



Torque sensors

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



Absolute Attention for tomorrow's world

Kistler develops solutions for challenges in measurement technology with a portfolio that comprises sensors, electronics, systems and services. We push the frontiers of physics in fields such as emission reduction, quality control, mobility and vehicle safety: our products deliver top performance to meet the standards of tomorrow's world, providing the ideal basis for Industry 4.0. This is how we pave the way for innovation and growth – for our customers, and with our customers.



Kistler: the byword for advances in engine monitoring, vehicle safety and vehicle dynamics. Our products deliver data that plays a key part in developing efficient vehicles for tomorrow's world.



Measurement technology from Kistler ensures top performance in sport diagnostics, traffic data acquisition, cutting force analysis and many other applications where absolutely reliable measurements are required despite extreme conditions.



By supporting all the stages in networked, digitalized production, Kistler's systems maximize process efficiency and costeffectiveness in the smart factories of the next generation.

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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: http://www.kistler.com/ch/en/products/systems/ maxymos-bl-tl-nc/



Product overview: torque sensors

Туре	Measuring	range N∙m					
		0 ^	~0	⁷ 00	1000	,0000	
4501A Slip-ring torque se strain gag	ensor, ge		_	0 ±2	2 1000 to 0 ±1000		
4502A Mini-sma torque se strain gag	art nsor, ge	-		0 ±0,5	0,5 1000 to 0 ±1000		
4520A Basic line torque se strain gag	ensor, ge			0 ±1	1 1000 to 0 ±1000		
4503B Torque se optional strain gag	ensor, dual range, ge				0,2 0 ±0,2 to 0 .	5000 ±5000	
4510B Torque measurin strain gag	g flange, ge				0 ±	100 20 100 to 0 ±20	000 000
4550A KiTorq to measurin strain gag	rque g flange, ge				100 0 ±100 to 0	5000 . ±5000	
4551A KiTorq to measurin strain gag	rque g flange, ge			-	50 0 ±50 to 0	5000 . ±5000	
9329A to 9389A	<, :tric			0 ±0,1	to 0 ±1000		
9275 Dynamor piezoelec	meter, :tric		0	0 ±20 to 0 ±	200		
9277A Dynamor piezoelec	meter, :tric		0 ±0,5 to 0	±25			
92458 93658 Quartz for Fz, Mz, piezoelec	orce link		Fz, 0 ± Mz 0 ±2,5 M	1 kN to 0 ±20 Nm to 0 ±200	kN, Nm		

Rated torque in N·mMeasuring range in N·m

Max. speed	Connector		Bearing	Sensor Signal transmission rotor – stator		ansmission – 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
12000 1/min	•	•	•		•		•		•	0 ±5 VDC	10
10000 1/min	•		•		•		•		•	0 ±10 VDC	11
50000 1/min	•		•		•		•		•	0 ±5 VDC or 0 ±10 VDC and 100 ±40 kHz and RS-232C	12
12000 1/min				•			•		•	0 ±10 VDC or 100 ±40 kHz and RS-232C	13
20000 1/min				•			•		•	0 ±10 VDC or 100 ±40 kHz, or 10 ±5 kHz or 240 ±120 kHz and RS-232C/USB or fieldbuses	14
20000 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		±2 170 ±100 pC/N·m (depending on size)	16
				•		•		Cable		±170 pC/N·m (depending on size)	17
				•		•		Cable		±600 ±250 pC/N·m (depending on size)	18
				•		•		Cable		±140 ±200 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 ... 1000 Nm



Туре 4501А...

Technical data		Туре	4501A
Rated torque	M _{nom}	N∙m	2/6/10/12/20/25/50/63/100/160/200/500/1000
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°
Rated speed		1/min	≤3000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L W H	mm mm mm	44 73 28 73 52 90
Operating temperat	ure 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	4501A (000-596)			

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

Torque sensors for rotating shafts

Mini-smart torque sensor, 0,5 ... 1000 Nm



Туре 4502А...

Technical data		Туре	4502A
Rated torque	M_{nom}	N∙m	0,5/1/2/5/6/10/12/18/20/50/63/100/150/160/ 200/250/300/500/1000
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°
Rated speed		1/min	≤12000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L W H	mm mm mm	44 73 28 73 52 90
Operating tempera	ture 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	4502A (000-597)			

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

Basic line torque sensor, 1 ... 1000 Nm



Туре 4520А...

Technical data		Туре	4520A
Rated torque	M _{nom}	N∙m	1/2/5/10/20/50/100/200/500/1000
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	≤10000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L D H	mm mm mm	58 85 58 91 70 103
Operating temperatur	e 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	4520A (000-765)			

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

Torque sensors for rotating shafts



Torque sensor, optional dual range



Туре 4503В...

Technical data		Туре	4503B
Rated torque	M_{nom}	N∙m	0,2/0,5/1/2/5/10/20/50/100/200/500/1000/ 2000/5000
Maximum torque			1,5×rated torque
Alternating torque			0,7×rated torque
Accuracy class			0,05
Linearity error including hysteresis		% FSO	±0,05
Output signal (rated value)	M_{nom}	VDC kHz	±5 or 10 100 ±40
Speed & angle measurement		pulses/rev.	up to 8192 + Z-pulse
Rated speed		1/min	50 000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L D H	mm mm mm	122 169 58 148 90,1 170,5
Operating temperature range °C		°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	4503B (000-767)		

Accessories		
Coupling socket, 7 pin Type		KSM000517
Coupling socket, 12 pin	Туре	KSM000703
SensorTool	Туре	4706A
Connecting cables	Туре	KSM124970-5, KSM186420-2,5, KSM186430-2,5, KSM219710-5
Couplings	Туре	2301A to 2303A
Mounting base (GU)	Туре	GU for 0,2 20 Nm 18030861 GU for 50 100 Nm 18030862 GU for 200 1000 Nm 18030863 GU for 2 000 5 000 Nm 18030864

Torque measuring flange for rotating shafts

Torque measuring flange: robust, bearingless, high accuracy, 100 ... 20000 Nm



Туре 4510В...

Technical data		Туре	4510B
Rated torque	M _{nom}	N∙m	100/200/500/1000/2000/4000/10000/20000
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	$<\pm0,1$ or $<\pm0,2$ (depending on model)
Output signal (rated value)	M_{nom}	VDC kHz	10 (B1) or 100 ±40 kHz und RS-232C (B2)
Speed measurement		pulses/rev.	60
Rated speed		1/min	≤12 000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L D H R	mm mm mm mm	60 197 297 300,5 362,7 78 83,5
Operating temperature range °C		°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	4510B (000-737)		

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

Torque measuring flange for rotating shafts

KiTorq torque measuring flange: slim, robust, bearingless, high accuracy, 100 ... 5 000 Nm



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

Technical data		Туре	Type 4550A KiTorq Rotor, Type 454xA KiTorq Stator
Rated torque	M _{nom}	N∙m	100/200/500/1000/2000/3000/5000
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	<20000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L D H R W	mm mm mm mm mm	44 133 210,5 242,5 48 53 210
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	4541A (000-879) 4542A (003-057) 4550A (000-880)		

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



KiTorq torque measuring flange: slim, robust, bearingless, high accuracy, 50 ... 5000 Nm



Туре 4551А...

Technical data		Туре	4551A KiTorq Rotor, Type 454xA KiTorq Stator
Rated torque	M _{nom}	N∙m	50/100/200/500/1000/2000/3000/5000
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 8192 pulses + Z-pulse
Rated speed		1/min	<20000 (Depending on measuring range)
Case material			hard-anodized aluminum
Dimensions	L D H R W	mm mm mm mm mm	44 112 253,5 189,5 331 34 64 210
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	4541A (000-879) 4542A (003-057) 4551A (003-169)	

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

Reaction torque sensors (piezoelectric)

Dynamometer



Туре 9329А

Technical Data		Туре	9329A	9339A	9349A
Measuring range		N∙m	–1 1	–10 10	-25 25
Calibrated meas. ranges N·m		01 00,1 0 0,1 0 1	010 01 0 1 0 10	025 02,5 0 2,5 0 25	
Sensitivity		pC/N·m	≈–2170	≈–460	≈–230
Rigidity	C _{Mz}	N∙m/µrad	≈0,02	≈0,10	≈0,19
Dimensions	D H	mm mm	20 26	30 34	36 42
Weight		g	50	137	243
Operating temperature range °C			-20 80	-40 120	-40 120

Technical data		Туре	9369A	9389A
Measuring range		N∙m	-200 200	-1000 1000
Calibrated meas. ra	nges	N∙m	0200 020 0 20 0 200	01000 0100 0 100 0 1000
Sensitivity		pC/N∙m	≈–130	≈–100
Rigidity	C _{Mz}	N∙m/µrad	≈0,90	≈1,54
Dimensions	D H	mm mm	54 60	100 130
Weight		g	800	6 720
Operating temperat	ture 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	9329A (000-463)		

Accessories				
Mounting flange	Туре	9580A		
	- >			

Dynamometer



Туре 9275

Technical data		Туре	9275
Measuring range		N∙m	-200 200
Calibrated meas. ranges		N∙m	0200 020 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 d H	mm mm mm	100 18,4 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	9275 (000-154)

Accessories				
Connecting cables	Туре	1609B		

Dynamometer



Туре 9277А25

Technical data		Туре	9277A5	9277A25
Measuring range		N∙m	-5 5	-25 25
Calibrated meas. ranges		N∙m	05 00,5 0 0,5 0 5	025 02,5 0 2,5 0 25
Sensitivity		pC/N·m	≈–600	≈–250
Natural frequency	Natural frequency		≈10	≈15
Rigidity	C _{Mz}	N∙m/µrad	≈0,08	≈0,10
Dimensions	D d H	mm mm mm	78 8,5 60	78 8,5 60
Weight		g	1720	1745
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	9277A (000-155)		

Accessories				
Connecting cables	Туре	1609B		

Load washer



Туре 9039

Technical data		Туре	9039	9049	9069
Measuring range		N∙m	-5 5	-25 25	-200 200
Calibrated meas. ra	nges	N∙m	0 –5 0 –0,5 0 0,5 0 5	025 02,5 0 2,5 0 25	0200 020 0 20 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 d H	mm mm mm	28,5 13 11	34,5 17 12	52 26,5 15
Weight g		38	61	150	
Operating temperature °C range		-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	4577A (000-674)			

Accessories		
Connecting cables	Туре	1631C
Preloading elements	Туре	9420A

Multi-component sensor

2-Component measuring element Fz, Mz



Туре 9345В

Technical data		Туре	9345B	9365B
Measuring range	Fz	kN	–10 10	-20 20
Calibrated meas. ran	ges	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. ran	ges	N∙m	0 –25 0 –2,5 0 2,5 0 25	0200 020 0 20 0 200
Sensitivity	Mz	pC/N∙m	≈–190	≈–140
Rigidity	c (calculated)	N∙m/µrad	≈0,19	≈0,92
Dimensions	D H	mm mm	39 42	56,5 60
Weight		g	267	834
Operating temperatu	ire 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	9345B (000-630)		

Accessories				
Connecting cables	Туре	1693A, 1694A, 1695A, 1698A		



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



Туре 5877...

Technical data	Туре	5877
Number of measuring channels		1×X/Y 8×X/Y
Resolution per channel	Bit	24
Accuracy class	%	0,3
Sensors that can be connected	Channel X Channel Y	Via menu choice: Potentiometer, transmitter ±10 V, incremental, SSI, LVDT, inductive, EnDat 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)	Туре	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		5877A (003-273)

Accessories		
Display Module (DIM) Completes an existing Measuring and Evaluation Module (MEM) by adding a touchscreen	Туре	5877AZ000
Measuring Module (MEM) Extends an existing maXYmos TL sys- tem with an additional XY channel pair	Туре	5877AK00
Basic Connector Set (1 set included in scope of delivery)	Туре	5877AZ010
Standard Rail Clip To mount the Measuring Module (MEM) on a DIN mounting rail	Туре	5877AZ
Windows® Software Basic Version	Туре	2830A1
Windows® Software Plus Version	Туре	2830A2
Power supply, 240 VAC / 24 VDC	Туре	5779A3

maXYmos TL XY monitor



Туре 5867А...

Technical data	Туре	5867A
Number of measuring channels		1×X/Y
Resolution per channel	Bit	24
Accuracy class	%	0,3
Sensors that can be connected	Channel X Channel Y	Potentiometer, transmitter ±10 V* Piezo, strain gage, transmitter ±10 V*
Measuring functions		Y(X), Y(t), Y(X,t), X(t)

Curve evaluation using evaluation objects (EOs)	Туре	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		5867A (000-863)

Accessories		
Connector Set for Strain Gage Version (1 set included in scope of delivery)	Туре	5867AZ010
Connector Set for Piezo Version (1 set included in scope of delivery)	Туре	5867AZ011
Windows® Software Basic Version	Туре	2830A1
Windows® Software Plus Version	Тур	2830A2
Netzteil 240VAC/24VDC	Тур	5779A3
maXYmos BL Seq. Mode	Тур	2832A1

CoMo torque evaluation instrument



Туре 4700В...

Technical data Type		Туре	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 cha	annels	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			4700B (000-944)		

Accessories		
Connecting cables	Туре	KSM185350-2,5 for Type 4501A Q/R, KSM185370-2,5 for Type 4501A QA, KSM186420-2.5 for Type 4501A QA,
		KSM186420-2,5 for Type 4503A / 4504 frequency, KSM185380-2,5 for Type 4502A / 4520A

Charge amplifiers for piezoelectric sensors

Other features

Data sheet: see www.kistler.com

ICAM Industrial charge amplifier



Technical data	Туре	5073A1	5073A2	5073A3	5073A4	5073A5
Number of channels		1	2	3	4	1 (4 inputs summed)
General technical da	ata					
Number of measurin	ng ranges	2 (switchable)				
Measuring range ad	justment	continuously v	ariable			
Measuring range 1 F Measuring range 2 F	=S pC =S pC	±100 1000 ±100 1000	±100 1 000 000 ±100 1 000 000			
Frequency (–3 dB)	kHz	≈0 20 (<±10000 pC) ≈0 2 (<±1000000 p	≈020 (<±1000 pC) ≈02 (<±100000 pC)			
Deg. of protection to	D IEC/EN 60529	optional IP60 (BNC) / IP65 (TNC)				
Output signal	V mA	±10 4 20 (only 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)				

Тур 5073А4...

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

• Peak memory

5073A (000-524)

Adjustable output offsetLow-pass filter

Strain gage amplifier

Measuring amplifier for strain gage sensors, mounted in aluminum casing



Version A



Versions B and C

Technical data Type		4701AA	4701AB	4701AC	
Number of ch	nannels		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)	insuit 0 5
	Resistive	V			(input 0 5 (input resistance 1 5 kΩ)
Cutoff freque	ency (–3 dB)	kHz	1	1	1

General technical dat	ta				
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 24 non-stabilized (±10%) (±10%)		24 non-stabilized (±10%)	
Connector Signal input Signal output		cable gland with soldering terminals cable gland with soldering terminals6 pin connector		6 pin socket 6 pin connector	
Data sheet: see www	v.kistler.com	4701A (000-621)	4701A (000-621)	4701A (000-621)	

Accessories			
Connecting cable, 5 m, 6 pin/6 pin	Туре	KSM071860-5	
Connecting cable, 5 m, 6 pin/free	Туре	KSM103820-5	KSM103820-5
	\langle		
Connecting cable, 5 m, 5 pin/5 pin	Туре		KSM106410-5

Software

SensorTool - PC software to parameterize, visualize and analyze torque sensor technology



Technical data	Туре	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.kistle	r.com	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

Туре		Name	For (sensor)	Max. speed1/min
2300AS 2305AS	R.O	Torsion-proof multi-disk coupling Clamping hub	Torque measuring flange Type 4551 / 4550	8000 15000
2300AF 2305AF	X0	Torsion-proof multi-disk coupling Flange connection	Torque measuring flange Type 4551 / 4550	8000 15000
2300AH 2305AH	e e	Torsion-proof multi-disk coupling Half-shell hub	Torque measuring flange Type 4551 / 4550	3100 8200
2300AA 2305AA	C	Adapter flange for drive side	Torque Mmasuring flange Type 4551/4550	8000 15000

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

Couplings for Rotating Torque Sensors

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

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



Adapter flange + coupling Type 2305A... Version S: Clamping hub



Adapter flange + coupling Type 2305A... Version H: Half-shell hub



Adapter flange + coupling Type 2305A... Version F: Flange

Application examples for rotating torque sensors



Torque sensor e.g. Type 4502A...RAU, Type 4503B... and Type 4520A... + coupling, Type 2301A...

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 2301A (000-673)



Torque sensor, Type 4502A...R/RA and Type 4520A... + coupling, Type 2302A...

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 Nm with a speed <500 1/min.

Data Sheet 2302A (000-671)



Torque sensors, Type 4502A...RAU, Type 4503B... and Type 4520A... + coupling, Type 2303A...

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 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



Coupling Type 2305A... Version F with flange



Coupling Type 2305A... Version H with half-shell hub



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

Technical data		Туре	2305A10	2305A16	2305A40
Coupling for sensor		Туре	4550A100	4550A200	4550A500
Rated torque	Τ _{κΝ}	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	10³∙N∙m/rad	60	90	320
Overall torsion resistance	$C_{_{Toverall}}$	10³∙N∙m/rad	30	45	160

Technical data		Туре	2305A64	2305A300	2305A500
Coupling for sensor		Туре	4550A1K	4550A2K/3K	4550A5K
Rated torque	Τ _{κΝ}	N∙m	1 100	3 500	5800
Peak transient torque	T _{Kmax}	N∙m	1 650	5250	8700
Outside diameter of coupling	DaK	mm	123	167	198
Torsion resistance (per assembly)	C _T	10³∙N∙m/rad	1 350	3480	11900
Overall torsion resistance	C _{Toverall}	10³∙N∙m/rad	675	1740	5950

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

Accessories		
Mounting screws	Туре	4550A

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



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



Coupling Type 2300A... Version F with flange



Coupling Type 2300A... Version H with half-shell hub



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

Technical data		Туре	2300A10	2300A25	2300A40
Coupling for sensor		Туре	4551A50/100	4551A200	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	10³∙N∙m/rad	60	290	320
Overall torsion resistance	C _{Toverall}	10³∙N∙m/rad	30	145	160

Technical data		Туре	2300A100	2300A300	2300A500
Coupling for sensor		Туре	4551A1K	4551A2K	4551A3K
Rated torque	Τ _{κΝ}	N∙m	1 600	3500	5800
Peak transient torque	T _{Kmax}	N∙m	2 400	5250	8700
Outside diameter of coupling	DaK	mm	143	167	198
Torsion resistance (per assembly)	C _T	10³∙N∙m/rad	1900	3 4 8 0	11900
Overall torsion resistance	C _{Toverall}	10³∙N∙m/rad	950	1740	5950

Technical data		Туре	2300A850
Coupling for sensor		Туре	4551A5K
Rated torque	Τ _{κΝ}	N∙m	9500
Peak transient torque	T _{Kmax}	N∙m	14250
Outside diameter of coupling	DaK	mm	234
Torsion resistance (per assembly)	C _T	10³·N·m/rad	20600
Overall torsion resistance	C _{Toverall}	10³·N·m/rad	10300

General technical data	
Data sheet: see www.kistler.com	2300A (000-667)

Accessories		
Mounting screws	Туре	4551A

Couplings for torque sensors

Metal bellows coupling with clamping hubs



Technical data		Туре	2301A15	2301A30	2301A60
Rated torque	T _{KN}	N∙m	15	30	60
Torsion resistance	C _{Tdvn}	10³∙N∙m/rad	20	39	76
Mass moment of inertia	J	10 ⁻³ ·kg·m²	0,06	0,12	0,32
Dimensions	L d2 ^{H7} (min max) D M	mm mm mm	59 8 28 49 M5	69 10 30 55 M6	83 12 35 66 M8
Mass		kg	0,15	0,3	0,4
Technical data		Type	2301480	23014150	23014200
		ijpe	250 1100	2301/130	25017200
Rated torque	Τ	N⋅m	80	150	200
Torsion resistance	C_,	10 ³ ·N·m/rad	129	175	191
Mass moment of inertia	I	10 ⁻³ ·kg·m ²	0,8	1,9	3,2
Dimensions	L d2 ^{H7} (min max) D M	mm mm mm	94 14 42 81 M10	95 19 42 82 M10	105 22 45 90 M12
Mass		kg	0,8	1,7	2,5
			,		
Technical data		Туре	2301A300	2301A500	2301A800
Rated torque	T	N∙m	300	500	800
Torsion resistance	C _{Tdvn}	10³·N·m/rad	450	510	780
Mass moment of inertia	J	10 ⁻³ ·kg·m ²	7,6	14,3	16,2
Dimensions	L d2 ^{H7} (min max) D M	mm mm mm	111 24 60 110 M12	133 35 60 124 M16	140 40 75 134 2×M16
Mass		kg	4	7,5	7
Technical data		Туре	2301A1500		
			4.500		
Tansian maintain	I _{KN}	103 N	1500		
	C _{Tdyn}	10 ³ ·N·m/rad	1304		
	J	10°•kg•m²	43		
Dimensions	L d2 ^{H7} (min max) D M	mm mm mm	166 50 80 157 2×M20		
Mass		kg	12		
General technical data					
Peak transient torque	T _{Kmax}	N∙m	brief overload or	f up to 1.5 times va	lue permissible
Max. speed	n _{max}	1/min	<10000 (>1000	00 on request)	
Operating temperature ra	nge	°C	-30 120		

2300A (000-667)

Data sheet: see www.kistler.com

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



Тур 2302А...

Technical data	_	Туре	2302A25	2302A37	2302A50
Rated torque		N⋅m	0,39	1,56	6,17
Peak transient torque	T	N∙m	0,54	2,19	8,64
Torsion resistance	C	10 ⁶ ·N·m/rad	3,89	25,986	39,768
Mass moment of inertia	J	10 ⁻⁶ ∙kg∙m²	1,83	11,1	28,56
Max. speed	n	1/min	64000	44 000	36000
Dimensions	L d2 ^{H7} (min max) D	mm mm mm	20,2 3 10 25,4	29,1 4 14 35,8	30,4 6 18 44,5
Mass		kg	0,022	0,062	0,1
Technical data		Туре	2302A62	2302A75	
Rated torque	T	N∙m	24,7	36,2	
Peak transient torque	T	N∙m	34,6	50,7	
Torsion resistance	C	10 ⁶ ·N·m/rad	103,572	161,76	
Mass moment of inertia	J	10 ⁻⁶ ·kg·m²	78,61	159,4	
Max. speed	n _{max}	1/min	28000	24000	
Dimensions	L d2 ^{H7} (min max) D	mm mm mm	36,6 10 24 57,4	41 12 28 64	
Mass		kg	0,195	0,278	
Data sheet: see www.kist	ler.com		2302A (000-67	1)	

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



Тур 2303А...

Technical data		Туре	2303A25	2303A37	2303A50
Rated torque	Τ _{κΝ}	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}	10³·N·m/rad	0,425	1,324	2,984
Mass moment of inertia	J	10 ⁻⁶ ∙kg∙m²	2,023	11,1	31,7
Max. speed	n _{max}	1/min	64000	44 000	36000
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		Туре	2303A62	2303A75
Rated torque	Τ _{κΝ}	N∙m	24,7	36,2
Peak transient torque	T _{Kmax}	N∙m	34,6	50,7
Torsion resistance	C _{Tdyn}	10³·N·m/rad	5,179	8,088
Mass moment of inertia	J	10 ⁻⁶ ·kg·m²	115,673	201,8
Max. speed	n _{max}	1/min	28000	24000
Dimensions	L d2 ^{H7} (min max) D	mm mm mm	66 10 24 57,4	71 12 28 64
Mass		kg	0,26	0,355

Data sheet: see www.kistler.com

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, +/- 10V, incremental).





Measuring chains to test rotary switches





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 trustworthybasis 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 ... 5 000 Nm. Additional measurement ranges are available upon request.



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.



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 1200 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.

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The KTDrq system is a tarque measuring fange system, consisting of the tarque measuring unit KTDrq robot Type 45554 and the tarque evaluation unit KTDrq stator Type 45654 The nature and stators of the KTDrq system that have the same speed option up to a used in avalent that have the same speed option up to a used in	C) a	WANLACE	D Brijzk
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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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