

## 3-Component Dynamometer

Type 9265B

-15 ... 30 kN, Top Plate 135x203 mm

Quartz 3-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.

- Large measuring range
- Universal applicable
- Suitable for cutting force measurement
- Water cooling possible

### Description

The dynamometer consists of a basic unit Type 9265B to which, depending on the application, either a tool holder Type 9441B (for turning with tools up to 32x32 mm or 32 mm dia) or a clamping plate Type 9443B for milling, grinding etc. is screwed on.

The basic unit consists of four 3-component force sensors fitted under high preload between a base plate 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.

When designing the dynamometer, particular attention was given to minimizing sensitivity to temperature influences during machining. The basic unit features a connectable water cooling unit, which ensures optimal stability during very critical measurements.

The basic unit Type 9265B is calibrated at the works with both the tool holder Type 9441B and the clamping plate Type 9443B. The user can replace both the holder and the clamping plate himself without need for recalibration.



### Technical Data

Type		9265B	9265B + 9411B	9265B +9443B
Range	$F_x, F_y$	kN	-15 ... 15 <sup>2)</sup>	-15 ... 15 <sup>1)</sup>
	$F_z$	kN	0 ... 30 <sup>2)</sup>	-10 ... 30 <sup>1)</sup>
Calibrated partial range	$F_x, F_y$	kN	0 ... 1,5	0 ... 1,5
	$F_z$	kN	0 ... 3	0 ... 3
Overload	$F_x, F_y$	kN	-20/20	-20/20
	$F_z$	kN	-12/40	-12/40
Threshold		N	<0,01	<0,01
Sensitivity	$F_x, F_y$	pC/N	≈-8	≈-8
	$F_z$	pC/N	≈-3,7	≈-3,7
Linearity, all ranges		%FSO	≤±0,5	≤±0,5
Hysteresis, all ranges		%FSO	≤0,5	≤0,5
Cross talk		%	≤±2	≤±2 <sup>3)</sup>
Rigidity	$c_x, c_y$	kN/μm	≈0,8	≈1
	$c_z$	kN/μm	≈2	≈2
Natural frequency (mounted on flanges)	$f_n(x, y)$	kHz	≈1,5	1,7
	$f_n(z)$	kHz	≈2,5	2,7
Operating temp. range		°C	0 ... 70	0 ... 70
Capacitance (of channel)		pF	≈500	≈500
Insulation resistance (20 °C)		Ω	>10 <sup>13</sup>	>10 <sup>13</sup>
Ground insulation		Ω	>10 <sup>8</sup>	>10 <sup>8</sup>
Protection class EN60529			IP67 <sup>4)</sup>	IP67 <sup>4)</sup>
Weight		kg	20	19,8
Clamping area		mm	-	135x203
Connection			Fischer flange, 9-pole neg.	

<sup>1)</sup> Application of force inside and max. 100 mm above top plate area.

<sup>2)</sup> Range for turning, application of force at point A

<sup>3)</sup> Application of force inside and max. 50 mm above top plate area

<sup>4)</sup> With connecting cable Type 1687B5, 1689B5, 1677A5, 1679A5

**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 wind tunnel models, etc.

**Montage**

The dynamometer may be mounted with screws or claws on any clean, face-ground supporting surface, such as the table of a machine 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.

To clamp the force introducing parts, two detachable units are available:

- In the tool holder Type 9441B cutting tools with a cross-section of max. 32x32 mm can be clamped without problems.
- In the top plate of the clamping plate Type 9443B 12 blind hole threads M12 are provided to clamp the force introducing parts (workpieces).

**Dimensions with Mounted Tool Holder (Turning)**

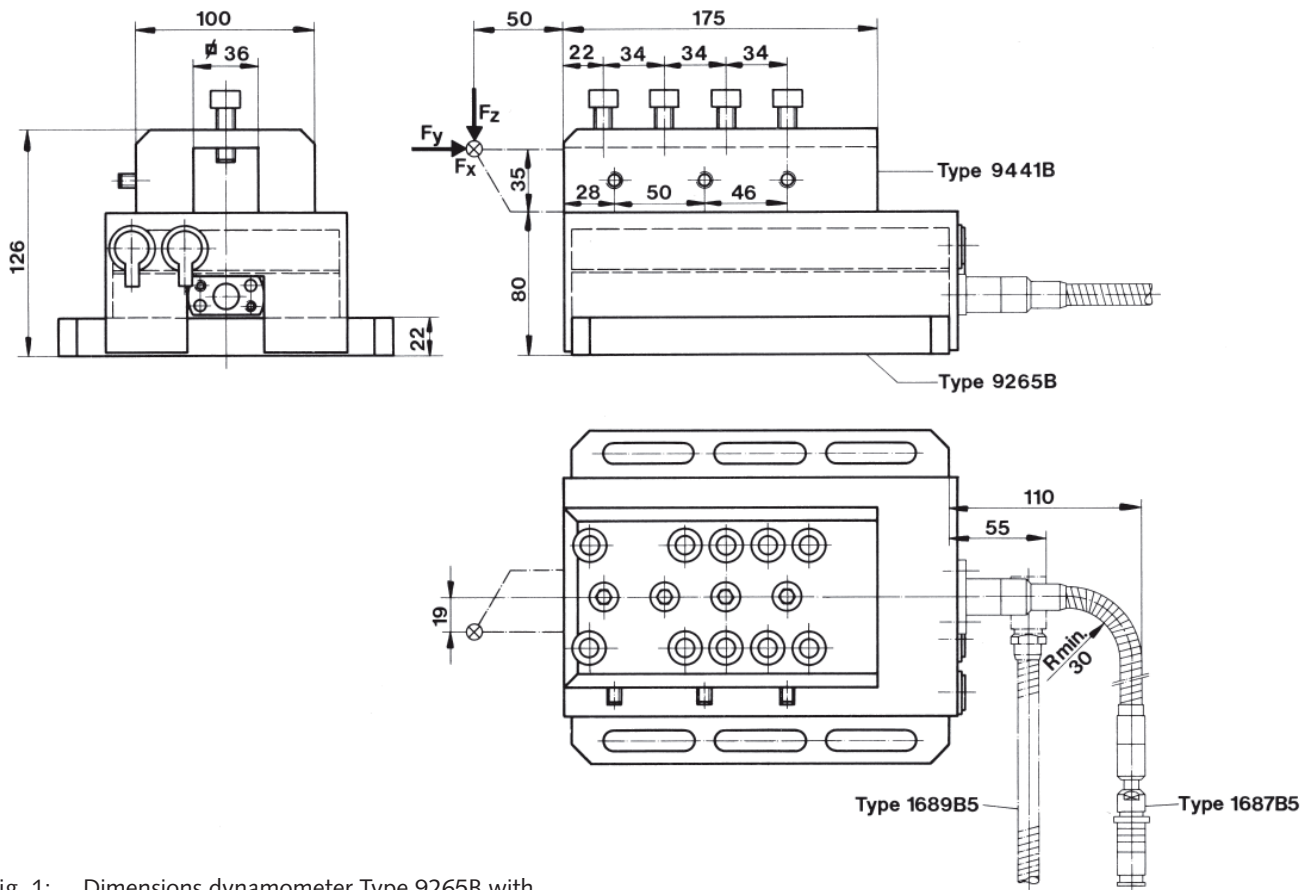


Fig. 1: Dimensions dynamometer Type 9265B with mounted tool holder Type 9441B

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**Dimensions with Mounted Clamping Plate  
(Milling, Grinding)**

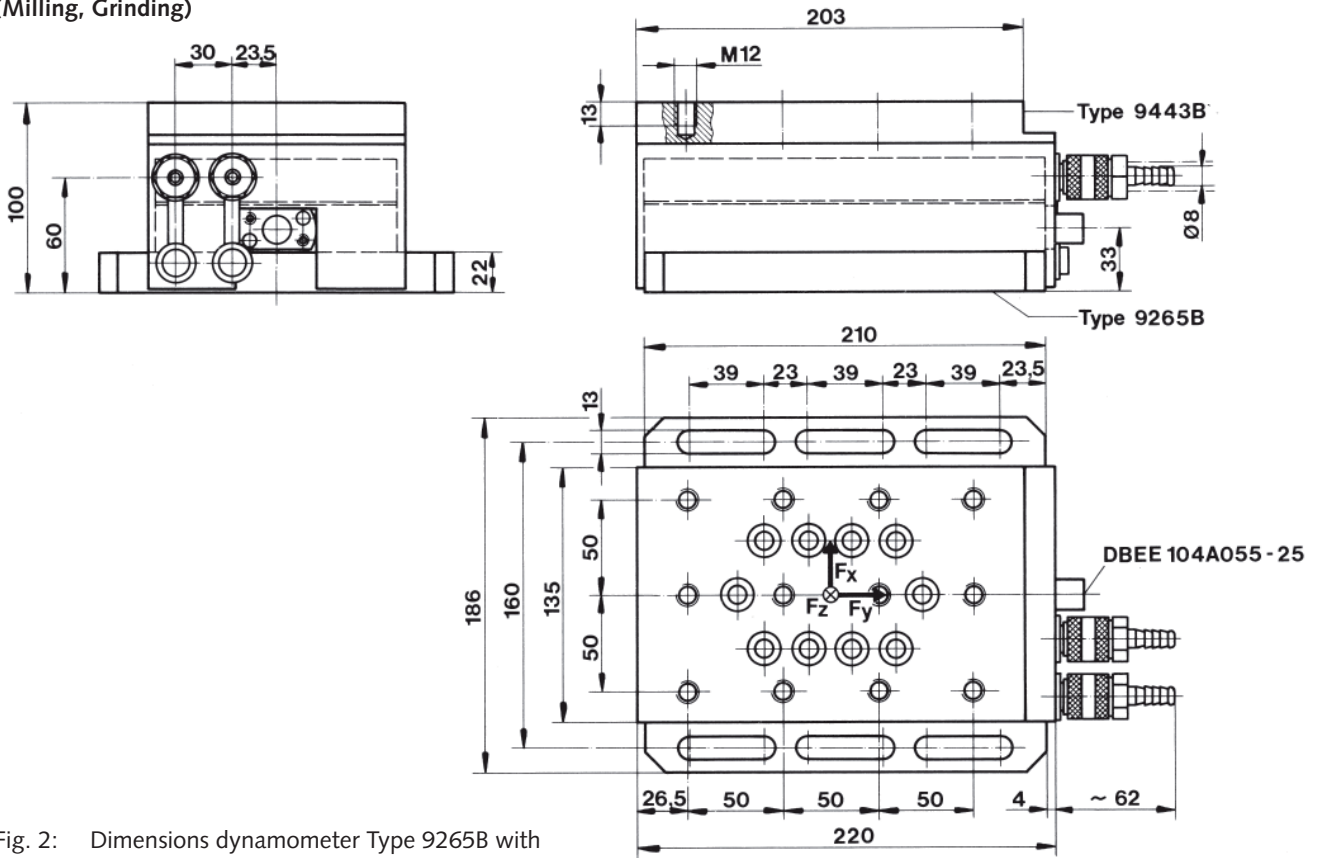


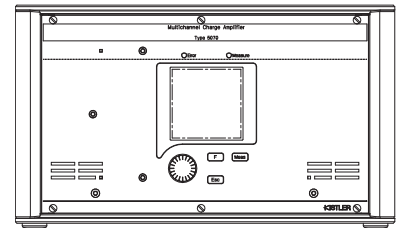
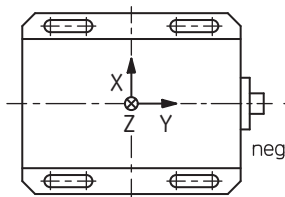
Fig. 2: Dimensions dynamometer Type 9265B with mounted clamping plate Type 9443B

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

Dynamometer  
Type 9265B

Cable

Charge Amplifier  
Type 5070Ax01xx



3 output signals  
from charge amplifier

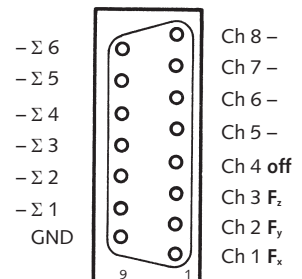


Fig. 3: Example of a measuring system with standard dynamometer

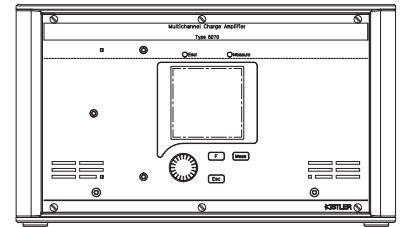
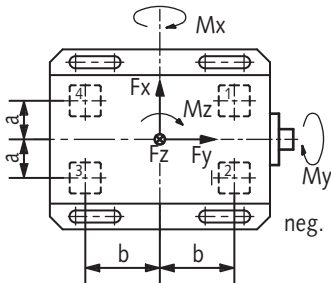
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### 6-Component Force and Moment Measurement $F_x, F_y, F_z, M_x, M_y, M_z$ with 8-Channel Charge Amplifier

Dynamometer  
Type 9265B

Cable

Charge Amplifier  
Type 5070Ax11xx



8 output signals  
from charge amplifier

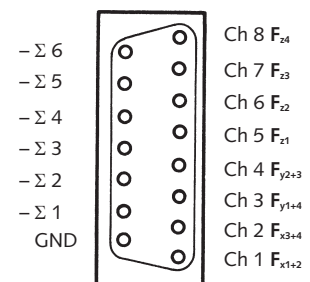


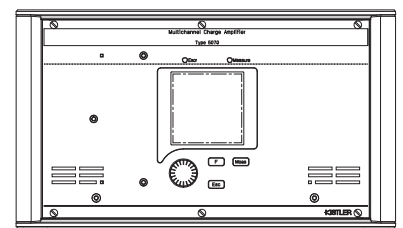
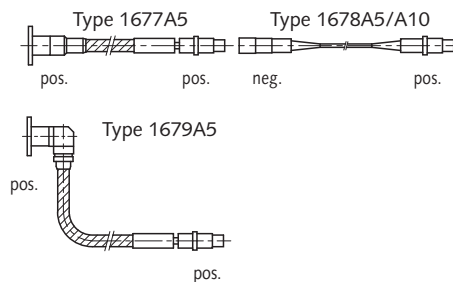
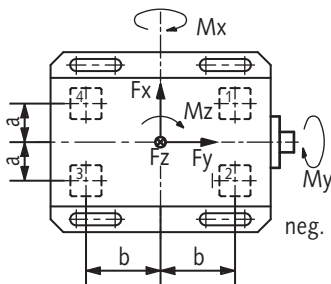
Fig. 4: Example of a measuring system with standard dynamometer

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

Dynamometer  
Type 9265B

Cable

Charge Amplifier  
Type 5070Ax21xx



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

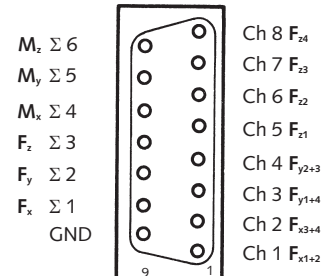


Fig. 5: Example of a measuring system with standard dynamometer

Values a,b for Type 9265B:

a	b
mm	mm
30,5	58,5

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**Supply Forms**

The basic unit Type 9265B as well as the both detachable units (tool holder Type 9441B or clamping plate Type 9443B) can be ordered and delivered separately.

However, the basic unit may **not** be used for measurements without tool holder or clamping plate.

**Signal Conditioning**

A charge amplifier is also needed to build a complete measuring system. The measurement signal is converted into an electrical voltage in the individual channels. The measured value is exactly proportional to the force acting.

The multichannel charge amplifier Type 5070A... has been specially developed for multicomponent force measurement systems.

**Accessories (Optional)**

	<b>Type</b>
• Tool holder	9441B
• Clamping plate	9443B
• 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



Fig. 6: Multichannel charge amplifier Type 5070A...

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