

# T10F

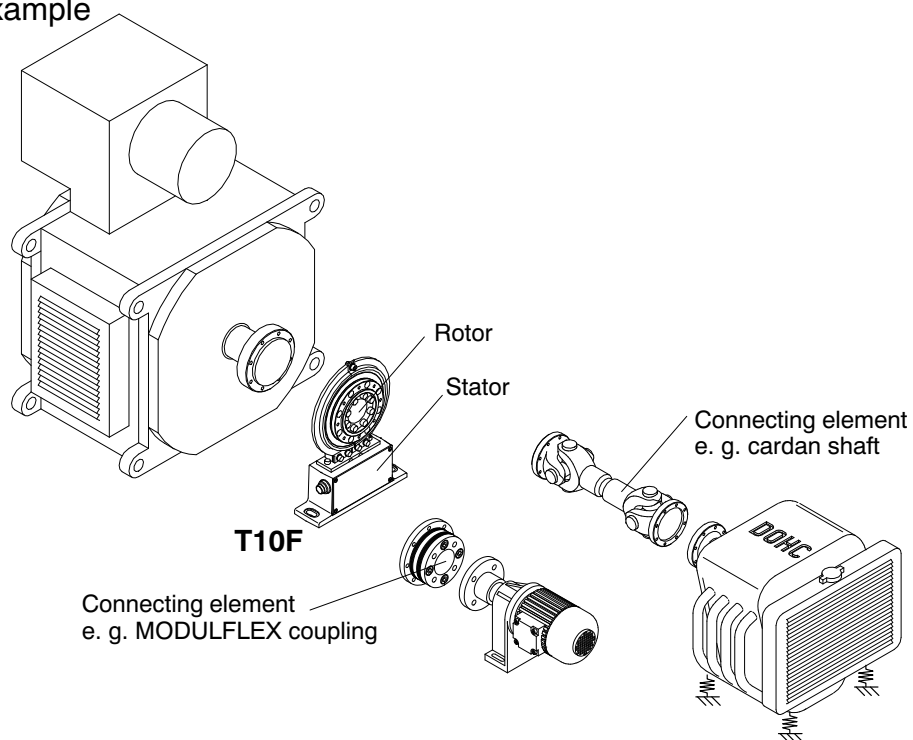
## Torque Flange



### Special features

- Extremely short design
- High permissible dynamic loads
- High permissible transverse forces and bending moments
- Very high torsional stiffness
- Contactless
- Selectable calibration signal
- Integral speed measurement (option)

### Installation example



# Specifications

Type	T10F									
<b>Accuracy class</b>	0.1									
<b>Torque measuring system</b>										
<b>Nominal (rated) torque M<sub>nom</sub></b> <b>for reference only</b>	N·m	50	100	200	500	1k	2k	3k	5k	10k
	ft·lb	37.5	75	150	375	750	1500	2250	3750	7500
<b>Nominal (rated) sensitivity</b> (nominal (rated) signal range between torque = zero and nominal (rated) torque)										
Frequency output	kHz	5								
Voltage output	V	10								
<b>Characteristic tolerance</b> (deviation of the actual output quantity at M <sub>nom</sub> from the nominal (rated) signal range)										
Frequency output	%	± 0.1								
Voltage output	%	± 0.2								
<b>Output signal at torque = zero</b>										
Frequency output	kHz	10								
Voltage output	V	0								
<b>Nominal (rated) output signal</b>										
Frequency output										
with positive nominal (rated) torque	kHz	15 (5V symmetric <sup>1</sup> )/12V asymmetric <sup>2</sup> )								
with negative nominal (rated) torque	kHz	5 (5V symmetric <sup>1</sup> )/12V asymmetric <sup>2</sup> )								
Voltage output										
with positive nominal torque	V	+10								
with negative nominal torque	V	-10								
<b>Load resistance</b>										
Frequency output	kΩ	≥ 2								
Voltage output	kΩ	≥ 5								
<b>Long-term drift over 48h</b>										
Voltage output	mV	≤ ± 3								
<b>Measurement frequency range</b>										
Voltage output	Hz	0 ... 1000 (-3dB)								
<b>Group delay time</b>										
Frequency output	ms	0.15								
Voltage output	ms	0.9								
<b>Residual ripple</b> Voltage output	%	0.4 (peak-to-peak)								
<b>Temperature influence per 10 K in the nominal (rated) temperature range</b>										
<b>on the output signal, related to the actual value of signal span</b>										
Frequency output	%	< ± 0.1								
Voltage output	%	< ± 0.2								
<b>on the zero signal, related to the nom. sensitivity</b>										
Frequency output	%	< ± 0.1								< ± 0.05
Voltage output	%	< ± 0.2								< ± 0.15
<b>Power supply (version KF1)</b>										
Excitation voltage (square wave)	V	54 ± 5% (peak-to-peak)								
Release of calibration signal	V	80 ± 5%								
Frequency	kHz	approx. 14								
Max. current consumption	A	1 (peak-to-peak)								
<b>Preamplifier excitation voltage</b>	V	0/0/+15								
<b>Preamplifier, max. current consumption</b>	mA	0/0/+25								
<b>Power supply (version SF1/SU2)</b>										
Nominal (rated) supply voltage (protective low voltage)	V (DC)	18 ... 30; asymmetric								
Current consumption in measuring mode	A	< 0.9								
Current consumption in start-up mode	A	< 2								
<b>Nominal (rated) power consumption</b>	W	< 12								
<b>Linearity deviation including hysteresis, related to the nominal (rated) sensitivity</b>										
Frequency output	%	< ± 0.1 (< ± 0.05 optional)								
Voltage output	%	< ± 0.1 (< ± 0.07 optional)								

<sup>1</sup>) RS 422 complementary signals; factory settings version SF1/SU2

<sup>2</sup>) Factory settings version KF1 (no switching possible)

Nominal (rated) torque $M_{nom}$ for reference only	N·m	50	100	200	500	1k	2k	3k	5k	10k	
	ft-lb	37.5	75	150	375	750	1500	2250	3750	7500	
<b>Rel. standard deviation of the repeatability</b> according to DIN 1319, by reference to variation of the output signal	%	< ± 0.03									
<b>Calibration signal</b>		approx. 50% of $M_{nom}$ ; value given to the identification plate									
<b>Tolerance of calibration signal</b>	%	< ± 0.05									
<b>Speed measuring system</b>											
<b>Measuring system</b>		optical, by means of infrared light and metallic slotted disc									
<b>Mechanical increments</b>	Number	360				720					
<b>Positional tolerance of the increments</b>	mm					± 0.05					
<b>Tolerance of the slot width</b>	mm					± 0.05					
<b>Pulses per rotation</b> adjustable	Number	360; 180; 90; 60; 30; 15				720; 360; 180; 90; 60; 30; 15					
<b>Output signal</b>	V	5 symmetric (RS 422 complementary signals) 2 square wave signals 90° phase shifted									
<b>Load resistance</b>	kΩ	≥ 2									
<b>Minimum speed for sufficient pulse stability</b>	rpm	2									
<b>Group delay time</b>	μs	< 5 typ. 2.2									
<b>Max. permissible axial displacement between rotor and stator</b>	mm	± 2									
<b>Max. permissible radial displacement between rotor and stator</b>	mm	± 1									
<b>Hysteresis of reversing the direction of rotation</b> <sup>3)</sup> with relative vibrations between rotor and stator											
Torsional rotor vibrations	Degree	< approx. 2									
Radial stator vibrations	mm	< approx. 2									
<b>Permitted degree of soiling</b> , in the optical path of the sensor fork (lenses, slotted disc)	%	< 50									
<b>Protection against scattered light</b>		by fork and infrared filter									
<b>General data</b>											
<b>EMC</b>											
<b>EMI (Immunity)</b> (EN50082-2)											
RF enclosure	V/m					10					
RF common mode	V <sub>PP</sub>					10					
Magnetic field	A/m					100					
Burst	kV					2/1					
ESD	kV					4/8					
<b>EME (Emission)</b> (EN55011; EN55022; EN55014)											
RFI voltage						Class A					
RFI power						Class B					
RFI field strength						Class B					
<b>Degree of protection according to EN 60 529</b>		IP 54									
<b>Weight</b> , approx. Rotor		0.9	0.9	1.8	3.5	3.5	5.8	7.8	14.0	15.2	
Rotor with speed measuring system		1.1	1.1	1.8	3.5	3.5	5.9	7.9	14.1	15.3	
Stator		1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.4	1.4	
<b>Reference temperature</b>	°C [°F]	+23 [73.4]									
<b>Nominal (rated) temperature range</b>	°C [°F]	+10...+60 [+50...+140]									
<b>Service temperature range</b>	°C [°F]	-10...+60 [+14...+140]									
<b>Storage temperature range</b>	°C [°F]	-20...+70 [-4...+158]									
<b>Impact resistance, test severity level to IEC 68; part 2-27; IEC 68-2-27-1987</b>											
Number of impacts	n					1000					
Duration	ms					3					
Acceleration (half-sine)	m/s <sup>2</sup>					650					
<b>Vibration resistance, test severity level to IEC 68, part 2-6; IEC 68-2-6-1982</b>											
Frequency range	Hz					5...65					
Duration	h					1.5					
Acceleration (amplitude)	m/s <sup>2</sup>					50					

<sup>3)</sup> Can be switched off

## Specifications (Continued)

<b>Nominal (rated) torque <math>M_{nom}</math></b>	N·m	50	100	200	500	1k	2k	3k	5k	10k	
<b>Nominal (rated) speed (x1000)</b>	rpm	15	15	15	12	12	10	10	8	8	
<b>Load limits<sup>4)</sup></b>											
<b>Limit torque, related to <math>M_{nom}</math></b>	%	400					200				160
<b>Breaking torque, related to <math>M_{nom}</math></b>	%	>800					>400				>300
<b>Axial limit force</b>	kN	2	2	4	7	7	12	14	22	31	
<b>Lateral limit force</b>	kN	1	1	3	6	8	15	18	30	40	
<b>Bending limit moment</b>	N·m	70	70	140	500	500	1000	1600	2500	4000	
<b>Oscillation bandwidth according to DIN 50100 (peak-to-peak)<sup>5)</sup></b>	kN·m	0.16	0.16	0.32	0.8	1.6	3.2	4.8	8.0	12.0	
<b>Mechanical values</b>											
<b>Torsional stiffness <math>C_T</math></b>	kN·m/rad	160	160	430	1000	1800	3300	5100	9900	15000	
<b>Torsion angle at <math>M_{nom}</math></b>	Degree	0.018	0.036	0.027	0.028	0.032	0.034	0.034	0.029	0.038	
<b>Maximum excursion at axial limit force</b>	mm	< 0.03									
<b>Additional max. concentricity error at lateral limit force</b>	mm	< 0.01			< 0.02			< 0.03			
<b>Additional plane-parallel deviation at bending limit moment</b>	mm	< 0.2									
<b>Balance quality-level to DIN ISO 1940</b>		G 6.3									
<b>Max. limits for relative shaft vibration (peak-to-peak)<sup>6)</sup></b> Wave oscillations in the area of the connection flanges acc. to ISO 7919-3											
Normal mode (continuous operation)	µm	$S_{(p-p)} = \frac{9000}{\sqrt{n}}$ (n in rpm)									
Start and Stop mode/resonance ranges (temporary)	µm	$S_{(p-p)} = \frac{13200}{\sqrt{n}}$ (n in rpm)									
<b>Mass moment of inertia of the rotor</b>											
$I_V$ (about axis of rotation) $\times 10^{-3}$	kg·m <sup>2</sup>	1.3	3.4	13.2	29.6	41	110	120			
$I_V$ with speed system $\times 10^{-3}$	kg·m <sup>2</sup>	1.7	3.5	13.2	29.6	41	110	120			
<b>Proportional mass moment of inertia (measuring-body side)</b>	%	51	44	39	38	33	31	33			
<b>Proportional mass moment of inertia with speed measuring system (measuring-body side)</b>	%	40	43	39	38	33	31	33			
<b>Max. permissible static eccentricity of the rotor (radially)<sup>7)</sup></b>	mm	$\pm 2$									
<b>Permissible axial displacement</b> between shaft and housing <sup>7)</sup>	mm	$\pm 2$			$\pm 2$			$\pm 3$			

<sup>4)</sup> Each type of irregular stress (bending moment, lateral or axial load, exceeding the nominal torque) can only be permitted with its given static load limit if none of the others can occur. Otherwise the limit values must be reduced. If for instance 30 % of the bending limit moment and also 30 % of the lateral limit force are present, only 40 % of the axial limit force are permitted, provided that the nominal (rated) torque is not exceeded. With the permitted bending moments, axial and lateral limit forces, measuring errors of about 1 % of the nominal (rated) torque can occur.

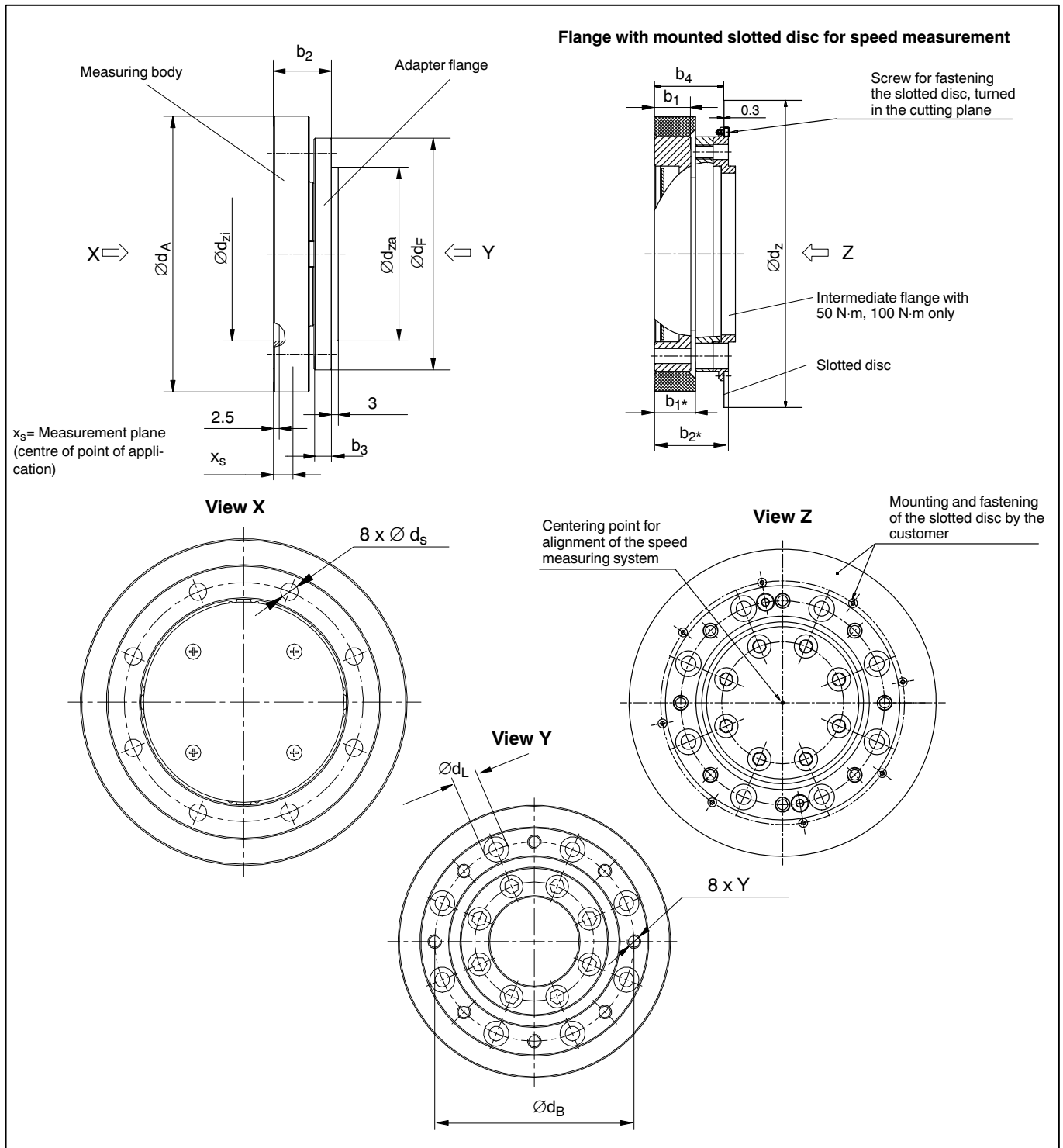
<sup>5)</sup> With T10F/50 N·m the nominal (rated) torque may be exceeded by 100 %, with T10F/100 N·m up to 10 kN·m the nominal (rated) torque may not be exceeded.

<sup>6)</sup> The impact 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 wave oscillation.

<sup>7)</sup> See restricted values with speed measuring system.

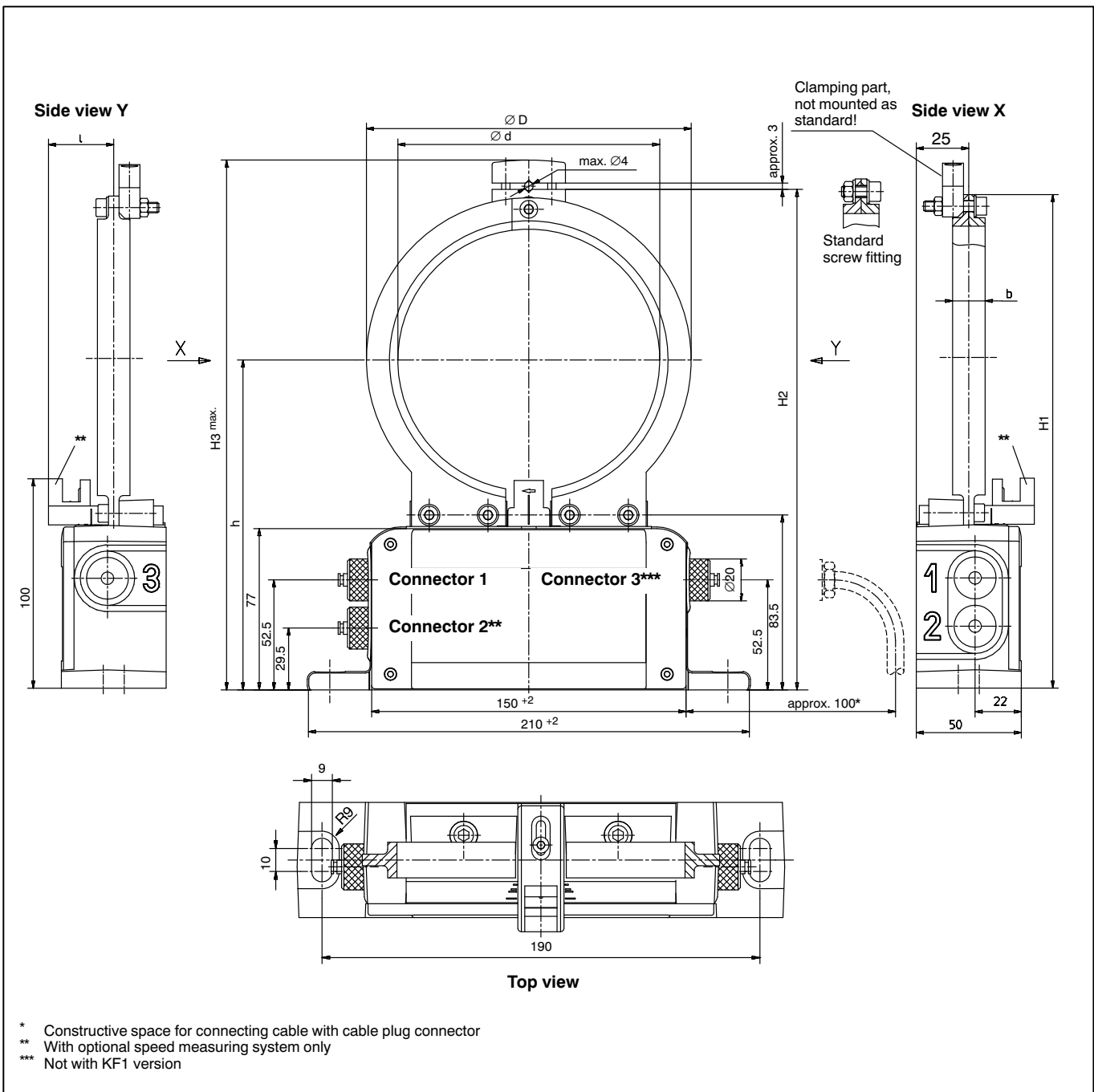
<b>T10F version</b>	<b>KF1</b>	<b>SF1</b>	<b>SU2</b>
<b>Measuring quantity</b>			
Torque	■	■	■
Speed (option)		■	■
<b>Power supply</b>			
Excitation voltage 54 V <sub>pp</sub> /14 kHz, square wave	■		
Supply voltage 18 V...30 V DC		■	■
<b>Output signal</b>			
10 kHz $\pm$ 5 kHz	■	■	■
$\pm$ 10 V			■
<b>Connecting cable</b>			
Torque	V1, V2, V3, V4	V5, V6	V5, V6
Speed		W1, W2	W1, W2

# Rotor dimensions (in mm; 1 mm=0.03937 inches)



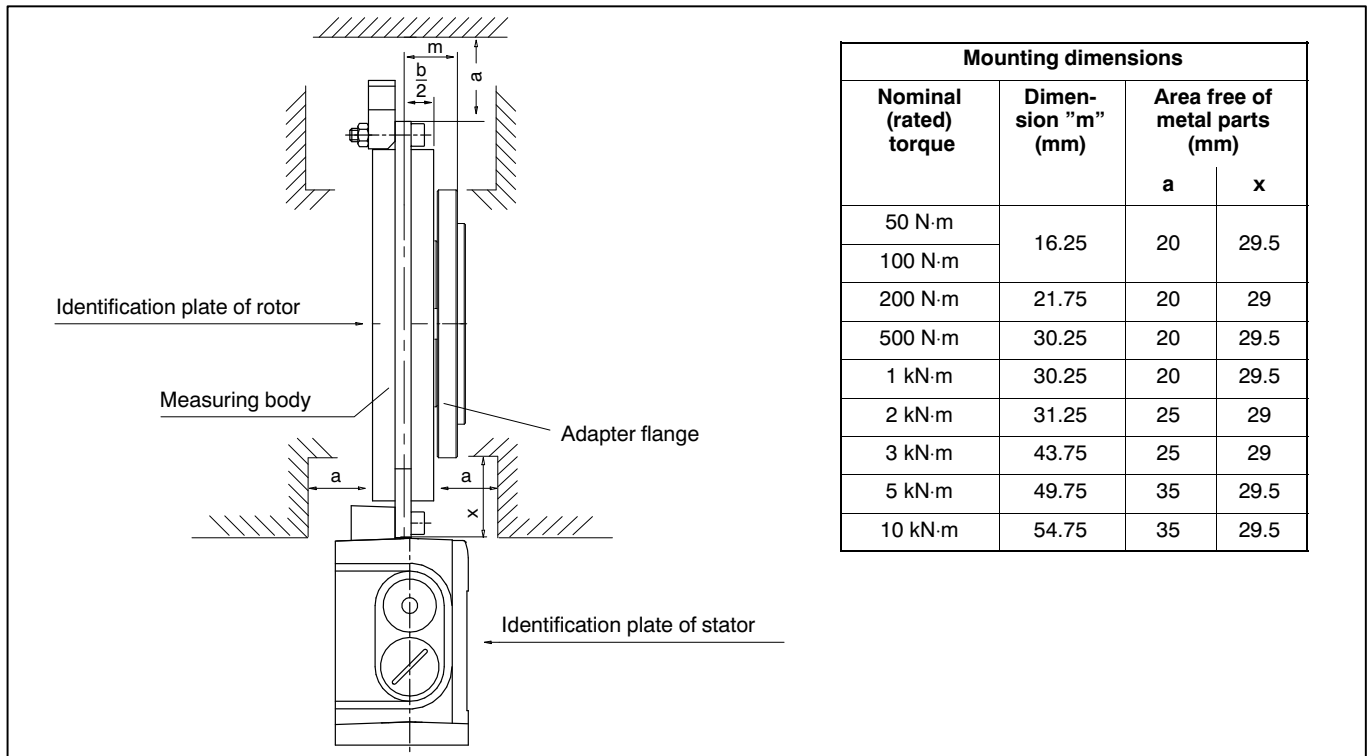
Nominal torque	Dimensions in mm															
	$b_1$	$b_1^*$	$b_2$	$b_2^*$	$b_3$	$b_4$	$\text{Ø}d_A$	$\text{Ø}d_B$	$\text{Ø}d_f$	$\text{Ø}d_L$	$\text{Ø}d_z$	$\text{Ø}d_{za} g5$	$\text{Ø}d_{zi} H6$	$\text{Ø}d_s$	Y	$x_s$
50 N·m	15.5	17.5	25	31.5	7.5	29.5	117	87	100	11	131	75	75	6.4	M6	13
100 N·m																
200 N·m	17.5	17.5	30.5	30.5	11	29.5	137	105	121	14	151	90	90	8.4	M8	14
500 N·m	20.5	20.5	40.5	40.5	18	33	173	133	156	20	187	110	110	13	M12	15.5
1 kN·m																
2 kN·m	22.5	22.5	42.5	42.5	18	35	207	165	191	24	221	140	140	15	M14	16.5
3 kN·m	27.0		55	55	26	35										18.8
5 kN·m	28.5	28.5	64	64	33.5	41	254	206	238	30	269	174	174	19	M18	19.5
10 kN·m	33.5		69	69												22.5

# Stator B dimensions (in mm; 1 mm=0.03937 inches)

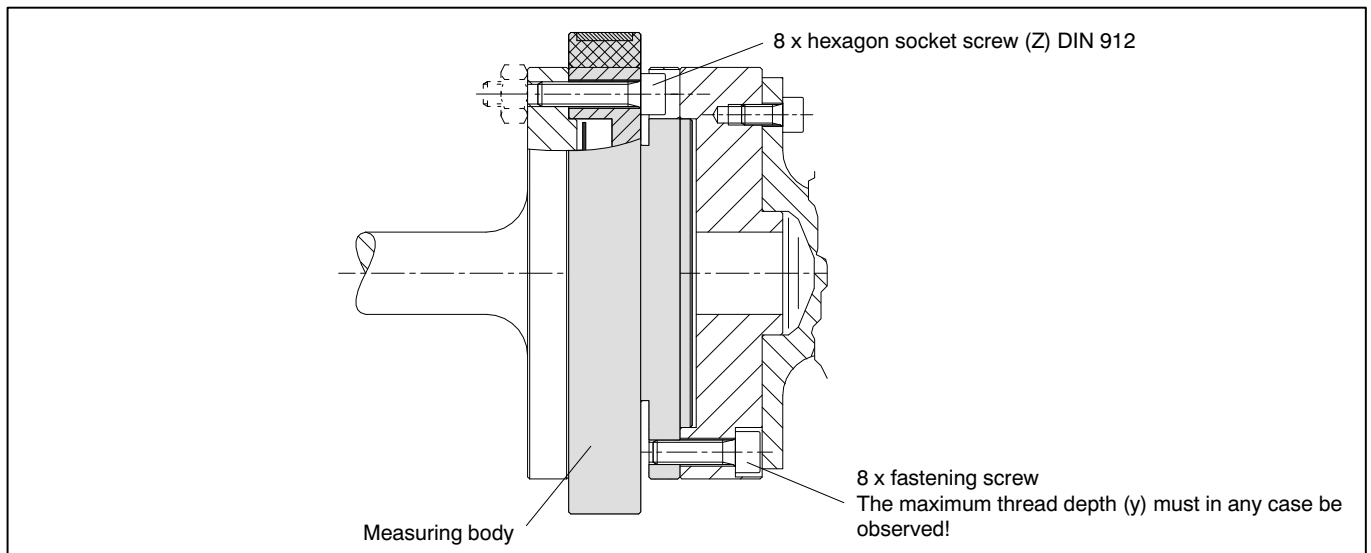


Nominal (rated) torque	Dimensions in mm							
	b	∅d	∅D	H1	H2	H3	h	l
50 N·m	17.5	125	155	235	239	253	157.5	31.5
100 N·m								
200 N·m	17.5	145	175	255	259	273	167.5	31.5
500 N·m	20.5	181	211	291	295	309	185.5	33.5
1 kN·m								
2 kN·m	22.5	215	245	325	329	343	202.5	34.5
3 kN·m								
5 kN·m	28.5	262	292	373	377	391	226.5	37.5
10 kN·m								

## Specifications (Continued)



## Screw fitting of the rotor



Nominal (rated) torque (N·m)	Fastening screws (Z)	Fastening screws class	Max. thread depth (y) in adapter flange (mm)	Prescribed fastening torque (N·m)
50	M6	10.9	7.5 <sup>1)</sup>	14
100				
200	M8		11	34
500	M12		18	115
1k	M12		18	115
2k	M14		18	185
3k	M14		26	185
5k	M18	12.9	33.5	400
10k	M18		33.5	470

<sup>1)</sup> With optional speed module 14mm; due to intermediate flange 6mm longer screws must be used.

## Ordering number

Code	Option 1: Measuring range
050Q	50 N·m
100Q	100 N·m
200Q	200 N·m
500Q	500 N·m
001R	1 kN·m
002R	2 kN·m
003R	3 kN·m
005R	5 kN·m
010R	10 kN·m

Code	Option 4: Speed measuring system <sup>2)</sup>
0	Without speed measuring system
1	360 pulses/revolution
2	180 pulses/revolution
3	90 pulses/revolution
4	60 pulses/revolution
5	30 pulses/revolution
6	15 pulses/revolution
7	720 pulses/revolution <sup>3)</sup>

Code	Option 2: Electrical configuration
KF1	Output signal 10 kHz $\pm$ 5 kHz, Excitation voltage 14 kHz / 54 V; square wave
SF1	Output signal 10 kHz $\pm$ 5 kHz, Supply voltage 18...30 V DC
SU2	Output signal 10 kHz $\pm$ 5 kHz and $\pm$ 10 V, Supply voltage 18...30 V DC

Code	Option 5: Connecting cable
V0	Without connecting cable
V1	Torque connecting cable for KF1, 423-free ends, 6 m
V2 <sup>3)</sup>	Torque connecting cable for KF1, 423-free ends, max. 80 m
V3	Torque connecting cable for KF1, 423-MS3106PEMV, 6 m
V4 <sup>3)</sup>	Torque connecting cable for KF1, 423-MS3106PEMV, max. 80 m
V5	Torque connecting cable for SF1/SU2, 423-D-Sub 15P, 6 m
V6 <sup>3)</sup>	Torque connecting cable for SF1/SU2, 423-D-Sub 15P, max. 50 m
W1	One torque and speed cable each, 423-D-Sub 15P, 6 m
W2 <sup>3)</sup>	One torque and speed cable each, 423-D-Sub 15P, max. 50 m

Code	Option 3: Linearity deviation Hysteresis included
S	< $\pm$ 0.1
G	< $\pm$ 0.05 <sup>1)</sup>

Code	Option 6: Mounted MODULFLEX <sup>®</sup> couplings <sup>4)</sup>
N	Without coupling
Y	With coupling

- 1) When voltage output  $\leq \pm 0.07$
- 2) Only option 2, Code SF1, SU2
- 3) Only option 1, Code 002R, 003R, 005R, 010R
- 4) Specifications see data sheet B0506

Order no.: K-T10F - [ ] [ ] [ ] [ ] - [ ] [ ] [ ] [ ] - [ ] [ ] [ ] [ ] - [ ] [ ] [ ] [ ] - [ ] [ ] [ ] [ ] - [ ] [ ] [ ] [ ] - [ ] [ ] [ ] [ ] m\*)

Ordering example:

K-T10F - 5 0 0 Q - S F 1 - S - 0 - V 5 - Y [ ] [ ] [ ] [ ] m\*)

\*) With V2, V4, V6 and W2 selected, please specify desired cable length.

## Accessories, to be ordered separately:

423G-7S cable socket, 7-pole, straight cable entry, for torque output (connector 1, 3), order no. 3-3101.0247

423W-7S cable socket, 7-pole, 90° cable entry, for torque output (connector 1, 3), order no. 3-3312.0281

423G-8S cable socket, 8-pole, straight cable entry, for speed output (connector 2), order no. 3-3312.0120

423W-8S cable socket, 8-pole, 90° cable entry, for speed output (connector 2), order no. 3-3312.0282

Raw cable Kab8/00-2/2/2, order no. 4-3301.0071

Modifications reserved.

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