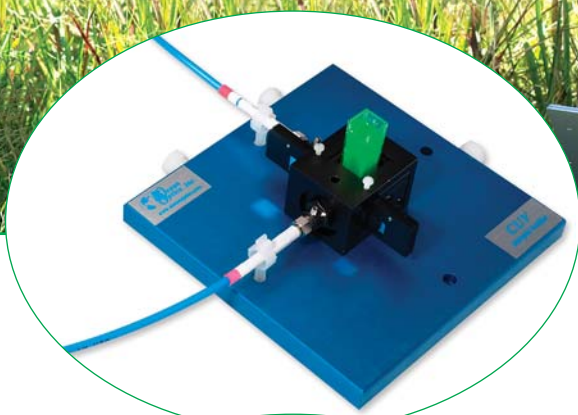


Sampling Accessories



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Overview: Sampling Accessories

Sampling Accessories for Every Application

Ocean Optics provides modular components that can be configured easily for absorbance, transmission, reflectance, fluorescence, emission or scattering experiments. Often the sampling accessory is where light or excitation energy is collected from the light source, interacts with the sample, and sends the absorbed/transmitted, reflected or emitted light to the spectrometer. Sampling accessories also include the fixtures, such as collimating lenses, that provide specific sampling geometries. Accessories and fibers can be combined in an almost endless variety of configurations.



What's Your Field of View?

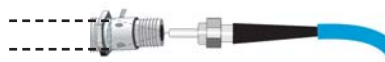
Four of our devices are used to control field of view (FOV) and aperture:

- Optical Fiber (25° FOV, aperture = fiber diameter)
- Collimating Lens (0° - 45° FOV, aperture = 3 mm)
- Cosine Corrector (180° FOV, aperture = 3.9 mm)
- Integrating Sphere (360° FOV, aperture = 25 mm)

Optical Fiber: 25°



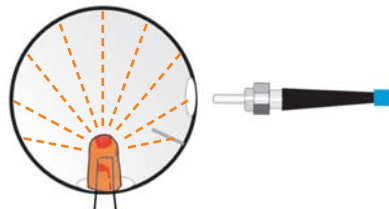
Adjustable Collimating Lens: ~0-45°



Cosine Corrector: ~180°



Integrating Sphere: 360°



Partner Spotlight: Mikropack



We've known the folks at Mikropack GmbH ever since the German supplier of thin film and spectroscopy products became a distributor of our products nearly a decade ago. Today, Ocean Optics is the exclusive worldwide distributor of Mikropack spectroscopy products, and remains a supplier of OEM spectroscopy components used in Mikropack's thin film and ellipsometry measurement systems.

By adding nearly 200 of Mikropack's spectrometer sampling accessories, light sources and more to our product line, we're able to offer our customers the most comprehensive line of miniature fiber optic spectroscopy products in the industry. Mikropack benefits from another sales outlet for its products, the integration of our spectrometers into its thin film measurement products, and the resale of our products in Germany, Austria and Switzerland.

TECH NOTE

The divergence (α) of a beam focused using a single lens is: $\tan(\alpha) = d/f$ where f is the focal length of the lens and d is the aperture or fiber diameter.



Sampling Accessories by Measurement Type

Our fiber optic sampling accessories create the optical interface part of our modular spectrometer systems. With so many sampling accessories from which to choose, you can meet the demands of a variety of experiments for absorbance, transmission, fluorescence, reflectance and emission.

Absorbance/Transmission



1-cm Cuvette Holder, p. 90



10-cm Cuvette Holder, p. 90



Longpass Flow Cells, p. 98



Cuvettes, p. 93

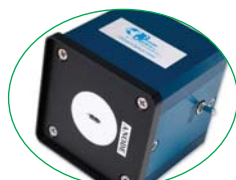


Integrated Sampling Systems, p. 92

Emission



Cosine Correctors, p. 107



LED Power Supply, p. 107



Integrating Spheres, p. 108

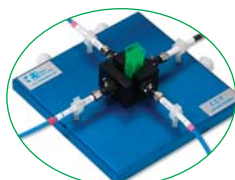


Collimating Lenses, p. 88



Direct-attach Integrating Sphere, p. 108

Fluorescence



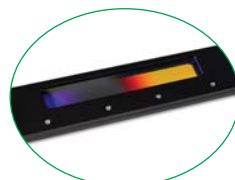
4-way Cuvette Holder, p. 90



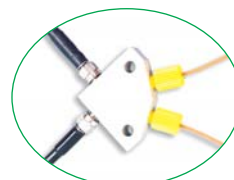
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EviDots and EviTags, p. 106



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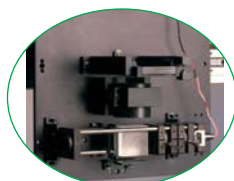
Reflectance



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Integrating Spheres, p. 109



Long Trace Profilometer, p. 116



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Reflection Sampling System, p. 114

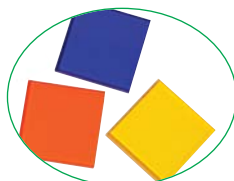
Modifying Light



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Multiplexer, p. 104



Collimating Lenses

74-series Lens Fixtures



The 74-series Collimating Lenses are the common fiber optic-coupled lens fixture used throughout our extensive line of sampling accessories. The 74-series Lenses have an inner barrel threaded for SMA 905 Connectors. (FC barrels are available for \$29; see page 156 for more.) The inner barrel slides relative to the lens fixture for adjusting the focus; a setscrew secures the barrel. Adjustment from a converging to diverging field of view (~45°) is possible.

74-UV Collimating Lens (200-2000 nm)

The 74-UV has an f/2 fused silica lens for 200-2000 nm. When focused for collimation, beam divergence is 2° or less, depending on fiber diameter. The 74-UV can be adjusted for UV-VIS or VIS-NIR setups.

74-VIS Collimating Lens (350-2000 nm)

The 74-VIS -- the basic lens fixture in an LS-1 Light Source -- has a BK-7 lens suitable for the VIS-NIR. These single-lens systems have the disadvantage of chromatic aberration, due to dispersion or variation in refractive index with wavelength.

74-ACR Collimating Lens (350-2000 nm)

The 74-ACR has two optical elements cemented together to form an achromatic doublet, optimized to correct for the spherical and chromatic aberrations inherent to single-lens systems.

74-DA Collimating Lens (200-2000 nm)

The 74-DA screw-in lens attaches directly to spectrometers for increased light throughput.

84-series Lens Fixture

The 84-series Collimating Lens is designed for coupling larger free-space beams to fibers. The fiber is coupled to the assembly with an inner 17.85-mm threaded barrel. The barrel positions the fiber ~100 mm from the lens surface and is adjusted to achieve a fine focus. The lens of the 84-UV-25 is especially suitable for collimating light at long distances in open air (it's been tested to distances of up to 40 feet). The 84-UV-25 has an 8-32 tapped hole for attaching to an optical post mount and then installing the mount in an optical breadboard or other fixture (far right).



Item	Diameter	Focal Length	Material	Wavelength	Operating Temp.	Connector	Price
74-UV	5 mm	10 mm	f/2 fused silica Dynasil	200-2000 nm	70 °C	SMA 905, 6.35-mm ferrule, 3/8-24 external thread	\$159
74-VIS	5 mm	10 mm	f/2 BK-7 glass	350-2000 nm	70 °C	SMA 905, 6.35-mm ferrule, 3/8-24 external thread	\$159
74-DA	5 mm	10 mm	f/2 fused silica Dynasil	200-2000 nm	70 °C	SMA 905, 1/4-36 internal thread, 3/8-24 external thread	\$159
74-ACR	5 mm	10 mm	BaF10 and FD10	350-2000 nm	70 °C	SMA 905, 6.35-mm ferrule, 3/8-24 external thread	\$199
74-UV-HT	5 mm	10 mm	High-temperature version of 74-UV	200-2000 nm	150 °C	SMA 905, 6.35-mm ferrule, 3/8-24 external thread	\$159
84-UV-25	25.4 mm	100 mm	f/2 fused silica Dynasil	200-2000 nm	70 °C	SMA 905, 6.35-mm ferrule, 3/8-24 external thread	\$499



Collimating Lens Accessories



Right-angle Collimating Lens Holder

The 74-90-UV is an assembly for mounting lenses at right angles, and is especially useful for applications involving awkward optical fiber routing. It has a mirror located under its cap that reflects light from the collimating lens to 90°. Two ports accommodate 74-series Collimating Lenses (not included). An included nipple allows you to mount the 74-90-UV in male or female ports.

74-90-UV: \$139



A Collimating Lens, above, is not included with the 74-90-UV.

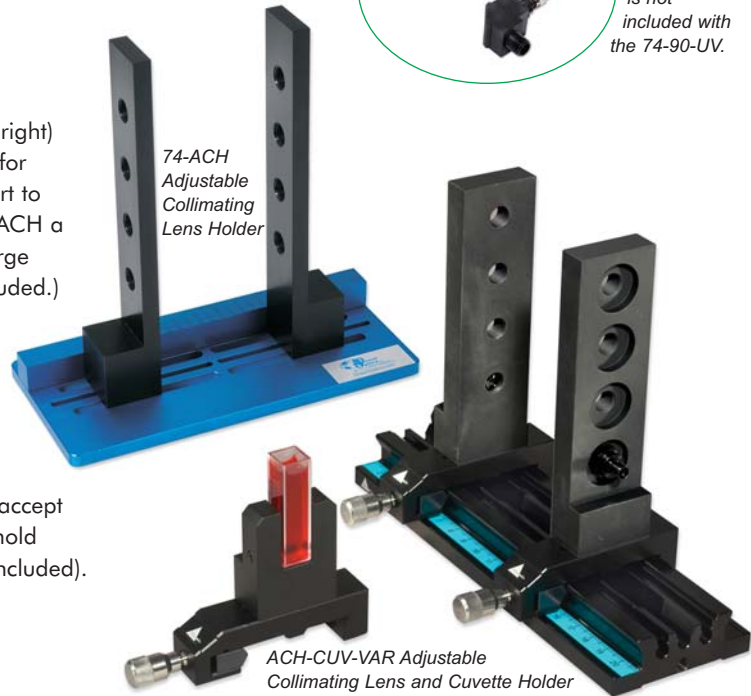
Adjustable Collimating Lens Holders

The 74-ACH Adjustable Collimating Lens Holder (near right) consists of adjustable bars with several threaded holes for collimating lenses. The bars can be set far enough apart to accept samples up to ~100 mm thick, making the 74-ACH a convenient option for transmission measurements of large samples. (Collimating lenses and optical fibers not included.)

The ACH-CUV-VAR Adjustable Collimating Lens and Cuvette Holder (see inset) is two products in one: a fixture for positioning collimating lenses at various heights or for holding extra-large or especially thick samples, and a holder for accepting cuvettes for transmission measurements. Its adjustable mount bars accept samples up to ~150 mm thick and its threaded holes hold collimating lenses (two 74-UV Collimating Lenses are included).

74-ACH: \$299

ACH-CUV-VAR: \$1,323



74-ACH Adjustable Collimating Lens Holder

ACH-CUV-VAR Adjustable Collimating Lens and Cuvette Holder

Optical Post-mount Assembly

Also available is the OPM-M, which is a post-mount assembly for optical tables with metric M6 grids. The OPM-M has a lens holder (for a 74-UV Collimating Lens), an M4 metric optical post and an M6 metric post holder.

OPM-M: \$180

Optical Post Mount & Optical Posts

The OPM-SMA is a fixture for mounting 74-series Collimating Lenses and SMA 905-terminated optical fibers. The OPM-SMA consists of a 1.5" OD disk with 3/8-24 threads to accommodate the lenses. You can use the OPM-SMA with SMA 905-terminated optical fibers. The OPM-SMA includes 8-32 (Imperial) and M6 (metric) threads for attaching to an optical post.

We offer four optical posts (in 25.4-mm, 50.8-mm, 76.2-mm and 101.6-mm heights) to attach to the OPM-SMA. These posts screw into optical breadboards via a 1/4-20 tapped hole in the bottom of each post.

OPM-SMA: \$149

OPM-1, -2, -3, -4: \$15 each



OPM-M Optical Post Mount Assembly

OPM-1, OPM-2 and OPM-4 Optical Posts

OPM-SMA Optical Post Mount

Specifications

	74-90-UV	74-ACH	ACH-CUV-VAR	OPM-SMA	OPM-M
Dimensions (in mm):	16.5 x 16.5 x 19.9	152.4 x 76.2 x 152.4	200 x 67 x 157	38.1 OD x 10.2 width	30 mm OD x 6.5 width
Weight:	11.3 g	890.2 g	1,000 g	130 g (including post)	220 g (including post)
Threads:	3/8-24 (ports)	3/8-24 (mounting bars)	3/8-24 (mounting bars)	3/8-24 (lens holder)	3/8-24 (lens holder)
	9.525 x 25.4 mm (nipple)	10-32 (setscrews for base)	M6 (setscrews for base)	8-32 (bore for mounting)	M4 (bore for mounting)
Material:	Black anodized Al	Blue anodized Al (base) Black anodized Al (bars)	Black anodized Al (base) Black anodized Al (bars)	Black anodized Al (mount) Stainless steel (post)	Black anodized Al (mount) Stainless steel (post)
Collimating lens included:	No	No	(2) 74-UV Lenses	No	No





Cuvette Holders



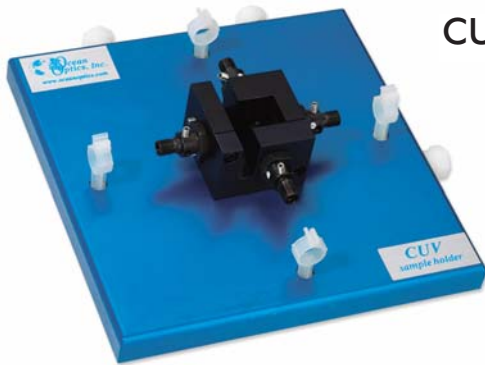
CUV-UV Cuvette Holder

The CUV-UV (200-2000 nm) couples to lamps and spectrometers to create absorbance or transmission measurement systems. Two 74-UV lenses are mounted across a cell holder for square 1-cm cuvettes. The base includes channels for connection to a water bath for temperature regulation. The unit also accepts filters. An optional cover (CUV-COVER) excludes ambient light.
CUV-UV: \$399



CUV-UV-10 Cuvette Holder

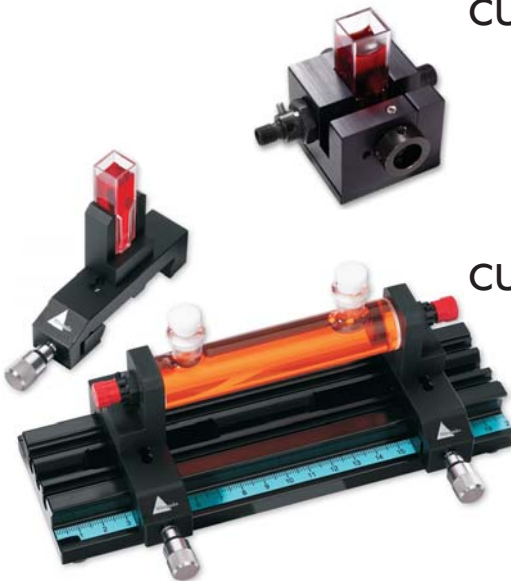
The CUV-UV-10 (200-2000 nm) accepts 10-cm cylindrical or flat-bottomed cuvettes. The CUV-UV-10 has two 74-UV Collimating Lenses that couple to light sources and spectrometers via optical fiber to make absolute absorbance systems for solutions and gases. Included is a shutter, a clamp for filters, water channels for temperature regulation, and a cover to exclude ambient light.
CUV-UV-10: \$549



CUV-ALL-UV 4-way Cuvette Holder

The CUV-ALL-UV provides ports for 1-cm cuvettes from four directions. Position two collimators at 180° for absolute absorbance and transmission measurements, position two collimators at 90° for fluorescence or scattering, or use all four for simultaneous absorbance and fluorescence measurements. For fluorescence applications, increase the signal by replacing collimators with 74-MSP Mirror Plugs (see inset), which redirect energy back to the sample or back into a collimating lens.

CUV-ALL-UV: \$809
74-MSP: \$99



CUV-FL-DA Direct-attach Cuvette Holder

The CUV-FL-DA attaches to our light sources and couples via fibers to our spectrometers, creating systems for fluorescence and relative absorbance. The holder has a collimating lens and two mirrored screw plugs (74-MSP), which can be positioned per your application. A 6.35-mm slot is included for filters.
CUV-FL-DA: \$399

CUV-VAR Variable Pathlength Cuvette Holder

The CUV-VAR has three functions: use its cuvette holder insert to create a 1-10 cm pathlength cuvette holder, create a 2-mm pathlength filter holder, or position its two 74-UV collimators to accept a flow cell. The included collimators are screwed into fixtures that slide along the base and can be set to create pathlengths up to 10 cm. Also available is a flow-cell adapter option (CUV-VAR-OPTION) for the CUV-VAR.

CUV-VAR: \$1,186
CUV-VAR-OPTION: \$363

Specifications

	CUV-UV	CUV-UV-10	CUV-ALL-UV	CUV-FL-DA	CUV-VAR
Dimensions:	58 mm x 140 mm x 38 mm	97 mm x 248 mm x 50 mm	147 mm x 147 mm x 40 mm	57 mm x 61 mm x 29 mm	200 mm x 67 mm x 70 mm
Weight:	230 g	1,040 g	540 g	80 g	726 g
Pathlength:	1 cm	10 cm	1 cm	1 cm	1 cm up to 10 cm
Filter slot:	Up to 6 mm, screw clamp	Up to 6 mm, wheel clamp	Up to 6 mm, screw clamp	Up to 6 mm, screw clamp	none
Water input fittings:	3.175-mm (1/8") NPT	3.175-mm (1/8") NPT	3.175-mm (1/8") NPT	none	none
Collimating lenses:	2 each 74-UV	2 each 74-UV	4 each 74-UV	2 each 74-UV	2 each 74-UV
Fiber termination:	SMA 905	SMA 905	SMA 905	SMA 905	SMA 905
"Z" dimension:	15 mm	15 mm	15 mm	15 mm	15 mm



Temperature-regulated Cuvette Holder

Precise Temperature Control

The CUV-TLC-50F Temperature-regulated Cuvette Holder is a high-quality, versatile sample chamber with a Peltier temperature controller calibrated against a NIST-traceable thermometer. The device controls the temperature of the holder from -55 °C to +105 °C and maintains a constant temperature to within ± 0.02 °C. The CUV-TLC-50F includes the cuvette holder and the external temperature controller box. To run the thermoelectric cooler efficiently, we offer a simple water pump and a water container.

Absorbance or Fluorescence

The CUV-TLC-50F (200-2000 nm) provides ports for viewing or illuminating 1-cm square cuvettes from four directions. Lenses are purchased separately to allow you to choose the best lenses for your application. For absorbance and transmission measurements, position two CUV-TLC-CL Collimating Lenses at 180°. For fluorescence applications, position two CUV-TLC-IL Imaging Lenses at 90° and position two CUV-TLC-MP Mirror Plugs in the remaining two collimator positions for increasing light throughput.

Additional Features

- A dry gas purge rids the chamber of condensation when operating at low temperatures or excludes O₂ (tubing for water and gas connections are included)
- Variable-speed magnetic stirring (a stir bar is included)
- Slit slots for each collimating lens port for modifying light entering and/or leaving the sample chamber (several removable optical slits included)

PC Adapter Package

An optional CUV-TLC-ADP adapter package comes with Windows-compatible software that allows you to remotely start a test sequence, operate the controller box and monitor experiments. Without the CUV-TLC-ADP, you can control the holder's temperature mechanically from the controller box.

Specifications

Full (maximum) temperature range:	-55 °C to +105 °C
Normal temperature range:	0 °C to 85 °C
Precision:	± 0.02 °C
Reproducibility:	± 0.05 °C
Maximum illuminated area:	12 x 10 mm
"Z" dimension:	8.5 mm



The CUV-TLC-IJ Insulation Jacket.

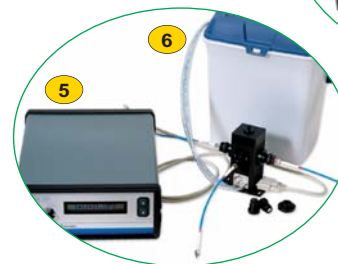
A Collimating Lens (far left) and Mirror Plug.



Another option is the CUV-TLC-FH Filter Holder.



An absorbance setup might include the USB2000 Spectrometer, an LS-1 Light Source and two optical fibers.



The CUV-TLC-50F includes the controller box and the cuvette holder. Optical fibers and the CUV-TLC-BATH are separate.

Item	Description	Price
1	CUV-TLC-50F Fiber optic temperature-controlled cuvette holder and controller box with slits, magnetic stirrer and tubing	\$3,820
2	CUV-TLC-FH Filter holder for the CUV-TLC-50F	\$470
3	CUV-TLC-CL AR-coated fused-silica collimating lens with SMA 905 Connector (comes with steering plate)	\$180
4	CUV-TLC-MP Mirror plug for use with CUV-TLC-IL when conducting fluorescence measurements	\$70
5	CUV-TLC-ADP Optional PC adapter package for remotely operating the cuvette holder (serial cable included)	\$95
6	CUV-TLC-BATH Water pump and bucket for running the thermoelectric cooler efficiently	\$99
7	CUV-TLC-IJ Insulating jacket for the CUV-TLC-50F	\$175
	CUV-TLC-IL Imaging or focusing lens snaps onto CL collimating lens with SMA 905 Connector (comes with steering plate)	\$290
	CUV-TLC-SP Steering plate that mounts a lens or mirror plug onto the cuvette holder	\$50
	CUV-TLC-ABSKIT A kit for absorbance/transmission; contains CUV-TLC-50F, CUV-TLC-ADP, two CUV-TLC-CL, CUV-TLC-BATH	\$4,374
	CUV-TLC-FLKIT A kit for fluorescence; contains the CUV-TLC-50F, the CUV-TLC-ADP, two CUV-TLC-IL, two CUV-TLC-MP, two CUV-TLC-SP, CUV-TLC-BATH	\$4,834
	CUV-TLC-MPKIT A kit with all of the items necessary for absorbance/transmission and fluorescence	\$4,964



Integrated Sampling Systems

An Integrated Sampling System is a spectroscopy accessory where the light source and sample compartments have been integrated into one package. These systems perform the same function as our cuvette holders, but have an advantage in that one or both fibers are eliminated from the setup.



USB-ISS-UV-VIS Integrated Sampling System

The USB-ISS-UV-VIS Integrated Sampling System is a direct-attach sample holder and deuterium tungsten halogen light source for 1-cm square cuvettes. The USB-ISS-UV-VIS allows you to adjust the intensity of the bulb via software. The sampling system has an electronic shutter for taking dark measurements and comes with a 5-volt power supply.

USB-ISS-UV-VIS: \$1,499



USB-ISS-VIS Integrated Sampling Systems

The USB-ISS-VIS and USB-ISS-T both have a violet LED-boosted tungsten source and a sample holder that bolts to a 10-pin connector on the front of a USB2000 Spectrometer, which provides the power and control signals for the light source. The USB-ISS-VIS holds 1-cm cuvettes while the USB-ISS-T holds 12-mm OD test tubes. Both sampling systems cover the 390-900 nm range.

USB-ISS-VIS: \$499

USB-ISS-T: \$499



ISS-UV-VIS Integrated Sampling System

The ISS-UV-VIS combines a light source with a 1-cm cuvette holder for absorbance measurements. The ultraviolet light is provided by a deuterium bulb; visible light from a tungsten halogen bulb is focused through the deuterium lamp onto a diffuser. Solarization-resistant fiber (not included) is recommended. A 12 VDC wall transformer is included.

ISS-UV-VIS: \$1,599

ISS-2 Integrated Sampling System

The ISS-2 combines a tungsten halogen light source with a diffuser on the illumination side and a collimating lens on the receiving side of a 1-cm cuvette holder, for absorbance measurements. A fiber (not included) connects the ISS-2 to any of our miniature spectrometers. A 12 VDC wall transformer is included.

ISS-2: \$799

Specifications

	USB-ISS-UV-VIS	USB-ISS-VIS	USB-ISS-T	ISS-UV-VIS	ISS-2
Dimensions (mm):	198 x 105.1 x 40.6	40.7 x 88.8 x 34.1	40.7 x 88.8 x 34.1	198 x 104.9 x 40.9	155 x 50 x 53.3
Weight:	200 g	130 g	130 g	400 g	240 g
Power consumption:	1.8 A @ 5 VDC	160 mA @ 5 VDC	160 mA @ 5 VDC	420 mA @ 12 VDC	600 mA @ 12 VDC
Wavelength range (source)*:	200-2000 nm	390-2000 nm	390-2000 nm	200-2000 nm	400-2000 nm
Pathlength:	1 cm	1 cm	12 mm OD	1 cm	1 cm
Cuvette shape:	Square	Square	Round test tube	Square	Square
Light source:	Deuterium tungsten	Tungsten and violet LED	Tungsten and violet LED	Deuterium tungsten	Tungsten
Bulb life (hours):	800 (deut.); 2,000 (tung.)	45,000	45,000	800 (deut.); 2,000 (tung.)	900
Time to stabilized output:	~30 minutes	~5 minutes	~5 minutes	~30 minutes	~30 minutes
Filter slot:	None	None	None	None	6.35 mm
Recommended optical fibers:	None	None	None	QP400-025-SR	QP400-2-UV-VIS
Spectrometers:	USB2000	USB2000	USB2000	All	All
"Z" dimension:	15 mm	15 mm	15 mm	15 mm	15 mm

* The wavelength range of the source may exceed the wavelength range of your spectrometer.



Cuvettes & Sample Cells

Disposable UV & VIS Cuvettes

Our CVD-series Disposable Cuvettes are a low-cost, no-maintenance alternative to quartz cuvettes. All cuvettes have a 1-cm pathlength, 220-900 nm or 350-900 nm wavelength range coverage, and various filling volumes.



Item	Range	Material	Volume	Window in mm	Clear Sides*	Cover Needed	Price
CVD-UV1S (100 pk)	220-900 nm	Plastic	1.5-3.0 mL	4.5 x 23	4*	square	\$55
CVD-UV1S-SAM (8 pk)							\$10
CVD-UV1U (100 pk)	220-900 nm	Plastic	70 µL-1.8 mL	2 x 3.5	2	round	\$55
CVD-UV1U-SAM (8 pk)							\$10
CVD-VIS1S (100 pk)	350-900 nm	Polystyrene	1.5-3.0 mL	5 x 23	4*	square	\$13
CVD-VIS1M (100 pk)	350-900 nm	Polystyrene	2.5-4.0 mL	10 x 35	2	square	\$11

Cuvettes with 4 clear sides are suitable for fluorescence measurements. Cuvettes with 2 clear sides are for "straight-through" absorbance and transmission measurements.

Cuvette Covers



Disposable cuvette covers (top) come in packs of 100.
CVD-ROUND: \$20
CVD-COVER (square): \$20



To block ambient light, use one of our black anodized covers.

CUV-COVER: \$25
CUV-COVER-TALL: \$30

Quartz Cuvette Cells

We offer several popular Suprasil quartz cuvettes made by Starna, including macro, semi-micro, flow and cylindrical cells. If you need a cell not listed here, you can order it through Ocean Optics using the Starna catalog number (see Starna.com for details). The cells listed here are suitable for use from 200-2700 nm.



Item	Description	Windows	Path	Lid	Exterior (mm)	Volume	Price
CV-Q-10	Standard	2 clear	10 mm	Teflon cover	12.5 x 12.5 x 45	3.5 mL	\$75
CVFL-Q-10	Fluorescence	4 clear	10 mm	Teflon stopper	12.5 x 12.5 x 45	3.5 mL	\$149
CVS-Q-10	Self-masking	2 clear	10 mm	Teflon stopper	12.5 x 12.5 x 48	1.4 mL	\$219
CVF-Q-10	Flow cell	2 clear	10 mm	M6 screws	12.5 x 12.5 x 35	0.42 mL	\$369
CV-Q-100	Cylindrical	2 clear	100 mm	Teflon stoppers	22 OD x 102.5	28.2 mL	\$165

Photometric Absorbance Standards

STAN-ABS Absorbance Standards are used to check the photometric accuracy of spectrophotometer systems. Data charts and NIST-traceable certificates of analysis come with each kit. Each kit consists of a background reference and low, medium and high absorbance solutions, each 125 mL in volume. These polymer-based standards utilize submicron, non-surface charged, solid spheres in ultrapure water. The STAN-ABS-UV is certified for wavelengths from 200-450 nm, while the STAN-ABS-VIS covers wavelengths from 400-900 nm.

STAN-ABS-UV: \$335
STAN-ABS-VIS: \$335





Linear Variable Filters



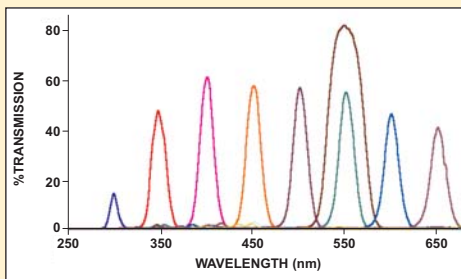
Novel Filtering Technology

We've combined our patented high-pass and low-pass Linear Variable Filters to create the world's first bandpass filter with an adjustable center wavelength and adjustable bandpass. Each filter features an excellent transmission band (~90%) and blocking band (99.8%). These filters -- with interference coatings applied to 57 mm x 10 mm quartz substrates -- are especially useful for spectrally shaping the excitation energy from broadband sources used for fluorescence.

Slide Carriers

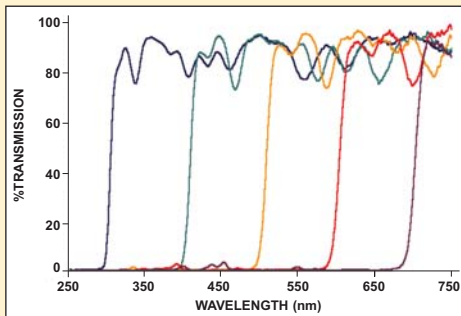
These off-the-shelf filters are epoxied into slide carriers that allow you to move the transmission or blocking band throughout the filter's wavelength range.

LVF-HL Variable Bandwidth Filter



These spectra were taken with an LVF-HL to show how a transmission bandwidth can be set throughout the filter's range (300-750 nm).

LVF-H High-pass Filter



The transition wavelength from blocking to transmission band varies according to the filter's position in front of the collimating lens.

Single High-pass & Single Low-pass Filter

The LVF-H High-pass Filter is a single filter that blocks light at 98.8% up to a transition wavelength that varies along its length. At that point, the LVF-H passes light better than 90%. The LVF-L Low-pass Filter is a single filter that passes light at 88% up to a transition wavelength that varies along its length. At that point, the LVF-L blocks light better than 98.8%.

Double High-pass & Double Low-pass Filters

We take two identical LVF-H or LVF-L filters, align them so that the transition wavelengths of both filters are matched, and then epoxy them together in their slide carriers. The benefit of having double filters versus a single filter is that the optical density of the blocking band increases to 99.96%. However, the transmission band is reduced to 80%.

High-pass & Low-pass Variable Bandpass Filters

By fastening together a high-pass filter and a low-pass filter, we created a variable bandpass filter that allows you to adjust the center wavelength and the bandwidth. We preset the transmission bandwidth at ~25 nm FWHM, but adjusting four screws allows you to slide the filters against one another to create a transmission bandwidth as wide as ~100 nm and as narrow as ~20 nm.

LVF Accessories

The LVF filters and slide carriers can be inserted easily into spectrometer setups with our LVF accessories. See the next page for details.

Item	Description	Price
LVF-H	A single high-pass filter for 300-750 nm	\$249
LVF-L	A single low-pass filter for 300-750 nm	\$249
LVF-HH	Two LVF-H high-pass filters epoxied together for 300-750 nm	\$499
LVF-LL	Two LVF-L low-pass filters epoxied together for 300-750 nm	\$499
LVF-HL	An LVF-H high-pass filter and LVF-L low-pass filter fastened together to create an adjustable bandpass linear variable filter	\$499
LVF-UV-H	A single high-pass filter for 230-500 nm	\$249
LVF-UV-L	A single low-pass filter for 230-500 nm	\$249
LVF-UV-HH	Two LVF-UV-H high-pass filters epoxied together for 230-500 nm	\$499
LVF-UV-LL	Two LVF-UV-L low-pass filters epoxied together for 230-500 nm	\$499
LVF-UV-HL	An LVF-UV-H high-pass filter and LVF-UV-L low-pass filter fastened together to create an adjustable bandpass linear variable filter	\$499



Accessories for Linear Variable Filters

LVF Accessories in Setups

We offer several LVF Linear Variable Filters as either high-pass, low-pass or, when we use them as pairs -- as we do for the LVF-HL -- variable bandwidth filters. These filters are installed into slide carriers, which can accommodate both the single-filter and double-filter configurations. The slide carriers fit into our slide carrier accessories, which make it possible to integrate LVFs with our spectrometers and accessories into fluorescence and absorbance setups.

In-Line Filtering with LVFs

The FHS-LVF is an in-line filter holder used in absorbance and transmission applications. This in-line LVF holder features two collimating lenses with SMA 905 Connectors. Its slot accommodates the LVF slide carrier. Screws hold the LVF in place.

Cuvette Holder Adapter

The LVF-CUV-ADP is an adapter that fits onto our 1-cm cuvette holders and holds the LVF slide carrier. The cuvette adapter slides over the top of the cuvette holder and includes screws to clamp the LVF's slide carrier into place. The LVF-CUV-ADP comes with a cover to block out ambient light.

Diffuser for Redirecting Excitation Light

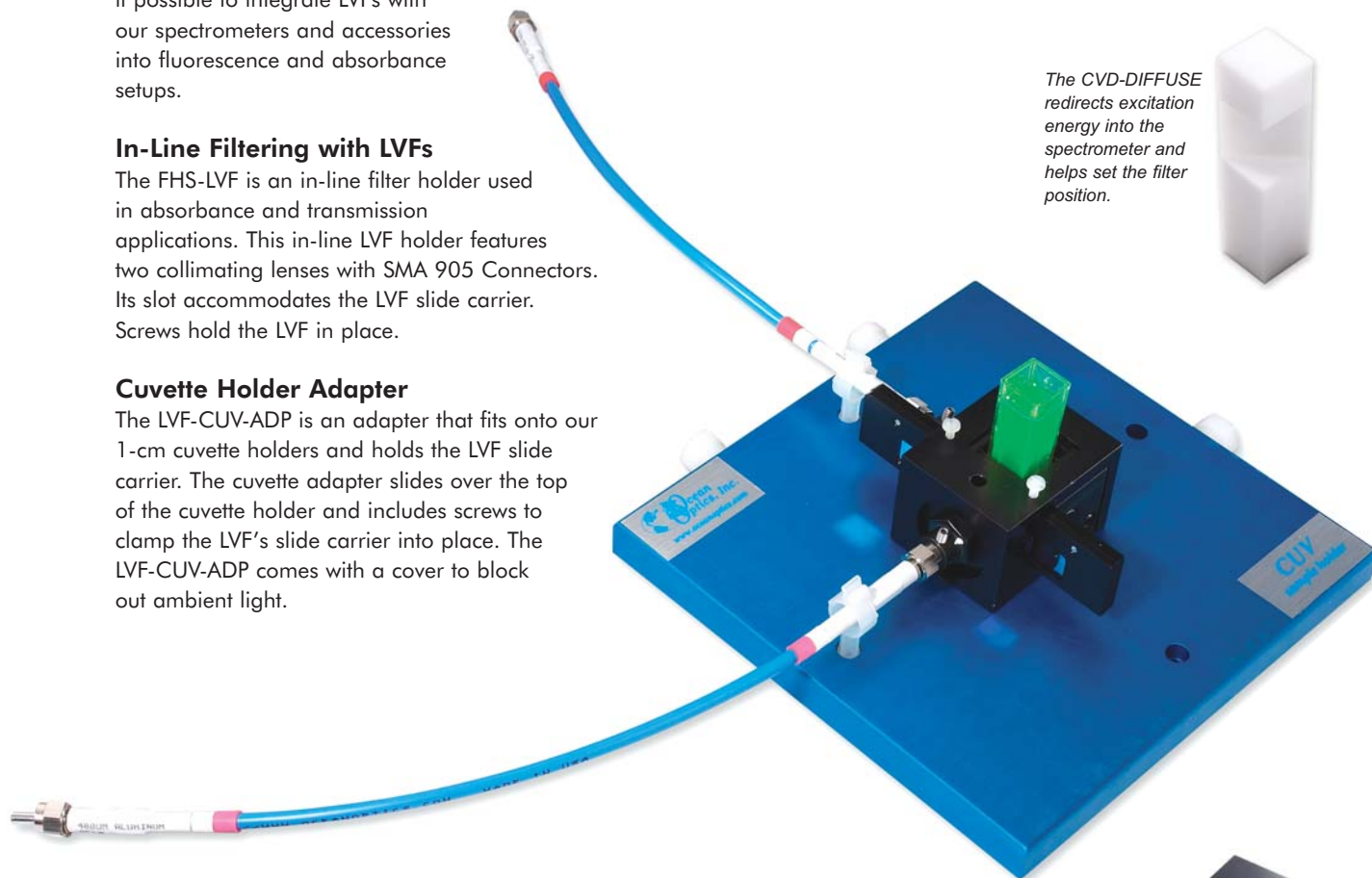
The CVD-DIFFUSE, a 1-cm cuvette-shaped piece of PTFE material, has a 45° surface at the measurement height and is used with an LVF in a fluorescence cuvette holder to redirect excitation energy 90° into the spectrometer. This facilitates setting the filter position -- i.e., while the CVD-DIFFUSE is inserted in the cuvette holder, you position the LVF to select the wavelength region passed by the filter.



The LVF is epoxied into a slide carrier, which fits into our LVF accessories, like the FH-LVF Filter Holder.



The CVD-DIFFUSE redirects excitation energy into the spectrometer and helps set the filter position.



When using an LVF with a cuvette holder like our CUV-ALL 4-way Cuvette Holder, you will need the LVF-CUV-ADP Cuvette Holder Adapter. The LVF (in a slide carrier) is inserted in front of the sample and held in place by the LVF-CUV-ADP (shown at right), with a cover to block ambient light.

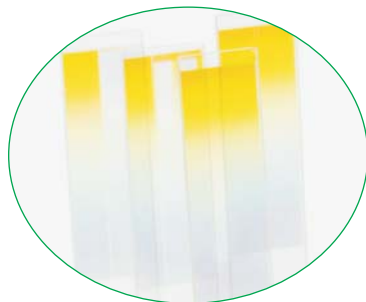
Item	Description	Price
LVF-CUV-ADP	An adapter for a 1-cm pathlength cuvette holder that holds the slide carriers in place	\$99
CVD-DIFFUSE	A 1-cm cuvette-shaped PTFE for redirecting excitation energy	\$99
FHS-LVF	In-line filter holder for LVFs	\$399
LVF-KIT	Consists of the LVF-HL, LVF-CUV-ADP, FHS-LVF and CVD-DIFFUSE	\$999
LVF-UV-KIT	Consists of the LVF-UV-HL, LVF-CUV-ADP, FHS-LVF and CVD-DIFFUSE	\$999



Filters & Filtering Technology



Schott off-the-shelf filters.



Custom interference filters.



LVF Linear Variable Filters.

Patented Filtering Technology

We offer a complete line of custom and off-the-shelf optical filters -- including filters produced using our novel dichroic filter array and linear variable filter technologies -- for a variety of optical-sensing applications.

Custom Filters

Our dichroic filters can be patterned in areas as small as 2 μm , with spatial registration to within 1 μm , to produce multiwavelength arrays, stochastic patterns and even images. We possess the design savvy and manufacturing capacity necessary to produce high-volume OEM orders of virtually any precision optical filter design. For details, see page 160.

Off-the-Shelf Filters

We inventory a variety of Schott filters, as well as our own LVF Linear Variable Filters, for installation into optical benches, light sources, cuvette holders and in-line filter holders. For a complete list of off-the-shelf filters, see page 164. Our optical filters can be categorized by function:

- Longpass (Order-Sorting) Filters eliminate second- and third-order effects in spectrometer setups, and are installed into the optical benches of spectrometers (page 43) or used as loose filters.
- Low-pass and High-pass Filters eliminate second-order effects, limit stray light, and block excitation energy in fluorescence experiments. Options include our LVF Filters (page 94) or Schott filters (page 164).
- Balancing Filters absorb energy in some regions while transmitting energy in others, such as the BG 34 filter that comes with our LS-1 Tungsten Halogen Source. We also offer Schott-brand balancing filters (page 164).
- Bandpass Filters pass energy in a certain region and block the energy above and below that region. We offer Schott filters and our LVF Filters, the latter in an adjustable-bandwidth design (page 94).

Filter Holders for Optical Fibers

The INLINE-FH In-line Filter Holder (top photo) holds INLINE-OF Filters or other filters 8 mm in diameter and 2-5 mm thick. The Filter Holder includes two collimating lenses and connects to two fibers for in-line filtering.

The FH-SMA (bottom photo) allows you to mount filters or diffusers at the end of SMA 905-terminated optical fibers. The FH-SMA accepts 8-mm diameter filters in thicknesses of 1-7 mm. We include an Allen wrench to adjust the barrel of the SMA 905 Connector to accommodate various filter thicknesses.

See page 164 for information on available Absorbing Glass Filters and Neutral Density Filters for the INLINE-FH or FH-SMA.

INLINE-FH:	\$402
INLINE-OF:	\$102
FH-SMA:	\$130

Specifications

	FH-SMA	INLINE-FH
Dimensions:	16 mm diameter	15 mm diameter
Weight:	10 g	20 g
Filter size:	8 mm diameter, 1-7 mm thick	8 mm diameter, 2-5 mm thick
Material:	Anodized aluminum	Stainless steel (collimating lenses have anodized housings)



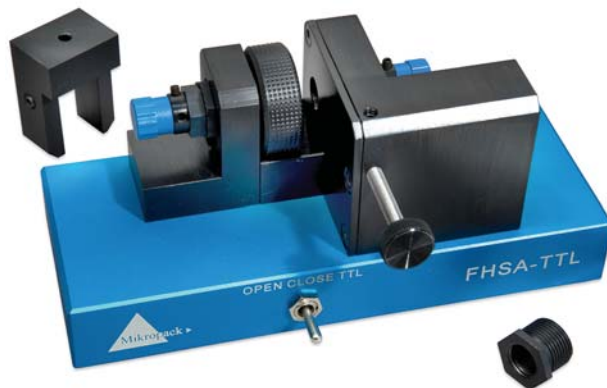
Filter Sample Holders

We offer a variety of fixtures that couple via SMA 905 Connectors to our fiber optic spectrometers and light sources for transmission measurements of optical filters.

Filter & Cuvette Holders

What's unique about the FHSA Filter/Cuvette Holders is you can configure the holders to sample either cuvettes or filters. Use the FHSAs to measure transmission of 1-cm square cuvettes or filters up to 7 mm thick. In addition, FHSAs interface via RS-232 bus to PCs, allowing you to control some functions of the FHSAs via software, which is included. With the FHSA-TTL, you have manual control of attenuation (adjustable from 0-100%), and manual or software control of a shutter. With the FHSA-RS232, you have software control of both the attenuation and shutter functions. Both versions include a 12 VDC power supply.

- FHSA-TTL: \$1,223
- FHSA-RS232: \$2,156



In-line Filter Holder

The FHS-UV In-line Filter Holder is a dual-purpose fixture for projecting a collimated beam of light through a flat optical filter. The FHS-UV can measure the transmission of filters, or provide a location in an optical system for inserting filters. It has two 74-UV Collimating Lenses mounted across a filter holder, which holds round filters up to 25 mm in diameter and samples up to 6 mm thick. (For large filters and other samples, see the 74-ACH Adjustable Collimating Lens Holder.) A bushing keeps the filter against the reference surface. A shutter facilitates taking dark measurements.

- FHS-UV: \$399



Direct-attach Filter Holder for USB2000

The USB-FHS Filter Holder has a light source mounted onto a base plate designed to fixture the lamp to a USB2000 Spectrometer. The light source includes a tungsten source and violet LED, which provide extra signal in the blue region. The USB-FHS is used to measure the transmission of filters and other samples up to 18-mm thick.

- USB-FHS: \$499



Specifications

	FHSA-TTL	FHS-UV	USB-FHS
Dimensions:	140 mm x 50 mm x 50 mm	50.6 mm x 140 mm x 43.1 mm	153.3 mm x 89 mm x 40.8 mm (with base plate)
Weight:	490 g	240 g	320 g (with base plate)
Power consumption:	100 mA @ 12 VDC	None	160 mA @ 5 VDC
Filter size (maximum):	Any sample up to 7 mm thick	25-mm diameter round; any sample up to 6-mm thick	50-mm diameter round; any sample up to 18-mm thick
Light source:	None	None	Tungsten bulb and violet LEDs
Wavelength range:	200-2000 nm	200-2000 nm	390-950 nm
Optical fibers required:	Yes	Yes	No
Spectrometer:	All	All	USB2000
Cuvette dimensions:	10 mm x 10 mm	None	None
Shutter frequency:	5 Hz/60 dB (maximum)	None	None
Shutter response time:	7 µsec	None	None





SpectroPipetter Microcell



Easy to Use -- Just Pipette and Measure

The PIP-10-2 SpectroPipetter Microcell is a combination micropipetter and 10-mm pathlength microcell for low-volume sampling.

Samples are loaded into a capillary tube with an optical fiber plunger, which is activated by depressing the thumbpad and releasing it to draw in the fluid. A mirror on the distal side of the capillary completes the optical path.

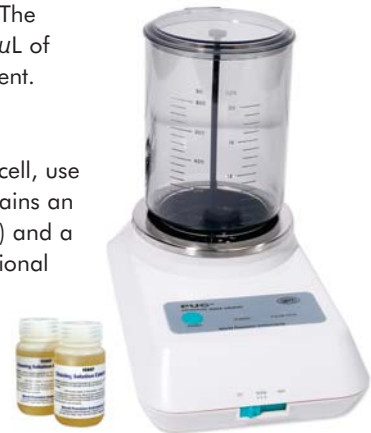
Requires 2 μL of Sample

The pipetter is equipped with a bifurcated fiber, which couples to our spectrometers and compact light sources to create low-volume absorbance systems. The SpectroPipetter requires only 2 μL of sample for a spectral measurement.

Cleaning Kit

To remove fluid or dye from the cell, use the PIP-UCK Cleaning Kit. It contains an ultrasonic cleaning bath (at right) and a bottle of cleaning solution. Additional PIP-UCK-CS Cleaning Solution (below right) is also available.

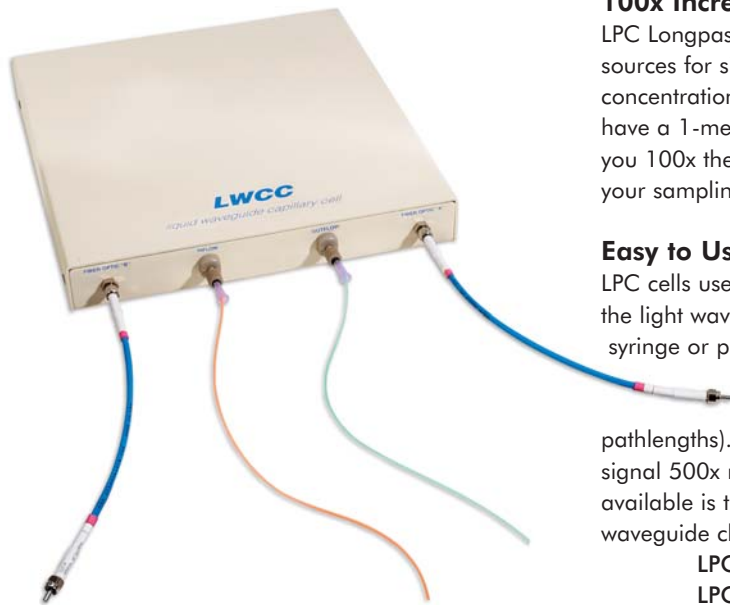
- PIP-10-2: \$1,995
- PIP-UCK: \$165
- PIP-UCK-CS: \$25



Specifications

Wavelength range:	230-850 nm
Sample volume:	2 μL
Light pathlength of cell:	10 mm
Temperature range:	4 $^{\circ}\text{C}$ to 99 $^{\circ}\text{C}$
Optical fiber length:	1.3 m
Core diameter of launch fibers:	Bundle of (3) 200 μm optical fibers
Core diameter of return fiber:	200 μm

Longpass Flow Cells



100x Increase in Sensitivity

LPC Longpass Flow Cells couple to our spectrometers and light sources for simple, efficient measurements of low-volume, low-concentration aqueous samples (230-800 nm). With the LPC-1, you have a 1-meter cell with an internal volume of only 240 μL , giving you 100x the sensitivity over a 1-cm pathlength cuvette holder as your sampling device.

Easy to Use

LPC cells use a capillary tube as both the sample compartment and the light waveguide. You inject the sample into the fluidic ports with a syringe or pump; optical fibers connect to SMA 905 Connectors to deliver and return light to the spectrometer. We offer these cells in 1- and 5-meter pathlengths (call for other pathlengths). A 5-meter cell (250 $\mu\text{L}/\text{meter}$) increases the absorbance signal 500x more than a 1-cm cuvette. Also available is the LPC-CLEANKIT (see inset), a waveguide cleaning kit for the LPCs.

- LPC-1: \$1,695
- LPC-5: \$3,350
- LPC-CLEANKIT: \$59



Specifications

Dimensions:	254 mm x 279 mm	Maximum sample temperature:	160 $^{\circ}\text{C}$
Weight:	140 g	Tubing inner diameter:	550 μm
Wavelength range:	230-800 nm (depending on sample solution)	Tubing:	Fused silica inner tubing coated with Teflon AF
Tubing volume:	250 $\mu\text{L}/\text{meter}$	Fluid fittings:	1/16", 1/32" compression fittings
Fiber connectors:	SMA 905	Maximum pressure:	2000 psi
Fiber core diameter:	400 μm	Chemical resistance:	Most organic and inorganic solvents



Cell for Capillary Electrophoresis

Solutions Absorbance

The CUV-CCE Electrophoresis Sample Cell is an optical fixture for measuring the absorbance of solutions in chromatography or capillary electrophoresis systems. The cell's design -- light projects through the sides of the silica tubing -- eliminates pressure limits commonly associated with tubing breakdown in electrophoresis systems.



Excellent Chemical Resistance

The CUV-CCE cell, fixtures and fittings are made of robust PEEK material. The cell, which can be purchased separately as CUV-CCE-CROSS, has a through-hole of 0.51 mm and comes with 10-32 coned female threads and four fittings. Two fibers (included) face each other across the sample tubing. To complete the system, we recommend a spectrometer and a DH2000-BAL Light Source (see 120).

Fibers & Tubing Sleeves Included

The CUV-CCE comes with two 300- μm solarization-resistant fibers and tubing sleeves to connect tubing to the threaded ports. You can also purchase the CUV-CCE-CROSS tubing sleeves separately. Other sleeve sizes are available.

- CUV-CCE: \$599
- CUV-CCE-CROSS: \$65
- CUV-CCE-TUBING: \$15

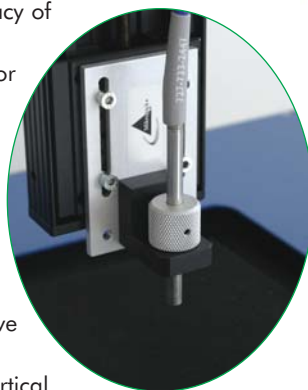
Specifications

Dimensions:	28.6 mm x 28.6 mm (cross); 50.8 mm x 50.8 mm (cross with fittings)
Weight:	9.4 g
Cell material:	PEEK polymer
Fixtures & fittings material:	PEEK polymer
Threads:	10-32
Through-hole:	0.51 mm
Fittings:	(4) F-300 double-winged nuts with F-142 ferrule
Swept volume:	0.721 μL
Tubing sleeve diameter:	0.41 mm inner diameter, 1.57 mm outer diameter
Tubing sleeve length:	31.8 mm
Tubing size accommodated:	350-390 μm outer diameter
Pressure rating (tubing):	6,000 psi (414 bar)

XYZ Mapping Tables

Versatile Design

We offer four high-precision linear XYZ Mapping Tables. The mapping table -- with a linear axis resolution of 1 μm and an accuracy of $\pm 5 \mu\text{m}$ -- is ideal for spatial mapping of spectral features or for multisampling in microwell plates. See the table below for a list of mapping table options and prices.

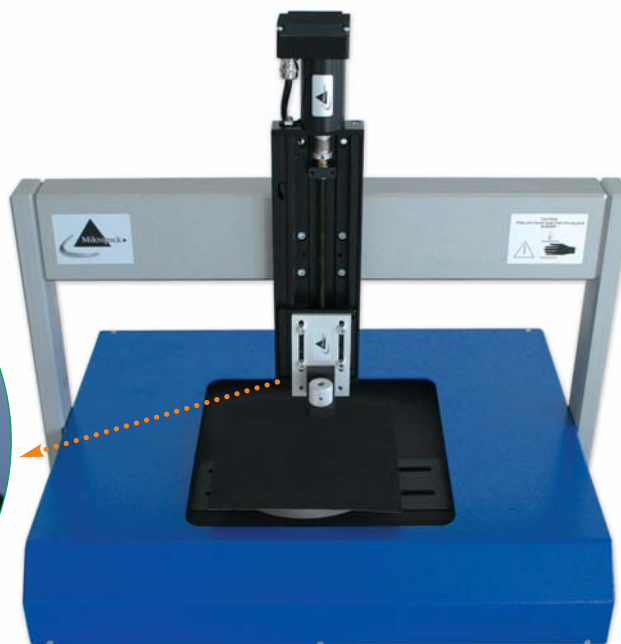


Additional Functions

The XYZ Table comes with an electric motor and encoder to drive each axis, along with a CNC Controller and a portal for the vertical (Z-axis) stage. The table makes it possible to measure every sample within an X-Y range of 150 mm x 150 mm or 200 mm x 150 mm. With the 100-mm vertical stage, you can attach holders for probes and other kinds of sampling devices, which are purchased separately.

PC Control

The system requires 110-240 VAC to operate (included) and interfaces via RS-232 bus to PCs. Computer-controlled operation of the motors is available. Speak to one of our Applications Scientists for details.



Item	X-axis	Y-axis	Z-axis	Price
XY(Z)-150 X150+	150 mm	150 mm	Optional	\$11,643
XY(Z)-200X150+	200 mm	150 mm	Optional	\$12,074
XYZ-150 X150X100	150 mm	150 mm	100 mm	\$14,165
XYZ-200X150X100	200 mm	150 mm	100 mm	\$14,595
Z-AXIS-100+	None	None	100 mm	\$2,660

Specifications

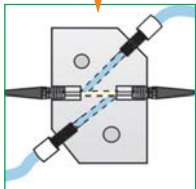
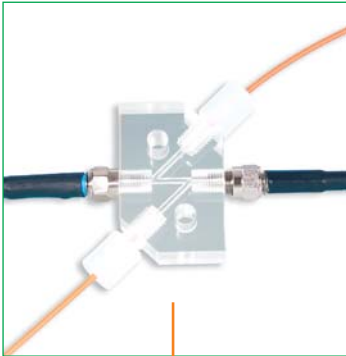
Dimensions base:	476 x 375 x 89 mm	Travel range:	150 mm x 150 mm (minimum)
Dimensions rail:	508 x 38 x 165 mm	Controller:	CNC Controller (2-3 axes)
Weight:	14.7 kg	Interface:	RS-232
Power input:	110-240 VAC		



Flow Cells for Flow Injection Analysis

We offer two optical flow cells with a "Z" configuration, to measure the optical absorbance of fluids moving through flow injection systems. Each flow cell has a 1.5-mm inner diameter; sample and waste tubing are connected with 1/4-28 fittings (included). Couple flow cells to our spectrometers to monitor chemical or biological processes, and immunoassays. These automated fluid sampling systems eliminate measurement errors that can occur with manual processes.

Specifications			
Cell materials:	PEEK, Plexiglas, Teflon or SS	FIA connectors:	1/4-28
Inner diameter:	1.5 mm	Tubing:	1/16" Teflon, ~3 m
Window material:	UV-grade fused silica	Fiber connectors:	SMA 905 for FIA-Z-SMA cells; 1.58-mm stainless steel ferrules for FIA-Z-CELL cells
Window thickness:	1 mm		
Wavelength range:	260-2000 nm		



FIA-Z-SMA: For Use with Standard Fibers

In the FIA-Z-SMA Flow Cell, optical fibers (available separately) connect to SMA 905 fittings to transmit and receive light through the central axis of the Z. The FIA-Z-SMA Cell uses silica windows as wetting surfaces at each fiber optic junction, and is available in PEEK polymer, Plexiglas (pictured top right), stainless steel or Teflon.

Item	Description	Pathlength	Cell Material	Price
FIA-Z-SMA-PEEK	Z Flow Cell with SMA 905 Connectors	10 mm	PEEK	\$529
FIA-Z-SMA-PLEX	Z Flow Cell with SMA 905 Connectors	10 mm	Plexiglas	\$529
FIA-Z-SMA-SS	Z Flow Cell with SMA 905 Connectors	10 mm	Stainless steel	\$529
FIA-Z-SMA-TEF	Z Flow Cell with SMA 905 Connectors	10 mm	Teflon	\$529
FIA-ZSMA-20-PE	Z Flow Cell with SMA 905 Connectors	20 mm	PEEK	\$529
FIA-ZSMA-20-PLE	Z Flow Cell with SMA 905 Connectors	20 mm	Plexiglas	\$529
FIA-ZSMA-20-SS	Z Flow Cell with SMA 905 Connectors	20 mm	Stainless steel	\$529
FIA-ZSMA-20-TEF	Z Flow Cell with SMA 905 Connectors	20 mm	Teflon	\$529
FIA-ZSMA-50-PE	Z Flow Cell with SMA 905 Connectors	50 mm	PEEK	\$629
FIA-ZSMA-50-PLE	Z Flow Cell with SMA 905 Connectors	50 mm	Plexiglas	\$629
FIA-ZSMA-50-SS	Z Flow Cell with SMA 905 Connectors	50 mm	Stainless steel	\$629
FIA-ZSMA-50-TEF	Z Flow Cell with SMA 905 Connectors	50 mm	Teflon	\$629



1/4-28 fittings come with the cells.

FIA-Z-CELL: For Use with Ferruled Fibers

The FIA-Z-CELL Flow Cell is a variation on the FIA-Z-SMA that instead of windows uses optical fibers in 1.58-mm ferrules, a design that allows you to slide the ferrules in and out of the cell to adjust the optical pathlength from 0-10 mm. Standard cell materials are PEEK polymer, Plexiglas, stainless steel and Teflon.

Item	Description	Pathlength	Cell Material	Price
FIA-ZCELL-PEEK	Z Flow Cell with ferrules	10 mm	PEEK	\$365
FIA-ZCELL-PLEX	Z Flow Cell with ferrules	10 mm	Plexiglas	\$365
FIA-ZCELL-SS	Z Flow Cell with ferrules	10 mm	Stainless steel	\$365
FIA-ZCELL-TEF	Z Flow Cell with ferrules	10 mm	Teflon	\$365



This fiber is designed for the FIA-Z-SMA.



These fibers have ferrules for use with the FIA-Z-CELL.

Fibers for Use with FIA Cells

An FIA-Z-SMA requires two 200 μm or 400 μm diameter optical fiber assemblies like the ones listed below, or see page 138 for more choices. The FIA-ZCELL requires two optical fiber assemblies with ferrule terminations. Each price below is for one assembly, but two are required.

Item	Description	For Cell	Price
P400-2-UV-VIS	(1) 400 μm fiber assembly with SMA 905 Connectors	FIA-Z-SMA	\$119
P200-2-UV-VIS	(1) 200 μm fiber assembly with SMA 905 Connectors	FIA-Z-SMA	\$99
FIA-P400-SR	(1) 400 μm fiber assembly with ferrule terminations	FIA-ZCELL	\$215
FIA-P200-SR	(1) 200 μm fiber assembly with ferrule terminations	FIA-ZCELL	\$210



Fluorescence Flow Injection Analysis System

Parts-per-trillion Sensitivity

The FIA-PMT-FL Photomultiplier Flow-through Detection System provides parts-per-trillion sensitivity for ultra-low fluorescence, chemiluminescence and bioluminescence measurements. Because of its heavy-duty, chemically resistant housing, the system can withstand harsh industrial environments.

Modular Design

The FIA-PMT-FL is built to order with either an internal excitation lamp or with an optical fiber interfacing to an external lamp. Excitation lamp source options include tungsten, mercury vapor, LEDs and laser diodes. Emission and excitation filters are mounted in slots in the enclosure, allowing for easy removal or exchange. Though the system uses a 100 μ L flow-through cuvette, you can use 1-cm pathlength cuvettes for manual measurements.

Easy PC Interface & Optimized Software

Included with the system is Windows-based software that allows you to set the integration time and voltage counts, and to obtain time histories of the measurements, both plotted and tabulated. The software can also automatically create calibration curves and control additional devices such as certain syringe and peristaltic pumps, injection valves, selection valves and autosamplers. ActiveX control is included for controlling the FIA-PMT-FL from your own software. The FIA-PMT-FL plugs into the RS-232 serial port of a PC.

FIA-PMT-FL: \$6,495



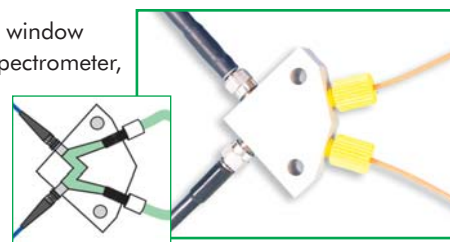
Specifications	
Spectral range:	310-750 nm
Detector:	Photo-counting photomultiplier tube
PMT dynamic range:	2×10^6
Responsivity:	5×10^{17} cps/watt (@ 400 nm)
Detection limits:	2 parts per trillion w/fluorescein @ 250 ms integration time
Pulse-pair resolution:	10 ns
Flow cell pathlength:	10 mm
Flow cell volume:	100 μ L with standard flow-through cuvette
Filters:	Excitation or emission; 11.8 mm diameter; call for details
Computer interface:	RS-232
Operating systems:	Windows 98/Me/2000/XP operating systems

Fluorescence Flow Cell for Flow Injection

With the FIA-SMA-FL Fluorescence Flow Cell, a fiber sends excitation energy via a window into a sample compartment. A second fiber, oriented at 90° and connected to a spectrometer, collects the emitted energy. Each cell has two optical windows and SMA 905 Connectors (which do not contact the fluids). Also included are Teflon tubing and chemically-resistant tubing connectors and seals. Two 600 μ m fibers are required.

FIA-SMA-FL: \$435

P600-2-UV-VIS: \$159 (each; 2 required)

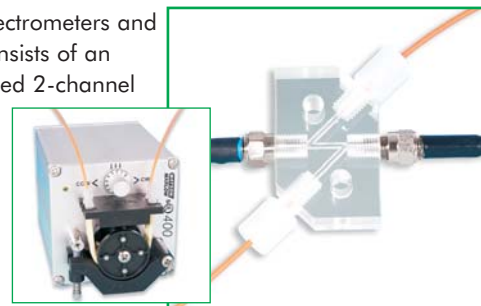


Flow Cell Kit for Flow Injection Analysis

The FIA-1000-Z Flow Cell Kit is a fluid sampling system that couples to our spectrometers and light sources for rapid, quantitative UV-VIS-NIR analysis of solutions. The kit consists of an FIA-Z-SMA "Z"-type flow cell (page 100), the FIA-PUMP-C (a computer-controlled 2-channel peristaltic pump), and operating software to control the pump via a PC's serial port. A pair of optical fibers (not included) is required. The FIA-Z-SMA has an optical pathlength of 10 mm and an inner diameter of 1.5 mm, and is available in PEEK polymer, Plexiglas, stainless steel or Teflon. (Tubing is not included.) You can also purchase the pump separately.

FIA-1000-Z: \$1,300

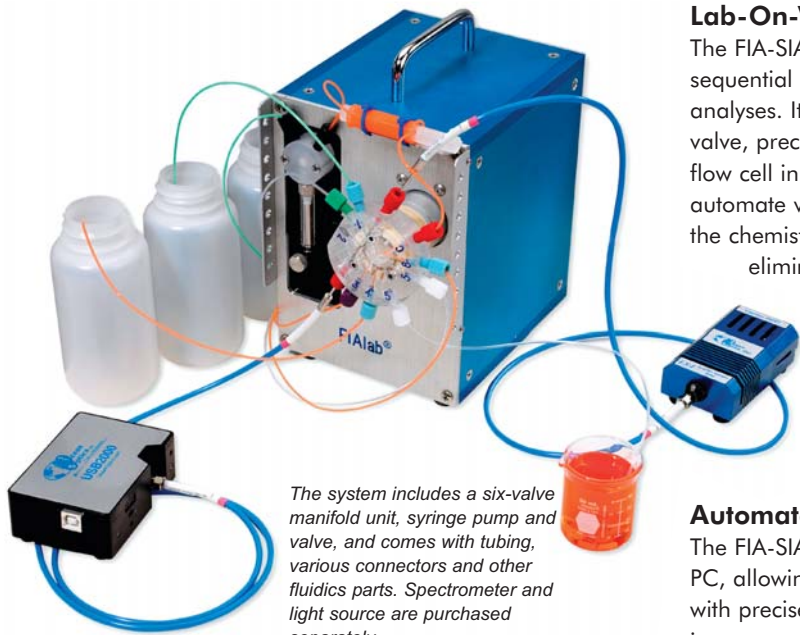
FIA-PUMP-C: \$804



Specifications			
Spectral range:	260-2000 nm	Pathlength:	10 mm
Cell materials:	PEEK, Plexiglas, stainless steel or Teflon	Tubing:	1/16" Teflon, ~3 m, with 1/4-28 connectors
Inner diameter:	1.5 mm	Pump:	105 mm x 105 mm x 185 mm; 2.1 kg
Window:	1 mm thick, UV-grade fused silica	Flow rate:	200 mL/minute/channel, depends on RPM and tubing diameter
Pathlength:	10 mm	Pressure rating:	25 psi



Sequential Injection System



The system includes a six-valve manifold unit, syringe pump and valve, and comes with tubing, various connectors and other fluidics parts. Spectrometer and light source are purchased separately.

Lab-On-Valve Technology

The FIA-SIA-LOV Lab-On-Valve System is a compact sequential injection analyzer for all-in-one chemical analyses. It combines a computer-controlled six-position valve, precision syringe pump, and spectrophotometric flow cell in a 12.7 cm x 15.3 cm package that can automate virtually any wet-chemistry lab procedure. All of the chemistry takes place within the valve manifold -- eliminating the need for additional tubing and connectors. All of the ports are interconnected by microchannels, and a built-in multi-purpose flow cell interfaces to optical fiber probes for spectral analyses in either absorbance or fluorescence mode.

Automate Virtually Any Wet Lab Procedure

The FIA-SIA-LOV comes with software and interfaces to a PC, allowing you to fully automate wet lab procedures with precise control of assay parameters including immunoassays, dilution monitoring and reagent/sample ratio for continuous or stopped-flow measurements. Via the software, you assign each of the Lab-On-Valve's ports a specific function. Software controls procedures with simple commands to set up and sequence through these processes. In fact, changing procedures is as easy as opening a stored script and switching reagent bottles.

Cost-effective Methodology

The FIA-SIA-LOV also offers a cost-effective, microliter-volume methodology -- it produces less waste, saves money and introduces fewer chemicals into the environment than other wet chemistry technologies. The unit weighs just 3.6 kg, making it both portable and easy to install in small incubators for temperature and humidity control. Also, the FIA-SIA-LOV easily can be positioned near ETAAS and MS systems so that micro-volumes of processed samples need not be transported through long conduits, which can cause sample degradation.

Modular Turnkey Chemical Analyzer

The FIA-SIA-LOV unit was developed by flow injection system specialist and Ocean Optics partner FIALab Instruments, and is compatible with our spectrometers, light sources and optical fibers for dynamic spectral analyses of optical absorbance or fluorescence of fluids. Nearly any standard colorimetric flow injection analysis method can be adapted to, and performed on, the FIA-SIA-LOV, with few or no modifications to the manifold.

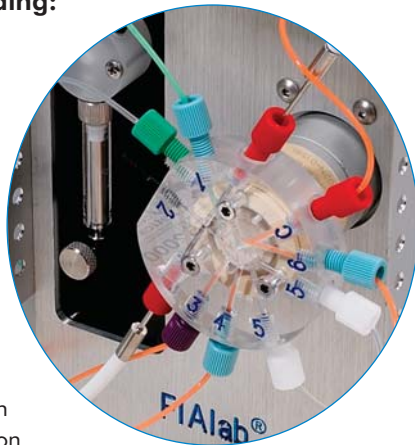
Replacement Parts

The FIA-SIA-LOV consists of the FIA-SIA Micro Sequential Injection Analyzer unit and the FIA-LOV Lab-on-a-Valve Manifold, each of which can be purchased separately.

- FIA-SIA-LOV: \$13,450
- FIA-SIA: \$10,950
- FIA-LOV: \$1,275

Control numerous assay parameters including:

- Bead trapping
- Composite sample handling
- Flow injection
- Flow through
- Holding coil
- Mixing
- Optical monitoring
- Reagent aspiration
- Sample dilution
- Sample aspiration
- Sequential injection
- Waste elimination



Specifications

Dimensions:	12.7 cm x 15.3 cm x 15.3 cm
Weight:	3.6 kg
Spectral range:	260-2000 nm
Cell materials:	PEEK, Plexiglas, Teflon or SS
Inner diameter:	1.5 mm
Window material:	UV-grade fused silica
Window thickness:	1 mm
Pathlength:	10 mm
Fiber connectors:	SMA 905
Tubing:	1/16" Teflon, ~3 m
Tubing connectors:	1/4-28
Pump dimensions:	105 mm x 105 mm x 185 mm
Pump weight:	2.1 kg
Flow rate:	200 mL/minute/channel (depending on RPM and tubing diameter)
Pressure rating:	25 psi



Positive Displacement Pump

Displaces Volumes from 1 μL

The PUMP-IT-1000 Positive Displacement Pump is a pulsed pump that displaces from 1 μL to 250 μL of fluid with each pump or cycle. The amount of fluid displaced with each cycle is set via software. The amount pumped is precise to 0.3% with repeatability of better than 0.5%.

Applications

The PUMP-IT is particularly useful for those wanting to automate the delivery of reagents into accurate flow setups. Typical applications include blood chemistry, blood analysis, particle sizing, in vitro diagnostics and biopharmaceutical analysis.

PC/Software-controlled

The pump connects to a PC via an RS-232 port and a controller box and is controlled with software (included). The PUMP-IT is a low-cost alternative to expensive syringe, vacuum, peristaltic and other pumps. Not only can you select the displacement amount, you can regulate the speed of the displacement via software.

Long-life Design

For accurate mixing and/or dilution of fluids, the pump has upper and lower limits that can be set mechanically and via the software. The pump provides a ripple-free and bubble-free flow. The pump's piston and head are made out of PEEK, while the body is made from aluminum. The piston in the pump will last about 1-2 million cycles before it shows evidence of wear. The PUMP-IT has the flexibility to be positioned in any orientation.

What's Included

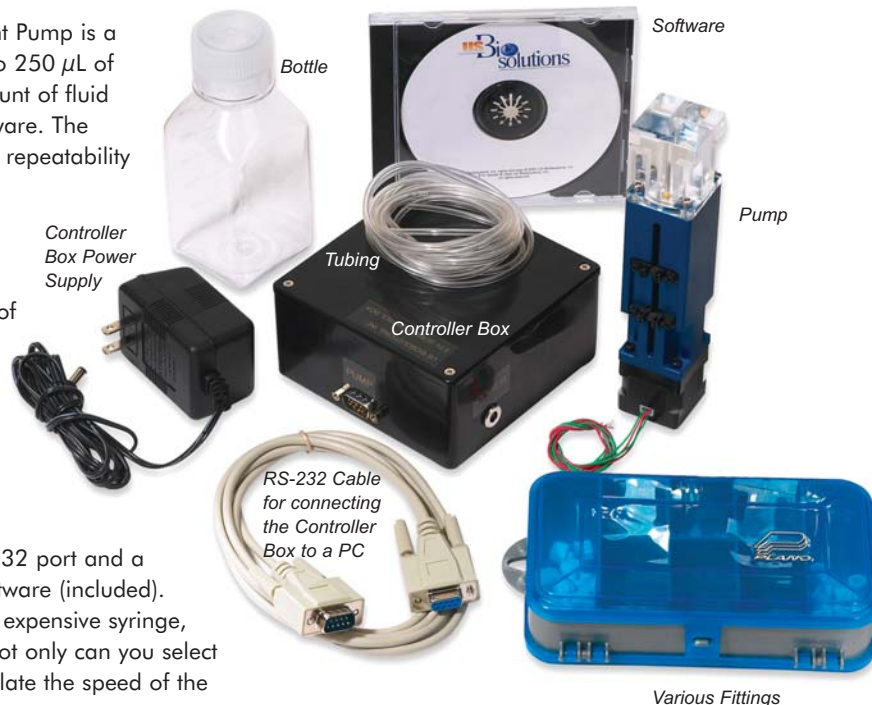
The PUMP-IT-1000 comes with the controller box and power supply; an RS-232 cord; software; 10 feet of tubing; various nylon fittings, plugs and caps; and a 250- μL sample bottle. You can also order the pump only (PUMP-IT-PUMP).

PUMP-IT-1000: \$999

PUMP-IT-PUMP: \$565

Specifications

Full scale volume:	250 μL
Volume per full step:	0.028 μL
Throughput:	>60% (based on 400 μm optical fiber)
Actuator:	5 VDC, 0.49 amp/phase, 10.2 ohm/phase, 9.6 mHz/phase
Repeatability:	<0.5%
Precision:	<0.3%
Pump head:	Acrylic (custom options include polycarbonate and PEEK)
Pump piston:	PEEK (custom options include stainless steel, ceramic and glass)
Pump body:	Aluminum (custom options include stainless steel and acrylic)
Dimensions:	Pump -- 3.50 cm x 3.50 cm x 16.94 cm Controller -- 11.93 cm x 11.93 cm x 6.35 cm
Controller:	Unipolar/Bipolar dual stepper motor control PCB, 7.5 VAC, 1 A
Baud rate:	2400 or 9600 baud serial connection
AC adapter:	7.5 VAC, 1 A
Tubing:	10 feet of Tygon tubing
Standard nylon fittings:	10 female Luer fittings, 1/4 hex to 10-32 thread 10 male Luer fittings, 1/4 hex to 10-32 thread 10 Luer plugs and 10 caps 10 1/16" ID barbed fittings with 10-32 thread 10 1/16" ID barbed tee fittings 10 1/16" ID elbow fittings





Optical Multiplexer



An MPM-2000-2x8 has two input ports and 16 outputs. Here, we used a USB2000 Spectrometer and an LS-1 Light Source as the input ports.



Flexibility for Multipoint Sampling

Our MPM-2000 Fiber Optic Multiplexers take light to a spectrometer or from a light source connected to one of the input ports and distribute it to either 8 or 16 outputs. The light is distributed through the output ports in sequential order, with switching times between channels of less than 150 milliseconds. Multiplexers often are found in process industries, where multiple locations need to be measured with one spectrometer channel and/or light source.

High-precision Instrument

All versions of the MPM-2000 include a DC motor, which has excellent speed control without sacrificing power. The motor is on a rotator block and includes an encoder, which converts movement into a digital pulsed output. Each channel in the multiplexer has a collimating lens connecting to an internal optical fiber system. The MPM-2000 provides accurate measurements with a repeatability of 99% and offers optical throughput better than 60%.

Multiple Versions

The MPM-2000 comes with either 2 input channels -- with each input channel corresponding to 8 output channels -- or with 1 input channel and 16 output channels. You must choose either a UV-VIS (250-800 nm) or VIS-NIR (350-2000 nm) multiplexer.

Software-controlled

The multiplexers interface to a PC via an RS-232 port and come with software and a driver for complete PC control. The software allows you full control of the switching order, switching delay time and system calibration.

- MPM-2000-1X16-UV: \$7,714
- MPM-2000-1X16-VIS: \$7,714
- MPM-2000-2X8-UV: \$8,021
- MPM-2000-2X8-VIS: \$8,021

Specifications

Dimensions:	230 mm x 200 mm x 150 mm (fits into 19" system: 33TE, 3HE, etc.)
Wavelength range:	250-800 nm (UV/VIS) or 350-2000 nm (VIS/NIR)
Optical throughput:	> 60% (when using standard 400 μ m fibers)
Motor:	Direct-current motor
Optical fibers:	400 μ m diameter optical fibers
Repeatability:	> 99%
Switching time:	150 milliseconds between adjacent positions
Interface:	RS-232 (optional USB)
Power requirement:	24 VDC, 1.2 A (includes WT-24V-E power supply)
Connectors:	SMA 905

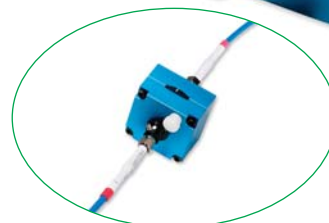
Fiber Optic Variable Attenuator

The FVA-UV Fiber Optic Variable Attenuator is an opto-mechanical device that helps control the amount of light transmitted between two fibers. Two fibers screw into either side of the FVA-UV via SMA 905 Connectors with collimating lenses, which project light across a metal disc in which a slit has been cut. The width of the slit varies as a function of radial position, which is adjusted manually. Rotating the disc varies the attenuation from 0-100% uniformly across a 200-2000 nm wavelength range. An FVA-ADP attaches the FVA-UV directly to a light source.

- FVA-UV: \$499
- FVA-ADP: \$99

Specifications

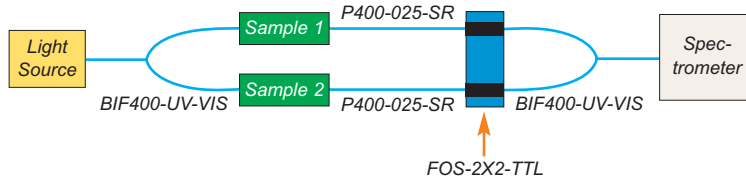
Dimensions:	38.1 mm x 59.4 mm x 40 mm
Weight:	90 g
Assembly ports:	3/8-24 threads for collimating lenses
Wheel lock:	6-32 nylon thumbscrew
ADP adapter:	Directly attaches to a light source with a collimating lens
Connector:	SMA 905



Fiber Optic Dual Switch with TTL Line

The FOS-2X2-TTL Fiber Optic Dual Switch was designed to provide you with flexibility in routing, splitting and controlling light. The FOS has two light channels; each has its own TTL-controlled shutter. You can opt to have one light channel open at a time, have both open, or have both closed. The FOS is useful for monitoring the drift of the light source or for measuring two samples with one spectrometer channel and one light source. The diagram below is an example of how the FOS can be utilized. In this setup, the FOS eliminates the need for a second spectrometer channel.

FOS-2X2-TTL: \$1,664



In this setup, light enters a Bifurcated Optical Fiber Assembly and then splits into two arms, one for each sample. Light interacts with each sample and travels through another fiber assembly, each into its own port in the FOS. Another Bifurcated Assembly collects the light from the FOS and sends it to the spectrometer. In this setup, you would switch the shutter on the FOS from one light channel to another in order to get clean data from each sample. Without the FOS, you would need another spectrometer channel to monitor the two samples.



Specifications

Dimensions:	100 mm x 70 mm x 70 mm
Weight:	455 g
Material:	Anodized aluminum
Switch frequency:	Maximum of 5 Hz
Power:	12 VDC
Operation:	Manual switch or TTL input signal

Electronic TTL Shutter

In spectrometer setups, the INLINE-TTL TTL-driven shutter allows you to block the light path without disturbing the experiment setup -- for example, by turning the light source on and off. The laser-cut shutter is installed between two collimating lenses, which attach to two optical fibers. The INLINE-TTL is driven by a small board with a TTL input. Included is a cable for interfacing to a spectrometer.

INLINE-TTL-S: \$988

Specifications

Dimensions:	140 mm x 50 mm x 50 mm
Weight:	~600 g
Shutter-Input:	TTL maximum 5 Hz
Power requirements:	12 VDC (power supply included)
Power consumption:	100 mA maximum
Maximum frequency:	5 Hz



Field of View Control

The Gershun Tube Kit (GER-KIT) controls the field of view of our SMA 905-terminated optical fiber. It also directly attaches to a spectrometer with an SMA 905 Connector. User-interchangeable apertures provide many different fields of view from 1° to 28°. (When the GER-KIT is used with our optical fiber, the field of view cannot exceed the optical fiber's 25° field of view if you are measuring radiance.)

GER-KIT: \$499

Specifications

Material:	Black anodized aluminum
Interior:	Bead-blasted surface to reduce off-axis reflections
Connection:	Directly attaches to one of our spectrometers or couples to an SMA 905-terminated optical fiber with included adapter barrel
Apertures:	1°, 3°, 8°, 10° and 14° apertures included, providing 1°, 2°, 3°, 6°, 8°, 10°, 14°, 16°, 20° and 28° fields of view





Semiconductor Nanocrystals

Evident Technologies, an Ocean Optics partner, develops extremely high-quality, low-cost semiconductor nanocrystals. These quantum dots are nanometer-scale materials that have properties between that of molecules and bulk materials. This enables Evident to produce "designer atoms" through atomic-level manipulation. When combined with our spectrometers and excitation sources, these nanocrystals have been used in biology applications as fluorescent tags to measure and quantify biological phenomena, and in photonics as tunable colors for light-emitting diodes. EviTags are an ideal tagging tool for high-throughput screening in micro-fluidic systems, as well as cell imaging and pathogen detection. For most applications, we recommend our USB2000-FLG Spectrometer and some combination of our light sources and filters to excite EviDots and EviTags. Contact one of our Applications Scientists for details.

EviDot Core & Core-shell Nanocrystals

EviDot Core Nanocrystals are manufactured quantum dots ranging in size from 2-10 nm with fewer than 1,000 atoms. Each Core type is made of the same material but exhibits different emission properties based on size. Cores produce high quantum yields with intense fluorescence at targeted peak wavelengths. EviDot Core-shell Nanocrystals are Core Nanocrystals with a zinc sulfide coating that stabilizes the Core, improves quantum yield and reduces photodegradation.



Item Code	Description	Semiconductor Nanocrystals	Vials	Volume per Vial	Price
QD-CS-VIS	Core Shell EviDot Test Kit with 1 vial each of the following: • 520 nm • 540 nm • 560 nm • 580 nm • 600 nm • 620 nm	Cadmium selenide nanocrystals with zinc sulfide shell (CdSe/ZnS)	6	30 mg dots in 4 mL of toluene solvent	\$649
QD-CS-1V	Core Shell EviDots. Specify 1 vial only from the following: • 490 nm • 520 nm • 540 nm • 560 nm • 580 nm • 600 nm • 620 nm	Cadmium selenide nanocrystals with zinc sulfide shell (CdSe/ZnS)	1	50 mg dots in 5 mL of toluene solvent	\$449
QD-C-VIS	Core EviDot Test Kit with 1 vial each of the following: • 500 nm • 520 nm • 545 nm • 570 nm • 595 nm • 618 nm	Cadmium selenide (CdSe)	6	35 mg dots in 4 mL of toluene solvent	\$649
QD-C-1V	Core EviDots. Specify 1 vial only from the following: • 500 nm • 520 nm • 545 nm • 570 nm • 595 nm • 618 nm	Cadmium selenide (CdSe)	1	50 mg dots in 5 mL of toluene solvent	\$349
QD-NIR	Core EviDot Test Kit with 1 vial of 850 nm and 950 nm	Lead sulfide (PbS)	2	10 mg dots in 4 mL toluene	\$249
QD-NIR-1V	Core EviDots. Specify 1 vial only of 850 nm or 950 nm	Lead sulfide (PbS)	1	10 mg dots in 4 mL toluene	\$199
QD-IR	Core EviDot Test Kit with 1 vial of 1310 nm and 1550 nm	Lead selenide (PbSe)	2	10 mg dots in 4 mL hexane	\$699
QD-IR-1V	Core EviDots. Specify 1 vial only from the following: • 1100 nm • 1310 nm • 1550 nm • 1900 nm	Lead selenide (PbSe)	1	10 mg dots in 4 mL hexane	\$524

For more details on EviDots, please visit our website at OceanOptics.com/Products/Evidots.asp.

EviTag Core-shell Nanocrystals

EviTag Nanocrystals are Core-shell Nanocrystals with an additional proprietary coating that makes the Core shells water-stable. EviTags now open the EviDot technology to life science applications. In fact, ligands (carboxyl or amine) are attached to the proprietary coating so that they can easily be bound to nucleic acids, antibodies and proteins.



Item Code	Description	Vials	Terminal Group	Volume per Vial	Price
QD-TAG-KIT	Core-shell EviTag Test Kit with 1 vial each of the following: • 490 nm • 520 nm • 540 nm • 560 nm • 600 nm	5	Carboxyl	0.125 mg tags in 0.5 mL of deionized water	\$1499
QD-TAG-1V	Core-shell EviTags. Specify 1 vial only from the following: • 490 nm • 520 nm • 540 nm • 560 nm • 580 nm • 600 nm • 620 nm	1	Carboxyl	0.125 mg tags in 0.5 mL of deionized water	\$399
QD-TAG-A-KIT	Core-shell EviTag Test Kit with 1 vial each of the following: • 490 nm • 520 nm • 540 nm • 560 nm • 600 nm	5	Amine	0.125 mg tags in 0.5 mL of deionized water	\$1499
QD-TAG-A-1V	Core-shell EviTags. Specify 1 vial only from the following: • 490 nm • 520 nm • 540 nm • 560 nm • 580 nm • 600 nm • 620 nm	1	Amine	0.125 mg tags in 0.5 mL of deionized water	\$399

For more details on EviTags, please visit our website at OceanOptics.com/Products/Evitags.asp.



Cosine Correctors for Emission Collection

Collect Radiation from 180°

Our Cosine Correctors couple to optical fibers and spectrometers for relative and absolute spectral intensity measurements, for emissive color applications, and for evaluation of light sources such as LEDs and lasers.

Probe Option

When the CC-3 and CC-3-UV are screwed onto the end of an optical fiber, the cosine corrector and optical fiber become an irradiance probe. The probe couples to one of our spectrometers to measure the intensity of light normal to the probe surface.

Direct-attach Option

The CC-3-DA screws directly onto the SMA 905 Connector of a USB2000, HR4000 or S2000 Spectrometer, creating a complete spectroradiometric system and eliminating the need for an optical fiber.

Diffusing Material: UV-VIS or VIS-NIR

The diffusing material used in the cosine corrector is a thin disk of opaline glass (350-1100 nm) or PTFE (200-1100 nm) that sits at the end of a stainless steel barrel. Call for details about our new HY-IRRAD irradiance collectors; one for air and one for water.

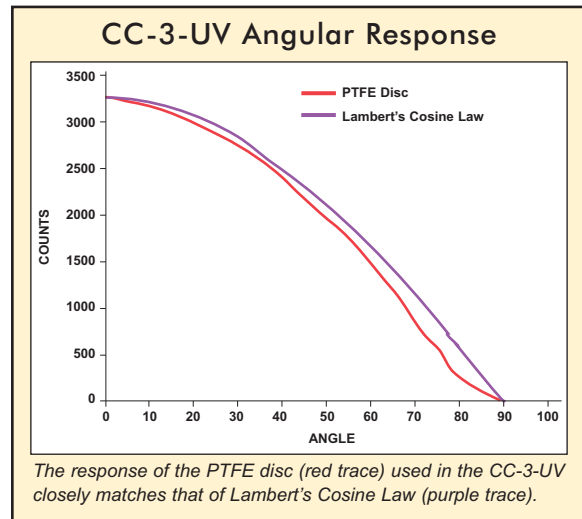
CC-3:	\$99
CC-3-UV:	\$129
CC-3-DA:	\$299
HY-IRRAD-A:	\$295
HY-IRRAD-W:	\$295

Specifications

	CC-3	CC-3-UV	CC-3-DA
Diffusing material:	Opaline glass	PTFE	PTFE
Wavelength range:	350-1000 nm	200-1100 nm	200-1100 nm
Dimensions:	6.35 mm OD	6.35 mm OD	12.7 mm OD
Field of view:	180°	180°	180°



The CC-3-DA (above center) attaches directly to an SMA 905 Connector on a spectrometer (left), creating a spectroradiometer. The CC-3 and CC-3-UV (above left and right) attach to optical fibers, creating Irradiance Probes.



Power Supply & Controller for LEDs

Measuring LEDs

The LED-PS Power Supply works with our spectrometers and the FOIS-1 Fiber Optic Integrating Sphere (see page 108) for spectroradiometric and color measurements of LEDs. The LED-PS unit has easy-to-reach electrical connectors for mounting LEDs that are 9.52-mm diameter or smaller with 2.77-mm lead spacing.

Adjustable Drive Current

The LED-PS holds the LED in place, powers the LED, and displays the LED's drive current. The drive current is adjustable, with a digital display to indicate the current level. With the LED-PS-NIST, the current meter is calibrated against a NIST-traceable standard. For more on LED measurements, see page 16.

LED-PS:	\$499
LED-PS-NIST:	\$749
LED-PS-RECAL:	\$199



Specifications

Dimensions:	56.8 mm x 56.8 mm x 56 mm
Weight:	170 g
Power consumption:	Up to 100 mA @ 12 VDC; depends on setting
LED drive current:	12-50 mA with 0.1 mA resolution
Drive current accuracy:	±1.0%
LED mount:	2.77 mm lead spacing, PTFE base



Integrating Spheres for Irradiance/Emission

ISP-I Integrating Spheres



Specifications

Weight:	330 g (ISP-30); 730 g (ISP-50); 1,650 g (ISP-80)
Spectral range:	200-2500 nm
Sphere coating:	Proprietary PTFE-based diffusing material
Reflectivity:	>98% (400-1500 nm); >95% (250-2000 nm)

Emission Collection

ISP-I Integrating Spheres are convenient sampling optics that couple to our spectrometers via optical fibers to measure the spectral output from 200-2500 nm of LEDs, lasers and other light sources. Each integrating sphere consists of a proprietary PTFE-based, sintered diffusing material -- in diameters of 30 mm, 50 mm or 80 mm -- that provides a Lambertian surface for irradiance measurements.

LED Measurement & Direct-attach Option

An ISP-LED-ADP adapter holds in place 3 mm, 5 mm or 8 mm LEDs and screws into the sample port of the ISP-50-8-I Integrating Sphere for measuring LEDs. The adapter ensures reproducibility. Another option is the USB-ISP-50 or USB-ISP-80, which directly attach to a USB2000 Spectrometer, eliminating the need for a read fiber. If the sample ports are too small, we offer custom sample port sizes for all ISPs. Custom machining for ports in diameters of 8, 10, 12, 14, 16 or 20 mm is available (see below).



Item	Description	Sample Port	Max. Fiber	Price
ISP-30-6-I:	Integrating sphere, 59 mm diameter, 58 mm high	6 mm	800 µm	\$1,228
ISP-50-8-I:	Integrating sphere, 80 mm diameter, 78 mm high	8 mm	600 µm	\$1,598
ISP-80-8-I:	Integrating sphere, 107 mm diameter, 117 mm high	8 mm	400 µm	\$1,981
ISP-LED-ADP:	Holds in place 3, 5 or 8 mm LED for reproducibility; for use with ISP-50-8-1	N/A	N/A	\$185
USB-ISP-50:	ISP-50-8-I with connector for directly attaching to a USB2000 Spectrometer	8 mm	600 µm	\$2,048
USB-ISP-80:	ISP-80-8-I with connector for directly attaching to a USB2000 Spectrometer	8 mm	400 µm	\$2,417
ISP-PORT-1:	Custom sample port machining of 8, 10, or 12 mm diameter	8, 10 or 12 mm	400 µm	\$172
ISP-PORT-2:	Custom sample port machining of 14,16 or 20 mm diameter	14, 16 or 20 mm	400 µm	\$323
HL-2000-CAL-ISP	NIST-traceable radiometric standard for use with ISP-50-8-I; see page 131	N/A	N/A	\$825

FOIS-1 Fiber Optic Integrating Spheres



In the picture top right, the FOIS-1 is being used to measure LEDs. In the picture bottom right, the FOIS-1 is attached to a 74-ACH, a setup often used when making transmission measurements of curved optics. An optic is set between the FOIS-1 and the right arm of the 74-ACH.

Specifications

Dimensions:	56.8 mm x 62.4 mm (housing) 38.1 mm diameter (sphere)	Weight:	240 g
Top mounts:	(2) 6-32; (2) 8-32; (1) 1/4-20	Spectral range:	200-2500 nm
Side mounts:	SMA 905 Connector; (1) 8-32	Sample port:	9.5 mm aperture
		Sphere coating:	Spectralon

360° Emission Collection

The FOIS-1 is a compact sampling optic that collects light from emission sources such as LEDs and lasers, or that measures light fields with a 360° field of view.

Principle of Operation

At the heart of the FOIS-1 is Spectralon, a white diffusing material with a highly Lambertian surface. Light enters the sphere via a 9.5-mm diameter port while a fiber -- oriented at 90° to the sample port -- collects the light. The size of the FOIS-1 and its three mounting holes make it easy to connect the sphere to other items, such as the 74-ACH Adjustable Collimating Lens Holder (at left).

Use with Calibrated Light Source

Before measuring the absolute spectral intensity of emission sources, use the LS-1-CAL-INT Calibrated Light Source to calibrate the absolute spectral response of your spectroradiometric system. For more on the LS-1-CAL-INT, see page 131.

FOIS-1: \$499



Integrating Spheres for Reflectance

ISP-REF Illuminated Integrating Sphere

The ISP-REF Illuminated Integrating Sphere couples to our spectrometers to measure the total integrated reflectance of surfaces placed against the sphere's sample port. The ISP-REF can measure variegated and opaque samples.

The ISP-REF measures the reflectance from flat surfaces pressed against its 10.3-mm diameter sample port. Illumination is provided by an internal tungsten halogen lamp powered with a 12 VDC wall transformer. The lamp is baffled so that all light that strikes the sample has been reflected from the sphere walls. The sphere's highly Lambertian interior provides a uniform 180° illumination field. The sample is viewed from 8° from normal by a lens system that couples to the fiber optic sample port. The field of view is restricted to the sample area, and has a divergence of ~2°. A simple switch allows you to open or close a gloss trap opposite the lens for the inclusion or exclusion of specular reflectance. A reference fiber port is provided to connect to a second spectrometer channel to monitor the output of the light source during long experiments, or for bringing external light into the sphere.

ISP-REF: \$1,599
 ISP-REF-B Bulb: \$40



ISP-R Integrating Spheres

The ISP-Rs are distinguished by their compact size and sturdy design. Each has SMA 905 fiber ports at 90° (to connect to a spectrometer) and 8° (to connect to a light source for direct illumination).

Each sphere is made of a sintered PTFE, which is >98% reflective in the visible. The spheres are available in diameters of 30 mm, 50 mm and 80 mm. Sample port diameters are 6 mm for the 30-mm sphere and 8 mm for the 50-mm and 80-mm spheres. If the 6-mm or 8-mm diameter sample ports are too small, custom sample port sizes for all ISP-Rs are available. For sample ports in diameters of 8, 10, or 12 mm, select ISP-PORT-1. To custom machine a 14,16 or 20 mm sample port, order an ISP-PORT-2.

The gloss-trap version (see inset, far right) comes with two cylindrical pieces -- one is made of black absorbing material and the other of white reflecting material -- that fit into a hole at the top of the sphere. When using the white gloss trap, you can make specular and diffuse measurements. When using the black gloss trap, you can use the ISP-Rs for diffuse measurements.

ISP-30-6-R: \$1,597
 ISP-50-8-R: \$1,844
 ISP-80-8-R: \$2,227
 ISP-50-8-R-GT: \$1,986
 ISP-PORT-1: \$172
 ISP-PORT-2: \$323



Specifications

	ISP-REF	ISP-30-6-R	ISP-50-8-R	ISP-80-8-R	ISP-50-8-R-GT
Dimensions:	54 mm x 57 mm x 83 mm	59 mm dia., 58 mm high	80 mm dia., 78 mm high	107 mm dia., 117 mm high	80 mm dia., 78 mm high
Weight:	864.7 g	330 g	730 g	1,650 g	743.3 g
Power consumption:	600 mA @ 12 VDC (lamp)	None	None	None	None
Spectral range:	360-2000 nm	200-2500 nm	200-2500 nm	200-2500 nm	200-2500 nm
Sphere diameter:	38.1 mm	30 mm	50 mm	80 mm	50 mm
Sample port diameter:	10.32 mm	6 mm	8 mm	8 mm	8 mm
Sphere coating:	Spectralon	PTFE material	PTFE material	PTFE material	PTFE material
Reflectance:	Diffuse or specular and diffuse	Specular and diffuse	Specular and diffuse	Specular and diffuse	Diffuse
Reflectivity:	>98% (400-1500 nm) >95% (250-2000 nm)	>98% (400-1500 nm) >95% (250-2000 nm)	>98% (400-1500 nm) >95% (250-2000 nm)	>98% (400-1500 nm) >95% (250-2000 nm)	>98% (400-1500 nm) >95% (250-2000 nm)
Bulb:	10,000-hour bulb; 2800 K	None	None	None	None



Diffuse Reflectance Standards



WS-1

WS-1 Diffuse Reflectance Standard

The WS-1 Diffuse Reflectance Standard (at left) is made of PTFE, a diffuse white plastic that provides a Lambertian reference surface for reflectance experiments. The WS-1 comes in an anodized aluminum housing, and is hydrophobic, chemically inert and very stable, even in deep-ultraviolet applications. It is >98% reflective from 250-1500 nm and >95% reflective from 250-2200 nm.

WS-1: \$299



WS-1-SL

WS-1-SL White Reflectance Standard with Spectralon

The WS-1-SL is a diffuse reflectance standard from Labsphere and is made from their patented diffuse reflectance material, Spectralon. Spectralon is hydrophobic and is thermally stable to 350 °C. The durable material provides highly accurate, reproducible data. Unlike all the other PTFE-based standards on this page, the WS-1-SL often can be smoothed, flattened and cleaned if nicked or soiled.

WS-1-SL: \$329



WS-1-SS

WS-1-SS Includes Stainless-steel Housing

The WS-1-SS comes in a stainless steel housing and has the same properties as the WS-1. In addition, the surface of the WS-1-SS is slightly recessed to allow the RPH-1 Reflection Probe Holder to sit on the standard without coming in direct contact with the standard's surface.

WS-1-SS: \$364

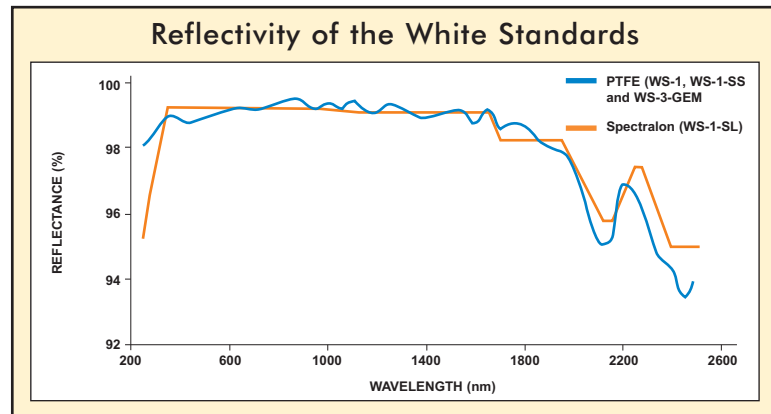


WS-3-GEM

WS-3-GEM White Reference Tile

Conceived for use in colorimetric applications involving diamonds and other gems, the WS-3-GEM White Reference Tile consists of a diffuse PTFE material, shaped to form a holder within its stainless steel receptacle. Because of its concave shape, the WS-3-GEM becomes an integrating sphere when illuminated. The WS-3-GEM has >98% reflectivity from 250-1500 nm and >95% reflectivity from 250-2200 nm. Like the WS-1, the WS-3-GEM's reflectance material is hydrophobic, chemically inert and very stable, even in deep-UV applications.

WS-3-GEM: \$487



Specifications				
	WS-1	WS-1-SL	WS-1-SS	WS-3-GEM
Dimensions:	38 mm diameter (housing) 32 mm OD, 10 mm thick (tile)	38 mm diameter (housing) 32 mm OD, 10 mm thick (tile)	38 mm diameter (housing) 32 mm OD, 10 mm thick (tile)	38 mm diameter (housing) 31 mm OD, 10 mm thick (tile)
Weight:	30 g	30 g	30 g	70 g
Spectral range:	250-2000 nm	250-2500 nm	250-2000 nm	250-2000 nm
Housing:	Aluminum	Delrin holder, protective cover	Stainless steel	Stainless steel
Reflectivity:	>98% (250-1500 nm) >95% (250-2200 nm)	99% (400-1500 nm) >96% (250-2000 nm)	>98% (250-1500 nm) >95% (250-2200 nm)	>98% (250-1500 nm) >95% (250-2200 nm)



Specular Reflectance Standards

Versatile & Durable Standards

We offer three specular reflectance standards for use as references when measuring the reflection of surfaces with high or low specular reflectivity. Each standard consists of a 31.7-mm outer diameter optical reflectance material in a protective aluminum receptacle with screw-on top. The superior coatings on the substrates are environmentally stable; they are able to withstand high temperatures and mechanical stresses.

Software Referencing & Calibration

Reflectivity values for the standards are built into our Spectroscopy Operating Software to provide a reference for any specular measurement. You simply choose the standard from a software menu and the software reads data from the electronic file shipped with the standard.

For High Reflectivity

The STAN-SSH High-reflectivity Specular Reflectance Standard is a fused-silica substrate coated with aluminum and protected by a thin layer of magnesium fluoride. This standard is typically used for measuring high-reflectance surfaces of optical substrates and coatings, machined metals and semiconductor materials. Values for the STAN-SSH are calculated for any angle from 0-45°.

For Calibrated High Reflectivity

Also available is a calibrated version of the STAN-SSH. The STAN-SSH-NIST is calibrated at a 6° angle traceable to NIST and is accurate to ±0.1% from 250-2500 nm. The STAN-SSH-NIST comes with calibrated reflectivity values (from a 6° angle) in both paper and electronic formats. We recommend a periodic recalibration of the STAN-SSH-NIST, which costs \$149. Should the calibrated surface become corrupted, a recoat and calibration service is available for \$299.

For Low Reflectivity

The STAN-SSL Low-reflectivity Specular Reflectance Standard is a black glass standard that can be used as a reference when measuring the low-reflectance surfaces of samples such as thin film coatings, anti-reflective coatings, blocking filters and substrates.

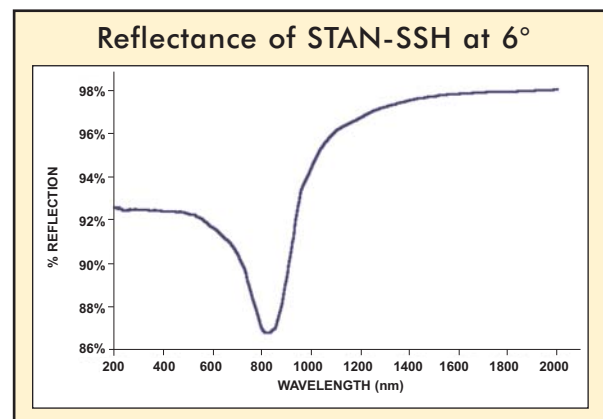
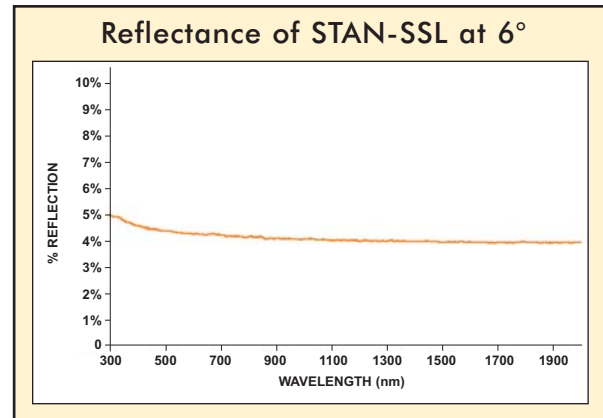
Holder Protects Standards

We also offer a holder for use with our reflectance standards. The STAN-HOLDER supports a standard during measurements, which helps to preserve its coating.

- STAN-SSH: \$499
- STAN-SSH-NIST: \$999
- STAN-SSL: \$499
- STAN-HOLDER: \$75



With the STAN-SSH High-reflectivity Specular Reflectance Standard (above), you receive a certificate of calibration in paper and electronic formats.



Specifications

	STAN-SSH	STAN-SSH-NIST	STAN-SSL
Substrate dimensions:	31.75 mm outer diameter x 6.35 mm height	31.75 mm outer diameter x 6.35 mm height	31.75 mm outer diameter x 6.35 mm height
Housing dimensions:	38 mm outer diameter x 19 mm height	38 mm outer diameter x 19 mm height	38 mm outer diameter x 19 mm height
Weight:	40 g	40 g	40 g
Reflectance material:	Front-surface protected aluminum mirror on fused silica substrate	Front-surface protected aluminum mirror on fused silica substrate	Schott ND9 glass
Reflectivity:	~87-93% (200-1000 nm) ~93-98% (1000-2500 nm)	~87-93% (200-1000 nm) ~93-98% (1000-2500 nm)	~5% (200-950 nm) ~4% (950-2500 nm)



Optical Flats



Visual Reference

Each Optical Flat is a finely polished optical reference surface that can be used to visually inspect the flatness of optical components such as mirrors, filters, prisms and windows. Flats can also be used as windows for interferometry applications.

What to Select

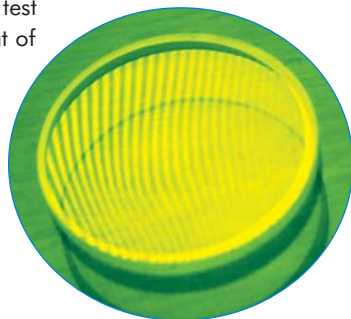
We offer single-sided flats made from either fused silica or Zerodur, each of which can be enhanced with an aluminum coating to increase contrast and improve the visual reference. We manufacture flats ranging from 1" to 6" in diameter and with flatness accuracies as precise as 1/20 wave.

Fused Silica or Zerodur

Your selection of fused silica or Zerodur flats depends on the application. Fused silica has a low thermal expansion and is highly resistant to abrasion. Zerodur is a glass ceramic that exhibits an even lower thermal expansion, making it useful for applications with significant temperature fluctuations.

How Flats Work

The choice of flatness accuracy depends on the application. For example, if the test surface is flatter than 1/4 wave, a more precise 1/10 wave flat is required to display the interference pattern change. When an Optical Flat is placed in contact with a test surface and illuminated with monochromatic light, an interference pattern of light and dark bands forms. A curved interference pattern like the one shown here indicates that the flatness of the test surface is less than that of the reference. Evenly spaced patterns indicate that the flatness of the test surface is equal to or higher than that of the reference.



Fused Silica Optical Flats

Item	Diameter	Center Thickness	Aluminum Coating	Flatness	Price
FLS-10-SS	1.0"	0.5"	No	1/10λ	\$200
FLS-10-SSM	1.0"	0.5"	Yes	1/10λ	\$250
FLS-12-SS	1.0"	0.5"	No	1/20λ	\$225
FLS-12-SSM	1.0"	0.5"	Yes	1/20λ	\$270
FLS-14-SS	1.0"	0.5"	No	1/4λ	\$170
FLS-14-SSM	1.0"	0.5"	Yes	1/4λ	\$210
FLS-20-SS	2.0"	0.5"	No	1/10λ	\$290
FLS-20-SSM	2.0"	0.5"	Yes	1/10λ	\$330
FLS-22-SS	2.0"	0.5"	No	1/20λ	\$350
FLS-22-SSM	2.0"	0.5"	Yes	1/20λ	\$400
FLS-24-SS	2.0"	0.5"	No	1/4λ	\$230
FLS-24-SSM	2.0"	0.5"	Yes	1/4λ	\$255
FLS-40-SS	4.0"	0.75"	No	1/10λ	\$650
FLS-40-SSM	4.0"	0.75"	Yes	1/10λ	\$765
FLS-42-SS	4.0"	0.75"	No	1/20λ	\$765
FLS-42-SSM	4.0"	0.75"	Yes	1/20λ	\$875
FLS-60-SS	6.0"	1.0"	No	1/10λ	\$1,200
FLS-60-SSM	6.0"	1.0"	Yes	1/10λ	\$1,325
FLS-62-SS	6.0"	1.0"	No	1/20λ	\$1,395
FLS-62-SSM	6.0"	1.0"	Yes	1/20λ	\$1,665

Zerodur Optical Flats

Item	Diameter	Center Thickness	Aluminum Coating	Flatness	Price
FLZ-10-SS	1.0"	0.5"	No	1/10λ	\$200
FLZ-10-SSM	1.0"	0.5"	Yes	1/10λ	\$250
FLZ-12-SS	1.0"	0.5"	No	1/20λ	\$225
FLZ-12-SSM	1.0"	0.5"	Yes	1/20λ	\$270
FLZ-14-SS	1.0"	0.5"	No	1/4λ	\$170
FLZ-14-SSM	1.0"	0.5"	Yes	1/4λ	\$210
FLZ-20-SS	2.0"	0.5"	No	1/10λ	\$290
FLZ-20-SSM	2.0"	0.5"	Yes	1/10λ	\$330
FLZ-22-SS	2.0"	0.5"	No	1/20λ	\$350
FLZ-22-SSM	2.0"	0.5"	Yes	1/20λ	\$400
FLZ-24-SS	2.0"	0.5"	No	1/4λ	\$230
FLZ-24-SSM	2.0"	0.5"	Yes	1/4λ	\$255
FLZ-40-SS	4.0"	0.75"	No	1/10λ	\$650
FLZ-40-SSM	4.0"	0.75"	Yes	1/10λ	\$765
FLZ-42-SS	4.0"	0.75"	No	1/20λ	\$765
FLZ-42-SSM	4.0"	0.75"	Yes	1/20λ	\$875
FLZ-60-SS	6.0"	1.0"	No	1/10λ	\$1,200
FLZ-60-SSM	6.0"	1.0"	Yes	1/10λ	\$1,325
FLZ-62-SS	6.0"	1.0"	No	1/20λ	\$1,395
FLZ-62-SSM	6.0"	1.0"	Yes	1/20λ	\$1,665

Specifications

	FLS (Fused Silica)	FLZ (Zerodur)
Surface quality:	60-40	60-40
Wedge:	< 5 minutes	< 5 minutes
Tolerance:	± 1 mm on CT ± 0.25 mm on diameter	± 1 mm on CT ± 0.25 mm on diameter
Refractive index:	1.458 n _d	1.542 n _d
Abbe #:	67.7 v _d	56.2 v _d
Thermal expansion:	0.55 x 10 ⁻⁶ °C ⁻¹	0.10 x 10 ⁻⁶ °C ⁻¹



Shear-plate Collimation Testers

Applications Versatility

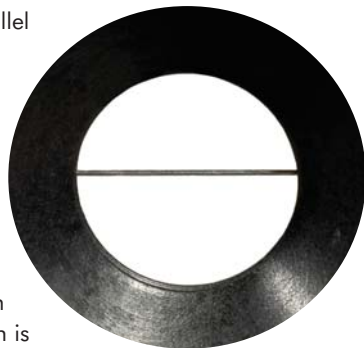
Use Shear-plate Collimation Testers to examine and adjust the collimation of laser light, or to measure the wavefront curvature and divergence/convergence magnitude of large-radius optical components.

Various Aperture Sizes from 350-2500 nm

Each tester is useable from 350-2500 nm, and is available in apertures ranging from 10-200 mm. Each tester consists of a wedged, high-quality optical flat housed in a heavy-duty anodized aluminum frame.

Basic Operation with Interferometric Design

The testers are remarkably easy to use: When a planar wavefront is incident at an angle of 45°, two reflected wavefronts result. The lateral separation of these wavefronts is referred to as shear. Fringes -- parallel patterns of light and dark areas -- will be seen in the overlapping region of the two images. Collimating the laser beam is a matter of adjusting the collimating system until the fringe pattern is parallel to the shadow of the collimation tester's reference wire.



Collimation Testers

Item Code	Aperture Size	Price
CT-10	10 mm	\$600
CT-20	20 mm	\$700
CT-50	50 mm	\$800
CT-75	75 mm	\$950
CT-100	100 mm	\$1,200
CT-125	125 mm	\$1,700
CT-150	150 mm	\$2,800
CT-200	200 mm	\$4,800

Thin Film Reference Wafer

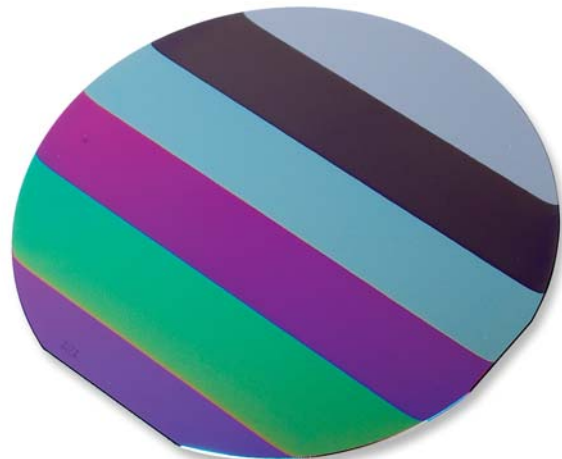
5-step Wafer

When measuring the thickness of substrates such as silicon wafers or optical layers, consider our Silicon-Silicon Dioxide (Si-SiO₂) Reference Wafer. This 9.8-cm (4") diameter, 5-step wafer has a calibrated thickness range of 0-500 nm, and is ideal for use as a reference standard when measuring the thickness of thin, transparent layers on various substrates.

Calibrated

The Reference Wafer consists of a thin wafer of silicon dioxide on silicon, with each transparent step numbered and etched on the wafer surface. A calibration data sheet -- the wafer is calibrated using an ellipsometer -- includes information for each step such as the X and Y positions, δ (Psi), ψ (Delta), period (in nm) and thickness (in nm).

REFERENCE: \$585



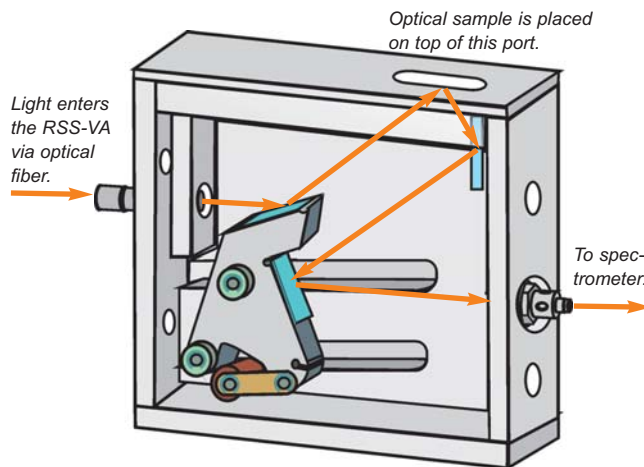
Step Sizes

0-500 nm with 100 nm steps:

- 0 nm (uncoated)
- 100 nm (± 20 nm)
- 200 nm (± 20 nm)
- 300 nm (± 20 nm)
- 400 nm (± 20 nm)
- 500 nm (± 20 nm)



Variable-angle Reflection Sampling System



Specifications

Dimensions:	114.3 mm x 41.3 mm x 101.6 mm
Weight:	980 g
Sample port:	19.0 mm x 6.4 mm
Connectors:	(2) SMA 905 Connectors (for illumination fiber & read fiber)
Surface mount:	3-point
Angles of incidence:	~10° to ~50° (user-adjusted)
Recommended fibers:	100 µm (illumination and read)
Material:	Black anodized aluminum

Measure Optical Substrates at Different Angles of Incidence

The RSS-VA Variable-angle Reflection Sampling System is a cleverly designed opto-mechanical device for measuring specular reflection of optical substrates at varying angles of incidence. When coupled to our spectrometers and light sources, the RSS-VA becomes a compact, low-cost alternative to the unwieldy, high-priced systems typically used to characterize optical substrates such as metallic and dielectric coatings.

Opto-Mechanical Design

The RSS-VA has two ports for SMA 905-terminated optical fibers: one to illuminate the optical substrate, the other to collect the reflectance and send it to the spectrometer (see drawing). This fiber-in/fiber-out design takes advantage of a sophisticated optical train that allows users to change the angle of incidence (AOI) from 10° to 50° simply by manipulating the carriage inside the black anodized stainless steel device housing. A thumbscrew locks the optical assembly at a fixed angle. Also included is a three-point surface mount for holding the sample in a fixed position.

Reflectance Standards

To normalize measurements taken with the RSS-VA, you will need a reflectance standard such as the STAN-SSH High-reflectivity Specular Reflectance Standard or STAN-SSL Low-reflectivity Specular Reflectance Standard (page 111). The STAN-SSH is also available in a NIST-traceable version, with values available in hard-copy and electronic formats.

Adapter Plate for Small Optics

The RSS-VA is available with an adapter (RSS-VA-ADP) to accommodate smaller optics. The adapter fits over the standard sample port aperture, which is 19.0 mm x 6.4 mm.

When AOI is A-OK

In many applications involving optical components it is necessary to understand how individual components function at varying AOI. In fact, most optical designs place components at AOI other than "normal" -- i.e., at 0°, with the beampath 90° to the substrate. For devices with multiple components -- our spectrometer optical benches, for example -- system efficiency can only be fully characterized by measuring the reflectivity of each component as a function of its AOI. To accomplish this, all that's needed is a USB2000-VIS-NIR Spectrometer, an LS-1 Tungsten Halogen Light Source, the RSS-VA, two optical fibers and a reflectance standard.

RSS-VA:	\$1,400
RSS-VA-ADP:	\$99



Reflection Stage

The Single-Point Reflection Stage is a probe holder for reflection measurements of optical layers and other substrates up to 150 mm in diameter. The probe holder accommodates fiber optic probes and other sampling devices up to 6.35 mm in diameter, and slides up and down a stainless steel post for adjustment to heights as great as ~63.5 mm. The reflection stage has an anodized base plate that is scored in concentric circles of varying diameters, to act as a guide when positioning round samples. For a list of all of our probe holders, see page 155.

STAGE: \$547



Specifications	
Dimensions (base):	152.4 mm diameter
Dimensions (sample area):	101.6 mm diameter*
Weight:	620 g
Height:	Rail height adjustable to 63.5 mm
Materials:	Anodized aluminum plate, stainless steel post and post holder

* Represents the area of scored concentric circles. You could use the entire base plate area, which is larger, for your sample.

Reflection & Transmission Stage

The Stage-RTL-T is a novel sampling system for analysis of substrate materials such as silicon, metals, glass and plastics. The RTL-T couples to our spectrometers and light sources, and can be configured in a variety of setups for reflection and transmission measurements.

The Stage-RTL-T consists of a variable rail attached to a base plate, with three devices that attach to the rail with a thumbscrew. From bottom to top, these devices are a fiber holder with collimating lens; a sample holder for reflection or transmission; and a light trap to mitigate the effects of back reflection and ambient light. (Remove the light trap to access a second collimating lens.)

The STAGE-RTL-T is remarkably versatile: perform reflection measurements with the probe positioned above or below the sample (measuring from below maintains a constant distance between probe and sample); make reflection measurements with the light trap in place; or measure transmission of samples using two fibers. For a list of all probe holders, see page 155.

STAGE-RTL-T: \$1,995



Specifications	
Dimensions (base):	206.3 mm diameter
Dimensions (sample area):	152.4 mm diameter (sample holder)
Weight:	4.5 kg
Height:	Rail height adjustable to 400 mm
Materials:	Anodized aluminum





Long Trace Profilometer



Unique Optical Profiling Tool

The LTP-V Long Trace Profilometer is an interferometric optical profiling instrument for absolute figure measurement of flats, spheres and aspheres up to 1500 mm in diameter. The LTP-V characterizes the figure and mid-frequency errors on cylindrical aspheres over 1 meter in length, and excels at measuring the shape of exotic aspheric optics, adaptive optics and mirror-bending mechanisms. With the LTP-V, optical surfaces can be measured quickly, easily and with nanometer precision and accuracy -- without the need for null corrector lenses or external reference surfaces. It is the only instrument now available for absolute figure measurement of optics as large as 150 cm in diameter.

About the Instrument

Conceived at Brookhaven National Laboratory and commercialized by Continental Optical in the early 1990s, the Long Trace Profilometer has been completely redesigned since our acquisition of Continental Optical in 2000. The LTP-V is a slope-measuring interferometer that measures the phase difference between two co-linear probe beams as they move across the sample surface. It is extremely insensitive to vibrations, which makes it suitable for use in laboratory environments.

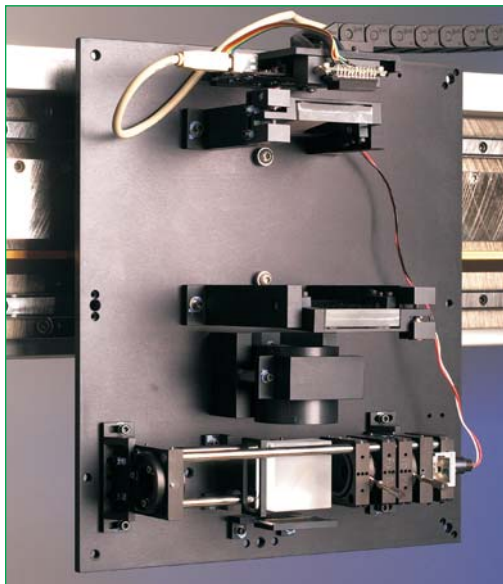
Absolute Accuracy

What sets the LTP-V apart from other profile-measuring instruments is its ability to correct for real-time probe beam angular errors during the traverse of the linear beam, without the need for a calibrated external reference standard. Variations in the probe beam pointing direction are measured and subtracted from the test surface slope, resulting in the absolute slope profile and measurement of the absolute radius of curvature of the test surface.

Pricing

A great deal of care and consultation is required before the purchase of an LTP-V. The cost for the LTP-V includes these consultations, shipping of the instrument, installation of the instrument, and training in its operation. The LTP-VMIR is an additional attachment for taking vertical and inverted mirror scans. The LTP-CALSTD is a calibrated standard mirror for use as a reference source.

LTP-V:	\$120,000
LTP-VMIR:	\$1,500
LTP-CALSTD:	\$1,000



The LTP-V has a linear servomotor that's so accurate it can position itself within 0.5 mm. The streamlined optical head design (shown above) is temperature-insensitive and has only two optical controls -- beam amplitude and sample-versus-reference balance. A polarizing beamsplitter is accurate to 1/20 wave. Included is a miniature CCD-array system that interfaces to PCs via a USB cable.

Specifications

Scan length:	1500 mm
Scan velocity:	3 mm/second (assuming 1-mm steps, 1 sample)
Position accuracy:	± 0.5 µm
Slope accuracy:	<1 microradian
Height accuracy:	<50 nm; 10-nm variations have been measured
Slope measurement range:	±5.0 milliradian

