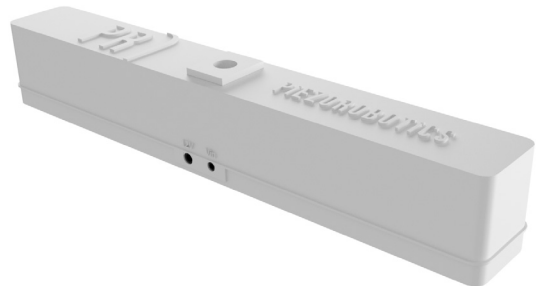


pr.PIMA – Piezoelectric Inertial Mass Actuator

The PiezoRobotics' Piezoelectric Inertial Mass Actuator is a high-performance electronic actuator used to reduce the dynamic response of a mechanical structure. It is the next generation of vibration absorbers, evolved from simple passive materials, benefiting from electronic controllability. By using an external energy source, the integrated electronics converts an input control signal into a dynamic mechanical force by means of a piezoelectric material. The actuator thus provides a controllable force that acts on the mechanical structure, useful in applications such as active vibration control.

Key Features

- Integrated amplifier
- Integrated accelerometer
- Low voltage input signal
- High generated peak force
- Broadband frequency response



Technical Specifications

Specification	Value	Notes
Supply Voltage	12 V _{DC}	
Supply Current	0.13 A to 0.42 A	
Supply Power	1.5 W to 5.0 W	
Input Control Signal	0 V to 3.0 V _{p-p}	DC offset = 1.5 V
First Resonance Frequency	100 Hz	customizable
Effective Moving Mass	0.1 kg	customizable
Peak Force	85 N	customizable
Operating Bandwidth	20 Hz to 600 Hz	customizable
Operating Temperature	-20°C to +40°C	
Dimensions	262 x 48 x 37 mm	customizable
Total Weight	0.325 kg	

Applications

Active Vibration Control, Active Mass Damping, Active Vibration Isolation, Active Noise Control, Vibration Shaker

Application Examples

The pr.PIMA can be used in damping mode, mounted onto a mechanical structure that is usually subject to internal vibrations. By using the feedback signal of the integrated accelerometer and a proper input control signal generated by an external controller, the vibrations of the mechanical structure can be reduced.

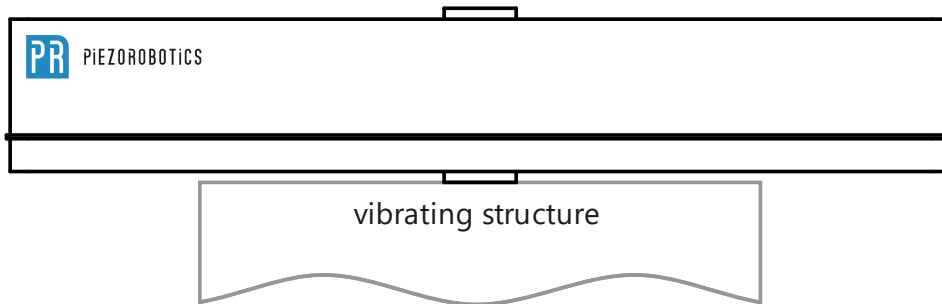


Figure 1. The pr.PIMA in active vibration damping mode

The pr.PIMA can also be used isolation mode, mounted between an external vibration source and the mechanical structure (e.g. sensitive equipment), to reduce the vibration transmission.

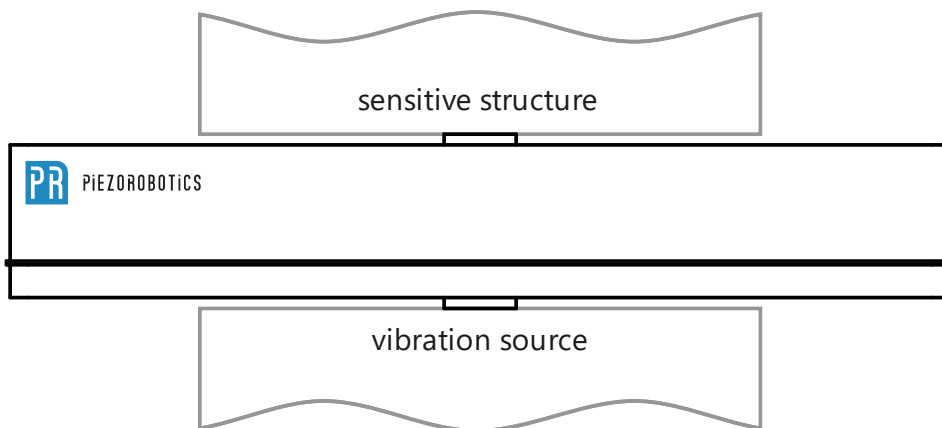


Figure 2. The pr.PIMA in active vibration isolation mode

Electrical Connection

The pr.PIMA is powered using a 3.2 mm plug and a 12 V_{DC} power supply. The analog input control signal and the analog output signal of the integrated accelerometer are transmitted using a 2.5 mm stereo plug (input in the Left channel, output in the Right channel).

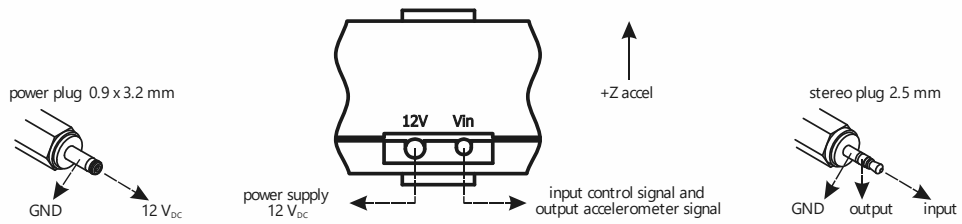


Figure 3. Power and analog signals connections

Mechanical Mounting

The pr.PIMA can be mounted onto any structure by means of a screw that passes through its total height, positioned at the center. The recommended tightening torque is 5 Nm.

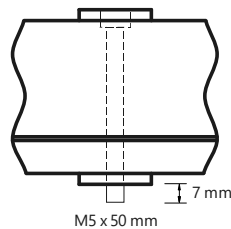


Figure 4. Mechanical mounting of the pr.PIMA using a screw

Operation

The pr.PIMA has an integrated high-voltage linear amplifier that converts the input control signal into a dynamic mechanical force, by means of a piezoelectric material. An external power supply is necessary. The integrated accelerometer measures the vibration level of the structure. An external controller can be used to generate the input control signal, based on the accelerometer signal, to perform vibration control.

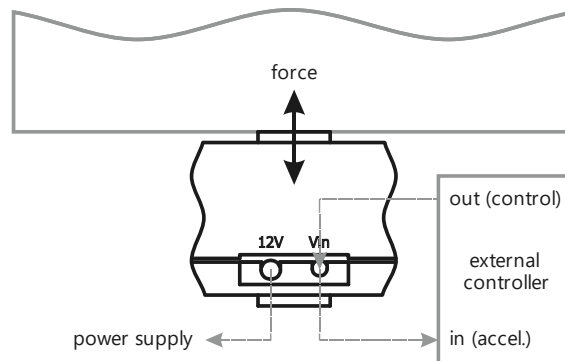


Figure 5. Electromechanical operation of the pr.PIMA

Accelerometer

The pr.PIMA has an integrated analog accelerometer positioned at the center mounting screw. The acceleration in the +Z direction of the vibrating structure is therefore measured. The acceleration signal can be used in applications such as active vibration control in the feedback control loop. The accelerometer has the following specifications:

Specification	Value	Notes
DC offset	1.5 V	Acceleration = 0 m/s ²
Sensitivity	17.74 mV / m/s ²	
Maximum acceleration	50 m/s ²	
Bandwidth	550 Hz	

Blocking Force Spectrum

The mechanical force generated by the pr.PIMA depends on the input control signal (waveform, amplitude and frequency) and the structure it is attached to. Figure 6 shows the measured force spectrum of the pr.PIMA, when it is mounted onto an infinitely rigid structure (blocked) and a sinusoidal waveform with constant amplitude across all frequencies is used ($V_{in} = 3.0 V_{p-p}$).

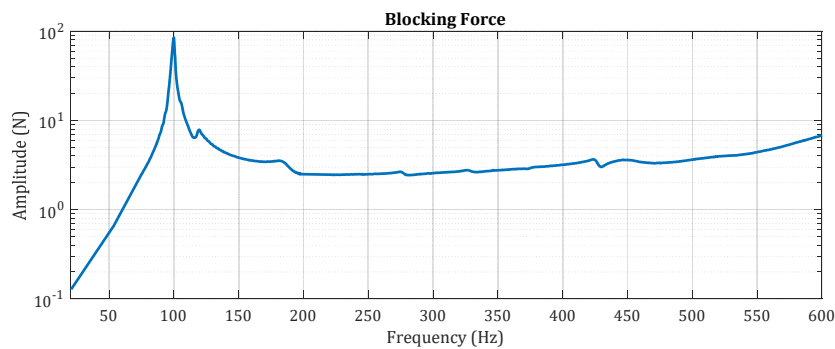


Figure 6. Blocking force spectrum

Dimensions

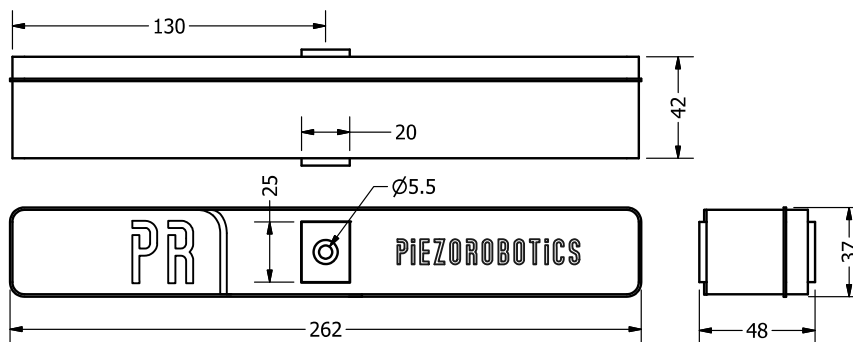


Figure 7. Dimensions of the pr.PIMA

Quality and Testing

Each actuator is individually tested for peak force and resonance frequency. A test report including the blocking force spectrum is provided with each delivery.

Safety

Internally, the pr.PIMA produces potentially lethal voltages up to 1 kV. All the external electrical connections (power plug and stereo plug) are safely isolated with an isolation resistance larger than 10 GΩ. The plastic casing also guarantees electrical isolation to the mounting screw and operator. Nevertheless, safety precautions should always be observed.

Customization

PiezoRobotics has the capability to customize the pr.PIMA according to your specific application and requirements. We can modify the resonance frequency, peak force, dimensions or other parameters. We also guarantee much lower prices for high volume purchases. Please contact us for further details.

Package Content

- 1 x Piezoelectric Inertial Mass Actuator
- 1 x Screw M5x50 mm
- 1 x Power supply cable
- 1 x Stereo plug 2.5 mm adapter