

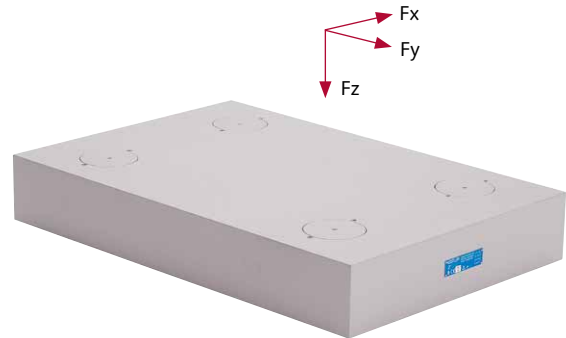
3D force plate

Type 9667AA...

For dynamic applications in biomechanics with digital output

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
- Integrated digital electronics with charge amplifier
- PTP synchronization of force plate systems (16+ plates)
- Various sizes



Description

The multicomponent force plates Type 9667AA... consist of an 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.

Applications

These force plates are designed specifically for use in basic research and sport. The available sizes, wide measuring range and high rigidity allow them to be employed for a very wide spectrum of measuring tasks and application sectors. Despite the very generous measuring range of up to 20 kN, they offer excellent accuracy and linearity and even under a large preload

allow precise measurement of minute forces. In all these situations the force plates can be mounted in any position without affecting the measurement result in any way.

The force plates of Type 9667AA... have a built-in charge amplifier and A/D converter compatible with all of the common motion analysis systems. Thanks to the PTP (precision time protocol) technology, exact time synchronization is achieved for all force plates in the network. This allows the system to be fully scalable.

Additional plates can be added to the system in a daisy chain configuration with a single cable running from plate to plate. With the use of ethernet switches supporting PTP several daisy chains can be linked and synchronized with each other to scale the number of force plates within a system up to a theoretically unlimited number.

Technical data

			9667AA0604	9667AA0906	9667AA0909	9667AA1206
Dimension		mm	600x400x100	900x600x100	900x900x100	1200x600x100
Measuring range	F_x, F_y	kN	-10 ... 10	-10 ... 10	-10 ... 10	-10 ... 10
	F_z	kN	-10 ... 20	-10 ... 20	-10 ... 15	-10 ... 18
Overload	F_x, F_y	kN	-15/15	-15/15	-13/13	-13/13
	F_z	kN	-10/25	-10/25	-13/20	-13/20
Calibrated range (high)	F_x, F_y	kN	0 ... 10	0 ... 10	0 ... 10	0 ... 10
	F_z	kN	0 ... 20	0 ... 20	0 ... 15	0 ... 18
Calibrated range (low)	F_x, F_y	kN	0 ... 0.4	0 ... 0.4	0 ... 0.4	0 ... 0.4
	F_z	kN	0 ... 0.4	0 ... 0.4	0 ... 0.4	0 ... 0.4

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Technical data (continuation)

Natural frequency	$f_n(x, y)$ $f_n(z)$	Hz Hz	$\approx 1\ 000$ $\approx 1\ 000$	≈ 750 ≈ 520	≈ 600 ≈ 390	≈ 750 ≈ 520
Center of pressure error (COP)	da_x da_y	mm mm	$5^{1) 2)}$ $5^{1) 2)}$	$5^{1) 2)}$ $5^{1) 2)}$	$5^{1) 2)}$ $5^{1) 2)}$	$5^{1) 2)}$ $5^{1) 2)}$
Weight		kg	16	25	30	28
Linearity	typical value	%FSO	$\leq \pm 0.2$ ± 0.1			
Hysteresis	typical value	%FSO	≤ 0.3 0.2			
Crosstalk	$F_x \leftrightarrow F_y$ $F_x, F_y \leftrightarrow F_z$ $F_z \rightarrow F_x, F_y$	% % %	$\leq \pm 1.5$ $\leq \pm 1.5$ $\leq \pm 0.5^{2)}$			
Threshold (low)	$F_{x, y}$ F_z	mN	20 40			
Operating temperature range		°C	0 ... 60			
Degree of Protection	EN 60529:1992		IP65			

¹⁾With global polynomial correction

²⁾Inside sensor rectangle

Electrical data

Supply voltage range		VDC	18 ... 30			
Power consumption per force plate		W	<5			
Resolution ADC/ channel		Bit	24			
Sampling rate		kHz	≤ 7.8125			
Synchronization error (IEEE1588 typ.)		μs	≤ 10			
Resolution (high)	$F_{x, y}$ F_z	N/bit N/bit	0.013 0.025			
Resolution (low)	$F_{x, y}$ F_z	N/bit N/bit	0.0009 0.0018			
Output noise (high)	$F_{x, y}$ F_z	N_{rms}	<0.25 <0.5			
Output noise (low)	$F_{x, y}$ F_z	N_{rms}	<0.02 <0.04			
Drift ($\Delta t = 0^\circ C$)		N/min	≤ 0.5			
Trigger/Sync output			Open-collector with internal pull-up			
Type						
Internal pull-up resistor		k Ω	9.4			
High-level output voltage		V	5			
Low-level output voltage		V	<0.2			
Trigger/Sync input						
Input voltage range		V	-2 ... 7			
High-level input voltage		V	>2.1			
Low-level input voltage		V	<0.5			

Note: For the data acquisition an anti-aliasing filter is automatically set with a cutoff frequency of 0.15 ... 0.45 x selected output rate

Connections

Cable type			Combined power and network cable
Ethernet interface			RJ45
Connector type			industrial M12

Measurement chain

Maximum number of daisy-chainable devices (e.g. force plates) ³⁾			16
Maximum current		A	4
Power consumption for 16-chained force plates		W	<80

³⁾ several daisy chains can be combined

Dimensions

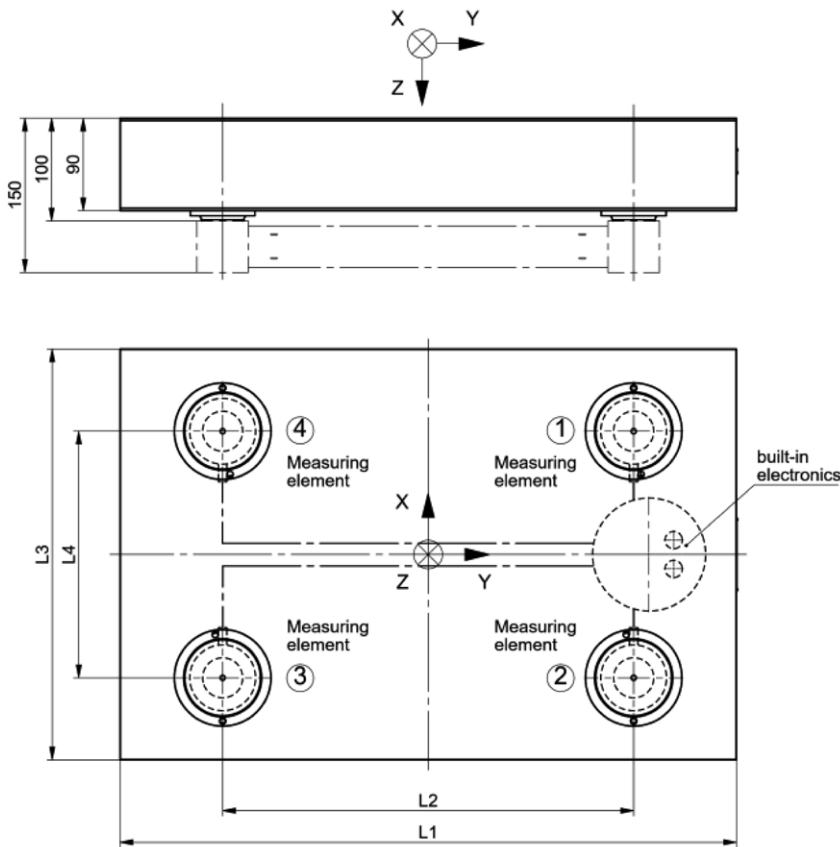


Fig. 1: Dimensions of force plates Type 9667AA...

Type	L1 [mm]	L2 [mm]	L3 [mm]	L4 [mm]
9667AA0604	600	400	400	240
9667AA0906	900	700	600	420
9667AA0909	900	700	900	700
9667AA1206	1 200	700	600	420

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Installation

All force plates are sensitive to ground vibrations. Therefore, a force plate must be mounted on a solid and heavy foundation that is as free as possible from ground vibration. In addition, the force plate should be mounted level with the surrounding floor to make it easily accessible and safe. This can be ensured

by using a mounting frame or four mounting anchors. More information can be found in the installation manual. It is important to involve Kistler as a consultant in the planning at an early stage.

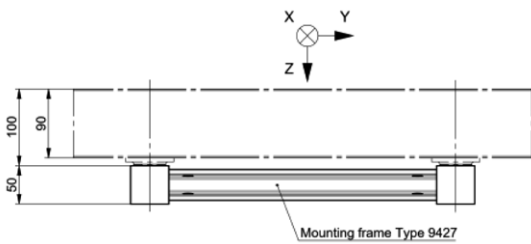


Fig. 2: Mounting frame Type 9423 and 9427

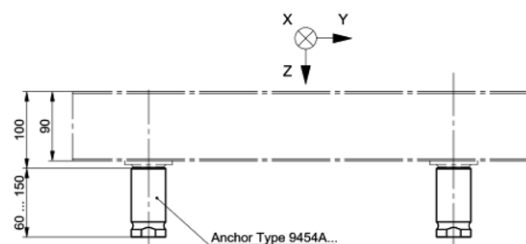


Fig. 3: Mounting anchor Type 9454...

Typical measuring chains

			
Digital force plate Type 9667AA...	Connecting cable Power & Ethernet Type 1200A263...	Power/Ethernet cable set Type 5793	Laptop (provided by user) with BioWare

Fig. 4: Configuration of a typical measuring chain – several force plates can be connected via daisy chain

					
Force plate with charge output	Connecting cable Type 1658A...	DAQ 2 Box Type 5437A1	Connecting cable Power & Ethernet Type 1200A263...	Power/Ethernet cable set Type 5793	Laptop (provided by user) with BioWare
Digital force plate Type 9667A...U69/U70					

Fig. 5: Configuration of a typical measuring chain after the upgrade of a force plate Type 9281EA/9281E or 9287CA/C

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Included accessories

- 1 Shim set
- 4 Eye bolts M6
- 4 Washers
- 4 Hexagon socket head cap screws M12x25
- 1 Hexagon socket wrench
- 1 Voltage equalizing cable
- 4 Installation handles

Type/Mat. No.

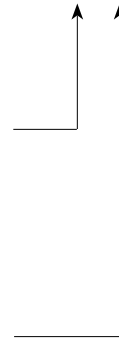
65013672
65013148
65013277
65012767

1391
65009873
7.511.437

Ordering key

600 x 400 x 100	0604
900 x 600 x 100	0906
900 x 900 x 100	0909
1 200 x 600 x 100	1206

Type 9667AA



Optional accessories

- Power/Ethernet cable set
- Sync box
- Connecting cable Power & Ethernet (various lengths and configurations)
 - angle (m) – angle (m)
L = 2, 5, 10 m
 - angle (m) – straight (m)
L = 10, 15, 20, 25, 30, 35 m
 - angle (m) – straight (f)
L = 2, 10, 20, 30, 40 m
 - straight (f) – straight (f)
L = 0.3, 2 m

Type/Mat. No.

5793A
5699A
1200A263...
1200A263AMAM...
1200A263AMSM...
1200A263AMSF...
1200A263SFSF..

Upgrade from type

9281EA/9287CA	U69
9281E/9287C	U70
9281EAQ10/9287CAQ10	U71
9287CAQ01/9287CAQ02	U69
9287CAQ01/9287CAQ02 (from SN 5788025)	U71

Mounting accessories

- Standard mounting frame for Type 9667AA0604/0906/1206
- Standard mounting frame for Type 9667AA0909
- Standard mounting anchor set (available in different heights)
- Other mounting frames for multiple installations

Type/Mat. No.

9427
Z20342
9454A...
on request

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