THORLABS

CAC400 and CAC400A Compact Automated Fiber Cleavers

User Guide

Table of Contents

Chapter 1 Warning Symbol Definitions

Below is a list of warning symbols you may encounter in this manual or on your device.

Symbol	Description
	Direct Current
	Alternating Current
	Both Direct and Alternating Current
	Earth Ground Terminal
	Protective Conductor Terminal
	Frame or Chassis Terminal
	Equipotentiality
	On (Supply)
	Off (Supply)
	In Position of a Bi-Stable Push Control
	Out Position of a Bi-Stable Push Control
	Caution: Risk of Electric Shock
	Caution: Hot Surface
	Caution: Risk of Danger
	Warning: Laser Radiation
	Caution: Spinning Blades May Cause Harm

Chapter 2 Safety

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly.

WARNING

Use great care when working near or handling the cleave blade, as the diamond tip is extremely sharp and can very easily cut through skin.

CAUTION

Do not pick up the unit by the fiber holder nest or push the nest hard forwards or backwards. Doing so will cause the nest to become misaligned, and will degrade the quality of the cleaves produced by the unit.

WARNING

Do not place the CAC400 or CAC400A on a flammable surface.

WARNING

Do not put your fingers between the nest and cleave mechanism at this point, or they will be pinched!

Chapter 3 Description

3.1. Introduction

These Vytran™ Compact Automated Fiber Cleavers are designed for cleaving fibers with claddings from Ø60 µm to Ø600 µm with a high degree of accuracy, ease of use, and versatility in manufacturing or research environments. The CAC400 is designed to produce flat cleaves perpendicular to the length of the fiber, while the CAC400A has a rotation stage for creating angle cleaves up to 15°.

Each unit operates with a tension-and-scribe cleave method, whereby axial tension is first applied to the fiber followed by an automated scribe process utilizing a diamond cleave blade. After the blade scribes the fiber, tension is maintained, causing the scribe to propagate across the fiber perimeter and complete the cleave. The CAC400A accomplishes angle cleaves by using the rotation stage to apply torsion to the fiber prior to scribing. The resulting cleave will be perpendicular to the maximum resultant stress created by the combined tension and torsion applied to the fiber. This method produces consistent low-angle cleaves with mirror-quality end-face finishes, ideal for splicing, and has a cleave angle accuracy of ±1.0°.

Both the CAC400 and CAC400A can be configured to accept Fujikura and Fitel fiber holders (also known as fiber clips), allowing for seamless process integration into their fiber processing systems. If you would like a CAC400 or CAC400A system designed around one of these fiber clips, please contact techsupport@thorlabs.com.

3.2. Parts Checklist

When unpacking the CAC400 or CAC400A for the first time, verify that the box contents are similar to this:

Figure 1 Unit and Accessories in Box

Check to make sure that you have the following items:

- The CAC400 or CAC400A System
- 12V DC Power supply
- Region-Specific Power Cord
- Ethernet cable
- Shipping fixture (on unit -- Section 3.4)
- This Operator's Manual
- 0.035" Allen key
- Tweezers
- Brush

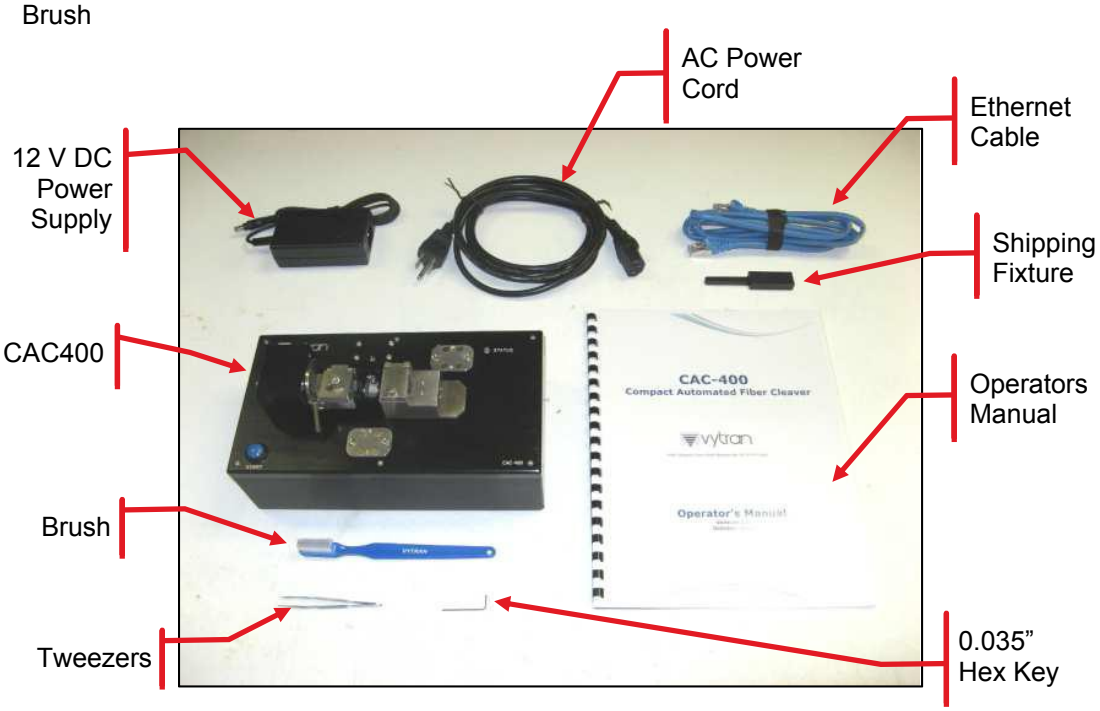


Figure 2 The CAC400A and Accessories

If you ordered additional inserts, or any fiber holders, or a CACM micrometer/camera assembly, then they should be in the box as well. If you order a shard extraction pump, it will be shipped separately.

If you are missing any of the accessories or need replacements, please contact TechSupport@Thorlabs.com.

Please save the packaging material and pink anti-static bag for returning the unit back to Thorlabs for service. This packaging will reduce the risk of damage during shipment.

Figure 3 Packaging Material Should be Saved

3.3. Shipping Fixture

The CAC400 and CAC400A contain a load cell (located under the fiber holder nest) that can be damaged if the nest is jarred violently. In order to protect the load cell during shipping, each unit is provided with an aluminum fixture which is used to fix the nest in place with respect to the rest of the unit. After unpacking the unit, remove the shipping fixture by loosening both thumbscrews, lifting both lids, and lifting out the shipping fixture.

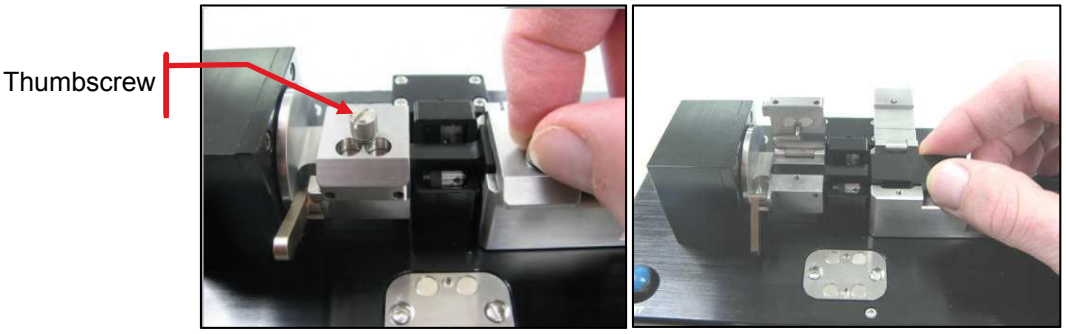


Figure 4 Removing the Shipping Fixture

Be sure to save the shipping fixture so that you will be able to use it in the event that you have to return the unit for service.

Figure 5 Shipping Fixture

3.4. Flat or Angled Cleaver Configurations

The illustrations below show the differences between a CAC400 Flat Cleaver and the CAC400A Angle Cleaver. The angle cleave version includes a rotary stage that can rotate the left fiber holding block in order to twist the fiber and produce an angle cleave.

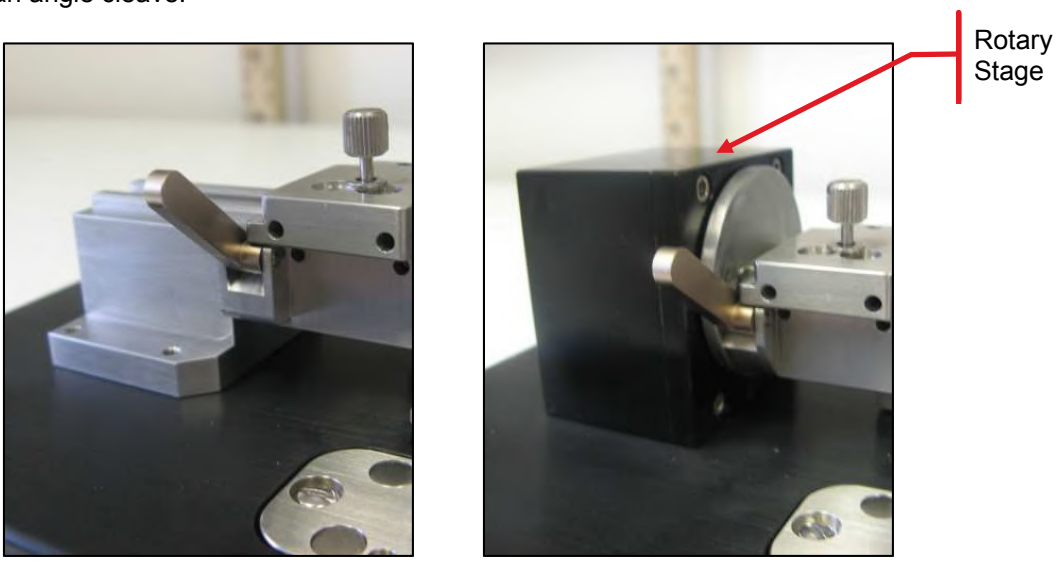


Figure 6 (Left) CAC400, (Right) CAC400A

3.5. Essential Accessories

It is necessary to purchase one bottom insert and one top insert in order to use the CAC400 or CAC400A. The inserts should be selected based on the cladding diameter of the fiber that is to be cleaved. See *Table 2* for more details.

Figure 7 Inserts

It is also necessary to have one fiber holder (also known as a fiber clip) in order to use the CAC400 or CAC400A. These are chosen based on the fiber buffer or coating diameter.

Figure 8 VHM250 Fiber Clip for 250 µm Diameter Fiber Buffer

3.6. Optional Accessories

The CAC400 and CAC400A are offered with eight optional accessories. They are:

- **CACM Micrometer Backstop and Camera** -- Includes a micrometer that can back up the fiber during cleaving and a USB camera for ensuring that the micrometer just touches the fiber prior to cleaving. Comes with a disk containing the camera software.

Figure 9 Micrometer/camera Assembly

- **Shard Suction Pump** --Includes a vacuum pump operated by a foot switch that can quickly and safely suck small fiber off-cuts into a collection vessel. This feature only works with fibers of relatively small diameter (<250 microns). Also includes a suction tube which must be added to CAC400 units (see Section 6.7.2). Please contact TechSupport@Thorlabs.com to order a shard extraction pump.

Figure 10 Shard Suction Pump

- **Calibration kit** -- Includes a set of weights and a pulley fixture to make it possible to re-calibrate the load cell used to sense fiber tension. The kit also includes a length of nylon monofilament line with one looped end and one knotted end. The monofilament line must be held by a fiber holder during calibration. The standard monofilament line can be held in a 250 micron fiber holder. Thicker monofilament line is available for fiber holders intended for larger fiber. For systems only provisioned with small-fiber fiber holders, it may be necessary to buy a separate 250 micron fiber holder in order to hold onto the monofilament line securely. Please contact TechSupport@Thorlabs.com to order a calibration kit.

Figure 11 Calibration Kit

- **Additional Fiber Holders** – Necessary if you plan on cleaving more than one fiber size.
- **Additional Bottom Inserts** -- There are four different v-groove inserts to choose from, and each is double-sided, so that two different size ranges can be accommodated with one insert. See *Table 2* for guidance.
- **Additional Top Inserts** -- There are two different top inserts to choose from, and each is double-sided, so that two different size ranges can be accommodated with one insert. See *Table 2* for guidance.
- **Computer** – A laptop computer is required to program and load parameter files onto the CAC400 and CAC400A. A computer is also required to display the camera image if the CACM backstop/camera option is purchased. Computers purchased with the CAC400 or CAC400A will come preloaded with the necessary software and drivers. Please contact TechSupport@Thorlabs.com to order a computer with the CAC400 or CAC400A cleavers.
- **Dust Cover** -- A cover is available to protect the unit from dust during periods when it is not in use. Please contact TechSupport@Thorlabs.com to order a dust cover.

Figure 12 Dust Cover

Chapter 4 Setup

4.1. Initial Setup

CAUTION

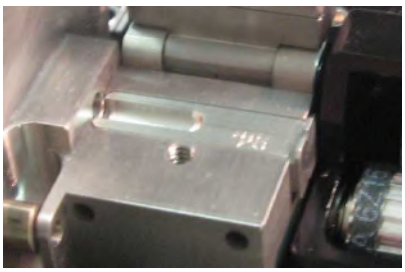
Do not place the CAC400 or CAC400A on a flammable surface.

1. Plug in the AC power cord. The power supply accepts an AC input of 100-240 VAC; 47-63 Hz.

2. Connect the AC power cord to the DC power supply.

3. Plug the DC power jack into the unit. To distinguish the CAC400's power jack from that of laptops you may be using, a band of blue heat-shrink tubing has been fitted to the jack. Take care not to plug a laptop power supply into the CAC400 or CAC400A power socket (do not plug the CAC400 power supply into a laptop power socket, either).

4. Attach the bottom insert to the fiber holding block and make sure it is the size you specified when you ordered the unit. Note that the inserts are double-sided, and it may be necessary to flip the insert over in order to find the size you are expecting.



5. Attach the top insert to the fiber holding block and make sure it is the size you specified when you ordered the unit. Again, the inserts are doublesided, and it may be necessary to flip the insert over in order to find the size you are expecting.

4.2. Power-up

To turn on the unit, press the blue button. The LED indicator will flash orange and the nest will move to the load position. Once the nest has moved into the load position, the LED will shine with a steady green light, indicating the unit is ready to cleave.

4.3. Performing the First Cleave

When the status LED is steady green, the unit is ready to perform a cleave. Ensure that the proper insert is in place (corresponding to the appropriate fiber cladding diameter), ensure that the cleave mechanism is in the *up* position (with cleave blade visible) and ensure you have stripped and cleaned the fiber properly.

Place the fiber holder holding the fiber onto the CAC400 or CAC400A nest and ensure the fiber is sitting in the insert in the fiber holding block. Close the fiber holding block lid, lift the lever for complete closing, and press the start button.

The LED will start flashing orange indicating that the unit is performing a process. The unit will apply tension to the fiber, and when the target tension is reached, the cleave blade assembly will start oscillating until it touches the fiber and performs the cleave. The nest assembly will move to the designated pullback position (if it is engaged) and the LED will flash green indicating that the process has finished. You can remove the fiber holder with the cleaved fiber tip, and discard the fiber remnant inside the insert, then press the start button to return the nest to the correct initial starting position.

4.4. Shut-down

To turn off the unit, unplug the power supply from the back of the unit.

Chapter 5 Operation

5.1. Controlling the CAC400 or CAC400A

The CAC400 and CAC400A are configured and controlled from a web interface accessible using any web browser. To communicate with the unit, connect it to a computer via the Ethernet cable provided with the unit. The web interface allows the user to read and modify all the parameters controlling the cleaving process. Open the web browser on the computer and type in the unit's IP Address into the browsers address bar. If a single CAC400 or CAC400A is connected directly to your computer, then the default IP Address is 169.254.19.63. If one or more them are connected through a LAN to the computer, then the IP Address is assigned by the DHCP Server. See your network administrator if you need help locating the IP Address.

A set of programs is loaded on the CAC400 and CAC400A at the factory. The user can easily modify and/or create new programs using the web interface. All of these programs (fiber files) will be saved on the unit and accessible any time you connect the unit to a computer.

5.1.1. Cleave Settings

The **Cleave Settings** window is the default window that is displayed when you enter the IP Address. This screen displays the fiber file currently in use along with a few of the fiber's main setup parameters for reference. On the left side of the screen is a list of menu items used to navigate between the other available setup screens. Also in this screen is an **Edit** button that allows you to modify the parameters for the current fiber file.

Figure 13 The Cleave Settings Window

5.1.2. Editing the Cleave Settings

The **Edit** window allows you to enter or modify the parameters that are required to produce the desired cleave. When you start a new file, default values are entered for many of these parameters. You must provide a File name, enter the Fiber Diameter in microns, and enter the desired Cleave Angle in degrees. Once these parameters are entered, you can click on the **Calculate** button to automatically calculate the required Tension, Applied Rotation and Blade Offset. These parameters as well as all the other available parameters can be adjusted as needed to produce the best possible cleave. Below is a brief description of each of these parameters.

- **Tension**: the force applied to the fiber before the cleave blade is activated to begin the cleave process.
- **Applied Rotation**: the amount the fiber is rotated to produce the required cleave angle.
- **Rotation Offset:** a distance to rotate the fiber to compensate for any twist that may be introduced when clamping the fiber.
- **Time Delay**: the time to wait between strikes of the cleave blade.
- **Pull Velocity**: the speed to move the Fiber Holding Block when applying the required Tension.
- **Blade Front**: the distance to move the blade forward on each strike.
- **Blade Back**: the distance to move the blade back on each strike.
- **Pre-Cleave Advance**: the starting position of the cleave blade before the first strike.

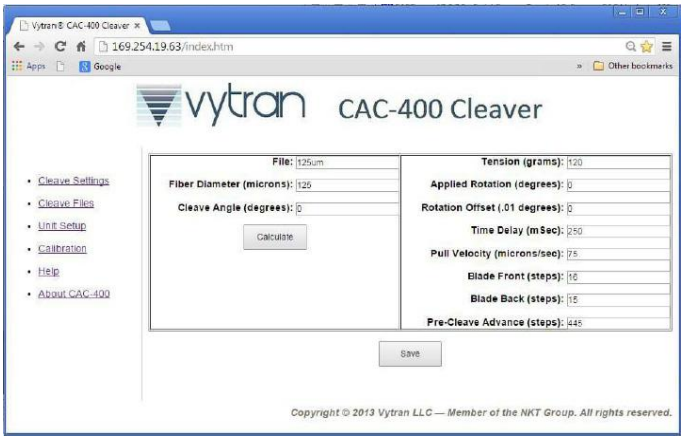


Figure 14 Editing Cleave Settings

Once you have entered or modified the required parameters, click on the **Save** button to save this file to the unit's memory.

5.1.3. Cleave Files

From the Cleave Files window, the user can navigate the stored fiber files, create a new file or delete an existing file. The Download button downloads files stored somewhere on the computer, and the Upload button uploads files from the CAC400 or CCA400A to the computer.

Figure 15 Cleave Files

5.1.4. Unit Setup

The **Unit Setup** screen gives access to the machine parameters that will be used by all fiber files during the cleave process. These parameters are defined below.

- **Fiber Load Position:** the starting position of the Fiber Holding Block when you load the fiber.
- **Pullback:** the distance to move the Fiber Holding Block once the cleave is complete to allow the fiber to be removed easily without damaging the endface.
- **Blade Service Position:** Where the blade assembly will move to make it easier to clean or replace the blade.

This screen also displays a count of the number of cleaves that have been performed. This value can be cleared by clicking on the **Reset** button.

The **Load** and **Cleave** buttons can be used to run the cleaver without pressing the blue button on the unit. The cleave button will only work if the nest is in load position. Finally, the results of the unit's calibration are displayed on the bottom of this screen.

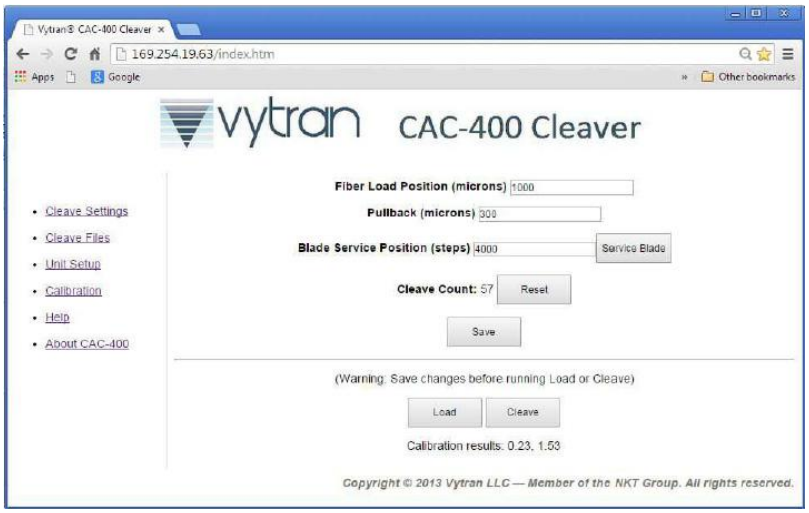


Figure 16 Unit Setup

5.1.5. Calibration

From the Calibration window, you can perform the steps required to calibrate the load cell in the CAC400 or CAC400A. The unit is calibrated when you receive it, but may require recalibration from time to time. From this screen you will be guided through the calibration procedure step by step.

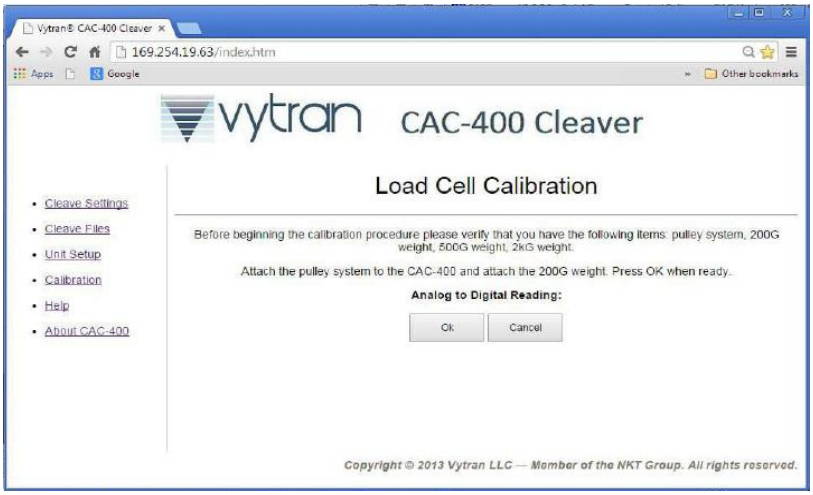


Figure 17 Calibration

5.2. Cleaving

CAUTION

Do not pick up the unit by the fiber holder nest or push the nest hard forwards or backwards. Doing so will cause the nest to become misaligned, and will degrade the quality of the cleaves produced by the unit.

5.2.1. Description of the Cleave Process

The CAC400 and CAC400A cleaves fiber using the tension-and-scribe technique as follows:

- A stripped fiber is secured in a fiber holder.
- The unstripped end is held in the fiber holder nest by a fiber clip/holder.
- The stripped end is held in the fiber holding block by a top/bottom insert pair.
- The nest moves away from the fiber holding block, creating tension in the fiber.
- A diamond-coated blade approaches the fiber and makes a small scribe.
- The tension causes the scribe to propagate through the fiber, resulting in a cleave.

To obtain an angled cleave (with CAC400A only), the fiber is twisted by the left rotary stage before the fiber is tensioned.

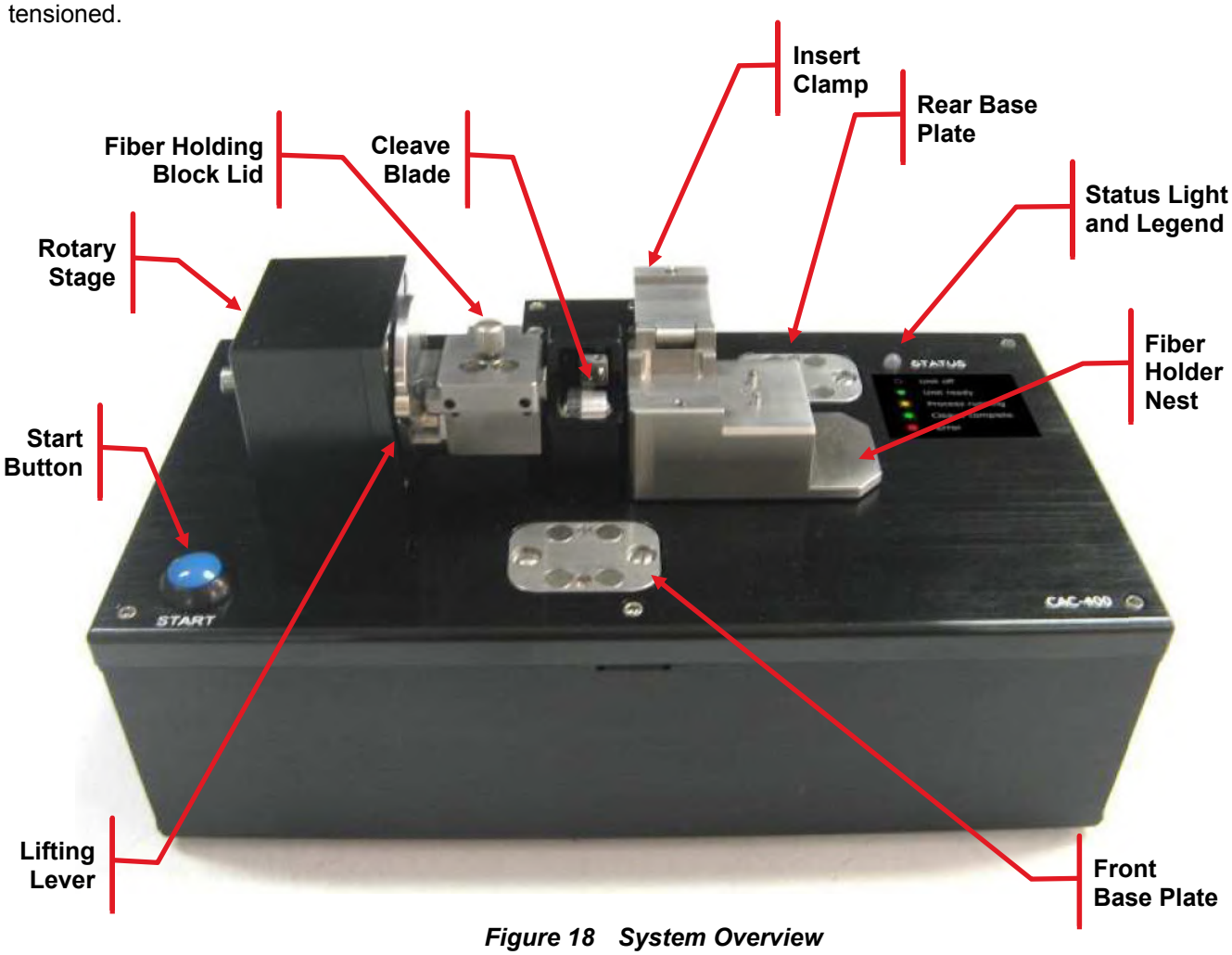


Figure 18 System Overview

5.2.2. The Fiber Holders, Inserts, Lifting Levers & Thumbscrews

The CAC400 and CAC400A require a fiber holder or fiber clip to hold the fiber. These fiber holders come in different sizes. “Size” here refers to the diameter of fiber coating they are designed for (not the outer dimensions of the fiber holder, which are invariable). Each fiber holder can accommodate a range of coating sizes. The nest surface should be clean of debris (using the provided toothbrush) to ensure proper positioning of the fiber holder.

On the left, the fiber cladding is held by a top and bottom insert pair in the fiber holding block (FHB). There are two different top inserts available: one for small fiber and one for large fiber. The top insert is two-sided, and each side covers a different range. The fiber size that each side is intended for is engraved in front of the v-groove. There are four different bottom inserts available, which can accommodate fiber varying from 60 to 600 µm in diameter (see *Table 2* for details).

A lifting lever is used to overcome the high clamping forces of the FHB magnets. To lift the FHB lid, press down on the lever first, and then lift the lid. When the lever is in the downward position, it serves to stop the FHB lid from slamming down on the fiber and damaging it. After the lid comes to rest on the lifting lever cam, lift the lever to gently and completely close the lid. **Make sure the lever is in the downward position before closing the lid to prevent damage to the fiber.**

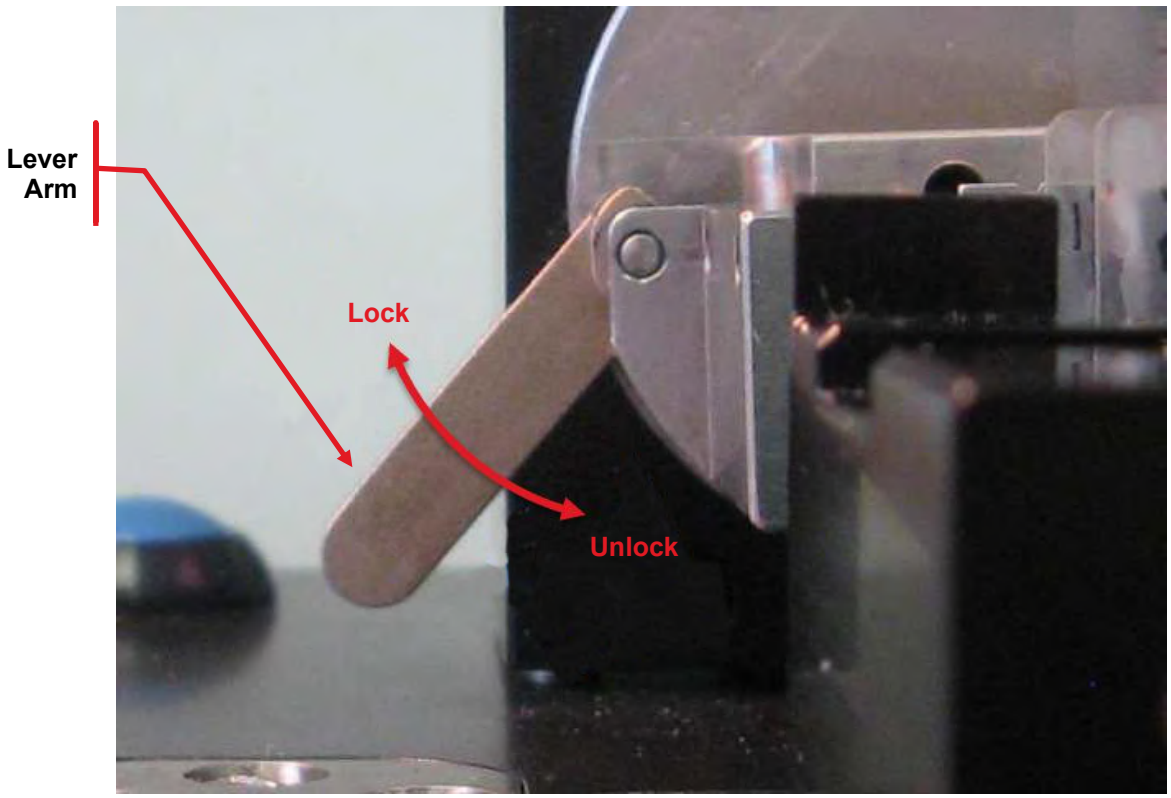


Figure 19 Lifting Lever

When cleaving larger diameter fibers (>400 µm) or slippery fibers, it is necessary to use the thumbscrew on the fiber holder nest to grip the fiber firmly. After closing the fiber holder clamp over the fiber holder, tighten the thumbscrew and the fiber should be held accurately in place without any risk of slippage.

Similarly, a thumbscrew on the fiber holding block lid provides added clamping force for large diameter fibers. If the thumbscrew is not required, it may be kept out of the way by threading it backwards into the lid or by removing it completely.

Sometimes the thumbscrew prevents the lid from closing fully. If this occurs, turn the thumbscrew counterclockwise slightly. This should allow the lid to close.

5.2.3. Stripping the Fiber

The fiber end should be stripped down to the cladding over a sufficient length to allow for the desired post-cleave length plus the discard length. The discard length should ideally allow for full clamping in the fiber holding block (FHB), and should therefore be 22 mm minimum. Strip the fiber down to the bare glass and clean it thoroughly with acetone or isopropyl alcohol.

Figure 20 Using a Miller Stripper to Strip the Fiber

5.2.4. Loading the Fiber

To load the fiber for cleaving:

1. Make sure that the correct fiber file and/or process parameters are selected for the fiber to be cleaved.
2. If the fiber FHB lid is closed, loosen the thumbscrews, press the lifting lever down to release the clamping force, and open the lid.
3. Check that the correct FHB inserts (top and bottom) are installed and that they are free from fiber/coating debris.
4. Position the fiber in the fiber holder. Some small amount of buffer should extend beyond the front of the holder. Close the lid.

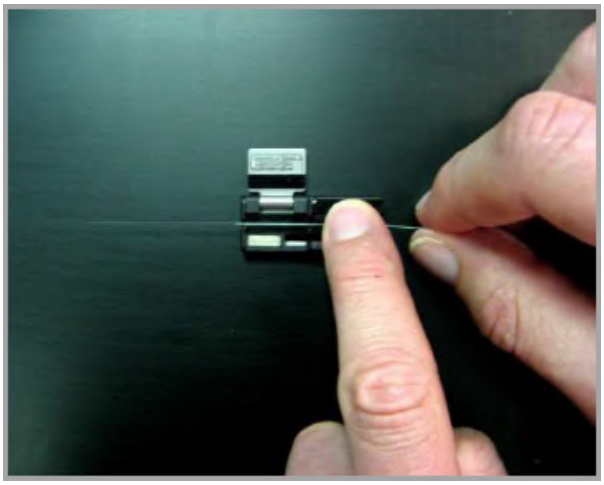


Figure 21 Positioning a Fiber in the Fiber Holder

5. Place the fiber holder into the nest. If the fiber you are cleaving has a cladding of 400 microns or more (or if the buffer is slippery), close the fiber holder clamp and tighten the thumb screw. Make sure the fiber in front of the cleave blade is bare glass.

Note: Damage to the diamond blade may occur if an attempt is made to cleave a coated section of fiber. Make sure the fiber is stripped down to bare glass and is cleaned thoroughly at the point where the blade will contact the fiber.

6. Make sure the stripped end of the fiber is sitting perfectly in the FHB insert v-groove. If using an angle cleave unit, an excessively long fiber will be difficult to seat in the v-groove, since you'll have to feed the end of the fiber into the rotation mechanism. For small fibers (125 micron and lower), you need only clamp on about 5mm of fiber to tension it sufficiently. For larger fibers, you will need to clamp on more. You should clamp on 10mm of fiber if cleaving 600 micron fiber.

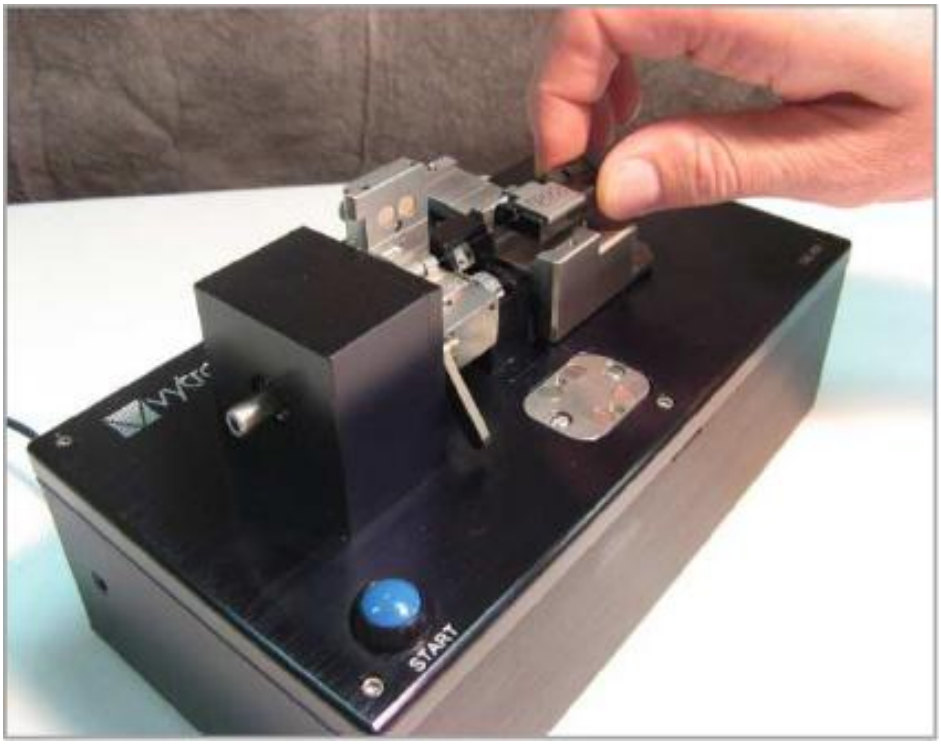


Figure 22 Placing a Fiber Holder into the Nest

7. Check that the lifting lever is in the downward position, then lower the FHB lid. If the thumbscrew prevents the lid from lowering properly, turn the thumbscrew counterclockwise until the lid drops.

8. With the lifting lever in the downward position, the lid will not contact the fiber and the fiber is still free to move. Raise the lever to clamp the fiber. If cleaving a fiber with a cladding diameter larger than 400 microns (or if the buffer is slippery) tighten the thumb screw on the FHB lid. Always close the FHB lid on the left (which holds the off-cut) after clamping the fiber holder on the right (which holds the longer length of fiber). This will prevent any twist created by clamping the coating on the right from resulting in unwanted torsion on the fiber. Clamping on the short off-cut which has no coating twists the fiber a lot less than clamping on the long, coated section.

The fiber is now ready to be cleaved.

5.2.5. Cleaving the Fiber

To cleave the fiber:

1. Confirm that the status LED is a steady green.
2. Confirm that the fiber is loaded properly and that the fiber holding block (FHB) lever is raised.
3. Confirm that the proper settings are selected.
4. Initiate the cleave process by pressing the blue START button on the unit. The cleave process is fully automated as follows:
    a. The rotary stage will rotate the FHB to the *Rotation Angle*.[1]

CAUTION!

Do not put your fingers between the nest and cleave mechanism at this point, or they will be pinched!

    b. The fiber holder nest will begin moving to the right, applying tension to the fiber.
    c. Once the *Cleave Tension* is reached, the fiber holder nest will stop moving.
    d. The cleave blade will move towards the fiber by the *Pre-Cleave Advance distance.*

Note: The cleave blade should not touch the fiber on the pre-cleave advance or damage to the blade could result.

    e. The cleave blade will begin oscillating in a forward-and-back motion and will progressively advance towards the fiber.
    f. Once the cleave blade contacts the fiber, a small scribe will be made and the fiber should cleave immediately.
    g. As soon as the fiber is cleaved, the CAC unit will sense the drop in tension on the fiber and will immediately move the nest back out of the way (if a *pullback distance* is set) and the rotation stage will rotate the FHB back to zero.[1]

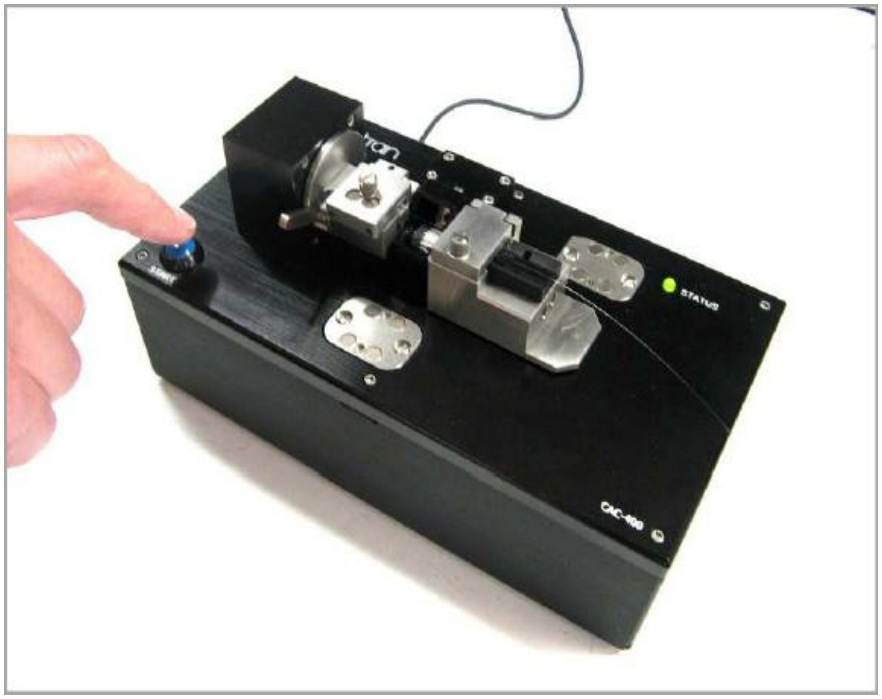


Figure 23 Initiating a Cleave by Pressing the Blue Start Button

[1] *Applicable only to the CAC400A Angle Fiber Cleaver.*[1]

5.2.6. Unloading the Fiber

To unload the fiber after cleaving:

1. After the fiber is cleaved, the status LED will indicate if the unit performed properly (flashing green) or an error occurred (flashing or steady red).
2. If the Thumbscrews were secured, turn them counter-clockwise until they disengage from the fiber holding block (FHB) and nest base.
3. If the clamp was used to press down on the fiber holder lid, open it.
4. Remove the fiber holder (with the fiber) from the nest.
5. Press down on the lever to raise the FHB lid slightly. **Note:** Using the lever will facilitate the opening of the FHB lid as the magnetic force holding the lid down is too strong to permit unassisted lifting of the lid. If the shard suction pump option is available, run the vacuum pump as you press down on the lever. This will suck away the fiber off-cut.
6. Raise the FHB lid fully.
7. If the off-cut has not been sucked away, remove it with tweezers and dispose of it safely.
8. Once the fiber holder and fiber off-cut have been removed, press the start button to send the nest to its initial position.

CAUTION!

Do not put your fingers between the nest and cleave mechanism at this point, or they will be pinched!

Once the nest returns to its initial position, the status LED will turn a steady green.

If the CAC400 and CAC400A homing process is interrupted or fails, all system functionality is disabled to prevent possible damage to the equipment. This state will be indicated by a flashing red light. Remove any fibers and/or off-cuts from the FHB's and cycle the power OFF then ON by unplugging the power jack and then plugging it back in. The CAC400 and CAC400A will initialize and a run the homing process again when the start button is pressed. If any further diffulty is experienced, contact TechSupport@Thorlabs.com for assistance.

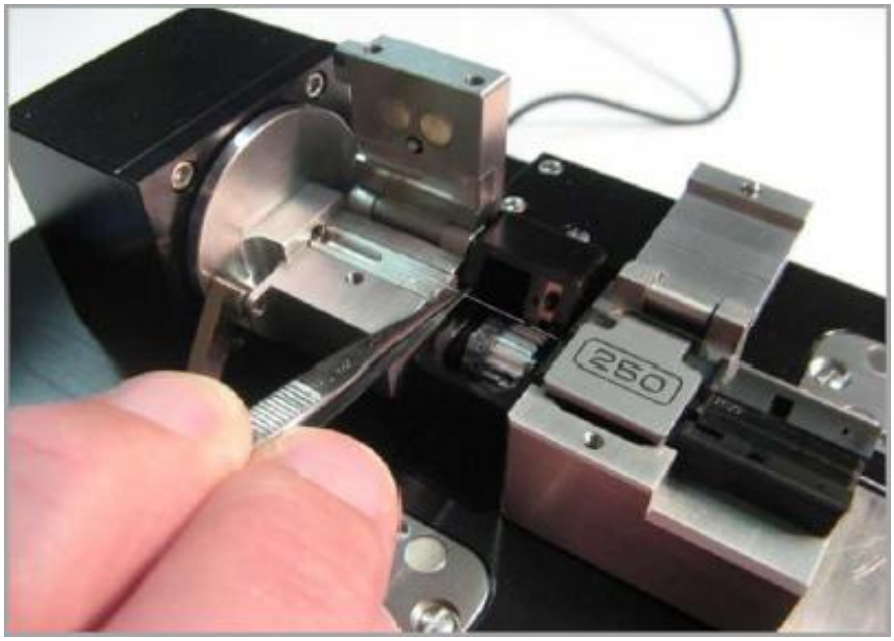


Figure 24 Removing a Fiber Off-Cut from the Fiber Holding Block

Chapter 6 Maintenance

The CAC400 and CAC400A are designed for a production environment to give trouble-free operation provided planned maintenance is performed as described below.

Planned Maintenance Schedule

- Inspect and clean the nest and fiber holding block every shift
- Inspect and clean the cleave blade every day
- Reposition the cleave blade as needed (roughly every month)
- Replace cleave blade assembly as needed (roughly every year)
- Return the unit to Thorlabs for recalibration as needed (roughly once a year)

6.1. Inspecting the Nest and the Fiber Holding Block

The fiber holder nest and fiber holding block (FHB) should be inspected daily for debris and/or damage, which may prevent the fiber holder from being positioned properly or stop the lid from closing fully. It is particularly important to make sure that the bottom insert vgroove surfaces and the top insert clamping surfaces are free of debris and oils. This will help to ensure that the fiber will not break or slip during tensioning. Remove debris using a nylon brush as shown below.

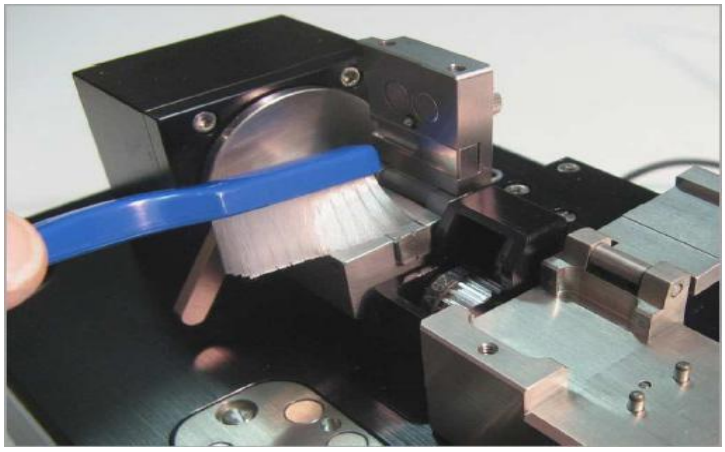


Figure 25 Removing Debris from the Fiber Holding Blocks

To remove oils from the inserts, use a cotton-tipped swab wetted with acetone or alcohol.

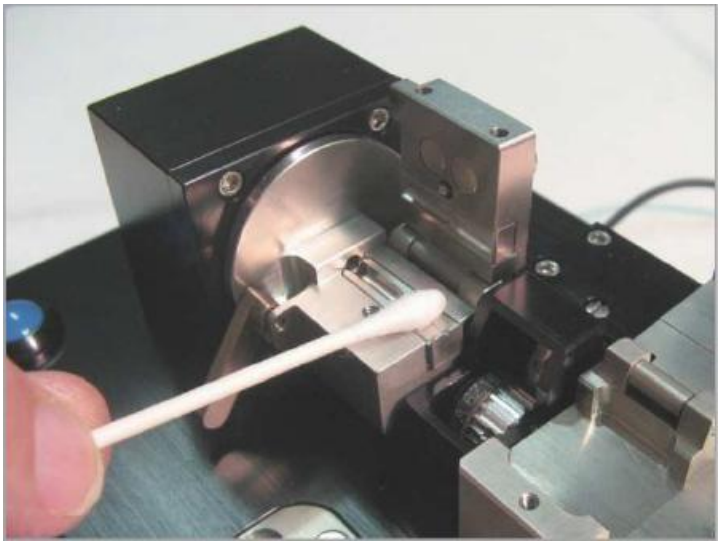


Figure 26 Removing Oils from Inserts

6.2. Inspecting and Cleaning the Cleave Blade

The diamond edge of the cleave blade should be inspected daily for debris and/or damage which may result in sub-optimum cleave performance.

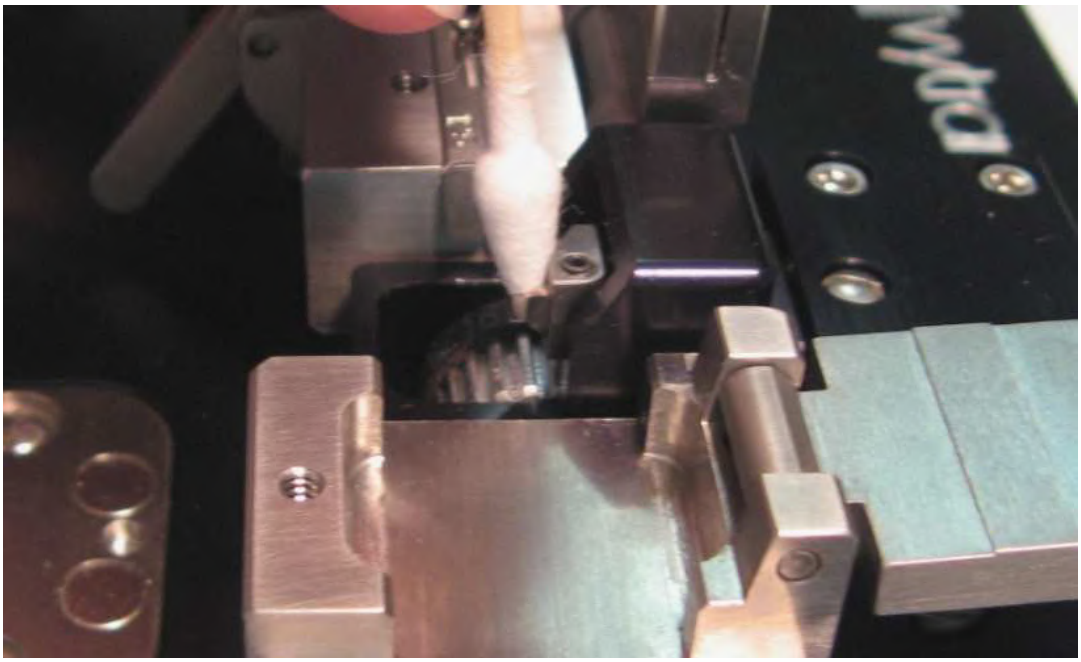


Figure 27 Cleaning the Cleave Blade

The cleave blade should be cleaned using a cotton-tipped swab wetted with acetone or isopropyl alcohol. Press the "Service blade" button in "Unit Setup" window of the GUI. Wipe both sides of the blade in a back-to-front direction, towards and over the diamond edge, using very light pressure only. Never touch the edge of the cleave blade with any hard or metal object. For very loose debris, the cleave blade may also be cleaned by blowing clean (canned) air across the edge.

CAUTION!

Use great care when working near or handling the cleave blade, as the diamond tip is extremely sharp and can very easily cut through skin.

6.3. Re-Positioning the Cleave Blade

Only a small portion of the cleave blade edge is used to scribe the fiber. If this portion of the edge gets damaged, the blade can be re-positioned to a new un-used section. While the lifetime of a given section of the blade can be very long (up to 5,000 cleaves), it is also very easy to damage the blade due to excessive lateral stresses (stresses perpendicular to the edge of the blade). This can occur if the blade is in contact with the fiber and the fiber then moves sideways across the edge of the blade. The most common occurrence of this is a result of cleave tension being set so low that the fiber is unable to be cleaved. In this scenario, the fiber will slide along the edge of the blade and take a small semi-circular “bite” out of the current section. For small localized damage such as this, the blade can be re-positioned up to a maximum of 10 times.

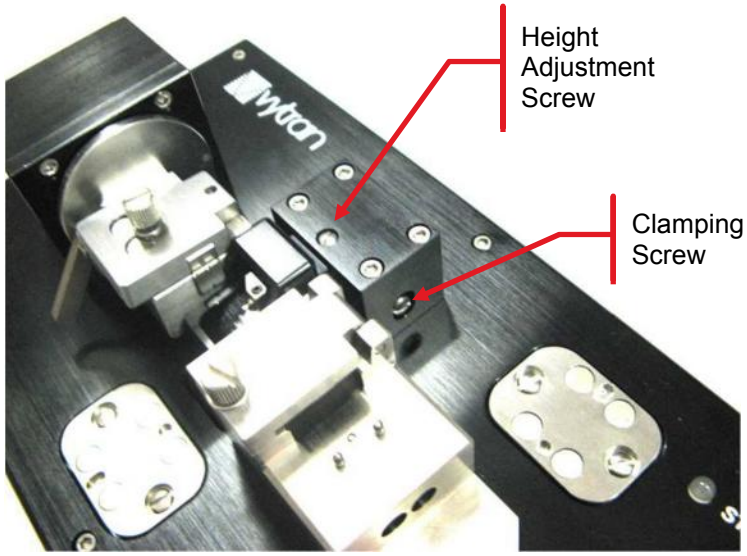


Figure 28 Screws Used to Adjust Height of Cleave Assembly

To re-position the cleave blade:

1. Obtain a small flat head screw driver.
2. Loosen the clamping screw. Since the magnets in the rear base plate are very strong, it helps to put a Post-It Note pad over the base, so that the magnets can't grab the screw driver.

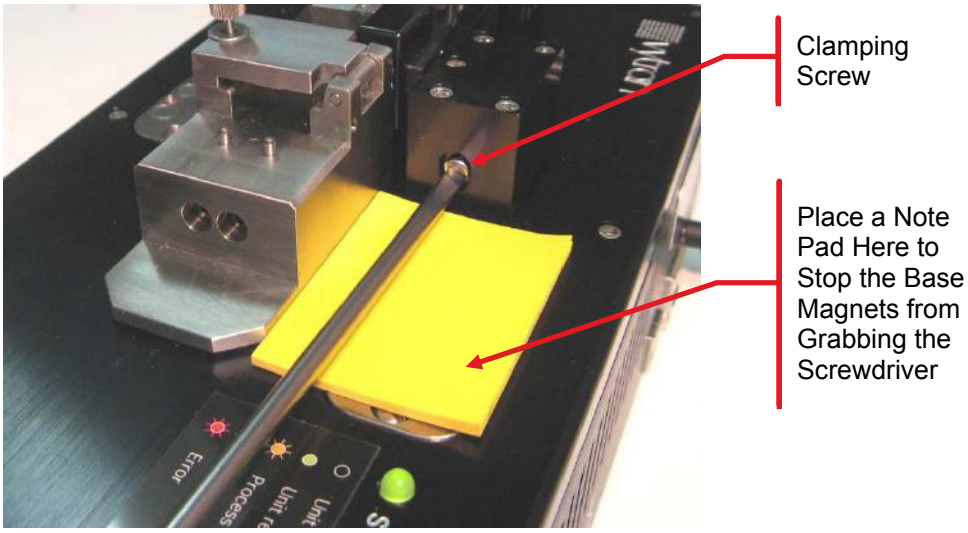


Figure 29 Loosening/Tightening Clamping Screw

3. Turn the height adjustment screw exactly ¼ turn clockwise. This will raise the "Cleave Blade Housing" and re-position the blade to a new section of the diamond edge.

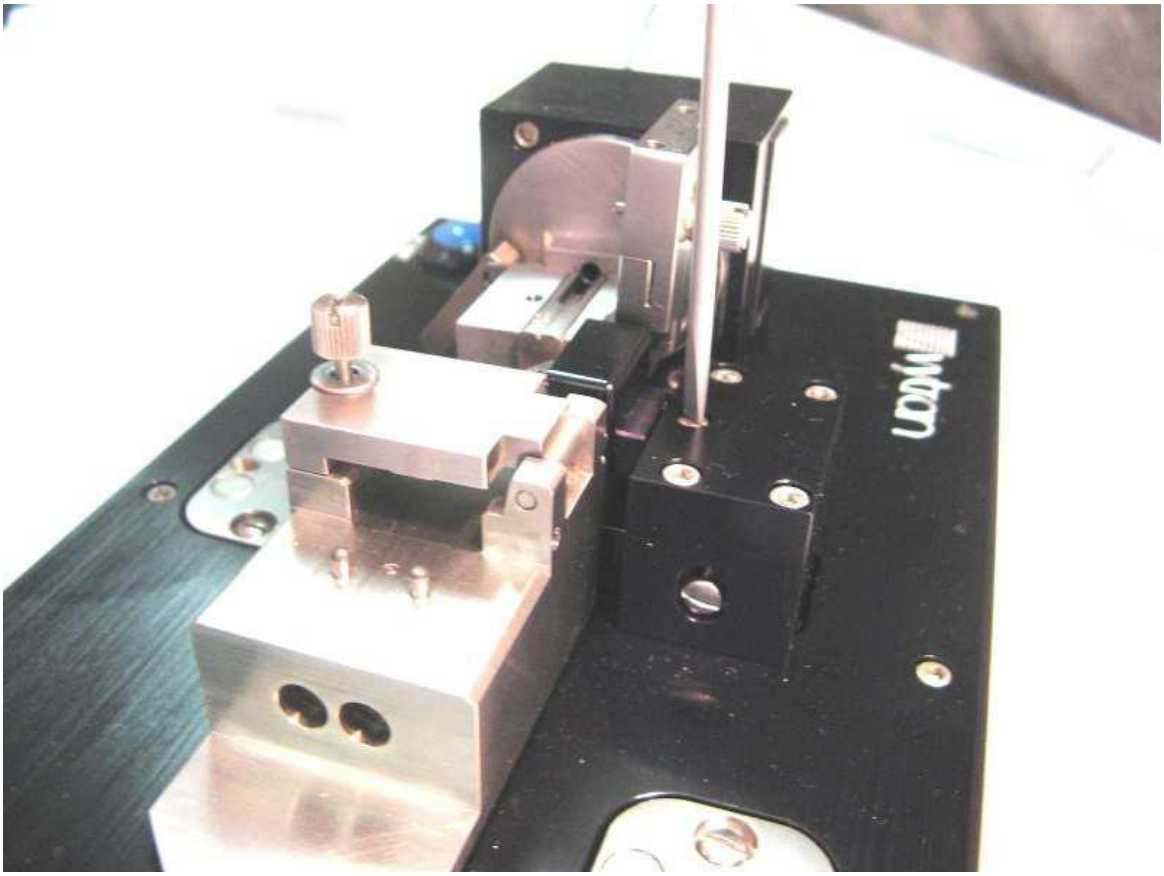


Figure 30 Adjusting the Height of the Cleave Blade

4. Tighten the clamping screw, and remove the Post-It Note pad.
5. After adjusting the height of the cleave blade, perform a cleave to ensure proper operation of the equipment.

Check to make sure that the cleave blade has not been raised so many times that the contact point is at the bottom edge of the diamond tip. If it is, it is time to replace the cleave blade. Also ensure that the cleave blade does not strike the fiber during the Pre-Cleave Advance, as this can easily damage the new section of diamond tip. After the Pre-Cleave Advance, the blade should oscillate for approximately 3 seconds prior to striking and cleaving the fiber.

If the blade cannot be raised any higher, then it is time to replace the cleave blade.

6.4. Replacing the Cleave Blade

If the cleave blade is so damaged along its edge such that it cannot be re-positioned to an “un-used” section, then replacement is required.

CAUTION!

Use great care when working near or handling the cleave blade, as the diamond tip is extremely sharp and can very easily cut through skin.

To replace the cleave blade assembly:

1. If present, remove the fiber from the fiber holding block and remove the fiber holder from the nest.
2. Move the cleave arm forwards by pressing “Service Blade” in the “Unit Setup” window of the GUI.
3. Place a narrow piece of a Post-It Note in front of the cleave pulley to catch the blade in case you drop it. If you don't do this, you risk dropping the cleave blade into the cowl and the interior of the unit, where it will be difficult to extricate!
4. Loosen the set screw in the top of the cleave blade assembly using the 0.035” Allen key provided.

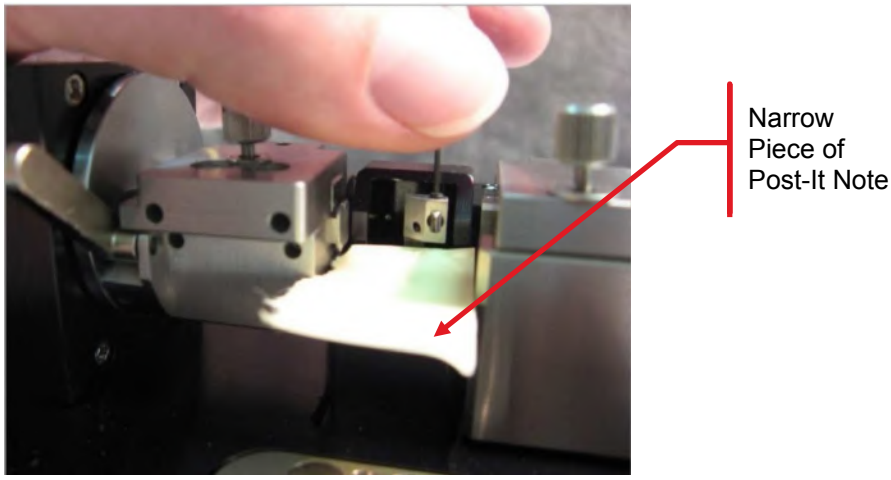


Figure 31 Loosening the Setscrew Holding the Cleave Blade in Place

5. Push the cleave blade out from behind by sticking the Allen key through the small opening in the back of the cowl.

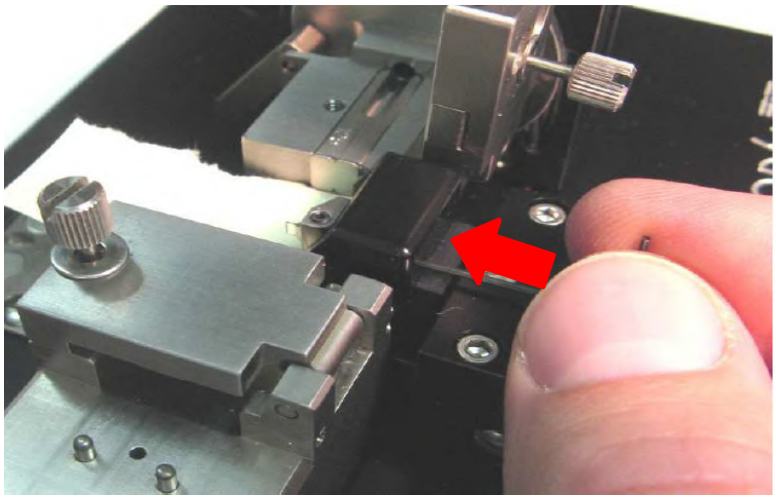


Figure 32 Pushing the Cleave Blade Out

6. Remove the cleave blade assembly with tweezers.

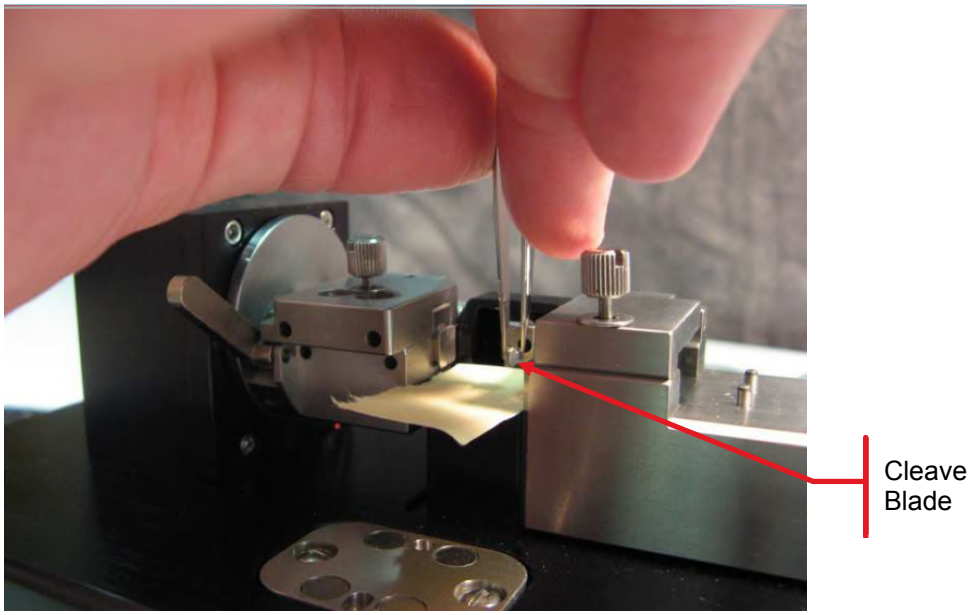


Figure 33 Replacing the Cleave Blade

7. Obtain a new cleave blade and insert it into the hole. This can be done with the unit lying on its back, so that gravity helps you slide the shank of the cleave blade into the hole.
8. Using the tip of a pointy cotton swab, rotate the blade until it is perfectly vertical.
9. Tighten the setscrew.
10. Restore power to the unit by plugging the power jack back in.

After replacing the cleave blade, the cleave assembly should be moved to its lowest position. This will drop the cleave blade down so that the very top portion of the diamond tip will be the first section of the edge to be used.

To lower the cleave assembly:

1. Obtain a small flat-head screw driver.
2. Loosen the clamping screw on the side of the cleave mechanism.
3. Place a fiber holder holding a piece of stripped fiber in the nest so that a length of stripped fiber sits right in front of the blade.
4. Turn the height-adjustment screw counter-clockwise until the very top of the cleave blade is right behind the fiber.
5. Re-tighten the clamping screw on the side of the cleave mechanism.
6. Perform a cleave to ensure proper operation of the equipment. Make sure the cleave blade is not so low that the contact point is right at the top edge of the diamond tip, or that the diamond tip “misses” the fiber completely. Also, check the blade oscillation time. After the Pre-Cleave Advance, the blade should oscillate for approximately 3 seconds prior to striking and cleaving the fiber.

6.5. Load Cell Calibration

The load cell calibration should be checked every year to ensure that accurate cleave tension is applied to the fiber and that optimal cleave angle and end-face quality is achieved. This task can be performed by a Vytran-certified technician. Alternatively, Thorlabs can provide the Calibration Kit to customers who want to perform the calibration on-site. The calibration process is outlined in section 6.7.3 and is accessible from the web-interface as a guided process.

6.6. Fiber Holder and Insert Selection

The following tables provide information about Thorlabs fiber holders and fiber holding block inserts. As the tables show, each fiber holder and each insert can hold a wide range of fiber diameters. However, you should always use the fiber holder or insert that most closely matches your fiber diameter to ensure optimum cleave quality.

Thorlabs fiber holders, also called "fiber clips", come in eight different sizes. Tholabs offers four different bottom insert and two top inserts that attach to the top or bottom of the fiber holding block.

Item #	Nominal Fiber Buffer Diameter[2]	Minimum Fiber Buffer Diameter	Maximum Fiber Buffer Diameter
VHM100	100 µm	67 µm	133 µm
VHM165	165 µm	110 µm	220 µm
VHM250	250 µm	167 µm	333 µm
VHM325	325 µm	217 µm	433 µm
VHM400	400 µm	267 µm	533 µm
VHM500	500 µm	333 µm	667 µm
VHM650	650 µm	433 µm	867 µm
VHM900	900 µm	600 µm	1200 µm

Table 1 Vytran Fiber Holder Selection

Item #	Side[3]	Nominal Fiber Cladding Diameter[4]	Minimum Fiber Cladding Diameter	Maximum Fiber Cladding Diameter
Bottom Inserts[5]				
VHL040060[6]	1	40 µm	27 µm	53 µm
	2	60 µm	40 µm	80 µm
VHL080125[7]	1	80 µm	53 µm	107 µm
	2	125 µm	83 µm	167 µm
VHL165250	1	165 µm	110 µm	220 µm
	2	250 µm	167 µm	333 µm
VHL400550	1	400 µm	267 µm	533 µm
	2	550 µm	367 µm	733 µm
Top Inserts[5]				
VHK000250	1	0 µm (No V-Groove)[8]	40 µm	200 µm
	2	250 µm	150 µm	350 µm
VHK400500	1	400 µm	300 µm	450 µm
	2	500 µm	400 µm	600 µm

Table 2 Insert Selection

[2] Our fiber clips are designed to hold fiber claddings with these nominal diameters. When deviating from this nominal size, the fiber will no longer be centered in front of the cleaving blade.
[3] V-grooves are located on both sides of the fiber insert with the nominal compatible cladding diameter engraved next to it for identification.
[4] Our fiber holder inserts are designed to hold fiber claddings with these nominal diameters. When deviating from this nominal size the fiber will no longer be centered in front of the cleaving blade.
[5] Whether this insert will fit into the top or bottom of the fiber holding block.
[6] Although this insert contains an additional V-groove for Ø27 µm to Ø53 µm cladding fiber, we do not recommend using fiber claddings under Ø60 µm due to a decrease in perfomance of the CAC400 and CAC400A Compact Fiber Cleavers.
[7] Although the VHL080125 Insert is a viable option for Ø60 µm cladding fiber, we recommend using the VHL040060 Insert to minimize the offset created in front of the cleave blade.
[8] Minimum is limited by the smallest possible cladding diameter that can be held by the bottom inserts.

6.7. Optional Accessories

6.7.1. CACM Micrometer Backstop and Camera

The backstop/camera assembly is used for cleaving highly stressed fibers or capillary tubing. The assembly includes a micrometer that can support the fiber to hold it steady during cleaving and a USB camera for ensuring that the micrometer just makes contact with the fiber prior to cleaving.

The assembly comes with a disk containing the software for the camera. To use the camera, simply copy the "SuperEyes" file to the desktop of your computer. The file is an executable, so there is no need to perform an installation.

To use the backstop/camera assembly, load the fiber as described in section 5.2.4. Then place the backstop/camera assembly on the front base plate as shown below.

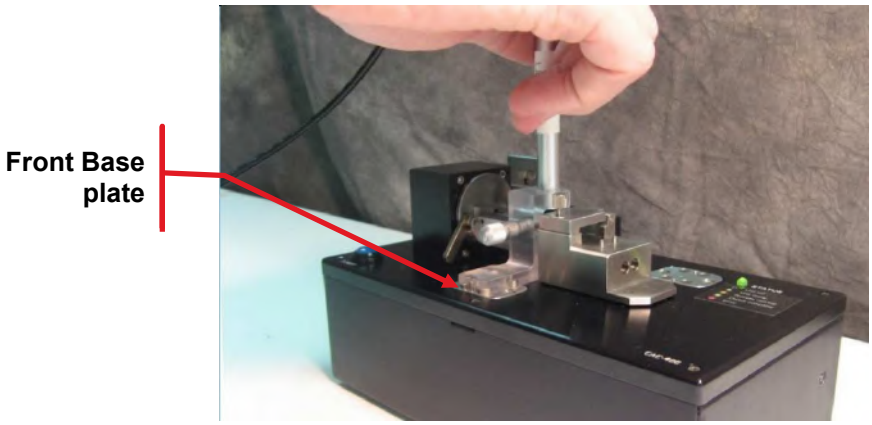


Figure 34 Placing the Backstop/Camera Assembly on the Front Base Plate

Double-click the "SuperEyes" icon on the desktop to start the camera software. A viewing screen showing the fiber should open. If necessary, focus the camera by turning the knob at the top. Slowly advance the backstop until it just touches the fiber (the backstop is advanced by turning the micrometer knob clockwise). Then initiate the cleave process by pressing the blue button.

When the cleave is complete, retract the backstop (the backstop is retracted by turning the micrometer knob counter-clockwise). Remove the backstop/camera assembly by tilting it back and then pulling it up. Place it in the storage position as shown below.

Figure 35 Backstop/Camera Assembly in Storage Position

6.7.2. Shard Suction Pump

The shard suction features a vacuum pump operated by a foot switch that can quickly and safely suck small fiber off-cuts into a collection vessel. This feature only works with fibers of a relatively small diameter (<250 microns).

After unpacking the assembly, place the pump on the floor and attach the collection vessel to the underside of the work surface using the adhesive-backed Velcro sheet. If you are using a CAC400 unit, slide the metal collection tube provided with the shard suction pump into the slot at the top of the fiber holding block and lock it in place by tightening the two set screws in the back, as shown in Figure 36.

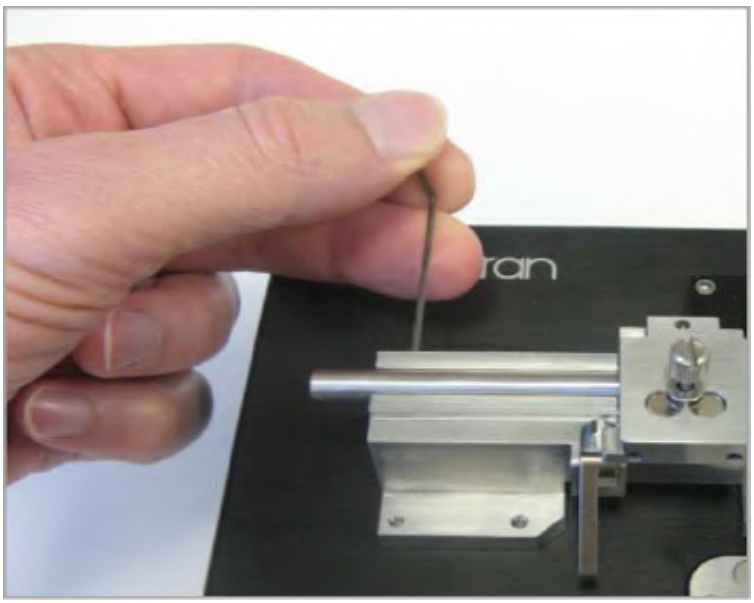


Figure 36 Installing a Shard Collection Tube in a Standard Unit

If you are using a CAC400A angled fiber cleaver, than the collection tube is already there, protruding out of the left side of the rotation stage.

Slide the suction tube over the collection tube and plug in the foot switch. Test the system by stepping on the foot switch. The pump should turn on for as long as the foot switch is depressed. Your shard suction pump is now ready to operate. After you cleave a small fiber, you can suck the off-cut into the collection vessel by stepping on the foot switch.

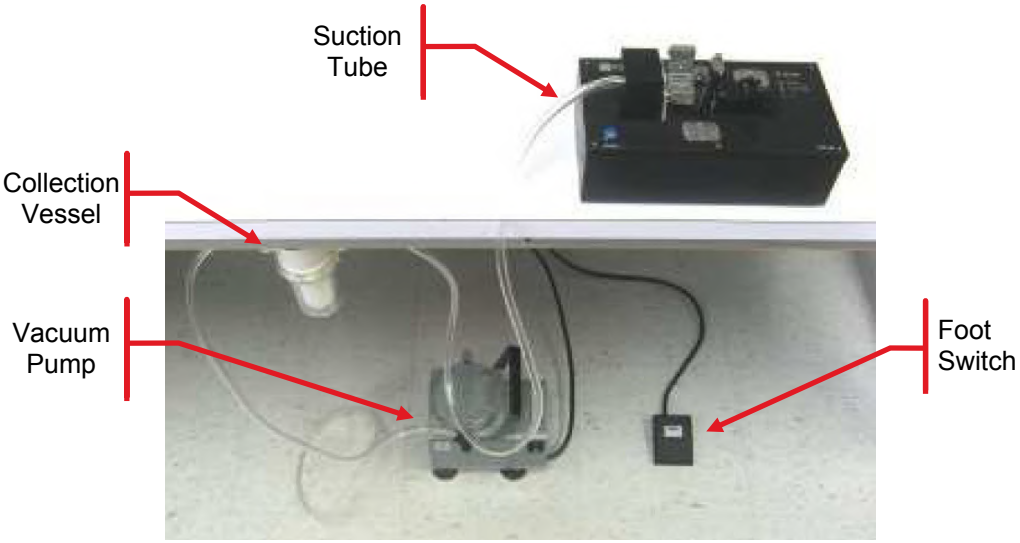


Figure 37 Shard Extraction System

6.7.3. Calibration Kit

The calibration kit includes a set of weights and a pulley fixture to make it possible to recalibrate the load cell used to sense fiber tension. The kit also includes a length of nylon monofilament line.

To recalibrate the load cell, follow this procedure:

1. Locate the monofilament line (it has a loop tied at one end and a knot tied at the other).
2. Open the lid of the fibe holding block (FHB).
3. Remove the bottom insert from the FHB.
4. Keep the FHB lid open.
5. If you are calibrating a unit with a shard collection system, loosen the two set-screws holding the collection tube in place and slide out the collection tube.
6. If you are calibrating an angle-cleave unit, insert the end of the monofilament line without the loop into the opening of the tube sticking out of the left side of rotary block. Push the of the monofilament line all the way through. If calibrating a standard unit, just drape monofilament line over te channel to the left of FHB.
7. Place non-loop end of the monofilament line in a fiber holder so that the knot is at the back of fiber holder.
8. Place the fiber holder on the fiber holder nest.
9. Close the fiber holder clamp and tighten the thumbscrew.
10. Lower the calibration fixture onto the block the FHB is attached to, pulling the monofilament line through the space above the pulley as you do.
11. Drape the monofilament line over the pulley.
12. Place the CAC400 or CAC400A at edge of a table, so that weights can be hung from monofilament line.
13. Ensure that the unit is connected to a computer via an Ethernet cable.
14. Turn on the computer.
15. Open a browser and enter the URL for the GUI.
16. Click on *Calibration*.
17. Follow the prompts.
18. The GUI will first prompt you to add a 200g, hit *save*, and remove the weight.
19. The GUI will then prompt you to add a 500g weight, hit *save*, and remove the weight.
20. The GUI will then prompt you to add a 2kg weight, hit *save*, and remove the weight.
21. Remove the calibration fixture, the monofilament line and the fiber holder.
22. Put bottom insert and the shard collection tube back, if there is one. Tighten set screws to lock in place.

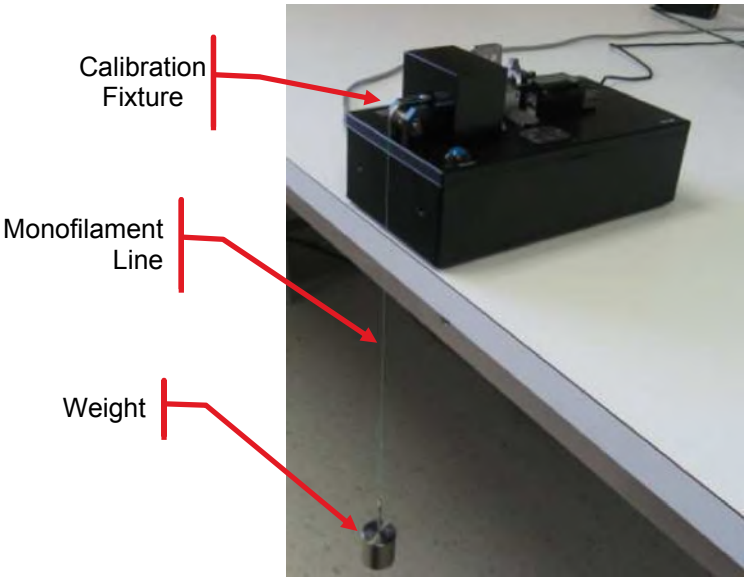


Figure 38 Calibrating the Load Cell

6.7.4. Extra Fiber Holders

If you plan on cleaving more than one fiber size you will need extra fiber holders. See *Table 1* for more information about which fiber holder should be used with what fiber. Contact Thorlabs for additional fiber holders.

6.7.5. Additional Bottom and Top Inserts

There are 4 different bottom v-groove inserts to choose from, and each is double-sided, so that two different size ranges can be accommodated with one insert. See *Table 2* for information about which insert should be used with what fiber. There are two different top inserts to choose from, and each is double-sided, so that different size ranges can be accommodated with one insert. See *Table 2* for information about which insert should be used with what fiber. Contact Thorlabs for additional bottom and top inserts.

To change inserts, loosen the set screws at the front of the fiber holding block and fiber holding block lid. Then lift out inserts and replace them with the new set. Gently tighten one of the set screws in the lid so you can close the lid without spilling the top insert. Lower the lid, loosen the one tightened set-screw in the lid so the top insert has the opportunity to settle against the bottom insert, and then re-tighten all the set screws.

6.7.6. Computer

In a stand-alone configuration, a computer or tablet is required to program and load parameter files onto the CAC400 or CAC400A. A computer is also required to display the camera image if the backstop/camera option is purchased. Please contact TechSupport@Thorlabs.com to order a computer with the CAC400 or CAC400A cleaver. The laptop will arrive preloaded with the necessary software and drivers.

6.8. Servicing

To return the unit for service, please contact TechSupport@Thorlabs.com**.**

Note: When returning the product to Thorlabs, please use the original packaging and pink anti-static bag that the unit came in. Also, be sure to install the shipping fixture.

The instructions and illustrations on this page show the correct way to install the shipping fixture and re-pack the CAC400 or CAC400A Unit. See Figure 41 and Figure 42 to see how the components should look when placed in the return box.

Here are instructions for installing the shipping fixture:

1. Unplug the power plug from the unit.
2. If the nest has been moved to the right, push it to the left as shown in Figure 39.
3. Place shipping fixture in unit so the wide part sits in nest and the narrow part sits in fiber holding block.

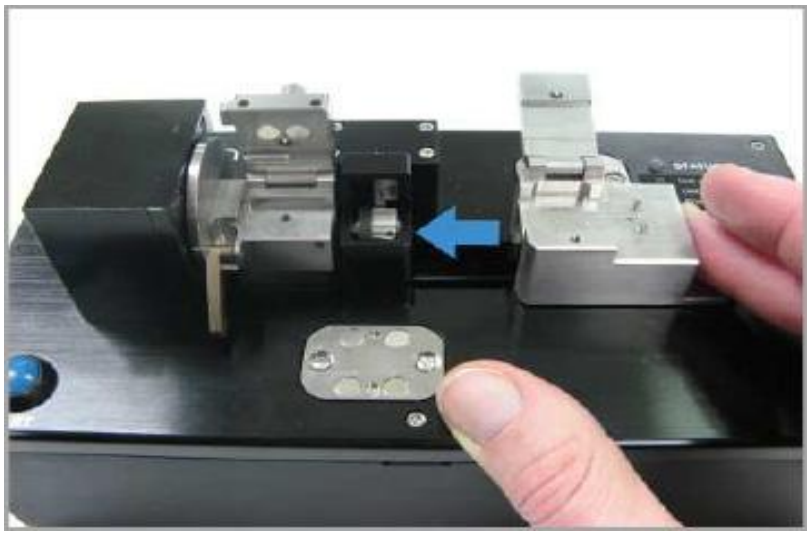


Figure 39 Pushing the Nest to the Left

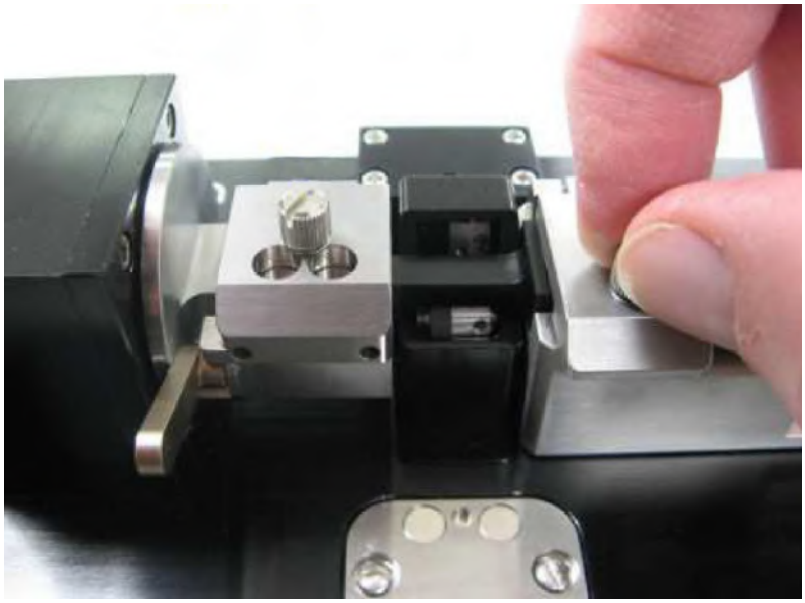


Figure 40 Locking the Shipping Fixture into Place

4. Close the lids to both the nest and the fiber holding block.
5. Tighten the thumbscrews of both lids.

Figure 41 Unit in Box with Accessories

Figure 42 Top Foam Insert in Place

Please ensure that the bottom of the box is taped securely before re-packing the unit. If returning a malfunctioning unit for repair, we ask that you return the following accessories with the unit, in case one of the accessories happens to be the source of the problems: power supply, AC power cord, ethernet cable, and inserts.

Chapter 7 Frequently Asked Questions

Q: What is the backstop/camera assembly used for?

The micrometer stop and the USB camera are primarily used for cleaving highly stressed (MM and PM) fibers and capillary tubing that require a lower than typical cleave tension. The micrometer stop process utilizes a support or “backing” applied to the fiber during the fiber loading. To use the micrometer stop, load the fiber in the fiber holder and place the fiber holder in the nest. advance the micrometer until the end just contacts the fiber. Close the fiber holding block lid. Initiate the cleave by pressing the blue button. After cleaving, back-off the micrometer away from the cleaved fiber prior to unloading. This will ensure that the fiber does not contact the micrometer during unloading.

Q: How many cleaves per blade?

With proper cleaving parameters, typical blade life is up to 5,000 cleaves per position and there are ~10 positions per blade.

Q: When do I use the thumbscrews?

Thumbscrews on the fiber holding block lid and the fiber holder clamp provide additional clamping force for large diameter fibers (>400 microns) or for fibers with very slippery buffer coatings requiring additional clamping force.

Q: How can I check the quality of my cleaves?

One way to check cleave quality is to use an interferometric cleave checker. However, if you are working with a GPX3400, GPX3600, or LFS4100 fusion splicer, it is much more efficient to use the GUI to measure the cleave angles and view the endface.

Q: How do I know how many degrees to twist the fiber to achieve an angle cleave?

The GUI will recommend starting parameters for target tension and rotation based on the desired cleave angle, the distance between the fiber holding block and the front of the fiber holder, and the diameter of the fiber cladding. However the amount of twisting and the axial tension required to achieve perfect cleaves are also affected by the fiber’s modulus of elasticity. For this reason, experimentation is required to determine the ideal parameters for an angle cleave of any particular fiber.

For other questions, contact TechSupport@Thorlabs.com.

Chapter 8 Specifications

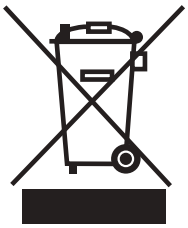
Item #	CAC400	CAC400A
Cleave Angle	0˚	0˚ to 15˚
Cleave Angle Accuracy	±0.5˚	±1.0˚
Cleave Method	Tension and Scribe	
Maximum Axial Tension[9]	21.6 N (4.9 lbs)	
Fiber Cladding	Ø60 µm to Ø600 µm	
Fiber Buffer/Coating	Ø67 µm to Ø1200 µm	
Clip-to-Cleave Length[10]	5.5 µm to 30 µm	
Minimum Fiber Waste Length[11]	22 mm	
System Dimensions	9.25” x 5.00” x 4.70” (235.0 mm x 127.0 mm x 119.4 mm)	
Weight	4.5 lbs (2.0 kg)	

[9] These cleavers are calibrated using standard weights that are hung off of a pulley, so the tension settings are programmed into the web interface in grams. This max tension corresponds to 2.2 kg.
[10] Distance from the end of the fiber clip to the cleave blade. This spacing is dependent on the Fiber Load Position parameter in the software.
[11] Minimum amount of fiber that should be present after the cleave blade.

Chapter 9 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated



Wheelie Bin Logo

As the WEEE directive applies to self-contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

Waste Treatment is Your Own Responsibility

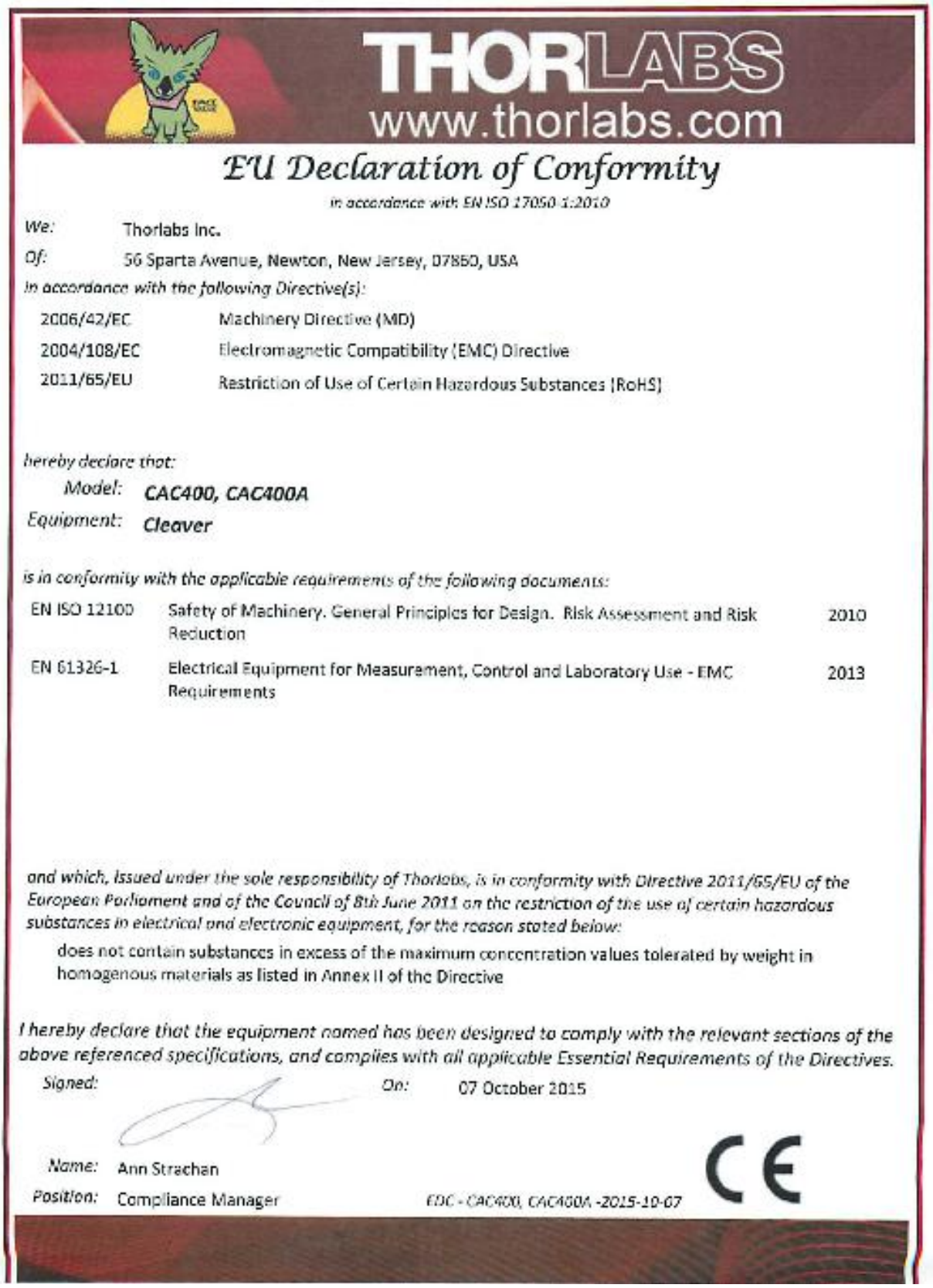
If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

Chapter 10 CE Certificate



THORLABS
www.thorlabs.com

EU Declaration of Conformity

in accordance with EN ISO 17050-1:2010

We: Thorlabs Inc.

Of: 56 Sparta Avenue, Newton, New Jersey, 07860, USA

In accordance with the following Directive(s):

2006/42/EC	Machinery Directive (MD)
2004/108/EC	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

Model: ***CAC400, CAC400A***

Equipment: ***Cleaver***

is in conformity with the applicable requirements of the following documents:

EN ISO 12100	Safety of Machinery. General Principles for Design. Risk Assessment and Risk Reduction	2010
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013

and which, issued under the sole responsibility of Thorlabs, is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8th June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, for the reason stated below:

does not contain substances in excess of the maximum concentration values tolerated by weight in homogenous materials as listed in Annex II of the Directive

I hereby declare that the equipment named has been designed to comply with the relevant sections of the above referenced specifications, and complies with all applicable Essential Requirements of the Directives.

Signed: *On:* 07 October 2015

Name: Ann Strachan

Position: Compliance Manager

EDC - CAC400, CAC400A -2015-10-07

CE

Chapter 11 Thorlabs Worldwide Contacts

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