

Sensors for Small Forces

Type 9215A, 9217A, 9217A1

-0,5 ... 0,5 N to -500 ... 500 N

These slim sensors are designed for dynamic and quasistatic tensile and compression forces. Depending on the design of the sensor, it is possible to measure small forces in measuring ranges between -0,5 ... 0,5 N to -500 ... 500 N. As a result of the high sensitivity of the integrated measuring element and special constructive measures during force application, the sensors' threshold is less than one millinewton. The sensors have a sealed housing and are designed for use in industry and the laboratory. Installation of the sensors directly into the structure is made possible by the thread on the shaft. Force is applied to the front side.

- 3 calibrated measuring ranges
- Highly sensitive, for forces from 1 mN
- For tensile and compression forces
- Slim design for small sensor distances

Description

The sensors are based on the piezoelectric measurement principle. The force acting on the highly sensitive transversal measuring element generates a proportional charge at the signal output. The measuring amplifier to be placed downstream (e.g., ICAM Type 5073A...) or process monitoring system (e.g., maXYmos Type 5867B... /5877A...) converts this into a process signal or curve that can be evaluated (e.g., 0 ... 10 V). The slim, pen-like structural shape of the sensor bodies and the force application on the axial tapped hole are important features of these sensors.

Application

Due to their slim geometry, the sensors are especially suitable for confined spaces, e.g., to simultaneously measure objects that are placed close together.

Due to the special property of the piezoelectric measuring element – almost constant measurement accuracy over a wide force range – the same sensor can be used across a large force spectrum. This advantage is further supported by the possibility of switching between measuring ranges by using appropriate amplifiers (ICAM Type 5073A...). This makes it possible to measure highly diverse parts at the same measuring station. The 'wide range measuring chain' also offers decisive advantages for use in a laboratory, where frequent sensor changes are part of everyday work. In addition, the extremely high overload protection when using the lower measuring ranges means there is no need for costly protective measures.



Type 9215A

Type 9217A/A1

Application Examples

- Contact measurement on keys, switches, relays, etc.
- Measuring spring characteristics
- Measuring pull-out forces on plug contacts
- Construction of highly sensitive miniature measuring platforms
- Force measurement on installation machines, robots, micromanipulators, etc.

Caution

These force sensors are very sensitive measuring instruments. The highest amount of vigilance is required when working with these sensors, as they are not equipped with a mechanical fuse against overload.

Technical Data

Please note that all technical data and further information in this data sheet is subject to change at any time without prior notice.

	Type	9215A	9217A	9217A1
Measuring range F_z	N	-20 ... 200	-500 ... 500	
Overload F_z	N	-30/300	-600/600	
Calibrated measuring ranges, F_z 100%	N	0 ... 200	0 ... 500 0 ... -500	0 ... 50 0 ... -50
10%	N	0 ... 20	0 ... 50 0 ... -50	0 ... 5 0 ... -5
1%	N	0 ... 2	0 ... 5	0 ... 0.5 0 ... -0.5
Threshold, F_z	N	<0.0005	<0.001	
Nominal sensitivity, F_z	pC/N	-95	-105	
Linearity, calibrated measuring ranges	%FSO	±1		±0.3
Hysteresis, all measuring ranges	%FSO	≤1		
Side load ¹⁾ , max., F_{xy}	N	90	50	
Maximum side load sensitivity $F_{x,y} \rightarrow F_z$	N/N	±0.05	±0.02	
Bending moment, max., $M_{x,y}$	N·m	0.5	1.78	
Maximum sensitivity to bending moment $M_{x,y} \rightarrow F_z$	N/N·m	±20	±4	
Torque, max., M_z	N·m	1.0	1.35	
Rigidity, c_z (F_z)	N/μm	≈100	≈15	
Natural frequency, f_n (F_z)	kHz	>50	>20	
Acceleration sensitivity axial	N/g	<0.002	<0.035	
radial	N/g	<0.0001	<0.0022	
Operating temperature range	°C	-50 ... 180	-50 ... 150	
Temperature coefficient of sensitivity, F_z	%/°C	<0.04	<0.04	
Insulation resistance at 20°C	Ω	>10 ¹³		
Capacity C	pF	≈15	≈45	
Connection		M4x0.35 neg.	KIAG 10-32 neg	
Protection class (with connected cable)	EN60529	IP65		
Case material	DIN	1.4542		
Weight	g	2.5	16	
Tightening torque, max., M_A M2	N·m	0.2		
M3	N·m		0.5	
M5x0,5	N·m	2		
M10x1	N·m		10	

¹⁾ Application of force on the flange level

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Dimensions

Dimensions of Type 9215A

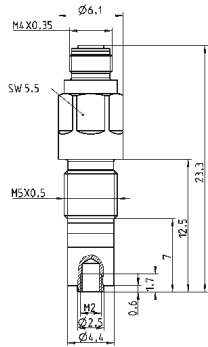


Fig. 1: Dimensions of sensor for small forces Type 9215A

Dimensions Type 9217A/A1

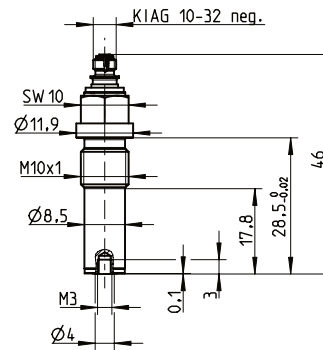


Fig. 2: Dimensions of sensor for small forces Type 9217A/A1

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Mounting Examples

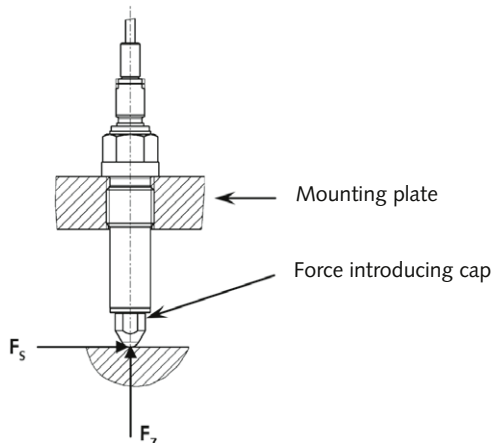


Fig. 3: Force application on force introducing cap

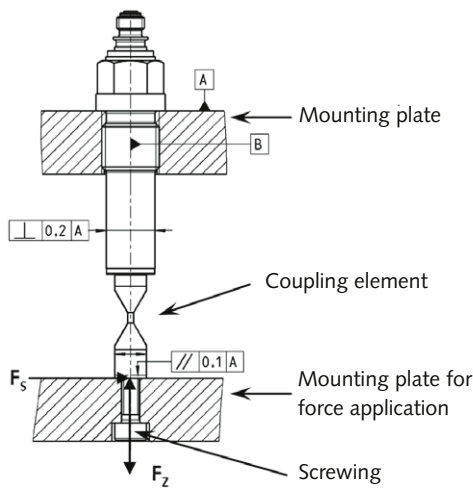


Fig. 4: Mounting with coupling element

Accessories

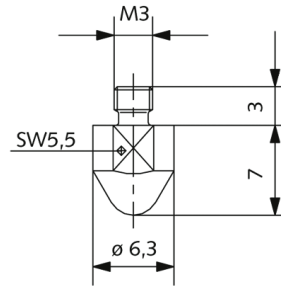


Fig. 5: Force introducing cap Art. No. 3.220.139 for Type 9217A/A1

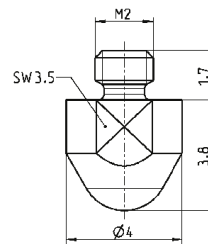


Fig. 6: Force introducing cap Art. No. 3.220.217 for Typ 9215A (included in delivery)

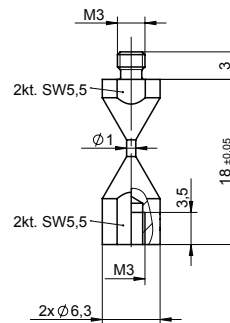


Fig. 7: Coupling element Type 9405 for Type 9217A/A1

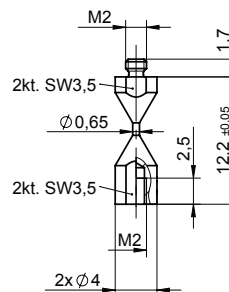


Fig. 8: Coupling element Type 9405A1 for Typ 9215A

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Optional Accessories

	Type
• Force introducing cap Type 9217A/A1	3.220.139
• Coupling element for Type 9217A/A1	9405
• Coupling element for Type 9215A	9405A1
• Connecting cable KIAG 10-32 pos. – BNC pos.	
Length 1 m	1631C1
Length 2 m	1631C2
Length 5 m	1631C5
Length 10 m	1631C10
• Connecting cable 10-32 pos. – BNC pos., highly flexible	
Length 1 m	1900A23A1201
Length 2 m	1900A23A1202
Length 3 m	1900A23A1203
Length 5 m	1900A23A1205
Length 10 m	1900A23A1210
• Connecting cable M4x0.35 pos. – BNC pos. for Type 9215A	
Length 1 m	1651C1
Length 2 m	1651C2
Length 5 m	1651C5
Length 10 m	1651C10
• Connecting cable M4x0,35 pos. – BNC pos., highly flexible	
Length 1 m	1900A23A2201
Length 2 m	1900A23A2202
Length 3 m	1900A23A2203
Length 5 m	1900A23A2205
Length 10 m	1900A23A2210
• Coupling for Type 9217A/A1 KIAG 10-32 neg. – KIAG 10-32 neg.	1729A
• Angle coupling for Type 9217A/A1 KIAG 10-32 pos. int. – KIAG 10-32 neg.	1700A29
• Cleaning and insulation spray 250 ml	1003
• Insulation testing device	5493

For connection, extension, and connecting cables, see data sheet for Cables for Force, Torque, and Strain Sensors (1631C_000-346).

For cable connectors, couplings, and accessories, see data sheet for Coaxial Cable Connectors (1700_000-347).

Ordering Code

	Type
• Sensor for small forces M5x0.5, axial connection, -20 ... 200 N	9215A
• Sensor for small tensile and compression forces M10x1, axial connection, -500 ... 500 N	9217A
• Sensor for small tensile and compression forces M10x1, axial connection, -50 ... 50 N	9217A1