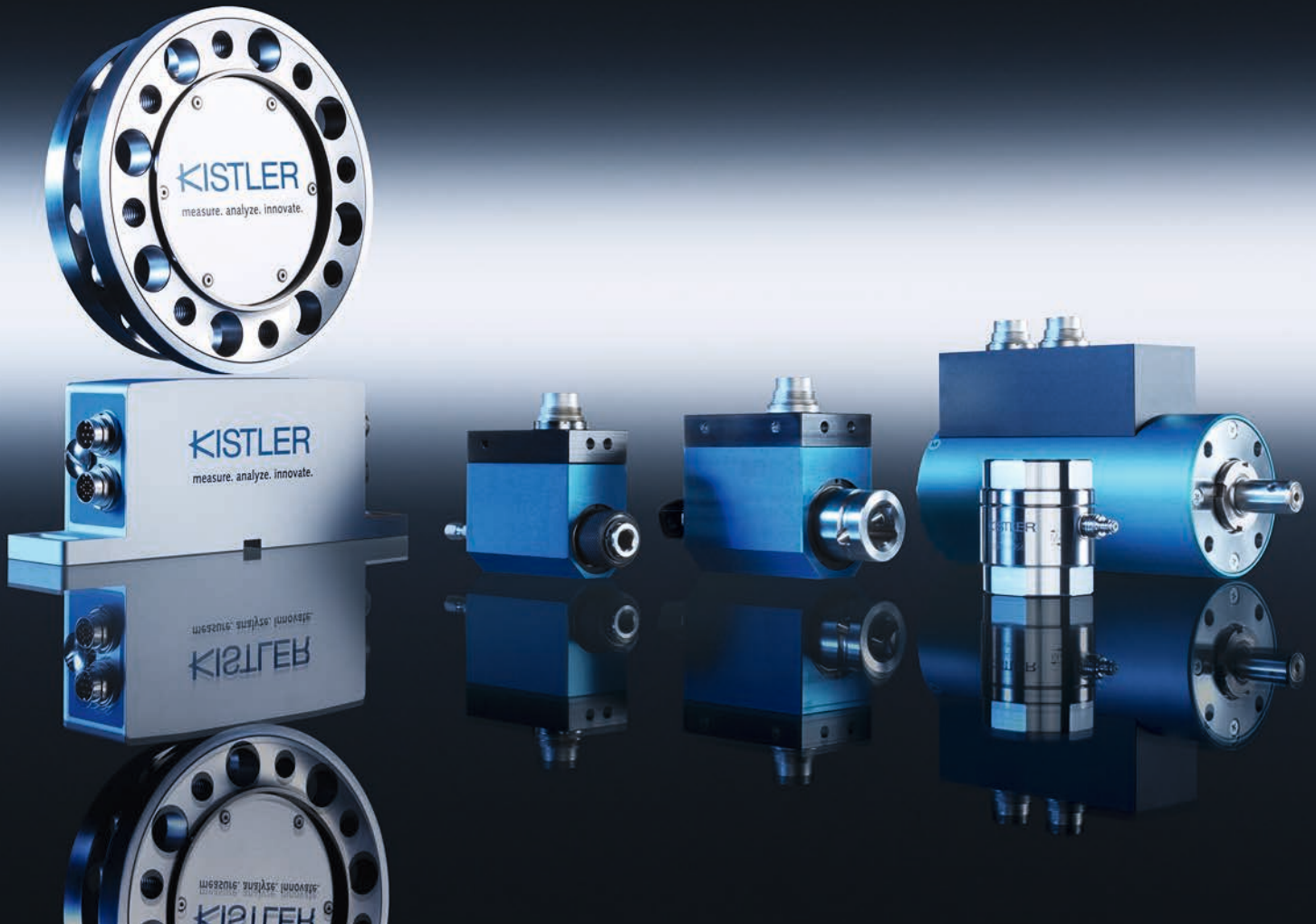


KISTLER

measure. analyze. innovate.



Torque sensors

Measurement instrumentation for process monitoring and quality assurance, test bench and drive technology

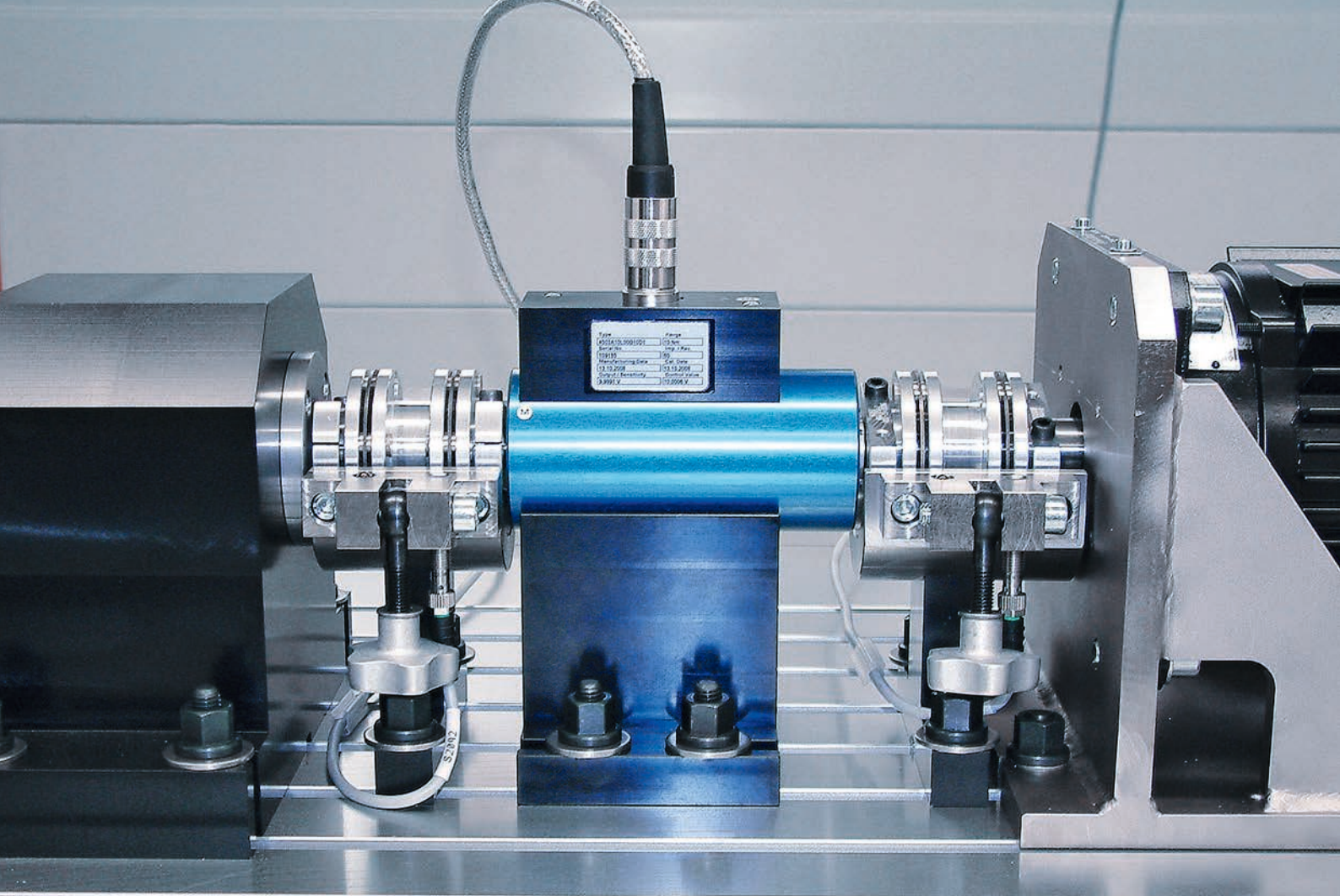


Kistler – Your partner for process efficiency and cost effectiveness

The Kistler Group is one of the world's leading manufacturers of sensors and systems to measure pressure, force, torque and acceleration. Thanks to systems from Kistler, measurement signals can be captured and analyzed – so companies benefit from increased process efficiency and enhanced business success over the long term.

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Product testing and assembly process monitoring are just two of the many industrial activities where Kistler sensors are used

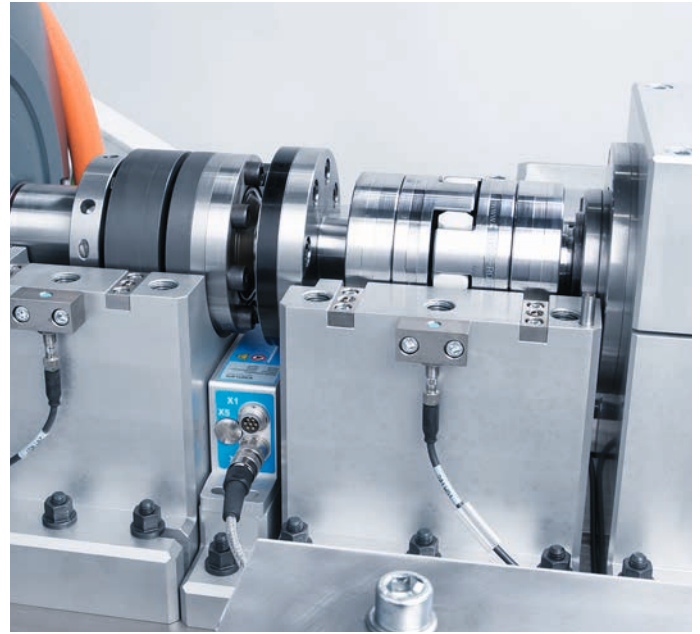
Reliability and efficiency in production and development

In industrial manufacturing, as well as research and development, standards for precision are becoming ever higher and time pressure is continually on the rise: these developments call for measuring systems that are both reliable and flexible. Thanks to close and continuous collaboration with research and industry partners, Kistler can offer a wide range of high-precision torque sensors that open up the way for innovative solutions in industrial measurement and system technology.

To achieve significant increases in safety, reliability and efficiency – in production, as well as R&D – action is required on two fronts: the mechanical and electrical characteristics of electrical machinery must undergo intensive testing; also, complete test bench systems must constantly be kept in line with the latest technological developments to ensure maximum precision and reliability. As a leading player in measurement and system technology, Kistler can draw on its wide range of torque sensors to offer the ideal solution for every application.

Benefits:

- Torque measurement is integrated in the production process
- Process monitoring ensures zero-defect production
- Quality costs are cut because deviations are detected at an early stage
- Process efficiency is optimized because the measuring equipment used is extremely flexible



Product testing and process monitoring

Growing numbers of manufacturers rely on Kistler's sensor technology for industrial production so that they can monitor every single assembly step in the manufacture of safety-related components. Safety, reliability and efficiency almost always go hand-in-hand here: for example, suppliers to the automotive industry can only guarantee that their components will function perfectly if they can perform tests during their own production to reliably prevent failures after the components reach the customer.

Research and development

Development work on new combustion engines or transmissions, and analysis of power trains by simulation on the test bench, set high standards for the accuracy and flexibility of a test system. Especially when it comes to determining efficiency and power factors, a rugged and highly accurate torque sensor is essential. Thanks to an extensive range of products, Kistler can offer the right sensor to meet these needs in every application area.














Increased process efficiency with Kistler – now online!

View our animation to experience convincing, first-class Kistler solutions – the sure way to optimize process efficiency: www.kistler.com/maxy mos



Product overview: torque sensors

Type	Measuring range N·m					
	0	1	10	100	1,000	10,000
4501A...  Slip-ring torque sensor, strain gage	Rated torque: 2 ... 1,000 Measuring range: 0 ... ±2 to 0 ... ±1,000					
4502A...  Mini-smart torque sensor, strain gage	Rated torque: 0.5 ... 1,000 Measuring range: 0 ... ±0.5 to 0 ... ±1,000					
4520A...  Basic line torque sensor, strain gage	Rated torque: 1 ... 1,000 Measuring range: 0 ... ±1 to 0 ... ±1,000					
4503B...  Torque sensor, optional dual range, strain gage	Rated torque: 0.2 ... 5,000 Measuring range: 0 ... ±0.2 to 0 ... ±5,000					
4510B...  Torque measuring flange, strain gage	Rated torque: 100 ... 20,000 Measuring range: 0 ... ±100 to 0 ... ±20,000					
4550A...  KiTorq torque measuring flange, strain gage	Rated torque: 100 ... 5,000 Measuring range: 0 ... ±100 to 0 ... ±5,000					
4551A...  KiTorq torque measuring flange, strain gage	Rated torque: 50 ... 5,000 Measuring range: 0 ... ±50 to 0 ... ±5,000					
9329A... to 9389A...  Force link, piezoelectric	Measuring range: 0 ... ±0.1 to 0 ... ±1,000					
9275  Dynamometer, piezoelectric	Measuring range: 0 ... ±20 to 0 ... ±200					
9277A...  Dynamometer, piezoelectric	Measuring range: 0 ... ±0.5 to 0 ... ±25					
9345B... 9365B...  Quartz force link Fz, Mz, piezoelectric	Measuring range: Fz, 0 ... ±1 kN to 0 ... ±20 kN, Mz 0 ... ±2.5 N·m to 0 ... ±200 N·m					

■ Rated torque in N·m
■ Measuring range in N·m

Max. speed	Connector				Bearing	Sensor		Signal transmission rotor – stator		Signal output	Pages
	Square drive	Hex drive	Round shaft	Flange		Fixed	Rotating	Slip-ring	Contactless		
<3,000 1/min	•	•	•		•		•	•		0 ... 2 mV/V	9
12,000 1/min	•	•	•		•		•		•	0 ±5 VDC	10
10,000 1/min	•		•		•		•		•	0 ±10 VDC	11
50,000 1/min			•		•		•		•	0 ±5 VDC or 0 ±10 VDC and 100 ±40 kHz and RS-232C	12
12,000 1/min				•			•		•	0 ±10 VDC or 100 ±40 kHz and RS-232C	13
20,000 1/min				•			•		•	0 ... ±10 VDC or 100 ±40 kHz, or 10 ±5 kHz or 240 ±120 kHz and RS-232C/USB or fieldbuses	14
20,000 1/min				•			•		•	0 ... ±10 VDC or 100 ±40 kHz, or 10 ±5 kHz or 240 ±120 kHz and RS-232C/USB or fieldbuses	15
						•		Cable		±2170 ... ±100 pC/N·m (depending on size)	16
						•		Cable		±170 pC/N·m	17
						•		Cable		±600 ... ±250 pC/N·m (depending on size)	18
						•		Cable		±190 ... ±140 pC/N·m (depending on size)	20



Torque sensors

Depending on the application, torques are measured in very different force ranges. Kistler offers sensor systems for every application area in production, development and research. We make a distinction between two designs:

Torque sensors to measure on rotating shafts

Sensors of this type use strain gage technology. They offer maximum accuracy, a very rigid structure and excellent temperature stability. For these torque measuring shafts, transmission of the power supply and the measurement signal is largely contactless.

Several features make integration into existing test systems easy: contactless digital signal transmission from the rotor to the stator, integrated signal conditioning, standardized analog and frequency outputs, and numerous interfaces.

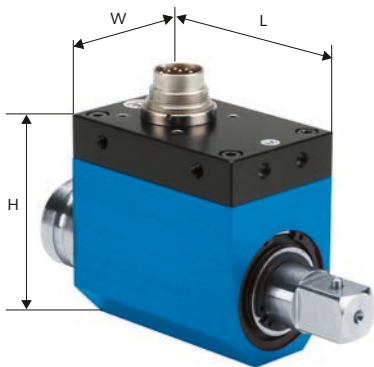
Reaction torque sensors (piezoelectric)

A torque acting on the sensor produces tangential shear stresses in the quartz disks. All the quartz disks are electrically connected in parallel, so the total output signal is proportional to the acting moment.

The sensor is integrated under high axial preload between a preload screw and a nut. The torque is therefore transmitted by frictional engagement to the shear-sensitive quartz disks. High resolution capacity and rugged structural design make it possible to measure the smallest dynamic changes, even with large torques.

Torque sensors for rotating shafts

Slip-ring torque sensor, 2 ... 1,000 N·m



Type 4501A...

Technical data			Type 4501A...
Rated torque	M_{nom}	N·m	2/6/10/12/20/25/50/63/100/160/200/500/1,000
Maximum torque			1.5 × rated torque
Accuracy class			0.2
Rated value		mV/V	1 or 2 (depending on model)
Speed & angle measurement		pulses/rev.	2 × 360° (Option)
Rated speed		1/min	≤ 3,000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L	mm	44 ... 73
	W	mm	28 ... 73
	H	mm	52 ... 90
Operating temperature range		°C	5 ... 50

General technical data

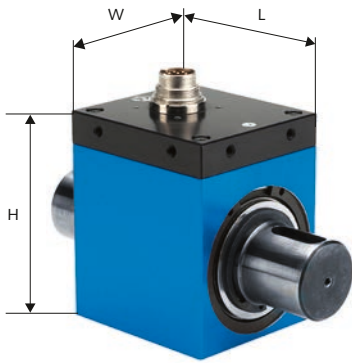
Deg. of protection to IEC/EN 60529	IP40
Connector	Binder, 6 or 12 pin
Data sheet: see www.kistler.com	Type 4501A (000-596)

Accessories

Coupling socket, 6 pin	Type KSM000822
	
Coupling socket, 12 pin	Type KSM000703
	
Connecting cables	Type KSM071860-5, KSM185350-2,5, KSM185370-2,5, KSM103820-5, KSM183150-5
	
Measuring amplifier for strain gage sensors	Type 4701A...
	

Torque sensors for rotating shafts

Mini-smart torque sensor, 0.5 ... 1,000 N·m






Type 4502A...

Technical data			Type 4502A...
Rated torque	M_{nom}	N·m	0.5/1/2/5/6/10/12/18/20/50/63/100/150/160/200/250/300/500/1,000
Maximum torque			1.5 × rated torque
Accuracy class			0.2
Output signal (rated value)	M_{nom}	VDC	5
Speed & angle measurement		pulses/rev.	2 × 360° (Option)
Rated speed		1/min	≤12,000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L	mm	44 ... 73
	W	mm	28 ... 73
	H	mm	52 ... 90
Operating temperature range		°C	10 ... 60

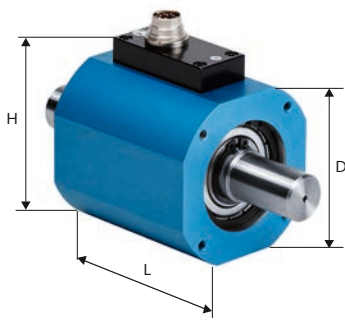
General technical data

Deg. of protection to IEC/EN 60529	IP40
Connector	Binder, 12 pin
Data sheet: see www.kistler.com	Type 4502A (000-597)

Accessories

Coupling socket, 12 pin		Type KSM000703
Connecting cables		Type KSM185380-2,5, KSM124970-5
Couplings		Type 2301A... to 2303A...

Basic line torque sensor, 1 ... 1,000 N·m



Type 4520A...

Technical data			Type 4520A...
Rated torque	M_{nom}	N·m	1/2/5/10/20/50/100/200/500/1,000
Maximum torque			1.5 × rated torque
Alternating torque			1 × rated torque
Accuracy class			0.5
Linearity error including hysteresis		% FSO	<±0.5
Output signal (rated value)	M_{nom}	VDC	10
Speed measurement		pulses/rev.	60
Rated speed		1/min	≤10,000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L	mm	58 ... 85
	D	mm	58 ... 91
	H	mm	70 ... 103
Operating temperature range		°C	10 ... 60

General technical data

Deg. of protection to IEC/EN 60529	IP40
Connector	Binder, 12 pin
Data sheet: see www.kistler.com	Type 4520A (000-765)

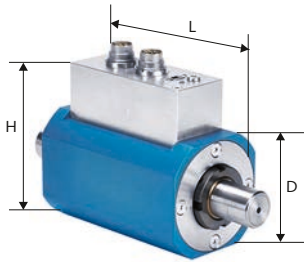
Accessories

Coupling socket, 12 pin	Type KSM000703
Connecting cables	Type KSM071860-5, KSM185380-2,5, KSM124970-5
Couplings	Type 2301A... to 2303A...



Torque sensors for rotating shafts

Torque sensor, optional dual range



Type 4503B...

Technical data			Type 4503B...
Rated torque	M_{nom}	N·m	0.2/0.5/1/2/5/10/20/50/100/200/500/1,000/2,000/5,000
Maximum torque			1.5 × rated torque
Alternating torque			0.7 × rated torque
Accuracy class			0,05 / 0,1
Linearity error including hysteresis		% FSO	<+-0,05 oder <+-0,1
Output signal (rated value)	M_{nom}	VDC kHz	±5 or 10 100 ±40
Speed & angle measurement		pulses/rev.	up to 8,192 + Z-pulse
Rated speed		1/min	50,000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L	mm	122 ... 169
	D	mm	58 ... 148
	H	mm	90.1 ... 170.5
Operating temperature range		°C	10 ... 60

General technical data

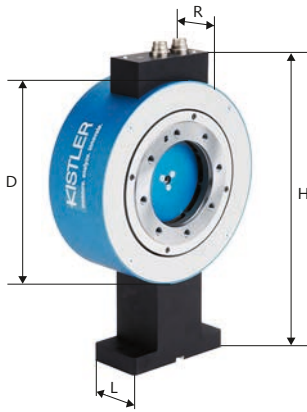
Deg. of protection to IEC/EN 60529	IP40
Connector	7 and 12 pin male plug
Data sheet: see www.kistler.com	Type 4503B (000-767)

Accessories

Coupling socket, 7 pin		Type KSM000517
Coupling socket, 12 pin		Type KSM000703
SensorTool		Type 4706A
Connecting cables		Type KSM124970-5, KSM186420-2,5, KSM186430-2,5, KSM219710-5
Couplings		Type 2301A... to 2303A...
Mounting base (GU)		GU for 0.2 ... 20 N·m Type 18030861 GU for 50 ... 100 N·m Type 18030862 GU for 200 ... 1,000 N·m Type 18030863 GU for 2,000 ... 5,000 N·m Type 18030864

Torque measuring flange for rotating shafts

Torque measuring flange: robust, bearingless, high accuracy, 100 ... 20,000 N·m







Type 4510B...

Technical data			Type 4510B...
Rated torque	M_{nom}	N·m	100/200/500/1,000/2,000/4,000/10,000/20,000
Maximum torque	M_{op}		min. 1.5 × rated torque
Alternating torque	M_{dyn}		1 × rated torque
Accuracy class			≤0.2
Linearity error including hysteresis		% FSO	<±0.1 or <±0.2 (depending on model)
Output signal (rated value)	M_{nom}	VDC kHz	10 (B1) or 100 ±40 kHz (B2) und RS-232C
Speed measurement		pulses/rev.	60
Rated speed		1/min	≤12,000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L	mm	60
	D	mm	197 ... 297
	H	mm	300.5 ... 362.7
	R	mm	78 ... 83.5
Operating temperature range		°C	10 ... 60

General technical data

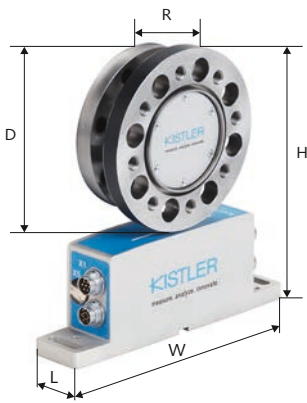
Deg. of protection to IEC/EN 60529	IP54
Connector	Binder, 7 and 12 pin
Data sheet: see www.kistler.com	Type 4510B (000-737)

Accessories

Coupling socket, 7 pin	Type KSM000517
	
Coupling socket, 12 pin	Type KSM000703
	
Connecting cables	Type KSM124970-5, KSM186420-2,5, KSM186430-2,5, KSM219710-5
	
SensorTool	Type 4706A
	

Torque measuring flange for rotating shafts

KiTorq torque measuring flange: slim, robust, bearingless, high accuracy, 100 ... 5,000 N·m



Type 4550A...
Connecting dimensions
according to
DIN ISO 7646

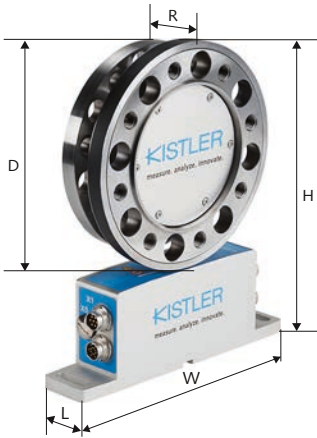
Technical data			Type 4550A... KiTorq Rotor, Type 454xA... KiTorq Stator
Rated torque	M_{nom}	N·m	100/200/500/1,000/2,000/3,000/5,000
Maximum torque			2 × rated torque
Alternating torque			1 × rated torque
Accuracy class			0.05
Linearity error including hysteresis		% FSO	0.03
Output signal (rated value)	M_{nom}	VDC kHz	10 or 10 ±5, 100 ±40, 240 ±120 and RS-232C/USB
Output signal (digital)			PROFINET, PROFIBUS, CANopen, EtherCAT, EtherNet/IP
Speed & angle measurement		pulses/rev.	up to 8,192 pulses + Z-pulse
Rated speed		1/min	≤20,000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L	mm	44
	D	mm	133
	H	mm	210.5 ... 242.5
	R	mm	48 ... 53
	W	mm	210
Operating temperature range		°C	10 ... 60

General technical data	
Deg. of protection to IEC/EN 60529	IP54
Connector	7, 12 and 14 pin male plug
Data sheet: see www.kistler.com	Type 4541A (000-879) Type 4542A (003-057) Type 4550A (000-880)

Accessories	
Coupling socket, 7 pin 	Type KSM000517
Coupling socket, 12 pin 	Type KSM000703
Coupling socket, 14 pin 	Type KSM038290
SensorTool 	Type 4706A
Couplings 	Type 2305A...



KiTorq torque measuring flange: slim, robust, bearingless, high accuracy, 50 ... 5,000 N·m



Type 4551A...

Technical data			Type 4551A... KiTorq Rotor, Type 454xA... KiTorq Stator
Rated torque	M_{nom}	N·m	50/100/200/500/1,000/2,000/3,000/5,000
Maximum torque			2 × rated torque
Alternating torque			1 × rated torque
Accuracy class			0,05
Linearity error including hysteresis		% FSO	0,03
Output signal (rated value)	M_{nom}	VDC kHz	10 or 10 ±5, 100 ±40, 240 ±120 and RS-232C / USB
Output signal (digital)			PROFINET, PROFIBUS, CANopen, EtherCAT, EtherNet/IP
Speed & angle measurement		pulses/rev.	up to 8,192 pulses + Z-pulse
Rated speed		1/min	≤20 000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L	mm	44
	D	mm	112 ... 253.5
	H	mm	189.5 ... 331
	R	mm	34 ... 64
	W	mm	210
Operating temperature range		°C	10 ... 60

General technical data	
Deg. of protection to IEC/EN 60529	IP54
Connector	7-, 12- and 14-pin male plug
Data sheet: see www.kistler.com	Type 4541A (000-879) Type 4542A (003-057) Type 4551A (003-169)

Accessories	
Coupling socket, 7 pin	Type KSM000517
	
Coupling socket, 12 pin	Type KSM000703
	
Coupling socket, 14 pin	Type KSM038290
	
SensorTool	Type 4706A
	
Couplings	Type 2300A...
	

Reaction torque sensors (piezoelectric)

Dynamometer



Type 9329A

Technical Data		Type 9329A	Type 9339A	Type 9349A
Measuring range	N·m	-1 ... 1	-10 ... 10	-25 ... 25
Calibrated meas. ranges	N·m	0 ... -1 0 ... -0.1 0 ... 0.1 0 ... 1	0 ... -10 0 ... -1 0 ... 1 0 ... 10	0 ... -25 0 ... -2.5 0 ... 2.5 0 ... 25
Sensitivity	pC/N·m	≈-2,170	≈-460	≈-230
Rigidity	C_{Mz} N·m/μrad	≈0.02	≈0.10	≈0.19
Dimensions	D	mm	20	36
	H	mm	26	42
Weight	g	50	137	243
Operating temperature range	°C	-20 ... 80	-40 ... 120	-40 ... 120

Technical data		Type 9369A	Type 9389A
Measuring range	N·m	-200 ... 200	-1,000 ... 1,000
Calibrated meas. ranges	N·m	0 ... -200 0 ... -20 0 ... 20 0 ... 200	0 ... -1,000 0 ... -100 0 ... 100 0 ... 1,000
Sensitivity	pC/N·m	≈-130	≈-100
Rigidity	C_{Mz} N·m/μrad	≈0.90	≈1.54
Dimensions	D	mm	54
	H	mm	60
Weight	g	800	6,720
Operating temperature range	°C	-40 ... 120	-40 ... 120

General technical data

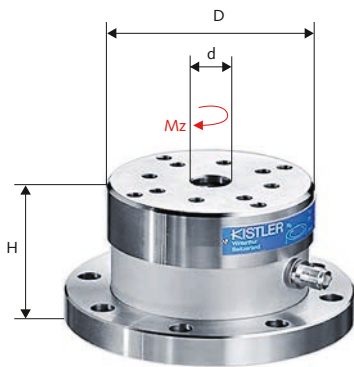
Deg. of protection to IEC/EN 60529	IP65 with connected cable IP67 with cable, Type 1983AD... and welded connector
Connector	KIAG 10-32 neg.
Preloaded	•
Calibrated	•
Data sheet: see www.kistler.com	Type 9329A (000-463)

Accessories

Mounting flange	Type 9580A...
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Dynamometer




Type 9275

Technical data			Type 9275
Measuring range	N·m		-200 ... 200
Calibrated meas. ranges	N·m		0 ... -200 0 ... -20 0 ... 20 0 ... 200
Sensitivity	Mz	pC/N·m	≈-170
Natural frequency		kHz	≈3.5
Rigidity	C_{Mz}	N·m/μrad	≈0.8
Dimensions	D	mm	100
	d	mm	18.4
	H	mm	70
Weight		g	2,900
Operating temperature range		°C	0 ... 70

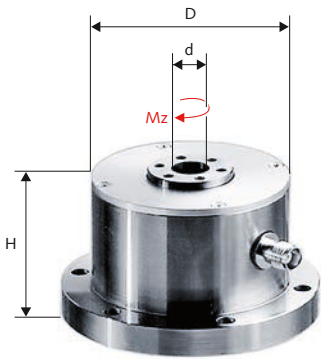
General technical data

Deg. of protection to IEC/EN 60529	IP65 with connected cable
Connector	TNC neg.
Ready to measure	•
Calibrated	•
Data sheet: see www.kistler.com	Type 9275 (000-154)

Accessories

Connecting cables	Type 1609B...
	

Dynamometer




Type 9277A25

Technical data			Type 9277A5	Type 9277A25
Measuring range	N·m		-5 ... 5	-25 ... 25
Calibrated meas. ranges	N·m		0 ... -5	0 ... -25
			0 ... -0.5	0 ... -2.5
			0 ... 0.5	0 ... 2.5
			0 ... 5	0 ... 25
Sensitivity	pC/N·m		≈-600	≈-250
Natural frequency	kHz		≈10	≈15
Rigidity	C_{Mz}	N·m/μrad	≈0.08	≈0.10
Dimensions	D	mm	78	78
	d	mm	8.5	8.5
	H	mm	60	60
Weight	g		1,720	1,745
Operating temperature range	°C		0 ... 70	0 ... 70

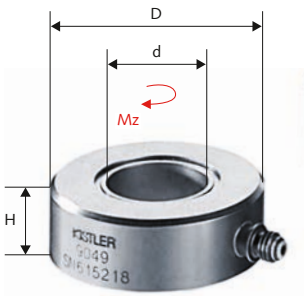
General technical data

Deg. of protection to IEC/EN 60529	IP65 with connected cable
Connector	TNC neg.
Ready to measure	•
Calibrated	•
Data sheet: see www.kistler.com	Type 9277A (000-155)

Accessories

Connecting cables	Type 1609B...
	

Load washer



Type 9039

Technical data		Type 9039	Type 9049	Type 9069
Measuring range	N·m	-5 ... 5	-25 ... 25	-200 ... 200
Calibrated meas. ranges	N·m	0 ... -5	0 ... -25	0 ... -200
		0 ... -0.5	0 ... -2.5	0 ... -20
		0 ... 0.5	0 ... 2.5	0 ... 20
		0 ... 5	0 ... 25	0 ... 200
Sensitivity	pC/N·m	≈-550	≈-250	≈-175
Rigidity	N·m/μrad	≈0.07	≈0.12	≈0.5
Preloading force	kN	15	25	120
Dimensions	D	mm	28.5	34.5
	d	mm	13	17
	H	mm	11	12
Weight	g	38	61	150
Operating temperature range	°C	-20 ... 120	-20 ... 120	-20 ... 120

General technical data

Deg. of protection to IEC/EN 60529	IP65 with connected cable IP67 with cable, Type 1983AD... and welded connector
Connector	KIAG 10-32 neg.
Data sheet: see www.kistler.com	Type 4577A (000-674)

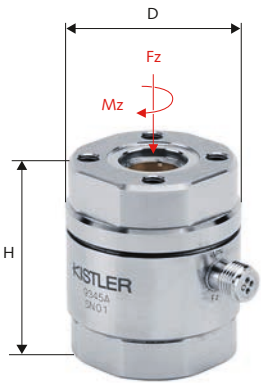
Accessories

Connecting cables	Type 1631C...
Preloading elements	Type 9420A...



Multi-component sensor

2-Component measuring element Fz, Mz



Type 9345B

Technical data			Type 9345B	Type 9365B
Measuring range	Fz	kN	-10 ... 10	-20 ... 20
Calibrated meas. ranges		kN	0 ... 1 0 ... 10	0 ... 2 0 ... 20
Sensitivity	Fz	pC/N	≈-3.7	≈-3.6
Rigidity	Cz	kN/μm	≈1.7	≈2.8
Measuring range		N·m	-25 ... 25	-200 ... 200
Calibrated meas. ranges		N·m	0 ... -25 0 ... -2.5 0 ... 2.5 0 ... 25	0 ... -200 0 ... -20 0 ... 20 0 ... 200
Sensitivity	Mz	pC/N·m	≈-190	≈-140
Rigidity	c (calculated)	N·m/μrad	≈0.19	≈0.92
Dimensions	D	mm	39	56.5
	H	mm	42	60
Weight		g	267	834
Operating temperature range		°C	-40 ... 120	-40 ... 120

General technical data

Deg. of protection to IEC/EN 60529	IP65 with connected cable
Connector	V3 neg.
Preloaded	•
Calibrated	•
Data sheet: see www.kistler.com	Type 9345B (000-630)

Accessories

Connecting cables	Type 1693A..., 1694A..., 1695A..., 1698A...
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Process monitoring systems for every application

The Kistler maXYmos family now provides users with a simple system that can quickly and accurately accomplish a variety of product testing tasks.

The maXYmos BL and TL feature XY monitors that can monitor and evaluate the quality of a product or manufacturing step on the basis of a profile. With the help of evaluation objects (EOs), the user adapts the curve evaluation to the specific monitoring task. Based on this specification, the maXYmos then decides whether each individual workpiece is good or bad.

Due to a wide variety of Interfaces, maXYmos TL provides an ideal platform for acquiring and evaluating a very diverse range of measurands.

Kistler's tried-and-tested amplifiers guarantee that the sensor signals are correctly conditioned to provide values that can be displayed.

Benefits of the maXYmos Family:

- Universal operating philosophy for force-displacement and torque monitoring
- In-process monitoring of joining and assembly operations
- Early detection of quality deviations in the production process
- Faster feedback thanks to transparency in the production process
- Traceable process results
- Additional test routines are eliminated

Monitoring devices

maXYmos TL XY monitor



Type 5877...

Technical data		Type 5877...
Number of measuring channels		1 × X/Y ... 8 × X/Y
Resolution per channel	Bit	24
Accuracy class	%	0.1
Sensors that can be connected	Channel X	Via menu choice: Potentiometer, transmitter ±10 V, incremental, SSI, LVDT, inductive, EnDat
	Channel Y	Via menu choice: Piezo, strain gage, transmitter ±10 V
Measuring functions		Y(X), Y(t), Y(X,t), X(t)
Curve evaluation using evaluation objects (EOs)	Type	UNI-BOX, HÜLLKURVE, LINE-X, LINE-Y, NO PASS, HYSTERESE-Y, HYSTERESE-X, GRADIENT-Y, GRADIENT-X, TUNNELBOX-X, TUNNELBOX-Y, BREAK, CALC, AVERAGE, GET-REF, SPEED, TIME
Evaluation results via	Dig. outputs Fieldbus Optical	IO, NIO IO, NIO, process values Curve, process values, trend display, traffic light
Data transfer via	Interface	Ethernet TCP/IP, USB, fieldbus: Profibus DP, EtherNet/IP, ProfiNet, EtherCat, CC-LINK
Power supply	V	24 (18 ... 30)
Housing		Front panel or desktop/wall mounting
Data sheet: see www.kistler.com		Type 5877A (003-273)

Accessories

Display Module (DIM) Completes an existing Measuring and Evaluation Module (MEM) by adding a touchscreen	Type 5877AZ000
Measuring Module (MEM) Extends an existing maXYmos TL system with an additional XY channel pair	Type 5877B0
Basic Connector Set (1 set included in scope of delivery)	Type 5877AZ010
Standard Rail Clip To mount the Measuring Module (MEM) on a DIN mounting rail	Type 5877AZ...
Windows® Software Basic Version	Type 2830A1
Windows® Software Plus Version	Type 2830A2
Power supply, 240 VAC/24 VDC	Type 5781B5

maXYmos TL XY monitor



Type 5867A...

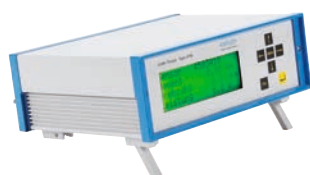
Technical data		Type 5867B...
Number of measuring channels		1 × X/Y
Resolution per channel	Bit	24
Accuracy class	%	0.3
Sensors that can be connected	Channel X	Potentiometer, transmitter ±10 V*
	Channel Y	Piezo, strain gage, transmitter ±10 V*
Measuring functions		Y(X), Y(t), Y(X,t), X(t)

Curve evaluation using evaluation objects (EOs)	Type	UNI-BOX, LINE-X, LINE-Y, NO-PASS, ENVELOPE
Evaluation results via	Dig. outputs Fieldbus Optical	IO, NIO IO, NIO, process values Curve, process values, traffic light
Power supply	VDC	18 ... 30
Signal input	Type/connector	Piezoelectric/BNC neg.
Data transfer via	Interface	Ethernet TCP/IP, USB, fieldbus: Profibus DP, ProfiNet, EtherCAT, EtherNet IP, CC-LINK
Power supply	V	24 (18 ... 30)
Housing		Panel or desktop/wall mounting
Data sheet: see www.kistler.com		Type 5867B (003-054)

Accessories

Connector Set for Strain Gage Version (1 set included in scope of delivery)	Type 5867AZ010
Connector Set for Piezo Version (1 set included in scope of delivery)	Type 5867AZ011
Windows® Software Basic Version	Type 2830A1
Windows® Software Plus Version	Type 2830A2
Netzteil 240VAC/24VDC	Type 5781B5
maXYmos BL Seq. Mode	Type 2832A1

CoMo torque evaluation instrument



Type 4700B...

Technical data		Type 4700B...
Number of channels	y1 = M/t, y2 = n/t	2
Signal inputs	Strain gage Active Frequency	mV/V VDC kHz
		±0.5 ... 3.5 (full bridge, 4/6 wire) ±5 ... ±10 ≤400
Cutoff frequency (-3 dB)	kHz	0.1 ... 1
Speed/rotation angle input Tracks A, B	kHz	≤300
Sensor excitation voltages	V	24 stabilized 5 strain gage unipolar 5 stabilized ±12 stabilized
Output signals, 3 channels	V	±10
Digital control		8 digital inputs TTL 8 digital outputs TTL or 24 VDC
Interfaces		RS-232C, USB 2.0
Data sheet: see www.kistler.com		Type 4700B (000-944)

Accessories

Connecting cables	Type KSM185350-2,5 for Type 4501A... Q/R, Type KSM185370-2,5 for Type 4501A... QA, Type KSM186420-2,5 for Type 4503A.../4504... analog, Type KSM186430-2,5 for Type 4503A.../4504... frequency, Type KSM185380-2,5 for Type 4502A.../4520A...
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Charge amplifiers for piezoelectric sensors

ICAM Industrial charge amplifier



Type 5073A4...

Technical data	Type 5073A1...	Type 5073A2...	Type 5073A3...	Type 5073A3...	Type 5073A5...
Number of channels	1	2	3	4	1 (4 inputs summed)

General technical data

Number of measuring ranges	2 (switchable)	
Measuring range adjustment	continuously variable	
Measuring range 1 FS	pC	$\pm 100 \dots 1,000,000$
Measuring range 2 FS	pC	$\pm 100 \dots 1,000,000$
Frequency (-3 dB)	kHz	$\approx 0 \dots 20$ ($< \pm 10,000$ pC) $\approx 0 \dots 2$ ($< \pm 1,000,000$ pC)
Deg. of protection to IEC/EN 60529	optional IP60 (BNC)/IP65 (TNC)	
Output signal	V mA	± 10 4 ... 20 (only Type 5073A1... and 5073A2...)
Power supply	VDC	18 ... 30
Signal input	Type/ connector	piezoelectric/optional BNC neg. piezoelectric/optional TNC neg.
Interface	RS-232C (for parameterization)	
Other features	<ul style="list-style-type: none"> • Peak memory • Adjustable output offset • Low-pass filter 	
Data sheet: see www.kistler.com	Type 5073A (000-524)	

Accessories

RS-232C cable, null modem, 5 m, D-Sub 9 pin pos./ D-Sub 9 pin neg.	Type 1200A27
Cable D-Sub/ 15 pin neg. with flying leads one end	Type 1500A41...

Strain gage amplifier

Measuring amplifier for strain gage sensors, mounted in aluminum casing



Version A




Versions B and C

Technical data			Type 4701A...A	Type 4701A...B	Type 4701A...C
Number of channels			1	1	1
Signal input	Strain gage	mV/V	approx. 1.5	approx. 1.0/2.0 (0.5 ... 3.0, full or half bridge, max. bridge input resistance 1,000 Ω)	input 0 ... 5 (input resistance 1 ... 5 kΩ)
	Resistive	V			
Cutoff frequency (-3 dB)		kHz	1	1	1

General technical data

Deg. of protection to IEC/EN 60529		with cable glands: IP54	with connectors: IP40	with connectors: IP40
Output signal	V	±0 ... 5 or ±0 ... 10	±0 ... 5 or ±0 ... 10	±0 ... 5 or ±0 ... 10
Power supply	VDC	24 non-stabilized (±10%)	24 non-stabilized (±10%)	24 non-stabilized (±10%)
Connector	Signal input	cable gland with soldering terminals	6 pin socket	6 pin socket
	Signal output	cable gland with soldering terminals	6 pin connector	6 pin connector
Data sheet: see www.kistler.com		Type 4701A (000-621)	Type 4701A (000-621)	Type 4701A (000-621)

Accessories

Connecting cable, 5 m, 6 pin/6 pin	Type KSM071860-5	
Connecting cable, 5 m, 6 pin/free	Type KSM103820-5	Type KSM103820-5
		
Connecting cable, 5 m, 5 pin/5 pin		Type KSM106410-5

Software

SensorTool – PC software to parameterize, visualize and analyze sensor technology



Technical data		Type 4706A
Supported equipment	Torque sensors, Type 4503B..., 4510B..., 4550A..., 4551A... CoMo Torque Evaluation Instrument, Type 4700B... Strain Gage Meter, Type 4703B	
Data sheet: see www.kistler.com	Type 4706A (000-626)	



Couplings

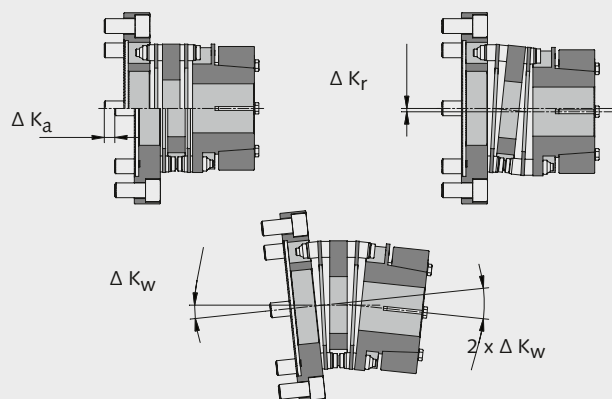
Torque on rotating shafts is measured directly in the machinery train, between a drive and a loading machine. External influences such as shear forces, axial forces or bending moments may affect the measurement signal. Couplings are used to exclude influences of this sort.

Couplings for use between the shaft and the sensor differ with regard to their flexibility. Some couplings can only correct a mechanical misalignment in one direction (these are known as singly flexible couplings); others are flexible in two directions (doubly flexible couplings) or in all directions.

Choosing the Coupling

The choice of coupling can be a crucial factor in measurement quality. For very dynamic measurements, the coupling must be highly torsion-proof; this is because the coupling changes the resonances of the mechanical structure with its torsion resistance, and this can cause undesirable torsional vibrations.




Permitted Shaft Displacements for Coupling Elements



With its two disk assemblies, the multi-disk coupling compensates for angular, axial and radial shaft misalignment.




Product overview: couplings

Couplings for measuring flanges

Type		Name	For (sensor)	Max. speed1/min
2300A...S... 2305A...S...		Torsion-proof multi-disk coupling Clamping hub	Torque measuring flange Type 4551/4550...	8,000 ... 15,000
2300A...F... 2305A...F...		Torsion-proof multi-disk coupling Flange connection	Torque measuring flange Type 4551/4550...	8,000 ... 15,000
2300A...A... 2305A...A...		Adapter flange for drive side	Torque Masuring flange Type 4551/4550...	8,000 ... 15,000

Note: Couplings for torque measuring flanges Type 4550A... and Type 4510B... available upon request

Couplings for Rotating Torque Sensors

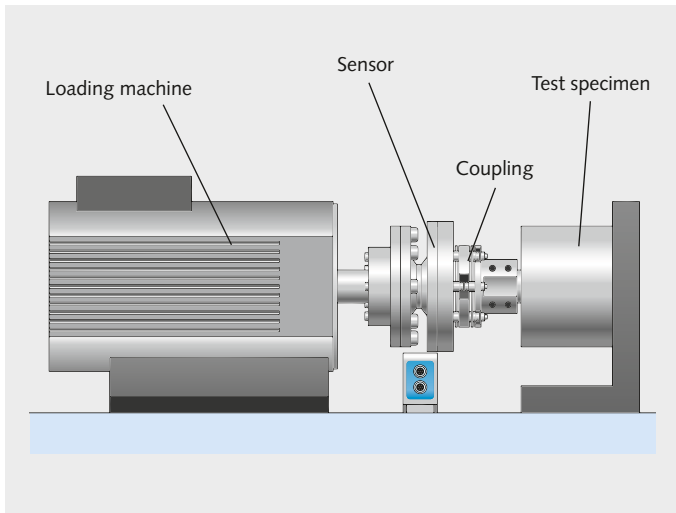
Type		Name	For (sensor)	For (measuring ranges)
2301A...		Torsion-proof, doubly flexible metal bellows coupling	Torque sensor Type 4520A..., Type 4502A..., and Type 4503A...	5 ... 1,500 N·m
2302A...		Torsion-proof, singly flexible miniature coupling	Torque sensor Type 4501A..., Type 4502A..., Type 4503A... and Type 4520A...	up to max. 36 N·m
2303A...		Torsion-proof, doubly flexible miniature coupling	Torque sensor Type 4501A..., Type 4502A..., Type 4503A... and Type 4520A...	up to max. 36 N·m

Application examples and adaptation options for measuring flanges

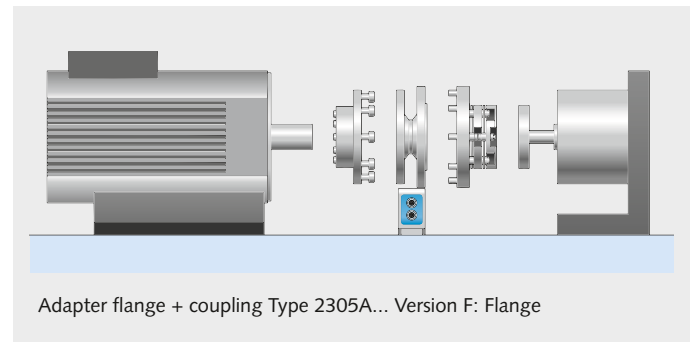
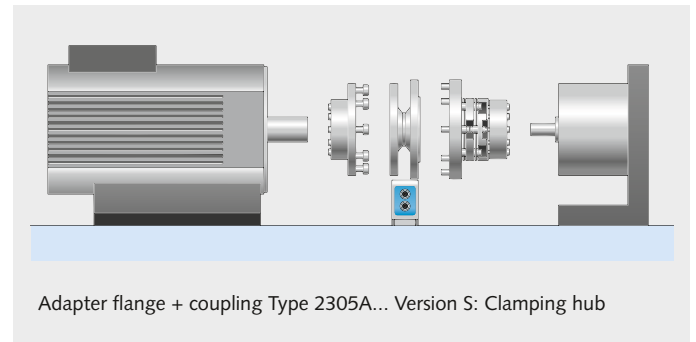
In principle, the choice of coupling is determined by the type of mounting for the torque sensor. For torque measuring flanges, a doubly flexible coupling is generally used between the torque sensor and the test specimen. On the drive side, the connection is made with a single adapter flange, without a coupling. With regard to torque measuring shafts, a distinction is made between

fixed and self-supporting mountings. Different types of coupling are used in each case. With a fixed mounting, the connection is usually made with doubly flexible couplings, whereas singly flexible couplings are chosen for self-supporting mountings.

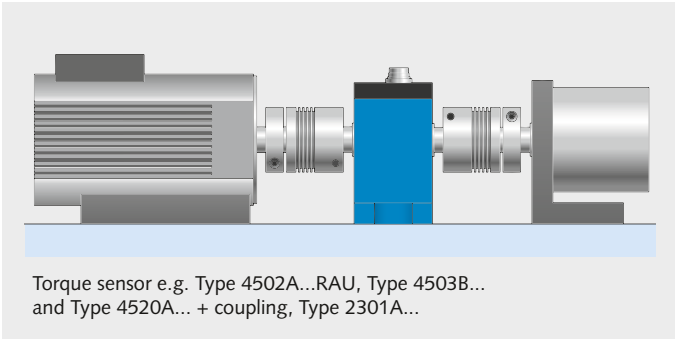
Application example



Adaptation options



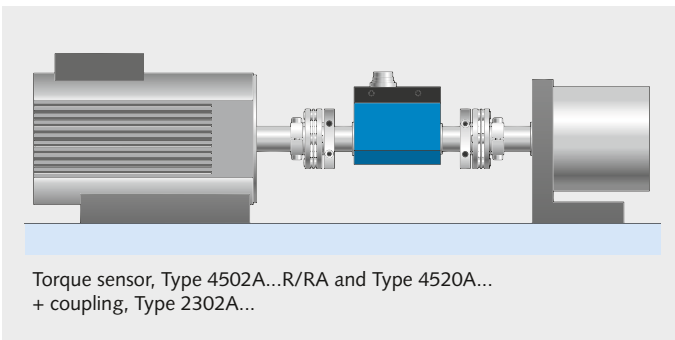
Application examples for rotating torque sensors



Application

The coupling allows compensation when the torque sensor is mounted in a fixed position in the line shafting. Possibilities for lateral and axial compensation are always a mandatory requirement in order to prevent measuring errors and damage to the sensor. For sensors with a fixed housing (or mounting base), a doubly flexible coupling must be fitted on both sides. Clamping hubs are used for the mounting on both sides. The frictional connection ensures that the installation is absolutely free of play.

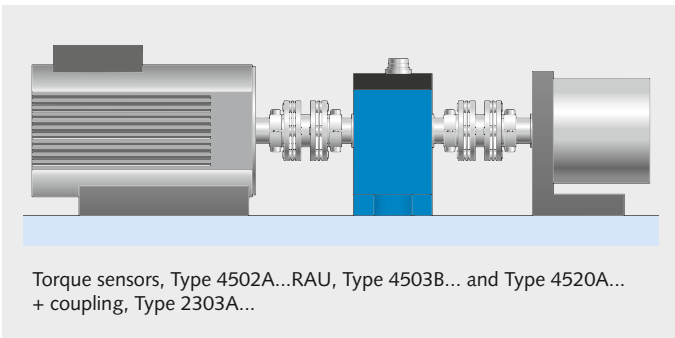
Data Sheet Type 2301A (000-673)



Application

The coupling allows compensation when a self-supporting mounting is used for torque sensors in a line shafting. Angular compensation for each coupling is always a mandatory requirement in order to prevent measuring errors and damage to the sensor. It is recommended that this type of mounting only be used for torque sensors $>50 \text{ N}\cdot\text{m}$ with a speed $<500 \text{ 1/min}$.

Data Sheet Type 2302A (000-671)



Application

The coupling allows compensation when the torque sensor is mounted in a fixed position in the line shafting. Possibilities for lateral and axial compensation are always a mandatory requirement in order to prevent measuring errors and damage to the sensor. For sensors whose housing (or mounting base) is installed in a fixed position, a doubly flexible coupling must be fitted on both sides. Clamping hubs are used for the mounting on both sides.

Data Sheet Type 2303A (000-672)

Couplings for torque sensors

Torsion-proof multi-disk coupling for torque measuring flange, Type 4550A...



Coupling
Type 2305A... Version S
with clamping hub

Technical data			Type 2305A10...	Type 2305A16...	Type 2305A40...
Coupling for sensor			Type 4550A100...	Type 4550A200...	Type 4550A500...
Rated torque	T_{KN}	N·m	100	300	650
Peak transient torque	T_{Kmax}	N·m	150	450	975
Outside diameter of coupling	DaK	mm	69	77	104
Torsion resistance (per assembly)	C_T	10^3 N·m/rad	60	90	320
Overall torsion resistance	$C_{Toverall}$	10^3 N·m/rad	30	45	160



Coupling
Type 2305A... Version F
with flange

Technical data			Type 2305A64...	Type 2305A300...	Type 2305A500...
Coupling for sensor			Type 4550A1K...	Type 4550A2K/3K...	Type 4550A5K...
Rated torque	T_{KN}	N·m	1,100	3,500	5,800
Peak transient torque	T_{Kmax}	N·m	1,650	5,250	8,700
Outside diameter of coupling	DaK	mm	123	167	198
Torsion resistance (per assembly)	C_T	10^3 N·m/rad	1,350	3,480	11,900
Overall torsion resistance	$C_{Toverall}$	10^3 N·m/rad	675	1,740	5,950



Adapter flange (rigid)
Type 2305A... Version A
with clamping hub

General technical data	
Data sheet: see www.kistler.com	Type 2305A (000-972)

Accessories	
Mounting screws	Type 4550A...

Torsion-proof multi-disk coupling for torque measuring flange, Type 4551A...



Coupling
Type 2300A... Version S
with clamping hub

Technical data			Type 2300A10...	Type 2300A25...	Type 2300A40...
Coupling for sensor			Type 4551A50/100...	Type 4551A200...	Type 4551A500...
Rated torque	T_{KN}	N·m	100	420	650
Peak transient torque	T_{Kmax}	N·m	150	630	975
Outside diameter of coupling	DaK	mm	69	89	104
Torsion resistance (per assembly)	C_T	10^3 N·m/rad	60	290	320
Overall torsion resistance	$C_{Overall}$	10^3 N·m/rad	30	145	160



Coupling
Type 2300A... Version F
with flange

Technical data			Type 2300A100...	Type 2300A300...	Type 2300A500...
Coupling for sensor			Type 4551A1K...	Type 4551A2K...	Type 4551A3K...
Rated torque	T_{KN}	N·m	1,600	3,500	5,800
Peak transient torque	T_{Kmax}	N·m	2,400	5,250	8,700
Outside diameter of coupling	DaK	mm	143	167	198
Torsion resistance (per assembly)	C_T	10^3 N·m/rad	1,900	3,480	11,900
Overall torsion resistance	$C_{Overall}$	10^3 N·m/rad	950	1,740	5,950



Adapter flange (rigid)
Type 2300A... Version A
with clamping hub

Technical data			Type 2300A850...
Coupling for sensor			Type 4551A5K...
Rated torque	T_{KN}	N·m	9,500
Peak transient torque	T_{Kmax}	N·m	14,250
Outside diameter of coupling	DaK	mm	234
Torsion resistance (per assembly)	C_T	10^3 N·m/rad	20,600
Overall torsion resistance	$C_{Overall}$	10^3 N·m/rad	10,300

General technical data

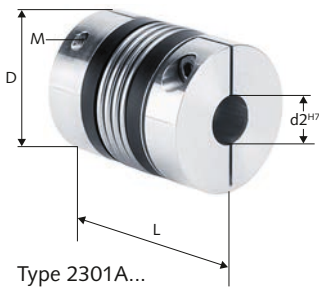
Data sheet: see www.kistler.com Type 2300A (000-667)

Accessories

Mounting screws Type 4551A...

Couplings for torque sensors

Metal bellows coupling with clamping hubs



Technical data			Type 2301A15	Type 2301A30	Type 2301A60
Rated torque	T_{KN}	N·m	15	30	60
Torsion resistance	C_{Tdyn}	10^3 N·m/rad	20	39	76
Mass moment of inertia	J	10^{-3} kg·m ²	0.06	0.12	0.32
Dimensions	L	mm	59	69	83
	$d2^{H7}$ (min ... max)	mm	8 ... 28	10 ... 30	12 ... 35
	D	mm	49	55	66
	M		M5	M6	M8
Mass		kg	0.15	0.3	0.4

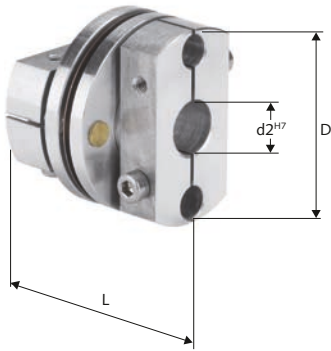
Technical data			Type 2301A80	Type 2301A150	Type 2301A200
Rated torque	T_{KN}	N·m	80	150	200
Torsion resistance	C_{Tdyn}	10^3 N·m/rad	129	175	191
Mass moment of inertia	J	10^{-3} kg·m ²	0.8	1.9	3.2
Dimensions	L	mm	94	95	105
	$d2^{H7}$ (min ... max)	mm	14 ... 42	19 ... 42	22 ... 45
	D	mm	81	82	90
	M		M10	M10	M12
Mass		kg	0.8	1.7	2.5

Technical data			Type 2301A300	Type 2301A500	Type 2301A800
Rated torque	T_{KN}	N·m	300	500	800
Torsion resistance	C_{Tdyn}	10^3 N·m/rad	450	510	780
Mass moment of inertia	J	10^{-3} kg·m ²	7.6	14.3	16.2
Dimensions	L	mm	111	133	140
	$d2^{H7}$ (min ... max)	mm	24 ... 60	35 ... 60	40 ... 75
	D	mm	110	124	134
	M		M12	M16	2 × M16
Mass		kg	4	7.5	7

Technical data			Type 2301A1500
Rated torque	T_{KN}	N·m	1,500
Torsion resistance	C_{Tdyn}	10^3 N·m/rad	1,304
Mass moment of inertia	J	10^{-3} kg·m ²	43
Dimensions	L	mm	166
	$d2^{H7}$ (min ... max)	mm	50 ... 80
	D	mm	157
	M		2 × M20
Mass		kg	12

General technical data			
Peak transient torque	T_{Kmax}	N·m	brief overload of up to 1.5 times value permissible
Max. speed	n_{max}	1/min	<10,000
Operating temperature range		°C	-30 ... 120
Data sheet: see www.kistler.com			Type 2300A (000-667)

Torsion-proof miniature coupling, singly flexible, with clamping hubs



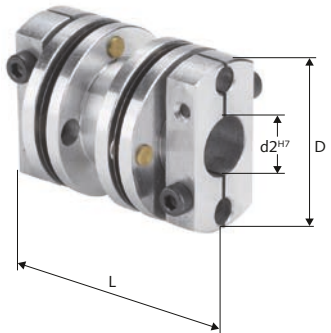
Type 2302A...

Technical data			Type 2302A25	Type 2302A37	Type 2302A50
Rated torque	T_{KN}	N·m	0.39	1.56	6.17
Peak transient torque	T_{Kmax}	N·m	0.54	2.19	8.64
Torsion resistance	C_{Tdyn}	10^6 N·m/rad	3.89	25.986	39.768
Mass moment of inertia	J	10^{-6} kg·m ²	1.83	11.1	28.56
Max. speed	n_{max}	1/min	64,000	44,000	36,000
Dimensions	L	mm	20.2	29.1	30.4
	$d2^{H7}$ (min ... max)	mm	3 ... 10	4 ... 14	6 ... 18
	D	mm	25.4	35.8	44.5
Mass		kg	0.022	0.062	0.1

Technical data			Type 2302A62	Type 2302A75
Rated torque	T_{KN}	N·m	24.7	36.2
Peak transient torque	T_{Kmax}	N·m	34.6	50.7
Torsion resistance	C_{Tdyn}	10^6 N·m/rad	103.572	161.76
Mass moment of inertia	J	10^{-6} kg·m ²	78.61	159.4
Max. speed	n_{max}	1/min	28,000	24,000
Dimensions	L	mm	36.6	41
	$d2^{H7}$ (min ... max)	mm	10 ... 24	12 ... 28
	D	mm	57.4	64
Mass		kg	0.195	0.278

Data sheet: see www.kistler.com Type 2302A (000-671)

Torsion-proof miniature coupling, doubly flexible, with clamping hubs



Type 2303A...

Technical data			Type 2303A25	Type 2303A37	Type 2303A50
Rated torque	T_{KN}	N·m	0.39	1.56	6.17
Peak transient torque	T_{Kmax}	N·m	0.54	2.19	8.64
Torsion resistance	C_{Tdyn}	10^3 N·m/rad	0.425	1.324	2.984
Mass moment of inertia	J	10^{-6} kg·m ²	2.023	11.1	31.7
Max. speed	n_{max}	1/min	64,000	44,000	36,000
Dimensions	L	mm	34	48	54
	$d2^{H7}$ (min ... max)	mm	3 ... 10	4 ... 14	6 ... 18
	D	mm	25.4	35.8	44.5
Mass		kg	0.028	0.077	0.133

Technical data			Type 2303A62	Type 2303A75
Rated torque	T_{KN}	N·m	24.7	36.2
Peak transient torque	T_{Kmax}	N·m	34.6	50.7
Torsion resistance	C_{Tdyn}	10^3 N·m/rad	5.179	8.088
Mass moment of inertia	J	10^{-6} kg·m ²	115.673	201.8
Max. speed	n_{max}	1/min	28,000	24,000
Dimensions	L	mm	66	71
	$d2^{H7}$ (min ... max)	mm	10 ... 24	12 ... 28
	D	mm	57.4	64
Mass		kg	0.26	0.355

Data sheet: see www.kistler.com Type 2303A (000-672)

Measuring chains

In order to integrate sensor technology into a given application, it is advisable to clarify these points in advance; this will provide the basis for selecting the relevant components to generate the measuring chain:

- Type of signal: voltage, frequency, digital (fieldbus/Ethernet) or charge for piezoelectric sensors
- Number of pins of the selected output
- Pin allocation for sensor and evaluation unit (see data sheet)

When installing the cables, make sure that the maximum permitted cable length is not exceeded. It is advisable to use original Kistler cables only.

Most torque sensors based on strain gage technology already have an internal amplifier. The sensors can be connected with the appropriate evaluation unit, or directly with the PLC in some cases.

Piezoelectric torque sensors require a charge amplifier. After the sensor signals have been converted, they can be evaluated by an amplifier in the customer's system.

For the analysis of dedicated XY processes (such as torque-rotation angle monitoring), the maXYmos family is highly suitable thanks to its user-friendly operation and wide variety of interfaces (Y-channel: piezo, strain gage, ± 10 V; X-channel: potentiometer, ± 10 V, incremental).

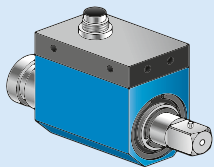
Measure

Connect

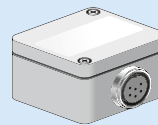
Amplify

Monitor & control

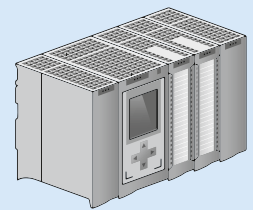
Measuring chains to test transmissions



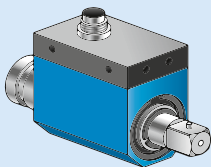
Type 4501A



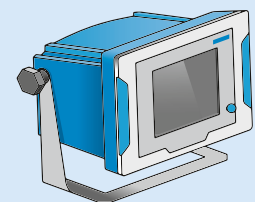
Type 4701A



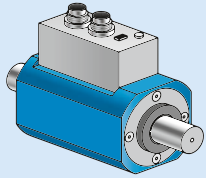
SPS



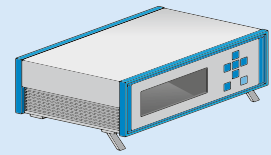
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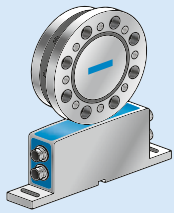
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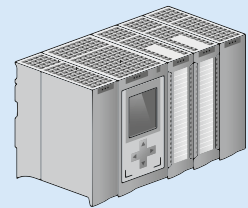
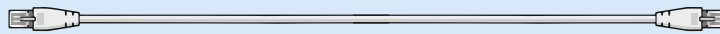
Type 4503B



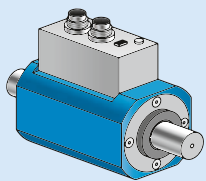
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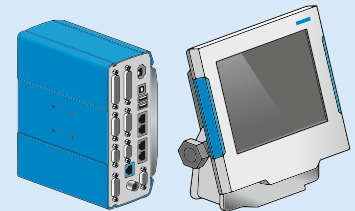
Type 4551A



SPS

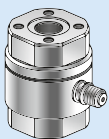


Type 4503B

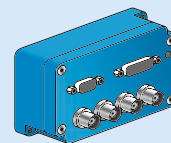


Type 5877

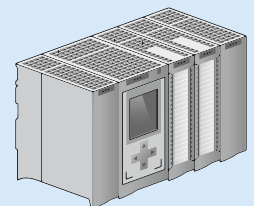
Measuring chains to test rotary switches



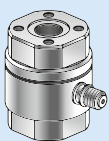
Type 9329A



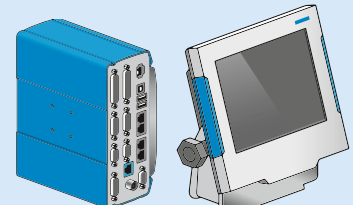
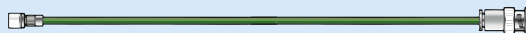
Type 5073A



SPS



Type 9329A



Type 5877



Torque measurement technology

Whether the test object is a torsion bar or a fast-running drive shaft: knowledge of the torques that occur provides information about static and dynamic loads, running characteristics of transmissions and – in combination with speed measurements – about the performance of a power train.

For torque measurements on rotating shafts, strain gage technology is the preferred choice. Maximum accuracy, a structure with the maximum possible rigidity and high temperature stability are the key requirements here.

For modern torque measuring shafts, transmission of the power supply and the measurement signal is usually contactless. If the bearing for the measuring shaft is also eliminated – as in the case of Types 4550A.../4551A... and Type 4510B... – the result is a high-precision measuring instrument that is completely wear-free.

Piezoelectric sensors prove effective for applications to measure reaction moments: the requirements here are large measuring ranges, an extremely high overload factor and high resolution. These sensors can also capture very small torque fluctuations without problems, even in the case of extremely high mechanical loads.

Strain gage or piezoelectric? Solutions for every requirement!

Strain gage torque sensors for

- Measurements on rotating shafts
- Maximum precision
- Continuous dynamic and static measurements

Piezoelectric reaction torque sensors for extremely high overload protection

- High signal resolution, even for the smallest partial ranges
- Wide frequency range

Calibration

Sensors and measuring instruments must be calibrated at regular intervals, as their characteristics – and hence, measurement uncertainties – can change over time due to frequent use, aging and environmental factors. Instruments used for calibration are traceable to national standards and subject to uniform, international quality control. Calibration certificates document calibration values and conditions.

Safe and reliable measurements

Quality assurance systems and product liability laws call for systematic monitoring of all test equipment used to measure quality characteristics. This is the only way of ensuring that measurement and test results provide a reliable and trustworthy basis for quality control.

All sensors and electronic measuring devices are subject to some degree of measurement uncertainty. As the deviations involved can change over time, the test equipment must be calibrated at regular intervals.

This involves determining the deviation of the measured value from an agreed upon, correct value; this is the reference value, also referred to as the calibration standard. The result of a calibration can either be used to assign the actual values of the measurand to the readings or to determine correction factors for display. The required information is documented on the calibration certificate.

Calibration process

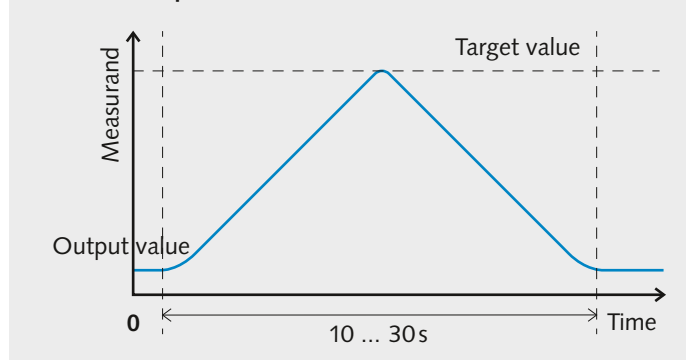
During calibration, sensors are subjected to known quantities of a physical input variable (such as torque) and the corresponding values of the output variable are recorded. The quantitative value of this load is accurately known, as it is measured with a traceably calibrated 'factory standard' at the same time. Depending on the method, sensors are calibrated either across the entire measuring range or in a partial range, i.e. according to choice:

- at a single point,
- continuously, or
- stepwise at several different points.

Measuring ranges

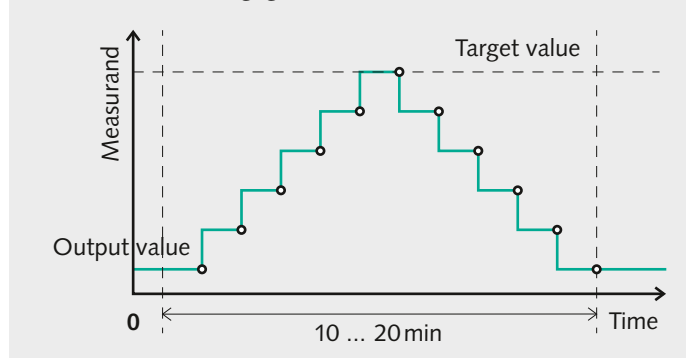
As standard, Kistler offers traceable calibrations from 0.005 N·m – 100,000 N·m. Additional measurement ranges are available upon request.

Calibration of piezo sensors



During continuous calibration, the load is continuously increased to the required value within a defined time and then reduced to zero within the same time. A 'best straight line' passing through the origin is defined for the resultant characteristic, which is never exactly linear. The gradient of this line corresponds to the sensitivity of the sensor within the calibrated measuring range.

Calibration of strain gage sensors



Step-by-step calibration involves the application of a load with or without unloading between successive increases or decreases, depending on the calibration method used. The process is halted after each increment until the measurement stabilizes.

Linearity is determined by the deviation of the characteristic from the best straight line. Hysteresis corresponds to the maximum difference between the rising and falling characteristics. Most Kistler single-axis or multiaxial force and torque sensors are factory calibrated.

This continuous approach is the most suitable calibration method for piezoelectric sensors. Strain gage sensors are preferably calibrated step-by-step.



From professional advice on installation to speedy deliveries of spare parts: Kistler's comprehensive range of services and training is at your disposal across the globe

Kistler service: customized solutions from A to Z

Kistler offers sales and service wherever automated manufacturing processes take place.

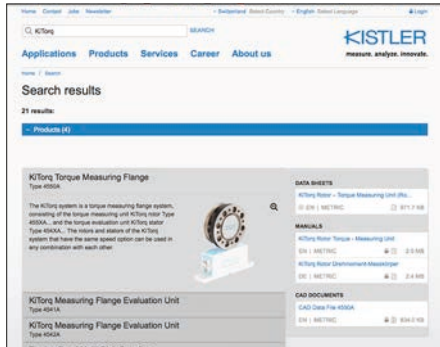
In addition to sensors and systems, Kistler offers a host of services – from professional advice on installation to speedy worldwide deliveries of spare parts. For an overview of the services we offer, visit www.kistler.com. For detailed information on our training courses, please contact our local distribution partners (see page 39).

Kistler service at a glance:

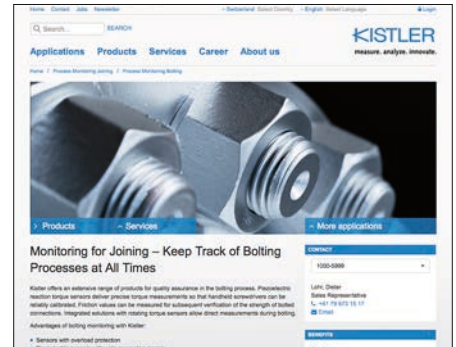
- Advice
- Support with system commissioning
- Process optimization
- Periodic onsite calibration of sensors
- Education and training events
- Development services

Kistler – at our customers' service across the globe

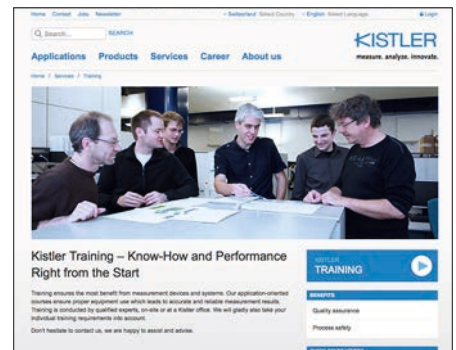
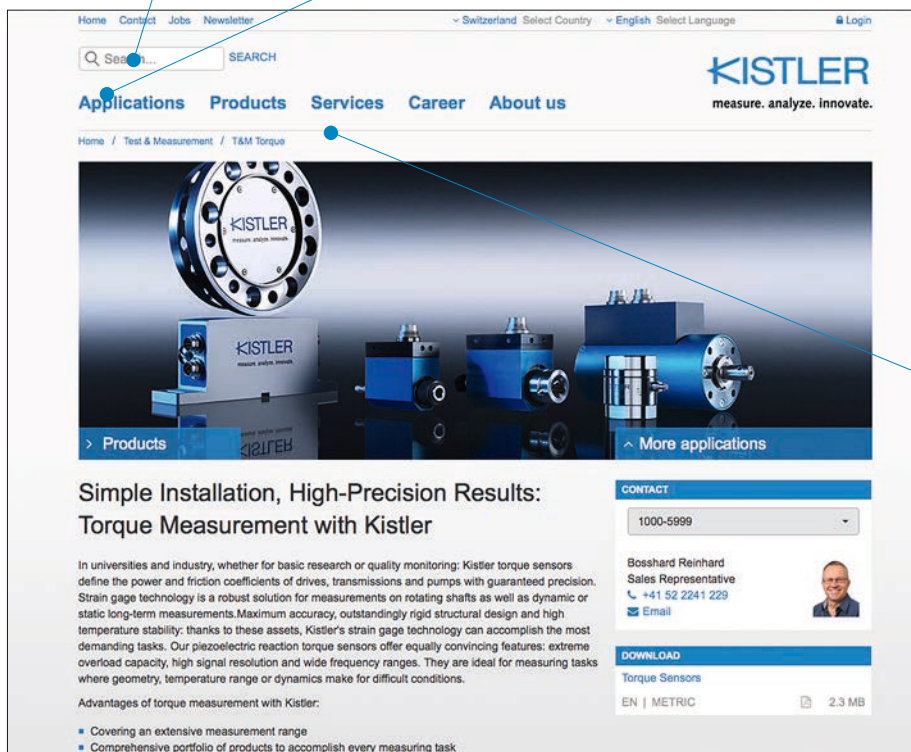
With over 1,200 employees, the Kistler Group leads the global market for dynamic measuring technology. 28 group companies and over 30 distributors ensure close contact with customers, individual application support and short delivery times.



Data sheets and documents
Use our search engine to download data sheets, brochures or CAD data.



Your contacts
No matter whether you come to us for advice or support with an installation – on our website, you will find the contact details for your personal partner anywhere in the world.



Education and training events
Education and training courses – when our sensors and measuring systems are explained by experienced Kistler experts – are the most efficient way for you to acquire the expertise you need.

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measure. analyze. innovate.

Increased efficiency with cavity pressure-based systems

Process monitoring and control
Efficient process management for injection molding

Increased cost efficiency with cavity pressure-based systems

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Optimized process management for injection molding

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