

## Surface strain sensor

Type 9232A...

### Highly sensitive, -600 ... 600 $\mu\epsilon$

The strain sensor is suitable for measuring dynamic and quasi-static forces on fixed or moving machine parts. The sensor measures the force-proportional strain at machine or structural surfaces (indirect force measurement). The high sensitivity and acceleration-compensated design of the sensor allows process monitoring on fast-running process machinery (e.g. presses, automatic assembly machines).

- Very high measuring sensitivity even minute forces can be accurately measured.
- Because of its low acceleration sensitivity also suitable for measurements on moving parts.
- Measuring range for tensile and compression forces.
- Extremely simple installation as sensor is secured with only one M6 screw.
- Overload-proof design.
- Degree of protection IP65 (with cable connected).
- Ground-isolated version available for eliminating noise due to ground loops (Type 9232AU41 optional available).

#### Description

The strain of the basic material acts via the two contact surfaces on the sensor as a change in distance. The sensor enclosure serves as an elastic transmission element and converts the change in distance into a force. The piezoelectric elements subjected to shear strain produce an electric charge  $Q$  (pC) proportional to this force.

The particular advantages compared with the familiar wire strain gage technology rest in the high sensitivity, large overload resistance and practically unlimited life even under fluctuating loads.

The measuring signal can be further processed as a relative value. For absolute value measurements (e.g. in N or kN), the strain sensor must be calibrated against an appropriate reference.

The sensor design allows it to be used in industrial environments. With its connected cable, the measuring chain satisfies the requirements of protective class IP65. The top part of the strain sensor enclosure is made of stainless steel. A KIAG 10-32 neg. is the integrated connector. This allows the use of a broad selection of connecting cables (see notes on accessories).



#### Application

- Monitoring of all types of machinery in C-frame construction: e.g. presses and automatic assembly machines. Because of its easy installation, the sensor is ideal for retrofitting on existing machinery.
- Machine safety monitoring, e.g. protecting mechanical presses against overload.
- Quality control on manufacturing plants for joining processes, e.g. in orbital riveting, clinching or resistance spot welding.
- Monitoring machine tools, e.g. prompt detection of tool breakage or tool collision.

#### Technical data

Measuring range	$\mu\epsilon$	-600 ... 600
Overload	$\mu\epsilon$	-900 ... 900
Calibrated measuring range*	$\mu\epsilon$	0 ... 300 0 ... -300
Sensitivity*	pC/ $\mu\epsilon$	$\approx$ -80
Linearity	%FSO	$\approx$ $\leq$ $\pm$ 2
Hysteresis	%FSO	$\leq$ $\pm$ 3
Natural frequency	kHz	$\geq$ 12
Acceleration sensitivity		
in measuring direction	$\mu\epsilon/g$	$\leq$ $\pm$ 0.03
in transverse direction	$\mu\epsilon/g$	$\leq$ $\pm$ 0.02
in fastening direction	$\mu\epsilon/g$	$\leq$ $\pm$ 0.01
Operating temperature range	$^{\circ}\text{C}$	0 ... 70
Insulation resistance		
at 20 $^{\circ}\text{C}$	$\Omega$	$\geq$ $10^{13}$
at 70 $^{\circ}\text{C}$	$\Omega$	$\geq$ $10^{10}$
Degree of protection (with cable connected)	EN60529	IP65
Weight	g	50

\* Data apply only to the test arrangement used at Kistler. For an accurate force measurement, the sensor must be recalibrated after mounting.

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This information corresponds to the current state of knowledge. Kistler reserves the right to make technical changes. Liability for consequential damage resulting from the use of Kistler products is excluded.

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**Dimensions**

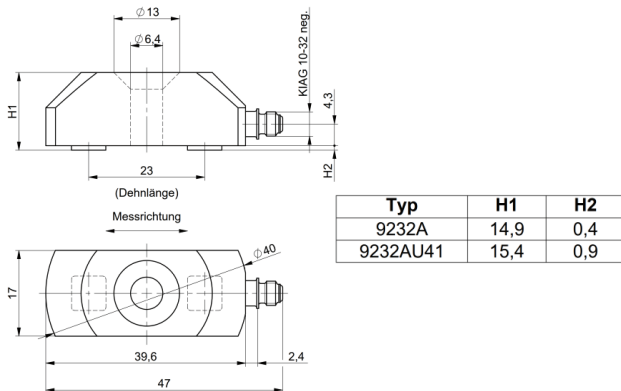


Fig. 1: Strain sensor Type 9232A...

**Mounting**

- Alignment of the sensor to the machine structure. The measuring axis should be positioned according to the best possible strain curve.
- The cable run close to the sensor should be as free as possible from pushing or pulling forces. The cable should be clamped in place to avoid strain or vibration transmission.
- Machining the surface at the measuring point and tapping the M6 thread (see Fig. 2).

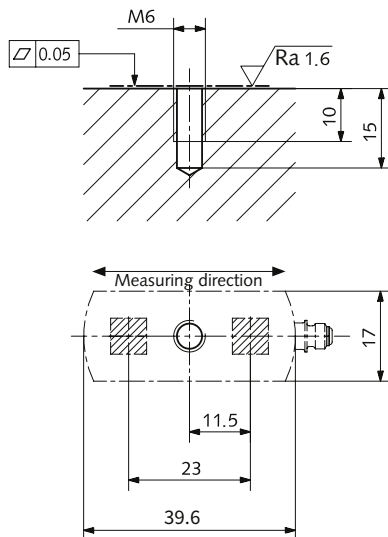


Fig. 2: Preparing the clamping surface

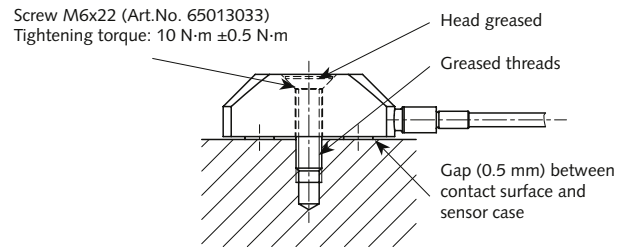
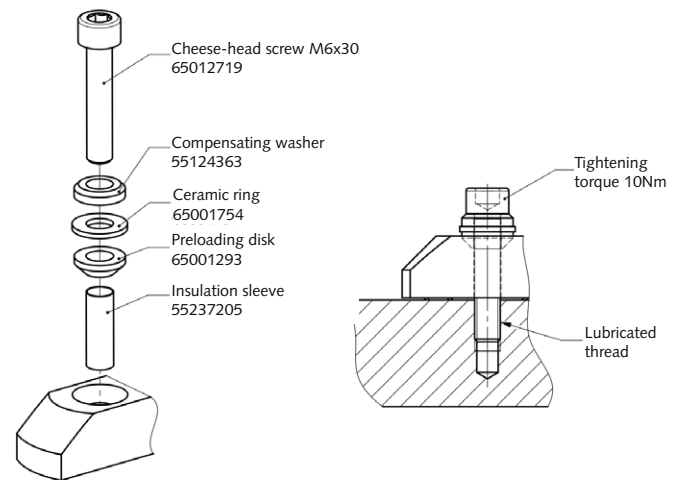


Fig. 3: Mounting Type 9232A



Note: Ceramic ring 65001754 is for one-time use only. It has to be replaced once sensor pretension is removed, since there is a high chance it will crack during pretension removal.

Fig. 4: Mounting Type 9232AU41

**Examples of measuring chains**

Strain sensor Type 9232A... combined with industrial charge amplifier Type 5073A... mounted on a structural surface.

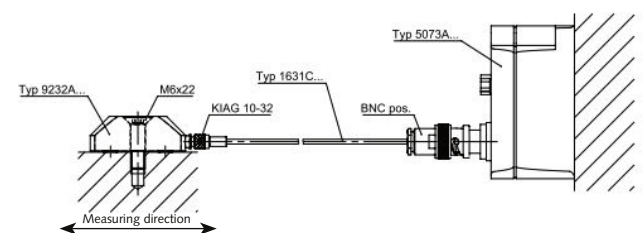


Fig. 5: Strain sensor Type 9232A... with industrial charge amplifier Type 5073A...

9232A\_000-137e-12.24

Parallel connection of two strain sensors Type 9232A... with industrial charge amplifier Type 5073A5. The amplifier sums the charge inputs.

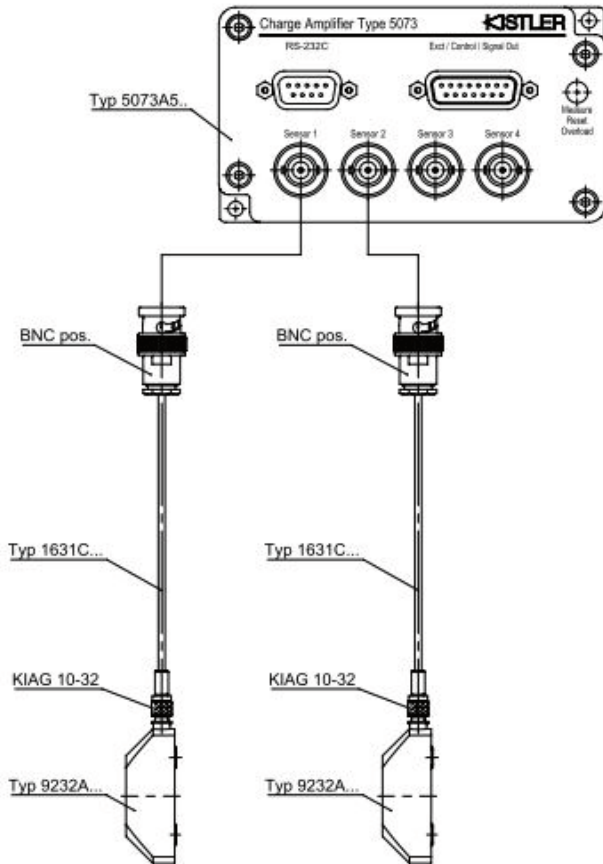


Fig. 6: Strain sensor Type 9232A... with industrial charge amplifier Type 5073A5

### Accessories included for Type 9232A

- Countersunk screw M6x22
- Special grease, tube, 5 g

### Art. No.

65013033  
18000009

### Accessories included for Type 9232AU41

- Cheese-head screw M6x30 with hexagon slot
- Compensating washer D12/6,4x3
- Ceramic ring D13/6,4x1,2
- Preloading disk D12/6,5x4
- Insulation sleeve D6,4/6x20,7
- Special grease, tube, 5 g

### Art. No.

65012719  
55124363  
65001754  
65001293  
55237205  
18000009

### Optional accessories Type 9232AU41Z1

- Connecting cable, KIAG 10-32 pos. – BNC pos. 1631C...
- Connecting cable, KIAG 10-32 pos. – KIAG 10-32 pos. 1635C...
- Connecting cable, KIAG 10-32 pos. – BNC pos., with robust metal protection hose 1900A21A12...
- Connecting cable, KIAG 10-32 pos. – KIAG 10-32 pos., with robust metal protection hose 1900A21A11...
- Connecting cable, KIAG 10-32 pos. – BNC pos., highly flexible, drag chain suitable 1900A23A12...
- Connecting cable, KIAG 10-32 pos. – KIAG 10-32 pos., highly flexible, drag chain suitable 1900A23A11...
- Further connecting cables (see data sheet cables for force, torque and strain sensors 1631C\_000-346)
- Insulation pad for 9232AU41 9232AU41Z1
- Mounting set for preparation of the clamping surface for strain sensors 9431B

### Ordering key

Type 9232A

Surface Strain Sensor	-	↑
Highly Sensitive, -600 ... 600 $\mu\epsilon$		
ground-isolated version	U41	