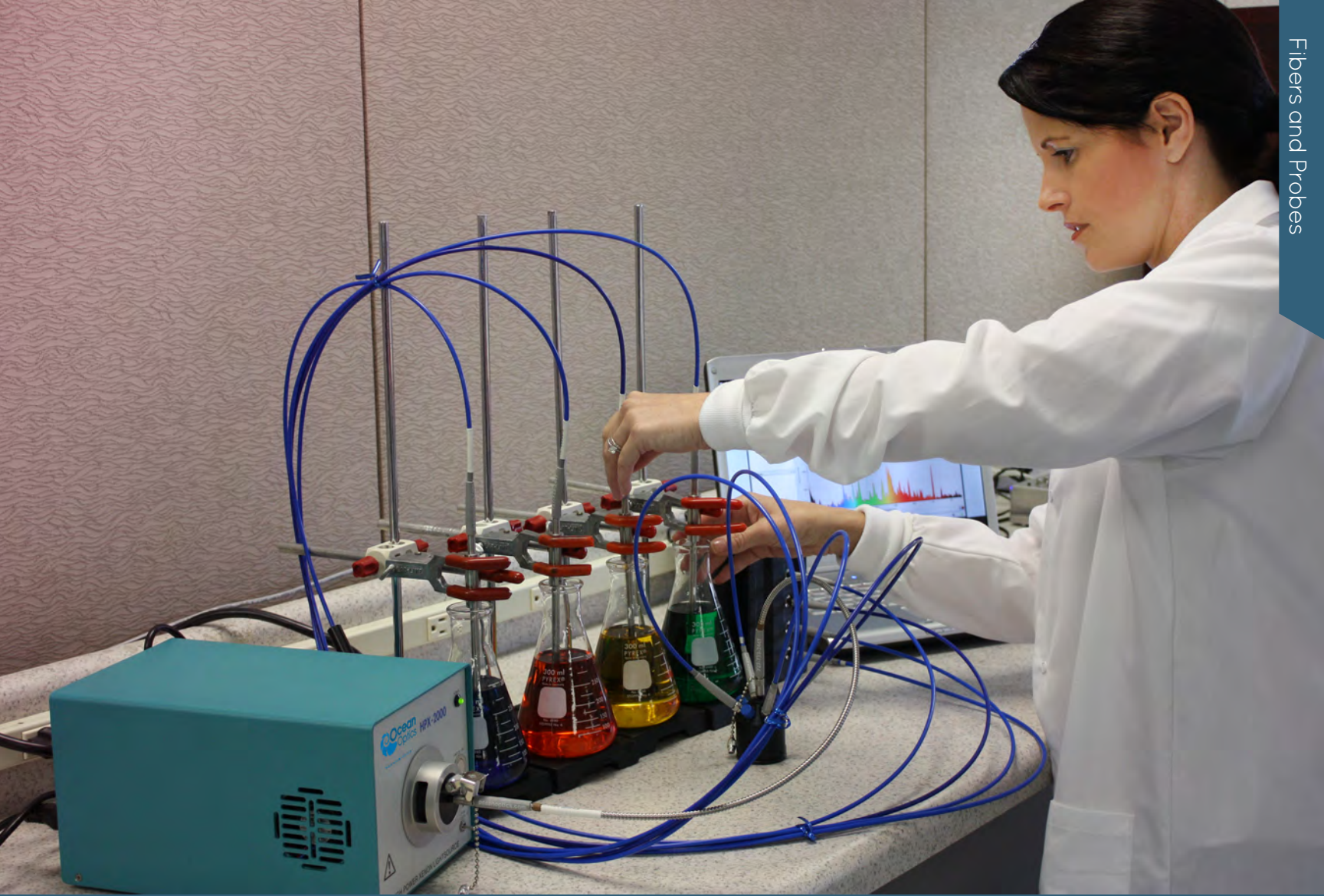


Fibers and Probes

Ocean Optics provides the most flexible line of optical fibers available. We craft our standard and custom fiber assemblies to provide you years of reliable, accurate results. You can depend on Ocean Optics for everything from one-off patch cords and custom assemblies to OEM builds for virtually any application you can imagine.

Our fiber accessories, fixtures and fiber assembly kits allow you to easily connect or manipulate fibers and integrate them into the most challenging application setups.

Tip

To get the most from your Ocean Optics optical fiber, it's important to use special care in handling. Never bend or wind fibers tightly and always store in a cool, dry place.

Fibers and Probes

The Most Flexible Line in the Industry

Anatomy of an Assembly

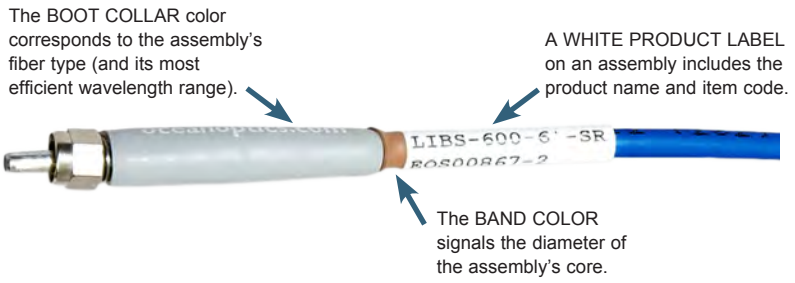
At the fiber's core is pure silica; it's the diameter of the core that you need to consider when purchasing an optical fiber assembly. (The core diameter is often in the product's item code. For example, the QP600-UV-VIS has a 600 µm diameter silica core).

Surrounding the core is a doped-fluorine silica cladding. A buffer material is then applied. A buffer coats the core and cladding , strengthens the fiber and reduces stray light even further. In most assemblies polyimide is used as the buffer; other assemblies use aluminum or acrylate. Then a jacketing is applied over the core, cladding and buffer to protect the fiber and provide strain relief.

For off-the-shelf Premium-grade "Q" Optical Fiber Assemblies, the standard jacketing is stainless steel silicone monocoil. There are several other jacketing options when creating a custom assembly. Precision SMA 905 Connectors terminate the assembly and are precisely aligned to the spectrometer's slit to ensure concentricity of the fiber. Finally, captive end caps protect the fiber tips against scratches and contaminants.

Assembly Identifiers

Our optical fiber and probe assemblies are clearly and cleanly labeled in three ways so that you always know the following about your assembly: its name, its core diameter, and its most efficient wavelength region.



Band Colors

The assembly's band color lets you know the fiber type and the most efficient wavelength range in which your fiber will work.

A color band tells you the diameter fiber with which you are working.

8 µm	Purple
50 µm	Blue
100 µm	Green
200 µm	Yellow
300 µm	Gray
400 µm	Red
500 µm	Orange
600 µm	Brown
1000 µm	Clear

Boot Color	Fiber Type	Most Efficient Wavelength Range	Premium-grade Optical Fiber Assembly for each Fiber Type
Gray	UV-VIS XSR Solarization-resistant	180-800 nm	
Gray	UV/SR-VIS High OH content	200-1100 nm	
Blue	UV-VIS High OH content	300-1100 nm	
Red	VIS-NIR Low OH content	400-2100 nm	
Black	Fluoride	300-4500 nm	

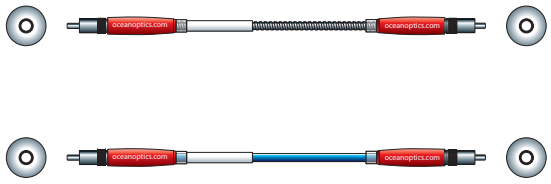
Note: An additional option for mid-IR wavelengths (2000-6000 nm) is Chalcogenide fiber. Standard assemblies are available.

Fibers and Probes: Overview

Standard Assemblies and Probes

From these half-dozen standard fiber designs, you can tackle an extensive range of absorbance, emission and reflectance spectroscopy needs. All Ocean Optics fibers have SMA 905 terminations for connecting to our spectrometers and accessories. Custom configurations, multiple-fiber bundles and special ferrule designs are also available.

Patch Cord Assemblies

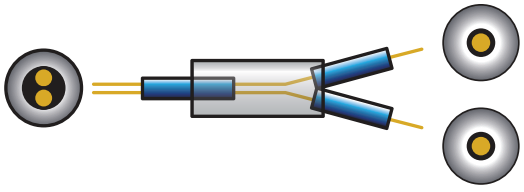


Our patch cord assemblies consist of a single fiber. Our standard, premium-grade options are available with stainless steel BX (top drawing) or silicone monocoil jacketing and PVDF.

Round to Keyed Linear Fiber

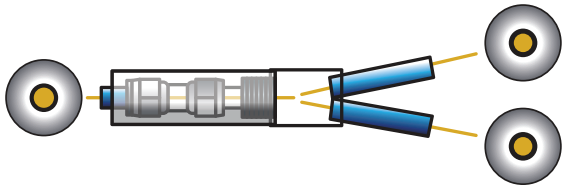
At one end of this seven-fiber assembly, the fibers are aligned linearly to more efficiently direct light into the optical bench and onto the detector. The collection end of the fiber has a six fibers-around-one design.

Bifurcated Fiber



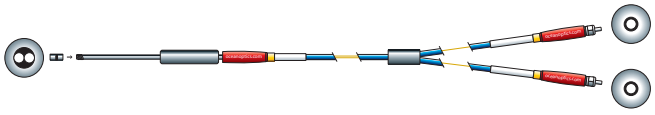
Bifurcated assemblies have two fibers side-by-side in the common end and break out into two legs at the other end. Each leg can be UV-VIS or VIS-NIR or mixed.

Splitter



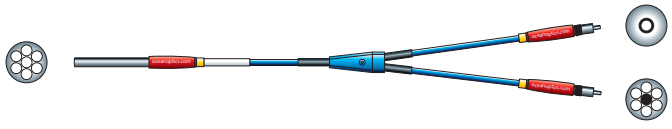
A splitter comprises three fibers – two fibers at one end that deliver light into the third fiber at the common end. All the fibers are epoxied together at the nexus of the assembly.

Transmission Dip Probe



We offer several versions of this standard two-fiber transmission probe, designed for immersion in process streams and solutions. Various pathlength tips are available.

Premium Reflection Probe



Our standard reflection probe arrangement has seven optical fibers – six illumination fibers around one read fiber – in a stainless steel ferrule. Additional configurations are available.

Fibers and Probes: Overview

Transmission Characteristics of UV-VIS Options

Ocean Optics offers fiber material types with wavelength ranges to best match your application. On these pages are the attenuation curves for each of the fiber types we offer. High OH, or high water content fiber, is optimized for transmission in the UV-VIS. For work in the UV, especially <300 nm, our XSR and UV/SR-VIS fibers are a fine choice. These silica-core fibers are doped with fluorine to mitigate the solarizing effects of UV radiation. An Applications Scientist can provide additional assistance.

Transmission Efficiency of Optical Fibers

Transmission efficiency is the ratio of light energy exiting an optical fiber to the energy that is projected onto the other end. Transmission of light by optical fibers, however, is not 100% efficient. Energy is lost by reflection when light is launched into the fiber and at the other end when it exits the fiber. This is called Fresnel reflection and occurs when light travels across an interface between materials with different refractive indices.

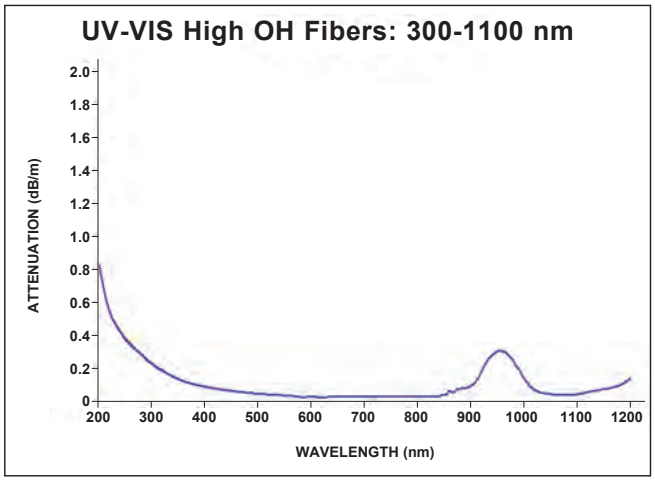
Ideally, light would travel inside the fiber by total internal reflection without any loss of energy. However, several factors can degrade the light during transmission and cause attenuation or absorption of light in the fiber.

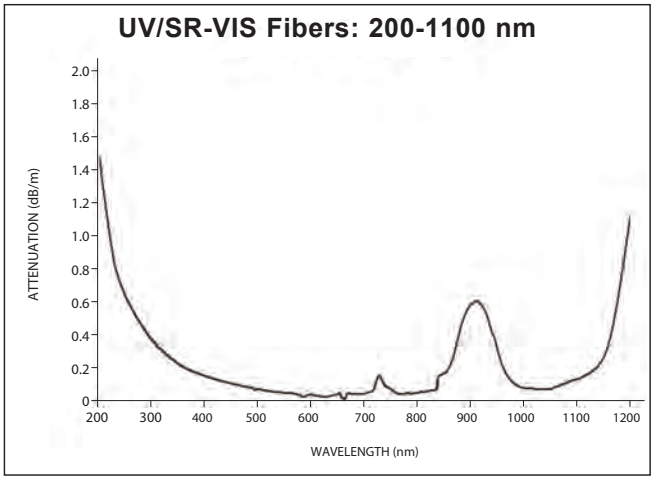
One reason for degradation of light is the presence of tiny imperfections in the fiber material, causing light at lower wavelengths to scatter. The fiber is also not completely transparent at all wavelengths. For example, high OH fiber is designed to transmit as much light as possible in the UV. However, the extra water has an absorption band that leads to dips in transmission efficiency in the NIR. To achieve good transmission in the NIR, the fiber material must be low OH.

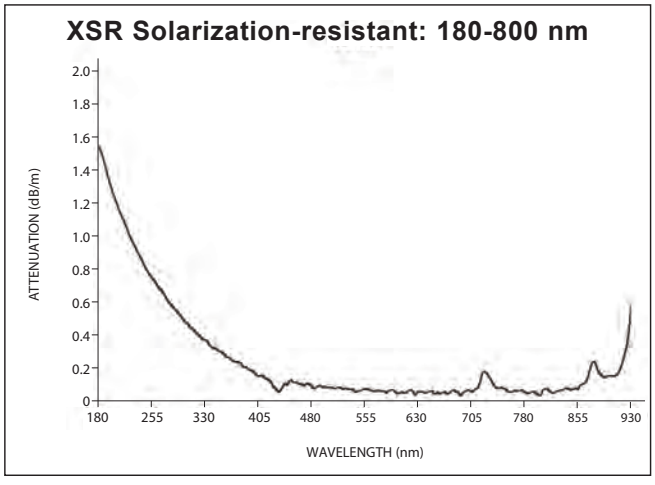
Another loss in transmission efficiency results from the evanescent field. When the light bounces off the interface between the core and cladding inside the fiber, its electric field penetrates the cladding. If the cladding material absorbs the light, the fiber will lose some of its energy.

Bending of fibers also contributes to attenuation. As the fiber is bent, it changes the angle at which light rays are striking the surface between the core and cladding. If the fiber is bent enough, light that had been below the critical angle will now exceed the critical angle and leak out of the fiber. Most of the bending occurs where a flexible fiber meets a rigid connector. To spread the bending along the length of the fiber, strain relief boots are added to the connectors.

Ocean Optics builds its fibers into assemblies that are cleaved, epoxied into precise SMA 905 or other connectors and polished with a very fine lapping film to reduce Fresnel reflection. The fiber is encased in mechanical sheathing to protect it and to provide good strain relief at the ends. As a result, the improvement in performance between Ocean Optics premium assemblies and ordinary telecom grade assemblies is quite significant.



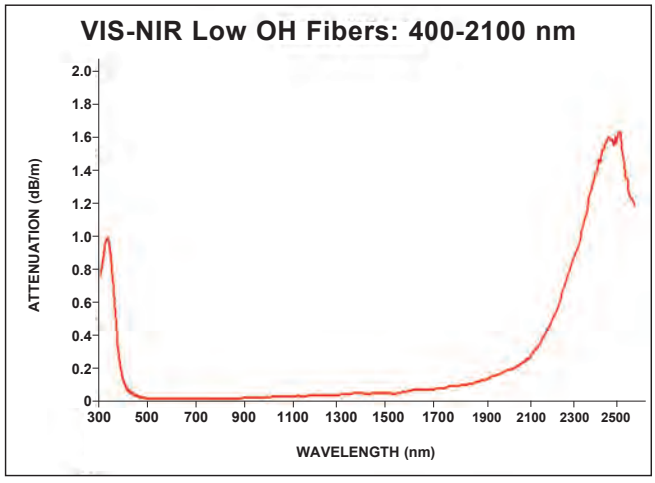


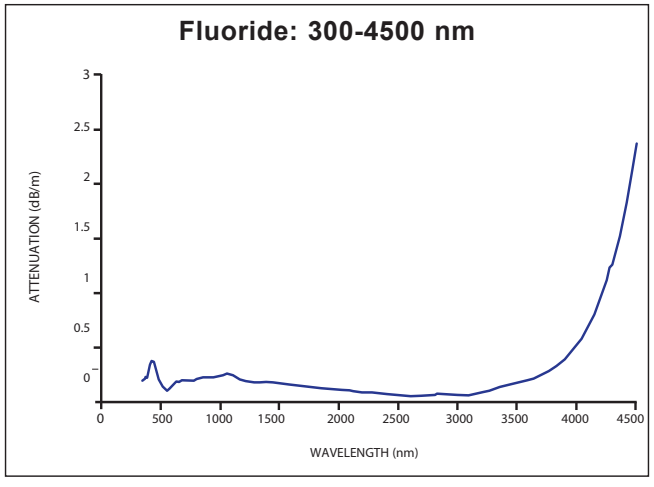


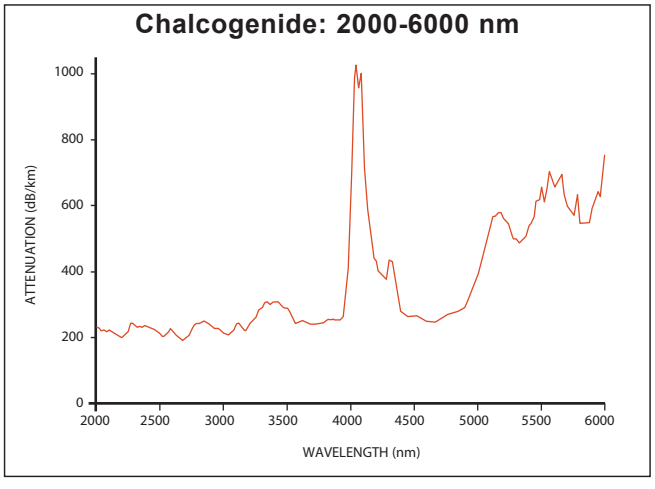
Fibers and Probes: Overview

Transmission Characteristics of VIS-NIR and Mid-IR Options

Ocean Optics offers several options for applications at higher wavelengths. For most Visible and Shortwave NIR setups, our low OH VIS-NIR fibers are a convenient, affordable option. If your work takes you farther into the NIR and mid-IR, consider our fluoride and chalcogenide fiber options. ZBLAN heavy-metal fluoride fibers are responsive to 4500 nm and distinguished by excellent IR transmittance performance. Chalcogenide fibers are responsive from 2000-6000 nm and characterized by low optical loss and great flexibility.



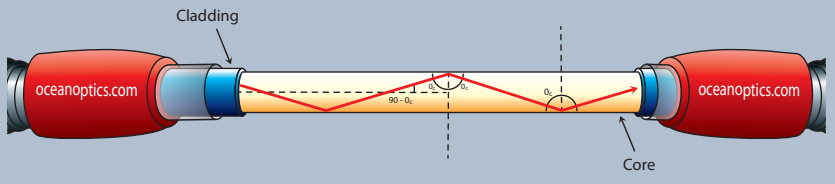




Numerical Aperture of Optical Fibers

Optical fibers are designed to transmit light from one end of the fiber to the other with minimal loss of energy. The principle of operation in an optical fiber is total internal reflection. When light passes from one material to another, its direction is changed. According to Snell's Law, the new angle of the light ray can be predicted from the refractive indices of the two materials. When the angle is perpendicular (90º) to the interface, transmission into the second material is maximum and reflection is minimum. Reflection increases as the angle gets closer to parallel to the interface. At the critical angle and below the critical angle, transmission is 0% and reflection is 100% (see figure below).

Light Passing Through an Optical Fiber



Snell's Law can be formulated to predict critical angle and also the launch or exit angle θ_{max} from the index of refraction of the core (n1) and cladding (n2) materials. The angle also depends on the refractive index of the media (n). Equation (1)

$$n \sin \theta_{max} = \sqrt{n_1^2 - n_2^2}$$

The left side of the equation is called the numerical aperture (NA) and determines the range of angles at which the fiber can accept or emit light.

Ocean Optics fibers have a numerical aperture of 0.22. If the fiber is in a vacuum or air, this translates into an acceptance angle θ_{max} of 12.7° (full angle is ~25°). When light is directed at the end of an optical fiber all the light rays or trajectories that are within the +/-12.7° cone are propagated down the length of the fiber by total internal reflection. All the rays that exceed that angle pass through the cladding and are lost. At the other end of the fiber, light exits in a cone that is +/- 12.7°.

There are many types of fibers available, with a variety of numerical apertures. While a fiber with a larger numerical aperture will collect more light than a fiber with a smaller numerical aperture, it is important to look at both ends of the system to ensure that light exiting at a higher angle can be used. In optical sensing, one end is gathering light from an experiment and the other is directing light to a detector. Any light that does not reach the detector will be wasted.

Premium Grade Optical Fiber Assemblies

Our premium-grade fibers are durable, high quality fibers optimized for spectroscopy and enhanced with extra strain relief for use even in demanding environments. We have a full range of standard patch cords and can customize assemblies (see pages 138-139 for options). Also available are assemblies (see table at bottom) consisting of multiple fibers stacked in a linear arrangement at one end to deliver light more efficiently into the spectrometer.

Premium-Grade Assemblies				Assembly Length					Jacketing				Bend Radius	
Wavelength Range	Item Code	Core Diameter	Buffer/ Coating	0.25 m	0.5 m	1 m	1.5 m	2 m	Silicone monocoil	Stainless-steel BX	PVDF Furcation	PEEK	LTBR	STBR
UV-VIS High OH Content 300-1100 nm	QP50-2-UV-VIS QP50-2-UV-BX	50 µm	Polyimide					X	X	 X			4 cm	2 cm
	QP100-2-UV-VIS QP100-2-UV-BX	100 µm	Polyimide					X	X	 X			4 cm	2 cm
	QP200-2-UV-VIS QP200-2-UV-BX	200 µm	Polyimide					X	X	 X			8 cm	4 cm
	QP400-1-UV-VIS QP400-1-UV-BX QP400-2-UV-VIS QP400-2-UV-BX	400 µm	Polyimide			X X		 X X	X X	 X X			16 cm	8 cm
	QP600-025-UV-VIS QP600-025-UV-BX QP600-1-UV-VIS QP600-1-UV-BX QP600-2-UV-VIS QP600-2-UV-BX	600 µm	Polyimide	X X		 X X		 X X	X X X	 X X X			24 cm	12 cm
	QP1000-2-UV-VIS QP1000-2-VIS-BX	1000 µm	Acrylate					X X	X	 X			40 cm	20 cm
VIS-NIR Low OH content 400-2100 nm	QP8-2-VIS-NIR	8 µm	Acrylate					X	X				4 cm	2 cm
	QP50-2-VIS-NIR QP50-2-VIS-BX	50 µm	Polyimide					X X	X	 X			4 cm	2 cm
	QP100-2-VIS-NIR QP100-2-VIS-BX	100 µm	Polyimide					X X	X	 X			4 cm	2 cm
	QP200-2-VIS-NIR QP200-2-VIS-BX	200 µm	Polyimide					X X	X	 X			8 cm	4 cm
	QP400-1-VIS-NIR QP400-1-VIS-BX QP400-2-VIS-NIR QP400-2-VIS-BX	400 µm	Polyimide			X X		 X X	X X	 X X			16 cm	8 cm
	QP600-025-VIS-NIR QP600-025-VIS-BX QP600-1-VIS-NIR QP600-1-VIS-BX QP600-2-VIS-NIR QP600-2-VIS-BX	600 µm	Polyimide	X X		 X X		 X X	X X X	 X X X			24 cm	12 cm
	QP1000-2-VIS-NIR QP1000-2-VIS-BX	1000 µm	Acrylate					X X	X	 X			40 cm	20 cm
Fluoride 300-4500 nm	P450-0.5-FLUORIDE P450-1.5-FLUORIDE P450-1-FLUORIDE	450 µm	Acrylate		X	 X	 X				 X		15 cm	8 cm
Chalcogenide 2000-6000 nm	P500-0.5-CHAL P500-1-CHAL	500 µm	Fluoropoly-mer and PVC		X	 X						X X	7.5 cm	7.5 cm

Keyed SMA Optical Fiber Assemblies

Keyed SMA Optical Fiber Assemblies, Round to Keyed Linear				Assembly Length					Jacketing					
Wavelength Range	Item Code	Core Diameter	Buffer/ Coating	0.25 m	0.5 m	1 m	1.5 m	2 m	Silicone monocoil	Stainless-steel BX	PVDF Furcation	PEEK	LTBR	STBR
300-1100 nm	PL100-2-UV-VIS	100 µm ± 3 µm	Polyimide					x	x				4 cm	2 cm
400-2100 nm	PL100-2-VIS-NIR	100 µm ± 3 µm	Polyimide					x	x				4 cm	2 cm
300-1100 nm and 400-2100 nm	PL100-2-MIXED	100 µm ± 3 µm	Polyimide					x x	x x				4 cm	2 cm
300-1100nm and 400-2100 nm	PL200-2-MIXED	200 µm ± 4 µm	Polyimide					x	x				8 cm	4 cm

Note: Fiber bend radius is expressed as Long Term (LTBR) and Short Term (STBR).

Bifurcated Optical Fiber Assemblies

Premium-grade bifurcated assemblies have two fibers in the common end of the assembly that break out into separate legs. Splitters comprise three fibers epoxied at the nexus of a Y-shaped assembly and have lower transmission efficiency than bifurcated fibers.

Premium-grade Bifurcated Optical Fiber Assemblies				Assembly Length	Jacketing		Bend Radius	
Wavelength Range	Item Code	Core Diameter	Buffer/ Coating	2 m	Silicone monocoil	Stainless-steel BX	LTBR	STBR
VIS-NIR Low OH content 400-2100 nm	QBIF50-VIS-NIR	50 µm	Polyimide	X	X			
	QBIF200-VIS-NIR QBIF200-NIR-BX	200 µm	Polyimide	X X	X	 X	8 cm	4 cm
	QBIF400-VIS-NIR QBIF400-NIR-BX	400 µm	Polyimide	X X	X	 X	16 cm	8 cm
	QBIF600-VIS-NIR QBIF600-NIR-BX	600 µm	Polyimide	X X	X	 X	24 cm	12 cm
UV-VIS High OH Content 300-1100 nm	QBIF50-UV-VIS	50 µm	Polyimide	X	X		4 cm	2 cm
	QBIF200-UV-VIS	200 µm	Polyimide	X	X		8 cm	4 cm
	QBIF400-UV-VIS	400 µm	Polyimide	X	X		16 cm	8 cm
	QBIF600-UV-VIS	600 µm	Polyimide	X	X		24 cm	12 cm
300-1100 nm and 400-2100 nm (Mixed)	QBIF200-MIXED	200 µm	Polyimide	X	X		8 cm	4 cm
	QBIF400-MIXED	400 µm	Polyimide	X	X		16 cm	8 cm
Splitter Optical Fiber Assemblies								
VIS-NIR Low OH content 400-2100 nm	SPLIT200-VIS-NIR	200 µm	Polyimide	X	X		8 cm	4 cm
	SPLIT400-VIS-NIR	400 µm	Polyimide	X	X		16 cm	8 cm
UV-VIS High OH Content 300-1100 nm	SPLIT200-UV-VIS	200 µm	Polyimide	X	X		8 cm	4 cm
	SPLIT400-UV-VIS	400 µm	Polyimide	X	X		16 cm	8 cm

Solarization Resistant Optical Fiber Assemblies

We offer two types of solarization-resistant fiber assemblies, which prevent transmission degradation in the UV: polyimide-buffer fibers for applications <300 nm and aluminum-buffer fibers that offer enhanced UV transmission (signal will transmit to 180 nm) and resistance to UV degradation.

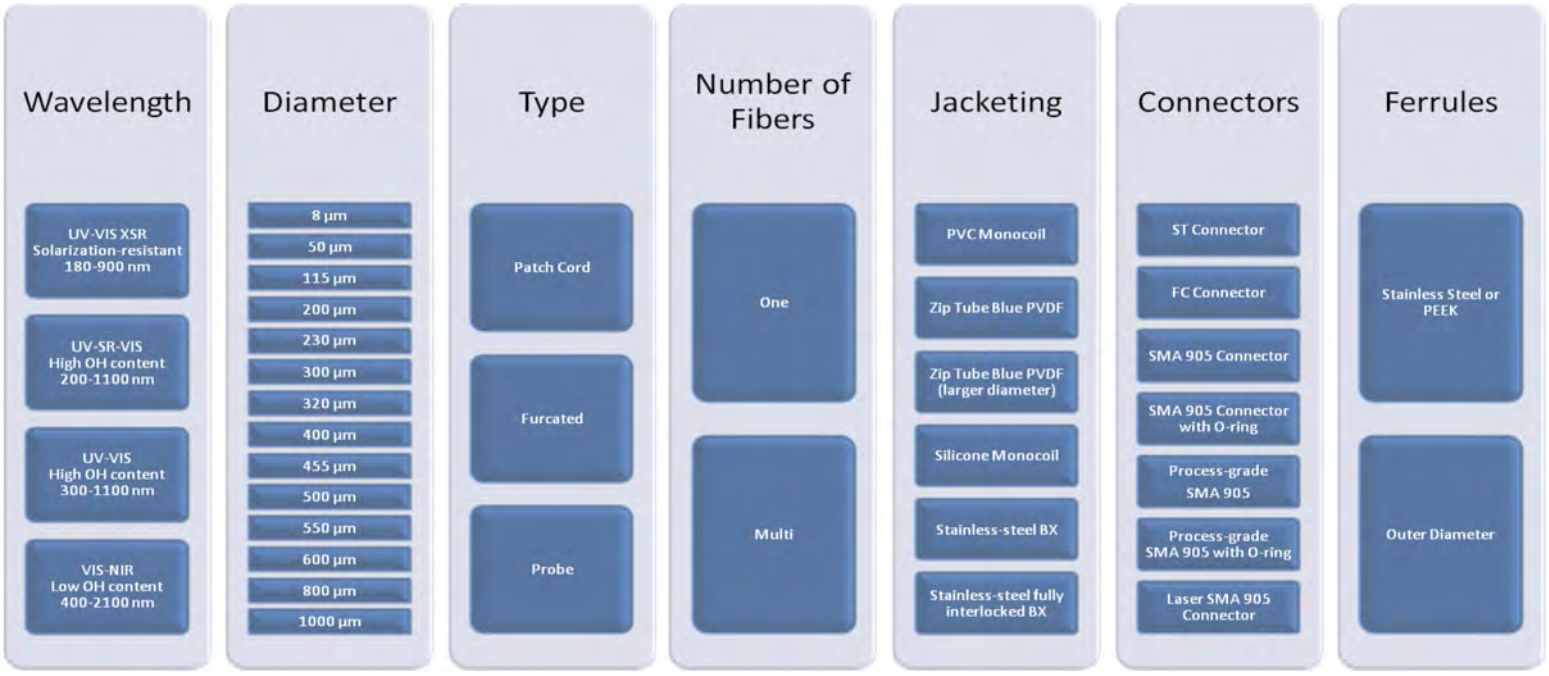
Extreme Solarization-Resistant				Assembly Length					Jacketing		Bend Radius	
Wavelength Range	Item Code	Core Diameter	Buffer/ Coating	0.25 m	0.5 m	1 m	1.5 m	2 m	Silicone monocoil	Stainless-steel BX	LTBR	STBR
UV/SR-VIS High OH content 200-1100 nm	QP200-2-SR-BX	200 µm	Polyimide					X		X	8 cm	2 cm
	QP300-1-SR QP300-1-SR-BX	300 µm	Polyimide			X X			X	 X	12 cm	6 cm
	QP400-025-SR QP400-025-SR-BX QP400-2-SR QP400-2-SR-BX	400 µm	Polyimide	X X				 X X	X X	 X X	16 cm	8 cm
	QP600-025-SR QP600-025-SR-BX QP600-1-SR QP600-1-SR-BX QP600-2-SR QP600-2-SR-BX	600 µm	Polyimide	X X		 X X		 X X	X X X	 X X X	24 cm	12 cm
UV-VIS XSR Solarization-resistant 180-900 nm	QP115-025-XSR-BX QP115-1-XSR-BX QP115-2-XSR-BX	115 µm	Aluminum (Primary)	X		 X		 X		X X X	4 cm	2 cm
	QP230-025-XSR-BX QP230-1-XSR-BX QP230-2-XSR-BX	230 µm	Aluminum (Primary)	X		 X		 X		X X X	4 cm	2 cm
	QP455-025-XSR-BX QP455-1-XSR-BX QP455-2-XSR-BX	455 µm	Aluminum (Primary)	X		 X		 X		X X X	8 cm	4 cm
	QP600-025-XSR-BX QP600-1-XSR-BX QP600-2-XSR-BX	600 µm	Aluminum (Primary)	X		 X		 X		X X X	24 cm	12 cm

Note: Fiber bend radius is expressed as Long Term (LTBR) and Short Term (STBR).

Fibers and Probes

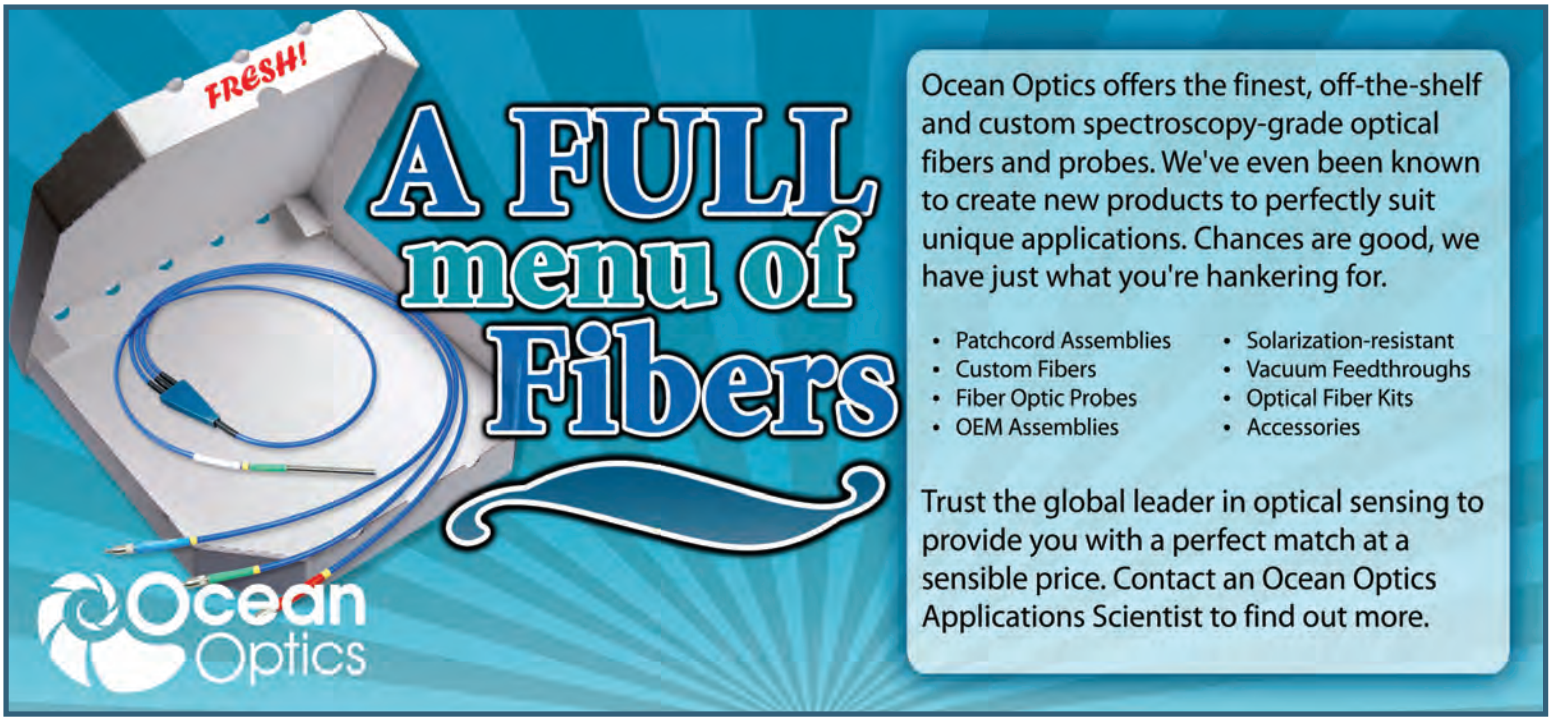
Custom Fiber and Probe Assemblies

Custom Fibers



After selecting the best fiber type, you should consider the diameter size of the pure silica core needed inside of your assembly. We offer several diameter sizes, and can recommend the appropriate assembly based on these criteria:

1. How much light do you need for your application? Reflection and fluorescence applications generally need more light, and larger diameter fibers are often better choices than smaller diameter fibers. For a laser application, however, we may suggest a smaller diameter fiber.
2. What is the entrance aperture size of your spectrometer? Make sure that your fiber diameter size and the entrance aperture to your spectrometer are compatible and are configured properly for your application needs.
3. If you have too much light in your setup, are there ways you can attenuate the light? We believe that it's better to have too much light than not enough.



Fibers and Probes
Custom Fiber and Probe Assemblies

Custom Option: Jacketing Options

The fiber assembly jacketing is designed to protect the fiber and provide strain relief. But we have jacketing options that can do so much more. We offer multiple jacketing options; our most popular selections are listed below.

Item		Description	Chemical Resistance	Steam Sterilizable	Mechanical Tolerance	Length Limits
1	PVC Monocoil	PVC covering SS monocoil only	Poor	No	Good	6 m
2	Zip Tube Blue PVDF	Best for budget-conscious applications; standard in Laboratory-grade Assemblies	Poor	No	Good	50 m
3	Zip Tube Blue PVDF	Best for budget-conscious applications; larger diameter than #2	Poor	No	Good	50 m
4	Silicone Monocoil	High-end jacketing; standard in Premium-grade Assemblies (sllicone covering SS monocoil)	Good	Yes	Good	20 m
5	Stainless-steel BX	OEM applications only; optional polyolefin heatshrink overcoat	Good	Yes	Poor	4 m
6	Stainless-steel fully interlocked BX	Excellent stainless steel jacketing supports longer lengths of fiber; optional polyolefin heatshrink overcoat	Good	Yes	Excellent	40 m

Custom Option: Connectors and Connector Adapters

Our fiber assemblies are available with several connector options. For an upgrade fee that includes the cost of the custom connector and labor, we will replace the standard SMA 905 Connector (included in the assembly price) with any custom connector from the list below. When ordering custom connectors, please specify the diameter size of the optical fiber to which it will be attached. You also can order connectors separately.

Item	Description
CONN-ST	Stainless-steel ST Connector
CONN-FC	Stainless-steel FC Connector
CONN-QSMA	Premium-grade SMA 905 Connector (standard in Premium-grade assemblies)
CONN-SMA	Laboratory-grade SMA 905 Connector (standard in Laboratory-grade assemblies)
CONN-QSMA-O	Premium-grade SMA 905 Connector with O-ring
CONN-SMA-O	Laboratory-grade SMA 905 Connector with O-ring

Custom Option: Ferrules for Probe Assemblies

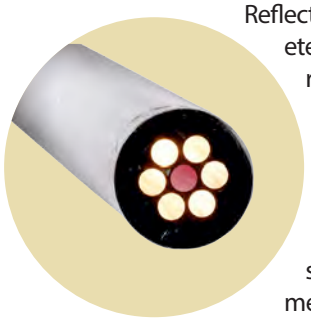
Description	Length
1/4” (6.35 mm) diameter stainless-steel dip probe often used in solution transmission measurements	3” (76.2 mm)
1/4” (6.35 mm) diameter PEEK dip probe used in harsh environments for solution transmission measurements	3” (76.2 mm)
1/4” (6.35 mm) diameter stainless-steel ferrule used in reflection measurements	3” (76.2 mm)
1/4” (6.35 mm) diameter PEEK ferrule used in harsh environments	3” (76.2 mm)
1/8” (3.2 mm) diameter stainless-steel ferrule	3” (76.2 mm)
1/16” (1.59 mm) diameter stainless-steel ferrule	2” (51 mm)
1/4” (6.35 mm) diameter stainless-steel ferrule with angled window	2” (51 mm)
Fiber-to-lens ferrule that comes with a collimating lens	2” (51 mm)

Reflection/Backscattering Probes

Our Reflection Probes are ideal for measuring diffuse or specular reflectance from solid surfaces or backscattering and fluorescence in solutions and powders. Probes are available in lab-grade (R-series) and premium-grade (QR-series) versions. Choose from nearly 40 standard options or customize a probe by selecting different lengths and other features.

Standard Reflection/Backscattering Probes			Fiber Bundle	Probe Ferrule		Jacketing				
Wavelength Range	Item Code	Core Diameter	6 illumination fibers around 1 read fiber	6.35 mm OD x 76.2 mm	3.18 mm OD x 74.3 mm	Silicone monocoil	Stainless-steel BX	Zip tube blue PVDF	LTBR	STBR
VIS-NIR Low OH content 400-2100 nm	QR200-7-VIS-NIR	200 µm	X	X		X			8 cm	4 cm
	R200-7-VIS-NIR		X	X				X		
	QR400-7-VIS-NIR	400 µm	X	X		X			16 cm	8 cm
	R400-7-VIS-NIR		X	X				X		
	QR400-7-VIS-BX		X	X			X			
	R400-7-VIS-BX		X	X			X			
	QR600-7-VIS-NIR	600 µm	X	X		X			24 cm	12 cm
	R600-7-VIS-125F		X		X			X		
	QR600-7-VIS-125F		X	X		X				
	QR600-7-VIS125BX		X	X			X			
UV-VIS High OH Content 300-1100 nm	QR200-7-UV-VIS	200 µm	X	X		X			8 cm	4 cm
	R200-7-UV-VIS		X	X				X		
	QR400-7-UV-VIS	400 µm	X	X		X			16 cm	8 cm
	R400-7-UV-VIS		X	X				X		
	QR400-7-VIS-BX		X	X			X			
	R400-7-VIS-BX		X	X			X			
	QR400-7-UV-BX		X	X			X			
	QR600-7-UV-VIS	600 µm	X	X		X			24 cm	12 cm
	R600-7-UV-125F		X		X			X		
	QR600-7-UV-125F		X		X	X				
	QR600-7-UV125BX		X		X		X			
UV/SR-VIS High OH content 200-1100 nm	QR200-7-SR	200 µm	X	X		X			8 cm	2 cm
	R200-7-SR		X	X				X		
	QR300-7-SR	300 µm	X	X		X			12 cm	6 cm
	R300-7-SR		X	X				X		
	QR400-7-SR	400 µm	X	X		X			16 cm	8 cm
	R400-7-SR		X	X				X		
	QR400-7-SR-BX		X	X			X			
	R400-7-SR-BX		X	X			X			
	QR600-7-SR-125F	600 µm	X	X		X			24 cm	12 cm
	R600-7-UV-125F		X		X			X		
	QR600-7-SR125BX		X		X		X			
	R600-7-SR-125F		X		X			X		
	QR600-7-UV-125F		X		X	X				
	QR600-7-UV125BX		X		X		X			
	QR600-7-VIS-125F		X		X	X				
	QR600-7-VIS-125BX		X		X		X			
UV-VIS XSR Solarization-resistant 180-900 nm	QR230-7-XSR	230 µm	X	X		X			4.6 cm	2.3 cm
	QR450-7-XSR	450 µm	X	X		X			9.0 cm	4.5 cm

Our most typical reflection probe design has a tightly packed 6-around-1 fiber bundle to ensure parallel orientation of the fibers.



Reflection probes couple to our spectrometers and light sources to measure reflection and fluorescence from solid surfaces or backscattering and fluorescence in liquids and powders. Sample applications include color and appearance measurements of solid surfaces such as filters and biological samples and backscattering measurements of milk, bulk powders and dyes. Also, we offer a 200 µm reflection probe in the same 6-around-1 design, but with a 76.2 mm PEEK ferrule for applications (such as corrosive environments) where non-metallic probes are necessary.

Item Code: RP200-7-UV-VIS

Reflection/Backscattering Probes

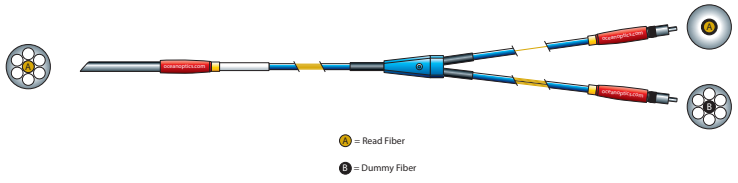
Reflection Probes with Reference Leg			Fiber Bundle	Probe Ferrule		Jacketing			
Wavelength Range	Item Code	Core Diameter	6 illumination fibers around 1 read	6.35 mm OD	3.18 mm OD	Silicone monocoil	Zip tube blue PVDF	LTBR	STBR
VIS-NIR Low OH content 400-2100 nm	QR200-7-REF-VIS-NIR R200-7-REF-VIS-NIR	200 µm	X X	X X		X	 X	8 cm	4 cm
UV-VIS High OH Content 300-1100 nm	QR200-7-REF-UV-VIS R200-7-REF-UV-VIS	200 µm	X X	X X		X	 X	8 cm	4 cm
Reflection/Backscattering Probes for Expanded Wavelength Coverage									
UV-VIS and VIS-NIR 300-1100 nm and 400-2100 nm	QR200-12-MIXED R200-12-MIXED	200 µm	6 UV-VIS and 6 VIS-NIR illumination fibers around 1 UV-VIS and 1 VIS-NIR fibers	X X		X	 X	8 cm	4 cm
Angled Probes for Solutions and Powders									
VIS-NIR Low OH content 400-2100 nm	QR200-7-ANGLE-VIS R200-7-ANGLE-VIS	200 µm	X X	X X		X	 X	8 cm	4 cm
	QR400-7-ANGLE-VIS R400-7-ANGLE-VIS QR400-ANGLE-VIS	400 µm	X X X	X X X		X X	 X	16 cm	8 cm
UV-VIS High OH Content 300-1100 nm	QR200-7-ANGLE-UV R200-7-ANGLE-UV	200 µm	X X	X X		X	 X	8 cm	4 cm
	QR400-7-ANGLE-UV R400-7-ANGLE-UV QR400-ANGLE-UV	400 µm	X X X	X X X		X X	 X	16 cm	8 cm

Reflection/Backscattering Probes for Expanded Wavelength Coverage

The QR200-12-MIXED has 14 fibers -- six UV-VIS and six VIS-NIR illumination fibers, plus one UV-VIS and one VIS-NIR read fiber (see bundle photo at left). It couples easily to a dual-channel spectrometer in which each channel is set for a different wavelength range.

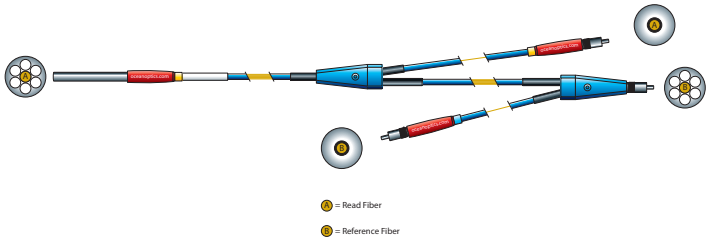
Item Code: QR200-12-MIXED

Angled Reflection Probe



Our Angled Reflection Probes have a 6-around-1 fiber design with a 30º window to remove specular effects when the probe is immersed in liquids or powders.

Reflection Probe With Reference Leg



In this design, an additional fiber leg is added to the probe to monitor an illumination or reference source. This is useful where the changing output of the source needs continuous monitoring.

FL-400
Flame-resistant Fiber Probe

Fiber core diameter:	400 µm
Assembly length:	20 cm (8")
Fiber core/cladding:	Silica
Fiber core/cladding diameter:	400 µm/440 µm
Fiber jacketing:	Gold
Fiber buffer/ tube diameter:	510 µm/0.9 µm
Fiber bundle:	1 single-strand, multi-mode read fiber
Wavelengths covered:	300-1100 nm
Probe sleeve (ferrule):	Stainless steel
Flame loop:	Nickel chromium 24 AWG
Temperature range:	-269° C to 750° C
Numerical aperture:	0.22
Fiber termination:	SMA 905

The FL-400 is a heat-resistant fiber optic probe that couples to Ocean Optics miniature fiber optic spectrometers to measure in situ emission spectra of samples such as dissolved metals and high-temperature plasmas.

High-temperature Fiber

The FL-400 Flame-resistant Fiber Probe consists of a high-temperature 400 µm gold-jacketed UV-VIS optical fiber in an 8-inch-long stainless steel sleeve. The probe is connected with a splice bushing to a standard SMA-terminated patch cord, which couples to the spectrometer to measure emission spectra.

Spectroscopy Teaching Tool

The FL-400 Flame-resistant Fiber Probe is especially beneficial as an emission spectroscopy teaching tool for use with Ocean Optics' CHEM4-series of low-cost, UV-VIS teaching-lab spectrophotometers. Use the probe in two ways:

- By introducing it into emission sample environments up to 750 °C
- By attaching the nickel wire loop at the probe tip so that users can observe flame emission spectra of samples such as sodium, potassium, calcium and copper

Item Code: FL-400

Transmission Dip Probes

General Purpose Probes for the Lab and Other Environments

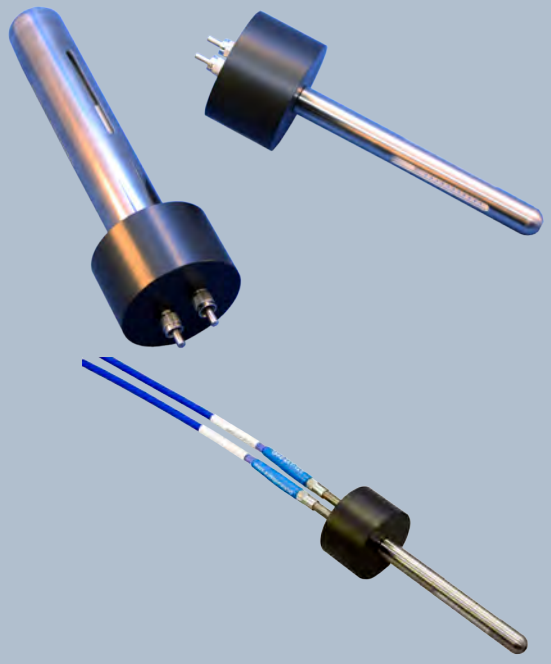
Our T300-RT and T200-RT Transmission Dip Probes couple to our spectrometers and light sources to measure absorbance and transmission in solutions. These probes are especially useful for embedding into process streams for real-time sample monitoring.

Item Code: T300-RT, T200-RT

Item	Specifications
Fiber type:	T300: 300 µm solarization-resistant or VIS-NIR optical fiber; T200: 200 µm VIS-NIR optical fiber
Outer diameter:	6.35 mm
Probe length:	127 mm
Fiber length:	2 meters
Breakout:	1.0 meters from the end of the probe
Optics:	Fused silica
Probe wetted materials:	Stainless steel, fused silica, Epotek 353ND
Pathlength:	2, 5 or 10 mm
Internal materials:	Second surface aluminum mirror
Fiber jacketing:	PVC Monocoil - PVDF zip tube
Probe sleeve:	Stainless steel (300 series)
Connector:	SMA 905
Operating temperature:	Up to 100 °C without sleeve

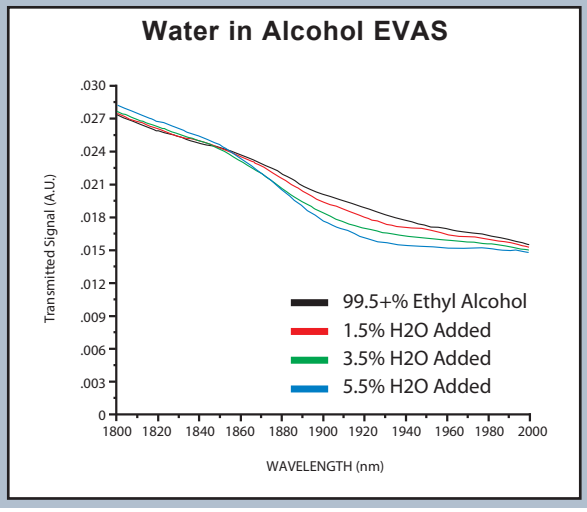
EVAS Probe

The Evanescent Wave Absorption Sensor



The EVAS evanescent wave absorption sensor consists of a sapphire fiber wound around a vertical PTFE shaft. The ends of the fiber are tapered up to facilitate the coupling of light into and out of the probe. The design permits the adjustment of the interaction length by more than an order of magnitude to accommodate the optical analysis of spectral features with widely different absorption coefficients. The EVAS is especially well suited for measurements in turbid fluids.

Item Code: EVAS-PROBE-50, EVAS-PROBE-65

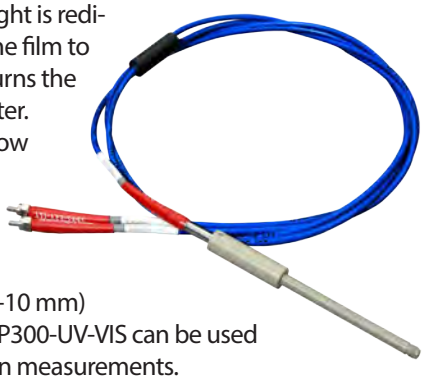


Transmission Probes

Transmission Dip Probes for Hostile Environments

The TP300-UV-VIS Transmission Dip Probe couples to our spectrometers and light sources to measure the absorbance and transmission of solutions in harsh environments.

Also, the TP300-UV-VIS Probe is a chemically inert PEEK transmission probe that can be equipped with a tip (RT-PH) for mounting transmissive pH films in the optical path. Light is directed via one fiber through the mounted film to a mirror. Then light is redirected back through the film to a receive fiber that returns the light to the spectrometer. The sample is free to flow over the sides of the film.



By using an RTP-2-10 (adjustable 2-10 mm) Transmission Tip, the TP300-UV-VIS can be used for routine transmission measurements.

Item Code: TP300-UV-VIS

Item	Specifications
Fiber type:	TP300-UV-VIS: 300 µm UV/SR optical fiber TP300-VIS-NIR: 300 µm VIS-NIR optical fiber
Outer diameter:	3.175 mm diameter for internal stainless steel assembly, 6.35 mm with PEEK polymer sleeve
Probe length:	107.9 mm
Fiber length:	2 meters
Optics:	Fused silica
Temperature limit:	Up to 200 ºC with PEEK sleeve
Pathlength:	Adjustable from 2-10 mm (the RTP-2-10) or from 10-20 mm (RTP-10-20)
Probe sleeve:	Stainless steel internal assembly, PEEK for outer sleeve
Fiber jacketing:	PVDF jacketing
Connector:	SMA 905
Operating temperature:	Up to 100 ºC without sleeve

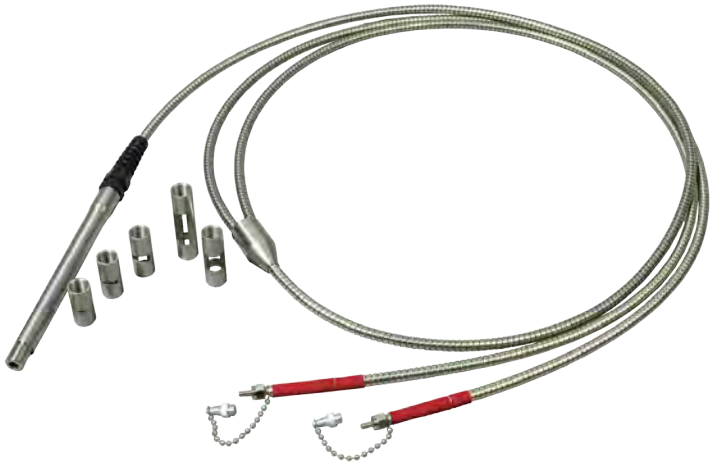
Industrial Transmission Process Probes

High-Pressure, High-Temperature

Item	Specifications
Fiber type:	TI300-UV-VIS - 300 µm diameter UV-SR fiber type (200-1100 nm) TI300-VIS/NIR - 300 µm diameter VIS-NIR fiber type (400-2100 nm)
Temperature limit:	300 °C (short term); 200 °C (continuous)
Sampling tip body:	316 stainless steel
Sampling tip optics:	Quartz back-coated mirror and quartz lens
Sampling tip O-ring:	Parker perfluoroelastomer (Parofluor ULTRA) O-ring seal
Probe ferrule:	12.7 mm outer diameter 316 stainless steel
Probe jacketing:	Fully interlocked stainless-steel jacketing over Teflon tubing; total 7.0 mm outer diameter
Length:	Fiber – 2 meters Ferrule – 12.7 cm without tip Tips – 2.6 cm to 4.99 cm, depending on tip
Breakout distance:	1 meter from the end of the probe
Immersible length:	12.7 cm
Optical pathlengths:	2, 5, 10, 25 and 50 mm pathlengths available
Connectors:	SMA 905

Our TI300-series Transmission Industrial Dip Probes can be used in high-pressure environments and at temperatures up to 300 °C (short term). The TI300-UV-VIS uses 300 µm diameter solarization-resistant optical fiber (200-1100 nm), while the TI300-VIS-NIR uses 300 µm diameter VIS-NIR optical fiber (400-2100 nm). The TI300 probes couple to our spectrometers and light sources to measure solution absorbance and transmission in industrial applications.

Item Code: TI300-UV-VIS, TI300-VIS-NIR

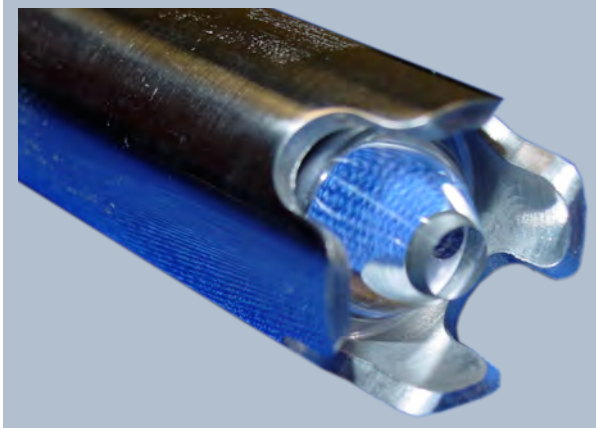


Attenuated Total Reflection Probe

Ideal for Samples with High Optical Density

The PRO-PROBE-ATR Probe is an Attenuated Total Reflection Probe designed for measuring highly absorbent samples. The ATR Probe is ideal for applications where the absorbance of samples is in the 4000-5000 AU/cm range. The ATR Probe can be inserted directly into the sample and spectra can be taken without sample dilution. Typical applications involve measurement of pure inks, dyes and crude oil samples. What's more, the ATR Probe can be used as a general deposition probe if the refractive index (RI) of the material that is depositing on the probe tip is greater than the RI of the ATR's sapphire crystal or is greater than 1.7.

Item Code: PRO-PROBE-ATR



Item	Specifications
Recommended fiber diameter:	600 µm
Outer diameter:	19 mm (0.75")
Probe length:	~305 mm
Body materials:	316 stainless steel (standard); Hastelloy C, Titanium and Monel also available
Crystal material:	Sapphire
Seals:	Viton (standard); Chemraz, Kalrez also available
Pressure limit:	10,000 psig
Fiber connections:	SMA 905
Temperature limit:	300 ºC
Wavelength range:	UV-NIR

Single and Double Pass Transmission Probes

Robust Transmission Probes for Process Applications

Single- and Double-Pass Transmission Probes are process-ready probes useful for online measurements (200-2400 nm) of sample streams. The probes send light energy from a source through the sample by offset-folding the beam 180º and back via a protected reflector. The transmitted/absorbed light is carried back to a spectrophotometer where the intensity of the returning optical energy can be converted to concentration units. Specify Single-pass Probes for pathlengths from 1-6 mm and Double-pass Probes for pathlengths from 5-20 mm.

Item Code: PRO-PROBE-SPP, PRO-PROBE-TR

	Single Pass	Double Pass
Recommended fiber diameter:	600 µm	600 µm
Outer diameter:	25.4 mm (1.0")	19.1 mm (0.75")
Probe length:	~305 mm	~305 mm
Pathlength:	1 mm-10 mm; please specify	2 mm-20 mm; please specify
Body materials:	316 stainless steel (standard); Hastelloy C, Titanium and Monel also available	316 stainless steel (standard); Hastelloy C, Titanium and Monel also available
Window materials:	Quartz (standard); sapphire also available	Quartz (standard); sapphire also available
Seals:	Viton (standard); Chemraz, Kalrez also available	Viton (standard); Chemraz, Kalrez also available
Pressure limit:	7,000 psig	7,000 psig
Fiber connections:	SMA 905	SMA 905
Temperature limit:	300 ºC for probe body	300 ºC for probe body
Wavelength range:	UV-NIR	UV-NIR
Fiber jacketing:	PVDF jacketing	PVDF jacketing
Connector:	SMA 905	SMA 905
Operating temperature:	Up to 100 ºC without sleeve	Up to 100 ºC without sleeve

OptoTemp Probes

Fiber Optic Thermometer - Contact up to 950 °C

Designed for reliable operation in harsh chemical and electrical environments, the OptoTemp 2000 is unaffected by microwave radiation and plasma. It measures temperature using fluorescent decay, a field-proven technique in hundreds of industrial installations for 25 years.

Item Code: OPTOTEMP-FLEX, OPTOTEMP-SUPER, OPTOTEMP-ULTRA

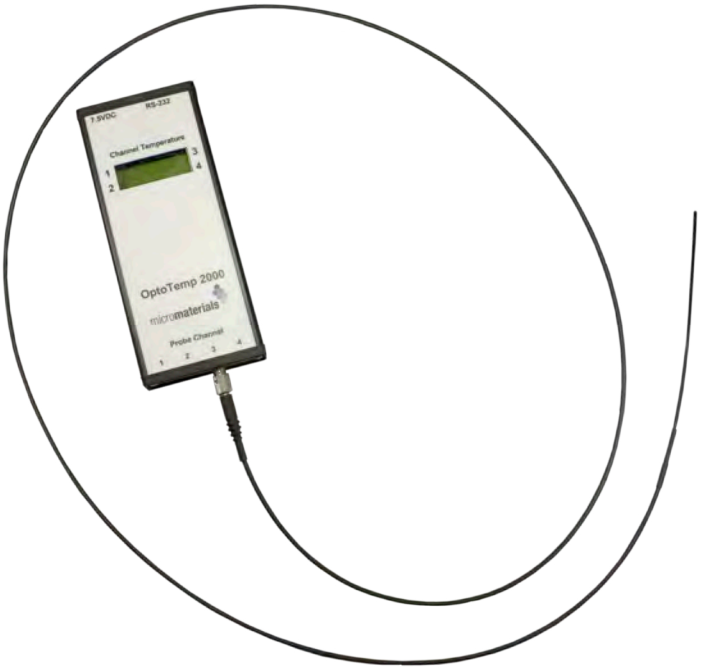
Features include:

- Immune to EMI, RF and microwave
- Operates up to 950 °C
- Precise and reliable
- Inert all-crystalline probe
- Micro sensing tip

Applications include:

- Microwave/RF heating
- Chemical processing
- Molten metal measurements
- Plasma processing
- Semiconductor processing

Product	OptoTemp 2000
Channels:	Up to 4
Measurable temperature range:	Flex: 10 °C to 150 °C Super: 20 °C to 400 °C Ultra: 200 °C to 950 °C
Response time:	250 msec
Sample rate:	4 samples/sec
Precision:	± 1.0 °C RMS over 8 samples
Accuracy:	± 2.0 °C
Power:	5W 7.5 VDC wall adapter at 90-260 VAC, 47 to 63 Hz
Output ports:	RS-232
Display:	LCD
Dimensions:	15 cm x 7 cm x 3.5 cm
Housing material:	Anodized aluminum



Front-Surface Fluorescence Probe

Real-Time Fluorescence Monitoring

The Front-surface Fluorescence Probe is a process-ready probe for measuring fluorescence from the surface of a liquid, solid, paste or slurry. The probe can be used as part of a process system or combined with Ocean Optics spectrometers and accessories to create a real-time monitoring system for a variety of fluorescence applications.

The Fluorescence Probe has a special optical configuration that has a very sharp focus at the wetted end of the window and does not need to penetrate deeply into the sample for a reading. This concentrated focus and shallow penetration depth significantly reduce the inner filter effect from competitive optical devices. The probe is 12 mm in diameter and can be inserted into a standard benchtop fermenter via a PG-13.5 fitting (contact an Applications Scientist for details).

Item Code: PRO-PROBE-BS

Item	Specifications
Recommended fiber diameter:	800 µm
Outer diameter:	12 mm; 12.7 mm (0.5") also available
Probe length:	~305 mm
Body materials:	316 stainless steel (standard); Hastelloy C, Titanium and Monel also available
Crystal materials:	Sapphire
Seals:	Viton (standard); Chemraz, Kalrez also available
Pressure limit:	7,000 psig
Fiber connections:	SMA 905
Temperature limit:	300 °C
Wavelength range:	UV-VIS
Housing material	Anodized aluminum

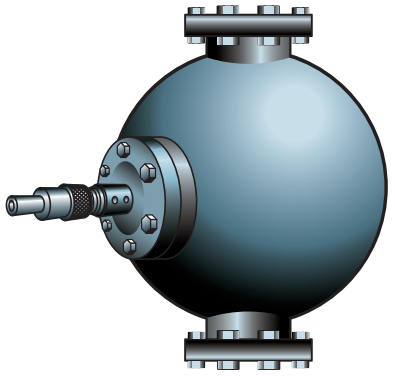
Feedthroughs for Vacuum Applications

Full Range of Fiber Accessories

We offer a full range of vacuum feedthrough (VFTs) accessories for your chamber applications. General-purpose bolt-style VFTs come with an O-ring and a pair of splice bushings and are designed to penetrate NEMA enclosures. For more robust environments, we offer VFTs with a conflat flange or ISO KF industrial-grade flange.

VFTs have in-vacuum and in-air sides with SMA 905 connectors for coupling to optical fibers (available separately). VFTs are an excellent option for optical measurement applications in semiconductor and thin film processing or anywhere ultra-high vacuum applications occur.

Gaskets, mounting hardware and other accessories are available through our reseller partner Accu-Glass Products, Inc. (accuglassproducts.com).



Wavelength	Item Code	Fiber Type	Flange Type or O-ring				
			1.33" OD Conflat	2.75" OD Conflat	1.18" OD KF16 ISO	2.16" OD KF40 ISO	O-ring
VIS-NIR Low OH Content 400-2200 nm	VFT-100-VIS	100 µm diameter VIS-NIR					X
	VFT-200-VIS Series	200 µm diameter VIS-NIR	X	X	X	X	X
	VFT-400-VIS Series	400 µm diameter VIS-NIR	X	X	X	X	X
	VFT-600-VIS Series	600 µm diameter VIS-NIR	X	X	X	X	X
	VFT-1000-VIS Series	1000 µm diameter VIS-NIR	X	X	X	X	X
UV-VIS High OH Content 300-1100 nm	VFT-100-UV	100 µm diameter UV-VIS					X
	VFT-200-UV Series	200 µm diameter UV-VIS	X	X	X	X	
	VFT-400-UV Series	400 µm diameter UV-VIS	X	X	X	X	
	VFT-600-UV Series	600 µm diameter UV-VIS	X	X	X	X	
	VFT-1000-UV Series	1000 µm diameter UV-VIS	X	X	X	X	X
UV/SR-VIS High OH Content 200-1100 nm	VFT-200-SR	200 µm diameter SR					X
	VFT-400-SR	400 µm diameter SR					X
	VFT-600-SR	600 µm diameter SR					X
UV-VIS XSR Solarization-resistant 180-900 nm	VFT-115-XSR-133	115 µm diameter XSR	X				
	VFT-230-XSR-133	230 µm diameter XSR	X				
	VFT-450-XSR-133	450 µm diameter XSR	X				
	VFT-600-XSR-133	600 µm diameter XSR	X				

Fibers and Probes

Fiber and Probe Fixtures and Holders

C-Mounts

Our C-MOUNT-MIC Adapter Assembly with adjustable focusing barrel has an SMA 905 Connector in its center for attaching to optical fibers. The internal C-mount threads of this assembly allow you to adapt fiber optic spectrometers to other optical devices such as microscopes and telescopes.

The MFA-C-MOUNT also connects to optical devices such as microscopes and telescopes, but its center connector is designed to accept probes with 6.35-mm (1/4") outer diameter ferrules.

Item Code: C-MOUNT-MIC, MFA-C-MOUNT

The MFA-C-MOUNT

The C-MOUNT-MIC Adapter Assembly

Phototubus Microscope Adapter

The MFA-PT Phototubus Microscope Adapter adapts to a Phototubus outlet on microscopes and accepts SMA 905-terminated optical fibers.

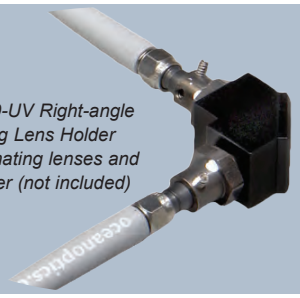
Item Code: MFA-PT

The MFA-PT Phototubus Microscope Adapter

Right-angle Collimating Lens Holder

The 74-90-UV is an assembly for mounting lenses at right angles, and is especially useful for applications involving awkward optical fiber routing. It has a mirror located under its cap bonded with high-temperature epoxy, and reflects light from the collimating lens to 90°. Two ports accommodate 74-series Collimating Lenses (not included).

Item Code: 74-90-UV



The 74-90-UV Right-angle Collimating Lens Holder with collimating lenses and optical fiber (not included)

Reflection Probe Holders

The RPH-1 (far right) and RPH-2 (near right) are anodized aluminum platforms with holes drilled at 45° and 90° angles to the surface. The RPH-1 holds 6.35-mm (1/4") diameter probes but with the RPH-ADP -- an adapter that fits on the RPH-1 -- you can secure 3.17 mm (1/8") diameter probes as well. The RPH-2 is for use only with probes with QSMA 905 Connectors. The Curved Surface Probe Holders accommodate 6.35-mm (1/4") outer diameter probes for measuring reflection of curved surfaces. The CSH (right) has a hole drilled at a 90° angle to the surface. The CSH-45 has a hole drilled at a 45° angle to the surface.

Item Code: RPH-1, RPH-2, CSH, CSH-45

RPH-2

RPH-1

CSH

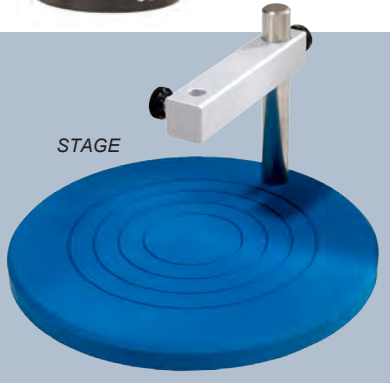
Optical Stages

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 and other sampling devices up to 6.35 mm in diameter.

The Stage-RTL-T is also a sampling system for analysis of substrate materials. The STAGE-RTL-T can be configured for reflection and transmission measurements.

Item Codes: STAGE, STAGE-RTL-T

STAGE



Fibers and Probes
Fiber and Probe Accessories

Bulkhead Bushing
The 21-01 SMA Bulkhead Bushing assembly is a device mount for optical fibers. The 21-01 SMA Bulkhead Bushing allows easy coupling of an LED or photodiode in a TO-18 can to an SMA-terminated optical fiber .
Item Code: 21-01


21-01 SMA Front


21-01 SMA Rear

Splice Bushings
The 21-02 SMA Splice Bushings are in-line adapters that connect SMA 905-terminated optical fibers (or any two objects with SMA 905 terminations). A splice bushing consists of a 0.75" screw with female ends. The standard 21-02 is made of nickel-plated brass while the 21-02-SS is made of stainless steel. They are useful for coupling patch cords to fiber optic probes and other devices, or for any multiple-fiber application where coupling our standard optical fibers and accessories is preferable to creating costly and complex fiber optic assemblies.
Item Code: 21-02, 21-02-SS


21-02 SMA

Bulkhead and Splice Bushing Combo
The 21-02-BH SMA Bulkhead Splice Bushing is an in-line adapter that connects SMA 905-terminated optical fibers through a chamber wall or panel. The 21-02-BH features an O-ring for sealing against the inside of the panel wall and a nut and lockwasher for mounting to the outside of the panel wall.
Item Code: 21-02-BH


21-02-BH SMA SMA 905

FC Barrel
Our collimating lenses come standard with SMA 905 Connectors and interface to our SMA-terminated fibers. If you have FC-terminated fiber, you could remove the inner 6.35-mm OD SMA barrel and replace it with this FC Barrel to connect to our products. Spare SMA 905 barrels are also available.
Item Code: FCBARREL


FC Barrel

Custom Option: Connector Adapters
Connector adapters allow you to mate an item with an SMA 905 Connector to an item with either an ST or FC Connector. Additional options are available for single-fiber laser coupling and other applications.
Item Code: SMA-ST-ADP, SMA-FC-ADP


SMA-ST-ADP


SMA-FC-ADP

Finger Fiber Wrench
The FOT-SMAWRENCH is a wrench that slips over the hex nut of the SMA 905 Connector used in Laboratory-grade Optical Fibers and helps to easily attach the fiber to connectors on spectrometers, light sources, collimating lenses and many other accessories.
Item Code: FOT-SMAWRENCH


FOT-SMAWRENCH

Modemixer/Modestripper
The Modemixer/Modestripper is an in-line, 3-mm Suprasil rod that connects two SMA 905-terminated optical fibers to mix core modes and eliminate clad modes throughout 180-2100 nm.
Item Code: ADP-SMA-SMA

ADP-SMA-SMA

Unjacketed Bulk Optical Fiber

DIY Fiber and Tools for the Modern Spectroscopist

We offer spooled, unjacketed optical fiber for customers who build their own assemblies. Choose from core diameters from 50 µm to 100 µm and High OH, Low OH and Solarization-resistant fiber. To improve the strength and flexibility of our fiber, we triple-coat it with a polyimide buffer prior to the spooling process.

Unjacketed Bulk Optical Fiber				Fiber Type				
Wavelength Range	Item Code	Core Diameter	Buffer/ Coating	UV-VIS	VIS-NIR	UV/SR-VIS	LTBR	STBR
VIS-NIR Low OH content 400-2100 nm	FIBER-50-VIS-NIR	50 µm	Polyimide		X		4 cm	2 cm
	FIBER-100-VIS-NIR	100 µm	Polyimide		X		4 cm	2 cm
	FIBER-200-VIS-NIR	200 µm	Polyimide		X		8 cm	4 cm
	FIBER-300-VIS-NIR	300 µm	Polyimide		X		12 cm	6 cm
	FIBER-400-VIS-NIR	400 µm	Polyimide		X		16 cm	8 cm
	FIBER-500-VIS-NIR	500 µm	Polyimide		X		20 cm	10 cm
	FIBER-600-VIS-NIR	600 µm	Polyimide		X		24 cm	12 cm
	FIBER-1000-VIS-NIR	1000 µm	Acrylate		X		30 cm	15 cm
UV-VIS High OH Content 300-1100 nm	FIBER-50-UV-VIS	50 µm	Polyimide	X			4 cm	2 cm
	FIBER-100-UV-VIS	100 µm	Polyimide	X			4 cm	2 cm
	FIBER-200-UV-VIS	200 µm	Polyimide	X			8 cm	4 cm
	FIBER-300-UV-VIS	300 µm	Polyimide	X			12 cm	6 cm
	FIBER-400-UV-VIS	400 µm	Polyimide	X			16 cm	8 cm
	FIBER-500-UV-VIS	500 µm	Polyimide	X			20cm	10 cm
	FIBER-600-UV-VIS	600 µm	Polyimide	X			24 cm	12 cm
	FIBER-1000-UV-VIS	1000 µm	Acrylate	X			30 cm	15 cm
UV/SR-VIS High OH content 200-1100 nm	FIBER-200-UV/SR-VIS	200 µm	Polyimide			X	4 cm	2 cm
	FIBER-300-UV/SR-VIS	300 µm	Polyimide			X	12 cm	6 cm
	FIBER-400-UV/SR-VIS	400 µm	Polyimide			X	16 cm	8 cm
	FIBER-600-UV/SR-VIS	600 µm	Polyimide			X	24 cm	12 cm

Bare Fiber Adapter Kit

DIY - Fiber Termination and Polishing

The BFA-KIT Bare Fiber Adapter Kit is for the fiber tinkerer who wants to polish bare (unjacketed) optical fiber. The kit comes with fiber polishing holders for various sizes of optical fibers.

The Bare Fiber Adapter Kit includes the following:

- 6 fiber polishing holders for various sizes of optical fiber (1 each for 100 µm, 200 µm, 300 µm, 400 µm, 600 µm and 1000 µm optical fibers)
- A BFA-KIT-CHUCK connect-and-release adapter (which can be purchased separately as well) to fasten the SMAs onto bare optical fiber
- Several pieces of wire for cleaning out the polishing holders and connect-and-release adapter

An SMA-PUCK polishing puck is not included with the BFA-KIT, but is available separately. The puck is used to polish the surface of an optical fiber.

The FT-KIT Fiber Tinkerer Kit (not shown) includes an assortment of randomly selected, unterminated UV-VIS and VIS-NIR optical fibers. Each fiber included in the kit will be at least one meter in length. The Fiber Termination Kit (TERM-KIT) includes all the tools needed to terminate and polish fiber.

Fiber Termination Kits

Repair and Retool Like a Pro

The TERM-KIT Termination Kit provides you with all the tools you need to properly polish and terminate an optical fiber. The TERM-KIT is great for inspecting, repairing and polishing optical fiber assemblies.

Included in the kit are polishing papers in thicknesses ranging from 1 mm to 30 mm.

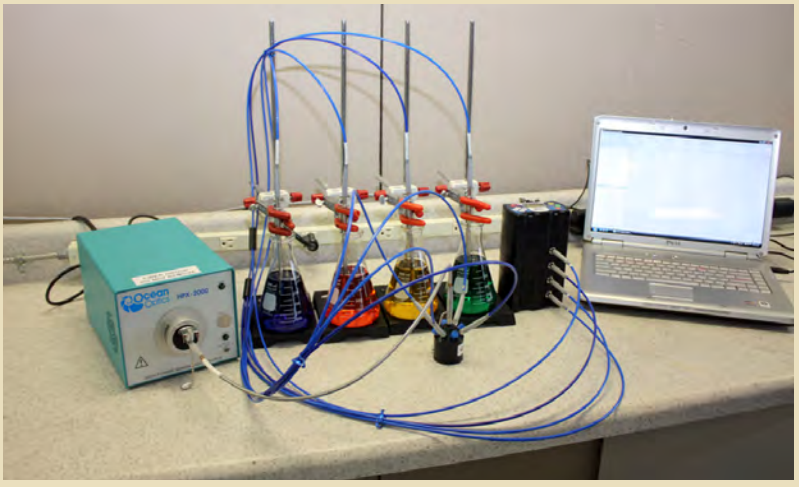
Included in Each TERM-KIT

- 4 SMA 905 Connectors for 50 µm or 100 µm fibers
- 4 SMA 905 Connectors for 200 µm optical fibers
- 4 SMA 905 Connectors for 400 µm optical fibers
- 4 SMA 905 Connectors for 600 µm optical fibers
- 4 SMA 905 Connectors for 1000 µm optical fibers
- Polishing puck
- Glass polishing plate (15 cm x 15 cm)
- Dozens of polishing papers
- 5-cavity crimp tool (for 2.6, 3.4, 3.8, 4.5 and 6.4 mm cavities)
- Scoring tool
- Inspection scope
- 2-hour cure epoxy
- Optical wipes

Technical Tip

Optical Probes in Air and Water

Fiber probes, such as the Ocean Optics transmission dip cells and "R" series reflection probes, are optical systems that are designed to work in either air or liquids. Their behavior changes when the refractive index of the media changes because the fibers and lenses in these systems are operating under Snell's Law. The refractive index of air is approximately 1, while the refractive index of water (1.33) and organic solvents like ethanol (1.36) are considerably higher. Ocean Optics silica fibers, for example, have a numerical aperture of 0.22 and an acceptance angle of about 25° in air. When placed in water, however, the acceptance angle is reduced to ~19°.



Our standard transmission dip probe is specifically designed for use in liquids. The probe has two fibers projecting light through a shared lens. Light from the source is focused by the lens onto a mirror across the sample gap. The light is reflected back through the lens to the read fiber, which brings the light to the spectrometer. The lenses are focused for use in water, and if used in air, will be severely out of focus and inefficient.

The CC-3 cosine corrector is a diffuser that screws on to the end of a fiber. It expands the fiber field of view to 180°, and transmits light energy to the fiber scaled to the cosine of the angle of the light. The cosine corrector works in air but fails in water because it is not waterproof. If water contacts the fiber, the acceptance angle will change and the calibration of the system will be in error.

The reflection probe, a bundle consisting of one fiber surrounded by six fibers, can work in air or water, but with quite different performance. In air, light exits the 6 illumination fibers in a 25° cone. The center read fiber accepts energy from a 25° cone. These cones overlap at a distance determined by the space between the fibers (usually twice the cladding thickness), so that samples that fluoresce or reflect light will be detected in this overlap region. When used in water, the cones are only 19° and the overlap region is smaller and farther from the tip of the probe.

A positive aspect of using fibers and probes in water is that the efficiency improves. This is because the Fresnel reflection (r) at the interface between a fiber or lens (n_1) and the media (n_2) scales with refractive indices:

$$r = ((n_1 - n_2)/(n_1 + n_2))^2$$

In a silica fiber, the fiber-to-air loss is about 3.5%. In water the loss is only 0.2%. An example of this benefit is the increase in signal obtained by using a reflection probe inserted in a liquid sample to measure fluorescence. The losses of excitation energy and fluorescence at the sample/probe interface are minimal. In comparison, there are eight air-to-silica interfaces in a standard cuvette-based system leading to a 25% reduction in signal.