burster

High-Precision Torque Sensor
rotating, contactless

MODEL **8661**

Highlights

- Measurement ranges of 0 … 0.02 N·m to 0 … 1000 N·m
- Very low linearity error ≤ ±0.05 % F.S.
- Output signal 0 … ±10 V
- Refresh rate 2000 measurements/s

Options

- Speed and angle measurement up to 2000 increments
- Dual range in different graduations
- Shaft end with keyway
- USB port including software

Applications

- Research & development
- Machinery and plant engineering
- Electric motor test
- Suitable for use in all types of test bench

With mounting block

With mounting block and couplings
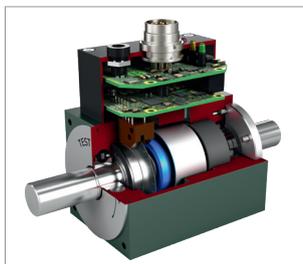
In the cross-section

With couplings

Product description

The non-contact torque sensor type 8661 works according to the strain gage principle. Thanks to the inductive and optical transmission of the signals, the sensor is maintenance-free, the signals are digitized directly on the shaft and made available by the evaluation electronics as a voltage signal or via USB. Thanks to the high-quality bearing, depending on the measuring range, up to 25,000 rpm is possible. The bidirectional voltage output from -10 V … +10 V allows the direction of rotation to be identified very easily.

To record the speed and angle of rotation, the sensor can optionally be equipped with different number of increments, up to 2000. This speed / angle signal is available as a TTL output signal.

The free DigiVision Light software is available in connection with USB, alternatively drivers for LabVIEW and DASYLab are ready for download.

Connection cables in various lengths, metal bellows couplings and mounting blocks are available for integration in customer-specific systems.

Technical Data

8661	–	4020	4050	4100	4200	4500	5001	5002
Measuring range calibrated in N·m from 0 …		±0.02 N·m	±0.05 N·m	±0.1 N·m	±0.2 N·m	±0.5 N·m	±1 N·m	±2 N·m
Accuracy								
Relative non-linearity		0.1 % F.S.		0.05 % F.S.				
Relative non-linearity dual range sensor		-				0.1 % F.S.		
Relative hysteresis		< 0.1 % F.S. / dual range sensor < 0.2 % F.S.						
Tolerance of sensitivity		±0.1 % F.S. / dual range sensor ±0.2 % F.S.						
Electrical values								
Rated supply voltage range		10 … 30 V DC (or 5 V via USB)						
DC power consumption		approx. 2 W						
Output voltage at ± rated torque		±10 V						
Output resistance		1 kΩ						
Insulation resistance		> 5 MΩ						
Refresh rate		2000/sek.						
Ripple		< 50 mV$_{ss}$						
Control signal		10.00 V DC						
Environmental conditions								
Range of operating and nominal temperature		0 °C … +60 °C						
Sensitivity of temperature effects		on the zero point 0.015 % F.S./K / 2. measuring range dual range sensor 0.03 % F.S./K on the sensitivity 0.010 % F.S./K / 2. measuring range dual range sensor 0.02 % F.S./K						
Mechanical values								
Dynamic overload safe		recommended 70 % of nominal torque						
Max. operation torque		200 % of nominal torque / dual range sensor 150 %						
Breakaway torque		300 % of nominal torque						
Alternating load		70 % of nominal torque						
Maximum limit axial load	[N]	50						
Maximum limit radial load	[N]	3				4	7	13
Spring constant	[N·m/rad]	10	20	50	100	100		180
Mass moment of inertia measuring side	[10⁻⁶ kg*m²]	0.048			0.05	0.06	0.062	0.077
Mass moment of inertia drive side	[10⁻⁶ kg*m²]	2.2						
Max. rotary speed	[min⁻¹]	25000						
Other								
Material		Housing: made of anodized aluminium; Shaft: high-strength aluminium 3.1354; shaft ends stainless steel 1.4542		Housing: made of anodized aluminium Shaft: stainless steel 1.4542				
Protection class		acc. EN 60529, IP40						
Weight	[g]	300						
Installation								
Installation instructions		Do not exceed the permitted axial and radial forces during fitting and operation. Please refer to our operating instructions for detailed information www.burster.com. Suitable couplings should be used to avoid strain resulting from parallel or angular offset between the shafts.						

Technical Data

8661	–	5005	5010	5020	5050	5100	5200	5500	6001
Measuring range calibrated in N·m from 0 …		±5 N·m	±10 N·m	±20 N·m	±50 N·m	±100 N·m	±200 N·m	±500 N·m	±1000 N·m
Accuracy									
Relative non-linearity		0.05 % F.S.							
Relative non-linearity dual range sensor		0,1 % F.S.							
Relative hysteresis		< 0.1 % F.S. / dual range sensor < 0.2 % F.S.							
Tolerance of sensitivity		±0.1 % F.S. / dual range sensor ±0.2 % F.S.							
Electrical values									
Rated supply voltage range		10 … 30 V DC (or 5 V via USB)							
DC power consumption		approx. 2 W							
Output voltage at ± rated torque		±10 V							
Output resistance		1 kΩ							
Insulation resistance		> 5 MΩ							
Refresh rate		2000/sek.							
Ripple		< 50 mV$_{ss}$							
Control signal		10.00 V DC							
Environmental conditions									
Range of operating and nominal temperature		0 °C … +60 °C							
Sensitivity of temperature effects		on the zero point 0.015 % F.S./K / 2. measuring range dual range sensor 0.03 % F.S./K on the sensitivity 0.010 % F.S./K / 2. measuring range dual range sensor 0.02 % F.S./K							
Mechanical values									
Dynamic overload safe		recommended 70 % of nominal torque							
Max. operation torque		200 % of nominal torque / dual range sensor 150 %							
Breakaway torque		300 % of nominal torque							
Alternating load		70 % of nominal torque							
Maximum limit axial load	[N]	200			300			500	
Maximum limit radial load	[N]	15	30	60	125	215		250	500
Spring constant	[N·m/rad]	800	1700	3000	14000	25000	40000	150000	220000
Mass moment of inertia measuring side	[10^{-6} kg*m^2]	2.2	2.35	2.6	33.3	33.7	35.0	600	600
Mass moment of inertia drive side	[10^{-6} kg*m^2]	14.3		14.6	85.7	85.9	85.5	1200	
Max. rotary speed	[min^{-1}]	15000						7000	
Other									
Material		Housing: made of anodized aluminium; Shaft: stainless steel 1.4542							
Protection class		acc. EN 60529, IP40							
Weight	[g]	900			1500			6000	
Installation									
Installation instructions		Do not exceed the permitted axial and radial forces during fitting and operation. Please refer to our operating instructions for detailed information www.burster.com. Suitable couplings should be used to avoid strain resulting from parallel or angular offset between the shafts.							

Dimensional drawing

Test side

Drive side

L2 L3 L4

65

40

4 x T2
on both sides

A1 ±0,05
A3 ±0,03

4 x ØD4 ±0,03
4 x T1

Keyway

2 x Keyway DIN 6885* at 5 ... 200 Nm optionally
4 x Keyway DIN 6885* from 500 Nm obligatory
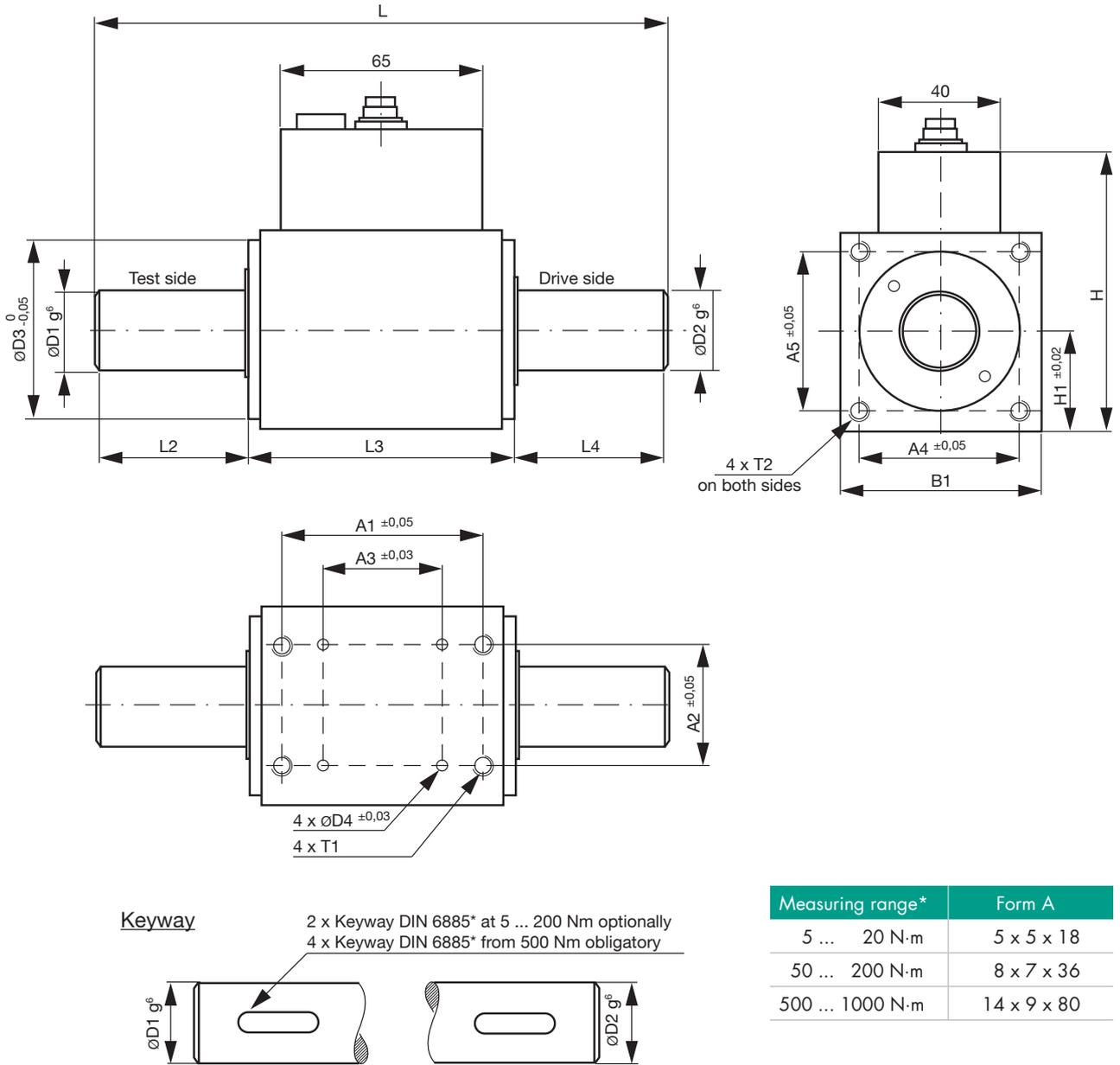
Measuring range*	Form A
5 ... 20 N·m	5 x 5 x 18
50 ... 200 N·m	8 x 7 x 36
500 ... 1000 N·m	14 x 9 x 80

For detailed dimensions you can find sensor CAD data on our website www.burster.com.

8661	–	4020	4050	4100	4200	4500	5001	5002
Measuring range from 0 …		±0.02 N·m	±0.05 N·m	±0.1 N·m	±0.2 N·m	±0.5 N·m	±1 N·m	±2 N·m
Geometry								
A1	[mm]	45						
A2	[mm]	31						
A3	[mm]	30						
A4	[mm]	26						
A5	[mm]	24						
B1	[mm]	40						
D1	[mm]	5g6						6g6
D2	[mm]	8g6						
D4 Ø / deep	[mm]	Ø 3.1 / 5						
H	[mm]	60						
H1	[mm]	15						
L	[mm]	87						
L2	[mm]	10						14
L3	[mm]	66						
L4	[mm]	11						14
T1 / deep	[mm]	M4 / 8						
T2 / deep	[mm]	M3 / 5,5						

8661	–	5005	5010	5020	5050	5100	5200	5500	6001
Measuring range from 0 …		±5 N·m	±10 N·m	±20 N·m	±50 N·m	±100 N·m	±200 N·m	±500 N·m	±1000 N·m
Geometry									
A1	[mm]	57						50	
A2	[mm]	44						90	
A3	[mm]	41						30	
A4	[mm]	45.3		54.4				88.4	
A5	[mm]	45.3		54.4				88.4	
B1	[mm]	55		64				107	
D1	[mm]	15g6		26g6				45g6	
D2	[mm]	15g6		26g6				45g6	
D4 Ø / deep	[mm]	Ø 3.1 / 5						Ø 4.1 / 10	
H	[mm]	85		94				137	
H1	[mm]	27.5		32				53.5	
L	[mm]	143		168				285	
L2	[mm]	30		45				95	
L3	[mm]	83		78				95	
L4	[mm]	30		45				95	
T1 / deep	[mm]	M5 / 9		M5 / 8				M8 / 20	
T2 / deep	[mm]	M4 / 6						M6 / 10	

Electrical values

12-pin connector or USB (Option, USB connection cable included)

Pin	Assignment	Cable colour (99540-000F-052XXXX)
Wiring Code depends on the options selected		
A	NC	
B	Angular exit B	violet
C	Moment output +	yellow
D	Moment output -	green
E	Supply -	blue
F	Supply +	red
G	Angular exit A	pink
H	NC	
J	Ground angle output, measuring range switchover	black
K	Control signal	White
L	Measuring range switchover	brown
M	NC	

Accessories

Mounting block model 8661-Z00X

If the sensor needs to be replaced, the locating pin speeds up replacement, avoiding the need for laborious realignment. This can be useful especially when the sensor is only used occasionally in the load path. The mounting block has a central hole and special design allowing a range of options for reliable cable attachment. Two clips ensure the sensor is fixed securely.

For further information please see accessories data sheet 8661-Z00X

Metal bellow couplings

For optimum compensation of misalignment we recommend torsionally free metal bellow couplings. They are characterized by their excellent torsional stiffness during torque load and their low restoring forces. The couplings are optionally with keyways available.

For further information please see accessories data sheet 869X.

Options

USB interface

This sensor version has a USB connection instead of the ±10 V output. The sensor is powered via USB, no further connections required.

In addition to torque, the speed or rotation angle measured values are optionally available. The calculated mechanical performance in is also displayed in DigiVision.

Free drivers are available for integration into LabVIEW and DASYLab, also a DLL for integration into your own programs.

Dual range

The sensor with two measuring ranges corresponds to its dimensions of the standard version, but has two separately calibrated measuring ranges. The measuring ranges are switched within <50 ms, even during measurement operation, by applying the operating voltage to pin L or via USB. The following graduations are available:

Graduation:	1:10	1:4	1:5
	Upper scale value of second range		
0.5 N·m	-	-	0.1 N·m
1 N·m	-	-	0.2 N·m
2 N·m	0.2 N·m	0.5 N·m	-
5 N·m	0.5 N·m	-	1 N·m
10 N·m	1 N·m	-	2 N·m
20 N·m	2 N·m	5 N·m	-

Graduation:	1:10	1:4	1:5
	Upper scale value of second range		
50 N·m	5	-	10 N·m
100 N·m	10 N·m	-	20 N·m
200 N·m	200 N·m	50 N·m	-
500 N·m	50 N·m	-	100 N·m
1000 N·m	10 N·m	-	100 N·m

The second, smaller measuring range can be activated via USB or by applying the operating voltage to pin L.

Torque sensor with integrated rotational speed / angular displacement measurement

8661 torque sensors are optionally available with integrated rotational speed and angular displacement measurement. Two pulse channels with TTL level – channel A and channel B – are always available. For clockwise rotation (looking at the test side), channel A leads channel B with a phase shift of 90°. Only one pulse channel is needed for speed measurement.

For angular displacement measurement (or direction detection), both channels need to be evaluated. To achieve the maximum angular resolution, four-edge decoding must be used to read both the rising and falling edges. For instance an angular resolution of up to 0.045° can then be achieved with an encoder disk having 2000 increments.

Maximum speed:

Encoder disk with 2000 increments: ≤ 3000 min^{-1}
Encoder disk with 1024 increments: ≤ 6000 min^{-1}
Encoder disk with 400 increments: ≤ 15000 min^{-1}
Encoder disk with 240 increments: ≤ 25000 min^{-1}

| Increments	from 0 ... 0,02 N·m to 0 ... 2 N·m	from 0 ... 5 N·m to 0 ... 200 N·m	from 0 ... 500 N·m to 0 ... 1000 N·m
2000	-	yes	-
1024	yes	yes	yes
400	yes	yes	-
240	yes	-	-
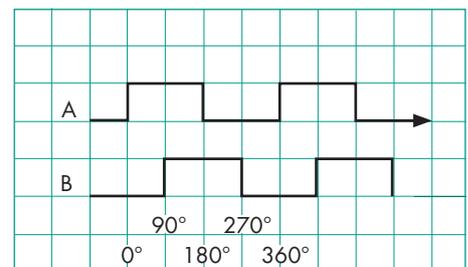
The measuring accuracy of the rotational speed and angular displacement measurement is directly related to the speed and the encoder disk used. With the USB option, another influencing factor is the setting of the averaging, which should be adapted to the speed range used.

DigiVision configuration and analysis software

Features

- Tare function
- Configuration options for averaging and filters; value stored in sensor
- Intuitive user interface
- Automatic sensor identification
- Sensor calibration data readout
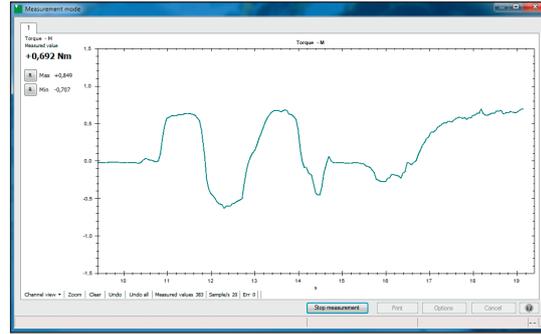
DigiVision Light PC software	
freely available on our website	DigiVision configuration and analysis software max. 200 measured value/s for one sensor
DigiVision Standard PC software	
Model 8661-P100	DigiVison configuration and analysis software up to 16 channels, no limit to the refreh rate
PC-Software DigiVision Professional	
Model 8661-P200	DigiVision configuration and analysis software with additional configurable maths channel; up to 32 channels

- Numerical & graphical display and measurement of the physical torque value
- Practical start and stop trigger functions
- 4 limits can be configured for each measurement channel
- MIN/MAX value acquisition
- Automatic scaling
- Measurement reports can be saved as Excel or PDF file
- Archive viewer for displaying sets of curves
- X Multichannel measurements, even with different sensors (e.g. 9206, 8631, 8625) available with standard version

Accessories

Order code	
9940	Mating connection 12 pin (scope of delivery)
9900-V539	Mating connection 90°-angle
99540-000F-0520030	Connecting cable, length 3 m, other end free
99539-000F-0520030	Connecting cable, length 3 m, plug with 90°-angle, other end free
99209-540G-0160030	Connecting cable for model 7281 and model 9311, length 3 m, with external supply
99163-540A-0520030	Connecting cable, length 3 m, 8661 to DIGIFORCE® 9307combined cannel D (option channel)
99209-215A-0090004	Adapter cable to DIGIFORCE® 9307 standard channel A/B and C (usable only in connection with type 99163-540A-052xxxx)
	DigiVision Light configuration and analysis software, max. 200 measured value/s for one sensor (freely available on our website)
9900-K349	USB cable, length 2 m (included with the USB version)
8661-P100	DigiVision Standard configuration and analysis software; up to 16 channels
8661-P200	DigiVision Professional with additional configurable maths channel; up to 32 channels
8600-Z00X	Mounting block, see accessories data sheet 8661-Z00X
8600-Z010	Power pack for external supply

Calibration

Manufacturer Calibration Certificate (WKS)	
	Special calibration for clockwise or/and counter clockwise direction torque, in 20 % steps of range up and down.
Calibration Certificate with accreditation symbol	
	Calibration certificate with accreditation symbol per DIN 51309, clockwise or/and anticlockwise torque, with eight steps spaced across the measurement range, increasing and decreasing.

Order code

Measuring Range		Code			
0 … ±0.02 N·m	4	0	2	0
0 … ±0.05 N·m	4	0	5	0
0 … ±0.1 N·m	4	1	0	0
0 … ±0.2 N·m	4	2	0	0
0 … ±0.5 N·m	4	5	0	0
0 … ±1 N·m	5	0	0	1
0 … ±2 N·m	5	0	0	2
0 … ±5 N·m	5	0	0	5
0 … ±10 N·m	5	0	1	0
0 … ±20 N·m	5	0	2	0
0 … ±50 N·m	5	0	5	0
0 … ±100 N·m	5	1	0	0
0 … ±200 N·m	5	2	0	0
0 … ±500 N·m	5	5	0	0
0 … ±1000 N·m	6	0	0	1

					Standard			
					0	0	0	0
8	6	6	1	–				– V

Standard sensor

■ Standard sensor, one measuring range	0
■ Dual-range version, graduation 1:10 available ≥ 2 N·m	1
■ Dual-range version, graduation 1:5 available ≥ 0.5 N·m	2
■ Dual-range version, graduation 1:4 available ≥ 2 N·m	3

■ Without speed/angle measurement	0
■ Speed/angle measurement 400 increments	1
■ Speed/angle measurement 1024 increments	2
■ Speed/angle measurement 240 increments	3
■ Speed/angle measurement 2000 increments	4

Output signals

■ Output voltage 0 … ±10 V	0
■ USB interface	1
■ Output voltage 0 … ±5 V	2

Versions

■ Round shaft ends	0
■ Shaft ends with keyway	2