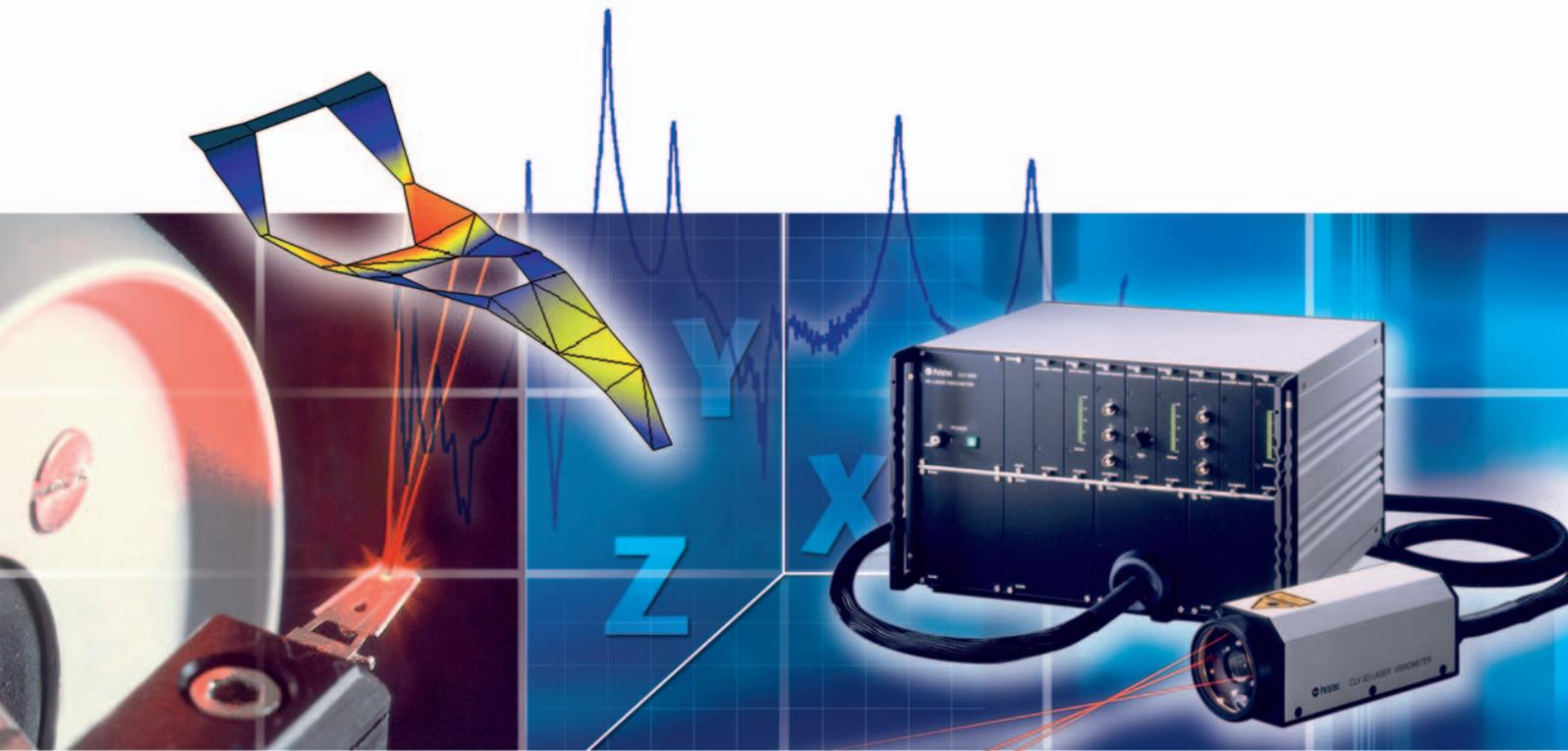


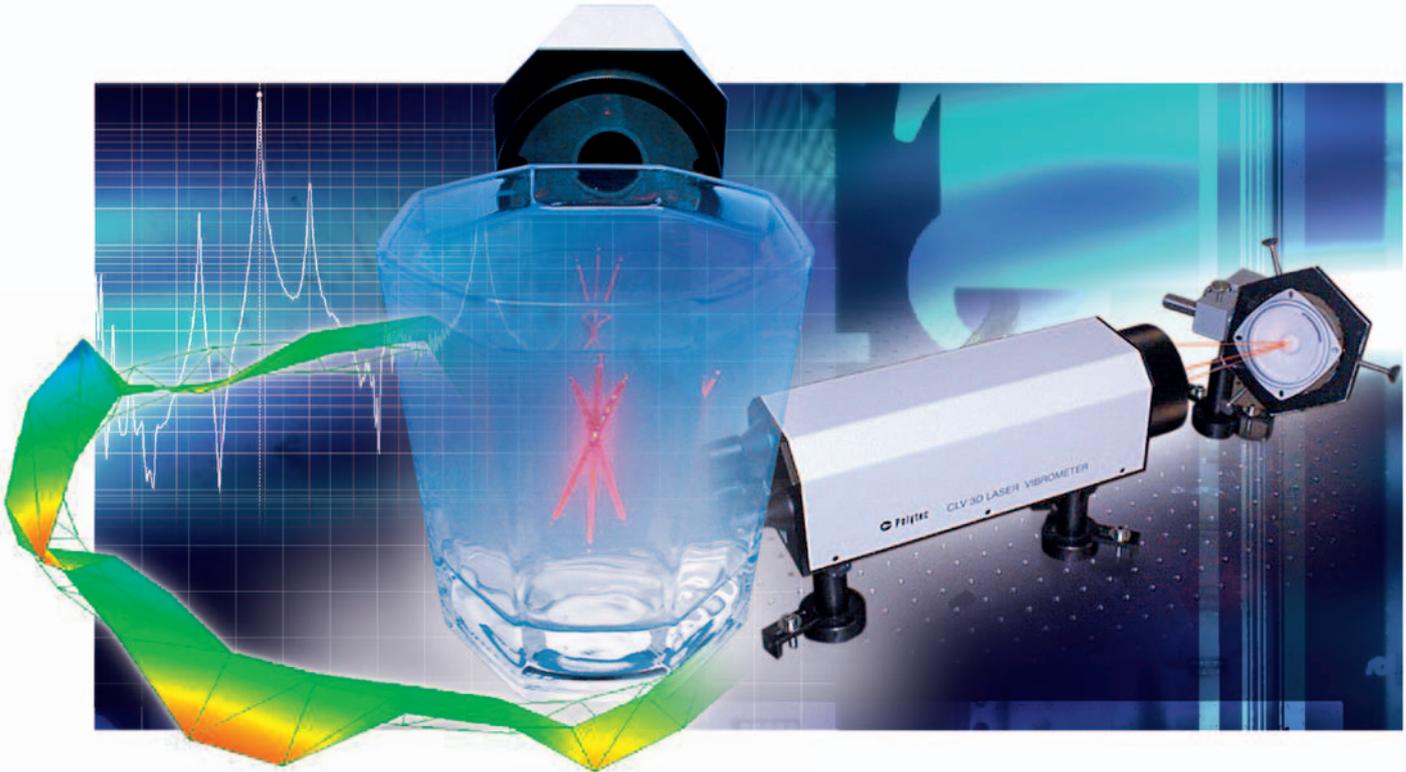
CLV-3D Compact 3-D Laser Vibrometer

For Simultaneous 3-D Measurement of Dynamics



**Non-contact
High Sensitivity
High Resolution
3-Axis Vibration Velocity**

3-D Vibration Measurements



Polytec's CLV-3D non-contact vibration sensor simultaneously measures all three linear velocity components at a single point on a vibrating structure. The individual vibration components are available as analog outputs. The CLV-3D's wide dynamic range, excellent bandwidth and low noise enable its use in many advanced applications.

Convenient Measurements with Zero Mass Loading

Using the CLV-3D, engineers can now make simple, non-contact measurement of all three vibration vector components simultaneously. Single-axis laser vibrometer users will especially appreciate the convenience of no longer having to make three separate measurements and then manually calculating v_x , v_y and v_z . In addition, users of tri-axial accelerometers will be pleased to finally make 3-axis measurements with no contact and zero mass loading. The small measurement spot diameter of only 80 μm is much smaller than any accelerometer footprint and allows measurement of smaller components. And, of course, with a bandwidth of 250 kHz, all three components of a high frequency vibration can be accurately measured simultaneously.

Key Features

- Simultaneous measurement of 3 orthogonal vibration velocity components
- Zero mass loading
- Geometry calculation module generates true v_x , v_y and v_z analog outputs in real time for velocities up to 1.25 m/s
- Two frequency ranges: 0.5 Hz to 50 kHz and 0.5 Hz to 250 kHz
- High sensitivity requires little or no reflectivity enhancement
- Three velocity ranges for high resolution
- Two different stand-off distances available
- Compact, ruggedized sensor head
- Optional motorized test stand

Applications

The unique capabilities of the CLV-3D make it an ideal tool for numerous applications where three-dimensional information is desired from a non-contact sensor. It takes the advantages of conventional 1-D laser-Doppler vibrometers one step further to replace tri-axial accelerometers.

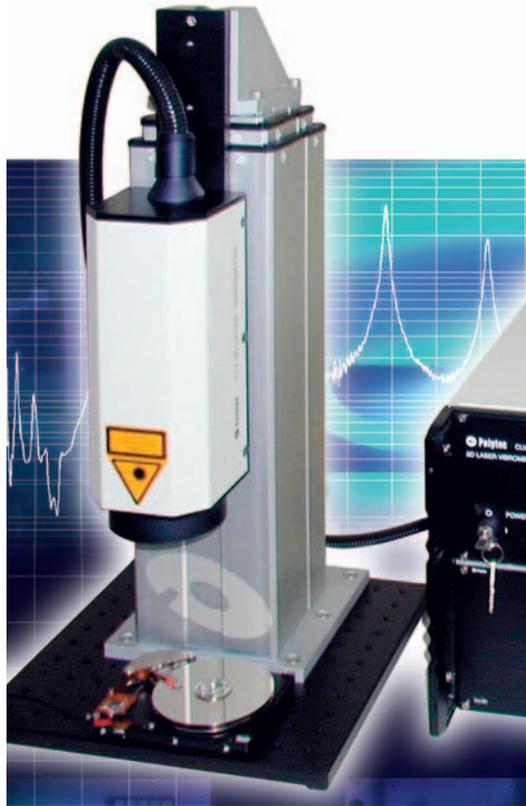
Disk Drives

The disk drive industry has achieved amazing improvements in performance while simultaneously slashing cost. Due to market pressures, the demand for increased performance at reduced cost is incessant. The CLV-3D can make comprehensive measurements for modal analysis of suspensions, E-blocks, actuator arms and HGA's. The ability to precisely quantify the out-of-track effect of an out-of-plane mode enables disk drive engineers to achieve higher and higher tracks per inch (TPI) values. With the integration of the CLV-3D with a 3-D stage driven scan system, 3-D modal analysis of disk drive components becomes a reality that helps increase disk drive performance.

Our Application Note "CLV-3D Application for Drive Suspension Modal Test" can be downloaded from www.polytec.com/usa/Lm-download.

Piezo Motors, Loudspeakers

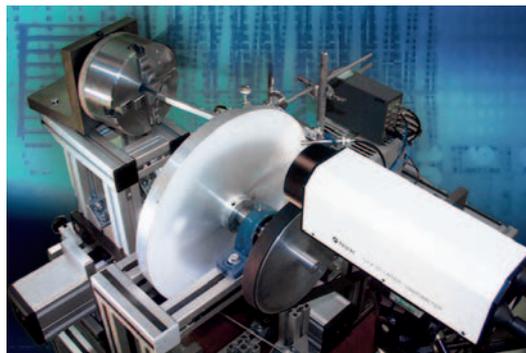
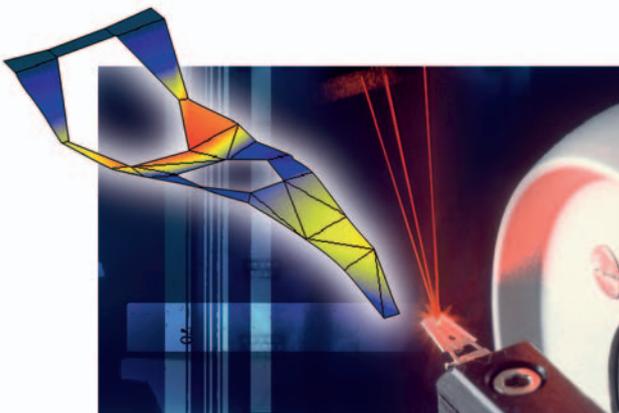
A piezo motor utilizes a piezo ceramics cylinder equipped with electrodes on its circumference. By applying electrical signals that are phased appropriately, the cylinder is deformed. The periodic deformation will cause a traveling wave moving the rotor and can be studied with the CLV-3D system. 3-D Vibrometers are also indispensable tools for loudspeaker design.



For more information about vibrometer applications please contact your local Polytec sales engineer or visit our website www.polytec.com.

Automotive

In the area of brake development, engineers have long desired 3-D vibration information to more accurately characterize "squeal". With the CLV-3D this need has been addressed. For convenient, full-field 3-D measurement and visualization of operational deflection shapes, Polytec has developed the PSV-400-3D Scanning Vibrometer (www.polytec.com/usa/psv3d).



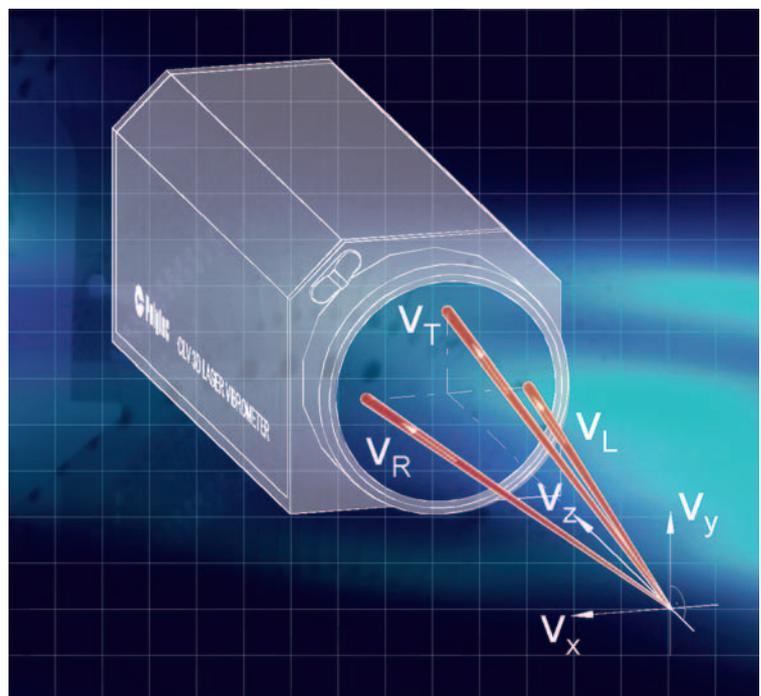
The CLV-3D System



The system comprises a three-channel CLV Compact Laser Vibrometer Controller unit coupled to a CLV-3D Optical Sensor Head containing three independent CLV optical systems, all focused to the same measurement point approximately 140 mm (or 300 mm) from the front lens.

Optical Sensor

The CLV-3D Optical Head contains the optical components of three independent CLV-700 sensors. Each output laser beam is inclined at a 12° angle ($f = 160$ mm lens version) with respect to the surface, but from three slightly different directions separated by 120° in the output plane. A 12° angle is small enough to allow the sensors to collect enough back-scattered light to make a high-quality measurement, but still large enough for good sensitivity to the in-plane vibration components. Furthermore, the narrow cone angle allows the beams to pass through small holes or windows in wind tunnels or environmental test chambers. For even narrower cone angle applications, a 310 mm focal length front lens may be fitted in combination with a 310 mm version of the geometry module.



Signal Outputs

The CLV-3D provides separate analog outputs for the vibration velocity along the three laser beams v_L , v_R and v_T . These outputs can be used to calculate the Cartesian velocity components v_x , v_y and v_z . For external software calculations, these raw outputs are connected to a three channel data acquisition board and processed by a computer. A better choice is Polytec's internal geometry calculation module where the Cartesian velocity components v_x , v_y and v_z are provided as three separate, real-time, analog outputs. With a "perfect" surface such as 3M™ Scotchlite™ retro-reflective tape, v_x and v_y have a noise floor of better than 1 $\mu\text{m/s}$ measured in a 10 Hz resolution bandwidth. v_z is better than 0.5 $\mu\text{m/sec}$.

Hardware

The controller unit is divided into upper and lower sections. The lower section contains three CLV

laser modules (CLV-810) plus the master power-supply module. The upper section comprises a 3-channel vibrometer signal processor, which generates the three analog velocity outputs v_x , v_y and v_z in addition to the "raw" outputs v_L , v_R and v_T . Doppler signal demodulation is performed by a combination of three input modules (type CLV-M200) and three velocity decoding modules (type CLV-M020.B for 50 kHz version or CLV-M030.B for 250 kHz version) chosen according to the bandwidth demanded by the application. A range selector knob controls the velocity range-setting for all three channels. Each input module generates an LED bar proportional to gathered light. A single monitor module conditions the raw Doppler signals from the three laser beams and outputs v_L , v_R and v_T . The single geometry module performs an analog coordinate transform and outputs the true v_x , v_y and v_z components. A switchable 10 Hz high-pass filter is provided for cutting off low-frequency vibrations.

Technical Data

Performance Specifications						
Output type	Analog voltage proportional to vibration velocity in L, R, T laser beam directions and in the Cartesian coordinates X, Y, Z					
Model	CLV-3220			CLV-3230		
Decoder module	CLV-M020.B			CLV-M030.B		
Frequency response	0.5 Hz to 50 kHz (± 0.5 dB)			0.5 Hz to 250 kHz (+0.3/-1 dB)		
Measurement ranges	3			3		
Scaling factor [mm/s/V]	5	25	125	5	25	125
Full scale (peak to peak) [mm/s]	100	500	2,500	100	500	2,500
Max. acceleration [g]	1,600	8,000	40,000	8,000	40,000	200,000
Analog velocity output	± 10 V, output impedance 50 Ω , BNC connectors					

v_x , v_y and v_z Outputs				
Frequency range	Resolution* ($\mu\text{m/s}$)			
	f = 160 mm		f = 310 mm	
	X, Y	Z	X, Y	Z
10 Hz ... 20 kHz	< 1	< 0.2	< 2	< 0.2
20 kHz ... 200 kHz	< 3	< 0.5	< 5	< 0.5
Output filter	High-pass filter 10 Hz (-3 dB), switchable			

* Resolution is defined as the signal amplitude (rms) at which the signal-to-noise ratio is 0 dB in a 10 Hz spectral resolution bandwidth (RBW), measured with 3M™ Scotchlite™ tape (reflective film).

Optics		
Laser type	Helium-Neon (HeNe), 633nm (red)	
Laser output	<3 mW (<1 mW per beam)	
Laser safety class	2M	
Focal length	160 mm	310 mm
Angle θ	11.6°	6.1°
Spot size	65 μm	130 μm
Nominal standoff distance	~140 mm	~300 mm

Housing and Operational Conditions		
	Controller	Optics
Dimensions [L x W x H]	450 mm x 400 mm x 275 mm (17.7 in x 15.7 in x 10.8 in) (19" rack mount)	100 mm x 99 mm x 246 mm
Weight	24 kg (52.9 lbs)	4 kg (8.8 lbs)
Operating temperature	+5 °C ... +40 °C (41 °F ... 104 °F)	
Storage temperature	-10 °C ... +65 °C (14 °F ... 149 °F)	
Relative humidity	Max. 80 %, non-condensing	
Connection cable	Length 3 m (9.8 ft), minimum bending radius 80 mm (3.1 in)	
Optics mounting	English and metric threaded holes in base	
Power	100 VAC ... 240 VAC \pm 10 %, 50/60 Hz, max. 100 VA	

Compliance with Standards	
Electrical safety	IEC/EN 61010
EMC	IEC/EN 61326; Emission: Class A IEC/EN 61000-3-2 and 61000-3-3 Immunity: IEC/EN 61000-4-2 to 61000-4-6 and IEC/EN 61000-4-11
Laser safety	IEC/EN 60825-1 (CFR 1040.10, CFR 1040.11)

For more information please contact your local Polytec sales engineer or visit our website www.polytec.com.



Accessories

The CLV-Z-018 Motorized Test Stand is available for positioning the CLV-3D Sensor Head in the Z-direction. The test stand can be used with both 160 mm and 310 mm focal length lenses and has three different speed ranges for precise positioning.



Polytec GmbH (Germany)
Polytec-Platz 1-7
76337 Waldbronn
Tel. + 49 (0) 7243 604-0
Fax + 49 (0) 7243 69944
info@polytec.de

Polytec-PI, S.A. (France)
32 rue Délizy
93694 Pantin
Tel. + 33 (0) 1 48 10 39 34
Fax + 33 (0) 1 48 10 09 66
info@polytec-pi.fr

Lambda Photometrics Ltd. (Great Britain)
Lambda House, Batford Mill
Harpenden, Herts AL5 5BZ
Tel. + 44 (0) 1582 764334
Fax + 44 (0) 1582 712084
info@lambdaphoto.co.uk

Polytec KK (Japan)
Hakusan High Tech Park
1-18-2 Hakusan, Midori-ku
Yokohama-shi, 226-0006
Kanagawa-ken
Tel. +81 (0) 45 938-4960
Fax +81 (0) 45 938-4961
info@polytec.co.jp

Polytec, Inc. (USA)
North American Headquarters
1342 Bell Avenue, Suite 3-A
Tustin, CA 92780
Tel. +1 714 850 1835
Fax +1 714 850 1831
info@polytec.com

Midwest Office
3915 Research Park Dr.
Suite A-12
Ann Arbor, MI 48108
Tel. +1 734 662 4900
Fax +1 734 662 4451

East Coast Office
25 South Street, Suite A
Hopkinton, MA 01748
Tel. +1 508 544 1224
Fax +1 508 544 1225