Precision Torque Sensor
Non-contact transmission for rotating applications
Optional measurement of angle and speed

Model 8661

Application
The series 8661 precision torque sensor is the ideal choice for reliable measurement of static and dynamic clockwise and counter-clockwise torques. Thanks to the non-contact transmission of the excitation voltage and measurement signal, the sensor offers virtually maintenance-free and fail-safe operation. This makes it perfect for industrial production and assembly applications where there is a need to measure actuating or breakaway torques, holding torques or tightening torques. Its high measurement quality means that the sensor is equally suited to quality control applications and laboratory-based research and development projects.

The applied torque can be read easily by evaluation units or controllers connected to the normalized analog interface. For network-independent, mobile use, the torque sensor offers an optional USB interface. This can be connected to a notebook running the PC software supplied with the device to take on-site measurements with accompanying visualization and archival of measurement values.

Its compact, robust and vibration-proof construction makes it suitable for use in the following example applications:

- Test setups for precision mechanics
- Measurements on micromechanical actuator elements
- Engine test benches including measurement of mechanical power
- Recording biomechanical movements in medical engineering
- Precision frictional torque measurements on bearings
- Use as test-bench measuring device

Description
The measuring shaft, which is made of high-quality materials, carries metal-film strain gauges. Torsion of the shaft by the torque to be measured produces a change in resistance in the full bridge, which is converted into a measurement signal that is proportional to the torque.

To ensure wear-free operation, the power is supplied by inductive coupling and the measurement signals are transmitted optically. The signal, which has been digitized already on the shaft, is converted and amplified into a 0 … ± 10 V signal by a 16 bit digital-to-analog converter on the stator. A high-resolution TTL output signal for the angular displacement and rotational speed measurement is achieved by optical sensing of an incremental encoder disk with up to 1024 divisions and two offset tracks plus four-edge decoding.

An extra socket in addition to the standard 12 pin connector provides another option for connecting an external supply. Continuous, online display of the various operating states is provided by a 3 LED optical indicator.

High-quality bearings, tight manufacturing tolerances and excellent balance are essential for achieving the optimum running stability that this sensor delivers at speeds of over 25 000 rpm.

Optional:
- USB interface
- Dual range

Technical changes reserved. All data sheets at www.burster.com
## Technical Data

### Table 1

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### Dimensional drawing

#### Keyway
2 x Keyway DIN 6885* at 5 ... 200 Nm optionally
4 x Keyway DIN 6885* from 500 Nm obligatory

#### Measuring Range* Form A

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Specifications, based on measurement range  

**Table 2**

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**Max speed with option angle and speed measurement refer to page 5.**

**Sensor with 2 Measurement Ranges (option)**

The sensor with two measuring ranges has the same dimensions as the standard version but it also has two different calibrated measuring ranges.

The dual range sensor offers significant advantages:

1. With a single sensor a very wide range of torques can be measured accurately.
2. Good overload protection particularly in smaller measuring ranges: For the smaller measuring range the sensor provides the overload protection of the larger measuring range.
3. No retooling time at all and only one coupling pair is needed.

Possible ratio of dual ranges sensor:

- 1:4
- 1:5
- 1:10

With the sensor with the 12 pin connector the measuring range is switched by applying a voltage level whose magnitude and whose ground reference correspond to the control signal. (For measuring range 1:1, 0 ... 3 V, for the extended measuring range 10 ... 30 V). The switching time is max. 50 ms.

Typical applications of the dual range sensor are:

- Test stands for motors, turbines and gears, extruders
- Engineering
- Drive engineering
- Aeronautics and space sector
- Automotive
- Product development
- Quality assurance

**Specification, based on measurement range  

**Table 3**

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<td>± 0.2 Nm</td>
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<td>± 0.5 Nm</td>
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<td>± 1 Nm</td>
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<td>± 2 Nm</td>
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<td>± 5 Nm</td>
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*X = 1: range extension 1:10, X = 2: range extension 1:5, X = 3: range extension 1:4*
Torque Sensor with integrated USB Interface (option)

- Includes powerful data acquisition software DigiVision
- Plug & Measure
- Numerical and graphical display of torque/speed/mechanical power as well as editable mathematical factors/results, etc.
- Suitable for mobile use with a notebook
- Power supply via the USB-port (External power supply is not required)
- DLL and LabView-driver for free

This sensor version has an USB-port instead of the 0...± 10 V output. The measurement signal is transferred digitally from the measuring shaft and then transmitted serially. This allows a PC-based evaluation of the measurement signals. Beside torque, speed or angular displacement measurement values are provided optionally. The DigiVision software displays the mechanical power values also calculated by the sensor.

Configuration and Evaluation Software DigiVision
Multichannel configuration and evaluation software suitable for easy PC-based analysis and reporting in mobile and stationary applications such as lab, R & D and industrial environment.

DigiVision Features
- Numerical and chart representation of the torque, speed, angle and mechanical power
- Intuitive user interface
- Automatic sensor detection
- Practical start and stop trigger features
- 4 limits per channel configurable
- Peak value memory for MIN/MAX
- Auto scale
- Storage function of the measuring log as Excel or PDF file
- Archive viewer including curve array display
- Multichannel operation with full version possible also with other sensors, e.g. 8625, 9206
- Calibration data are stored in the sensor

Signal processing
Measuring rate:
- up to 200 meas./s (with 8661-P001) for each channel
- up to 400 meas./s (with 8661-P100) for each channel
- up to 1000 meas./s (with 8661-P200) for each channel
A/D conversion: 16 bit

Operating System requirements
Windows 2000, XP, Vista, Windows 7, Windows 8 und Windows 10

Accessories
Configuration and evaluation software DigiVision for torque / speed / mechanical power (up to 200 meas/s supply with the device) 8661-P001
Configuration and evaluation software DigiVision with option for torque / speed / mechanical power up to 400 meas/s for up to 16 channels 8661-P100
Configuration and evaluation software DigiVision with option for torque / speed / mechanical power / editable mathematical auxiliary channel, max. 1000 meas/s for up to 32 channels 8661-P200
USB cable with screwing, 2 m length (included) 8661-Z010

DigiVision is available in three versions:

DigiVision, 8661-P001 (included)
- For a single sensor only
- Max. 200 measuring values per second

DigiVision, 8661-P100, 8661-P200
- For more sensors, up to 16 channels (up to 32 channels*)
- Max. 1000 measuring values per second, per channel*
- Display per sensor (depending on the sensor type)
  - torque and / or angle or
  - torque / speed / mechanical power
  - editable mathematical auxiliary channel*
- for 8661-P200 only

Screenshot P001: Multichannel display of a single sensor, below right: printed measuring record

Screenshot P100: Multichannel display of two sensors, torque / speed / mechanical power

*for 8661-P200 only
Torque sensor with integrated rotational speed / angular displacement measurement (option)

8661 torque sensors are optionally available with integrated rotational speed and angular displacement measurement. Two pulse channels – channel A and channel B – are always available. For clockwise rotation (looking at the drive end), 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, the rising and falling edges should be read out with four-edge evaluation.

Angular displacement measurement* (angular resolution with four-edge evaluation):
- Encoder disk with 2000 increments: 0.045°
- Encoder disk with 1024 increments: 0.088°
- Encoder disk with 400 increments: 0.225°
- Encoder disk with 240 increments: 0.375°

Speed measurement*:
- Encoder disk with 2000 increments: ≤ 3000 min⁻¹
- Encoder disk with 1024 increments: ≤ 6000 rpm
- Encoder disk with 400 increments: ≤ 15 000 rpm
- Encoder disk with 240 increments: ≤ 25 000 rpm

* Not all angular displacement / speed options are available for every measurement range.

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<td>-</td>
<td>-</td>
<td>-Vx3xx</td>
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</table>

Accessory metal bellows coupling series 8690

The compensation of misalignment is beside torque transmission the second essential function of a coupling. Generally, misalignments are classed in three categories.

- **Axial misalignment**
  - This is change in length along the longitudinal axis of the drive shafts relative to each other.

- **Angular misalignment**
  - This misalignment is caused by assembly related offsets of the drive shaft to the output shaft.

- **Lateral misalignment**
  - This misalignment is a parallel offset of both shafts.

For further information please see accessories data sheet.

Metal bellows couplings for optimum compensation of misalignments

For optimum compensation of misalignment we recommend torsionally free metal bellows couplings. They are characterized by their excellent torsional stiffness during torque load and their low restoring forces. Whenever a rotational movement has to be transmitted, these couplings should be used.

Accessory mounting block model 8661-Z00X

If the sensor is removed and refitted quite often it is recommendable to mount it permanently. 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 measuring ranges < 100 Nm (because of the load from its own weight) and at higher speeds of 10,000 rpm and above (because of resonance effects), the sensor housing should be mounted on the existing mechanical structure. A mounting block is provided for this purpose.

For further information please see accessories data sheet.
**Technical data**

**Electrical values**

- Rated supply voltage range $U_n$: 10 ... 30 V DC
- DC power consumption (without option): approx. 2 W
- Output voltage at ± rated torque (sensitivity): ± 10 V
- Output impedance: ≤ 1 kΩ
- Insulation resistance: > 5 MΩ
- Sampling rate: 400 Hz
- Ripple: < 50 mV
- Calibration signal: 10.00 V DC
- Drive signal (pin K): 10 ... 30 V DC
- *Sampling rate 1000 Hz: on request*

**Electrical connection**

- Standard sensor: 12 pins connector art. 9940
- USB sensor (option): Mini USB with screwing
- Power pack: Plug diameter 5.7 mm, center pin 2.0 mm
  (Supply and measuring channel are galvanically isolated)

**Speed/angular displacement measurement (option)*

| Output without external circuit: | TTL level |
| Output with external circuit: | Open Collector |
| Internal pull-up resistor: | 2 kΩ (5 V level) |
| External circuit (Open Collector): | $U_{max} = 30$ V / $I_{max} = 30$ mA |

**Angular displacement measurement**

- Encoder disk with 2000 increments: 0.045°
- Encoder disk with 1024 increments: 0.088°
- Encoder disk with 400 increments: 0.225°
- Encoder disk with 240 increments: 0.375°

**Mechanical values**

- Relative linearity deviation:
  - Measuring range 0.02 to 0.05 Nm: $< 0.1 \%$ F.S., $< 0.05 \%$ F.S.
  - Measuring range 0.1 to 1000 Nm: $< 0.1 \%$ F.S., $< 0.05 \%$ F.S.
- Relative reversal error:
  - Measuring range 0.02 to 0.05 Nm: $< 1 \%$ F.S., $< 0.1 \%$ F.S.
  - Measuring range 0.1 to 1000 Nm: $< 0.2 \%$ F.S., $< 0.1 \%$ F.S.
- Relative tolerance of the sensitivity:
  - $± 0.1 \%$ F.S., $± 0.2 \%$ F.S.
- Max. operating torque:
  - 200 % of rated torque
  - 150 % of rated torque
- Failure torque: 300 % of rated torque
- Alternating load: up to 70 % of rated torque

**Material:**

- Housing: anodized aluminium
- Shaft ≤ 0.2 Nm, aluminium measuring shaft, shaft ends made of stainless steel 1.4542
- Shaft ≥ 0.5 Nm: measuring shaft made of stainless steel 1.4542
- Degree of protection to EN 60529: IP40

**Fixing method:**

- see dimensional drawing page 2

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**Mounting Instructions**

- Make sure that the connecting shaft is exactly aligned.
- Suitable couplings should be used to avoid strain resulting from parallel or angular offset between the shafts.
- Do not exceed permissible axial and radial forces (see table 2) during installation or operation.
- For detailed installation information, please refer to our operating manual (www.burster.com).

**Accessories**

- 12 pin mating connector (supplied with device) 9940
- 12 pin mating connector, 90° 9900-V539
- Connecting cable, (torque and rotational angle/speed), length 3 m, one end open 99540-000F-0520030
- Connecting cable, length 3 m, from 8661 without angle/speed measuring option to 9163 of housing 99209-540E-0160030
- Connecting cable, length 3 m, 8661 to DIGIFORCE® 9307 combined D (option channel) 99163-540A-0150030
- Adapter cable to DIGIFORCE® 9307 standard channel A/B and C (usable only in connection with type 99163-540A-015xxxx) 99209-215A-0090004
- Power pack for external supply 8600-Z010
- Mounting block (see page 5) 8661-Z001
- Measurement range 0 ... ± 0.2 Nm up to 0 ... ± 2 Nm 8661-Z002
- Measurement range 0 ... ± 5 Nm up to 0 ... ± 20 Nm 8661-Z003
- Measurement range 0 ... ± 50 Nm up to 0 ... ± 200 Nm 8661-Z004
- Couplings Series 8690

**Display and evaluation instruments**

- Torque and angle e.g. SENSORMASTER 9163
e.g. DIGIFORCE® 9307
- see product section 9

**Order Code**

- Torque sensor 8661-XXXX-V

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**Order Information**

- 8661 with 100 Nm measuring range, with high-resolution angular displacement measurement, 1024 increments. Option: 2nd measuring range 0 ... 20 Nm with USB interface including measurement and evaluation software 8661-P001 8661-5100-V2210

**Manufacturer Calibration Certificate (WKS)**

Calibration of a sensor or a measuring chain, clockwise and/or counterclockwise torque in 20 % steps, increasing and decreasing.

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**Technical changes reserved. All data sheets at www.burster.com**