Data Sheet

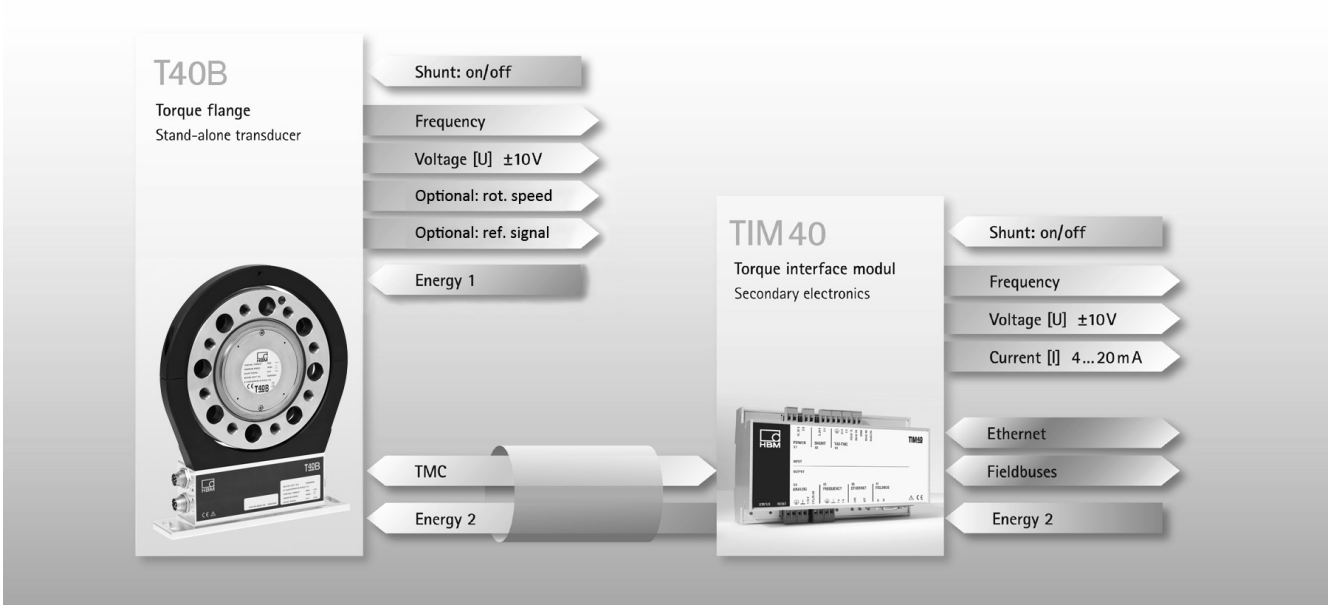
T40B

Torque Flange

Special features

- **Nominal (rated) torques 200 N·m, 500 N·m, 1 kN·m, 2 kN·m, 3 kN·m, 5 kN·m and 10 kN·m**
- **Nominal (rated) rotational speeds of 10,000 rpm to 20,000 rpm**
- **Accuracy class 0.05**
- **Large measurement frequency range up to 6 kHz (-3 dB)**
- **Digital transmission of measured values**
- **Compact design**
- **Low rotor weights and mass moments of inertia**
- **Optional: rotational speed measuring system, reference signal**

Overall concept



Specifications

Type		T40B						
Accuracy class		0.05						
Torque measuring system								
Nominal (rated) torque M_{nom}	N·m	200	500					
	kN·m			1	2	3	5	10
Nominal (rated) rotational speed	rpm	20 000			15 000		12 000	10 000
Non-linearity including hysteresis, relative to the nominal (rated) sensitivity								
Frequency output	%	< ± 0.03						
Voltage output	%	< ± 0.03						
Relative standard deviation of repeatability per DIN 1319, relative to the variation of the output signal								
Frequency output	%	< ± 0.03						
Voltage output	%	< ± 0.03						
Effect of temperature per 10 K in the nominal (rated) temperature range								
on the output signal, relative to the actual value of the signal spread								
Frequency output	%	± 0.05						
Voltage output	%	± 0.2						
on the zero signal, relative to the nominal (rated) sensitivity								
Frequency output	%	± 0.05						
Voltage output	%	± 0.1						
Nominal (rated) sensitivity (spread between torque = zero and nominal (rated) torque)								
Frequency output 10 kHz / 60 kHz / 240 kHz	kHz	5/30/120						
Voltage output	V	10						
Sensitivity tolerance (deviation of the actual output quantity at M_{nom} from the nominal (rated) sensitivity)	%	± 0.1						
Output signal at torque = zero								
Frequency output	kHz	10/60/240						
Voltage output	V	0						
Nominal (rated) output signal								
Frequency output								
with positive nominal (rated) torque	kHz	15 [1] / 90 [2] / 360 [3] (5 V symmetrical [4])						
with negative nominal (rated) torque	kHz	5 [1] / 30 [2] / 120 [3] (5 V symmetrical [4])						
Voltage output								
with positive nominal (rated) torque	V	+10						
with negative nominal (rated) torque	V	-10						
Load resistance								
Frequency output	kΩ	≥ 2						
Voltage output	kΩ	≥ 10						
Long-term drift over 48 h								
Frequency output	%	< ± 0.03						
Voltage output	%	< ± 0.03						
Measurement frequency range, -3 dB	kHz	1 [1] / 3 [2] / 6 [3]						
Group delay	µs	< 400 [1] / < 220 [2] / < 150 [3]						
Residual ripple								
Voltage output [5]	mV	< 40						
Maximum modulation range [6]								
Frequency output	kHz	2.5 … 17.5 [1] / 15 … 105 [2] / 60 … 420 [3]						
Voltage output	V	-12 … +12						
Energy supply								
Nominal (rated) supply voltage (separated extra-low DC voltage)	V	18 … 30						
Current consumption in measuring mode	A	< 1						
Current consumption in startup mode	A	< 4 (typ. 2) 50 µs						
Nominal (rated) power consumption	W	< 10						
Maximum cable length	m	50						

[1] Option 5, 10 ± 5 kHz (code SU2)
[2] Option 5, 60 ± 30 kHz (code DU2)
[3] Option 5, 240 ± 120 kHz (code HU2)
[4] RS-422 complementary signals, note termination resistor.
[5] Signal frequency range 0.1 to 10 kHz
[6] Output signal range in which there is a repeatable correlation between torque and output signal.

Specifications (continued)

Nominal (rated) torque M_{nom}	N·m	200	500					
	kN·m			1	2	3	5	10
Shunt signal		approx. 50 % of M_{nom}						
Tolerance of the shunt signal, relative to M_{nom}	%	< ± 0.05						
Nominal (rated) trigger voltage	V	5						
Trigger voltage limit	V	36						
Shunt signal ON	V	min. >2.5						
Shunt signal OFF	V	max. <0.7						
Rotational speed measuring system								
Measurement system		Magnetic, via AMR sensor (Anisotropic Resistive Effect) and magnetized plastic ring with embedded steel ring						
Magnetic poles		72	86		108		126	156
Maximum position deviation of the poles		± 50 angular seconds						
Output signal	V	5 V symmetrical (RS-422); 2 square wave signals approx. 90° phase shifted						
Pulses per revolution		1024						
Minimum rotational speed for sufficient pulse stability	rpm	0						
Pulse tolerance [7]	degrees	< ± 0.05						
Maximum permissible output frequency	kHz	420						
Group delay	µs	<150						
Radial nominal (rated) distance between sensor head and magnetic ring (mechanical distance)	mm	1.6						
Working distance range between sensor head and magnetic ring	mm	0.4 … 2.5						
Max. permissible axial displacement of the rotor to the stator [8]	mm	± 1.5						
Hysteresis of reversing the direction in the case of relative vibrations between the rotor and the stator								
Torsional vibration of the rotor	degrees	<approx. 0.2						
Horizontal stator vibration displacement	mm	<approx. 0.5						
Magnetic load limit								
Remanent flux density	mT	>100						
Coercive field strength	kA/m	>100						
Permissible magnetic field strength for signal deviations	kA/m	<0.1						
Load resistance [9]	kΩ	≥2						
Reference signal measuring system (0 index)								
Measurement system		Magnetic, via Hall sensor and magnet						
Output signal	V	5 V symmetric (RS-422)						
Pulses per revolution		1						
Minimum rotational speed for sufficient pulse stability	rpm	2						
Pulse width, approx.	degrees	0.088						
Pulse tolerance [7]	degrees	< ± 0.05						
Group delay	µs	<150						
Axial nominal (rated) distance between sensor head and magnetic ring (mechanical distance)	mm	2.0						
Working distance range between sensor head and magnetic ring	mm	0.4 … 2.5						
Max. permissible axial displacement of the rotor to the stator [8]	mm	± 1.5						

7) At nominal (rated) conditions.
8) The data refers only to a central axial alignment. Deviations lead to a change in pulse tolerance.
9) Note the termination resistances as per RS-422.

Nominal (rated) torque M_{nom}	N·m	200	500					
	kN·m			1	2	3	5	10
General information								
EMC								
Emission (per EN 61326-1, Section 7)								
RFI field strength	-	Class B						
Immunity from interference (EN 61326-1, Table 2)								
Electromagnetic field (AM)	V/m	10						
Magnetic field	A/m	100						
Electrostatic discharge (ESD)								
Contact discharge	kV	4						
Air discharge	kV	8						
Fast sweeps (burst)	kV	1						
Impulse voltages (surge)	kV	1						
Conducted interference (AM)	V	10						
Degree of protection per EN 60529		IP 54						
Reference temperature	°C	23						
Nominal (rated) temperature range	°C	+10 … +70						
Operating temperature range	°C	-20 … +85						
Storage temperature range	°C	-40 … +85						
Mechanical shock per EN 60068-2-27 [10]								
Number	n	1000						
Duration	ms	3						
Acceleration (half sine)	m/s^2	650						
Vibrational stress in 3 directions per EN 60068-2-6 [10]								
Frequency range	Hz	10 … 2000						
Duration	h	2.5						
Acceleration (amplitude)	m/s^2	200						
Load limits [11]								
Limit torque, relative to M_{nom} [12]	%	200				160		
Breaking torque, relative to M_{nom} [12]	%	> 400				> 320		
Longitudinal limit force [13]	kN	10	13	19	30	35	60	80
Lateral limit force [13]	kN	2	4	5	9	10	12	18
Limit bending moment [13]	N·m	100	200	220	560	600	800	1200
Oscillation width per DIN 50100 (peak-to-peak) [14]	N·m	400	1000	2000	4000	4800	8000	16000

10) The antenna ring and connector plug must be fixed in place.

11) Each type of irregular stress (bending moment, lateral or longitudinal force, exceeding nominal (rated) torque), can only be permitted up to its specified load limit, provided none of the others can occur at the same time. If this condition is not met, the limit values must be reduced. If 30% of the limit bending moment and lateral limit force occur at the same time, only 40% of the longitudinal limit force is permissible and the nominal (rated) torque must not be exceeded. The permissible bending moments, longitudinal forces and lateral forces can affect the measurement result by approx. 0.3% of the nominal (rated) torque. The load limits only apply for the nominal (rated) temperature range. At temperatures < 10 C°, load limits are expected to reduce by up to 30%, because there is an increased reduction in toughness as temperatures fall.

12) With static loading.

13) Static and dynamic.

14) The nominal (rated) torque must not be exceeded.

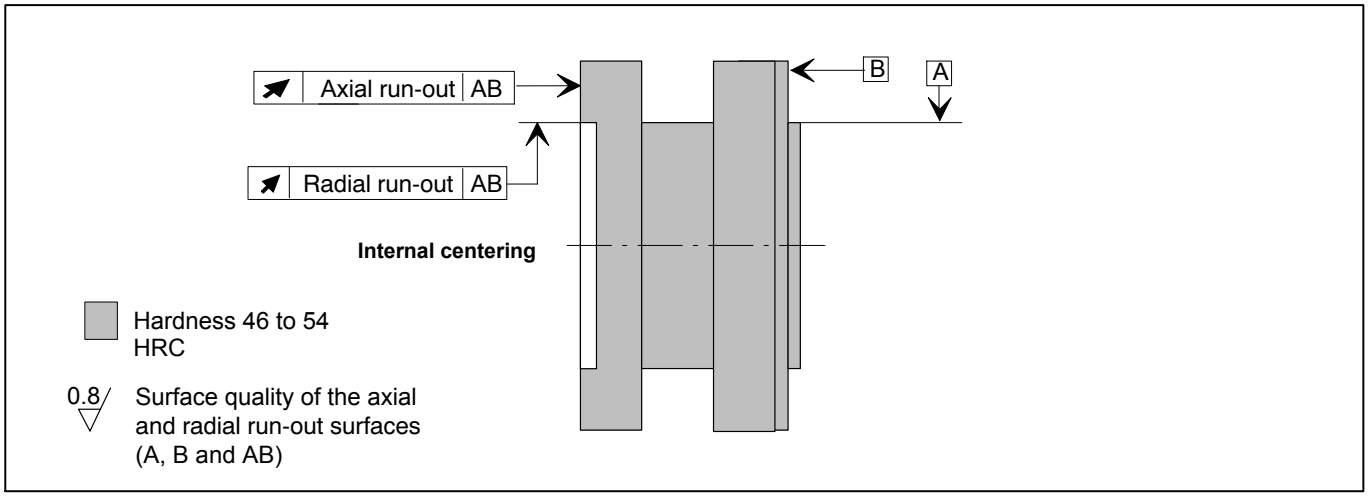
Specifications (continued)

Nominal (rated) torque M_{nom}	N·m	200	500					
	kN·m			1	2	3	5	10
Mechanical values								
Torsional stiffness c_T	kN·m/rad	360	745	1165	2515	3210	5565	14335
Torsion angle at M_{nom}	degrees	0.032	0.038	0.049	0.046	0.054	0.051	0.040
Stiffness in the axial direction c_a	kN/mm	540	450	580	540	570	760	960
Stiffness in the radial direction c_r	kN/mm	315	560	860	1365	1680	2080	2940
Stiffness with bending moment round a radial axis c_b	kN·m/deg.	3.6	4.2	5.9	9	9.3	20.2	45.5
Maximum deflection at longitudinal limit force	mm	< 0.04	< 0.05		< 0.06		< 0.08	< 0.09
Additional max. radial deviation at lateral limit force	mm	< 0.02						
Additional plumb/parallel deviation at limit bending moment (with ∅ d_B)	mm	< 0.06	< 0.11	< 0.09	< 0.18	< 0.19	< 0.14	< 0.12
Balance quality level per DIN ISO 1940		G 2.5						
Max. limits for relative shaft vibration (peak-to-peak) [15] Undulation in the connection flange area following ISO 7919-3								
Normal operation (continuous operation)	µm	$s_{(p-p)} = \frac{9000}{\sqrt{n}}$ (n in min^{-1})						
Start and stop operation/resonance ranges (temporary)	µm	$s_{(p-p)} = \frac{13200}{\sqrt{n}}$ (n in min^{-1})						
Mass moment of inertia of the rotor J_V								
without rotational speed measuring system	$kg·m^2$	0.0017	0.0039		0.0128		0.0292	0.0771
with magn. rotational speed measuring system	$kg·m^2$	0.0022	0.0048		0.0145	0.0146	0.0333	0.0872
Proportional mass moment of inertia for the transmitter side (side of the flange with external centering)								
without rotational speed measuring system	% of J_V	62	59		54		53	54
with magn. rotational speed measuring system	% of J_V	48	48		48		47	48
Max. permissible static eccentricity of the rotor (radially) to the center point of the stator								
without rotational speed measuring system	mm	±2						
Permissible axial displacement between rotor and stator[16]								
without rotational speed measuring system	mm	±2						
Weight								
Rotor without rotational speed measuring system	kg	1.1	1.9		3.8	3.9	6.5	10.9
Rotor with magn. rotational speed measuring system	kg	1.3	2.1		4.1	4.1	6.9	11.7
Stator	kg	1.1	1.1		1.1	1.1	1.2	1.3

15) The influence of radial deviations, eccentricity, defects of form, notches, marks, local residual magnetism, structural inhomogeneity or material anomalies needs to be taken into account and isolated from the actual undulation.

16) Above the nominal (rated) temperature range: ±1.5 mm.

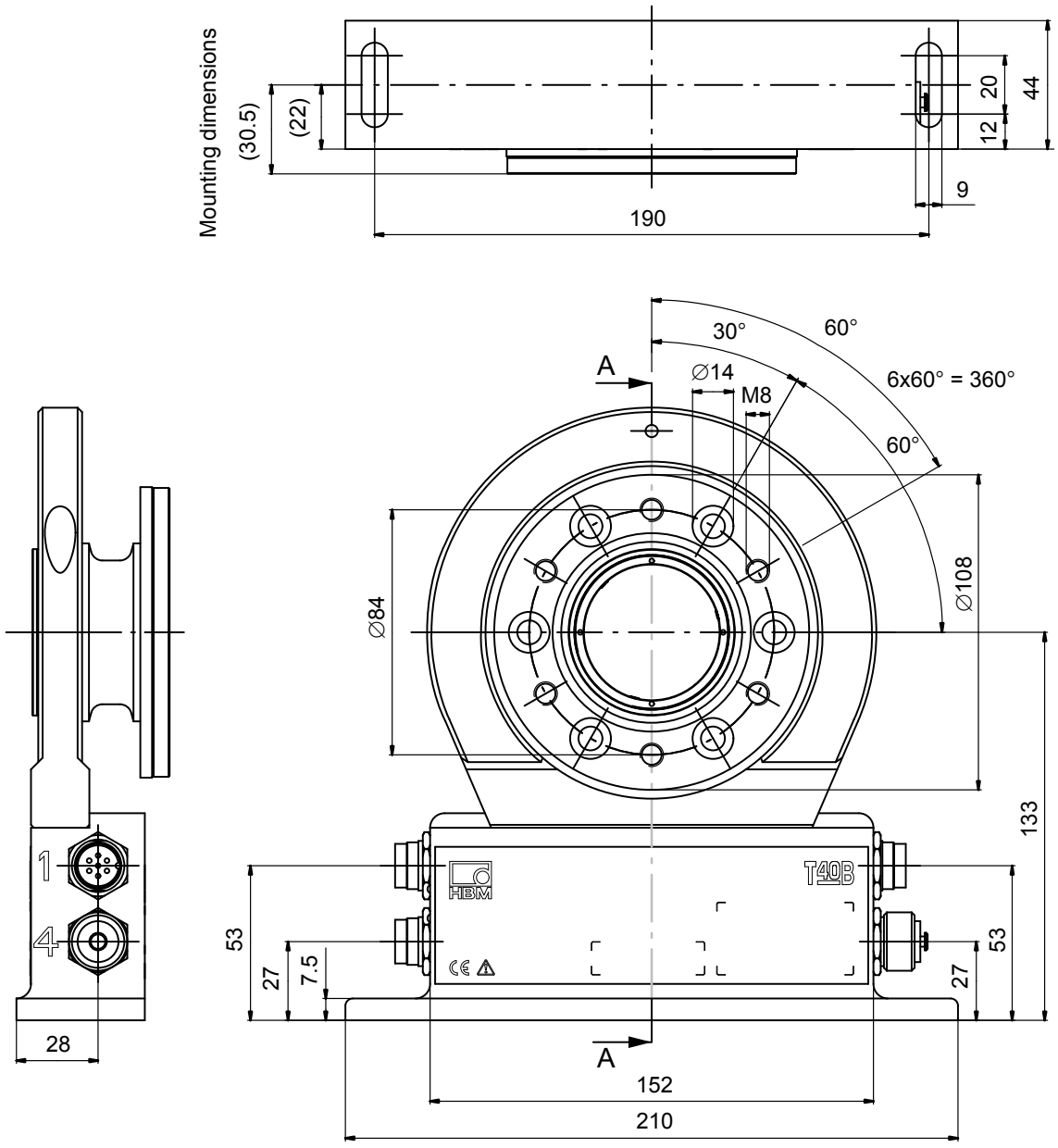
Radial and axial run-out tolerances



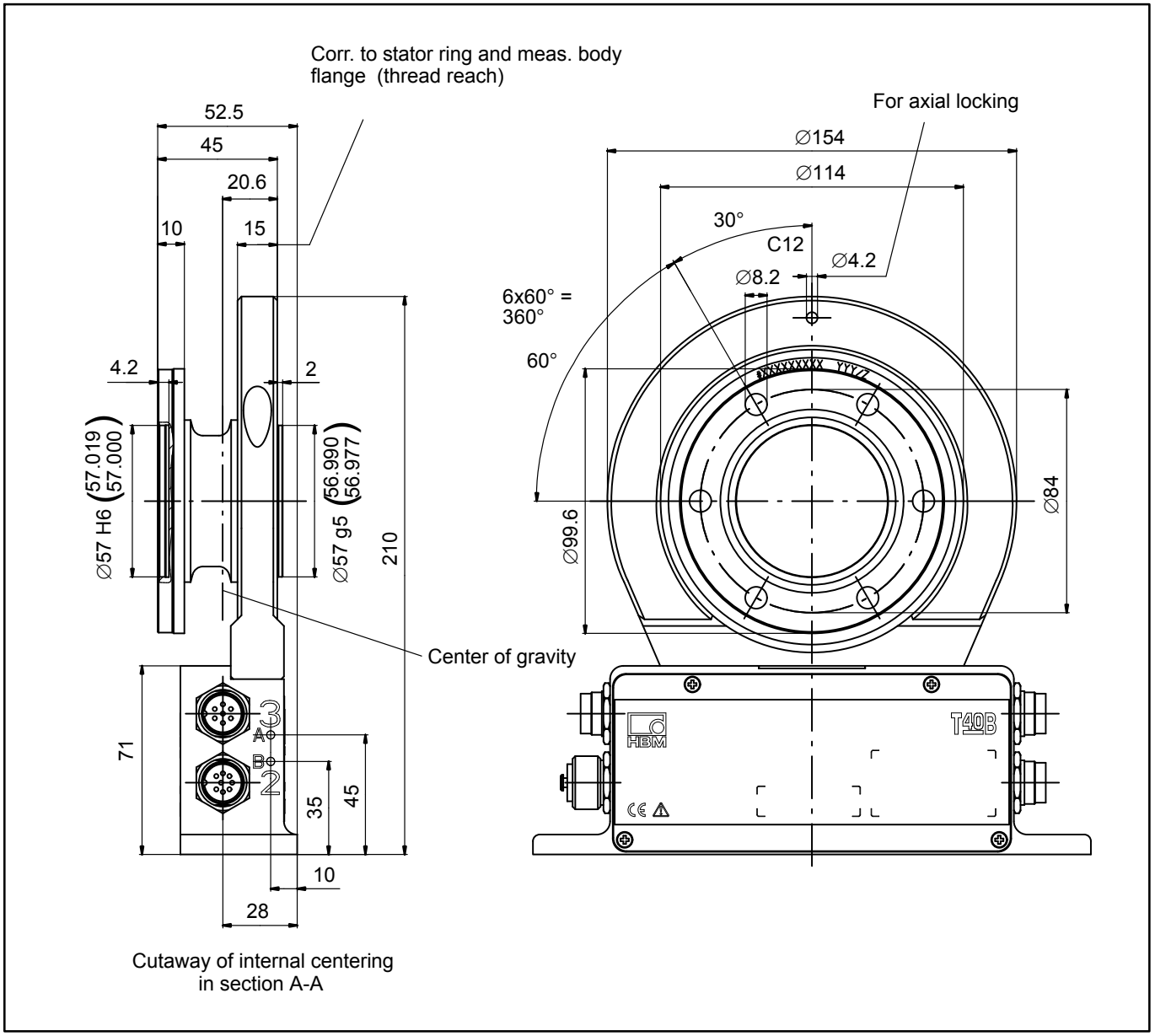
Measuring range (N·m)	Axial run-out tolerance (mm)	Radial run-out tolerance (mm)
200	0.01	0.01
500	0.01	0.01
1 k	0.01	0.01
2 k	0.02	0.02
3 k	0.02	0.02
5 k	0.02	0.02
10 k	0.02	0.02

Dimensions of T40B/200 Nm without rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)

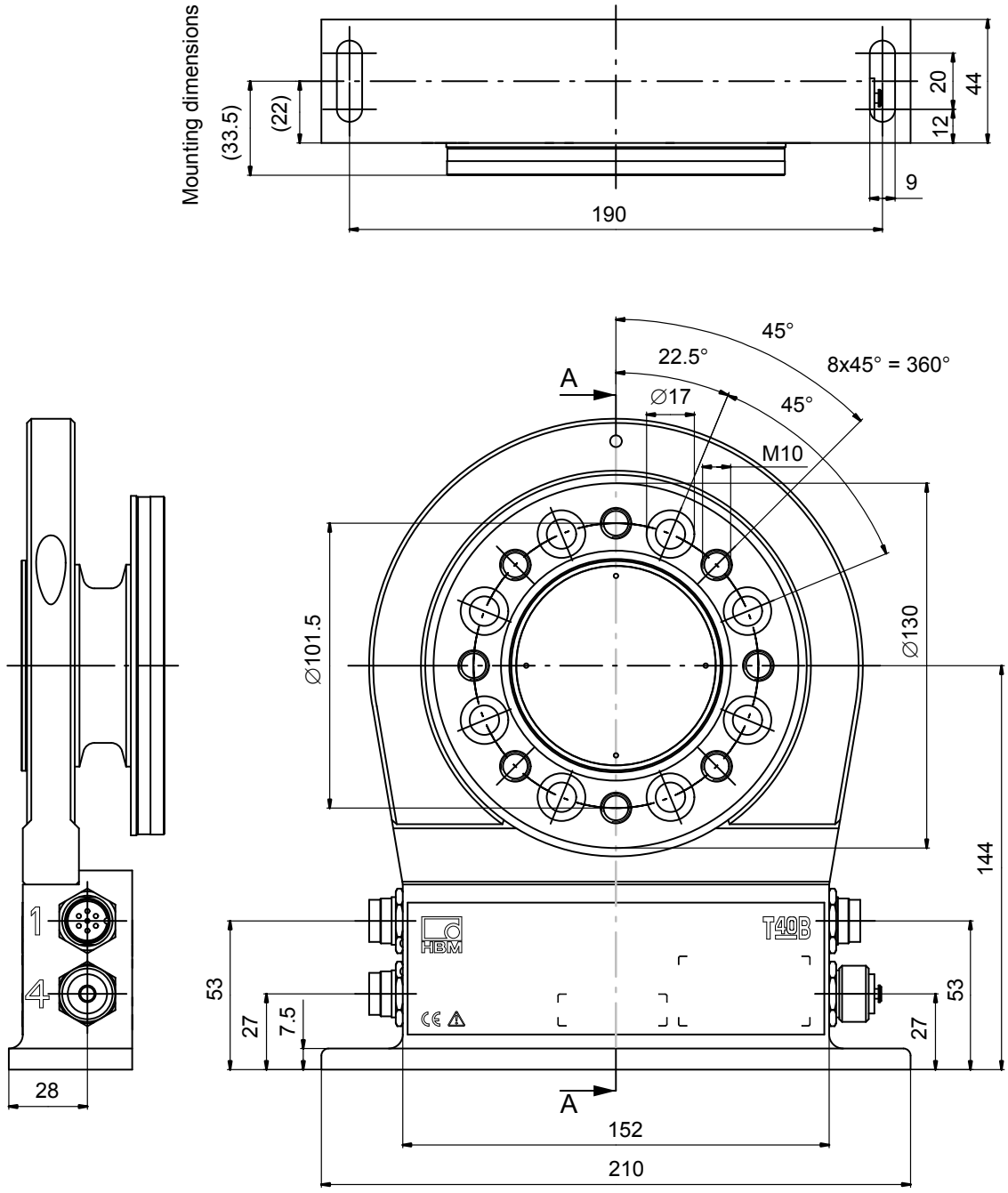


Dimensions of T40B/200 Nm without rotational speed measurement, continued

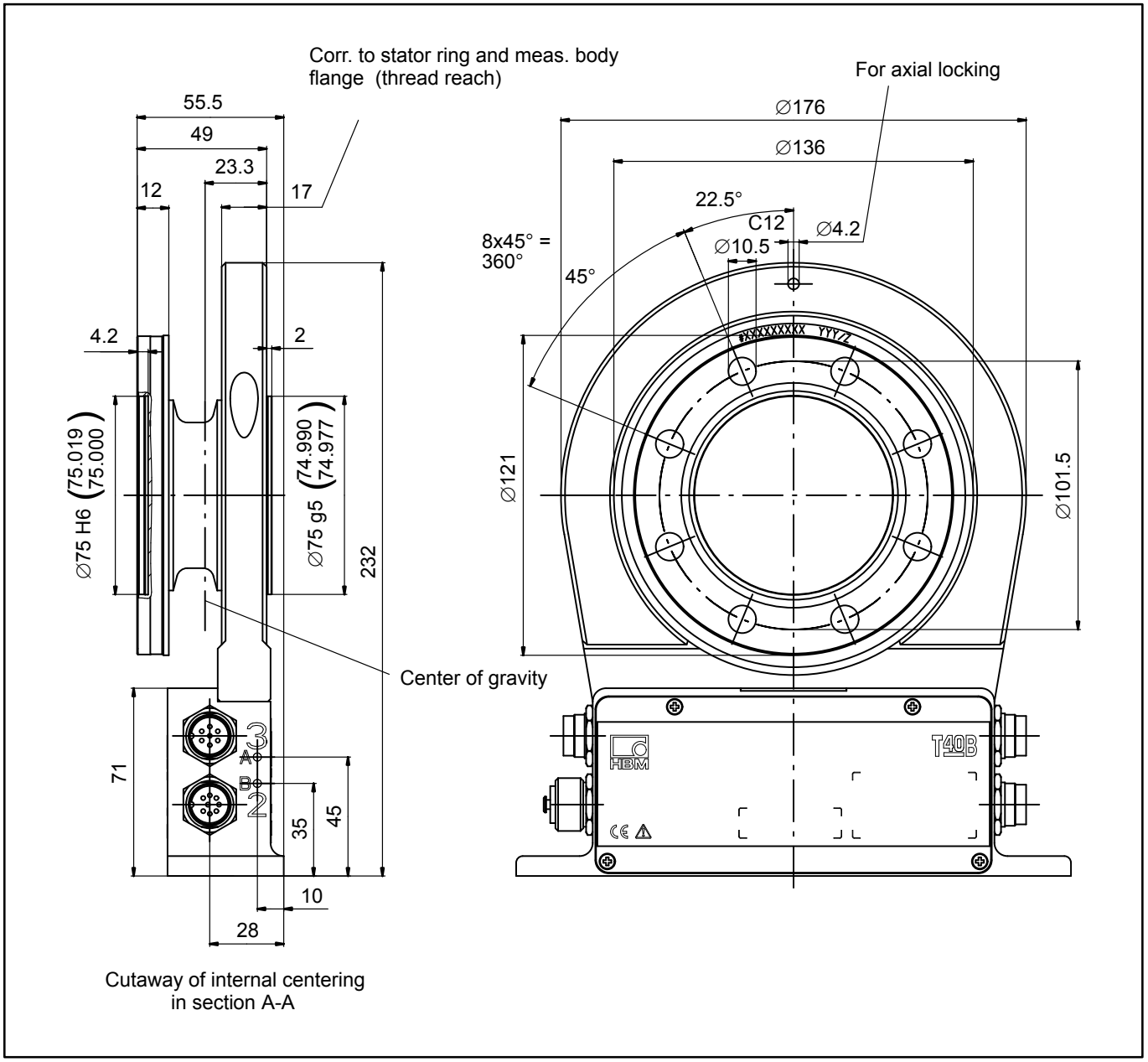


Dimensions of T40B/500 Nm and 1 kNm without rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)



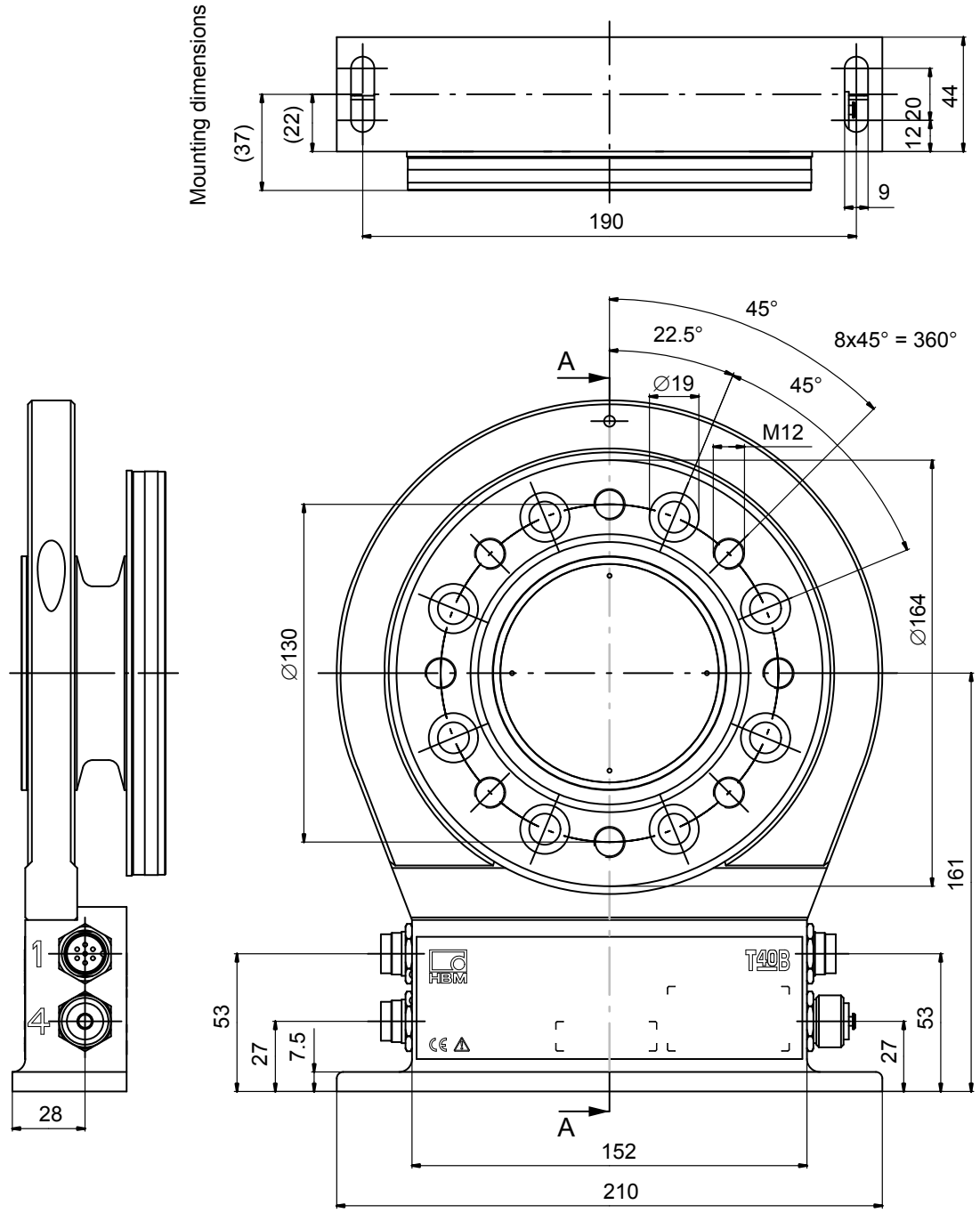
Dimensions of T40B/500 Nm and 1 kNm without rotational speed measurement, continued



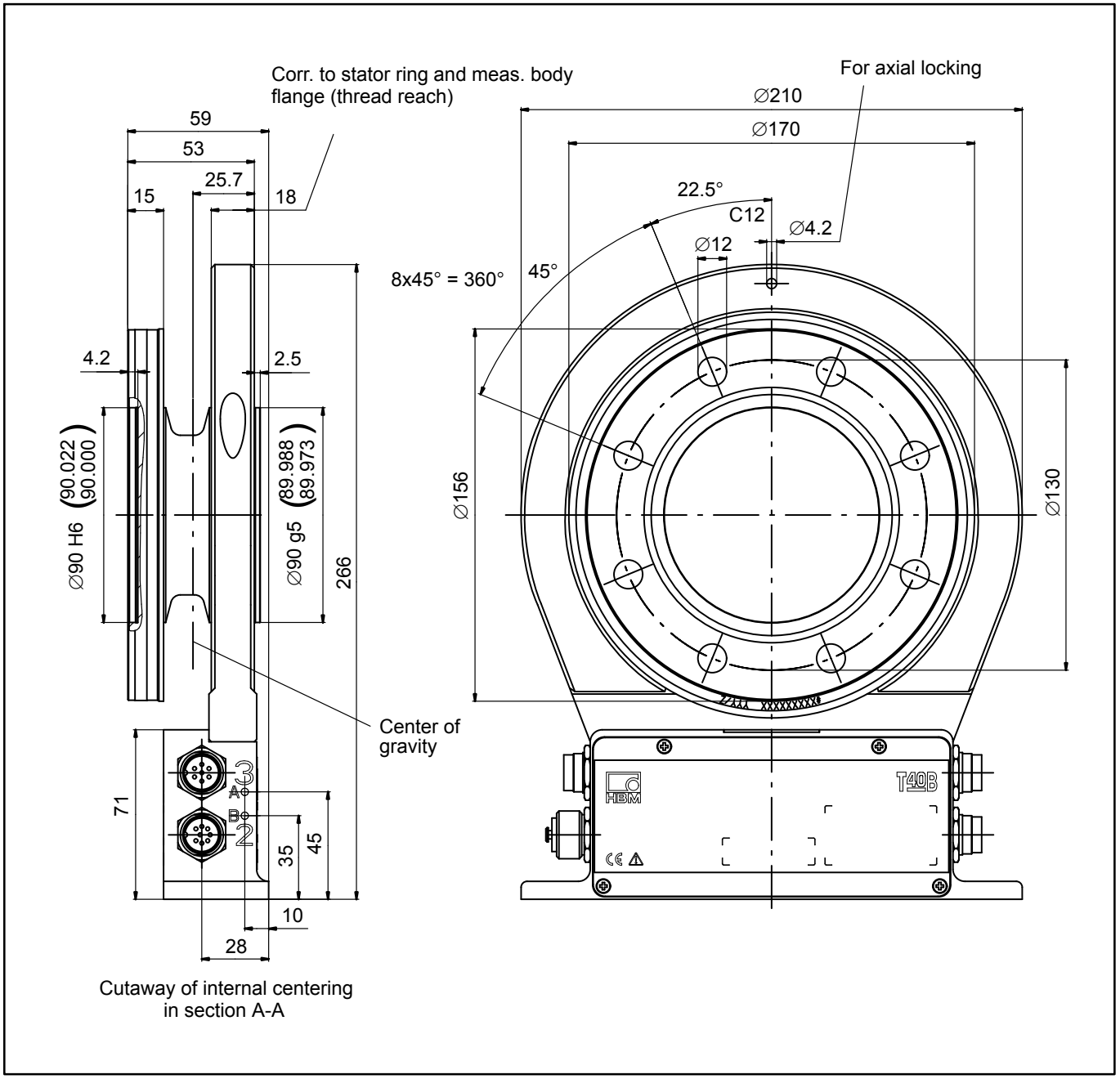
Cutaway of internal centering in section A-A

Dimensions of T40B/2 kNm and 3 kNm without rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)

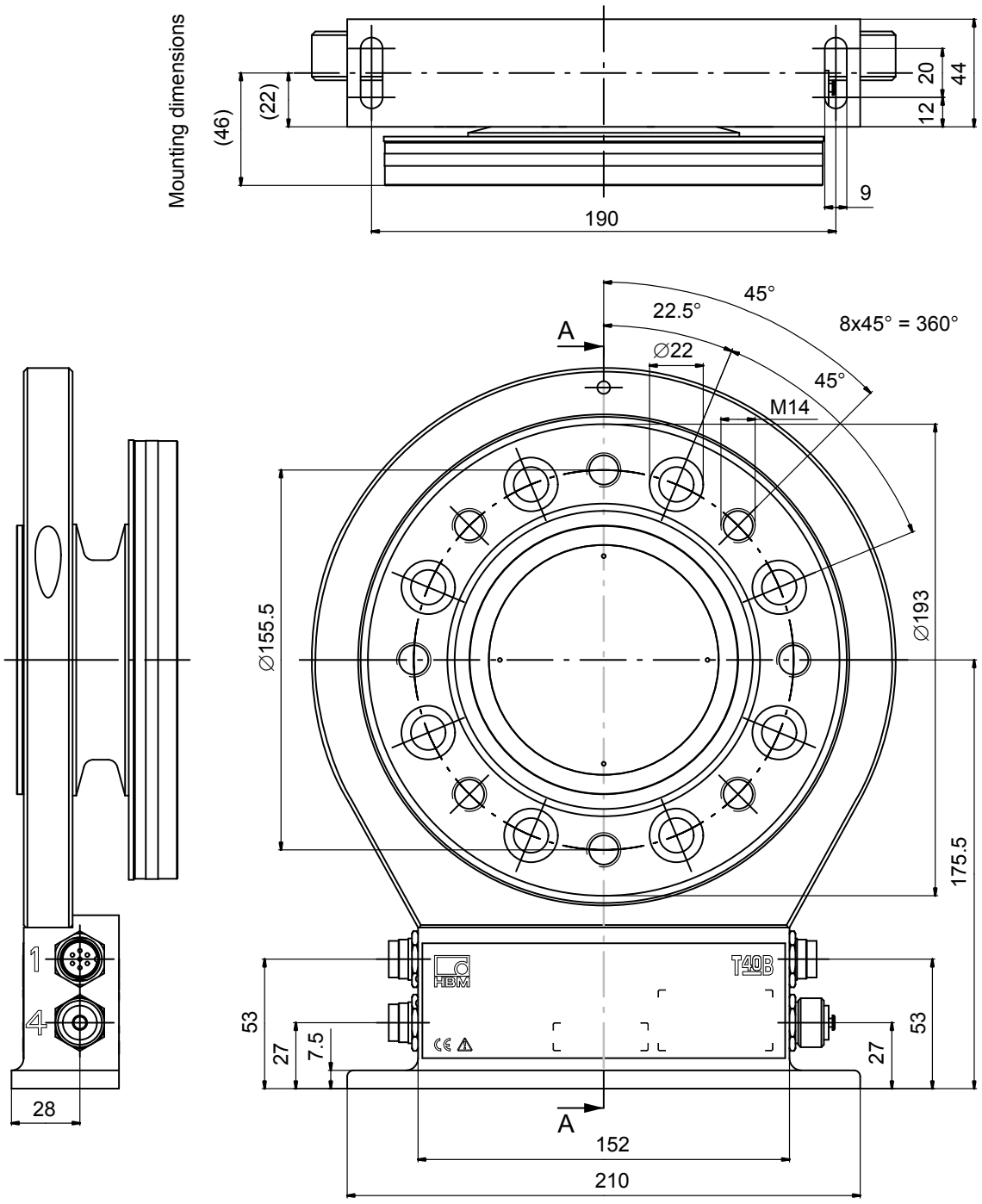


Dimensions of T40B/2 kNm and 3 kNm without rotational speed measurement, continued

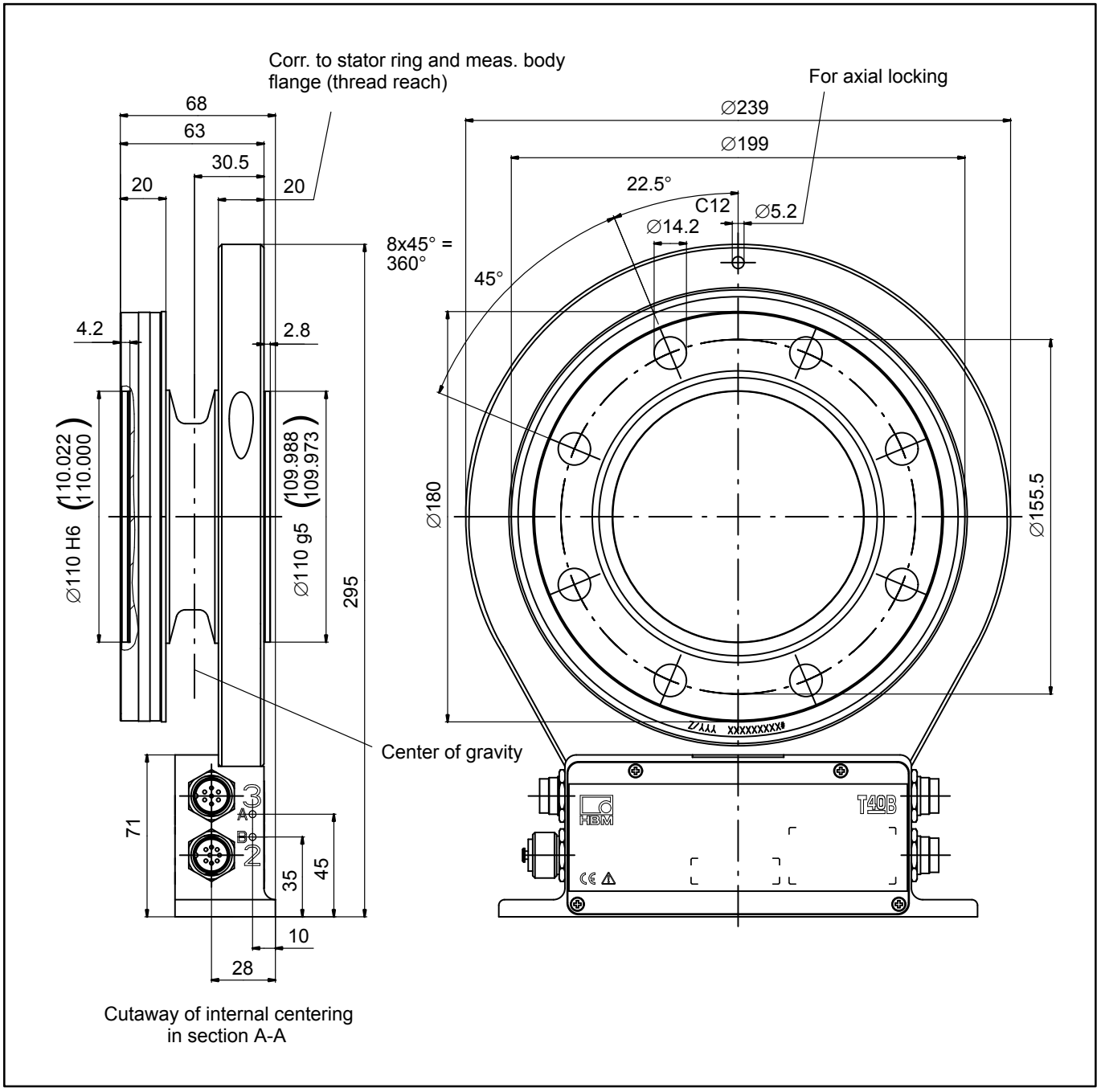


Dimensions of T40B/5 kNm without rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)

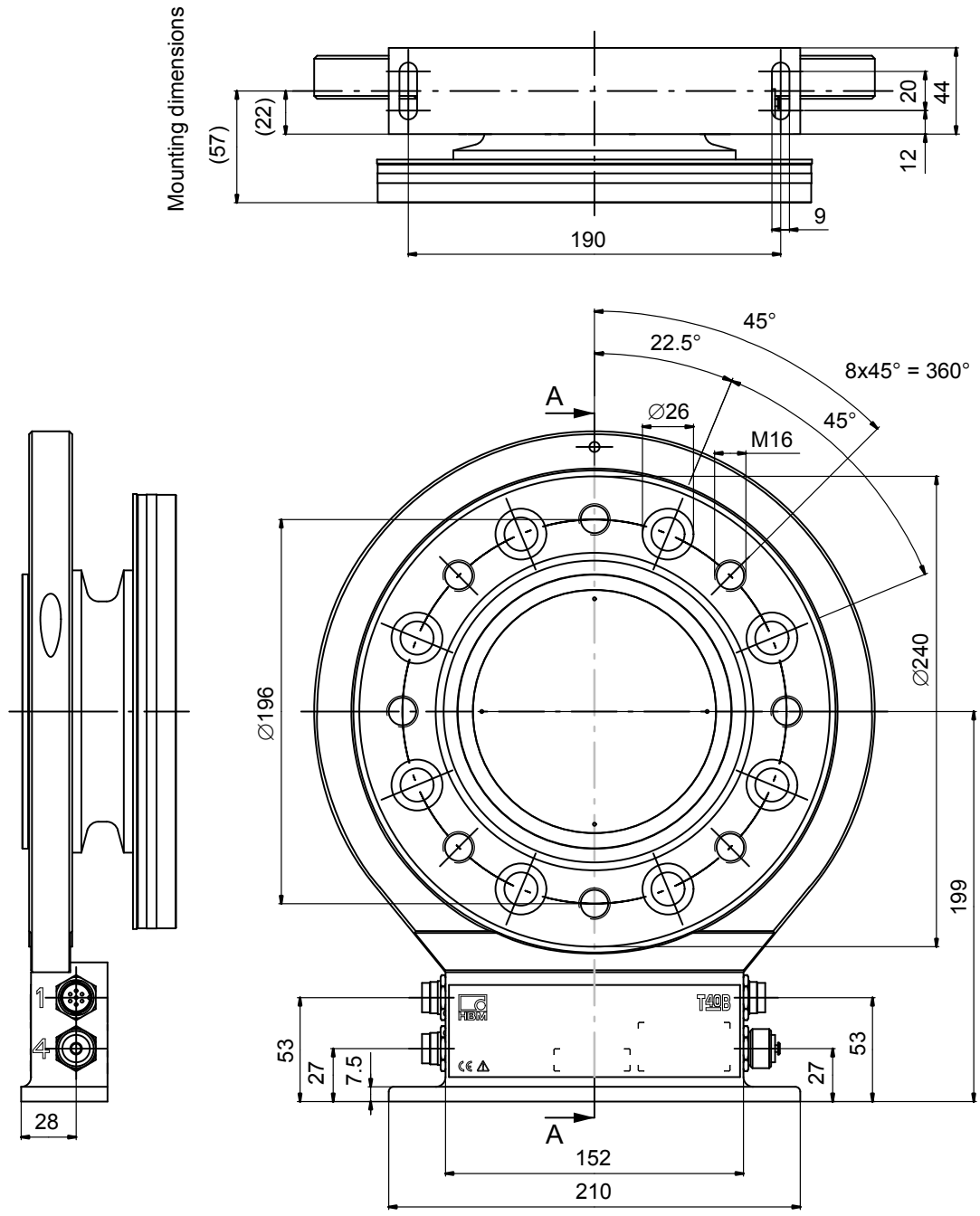


Dimensions of T40B/5 kNm without rotational speed measurement, continued

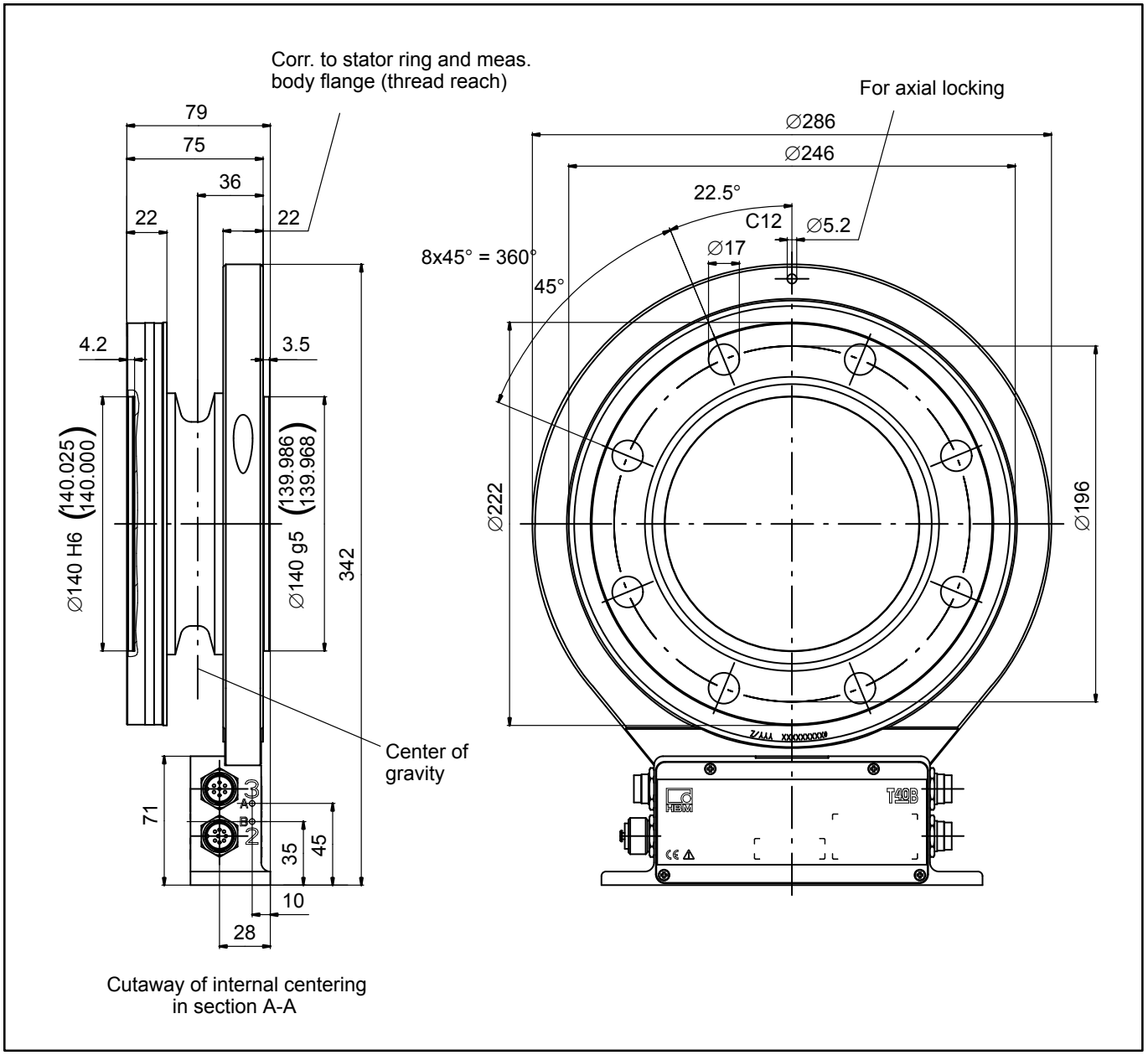


Dimensions of T40B/10 kNm without rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)

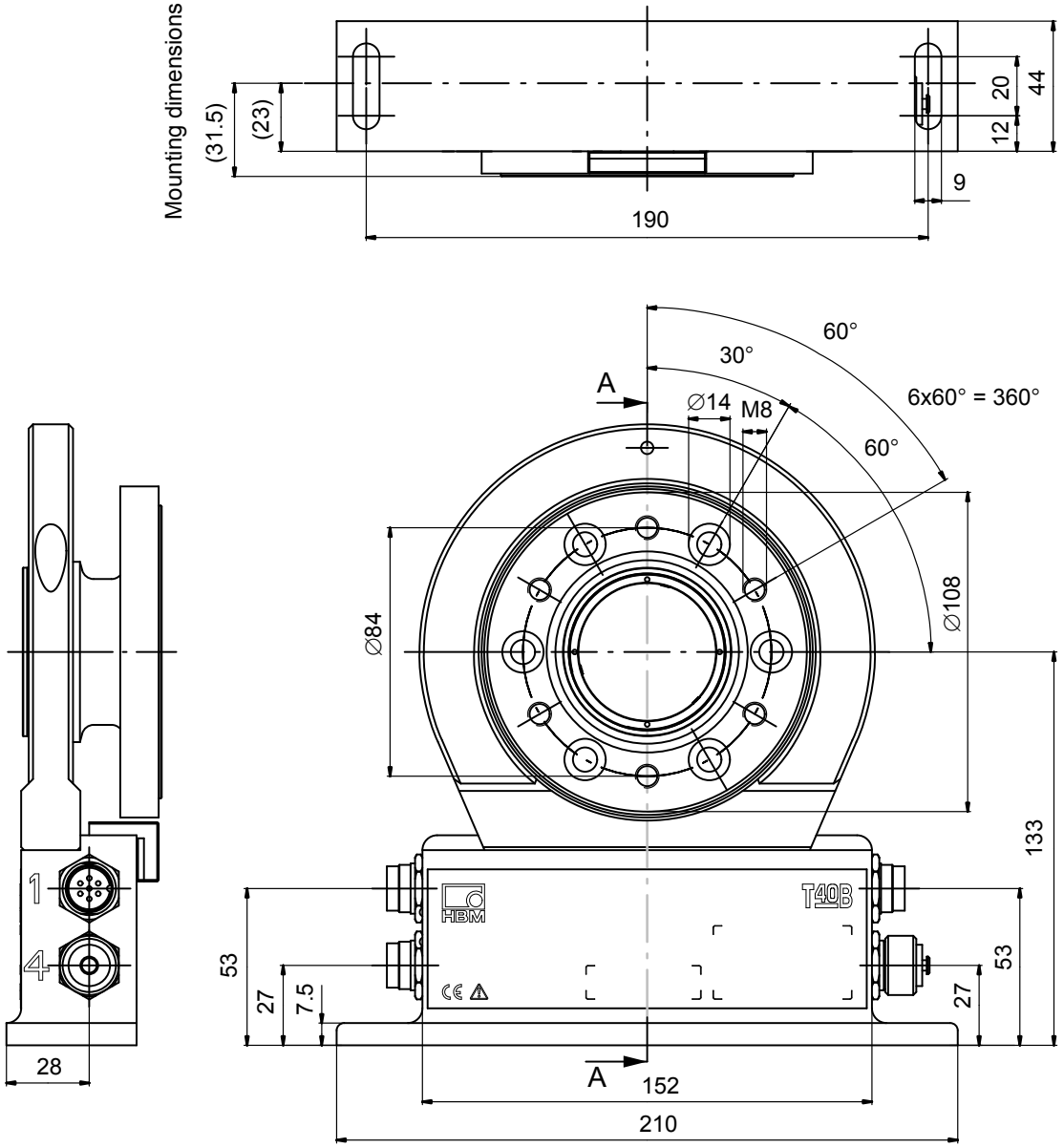


Dimensions of T40B/10 kNm without rotational speed measurement, continued

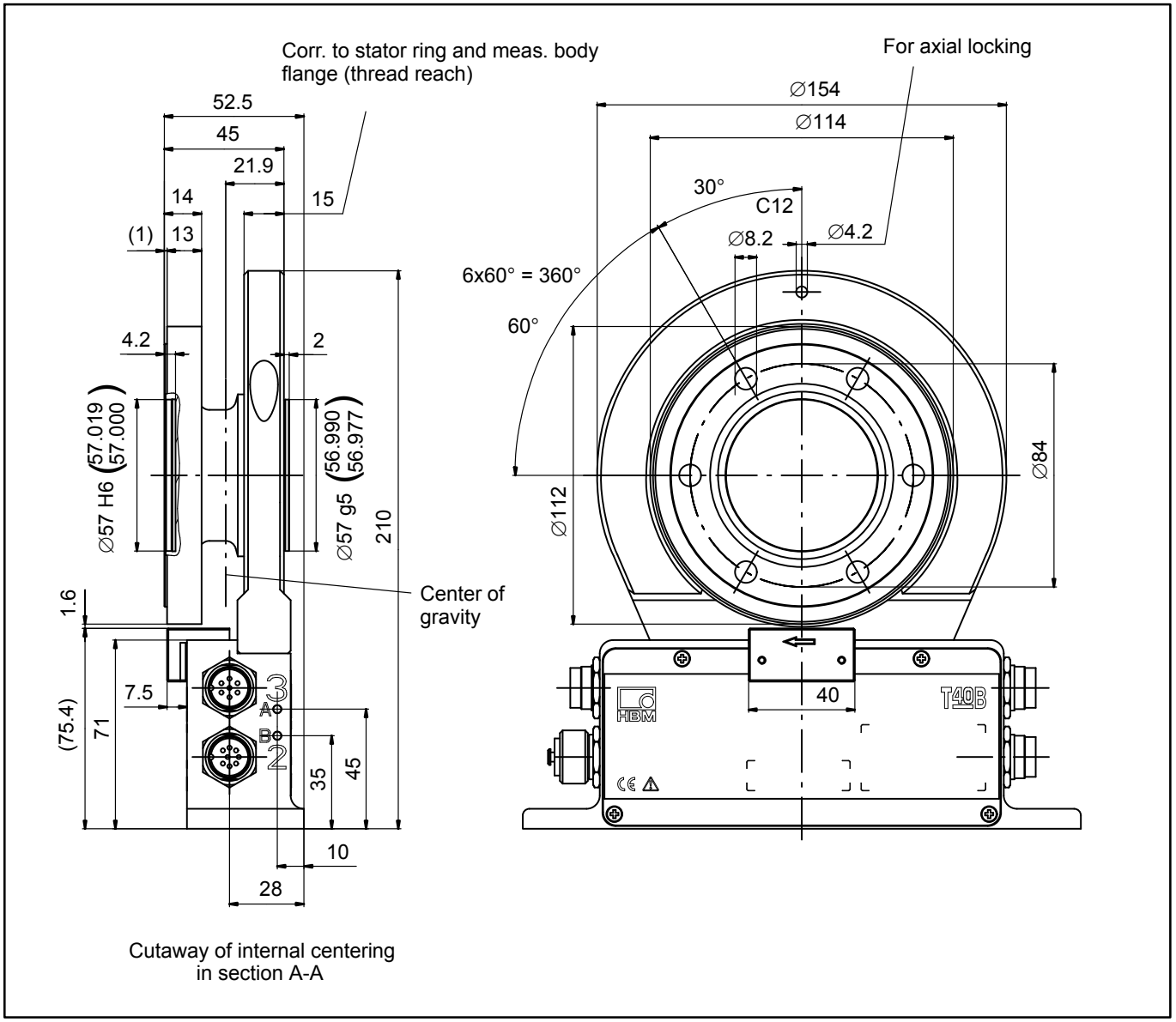


Dimensions of T40B/200 Nm with rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)

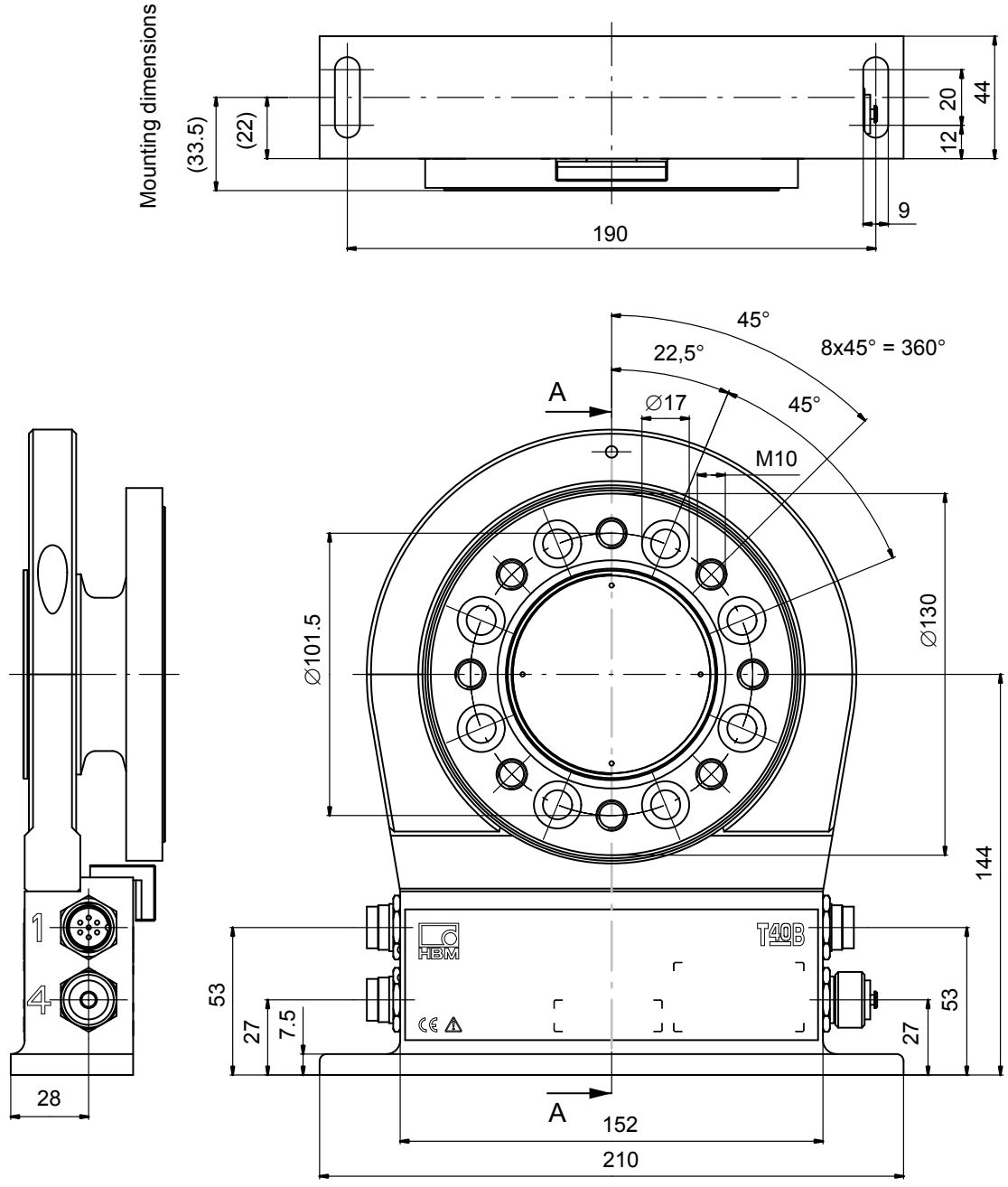


Dimensions of T40B/200 Nm with rotational speed measurement, continued

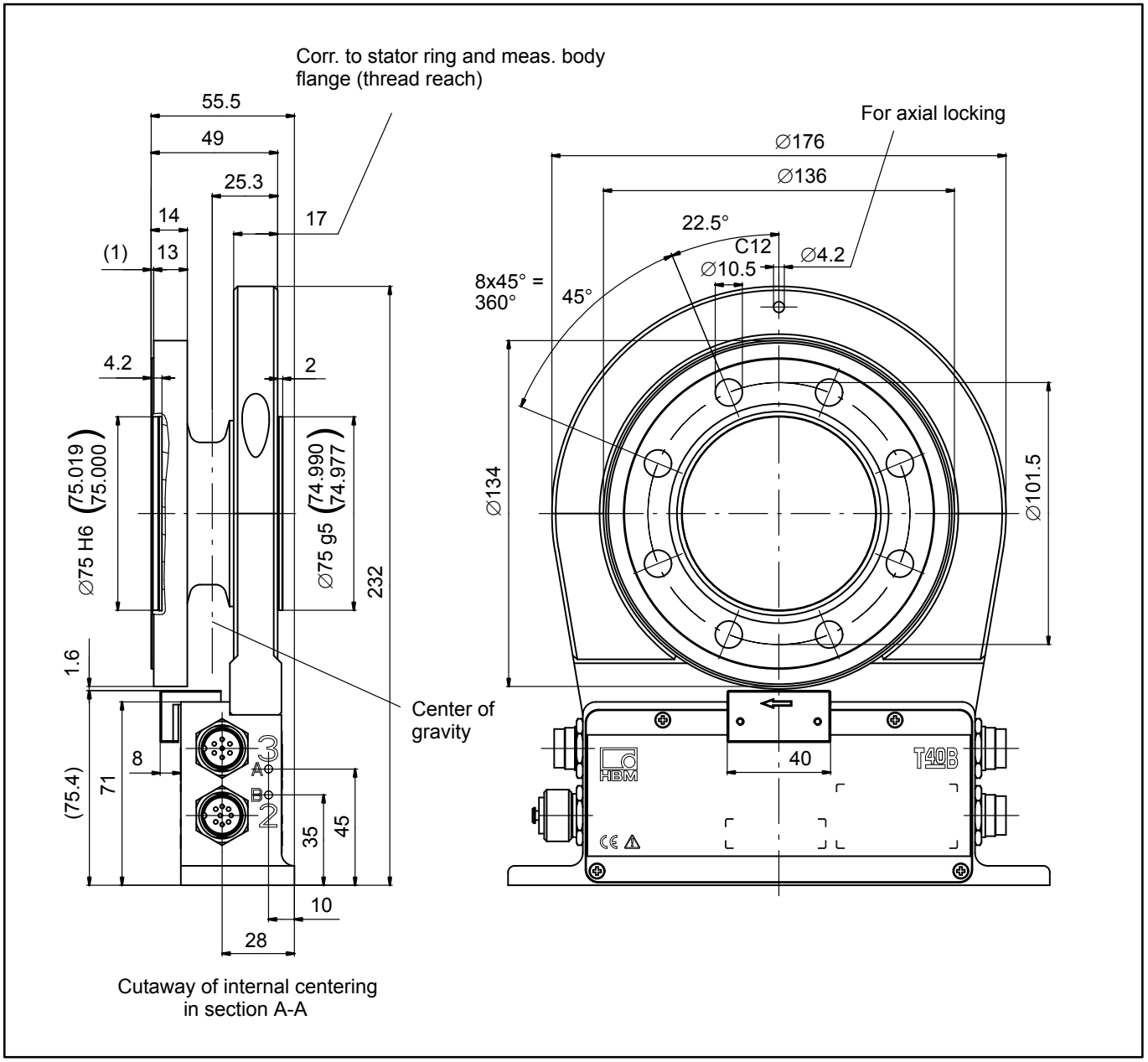


Dimensions of T40B/500 Nm and 1 kNm with rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)

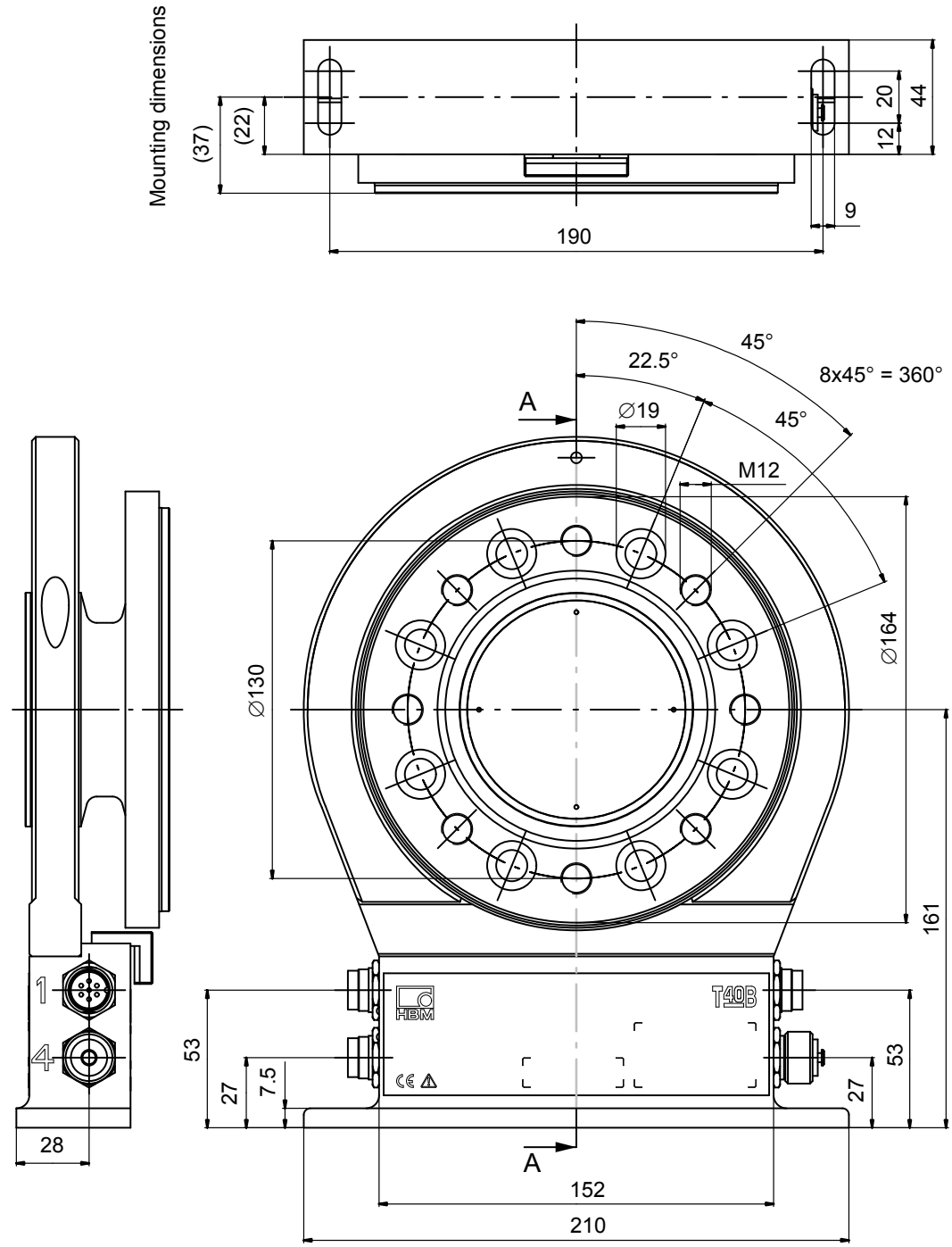


Dimensions of T40B/500 Nm and 1 kNm with rotational speed measurement, continued

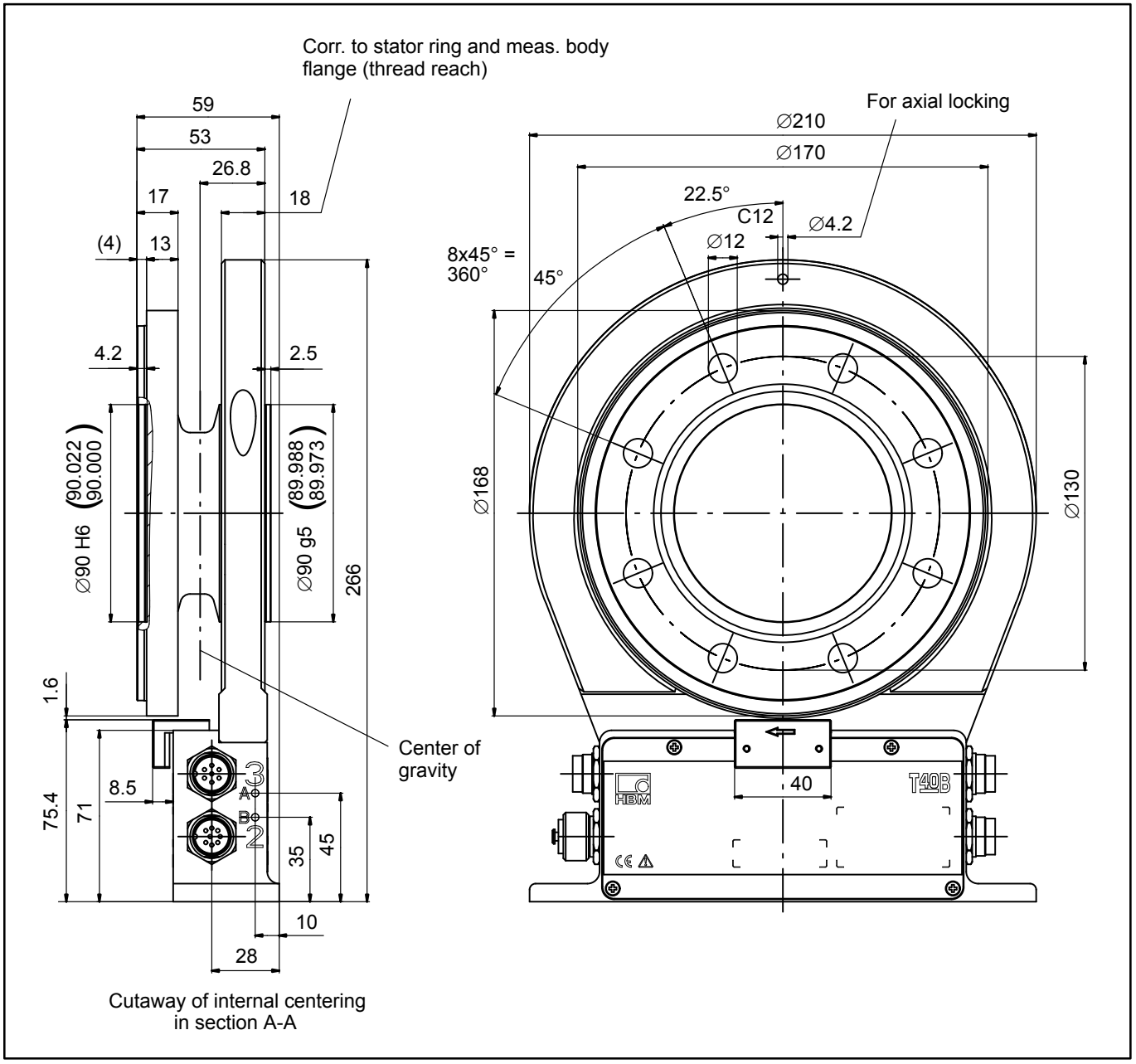


Dimensions of T40B/2 kNm and 3 kNm with rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)

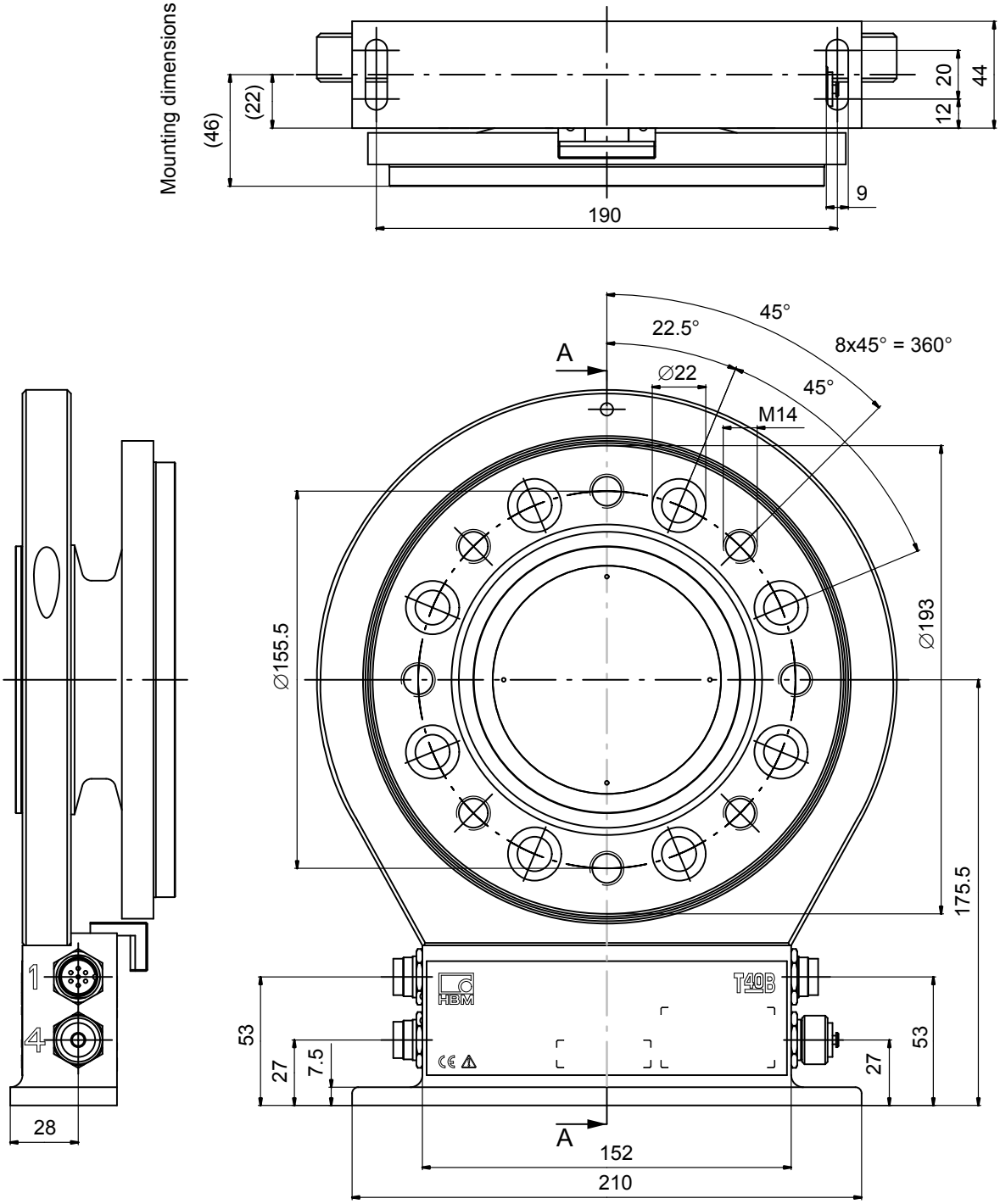


Dimensions of T40B/2 kNm and 3 kNm with rotational speed measurement, continued

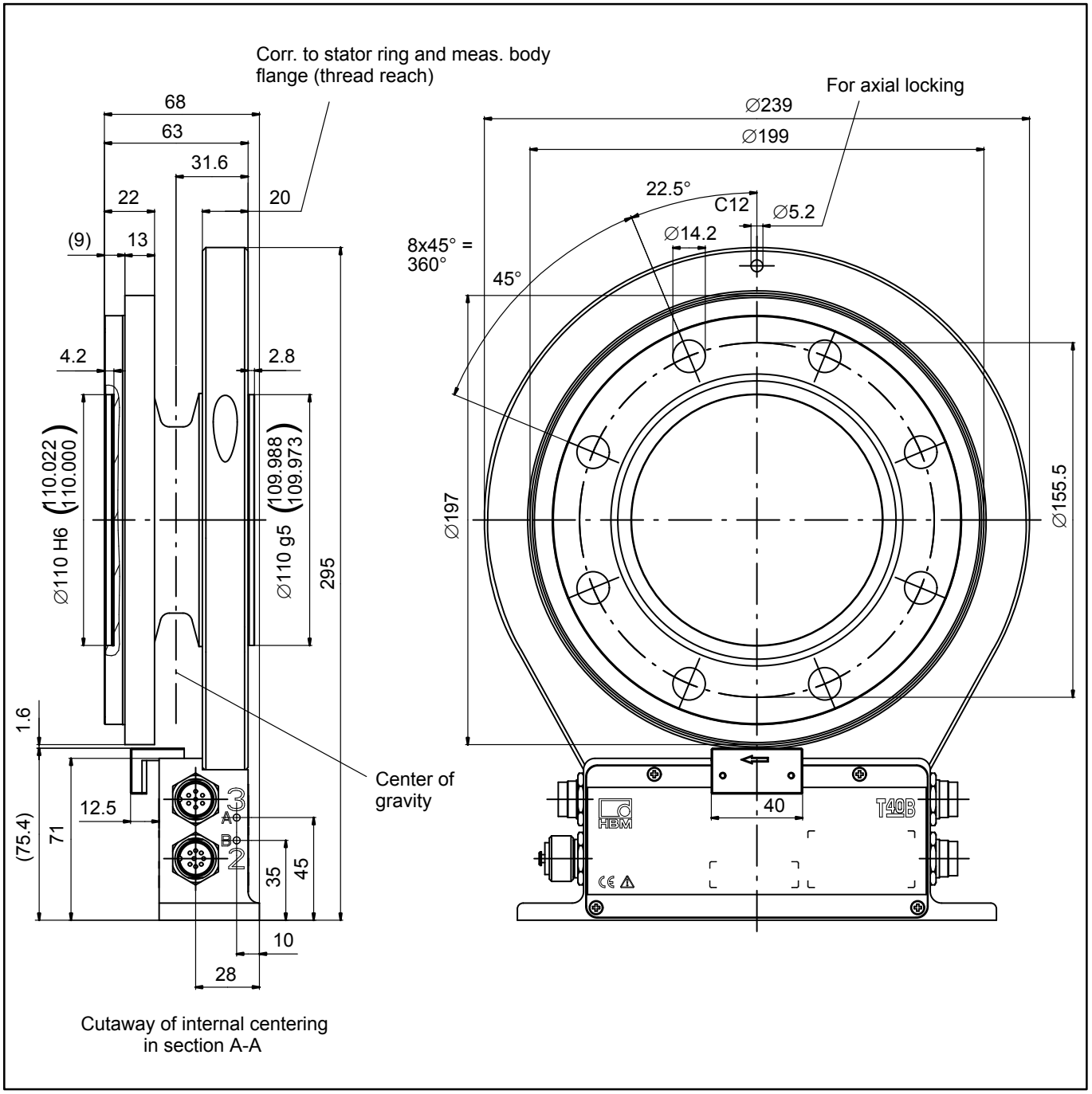


Dimensions of T40B/5 kNm with rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)

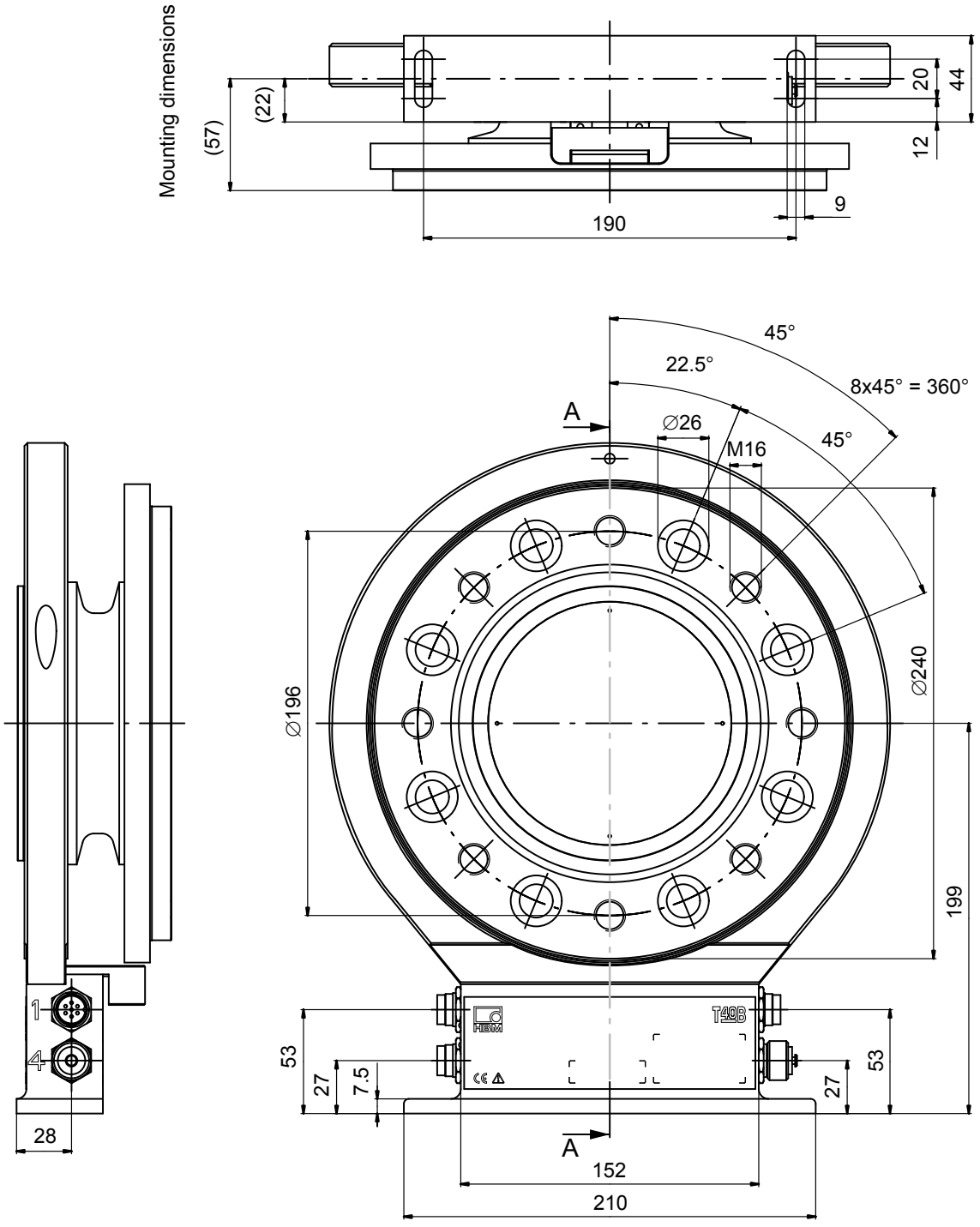


Dimensions of T40B/5 kNm with rotational speed measurement, continued

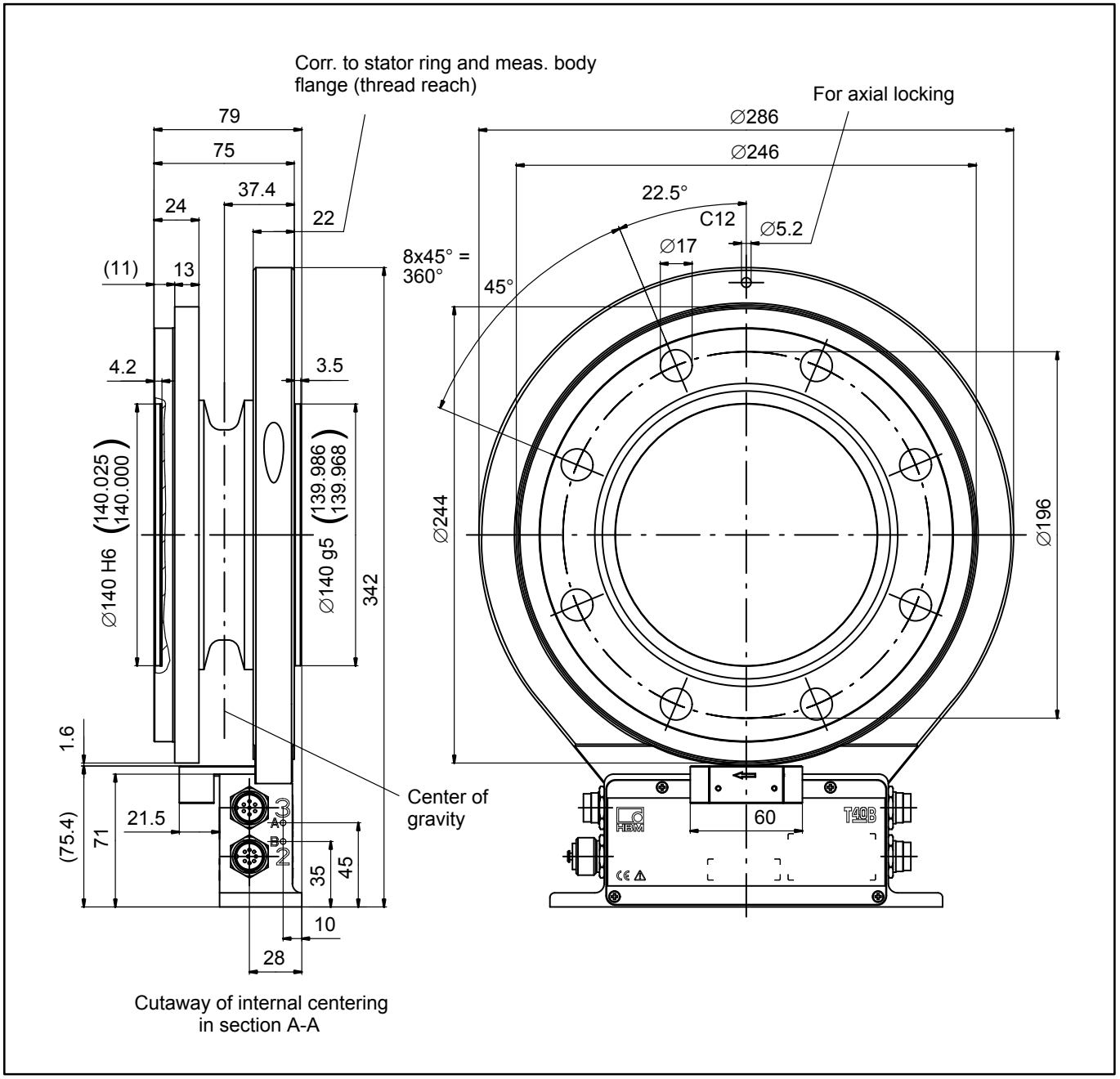


Dimensions of T40B/10 kNm with rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)

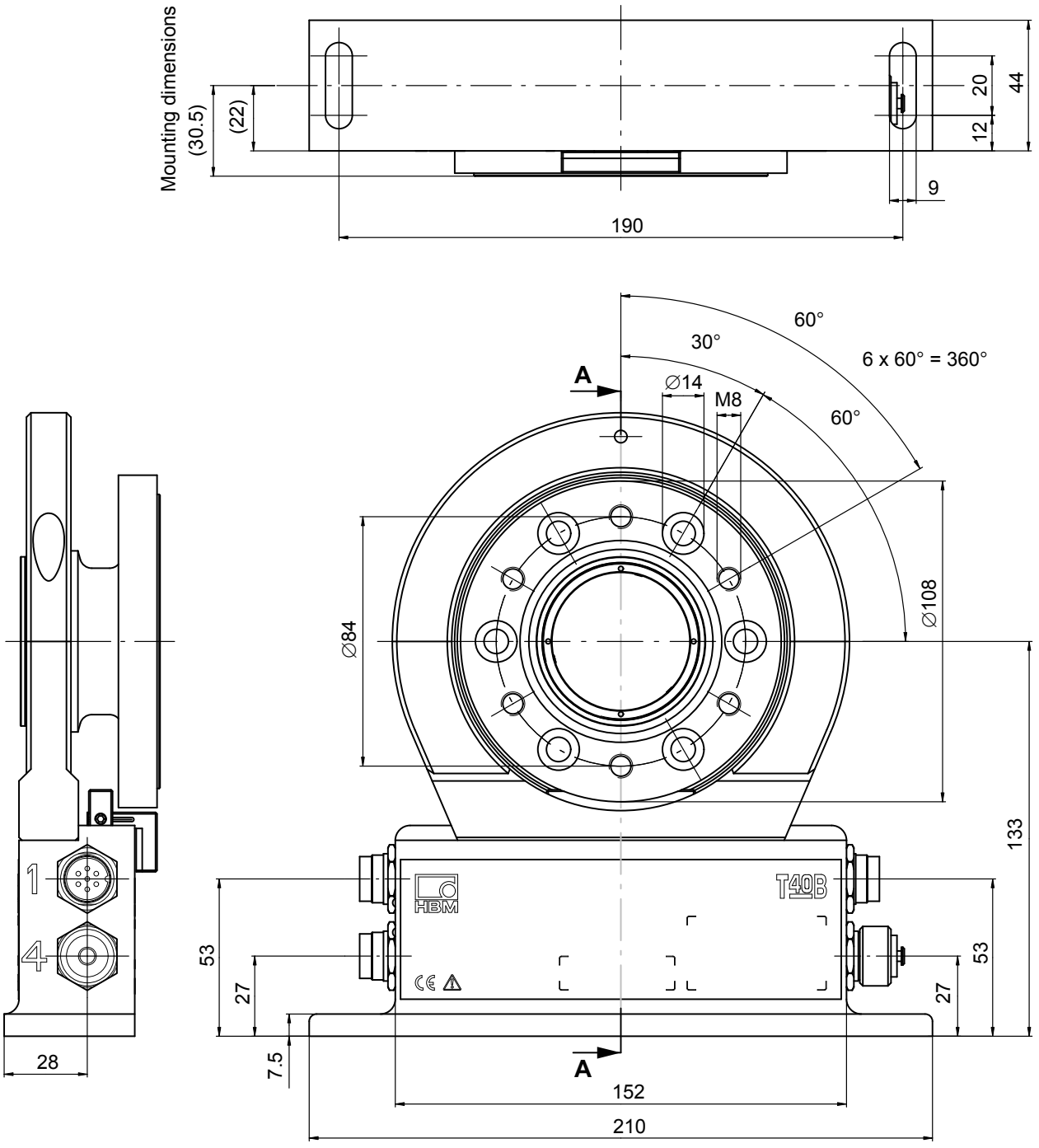


Dimensions of T40B/10 kNm with rotational speed measurement, continued

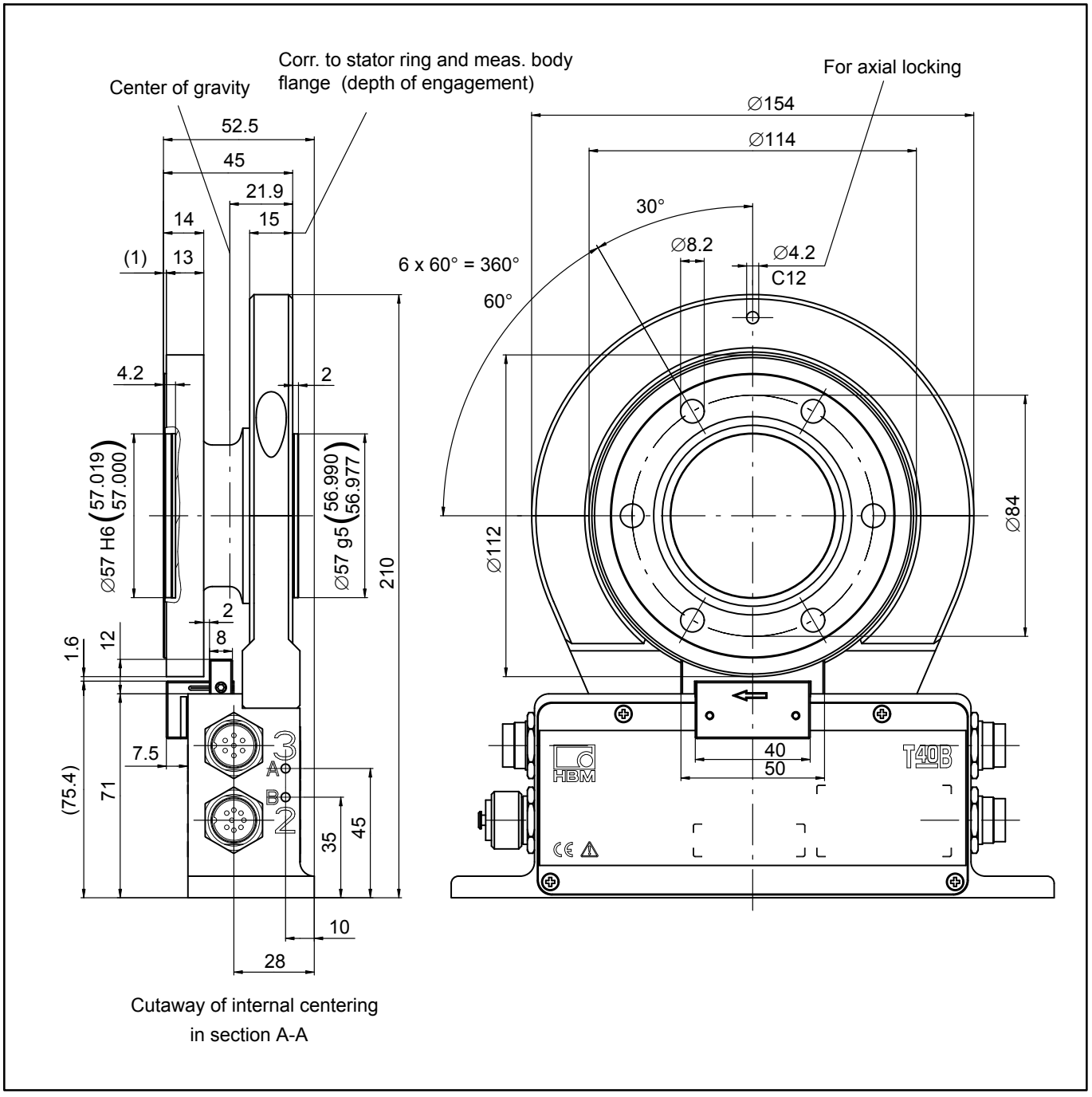


Dimensions of T40B/200 Nm with rotational speed measurement and reference signal

Dimensions in mm (1 mm = 0.03937 inches)



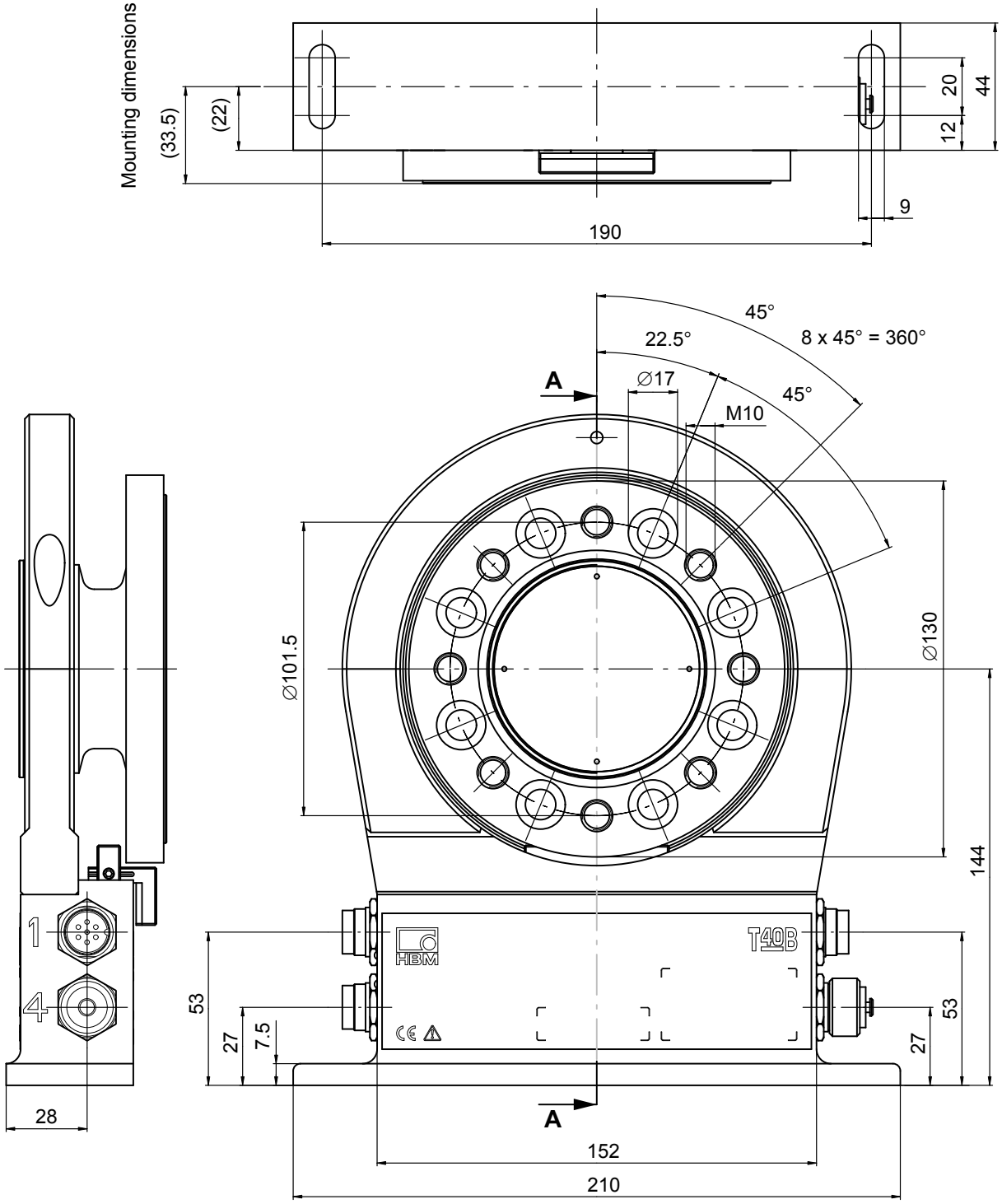
Dimensions of T40B/200 Nm with rotational speed measurement and reference signal, continued



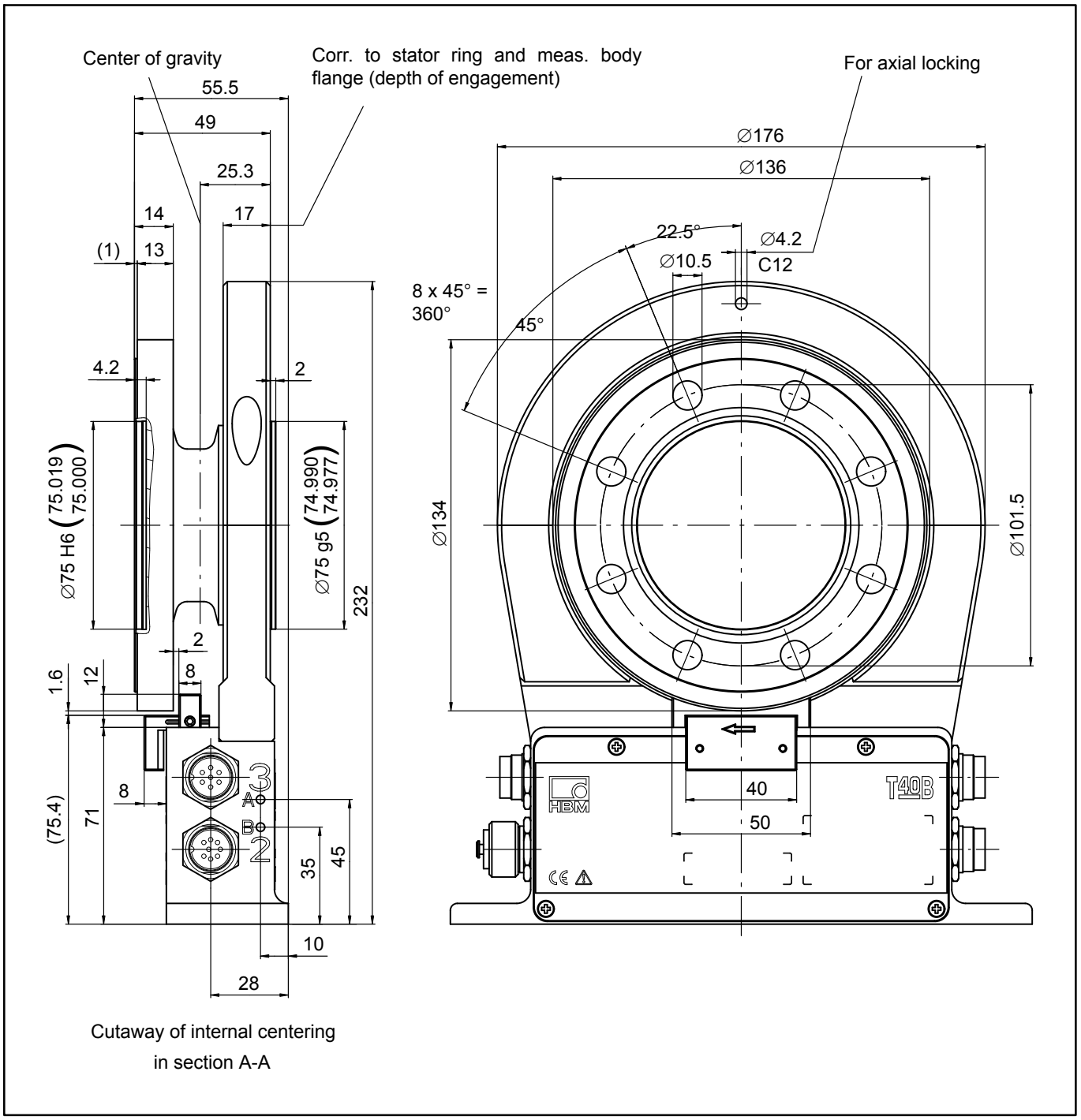
Cutaway of internal centering
in section A-A

Dimensions of T40B/500 Nm and 1 kNm with rotational speed measurement and reference signal

Dimensions in mm (1 mm = 0.03937 inches)

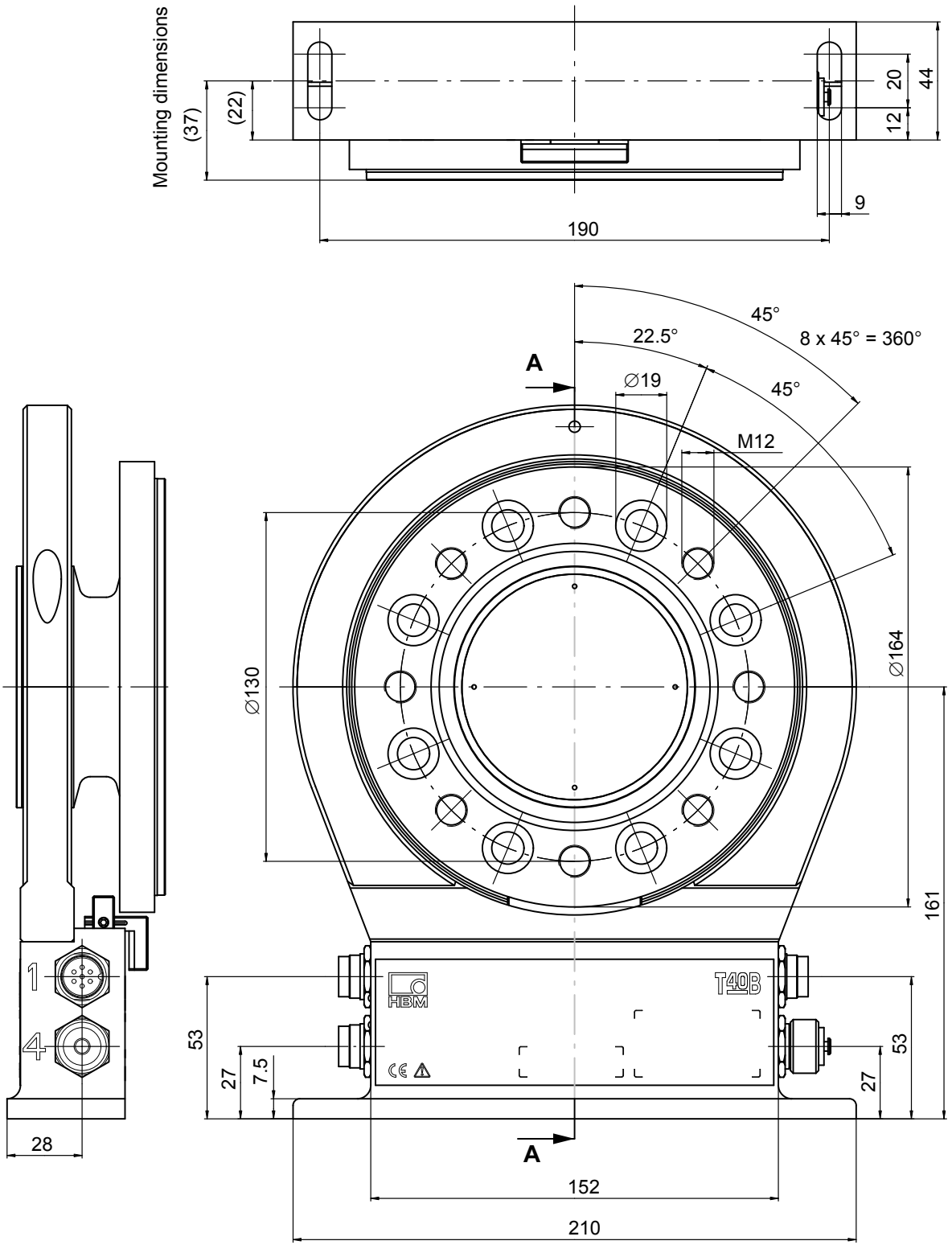


Dimensions of T40B/500 Nm and 1 kNm with rotational speed measurement and reference signal, continued

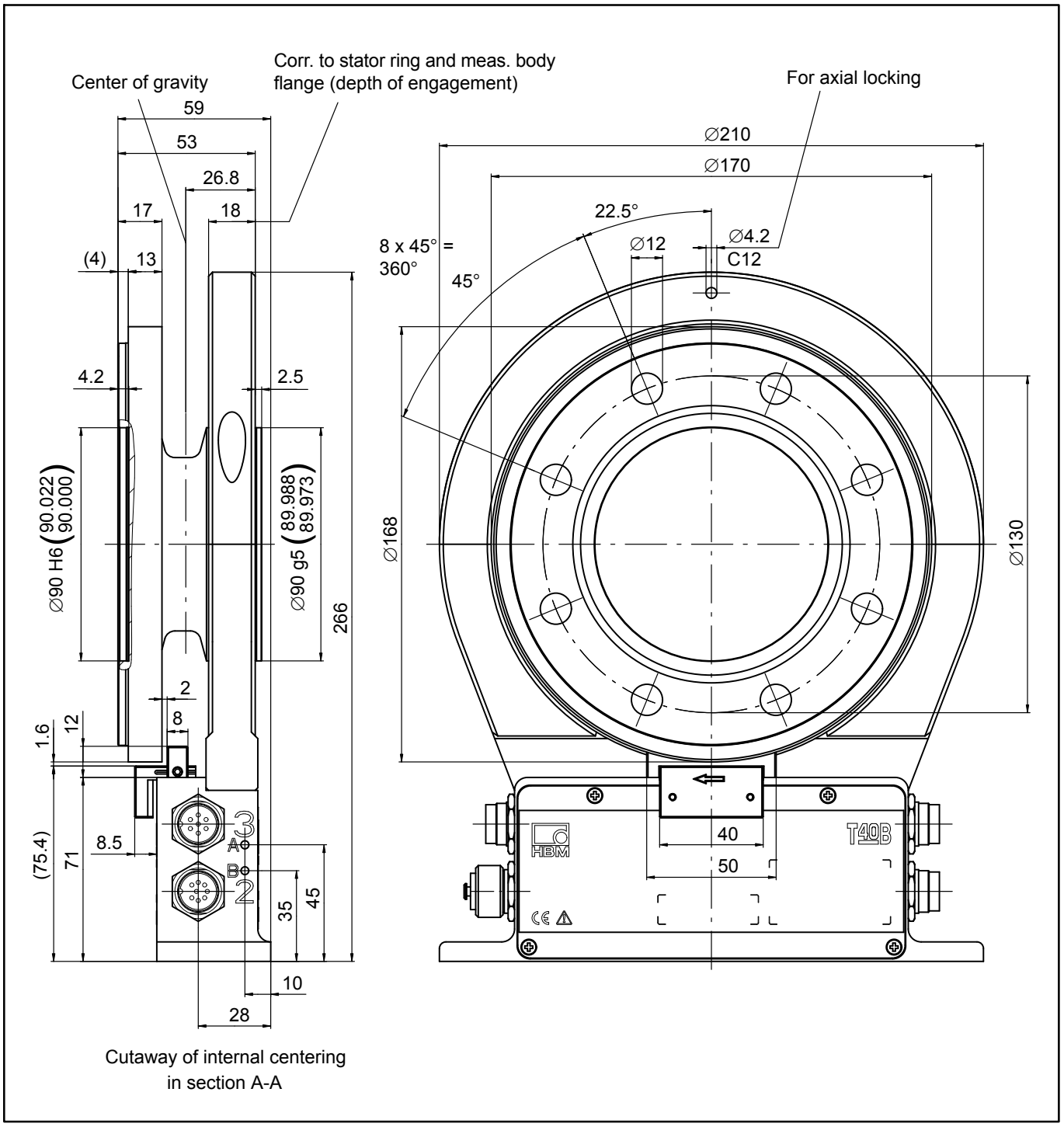


Dimensions of T40B/2 kNm and 3 kNm with rotational speed measurement and reference signal

Dimensions in mm (1 mm = 0.03937 inches)

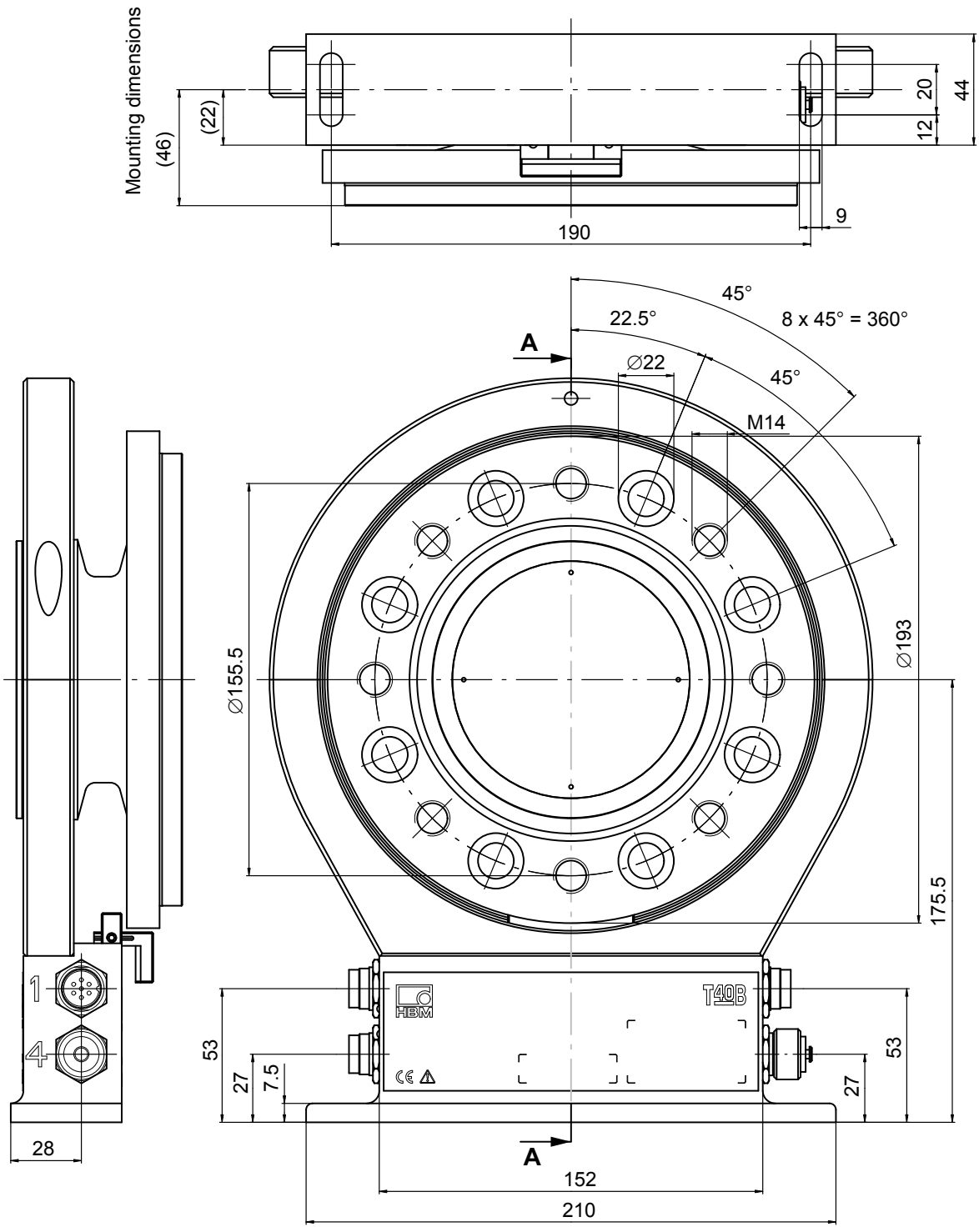


Dimensions of T40B/2 kNm and 3 kNm with rotational speed measurement and reference signal, continued

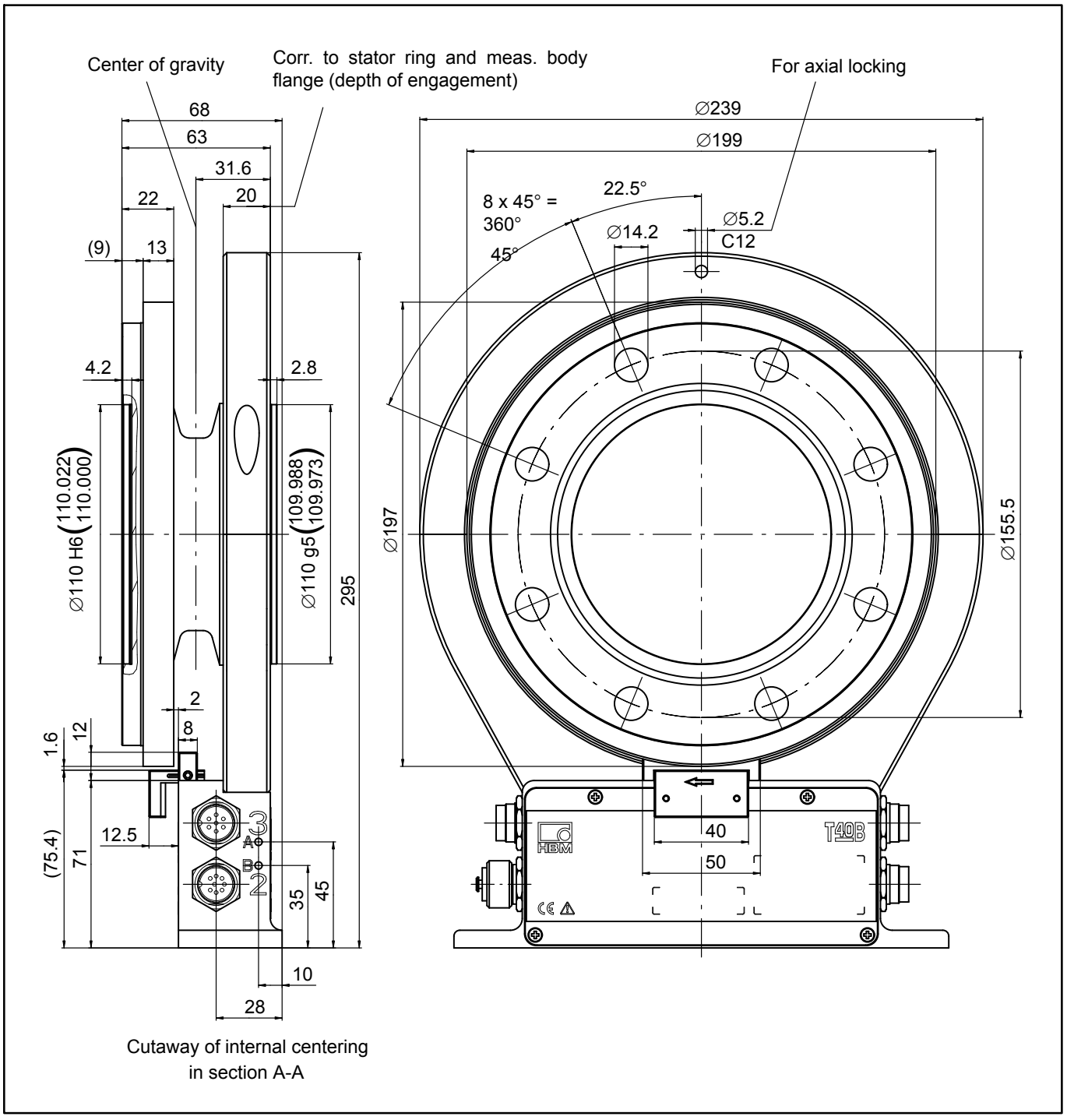


Dimensions of T40B/5 kNm with rotational speed measurement and reference signal

Dimensions in mm (1 mm = 0.03937 inches)



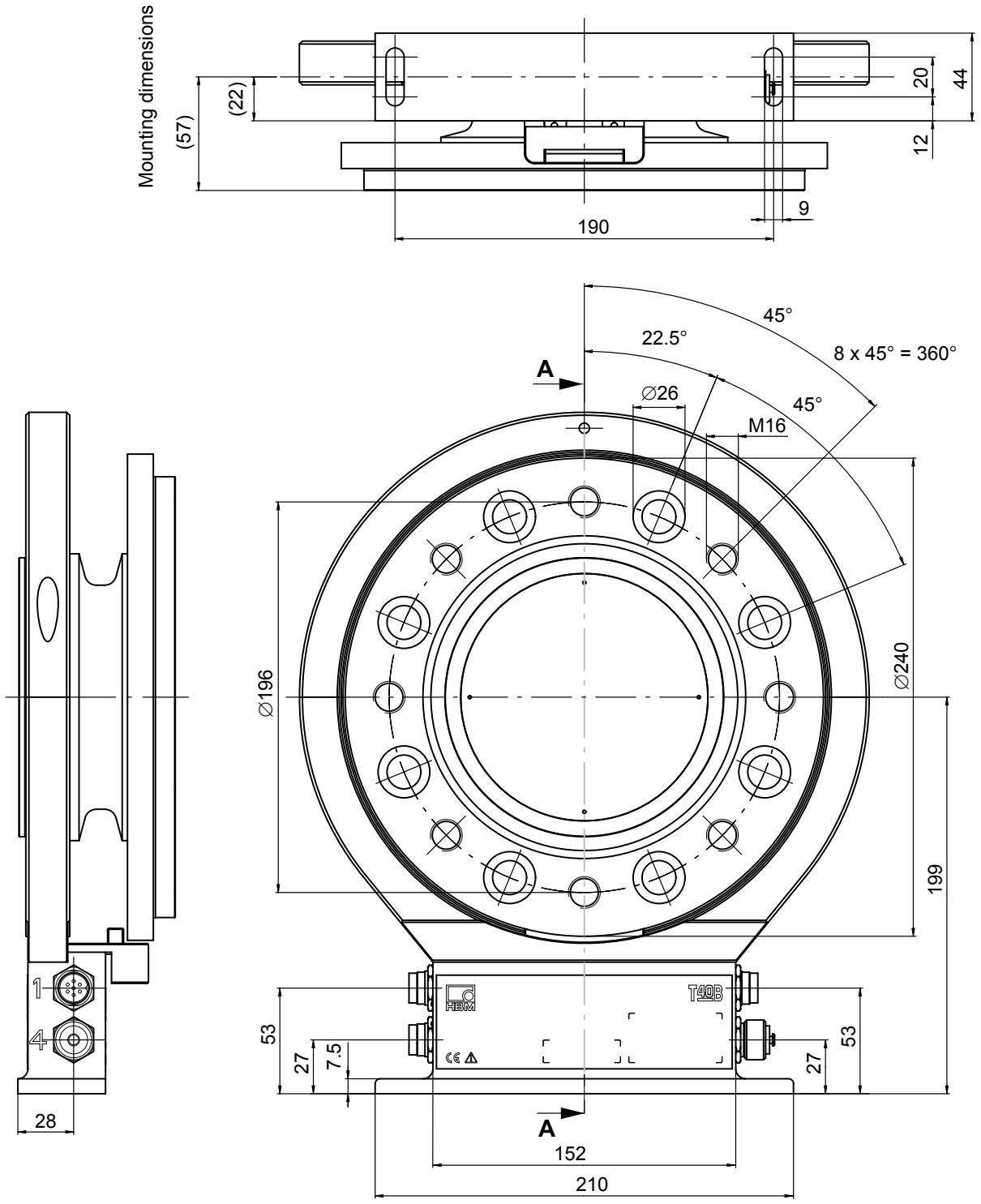
Dimensions of T40B/5 kNm with rotational speed measurement and reference signal, continued



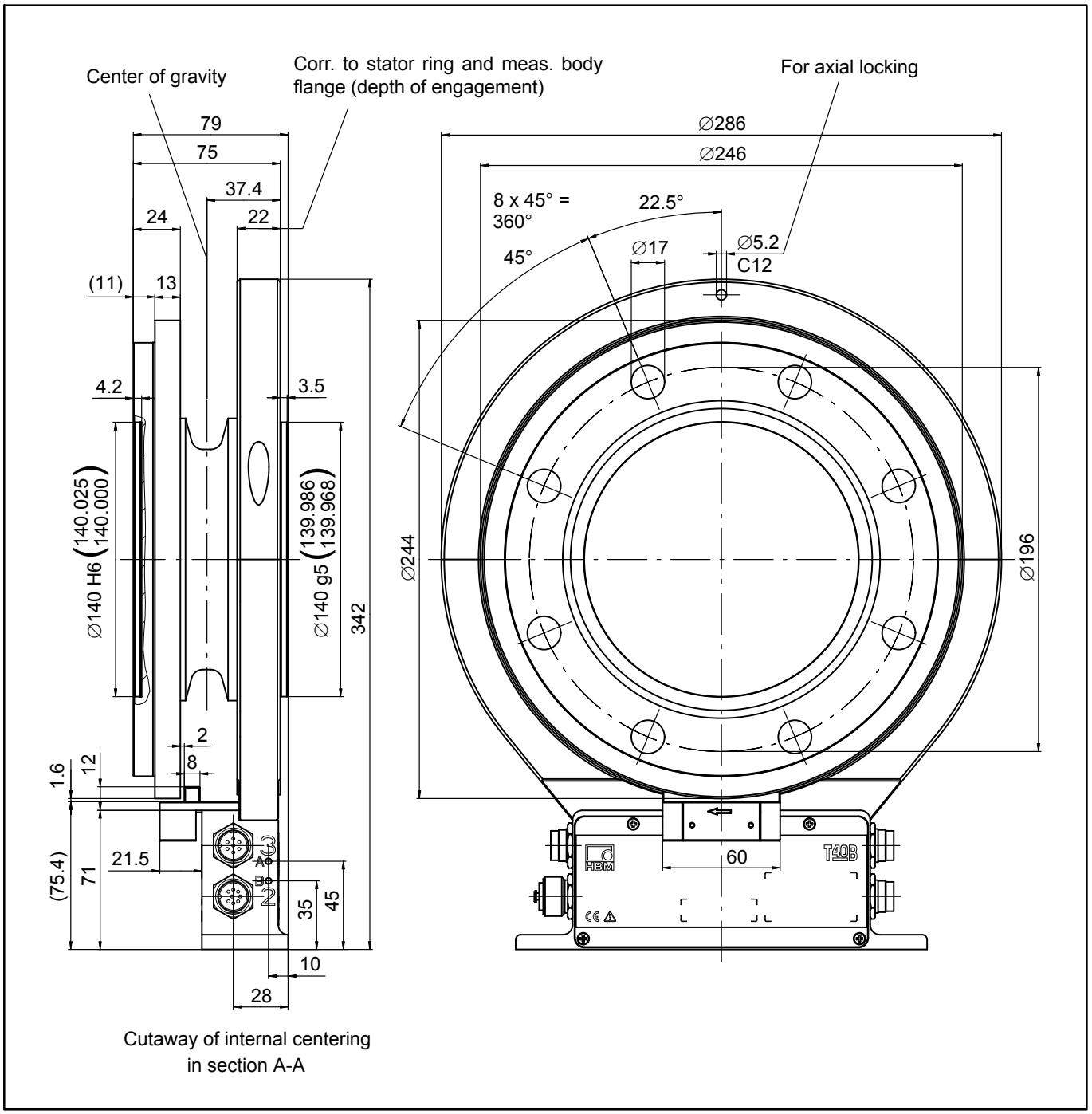
Cutaway of internal centering in section A-A

Dimensions of T40B/10 kNm with rotational speed measurement and reference signal

Dimensions in mm (1 mm = 0.03937 inches)



Dimensions of T40B/10 kNm with rotational speed measurement and reference signal, continued



Cutaway of internal centering in section A-A

Ordering numbers

Order no.

K-T40B [only with Option 2 = MF / ST]

Code	Option 1: Measuring range up to	
200Q	200 N·m	[only with Option 2 = MF / RO]
500Q	500 N·m	[only with Option 2 = MF / RO]
001R	1 kN·m	[only with Option 2 = MF / RO]
002R	2 kN·m	[only with Option 2 = MF / RO]
003R	3 kN·m	[only with Option 2 = MF / RO]
005R	5 kN·m	[only with Option 2 = MF / RO]
010R	10 kN·m	[only with Option 2 = MF / RO]

Code	Option 2: Component
MF	Measurement flange, complete
RO	Rotor
ST	Stator

Code	Option 3: Accuracy
S	Standard

Code	Option 4: Adjustment
M	Metric (N·m)

Code	Option 5: Elektrical configuration	[only with Option 2 = MF / ST]
SU2	10 kHz ±5 kHz and ±10 V output signal, 18...30 V DC supply voltage	
DU2	60 kHz ±30 kHz and ±10 V output signal, 18...30 V DC supply voltage	
HU2	240 kHz ±120 kHz and ±10 V output signal, 18...30 V DC supply voltage	

Code	Option 6: Rotational speed measuring system
0	Without rotational speed measuring system
1	Magnetic rot. speed measuring system: 1024 pulses/revolution
A	Magnetic rot. speed meas. system (1024 pulses/revolution) and reference impuls

Code	Option 7: Customized modification
S	No customer-specific modification

K-T40B- [0] [0] [1] [R] - [M] [F] - [S] - [M] - [D] [U] [2] - [0] - [S]

= **PREFERENCE Types**

Accessories, to be ordered separately

Article	**Order no.**
Connection cable, set	
Torque connection cable, binder 423 - D-Sub 15P , 6 m	1-KAB149-6
Torque connection cable, binder 423 - free ends, 6 m	1-KAB153-6
Rotational speed connection cable, binder 423 – 8-pin, free ends, 6 m	1-KAB154-6
Rotational speed connection cable, binder 423 – 8-pin D–Sub, free ends, 6 m	1-KAB163-6
TMC connection cable, binder 423 – 16-pin free ends, 6 m	1-KAB174-6
Cable sockets	
423G–7S, 7-pin (straight)	3-3101.0247
423W–7S, 7-pin (angle)	3-3312.0281
423G–8S, 8-pin (straight)	3-3312.0120
423W–8S, 8-pin (angle)	3-3312.0282
Connection cable, by the meter (min. order quantity: 10 m, price per meter)	
Kab8/00-2/2/2	4-3301.0071

B3406-6.0 en