

KiTorq Rotor

Type 4551A...

Torque Measuring Unit (Rotor) for a Torque Measuring Flange

KiTorq Rotor Type 4551A... for measuring highly dynamic torques.

- Combinations of various rotors and stators
- Wireless transmission
- High precision, maximum dynamics
- High resolution rotational speed or angle measurement

Description

The KiTorq System is a torque measuring flange system, consisting of the Type 4551A... KiTorq Rotor torque measuring unit and the Type 454xA... KiTorq Stator torque evaluation unit. The rotors and stators of the KiTorq System that have the same speed option can be used in any combination with each other.

Rotational speed or angle measurement up to 8 192 pulses per revolution. Additional measurement of absolute zero value (called Z-Impulse) by means of which absolute angle positions can be determined. Using the ordering key, the Type 4551A... rotor can be purchased individually or as a calibrated torque measurement chain, together with a KiTorq Stator. The stator detects automatically a change of rotor, and sets the required parameters.

All KiTorq Rotors capture the torque using strain gages (DMS). The signal that they generate is amplified and then processed at approx. 35 kSample. The high sampling rate means that very high dynamic torques can be measured.

KiTorq Stator Type 454x...

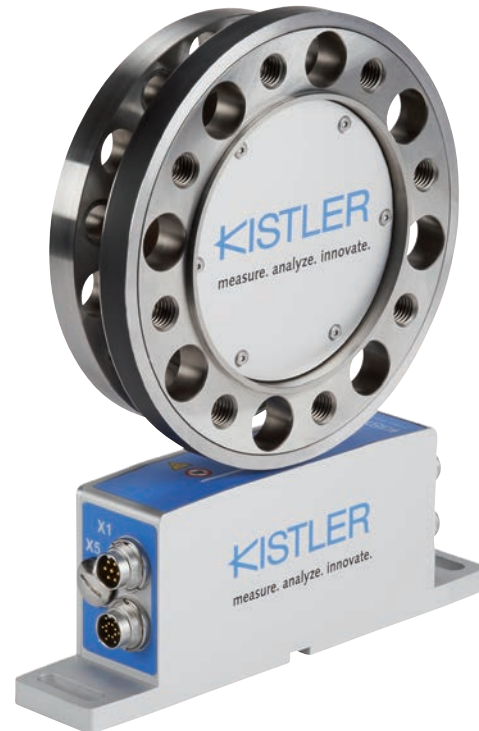
The torque evaluation unit supplies power to the KiTorq Rotor and receives measurement values from it. The evaluation unit has an integrated speed measuring unit and provides various signal outputs, depending on type.

Calibration

Various calibration options are available for the configurable output signals of the KiTorq System. The calibration takes place on a high-precision calibration system that is traceable to national standards.

Application

The properties of the Type 4551A... KiTorq Rotor make it predestined for applications in test bench engineering, such as electric motor, gear, pump, and combustion engine test stands.



General Technical Data

Accuracy class		0,05
Linearity error including hysteresis	% FSO	0,03
Temperature influence on the zero point TK0	% FSO/10 K	0,05
Temperature influence on the nominal value TKC	% FSO/10 K	0,05
Rel. standard deviation of repeatability	% FSO	0,03
Hysteresis	% FSO	0,03
Zero point stability (48 h)	% FSO	0,03
Limit frequency -3 dB	kHz	10
Operating temperature range (Rated temperature range)	°C	10 ... 60
Service temperature range	°C	0 ... 70
Storage temperature range	°C	-25 ... 80
Scanning rate	kSample	35
Protection class		IP54

Technical Data

Mechanical Basic Data

Type 4551A...			50...	100...	200...	500...	1k...	2k...	3k0...	5k0...
Rated torque	M_{nom}	N·m	50	100	200	500	1 000	2 000	3 000	5 000
Measuring range		N·m	±50	±100	±200	±500	±1 000	±2 000	±3 000	±5 000
Limiting torque ¹⁾	M_{op}	N·m	100	200	400	1 000	2 000	4 000	6 000	10 000
Rupture torque ¹⁾	M_{rupt}	N·m	200	400	800	2 000	4 000	8 000	10 200	17 000
Alternating torque	M_{dyn}	N·m	50	100	200	500	1 000	2 000	3 000	5 000
Nominal speed	n_{nom}	1/min	20 000	20 000	17 000	14 000	14 000	11 000	11 000	9 000
Torsional rigidity	C_T	kN·m/rad	0,013	221	300	877	1.322	2.340	3.106	4.502
Torsion angle at M_{nom}	φ	°	25	0,026	0,038	0,033	0,043	0,049	0,055	0,064
Max. bending torque ^{2) 3)}	M_b	N·m	0,5	40	50	115	210	220	300	475
Rigidity for bending torque (radial axis)		kN/Grad	0,3	0,5	0,6	1,1	2,2	2,5	4,0	6,7
Additional planar parallelism error At limit bending torque		mm	<0,3							
Longitudinal load limit ^{2) 3)}	F_A	kN	1,5	3,0	3,0	4,0	6,0	8,0	12,0	14,0
Rigidity in axial direction		kN/mm	176	176	188	267	375	400	462	483
Max. displacement at longitudinal load limit		mm	<0,03							
Transverse load limit ^{2) 3)}	F_Q	kN	0,4	1,0	1,0	3,2	5,5	6,0	9,0	12,0
Rigidity in radial direction		kN/mm	159	159	161	200	275	300	391	546
Additional max. runout error at transverse load limit		mm	<0,025							
Mass	m	kg	1,2	1,2	1,7	2,7	2,9	4,1	5,2	10,6
Partial mass of measurement side	m_{Meas}	kg	0,7	0,7	1	1,5	1,6	2,3	2,8	5,7
Mass moment of inertia	j	kg·m ²	0,0019	0,0019	0,0038	0,0099	0,01	0,0224	0,0276	0,084
Partial mass moment of inertia on measurement side	j_{Meas}	kg·m ²	0,0012	0,0012	0,0025	0,0058	0,0059	0,0132	0,0161	0,0483
Balancing class	Q		G 2,5							

¹⁾ static, ²⁾ static and dynamic

³⁾ the effects of permissible parasitic forces (bending moment M_b , longitudinal F_A and lateral forces F_Q) can be up to 0,3 % of nominal torque. Each type of irregular stress (M_b , F_A oder F_Q) is only permitted up to its specific load limit, provided none of the others will occur at the same time. If this condition is not met, the limit values must be reduced. If 30 % of M_b and F_Q occur at the same time, only 40 % of F_A is permissible and the nominal (rated) torque must not be exceeded.

Additional Technical Data

Noise Immunity (EN 61326-1, Table 2)

Electromagnetic field (AM)	V/m	10
Magnetic field	A/m	100
Electrostatic discharge (ESD)		
Contact discharge	kV	8
Air discharge	kV	4
Fast transients (burst)	kV	1
Impulse voltage (surge)	kV	1
Conducted emissions (AM)	V	10

Mechanical Shock (EN 60068-2-27)

Quantity	n	1 000
Duration	ms	3
Acceleration	m/s ²	650

Vibrational Loads in 3 Directions (EN 60068-2-6)

Frequency range	Hz	10 ... 2 000
Duration	h	2,5
Acceleration (Amplitude)	m/s ²	200

Speed Measuring/Rotation Angle

Speed measurement option N2		
Pulses/revolution		1x60
Angle measurement option N3		up to 8 192
Pulses/revolution (Track A+B)		90° displaced, TTL
Jitter (oscillation period)	%	2
Resolution angle measurement	°	0,03

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Dimensions

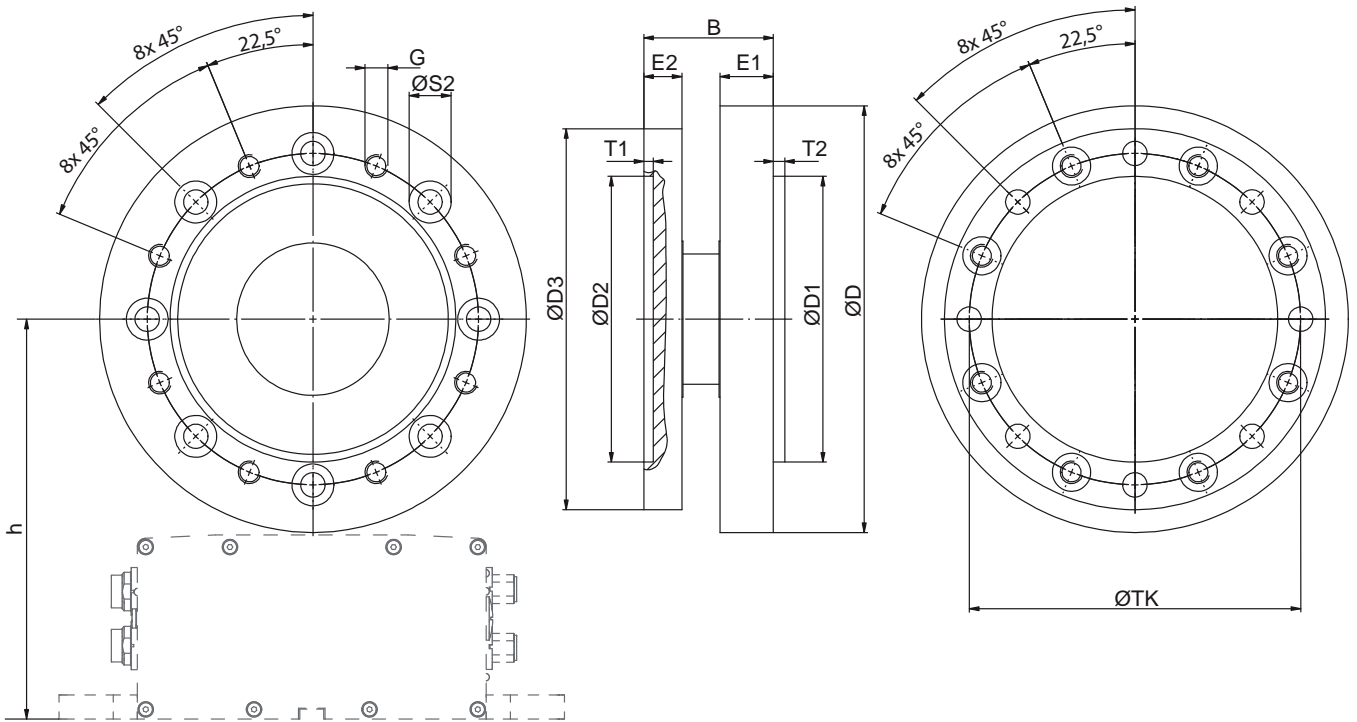


Fig. 1: Dimensional drawing of Type 4551A... KiTorq Rotor torque measuring unit

Dimensions of KiTorq Rotor Torque Measuring Unit in mm

Type	Nominal torque N·m	øD	øTK	øD1 ⁸⁶	øD2 ^{H6}	øD3	B	E1	E2	øS2	G	T1	T2	h ±0,5
4551A50...	50	112	87	75	75	100	34	14	10	11	M6	2,5	3	133,5
4551A100...	100	112	87	75	75	100	34	14	12	11	M6	2,5	3	133,5
4551A200...	200	134	105	90	90	120	34	14	12	13,7	M8	2,5	3	144,5
4551A500...	500	167,5	133	110	110	155	40,5	14	14	20	M12	3	3	161,25
4551A1k0...	1 000	167,5	133	110	110	155	48	14	14	20	M12	3	3	161,25
4551A2k0...	2 000	201,5	165	140	140	190	46	14	14	22	M14	4	3	178,25
4551A3k0...	3 000	201,5	165	140	140	190	55	17	17	22	M14	4	3	178,25
4551A5k0...	5 000	253,5	206	174	174	238	64	21	21	30	M18	4	3	204,25

Application Examples

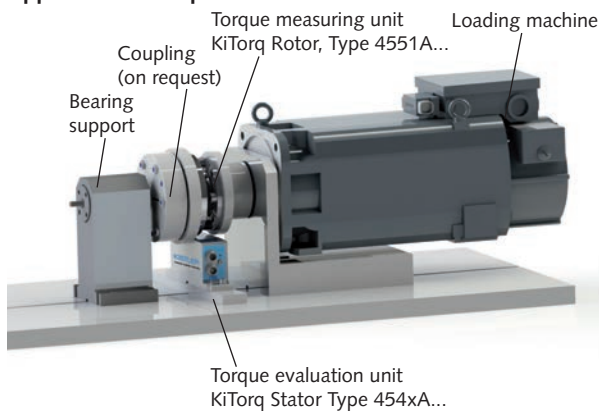


Fig. 2: Example of application with KiTorq

Metal-Free Room

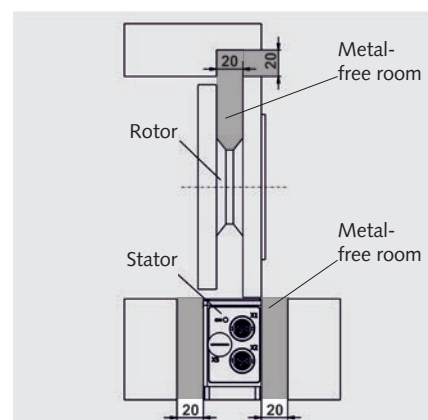


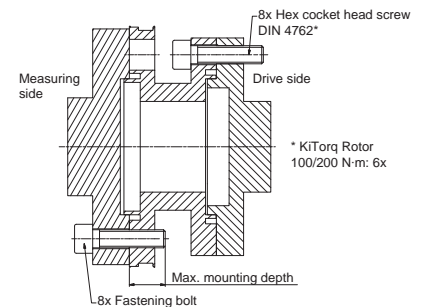
Fig. 3: Example of application metal-free room

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Mounting

Rotor Screw Connection, Mounting Screws

Nominal torque M_{nom}	N·m	50/ 100	200	500	1 000	2 000	3 000	5 000
Thread		M6	M8	M12	M12	M14	M14	M18
Property class		12.9						
Minimum mounting depth	mm	6	8	12	12	14	14	18
Maximum mounting depth ¹⁾	mm	16	16	16	16	16	19	23
Fastening torque M_A	N·m	14	34	80	115	140	190	400
Counterflange flatness	mm	0,01						
Counterflange concentricity	mm	0,02						
Maximum axial displacement Rotor → Stator	mm	±1						
Air gap (target dimension)	mm	1 ±0,5						



¹⁾ Important: The maximum mounting depth must never be exceeded!

Calibration

Standard Calibration: The rotor is calibrated per WKS 1 as a standard. If ordered as a measurement chain with a KiTorq Stator, the rotor and stator are calibrated as a torque measurement chain according to WKS 1.

The following signals are set as standard:

- Frequency: 240 kHz ±120 kHz
- Analog: ±10 V

Special Calibration: Upon request, additional calibrations can be ordered (e.g., second measuring range, another frequency, DAkkS calibration, ...). More information is available in the data sheet for the desired Type 454xA... KiTorq Stator.

The torque measurement chain, consisting of the KiTorq Rotor and KiTorq Stator, has its own separate calibration certificate and a serial number.

If one of the components is replaced (e.g., with a KiTorq Rotor with a different measuring range), then the virtual calibration values for the new measurement chain can be calculated from the individual calibration certificates for the rotor and stator.

All output settings can be changed afterward by the customer. The calibration certificates apply only to the settings at delivery, according to the order.

Definition of Calibration Terms:

- **WKS 1:** Works calibration at 5 points right, 3 points left
- **WKS 2:** Works calibration at 5 points right and left, and repeat series
- **DAkkS:** Calibration per DIN 51309

Our calibration service DAkkS-K-17650-01 provides traceable calibrations for torque sensors from all manufacturers.

Optional Accessories

- Adapter flanges and couplings (on request) 2300A...

Ordering Key

Nominal Torque in N·m

50	050
100	100
200	200
500	500
1 000	1k0
2 000	2k0
3 000	3k0
5 000	5k0

Stator

Without	S00
KiTorq Stator Type 4541A...	S10
KiTorq Stator Type 4542A... PROFINET	S2A
KiTorq Stator Type 4542A... PROFIBUS	S2B
KiTorq Stator Type 4542A... CANopen	S2C
KiTorq Stator Type 4542A... EtherCAT	S2D
KiTorq Stator Type 4542A... EtherNet/IP	S2E

Speed/Rotating Angle

1x60 pulses per revolution + Z-pulse	N2
Rotational speed or angle measurement up to 8 192 pulses per revolution + Z-pulse	N3

Calibration

WKS 1 single range	KA0
WKS 1 dual range 1:1 and/or 1:10	KA1
WKS 1 dual range 1:1 and/or 1:5	KA2
WKS 2 single range	WA0
WKS 2 dual range 1:1 and/or 1:10	WA1
WKS 2 Dual range 1:1 and/or 1:5	WA2
DAkkS 5 single range, 5 meas. points	DK5
DAkkS 8 single range, 8 meas. points	DK8
DAkkS 5 Dual range, 5 meas. points	D52
DAkkS 8 Dual range, 8 meas. points	D82

Type 4551A

