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THORLABS

FS200 - November 4, 2015

Item FS200 was discontinued on November 4, 2015. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

INSPECTION TOOLS

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

Selection Guide
Fiber Inspection Scope
SMA Height Gauge
Eye Loupes
Head-Worn Magnifier
Inspection Mirror
Scratch-Dig Paddle

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 connectorized 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.

Fiber Inspection Scope

- Critically Examine Fiber Polish Quality
- Adapters Provide Compatibility with Common Connectors:
  - FS200-FC: FC/PC, FC/APC, ST/PC®, and SC/PC Connectors
  - FS200-SMA: SMA905 and SMA906 Connectors
  - FS200-LC: LC/PC® and LC/APC Connectors
- FS200 Includes FS200-FC and FS200-SMA Adapters, FS200-LC Adapters Sold Separately

Click to Enlarge
Available Adapters: FS200-FC (Included with FS200), FS200-SMA (Included with FS200), and FS200-LC (Sold Separately)


Click to Enlarge
View of a Ø105 µm Core Multimode Fiber with the FS200 Inspection Scope

FS200 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	2 AAA Batteries (Included)

The FS200 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 FS200 offers both coaxial and oblique illumination settings. The oblique setting provides light at an off-center angle to the fiber end face for higher contrast. For critical examination of polish quality, we strongly recommend this fiber inspection scope.

The FS200 includes the FS200-FC adapter for FC-/ST-/SC-terminated fibers (Ø2.5 mm ferrules) and the FS200-SMA adapter for SMA905- and SMA906-terminated fibers (Ø3 mm ferrules). The FS200-LC adapter is also available for LC-terminated fibers (Ø1.25 mm ferrules).

Fiber Scope Operation

Insert the fiber connector into the adapter until it stops, then hold firmly in place during inspection. To activate regular illumination, press the black button briefly. Press the button again to turn off the illumination source. To activate oblique illumination, press the button for 3 seconds when the scope is off. The scope will automatically shut off after two minutes regardless of illumination mode.

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.

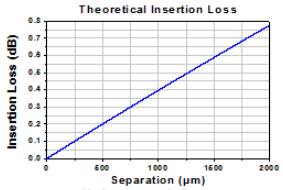
Adapter Alignment

When using the FS200 scope with new adapters, it may be necessary to align the adapter to center the fiber in the field of view. 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	**Customer Inspired!Fiber Inspection Scope, FS200-FC and FS200-SMA Adapters Included**	**$202.00**	**3-5 Days**
FS200-LC	**Customer Inspired!LC-Type Connector Adapter for FS200 Fiber Inspection Scope**	**$28.00**	**Today**
FS200-FC	**FC-Type Connector Adapter for FS200 Fiber Inspection Scope**	**$35.00**	**Today**
FS200-SMA	**SMA-Type Connector Adapter for FS200 Fiber Inspection Scope**	**$28.00**	**Today**

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 connectorized 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.

Part Number	Description	Price	Availability
10125HG	Fiber Optic SMA905 Connector Height Gauge	$380.00	Today

Premium Eye Loupes: 6X and 10X Magnification

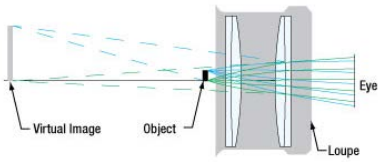
- Magnification: 6X or 10X
- Uses a Pair of Glass Achromatic Doublets
- AR Coating on All Glass-to-Air Optical Surfaces
- Large Field of View: Ø1.4" for 6X and Ø1.1" for 10X
- Small Form Factor

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, AOI=0°		
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:

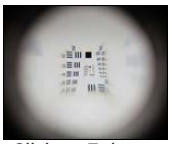
$$M = \frac{254\ mm}{f} + 1$$

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**	**$150.00**	**Today**
EYL10X	**Premium 10X Eye Loupe**	**$150.00**	**Today**

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**	**$23.26**	**Today**

Head-Worn Magnifier

- 2.0X Magnification
- Can be Worn With or Without Eyeglasses
- ESD Compliant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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, ESD Compliant	$30.91	Today

Inspection Mirror

- Corrosion-Resistant Stainless Steel Telescoping Handle
- High-Quality, Low Distortion Glass Mirror
- Articulated Joint Adds Versatility in Mirror Positioning
- 8.50" Solid Length, 35" Extended Length


Click to Enlarge
Partial Extension of Telescoping Arm

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

Part Number	Description	Price	Availability
TM1	Telescoping Inspection Mirror	$23.60	Today

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

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")	Ñ0.01016 mm ($4x10^{-4}$")	20 mm (0.787")
20	0.20 mm (0.0079")	Ñ0.00762 mm ($3x10^{-4}$")	20 mm (0.787")
10	0.10 mm (0.0039")	Ñ0.00508 mm ($2x10^{-4}$")	1 mm (0.040")

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.

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	$34.70	Today

Visit the *Inspection Tools* page for pricing and availability information:
https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=1427