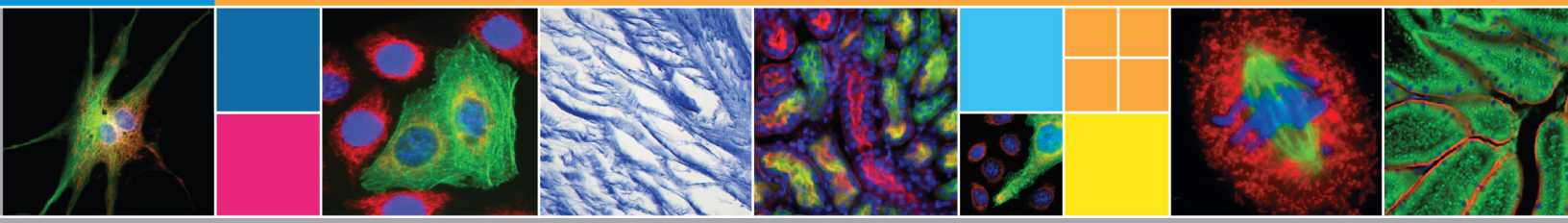
RETIGA™ 6000

USER MANUAL



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Applicability

This document applies to the Retiga™ 6000 camera. For the latest updates, please visit **www.qimaging.com**.

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QImaging Technical Support

Technical support is available to all registered users of QImaging products from 9am to 5pm Pacific Standard Time.

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http://www.qimaging.com/support/contact

QIMAGING LIMITED WARRANTY

Standard Product Warranty Plan

A Standard Product Warranty Plan is included with every QImaging camera purchase. This Warranty Plan includes parts and labor for two full years (starting from the shipping date of the camera). The Standard Product Warranty Plan is provided on all new and used equipment, including retired demonstration cameras.

Extended Product Warranty Plan

Extended Product Warranty Plans are conveniently priced and very easy to purchase. Available for all QImaging cameras, the Extended Product Warranty Plan includes parts and labor, and is available in one-year increments up to five years.

When you purchase an Extended Product Warranty Plan from QImaging, you are assured of our commitment to minimizing down times. Your needs are our top priority and QImaging responds immediately. The QImaging Service and Support team is focused on expediting all customer requests to provide a fast and complete solution.

QImaging also offers on-site training as well as online operational training programs. These programs are designed to get you up and running with your new camera quickly and efficiently.

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RETIGA 6000 CERTIFICATE OF CONFORMITY

CERTIFICATE

of Conformity

EMC Directive 2004/108/EC

TÜVRheinland®

Certificate No.: 31361867 001C

Holder: Photometrics
3440 East Britannia Drive
Tuscon AZ 85706
U.S.A.

Product: Scientific Digital Camera

Identification:
Model Number: 3000Color (inc. 3000Mono)
Serial Number: Q34106

Model Number: 6000Color (inc. 6000Mono)
Serial Number: Q34108

Tested acc. to:
EN 55011:2009-A1
FCC Part 15 Subpart B:2012
EN 61326-1:2006
EN 61326-1:2013
EN 61000-3-2:2006+A1+A2
EN 61000-3-3:2008

This certificate of conformity is based on an evaluation of a sample of the product as specified in the certificate. This is to certify that the tested sample is in conformity with all provisions of Council Directive 2004/108/EC, referred to as the EMC Directive. This certificate does not imply assessment of the production of the product and does not permit the use of a TÜV Rheinland mark of conformity.

Date 11.09.2013

Conan Boyle
Laboratory Manager, EMC-Telecom

TUV Rheinland of North America, Inc., 1279 Quarry Lane Ste. A, Pleasanton, CA 94566, Tel: 925-249-9123

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CHAPTER 1

INTRODUCTION

The Retiga 6000 from QImaging is a 14-bit, 20MHz scientific interline CCD camera system optimized to enable large-area imaging for applications in bright-field and fluorescence light microscopy. Its 6.05MP resolution, 16mm sensor diagonal, and 4.54µm pixel pitch allow you to image more of your sample in a single acquisition — with extremely high resolution and clarity. Low-noise electronics, cooled sensor technology, and excellent quantum efficiency (QE) yield superb sensitivity for low-light fluorescence applications.

This manual describes the installation and configuration procedures for your new Retiga 6000 color or monochrome camera. Descriptions of Retiga 6000 camera settings are also included.

System Components

Your new camera system includes:

- Retiga 6000 camera
- 5V 4A power supply
- 1 Meter USB 2.0 cable
- Black lens cap
- USB flash drive: PVCAM driver, QCapture Pro installer, manual, datasheet, training materials
- USB security key (required for QCapture Pro software)
- StarTech 2 Port PCI Express (PCIe) SuperSpeed USB 3.0 Card Adapter

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Precautions

The CCD and other Retiga 6000 camera system electronics are extremely sensitive to electrostatic discharge (ESD). To avoid permanently damaging the system, please observe the following precautions:

- If you are using high-voltage equipment (such as an arc lamp) with your camera system, be sure to turn the camera power *on last* and power the camera *off first*.
- Never connect or disconnect any cable while the camera system is powered on.
- Although you should turn off the *camera's* power supply before disconnecting any camera system cable, you do not need to power off your computer to detach the cables.
- Use caution when triggering high-current switching devices (such as an arc lamp) near your system. The CCD can be permanently damaged by transient voltage spikes. If electrically noisy devices are present, an isolated, conditioned power line or dedicated isolation transformer is highly recommended.
- Always leave at least one inch of space around the camera housing.
- Never open the camera. There are no user-serviceable parts inside the Retiga 6000 camera. Opening the camera voids the warranty.
- Use only the integrated USB 2.0 interface, cables, and power supply designated for this camera system. Using non-Retiga 6000 cables or power supplies may result in permanent damage to your system.
- Do not use a C-mount lens that has optics that extend behind the flange of the lens.

Environmental Conditions for Operation and Storage

Your Retiga 6000 camera system should be operated in a clean, dry environment. The camera system's ambient operating temperature is 0°C to 30°C with 80% relative humidity, noncondensing.

Store the Retiga 6000 camera system in its original containers. To protect the system from excessive heat, cold, and moisture, store at an ambient temperature between -20°C and 60°C with a relative humidity of 0% to 90%, noncondensing.

Microscopes, Lenses, Tripods

Retiga 6000 has a standard threaded video mount and can be mounted to any microscope that accepts a standard C-mount adapter. The camera also allows you to install any lens that is compatible with a standard threaded video mount as long as its optics do not extend behind the flange of the lens.

The Retiga 6000 camera can be mounted to a tripod using the tripod mounting attachment located on the bottom of the camera. See the Specifications chapter for more information.

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Cleaning

Clean the exterior surfaces of the camera with a dry, lint-free cloth. To remove stains, contact QImaging Support. To clean the camera's imaging window, use only a filtered compressed-air source. Handheld cans are not recommended, as they may spray propellant onto the window. Do not touch the window.

Repair

The Retiga 6000 camera system contains no user-serviceable parts. Repairs must be done by QImaging. Should your camera system need repair, contact QImaging Support. Please save the original packing materials so you can safely ship the camera system to another location or return it for repairs if necessary.

IMPORTANT: DO NOT OPEN the camera. Opening the Retiga 6000 camera voids the warranty.

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CHAPTER 2

INSTALLATION

This chapter will detail the proper installation of your Retiga 6000 camera. In order to install and use the camera, the following items are required:

- Retiga 6000 camera (supplied)
- USB 2.0 data cable (supplied)
- 5V 4A power supply (supplied)
- USB "installer" flash drive (supplied)
- StarTech 2 Port PCIe SuperSpeed USB 3.0 Card Adapter (supplied)
- 110V/220V power connection
- A PC that meets host computer requirements

Host Computer Requirements

The host computer for your Retiga 6000 camera must include:

- Windows 7 operating system (32/64 bits)
- 2.0 GHz or faster Intel processor: either Xeon or Core i5
- 4+ GB RAM
- 250+ GB serial ATA (SATA) HDD and/or >64 GB solid state drive (SDD) for high-speed imaging and storage
- 256+ MB slot-based ATI/NVIDIA video graphics card (i.e., not an "onboard/integrated graphics" adapter)
- CD-ROM drive or internet access to install the driver
- At least one USB interface port

NOTE: Minimum requirements as of January 2014. Supported computer systems will change as new cameras, computer hardware, and operating systems are introduced and older models then become obsolete. For current information on recommended computer specifications, please visit: **http://www.qimaging.com/support/recommended-computer-specifications.php**

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Camera Power Requirements

- 5V DC, 4A (maximum)

A power supply for use with your Retiga 6000 camera has been provided by QImaging.

IMPORTANT: Follow these steps in order. DO NOT CONNECT the camera until the driver is installed.

Installation Step 1: Install the USB 3.0 PCIe Card

In order to guarantee optimal camera performance, it is recommended that you use the supplied USB 3.0 PCIe card over any native USB ports on the computer. This will provide the necessary bandwidth and avoid any memory allocation competition from other devices. To install the USB PCIe card, please follow these steps:

- Shut down your computer.
- Open the case, and install the included USB 3.0 card into an empty PCIe slot. See the user's manual for your computer for complete instructions on installing new PCI-Express cards.
- Restart your computer.
- Use the CD supplied with the USB card to install the appropriate drivers. Refer to the USB card package for further details on installation.

If you elect to use a native USB port on your computer instead of the USB card, please refer to Appendix A for more information on USB port compatibility.

Installation Step 2: Install the Camera Driver

In order for the Retiga 6000 to communicate with the host PC, the camera's device driver (PVCAM) must first be installed. Before connecting the camera to the computer, use the supplied USB flash drive to run the PVCAM installer executable. Be sure to select the appropriate installer based on your PC's operating system (32-bit or 64-bit).

After completing the PVCAM installation, restart your PC when prompted by the wizard. Next, install the QCapture Pro imaging software from the USB flash drive.

The camera is now ready to connect to the computer. Make sure the camera's power switch is set to the *Off* position.

NOTE: Supplemental PVCAM installation information can be found on the QImaging website:
http://www.qimaging.com/support/downloads/

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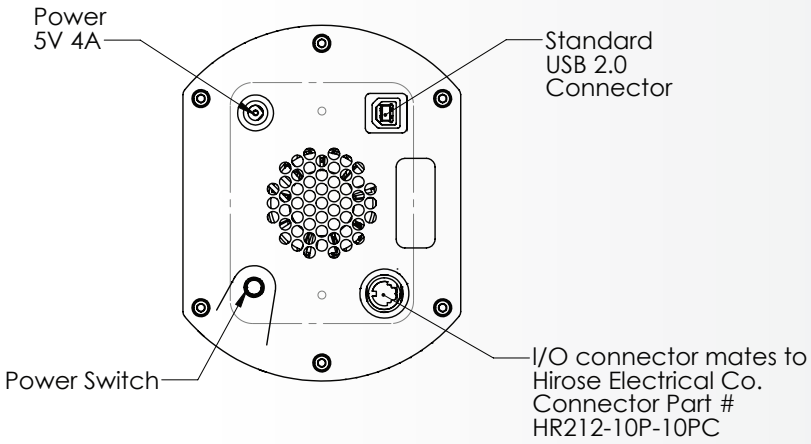
Installation Step 3: Connect the Camera

In addition to a power switch, there are three connectors on the back of the Retiga 6000 camera: a USB 2.0 connector, a power supply connector, and an I/O connector. Connect the camera following these steps:

IMPORTANT: Ensure the power switch is set to the OFF position and before connecting the camera

1. After the USB 2.0 cable has been connected to the computer and camera, connect the Retiga 6000 power supply's cable to the power connector located on the back of the camera. (Your Retiga 6000 camera is powered by the 5V 4A power supply provided by QImaging.) Lastly, plug the power supply's cord into an appropriate power source.
2. You may now power on your camera by setting its power switch to the *On* position.
3. Optional: An I/O connector is available on your camera for optional hardware triggering. The I/O connector provides multiple I/O signals that allow highly precise synchronization with external hardware components such as light sources and motorized microscope stages via TTL signals. Information on how to set up and configure the Retiga 6000 camera for hardware triggering can be found in the next chapter of this manual.



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CHAPTER 3

USING YOUR RETIGA 6000 CAMERA

Imaging Software

The easy-to-use QCapture Pro software supplied with your Retiga 6000 provides complete control over the camera's settings and image capture functions. For an up-to-date list of other compatible third-party imaging software applications, please visit:
http://www.qimaging.com/resources/pdfs/Software-Compatibility-Matrix.pdf

The Retiga 6000 camera's image capture capabilities are controlled entirely through your imaging software. Basic functionalities include control over exposure time, gain state, clearing mode, region of interest (ROI), and pixel binning. For information describing how to implement changes to the camera's parameters, refer to your imaging software's instruction manual.

Basic Camera Parameters

Exposure Time

The Retiga 6000 camera's exposure controls allow you to adjust the integration time for each acquisition (0 ms – 30 min). By increasing the exposure time, more light is captured by the sensor and a better signal-to-noise ratio (SNR) is achieved. The longer the exposure time however, the longer you also expose your cells to more light, increasing the effects of photo toxicity and photo-bleaching. The exposure time should be adjusted to a level that achieves the shortest integration time possible while still maintaining sufficient SNR.

Gain State

Gain (with regards to cameras) is defined as the conversion factor of captured electrons to a digital signal, often referred to as a grey value or ADU (Analogue to Digital Unit) and has units of electrons per ADU (e/ADU). Knowing the gain of a camera allows users to directly compare an ADU value as measured from their software to the physical number of electrons actually captured by the camera's sensor. Gain plays a critical role in many of the camera's parameters including dynamic range and read noise.

The Retiga 6000 provides three user-selectable gain states enable optimal camera performance for different imaging environments:

- Gain State 1 ≈ 1.8e-/ADU (0.5x Gain - High Light: 1/2 single pixel full well = max bit depth)
- Gain State 2 ≈ 1.2e-/ADU (1x Gain - Mapped: single pixel full well = max bit depth)
- Gain State 3 ≈ 0.3e-/ADU (3x Gain - Low Light: 1/3 single pixel full well = max bit depth)

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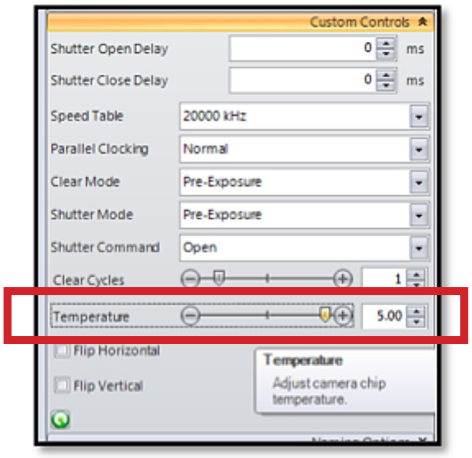
Gain State 2 uses the full dynamic range of the camera and is recommended for bright field applications. Gain State 3, although only using a third of the single pixel full well, is ideal for resolving low luminescence signals. Therefore, Gain State 3 is recommended for fluorescence applications.

Sensor Cooling



To reduce thermally generated noise attributable to dark current, the Retiga 6000 camera system provides stabilized sensor cooling of 0°C at up to a 30°C ambient room temperature. Additional temperature control is available to allow flexibility in reaching different stabilized sensor temperatures for various ambient room conditions. The sensor temperature is set via software.

Additionally, the Retiga 6000 has the option of disabling its internal fan for vibration-free and/or electrically sensitive applications. The camera's fan can be turned off by setting the temperature to +5°C.

Clocking Mode

The Retiga 6000 camera has two CCD clocking modes, one of which allows removal of the glow that can appear in an image's corners at longer exposures (arising from preamplifiers). In the PVCAM implementation, the clocking modes are referred to as "Normal" and "Alternate Normal."

In "Normal" mode, the CCD is optimized for precise exposure time control and maximum frame rate.

In "Alternate Normal" mode, the preamplifier is switched off during the exposure to eliminate the background generated by preamplifier glow. However, switching the preamplifier off and on again adds additional time to each exposure, especially noticeable when in Overlap mode (defined below). Since the actual exposure time is slightly longer than the entered exposure time, Alternate Normal mode will increase the image brightness due to the increase in light collected by the slightly longer exposure, as well as slightly decreasing frame rate. As a result, it is usually beneficial to operate the camera in Alternate Normal mode for long exposures (>1 sec, where preamplifier glow begins to be noticeable), and in Normal mode for short exposures (<1 sec, where frame rate and precise exposure time are more critical).

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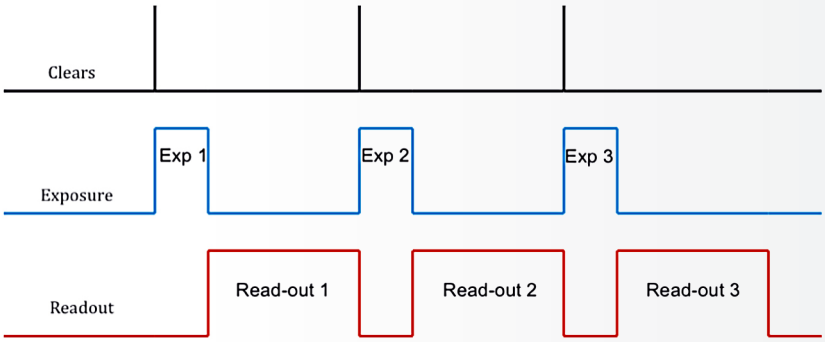
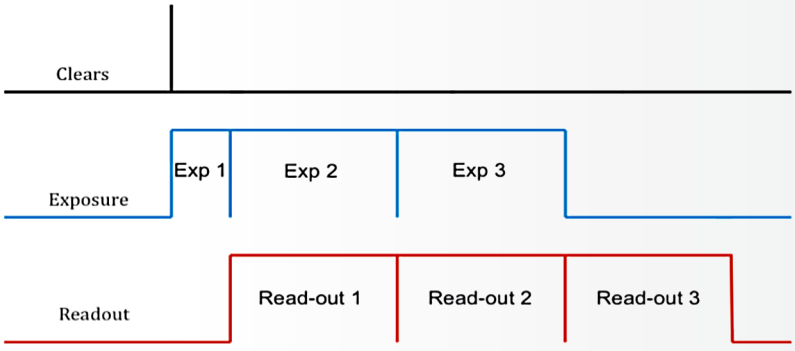
Clearing Mode

When the camera does not expose and read out images simultaneously, it is in Non-Overlap mode. Non-Overlap mode is set by choosing "Pre-Exposure Clearing" for the clearing mode of the camera. This allows a clear before each exposure. The following waveforms show how Non-Overlap mode functions. The main benefit of Non-Overlap mode is that there are no limitations imposed upon the exposure time, and the set exposure time is the actual exposure time. The tradeoff for this accuracy is the frame rate, as each frame must be completely read out before beginning the next exposure.



When the camera is able to expose and read out images simultaneously, it is in Overlap mode. Overlap mode is set by choosing "Pre-Sequence Clearing" for the clearing mode of the camera. This allows one clear before the imaging sequence starts. The following waveforms show how Overlap mode functions. When using Overlap mode, the frame rate is higher as compared to Non-Overlap mode and provides the ability to continuously image. However, since exposure and readout occur simultaneously, the minimum exposure time is dependent on the time taken to complete readout. As such, excluding the first frame, any exposure time smaller than the readout time defaults to an exposure duration equal to the readout time.



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ROI / Binning

The Retiga 6000 supports both user-defined, arbitrary regions of interest (ROI) as well as hardware pixel binning modes of 1x1, 2x2, 4x4, and 8x8. Both ROIs and pixel binning will enable faster frame rates, making focusing and scanning much easier. Pixel binning also has the advantage of significantly increasing the signal-to-noise ratio (SNR) of the image.

For color cameras, pixel binning will result in the loss of the native color interpolation. When using the Retiga 6000 color camera for low light fluorescence documentation, binning can be used to improve SNR, but pseudo-coloring will be required to obtain color images. Pseudo-coloring is a commonly used method and is a function typically available in most imaging software applications (including QCapture Pro 7). This will allow you to apply the tint of the fluorescent labels used to the acquired images for documentation and publication purposes. When using pixel binning, the acquired images will appear to be grayscale although they will have an RGB pixel value. Simply convert the images to a single channel greyscale value (8-bit mono, 12-bit mono, etc.) and use your software application to apply a color tint.

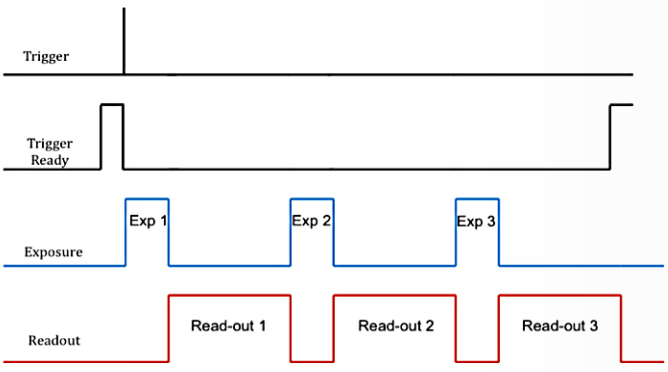
Device Synchronization

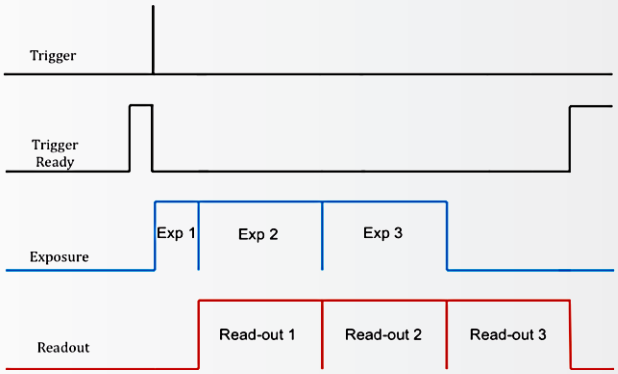
Your Retiga 6000 camera offers several methods of hardware synchronization via TTL signals with external devices, including function generators, light sources, shutters and filters. Each camera has an I/O connector (pin out functions are described in the specifications chapter) on the back for trigger-in/out and various TTL input and output operations.

A special cable is available to access primary signals such as "Trigger-in," "Expose out," and "Frame Readout". In the default mode, the camera triggers on the rising edge of a TTL signal. Retiga 6000 cameras support three trigger modes:

Trigger-first mode

In this mode, the camera requires one trigger to begin the acquisition of a stream of images. Once a single trigger is received, the camera will use its internal clock to acquire the entire image stream, independent of any future triggers. It is possible to run this triggering mode in either Non-Overlap mode (left) or Overlap mode (right).





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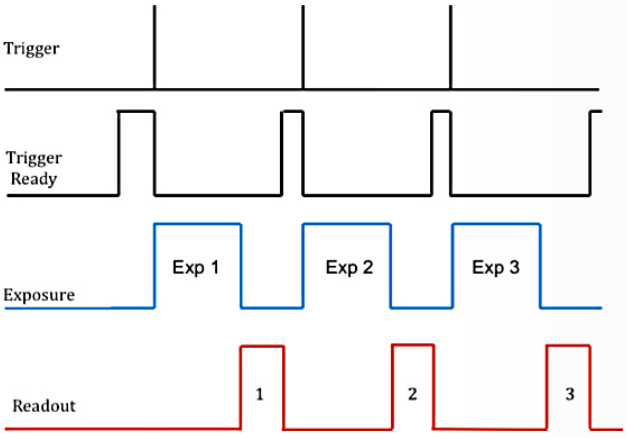
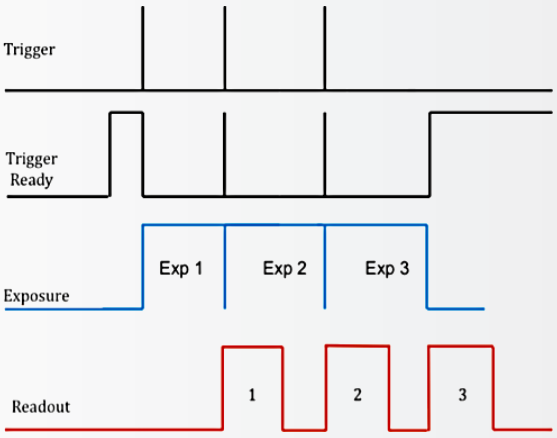
Strobe mode

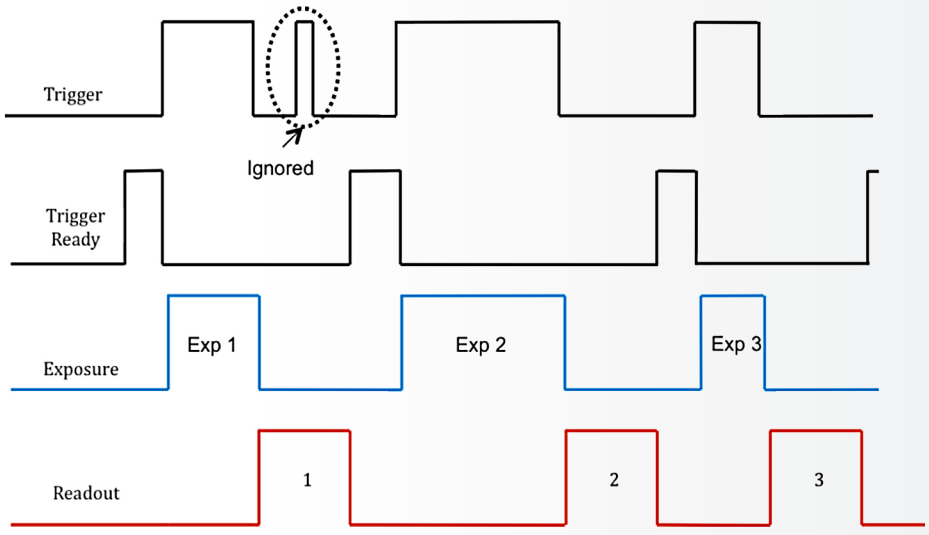
In this mode, each frame in the sequence requires a trigger. When a trigger is received, the camera exposes for the time set in the software. If Strobe mode is set to run in Overlap mode, then all exposures except the initial one will be equal to, or larger than, the readout time. Triggers received while Trigger Ready is low are ignored. For a sequence of one frame, Strobe mode and Trigger-first mode are the same. Non-Overlap mode is shown on the left; Overlap mode is shown on the right.





Bulb mode

In this mode, each frame in the sequence requires a trigger. The camera exposes for the duration the trigger signal is high. Exposure time entered into the software is not used in this mode. Triggers received when Trigger Ready is low are ignored. Non-Overlap mode is shown below.



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Recommended Settings

Retiga 6000 Monochrome Camera	Retiga 6000 Color Camera
Default settings: ■ 14 bits ■ Gain State 2 ■ Binned 2x2 for live preview (binned 1x1 for capture) - Adjust exposure time for binning applied - Set for preview mode only - Captured image should be full frame binned 1x1 **All other settings should be "locked":** ■ Full frame (no ROI) ■ Normal mode ■ Clear Pre-Exposure ■ Gamma = 1 ■ 30ms exposure	**Default settings:** ■ 24 bits ■ Gain State 2 ■ Binned 1x1 ■ Center quad ROI for live preview - Set for preview mode only - Captured image should be full frame **All other settings should be "locked":** ■ Normal mode ■ Clear Pre-Exposure ■ Gamma = 1 ■ 10ms exposure ■ RGB values R = 1.6, G = 1, B = 1.5

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CHAPTER 4

TROUBLESHOOTING

Resolving Problems with the Camera

Computer Does Not Recognize Newly Installed Camera

Confirm that the latest PVCAM camera driver is installed on the computer while also checking to make sure the computer meets the minimum system configuration requirements to run the Retiga 6000. Confirm that the camera's power switch is set to the *On* position. Then power off the camera and the host computer and check all system connections. Restart.

If a New Hardware Found dialog box still does not appear, contact QImaging Support.

Images Not Displayed

If no images appear:

- Confirm that the camera's power switch is set to the *On* position.
- Confirm that the correct Retiga 6000 camera is selected in your imaging software application.
- Power off the camera and the host computer and check all system connections. Restart.
- Confirm that the camera is operational by taking an image with a standard C-mount lens attached to your Retiga 6000. Using normal room lighting, place the camera on a table about 3 meters away from an object and acquire an image.

If the camera is powered on and recognized by the computer and still is not able to capture an images, please contact QImaging Support.

PVCAM Error Message Appears

If a PVCAM error message appears, please note the message's number code and contact QImaging Support.

Lengthy Pauses During Imaging

If you notice lengthy pauses marked by a lot of disk activity while imaging:

- Close any other programs that may be running.
- Install more physical memory to your computer system.

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Camera Fan Not Running

Check the set point temperature in your software application. Make sure it is set to a temperature cooler than +5°C. (The stabilizing temperature when the fan is turned off is +5°C.) Try modifying the sensor temperature to see if the fan turns on. Contact QImaging Support if the fan still does not run.

Camera Running Too Warm

It is normal for the camera to be slightly warm to the touch while in operation. However, if the camera is more than slightly warm to the touch (and at least one inch of space has been left around the camera housing), switch off the camera immediately and contact QImaging Support.

Unresolved Problems - Contacting QImaging Support

If you are still unable to resolve your problem, contact QImaging Support for assistance in one of four ways:

- Visit **http://www.qimaging.com/support/faq/** for a list of all frequently asked questions. Your issue may be resolved in one of these faqs.
- Visit **http://www.qimaging.com/contact/** and fill out a support form online.
- E-mail **support@qimaging.com** with complete details of your problem (including Error Message and Code if possible), camera model, computer hardware configuration, and operating system.
- Call one of QImaging's regional support offices at the appropriate number below.
  To assist you better and to quickly resolve the issue, it is recommended that you are at your computer during the call.

United States and Canada
QImaging
Tel: +1 800.874.9789

China
Shanghai Roper Industries Trading Co., Ltd.
Tel: +86.21.3377.3519

Japan
Nippon Roper K.K.
Tel: 81.3.5639.2731

Europe
Roper Engineering s.r.o.
Tel: 420.597.305.857

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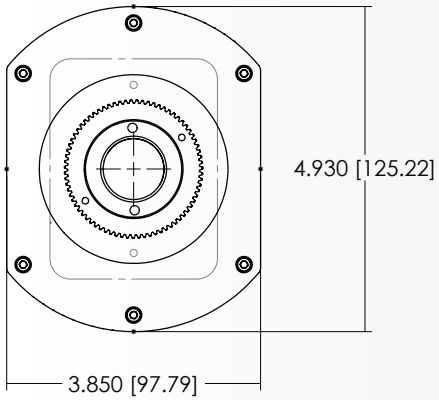
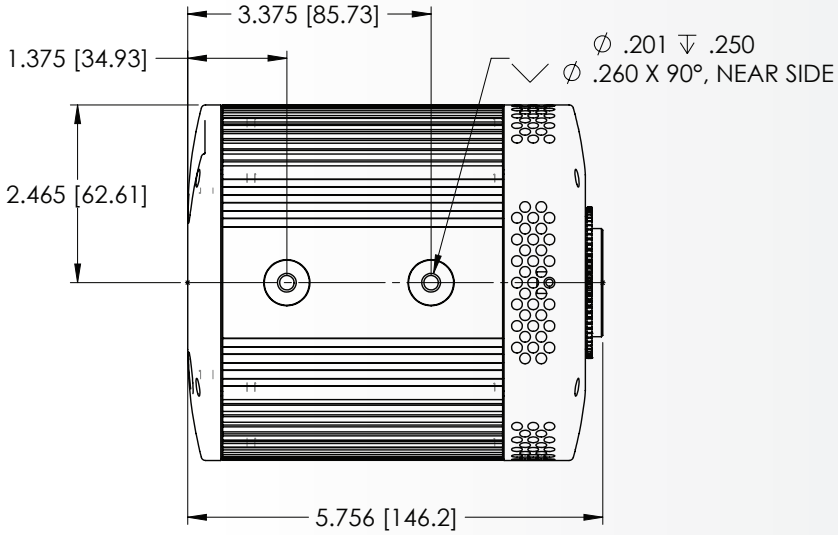
CHAPTER 5

SPECIFICATIONS

Camera Dimensions (Front)



Camera Dimensions (Bottom)



Additional Camera Measurements

Dimensions:	97.79 mm x 125.22 mm x 146.2 mm
Camera weight:	3.10 lbs (1.406 kg)
Optical interface:	1", C-mount optical format
Mounting hole thread size:	1/4"-20 thread

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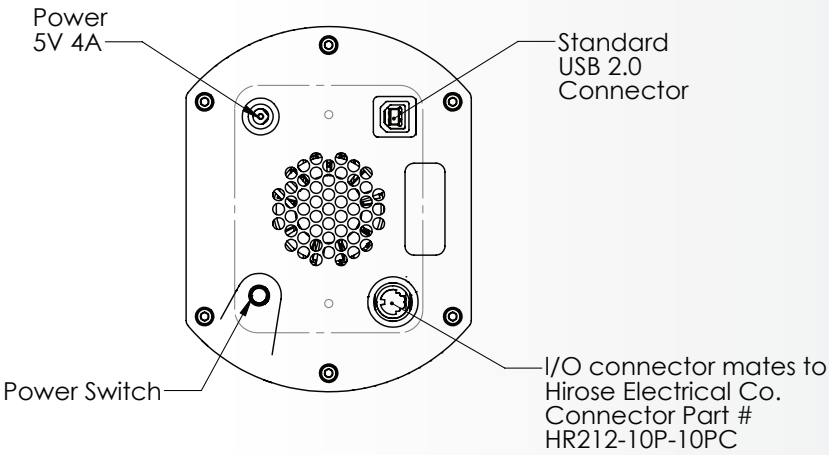
Connectors on Back of Camera



Power Supply Specifications

IMPORTANT: Only operate the Retiga 6000 camera with the power supply provided by QImaging.

Voltage output: +5 V DC, 4 A

Voltage input: 100 – 240 V @ 50 – 60 Hz

IMPORTANT: Must not exceed 5V DC, 4A.

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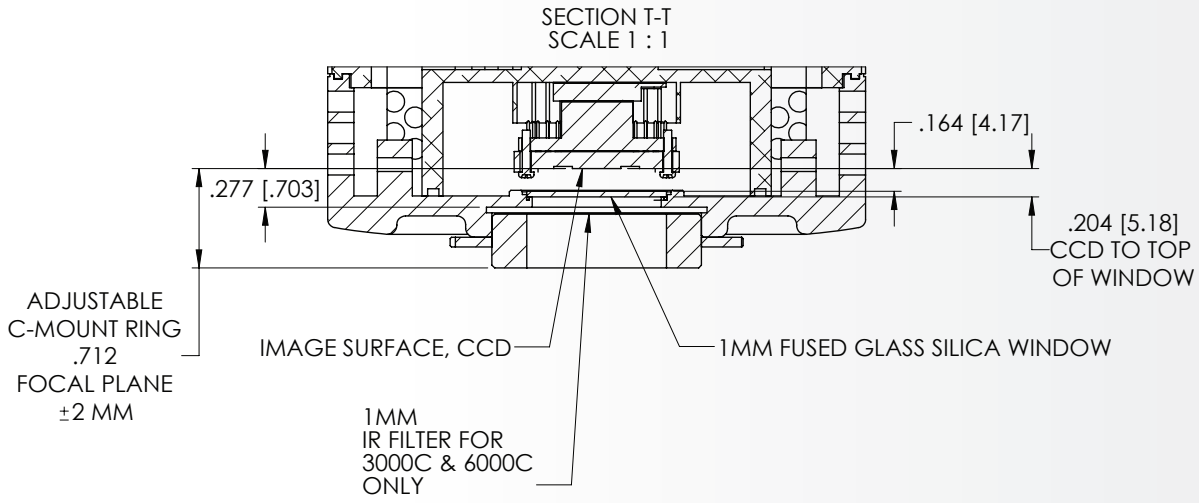
Focal Plane Measurement



Sensor Specifications

Image type:	Color or Monochrome Scientific CCD (depending on camera model)
Dimensions:	12.5 mm x 10.0 mm (16mm diagonal)
Resolution:	2750 x 2200 (6.05 MP)
Pixel size:	4.54 µm x 4.54 µm
Single-pixel full well:	16,000 e- (24,000e- binned 2x2)
Peak QE:	75% @ 600 nm (measured using monochrome model)
Readout frequency:	20 MHz
Cooling:	0°C (stabilized)

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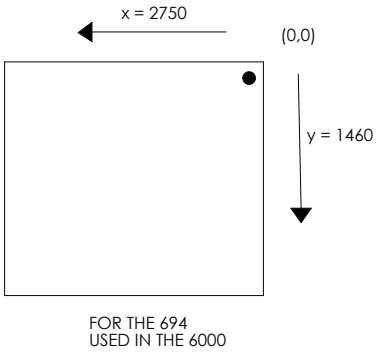
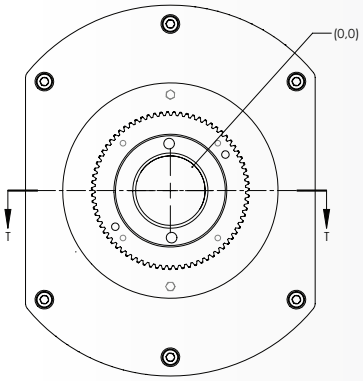
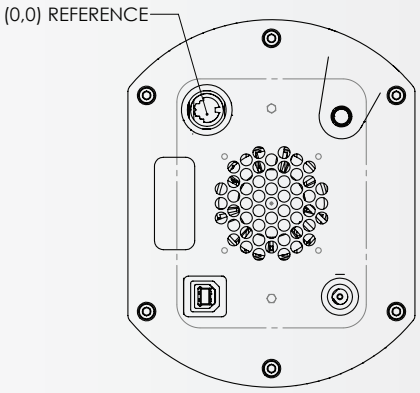
Sensor Orientation







When the Retiga 6000 is coupled to the side port of an **inverted** microscope with the flat surface of the camera parallel to the table, the CCD orientation will match the view seen through the eyepiece. This allows for easy access to the mounting holes to stabilize the camera while maintaining a consistent perspective between the captured images and what's seen down the eyepiece of the microscope.

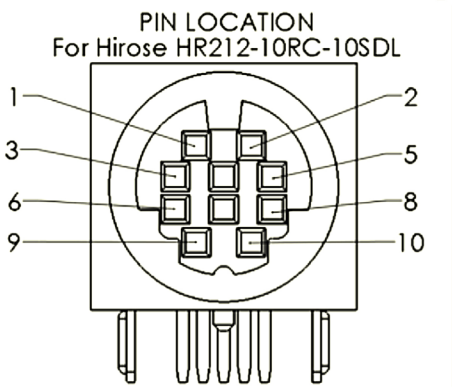
For the top port of **upright** microscopes and bottom ports to some inverted microscopes, the Retiga 6000 must be rotated 90° counter-clockwise to match the view seen through the eyepiece. This is due to the differences in the optical paths between inverted side ports and upright top ports.

I/O Connector Pinout

The I/O (Input/Output Status) connector provides information about trigger function, DAC, and TTL signals. Inputs must be at least 3.15 V for a high and less than 0.9 V for a low.

The numbers on the I/O connector diagram correspond to the numbers given to the definition of each of the pins.

The I/O trigger cable connects to Hirose connector HR212-10RC-10SDL(74) on the back of the camera. Below is a description of each of the trigger pins:



Pin #	Signal	Pin #	Signal
1	Trigger In	6	Trigger Ready Out
2	Expose Out	7	Spare Output
3	Read Out	8	Spare Input
4	Shutter Output	9	Power Ready
5	Spare Input	10	Ground

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Triggering signal behavior:

- **Trigger In** – the input trigger to the camera
- **Camera Expose** – represents when the camera is exposing/acquiring an image
- **Read Out** – represents the readout of the image
- **Shutter Output** – TTL output to control timing of an external shutter driver
- **Trigger Ready** – represents when the camera is ready to receive a trigger
- **Power Ready** – reflects power status for the camera (+5 V = on, 0 V = off)
- **Ground** – system digital ground

Types of triggering supported by the Retiga 6000:

- **Trigger-first mode** (Overlap/Non-Overlap)
- **Strobe mode** (Overlap/Non-Overlap)
- **Bulb Mode** (Non-Overlap)

Five shutter behavior modes are available:

- **Open Never** – Shutter is always closed.
- **Open Pre-Exposure** – Open before every exposure, closed when not exposing.
- **Open Pre-Sequence** – Open before start of sequence, closed at end of sequence.
- **Open Pre-Trigger** – Causes shutter to open before external trigger is received. In non-triggered mode, operates as "Open Pre-Exposure".
- **Open No Change** – Sends no signals to open or close the shutter.

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Appendix A

USB Information

USB 2.0 Chipset Incompatibility Notice

The USB 2.0 hardware used in the Retiga 6000 cameras is incompatible with new computers using native Intel USB 3.0 host controllers. A third party PCIe USB 3.0 card is required to resolve the problem.

Newer computers from leading manufacturers including Dell and HP predominately use Intel based internal hardware and chipset controllers for managing the different components of the PC. Nearly every computer now also includes the latest interface ports including USB 3.0 SuperSpeed. However, up until the Fall of 2013, while USB 3.0 interface ports were being introduced onto laptops and desktop computers, the internal drivers and host controllers were actually from companies outside of Intel including Renesas and Texas Instruments. With these computers, QImaging USB 2.0 based cameras, including the Retiga 6000, were tested and qualified to be fully functional.

However, starting in the Fall of 2013, Intel released a new version of their mother board chipsets (Series 7/C216, Series 8/C220 and later) with a native Intel based USB 3.0 host controller (USB3 extensible host controller, xHCI in the Device Manager). On these newer PCs, the Intel USB 3.0 host controller does not communicate properly with some traditional USB 2.0 chipsets to the extent where data is not properly delivered. This hardware incompatibility is unfortunately the cause of recently discovered bugs with the Retiga 6000 cameras and new Dell and HP computers. These problems manifest as black frames or failed frame deliveries when attempting to view live or capture images and is only seen on PCs that have USB 3.0 ports and native Intel host controllers.

If a PC or laptop has only USB 2.0 ports or USB 3.0 ports that use third party host controllers, the cameras will be fully functional. However, most new computers purchased in 2014 will likely have Intel based host controllers. To alleviate this problem, each Retiga 6000 camera now includes a StarTech 2 Port PCI Express SuperSpeed USB 3.0 Card Adapter. This card installs an independent Renesas host controller which allows the Retiga cameras to run properly even on newer desktop computers. As this workaround requires a separate USB 3.0 card, this solution is only viable for desktop computers and not laptops. For the immediate future, there is no solution for laptop computers which are therefore are not supported by these cameras.

QImaging is currently working with the engineering team at Intel to further investigate this issue and will continue to work towards a long term solution that will not require a third party USB card. For any further questions and assistance, please contact QImaging technical support.

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Determining if a USB port is on a Root Hub

As discussed above, if a PC or laptop has only USB 2.0 ports or USB 3.0 ports that use third party host controllers, the cameras will be fully functional and the supplied USB 3.0 card is not required. If you elect to use a native USB port rather than the supplied USB 3.0 card, please ensure that the port you use is on its own dedicated Root Hub with no other devices connected.

Each USB host controller on a PC or laptop has a Root Hub to which multiple physical ports are connected. Each port can have a device plugged in or another hub to allow connection of more devices. However, the Retiga 6000 camera should be the only device connected to a single USB Root Hub. If other devices are connected to the same Root Hub, then camera communication may fail, which can result in camera hanging or image tearing.

Since it is not always straightforward to tell which port on a PC is connected to which Root Hub, follow the procedure below to make sure that the camera is the only device connected to its particular Root Hub.

1. Open Device Manager (click the Start Button and type "Device Manager")
2. In the menu, click View -> Devices by Connection (Figure 1)
3. According to Figure 2, find the USB host controllers, expand them, and check whether your camera is the only device connected to the Root Hub.

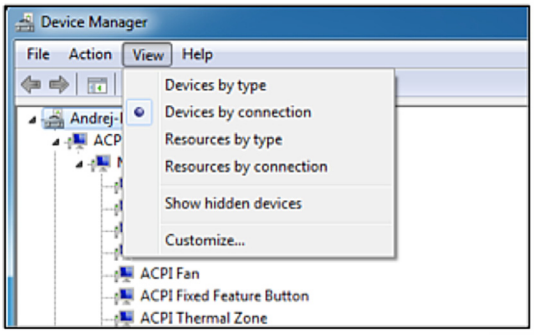

Figure 1. Devices by connection

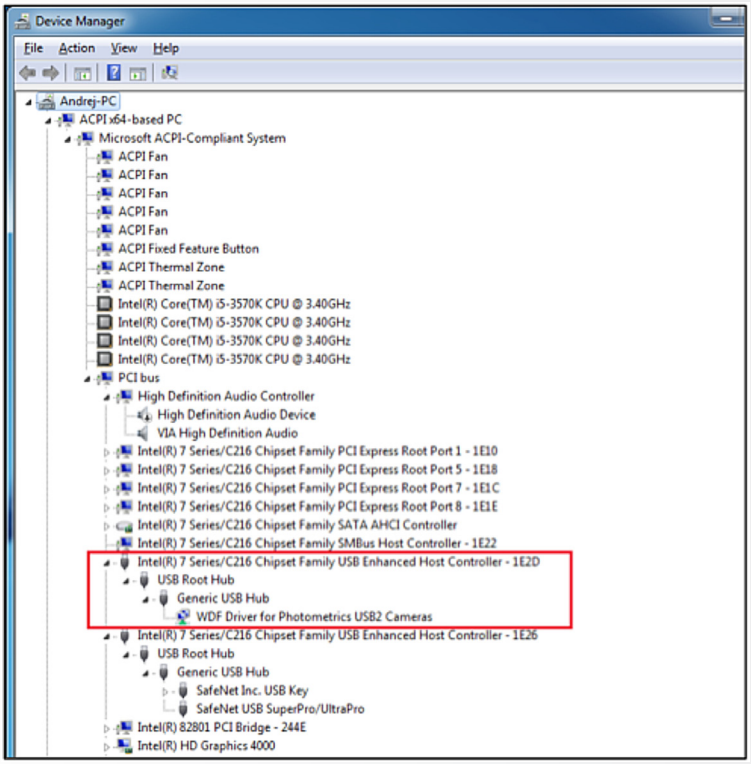

Figure 2. Photometrics USB2 camera is the only device on its USB Root Hub.

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If more devices are connected to the same USB Root Hub, please reconnect them to a different port for optimal camera performance or use the supplied USB 3.0 card. For any further questions and assistance, please contact QImaging technical support.

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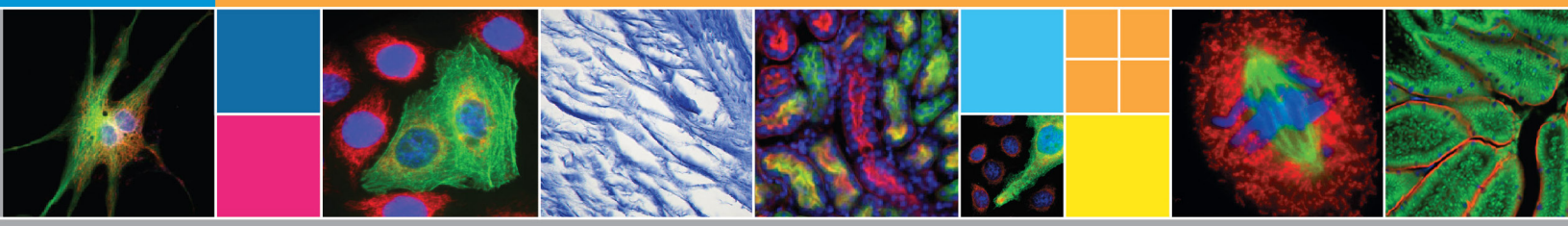

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