

PICOSCALE Vibrometer Shaker Stage PV-SHK-V1.0

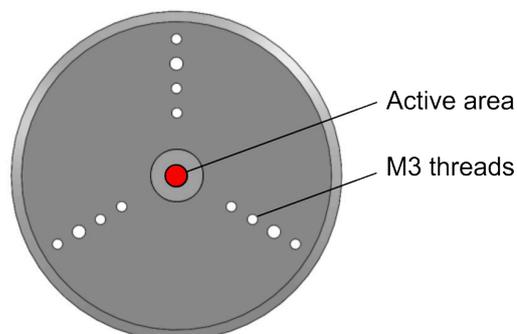
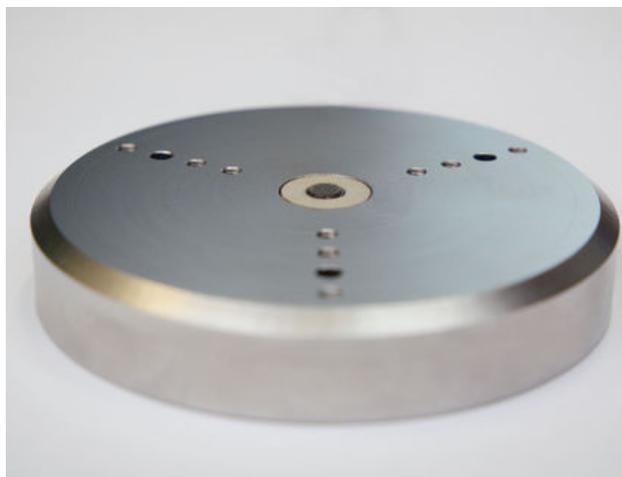


Figure 1. Schematic drawing of the shaker stage. Vibrations are induced at the active area (shown in red).

Table 1. Specifications of the shaker stage.

The shaker stage is intended for use with the **PICOSCALE Vibrometer**. It allows the mechanical excitation of samples at frequencies of up to 1.5 MHz. Applications include the excitation of motion sensors and micro-cantilevers in order to find their resonance frequencies and bending modes. The shaker stage can also be used as a stable passive mount for small samples.

1. SPECIFICATIONS

The heart of the shaker stage is a fast piezo actuator that is mounted in a solid stainless steel housing. The piezo actuator is driven by a power amplifier within the **PICOSCALE Vibrometer** stage controller. Frequency and amplitude of the drive signal can be set in the control software. Vibrations are only induced at the central 5 mm diameter titanium disc (Figure 1). Table 1 summarizes the specifications of the shaker stage.

2. SAMPLE MOUNTING

The shaker stage rests on three PTFE sliders such that it can be easily moved over the granite base of the **PICOSCALE Vibrometer**. This permits an easy positioning of the sample with respect to the measurement laser beam. Samples can be mounted on the shaker stage with a small amount of adhesive material such as vacuum grease, double sided sticky tape or bluetack. The use of liquids should be avoided as these can enter the shaker stage and will damage the piezo actuator. Samples that are larger than the active area of the shaker stage can be mounted such that at least a part of the sample is in contact with the active area. The mass of the sample will affect the induced vibrations, especially at higher frequencies the amplitude will be reduced.

| Property | Value |
|--|-------------------------------|
| Vibration amplitude [μm_{RMS}] | <0.1 |
| Typical drive signal ¹ [V_{PP}] | 5 |
| Bandwidth ² [MHz] | >1.5 |
| Connector | FGG.0B.302.CLAD 2 pin Lemo |
| Noise level ³ [dB(A)] | <54 |
| Active area \varnothing [mm] | 5.0 |
| Material active area | Titanium |
| Housing \varnothing x H [cm] | 8.0 x 1.5 |
| Material housing | Inox |
| Weight [kg] | 0.8 |

¹With a 7.5 V DC component.

²See Figure 2 for the amplitude spectrum.

³Measured at 50 cm distance.

3. OPEN-LOOP OPERATION

Due to its high bandwidth, the shaker stage operates in open-loop. This means that the amplitude depends on the driving voltage and frequency but also on the mass of the sample and its position on the active area of the shaker stage. As with any high-speed motion system, the dynamic behavior is a convolution of mechanical resonance frequencies of the individual components and of the electrical resonances in the electronic circuit. The shaker stage and driving electronics are optimized to deliver a smooth response by mini-

mizing pronounced peaks in its amplitude spectrum (Figure 2). Although the shaker stage operates in open-loop it is possible to obtain the quantitative response of a sample by performing differential measurements (vibrations measured on the sample are compared with those measured on the background).

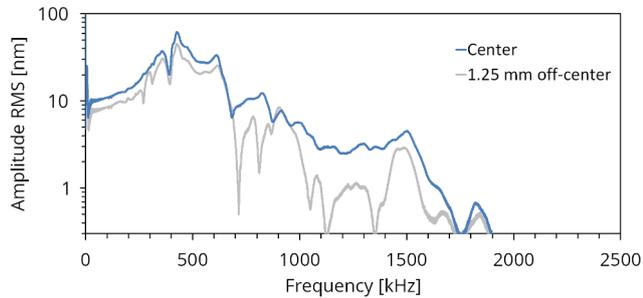


Figure 2. Typical response of the shaker stage measured with the PICOSCALE Vibrometer. The $5V_{pp}$ drive signal was generated by the stage controller, no sample was mounted. At the vertical axis the actual RMS amplitude is shown at each frequency. The blue curve was recorded at the center of the active area, up to 1.6 MHz the induced amplitude is more than 1 nm. The gray curve was recorded 1.25 mm towards the periphery.

4. ORDER CODES

The order code of the PICOSCALE *Vibrometer* shaker stage is given in Table 2.

Table 2. Order code of the PICOSCALE *Vibrometer* shaker stage.

| Order code | Description |
|-------------|--|
| PV-SHK-V1.0 | PICOSCALE <i>Vibrometer</i> shaker stage |

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