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

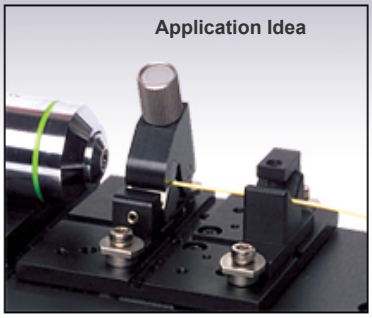
THORLABS

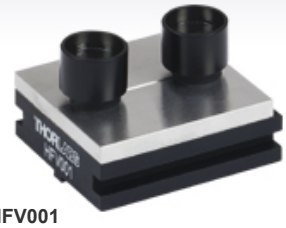
HFB004 - December 15, 2021

Item # HFB004 was discontinued on December 15, 2021. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

FIBER HOLDERS AND FORCE SENSORS FOR MULTI-AXIS FLEXURE STAGES

- ► Adjustable, Magnetic, & Simplified Fiber Clamps
- ► Fiber Array, Connectorized, & V-Groove Holders
- ► FC/PC-Connectorized Axial Force Sensor & Cable Strain Relief




HFV001

HFS001


HFF001


HFV002

HFA001

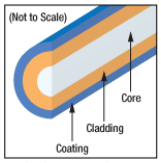
HFB004


HFB005N

OVERVIEW

This page contains our selection of accessories for multi-axis flexure fiber stages. These include fiber clamps, fiber holders, and axial force sensors. Additionally, we manufacture magnetic clamps that hold fibers in our V-groove fiber holders. We also offer bare fiber chucks and a rotator for Fiber Launch platforms, as well as other Fiber Optomechanics.

Other Bare Fiber Mounts			
Post Mountable or SM Threaded	Flexure Stage Compatible		
V-Mounts	Clamps	Chucks	Rotator



Click to Enlarge
Basic Structure of a
Typical Optical Fiber

The V-groove fiber holders on this page are typically used to clamp fibers with the coating intact. The diagram to the right shows the structure of a typical fiber, which consists of a core, a cladding, and a coating (note that the diagram is not to scale). The coating serves to protect the cladding of glass fibers from particulates that may land on the surface of the fiber, causing it to become brittle. Although this layer may also have optical properties that allow it to double as a second cladding, it is still referred to as the coating layer due to the protective properties. The term “buffer” is often used instead of “coating” when the layer surrounding the cladding is composed of Tefzel, as this material bonds differently to the glass cladding than other common coating materials such as acrylate or TECS. Some fibers may also have an additional jacket, or buffer applied on top of the coating layer. To determine whether one of the clamps available below is compatible with the fiber used in your application, you must know the diameter of the outer layer (coating, additional jacket, or buffer layer). This value needs to be within the range of specified fiber diameters for the clamp.

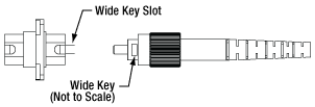
Flexure stage mounts can be fixed in position using AMA010(/M) mounting cleats, which are sold below. Each cleat is designed with one edge milled flat, making it possible to insert or remove a flexure stage mount without removing the clamp. Simply loosen the clamp screw and rotate the flat side of the lock-down clamp inward to release the flexure stage mount.

Multi-Axis Stage Accessories											
											
Fiber Mounts	Fiber Rotators	Waveguide Mounts	Diode Mounts	Fixed Mounts	Kinematic Mounts	Top Plates	Extension Platforms	Fiber Chucks	Slide Holders	Kinematic Platforms	Adapter Plates

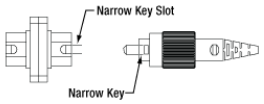
KEY ALIGNMENT

FC/PC and FC/APC Patch Cable Key Alignment

FC/PC and FC/APC Patch Cables are equipped with either a 2.0 mm narrow or 2.2 mm wide alignment key that fits into a corresponding slot on a mated component. These keys and slots are essential to correctly align the cores of connected fiber patch cables and minimize the insertion loss of the connection.



Click to Enlarge
Mating Between a Wide-Key Mating Sleeve and Connector



Click to Enlarge
Mating Between a Narrow-Key Mating Sleeve and Connector

As an example, Thorlabs designs and manufactures mating sleeves for FC/PC- and FC/APC-terminated patch cables to precise specifications that ensure good alignment when used correctly. To ensure the best alignment, the alignment key on the patch cable is inserted into the corresponding narrow or wide-key slot on the mating sleeve.

Wide-Key-Slot Mating Sleeves

2.2 mm wide-key-slot mating sleeves are compatible with both wide-key and narrow-key connectors. However, using a narrow-key connector in a wide-key slot will allow the connector to rotate slightly in the mating sleeve (as shown in the animation below and to the left). While this configuration is acceptable for patch cables with FC/PC connectors, for FC/APC applications, we recommend using narrow-key-slot mating sleeves to ensure optimum alignment.

Narrow-Key-Slot Mating Sleeves

2.0 mm narrow-key-slot mating sleeves allow for optimal alignment of angled, narrow-key FC/APC connectors, as shown in the animation below and to the right. Therefore, they are not compatible with connectors that have a 2.2 mm wide key. Please note that all FC/PC and FC/APC patch cables manufactured by Thorlabs use narrow key connectors.

Wide-Key-Slot Mating Sleeve and Narrow Key Connector

When a narrow key connector is inserted into a wide-key-slot mating sleeve, the connector has room to rotate. For narrow key FC/PC connectors, this is acceptable, but for narrow key FC/APC connectors, significant coupling losses will result.

Narrow-Key-Slot Mating Sleeve and Narrow Key Connector

Once a narrow key connector is inserted into a narrow-key-slot mating sleeve, the connector will not rotate. We therefore recommend these mating sleeves for FC/PC and FC/APC connectors with narrow keys.

Insights into Optical Fiber

Scroll down to read about:

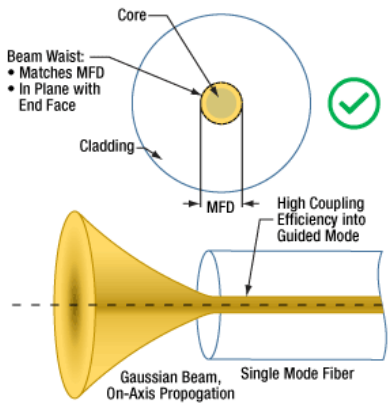
- What factors affect the amount of light coupled into a single mode fiber?
- Is the max acceptance angle constant across the core of a multimode fiber?

Click here for more insights into lab practices and equipment.

What factors affect the amount of light coupled into a single mode fiber?

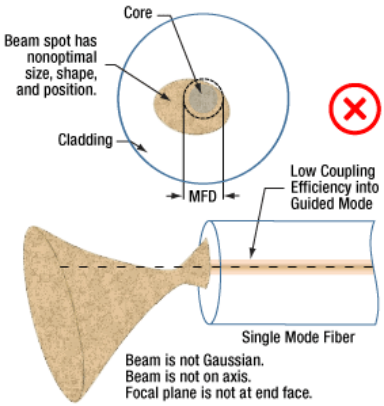
Adjusting the incident beam's angle, position, and intensity profile can improve the coupling efficiency of light into a single mode optical fiber. Assuming the fiber's end face is planar and perpendicular to the fiber's long axis, coupling efficiency is optimized for beams meeting the following criteria (Figure 1):

- Gaussian intensity profile.
- Normal incidence on the fiber's end face.
- Beam waist in the plane of the end face.
- Beam waist centered on the fiber's core.
- Diameter of the beam waist equal to the mode field diameter (MFD) of the fiber.



Click to Enlarge

Figure 1 For maximum coupling efficiency into single mode fibers, the light should be an on-axis Gaussian beam with its waist located at the fiber's end face, and the waist diameter should equal the MFD.



Click to Enlarge

Figure 2 Conditions which can reduce coupling efficiency into single mode fibers include anything that reduces the similarity of the incident beam to the optical properties of the fiber's guided mode.

Deviations from these ideal coupling conditions are illustrated in Figure 2.

These beam properties follow from wave optics analysis of a single mode fiber's guided mode (Kowalevicz).

The Light Source can Limit Coupling Efficiency

Lasers emitting only the lowest-order transverse mode provide beams with near-Gaussian profiles, which can be efficiently coupled into single mode fibers.

The coupling efficiency of light from multimode lasers or broadband light sources into the guided mode of a single mode fiber will be poor, even if the light is focused on the core region of the end face. Most of the light from these sources will leak out of the fiber.

The poor coupling efficiency is due to only a fraction of the light in these multimode sources matching the characteristics of the single mode fiber's guided mode. By spatially filtering the light from the source, the amount of light that may be coupled into the fiber's core can be estimated. At best, a single mode fiber will accept only the light in the Gaussian beam output by the filter.

The coupling efficiency of light from a multimode source into a fiber's core can be improved if a multimode fiber is used instead of a single mode fiber.

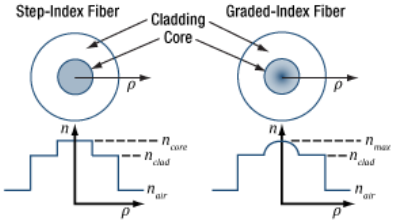
References

Kowalevicz A and Bucholtz F, "Beam Divergence from an SMF-28 Optical Fiber (NRL/MR/5650--06-8996)." Naval Research Laboratory, 2006.

Date of Last Edit: Jan. 17, 2020

Is the max acceptance angle constant across the core of a multimode fiber?

It depends on the type of fiber. A step-index multimode fiber provides the same maximum acceptance angle at every position across the fiber's core. Graded-index multimode fibers, in contrast, accept rays with the largest range of incident angles only at the core's center. The maximum acceptance angle decreases with distance from the center and approaches 0° near the interface with the cladding.



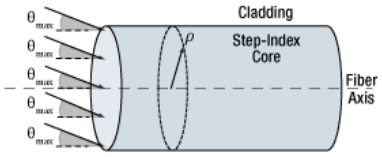
Click to Enlarge

Figure 3: Step-index multimode fibers have an index of refraction (n) that is constant across the core. Graded-index multimode fibers have an index that varies across the core. Typically the maximum index occurs at the center.

Step-Index Multimode Fiber

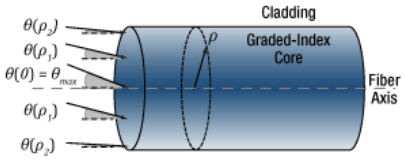
The core of a step-index multimode fiber has a flat-top index profile, which is illustrated on the left side of Figure 3. When light is coupled into the planar end face of the fiber, the maximum acceptance angle (θ_{max}) is the same at every location across the core (Figure 4). This is due to the constant value of refractive index across the core, since the acceptance angle depends strongly on the index of the cladding.

Regardless of whether rays are incident near the center or edge of the core, step-index multimode fibers will accept cones of rays spanning angles $\pm\theta_{max}$ with respect to the fiber's axis.



Click to Enlarge

Figure 4: Step-index multimode fibers accept light incident in the core at angles $\leq|\theta_{max}|$ with good coupling efficiency. The maximum acceptance angle is constant across the core's radius (ρ). Air is assumed to surround the fiber.



Click to Enlarge

Figure 5: Graded-index multimode fibers have acceptance angles that vary with radius (ρ), since the refractive index of the core varies with radius. The largest acceptance angles typically occur near the center, and the smallest, which approach 0°, occur near the boundary with the cladding ($0 < \rho_1 < \rho_2$). Air is assumed to surround the fiber.

Graded-Index Multimode Fibers

The core of a typical graded-index multimode fiber, shown on the right side of Figure 3, has a refractive index that is greatest at the center of the core and decreases with radial distance (ρ). The equation included below the diagram in Figure 5 shows that the radial dependence of the core's refractive index results in a radial dependence of the maximum acceptance angle and numerical aperture (NA). This equation also assumes a planar end face, normal to the fiber's axis that is surrounded by air.

Cones of rays with angular ranges limited by the core's refractive index profile are illustrated Figure 5. The cone of rays with the largest angular spread ($\pm\theta_{max}$) occurs on the fiber's axis ($\rho = 0$). The angular spread decreases as the radial distance to the axis increases.

Step-Index or Graded Index?

A step-index multimode fiber has the potential to collect more light than a graded-index multimode fiber. This is due to the NA being constant across the step-index core, while the NA decreases with radial distance across the graded-index core.

However, the graded-index profile causes all of the guided modes to have similar propagation velocities, which reduces the modal dispersion of the light beam as it travels in the fiber.

For applications that rely on coupling as much light as possible into the multimode fiber and are less sensitive to modal dispersion, a step-index multimode fiber may be the better choice. If the reverse is true, a graded-index multimode fiber should be considered.

References

Keiser G, "Section 2.6." *Optical Fiber Communications*. McGraw-Hill, 1991.

Date of Last Edit: Jan. 2, 2019

Flexure Stage Accessories: Connectorized-Fiber Holders

- Holders for Connectorized Fibers:
  - HFB001B: SMA
  - HFB004: FC/PC, Wide Key Slot (2.2 mm)
  - HFB004N: FC/PC, Narrow Key Slot (2.0 mm)
  - HFB005: FC/APC, Wide Key Slot (2.2 mm)
  - HFB005N: FC/APC, Narrow Key Slot (2.0 mm)
- 12.5 mm Optical Axis Height

These connectorized-fiber holders are compatible with the mounting platforms of our multi-axis flexure stages. Each holder is designed to securely hold the center of the connector 12.5 mm (0.49") above the flexure stage platform. The design virtually eliminates fiber tip motion when the fiber cable is moved and significantly improves the repeatability of the positioning of the fiber tip. Our holders for FC/PC- and FC/APC-connectorized fibers are available with either wide key (2.2 mm) or narrow key (2.0 mm) slots. Please see the *Key Alignment* tab for more information.

Part Number	Description	Price	Availability
HFB001B	**NEW! SMA-Connectorized-Fiber Holder for Multi-Axis Stages**	**$66.00**	**Today**
HFB004	**Wide Key FC/PC-Connectorized-Fiber Holder for Multi-Axis Stages**	**$51.40**	**Today**
HFB004N	**Narrow Key FC/PC-Connectorized-Fiber Holder for Multi-Axis Stages**	**$68.00**	**Today**
HFB005	**Customer Inspired! Wide Key FC/APC-Connectorized-Fiber Holder for Multi-Axis Stages**	**$62.76**	**Today**
HFB005N	**Narrow Key FC/APC-Connectorized-Fiber Holder for Multi-Axis Stages**	**$68.00**	**Today**

Flexure Stage Accessories: Quick-Release, Adjustable Fiber Clamp

- Multi-Purpose V-Groove Insert Features 5 Different V-Grooves and 1 Flat Surface
- Accommodates Fibers or Cylindrical Optical Elements with Diameters from 125 µm to 2.66 mm
- Fiber Clamping Arm with Adjustable Knob Provides 0.25 - 2.0 N (0.06 - 0.45 lb) of Holding Force

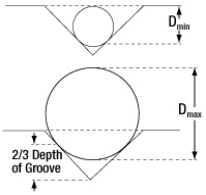
This quick-release, adjustable-force fiber clamp has many features that make it our most versatile fiber clamp. The top knob is used to adjust the force that the clamping arm exerts on the fiber. This feature is useful when working with specialty fibers, such as highly birefringent fibers, photonic crystal fibers, or exotic glass fibers containing fluoride or tellurite.

The fiber holder features a grooved central ferrule with six mounting surfaces, which together accept fibers or other cylindrical objects that have an outer diameter between 125 µm to 2.66 mm. Simply rotate the ferrule to align the correct mounting groove with the clamping arm and secure with the included M4 setscrew. It has been designed to allow rapid mounting and dismounting of a variety of photonic components, including bare optical fibers, optical fibers mounted in ceramic ferrules, and multi-channel waveguides.

To determine whether this clamp is suitable for your application, you must know the diameter of the cylindrical object that you wish to secure in the clamp, such as the outer layer (coating or additional jacket or buffer layer) of your fiber or the size of your ferrule. The table to the right specifies the minimum and maximum diameters a cylindrical object can have in order to be securely held by each groove in the HFF001.

Accepted Diameters[a]		
Hexagon Flat	**D_{min}**	**D_{max}**
1	0.125 mm	0.240 mm
2	0.147 mm	0.333 mm
3	0.3 mm	0.666 mm
4	0.6 mm	1.333 mm
5	1.2 mm	2.66 mm

a. These values are typical and do not take manufacturing tolerances into account.



For a simpler clamp for coated fiber, please consider the HFF003 Quick-Release Fiber Clamp listed below.

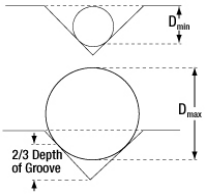
Part Number	Description	Price	Availability
HFF001	**Quick-Release Cylindrical Device Mount for Multi-Axis Stages**	**$360.71**	**Today**

Flexure Stage Accessories: V-Groove Fiber Holder

- Precision V-Groove Designed to Hold Ø150 µm to Ø341 µm Fibers
- Stainless Steel Construction Provides Robust, Wear-Resistant Surface
- HFM001 Magnetic Clamps Feature a Soft Elastomer Pad to Protect Fiber Cladding from Damage

Accepted Diameters[a]	
D_{min}	D_{max}
150 µm	341 µm

a. These values are typical and do not take manufacturing tolerances into account.



For ease of mounting and experimental flexibility, the HFV001 Standard V-Groove Fiber Holder is an ideal solution for securing bare (coating intact), single mode fibers. The fiber is held in the precision V-groove by two magnetic clamps. The clamps have a special elastomer pad that locally distorts around the fiber to provide a secure but delicate grip. The base of the holder is made of anodized aluminum, and the top plate is made of magnetic stainless steel.

For a longer holder optimized for fiber coupling to smaller devices, please consider the HFV002 Tapered V-Groove Fiber Holder sold below. The HFM001 Magnetic Clamps are also available separately below.

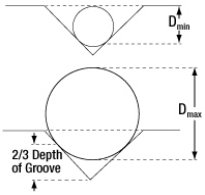
Part Number	Description	Price	Availability
HFV001	**Standard V-Groove Fiber Holder for Multi-Axis Stages**	**$147.17**	**7-10 Days**

Flexure Stage Accessories: Tapered V-Groove Fiber Holder

- Precision V-Groove Designed for Ø150 µm to Ø341 µm Fibers
- Stainless Steel Construction Provides Robust, Wear-Resistant Surface
- Tapered End Maximizes Access to Fiber in Industrial Coupling Applications

Accepted Diameters[a]	
D_{min}	D_{max}
150 µm	341 µm

a. These values are typical and do not take manufacturing tolerances into account.



The HFV002 Tapered V-Groove Fiber Holder, which is longer than our HFV001 Fiber Holder sold above, is designed to allow access to smaller devices. When butt-coupling fibers to small waveguide devices (particularly when the device is mounted on a waveguide manipulator), it is often difficult to support and position the end of the fibers close enough to the input ports of the waveguide with standard V-groove holders. The tapered top plate of this mount improves the user's ability to visually observe the fiber-waveguide interface.

The fiber is secured with the two provided HFM001 Magnetic Clamps. These clamps are also available separately below.

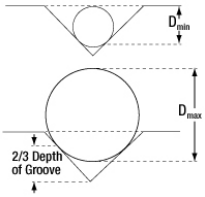
Part Number	Description	Price	Availability
HFV002	**Tapered V-Groove Fiber Holder for Multi-Axis Stages**	**$151.49**	**Today**

Flexure Stage Accessories: Simplified Fiber Clamp

- Precision V-Groove Designed to Hold Ø150 µm to Ø341 µm Fibers
- Magnet Holds Clamping Arm in Place
- Simplified Mechanical Design

Accepted Diameters[a]	
D_{min}	D_{max}
150 µm	341 µm

a. These values are typical and do not take manufacturing tolerances into account.



This fiber clamp is intended for applications that do not require the extra features offered by the HFF001 Fast-Release Fiber Clamp listed above. The clamping arm is designed to swing approximately 120° from the clamping surface to allow easy loading of the fiber into the V-groove. A rare earth magnet is used to hold the clamping arm in place once it is lowered onto the fiber. A M4 (1.5 mm hex) magnetic setscrew is also embedded in the arm to provide a simple means of adjusting the clamping force.

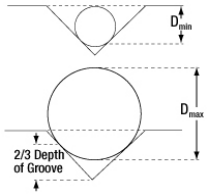
Part Number	Description	Price	Availability
HFF003	**Quick-Release Ø150 µm to Ø341 µm Fiber V-Groove for Multi-Axis Stages**	**$125.53**	**Today**

Flexure Stage Accessories: Cable Strain Relief

- Secures 900 µm or 3 mm Diameter Cables
- Mounts Directly on the Deck of Our Popular Multi-Axis Stages
- Prevents Accidental Misalignment

Accepted Diameters[a]	
D_{min}	D_{max}
0.663 mm	5.93 mm

a. These values are typical and do not take manufacturing tolerances into account.

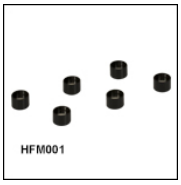


This strain relief accessory ensures that disturbances to the fiber cable are not translated into unwanted movement of the fiber end face, saving time while setting up and running experiments. It is especially useful for large-diameter fibers. A M2.5 (2 mm hex) setscrew allows for vertical adjustment of the clamping arm, and a M2 (1.6 mm hex) clamp setscrew secures the cable in the clamp's V-groove.

To determine whether this clamp is suitable for your application, the diameter of the outer layer (coating or additional jacket or buffer layer) of the fiber must be known. The table above specifies the minimum and maximum diameters that can be held securely. For an brief summary of fiber terminology, please see the *Overview* tab above.

Part Number	Description	Price	Availability
HFS001	**Strain Relief Clamp for Fiber Optic Cables for Multi-Axis Stages**	**$51.40**	**Today**

Flexure Stage Accessories: Magnetic Clamps



- Soft Elastomer on Bottom Surface Protects Exposed Fiber Cladding
- Sold in Packages of Six

These magnet assemblies are used to securely hold fibers to our V-groove style fiber holders. Please note that two of these fiber clamps are included with each V-groove style fiber holder. We offer these magnetic clamps as replacement parts. They are also useful for customers building customized fiber optic assemblies.

Part Number	Description	Price	Availability
HFM001	**Pack of 6 Magnetic Clamps for Multi-Axis Stages**	**$27.06**	**Today**

Flexure Stage Accessories: Fiber Array Holder

- Accepts Rectangular Fiber Arrays up to 12 mm Wide
- Actuator Knob Controls Clamping Mechanism and Allows Easy Loading
- Angled Contact Pads Ensure that the Optical Element Sits Flat on the Support Surface
- Also Useful for Mounting Rectangular Optics

The HFA001 Fiber Array Holder uses a single actuator knob to simultaneously move both sides of the clamping mechanism. This two-sided mechanism ensures the device being mounted is centered on the support surface. Three angled clamping surfaces provide a slight downward pressure and stable, three-point contact. The third clamping point is located at the end of a spring-loaded flexure rod that allows the holder to adapt to differently sized optical elements.

Part Number	Description	Price	Availability
HFA001	**Standard Adjustable fiber array holder for Multi-Axis Stages**	**$443.67**	**7-10 Days**

Multi-Axis Flexure Stage Accessories: Axial Force/Touch Sensor Platform

- Load Capacity: 30 N (6.7 lb)
- Sensitivity: 0.03 N (0.0067 lb)
- 62.5 mm Deck Height with AMA034 Support Post
- 112.5 mm Deck Height with AMA035 Support Post

Click To Enlarge
The FSC103 secured onto the AMA034 has the same deck height as our 3-axis platforms.

The FSC103 Axial Force Sensor is a force-sensing cell that can be used to position an optical fiber with respect to another device in the direction of the optical axis. When the fiber makes contact with the device, a force arises that is detected by a strain gauge. This generates an electrical signal that is available for the actuator controller to indicate that the desired position has been reached.

These cells mount in the groove of our AMA034 and AMA035 Post Assemblies. The AMA034 delivers a deck height of 62.5 mm (optical height of 75 mm), which is the same as our 3-axis NanoMax, RollerBlock, and MicroBlock platforms. The AMA035 delivers a 112.5 mm deck height (optical height of 125 mm), which matches our NanoMax 600 6-axis stages.

The FSC103 sensor is compatible with the other flexure stage accessories sold on this page. The KSG101 K-Cube™ Strain Gauge Reader is ideal for monitoring the output of the stage's sensor. A PAA622 cable is included with the force sensor for connection to the strain gauge reader.

Part Number	Description	Price	Availability
FSC103/M	**Axial Force Sensor with Grooved Platform for Multi-Axis Stages, Metric**	**$767.23**	**Today**
AMA034	**Post for FSC103 Axial Force Sensor, 75 mm Optical Height**	**$141.45**	**Today**
AMA035	**Post for FSC103 Axial Force Sensor, 125 mm Optical Height**	**$193.70**	**Today**
FSC103	**Axial Force Sensor with Grooved Platform for Multi-Axis Stages**	**$767.23**	**Today**

Flexure Stage Accessories: V-Groove Axial Force Sensor Fiber Holder

- Load Capacity: 30 N (6.7 lb)
- Sensitivity: 0.03 N (0.0067 lb)
- Two Magnetic HFM001 Fiber Clamps Included

Compatible Controllers
KSG101 K-Cube™ Strain Gauge Reader
BPC301 1-Channel Benchtop Piezo Controller
BPC301 3-Channel Benchtop Piezo Controller

This force-sensing cell uses the same principle as the FSC103 Axial Force Sensor sold above, but is used to position a bare optical fiber with respect to another device. When the fiber makes contact with the device, a force arises that is detected by a strain gauge. This generates an electrical signal that is available for the actuator controller to indicate that the desired position has been reached.

The fiber is secured with the two provided HFM001 Magnetic Clamps. These clamps are also available separately above.

Part Number	Description	Price	Availability
FSC102	**V-Grooved Fiber Holder Axial Force Sensor for Multi-Axis Stages**	**$780.20**	**Today**

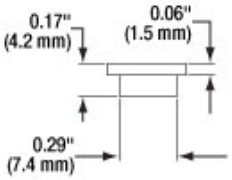
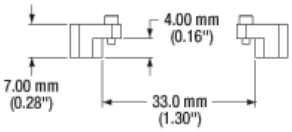
Accessory Lockdown Clamps

Click for Details
Accessories mounted in close proximity using the AMA110 Mounting Block.

- Secures Components to NanoMax, MicroBlock, or RollerBlock Stages
- Cleats for Mounting Single Components
- Mounting Blocks and Clamps for Close Proximity Mounting of Multiple Components

To lock an accessory in place, rotate the AMA010 cleat so that the flat is facing the stage's groove. Place the accessory into the groove between the cleats, rotate the cleat so that the rounded edge covers the edge of the mount, and lock down the cap screw.

The AMA010(/M) Cleats have a flat milled along one side. To lock an accessory along the center alignment groove, rotate the cleat so that the flat is facing the groove. Place the accessory into the groove between the cleats, rotate the cleat so that the rounded edge covers the edge of the mount, and lock down the 6-32 (M3) locking screw and washer. The cleats can be rotated without needing to remove the locking screws. See the animation to the right for details. The included screws are 5/16" (8 mm) long and are used with a 3/32" (2.5 mm) hex key.

Lockdown Clamps					
Item #	**AMA010**	**AMA010/M**	**AMA110**	**AMA110/M**	**AMA111**
Included Hardware	6-32 Cap Screw (x15) M3.5 Washer (x15)	M3 Cap Screw (x15) M3 Washer (x15)	6-32 Nylon Tip Setscrew (x12) 6-32 Cap Screw (x4)	M3 Nylon Tip Setscrew (x12) M3 Cap Screw (x4)	6-32 Cap Screw (x2) M3 Cap Screw (x2) M3.5 Washer (x2) M3 Washer (x2) 7/64" Hex Key 2.5 mm Hex Key
Mechanical Diagram (Click for Details)					

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Close proximity mounting using the AMA010 Cleat and AMA111 Clamp.

For mounting multiple components in close proximity, we offer the AMA110 mounting blocks. These mounting blocks feature a line of nylon-tipped setscrews to secure components, and allow for easy repositioning and very close mounting. The blocks are secured via two holes and are supplied with either 6-32 or M3 cap screws.

The AMA111 Narrow Device Mounting Clamps offer an alternative solution when devices need to be mounted close together. They are secured using an M3.5 or M3 washer and a 6-32 or M3 cap screw, compatible with a 7/64" or 2.5 mm hex key, respectively.

Part Number	Description	Price	Availability
AMA010/M	**Cleats with M3 Locking Screws, Qty. 15**	**$40.58**	**Today**
AMA110/M	**Optic Mounting Block, Qty. 2, Metric**	**$55.00**	**Today**
AMA111	**Narrow Device Mounting Clamps, Qty. 2**	**$28.68**	**Today**
AMA010	**Cleats with 6-32 Locking Screws, Qty. 15**	**$40.58**	**Today**
AMA110	**Optic Mounting Block, Qty. 2**	**$55.00**	**Today**