

# 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
- Compact design
- High permissible lateral forces
- High radial and torsional stiffness
- No bearings or slip rings
- Digital transmission of measured values
- Large measurement frequency range up to 6 kHz (-3 dB)
- Optional: magnetic rotational speed measuring system

## Overall concept



# Specifications

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

<sup>1)</sup> Output signal range in which there is a repeatable correlation between torque and output signal.

## Specifications (continued)

Torque measuring system, voltage output										
<b>Nominal (rated) sensitivity</b> (spread 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)	%	$\pm 0.2$								
<b>Non-linearity including hysteresis</b> , relative to the nominal (rated) sensitivity	%	$< \pm 0.1$								
	Optional	$< \pm 0.05$								
<b>Relative standard deviation of reproducibility (variability)</b> , per DIN 1319, relative to the variation in the output signal	%	$< \pm 0.05$								
<b>Output signal at torque zero</b>	V	0								
<b>Nominal output signal</b> with positive nominal (rated) torque	V	10								
	with negative nominal (rated) torque	V	-10							
<b>Maximum modulation range</b> <sup>2)</sup> <b>invalid measured value</b>	V	$\pm 12$								
	V	13 ... 15								
<b>Load resistance</b>	k $\Omega$	$> 10$								
<b>Residual ripple</b> <sup>3)</sup>	mV	$< 40$ (peak-to-peak)								
<b>Temperature effect per 10 K in the nominal (rated) temperature range</b> <b>on the output signal</b> , relative to the actual value of the signal range	%	$< \pm 0.2$								
	<b>on the zero signal</b> , relative to the nominal (rated) sensitivity	%	$< \pm 0.15$							
<b>Long-term drift over 48 h at reference temperature</b> , relative to nominal (rated) sensitivity	%	$\leq 0.03$								
Rotational speed measuring system										
<b>Nominal (rated) torque <math>M_{nom}</math></b>	kN·m	15	20	25	30	40	50	60	70	80
<b>Measurement system</b>		Magnetic, via AMR sensor (Anisotropic Resistive Effect) and magnetized plastic ring with embedded steel ring								
<b>Magnetic poles</b>		158			186			204		
<b>Maximum position deviation of the poles</b>		$\pm 50$ angular seconds								
<b>Output signal</b>	V	5 V symmetrical (RS-422); 2 square wave signals approx. 90° phase shifted								
<b>Pulses per revolution</b>		1024								
<b>Minimum rotational speed for sufficient pulse stability</b>	rpm	0								
<b>Pulse tolerance</b> <sup>4)</sup>	degrees	$< \pm 0.05$								
<b>Maximum permissible output frequency</b>	kHz	420								
<b>Group delay</b>	$\mu$ s	$< 150$								
<b>Radial nominal (rated) distance between sensor head and magnetic ring</b> (mechanical distance)	mm	1.6								
<b>Working distance range between sensor head and magnetic ring</b> <sup>5)</sup>	mm	0.4 ... 2.5								
<b>Max. permissible axial displacement of the rotor to the stator</b> <sup>6)</sup>	mm	$\pm 1.5$								
<b>Hysteresis of reversing the direction in the case of relative vibrations between the rotor and the stator</b> Torsional vibration of the rotor	degrees	$< \text{approx. } 0.2$								
	Horizontal stator vibration displacement	mm	$< \text{approx. } 0.5$							
<b>Load resistance</b> <sup>7)</sup>	k $\Omega$	$\geq 2$								

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

3) Signal frequency range 0.1 to 10 kHz.

4) At nominal conditions.

5) The pulse tolerance improves with reduced distance and vice versa.

6) The data refers only to a central axial alignment. Deviations lead to a change in pulse tolerance.

7) Note the termination resistances as per RS-422.

## Specifications (continued)

Application limitations											
Reference temperature	°C	+20									
Nominal temperature range	°C	+10 ... +70									
Operating temperature range <sup>8)</sup>	°C	-20 ... +85									
Storage temperature range	°C	-40 ... +85									
Permissible ambient humidity Relative humidity / no condensation	%	5 ... 95									
Load limits <sup>9)</sup>											
Nominal (rated) torque $M_{nom}$	kN·m	15	20	25	30	40	50	60	70	80	
Limit torque	kN·m	32			60			110			
Max. limit load of measuring body <sup>10)</sup>	kN·m	100			200			350			
Breaking torque (static)	kN·m	>100			>200			>350			
Longitudinal limit force (static)	kN	60			120			240			
Lateral limit force (static)	kN	80			160			240			
Limit bending moment (static)	N·m	6000			12000			24000			
Oscillation width, per DIN 50100 (peak-to-peak) <sup>11)</sup>	kN·m	30	32		60			100			
Protection class, as per EN 60529 (rotor/stator)	-	IP 54									
Shunt											
Nominal (rated) trigger voltage	V	5									
Trigger voltage limit	V	36									
Calibration signal on	$V_{min}$	>2.5									
Calibration signal off	$V_{max}$	<0.7									
Tolerance of the shunt signal, relative to $M_{nom}$ at reference temperature	%	< ± 0.05									
Energy supply											
Nominal (rated) supply voltage (separated extra-low voltage)	$V_{DC}$	18 to 30									
Rated current consumption	In measuring mode	<1 (typ. 0.3 at 20 V supply voltage)									
	In startup mode	<4 (typ. 2) for max. 50 $\mu$ s									
Nominal (rated) power consumption	W	<10 (typ. 6)									
Maximum cable length	m	50									

<sup>8)</sup> Heat conductance via the stator base plate necessary over 70°C. The temperature of the base plate must not exceed 85°C.

<sup>9)</sup> Each type of irregular stress (bending moment, lateral or longitudinal force, exceeding nominal (rated) torque) can only be permitted up to its specified static 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. 1 % of the nominal (rated) torque. The load limits only apply for the nominal (rated) temperature range. At temperatures <10°C, the load limits must be reduced by approx. 30% (viscosity reduction).

<sup>10)</sup> The data refer to static loading of the measuring body; note the screw connection!

<sup>11)</sup> The nominal (rated) torque must not be exceeded.

## Specifications (continued)

General information										
<b>EMC</b>										
Emission, as per EN 61326-1, Section 7 RFI field strength	-	Class B								
<b>Immunity from interference</b> , as per EN 61326-1, EN 61326-2-3										
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 sweeps (burst)	kV	1								
Impulse voltages (surge)	kV	1								
Conducted interference (AM)	V	10								
<b>Mechanical shock</b> , as per EN 60068-2-72 <sup>12)</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>12)</sup>										
Frequency range	Hz	10 ... 2000								
Duration	h	2.5								
Acceleration (amplitude)	m/s <sup>2</sup>	200								
Mechanical data										
<b>Nominal (rated) torque M<sub>nom</sub></b>	kN-m	15	20	25	30	40	50	60	70	80
<b>Torsional stiffness c<sub>T</sub></b>	kN-m/rad	32050			63260			106200		
<b>Torsion angle at M<sub>nom</sub></b>	degrees	0.027	0.036	0.045	0.027	0.036	0.045	0.033	0.038	0.043
<b>Stiffness in the axial direction c<sub>a</sub></b>	kN/mm	1380			1710			2280		
<b>Stiffness in the radial direction c<sub>r</sub></b>	kN/mm	3900			5080			6170		
<b>Stiffness during the bending moment round a radial axis c<sub>b</sub></b>	kN-m/degree	94			188			290		
<b>Maximum deflection at longitudinal limit force</b>	mm	<0.05			<0.08			<0.12		
<b>Additional max. radial run-out deviation at lateral limit force</b>	mm	<0.05			<0.05			<0.05		
<b>Additional maximum plumb/parallel deviation at limit bending moment</b>	mm	<0.5						<0.7		
<b>Balance quality level</b> , as per DIN ISO 1940		G 6.3								
<b>Max. permissible vibration displacement of the rotor (peak-to-peak)</b> <sup>13)</sup> Undulations in the area of the connection flange, 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)								
<b>Mass moment of inertia of rotor J<sub>v</sub></b> (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		
<b>Proportional mass moment of inertia for the transmitter side</b> (side of the flange with external centering)										
without rotational speed measuring system	% of J <sub>v</sub>	28			23			26		
with rotational speed measuring system	% of J <sub>v</sub>	37			30			32		
<b>Permissible eccentricity</b> of the rotor (radially) to the center point of the stator (without rotational speed measuring system)	mm	± 2								
<b>Permissible axial displacement</b> between rotor and stator (without rotational speed measuring system) <sup>14)</sup>	mm	± 2								
<b>Weight</b>										
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		

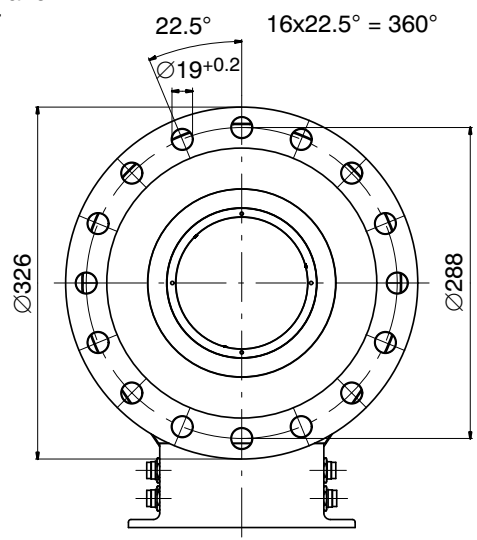
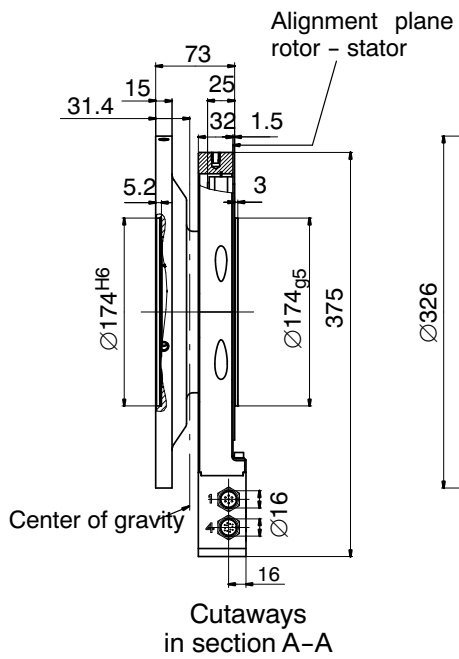
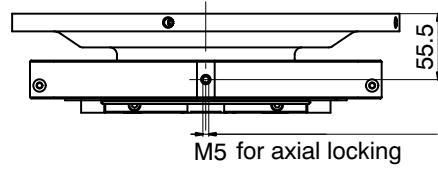
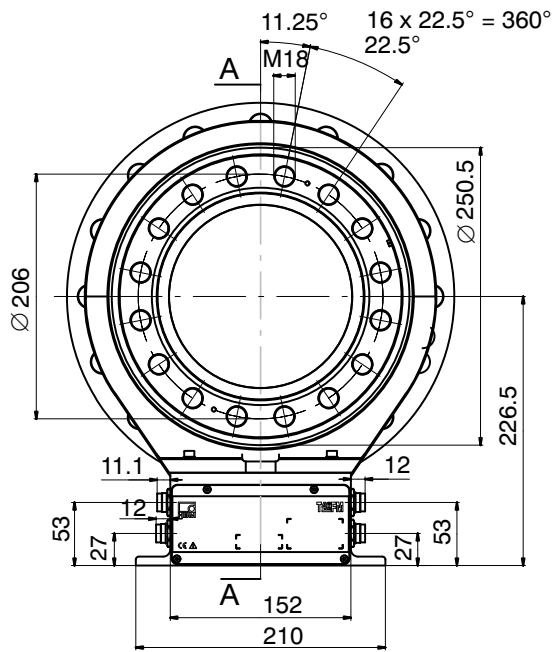
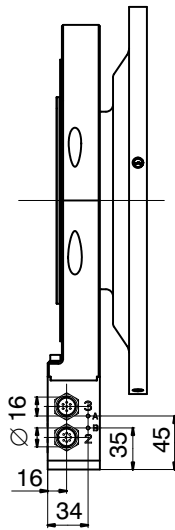
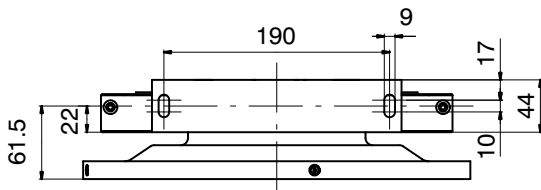
<sup>12)</sup> The antenna ring and connection plug must be fixed.

<sup>13)</sup> The influence of radial run-out deviations, eccentricity, defects of form, notches, marks, local residual magnetism, structural variations or material anomalies needs to be taken into account and isolated from the actual undulation.

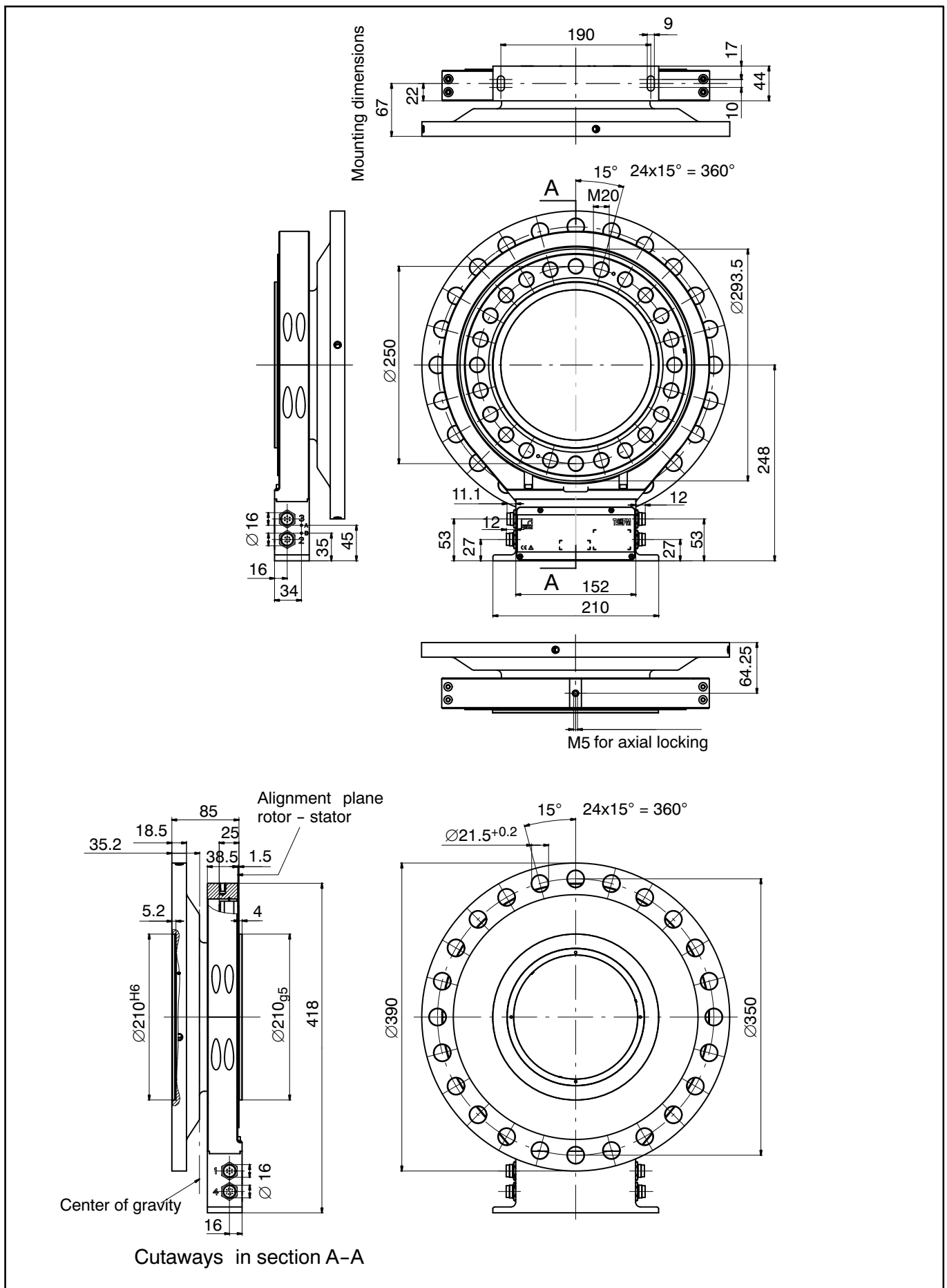
<sup>14)</sup> Above the nominal (rated) temperature range ±1.5 mm.

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

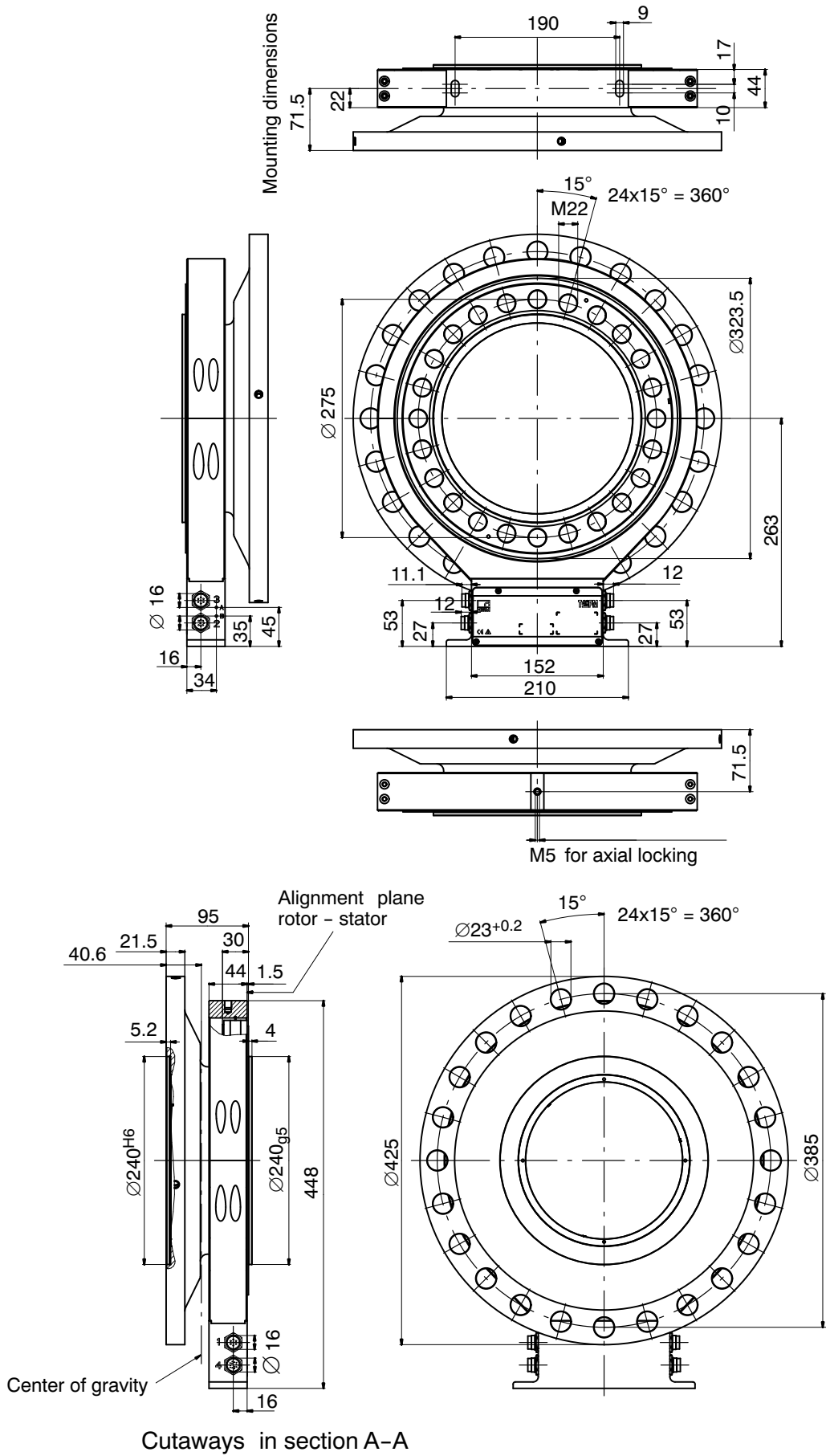
Mounting dimensions



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

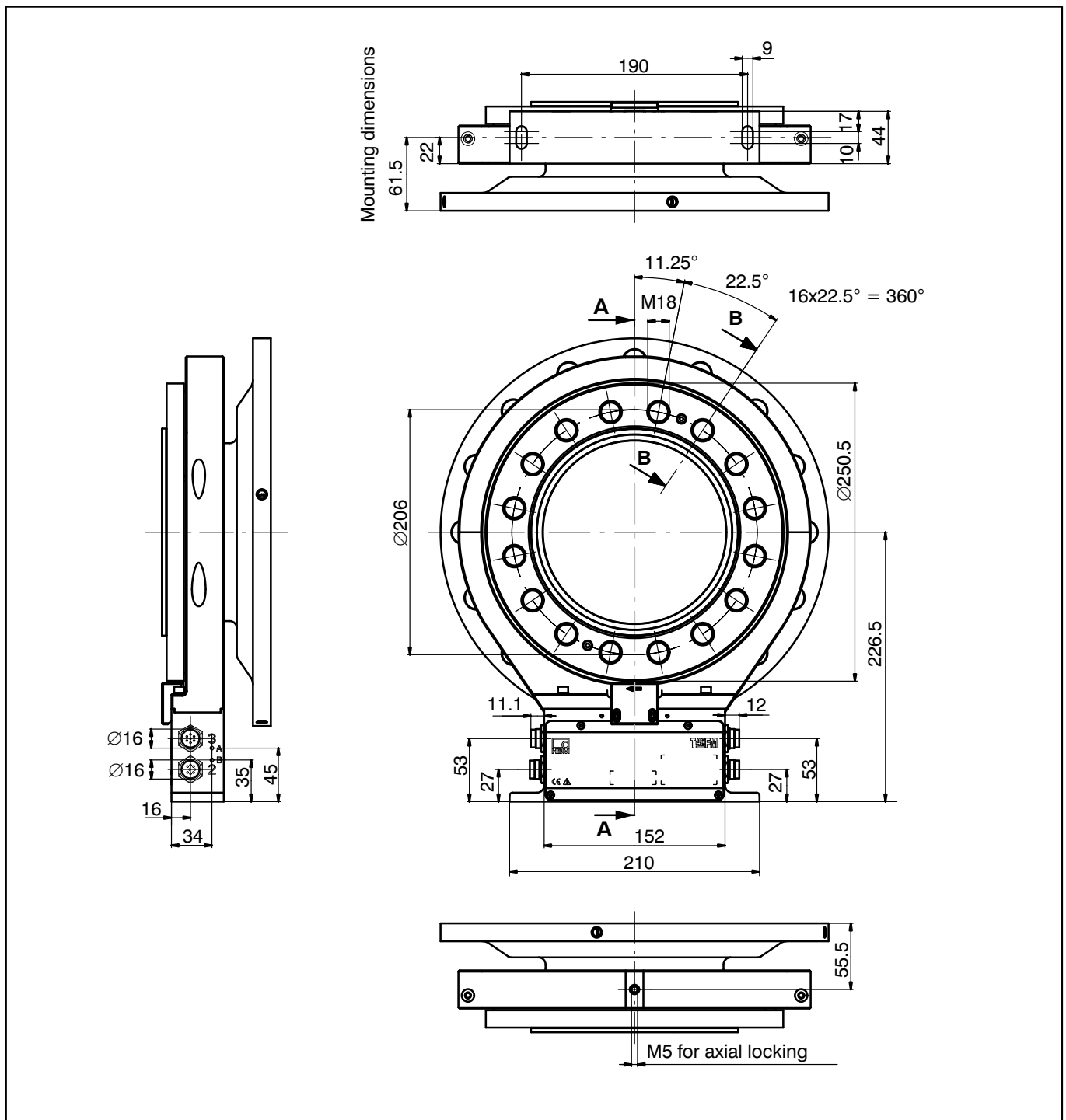


# Dimensions T40FM 60kNm - 80 kNm without rotational speed measurement

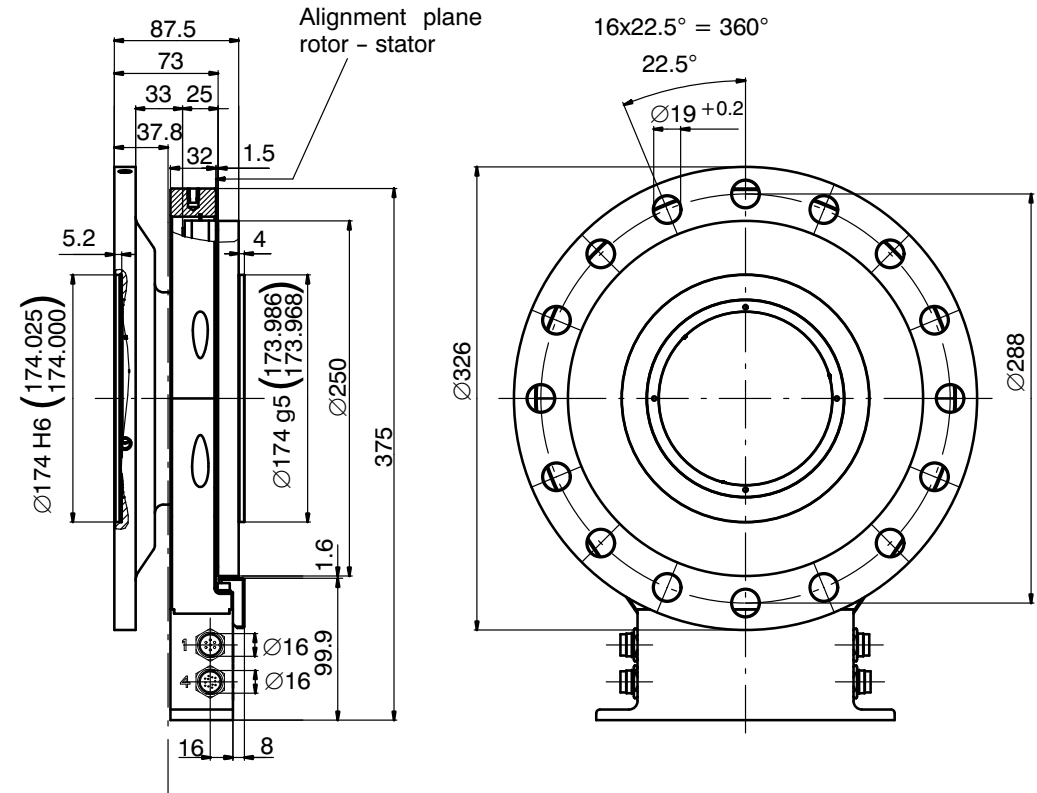




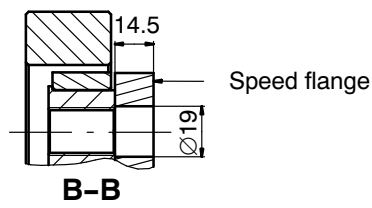
# Dimensions T40FM 15 kNm – 25 kNm with rotational speed measurement



Dimensions T40FM 15 kNm – 25 kNm with rotational speed measurement (continued)

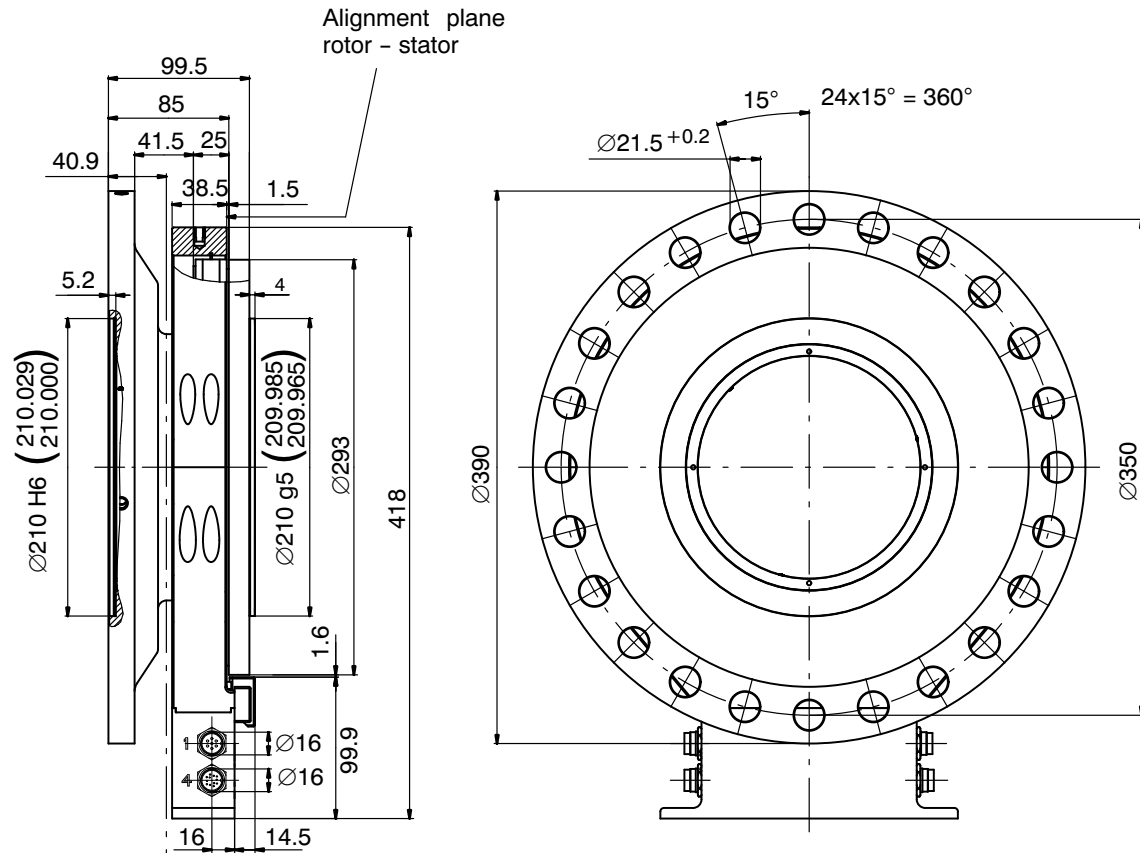


Center of gravity  
Cutaways in section A-A

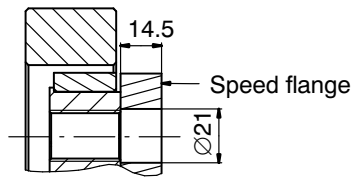




Dimensions T40FM 30 kNm – 50 kNm with rotational speed measurement (continued)



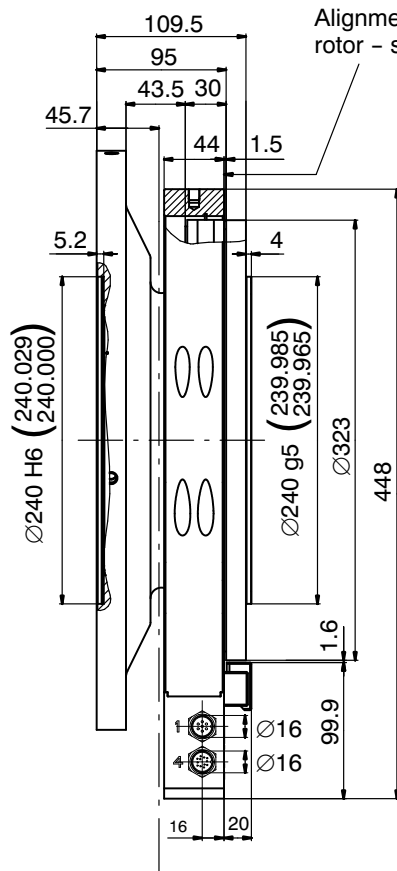
Center of gravity  
Cutaways in section A-A



A-A

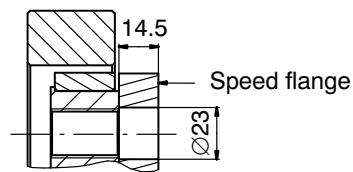
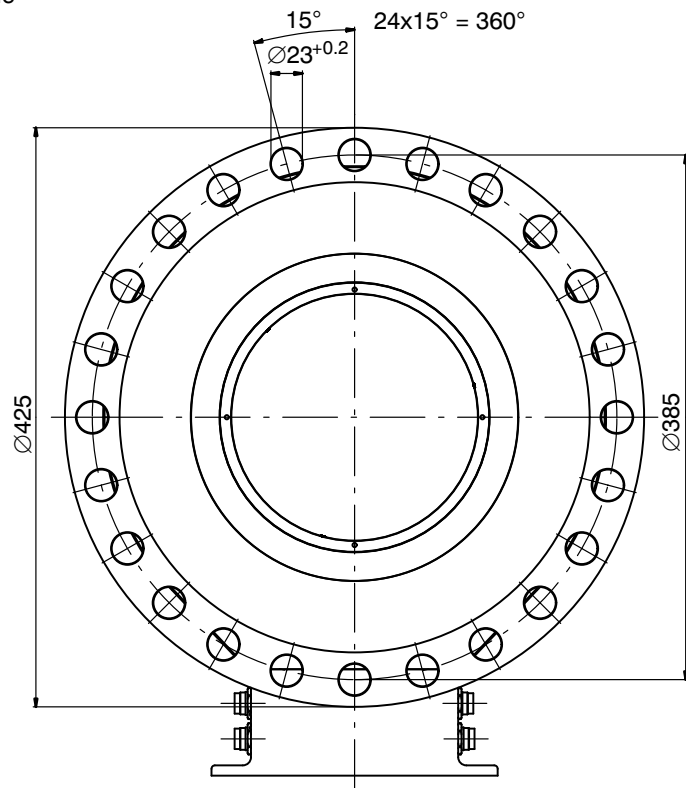


**Dimensions T40FM 60 kNm – 80 kNm with rotational speed measurement (continued)**



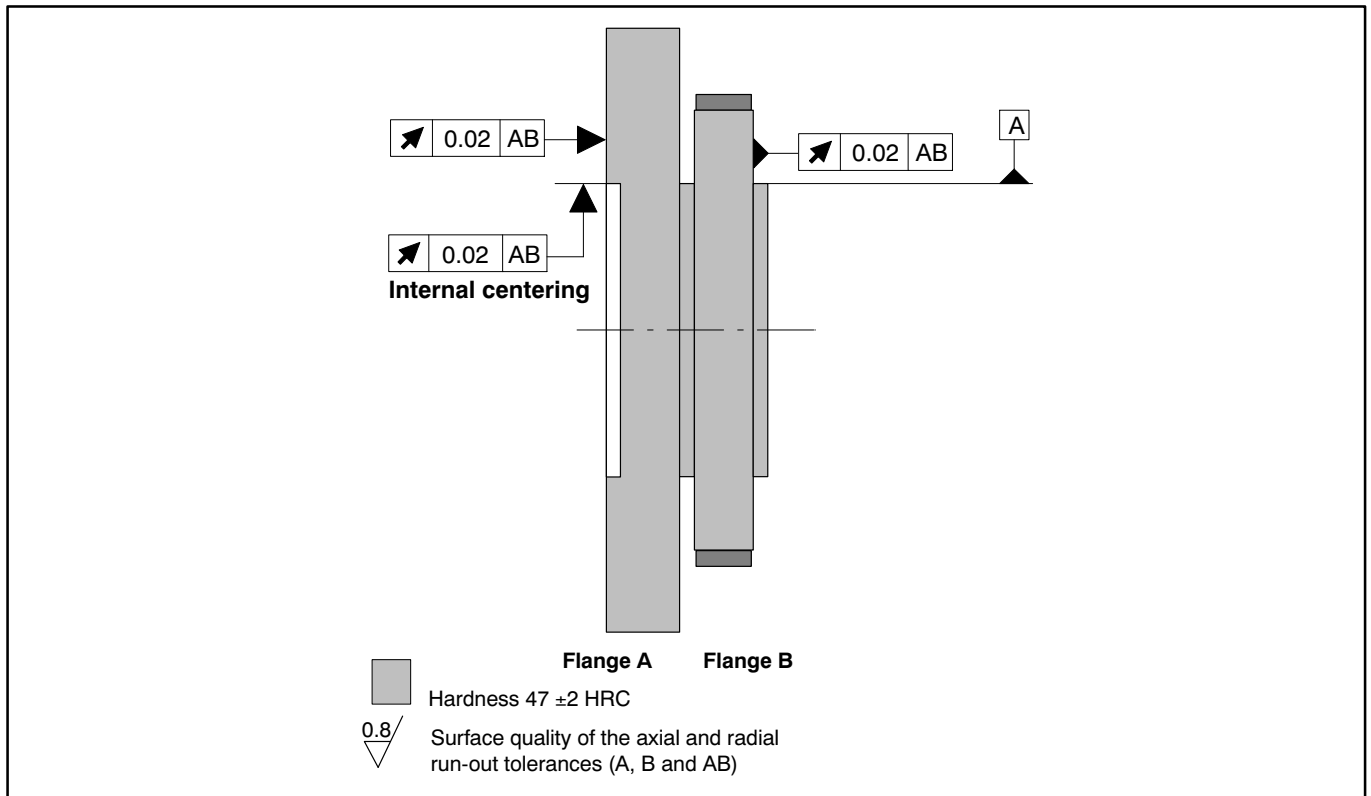
Center of gravity

Cutaways in section A-A

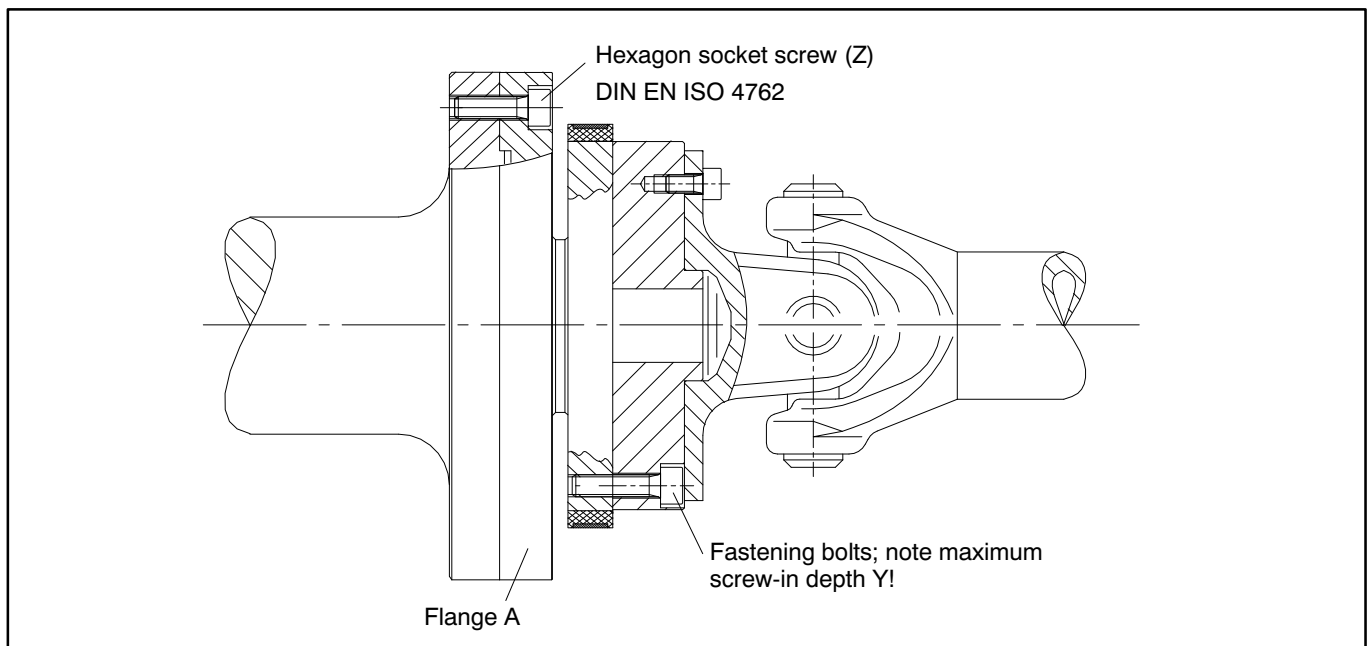


**A-A**

## Radial and axial run-out tolerances



## Fastening screws



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

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

## Order number

Order no.		
K-T40FM		Basic price Stator: [ only with Option 2 = MF / ST ]
<b>Code</b>	Option 1: Measuring range up to	
015R	15 kN·m	Basic price Rotor: [ only with Option 2 = MF / RO ]
020R	20 kN·m	Basic price Rotor: [ only with Option 2 = MF / RO ]
025R	25 kN·m	Basic price Rotor: [ only with Option 2 = MF / RO ]
030R	30 kN·m	Basic price Rotor: [ only with Option 2 = MF / RO ]
040R	40 kN·m	Basic price Rotor: [ only with Option 2 = MF / RO ]
050R	50 kN·m	Basic price Rotor: [ only with Option 2 = MF / RO ]
060R	60 kN·m	Basic price Rotor: [ only with Option 2 = MF / RO ]
070R	70 kN·m	Basic price Rotor: [ only with Option 2 = MF / RO ]
080R	80 kN·m	Basic price Rotor: [ only with Option 2 = MF / RO ]
<b>Code</b>	Option 2: Component	
MF	Measurement flange, complete	
RO	Rotor	
ST	Stator	
<b>Code</b>	Option 3: Accuracy	
S	Standard	
G	Linearity deviation including hysteresis < ±0.05	
<b>Code</b>	Option 4: Adjustment	
M	Metric (N·m)	
<b>Code</b>	Option 5: Electrical 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	
<b>Code</b>	Option 6: Rot. speed measuring system	
0	Without rot. speed measuring system	
1	Magnetic rot. Speed measuring system; 1024 pulses/revolution	
<b>Code</b>	Option 7: Customised modification	
S	No customer-specific modification	
H	Permissible rotational speed, depending on measuring range 4500 rpm to 8000 rpm	
K-T40FM- 0 3 0 R - MF - S - M - DU 2 - 0 - S		■ = PREFERENCE Types

## Accessories, to be ordered separately

Article	Order no.
<b>Connection cable, set</b>	
Torque connection cable, 423 - D-Sub 15P, 6 m	1-KAB149-6
Torque connection cable, 423 - free ends, 6 m	1-KAB153-6
Connection cable TIM40/TMC, 6 m	1-KAB174-6
<b>Cable sockets</b>	
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
<b>Connection cable, by the meter (min. order quantity: 10 m, price per meter)</b>	
Kab8/00-2/2/2	4-3301.0071

Modifications reserved.

All product descriptions are for general information only. They are not to be understood as a guarantee of quality or durability and do not constitute any liability whatsoever.

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