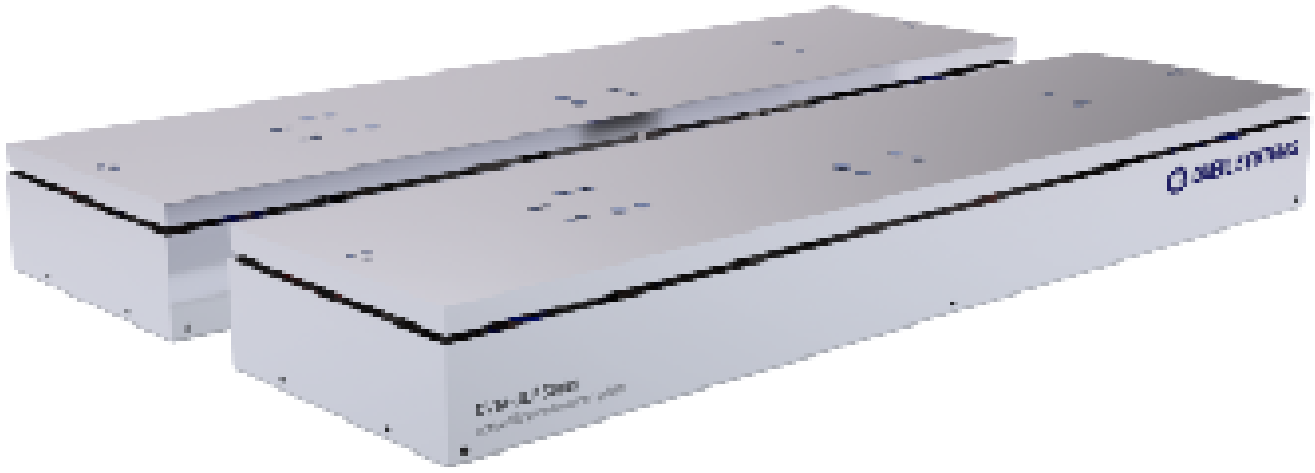
DAEIL SYSTEMS

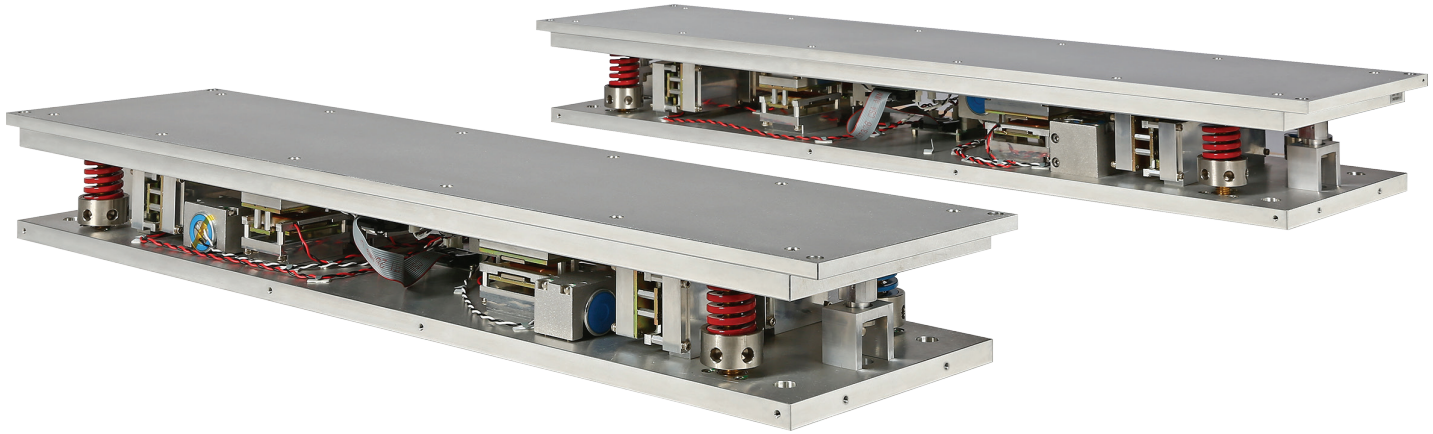
# Active Vibration Isolation System

# DVIA-ULF Series



## DVIA-ULF Series

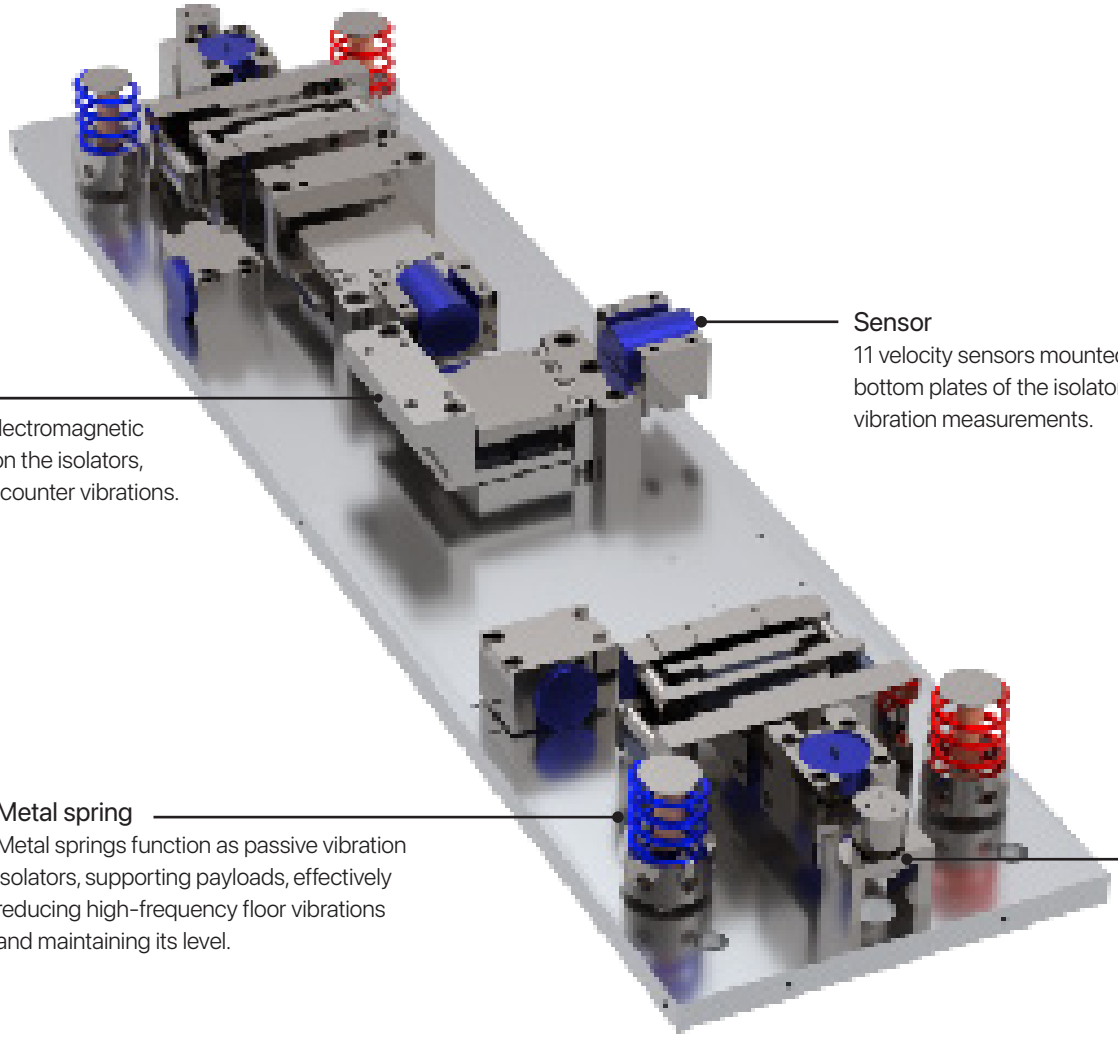
Modular Active Vibration Isolation System for Electron Microscopes.



Introducing the DVIA-ULF: a groundbreaking active vibration isolation platform engineered to meet the exacting demands of today's most sensitive instruments—such as electron microscopes and other precision research tools. Its modular architecture allows you to tailor the number of vibration isolators to your instrument's unique specifications—whether it's a compact tabletop unit or a large-scale, high-performance microscope. This adaptability ensures exceptional vibration control across diverse laboratory environments.

Moreover, the DVIA-ULF's slide-in design enables swift, seamless installation into custom tables, bases, or built-in solutions. Labs can easily reconfigure or expand their setup with minimal disruption, maintaining focus on critical research objectives. Harnessing this simple, scalable, and ultra-low-frequency isolation approach elevates precision, safeguards equipment, and ultimately boosts productivity. Discover how the DVIA-ULF raises the bar in advanced vibration isolation—empowering you to achieve peak performance in nanotechnology, materials science, and beyond.

## Hardware Configureation



**Actuator**
The system has 11 electromagnetic actuators mounted on the isolators, generating forces to counter vibrations.

**Sensor**
11 velocity sensors mounted on both the top and bottom plates of the isolator provide real-time vibration measurements.

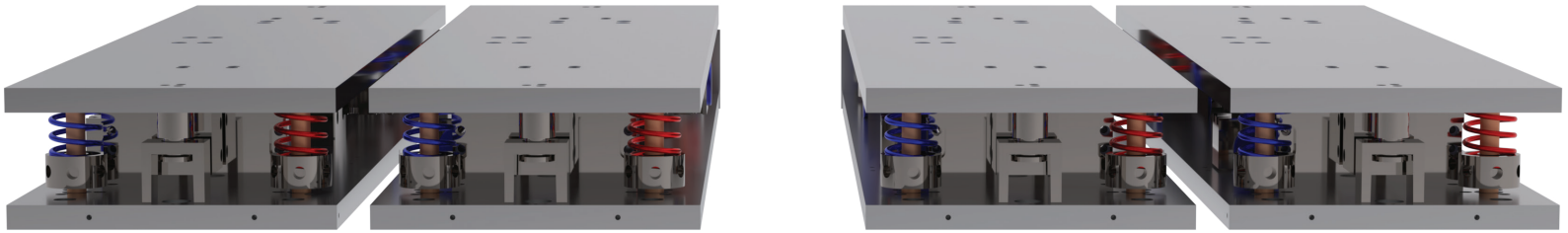
**Metal spring**
Metal springs function as passive vibration isolators, supporting payloads, effectively reducing high-frequency floor vibrations and maintaining its level.

**Level gauge block**
The level gauge block visually confirms that the passive vibration isolators are floating, level, and compressed uniformly to their target height.

## Features

### Custom modular design solution for every microscope

The DVIA-ULF's modular isolator units allow seamless scalability. Users can effortlessly add units tailored precisely to their microscope's dimensions and weight, from compact research SEMs to large-scale TEMs. Each setup can be individually optimized according to specific weight and geometric requirements. Installation requires no extensive site preparation, making it ideal for modern cleanrooms and space-constrained laboratories. Its streamlined design integrates effortlessly into existing configurations, delivering exceptional vibration isolation even in challenging low-frequency environments.



Multiple Isolators Configuration

### Preserved microscope ergonomics for user comfort

By matching the original working height of microscopes, the low-profile DVIA-ULF isolators maintain microscopes at comfortable working levels, stage clearances, and enclosure positioning. This eliminates the need for recalibration or user retraining after installation.

## Effortless slide-in installation - No heavy lifting

The DVIA-ULF isolators feature a low-profile design, with an overall height of only 86 mm, allowing direct placement under microscope bases.

This side-access design eliminates the need for cranes, forklifts, or other rigging equipment during installation. Each isolator is slim enough to fit under the microscope's frame, allowing side insertion with minimal clearance.

Slide-in installation

## Engineered to thrive on "Soft" floors

The electromagnetic actuators of the DVIA-ULF isolators do not require rigid floors to isolate vibrations. Because the drive coil reacts against a stationary magnet without mechanical linkage, the isolators effectively cancel motion independently of floor stiffness. Thus, the DVIA-ULF isolators can be installed on nearly any floor, including upper stories, without the need for floor reinforcement or lab modifications such as heavy concrete pads.

### Advanced sensor amplifier to obtain vibration signals down to around 0.3 Hz

The velocity sensor significantly enhances the detection of ultra-low-frequency vibrations—down to approximately 0.3 Hz—through a specialized amplifier board and advanced digital filtering. This dual approach ensures even subtle low-frequency signals are clearly amplified and precisely captured. By boosting the sensor's sensitivity specifically at low frequencies, the hardware-based amplifier maximizes signal clarity. The digital filter further refines this output by correcting any signal attenuation, making even the faintest vibrations detectable. The immediate benefit: outstanding vibration isolation performance starting from as low as 1 Hz, enabling optimal stability and accuracy for sensitive instrumentation.

### High-performance digital signal processor with 0.0005 seconds response time to vibration

The DVIA-ULF Series is equipped with a high-performance floating-point digital signal processor (DSP), delivering 1800 MFLOPS and 2400 MIPS for rapid and precise vibration response. It features 16-bit A/D converters with 19 channels and 24-bit D/A converters with 10 channels, ensuring accurate and synchronized data sampling. By leveraging advanced digital signal processing and precise converters, the system can detect and respond to vibrations with minimal delay, making it ideal for high-precision vibration isolation applications.

### No air, minimal utility requirements.

The DVIA-ULF requires only a standard electrical outlet, eliminating the need for compressed air supplies. By removing external compressors and hoses, it simplifies setup, reduces maintenance, and minimizes noise. The system actively adjusts electronically, with no air leaks or ongoing pressure adjustments.

### Robust passive isolators with enhanced stiffness

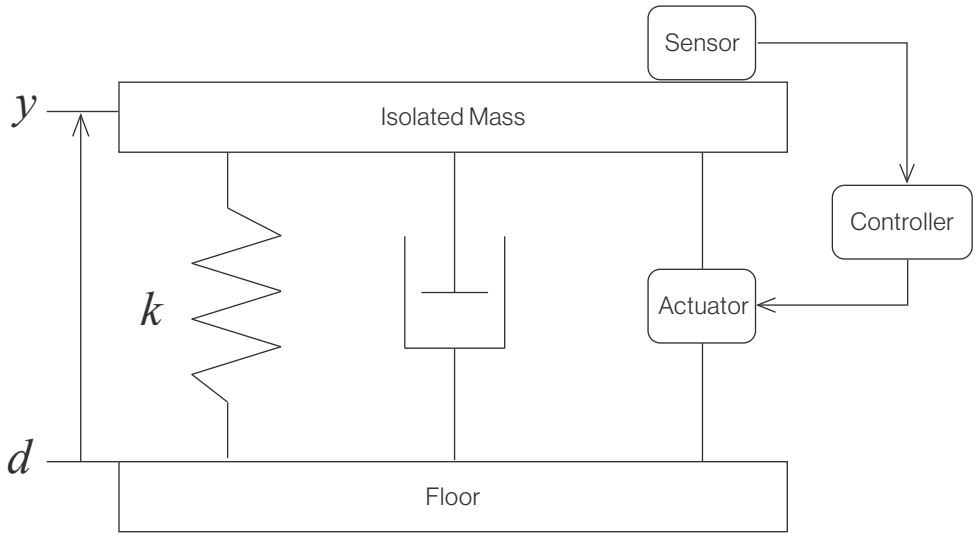
The DVIA-ULF Series utilizes metal springs for its passive vibration isolators, eliminating the need for an air supply while providing increased stiffness. This higher stiffness reduces settling time compared to pneumatic isolators, making the system particularly well-suited for metrology tools equipped with motorized linear stages.

## Feedback Control

The feedback control embedded in the DVIA-ULF continuously delivers superior stability through an intelligent, real-time feedback control mechanism. Unlike traditional passive systems, the sensors measure incoming vibrations and immediately corrects disturbances, maintaining precision and eliminating vibration interference.

Imagine a platform that intelligently "feels" and reacts to motion—any vibration or drift is instantly detected by sensors, transformed into precise electrical signals, and swiftly corrected by actuators guided by a sophisticated controller. This closed-loop system consistently compares actual movement to an ideal stable state, automatically applying corrective forces to maintain optimal equilibrium. If the isolated mass moves upward, the actuator pushes it down; if downward, it pushes it up, ensuring the mass remains consistently still.

This dynamic response provides powerful benefits: the feedback mechanism inherently prevents resonance, the destructive amplification of vibration common in passive systems. The moment vibrations or resonances begin, the system counters them instantly, preserving stability and precision. Moreover, the feedback control continuously manages slow environmental shifts—such as thermal expansion or floor tilt—automatically adjusting to maintain perfect positioning over time. The result is unmatched vibration control, ensuring users' sensitive equipment remains precisely where users need it, delivering optimal performance every time.

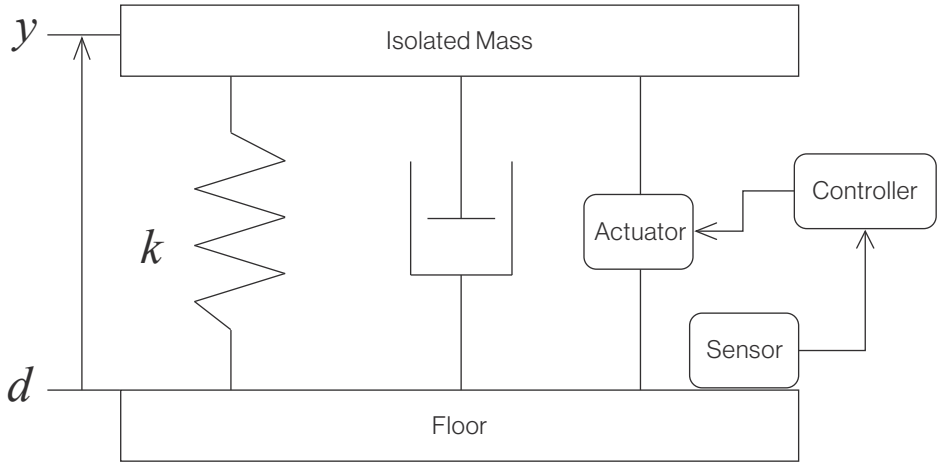


## Feedforward Control

Feedforward control in the DVIA-ULF system actively cancels floor vibrations before they reach the payload. Ground sensors detect vibrations in real-time, instantly sending signals to the controller, which calculates and applies an equal-and-opposite force through actuators. This proactive approach dramatically reduces transmissibility at low frequencies, ensuring the isolated mass experiences minimal motion from the start.

However, feedforward alone can't handle disturbances it doesn't detect—like direct forces on the payload or modeling inaccuracies. To address this, the DVIA-ULF integrates feedback control. This feedback loop uses an inertial sensor on the payload to detect and correct any residual vibrations, fine-tuning isolation performance and handling uncertainties or drift that feedforward might miss.

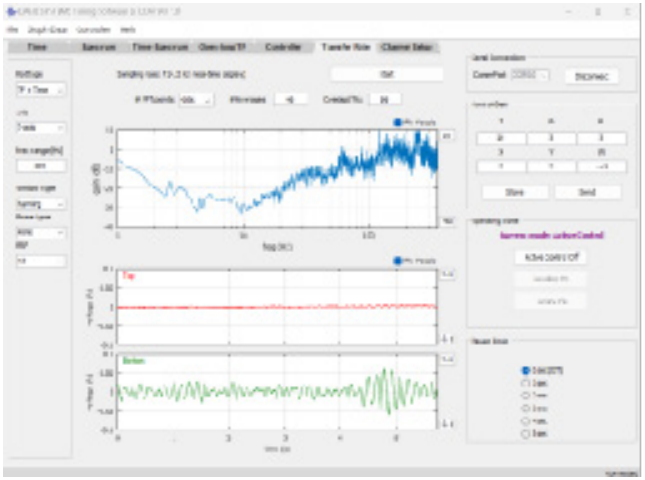
In the DVIA Series systems, the feedforward loop handles the bulk of predictable floor-induced motion, essentially flattening the floor disturbances, while the feedback loop fine-tunes the result by quelling any remaining vibration of the payload.  By combining these two control architecture yields a robust solution: the feedforward provides the heavy lifting for low-frequency isolation, and the feedback ensures any errors or unknown disturbances are corrected, in which achieves the phenomenal low-frequency vibration isolation.



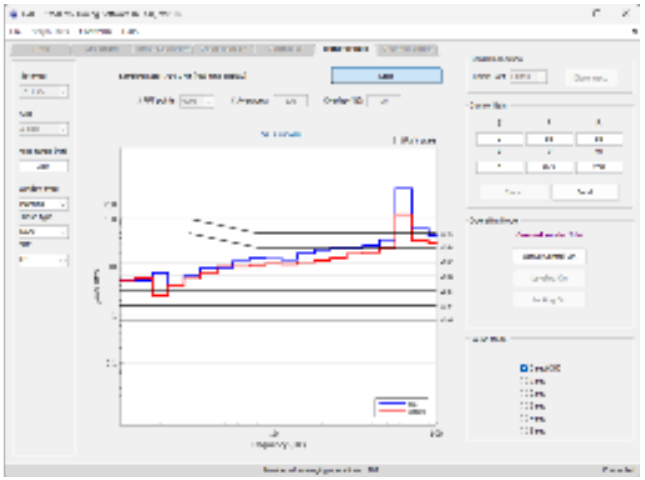
## User Interface for data transparency

The DVIA-ULF is equipped with a user interface that allows real-time monitoring of vibration measurements, vibration isolation performance, and sensor and actuator outputs.

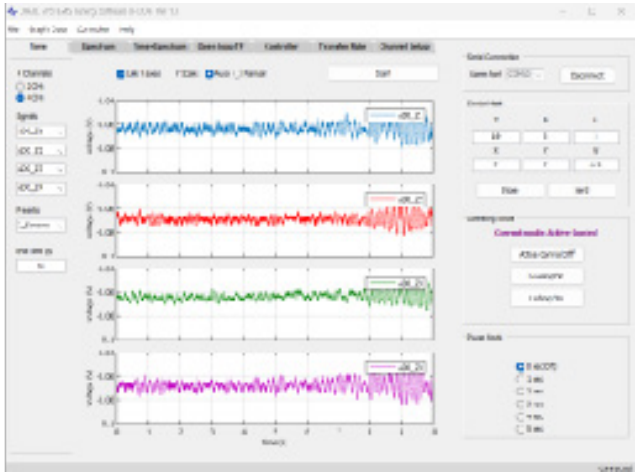
DAEIL SYSTEMS is confident that our active vibration isolation system significantly enhances equipment imaging results and overall performance.



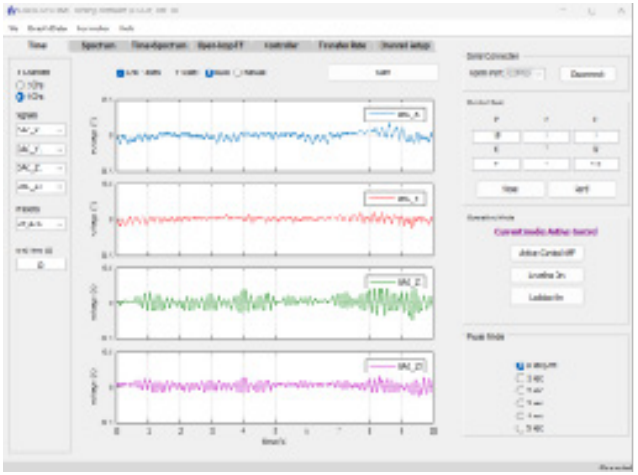
Transmissibility curves



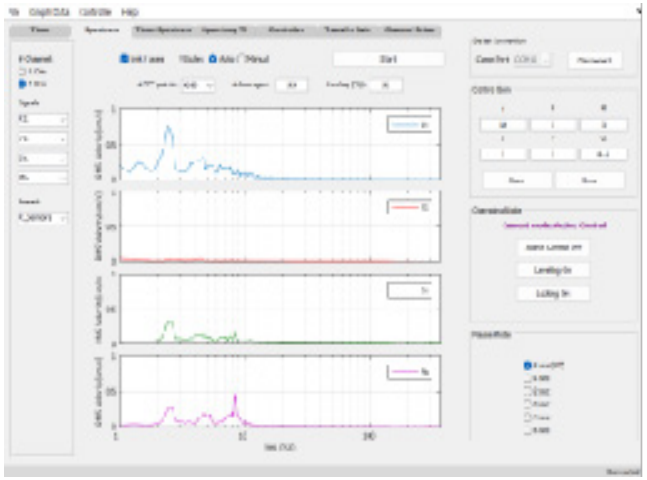
Vibration Criteria curves (VC curves)



Sensor Signal



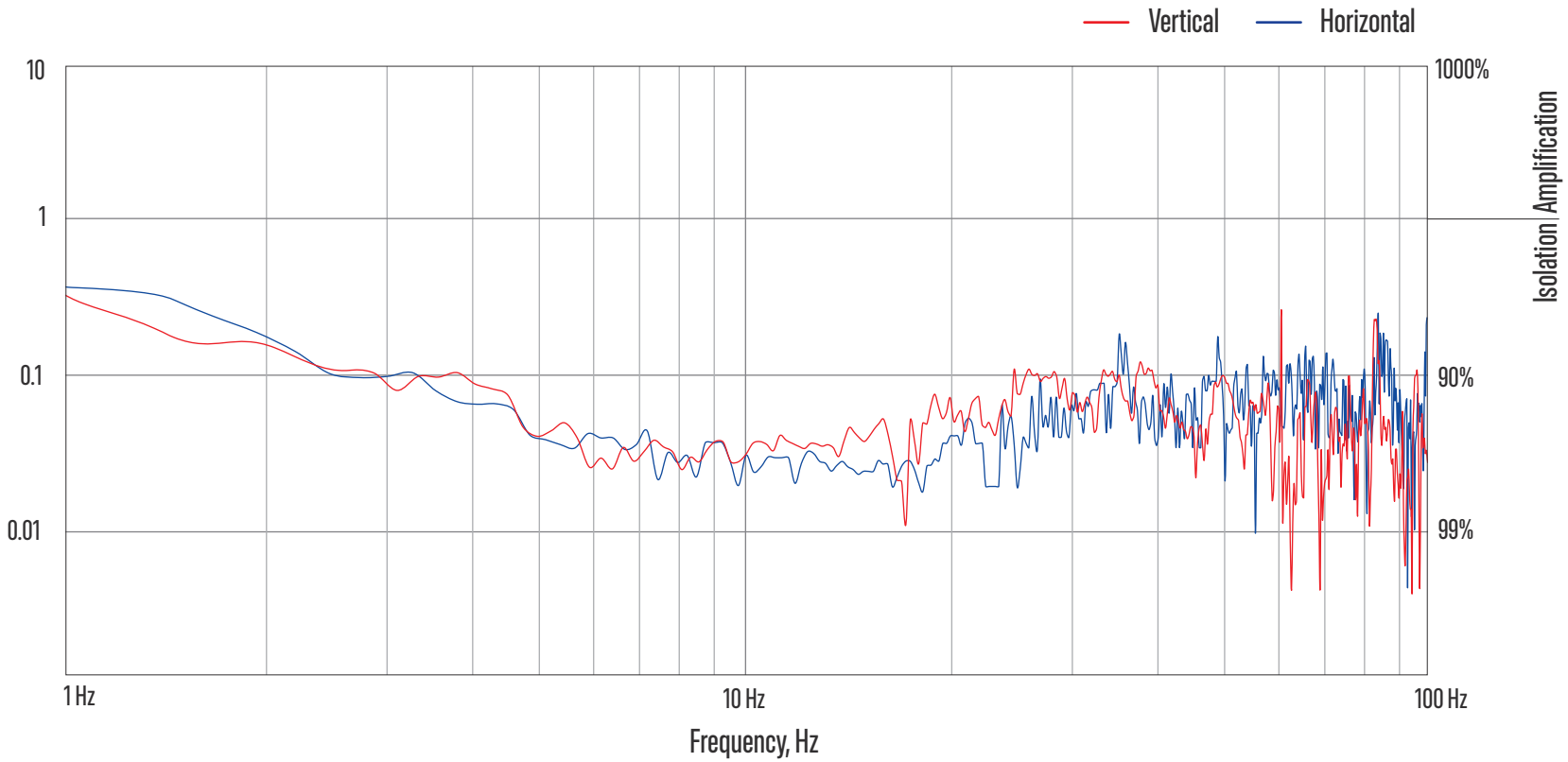
Actuator Force



Autospectrum (floor and isolated mass)

## Performance

The DVIA-ULF delivers 40 – 50% vibration isolation at 1 Hz and 80 – 90% vibration isolation at 2 Hz.




*Vibration isolation was measured on a floor that satisfied the VC-C criterion, using a vibration generator to apply controlled excitation.

# Specifications

| Model | DVIA-ULF350 | DVIA-ULF700 | DVIA-ULF1000 | DVIA-ULF1500 |
|---|---|---|---|---|
| Isolator Quantity | 2 EA (Expandable via adding isolators) | | | |
| Dimensions | M: 780 x 160 x 86 mm<br>L: 820 x 160 x 86 mm | M: 780 x 200 x 86 mm<br>L: 820 x 200 x 86 mm | M: 780 x 200 x 86 mm<br>L: 820 x 200 x 86 mm | M: 780 x 240 x 86 mm<br>L: 820 x 240 x 86 mm |
| Maximum Load Capacity* | 350 kg | 700 kg | 1200 kg | 1500 kg |
| Vibration Isolation Technology | Feedback and Feedfoward Control | | | |
| Degrees of Freedom | 6 (X, Y, Z, Roll, Pitch, Yaw) | | | |
| Active Isolation Bandwidth | 0.5 – 200 Hz | | | |
| Vibration Isolation* | 40 – 50% at 1 Hz, 80 – 90% at 2 Hz | | | |
| Actuator | Electromagnetic Actuator | | | |
| Maximum Actuator Force | Vertical: 40 N<br>Horizontal: 20 N | Vertical: 40 N<br>Horizontal: 20 N | Vertical: 40 N<br>Horizontal: 20 N | Vertical: 80 N<br>Horizontal: 40 N |
| Vibration Sensor | Velocity, Sensitivity: 2.55 V/in/s (100.4 V/m/s) ± 10% | | | |
| Response Time | < 0.5 ms | | | |
| Magetic Field | < 0.05 μT | | | |
| Controller | External, RS232C for Communication and UI | | | |
| Environmental Protection Requirements | CE, TÜV | | | |
| Power Requirements | 100 – 240 V AC, 50/60 Hz | | | |
| Environmental Requirements | Temperature: 5 – 50 °C, Humidity: 20 – 90 % | | | |

*Maximum load capacity can be increased as adding the isolators.

DAEIL SYSTEMS

We enable nanoscale imaging to make the world a better place.

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