

MiniDyn

Type 9119AA1

Multicomponent Dynamometer up to 4 000 N, cover plate 39x80 mm

Multicomponent dynamometer for measuring the three orthogonal components of a force. Its very low threshold and the high sensitivity allow measuring extremely small forces.

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

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 9-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 1687B5 or Type 1677A5 meets the degree of protection IP67.

Application examples

- Multicomponent force measurement of small forces
- Cutting force measurement in
 - precision machining
 - micromachining
 - Ultra-high precision machining of brittle materials



Technical data

Measuring range (central) single component	F_x, F_y, F_z	kN	–4 ... 4
	M_x, M_y	N·m	–125 ... 125
	M_z	N·m	–250 ... 250
Measuring range when components act simultaneously (central), $M_x, M_y, M_z = 0$	F_x, F_y, F_z	kN	–2,0 ... 2,0
Calibrated measuring range			
100 %	F_x, F_y, F_z	N	0 ... 4 000
10 %	F_x, F_y, F_z	N	0 ... 400
1 %	F_x, F_y, F_z	N	0 ... 40
Overload (central)	F_x, F_y, F_z	kN	–4,5/4,5
Threshold		N	<0,002
Sensitivity	F_x, F_z	pC/N	≈–26
	F_y	pC/N	≈–13
Linearity			
Meas. range 10% ... 100%		%/FSO	≤±0,3
Meas. range 0% ... <10%		%/FSO	≤±0,5
Hysteresis			
Meas. range 10% ... 100%		%/FSO	≤±0,3
Meas. range 0% ... <10%		%/FSO	≤±0,5
Crosstalk	$F_z \rightarrow F_x, F_y$	%	≤±2
	$F_x \leftrightarrow F_y$	%	≤±2
	$F_x, F_y \rightarrow F_z$	%	≤±2
Natural frequency (without additional mass)	$f_n (x)$	kHz	≈6,0
	$f_n (y)$	kHz	≈6,4
	$f_n (z)$	kHz	≈6,3
Operating temperature range		°C	–20 ... 70
Capacitance	F_x, F_y, F_z	pF	≈230
Insulation resistance (20 °C)		Ω	>10 ¹³
Ground isolation		Ω	>10 ⁸
Degree of protection EN60529		–	IP67 ¹⁾
Weight			
Dynamometer		kg	0,93
Cover plate		kg	0,30
Mounting surface		mm	39x80

¹⁾ with connection cables Type
1687B5, 1689B5,
1677A5, 1679A5

Dimensions

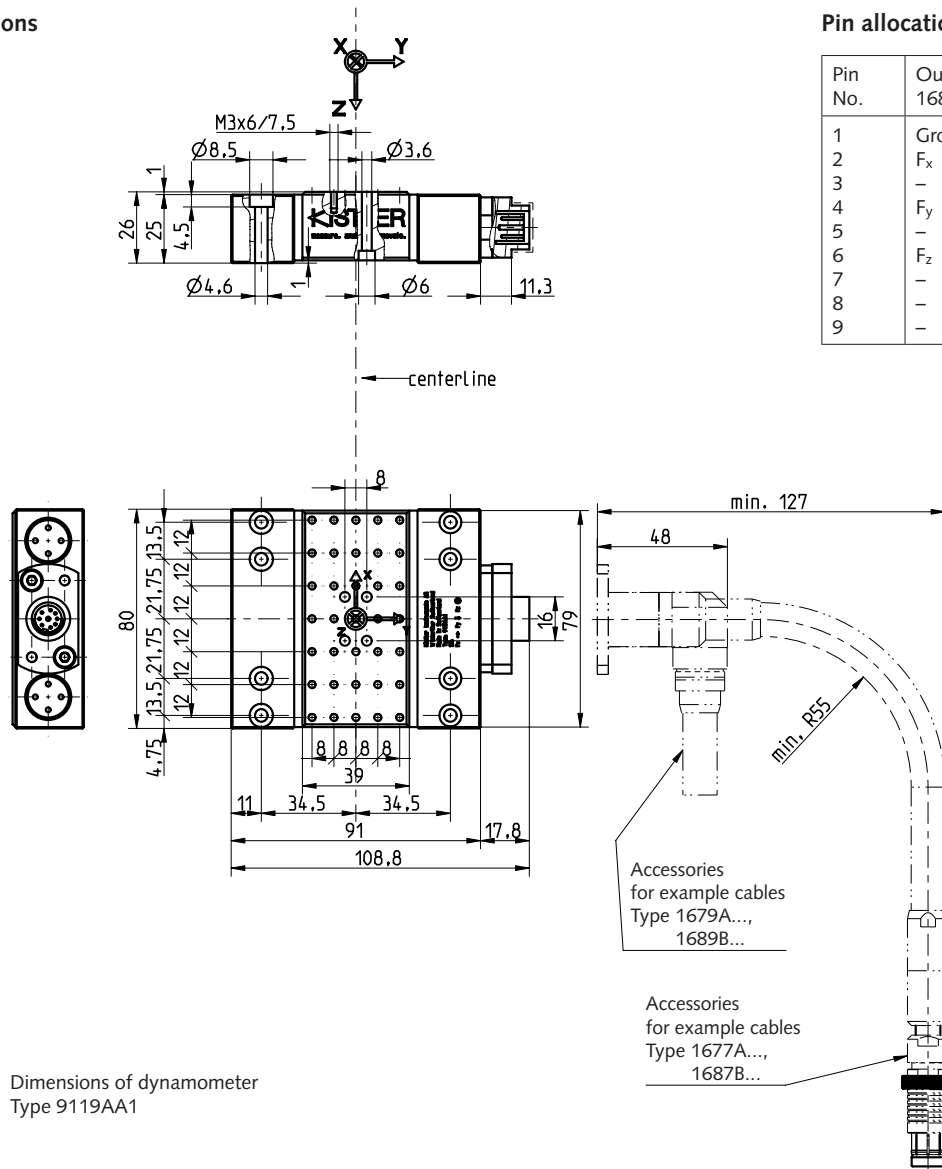


Fig 1: Dimensions of dynamometer
Type 9119AA1

Mounting

The dynamometer can be mounted with eight screws 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.

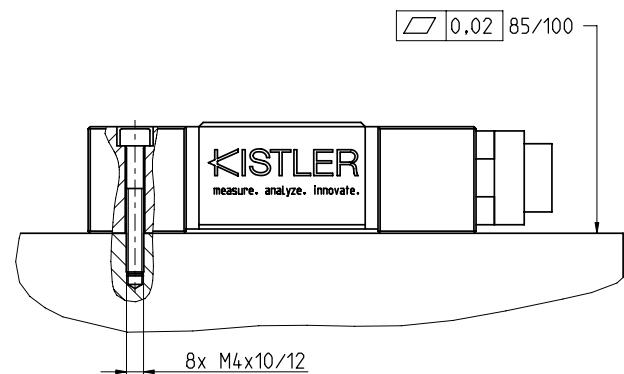


Fig. 2: Mounting of dynamometer Type 9119AA1

Processing the measurement signals

Charge amplifier channels are also needed to build a complete measuring system (e.g. Type 5080A...). These convert the measurement signal into an electrical voltage. The measured value is exactly proportional to the force acting.

Data acquisition and analysis

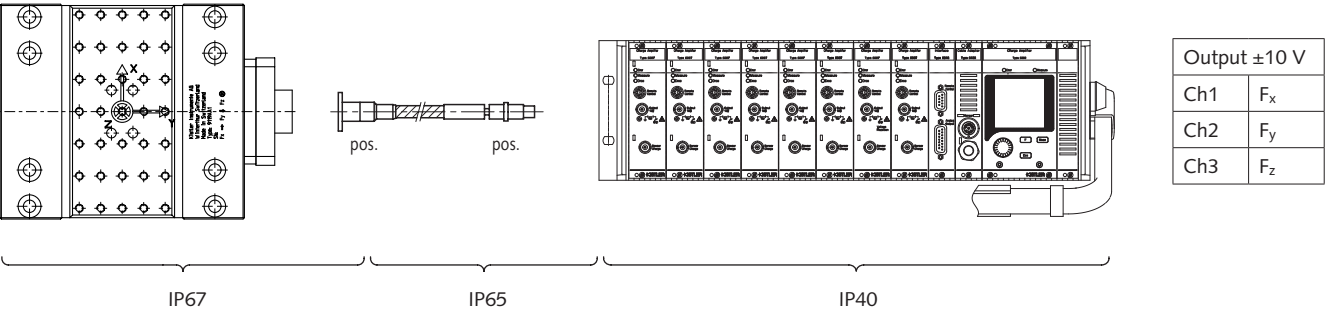
Kistler offers with the Type 5697A1 DAQ system an universal and easy to operate package, consisting of a hardware for the data acquisition and the DynoWare software. For details see data sheet 5697A_000-745.

3-component force measurement F_x , F_y , F_z

Dynamometer
Type 9119AA1

Connection cable
Type 1687B5

Multicomponent charge amplifier
Type 5080Axx3x001



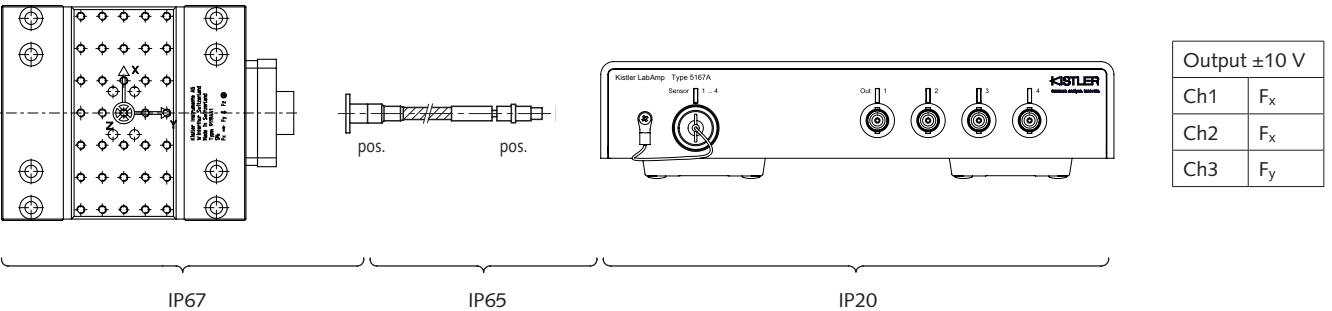
Degree of protection EN60529

Fig. 3: Measuring system for 3-component measurement with multi-channel charge amplifier

Dynamometer
Type 9119AA1

Connecting cable
Type 1687B5

Laboratory charge amplifier
Type 5167A41xK



Degree of protection EN60529

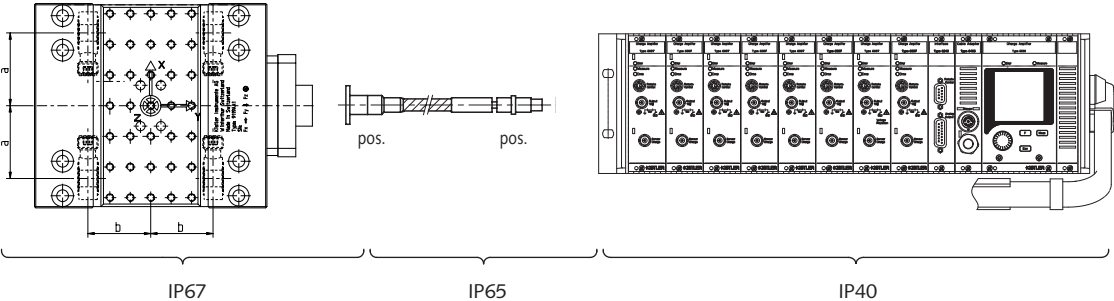
Fig. 4: Measuring system for 3-component measurement with laboratory charge amplifier

6-component force measurement $F_x, F_y, F_z, M_x, M_y, M_z$

Dynamometer
Type 9119AA1

Connection cable
Type 1677A5

Multicomponent charge amplifier
Type 5080Axx8x004



Output ± 10 V	
Ch1	F_{x1+2}
Ch2	F_{x3+4}
Ch3	F_{y1+4}
Ch4	F_{y2+3}
Ch5	F_{z1}
Ch6	F_{z2}
Ch7	F_{z3}
Ch8	F_{z4}

Degree of protection EN60529

Fig. 5: Measuring system for 6-component measurement with multi-channel charge amplifier

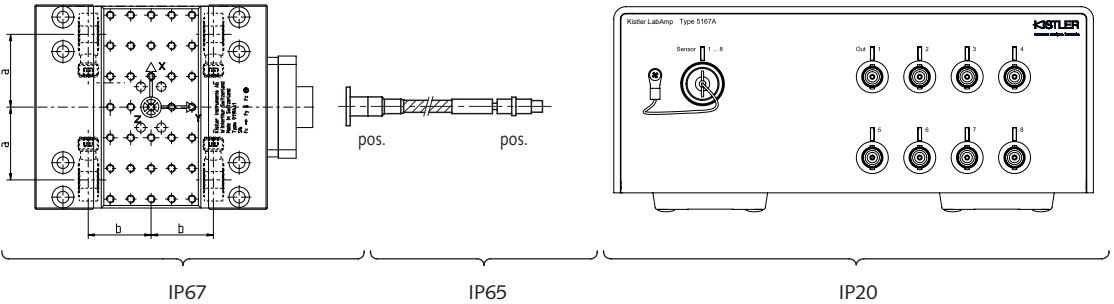
Value a,b for Type 9119AA1:

a	b
mm	mm
28,5	24,5

Dynamometer
Type 9119AA1

Connection cable
Type 1677A5

Laboratory charge amplifier
Type 5167A81xK



Output ± 10 V	
Ch1	F_{x1+2}
Ch2	F_{x3+4}
Ch3	F_{y1+4}
Ch4	F_{y2+3}
Ch5	F_{z1}
Ch6	F_{z2}
Ch7	F_{z3}
Ch8	F_{z4}

Degree of protection EN60529




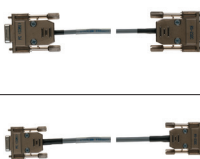

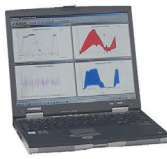
Fig. 6: Measuring system for 6-component measurement with laboratory charge amplifier

Value a,b for Type 9119AA1:





a	b
mm	mm
28,5	24,5

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Typical measuring chain with DAQ system Type 5697A1

					
Dynamometer	Connection cable, high impedance	Charge amplifier	Connecting cable	DAQ system	Notebook (from customer side) with DynoWare
Type 9119AA1	Type 16xx	Type 5080A	Type 1700A111A2 Type 1200A27	Type 5697A1	

Typical measuring chain with LabAmp system Type 5167A...

			
Dynamometer	Connection cable, high impedance	Charge amplifier with integrated DAQ	Notebook (from customer side) with DynoWare
Type 9119AA1	Type 16xx	Type 5167A...	

Ordering Code

- Multicomponent dynamometer up to 4 kN, cover plate 39x80 mm

Included Accessories

- Mounting screws M4x25 (8 pieces)

Type/Art. No.
9119AA1

65012704

Optional accessories

For 3-component force measurement F_x , F_y , F_z

- Connecting cable, 3 wire, with flexible metal sheath (L = 5 m) **1687B5**
- Connecting cable, 3 wire, steel braided, flexibel (L = 5 m) **1687BQ02**
- Extension cable, 3 wire, high insulation (L = 5 m) **1688B5**
- Connecting cable, 3 wire, with flexible metal sheath and angle connector (L = 5 m) **1689B5**

For 6-component force and moment measurement

F_x , F_y , F_z / M_x , M_y , M_z

- Connecting cable, 8 wire, with flexible metal sheath (L = 5 m) **1677A5**
- Connecting cable, 8 wire, with steel braided, flexibel (L = 5 m) **1677AQ02**
- Extension cable, 8 wire, high insulation (L = 5 m) **1678A5**
- Connecting cable, 8 wire, with flexible metal sheath and angle connector (L = 5 m) **1679A5**