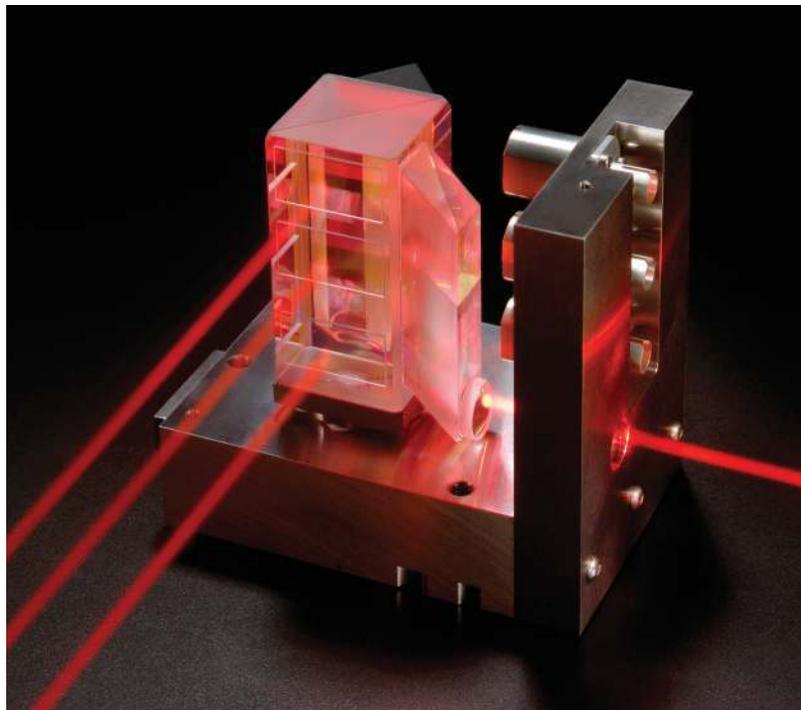


Keysight Technologies Transducer Systems

Leading the Future for Extreme
Accuracy Positioning Applications



Keysight Laser Interferometry Systems

- Highest accuracy
- Flexible standard system design
- Custom design available

When nanometer accuracy matters – you can rely on Keysight.

Keysight Technologies, Inc. is a world leader in the design and manufacture of laser interferometry systems, advanced electronic measurement systems, high-precision optical components, complex monolithic optics (CMOs), and opto-electric systems design for the most demanding metrology applications. With more than 11,000 systems delivered, Keysight's modular interferometry solutions have set the standard for precision measurement for the most challenging applications in semiconductor lithography, aerospace/defense, metrology, and manufacturing. And, we continue to develop systems that will enable the future in each of these markets.

Our systems offer:

- High-precision in a wide dynamic range
- Simultaneously measure a position with multiple degrees of freedom
- The highest accuracy available in both air and vacuum

We deliver a selection of modular lasers, optics, electronics, and accessories that are designed to work together and give customers the flexibility they need in a precision laser measurement system for a variety of applications. A wide-range of standard systems and components is available and can be configured to meet your specific needs. In addition, our team of expert engineers will work with you to design custom system solutions.

A state-of-the-art optics design and fabrication facility in Santa Clara, CA allows our engineering and production teams to work together and tightly manage the design and production processes resulting in the high quality and dependability that our customers rely on. Deterministic manufacturing processes allow Keysight to maintain quality control that responds to the toughest optical challenges and deliver high-precision designs with cost-effective solutions for both standard applications and high-volume custom requirements.

Typical Applications

- ▶ Semiconductor
- ▶ 3D packaging
- ▶ CMM
- ▶ Flat panel
- ▶ R&D investigations
- ▶ Manufacturing test

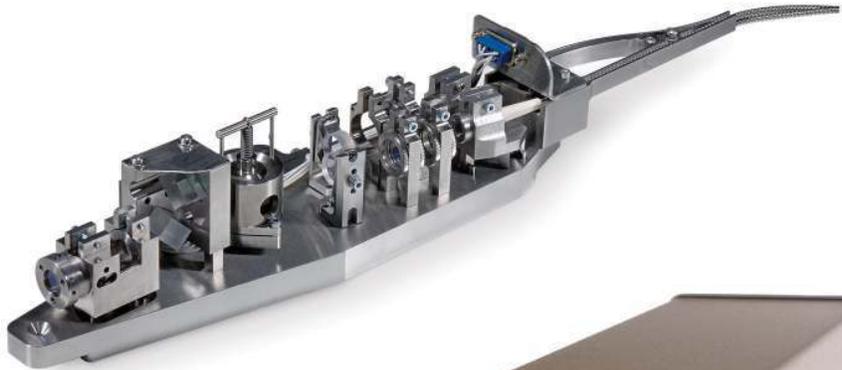


Figure 1. The Keysight N1212A Remote Optical Combiner offers extremely low heat loads for thermally sensitive applications and high velocity capability.



Figure 2. Keysight 5517 Lasers offer a wide range of specifications that can be selected to optimize system performance.

Transducer Systems

Keysight laser measurement systems are both accurate and highly configurable. Multiple choices for each of the key system components are available enabling the creation of custom systems using standard products;

- Laser source
- Beam directing optics
- Measurement optics
- Optical receiver
- Axis electronics

Additional products are available for accurately measuring the air environment and creating a compensation factor to correct the measurement values due to variation in the air pressure, temperature, and humidity.

Most products can be mixed and matched as needed for the specific application, desired interface, and required performance level.

USB electronics

The E1735A is a single axis solution for simple measurement-only applications.

VME compatible electronics

Keysight offers three axis boards for VMEbus systems. All have the same flexible hardware interface along with similar software interfaces, enabling mixing boards as required within multi-axis systems.

- The 10897D provides a solution for single axis systems as well as multi-axis systems requiring continuous (versus sampled) feedback from all axes.
- The 10898D is a dual axis board with increased velocity range.
- The N1225A has four times the resolution of other solutions and handles three to four axes.

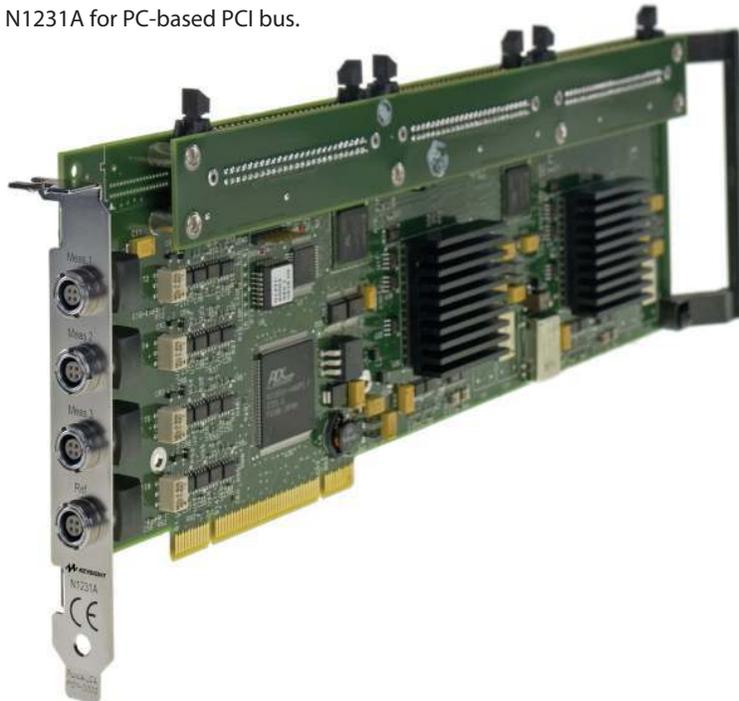
Keysight also offers an interface and control system enabling a set of VMEbus axis boards to send compensated data to a Delta Tau PMAC/UMAC motion control system. The N1226A, N1227A and N1228A/B products are used to make up this system.

PC-based PCI electronics

Two solutions are available for PC-based PCI bus systems. The three-axis 1231A contains a plug compatible interface to the PMAC/UMAC series of motion controllers from Delta Tau. The three-axis N1231B offers two times the resolution of the N1231A and contains a flexible hardware interface similar to Keysight's VMEbus boards.



Figure 3. Keysight electronics solutions are available for multiple platforms and include the N1225A VMEbus and the N1231A for PC-based PCI bus.



Standard Multi-Axis Optics

A wide variety of standard multi-axis optics are available that allow the measurement of pitch and or yaw with displacement in several measurement configurations. These include:

These include:

- The Z4399A enables measurement of distance, pitch, and yaw.
- The 10721A makes two differential measurements between two vertically offset mirrors to obtain distance and yaw.
- The E1827A is based on Keysight's proprietary CMO technology and enables distance and yaw measurements.
- The Z4420B enables distance and yaw measurement of two vertically offset stages while measuring pitch of the bottom stage.

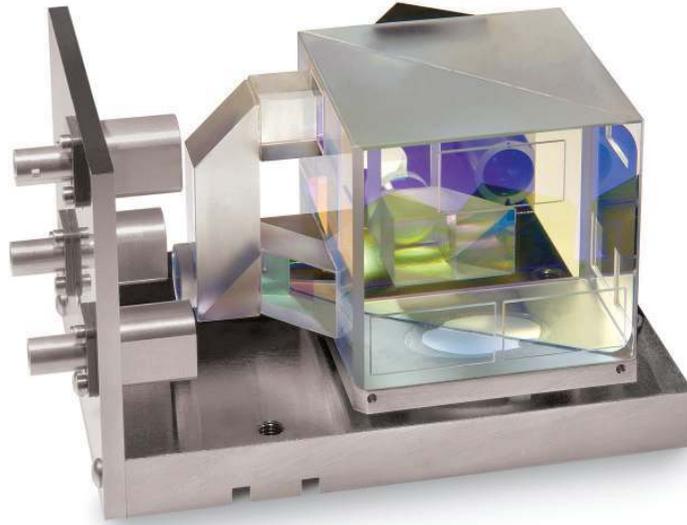


Figure 4. Keysight's multi-axis interferometers are designed and produced using our unique Complex Monolithic Optics (CMOs) technology and provide extreme precision and reliability in a compact form factor.

Precision Designed Optical Components

Keysight is a world-leader in the design and fabrication of precision optics. The accuracy of your measurement depends upon the optical components used in your system. Keysight offers a number of beam delivery optics ranging from bare optics to beam translation components which are built to exacting wavefront specifications.



Figure 5. A broad selection of beam directing optics and mounts are available for integration into complex multi-axis measurement systems.

Vacuum Compatibility

Keysight offers several standard interferometers that can be configured for vacuum environments. The housings of these components are made of stainless steel and the optical elements are attached to these housings using a low volatility UHV compatible adhesive.

The entire assembly is verified to be free of trapped air pockets and is manufactured in a class 100 clean room environment to prevent contamination of your vacuum system.

Custom Interferometer Design

Keysight's staff of optical engineers is ready to apply their many years of leading-edge optical design experience to your project. Whether it's a coating design to exacting specifications, the design of a new optic, consultation on an optical configuration question, or help with a metrology or process control problem, we can provide specific state-of-the-art expertise to rapidly and efficiently address your needs.

Services available

- Optical design
- Thin film coating design
- Optical fabrication consulting
- Monolithic opto-mechanical assembly design
- Optical metrology consulting and design
- Process control consulting
- Environmental test

And, unlike optical design labs that outsource manufacturing, Keysight offers comprehensive and proven services from initial concept through volume production, even for complex assemblies. The result: faster turnaround, clear accountability, and the benefits of decades of real world manufacturing experience.

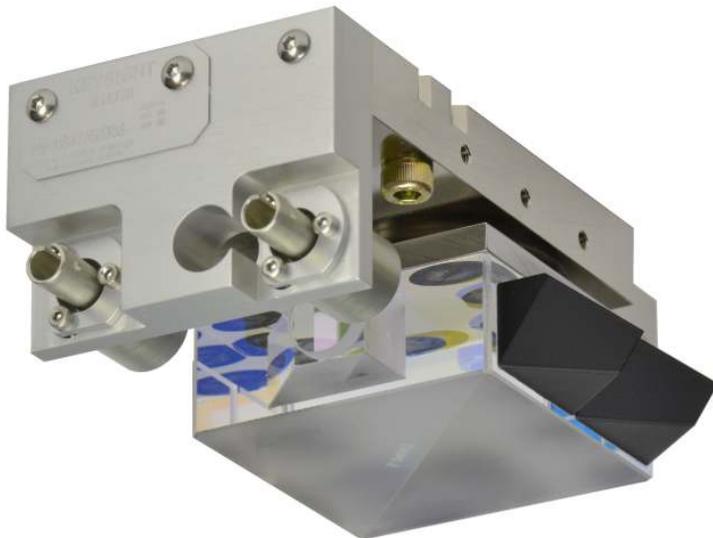


Figure 6. Keysight's unique CMO technology allows us to design and manufacture standard and custom interferometers that are highly accurate, never need alignment and are light weight and space efficient.

Keysight Lasers Proven Technology and Innovation Together in a Single Solution



Figure 7. The Keysight 5517 Laser is a stabilized dual-frequency laser that enables high accuracy measurements.

The heart of the interferometry system is Keysight's dual-frequency (heterodyne) stabilized HeNe laser. Offering unsurpassed reliability and stability, Keysight lasers are industry recognized for performance and accuracy. With more than 50,000 hours mean-time-between-failures (MTBF), the laser has the longest life-time available.

Innovative Complex Monolithic Optic (CMO) Design Measurement Integrity Built-In

Keysight's unique complex monolithic optic (CMO) technology is at the heart of our two- to six-axis interferometers. Interferometers designed using CMO technology offer higher performance, reliability, and stability in smaller footprints than traditional designs. By implementing CMO designs, we can offer high performance and reliability in small packages. Keysight offers the fully integrated design, engineering, and manufacturing services needed to take advantage of CMO technology.

Improved stability is insured with glass-to-glass bonding and mounting techniques. As a result, the optics stay aligned as specified and both performance and reliability are enhanced. Further, Keysight optics are built to be rugged and thermally stable in order to withstand the rigors of a manufacturing environment.

CMOs can be adapted for a wide variety of industrial and scientific applications where custom beam combining, beam separating and multiple wavelengths are required. Keysight's CMO design offers customers the ability to choose and easily change between wavelengths. And, the CMO's stable, rugged and monolithic design guarantees that they are fully aligned before they leave the factory and that they will require no alignment – ever. You can count on extremely accurate measurements time after time.

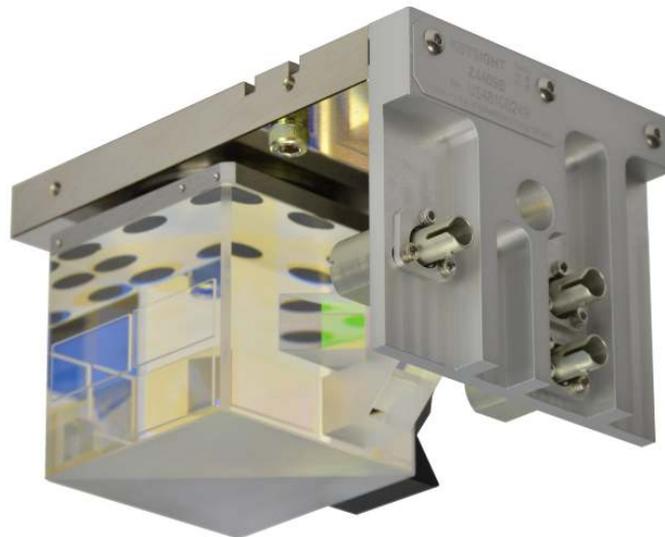


Figure 8. Keysight interferometers are one example of CMO technology implementation.

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