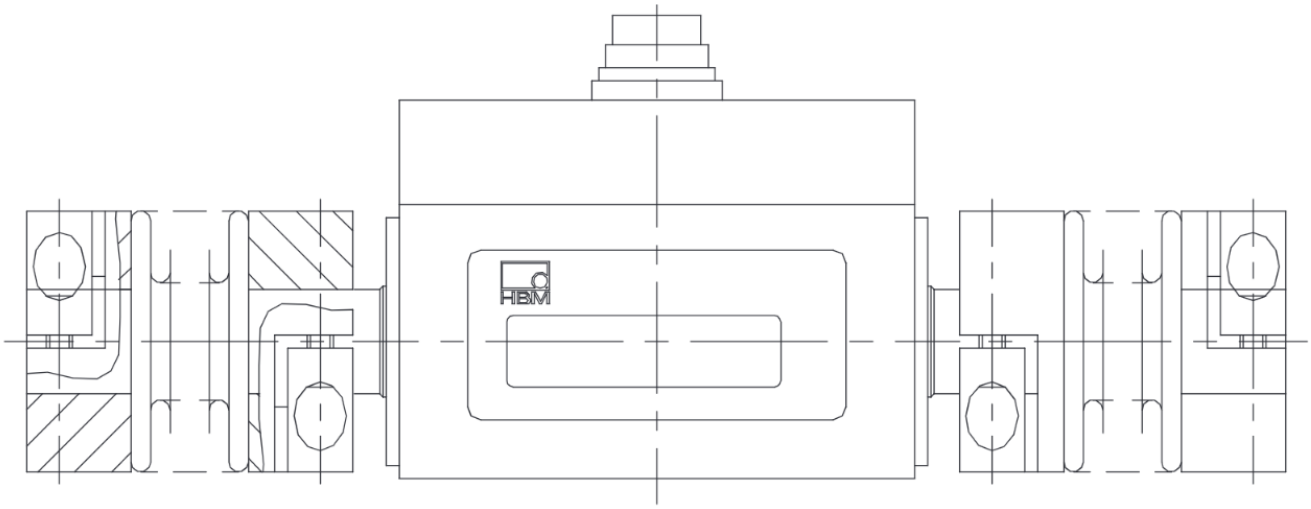
DATA SHEET

# T210
# Torque transducers

## SPECIAL FEATURES

- Linearity deviation, including hysteresis ≤ ±0.05%
- Nominal (rated) torque of 0.5 to 200 Nm
- High speeds of up to 30,000 rpm
- Variant with and without rotational speed measurement with 512/1024 pulses/revolution available
- Output signals ±10 V and 10 kHz ±5 kHz
- Non-contacting transmission of measured values
- Cylindrical shaft ends for friction fits


## INSTALLATION EXAMPLE WITH BELLOWS COUPLINGS



## SPECIFICATIONS

| Type | | T210 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Accuracy class** | | 0.1 | | | | | | | | |
| **Size** | | BG1 | | | BG2 | | | BG3 | | |
| **Nominal (rated) torque $M_{nom}$** | **Nm** | **0.5** | **1** | **2** | **5** | **10** | **20** | **50** | **100** | **200** |
| **Maximum speed $n_{max}$** | **rpm** | **30,000** | | | **20,000** | | | **14,000** | | |
| **Torque measuring system** | | | | | | | | | | |
| **Linearity deviation including hysteresis** relating to the rated output (nominal) | % | ≤ ±0.05 | | | | | | | | |
| **Relative standard deviation of repeatability**, as per DIN 1319 relating to the variation of the output signal | % | ≤ ±0.05 | | | | | | | | |
| **Temperature effect per 10 K in the nominal (rated) temperature range** | | | | | | | | | | |
| on the output signal, relating to the actual value of the signal spread | | | | | | | | | | |
| Frequency output | % | ≤ ±0.1 | | | | | | | | |
| Voltage output | % | ≤ ±0.1 | | | | | | | | |
| on the zero signal relating to the rated output (nominal) | | | | | | | | | | |
| Frequency output | % | ≤ ±0.1 | | | | | | | | |
| Voltage output | % | ≤ ±0.1 | | | | | | | | |
| **Nominal (rated) sensitivity** (nominal (rated) signal range between torque = zero and nominal (rated) torque) | | | | | | | | | | |
| **Frequency output 10 kHz** | kHz | 5 | | | | | | | | |
| **Voltage output** | V | 10 | | | | | | | | |
| **Rated output tolerance** (deviation of the actual output quantity at $M_{nom}$ from the nominal (rated) signal range) | % | ≤ ±0.1 | | | | | | | | |
| **nominal (rated) output signal** | | | | | | | | | | |
| Frequency output (RS422, 5V symmetrical) | | | | | | | | | | |
| with positive nominal (rated) torque | kHz | 15 | | | | | | | | |
| with negative nominal (rated) torque | kHz | 5 | | | | | | | | |
| Voltage output | | | | | | | | | | |
| with positive nominal (rated) torque | V | +10 | | | | | | | | |
| with negative nominal (rated) torque | V | -10 | | | | | | | | |
| **Output signal at torque = zero** | | | | | | | | | | |
| Frequency output | kHz | 10 | | | | | | | | |
| Voltage output | V | 0 | | | | | | | | |
| **Calibration signal** | %vC | 50 | | | | | | | | |
| **Load resistance** | | | | | | | | | | |
| Frequency output (differential) | Ω | ≥100 | | | | | | | | |
| Voltage output | kΩ | ≥100 | | | | | | | | |
| **Long-term drift over 48 h at reference temperature** | | | | | | | | | | |
| Frequency output | % | <005 | | | | | | | | |
| Voltage output | % | <0.5 | | | | | | | | |
| **Measurement frequency range**, -3 db | kHz | 1 | | | | | | | | |
| **Residual ripple** (voltage output) | $mV_{SS}$ | <100 | | | | | | | | |
| **Group delay** | ms | <1 | | | | | | | | |
| **Maximum modulation range** | | | | | | | | | | |
| Frequency output | kHz | 4.4 ... 15.6 (switch-on process: approx. 0) | | | | | | | | |
| Voltage output | V | -11.2 ... +11.2 (switch-on process: approx. -14) | | | | | | | | |
| **Resolution** | | | | | | | | | | |
| Frequency output | Hz | 0.5 at 10 kHz | | | | | | | | |
| Voltage output | mV | 0.5 | | | | | | | | |

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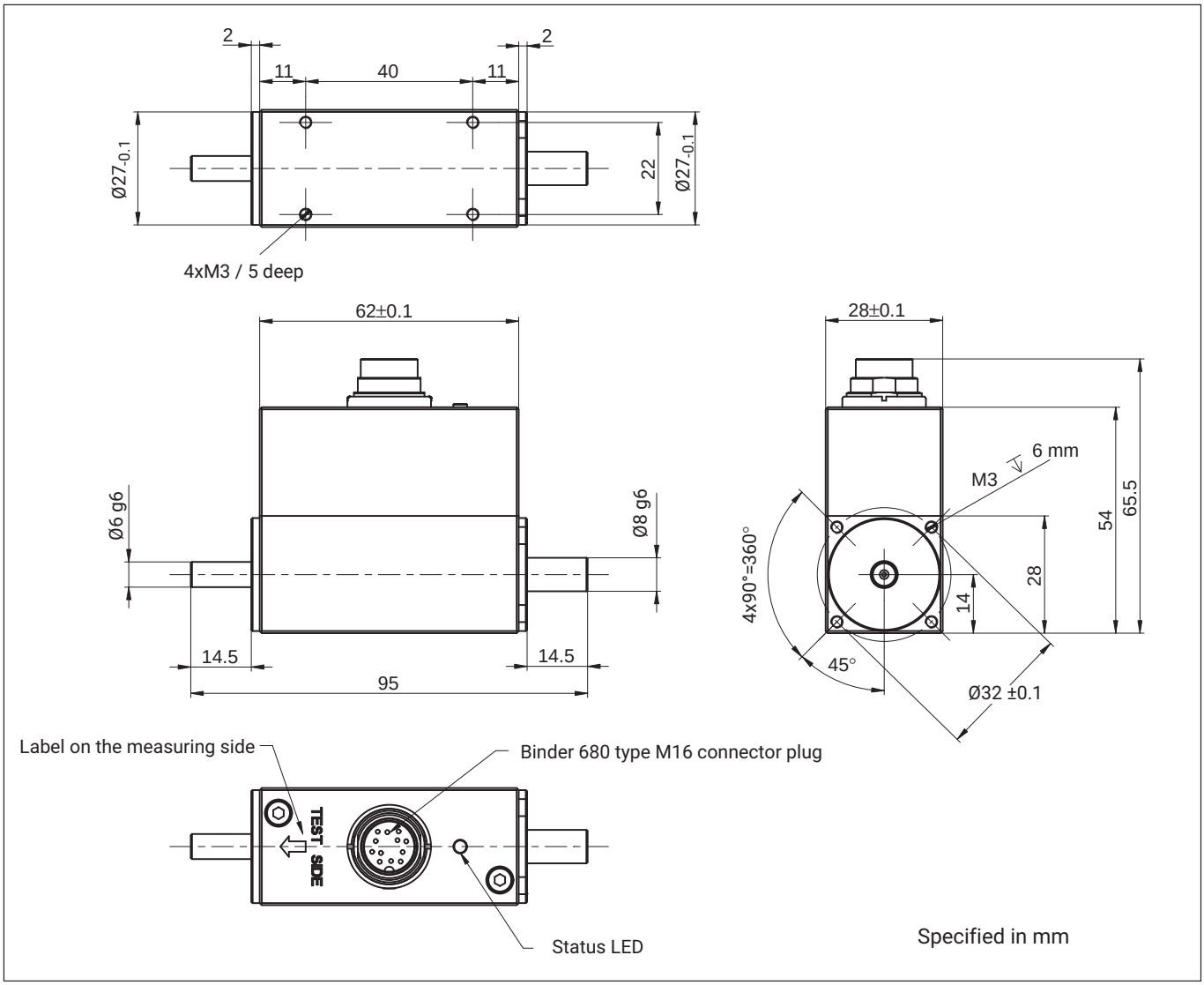
|---|---|---|---|---|---|---|---|---|---|---|
| **Nominal (rated) torque $M_{nom}$** | **Nm** | **0.5** | **1** | **2** | **5** | **10** | **20** | **50** | **100** | **200** |
| **Maximum speed $n_{max}$** | **rpm** | **30,000** | | | **20,000** | | | **14,000** | | |
| **Energy supply** | | | | | | | | | | |
| Nominal (rated) supply voltage (safety extra low voltage (SELV)) | V DC | 10…30 | | | | | | | | |
| Calibration signal triggering | V | 3 … 30 | | | | | | | | |
| Current consumption in measuring mode | A | <0.2 (at $U_{b12V}$) | | | | | | | | |
| Nominal (rated) power consumption | W | <2.5 (in the range of the nominal (rated) supply voltage) | | | | | | | | |
| Permissible residual ripple of supply voltage | $mV_{SS}$ | 400 | | | | | | | | |
| **Measurement system for rotational speed/angle of rotation** | | | | | | | | | | |
| **Measurement system** | | Optical | | | | | | | | |
| **Pulses per revolution** | - | 512/1024 [1)] | | | | | | | | |
| **Output signal** | V | 5 (asymmetrical), two square wave signals, shifted by approx. 90° | | | | | | | | |
| **Minimum rotational speed for sufficient pulse stability** | rpm | 0 | | | | | | | | |
| **Load resistance** | Ω | >200 | | | | | | | | |
| **Group delay** | µs | 1.5 | | | | | | | | |
| **General information** | | | | | | | | | | |
| **EMC immunity to interference (as per EN 61326-1, Table A.1)** | | | | | | | | | | |
| Electromagnetic field | V/m | 10 | | | | | | | | |
| Magnetic field | A/m | 100 | | | | | | | | |
| **Electrostatic discharge (ESD)** | | | | | | | | | | |
| Contact discharge | kV | 4 | | | | | | | | |
| Air discharge | kV | 4 | | | | | | | | |
| Fast transients (burst) | kV | 1 | | | | | | | | |
| **Emission (as per EN 61326-1, Table 3)** | | | | | | | | | | |
| RFI voltage | | Class B | | | | | | | | |
| RFI power | | Class B | | | | | | | | |
| RFI field strength | | Class B | | | | | | | | |
| **Degree of protection as per EN 60529** | | IP40 | | | | | | | | |
| **Weight**, approx. | kg | 0.2 | | | 0.6 | | | 1.3 | | |
| **Nominal (rated) temperature range** | °C | +10…+70 | | | | | | | | |
| **Operating temperature range** | °C | -20…+85 | | | | | | | | |
| **Storage temperature range** | °C | -40…+85 | | | | | | | | |
| **Mechanical shock resistance according to EN 60068-2-27** | | | | | | | | | | |
| **Number** | n | 1,000 | | | | | | | | |
| **Duration** | ms | 3 | | | | | | | | |
| **Acceleration (half sine)** | $m/s^2$ | 650 | | | | | | | | |
| **Vibration testing per EN 60068-2-6** | | | | | | | | | | |
| **Frequency range** | Hz | 10…2,000 | | | | | | | | |
| **Duration** | h | 1.5 | | | | | | | | |
| **Acceleration** | $m/s^2$ | 50 | | | | | | | | |

| Type | | T210 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Nominal (rated) torque $M_{nom}$** | **Nm** | **0.5** | **1** | **2** | **5** | **10** | **20** | **50** | **100** | **200** |
| **Load limits** [2] | | | | | | | | | | |
| Limit torque, relating to $M_{nom}$ | % | 200 | | | | | | | | |
| Breaking torque, relating to $M_{nom}$ | % | ≥300 | | | | | | | | |
| Axial limit force | N | 200 | 350 | 500 | 1,100 | 1,750 | 2,500 | 5,000 | 7,000 | 9,500 |
| Lateral limit force [3] | N | 4 | 6 | 10 | 15 | 30 | 50 | 100 | 150 | 250 |
| Oscillation width as per DIN 50100 (peak-to-peak) [4] | % | 80 | | | | | | | | |
| **Mechanical values** | | | | | | | | | | |
| **Torsional stiffness $c_T$** | Nm/rad | 46 | 89 | 133 | 585 | 1,367 | 2,933 | 10,893 | 24,043 | 50,388 |
| **Torsion angle at $M_{nom}$** | ° | 0.62 | 0.64 | 0.86 | 0.49 | 0.42 | 0.39 | 0.26 | 0.24 | 0.23 |
| **Max. permissible vibration displacement of the rotor** (peak-to-peak)[5] Undulations in the connection geometry, based on ISO 7919-3 | µm | $s_{max} = \frac{4500}{\sqrt{n}}$ (n in $min^{-1}$) | | | | | | | | |
| **Effective velocity** in the vicinity of the housing, as per VDI 2056 | | $v_{eff} = \frac{\sqrt{n}}{3}$ (n in $min^{-1}$) | | | | | | | | |
| **Mass moment of inertia of the rotor** (around the rotary axis) **with rotational speed measuring system** | g*cm² | 9.5 | 9.5 | 9.5 | 130 | 135 | 140 | 910 | 920 | 930 |
| **Mass moment of inertia of the rotor (around the rotary axis) without rotational speed measuring system** | g*cm² | 9.1 | 9.1 | 9.5 | 124 | 129 | 134 | 891 | 901 | 911 |
| **Balance quality level** as per DIN ISO 1940 | | G6.3 | | | | | | | | |

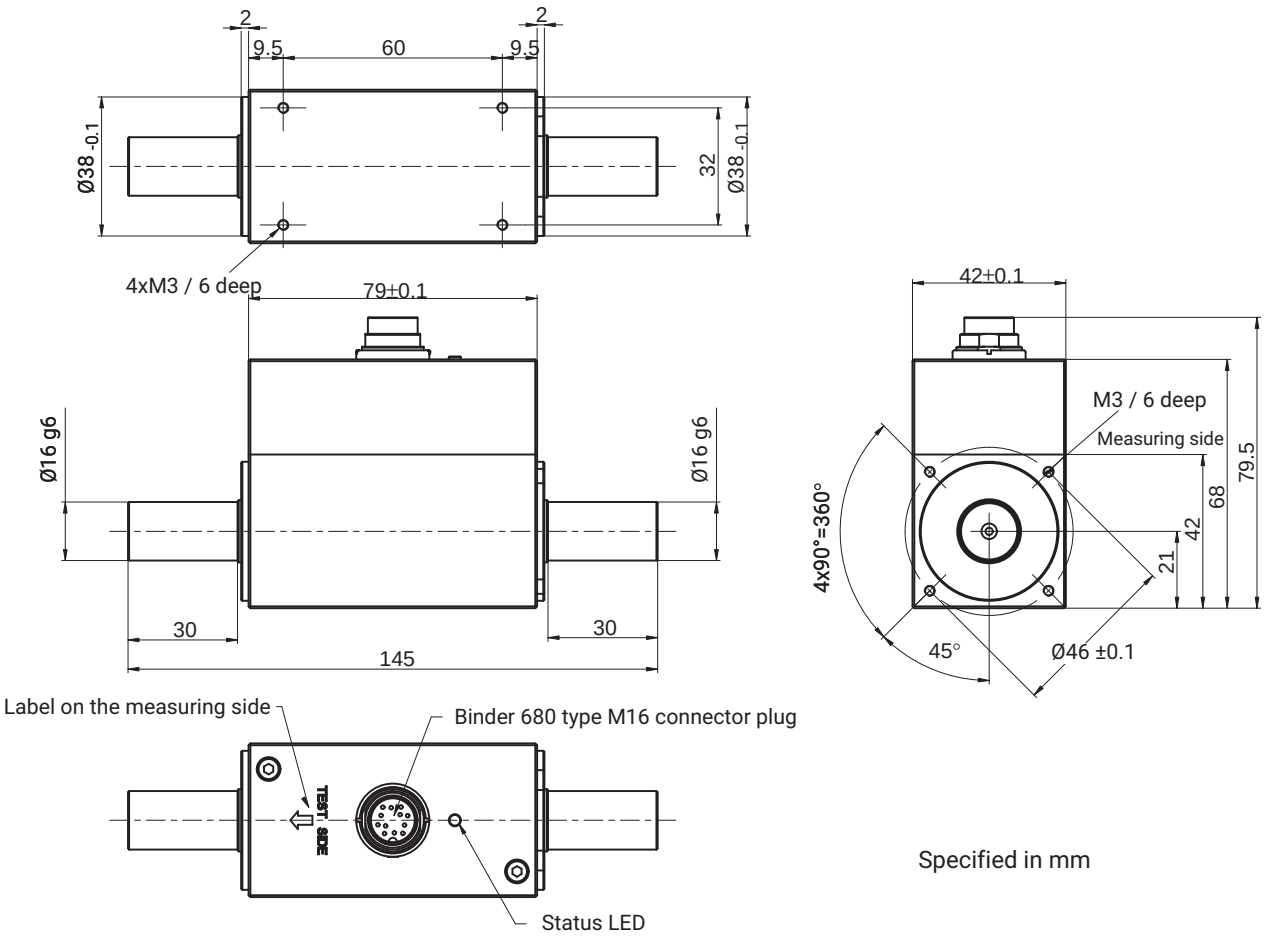
1) 512 pulses/revolution as standard with 1-T210
1024 pulses/revolution optionally via K-T210
2) Each type of irregular stress (lateral or longitudinal force, exceeding nominal (rated) torque) can only be permitted up to its specified static load limit and provided none of the others can occur at the same time. If this condition is not met, the limit values must be reduced. If 50% of the lateral limit force occurs, only 50% of the axial limit force is permissible and the nominal (rated) torque must not be exceeded. In the measurement result, the permissible irregular stresses can have an effect of approx. 1% of the nominal (rated) torque.
The specified loads only apply to the measurement shaft and must not be routed or stabilized via the housing.
3) Measured on the center of the shaft stub.
4) The nominal (rated) torque must not be exceeded.
5) The influence on the vibration measurements caused by radial run-out deviations, eccentricity, defects of form, notches, marks, local residual magnetism, structural inhomogeneity or material anomalies must be taken into account and isolated from the actual undulation.

## DIMENSIONS

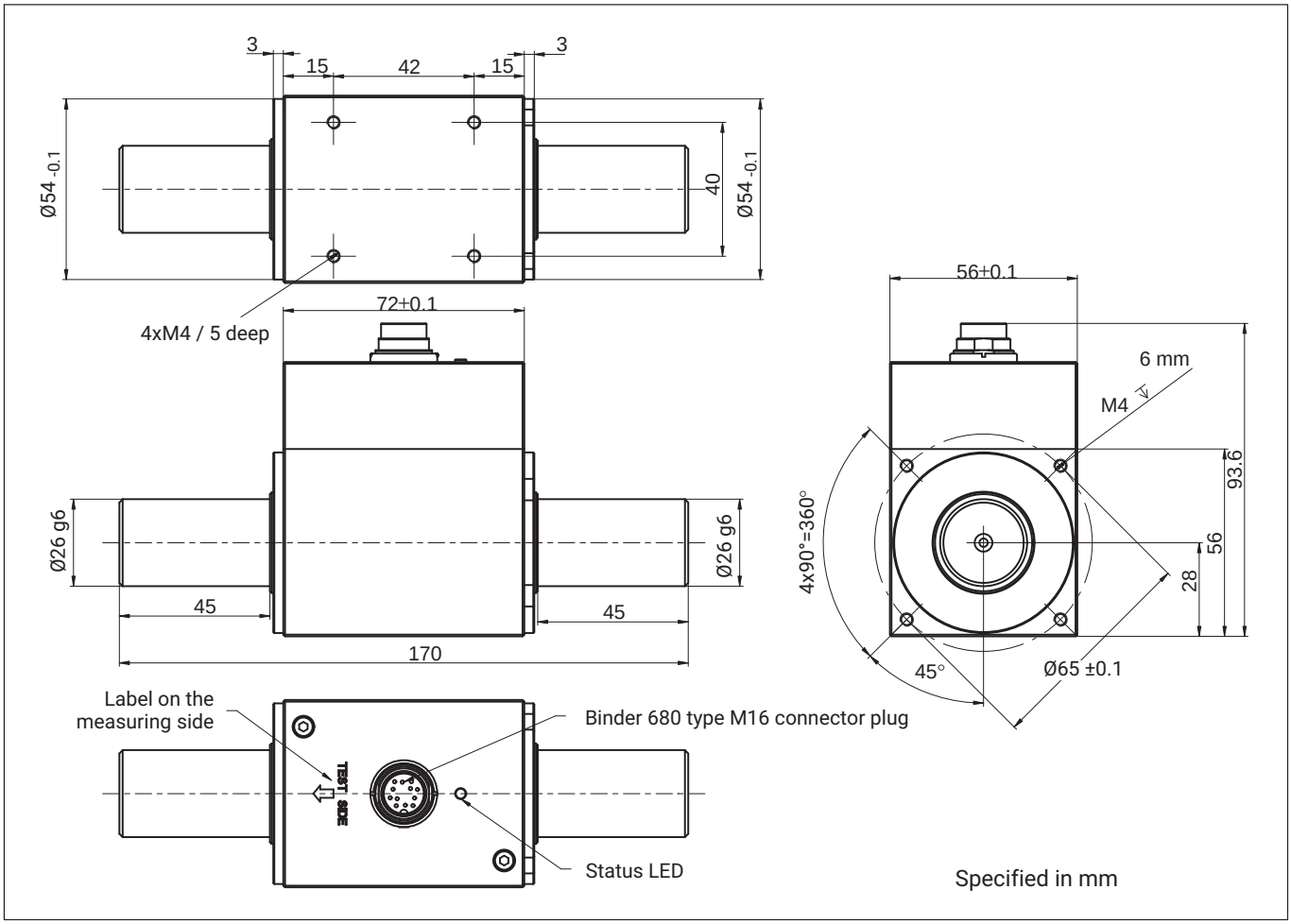
### BG1 – 0.5 Nm, 1 Nm·, 2 Nm



**BG2 – 5 Nm, 10 Nm, 20 Nm**



**BG3 – 50 Nm, 100 Nm, 200 Nm**




## ORDERING NUMBERS

The following versions are available from stock at short notice as a standard product in the configuration with a 512 pulses/revolution rotational speed measuring system:

| Material no. | Nominal (rated) torque (Nm) |
|---|---|
| 1-T210/0.5NM | 0.5 |
| 1-T210/1NM | 1 |
| 1-T210/2NM | 2 |
| 1-T210/5NM | 5 |
| 1-T210/10NM | 10 |
| 1-T210/20NM | 20 |
| 1-T210/50NM | 50 |
| 1-T210/100NM | 100 |
| 1-T210/200NM | 200 |

The product is also available as a configurable variant.

## PRODUCT DESIGNATION (OVERVIEW)

| K-T210 | | |
|---|---|---|
| 1 | **Code** | **Option 1: Measuring range** |
| | **1** | 1 Nm |
| | **2** | 2 Nm |
| | **5** | 5 Nm |
| | **10** | 10 Nm |
| | **20** | 20 Nm |
| | **50** | 50 Nm |
| | **100** | 100 Nm |
| | **200** | 200 Nm |
| 2 | **Code** | **Option 2: Accuracy** |
| | **S** | Standard |
| 3 | **Code** | **Option 3: Maximum speed** |
| | **S** | Standard |
| 4 | **Code** | **Option 4: Electrical outputs** |
| | **FA** | Frequency + Analog |
| 5 | **Code** | **Option 5: Rotational speed measuring system** |
| | **0** | Without rotational speed measuring system |
| | **1** | 512 pulses/revolution and reference pulse |
| | **2** | 1024 pulses/revolution and reference pulse |
| 6 | **Code** | **Option 6: IO-Link firmware version** |
| | **N** | No firmware |

**K-T210** - [ ][ ][ ] - [S] - [S] - [F][A] - [ ] - [N]

1 2 3 4 5 6

Preferred types

## SCOPE OF SUPPLY

- T210 torque transducer
- Test report
- Mounting instructions

## ACCESSORIES

To be purchased separately.

- Transducer connection cable, 5 m long, order no. 3-3301.0158
- Transducer connection cable, 10 m long, order no. 3-3301.0159
- Cable socket, 12-pin (binder), order no. 3-3312.0268
- Junction box, order no. 1-VK20A
- Bellows couplings, e.g. 1-4413.00xx

## ACCESSORIES FOR JUNCTION BOX VK20A

To be purchased separately.

- Connection cable, 1.5 m long (D-Sub, 15-pin – free ends), order no. 1-KAB151A-1.5
- Connection cable, 1.5 m long (SUBCON5 – free ends), order no. 1-KAB152-1.5

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