

FASTEC Imaging

HIGH-SPEED IMAGING IN THE PALM OF YOUR HAND



IL3, IL4 and IL5 High-Speed Cameras Operator's Manual

Camera Software 2.5.x

Copyrights and Disclaimer

This documentation is copyrighted material. Making unauthorized copies is prohibited by law. No part of this documentation may be reproduced, transmitted, transcribed, stored in a retrieval system or translated into any human or computer language without the prior written permission of Fastec Imaging Corporation.

Information in this document is provided in connection with Fastec Imaging products. Fastec Imaging believes the printed matter contained herein to be accurate from date of publication and reserves the right to make changes as necessary without notice. Fastec Imaging makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to the software or documentation.

No license, express or implied, or otherwise, to any intellectual property rights is granted by this document. Except as provided in Fastec Imaging's Terms and Conditions of Sale for such products, Fastec Imaging assumes no liability whatsoever.

THIS MANUAL IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, RELATING TO SALE AND/OR USE OF FASTEC IMAGING PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. FASTEC IMAGING FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THIS MANUAL. FASTEC IMAGING SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THIS DOCUMENT.

Fastec Imaging products are not intended for use in medical, lifesaving or life sustaining applications. Fastec Imaging customers using or selling Fastec Imaging products for use in such applications do so at their own risk and agree to fully indemnify Fastec Imaging for any damages resulting from such improper use or sale.

Trademarks

Windows™ is a registered trademark of Microsoft Corporation. Other brand or product names are trademarks of their respective holders.

Product names or services listed in this publication are for identification purposes only, and may be trademarks of third parties. Third-party brands and names are the property of their respective owners.

Reader Response

We at Fastec Imaging strive to produce quality documentation and welcome your feedback. Please contact us with technical questions, comments and suggestions.

Fastec Imaging Corporation
17150 Via Del Campo
Ste. 301
San Diego, CA 92127
+1-858-592-2342
support@fastecimaging.com

Contents

Copyrights and Disclaimer	i
Trademarks	i
Reader Response	i
1 Product Overview	1
1-1 Product Description	1
1-2 ILx Product Differentiation	2
1-3 ILx Controls, Indicators, and Connectors	3
2 IL3 / IL4 / IL5 Getting Started	7
2-1 Unpacking the Camera	7
2-2 Installing the Lens.....	7
2-3 Power	8
2-4 ILx Memory and Mass Storage Options.....	8
2-5 I/O Connections.....	11
3 IL3 / IL4 / IL5 Setup and Control	7
3-1 FasMotion Software	7
3-2 Web-App	8
3-3 Custom Software via SDK.....	8
Appendix.....	10
Appendix A: IL3 / IL4 Specifications	10
Appendix B: IL5 Specifications	11
Appendix C: IL3 / IL4 Record / Resolution Tables.....	12
Appendix D: IL5 Record / Resolution Tables	17
Appendix E: Power and I/O Connections	25
Appendix F: Adjusting Back Focus.....	28
Appendix G: Camera Status LEDs	30
Appendix H: IL3 Updates	31
Appendix I: Physical Measurements	33
Appendix J: Crop Factor	34

Table of Figures

Figure 1-1: ILx Back View	3
Figure 1-2: ILx Front View	4
Figure 1-3: ILx Top View	4
Figure 1-4: ILx Side Views	5
Figure 1-5: ILx Bottom View	5
Figure 2-1: ILx Connections	9
Figure 2-2: I/O Cables and Connections.....	11
Figure 3-1: FasMotion with 2 Camera Views	7
Figure 3-2: Web-app on an iPhone	8
Figure 3-3: Fastec SDK Menu.....	9
Figure 4-1: Sync I/O Cable Drawing	26
Figure 4-2: Sync I/O Camera Interface Schematic	26
Figure 4-3: PLC to 3.3V Adapter Schematic.....	27
Figure 4-4: PLC 24V as Camera Trigger.....	27
Figure 4-5: PLC Low as Camera Trigger	27
Figure 4-6: Focus Chart	28
Figure 4-7: C-Mount.....	28
Figure 4-8: Navitar 50mm f/95 Lens	29
Figure 4-9: Camera Update Screens.....	31
Figure 4-10: Contents of Update SD Card	31
Figure 4-11: SD Card Restorer Messages	32
Figure 4-12: Physical Measurements.....	32
Figure 4-13: Crop Factor 1280 x 1024	33
Figure 4-14: Crop Factor 1280 x 720	34
Figure 4-15: Crop Factor 800 x 600	34

Table of Tables

Table 1-1: ILx Models	2
Table 1-2: Part Number Legend.....	2
Table 1-3: Camera Part Locations	3
Table 2-1: Package Contents:	7
Table 2-2: Lens Selection.....	8
Table 2-3: ILx Mass Storage Functionality.....	10
Table 4-1: Specifications	10
Table 4-2: IL3 / IL4 Resolutions, Rates, and Times	12
Table 4-3: IL5 Resolutions, Rates, and Times	17
Table 4-4: Power Pin Out	25
Table 4-5: I/O Connector Pin Out	25
Table 4-6: Camera Status LEDs	30
Table 4-7: Crop Factor	34

1 Product Overview

1-1 Product Description

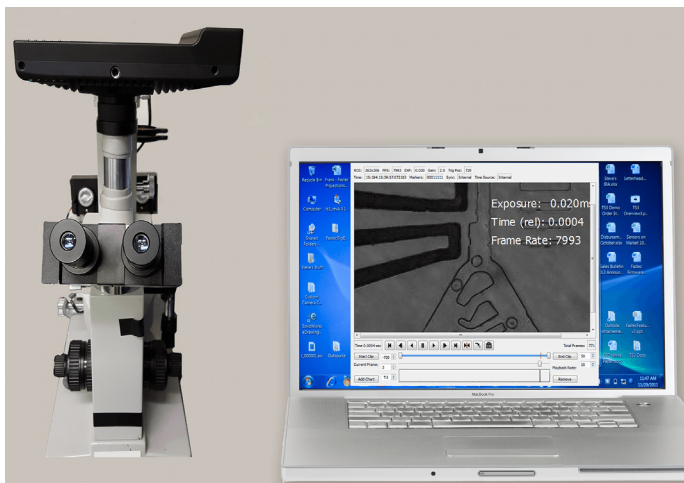
The Fastec ILx is a high-speed digital camera line with models capable of capturing high-resolution 1920 x 1080-pixel images at 634 frames per second, smaller-resolution images at much higher frame rates, and higher-resolution images at lower frame rates. Recording image data at high frame rates makes it possible to play back high-quality video sequences in slow motion, enabling the user a greatly enhanced ability to analyze events that occur much too quickly for human vision to perceive.

The ILx, with its many modes of operation, including its unique stand-alone capabilities and its high-speed imaging performance, resolution, and sensitivity, make it an excellent choice for many different applications. For multi-camera use or where the camera might be set up and left in more remote applications, its networking and master/slave capabilities come into play. When the action becomes fast and furious, FasFire mode helps to capture many triggered events. When triggering isn't an option, and for very long events, models with Long Recording (LR) modes capture all the action by streaming image data to built-in SSDs.

Fastec Imaging high-speed cameras are used in hundreds of different industrial manufacturing sites to analyze motion in machinery and production line processes. Reduce jams, speed up line setup and changeovers, lower scrap and rejected material costs and reduce downtime and maintenance expenses.



Universities worldwide use Fastec cameras for a variety of research studies. Animal locomotion, mechanical engineering, flow visualization, combustion studies, biomechanics & kinesiology, physics, chemistry, tensile testing and more.



High-speed cameras are used in mining and blasting applications to determine the effects of blasts on structures or vehicles or determine the actual firing times of blast holes and the nature of the rock movement. Delay detonators provide the timing blasts needed under specific blasting

conditions. Blast holes firing at incorrect times reduce rock fragmentation, effect blast movement, and can increase blast vibrations.

Military customers worldwide use high-speed video to design and test weapons, counter measure and defensive systems and components. Fastec cameras have been used for "chase plane" applications such as airborne stores separation and in-flight aeronautics testing.



1-2 ILx Product Differentiation

Fastec Imaging sells several different ILx high-speed digital camera models. These cameras are offered in either monochrome or color with various high-speed digital recording capabilities using a wide range of recording rates, sensor resolutions, and on-board memory options. All cameras are equipped with a standard C-mount lens mount, and 1/4-20 tripod mount. Additional lens mount options are available.

ILx cameras support the following modes of operation:

- Local or remote operation via a wired GigE connection, using FasMotion, the Fastec camera control software or the Fastec Web Application via GigE, wired or WiFi (with WiFi option). With the Web Application, any host device (PC, tablet, smartphone) with a common Web browser may be used to control the camera.
- Unattended operation: The camera is set up using the camera control or web application, set for AutoSave and Armed, then left waiting only for a trigger input.

The ILx camera housing is made of 100% machined aluminum with a black anodized finish. It is both attractive and extremely durable. LEMO connectors are used for critical power and Sync/Trigger connections. It has side-mounted USB-OTG, HDMI, Gig-E, Sync/Trigger, and Power connectors as well as a SD-Card slot. Power is supplied by an AC power adapter or any 10-26v DC source.

Table 1-1: ILx Models

Camera	Max Resolution / Frame Rate	Standard Memory	Sensor Size	Optional Memory	Optional Solid-State Drive
IL3L	800 x 600 @1250fps	4GB	14mm	8GB	256GB / 512GB / 1TB / 2TB
IL3S	1280 x 1024 @ 510fps	4GB	22.9mm	8GB	256GB / 512GB / 1TB / 2TB
IL4100-LR2/3	1280 x 1024 @ 510fps	8GB	22.9mm	8GB	256GB / 512GB / 1TB
IL5L	800 x 600 @ 1126fps	4GB	5mm	8GB	256GB / 512GB / 1TB / 2TB
IL5S	1280 x 1024 @ 668fps	4GB	8.2mm	8GB	256GB / 512GB / 1TB / 2TB
IL5H	1920 x 1080 @ 634fps	4GB	11mm	8GB	256GB / 512GB / 1TB / 2TB
IL5Q	2560 x 2048 @ 253fps	4GB	16.4mm	8GB	256GB / 512GB / 1TB / 2TB

Except for the IL3L, all cameras record at higher frame rates at higher frame rates at reduced resolutions.

The IL4100 in Long Recording Mode: 1280 x 1024 @ 183fps (LR2: SATA II) / 366fps (LR3: SATA III)

IL3 and IL5 cameras with the “D” (Dual Mode) option also record in Long record mode at SATA III speeds.

Table 1-2: Part Number Legend

IL3XXXxxxX	Component	Options	Examples
IL3LM8512D	Long Record	None / D*	IL3LM8512D = 800 x 600, Mono, 512GB SSD, Dual Mode
IL4LR3C8512	Drive (GB SSD)	None/ 256 / 512	IL4LR3C8512 = 512GB SSD
IL3100LC4	Memory (GB)	4 / 8	IL3100LC4 = 800 x 600, Color, 4GB (no SSD)
IL3100SM4	Sensor	Color or Mono	IL3100SM4 = 1280 x 1024, Mono, 4GB (no SSD)
IL3100LSM8256	Sub-Model	L / S / LR / H / Q	IL3100LSM8256 = 1280 x 1024, Mono, 8GB, 256GB SSD
IL4LR3C8512=	Model	3 / 4 / 5	IL4LR3C8512= 1280 x 1024, Color, Long Rec, 512GB SATA III

1-3 ILx Controls, Indicators, and Connectors

Table 1-3: Camera Part Locations

Camera Part	Link to View
LED Indicators	"Figure 1-1: ILx Back View" / "Figure 1-2: ILx Front View"
C-Mount	"Figure 1-2: ILx Front View"
C-Mount Lock Screws	"Figure 1-3: ILx Top View" / "Figure 1-5: ILx Bottom View"
Lens Mount Holes	"Figure 1-3: ILx Top View"
1/4-20 Tripod Mounts	"Figure 1-3: ILx Top View" / "Figure 1-5: ILx Bottom View"
USB Port	"Figure 1-3: ILx Top View"
USB OTG Port	"Figure 1-4: ILx Side Views"
SD-Card Slot	"Figure 1-4: ILx Side Views"
Gig-E Connector	"Figure 1-4: ILx Side Views"
Sync I/O Connector	"Figure 1-4: ILx Side Views"
HDMI Connector	"Figure 1-4: ILx Side Views"
Power Connector	"Figure 1-4: ILx Side Views"

Figure 1-1: ILx Back View

Note: See "Appendix I: Physical Measurements" on page 33 for dimensions.



Figure 1-2: ILx Front View

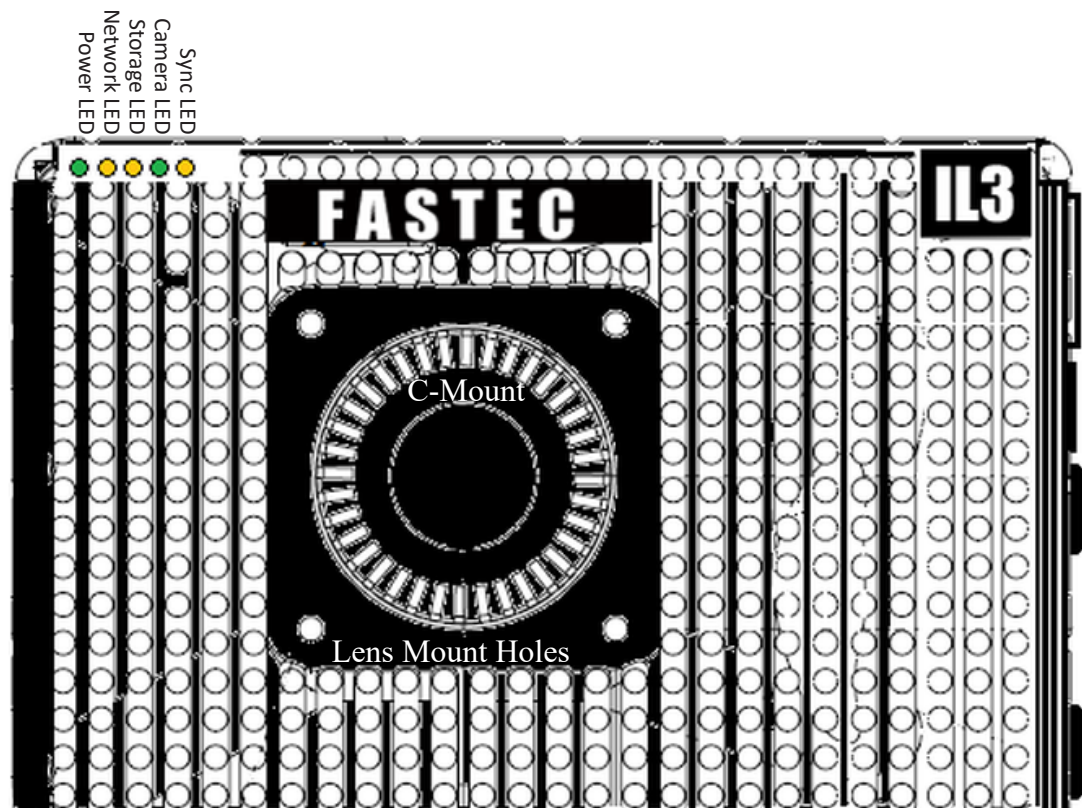


Figure 1-3: ILx Top View

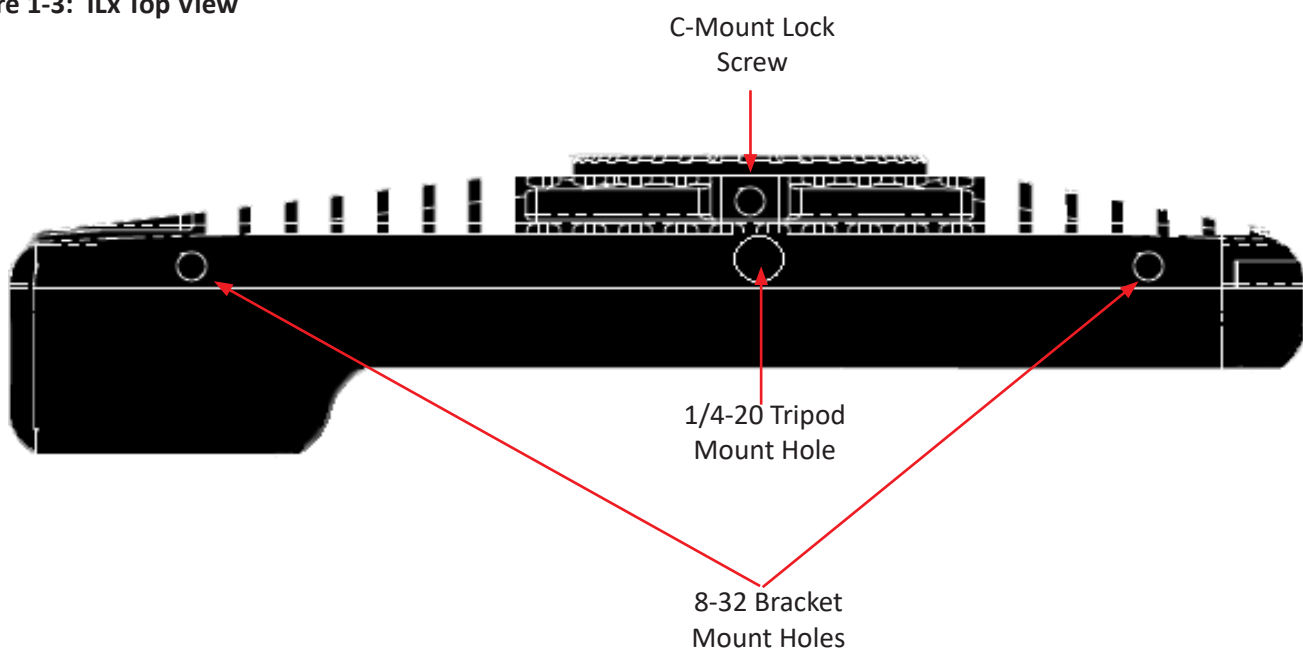


Figure 1-4: ILx Side Views

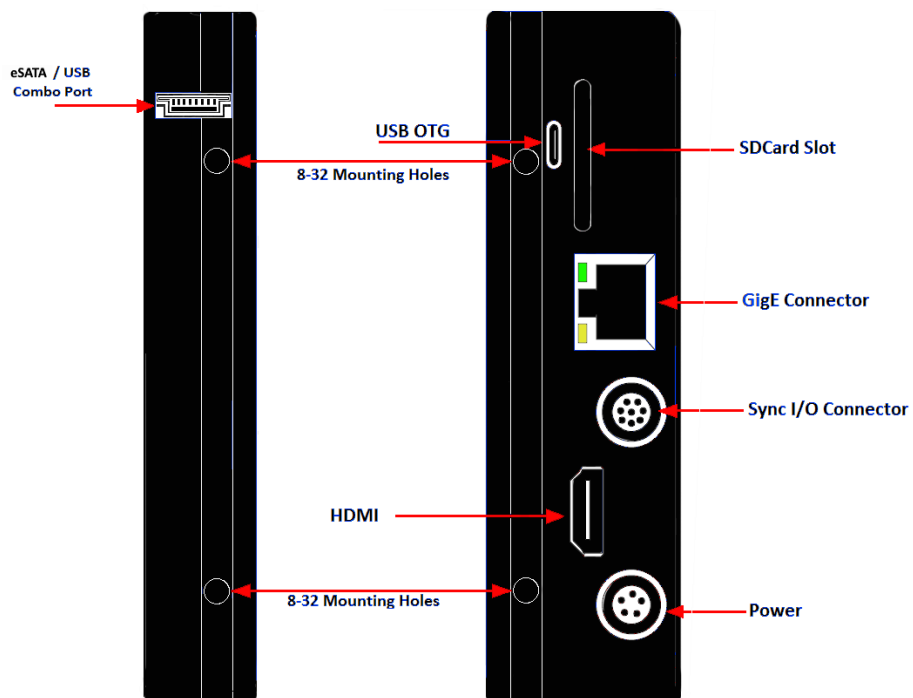
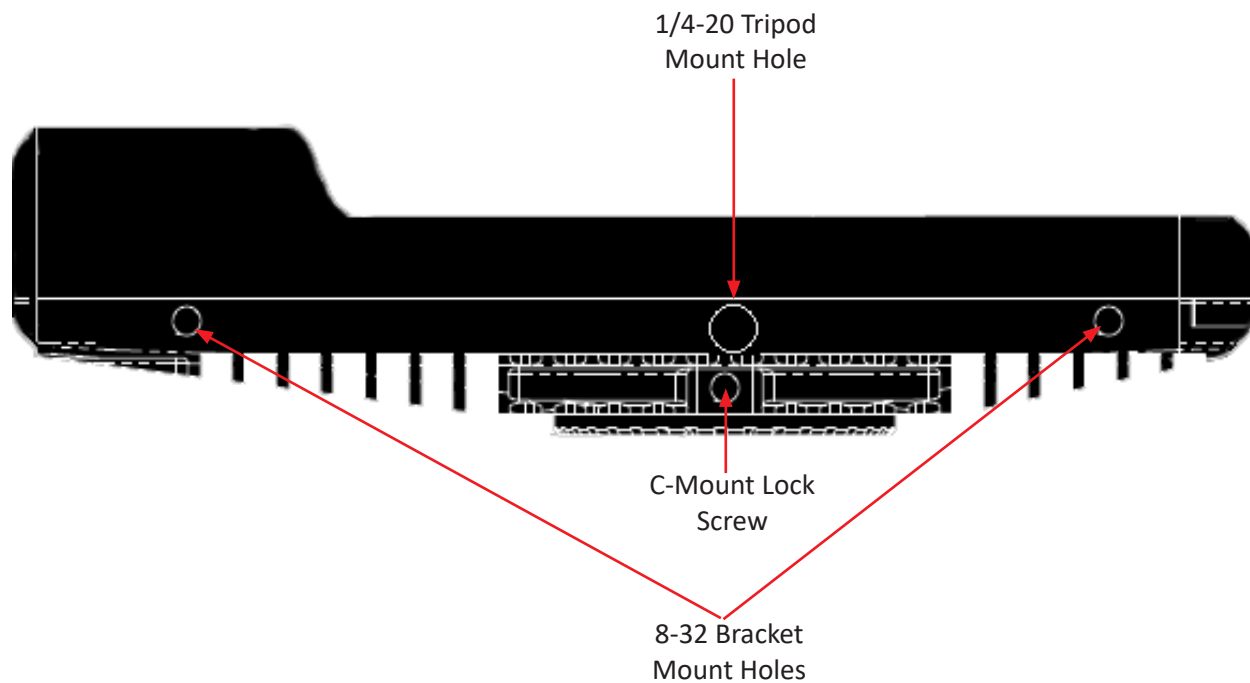


Figure 1-5: ILx Bottom View



2 IL3 / IL4 / IL5 Getting Started

2-1 Unpacking the Camera

Table 2-1: Package Contents:

Part	STD	OPT	Part #
ILx Camera	X		ILXxxxXXX
C-Mount (factory installed and adjusted on the camera)	X		1105-0026
F-Mount (factory installed and adjusted on the camera)		X	1105-0200
PL-Mount (factory installed and adjusted on the camera)		X	1105-0115
DC Power Supply-- 110/220VAC, 50/60Hz, 12V @ 4.17A, with IEC-320 C8 inlet and 5-pin LEMO connector (no power cord included)	X		1105-0250
16 GB SDHC Card	X		1105-0261
32 GB SDHC Card		X	1105-0262
I/O Cable 18": 8-pin LEMO camera connector to 3 BNC connectors for Sync-In, Sync-Out, and Trigger-In (3 I/O connections)	X		1105-0401
I/O Cable 18": 8-pin LEMO camera connector to 6 BNC connectors for Sync-In, Sync-Out, and Trigger-In, Trigger-Out, Arm-In, Arm-Out (6 I/O connections)		X	1105-0405
Wireless 802.11n USB WiFi Adapter		X	1105-0275
External 12V Li-Ion Battery Pack, 98Wh, w/charger, 4-pin XLR to LEMO cable		X	1105-0253
External 12V Battery Belt, 144Wh, w/charger, LED power gauge, 4-pin XLR to LEMO cable		X	1105-0254
Documentation and Software (on USB thumb drive)	X		

Fastec Imaging retails its cameras through independent distributors. Fastec or its distributors can provide the accessory items required for camera operation according to each customer's particular application needs.

2-2 Installing the Lens

The camera is shipped with a C-mount lens adaptor installed and adjusted at the factory. To install a C-mount lens, follow these steps:

1. Select a C-mount lens for use with the camera.

NOTE: There are many C-mount lens formats and focal lengths available. The 22.9mm diagonal sensor of the IL3S / IL4 is larger than the light circle produced by many C-mount lenses. This is especially true for wide angle lenses, but it is dependent on lens design and format. Vignetting (darkening at the corners or edges of the image) will occur when the image on the sensor, the size and location of which is dependent on resolution and image offset, is not covered by the image circle of the lens. (See "Table 2-2: Lens Selection".)

2. Remove the lens receptacle cover from the camera's C-mount. This is a cover that is installed at the factory to protect the camera optics and sensor from dust contamination.

NOTE: Whenever threading lenses on or off the camera, face the camera lens down so that any contamination on the threads will tend to fall away from the camera rather than into it.

3. Thread the C-mount lens into the lens mount located in the front of the camera. DO NOT over-tighten the lens! The lens should be "finger tight" only--just tight enough that you can adjust focus and aperture without unscrewing the lens.

NOTE: Limit the time between removal of the receptacle cover and installation of the lens. Dust could settle on the face of the sensor cover glass and degrade the image quality.

Table 2-2: Lens Selection

Resolution	Sensor Diagonal		Required Lens Format to avoid noticeable Vignetting		Field of View From 10M with 50mm Lens	
	IL3/IL4	IL5	IL3/IL4	IL5	IL3/IL4	IL5
1920 x 1080	NA	11.0mm	NA	2/3"	NA	1.9 x 1.1m
1280 x 1024	22.9mm	8.2mm	4/3"	1/2"	3.6 x 2.9m	1.3 x 1.0m
1024 x 1024	17.5mm	7.2mm	4/3"*	1/2"	2.9 x 2.9m	1.0 x 1.0m
1280 x 720	20.5mm	7.35mm	4/3"	1/2"	3.6 x 2.0m	1.3 x .7m
800 x 600	14mm	5mm	1"	1/3"	2.2 x 1.7m	800 x 600cm
640 x 480	11.2mm	4mm	2/3"	1/3"	1.8 x 1.3m	640 x 480cm
320 x 256	5.7mm	2mm	1/3"	1/3"	900 x 700cm	320 x 256cm

*The 17.5mm diagonal @ 1024 x 1024 is slightly larger than the 16mm specification for 1" C-mount lenses. Many, but not all 1" format lenses will satisfactorily cover this resolution.

This table assumes that the images are centered (no custom offset applied). It also assumes that no binning or subsampling is used on the IL5.

Note: All F-mount and PL-mount lenses will easily cover the full 22.9m full resolution image plane.

2-3 Power

Attaching the External DC Power Supply

The 12V DC Power Supply operates on 100-240VAC, 50-60Hz. The socket is a standard IEC-320 C8 AC inlet, used worldwide for all types of electronic equipment. The power supply is shipped without power cord so that the user may use one appropriate for local power outlets.

1. Attach a power cord to the power supply and connect it to an AC power outlet.
2. Attach the power supply output cord to the camera via the LEMO connector. Note that the LEMO connector is keyed: the red dot on the connector will face the back of the camera.

DO NOT PLUG THE POWER INTO THE I/O PORT! THIS MAY DAMAGE THE CAMERA!

3. The camera will automatically begin to boot as soon as power is applied. While powering on, the green camera LED will light up for about 15 seconds and go off, then the green power LED will light up. After about 45 seconds, when both power and camera LEDs are lit, the camera is fully booted. If attached to a network, the amber network LED will blink occasionally.

Note: There is also an ON/OFF button located on the backside of the camera. This can be used to turn the camera on and off while power is applied. It is also used to manually update the camera.

Note: If another power source is used, such as the optional external batteries, there may be no indication or warning before the battery power is low.

2-4 ILx Memory and Mass Storage Options

The ILx camera is equipped with 4GB or 8GB of internal high-speed internal memory that can be partitioned for one or more image sequences. Images stored in this memory may be reviewed on the camera, external monitor via HDMI, or PC, then saved to any of four types of mass storage devices:

1. Solid State Drive (optional on the IL3 and IL5) drive (internal SATA SSD or external eSATA SSD).
2. SD-Cards (SDHC) inserted by the operator into the SDHC slot on the side of the ILx.
3. USB devices such as thumb drives or USB external hard drives connected via the USB port.
4. Memory devices on a networked PC using Fastec Camera Control (not Web Browser).

ILx Solid State Hard Drives (SSDs)

Solid state drives (SSDs) are available on the IL3, IL4 and IL5. (See “Table 1-1: ILx Models” on page 2.) These drives serve as mass storage devices for the camera. Image data from the ILx’s high-speed internal memory may be downloaded to the SSD, thus making room for the next high-speed image capture.

While the SSD does not add to the recording time of the camera operating in Standard mode (not “Long Record” mode), it does allow the user to save large quantities of image data without ever connecting the ILx to a PC or other external device.

SSDs for Long Record **Figure 2-1: ILx Connections**

SSDs are standard equipment on all “Dual Mode” cameras, which include the IL3 and IL5 with the “D” option and the IL4. They may be used as described above, or in Long Record mode whereby the image data is streamed directly to the SSD, thereby greatly adding to the record time.

SD-Card (SDHC only)

The ILx is shipped with a 16GB SD-Card. (32GB cards are an available option.) This card has two functions:

- It can be used as a mass storage device for downloading and distributing images. SD-Cards and card readers are very commonly used storage devices among PC users and photographers.
- Any field software updates for the ILx from Fastec will be installed via the SD-Card.

Note: An SD-Card when used for a software update must be reformatted before it can be reused as a mass storage device. See “Appendix H: IL3 Updates” on page 31.



USB Port (USB 2.0)

The ILx will act as a **Host** to any USB 2.0 mass storage device connected at the USB port. (See “ILx Side Views” on page 5.) Image data may be saved to these devices.

USB-On The Go!

The USB-OTG port allows the camera to be connected as a slave to any PC using a USB-A to USB-Micro-B cable. Once connected via the ILx's OTG port, any mass storage device on the camera can be accessed by the PC. This includes an SD-Card, Solid State Drive, or thumb drive in the USB port.

This interface can be used in situations where network connectivity is not possible. It may take a while for the PC to recognize the camera. Transfers are generally much faster via Gig-E network and FasMotion.

1. Power up the camera.
2. Install thumb drive and/or SD-Card in the camera. (Any device that is connected to the camera *after* the camera and PC are connected will not be seen by the PC.)
3. Attach the camera to the PC via the camera's USB-OTG port, which is next to the SD-Card slot on the side of the camera. As each device is located by the PC an Autoplay window on the PC will open. This is a very simple way to transfer image data to a PC. This is for file access only--there is no way to control the camera via USB-OTG.

When you are finished, you need to eject the media from the PC. Click on the “Safely Remove Hardware and eject Media” icon on your computer's task bar and select “Eject Fastec Camera.”

Note: Use this method for relatively small image transfers. Much faster and more efficient work flows are available using FasMotion.

Table 2-3: ILx Mass Storage Functionality

	Target Drive(s)	Functions
FasMotion Utilities:		
Storage/Explore	PC Drives+SSD/USB/SDHC	Move, Copy, Delete*, Batch, Convert to AVI, Load CAP, review metadata
Storage/Format	SSD/USB/SDHC	Format drive
Review/Save	PC Drives+SSD/USB/SDHC	Save image Data from Internal High-Speed Memory, Load CAP file
Record Still	PC Drives+SSD/USB/SDHC	Save a single still Image
Autosave	PC Drives+SSD/USB/SDHC	Autosave image Data from Internal High-Speed Memory
Stream (Long Record)	SSD (proprietary format)	Long Record Basic, Long Record BROCC, Long Record ROC
PC via Gig-E Connection:		
Explore	SSD/USB/SDHC	Open, Copy files, multiple files, directories From ILx to PC only
Web Application:		
Storage/Browse	SSD/USB/SDHC	Move, Copy, Delete* (1 file at a time), review metadata of Image files
Storage/Format	SSD/USB/SDHC	Format drive
Review/Save	SSD/USB/SDHC	Save image Data from Internal High-Speed Memory
Record Still	SSD/USB/SDHC	Save a single still Image
Autosave	SSD/USB/SDHC	Autosave image Data from Internal High-Speed Memory
Stream (Long Record)	SSD (proprietary format)	Long Record Basic, Long Record BROCC, Long Record ROC
PC via USB-OTG:		
Explore	SSD/USB/SDHC	Copy files and directories from ILx (no deletion)

* Deletion is not supported on the SSD

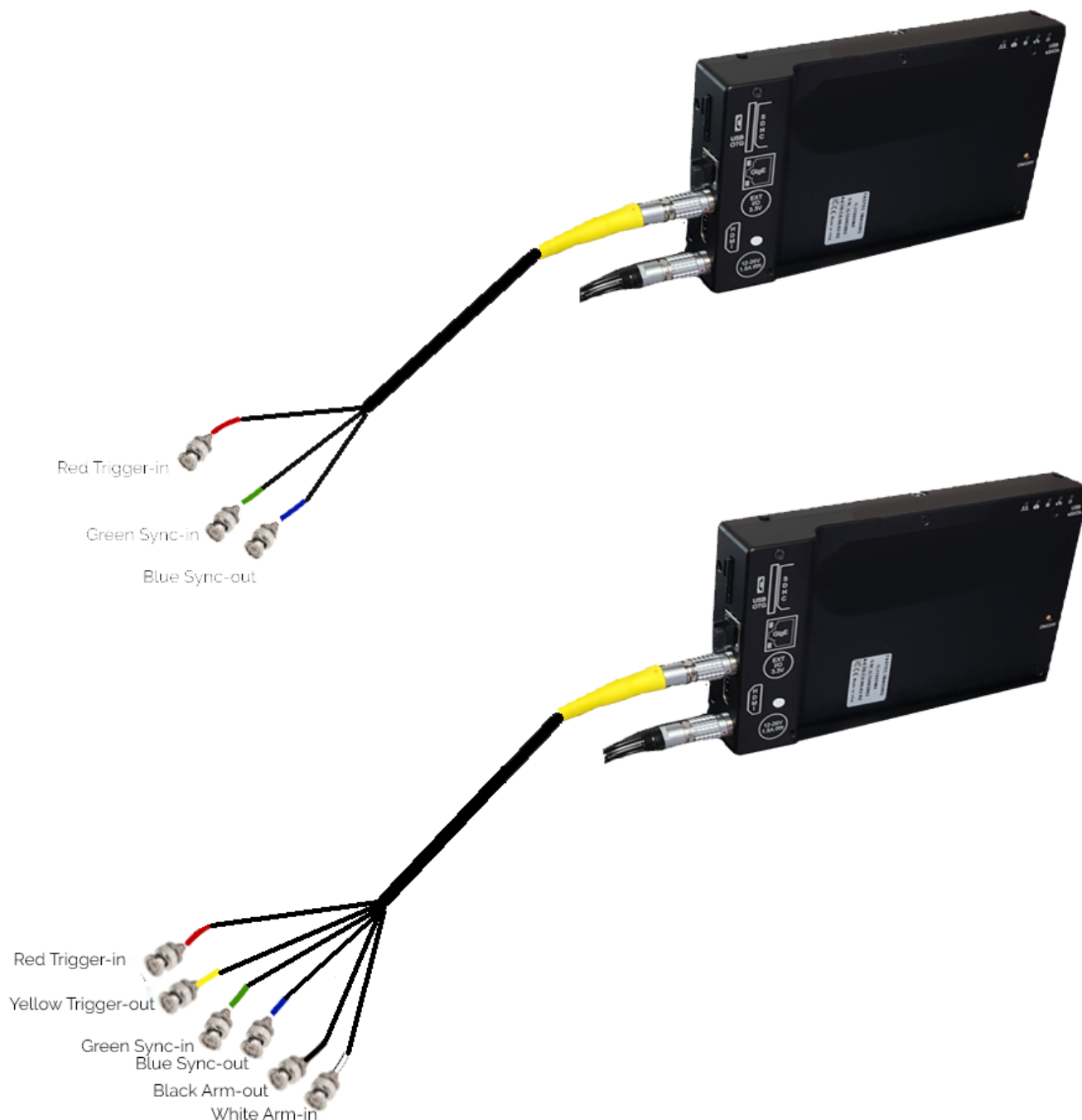
2-5 I/O Connections

The standard I/O cable shipped with IL cameras has three BNC connectors, labeled Trig-in, Sync-in and Sync-out. All of these are internally connected to LVTTTL (3.3v) transceivers. See “Table 4-5: I/O Connector Pin Out” on page 25.

There is also an optional 6-BNC version of this that adds Trig-out, Arm-in, and Arm-out functions.

All these connections may either be used for the specified function, or as an input for marker data. Please refer to the FasMotion manual for details.

Figure 2-2: I/O Cables and Connections



3 IL3 / IL4 / IL5 Setup and Control

There are several options for setup and control of Fastec IL-series cameras:

- FasMotion software: Fastec's control software run from a Windows PC, Mac, or Fastec (Linux) Controller. All requiring a network connection
- Web-Application: web server built into the IL camera run from any networked device with a compatible internet browser
- Custom software, based on the Fastec SDK. Several OEMs and labs have developed their own software.

Autonomous operation is also possible. Once the camera has been configured, it will maintain its setup after rebooting if it is powered down “politely” via software command or use of the on/off button. The camera may be configured to run and trigger via I/O signals and either play back saved images or store captured images automatically to local camera storage. For details, please refer to the FasMotion manual.

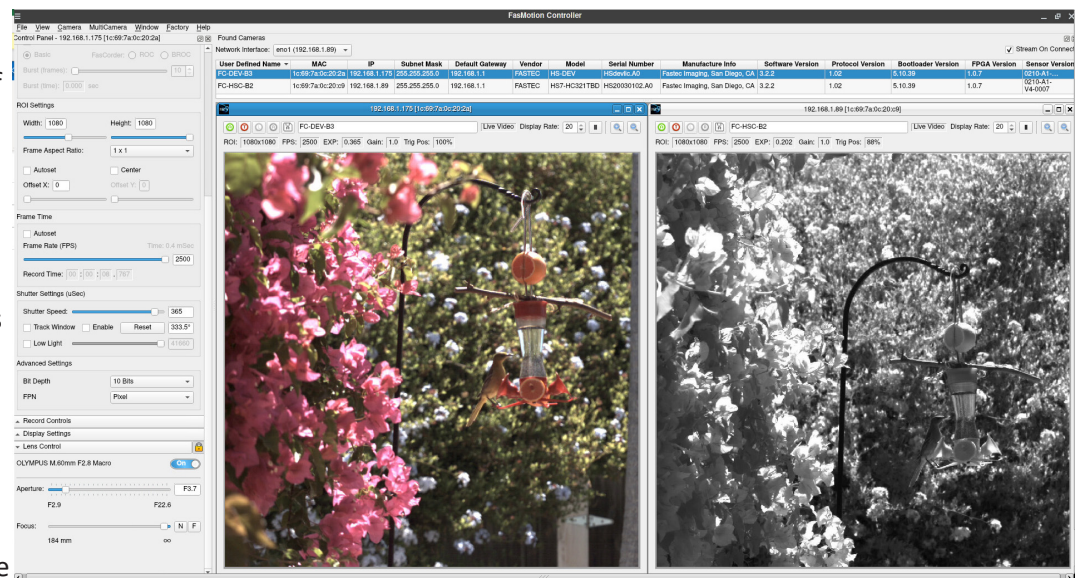
3-1 FasMotion Software

Fastec's FasMotion software may be used with TS, IL, and HS cameras. Windows and MacOS, versions are available for download and free distribution via the Fastec website for all registered camera users: [Register for Fastec Software](#)

FasMotion Feature Overview:

- Single or multi-camera control of IL, TS, HS systems
- Automatic notification of available software/firmware updates
- Update and download software/firmware directly from application
- Setup and capture video in all modes
- Setup all I/O parameters
- View markers on timeline
- Attach overlay text and/or images to video
- Playback from camera memory, from SSD in LR, from video and stacks saved to any path
- Save all file types for captured video to all camera devices and paths
- Batch save and transcode video from camera device storage

Figure 3-1: FasMotion with 2 Camera Views



Please refer to the FasMotion Manual (available on the Fastec website for registered users) for details.

Control PC Requirements for Fas/Motion

- Windows PC (running Win7, 8, or 10), or Mac PC (Mountain Lion or higher)
- 6 GB of memory for 1-camera systems, 2GB additional memory recommended for each additional camera
- Gigabit Ethernet network interface controller. Support for 9K Jumbo packets is recommended. (qualifying Thunderbolt-2 and USB-C to Gig-E adapters are available)
- Storage for image files: SSD recommended

3-2 Web-App

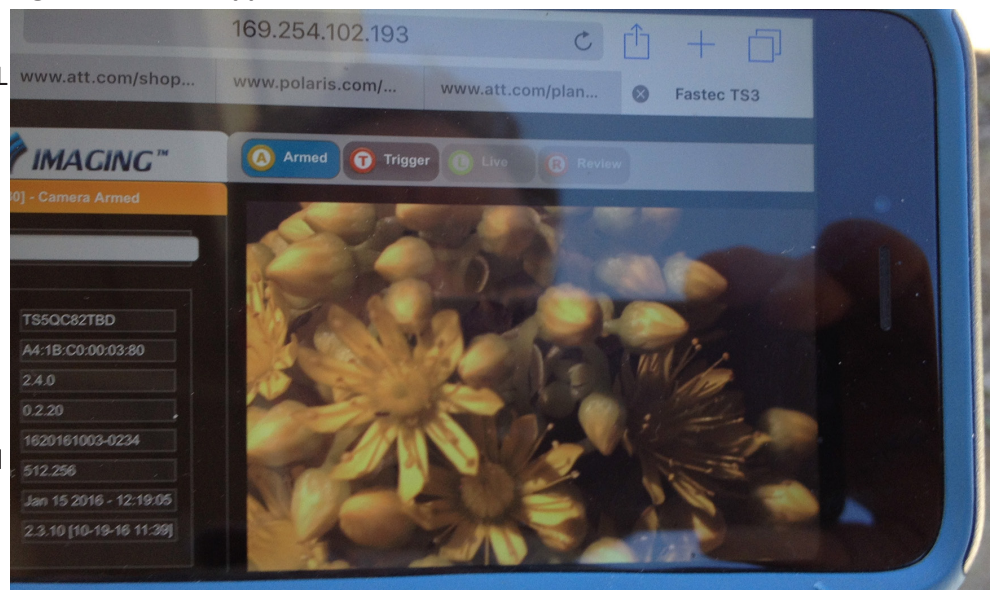
All Fastec IL and TS cameras feature a web-server based application accessible via common web browsers on computers or mobile devices. No software needs to be loaded.

Figure 3-2: Web-app on an iPhone

Web-App Feature Overview:

- Single camera control of IL or TS cameras
- Setup and capture video in all modes
- Setup all I/O parameters
- Playback from camera memory, from SSD of CAP (partition capture files) and LR recordings

Save all file types for captured video to all camera devices (does not save to path via computer or mobile device)



Web-App Device Requirements

- Network connection to camera via LAN
- Internet browser such as Chrome, Firefox, Edge, or Safari
- High-resolution display preferred for menus, photographic setup (frame and focus), and playback
- Touch screen and/or input devices (keyboard and mouse)

Please refer to the Web-App manual (available on the Fastec website for registered users) for details.

3-3 Custom Software via SDK

The Fastec Imaging camera API offers a library of “straight C” functions and associated data structures that enable customer software control of Fastec cameras. The API is designed for portability onto a variety of host platforms (Windows/Linux/Mac) with minimal dependencies, and is intended to integrate with a variety of higher-level application development frameworks such as Microsoft .NET or Qt.

The SDK has been used by Fastec OEMs for sophisticated projects as well as some simpler and less ambitious applications.

Figure 3-3: Fastec SDK Menu

The Fastec Camera SDK is offered without charge to all Fastec customers. Due to its proprietary nature and the level of detailed information included with the SDK, however, Fastec requires an NDA in place for its use.

If interested in access to the SDK or if interested in the development of custom software or features, please contact [Fastec Sales](#).



Appendix

Appendix A: IL3 / IL4 Specifications

Table 4-1: Specifications

Sensor	10 bit CMOS sensor, color or monochrome
Resolution IL3S / IL4	1280 x 1024 pixels maximum
Resolution IL30-L	800 x 600 pixels maximum
Pixel Size	14 μm square
Light Sensitivity	3,200 ISO monochrome, 1,600 ISO color
Record Rate IL3S / IL4	24 to 510 fps @ 1280 x 1024, over 64,000 fps at reduced resolutions
Record Rate IL3L	24 to 1250 fps @ 800 x 600
Long Record IL4LR2	24 to 183 fps @ 1280 x 1024, up to 3,000 fps at reduced resolutions
Long Record IL4LR3 / IL3D	24 to 366 fps @ 1280 x 1024 up to 6,000 fps at reduced resolutions
Shutter	Global electronic shutter from 2μsec to 41.667ms
Image Memory	4GB standard, 8GB optional
Removable Storage	SD card (SDHC: 32GB maximum), USB Flash drive
Recording Modes	Normal (Basic), Autosave, FasFire, Long Recording (IL4 and IL3D)
File Formats	BMP, TIFF, JPG, AVI, TIFF (RAW), DNG, CAP
Lens Mount	C-mount, F-mount, or PL-mount
PC Communication Ports	USB 2.0 device (Micro-B) Ethernet (10/100/1000Base-T)
Control Software	FasMotion (for PC or Mac), web interface (all platforms)
External I/O Sync	Trigger In/Out, Sync In/Out, Arm In/Out (LVTTTL or switch closure)
Video Out	HDMI (1080p, 720p, 480p)
Construction	Machined aluminum housing
Power	10-26 VDC external power supply
Power Consumption	20 Watts maximum
Operating Environment	+5°C to +40°C
Size and Weight	185mm W x 112mm H x 45.5mm D. 1 Kg
Optional Features	
WiFi	802.11 b/g/n, security: open, WEP, WPA(2) - PSK
SSD Storage	Solid State Drive (SSD): 250GB, 500GB, 1TB, 2TB
Long Record on IL3 "D"	Streams uncompressed video to SSD; 8GB mem. + SSD required

Appendix B: IL5 Specifications

Sensor	12-bit 5MP CMOS sensor with 5µm square pixels, color or monochrome
Sensor Modes	Standard; binning 2x2, 4x4; sub-sampling 2x2, 4x4; combination 2x bin + 2x sub
Minimum Frame Rate (all modes and models)	24fps
Maximum frame Rate at Maximum Resolution by Model	IL5-Q: QSVGA 2560 x 2048 @ 253fps; IL5-H: HD 1920x1080 @ 634fps; IL5-S: SXGA 1280x1024 @ 991fps (1280 x 1014 @ 1000fps); IL5-L SVGA 800x600 @ 1677fps
Maximum Frame Rate at Minimum Resolution (all models)	64 x 32 @ 29,090fps
Long Record Opt: Max frame Rate at Max Resolution by Model	IL5-Q: QSVGA 2560 x 2048 @ 91fps; IL5-H: HD 1920x1080 @ 231fps; IL5-S: SXGA 1280x1024 @ 366fps; IL5-L SVGA 800x600 @ 993fps
Long Record Opt: Max Frame Rate at Min Resolution (all models)	320 x 240 @ 5000fps (cameras with 1TB SSD may do frame rates >6000fps)
Light Sensitivity	1600 to 12,800* ISO monochrome, 800 to 6400* ISO color (depending on mode)
Shutter	Global electronic shutter from 3µsec to 41.654ms
Image Memory	4GB (std.) or 8GB (optional)
Removable Storage	SDHC SD card (32GB maximum), USB flash drive
File Formats	Stacks – BMP, DNG, JPEG, TIFF, Tiff(raw); Video – AVI, CAP(raw); Still – JPEG
Lens Mounts	C-mount (std.), F-mount or PL-mount (optional)
Communication Ports	USB 2.0 device (micro-B), Ethernet (10/100/1000Base-T)
Control Software	FasMotion (PC/Mac application), web interface (browser on all platforms)
Six External I/O Ports	Markers, Trigger In/Out, Sync In/Out, Arm In/Out (LVTTTL (3.3V) or switch closure)
Marker Data Views	FasMotion playback timeline and o-scope mode, XML file
Video Out	HDMI (1080p30, 1080p60, 720p, 480p)
Construction	Anodized machined aluminum housing
Power	10-26v @ 22W (max). Universal power supply included
Operating Environment	+5°C to +50°C
Size and Weight	184mm W x 112mm H x 40mm D. 1Kg (2.2 lbs.).
Optional Features	
WiFi	802.11 b/g/n, security: open, WEP, WPA(2) - PSK
SSD Storage	Solid State Drive (SSD): 250GB, 500GB, 1TB, 2TB
Long Record	Streams uncompressed video to SSD; 8GB mem. + SSD required

Appendix C: IL3 / IL4 Record / Resolution Tables

NOTE: These tables include only a sampling of resolution and frame rate values. Resolutions are available in increments of 2 x 2 pixels from 48 x 32 (maximum 60518fps) to 1280 x 1024 (to 800 x 600 in IL3100L models). Minimum resolution in for the IL4 in Long Recording mode is 320 x 240. All are available via Advanced Settings on the camera GUI, the Web-App or FasMotion software. Frame rates are available in 1fps increments from 24 fps to the maximum rate for any resolution and mode.

4:3 Resolutions (Standard Modes)

Table 4-2: IL3 / IL4 Resolutions, Rates, and Times

Resolution		Frame Rate	4GB Capacity				8GB Capacity			
H.	V.	FPS	8-bit		10-bit		8-bit		10-bit	
			Time (s)	Frames	Time (s)	Frames	Time (s)	Frames	Time (s)	Frames
320	240	60	921.4	55286	687.3	41240	1853.1	111187	1385.6	83139
320	240	125	442.3	55286	329.9	41240	889.5	111187	665.1	83139
320	240	250	221.1	55286	165.0	41240	444.7	111187	332.5	83139
320	240	500	110.6	55286	82.5	41240	222.3	111187	166.3	83139
320	240	1000	55.3	55286	41.2	41240	111.2	111187	83.1	83139
320	240	1250	44.2	55286	33.0	41240	88.9	111187	66.5	83139
320	240	1500	36.9	55286	27.5	41240	74.1	111187	55.4	83139
320	240	2000	27.6	55286	20.6	41240	55.6	111187	41.6	83139
320	240	4000	13.8	55286	10.3	41240	27.8	111187	20.8	83139
320	240	5600	9.9	55286	7.4	41240	19.8	111187	14.8	83139
320	240	6259 (Max)	8.8	55286	6.6	41240	17.8	111187	13.3	83139
640	480	60	230.4	13825	172.3	10337	463.4	27805	346.5	20789
640	480	125	110.6	13825	82.7	10337	222.4	27805	166.3	20789
640	480	250	55.3	13825	41.3	10337	111.2	27805	83.1	20789
640	480	500	27.7	13825	20.7	10337	55.6	27805	41.6	20789
640	480	1000	13.8	13825	10.3	10337	27.8	27805	20.8	20789
640	480	1250	11.1	13825	8.3	10337	22.2	27805	16.6	20789
640	480	1959 (Max)	7.1	13825	5.3	10337	14.2	27805	10.6	20789
800	600	60	147.5	8848	110.5	6628	296.6	17796	222.2	13330
800	600	125	70.8	8848	53.0	6628	142.4	17796	111.1	13330
800	600	250	35.4	8848	26.5	6628	71.2	17796	53.3	13330
800	600	500	17.7	8848	13.3	6628	35.6	17796	26.7	13330
800	600	1000	8.8	8848	6.6	6628	17.8	17796	13.3	13330
800	600	1299 (Max)	6.4	8848	5.1	6628	13.7	17796	10.3	13330
(5:4):										
1280	1024	60	54.0	3240	40.5	2428	108.6	6517	81.4	4884
1280	1024	125	25.9	3240	19.4	2428	52.1	6517	39.1	4884
1280	1024	250	13.0	3240	9.7	2428	26.1	6517	19.5	4884
1280	1024	500	6.5	3240	4.9	2428	13.0	6517	9.8	4884
1280	1024	510 (Max)	6.4	3240	4.8	2428	12.9	6517	9.6	4884

16:9 IL3 / IL4 Resolutions (Standard Modes)

Resolution		Frame Rate	4GB Capacity				8GB Capacity			
H.	V.	FPS	8-bit		10-bit		8-bit		10-bit	
			Time (s)	Frames	Time (s)	Frames	Time (s)	Frames	Time (s)	Frames
480	270	60	546.1	32767	409.6	24577	1098.3	65899	823.8	49428
480	270	125	262.1	32767	196.6	24577	527.2	65899	395.4	49428
480	270	250	131.1	32767	98.3	24577	263.6	65899	197.7	49428
480	270	500	65.5	32767	49.2	24577	131.8	65899	98.8	49428
480	270	1000	32.8	32767	24.6	24577	65.9	65899	49.4	49428
480	270	1500	21.8	32767	16.4	24577	43.9	65899	32.9	49428
480	270	2000	16.4	32767	12.3	24577	32.9	65899	24.7	49428
480	270	3000	10.9	32767	8.2	24577	21.9	65899	16.5	49428
480	270	4187 (Max)	7.8	32767	5.9	24577	15.7	65899	11.8	49428
640	360	60	307.2	18433	229.7	13782	617.9	37072	461.9	27718
640	360	125	147.5	18433	110.3	13782	296.6	37072	221.7	27718
640	360	250	73.7	18433	55.1	13782	148.3	37072	110.9	27718
640	360	500	36.9	18433	27.6	13782	74.1	37072	55.4	27718
640	360	1000	18.4	18433	13.8	13782	37.1	37072	27.7	27718
640	360	1500	12.3	18433	9.2	13782	24.7	37072	18.5	27718
640	360	2600 (Max)	7.1	18433	5.3	13782	14.3	37072	10.7	27718
800	450	60	196.6	11798	147.3	8837	395.4	23727	296.2	17773
800	450	125	94.4	11798	70.7	8837	189.8	23727	142.2	17773
800	450	250	47.2	11798	35.3	8837	94.9	23727	53.3	17773
800	450	500	23.6	11798	17.7	8837	47.4	23727	35.5	17773
800	450	1000	11.8	11798	8.8	8837	23.7	23727	17.8	17773
800	450	1500	7.9	11798	5.9	8837	15.8	23727	11.8	17773
800	450	1727 (Max)	6.8	11798	5.1	8837	13.7	23727	10.3	17773
1024	576	60	120.0	7201	89.8	5390	241.4	14482	180.7	10841
1024	576	125	57.6	7201	43.1	5390	115.9	14482	86.7	10841
1024	576	250	28.8	7201	21.6	5390	58.0	14482	43.4	10841
1024	576	500	14.4	7201	10.8	5390	30.0	14482	21.7	10841
1024	576	750	9.6	7201	7.2	5390	19.3	14482	14.4	10841
1024	576	1106 (Max)	6.5	7201	4.9	5390	13.2	14482	9.9	10841
1280	720	60	76.8	4608	57.6	3454	154.5	9269	115.8	6946
1280	720	125	36.9	4608	27.6	3454	74.1	9269	55.6	6946
1280	720	250	18.4	4608	13.8	3454	37.1	9269	27.8	6946
1280	720	500	9.2	4608	6.9	3454	18.5	9269	13.9	6946
1280	720	725 (Max)	6.4	4608	4.8	3454	12.8	9269	9.6	6946

1:1 IL3 / IL4 Resolutions (Standard Mode)

Resolution		Frame Rate	4GB Capacity				8GB Capacity			
H.	V.	FPS	8-bit		10-bit		8-bit		10-bit	
			Time (s)	Frames	Time (s)	Frames	Time (s)	Frames	Time (s)	Frames
256	256	60	1079.7	64784	803.6	48217	2171.47	130288	1616.2	96970
256	256	125	518.3	64784	385.7	48217	1042.3	130288	775.8	96970
256	256	250	259.1	64784	192.9	48217	521.2	130288	387.9	96970
256	256	500	129.6	64784	96.4	48217	260.6	130288	193.9	96970
256	256	1000	64.8	64784	48.2	48217	130.3	130288	97.0	96970
256	256	1500	43.2	64784	32.1	48217	86.9	130288	64.6	96970
256	256	2000	32.4	64784	24.1	48217	65.1	130288	48.5	96970
256	256	4000	16.2	64784	12.1	48217	32.6	130288	24.2	96970
256	256	6870 (Max)	9.4	64784	7.0	48217	19.0	130288	14.1	96970
400	400	60	442.4	26543	330.2	19809	889.7	53381	664.0	39838
400	400	125	212.3	26543	158.5	19809	427.0	53381	318.7	39838
400	400	250	106.2	26543	79.2	19809	213.5	53381	159.3	39838
400	400	500	53.1	26543	39.6	19809	106.8	53381	79.7	39838
400	400	1000	26.5	26543	19.8	19809	53.4	53381	39.8	39838
400	400	2000	13.3	26543	9.9	19809	26.7	53381	19.9	39838
400	400	3339 (Max)	7.9	26543	5.9	19809	16.0	53381	11.9	39838
512	512	60	270.0	16201	202.1	12128	543.0	32583	406.5	24391
512	512	125	129.6	16201	97.0	12128	260.7	32583	195.1	24391
512	512	250	64.8	16201	48.5	12128	130.3	32583	97.6	24391
512	512	500	32.4	16201	24.3	12128	65.2	32583	48.8	24391
512	512	1000	16.2	16201	12.1	12128	32.6	32583	24.4	24391
512	512	1500	10.8	16201	8.1	12128	21.7	32583	16.3	24391
512	512	2162 (Max)	7.5	16201	5.6	12128	15.1	32583	11.3	24391
800	800	60	110.6	6636	82.9	4971	222.4	13347	166.6	9998
800	800	125	53.1	6636	39.8	4971	106.8	13347	80.0	9998
800	800	250	26.5	6636	19.9	4971	53.4	13347	40.0	9998
800	800	500	13.3	6636	9.9	4971	26.7	13347	20.0	9998
800	800	977 (Max)	6.8	6636	5.1	4971	13.7	13347	10.2	9998
1024	1024	60	67.7	4059	50.5	3032	135.8	8146	101.6	6098
1024	1024	125	32.5	4059	24.3	3032	65.2	8146	48.8	6098
1024	1024	250	16.2	4059	12.1	3032	32.6	8146	24.4	6098
1024	1024	500	8.1	4059	6.1	3032	16.3	8146	12.2	6098
1024	1024	624 (Max)	6.5	4059	4.9	3032	13.1	8146	9.8	6098

IL4100LR2 and IL3D with External SSD in Long Record mode							
Resolution		LR2 8-bit Frame Rates and Times hh:mm:ss			LR2 10-bit Frame Rates and Times hh:mm:ss		
H.	V.	FPS	256GB SSD	512GB SSD	FPS	256GB SSD	512GB SSD
320	240	60	15:13:34	30:27:08	60	11:07:35	22:15:11
320	240	125	7:18:31	14:37:01	125	5:20:27	10:40:53
320	240	250	3:39:15	7:18:31	250	2:40:13	5:20:27
320	240	500	1:49:38	3:39:15	500	1:20:07	2:40:13
320	240	1000	0:54:49	1:49:38	1000	0:40:03	1:20:07
320	240	2000	0:27:24	0:54:49	2000	0:20:02	0:40:03
320	240	3083 (Max)	0:17:47	0:35:34	2253 (Max)	0:13:00	0:25:59
400	400	60	7:13:55	14:27:50	60	5:27:30	10:55:00
400	400	125	3:28:17	6:56:34	125	2:37:12	5:14:24
400	400	250	1:44:08	3:28:17	250	1:18:36	2:37:12
400	400	500	0:52:04	1:44:08	500	0:39:18	1:18:36
400	400	1000	0:26:02	0:52:04	1000	0:19:39	0:39:18
400	400	1464 (Max)	0:17:47	0:35:34	1105 (Max)	0:13:25	0:26:51
512	512	60	4:31:13	9:02:26	60	3:21:49	6:43:38
512	512	125	2:10:11	4:20:22	125	1:36:52	3:13:44
512	512	250	1:05:06	2:10:11	250	0:48:26	1:36:52
512	512	500	0:32:33	1:05:06	500	0:24:13	0:48:26
512	512	901 (Max)	0:18:04	0:36:07	681 (Max)	0:13:26	0:26:53
640	480	60	3:51:26	7:42:52	60	2:51:50	5:43:41
640	480	125	1:51:05	3:42:10	125	1:22:29	2:44:58
640	480	250	0:55:33	1:51:05	250	0:41:14	1:22:29
640	480	500	0:27:46	0:55:33	500	0:20:37	0:41:14
640	480	770 (Max)	0:18:02	0:36:04	580 (Max)	0:13:23	0:26:47
800	600	60	2:27:06	4:54:11	60	1:50:33	3:41:05
800	600	125	1:10:36	2:21:13	125	0:53:04	1:46:07
800	600	250	0:35:18	1:10:36	250	0:26:32	0:53:04
800	600	496 (Max)	0:17:48	0:35:35	373 (Max)	0:13:22	0:26:45
1280	720	60	1:17:07	2:34:14	60	1:29:55	2:59:50
1280	720	125	0:37:01	1:14:02	125	0:43:10	1:26:19
1280	720	259 (Max)	0:17:52	0:35:44	194 (Max)	0:20:50	0:41:40
1024	1024	60	1:07:48	2:15:37	60	0:50:44	1:41:29
1024	1024	125	0:32:33	1:05:06	125	0:24:21	0:48:42
1024	1024	227 (Max)	0:17:55	0:35:51	170 (Max)	0:13:25	0:26:49
1280	1024	60	0:54:13	1:48:27	60	0:40:38	1:21:17
1280	1024	125	0:26:02	0:52:03	125	0:19:30	0:39:01
1280	1024	183 (Max)	0:17:47	0:35:33	136 (Max)	0:13:19	0:26:39

IL4100LR3 / IL3-D in Long Record mode (max fps limited to 1250fps on TS3L models)							
Resolution		LR3 8-bit Frame Rates and Times hh:mm:ss			LR3 10-bit Frame Rates and Times hh:mm:ss		
H.	V.	FPS	256GB SSD	512GB SSD	FPS	256GB SSD	512GB SSD
320	240	60	15:13:34	30:27:08	60	11:07:35	22:15:11
320	240	125	7:18:31	14:37:01	125	5:20:27	10:40:53
320	240	250	3:39:15	7:18:31	250	2:40:13	5:20:27
320	240	500	1:49:38	3:39:15	500	1:20:07	2:40:13
320	240	1000	0:54:49	1:49:38	1000	0:40:03	1:20:07
320	240	2000	0:27:24	0:54:49	2000	0:20:02	0:40:03
320	240	4000	0:13:42	0:27:24	4000	0:10:01	0:20:02
320	240	6167 (Max)	0:08:53	0:17:47	4507 (Max)	0:06:30	0:12:59
400	400	60	7:13:55	14:27:50	60	5:27:30	10:55:00
400	400	125	3:28:17	6:56:34	125	2:37:12	5:14:24
400	400	250	1:44:08	3:28:17	250	1:18:36	2:37:12
400	400	500	0:52:04	1:44:08	500	0:39:18	1:18:36
400	400	1000	0:26:02	0:52:04	1000	0:19:39	0:39:18
400	400	2929 (Max)	0:08:53	0:17:47	2211 (Max)	0:06:43	0:13:25
512	512	60	4:31:13	9:02:26	60	3:21:49	6:43:38
512	512	125	2:10:11	4:20:22	125	1:36:52	3:13:44
512	512	250	1:05:06	2:10:11	250	0:48:26	1:36:52
512	512	500	0:32:33	1:05:06	500	0:24:13	0:48:26
512	512	1802 (Max)	0:09:02	0:18:04	1362 (Max)	0:06:43	0:13:26
640	480	60	3:51:26	7:42:52	60	2:51:50	5:43:41
640	480	125	1:51:05	3:42:10	125	1:22:29	2:44:58
640	480	250	0:55:33	1:51:05	250	0:41:14	1:22:29
640	480	500	0:27:46	0:55:33	500	0:20:37	0:41:14
640	480	1541 (Max)	0:09:01	0:18:01	1160 (Max)	0:06:41	0:13:23
800	600	60	2:27:06	4:54:11	60	1:50:33	3:41:05
800	600	125	1:10:36	2:21:13	125	0:53:04	1:46:07
800	600	250	0:35:18	1:10:36	250	0:26:32	0:53:04
800	600	500	0:17:39	0:35:18	500	0:13:16	0:26:32
800	600	993 (Max)	0:08:53	0:17:47	746 (Max)	0:06:41	0:13:22
1280	720	60	1:17:07	2:34:14	60	1:29:55	2:59:50
1280	720	125	0:37:01	1:14:02	125	0:43:10	1:26:19
1280	720	250	0:18:31	0:37:01	250	0:21:35	0:43:10
1280	720	518 (Max)	0:08:56	0:17:52	389 (Max)	0:10:25	0:20:50
1280	1024	60	0:54:13	1:48:27	60	0:40:38	1:21:17
1280	1024	125	0:26:02	0:52:03	125	0:19:30	0:39:01
1280	1024	365 (Max)	0:08:55	0:17:50	273 (Max)	0:06:41	0:13:22

Appendix D: IL5 Record / Resolution Tables

NOTE: These tables include only a sampling of resolution and frame rate values. Resolutions are available in increments of 2 x 2 pixels from 64 x 32 to the maximum resolution for each model. Minimum resolution in for the IL5-D models in Long Recording mode is 320 x 32. Frame rates are available in 1fps increments from 24 fps to the maximum rate for any resolution. Note that maximum frame rates are higher when binning is enabled on resolutions equal to or less than 768 wide.

Sample IL5 16:9 Resolutions

Table 4-3: IL5 Resolutions, Rates, and Times

Resolution		Time and Frames listed for 8GB cameras (for 4GB cameras divide by 2)								
H.	V.	8-bit			10-bit			12-bit		
128	72	FPS	Time (s)	909,446 Frames	FPS	Time (s)	677,396 Frames	FPS	Time (s)	560,404 Frames
		125	7275.6		125	5419.2		125	4483.2	
		250	3637.8		250	2709.6		250	2241.6	
		500	1818.9		500	1354.8		500	1120.8	
		1000	909.4		1000	677.4		1000	560.4	
		2500	363.7		2500	270.9		2500	224.1	
		5000	181.8		5000	135.4		5000	112.0	
		10,000	90.9		10,000	67.7		10,000	56.0	
		12,099*	75.1		10,139*	66.8		10,139*	55.2	
		17,108**	53.1		14,257**	47.5		14,257**	39.3	
320	180	125	1167.5	145,935 Frames	125	872.8	109,103 Frames	125	729.8	91,228 Frames
		250	583.7		250	436.4		250	364.9	
		500	291.9		500	218.2		500	182.5	
		1000	145.9		1000	109.1		1000	91.2	
		2000	72.9		2000	54.5		2000	45.6	
		4000	36.4		4000	27.2		4000	22.8	
		5329*	27.3		4451*	24.5		4451*	20.4*	
		8100**	18.0		6750**	16.1		6750**	13.5**	
448	252	125	595.8	74,477 Frames	125	444.9	55,613 Frames	125	370.7	46,346 Frames
		250	297.9		250	222.4		250	185.3	
		500	148.9		500	111.2		500	92.6	
		1000	74.4		1000	55.6		1000	46.3	
		2000	37.2		2000	27.8		2000	23.1	
		3881*	19.1		3234*	17.1		3234*	14.3	
		5995**	12.4		4996**	11.1		4996**	9.2	
640	360	125	292.0	36,499 Frames	125	218.3	27,289 Frames	125	14.8	22,813 Frames
		250	146.0		250	109.2		250	91.3	
		500	73.0		500	54.6		500	45.6	
		750	48.7		750	36.4		750	30.4	
		1000	36.5		1000	27.3		1000	22.8	
		1500	24.3		1500	18.2		1500	15.2	
		2000	18.2		2000	13.6		2000	11.4	
		2757*	13.2		2297*	11.8		2297*	9.9	
		4314**	8.4		3595**	7.5		3595**	6.3	

*maximum frame rate without binning

**maximum frame rate with binning enabled

IL5 16:9 Resolutions, Continued

Resolution		8GB Capacity (for 4GB cameras divide Time by 2)								
H.	V.	8-bit			10-bit			12-bit		
800	450	FPS	Time (s)	23,360 Frames	FPS	Time (s)	17,498 Frames	FPS	Time (s)	14,600 Frames
		60	389.3		60	291.6		60	243.3	
		125	186.9		125	140.0		125	116.8	
		250	93.4		250	70.0		250	58.4	
		500	46.7		500	35.0		500	29.2	
		1000	23.4		1000	17.5		1000	14.6	
		1500	15.5		1500	11.6		1500	9.7	
		2221	10.5		1851	9.4		1851	7.8	
Supported by IL5-S, H, and Q Models:										
1024	576	125	114.1	14,258 Frames	125	85.4	10,673 Frames	125	889.5	8,903 Frames
		250	57.0		250	42.7		250	444.7	
		500	28.5		500	21.3		500	222.3	
		750	19.0		750	14.2		750	27.8	
		1000	14.2		1000	10.6		1000	8.9	
		1746	8.1		1455	7.3		1455	6.1	
1280	720	125	73.0	9,125 Frames	125	54.7	6,839 Frames	125	45.6	5,703 Frames
		250	36.5		250	27.4		250	22.8	
		500	18.3		500	13.7		500	11.4	
		750	12.2		750	9.1		750	7.6	
		1000	9.1		1000	6.8		1000	5.7	
		1403	6.5		1169	5.8		1169	4.8	
Supported by IL5-H and Q Models:										
1600	900	125	46.7	5840 Frames	125	35.0	4374 Frames	125	29.2	3650 Frames
		250	23.4		250	17.5		250	14.6	
		500	11.7		500	8.7		500	7.3	
		625	9.3		625	7.0		625	5.8	
		758	7.7		633	6.9		633	5.8	
1920	1080	60	67.6	4,055 Frames	60	50.7	3,041 Frames	60	42.2	2,534 Frames
		125	32.4		125	24.3		125	20.3	
		250	16.2		250	12.2		250	10.1	
		500	8.1		500	6.1		500	5.1	
		634	6.4		529	5.7		529	4.8	
Supported by IL5-Q only:										
2560	1440	60	38.0	2,281 Frames	60	28.5	1,709 Frames	60	23.8	1,425 Frames
		125	18.2		125	13.7		125	11.4	
		250	9.1		250	6.8		250	5.7	
		359	6.4		300	5.7		300	4.8	

Sample IL5 5:4 Resolutions

Resolution		8GB Capacity (for 4GB cameras divide Time by 2)								
H.	V.	8-bit			10-bit			12-bit		
		FPS	Time (s)	642,615 Frames	FPS	Time (s)	477,872 Frames	FPS	Time (s)	395,828 Frames
128	102	125	5140.9		125	3823.0		125	3166.6	
		250	2570.5		250	1911.5		250	1583.3	
		500	1285.2		500	955.7		500	791.7	
		1000	642.6		1000	477.8		1000	395.8	
		2000	321.3		2000	238.9		2000	197.9	
		4000	160.6		4000	119.4		4000	98.9	
		8943*	71.8		7452*	64.1		7452*	53.1	
		13,071**	49.1		10,892**	43.8		10,892**	36.3	
250	200	125	1334.2	166,770 Frames	125	1000.8	125,097 Frames	125	840.7	105,089 Frames
		250	667.1		250	500.4		250	420.4	
		500	333.5		500	250.2		500	210.2	
		1000	166.8		1000	125.1		1000	105.1	
		2000	83.4		2000	62.5		2000	52.5	
		4828*	34.5		4023*	31.0		4023*	26.1	
		7380**	22.5		6150**	20.3		6150**	20.3	
320	256	125	831.6	103,950 Frames	125	621.8	77,727 Frames	125	519.7	64,968 Frames
		250	415.8		250	310.9		250	259.9	
		500	207.9		500	155.5		500	129.9	
		1000	104.0		1000	77.7		1000	65.0	
		2000	51.3		2000	38.3		2000	32.0	
		3823*	26.8		3186*	24.0		3186*	20.1	
		5910**	17.3		4925**	15.5		4925**	13.0	
512	410	60	676.3	40,575 Frames	60	506.2	30,372 Frames	60	420.2	25,212 Frames
		125	324.6		125	243.0		125	201.7	
		250	162.3		250	121.5		250	100.9	
		500	81.2		500	60.7		500	50.4	
		1000	40.6		1000	30.4		1000	25.2	
		2431*	16.4		2026*	14.8		2026*	12.2	
		3818**	10.4		3182**	9.4		3182**	7.8	
640	512	60	329.7	19,783 Frames	60	294.8	17,685 Frames	60	270.8	16,247 ,Frames
		125	158.3		125	141.5		125	130.0	
		250	79.1		250	70.7		250	65.0	
		500	39.6		500	35.4		500	32.5	
		1000	19.8		1000	17.7		1000	16.3	
		1959	13.1		1632*	11.7		1632*	9.8	
		3093**	8.2		2577**	7.4		2577**	6.2	
750	600	60	310.7	18,639 Frames	60	233.6	14,016 Frames	60	194.7	11,680 Frames
		125	149.1		125	112.1		125	93.4	
		250	74.6		250	56.1		250	46.7	
		500	37.3		500	28.0		500	23.4	
		1000	18.6		1000	14.0		1000	11.6	
		1677*	11.1		1398*	10.0		1398*	8.3	
		2657**	7.0		2214**	6.3		2214**	5.2	

IL5 5:4 Resolutions, Continued

Resolution		8GB Capacity (for 4GB cameras divide Time by 2)								
H.	V.	8-bit			10-bit			12-bit		
		FPS	Time (s)	Frames	FPS	Time (s)	Frames	FPS	Time (s)	Frames
Supported by IL5-S, H, and Q Models:										
1024	820	60	169.1	10,145 Frames	60	126.6	7,594 Frames	60	105.6	6,334 Frames
		125	81.2		125	60.8		125	50.7	
		250	40.6		250	30.4		250	25.3	
		500	20.3		500	15.2		500	12.7	
		750	13.5		625	12.2		625	10.1	
		1234	8.1		1028	7.2		1028	6.0	
1280	1024	60	108.3	6,499 Frames	60	81.2	4,870 Frames	60	67.7	4,062 Frames
		125	52.0		125	39.0		125	32.5	
		250	26.0		250	19.5		250	16.3	
		500	13.0		500	9.7		500	8.1	
		991	6.4		826	5.8		826	4.8	
Supported by IL5-H and Q Models:										
1350	1080	60	97.2	5,834 Frames	60	73.0	4,382 Frames	60	60.1	4,382 Frames
		125	46.7		125	35.1		125	28.8	
		250	23.3		250	17.5		250	14.4	
		500	11.7		500	8.8		500	7.2	
		634	9.2		529	8.3		529	6.8	
1500	1200	60	77.9	4,672 Frames	60	58.4	3,504 Frames	60	48.7	2,920 Frames
		125	37.4		125	28.0		125	23.4	
		250	18.7		250	14.0		250	11.7	
		500	9.3		477	7.3		477	6.1	
		571	8.2							
Supported by IL5-Q only:										
2000	1600	60	43.8	2,628 Frames	60	32.8	1,970 Frames	60	27.4	1,642 Frames
		125	21.0		125	15.8		125	13.1	
		250	10.5		250	7.9		250	6.6	
		404	6.5		337	5.8		337	4.9	
2560	2048	60	26.7	1,604 Frames	60	20.0	1,202 Frames	60	16.7	1,002 Frames
		125	12.8		125	9.6		125	8.0	
		253	6.3		211	5.7		211	4.7	

Sample IL5 4:3 Resolutions

Resolution		8GB Capacity (for 4GB cameras divide Time by 2)								
H.	V.	8-bit			10-bit			12-bit		
		FPS	Time (s)	Frames	FPS	Time (s)	Frames	FPS	Time (s)	Frames
128	96	125	5461.4	682,675 Frames	125	4067.0	508,375 Frames	125	3364.2	420,527 Frames
		250	2730.7		250	2033.5		250	1682.1	
		500	1365.4		500	1016.8		500	841.1	
		1000	682.7		1000	508.4		1000	420.5	
		2000	341.3		2000	254.2		2000	210.3	
		4000	170.7		4000	127.1		4000	105.1	
		9485*	72.3		7862*	64.6		7862*	53.4	
		13,718**	49.765		11,432**	44.4		11,432**	36.7	
256	192	125	1368.0	171,001 Frames	125	1018.2	127,278 Frames	125	842.1	105,258 Frames
		250	684.0		250	509.1		250	421.0	
		500	342.0		500	254.6		500	210.5	
		750	228.0		750	169.7		750	140.3	
		1000	171.0		1000	127.3		1000	105.3	
		2000	85.5		2000	63.6		2000	52.6	
		5017*	34.0		4180*	30.4		4180*	25.1	
		7652**	22.3		6377**	19.9		6377**	16.5	
320	240	125	875.7	109,466 Frames	125	654.8	81,852 Frames	125	547.4	68,427 Frames
		250	437.9		250	327.4		250	273.7	
		500	218.9		500	163.7		500	136.9	
		1000	109.5		1000	81.9		1000	68.4	
		2000	54.7		2000	40.9		2000	34.2	
		4065*	26.9		3387*	24.1		3387*	20.2	
		6267**	17.4		5222**	15.6		5222*	13.1	
512	384	60	712.9	42,771 Frames	60	533.6	32,017 Frames	60	443.0	26,578 Frames
		125	342.2		125	256.1		125	212.6	
		250	171.1		250	128.1		250	106.3	
		500	85.5		500	64.0		500	53.2	
		1000	42.8		1000	32.0		1000	26.6	
		2590*	16.5		2158*	14.8		2158*	12.3	
		4061**	10.4		3384**	9.4		3384**	7.8	
640	480	60	456.3	27,375 Frames	60	341.1	20,468 Frames	60	285.2	17,110 Frames
		125	219.0		125	163.7		125	136.9	
		250	109.5		250	81.9		250	68.4	
		500	54.8		500	40.9		500	34.2	
		1000	27.4		1000	20.5		1000	17.1	
		2086*	13.1		1738*	11.7		1738*	9.8	
		3289**	8.3		2741**	7.4		2741**	6.2	

IL5 4:3 Resolutions, Continued

Resolution		8GB Capacity (for 4GB cameras divide Time by 2)								
H.	V.	8-bit			10-bit			12-bit		
800	600	FPS	Time (s)	17,520 Frames	FPS	Time (s)	13,124 Frames	FPS	Time (s)	10,950, Frames
		60	292.0		60	218.7		60	182.5	
		125	140.2		125	105.0		125	87.6	
		250	70.1		250	52.5		250	43.8	
		500	35.0		500	26.2		500	21.9	
		750	23.4		750	17.5		750	14.6	
		1677	10.4		1398	9.3		1398	7.8	
Supported by IL5-S, -H and -Q models:										
1024	768	60	178.2	10,694 Frames	60	133.4	8 005 Frames	60	111.3	6,677 Frames
		125	85.6		125	64.0		125	53.4	
		250	42.8		250	32.0		250	26.7	
		500	21.4		500	16.0		500	13.4	
		750	14.3		750	10.6		750	8.9	
		1316	8.1		1097	7.2		1097	6.0	
1280	960	60	114.1	6,844 Frames	60	85.5	5,129 Frames	60	71.3	4,277 Frames
		125	54.8		125	41.0		125	34.2	
		250	27.4		250	20.5		250	17.1	
		500	13.7		500	10.3		500	8.6	
		1057	6.4		880	5.8		880	4.8	
Supported by IL5-H and -Q models:										
1440	1080	60	90.1	5,407 Frames	60	67.6	4,055 Frames	60	56.3	3,379 Frames
		125	43.3		125	32.4		125	27.0	
		250	21.6		250	16.2		250	13.5	
		500	10.8		500	8.1		500	6.8	
		634(Max)	8.5		529(Max)	7.7		529(Max)	6.4	
Supported by IL5 Q only:										
2000	1500	60	46.7	2,803 Frames	60	35.0	2,101 Frames	60	29.2	1,752 Frames
		125	22.4		125	16.8		125	14.0	
		250	11.2		250	8.4		250	7.0	
		431(Max)	6.5		359(Max)	5.9		359(Max)	4.9	
2560	1920	60	28.5	1,711 Frames	60	21.4	1,282 Frames	60	17.8	1,069 Frames
		125	13.7		125	10.3		125	8.6	
		270f(Max)	6.3		225(Max)	5.7		225(Max)	4.8	

IL5-D Long Record

Resolution		1TB Capacity SSD (for cameras with 512GB divide by 2)											
H	V	8 Bits				10 Bits				12 Bits			
		FPS	Hr	Min	Sec	FPS	Hr	Min	Sec	FPS	Hr	Min	Sec
320	240	60	59	28	32	60	43	27	47	60	37	40	3
		125	28	32	53	125	20	51	44	125	18	4	49
		250	14	16	26	250	10	25	52	250	9	2	24
		500	7	8	13	500	5	12	56	500	4	31	12
		1000	3	34	6	1000	2	36	28	1000	2	15	36
		2000	1	47	3	2000	1	18	14	2000	1	7	48
		3082e	1	9	19	2252e	1	9	28	1952e	1	9	28
		3394*	1	3	5	3394**	0	46	6	3394**	0	39	57
		5000**	0	41	0	4505***	0	34	43	3905***	0	34	43
512	512	60	17	39	24	60	13	8	22	60	10	58	16
		125	8	28	31	125	6	18	25	125	5	15	58
		250	4	14	15	250	3	9	12	250	2	37	59
		500	2	7	7	500	1	34	36	500	1	18	59
		915e	1	9	28	681e	1	9	27	568e	1	9	32
		1634	0	38	54	1362	0	34	43	1137	0	34	44
640	480	60	15	4	0	60	11	11	17	60	9	25	0
		125	7	13	55	125	5	22	13	125	4	31	12
		250	3	36	57	250	2	41	6	250	2	15	36
		500	1	48	28	500	1	20	33	500	1	7	48
		781e	1	9	26	580e	1	9	26	488e	1	9	28
		1562	0	34	43	1160	0	34	43	976	0	34	44
800	600	60	9	34	34	60	7	11	51	60	6	0	38
		125	4	35	47	125	3	27	17	125	2	53	6
		250	2	17	53	250	1	43	38	250	1	26	33
		496e	1	9	30	373e	1	9	28	311e	1	9	34
		500	1	8	56	500	0	51	49	500	0	43	16
		993	0	34	43	746	0	34	44	623	0	34	43
Supported by IL5-S, -H and -Q models:													
1280	720	60	5	1	20	60	3	45	14	60	3	8	20
		125	2	24	38	125	1	48	7	125	1	30	24
		250	1	12	19	250	0	54	3	250	0	45	12
		260e	1	9	32	194e	1	9	39	162e	1	9	45
		520	0	34	46	389	0	34	44	325	0	34	46

*Maximum frame rate in LR3 (Fast SSD) without binning.

**Maximum frame rate in LR3 (Fast SSD) binning enabled.

eMaximum frame rate for External SSD (eSATA)

IL5-D Long Record, Continued

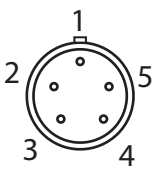

Resolution		1TB Capacity SSD (for cameras with 512GB divide by 2)											
H	V	8 Bits				10 Bits				12 Bits			
		FPS	Hr	Min	Sec	FPS	Hr	Min	Sec	FPS	Hr	Min	Sec
1280	1024	60	3	31	52	60	2	38	45	60	2	12	24
		125	1	41	42	125	1	16	12	125	1	3	33
		183e	1	9	28	137e	1	9	31	114e	1	9	41
		250	0	50	51	274	0	34	45	228	0	34	50
		366	0	34	44								
Supported by IL5-H and -Q models:													
1350	1080	60	3	9	54	60	2	22	43	60	1	58	56
		125	1	31	9	125	1	8	30	125	0	57	5
		164e	1	9	28	123e	1	9	37	102e	1	9	57
		250	0	45	34	246	0	34	48	205	0	34	48
		328	0	34	44								
1920	1080	60	2	13	43	60	1	40	26	60	1	23	41
		115e	1	9	46	86e	1	10	4	72e	1	9	44
		125	1	4	11	125	0	48	12	125	0	40	10
		231	0	34	44	173	0	34	50	144	0	34	52
Supported by IL5 Q only:													
2560	1440	30	2	30	36	30	1	52	51	30	1	34	9
		60	1	15	18	60	0	56	25	60	0	47	4
		65e	1	9	30	48e	1	10	32	40e	1	10	36
		130	0	34	45	97	0	34	54	81	0	34	52
2560	2048	30	1	45	53	30	1	19	21	30	1	6	12
		45e	1	10	35	34e	1	10	1	28e	1	10	56
		60	0	52	56	68	0	35	0	57	0	34	50
		91	0	34	54								

eMaximum frame rate for External SSD (eSATA)

Appendix E: Power and I/O Connections

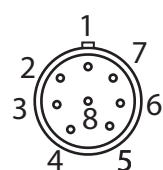
Power Connections For the IL3

Table 4-4: Power Pin Out

(View from Solder cup side of connector) 		Use Lemo 1B.305 compatible plug (FGG.305.CLAD.42.NZ Pictured here) Refer to http://www.lemo.com 
Pin	Signal	
1	+12 to 24VDC	
2	+12 to 24VDC	
3	No Connection	
4	Ground	
5	Ground	

I/O Connections: Sync and Trigger

Table 4-5: I/O Connector Pin Out

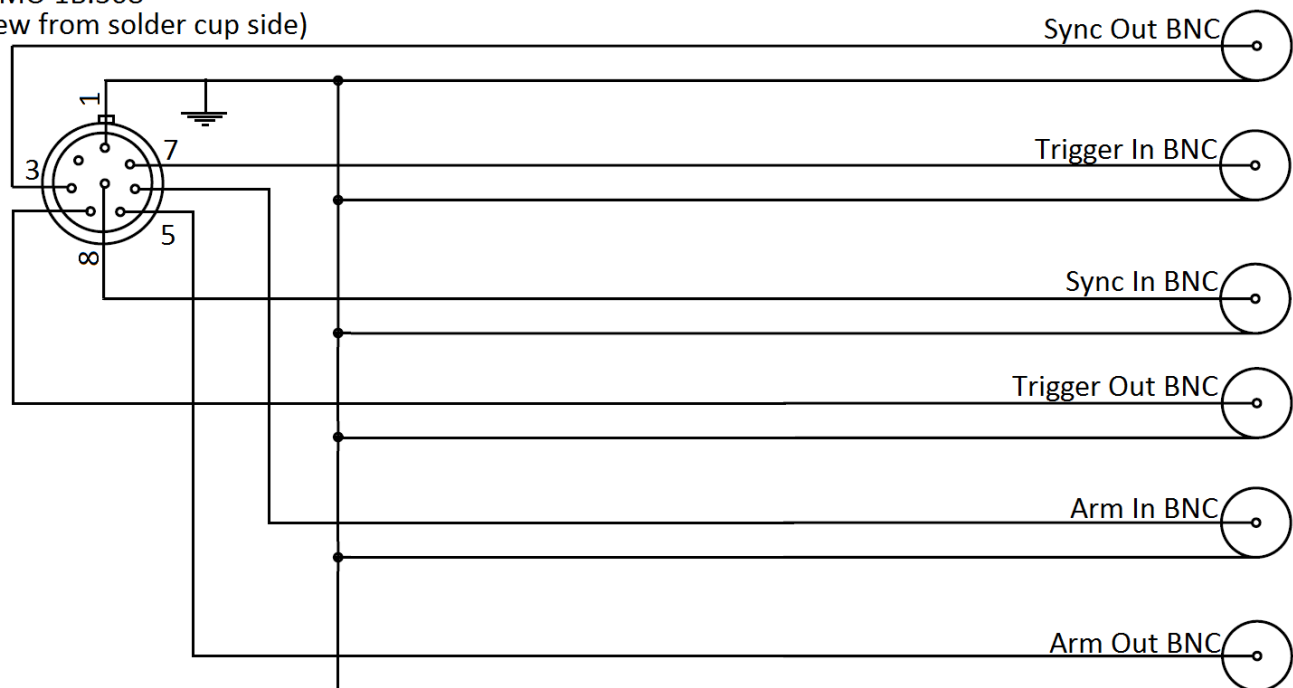
(View from Solder cup side of connector) 		Use Lemo 1B.308 compatible plug Refer to http://www.lemo.com
Pin	Signal	
1	Ground	
2	Analog Reserved	
3	LVTTTL Sync Out	
4	LVTTTL Trigger Out	
5	LVTTTL Arm Out	
6	LVTTTL Arm In	
7	LVTTTL Trigger In	
8	LVTTTL Sync In	

The IL3 is shipped with a Sync I/O cable for connecting external Trigger, Sync Out, and Sync In signals. The cable has a LEMO connector for the IL3 end and BNC connectors for the three signals.

Figure 4-1: Sync I/O Cable Drawing

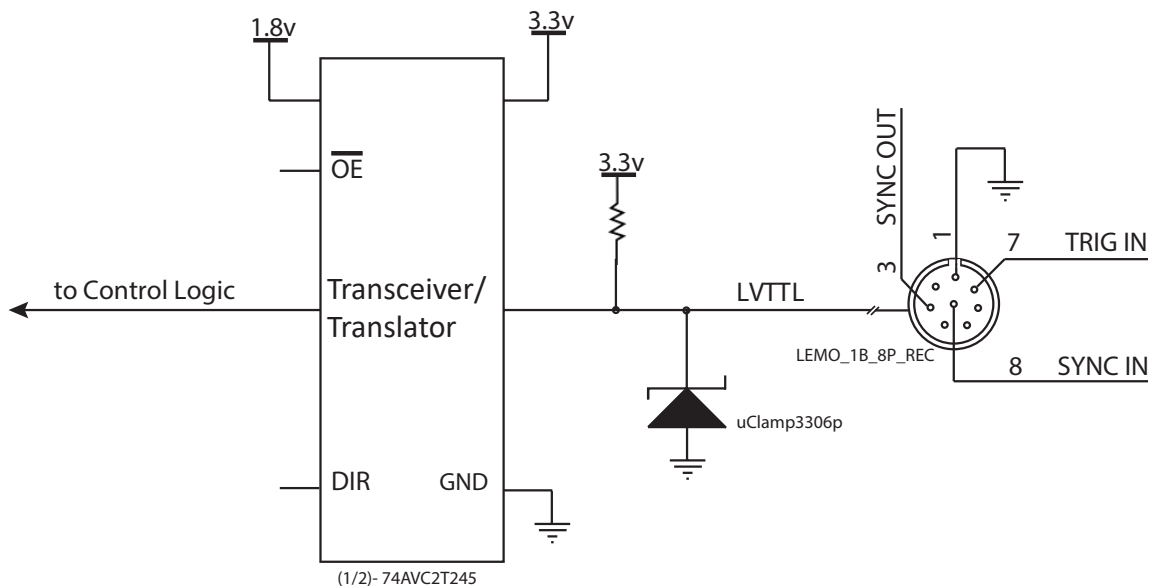
LEMO 1B.308

(View from solder cup side)



For simplicity, the schematic below represents one I/O signal.

The μ Clamp is for ESD protection.

Figure 4-2: Sync I/O Camera Interface Schematic

The ILx I/O circuits are designed to operate at LVTTL levels (3.3v). The inputs will respond to simple switch closures.

NOTE: THESE I/O PORTS ARE FOR LVTTL LEVELS ONLY. VOLTAGES ABOVE 3.3V WILL HARM THE ILx.

There is an I/O conditioning accessory available from Fastec that accepts signals up to 24v. The conditioner uses opto-isolators to protect the camera from over-voltage.

For inputs greater than 3.3v:

PLCs and other devices that operate on higher voltage levels than the TSx may be used for triggering and other I/O inputs with the proper conditioning circuit.

The output of the triggering device may be connected to the conditioning circuit in one of two ways, depending on whether the output is capable of sourcing or sinking $\geq 5\text{mA}$.

The conditioning circuit also provides opto-isolation between the driving circuit and the camera. The opto-isolator adds about 2msec (0.002 seconds) of delay to the input.

The PLC to 3.3V Adapter is available directly through Fastec:

support@fastecimaging.com

(858) 592-2342

Figure 4-3: PLC to 3.3V Adapter Schematic

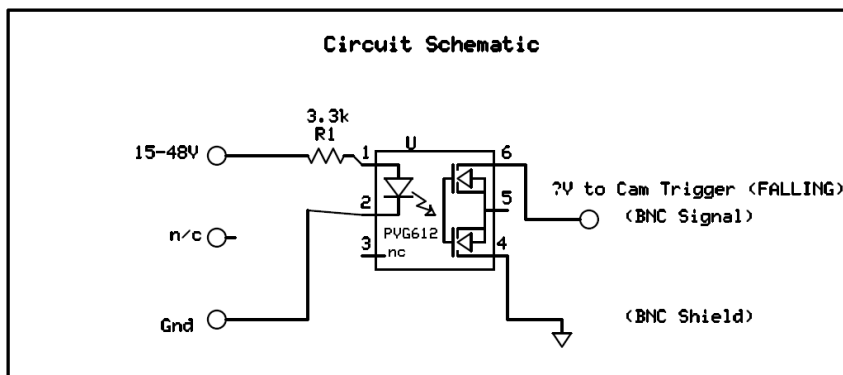


Figure 4-4: PLC 24V as Camera Trigger

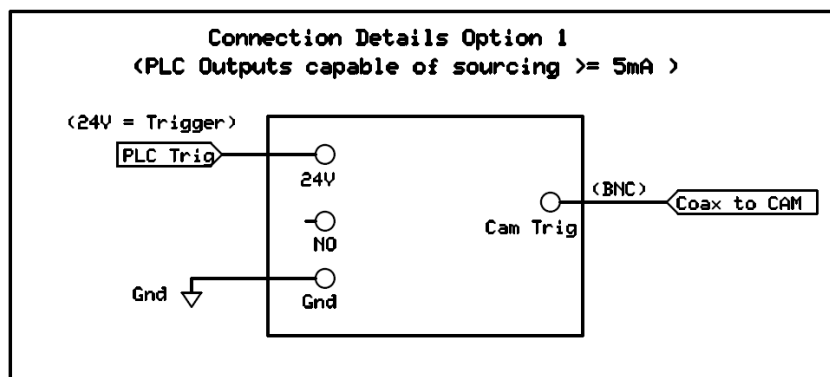
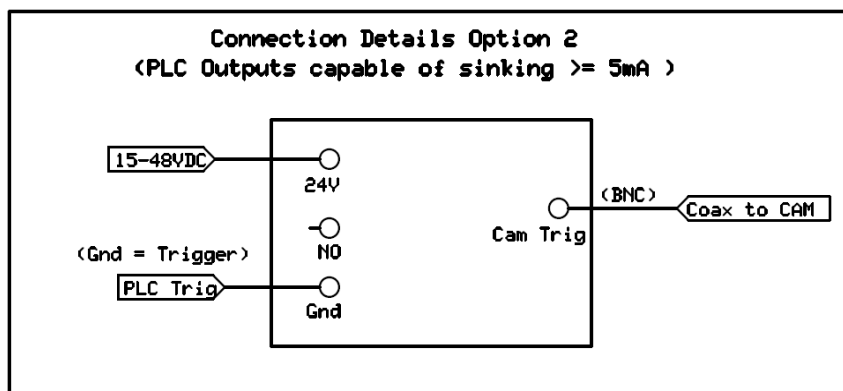


Figure 4-5: PLC Low as Camera Trigger

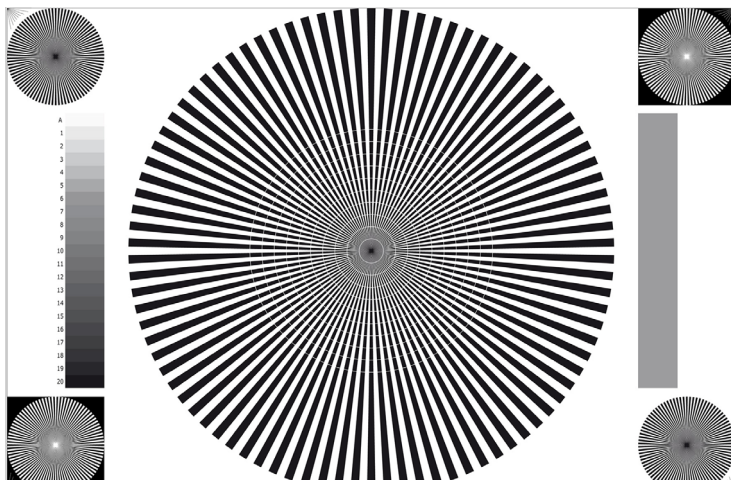


Appendix F: Adjusting Back Focus

Symptoms of incorrect Back Focus Adjustment:

- Zoom lenses lose focus when zooming in or out. (Not all zoom lenses are designed to remain focused, so be careful not to prematurely jump to the conclusion that the back focus needs adjustment.)
- Lenses will not focus at infinity.
- The witness marks (distance marks) on lenses are always off in the same direction.

Figure 4-6: Focus Chart



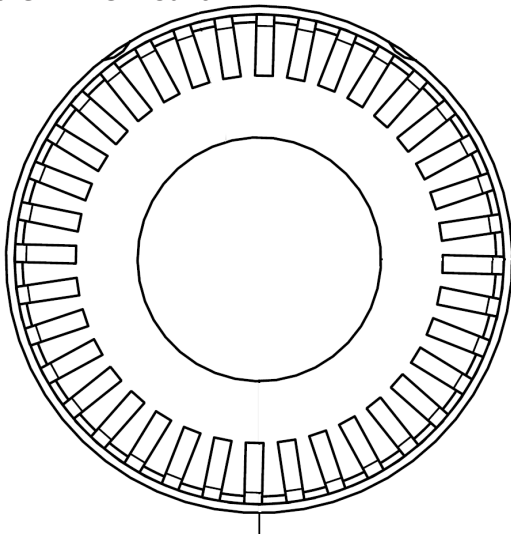
Adjustment procedure:

1.

Tools required for Back Focus Adjustment:

- High-quality lens--or lens that you need to use for a particular test --Best if it is very fast--f/1.4 or faster.
- A high-quality focus chart can be very helpful. In a pinch, you can print one yourself. An 8 1/2 x 11" or A-Size Siemens Star chart will work for the example here.
- A 3/32" hex Allen wrench for the C-mount lock screws. (See "ILx Top View" on page 4.)

Figure 4-7: C-Mount



to a wall is the easiest.

Connect the IL3 to an LCD display, either via a PC connection or the HDMI port. You will wish to have a particularly good view of the image--the larger the better.

2. Select the lens you wish to use. For our discussion we will use a 1" format Navitar 50mm f/.95 lens.
3. Decide on a distance. For this discussion we will use 5', or 1.5m.
4. Set your target 5' / 1.5m from the target. The proper way to measure is from the image plane to the target. The image plane would be about 17.5 mm behind the face of the C-mount. Set the target as flat and square to the camera as possible. Usually, taping it

5. Get plenty of flat white light on the target.
6. Set the ILx up to frame the image. Using a 50 mm lens at 1.5m, the field of view at 800 x 600 resolution, the image will be just a little larger than the focus chart. Use smaller resolutions to zoom-in for fine adjustment.
7. Make a reference mark on the C-mount adapter to mark your starting point. This can be done with a little dab of white out, or a small piece of tape.
8. Frame and focus the camera on the focus target.
9. Set the lens aperture wide open: f/.95 for this lens.

10. Adjust the illumination and/or the exposure setting to get the right exposure, avoiding saturation. (Keep the lens set at its largest aperture. It is important to use the shallowest depth of focus possible.)
 11. Look at the witness mark on the lens. It should be pointing to 5'/1.5m. If it is not, continue on with the adjustment.
 12. Set the lens to the 5'/1.5m witness mark.
 13. If the focus got noticeably worse, go on with the adjustment.
 14. Loosen the two C-Mount Lock screws (see "Figure 1-2: ILx Front View" on page 4). The C-Mount is threaded onto the IL3 Optical Block. Loosening the screws enable turning the C-Mount for adjustment.
 15. Turn the C-mount adapter a short distance one direction, then back to where it was, then the other direction. You will quickly learn which way to turn it to get better results.
- Note: The C-mount has 3/32 threads on it. It also has a scalloped pattern on its edge comprising 36 indentations. Rotating the mount, the distance of one of these indentations is equivalent to adjusting the back focus distance a .022mm or a little less than .001." It is a good goal to adjust the back focus to within a couple of these indentations, or less than .05mm / .002."
16. When you are satisfied that the back focus is adjusted as well as you can get it, tighten the two adjustment screws, and reconfirm the focus.

Setting For Infinity:

If you will be using the IL3 exclusively for close by objects and are satisfied that the back focus is correct, you may skip this part. If, however, you will be using the camera for activities where it will be imaging far away objects, you will want to confirm that it can focus to infinity.

To do this you will need to find a place where you can set the camera up that has a good view of objects at various distances.

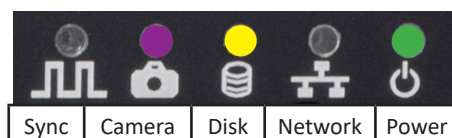
Figure 4-8: Navitar 50mm f/95 Lens



17. Check the location of the reference mark made on the lens in #7, above.
18. Look at the last witness mark on the lens before infinity. Find an object in your field of view that is approximately the distance indicated by that last witness mark. For example, on the Navitar 50mm f/.95 lens, the last witness mark before infinity is 10m. So you would find an object approximately 10m away and focus on it.
19. Is the lens now set close to the 10m witness mark? Continue finding targets farther and farther away to get a feel for how far the lens can focus to. If the best focus for far away objects is at or a tiny bit before the infinity stop, the lens is OK. If you find that the best focus for the farthest objects is not close to the infinity stop, or you find that you just cannot focus on far away objects, repeat #14 through #16 above.

Appendix G: Camera Status LEDs

Table 4-6: Camera Status LEDs



Power LED:		Solid Green whenever the ILx is powered up.
Network LED:		Fast blinking Amber whenever the ILx is sending or receiving on the network.
Disk LED:		Fast blinking Amber whenever the ILx SSD or SDHC are accessed.
Camera LED:		Solid Green whenever in Live mode (operating, but not recording).
		Blinking Red slowly (1Hz) when the ILx is Armed, not triggered; Recording in ROC or BROCC
		Blinking Amber slowly (1Hz) when ILx is Armed, not recording in ROC or BROCC
		Blinking Red quickly (2Hz) when the ILx is Triggered in Basic and FasFire
		Blinking Purple slowly (1Hz) when the ILx is Armed in Autosave (recording, not triggered).
		Blinking Purple quickly (2Hz) when the ILx is Triggered in Autosave.
Sync LED:		Solid Amber when in Review mode (playing back recorded images).
		Solid Yellow: Sync = Per/Frame, IRIG= 0, Signal state= any
		Blinking Purple: Sync = Per Second (not synchronized)
		Solid Purple: Sync = Per Second
		Off: Sync disabled

Appendix H: IL3 Updates

If you are notified by Fastec or one of its distributors that an update is available, they will give you a link to download it to a PC. The PC will need to have an SD Card port or have a card reader attached to it. (Note: It is possible to use the camera's SD Card port for this purpose by attaching to the PC via the OTG cable.)

Important: Save all image data on the camera before updating. File metadata structures may change with updated firmware!

Update Procedure:

1. Download the update file to a Windows PC. The update file name will be in the form of "ts3_revxx.x.x_<Year>_<date>.exe." For example, the latest revision as of the 1st of August, 2013 is: ts3_rev1.6.34_2013_0301.exe and FasMotion_1.6.34.exe. Updates always include both camera firmware and FasMotion software. The version numbers should match. **Update the camera first!**
2. Insert the SDHC card into the PC card slot or card reader. **Please note the drive letter the PC assigns the card.**
3. Double click on the update file. The Update Screen will appear. Click Next.
4. A License Agreement will appear. Click the check box to accept the terms and click Next.
5. A screen will appear for selecting the SD Card. **Make sure that you have selected the correct drive letter before clicking on Install.** A new window with a progress bar will appear.
6. Once the update program has finished writing to the SD Card, a final screen will appear. Click on Finish. Eject the SD Card from Windows and remove it from the PC.
7. Insert the SD Card into the SDHC slot of the ILx.
8. Open the camera in FasMotion and Select "Update" in the Camera Menu. The camera will now disconnect and perform the update internally, then reboot. This will take a few minutes.
9. After the camera boots up, re-connect to FasMotion.
10. Confirm the Software Version in the Find Camera window.
11. Go to the Configuration menu and select "Factory Config." The camera will reboot.
12. Perform a black level calibration.
13. If the ILx has an SSD, it should be formatted before use.
14. Restore the SD Card before using it for image file storage. (See "Restoring the SD Card.")

Figure 4-9: Camera Update Screens

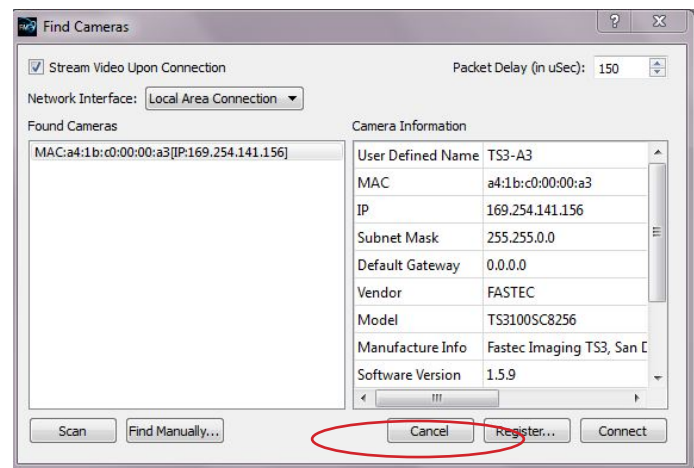
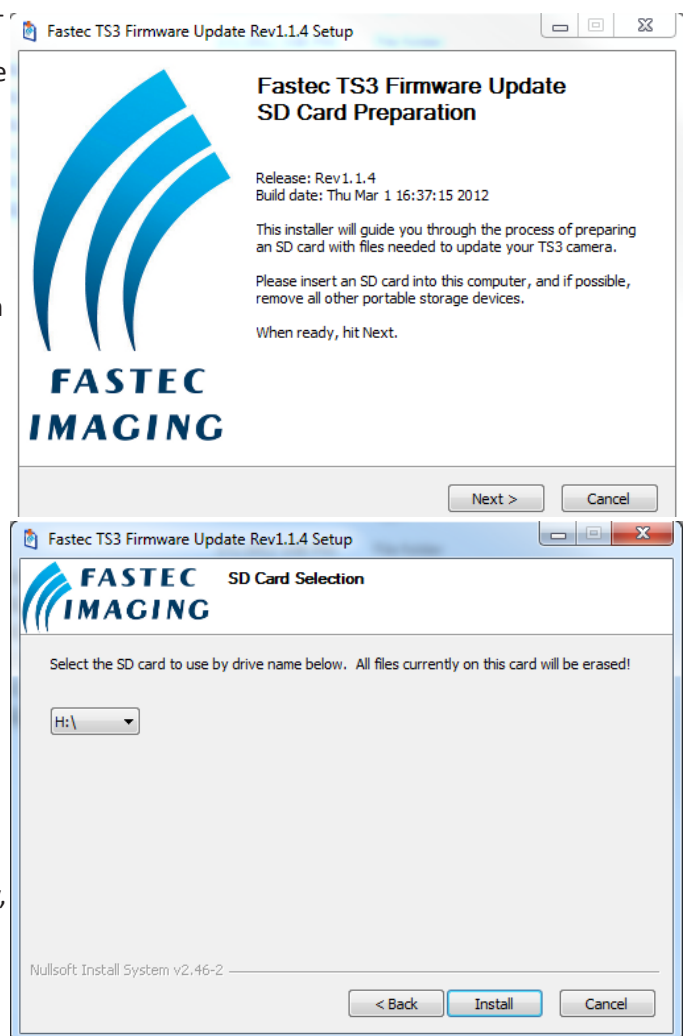


Figure 4-10: Contents of Update SD Card



Alternate Update Methods

Update from using the Power Button:

1. Follow #s 1-7 on the previous page.
2. Power down the ILx.
3. Press and hold the ON/OFF button while applying power to the ILx. You may release the button as soon as you see the LEDs flashing on the ILx.
4. Once the ILx is booted, follow steps 9-14 on the previous page.

Restoring the SD Card

The SD card you have used for the camera update now contains the files and folders listed in Figure 4-10. Refer to the TS3_Release_Notes file for information about the update.

The format of the SD Card has been changed and now there is very little (35MB) accessible space left.

To Restore the SD Card:

1. Attach the SD Card to a Windows PC.
2. Run card_restorer.exe from the SD Card.
3. You will see a message box asking if you wish to re-partition and erase the SD card. Click on "Yes."
4. The next message box will tell you that the process will take a few moments. Click on "OK."
5. Next, you will see a command window open and see some text scrolling by.
6. Finally, you will see a message box saying, "Reformatting is now complete!"

Figure 4-11: SD Card Restorer Messages

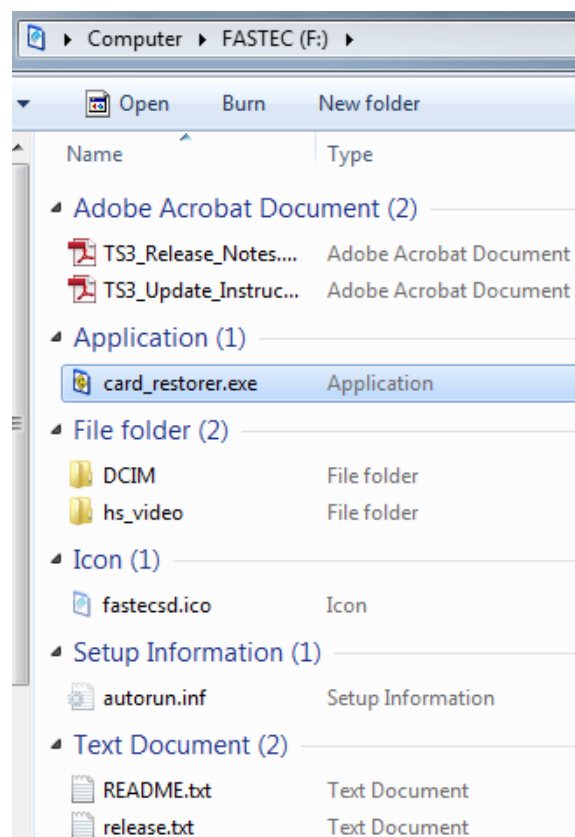
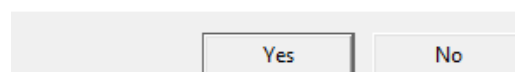


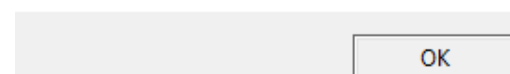
Figure 4-12: Physical Measurements

The camera firmware updater removable drive [F] will now be re-partitioned and all data on it will be erased!

Are you ABSOLUTELY sure you want to do this?



This make take a few moments. Please click OK and wait for another popup indicating completion.



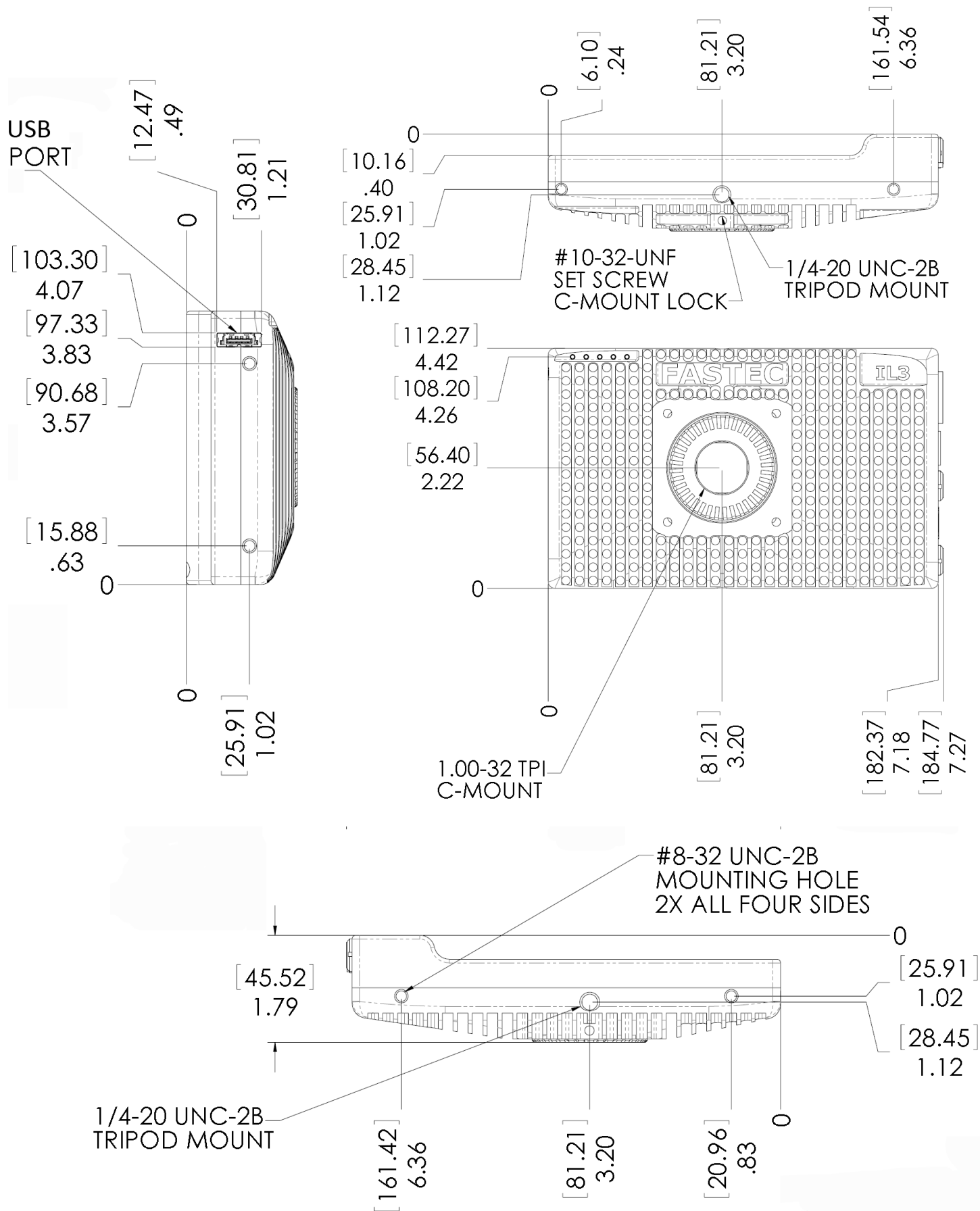
```
C:\Windows\System32\cmd.exe
Insert new disk for drive F:
and press ENTER when ready... The type of the file system is RAW.
The new file system is FAT32.
QuickFormatting 7579M
Initializing the File Allocation Table (FAT)...
Format complete.
  7.4 GB total disk space.
  7.4 GB are available.

  4,096 bytes in each allocation unit.
  1,936,382 allocation units available on disk.

  32 bits in each FAT entry.
Volume Serial Number is F6BC-64AC
```


Appendix I: Physical Measurements

Figure 4-13: Crop Factor 1280 x 1024



Appendix J: Crop Factor

Crop Factor is a term used in digital photography that expresses the size of the sensor image plane as compared to that of 35mm film. In Figure 4-13 through Figure 4-15, below, the Black border represents the image on 35mm film, the Red border represents the image on the sensor using the same focal length lens.

Diagonal of 35mm film / Diagonal of the Sensor area used = Crop Factor

The diagonal of 35mm film is 43.3, compared to the 22.95mm diagonal of the ILx, you get a crop factor of 1.89:

43.3mm / 22.95mm = 1.89

The photographic advantage of knowing the crop factor is that if you know the lens you would use for a given field of view with a 35mm camera, you can divide the crop factor into that number to give you the focal length of the lens with the same field of view for your IL3. For example, if you are using a 125mm lens on your 35mm SLR, you will need about a 65mm lens on the ILx at full resolution (125mm / 1.89 = 66.14).

Table 4-7: Crop Factor

H-Res	V-Res	Diagonal	Crop Factor
1280	1024	22.95	1.89
1280	720	20.56	2.11
1024	1024	20.27	2.14
1280	256	18.27	2.37
800	600	14.00	3.09
1024	600	16.62	2.61
640	480	11.20	3.87
800	480	13.06	3.32
512	512	10.14	4.27
320	240	5.60	7.73
320	200	5.28	8.20
256	256	5.07	8.54

Figure 4-14: Crop Factor 1280 x 720

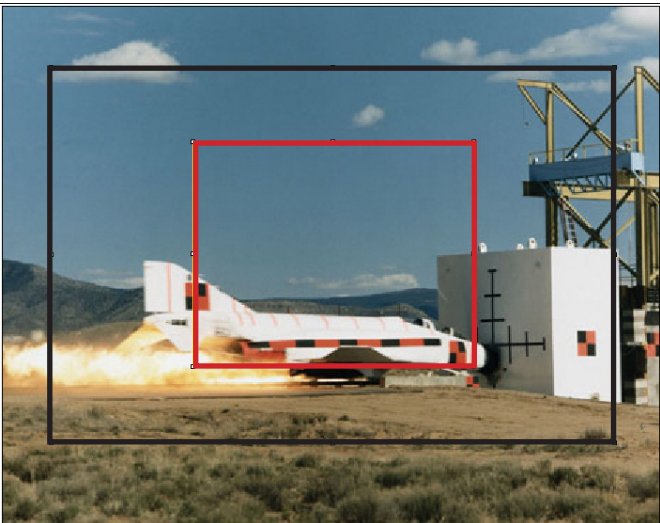


Figure 4-15: Crop Factor 800 x 600

