

## Laboratory IEPE MEMs Accelerometer InstantVib® Patented Electronic (pending)

### Main Characteristics

- Quasi-Static measurement down to 0.1 Hz
- High-Frequency capabilities up to 17 kHz
- $\pm 100$  g Dynamic with 100 mV/g sensitivity (World first)
- Broadband Resolution (1 Hz to 10 kHz): 0.004 g rms
- Spectral Noise as low as  $60 \mu\text{g} / \sqrt{\text{Hz}}$  at 0.5 Hz
- Ground isolated from the mounting surface
- TEDS-compatible (IEEE-P1451.4 Compliant)
- Sensing element: Analog Device MEMs (ADXL 1001)
- Long term stability as good as piezoelectric quartz sensors and way better than piezo ceramic.
- Microdot 10-32 connector
- Low price and high volume monthly production thanks to robotized assembly.



Model 451.I51 (Hex 12mm, Height 23mm, weight 10 grammes)

### Competitive advantages

Protected Worldwide by numerous pending patents, VibraSens has released an incredibly versatile accelerometer that is setting the future of vibration measurements. Our InstantVib IEPE electronic has been able to enhance the already excellent ADXL 1001 MEMs from the company Analog Device. Microelectromechanical systems technology represents the future for vibrations acquisition needed by industry 4.0 and millions of IoT accelerometers. Compared to now-dated IEPE Piezoelectric vibration sensors, Model 451 InstantVib® IEPE MEMs sensor has the following advantages:

- Frequency response from 0.1 Hz to 17 kHz (-3dB).
- Tight  $\pm 5\%$  sensitivity tolerance.
- $300 \mu\text{g} / \sqrt{\text{Hz}}$  spectral noise at 0.1 Hz gives crystal clear quasi-static measurement.
- $60 \mu\text{g} / \sqrt{\text{Hz}}$  spectral noise at 1 Hz allows for perfect analog integration and a noise-free velocity signal at very low frequency.
- Instantaneous settling time so you can immediately start measuring even when doing the quasi-static measurement.
- Long-term sensitivity stability significantly better than piezo ceramic and similar to quartz accelerometer. Periodic recalibration is not needed.
- Improved dynamic range  $\pm 100$  g for 100 mV/g sensor. You are less prone to saturation than counterpart piezo sensors.
- Fully robotized lean assembly for repeatable sensors, better pricing, and better delivery time.
- Excellent protection from shocks enables reliable magnet mounting (no piezoelectric effect that burns input transistors).
- Lower Transverse sensitivity (thanks to MEMs high precision silicon machining).
- Less sensitive to base strain (MEMs is smaller and better isolated than Piezo disc).
- Expensive glass seal connectors are not needed as the MEMs is not sensitive to humidity.
- Better temperature response ( $\pm 1\%$  from  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ ) thanks to tricky electronics and ADXL 1001 MEMs performance.
- Ground isolated by design. The frequency response is not affected by any additional isolated option. No price increase applies.
- Low noise quasi-static measurement is possible even with such small and lightweight sensors.
- Better linearity as low as  $\pm 0.1\%$  thanks to MEMs performance and optimized IEPE electronics.
- Not sensitive to a magnetic field.
- Stable or downtrend long-term pricing thanks to future increased MEMs manufacturing volume and fully robotized assembly.

## Description

The InstantVib® IEPE Laboratory MEMs accelerometer model 451 uses the industry-standard ©ICP / ©IEPE / 2-wire voltage transmission technique. With a 4mA constant current supply a 20 kHz AC signal is transmitted over 100 meters without distortion. Signal ground is isolated from the mounting surface and outer case to prevent any ground loops. The top connector is a standard 10-32 UNF microdot. It is equipped with a high-quality gold-plated contact socket, MIL certified for measurements in high vibrations and shock.

It can be interfaced with all devices with built-in IEPE compatible instruments like FFT analyzers, data acquisition cards, data collectors, ... The TEDS compatibility will also ease the auto-calibration of those instruments.

For a 17 kHz bandwidth, this sensor should be screwed on the machine Nevertheless for quick medium frequency measurement below 2 kHz magnet mounting is also available.

## Typical applications

Model 451 is so versatile that it can replace many IEPE piezoelectric laboratory accelerometers each dedicated to a specific application.

Thanks to its 0.1 Hz quasi-static capabilities and an optimized 15° Maximum phase at 0.5 Hz, Model 451 sensor is ideal for modal measurement. We have also taken care of phase shift congruence between sensors to be within ±3°.

With 60 µg/√Hz spectral noise at 0.5 Hz and 300 µg/√Hz at 0.1 Hz, structural and low-speed vibration monitoring (paper industries, wind turbines, dams, ...) at very low frequency is now possible with a low cost, small and lightweight 10 grams sensor.

Balancing and general industrial monitoring like pumps, motors, and fans usually associated with high dynamic above 50g is also a perfect suit. Moreover, our patented electronic will give after analog or digital integration a perfectly stable velocity measurement so important in general industrial vibration monitoring. With 60 µg /√ Hz spectral noise at 0.5 Hz, low-speed machines down to 25 RPM can now be monitored with velocity parameters.

Even the most difficult monitoring like bearing analysis is achievable. Our patented InstantVib IEPE MEMs sensor can accurately measure micro g shock between 5 and 10 kHz even buried in 80 g large band signals.

## Typical customers

Original Equipment Manufacturers that are looking for a unique sensor for their vibration monitoring systems. MEMs technology and fully automated assembly will fit OEM in need of monthly very high-volume sensors for their IoT vibration monitoring systems. Full assembly in-house, OEM customers will also benefit from a quick turnaround even with custom private labeling for sensors and packaging.

With VibraSens as the claimed inventor of the IEPE for MEMs vibration transducer, customers will have access to a unique accelerometer with unprecedented specifications previously unachievable by any now-dated piezoelectric sensors. We also offer customization for OEM-specific applications.

Call us for a trouble-free and low-cost solution for all your vibration sensor needs.

## Approvals



## Comparing apples to apples

As experts and World leaders in our field we think it is important for Vibration Engineers to understand the value creation using our IEPE MEMs laboratory vibration sensors.

Isolated: if not, you will have ground loop and measurements issues.

Settling time: as low as possible as it will greatly accelerate your point to point measurement time.

0.1 Hz: only useful for modal measurement. To be compared to big, expensive and noisy piezo quartz sensors.

Dynamic: As high as possible so you are sure to not saturate and get faulty distorted signals.

Spectral Noise: as low as possible so your instrument can capture the smallest acceleration. Only noise below 10 Hz is relevant as above acceleration is always present.

Protection: Protect your investment. Check for power supply reverse protection and ESD protection.

## Revision History

February 2021 : Released

## Ordering information

To order, specify model number with below options :

### 451.I51- A - B - HH

#### A : Sensitivity

6 ..... 100 mV/g  $\pm$  5 %

#### B : Connector

1 ..... Microdot 10-32 UNF

#### HH : Housing thread

H2 (or Omitted) ..... 10-32 UNF

H5 ..... M5x0.8

#### OEM / Customer Engraving :

Add ZXX at the end of the part number.

XX is a number supplied by VibraSens.

#### In stock Model

451.I51-6-1 Laboratory accelerometer, Top Microdot connector, 100 mV/g  $\pm$ 5%

## Patents

Europe (Priority 2018-05-22) ..... FR1854259A - EP3572818A1 (pending)

United States of America ..... US2019361473A1 (pending)

China ..... CN110514869A (pending)

Other patents applied and are still pending

## Specifications

### **Dynamic**

Frequency response A=6 (100mV/g) ..... see Fig1  
 $\pm$ 5 % : 0.5 to 12 500 Hz  
 $\pm$ 10 % : 0.3 to 15 000 Hz  
 $\pm$ 3 dB : 0.1 to 17 000 Hz

Mounted Resonant frequency ..... 22 kHz Nom.

#### Dynamic range

A=6 (100mV/g) .....  $\pm$ 100 g pk.

Transverse response sensitivity ..... <1.5%

Sensitivity Temperature response ..... see Fig3

Linearity .....  $\pm$ 0.1%

Warm up time - Discharge time constant ..... 100  $\mu$ sec

Settling time (within 10% of Bias) ..... 100  $\mu$ sec

### **Electrical**

Electrical Grounding ..... Isolated from machine ground and housing

Electrical Isolation (Base) ..... 100 M $\Omega$  Min

Capacitance to ground ..... Tbd pF Nom

Output impedance ..... 50  $\Omega$  Nom

DC output bias voltage ..... 12.65 VDC  $\pm$ .1%

DC output bias voltage versus temperature ..... see Fig2

Residual noise (24°C) : A=6 (100mV/g)

0.1 Hz	300 µg /√ Hz
0.5 Hz	60 µg /√ Hz
10 Hz	50 µg /√ Hz
100 Hz	50 µg /√ Hz
1000 Hz	50 µg /√ Hz

Power requirements (IEPE Compatible) ..... Constant current : +4 to +20mA DC

WARRANTY: Dommage to the built-in electronics resulting from the application of incorrect power is NOT covered by warranty. Under no circumstances should a voltage be supplied to an IEPE accelerometer without a current regulating circuit. This may include ohmmeters, multimeters and continuity testers.

Compliance / Excitation Voltage for Full dynamic ..... +22 to +28 VDC

Protection :

Overvoltage	Yes
Reverse polarity	Yes
ESD Protection	> 40 V

## Environmental

Temperature, operating continuous : max. current =4mA ..... -40 to 125 °C (-40 to 250 °F)

Temperature, non operating ..... -55 to 150 °C (-67 to 302 °F)

Humidity / Enclosure ..... IP68, epoxy sealed

Acceleration limit : Shock ..... ±10 000 g peak

Continuous vibration ..... ±800 g peak

## Physical

Design ..... Capacitive based, microelectromechanical systems (MEMS)

Size (Hex x Height) ..... Hex 12mm x Height 23mm

Weight ..... 10 gr Nom (0.3 Oz)

Material ..... AISI 316L, DIN 1.4404 (Stainless steel)

Mounting torque (M5, 10-32 UNF) ..... 2,4 N.m (21 in-lbs)

## European Directive

EMC Directive ..... 2014/30/EU

Standards ..... 61326-1

RoHS Directive ..... 2011/65/EU

## Accessories, supplied

Calibration supplied ..... Sensitivity (5g, 160 Hz)

Plastic Black Box ..... 120 x 70 x 35mm

## Accessories, not supplied

Cable assembly Microdot Connector to BNC :

PVC Cable, 80°C, RG174 dia 2.8mm ..... 10.01-R02-F02-51-Length

LSFH Cable, 105°C, very flexible, dia 1.8mm ..... 10.01-R02-F02-56-Length

Available length : 2m, 5m, 10m, 15m, 20m, 30m, 40m, 50m.

Mounting Stud for <u>10-32</u> sensor thread	
M5 machine thread .....	191.01-15-05-1
10-32 machine thread .....	191.01-15-15-1
M6 machine thread .....	191.01-15-06-1
1/4" 28 UNF machine thread .....	191.01-15-16-1
Mounting Stud for <u>M5</u> sensor thread	
M5 machine thread .....	191.01-05-05-1
10-32 machine thread .....	191.01-05-15-1
M6 machine thread .....	191.01-05-06-1
1/4" 28 UNF machine thread .....	191.01-05-16-1
Mounting Pad for 10-32 UNF sensor thread .....	204.01-15-13-1
Mounting Pad for M5 sensor thread .....	204.01-05-13-1
Calibration, back to back, Frequency response (10 Hz-10 kHz), 4 pages .....	501.11
Calibration, back to back, single point., A4 certificates .....	501.01

## Repair

Consult factory for glass seal connector replacement in case of broken or bended pins  
 Repair of the electronic / plastic connector is not possible.

Fig 1. Frequency Response

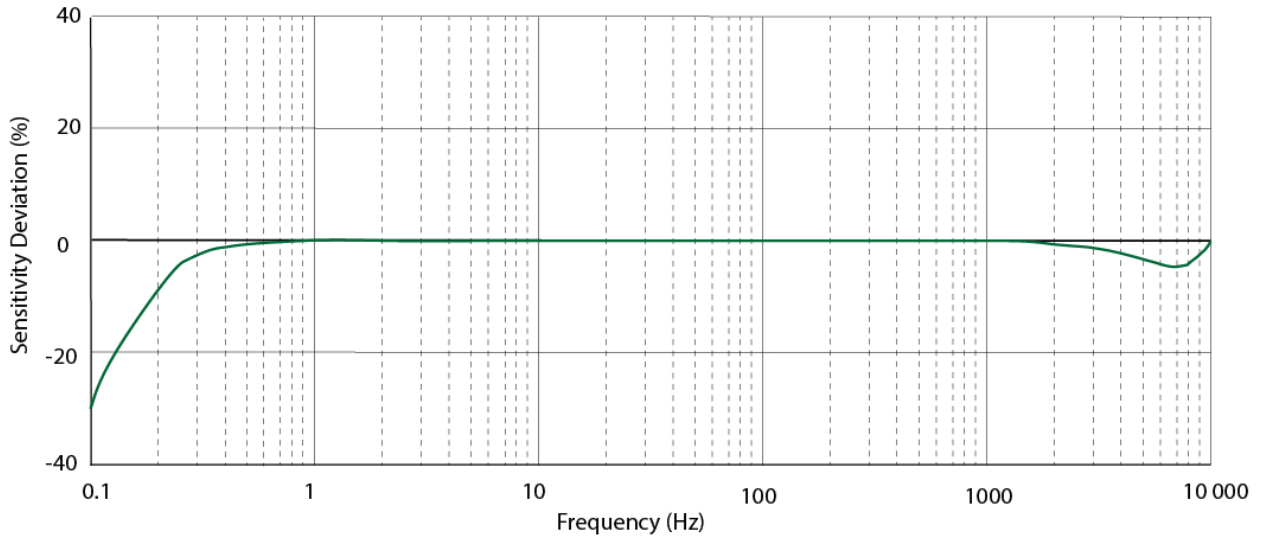


Fig 2. DC (Bias) deviation versus temperature

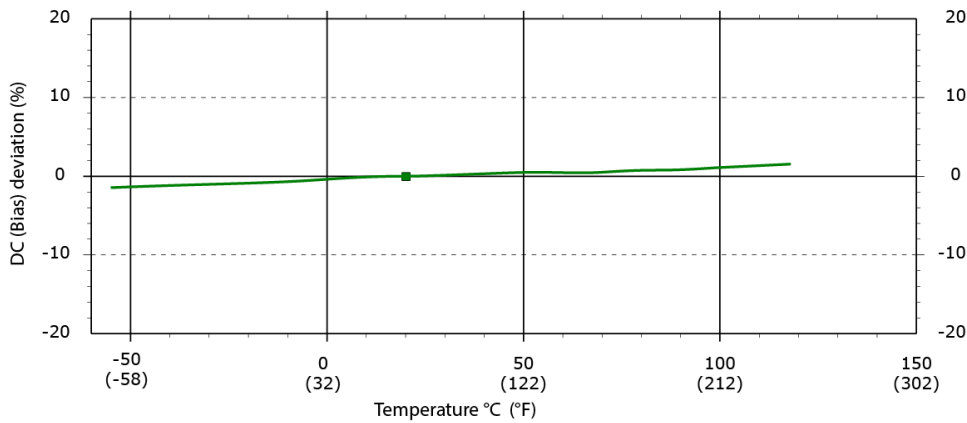
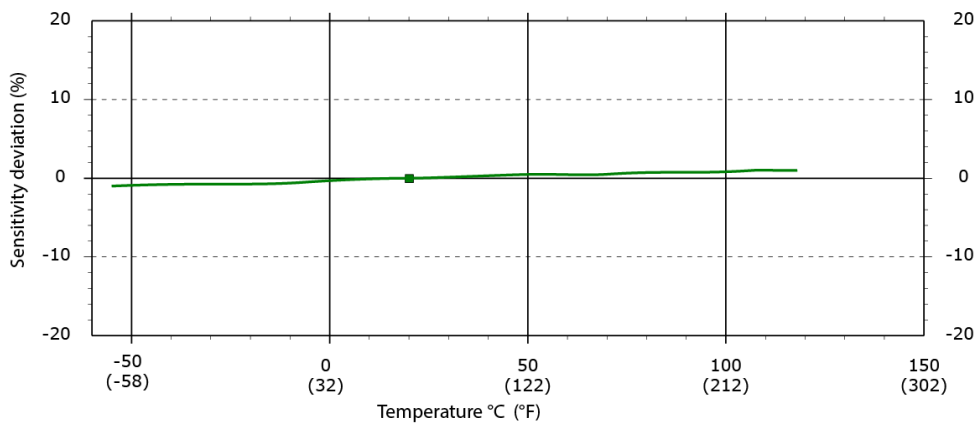


Fig 3. : Sensitivity deviation versus temperature



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