

Torque Sensor

Type 4503A...

Dual-Range Sensor with Brushless Transmission

Type 4503A... 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.

- 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: 0,1
In the extended measuring range: 0,2
- Integral speed sensor
- Serial data output RS-232C for torque signals

Additional advantages of second range:

- Natural overload protection of smaller range because of special design
- One sensor for two separately calibrated measuring ranges

Description

The version with a second measuring range (optional) is ideal for applications with a high peak torque but moderate operating torque. A torque sensor with only one measuring range would have to be chosen to withstand the peak torque. As a result it would, however, be oversized for measuring the operating torque actually of interest.

The dual range sensor offers the advantage of range switching, which allows highly accurate measurement of both the peak and particularly the operating torque.

Power is supplied and the measurement signals transferred between the rotating shaft and the case without contact. In addition to suitable mounting of the shaft, low production tolerances and high grade balancing, this is a further prerequisite for the high speed limit of up to 50 000 1/min achieved with the "H" version.



Application

The Type 4503A... torque sensors are used:

- In automotive and vehicle engineering
- In the aeronautical industry
- In mechanical and process plant engineering
- In electric motor manufacture

They are universal in application, being suitable for the development laboratory, production or quality assurance.

They are typically used for testing of electric motors, generators, drive performance, measurement of transmission or spindle drive friction, at a manual workstation or in networked, automated production cells.

With a torque sensor Type 4503A... you will solve your measurement requirement.

Technical Data

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}
Speed measurement for version "W"	pulses/revolut.	1x60 2x360 90° displaced, TTL up to 7 000 1/min
Nominal Speed		depending on measuring range and design (see details)
Balancing class Q for version "L"		6,3
for version "H"		2,5
Housing material		Anodized aluminum
Exception: size 4, version "H"		stainless steel
Protection class		IP40

General Electrical Specifications

Cut-off frequency –3 dB for voltage output	kHz	1
Output signal at M_{nom} (rated value)	VDC	±0 ... 5
	VDC	5 *
Load resistance	kΩ	>10
Operating temperature range (rated temperature range)	°C	10 ... 60
Service temperature range	°C	0 ... 70

* Further options available

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	<3
Electrical connection		12 pin/7 pin built-in connector

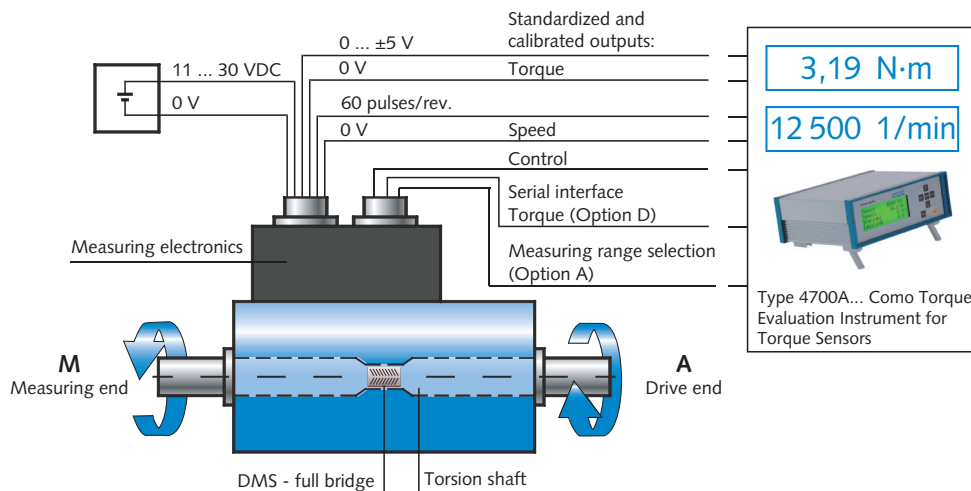
Electrical Measuring Data – Standard Measuring Range 1:1

Rated torque [N·m]	0,2 ... 2	5 ... 5 000
Accuracy class	0,1	0,1
Linearity error [% FSO] including hysteresis		<±0,1 optional version: <±0,05
Temperature influence zero point	% FSO/°C	<±0,005
Temperature influence nominal value	% FSO/°C	<±0,01
Torque control signal for voltage output/frequency output	%	100 ±0,2

Electrical Measuring Data – Extended Measuring Range 1:5, 1:10

Rated torque	N·m	1 ... 5 000
Accuracy class		0,2
Linearity error including hysteresis	% FSO	<±0,2
Temperature influence zero point	% FSO/°C	<±0,02
Temperature influence nominal value	% FSO/°C	<±0,02
Torque control signal for voltage output/frequency output	%	100 ±0,3

Principle of Function



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Measuring Ranges and Maximum Speed

Measuring range N·m	Version	
	"L" (low speed) 1/min	"H" (high speed) 1/min
0,2	20 000	50 000
0,5	20 000	50 000
1	20 000	50 000
2	20 000	50 000
5	20 000	50 000
10	20 000	50 000
20	20 000	50 000
50	12 000	30 000
100	12 000	30 000
200	8 000	20 000
500	8 000	20 000
1 000	8 000	20 000
2 000	5 000	10 000
5 000	5 000	10 000

Spring Constant and Inertia of Mass

Measuring range N·m	Spring constant N·m/rad	Inertia of mass kgcm ²	
		Measuring end	Drive end
0,2	10	0,0015	0,14
0,5	10	0,0015	0,14
1	180	0,0054	0,16
2	250	0,006	0,17
5	450	0,006	0,17
10	520	0,008	0,19
20	580	0,008	0,19
50	9100	0,54	1,16
100	13 500	0,54	1,16
200	60 000	4	8,3
500	100 000	4,2	8,3
1 000	135 000	4,2	8,3
2 000	520 000	61	85
5 000	720 000	61	85

Limit Values for Dynamic Load

Version "L" (low speed)

Size	Measuring range N·m	Weight kg	Speed 1/min	Measuring end			Drive end		
				Proportional Mass kg	Lateral force N max.	Axial force N max.	Proportional Mass kg	Lateral force N max.	Axial force N max.
1	0,2	0,8	20 000	0,07	10	50	0,25	100	50
	0,5			0,2	25	50	0,25	150	50
	1			0,2	50	50	0,25	200	50
2	2	1,4	20 000	0,2	100	50	0,25	200	50
	5			0,2	200	50	0,25	200	50
	10			0,2	200	50	0,25	200	50
	20			0,2	200	50	0,25	200	50
3	50	2	12 000	2,2	200	100	3	400	800
	100			3	400	200	3	800	800
4	200	5	8 000	3,5	400	200	10	2 000	2 000
	500			7	1 000	500	10	2 000	2 000
	1 000			10	2 000	1 000	10	2 000	2 000
5	2 000	18	5 000	40	4 000	2 000	40	10 000	10 000
	5 000			80	10 000	5 000	80	10 000	10 000

Version "H" (high speed)

Size	Measuring range N·m	Weight kg	Speed 1/min	Measuring end			Drive end		
				Proportional Mass kg	Lateral force N max.	Axial force N max.	Proportional Mass kg	Lateral force N max.	Axial force N max.
1	0,2	0,9	50 000	0,011	10	50	0,2	100	50
	0,5			0,034	25	50	0,2	150	50
	1			0,06	50	50	0,2	200	50
2	2	1,5	50 000	0,08	75	50	0,2	200	50
	5			0,1	100	50	0,2	200	50
	10			0,15	100	50	0,2	200	50
	20			0,2	100	50	0,2	200	50
3	50	2,1	30 000	0,38	200	100	2,5	300	100
	100			0,5	200	100	3	300	100
4	200	5,1	20 000	0,6	400	200	4	400	200
	500			1,2	400	200	4	400	200
	1 000			2,2	400	200	4	400	200
5	2 000	18	10 000	10	4 000	2 000	40	4 000	2 000
	5 000			25	4 000	2 000	80	4 000	2 000

Version "H" size 4 consist of stainless steel (not blue anodized)

Dimensions

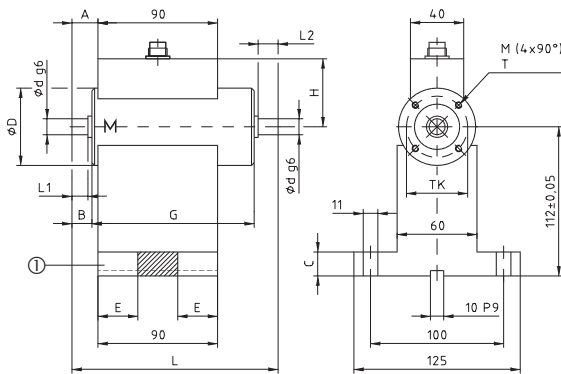


Fig. 1: Type 4503A... size 1 ... 3

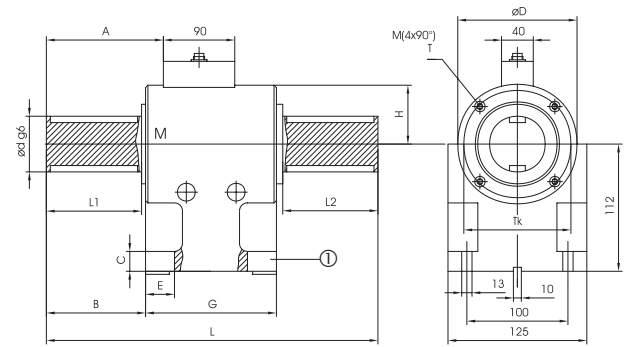
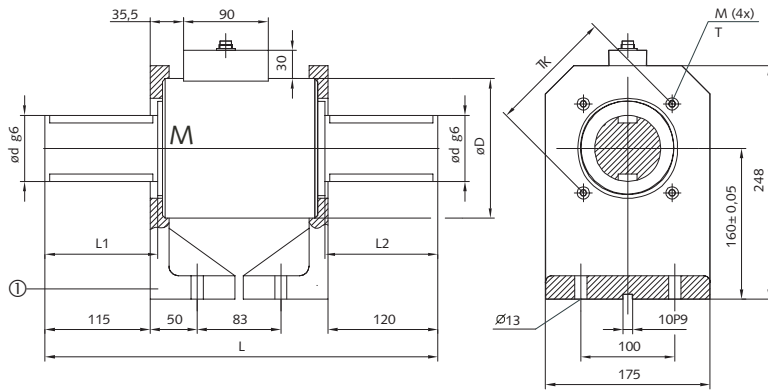


Fig. 2: Type 4503A... size 4



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

Fig. 3: Type 4503A... size 5

Dimensions in mm

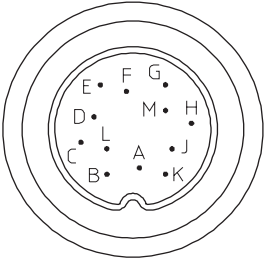
Size	1		2		3	4	5
Rated torque N·m	0,2/0,5	1	2/5	10/20	50/100	200/500/ 1 000	2 000/5 000
L	160,5	159	163	166	180	267	418
L1	16	16	18	20	28	60	122
L2	16	16	18	20	28	61	122
øD	58	58	58	58	78	98	148
ød g6	9	9	10	12	22	42 ¹⁾	70 ²⁾
A	23,5	22	24	25	43,5	83,5	
B	19	17,5	19,5	20,5	34	64,5	
C	18		18		18	15	
E	30		30		30	32	
G	122		122		113	137	
H	51		51		66	78	
TK	46		46		64	87	132
M	M5		M5		M6	M6	M8
T	10 tief		10 tief		12 tief	12 tief	16 tief

¹⁾ both shaft ends with keyways (12 P9x50/2x180°) according to DIN 6885, Bl. 1
²⁾ both shaft ends with keyways (20 P9x110/2x180°) according to DIN 6885, Bl. 1

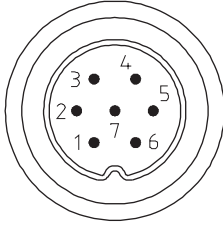
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Electrical Connections

Pin Allocation of the 12 Pin Built-in Standard Connector

	Function	PIN	Description
	Supply	F A	+U _B GND 11 ... 30 VDC, power consumption <3 W Ground relating to +U _B
	Shield	M	In sensor connected to housing
	Torque output	C	U _A ±5 VDC at ±M _{nom} at >2 kΩ 5 VDC at control signal activation R _c = 10 Ω, output short circuit proof relating to AGND Ground relating to U _A
		D	AGND
	Speed-/angle of rotation pulses	H	Track A Open collector – output (open collector) Internal 1 kΩ resistance to 5 VDC (pull up), TTL-level
		G	Track B Option N2 and N3 as track A, 90° displaced
		J	Track Z Not connected
	100% control input	K	Control Off: 0 ... 2 VDC On: 3,5 ... 30 VDC R _K = 10 kΩ
	RS-232C interface to the CoMo Torque	B	TXD Digital send path to the CoMo Torque
		L	RXD Digital receive path
	Digital mass potential	E	DGND Ground relating to speed- or angle of rotation pulses, control input, digital connection to CoMo Torque

Pin Allocation of the 7 Pin Built-in Connector for Range Switch Option A

	Function	PIN	Description
	Measuring range selection	1	Amplification Normal (1:1) with 0 ... 2 VDC Extended (1:5 / 1:10) 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
		2	For company internal functions, don't use!

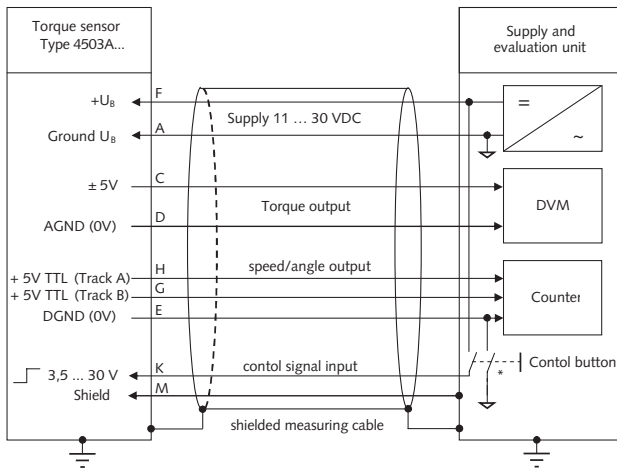


Fig. 4: Connection diagram of 12 pin built-in connector (standard)

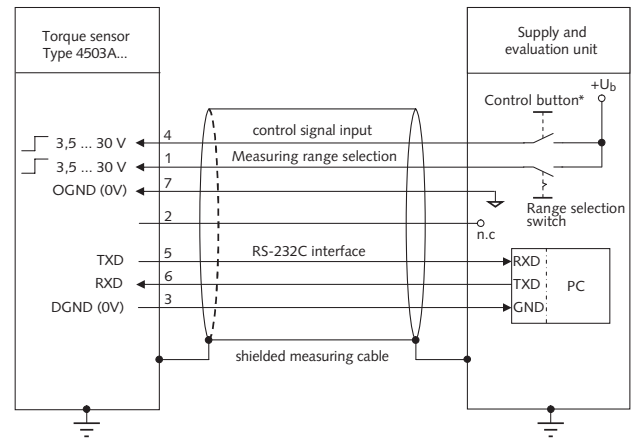


Fig. 5: Connection diagram of 7 pin built-in connector (Option A1/A2: range selection)

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Included Accessories

- None

Optional Accessories

	Type/Art. No.
• Mounting base "GU", for measuring ranges 0,2 ... 20 N·m	KSM003799
• Mounting base "GU", for measuring ranges 50 ... 100 N·m	KSM003801
• Mounting base "GU", for measuring ranges 200 ... 1 000 N·m	KSM003922
• Mounting base "GU", for measuring ranges 2 000 ... 5 000 N·m	KSM004020
• Female connector with solder eye 12 pin	KSM000703
• Female connector with solder eye 7 pin	KSM000517
• Connection cable, 5 m, 12 pin	KSM007203
• Connection cable, 5 m, 12 pin – open ends	KSM124970-5
• Connection cable, 5 m, 7 pin – open ends	KSM219710-5
• Connection cable 2,5 m, 12 pin – CoMo Torque	KSM186420-2,5
• Connection cable 5 m, RS-232C 7 pin/D-Sub 9 pin	KSM214680-5
• ControlMonitor CoMo Torque Evaluation instrument for torque sensors	4700A...

Order example without options:

Type 4503A50L0000000

Torque sensor with 1 measuring range: rated torque 50 N·m,
Version L: max. speed 12 000 1/min,
Standard output signal ±5 VDC

Order example with options:

Type 4503A50LA1B2D

Version L : max. speed 12 000 1/min,
Torque sensor **A1** with 2 measuring ranges:
1. rated torque 50 N·m, 2. rated torque 5 N·m,
B2: frequency output TTL, **D**: RS-232C interface

- (1) no **Range Selection A1** and **A2** possible
(2) no **Increased Accuracy C** possible

Ordering Key

Type 4503A

Measuring Ranges in N·m

0,2 (1) (2)	0,2
0,5 (1) (2)	0,5
1 (2)	1
2 (2)	2
5	5
10	10
20	20
50	50
100	100
200	200
500	500
1 000	1K
2 000	2K
5 000	5K

Impulses per Revolution

Low speed 60	L
High speed 60	H
Low speed 360	W

Range Selection

Without	00
Dual range sensor, rated torque 1:10 (Measuring range selection)	A1
Dual range sensor, rated torque 1:5 (Measuring range selection)	A2

Output Signal

Output signal ±5 VDC	00
Output signal ±10 VDC	B1
100 ±40 kHz (TTL)	B2
100 ±40 kHz (24 V)	B3
100 ±40 kHz (±5 push-pull)	B4

Increased Accuracy

Without	0
Increased accuracy	C

Interface

Without	00
Interface RS-232C incl. calibration	D1