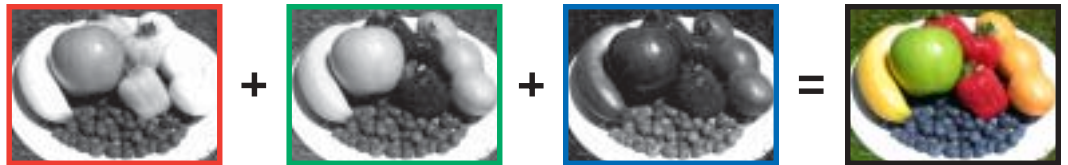
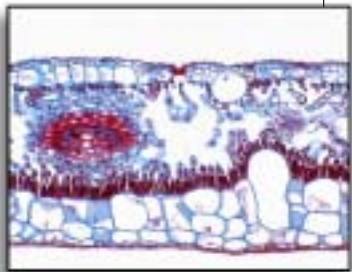
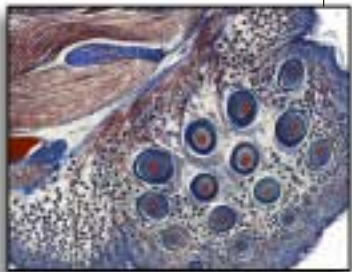




# HIGH-RESOLUTION COLOR FROM YOUR MONOCHROME CAMERA

**Micro\*Color™ & Macro\*Color™** tunable RGB filters for digital imaging



**Maximize resolution and color rendition for:**

- Brightfield and fluorescence microscopy
- Pathology
- Historical document imaging
- Machine vision

## Next-generation Micro\*Color C-mount microscope coupler

- Brighter
- Sharper
- Better
- Slide the RGB filter in or out
- Uses standard C-mount port



Benefits of using the new Micro\*Color 2 coupler, a 0.65X microscope coupler with a built-in liquid crystal RGB filter:

- Simply pull a lever to switch between **B&W or COLOR**
- **Twice the brightness** of a normal 1X microscope coupler at the image plane
- **Twice the field-of-view** of a normal 1X microscope coupler, which means that more of what is visible through the eyepieces can be captured on the CCD
- **Uses standard C-mount hardware** to fit all microscopes equipped with standard C-mount camera ports
- Utilizes **apochromatic optics**, which means that the red, green, and blue images formed are relayed to the CCD without color-based changes in sharpness

## MICRO\*COLOR™ & MACRO\*COLOR™ TUNABLE RGB FILTERS

TRUE COLOR WHEN YOU NEED IT—Turn your monochrome CCD camera into a high-resolution color imaging system using CRI's Micro\*Color or Macro\*Color liquid crystal tunable RGB filters.

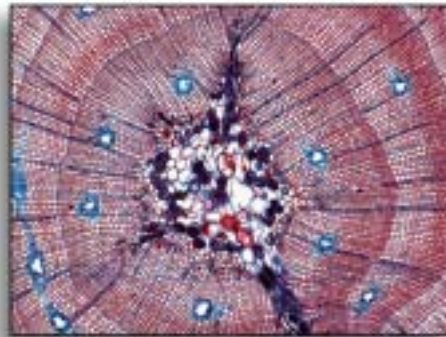
CRI's tunable RGB filters utilize liquid crystal technology to switch rapidly between the red, green, and blue color states. Each color state is carefully designed to transmit, as closely as possible, wavelength ranges that match the individual color sensitivity curves of the human eye. The red, green, and blue color states can be selected by computer control in any order, and the exposure time for each color can be varied to provide an accurate white balance.

Three grayscale images are acquired in quick succession as the filter automatically changes color states. The images are combined into a single high-quality RGB image. The whole vibration-free process occurs within milliseconds and uses no beamsplitters, filter wheels, or any moving parts.

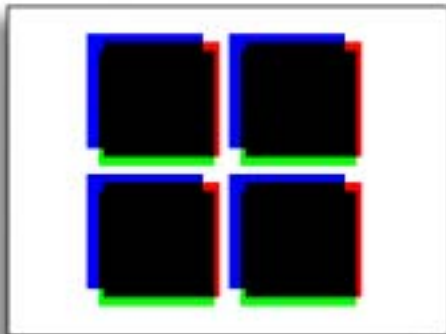
The Micro\*Color filter is designed for use on microscopes with C-mount camera ports and comes built into a slider mechanism in a 0.65X microscope coupler. The C-mount equipped coupler simply screws onto standard C-mount fixtures between your microscope and your digital camera. No other adapters are necessary.

The Macro\*Color filter is designed to accommodate the wide variety of cameras and lens adapters used in standard or macro digital photography, and features a large, 35 mm active area.

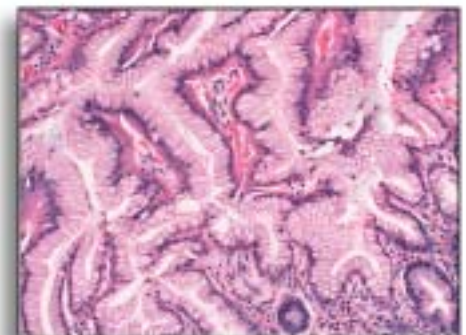
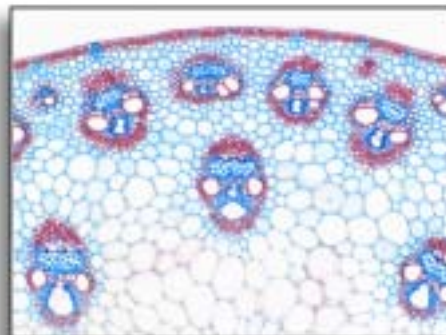
Both the Micro\*Color and Macro\*Color filters are operated using computer control via a separate compact electronics controller box that accepts simple commands from either a serial (COM) port, parallel (LPT) port, or a TTL/Sync source.



## SOLID-STATE: NO MOVING PARTS AND NO VIBRATION



Filter wheel vibration during image capture can cause misregistration of colors. Solid-state CRI filters prevent this from happening.



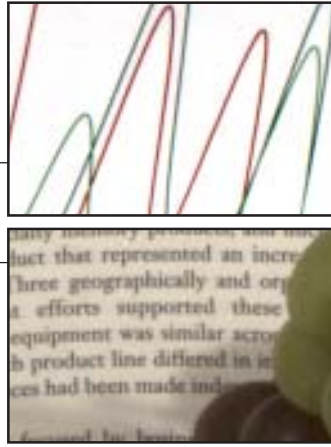
### FEATURES AND BENEFITS

- High-resolution color images from a monochrome CCD camera when you want them
- Better spatial resolution and color accuracy than conventional "painted-pixel" CCD cameras
- Lower cost than triple-CCD cameras and no pixel misregistration issues
- Solid-state liquid crystal technology with no moving parts, no vibration, and no noise

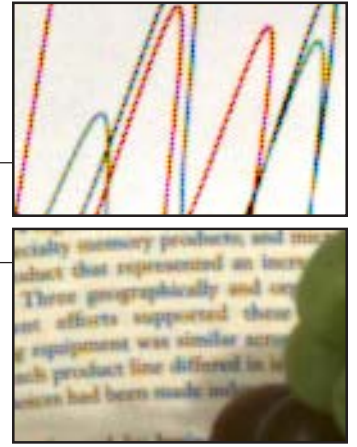
Detailed scene imaged using two camera configurations under the same conditions



Macro\*Color filter with 1.4 megapixel monochrome camera



Conventional 1.4 megapixel "painted-pixel" color camera



## EXTRAORDINARY COLOR AND OUTSTANDING RESOLUTION

The closer you look, the more you'll notice that not only are images taken with the Micro\*Color and Macro\*Color filters exceptionally accurate in color rendition, but they also contain detail not reproducible using conventional color cameras. CRI's Micro\*Color and Macro\*Color filters enable you to exploit the full potential of your high-resolution monochrome camera for both color and black & white images.

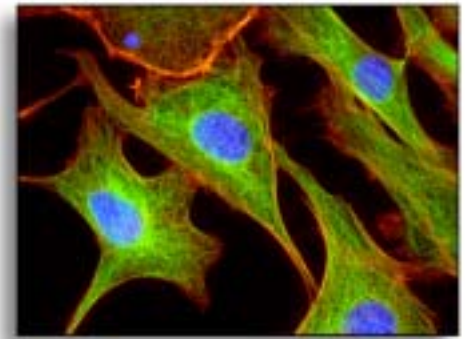
Micro\*Color and Macro\*Color filters also contain Color Shaping Glass (CSG), which corrects for the spectral response of most CCD cameras to improve color balance and dynamic range. The CSG also acts as a blocker of unwanted near-infrared (NIR) light.

### MICRO\*COLOR APPLICATIONS

- Brightfield microscopy
- Fluorescence microscopy
- Pathology

### MACRO\*COLOR APPLICATIONS

- High-resolution film scanning
- Historical document imaging
- Machine vision



The Micro\*Color coupler allows you to slide the liquid crystal out of the light path when needed for low light level fluorescence.

## COMPATIBLE WITH MANY CAMERAS AND THIRD-PARTY SOFTWARE PACKAGES

### Why is a tunable RGB filter better than conventional color cameras?

Most digital color cameras utilize a single "painted-pixel" image sensor, in which the individual pixels are coated with either a red, green, or blue dye. Since individual pixels only receive light of a single color, software interpolation routines are necessary to estimate the actual color present in each pixel using information from surrounding pixels. This process introduces artifacts that can negatively affect color fidelity and the resolution of fine detail.

Triple-CCD cameras use a three-way beamsplitter and three image sensors, but are expensive, bulky, and susceptible to misalignment.

CRI's tunable filter technology uses every pixel of a monochrome image sensor to capture information from all three red, green, and blue color states in rapid succession. Depending on the bit-depth of the individual grayscale images, merging the three color planes together will create true 24-, 36-, or even 48-bit color images. No interpolation routines are needed for getting accurate color, pixel-by-pixel, and the image possesses maximum sharpness.

Thus, compromises in color fidelity, resolution, and cost (for triple-CCD designs) are not necessary.

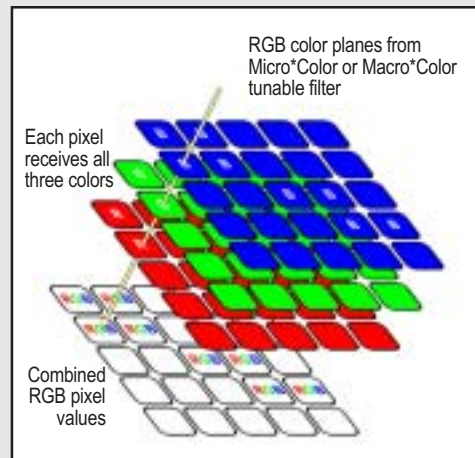


Figure 1. The Micro\*Color and Macro\*Color filters allow you to take three images: one each in the red, green, and blue color states. Every pixel contains uninterpolated, full-color information in the final merged image.

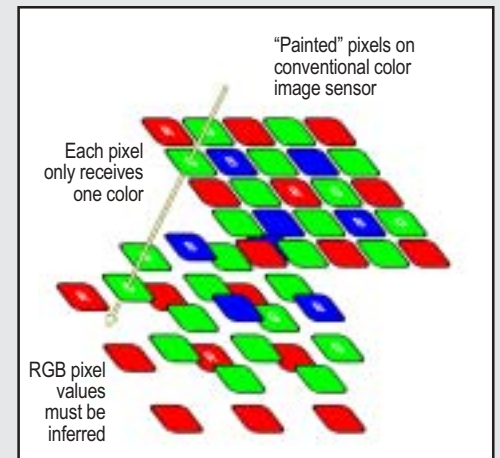


Figure 2. Many conventional color cameras use a pattern of "painted" pixels to produce a color image. Since each pixel can only sample one color from the scene, software interpolation is necessary to infer the values of the other two colors from adjacent pixels. The result is compromised color and spatial fidelity.

## SPECIFICATIONS

LC filter aperture	20 mm (Micro*Color models) 35 mm (Macro*Color)
Computer interface <sup>1</sup>	Serial (COM), Parallel (LPT), or TTL/Sync
Color States	Red, green, and blue (RGB)
Field-of-view	+/- 20-degrees off-axis
Wavelength range	Approx. 400 nm to 700 nm
Switching time	See Figure 3, below.
Maximum optical throughput	500 mW/cm <sup>2</sup>
Power for electronics box	110/220 VAC, 50/60 Hz
Operating temperature	10° to 40° C
Storage temperature	-15° to 55° C
Demo CRI Capture software <sup>2</sup>	Windows 98/2000/XP compatible

<sup>1</sup> Cables and adapters are included for use with PC-compatible ports, as well as Macintosh-compatible serial ports.

<sup>2</sup> Third-party software packages are available with CRI-compatible drivers for image capture, display, and analysis. See your authorized CRI distributor, or visit [www.cri-inc.com](http://www.cri-inc.com) for more information.

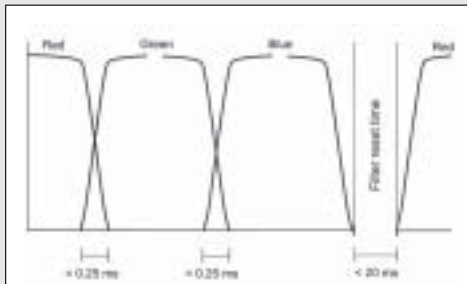


Figure 3. The switching speed of the Micro\*Color and Macro\*Color RGB tunable filter as it is cycled through the red, green, and blue color states, and then back to the red state.

Note that the filter can remain in any color for any desired exposure time.

## COMPATIBLE SOFTWARE

Any program capable of controlling devices such as microscope stages or filter wheels using serial (COM) or parallel (LPT) signals can easily control the Micro\*Color and Macro\*Color filters.

Many popular third-party image processing and analysis programs have plug-ins or extensions written to drive the Micro\*Color or Macro\*Color filters. These include the following, who have implemented image capture procedures utilizing the RGB filter and compatible cameras:

AIS™ (Image Research, Inc.)  
AnalySIS® (Soft Imaging System)  
AQM (Kinetic Imaging, Ltd.)  
Image™ (QED Imaging, Inc.)  
ImagePro® Plus (Media Cybernetics®)  
IPLab (Scanalytics, Inc.)  
MCID™ Elite (Imaging Research, Inc.)  
Metamorph® (Universal Imaging Corp.™)  
Openlab (Improvision®)  
Quantim (Zedec Technologies)  
SimplePCI (Compix, Inc.)

## COMPATIBLE CAMERAS

Micro\*Color and Macro\*Color filters are compatible with a growing number of scientific and industrial cameras such as those manufactured by:

Apogee Instruments, Inc.  
The Cooke Corporation  
Eastman Kodak  
Hamamatsu Corporation  
QImaging  
Red Lake MASD, Inc.  
Roper Scientific, Inc.



## CRI – INSTRUMENTS

Founded in 1985, Cambridge Research & Instrumentation, Inc. (CRI) is a photonics company and the leading provider of liquid crystal based imaging technology.

Our Instrument Division (CRI – Instruments) offers a broad array of tunable solid-state optical components and modules for use in wavelength selection, polarization optics, and light modulation in digital imaging applications.

We also develop and manufacture high-performance instruments and systems that exploit multispectral and polarized-light imaging and detection for pharmaceutical drug discovery, life science and clinical research, and industrial process control.

CRI services a global network of distributors and partners through direct sales of systems and strategic alliances as an OEM supplier.

For more information contact  
our Sales team at

E-mail: [sales@cri-inc.com](mailto:sales@cri-inc.com)

TOLL-FREE (USA): 1.800.383.7924

DIRECT (Worldwide): +1.781.935.9099

CRI, INC. 35-B CABOT ROAD WOBURN, MA 01801

[WWW.CRI-INC.COM](http://WWW.CRI-INC.COM)

All trademarks mentioned in this publication are the properties of their respective owners. Micro\*Color and Macro\*Color are trademarks of CRI, Inc.



Your local CRI agent or distributor is: