Multicomponent Force Plate

Portable – for Applications in Biomechanics, \( F_z \) 0 ... 10 kN

Portable multicomponent force plate with aluminum top plate for measuring ground reaction forces, moments and the center of pressure in biomechanics.

- Excellent accuracy of center of pressure (COP)
- Very wide measuring range
- Easy mounting
- Flexible, mobile application
- Threshold \( F_z < 250 \) mN

**Description**

Rather than conventional frame mounted force plates, the multicomponent force plate Type 9286B... can simply be used on any flat surface. This drastically cuts installation costs. The plate's low overall height of just 35 mm and weight of under 18 kg allows flexible, portable use.

The piezoelectric 3-component force sensors have very low crosstalk values and in conjunction with the special design principle ensure excellent accuracy of the center of pressure.

**Application**

This force plate is designed specifically for use in gait and balance analyses. The Type 9286BA has a built-in charge amplifier compatible with all of the common motion analysis systems. Despite the very wide measuring range (0 ... 10 kN), this force plate offers excellent accuracy and linearity over the entire spectrum of applications (4 measuring ranges) and guarantees overload protection up to 12 kN.

**Technical Data**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>mm</th>
<th>600x400x35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>( F_x, F_y ) kN</td>
<td>-2.5 ... 2.5</td>
</tr>
<tr>
<td></td>
<td>( F_z ) kN</td>
<td>0 ... 10</td>
</tr>
<tr>
<td>Overload</td>
<td>( F_x, F_y ) kN</td>
<td>-3/3</td>
</tr>
<tr>
<td></td>
<td>( F_z ) kN</td>
<td>0/12</td>
</tr>
<tr>
<td>Linearity</td>
<td>%FSO</td>
<td>&lt;±0.2</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>%FSO</td>
<td>&lt;0.3</td>
</tr>
<tr>
<td>Crosstalk</td>
<td>( F_x \leftrightarrow F_y ) %</td>
<td>&lt;±1.5</td>
</tr>
<tr>
<td></td>
<td>( F_x, F_y \rightarrow F_z ) %</td>
<td>&lt;±2.0</td>
</tr>
<tr>
<td></td>
<td>( F_y \rightarrow F_x, F_y ) %</td>
<td>&lt;±0.5</td>
</tr>
<tr>
<td>Rigidty</td>
<td>( x)-axis ((a_y = 0)) N/µm</td>
<td>&lt;12</td>
</tr>
<tr>
<td></td>
<td>( y)-axis ((a_x = 0)) N/µm</td>
<td>&lt;12</td>
</tr>
<tr>
<td></td>
<td>( z)-axis ((a_x = a_y = 0)) N/µm</td>
<td>&lt;8</td>
</tr>
<tr>
<td>Natural frequency</td>
<td>( f_n (x, y) ) Hz</td>
<td>≈350</td>
</tr>
<tr>
<td></td>
<td>( f_n (z) ) Hz</td>
<td>≈200</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>°C</td>
<td>0 ... 60</td>
</tr>
<tr>
<td>Weight</td>
<td>kg</td>
<td>17.5</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>EN 60529:1992</td>
<td>IP50/IP63</td>
</tr>
</tbody>
</table>

**Force Plate without Charge Amplifier, Type 9286B**

| Calibrated range | \( F_x, F_y \) kN | -2.5 ... 2.5 |
| | \( F_z \) kN | 0 ... 5 |
| Calibrated partial range | \( F_x, F_y \) kN | 0 ... 0.25 |
| | \( F_z \) kN | 0 ... 1 |
| Threshold | \( F_x, F_y, F_z \) mN | <10 |
| Sensitivity | \( F_x, F_y \) pC/N | -7.8 |
| | \( F_z \) pC/N | -3.6 |

1) inside sensor rectangle
2) Type 9286 with charge output IP63
3) nominal value

This information corresponds to the current state of knowledge. Kistler reserves the right to make technical changes. Liability for consequential damage resulting from the use of Kistler products is excluded.
Multicomponent Force Plate – Portable, for Applications in Biomechanics, F, 0 ... 10 kN, Type 9286B...

**Force Plate with Built-in 8 Channel Charge Amplifier, Type 9286BA**

<table>
<thead>
<tr>
<th>Calibrated range 3</th>
<th>Fx, Fy</th>
<th>kN</th>
<th>–2,5 ... 2,5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fz</td>
<td>kN</td>
<td>0 ... 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calibrated partial range</th>
<th>Fx, Fy</th>
<th>kN</th>
<th>0 ... 0,25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fz</td>
<td>kN</td>
<td>0 ... 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensitivity range 1</th>
<th>Fx, Fy</th>
<th>mV/N</th>
<th>≈400</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fz</td>
<td>mV/N</td>
<td>≈180</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensitivity range 4</th>
<th>Fx, Fy</th>
<th>mV/N</th>
<th>≈200</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fz</td>
<td>mV/N</td>
<td>≈90</td>
</tr>
</tbody>
</table>

| Ratio ranges 1:2:3:4 | 1 : 5 : 10 : 20
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold</td>
<td>mN</td>
</tr>
</tbody>
</table>
| Drift               | mN/s | <±10
| Supply voltage      | V, DC | 10 ... 30 |
| Supply current      | mA | ≈45 |

**Output voltage**  
V 0 ... ±5

**Output current**  
mA –2 ... 2

**Control inputs (optocoupler)**  
V 5 ... 45

mA 0,4 ... 4,4

Conforms to the CE safety standards (73/23/EG) for electrical equipment and systems:  
EN 60601-1:2005, EN 61010-1:2001

and the EMC standards (89/336/EG):  
EN 60601-1:2005 (EN 55022 Class B), EN 61000-6-3:2004 (EN 55022 Class B), EN 61000-6-4:2001 (EN 55011 Class B), EN 60601-1:2005, EN 61000-6-1:2001, EN 61000-6-2:2005

**Dimensions**

![Dimensions diagram]

Fig. 1: Dimensions of portable multicomponent force plate Type 9286BA

**Walkway Type 9401B...**

Four different lightweight sandwich elements are available for assembling a walkway of any length with various arrangements of force plates. An anti-slip floor covering provides safety on the walkway as well as on the force plate.

![Walkway diagram]

Fig. 2: Mounting examples

Walkway:  
1 = Type 9401B01, 2 = Type 9401B02, 3 = Type 9401B03, 4 = Type 9401B04

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BioWare®

BioWare software is the engine behind the force plate system. It collects data from the force plates, converts the trials into useful information and plots the results. The force plates and charge amplifiers are fully remotely controlled by BioWare thus making the system extremely flexible and easy-to-use.

Parameters of Gait

BioWare provides several performance specific evaluations.

Parameters of Countermovement Jump CMJ

- Acceleration, velocity and displacement of the center of mass (COM)
- Work, energy, impulse
- Statistics, digital filters

Other functions
- Coefficient of friction (COF)
- Frequency analysis, statistics, digital filters
- Full Windows® functionality

Other parameters
- Acceleration, velocity and displacement of the center of mass (COM)
- Work, energy, impulse
- Statistics, digital filters

Windows® is a registered trade mark of Microsoft Corporation.
Multicomponent Force Plate – Portable, for Applications in Biomechanics, Fz 0...10 kN, Type 9286B...

Typical Measuring Chains

<table>
<thead>
<tr>
<th>Force plate with built-in charge amplifier</th>
<th>Connection cable Type 1758A...</th>
<th>DAQ system (USB 2.0) Type 5691A1</th>
<th>Laptop (provided by user) with BioWare</th>
</tr>
</thead>
</table>

Included Accessories  
- 1 shim set  
- 1 voltage equalizing cable  

Type/Art. No.  
7.050.031  
5.590.175

Optional Accessories  
For Type 9286BA with built-in charge amplifier  
- 16ch DAQ-System for BioWare (USB 2.0)  
- Connection cable for 5691A, straight plug  
- Connection cable for 5691A, angle plug  
- 64ch DAQ-System for BioWare (USB 2.0)  
- Connection cable for 5695A, straight plug  
- Connection cable for 5695A, angle plug  
- External Control Unit (BNC out)  
- Connection cable, straight for Type 5233A...  
- Connection cable, angled for Type 5233A...  
- DAQ system BioWare (PCI-Bus)  

Type/Art. No.  
5691A1  
1758A...  
1759A...  
5695A1  
1700A105B...  
1700A105A...  
5233A2  
1760A...  
1757A...  
2812A...

For Type 9286B with charge output  
- External charge amplifier  
- Connection cable, straight plug  
- Connection cable, angle plug  
- DAQ system for BioWare (PCI-Bus)  

Type/Art. No.  
9865E...  
16858...  
1686A...  
2812A...

For Type 9286B...  
- Walkway, central piece  
- Walkway, extension  
- Walkway, intermediary piece  
- Walkway, ramp  

Type/Art. No.  
9401C01  
9401C02  
9401C03  
9401C04

Ordering Key

Portable Multicomponent Force Plate  
with charge output –  
with built-in charge amplifier A

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