

Megapixel USB2.0 CMOS  
**CAMERA**

# Data Sheet

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SMX-10Mxx Series USB2.0 Cameras

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SMX-10Mxx Series USB2.0 Cameras Data Sheet

Revision 2.0

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## Introduction

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The **SMX-10Mxx** series cameras are megapixel CMOS cameras with USB2.0 interface designed for capturing, streaming and storing high quality digital images in scientific and industrial applications.

There are the following models of the SMX-10Mxx series cameras:

- **SMX-10M1M** camera - monochrome 1.3 megapixel CMOS camera with USB2.0 interface which features high sensitivity, low power consumption, frame rate of 30 fps (48 MHz) at the full resolution (1280 x 1024), small size, and external trigger. The SMX-10M1M camera is available in 8bit or 10bit modification
- **SMX-10M2C** camera - color 2 megapixel CMOS camera with USB2.0 interface which features low power consumption, frame rate of 20 fps (48 MHz) at the full resolution (1600 x 1200), small size, and external trigger. The SMX-10M2C camera is available in 8bit or 10bit modification
- **SMX-10M3C** camera - color 3 megapixel CMOS camera with USB2.0 interface which features low power consumption, frame rate of 12 fps (48 MHz) at the full resolution (2048 x 1536), small size, and external trigger. The SMX-10M3C camera is available in 8bit or 10bit modification

The SMX-10Mxx cameras are available in **8 bits** and **10 bits** of output modifications.

Rolling shutter and Snapshot mode are available with the SMX-10Mxx.

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

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

## Key Features

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All SMX-10Mxx 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
- Complete SDK

## Specifications

**Table 1-1** Cameras specification

<b>Output video and camera control characteristics</b>			
	<b>SMX-10M1M</b>	<b>SMX-10M2C</b>	<b>SMX-10M3C</b>
Maximum resolutions of output window	1280 x 1024, full resolution mode 640 x 512, decimated by 2 mode	1600 x 1200, full resolution mode	2048 x 1536, full resolution mode
Frame rate at resolution (48MHz)*	30 fps at 1280 x 1024 111 fps at 640 x 480 184 fps at 400 x 400	20 fps at 1600 x 1200 28 fps at 1280 x 1024 100 fps at 640 x 480	12 fps at 2048 x 1536 20 fps at 1600 x 1200 27 fps at 1280 x 1024 43 fps at 1024 x 768 94 fps at 640 x 480
Output bits per pixel	<ul style="list-style-type: none"> <li>● 8 bit modification - 8 bit</li> <li>● 10 bit modification - 10 bit</li> </ul>	<ul style="list-style-type: none"> <li>● 8 bit modification - 8 bit</li> <li>● 10 bit modification - 10 bit</li> </ul>	<ul style="list-style-type: none"> <li>● 8 bit modification - 8 bit</li> <li>● 10 bit modification - 10 bit</li> </ul>
Pixel rates	12 MHz, 24 MHz, 48 MHz	12 MHz, 24 MHz, 48 MHz	12 MHz, 24 MHz, 48 MHz
Exposure range (at highest resolution), ms	min: 0.03 (at 48 MHz) max: 131.40 (at 12 MHz)	min: 0.04 (at 48 MHz) max: 193.82 (at 12 MHz)	min: 0.05 (at 48 MHz) max: 313.84 (at 12 MHz)
Pixel gain control	Programmable hardware gain: 48 gain levels from 1 to 15 From 1 to 4 with increment 0.125 From 4.25 to 8 with increment 0.25 From 9 to 15 with increment 1	Programmable hardware gain controls for R, G, B: 48 gain levels from 1 to 15 From 1 to 4 with increment 0.125 From 4.25 to 8 with increment 0.25 From 9 to 15 with increment 1	Programmable hardware gain controls for R, G, B: 161 gain levels from 1 to 128 From 1 to 4 with increment 0.125 From 4.25 to 8 with increment 0.25 From 9 to 128 with increment 1

**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 look-up table	Programmable with look-up table	Programmable with look-up 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 1.3 megapixel CMOS sensor with an optical format of 1/2 inch manufactured by Micron Technology, Inc	Color 2 megapixel CMOS sensor with an optical format of 1/2 inch manufactured by Micron Technology, Inc	Color 3 megapixel CMOS sensor with an optical format of 1/2 inch manufactured by Micron Technology, Inc
Pixel size	5.2 $\mu\text{m}$ x 5.2 $\mu\text{m}$	4.2 $\mu\text{m}$ x 4.2 $\mu\text{m}$	3.2 $\mu\text{m}$ x 3.2 $\mu\text{m}$
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	2.1 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
Maximum supply current	176 mA (at 5.0 V)	176 mA (at 5.0 V)	176 mA (at 5.0 V)

**Table 1-1** *Cameras specification*

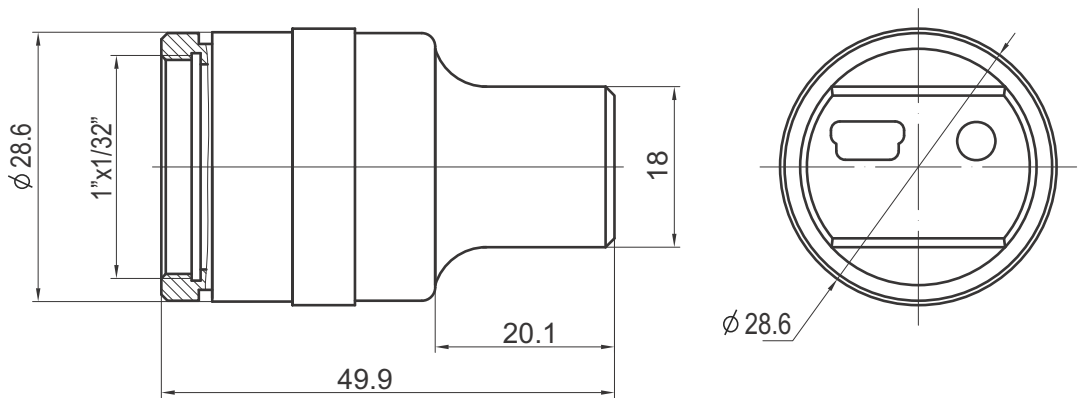
Maximum power consumption	0.88 W	0.88 W	0.88 W
<b>Camera interface characteristics</b>			
Interface Type	USB2.0, 480 Mbps	USB2.0, 480 Mbps	USB2.0, 480 Mbps
Connector Type	USB mini-B, 2 pin	USB mini-B, 2 pin	USB mini-B, 2 pin
<b>System requirements</b>			
Operating System	Windows XP SP1+/2003/Vista/2008/7 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
<b>Camera physical characteristics</b>			
Operating temperature	0 to +60°C	0 to +60°C	0 to +60°C



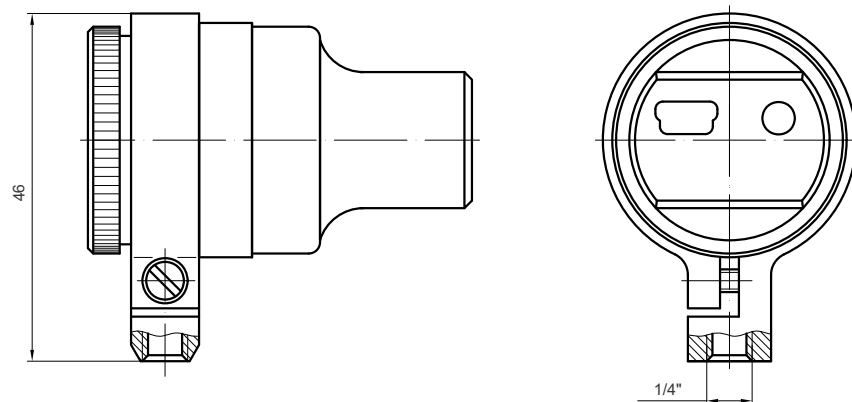
**Table 1-1** Cameras specification

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)	50.8 x 30.2 mm	50.8 x 30.2 mm	50.8 x 30.2 mm
Camera housing material	Duralumin	Duralumin	Duralumin

## Camera Mechanicals



**Figure 1-1** The SMX-10Mxx camera case drawing

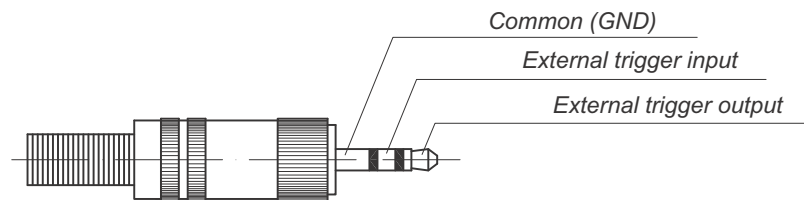


**Figure 1-2** The SMX-10Mxx camera case drawing with the Tripod Adapter



**Figure 1-3** SMX-10Mxx camera outlook

### External Connector Pinout



### 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-10M1M Camera

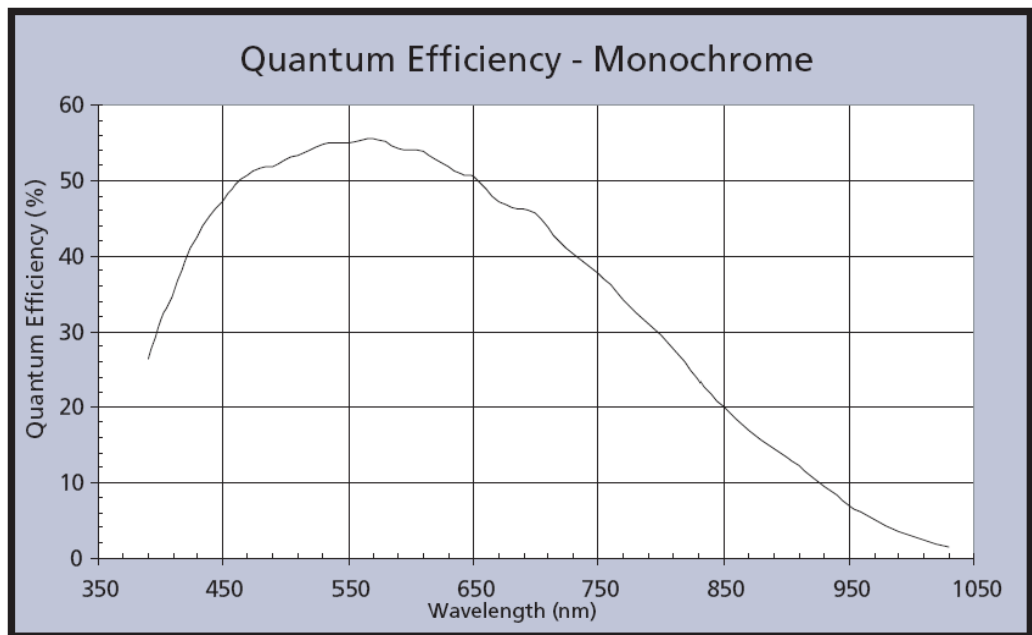
The SMX-10M1M camera uses Micron® Imaging MT9M001 which is an SXGA-format with a 1/2-inch CMOS active-pixel digital image sensor. The active imaging pixel array is of 1,280 H x 1,024 V.

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 1-4](#).



**Figure 1-4** Quantum efficiency - monochrome

### SMX-10M2C Camera

The SMX-10M2C camera uses 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-10M3C Camera

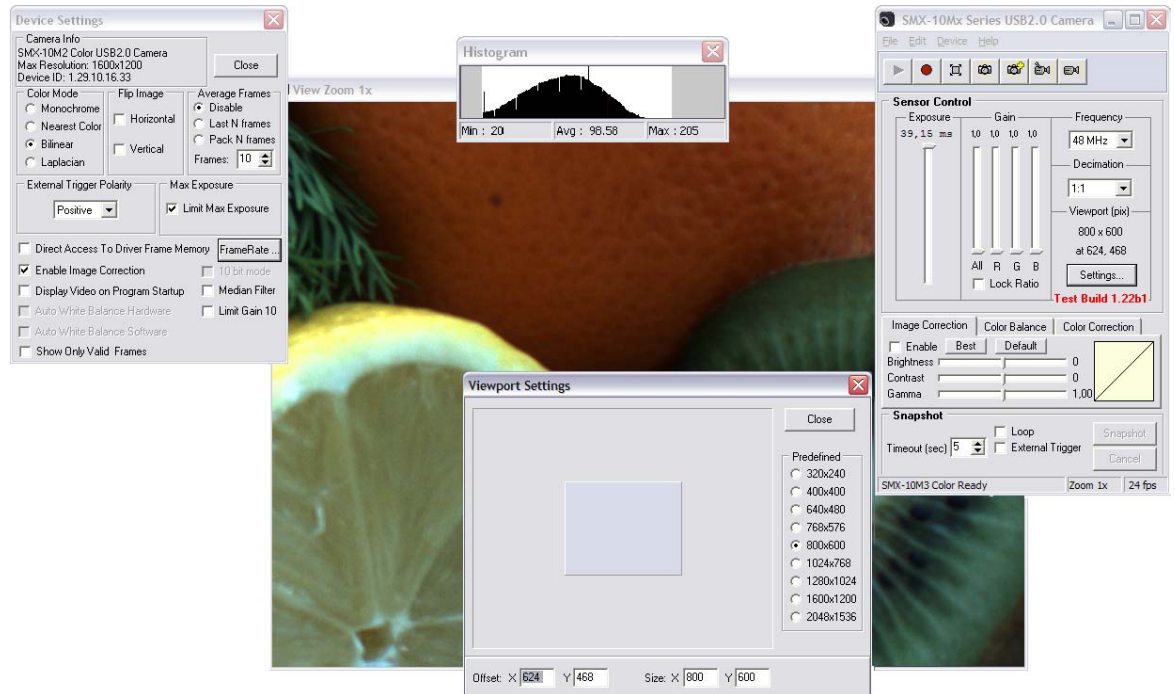
The SMX-10M3C camera uses Micron® Imaging MT9T001 which is a QXGA-format with a 1/2-inch CMOS active-pixel digital image sensor. The active imaging pixel array is 2,048 H x 1,536 V. The default mode outputs a QXGA image at 12 frames per second (fps).

## SMX-10Mxx Software Package

The SMX-10Mxx cameras usually go with the 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 1-5** SMX-10Mxx camera application

## Drivers

- WDM compatible
- Linux (upcoming)

## System Requirements

- Windows 7 or XP 1 and higher

For more information see ["System requirements" on page 8.](#)

## 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 Exposure
- Histogram
- Software zoom
- Frame rate control

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

### Third-Party IDE/Software Compatibility

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The SMX-10Mxx 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)
- C# 2003, 2008
- C++ Net
- HALCON (SDK) (upcoming)
- LabVIEW (SDK)
- MATLAB (SDK)
- Streampix (SDK)

## Assistance and Help

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

## Camera Customization

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

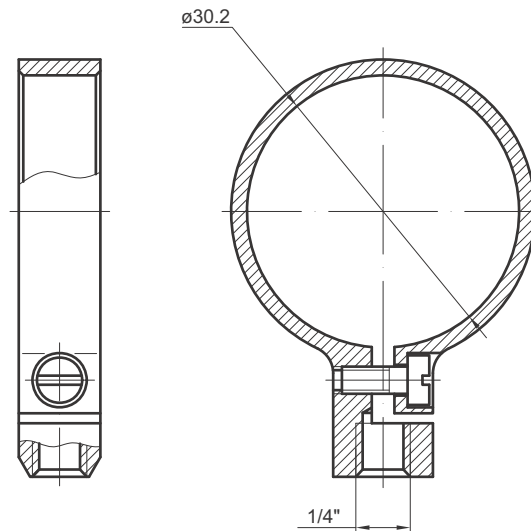
- Camera case mechanical modification
- External trigger output mode customization
- Unique sensor modification

## Camera Accessories

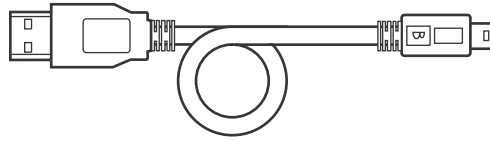
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The SMX-10Mxx series USB2.0 cameras usually go with:

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



- 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-10Mxx camera from SC-mount (the initial form factor of the SMX-10Mx 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-10Mx 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-10Mxx 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-10Mx 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-10Mxx monochrome cameras.





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