

Multicomponent Dynamometer

Type 9257B

-5 ... 10 kN, Top Plate 100x170 mm

Quartz three-component dynamometer for measuring the three orthogonal components of a force. The dynamometer has a great rigidity and consequently a high natural frequency. Its high resolution enables the smallest dynamic changes in large forces to be measured.

- Universal applicable
- For cutting force measurements
- Stable and reliable



Description

The dynamometer consists of four three-component force sensors fitted under high preload between a baseplate and a top plate. Each sensor contains three pairs of quartz plates, one sensitive to pressure in the z direction and the other two responding to shear in the x and y directions respectively. The force components are measured practically without displacement.

The outputs of the four built-in force sensors are connected inside the dynamometer in a way to allow multicomponent measurements of forces and moments to be performed. The eight output signals are available at the 9-conductor flange socket.

The four sensors are mounted ground-insulated. Therefore ground loop problems are largely eliminated.

The dynamometer is rustproof and protected against penetration of splashwater and cooling agents. Together with the connecting cable Type 1687B5/1689B5 and Type 1677A5/1679A5 it corresponds to the protection class IP67.

A special thermal isolation coating is integrated in the top plate which renders the dynamometer largely insensitive to temperature influences.

Application Examples

- Dynamic and quasistatic measurement of the three orthogonal components of a force
- Measuring cutting force when turning, milling, grinding etc. In conjunction with the calibrated partial ranges the high sensitivity and low threshold allow exact measurements on small tools and when grinding.
- Measurements on scale models in wind channels

Technical Data

Range	F_x, F_y, F_z	kN	-5 ... 5 ¹⁾
	F_z for F_x and $F_y \leq 0,5 F_z$	kN	-5 ... 10 ²⁾
Calibrated partial range 1	F_x, F_y	N	0 ... 500
	F_z	N	0 ... 1 000
Calibrated partial range 2	F_x, F_y	N	0 ... 50
	F_z	N	0 ... 100
Overload	F_x, F_y, F_z	kN	-7,5/7,5
	F_z for F_x and $F_y \leq 0,5 F_z$	kN	-7,5/15
Threshold		N	<0,01
Sensitivity	F_x, F_y	pC/N	$\approx -7,5$
	F_z	pC/N	$\approx -3,7$
Linearity, all ranges		%FSO	$\leq \pm 1$
Hysteresis, all ranges		%FSO	$\leq 0,5$
Cross talk		%	$\leq \pm 2$
Rigidity	c_x, c_y	kN/ μ m	>1
	c_z	kN/ μ m	>2
Natural frequency	$f_n(x, y, z)$	kHz	$\approx 3,5$ ⁴⁾
Natural frequency (mounted on flanges)	$f_n(x, y)$	kHz	$\approx 2,3$ ⁴⁾
	$f_n(z)$	kHz	$\approx 3,5$ ⁴⁾
Operating temperature range		°C	0 ... 70
Capacitance	F_x, F_y, F_z	pF	≈ 220
Insulation resistance (20 °C)		Ω	$>10^{13}$
Ground insulation		Ω	$>10^8$
Protection class EN60529		-	IP67 ³⁾
Weight		kg	7,3
Clamping area	mm		100x170
Connection			Fischer flange, 9 pol. neg.

¹⁾ Application of force inside and max. 25 mm above top plate area

²⁾ Range for turning, application of force at point A

³⁾ With connecting cable Types 1687B5, 1689B5, 1677A5, 1679A5

⁴⁾ Without tool holder Type 9403

Dimensions Milling, Grinding

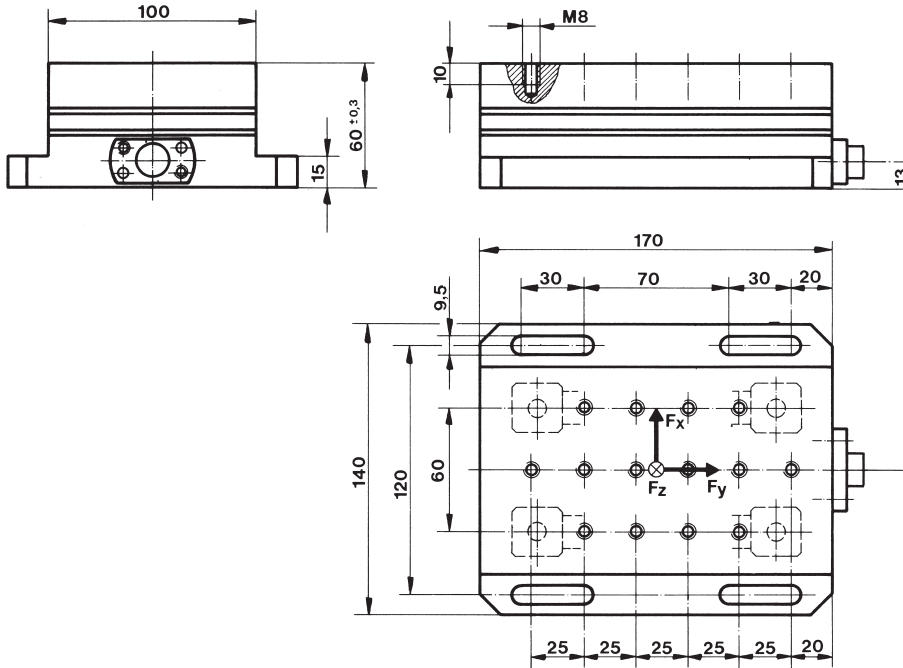


Fig. 1: Dimensions dynamometer Type 9257B

Dimensions Turning

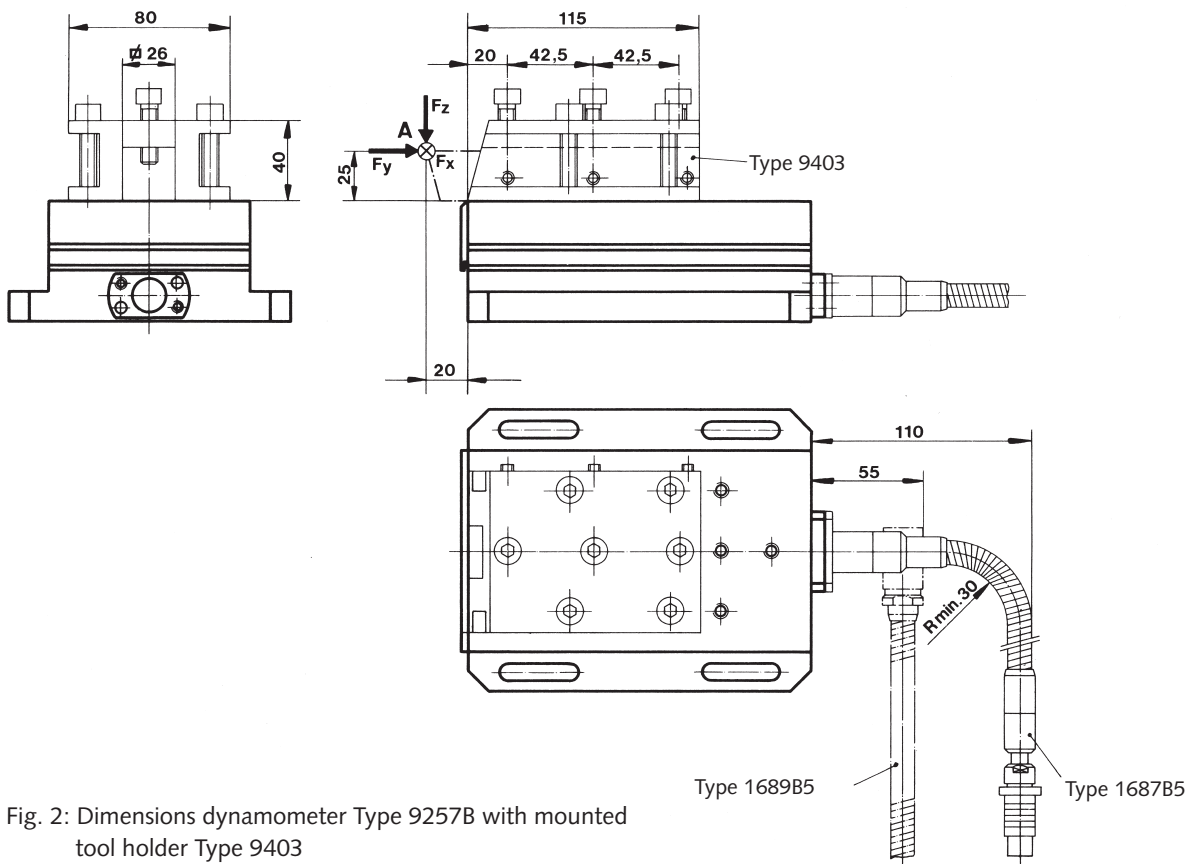
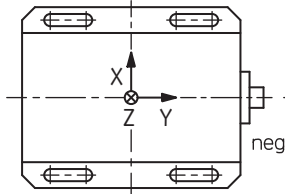


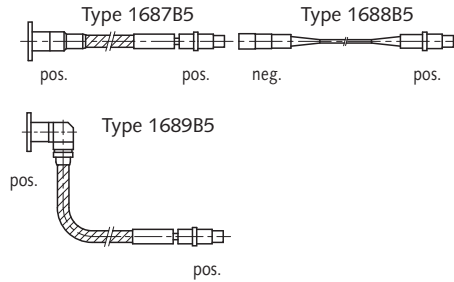
Fig. 2: Dimensions dynamometer Type 9257B with mounted tool holder Type 9403

3-Component Force Measurement F_x, F_y, F_z with 4-Channel Charge Amplifier

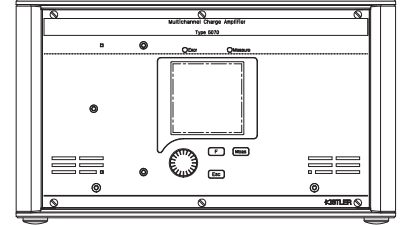
Dynamometer
Type 9257B



Cable



Charge Amplifier
Type 5070Ax01xx



3 output signals
from charge amplifier

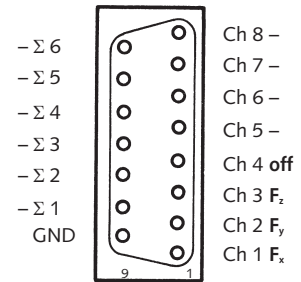
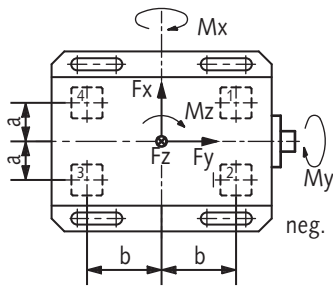


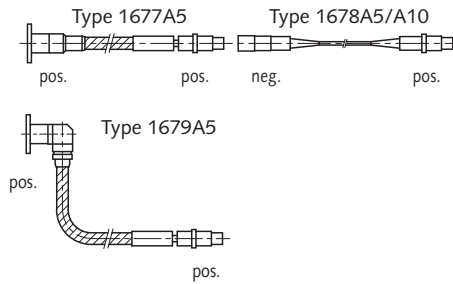
Fig. 3: Example of a measuring system with standard dynamometer

6-Component Force and Moment Measurement $F_x, F_y, F_z, M_x, M_y, M_z$ with 8-Channel Charge Amplifier

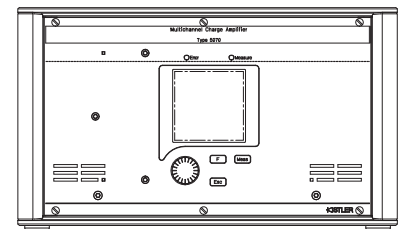
Dynamometer
Type 9257B



Cable



Charge Amplifier
Type 5070Ax11xx



8 output signals
from charge amplifier

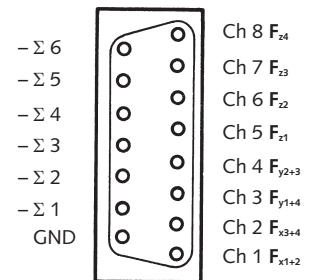


Fig. 4: Example of a measuring system with standard dynamometer

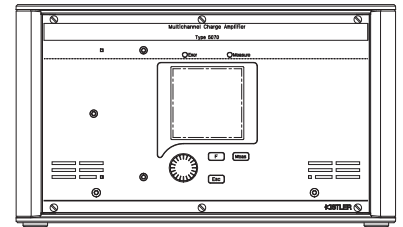
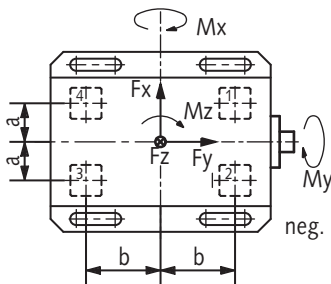
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6-Component Force and Moment Measurement $F_x, F_y, F_z, M_x, M_y, M_z$ with 8-Channel Charge Amplifier with 6-Component-Summing Calculator

Dynamometer
Type 9257B

Cable

Charge Amplifier
Type 5070A21xx



8 output signals from charge amplifier
6 output signals from summing calculator

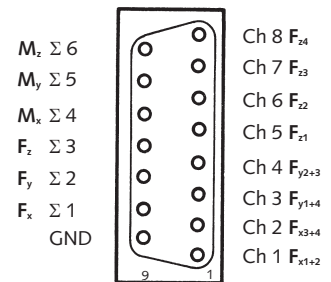


Fig. 5: Example of a measuring system with standard dynamometer

Values a,b for Type 9257B:

a	b
mm	mm
30	57,5

Mounting

The dynamometer may be mounted with screws or claws on any clean, face-ground supporting surface, such as the table of a machining tool for example. Uneven supporting surface may set up internal stresses, which will impose severe additional loads on the individual measuring elements and may also increase cross talk.

For mounting the force-introducing components, such as lathe tools and workpieces, fourteen M8x1,25 mm blind tap holes in the cover plate are available. The supporting surfaces for the force-introducing parts must be face-ground to obtain good mechanical coupling to the cover plate.

For satisfactory mounting of lathe tools up to 26x26 mm shank cross section, the tool holder Type 9403 may be used. This holder is not included in the standard accessories and must therefore be ordered separately.

Signal Conditioning

In addition to the dynamometer, a four-component measuring system needs a multi-core high-insulation connecting cable and four charge amplifier channels. These convert the charge

signals from the dynamometer into output voltages. The output voltage is proportional to the forces and moments occurring. The multichannel charge amplifier Type 5070A... is ideal for this purpose. For details, see the data sheet 5070A_000-485.

Data Acquisition and Evaluation

Kistler DynoWare is an easy to use universal software and is ideal for multi-component force measurement with dynamometers. For details, see the data sheet 2825A_000-371.

Optional Accessories

Optional Accessories	Type
• Tool holder	9403
• Connecting cable, length l = 5 m (3 leads)	1687B5 1689B5
• Extension cable, length l = 5 m (3 leads)	1688B5
• Connecting cable, length l = 5 m (8 leads)	1677A5 1679A5
• Extension cable, length l = 5 m (8 leads)	1678A5

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