SUMIX
corporation

Megapixel USB2.0 CMOS

CAMERA

Data Sheet

SMX-M8xx Series USB2.0 Cameras

Contents

Introduction

The **SMX-M8xx series** are megapixel CMOS cameras with USB2.0 interface designed for capturing, streaming and storing high quality digital images in scientific and industrial applications.

The SMX-M8xx Series Cameras are available in three modifications:

- **SMX-M81M** camera has a monochrome 1/2 inch 1.3 megapixel CMOS sensor and features high sensitivity, low power consumption, frame rate of 15 fps (24 MHz) at the full (1280 x 1024) resolution and small size

- **SMX-M82C** camera has a color 1/2 inch 2 megapixel CMOS sensor and features low power consumption, frame rate of 10 fps (24 MHz) at the full (1600 x 1200) resolution and small size

- **SMX-M83C** camera has a color 1/2 inch 3 megapixel CMOS sensor and features low power consumption, frame rate of 6 fps (24 MHz) at the full (2048 x 1536) resolution and small size

Rolling shutter and Snapshot mode are available with the SMX-M8xx Series cameras.

Capturing of initial live streaming video images and still images is provided across a USB 2.0 digital interface - no additional frame grabber is needed.

The cameras are provided with Software package, all needed drivers and API library allowing quick integration of camera functions into user's applications.

Key Features

All **SMX-M8xx** cameras feature:

- USB2.0 interface
- Low power consumption: 0.45 - 0.8 W
- Low image noise
- Plug and play
- C/CS-Mount
- No external power supply required
- Small size
- Video and snapshot operations
- Selectable pixel data: 8 bit or 10 bit
- DirectShow compatible
- TWAIN compatible
- Complete SDK

Specifications

Table 1-1 *Cameras specification*

Output video and camera control characteristics

	SMX-M81M	SMX-M82C	SMX-M83C
Maximum resolutions of output window	1280 x 1024, full resolution mode	1600 x 1200, full resolution mode	2048 x 1536, full resolution mode
Frame rate at resolution (48MHz)*	15 fps at 1280 x 1024 24 fps at 1024 x 768 37 fps at 800 x 600 40 fps at 768 x 576 54.7 fps at 640 x 480 89.5 fps at 400 x 400 166 fps at 320 x 240	10 fps at 1600 x 1200 14 fps at 1280 x 1024 22.7 fps at 1024 x 768 34.6 fps at 800 x 600 37 fps at 768 x 576 50 fps at 640 x 480 79.6 fps at 400 x 400 145 fps at 320 x 240	6 fps at 2048 x 1536 10 fps at 1600 x 1200 13.9 fps at 1280 x 1024 21.9 fps at 1024 x 768 33 fps at 800 x 600 35.7 fps at 768 x 576 48 fps at 640 x 480 75 fps at 400 x 400 138.5 fps at 320 x 240
Output bits per pixel	Selectable, 8 bits or 10 bits	Selectable, 8 bits or 10 bits	Selectable, 8 bits or 10 bits
Lookup table	Software, converts 10 bits of imaging chip's ADC to 8 bits of output for user selected 8 bits mode	Software, converts 10 bits of imaging chip's ADC to 8 bits of output for user selected 8 bits mode	Software, converts 10 bits of imaging chip's ADC to 8 bits of output for user selected 8 bits mode
Pixel rates	12 MHz, 24 MHz	12 MHz, 24 MHz	12 MHz, 24 MHz
Exposure range (at highest resolution), ms	min: 0.06 (at 24 MHz) max: more than 2 sec (with fps decrease)	min: 0.07 (at 24 MHz) max: more than 2.5 sec (with fps decrease)	min: 0.09 (at 24 MHz) max: more than 200 sec (with fps decrease)
Pixel gain control	Programmable (Hardware): 48 gain levels from 1 to 15	Programmable (Hardware): 48 gain levels from 1 to 15 Gain controls for R, G, B: 48 gain levels from 1 to 15	Programmable (Hardware):161 gain levels from 1 to 128 Gain controls for R, G, B: 161 gain levels from 1 to 128

Table 1-1 *Cameras specification*

Output window modes	View port (from 1280 x 1024 to 8 x 8 with 2 pixels/ 2 lines step positioning) Frame Decimation (1:1, 1:2, 1:4, 1:8) Horizontal mirroring, hardware Vertical flipping, hardware	View port (from 1600 x 1200 to 8 x 8 with 2 pixels/ 2 lines step positioning) Frame Decimation (1:1, 1:2, 1:4, 1:8) Horizontal mirroring, hardware Vertical flipping, hardware	View port (from 2048 x 1536 to 8 x 8 with 2 pixels/ 2 lines step positioning) Frame Decimation 1:1, 1:2, 1:3, 1:4, 1:5, 1:6, 1:7, 1:8 Frame Binning: 1:1, 1:2, 1:3, 1:4 Horizontal mirroring, hardware Vertical flipping, hardware
Gamma, brightness and contrast control	Programmable with lookup table, software gamma correction	Programmable with lookup table, software gamma correction	Programmable with lookup table, software gamma correction

* Listed frame rate values at the defined resolutions are not the maximal possible. Increasing of frame rate can be done by reducing of the current Exposure value (the lower Exposure the higher frame rate), hiding of the active video window from the display, running the camera with a fast speed computer, etc.

Imaging chip characteristics

Type	Monochrome 1/2 inch 1.3 megapixel CMOS sensor manufactured by Micron Technology, Inc	Color 1/2 inch 2 megapixel CMOS sensor manufactured by Micron Technology, Inc	Color 1/2 inch 3 megapixel CMOS sensor manufactured by Micron Technology, Inc
Pixel size	5.2 μm x 5.2 μm	4.2 μm x 4.2 μm	3.2 μm x 3.2 μm
Image array size	8.4 mm diagonal	8.4 mm diagonal	8.4 mm diagonal
Shutter	Rolling	Rolling	Rolling (Optional Global Reset)
Scanning mode	Progressive	Progressive	Progressive
ADC resolution	10 bit	10 bit	10 bit
Sensitivity	2.1 V/lux-sec	1.2 V/lux-sec (550nm)	>1.0 V/lux-sec (550nm)
Dynamic Range	68.2dB	>61dB	61dB

Camera electrical characteristics

Supply voltage	5 V supplied by USB2.0 interface	5 V supplied by USB2.0 interface	5 V supplied by USB2.0 interface
Supply current	90 - 160 mA	90 - 160 mA	90 - 160 mA
Power consumption	0.45 - 0.8 W	0.45 - 0.8 W	0.45 - 0.8 W

Camera interface characteristics

Table 1-1 *Cameras specification*

Interface Type	USB2.0, 480 Mbps	USB2.0, 480 Mbps	USB2.0, 480 Mbps
Connector Type	USB mini-B, 5 pin	USB mini-B, 5 pin	USB mini-B, 5 pin
System requirements			
Operating System	Windows XP SP1+/2003/Vista/2008/7 recommended: Windows 7 or XP 1+	Windows XP SP1+/2003/Vista/2008/7 recommended: Windows 7 or XP 1+	Windows XP SP1+/2003/Vista/2008/7 recommended: Windows 7 or XP 1+
Processor	Intel P4 or higher recommended: Intel Core 2 Duo	Intel P4 or higher recommended: Intel Core 2 Duo	Intel P4 or higher recommended: Intel Core 2 Duo
RAM	256 MB for XP (512 MB for 2008/Vista) recommended: 512 MB (1024 MB for W7)	256 MB for XP (512 MB for 2008/Vista) recommended: 512 MB (1024 MB for W7)	256 MB for XP (512 MB for 2008/Vista) recommended: 512 MB (1024 MB for W7)
Performance	minimum: 300 Mflops recommended: 400 Mflops or higher	minimum: 300 Mflops recommended: 400 Mflops or higher	minimum: 300 Mflops recommended: 400 Mflops or higher
Hard Disk Space	About 15 MB for installation plus additional space for captured images	About 15 MB for installation plus additional space for captured images	About 15 MB for installation plus additional space for captured images
Video	8 MB memory, recommended GeForce 4xxx/Radeon 9xxx or higher	8 MB memory, recommended GeForce 4xxx/Radeon 9xxx or higher	8 MB memory, recommended GeForce 4xxx/Radeon 9xxx or higher
Hardware Interface	USB 2.0 Host Controller: recommended Intel integrated Host Controller (VIA-based USB Controller not recommended) USB 3.0 Host Controller is also supported at least one USB 2.0 port for connection	USB 2.0 Host Controller: recommended Intel integrated Host Controller (VIA-based USB Controller not recommended) USB 3.0 Host Controller is also supported at least one USB 2.0 port for connection	USB 2.0 Host Controller: recommended Intel integrated Host Controller (VIA-based USB Controller not recommended) USB 3.0 Host Controller is also supported at least one USB 2.0 port for connection
Camera physical characteristics			
Operating temperature	0 to +60℃	0 to +60℃	0 to +60℃
Lens mount type	C/CS-mount	C/CS-mount	C/CS-mount
Weight (without lens)	55 g	55 g	55 g
Dimensions (L x D)	50.7 x 36 mm	50.7 x 36 mm	50.7 x 36 mm

Table 1-1 *Cameras specification*

Camera housing material	Duralumin	Duralumin	Duralumin

Camera Mechanicals

SMX-M8xx cameras case drawing: C-mount

Using C-mount adapter with an IR-cut filter:
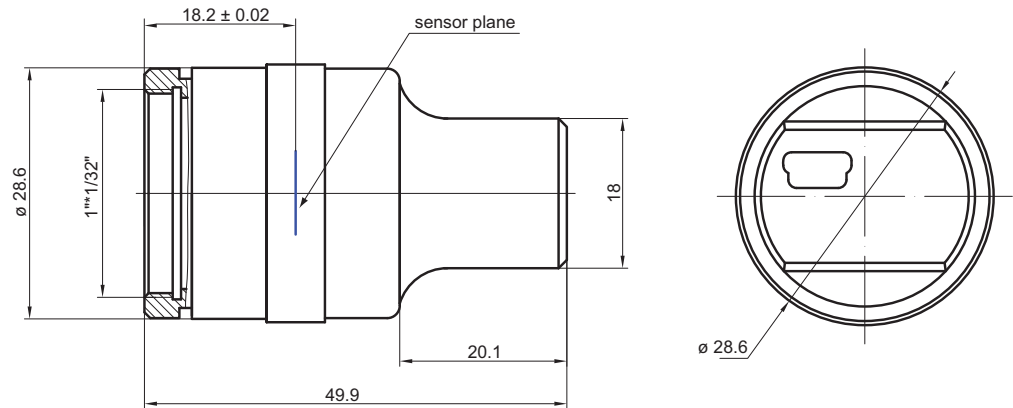

Figure 1-1 *The SMX-M8xx Camera case drawing with the C-mount Adapter and IR-cut filter*
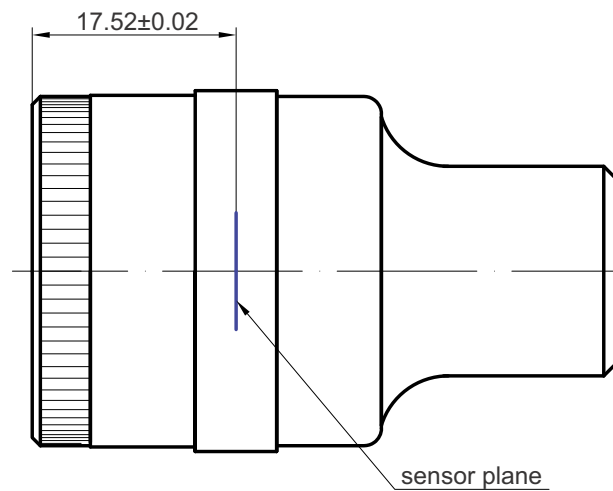
Using C-mount adapter:

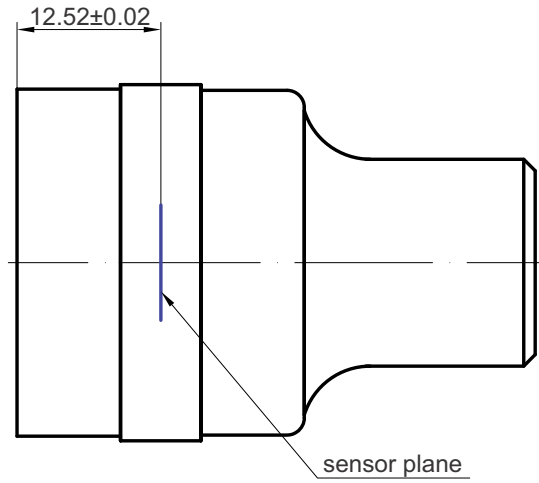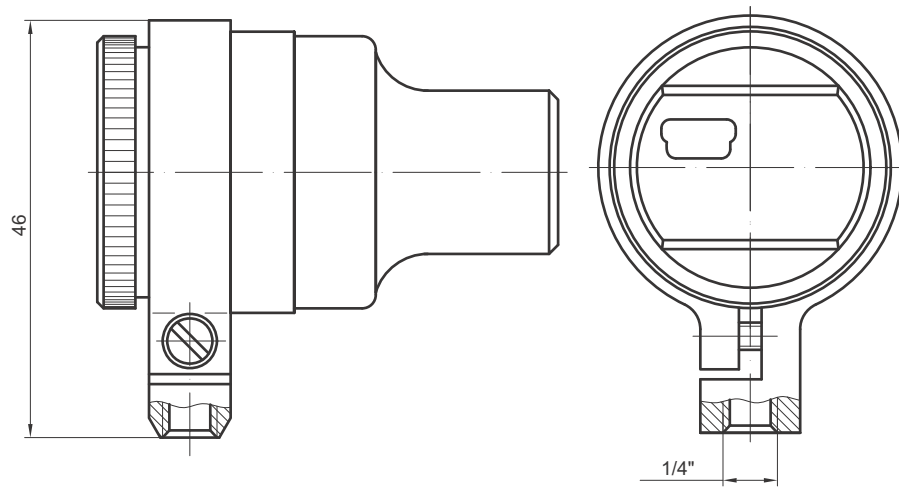**Figure 1-2** *The SMX-M8xx Camera case drawing with the C-mount Adapter*

SMX-M8xx cameras case drawing: CS-mount

12.52±0.02

sensor plane

Figure 1-3 *The SMX-M8xx cameras case drawing, CS-mount*

SMX-M8xx cameras case drawing with the Tripod Adapter:

46

1/4"

Figure 1-4 *SMX-M8xx cameras case drawing with the Tripod Adapter*

Figure 1-5 *SMX-M8xx camera outlook*

General Sensor Characteristics

All Micron® CMOS image sensors feature Digital-Clarity - a low-noise CMOS imaging technology that achieves CCD image quality (based on signal-to-noise ratio and low-light sensitivity) while maintaining the inherent size, cost, and integration advantages of CMOS.

It incorporates sophisticated camera functions on-chip such as windowing, column and row skip mode.

The sensor is operated in its default mode and programmed for frame size, exposure, gain setting and other parameters.

An on-chip analog-to-digital converter (ADC) provides 10 bits per pixel.

SMX-M81M Camera

The SMX-M81M camera uses the Micron® Imaging MT9M001 which is an SXGA-format with a 1/2-inch CMOS active-pixel digital image sensor. The active imaging pixel array is of 1,280 H x 1,024 V.

The sensor is operated for frame size, exposure, gain setting, and other parameters.

The default mode outputs an SXGA-size image at 30 frames per second (fps).

Quantum efficiency

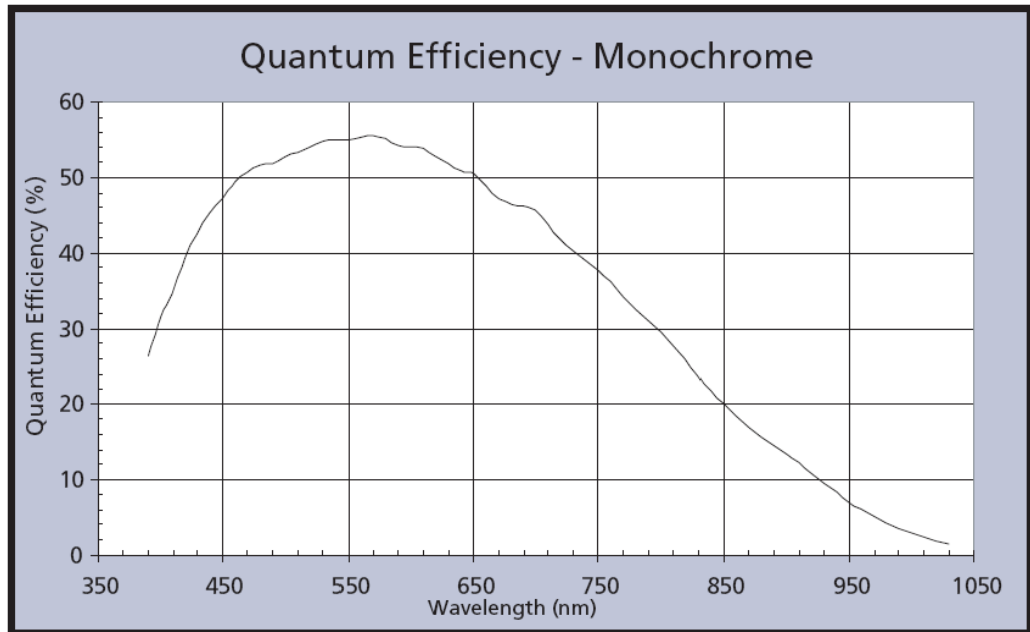The Quantum efficiency is described in .

Figure 1-6 *Quantum efficiency - monochrome*

SMX-M82C Camera

The SMX-M82C camera uses a Micron® Imaging MT9D001 which is a UXGA-1/2-inch format CMOS active-pixel digital image sensor. The active imaging pixel array is 1,600 H x 1,200 V.

The default mode outputs a UXGA-size image at 20 frames per second (fps).

SMX-M83C Camera

The SMX-M83C camera uses a Micron® Imaging MT9T001 which is a QXGA-format with a 1/2-inch CMOS active-pixel digital image sensor. The active imaging pixel array is 2,048 H x 1,536 V. The default mode outputs a QXGA image at 12 frames per second (fps).

SMX-M8xx Software Package

The SMX-M8xx cameras usually go with its software package that contains a Standard Application, Drivers, User Guide and SDK (API, examples, documentation).

Standard Application provides control of various set-up commands demonstrating cameras performance.

API allows a full control of all camera features and along with examples and documentation enable easy integration of the camera into the customers' own applications.
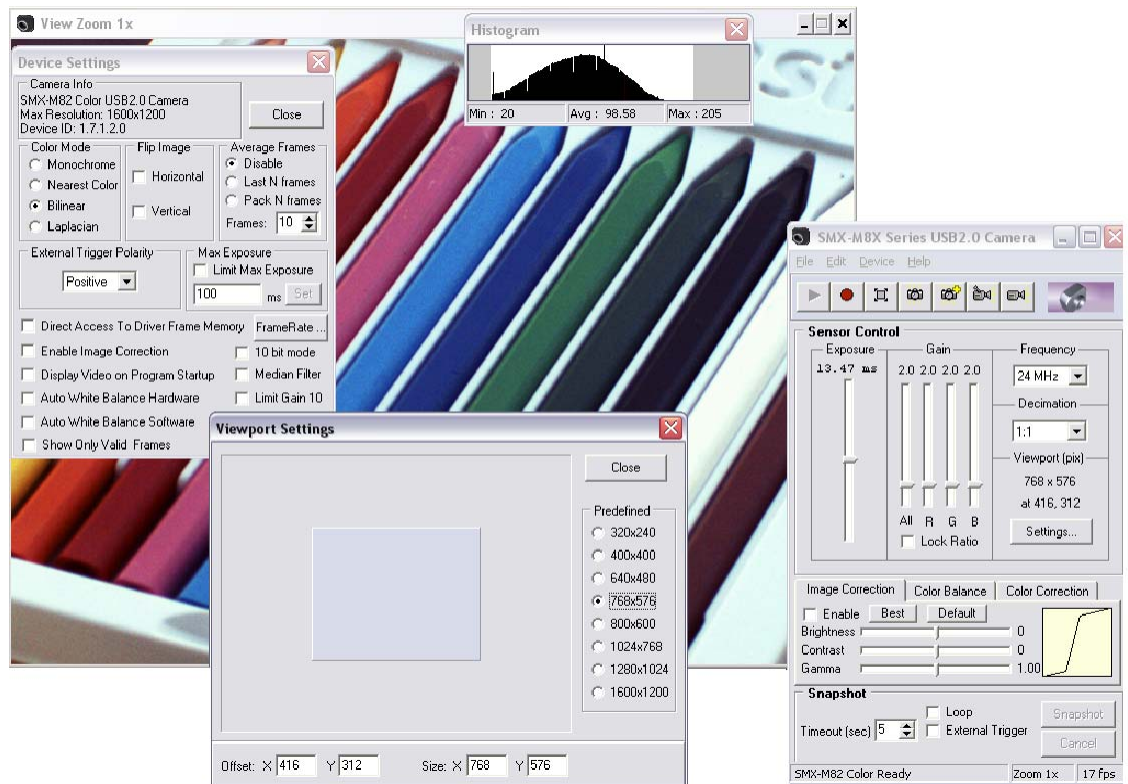
Figure 1-7 *SMX-M8xx camera application*

Drivers

- WDM compatible
- Twain included
- Linux (upcoming)

System requirements

- Windows 7 or XP 1 and higher

For more information see .

API function categories

- Get camera info
- Get/Set camera features
- Video stream controls (Start/Stop)
- Image grabbing
- Image correction controls (brightness, contrast, gamma)
- Snapshot controls (Exposure)
- Open /Close camera

Camera application controls

- Image correction (brightness, contrast, gamma)
- Color Balance (R, G, B, for color models only)
- Color Correction (Brightness, Contrast, Saturation, for color models only)
- Viewport
- Image capture
- Video capture
- Color Bayer algorithm selection
- Selectable Exposure, Gain and Frequency (sensor controls)
- Decimation
- Auto Exposure
- Horizontal and Vertical flipping
- Averaging frames
- Limit Gain (10)
- Limit Exposure
- Histogram
- Software zoom
- 8/10 bits output
- Frame rate control

A set of examples included into SDK serve as tutorial in developing new applications.

Third-Party IDE/Software Compatibility

The SMX-M8xx Series USB2.0 Cameras are compatible with the following programming environments and software:

- Visual Studio 6.0 (2002, 2003, 2005, 2008, 2010) (SDK)
- Delphi/Builder C++ (SDK)
- C# (SDK) (upcoming)
- C# 2003, 2008
- C++ Net
- HALCON (SDK)
- LabVIEW (SDK)
- MATLAB (SDK)

- Streampix (SDK) (upcoming)
- Visual Basic 6.0 (SDK)

Assistance and Help

Our developers are ready to advise and assist with integration of the SDK into relevant applications.

Camera Customization

Sumix Corporation offers hardware and software customization services to meet customers' specific needs. Recent camera custom development examples:

- Camera case mechanical modification
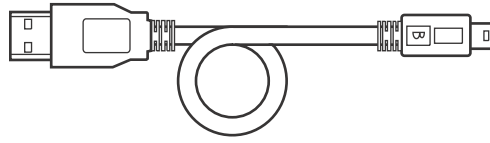- External trigger output mode customization
- Unique sensor modification

Camera Accessories

The SMX-M8xx Series USB2.0 Cameras usually go with:

1 Tripod adapter: the lightweight duralumin adapter allows quick and easy camera fixing to the tripod, offering additional protection of the camera

ø30.2

1/4"
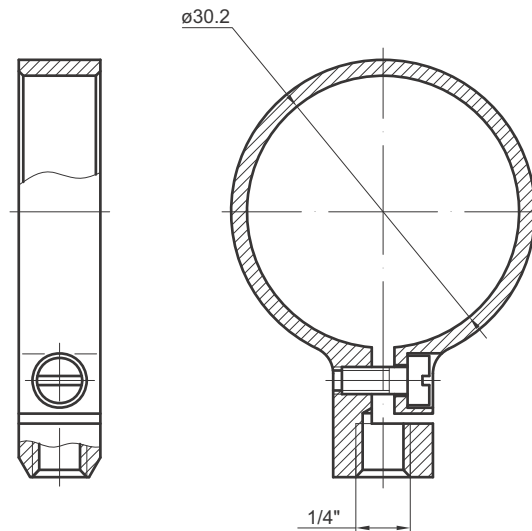
2 USB A to Mini B cable, 1.75 m long

3 C-mount Adapter

C-mount Adapter is an adapter that converts the SMX-M8xx camera from SC-mount (the initial form factor of the SMX-M8xx cameras) to C-mount

4 C-mount Adapter with IR-cut Filter

C-mount Adapter with IR-cut Filter can be used for both color and monochrome SMX-M8xx camera models.

C-mount Adapter with IR-cut filter is a C-mount adapter that additionally contains a built-in IR-cut filter.

The SMX-M8xx color cameras are sensitive to IR-light. IR-cut filter will block the (near) infrared light and make the colors of the image more realistic.

SMX-M8xx monochrome cameras are more sensitive to the infrared light than color models. Using the camera in an environment rich for infrared light may result in highlighted images. In order to avoid highlighted images use the C-mount Adapter with IR-cut filter for the SMX-M8xx monochrome cameras.

Figures