

Torque Sensor

Rotating, contact ring transfer

Model 86403 with square end

Model 86413 with round shaft ends

Model 86423 with hexagonal shaft end

| | |
|-----------|-----------|
| Code: | 86403 EN |
| Delivery: | 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



Model 86403



Model 86413



Model 86423

NEW
Measurement ranges from 0 ... 1 Nm

- Measuring ranges between 0 ... ± 1 Nm and 0 ... 1000 Nm
- Excellent reproducibility
- Standardized output signal makes exchange easy
- Optionally available with factory calibration certificate
- Designed for clockwise and counterclockwise torque
- Optionally available with integrated angle measurement
- Rotation speed up to 3000 min⁻¹/min (short-term)

Application

Precise, reliable measurements of both static and dynamic torques in either direction can be made with this range of sensors.

This opens a wide range of possible applications to the user. These torque sensors are standard equipment in a wide range of industrial automation, quality control and automotive components industry applications, as well as in laboratories.

Typical applications:

Screwing technology

- ▶ Checking and adjusting bolting tools such as torque limiting wrenches, screwdrivers
- ▶ Testing bolted connections

Measuring the drag torque of motors and pumps

- ▶ Frictional torques of gears, bearings and seals
- ▶ Testing torsion springs
- ▶ Adjusting equipment in the automobile industry (sunroof, power windows etc.)

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Description

Strain gauges are mounted on the torsion shaft of the sensor element, itself made of steel, connected to form a full bridge. The electrical power excitation for the wire strain gauge full bridge and the transmission of the measured signal is provided through a high-quality slip-ring system between the stator and the rotor.

For a clockwise torque, the measurement signal is positive, and it is negative for a counterclockwise torque.

The sensor for the optionally available angle measurement for the square shaft versions is fitted with an additional pulse-generating disk.

With the aid of a second encoder track, displaced by 90°, allows the subsequent evaluation units to perform 4-fold edge evaluation. This allows significantly improved resolution to be achieved. The offset track makes it possible to detect the direction of the rotation.

The characteristic parameters for the sensors are standardized in order to reduce the effort required to check a connected amplifier or to exchange the sensor.

Technical Data

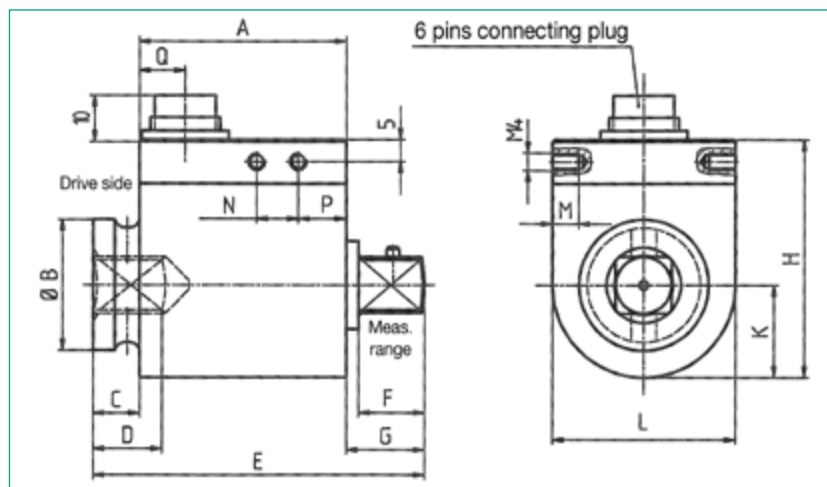
Model 86403

Torque sensor, rotating, standard square ends according to DIN 3121

| Order Code | Measurement Range | Sensitivity [mV/V] | Square Ends | Spring Constant [Nm/rad] | Max. Lateral Force [N] | Torque of Inertia Drive End J in [kg m ²] | Mass [kg] | Dimensions [mm] | | | | | | | | | | | | | |
|------------|-------------------|-----------------------|-------------|-----------------------------|---------------------------|--|--------------|-----------------|------|------|------|-----|------|------|----|----|----|---|-----|-----|------|
| | | | | | | | | A | B | C | D | E | F | G | H | L | K | M | N | P | Q |
| 86403-5001 | 0 ... ± 1 Nm | 0.5 | 1/4" | 1.9·10 ² | 4 | 2.9·10 ⁻⁷ | 0.14 | 45.5 | 13 | 8.6 | 8 | 64 | 7.2 | 9.9 | 39 | 24 | 12 | 5 | 9 | 8.6 | 12.2 |
| 86403-5002 | 0 ... ± 2 Nm | 0.5 | 1/4" | 4.3·10 ² | 5 | 2.9·10 ⁻⁷ | 0.14 | 45.5 | 13 | 8.6 | 8 | 64 | 7.2 | 9.9 | 39 | 24 | 12 | 5 | 9 | 8.6 | 12.2 |
| 86403-5005 | 0 ... ± 5 Nm | 2 | 1/4" | 2.7·10 ² | 7 | 2.9·10 ⁻⁷ | 0.14 | 45.5 | 13 | 8.6 | 8 | 64 | 7.2 | 9.9 | 39 | 24 | 12 | 5 | 9 | 8.6 | 12.2 |
| 86403-5012 | 0 ... ± 12 Nm | 2 | 1/4" | 6.6·10 ² | 7.5 | 3.0·10 ⁻⁷ | 0.14 | 45.5 | 13 | 8.6 | 8 | 64 | 7.2 | 9.9 | 39 | 24 | 12 | 5 | 9 | 8.6 | 12.2 |
| 86403-5025 | 0 ... ± 25 Nm | 2 | 3/8" | 2.3·10 ³ | 12 | 1.2·10 ⁻⁵ | 0.32 | 47.5 | 22 | 10.1 | 12.2 | 71 | 10.4 | 13.5 | 54 | 42 | 21 | 6 | 9.5 | 11 | 10.5 |
| 86403-5063 | 0 ... ± 63 Nm | 2 | 3/8" | 5.7·10 ³ | 28 | 1.2·10 ⁻⁵ | 0.32 | 47.5 | 22 | 10.1 | 12.2 | 71 | 10.4 | 13.5 | 54 | 42 | 21 | 6 | 9.5 | 11 | 10.5 |
| 86403-5160 | 0 ... ± 160 Nm | 2 | 1/2" | 1.4·10 ⁴ | 65 | 1.7·10 ⁻⁵ | 0.35 | 47.5 | 29.7 | 10.7 | 15.9 | 76 | 15.1 | 17.9 | 54 | 42 | 21 | 6 | 9.5 | 11 | 10.5 |
| 86403-5500 | 0 ... ± 500 Nm | 2 | 3/4" | 5.9·10 ⁴ | 200 | 1.1·10 ⁻⁴ | 0.80 | 55 | 44 | 19.1 | 24.9 | 100 | 22.6 | 25.9 | 68 | 60 | 30 | - | - | - | 10.5 |
| 86403-6001 | 0 ... ± 1000 Nm | 2 | 1" | 1.1·10 ⁵ | 240 | 2.6·10 ⁻⁴ | 1.40 | 55 | 54 | 33.1 | 29.6 | 132 | 27.4 | 43.9 | 68 | 60 | 30 | - | - | - | 10.5 |

Higher ranges on request

Dimensional drawing Model 86403

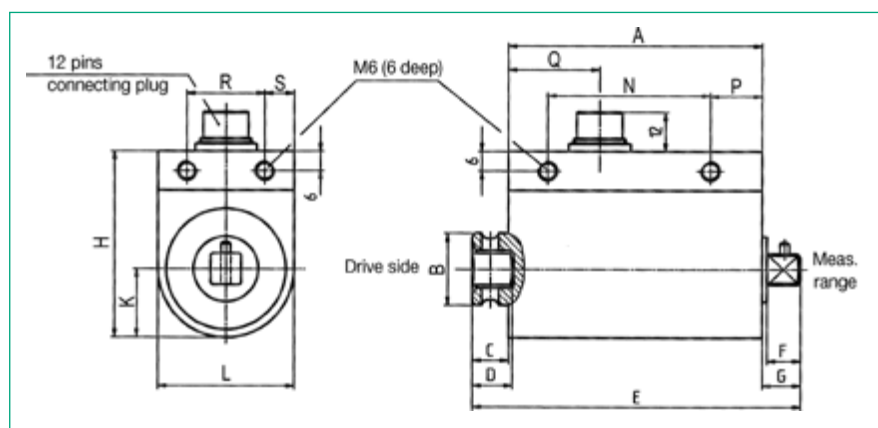


Model 86403-...-V501

Torque sensor, rotating, standard square ends, with angle measurement

| Order Code | Measurement Range | Sensitivity [mV/V] | Square Ends | Spring Constant [Nm/rad] | Max. Lateral Force [N] | Torque of Inertia Drive End J in [kg m ²] | Mass [kg] | Dimensions [mm] | | | | | | | | | | | | | | | | | |
|-----------------|-------------------|-----------------------|-------------|-----------------------------|---------------------------|--|--------------|-----------------|------|------|------|-------|------|------|------|----|----|----|----|------|------|----|----|--|--|
| | | | | | | | | A | B | C | D | E | F | G | H | L | K | M | N | P | Q | R | S | | |
| 86403-5001-V501 | 0... ± 1 Nm | 0.5 | 1/4" | 1.4 · 10 ² | 4 | 3.2 · 10 ⁻⁶ | 0.5 | 65 | 13 | 9 | 8 | 84 | 7.2 | 10 | 48.5 | 34 | 17 | 4 | 9 | 10.5 | 30.5 | 10 | 12 | | |
| 86403-5002-V501 | 0... ± 2 Nm | 0.5 | 1/4" | 4.5 · 10 ² | 5 | 3.3 · 10 ⁻⁶ | 0.5 | 65 | 13 | 9 | 8 | 84 | 7.2 | 10 | 48.5 | 34 | 17 | 4 | 9 | 10.5 | 30.5 | 10 | 12 | | |
| 86403-5005-V501 | 0... ± 5 Nm | 2 | 1/4" | 3.0 · 10 ² | 7 | 3.3 · 10 ⁻⁶ | 0.5 | 65 | 13 | 9 | 8 | 84 | 7.2 | 10 | 48.5 | 34 | 17 | 4 | 9 | 10.5 | 30.5 | 10 | 12 | | |
| 86403-5012-V501 | 0... ± 12 Nm | 2 | 1/4" | 6.7 · 10 ² | 7.5 | 3.3 · 10 ⁻⁶ | 0.5 | 65 | 13 | 9 | 8 | 84 | 7.2 | 10 | 48.5 | 34 | 17 | 4 | 9 | 10.5 | 30.5 | 10 | 12 | | |
| 86403-5025-V501 | 0... ± 25 Nm | 2 | 3/8" | 2.4 · 10 ³ | 12 | 1.2 · 10 ⁻⁵ | 0.5 | 78 | 22 | 11 | 12.2 | 100.8 | 10.4 | 11.8 | 57 | 42 | 21 | 6 | 50 | 16 | 28 | 24 | 9 | | |
| 86403-5063-V501 | 0... ± 63 Nm | 2 | 3/8" | 6.8 · 10 ³ | 28 | 1.2 · 10 ⁻⁵ | 0.5 | 78 | 22 | 11 | 12.2 | 100.8 | 10.4 | 11.8 | 57 | 42 | 21 | 6 | 50 | 16 | 28 | 24 | 9 | | |
| 86403-5160-V501 | 0... ± 160 Nm | 2 | 1/2" | 1.2 · 10 ⁴ | 65 | 1.7 · 10 ⁻⁵ | 0.6 | 78 | 29.8 | 12 | 16.9 | 106 | 15.1 | 16 | 57 | 42 | 21 | 6 | 50 | 16 | 28 | 24 | 9 | | |
| 86403-5500-V501 | 0... ± 500 Nm | 2 | 3/4" | 3.9 · 10 ⁴ | 200 | 9.2 · 10 ⁻⁵ | 1.3 | 92 | 44 | 18 | 24.9 | 135 | 22.6 | 25 | 70 | 56 | 28 | 10 | 66 | 13 | 43 | 24 | 16 | | |
| 86403-6001-V501 | 0... ± 1000 Nm | 2 | 1" | 8.9 · 10 ⁴ | 240 | 3.6 · 10 ⁻⁴ | 1.5 | 92 | 54 | 53.1 | 29.9 | 177 | 27.3 | 31.9 | 70 | 56 | 28 | 10 | 66 | 13 | 43 | 24 | 16 | | |

Dimensional drawing Model 86403-...V501



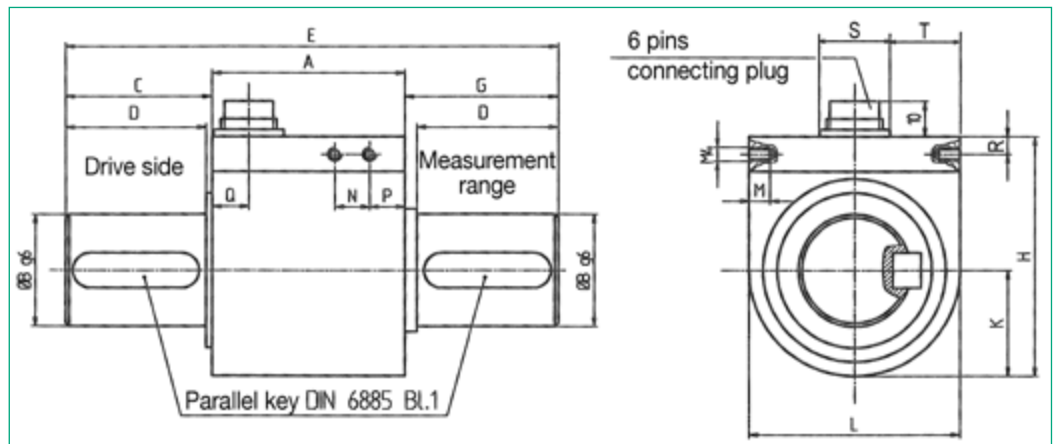
Technical Data

Model 86413

Torque sensor, rotating, round shaft ends with parallel key

| Order Code | Measurement Range | Sensitivity [mV/V] | Spring Constant [Nm/rad] | Max. Lateral Force [N] | Torque of Inertia Drive End J in [kg m ²] | Mass [kg] | Dimensions [mm] | | | | | | | | | | | | | |
|------------|-------------------|-----------------------|-----------------------------|---------------------------|--|--------------|-----------------|----|------|----|-----|------|----|----|----|---|-----|------|------|---|
| | | | | | | | A | B | C | D | E | G | H | L | K | M | N | P | Q | R |
| 86413-5001 | 0 ... ± 1 Nm | 0.5 | 1.9 · 10 ² | 4 | 1.34 · 10 ⁻⁶ | 0.16 | 45.5 | 8 | 19.7 | 18 | 85 | 19.7 | 39 | 24 | 12 | 5 | 9 | 27.9 | 33.3 | 5 |
| 86413-5002 | 0 ... ± 2 Nm | 0.5 | 1.9 · 10 ² | 5 | 1.34 · 10 ⁻⁶ | 0.16 | 45.5 | 8 | 19.7 | 18 | 85 | 19.7 | 39 | 24 | 12 | 5 | 9 | 27.9 | 33.3 | 5 |
| 86413-5005 | 0 ... ± 5 Nm | 2 | 2.43 · 10 ² | 7 | 1.34 · 10 ⁻⁶ | 0.16 | 45.5 | 8 | 19.7 | 18 | 85 | 19.7 | 39 | 24 | 12 | 5 | 9 | 27.9 | 33.3 | 5 |
| 86413-5010 | 0 ... ± 10 Nm | 2 | 4.56 · 10 ² | 7.5 | 1.35 · 10 ⁻⁶ | 0.16 | 45.5 | 8 | 19.7 | 18 | 85 | 19.7 | 39 | 24 | 12 | 5 | 9 | 27.9 | 33.3 | 5 |
| 86413-5020 | 0 ... ± 20 Nm | 2 | 1.77 · 10 ³ | 12 | 1.16 · 10 ⁻⁵ | 0.35 | 47.5 | 15 | 21.1 | 20 | 90 | 21.5 | 54 | 42 | 21 | 6 | 9.5 | 11 | 10.5 | 5 |
| 86413-5050 | 0 ... ± 50 Nm | 2 | 4.82 · 10 ³ | 28 | 1.17 · 10 ⁻⁵ | 0.38 | 47.5 | 15 | 21.1 | 20 | 90 | 21.5 | 54 | 42 | 21 | 6 | 9.5 | 11 | 10.5 | 5 |
| 86413-5100 | 0 ... ± 100 Nm | 2 | 9.85 · 10 ³ | 65 | 1.25 · 10 ⁻⁵ | 0.42 | 47.5 | 18 | 24 | 22 | 95 | 23.6 | 54 | 42 | 21 | 6 | 9.5 | 11 | 10.5 | 5 |
| 86413-5200 | 0 ... ± 200 Nm | 2 | 2.80 · 10 ⁴ | 80 | 9.15 · 10 ⁻⁵ | 0.90 | 55 | 32 | 41.6 | 40 | 140 | 43.4 | 68 | 60 | 30 | - | - | - | 10.5 | 5 |
| 86413-5500 | 0 ... ± 500 Nm | 2 | 6.33 · 10 ⁴ | 200 | 9.42 · 10 ⁻⁵ | 0.90 | 55 | 32 | 41.6 | 40 | 140 | 43.4 | 68 | 60 | 30 | - | - | - | 10.5 | 5 |

Dimensional drawing Models 86413 and 86413-...V501



Model 86413-...V501

Torque sensor, rotating, round shaft with keyways and internal angle measurement

| Order Code | Measurement Range | Sensitivity [mV/V] | Spring Constant [Nm/rad] | Max. Lateral Force [N] | Torque of Inertia Drive End J in [kg m ²] | Mass [kg] | Dimensions [mm] | | | | | | | | | | | | | | |
|-----------------|-------------------|-----------------------|-----------------------------|---------------------------|--|--------------|-----------------|----|------|------|-----|------|----|----|----|----|------|------|-----|----|----|
| | | | | | | | A | B | C/G | D | E | H | L | K | M | N | P | Q | R | S | T |
| 86413-5001-V501 | 0 ... ± 1 Nm | 0.5 | 2.3 · 10 ² | 4 | 3.3 · 10 ⁻⁶ | 0.5 | 65 | 10 | 17.5 | 15.5 | 100 | 48.5 | 34 | 17 | 4 | 9 | 10.5 | 30.5 | 6.5 | 20 | 7 |
| 86413-5002-V501 | 0 ... ± 2 Nm | 0.5 | 2.3 · 10 ² | 5 | 3.3 · 10 ⁻⁶ | 0.5 | 65 | 10 | 17.5 | 15.5 | 100 | 48.5 | 34 | 17 | 4 | 9 | 10.5 | 30.5 | 6.5 | 20 | 7 |
| 86413-5005-V501 | 0 ... ± 5 Nm | 2 | 2.9 · 10 ² | 7 | 3.3 · 10 ⁻⁶ | 0.5 | 65 | 10 | 17.5 | 15.5 | 100 | 48.5 | 34 | 17 | 4 | 9 | 10.5 | 30.5 | 6.5 | 20 | 7 |
| 86413-5010-V501 | 0 ... ± 10 Nm | 2 | 5.6 · 10 ² | 7.5 | 1.1 · 10 ⁻⁵ | 0.5 | 65 | 10 | 17.5 | 15.5 | 100 | 48.5 | 34 | 17 | 4 | 9 | 10.5 | 30.5 | 6.5 | 20 | 7 |
| 86413-5020-V501 | 0 ... ± 20 Nm | 2 | 1.6 · 10 ³ | 12 | 1.1 · 10 ⁻⁵ | 0.6 | 78 | 15 | 21 | 20 | 120 | 57 | 42 | 21 | 6 | 50 | 16 | 28 | 6 | 20 | 11 |
| 86413-5050-V501 | 0 ... ± 50 Nm | 2 | 4.1 · 10 ³ | 28 | 1.1 · 10 ⁻⁵ | 0.6 | 78 | 15 | 21 | 20 | 120 | 57 | 42 | 21 | 6 | 50 | 16 | 28 | 6 | 20 | 11 |
| 86413-5100-V501 | 0 ... ± 100 Nm | 2 | 7.9 · 10 ³ | 65 | 1.3 · 10 ⁻⁵ | 0.6 | 78 | 18 | 25 | 24 | 128 | 57 | 42 | 21 | 6 | 50 | 16 | 28 | 6 | 20 | 11 |
| 86413-5200-V501 | 0 ... ± 200 Nm | 2 | 2.8 · 10 ⁴ | 80 | 1.0 · 10 ⁻⁴ | 1.3 | 92 | 32 | 44 | 40 | 180 | 70 | 56 | 28 | 10 | 66 | 13 | 43 | 6 | 20 | 18 |
| 86413-5500-V501 | 0 ... ± 500 Nm | 2 | 5.3 · 10 ⁴ | 200 | 1.0 · 10 ⁻⁴ | 1.3 | 92 | 32 | 44 | 40 | 180 | 70 | 56 | 28 | 10 | 66 | 13 | 43 | 6 | 20 | 18 |

Model 86423

Torque sensor, rotating, standard hexagonal shaft ends 1/4" DIN 3126 Form E/F

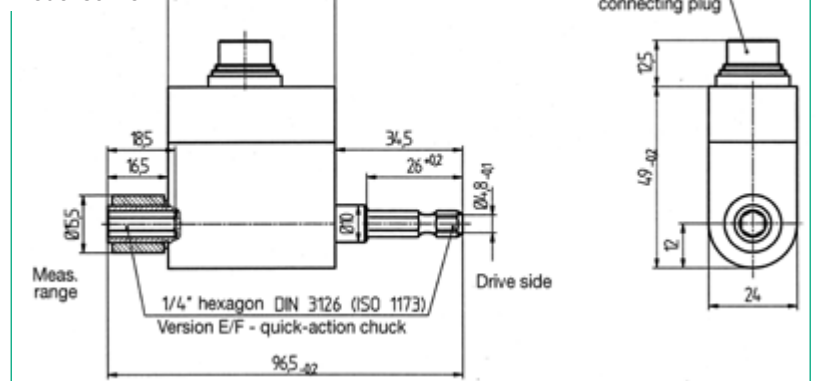
| Order Code | Measurement Range | Sensitivity [mV/V] | Mass [kg] |
|------------|-------------------|-----------------------|--------------|
| 86423-5001 | 0 ... ± 1 Nm | 0.5 | 0.2 |
| 86423-5002 | 0 ... ± 2 Nm | 1 | 0.2 |
| 86423-5005 | 0 ... ± 5 Nm | 1 | 0.2 |
| 86423-5010 | 0 ... ± 10 Nm | 2 | 0.2 |
| 86423-5020 | 0 ... ± 20 Nm | 2 | 0.2 |

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.

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Dimensional drawing Model 86423



- ▶ Drive end --- hexagon head
- ▶ Measurement side --- hexagon socket
- ▶ Quick-action chuck

Note: The max. allowed static lateral force is smaller than 10 % of the lower value of the measurement range.

General Technical Data for all Sensors

Electrical values

Torque sensor

| | |
|----------------------------------|---|
| Bridge resistance (full bridge): | 350 Ω |
| Excitation voltage: | 2 ... 12 V DC |
| Characteristic: | standardized 0.5 mV/V, 1mV/V or 2 mV/V (refer to tables) |
| Tolerance of characteristic: | ± 0.1 % |

Test (option):

If the full bridge is connected to the positive strain gauge excitation voltage, it generates an electrical signal equivalent to 100 % of the nominal signal.

Angle displacement sensor (refer to options)

| | |
|---|---------------------|
| Excitation voltage: | 5 V DC |
| Angle displacement measurement: | 360 pulses/rotation |
| 2 TTL outputs with two encoders, angle displacement 90° for detection of direction. | |

Environmental conditions

| | |
|---|-------------------------|
| Range of operation temperature: | ± 10 °C ... + 60 °C |
| Range of nominal temperature: | ± 5 °C ... + 50 °C |
| Influence of temperature in range of nominal temperature: | |
| to zero signal | ± 0.01 % F.S./K |
| to characteristic | ± 0.003 % Rdg./K |

Mechanical values

| | |
|--|------------------------|
| Measurement error, consisting of non-linearity and hysteresis | $\leq \pm 0.1$ % F.S. |
| Relative spread in unchanged mounting position: | $\leq \pm 0.05$ % F.S. |
| Range of rotation: | |
| an exceedance of the max. rotary speed, up to 1.5 x max. rotary speed, is possible only for short time | |

max. rotary speed for

| | | |
|-----------------|--------------------------------|------------------------|
| ranges from von | ≤ 0 ... 12 Nm | 2000 ¹ /min |
| ranges from | 0 ... 25 Nm to 0 ... 160 Nm | 1500 ¹ /min |
| ranges from | 0 ... 500 Nm to 0 ... 1000 Nm | 1000 ¹ /min |
| ranges from | 0 ... 2000 Nm to 0 ... 5000 Nm | 500 ¹ /min |

| | |
|---------------------------------------|-----------------------------|
| Max. operation torque: | 120 % of nominal torque |
| Dynamic torques (peak-peak): | max. 70 % of nominal torque |
| Limit torque (static): | 130 % of nominal torque |
| Breakaway torque (static): | 250 % of nominal torque |
| Angle displacement at nominal torque: | < 0.5 ° |

Material: high strength heat-treated steel, similar to 1.2826 or 12738

Protection class: acc. to EN 60529 IP50

Dimensions: refer to table and dimensional drawing

Maintenance/cleaning (contact ring abrasion, recommended change of the brushes): after approx. 5×10^7 rotations

Mechanical connection:

| | |
|-------------|---|
| model 86403 | Internal and external square acc. to DIN 3121, used for connection to assembling tools for bolt and nuts. |
| model 86413 | Version with keyways on both shaft ends (2 x 180 °) acc. to DIN 6885 page 1 |
| model 86423 | Hexagon head and socket 1/4", acc. to DIN 3126 (ISO 1173) version E/F quick-action chuck |

Electrical connection:

Sensors without measurement of angle displacement
6 pin plug-in connection Mating connector model 9953

Wiring:

| | | | |
|---|--------------------------------------|----------|-----------------------|
| 1 | excitation | negative | |
| 2 | excitation | positive | |
| 3 | shield (not connected in the sensor) | | |
| 4 | output | positive | for clockwise torques |
| 5 | output signal | negative | for clockwise torques |
| 6 | 100 % check | | |

Sensors with measurement of angle displacement

12 pin plug-in connection Mating connector model 9940

Wiring:

| | | | |
|---|-----------------------------------|-------------------------------|-----------------|
| A | excitation | negative for torque | (0 V DC) |
| B | excitation | positive for torque | (2 ... 12 V DC) |
| C | output signal | positive for clockwise torque | |
| D | output signal | negative for clockwise torque | |
| E | excitation | negative for angle displ. | (0 V DC) |
| F | excitation | positive for angle displ. | (+ 5 V DC) |
| G | angle output 1 | (TTL pulses) | |
| H | angle output 2 | (TTL pulses) | |
| J | angle output | | (0 V DC) |
| K | check, shunt calibration (option) | | |
| L | NC | | |
| M | shield | | |

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Order Information

- Torque sensor, rotating, square end measurement range 0 ... 1 Nm **Model 86403-5001**
- Torque sensor, rotating, square end, with meas. of angle displ. measurement range 0 ... 63 Nm **Model 86403-5063-V501**

Accessories

for sensors without measurement of angle displacement

| | |
|--|---------------------------------|
| Mating connector 6 pin, in scope of delivery | Model 9953 |
| Mating connector 6 pin, 90° outlet | Model 9900-V589 |
| Connection cable, one end open, length 3 m | Model 99553-000A-0110030 |
| Connection cable to burster desktop devices with 12 pin panel jack, length 3 m | Model 99141-553A-0150030 |
| Connection cable to 9235 and 9310 length 3 m | Model 99209-553A-0110030 |
| Cable adapter to 9163-V3XXXX length 0.2 m | Model 99209-609A-0090002 |

for sensors with measurement of angle displacement

| | |
|---|---------------------------------|
| Mating connector 12 pin, in scope of delivery | Model 9940 |
| Mating connector 12 pin, 90° outlet | Model 9900-V539 |
| Connection cable, one end open, length 3 m | Model 99540-000K-0270030 |
| Connection cable to model 9306, length 3 m | Model 99141-540K-0270030 |

Strain gauge simulator

Model 9405

The sensor will be replaced by the strain gauge simulator for checking amplifiers or indicators.

Supply units, amplifiers and process control units like modular amplifiers models 9243, 9205, 9163 or 9306

refer to section 9 of the catalog.

Options

Higher measurement ranges on request.

Manufacturers Calibration Certificate (WKS)

Calibration of a torque sensor with or without amplifier / indicator (measurement chain) in clockwise or / and counter clockwise direction in increments of 20 % of the measurement range.

Mounting Instructions

The sensors, particularly those with small measuring ranges, must be mounted carefully. It is important that the drive and measuring ends are not reversed during assembly. The slip-ring rotation transmitter is located on the drive side. If fitted incorrectly (measuring side and drive side swapped), its friction, which is unavoidable, will be included in the measurement.

The correct position of the measuring side is indicated on the corresponding dimensional drawing. The measuring shaft should always be cleaned prior to assembly and should be supported during fitting, to ensure that no foreign objects are sticking to it. It is recommended that the sensor is electrically connected and that the output signal is watched at the time of fitting. Vibrations originating in the equipment should be kept away from the sensor. The sensor should only be mounted on the coupling after the parts have been accurately aligned. This should be done without free play or lateral forces. It is recommended that the cable connection points upwards, so that abrasion dust cannot fall onto the brush connections.