3D Shaker

Excitation in x-, y- & z-axis

MB DYNAMICS
Sound & Vibration Testing Technology

3D shaker for squeak & rattle and fatigue testing in x-, y- and z-axes

Testing a component under excitation in multiple axes is not only part of many test specifications, it is often necessary to target and investigate structural weaknesses or noise sources. Our 3D shaker tables allow a wide range of parts and components to be excited in the x, y and z axes. Real-world vibration conditions and noise-critical excitation can be accurately replicated in multiple axes in the laboratory. With excitation forces of up to 12 kN and an optional climatic package for use in a climatic chamber, the shaker can be universally used for squeak and rattle tests and fatigue tests in accordance with a wide range of test specifications. Our 3D shaker tables can also be upgraded at any time for simultaneous x, y and z axis excitation or vertical pitch & roll testing by adding two additional shakers. Our 3D shakers are modular, upgradeable "universal" shakers that meet the requirements of a wide variety of OEM test specifications and will continue to grow with your test requirements in the future..

Features & Benefits:

- Universally applicable
- Upgradeable to simultaneous excitation in 3 axes and Vertical Pitch & Roll excitation
- Low operating noise – ideal for Squeak & Rattle testing
- High excitation forces of up to 12000N
- Vibration displacement up to 25mm pk-pk
- Frequency range 3Hz to 200Hz
- Suitable for specimens up to 400kg
- Short set-up times, no need to remove the specimen from the shaker table
- Vibration table 1350mm*600mm (standard), other sizes optionally available
- Small footprint
- High efficiency and low power consumption
- Robust design, low maintenance, reliable and durable

Typical applications:

- Noise analysis (squeak & rattle tests) on various components
- Fatigue testing with and without climatic overlay

Options / Accessories:

- Water cooling for ALPHA shakers
- Climate option for use in a climatic chamber (-40°C to +80°C)
- Climatic barrier for connecting the vibration table to a climatic chamber
- Test sequence control for fully automated execution of predefined test sequences
- Mobile BSR SUITE measurement system for objective evaluation of Buzz, Squeak and Rattle noise

3D Shaker

Excitation in x-, y- & z-axis

MB DYNAMICS
Sound & Vibration Testing Technology

Movable *ALPHA* MLB shakers allow excitation in 3 axes

Three axis excitation is provided by our ALPHA MLB series of moveable, quiet shakers. Integrated spring ball rollers and electromagnetic clamping allow easy and convenient positioning and mounting of the shakers for excitation of the shaker table in the x, y and z axes. Switching between excitation directions takes only a few minutes and does not require removing the specimen from the shaker table. With excitation forces of up to 12kN and a maximum stroke of 25mm, the 3D shaker tables can be used universally for squeak & rattle, functional and fatigue testing.

Figure 1: The ALPHA MLB shaker can be moved to excite the 3D shaker table in the x, y and z axes, allowing the direction of excitation to be changed quickly and easily without dismantling the specimen.

Fig. 2: Magnesium honeycomb structure enables the construction of rigid, lightweight vibration tables with integrated threaded inserts for flexible mounting of specimens.

Magnesium Honeycomb Vibrating Tables

A magnesium honeycomb structure enables the construction of heavy duty, rigid and lightweight vibration tables. The standard size of the vibration table is 1350mm*600mm. Other sizes are available as an option. The weight and the radiating surface are minimised by the honeycomb structure, which results in a higher maximum acceleration and a minimum of operating noise. All vibration tables have M8 threaded inserts in a 75mm x 75mm grid to allow flexible mounting of a variety of test specimens and test specimen fixtures.

Minimising uncontrolled lateral accelerations

In practice, soft suspension of the vibration table, e.g. using air springs without additional guidance, often leads to uncontrolled lateral accelerations and rotational motions which have different effects on the resulting vibration conditions depending on the centre of mass of the test specimen. These uncontrolled excitations cause the resulting excitation signal to be mismatched with the desired excitation and are often the cause of large variations in test results. Our 3D Vibration Tables use guide and transmission arms to provide synchronous excitation and forced guidance in the x- and y-axes, ensuring controlled and reproducible excitation of the vibration table.

Figure 3: Guide and transmission arms ensure synchronous excitation and guidance of the magnesium table.

3D Shaker

Excitation in x-, y- & z-axis

MB DYNAMICS
Sound & Vibration Testing Technology

Climate package for use in temperatures ranging from -40C to +80°C

The optional climate package allows ALPHA shakers to be used in a climate chamber. The shakers are thermally insulated and equipped with water cooling. A combined heating/cooling unit outside the climate chamber ensures that the shaker is kept at a constant operating temperature regardless of the current load and ambient temperature.

Figure 4: Thermally insulated, water cooled ALPHA 2025 MLB shaker. The temperature is controlled by a dedicated heating/cooling unit.

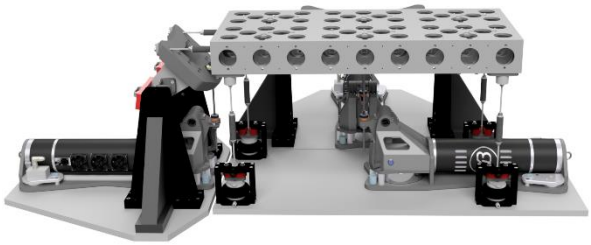


Figure 6: Simultaneous excitation in x, y and z axis or in Vertical Pitch & Roll (VPR) mode with 3 ALPHA MLB shakers.

Upgradable: Simultaneous x/y/z and Vertical Pitch & Roll excitation

By adding two additional ALPHA MLB shakers, simultaneous excitation in x/y/z and Vertical Pitch & Roll (VPR) mode is possible. Squeak and Rattle and fatigue tests from different OEMs can be performed on a single test stand.

Precise and repeatable excitation in all axes

The control of the three excitation axes by a feedback multi-axis vibration control system allows reproducible excitation in one, two or three axes with different excitation signals such as sine, sine sweep, random excitation, recorded time signal data from different test tracks, square wave signals or externally generated wavelets. Transfer of external data to the vibration control system is quick and easy using common file formats such as TXT, CSV, HDF, RPC, TDMS or UFF58.

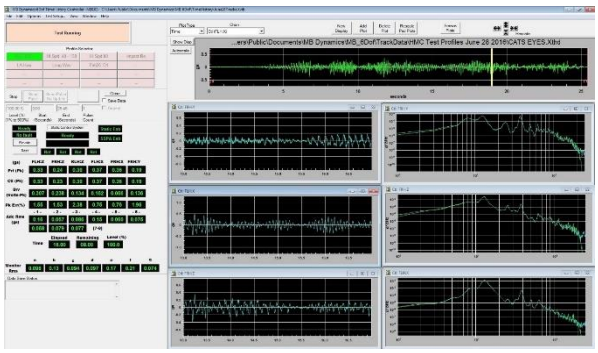
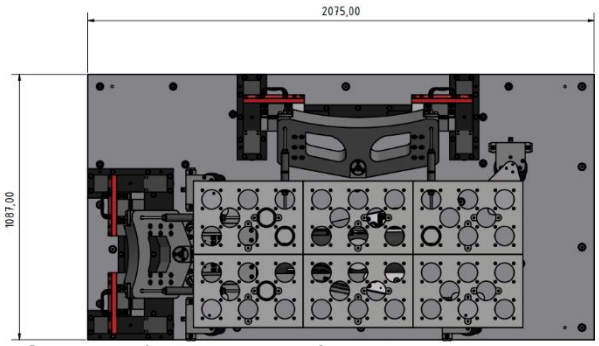


Figure 5: Multi-axis vibration control system for feedback control and monitoring of excitation in x, y and z axes.



Compact design allows easy integration into acoustic rooms

The compact design and small footprint of the 3D shaker allows easy integration into acoustic rooms and test laboratories. The easy access to the magnesium mounting table facilitates the mounting of specimens and test fixtures, as well as noise analysis during a running test.

3D Shaker

Excitation in x-, y- & z-axis

MB DYNAMICS
Sound & Vibration Testing Technology

Technical data:

3D shaker tables for excitation in x-, y- and z-axis				
	3D-2025	***3D-2050***	***3D-4050***	***3D-6050***
Shakers used	ALPHA 2025 MLB	ALPHA 2050 MLB	ALPHA 4050 MLB	ALPHA 6050 MLB
Mounting surface vibrating table	1350mm*600mm	1350mm*600mm	1350mm*600mm	1350mm*600mm
Mounting hole grid	M8 threaded inserts on 75mm*75mm hole grid	M8 threaded inserts on 75mm*75mm hole grid	M8 threaded inserts on 75mm*75mm hole grid	M8 threaded inserts on 75mm*75mm hole grid
Lever arm ratio	2:1	2:1	2:1	2:1
Max. dyn. excitation force				
Sine	4000N peak	4000N peak	8000N peak	12000N peak
Random	2400N rms	2400N rms	4800N rms	7200N rms
Time signal replication	8000N peak	8000N peak	16000N peak	24000N peak
Operating noise *				
Sound level **	<32dB(A)	<32dB(A)	<35dB(A)	<35dB(A)
Loudness, N10 percentile ***	<1 Sone	<1 Sone	<1.2 Sone	<1.2 Sone
Max. vibration displacement	12.5mm pk-pk	25mm pk-pk	25mm pk-pk	25mm pk-pk
Max. velocity	1m/s	1m/s	1m/s	1m/s
Max. acceleration ****				
bare table, Sine	25m/s² peak	23m/s² peak	39m/s² peak	58m/s² peak
bare table, Random	15m/s² rms	14m/s² rms	23m/s² rms	35m/s² rms
@100kg, Sine	13m/s² peak	12m/s² peak	23m/s² peak	34m/s² peak
@100kg, Random	8m/s² rms	7m/s² rms	14m/s² rms	20m/s² rms
@200kg , Sine	9m/s² peak	8m/s² peak	16m/s² peak	24m/s² peak
@200kg, Random	5m/s² rms	5m/s² rms	10m/s² rms	14m/s² rms
Frequency range	3-200Hz	3-200Hz	3-200Hz	3-200Hz
Max. payload	250kg	250kg	400kg	400kg
Crosstalk axes *****	<10%	<10%	<10%	<10%
Overtravel protection	Yes	Yes	Yes	Yes
Overtemp protection	Yes	Yes	Yes	Yes
Automatic load support	Yes	Yes	Yes	Yes
Integrated air cooling	Yes, air-cooled	Yes, air-cooled	Yes, air-cooled	Yes, water-cooled
Water cooling	Optional	Optional	Optional	Integrated
Thermal barrier	Optional	Optional	Optional	Optional

* Measured at a distance of 70 cm from the centre of the bare shaker table when excited with typical squeak and rattle test profiles in the frequency range of 5 Hz to 100 Hz, mean acceleration value of 0.3 g RMS.

** A-weighted sound pressure level, FAST (125ms), 100Hz to 20kHz

*** N10 percentile level, loudness according to DIN45631/A1, measured in accordance with GMW14011

**** Adequate cooling of the shaker is required for maximum excitation forces.

***** Related to the RMS value of the accelerations in the frequency range 5Hz-100Hz