

## Set SlimLine

Type 9143BA... to 9147BA...

### with Integrated, Single-Component SlimLine Shear Force Sensor

Ready-to-connect compact assembly kit with integrated, single-component SlimLine (SLS) shear force sensors. 2, 3 or 4 ultra-flat quartz sensors are contained in a fixed connection. Measurement of the total force (total signal) or partial force (individual signal) per sensor can be made with an appropriate connecting cable.

The SlimLine kit is supplied **uncalibrated**. The sensors must be calibrated in situ **after** mounting.

- Flexible, compact installation in structures
- Total or individual signals
- Cable length can be chosen for each sensor
- Sensors ground level

#### Description

The SlimLine kit consists of 2, 3 or 4 SLS sensors connected permanently to a connector. The cable length of the sensors can be individually selected between 0,1 m and 2 m.

The total force  $F$  to be measured is applied to the sensors through special preloaded or fitted elements. Each loaded sensor produces an electric charge proportional to its force component. The charge signals are fed out through electrodes and integrated cables.

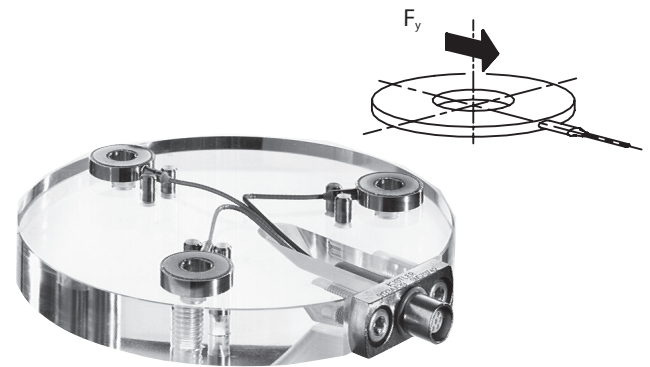
The individual sensor cables in the SL kit are connected permanently to a special 7-pole connector. The sensor signals in it are individually fed to the corresponding pin positions. The further signal processing can be determined by an appropriate connecting cable. The following versions are possible:

- Total signal (through connecting cable Type 1971A..., connector connected in parallel): Measurement of the total shear force  $F$ . The partial forces on each sensor are summed to give the total force.
- Individual signals (through connecting cable Type 1973A..., connector connected in series): Measurement of specific forces (force components) acting on the individual sensors.

#### Application

As a result of their great rigidity, SlimLine sensors are particularly suitable for the measurement of rapidly changing forces. Quasistatic measurements over several minutes are possible.

The SL assembly is particularly suitable for the measurement of shear forces in force shunt mode. This means that the sensors are embedded and preloaded in an/a environmental/surrounding structure. Thanks to its small design, the sensor



can be installed in structures like force plates, fitting strips and follow-on tools. The sensor is used in industrial production processes where forces must be monitored or measured. Connected to a control monitor, the sensor is ideal for quality control and monitoring of production series.

#### Application Examples

- Monitoring of shear forces in machinery, tools and assembly processes.
- Construction of platforms and dynamometers with small dimensions.

#### Technical Data

Set SlimLine	SlimLine Sensor	Range $F_y$ (kN)	Overload $F_y$ (kN)	Sensitivity (pC/N)
9143BA...	9143B...	0 ... $\pm 0,9$	1,1	$\approx -6,5$
9144BA...	9144B...	0 ... $\pm 1,7$	2,0	$\approx -7,5$
9145BA...	9145B...	0 ... $\pm 2,7$	3,3	$\approx -7,5$
9146BA...	9146B...	0 ... $\pm 4,0$	4,7	$\approx -7,5$
9147BA...	9147B...	0 ... $\pm 8,0$	10,0	$\approx -8,1$

#### Further Technical Data

Linearity (preloaded)	%/FSO	$\leq \pm 1,0$
Hysteresis (preloaded)	%/FSO	$\leq 1,0$
Threshold	N	$< 0,01$
Operating temperature range	$^{\circ}\text{C}$	$-20 \dots 120$
Preloading force (recommended)	$F_p$	
Axial <sup>1)</sup>	FS	$\approx 10x$
Degree of protection <sup>2)</sup>	EN60529	IP65

<sup>1)</sup> Can not be measured with the sensor.

<sup>2)</sup> The degree of protection according EN60529 is determined by water, oil, emulsions, cooling lubricant etc. have mostly a better wetting and penetration ability. The degree of protection in contact with such liquid is classified accordingly lower.

**Dimensions of the Individual Sensors**

Set	D External diameter (mm)	d Internal diameter (mm)	Height (mm)
SlimLine			
9143BA...	16	6,1	3,5
9144BA...	20	8,1	3,5
9145BA...	24	10,1	3,5
9146BA...	30	12,1	4,0
9147BA...	36	14,1	5,0

**Mounting**

A shear force sensor must always be fitted under preload, since the shear forces are transmitted by stiction. The contact surfaces with the sensor must be absolutely free of grease, finish machined and rigid. The adjacent table contains the most important information concerning preloading. Note: The stated tightening torque applies only to the screw thread M mentioned (lightly greased). Markings on the sensor case facilitate its alignment. Two pins can be used to prevent the sensor from turning during its installation (Fig. 2). **The SlimLine kit is supplied uncalibrated. Only after mounting can the sensitivity be determined through calibration.**

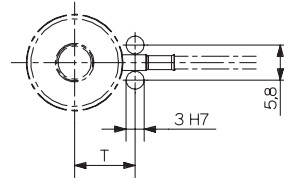


Fig. 2: Two pins prevent the sensor from turning

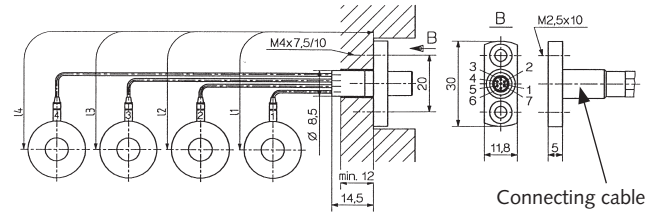


Fig. 3: Set SlimLine

Basic Type	Range $F_y$ [kN]	Preloading Force $F_p$ [kN]	Tightening Torque [N·m]
9143B...	0,9	9,0	10,0
9144B...	1,7	17,0	23,0
9145B...	2,7	27,0	46,0
9146B...	4,0	40,0	79,0
9147B...	8,0	80,0	135,0

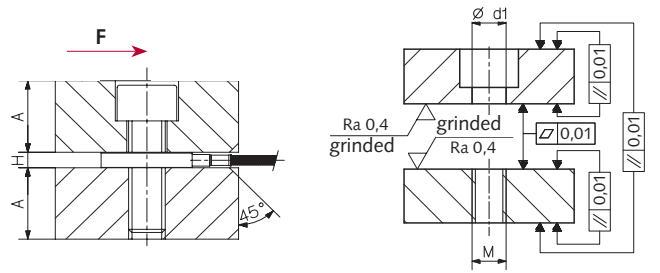
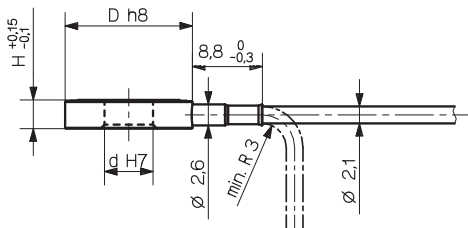


Fig. 4: Mounting dimensions with direct force measurement

→ Measuring direction +  $F_y$  cover plate



← Measuring direction -  $F_y$  base plate

Fig. 1: Dimensions SlimLine Sensor

**Installation Examples in Shear Force Plates**

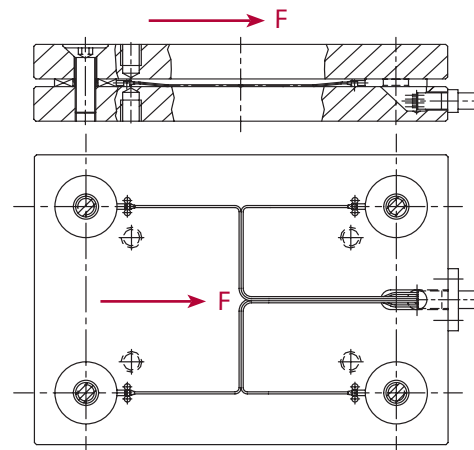


Fig. 5: Single-component dynamometer. Measurement of shear forces  $F_y$ . Note: two sensors must be fitted so that they are arranged around the connector axis.

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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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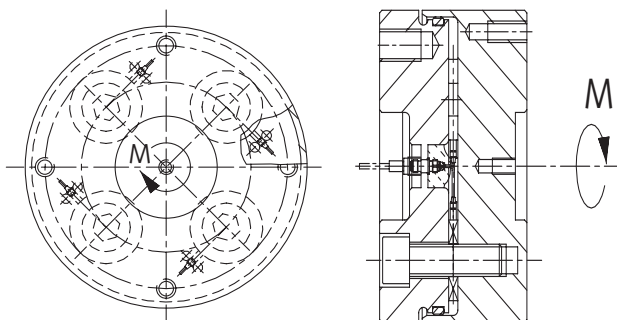


Fig. 6: Torque dynamometer. The resultant torque  $M$  can be calculated by measuring the shear forces  $F_s$ .

### Preloading Disk

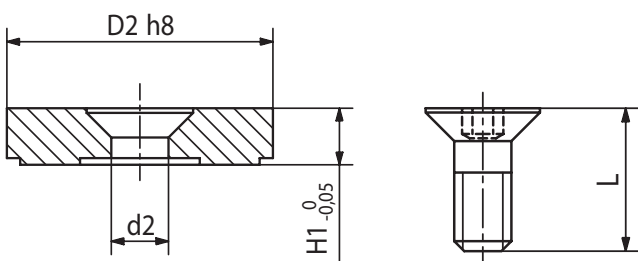


Fig. 7: One countersunk screw is delivered with each preloading disk.

Type	9410A3	9410A4	9410A5	9410A6	9410A7
for SLS Type	9143B...	9144B...	9145B...	9146B...	9147B...
Thread	M3	M4	M5	M6	M8
Inner- $\varnothing$ D2	16,0	20,0	24,0	30,0	36,0
Outer- $\varnothing$ d2	3,2	4,3	5,3	6,4	8,4
Disk thickness H1	4,25	4,25	4,25	5,5	7,0
Screw length L	10,0	10,0	10,0	14,0	16,0

You can find more information in data sheet 9143B\_000-113 "SlimLine Sensors" .

### Insulating Foils

Insulating foils are available for ground-insulated installation. The friction between sensor and base or cover plate is not reduced by this foil, but increased.

**Two insulating foils need to be ordered for every sensor of the SlimLine Set.**

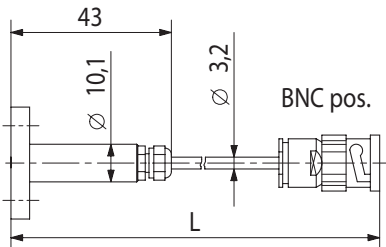
For Sensor	Type	9143B...	9144B...	9145B...	9146B...	9147B...
Insulating foil	Art. Nr.	3.221.284	3.221.285	3.221.286	3.221.287	3.221.487
Outer- $\varnothing$	mm	16	20	24	30	36
Inner- $\varnothing$	mm	6,1	8,1	10,1	12,1	14,1
Thickness	mm	0,125	0,125	0,125	0,125	0,125

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### Connecting Cable

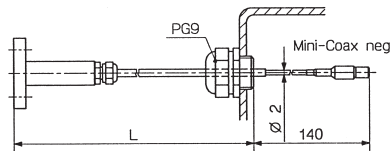
#### Connecting Cable for Total Signal (Sums All)

Type 1971AX1..., Plug connection: BNC pos.



For connecting to charge amplifier Types: 5058A..., CoMo and 5855B...

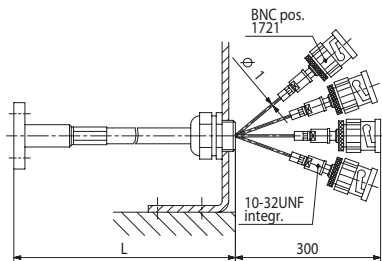
Type 1971AX2..., Plug connection: Mini-Coax neg.



For connecting to charge amplifier Types: 5034A..., 5037B... and 5038A...

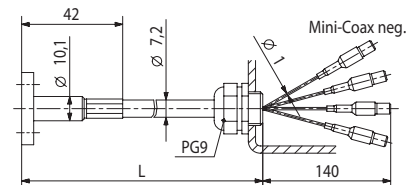
#### Connecting Cable for Single Signal

Type 1973AX1..., Plug connection: BNC pos.



For connecting to charge amplifier Types: 5058A..., 5073A..., CoMo and 5855B...

Type 1971AX2..., Plug connection: Mini-Coax neg.



For connecting to charge amplifier Types: 5034A..., 5037B... and 5038A...

(X = Number of sensors in set)

#### Optional Accessories

- Preloading disk for SL Set Type 9143BA...
- Preloading disk for SL Set Type 9144BA...
- Preloading disk for SL Set Type 9145BA...
- Preloading disk for SL Set Type 9146BA...
- Preloading disk for SL Set Type 9147BA...

#### Type

- 9410A3
- 9410A4
- 9410A5
- 9410A6
- 9410A7

#### Ordering Key for Set SlimLine

Type 914  BA  9

#### Measuring Range

Set with SL sensor Type 9143B...	3
Set with SL sensor Type 9144B...	4
Set with SL sensor Type 9145B...	5
Set with SL sensor Type 9146B...	6
Set with SL sensor Type 9147B...	7

Set with 2 sensors	2
Set with 3 sensors	3
Set with 4 sensors	4

Specify cable length for each cable separately  
 l = 0,1 ... 2 m  
 (l1 = ..., l2 = ..., usw.)

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