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Upgradation of 9155D to primary laser calibration

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The Modal Shop, a PCB Group Company, provides structural vibration and acoustic sensing systems to engineers worldwide. The Modal Shop specializes in sound and vibration sensing systems for the multichannel, acoustics, modal, and NVH markets. Products include Accelerometers, TEDS, Shaker stands, stingers, air rides, coordinate digitizers, hammers, modal accelerometers, 440 Series Modular Signal Conditioners, and shaker amplifiers.

Structural Solutions Pvt. Ltd exclusively represents Ms. The Modal Shop., Cincinnati USA in India. Structural Solutions Private Limited is an ISO 9001 certified professional engineering company engaged in offering high end technology- intensive products and system solutions to Indian Automotive, Space, Aerospace & Institutional R&D Market segments.

Accelerometer calibration via reference (or transfer) standard is the most common calibration method for most typical accelerometer users. This is the method used by virtually every accelerometer manufacturer to calibrate the sensors at the factory. The sensor under test (SUT) is mounted to a calibration exciter instrumented with a reference accelerometer that sees the same vibration as the test sensor. The signals are compared to the reference thus providing the calibration constant for the test accelerometer. The method is quick and affordable. Depending on different systems, following uncertainty obtained:

Manual calibration systems	typically 3-5% or greater	generally used for low numbers of axes of calibration.
Automated calibration system with an acceptable electromechanical shaker	typically 2.5-3.5% worst case at <10 kHz	generally used for 100 axes of calibration per year.
Fully automated, database driven calibration system with high accuracy calibration grade air-bearing exciter	typically 1.8 – 2.5% worst case at <10 kHz	generally used for large volume calibration users and metrology houses.

With the advent of high-resolution digital acquisition and the evolution of sophisticated test strategies, test engineers are demanding higher accuracy from their measuring equipment. For vibration applications, arguably the most important links in the measurement chain are the choice of accelerometer and the calibration of its sensitivity.

Historically, because of cost and complexity, primary calibration was performed mainly at National Metrology Institutes (NMI) such as NIST (National Institute of Standards and Technology) in the United States, NPL (National Physical Laboratory) in India, etc. Trace ability to the NMI is maintained through a transfer standard. A calibration facility would send a primary transfer standard to the NMI for periodic calibration (annually or biannually). The primary standard is then used to calibrate the manufacturer's working standards.

Today to meet the test engineer's demand for more accurate calibrations with low uncertainty levels, accelerometer manufacturers are starting to develop the in-house ability to perform primary calibrations. There are number of factors driving this: in many cases the NMI cannot meet the accuracy needs of the accelerometer manufacturer; in-house primary standards can be calibrated more frequently; calibrations can be performed over frequency ranges not offered by the NMI; and back-to-back standards can be calibrated by a primary method eliminating errors introduced by the transfer standard. When a facility performs primary calibration, traceability to the NMI is ensured through the use of traceable measuring equipment and proficiency testing.

Primary calibration most often takes a laser interferometer and provides an absolute calibration by comparing the dynamic vibration to the wave

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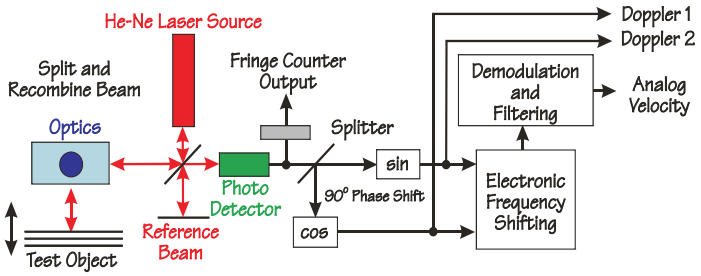
length of the laser light.. Primary calibration is the standardized means to obtain the absolute minimum in uncertainty. This very high accuracy method of vibration measurement comparison provides calibration with uncertainties in the 0.2 – 1.5% (k=2 for all uncertainties) over the frequency range up to 15 kHz.

Now good news to all our customers using our calibration workstation. The Modal Shop offers 9155D-575 Laser primary option, which allows the mythologist to perform primary calibration of vibration sensors with extremely by low measurement uncertainty, meeting the performance requirements specified in ISO 16063-11. The system seamlessly integrates with the Model 9155D Accelerometer calibration workstation, allowing for both primary calibrations using an all-digital laser vibrometer and secondary calibrations using the system's reference standard accelerometer in a back-to-back comparison configuration, as specified in ISO 16063-21.

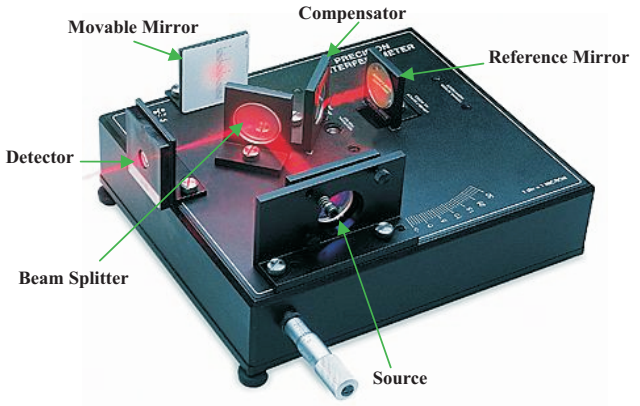
The system applies a Michelson interferometer to measure the velocity of calibration platform. This signal is directly demodulated from the in-phase and quadrature-phase components of the laser droppler signal. The result is a primary calibration based upon a physical constant, the wavelength of a He-Ne laser.

Michelson Interferometer:



The intensity of recombined beam is modulated according to F=v/(½)where
F_d=Doppler frequency
v=test object velocity

The basis for the laser interferometer is the constructive and destructive interference of two coherent light waves, one being a reference beam with a fixed path and second beam reflected from the moving surface to be measured. The interferometer's photodetector responds to intensity of interfering light.



When selecting the 9155D-575 Laser Primary option, either the 9155D-830 or –831 air bearing shaker option is required. This option upgrades the base 9155D system to include the K394A30 or K394A31 air bearing shaker system, providing superior calibration performance compared to traditional flexure-based electromechanical calibration shakers. Using this air bearing shaker, transverse motion can be effectively eliminated meeting the recommendations specified in ISO 16063-21, greatly reducing measurement uncertainties.

System Benefits:

- Provides both primary and secondary calibrations, for accurate NIST and/or PTB traceable calibrations
- Direct demodulation of Doppler laser signal assures low measurement uncertainty.
- Dual beam dual pass laser allows for increased efficiency and accuracy
- Setup tests, acquire data, save results and print reports quickly with precision and automation.
- Define multiple pass/fail criteria for each test and automatically recall them from the internal database
- Printed certificates comply with ISO 17025
- Automates calibration procedures
- Customizable system fits any application or need
- Calibrates up to 200 frequencies

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