

SMX-15M5x
Camera

Data Sheet

SMX-15M5x Series USB3.0 Camera Data Sheet

Revision 1.1.1

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Introduction

The **SMX-15M5x** Series are one of the smallest and lightest 5Megapixel (2592 x 1944) USB 3.0 cameras in the world. They are suitable for any digital imaging applications like industrial, scientific, surveillance, medical, etc.

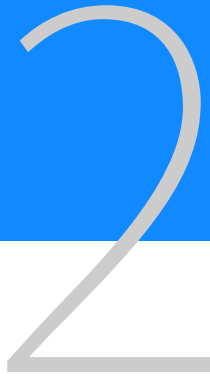
The **SMX-15M5x** Series cameras are available in two modifications:

- **SMX-15M5M** camera is based on monochrome 5 megapixel CMOS sensor with an optical format of 1/2.5 inch
- **SMX-15M5C** camera is based on color 5 megapixel CMOS sensor with an optical format of 1/2.5 inch.

Rolling shutter, Global Start Shutter (for Snapshot mode), programmable general purpose TTL input/output and triggering options are available with the SMX-15M5x cameras. They can be easily integrated into your system or synchronized with other cameras.

Capturing of initial live streaming video images and still images are provided via USB 3.0 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.



Features and Benefits

TABLE 2.1

Ultra compact:	<p>One of the smallest USB 3.0 cameras in the world — less than one cubic inch volume</p> <p>Cylinder-shaped</p> <p>Fits into places where no other camera can fit</p> <p>Can be installed with the optics in a tube</p>
Lightweight:	<p>Weighs only 20 grams (0.7 Oz)^a</p> <p>Perfect for autonomous systems like robots, aerospace applications, etc.</p>
Extremely fast:	<p>USB3.0 interface allows data rate up to 400 MBytes per second (10 times faster than USB2.0)</p> <p>Especially well-suited to use in multi-camera systems and 3D applications, as well as for fast process capturing</p>
Robust:	<p>Unibody aircraft grade aluminum housing with a screw lock for USB cable, as well as shockproof electronic design allows the camera to survive 32 g of sinusoidal vibration and 6000 g shock tests ^b</p> <p>Highly reliable even in harsh, demanding environments</p>
Efficient and cool:	<p>Less than 1 W power consumption through the USB cable</p> <p>Increases battery lifetime for autonomous devices with the camera onboard</p> <p>No additional heat sinks required due to low heat generation</p>
Connectivity:	<p>Programmable general purpose TTL input/output and triggering options</p> <p>Can be easily integrated into your system or synchronized with other cameras</p>
Compatibility:	<p>Comes with a set of software examples included into the SDK, is compatible with popular vision and image processing libraries and third party software like Labview, MATLAB, HALCON, etc.</p> <p>Simplifies integration into existing systems, no need to employ highly-qualified software developers</p>
USB2.0 High Speed mode support:	<p>Backward compatible to USB 2.0</p> <p>Enables an old system without a USB3.0 interface to utilize new generation cameras</p>

a. CS-mount, without accessories

b. Maximum tested values consult with Sumix prior to using the camera under high g-force

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Specifications

3.1 Output Video and Camera Control

Output Video and Camera Control characteristics are shown in the table below.

TABLE 3.1

	SMX-15M5x
Maximum resolutions of output window:	2592 × 1944
Frame rate at resolution (96 MHz):	14 fps at 2592 × 1944 63 fps at 1024 × 768 124 fps at 640 × 480
Output bits per pixel:	Selectable, 8 bits or 12 bits
Lookup table:	Programmable for user selected 8 bits mode: converts 12 bits of imaging chip's ADC to 8 bits of output
Pixel rates:	6-96 MHz
Exposure range (at maximum resolution), ms:	Min: 0.029 (at 96 MHz); max: 1000 (at 6 MHz)
Pixel gain control:	Programmable hardware gain controls: 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
Output window modes:	View port (from 2592 × 1944 to 8 × 8 with 4 pixels/2 lines step positioning) Frame Decimation (1:1, 1:2, 1:3, 1:4, 1:6), hardware Frame Binning (1:2, 1:4), hardware Horizontal and Vertical flipping, hardware
Gamma, brightness and contrast control:	Programmable with lookup table

3.2 Imaging Chip

The SMX-15M5x Series cameras use Aptina's 1/2.5-inch CMOS digital image sensor with an active-pixel array of 2592 H x 1944 V and on-chip analog-to-digital converter (ADC) that provides 12 bits per pixel.

The 5-megapixel CMOS image sensor features DigitalClarity Aptina's low-noise CMOS imaging technology that achieves CCD image quality (based on signal-to-noise ratio and low-light sensitivity).

It incorporates sophisticated camera functions, such as windowing, column and row skip mode, snapshot mode. The SMX-15M5x Series camera sensor produces extraordinarily clear and sharp digital pictures. It is able to capture both continuous video and single frames.

TABLE 3.2

	SMX-15M5x
Types:	Monochrome (SMX-15M5M) and color (SMX-15M5C) 5 megapixel CMOS sensor with an optical format of 1/2.5 inch manufactured by Aptina Imaging Corp.
Pixel size:	2.2 μm \times 2.2 μm
Image array size:	7.13 mm diagonal
Shutter:	Rolling, Global Start Shutter (only for Snapshot mode)
Scanning mode:	Progressive
ADC resolution:	12 bits
Sensitivity:	1.4 V/lux-sec (550nm)
Dynamic Range:	70.1 dB

3.3 Camera Electrical

Camera Electrical characteristics are shown in the table below

TABLE 3.3

	SMX-15M5x
Supply voltage:	5V supplied by USB 3.0 interface
Power consumption:	Less than 1 W (depends on operating modes)

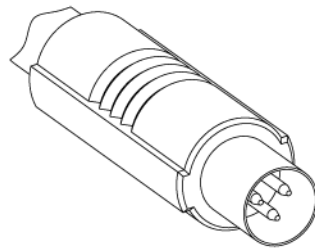
3.4 Trigger Connector

Camera has one configurable input and one configurable output, which could be used for synchronization of image shooting with external devices as well as for general purpose Input/Output.

Both input and output are 5V TTL compatible.

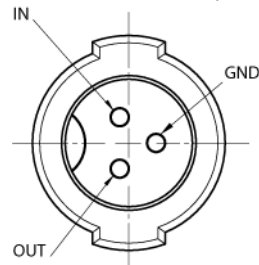
Maximum allowed voltage on trigger connector pins is 5.3V.

FIGURE 3.1 *3-pin Hirose trigger connector (without a cable)*



Trigger connector pin-out could be found on picture below, also on camera body.

FIGURE 3.2 *External connector pinout*



Where: Common (GND), External trigger input (IN), External trigger output (OUT).

Trigger internal circuits are shown on figure below. Both input and output are equipped with internal 10 k Ω pull-up resistors and Transient Voltage Suppressor Diodes.

FIGURE 3.3 *Trigger internal circuits*

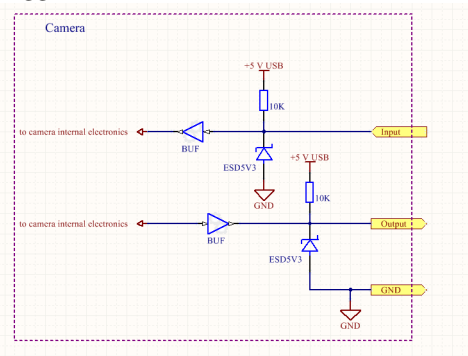
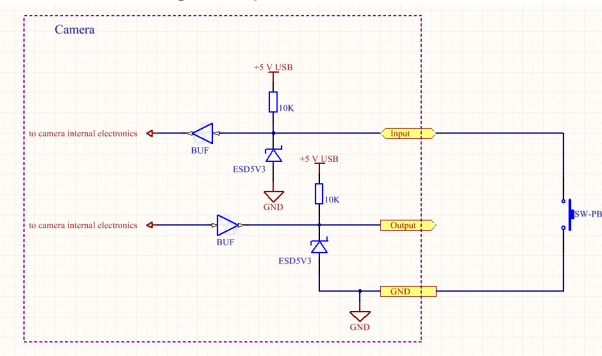


FIGURE 3.4 *Push button using example*



3.5 Camera Interface

Camera Interface characteristics are shown in the table below

TABLE 3.4

SMX-15M5x	
Interface Type:	USB 3.0
Connector Type:	USB 3.0 micro-B with locking screws (USB3 Vision compliant) USB 2.0 HighSpeed interface, micro-B connector compatible

3.6 System Requirements

Camera System Requirements are shown in the table below

TABLE 3.5

SMX-15M5x		
Operating System:	Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, Windows 7, Windows 8, Windows 8.1, Windows 10, Linux Ubuntu	
Processor:	Recommended configuration Cameras will function with nominal frame rates Intel i7-3770, Samsung Exynos5422 Cortex™-A15 2.0Ghz quad core, Cortex™-A7 quad core	Minimal configuration Cameras will function with reduced frame rates PIV 2Ghz
RAM:	4GB DDR3	2048 Mb
Video Card:	Any with 24 bit True Color	Any with 24 bit True Color
Hardware Interface:	Intel integrated USB 3.0 Host Controller. At least one USB 3.0 port for connection	Any USB 2.0 Host Controller. At least one USB 2.0 port for connection
Hard Drive:	SSD (write speed 150 MB/s minimum)	N/A

3.7 Camera Physical Characteristics

Camera physical characteristics are shown in the table below

TABLE 3.6

	SMX-15M5x
Operating temperature *	0 to +50°C
Lens mount type	C/CS - mount
Weight (CS-mount, without lens, tripod adapter and lens cap):	20 g (0.71 oz)
Dimensions (L x D)	CS-mount - 22.6 × 28 mm (0.89 × 1.1 inches) C-mount - 27.6 × 28 mm (1.09 × 1.1 inches)
Camera housing material	Aircraft grade aluminum

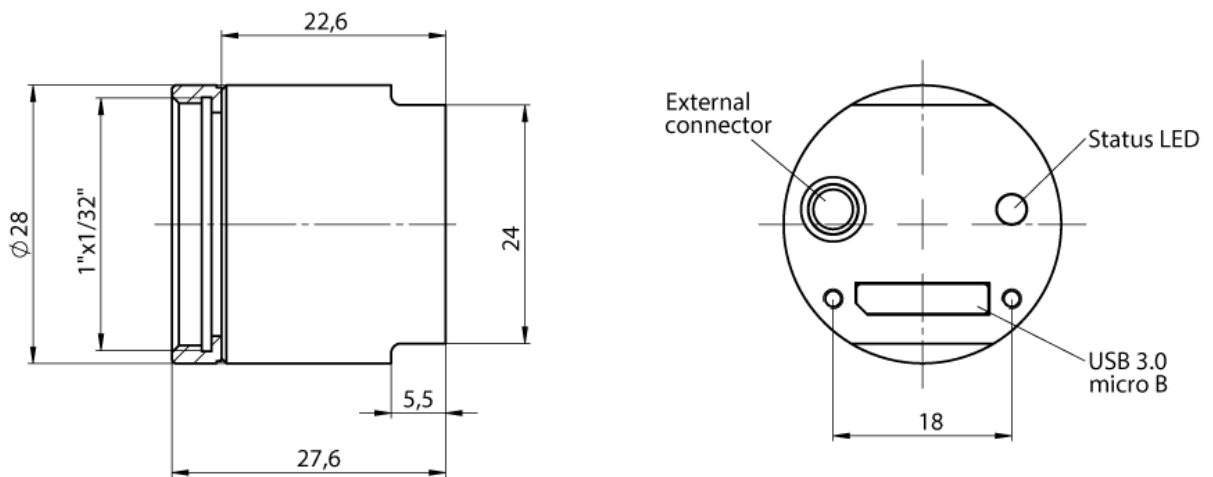
*. camera case temperature should not rise above 60 degrees Celsius for normal operation. It's not recommended to power-on camera without lens or another heatsink. Any industrial C or CS-mount lens is enough for addition camera heat dissipation.

4 Camera Mechanicals

FIGURE 4.1 *SMX-15M5x Series camera case view*



FIGURE 4.2 *SMX-15M5x Series camera case drawings. Units: mm*



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SMX-15M5x Software Package

Sumix camera software package contains a standard application, drivers, User Guide and SDK (API, examples, documentation).

Standard application is a ready solution covering basic user requirements.

API provides full control of all camera features from user applications using many programming languages and platforms (C/C++, C#, VB, LabView, MatLab). Along with examples and documentation it enables easy integration of the camera into the custom-developed applications.

5.1 Camera Standard Application Controls

- Image sensor options (viewport, decimation, image, flip, exposure, gain, frequency)
- Selectable video data depth
- Frame rate control
- Auto Exposure
- Image correction (brightness, contrast, gamma)
- Input/Output trigger control
- Color balance (color models)
- Color Bayer algorithm selection
- White balance (color models)
- Histogram
- Image and video capture
- Software zoom

5.2 Compatibility With 3rd Party Software/IDE

- HALCON
- MATLAB IMAQ adapter
- MATLAB mex-file, extending basic MATLAB command set to control the camera parameters
- ActiveX component
- LabVIEW
- Streampix

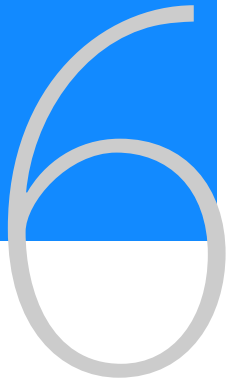
API allows:

- getting camera/sensor identification information
- getting/setting all sensor parameters
- image grabbing
- image correction: white balance, hot pixel correction
- connectivity with external devices
- multi-camera configuration

A set of examples is included into the SDK as a tutorial for developing new applications in:

- C/C++
- Matlab
- C#
- LabView

Our developers are ready to advise and assist with the integration of the SDK into your application.



Assistance and Help

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

For questions/proposals contact us via camera@sumix.com

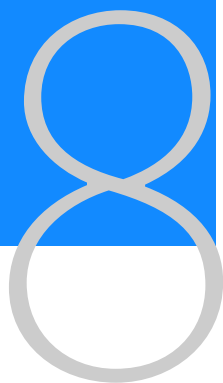


Camera Customization

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

For more information please contact us via camera@sumix.com

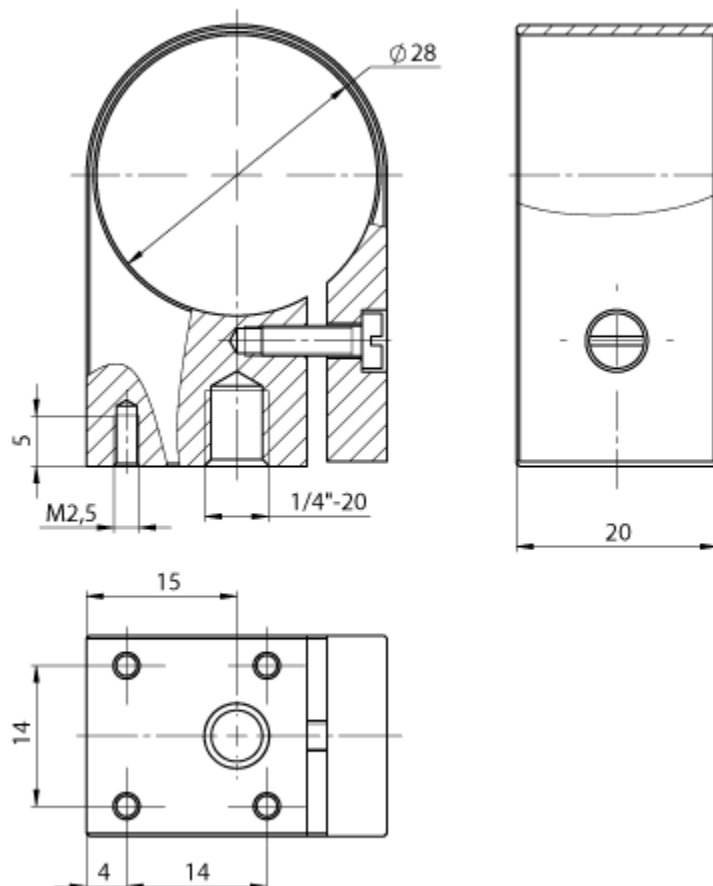


Camera Accessories

The SMX-15M5x Series USB3.0 Cameras usually go with:

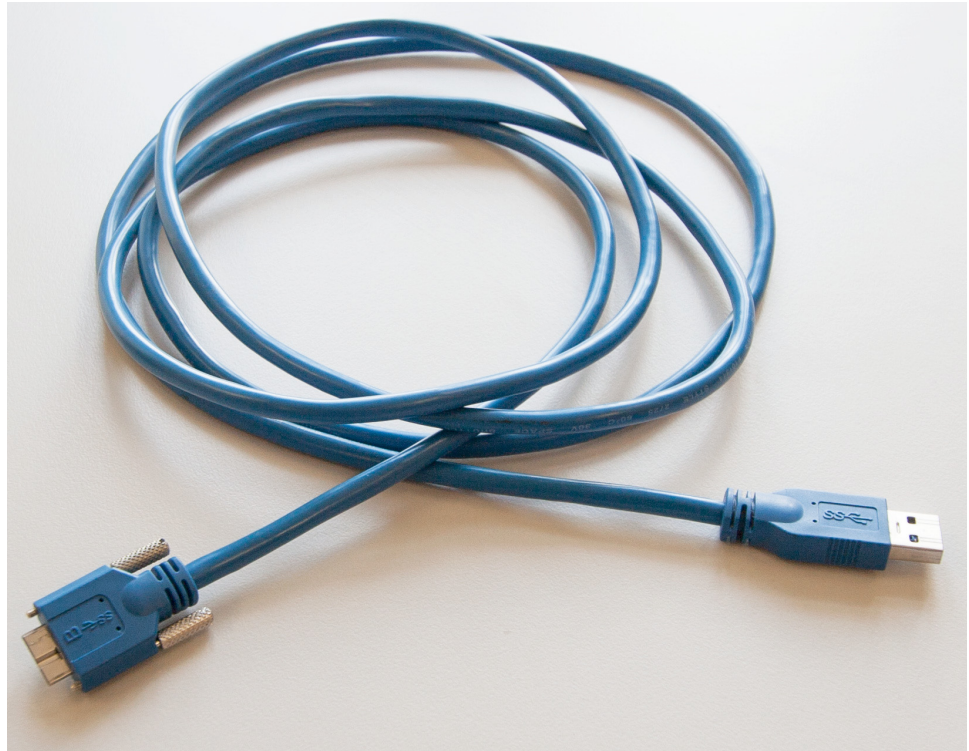
- Tripod adapter:

FIGURE 8.1 *The lightweight aluminum adapter allows quick and easy camera fixing to the tripod or other surfaces (with 4 M2.5 screws), offering additional protection and heat sink for the camera.*



- USB 3.0 A to Micro B screwable cable 2 m long

FIGURE 8.2 *USB 3.0 A to Micro B screwable cable*



- C-mount Adapter allows compatibility of converting the camera from the CS-mount to C-mount lens.

FIGURE 8.3 *C-mount Adapter*

