FLI

Finger Lakes Instrumentation

Engineering Excellence
Because Your Image Depends On It

FLI
CCD Imaging Systems

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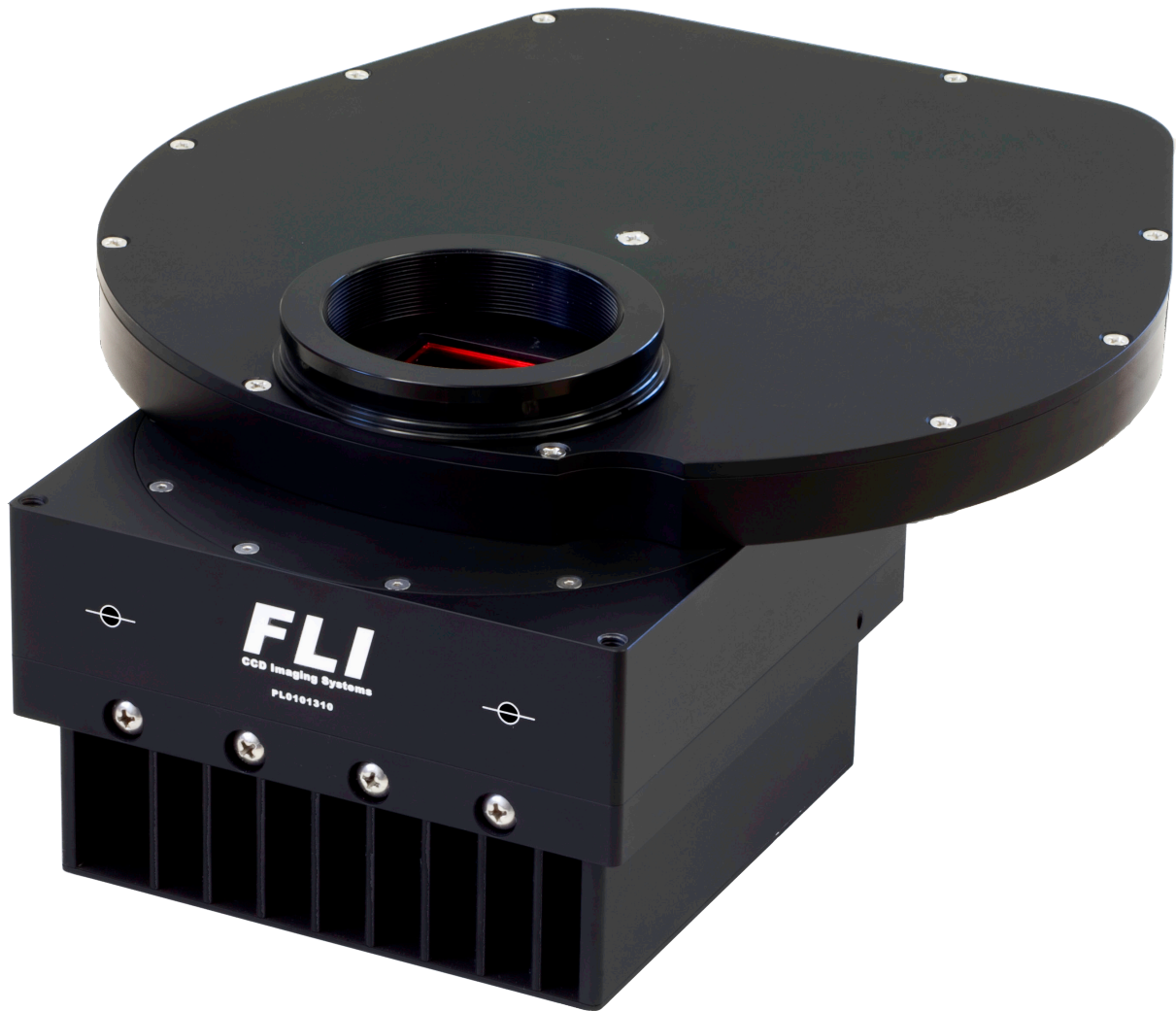
Color Filter Wheel User's Guide

Welcome

Thank you for purchasing an FLI Color Filter Wheel. We know that your accessory will bring you years of enjoyment and excellent imaging results.

This User's Guide is intended as a reference tool for you to use with all single-wheel FLI Color Filter Wheels. Please read it and follow the procedures to ensure trouble-free installation of your hardware and software.

The information in this Guide pertains to the following Color Filter Wheels:
CFW-1-5, CFW-1-8, CFW-2-7, CFW-3-10, CFW-3-12, CFW-3-20, CFW-4-5, CFW-5-7, CFW-6-6, CFW-9-5.
For information on FLI CenterLine Color Filter Wheels, please visit our website at www.flicamera.com.

When differences between these products exist, such as when replacing filters, information is clearly specified.

If you have any questions about your purchase, please contact us.

Contact Information

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Lima, New York 14485

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Email: support@flicamera.com
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FLI Yahoo Group is an active forum for members wishing to discuss FLI imaging systems, share imaging experiences, techniques, and results, and discuss imaging solutions and problem solving. The forum is accessible online at http://tech.groups.yahoo.com/group/FLI_Imaging_Systems.

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Check your Shipment

Please ensure that all the accessories and related components have arrived safely. In the unlikely event of a missing or damaged component, immediately notify FLI or your FLI dealer.

A Color Filter Wheel order should include the following items:

- Color Filter Wheel
- USB cable (15' long)
- 12 volt power supply
- 5/64" Hex wrench (for adapter pocket/camera coupling)
- O-rings for each filter pocket/cup of the CFW-1-5, CFW-1-8, CFW-3-12, CFW-3-20 and CFW-6-6
- Threaded Filter Retaining Ring installed on each filter pocket/cup of the CFW 2-7
- Filter mounting hardware (retaining screws and washers) for each filter pocket/cup
- 2-inch Draw Tube (DT-1) for the CFW-1-5, CFW-1-8, and CFW-2-7
- Packing list
- User's Guide

If you ordered other items, these items should be included. Please check that your order is complete.

Product Safety

This FLI Color Filter Wheel is shipped with a 12-volt power supply. Do not use any other power supply with this System or use the power supply in a way other than described in this Guide as it may cause damage to the Color Filter Wheel that will not be covered under the warranty.

If you are concerned about lightning strikes in the area in which you use your Color Filter Wheel, you may want to take safety precautions as electrical surges can damage electrical equipment. We recommend that when your Color Filter Wheel is not in use that you unplug the Color Filter Wheel from power and unplug the USB cable from the Color Filter Wheel.

Color Filter Wheel Overview

An FLI Color Filter Wheel provides the basis for uncompromised images night after night without fail. Each traditional style FLI Color Filter Wheel is precision engineered with a highly accurate stepper motor and chain drive. The large diameter pivot pin and bushing are precision ground and matched for smooth, quiet no-fuss operation. FLI Color Filter Wheels use no internal lights for homing to protect your images from stray light interference. Our traditional Color Filter Wheel line has six different body styles that hold either round of square filters in various sizes as described in Table 1. The Color Filter Wheel product number identifies the body type and the number of filter cups. Hence, a CFW-3-10 has a body type 3 and holds 10 filters.
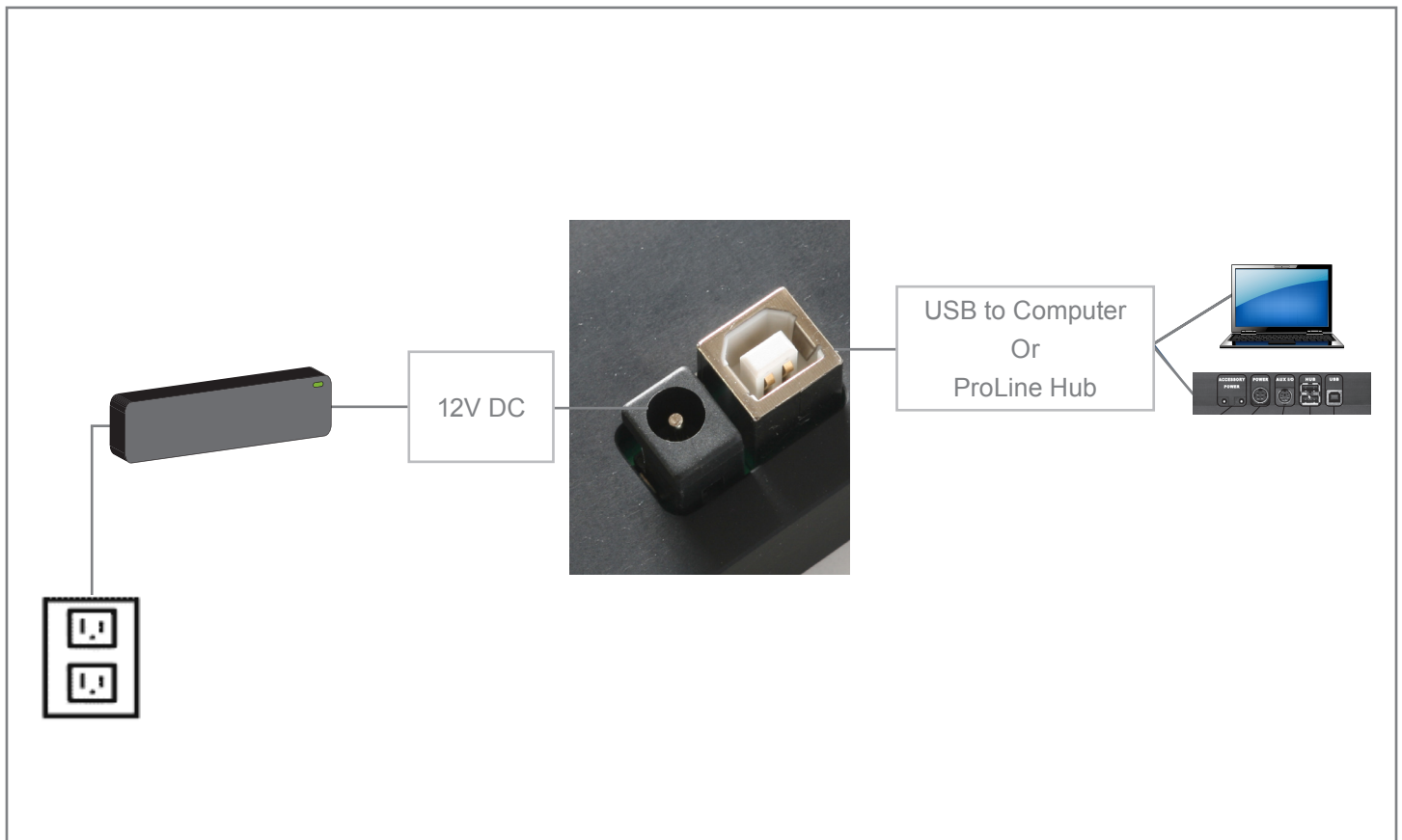
Filter Wheels

All filter wheels below are software controlled. All use a stepper motor and magnetic Hall-effect homing device.
For additional detail regarding mechanical specifications, please see drawings at http://www.flicamera.com/cfw/index.html

Model	# of Wheels	FW Thickness[1] inch (mm)	Weight lbs (kg)	Filter Positions	Filter Size[2]	Filter Thickness	Frame Connection[3]	Cover Connection[4]	OBFD with ProLine[5]	OBFD with MicroLine[6]
CFW1-5	1	0.810 (20.57)	1.7 (0.77)	5	2" / 50 mm[7]	3-5 mm[8]	2.930" pocket	2" 24tpi	41.6 mm	36.3 mm
CFW1-8	1	0.810 (20.57)	1.7 (0.77)	8	28 mm[9]	3-5 mm[8]	2.930" pocket	2" 24tpi	41.6 mm	36.3 mm
CFW2-7	1	0.822 (20.88)	2.9 (1.32)	7	2" / 50 mm[7]	1-5 mm	2.930" pocket	2" 24tpi	41.9 mm	36.6 mm
CFW3-10	1	0.848 (21.54)	6.9 (3.14)	10	50 mm SQ	1-5 mm	2.930" pocket	3" 24tpi	42.5 mm	37.2 mm
CFW3-12	1	0.848 (21.54)	6.9 (3.14)	12	2" / 50 mm[7]	1-5 mm	2.930" pocket	3" 24tpi	42.5 mm	37.2 mm
CFW3-20	1	0.848 (21.54)	6.9 (3.14)	20	28 mm[9]	1-5 mm	2.930" pocket	3" 24tpi	42.5 mm	37.2 mm
CFW4-5	1	0.785 (19.94)	2.9 (1.32)	5	50 mm SQ	1-5 mm	2.930" pocket	3" 24tpi	40.9 mm	35.6 mm
CFW5-7	1	0.85 (21.59)	4.3 (1.95)	7	50 mm SQ	1-5 mm	2.930" pocket	3" 24tpi	42.6 mm	37.3 mm
CFW9-5	1	0.595 (15.11)	3.2 (1.45)	5	65 mm SQ	1-5 mm	10-32 BP[10]	M92-1	36.1 mm	30.8 mm
CFW10-7	1	0.731 (18.57)	3.2 (1.45)	7	65 mm SQ	1-5 mm	10-32 BP	M92-1	39.6 mm	34.3 mm
CFW14-5	1	0.73 (18.5)	5.2 (2.36)	5	74.8-76.5 mm SQ	1-5.5 mm	M4 x 0.7 BP	M4 x 0.7 BP	39.5 mm	34.2 mm
CL-1-10	2	1.10 (27.94)	4.3 (1.95)	10[11]	50 mm SQ	1-5 mm	3.43" ZTA[12]	3.43" ZTA	48.9 mm[13]	43.6 mm[13]
CL-1-14	2	1.10 (27.9)	4.3 (1.95)	14[11]	2" / 50 mm[7]	1-5 mm	3.43" ZTA	3.43" ZTA	48.9 mm[13]	43.6 mm[13]
CL-1-20	2	1.10 (27.94)	4.3 (1.95)	20[11]	25 mm	1-5 mm	3.43" ZTA	3.43" ZTA	48.9 mm[13]	43.6 mm[13]

Notes:
1. Front to back thickness of the filter wheel excluding motor, in inches (mm).
2. Filters are round unless followed by SQ, indicating square.
3. Typically the camera side of the filter wheel.
4. Typically the optical side of the filter wheel (for example, lens or telescope).
5. PL OBFD = Optical back focal distance (image plane of CCD to cover side of filter wheel) for PL or ML camera with 65 mm shutter. See note 14.
6. ML OBFD = OBFD for standard 25mm or 45mm MicroLine with FLI dovetail + filter wheel. See note 14.
7. Carousel will accept either 2" or 50 mm filters.
8. May accept thinner filters with an O-ring; however, the O-ring will reduce the aperture.
9. May be made for 25 mm / 1" filters on special request.
10. BP = bolt pattern
11. Because the carousels overlap, one position in each is normally left open. For example, eight + two open positions for the CL-1-10.
12. ZTA = CenterLine Zero Tilt Adapter™
13. Assumes CL ZTA flange on front of camera. Add 9.22mm for CL adapter to FLI dovetail (AD70 or AD71).
14. For most materials, subtract 1/3 of the thickness of any filter (e.g. subtract 1mm for a 3mm thick filter) as well as 1/3 of the thickness of any cover glass on the CCD.

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Color Filter Wheel Connections

12V DC

USB to Computer
Or
ProLine Hub

Installing the FLI Filter Software

Obtain the most up to date software to install and test your Color Filter Wheel from http://www.flicamera.com/software. Select the FLI Filter application. Follow the onscreen prompts for the installation instructions. On-screen prompts will indicate subsequent steps and the completion of the installation process.

> Note: Run the FLI Software Installation Kit before you set up and power the Color Filter Wheel to ensure the system recognizes and correctly initializes the Color Filter Wheel when you connect it.

Setting-up and Powering a Color Filter Wheel

Assemble all components in one area before beginning this set up procedure. Refer to the next topic for installing filters into the Color Filter Wheels.

1. Plug the power supply cable into the Color Filter Wheel.
2. Attach the USB cable between the Color Filter Wheel and your computer.
3. Plug the power supply cable into a wall socket or switched AC power strip.
4. Run FLI Filter to initialize the Color Filter Wheel and make control selections.

The following notes are provided to assist you with the FLI Filter Software:

• The FLI Filter software should automatically recognize the type of Color Filter Wheel that is attached to your computer and display the correct number of filter positions. If the computer does not correctly identify this information, refer to the Troubleshooting topic later in this Guide for instructions.

• Upon correct installation and installation of filters, you should initiate a Homing procedure. To do this, on the FLI Filter dialog, click Home. The Color Filter Wheel will move to display the zero position in the aperture. Verify the filter is positioned in the center of the Color Filter Wheel aperture. The filter pocket/cup in the aperture position is displayed at the bottom of the dialog.

• You can move the Color Filter Wheel to a particular filter pocket/cup position. To do so, on the FLI Filter dialog, click the button corresponding to the pocket/cup. The Color Filter Wheel will move to display the selected pocket/cup position in the aperture.

• To rename a filter on the FLI Filter dialog, simply right click on the button corresponding to the filter name. On the displayed dialog enter the new name, then close the dialog.

• To incrementally move the filter displayed in the Color Filter Wheel aperture, use the directional buttons (CW or CCW). The wheel moves in small steps in the selected direction.

Filter Installation (CFW-2-7)

1. Remove power from the Color Filter Wheel and remove the Color Filter Wheel's USB cable from the computer.
2. Remove the Color Filter Wheel's protective cover by removing the Phillips head cover screws on the frame.
3. Remove the factory-installed threaded Filter Retaining Ring on the filter aperture using a small flat screw driver or tweezers on the Ring notches to grab and remove it.
4. Place a round filter into the appropriate filter pocket/cup.
5. Carefully "snug" the Retaining Ring to secure the filter in place. Do not cross thread the Ring and do not force it on. If it binds, rotate the Ring in the opposite direction to correctly restart threading it. Do not "over tighten" the Ring.
6. Repeat steps 3 through 5 to install filters in remaining pockets/cups.'
7. Install and tighten the Phillips head cover screws to secure the protective cover on the frame.
8. Plug the Color Filter Wheel's USB cable into the computer and supply power to the Color Filter Wheel.
9. Initiate a homing procedure.

Some Color Filter Wheels with a large aperture are designed for filter installation without the need to remove the cover.

Filter Installation (CFW-1-5, CFW-1-8, CFW-6-6)

1. Remove power from the Color Filter Wheel and remove the Color Filter Wheel's USB cable from the computer.
2. Remove the Color Filter Wheel's protective cover by removing the Phillips head cover screws on the frame.
3. Place a square filter into the filter pocket/cup.
4. Use a nylon washer with each retaining screw. Depending on the filter thickness, you may need to use a long (2-56x1/4") or a short (2-56x3/16") screw to secure the filter in the filter pocket/cup. Use a short screw for thin filters and a long screw for thicker ones. With a small Phillips head screw driver tighten the two screws to secure filters in position. Do not "over tighten" the screws.
5. Repeat steps 3 and 4 to install filters in remaining pockets/cups.
6. Install and tighten the Phillips head cover screws to secure the protective cover on the frame.
7. Plug the Color Filter Wheel's USB cable into the computer and supply power to the Color Filter Wheel.
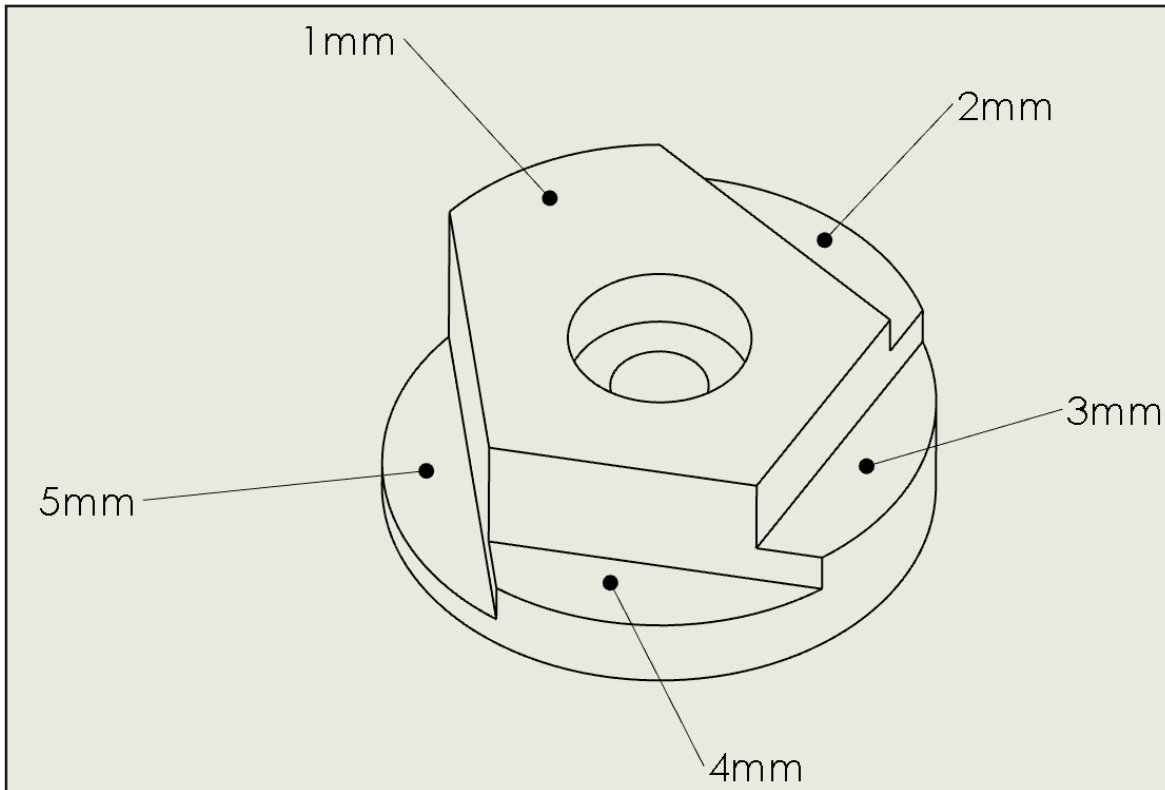8. Initiate a homing procedure.

Filter Installation (CFW-5-7)

The CFW internal wheel has "Multi-Step" Filter Retainers that can be adjusted to accommodate filters from 1mm to 5mm thick.

NOTE: The thinnest Filter Retainer Ledge accommodates the thickest Filter and the Thickest Filter Retainer Ledge accommodates the Thinnest Filter.

1. Remove the Cover and set the eleven Cover Screws aside.
2. Remove the Three Screws that secure the Filter Wheel to the Bearing Hub. (The Bearing Hub is located in the center of the wheel.)
3. Place the three Hub Screws aside.
4. Lift the Filter Wheel and Chain from the Frame and Motor Drive sprocket.
5. Turn the Filter Wheel over so that the "Multi-Step" Filter Retainers are Facing Up.
6. Select one of the Filter Pockets to install a Filter, and Remove both filter Retainers using a Philips Head Screw Driver.
7. Carefully place the filter into the filter pocket.
8. Install the filter Retainers by aligning the appropriate Filter Retainer "Ledge" to secure the filter.
9. Do not over tighten the Retainer screws.
10. Repeat Steps 5 through 7 for the remaining filters.
11. Turn the Filter Wheel over so the Labeled Filter Positions are Facing up.
12. Position the chain around the perimeter and over the teeth of the Filter Wheel
13. Place the chain around the Motor Drive Sprocket and align the Wheel over the Bearing Hub.
14. Secure the wheel to the Bearing Hub using the three screws you removed in Step 2.
15. Place the Cover onto the Frame and secure it with the eleven screws removed in Step 1.

Filter Installation (CFW-4-5, CFW-9-5, CFW-3-10, CFW-3-12, CFW-3-20)

1mm

2mm

3mm

5mm

4mm

Multi-Step Filter Retainer

The CFW internal wheel has "Multi-Step" Filter Retainers (see above) that can be adjusted to accommodate filters from 1mm to 5mm thick.

> NOTE: The thinnest Filter Retainer Ledge accommodates the thickest Filter and the Thickest Filter Retainer Ledge accommodates the Thinnest Filter.

> NOTE: It is not necessary to remove the cover to install the filters.

1. Remove both filter Retainers.
2. Carefully place the filter into the filter pocket.
3. Install the filter Retainers by aligning the appropriate Filter Retainer "Ledge" to secure the filter.
4. Do not over tighten the Retainer screws.
5. Repeat Steps 1 though 3 for the remaining filters.

Connecting Adapters to traditional Color Filter Wheels

All FLI traditional Color Filter Wheels accept FLI cameras directly. FLI Color Filter Wheels can be mated with other types of cameras using various adapters.

Color Filter Wheels with body types 1 and 2 have covers that are threaded to mate with a standard 2-inch nosepiece common to many astronomical devices. The FLI DT -1 is a 2" Draw Tube shipped with Color Filter Wheels that have body type 1 or 2. The DT-1 is typically mounted to the Color Filter Wheel's "telescope side." Other adapters fit into the adapter pocket which is generally the Color Filter Wheel's "camera side."

1. Remove the Color Filter Wheel's adapter pocket disk. Save this disk and replace the disk when an adapter is not connected to prevent dust from entering the filter chamber.
2. Place the V-groove side of the adapter into the aperture.
3. Snug the screws using the provided hex wrench. The adapter should align itself during the snugging procedure.

Appendix A - Troubleshooting

Issue	Remedy
The computer does not correctly identify the attached Color Filter Wheel.	Check that the Color Filter Wheel's power supply and USB cable are properly connected. If so, follow the steps below. 1. On the FLI Filter dialogue box right click on the top of the dialogue box and select "Communications Settings". 2. On the new dialogue box select "Scan USB," then click OK. The system should display the correct number of positions. 3. Click Scan. The system should display "flifil0" or "flifil1." 4. If a problem persists, unplug the Color Filter Wheel power and USB cable, then reinstall FLI Filter.
A filter is not centered in the CFW aperture	In the FLI Filter dialogue box, click HOME. The CFW moves to place the filter in position 0 in the aperture.
The filter pocket cup I want to see is not displayed in the aperture.	On the FLI Filter dialogue box, click any button that identifies a filter pocket/cup position to move that filter pocket/cup into the aperture position.

Appendix B - Warranty for FLI Products

Unless otherwise noted, the standard statement of warranty described below applies to customers who purchase this product. This warranty may not apply in special circumstances in which prior arrangements have been made and separate documentation has been supplied prior to, or with, the product.

This warranty applies to all FLI Products.

1. All products and services are FOB Lima, N.Y.. The customer is responsible for shipping and insurance to and from FLI.
2. The product is warranted against defects in materials and workmanship for a period of one (1) year after delivery to the original purchaser.
3. A CCD array is warranted by the CCD manufacturer for one (1) year.
4. In the event of a CCD array failure or malfunction, FLI will assist in testing, replacement, shipping and required communications with the CCD manufacturer in order to facilitate a resolution of the problem.
5. The internal environment of a camera is warranted to remain moisture free for a period of one (1) year when used under normal conditions.
6. Damage arising from ESD (electrostatic discharge) events, exposure to the elements, mechanical shock, over-voltage, reverse polarity connections, or other environmental hazards is not covered under warranty.
7. FLI will be the sole judge of what constitutes defects vs. normal performance.
8. FLI application software is supplied for demonstration purposes only. The software carries no warranty of fitness for any purpose. FLI supplies the necessary information, drivers, and libraries, for users and 3rd party vendors to develop software for their specific purposes.
9. FLI works to maintain compatibility with many 3rd party software vendors, however FLI cannot guarantee operation with non-FLI software. FLI is not responsible for changes, upgrades, or errors in 3rd party programs.
10. Incidental and consequential damages resulting from the use of FLI products, malfunction or failure to perform, or lack of fitness for a particular purpose, are not the responsibility of FLI and are hereby excluded both for property damage and to the extent permitted by law, for personal injury damage.
11. FLI products are not authorized for use as critical components in life support or medical diagnostic applications where failure to perform could result in injury, faulty diagnosis, or other risk to patients or personnel.
12. FLI products are not authorized for use in robotic control systems where malfunction or failure could cause system motions hazardous to personnel.
13. This warranty applies to the original purchaser.

Appendix C - FLI Return Procedure

If you need to return a product, please follow the instructions outlined below.

1. Contact FLI by phone or email to obtain authorization to return the camera/product and:

   a. If you are outside the United States, contact your Customs Authority to register the merchandise to be returned to the United States for warranty repair or refund. Use the Harmonized Code number 9801.00.1012 on your shipping documentation. The monetary value you place on the item should be stated for insurance purposes. Clearly state that the "Value is for Customs purposes ONLY." When FLI returns the repair item to you, we will use the same monetary value.

   b. For all customers, prepare a Pro Forma invoice to accompany the shipment with the following statement:
      - For Equipment not covered under warranty: "American goods returned for repair only with NO Commercial Value. Temporary return only"
      - For Equipment covered under warranty: "American goods returned for Warranty Repair only with NO Commercial Value. Temporary return only"

   c. For all customers, if you are requesting service under warranty or a return, a copy of your original receipt.

   d. For you records, make a copy of these documents.

   e. Prepare a large shipping label with the appropriate return address (FLI or distributor) and for shipments from outside the U.S., include the Harmonized Code number.

2. Locate the original shipping boxes in which your item(s) was packaged. These boxes are designed to protect the products.

   OR:

   If you do not have the original shipping boxes, obtain a rigid box that is at least 3" (7.5 cm) larger in all dimensions than the items. A smaller box will not allow appropriate cushioning. Tape the side and bottom seams to secure the box.

3. If you have the original packing materials, place the item(s) in the original plastic bag(s) and place the bagged item in the appropriate foam cutout in the proper orientation. Insert other items into their appropriate compartments.

   OR:

   If you do not have the original bag, place the item(s) in a plastic bag and seal it. Wrap the bagged item(s) with at least two layers of bubble wrap or two bubble wrap bags. Wrap other items in the same manner. Into the bottom of the box, place two inches of packing material (Styrofoam peanuts or additional bubble wrap). Place the item(s) on the bottom layer with space around each. Add additional packing material around the sides of each item(s) and on top of the item(s).

4. Write a letter that includes the following: reason the item is being returned to FLI or distributor, your complete contact information (name, phone number(s), email address, return shipping address), and if appropriate, payment method and information. On top of the item(s) in the box, add the required paperwork described in step 1 and the letter described in step 4. Seal the box with packing tape. Tape the top flaps and label the box with the shipping label prepared in step 1.

5. Contact a shipper for pickup or bring it to a reliable carrier. As noted in step 1, use the appropriate value on shipping forms. FLI is not responsible for damage to any item or items when they are in the possession of a carrier.

Return Addresses by Carrier

UPS and Fed Ex Returns

Finger Lakes Instrumentation
Att. Greg Terrance
7287 West Main St.
Lima, N.Y. 14485

USPS Returns

Finger Lakes Instrumentation
Att. Gregory Terrance
P.O. Box 19A
7298 West Main St.
Lima, N.Y. 14485

Return Addresses by Carrier