

LASER VIBROMETER

- **NON-CONTACT VIBRATION MEASUREMENT**
- **VIBRATION DISPLACEMENT ANALOG OUTPUT**
- **SUB-NANOMETER SENSITIVITY**
- **DYNAMIC RANGE LARGER THAN 100 dB**
- **FREQUENCY RANGE 0.01-70000 Hz**
- **WORKS ON ALL DIFFUSIVE SURFACES**
- **NOVEL AND SIMPLE INTERFEROMETRIC CONFIGURATION**
- **EASY BEAM ALIGNMENT**

The new Laser Vibrometer allows easy and accurate non-contact vibration measurements on all rough and diffusive surfaces (e.g.: plastic, rubber, unfinished metal, paper, etc.). It provides an analog electrical output which is a replica of the target displacement (10 mV/ μ m responsivity), in a frequency range 0.01 Hz – 70 kHz with a sensitivity of 0.1 nm in 1 Hz bandwidth and a peak-to-peak maximum vibration amplitude of 0.6 mm at low frequencies.



PRINCIPLE OF OPERATION

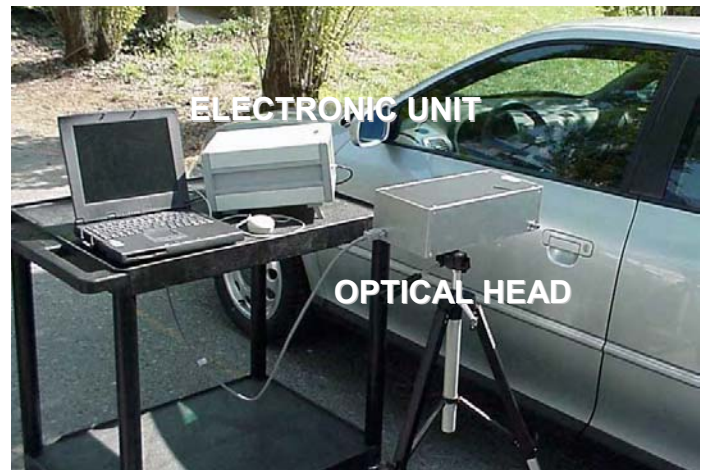
The new Laser Vibrometer is based on a novel and simple self-mixing interferometric scheme, and it uses a semiconductor diode laser. The Michelson interferometric configuration used in conventional Laser Doppler Vibrometers/Velocimeters (LDVs) includes several lenses, polarizing beamsplitters, waveplates and dual balanced photoreceiver. Conversely, the new self-mixing scheme is based on the coherent interference of the backscattered light directly into the laser diode cavity, and it needs a reduced set of optics and a single photodetector. The target displacement is reconstructed from the interferometric signal by an electronic feedback loop. The new Laser Vibrometer has a high sensitivity that allows correct operation even for weak intensities of light backscattered by the target. Operation is demonstrated on nearly all diffusive surfaces and on back-reflecting surfaces.

FEATURES

- Easy-to-use equipment
- Sub-nanometer sensitivity (noise floor: 90 pm/ $\sqrt{\text{Hz}}$ @ 1kHz)
- Dynamic range larger than 100 dB (0.6 mm peak-to-peak displacement at frequencies < 200 Hz)
- Wide small-signal frequency response (0.01 Hz – 70 kHz)

APPLICATIONS

- Non-contact measurement of vibration displacement
- Material analysis
- Vibration measurement without mass-loading on small, soft and delicate structures
- Loudspeaker testing
- Piezoceramic testing
- Modal analysis
- On-line process control in industrial plants
- Quality tests



USE

The optical head shall be placed in front of the vibrating surface, approximately at the operating distance of 0.5 m (user selectable). Electrical vibration signal is then readily available from the BNC output connector of the electronic unit. The signal can be supplied to an oscilloscope, or to a FFT analyzer for frequency domain analysis. The electronic unit also provides digital measurements of the RMS amplitude and frequency of the vibration, through 7-segments displays.

An easy manual tracking/alignment procedure may be preliminarily carried out to avoid signal fading caused by speckle-pattern effects. An indicator that measures the strength of the backscattered light signal makes the alignment procedure quick and reliable. This procedure is performed automatically in the version of the vibrometer customized for on-line process control in industrial plants. An option for the measurement of target distance with 1 mm accuracy is also available.

PRELIMINARY



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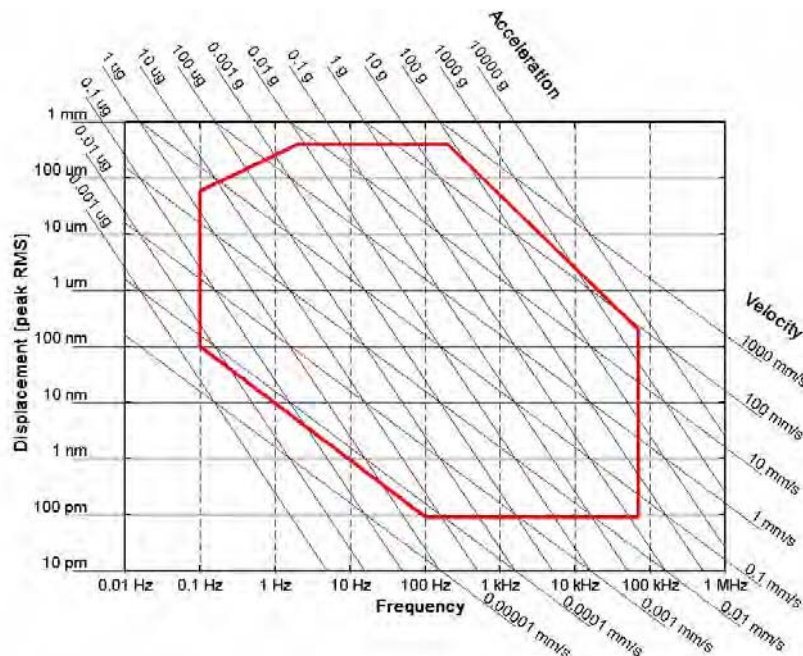


Performance	
Noise floor	90 pm/ $\sqrt{\text{Hz}}$ ¹⁾
Maximum measurable vibration	300 μm ²⁾
Small-signal frequency response (-3 dB)	0.01 ÷ 70000 Hz
Output signal responsivity	10 mV/ μm
Output signal polarity	Positive for target moving away from sensor
Output signal accuracy	1 %
Working distance	50 ± 8 cm
Spatial transversal resolution	50 μm
Amplitude display autoranges	20-1000 nm 1-100 μm
Amplitude display accuracy	3 % relative or 0.1 % of full-scale, whichever is larger
Frequency display accuracy	5 % relative
Target surface	Diffusive or back-reflecting

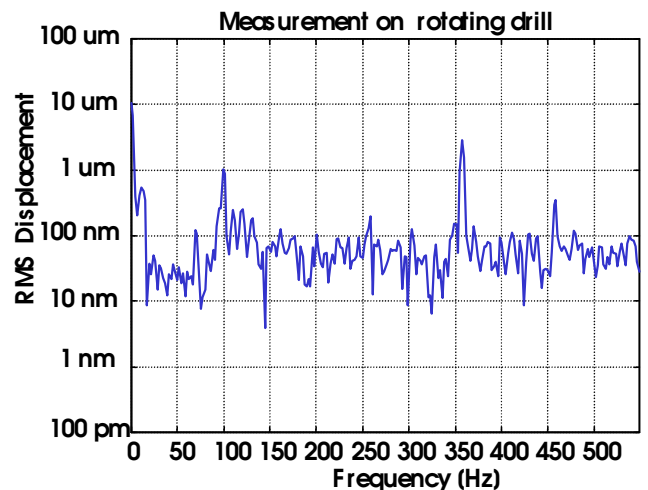
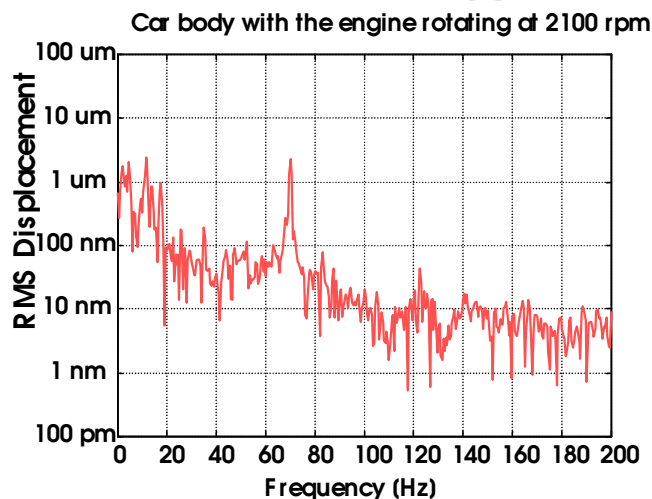
Physical	
Laser power	17 mW
Laser wavelength	800 ± 5 nm
Laser safety class	III B
Output signals	•Vibration displacement
Output connectors	BNC
Front panel displays	•Digital: vibration amplitude and frequency •Analog: vibration amplitude (measure mode) or backscattered signal strength (alignment mode)
Front panel switches	•Laser: ON/OFF •Mode: Alignment/Measure
Output lens adjustment	Lateral offset
Operating temperature	15 ± 35 °C
Optical head dimensions	370 x 170 x 110 mm (L x W x H)
Optical head weight	3.1 kg
Electronic unit dimensions	270 x 350 x 180 mm (L x W x H)
Electronic unit weight	5.5 kg
Power supply	220-240 V ac / 50-60 Hz

¹⁾Peak equivalent displacement, @ 1 kHz; ²⁾Peak displacement, @ 100 Hz;

VIBROMETER PERFORMANCE



MEASUREMENT EXAMPLES



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