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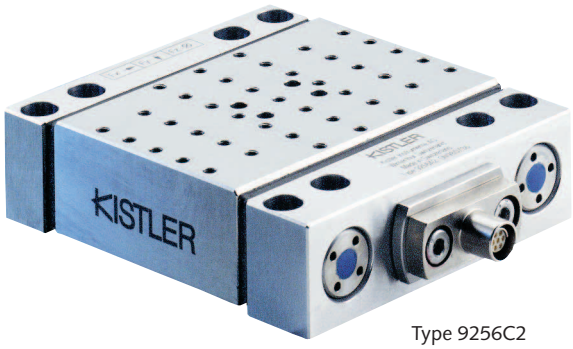
MiniDyn

Type 9256C...

Multicomponent Dynamometer up to 250 N

Multicomponent dynamometer for measuring the three orthogonal components of a force. Its very low threshold allows measuring extremely small forces.

- For cutting force measurements in ultra precise machining
- Small design
- High sensitivity and natural frequency
- Small temperature error
- Top plate made of titanium



Type 9256C2

Description

The dynamometer consists of four 3-component force sensors mounted under high preload between the cover plate and the two lateral base plates.
A low temperature error is obtained by this special mounting of the sensors. Each force sensor contains three crystal rings, of which one is sensitive to pressure in the y-direction and the two others to shear in the x- and z-directions. The forces are measured practically without displacement.
The outputs of the four mounted force sensors are fed to the 7-pole flanged socket. There are also multicomponent force-moment measurements possible.
The four sensors are fitted so that they are ground-isolated. This largely eliminates ground loop problems.
The dynamometer is corrosion-resistant and protected against penetration by splashing water or cutting fluid. The dynamometer including connecting cable Type 1696A5 or Type 1697A5 meets the degree of protection IP67.

Examples of Application

- Cutting force measurement in precision machining such as:
  - cutting wafers
  - grinding hard-disk read heads
  - diamond turning
  - high speed machining
- Ultra-high precision machining of brittle hard materials
- Multicomponent force measurement of small forces
- Force measurement in confined spaces

Technical Data

			9256C1	9256C2
Measuring range	F_x, F_y, F_z	N	–250 … 250	
	M_x, M_z	Nm	–8 … 8	–11 … 11
Calibrated measuring range				
100 %	F_x, F_y, F_z	N	0 … 250	
10 %	F_x, F_y, F_z	N	0 … 25	
Overload	F_x, F_y, F_z	N	–300/300	
Threshold		N	<0,002	
Sensitivity	F_x, F_z	pC/N	≈–26	
	F_y	pC/N	≈–13	
Linearity, all ranges		% FSO	≤±0,4	
Hysteresis, all ranges		% FSO	≤0,5	
Crosstalk		%	≤±2	
Rigidity	c_x, c_z	N/µm	>250	
	c_y	N/µm	>300	
Natural frequency				
(mounted on rigid base)	f_n (x)	kHz	≈5,1	≈4,0
	f_n (y)	kHz	≈5,5	≈4,8
	f_n (z)	kHz	≈5,6	≈4,6
Operating temperature range		°C	0 … 70	
Insulation resistance		Ω	$>10^{14}$	
Ground isolation		Ω	$>10^{8}$	
Degree of protection EN60529			IP67 **)	
Weight				
Dynamometer		kg	0,75	0,87
Top plate		kg	0,24	0,36
Clamping area		mm	39x80	55x80

**) With connecting cable Type 1696A5/1697A5

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Dynamometer Type 9256C...

Dimensions

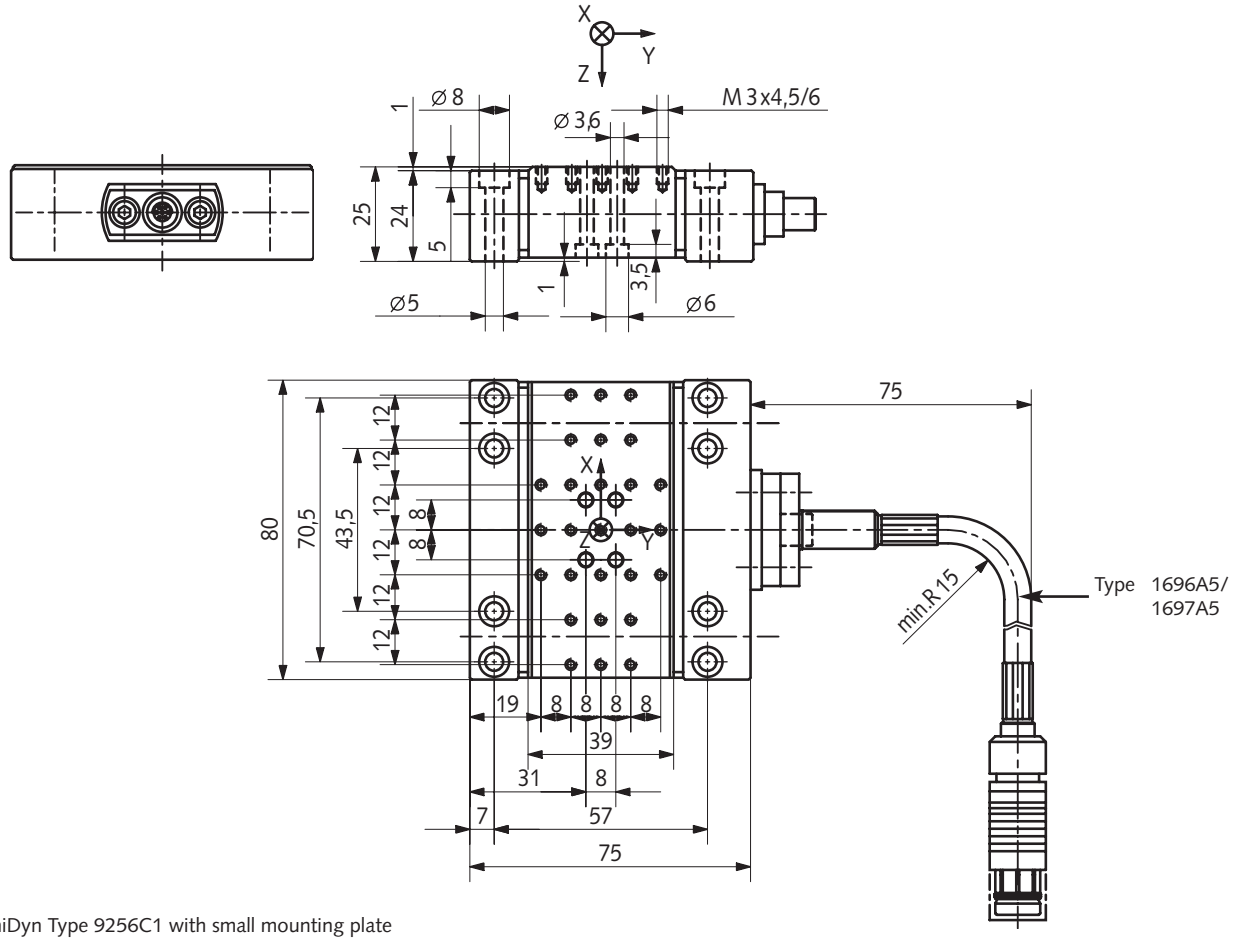

Fig. 1: MiniDyn Type 9256C1 with small mounting plate

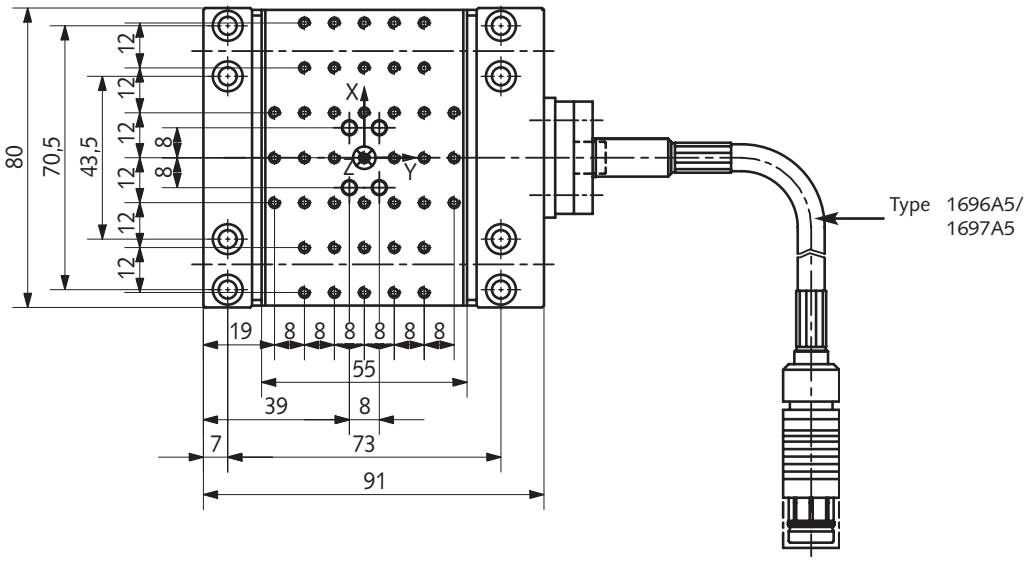

Fig. 2: MiniDyn Type 9256C2 with large mounting plate

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Mounting

The dynamometer can be mounted with screws or clamps to any face-ground, clean mounting surface such as on a machine tool table. The measuring instrument can also be mounted on a magnetic plate. It must be noted that uneven contact surfaces may cause internal distortions, placing additional heavy stresses on the individual measuring elements and increasing the cross talk.

There are M3 tapped blind holes in the mounting plate for clamping the force-introducing components such as workpieces or toolholder. The contact surfaces of the force-introducing parts must be surface ground to achieve good mechanical coupling to the mounting plate.

Electronics

A 3-component force measuring system requires, in addition to the dynamometer, three charge amplifiers, which convert the charge signals of the dynamometer into output voltages, which are proportional to the forces occurring.

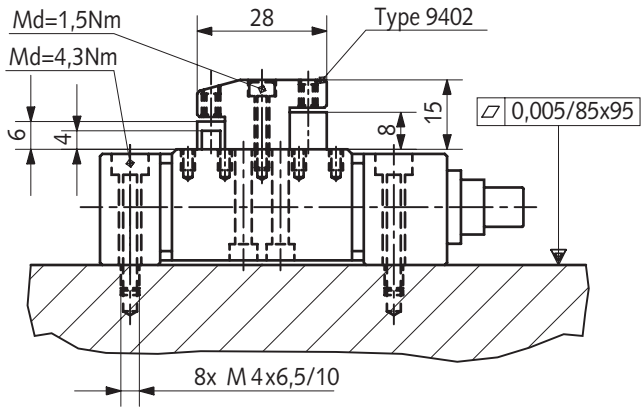
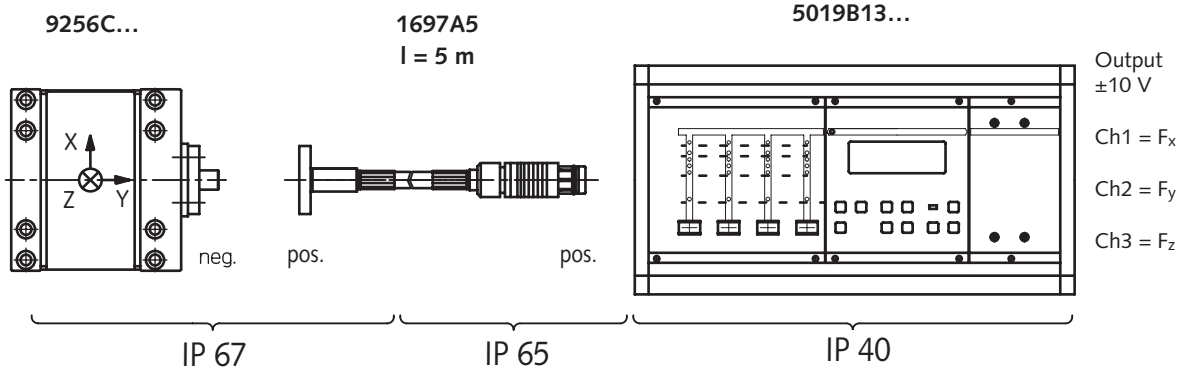


Fig. 3: Mounting the dynamometer

Measuring System

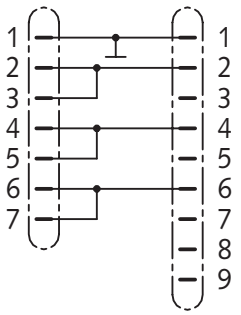


Degree of protection EN60529

Fig. 4: Measuring system for 3-component measurement (F_x, F_y, F_z)

Input signals	Pin.No.
Ground	1
X1 + 2	2
X3 + 4	3
Y1 + 4	4
Y2 + 3	5
Z1 + 2	6
Z3 +4	7

Input



Output

Pin.No.	Output signals
1	Ground
2	Fx
3	--
4	Fy
5	--
6	Fz
7	--
8	--
9	--

Fig. 5: Cable diagram Type 1697A5

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Measuring System

9256C... **1696A5** **5409A4** **5017B15... (5 channels)**

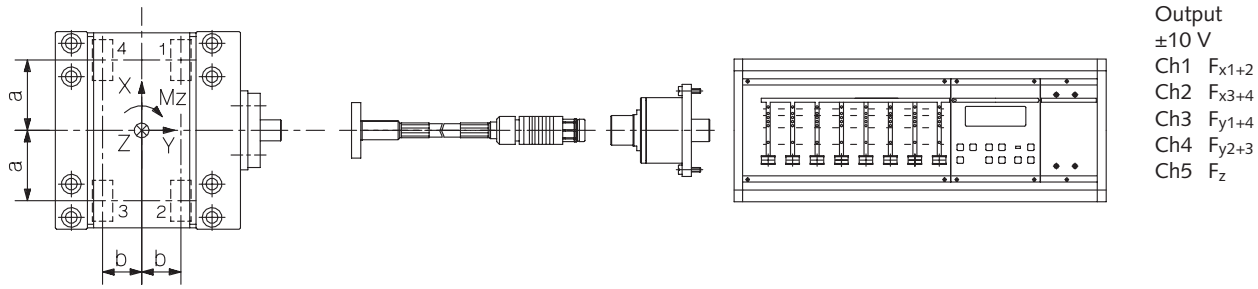
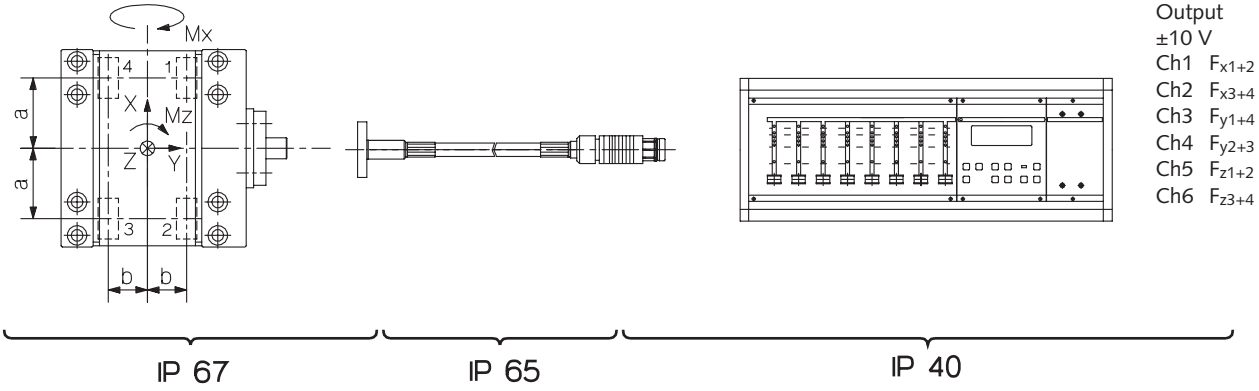


Fig. 6: Measuring system for 4-component measurement (F_x, F_y, F_z, M_z)

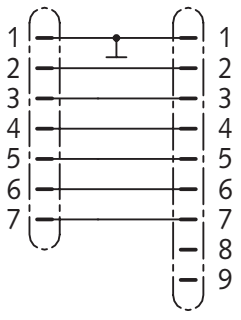
9256C... **1696A5 1696Asp** **5017B16... (6 channels)**



Degree of protection EN60529

Fig. 7: Measuring system for 5-component measurement (F_x, F_y, F_z, M_x, M_z)

Input signals	Pin.No.
Ground	1
X1 + 2	2
X3 + 4	3
Y1 + 4	4
Y2 + 3	5
Z1 + 2	6
Z3 +4	7



Pin.No.	Output signals
1	Ground
2	Fx 1+2
3	Fx 3+4
4	Fy 1+4
5	Fy 2+3
6	Fz 1+2
7	Fz 3+4
8	--
9	--

Fig. 8: Cable diagram Type 1696A5

Calculations

$F_x = F_{x1+2} + F_{x3+4}$

$F_y = F_{y1+4} + F_{y2+3}$

$F_z = F_{z1+2} + F_{z3+4}$

$M_x = b \bullet (F_{z1+2} - F_{z3+4})$

$M_z = b \bullet (-F_{x1+2} + F_{x3+4}) + a \bullet (F_{y1+4} - F_{y2+3})$

a = Distance of the Sensoraxes from the y-axis
Type 9256C1 a = 28,5 mm
Type 9256C2 a = 28,5 mm

b = Distance of the Sensoraxes from the x-axis
Type 9256C1 b = 15,5 mm
Type 9256C2 b = 23,5 mm

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Accessories Included	Type
• Mounting screws (8 pieces M4x25)	6.120.015

Optional Accessories

For 3-component force measurement F_x, F_y, F_z

• Connecting cable (3 leads), L = 5 m	1697A5
• Toolholder	9402

For 4/5-component force and moment measurement F_x, F_y, F_z, M_x, M_z

• Connecting cable (6 leads), L = 5 m	1696A5

Ordering Key

9256C □

Dimensions 80 x 75 mm	**1**
Dimensions 80 x 91 mm	**2**

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