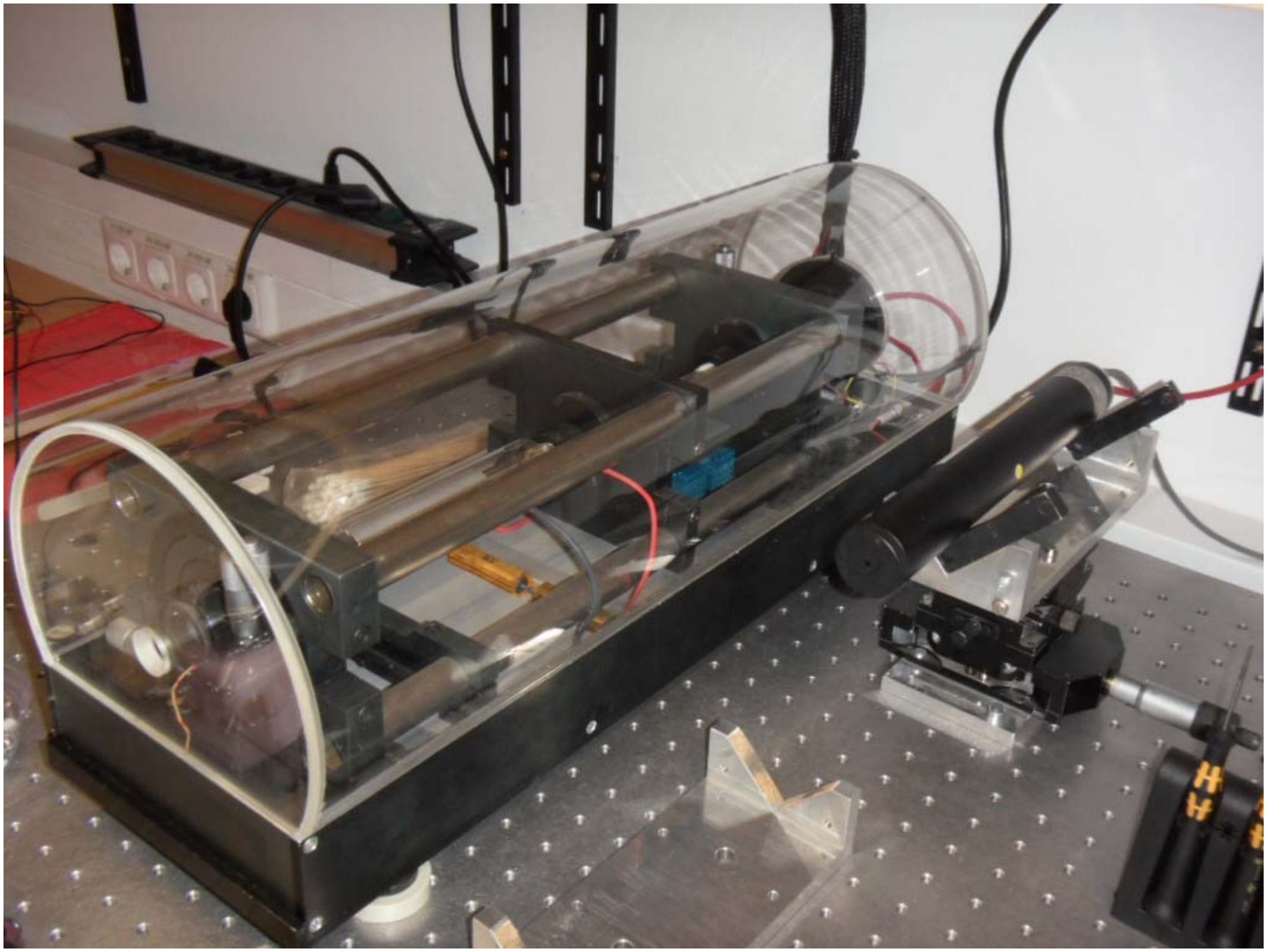

Stabilized
HeNe Laser

SL 02-Series

SIOS
Meßtechnik GmbH

Design and Operation

SL 02-Series stabilized HeNe lasers employ a patented two-mode stabilization technique providing high frequency stability in conjunction with rapid warm-up. The stabilized HeNe laser is installed in a compact cylindrical case. For the power supply only a single 13.5 V-AC adapter is necessary. The output beam is linearly polarized. Two different models, either with one single mode (Model SL 02/1), or with two polarized modes (Model SL 02/2) are available. An internal thread at the beam exits may be used for installing mechanical shutters or various types of optical components. Fiber couplers directly installed on the laser head have the advantage of stable and nearly alignment-free operation. Couplers with pigtails mating to singlemode or multimode fibers are available as an option.

Technical Data		Model SL 02/1	Model SL 02/2
Wavelength (nominal)	nm	632.9914 ± 0.0003	
Output power	mW	≥ 1.0	≥ 2.0
Amplitude noise (30 Hz - 10 MHz)	%	< 0.2	< 0.3
Amplitude modulation (39 kHz)	%	< 0.2	< 0.3
Amplitude stability over 24 h / 1 min	%	< 5 / < 0.5	
Beam diameter at $1/e^2$ power points (TEM_{00})	mm	0.63	
Beam divergence, full angle (TEM_{00})	mrad	1.3	
Beam polarization		Single linearly polarized longitudinal mode	Two mutually orthogonal linearly polarized modes
Longitudinal mode spacing	MHz	–	730
Warm-up time to achieve stable operation	min	< 10	
Frequency drift:			
Max. thermal frequency drift	MHz / K	± 4	
Max. total frequency drift	MHz	± 25	
Frequency stability over 1 min / 1 h / 24 h after 40 min warm-up		$\pm 2 \cdot 10^{-9}$ / $\pm 1 \cdot 10^{-8}$ / $\pm 2 \cdot 10^{-8}$	
Max. tolerated optical feedback		$< 10^{-5}$	
Maximum tolerated magnetic fields at laser head:			
Magnetodynamic field	T	$< 10^{-6}$	
Magnetostatic field	T	$< 10^{-4}$	
Operating temperature range	°C	+ 15 ... + 30	
Storage temperature range	°C	– 20 ... + 50	
Typical life time	hrs	15,000	
Power consumption in stabilized condition	W	Approx. 20	
Line voltage	VAC	95 ... 265	
Dimensions of laser head [Dia. x L]	mm	∅ 50 x 410	
Internal thread at beam exit standard / optional		1.279“ – 32 / 1.000“ – 32	
Length of cable between laser head and AC adapter	m	1.5	
Weights of laser head / AC adapter	g	900 / 350	
Laser Safety Class		3R	

Major Features and Benefits

- High long-term frequency stability
- Rapid warm-up
- Compact design
- Internal thread at beam exit for installing items such as fiber couplers
- Bear the CE-symbol certifying compliance with:

  EC-Guidelines: 73/23/EEC and 89/336/EEC
  Harmonized EC-Standards: EN 61010-1, EN 60825-1, EN 55011 and EN 50082-1

Options

- Datasheet with absolute frequency (maximum error 1 MHz) measured in comparison with an iodine-stabilized HeNe laser
- Marking indicating the beam’s plane of polarization
- Adjustable operating temperature range
- Fiber coupler installation and alignment
- Installation and alignment of a Faraday isolator in order to eliminate optical feedback
- Additional module for alternatively single or dual mode operation (Model SL 02/2)

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Warning:

LASER RADIATION
DO NOT STARE INTO BEAM OR VIEW BEAM USING OPTICAL INSTRUMENTS.
LASER CLASS 3R

Stabilized
HeNe Laser

SL 03-Series

SIOS Meßtechnik GmbH

Design and Operation

Our SL 03-Series stabilized HeNe lasers employ a patented dual longitudinal mode stabilization technique providing high frequency and amplitude stabilities, low optical feedback, and extremely rapid warm-up. They consist of a compact cylindrical head incorporating the laser tube, plus a separate table-top housing incorporating a high-voltage supply and control electronics equipped with a front-panel switch for selecting frequency-stabilized or amplitude-stabilized mode of operation. An internal thread at their beam exit provides a rigid mounting for mechanical shutters or various types of optical components. Fiber couplers mating to singlemode or multimode fibers are available as an option.

Technical Data		SL 03/1
Nominal wavelength	nm	632.9910 ± 0.0002
Output power	mW	≥ 0.8
Amplitude noise (30 Hz - 10 MHz)	%	< 0.2
Amplitude stability over 24 h / 1 min (frequency stabilization mode)	%	< 5 / < 0.5
Amplitude stability over 24 h / 1 min (amplitude stabilization mode)	%	< 0.5 / < 0.2
Beam diameter (TEM_{00})	mm	0.55
Beam divergence (TEM_{00})	mrad	1.5
Polarization		Linearly polarized longitudinal mode
Time required to warm-up to stabilized condition	min	≈ 10
Frequency drift:		
Max. thermal frequency drift	MHz/K	± 2
Max. total frequency drift	MHz	± 5
Frequency stability over 1 min / 1 h / 24 h after 30-min warm-up		$\pm 1 \times 10^{-9}$ / $\pm 2 \times 10^{-9}$ / $\pm 1 \times 10^{-8}$
Max. tolerated optical feedback		$< 10^{-5}$
Maximum tolerated magnetic fields at laser head:		
Magnetodynamic field	T	$< 10^{-6}$
Magnetostatic field	T	$< 10^{-4}$
Operating temperature range	°C	+ 15…+ 30
Storage temperature range	°C	– 20…+ 50
Typical life time	h	≥ 15,000
Power consumption in stabilized condition	W	< 20
Line voltage	VAC	100 - 240
Dimensions of laser head [Dia. x L] / electronic unit [W x H x D]	mm	∅ 34.9 x 280 / 172 x 60 x 230
Internal thread at beam exit		1.279"–32
Length of cable interconnecting laser head and electronic unit	m	0.8
Weights of laser head / electronic unit	g	450 / 1,200
Laser Safety Class according DIN EN 60825-1		2M

Major Features and Benefits

- High frequency and amplitude stabilities
- Choice of two modes of operation, frequency stabilized or amplitude stabilized
- Rapid warm-up (typically 10 min)
- Compactly designed
- Laser heads come equipped with an internal thread at their beam exit for installing, e.g., fiberoptic couplers, as standard.
- All units bear the CE-symbol certifying compliance with EG-Guidelines 73/23/EWG and 89/336/EWG and harmonized EN-Standards EN 61010-1, EN 60825-1, EN 55011, and EN 50082-1.

Options

- Datasheet with absolute frequency (maximum error 1 MHz) measured in comparison with an iodine-stabilized HeNe laser
- Marking indicating the beam's plane of polarization
- Extended or shifted operating temperature range
- Faraday isolator
- Couplers for multimode or singlemode optical fibers
- Fiberoptic connector, e.g., a DIN-connector, installed on the fiber exit end

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Warning:

LASER RADIATION
DO NOT STARE INTO BEAM OR VIEW BEAM
USING OPTICAL INSTRUMENTS.
LASER CLASS 2M

Miniature Retroreflector Interferometer

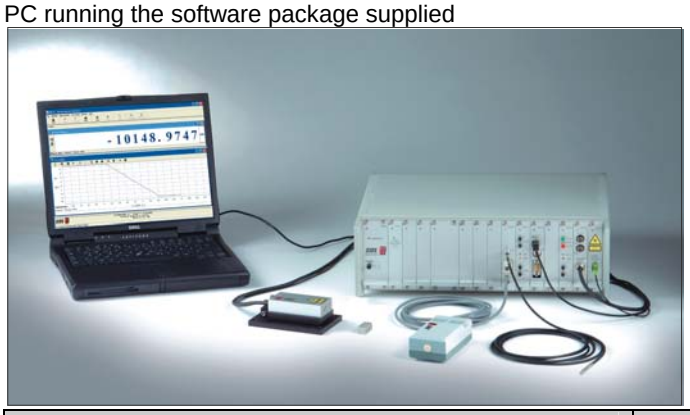
MI-Series

SIOS
Meßtechnik GmbH

Design and Operation

Our MI-Series miniature interferometers equipped with triple-faceted retroreflectors are precision length measurement instruments designed for incorporation into customer supplied systems, and are readily adapted to suit a wide variety of experimental setups and tasks. The miniaturized sensor head and triple-faceted retroreflector allow for their employment as permanently installed metrological systems. The fiberoptic coupled sensor head provides major benefits in many types of applications and makes the overall metrological systems more versatile. The miniature interferometer converts motions of the triple-faceted retroreflector into optical interference signals that are transmitted to the opto-electronic signal processing/power supply unit for processing and output as lengths. A HeNe laser serves as the light source for the miniature interferometer and is frequency stabilized on models with large dynamic ranges. Compensation of environmental influences form the basis for high metric precisions and are achieved through the correction of laser wavelengths.

The instruments themselves are free of linearity errors. Instrument operation and display of measurement results are controlled either through a separate keypad/display unit or a PC running the software package supplied



Major Performance Features

- Ultraprecise length measurement instruments
- Versatile instruments for incorporation into customer supplied systems, readily adaptable to suit a wide variety of tasks, easy to align
- Allows high retroreflector translation rates
- Insensitive to retroreflector angular misalignments
- Fiberoptic coupled sensor head
- Causes no thermal interference
- Employs signal-acquisition/transmission hardware immune to electromagnetic interference
- Employs a HeNe Laser with high frequency stability as a length standard
- Corrects for variations in laser wavelength caused by ambient conditions

Applications

- Precision laser interferometric length measurement instruments for incorporation into single/ multi-axis translation stages, microscope stages, machine tools, or positioning systems
- Positioning single/ multi-axis machine beds
- Calibrating machine tools or coordinate-measurement machines
- Angular measurements
- Handling precision length measurement tasks in research and development work

Technical Data		Model MI 60	Model MI 150	Model MI 5000
Measurement range	mm	60	150	5,000
Metric resolution, standard	nm	1	1	1
optionally	nm	0.1	0.1	0.1
Nominal laser wavelength	nm	632.8	632.8	632.8
Laser frequency stability (after warm-up)		3×10^{-7}	3×10^{-7}	2×10^{-8}
Laser warm-up period	min	1	1	10 - 20
Operating temperature range	°C	15 - 30	15 - 30	15 - 30
Maximum retroreflector translation rate	mm/s	600	600	600
Dimensions (H x W x D):				
Sensor head	mm	22 x 50 x 100	22 x 50 x 100	22 x 50 x 100
Retroreflector	mm	13 x 30 x 15	13 x 30 x 15	13 x 30 x 15
Optoelectronic signal processing/ Power supply unit (OPU)	mm	150 x 450 x 400	150 x 450 x 400	150 x 450 x 400
Keypad/display unit	mm	48 x 190 x 138	48 x 190 x 138	48 x 190 x 138
Mass:				
Sensor head	g	200	200	200
Retroreflector	g	12	12	12
OPU	g	9,500	9,500	9,500
Keypad/display unit	g	630	630	630
Interface: serial		RS 232 C	RS 232 C	RS 232 C
optionally		USB	USB	USB
Fiberoptic cable length from sensor head to OPU	m	3, option. up to 25	3, option. up to 25	3, option. up to 25
Supply-line voltage	VAC	100 - 240	100 - 240	100 - 240
Supply-line frequency	Hz	47 - 60	47 - 60	47 - 60

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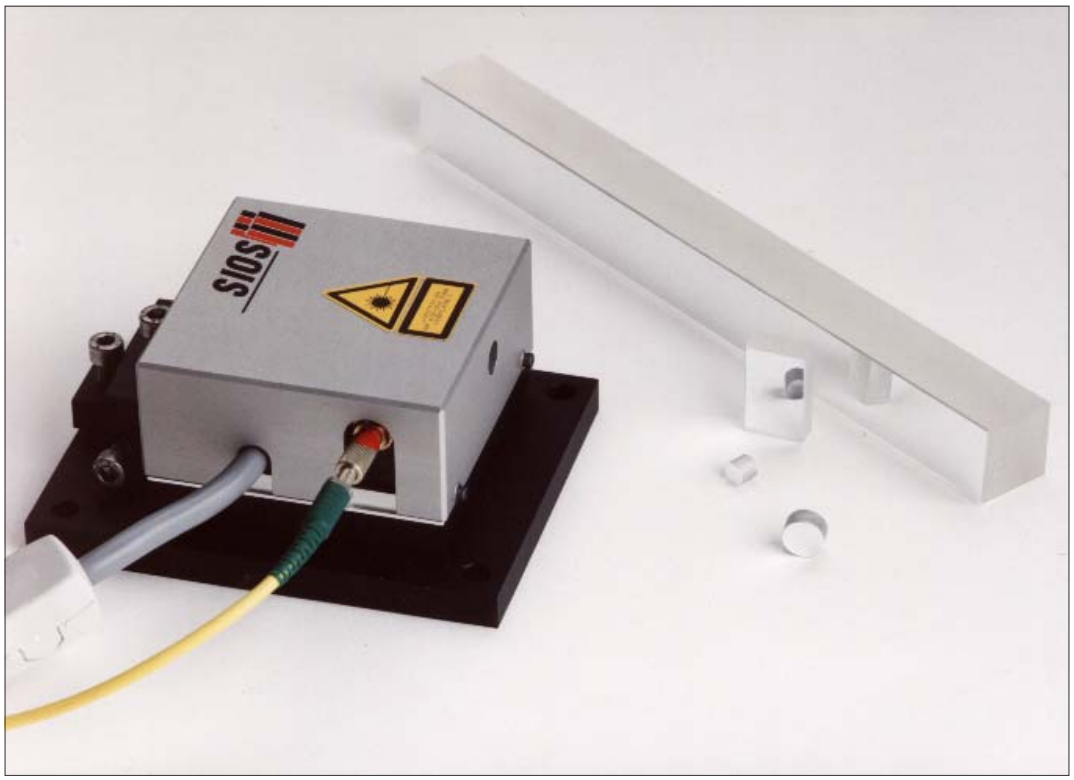
Miniature Plane-Mirror Interferometer



SP-Series

SIOS Meßtechnik GmbH

Design and Operation

Our SP-Series miniature plane-mirror interferometers are precision length measurement instruments designed for incorporation into customer supplied systems, and are readily adapted to suit a wide variety of experimental setups and tasks. The miniaturized sensor head allows their employment as permanently installed metrological systems.

Planar mirrors or other optical-quality reflective surfaces may be employed as reflectors on their translating arms, and may be angularly misaligned by as much as several minutes of arc with respect to the laser beam without adversely affecting the operation of the interferometer. The beam from the laser light source is transmitted to the sensor head by a fiberoptic cable.

The miniature interferometer converts motions of the planar mirror along the beam axis into optical interference signals that are transmitted to an optoelectronic signal processing/power supply unit for processing and output as lengths.

Instrument operation and display of measurement results are controlled either through a separate keypad/display unit or a PC running an optional software package.

Major Performance Features

- Ultraprecise length measurement instruments
- Single beam design minimizes Abbe aberrations when correctly aligned
- Versatile instruments for incorporation into customer supplied systems, readily adapted to suit a wide variety of tasks
- Fiberoptic coupled sensor head
- A planar mirror or other reflective surface may be employed as the moving reflector
- Objects being measured may wander off the beam axis if the mirror or other reflective surface employed is sufficiently large
- Low heat loss to the environment
- Employs frequency-stabilized HeNe lasers as light sources
- Corrects for variations in laser wavelength caused by ambient conditions

Applications

- Precision laser interferometric length measurement systems for incorporation into, or calibrating, translation stages, microscope stages, positioning stages, metrological equipment, machine tools, or hardness testing and materials testing equipment
- Single/dual/multi-axis coordinate measurements
- Dual-coordinate measurements in a single plane on, e.g., plane tables
- Calibrating length measurement instrumentation
- Runout and eccentricity measurements
- Noncontact surface profiling

Technical Data		Model SP 120	Model SP 2000
Measurement range	mm	100	2,000
Metric resolution, standard	nm	1	1
optionally	nm	0.1	0.1
Nominal laser wavelength	nm	632.8	632.8
Laser frequency stability (after warm-up)		$3 \cdot 10^{-7}$	$2 \cdot 10^{-8}$
Laser warm-up period	min	1	10 - 20
Operating temperature range	°C	15 - 30	15 - 30
Maximum mirror translation rate	mm/s	600	600
Dimensions (H x W x D):			
Sensor head	mm	36 x 70 x 70	36 x 70 x 70
Optoelectronic signal-processing/power-supply unit	mm	150 x 450 x 400	150 x 450 x 400
Keypad/display unit	mm	48 x 190 x 138	48 x 190 x 138
Mass:			
Sensor head	g	200	200
Optoelectronic signal-processing/power-supply unit	g	9,500	9,500
Keypad/display unit	g	630	630
Interface: serial		RS 232 C	RS 232 C
optionally		USB	USB
Fiberoptic cable length	m	3, optionally up to 10	3, optionally up to 10
Supply-line voltage	VAC	100 - 240	100 - 240
Supply-line frequency	Hz	47 - 60	47 - 60

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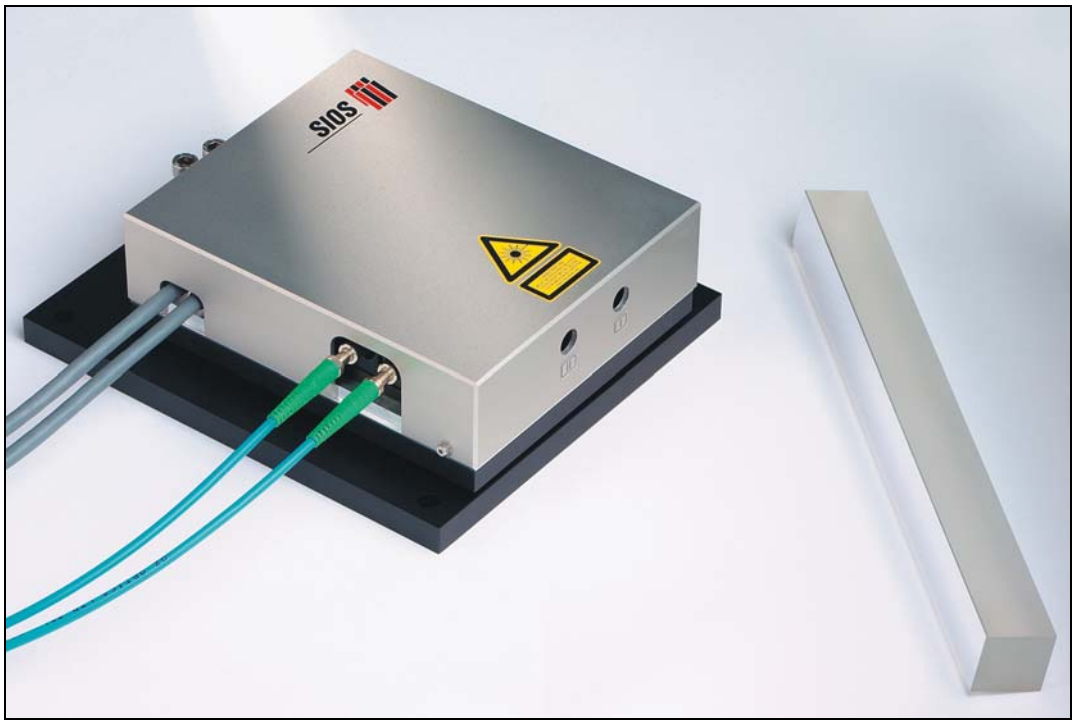
Your contact for further information:

10/2005

Miniature Double Plane Mirror Interferometer



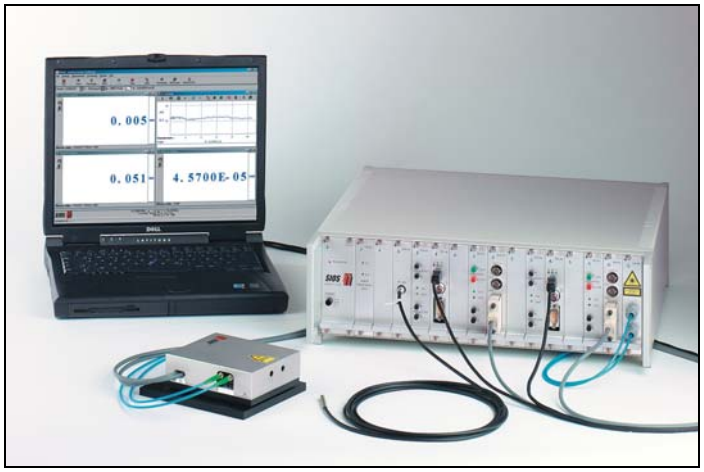
SP-D Series

SIOS Meßtechnik GmbH

Design and Operation

Our Series SP-D double plane mirror interferometers are designed for incorporation into customer supplied systems, and are used for simultaneously making pairs of nanoprecision length measurements. The differences in these pairs of length measurements and the separations between their two beams are then used for accurately determining the associated angles involved, where the angular measurement range is approximately two minutes of arc and independent of beam separation. In cases involving small length changes, focusing their external beams on the objects being measured increases the angular measurement range up to ± 30 minutes of arc.

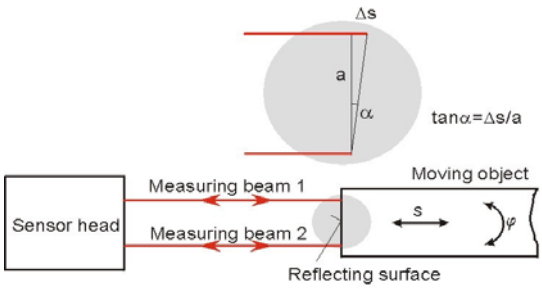
Laser light sources are coupled to the sensor heads via fiberoptic cables. The miniature interferometers convert motions of moving mirrors into pairs of optical interference signals that are transmitted to electronic power supply/signal processing modules for processing. HeNe lasers serve as light sources for the interferometer and are frequency stabilized on models with large dynamic ranges. Compensation of environmental influences form the basis for high metric precisions and are achieved through the correction of laser wavelengths. A PC running a custom software package is employed for operating the electronic modules and displaying measurement results.



Major Performance Features

- Makes ultraprecise simultaneous length and angular measurements.
- Employs highly frequency stabilized HeNe lasers as light sources.
- Fiberoptic coupled sensor heads
- The beam separations may be tailored to suit customers' special requirements.
- Compensates for shifts in laser wavelength due to environmental influences.

Operating Principle



Applications

- Making measurements on plane tables, microscope stages, positioning systems, coordinate-measuring machines, or machine tools.
- Correcting angular errors on dual-axis and multi-axis coordinate measuring machines.
- Measuring linear displacements relative to reference points
- Deformation studies
- Noncontact surface profiling
- Materials testing, e.g., dilatometry

Technical Data		Model SP 120-D	Model SP 2000-D
Length measurement range	mm	100	2,000
Length Resolution	nm	1	1
Length Resolution, optional at extra cost	nm	0.1	0.1
Beam separation	mm	2…4, ≥ 10	2…4, ≥ 10
Angular measurement range	arcmin	± 2	± 2
Angular Resolution at length resolution of 1 nm:			
Beam separation: 2 mm	arcsec	0.1	0.1
Beam separation: 4 mm	arcsec	0.05	0.05
Beam separation: 12.7 mm	arcsec	0.02	0.02
Beam separation: 25.4 mm	arcsec	0.01	0.01
Angular measurement range with beam focussing	arcmin	30	30
Nominal laser wavelength	nm	632.8	632.8
Laser frequency stability (after warm-up period)		$3 \cdot 10^{-7}$	$2 \cdot 10^{-8}$
Laser warm-up period	min	1	10...20
Operating temperature range	°C	15…30	15…30
Maximum moving-reflector translation range	mm/s	600	600
Interface: serial		RS 232 C	RS 232 C
optional at extra cost		USB	USB
Cable length between sensor head and electronics module	m	3, optionally up to 25	3, optionally up to 25
Line voltage / frequency	VAC / Hz	100…240 / 47…60	100…240 / 47…60

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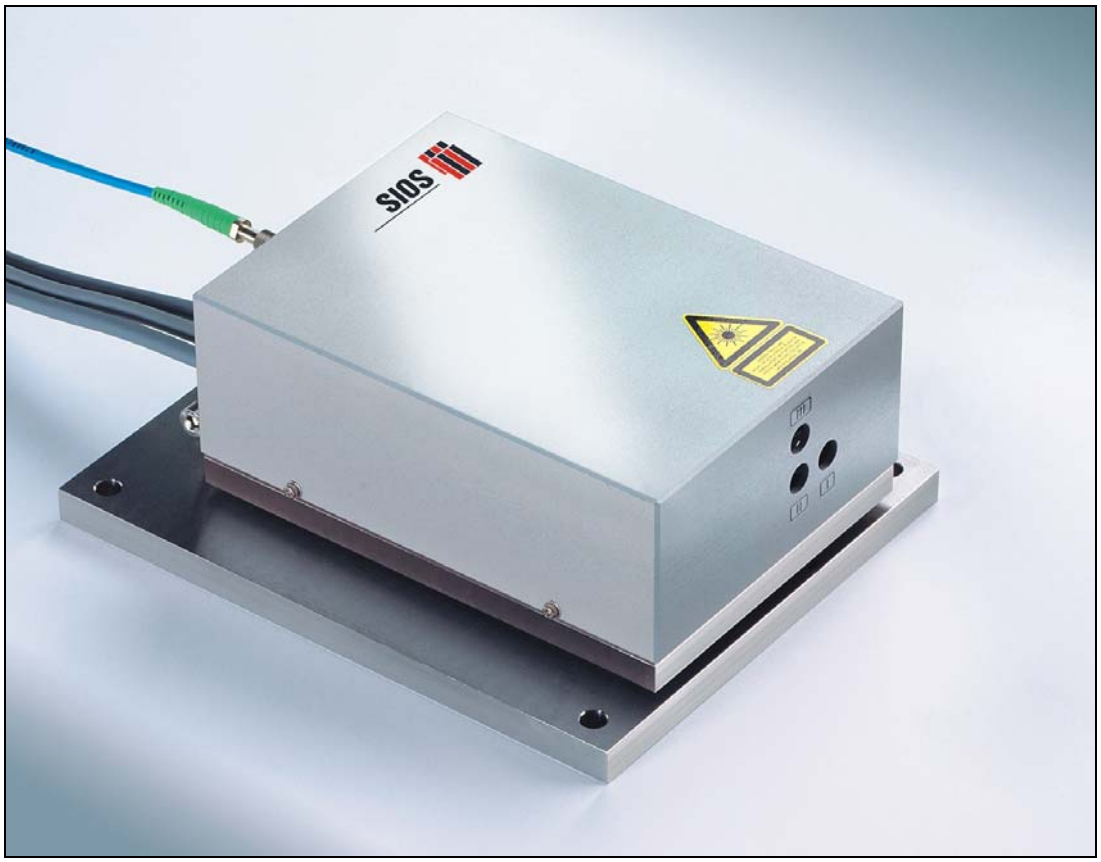
Your contact for further information:

Triple-Beam
Plane-Mirror Interferometer



SP-TR Series

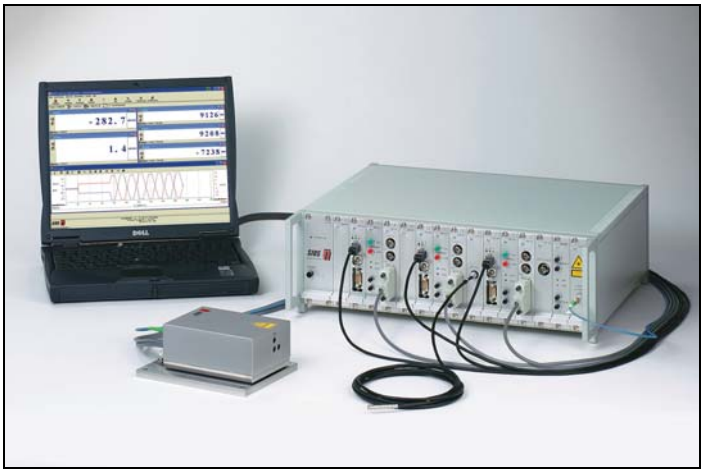
SIOS
Meßtechnik GmbH

Design and Operation

Our triple-beam interferometers combine three interferometers into a single unit and thus are capable of making simultaneous, nanometer-precision, triaxial length measurements. They are intended for incorporation into customer supplied systems. Angles may be determined with high precisions from the differences between pairs of length measurements and the respective beam separations involved. The dynamic ranges for pitch and yaw measurements are approximately two minutes of arc.

A HeNe laser emitting an ultrastable wavelength supplies all three interferometers so that all three length measurements will be based on the same reference length. A single fiberoptic lightguide conducts its output beam to the interferometric sensor head. Motions of the moving mirrors are converted into modulated signals that are transmitted to an electronic power supply/ signal processing unit.

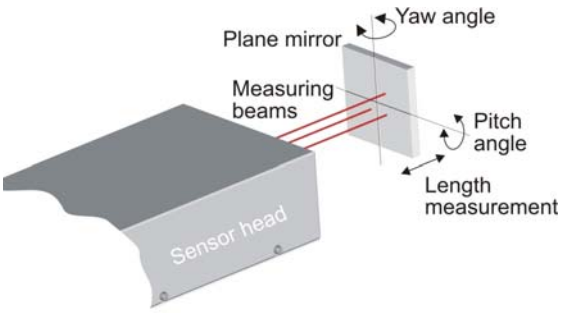
A HeNe laser serves as the light source for the miniature interferometer and is frequency stabilized on models with large dynamic ranges. Compensation of environmental influences form the basis for high metric precisions and are achieved through the correction of laser wavelengths. A PC running a custom software package is employed for operating the electronic modules and displaying measurement results.



Major Performance Features

- Simultaneous, ultraprecise, triaxial length measurements as well as pitch and yaw angle measurements
- A single laser supplies the beams for all three measuring arms
- Factory made calibration of beam separations

Operating Principle



Applications

- Laser-interferometric measurements on guides and translation, microscope, and positioning stages
- High precision pitch and yaw corrections during biaxial or multiaxial length measurements
- Calibrating metrological equipment and machine tools
- Differential measurements (dilatometry, materials testing)
- Angular measurements over extended ranges (> ± 2 arcmin; available on special order)

Technical Data		Model SP 2000-TR	Model SP 120-TR
Length measuring ranges, each axis	mm	2.000	100
Length resolution	nm	1	1
Optional length resolution	nm	0.1	0.1
Pitch and yaw measuring ranges	arcmin	± 2	± 2
Horizontal and vertical beam separations	mm	12	12
Angular resolution at 1 nm length resolution	arcsec	0.02	0.02
Laser wavelength	nm	632.8	632.8
Laser frequency stability (after warm-up period)		$2 \cdot 10^{-8}$	$3 \cdot 10^{-7}$
Laser warm-up period	min	10…20	1
Maximum moving mirror translation rate	mm/s	800	800
Operating temperature range	°C	15…30	15…30
Interfaces		RS 232 C USB	RS 232 C USB
Laser safety class per DIN EN 60825-1		2M	2M
Length of cable interconnecting sensor head and signal processing unit	m	3, optionally up to 10	3, optionally up to 10
Electrical supply line voltage/frequency	VAC / Hz	100…240 / 47…60	100…240 / 47…60

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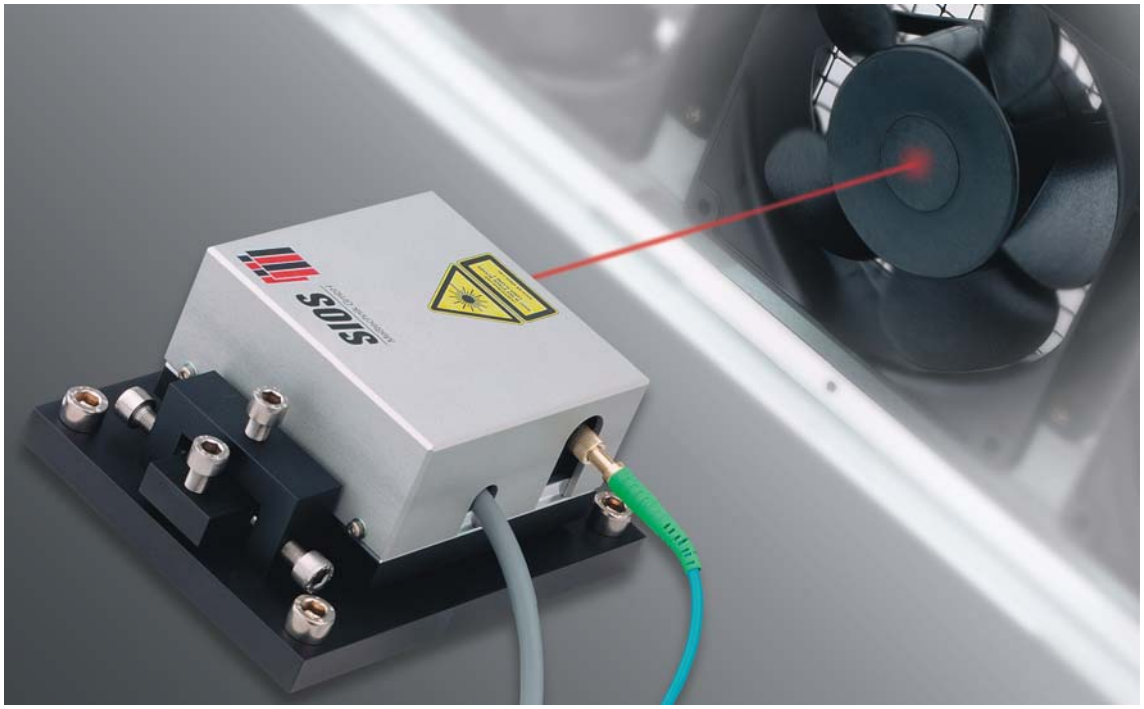
Your contact for further information:

Laserinterferometric Vibrometer



SP-S Series

SIOS Meßtechnik GmbH

Design and Operation

Our laserinterferometric vibrometers are ideal instruments for accurate, noncontact determinations of temporal changes in the positions of objects or surfaces and detect mechanical vibrations at frequencies ranging from 0 to 500 kHz.

These instruments have been designed based on the proven concept of our SP-Series miniature plane-mirror interferometers. The sensor heads of Series SP-S interferometers are equipped with additional optics that allow for making measurements on surfaces having arbitrary roughness.

The complete system consists of a modularly designed electronics unit incorporating a laser, a compactly designed sensor head, and various interfaces.

The fiberoptic-coupled interferometer converts motions along the optical axes into interference fringes that are transmitted to fast, high-resolution, demodulation electronics for processing. Operation and display of results employs a PC running specialized data-analysis software.

Technical Data

Working distance: (Permanently factory set per customer specification.)	30…70 mm, 240 mm
Laser-spot diameter: (Varies with distance)	12...30 µm, 100 µm
Measurement range: (Varies with the characteristics of the surface involved.)	≤ ± 20 mm
Resolution:	0.3 nm
Sampling frequency range:	1…1000 kHz
Frequency range:	0…500 kHz
Wavelength:	632.8 nm
Surface roughness:	arbitrary
Surface reflectivity:	≥ 5 x 10^{-4}
Translation rate:	1.5 m/s
Dimensions (H x W x D)	
• Sensor head:	36 x 72 x 72 mm
• Sensor head with alignment fixture:	54 x 115 x 90 mm
• Electronic signal-processing/ power-supply unit:	150 x 450 x 400 mm
Length of the cable interconnecting the sensor head and electronics unit :	3 m; optionally available in lengths ranging up to 10 m

Software for Windows

- Spectrum analysis
- Digital filtering
- Record lengths ranging from 256 to 32,768 data points
- Computation of the speeds and accelerations of vibrational motions
- Spectral averaging
- Triggering by external hardware

Features

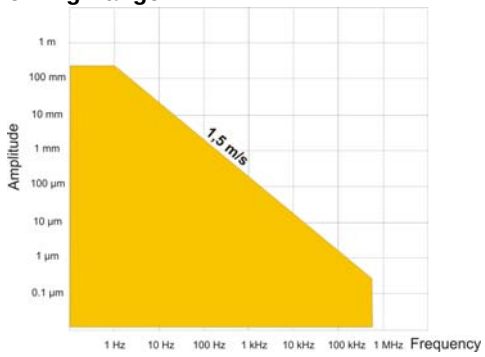
- A high precision vibration analysis and length measurement system
- Noncontact measurements
- Flexible installation
- Adaptable to suit customers' needs
- Fiberoptic coupling of the laser beam (eliminates thermal influences on measurement results)
- Corrects for ambient conditions
- Easy to align and use
- Lateral motions of objects being measured are not allowed if the objects involved have rough surfaces.
- Includes FFT spectrum-analysis software

Standard signal processor

Incremental signal-processing board equipped with vibrometer option:

- High speed signal processing board
- Cyclic data acquisition
- External triggering input
- Wavelength correction electronics
- RS-232 C serial interface
- USB interface

Working Range:



Optional signal processor

Analog data output:

- 8 length ranges
- 16-bit resolution for output amplitudes up to ± 3 V
- Cutoff frequency 150 kHz
- Continuous data output

Applications

- Making noncontacting vibration measurements on surfaces of arbitrary roughness
- Determining the vibrational modes of plates and shells
- Determining the resonant frequencies of microscopic objects
- Making multi-coordinate measurements employing several systems
- Performing high-precision length measurements

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Your contact for further information:

Laser Interferometric Gauging Probe

LM-Series

SIOS Meßtechnik GmbH

Design and Operation

Our LM-Series laser interferometric gauging probes are precision length measurement instruments; the first of their kind to make contact length measurements over ranges of 0 - 20 mm to 0 - 50 mm with nanometer precision.
Compactly designed gauging heads and 8h6-mm diameter probe shafts allow for their use with conventional length measurement systems.
The integral miniature interferometer converts displacements of the motor driven probe shaft into optical interference signals that are transmitted on a fiberoptic cable to an optoelectronic signal processing/power supply unit for processing and output as lengths.
A frequency stabilized HeNe Laser serves as the light source for the miniature interferometer. Compensation of environmental influences form the basis for high metric precisions and are achieved through the correction of laser wavelengths.
Instrument operation and display of measurement results are controlled either through a separate keypad/display unit or a PC running the software package supplied.

Major Performance Features

- Ultrahigh precision and accuracy achieved through the employment of a laser interferometric measurement technique
- Employs a frequency stabilized HeNe laser as a length standard
- Excellent linearity in the whole measurement coverage
- Force exerted by the gauging probe remains constant over the full dynamic range
- Employs a fiberoptic coupled gauging probe
- Employs signal acquisition/transmission hardware immune to electromagnetic interference
- Causes no thermal interference with other metrological equipment experimental setups
- Corrects for variations in laser wavelength caused by ambient conditions
- Motor-driven probe shafts
- Usable in any orientation

Applications

- Precision length measurements
- Final dimensional checks
- Calibrating gauge blocks/pins/plugs, rules, dial gauges, and other measuring devices
- Measuring thicknesses of, e.g., plastic films
- Measuring depths of indentations produced by hardness testers
- Contact surface profiling
- Measuring deformations
- Gauging tasks in research and development work at near-reference-standard precision

Technical Data		Model LM 20	Model LM 50
Measurement range	mm	20	50
Metric resolution	nm	1 (0.1)	1 (0.1)
Nominal laser wavelength	nm	632.8	632.8
Operating temperature range	°C	10 - 30	10 - 30
Probe-shaft diameter	mm	8h6	8h6
Force exerted by probe shaft (permanently factory preset)	N	0.5 - 1.5	0.5 - 1.5
Dimensions (H x W x D):			
Gauging head (less probe shaft)	mm	137 x 60 x 36	170 x 60 x 36
Gauging head (including probe shaft)	mm	170 x 60 x 36	220 x 60 x 36
Optoelectronic signal-processing/power-supply unit	mm	150 x 450 x 400	150 x 450 x 400
Keypad/display unit	mm	48 x 190 x 138	48 x 190 x 138
Mass:			
Gauging head	g	370	420
Optoelectronic signal-processing/power-supply unit	g	9,500	9,500
Keypad/display unit	g	630	630
Interface: serial		RS 232 C	RS 232 C
optionally		USB	USB
Fiberoptic cable length	m	3, optionally up to 25	3, optionally up to 25
Supply-line voltage	VAC	100 - 240	100 - 240
Supply-line frequency	Hz	47 - 60	47 - 60

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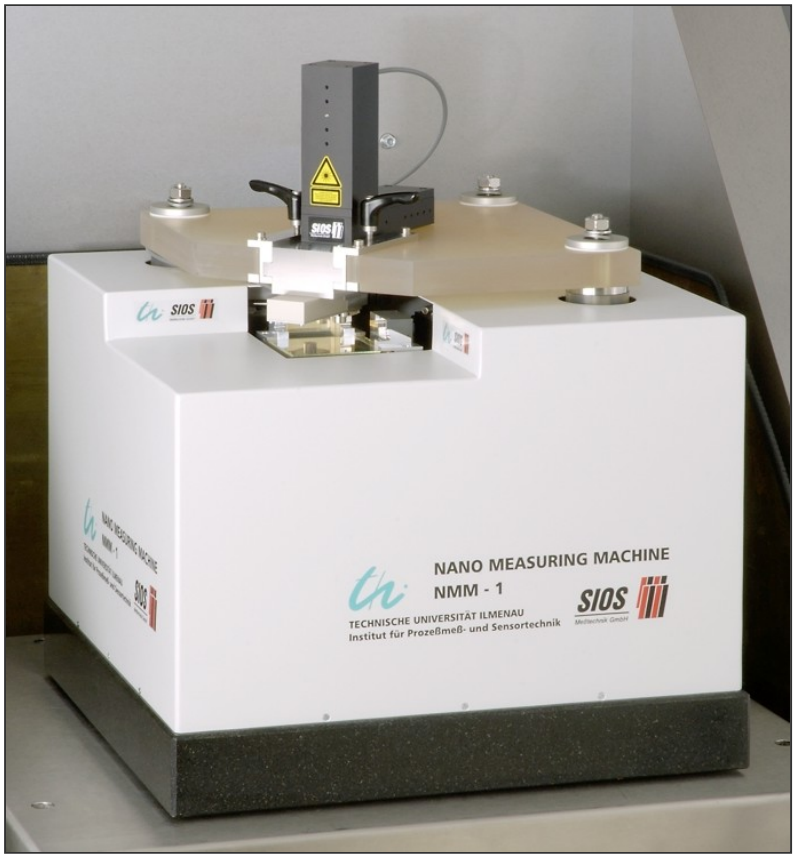
Nanopositioning and Nanomeasuring Machine



NMM-1

SIOS Meßtechnik GmbH

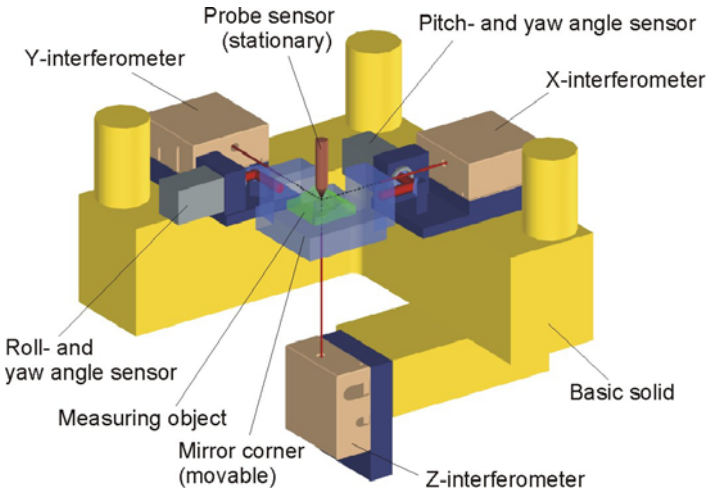
Design and Operation

The Nanopositioning and Nanomeasuring Machine is used for three-dimensional coordinate measurement in a range of 25 mm x 25 mm x 5 mm with a resolution of 0.1 nm. Its unique sensor arrangement provides Abbe error-free measurements on all three coordinate axes. The measurement axes of three miniature plane mirror interferometers for length measurements intersect with the contacting point of the probe sensor at the object being measured at a single point.

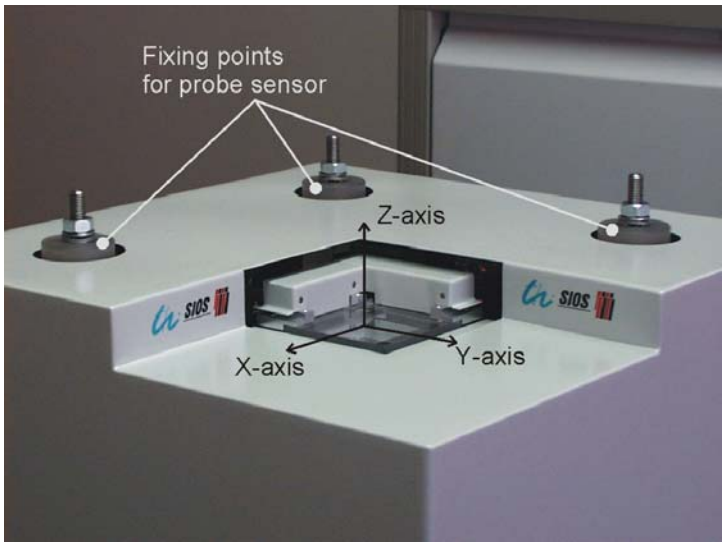
The object to be measured is placed directly on a movable mirror corner. The position of this mirror corner is monitored by the three fixed miniature interferometers. The mirror corner is positioned by a three axis driving system. Any angular deviations that may occur during the positioning process are measured and corrected by two angle sensors.

The light of three stabilized lasers are guided from the electronics unit to the interferometer heads by fiberoptic lightguides, providing a compact, thermally stable set-up of the Nanopositioning and Nanomeasuring Machine. The heart of its electronics unit is a digital signal processor (DSP) that processes all incoming signals, controls its drive system and governs the course of measurement procedures.

Basic set-up according to the comparator principle of Abbe



Measurement table of NMM-1 showing its measurement axes



Major Performance Features

- Three dimensional coordinate positioning and measuring system of the highest accuracy
- Abbe Comparator principle employed in each of the three measuring axes
- Modes of operation:
  1. as a dynamic positioning system
  2. as a measuring system operating in either continuous-scan mode or single-step mode
- Control of NMM-1 employs an easy to use script language running on the host PC equipped with a USB-interface
- An optional contact system acts as zero-indicator and is interchangeable.
- The probe sensors can be attached according to customer requirements, e.g. laser focus sensors LFS-series, scanning tunnelling and scanning atomic force microscopes, capacitive or inductive sensing systems.

Technical Data

Measuring and positioning range:	25 mm x 25 mm x 5 mm
Resolution:	0.1 nm

Driving speed, except in measurement mode:

• X,Y axis	≤ 2 mm/s
• Z axis	≤ 50 mm/s

Measuring speed depends on probe system and application

Probe sensors:	external analog interface for customized probe sensor system is provided (input-voltage max. ± 10 V, resolution 16 Bit)

Length of the cable between measuring table and electronics unit: approx. 4 m

Dimensions (H x W x D):

• NMM-1:	(340 x 420 x 420) mm
• Electronics unit:	(700 x 553 x 600) mm

Weight:

• NMM-1:	95 kg
• Electronics unit:	75 kg

Applications

- Positioning, manipulation, processing and measurement of objects in the fields of micromechanics, microelectronics, optics, molecular biology and microsystems engineering with nanometric precision within a large range
- Measurement of precision parts, such as the tips of hardness testing probes, membranes and micro lenses
- Calibration of step height standards and pitch standards

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Optical-Interference Testing Rig for Applanation Tonometers

PT-Series

SIOS Meßtechnik GmbH

Design and Operation

Our PT-Series optical interference testing rig for applanation tonometers consists of an automated laser based testing device equipped with a USB interface for coupling to a PC, plus signal-processing software running on standard PCs/notebook computers. Its flexibility of configuration allows its use with various types of tonometers. The buckling force set on the tonometer to be tested is automatically recorded over its full travel. Detecting the limits of the tonometer's travel allows outputting both its buckling force characteristic curve over its full travel and the buckling force at the midpoint of its travel, as stipulated by testing regulations.

The force sensor employed is an optical interferometric device with a measurement range of 100 mN and a resolution of 0.01 mN. To test a tonometer, the tonometer is driven up against this force sensor by an electromechanical drive, where the measured buckling force characteristic curve is employed internally for controlling the motions of the drive and detecting the limits of the tonometer's travel. The measured value of the buckling force at the midpoint of the travel is then compared with the prescribed tolerance range and displayed either in green, indicating that it falls within that range, or in red, indicating that it falls outside that range. A complete series of measurements, including printing the calibration certificate, takes less than five minutes, thanks to the fully automated test procedures of the rig. The facilities provided for calibrating its optical interference force sensor using standard weights allow tracing its calibration back to national reference standards.

Major Performance Features

- Allows making orientation independent force measurements by laser interferometric force sensor over the full measurement range while maintaining compliance with tolerated error limits.
- Provides automated test procedures complying with ISO 8612 testing regulations for applanation tonometers (determinations of both buckling forces at the midpoints of their travels and hysteresis).
- Diagram of tonometers' buckling-force characteristic curves over their full travels
- The first rig to allow the testing of tonometers over the full prescribed temperature range of 15°C to 30°C.
- Testing, including setup, takes only about 10 min.
- Printout of a calibration certificate
- Calibration using standard weights allows tracing its calibration back to national standards.
- The rig is portable, and thus may be used on-site e.g. at hospitals or ophthalmologists' offices.
- Certification by German calibration authorities has been granted.

Technical Data

Suitable for use with all types of applanation tonometers.

Measurement range:	0 ... 10 g	(100 mN)
Resolution:	1 mg 0.1 mg internally	(0.01 mN)
Standard calibration error of the force sensor employed:	< 0.5 mg	(0.005 mN)
Test duration:	≤ 5 min	
Laser Safety Class acc. DIN EN 60825-1	2M	
Dimensions (H x W x D)		
• Testing rig:	360 mm x 390 mm x 190 mm	
• Electronics module:	150 mm x 240 mm x 400 mm	

Applications

- Conducting metrological accuracy checks on applanation tonometers in accordance with § 11, section 3, MPBetreibV, both in the laboratory and on-site at remote locations.
- Testing tonometers for compliance with the EN ISO 8612 testing standard.
- Quality control testing during tonometer manufacture.

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