

# T40FM

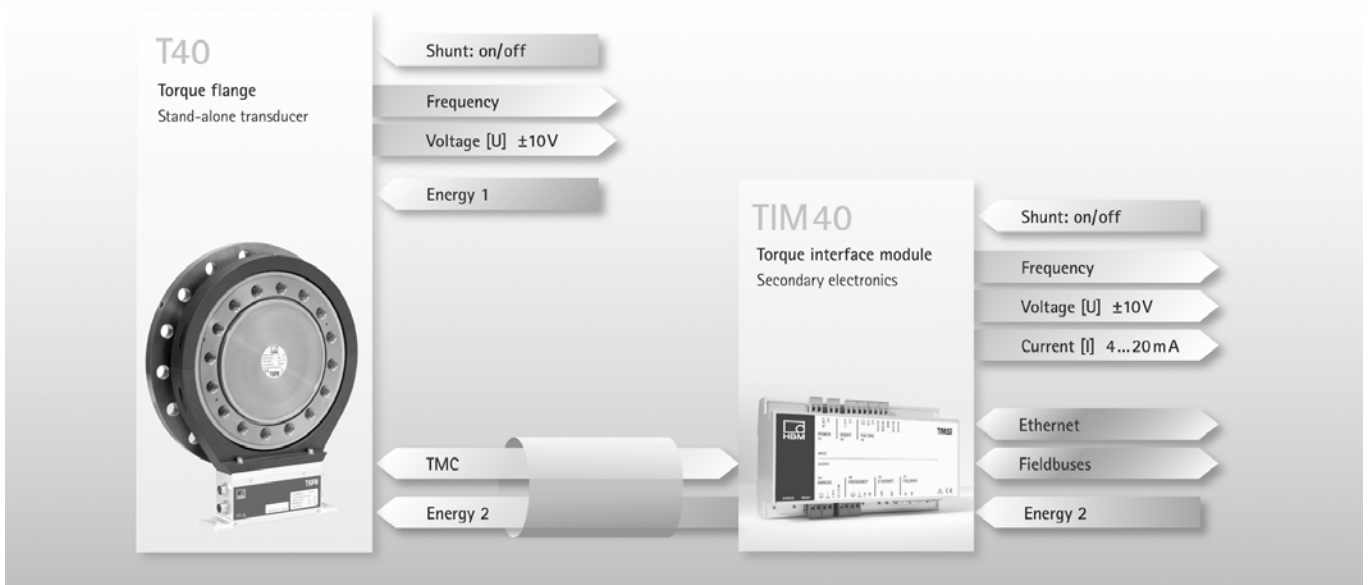
## Torque Flange

### Special features

- Nominal (rated) torque: 15 kN·m, 20 kN·m, 25 kN·m, 30 kN·m, 40 kN·m, 50 kN·m, 60 kN·m, 70 kN·m and 80 kN·m
- Nominal (rated) rotational speed up to 8000 rpm (dependent on the measuring range)
- Compact design
- High permissible lateral forces
- High radial and torsional stiffness
- Without bearings or slip rings
- Digital transmission of measured values
- Large measurement frequency range up to 6 kHz (-3 dB)
- Accuracy class 0.1 (optional 0.05)
- Optional: rotational speed measuring system, reference signal



### Overall concept



# Specifications

Type	T40FM									
Accuracy class	0.1 (optional 0.05)									
Torque measuring system, frequency output										
Nominal (rated) torque $M_{nom}$	kN·m	15	20	25	30	40	50	60	70	80
Nominal (rated) rotational speed	rpm	6000			4000			3000		
optional	rpm	8000			6000			4500		
Non-linearity including hysteresis, related to nominal (rated) sensitivity										
For a max. torque in the range:										
between 0% of $M_{nom}$ and 20% of $M_{nom}$	%	<±0.03 (optional <±0.015)								
> 20% of $M_{nom}$ and 60% of $M_{nom}$	%	<±0.065 (optional <±0.035)								
> 60% of $M_{nom}$ and 100% of $M_{nom}$	%	<±0.1 (optional <±0.05)								
Relative standard deviation of reproducibility (variability), per DIN 1319, related to the variation of the output signal	%	<±0.05								
Temperature effect per 10 K in the nominal (rated) temperature range										
on the output signal, related to the actual value of the signal span	%	<±0.05								
on the zero signal, related to the nominal (rated) sensitivity	%	<±0.05								
Nominal (rated) sensitivity (span between torque = zero and nominal (rated) torque)										
Option SU2	kHz	5								
Option DU2	kHz	30								
Option HU2	kHz	120								
Sensitivity tolerance (deviation of the actual output frequency at $M_{nom}$ from the nominal (rated) sensitivity)	%	±0.2								
Load resistance	kΩ	>2								
Output signal at zero torque										
Option SU2	kHz	10								
Option DU2	kHz	60								
Option HU2	kHz	240								
Nominal (rated) output signal (RS422, 5 V symmetrical)										
with positive nominal (rated) torque, Option SU2	kHz	15								
with positive nominal (rated) torque, Option DU2	kHz	90								
with positive nominal (rated) torque, Option HU2	kHz	360								
with negative nominal (rated) torque, Option SU2	kHz	5								
with negative nominal (rated) torque, Option DU2	kHz	30								
with negative nominal (rated) torque, Option HU2	kHz	120								
Load resistance <sup>1)</sup>	kΩ	≥ 2								
Long-term drift over 48 h at reference temperature, related to nominal (rated) sensitivity	%	≤ 0.03								
Measurement frequency range (-3 dB)										
Option SU2	kHz	1								
Option DU2	kHz	3								
Option HU2	kHz	6								
Group delay										
Option SU2	μs	<400								
Option DU2	μs	<220								
Option HU2	μs	<150								
Maximum modulation range <sup>2)</sup>										
Option SU2	kHz	2.5 to 17.5								
Option DU2	kHz	15 to 105								
Option HU2	kHz	60 to 420								

1) Note the necessary termination resistances as per RS-422.

2) Output signal range in which there is a repeatable correlation between torque and output signal.

## Specifications (continued)

Torque measuring system, voltage output										
Nominal (rated) torque $M_{nom}$	kN·m	15	20	25	30	40	50	60	70	80
<b>Non-linearity including hysteresis</b> , related to nominal (rated) sensitivity For a max. torque in the range: between 0% of $M_{nom}$ and 20% of $M_{nom}$ > 20% of $M_{nom}$ and 60% of $M_{nom}$ > 60% of $M_{nom}$ and 100% of $M_{nom}$	% % %	<±0.03 (optional < ±0.015) <±0.065 (optional < ±0.035) <±0.1 (optional < ±0.05)								
<b>Relative standard deviation of reproducibility (variability)</b> , per DIN 1319, related to the variation of the output signal	%	<±0.05								
<b>Temperature effect per 10 K in the nominal (rated) temperature range</b> <b>on the output signal</b> , related to the actual value of the signal span <b>on the zero signal</b> , related to the nominal (rated) sensitivity	% %	<±0.15 <±0.15								
<b>Nominal (rated) sensitivity</b> (span between torque = zero and nominal (rated) torque)	V	10								
<b>Sensitivity tolerance</b> (deviation of the actual output frequency at $M_{nom}$ from the nominal (rated) sensitivity)	%	±0.2								
<b>Output signal at torque = zero</b>	V	0								
<b>Nominal (rated) output signal</b> At positive nominal (rated) torque At negative nominal (rated) torque	V V	10 -10								
<b>Load resistance</b>	kΩ	>10								
<b>Long-term drift over 48 h at reference temperature</b> , related to nominal (rated) sensitivity	%	≤0.03								
<b>Measurement frequency range</b> (-3 dB) Option SU2 Option DU2 Option HU2	kHz kHz kHz	1 3 6								
<b>Residual ripple</b> <sup>3)</sup>	mV	< 40 (peak-to-peak)								
<b>Maximum modulation range</b> <sup>4)</sup> <b>invalid measured value</b>	V V	± 12 13 to 15								
Torque measuring system in general										
Energy supply										
<b>Nominal (rated) supply voltage</b> (separated extralow voltage)	$V_{DC}$	18 to 30								
<b>Current consumption</b> in measuring mode in startup mode	A A	<1 (typ. 0.3 for a 20 V supply voltage) <4 (typ. 2) for max. 50μs								
<b>Nominal (rated) power consumption</b>	W	<10 (typ. 6)								
<b>Maximum cable length</b>	m	50								
Shunt										
<b>Tolerance of the shunt signal, related to <math>M_{nom}</math> at reference temperature</b>	%	< ± 0.05								
<b>Nominal (rated) trigger voltage</b>	V	5								
<b>Trigger voltage limit</b>	V	36								
<b>Shunt signal on</b>	V	>2.5								
<b>Shunt signal off</b>	V	<0.7								

<sup>3)</sup> Signal frequency range 0.1 to 10 kHz.

<sup>4)</sup> Output signal range in which there is a repeatable correlation between torque and output signal.

## Specifications (continued)

Rotational speed measuring system										
Nominal (rated) torque $M_{nom}$	kN·m	15	20	25	30	40	50	60	70	80
Measurement system		Magnetic, via AMR sensor (Anisotropic Resistive Effect) and magnetized plastic ring with embedded steel ring								
Magnetic poles		158			186			204		
Maximum positional variation 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 <sup>5)</sup>	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 <sup>6)</sup>	mm	0.4 to 2.5								
Max. permissible axial displacement of the rotor to the stator <sup>7)</sup>	mm	± 1.5								
Hysteresis of direction of rotation reversal in the case of relative vibrations between rotor and stator										
Torsional vibration of the rotor	degrees	<approx. 0.2								
Horizontal stator vibration displacement	mm	<approx. 0.5								
Load resistance <sup>8)</sup>	kΩ	≥2								
Reference signal measuring system (0 index)										
Measurement system		Magnetic, with Hall sensor and magnet								
Output signal	V	5 V symmetrical (RS 422)								
Pulses per revolution		1								
Minimum rotational speed for sufficient pulse stability	rpm	2								
Pulse width, approx.	degrees	0.088								
Pulse tolerance <sup>5)</sup>	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 to 2.5								
Max. permissible axial displacement of rotor to stator <sup>7)</sup>	mm	± 1.5								

<sup>5)</sup> At nominal (rated) conditions.

<sup>6)</sup> The pulse tolerance improves with reduced distance and vice versa.

<sup>7)</sup> The data refers only to a central axial alignment. Deviations lead to a change in pulse tolerance.

<sup>8)</sup> Note the necessary termination resistances as per RS-422.

## Specifications (continued)

General information										
<b>EMC</b>										
<b>Emission</b> (per FCC 47, Part 15, sub part C)	-									
<b>Emission</b> (per EN 61326-1, Section 7) RFI field strength	-	Class B								
<b>Immunity from interference</b> , as per EN61326-1, EN61326-2-3										
Electromagnetic field (AM)	V/m	10								
Magnetic field	A/m	100								
<b>Electrostatic discharge (ESD)</b>										
Contact discharge	kV	4								
Air discharge	kV	8								
Fast transients (burst)	kV	1								
Impulse voltages (surge)	kV	1								
Conducted interference (AM)	V	10								
<b>Degree of protection</b> , as per EN 60 529 (rotor/stator)										
	-	IP54								
<b>Reference temperature</b>										
	°C	+23								
<b>Nominal (rated) temperature range</b>										
	°C	+10 to +70								
<b>Operating temperature range</b> <sup>9)</sup>										
	°C	-20 to +85								
<b>Storage temperature range</b>										
	°C	-40 to +85								
<b>Permissible ambient humidity</b>										
Relative humidity / no condensation	%	5 to 95								
<b>Mechanical shock</b> , as per EN 60068-2-72 <sup>10)</sup>										
Number	n	1000								
Duration	ms	3								
Acceleration (half sine)	m/s <sup>2</sup>	650								
<b>Vibrational stress in 3 directions</b> , as per EN 60068-2-6 <sup>10)</sup>										
Frequency range	Hz	10 to 2000								
Duration	h	2.5								
Acceleration (amplitude)	m/s <sup>2</sup>	200								
<b>Load limits</b> <sup>11)</sup>										
<b>Nominal (rated) torque M<sub>nom</sub></b>	kN·m	15	20	25	30	40	50	60	70	80
<b>Limit torque</b>	kN·m	32			60			110		
<b>Max. limit load of measuring body</b> <sup>12)</sup>	kN·m	100			200			350		
<b>Breaking torque (static)</b>	kN·m	>100			>200			>350		
<b>Longitudinal limit force (static)</b>	kN	60			120			240		
<b>Lateral limit force (static)</b>	kN	80			160			240		
<b>Limit bending moment (static)</b>	N·m	6000			12000			24000		
<b>Oscillation width</b> , per DIN 50100 (peak-to-peak) <sup>13)</sup>	kN·m	30	32		60			100		

<sup>9)</sup> Heat conductance via the stator base plate necessary over 70°C. The temperature of the base plate must not exceed 85°C.

<sup>10)</sup> The antenna ring and connector plug must be fixed.

<sup>11)</sup> Each type of irregular stress (bending moment, lateral or longitudinal force, exceeding nominal (rated) torque) can only be permitted up to its specified 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 effects of permissible bending moments, longitudinal and lateral forces on the measurement result are  $\leq \pm 1\%$  of the nominal (rated) torque. The load limits only apply for the nominal (rated) temperature range. At temperatures  $<10^\circ\text{C}$ , the load limits must be reduced by approx. 30% (strength reduction).

<sup>12)</sup> The data refer to static loading of the measuring body; note the bolted connection!

<sup>13)</sup> The nominal (rated) torque must not be exceeded.

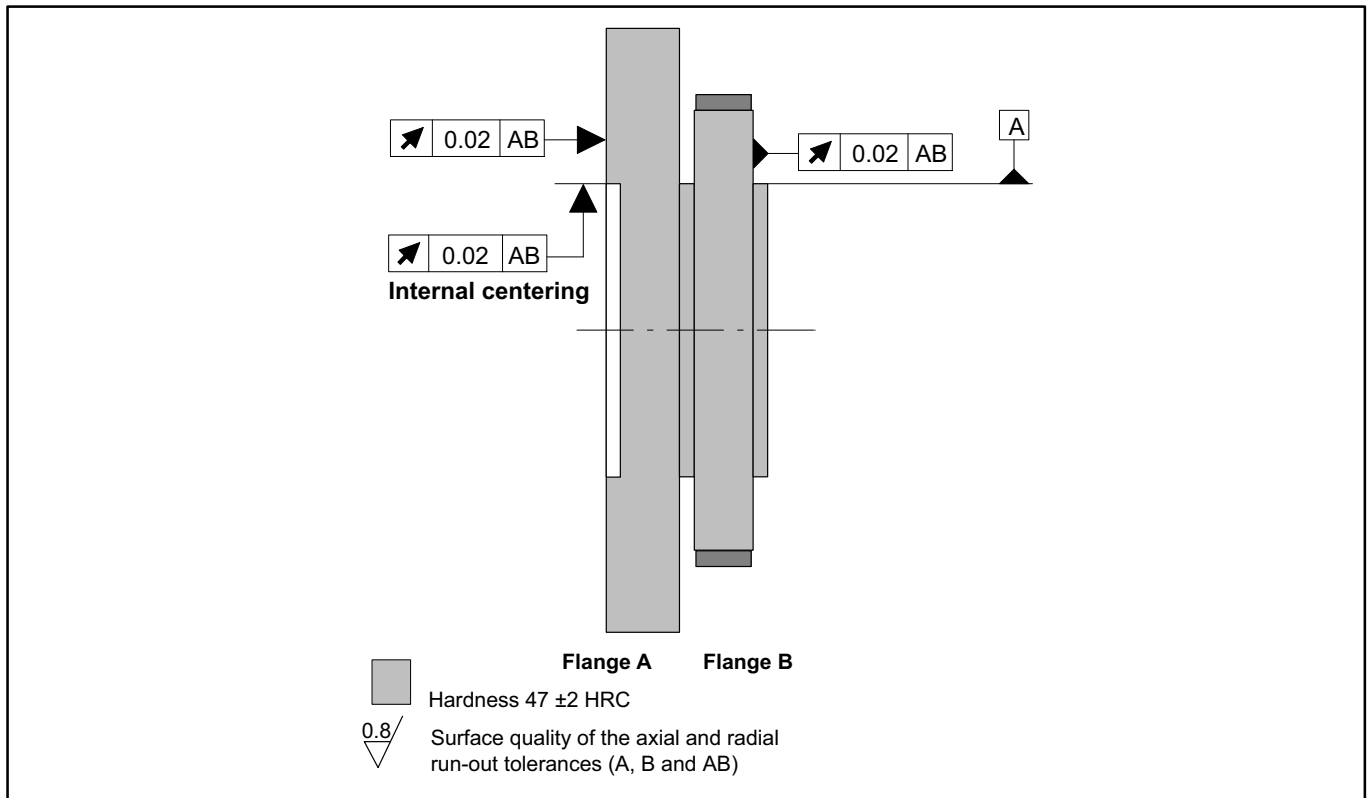
## Specifications (continued)

Mechanical values										
Nominal (rated) torque $M_{nom}$	kN·m	15	20	25	30	40	50	60	70	80
Torsional stiffness $c_T$	kN·m/rad	32050			63260			106200		
Torsion angle at $M_{nom}$	degrees	0.027	0.036	0.045	0.027	0.036	0.045	0.033	0.038	0.043
Stiffness in the axial direction $c_a$	kN/mm	1380			1710			2280		
Stiffness in the radial direction $c_r$	kN/mm	3900			5080			6170		
Stiffness during the bending moment round a radial axis $c_b$	kN·m/degrees	94			188			290		
Maximum deflection at longitudinal limit force	mm	<0.05			<0.08			<0.12		
Additional max. radial deviation at lateral limit force	mm	<0.05			<0.05			<0.05		
Additional maximum plumb/parallel deviation at limit bending moment	mm	<0.5						<0.7		
Balance quality level, as per DIN ISO 1940		G 6.3								
Permissible max. rotor vibration displacement (peak-to-peak) <sup>14)</sup> Undulations in the connection flange area, based on ISO 7919-3										
Normal operation (continuous operation)	µm	$s_{(p-p)} = \frac{9000}{\sqrt{n}}$ (n in rpm)								
Start and stop operation/resonance ranges (temporary)	µm	$s_{(p-p)} = \frac{13200}{\sqrt{n}}$ (n in rpm)								
Mass moment of inertia of rotor $J_v$ (around the rotary axis; does not take flange bolts into account)										
without rotational speed measuring system	kg·m <sup>2</sup>	0.20			0.46			0.75		
with rotational speed measuring system	kg·m <sup>2</sup>	0.22			0.51			0.81		
Proportional mass moment of inertia for the transmitter side (side of the flange with external centering)										
without rotational speed measuring system	% of $J_v$	28			23			26		
with rotational speed measuring system	% of $J_v$	37			30			32		
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 <sup>15)</sup>										
without rotational speed measuring system	mm	±2								
Weight										
Rotor without rotational speed measuring system	kg	18			28			39		
Rotor with rotational speed measuring system	kg	20			32			42		
Stator	kg	1.8			2.1			3.0		

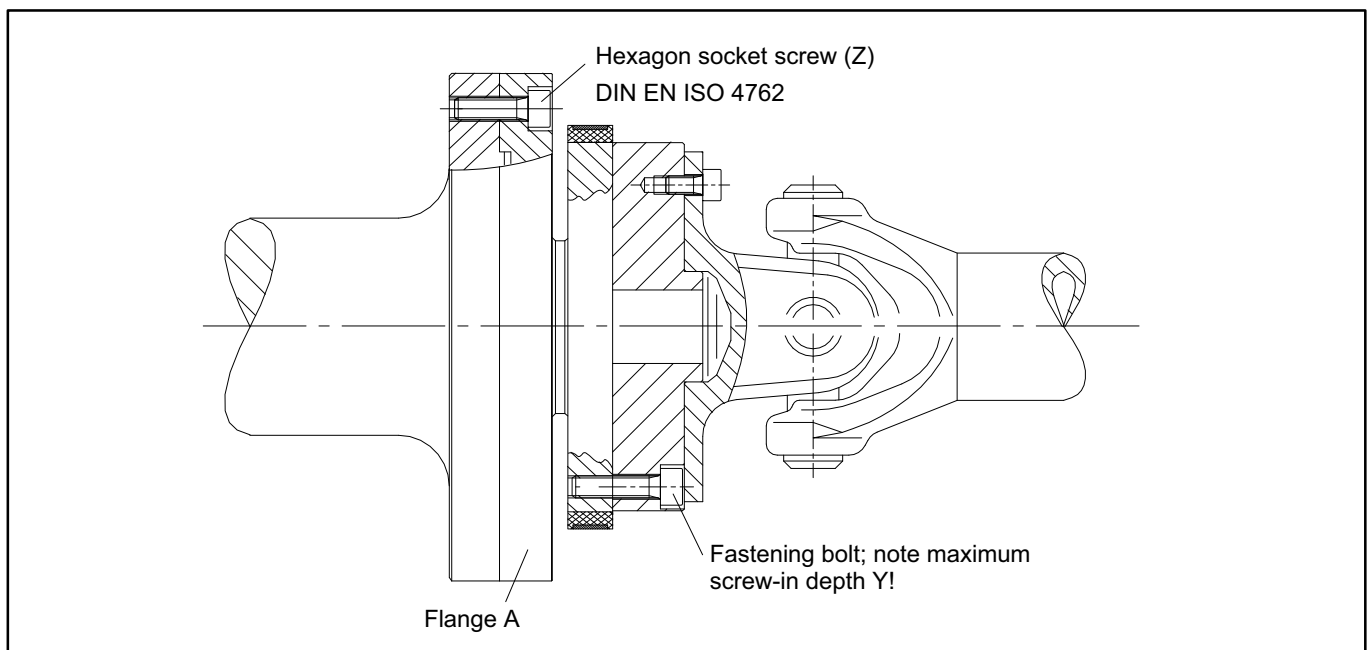
<sup>14)</sup> The influence of radial deviations, impact, defects of form, notches, marks, local residual magnetism, structural variations or material anomalies on the vibrational measurements needs to be taken into account and isolated from the actual undulation.

<sup>15)</sup> Above the nominal (rated) temperature range ±1.5 mm.

## Radial and axial run-out tolerances



## Fastening bolts

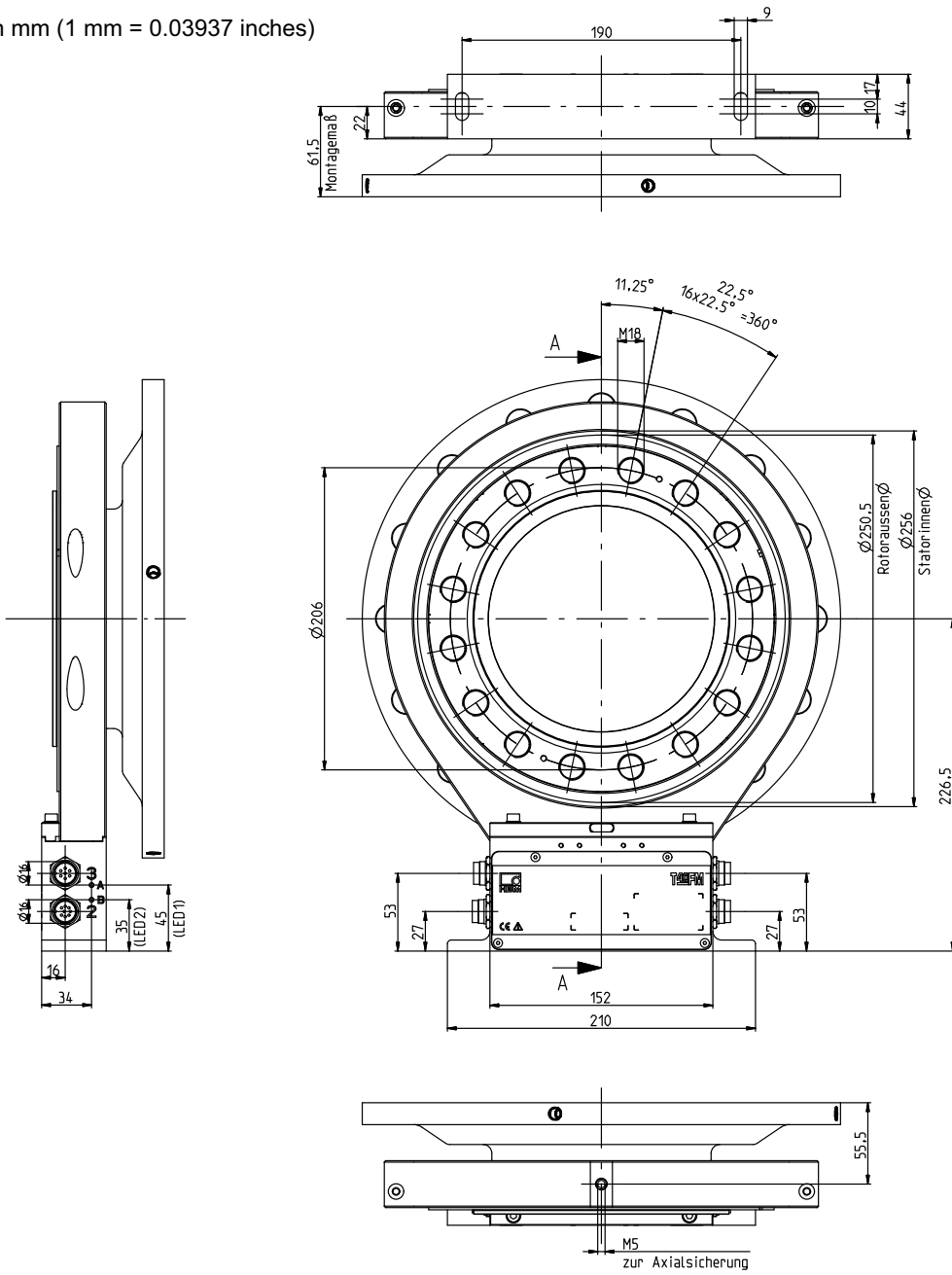


Measuring range (kN·m)	Fastening bolts (Z) <sup>1)</sup>	Fastening bolts property class	Prescribed tightening moment (N·m)
15/20/25	M18	10.9	400
30/40/50	M20		560
60/70/80	M22		760

1) DIN EN ISO 4762; black/oiled/ $\mu_{tot}=0.125$

# Dimensions T40FM 15 kNm - 25 kNm without rotational speed measurement

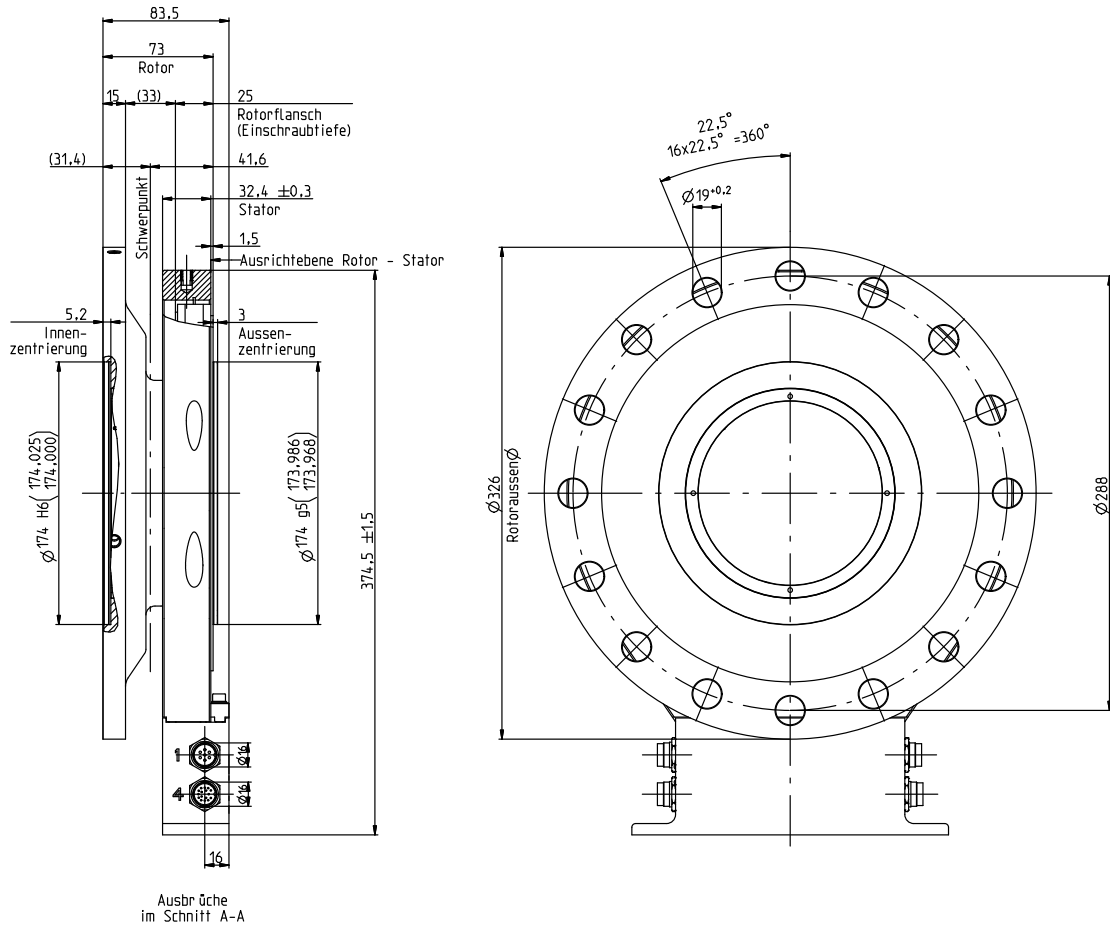
Dimensions in mm (1 mm = 0.03937 inches)





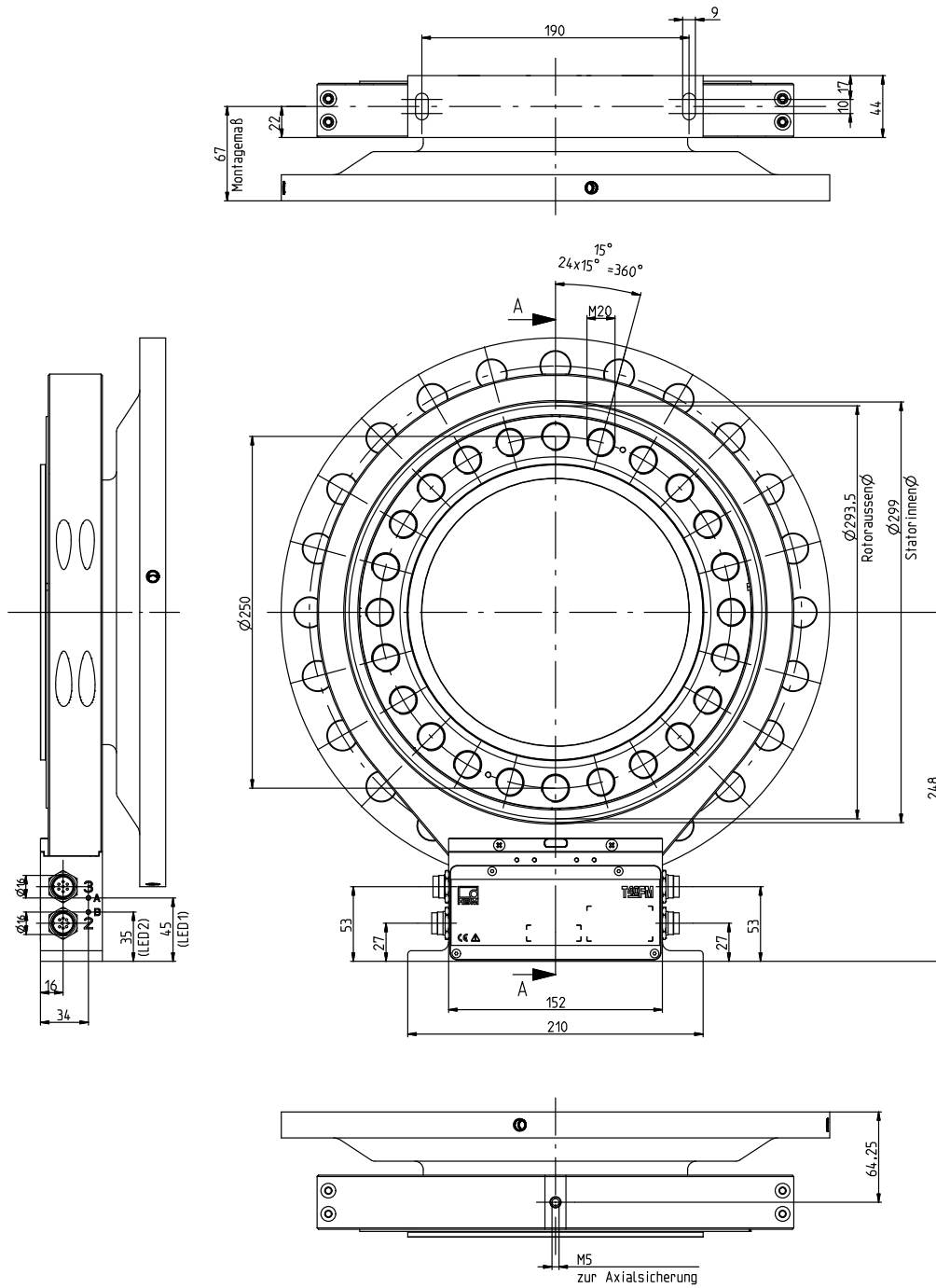
# Dimensions T40FM 15 kNm - 25 kNm without rotational speed measurement (cont.)

Dimensions in mm (1 mm = 0.03937 inches)



# Dimensions T40FM 30 kNm - 50 kNm without rotational speed measurement

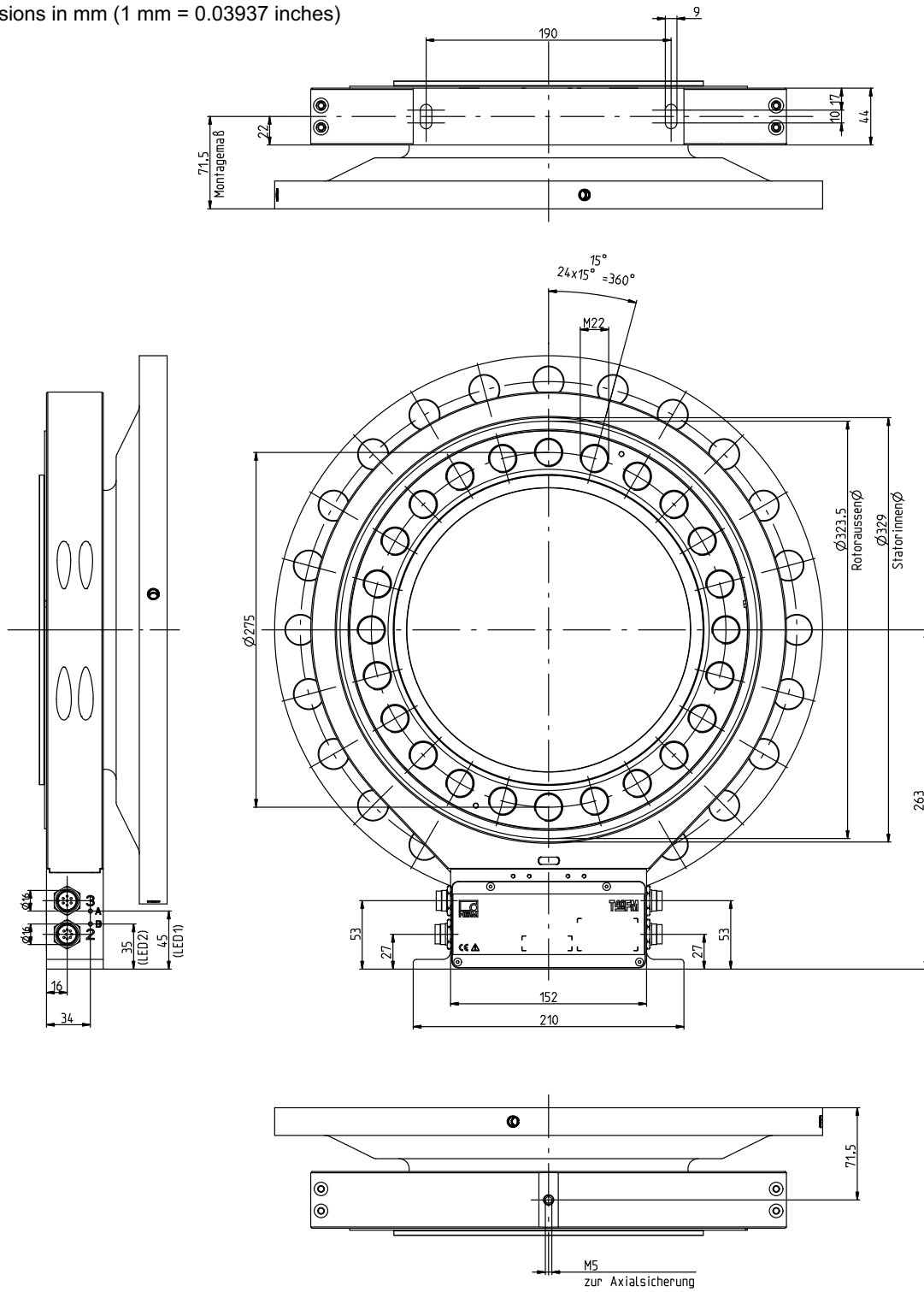
Dimensions in mm (1 mm = 0.03937 inches)





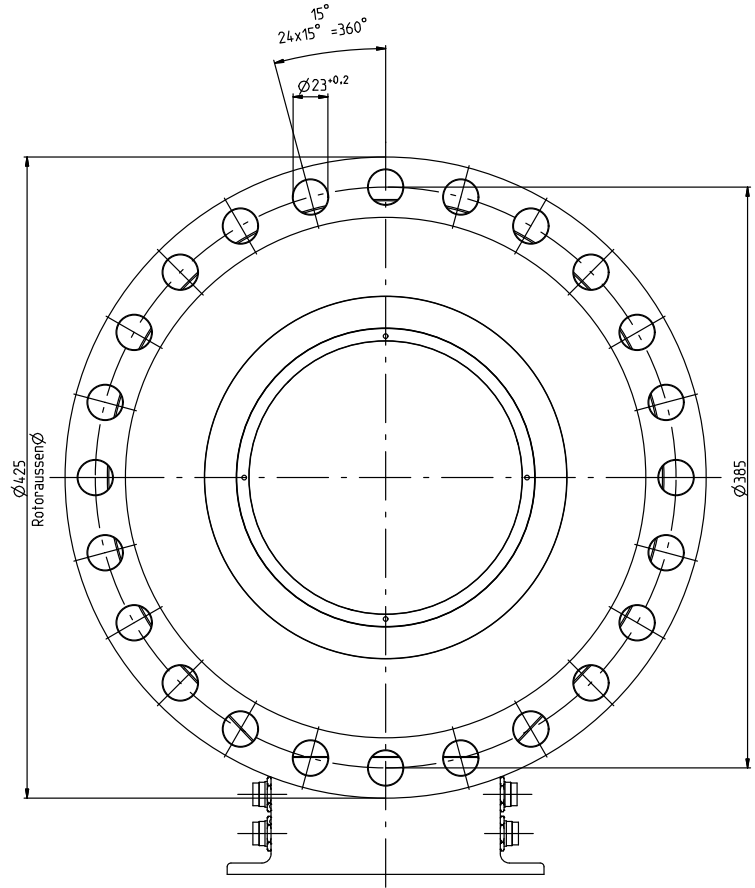
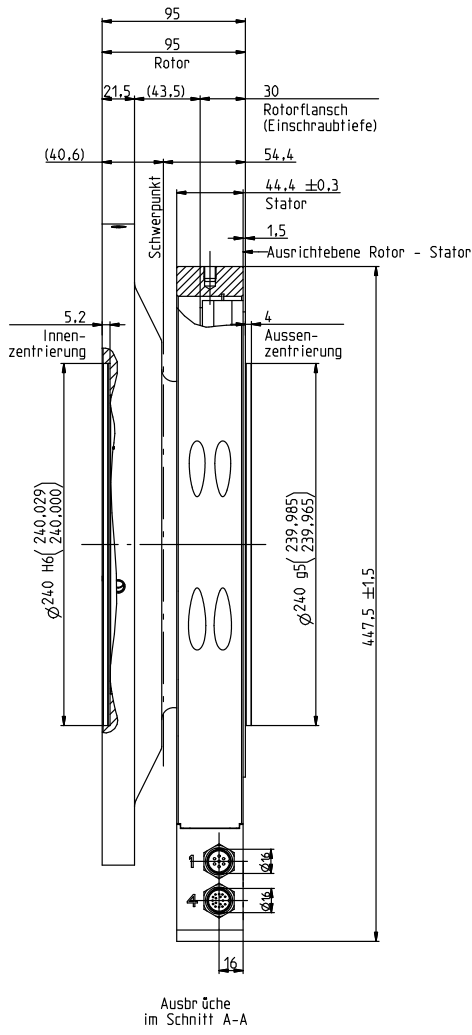
# Dimensions T40FM 60 kNm - 80 kNm without rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)



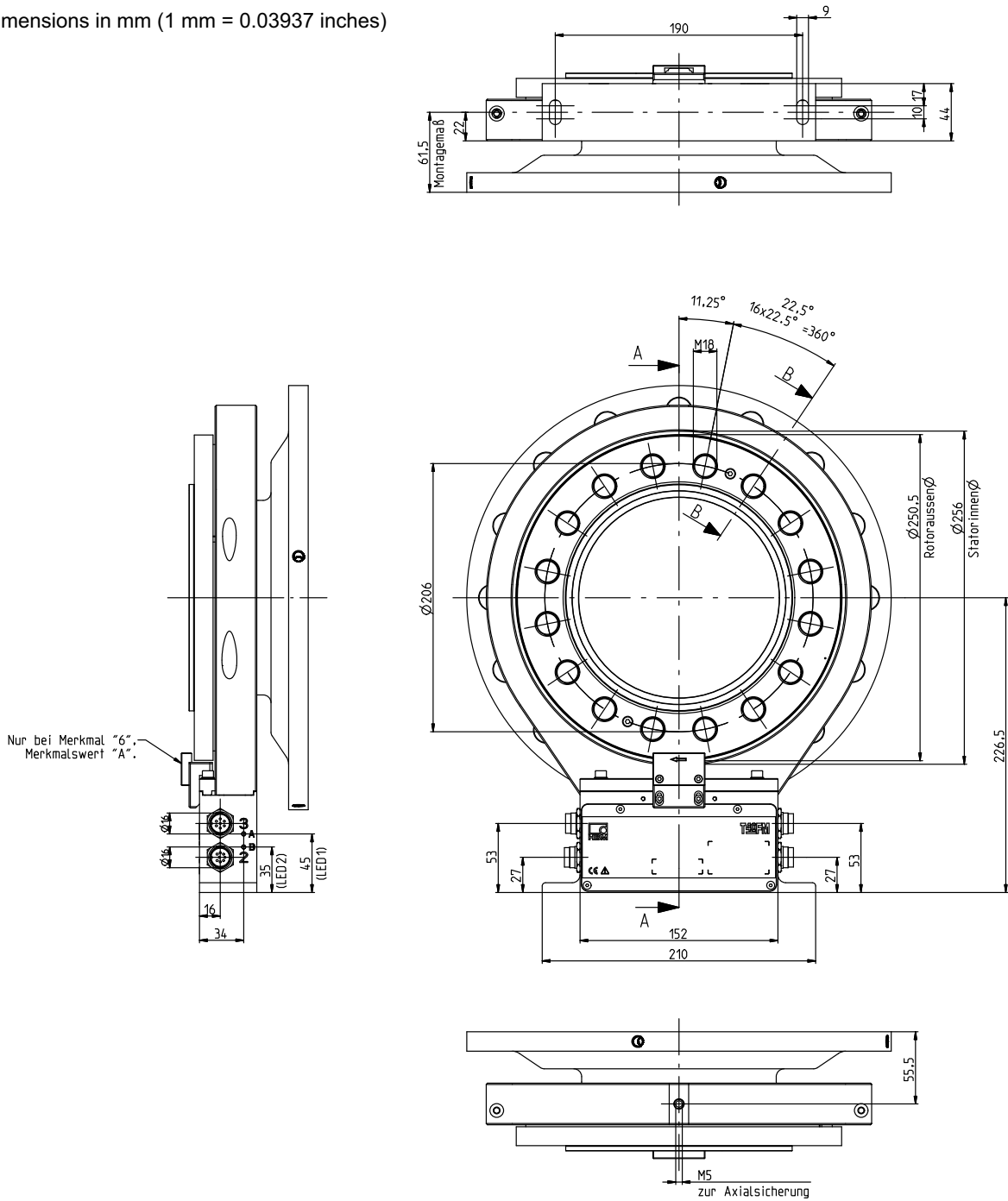
# Dimensions T40FM 60 kNm - 80 kNm without rotational speed measurement (cont.)

Dimensions in mm (1 mm = 0.03937 inches)



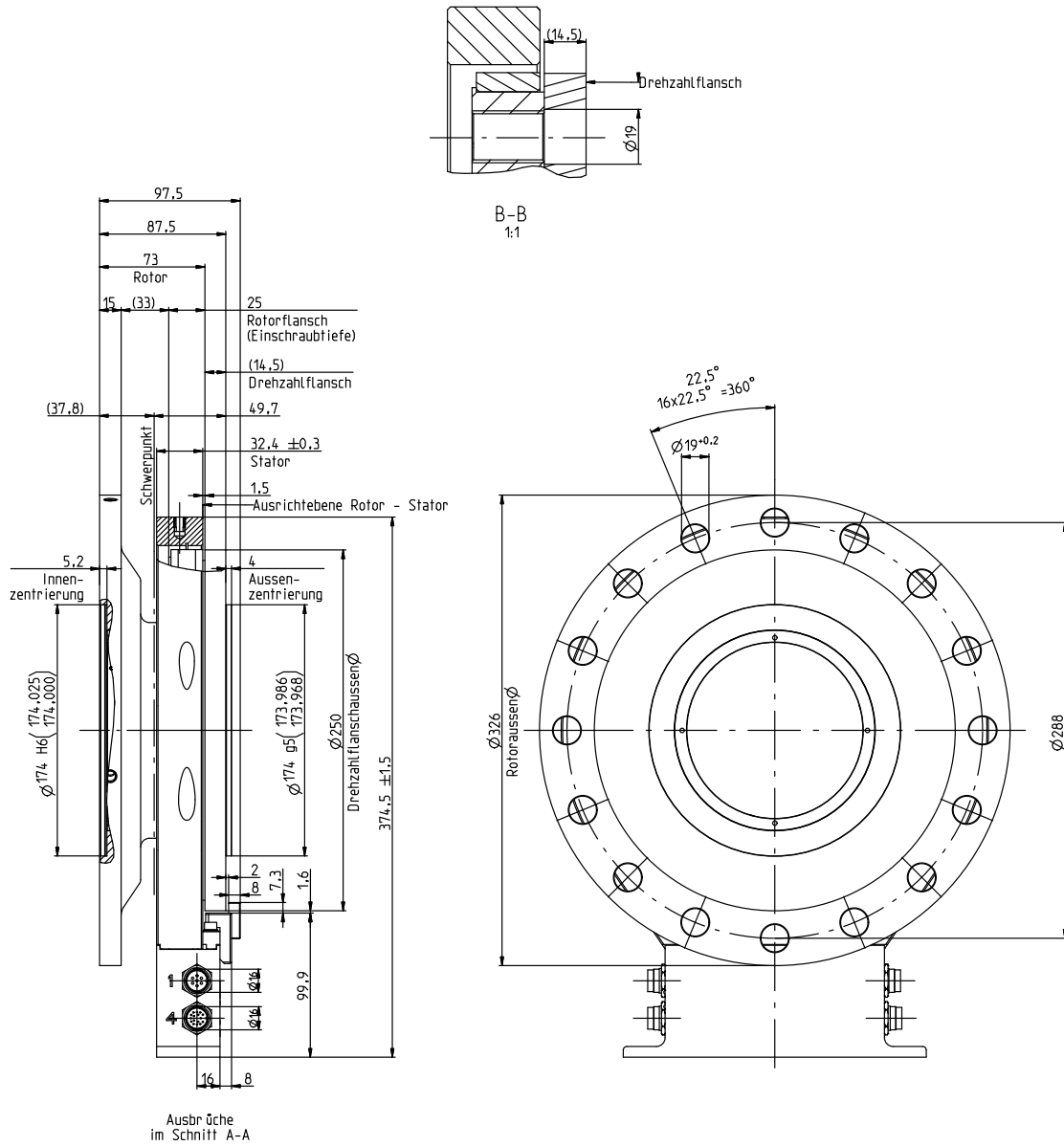
# Dimensions T40FM 15 kNm - 25 kNm with rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)



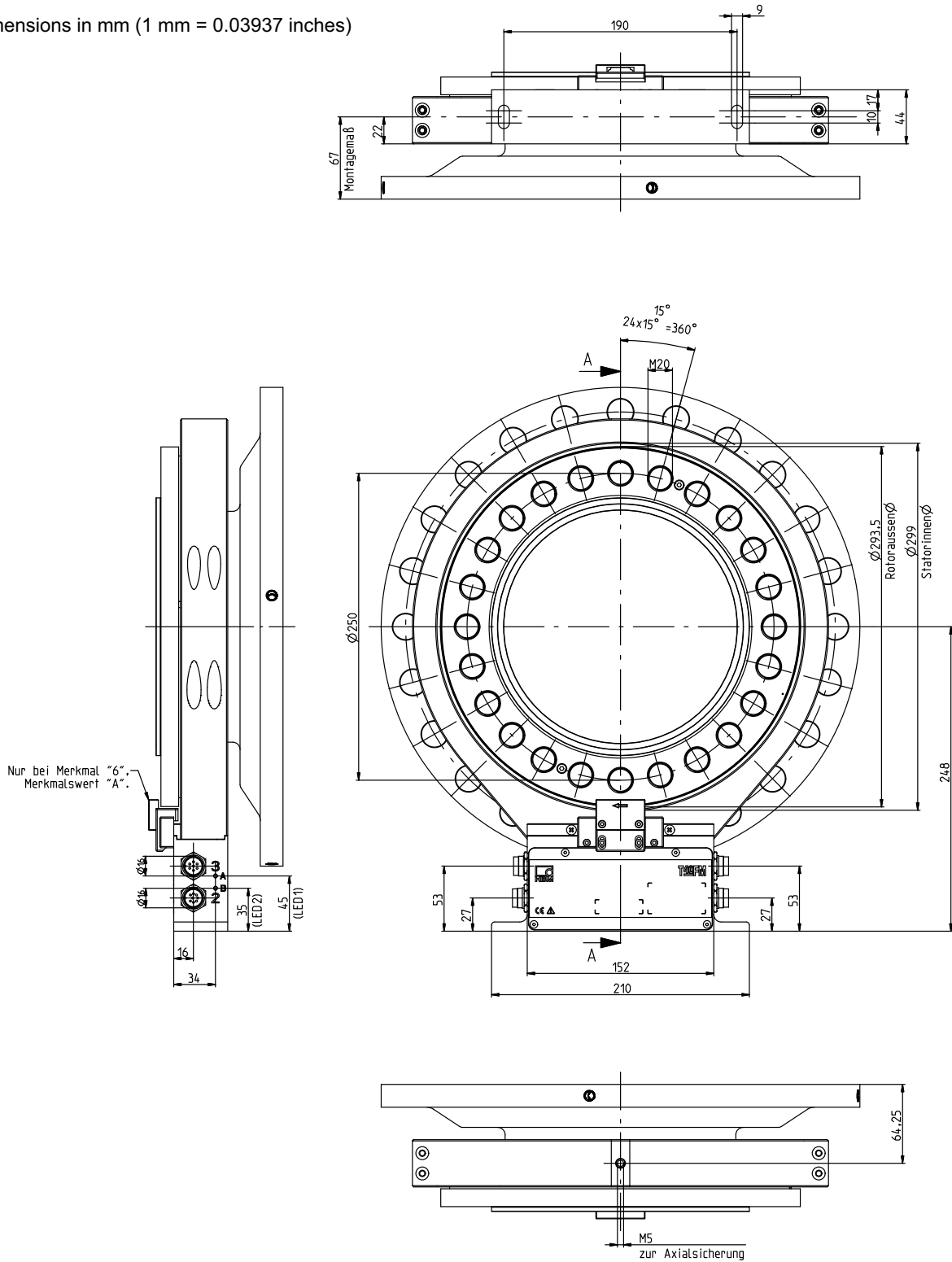
# Dimensions T40FM 15 kNm - 25 kNm with rotational speed measurement (cont.)

Dimensions in mm (1 mm = 0.03937 inches)



# Dimensions T40FM 30 kNm - 50 kNm with rotational speed measurement

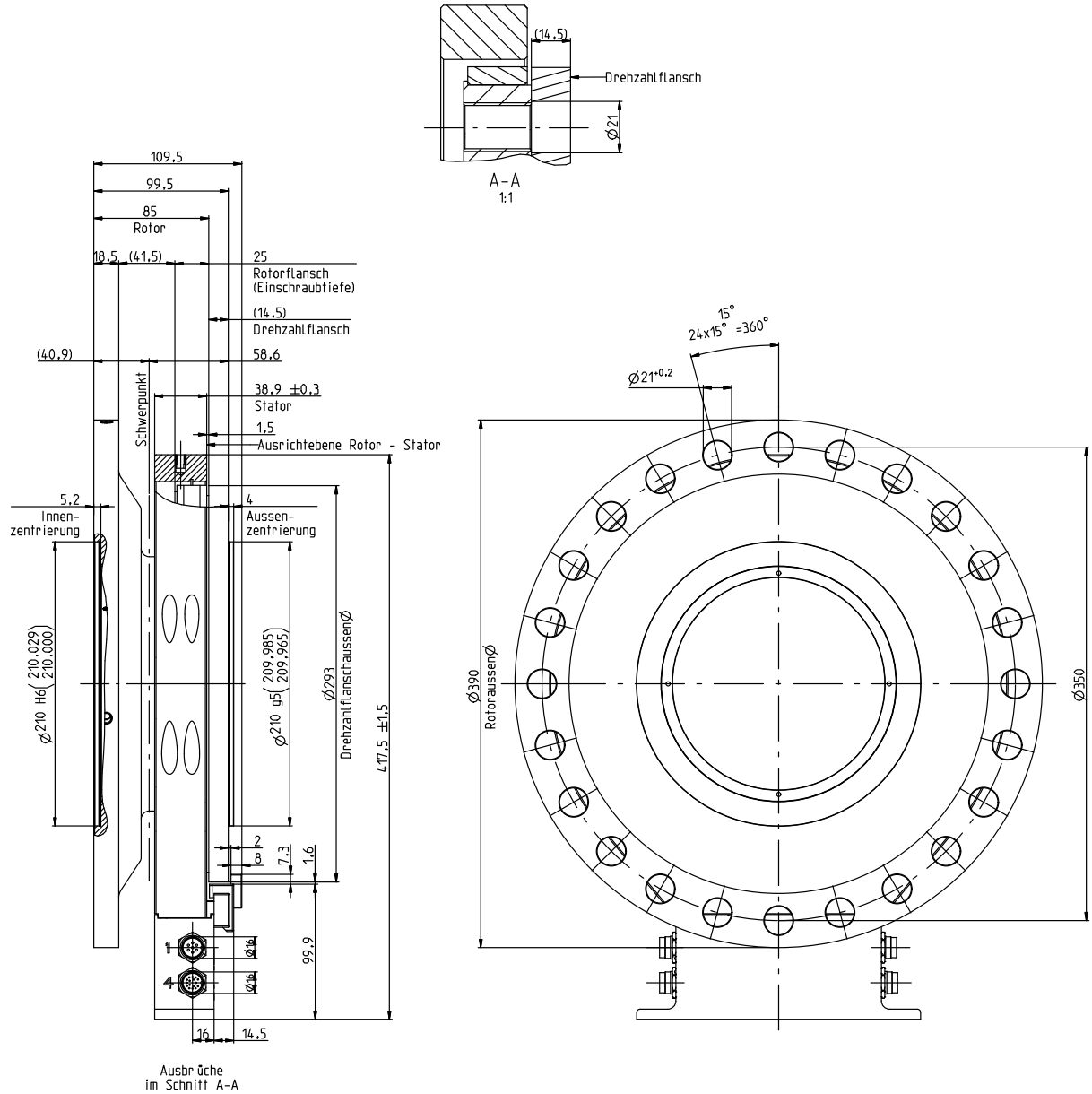
Dimensions in mm (1 mm = 0.03937 inches)





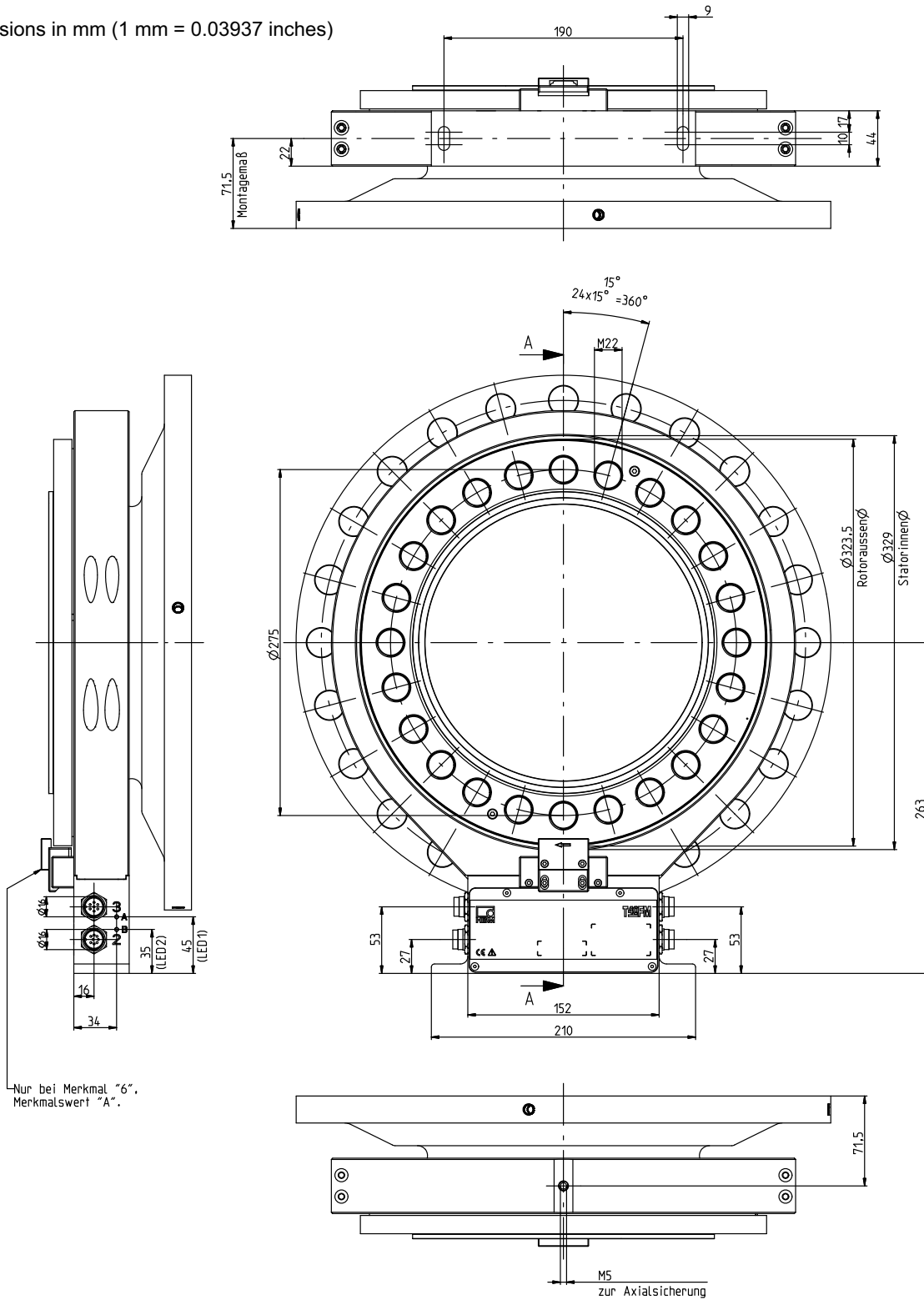
# Dimensions T40FM 30 kNm - 50 kNm with rotational speed measurement (cont.)

Dimensions in mm (1 mm = 0.03937 inches)



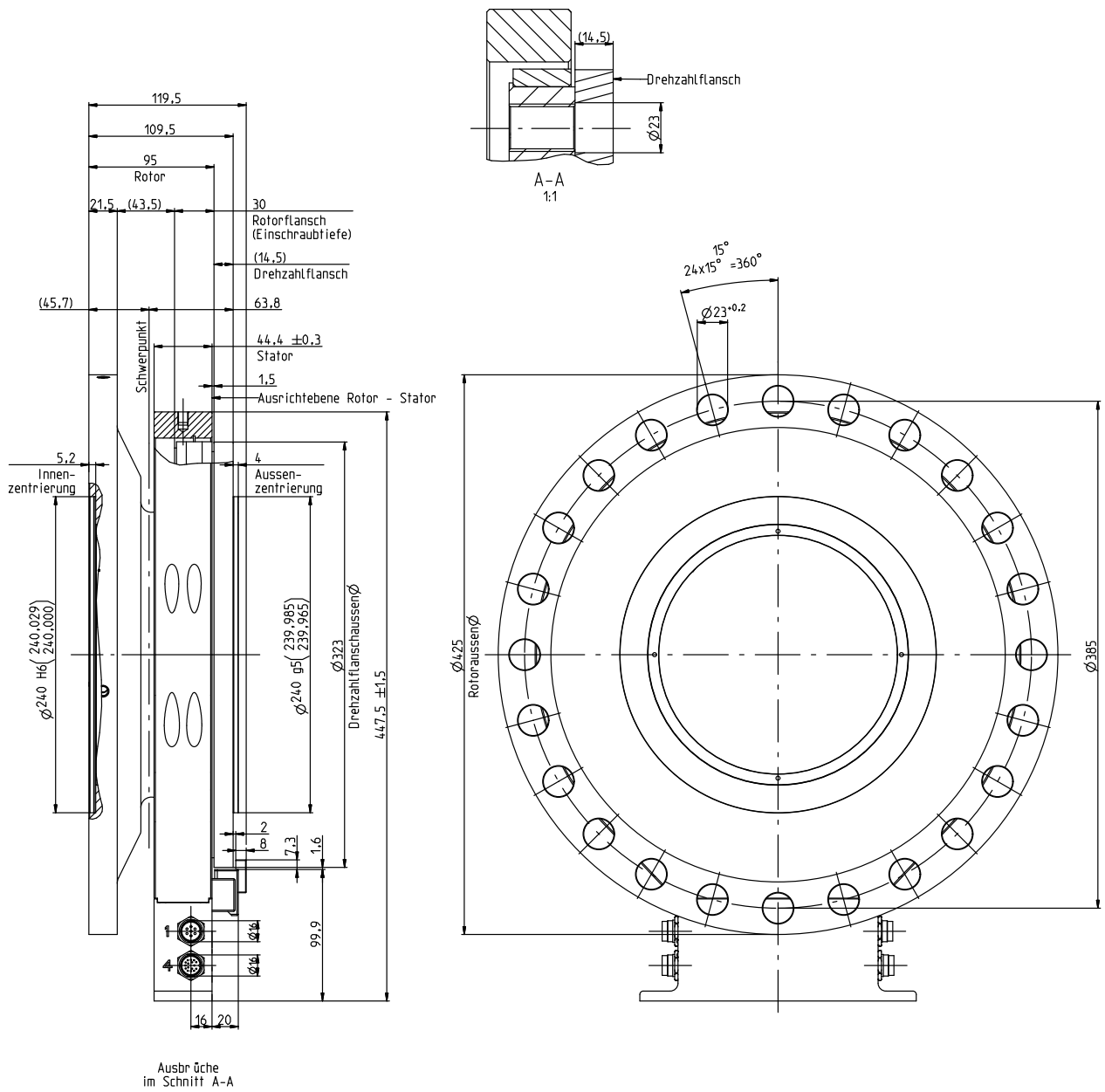
# Dimensions T40FM 60 kNm - 80 kNm with rotational speed measurement

Dimensions in mm (1 mm = 0.03937 inches)



# Dimensions T40FM 60 kNm - 80 kNm with rotational speed measurement (cont.)

Dimensions in mm (1 mm = 0.03937 inches)



# Ordering number

Order no.
<b>K-T40FM</b> <span style="float: right;">[only with Option 2 = MF/ST]</span>

Code	Option 1: Measuring range up to	
<b>015R</b>	15 kN·m	[only with Option 2 = MF/ST]
<b>020R</b>	20 kN·m	[only with Option 2 = MF/ST]
<b>025R</b>	25 kN·m	[only with Option 2 = MF/ST]
<b>030R</b>	30 kN·m	[only with Option 2 = MF/ST]
<b>040R</b>	40 kN·m	[only with Option 2 = MF/ST]
<b>050R</b>	50 kN·m	[only with Option 2 = MF/ST]
<b>060R</b>	60 kN·m	[only with Option 2 = MF/ST]
<b>070R</b>	70 kN·m	[only with Option 2 = MF/ST]
<b>080R</b>	80 kN·m	[only with Option 2 = MF/ST]

Code	Option 2: Component
<b>MF</b>	Measurement flange, complete
<b>RO</b>	Rotor
<b>ST</b>	Stator

Code	Option 3: Accuracy
<b>S</b>	Standard
<b>G</b>	Linearity deviation including hysteresis $< \pm 0.05$

Code	Option 4: Adjustment
<b>M</b>	Metric (N·m)

Code	Option 5: Electrical configuration	[only with Option 2 = MF/ST]
<b>SU2</b>	10 kHz $\pm 5$ kHz and $\pm 10$ V output signal, 18...30 V DC supply voltage	
<b>DU2</b>	60 kHz $\pm 30$ kHz and $\pm 10$ V output signal, 18...30 V DC supply voltage	
<b>HU2</b>	240 kHz $\pm 120$ kHz and $\pm 10$ V output signal, 18...30 V DC supply voltage	

Code	Option 6: Rotational speed measuring system
<b>0</b>	Without rotational speed measuring system
<b>1</b>	Magnetic rotational speed measuring system; 1024 pulses/revolution
<b>A</b>	Magnetic rotational speed measuring system; 1024 pulses/revolution with reference pulse

Code	Option 7: Customized modification
<b>S</b>	No customer-specific modification
<b>H</b>	Permissible rotational speed depending on measuring range 4500 rpm to 8000 rpm

K-T40FM - 0 3 0 R - M F - S - M - D U 2 - 0 - S

= PREFERENCE Types

## Accessories, to be ordered separately

Article	Order no.
<b>Connection cable for torque output</b>	
Torque connection cable, 423 – D-Sub 15P, 6 m	1-KAB149-6
Torque connection cable, 423 – free ends, 6 m	1-KAB153-6
<b>Connection cable for rotational speed output</b>	
Rotational speed connection cable, 423 – D-Sub 15P, 6 m	1-KAB150-6
Rotational speed connection cable, 423 – free ends, 6 m	1-KAB154-6
Rotational speed with reference signal connection cable, 423 8-pin – D-Sub 15P, 6 m	1-KAB163-6
Rotational speed with reference signal connection cable, 423 8-pin – free ends, 6 m	1-KAB164-6
<b>TMC connection cable</b>	
TIM40/TMC connection cable, 6 m	1-KAB174-6
<b>Cable sockets</b>	
423G-7S, 7-pin (straight)	3-3101.0247
423W-7S, 7-pin (angular)	3-3312.0281
423G-8S, 8-pin (straight)	3-3312.0120
423W-8S, 8-pin (angular)	3-3312.0282
<b>Connection cable, by the meter (min. order quantity: 10 m)</b>	
Kab8/00-2/2/2	4-3301.0071

Subject to modifications.  
All product descriptions are for general information  
only. They are not to be understood as a guarantee  
of quality or durability.

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