

DATA SHEET

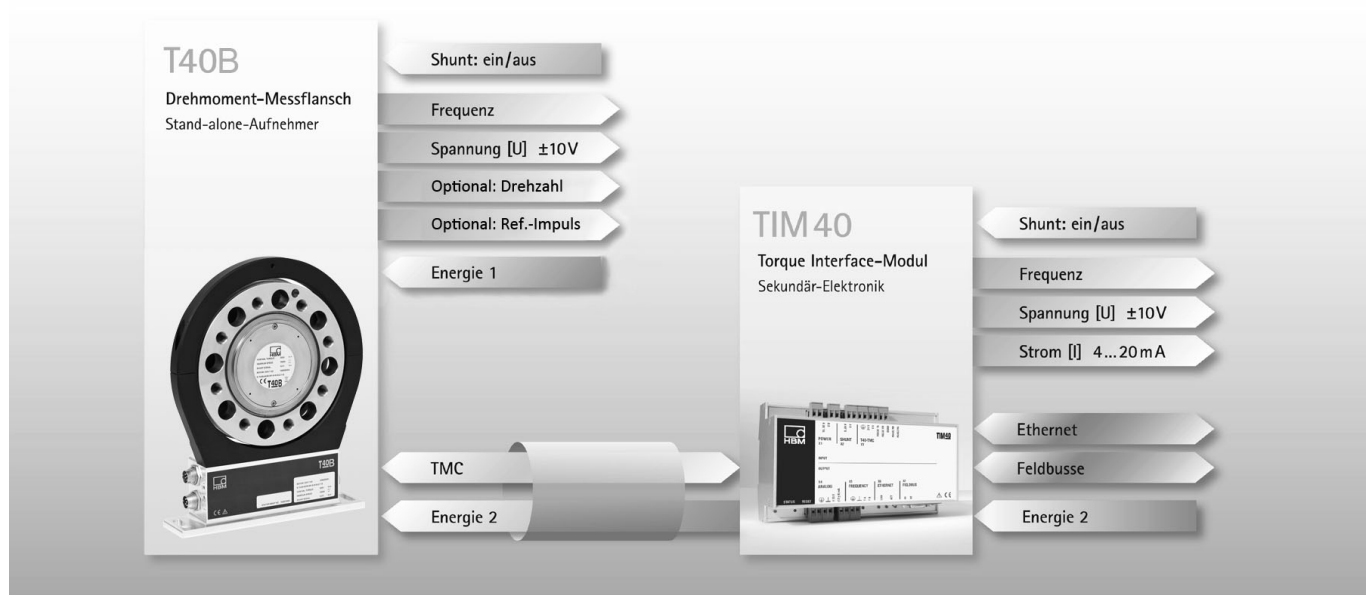
T40B Torque Flange

SPECIAL FEATURES

- Nominal (rated) torques 50 N·m, 100 N·m, 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 up to 24,000 rpm (depending on the nominal (rated) range and option)
- Accuracy class 0.05 (50 N·m: 0.1)
- 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		0.1	0.05								
Nominal (rated) torque M_{nom}	N·m	50	100	200	500						
	kN·m					1	2	3	5	10	
Torque measuring system											
Nominal (rated) rotational speed			20000			15000	12000	10000			
Standard (Option M)	rpm		24000			23000	18000	14000	12000		
High-speed version (Option H)	rpm										
Non-linearity including hysteresis, relative to nominal (rated) sensitivity											
Frequency output for a max. torque in the range:											
Between 0% of M_{nom} and 20% of M_{nom}	%		<±0.01								
> 20% of M_{nom} and 60% of M_{nom}	%		<±0.02								
> 60% of M_{nom} and 100% of M_{nom}	%		<±0.03								
Voltage output for a max. torque in the range:											
Between 0% of M_{nom} and 20% of M_{nom}	%		<±0.01								
> 20% of M_{nom} and 60% of M_{nom}	%		<±0.02								
> 60% of M_{nom} and 100% of M_{nom}	%		<±0.03								
Rel. standard deviation of repeatability as per DIN 1319, relative to the variation of the output signal											
Frequency output	%		≤± 0.03								
Voltage output	%		≤± 0.03								
Temperature effect per 10 K in the nominal (rated) temperature range on the output signal relative to the actual value of the signal span											
Frequency output	%	±0.1						±0.05			
Voltage output	%	±0.4						±0.2			
on the zero signal relative to the nominal sensitivity											
Frequency output	%	±0.1						±0.05			
Voltage output	%	±0.2						±0.1			
Nominal sensitivity (span between torque = zero and nominal (rated) torque)											
Frequency outp. 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 sensitivity)											
Frequency output	%		±0.1								
Voltage output	%		±0.1								
Output signal at torque = zero											
Frequency output	kHz							10/60/240			
Voltage output	V							0			

Type	T40B										
Nominal (rated) torque M_{nom}	N·m	50	100	200	500						
	kN·m					1	2	3	5	10	
Nominal output signal											
Frequency output											
with positive nominal (rated) torque	kHz	15 ¹⁾ / 90 ²⁾ / 360 ³⁾ (5 V balanced ⁴⁾)									
with negative nominal (rated) torque	kHz	5 ¹⁾ / 30 ²⁾ / 120 ³⁾ (5 V balanced 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 at reference temperature											
Frequency output	%	<±0.06 <±0.03									
Voltage output	%	<±0.06 <±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 range⁶⁾											
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 (safety 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									
Shunt signal		approx. 50% of M_{nom}									
Tolerance of 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											
Measuring system		Magnetic, via AMR sensor (Anisotropic Resistive Effect) and magnetized plastic ring with embedded steel ring									
Magnetic poles		72		86		108		126		156	
Maximum positional variation of the poles		50 angular seconds									
Output signal	V	5 V balanced (RS-422); 2 square-wave signals approx. 90° phase-shifted									
Pulses per revolution		1024 (Option 6, code 1 & A) 128 (Option 6, code 2 & B)									
Minimum rotational speed for sufficient pulse stability	rpm	0									
Pulse tolerance⁷⁾	degrees	<±0.05 (1024 pulses) <±0.10 (128 pulses)									
Maximum permissible output frequency	kHz	420									

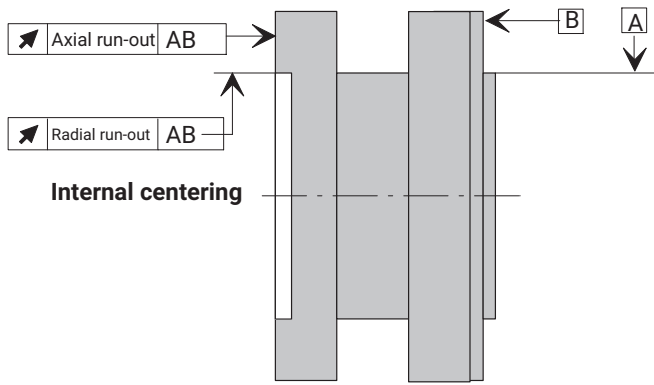
Type	T40B										
Nominal (rated) torque M_{nom}	N·m	50	100	200	500						
	kN·m					1	2	3	5	10	
Group delay	µs	<150									
Radial nominal (rated) distance between sensor head and magnetic ring (mechanical distance)	mm	1.6									
Working distance range between sensor head and magnetic ring	mm	0.4 ... 2.5									
Max. permissible axial displacement of rotor in relation to stator⁸⁾	mm	±1.5									
Hysteresis of direction of rotation reversal when there are relative vibrations between rotor and stator											
Rotor torsional vibration	degrees	< approx. 0.2									
Stator horizontal 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 resistance⁹⁾	kΩ	≥2									
Reference signal measuring system (0 index)											
Measuring system		Magnetic, with Hall sensor and magnet									
Output signal	V	5 V, balanced (RS-422)									
Pulses per revolution		1									
Minimum rotational speed for sufficient pulse stability	rpm	2									
Pulse width, approx.	degrees	0.088 / 0.703 (1024 pulse/rev; 128 pulse/rev)									
Pulse tolerance⁷⁾	degrees	<±0.05									
Group delay	µs	<150									
Axial nominal (rated) distance between sensor head and magnetic ring (mechanical distance)	mm	2.0									
Max. permissible axial displacement of rotor in relation to stator⁸⁾	mm	±1.5									
General information											
EMC											
Emission (as per FCC 47, Part 15, Section C) ¹⁰⁾											
Emission (as per EN 61326-1, Section 7) ¹¹⁾											
RFI field strength	-	Class B									
Immunity to interference (EN 61326-1, Table 2)											
Electromagnetic field (AM)	V/m	10									
Magnetic field	A/m	100									
Electrostatic discharge (ESD)											
Contact discharge	kV										
Air discharge	kV	8									
Fast transients (burst)	kV	1									
Surge voltages	kV	1									
Conducted interference (AM)	V	10									
Degree of protection as per EN 60 529		IP 54									
Reference temperature	°C	23									

Type	T40B										
Nominal (rated) torque M_{nom}	N·m	50	100	200	500						
	kN·m					1	2	3	5	10	
Nominal temperature range	°C	+10 ... +70									
Operating temperature range ¹²⁾	°C	-20 ... +85									
Storage temperature range	°C	-40 ... +85									
Mechanical shock as per EN 60068-2-27¹³⁾											
Number	n	1000									
Duration	ms	3									
Acceleration (half sine)	m/s ²	650									
Vibrational stress in 3 directions as per EN 60068-2-6¹³⁾											
Frequency range	Hz	10 ... 2000									
Duration	h	2.5									
Acceleration (amplitude)	m/s ²	200									
Load limits¹⁴⁾											
Limit torque, relative to M_{nom} ¹⁵⁾	%	400	200					160			
Breaking torque, relative to M_{nom} ¹⁵⁾	%	800	> 400					> 320			
Axial limit force ¹⁶⁾	kN	5	5	10	13	19	30	35	60	80	
Lateral limit force ¹⁶⁾	kN	1	1	2	4	5	9	10	12	18	
Bending moment limit ¹⁶⁾	N·m	50	50	100	200	220	560	600	800	1200	
Oscillation width as per DIN 50100 (peak-to-peak)¹⁷⁾	N·m	200	200	400	1000	2000	4000	4800	8000	16000	
Mechanical values											
Torsional stiffness c_T	kN m/ rad	180	180	360	745	1165	2515	3210	5565	14335	
Torsion angle at M_{nom}	degrees	0.016	0.032	0.032	0.038	0.049	0.046	0.054	0.051	0.040	
Stiffness in the axial direction c_a	kN/mm	285	285	540	450	580	540	570	760	960	
Stiffness in the radial direction c_r	kN/mm	160	160	315	560	860	1365	1680	2080	2940	
Stiffness at the bending moment round a radial axis c_b	kN·m/ degrees	1.9	1.9	3.6	4.2	5.9	9	9.3	20.2	45.5	
Maximum deflection at axial limit force	mm	< 0.04			< 0.05		< 0.06		< 0.08	< 0.09	
Additional max. radial run-out at lateral limit force	mm	< 0.02									
Additional deviation from plane parallelism at bending moment limit (at $\varnothing d_B$)	mm	< 0.06			< 0.11	< 0.09	< 0.18	< 0.19	< 0.14	< 0.12	
Balance quality level as per DIN ISO 1940		G 2.5									
Max. limit for rotor vibration displacement (peak-to-peak)¹⁸⁾											
Undulations in the connection flange area, based on ISO 7919-3											
Normal operation (continuous operation)	µm	$s_{(p-p)} = \frac{9000}{\sqrt{n}} (n \text{ in } \text{min}^{-1})$									
Start and stop operation/resonance ranges (temporary)	µm	$s_{(p-p)} = \frac{13200}{\sqrt{n}} (n \text{ in } \text{min}^{-1})$									
Rotor mass moment of inertia J_v											
without rotational speed measuring system	kg·m ²	0.0010	0.0010	0.0017	0.0039		0.0128		0.0292	0.0771	
with magn. rotational speed measuring system	kg·m ²	0.0015	0.0015	0.0022	0.0048		0.0145	0.0146	0.0333	0.0872	

Type	T40B									
Nominal (rated) torque M_{nom}	N·m	50	100	200	500					
	kN·m					1	2	3	5	10
Proportional mass moment of inertia for the transmitter side (side of the flange with external centering)										
without rotational speed measuring system	% of J_v	68	68	62	59		54		53	54
with magn. rotational speed measuring system	% of J_v	44	44	48	48		48		47	48
Max. permissible static eccentricity of rotor (radially) to center point of stator										
without rotational speed measuring system	mm	±2								
Permissible axial displacement between rotor and stator¹⁹⁾										
without rotational speed measuring system	mm	±2								
Weight										
Rotor without rotational speed measuring system										
Rotor with magnetic rotational speed measuring system	kg	0.7	0.7	1.1	1.9		3.8	3.9	6.5	10.9
	kg	0.8	0.8	1.3	2.1		4.1	4.1	6.9	11.7
Stator	kg	1.1	1.1	1.1	1.1		1.1	1.1	1.2	1.3

- 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 line termination.
- 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.
- 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.
- 10) Option 7, code U
- 11) Option 7, code S
- 12) Heat conductance via the stator base plate necessary over 70°C. The temperature of the base plate must not exceed 85°C.
- 13) The antenna ring and connector must be fixed.
- 14) 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 bending moment limit and the lateral limit force occur at the same time, only 40% of the axial limit force is permissible and the nominal (rated) torque must not be exceeded. The effects of the permissible bending moments, axial and lateral forces on the measurement result are ≤ ±0.3% (50Nm: ≤ ±0.6%) of the nominal (rated) torque. The load limits only apply for the nominal (rated) temperature range. At temperatures of <10 °C, the load limits are expected to reduce by up to 30%, because there is an increased reduction in strength as temperatures fall.
- 15) With static load.
- 16) Static and dynamic.
- 17) The nominal (rated) torque must not be exceeded.
- 18) The influence on the vibration measurements caused by radial run-out, eccentricity, defects of form, notches, marks, local residual magnetism, structural inhomogeneity or material anomalies must be taken into account and isolated from the actual undulation.
- 19) Above the nominal (rated) temperature range: ±1.5 mm.

RADIAL AND AXIAL RUN-OUT TOLERANCES



■ Hardness 46 ... 54 HRC

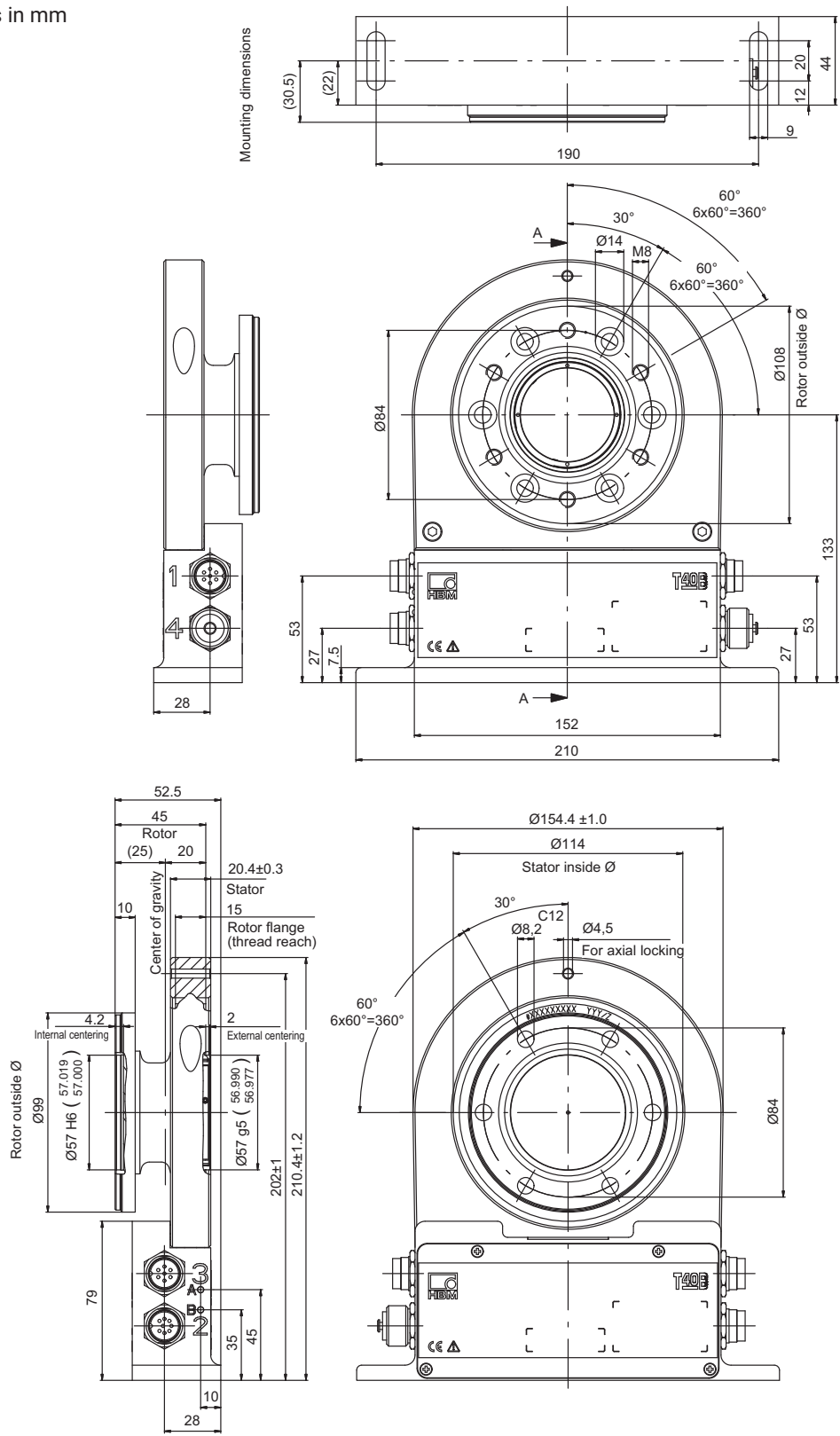
0.8 / √ Surface quality of the axial and radial run-out surfaces (A, B and AB)

Measuring range (N·m)	Axial run-out tolerance (mm)	Radial run-out tolerance (mm)
50	0.01	0.01
100	0.01	0.01
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

T40B: 50 Nm - 100 Nm without rotational speed measurement

Dimensions in mm

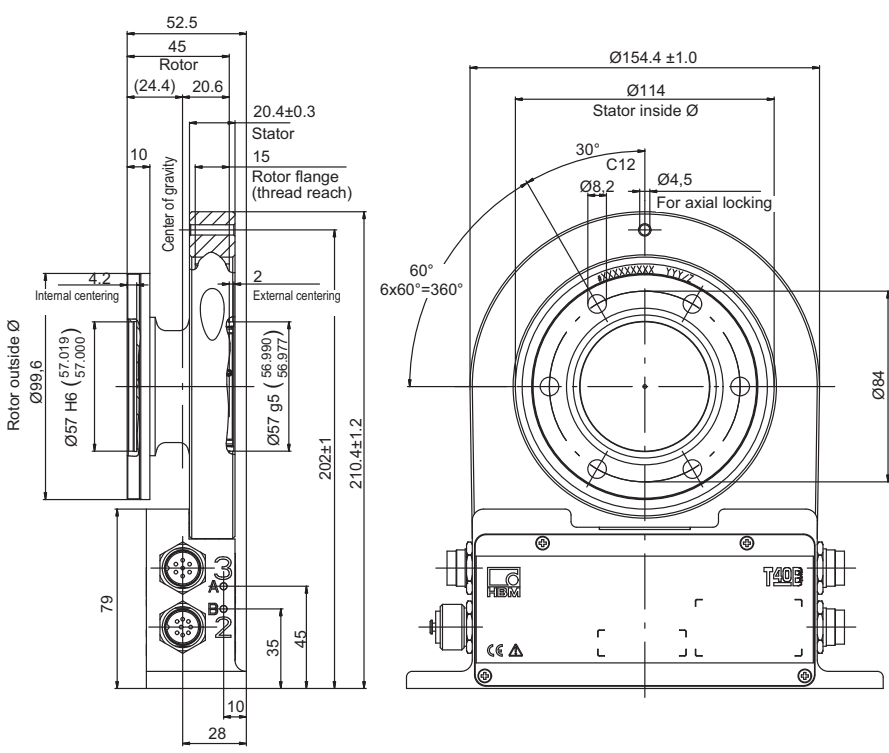
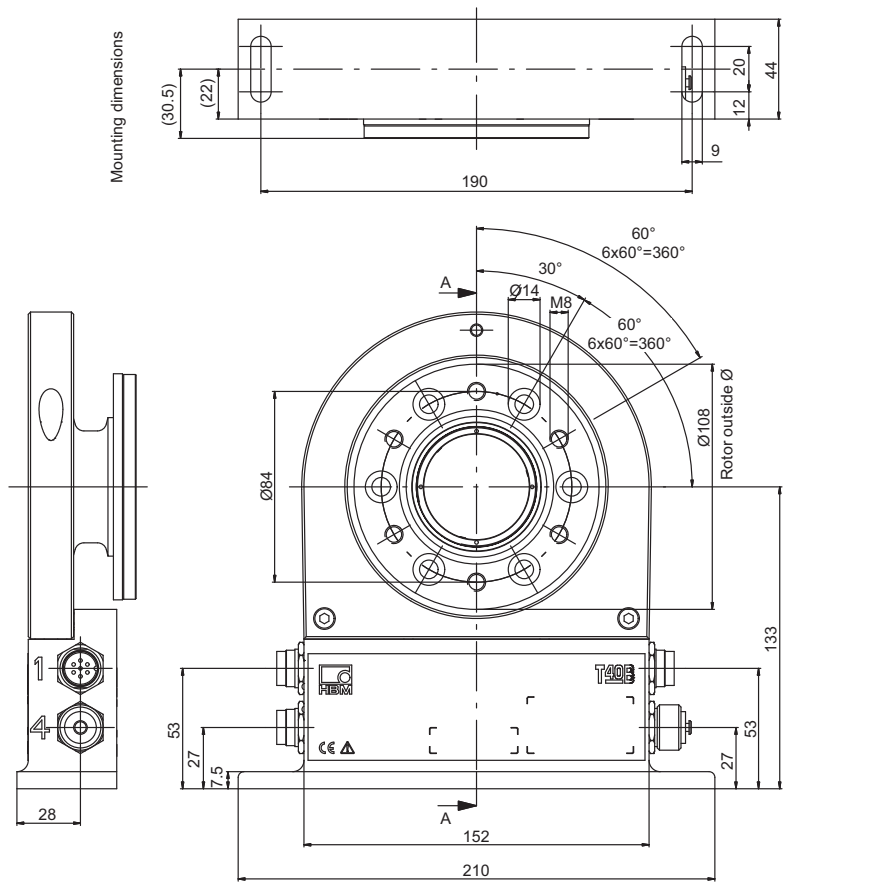


Cutaways in section A-A

Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 200 Nm without rotational speed measurement

Dimensions in mm

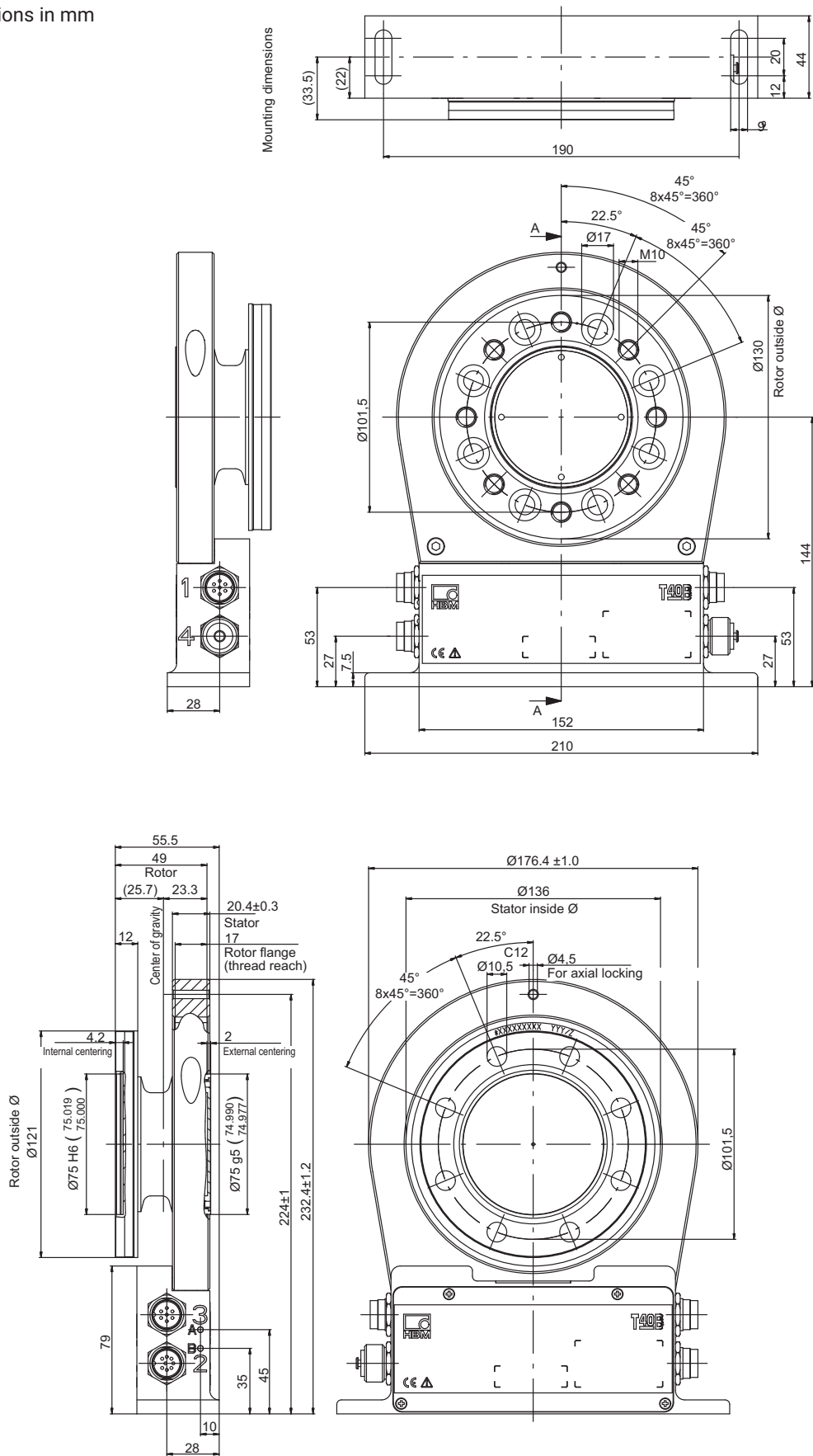


Cutaways in section A-A

Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 500 Nm - 1 kNm without rotational speed measurement

Dimensions in mm

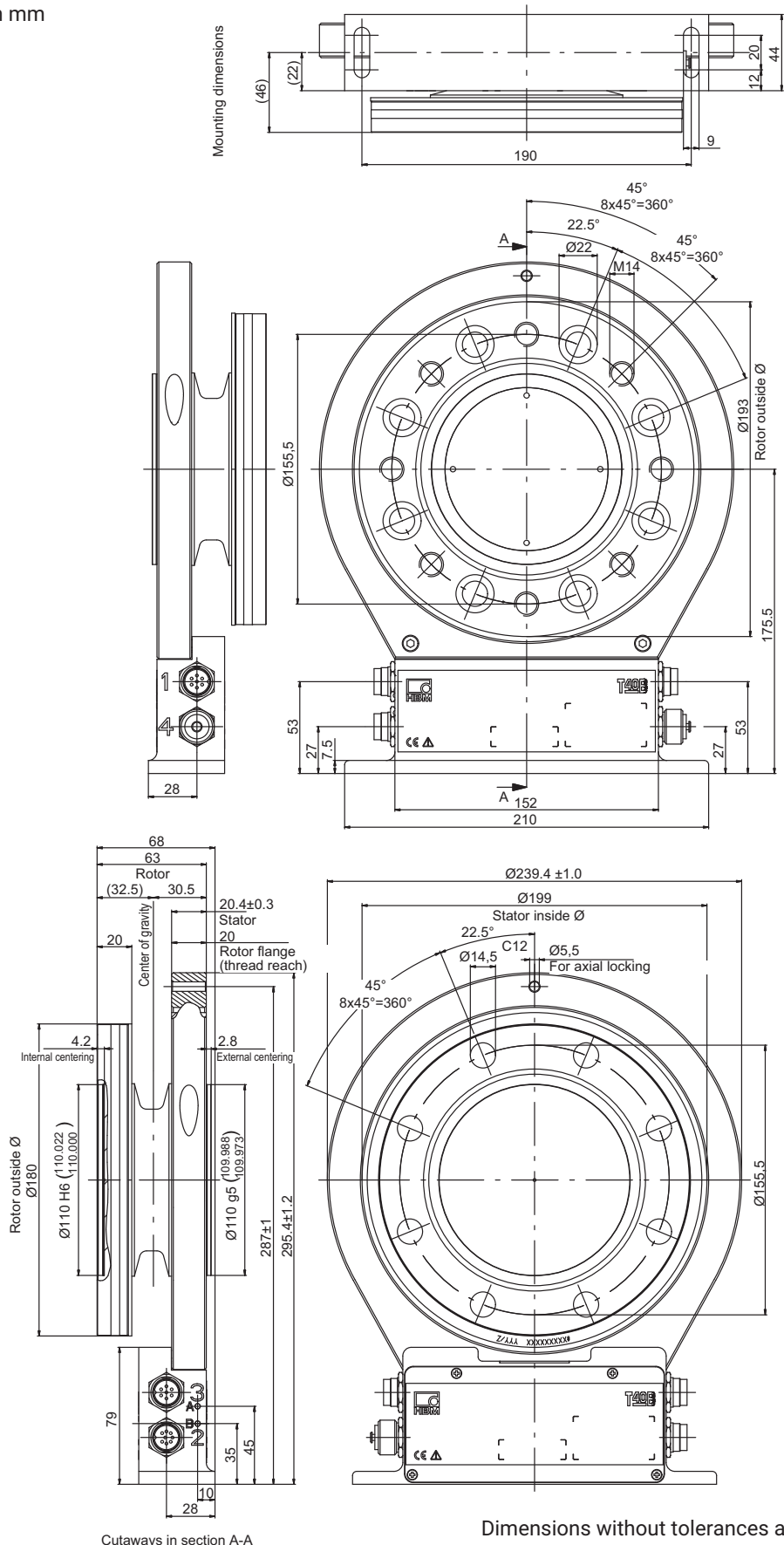


Cutaways in section A-A

Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 5 kNm without rotational speed measurement

Dimensions in mm

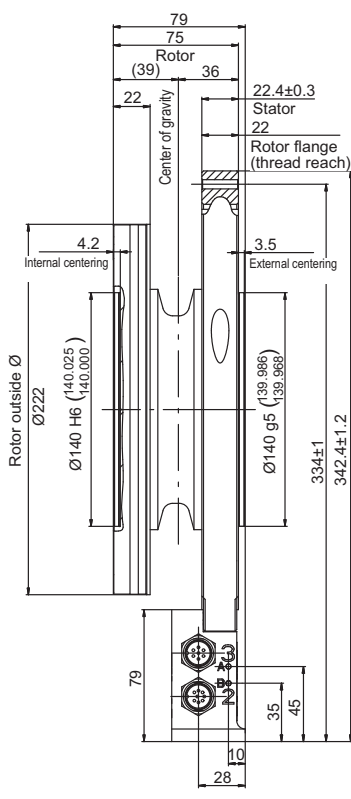
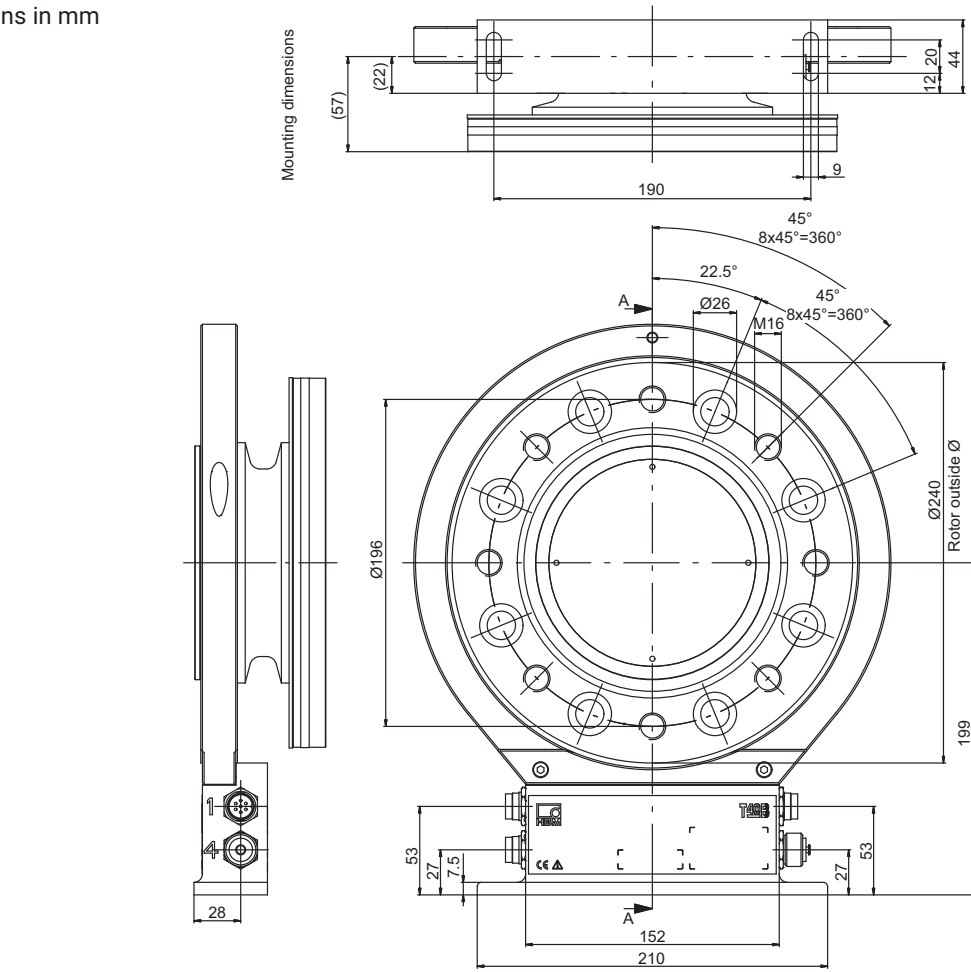


Cutaways in section A-A

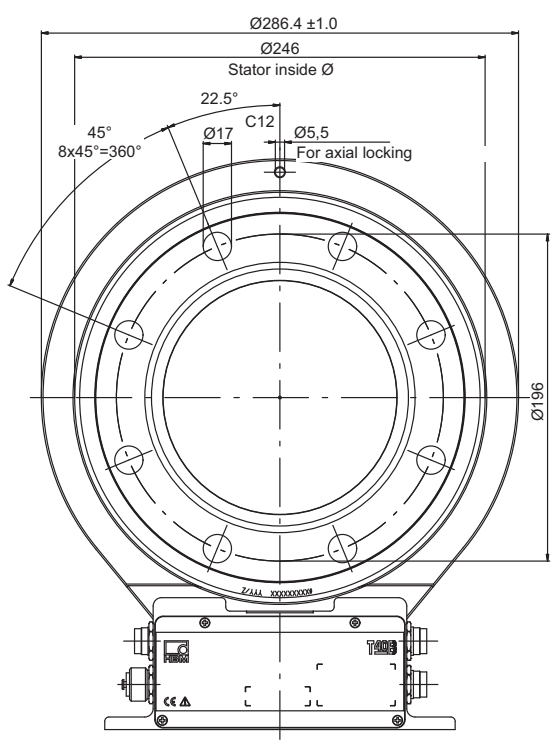
Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 10 kNm without rotational speed measurement

Dimensions in mm



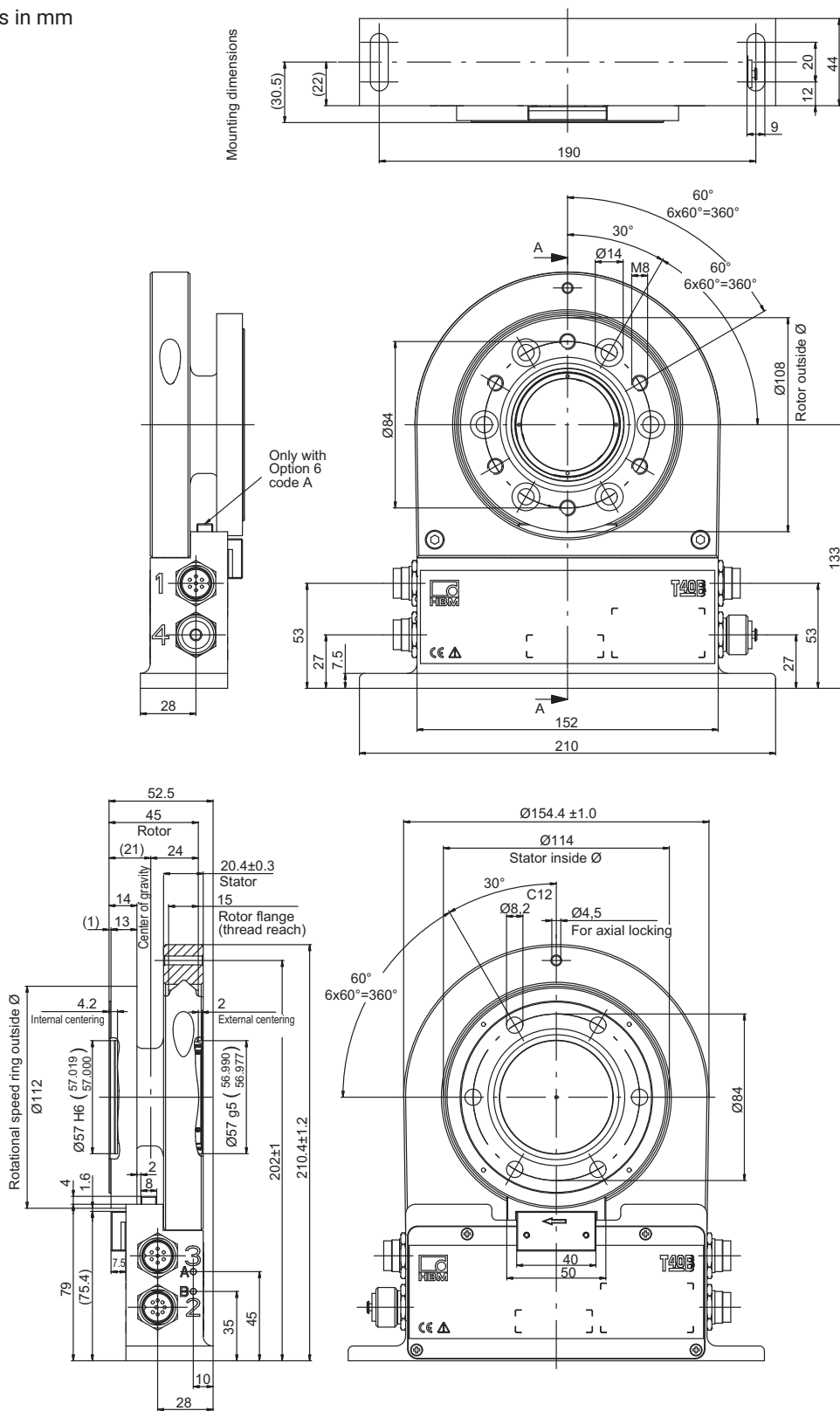
Cutaways in section A-A



Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 50 Nm - 100 Nm with rotational speed measurement and reference signal

Dimensions in mm

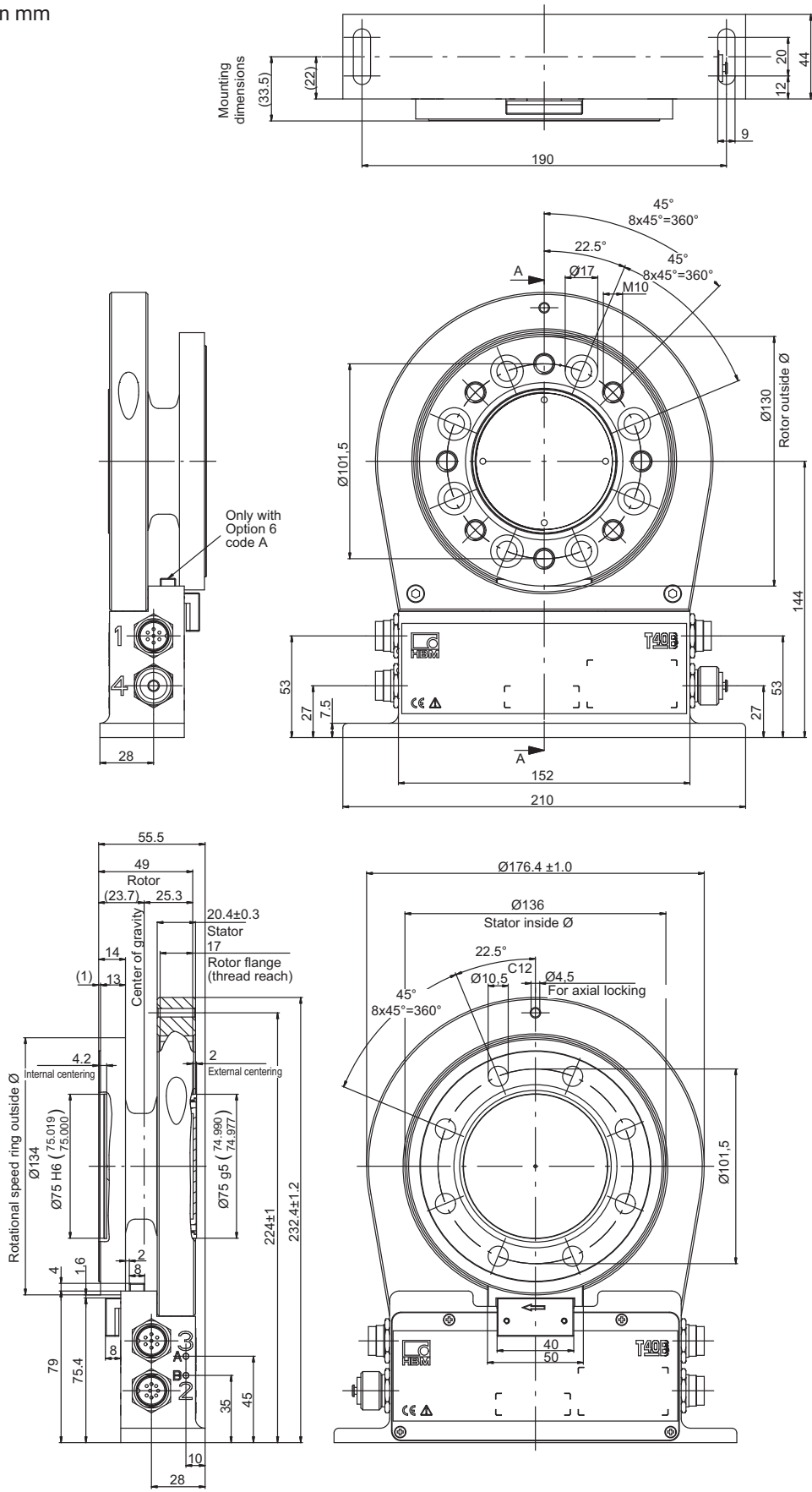


Cutaways in section A-A

Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 500 Nm - 1 kNm with rotational speed measurement and reference signal

Dimensions in mm

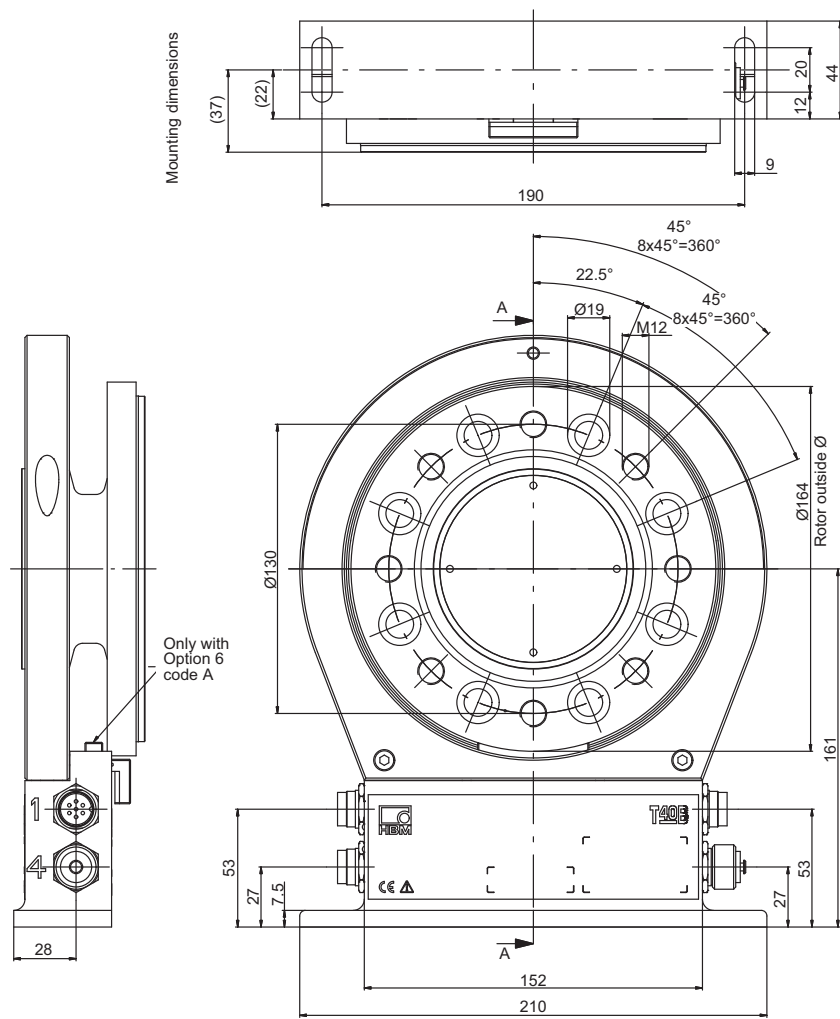


Cutaways in section A-A

Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 2 kNm - 3 kNm with rotational speed measurement and reference signal

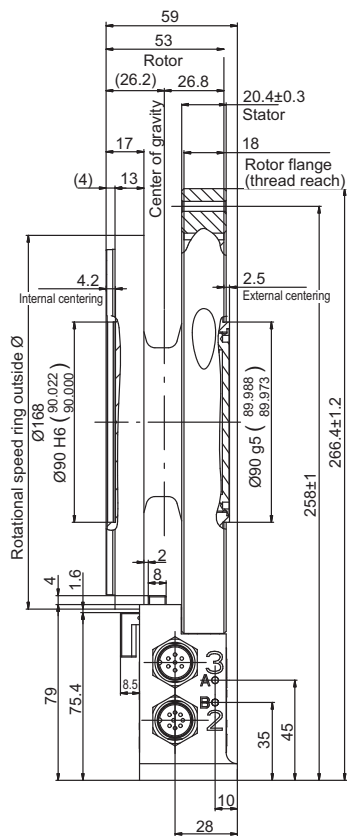
Dimensions in mm



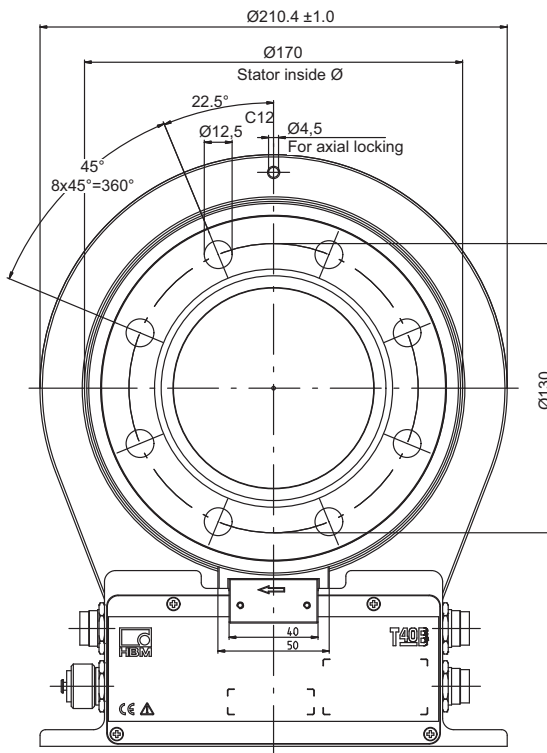
Dimensions without tolerances according to DIN ISO 2768-mk

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

Dimensions in mm



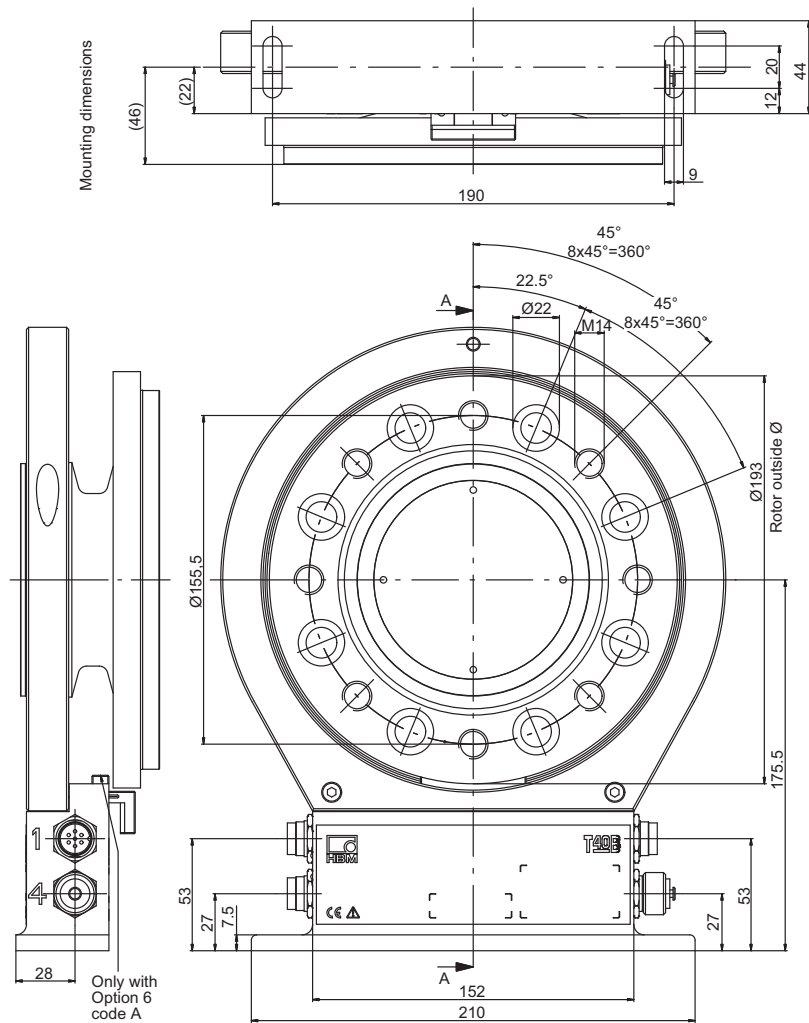
Cutaways in section A-A



Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 5 kNm with rotational speed measurement and reference signal

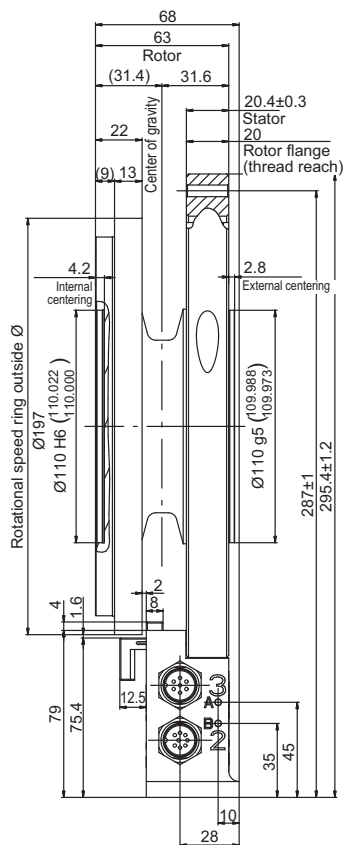
Dimensions in mm



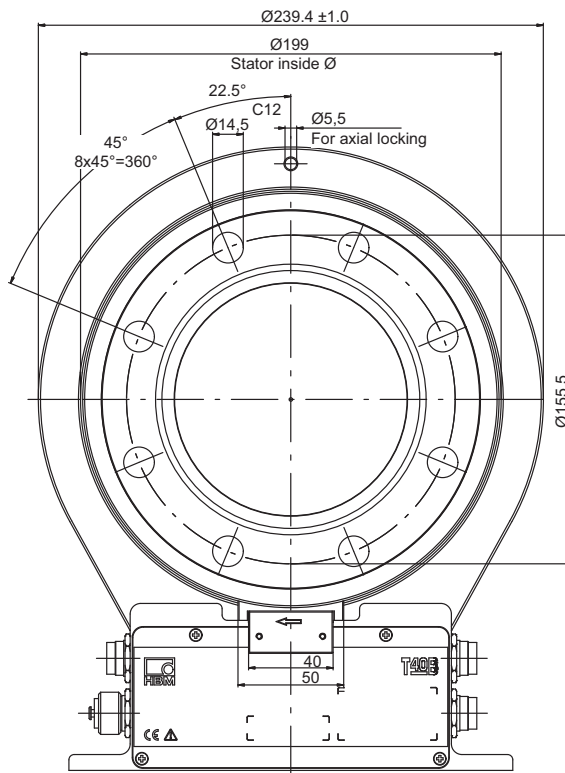
Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 5 kNm with rotational speed measurement and reference signal, continued

Dimensions in mm



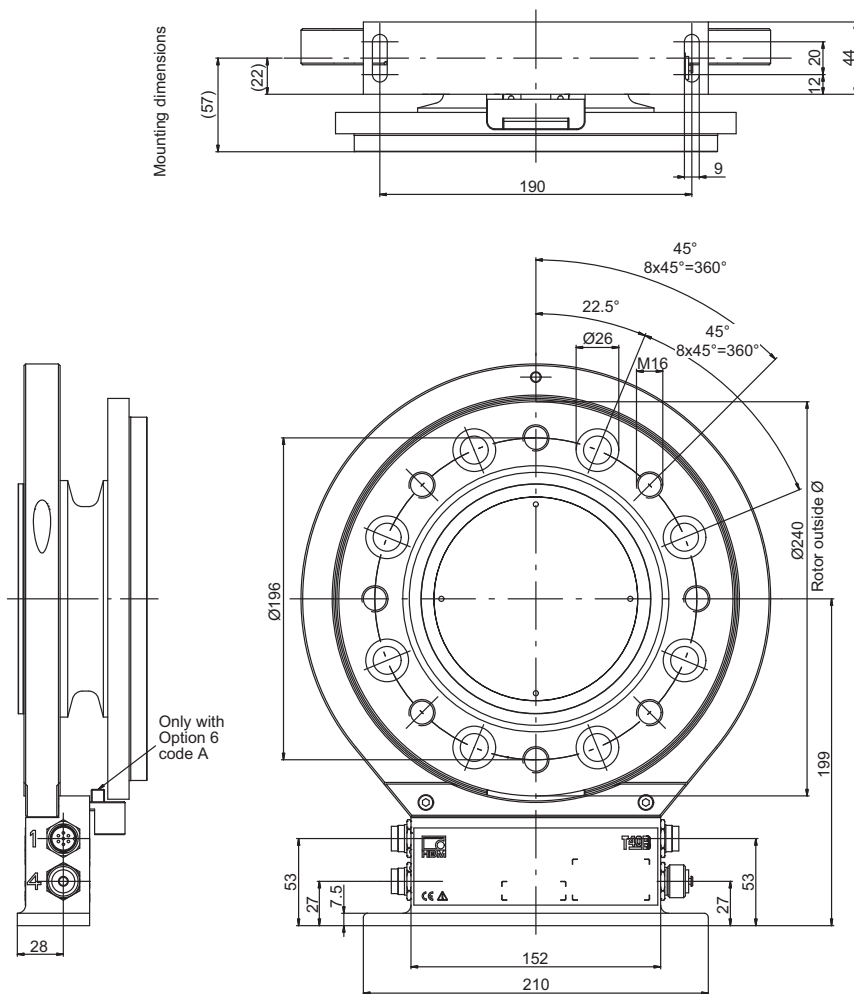
Cutaways in section A-A



Dimensions without tolerances according to DIN ISO 2768-mk

T40B: 10 kNm with rotational speed measurement and reference signal

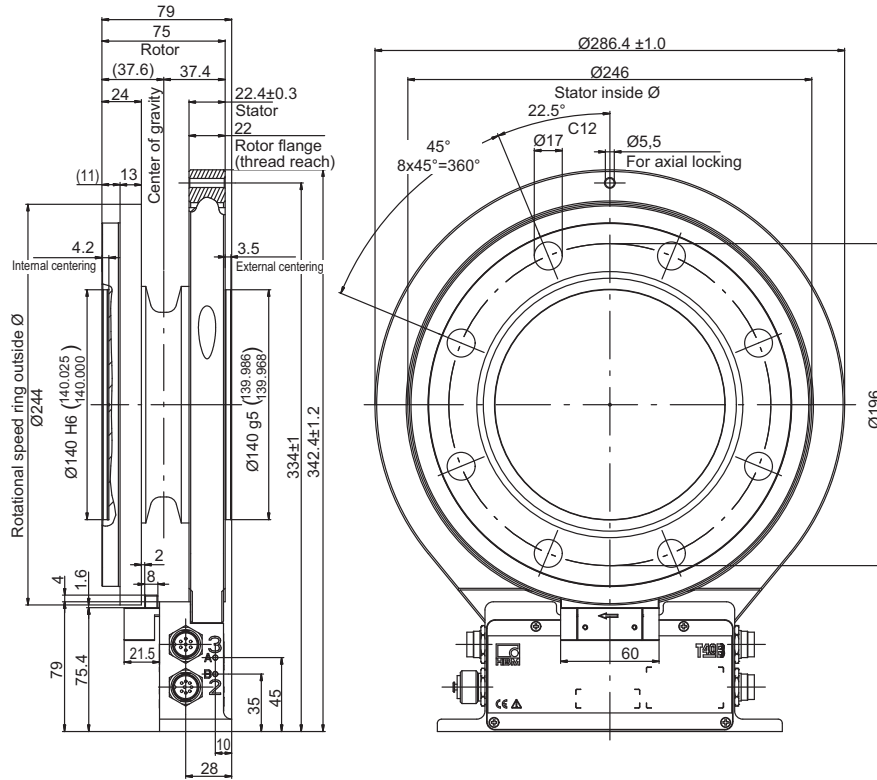
Dimensions in mm



Dimensions without tolerances according to DIN ISO 2768-mk

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

Dimensions in mm



Cutaways in section A-A

Dimensions without tolerances according to DIN ISO 2768-mk

ORDERING NUMBERS

K-T40B		[only with Option 2 = MF / ST]
1	Code	Option 1: Measuring range to
	050Q	50 N·m [only with Option 2 = MF/RO]
	100Q	100 N·m [only with Option 2 = MF/RO]
	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]	
2	Code	Option 2: Components
	MF	Complete measurement flange
	RO	Rotor
	ST	Stator
3	Code	Option 3: Accuracy
	S	Standard
4	Code	Option 4: Nominal (rated) rotational speed range
	M	Standard
	H	High-speed version
5	Code	Option 5: Electrical configuration [only with Option 2 = MF/ST]
	SU2	Output signal 10 kHz \pm 5 kHz and \pm 10 V, supply voltage 18...30 V DC
	DU2	Output signal 60 kHz \pm 30 kHz and \pm 10 V, supply voltage 18...30 V DC
	HU2	Output signal 240 kHz \pm 120 kHz and \pm 10 V, supply voltage 18...30 V DC
6	Code	Option 6: rotational speed measuring system
	0	Without rotational speed measuring system
	1	Magnetic rotational speed measuring system; 1024 pulses/revolution
	2	Magnetic rotational speed measuring system; 128 pulses/revolution
	A	Magnetic rotational speed measuring system; 1024 pulses/revolution and reference signal
B	Magnetic rotational speed measuring system; 128 pulses/revolution and reference signal	
7	Code	Option 7: Customized modification
	U	No customized modification

K-T40B - - - S - - - U

1 2 3 4 5 6 7

ACCESSORIES, TO BE ORDERED SEPARATELY

Item	Order no.
Connection cable, pre-wired	
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, 6 m	1-KAB150-6
Rotational speed connection cable, reference signal, Binder 423 - 15-pin D-Sub, 6 m	1-KAB163-6
Rotational speed connection cable, reference signal, Binder 423 - 8-pin, free ends, 6 m	1-KAB164-6
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

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 They are not to be understood as a guarantee of quality or durability.