

## 6-Axis Force Sensor K6D110 1kN/100Nm/MP11

Item number: 9723



The multi-component sensor K6D110 allows force and torque measurement in three mutually perpendicular axes.

The multi-component sensor K6D110 is characterized by a big measuring range for torques at the same time with the small outer diameter.

With this multi-component sensor of the „second generation“ is used rod construction, which absorbs forces and torques directly on the pitch circle of the fastening thread.

The force transmission is applied on the 1 mm raised segments. The inner diameter of segments is used for the centering. Due to segmented, ring-shaped front surface, the optimal force transmission and therefore the best possible reproducibility in the range of about 0,1 % will be obtained.

The multi-component force sensor is very well suited for use in robotics, e.g.

- For collision detection
- "Teach-In"
- Collision detection
- Force or torque-controlled operation
- Load measurement in medicine, prosthetics, orthopaedic engineering
- Measurement in sports medicine
- Comfort / ergonomics measurements

The force and torque loadings are evaluated e.g. using a GSV-8AS measurement amplifier or an integrated electronic of type GSV-6.

The sensor K6D110 4kN/250Nm is made of aluminium alloy, the sensor K6D110 10kN/750Nm is made of high-strength stainless steel 1.4542.

## Technical Data

| Basic Data           |                     | Unit |
|----------------------|---------------------|------|
| Type                 | 6-axis force sensor |      |
| Force direction      | Tension/Compression |      |
| Rated force Fx       | 1                   | kN   |
| Rated force Fy       | 1                   | kN   |
| Rated force Fz       | 2.5                 | kN   |
| Force introduction   | Internal thread     |      |
| Dimension 1          | 6x M10x1,5          |      |
| Sensor Fastening     | Internal thread     |      |
| Dimension 2          | 6x M10x1,5          |      |
| Operating force      | 300                 | % FS |
| Material             | aluminum-alloy      |      |
| Natural frequency fx | 1587.1              | Hz   |
| Height               | 60                  | mm   |
| Length or Diameter   | 110                 | mm   |
| Rated torque Mx      | 100                 | Nm   |
| Rated torque My      | 100                 | Nm   |
| Rated torque Mz      | 100                 | Nm   |
| Torque limit         | 300                 | % FS |
| Bending moment limit | 300                 | % FS |

| Electrical Data                            |       | Unit |
|--|-------|------|
| Input resistance                           | 350   | Ohm  |
| Tolerance input resistance                 | 10    | Ohm  |
| Output resistance                          | 350   | Ohm  |
| Tolerance output resistance                | 10    | Ohm  |
| Insulation resistance                      | 2     | GOhm |
| Rated range of excitation voltage from     | 2.5   | V    |
| Rated range of excitation voltage to       | 5     | V    |
| Operating range of excitation voltage from | 1     | V    |
| Operating range of excitation voltage to   | 5     | V    |
| Zero signal from                           | -0.05 | mV/V |
| Zero signal to                             | 0.05  | mV/V |
| Characteristic value range from            | 0.4   | mV/V |
| Characteristic value range to              | 0.8   | mV/V |

| Eccentricity and Crosstalk |   | Unit |
|----------------------------|---|------|
| Crosstalk                  | 1 | %FS  |

| Accuracy Data                              |      | Unit  |
|--|------|-------|
| Accuracy class                             | 0,2  |       |
| Relative linearity error                   | 0.1  | %FS   |
| Relative zero signal hysteresis            | 0.1  | %FS   |
| Temperature effect on zero signal          | 0.1  | %FS/K |
| Temperature effect on characteristic value | 0.01 | %RD/K |
| Relative creep                             | 0.1  | %FS   |
| Relative repeatability error               | 0.5  | %FS   |

| Environmental Data               |      | Unit |
|----------------------------------|------|------|
| Rated temperature range from     | -10  | °C   |
| Rated temperature range to       | 70   | °C   |
| Operating temperature range from | -10  | °C   |
| Operating temperature range to   | 85   | °C   |
| Storage temperature range from   | -10  | °C   |
| Storage temperature range to     | 85   | °C   |
| Environmental protection         | IP65 |      |

Abbreviation : RD: „Reading“; FS: „Full Scale“; The application of a calibration matrix is required for the determination of the forces  $F_x$ ,  $F_y$ ,  $F_z$  and moments  $M_x$ ,  $M_y$ , and  $M_z$  from the 6 measurement channels, and to compensate for the crosstalk.

The calibration data are individually determined and documented for the sensor.

The measurement error is expressed individually by the specification of the extended measurement uncertainty ( $k = 2$ ) for the forces  $F_x$ ,  $F_y$ ,  $F_z$ , and moments  $M_x$ ,  $M_y$ ,  $M_z$ .

## PIN Assignment

| Channel | Symbol | Designation            | Color        | PIN |
|---------|--------|------------------------|--------------|-----|
| 1       | +Us    | positive bridge supply | white        | 1   |
|         | -Us    | negative bridge supply | brown        | 2   |
|         | +Ud    | positive bridge output | green        | 3   |
|         | -Ud    | negative bridge output | yellow       | 4   |
| 2       | +Us    | positive bridge supply | gray         | 5   |
|         | -Us    | negative bridge supply | pink         | 6   |
|         | +Ud    | positive bridge output | blue         | 7   |
|         | -Ud    | negative bridge output | red          | 8   |
| 3       | +Us    | positive bridge supply | black        | 9   |
|         | -Us    | negative bridge supply | purple       | 10  |
|         | +Ud    | positive bridge output | gray-pink    | 11  |
|         | -Ud    | negative bridge output | red-blue     | 12  |
| 4       | +Us    | positive bridge supply | white-green  | 13  |
|         | -Us    | negative bridge supply | brown-green  | 14  |
|         | +Ud    | positive bridge output | white-yellow | 15  |
|         | -Ud    | negative bridge output | yellow-brown | 16  |
| 5       | +Us    | positive bridge supply | white-gray   | 17  |
|         | -Us    | negative bridge supply | gray-brown   | 18  |
|         | +Ud    | positive bridge output | white-pink   | 19  |
|         | -Ud    | negative bridge output | pink-brown   | 20  |
| 6       | +Us    | positive bridge supply | white-blue   | 21  |
|         | -Us    | negative bridge supply | brown-blue   | 22  |
|         | +Ud    | positive bridge output | white-red    | 23  |
|         | -Ud    | negative bridge output | brown-red    | 24  |

Shield: connected with sensor housing;

## Mounting

The forces is applied to an annulus ( $\varnothing 100\text{-}\varnothing 65$ ) on the end faces of the sensor. No force is applied to the area inside the ring.

A centring hole is provided to secure the angular position.

## Stiffness Matrix

|            |            |             |           |           |          |
|------------|------------|-------------|-----------|-----------|----------|
| 34.3 kN/mm | 0          | 0           | 0         | 1030 kN   | 0        |
| 0          | 34.3 kN/mm | 0           | -1030 kN  | 0         | 0        |
| 0          | 0          | 140.8 kN/mm | 0         | 0         | 0        |
| 0          | -1030 kN   | 0           | 124.8 kNm | 0         | 0        |
| 1030 kN    | 0          | 0           | 0         | 124.8 kNm | 0        |
| 0          | 0          | 0           | 0         | 0         | 91.6 kNm |

- The elements with the unit kN/mm describe the relationship between force and path.
- The elements with the unit kNm describe the relationship between torque and twist.
- The elements with the unit kN describe the relationship between torque and path (columns 1 to 3) or the relationship between force and twist (columns 4 to 6)