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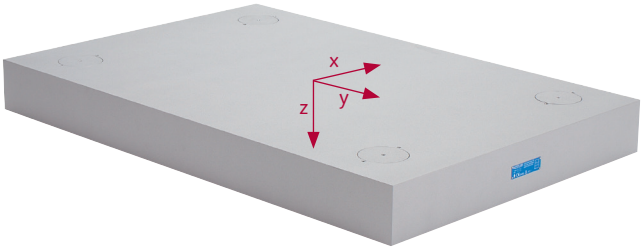
Multicomponent Force Plate

Type 9287C...

Large – for Dynamic Applications in Biomechanics, F_z –10 ... 20 kN

Multicomponent force plate with wide range for measuring ground reaction forces, moments and the center of pressure in biomechanics.



- Extremely wide measuring range
- Excellent measuring accuracy
- High natural frequency
- Versatile
- Threshold F_z <250 mN
- Large dimensions

Description

The multicomponent force plate Type 9287C... consists of a 900x600 mm aluminum sandwich top plate of advanced, lightweight construction and four built-in piezoelectric 3-component force sensors. Thus it is extremely rigid overall, and allows measurements over a very wide useful frequency range.

Thanks to the special properties of the piezoelectric sensors, the force plate is highly sensitive and can simultaneously measure very dynamic phenomena involved in a wide range of applications.

Application

This force plate is designed specifically for use in basic research and sport. Its large size, wide measuring range and high rigidity allow it to be employed for a very wide spectrum of measuring tasks and application sectors. Despite the very generous measuring range of –10 ... 20 kN, it offers excellent accuracy and linearity and even under a large preload allows precise measurement of minute forces. In all these situations the force plate can be mounted in any position without affecting the measurement result in any way.

The Type 9287CA has an built-in charge amplifier compatible with all of the common motion analysis systems.

Technical Data

Dimensions		mm	900x600x100
Measuring range	F_x, F_y	kN	–10 ... 10
	F_z	kN	–10 ... 20
Overload	F_x, F_y	kN	–13/13
	F_z	kN	–10/25
Linearity		%FSO	<±0,2
Hysteresis		%FSO	<0,3
Crosstalk	F_x <–> F_y	%	<±1,5
	F_x, F_y –> F_z	%	<±1,5
	F_z –> F_x, F_y	%	<±0,5 [1]
Rigidity	x-axis (a_y = 0)	N/µm	≈150
	y-axis (a_x = 0)	N/µm	≈200
	z-axis (a_x = a_y = 0)	N/µm	≈30
Natural frequency	f_n (x, y)	Hz	≈750
	f_n (z)	Hz	≈520
Operating temperature range		°C	0 ... 60
Weight		kg	25
Degree of protection	EN 60529:1992		IP65

Force Plate without Charge Amplifier, Type 9287C

Calibrated range	F_x, F_y	kN	0 ... 10
	F_z	kN	0 ... 20
Calibrated partial range	F_x, F_y	kN	0 ... 1
	F_z	kN	0 ... 2
Threshold	F_x, F_y, F_z	mN	<50
Sensitivity	F_x, F_y	pC/N	–7,5 [2]
	F_z	pC/N	–3,8 [2]

[1] inside sensor rectangle
[2] nominal value

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Force Plate with Built-in 8 Channel Charge Amplifier, Type 9287CA

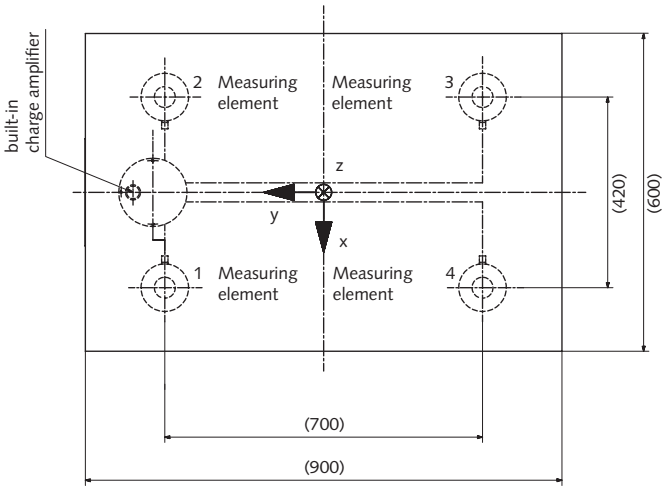
Calibrated range	F_x, F_y	kN	0 ... 5
	F_z	kN	0 ... 20
Calibrated partial range	F_x, F_y	kN	0 ... 1,25
	F_z	kN	0 ... 5
Sensitivity range 1	F_x, F_y	mV/N	≈40 [2]
	F_z	mV/N	≈18 [2]
Sensitivity range 4	F_x, F_y	mV/N	≈2,0 [2]
	F_z	mV/N	≈0,9 [2]
Ratio ranges 1:2:3:4			1 : 5 : 10 : 20 [3]
Threshold		mN	<250 [4]
Drift		mN/s	<±10
Supply voltage		VDC	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

[2] nominal value
[3] ±0,5 % accuracy
[4] only range 1

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



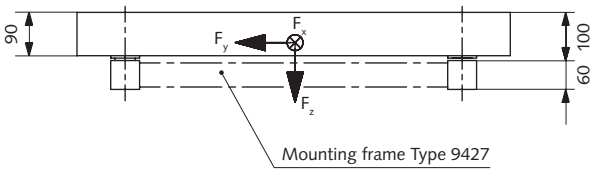


Fig. 1: Dimensions of the large multicomponent force plate Type 9287CA

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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 remote controlled by BioWare thus making the system extremely flexible and easy-to-use.

Parameters of Gait

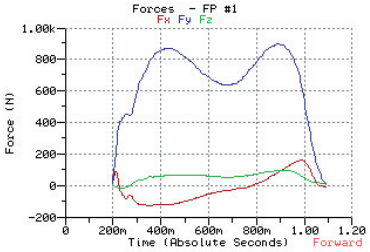

Fig. 2: Ground reaction forces (GRF)

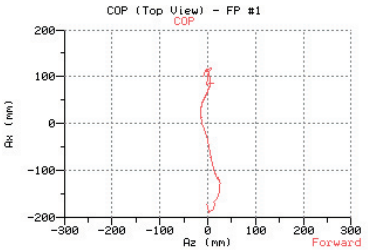

Fig. 3: Center of pressure (COP)

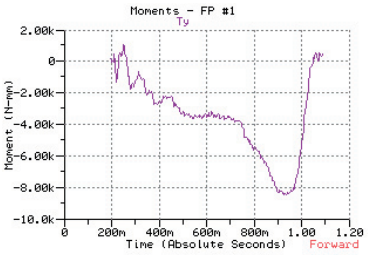

Fig. 4: Frictional torque T_z

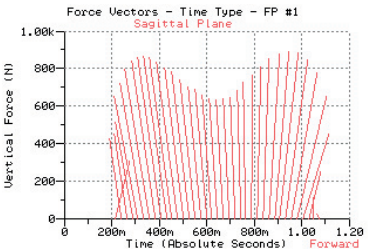

Fig. 5: Force vector

Other functions

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

BioWare provides several performance specific evaluations.

Parameters of Countermovement Jump CMJ

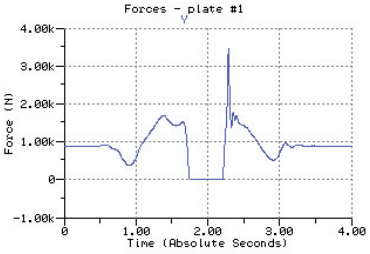

Fig. 6: Jump force

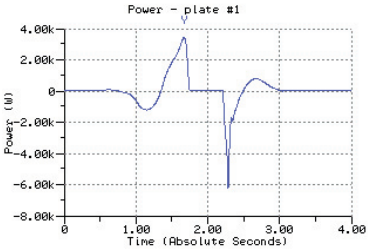

Fig. 7: Power

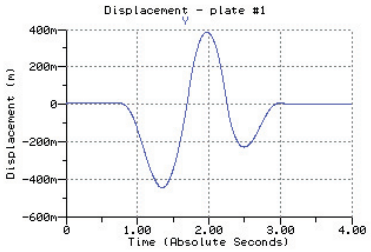

Fig. 8: Jump height (COM)

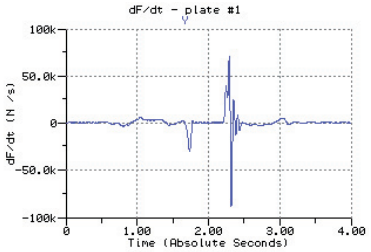

Fig. 9: Force gradient (Explosivity)

Other parameters

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

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Typical Measuring Chains

			
Force plate with charge amplifier Type 9287CA	Connection cable Type 1759A...	DAQ system (USB 2.0) Type 5691A1	Laptop (provided by user) with BioWare

Fig. 10: Configuration of a typical measuring chain

			Ch 1 = F_x 1+2 Ch 5 = F_z 1 Ch 2 = F_x 3+4 Ch 6 = F_z 2 Ch 3 = F_y 1+4 Ch 7 = F_z 3 Ch 4 = F_y 2+3 Ch 8 = F_z 4
Force plate with charge amplifier Type 9287CA	Connection cable Type 1757A...	External Control Unit (8xBNC neg.) Type 5233A2	DAQ system provided by user (8 analog channels)

Fig. 11: Configuration of a typical measuring chain

Included Accessories	**Type/Art. No.**
For Type 9287C...	
• 1 Shim set	7.050.011
• 4 Eye bolts M6 with	6.170.007
washers	6.220.040
• 4 Hexagon socket head cap screws M12x25	6.120.106
• 1 Hexagon socket wrench	1391
• 1 Voltage equalizing cable	5.590.175
• 4 Installation handles	7.511.437

Optional Accessories	**Type/Art. No.**
For Type 9287CA with built-in charge amplifier	
• 16ch DAQ-System for BioWare (USB 2.0)	5691A1
• Connection cable for 5691A, angle plug	1759A...
• 64ch DAQ-System for BioWare (USB 2.0)	5695B1
• Connection cable for 5695B, angle plug	1700A105A...
• External Control Unit (BNC out)	5233A2
• Connection cable for Type 5233A...	1757A...
• DAQ system BioWare (PCI-Bus)	2812A...

For Type 9287C with charge output	
• External charge amplifier	9865E...
• Connection cable, angle plug	1686A...
• DAQ system BioWare (PCI-Bus)	2812A...

Mounting frame for Type 9287C...	
• Standard mounting frame	9427
• Other mounting frames for multiple installations	on request

Ordering Key

Type 9287C ☐

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

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