



*Intellium*TM Fizeau Accessories

Product guide for your Fizeau interferometer metrology

Rev 12212007.5



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This document lists some of the many accessories available from ESDI. For other products, pricing and availability, contact ESDI representative.

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Transmission Components

Transmission Flats (TF)

Transmission Flats (TF) are used to measure surface quality or transmitted wavefront of flat surfaces and optics. Clear apertures from 30 millimeters (1 inch) to 300 millimeters (12 inches) are available. Each component is mounted in a cell and is stored in a metal protection case. All TF mount directly into a variety of adjustable mounts.

Aperture	Surface Error	P/N
30 mm (1 inch)	$\lambda/20$	30-TF30-20.4
40 mm (1.5 inches)	$\lambda/20$	40-TF40-20.4
100 mm (4 inches)	$\lambda/20$	100-TF100-20.4
150 mm (6 inches)	$\lambda/20$	100-TF150-20.4
200 mm (8 inches)	$\lambda/20$	100-TF200
300 mm (12 inches)	$\lambda/20$	100-TF300



Transmission Flat

Transmission Spheres (TS)

Transmission Spheres (TS) are used to measure surface quality or transmitted wavefront of concave or convex surfaces and optics. The surface of a concave or convex spherical optic can be measured for surface figure and irregularity by placing its center of curvature in the confocal position, or coincident with the focus of the transmission sphere.

Clear apertures from 30 mm (1 inch) to 150 mm (6 inches) with various f/numbers are available. Each optic is mounted in a cell and is stored in a metal case for protection. The spheres mount directly into a variety of adjustable mounts.

Aperture	f/No.	Surface Error	P/N
30 mm (1 inch)	0.6	$\lambda/10$	30-TS/0.60
30 mm (1 inch)	0.7	$\lambda/10$	30-TS/0.70
30 mm (1 inch)	1.0	$\lambda/10$	30-TS/1
30 mm (1 inch)	2.0	$\lambda/10$	30-TS/2
30 mm (1 inch)	2.8	$\lambda/10$	30-TS/2.8
30 mm (1 inch)	5.6	$\lambda/10$	30-TS/5.6
30 mm (1 inch)	8.0	$\lambda/10$	30-TS/8
40 mm (1.5 inches)	0.75	$\lambda/10$	40-TS/0.75-10
40 mm (1.5 inches)	1.0	$\lambda/10$	40-TS/1-10
40 mm (1.5 inches)	2.0	$\lambda/10$	40-TS/2-10
40 mm (1.5 inches)	3.0	$\lambda/10$	40-TS/3-10
40 mm (1.5 inches)	4.0	$\lambda/10$	40-TS/4-10
40 mm (1.5 inches)	6.0	$\lambda/10$	40-TS/6-10
100 mm (4 inches)	0.75	$\lambda/10$	100-TS/0.75-10
100 mm (4 inches)	1.5	$\lambda/10$	100-TS/1.5-10
100 mm (4 inches)	3.3	$\lambda/10$	100-TS/3.3-10
100 mm (4 inches)	7.0	$\lambda/10$	100-TS/7-10
100 mm (4 inches)	11.0	$\lambda/10$	100-TS/11-10



Transmission Spheres

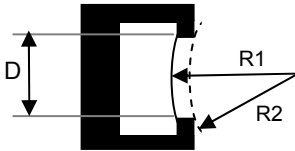
Call for 150 mm (6 inches) transmission spheres

Transmission Spheres (TS)

Transmission Spheres (TS) with diameter 100 millimeters (4 inches) from f/0.75 to f/11 are available for measuring both convex and concave spherical surfaces.

Virtually any Concave spherical surface can be measured by matching the f/number of the test sphere with a TS.

Measuring convex spherical surfaces are limited by the diameter of the TS. See the following table. D is the diameter of the housing opening. R1 is the radius of the transmission sphere. R2 is the maximum measurable radius for convex surfaces with a diameter larger than D.



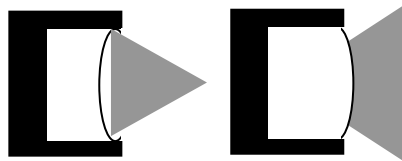
Input Aperture	Output f/No.	R ₁ (mm)	D (mm)	R ₂ (mm)
100 mm (4 inches)	0.75	48.24	65.5	46
100 mm (4 inches)	1.5	121.21	84.1	115
100 mm (4 inches)	3.3	298.03	89.2	281
100 mm (4 inches)	7.0	681.70	98.1	674
100 mm (4 inches)	11.0	1039.20	100.	1029

The part numbers of these transmission spheres are listed on page 1.

Transmission Convergents and Divergers

A converging transmission sphere has a concave wavefront. It's used to measure a variety of midrange convex spherical surfaces. A Converger has a real focus and thus the test surface must have a radius less than or equal to the Converger's radius.

A diverging transmission sphere has a convex wavefront. Because it has a virtual focus it is used for measuring a variety of midrange concave spherical surfaces. For proper measurement, the center of curvature should be coincident with focus, thus the test surface radius must be equal to or larger than the Diverger's radius.



Available upon request.

Reference Components

Reference Flats (RF)

Reference Flats (RF) are used in combination with transmission flats for measuring flat optic transmitted wavefront. Clear apertures from 30 millimeters (1 inch) to 300 mm (12 inches), with varying reflectivity are available. Each optic is mounted in a cell and is stored in a protective metal case. All RF insert directly into a variety of adjustable mounts.

Aperture	Reflectivity	Surface Error	P/N
30 mm (1 inch)	4%	$\lambda/20$	30-TF
40 mm (1.5 inches)	4%	$\lambda/20$	40-TF40
40 mm (1.5 inches)	4% backside not polished	$\lambda/20$	40-RF40
40 mm (1.5 inches)	90%	$\lambda/20$	40-RRF40
75 mm (3 inches)	4% backside not polished	$\lambda/20$	100-RF75
100 mm (4 inches)	4%	$\lambda/20$	100-TF100
100 mm (4 inches)	4% backside not polished	$\lambda/20$	100-RF100
100 mm (4 inches)	90%	$\lambda/20$	100-RRF100
150 mm (6 inches)	4%	$\lambda/20$	100-TF150
150 mm (6 inches)	90%	$\lambda/20$	100-RRF150
200 mm (8 inches)	4%	$\lambda/20$	100-TF200
300 mm (12 inches)	4%	$\lambda/20$	100-TF300



Reference Flats

Note that the 4% reflectivity 30 mm (1 inch), 40 mm (1.5 inches), 100 mm (4 inches), 150 mm (6 inches), 200 mm (8 inches), and 300 mm (12 inches) Reference Flats are Transmission Flats.

Reference Spheres (RS)

Reference Spheres (RS) are used in combination with transmission spheres for measuring spherical transmitted wavefront. They are available in a variety of aperture sizes.

Each optic is mounted in a cell and is stored in a protective metal case. The spheres insert into a variety of adjustable mounts.

Aperture	R/No	Reflectivity	Surface Error	P/N
40 mm	F/0.65	4%	$\lambda/15$	40-RS/0.65-15

Other sizes available upon request.

Mounts

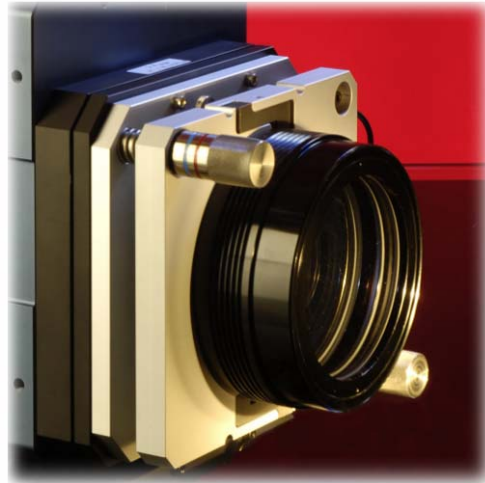
Mounts are used with various accessories and test setups. In most cases, the centerline height is consistent with other accessories, eliminating the need for additional adjustments.

Tip/Tilt Receptacles

The Tip/Tilt Receptacle provides two axis adjustments for transmission elements attached to the front of the interferometer or PMR. There are two sizes to fit either 40 mm (1.5 inches) or 100 mm (4 inches) diameter optical components.



Tip/Tilt Receptacle, 40 mm (1.5 inches)
with PMR & Transmission Flat



Tip/Tilt Receptacle 100 mm (4 inches)
with PMR & Transmission Flat

Aperture	P/N
40 mm (1.5 in)	40-TT40
100 mm (4 in)	100-TT100

Tip/Tilt Stage, 2 Axis

The 2-Axis Vertical Tip/Tilt Stage provides tip/tilt adjustment for vertically mounted interferometer configurations.

Diameter	P/N
100 mm (4 in)	TTV100

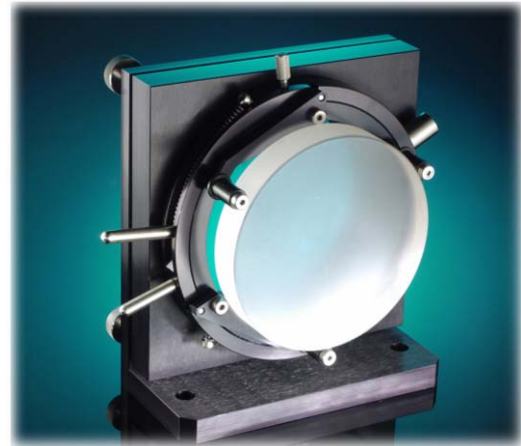


2-Axis Tip/Tilt Stage

Adjustable Mount, 2-Axis

These mounts provide two axis adjustments for test or reference optics when measuring transmitted wavefront. The mount accepts self centering holders and universal element holders. The mount provides $\pm 4^\circ$ adjustment in tip/tilt. It can hold optics up to 108 mm (4.25 inches) diameter.

Diameter	P/N
108 mm (4.25 in)	100-LH2



Adjustable Self Centering Mount, 2-Axis, 4 inches with test sample

High Accuracy Mount, 100 mm (4 inches)

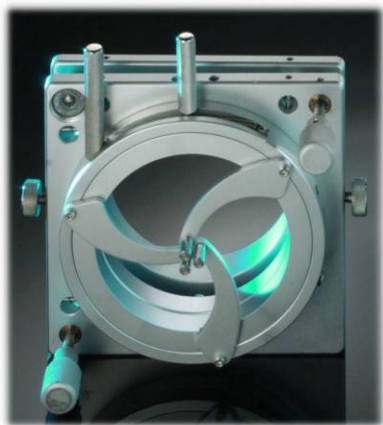
Our High Accuracy Mount has x&y tilt, x, y, z translation, rotation, and angle adjustments, with 50 mm translation travel.

Mount	P/N
7-Axis Stage	100-LH7

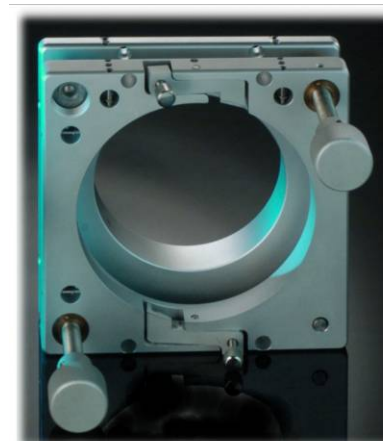
The mount comes with the Self Centering Component Holder and Bayonet Component Holder (below). Self Centering Component Holder provides flexible mounting of round parts with varying diameters and the Bayonet Component Holder provides easy attachment of standard bayonet mounted optics such as reference optics. Both the Self Centering Component Holder and Bayonet Component Holder are mountable into the 7-Axis Stage.



Horizontal, 7-Axis Stage with Bayonet Mount and Transmission Sphere



Self Centering Component Holder, 100 mm (4 inches)



Bayonet Component Holder, 100 mm (4 inches)

More Accessories

Phase Modulating Receptacles (PMR)

PMR's are used for mechanically phase-shifting a transmission optic for high accuracy wavefront measurements. They are available in 40 mm (1.5 inches), 100 mm (4 inches), and 300 mm (12 inches) apertures sizes. The PMR either connects to the front of the interferometer or to standalone adjustable stages.

Aperture Size	P/N
40 mm (1.5 inches)	40-PMR
100 mm (4 inches)	100-PMR
300 mm (12 inches)	300-PMR



PMR for 40 mm (1.5 inches) and 100 mm (4 inches)

Attenuation Filters and Screens

Good fringe contrast requires the test and reference beams have similar intensities. Uncoated Reference optics typically have 4% reflectivity. This allows test surfaces with 0.1% to 40% reflectivity to be measured with acceptable fringes.

Attenuation filters are required for measuring test surfaces with reflectivity greater than 40% in order to achieve good fringe contrast.

Our Attenuation Filters come with a protective housing. They can be mounted directly on a transmission component. These filters have transmitted wavefront distortion less than $\lambda/10$.



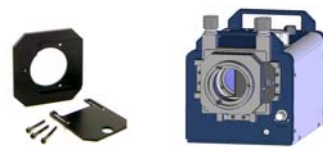
Attenuation Filter for 30 mm (1 inch) aperture

Aperture Size	Type	P/N
30 mm (1 inch)	Filter	30-AF30
40 mm (1.5 inches)	Filter	40-AF40
100 mm (4 inches)	Filter	100-AF100

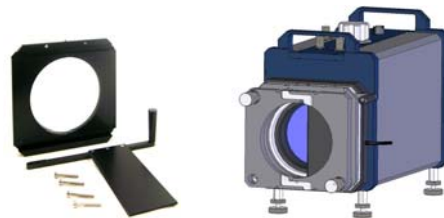
The Corner Cube Beam Block

The Corner Cube Beam Block accessory seamlessly interfaces with ESDI's the **Intellium™ Z40** and **Intellium™ Z100** interferometers for easy measurement of corner cubes in single pass mode. Simply slide the corner cube block in place for single pass angle error measurements, or slide it out for double pass measurements. **IntelliWave™** can measure a variety of important corner cube parameters including angle deviation, angle error, tilt, PV, and RMS.

Interferometer Size	P/N
Intellium™ Z40	40-CCB
Intellium™ H2000 & Z100	100-CCB



40mm – Corner Cube Beam Block



100mm – Corner Cube Beam Block

Mirror Adapter

Mirror adapter plate that attaches a 150 mm (6 inches) mirror to a 100 mm (4 inches) interferometer.

Adapter Size	P/N
100 mm (4 inches) interferometer to 150 mm (6 inches) mirror	100-MA150



Mirror adapter plate

Vibration Isolation Table

Vibration Isolation Tables isolate interferometer optical systems from external vibration and are required for high performance of standard phase-shifting interferometers. Either English or metric threaded table top configurations are available.

Call for sizes.



Vibration Isolation Table

Adjustable Interferometer Legs

Accessory kits for securing the *Intellium™* Fizeau interferometers at variable heights on a table are available. The kits include four adjustable feet, M6 or ¼-20 mounting screws, and specialized brackets.

Interferometer Size	P/N
Compatible with all <i>Intellium™</i> Fizeau Interferometers except <i>Intellium™ Z30</i>	LEGS

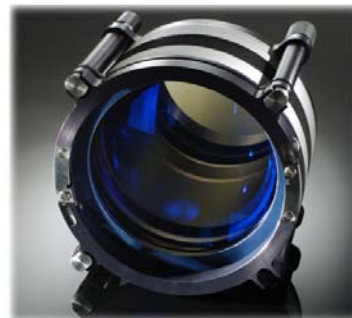


Four Adjustable Legs

Aperture Converters

Our aperture converters reduce or expand the interferometer beam to different sizes, while maintaining collimation. These converters mount directly to the front of the interferometer.

Size	P/N
100 mm (4 inches) to 150 mm (6 inches)	BE-150



Aperture Converter
100 mm (4 inches) to 150 mm (6 inches)

Vertical Workstation Kits

Our Vertical Workstation Kits are used for mounting the interferometer in a vertical orientation. The kit includes: three rods or back plane, base plate, mounting arms, and a 2 or 5-axis stage. The 5-Axis Stage, used for measuring spheres, has x, y, tip, tilt, and z axis adjustments, while the 2-axis stage is for testing flats.



Interferometer Vertical Workstation Kit for 30 mm (1.5 inches) flats or spheres.



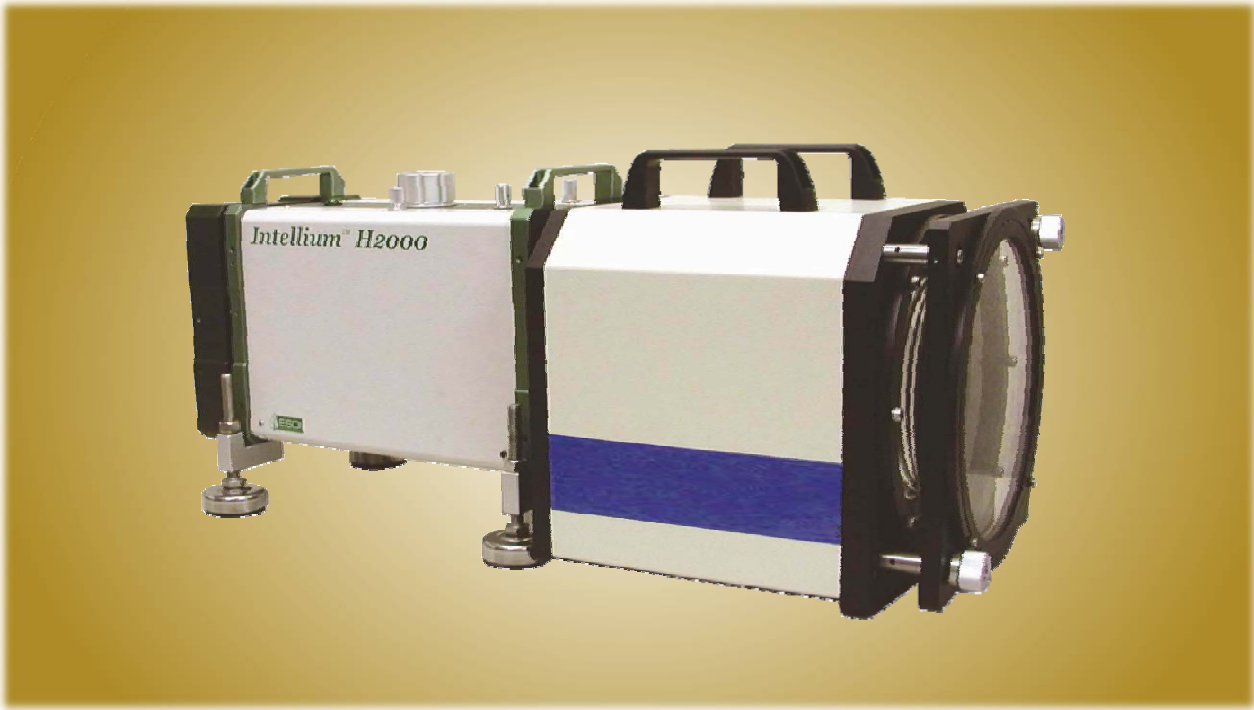
Interferometer Vertical Workstation Kit for 40 mm (1.5 inches) Aperture flats or spheres.



Interferometer Vertical Workstation Kit for 100 mm (4 inches) Aperture Flats.

Aperture	Stage Length	P/N
30 mm (1 inch)	457 mm (18 in)	30-WVS
40 mm (1.5 inches)	760 mm (30 in)	40-WVS
100 mm (4 inches)	660 mm (26 in)	100-WV

Large Aperture Systems



Typical Large Aperture System, shown with **Intellium™ H2000**, 200 mm Beam Expander, Tip/Tilt Mount, and Transmission Flat.

Beam Expanders

Beam Expanders expand the output beam of a 100 mm (4 inches) interferometer for use in large aperture systems. In some configurations, the mounting hardware for the transmission optic is part of the beam expander. The 200 mm (8 inches) beam expander has an attached tip/tilt stage. The 300 mm (12 inches) beam expander has a stand alone 2-Axis Adjustable Mount. Both versions of the beam expanders are available with a PMR (Phase Modulating Receptacle) for mechanical phase measurements. Beam expanders without a PMR can be integrated with a simultaneous phase-shifting interferometer, spatial carrier software **IntelliPhase™**, or used for simple fringe metrology. All expanders are compatible with **Intellium™** Fizeau interferometers using **IntelliPhase™ (IntelliWave™)** software.



300 mm Beam Expander shown

Size	Description	P/N
200 mm (8 inches)	w/o PMR	BE-200
200 mm (8 inches)	with PMR	BE-200-P
300 mm (12 inches)	w/o PMR	BE-300
300 mm (12 inches)	with PMR	BE-300-P

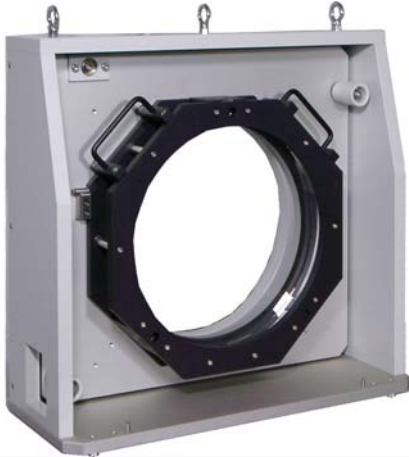
Adjustable Mount, Large Aperture

All 300 mm Beam Expanders come with 2-Axis Adjustable Mount providing $\pm 2^\circ$ adjustment in tip/tilt. The mounts are available in 200 mm (8 inches), and 300 mm (12 inches) sizes. This mount is also available individually.

Size	P/N
300 mm (12 inches) aperture	300-LH2



300 mm 2-Axis Adjustable Mount shown



300 mm 2-Axis Adjustable Mount with 300 mm Transmission Flat shown



300 mm 2-Axis Adjustable Mount with Phase Modulating Receptacle shown

This page does not cover all large aperture components. Contact your ESDI representative for more information on large aperture systems.

NIR Large Aperture Systems



Large Aperture System for 1300 nm, shown with **Intellium™ Z100NIR**, 300 mm Beam Expander, Transmission Flat, and PMR. Both the Transmission Flat & PMR are attached to 2-Axis Adjustable Mounts.

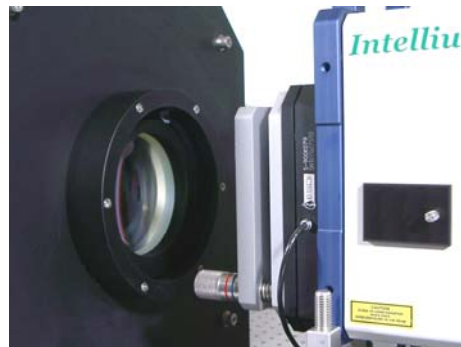
NIR Beam Expanders

The 300 mm (12 inches) beam expanders are available for 1064 nm or 1300 nm wavelengths and can utilize a PMR (Phase Modulating Receptacle) for mechanical phase measurements. Beam expanders without PMR can be integrated with a simultaneous phase-shifting interferometer, or spatial carrier software **IntelliPhase™**, or used for simple fringe metrology. All expanders are compatible with **Intellium™** Fizeau interferometers using **IntelliPhase™ (IntelliWave™)** software.

Adjustable Mounts, Large Aperture

All Beam Expanders come with 2-Axis Adjustable Mount.

Size	Wavelength	Description	P/N
300 mm (12 inches)	1064 nm	w/o PMR	BE-300-1064
300 mm (12 inches)	1300 nm	w/o PMR	BE-300-1300



Phase Modulating Receptacle (PMR) shown is attached to the interferometer. Other option is to attach the PMR to the 2-Axis Adjustable Mount.

Radius of Curvature Options

Short Radius Kit (vertical)

These kits are for measuring radii with interferometers in a vertical orientation. They are for 30 mm (1.5 inches) and 40 mm (2 inches) **Intellium™** Fizeau interferometers. The Kits include: a digital scale/ meter and RS232 communication hardware. The scale readout has 1 μ m resolution. Associated transmission spheres are sold separately.

Interferometer Size	Stage Length	P/N
30 mm (1 inch)	457 mm (18 in)	30-WVS-RC
40 mm (1.5 inches)	760 mm (30 in)	40-WVS-RC

NOTE: About Resolution and Accuracy

Accuracy depends on many factors, including guide bar straightness, table flatness, scale alignment to the interferometer, and environmental conditions.



Short Radius Kit for 40 mm (1.5 inches) aperture

Long Radius Kit (horizontal)

These kits are for measuring radii with interferometers in a horizontal orientation. They are for 100 mm (4 inches) **Intellium™** Fizeau interferometers. The Kits include: a digital scale/ meter, rail, and RS232 communication hardware. The scale readout has 1 μ m resolution. Associated transmission spheres are sold separately.

Interferometer Size	Rail Length	P/N
100 mm (4 inches)	1.2 meter	100-WH
100 mm (4 inches)	other	call



Digital Radius Scale, 1.2-meter Rail and 7-Axis Stage

Sphere Calibration

CaliBall™

CaliBall™ assures the quality of your reference optics by identifying aberrated errors. Once any errors are identified, they can be subtracted from test measurements. **CaliBall™** is a low-cost solution in maintaining the quality of your measurements. Since it has a bayonet style attachment, it is easy to setup with almost any interferometers.

The **CaliBall™** is positioned in x, y and z with its center at the focus of the transmission sphere so light is reflected back into the interferometer by the convex ball surface. A wavefront is taken and stored. The **CaliBall™** is lifted out of its kinematics mount, rotated to an arbitrary new position and replaced. Another wavefront is taken and averaged with the first. The process is repeated several times. The average is an estimate of the residual error in the transmission sphere because the errors in the **CaliBall™** average to zero in the limit of a large number of tests. The calibration can be done in as little as 10 minutes.



CaliBall™

Item	P/N
CaliBall™	CAL1
CaliBall™ with Bayonet Mount	CAL1-M



CaliBall™ with Bayonet Mount

The Photographs are representative only. Specifications and part numbers are subject to change without prior notice.

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