FLI

Finger Lakes Instrumentation

MicroLine Imaging System
User's Guide

Welcome

Thank you for purchasing an FLI camera. We know that your new camera will bring you years of enjoyment and excellent imaging results.

This User Guide is intended as a reference tool for you to use with the MicroLine Imaging System. Please read it and follow the procedures to ensure trouble-free installation of your hardware and software.

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

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If you are not aware of the FLI Yahoo Group you might want to look it up at http://tech.groups.yahoo.com/group/FLI_Imaging_Systems. This forum is for members wishing to: discuss FLI imaging systems, share imaging experiences, techniques and results, and discuss imaging solutions and problem solving.

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Check your Shipment

Please ensure that all the components have arrived safely and verify that all the items you ordered were properly delivered to you. In the unlikely event of a missing or damaged component, immediately notify your FLI dealer or FLI.

A camera order should include the following items:

- Camera with shutter cover installed (save this cover)
- Camera Test Report
- USB cable
- 12 volt power supply
- Power supply line cord
- Packing list
- User Guide

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

Product Safety

The MicroLine Imaging System 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 Camera that will not be covered under the warranty.

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

MicroLine Imaging System Overview

MicroLine High Performance CCD Cameras set the standard in key performance areas that include: Download Speeds, Cooling, Low Noise Operation, RBI Anti-Ghosting Technology, Image Quality, and Linearity. MicroLine cameras are available with a wide variety of sensors that include full-frame front illuminated, full-frame back illuminated, frame transfer and interline.

The System is ideal for:

- X-ray Applications
- Astronomical Imaging
- Scientific Imaging
- Medical Applications
- Forensic Applications
- Transmission Electron Microscopy.

Custom applications have included high altitude imaging, vacuum setup, mine searches, ultra cold weather installations, and internal lens mounting (within 0.006” of the sensor surface).

MicroLine System with lens

System Accessories

A variety of accessories that are available for your MicroLine System are described below.

- FLI Research Grade filters are high transmission filters manufactured in the United States with the highest quality fabrication techniques available. FLI offers a full line of filter types and sizes. Choose from LRGB, Ha, SII, OIII and UBVRI.
- Our Color Filter Wheel's robust mechanical design provides the basis for uncompromised images. Each FLI color filter wheel is precision engineered with a highly accurate, no-slip drive chain driven and stepper motor. The large diameter pivot pin and bushing are precision ground and matched for smooth, quiet no-fuss operation night after night. FLI color filter wheels use no internal lights for homing to protect your images from stray light interference.
- High Speed Filter Wheels use high-performance servo motors featuring rare earth magnets coupled with backlash-free power transfer to provide ultimate torque which translates to ultimate speed. Filter exchange rates under 30 milliseconds are possible.
- Digital focusers are designed for CCD astronomy where the digital imaging system is mounted very close to correct focus. The thin designs allow focusing with short-travel optical designs. All of our focusers are ASCOM compliant and are supplied with a trial version of FocusAide. Additional information about the Focuser is available in a separate document, "Focuser User's Guide" that is supplied with this product.
- FLI stocks a large variety of adapters for the most popular telescopes. We will design custom adapters to meet your imaging needs free of charge when ordering an imaging system.

Liquid Cooling Information

All FLI cameras incorporate a fan-assisted TEC (Peltier) that enables the camera to cool the sensor. Temperature reductions of up to 65°C below ambient temperature are possible with the air cooled back. The actual cooling for any given camera will depend on the sensor size and ambient temperatures. The Liquid Cooled option typically improves upon cooling by an additional 5°C to 10°C. The MicroLine Liquid Cooler has a flow rate range of 0.25 to .5 gallon/minute (.945 to 3.78 liter/min).

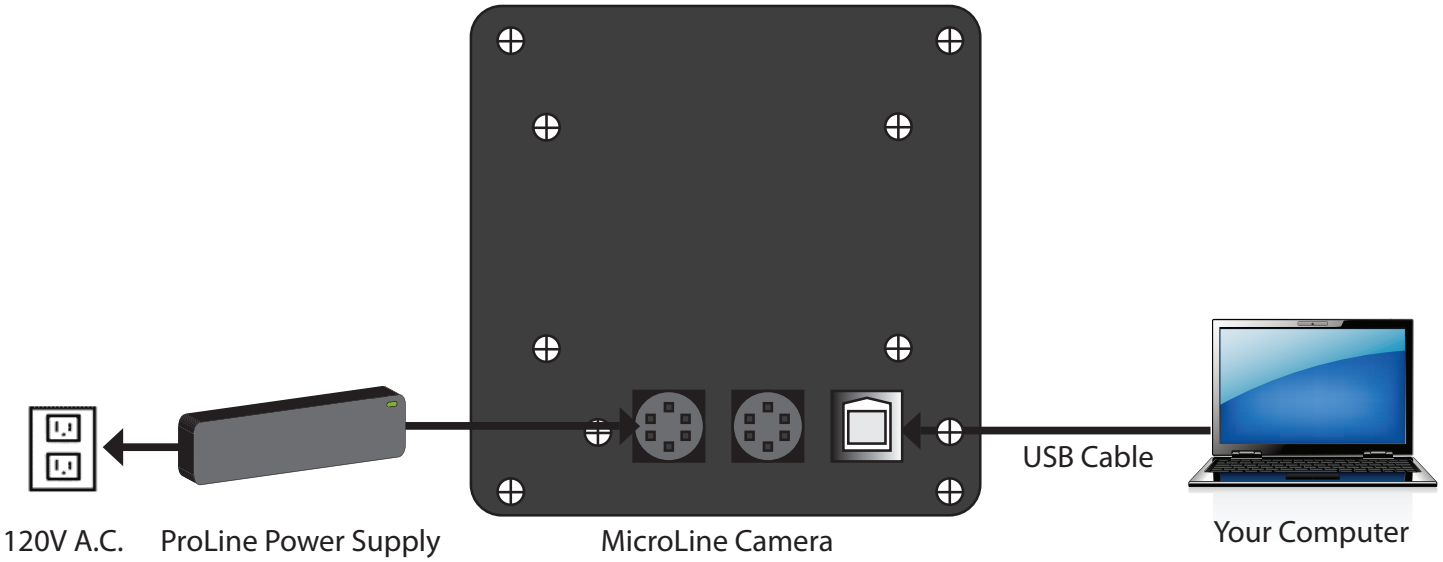
MicroLine with optional liquid cooling

MicroLine Imaging System Connections

Setting-up and Powering Your System

Assemble all System components in one area before beginning this set up procedure. The image below depicts an assembled System.

Note: Run the FLI Software Installation Kit before you set up and power your system to ensure the system recognizes and correctly initialized the camera.



Setup the components as described in the procedure below.

1. Attach the USB cable between your MicroLine camera and your PC.
2. Connect the 12-volt power supply between the camera's 4-pin "DC Power Jack" connector and a wall socket or switched AC power strip. The camera's fans will start running. Your computer should display a screen indicating that the system has found new hardware.
3. To connect a focuser or a color filter wheel to the camera you will need a short cable. A short cable kit is available from FLI. Install the power cable from the camera to the focuser or from the camera to the color filter wheel. If both are accessories were ordered, two sets of cables are provided.

Note: Refer to Appendix A for information about external triggering using the 6 pin DIN Auxillary I/O connector.

Installing the FLI Software Installation Kit

Obtain the most up to date software to install and test your System from www.flicamera.com/fli/software.asp. Select the FLI Software Installation Kit. Follow the onscreen prompts for the installation instructions. Onscreen prompts will indication subsequent steps and its completion.

Note: If an earlier version of the FLI Software is installed on your computer, uninstall/remove it by following the onscreen prompts. Then install the most current version. Overwriting an old file is not recommended.

Note: Your camera may be enabled with more than one mode or speed. If this applies to your camera, the selections will be available in the software after installation.

3rd Party Software

3rd party software is available that allows you to control the functions of your camera as well as process images captured with your FLI camera. Such software includes:
Astroart from MSB software that has a multi-lingual interface (www.msb-astroart.com)
MaximDL from Diffraction Ltd (www.cyanogen.com)
CCDSoft from Software Bisque (www.bisque.com).

Note: Before acquiring one of these or any other software to control your camera we strongly advise you to check with the software vendor that supports your camera. New cameras and versions of the software are always being released and may differ in functionality from previous versions of the same software.

Confirming Driver Installation

Note: Different operating system versions may have slightly different context.

You can determine if the camera drivers have been properly installed after connecting and powering the camera.

1. Choose the Control Panel from the start menu.
2. Choose System Properties.
3. Select the Hardware tab and select Device Manager.
4. Click the (+) next to Universal Serial Bus Controllers.
5. If the FLI Camera is displayed, the drivers are correctly installed.
6. Right Click on FLI Camera, choose Properties to view the driver status, driver date, etc.

Note: If the driver does not show up un-install FLIGrab then re-install FLIGrab

Video Mode Setup

You can use cameras with interline sensors to focus and center an image in near real-time using FLI Grab. If you are using 3rd party software refer to its documentation for a similar feature.

Interline sensors used in MicroLine cameras

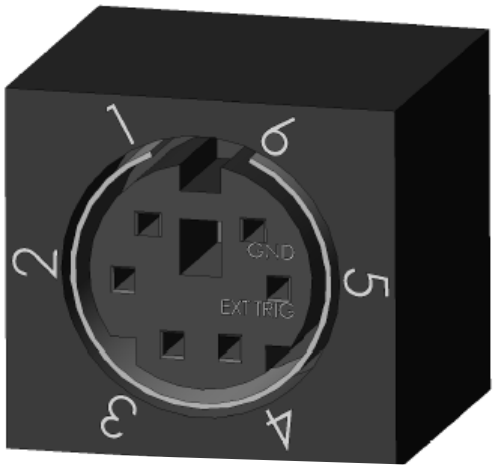
- ML01050
- ML0340
- ML11002-C and ML11002M-65
- ML16000M-65
- ML2020
- ML4022 and ML4022-C.

To use video mode

1. Setup the camera with power and the USB cable as described earlier in this guide.
2. Open FLIGrab then wait for the system to find the new hardware.
3. From the menu selections, select Grab then Camera Control to display the Grab Control menu.
4. On the Grab Control menu make the following selections or entries: Video as the Type, 3 (recommended) or 2 for X Bin; 0.05 or 0.1 sec for Exposure.
5. Select Grab. The image is displayed.
6. Use the image to focus and center the image.
7. For additional focusing, select Abort. Click the mouse to display the box tool and move the box over the area on which you want additional focusing. Select Grab then Camera Control. On the displayed menu, enter 1 in the X Bin field for the best focus. A value of 1 is the actual resolution. Select Grab to display the image. Refocus the camera as necessary.

Appendix A – External Triggering

The MicroLine Imaging Systems has a six pin connector shown in the image below.



Pin 6 is the electrical ground. Pin 5 is the logic input for the external trigger. (This input has a 22.1K pullup resistor to +3.3V). The external trigger can be setup for either rising edge or falling edge trigger.

To externally trigger the camera using FLIGrab

1. Select the Shutter Control.
2. Select the desired triggering on the pull down menu:
   - ∞ Select "External trigger on LOW" for low edge triggering.
   - ∞ Select "External trigger on HIGH" for high edge triggering.
3. Select "Done".
4. Open the Grab Menu.
5. Select desired frame and exposure settings.
6. Click the Grab button.
7. The camera will now wait for an external trigger.

A camera waiting for an external trigger "HIGH" will initiate a frame grab when a 0V transition to +3.3V signal or equivalent LVTTL signal is applied to pin 5.

A camera waiting for an external trigger "LOW" will initiate a frame grab when a +3.3V transition to 0V signal or equivalent LVTTL signal is applied to pin 5.

Shutter Open Indicator

Pin 1 on the AUX I/O connector provides an LVTTL compatible signal for shutter open indication. When the shutter is opened, pin 1 is pulled to +3.3V through an internal 22.1Kohm resistor. When the shutter is closed, pin 1 is pulled down to ground through a 332-ohm resistor within the camera. Pin 6 is the ground reference for this signal.

Appendix B – Accessories and Ordering Options

Filter Wheels

The recommended Color Filter Wheels (CFW) are described below. All FLI Color Filter Wheels' robust mechanical design provides the basis for stunning, uncompromised images. Each FLI CFW is precision engineered with a highly accurate, no-slip drive chain driven and stepper motor. The large diameter pivot pin and bushing are precision ground and matched for smooth, quiet no-fuss operation night after night. FLI CFW use no internal lights for homing to protect your images from stray light interference.

Color Filter Wheel Specifications	CFW-1-5	CFW-1-8	CFW-2-7	CFW-3-20	CFW-3-12	CFW-3-10	CFW-4-5	CFW-5-7	CFW-6-6
Overall Thickness (less motor)	0.81	0.81	0.822	0.8475	0.8475	0.8475	0.785	0.8475	0.97
Weight	1.7 lbs	1.7 lbs	2.9 lbs	6.9 lbs	6.9 lbs	6.9 lbs	2.9 lbs	4.3 lbs	5.2 lbs
Filter Positions	5	8	7	20	12	10	5	7	6
Recommended Filter Diameter	2 inch	28mm	50mm	50mm	50mm	50 mm (square)	50 mm (square)	50 mm (square)	65mm - 79mm
Filter Thickness Range	3mm - 5mm	3mm - 5mm	3mm - 5mm	3mm - 5mm	3mm - 5mm	3mm - 5mm	3mm - 5mm	3mm - 5mm	3mm - 5mm
Homing Device Type	Magnet / Hall Effect	Magnet / Hall Effect	Magnet / Hall Effect	Magnet / Hall Effect	Magnet / Hall Effect	Magnet / Hall Effect	Magnet / Hall Effect	Magnet / Hall Effect	Magnet / Hall Effect
Motor / Drive Type	Stepper / Chain	Stepper / Chain	Stepper / Chain	Stepper / Chain	Stepper / Chain	Stepper / Chain	Stepper / Chain	Stepper / Chain	Stepper / Chain
Software Controlled	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Path increase with FLI Camera	0.530"	0.530"	0.509"	0.5345	0.5345	0.5345	0.472"	0.535"	0.657"
Frame Side Connection	2.930" Pocket	2.930" Pocket	2.930" Pocket	2.930" Pocket	2.930" Pocket	2.930" Pocket	2.930" Pocket	2.930" Pocket	2.930" Pocket
Cover Side Connection	2.005" - 24 UNS-2B	2.005" - 24 UNS-2B	2.005" - 24 UNS-2B	3.005" - 24 UNS-2B	3.005" - 24 UNS-2B	3.005" - 24 UNS-2B	3.005" - 24 UNS-2B	3.005" - 24 UNS-2B	3.005" - 24 UNS-2B and 4X 8-32UNC on 3.500"BC
CCD to CFW Cover Side (MicroLine)	43.7mm	43.7mm	43.2mm	43.8mm	43.8mm	43.8mm	42.2mm	43.8mm	46.9mm
CCD to CFW Cover Side (MicroLine)	38.4mm	38.4mm	37.9mm	38.5mm	38.5mm	38.5mm	37.0mm	38.5mm	41.7mm

Appendix C – Troubleshooting

Issue	Remedy
The fan on the camera does not turn.	Check that the camera is plugged into a suitable power supply and that power is available.
The fan turns but when I use FLIGrab, but the camera does not work or works erratically.	Make certain that all cables are well seated and are not stretched.
FLIGrab runs, the camera fan turns but FLIGrab cannot locate the camera.	Please turn off your computer and camera and leave them switched off for two to three minutes, this will flash the USB chips. Try again.
I get a Windows “Communication” error.	Please turn off your computer and camera and leave them switched off for two to three minutes, this will flash the USB chips. Try again.
Everything is connected and FLIGrab has been installed but the software cannot locate the camera.	Please make certain that you have installed the software and drivers as per the instructions in this manual. Letting Windows locate the camera during installation is likely to create problems. Uninstall FLIGrab and install it again following the installation process.
FLIGrab runs and has identified my camera. I have Grabbed an image but the image appears as a flat black frame.	You are over exposing or under exposing. Check the settings in the software.

Appendix D- MicroLine Shutter Information

Shutter ordering options include the Uniblitz CS25, CS45 and CS65, the FLI 41 or no shutter. For smaller MicroLine camera sensors the FLI 41mm shutter is standard. For larger sensors the CS65mm shutter is standard. Refer to information later in this appendix for shutter specifications if a shutter is installed in your camera.

If you suspect a problem with the shutter, contact FLI.

If FLI sends you a replacement FLI 41mm shutter assembly, follow the procedure below to disassemble, clean, inspect and reassemble this shutter.

If you must replace other shutter types installed in your camera, contact FLI for assistance.
Replace the FLI 41 mm Camera Shutter Assembly
The 41mm shutter is an FLI-designed shutter capable of exposures as short as 40 milliseconds. It consists of four stainless-steel blades driven by a drive ring and solenoid.

Prior to beginning any procedure in this topic, do the following:
Always wear an ESD wrist strap when performing this procedure.
Use extreme caution when handling a shutter. You may damage the shutter if you do not handle it properly.
Protect the shutter the camera's original shutter with cover.

The tools required to replace the shutter assemble are:

- Isopropyl alcohol
- Two clean cloths
- Canned air
- Phillips head screw driver

Disassembling and Cleaning the Shutter

1. Loosen and remove the four screws holding the shutter flange on the camera body and set the flange and screws aside.
2. Carefully remove the black plastic shutter drive ring from the camera. Use caution as the drive ring may stick to one of the shutter pivot balls or the solenoid drive pin.
3. Remove the four stainless steel shutter blades by gently pulling them away from the camera body.
4. Wipe each shutter blade with a cloth moistened with isopropyl alcohol, then set them aside.
5. Wipe the plastic shutter drive ring with a water moistened cloth and set it aside.
6. Use canned air to carefully remove any dust or debris from the camera housing where the shutter blades and drive ring are normally located. Do not spray air directly at or close to the camera window.

Inspecting the Shutter Assembly

1. Inspect each blade for the presence of a pivot ball on each side.
2. Use a magnifier to inspect the blade weld area opposite each ball for cracks. Replace any blade that is defective.
3. Inspect the drive ring. Check that the drive ring solenoid-slot moves freely over the solenoid drive pin. Check that the drive ring shutter-ball-slots does not have any burrs. Check that the shutter blade balls should moves freely within its slot.
4. Move the bare solenoid pin back and forth by hand. The pin should move freely (not stick or catch at any point). The solenoid body should be tight within the camera body.

Re-assembling the Shutter

1. Position the camera so the solenoid is located in the 5:00 position of a clock.
2. Hold a shutter blade and orient its curved side toward the center of the camera window.
3. Place the shutter blade pivot ball into the first shutter ball cavity.
4. Orient the shutter blade so that it is in the open position and not obscuring the camera window.
5. Repeat steps 2-4 for the other shutter blades/shutter ball cavities. Each blade should overlap the previous blade. That is, blade 2 sits on top of blade 1 and blade 3 sits on top of blade 2, etc. Correct installation of all four blades allows a full view of the camera window.
6. Place the drive ring over only the solenoid drive pin.
7. With the drive ring positioned above the blades (but not engaged), rotate the solenoid to the open position and place the drive ring slots over each shutter blade ball.
8. Slowly allow the solenoid to move to the normal closed position so the shutter blades close over the camera window. Try to move the drive ring so that all the blades are positioned equally over the camera window. Place the shutter flange over the shutter blades and drive ring, but do not press down tightly.
9. Move the shutter drive pin until the shutters align and open and close normally.
10. Reinstall the cover screws.

Appendix E – Warranty for MicroLine Imaging Systems

Unless otherwise noted, the standard statement of warranty described below applies to customers who purchase this System. 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 System.

This warranty applies to MicroLine Imaging Systems.

All cameras and services are FOB Lima, NY. The customer is responsible for shipping and insurance to and from FLI.

The camera is warranted against defects in materials and workmanship for a period of one (1) year after delivery to the original purchaser.

The CCD array is warranted by the CCD manufacturer (Kodak) for one (1) year.

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.

The internal environment of the camera is warranted to remain moisture free for a period of one (1) year when used under normal conditions.

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.

FLI will be the sole judge of what constitutes defects vs. normal performance.

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.

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.

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.

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.

FLI products are not authorized for use in robotic control systems where malfunction or failure could cause system motions hazardous to personnel.

This warranty applies to the original purchaser.

Appendix F – Camera and Supplies Return Procedure

If you need to return a camera or supplies, please follow the instructions outlined below.

1. Obtain authorization to return the camera/products in advance by phone or email contact with FLI and:
   - ∞ 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.
   - ∞ 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"

   OR:
   - ∞ 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.
   - ∞ For you records, make a copy of these documents.
   - ∞ 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. 4.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 items when it is in the possession of a carrier.