

Piezoelectric force sensor kit SlimLine

Piezoelectric force sensor kit

Type 9130CA..., 9132CA...,
9133CA, 9134CA...,
9135CA..., 9136CA...,
9137CA...

Ready-to-connect, compact measuring kit with integrated piezoelectric force sensors or piezoelectric load cells in the SlimLine format. 2, 3 or 4 of the ultra-flat quartz measuring load washers are grouped together in a fixed plug connection. The measurement of the total force (summation signal) or of the partial force (single signal per sensor) can be performed with an appropriate connecting cable.

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

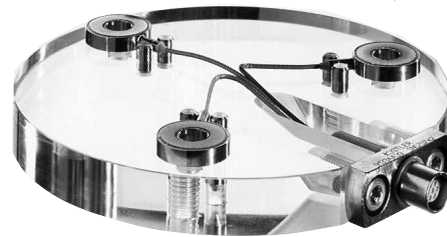
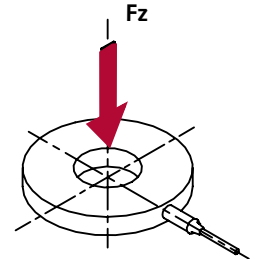
- Flexible, compact installation in structures
- Total or single signals
- Cable length can be chosen for each sensor
- Sensors ground to the same height

Description

The Kit 913xCA consists of 2, 3 or 4 SlimLine force sensors that are grouped into a single, permanent, plug connection. The cable lengths of the sensors can be individually selected between 0.1 m and 2 m.

The total force to be measured F_z acts on the sensors through the mounting or preloading elements. Each loaded sensor produces an electrical charge that is proportional to its force component. The charge signals are fed out through electrodes and integrated cables.

The individual sensor cables in the SlimLine kit are guided separately and **inseparably** to the corresponding pin positions of the 7-pin plug connection. With connecting cables Type 1971A or Type 1973A, the signals can be summed or individually passed on to the charge amplifier as necessary.



Application

SlimLine sensors are particularly suitable for measuring rapidly changing forces thanks to their enormous rigidity. Measurements over several minutes are possible. The extremely compact design is especially convenient for installation in structures such as force plates, fitting strips and follow-on tools. The kit is used in industrial manufacturing processes where forces are monitored or measured. In combination with a ControlMonitor, the kit is ideally suited for quality control and monitoring in industrial series production.

Application examples

- Monitoring of pressing forces, punching forces, etc.
- Monitoring of follow-on tools
- Measurement of large forces in force shunt mode
- Installation in dynamometers with small dimensions

Technical data

SlimLine kit	SlimLine Sensor	Range (kN)	Overload (kN)	Sensitivity (pC/N)
9130CA...	9130C...	0 ... 3	3.5	≈-3.7
9132CA...	9132C...	0 ... 7	8	≈-4.0
9133CA...	9133C...	0 ... 14	17	≈-4.0
9134CA...	9134C...	0 ... 26	30	≈-4.3
9135CA...	9135C...	0 ... 36	42	≈-4.3
9136CA...	9136C...	0 ... 62	72	≈-4.3
9137CA...	9137C...	0 ... 80	96	≈-4.0

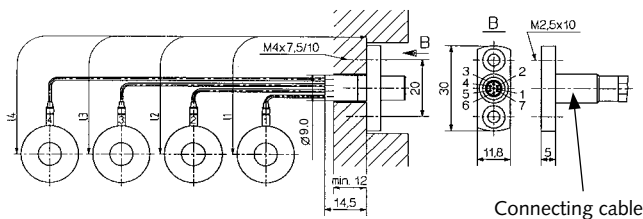


Fig. 1: SlimLine kit

For the detailed technical data, please refer to the data sheet of the individual sensors at www.kistler.com/force

9130CA_003-419e-03.20

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.

© 2020 Kistler Group, Eulachstraße 22, 8408 Winterthur, Switzerland
Tel. +41 52 224 11 11, info@kistler.com, www.kistler.com. Kistler Group products are protected by various intellectual property rights. For more details visit www.kistler.com.

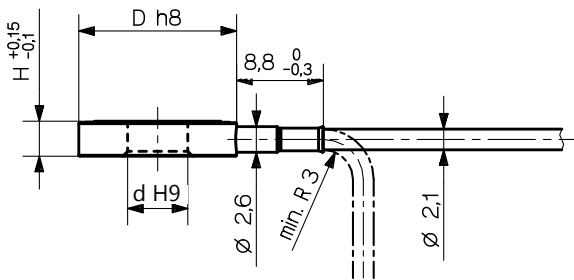


Fig. 2: SlimLine sensor dimensions

Sensor mounting

SlimLine sensors should generally be used only preloaded in a mounting structure:

- direct measurement in the force flux
- indirect measurement in force shunt mode

While most of the process force flows through the sensor with direct force measurement, with force shunt measurements it is loaded with only a very small part of the process force.

Direct measurement in the force flux

With direct force measurement, nearly the entire process force flows through the sensor. The measuring range must therefore be selected so that the sum of preloading force F_v and maximum occurring process force F_z is within the measuring range of the sensor. The mounting surfaces must be flat, stiff and ground (Fig. 3). The preloading bolt produces a force shunt of $\approx 7 \dots 10\%$ and a sensitivity that is reduced accordingly. In general, a preloading force of at least 20% of the measuring range is recommended; with tensile forces, proportionately more. If the process force permits, preloading of 50% of the measuring range should be used as the tolerance with respect to the bending moments is then at its greatest. Further explanations or calculation examples can be found in the data sheet or in the user manual.

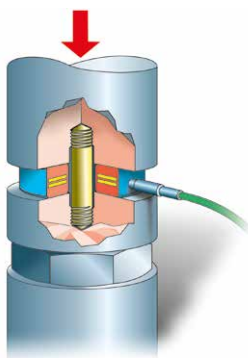


Fig. 3: Direct force measurement

Dimensions

Type	D [mm]	d [mm]	H [mm]
9130C...	8.0	2.7	3.0
9132C...	12.0	4.1	3.0
9133C...	16.0	6.1	3.5
9134C...	20.0	8.1	3.5
9135C...	24.0	10.1	3.5
9136C...	30.0	12.1	4.0
9137C...	36.0	14.1	5.0

Mounting dimensions

Mounting dimensions Type	Thread		Mounting d1 [mm]	Plate thickness ¹⁾ A [mm]
	M	Pitch		
9130C...	M2.5	0.45	2.9	8.0
9132C...	M4	0.7	4.3	8.0
9133C...	M6	1.0	6.4	12.0
9134C...	M8	1.25	8.4	16.0
9135C...	M10	1.5	10.5	20.0
9136C...	M12	1.75	13.0	24.0
9137C...	M14	2.0	15.0	27.0

¹⁾ Recommended minimum plate thickness

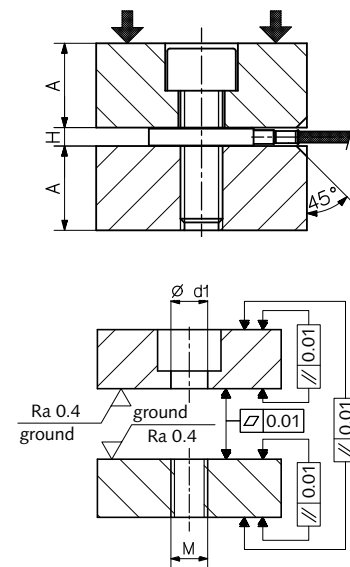


Fig. 4: Mounting dimensions for direct force measurement

9130CA_003-419e-03:20

Force shunt measurement

When mounted in force shunt mode, the SlimLine sensor can be used to solve a wide range of measurement problems. The mounting surface must be flat and ground as finely as possible. The SlimLine sensor is mounted preferably with a preloading disk from Kistler (optional accessory) and preloaded to approx. 20% of the measuring range. The structure and preloading disk are to be ground jointly, with the sensor mounted and preloaded. The slight projection P recommended for the preloading disk is achieved by removing the sensor and then again grinding over the structure one path with the same depth of cut. Such a procedure ensures a reproducible force shunt and good linearity.

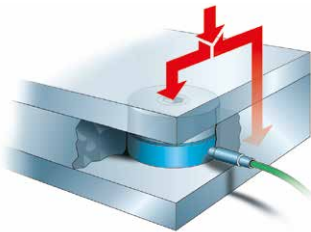


Fig. 5: Force shunt measurement

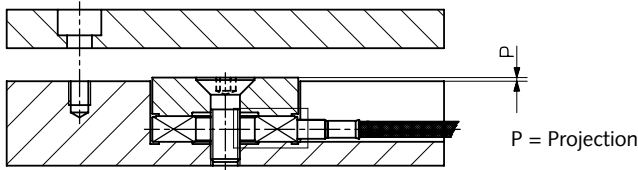


Fig. 6: Installation with preloading disk Type 9410A ...

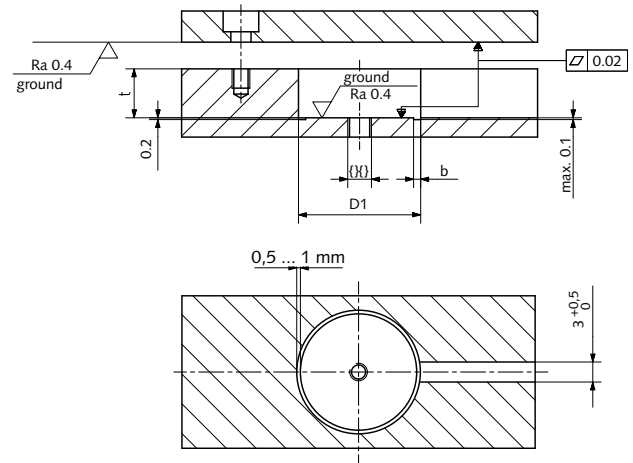


Fig. 7: Mounting in force shunt mode

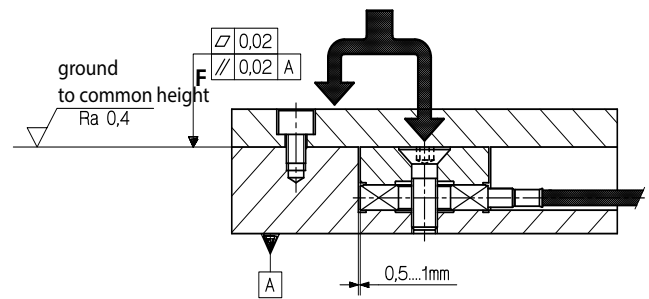


Fig. 8: Assembly with preloading disk Type 9410A...

Mounting dimensions

SlimLine sensor Type	Thread Ma	Bore diameter D1 [mm]	Bore depth t [mm]	Undercut b [mm]	Projection P [µm]
9130C...	M2	8.5	6.5	1.2	0 ... 2
9132C...	M2.5	12.5	6.5	1.2	0 ... 2
9133C...	M3	16.5	7.7	1.2	0 ... 3
9134C...	M4	20.5	7.7	1.2	0 ... 3
9135C...	M5	24.5	7.7	1.5	0 ... 3
9136C...	M6	30.5	9.5	1.5	0 ... 3
9137C...	M8	36.5	12.0	1.5	0 ... 3

Preloading disk

Type	for SlimLine Sensor	Thread	D2 [mm]	d2 [mm]	H1 [mm]	L [mm]
9410A0	9130C...	M2	8.0	2.7	3.50	8.0
9410A2	9132C...	M2.5	12.0	2.7	3.50	8.0
9410A3	9133C...	M3	16.0	3.2	4.25	10.0
9410A4	9134C...	M4	20.0	4.3	4.25	10.0
9410A5	9135C...	M5	24.0	5.3	4.25	10.0
9410A6	9136C...	M6	30.0	6.4	5.50	14.0
9410A7	9137C...	M8	36.0	8.4	7.00	16.0

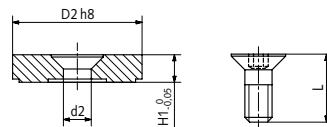
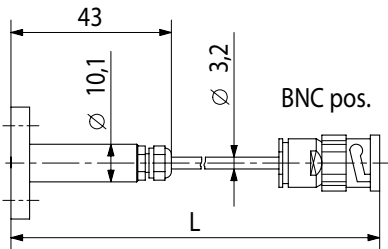


Fig. 9: Preloading disk with flat-head screw

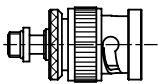
Connecting cable

Connecting cable for total signal (summed)

Type 1971A1_, plug connection: BNC pos.

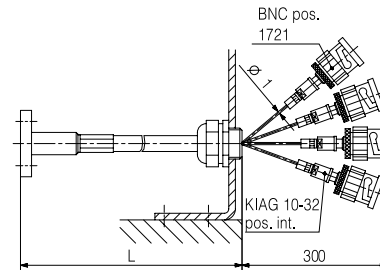


Coupling Type 1721



Connecting cable for single signals

Type 1973A_1_, plug connection: KIAG 10-32 pos. Coupling Type 1721 is supplied



Compatibilities of cables and charge amplifiers

Output Signal	Cable/Adapter	Cable Properties	Length [m]		Temp. Range	IEC/EN 60529	Connector Sensor	Connector Amplifier	IEC/EN 60529	Industrial Amplifier		Laboratory Amplifier									
			min	max						Channels	5030A	5039A	5073A...	5074A...	5877B...	5015A...	5018A...	5080A...	5165A...	5167A...	KIDAQ
sum	1	1971A1x	PFA	0.1	20	IP65	Fischer 7-pol	BNC pos.	IP40	-	✓	-	-	-	-	-	-	-	-		
		1971A3x	PFA	0.1	20			Fischer KE102A014-14		Plug screwed	-	✓	✓	-	-	-	-	-	-	-	-
		1971A4x	PFA	0.1	20			TNC pos.			IP65	✓	✓	-	-	-	-	-	-	-	-
		1971A5x	PFA	0.1	20			KIAG 10-32 pos. int.			IP65	✓	-	✓	-	-	-	-	-	-	-
add. Cable needed		-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				
separate	2	1973A21x	PFA	0.1	20	IP65	Fischer 7-pol	KIAG 10-32 pos. int.	IP65	✓	-	✓	-	-	-	-	-	-	-		
		1973A31x	PFA, PUR protection tube	0.1	20			KIAG 10-32 pos. int.		IP65	✓	-	✓	-	-	-	-	-	-	-	
		1973A41x	PUR protection tube	0.1	20			KIAG 10-32 pos. int.		IP65	✓	-	✓	-	-	-	-	-	-	-	
		add. Cable needed		-	-			-		-	-	-	-	-	-	-	-	-	-	-	-
	1721	Adapter for cables with KIAG 10-32 pos. int.			-55...200°C	IP65	KIAG 10-32 neg.	IP40	-	✓	-	✓	-	✓	✓	✓	✓	✓			
	1729A	Cable gland with KIAG 10-32 pos. int.					KIAG 10-32 neg.		IP65	✓	-	✓	-	-	-	-	-	-	-		

9130CA_003-419e-03:20

Optional accessories

- Preloading disk for SlimLine kit Type 9130CA...
- Preloading disk for SlimLine kit Type 9132CA...
- Preloading disk for SlimLine kit Type 9133CA...
- Preloading disk for SlimLine kit Type 9134CA...
- Preloading disk for SlimLine kit Type 9135CA...
- Preloading disk for SlimLine kit Type 9136CA...
- Preloading disk for SlimLine kit Type 9137CA...

Type
9410A0
9410A2
9410A3
9410A4
9410A5
9410A6
9410A7

Ordering key for the SlimLine kit

Type 913 CA 9

Measuring range

Kit with SlimLine sensor Type 9130C...	0
Kit with SlimLine sensor Type 9132C...	2
Kit with SlimLine sensor Type 9133C...	3
Kit with SlimLine sensor Type 9134C...	4
Kit with SlimLine sensor Type 9135C...	5
Kit with SlimLine sensor Type 9136C...	6
Kit with SlimLine sensor Type 9137C...	7

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

Specify the cable length for each sensor separately
 $l = 0.1 \dots 2 \text{ m}$
 ($l_1 = \dots, l_2 = \dots$, etc.)

Ordering key for connecting cables for total signal (summed)

Type 1971A

Cable lengths

Standard length, 3 m, BNC pos.	11
Cable length dependent on order, BNC pos.	19
Standard length, 3 m, TNC pos.	41
Cable length dependent on order, TNC pos.	49
Standard length, 3 m, KIAG 10-32 pos.	51
Cable length dependent on order, KIAG 10-32 pos.	59

Ordering key for connecting cables for single signals

Type 1973A

For number of sensors

2 sensors	2
3 sensors	3
4 sensors	4

Connector type

KIAG 10-32 positive	1
---------------------	---

Cable lengths

Standard length, 3 m	1
Cable length dependent on order	9

9130CA_003-419e-03:20