

3-Component Quartz Force Link

Typ 9327C

42x42x42 mm, -8 ... 8 kN

Quartz force links are able to measure the three perpendicular components of a dynamic or quasistatic force in any direction.

- Precise measurement regardless of the acting point of the force
- Large useable frequency range
- Compact size
- Rust free and sealed sensor case
- Plug connection via robust multipole connector

Description

The 3-component force sensor is mounted under preload between two mounting flanges. The quartz force link can therefore measure compression and tensile forces.

The force measurement of the sensor is based on the piezoelectric principle. The application of a force results in the quartz washers in the sensor (one for each of the force components to be measured) yielding a charge proportional to the force. This is picked off by built-in electrodes and transferred to the corresponding connector.

The contact faces of the sensor are covered with ceramic discs to facilitate ground-isolated mounting of the sensor. The straightforward and vibration-resistant design of the sensor produces a very rigid structure. The resulting high natural frequency makes highly dynamic force measurements possible over a large frequency range.

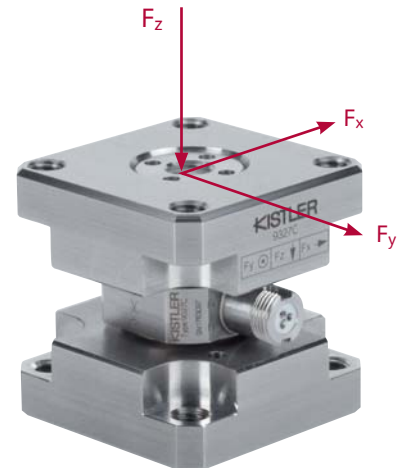
The cable connection of the sensors is made via a 3-pole connector V3 neg. (design patented). This is provided with a positioning aid for simple centering that also protects the plug and receptacle connector against unintended rotation.

After correct mounting the sensor is immediately ready for use without recalibration.

Application

Kistler 3-component quartz force links measure simply, directly and precisely. They are used in the measurement of:

- Cutting forces in metal cutting processes
- Collision forces in crash tests
- Recoil forces of rocket motors
- Vibration and friction forces
- Ground reaction forces in biomechanics
- Vehicle forces on the road and test bed
- Forces on wind tunnel balances



Technical Data

Range	F_x, F_y	kN	-4 ... 4
(without moment loading, e.g. if four measuring elements are mounted on a platform)			
Range	F_x, F_y	kN	-1 ... 1
(example with force application point of the cover plate surface)			
Range	F_z	kN	-8 ... 8
(central force application point)			
Overload	F_x, F_y, F_z	%	20
Calibrated range	F_x, F_y	kN	0 ... 1
(force application point 8 mm below cover plate surface)			
Calibrated range	F_z	kN	0 ... 8
(central force application point)			
Permissible moment loading	M_x, M_y	N·m	-22/22
$(M_z = 0; F_z = 0)$			
Permissible moment loading	M_z	N·m	-23/23
$(M_{x,y} = 0, F_z = 0)$			
Threshold		N	<0,01
Sensitivity	F_x, F_y	pC/N	≈-7,8
	F_z	pC/N	≈-3,8

Additional Technical Data

Linearity, each axis	%FSO	≤±0,5
Hysteresis, each axis	%FSO	≤0,5
Crosstalk	F _z → F _x , F _y %	≤±1
(Crosstalk F _x , F _y → F _z)	F _x ↔ F _y %	≤±3
is ≤±2 %, if e.g. four force links are mounted in a dynamometer)	F _x , F _y → F _z %	≤±3
Natural frequency	f _n (x) kHz	≈3,2
	f _n (y) kHz	≈3,2
	f _n (z) kHz	≈12
Operating temperature range	°C	-40 ... 120
Insulation resistance at 20 °C	Ω	>10 ¹³
Ground isolation	Ω	>10 ⁸
Capacitance, each channel	pF	30
Connector		V3 neg.
Weight	g	380

Mounting

In order to ensure optimal force transmission onto the measuring element the contact surfaces must be flat, rigid and clean. If four measuring elements are used when building a measuring platform (dynamometer), these must be ground to the same height. To obtain good measuring results, the material used for the base and cover plate of the measuring platform (dynamometer) must be sufficiently rigid.

The measuring element can either be secured with four M6 bolts from outside or with four M5 bolts from the inside.

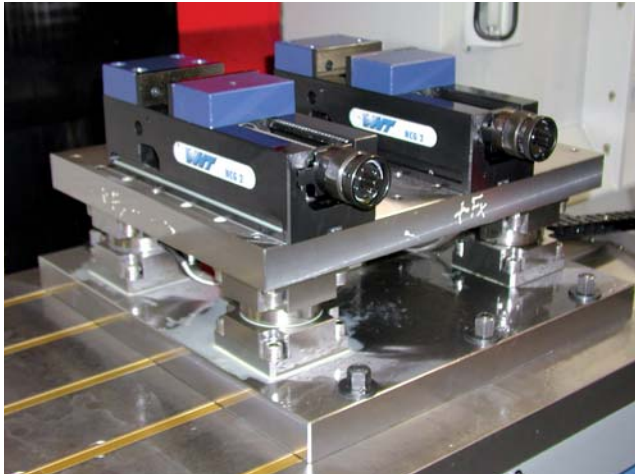


Fig. 1: Measuring platform for acquiring cutting forces, built with 3-component quartz force links

Dimensions of 3-Component Quartz Force Link Type 9327C

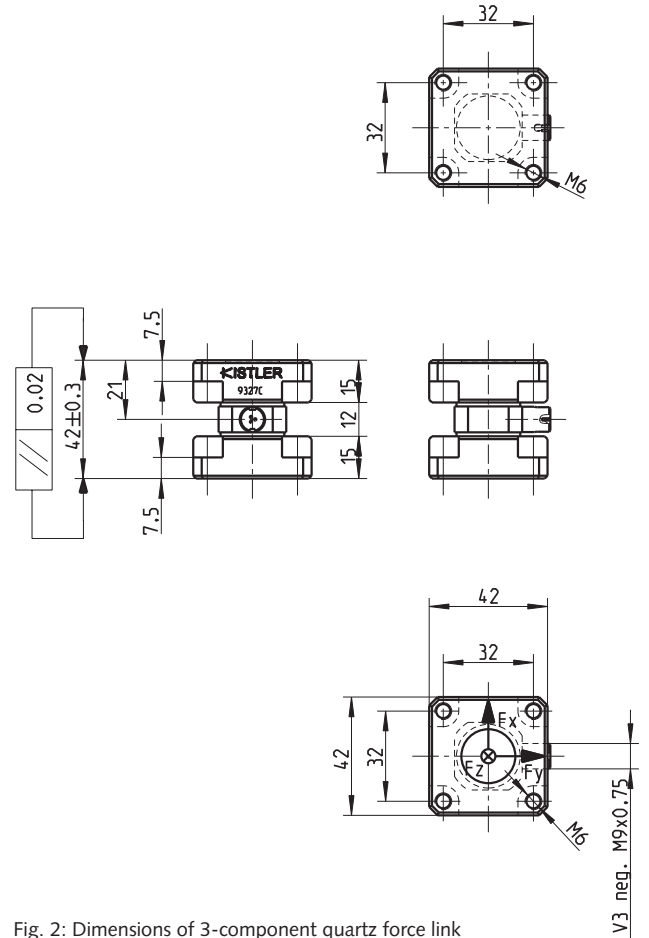
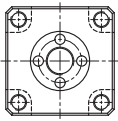
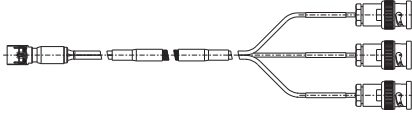
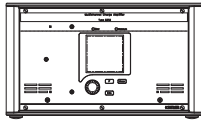
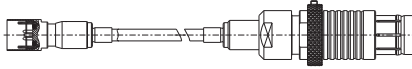
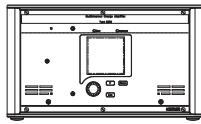
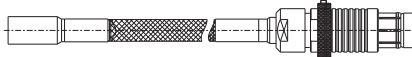


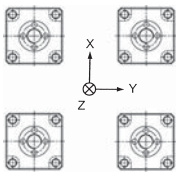
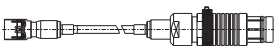
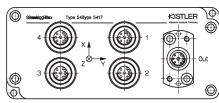

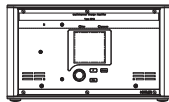

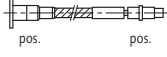
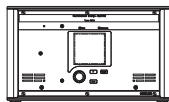
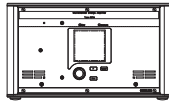
Fig. 2: Dimensions of 3-component quartz force link Type 9327C

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Measuring System with 3-Component Quartz Force Link

3-Component quartz force link with V3 neg. connector	Degree of protection EN60529	Connecting cable ¹⁾	Multichannel charge amplifier ²⁾	Meas. value
<p>Type 9327C</p>  <p>V3 neg.</p>	IP65	<p>Type 1698AA...</p>  <p>V3 pos. 3 x BNC pos.</p>	<p>Type 5070Ax00xx</p> 	<p>F_x F_y F_z</p>
		<p>Type 1698AB...</p>  <p>V3 pos. Fischer 9 pole pos.</p>	<p>Type 5070Ax01xx</p> 	
	IP67 Cable welded to sensor	<p>Type 1698ACsp</p>  <p>V3 pos. Fischer 9 pole pos.</p>		

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

3-Component quartz force link with V3 neg. connector	Degr. of prot. EN60529	Connecting cable ¹⁾	Summing box	Conn. cable ¹⁾	Multichannel charge amplifier ²⁾	Meas. value
<p>Type 9327C</p> <p>4 pieces</p>  <p>4 x V3 neg.</p>	IP65	<p>Type 1698AB...</p>  <p>V3 pos. Fischer 9 pole pos.</p>	<p>Type 5417</p> <p>IP65</p>  <p>148x62x35 mm</p>	<p>Type 1687B...</p>  <p>3-core pos. pos.</p>	<p>Type 5070Ax01xx</p> 	<p>F_x F_y F_z</p>
		IP67 Cable welded to sensor	<p>Type 1698ACsp</p>  <p>V3 pos. Fischer 9 pole pos.</p>	<p>4 x Fischer 9 pole neg. Fischer Flange 9 pole neg.</p>	<p>Type 1677A...</p>  <p>8-core pos. pos.</p>	<p>Type 5070Ax11xx</p> 
					<p>Type 5070Ax21xx</p> 	<p>F_x F_y F_z M_x M_y M_z</p>

¹⁾ see Cables for multicomponent force sensors, dynamometer and measuring platforms data sheet 1687B_000-545

²⁾ see Multichannel charge amplifier for multicomponent force measurement data sheet 5070A_000-485

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Force Application

If a single quartz force link is used, the resulting force vector should pass through the center of the sensor where possible. Eccentric force application creates a moment loading on the sensor. This is only permissible up to the specified values. The maximum force ranges must be reduced correspondingly.

A dynamometer of sufficiently rigid structure with four quartz force links prevents too great moment loading on the single sensor element.

Paralleling

When building a dynamometer, the four quartz force links are mechanically paralleled. The measuring signals (electric charge) of the four sensors can also be paralleled (summed). The summated signal corresponds to the algebraic total of the individual forces.

Type 5417 summing box facilitates the simple and reliable interconnection of measuring signals.



Fig. 3: Summing box Type 5417

Measuring Signal Processing

For the measuring system a charge amplifier is needed. This converts the measuring signal (charge) into a voltage. The value that is output is exactly proportional to the force.

Type 5070A... multichannel charge amplifier was built specifically for the multicomponent force measuring system.



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

There is also Type 5080A... charge amplifier. This provides an extended measuring range and a higher degree of accuracy, particularly when measuring low forces.



Fig. 5: Multichannel charge amplifier Type 5080A...

Included Accessories

- None

Optional Accessories

- Connecting cable, 3-core
- Connecting cable, 3-core
- Connecting cable, 3-core
- Summing box

Type	1698AA...
	1698AB...
	1698ACsp
	5417

Ordering Key

- **3-Component quartz force link**
42x42x42 mm, -8 ... 8 kN

Type	9327C
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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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