

3-Component Force Link

Type 9347C

55x55x60 mm, -30 ... 30 kN

Quartz force link for measuring the three orthogonal components of a dynamic or quasistatic force acting in an arbitrary direction.

- Accurate measurement independent of the force application point
- Wide frequency range
- Easy installation
- Stainless, sealed sensor case
- Rugged multipole plug connection

Description

The 3-component force sensor is mounted under preload between two plates and measures positive and negative forces in all three cartesian directions.

In accordance with the piezoelectric principle, a force produces a proportional electric charge. This is conducted via an electrode to the appropriate connector.

The simple and vibration-resistant design of the force link is very rigid resulting in a high natural frequency, which is a requirement for highly dynamic force measurements.

The 3-pole connector V3 neg. (design protected) is provided with a positioning aid. This guarantees accurate assignment and centering of the connector pins and sockets before connection. The plug connection is protected against rotation.

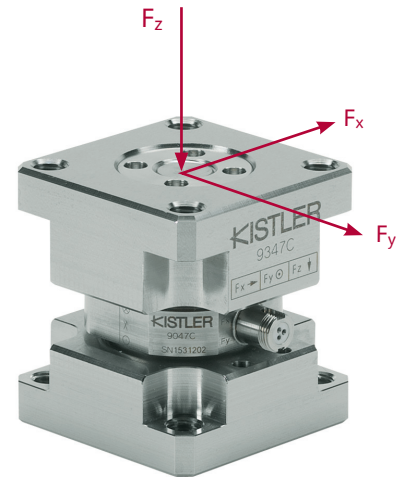
After correct installation, the sensor is ready to use immediately without recalibration.

Quartz 3-component force links allow simple, direct and very precise measurements.

Application

3-component force links measure:

- Cutting forces during machining
- Impact forces in crash tests
- Recoil forces of rocket engines
- Vibration forces of components for space travel
- Friction forces
- Forces in product testing
- Ground reaction forces in biomechanics
- Vehicle forces on a road and a test stand
- Forces on a wind tunnel balance



Technical Data

Range (Without moment loading, e.g. when four force links are mounted in a force plate)	F_x, F_y	kN	-15 ... 15
Range (Example with force application point on the surface of the cover plate)	F_x, F_y	kN	-5 ... 5
Range (Force application point centric)	F_z	kN	-30 ... 30
Overload	F_x, F_y, F_z	%	10
Calibrated range (Force application point 10 mm below the surface of the cover plate)	F_x, F_y	kN	0 ... 5 0 ... 0,5
Calibrated range (Force application point centric)	F_z	kN	0 ... 30 0 ... 3
Permissible moment load ($M_z = 0; F_z = 0$)	M_x, M_y	N·m	-150/150
Permissible moment load ($M_{x,y} = 0, F_z = 0$)	M_z	N·m	-150/150
Threshold		N	<0,01
Sensitivity	F_x, F_y	pC/N	≈-7,8
	F_z	pC/N	≈-3,7

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Other Technical Data

Linearity, each axis		%FSO	≤±0,5
Hysteresis, each axis		%FSO	≤0,5
Crosstalk (Crosstalk $F_x, F_y \rightarrow F_z$ is ≤±2 % when, for example, four force links are mounted in a dynamometer)	$F_z \rightarrow F_x, F_y$	%	≤±1
	$F_x \leftrightarrow F_y$	%	≤±2
	$F_x, F_y \rightarrow F_z$	%	≤±3
Rigidity	C_x, C_y	N/μm	≈500
	C_z	N/μm	≈1 300
Natural frequency	$f_n (x)$	kHz	≈3,6
	$f_n (y)$	kHz	≈3,6
	$f_n (z)$	kHz	≈10
Operating temperature range		°C	-40 ... 120
Insulation resistance at 20 °C		Ω	>10 ¹³
Ground insulated		Ω	>10 ⁸
Capacitance, each channel		pF	70
Connecting plug			V3 neg.
Weight		kg	1,0

Mounting

The two contact surfaces of the component which transfer the forces onto the force link must be flat, rigid and clean. When four force links are used to construct a dynamometer, they must be machined to the same level. The base and cover plates of the dynamometer must be selected for sufficient rigidity. The force links can be secured either from the outside using four M8 screws in each case or from the center also using four M6 screws in each case.

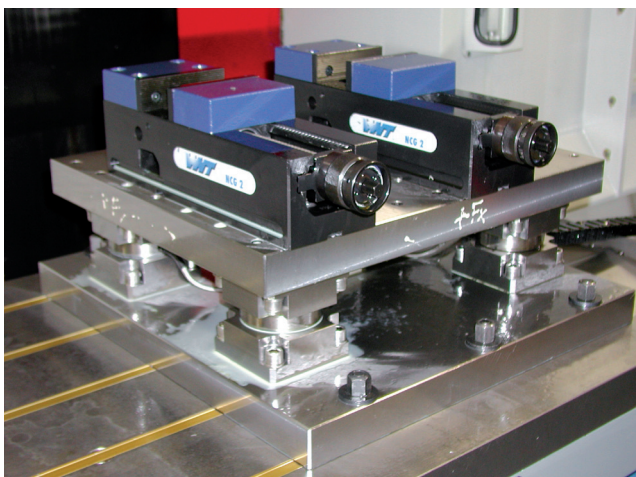


Fig. 1: Cutting force dynamometer constructed with four 3-component force links

Dimensions 3-Component Force Link Type 9347C

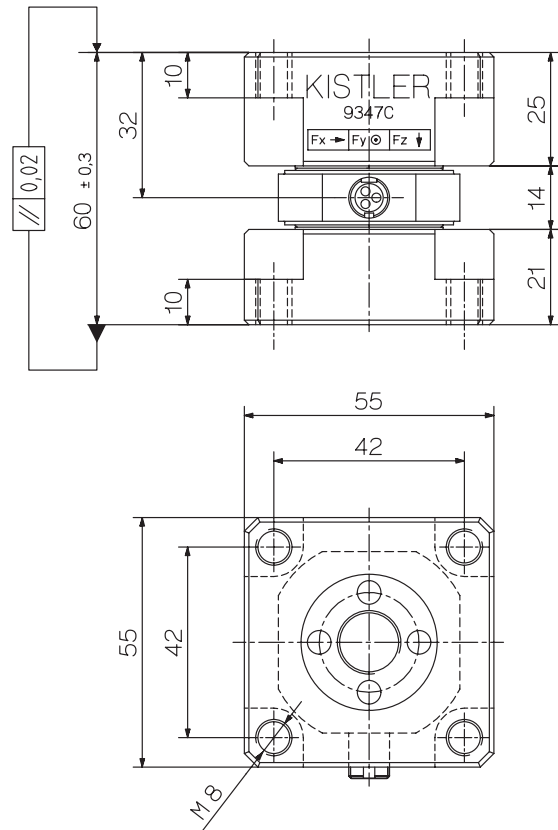
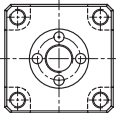
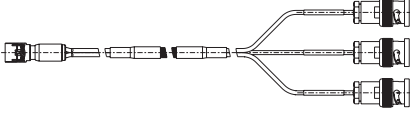
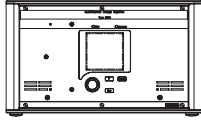
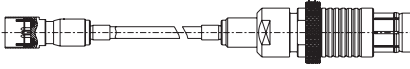
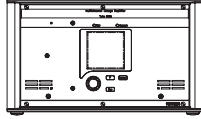
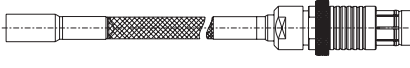


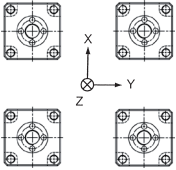

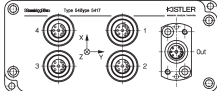
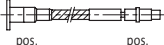
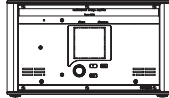


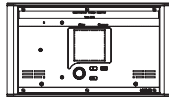
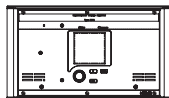
Fig. 2: Dimensions 3-component force link Type 9347C

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Measuring System with 3-Component Force Link

3-Comp. Force Link with V3 neg. Connector	Degree of Protection EN60529	Connecting Cable ¹⁾	Multichannel Charge Amplifier ²⁾	Reading
 V3 neg.	IP65	Type 1698AA...  V3 pos. 3 x BNC pos.	Type 5070Ax00xx 	F _x F _y F _z
		Type 1698AB...  V3 pos. Fischer 9-pole pos.	Type 5070Ax01xx 	
	IP67 cable welded to sensor	Type 1698ACsp  V3 pos. Fischer 9-pole pos.		

Measuring System with four 3-Component Force Links (Dynamometer)

3-Comp. Force Link with V3 neg. Connector	Degree of Protection EN60529	Connecting Cable ¹⁾	Summing Box	Connecting Cable ¹⁾	Multichannel Charge Amplifier ²⁾	Reading
Type 9347C 4 pcs.  4 x V3 neg.	IP65	Type 1698AB... 4 pcs.  V3 pos. Fischer 9-pole pos.	Type 5417 IP65  148x62x35 mm	Type 1687B... 3 wire  pos. pos.	Type 5070Ax01xx 	F _x F _y F _z
		IP67 cable welded to sensor	Type 1698ACsp 4 pcs.  V3 pos. Fischer 9-pole pos.	4 x Fischer 9-pole neg. Fischer Flange 9-pole neg.	Type 1677A... 8 wire  pos. pos.	Type 5070Ax11xx  Type 5070Ax21xx 

¹⁾ see data sheet cables for multi-component force sensors, dynamometers and force plates 1687B_000-545.

²⁾ see data sheet multi-channel charge amplifier for multi-component force measurement 5070A_000-485.

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Introduction of Force

When only one force link is used, then if at all possible the resulting force vector should run through the center of the sensor. An eccentric introduction of force produces a moment load on the sensor. This is allowed only up to the specified values. The maximum force ranges must be reduced accordingly.

A sufficiently rigidly constructed dynamometer with four force links largely prevents moment loads on the sensor element.

Parallel Connection

When a dynamometer is constructed, the four force links are connected mechanically in parallel. The measuring signals (electric charge) of the four sensors can also be connected in parallel (summed). The summed signal corresponds to the algebraic sum of the individual forces. The summing box Type 5417 allows simple and reliable connection of the measuring signals for the desired type of multi-component force measurement.



Fig. 3: Summing box Type 5417

Measuring Signal Processing

Charge amplifier channels are additionally required for the complete measuring system. These convert the measuring signal into a voltage. The reading is exactly proportional to the force applied.

The multichannel charge amplifier Type 5070A... has been designed specifically for multi-component force measuring systems.



Fig. 4: Multichannel charge amplifier Type 5070A...

Included Accessories

- None

Optional Accessories

- Connecting cable, 3 wire
- Connecting cable, 3 wire
- Connecting cable, 3 wire
- Summing box

Type

- 1698AA...
- 1698AB...
- 1698ACsp
- 5417

Ordering Code

- **3-Component Force Link**
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Type

- 9347C**

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