

JPK Acoustic Enclosure with Temperature Control for live cell applications

High-performance AFM studies rely not only on the instrument, but also on the environment around it. In some cases the environmental conditions in a laboratory are not optimal for high-performance measurements (e.g. when there are refrigerators, fans or air-conditioning systems nearby). To assist our customers in achieving high-resolution imaging using the NanoWizard® AFM, JPK has developed a new, versatile acoustics and vibration isolation platform. The option to control the temperature of the entire system enables the investigation of biological samples. Thus, a seamlessly integrated platform can be offered to give our instruments the best environmental conditions.

Setup Description

Aside from the stability and vibration damping, the key issue in designing such a platform is to ensure size flexibility to fit all possible setups. These range from JPK TopViewOptics™ to sophisticated setups integrated with inverted optical microscopes, which in turn may add their own accessories to expand the range of microscopy applications. Yet this need for space has to be met by an acoustic enclosure construction which should fit even in smaller laboratories.

The JPK Acoustic Enclosure consists of two pieces, so that it can be taken apart for transport and fits through standard door frames (as little as 800mm wide). When installed, both parts join together utilizing an overlapping joint to ensure maximum acoustic noise damping.

Heating elements keep the enclosure at constant temperature. Using an adjustable air flow the entire setup including AFM, optical components and more can be quickly adjusted to the desired temperature. The air flow is equally distributed in the enclosure ensuring a homogeneous temperature. The advanced design of the installation allows AFM scanning while keeping the heating turned on.

For adjustments of the AFM or an optical microscope, the small doors on the front can be used leading to no more than 0.1 K temperature drop.



Fig. 1 JPK Acoustic Enclosure with temperature control

To meet the requirements of laboratories with biosafety level 1 the acoustic enclosure can be wiped clean on the outside as well as on the inside. The surface is easy to clean and inert to disinfectants.

In order to allow working with high-end optical detectors it is possible to darken the front and side windows completely so that no light from the outside enters.

Four conveniently placed openings serve as lead throughs for cables to the outside of the enclosure. Maximum acoustic isolation is achieved by sealing those openings again after installation.

Sturdy Base

The base for the JPK Acoustic Enclosure consists of a simple but effective heavy steel frame, which has an opening at the front side designed to house the JPK Vortis™ Controller. The steel framing has been designed using FEM to eliminate shear vibrations (off-normal), which

are known to cause a problem for active vibration isolation control. A sturdy table board matches the performance of the steel base and delivers great support for either a stand alone system or the JPK Acoustic Enclosure.



Fig. 2 Base for JPK Acoustic Enclosure with heavyweight sandwich construction table top.

The whole system is designed to accommodate all standard active vibration isolation tables such as i4 from Accurion, TS line from Herzan or MinusK tables.

The JPK base and table top is useful as a solid base table for AFM scanning even without the acoustic enclosure. The 1m x 1m table top dimension allows for larger experiments such as AFM or SPM combined with fluorescence microscopes, interferometers etc.

The JPK Acoustic Enclosure covers the whole area of the table top, to accommodate larger experimental setups such as an AFM combined with an inverted microscope.

Applications

Constant temperature control of the entire system ensures drift-free measurements for even the most advanced samples like living cells, biomolecules or membranes.

The JPK Acoustic Enclosure is most suitable for experiments that require liquid exchange as the buffer solutions can be heated as well. Living cell imaging or the kinetic/dynamic investigation of biological samples can be combined with the advantages of an incubator.

High resolution optical techniques utilizing immersion objectives become more stable enabling long term drift-free experiments.

Specifications

JPK Acoustic Enclosure:

- inner dimensions:
1130 mm height x 1000mm width x 970mm depth
- weight: ~200kg
- 38mm MDF sandwich wall construction
- 4 openings (diameter 75mm) for cable access
- Certified in accordance with DIN 11546-1 to provide an overall acoustic noise reduction of 33dB (DIN 717-1).
- may be taken apart for transportation to fit through standard doors (800mm)
- windows can be obscured for measurements in the dark
- perfect cleaning capabilities for use with genetically modified cells, bacteria, yeast or other sensitive samples

JPK heating system for Acoustic Enclosure:

- homogeneous air flow
- temperature stability ± 0.1 K at 37°C
- simultaneous heating and AFM scanning
- exchange liquids (like buffer solution) can be kept at sample temperature

JPK Base with table top for Acoustic Enclosure:

- dimensions (frame):
1000mm x 1000mm x 750mm height
- black powder-coated steel frame
- robust steel frame minimizes shear vibrations
- accommodates JPK Vortis™ Controller
- sandwich construction table top with easy-to-clean surface