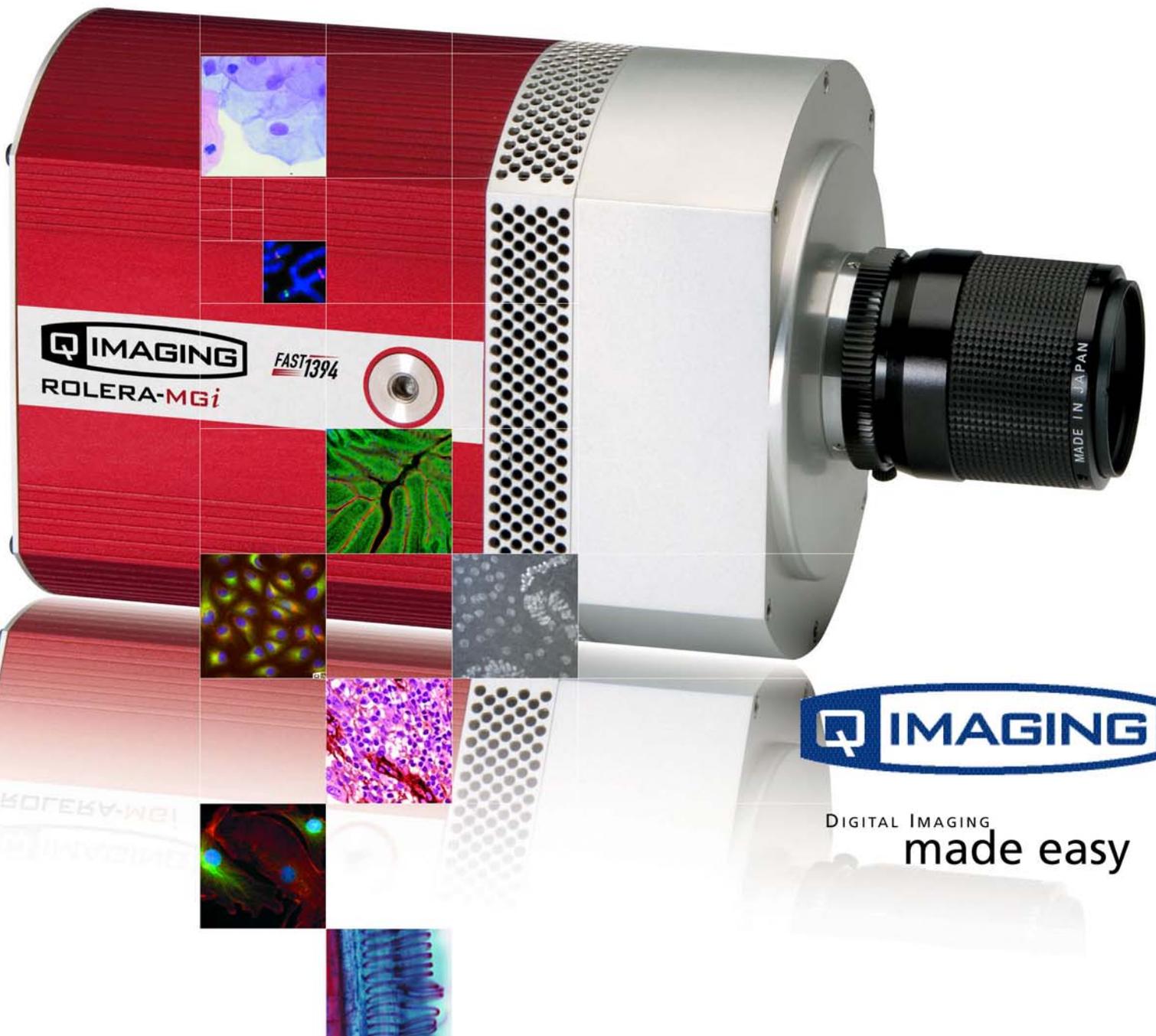


# User Manual

## ROLERA™-MG*i*

Monochrome Super High Sensitivity, Digital IEEE 1394 FireWire™ EMCCD Camera



DIGITAL IMAGING  
made easy

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# **Rolera-MGi User's Manual**

## **Applicability**

This document applies to the Rolera-MGi camera. For the latest updates, please visit [WWW.QIMAGING.COM](http://WWW.QIMAGING.COM).

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## **INTRODUCTION**

The QImaging Rolera-MGi camera is the first in a series to introduce the power of EMCCD technology with the simplicity of FireWire interface technology. EMCCD technology uses impact ionization to produce on-chip multiplication gain to levels above read noise. This increases sensitivity while maintaining high frame rates.

Features of the Rolera-MGi:

- Uses a 512x512 L3Vision Frame Transfer CCD from e2v Technologies
- 16um x 16um pixels
- Multiplication Readout and Standard Readout
- FireWire interface
- 14-bit readout

## **Power Requirements**

The Rolera-MGi is powered through the supplied power source.

Input Power:	100-240 V ~ 47-63 Hz
Current Input:	8.0 A
Voltage Output:	+12 VDC
Maximum Power Output:	96W

## **Host Requirements**

### **For Windows PCs:**

- Pentium® CPU, running at 1GHz.
- 256 MB RAM (512MB RAM preferred).
- Video card with 8 MB video memory capable of 32-bit color output.
- Windows 2000 or Windows XP Professional.
- If the PC is not equipped with a FireWire card, the included card must be installed.

## **IEEE 1394 (FireWire) Interface**

The Rolera-MGi can be powered and controlled through an IEEE 1394 (FireWire) digital interface. To realise the full benefits of the Rolera-MGi, a single FireWire connection from the camera to the computer combined with the external power connection will allow full control of the camera and rapid image data transfer from the camera to the computer.

## **Cables**

A FireWire interface cable is included with the camera. One end of this cable connects the available FireWire port at the back of the camera; the other end of the cable plugs into your computer's 6-pin FireWire port.

Some computers have 4-pin FireWire ports. These ports may be used if they are OHCI compliant, but you will need to purchase a 4-pin to 6-pin FireWire cable from your local computer store or a 4-pin to 6-pin adapter from QImaging. When connecting the Rolera-MGi to any FireWire port, you will need to use an external power supply.

### **What is the difference between 4-pin, 6-pin and 9-pin FireWire ports?**

FireWire cables are available in three varieties: 4-pin, 6-pin and 9-pin. 9-pin and 6-pin FireWire cables are capable of providing both power and a communication interface between the camera and computer while 4-pin cables provide only a communication interface. Some laptop computers have 6-pin FireWire jacks that do not provide power. If your computer has such a port, you will have to power your Rolera-MGi by attaching the included external power supply to the system.

## **Imaging Software for Your Camera**

### **Industry Standard Imaging Applications**

The Rolera-MGi works with industry-standard Windows imaging software. Please go to the following URL for an up to date listing of third party software companies that support QImaging cameras.  
[WWW.QIMAGING.COM/PARTNERS/](http://WWW.QIMAGING.COM/PARTNERS/)

### **QCapture Suite Software**

The Rolera-MGi operates only on Windows-based systems. QCapture Suite Software for Windows is available at [WWW.QIMAGING.COM](http://WWW.QIMAGING.COM). The easy-to-use QCapture software gives you complete control over the camera's settings and image capture functions. QCapture Suite also includes a TWAIN-compliant interface that allows many Windows image-editing applications to acquire images using QImaging cameras.

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# INSTALLATION

**IMPORTANT:** Follow these steps *in order* to complete the installation.

**DO NOT CONNECT** the camera until the camera driver is installed.

1. Windows PC users only: Install the IEEE 1394 PCI card - *only if necessary*.
2. Imaging Software - Install the software and drivers that your new QImaging camera needs to capture images.
3. Rolera-MGi - Connect the camera to your computer using the included IEEE 1394 cable.

**DO NOT CONNECT** the camera until you have a functioning FireWire port in your computer and the camera driver is installed.

## Step 1. Install the 1394 PCI card

### Check your computer for an existing FireWire port:

The Rolera-MGi connects to your Windows PC via a FireWire port. If you already have a FireWire port, you do not have to install the IEEE 1394 PCI card. Check the connectors at the back of your PC for a port that matches the FireWire port of the connection shown in Figure 1.

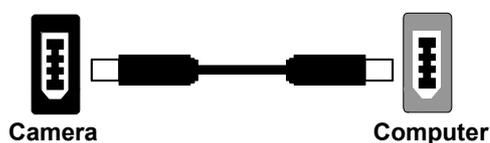


Figure 1 — 6-pin to 6-pin FireWire (IEEE 1394) Port connection

If your PC does not have a functioning FireWire port, you must install the IEEE 1394 PCI card that came with your camera.

If necessary, install the included IEEE 1394 PCI card:

- Shut down your computer.
- Open the case, and install the included IEEE 1394 card into an empty PCI slot. See the user's manual for your computer for complete instructions on installing new PCI cards.
- Restart your computer. Windows should automatically install the appropriate software drivers for the card.

## Step 2. Install Your Imaging Software

Once the IEEE 1394 card is installed in your computer, you are ready to install the FireWire drivers and imaging software. See your Imaging Software User's Guide for complete installation instructions.

## Step 3. Connect the Rolera-MGi

Once your imaging software is installed, connect your camera. For the Rolera-MGi, in order to operate the cooling, the camera must have the external power connected.

### Connecting the QImaging Camera

Perform the following for connecting your camera.

- Remove the FireWire cable from the camera box, and plug one end of the cable into the camera's FireWire socket.

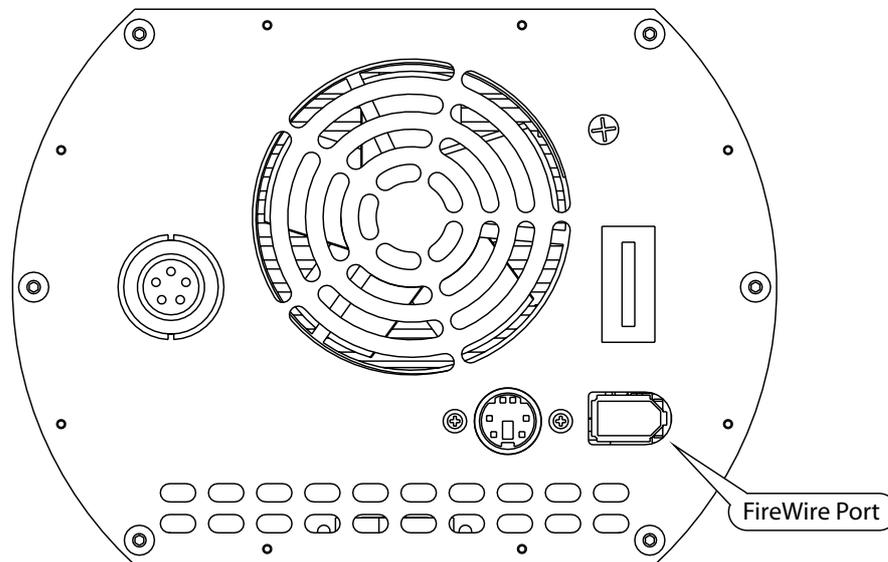
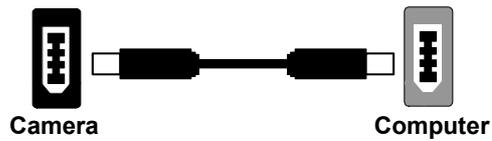


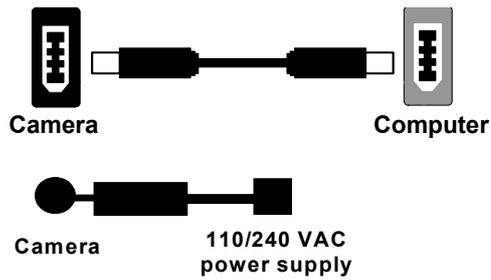
Figure 2 — Camera FireWire Socket

- Plug the other end of the cable into a FireWire port on your computer



**Figure 3 — Desktop Computer FireWire Connection**

- In order to obtain the cooling specification of the camera, the supplied external power adapter needs to be connected to the camera as shown in Figure 4 below.



**Figure 4 — FireWire and External Power Supply Connection**

- If you have a laptop computer, you can use the built in FireWire port or a PCMCIA card. However, should you connect to a laptop computer you will still be required to connect the supplied external power supply to the camera in order to power it (see Figure 4). Optional powering of the PCMCIA card will not be required in this configuration

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## CAMERA BASICS

The Rolera-MGi's image capture capabilities are controlled entirely by your imaging software. This chapter provides basic instructions for working with the camera itself.

### Turning the Camera On and Off

To turn the Rolera-MGi on, flip the power switch to the "I" position ensuring that you have the appropriate configuration of "Step 3" in the "Introduction" section. Refer to this step for all system configurations ensuring that the FireWire cable(s) are connected as specified.

To turn the Rolera-MGi off, flip the power switch to the "O" position.

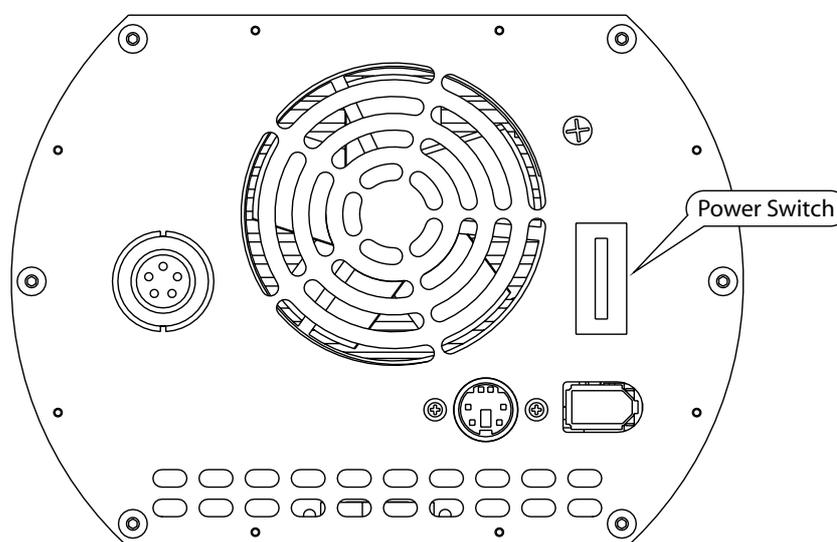


Figure 5 — Power Switch on the Rolera-MGi

### Connecting the Rolera-MGi to your Optics

The Rolera-MGi connects directly to widely available C-mount optics, which are standard on most microscopes and lenses.

#### To attach the camera to a microscope:

Carefully thread the camera onto the microscope's C-mount adapter, rotating the camera until it is mounted securely. Use the microscope controls to adjust focus.

### **To attach a C-mount lens to the camera:**

Carefully thread the C-mount lens onto the camera's lens ring, rotating the lens in a clockwise direction until it is mounted securely. Use the lens controls to adjust focus.

### **To attach an F-mount lens to the camera:**

Carefully thread the C-to-F mount adapter onto the camera's lens ring, rotating the lens in a clockwise direction until it is mounted securely. Carefully connect the F-Mount lens to the adapter, ensuring the correct position of the lens to the adapter by position the red dot on the lens to the red dot on the adapter. Use the lens controls to adjust focus.

## **Capturing Images with the Rolera-MGi**

Consult your imaging application's user's manual for more details.

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## ADVANCED CAMERA CONTROLS

The Rolera-MGi offers many advanced features. This section provides information on how to make the most of your QImaging camera.

### Cooling Capability

The Rolera-MGi offers the user the option of selecting the cooling temperature in one (1) degree increments. The maximum cooling of the Rolera-MGi is -25C.

### Triggering the Rolera-MGi Externally

Externally triggering the Rolera-MGi provides a sophisticated method of imaging and synchronizing your camera to external parts of your system, offering advanced capabilities. To use this feature effectively, it is important to understand the operation and configuration of your camera.

The External Trigger Port of the Rolera-MGi is a 6-pin mini-din connection on the back of the camera. The camera port accepts digital logic signals that are used to control the camera's integration. Refer to Appendix A for pinout and schematic diagram of the external trigger port.

In externally triggered modes of operation, the user inputs a pulse on the External Trigger Port that controls the camera's integration in one of two ways depending on the triggering mode.

#### Triggering Modes

When using External Triggering, there are two different types of triggering modes: Edge High and Pulse High. The Edge mode allows the camera to start integrating on the rising edge of the trigger pulse with the integration time controlled internally by the camera. Using this method allows you to externally trigger the camera as fast as possible, and allows you to take advantage of the simultaneous readout and exposure function.

Pulse Mode allows the user to control the integration period where the time is dictated by the duration of the pulse. The time the pulse is high is the time of the integration period.

#### Connecting External Sources to the Camera

Before you can begin to externally trigger your camera, you need to connect the necessary trigger signal source to the camera. To do this you need to ensure that you have a 6-pin miniature circular din cable and ensure that the pinouts are set correctly from your trigger source. Refer to Appendix A for further details on pin assignments and a diagram of the mini-din connector.

There are several ways that you can provide an external pulse to the camera, one of them being via the QImaging External Trigger Board, which is available through QImaging, and another common device is a function generator. To trigger the camera, you need to provide a 5V TTL pulse through the pin stated in Appendix A.

To ensure that you will use the external triggering mechanism correctly, it is important to ensure that the following questions have been answered when devising or architecting your system design:

- Has a system design been developed that incorporates the necessary elements such as:
  - a Timing Diagram,
  - Flow of Events (e.g. a simple state diagram),
  - necessary components (e.g. microscope, flash lamp, shutter etc),
  - a software solution for extracting and/or processing your images,
  - External Triggering source (e.g. QImaging Trigger board, function generator etc)
- Have you Determined the type of triggering mode you require for you application.
- Are you sure the settings in the camera have been set correctly. For instance, are your monitoring the SYNCB output and if so have you set the correct output mode for your system?

The above list should be used as a guide and should be consulted before contacting QImaging Technical Support.

Trigger Mode	Trigger Source	Exposure Control
Continuous	Internal to Camera	Internal to Camera
Edge Hi	External Trigger Port	Internal to Camera
Pulse Hi	External Trigger Port	Length of User Pulse
Software	QCAM API Trigger Event	Internal to Camera

**Table 1—Trigger Sources and Integration Modes**

## Gain and Offset Controls

Most users wish to operate the camera in a mode that maximizes dynamic range. The factory default electrical gain and offset are calibrated values that maximize the dynamic range. The electrical gain and offset can be controlled in software by the CCD Gain and Offset controls.

### On-Chip Multiplication Gain

The Rolera-MGi uses an EMCCD (Electron Multiplying CCD) which uses an electron bombardment technique to increase the charge of the pixels. This allows the visualisation of extremely photon starved cells. The slider in QCapture Suite allows the easy use of the EM gain. On the Rolera-MGi, this option can be turned on by EM Gain Port as the preferred readout port in your software.

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## CARING FOR YOUR CAMERA

The Rolera-MGi camera requires no regular maintenance except occasional external cleaning of the CCD window (the glass window between the camera sensor and the microscope or lens).

### To clean the CCD window:

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**CAUTION — The camera's CCD sensor, and circuits are sensitive to static discharge. Ensure you are using a static strap or are completely grounded at all times to release any static energy before you clean the CCD window.**

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- Use clean forced air (available at stores that sell cameras and computer cleaning supplies) to dust the CCD window.
- If the image still appears dirty, gently wipe the face of the CCD window with a small amount of optical grade isopropyl alcohol and lens paper.
- Apply forced air again to remove any loose particles.

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# TROUBLESHOOTING

## Resolving issues with the camera

### The camera does not power on

- Check all the cable connections.
- Flip the switch at the back of the camera.
- If your camera is still not responding, then your camera may not be receiving the required power. Ensure the supplied external power adapter is connected to the camera.

### Image occasionally goes bright on one side or stays dark on one side

Turn off the overhead lights in the room. Fluorescent lights may interact with the camera to create fluctuating image brightness.

### Hazy image or poor contrast

- If you are using the camera on a microscope, check the magnification of the microscope coupler. Consult your microscope manufacturer to find the type of coupler that works optimally with the Retiga-MGi camera's sensor.
- Point the camera at something in the far distance. Loosen the set-screw of the C-mount ring (there are three: one on the side and two on the top). Adjust the C-mount ring until the image is in focus. Then tighten the set-screw so that the C-mount ring does not move.
- This effect may also be caused by excessive infrared (IR) illumination. Verify that your camera or optical system is blocking the IR. Contact QImaging to order an IR filter.

### Images That Do Not Appear "Sharp"

If the image does not seem "sharp," check the format of the lens or the coupler being used on the microscope. Retiga-MGi is equivalent to the CCD sensor and requires the appropriate lens or coupler. An incorrect coupler on the microscope will not provide the correct field of view, and will reduce the light available to the sensor.

## **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 [WWW.QIMAGING.COM/SUPPORT/FAQ/](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 [WWW.QIMAGING.COM/SUPPORT/CONTACT/](http://WWW.QIMAGING.COM/SUPPORT/CONTACT/) and fill out a support form online with the details of your problem.
- E-mail [SUPPORT@QIMAGING.COM](mailto: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 +1-604-708-5061. Try to be in front of your computer when you call.

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# **GLOSSARY**

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## **Binning**

Binning is a method of increasing camera speed and sensitivity to boost low signals. Binning causes the acquired image to be brighter and smaller, but the resolution will be lower as a result. Because the image is smaller, the image transfer time is reduced significantly.

When you select a binning setting in your imaging software, the camera combines data from several pixels in the camera's CCD into a single super pixel. For example, a 2x2 bin means that 2 pixels in the horizontal direction and 2 pixels in the vertical direction are combined to form one super pixel.

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## **C-Mount**

A standard threaded lens mount used to attach a camera to a microscope, or a separate lens to a camera.

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## **CCD**

Charge Coupled Device (abbr.)

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## **CCD Gain**

The amount of analog signal amplification. The gain is factory-optimized for the camera's maximum dynamic range.

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## **Charge Coupled Device**

The light sensitive silicon chip near the optical interface of the camera that converts light intensities into electrical signals. These are typically made up of many pixel elements whose intensities are interpreted by imaging software to display an image on the screen.

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## **Dynamic Range**

The ratio of the saturation level of the CCD to the readout noise of the CCD camera system. Dynamic range is a measure of the ability of the camera to capture both bright and dark features in a single image. In general, the higher the camera's dynamic range, the more information per pixel it can capture.

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## **Exposure**

The amount of time that light reaches the image sensor.

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## **Field of View**

The area visible through the camera's optics.

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## **FireWire**

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See IEEE 1394.

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## **IEEE 1394**

High bandwidth (40 megabytes/second - 1394a; 80 megabytes/second - 1394b) interface for connecting digital imaging, storage, and other devices to host computers.

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## **Image Intensifier**

An electro-optical vacuum tube which intensifies or amplifies on low light level images.

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## **Integration**

The active collection of photons as done by an image sensor.

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## **Iris**

A diaphragm in the lens that opens or closes to set the aperture (the amount of light that passes through the lens to the CCD).

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## **ms**

millisecond (abbr.); unit of measure for exposure time.

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## **ns**

nanosecond (abbr.); unit of measure for exposure time.

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## **Offset**

The offset value adjusts the CCD blacklevel relative to the analog-to-digital converter zero. It is factory-optimized for the camera's maximum dynamic range.

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## **Pixel**

The smallest spatial element of a digital image.

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## **s**

second (abbr.); unit of measure for exposure time.

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## **us**

microsecond (abbr.); unit of measure for exposure time.

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## APPENDICES

### APPENDIX A: External Trigger Port

The external trigger port at the rear of the camera is a 6-pin miniature circular DIN receptacle (AMP 749265-1). The mating connector is a Singatron Enterprises part number 62000-6P, available from Digikey ([www.digikey.com](http://www.digikey.com))

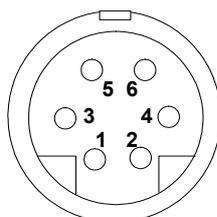


Figure 6 — External Trigger Port Connector

The pinout for the connector is as follows

Pin Number	Signal Name	Signal Source	Description
2	Trigger (input)	User	Active Low Trigger Input
3	SYNC-A (output)	Camera	Indicates CCD Read-out
5	SYNC-B (output)	Camera	Exposure
6	Ground	User	Connected to Camera Ground

Table 2—Pin-out of the External Trigger Port Connector

#### Input Signals

In order to use the External Trigger Port correctly and ensure external triggering operation for your camera, you need to supply an input signal to begin triggering the camera through Pin 2 and it should be a 5V TTL pulse.

#### Output Signals

There are two output signals provided on the Retiga-MGi, SYNC A and SYNC B.

**SYNCA:** This signal indicates the readout time of the camera and this signal is active high. A user could monitor this signal as a means of knowing when to trigger the next frame.

**SYNCB:** This signal will indicate the exposure pulse of the camera. This signal is active high and may be used to synchronize an external shuttering device.

## Signal Timing

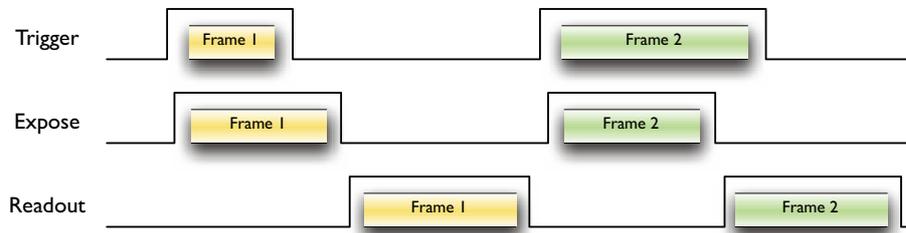


Figure 7 — External Trigger Signal Timing

- The integration time corresponds to the length of time that the CCD has been programmed to be exposed to the image.
- The readout time corresponds to the time required to readout the CCD.

## APPENDIX B: Clearing Modes

### Pre-frame Clearing

In Pre-frame Clearing mode, the CCD is cleared before exposing for the desired length of time. CCD data is then immediately shifted to the frame-transfer section which is followed by a readout. The cycle begins again with another clearing of the CCD

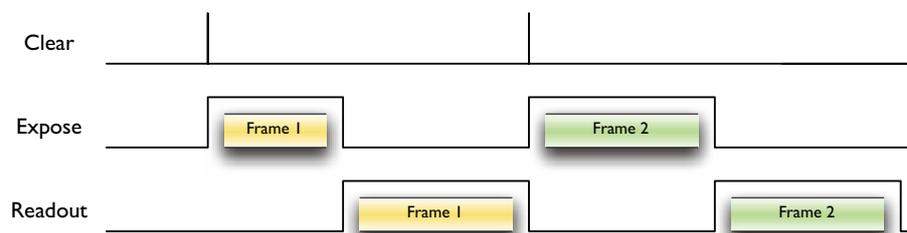


Figure 8 — Timing Diagram for Pre-frame Clearing

## Non-Clearing

The Non-Clearing mode is particularly beneficial in situations where high frame rates are desired. This is a result of allowing the CCD to expose during readout, thus significantly reducing the amount of time between frames. It is important to note that the effective minimum exposure time in this mode will be the readout time.

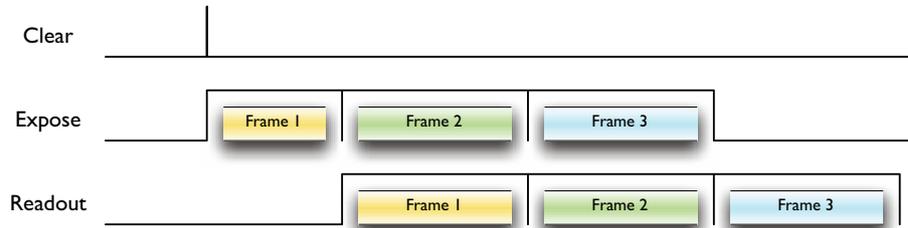


Figure 9 — Timing Diagram for Non-Clearing Mode (exposure equal to readout)

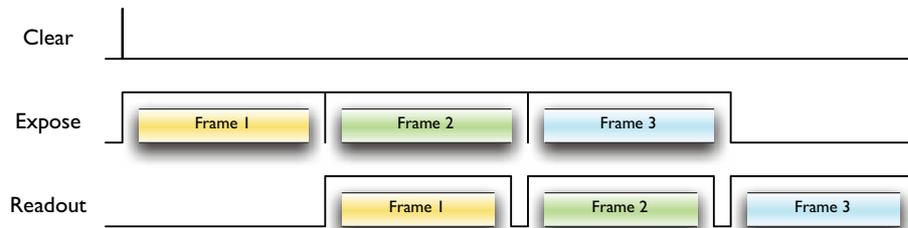


Figure 10 — Timing Diagram for Non-Clearing Mode (exposure longer than readout)