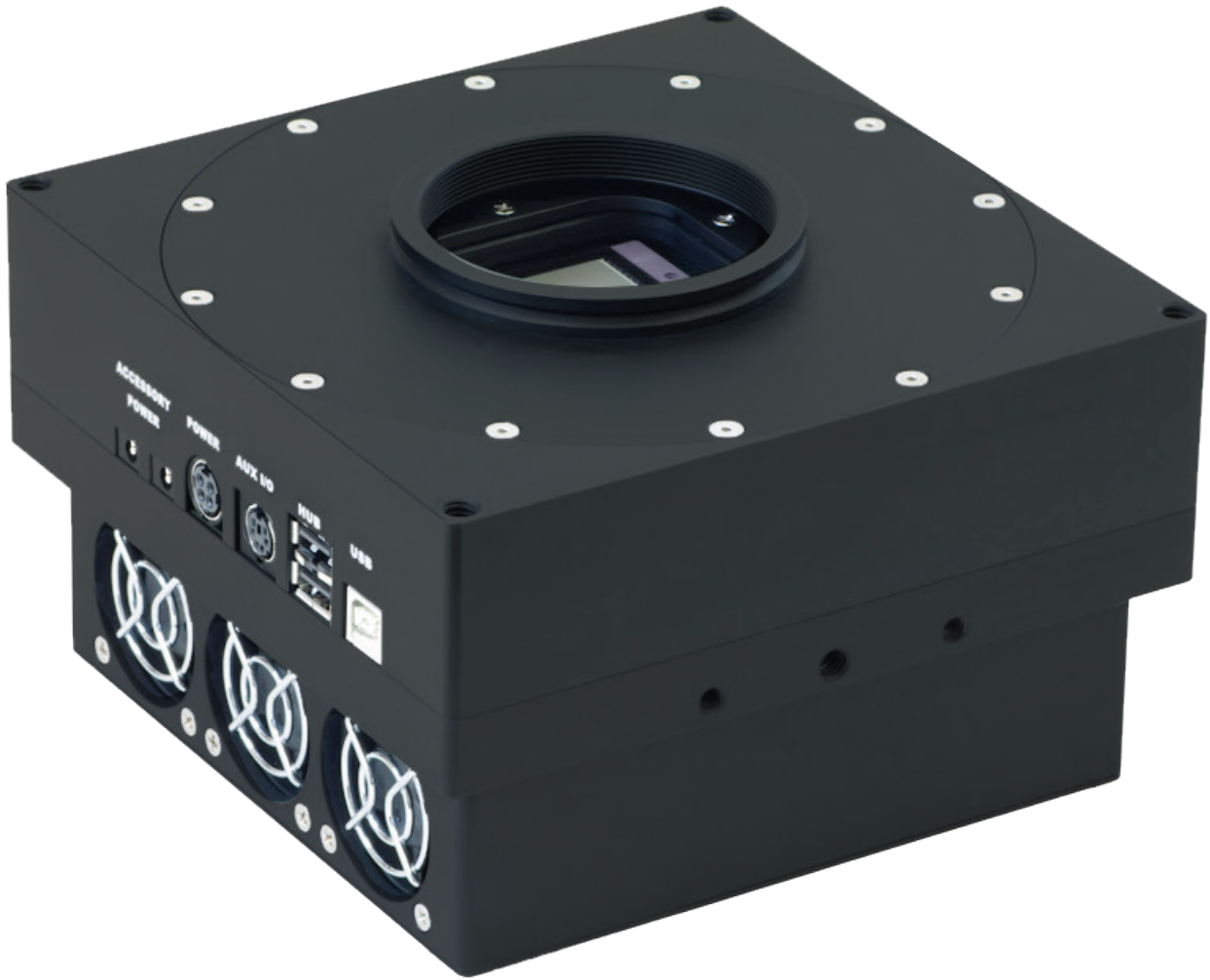




Engineering Excellence
Because Your Image Depends On It



ProLine 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 Ú![] Line 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.

Contact Information

Finger Lakes Instrumentation, LLC
7287 West Main St.
Lima, New York 14485

Phone: 585-624-3760

Email: support@flicamera.com

Web: www.flicamera.com

Fax: 585-624-9879

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 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

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

Product Safety

The ProLine 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.

ProLine Imaging System Overview

ProLine 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. ProLine 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
- ▶ 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).



ProLine System with color filter wheel, digital focuser, and lens

System Accessories

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

- ▶ 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. 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. If you do not find what you need on our website, please contact www.preciseparts.com.
- ▶ 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.
- ▶ Threaded shutter cover available for all ProLine cameras.

Liquid Cooling Information

As a standard, all FLI cameras incorporate a TEC (Peltier) that enables the camera to cool the sensor. The actual cooling for any given camera will depend on the sensor size and ambient temperatures. The ProLine Liquid Cooler can accept a flow rates up to 0.5 gallon/minute (1.91 liter/min). Please contact FLI with your custom cooling requirements for either air, liquid, or un-cooled system. Please see Appendix G for all available ProLine liquid cooling configurations.

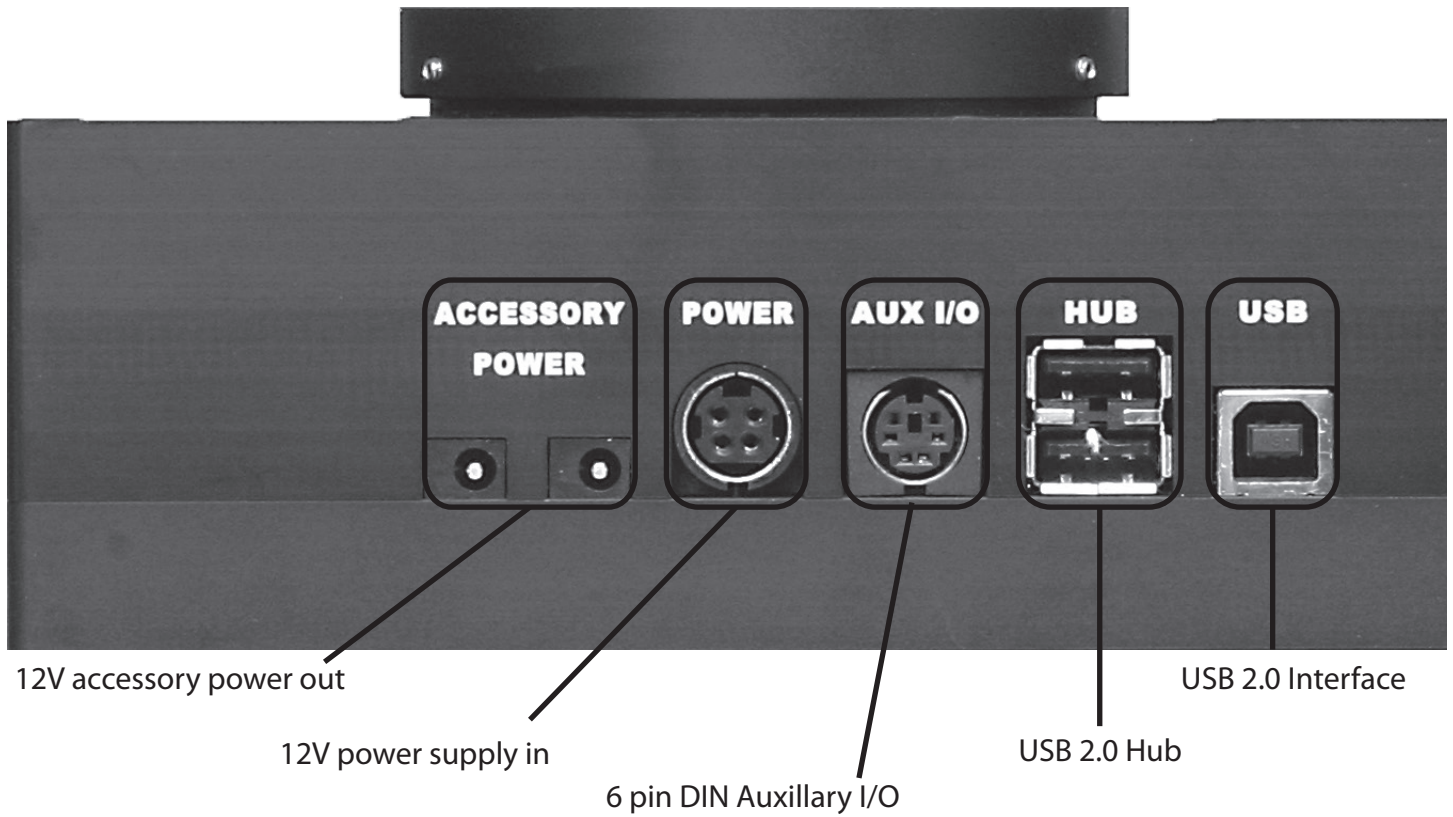
! Warning: Using flow rates above the recommended flow rates may cause the liquid cooling system to leak and will void the warranty.

Note: *Maximum ProLine Liquid Cooler inlet pressure is 50 psig. Ensure tubing selected has the proper pressure rating. To avoid undesired pressure build up in Liquid Cooler shut off flow on the inlet side before detaching or closing outlet connections.*



ProLine with optional liquid cooling and dry disconnect fittings

ProLine 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 ProLine 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.

Note: Refer to Appendix A for information about external triggering using the 6 pin DIN Auxiliary 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/software/index.html. Select the FLI Software Installation Kit. Follow the onscreen prompts for the installation instructions. Onscreen prompts will indicate 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

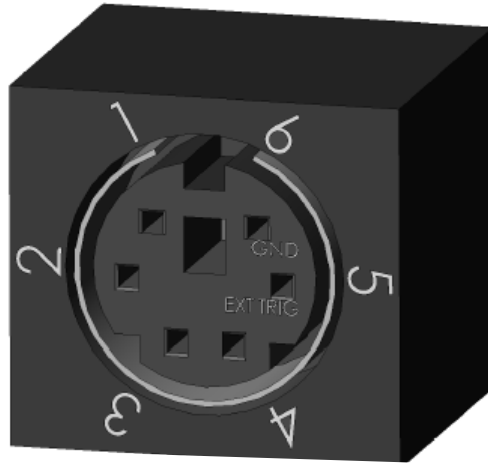
You can use cameras with interline sensors to focus and center an image in near real-time using FLI Grab. If you are using 3rd party software refer to its documentation for a similar feature.

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 ProLine 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:
 - a. Select "External trigger on LOW" for low edge triggering.
 - b. 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.

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

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

Exposure Active Indicator

Pin 1 is an exposure active indicator. It becomes an LVTTTL high with respect to the ground (pin6) when the camera exposure starts and it becomes an LVTTTL low when the camera exposure is finished. It will remain low until the next exposure. It has a 332 Ohm source impedance.

Shutter Open Indicator

Pin 2 on the AUX I/O connector provides an LVTTTL compatible signal for shutter open indication. When the shutter is opened, pin 2 is pulled to +3.3V through an internal 22.1Kohm resistor. When the shutter is closed, pin 2 is pulled down to ground through a 332-ohm resistor within the camera. Pin 6 is the ground reference for this signal.

Pins 3 and 4 are uncommitted camera I/O signals.

Notes:

The mating part for the external trigger connection is a 6-pin male (CUI MD-60).

The Digi-Key part number for this part is CP-2060-ND.

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.

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.	<p>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.</p> <p>Uninstall FLIGrab and install it again following the installation process.</p>
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 - 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 E - FLI Return Procedure

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

- 1.** Obtain authorization to return the camera/product in advance by phone or email contact with FLI 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.
- 3.** OR:
- 4.** 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.
- 5.** 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.
- 6.** OR:
- 7.** 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).
- 8.** 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.
- 9.** 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.

Return Addresses by Carrier

UPS and Fed Ex Returns

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

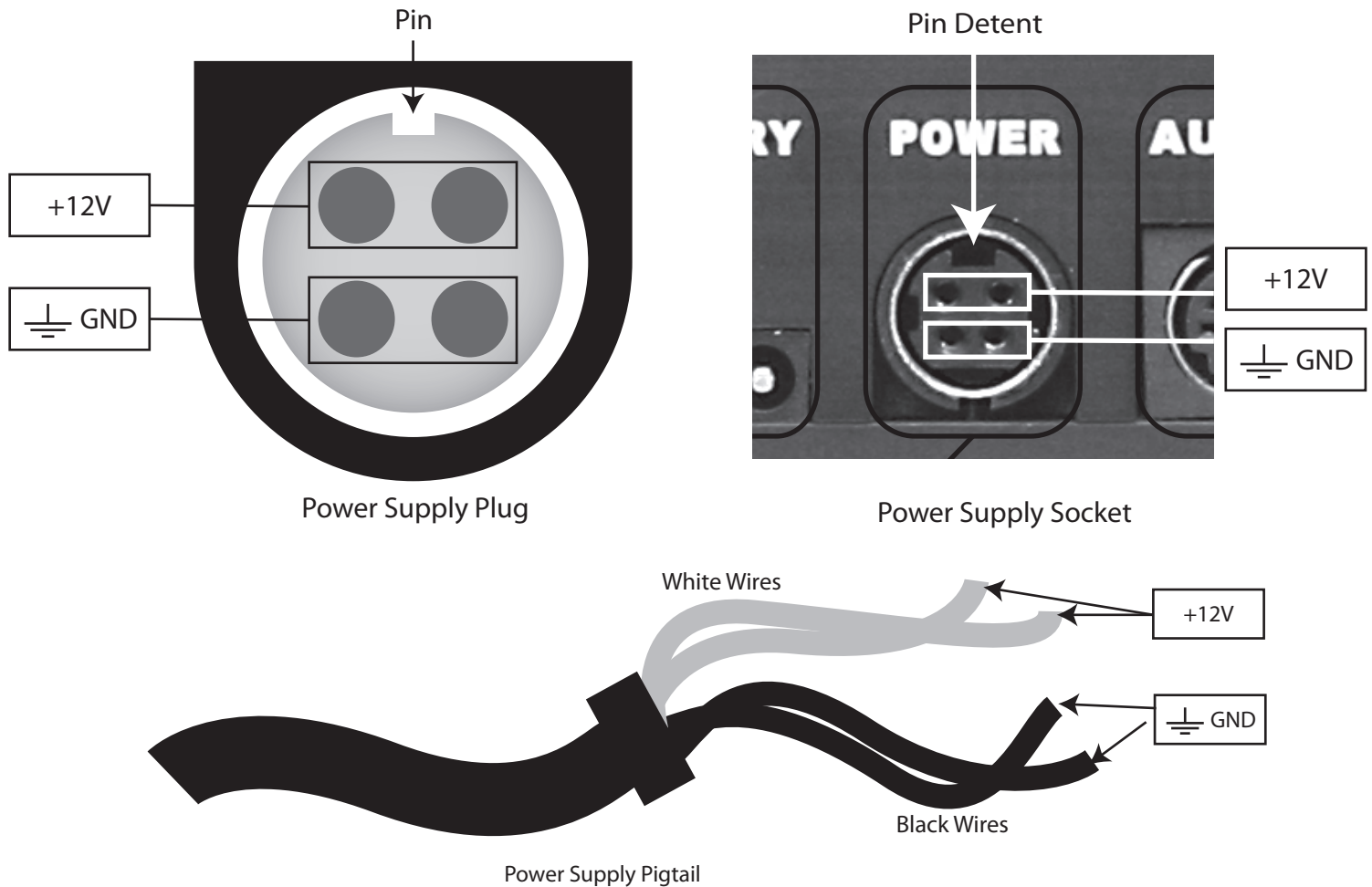
USPS Returns

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

Appendix F - Four Conductor Power Cable (PT1)

The Four Conductor Power Cable (PT1) is available to customers who are not able to use the Power Supply (PowerSolve PSG120-12-10 Inverter) shipped with the FLI ProLine and FLI MicroLine Imaging Systems.

! Warning: If the polarity of the power connection is reversed it can cause damage to the camera. This damage will not be covered by the FLI product warranty. Verify the polarity of the voltage using a meter before attaching a power cable to the camera. Also verify the chosen system has the same current capability.

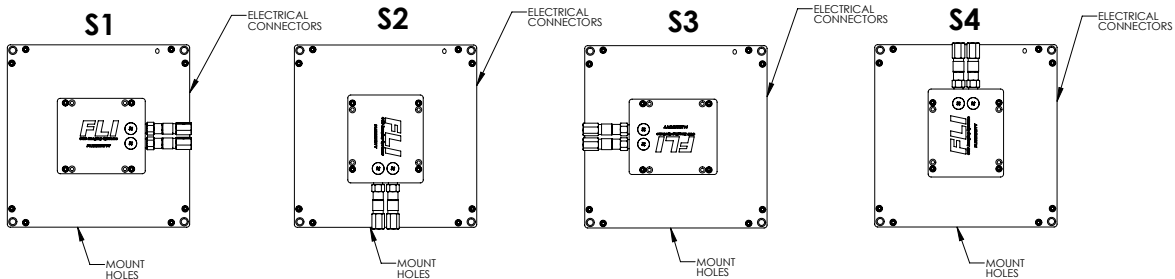


The 4 Pin Jack Socket shield is also connected to ground. The 4 Pin Jack Socket is available from www.mouser.com by searching for KPJX-4.

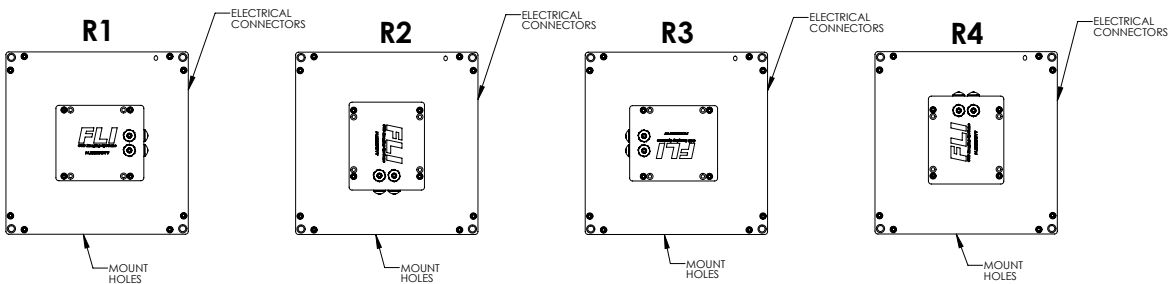
Appendix G - Liquid Cooling Options

Listed below are the available connector configurations for ProLine cameras as viewed from the bottom. When ordering the liquid cooling option please reference the desired configuration using the numbers (Sx or Rx) below.

SIDE MOUNT CONFIGURATIONS:



REAR MOUNT CONFIGURATIONS:



The following connection fittings are currently available:

Connector	Standard User Interface	Additional Information
1/8" ID Hose Barb	1/8" ID Tubing	FLI recommends use of hose clamps. User supplies tubing and clamps with appropriate pressure rating for their application
Quick Connect Double Shutoff	#10-32 UNC male coupling	FLI supplies both female and male connectors, User supplies the interface
Quick Connect Dry Break	#10-32 UNC male coupling	FLI supplies both female and male connectors, User supplies the interface
Custom	Per Customer Requirements	FLI is able to plumb to interfaces not listed. Please contact FLI with your connection requests.