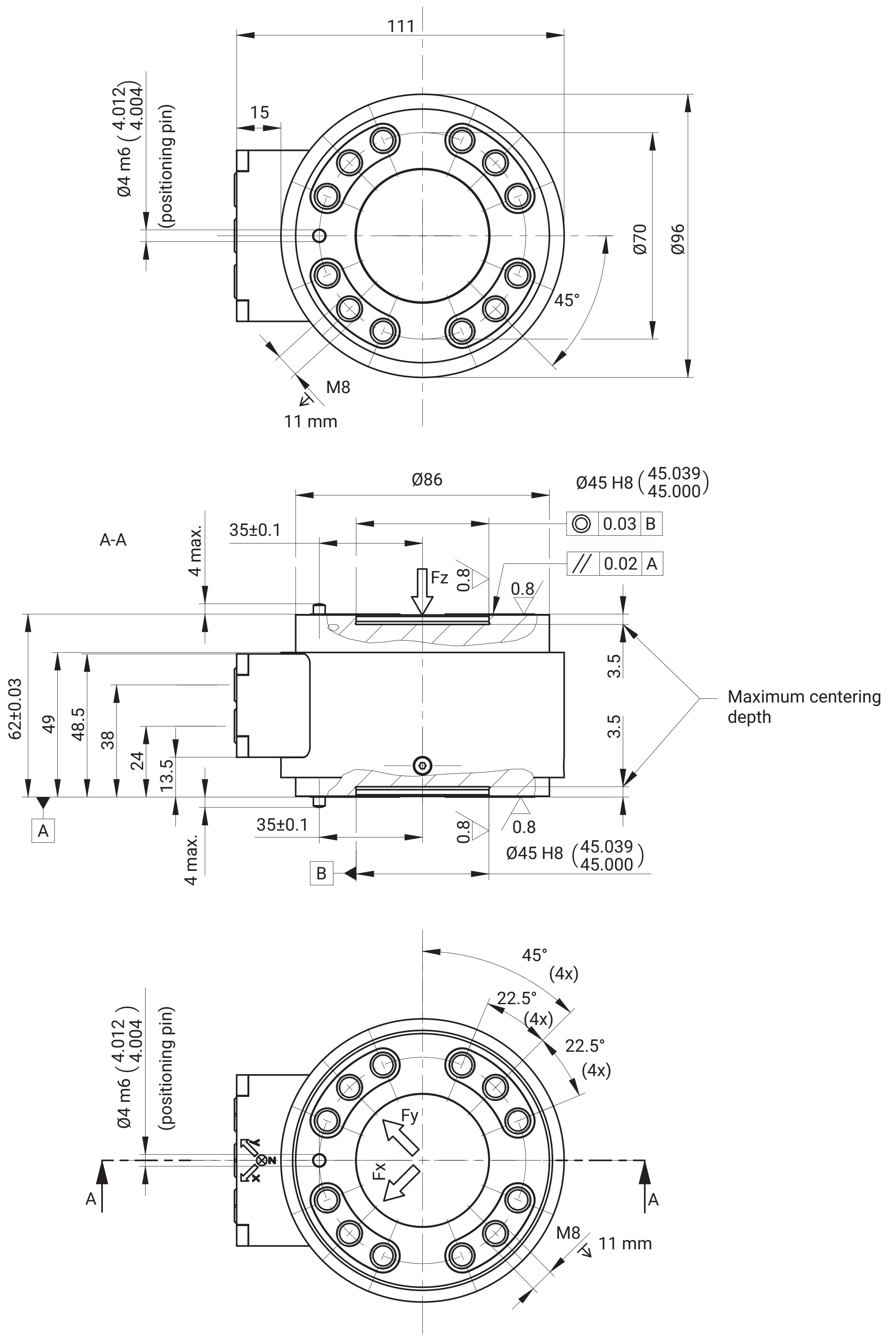
Size		BG1	BG2			BG3	
Type		**005**	**010**	**025**	**050**	**100**	**200**
Mechanical values							
Nominal (rated) displacement at lateral force Fx & Fy	mm	<0.03	<0.04	<0.05	<0.05	<0.05	<0.07
Nominal (rated) displacement at axial force Fz	mm	<0.02	<0.03	<0.03	<0.04	<0.04	<0.05
Tilt angle at $M_{x,nom}$; $M_{y,nom}$	degrees	<0.04	<0.05	<0.05	<0.06	<0.05	<0.05
Torsion angle at $M_{z,nom}$	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[4] in radial direction (x or y)	kHz	2.4	1.7	1.9	2.5		3.4
Natural frequency[4] in axial direction (z)		7.4	5.2	5.6	7.2	6.4	7.9
Natural frequency[4] around a radial axis (x or y)		8.5	6	6.5	8.4	7.8	9.9
Natural frequency[4] around the axial axis (z)		3.8	2.8	3.1	4		5.1
General information							
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) **Electromagnetic fields (AM)** **Power-frequency magnetic fields** **Electrostatic discharge (ESD)** Contact discharge Air discharge **Fast transients (burst)** **Impulse voltages (surge)** **Conducted interference (AM)**	 V/m A/m kV kV kV kV V	 10 100 4 8 1 1 10					
Mechanical shock (EN 60068-2-27) **Number** **Duration** **Acceleration (half sine)**	 n ms m/s^2	 1000 3 650					
Vibration in 3 directions (EN 60068-2-6) **Frequency range** **Duration** **Acceleration (amplitude)**	 Hz h m/s^2	 10…2000 2.5 150					

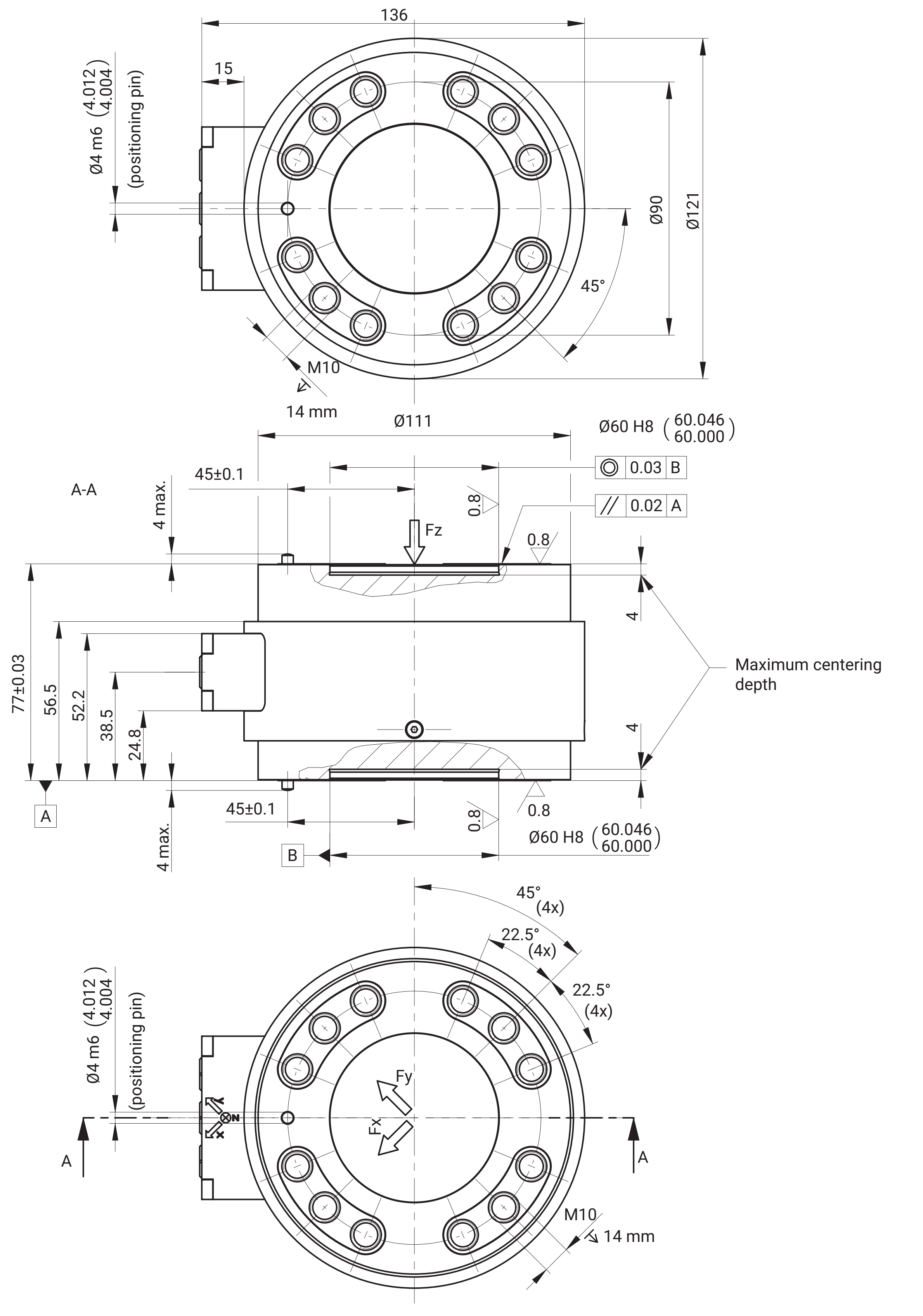
4) The natural frequency in the specifications only takes into account the transducer, not the necessary loading fittings. The relevant natural frequency of the overall setup changes naturally if additional masses are mounted on the transducer. Consequently, this is a recommended value serving as a guide,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

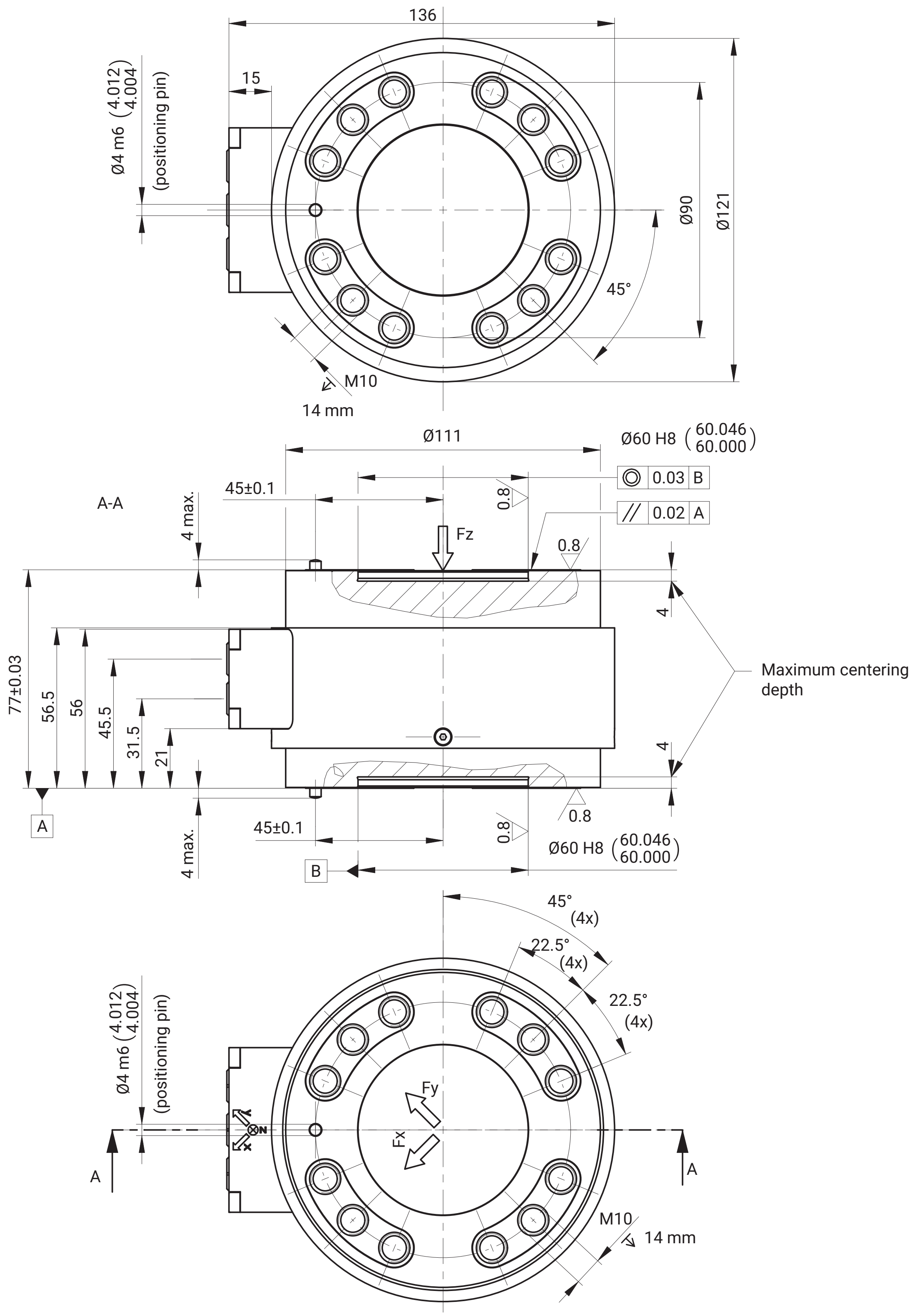

84
16
Ø2.5 m6 (2.508 / 2.502)
(positioning pin)
Ø50
Ø68
45°
M5
8 mm
Ø58
Ø30 H8 (30.033 / 30.000)
0.03 B
0.02 A
A-A
4 max.
25±0.1
Fz
0.8
0.8
3.5
3.5
Maximum centering depth
45±0.03
43.7
36.2
22.5
8.8
A
4 max.
25±0.1
0.8
0.8
Ø30 H8 (30.033 / 30.000)
B
45°
(4x)
22.5°
(4x)
22.5°
(4x)
Ø2.5 m6 (2.508 / 2.502)
(positioning pin)
Fy
Fx
Y
N
X
A
A
M5
8 mm

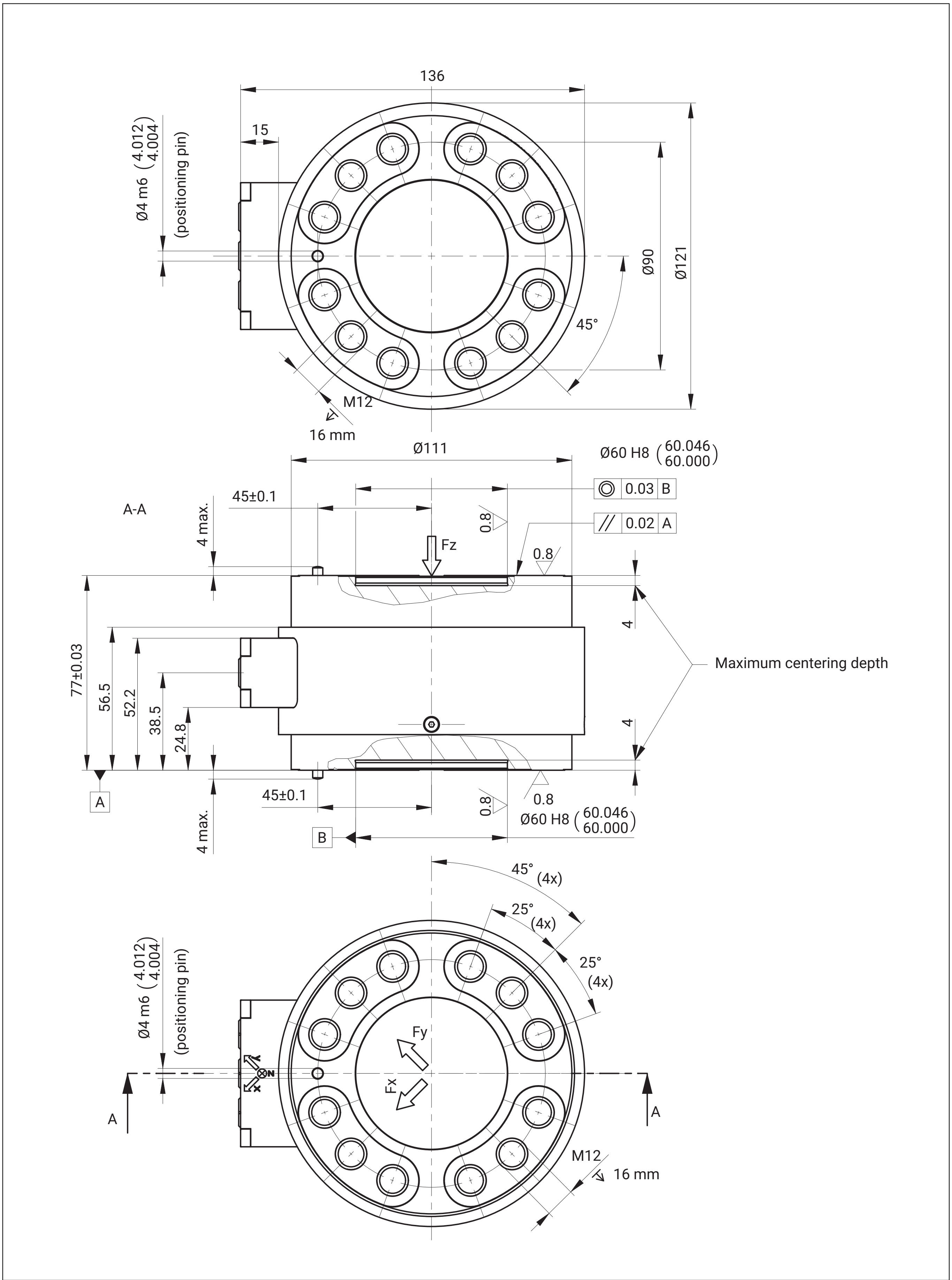

84
16
Ø2.5 m6 (2.508 / 2.502)
(positioning pin)
Ø50
Ø68
45°
M5
8 mm
Ø58
Ø30 H8 (30.033 / 30.000)
0.03 B
0.02 A
A-A
25±0.1
4 max.
Fz
0.8
3.5
Maximum centering depth
45±0.03
43.7
43.2
32.7
18.7
8.2
A
B
45° (4x)
22.5° (4x)
Fy
Fx
N
X
Y

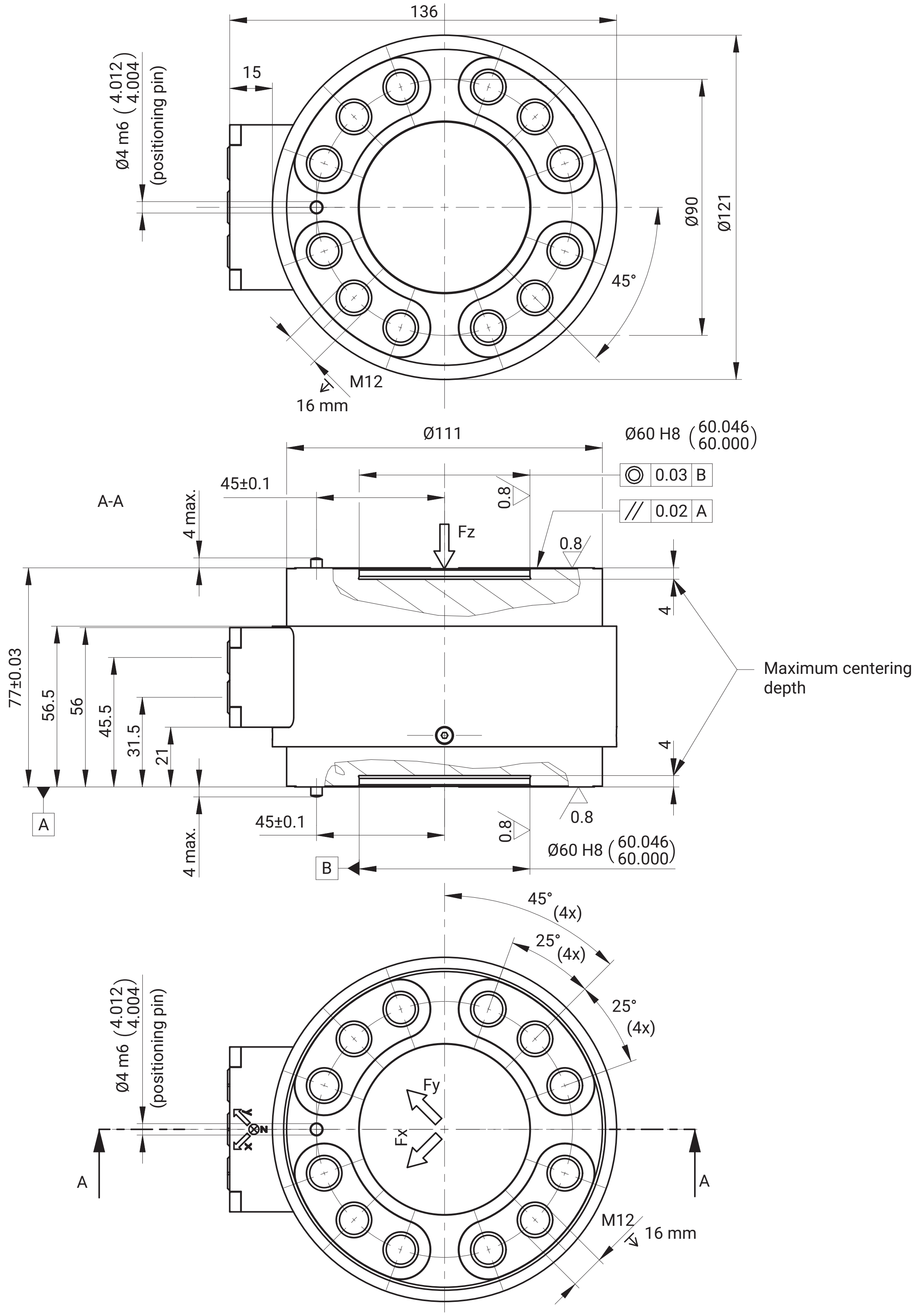

111
15
Ø4 m6 (4.012 / 4.004)
(positioning pin)
Ø70
Ø96
45°
M8
11 mm
Ø86
Ø45 H8 (45.039 / 45.000)
A-A
4 max.
35±0.1
0.8
Fz
0.03 B
0.02 A
0.8
3.5
Maximum centering depth
3.5
62±0.03
49
44.7
31
17.3
A
35±0.1
0.8
0.8
Ø45 H8 (45.039 / 45.000)
4 max.
B
45° (4x)
22.5° (4x)
22.5° (4x)
Ø4 m6 (4.012 / 4.004)
(positioning pin)
Fy
Fx
A
A
M8
11 mm


111
15
Ø4 m6 (4.012 / 4.004)
(positioning pin)
Ø70
Ø96
45°
M8
11 mm
Ø86
Ø45 H8 (45.039 / 45.000)
0.03 B
0.02 A
A-A
35±0.1
4 max.
Fz
0.8
0.8
3.5
3.5
Maximum centering depth
62±0.03
49
48.5
38
24
13.5
A
35±0.1
0.8
0.8
Ø45 H8 (45.039 / 45.000)
4 max.
B
45°
(4x)
22.5°
(4x)
22.5°
(4x)
Ø4 m6 (4.012 / 4.004)
(positioning pin)
Fy
Fx
A
A
M8
11 mm


136
15
Ø4 m6 (4.012 / 4.004)
(positioning pin)
Ø90
Ø121
45°
M10
14 mm
Ø111
Ø60 H8 (60.046 / 60.000)
0.03 B
0.02 A
A-A
45±0.1
4 max.
0.8
Fz
4
Maximum centering depth
77±0.03
56.5
52.2
38.5
24.8
A
B
45°
(4x)
22.5°
(4x)
Fy
Fx


136
15
Ø4 m6 (4.012 4.004)
(positioning pin)
Ø90
Ø121
45°
M10
14 mm
Ø111
Ø60 H8 (60.046 60.000)
0.03 B
0.02 A
45±0.1
A-A
4 max.
0.8
Fz
4
Maximum centering depth
77±0.03
56.5
56
45.5
31.5
21
A
B
45°
(4x)
22.5°
(4x)
Fy
Fx
A

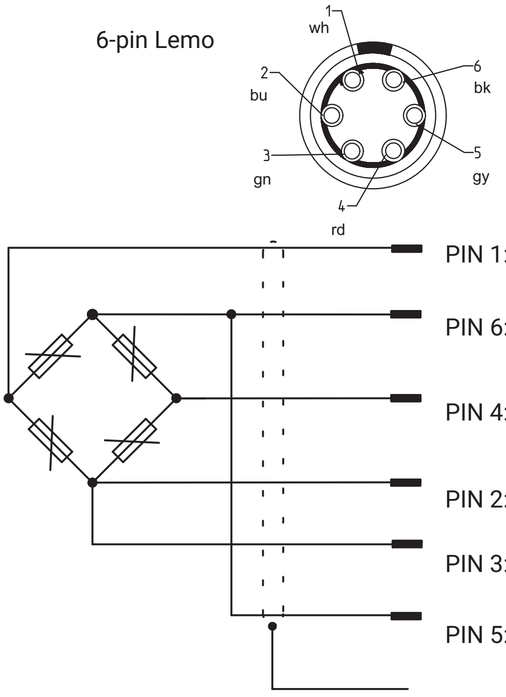

136
15
Ø4 m6 (4.012 / 4.004)
(positioning pin)
Ø90
Ø121
45°
M12
16 mm
Ø111
Ø60 H8 (60.046 / 60.000)
0.03 B
0.02 A
A-A
45±0.1
4 max.
0.8
Fz
4
Maximum centering depth
77±0.03
56.5
52.2
38.5
24.8
A
B
45° (4x)
25° (4x)
25° (4x)
Fy
Fx
A
A
M12
16 mm


136
15
Ø4 m6 (4.012 / 4.004)
(positioning pin)
Ø90
Ø121
45°
M12
16 mm
Ø111
Ø60 H8 (60.046 / 60.000)
0.03 B
0.02 A
45±0.1
A-A
4 max.
0.8
Fz
Maximum centering depth
4
77±0.03
56.5
56
45.5
31.5
21
A
B
45° (4x)
25° (4x)
Fy
Fx

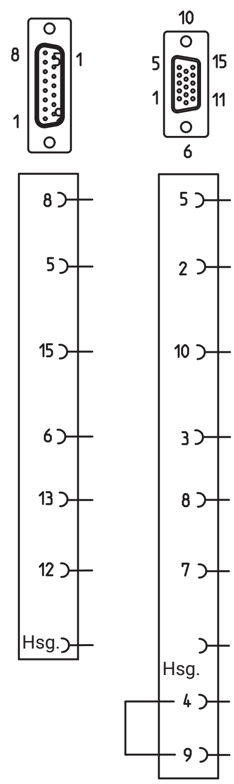
PIN ASSIGNMENT

Transducer assignment

6-pin Lemo

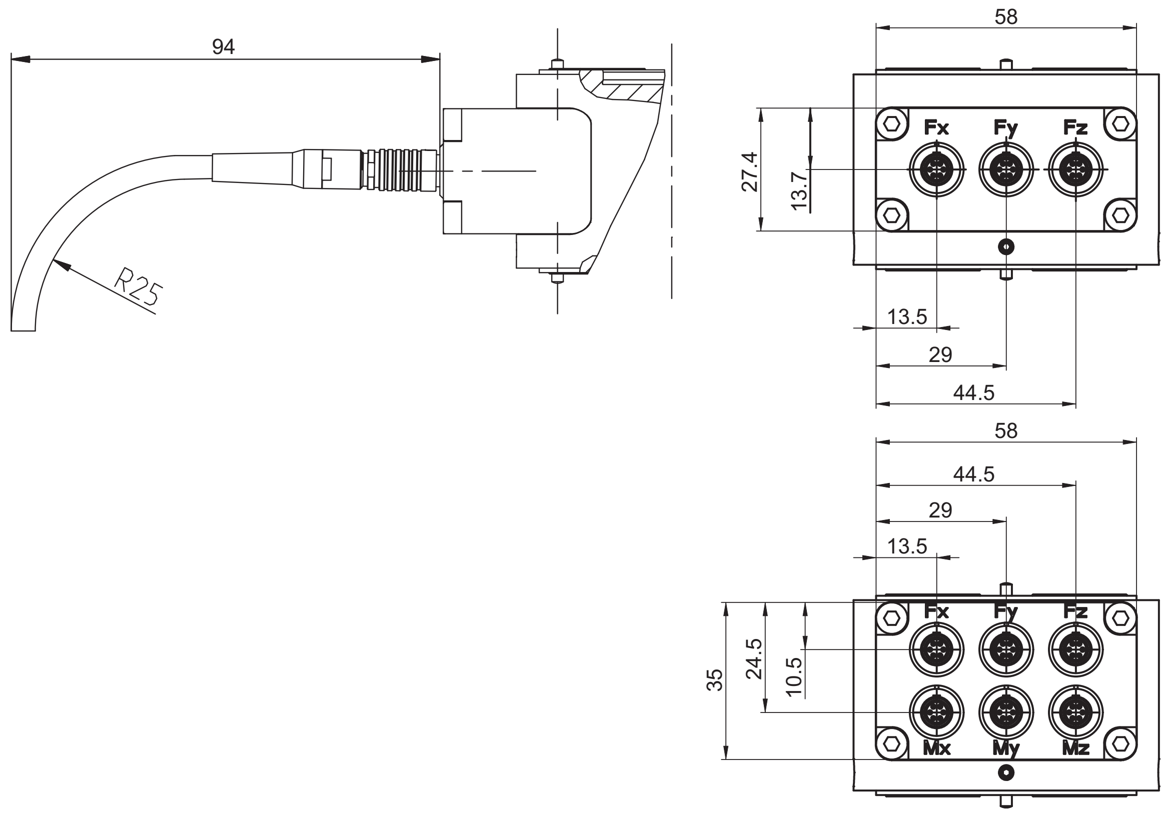


Amplifier assignment



Transducer assignment	Free ends	D-Sub	D-Sub-HD
PIN 1: Measurement signal (+) U_A	wh (white)	8	5
PIN 6: Bridge excitation voltage (-) U_B (optional: TEDS chip)	bk (black)	5	2
PIN 4: Measurement signal (-) U_A	rd (red)	15	10
PIN 2: Bridge excitation voltage (+) U_B	bu (blue)	6	3
PIN 3: Sense lead (+)	gn (green)	13	8
PIN 5: Sense lead (-) (optional: TEDS chip)	gy (gray)	12	7
Cable shield, connected to the housing	Shield	Hsg.	Hsg.

CABLE



ORDERING NUMBER MCS10

Ordering number		
K-MCS10		
1	Code	Measurement range
	005	F_x=1 kN; F_y=1 kN; F_z=5 kN; M_x=0.05 kNm; M_y=0.05 kNm; M_z=0.05 kNm
	010	F_x=2 kN; F_y=2 kN; F_z=10 kN; M_x=0.15 kNm; M_y=0.15 kNm; M_z=0.15 kNm
	025	F_x=5 kN; F_y=5 kN; F_z=25 kN; M_x=0.35 kNm; M_y=0.35 kNm; M_z=0.25 kNm
	050	F_x=10 kN; F_y=10 kN; F_z=50 kN; M_x=0.7 kNm; M_y=0.7 kNm; M_z=0.5 kNm
	100	F_x=20 kN; F_y=20 kN; F_z=100 kN; M_x=2 kNm; M_y=2 kNm; M_z=1.5 kNm
	200	F_x=40 kN; F_y=40 kN; F_z=200 kN; M_x=3,5 kNm; M_y=3,5 kNm; M_z=3 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)

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

B04439 11 E00 00 02.03.2023

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