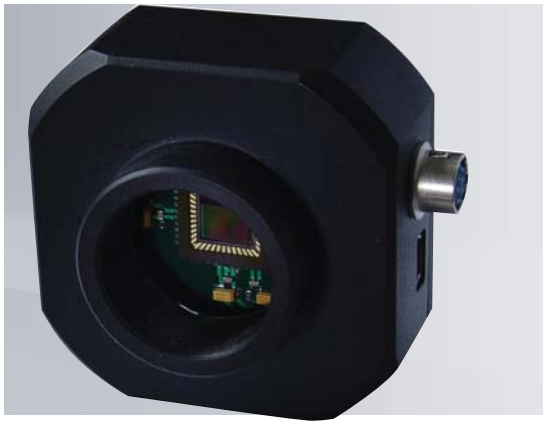
SUMIX corporation



Megapixel USB2.0 CMOS

# CAMERA

# User Guide

## SMX-M7xx Series USB2.0 Cameras

SMX-M7xx Series USB2.0 Camera User Guide

Revision 3.0

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Chapter 1

# INTRODUCTION

The **SMX-M7xx Series Cameras** are megapixel CMOS cameras with USB2.0 interface suitable for scientific and industrial applications. The cameras are designed for capturing, streaming and storing high quality digital images.

The cameras are available in three modifications:

- SMX-M71M (1.3 Megapixel, monochrome)
- SMXM72 (2 Megapixel, color)
- SMX-M73 (3 Megapixel, color)

All the SMX-M7x cameras feature:

- Communication interface - USB2.0
- External trigger - 6 pin Hirose connector
- Form factor - a duralumin housing with C-mount

SMX-M7x cameras provide the benefits:

- High speed
- No external power supply required
- Ease of use
- Compact size

Programmable functions include viewport window settings, adjustable exposure time and gain, selectable sensor clock frequency and image decimation, flipping the image horizontally and vertically.

The SMX-M7xx Series cameras can be used in microscopy, video conferencing, webcasting, surveillance and security systems, etc.

Chapter 2

# Installation and Update

Before installing the camera software, install a USB2.0 adapter if needed. Install all required drivers. Installation of the USB2.0 adapter is beyond the scope of this document.

## System Requirements

| | |
|---|---|
| **Operating System** | XP SP1+/2003/Vista/2008/7, recommended: Windows 7 or XP SP1 and higher |
| **Processor** | Intel PIII or higher, recommended: Intel Core 2 Duo |
| **Performance** | Minimum 300 Mflops, recommended: 400 Mflops or higher |
| **Memory** | 256 MP for XP (512 MB for 2008/Vista/7), recommended: 512 MB (1024 MB) |
| **USB 2.0** | Recommended: Intel integrated Host Controller, not recommended: VIA-based USB 3.0 Host Controller is also supported |
| **Video** | 8 MB memory, recommended: GeForce 4xxx/Radeon 9xxx or higher |

## Installation

### To install the SMX-M7xx camera application software:

1. Run the **SMXM7X-<version>.exe** file downloaded via the URL provided by Sumix Corporation.
2. **Welcome to the SMX-M7x USB 2.0 Camera Software Setup Wizard** starts. The wizard will guide you through the software and hardware drivers installation. Close all other applications that are running on your computer and then click the **Next** button to continue the installation.

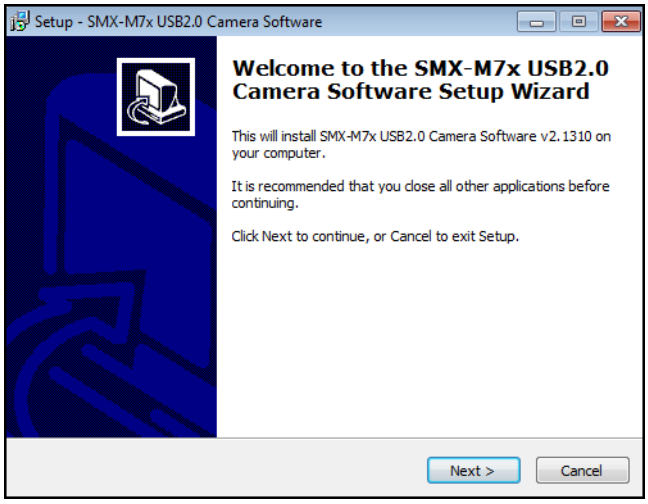



**Figure 2-1** *Welcome to the SMX-M7x Camera Setup Wizard*

3 In the **License Agreement** box, read the license. Then select **I accept the agreement** and click **Next**.

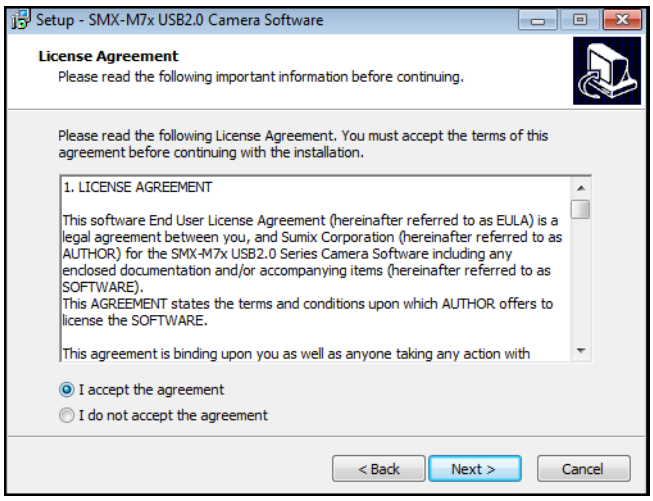



**Figure 2-2** *License Agreement dialog box*

4 The wizard starts to check your system information. Upon completion, a table with check results is displayed in the **System Information** box.

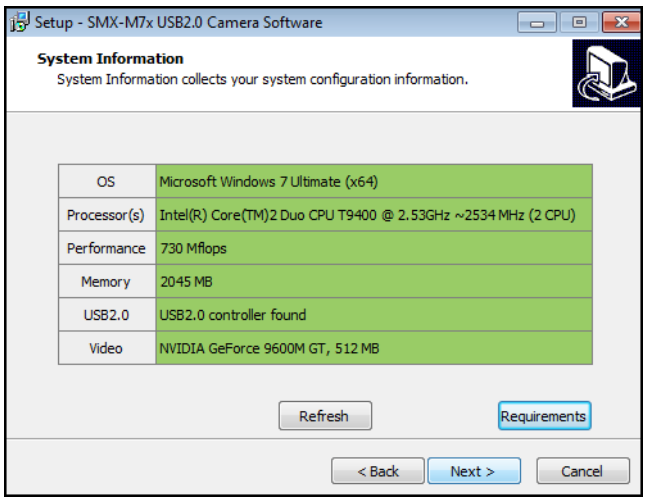



**Figure 2-3** *System Information box*

5 Do one of the following, depending on the results of the check:

- click the **Next** button if all table cells with system parameters are green (the parameters satisfy the software requirements)
- update your system if at least one cell is red - such configuration is not recommended
- update your system if at least one cell is yellow, otherwise the technical characteristics declared for the camera will not be achieved.

To see the recommended system requirements, click the **Requirements** button in the **System Information** dialog box:

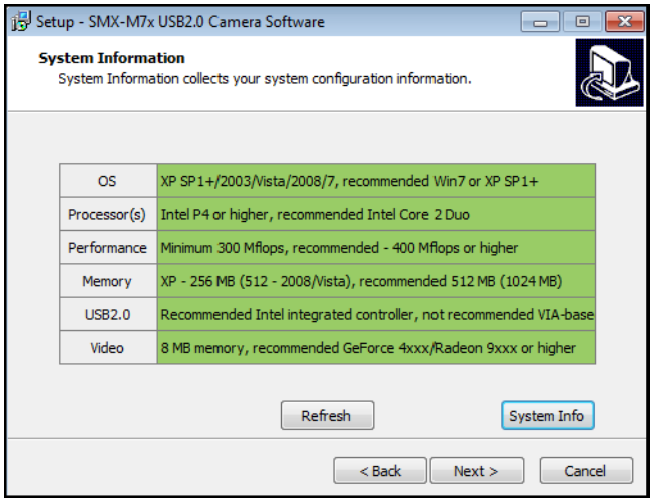



**Figure 2-4** *Recommended system configuration*

6 In the **Select Destination Location** box, click **Browse** to change the folder in which the SMX-M7x camera application software will be installed, or leave the one suggested by the wizard. Click **Next**.

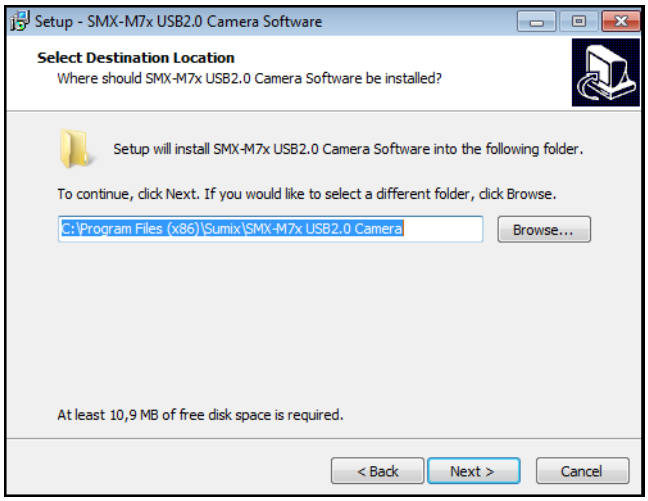



**Figure 2-5** *Select Destination location box*

7 In the same way, in the **Select Start Menu Folder** box, leave the suggested location or specify the folder you wish. Click **Next**.

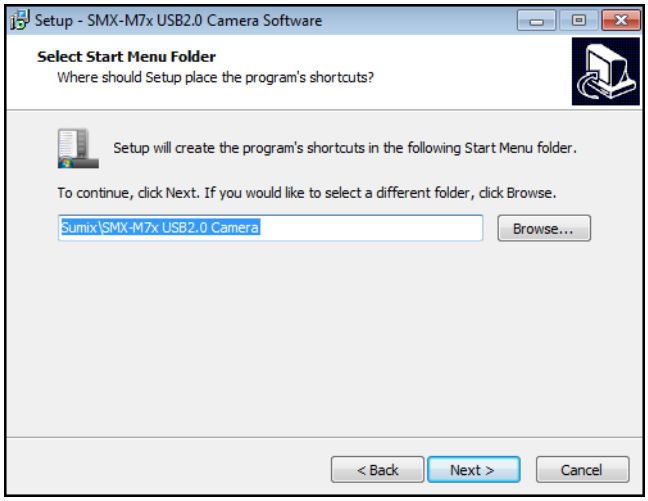



**Figure 2-6** *Select Start Menu Folder box*

8 In the next wizard box select additional icon that you wish to create and choose whether you want to launch the application right after the installation, or not.

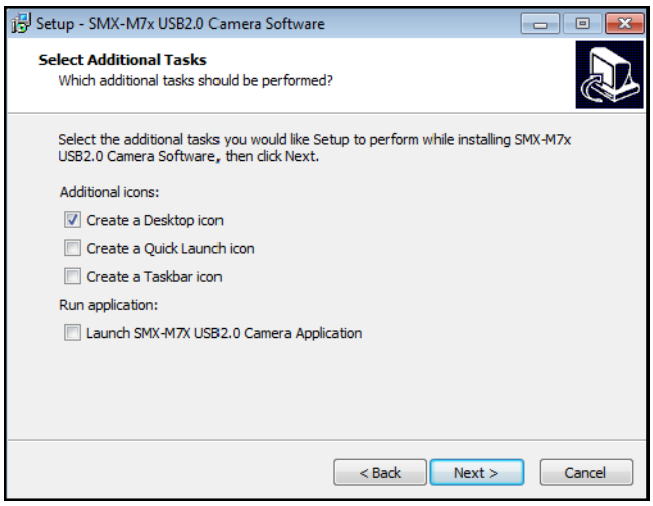



**Figure 2-7** *Select Additional Tasks box*

**9** In the **Ready to Install** step, view the options you selected and click **Install**.

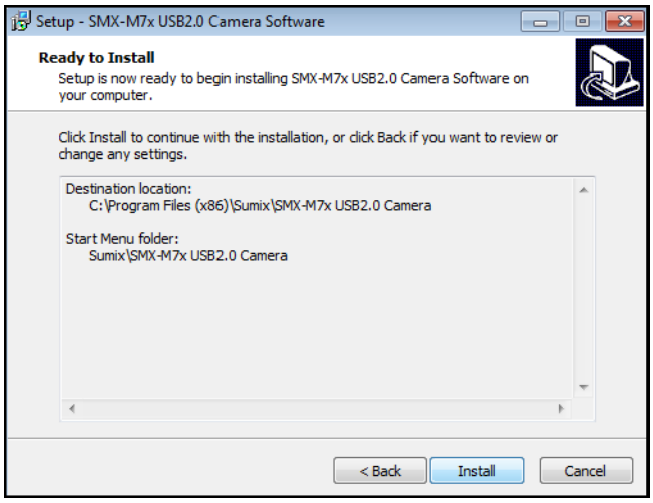



**Figure 2-8** *Ready to Install box*

**10** The wizard will start to install the application on your computer.

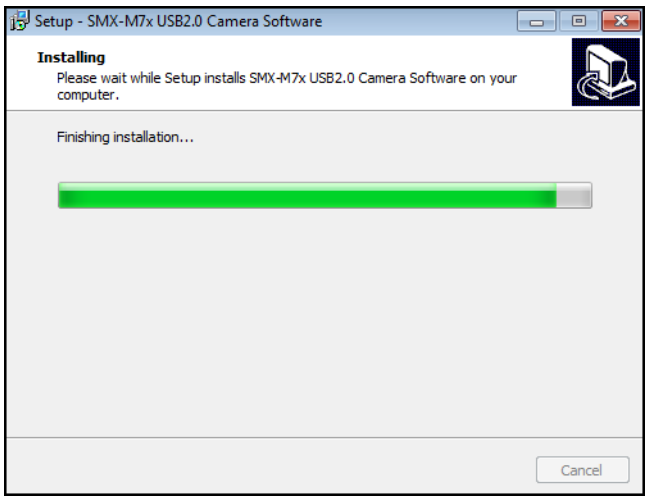



**Figure 2-9** *Installing box*

During the installation, the system will ask you whether you want to install the device software. Press **Install** to proceed.

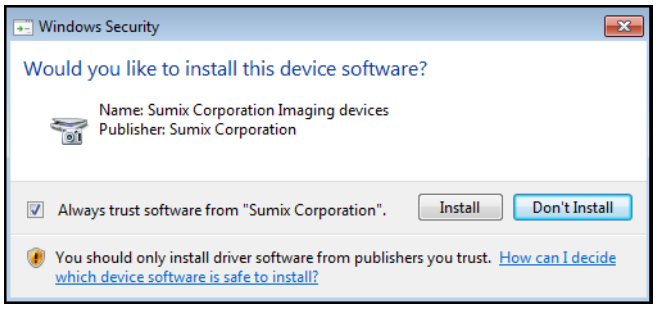



**Figure 2-10** *Windows Security box*

11 When done, click **Finish**. The software has been successfully installed.

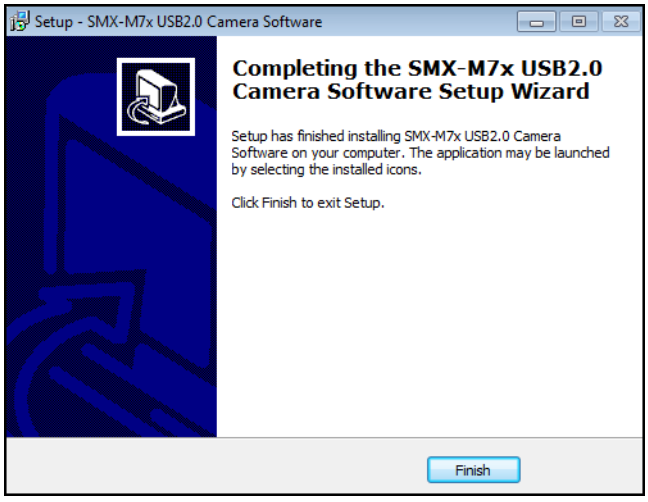



**Figure 2-11** *The last installation step*

*Note:* *If you face problems during the camera installation, see* "Troubleshooter" on page 18.

The installation of the camera driver will be completed when you first connect the camera to the computer's USB port.

# Update

The camera application software is constantly developed and improved. When a new version is available, the customers are notified and a new installer file is sent to them.

The update procedure is exactly the same as the installation described in the previous section. Simply run the new installer **SMXM7X<version>.exe** and follow the wizard (see "Installation" on page 9).

## Driver Update

When a new camera driver version is available, you can update it via the Windows device manage.

### To update the camera driver:

1. Connect the camera to the computer.
2. Open the **Device Manager** window in the **Control panel** window.
3. Double-click **Imaging devices**.
4. Right-click **SMX-M7x Series USB2.0 Camera** and select **Update Driver Software...**

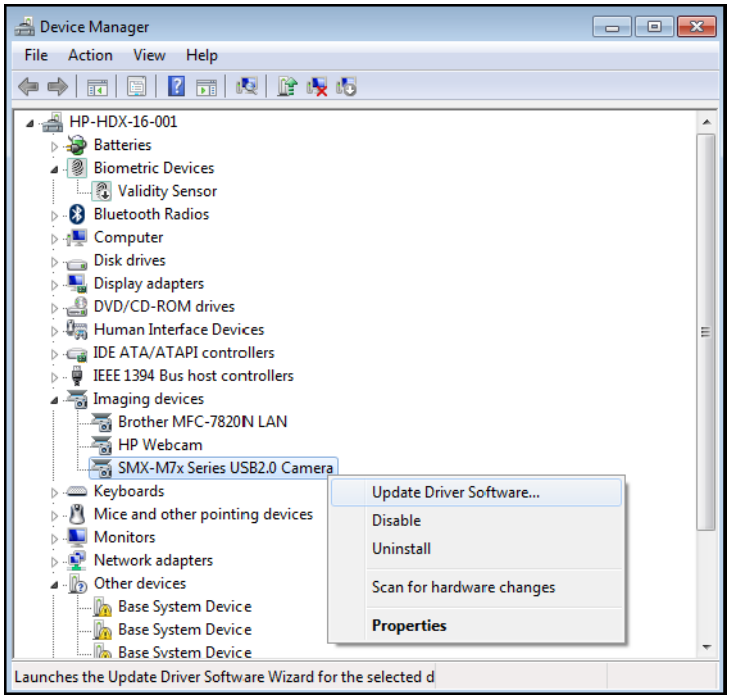



**Figure 2-12** *Updating the camera driver*

5 Follow the easy-on-screen instructions. On the first step, select **Browse my computer for driver software**.

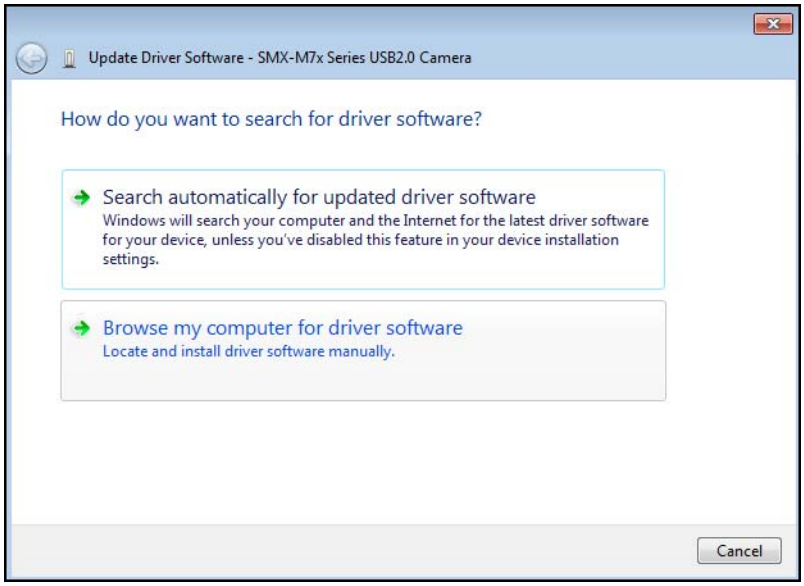



**Figure 2-13** *Updating the camera driver: step1*

6 On the next step, browse for the location on your computer where the driver is saved and click **Next**.

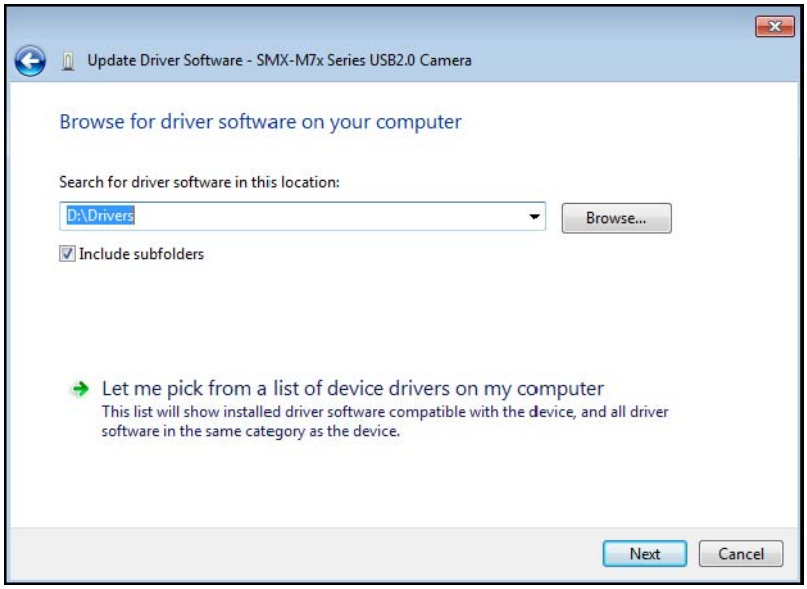



**Figure 2-14** *Updating the camera driver: step 2*

7 The system will start installing the driver. In the end, a message that the installation is successful will appear. Press **Close** to finish.

## Removal

To remove the camera application software, use the **Add/Remove Programs** section in the **Windows Control Panel**. Remove the application according to the general Windows application uninstallation rules.

Alternatively, you can click the uninstallation shortcut in the application folder (**Start** > **All Programs** > **Sumix** > **SMX-M7x USB2.0 Camera**> **Uninstall SMX-M7X USB2.0 Camera Software**) and follow the uninstallation wizard.

After removing the software, you need also to remove the camera driver.

### To remove the camera driver:

1 Connect the camera to the computer.

2 Open the **Device Manager** window in the **Control panel** window.

3 Double-click **Imaging devices**.

4 Right-click **SMX-M7x Series USB2.0 Camera** and select **Uninstall**.

5 Confirm removing the driver: check the **Delete the driver software for this device** and click **OK**.

**Figure 2-15** *Driver removal confirmation*

6 After the driver is uninstalled, the **SMX-M7x Series USB2.0 Camera** will disappear from the **Imaging Devices** section of the **Device Manager**.

## Troubleshooter

If you face problems with installation and detection of the camera, use this Troubleshooter. If you face problems that are not described below, contact Sumix Technical Department.

*Note: Tasks and problems in this section are demonstrated in Windows XP operating system.*

### Camera Was Not Detected or Recognized

If after connecting the camera to your computer the system does not detect it: there is no icon on the Taskbar or the camera was not recognized by the system:

Try doing the following:

- Check if the device was installed successfully: open system folder *WINDOWS\system32\drivers* and check if there is the *SMXM7X.sys* file (normally it is located on the *C:* hard disk). If not, run the Driver installation again. Be sure that no camera is connected during installation.
- If the problem still persists, manually save the *SMXM7X.sys* file to the *\WINDOWS\system32\drivers* folder (the *SMXM7X.sys* file is located in the *\Sumix\SMX-M7x USB2.0 Camera\Drivers* folder).

If the problem still persists, try one of the following:

- Reconnect the camera.
- Use other USB2.0 port of your computer - the problem might be due to the USB2.0 port malfunction.
- Use another USB2.0 cable - the problem might be due to the USB2.0 cable malfunction.
- Connect other SMX-M7x camera (if any) to the same USB2.0 port - the problem might be due to the camera malfunction.
- Disconnect the camera and restart your computer.

If any of the above steps did not help and the device is not recognized yet, try the following:

1. Connect the problematical camera to the computer.
2. Open the **Device Manager** window (right-lick **My Computer** desktop icon, select **Properties**, select **Hardware** tab, and then click **Device Manager**).
3. In **Device Manager**, double-click **Universal Serial Bus** controllers.
4. In **Device Manager**, select one of the following:

- **Imaging devices> SMX-M7x Series USB2.0 Camera** with Warning status, if it is available there:

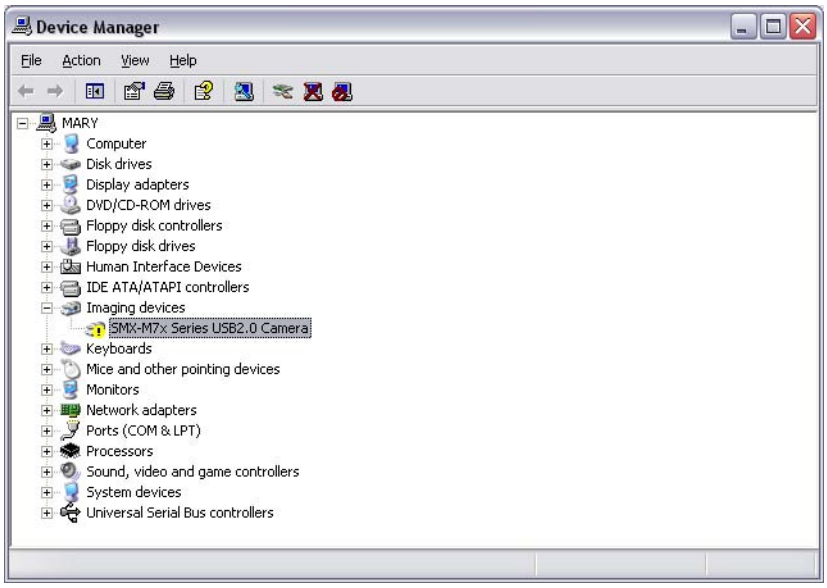



**Figure 2-16** *Device Manager: the SMX-M7x camera with Warning status*

- **Universal Serial Bus controllers> Unknown device**:

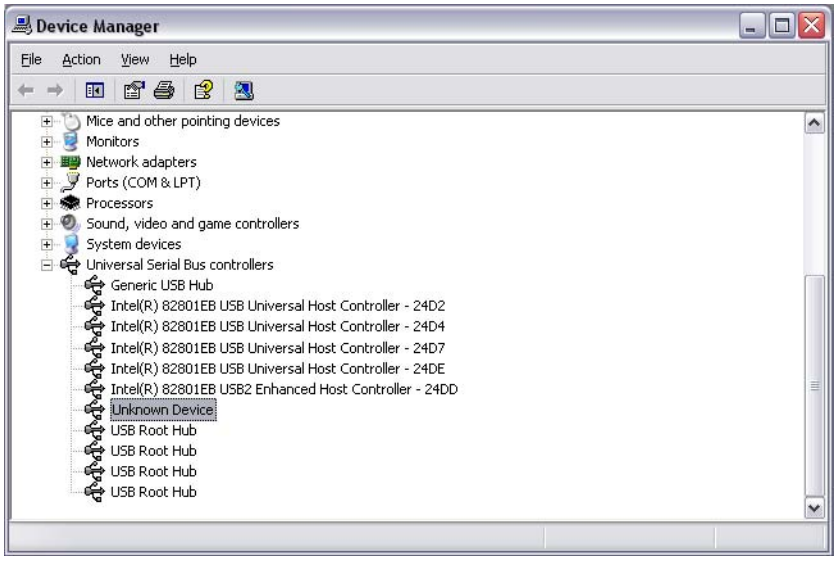



**Figure 2-17** *Device Manager: the SMX-M7x camera is detected as Unknown device*

**5** Right-click and select **Update Driver…**:

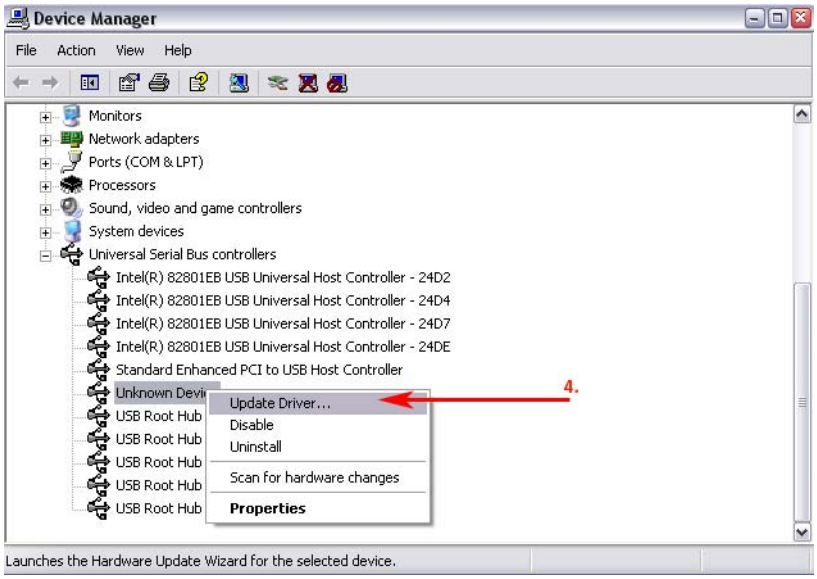



**Figure 2-18** *Device Manager: Updating the SMX-M7x camera driver*

Run the **Hardware Update Wizard** the same way as the **Found New Hardware Wizard** by choosing the **Install the software automatically (Recommended)** option:

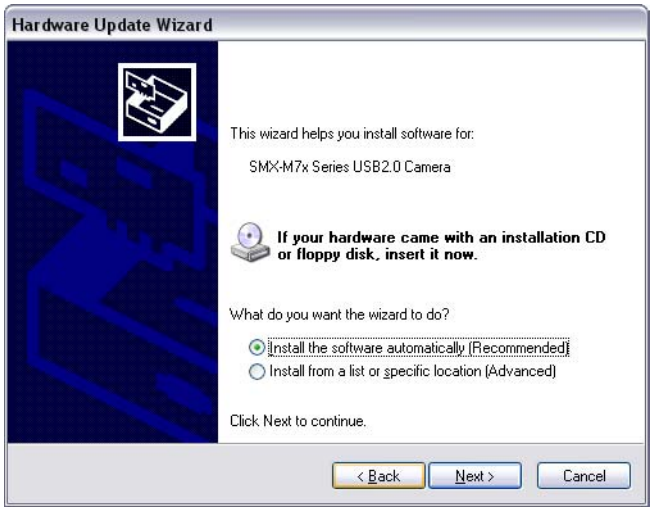



**Figure 2-19** *Hardware Update Wizard: the Welcome window*

6 If some problems occur during the manual hardware installation, read the next section of this Troubleshooter.

## Cannot Install the Hardware

If the **Found New Hardware Wizard\Hardware Update Wizard** failed to install the hardware (the wizard that starts after the first connection of the camera or the **Wizard** that starts for updating the hardware; failure occurs after you browse to the files needed for the installing),

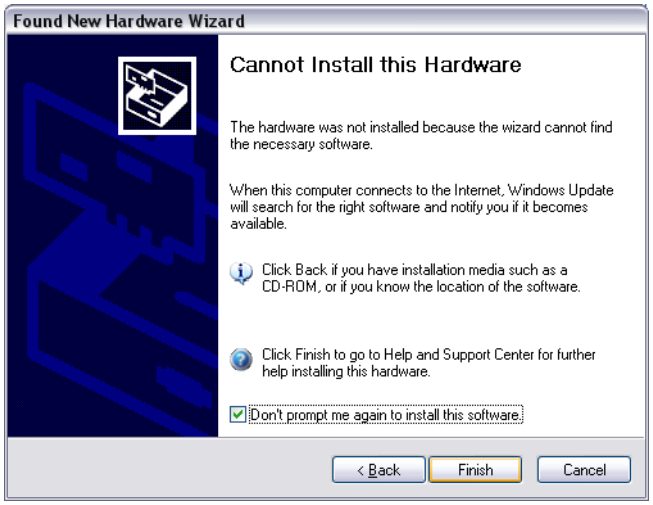



**Figure 2-20** *Found New Hardware Wizard: Cannot install this Hardware*

try doing the following:

1 Click **Back** in the F**ound New Hardware Wizard** and select **Install from a list or specific location (Advanced)**.

2 Click **Next**.

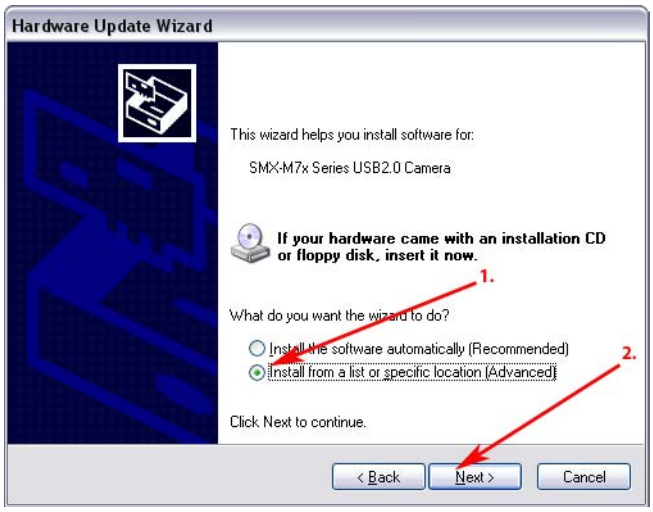



**Figure 2-21** *Found New Hardware Wizard: Installing from a list or specific location (Advanced)*

3 Select **Search for the best driver in these locations**.

4 Check the **Include this location in the search box**.

5 Browse to the Drivers folder - on the SMX-M7x Camera CD or in the **Sumix\SMX-M7x USB2.0 Camera** folder (located on the hard disk where you installed the SMX-M7x Camera Software, normally it is the **C:\Program Files\Sumix\SMX-M7x USB2.0 Camera**).

6 Click **Next**.

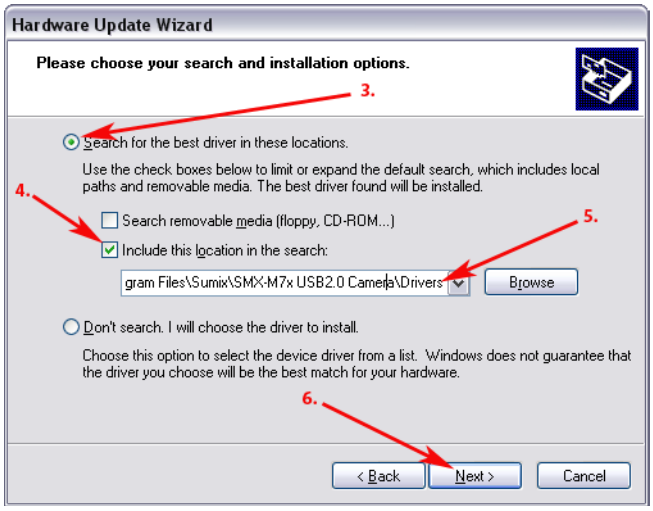



**Figure 2-22** *Installing from a list or specific location: specifying location*

7 In the list, select the last item.

8 Click **Next**.

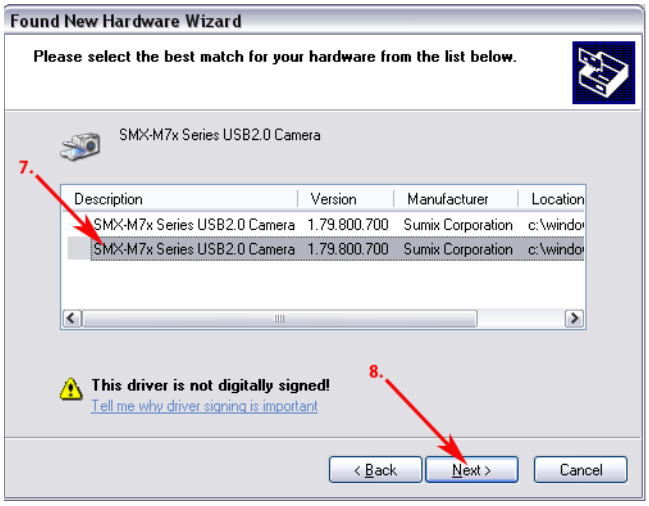



**Figure 2-23** *Install from a list or specific location: selecting file among the Wizards's search results*

9 Wait till the wizard installs all files.

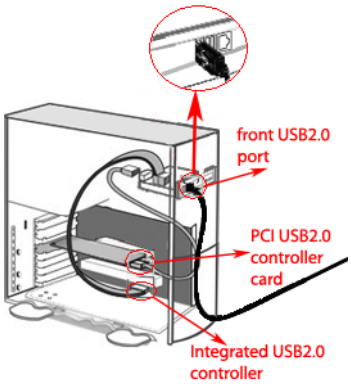
10 Click **Finish** if installation passed successfully.

Chapter 3

# GETTING STARTED

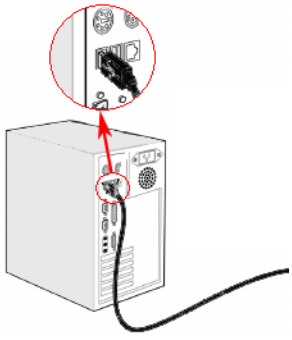
## Recommendations on the Camera Connection

Most computers have both front and back USB2.0 ports location. We do not recommend using the front USB2.0 port of your computer since it is not directly connected to the computer's USB Host Controller.




As shown on the picture above, the front USB2.0 port is connected to the USB Host Controller by long cables inside computer, meanwhile back USB2.0 port is connected directly to its controller at the back panel of computer.

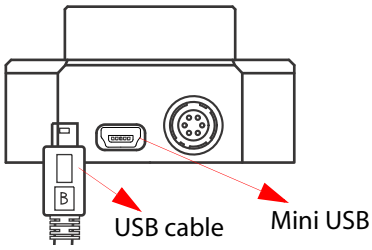
So, when connecting the camera to the front USB2.0 port the device might not work properly. We recommend to use the back USB2.0 port to avoid problems with the camera work (see the picture below).



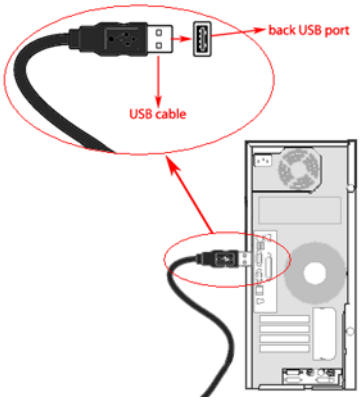
*Note:* *Design and configuration of the front USB2.0 port location shown on the pictures above might differ from yours. The pictures' goal is only to show how the front USB2.0 port is connected to its controller*

## Plugging in the Camera

Connect SMX-M7x camera with USB2.0 cable.




Connect the other end of the USB cable to the back USB2.0 port of your computer.



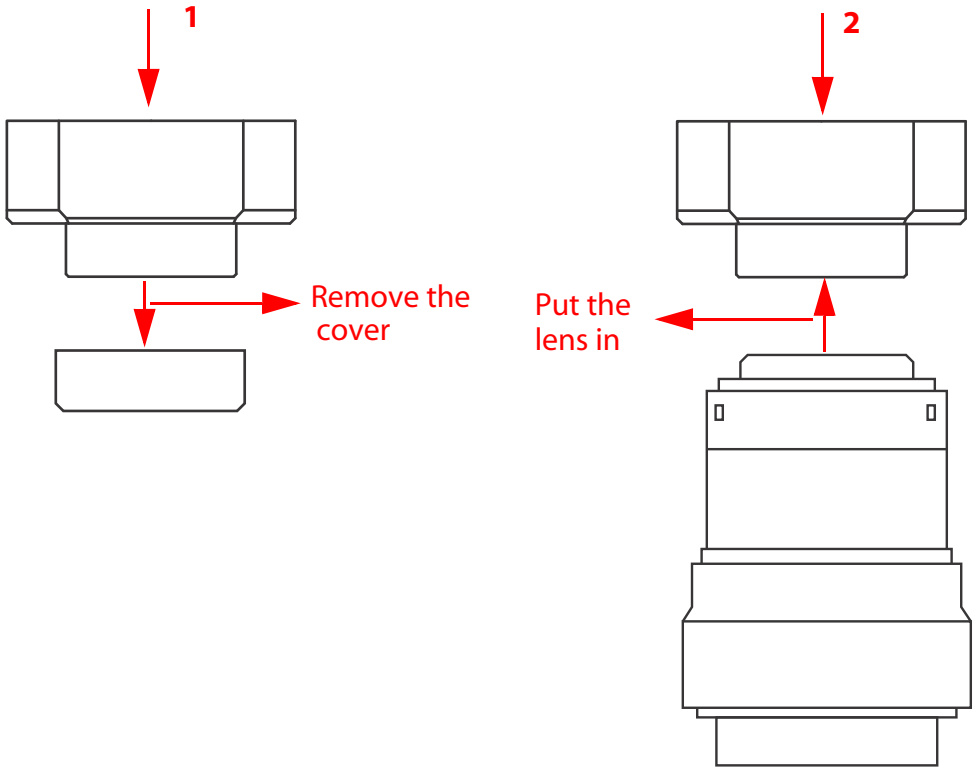

## Installing Lens

To use a lens with the camera, remove the cover from the camera and install a lens as described below.

It is recommended to remove the cover and install a lens (as well as remove a lens and put on the cover) when the camera is faced down, to prevent the sensor contamination.

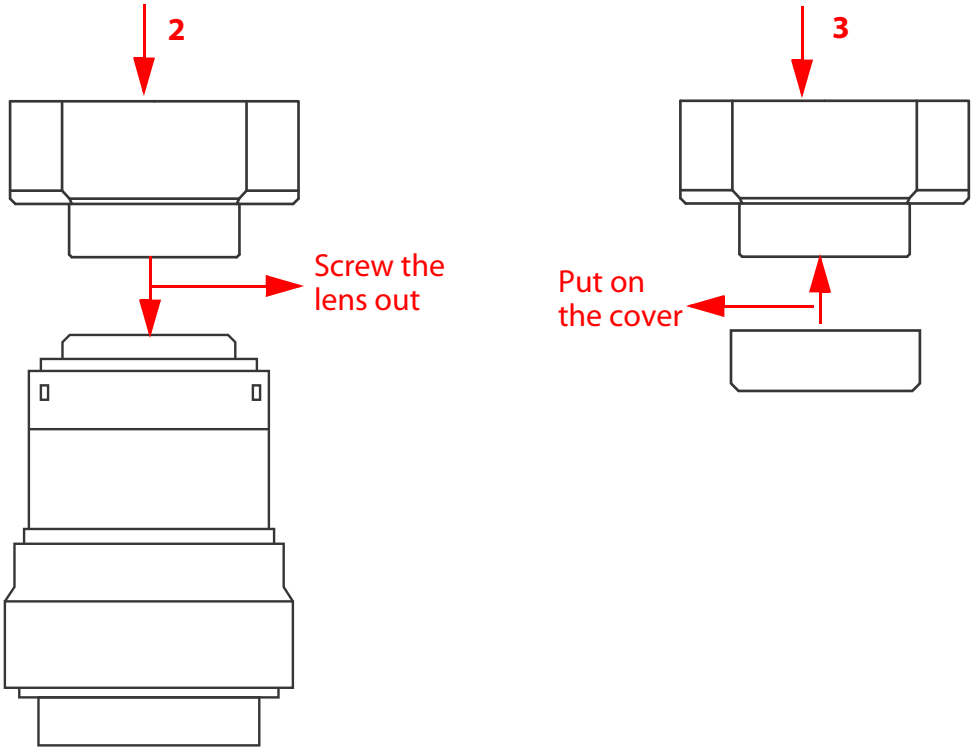
### To install a lens:

1. Face the camera down.
2. Remove the camera cover.
3. Screw the lens in (see the picture below):



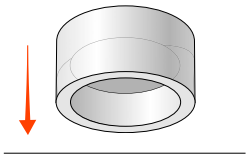

### To remove the lens

1. Face the camera down.
2. Screw the lens out.
3. Put on the cover (see the picture below):




*Note:* *Before screwing the lens in or putting on the cover, make sure that the surfaces are free from dust*

*When you remove the cover, put it facing down to keep dust out*



## Installing Driver Software

After you connect the camera to the USB port of you computer, a **Found New Hardware** message will appear in the notification area of the task bar, and Windows will install the hardware driver. When the installation is finished, a message will appear in the notification area:

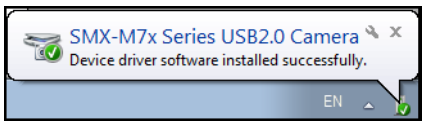



**Figure 3-1** *Notification about successful camera installation*

*Note* *If you experience problems during the driver software installation, refer to the Installation Troubleshooter and learn how to fix such problems (see "Troubleshooter" on page 18).*

## Starting the Application

After the camera hardware has been installed, you can start the application.

### To start the camera application:

Click **Start** > **All Programs** > **Sumix** > **SMX-M7x USB2.0 Camera** > **SMX-M7x USB2.0 Camera Application Program**. If during the installation you chose to install a desktop icon and/or a quick launch icon, you can also click the icon to launch the application. The SMX-M7x camera application will start with its main window.

The SMX-M7x camera application consists of the following parts:

- Main window which contains the main functions. On the top of the main window, there is an application toolbar:

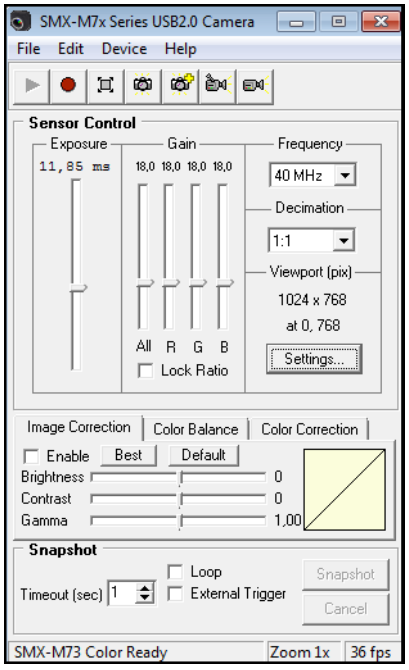



**Figure 3-2** *SMX-M7x application main window*

- **Histogram** which reflects all color settings of the camera.

### To open the histogram:

Press the **h** button on the keyboard or select **Histogram** from the **Device** menu.

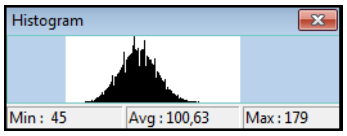



**Figure 3-3** *Camera histogram*

*Note:* *The histogram window is empty when the video is not started.*

- **Device Settings** window contains the camera settings.

### To open the Device Settings window:

Select **Settings** from the **Device** menu or press **Alt+s** on the keyboard.

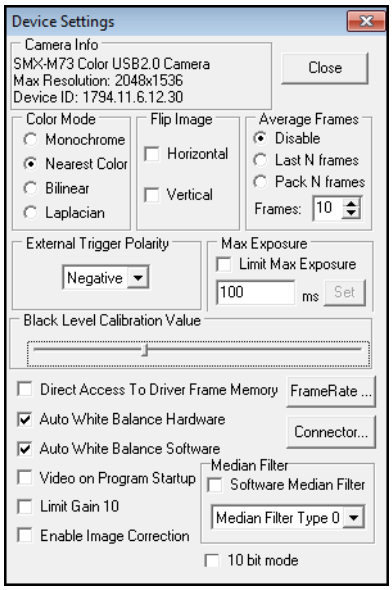



**Figure 3-4** *Device Settings window*

- **Video mode** window which shows a live view from the camera and reflects all settings of the image

**Figure 3-5** *Video mode window*

### To start video from the camera:

Click the **Start Video** button in the toolbar:

**OR**

Select **Start Video** from the **Device** menu.

*Note:* *To display video right after you enter the application, select the* **Video on Program Startup** *check box in the* **Device Settings** *window. Then you will not need to click the* **Start Video** *button.*

If the **Start Video** button is not active, go to the **Device** menu in the main window, choose **Switch Multiple…** and select the connected camera.

## Switching Between Cameras

If you have more than one SMX-M7x camera connected to your PC, the camera application allows you to switch between them or make sure the application operates the required camera.

### To switch between multiple cameras:

1 In the **Device** menu of the application's main window, select the **Switch Multiple** command.

2 The **Choose a Camera** window will appear.

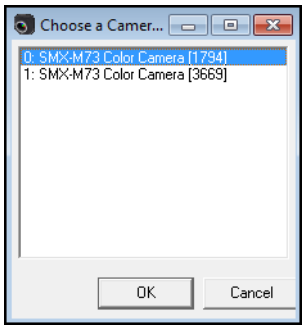



**Figure 3-6** *Switching between cameras*

3 In the list of the present cameras, select the desired one and click **OK.**

*Note: When two or more cameras run on the same computer, frame rate of each camera decreases.*

## Viewing Camera ID

The camera ID is shown on the top of the **Device Settings** window.

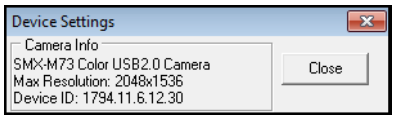



**Figure 3-7** *Camera ID*

## Reducing CPU Load

You can reduce CPU load by enabling the **Direct Access to Driver Frame Memory** option at the bottom of **Device Settings** window.

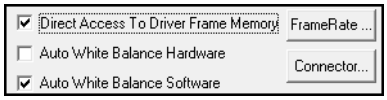



**Figure 3-8** *Direct Access to Driver Frame Memory checkbox*

See API documentation for the details on how to provide direct pointer to the driver frame memory instead of copying the frame to the user buffer.

# Chapter 4
# TUNING GUIDELINES

## Initial Settings

Check if the **Start Video** button on the camera application's toolbar is enabled:

If it is not enabled, check the list of all available cameras in **Main menu > Device > Switch Multiple…** If the list is empty, check if the camera is connected and if the driver is installed correctly.

The illumination of the camera's image depends on the values of frequency, exposure, gain, the image dimensions (resolution) and decimation factor.

The recommended initial settings are:

- **Gain** and **Exposure** sliders are in the lowest position
- **Decimation** is 1:1
- **Viewport size** is 800 x 600 (the **Viewport settings** dialog box is activated with the button on the camera application toolbar or **Alt + v** on the keyboard)
- **Color Mode** is set to **Bilinear** (**Main Menu > Device > Settings...** dialog box, **Color Mode** section)
- **Histogram** is active (**Main menu >Device > Histogram** is selected or **h** is pressed)

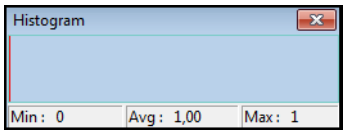



**Figure 4-1** *Histogram of initial state*

- The **Image Correction** tab is selected
- The **Enable** check box is set
- The **Brightness**, **Contrast**, **Gamma** sliders of the **Image Correction** tab are in the central position (their values are 0, 1, 1, respectively). To reset the values for all sliders at one go, click the **Default** button. To reset one of them, double-click its value at the right end of the slider bar
- The **R**, **G**, **B** sliders of the **Color Balance** tab are in the central position (their values are 1, 1, 1, respectively). To reset the values for all sliders at one go, click the **Default** button. To reset one of them, double-click its value at right end of the slider bar

- The **Brightness**, **Contrast**, **Saturation** sliders of the **Color Correction** tab are in the central position (their values are 0, 1, 1 - respectively). To reset the values for all sliders at one go, click the **Default** button. To reset one of them, double-click its value at right end of the slider bar

*Note:* *The slider values will affect the image, only if the **Enable** box is checked.*

## Tuning Light in the Image

To tune illumination, install a lens (see "Installing Lens" on page 26).

### To tune light in the image:

1. Use maximum diaphragm aperture of your lens.
2. Try to get enough light using the **Exposure** slider.
3. If the **Exposure** slider is at maximum and more light is needed, decrease frequency (it will enlarge the exposure interval).
4. If illumination is not enough, use the **Gain** group of sliders (**All, R, G, B**).
5. Press **e** on the keyboard to adjust the exposure automatically.

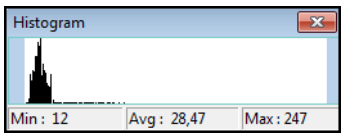



**Figure 4-2** *Histogram after illumination is tuned*

6. If the image is still too dark, you can also change black level:
   a. Open the **Device Setting** window by pressing **Alt+s**.
   b. Go to the Black Level Calibration Value control and move the slider until the image becomes as bright as you need.

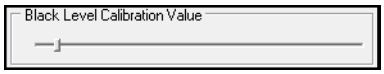



**Figure 4-3** *Black Level Calibration control*

## Color Tuning

### To tune color of the image:

1. Put a white object (for example, a piece of paper) in front of the camera.
2. Perform **White Balance (Hard)**: select **Device > White Balance (Hard)** or press **Alt+w**. It will balance the **RGB** components of white at the hardware level.

3 Select **Main > Device > White Balance (Soft)** item or press **w** on the keyboard (color balance at software level).

4 On the Image Correction tab of the main window, set **Brightness** to **127** and **Contrast** to **64.**

5 If the colors are still faint, make sure that the **Image Correction** tab is active and click the **Best** button.

To control the color components, use the **R, G, B** sliders of the **Color Balance** tab and the **Brightness**, **Contrast** and **Saturation** sliders of the **Color Correction** tab.

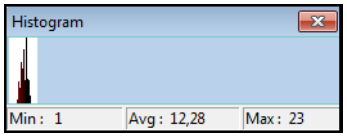



**Figure 4-4** *Histogram after performing White Balance (Soft)*

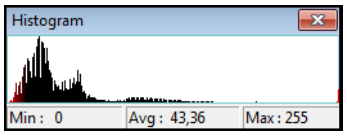



**Figure 4-5** *Histogram after the Best button is applied*

*Note: The **Best** button should be used every time when light conditions change*

## Contrast Tuning

Activate the **Histogram (H)**, activate the **Image Correction** tab, set the **Enable** check box and use the **Contrast** slider to get the histogram as wide as possible (ideal min = 0, max = 255 provided there are no red points at the extremities of the histogram window).

## Sensor Controls

The sensor control options are located in the **Sensor Control** section of the application main window. They are as follows.

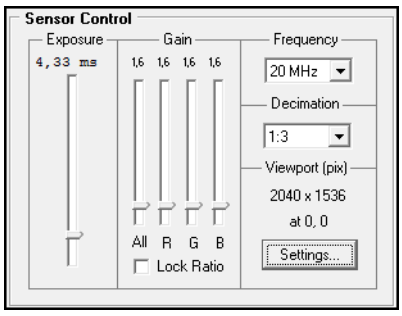



**Figure 4-6** *Sensor controls*

## Exposure

The exposure parameter defines time during which the sensor will consume light energy before starting to record data.

Use the **Exposure** slider to adjust the camera exposure time manually. The current exposure time in milliseconds is displayed above the control. This value depends on viewport height, decimation and sensor frequency.

If you need to set exposure even higher than the maximum slider value, use the **Max Exposure** control in the **Device Settings** window. Check the **Limit Max Exposure** box, enter new limit value and press **Set**.

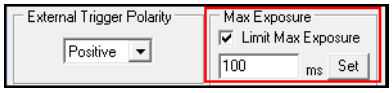



**Figure 4-7** *Max Exposure control*

### To tune exposure automatically:

In the **Device** menu select the **Auto Exposure** command, or press **E** on the keyboard.

## Gain

Gain can be controlled independently for **Red**, **Green** and **Blue** channels (**R**, **G**, **B**). All gain sliders control the camera's hardware gain amplifier. The **R, G** and **B** gain sliders control the software gain for each color channel.

Checking the **Lock Ratio** check box allows controlling gain on three channels simultaneously keeping the fixed **R**; **G**; **B** gain ratio.

Use the '**White balance (Hard)**' menu item (**Device> White Balance (Hard)** or **Alt+w** to balance the gain of all three channels so they are equally intense.

*Note:* ***Auto Exposure*** *is done automatically every time* ***White Balance (Hard)*** *is performed.*

In case of SMX-M71M monochrome camera, set gain using the **All** slider.

You can limit the maximal set gain value to 10. Use the **Limit Gain 10** checkbox in the **Device Settings** window.

**Figure 4-8** *Limit Gain control*

If this box is checked, you will not be able to set gain higher than 10.

### Frequency

The **Frequency** drop-down box provides values for the pixel clock frequency of the sensor. The lower the frequency, the higher the maximum possible exposure time and the less the frame rate is. This control defines the frequency of polling the camera for its image stream.

### Decimation

Use the **Decimation** drop-down box to decimate (sub-sample) the picture by 2, 3, 4 or 6. The decimation means excluding pixels and rows from the scan process (for example, every second pixel and second row for the 1:2 decimation). This mode thus allows viewing the picture at the higher frame rate.

The higher decimation can be used for preview, when the full 1600 x 1200 image can be displayed as 800 x 600 with the frame rate two times higher.

### Viewport

Viewport is a rectangular area of the sensor on which the image is scanned. It can have variable size: from the full sensor field of view to the small area of 8 x 8 pixels. The smaller vertical size (in lines) of the viewport, the faster the scan process and the higher the frame rate is.

#### To change the viewport:

1 Press **Alt+v** on the keyboard

**OR**

Click the **Settings…** button below **Viewport (pix)**

**OR**

Click the **Viewport Settings** button on the toolbar:

2 The **Viewport Settings** window will open.

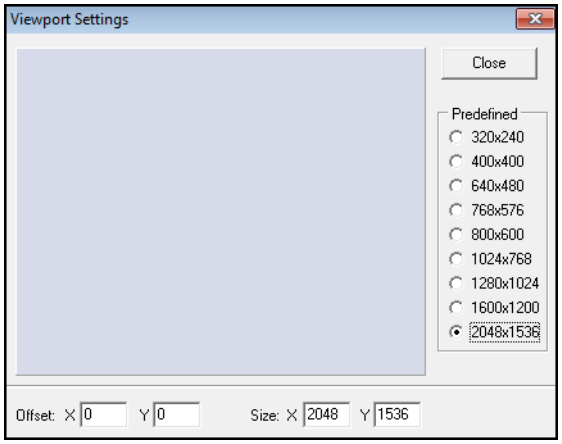



**Figure 4-9** *Viewport Settings window*

3 You can select one of the predefined viewport options and then drag the rectangle across the full viewport resolution area for the viewport window. You will notice how the image in the **View Mode** window changes with the movement.

4 Alternatively, you can change values in the following fields:

- **Offset X, Y** fields with coordinates of the top left corner of the rectangle
- **Size X, Y** fields with coordinates of the bottom right corner of the rectangle

If the viewport size is smaller than 2048x1536, you can also change it by dragging the video image in the **Video mode** window.

## Image Correction

The **Image Correction** controls are designed for setting up the camera brightness, contrast and gamma. These corrections are programmable with the conversion (lookup) table of the values. They do not affect any electrical settings of the camera. The gamma correction is done by the camera hardware.

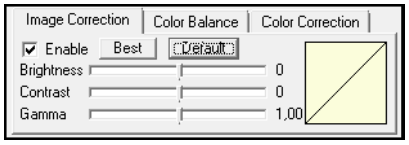



**Figure 4-10** *Image correction controls*

To use these controls, check the **Enable** box - the **Brightness**, **Contrast** and **Gamma** sliders become editable. By default, the values of **Brightness**, **Contrast** and **Gamma** are set to **0; 0; 1, 00**, respectively.

You can restore the default values at any step, just click the **Default** button on the **Image Correction** tab.

Click the **Best** button to automatically achieve the optimal combination of brightness, contrast and gamma instead of setting them manually. As the result, the application will transform the look-up table of 8 and 10 bit to increase the dynamic range.

*Note* *The default values of **Image Correction** are the most suitable and recommended for performing **White Balance (Hard).***

*The SMX-M7x camera software does not display changes of the Image Correction look -up table when the **Best** button is pressed.*

With every change of any **Image Correction** control, you can view a graphical interpretation of dependence of the image's changes from the changes of the **Image Correction** controls.

## Color Balance

The **Color Balance Controls** are designed for the SMX-M72 and SMX-M73 (color) models to adjust the ratio of the main induced color components (**Red**, **Green** and **Blue**) of the image. This correction is performed on the software level and does not affect any electrical settings of the camera.

To use the **Color Balance Controls**, set the **Enable** check box on the **Color Balance** tab - **R**, **G** and **B** sliders become editable.

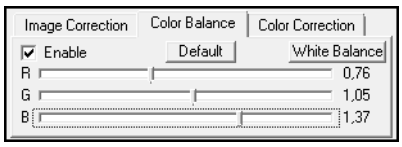



**Figure 4-11** *Enabling the Color Balance Controls*

Use the **White Balance** button for white color balancing (the same can be done in **Device> White Balance** or by pressing **w** on the keyboard) on the **Color Balance** tab. The **Default** button returns the color balance controls to their default values: 1.00; 1.00; 1.00, respectively.

Single step of the **Color Balance** controls is 10 times smaller than **R, G, B (Gain)** of the **Sensor Controls**, so all changes of **Color Balance** can be performed with more accuracy than it can be done using **R, G, B (Gain)** of **Sensor Controls**.

*Note:* *The difference between **White balance (Soft)** and **White Balance (Hard)** is as follows: the **White Balance (Soft)** operation is done only on the software level, so it changes the **Color Balance** controls. The **White Balance (Hard)** operation is done programmatically by the camera firmware, so it changes **R**, **G** and **B** (**Gain**) of **Sensor Controls**.*

*Note:* *It is not recommended to perform **White Balance (Hard)** when **White Balance (Soft)** is already performed. It may cause the image colors distortion.*

## Color Correction

The **Color Correction Controls** are designed for the SMX-M72 and SMX-M73 (color) models to adjust the intensity of the color properties (brightness, contrast and saturation) of the image. This correction is performed on the software level and does not affect any electrical settings of the camera.

Check the **Enable** check box on the **Color Correction** tab to make the **Color Correction Controls** available.

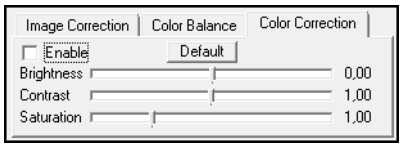



**Figure 4-12** *Enabling the Color Correction tab*

Use the **Default** button to restore the default values of brightness, contrast and saturation - 0.0; 1.00; 1.00, respectively.

## Advanced Sensor Controls

Apart of the controls in the main application window, you can also use controls available in the **Device Settings** window. To access the **Device Settings** window, press **Alt+s** on the keyboard or select **Settings** from the **Device** menu.

### Color Mode

The **Color Mode** section defines the rules for decoding the stream of source pixels from the sensor and transforming it into the output image. This control is available for the SMX-M72 and SMX-M73 color models.

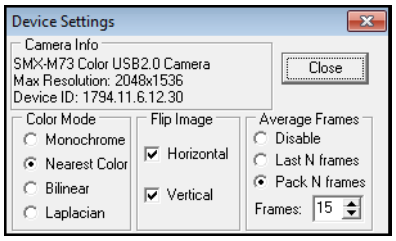



**Figure 4-13** *Advanced sensor controls*

- The **Monochrome** mode forces the transformation of the sensor pixels data into monochrome stream.
- The **Nearest Color** mode: Bayer matrix from the sensor is transformed into destination stream using the Nearest Color algorithm (the fastest algorithm that gives the worst, compared to other algorithms, image quality).

- The **Bilinear** mode: Bayer matrix from the sensor is transformed into destination stream using the Bilinear algorithm (a slower algorithm that gives better quality).
- The **Laplacian** mode: Bayer matrix from the sensor is transformed into destination stream using the Linear Interpolation with Laplacian second-order correction terms (the slowest algorithm that gives the best quality).

## Image Flip

You can flip the image in the **Video** mode window horizontally and/or vertically. Check the corresponding boxes in the **Flip Image** section of the **Device Settings** window. Using the flip controls, you can rotate the image without changing the camera position itself.

## Increasing Image Quality

You can increase the image quality by compensating the random noise of the sensor. For this purpose, use the **Average Frames** controls in the **Device Settings** window.

There are two averaging modes:

- **Last N frames**: the currently displayed frame is the average of the last N frames set in the **Frames** box. The picture is updating every frame
- **Pack N Frames**: the currently displayed frame is the average of the last N frames set in the **Frames** box. The picture is updating every N-th frame.

*Note* *Use the averaging only for static pictures. Displaying moving objects in the average mode will lead to the image blurring.*

## Frame Rate

You can change the frame rate for the current sensor parameters (for example, frequency or viewport) using the **FrameRate Control** button in the lower part of the **Device Settings** window.

### To change frame rate:

1. Open the **Device Settings** window by pressing **Alt+s** on the keyboard.
2. Press the **FrameRate Control** button.

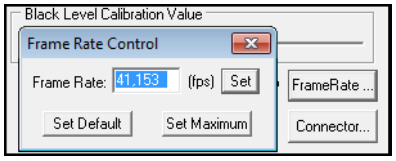



**Figure 4-14** *The Frame Rate Control window*

3. The **Frame Rate Control** box opens. By default, it shows the maximum value for the current sensor parameters.

4 Type in the new value in the **Frame Rate** field, then press **Set**. You will not be able to set frame rate lower or greater than limits. To check the maximum limit, press the **Set Maximum** button.

The **Set Default** button - if applied, the default value of frame rate for the camera with current settings will be performed. The default value is flashed in every camera and is applied automatically when the camera's settings are changed.

*Note: For the Snapshot Loop mode, it is recommended to use the default value of frame rate*

As a result, the **Frame Rate** value will not be greater than the one you entered in the **Frame Rate Control** window. Check it when running video: frame rate value will be displayed at the bottom-right corner of the status bar in the application's main window.

*Note: When running the camera on a system that does not meet the minimal requirements (see "System Requirements" on page 9), the frame rate value can be less than it is set with the* **Frame Rate Control** *option, especially when running with full viewport and with high frequencies.*

## Auto White Balance

*Note: These controls are used for the SMX-M72 and SMX-M73 color camera models.*

Enable the **Auto White Balance Hardware** and/or **Auto White Balance Software** checkboxes if you want to automatically balance white at the hardware and/or software levels every time when the picture changes. For **Auto White Balance Software** operation, check also the **Enable** box on the **Color Balance** tab of the main window.

**Figure 4-15** *Auto White Balance checkboxes*

For more information on white balance, see "Color Balance" on page 39.

## Output Bits per Pixel

If the **Use 10 bits** box is checked, it enables the software to transmit **10 bit** images from the camera as opposed to regular **8 bit**.

**Figure 4-16** *10 bit mode check box*

## Median Filter

The median filter is a technique of removing noise from an image. The SMX-M7x cameras have two median filters:

- The **Software Median Filter** which turns on pixel averaging. The brightness of every single pixel becomes affected by the brightness of its neighbor pixels and the whole

image becomes smoother. To enable this filter, check the **Software Median Filter** box.

- The **Hardware Median Filter** which detects and corrects isolated missing pixels in the output stream of an image sensor. It is based on the prediction of the allowed range of gray values for a pixel, from the gray values of the neighborhood of that pixel. To enable this filter, select a type in the drop-down box.

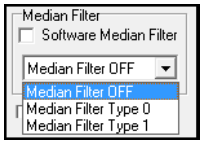



**Figure 4-17** *Median Filter controls*

There are two types of the hardware median filter:

- **Median Filter Type 0**, which reduces speckle noise and salt and pepper noise.
- **Median Filter Type 1**, which preserves edges and is useful when edge blurring is undesirable.

## Saving and Loading Camera Profiles

The SMX-M7x camera application automatically stores most of the camera settings on exit and restores them on startup. You can also store current settings in profile files (***.pro**) and load them whenever you need. Profiles store frequency, gain, exposure, viewport, flip, black level and column balancing, and other settings.

**To save current camera settings into a profile:**

1 Press **Ctrl+s**.

**OR**

In the **File** menu select the **Save Profile** command.

2 **Save Camera Profile** box appears. Type in profile title and select a folder where you want to save the file.

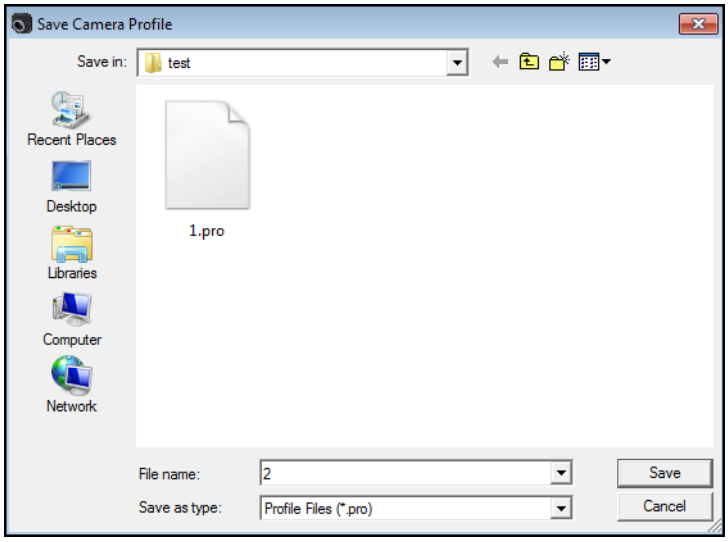



**Figure 4-18** *Saving camera profile*

3 Press **Save**.

### To load a profile:

1 Press **Ctrl+o** or in the **File** menu, select the **Open Profile** command.

2 **Load Camera Profile** box appears. Browse to a folder with profile files and select one you want to load.

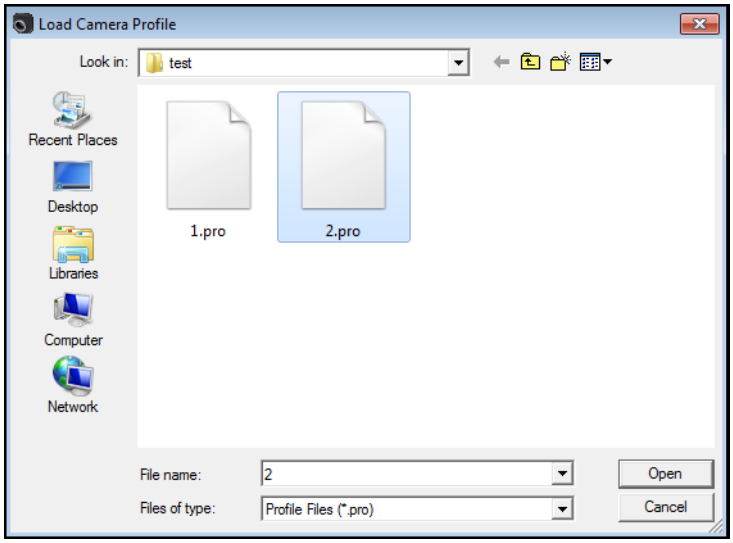



**Figure 4-19** *Loading camera profile*

3 Press **Open**.

# Chapter 5 CAPTURING

The SMX-M7x camera application enables you to capture images from the camera and to store them in BMP or TIFF format files. You can also save files with video that you record.

## Capturing Images

### To capture frames:

1. Start video (press **F5** or the button **Start Video** in the toolbar).
2. You can capture a single frame or a frame sequence:
   - For a single frame press **F2** or the button in the toolbar
   - For a sequence press **F3** or the button in the toolbar.
3. The frame/frame sequence is captured immediately and saved in the folder specified in **Capture Options** (see "Saving Options" on page 47).

### Capture Limits

The **Limits** section in the **Capture Options** dialog box allows controlling the capture parameters. To open the dialog box, press **Alt+c** on the keyboard.

You can lower the noise level in the frame being captured using the **Capture single frame as average** of box. Check the box and type in the number of frame you want to average.

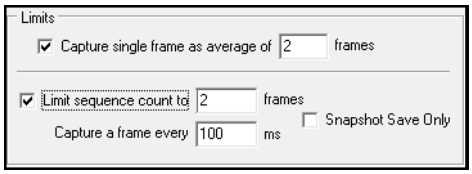



**Figure 5-1** *Limits section of Capture Options*

By default, two frames are captured in a sequence. You can increase this value:

1. Check the **Limit sequence count to** box.
2. Type in the new value in the field near the checkbox.
3. Change the time period for capturing frames in the **Capture a frame every** field. The sequence capture interval cannot be less than current frame exposure time. If it is less, an error message will be displayed when you try to perform a sequence capture:

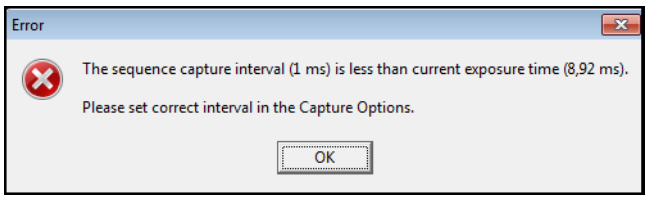



**Figure 5-2** *Message about incorrect sequence capture interval*

4 Press **OK**.

## Recording Video

### To record a video:

1 Start video (press **F5** or the button **Start Video** in the toolbar).

2 To start video recording, press **F4** or the button in the toolbar.

3 Press **Shitf+F5** to stop the video stream or click the **Stop Video** button in the toolbar.

4 The video is recorded and saved in the folder specified in **Capture Options** (see "Saving Options" on page 47) as an **.avi** file.

## Saving Video to Memory

You can save video or frames to the core memory. This is done without a delay between frames. Do the following:

1 Start video.

2 Press the **Save Video to Memory** button in the toolbar or press **Shift+F4** on the keyboard.

Number of frames in the video is set via the **Capture Options** box. Type in the required number in the **Capture Limit** field:

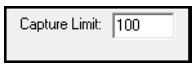



**Figure 5-3** *Save Video to Memory section*

When you use the **Save to Memory** option, frames will be saved as image files similarly to the simple saving (see "Saving Options" on page 47). Video will be saved as a **.smx** file which can be replayed and converted to the **.avi** file with the **SMXView** utility that goes with the standard SMX-M7x software package.

Saving video directly to memory can slow down the camera's output visualization, but this method insures that no frames are missing in the saved file.

# Saving Options

When you capture frames or record a video, they are saved in directory and with file prefix specified in **Capture Options**.

### To change options for saving frames/video:

1 Open the **Capture Options** dialog by pressing **Alt+c** on the keyboard or go to the **File** menu and select **Capture Options**.

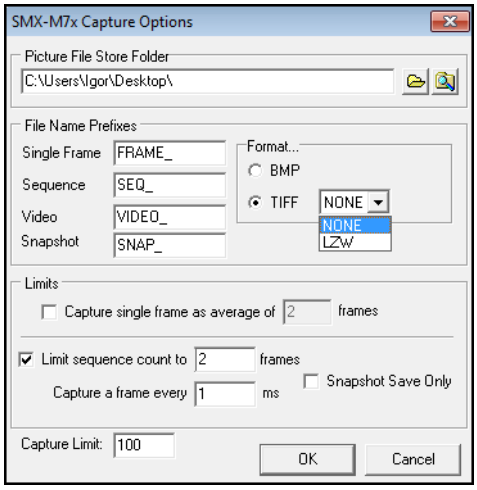



**Figure 5-4** *Capture Options box*

2 Set the options:

**a.** In the **Picture File Store Folder** box, change the directory in which you want to save frames/video or leave the default one.

*Note:* *This folder will also store snapshots (see "Snapshots" on page 49).*

**b.** Change the prefix that will be assigned to all frame/frame sequence and video files or leave the default ones. Use the **Single Frame**, **Sequence** and **Video** fields. The files are named automatically by combining the corresponding **File Name Prefix** and numerical value that is calculated by the number of last captured file + 1.

**c.** Select image file format for frames:

- **BMP** - saves any 8 bit or 10 bit image as 8 bit BMP image.
- **TIFF** - saves 8 bit image as 8 bit TIFF image and 10 bit image as 10 bit TIFF image. Select also compression type: **NONE** (without compression) or **LZW** (Lemple-Zif-Welch - lossless type of compression).

*Note:* *The selected image format will also be used for snapshots.*

3 Press **OK**.

# Chapter 6
# SNAPSHOTS

## Snapshots Basics

The SMX-M7xx Series Cameras can work only in one of the two modes at the same time: **Video** or **Snapshot**. When the camera is not in the video mode, it is possible to take a snapshot - to capture a still image. A snapshot can be triggered by the software, or by external (with respect to the camera) hardware.

The Video mode is the normal mode when the camera is producing the image data. The Snapshot mode forces the camera to capture a still image (a single frame).

To take a snapshot from the camera, use the **Snapshot** section of the camera application main window. Remember that you need to stop video (**Shift+F5**) before you turn on the snapshot mode. To start the snapshot process, press the **Snapshot** button.

## Taking Snapshots Using Software Trigger

### To make a snapshot using the software trigger:

1. Turn the video mode on (press **F5** or the **Start Video** button in the toolbar).
2. Set exposure, gain, viewport, etc.
3. Turn the video mode off (press **Shift+F5** or the **Stop Video** button in the toolbar).
4. Click the **Snapshot** button in the **Snapshot** section of the main window.

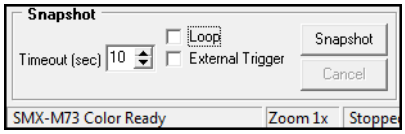



**Figure 6-1** *Making a snapshot using software trigger*

5. The **Snapshot** window will open.

*Note:* *In the **Video** mode, the **Exposure** slider controls the exposure time for the video. When the video is stopped, the **Exposure** slider controls the exposure time of the snapshot.*

For continuous sequence of snapshots, use the **Loop** option. The stream of continuous snapshots will be displayed in the **Snapshot** window. This mode can be useful to adjust the picture parameters for the Snapshot mode.

### To make a continuous sequence of snapshots:

1. Turn off the video.

2 Check the **Loop** box in the **Snapshot** section of the main window.

3 Click the **Snapshot** button. Snapshots will continuously appear in the **Snapshot** window.

4 To stop taking snapshots, press **Cancel**.

*Note: It is strongly recommended not to change any of the camera's settings when running the **Snapshot Loop** mode. This may interrupt the camera operation.*

## Taking Snapshots Using Hardware Trigger

### To take a snapshot using a hardware trigger:

1 Connect an external device (equipment).

2 Turn the video mode off (press **Shift+F5** or the **Stop Video** button in the toolbar).

3 Set exposure, gain, viewport, etc.

4 Set **Timeout** (seconds to wait for external triggering pulse).

5 Check the **External Trigger** box.

6 Click the **Snapshot** button.

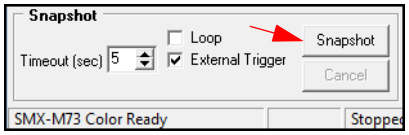



**Figure 6-2** *Taking a snapshot using the hardware trigger*

7 Apply triggering pulse (see "External Trigger Connector Pinout" on page 50).

8 As a result, the **Snapshot** window will open if the camera has detected the external triggering pulse.

9 If it failed to detect the external triggering pulse, the **Snapshot** window will not open and a timeout message will be displayed in the application status bar).

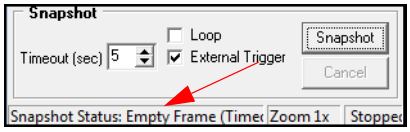



**Figure 6-3** *Timeout message in the application status bar*

## External Trigger Connector Pinout

The following table explains layout of trigger pins..

| Pin Number | Direction | Signal | Polarity |
|---|---|---|---|
| 1 | Input | Trigger / 'Time stamp' input | Positive |
| 2 | Output | Programmable output | - |
| 3 | Output | Programmable output | - |
| 4 | Input | Trigger / 'Time stamp' input | Negative |
| 5 | Output | Programmable output | - |
| 6 | - | Common (Ground) | - |

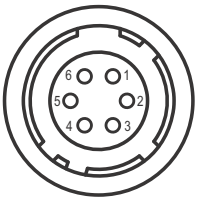



**Figure 6-4** *Camera Connector View, as mounted on the camera*

## 'Time Stamp' Feature

- bit7 bit6 bit5 - three highest bits of line counter
- bit7 - pin1 of the external connector.
- bit6 - inverted pin4 of the external connector.
- bit5 - Software controlled. Connected to bit 7 of register#3.

Bit6 of the Register #3 controls the mode of the 'Time stamp' feature.

**0** is the **Continuous** mode. Each signal is connected directly to the corresponding highest bit of line counter.

**1** is **Reset** mode. Highest bits of the line counter are reset in the beginning of a new line.

In other words:

- if R3.6=0, each signal is connected to the corresponding bit in the line counter
- if R3.6=1, each signal is latched in RS trigger, which is reset in the beginning of each line.

## Programmable Outputs

Each programmable output pin can be programmed to the following output signals:

- TRG - Trigger signal output (for external device or second camera synchronization)
- STROBE - Refer to 1.3 Mpixel, 2 Mpixel or 3 Mpixel sensor data sheets for details
- EXTTRGRDY - Ready_for_triggering signal
- TRG_D - Delayed trigger signal output (delay and width are controlled via R8..R6 (delay), and R9 (width)
- FRAME_VALID - Refer to 1.3 Mpixel, 2 Mpixel or 3 Mpixel sensor data sheets for details
- LINE_VALID - Refer to 1.3 Mpixel, 2 Mpixel or 3 Mpixel sensor data sheets for details
- CLK - System clock
- Low level - Logic 0
- High level - Logic 1

Signal controls are as follows:

- Pin2 is controlled by bits [5,4,3] of R4
- Pin3 is controlled by bits [2,1,0] of R5
- Pin5 is controlled by bits [2,1,0] of R4

Pin control codes are as follows:

**Pin2**:

- TRG_D - [000]
- TRG - [001]
- EXTTRGRDY - [010]
- STROBE - [011]
- CLK - [100]
- STARTEXP - [101]
- Low level - [110]
- High level - [111]

**Pin3:**

- STROBE - [000]
- TRG - [001]
- EXTTRGRDY - [010]
- TRG_D - [011]
- FRAME_VALID - [100]
- CLK - [101]
- Low level - [110]

- High level - [111]

**Pin5:**

- TRG - [000]
- STROBE - [001]
- EXTTRGRDY - [010]
- TRG_D - [011]
- FRAME_VALID - [100]
- LINE_VALID - [101]
- Low level - [110]
- High level - [111]

*Important:* *Do not change any bits except mentioned above when writing pin control codes to registers R4, R5.*

## Global Reset Release (GRR) Snapshot Mode for MT9T001 Sensor (3Mpixels)

To setup the GRR Snapshot mode, follow the procedure described in the MT9T001 sensor data sheet. In addition, to enable the GRR mode, the application should set bit 2 of Altera register R0 to '1' in FPGA logic.

*Note:* *It is necessary to reverse all changes before switching to video or Rolling Shutter snapshot modes.*

Refer to Q37-GRR.GIF for explanation of control signals available at the external trigger connector.

Strobe signal in different revisions of MT9T001 3Mp sensors is the following:

- **rev.5649** - Strobe signal is present in both rolling and GRR snapshot modes
- **rev.5665** - Strobe signal is present only in GRR snapshot mode

## Configuring Outputs via the Interface

You can configure outputs directly from the application interface.

### To configure outputs:

1 Press the **Connector** button in the **Device Settings** box.

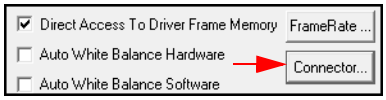



**Figure 6-5** *Connector button*

2 Select a control code for **Pin2**, **Pin3** and **Pin5**:

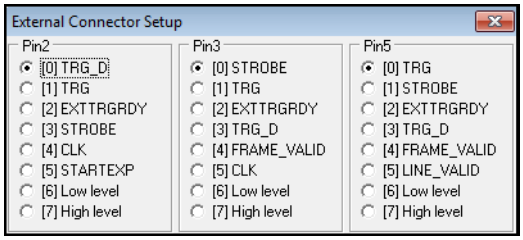



**Figure 6-6** *External Connector Setup*

## Saving Snapshots

When you take snapshots, they are saved in directory and with file prefix specified in **Capture Options**.

### To change options for saving snapshots:

1 Open the **Capture Options** dialog by pressing **Alt+c** on the keyboard or go to the **File** menu and select **Capture Options**.

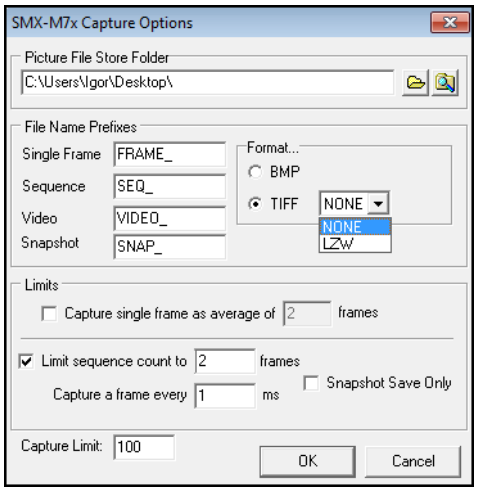



**Figure 6-7** *Snapshot saving options*

2 Set the options:

**a.** In the **Picture File Store Folder** box, change the directory in which you want to save snapshots or leave the default one.

*Note:* *This folder will also store captured videos and frames.*

**b.** Change the prefix that will be assigned to all snapshot files or leave the default one. Use the **Snapshot** field. The files are named automatically by combining the corresponding **File Name Prefix** and numerical value that is calculated by the number of last captured file + 1.

c. Select image file format:

- **BMP** - saves any 8 bit or 10 bit image as 8 bit BMP image.
- **TIFF** - saves 8 bit image as 8 bit TIFF image and 10 bit image as 10 bit TIFF image. Select also compression type: **NONE** (without compression) or **LZW** (Lemple-Zif-Welch - lossless type of compression).

*Note: The selected image format will also be used for captured frames.*

d. Check the **Snapshot Save Only** to save snapshots without showing them on the screen.

e. Press **OK**.

# Chapter 7 WIA

You can get a picture from the SMX-M7x camera using the **Scanners and Cameras** option - the standard Window's Administrative Tool (open **Start> Control Panel>Scanners and Cameras**). You can use almost any image editing program to get the image from the SMX-M7x camera using **Scanners and Cameras**.

The information in this section of the document is based on the image editor that is always available in Windows XP - Microsoft Paint.

*Note: WIA operation with the camera is demonstrated in Windows XP operating system.*

## Installation

To use the SMX-M7x camera for getting images, you should first install the required software - TWAIN Driver.

If the TWAIN driver was installed during the SMX-M7x USB2.0 camera software package installation (see "Installation" on page 9), it is ready to be used. If not, browse to the *Sumix* folder where the software was installed and open the *\SMX-M7x USB2.0 Camera\Drivers\TWAIN* subfolder. Then run the *SMXM7WIA.exe* file and wait awhile until the installation is complete.

The TWAIN driver is installed and ready to be used now.

*Note: The TWAIN driver is not available yet for 64 bit Windows.*

## How it Works

### Location

Open the **Control Panel** window (**Start>Control Panel**), then open **Scanners and Cameras**.

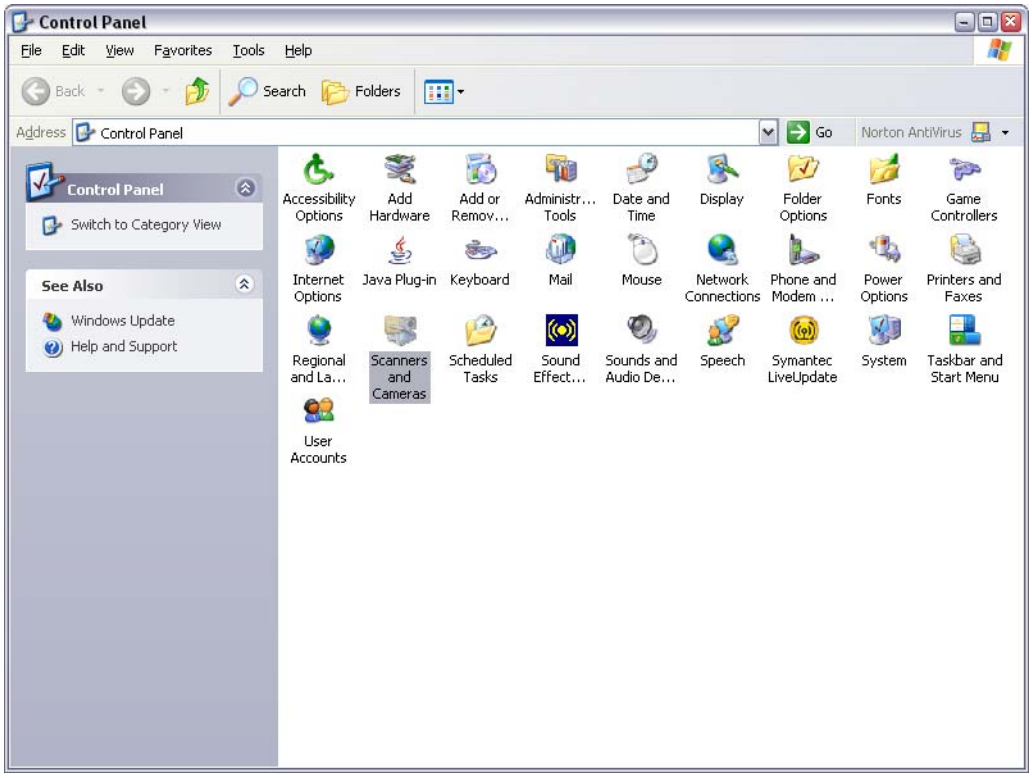



**Figure 7-1** *The Scanners and Cameras item in the Control Panel window*

Since TWAIN driver is already installed, the **SMX-M7x USB2.0 Camera WIA** should be present there.

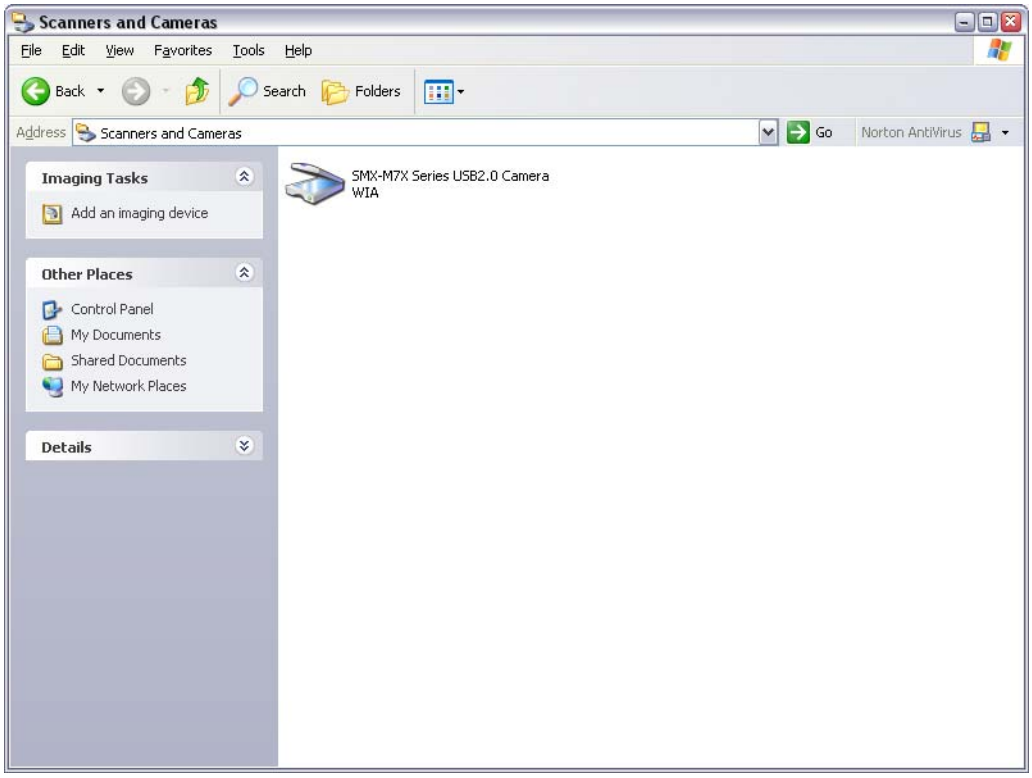



**Figure 7-2** *Scanners and Cameras*

Now you can use WIA to get images from the camera.

## Getting Image Using the Scanner and Camera Wizard

### To get the image using the Scanner and Camera Wizard:

1. Connect the SMX-M71M, SMX-M72 or SMX-M73 camera to your computer.
2. Open **Control Panel>Scanners and Cameras**.
3. Select the **SMX-M7x USB2.0 Camera WIA** and do one of the following:
   - Right-click and select **Get picture using Scanner Wizard**
   - Double-click the selection

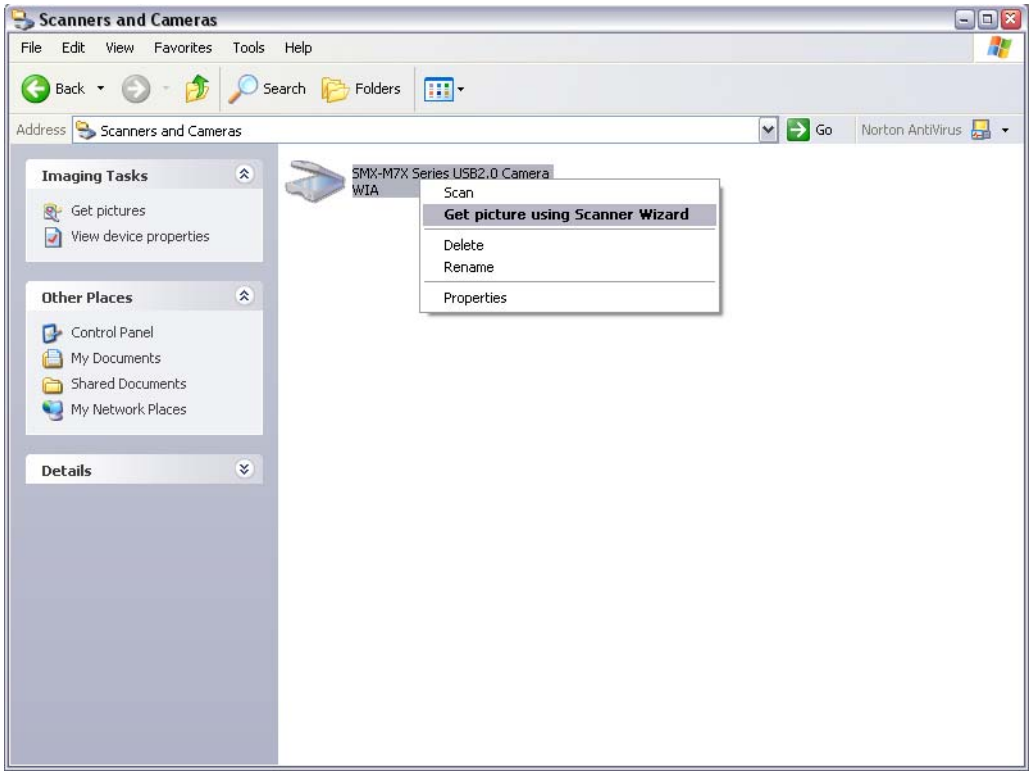



**Figure 7-3** *Selecting the Scanner Wizard for getting image from the camera*

4 **Welcome to the Scanner and Camera Wizard** will appear.

**Figure 7-4** *The Scanner and Camera Wizard welcome window*

5 Click the **Next** button to go to the next step of the **Scanner and Camera Wizard.**

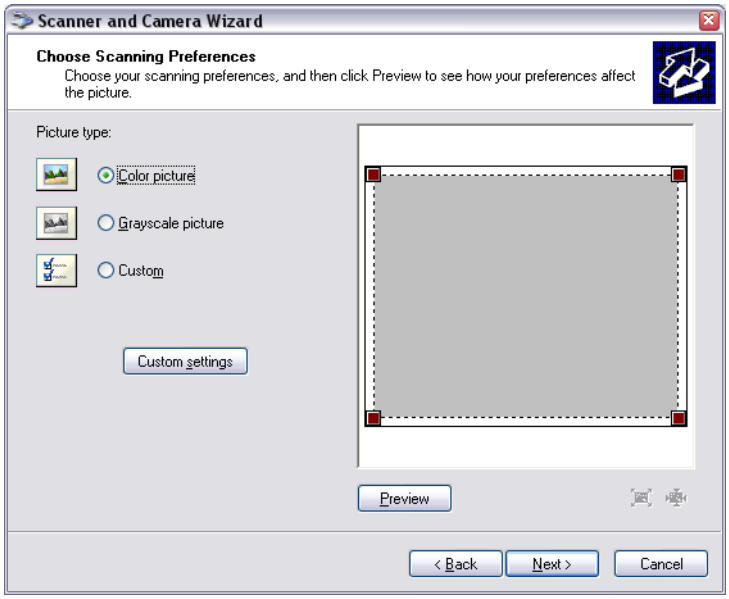



**Figure 7-5** *The Scanner and Camera Wizard: selecting scanning preferences*

6 Select **Picture Type** and adjust image settings:

- **Color picture** - to get color image (for SMX-M72 and SMX-M73 models)
- **Grayscale picture** - to get black-and-white image (for SMX-M71M model)
- Click the **Custom Settings** button to adjust properties of the image:

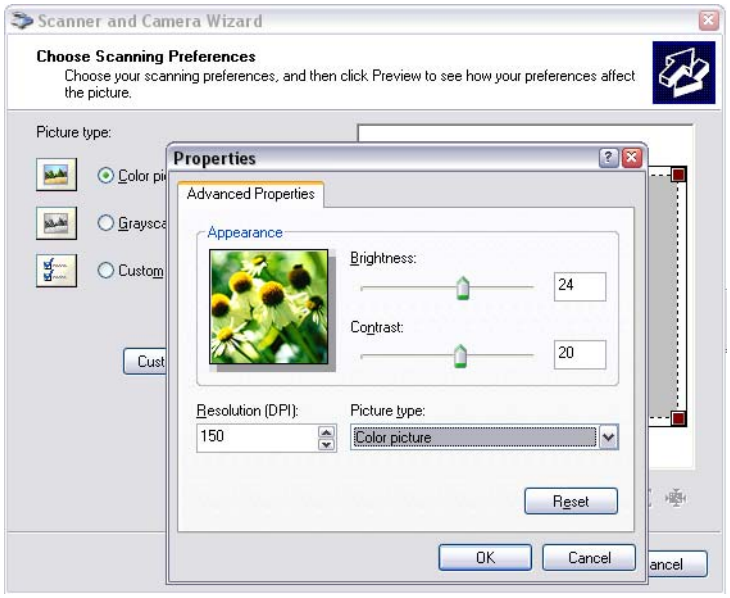



**Figure 7-6** *The Scanner and Camera Wizard: the Advanced Properties window*

7 Click the **Preview** button to view the image from the camera to be scanned.

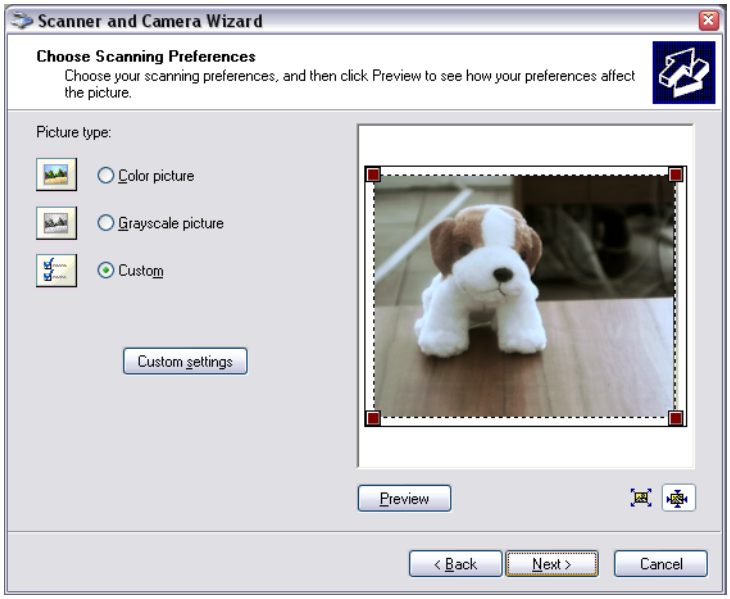



**Figure 7-7** *The Scanner and Camera Wizard: previewing*

8 Resize the image if needed.

9 Click the **Next** button to go to the next step of the **Scanner and Camera Wizard**.

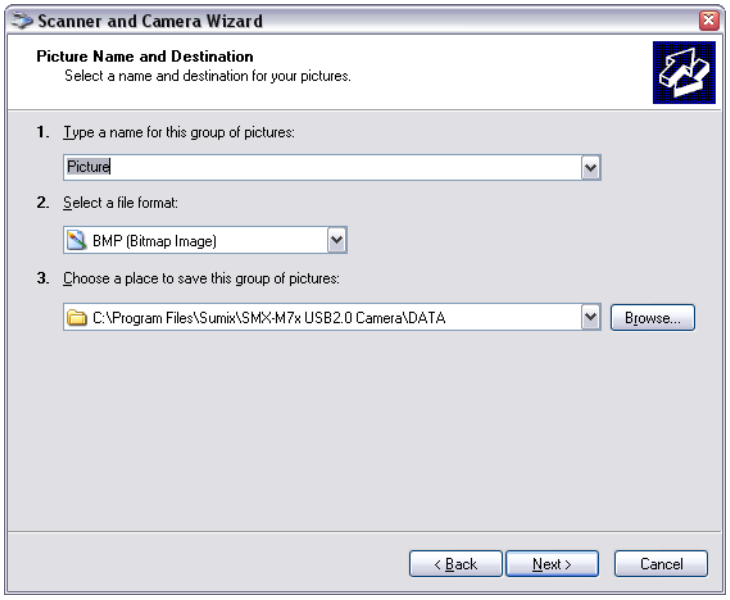



**Figure 7-8** *The Scanner and Camera Wizard: picture name and destination window*

10 Enter name, select file format and location where you want to save your picture.

11 Click the **Next** button - the **Scanner and Camera Wizard** starts scanning your picture.

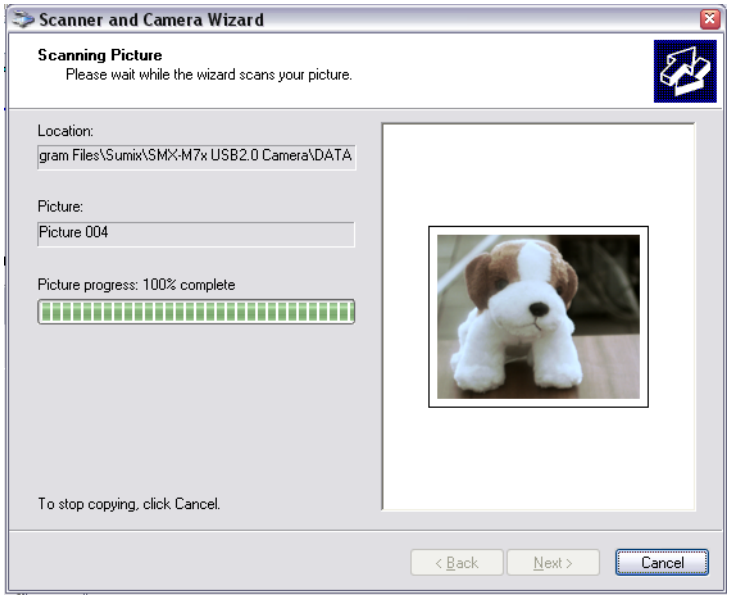



**Figure 7-9** *The Scanner and Camera Wizard: scanning picture*

**12** After the **Wizard** finishes scanning the picture, you will be asked to select one of the options. Select the last option and click the **Next** button.

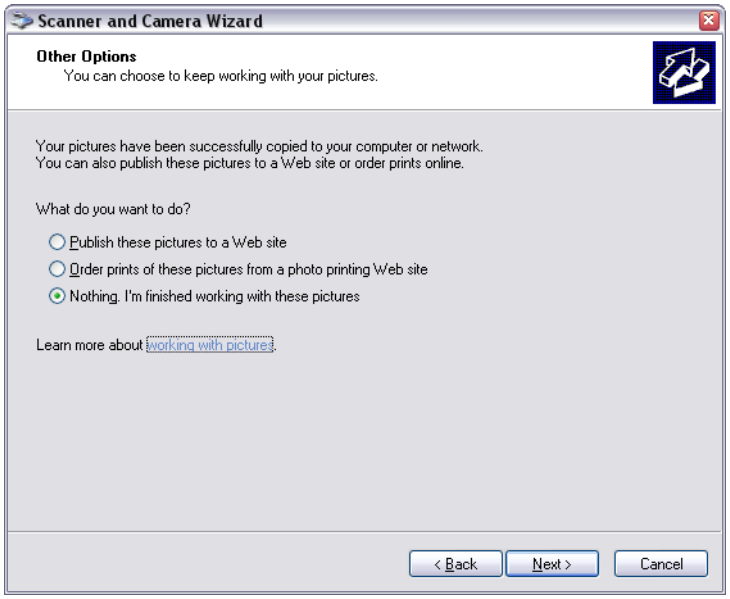



**Figure 7-10** *The Scanner and Camera Wizard: other options window*

**13** View the last window of the **Scanner and Camera Wizard** and click the **Finish** button.

**Figure 7-11** *The Completing the Scanner and Camera Wizard window*

Microsoft Windows will open the folder where you saved the scanned image.

## Getting Image Using Scan

### To get the image using Scan:

1. Connect the SMX-M71, SMX-M72 or SMX-M73 camera to your computer.
2. Open **Control Panel>Scanners and Cameras**.
3. Right-click the **SMX-M7x USB2.0 Camera WIA** and select **Scan** (see Figure 7-12 Scanners and Cameras: selecting Scan).

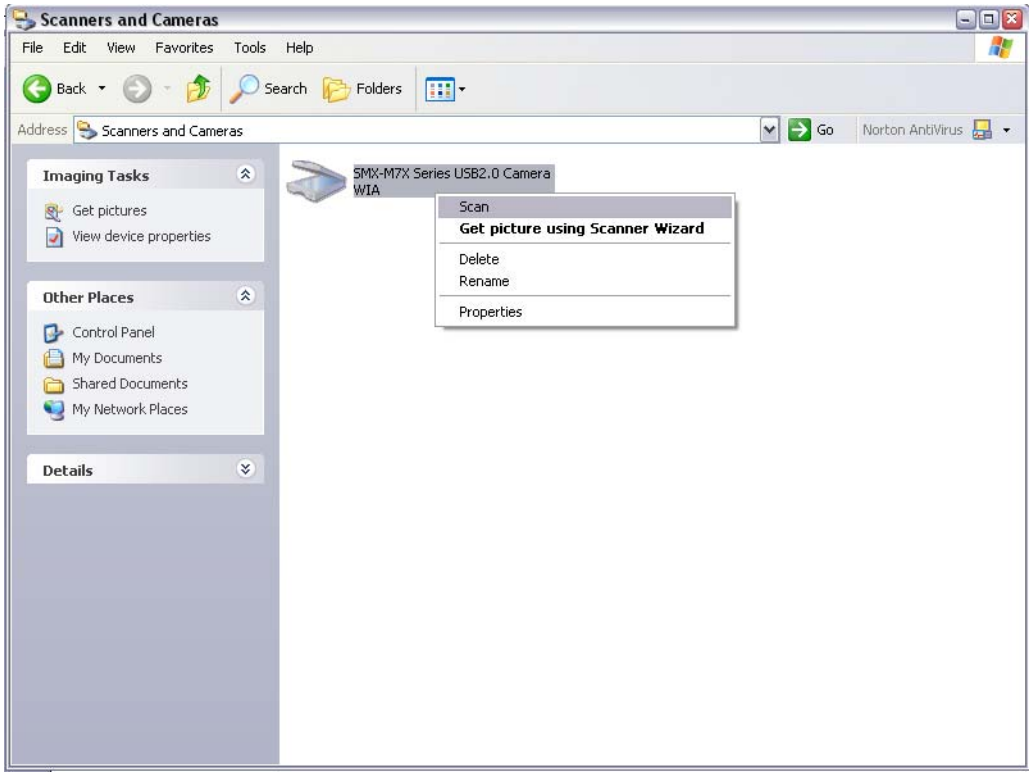



**Figure 7-12** *Scanners and Cameras: selecting Scan*

**4** A window with the list of available programs for image scanning will appear.

**Figure 7-13** *Select the program to launch for Scanning window*

*Note:* *Some image editors that can be also used for scanning images might not be present in the list that is displayed. It might be due to the current operating system settings or the image editor configuration. For more information, see **Help Topics** of Windows operating system about **Scanners and Cameras** or **Help Topics** of the image editors.*

**5** Select the program most suitable for you and click the **OK** button - the selected program will start and **Scan Using SMX-M7x Series USB2.0 Camera WIA** will open.

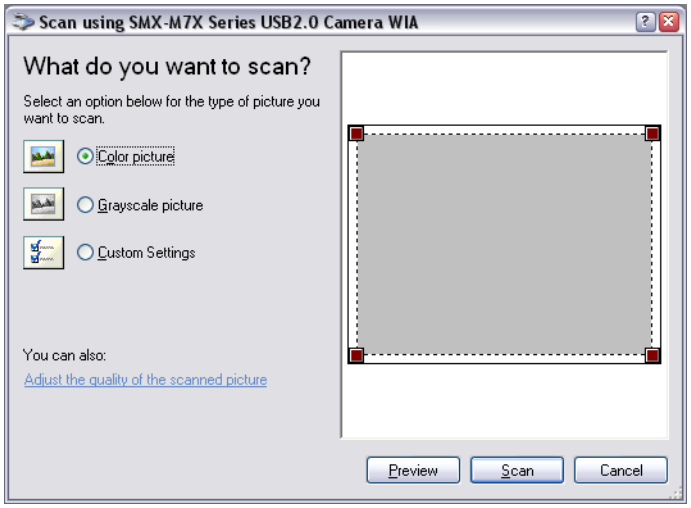



**Figure 7-14** *Scan using SMX-M7x Series USB2.0 Camera WIA window*

*Note: Not all image editors open the **Scan Using SMX-M7X Series USB2.0 Camera WIA** window automatically - some of them just open the program's main window. It depends on the program configuration. In this case, for more information see Help Topic for this program.*

6 Select **Color** or **Grayscale** picture or click the **Adjust the quality of the scanned picture** link to change the image settings. Click the **Preview** button to preview the image to be scanned.

7 When ready, click the **Scan** button - the image editor will start scanning and will show the scanned image in the current program's window.

## Getting Image Using Microsoft Paint

### To get the image from the camera using Microsoft Paint:

1 Open **Microsoft Paint** (**Start>All Programs>Accessories>Paint**).

2 Connect the SMX-M71, SMX-M72 or SMX-M73 camera to the computer.

3 In **Microsoft Paint**, open **File>From Scanner or Camera…** - **Scan Using SMX-M7x Series USB2.0 Camera WIA** will open.

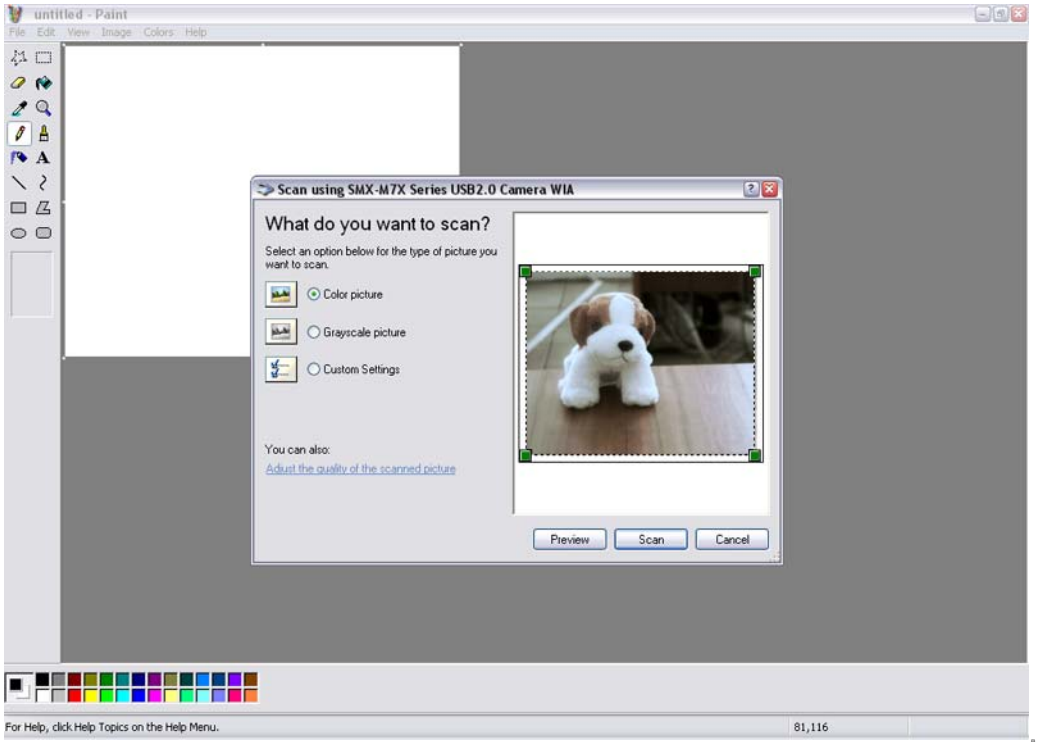



**Figure 7-15** *Getting image from the camera using Microsoft Paint*

4 Adjust the image settings, click **Preview** to view the image that is scanning.

5 When ready, click the **Scan** button.

6 When done, save the scanned image.

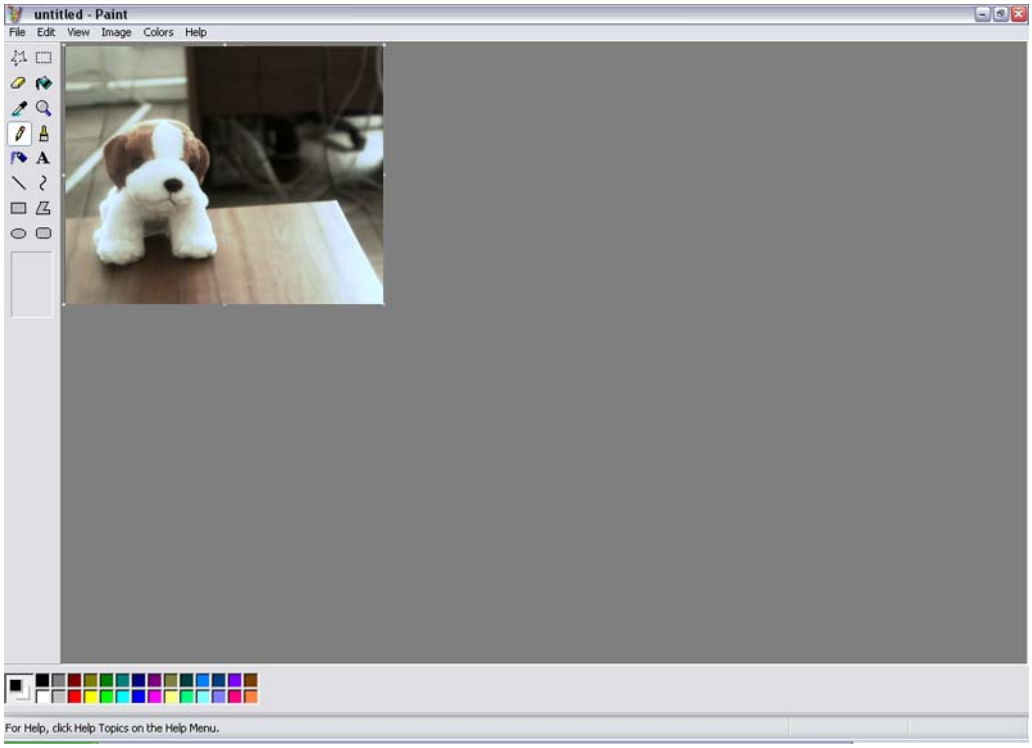


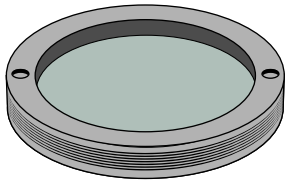

**Figure 7-16** *Microsoft Paint: Image received after scanning*

*Note* *To get more information about the **Scanners and Cameras** operation, see standard **Window's XP Help Topics** about it*

Chapter 8

# IR-CUT FILTER

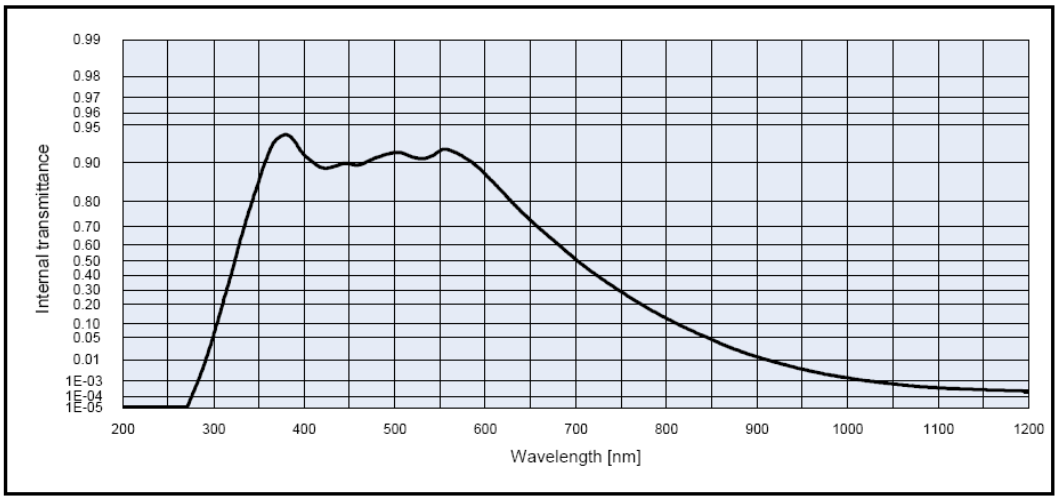
The SMX-M72 and SMX-M73 color cameras can be supplied with an IR-cut filter:

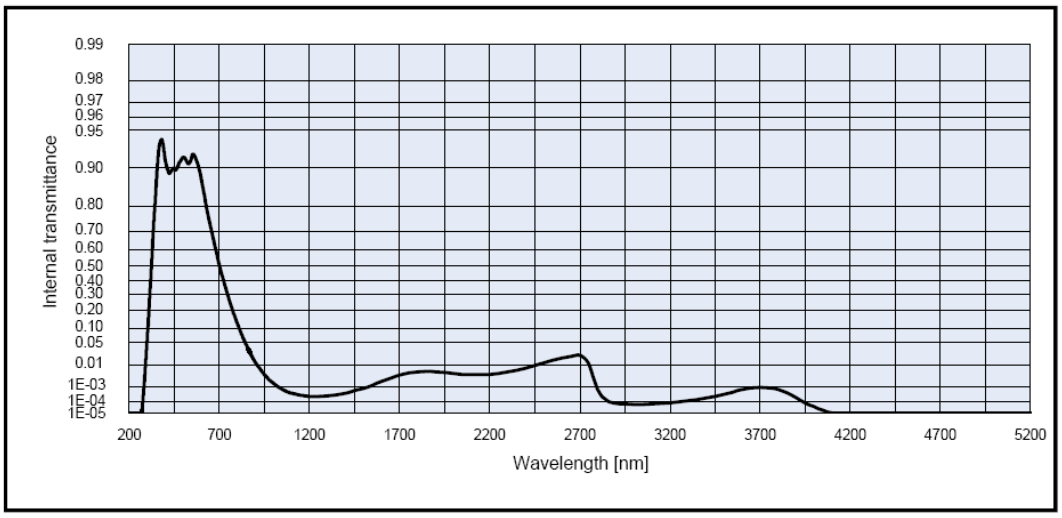


The IR-cut filter provided with the camera has the following characteristics:

- Diameter = 20mm
- Thickness = 2 mm

Chart of the IR-cut filter transmission characteristics:




## When to Use

The IR-cut filter can be used for both color and monochrome SMX-M7x cameras.

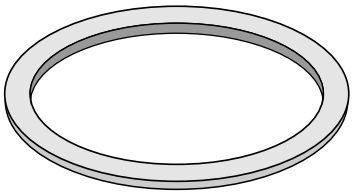
### Using IR-cut Filers with SMX-M7x Color Cameras

IR-cut filter is a color filter that blocks infrared light. Since the SMX-M7x color cameras are sensitive to IR-light, use the IR-cut filter with color camera models to make colors of the image more realistic.

Many light sources, including the sun, emit infrared light, so the color camera in daylight will see a significant amount of infrared light without the IR-cut filter. As a result, strange and non-realistic colors appear.

Another reason for using the IR-cut filter is the limited color correction for many lenses. A lot of lenses have different depth of focus for visible and infrared spectrum. The IR-cut filter cuts away a significant amount of the overall collected light and thereby affects the sensitivity in a negative way. In general, color cameras are one factor less sensitive compared to monochrome (depending on the sensor). This is primarily due to the IR-cut filter.

*Note:* *When the camera is used with the IR-cut filter, the focus distance is increased to 0.66mm. To restore the focus distance to the original value (when the camera is used without the IR-cut filter ring and ring-adapter) we suggest using a ring-adapter:*



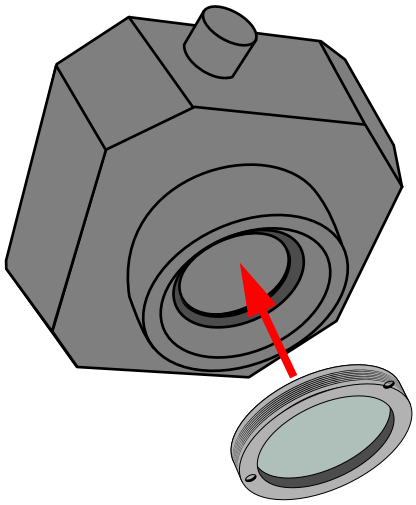
## How to Use

Usually the camera is supplied with the IR-cut filter screwed in.

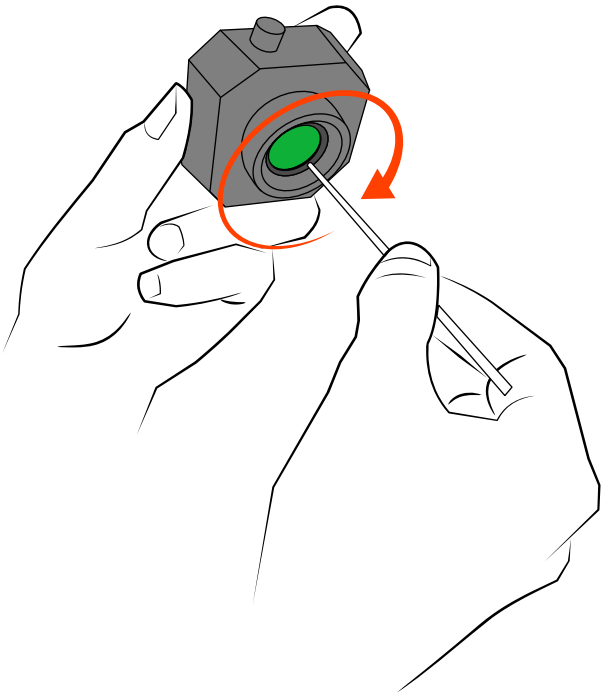
The procedure of screwing the IR-cut filter in, and using the ring-adapter is described below.

Install the IR-cut filter in the following way:

1. Remove the cover from the camera.
2. Put the IR-cut filter to the camera so that two holes of the filter are on top:

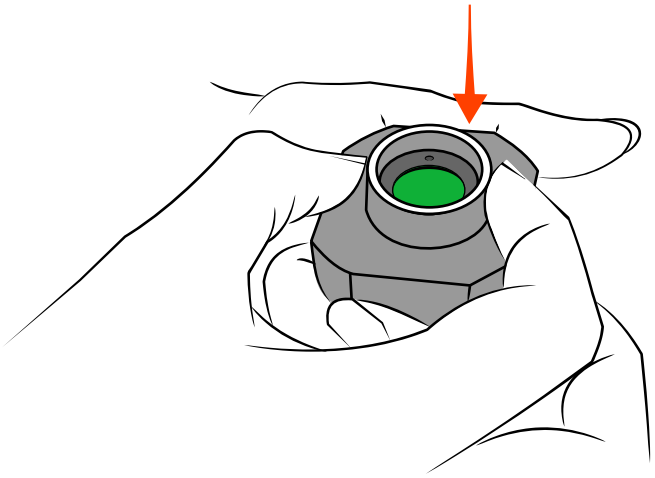


3 Use a needle-like tool (e.g. tweezers) and screw the IR-cut filter in:



*Note:* *The latest SMX-M7x color cameras have blocking elements on the inner thread to avoid the IR-cut filter falling on the sensor. The previously manufactured cameras do not have these blocking elements, so when screwing the IR-cut filter into these cameras, make no more than 10-11 full turns.*

4 Once the IR-cut filter is screwed in, put the ring-adapter as shown in the picture:



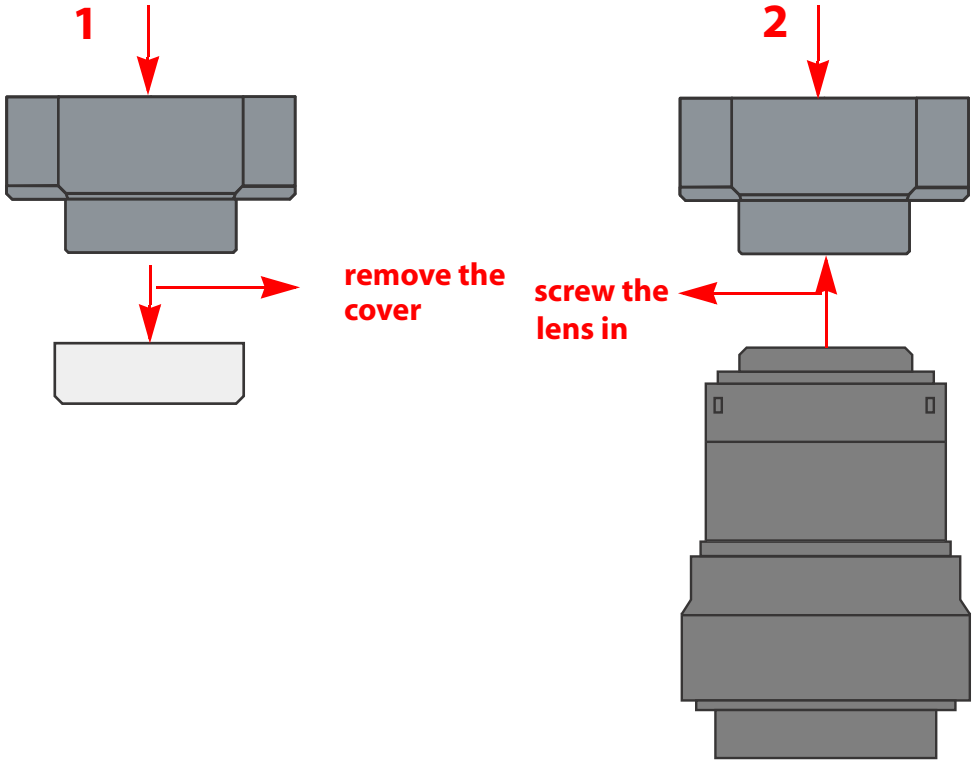
5 Screw the lens in:

Please note that when the camera is used without the IR-cut filter, it is recommended to remove the cover and screw the lens in (as well as to screw the lens out and put the cover on) when the camera is faced down - to prevent contamination of the sensor.

To screw the lens in the camera that contain no IR-cut filter, put the camera facing down and do the following:

1 Remove the cover.

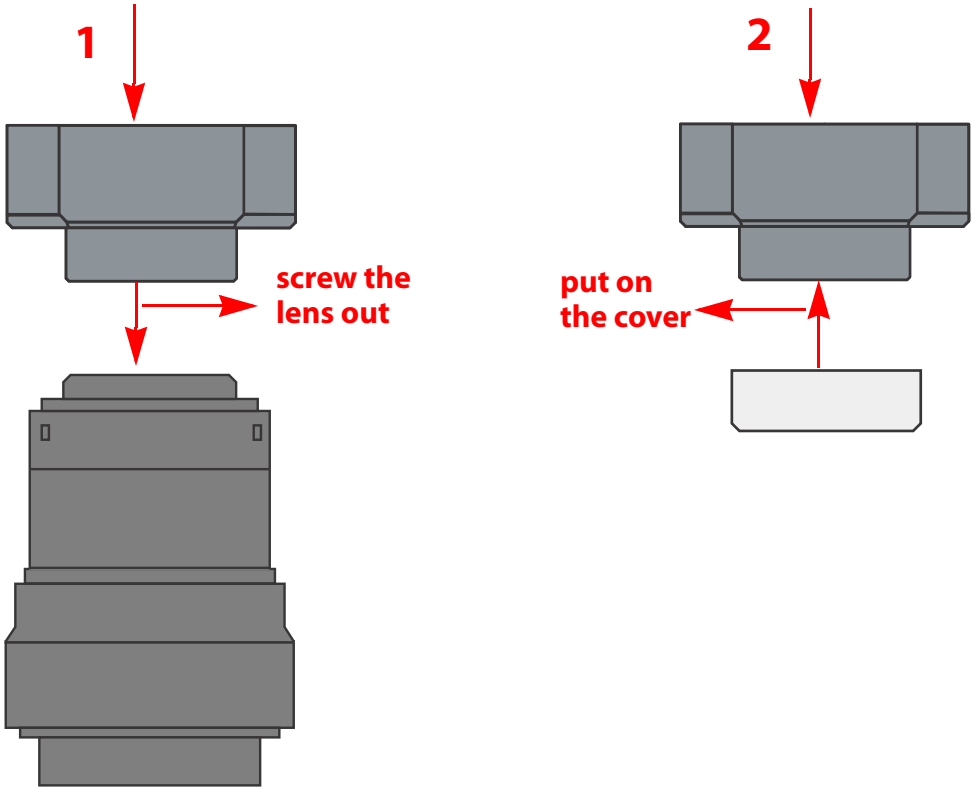
2 Put the lens in.



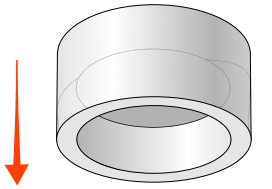

To screw the lens out of the camera that contains no IR-cut filter, put the camera facing down and do the following:

1 Screw the lens out.

2 Put the cover on.




*Note:* *Before screwing the lens in or putting the cover on, make sure that its surface is free from the dust. When you remove the cover put it facing down to keep the dust out*



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Chapter 9

# TRIGGER CONNECTOR

This chapter describes how to use a Hirose trigger connector and cable with a SMX-M7xx Series camera. Hirose trigger connector is included in the standard camera kit. Since a cable is not included in the standard connector package, this document will guide on how to use the connector with a cable.

## Soldering of Connector with Cable

A cable should be soldered to the connector according to the pin layout (see "External Trigger Connector Pinout" on page 50).

Prepare a standard (6-core) cable with already opened contacts for soldering with the connector.

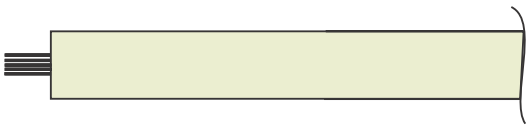

**Figure 9-1** *A cable for soldering with the connector*

Prepare a tweezers-like tool for the connector assembling.

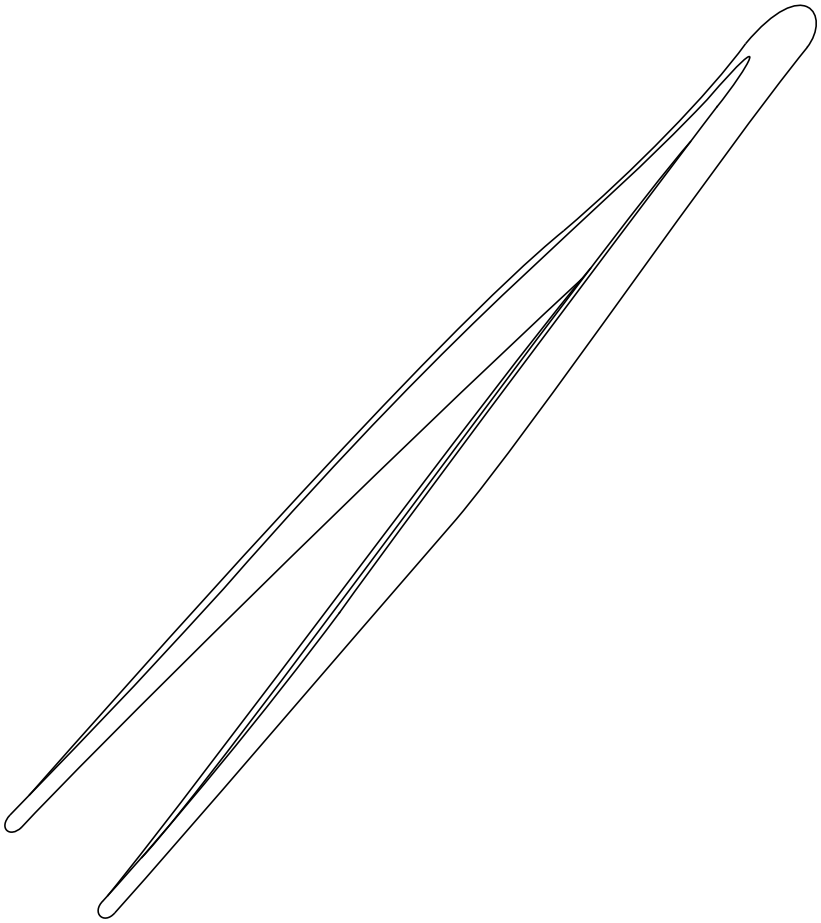

**Figure 9-2** *Tweezers tool for the connector modifying*

Unscrew the rear part of the connector.

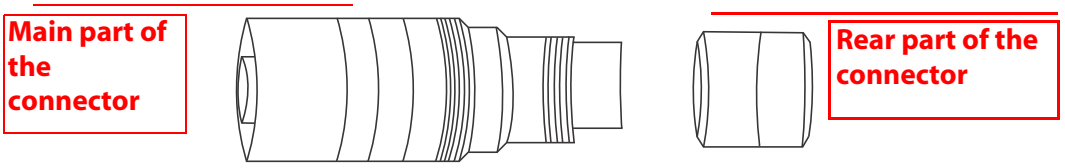


**Figure 9-3** *The rear part and the main part of the connector*

Use tweezers and remove it from the main part in the following way:

1 Fix the inner part of the connector with tweezers.

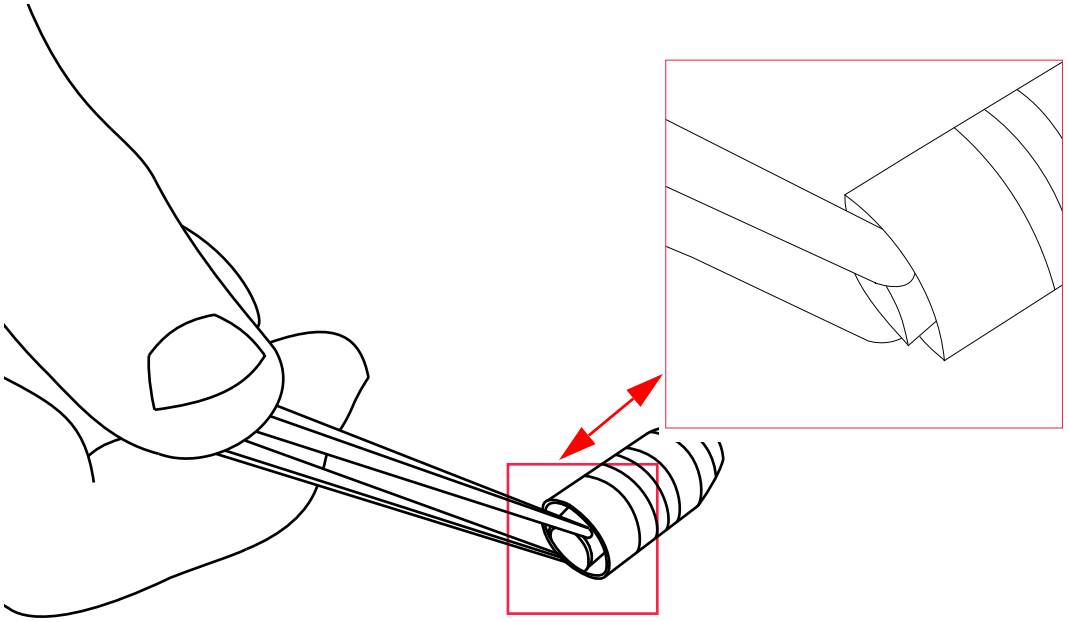

**Figure 9-4** *Fixing of the inner part of the connector with tweezers*

2 Unscrew the rear part of the connector with fingers clockwise.

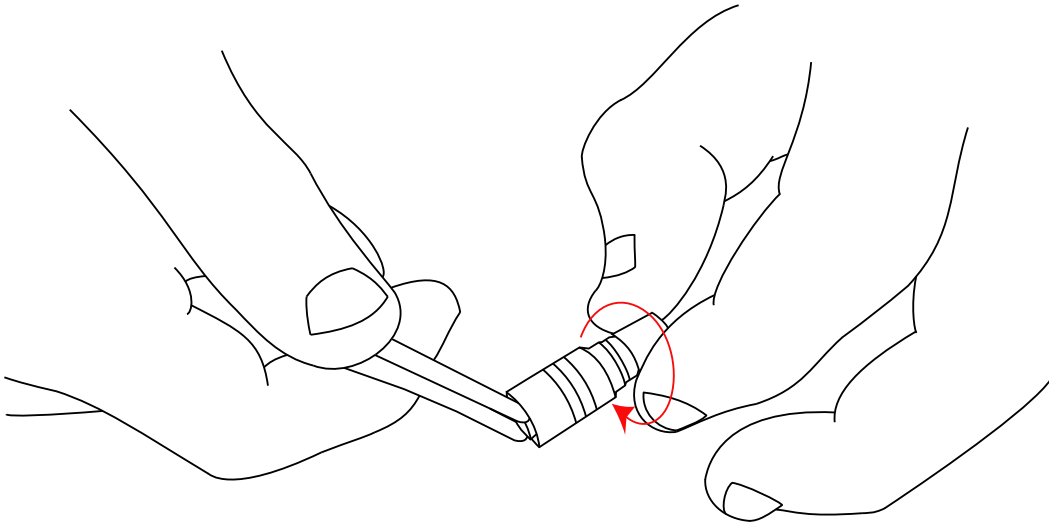

**Figure 9-5** *Unscrewing of the rear part of the connector*

3 Remove the rear part of the connector from the main part.

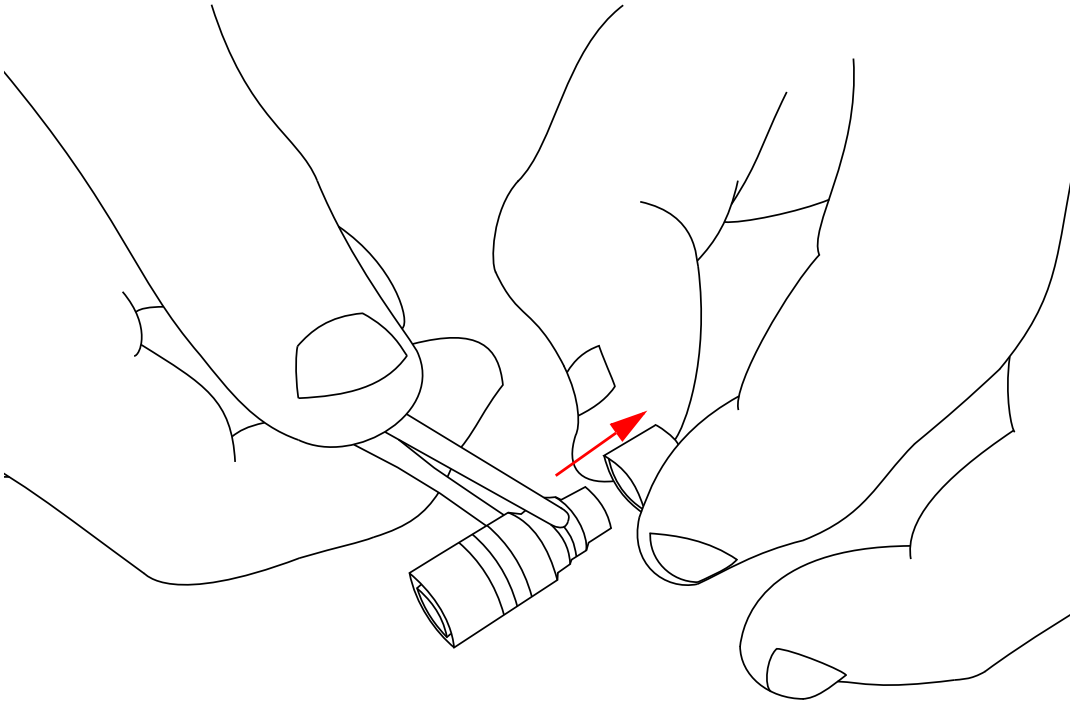

**Figure 9-6** *Removing of the rear part of the connector from the main part*

Unscrew the inner part of the connector:

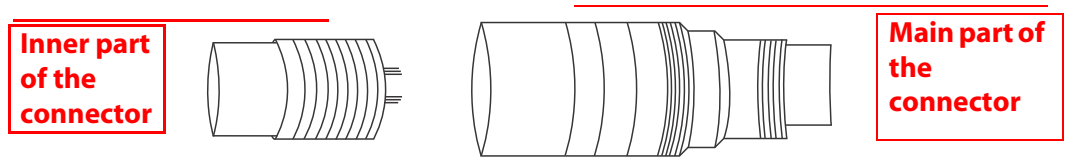


**Figure 9-7** *The inner part and the main part of the connector*

To unscrew, perform the following steps:

1 Hold the main part of the connector with your fingers.

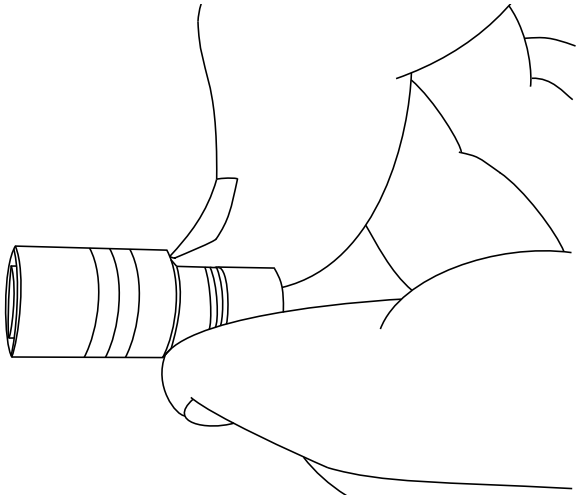

**Figure 9-8** *Gripping the main part of the connector with fingers*

2 Fix the inner part of the connector with tweezers (see Figure 9-4 Fixing of the inner part of the connector with tweezers).

3 Rotate tweezers counterclockwise.

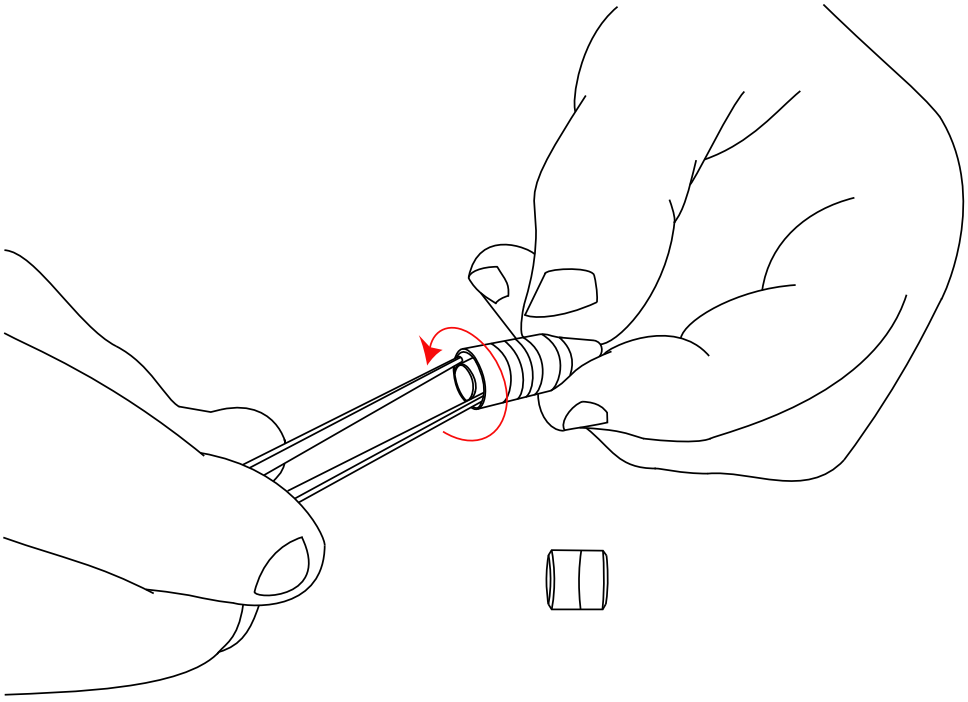

**Figure 9-9** *Unscrewing the inner part of the Connector from the main part*

4 Remove the inner part of the connector from the main part.

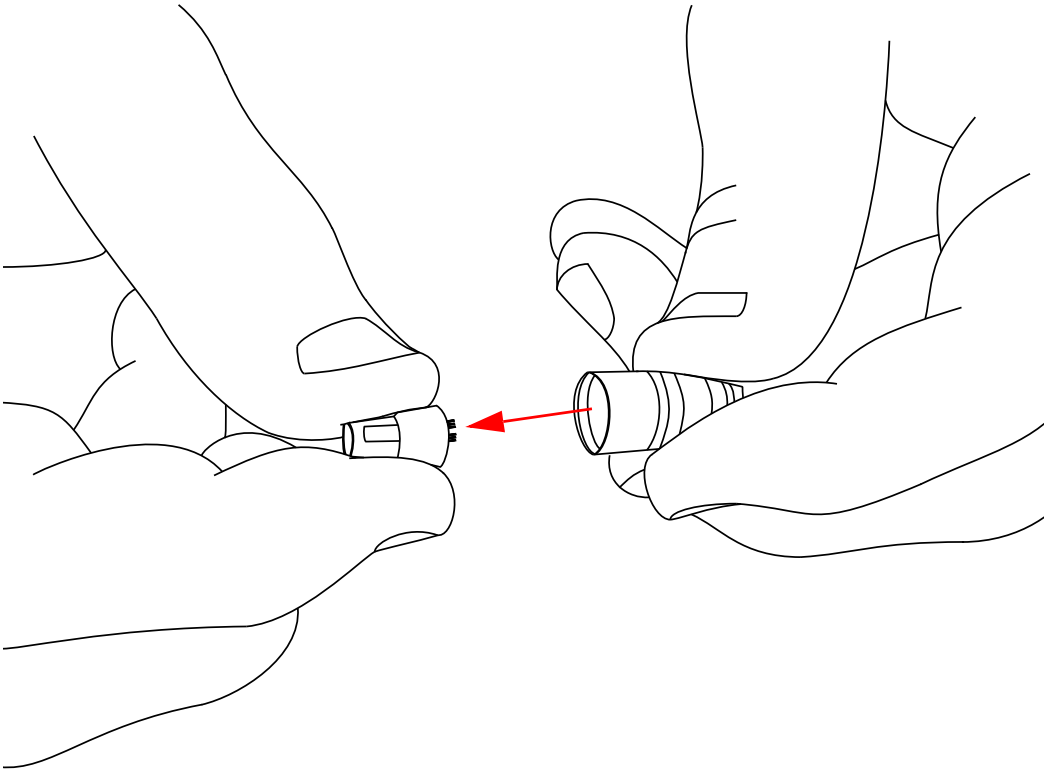

**Figure 9-10** *Removing the inner part of the connector from the main part*

As a result, all connector parts will be disassembled:

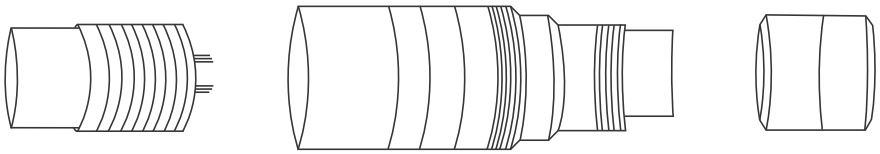

**Figure 9-11** *All parts of the connector are disassembled*

Insert a cable into the rear part of the connector.

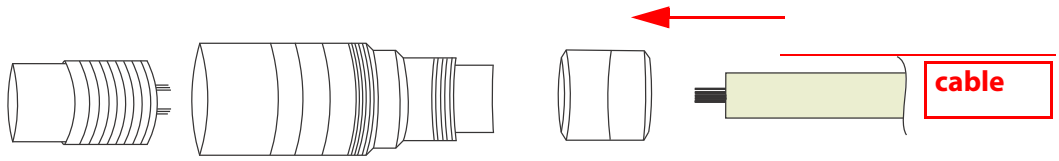


**Figure 9-12** *Inserting of a cable in the rear part of the connector*

Then insert it into the main part.

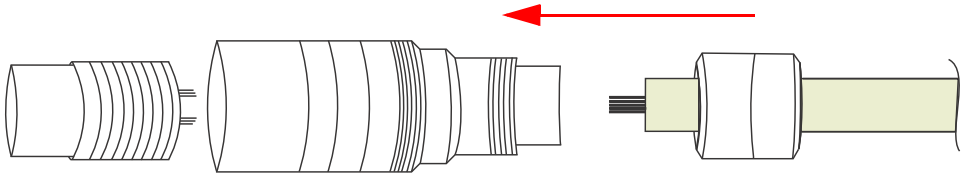

**Figure 9-13** *Inserting of a cable in the main part of the connector*

When a cable is inserted into the rear part and the main part correspondingly, solder each pin of the connector with opened contacts of a cable according to the layout (see "Soldering of Connector with Cable" on page 77) and your specific needs:

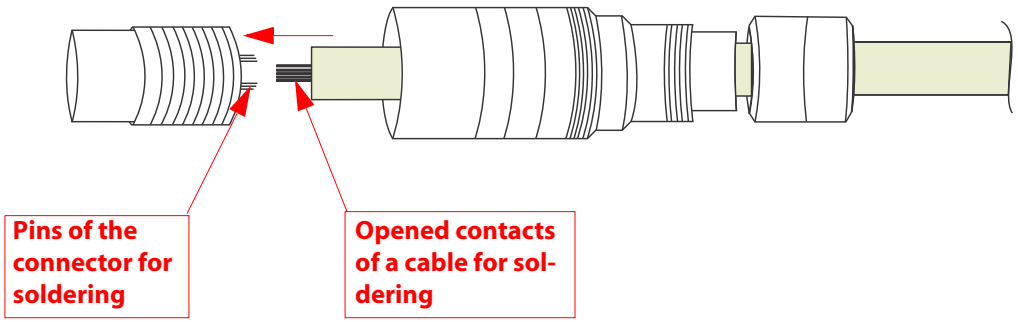


**Figure 9-14** *Inserting and soldering of a cable to the inner part of the connector*

Please note that each pin is marked with a number according to the pin layout (see "Soldering of Connector with Cable" on page 77). The pins numbering is located at the internal side of the inner part of the connector.

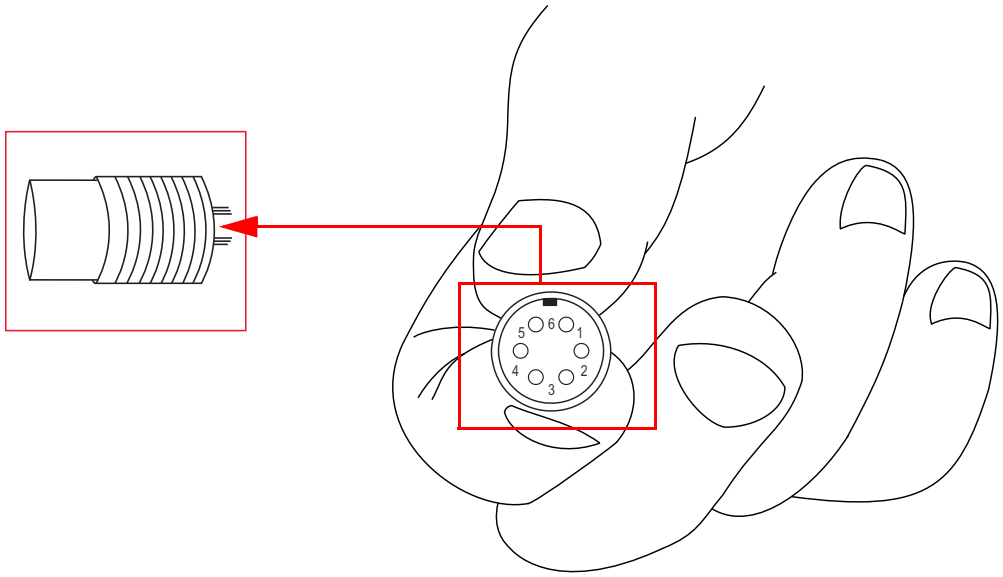


**Figure 9-15** *Connector pinout outlook*

Note also that direction of pin numbering is done clockwise starting from the key at the upper edge of the inner part of the connector.

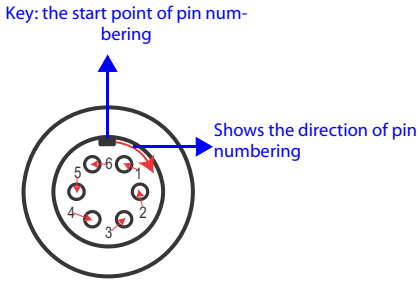


**Figure 9-16** *The pin numbering direction*

When the soldering is done, insert the inner part of the connector in the main part.

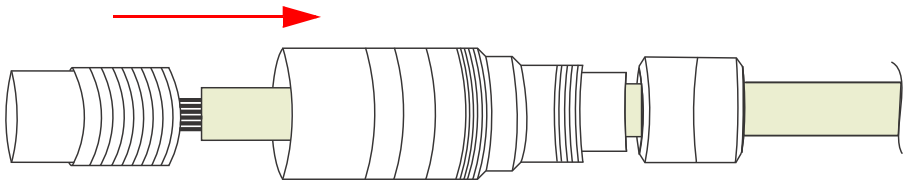

**Figure 9-17** *Inserting of the inner part of the connector in the main part*

Screw in the inner part of the connector in the following way:

1 Fix the inner part of the connector with tweezers (see Figure 9-4 Fixing of the inner part of the connector with tweezers).

2 Hold the main part of the connector with fingers.

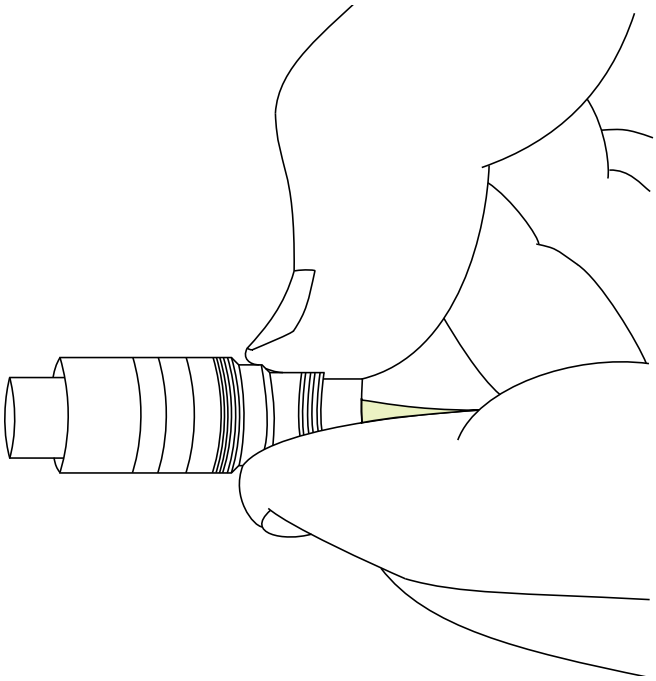

**Figure 9-18** *Gripping of the main part of the connector with fingers*

3 Screw the main part of the connector in counterclockwise.

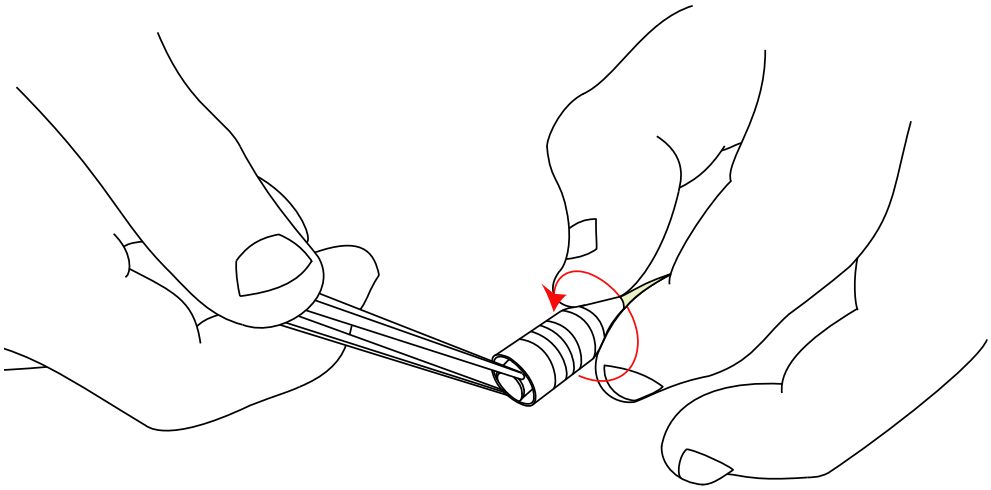

**Figure 9-19** *Screwing the inner part of the connector in*

Insert the main part of the connector into the rear part.

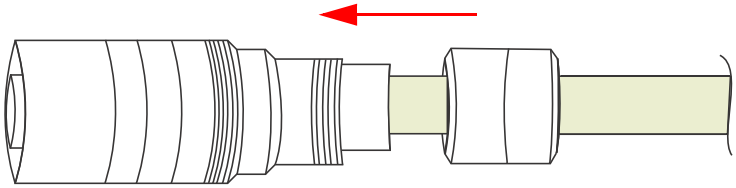

**Figure 9-20** *Inserting of the main part of the connector into the rear*

Screw the rear part in using tweezers in the following way:

1. Fix the inner part of the connector with tweezers (see Figure 9-4 Fixing of the inner part of the connector with tweezers).
2. Screw the rear part of the connector in with your fingers counterclockwise.

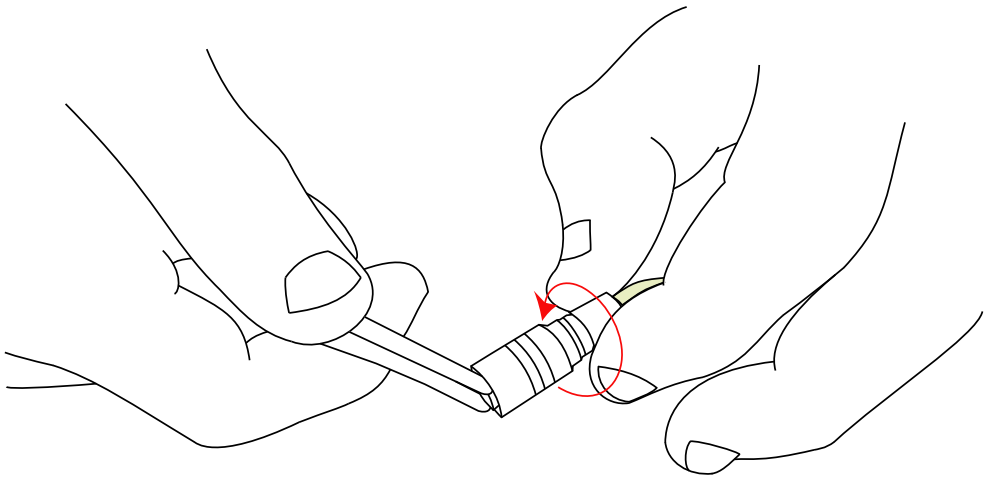

**Figure 9-21** *Screwing of the rear part of the connector in to the main part*

Connector is ready to be used.

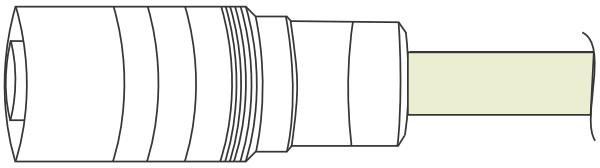

**Figure 9-22** *Soldered connector with a cable*

*Appendix 1*

# KEYBOARD SHORTCUTS

| Keyboard shortcut | Description |
|---|---|
| **F1** | Help |
| **F2** | Captures a frame into bitmap file |
| **F3** | Captures a sequence of frames into bitmap files |
| **F4** | Captures a sequence of frames into AVI file |
| **Shift + F4** | Captures a sequence of frames to the memory |
| **F5** | Starts live video display in the View window |
| **Shift+F5** | Stops live video display and closes the View window |
| **F9** | Takes a snapshot |
| **F12** | Brings up the Main window when displaying the live video |
| **Esc** | Same as Shift + F5, stops the video |
| **Ctrl + O** | Opens Camera Profile |
| **Ctrl + S** | Saves Camera Profile |
| **Ctrl+C** | Copies an image from the camera to buffer |
| **Alt + C** | Brings up the Capture Options dialog box |
| **Alt + S** | Brings up the Device Settings dialog box |
| **Alt + V** | Brings up the Viewport Settings dialog box |
| **H** | Brings up the Histogram |
| **W** | Performs White Balance (Soft) using Color Balance |
| **Alt + W** | Performs White Balance (Hard) using Gain Controls |
| **Numpad +/-** | Zoom In/Zoom Out the picture in the View window |
| **Numpad *** | Restores the picture in the View window to its original (100%) size |

*Appendix 2*

# TOOLBAR OVERVIEW

The most common menu commands are duplicated on the application toolbar:

Starts live video display in the View window

Stops live video display and closes the View window

Brings up the Viewport Setup dialog box

Captures a frame into BMP/TIFF file

Captures a sequence of frames into BMP/TIFF files

Starts saving Video to a file

Starts saving Video to memory

*Appendix 3*

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