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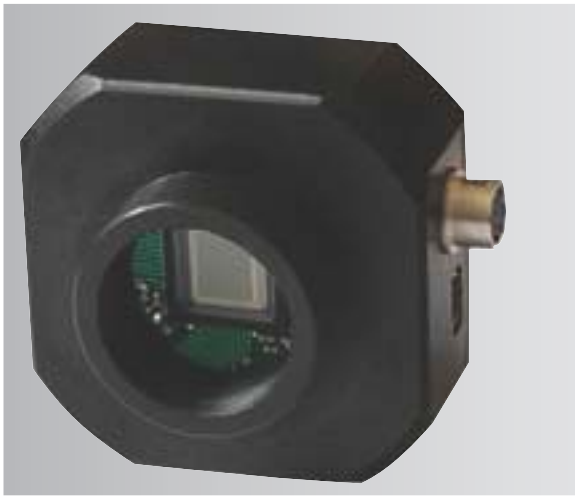

Megapixel USB2.0 CMOS

CAMERA

Data Sheet

SMX-155M USB2.0 Camera

SMX-155M USB2.0 Camera Data Sheet

Revision 3.0

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Introduction

SMX-155M USB2.0 Camera is a high speed monochrome 1.3 megapixel (1280 x 1024) CMOS camera with USB2.0 interface and frame rate up to 27.5 fps (40 MHz).

Global shutter, external trigger and rich set of the camera controls make the SMX-155M Camera suitable for demanding machine vision applications.

The SMX-155M Camera can be used in microscopy, video conferencing, web casting, photo ID systems, surveillance and security systems, etc.

For special applications the SMX-155M camera is available in the following modification:

- The SMX-155M-W camera with a protection glass lid removed

The camera is provided with a Software package, all needed drivers and API library, which allows quick integration of the camera functions into user's applications.

Key Features

- High speed: 27.5 fps at full 1280 x 1024 resolution (40 MHz)
- External trigger output mode
- Global and Rolling shutters
- Video and snapshot operations
- Selectable camera color depth and image color depth
- Low image noise
- Small size
- Plug and play
- USB2.0 interface (480 Mbps)
- No external power supply required
- C-Mount
- Complete SDK

The SMX-155M Camera has several features, which make it stand out:

- Adjustable frame rate from 2 fps up to the maximum
- The Hardware Filter which allows preservation of edges or receiving smooth image at one's discretion
- Adjustable flash pulse and integration start time
- Flexible external pins configuration

- On-board non-volatile memory for storing the camera settings: when the camera is shut down, it can be restarted with the same settings even when connected to a different computer

Specifications

Table 1-1 *Camera Specification*

Output video and camera control characteristics	
Maximum resolutions of output window	1280 x 1024, full resolution mode 640 x 512, decimated by 2 mode
Frame rate at resolution (40MHz)*	27.5 fps at 1280 x 1024, full resolution 45 fps at 1024 x 768 76 fps at 768 x 576 106 fps at 640 x 480 182 fps at 400 x 400 494 fps at 220 x 220
Output bits per pixel	Selectable, 8 bits or 10 bits
Lookup table	Downloadable for user selected 8 bits mode: converts 10 bits of imaging chip's ADC to 8 bits of output
Pixel rates	3.75 MHz, 5 MHz, 6 MHz, 6.66 MHz, 7.5 MHz, 8 MHz, 9 MHz, 10 MHz, 12 MHz, 13.3 MHz, 15 MHz, 16 MHz, 18 MHz, 20 MHz, 24 MHz, 26.7 MHz, 30 MHz, 36 MHz, 40 MHz
Exposure range (at highest resolution), ms	Rolling shutter: 0.04 - 36.44 ms Global shutter: 0.001 ms - 1 s
Pixel gain control	Programmable (hardware), 17 gain levels from 0 to 12.42 dB
Output window modes	View port (from 1280 x 1024 to 8 x 2 with 2 pixels/1 line step positioning) Frame Decimation (1:1, 1:2) Vertical flipping
Gamma, brightness and contrast control	Programmable with lookup table
* Listed frame rate values at the defined resolutions are not the maximal possible. Increasing of frame rate can be done by reducing the current Exposure value (the lower Exposure, the higher frame rate), hiding 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 2/3"; manufactured by Cypress (FillFactory)
Pixel size	6.7 µm x 6.7 µm
Image array size	8.6 mm x 6.9 mm

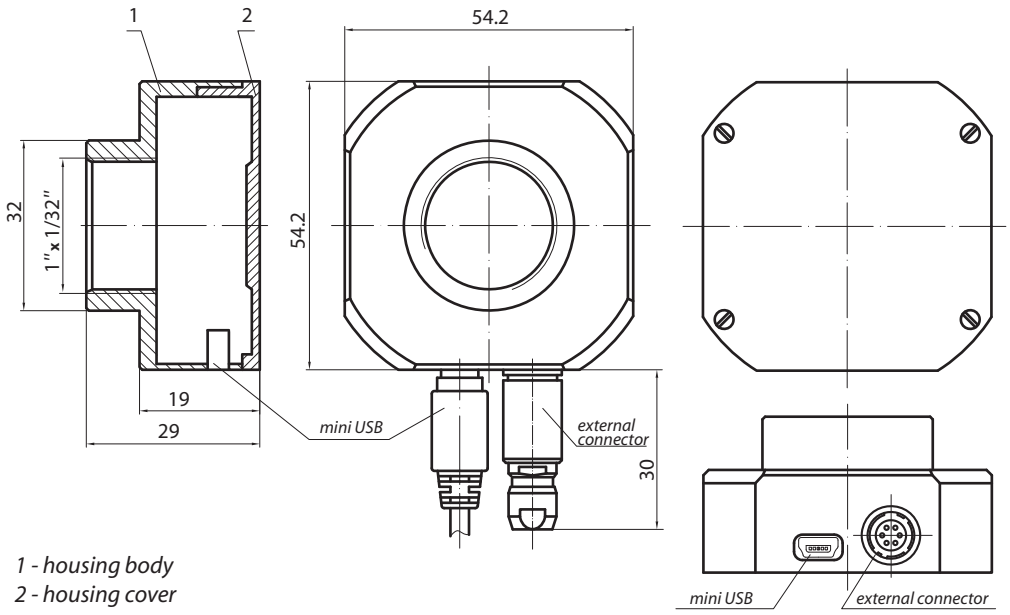
Table 1-1 *Camera Specification*

Shutter	Rolling shutter; Global Shutter -triggered synchronous shutter with integration and readout separate in time
Scanning mode	Progressive
ADC resolution	10 bits
Pixel architecture	4-transistor active pixel sensor. Allows for both rolling and synchronous (snapshot) shutter
Sensitivity	3.29 V/lux.s Visible band only (180 lux = 1 W/ m2)
Dynamic range	Optical, 64 dB (1600:1) in single slope operation and 80…100 dB in multiple slope operation
Camera electrical characteristics	
Supply voltage	4.40 to 5.25 V supplied by USB2.0 interface
Supply power	< 1.6 W
Camera interface characteristics	
Interface Type	USB2.0, 480 Mbps
Connector Type	USB mini-B, 5 pin
Maximum data rate	46.2 MB/s
System requirements	
Operating System	Windows XP SP1+/2003/Vista/2008/7 recommended: Windows 7 or XP 1+
Processor	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)
Performance	minimum: 300 Mflops recommended: 400 Mflops or higher
Hard Disk Space	About 15 MB for installation plus additional space for captured images
Video	8 MB memory, recommended GeForce 4xxx/ Radeon 9xxx or higher

Table 1-1 *Camera Specification*

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
Camera physical characteristics	
Operating temperature	0 to +50°C
Lens mount type	C-mount
Weight (without lens)	108 g
Dimensions (W x L x H)	54.2 x 54.2 x 32.6 mm
Camera housing material	Duralumin

Camera Mechanicals



1 - housing body
2 - housing cover

Units: mm

Figure 1-1 *Camera drawing*

Figure 1-2 *SMX-155M camera outlook*

External connector pinout

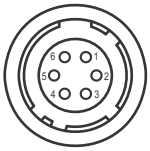


Figure 1-3 *Pinout*

1. External trigger input (Positive)
2. Delayed synchronous shutter start output (Positive)
3. User programmed output
4. External trigger input (Negative)
5. Synchronous shutter start output (Positive)
6. Common (ground)

General Sensor Specifications

The **SMX-155M USB2.0 Cameras** use the IBIS5A-1300 monochrome sensors manufactured by Cypress (FillFactory).

The IBIS5A-1300 sensor has a 10 bit flash analog digital converter running nominally at 40 Msamples/s. The ADC is electrically separated from the image sensor.

Spectral response curve

The curve is measured directly on the pixels. It includes effects of non-sensitive areas in the pixel, e.g. interconnection lines. The sensor is light sensitive between 400 and 1000 nm. The peak QE * FF is approximately 30% between 500 and 700 nm. In view of a fill factor of 50%, the QE is thus larger than 60% between 500 and 700 nm.

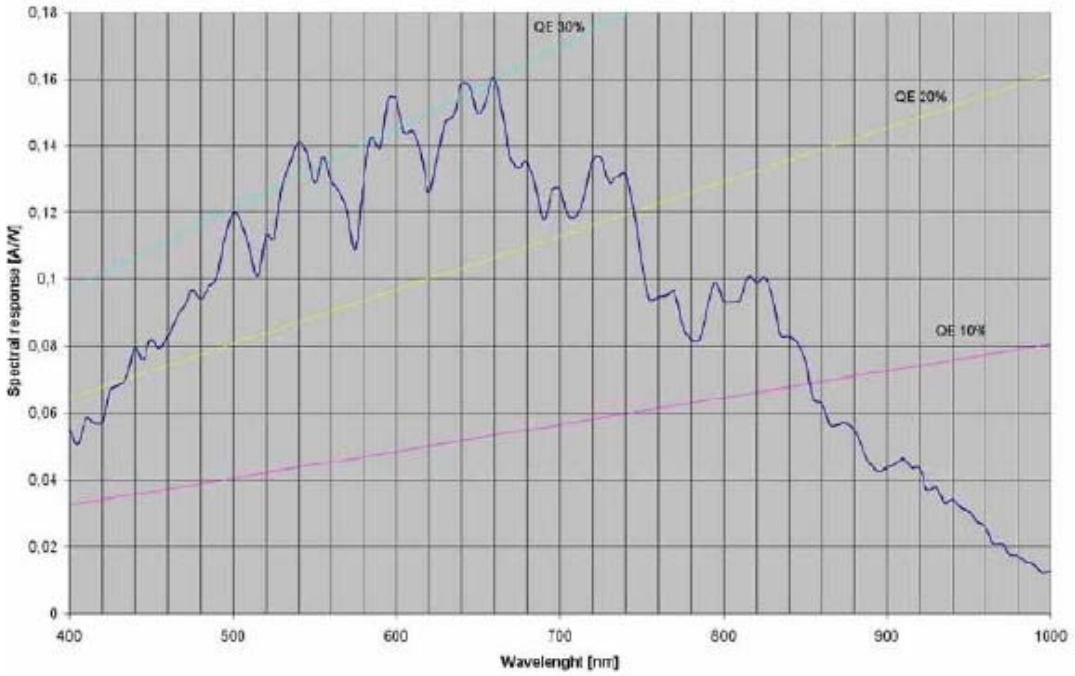


Figure 1-4 *Spectral response characteristics*

Photo-voltaic response curve

Figure 1-5 shows the pixel response curve in linear response mode. This curve is the relation between the electrons detected in the pixel and the output signal. The voltage to electrons conversion gain of the pixel is 17.6 µV/electron.

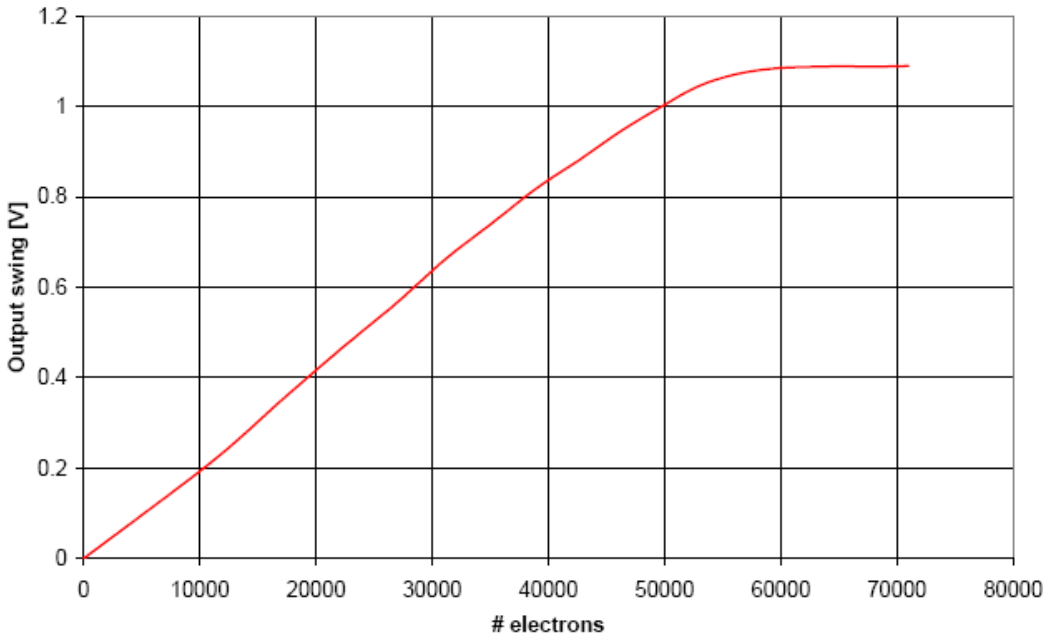


Figure 1-5 *Photo-voltaic response curve*

Pixel architecture

The pixel architecture used in the IBIS5A-1300 sensor is 4-transistor pixel as shown in Figure 1-6.

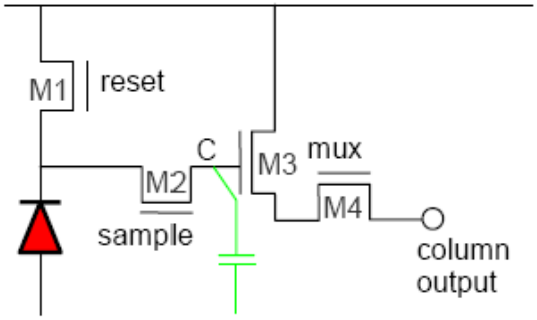


Figure 1-6 *Architecture of the 4T -pixel*

Cover glass

A D263 glass is used as protection glass lid on top of the IBIS5A-1300 monochrome sensors. Figure 1-7 shows the transmission characteristics of the D263 glass.

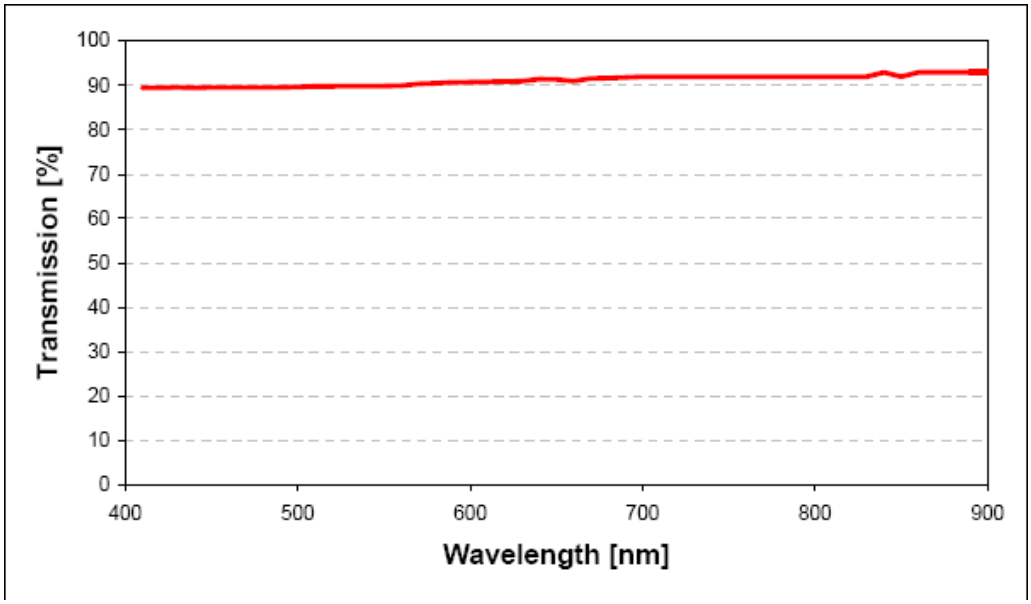


Figure 1-7 *Transmission characteristics of the D263 glass used as protective cover for the IBIS5A-1300 sensors (monochrome)*

Multiple slope integration

The Exposure modes are provided to extend the dynamic range by integrating long and short frame exposure. Multiple Slope Exposure is done for Global shutter.

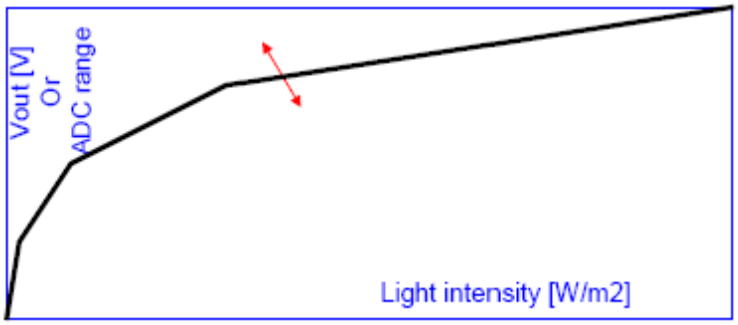


Figure 1-8 *Multiple slope response*

SMX-155M Software Package

The **SMX-155M USB2.0 Cameras** go with the camera software package.

The camera software package includes:

- Standard Application
- Drivers
- User Guide

- SDK (API, examples, documentation)

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

API allows full control of all camera features and along with examples and documentation enables easy integration of the camera into the customers' applications.

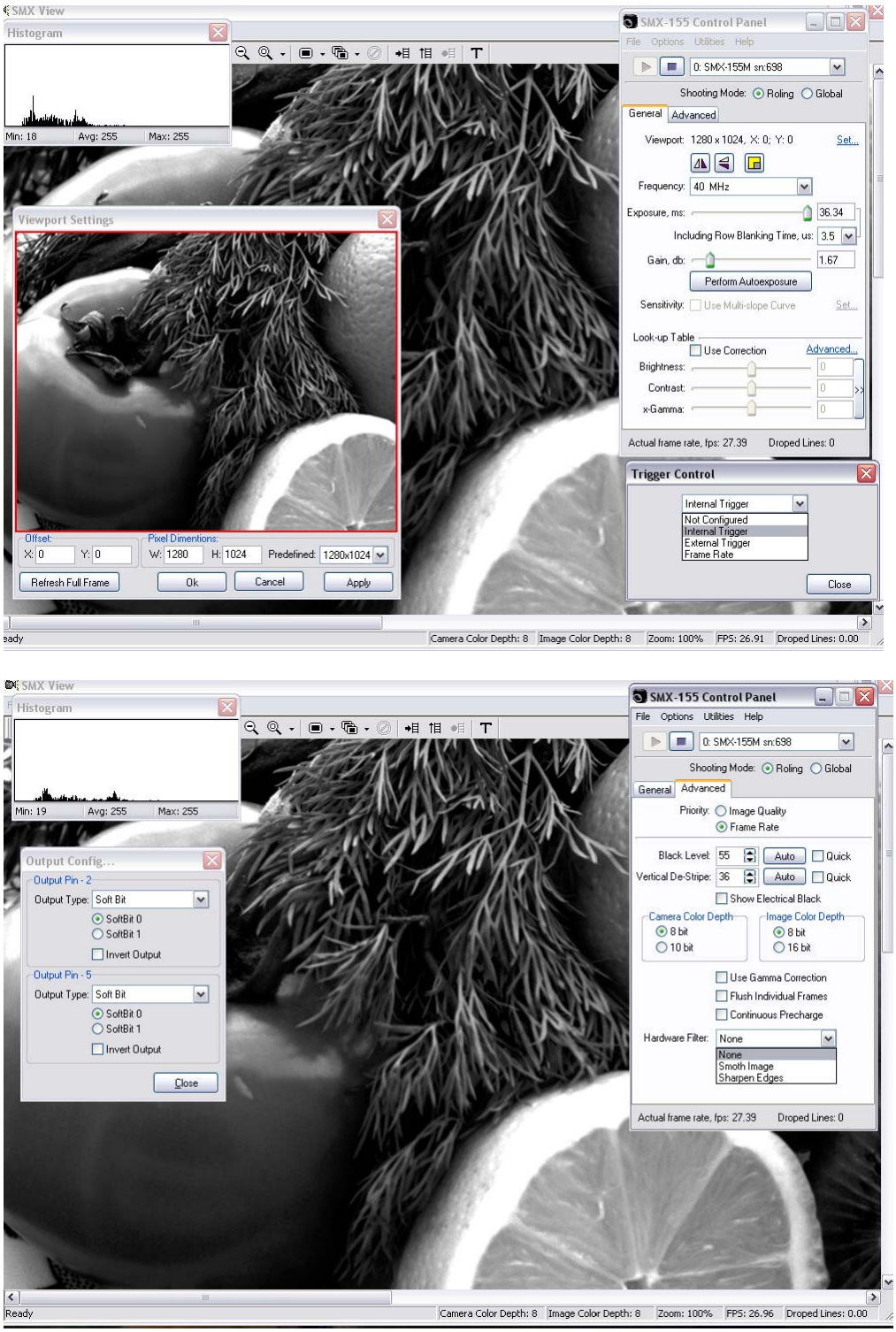


Figure 1-9 *SMX-155M application*

Drivers

- WDM compatible
- Real time operating system QNX v 6.3.0 SP1 or SP2 (VIA chipset not supported)

System requirements

- Windows 7 or XP 1 and higher
- For more information, see "System requirements" on page 8.

API function categories

- Open/close device functions
- Device information functions
- Shutter control functions
- Frequency control functions
- Color depth control functions
- USB bandwidth checking function
- Streaming control functions
- Exposure control functions
- View port control function
- On-board lookup table controls
- Various sensor controls
- Digital filter controls
- Stream priority mode controls

Camera application controls

- Image correction (brightness, contrast, and gamma)
- Viewport
- Black level
- Vertical De-Stripe
- Frame rate control
- Image capture
- Software zoom
- Global shutter video mode (for 40 MHz only)
- Rolling shutter video mode
- Histogram

- Selectable (8 bits or 10 bits) mode output
- Multiple slope mode (for global shutter only)
- Hardware Filter - selectable
- Gamma Correction

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

Third-Party IDE/Software Compatibility

The **SMX-155M 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)
- IC Imaging Control (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 SDK into relevant applications.

Camera Customization

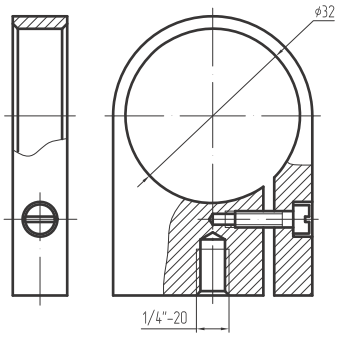
Sumix Corporation offers hardware and software customization services to meet customers' specific needs. Recent camera custom development examples:

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

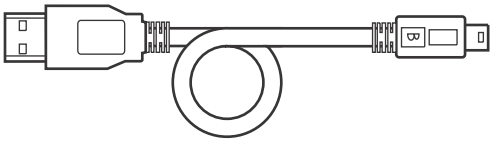
Camera Accessories

The **SMX-155M USB2.0 Cameras** usually go with:

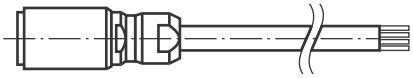
1. Tripod adapter. The lightweight duralumin adapter allows quick and easy camera fixing to the tripod, offering additional protection of the camera



2. USB A to Mini B cable, 1.75 m long



3. 6 pin Hirose trigger connector (without a cable)



Figures