

# T10FS

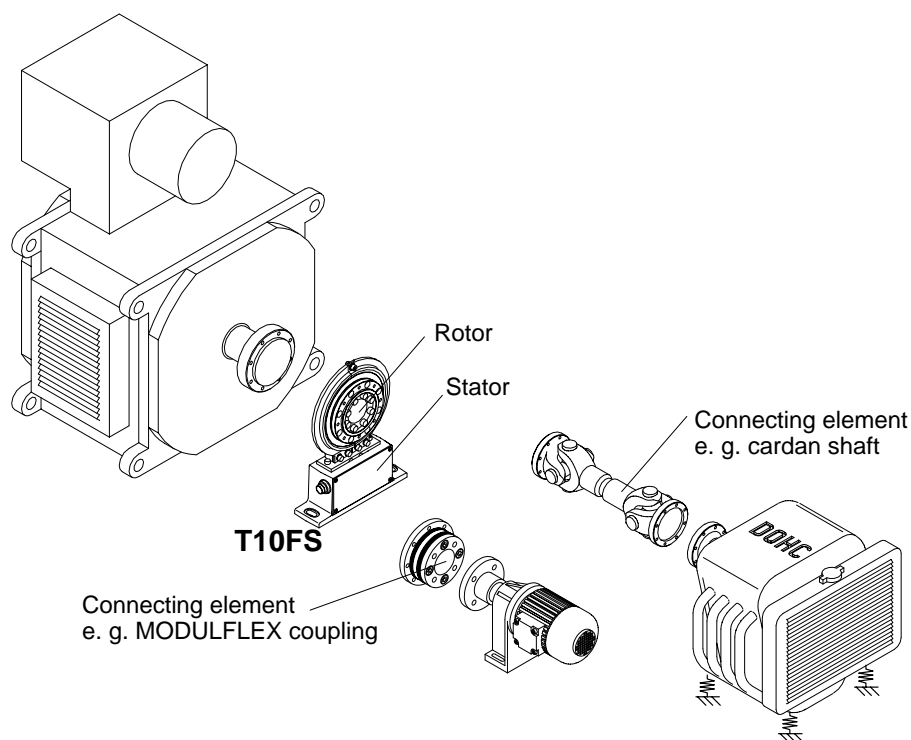
## Torque Flange



### 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						
<b>Accuracy class</b>	0.1						
<b>Torque measuring system</b>							
<b>Nominal (rated) torque <math>M_{nom}</math></b> 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
<b>Nominal sensitivity</b> (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 $M_{nom}$ from the nominal sensitivity)							
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 output signal</b>							
Frequency output with positive nominal (rated) torque	kHz	15 (5 V symmetric <sup>1</sup> )/12 V asymmetric <sup>2</sup> )					
Frequency output with negative nominal (rated) torque	kHz	5 (5 V symmetric <sup>1</sup> )/12 V asymmetric <sup>2</sup> )					
Voltage output with positive nominal (rated) torque	V	+10					
Voltage output with negative nominal (rated) torque	V	-10					
<b>Load resistance</b>							
Frequency output	kΩ	≥2					
Voltage output	kΩ	≥5					
<b>Long-term drift over 48 h</b>							
Voltage output	mV	≤±3					
<b>Measurement frequency range</b>							
Voltage output	Hz	0 ... 1000 (-3 dB)					
<b>Group delay time</b>							
Frequency output	ms	0.15					
Voltage output	ms	0.9					
<b>Residual ripple</b>							
Voltage output	mV	40 (peak-to-peak)					
<b>Temperature influence per 10 K in the nominal temperature range 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	%	<±0.05 (<±0.03 optional)					
Voltage output	%	<±0.15 (<±0.13 optional)					
<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>Preamplicator excitation voltage</b>	V	0/0/+15					
<b>Preamplicator, max. current consumption</b>	mA	0/0/+25					
<b>Power supply (version SF1/SU2)</b>							
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					
<b>Nominal (rated) power consumption</b>	W	< 12					
<b>Linearity deviation including hysteresis, related to the nominal sensitivity</b>							
Frequency output	%	<±0.05 (<±0.03 optional)					
Voltage output	%	<±0.07 (<±0.05 optional)					

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

<sup>2.)</sup> 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
<b>Rel. standard deviation of the reproducibility</b> according to DIN 1319, by reference to variation of the output signal Frequency output Voltage output	%	< ±0.02 < ±0.03					
<b>Calibration signal</b>		approx. 50% of $M_{nom}$ ; value given to the identification plate					
<b>Tolerance of calibration signal related to <math>M_{nom}</math></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					
<b>Positional tolerance of the increments</b>	mm	±0.05					
<b>Tolerance of the slot width</b>	mm	±0.05					
<b>Pulses per rotation (electrically adjustable)</b>	Number	360 <sup>*)</sup> ; 180; 90; 60; 30; 15				720; 360 <sup>*)</sup> ; 180; 90; 60; 30; 15	
<b>Output signal</b>	V	5 <sup>3)</sup> symmetric; 2 square wave signals approx. 90° phase shifted					
<b>Minimum speed for sufficient pulse stability</b>	rpm	2					
<b>Group delay time</b>	µs	< 5 (typ. 2.2)					
<b>Hysteresis of reversing the direction of rotation 4.)</b> with relative vibrations between rotor and stator Torsional rotor vibrations Radial stator vibrations	degree mm	< approx. 2 < approx. 2					
<b>Load resistance</b>	kΩ	≥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>Measuring system: reference pulse</b>							
<b>Measuring system</b>	magnetic by magnetic-field dependent resistor and magnet, synchronized with rising <sup>*)</sup> or falling edge of the optical speed measuring system's 0° output signal						
<b>Output signal</b>	V	5 symmetric					
<b>Pulse width</b>		0.5 degrees with 360 speed pulses/rev. (factory settings)					
<b>Pulses per revolution</b>		1					
<b>Minimum speed for sufficient pulse stability</b>	rpm	2					
<b>Group delay time</b>	µs	< 5 (typ. 2.2)					
<b>Additional phase error with</b> < 20 rpm > 20 rpm	degree degree	typ. < 0.1; leading negligible					
<b>Repeatability with 360 speed pulses/rev.</b>	degree	typ. < ±0.04 (ideal mounting, non-vibrating operation)					
<b>General data</b>							
<b>EMC</b>							
<b>EME (Emission according to EN61326-1, table 4)</b> RFI field strength	-	Class B					
<b>Immunity from interference (EN61326-1, table A.1)</b> 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					
<b>Degree of protection according to EN 60529</b>		IP 54					
<b>Weight</b> , 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
<b>Reference temperature</b>	°C [°F]	+23 [73.4]					
<b>Nominal 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]					

<sup>\*)</sup> Factory settings    <sup>3.)</sup> RS 422 complementary signals    <sup>4.)</sup> Can be switched off

## Specifications (Continued)

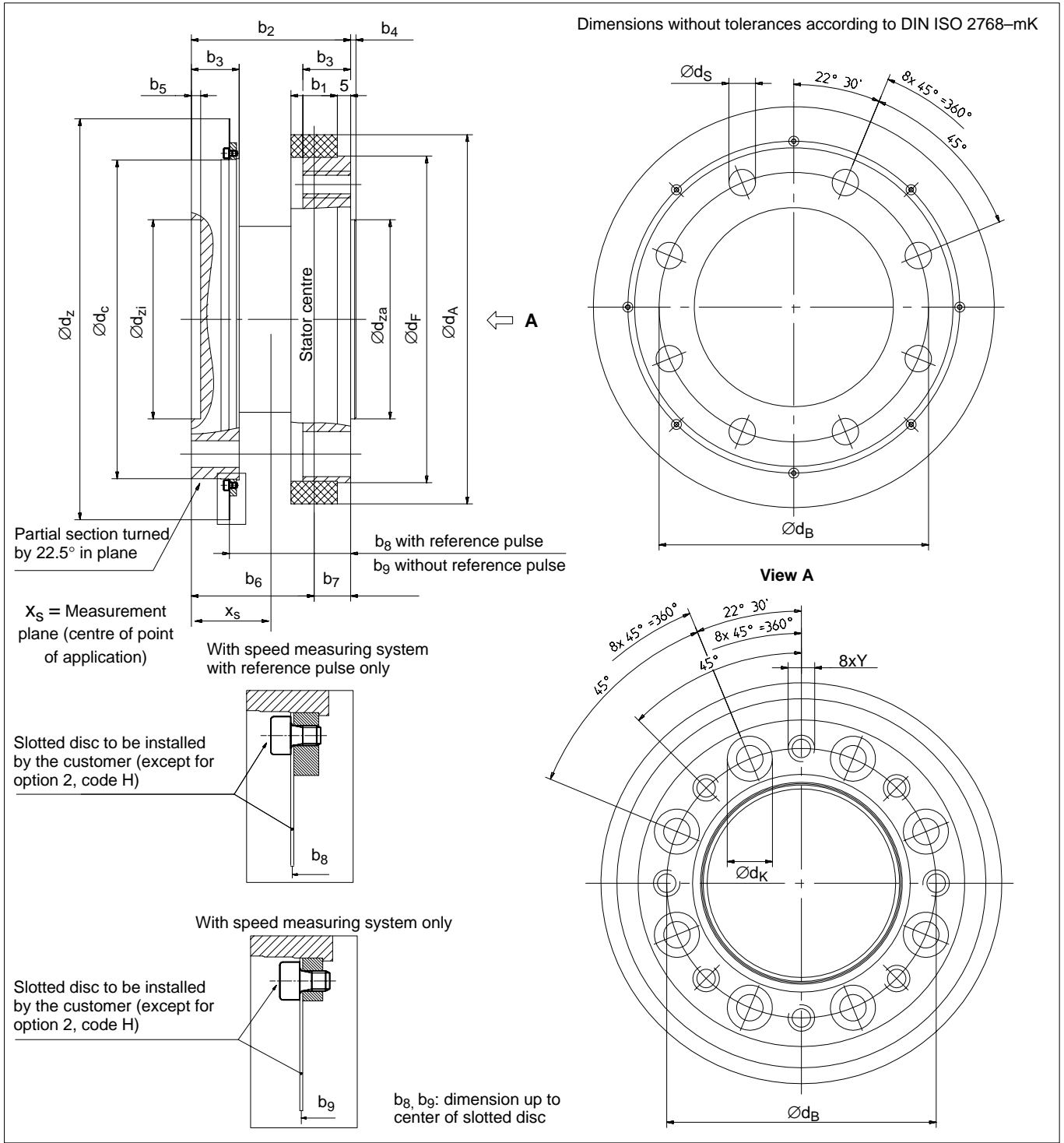
<b>Nominal (rated) torque <math>M_{nom}</math></b> for reference only	N-m	500	1 k	2 k	3 k	5 k	10 k
	ft-lb	375	750	1,500	2,250	3,750	7,500
<b>Impact resistance, test severity level to IEC 68; part 2-27; IEC 68-2-27-1987</b>							
Number of impacts	n	1000					
Duration	ms	3					
Acceleration (half-sine)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

<sup>5.)</sup> 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.

<sup>6.)</sup> Relative undulations within the range of the connecting flanges in accordance with DIN 45670/VDI 2059.

<b>T10FS version</b>		<b>KF1</b>	<b>SF1</b>	<b>SU2</b>
<b>Measured quantity</b>				
Torque		■	■	■
Speed (option)			■	■
Speed and reference pulse (Option)			■	■
<b>Power supply</b>				
Excitation voltage 54V <sub>pp</sub> /14kHz, square wave		■		
Supply voltage 18V...30V DC			■	■
<b>Output signal</b>				
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

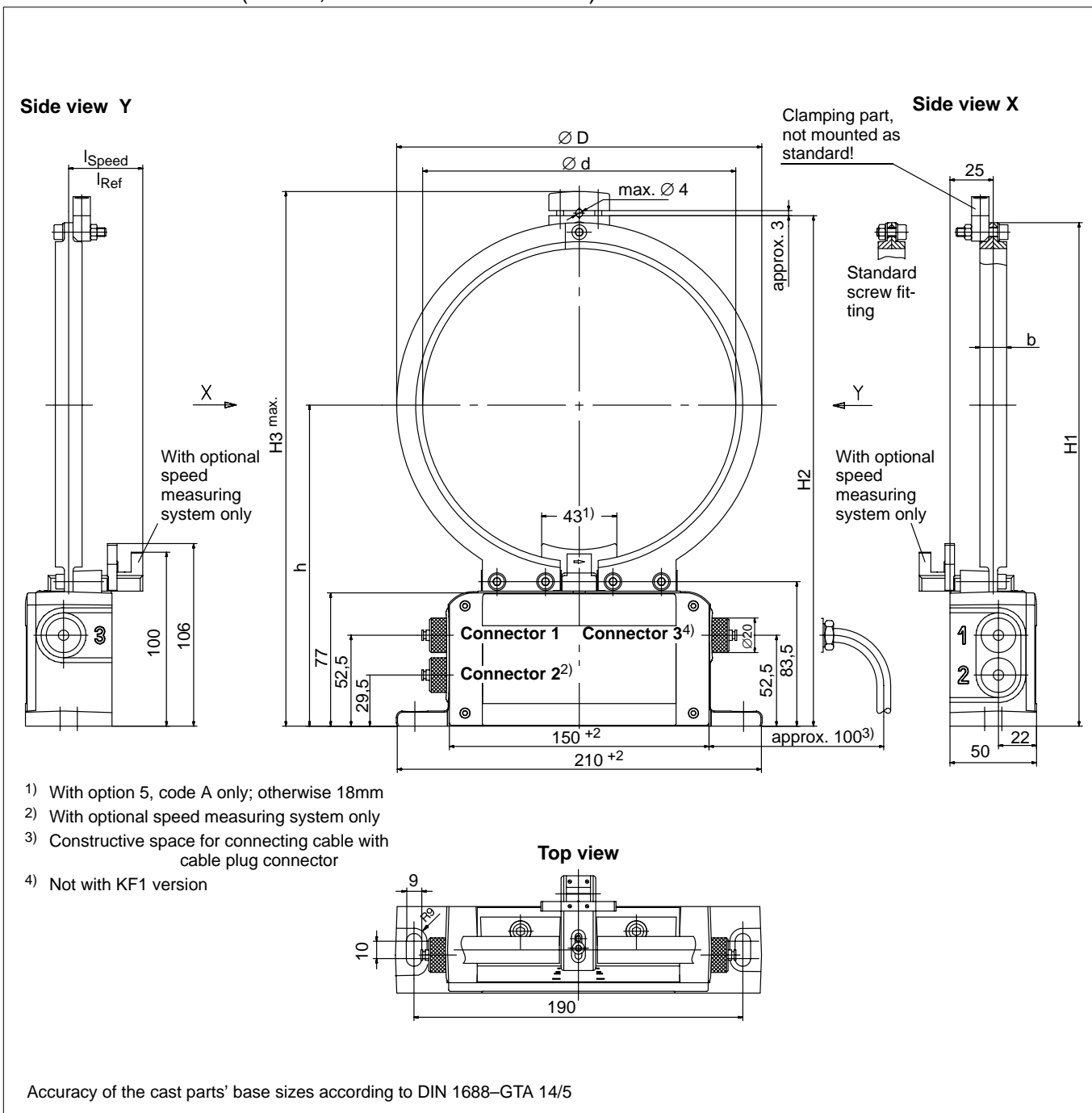
# Dimensions Rotor (in mm; 1mm=0.03937 inches)



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

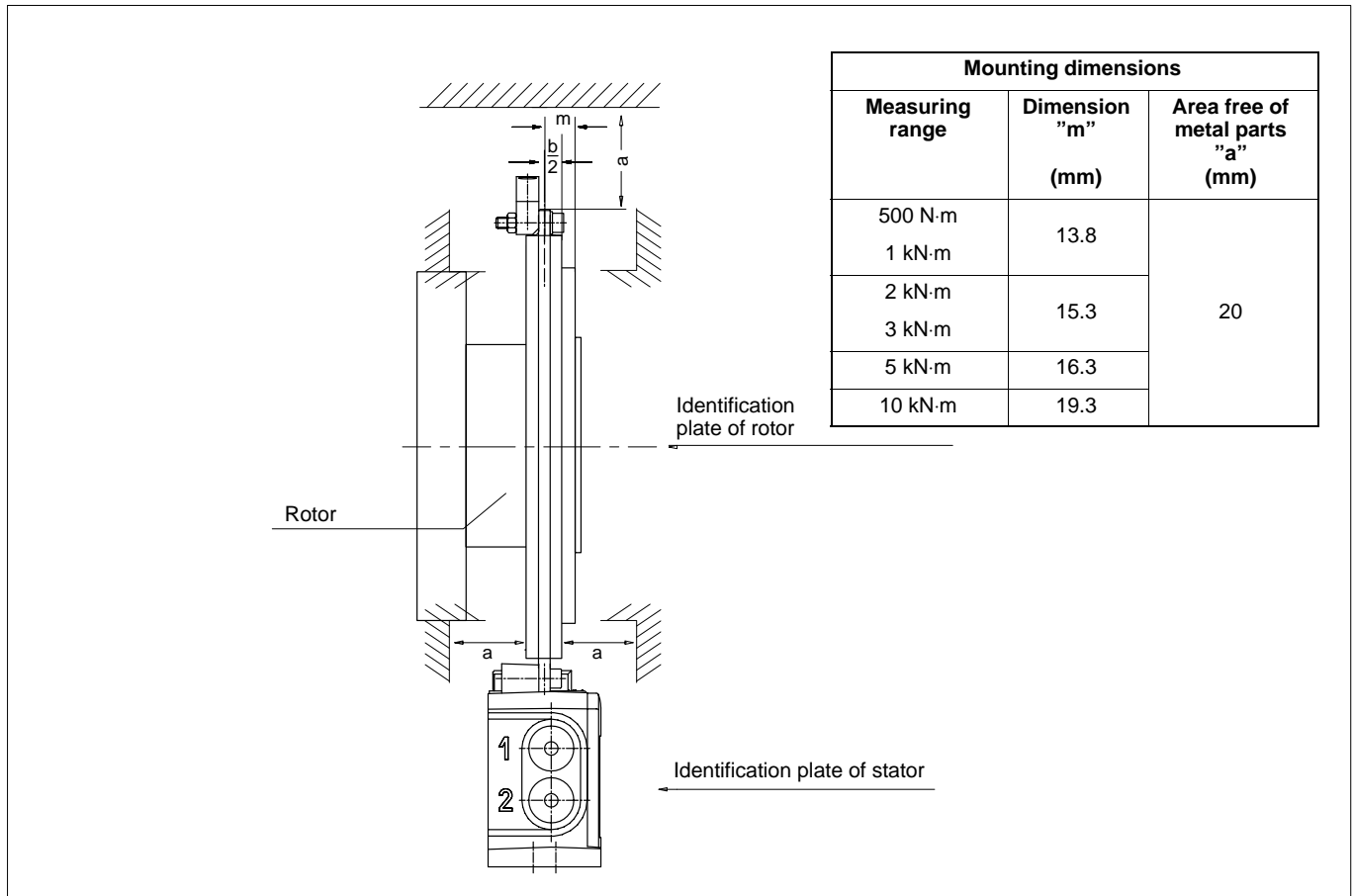
Measuring range	Dimensions in mm									
	$\varnothing d_A$	$\varnothing d_B$	$\varnothing d_C$	$\varnothing d_F$	$\varnothing d_K$	$\varnothing d_S^{C12}$	$\varnothing d_Z$	$\varnothing d_{za\ g5}$	$\varnothing d_{zi}^{H6}$	
500 N-m / 1 kN-m	139	101.5	120	123	17	10	151	75	75	
2 kN-m / 3 kN-m	175	130	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)**

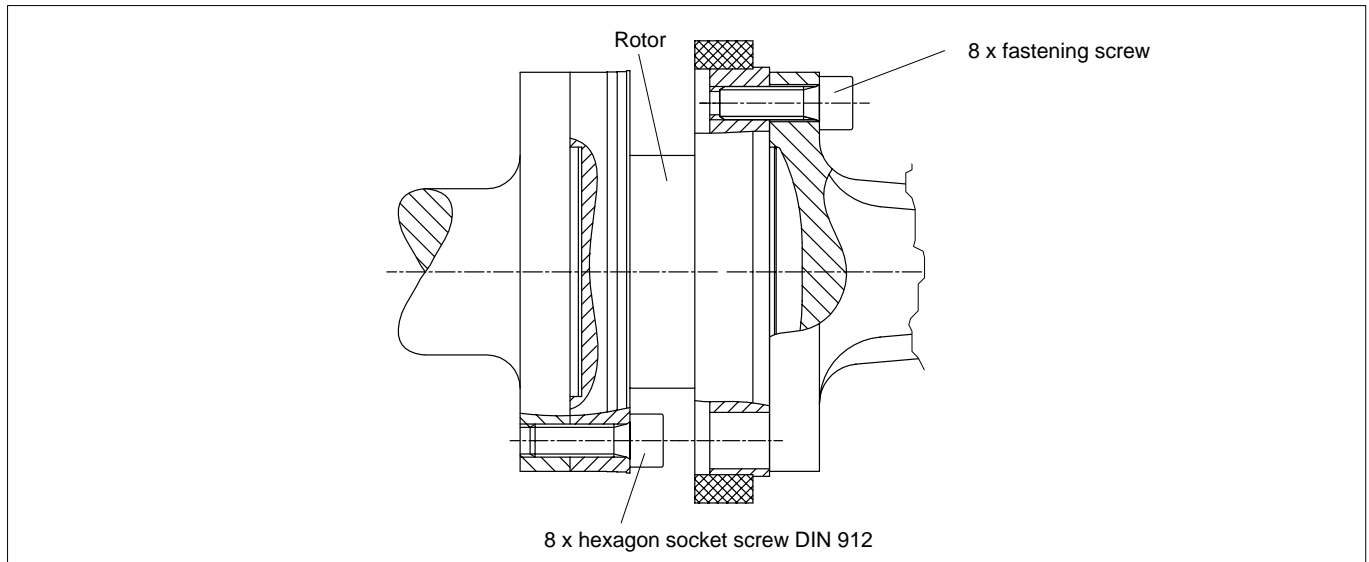


Measuring range	Dimension in mm								
	b	Ød	ØD	H1	H2	H3	h	l <sub>Speed</sub>	l <sub>Ref</sub>
500 N·m 1 kN·m	17,5	145	175	255	259	273	167.5	42	42.5
2 kN·m 3 kN·m	20.5	181	211	291	295	309	185.5	42.5	43
5 kN·m	22.5	215	245	324	329	343	202.5	57	57
10 kN·m	28.5	263	293	373	377	391	226.5	58	58

**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 $\pm$ 5 kHz, Supply 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 4: Accuracy
S	Standard
G	Increased accuracy <sup>1)</sup> Lin. $< \pm 0.03\%$ and $TK_0 < \pm 0.03\%$

Code	Option 5: Speed measuring system <sup>2)</sup>
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 <sup>*)</sup>	Torque connecting cable for KF1, 423-free ends, max. 80 m
V3	Torque connecting cable for KF1, 423-MS3106PEMV, 6 m
V4 <sup>*)</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>*)</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>*)</sup>	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 <sup>*)</sup>	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.  $< \pm 0.05\%$  ;  $TK_0 < \pm 0.13\%$

2) Only option 3, Code SF1, SU2

Order no.:

K-T10FS - [ ] [ ] [ ] [ ] - [ ] - [ ] [ ] [ ] [ ] - [ ] - [ ] [ ] [ ] [ ] - [ ] [ ] [ ] [ ] m<sup>\*)</sup>

Ordering example:

K-T10FS - [ 5 ] [ 0 ] [ 0 ] [ Q ] - [ H ] - [ S ] [ F ] [ 1 ] - [ S ] - [ 0 ] - [ V ] [ 5 ] - [ N ] [ ] [ ] [ ] [ ] m<sup>\*)</sup>

\*) 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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