

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 grinded to same height

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 pretensioned 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.

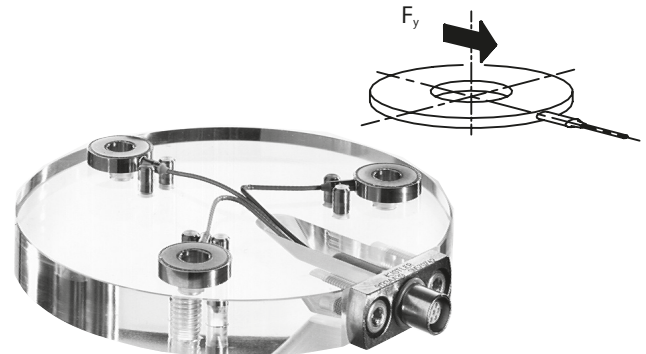
The individual sensor cables in the SL kit are connected **inseparable** to a special 7-pole connector. Sensors and connector are firmly connected and cannot be separated. The sensor signals in it are individually fed to the corresponding pin positions. The further signal processing can be determined 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 sen-



sors are embedded and pretensioned 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 incl. hysteresis (pretensioned)	% FSO	$\leq \pm 1,0$
Threshold	N	$< 0,01$
Operating temperature range	$^{\circ}\text{C}$	-20 ... 120
Degree of protection ¹⁾	EN60529	IP65

¹⁾ 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 SlimLine	D External diameter (mm)	d Internal diameter (mm)	Height (mm)
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

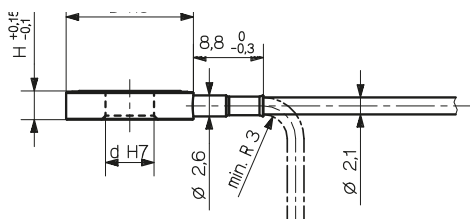
Mounting

A shear force sensor must always be fitted under pre-tension, 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 pretensioning. 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.**

Basic Type	Range	Pretensioning Force ¹⁾	Tightening Torque [N·m]
	F _y [kN]	F _p [kN]	
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

¹⁾ Can not be measured with the sensor

→ Measuring direction + F_y cover plate



← Measuring direction - F_y base plate

Fig. 1: Dimensions SlimLine Sensor

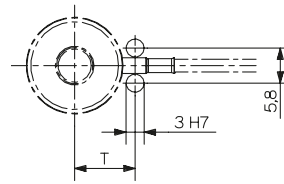


Fig. 2: Two pins prevent the sensor from turning

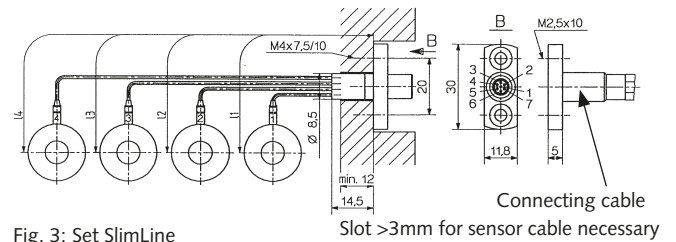


Fig. 3: Set SlimLine

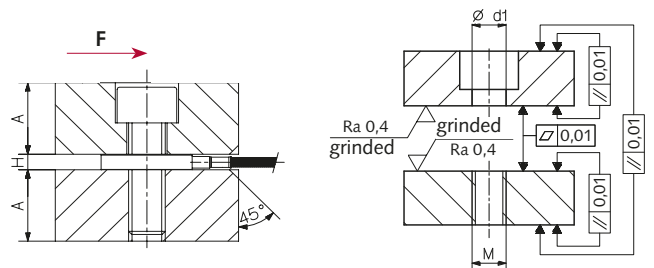


Fig. 4: Mounting dimensions with direct force measurement

Installation Examples in Shear Force Plates

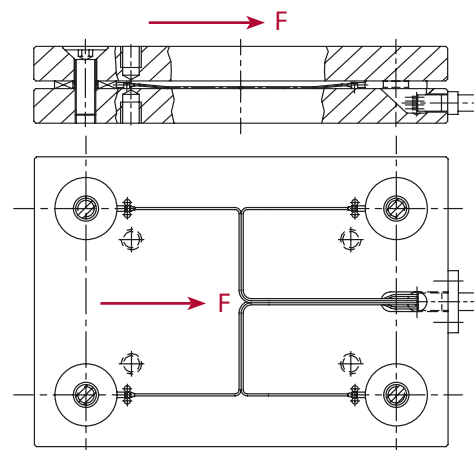


Fig. 5: Single-component dynamometer. Measurement of shear forces F_y. Note: two sensors must be fitted so that they are arranged around the connector axis.

9143BA to 9147BA_000-766e-09.16

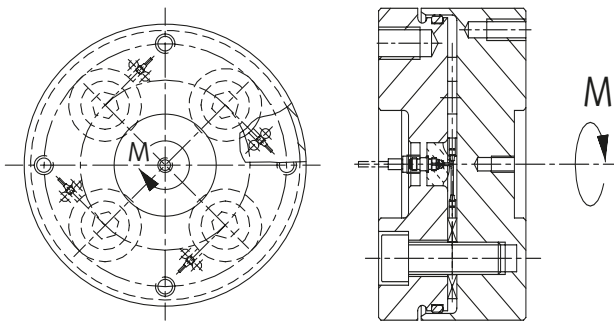


Fig. 6: Torque dynamometer. The resultant torque M can be calculated by measuring the shear forces F_s .

Pretensioning Disk

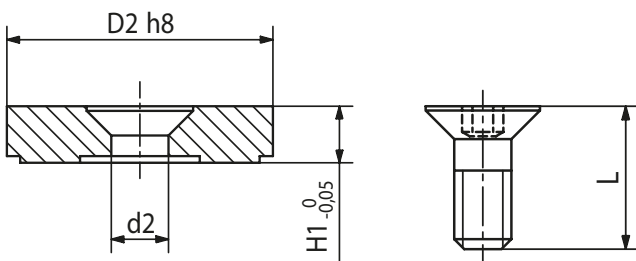


Fig. 7: One countersunk screw is delivered with each pretensioning disk.

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.

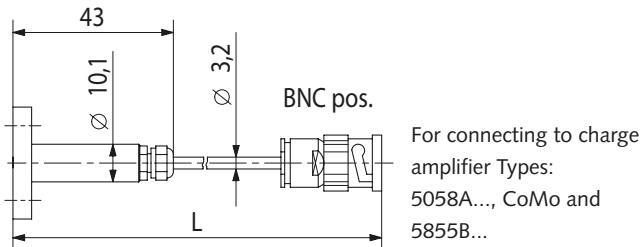
Two insulating foils need to be ordered for every sensor of the SlimLine Set.

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

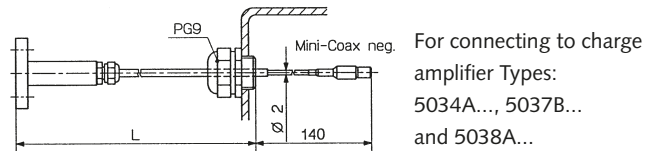
Connecting Cable

Connecting Cable for Total Signal (Sums All)

Type 1971A_1_, Plug connection: BNC pos.

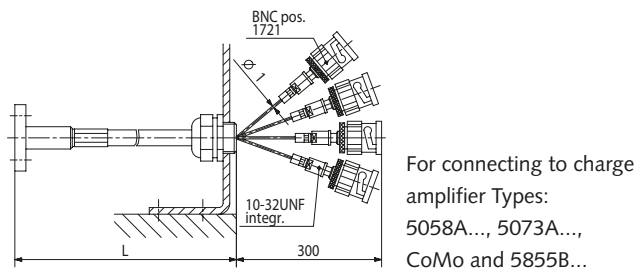


Type 1971A_2_, Plug connection: Mini-Coax neg.

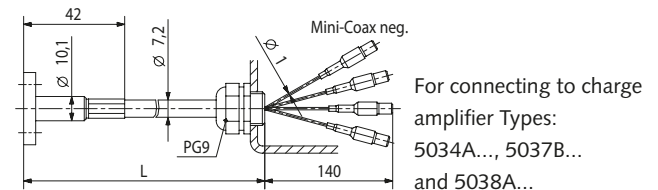


Connecting Cable for Single Signal

Type 1973A_1_, Plug connection: KIAG 10-32 pos.



Type 1973A_2_, Plug connection: Mini-Coax neg.



(Coupling Type 1721 is part of the delivery)

Optional Accessories

	Type
• Pretensioning disk for SL set Type 9143BA...	9410A3
• Pretensioning disk for SL set Type 9144BA...	9410A4
• Pretensioning disk for SL set Type 9145BA...	9410A5
• Pretensioning disk for SL set Type 9146BA...	9410A6
• Pretensioning disk for SL set Type 9147BA...	9410A7

Ordering Key for Set SlimLine

Type 914 BA 9

Measuring Range

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

Kit with 2 sensors	2
Kit with 3 sensors	3
Kit with 4 sensors	4

Specify cable length for each cable separately

$l = 0,1 \dots 2 \text{ m}$

($l_1 = \dots, l_2 = \dots$, etc)

Connecting Cable for Total Signal (Sums All)

Type 1971A

Cable lengths

Standard length, 3 m, BNC pos.	11
Cable length depends on ordering, BNC pos.	19
Standard length, 3 m, Mini Coax neg.	21
Cable length depends on ordering, Mini Coax neg.	29

Connecting Cable for Single Signal

Type 1973A

Sensor Number

2 sensors	2
3 sensors	3
4 sensors	4

Connector Type

KIAG 10-32 positive	1
Mini-Coax negative	2

Cable Lengths

Standard length, 3 m	1
Cable length depends on ordering	9