

DATA SHEET

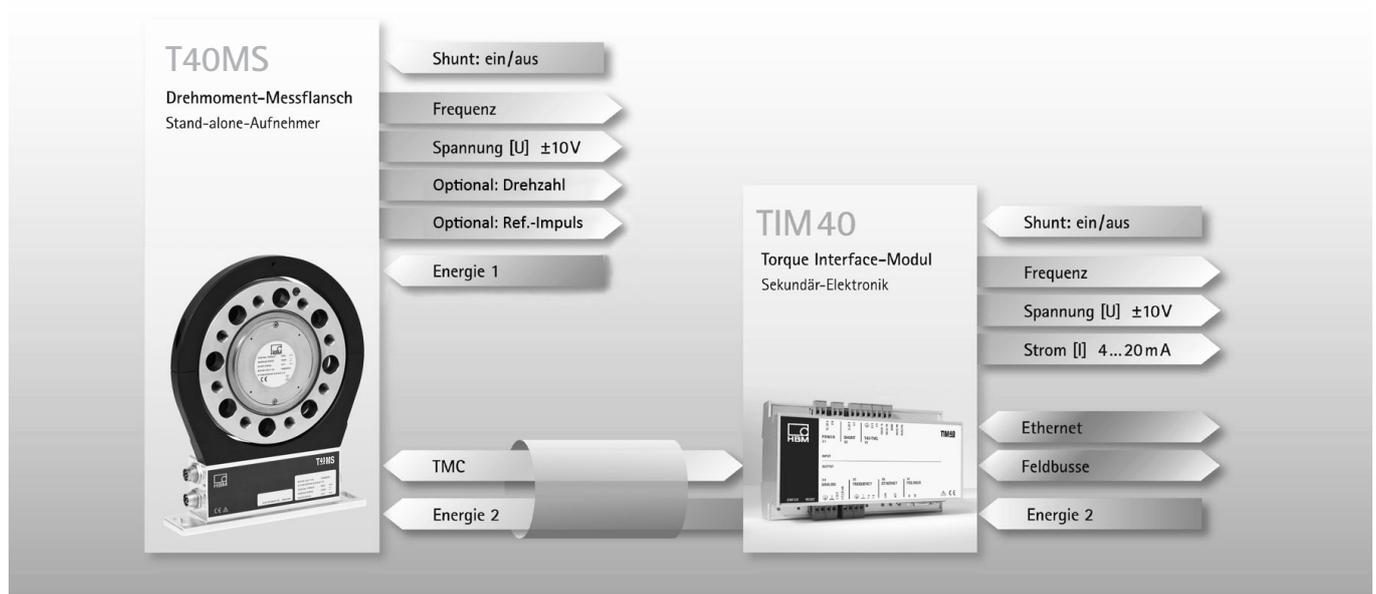
T40MS Torque Flange

SPECIAL FEATURES

- Nominal (rated) torques 200 N·m, 500 N·m, 1 kN·m and 2 kN·m
- Nominal (rated) rotational speed up to 25,000 rpm
- Optional: Nominal (rated) rotational speed up to 30,000 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		T40MS			
Accuracy class		0.05			
Nominal (rated) torque M_{nom}	N·m	200	500	1000	2000
Torque measuring system					
Nominal (rated) rotational speed	rpm	25,000 (optional: 30,000)			
Non-linearity including hysteresis, relative to the nominal sensitivity					
Frequency output					
For a max. torque in 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 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			
Relative standard deviation of repeatability to DIN 1319, relative to variation of the output signal					
Frequency output					
Voltage output					
%					
< ± 0.03					
< ± 0.03					
Temperature effect per 10K in nominal (rated) temperature range on the output signal relative to the actual value of the signal span					
Frequency output					
Voltage output					
%					
%					
< ± 0.05					
< ± 0.2					
on the zero signal relative to the nominal sensitivity					
Frequency output					
Voltage output					
%					
%					
< ± 0.05					
< ± 0.1					
Nominal sensitivity (span between torque = zero and nominal (rated) torque)					
Frequency output 10 / 60 / 240 kHz					
Voltage output					
kHz					
V					
5 ¹⁾ / 30 ²⁾ / 120 ³⁾					
10					
Sensitivity tolerance (deviation of the actual output quantity at M_{nom} from the nominal sensitivity)					
Frequency output					
Voltage output					
%					
%					
< ± 0.1					
< ± 0.1					
Output signal at torque = zero					
Frequency output					
Voltage output					
kHz					
V					
10 ¹⁾ / 60 ²⁾ / 240 ³⁾					
0					
Nominal output signal					
Frequency output					
with positive nominal (rated) torque					
with negative nominal (rated) torque					
Voltage output					
with positive nominal (rated) torque					
with negative nominal (rated) torque					
kHz					
kHz					
V					
V					
15 ¹⁾ / 90 ²⁾ / 360 ³⁾ (5 V balanced ⁴⁾)					
5 ¹⁾ / 30 ²⁾ / 120 ³⁾ (5 V balanced ⁴⁾)					
+10					
-10					
Load resistance					
Frequency output					
Voltage output					
kΩ					
kΩ					
≥ 2					
≥ 10					

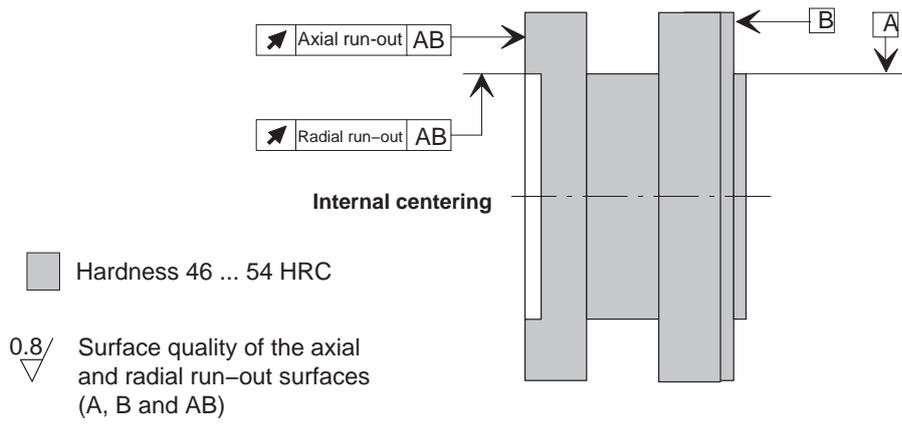
Nominal (rated) torque M_{nom}	N·m	200	500	1000	2000
Long-term drift over 48 h					
Frequency output	%		< ± 0.03		
Voltage output	%		< ± 0.03		
Signal bandwidth (-3 dB)			1 ¹⁾ / 3 ²⁾ / 6 ³⁾		
Group delay	µs		< 400 ¹⁾ / < 220 ²⁾ / < 150 ³⁾		
Residual ripple					
Voltage output ⁵⁾	mV		< 40		
Maximum modulation 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; asymmetrical		
Current consumption in measuring mode	A		< 1		
Current consumption in startup mode	A		< 4 (typical value 2) 50 µs		
Nominal (rated) power consumption	W		< 10		
Maximum cable length	m		50		
Shunt signal					
Tolerance of calibration signal, relative to M_{nom}	%		approx. 50% of M_{nom} ; value stated on type plate		
Nominal (rated) trigger voltage	V		< ± 0.05		
Trigger voltage limit	V		5		
Shunt signal ON	V		36		
Shunt signal OFF	V		min. > 2.5		
	V		max. < 0.7		
rotational speed measuring system					
Measuring system			Magnetic, via AMR (anisotropic magneto-resistive) sensor and magnetized plastic ring on embedded titanium ring		
Magnetic poles			72		
Output signal	V		5 V, balanced (RS-422); 2 square-wave signals approx. 90° phase shifted		
Pulses per revolution			512 (Option 6, Code 3 & C); 128 (Option 6, Code 2 & B)		
Minimum rotational speed for sufficient pulse stability	rpm		0		
Pulse tolerance⁷⁾	degrees		< ± 0.05 (512 pulses) < ± 0.1 (128 pulses)		
Maximum permissible output frequency	kHz		420		
Group delay	µs		< 150		
Radial nominal (rated) distance between sensor head and magnetic ring (mechanical distance)	mm		1.2		
Working distance range between sensor head and magnetic ring	mm		0.4 ... 2.0		
Max. permissible axial displacement of rotor in relation to stator⁸⁾	mm		± 0.5		
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		

Nominal (rated) torque M_{nom}	N·m	200	500	1000	2000
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	0.176 / 0.703 (512 pulse/rev; 128 pulse/rev)			
Group delay	µs	< 150			
Axial nominal (rated) distance between sensor head and magnetic ring (mechanical distance)	mm	3.5			
Working distance range between sensor head and magnetic ring	mm	3 ... 4			
Max. permissible axial displacement of rotor in relation to stator ⁸⁾	mm	± 0.5			
General information					
EMC					
Emission (as per FCC 47, Part 15, Section C)	-				
Emission (as 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 transients (burst)	kV	1			
Surge voltages	kV	1			
Conducted interference (AM)	V	10			
Degree of protection as per EN 60529		IP 54			
Reference temperature	°C	23			
Nominal (rated) temperature range	°C	+10 ... +70			
Operating temperature range ¹⁰⁾	°C	-20 ... +85			
Storage temperature range	°C	-40 ... +85			
Impact resistance, test severity level according to DIN IEC 68; Part 2-27; IEC 68-2-27-1987¹¹⁾					
Number	n	1000			
Duration	ms	3			
Acceleration (half sine)	m/s ²	650			
Vibrational stress in 3 directions according to EN 60068-2-6; IEC 68-2-6-1982¹¹⁾					
Frequency range	Hz	5 ... 65			
Duration	h	1.5			
Acceleration (amplitude)	m/s ²	50			
Load limits¹²⁾					
Limit torque, related to M_{nom} ¹³⁾	%	150	150	150	110
Breaking torque relative to M_{nom} ¹³⁾	%	300	300	300	150
Axial limit force ¹⁴⁾	kN	10	15	15	3
Lateral limit force ¹⁴⁾	kN	2	5	5	1
Bending moment limit ¹⁴⁾	N·m	100	220	220	50
Oscillation width as per DIN 50100 (peak-to-peak) ¹⁵⁾	kN·m	0.4	1	2	3
Mechanical values					
Torsional stiffness c_T	kN m/rad	300	550	610	830
Torsion angle at M_{nom}	degrees	0.04	0.05	0.09	0.14
Stiffness in the axial direction c_a	kN/mm	1100	1450	1500	1700
Stiffness in the radial direction c_T	kN/mm	270	450	500	630

Nominal (rated) torque M_{nom}	N·m	200	500	1000	2000
Stiffness at the bending moment round a radial axis c_b	kN·m/ degrees	8.8	10.6	10.6	12.7
Maximum deflection at axial limit force	mm	< 0.01	< 0.02	< 0.02	< 0.003
Additional max. radial run-out at lateral limit force	mm	< 0.02	< 0.03	< 0.03	< 0.003
Additional deviation from plane parallelism at bending moment limit (at $\emptyset d_B$)	mm	< 0.03	< 0.04	< 0.04	< 0.008
Balance quality level as per DIN ISO 1940		G 2.5			
Max. limit for rotor vibration displacement (peak-to-peak) ¹⁶⁾ Undulations in the connection flange area, based on ISO 7919-3 Normal operation (continuous operation) Start and stop operation/resonance ranges (temporary)	μm μm	$S_{(p-p)} = \frac{9000}{\sqrt{n}}$ (n in rpm) $S_{(p-p)} = \frac{13000}{\sqrt{n}}$ (n in rpm)			
Rotor mass moment of inertia J_v without rotational speed measuring system with magnetic rotational speed measuring system	kg·m ² kg·m ²	0.0012 0.0015			
Proportional mass moment of inertia for the transmitter side (side of the flange with external centering) without magn. rotational speed measuring system with magn. rotational speed measuring system	% of J_v % of J_v	51 45			
Max. permitted static radial run-out of rotor (radially) to center point of stator without rotational speed measuring system	mm mm	± 1 ± 1.5			
Permissible axial displacement between rotor and stator ¹⁹⁾ without rotational speed measuring system	mm mm	± 1.5 ± 0.5			
Weight Rotor without rotational speed measuring system Rotor with magnetic rotational speed measuring system Stator	kg kg kg	approx. 0.8 approx. 0.9 approx. 1.1			

- 1) 10 ± 5 kHz
- 2) 60 ± 30 kHz
- 3) 240 ± 120 kHz
- 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.
- 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 resistors required as per RS-422.
- 10) From temperatures of 70 °C, heat must be conducted via the base plate of the stator. The temperature of the base plate must not exceed 85 °C.
- 11) The antenna ring and connector must be fixed.
- 12) 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 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 10% of the permissible bending moments, axial and lateral forces on the measurement result are $\pm 0.3\%$ of the nominal (rated) torque. The load limits only apply for the nominal (rated) temperature range.
- 13) With static load
- 14) Static and dynamic
- 15) The nominal (rated) torque must not be exceeded.
- 16) 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.
- 17) Above the nominal (rated) temperature range: ± 1.5 mm.

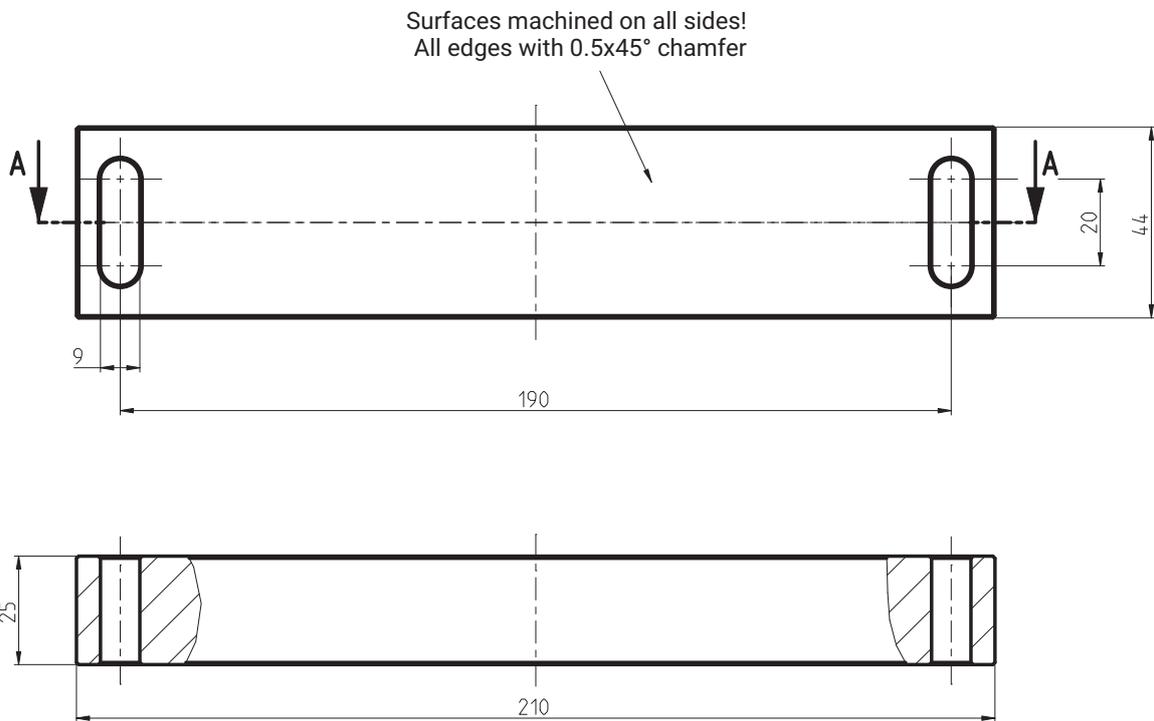
RADIAL AND AXIAL RUN-OUT TOLERANCES



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	0.01	0.01

DIMENSIONS

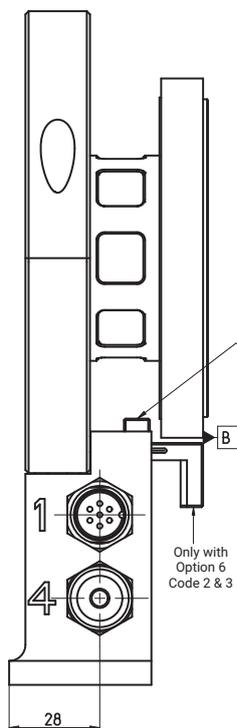
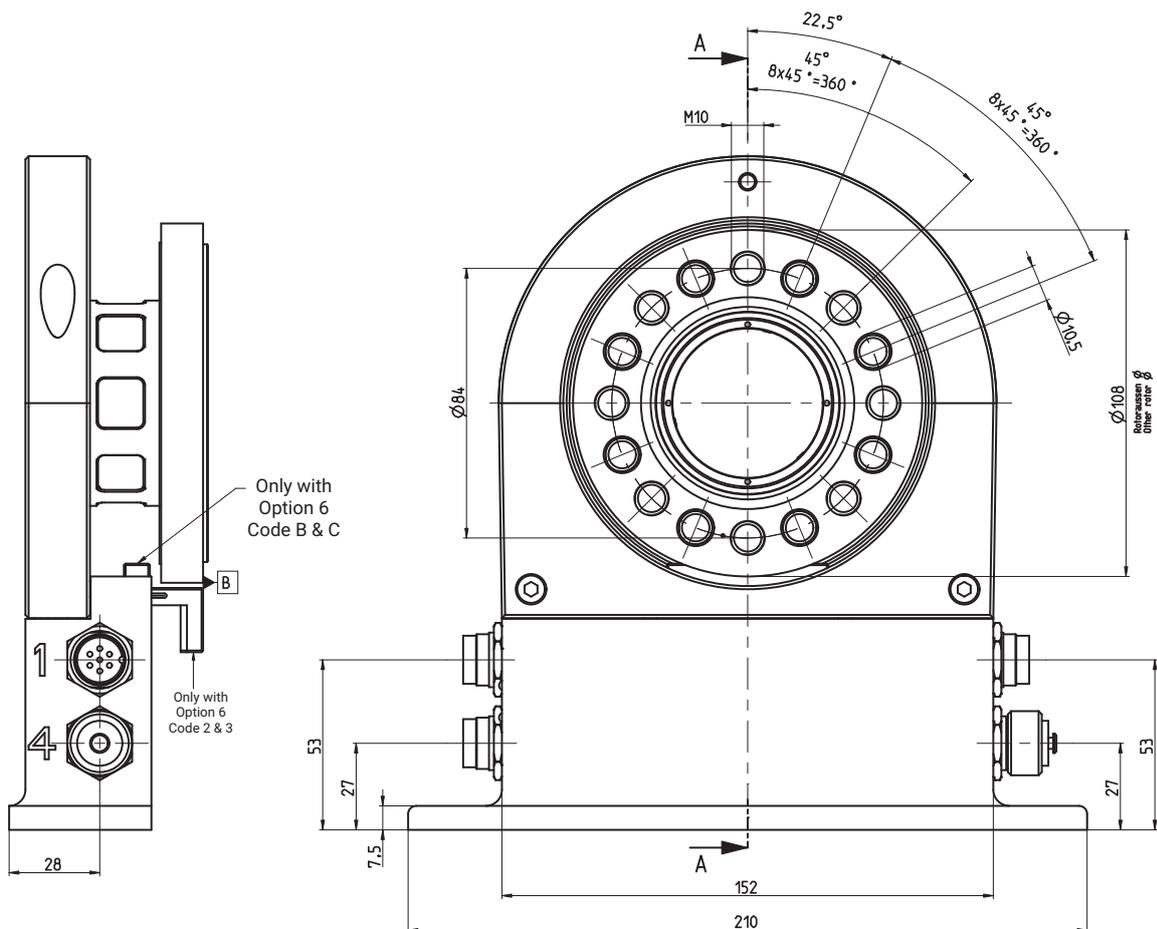
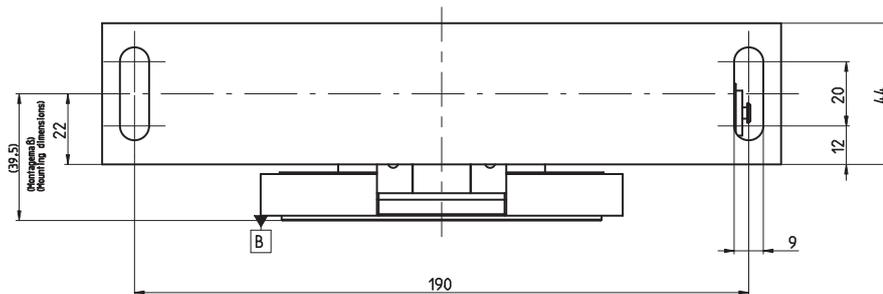
Adapter plate T11 to T40MS



A-A

T40MS 200 Nm - 2 kNm without rotational speed measurement

Dimensions in mm
 Dimensions without tolerances
 according to DIN ISO 2768-mk



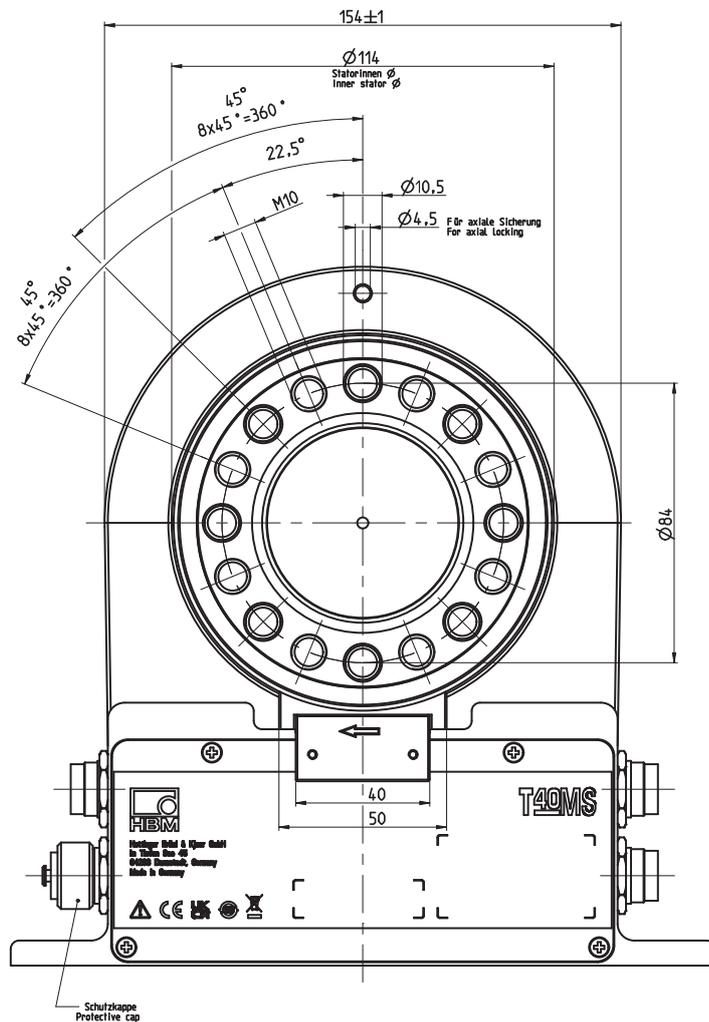
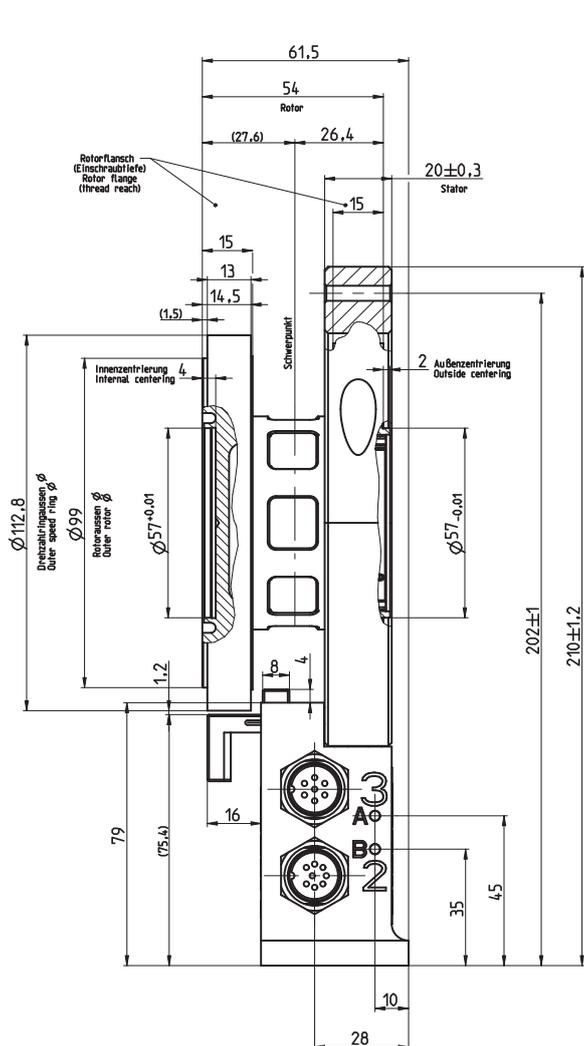
Only with
 Option 6
 Code B & C

Only with
 Option 6
 Code 2 & 3

T40MS 200 Nm - 2 kNm with rotational speed measurement and reference signal

Dimensions in mm

Dimensions without tolerances according to DIN ISO 2768-mk



Ausbrüche im Schnitt
Partial sections cut
A-A

