56 Sparta Avenue • Newton, New Jersey 07860
(973) 300-3000 Sales • (973) 300-3600 Fax
www.thorlabs.com

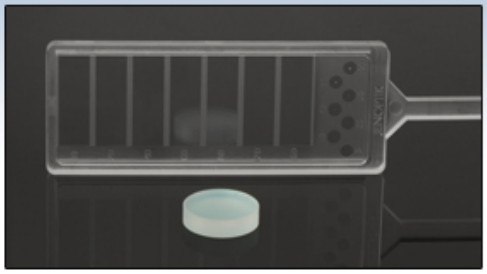
THORLABS

SDPK - January 11, 2018

Item # SDPK was discontinued on January 11, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

INSPECTION TOOLS

Fiber Scope with 200X Magnification
6X and 10X Eye Loupes
Head Magnifier and Inspection Mirror



SDPK
Scratch-Dig Paddle

10125HG
SMA Height Gauge

FS200-LC
LC Adapter for FS201 Scope

MAG200K
Magnifier

EYL10X
10X Eye Loupe

FS201
Fiber Inspection Scope

Hide Overview

OVERVIEW

Features

- Fiber Inspection Scope to Examine Fiber Polish Quality
- SMA Height Gauge for Connector Coupling Applications
- Eye Loupes Provide 6X or 10X Magnification
- Head-Worn Magnifier Provides Hands-Free 2X Magnification
- Inspection Mirror with Telescoping Handle
- Scratch-Dig Paddle for Determining the Cosmetic Quality of Optical Surfaces

The tools on this page are primarily used for inspecting fiber optic ends and other optics. A fiber inspection scope is used to examine the polished end of a terminated fiber. The scope illuminates and magnifies the fiber tip so scratches and other defects can be seen. An SMA connector height gauge provides a way to accurately measure the length of an SMA905 connector, which is important in SMA to SMA coupling. Our premium eye loupes with 6X or 10X magnification are ideal for use in quality control departments. We also offer a head-worn magnifier, an inspection mirror, and a scratch-dig paddle.

Quick Links
Fiber Inspection Scope
Connector Adapters
SMA Height Gauge
Eye Loupes
Head-Worn Magnifier
Inspection Mirror
Scratch-Dig Paddle

Hide Smart Pack

SMART PACK

Smart Pack

- Reduce Weight of Packaging Materials
- Increase Usage of Recyclable Packing Materials
- Improve Packing Integrity
- Decrease Shipping Costs

Thorlabs' Smart Pack Initiative is aimed at waste minimization while still maintaining adequate protection for our products. By eliminating any unnecessary packaging, implementing packaging design changes, and utilizing eco-friendly packaging materials for our customers when possible, this initiative seeks to improve the environmental impact of our product packaging. Products listed above are now shipped in re-engineered packaging that minimizes the weight and the use of non-recyclable materials.[b] As we move through our product line, we will indicate re-engineered packages with our Smart Pack logo.

Item #	% Weight Reduction	CO_2-Equivalent Reduction[a]
10125HG	44.38%	1.59 kg

Click to Enlarge
10125HG Packaging

- Travel-based emissions reduction calculations are estimated based on the total weight reduction of packaging materials used for all of 2013's product sales, traveling 1,000 miles on an airplane, to provide general understanding of the impact of packaging material reduction. Calculations were made using the EPA's shipping emissions values for different modes of transport.
- Some Smart Pack products may show a negative weight reduction percentage as the substitution of greener packaging materials, such as the Greenwrap, at times slightly increases the weight of the product packaging.

Hide Fiber Inspection Scope

Fiber Inspection Scope

Critically Examine Fiber Polish Quality
Scope Includes Two Fiber Adapters:
- FS200-FC: FC/PC, FC/APC, ST®/PC, and SC/PC Connectors
- FS201-SMA: SMA905 and SMA906 Connectors

Additional Connector Adapters Sold Separately Below

Click to Enlarge
View of Panda-Style PM Fiber with the FS201 Inspection Scope and FS201-PM Adapter

FS201 Specifications	
Optical Magnification	200X
Field of View	~Ø600 µm
Illumination	Coaxial and Oblique White LEDs (100 000 Hour Lifetime)
Optical Filter	Built-In IR Filter
Power	3 LR44 Button Batteries (Included)
Included Adapters	FS200-FC FS201-SMA

The FS201 Fiber Inspection Scope produces a high-quality, low-distortion image of both the fiber end and surrounding ferrule. With a high-intensity illumination system and 200X magnification, this microscope is powerful enough to offer a clear image of the fiber core as well as the surrounding cladding. The FS201 offers both coaxial and oblique illumination settings. The coaxial setting provides symmetric lighting for high-detail inspection, and the oblique setting provides light at an off-center angle to the fiber end face for higher contrast.

The FS201 includes the FS200-FC adapter for FC-/ST-/SC-terminated fibers (Ø2.5 mm ferrules) and the FS201-SMA adapter for SMA905- and SMA906-terminated fibers (Ø3 mm ferrules). The FS200-LC adapter for LC-terminated fibers (Ø1.25 mm ferrules) and the FS201-PM for polarization-maintaining fibers are available separately below.

Fiber Scope Operation
Insert the fiber connector into the adapter until it stops and then firmly hold in place during inspection. To activate illumination, flip the switch on the bottom of the scope; "|" activates coaxial illumination, while "||" activates oblique illumination. Once finished, flip the switch back to "O" to turn the scope off.

To inspect the full surface area of fibers with larger cores or fibers with angled faces, it may be necessary to rotate the fiber connector. This is also useful for differentiating between contaminants on the face of the fiber connector and those on the scope optic itself. In order to see the entire field of view, the rubber eyepiece should be as close as possible to the operator's eye. Operators who normally wear eyeglasses should remove them to fully inspect the fiber. Please note that under normal operation, the focus adjustment knob should not be rotated to its limits. Doing so repeatedly may cause the unit to fail over time.

Adapter Alignment
Although each adapter comes pre-aligned for use with the FS201, it may be necessary to align the adapter to center the fiber in the field of view for fibers with poor centration. First, follow the basic steps above to inspect a test fiber. Using a 1.5 mm hex key or balldriver, loosen the three setscrews around the edge of the connector adapter at the end of the scope. Look through the illuminated scope, focus on the fiber ferrule, and align the connector until the ferrule face is centered within the field of view. Progressively adjust the three setscrews until the end face is in the center of the scope view.

Part Number	Description	Price	Availability
FS201	**Fiber Inspection Scope with FS200-FC and FS201-SMA Adapters**	**$211.14**	**Today**

Hide Connector Adapters for Fiber Inspection Scope

Connector Adapters for Fiber Inspection Scope

Connector Adapters Compatible with the FS201 Fiber Inspection Scope

Connector Adapters for the FS201 Fiber Inspection Scope[a]

Options Available for FC, ST, SC, SMA905, SMA906, or LC Connector Types
FS201-PM Adapter Features V-Groove Aligned to Wide Key Slot (2.2 mm) of the FC/PC Bulkhead

These connector adapters are used with the FS201 Fiber Inspection Scope sold above to enable compatibility with different ferrule and connector types (see table to the right for options). The FS201-PM adapter is like the FS200-FC adapter, except it features a V-groove that is aligned with the wide key slot on the FC/PC bulkhead. This provides a rough guide for determining the relative alignment of the connector key to the fiber stress members when used with polarization-maintaining patch cables.

Connector Adapters for the FS201 Fiber Inspection Scope[a]				
Photos (Click to Enlarge)				
Item #	FS200-FC	FS201-PM	FS201-SMA	FS200-LC
Compatible Connectors	FC/ST/SC	PM FC[b]	SMA905 SMA906	LC
Included with FS201	Yes	No	Yes	No

a. All of these adapters are also compatible with the FS200 Fiber Inspection Scope.
b. This adapter features a v-groove aligned with the FC connector key on polarization-maintaining patch cables. However, It is also compatible with standard FC, ST, and SC connectors.

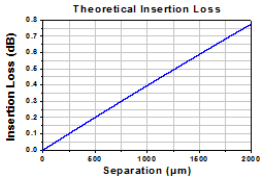
Although each adapter comes pre-aligned for use with the FS201, it may be necessary to align the adapter to center the fiber in the field of view for fibers with poor centration. First, follow the basic steps above to inspect a test fiber. Using a 1.5 mm hex key or balldriver, loosen the three setscrews around the edge of the connector adapter at the end of the scope. Look through the illuminated scope, focus on the fiber ferrule, and align the connector until the ferrule face is centered within the field of view. Progressively adjust the three setscrews until the end face is in the center of the scope view.

Part Number	Description	Price	Availability
FS200-FC	**FC-Type Connector Adapter for FS201 Fiber Inspection Scope**	**$36.47**	**Today**
FS201-PM	**Customer Inspired!FC-Type Connector Adapter with Key Alignment Groove for FS201 Fiber Inspection Scope**	**$45.00**	**Today**
FS201-SMA	**SMA-Type Connector Adapter for FS201 Fiber Inspection Scope**	**$29.33**	**Today**
FS200-LC	**Customer Inspired!LC-Type Connector Adapter for FS201 Fiber Inspection Scope**	**$29.33**	**Today**

Hide SMA Height Gauge

SMA Height Gauge

Measures SMA905 Ferrule Height Relative to 0.3860"
Calibration Pin Included
Detailed Calibration and Usage Instructions in Manual



Click to Enlarge

The 10125HG SMA height gauge is ideal for accurately measuring the height of a polished fiber optic SMA905 connector. SMA-to-SMA couplers are designed to have a non-contact interface, and since the insertion loss (IL) of an SMA-SMA junction is dependent on the distance between the two SMA connector end faces, the height of the polished SMA connector is important. We recommend frequent calibration using the attached calibration pin. For detailed calibration instructions, please see the manual. Please note that this gauge is not compatible with SMA906 connectors.

To use, thread an SMA905-terminated fiber into the port at the bottom of the gauge and hand tighten. The connector height measurement on the gauge face is with respect to 0.3860". The photo above shows a ferrule with a height of 0.3863" which reads as +3 ticks on the gauge face. Be sure the gauge is properly calibrated prior to use.

Please note the IEC standard for SMA ferrule height is 0.3850" to 0.3863" (IEC61754-22).

The graph to the right shows the theoretical insertion loss as a function of the separation of two SMA connectors using our M38L01 patch cable. The fiber in this cable has a core diameter of 200 µm, a numerical aperture of 0.39, and an index of 1.4571 at 633 nm. This graph was generated using the following equation:

$$L_{logitudinal} = -10\log\left[1+\frac{z}{a}\sin^{-1}\left(\frac{NA}{n_0}\right)\right]^{-2}$$

where z is the separation distance, a is the radius of the core size in µm, NA is the numerical aperture of the fiber, and n_0 is the index of the core. Click here to download an interactive Excel file which can be used to calculate and graph the theoretical insertion loss for any fiber.

The height gauge should not be used for testing high-power fiber patch cables as the contact between the gauge and connector end can damage the exposed fiber tip.

Part Number	Description	Price	Availability
10125HG	**Fiber Optic SMA905 Connector Height Gauge**	**$395.76**	**Today**

Hide Premium Eye Loupes: 6X and 10X Magnification

Premium Eye Loupes: 6X and 10X Magnification

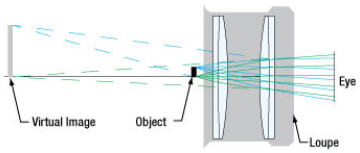
Magnification: 6X or 10X
Uses a Pair of Glass Achromatic Doublets
AR Coating on All Glass-to-Air Optical Surfaces
Large Field of View: Ø1.4" for 6X and Ø1.1" for 10X
Small Form Factor


Click to Enlarge
The R3L3S1P test target viewed through the EYL10X.

Thorlabs' Premium Eye Loupes provide clear magnification that is ideal for inspecting optics and small parts. The eye loupes were designed by Thorlabs to maximize working distance when used with the knurled edge oriented towards the eye. They use a pair of glass achromatic doublets to minimize chromatic and other aberrations. The AR coating on each optical surface is optimized to reduce internal reflections at wavelengths visible to the human eye. These high-quality magnifiers are suitable for quality control applications in industry or inspecting optics in the lab. They are available in 6X and 10X magnifications.

Specifications		
Item #	EYL06X	EYL10X
Magnification	6X	10X
Working Distance[a]	30 mm (1.2")	20 mm (0.8")
Field of View	35 mm (1.4")	27 mm (1.1")
Clear Aperture	Ø27.9 mm (Ø1.10")	
Surface Quality	40-20 Scratch-Dig	
Lens Materials	N-BAF10/N-SF6HT	
Broadband AR Coating		
Wavelength Range	350 - 700 nm	
Average Reflectance	<0.5%	

a. Relative to the Housing



Click to Enlarge
This ray tracing demonstrates the virtual image seen through the EYL06X eye loupe.

Eye Loupe Magnification

The magnification specification provided for these eye loupes is determined using the standard magnification definition:

$$M = \frac{H_{object}}{H_{image}}$$

where M is the magnification, H_{image} is the image height, and H_{object} is the object height. This definition is valid when used at the specified working distance. When using this equation, the magnification of EYL06X and EYL10X is 6.0 and 10.0, respectively, as specified in the table above.

The maximum magnification that can be achieved on the human retina is given by the loupe magnification definition, which is a thin-lens formula:

$$M = \frac{254\ mm}{f} + 1$$

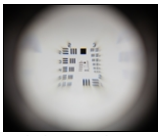
where M is the magnification and f is the focal length of the lens in mm. When using this equation, the magnification of EYL06X is 5.5 and the magnification of EYL10X is 8.9.

Part Number	Description	Price	Availability
EYL06X	**Premium 6X Eye Loupe**	**$156.06**	**Today**
EYL10X	**Premium 10X Eye Loupe**	**$156.06**	**Today**

Hide Standard 10X Eye Loupe

Standard 10X Eye Loupe

10X Magnification
Hastings Design
Lightweight


Click to Enlarge
The R3L3S1P test target viewed through the JEL10.

This Bausch + Lomb® loupe is an ideal, economical tool for inspecting optics and small parts. The eyepiece provides a clear, 10X magnification. This loupe is designed to be used with the flared edge facing the eye. If the JEL10X does not meet your inspection needs, our premium eye loupes (featured above) provide a higher image quality and a wider field of view suitable for industry inspection applications.

Part Number	Description	Price	Availability
JEL10	**Standard 10X Eye Loupe**	**$24.28**	**Today**

Hide Head-Worn Magnifier

Head-Worn Magnifier

2.0X Magnification
Can be Worn With or Without Eyeglasses
ESD Compliant


Click to Enlarge

This head-worn inspection magnifier is ESD compliant and cleanroom compatible. It is ideal for inspecting components when high magnification is not required and may be worn with or without prescription eyeglasses. The position of the magnifying lenses is adjustable so that they can be swung out of your line of sight when magnification is not needed.

Part Number	Description	Price	Availability
MAG200K	MagEyes Inspection Magnifier	$32.39	Today

Hide Inspection Mirror

Inspection Mirror

Corrosion-Resistant Stainless Steel Telescoping Handle
High-Quality, Low Distortion Ø1.25" Glass Mirror
Articulated Joint Adds Versatility in Mirror Positioning
8.50" (21.6 cm) Solid Length, 35" (88.9 cm) Extended Length

This telescoping inspection mirror is ideal for viewing components in hard-to-reach areas of the lab.

Click to Enlarge
Partial Extension of Telescoping Arm

Part Number	Description	Price	Availability
TM1	Telescoping Inspection Mirror	$24.58	Today

Hide Scratch-Dig Paddle

Scratch-Dig Paddle

Visual Scratch-Dig Reference
Scratch: Any Marking or Tearing of the Glass Surface
Dig: A Small Rough Spot on the Glass Surface, Similar to a Pit in Appearance

Scratch-dig paddles are used to determine the cosmetic surface quality of an optic. Thorlabs' SDPK Scratch-Dig Paddle has 7 rectangular sections and 7 circular sections each of which contains a different scratch or a different dig. Scratch-dig refers to the cosmetic quality of the surface of an optic and is defined by the U.S. military (MIL-PRF-13830B). Although not certified, this paddle contains scratch and dig features that can be compared to any optic for classification. To use the paddle, place it next to the optic you are inspecting and compare the imperfections on the optic's surface to the imperfections on the paddle.

Dig Number	Mean Dig Diameter	Dig Diameter Tolerance	Dig Separation Distance
160	1.60 mm (0.0630")	-	20 mm (0.787")
120	1.20 mm (0.0473")		20 mm (0.787")
80	0.80 mm (0.0315")		20 mm (0.787")
60	0.60 mm (0.0236")		20 mm (0.787")
40	0.40 mm (0.0158")	±0.01016 mm ($4x10^{-4}$")	20 mm (0.787")
20	0.20 mm (0.0079")	±0.00762 mm ($3x10^{-4}$")	20 mm (0.787")
10	0.10 mm (0.0039")	±0.00508 mm ($2x10^{-4}$")	1 mm (0.040")

Procedure:
The surface quality is to be specified by a number such as 60-40 scratch-dig. The first number corresponds to the max scratch width compared to the reference scratches on the SDPK paddle. It does not correspond directly to a precise scratch width. The next number indicates the mean diameter of a dig in hundredths of a millimeter. The table to the right can be used to quickly convert the dig number into millimeters or inches.

Part Number	Description	Price	Availability
SDPK	Scratch-Dig Paddle	$36.21	Lead Time


10
20
40
60
80
120
160
10
40
70
5
20
50
100
JENOPTIK