K6D40

6 Axis Force sensor

CG

MP11

Description

The K6D40 multi-component sensor is designed to measure the forces and torques on three mutually perpendicular axes.
Owing to this sensor's very light weight of only 160 g (K6D40 200 N / 5 Nm) or 450 g (K6D40 500 N / 20 Nm), it is very well suited for use in robotics, e.g.

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

The force and torque loadings are evaluated e.g. using a GSV-1A8USB measurement amplifier. The 6 load values can be calculated using a Windows DLL or using LabVIEW with the aid of a digital calibration document provided. The calibration document contains the individual calibration factors and error corrections for the sensor.
The K6D40 200 N / 5 Nm sensor is made from aluminium alloy with a stainless steel housing. The K6D40 500N/20Nm sensor is made entirely of stainless steel.

Technical characteristics

Modèles	K6D40 (50N/5Nm/CG)	K6D40 (50N/5Nm/MP11)	K6D40 (200N/5Nm/CG)	K6D40 (200N/5Nm/MP11)	K6D40 (500N/20Nm/CG)	K6D40 (200N/20Nm/MP11)
Fx [N]	50	50	200	200	500	500
Fy [N]	50	50	200	200	500	500
Fz [N]	200	200	500	500	2000	2000
Mx [Nm]	5	5	5	5	20	20
My [Nm]	5	5	5	5	20	20
Mz [Nm]	10	10	10	10	40	40
Connectique	Cable	Connecteur MP11	Cable	Connecteur MP11	Cable	Connecteur MP11
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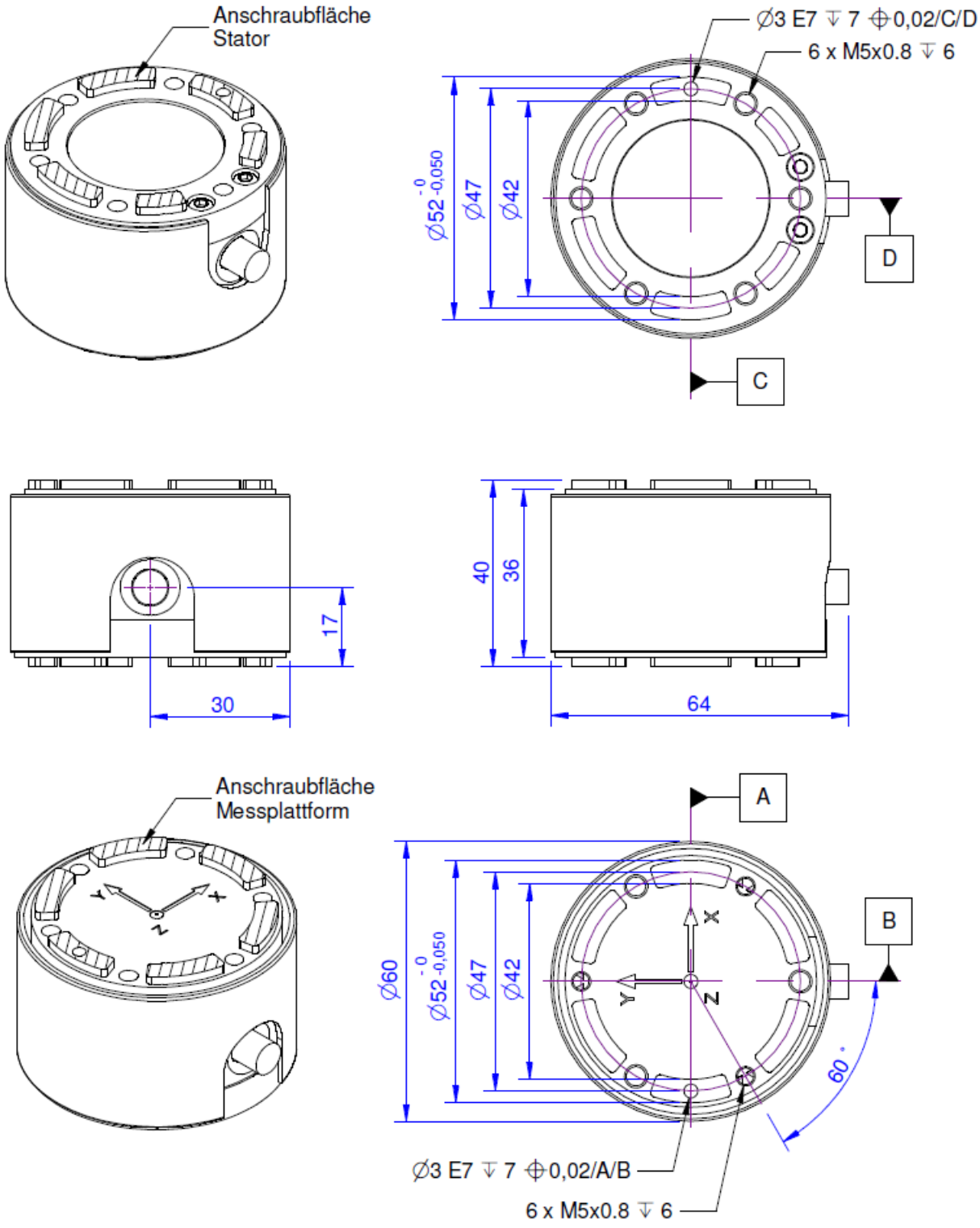
Dimensions (CG)



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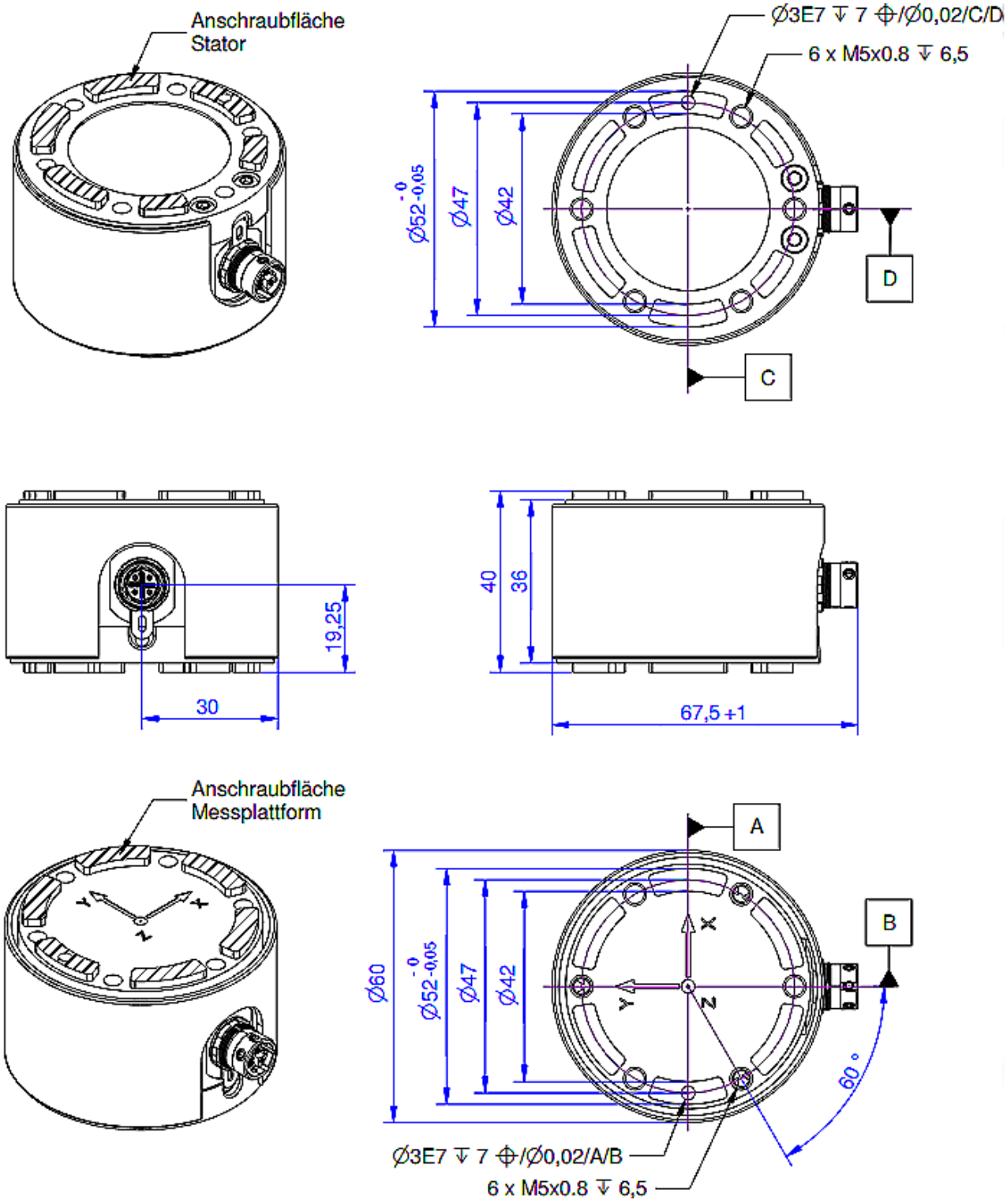
Dimensions (MP11)



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K6D40

6 Axis Force sensor

Specification : Model K6D40 (50N/5Nm/CG)

Force sensor		
Type	6-Axis force sensor	
Force direction	Tension / Compression	
Rated force Fx	50	N
Rated force Fy	50	N
Rated force Fz	200	N
Force introduction	Inner thread	
Dimension 1	6x M5x0,8	
Sensor Fastening	Inner thread	
Dimension 2	6x M5x0,8	
Operating force	400	% FS
Material	Stainless steel	
Dimensions	Ø60 x 40	mm
Height	40	mm
Length or Diameter	60	mm
Rated torque Mx	5	Nm
Rated torque My	5	Nm
Rated torque Mz	10	Nm
Torque limit	300	% FS
Bending moment limit	500	% FS

Electrical Data		
Input resistance	1000	Ohm
Tolerance input resistance	10	Ohm
Output resistance	1000	Ohm
Tolerance output resistance	10	Ohm
Insulation resistance	2	GOhm
Rated range of excitation voltage f	2.5 ... 5	V
Operating range of excitation voltage f	1 ... 5	V
Zero signal to	-1.5	mV/V
Zero signal from	1.5	mV/V

Precision		
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	0.05	%RD/K
Relative creep	0.1	%FS
Relative repeatability error	0.5	%FS

Connection Data	
Connection type	24 conductor open

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Specification : Model K6D40 (50N/5Nm/CG)

Name of the connection	round plug connector MP11, 24-pole, male	
Cable length	5	m

Eccentricity and Crosstalk		
Crosstalk	1	%FS

Temperature		
Rated temperature range f	-10 ... 70	°C
Operating temperature range f	-10 ... 85	°C
Storage temperature range f	-10 ... 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 Fx, Fy, Fz and moments Mx, My, and Mz 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 Fx, Fy, Fz, and moments Mx, My, Mz.

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K6D40

6 Axis Force sensor

Specification : Model K6D40 (50N/5Nm/MP11)

Force sensor		
Type	6-Axis force sensor	
Force direction	Tension / Compression	
Rated force Fx	50	N
Rated force Fy	50	N
Rated force Fz	200	N
Force introduction	Inner thread	
Dimension 1	6x M5x0,8	
Sensor Fastening	Inner thread	
Dimension 2	6x M5x0,8	
Operating force	400	% FS
Material	Stainless steel	
Dimensions	Ø60 x 40	mm
Height	40	mm
Length or Diameter	60	mm
Rated torque Mx	5	Nm
Rated torque My	5	Nm
Rated torque Mz	10	Nm
Torque limit	300	% FS
Bending moment limit	500	% FS

Electrical Data		
Input resistance	1000	Ohm
Tolerance input resistance	10	Ohm
Output resistance	1000	Ohm
Tolerance output resistance	10	Ohm
Insulation resistance	2	GOhm
Rated range of excitation voltage f	2.5 ... 5	V
Operating range of excitation voltage f	1 ... 5	V
Zero signal to	-1.5	mV/V
Zero signal from	1.5	mV/V

Precision		
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	0.05	%RD/K
Relative creep	0.1	%FS
Relative repeatability error	0.5	%FS

Connection Data	
Connection type	24 conductor open

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Specification : Model K6D40 (50N/5Nm/MP11)

Name of the connection	round plug connector MP11, 24-pole, male	
Cable length	5	m

Eccentricity and Crosstalk		
Crosstalk	1	%FS

Temperature		
Rated temperature range f	-10 ... 70	°C
Operating temperature range f	-10 ... 85	°C
Storage temperature range f	-10 ... 85	°C
Environmental protection	IP65	

Abbreviation : RD: „Reading“; FS: „Full Scale“;

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K6D40

6 Axis Force sensor

Specification : Model K6D40 (200N/5Nm/CG)

Force sensor		
Type	6-Axis force sensor	
Force direction	Tension / Compression	
Rated force Fx	200	N
Rated force Fy	200	N
Rated force Fz	500	N
Force introduction	Inner thread	
Dimension 1	6x M5x0,8	
Sensor Fastening	Inner thread	
Dimension 2	6x M5x0,8	
Operating force	400	% FS
Rated displacement	0.1	mm
Twist	0.01	rad
Material	Aluminium alloy	
Natural frequency	2.8	kHz
Dimensions	Ø60 x 40	mm
Height	40	mm
Length or Diameter	60	mm
Rated torque Mx	5	Nm
Rated torque My	5	Nm
Rated torque Mz	10	Nm
Torque limit	300	% FS
Bending moment limit	500	% FS

Electrical Data		
Input resistance	1000	Ohm
Tolerance input resistance	10	Ohm
Output resistance	1000	Ohm
Tolerance output resistance	10	Ohm
Insulation resistance	2	GOhm
Rated range of excitation voltage f	2.5 ... 5	V
Operating range of excitation voltage f	1 ... 5	V
Zero signal to	-1.5	mV/V
Zero signal from	1.5	mV/V

Precision		
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	0.05	%RD/K
Relative creep	0.1	%FS
Relative repeatability error	0.5	%FS

Connection Data

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K6D40

6 Axis Force sensor

Specification : Model K6D40 (200N/5Nm/CG)

Connection type	24 conductor open	
Name of the connection	33-24 PUR/24x0,03 mm²	
Cable length	5	m

Eccentricity and Crosstalk		
Crosstalk	1	%FS

Temperature		
Rated temperature range f	-10 ... 70	°C
Operating temperature range f	-10 ... 85	°C
Storage temperature range f	-10 ... 85	°C
Environmental protection	IP65	

Abbreviation : RD: „Reading"; FS: „Full Scale";

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6 Axis Force sensor

Specification : Model K6D40 (200N/5Nm/MP11)

Force sensor		
Type	6-Axis force sensor	
Force direction	Tension / Compression	
Rated force Fx	200	N
Rated force Fy	200	N
Rated force Fz	500	N
Force introduction	Inner thread	
Dimension 1	6x M5x0,8	
Sensor Fastening	Inner thread	
Dimension 2	6x M5x0,8	
Operating force	400	% FS
Rated displacement	0.1	mm
Twist	0.01	rad
Material	Aluminium alloy	
Dimensions	Ø60 x 40	mm
Height	40	mm
Length or Diameter	60	mm
Rated torque Mx	5	Nm
Rated torque My	5	Nm
Rated torque Mz	10	Nm
Torque limit	300	% FS
Bending moment limit	500	% FS

Electrical Data		
Input resistance	1000	Ohm
Tolerance input resistance	10	Ohm
Output resistance	1000	Ohm
Tolerance output resistance	10	Ohm
Insulation resistance	2	GOhm
Rated range of excitation voltage f	2.5 ... 5	V
Operating range of excitation voltage f	1 ... 5	V
Zero signal to	-1.5	mV/V
Zero signal from	1.5	mV/V

Precision		
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	0.05	%RD/K
Relative creep	0.1	%FS
Relative repeatability error	0.5	%FS

Connection Data		
Connection type	24 conductor open	

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Specification : Model K6D40 (200N/5Nm/MP11)

Name of the connection	round plug connector MP11, 24-pole, male	
Cable length	5	m

Eccentricity and Crosstalk		
Crosstalk	1	%FS

Temperature		
Rated temperature range f	-10 ... 70	°C
Operating temperature range f	-10 ... 85	°C
Storage temperature range f	-10 ... 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 Fx, Fy, Fz and moments Mx, My, and Mz 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 Fx, Fy, Fz, and moments Mx, My, Mz.

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K6D40

6 Axis Force sensor

Specification : Model K6D40 (500N/20Nm/CG)

Force sensor		
Type	6-Axis force sensor	
Force direction	Tension / Compression	
Rated force Fx	500	N
Rated force Fy	500	N
Rated force Fz	2000	N
Force introduction	Inner thread	
Dimension 1	6x M5x0,8	
Sensor Fastening	Inner thread	
Dimension 2	6x M5x0,8	
Operating force	400	% FS
Rated displacement	0.03	mm
Twist	0.003	rad
Material	Stainless steel	
Natural frequency	2.8	kHz
Dimensions	Ø60 x 40	mm
Height	40	mm
Length or Diameter	60	mm
Rated torque Mx	20	Nm
Rated torque My	20	Nm
Rated torque Mz	40	Nm
Torque limit	300	% FS
Bending moment limit	500	% FS

Electrical Data		
Input resistance	1000	Ohm
Tolerance input resistance	10	Ohm
Output resistance	1000	Ohm
Tolerance output resistance	10	Ohm
Insulation resistance	2	GOhm
Rated range of excitation voltage f	2.5 ... 5	V
Operating range of excitation voltage f	1 ... 5	V
Zero signal to	-1.5	mV/V
Zero signal from	1.5	mV/V

Precision		
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	0.05	%RD/K
Relative creep	0.1	%FS
Relative repeatability error	0.5	%FS

Connection Data

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Specification : Model K6D40 (500N/20Nm/CG)

Connection type	24 conductor open	
Name of the connection	33-24 PUR/24x0,03 mm²	
Cable length	5	m

Eccentricity and Crosstalk

Crosstalk	1	%FS

Temperature

Rated temperature range f	-10 ... 70	°C
Operating temperature range f	-10 ... 85	°C
Storage temperature range f	-10 ... 85	°C
Environmental protection	IP65	

Abbreviation : RD: „Reading"; FS: „Full Scale";

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K6D40

6 Axis Force sensor

Specification : Model K6D40 (500N/20Nm/MP11)

Force sensor		
Type	6-Axis force sensor	
Force direction	Tension / Compression	
Rated force Fx	500	N
Rated force Fy	500	N
Rated force Fz	2000	N
Force introduction	Inner thread	
Dimension 1	6x M5x0,8	
Sensor Fastening	Inner thread	
Dimension 2	6x M5x0,8	
Operating force	400	% FS
Rated displacement	0.03	mm
Twist	0.003	rad
Material	Stainless steel	
Dimensions	Ø60 x 40	mm
Height	40	mm
Length or Diameter	60	mm
Rated torque Mx	20	Nm
Rated torque My	20	Nm
Rated torque Mz	40	Nm
Torque limit	300	% FS
Bending moment limit	500	% FS

Electrical Data		
Input resistance	1000	Ohm
Tolerance input resistance	10	Ohm
Output resistance	1000	Ohm
Tolerance output resistance	10	Ohm
Insulation resistance	2	GOhm
Rated range of excitation voltage f	2.5 ... 5	V
Operating range of excitation voltage f	1 ... 5	V
Zero signal to	-1.5	mV/V
Zero signal from	1.5	mV/V

Precision		
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	0.05	%RD/K
Relative creep	0.1	%FS
Relative repeatability error	0.5	%FS

Connection Data	
Connection type	24 conductor open

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Specification : Model K6D40 (500N/20Nm/MP11)

Name of the connection	round plug connector MP11, 24-pole, male	
Cable length	5	m

Eccentricity and Crosstalk		
Crosstalk	1	%FS

Temperature		
Rated temperature range f	-10 ... 70	°C
Operating temperature range f	-10 ... 85	°C
Storage temperature range f	-10 ... 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 Fx, Fy, Fz and moments Mx, My, and Mz from the 6 measurement channels, and to compensate for the crosstalk.
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Pin Configuration (CG)

Channel	Symbol	Description	Wire colour
1	+Us	positive bridge supply	red
	-Us	negative bridge supply	black
	+Ud	positive bridge output	green
	-Ud	negative bridge output	white
2	+Us	positive bridge supply	blue
	-Us	negative bridge supply	yellow
	+Ud	positive bridge output	purple
	-Ud	negative bridge output	grey
3	+Us	positive bridge supply	orange
	-Us	negative bridge supply	brown
	+Ud	positive bridge output	pink
	-Ud	negative bridge output	transparent
4	+Us	positive bridge supply	green-black
	-Us	negative bridge supply	black-white
	+Ud	positive bridge output	red-black
	-Ud	negative bridge output	white-black
5	+Us	positive bridge supply	purple-black
	-Us	negative bridge supply	yellow-black
	+Ud	positive bridge output	bue-black
	-Ud	negative bridge output	gray-black
6	+Us	positive bridge supply	pink-black
	-Us	negative bridge supply	brown-black
	+Ud	positive bridge output	orange-black
	-Ud	negative bridge output	transparent-black

Shield: connected with sensor housing;

Mounting

The force is applied to an annulus / to 6 segments of a circle, 52 mm – 42mm in diameter, on the end faces of the sensor. No force is applied to the area inside the ring with a diameter of 42 mm.

The areas outside the annuli can be used for centring purposes. A centring hole is provided to secure the angular position.

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Pin Configuration (MP11)

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

Shield: connected with sensor housing;

Mounting

The force is applied to an annulus / to 6 segments of a circle, 52 mm – 42mm in diameter, on the end faces of the sensor. No force is applied to the area inside the ring with a diameter of 42 mm.

The areas outside the annuli can be used for centring purposes. A centring hole is provided to secure the angular position.

K6D40_200N_10Nm_CG.pdf | K6D40_200N_10Nm_MP11.pdf | K6D40_500N_10Nm_CG.pdf | K6D40_500N_10Nm_MP11.pdf | K6D40_2kN_40Nm_CG.pdf | K6D40_2kN_40Nm_MP11.pdf

K6D40

6 Axis Force sensor

Manual

Stiffness Matrix K6D40 (50N/5Nm - CG & MP11)

2.9 kN/mm	0.0	0.0	0.0	58.4 kN	0.0	u_x
0.0	2.9 kN/mm	0.0	-58.4 kN	0.0	0.0	u_y
0.0	0.0	16.2 kN/mm	0.0	0.0	0.0	u_z
0.0	-58.4 kN	0.0	4.7 kNm	0.0	0.0	phi_x
58.4 kN	0.0	0.0	0.0	4.7 kNm	0.0	phi_y
0.0	0.0	0.0	0.0	0.0	2.5 kNm	phi_z

Stiffness Matrix K6D40 (200N/5Nm - CG & MP11)

5.8 kN/mm	0.0	0.0	0.0	116 kN	0.0	u_x
0.0	5.8 kN/mm	0.0	-116 kN	0.0	0.0	u_y
0.0	0.0	32.3 kN/mm	0.0	0.0	0.0	u_z
0.0	-116 kN	0.0	9.3 kNm	0.0	0.0	phi_x
116 kN	0.0	0.0	0.0	9.3 kNm	0.0	phi_y
0.0	0.0	0.0	0.0	0.0	5.0 kNm	phi_z

Stiffness Matrix K6D40 (500N/20Nm - CG & MP11)

15.9 kN/mm	0.0	0.0	0.0	319 kN	0.0	u_x
0.0	15.9 kN/mm	0.0	-319 kN	0.0	0.0	u_y
0.0	0.0	88.5 kN/mm	0.0	0.0	0.0	u_z
0.0	-319 kN	0.0	25.5 kNm	0.0	0.0	phi_x
319 kN	0.0	0.0	0.0	25.5 kNm	0.0	phi_y
0.0	0.0	0.0	0.0	0.0	13.8 kNm	phi_z

Caption

Element	Description
[kN/mm]	froce- displacement
[kNm]	torque- twist
[kN]	force- twist and torque- displacement

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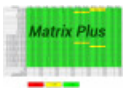
K6D40

6 Axis Force sensor

Accessories

	Description	Description
	K6D-CalibrationMatrix SL	Standard calibration matrix "Small load" for the sensors with small measuring ranges
	K6D-CalibrationMatrix SL/Plus	High accuracy calibration matrix for 6-axis force/torque sensors;
	GSV-8DS	8-channel amplifier with USB port, analog output, UART interface. Other versions GSV-8AS CAN with Canbus and GSV-8AS EC with EtherCAT fieldbus.
	Configuration D-Sub44/m/HD	Assembling the connector to sensor cable; Connector Type SubD, 44 pins, male (male), with hood
	GSV-8AS	8-channel amplifier with USB port, analog output, UART interface. Other versions GSV-8AS CAN with Canbus and GSV-8AS EC with EtherCAT fieldbus.
	Configuration 24p/m/M16	Round plug, 24 pole, configured with sensor cable
	K6D-Adapter Development	Indicative offer for an adapter set, Consisting of e.g. 2 plates, For mounting a device / flange on K6D sensor;
	Connection cable MP11/f-D-Sub44HD/m	Connection cable for connecting the K6D sensor to an 8-channel measuring amplifier GSV-8DS SubD44HD
	Connection cable MP11/f-D-Sub44HD/m/straight	Straight connection cable for connecting the K6D sensor to an 8-channel measuring amplifier GSV-8DS SubD44HD
	Connection cable MP11/f-D-Sub44HD/m/angled	Angled connection cable for connecting the K6D sensor to an 8-channel measuring amplifier GSV-8DS SubD44HD
	Connection cable MP11/f-M16/24p/m	Connection cable for the K6D sensor to 8-channel measuring amplifier GSV-8AS
	Connection cable MP11/f-M16/24p/m/angled	Angled connection cable for the K6D sensor to 8-channel measuring amplifier GSV-8AS

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