

# ORCA Digital Cameras



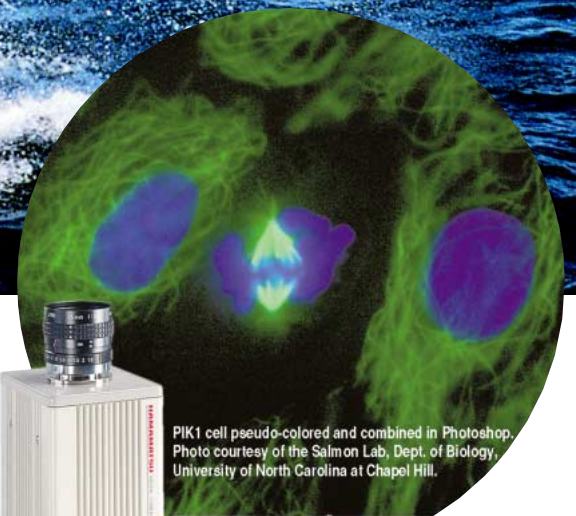
The ORCA Series offers high-speed scanning, a high dynamic range, a high signal-to-noise ratio, and high resolution, all at one time....all in one camera.

As if that weren't enough, you can count on features like software and frame grabber compatibilities, no mechanical shutter, a progressive scan interline CCD, and application flexibility including GFP. Add it all up and you'll see....it's a whale of a deal.

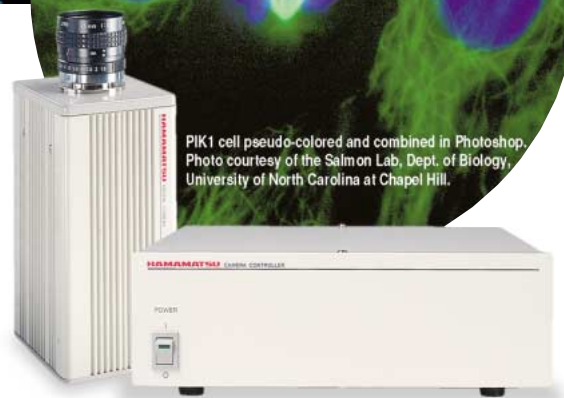
Like everything in nature, species evolve.

So naturally, ORCA is now available in a 12-bit version as well as B/W and Color configurations offering total flexibility to meet all your application needs.

Hamamatsu's ORCA Digital Cameras. They deliver all the features you're looking for....without swallowing up your budget.



PIK1 cell pseudo-colored and combined in Photoshop. Photo courtesy of the Salmon Lab, Dept. of Biology, University of North Carolina at Chapel Hill.



## HAMAMATSU

# High Resolution Digital B/W CCD Cameras

## ORCA

High Sensitivity

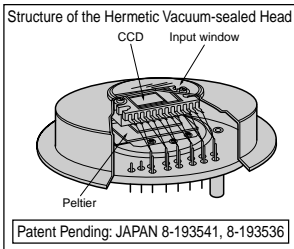


## ORCA II

Ultra High Sensitivity

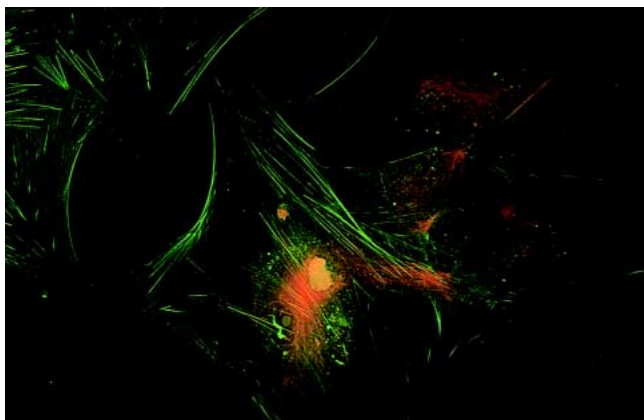


The ORCA and ORCA II are High Resolution Digital B/W CCD Cameras using a progressive scan interline CCD chip with no mechanical shutter. In addition to a high resolution of 1.3 million pixels, a wide dynamic range and a high sensitivity, these cameras serve a wide application range, down to low-light level imaging. Peltier cooling drastically reduces dark noise and minimizes thermal drift which makes this camera an ideal choice for demanding scientific and industrial applications. RS422A digital output ensures compatibility with a large number of commercially available frame grabber boards. In addition, a standard C-mount lens coupling makes it easy to connect to optical microscopes and lenses. ORCA II employs a hermetic vacuum-sealed head which can be cooled to  $-50^{\circ}\text{C}$  and guarantees maintenance-free operation.



## APPLICATIONS

- Routine Fluorescence Microscopy
- Green Fluorescent Protein applications
- DNA and Ploidy analysis
- Fluorescence In Situ Hybridization studies
- Red and Near Infrared Fluorescent applications
- Motility and Motion analysis
- Combined DIC/Phase and Fluorescence
- Histology, Pathology and Cytology
- Metallurgical Microscopy
- Failure analysis
- Semiconductor inspection
- X-ray Scintillator readout

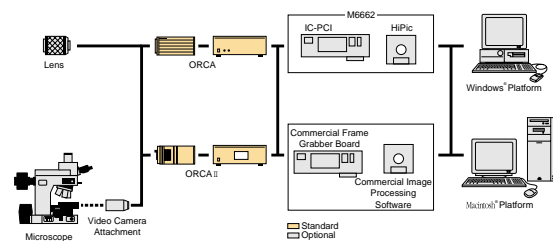


▲ Immunofluorescence image of mouse fibroblasts (multi stained), fluorescence filters for FITC and Rhodamine emission. Pseudo color of multiple B/W images.

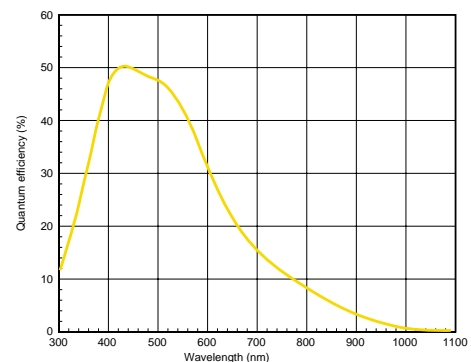
## FEATURES

- High resolution of 1.3 million pixels
- Full remote control from PC
- Progressive scan interline CCD chip with no mechanical shutter
- Low readout noise
- Binning function for improved sensitivity
- Low dark noise with peltier cooling
- UV option (down to 193 nm)
- Hermetic vacuum sealed Head (ORCA II)

## SYSTEM CONFIGURATION



## SPECTRAL RESPONSE CHARACTERISTICS



\* This is typical, not guaranteed.

## SPECIFICATIONS

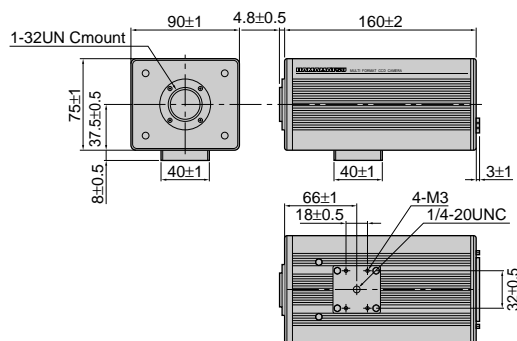
Model	ORCA		ORCA II	
			High-speed readout	High-precision readout
Imaging device	Progressive scan interline CCD			
Effective no. of pixels	1280 (H) × 1024 (V) or 1024 (H) × 1024 (V)		1280 (H) × 1024 (V)	
Cell size	6.7 μm × 6.7 μm (square format)			
Effective area	8.58 mm × 6.86 mm / 2/3-inch format			
Pixel clock rate	14.75M Hz/pixel		10.00M Hz/pixel	1.25M Hz/pixel
Frame rate	9 Hz		5.3 Hz	0.8 Hz
2 × 2 binning	18 Hz		10.1 Hz	1.6 Hz
4 × 4 binning	32 Hz		17.8 Hz	3.0 Hz
8 × 8 binning	53 Hz (option)		28.8 Hz	5.2 Hz
Readout noise (r.m.s.)	8 to 12 electrons		10 electrons	3 to 5 electrons
Full well capacity	13000 electrons		16000 electrons	
binning			40000 electrons	
Dynamic range*	1300:1		1800:1	
binning			6000:1 10000:1	
Cooling method	Peltier cooling, air radiation system			
Cooling temperature	+5 °C		-40 °C to -50 °C	
Dark current	1 electron/pixel/sec		0.001 electron/pixel/sec	
A/D converter	12 bit		12 bit	12 bit or 14 bit
Output signal (digital output)	RS-422A 10/12-bit parallel output		RS-422A 12 bit parallel output	RS-422A 12/14-bit parallel output
Exposure time	130 μsec to 10 sec		20 msec to 1 hour	
External control	RS-232C (full remote for all camera functions)			
Sub array	—		yes	
External trigger	yes		yes	
Contrast enhancement	1 to 10 times		1 to 6 times	1, 3, 6 times
Power consumption	70 VA		Approx. 220 VA	
Ambient storage temperature	-10 to +50 °C			
Ambient operating temperature	0 to +40 °C			
Ambient operating/storage humidity	70% max. (no condensation)			

\* Calculated from the ratio of the maximum saturation charge and average readout noise.

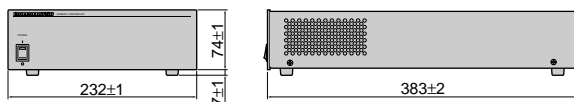
## DIMENSIONAL OUTLINES (Unit: mm)

### ORCA

- Camera head (approx. 1.3 kg)

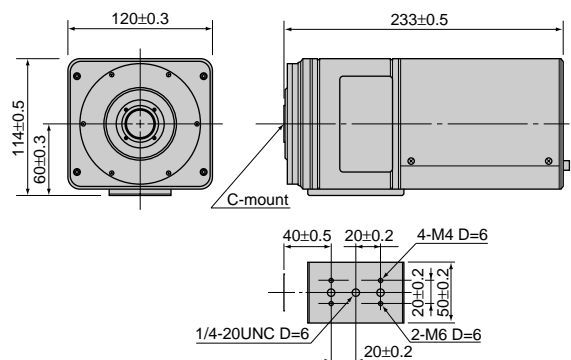


- Camera controller (approx. 6.3 kg)

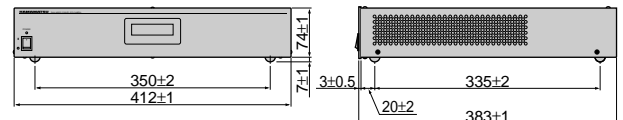


### ORCA II

- Camera head (approx. 2.5 kg)



- Camera controller (approx. 8.5 kg)

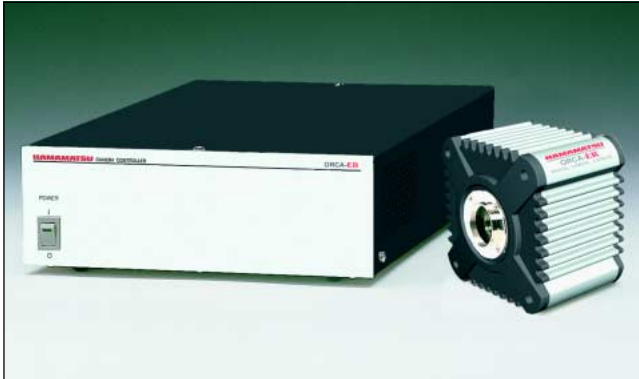




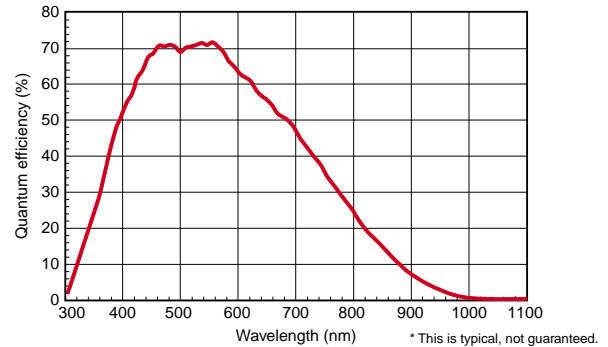
# High Resolution Digital B/W CCD Camera

ORCA-ER

For NIR Observation



## SPECTRAL RESPONSE CHARACTERISTICS

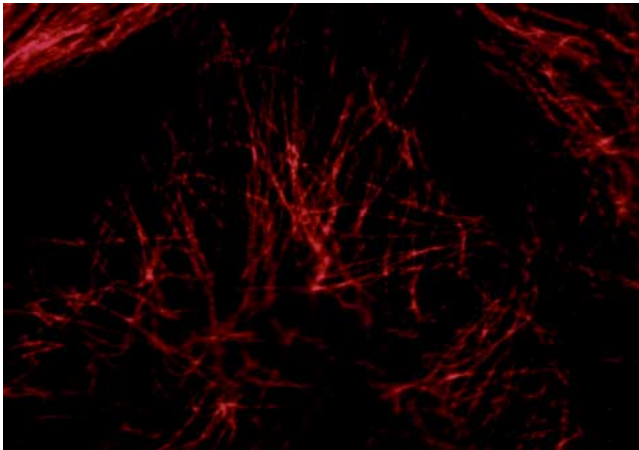


The ORCA-ER is a next-generation B/W CCD digital camera using an advanced progressive scan interline CCD chip with high sensitivity in VIS-NIR region offering substantially better noise characteristics at high frame rates. The Peltier cooled hermetic vacuum-sealed head can be cooled to  $-20^{\circ}\text{C}$ , reducing dark noise and minimizing thermal drift which makes this camera an ideal choice for demanding scientific and industrial applications.

RS422A digital output ensures compatibility with a large number of commercially available frame grabber boards. In addition, a standard C-mount lens coupling makes it easy to connect to optical microscopes and lenses. Fast electronic shuttering, fast readout and low noise integration all combine to make this camera a great choice for both high and low level imaging applications.

## APPLICATIONS

- Routine Fluorescence Microscopy
- Green Fluorescent Protein applications
- DNA and Ploidy analysis
- Fluorescence In Situ Hybridization studies
- Red and Near Infrared Fluorescent applications

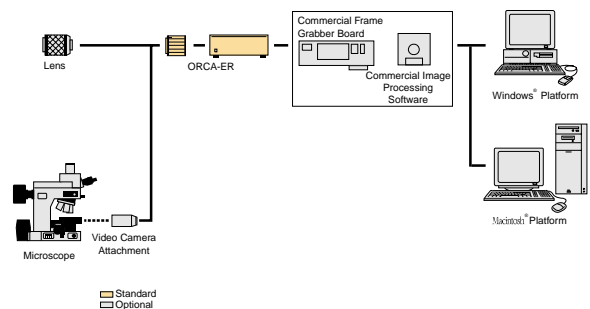


▲ Newt lung epithelial cells labelled with 1.5 mg/ml x-rhodamine tubulin.  
(Image taken with a 1.2 second exposure and a 60x Plan ADo, NAB 1.4 lens.)  
\*\* 1 to 5 fluorophores per speckle.

## FEATURES

- High sensitivity in VIS-NIR region
- Hermetic vacuum sealed head
- Low dark noise with peltier cooling
- High resolution of 1.37 million pixels
- Progressive scan interline CCD chip with no mechanical shutter
- Low readout noise
- Binning function for improved sensitivity
- Full remote control from PC

## SYSTEM CONFIGURATION



- Motility and Motion analysis
- Combined DIC/Phase and Fluorescence
- Histology, Pathology and Cytology
- Metallurgical Microscopy
- Failure analysis
- Semiconductor inspection
- X-ray Scintillator readout

## SPECIFICATIONS

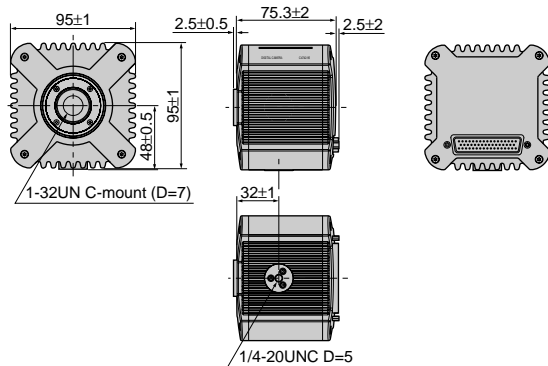
Imaging device	Progressive scan interline CCD with micro-lens
Effective no. of pixels	1344 (H) × 1024 (V)
Cell size	6.45 μm × 6.45 μm (square format)
Effective area	8.67 mm 6.60 mm ( 2/3-inch format)
Pixel clock rate	14.75 MHz/pixel
Frame rate	8.3 Hz
2 × 2 binning	16. Hz
4 × 4 binning	28 Hz
8 × 8 binning	45 Hz
Readout noise (r.m.s.)	8 electrons
Full well capacity	18000 electrons
Dynamic range*	2250:1
Cooling method	Peltier cooling with hermetic vacuum sealing
Cooling temperature	- 20 °C at 20 °C ambient temperature
Dark current	0.1 electron/pixel/sec
A/D converter	12 bit
Output signal (digital output)	RS-422A 12-bit parallel output
External control	RS-232C (full remote for all camera functions)
Sub array**	yes
External trigger	yes
Contrast enhancement	Analog Gain (10 times max.) and Offset functions
Power consumption	70 VA
Ambient storage temperature	-10 to +50 °C
Ambient operating temperature	0 to +40 °C
Ambient operating/storage humidity	70% max. (no condensation)

\* Calculated from the ratio of the maximum saturation charge and average readout noise.

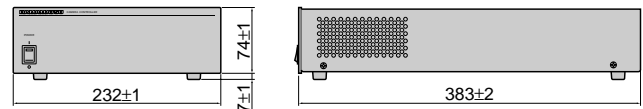
\*\* Note: Includes 1280 × 1024 image size software compatibility with ORCA and ORCA II series.

## DIMENSIONAL OUTLINES (Unit: mm)

- Camera head (approx. 1.3 kg)



- Camera controller (approx. 6.3 kg)



# Single Chip High Resolution Digital CCD Color Camera

## ORCA<sub>III</sub>m

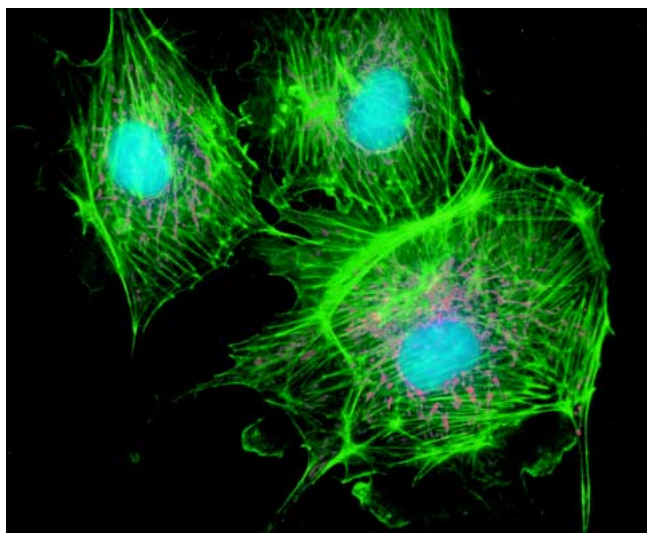


The ORCA<sub>III</sub>m is a newly developed High Resolution Digital Color Camera employing a progressive scan interline CCD chip with matrix filters. In addition to its high resolution of 1.3 million pixels, a 12-bit output, wide dynamic range and high sensitivity, the camera offers high-quality color images for various scientific applications.

One-stage electric thermal cooler cools the CCD sensor to 5 °C and the dark current of the CCD is drastically reduced to 1 electron/pixel/sec. As a result, the camera works with 9 Hz for high-light imaging and can detect the low-light image with a long exposure.

## APPLICATIONS

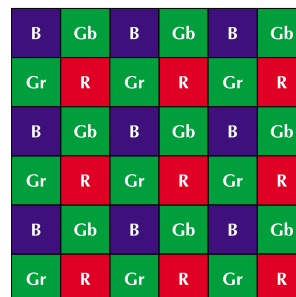
- Fluorescence In Situ Hybridization studies
- Histology, Pathology and Cytology
- Metallurgical Microscopy
- Failure analysis
- Semiconductor inspection
- Textile inspection
- Print monitoring



▲ Cell of the pulmonary artery blood vessel

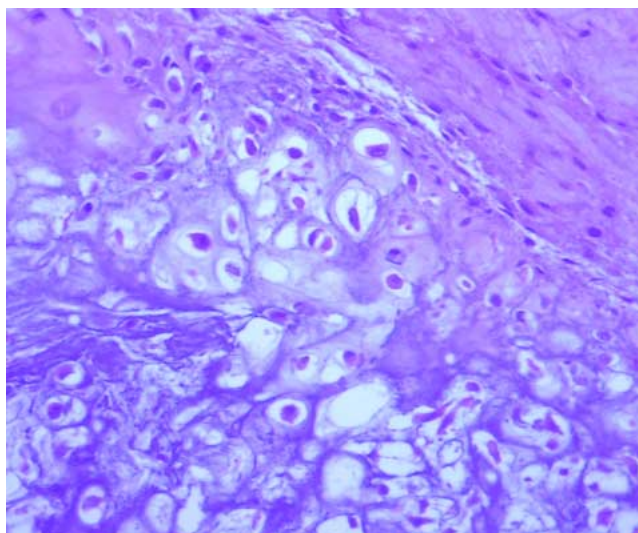
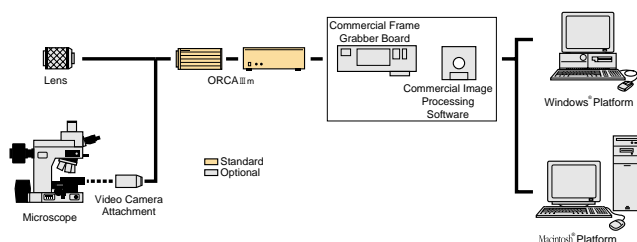
## FEATURES

- **High resolution of 1.3 million pixels**  
1280 (H) × 1024 (V) pixel format single chip color CCD
- **Color filter**  
RGB matrix filter is applied to each pixel.



- **Integration time**  
130 μs to 10 sec
- **Frame rate**  
Full pixel readout of 9 Hz
- **Binning**  
With 2 × 2 binning, it is possible to get a virtual B/W readout with 18 Hz.

## SYSTEM CONFIGURATION



▲ Pathological Image of Histological section from a well differentiated chondrosarcoma (Image courtesy of Dr. Bjørn Risberg, Department of Pathology, The Norwegian Radium Hospital).

## SPECIFICATIONS

Imaging device	Progressive scan interline CCD
Effective no. of pixels	1280 (H) × 1024 (V) or 1024 (H) × 1024 (V)
Cell size	6.7 μm × 6.7 μm (square format)
Effective area	8.58 mm × 6.86 mm / 2/3-inch format
Frame rate	9 Hz
Read out noise	13 electrons r.m.s. typ.
Full well capacity	13000 electrons
Dynamic range*	Better than 1000:1
A/D converter	12 bit
Cooling method	Peltier cooling, air radiation system
Lens mount	Camera head: C mount
Color filter	Matrix filter
Contrast enhancement	1 to 10 times
Exposure time	130 μs to 10 sec
Binning scan	With 2 × 2 binning, it is possible to get a virtual B/W readout with 18 Hz.
Output signal (digital output)	RS-422A 10/12 bit parallel output
External control	RS-232C (full remote for all camera functions)
Line voltage	100/117/220/240 VAC 50/60 Hz
Power consumption	70 VA
Ambient storage temperature	-10 to +50 °C
Ambient operating temperature	0 to +40 °C
Ambient operating/storage humidity	70% max. (no condensation)

\* Calculated from the ratio of the maximum saturation charge and average readout noise.

## COLOR DETECTION PRINCIPLES

- Matrix filter system

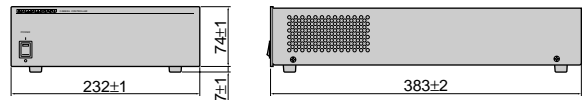
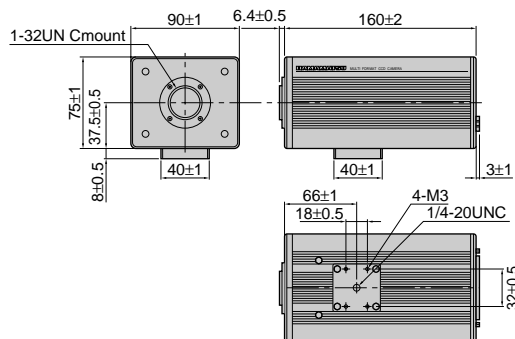
A camera with a matrix filter system has a special CCD built in, where each pixel is covered with either a red, green or blue color separation filter. Four pixels arranged in a square correspond to one full color set. The filter matrix is arranged in a regular pattern similar to conventional 1-chip CCD cameras. This arrangement allows consistent high spatial resolution and good color matching. With digital image processing, a color image can be formed and the RGB color distribution can be calculated. The resolution of this camera is slightly superior to conventional 3-chip color cameras which operate with standard video resolution.

The camera allows control of exposure time from 130 μs to 10 s. This covers an intensity range from bright field down to weak fluorescence signals.

## DIMENSIONAL OUTLINES (Unit: mm)

- Camera head (approx. 1.3 kg)

- Camera controller (approx. 6.3 kg)

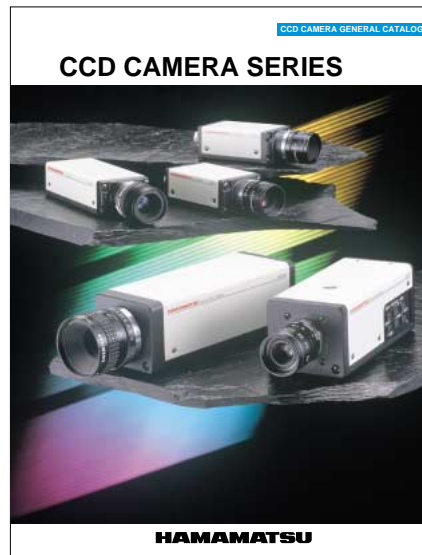


# OTHER CAMERAS AVAILABLE FROM HAMAMATSU

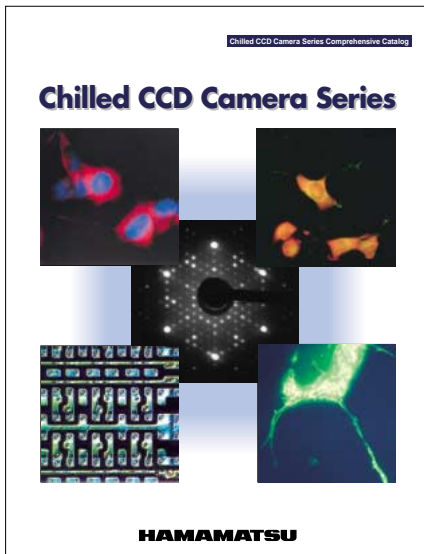
## Digital CCD Camera Series



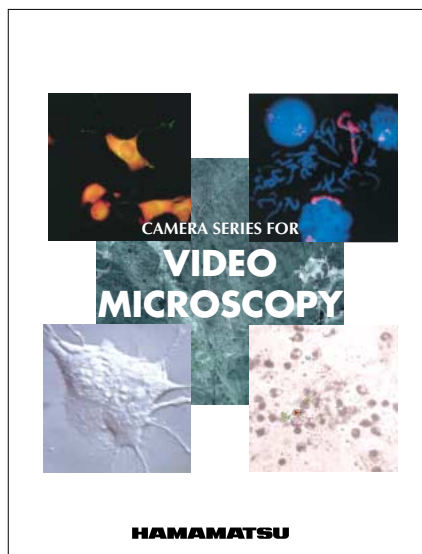
## CCD Camera Series



## Chilled CCD Camera Series



## Camera Series for Videomicroscopy



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