

APPLICATIONS

- Rated torque: 0,2 ... 5 000 N·m
- Ratio for second range:
 - 1:10 or 1:5 of rated torque
- Speed ranges up to 50 000 1/min
- Accuracy class in standard measuring range:
 - 0,05/0,1
- In the extended measuring range:
 - 0,1/0,2/0,4
- Integral speed sensor
- Serial data output RS-232C for torque signals



DESCRIPTION

Type 4503B... torque sensors with built-in speed sensor operate on the strain gage principle. An integral, digital measurement conditioning system produces analog or digital output signals.

TECHNICAL FEATURES
Mechanical basic data

Measuring range	N-m	±0,2 ... 5 000
Rated torque M_{nom}	N-m	0,2 ... 5 000
Overload capacity at limiting torque		1,5 x M_{nom}
Alternating torque		0,7 x M_{nom}
Rupture torque		4 x M_{nom}
Built-in speed sensor	pulses/revolut.	1x60
speed measurement optional		
Minimum rotational speed for sufficient pulse stability	min ⁻¹	>2
Nominal Speed		depending on measuring range and design (see details)
Balancing class Q		
for version "L" and "W"		6,3
for version "H"		2,5
Housing material		Anodized aluminum
Protection class		IP40

General electrical specifications

Cut-off frequency -3 dB for voltage output	kHz	10
Group delay Moment at 10 kHz	µs	<220
Noise with TP filter with	Hz	1 000
Cut-off frequency (-3 dB) in measuring range 1:1	% FSO	<±0,05
Output signal	VDC	±0 ... 5/10
at M_{nom} (rated value)	kHz	100 ±40
Load resistance	kΩ	>10
Operating temperature range (rated temperature range)	°C	10 ... 60
Service temperature range	°C	0 ... 70
Storage temperature range	°C	-25 ... 80
100 % control input	VDC	"On" 3,5 ... 30 "Off" 0 ... 2
Supply voltage	VDC	11 ... 30
Power consumption	W	<10
Electrical connection		12 pin/7 pin built-in connector

Speed/Rotation angle measuring system (optional)

Size		1 ... 5
Measuring system		magnetoresistive
Output signal	V	5 TTL
Pulses per revolution (N)		2x 1 ... 8 192
Pulse tolerance (Jitter of each flank)	°	±0,03
Minimum rotational speed for sufficient pulse stability	min ⁻¹	>0
Admissible maximum output frequency f_{out}	kHz	500 ¹⁾
Group delay	µs	<100
Load resistance	kΩ	≥2
Jitter of the oscillation period (J_p)	%	$J_p = (0,03°/180°) \times N \times 100$

¹⁾ Maximum numbers of output pulses N^{max} = maximum allowable output frequency f_{out} (Hz) x 60 / rotational speed n (min⁻¹).
With 8 192 pulses means a maximum speed of 3 660 min⁻¹

Reference pulse measuring system (0-Index)

Measuring system		magnetoresistive
Output signal	V	5 TTL
Pulses per revolution		1
Pulse tolerance	°	≤0,03
Minimum rotational speed for sufficient pulse stability	min ⁻¹	>0
Group delay	µs	<100
Load resistance	kΩ	≥2

Noise immunity (EN 61326-1, Table 2)

Electromagnetic field (AM)	V/m	10
Magnetic field	A/m	100
Electrostatic discharge		
Contact discharge (ESD)	kV	8
Electrostatic discharge		
Air discharge (ESD)	kV	4
Fast transients (burst)	kV	1
Impulse voltage (surge)	kV	1
Conducted emissions (AM)	V	10

Mechanical shock (EN 60068-2-27)

Number of cycles	–	1 000
Cycle time	ms	3
Acceleration shock	g	650

Vibrational loads in 3 directions (EN 60068-2-6)

Frequency range	Hz	10 ... 2 000
Load duration	h	2,5
Acceleration (Amplitude)	g	200

Measurement features

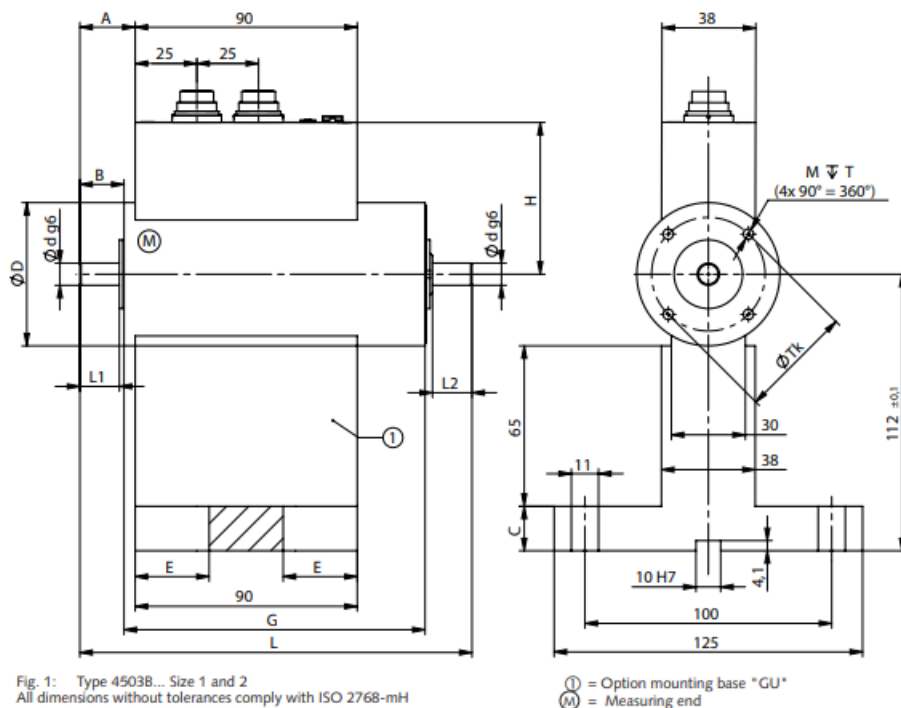
Size/Rated torque M_{nom}	N·m	0,2	0,5	1	2	5	10	20	50	100	200	500	–	–	–
	kN·m	–	–	–	–	–	–	–	–	–	–	–	1	2	5
Torque measuring system															
Nominal speed	n_{nom}														
Version "L" + "W" (Low Speed)	min ⁻¹	20 000							12 000		8 000		5 000		
Version "H" (High Speed)	min ⁻¹	50 000							30 000		20 000		10 000		
Measurement features in the measuring range 1:1 (single range)															
Accuracy class		0,1				0,05									
Linearity error including hysteresis	% FSO	<±0,1				<±0,05									
Rel. standard deviation of repeatability	% FSO	<±0,1				<±0,05									
Temperature influence zero point	%/10 K	<±0,1				<±0,05									
Temperature influence nominal value	%/10 K	<±0,1				<±0,05									

Size/Rated torque M_{nom}	N·m	0,2	0,5	1	2	5	10	20	50	100	200	500	–	–	–
	kN·m	–	–	–	–	–	–	–	–	–	–	–	1	2	5
Measurement features in the measuring range 1:5 / 1:10															
Accuracy class		0,4		0,2		0,1									
Linearity error including hysteresis	% FSO	<±0,4		<±0,2		<±0,1									
Rel. standard deviation of repeatability	% FSO	<±0,4		<±0,2		<±0,1									
Temperature influence zero point	%/10 K	<±0,4		<±0,2		<±0,1									
Temperature influence nominal value	%/10 K	<±0,4		<±0,2		<±0,1									

General technical data															
Size/Rated torque M_{nom}	N·m	0,2	0,5	1	2	5	10	20	50	100	200	500	–	–	–
	kN·m	–	–	–	–	–	–	–	–	–	–	–	1	2	5
Load limits ¹⁾															
Limiting torque, referred to M_{nom} ²⁾	%	150													
Rupture torque, referred to M_{nom}	%	>400													
Oscillation width according to DIN 50100 (peak / peak) ⁴⁾	%	70													
Version "L" + "W" (Low Speed)															
Longitudinal load limit on the drive side ³⁾	N	80							150		250		450		
Transverse load limit on the drive side ³⁾	N	120							280		700		1 500		
Longitudinal load limit on the measurement side ³⁾	N	50			80				120		200		350		
Transverse load limit on the measurement side ³⁾	N	1,6	3,3	5	10	28	30	35	200		450		700		
Version "H" (High Speed)															
Longitudinal load limit on the drive side ³⁾	N	30							75		170		250		
Transverse load limit on the drive side ³⁾	N	100							200		400		800		
Longitudinal load limit on the measurement side ³⁾	N	30							40		100		160		
Transverse load limit on the measurement side ³⁾	N	1,6	3,3	5	10	28	30	35	100		250		450		

Other technical data														
Size/Rated torque M_{nom}	N·m	0,2	0,5	1	2	5	10	20	50	100	200	500	–	–
	kN·m	–	–	–	–	–	–	–	–	–	–	–	1	2
Mechanical basic data														
Torsional rigidity c_t	kN·m/rad	0,08	0,15	0,38	0,78	1,72	2,70	11,7	15,2	74,0	97,8	134	506	685
Torsion angle at M_{nom}	°	0,14	0,35	0,38	0,30	0,37	0,33	0,43	0,25	0,38	0,15	0,29	0,43	0,23
Proportional mass moment of inertia of rotor measuring side	kgcm ²	0,051			0,052		0,062		0,47	0,48	6,90	6,96	7,14	59,1
Proportional mass moment of inertia of rotor drive side	kgcm ²	0,285			0,285		0,276		0,71	0,72	5,99	6,41	6,59	58,7
Mass moment of inertia rotor	kgcm ²	0,336			0,337		0,338		1,18	1,19	12,9	13,4	13,7	118
Natural frequency of the rotor (torsional vibration)	kHz	1,16	1,51	1,95	1,99	2,55	2,55	2,46	2,99	1,88	2,33	2,70	1,67	1,96
Balancing class according to DIN ISO 1940														
Version "L" + "W" (Low Speed)	–	G 6,3												
Version "H" (High Speed)	–	G 2,5												
Nominal lifetime of bearings L_{10h} according to ISO2815 281 ⁵⁾														
Version "L" + "W" (Low Speed)	h	18632							24400		23900		21500	
Version "H" (High Speed)	h	12009							16275		11470		14638	

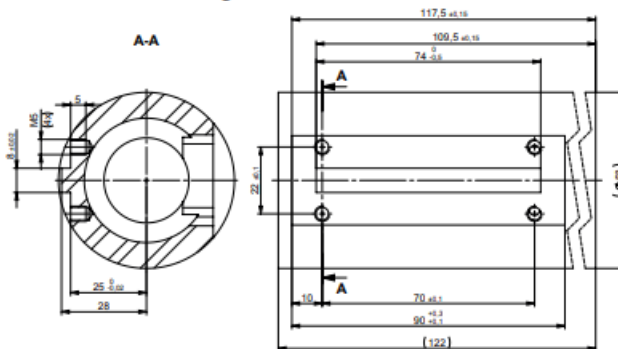
Dimensions Type 4503B..., Measuring ranges 0,2 / 0,5 / 1 / 2 and 5 / 10 and 20 N-m



Dimensions size 1 and 2 in mm

Size	1			2	
Rated torque N-m	0,2	0,5	1	2 / 5	10 / 20
L	159			163	167
L1	16			18	20
L2	16			18	20
øD	58			58	58
ød g6	9			10	12
A	22,5			24,5	26,5
B	18			20	22
C	18			18	
E	30			30	
G	122			122	
H	61,5			61,5	
øTk	46			46	
M	M5 (4x90°)			M5 (4x90°)	
T	6 deep			6 deep	

Dimensions for mounting base (GU)



Connecting dimensions for mounting base	Size 1 and 2
N-m	Tightening torque
0,2 / 0,5 / 1	6 N-m
2 / 5	(strength class of the screw: 8.8)
10 / 20	

All dimensions without tolerances comply with ISO 2768-mH

Dimensions Type 4503B..., Measuring ranges 50 / 100 N·m

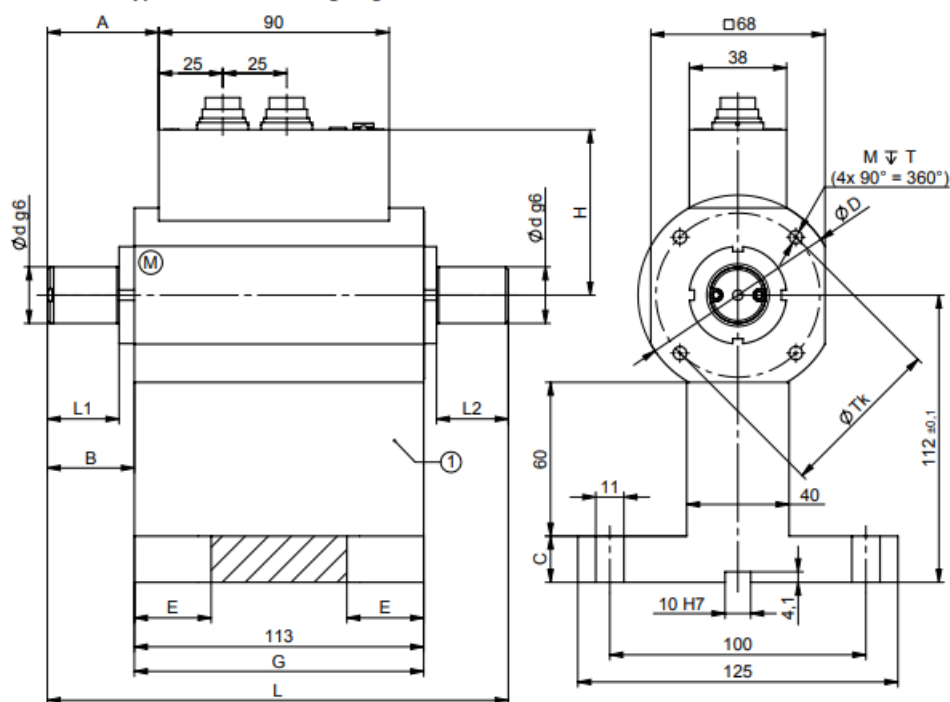


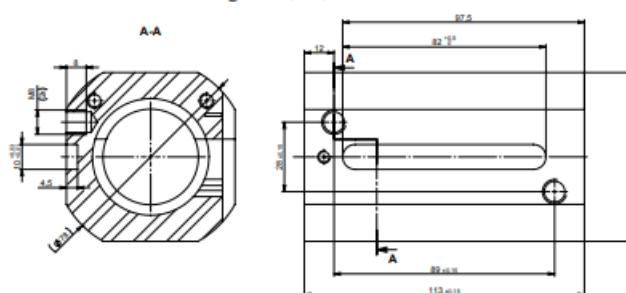
Fig. 2: Type 4503B... Size 3
All dimensions without tolerances comply with ISO 2768-mH

① = Option mounting base "GU"
 (M) = Measuring end

Dimensions size 3 in mm

Size	3
Rated torque N-m	50 / 100
L	180
L1	28
L2	28
øD	78
ød_g6	22
A	43,5
B	34
C	18
E	30
G	113
H	64,5
øTk	64
M	M6 (4x90 °)
T	12 deep

Dimensions for mounting base (GU)



Connecting dimensions for mounting base	Size 3
N·m	Tightening torque
50	25 N·m
100	(strength class of the screw: 8.8)

All dimensions without tolerances comply with ISO 2768-mH

Dimensions Type 4503B..., Measuring ranges 200 / 500 / 1 000 N-m

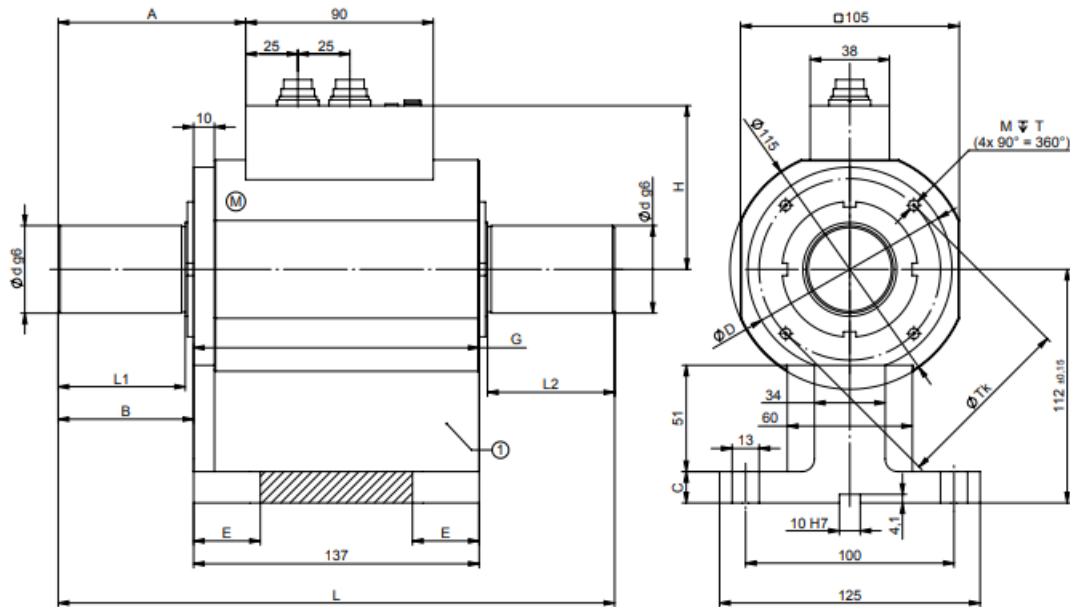


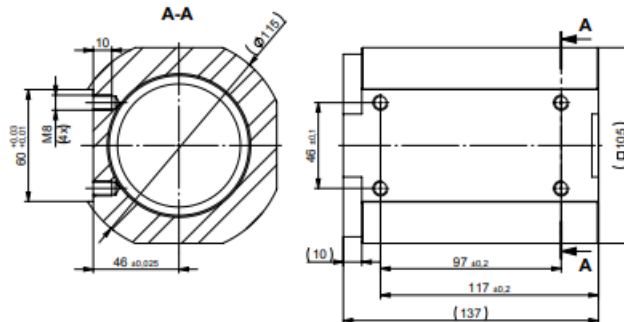
Fig. 3: Type 4503B... size 4
All dimensions without tolerances comply with ISO 2768-mH

① = Option mounting base "GU"
Ⓜ = Measuring end

Dimensions size 4 in mm

Size	4
Rated torque N-m	200 / 500 / 1 000
L	267
L1	61
L2	61
øD	98
ød g6	42
A	90
B	65
C	15
E	32
G	137
H	78,5
øTk	87
M	M6 (4x90 °)
T	12 deep

Dimensions for mounting base (GU)



Connecting dimensions for mounting base	Size 4
N-m	Tightening torque
200	25 N-m
500	(strength class of the screw: 8.8)
1 000	

All dimensions without tolerances comply with ISO 2768-mH

Dimensions Type 4503B..., Measuring ranges 2 000 / 5 000

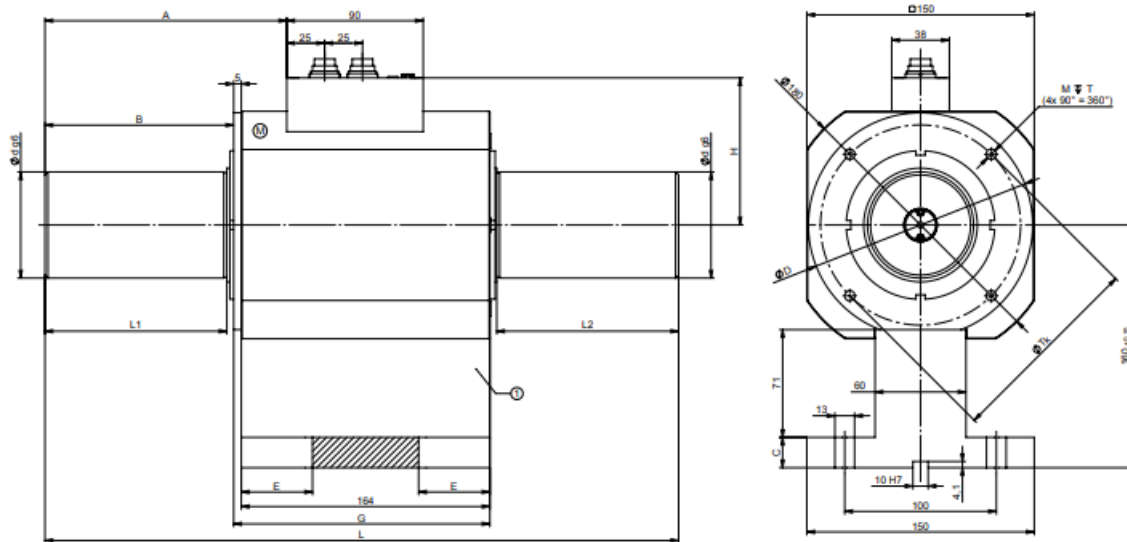


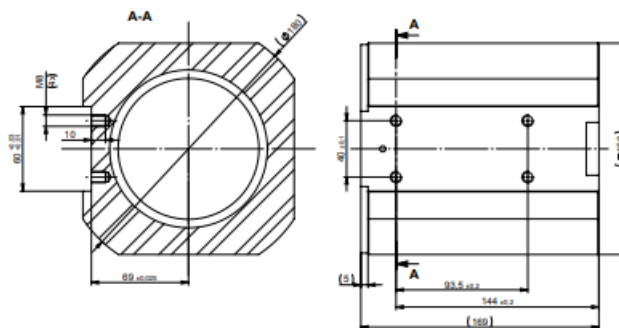
Fig. 4: Type 4503B... Size 5
All dimensions without tolerances comply with ISO 2768-mH

① = Option mounting base "GU"
Ⓜ = Measuring end

Dimensions size 5 in mm

Size	5
Rated torque N-m	2 000 / 5 000
L	418
L1	120
L2	120
øD	143
ød g6	70
A	159,5
B	124,5
C	20
E	47
G	169
H	97
øTk	132
M	M8 (4x90 °)
T	16 deep

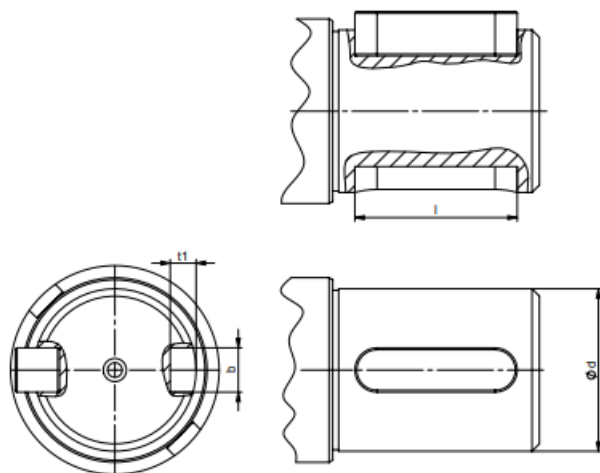
Dimensions for mounting base (GU)



Connecting dimensions for mounting base	Size 5
N-m	Tightening torque
2 000	25 N-m
5 000	(strength class of the screw: 8.8)

All dimensions without tolerances comply with ISO 2768-mH

Dimensions feather key groove acc. to DIN 6885-1 (option P1)



Dimensions in mm

Size		1			2		3	4	5
Rated torque N-m		0,2	0,5	1	2 / 5	10 / 20	50 / 100	200 / 500 / 1 000	2 000 / 5 000
$\varnothing d_{g6}$	mm	9			10	12	22	42	70
$b^{+0,1}$	mm	3			3	4	6	12	20
t1	mm	1,8 ^{+0,1}			1,8 ^{+0,1}	2,5 ^{+0,1}	3,5 ^{+0,1}	5 ^{+0,2}	7,5 ^{+0,2}
l	mm	12 ^{+0,2}			14 ^{+0,2}	16 ^{+0,2}	22 ^{+0,2}	50 ^{+0,3}	110 ^{+0,3}

Feather key according to DIN 6885-1

Mounting torque sensor Type 4503B... between drive and brake

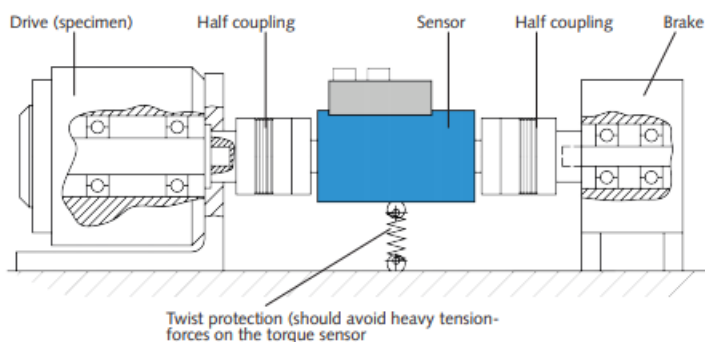


Fig. 5: Installation without holding bracket or housing base (GU).

Mounting torque sensor Type 4503B... with holding bracket (GU) or housing base

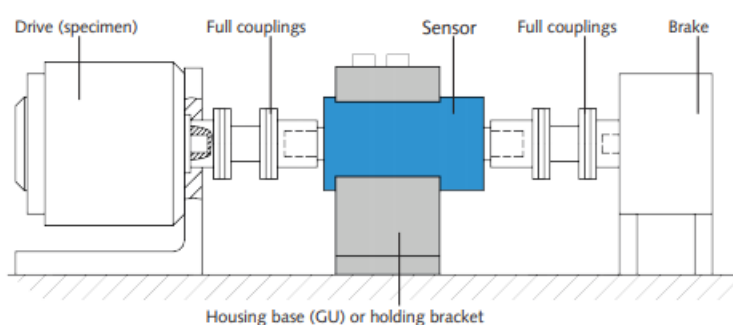
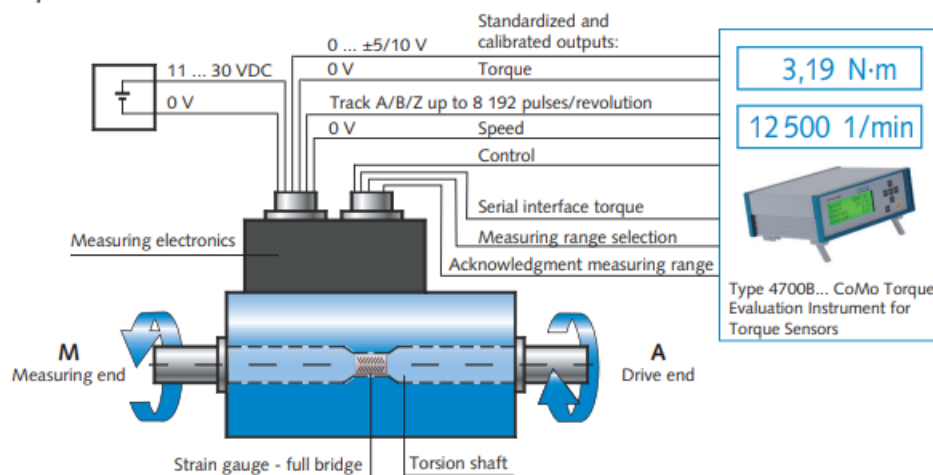


Fig. 6: Installation with holding bracket or housing base (GU).

Principle of function

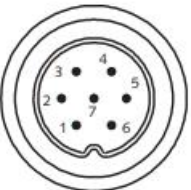


Electrical connections

Pin allocation of the 12 Pin built-in standard connector

Function	PIN	Description	
Supply voltage	F A	+U _s GND 11 ... 30 VDC, power consumption <10 W Ground relating to +U _s	
Shield	M	In sensor connected to housing	
Torque output	C	U _A Voltage output ±5/10 VDC at ±M _{nom} at >10 kΩ 5/10 VDC at control signal activation	Frequency output F ^A Frequency output >2 kΩ 100 kHz ± 40 kHz
	D	AGND Ground relating to U _s	Ground relating to F _A
Speed-/angle of rotation pulses	H G J	Track A Track B Track Z	Active, TTL level Active, TTL level, 90 ° displaced only option H, W Active, TTL level, reference pulse only option H, W
100 % control input	K	Control	Off: 0 ... 2 VDC On: 3,5 ... 30 VDC R _K = 10 kΩ
RS-232C interface (CoMo Torque)	B L	TXD RXD	Digital send path to the CoMo Torque Digital receive path
Digital ground potential	E	DGND	Ground relating to speed- or angle of rotation pulses, control input, digital connection to RS-232C

Pin allocation of the 7 Pin built-in connector for range switch

	Function	PIN	Description
	Measuring range selection	1	Amplification Normal (1:1) with 0 ... 2 VDC Extended (1:x) with 3,5 ... 30 VDC
	100 % control input	4	Control Off: 0 ... 2 VDC On: 3,5 ... 30 VDC
		7	OGND Opto isolated ground for measuring range selection and control input
	RS-232C interface	5	TXD Serial send path of the torque sensor
		6	RXD Serial receive path of the torque sensor
		3	DGND Ground relating the RS-232C interface
	Scaling selector switch	2	ACK 0 VDC at normal (1:1) 24 VDC at (1:x)
	Acknowledgment output		

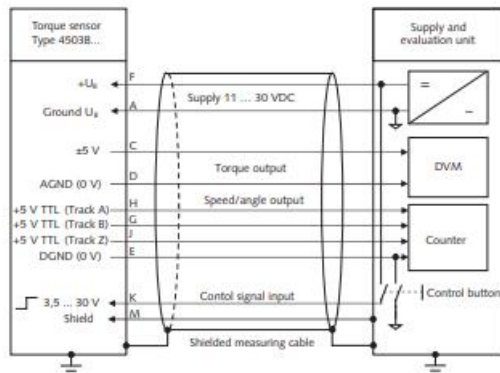


Fig. 5: Connection diagram of 12 pin built-in connector (standard)

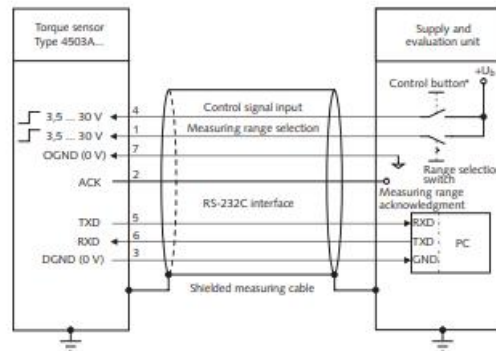


Fig. 6: Connection diagram of 7 pin built-in connector



U_s GND (A) and AGND (D) must not be connected (electronics can be damaged).
It is recommended to use a differential amplifier input for the output U_A/AGND.

Included accessories

- USB Cable

Type/Art. No.
55115378

Optional accessories

- Mounting base "GU", for measuring ranges 0,2 ... 20 N-m 18030861
- Mounting base "GU", for measuring ranges 50 ... 100 N-m 18030862
- Mounting base "GU", for measuring ranges 200 ... 1 000 N-m 18030863
- Mounting base "GU", for measuring ranges 2 000 ... 5 000 N-m 18030864
- Female connector with solder eye 12 pin 18008371
- Female connector with solder eye 7 pin 18008363
- Connection cable, 5 m, 12 pin 18008935
- Connection cable, 5 m, 12 pin – open ends 18008943
- Connection cable, 5 m, 7 pin – open ends 18008996
- Connection cable 2,5 m, 12 pin – CoMo Torque 18008967
- Connection cable 5 m, RS-232C 7 pin/D-Sub 9 pin 18008994
- Control/Monitor CoMo Torque Evaluation instrument for torque sensors 4700B...

Cable according to the data sheet 000-615.

Definition of calibration terms:

- **WKS 1:** Works calibration at 5 points right, 3 points left
- **WKS 2:** Works calibration at 5 points right and left, and repeat series
- **DAkS:** Calibration per DIN 51309

Our calibration service D-K-15127-02-00 provides traceable calibrations for torque sensors from all manufacturers.

Order example:

Type 4503B050LP000KA0

Torque sensor with 1 measuring range: rated torque 50 N-m: **050**, version L: max. speed 12 000 min⁻¹, without feather key groove: **P0**, Standard output signal ± 5 VDC and frequency 100 ± 40 kHz: **00**, calibration WKS1 single range: **KA0**

Ordering key

Type 4503B

Measuring ranges in N-m

0,2	0,2
0,5	0,5
1	001
2	002
5	005
10	010
20	020
50	050
100	100
200	200
500	500
1 000	1K0
2 000	2K0
5 000	5K0

Pulses per revolution

Low speed 60	L
High speed up to 2 x 8 192 + Z	H
Low speed up to 2 x 8 192 + Z	W

Feather key groove

Without	P0
With	P1

Output signal

Voltage ± 5 VDC and Frequency 100 ± 40 kHz	00
Voltage ± 10 VDC and Frequency 100 ± 40 kHz	B1

Calibration

WKS 1 – single range	KA0
WKS 1 – dual range 1:1 and 1:10	KA1
WKS 1 – dual range 1:1 and 1:5	KA2
WKS 2 – single range	WA0
WKS 2 – dual range 1:1 and 1:10	WA1
WKS 2 – dual range 1:1 and 1:5	WA2
DAkS 5 – single range, 5 measuring point	DK5
DAkS 8 – single range, 8 measuring point	DK8
DAkS 5 – dual range, 5 measuring point 1:1 and 1:10	D51
DAkS 5 – dual range, 5 measuring point 1:1 and 1:5	D52
DAkS 8 – dual range, 8 measuring point 1:1 and 1:10	D81
DAkS 8 – dual range, 8 measuring point 1:1 and 1:5	D82

