

T10FS

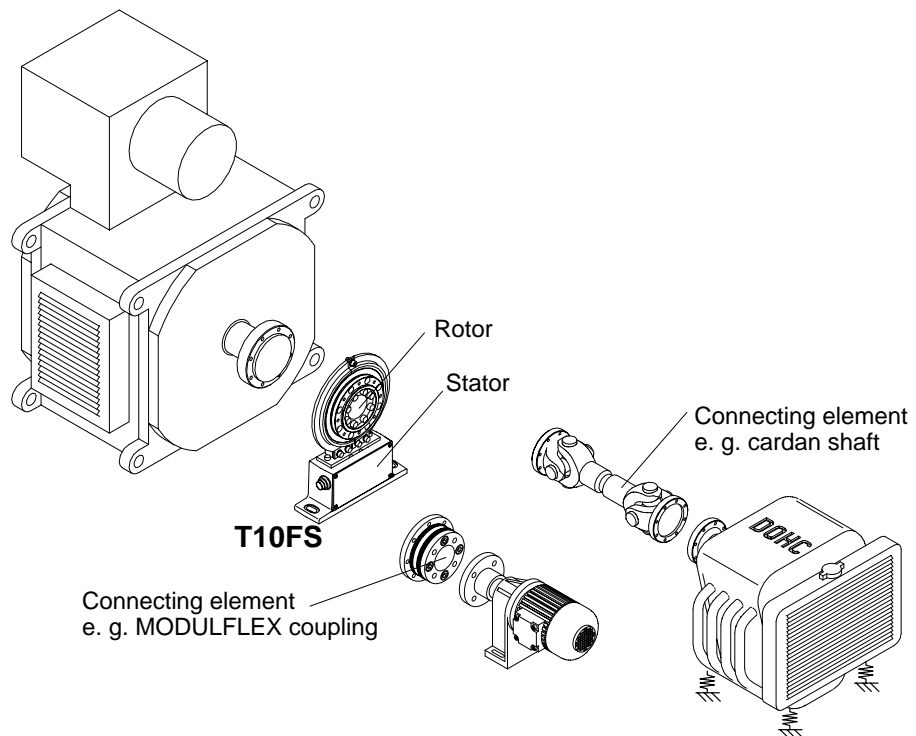
Torque Flange



Special features

- Nominal (rated) torques:
500 N·m, 1 kN·m, 2 kN·m,
3 kN·m, 5 kN·m, 10 kN·m
- Nominal speed from
12,000 rpm to 22,000 rpm
- Low rotor weights
- Small mass moments of inertia
- Small outside diameters
- Non-contacting
- Option: integrated speed measurement, additional reference pulse

Installation example



Specifications

Type	T10FS						
Accuracy class	0.1						
Torque measuring system							
Nominal (rated) torque M_{nom} for reference only	N·m	500	1 k	2 k	3 k	5 k	10 k
	ft·lb	375	750	1,500	2,250	3,750	7,500
Nominal sensitivity (range between torque = zero and nominal (rated) torque)							
Frequency output	kHz	5					
Voltage output	V	10					
Characteristic tolerance (deviation of the actual output quantity at M_{nom} from the nominal sensitivity)							
Frequency output	%	±0.1					
Voltage output	%	±0.2					
Output signal at torque = zero							
Frequency output	kHz	10					
Voltage output	V	0					
Nominal output signal							
Frequency output with positive nominal (rated) torque	kHz	15 (5 V symmetric ¹)/12 V asymmetric ²)					
Frequency output with negative nominal (rated) torque	kHz	5 (5 V symmetric ¹)/12 V asymmetric ²)					
Voltage output with positive nominal (rated) torque	V	+10					
Voltage output with negative nominal (rated) torque	V	-10					
Load resistance							
Frequency output	kΩ	≥2					
Voltage output	kΩ	≥5					
Long-term drift over 48 h							
Voltage output	mV	≤±3					
Measurement frequency range							
Voltage output	Hz	0 ... 1000 (-3 dB)					
Group delay time							
Frequency output	ms	0.15					
Voltage output	ms	0.9					
Residual ripple							
Voltage output	mV	40 (peak-to-peak)					
Temperature influence per 10 K in the nominal temperature range on the output signal, related to the actual value of signal span							
Frequency output	%	<±0.1					
Voltage output	%	<±0.2					
on the zero signal, related to the nom. sensitivity							
Frequency output	%	<±0.05 (<±0.03 optional)					
Voltage output	%	<±0.15 (<±0.13 optional)					
Power supply (version KF1)							
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)					
Pre-amplifier excitation voltage	V	0/0/+15					
Pre-amplifier, max. current consumption	mA	0/0/+25					
Power supply (version SF1/SU2)							
Nominal 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					
Nominal (rated) power consumption	W	< 12					
Linearity deviation including hysteresis, related to the nominal sensitivity							
Frequency output	%	<±0.05 (<±0.03 optional)					
Voltage output	%	<±0.07 (<±0.05 optional)					

1.) RS 422 complementary signals; factory settings version SF1/SU2

2.) Factory settings version KF1 (no switching possible)

Specifications (Continued)

Nominal (rated) torque M_{nom} for reference only	N·m	500	1 k	2 k	3 k	5 k	10 k
	ft·lb	375	750	1,500	2,250	3,750	7,500
Rel. standard deviation of the reproducibility according to DIN 1319, by reference to variation of the output signal Frequency output Voltage output	%	< ±0.02 < ±0.03					
Calibration signal		approx. 50% of M_{nom} ; value given to the identification plate					
Tolerance of calibration signal related to M_{nom}	%	< ±0.05					
Speed measuring system							
Measuring system	optical, by means of infrared light and metallic slotted disc						
Mechanical increments	Number	360					
Positional tolerance of the increments	mm	±0.05					
Tolerance of the slot width	mm	±0.05					
Pulses per rotation (electrically adjustable)	Number	360 ^{*)} ; 180; 90; 60; 30; 15				720; 360 ^{*)} ; 180; 90; 60; 30; 15	
Output signal	V	5 ³⁾ symmetric; 2 square wave signals approx. 90° phase shifted					
Minimum speed for sufficient pulse stability	rpm	2					
Group delay time	µs	< 5 (typ. 2.2)					
Hysteresis of reversing the direction of rotation 4.) with relative vibrations between rotor and stator Torsional rotor vibrations Radial stator vibrations	degree mm	< approx. 2 < approx. 2					
Load resistance	kΩ	≥2					
Permitted degree of soiling , in the optical path of the sensor fork (lenses, slotted disc)	%	< 50					
Protection against scattered light		by fork and infrared filter					
Measuring system: reference pulse							
Measuring system	magnetic by magnetic-field dependent resistor and magnet, synchronized with rising ^{*)} or falling edge of the optical speed measuring system's 0° output signal						
Output signal	V	5 symmetric					
Pulse width		0.5 degrees with 360 speed pulses/rev. (factory settings)					
Pulses per revolution		1					
Minimum speed for sufficient pulse stability	rpm	2					
Group delay time	µs	< 5 (typ. 2.2)					
Additional phase error with < 20 rpm > 20 rpm	degree degree	typ. < 0.1; leading negligible					
Repeatability with 360 speed pulses/rev.	degree	typ. < ±0.04 (ideal mounting, non-vibrating operation)					
General data							
EMC							
EME (Emission according to EN61326-1, table 4) RFI field strength	-	Class B					
Immunity from interference (EN61326-1, table A.1) Electromagnetic field AM Magnetic field ESD Contact discharge Air discharge Burst Surge Line-conducted disturbance (AM)	V/m A/m kV kV kV kV V	10 30 4 8 1 1 3					
Degree of protection according to EN 60529		IP 54					
Weight , approx. Rotor Stator	kg kg	2.4 1.2	2.4 1.2	4.9 1.3	4.9 1.3	8.3 1.3	14.6 1.3
Reference temperature	°C [°F]	+23 [73.4]					
Nominal temperature range	°C [°F]	+10...+60 [+50...+140]					
Service temperature range	°C [°F]	-10...+60 [+14...+140]					
Storage temperature range	°C [°F]	-20...+70 [-4...+158]					

*) Factory settings 3.) RS 422 complementary signals 4.) Can be switched off

Specifications (Continued)

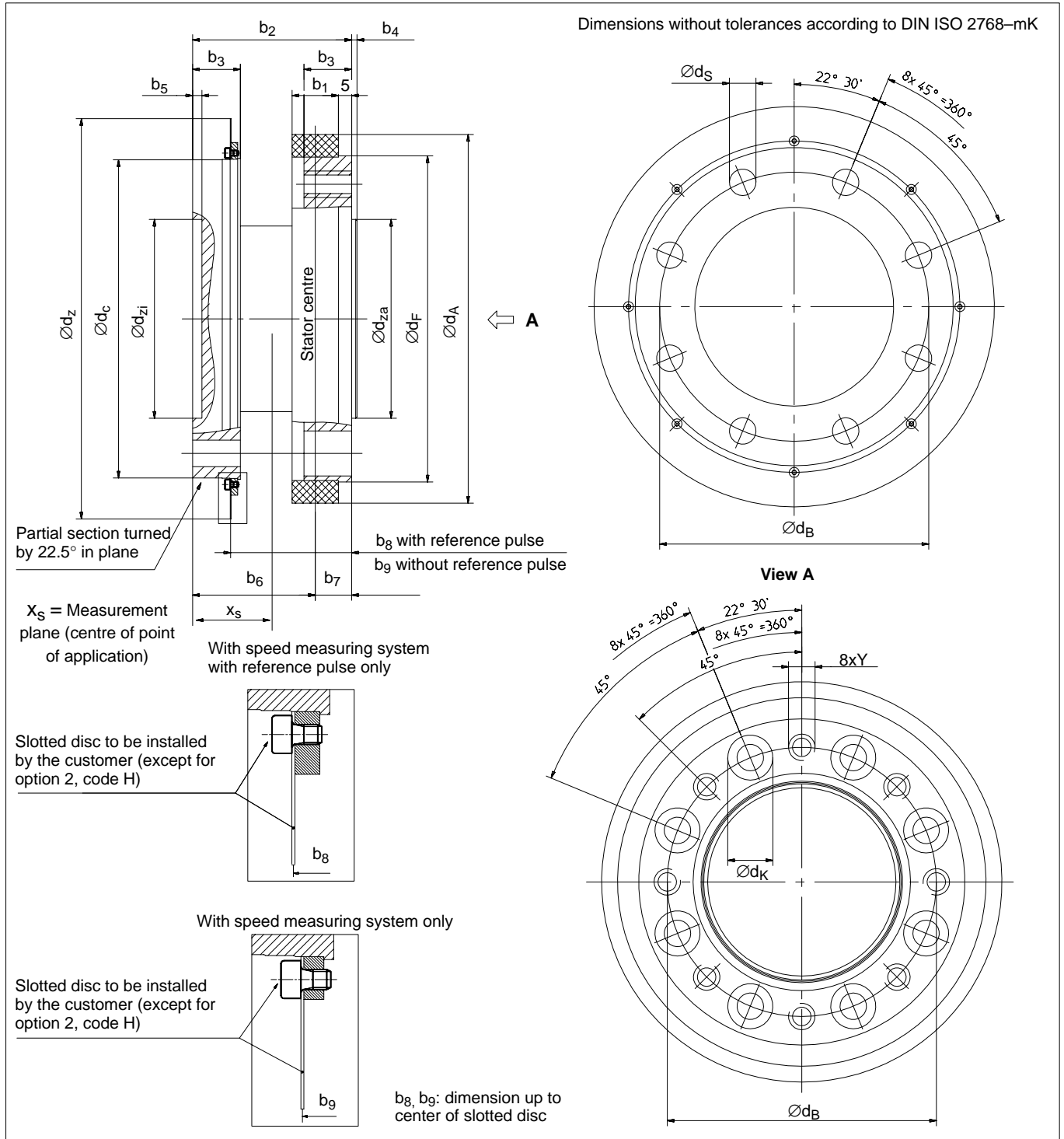
Nominal (rated) torque M_{nom} for reference only	N·m	500	1 k	2 k	3 k	5 k	10 k
	ft·lb	375	750	1,500	2,250	3,750	7,500
Impact resistance, test severity level to IEC 68; part 2-27; IEC 68-2-27-1987							
Number of impacts	n	1000					
Duration	ms	3					
Acceleration (half-sine)	m/s ²	650					
Vibration resistance, test severity level to IEC 68, part 2-6; IEC 68-2-6-1982							
Frequency range	Hz	5...65					
Duration	h	1.5					
Acceleration (amplitude)	m/s ²	50					
Nominal speed	rpm	12 000				10000	8000
Nominal speed optional	rpm	22 000		18 000		14000	12000
Load limits ^{5.)}							
Limit torque, related to M_{nom}	%	200			160		
Breaking torque, related to M_{nom}	%	> 400			> 320		
Axial limit force	kN	16	19	39	42	80	120
Lateral limit force	kN	4	5	9	10	12	18
Bending limit moment	N·m	200	220	560	600	800	1200
Oscillation bandwidth according to DIN 50100 (peak-to-peak)	N·m	1000	2000	4000	4800	8000	16000
Mechanical values							
Torsional stiffness C_T	kN·m/rad	540	900	2300	2600	4600	7900
Torsion angle at M_{nom}	degree	0.055	0.066	0.049	0.066	0,06	0,07
Maximum excursion at axial limit force	mm	< 0.03		< 0.05		< 0.1	
Additional max. concentricity error at lateral limit force	mm	< 0.01					
Additional plane-parallel deviation at bending limit moment	mm	< 0.04		< 0.06		< 0.09	
Balance quality-level to DIN ISO 1940		G 2.5					
Max. limits for relative shaft vibration (peak-to-peak)^{6.)}	μm	$s_{max} = \frac{4500}{\sqrt{n}}$ (n in rpm)					
Mass moment of inertia of the rotor							
I_V (about axis of rotation)	kg·m ²	0.0059		0.0192		0.037	0.097
I_V with speed system	kg·m ²	0.0061	0.0062	0.0196		0.0375	0.0976
Max. permissible static eccentricity of the rotor (radially)							
without speed measuring system	mm	± 2					
with speed measuring system	mm	± 1					
Permissible axial displacement between shaft and housing							
without speed measuring system	mm	± 3					
with speed measuring system	mm	± 2					

^{5.)} Each type of irregular stress can only be permitted with its given static load limit (bending moment, lateral or axial load, exceeding the nominal (rated) torque) 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.

^{6.)} Relative undulations within the range of the connecting flanges in accordance with DIN 45670/VDI 2059.

T10FS version		KF1	SF1	SU2
Measured quantity				
Torque		■	■	■
Speed (option)			■	■
Speed and reference pulse (Option)			■	■
Power supply				
Excitation voltage 54V _{pp} /14kHz, square wave		■		
Supply voltage 18V...30V DC			■	■
Output signal				
10kHz ± 5kHz		■	■	■
± 10V				■
Connecting cable				
Torque		V1, V2, V3, V4	V5, V6	V5, V6
Speed			W1, W2	W1, W2
Speed and reference pulse			W5, W6	W5, W6

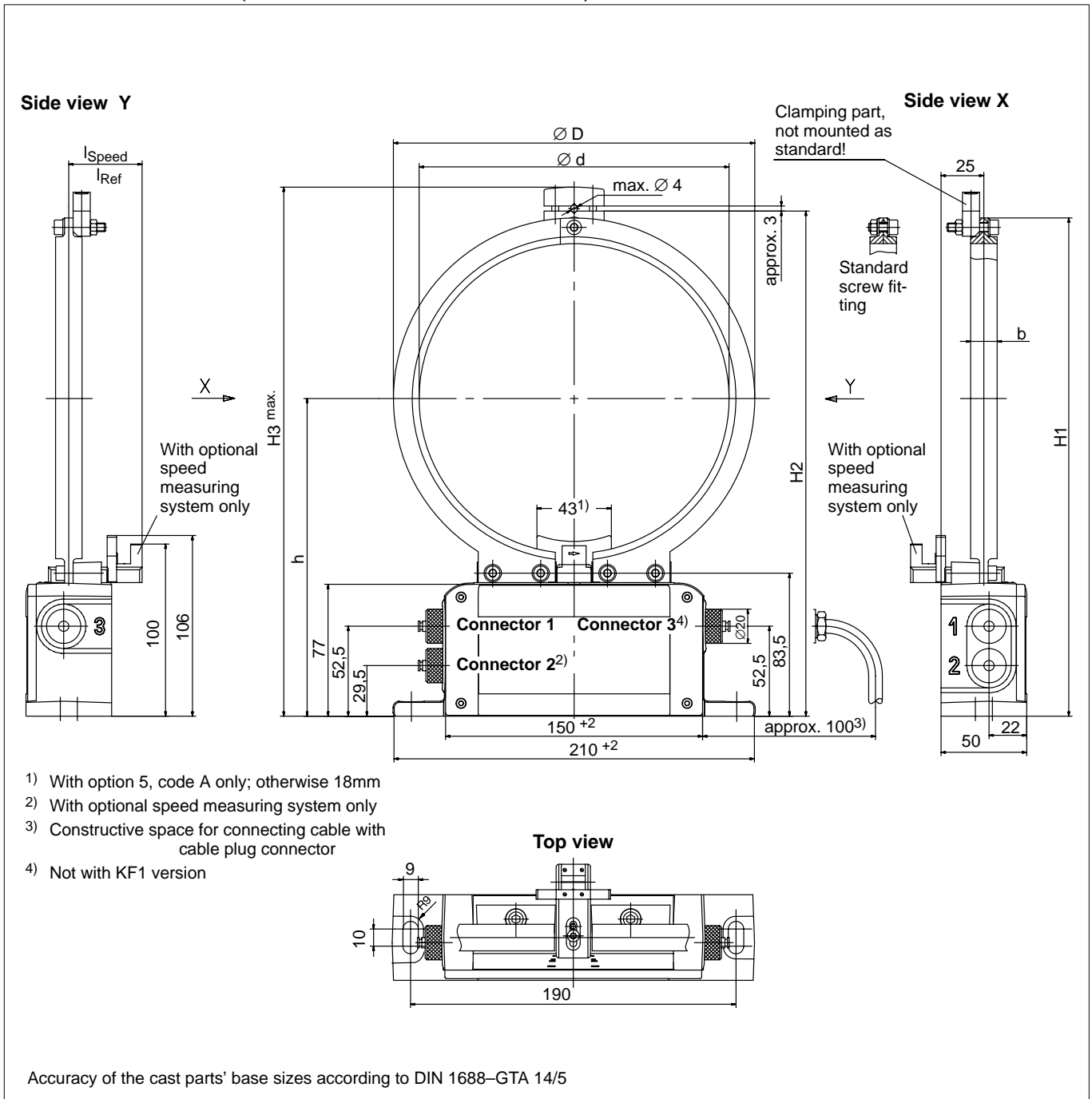
Dimensions Rotor (in mm; 1mm=0.03937 inches)



Measuring range	Dimensions in mm										
	b_1	b_2	b_3	b_4	b_5	b_6	b_7	b_8	b_9	x_S	Y
500 N·m / 1 kN·m	17.5	60	18	2	3.5	46.25	13.75	45.5	45	30	M10
2 kN·m / 3 kN·m	20.5	64	20	2.5	5	48.75	15.25	47.5	47	32	M12
5 kN·m	22.5	84	26	2.8	3	67.75	16.25	62.65	62.65	42	M14
10 kN·m	28.5	92	30	3.5	4	72.75	19.25	66.65	66.65	46	M16

Measuring range	Dimensions in mm									
	$\varnothing d_A$	$\varnothing d_B$	$\varnothing d_C$	$\varnothing d_F$	$\varnothing d_K$	$\varnothing d_S^{C12}$	$\varnothing d_Z$	$\varnothing d_{za\ g5}$	$\varnothing d_{zi\ H6}$	
500 N·m / 1 kN·m	139	101.5	120	123	17	10	151	75	75	
2 kN·m / 3 kN·m	175	130	155	160	19	12	187	90	90	
5 kN·m	209	155.5	180	188	22	14.2	221	110	110	
10 kN·m	256	196	222	230	26	17	269	140	140	

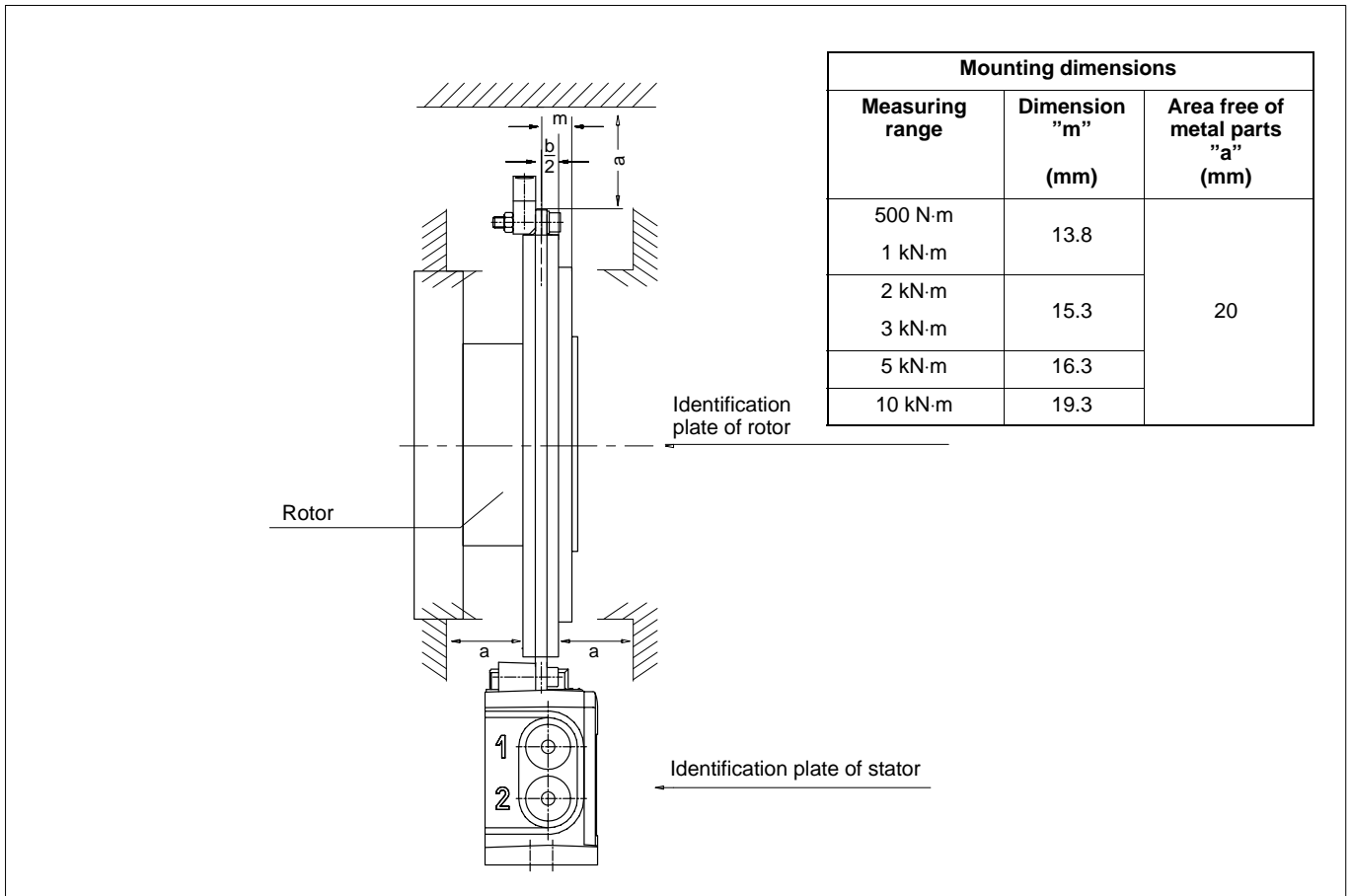
Dimensions Stator (in mm; 1 mm=0.03937 inches)



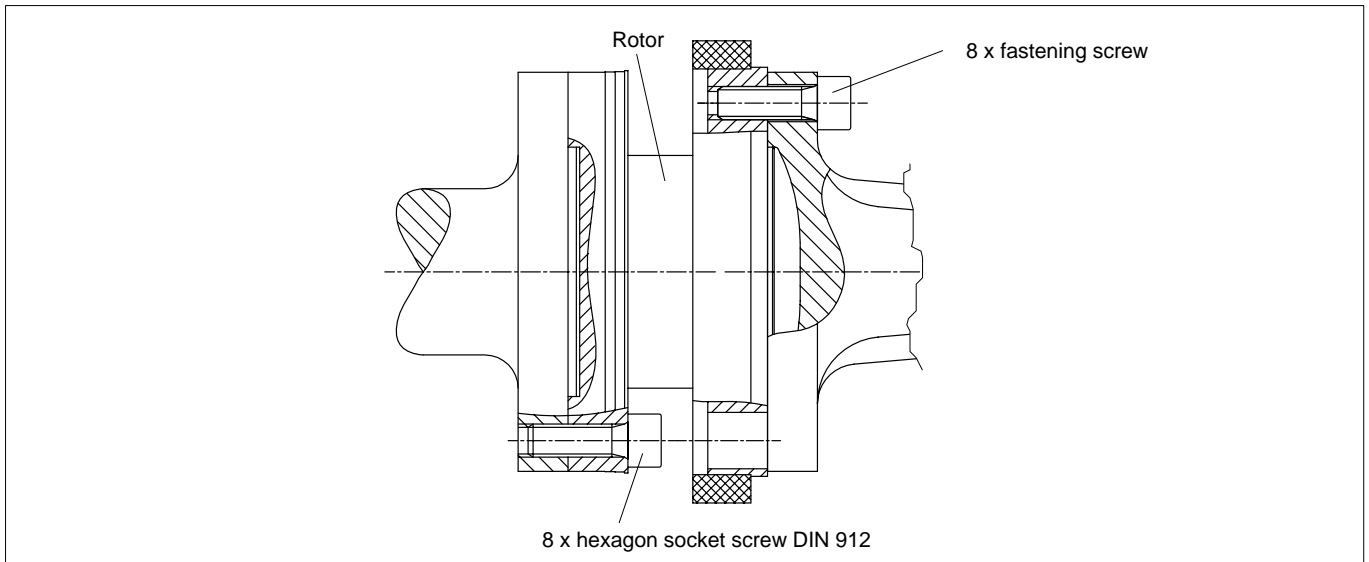
- 1) With option 5, code A only; otherwise 18mm
- 2) With optional speed measuring system only
- 3) Constructive space for connecting cable with cable plug connector
- 4) Not with KF1 version

Measuring range	Dimension in mm								
	b	Ød	ØD	H1	H2	H3	h	l _{Speed}	l _{Ref}
500 N·m 1 kN·m	17,5	145	175	255	259	273	167.5	42	42.5
2 kN·m 3 kN·m	20.5	181	211	291	295	309	185.5	42.5	43
5 kN·m	22.5	215	245	324	329	343	202.5	57	57
10 kN·m	28.5	263	293	373	377	391	226.5	58	58

Dimensions (in mm; 1mm=0.03937inches)



Screw fitting of the rotor



Nominal (rated) torque (N·m)	Fastening screws	Fastening screws class	Prescribed fastening torque (N·m)
500	M10	10.9	67
1 k			
2 k	M12	12.9	115
3 k			
5 k	M14	12.9	220
10 k	M16		340

Ordering number

Code	Option 1: Measuring range
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 2: Nominal speed
L	Normal speed depending on meas. range 8,000 rpm to 12,000 rpm
H	Normal speed depending on meas. range 12,000 rpm to 22,000 rpm

Code	Option 3: Electrical configuration
KF1	Output signal 10 kHz ± 5 kHz, Supply voltage 14 kHz / 54 V; square wave
SF1	Output signal 10 kHz ± 5 kHz, Supply voltage 18...30 V DC
SU2	Output signal 10 kHz ± 5 kHz and ± 10 V, Supply voltage 18...30 V DC

Code	Option 4: Accuracy
S	Standard
G	Increased accuracy ¹⁾ Lin. < ± 0.03 % and TK ₀ < ± 0.03 %

Code	Option 5: Speed measuring system ²⁾
0	Without speed measuring system
1	With speed measuring system, 360 pulses/revolution
A	With speed measuring system, 360 pulses/revolution and reference pulse

Code	Option 6: Anschlusskabel
V0	Without connecting cable
V1	Torque connecting cable for KF1, 423-free ends, 6 m
V2 ^{*)}	Torque connecting cable for KF1, 423-free ends, max. 80 m
V3	Torque connecting cable for KF1, 423-MS3106PEMV, 6 m
V4 ^{*)}	Torque connecting cable for KF1, 423-MS3106PEMV, max. 80 m
V5	Torque connecting cable for SF1/SU2, 423-D-Sub 15P, 6 m
V6 ^{*)}	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 ^{*)}	One torque and speed cable each, 423-D-Sub 15P, max. 50 m
W5	One cable for torque and speed each with reference pulse, 423-free ends, 6 m
W6 ^{*)}	One cable for torque and speed each with reference pulse, 423-free ends, max. 50 m

Code	Option 7: Accessories
N	Without accessories

1.) With voltage output: Lin. < ± 0.05 % ; TK₀ < ± 0.13 %
 2.) Only option 3, Code SF1, SU2

Order no.:

K-T10FS - [] [] [] [] - [] - [] [] [] [] - [] - [] [] [] [] [] [] [] [] [] [] m^{*)}

Ordering example:

K-T10FS - [5] [0] [0] [Q] - [H] - [S] [F] [1] - [S] - [0] - [V] [5] - [N] [] [] [] [] m^{*)}

*) With V2, V4, V6, W2 and W6 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

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