

Torque Sensor with Dual-Range-Option

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.

- 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
In the extended measuring range: 0,1
- Integral speed sensor, high resolution speed/angle measurement sensor up to 8 192 pulses/revolution as option
- Serial data output RS-232C and USB interface

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

The sensor offers an integrated high resolution speed/angle measurement sensor up to 8 192 pulses/revolution, freely scalable. Additionally, the rotational direction as well as an absolute zero point (Z-line) are available.

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 4503B... 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.

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

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}
Built-in speed sensor	pulses/revolut.	1x60
speed measurement optional	(optional)	2x 1 ... 8 192
speed and angular measurement with reference pulse		90° displaced, TTL
(Version "H" and "W")		+ Z-pulse
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
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	<5
Electrical connection		12 pin/7 pin built-in connector

Electrical Measuring Data – Standard Measuring Range 1:1

Rated torque	N·m	0,2 ... 5 000
Accuracy class		0,05
Linearity error including hysteresis	% FSO	<±0,05
Temperature influence zero point	% FSO/10 K	<±0,05
Temperature influence nominal value	% FSO/10 K	<±0,05
Torque control signal for voltage output/frequency output	% FSO	100 ±0,2

Electrical Measuring Data – Extended Measuring Range 1:x

Rated torque	N·m	0,02 ... 1 000	0,02
Accuracy class		0,1	0,2
Linearity error including hysteresis	% FSO	<±0,1	<±0,2
Temperature influence zero point	% FSO/10 K	<±0,1	<±0,2
Temperature influence nominal value	% FSO/10 K	<±0,1	<±0,2
Torque control signal for voltage output/frequency output	% FSO	100 ±0,3	

Speed/Rotation Angle Measuring System

Size		1 ... 5
Measuring system		magnetoresistive
Output signal	V	5 TTL
Pulses per revolution		1 ... 8 192
Pulse tolerance	°	≤0,03
Minimum rotational speed for sufficient pulse stability	min ⁻¹	>0
Admissible maximum output frequency	kHz	500
Group delay	μs	<150
Load resistance	kΩ	≥2

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	<150
Load resistance	kΩ	≥2

Measuring Ranges and Maximum Speed

Measuring range N·m	Version "L" (low speed) 1/min	Version "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	101	0,021	0,36
0,5	101	0,021	0,36
1	213	0,023	0,36
2	480	0,024	0,36
5	1 220	0,024	0,36
10	2 757	0,034	0,37
20	6 095	0,034	0,37
50	13 020	0,8	0,49
100	16 860	0,85	0,5
200	81 860	6,57	6,08
500	119 300	6,64	6,51
1 000	148 000	6,82	6,69
2 000	603 300	58,9	61,2
5 000	725 250	60,31	62,9

Limit Values for Dynamic Load

Version "L/W" Measuring Side (low speed)

Size	Measuring range N·m	Weight kg	Speed 1/min	Measuring end		Drive end	
				Lateral force N max.	Axial force N max.	Lateral force N max.	Axial force N max.
1	0,2	1,4	20 000	1,6	50	120	80
	0,5			3,3	50	120	80
	1			5	50	120	80
2	2	1,4	20 000	10	80	120	80
	5			28	80	120	80
	10			30	80	120	80
	20			35	80	120	80
3	50	2,1	12 000	200	120	280	150
	100			200	120	280	150
4	200	5,8	8 000	450	200	700	250
	500			450	200	700	250
	1 000			450	200	700	250
5	2 000	22	5 000	700	350	1 500	450
	5 000			700	350	1 500	450

Version "H" Measuring Side (high speed)

Size	Measuring range N·m	Weight kg	Speed 1/min	Measuring end		Drive end	
				Lateral force N max.	Axial force N max.	Lateral force N max.	Axial force N max.
1	0,2	1,4	50 000	1,6	30	100	30
	0,5			3,3	30	100	30
	1			5	30	100	30
2	2	1,4	50 000	10	30	100	30
	5			28	30	100	30
	10			30	30	100	30
	20			35	30	100	30
3	50	2,1	30 000	100	40	200	75
	100			100	40	200	75
4	200	5,8	20 000	250	100	400	170
	500			250	100	400	170
	1 000			250	100	400	170
5	2 000	22	10 000	450	160	800	250
	5 000			450	160	800	250

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Dimensions

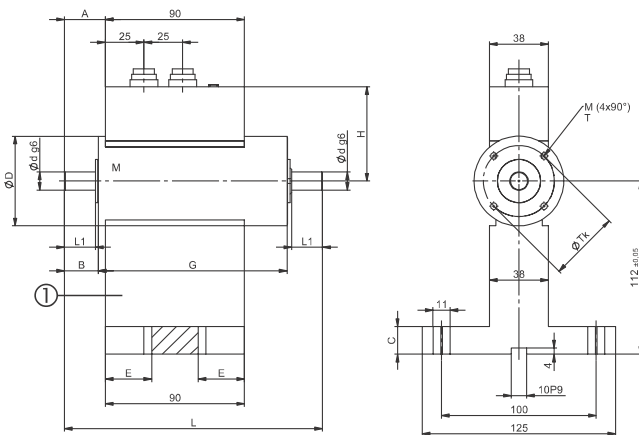


Fig. 1: Type 4503B... size 1 and 2

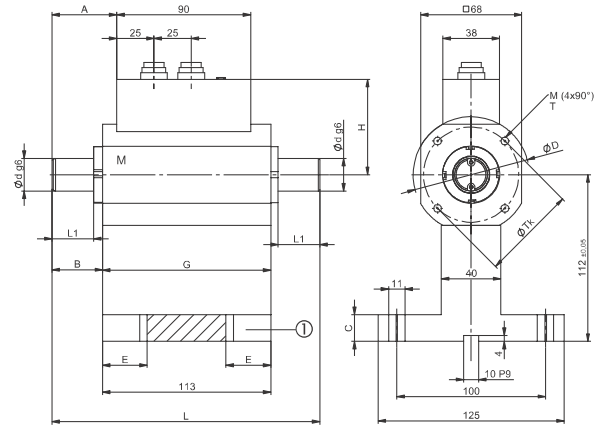


Fig. 2: Type 4503B... size 3

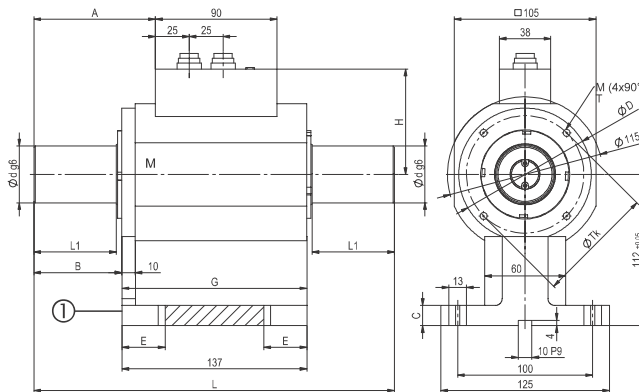


Fig. 3: Type 4503B... size 4

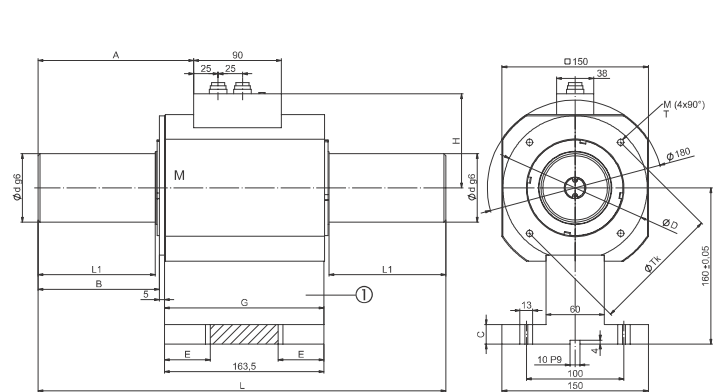


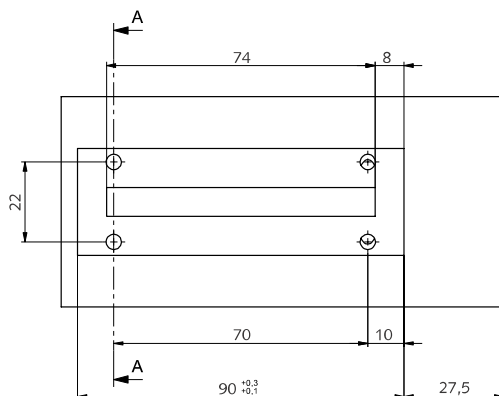
Fig. 4: Type 4503B... size 5

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

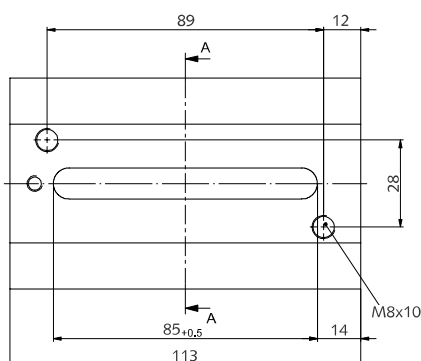
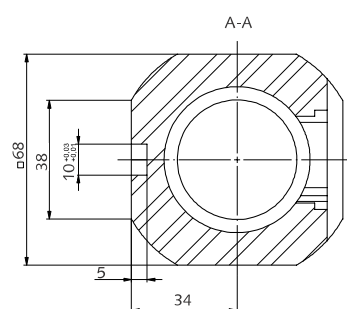
Dimensions in mm

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	159	159	159	163	167	180	267	418
L1	16	16	16	18	20	28	61	120
L2	16	16	16	18	20	28	61	120
ØD	58	58	58	58	58	78	98	148
ød g6	9	9	9	10	12	22	42	70
A	22,5	22,5	22,5	24,5	26,5	43,5	90	259,5
B	18	18	18	18	22	34	65	124,5
C	18			18		18	15	20
E	30			30		30	32	47
G	122			122		113	137	169
H	61,5			61,5		64	78	96,5
TK	46			46		64	87	132
M	M5			M5		M6	M6	M8
T	6 deep			6 deep		12 deep	12 deep	16 deep

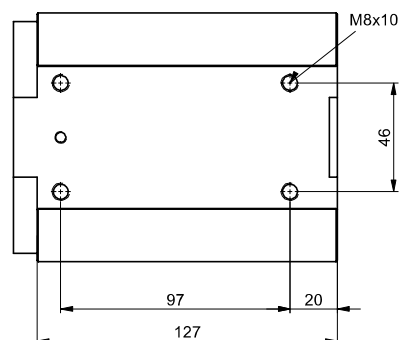
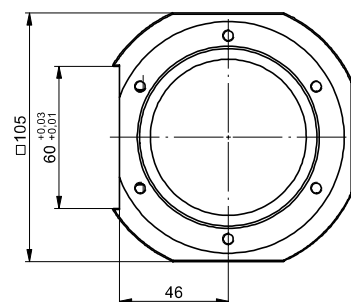
Option: both shaft ends with keyways. Keyways (2x180°) to DIN 6885, Bl. 1



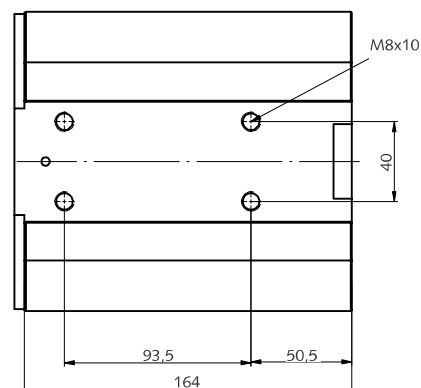
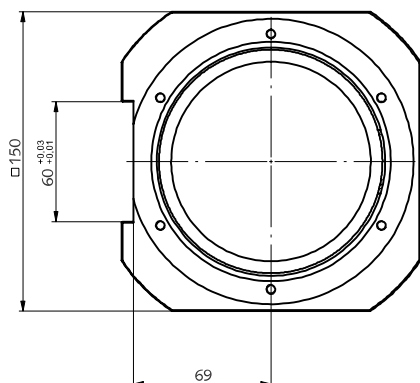
Connecting dimensions for mounting base	Size 1 and 2
N·m	Thread
0,2	M5x6 (4x)
0,5	
1	
2	
5	
10	
20	



Connecting dimensions for mounting base	Size 3
N·m	Thread
50	M8x10 (2x)
100	



Connecting dimensions for mounting base	Size 4
N·m	Thread
200	M8x10 (4x)
500	
1 000	



Connecting dimensions for mounting base	Size 5
N·m	Thread
2 000	M8x10 (4x)
5 000	

Mounting Torque Sensor Type 4503B... between Drive and Brake

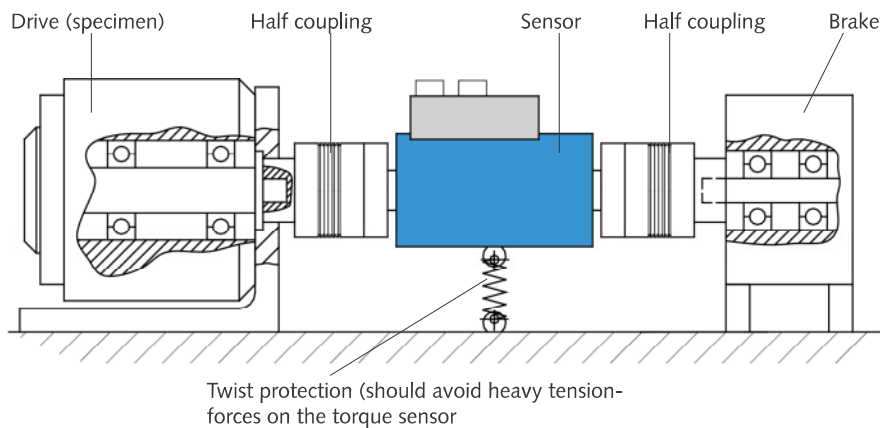


Fig. 5: Installation without holding bracket or housing base.

Mounting Torque Sensor Type 4503B... with Holding Bracket (GU) or Housing Base

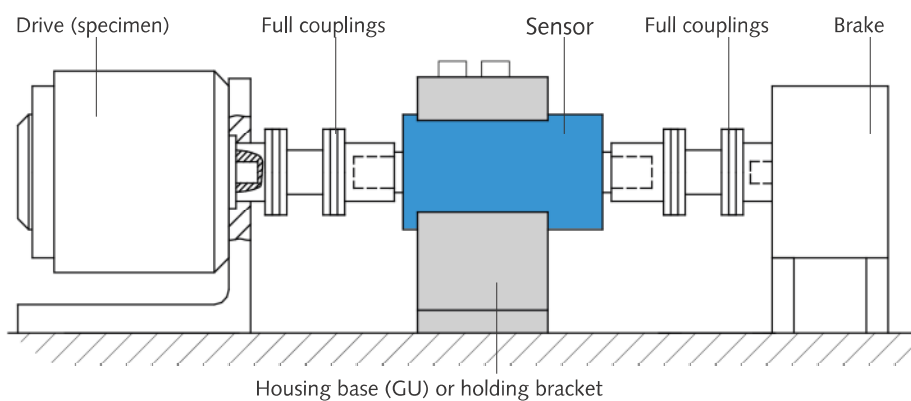
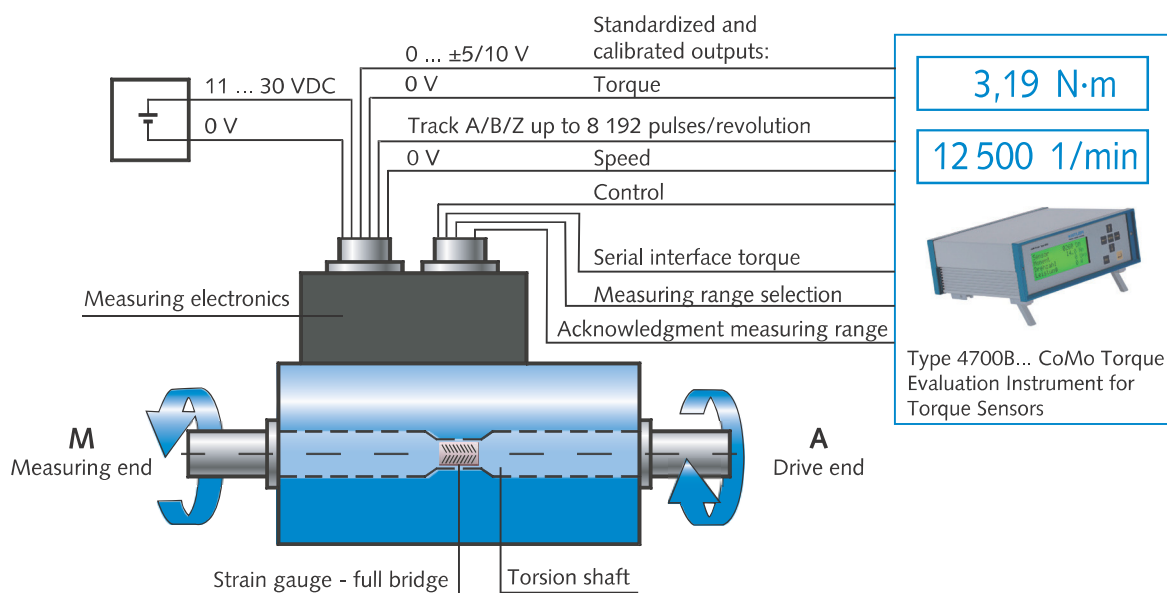


Fig. 6: Installation with holding bracket or housing base.

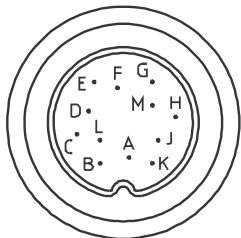
Principle of Function



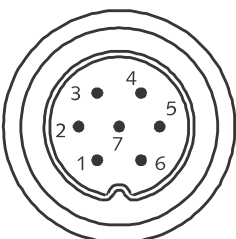
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Electrical Connections

Pin Allocation of the 12 Pin Built-in Standard Connector

	Function	PIN	Description		
	Supply voltage	F A	+U _B Ground relating to +U _B		
	Shield	M	In sensor connected to housing		
	Torque output	C	U _A	Voltage output ±5/10 VDC at ±M _{nom} at >2 kΩ 5/10 VDC at control signal activation	Frequency output F ^A Frequency output 100 kHz ± 40 kHz
		D	AGND	Ground relating to U _A	Ground relating to F _A
	Speed-/angle of rotation pulses	H	Track A	Active, TTL level	
		G	Track B	Active, TTL level, 90 ° displaced only option H, W	
		J	Track Z	Active, TTL level, reference pulse only option H, W	
	100 % control input	K	Control	Off: 0 ... 2 VDC On: 3,5 ... 30 VDC R _{i,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				

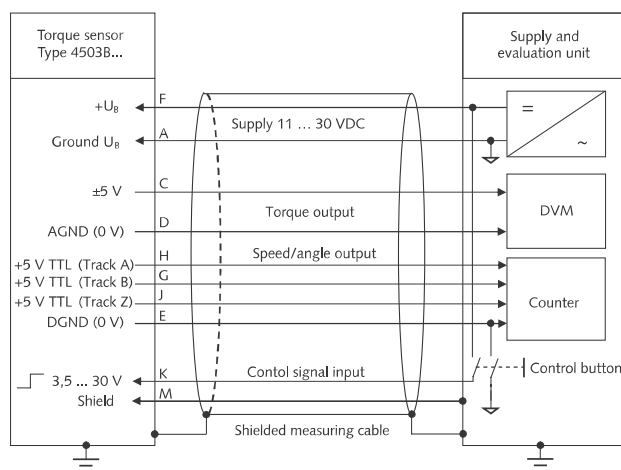


Fig. 7: Connection diagram of 12 pin built-in connector (standard)

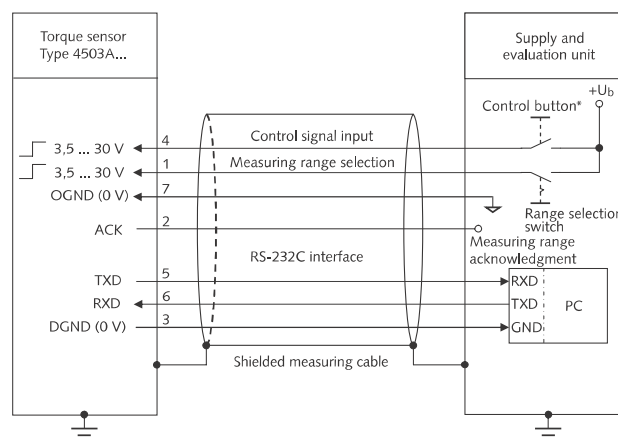


Fig. 8: Connection diagram of 7 pin built-in connector

Included Accessories

- USB Cable

Type/Art. No.

55115378

Optional Accessories

- Mounting base "GU", for measuring ranges 0,2 ... 20 N·m
- Mounting base "GU", for measuring ranges 50 ... 100 N·m
- Mounting base "GU", for measuring ranges 200 ... 1 000 N·m
- Mounting base "GU", for measuring ranges 2 000 ... 5 000 N·m
- Female connector with solder eye 12 pin
- Female connector with solder eye 7 pin
- Connection cable, 5 m, 12 pin
- Connection cable, 5 m, 12 pin – open ends
- Connection cable, 5 m, 7 pin – open ends
- Connection cable 2,5 m, 12 pin – CoMo Torque
- Connection cable 5 m, RS-232C 7 pin/D-Sub 9 pin
- ControlMonitor CoMo Torque Evaluation instrument for torque sensors

Type/Art. No.

18030861

18030862

18030863

18030864

18008371

18008363

18008935

18008943

18008996

18008967

18008994

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
- **DAkks:** Calibration per DIN 51309

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

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www.si-instruments.com.au

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/or 1:10	KA1
WKS 1 – dual range 1:1 and/or 1:5	KA2
WKS 2 – single range	WA0
WKS 2 – dual range 1:1and/or 1:10	WA1
WKS 2 – dual range 1:1 and/or 1:5	WA2
DAkks 5 – single range, 5 measuring point	DK5
DAkks 8 – single range, 8 measuring point	DK8
DAkks 5 – dual range, 5 measuring point	D52
DAkks 8 – dual range, 8 measuring point	D82

