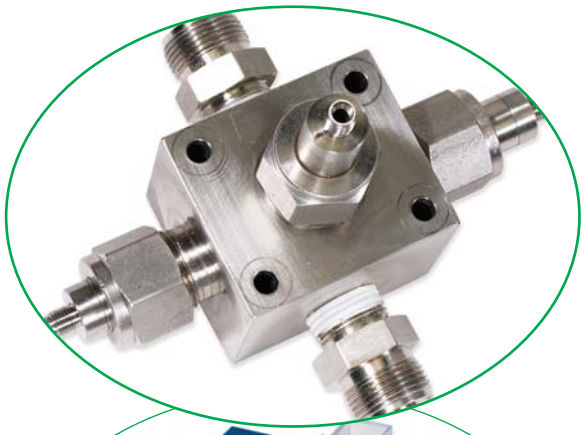
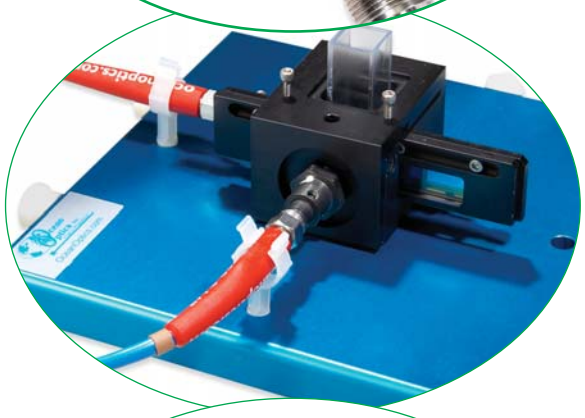
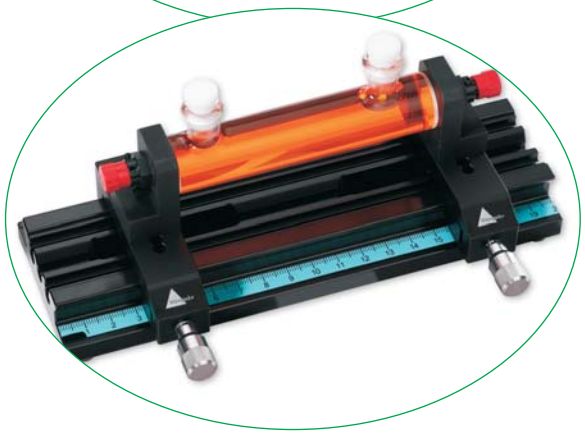
Sampling Accessories







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:

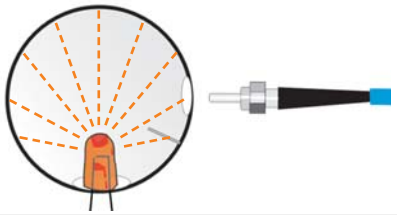
- Optical Fiber (25° FOV, aperture = fiber diameter)
- Collimating Lens (0°-45° FOV, aperture = 3 mm)
- Cosine Corrector (180° FOV, aperture = 3.9 mm)
- Integrating Sphere (360° FOV, aperture = 25 mm)

Optical Fiber: 25°

Adjustable Collimating Lens: ~0-45°

Cosine Corrector: ~180°

Integrating Sphere: 360°



Partner Spotlight: FIAlab Instruments

In 1987, Alitea USA was a distributor of Alitea AB peristaltic pumps. However, after demand for complete flow injection systems quickly grew, Alitea USA began to manufacture their own instruments. These early instruments are still widely used, evident by frequent mentions in scientific papers and conferences. In 1989, Alitea USA changed its name to FIAlab Instruments and have since introduced seven new state-of-the-art flow injection and sequential injection analysis systems, as well as a line of flow cells, sample changers and syringe pumps.

Innovative technology, top quality components, and the highest level of experience make FIAlab's FIA and SIA instruments the most advanced, precise, compact and economical available. Automation of reagent-based assays is critical to laboratory research in chemistry, biotechnology, drug screening and environmental studies, as well as in process control in industry. FIAlab brings quality and precision to this automation. The technical staff of FIAlab Instruments have a unique level of expertise in flow injection and sequential injection analyses with more than 20 years of direct research.

All of FIAlab's instruments are constructed with the best components available. Alitea peristaltic pumps ensure precise dispensing of fluids. Cavro microsyringe pumps offer a wide range of speeds and volumes. Valco "intelligent" valves are robust and highly reliable, and Upchurch fittings come in a large variety of chemically resistant and biocompatible materials.

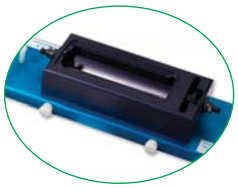
For more information on FIAlab Instruments' products, see pages 43-44, 94-95, and 100-101. You can contact them directly at 800-963-1101 or visit their web site at www.flowinjection.com.

Sampling Accessories by Measurement Type

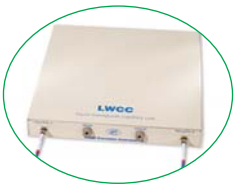
Our fiber optic sampling accessories create the optical interface part of our modular spectrometer systems. With so many sampling accessories from which to choose, you can meet the demands of a variety of experiments for absorbance, transmission, fluorescence, reflectance and emission.

Absorbance/Transmission

1-cm Cuvette Holder, p. 90



10-cm Cuvette Holder, p. 90



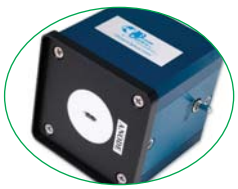
Longpass Flow Cells, p. 98

Cuvettes, p. 93

Integrated Sampling Systems, p. 92

Emission

Cosine Correctors, p. 104



LED Power Supply, p. 104

Integrating Spheres, p. 105

Collimating Lenses, p. 88

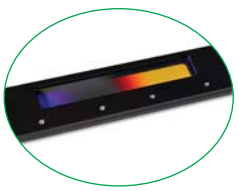
Direct-attach Integrating Sphere, p. 105

Fluorescence

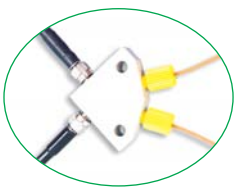
4-way Cuvette Holder, p. 100

Temperature-regulated Cuvette Holder, p. 91

EviDots and EviTags, p. 102



Linear Variable Filters, p. 114

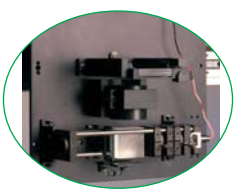


Flow Cells, p. 94

Reflectance

Diffuse Reflectance Standard, p. 107

Integrating Spheres, p. 106



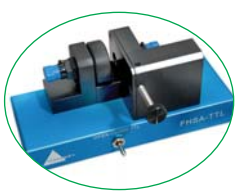
Long Trace Profilometer, p. 112

Reflection Stage, p. 109

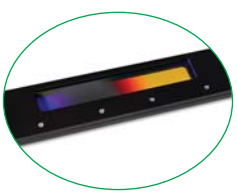
Reflection Sampling System, p. 109

Modifying Light

Variable Attenuator, p. 117



Filter Holders, p. 113



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Gershun Tube Kit, p. 116

Multiplexer, p. 117

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 Collimating Lenses have an inner barrel threaded for SMA 905 Connectors. (FC barrels are available for $29; see page 158 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.

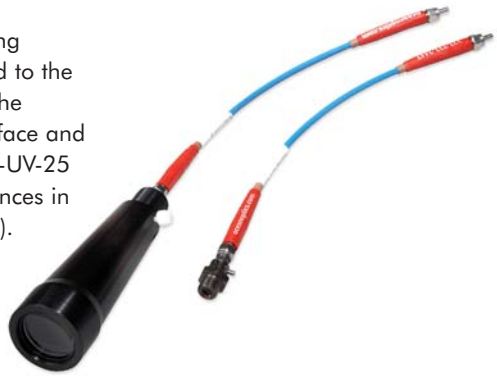
74-VIS Collimating Lens (350-2000 nm)
The 74-VIS -- the basic lens fixture in an LS-1 Light Source -- has a BK7 lens suitable for the VIS-NIR. These single-lens systems have the disadvantage of chromatic aberration, due to dispersion or variation in refractive index with wavelength.

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 (at left).



Item	Diameter	Focal Length	Material	Wavelength	Operating Temp.	Connector	Price
74-UV	5 mm	10 mm	f/2 fused silica Dynasil	200-2000 nm	120 °C	SMA 905, 6.35-mm ferrule, 3/8-24 external thread	$159
74-VIS	5 mm	10 mm	f/2 BK7 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
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 is temperature rated to 120 °C and 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) and an included adapter allows you to mount the 74-90-UV in male or female ports.

74-90-UV: $139

The 74-90-UV comes with a threaded adapter. It can be used for routing light around corners.

Adjustable Collimating Lens Holders

The 74-ACH Adjustable Collimating Lens Holder 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 are not included.)

The ACH-CUV-VAR Adjustable Collimating Lens and Cuvette Holder 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: $1,439

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

OPM-M Optical Post Mount Assembly

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

OPM-SMA Optical Post Mount

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.

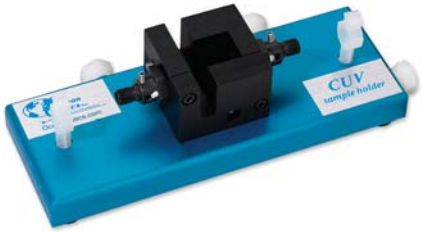
We offer four optical posts (in 25.4-mm, 50.8-mm, 76.2-mm and 101.6-mm heights) to attach to the OPM-SMA. These posts screw into optical bread-boards via a 1/4-20 tapped hole in the bottom of each post.

OPM-SMA: $149
OPM-1, -2, -3, -4: $15 each

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) 9.525 x 25.4 mm (nipple)	3/8-24 (mounting bars) 10-32 (setscrews for base)	3/8-24 (mounting bars) M6 (setscrews for base)	3/8-24 (lens holder) 8-32 (bore for mounting)	3/8-24 (lens holder) 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

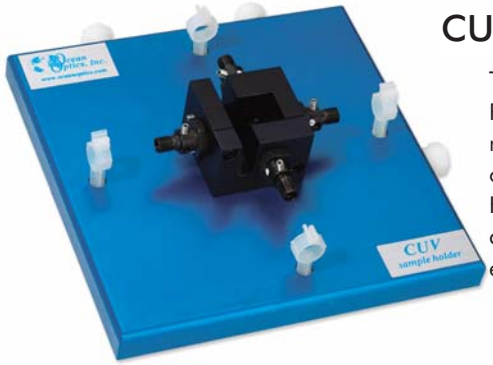
The CUV-UV (200-2000 nm) couples to lamps and spectrometers to create absorbance or transmission measurement systems. Two 74-UV lenses are mounted across a cell holder for square 1-cm cuvettes. The base includes channels for connection to a water bath for temperature regulation. The unit also accepts 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: $1,291
CUV-VAR-OPTION: $399

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 O_2 (tubing for water and gas connections are included)
- Variable-speed magnetic stirring (a stir bar is included)
- Several removable optical slits included for modifying light entering and/or leaving the sample chamber
- Slots for removable slits at each collimating lens port

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.

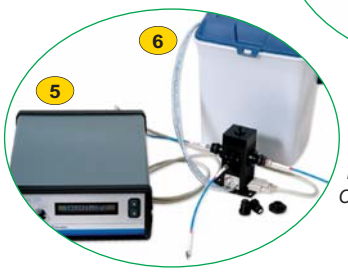
Specifications	
Full (maximum) temperature range:	-55 °C to +105 °C
Normal temperature range:	0 °C to 85 °C
Precision:	±0.02 °C
Reproducibility:	±0.05 °C
Maximum illuminated area:	12 x 10 mm
"Z" dimension:	8.5 mm

A Collimating Lens (far left) and Mirror Plug.

The CUV-TLC-IJ Insulation Jacket.

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

An absorbance setup might include the USB2000 or USB4000 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 attaches directly to USB2000 and USB4000 Spectrometers. The sampling system 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

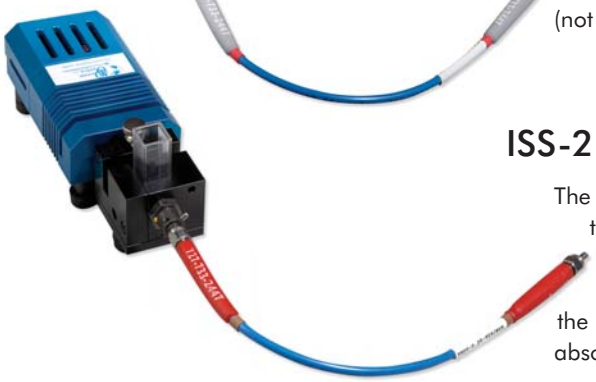
The USB-ISS-VIS and USB-ISS-T both have a violet LED-boosted tungsten source and a sample holder that bolts to the front of a USB2000 or USB4000 Spectrometer, which provides the power and control signals for the light source. The USB-ISS-VIS holds 1-cm cuvettes while the USB-ISS-T holds 12-mm OD test 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 Integrated Sampling System is a 1-cm cuvette holder and tungsten halogen light source. The ISS-2 combines the light source with a diffuser on the illumination side and a collimating lens on the receiving side of the cuvette holder. A fiber (not included) connects the ISS-2 to a spectrometer to create a small-footprint system for VIS-NIR absorbance measurements. 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 and USB4000	USB2000 and USB4000	USB2000 and USB4000	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.

CVD-UV1S

CVD-UV1U

CVD-VIS1S

CVD-VIS1M

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	$63
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	$63
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	$14

** 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-RB:	$20
CVD-ROUND-RG:	$20
CVD-ROUND-RO:	$20
CVD-ROUND-RY:	$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.

CV-Q-10

CVFL-Q-10

CVS-Q-10

CVF-Q-10

CV-Q-100

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

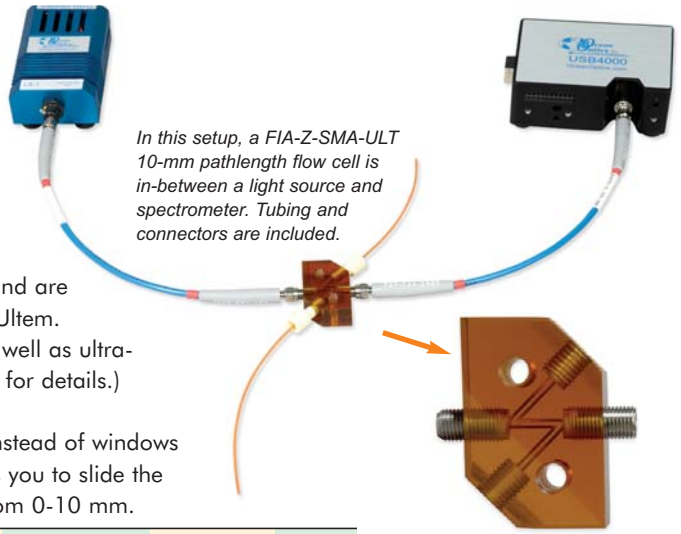
Photometric Absorbance Standards

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: $370
STAN-ABS-VIS: $370

Flow Cells for Flow Injection Analysis

We offer several optical flow cells with a "Z" configuration, to measure the optical absorbance of fluids. Couple them to our spectrometers to monitor chemical or biological processes, and immunoassays.

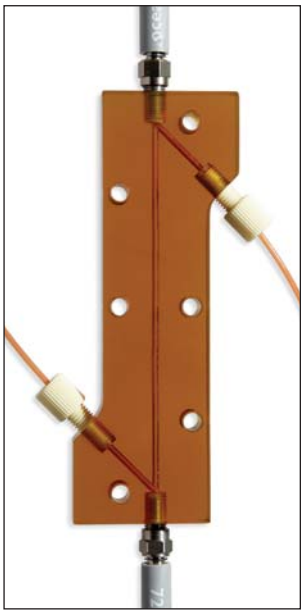


In this setup, a FIA-Z-SMA-ULT 10-mm pathlength flow cell is in-between a light source and spectrometer. Tubing and connectors are included.

In the FIA-Z-SMA Flow Cells, standard 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 Cells use silica windows as wetting surfaces at each fiber optic junction, and are available in PEEK polymer, Plexiglas, stainless steel, Teflon and Ultem. Common optical pathlengths are listed below. (Microvolume as well as ultra-short pathlength cells are also available. Contact Ocean Optics for details.)

The FIA-Z-CELL Flow Cells are different from the FIA-Z-SMAs; instead of windows they use 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.

Item	Description	Path-length	Cell Material	Fiber Type Needed	Price
FIA-Z-SMA-PEEK	Z Flow Cell with SMA 905 Connectors	10 mm	PEEK	Standard	$529
FIA-Z-SMA-PLEX	Z Flow Cell with SMA 905 Connectors	10 mm	Plexiglas	Standard	$529
FIA-Z-SMA-SS	Z Flow Cell with SMA 905 Connectors	10 mm	Stainless steel	Standard	$529
FIA-Z-SMA-TEF	Z Flow Cell with SMA 905 Connectors	10 mm	Teflon	Standard	$529
FIA-Z-SMA-ULT	Z Flow Cell with SMA 905 Connectors	10 mm	Ultem	Standard	$529
FIA-Z-SMA-20-PE	Z Flow Cell with SMA 905 Connectors	20 mm	PEEK	Standard	$529
FIA-Z-SMA-20-PLE	Z Flow Cell with SMA 905 Connectors	20 mm	Plexiglas	Standard	$529
FIA-Z-SMA-20-SS	Z Flow Cell with SMA 905 Connectors	20 mm	Stainless steel	Standard	$529
FIA-Z-SMA-20-TEF	Z Flow Cell with SMA 905 Connectors	20 mm	Teflon	Standard	$529
FIA-Z-SMA-20-ULT	Z Flow Cell with SMA 905 Connectors	20 mm	Ultem	Standard	$529
FIA-Z-SMA-50-PE	Z Flow Cell with SMA 905 Connectors	50 mm	PEEK	Standard	$629
FIA-Z-SMA-50-PLE	Z Flow Cell with SMA 905 Connectors	50 mm	Plexiglas	Standard	$629
FIA-Z-SMA-50-SS	Z Flow Cell with SMA 905 Connectors	50 mm	Stainless steel	Standard	$629
FIA-Z-SMA-50-TEF	Z Flow Cell with SMA 905 Connectors	50 mm	Teflon	Standard	$629
FIA-Z-SMA-50-ULT	Z Flow Cell with SMA 905 Connectors	50 mm	Ultem	Standard	$629
FIA-Z-SMA-100-PE	Z Flow Cell with SMA 905 Connectors	100 mm	PEEK	Standard	$729
FIA-Z-SMA-100-PLE	Z Flow Cell with SMA 905 Connectors	100 mm	Plexiglas	Standard	$729
FIA-Z-SMA-100-SS	Z Flow Cell with SMA 905 Connectors	100 mm	Stainless steel	Standard	$729
FIA-Z-SMA-100-TEF	Z Flow Cell with SMA 905 Connectors	100 mm	Teflon	Standard	$729
FIA-Z-SMA-100-ULT	Z Flow Cell with SMA 905 Connectors	100 mm	Ultem	Standard	$729
FIA-Z-CELL-PEEK	Z Flow Cell with ferrules	10 mm	PEEK	Ferruled	$365
FIA-Z-CELL-PLEX	Z Flow Cell with ferrules	10 mm	Plexiglas	Ferruled	$365
FIA-Z-CELL-SS	Z Flow Cell with ferrules	10 mm	Stainless steel	Ferruled	$365
FIA-Z-CELL-TEF	Z Flow Cell with ferrules	10 mm	Teflon	Ferruled	$365



This FIA-Z-SMA-100-ULT is a 100 mm pathlength cell made out of Ultem.

Specifications

Cell materials:	PEEK, Plexiglas, Teflon, stainless steel or Ultem	Wavelength range:	200-2000 nm
		FIA connectors:	1/4-28 fittings (included)
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		

Our standard fibers are designed for the FIA-Z-SMA cells.

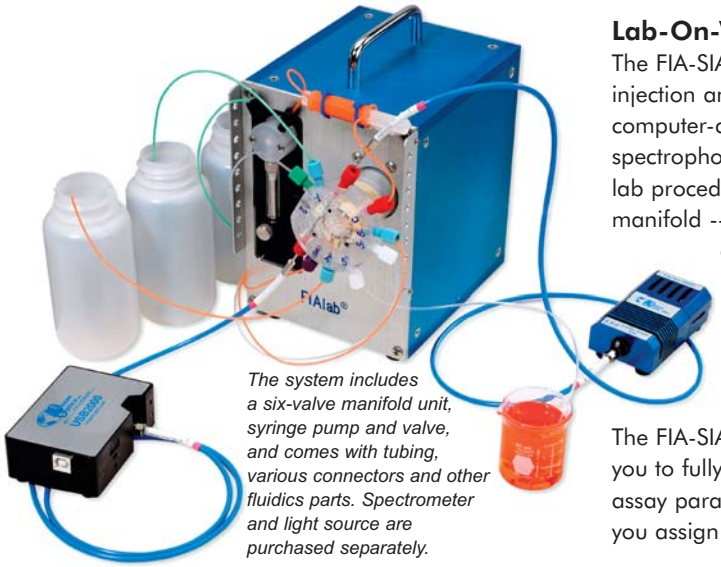
Fibers for Use with FIA Cells

An FIA-Z-SMA requires two 200 µm or 400 µm diameter fiber assemblies like the ones listed below. (Your application may require optical fibers optimized for a specific wavelength range. See pages 142-146 for more choices.) The FIA-ZCELL requires two fiber assemblies with ferrule terminations. Each price below is for one assembly (two are required).

The FIA-P400-SR and FIA-P200-SR fiber assemblies have ferrules for use with the FIA-Z-CELL cells.

Item	Description	For Use With	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-Z-CELL	$215
FIA-P200-SR	(1) 200 µm fiber assembly with ferrule terminations	FIA-Z-CELL	$210

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 that can automate many wet-chemistry lab procedures. 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 flow cell interfaces to optical fiber probes for spectral analyses in either absorbance or fluorescence mode.

Automate Wet Lab Procedures

The FIA-SIA-LOV includes software and interfaces to a PC, allowing you to fully automate wet lab procedures with precise control of assay parameters such as flowrates and volumes. Via the software, you assign each of the Lab-On-Valve's ports a specific function.

Control many assay parameters including:

- Bead trapping
- Flow injection
- Flow through
- Holding coil
- Mixing
- Reagent aspiration
- Sample dilution
- Sample aspiration
- Sequential injection
- Waste elimination

Cost-effective Methodology

The FIA-SIA-LOV 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 3.6 kg, making it portable and easy to install in small incubators for temperature and humidity control. Also, the FIA-SIA-LOV can easily be positioned near ETAAS and MS systems so that samples are not transported through long conduits, which can cause sample degradation.

Modular Chemical Analyzer

The FIA-SIA-LOV unit was developed by flow injection system specialist and Ocean Optics partner FIAlab Instruments. It is compatible with our spectrometers and accessories for dynamic spectral analyses of absorbance or fluorescence of fluids. 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

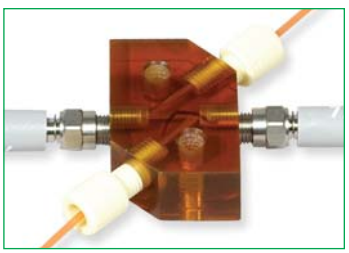
Specifications	
Dimensions:	12.7 cm x 15.3 cm x 15.3 cm
Weight:	3.6 kg
Spectral range:	260-2000 nm
Cell materials:	PEEK, Plexiglas, Teflon, stainless steel or Ultem
Inner diameter:	1.5 mm
Window material:	UV-grade fused silica
Window thickness:	1 mm
Pathlength:	10 mm
Fiber connectors:	SMA 905
Tubing:	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 (depends on RPM an tubing diameter)
Pressure rating:	25 psi

Flow Cell Kit for Flow Injection Analysis

FIA-PUMP-C 2-channel peristaltic pump.

The FIA-1000-Z Flow Cell Kit is a fluid sampling system that couples to our spectrometers and light sources for rapid, quantitative analysis of solutions. The kit consists of an FIA-Z-SMA flow cell (see page 94 for details), tubing and fittings, the FIA-PUMP-C (a computer-controlled 2-channel peristaltic pump), and software to control the pump via a PC's serial port. Two optical fibers (not included) are required. You can also purchase the FIA-PUMP-C pump separately.

FIA-1000-Z: $1,470
FIA-PUMP-C: $974



FIA-Z-SMA "Z"-type flow cell in Ultem.

Specifications			
Spectral range:	260-2000 nm	Pathlength:	10 mm
Cell materials:	PEEK, Plexiglas, Teflon, stainless steel or Ultem (shown)	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

Process Flow Cells

About Custom Sensors & Technology

Custom Sensors & Technology, Inc. is a full-service designer and manufacturer of photometric transmitters, fiber optic probes and flow cells, oxygen transmitters, sampling handling systems and other products for process applications. In addition, Custom Sensors & Technology offers applications assistance, product validation and other services. Their process flow cells can easily be connected to our spectrometers for spectral analysis of samples in online process applications.

Cross Process Flow Cells

The Adjustable-pathlength Cross Process Flow Cells are used in a variety of demanding online flow analysis applications in industrial gas or liquid stream environments. The 1/2" and 3/8" cells are available in various materials and have adjustable pathlengths.

The 1/2" version has a pathlength that can easily be adjusted from 0.1-2.5 cm. This version comes with two Optical Interface Couplers that collimate light and easily connect optical fiber assemblies to the flow cell, spectrometer and light source. Also available is a version that has a viewport; call for details.

The 3/8" version has a pathlength that can be adjusted from 0.1-1.5 cm. It does not include Optical Interface Couplers but they can be purchased separately. The PRO-CFC-3/8's titanium body (standard) allows the cell to be used in highly aggressive process streams such as those often encountered in pulp and paper applications.

PRO-CFC-1/2: $3,250
PRO-CFC-3/8: $3,096

Micro Process Flow Cells

Process-ready Micro Flow Cells are useful for online measurements in gas or liquid streams in demanding industrial environments The cells provide extremely small pathlengths (to 0.02 mm) without restricting sample flow. Micro Flow Cells are available in 1/8" and 3/8" sizes and have adjustable pathlengths.

The PRO-MFC-OIC-VP includes a viewport for viewing the sample as it flows through the cell. See a close-up of the viewport below.

The PRO-MFC is a 3/8" Micro Flow Cell. The PRO-MFC-OIC is a 1/8" Micro Flow Cell that can be used in a variety of online flow analysis applications. The PRO-MFC-OIC-VP includes a quartz port that allows the user to view the setting and the sample as it flows through the cells. The PRO-MFC-S Sanitary Micro Flow Cell is designed for online flow analysis applications to 200 AU/CM and has high absorption characteristics from 200-2000 nm. Constructed of 316 stainless steel, the cell is available with outer diameters from 0.5" to 2.0".

PRO-MFC: $2,675
PRO-MFC-OIC: $5,400
PRO-MFC-OIC-VP: $6,000
PRO-MFC-S: $5,250

Specifications

	PRO-CFC-1/2	PRO-CFC-3/8	PRO-MFC	PRO-MFC-OIC	PRO-MFC-OIC-VP	PRO-MFC-S
Pathlength:	Adjustable 0.1-2.5 cm	Adjustable 0.1-2.5 cm	Adjustable 0.02-2.0 mm	Adjustable 0.02-2.0 mm	Adjustable 0.02-2.0 mm	0.02-2.0 mm
Body & barrel:	316 stainless steel (Hastelloy C, Titanium and Monel available)	316 stainless steel (Hastelloy C, Titanium and Monel available)	Titanium (316 stainless steel, Hastelloy C and Monel available)	316 stainless steel	316 stainless steel	316 stainless steel; wetted body
Sample inlet/outlet:	1/2" compression fittings	3/8" compression fittings	3/8" compression fittings	1/8" compression fittings	1/8" compression fittings	1/8" compression fittings
Window materials:	Quartz (Sapphire available)	Quartz (Sapphire available)	Quartz (Sapphire available)	Quartz	Quartz	Quartz
Seals:	Viton (Chemraz and Kalrez available)	Viton (Chemraz and Kalrez available)	Viton (Chemraz, Kalrez, TFE, Buna-N available)	Viton (Chemraz, Kalrez, TFE, Buna-N available)	Viton (Chemraz, Kalrez, TFE, Buna-N available)	Sample end: B-type VCO L-Ring Face Seal Fitting; Process end: Tri-Clamp
Temperature limit:	204 °C (400 °F)	204 °C (400 °F)	121 °C (250 °F)	121 °C (250 °F)	121 °C (250 °F)	149-232 °C (300-450 °F) depending on gasket
Pressure limit:	2000 psig	2000 psig	1000 psig	250 psig	250 psig	2500 psig (137 Bar)
Fiber connections:	SMA 905	SMA 905	SMA 905	SMA 905	SMA 905	SMA 905
Wavelength range:	UV-NIR	UV-NIR	UV-NIR	UV-NIR	UV-NIR	UV-NIR

Process Flow Cells

Fluorescence Process Flow Cells

The PRO-FC-FL+TR Fluorescence Flow Cell is an adjustable-pathlength fluorescence flow cell that can be used for fluorescence and transmission measurements in a variety of industrial online flow analysis applications. The PRO-FC-FL+TR can be configured with Optical Interface Couplers (three OICs included) at 90° for fluorescence applications. Add a third OIC at 180° to make transmission and fluorescence measurements simultaneously. The cell's pathlength can easily be adjusted from 0.5-15.0 mm.

PRO-FC-FL+TR: $3,750

End-of-Column Process Flow Cells

The Biotech End-of-Column Flow Cell is an adjustable-pathlength flow cell for optical measurements in a variety of industrial online flow analysis applications. The stainless steel PRO-FC-BIO is a Titanium cell body that features an electropolished (RA 12 or better) interior and two fiber-lensed Optical Interface Couplers (included). OICs and sample inlet/outlet are secured in the cell body with standard Upchurch fittings. The cell's pathlength can easily be adjusted from 0.02-10.0 mm.

PRO-FC-BIO: $2,572

Long Pathlength Process Flow Cells

The PRO-FC-LP Long Pathlength Process Flow Cell can be used in a variety of online flow analysis applications when longer pathlengths are required. The PRO-FC-LP is available in pathlengths from 50-500 mm. Contact an Applications Scientist for detailed ordering information. Two Optical Interface Couplers (included) collimate light and easily connect fiber optic cables to the flow cell, spectrometer and light source.

PRO-FC-LP: $3,145

Specifications

	PRO-FC-LP	PRO-FC-FL+TR	PRO-FC-BIO
Pathlength:	50-500 mm	0.5-15.0 mm	0.02-10.0 mm
Body & barrel material:	316 stainless steel (Hastelloy C, Titanium and Monel available)	316 stainless steel (Hastelloy C, Titanium and Monel available)	316 stainless steel (Hastelloy C, Titanium and Monel available)
Sample inlet/outlet:	3/4" compression fittings	1/2" compression fittings	1/8" Upchurch compression fittings
Window materials:	Quartz (Sapphire available)	Quartz (Sapphire available)	Quartz (Sapphire available)
Seals:	Viton (Chemraz, Kalrez, TFE, Buna-N available)	Viton (Chemraz, Kalrez, TFE, Buna-N available)	Viton (Chemraz, Kalrez, TFE, Buna-N available)
Temperature limit:	400 °F, 205 °C	400 °F, 205 °C	200 °F, 93 °C
Pressure limit:	2500 psig	2500 psig	250 psig
Fiber connections:	SMA 905	SMA 905	SMA 905
Wavelength range:	UV-NIR	UV-NIR	UV-NIR

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.

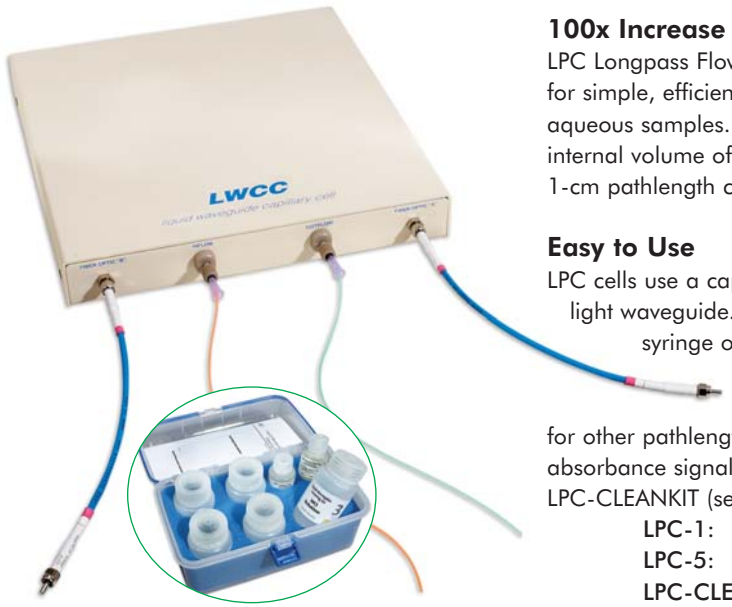
Cleaning Kit

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 °C to 99 °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. 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 µL/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 °C
Weight:	140 g	Tubing inner diameter:	550 µm
Wavelength range:	230-800 nm for LPC-1, 325-700 nm for LPC-5	Tubing:	Fused silica inner tubing coated with Teflon AF
Tubing volume:	250 µL/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 page 122).

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)

Positive Displacement Pump

Displaces Volumes from 1 µL

The PUMP-IT-1000 Positive Displacement Pump Kit 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%. The pump provides a ripple-free and bubble-free flow. For accurate mixing and/or dilution of fluids, the pump has upper and lower limits that can be set mechanically and via the software (included), which also allows you to select the displacement amount and the speed of the displacement.

Applications

The PUMP-IT-1000 Kit is 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. The PUMP-IT-1000 comes with everything needed for a flow setup; you can also purchase the pump separately (PUMP-IT-PUMP).

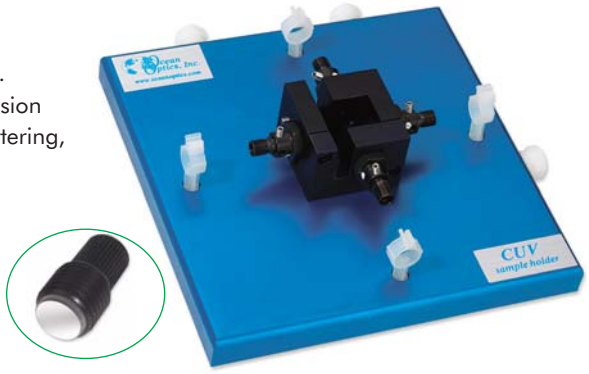
PUMP-IT-1000: $999
PUMP-IT-PUMP: $565

Specifications	
Volume:	250 µL full scale; 0.028 µL volume per full step
Throughput:	>60% (based on 400 µm optical fiber)
Actuator:	5 VDC, 0.49 amp/phase, 10.2 ohm/phase, 9.6 mHz/phase
Accuracy:	<0.5% repeatability; <0.3% precision
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 (in cm):	Pump: 3.50 x 3.50 x 16.94; Controller: 11.93 x 11.93 x 6.35
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
Nylon fittings:	10 female Luer fittings, 1/4 hex to 10-32 thread; 10 1/16" ID elbow fittings; 10 male Luer fittings, 1/4 hex to 10-32 thread; 10 Luer plugs and 10 caps; 10 1/16" ID barbed fittings with10-32 thread; and 10 1/16" ID barbed tee fittings

The PUMP-IT-1000 Kit comes with the Positive Displacement Pump, a 250-µL sample bottle, 10 feet of tubing, various nylon fittings, controller box and power supply, RS-232 cable and software.

Fluorescence Sampling Tools

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

Fluorescence Standard

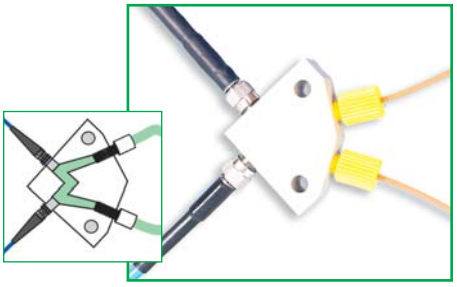
For quickly and easily checking the calibration, stability, and performance of your fluorescence system, use this Solid Secondary Fluorescence Standard.

STAN-FL-RED: $179

Linear Variable Filters

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 are especially useful for spectrally shaping the excitation energy from broadband sources used for fluorescence. The filters are epoxied into slide carriers that allow you to move the transmission or blocking band throughout the filter's wavelength range. The LVF filters and slide carriers can be inserted easily into spectrometer setups. For details, see page 114.

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 μm fibers are required. See the bottom of page 94 for fiber details.

FIA-SMA-FL: $435

Fluorescence Process Flow Cells

The PRO-FC-FL+TR Fluorescence Flow Cell is an adjustable-pathlength fluorescence flow cell that can be used for fluorescence and transmission measurements in a variety of industrial online flow analysis applications. The PRO-FC-FL+TR can be configured with Optical Interface Couplers (three OICs included) at 90° for fluorescence applications. Add a third OIC at 180°s to make transmission and fluorescence measurements simultaneously. The cell's pathlength can easily be adjusted from 0.5-15.0 mm.

PRO-FC-FL+TR: $3,750

Fluorescence Flow Analysis PMT

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.

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 source options include tungsten, mercury vapor, LEDs and laser diodes. Emission and excitation filters are mounted in slots in the system, allowing for easy removal. Though the system uses a 25 µL flow-through cuvette, you can also use standard 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	
Dimensions:	~13 cm x 18 cm x 25.4 cm
Spectral range:	310-750 nm (filter/lamp selection dependent)
Detector:	Photo-counting photomultiplier tube
PMT dynamic range:	2 x 10^6
Responsivity:	5 x 10^{17} cps/watt (@ 400 nm)
Detection limits:	10 parts per trillion measured with fluorescein @ 200 msec integration time and internal LED
Pulse-pair resolution:	10 ns
Flow cell :	10 mm path, 25 µL volume with flow-through cuvette
Filters:	Your waveband choice of 1 excitation filter and 1 emission filter (call for options)
Computer interface:	RS-232 to Windows 98/Me/2000/XP OS

Fiber Optic Scanning Monochromator

Monochromator Allows 2 nm Bandwidth

The MonoScan2000 is a computer-controlled scanning monochromator with a 300-700 nm wavelength range. It takes the MonoScan2000 only three seconds to scan from 300-700 nm. To scan only one nanometer takes about 15-20 milliseconds. The MonoScan2000 is compatible with all Ocean Optics spectrometers, light sources, accessories and optical fibers.

Use as a Tunable Light Source or Excitation for Fluorescence

In this setup, a broadband light source provides light via optical fiber to the MonoScan2000. You select a 2-to-3 nm bandpass in which the light passes before exiting the MonoScan, interacting with a sample and passing to a spectrometer. In this situation, the MonoScan takes the place of a filter. A scanning monochromator is better able to provide excitation intensity than a filter because of the monochromator's ability to reject out-of-band illumination. Filters can provide adequate excitation intensity but at reduced optical transmittance because they typically have a wider bandpass. You often sacrifice dynamic range with filters.

Use with Single-element Detector

A light source provides light via optical fiber to a sample, interacts with the sample, and sends light to the MonoScan2000. The monochromator captures the incoming light, transmits it via fiber to a single-element detector, such as a photodiode, one wavelength at a time. The MonoScan2000 allows a high optical throughput and provides an intense spectral signal. The MonoScan has the ability to scan through a wavelength range you select via software. Because the MonoScan has no slit, the diameter size of the optical fiber determines the optical resolution of the system. When using 200 µm fibers, for example, optical resolution is <3 nm (FWHM).

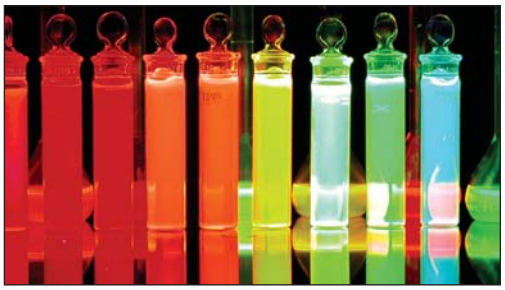
MonoScan2000: $5,219

Specifications	
Dimensions:	112 mm x 132 mm x 145 mm
Weight:	1.1 kg
Wavelength range:	300-700 nm
Optical resolution:	Fiber diameter dependent; ~4 nm (FWHM) using a 400 µm fiber
Holographic grating:	1250 l/mm, blazed at 350 nm
Accuracy:	<0.5 nm
Repeatability:	0.2 nm
Transition speed:	From wavelength to wavelength is ca 3s 300-700 nm 1 nm step ~ 15 ms
Dispersion:	~10 nm per mm
Optical throughput:	>50% with a 1000 µm fiber at 350 nm >30% with a 1000 µm fiber at 500 nm
Grating scan angle:	14.8° (300-700 nm)
Computer interface:	USB and RS-232
Power requirement:	12 VDC max. 1.2A (WT-12V-E)
Gearbox ratio:	1:261

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.

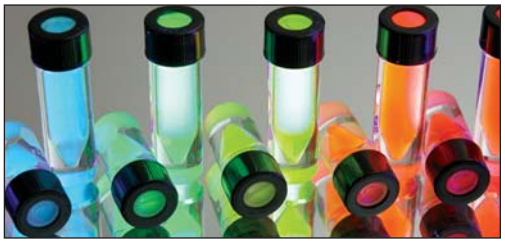
EviDot Core & Core-shell Nanocrystals



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 Kit. Choose 6 vials 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)	6	0.5 mg dots in 4 mL of toluene solvent	$699
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

EviTag Core-shell Nanocrystals



EviTag Nanocrystals are Core-shell Nanocrystals with an additional proprietary coating that makes the Core shells water-stable. These EviTags are cadmium selenide nanocrystals with a zinc sulfide shell. Carboxyl ligands are attached to the proprietary coating so that they can easily be bound to nucleic acids, antibodies and proteins, making the EviTag technology available to life science applications.

Item Code	Description	Volume per Vial	Price
QD-T2-MP-1V	Single vial of cadmium selenide nanocrystal compound with a zinc sulfide shell (CdSe/ZnS) and a proprietary coating containing carboxyl terminal groups; specify one of the following • 490 nm • 520 nm • 540 nm • 560 nm • 580 nm • 600 nm • 620 nm	6 nanomoles of EviTags per 0.5 milliliters of deionized water	$399
QD-T2-MP-A-1V	Single vial of cadmium selenide nanocrystal compound with a zinc sulfide shell (CdSe/ZnS) and a proprietary coating containing amine terminal groups; specify one of the following • 490 nm • 520 nm • 540 nm • 560 nm • 580 nm • 600 nm • 620 nm	6 nanomoles of EviTags per 0.5 milliliters of deionized water	$399

FluoroVette Micro-volume Cells

Fluorescence Cells for Nano-molar Detection

The FluoroVettes are ultra low-volume, disposable cells for nano-molar range fluorescence detection. Only 50 µL of fluid fills the microfluidic channel of a FluoroVette, which then slides into a 1-cm cuvette adapter for use in a fluorescence setup with a spectrometer and cuvette holder.

Advantages Versus Cuvettes

For only $125, you receive 10 disposable FluoroVettes with a Cuvette Adapter, making these cells a great alternative to expensive quartz cuvettes. For the price of one micro-volume quartz cuvette, you could use over 30 disposable FluoroVettes with no risk of sample contamination.

Two Types of Disposable 50 µL FluoroVettes

There are two types of FluoroVettes. The CFV-PIP-SP has an inlet port for loading the sample into the FluoroVette with a standard 20-200 µL pipetter and ordinary tips, making it a snap to fill and perform measurements. The CFV-PUMP-SP has tubing barbs at the inlet and outlet ports so the FluoroVette can be used in continuous or flow injected measurements using a syringe or peristaltic pump. Each type of FluoroVette slips easily into the Cuvette Adapter for using with a standard 1-cm cuvette holder, such as our CUV-ALL-UV 4-way Cuvette Holder. The Cuvette Adapter's two ports are positioned at 90° for fluorescence measurements. (See complete setup below.)

In this setup, the CFV-PUMP-SP FluoroVette and Cuvette Adapter sit in a CUV-ALL 4-way Cuvette Holder. A pump circulates the sample through the FluoroVette.

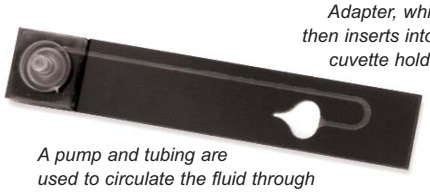
High-sensitivity Applications of Precious Samples

FluoroVettes are easy to fill and empty, making it possible to perform a dilution series to optimize data from scarce samples. The FluoroVettes are ideal for a variety of real-time high-sensitivity fluorescence applications, such as

- Assay development with quantum dots
- GFP-based assays
- Protein conformation analysis
- DNA quantification via Pico-Green assay reagent
- Cell marker identification
- Enzyme inhibitors using FRET Assays

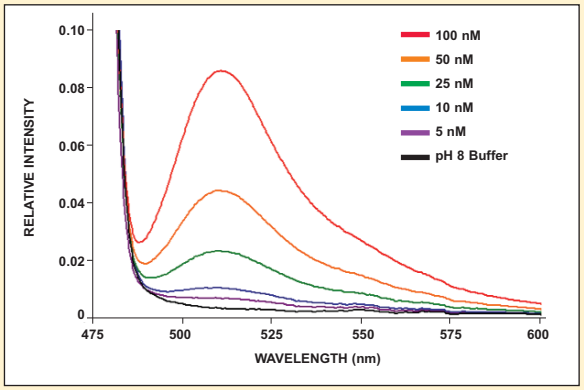
A pipetter is used to inject fluid into the CFV-PIP-SP FluoroVette.

A FluoroVette slides into the top of the Cuvette Adapter, which then inserts into a cuvette holder.



A pump and tubing are used to circulate the fluid through the CFV-PUMP-SP FluoroVette.

Fluorescein Spectra in pH 8 Buffer



Detection of fluorescein in the nanomolar range (nM) is typical with FluoroVettes. These spectra were made with a CFV-PIP-SP, USB2000-FLG Spectrometer, LS-450 Blue LED, CUV-ALL-UV Cuvette Holder, 1000 µm illumination fiber and 600 µm read fiber. The integration time was 1000 msec; a longer integration time provides even lower detection limits.

Specifications	
Size:	50 mm tall, 9 mm wide, and 1 mm thick
Volume:	50 µL
Pathlength:	0.75 mm
Detection limit:	5 nM detection limit of fluorescein with pH 8 buffer and 1000 msec integration time
Dead volume:	1 µL for pipette interface; for tubing interface, dead volume depends on tubing length
Wavelength range:	220-2500 nm
Accuracy:	FluoroVettes are linear over the concentration range, typical error is less than 5%

Item	Description	Price
CFV-PIP-SP	Pack of 10 FluoroVettes with pipetter interface (for use with a pipetter) and one FluoroVette Cuvette Adapter Assembly for 1-cm standard cuvette holders	$125
CFV-PUMP-SP	Pack of 10 FluoroVette Flow Cells with tubing interface (for use with pump and tubing, neither included) and one FluoroVette Cuvette Adapter Assembly for 1-cm standard cuvette holders	$125

Cosine Correctors: 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.

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

Direct-attach Option

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

Diffusing Material: UV-VIS or VIS-NIR

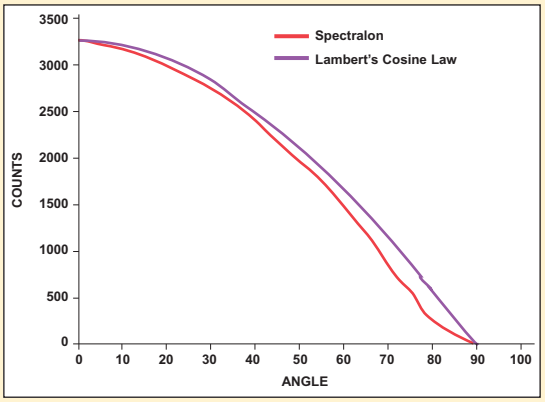
The diffusing material used in the cosine corrector is a thin disk of opaline glass (350-1100 nm) or Spectralon (200-1100 nm) that sits at the end of a stainless steel barrel.

CC-3:	$99
CC-3-UV:	$129
CC-3-DA:	$299

Specifications

	CC-3	CC-3-UV	CC-3-DA
Diffusing material:	Opaline glass	Spectralon	Spectralon
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°

CC-3-UV Angular Response



The response of the Spectralon disc (red trace) used in the CC-3-UV closely matches that of Lambert's Cosine Law.

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 105) 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 56.

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: 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. Other options are the USB-ISP-50 or USB-ISP-80, which directly attach to a USB2000 and USB4000 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	$1,337
ISP-50-8-I	Integrating sphere, 80 mm diameter, 78 mm high	8 mm	600 µm	$1,741
ISP-80-8-I	Integrating sphere, 107 mm diameter, 117 mm high	8 mm	400 µm	$2,156
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	$202
USB-ISP-50-I	ISP-50-8-I designed to directly attach to a USB2000 or USB4000 Spectrometer	8 mm	600 µm	$2,217
USB-ISP-80-I	ISP-80-8-I designed to directly attach to a USB2000 or USB4000 Spectrometer	8 mm	600 µm	$2,632
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	$335
HL-2000-CAL-ISP	NIST-traceable radiometric standard for use with ISP-50-8-I; see page 133	N/A	N/A	$883

FOIS-1 Fiber Optic Integrating Sphere

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
		Spectral range:	200-2500 nm
Top mounts:	(2) 6-32; (2) 8-32; (1) 1/4-20	Sample port:	9.5 mm aperture
Side mounts:	SMA 905 Connector; (1) 8-32	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 133.

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: $1,739
ISP-50-8-R: $2,009
ISP-80-8-R: $2,424
ISP-50-8-R-GT: $2,163
ISP-PORT-1: $172
ISP-PORT-2: $335

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:	900-hour bulb; 3100 K color temp.	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: $396

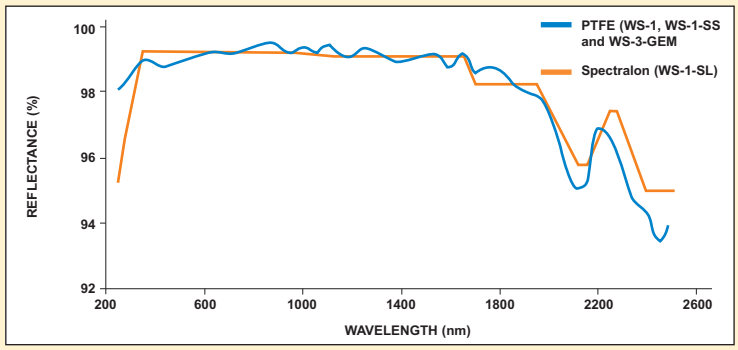

WS-3-GEM

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: $530

Reflectivity of the White Standards



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	30 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.

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

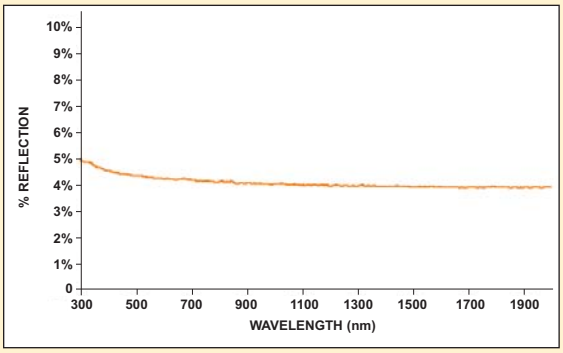
For High Reflectivity

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.

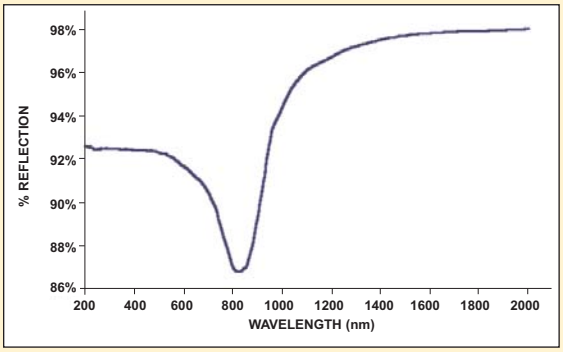
Reflectance of STAN-SSL at 6°



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.

Reflectance of STAN-SSH at 6°



Holder Protects Standards

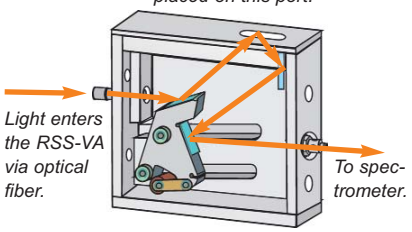
We also offer a holder for use with our reflectance standards. The STAN-HOLDER supports a standard during measurements, which helps to preserve its coating.

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

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)

Variable-angle Reflection Sampling System



Measure Optical Substrates at Different AOI

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 (AOI). When coupled to our spectrometers and light sources, the RSS-VA becomes a compact alternative to unwieldy, high-priced systems typically used to characterize optical substrates.

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. Also included is a three-point surface mount for holding the sample in a fixed position. To normalize measurements taken with the RSS-VA, you will need a reflectance standard such as the Specular Reflectance Standards on page 108.

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

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

Reflection & Transmission Stages

The Single-Point Reflection Stage (at right) 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 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 Stage has an anodized base plate scored in concentric circles of varying diameters, to act as a guide when positioning round samples.

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 used 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. 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. 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.

STAGE: $631
STAGE-RTL-T: $2,303

Specifications

	STAGE	STAGE-RTL-T
Dimensions:	152.4 mm diameter (base)	206.3 mm diameter (base)
Dimensions:	101.6 mm diameter* (sample area)	152.4 mm diameter (sample area)
Weight:	620 g	4.5 kg
Height:	Rail height adjustable to 63.5 mm	Rail height adjustable to 400 mm
Materials:	Anodized aluminum plate, stainless steel post and post holder	Anodized aluminum

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

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

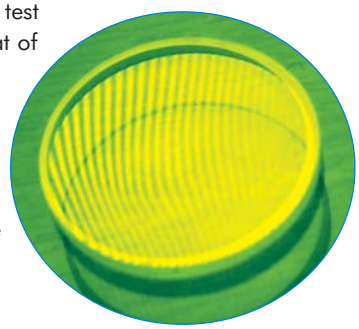
We offer single-sided flats made from either fused silica or Zerodur, each of which can be enhanced with an aluminum coating to increase contrast and improve the visual reference. We manufacture flats ranging from 1" to 6" in diameter and with flatness accuracies as precise as 1/20 wave.

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

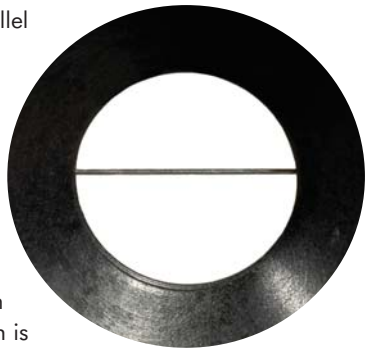
Use Shear-plate Collimation Testers to examine and adjust the collimation of laser light, or to measure the wavefront curvature and divergence/convergence magnitude of large-radius optical components.

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

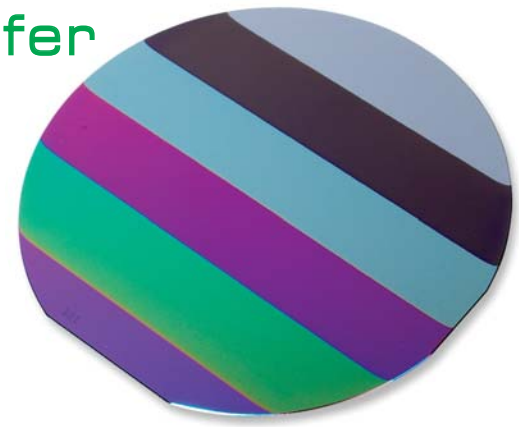
5-step Wafer

When measuring the thickness of substrates such as silicon wafers or optical layers, consider our Silicon-Silicon Dioxide (Si-SiO_2) 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).

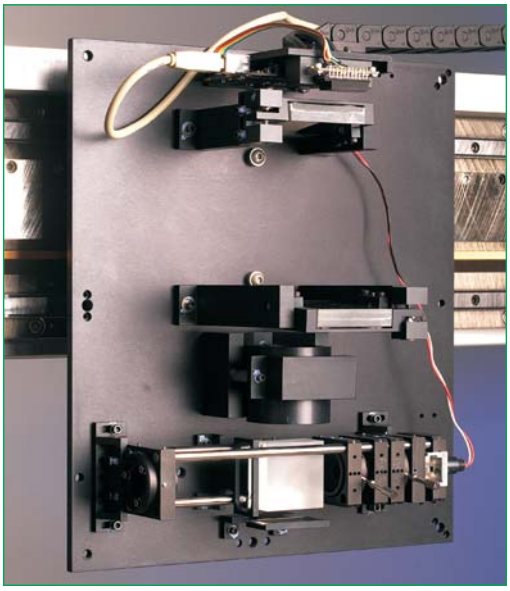
REFERENCE: $669



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)

Long Trace Profilometer



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

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 one 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

Filter Sample Holders

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 six millimeters 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.

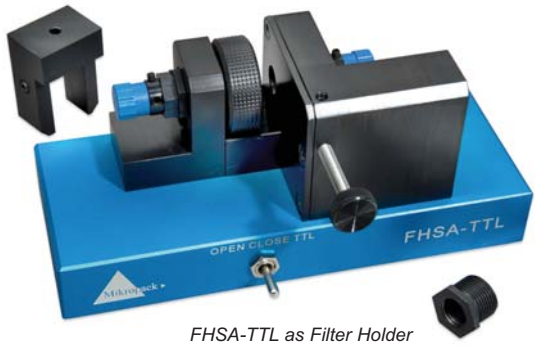
FHS-UV: $399

FHS-UV In-line Filter Holder

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 seven millimeters 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.

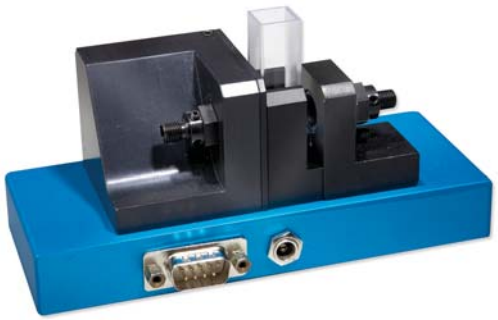
FHSA-TTL: $1,332
FHSA-RS232: $2,349



FHSA-TTL as Filter Holder

Specifications

	FHSA-TTL	FHS-UV
Dimensions:	140 mm x 50 mm x 50 mm	50.6 mm x 140 mm x 43.1 mm
Weight:	490 g	240 g
Power consumption:	100 mA @ 12 VDC	None
Filter size (maximum):	Any sample up to 7 mm thick	25-mm diameter round; any sample up to 6-mm thick
Light source:	None	None
Wavelength range:	200-2000 nm	200-2000 nm
Optical fibers required:	Yes	Yes
Cuvette dimensions:	10 mm x 10 mm	None
Shutter frequency:	5 Hz/60 dB (maximum)	None
Shutter response time:	7 µsec	None



FHSA-TTL as Cuvette Holder

Filter Holders for Optical Fibers

The INLINE-FH In-line Filter Holder (top photos) 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 photos) 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. See page 164 for information on available filters for the INLINE-FH or FH-SMA.

INLINE-FH: $436
INLINE-OF: $102
FH-SMA: $142

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)

Linear Variable Filters

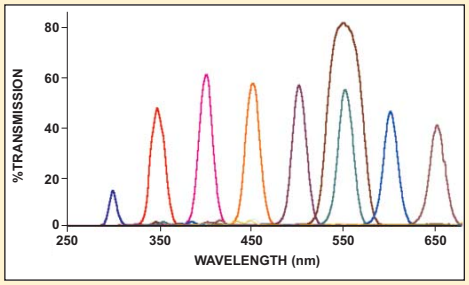
Novel Filtering Technology

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).

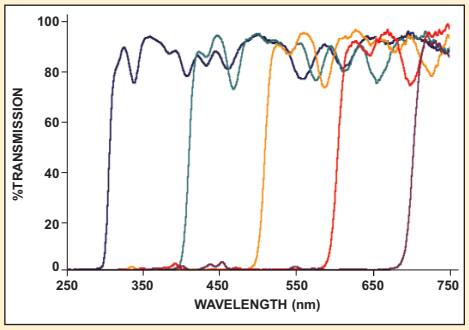
Single High-pass & Single Low-pass Filter

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%.

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.

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

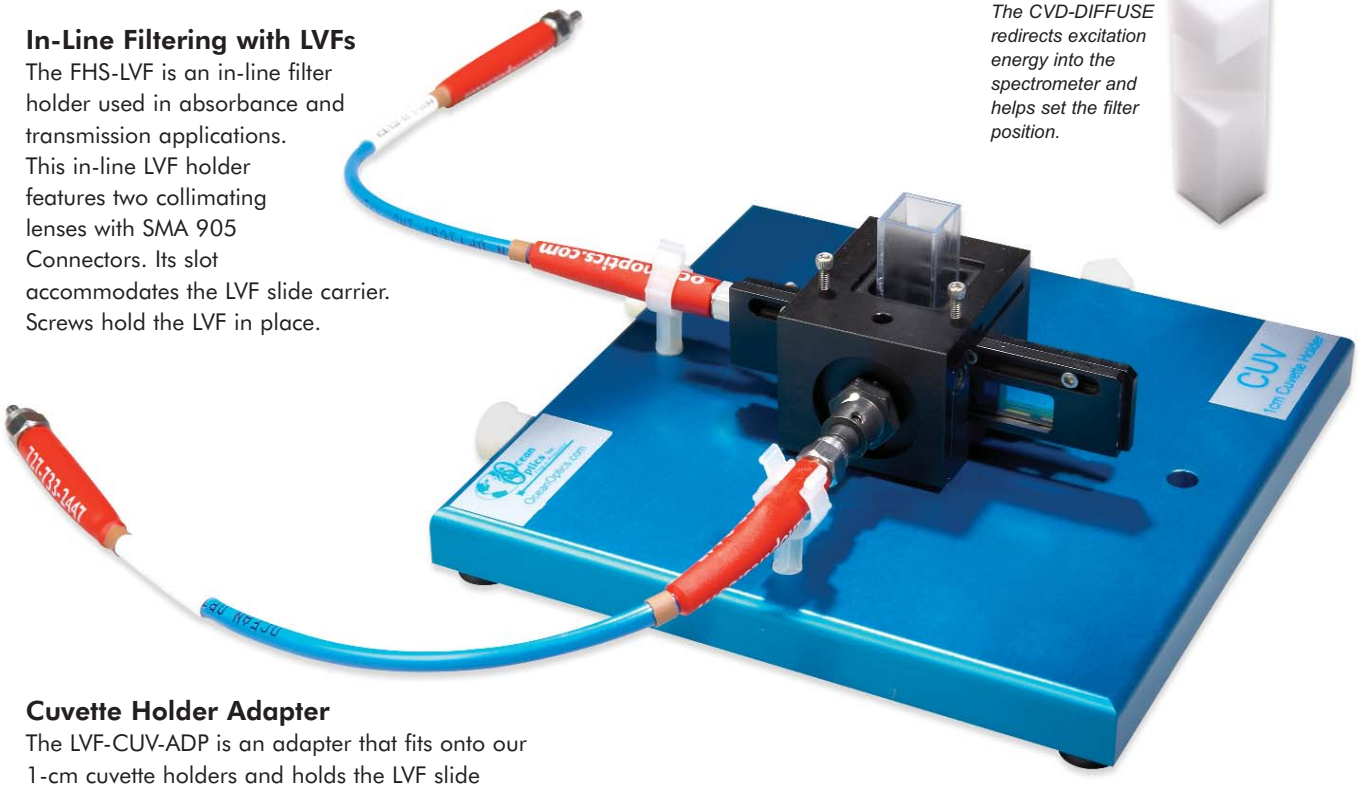
We offer several LVF Linear Variable Filters as either high-pass, low-pass or, when we use them as pairs -- as we do for the LVF-HL -- variable bandwidth filters. These filters are installed into slide carriers, which can accommodate both the single-filter and double-filter configurations. The slide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

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

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.

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



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.

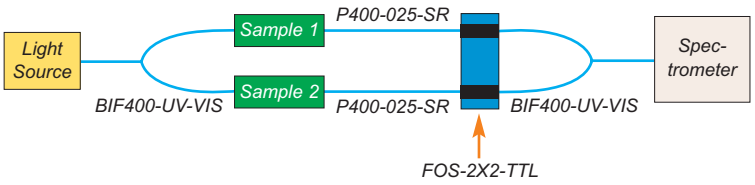
When using an LVF with a cuvette holder like our CUV-ALL 4-way Cuvette Holder, you will need the LVF-CUV-ADP Cuvette Holder Adapter. The LVF (in a slide carrier) is inserted in front of the sample and held in place by the LVF-CUV-ADP (shown at right), with a cover to block ambient light.

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

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. You can opt to have one light channel open at a time 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. Here 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 -- 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: $1,076

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

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 an excellent repeatability of 99%.

Multiple Versions

The MPM-2000 comes with either two input channels -- with each input channel corresponding to eight output channels -- or with one input channel and 16 output channels. 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:	$8,401
MPM-2000-1X16-VIS:	$8,401
MPM-2000-2X8-UV:	$8,736
MPM-2000-2X8-VIS:	$8,736

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 µm fibers @ 650 nm
Motor:	Direct-current motor
Optical fibers:	400 µm 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

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 ±5 µm -- is ideal for spatial mapping of spectral features or for multisampling in microwell plates. See the table below for 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 (Z-axis) stage, you can attach holders for probes and other 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. Contact an Applications Scientist for details.

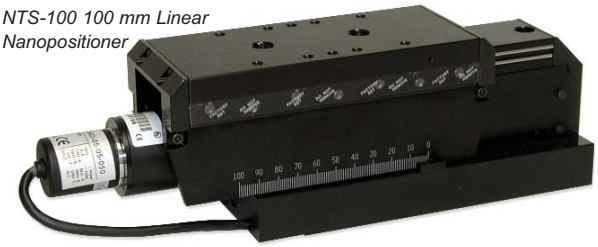
Item	X-axis	Y-axis	Z-axis	Price
XY(Z)-150 X150+	150 mm	150 mm	Optional	$12,650
XY(Z)-200X150+	200 mm	150 mm	Optional	$13,119
XYZ-150 X150X100	150 mm	150 mm	100 mm	$15,397
XYZ-200X150X100	200 mm	150 mm	100 mm	$15,866
Z-AXIS-100+	None	None	100 mm	$2,896

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

NTS-series Linear Nanopositioners

NTS-25 25 mm Linear Nanopositioner

NTS-100 100 mm Linear Nanopositioner



NTS-ND-3 Controller

Item	Description	Price
NTS-10	Nanopositioner, 10 mm travel	$3,500
NTS-25	Nanopositioner, 25 mm travel	$3,800
NTS-100	Nanopositioner, 100 mm travel	$4,950
NTS-ND-1	NTS Controller, 1 axis	$2,000
NTS-ND-2	NTS Controller, 2 axes	$2,500
NTS-ND-3	NTS Controller, 3 axes	$3,000
NTS-NJ	Joystick controller	$400
NTS-SOFTWARE	NTS Operating Software	Free

LabVIEW software available; contact an Applications Scientist for details.

The NTS-series Linear Nanopositioners are software-controlled linear nanopositioning systems that combine superior 0.4 nm high-resolution incremental movement and extended travel range (10 mm, 25 mm and 100 mm). Competing technologies are limited in that they provide either high resolution or extended travel range, but not both. What's more, the systems offer long-term stability in open loop mode of less than 2 nm drift per hour for high repeatability and accuracy. The NTS-series Nanopositioners can be used in applications including metrology, semiconductor analysis, microscopy, cell manipulation, microlithography and fiber optic alignment.

The nanopositioners feature piezoelectric motors that have high torque (0.2 Newton meter), variable speeds and high angular resolution. Additionally, the motor uses a shaft-mounted 4000 counts/revolution optical encoder. These features enable both continuous or step operation modes to provide accurate angular positioning. For details on the NTS Nanopositioners and Controllers, visit www.oceanoptics.com/products/nts10.asp.

Features include:

- Resolution of 1 nm and wide velocity range (5 orders)
- Acceleration time to maximum velocity less than 0.3 ms
- Continuous or stepping modes
- Self-locking technology, eliminated "stick-slip" effect
- DSP Controllers for 1-, 2- or 3-channel configurations enable wide dynamic range and high accuracy
- Stages support loads up to 3 kg