

Multicomponent Force Link Set

Type 9366CDsp

ø72 mm, -25 ... 60 kN

This is a ready-to-connect kit for customer assembly of multicomponent force plates. The size of the top plate can be chosen within wide limits.

- For assembling your multicomponent force plate
- Easy assembly
- Detachable sensor cables
- Reliable
- No recalibration necessary

Description

The 3-component force sensor is mounted between two flanges under preload. It is able to measure both compression and tensile forces in any direction. A force produces a proportional electric charge according to the piezoelectric principle. The simple, vibration-resistance design of the force link is very rigid in order to ensure a high natural frequency as required for highly dynamic force measurement.

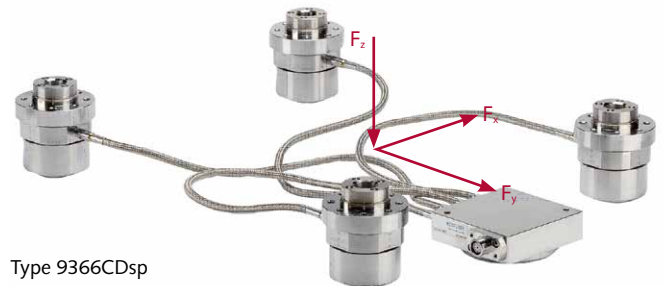
The outputs of the four force links are interconnected in the summing box to enable measurement of the three orthogonal forces F_x , F_y and F_z as well as 6-component force and moment (F_x , F_y , F_z , M_x , M_y and M_z) acquisition. The four sensors are mounted with ground isolation to largely rule out ground loop problems. The rustproof set is protected against entry of splashing water and coolant. Together with the connecting cable Type 1687B.../1677A... it satisfies the requirements for IP67 penetration. The summing box is available separately as Type 5447A.

Multicomponent quartz force links measure simply, directly and very accurately.

Applications

A multicomponent force plate measures:

- Cutting forces involved in metal-cutting machining
- Impact forces in crash tests
- Rocket engine thrust forces
- Vibration forces in aerospace components
- Friction forces
- Product testing forces
- On-road and test stand vehicle forces
- Forces on wind tunnel balances



Type 9366CDsp

Technical Data

Max. allowed measuring range	F_x and F_y	kN	-25 ... 25
mounted on steel top plate	F_z	kN	-25 ... 60
300x300x35 mm (LxWxH)			
Allowed measuring ranges	F_x , F_y and F_z		see Fig. 5
with top plates of various sizes			
Calibrating measuring range	F_x and F_y	kN	0 ... 25
mounted on steel top plate	F_z	kN	0 ... 60
300x300x35 mm (LxWxH)			
Calibrated partial measuring range	F_x , F_y and F_z	kN	0 ... 2,5
		kN	0 ... 6
Threshold		N	<0,01
Sensitivity, nominal	F_x , F_y and F_z	pC/N	≈-7,8
		pC/N	≈-3,8
Difference in sensitivity	F_x , F_y and F_z	%	±2
with top plates of various sizes			
Linearity, all ranges		%	FSO ±1
Hysteresis, all ranges		%	FSO ≤1
Crosstalk	$F_z \rightarrow F_x$ and F_y	%	2
	$F_x \leftrightarrow F_y$	%	2
	F_x and $F_y \rightarrow F_z$	%	2
Natural frequency	$f_n(x)$, $f_n(y)$ and $f_n(z)$		see Fig. 6
with mounted top plate			
Operating temperature range		°C	-20 ... 70
Capacitance of	x_i , y_i channels	pF	330
Type 9366CD (0.5 m cable)	z_i channels	pF	170
Insulation resistance at 20 °C		Ω	>10 ¹³
Ground isolation		Ω	>10 ⁸
Protection rating to EN 60519			IP67
Connection			Fischer flange 9-pin neg.
Weight of Type 9366CDsp		kg	≈7,0

Assembly

The multicomponent force link set is first connected to the 4 sensor cables of the summing box and then mounted on the prepared top plate fabricated as directed in the instruction manual. Four M12 Allen screws are then used to mount the fully assembled force plate on a flat, clean base plate. Uneven bearing surfaces induce internal stresses that substantially increase the loading on the individual force links and can increase crosstalk.

The four mounting holes in the top plate are sealed with a protective lid (optional accessory).

Once the set has been correctly assembled, the force plate is ready for immediate use without recalibration.

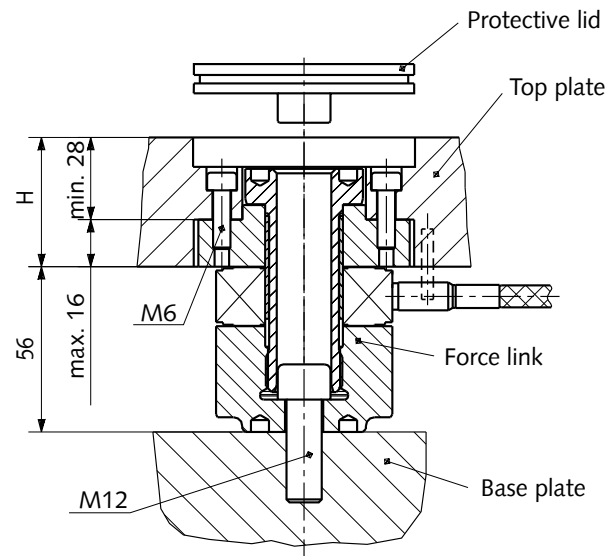


Fig. 1: Mounting set Type 9366CDsp

Dimensions

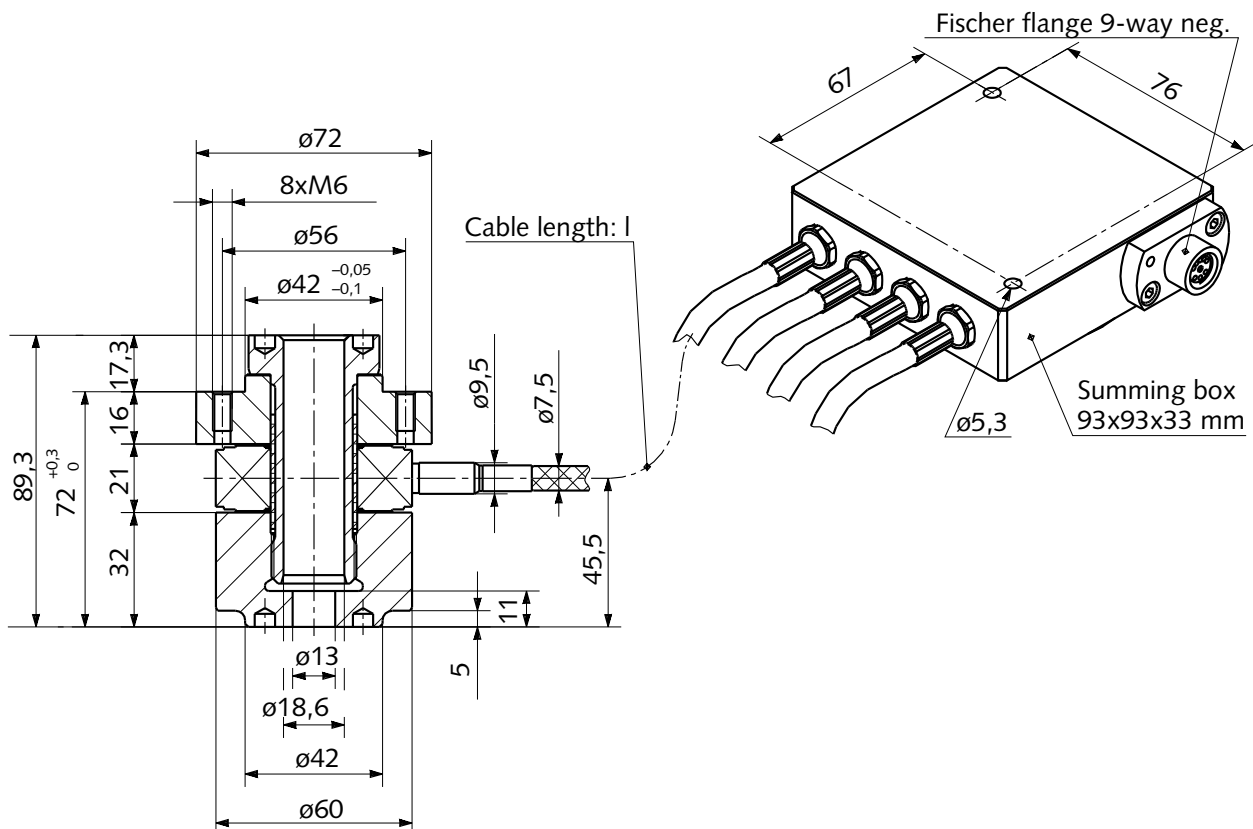


Fig. 2: Dimensions of multicomponent force link set Type 9366CDsp

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Size of Top Plate

The top plate must have dimensions between 300x300 mm and 900x900 mm. The size of steel top plates chosen must not exceed 600x600 mm. A cable length of 0.5 m is sufficient for top plates up to 750x750 mm in size. For larger sizes the corresponding cable length has to be specified.

Weight of Top Plate

The weight of the top plate can be calculated from the dimensions as follows:

- Weight of steel top plate $L \times B \times H \times 7,8 \times 10^{-6} \text{ kg/mm}^3$
- Weight of aluminum top plate $L \times B \times H \times 2,8 \times 10^{-6} \text{ kg/mm}^3$

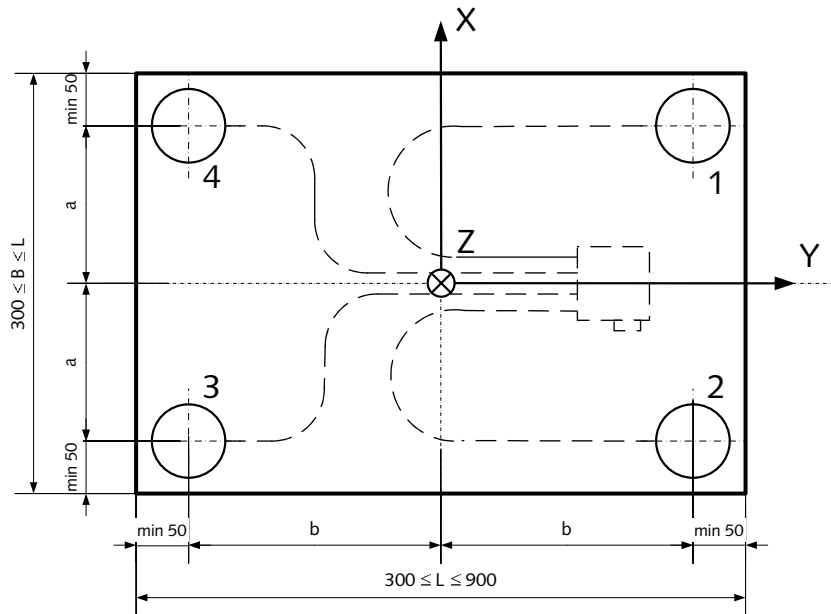


Fig. 3: Size of top plate

Thickness of Top Plate

The thickness depends on the size, load and material of the top plate. It must not be less than the recommended values.

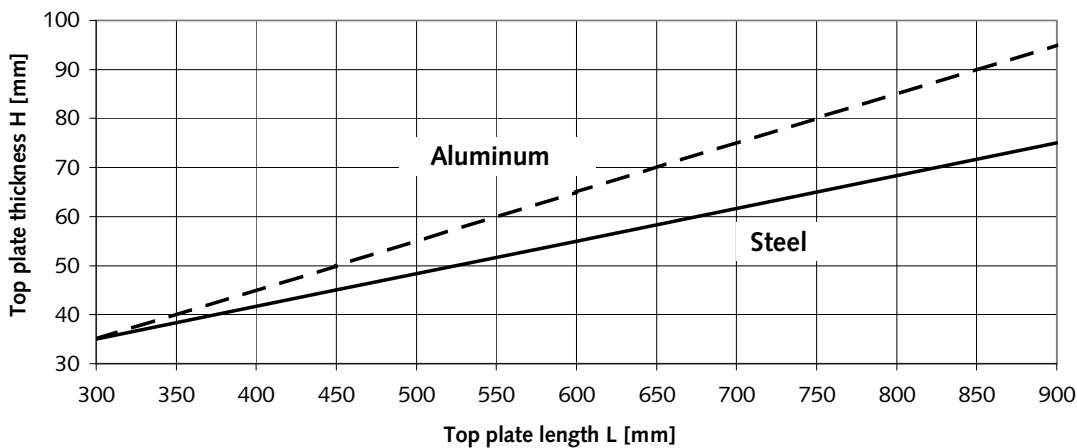


Fig. 4: Size of top plate

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Measuring Ranges

The maximum allowed measuring range of the force plate depends on the dimensions and material of the top plate and on the point of force application.

The maximum measuring ranges applied for a point of force application within and no more than 100 mm above the surface of the top plate.

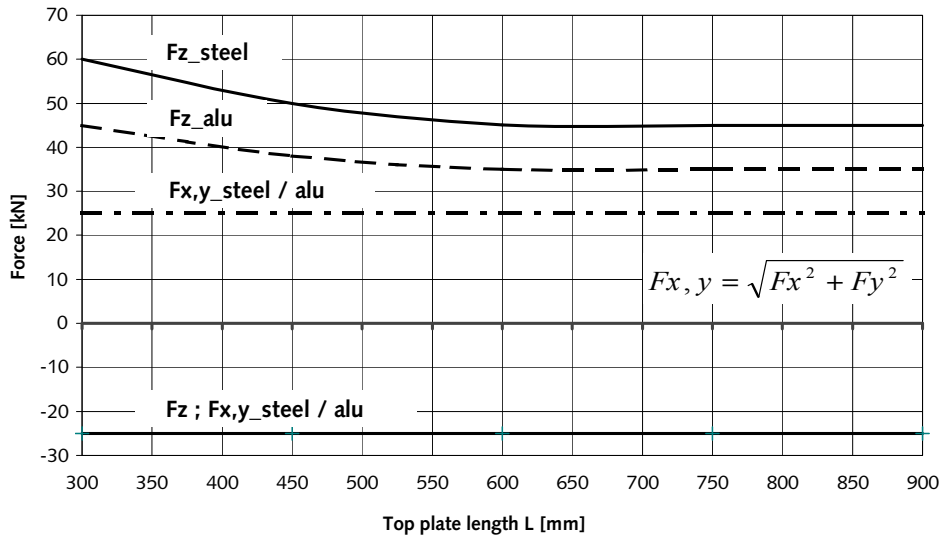


Fig. 5: Measuring ranges

Natural Frequency

A carefully mounted force plate of the recommended thickness achieves the following approximate natural frequencies.

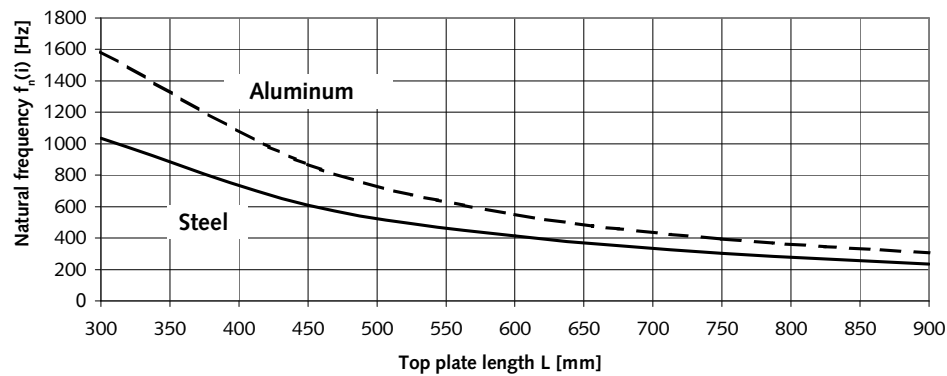






Fig. 6: Natural frequency

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Measuring system

Multicomponent Measurement force link set	Connection cable ¹⁾	Multichannel charge amplifier	Measurement
	Type 1687B... 3-conductor  pos. pos.	Type 5167Ax1 	F_x F_{x12} F_y F_{y34} F_z F_{y14} F_{y23} F_{z1} F_{z2} F_{z3} F_{z4}
	Type 1677A... 8-conductor  pos. pos.		

¹⁾ See data sheet entitled Cables for Multicomponent Force Sensors, Dynamometers and Force Plates (1687B_000-545).

Parallel Connection

When assembling the force plate the four force links are mechanically connected in parallel. The measurement signals (electric charge) of the four sensors are also connected in parallel in the summing box. The summed signal corresponds to the algebraic sum of the individual forces.

Calibration

The multicomponent force link set is calibrated in the factory with a 300x300x35 mm steel top plate. Depending on the chosen size of top plate, the sensitivity of the three force components F_x , F_y and F_z can deviate up to ± 2 % from the calibrated value.

Measurement Signal Conditioning

A multichannel charge amplifier is required to complete the measuring system. It converts the measurement signals into an electrical voltage. The measurement is exactly proportional to the acting force. Multichannel charge amplifier Type 5080A... has been manufactured specifically for multicomponent force measuring systems.



Fig. 7: Multichannel charge amplifier Type 5080A...

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Included Accessories

- Allen screw M12x25 (4 pcs.)
- Allen screw M6x20 (32 pcs.)
- Allen screw M5x45 (2 pcs.)
- Spring washer for M5 (2 pcs.)
- Cylindrical pin ø4h6x32 (2 pcs.)
- Set of washers for taking up play (1 pce.)
- Allen key 10 mm (1 pce.)

Type/Mat. No.

65012767
65012830
65012806
65013336
65013599
65013672
1391

Ordering Key

- **Multicomponent force link set**
ø72 mm, -30 ... 60 kN
consisting of 4 force links
plus summing box 5447Asp with
integrated cables
Connection: Fischer flange, 9 pin neg.
minimum length l=0.2 m
Specify cable length in order

Type

9366CDsp

Optional Accessories

- Protective lid (steel, 1.4057)
- Protective lid (aluminum, 3.2315)
- Connecting cable, 3-conductor
- Connecting cable, 8-conductor

Type/Mat. No.

3.322.118
3.322.326
1687B...
1677A...