

Torque Sensor

Rotating, non-contact transmission of measured value,
integrated detection of angle or speed of rotation (option)

Model 8651

| | |
|-----------|--------------------|
| Code: | 8651 EN |
| Delivery: | ex stock / 4 weeks |
| Warranty: | 24 months |

CAD data 2D/3D for this sensor:
Download directly at www.traceparts.com
Info: refer to data sheet 80-CAD-EN



- Ranges 0 ... ± 0.02 Nm up to 0 ... ± 1000 Nm
- Non-linearity up to 0.1 % F.S.
- Analog output signal ± 10 V
- Maintenance-free operation
- Angle or speed measurement (option)
- Max. speed 35000 min⁻¹
- Special versions
- Protection class IP67, data sheet on request

Application

The slip-ring-free torque sensor for the measurement of torque, angular rotation or speed with integral measuring amplifier is suitable for use in the laboratory and in an industrial environment.

Thanks to the inductive, non-contact transfer of the excitation voltage and the optical, non-contact transmission of the measuring signal, the sensor can be used wherever low-wear and maintenance-free operation, high speeds or continuous running are required.

The reliable measurement of constant and variable torques on rotating and standing shaft enables it to be used in quality assurance in the test area and in test rigs and machines as well as in the service area.

Description

The main components of the torque sensor consist of the measuring shaft with applied precision strain gauge, the rotating electronics with secondary coil and optical transmission ring. Power is supplied to the strain gauge bridge without contact by means of a rotary transformer.

A torque applied between the two ends of the shaft produces a mechanical strain, which is measured with the help of a strain gauge bridge circuit. An output signal is obtained from the bridge, which is proportional to the applied torque. This voltage converted into a frequency-modulated signal is transmitted by means of infrared LEDs to the receiver in the stator.

As an option, a conditioned, rectangular output voltage of 5 V can be provided for the direct further processing of the angle or speed of rotation signal by means of the electronics integrated within the sensor.

Use couplings to avoid axial lateral forces and bending moments caused by parallel or angle deviation.

Table 1

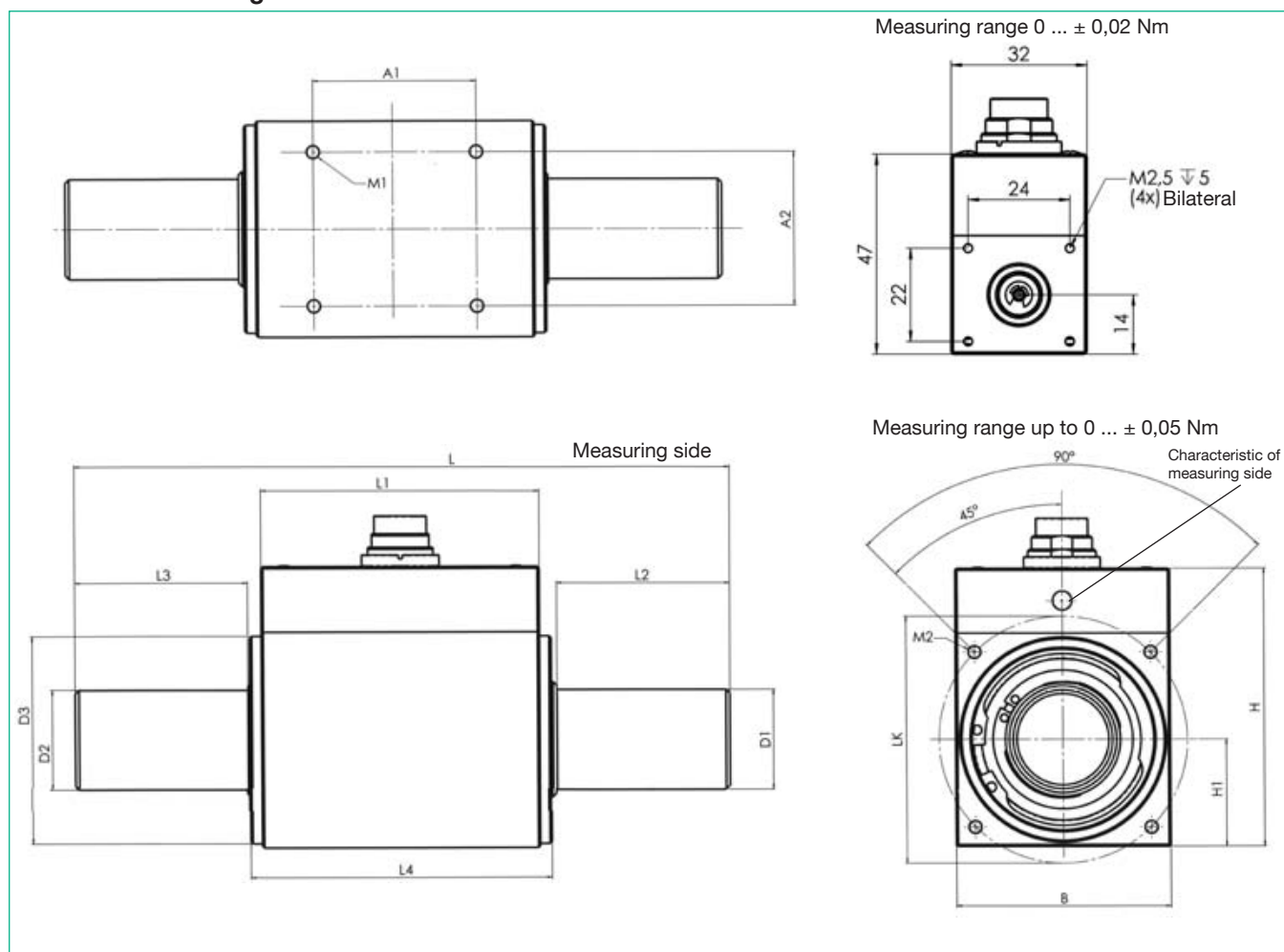
Technical Data

| Order Code | Measurement Range [Nm] | Dimensions [mm] | | | | | | | | | | | | | | | |
|-------------------|------------------------|-----------------|----|----|-----------|-----------|-------------|------|----|-----|----|-----|-----|----|-------------|----------------|---------------|
| | | A1 | A2 | B | D1g6 ø | D2g6 ø | D3-0,1 ø | H | H1 | L | L1 | L2 | L3 | L4 | LK±0.1 ø | M1 | M2 |
| 8651 - 4020-V0000 | 0 ... ± 0.02 | 50 | 24 | 32 | 3 | 3 | 15 | 47 | 14 | 82 | 63 | 7,5 | 7,5 | 67 | - | M 2,5 x 5 deep | |
| 8651 - 4050-V0000 | 0 ... ± 0.05 | 40 | 22 | 28 | 5 | 8 | 27 | 48.5 | 14 | 89 | 62 | 10 | 11 | 66 | 32 | M 3 x 5 deep | M 3 x 6 deep |
| 8651 - 4100-V0000 | 0 ... ± 0.1 | 40 | 22 | 28 | 5 | 8 | 27 | 48.5 | 14 | 89 | 62 | 10 | 11 | 66 | 32 | | |
| 8651 - 4200-V0000 | 0 ... ± 0.2 | 40 | 22 | 28 | 5 | 8 | 27 | 48.5 | 14 | 89 | 62 | 10 | 11 | 66 | 32 | | |
| 8651 - 4500-V0000 | 0 ... ± 0.5 | 40 | 22 | 28 | 5 | 8 | 27 | 48.5 | 14 | 89 | 62 | 10 | 11 | 66 | 32 | | |
| 8651 - 5001-V0000 | 0 ... ± 1 | 40 | 22 | 28 | 5 | 8 | 27 | 48.5 | 14 | 89 | 62 | 10 | 11 | 66 | 32 | | |
| 8651 - 5002-V0000 | 0 ... ± 2 | 40 | 22 | 28 | 6 | 8 | 27 | 48.5 | 14 | 95 | 62 | 14 | 14 | 66 | 32 | | |
| 8651 - 5005-V0000 | 0 ... ± 5 | 60 | 32 | 42 | 15 | 15 | 38 | 58 | 21 | 145 | 79 | 30 | 30 | 83 | 46 | M 3 x 6 deep | M 3 x 6 deep |
| 8651 - 5010-V0000 | 0 ... ± 10 | 60 | 32 | 42 | 15 | 15 | 38 | 58 | 21 | 145 | 79 | 30 | 30 | 83 | 46 | | |
| 8651 - 5020-V0000 | 0 ... ± 20 | 60 | 32 | 42 | 15 | 15 | 38 | 58 | 21 | 145 | 79 | 30 | 30 | 83 | 46 | | |
| 8651 - 5050-V0000 | 0 ... ± 50 | 42 | 40 | 56 | 26 | 26 | 54 | 73 | 28 | 170 | 72 | 45 | 45 | 78 | 65 | M 4 x 8 deep | M 4 x 8 deep |
| 8651 - 5100-V0000 | 0 ... ± 100 | 42 | 40 | 56 | 26 | 26 | 54 | 73 | 28 | 170 | 72 | 45 | 45 | 78 | 65 | | |
| 8651 - 5200-V0000 | 0 ... ± 200 | 42 | 40 | 56 | 26 | 26 | 54 | 73 | 28 | 170 | 72 | 45 | 45 | 78 | 65 | | |
| 8651 - 5500-V0000 | 0 ... ± 500 | 46 | 70 | 88 | 45 | 45 | 80 | 104 | 44 | 270 | 84 | 85 | 85 | 90 | 98 | M 6 x 12 deep | M 6 x 12 deep |
| 8651 - 6001-V0000 | 0 ... ± 1000 | 46 | 70 | 88 | 45 | 45 | 80 | 104 | 44 | 270 | 84 | 85 | 85 | 90 | 98 | | |

Higher measurement ranges, up to 20 000 Nm, on request.

Dim. tolerance acc. DIN 2768-m

Dimensional drawing model 8651



The CAD drawing (3D/2D) for this sensor can be imported online directly into your CAD system.

 Download via www.burster.com or directly at www.traceparts.com. For further information about the burster traceparts cooperation refer to data sheet 80-CAD-EN.

Specifications, based on measurement range

Table 2

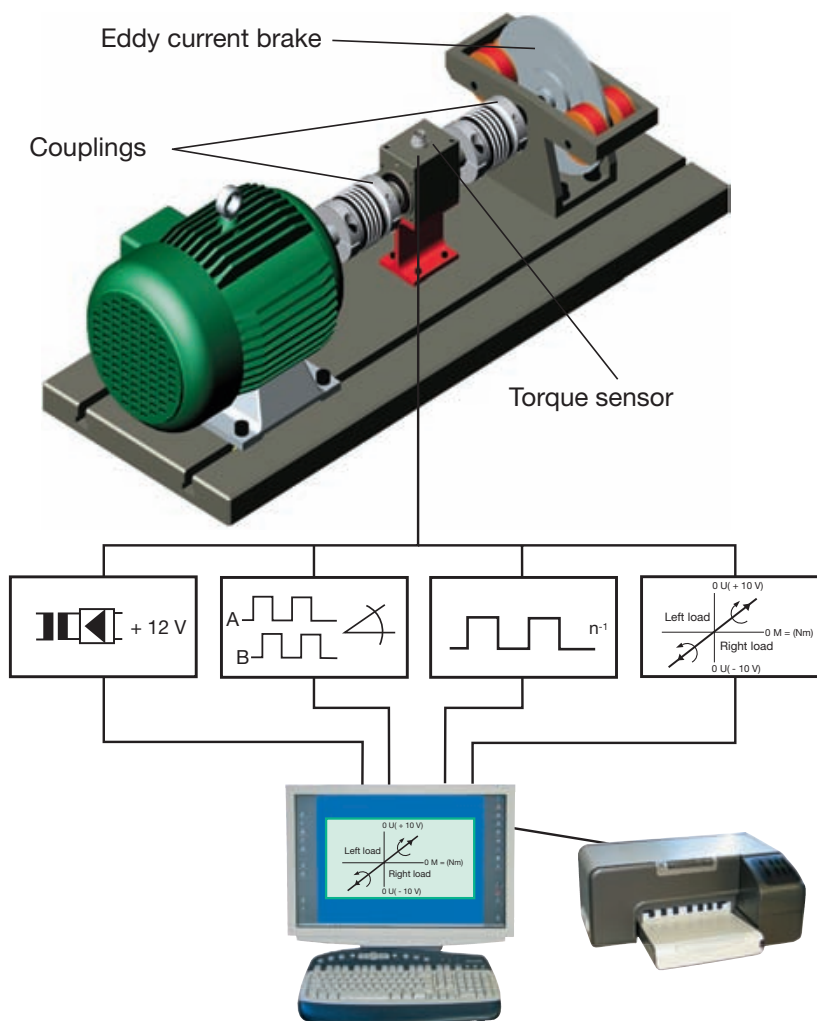
| Order Code | Measurement Range [Nm] | Spring Constant C [Nm/rad] | Mass Moment of Inertia J ¹ [g · cm ²] | Maximum Permissible ² Axial Load [N] | Maximum Permissible ² Radial Load [N] | Weight [g] | Max. Rotary Speed ³ [°/min] |
|-------------------|------------------------|----------------------------|--|---|--|------------|--|
| 8651 - 4020-V0000 | 0 ... ± 0.02 | 13 | 0.313 | 35 | 30 | 200 | 20 000 |
| 8651 - 4050-V0000 | 0 ... ± 0.05 | 50 | 2 | 105 | 2 | 170 | 35 000 |
| 8651 - 4100-V0000 | 0 ... ± 0.1 | 80 | 2 | 140 | 3 | 170 | 35 000 |
| 8651 - 4200-V0000 | 0 ... ± 0.2 | 80 | 2 | 140 | 3 | 170 | 35 000 |
| 8651 - 4500-V0000 | 0 ... ± 0.5 | 100 | 2 | 160 | 4 | 170 | 35 000 |
| 8651 - 5001-V0000 | 0 ... ± 1 | 175 | 2 | 210 | 7 | 170 | 35 000 |
| 8651 - 5002-V0000 | 0 ... ± 2 | 250 | 2 | 210 | 13 | 170 | 35 000 |
| 8651 - 5005-V0000 | 0 ... ± 5 | 1 000 | 70 | 1 200 | 15 | 600 | 19 000 |
| 8651 - 5010-V0000 | 0 ... ± 10 | 2 200 | 70 | 1 300 | 30 | 600 | 19 000 |
| 8651 - 5020-V0000 | 0 ... ± 20 | 4 100 | 70 | 1 300 | 60 | 600 | 19 000 |
| 8651 - 5050-V0000 | 0 ... ± 50 | 17 x 10 ³ | 690 | 1 800 | 125 | 1 300 | 13 000 |
| 8651 - 5100-V0000 | 0 ... ± 100 | 31 x 10 ³ | 700 | 1 800 | 215 | 1 300 | 13 000 |
| 8651 - 5200-V0000 | 0 ... ± 200 | 55 x 10 ³ | 730 | 1 800 | 450 | 1 300 | 13 000 |
| 8651 - 5500-V0000 | 0 ... ± 500 | 266 x 10 ³ | 9 400 | 4 150 | 650 | 4 500 | 7 900 |
| 8651 - 6001-V0000 | 0 ... ± 1000 | 400 x 10 ³ | 9 600 | 4 150 | 1 275 | 4 500 | 7 900 |

¹ The relationship of the torques of inertia of measurement side and drive side is approx. 1 : 5.

² The values of axial and radial load are valid for the unfixed housing. They have only a small influence on the measurement signal.

³ With option measurement of rotary speed max. 1000°/min. without 500 Nm and 1000 Nm, with option measurement of angle displacement.

Application Motor Test Stand



Technical Data

Electrical values

Torque sensor

| | | |
|------------------------------------|--|------------|
| Excitation voltage U_b : | + 15 V DC | +5 %/-10 % |
| Excitation current: without option | < 130 mA | |
| with option | < 150 mA | |
| Output at rated capacity: | ± 10 V | |
| Rise time 10 ... 90 %: | 2 ms | |
| Internal resistance: | 100 Ω | |
| Insulation resistance: | > 5 M Ω | |
| Cut-off frequency - 3dB: | 200 Hz | |
| Ripple: | < 100 mV _{SS} | |
| Calibration signal: | the output voltage is +10V, if U_b at Pin 6 res. Pin K is put on | |

The supply is electrically isolated from the measuring channel.

Angle and speed sensor (options, see table below)

| | |
|--|--|
| Output: | open coll. |
| Internal pull-up resistor: | 10 k Ω (5 V level) |
| External pull-up | $U_{max.} = 24$ V / $I_{max.} = 20$ mA |
| (Current open-collector output: | $I_{max.} = 20$ mA) |
| Angle measurement: | 360 pulses per round |
| indicated of direction by two pulse-outputs, displacement of phase 90° ahead output A, at clockwise direction of the driving side. | |
| Max. speed: | 3 000 ¹ /min |
| Speed measurement: | 60 pulses/rev. |
| Max. speed: | 10 000 ¹ /min |

Environmental conditions

| | |
|------------------------------|---------------------|
| Operating temperature range: | 0 °C ... 60 °C |
| Temperature compensated: | 5 °C ... 45 °C |
| Temperature effect: | |
| on zero | ± 0.02 % F.S./K |
| on span | + 0.01 % F.S./K |

Mechanical values

| | | |
|---------------------------------|--|------------------------------|
| Non-linearity: | | |
| measuring ranges | 0 ... ± 0.02 Nm | < ± 0.15 % F.S. |
| measuring ranges from 0 | ... ± 0.05 Nm | < ± 0.1 % F.S. |
| Hysteresis: | | |
| measuring ranges | 0 ... ± 0.02 Nm | < ± 0.15 % F.S. |
| measuring ranges from 0 | ... ± 0.05 Nm | < ± 0.1 % F.S. |
| Torque of usage: | 200 % of nominal torque | |
| Fracture torque: | 300 % of nominal torque | |
| Alternating load: | 70 % of nominal torque | |
| Material: | | |
| case | high tensile, | anodized aluminium |
| shafts | up to 2 Nm: | stainless steel |
| | from 5 Nm: | stainless construction steel |
| Protection class acc. EN 60529: | | IP40 |
| Mechanical coupling: | | round shaft ends |
| Weight: | | see table 2 |
| Electrical connection: | 6 pins coupling socket, model 9953 | |
| | sensor without option angle or speed detection (included on delivery) | |
| Electrical connection: | 12 pins coupling socket model 9940 | |
| | sensor with option angle or speed detection (included on delivery) | |
| Mounting: | both ends and bottom of sensor case with 4 thread holes for fixing see drawing and table | |

Mounting Instructions

Installing the sensor, make sure that the shaft ends are aligned as much possible to each other. Damages through radial and angle disalignment must be avoided by couplings. For further information refer to the manual. Never exceed the limit of axial and radial forces, shown in table 2 on page 3.

Order Information

| | |
|---|------------------------------|
| Torque sensor, range 100 Nm | Model 8651-5100-V0000 |
| Torque sensor, range 2 Nm, angle detection integrated | Model 8651-5002-V0010 |
| Torque sensor, range 5 Nm with keyways | Model 8651-5005-V0002 |

Accessories

For sensor without option speed or angle detection

| | |
|--------------------------------|------------------------|
| Mating connector 6 pin | Model 9953 |
| Mating connector 6 pin, angled | Model 9900-V589 |

| | |
|--|---------------------------------|
| Connecting cable, length 3 m, one end free | Model 99553-000C-0160030 |
|--|---------------------------------|

| | |
|---|---------------------------------|
| Connecting cable, length 3 m, with connector 9941 e.g. for SENSORMASTER 9163-V3.... | Model 99209-553D-0090030 |
|---|---------------------------------|

| | |
|---|---------------------------------|
| Connecting cable, length 3 m, for DIGIFORCE® 9306-V510x | Model 99141-553D-0090030 |
|---|---------------------------------|

For sensor included option speed or angle detection

| | |
|---------------------------------|------------------------|
| Mating connector 12 pin | Model 9940 |
| Mating connector 12 pin, angled | Model 9900-V539 |

| | |
|--|---------------------------------|
| Connection cable, length 3 m, one end free | Model 99540-000B-0270030 |
|--|---------------------------------|

For sensor included option angle detection

| | |
|---|---------------------------------|
| Connecting cable, length 3 m, with connector 9941 for DIGIFORCE® 9306-V510X | Model 99141-540M-0270030 |
|---|---------------------------------|

| | |
|--|------------------------|
| Mains adapter for standard rail, 15 V DC, ± 5 %, 0,4 A | Model 8651-Z004 |
|--|------------------------|

| | |
|--|------------------------|
| Mains adapter 15 V DC, stabilized, 1 A | Model 4497-V001 |
|--|------------------------|

Instrumentation

| | |
|----------------------------------|--|
| For torque measurement | e.g. SENSORMASTER 9163 |
| for torque and angle measurement | e.g. DIGIFORCE® 9306 see section 9 of the catalog. |

Options

| Code | Description |
|--------------|--|
| Vxx1x | integral angle detection, 360 pulses per round, resolution 1/4° possible |
| Vxx2x | integral speed detection, 60 pulses per round |
| Vxxx1 | shaft end with one cross hole, ranges from 0 ... 0.05 Nm to 0 ... 2 Nm |
| Vxxx2 | shaft end with keyways, ranges from 0 ... ± 5 Nm |

Manufacturer Calibration Certificate (WKS)

Calibrated of a sensor or a sensor with indicator for clockwise or counter clockwise torques in 20 % steps raising and decreasing.