Allied Vision

10 GiGE VISION™

SMR
Manual

SMR cameras

Valid for VisualMARC3

Allied Vision Gilching GmbH // Ferdinand-Porsche-Str. 3, 82205 Gilching, Germany

2026-January-28

Content

List of figures

General information

1.1 Company information

Allied Vision Gilching GmbH

Ferdinand-Porsche-Str. 3

82205 Gilching

Germany

Tel.: +49 8105 3987-60

Fax: +49 8105 3987-699

Mail: info@alliedvision.com

Web: www.alliedvision.com

1.1.1 Disclaimer

This manual contains important instructions for safe and efficient handling of ourproducts. This manual is part of the product and must be kept accessible in the immediate vicinity of the product for any person working on or with this product .

Read carefully and make sure you understand this manual prior to starting any work with this product. The basic prerequisite for safe work is compliant with all specified safety and handling instructions.

Accident prevention guidelines and general safety regulations should be applied.

Illustrations in this manual are provided for basic understanding and can vary from the actual model of this product. No claims can be derived from the illustrations in this manual.

The product has been produced with care and has been thoroughly tested. In case of any complaint, contact your local Allied Vision distributor. You will find a list of distributors in your area on Allied Vision Distributors.

1.1.2 Copyright notice

The specification is subject to change without notice in advance. The brand and product names are trademarks of their respective companies. Any configuration other than original product specification is not guaranteed.

1.2 Legal information

Errors and omissions excepted.

These products are designed for industrial applications only. Cameras from Allied Vision Gilching GmbH are not designed for life support systems where malfunction of the products might result in any risk of personal harm or injury. Customers, integrators and end users of Allied Vision Gilching GmbH products might sell these products and agree to do so at their own risk, as Allied Vision Gilching GmbH will not take any liability for any damage from improper use or sale.

1.2.1 Registered trademarks

In this manual the following registered trademarks may be used:

- ImageBLITZ®
- Eo*Sens*®
- GenICam®
- Microsoft® and Windows®
- Intel®

Throughout the manual, these trademarks are not specifically marked as registered trademarks. This in no way implies that these trademarks can be used in another context without the trademark sign.

1.2.2 Conformity and use

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These requirements are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions given in this guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will have to correct the interference at its own expense.

> You are herewith cautioned that any changes or modifications not expressly approved in this description could void your authority to operate this equipment.

1.2.3 Rules and regulations for USA and Canada

This device complies with part 15 of the FCC Rules. Operation is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

> This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules.

It is necessary to use a shielded power supply cable. You can then use the “shield contact” on the connector which has GND contact to the device housing. This is essential for any use. If not done and the device is destroyed due to Radio Magnetic Interference (RMI) WARRANTY is void!

- Power: US/UK and European line adapter can be delivered. Otherwise use filtered and stabilized DC power supply.
- Shock & vibration resistance is tested. For detailed specifications refer to the section on specifications.

1.2.4 Rules and regulations for Europe

This device is CE tested, the following rules apply:

- EN 55032:2015
- EN 61000-6-2:2019

The product is in compliance with the requirements of the following European directives:

- 2011/65/EU
- 2015/863/EU

All products of Allied Vision Gilching GmbH comply with the recommendation of the European Union concerning RoHS rules.

1.2.5 Warranty and non-warranty clause

> The camera does not contain serviceable parts. Do not open the body of the camera. If the camera has been opened, the warranty will be void.

> The camera has to be used with a supply voltage according to the camera’s specification. Connecting a lower or higher supply voltage, AC voltage, reversal polarity or using wrong pins of the power connector may damage the camera. Doing so will void warranty.

Our warranty does not protect against accidental damage, loss, or acts of nature.

Allied Vision Gilching GmbH cannot be held responsible for the loss of data. We recommend a backup plan.

1.3 Supplements

FOR CUSTOMERS IN CANADA

This apparatus complies with the Class A limits for radio noise emissions set out in Radio Interference Regulations.

POUR LES UTILISATEURS AU CANADA

Cet appareil est conforme aux normes Classe A pour bruits radioélectriques, spécifiées dans le Règlement sur le brouillage radioélectrique.

LIFE SUPPORT APPLICATIONS

The products described in this manual are not designed for use in life support appliances or devices and systems where malfunction of these products can reasonably be expected to result in personal injury.

Allied Vision Gilching GmbH customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Allied Vision Gilching GmbH for any damages resulting from such improper use or sale.

1.4 Tips and notes

This manual contains notes that help to avoid data loss or camera damage, and tips that provide information to improve handling the camera. They are marked as follows:

TIPS

Provides information that may help to improve camera handling or avoid data loss.

NOTES

> Provides information to avoid damage to the system.

1.5 Support

In case of issues with the camera we are happy to help. For being able to help you in a fast and efficient way, we ask you for a description of the issues using camera in your support request.

- Put your support request to us via the support form: Support & Repair (RMA)
- Fill the form with information about the camera model, the frame grabber model, and operating system. Our support team will come back to you.

Introduction

2.1 Intended use

The camera SMR belongs to the product class of so-called recording cameras that can be used for a variety for purposes.

Recording cameras are designed to capture and record fast movement, processes or short events and replay at slower speed, for example for slow-motion replay of movements in sports, during manufacturing processes, or for scientific research.

OTHER USES

Any other use is regarded as unintended use and leads to the loss of guarantee and liabilities. Contact the manufacturer for other uses.

These products are designed for industrial applications only. **The cameras are not designed for life support systems where malfunction of the products might result in any risk of personal harm or injury.**

2.2 Scope of delivery

The following components are part of delivery. Before installing the camera, check if the delivery is complete:

- SMR camera as ordered.
- One CAT 6 Gbit Ethernet cable (3 m).
- USB storage with user guides for the camera and VisualMARC3 software.
- Quick Start Guide.

2.3 Accessories

POWER SUPPLY

When not using Power over Ethernet (PoE), an external power supply unit is needed, e.g.:

- MIK-NTCAM133XL1.5 (12 V / 3.5 A) with 5-pin Lemosa plug and 1.5 m cable.

2.4 System requirements

- At least a 1 Gbit Ethernet adapter, up to 10 Gbit Ethernet are possible.
- Windows 10 or newer for the operating system.
- Additionally, VisualMARC3 software to configure and control the camera.

The camera

3.1 Camera description

The SMR camera is our first member of a new generation of high-speed recording cameras.

VisualMARC3 software provides basic and advanced features.

The camera is available in monochrome and color.

BAYER FILTER

The sensor of the SMR colour cameras is supplied with a Bayer colour filter. In order to get the colour information, the imaging software has to decode the information of each pixel into red, green, and blue (RGB) by using the values of its neighbouring pixels. Each red, green and blue filter element covers exactly one pixel on the sensor. A matrix of 2 x 2 filter elements builds a filter element matrix. A Bayer pattern image therefore must have an even number of pixels and an even number of lines.

3.1.1 Identification plate

The product label contains the following information:

- Camera name
- Article description
- Serial number (e.g. S/N00002)

3.1.2 External synchronization

The frame rate per second (fps) of the camera can be synchronized by an external signal. You have to apply the external signal to one of the digital inputs.

> Internally generated frame rates can only be configured in integer values, externally stimulated frame acquisition may result in fractional values for fps.

3.2 Operating temperature

If the camera is mounted on mechanical parts, heat, generated during operation, is dissipated by the cooling fans of the camera and the mechanical parts.

The camera temperature can be displayed by activating the function *Show Camera Temperature* in the VisualMARC3 software or the adequate feature in GenICam.

> The maximal temperature of the camera's body must not exceed 60 °C (140 °F).

In case of overheating, switch the camera off and take further cooling options. Wait until the camera has cooled down, then switch it on again.

3.3 Cooling

During operation, the heat from the camera’s sensor dissipates to the housing. To maintain reliable performance, it is crucial to adhere to the operating temperature range specified in the camera's technical data.

- Install the camera so that the housing openings at the back or at the sides are not blocked and ventilation is possible under all operating conditions.
- Check the unhindered air flow after installation of surrounding components such as cables.

ADDITIONAL COOLING

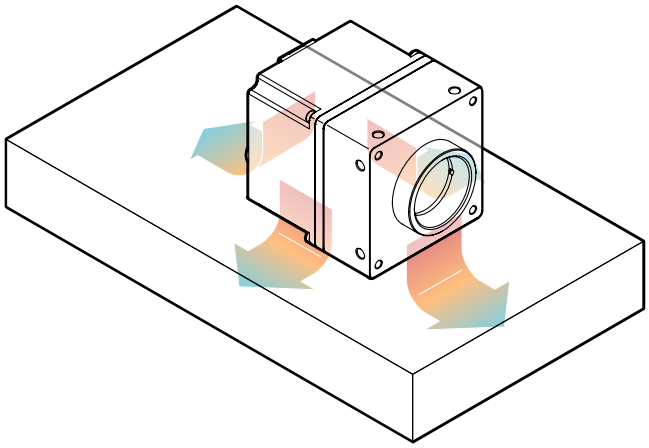


Fig. 3-1: Camera mounted to a heat sink (example)

If the temperature consistently exceeds the maximum operating temperature specified for the camera, additional cooling measures are necessary. This can be achieved by:

- Mounting the camera housing to a heat sink or other heat-dissipating material. For optimal cooling efficiency, ensure that the contact area between the camera housing and the cooling material is as large as possible, allowing for better heat transfer.
  In addition, vibrations will be minimized within the entire system.
- If available, activating the built-in fan or adjust the fan control threshold.
- If available, activating the built-in thermoelectric cooling feature.
- Using an air- or water-cooling system.

> Even if the housing temperature remains below the maximum operating temperature, using additional cooling is recommended to ensure optimal image quality and power efficiency.

3.4 Interfaces of the camera

The connectors and the LED lights are situated on the back of the camera.

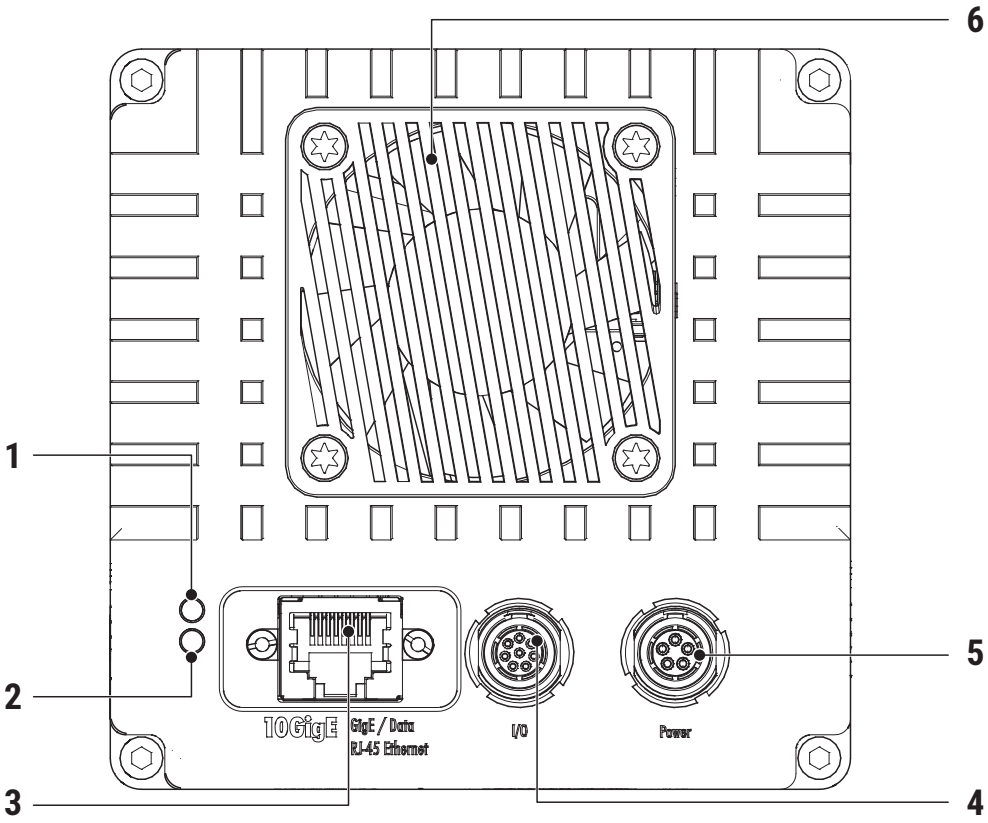


Fig. 3-2: Interfaces of the camera SMR

1	Power/ status LED	**2**	Recording LED
3	10 GigE Vision interface	**4**	I/O connector
5	Power connector	**6**	Fan

3.4.1 Status LED

STATUS / POWER LED

Color	Description
Yellow slow blinking	Internal boot process
Yellow fast blinking	Connection setup
Yellow solid	Idle mode
Green solid	Uploading data

Color	Description
Purple fast blinking	Processing data
Purple solid	Update finished

Table: 3-1: Status LED

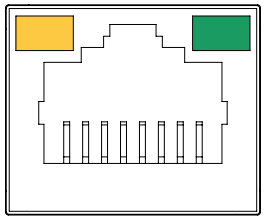
RECORDING LED

Color	Description
Green slow blinking	Live mode active
Green solid	Live mode idle
Orange slow blinking	Single recording mode active
Orange slow blinking	Ring recording mode active, waiting for stop trigger signal
Orange fast blinking	Ring recording mode active, recording post-trigger frames
Orange solid	Recording mode stopped
Blue slow blinking	Streaming mode active
Blue solid	Streaming mode stopped

Table: 3-2: Recording LED

3.4.2 10GigE interface

> We recommend to use the setting "Jumbo Packet" (see "Accelerate the network speed").



The 10GigE interface can be used to transfer data from the camera to an image processing system (e.g. a PC) or to control the camera (e.g. starting or stopping a recording).

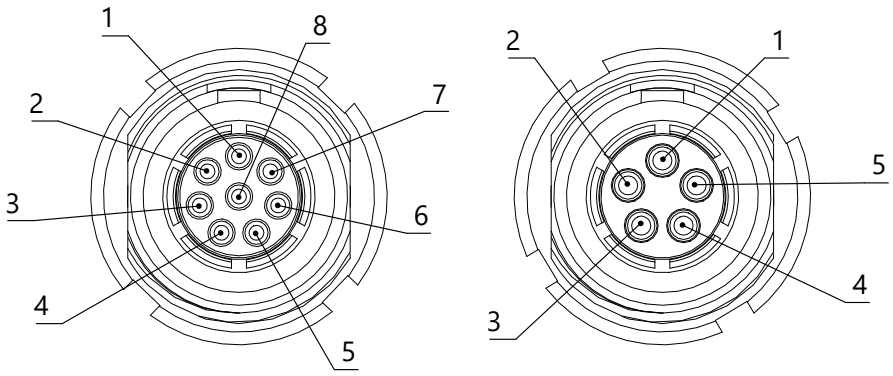
When downloading frames from the camera to a PC or image processing system, up to 800 MB/s can be transferred.

3.4.3 External I/Os

There are four digital inputs. Digital input signals can be used to synchronize, start or stop the camera (events), or to control the output. The status of the input signals can be saved in the metadata of a frame (refer to "The Trigger Control panel" on page 75).

The digital outputs can deliver a STROBE or ARM signal. They allow to output the camera status or to synchronize other cameras.

The external I/O connector 8-pin Lemosa provides the following signals:



PIN	I/O	POWER
1	IOGND (All IO signals refer to this GND)	+10.5 ... 30V
2	n.c	+10.5 ... 30V
3	DigOUT (Digital output configurable)	n.c
4	DigIN 1 (Digital input configurable)	GND
5	DigIN 2 (Digital input configurable)	GND
6	IRIG IN (IRIG-B timestamp decoder)	
7	DigIN 3 (Digital input configurable)	
8	DigIN 4 (Digital input configurable)	

Setting up

4.1 Connecting the camera

When using a GenICAM SDK, have the documentation of the SDK ready.

CONNECTING THE CAMERA

> In multi-camera mode we recommend to connect all cameras via a switch with the Ethernet controller of your PC.

1. Make sure the Ethernet controller has been installed properly.
2. Take off the cover of the camera sensor and mount the lens.
3. Connect the power supply first with the camera, then with the main supply. The status LED turns orange and then green after the successful boot sequence.
4. Connect the Ethernet cable first with the camera, then with the Ethernet connector of the PC.
5. Plug in the USB storage device containing the VisualMARC3 software.

To use a GenICAM SDK, follow the instructions of the SDK documentation.

> In most cases, an IP address will be assigned automatically. This may take a few minutes via DHCP. To accelerate this process or to assign a fixed IP address, see "Manually assigning an IP address" on page 21.

4.2 Connecting the power supply

The power connector is a 5-pin Lemosa connector.

1. Connect the power connector of the camera with the supplied DC power supply.

> When disconnecting the camera from the power supply, all data in the internal memory will be lost. Save the data you want to keep before disconnecting the power supply.

Power consumption will amount to about 30 W@2500 fps.

4.3 Manually assigning an IP address

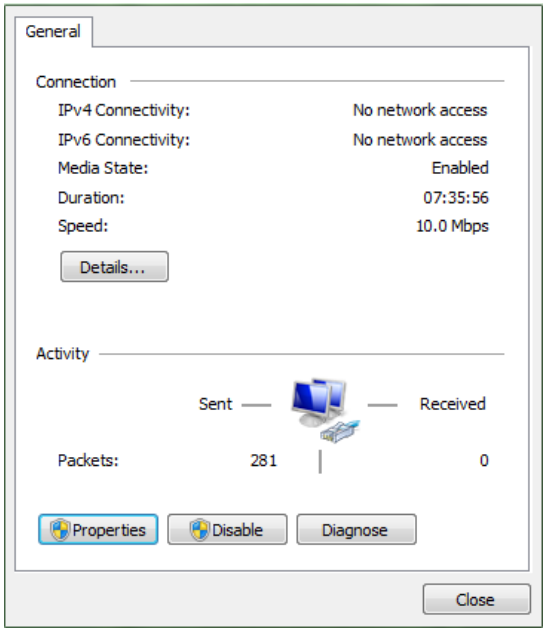
The image processing system (e.g. PC) communicates with the camera via Ethernet. Therefore, an appropriate IP address must be assigned to the network card.

In most cases, the IP address will be assigned automatically after connecting a camera. This may take some time.

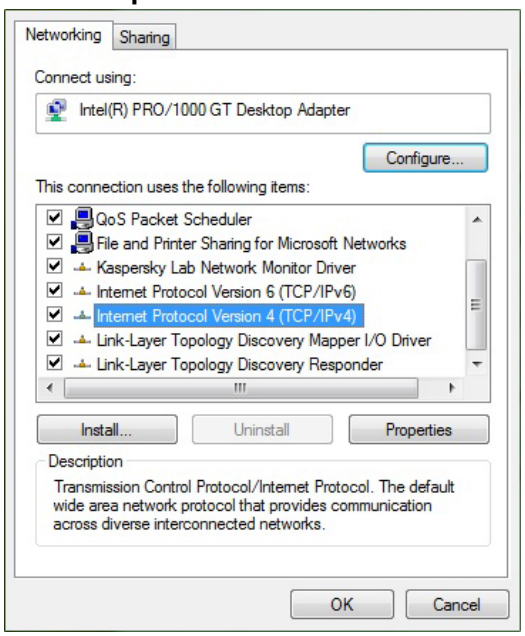
To accelerate this process, or to assign a fixed IP address, proceed as described below.

> To make changes to the settings, administrator rights on the PC are required.

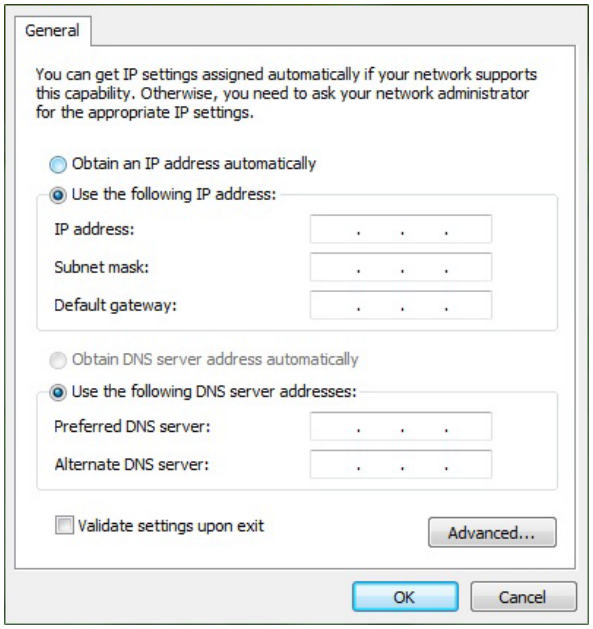
1. Connect the camera via Gigabit Ethernet with the image processing system.
2. Open the *Control Panel Items* in Windows.
3. Open *Network and Sharing Center*.
4. Open *LAN connection*.



5. Select **Properties**.



6. Check if Internet Protocol Version 4 (PCT / IPv4) is enabled.
7. Select **Properties**.



8. Assign a valid IP address that is currently not in use, e.g. "192.168.110.1", subnet-mask: "255.255.255.0".
9. Click **OK**.

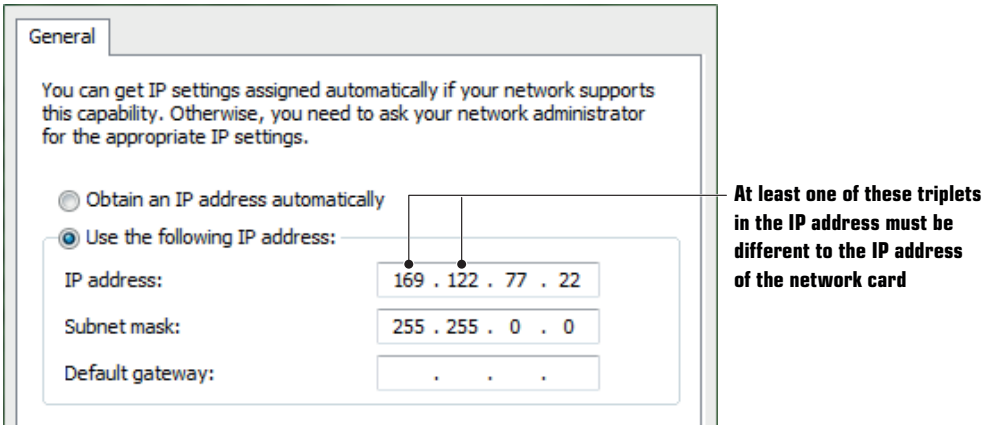
4.4 Using multiple network cards

When using multiple network cards, it is necessary to assign an IP address to each. Proceed for each card as described below and make sure that the sub-net of the two differs.

If for example the IP address "169.122.77.22" is assigned to the first network controller, the IP address of the second controller has to differ in at least one address part above the 255 in the subnet mask.

EXAMPLE

In the example below the subnet mask includes twice the number 255. The IP address of the second card has therefore either to differ in the first or the second three digits, e.g. "169.121.77.22".



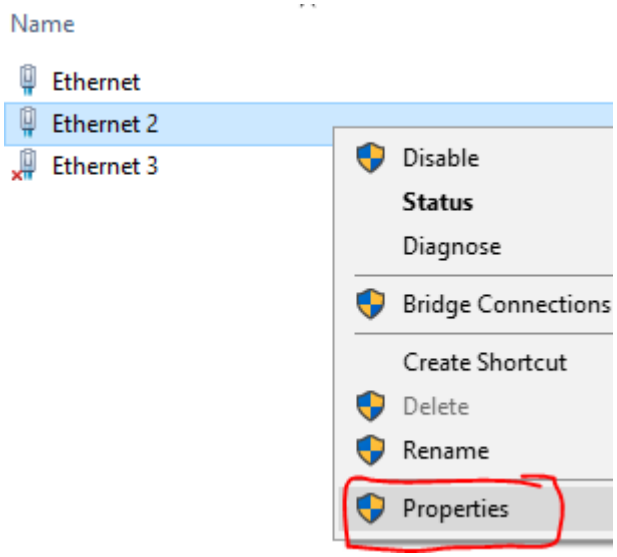
4.5 Configuring the network adapter settings for GigE or 10GigE

> If the NIC is not set optimally, it can lead to loss of performance, lost network packets, lost frames, and connection losses.

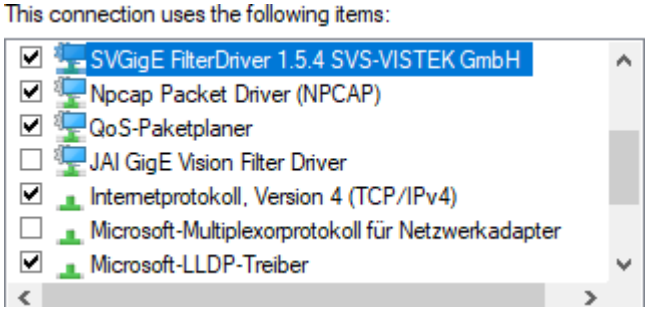
1. Insert the network card or network grabber into the uppermost PCIe interface, i.e. closest to the CPU.
2. Install the latest driver for the network adapter.

   > For Intel network adapters, we recommend the Intel Pro network driver which can be downloaded from the Intel website.
3. When using a laptop, connect it to the power supply.

4. Set the PC to "High Performance" in the Power Options (Windows Control Panel).
5. Open Control Panel\Network Connections and right click on the network adapter that is connected to the camera
6. Open “Properties”.



7. Only activate the driver of your software e.g. our SVGigE FilterDriver, as other drivers might slow down network transmission.



8. Open the “Performance Options” properties and set the following parameters:
   - Interrupt throttling: activated
   - Jumbo Packages: 9014 Byte (9K)
   - Max. number of RSS queues: 8 queues (depends on CPU and used Image Acquisition Software) (for low End CPUs lower queues might work better)
   - Receive buffer: 4096 (or the supported maximum)
   - Flow control: RX and TX activated.

     > Intel I219-V and I219-LM Adapter sometimes need flow control disabled.

   - Interrupt throttling rate: Adaptive
   - Transmission buffer: 4096 (or the supported maximum)

- If available: Log connection event: deactivated
- If available: Energy-efficient Ethernet: deactivated

> - Not all these parameters must be available. It depends on NIC manufacture, type, and driver version.
> - On some Systems disabling the C-States (Power Saving Modes for the CPU) in the BIOS helps, improving the system stability.
> - We only recommend disabling the firewall for testing / debugging purposes.
> - If it brings stability improvements, try setting more specific firewall rules for SVCapture with enabled firewall.

4.6 Cleaning sensor and lens

1. If there are coarse particles on the lens or the window of the sensor, use a vacuum cleaner to remove them before cleaning to prevent scratches.
2. Clean the window of the sensor and the lens with a dry and soft lens-cleaning tissue.

> Do not use tools that may harm the sensor or lens.

The VisualMARC3 software

The following section describes the usage of the software VisualMARC3, optimized for the camera SMR.

5.1 Introduction

5.1.1 About the VisualMARC3 software

VisualMARC3 enables you to set various parameters to control Allied Vision Gilching GmbH cameras and process the recorded images. In addition, the software has the following features:

- Compatible to Director2 software (for loading Director2 *.REC files) and VisualMarc2 software
- Clearly structured menus and functionality to enhance intuitive working
- Features for fast loading, storing, processing and analysis of image data

5.1.2 Prerequisites

The camera has to be connected via Ethernet with your PC or image processing system (also refer to the setup instructions of the camera). The PC or image processing system used has to be equipped with an Ethernet adapter and the most recent drivers for connectivity

> For details consult your Ethernet adapter documentation.

- Microsoft NET Framework 4.6 or higher

5.1.3 System requirements

For VisualMARC3, the hardware and operating system has to meet minimum requirements. To assure fast image processing, we recommend a more powerful equipment than listed under “Minimum requirements”.

> The VisualMARC3 software requires at least 200 MB free hard disk space.

MINIMUM REQUIREMENTS

- Microsoft Windows 10 or newer with the most recent system updates
- Intel Core-i CPU (2nd generation) or comparable CPU of another manufacturer
- 2 GB PC RAM and 128 MB graphics memory
- Display resolution of 1280 x 1024 pixels

RECOMMENDED

- Microsoft Windows 10 or newer with the most recent system updates
- Quad Core CPU
- 8 GB PC RAM and 256 MB graphics memory
- Display resolution of 1920 x 1080 pixels

5.1.4 Installing the software

1. Download the software from the server and unpack the downloaded file.
2. Double click the file setup.exe.
3. Follow the instructions of the installation wizard to install the software on the image processing system.
4. Start the software on the desktop or in the Windows Start menu.

5.2 The user interface

5.2.1 Overview

This section provides general information about:

- How to start communicating with the camera (see "Start communicating with the camera" on page 27)
- The basic structure of the tabs and functions of the user interface and how to arrange the workspace (see "The workspace" on page 28)
- The meaning of the status bar entries at the bottom of the window (see "Status bar entries" on page 30)

5.2.2 Start communicating with the camera

> Read the reference guide of your camera before connecting it with the PC or imaging system.

After connecting a recording camera and starting the software, the Connection Manager tab is displayed.

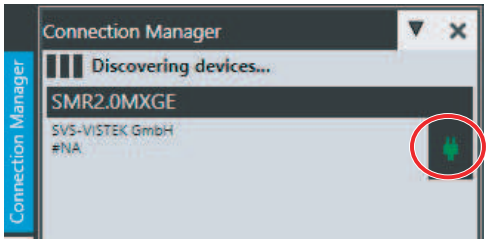


Fig. 5-1: The Connection Manager tab

The camera model is recognized automatically and its name is displayed in the header of the Connection Manager tab.

For connecting a camera, see "The Connection Manager tab" on page 31.

> For the camera to connect automatically after the next start, enable the “Automatic Connection” in Application Settings (see "The Application Settings tab" on page 34).

5.2.3 The workspace

After connecting the camera several tabs and panels are displayed and grouped around the central work space where the camera image is displayed. The tabs and panels provide access to functions and features of the camera and the imaging processes.

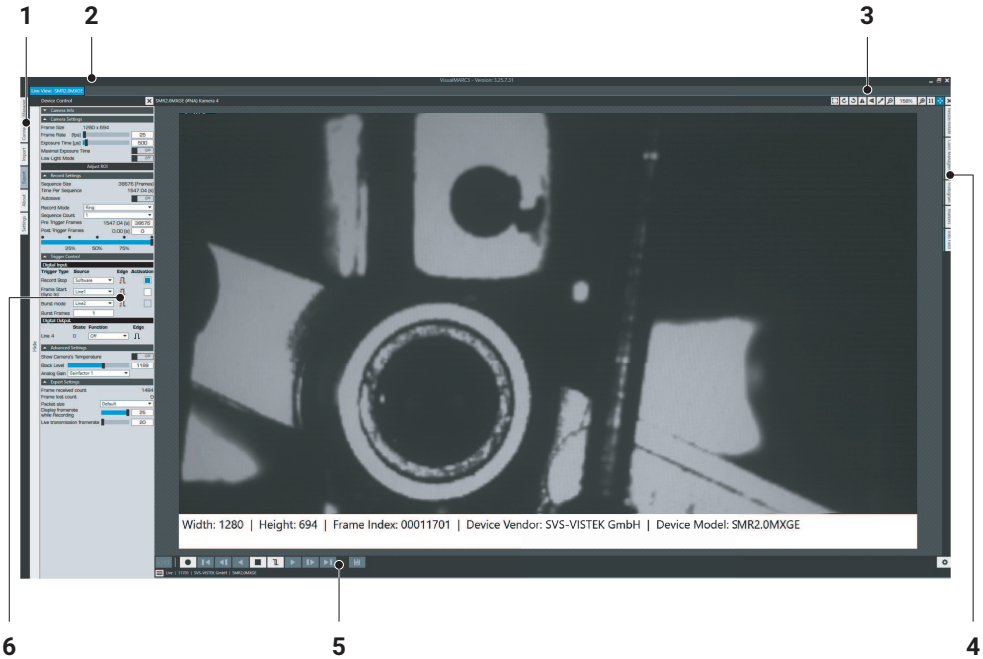


Fig. 5-2: The workspace

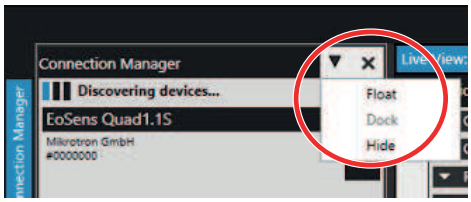
1 Global functions tabs (see "The global function tabs" on page 31)	**2** Window tabs (see "Toggle, move, or rearrange image tabs" on page 30)

3	Tools bar (see "The Tools bar" on page 35)	**4**	Image processing and analysis tabs (see "The image processing and analysis tabs" on page 37)
5	Recording and live view control bar (see "The Recording and Live View Control bar" on page 60)	**6**	Device control panels (see "The device control panels" on page 66)

SHOW OR HIDE TABS

To arrange the workspace you can show or hide tabs and set tabs to float on the screen or docked to the side of the workspace to provide more viewing area.

1. Click the triangle to open the tab options.

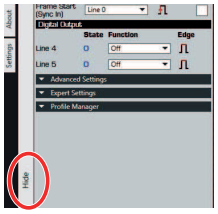


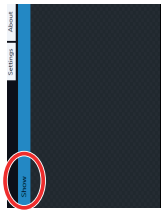
2. Select **Float**, **Dock**, or **Hide**.

> You can also hide any panel by clicking the **X**.

SHOW OR HIDE THE DEVICE CONTROL PANELS

The device control panels can be displayed or hidden as a group or individually.





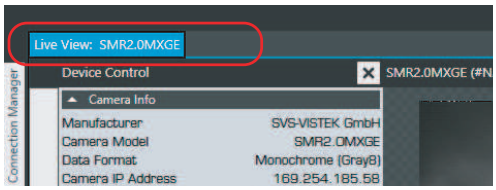
1. Click **Hide** on the bar left of the panels.
2. Click **Show** to display the panels.
3. To show or hide an individual panel, click on the triangle next to the panel name.

SHOW OR HIDE THE RECORDING AND LIVE CONTROL BAR

The recording control bar can be shown or hidden.

1. Click the white arrow at the bottom of the screen.

TOGGLE, MOVE, OR REARRANGE IMAGE TABS



If several image tabs are open, several options are possible to rearrange the tabs:

- Click the tab of the image you want to bring in front.
- Click and drag the tab to rearrange the tab order.
- Click and drag the tab on another screen if multiple screens are attached.

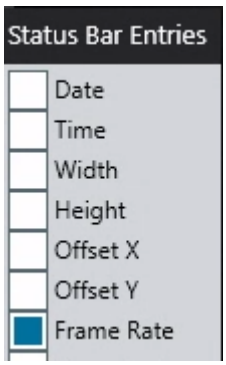
5.2.4 Status bar entries

The status bar at the bottom of the workspace during live stream events displays a defined set of information, depending on the camera type.

Status	Stopped, Live, Recording, Playing (this information is not exported)
Date	Date of frame
Time	Time of frame
Width	Frame width
Height	Frame height
Offset X	Left horizontal offset of the ROI area
Offset Y	Top vertical offset of the ROI area
Frame Rate	The number of frames per second (fps)
Frame Index	Actual frame number
Exposure Time	Time in µs (Microseconds)
Digital IO	Available I/Os
Trigger_Offset	Time difference between trigger and cursor position
Device Vendor	Manufacturer of the camera
Device Model	Camera name

DEFINING THE VISIBILITY OF THE STATUS BAR ENTRIES

1. Select the info field icon .
2. Enable the entries in the status bar.



5.3 The global function tabs

5.3.1 The Connection Manager tab

The first time SMR is started, the camera has to be connected with the software via the Connection Manager. The Connection Manager tab displays all connected cameras and their respective status.

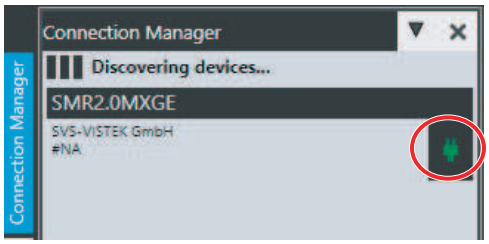


Fig. 5-3: The Connection Manager tab

The red color of the connector button indicates that the camera is not yet communicating with the software.

1. Open the Connection Manager tab in the global function to check the connection status. The camera model, the manufacturer name, and the serial number ("#0000xxx") of the connected cameras are displayed.
2. Click the red connector icon to establish the connection.
   - The connector icon turns yellow as the connection is attempted.
   - The connector icon turns green as soon as the camera is connected.

The Connection Manager tab is closed automatically when the connection to the camera is established.

> Keeping the Connection Manager open to monitor the current connection status carries a bandwidth load that may not be desirable in unstable networks.

5.3.2 The Import tab

The Import tab provides the settings for importing files. The following file formats can be imported:

Format	Description
DAT	Allied Vision Gilching GmbH proprietary RAW container format for the high-speed recording systems LTR, CVR, and Director2 Kit. This RAW format can be imported, displayed, and processed with the functions in the Image Processing and Analysis bar.
Image files	BMP, JPG, JPEG, PNG, TIF and TIFF formats can be imported, displayed, and processed with the functions in the Image Processing and Analysis bar.
REC	Allied Vision Gilching GmbH proprietary RAW container format. Old REC format files of Director2 and VisualMarc2 can be imported as well.

Table: 5-1: File formats for import

In RAW format all raw image data and recording information are stored in one file with the extension '*.REC. This format is recommended to be used whenever a sequence needs to be read out fast.

> You can also drag a file from your directory and drop it into the workspace of VisualMARC3.

1. Select **Import**.
2. Select the folder from the file explorer of the operating system.
3. Select the file to be imported.
4. Select **Open** or open the file by double-clicking.

As soon as the image or video has been imported, it will be displayed in the window and an additional tab is displayed.

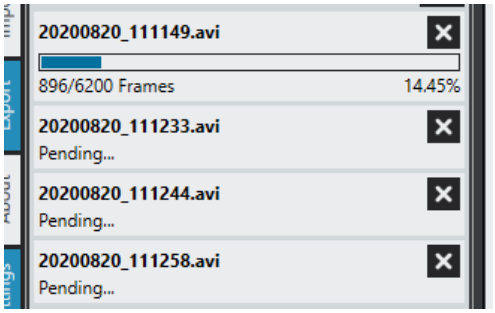
5.3.3 The Export tab

The software supports the export of a single file or multiple files concurrently. The Export tab displays the export progress of all files.

MONITOR THE EXPORT

> The export of small files needs only a short time and might already be finished when opening the export tab. In this case, check the target folder.

1. Open the Export tab. The progress of the file export is displayed. When the export is finished, the progress bar and the file name are no longer displayed.



> Depending on the size of the image sequence, the export may take a while. When exporting multiple file using a low bandwidth, the throughput can be throttled to prevent data loss (see "The Expert Settings panel" on page 81). This will increase the time required for export.

ABORT THE EXPORT

1. Open the Export tab.
2. Click ✕ next to the export. The selected export process is canceled.

5.3.4 The “About” tab

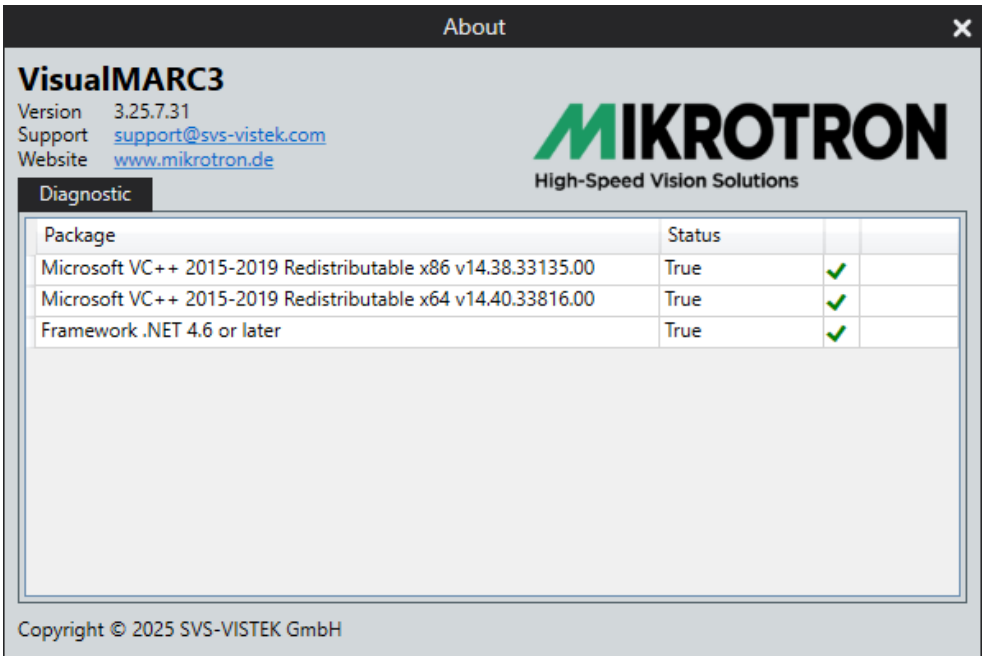


Fig. 5-4: About tab

The “About” tab displays the installed VisualMARC3 version, the email address for support requests, and the Allied Vision Gilching GmbH web address.

> The version number of the current build is also displayed in the window top bar.

Additionally, a column indicates whether all necessary software components are installed in column "Status". If a components is marked as missing, it can be installed.

5.3.5 The Application Settings tab

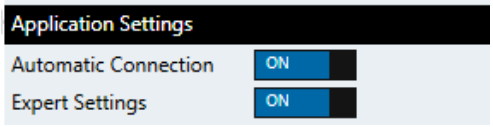


Fig. 5-5: The Application settings tab

The Application Settings tab provides the following options:

- **Automatic Connection**: If the automatic connection is enabled the first camera found by the application will automatically be connected when SMR is started. Additional cameras must be added manually (see "Start communicating with the camera" on page 27).
- **Expert Settings**: If the expert settings are enabled, the additional Expert Settings panel will be added to the device control panels (see "The Expert Settings panel" on page 81).

5.4 The Tools bar

5.4.1 Overview

Fig. 5-6: The tools bar

The tools bar provides quick access to image editing functions.

After clicking at a tool bar icon, the corresponding command will be executed immediately.

5.4.2 The Tools bar icons

Icon	Function
	**Toggle Crop View**: Starts or stops cropping the selected image. When cropping, the image window is divided into the raw (original) view and the output (cropped) view. • The raw view displays the image "as is" (i.e. without editing such as color corrections) • The region of interest (ROI) to be cropped can be selected with the mouse. This selection is displayed in the output view. *When adjusting the cropped window with the mouse, size and offset of the ROI are displayed in the Resize / Rotate tab (see "Resize and rotate tab" on page 38).*
	**90 clockwise rotation** of the frame: Clicking the icon several times continues rotation in clockwise direction.
	**90 counter clockwise rotation** of the frame. Clicking the icon several times continues rotation in counter-clockwise direction.
	**Horizontal flip**: Clicking flips the frame on a horizontal axis, e.g. for a mirror image.
	**Vertical flip**: Click to reverse the frame vertically, e.g. for a mirror image.
	**Color picker**: A window displays the RGB or Gray values of the pixel selected and its column and line number. The window follows the cursor when moved. Clicking the icon again disables the color picker (see "Adjust RGB values" on page 40).
	**Zoom out**: Clicking several times adjusts the zoom level. The zoom level is displayed in the Frame size window.

Icon	Function
99%	**Frame size**: Displays the actual frame size in percent. Entering a value changes the frame size.
	Zoom in: Clicking several times adjusts the zoom level. The zoom level is displayed in the Frame size window.
1:1	**1:1 scale**: Clicking scales 1 pixel of the image to 1 pixel of the display.
	Fit to screen: Clicking enables or disables the fit to screen function. If fit to screen is enabled (blue), the frame will automatically be adjusted to the window size.

Table: 5-2: The Tools bar icons

5.4.3 Assignment of keys

Instead of using icons, keys can be used to move between frames, make selections, and start or stop recording or abort a function.

Key	Description
C	**Go to selection start/stop** See "Selections" on page 64
Pag↑	**100 frames forward** Clicking a position in a slider and pressing the button increases the value by 100.
Pag↓	**100 frames backward** Clicking a position in a slider and pressing the button decreases the value by 100.
←	**1 frame backward** Clicking a position in a slider and pressing the button decreases the value by 1.
→	**1 frame forward** Clicking a position in a slider and pressing the button increases the value by 1.
↑	**10 frames forward** Clicking a position in a slider and pressing the button increases the value by 10.
↓	**10 frames backward** Click a position in a slider and press the button to decrease the value by 10
F5	**Start recording**
F8	**Software trigger** (if configured)

Key	Description
F12	**Stop recording**
Esc	**Abort recording**

Table: 5-3: Key assignment

5.5 The image processing and analysis tabs

5.5.1 Overview

Fig. 5-7: Image processing and analysis tabs

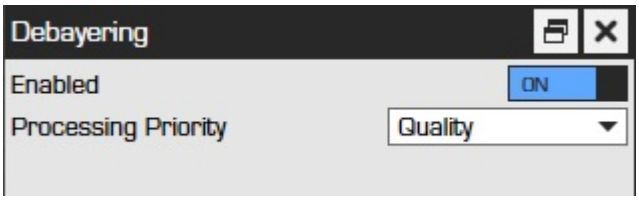
The image processing and analysis tabs display several tabs to process recorded images.

> The availability of a tab depends on the camera connected (monochrome or color).

If the color camera delivers RAW data, an additional Debayering tab is displayed.

5.5.2 Debayering tab

If the color camera delivers RAW data to be displayed on the screen, the Debayering tab is used. When displaying RAW data, you have the choice between quality and performance.



1. Enable Debayering.
2. Set the **Processing Priority.**
   - Select *Quality* if the computer provides enough processing power to display the recorded frames in high quality.
   - If the performance of the PC is not sufficient, choose *Performance* to accelerate the display process.

5.5.3 Resize and rotate tab

The tab Resize / Rotate contains the following functions:

- Selecting a part of a frame and cropping the frame (see "Cropping the frame" on page 38)
- Flipping and rotating a frame vertically and horizontally (see "Flipping and rotating a frame" on page 39)

CROPPING THE FRAME

Cropping a frame reduces the file size of the cropped image and decreases the transfer time over the network.

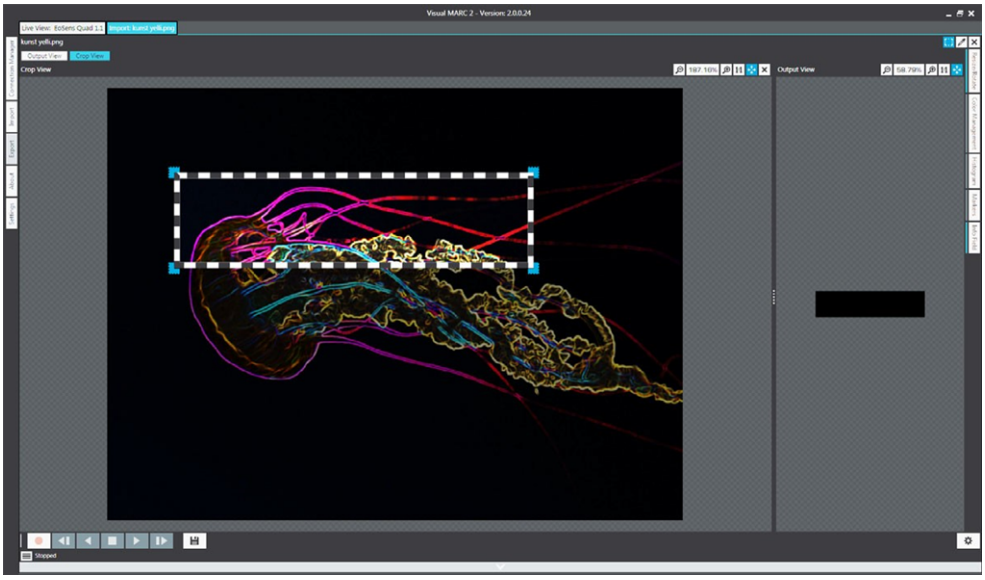
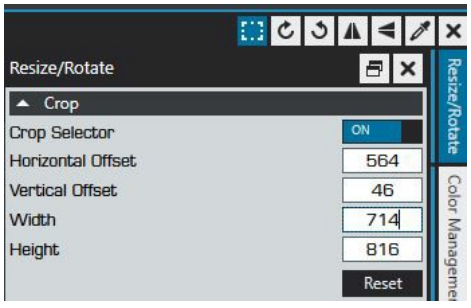


Fig. 5-8: Cropping the frame

> When adjusting the cropped window with the mouse, size and offset of the cropped window are displayed in the Resize/Rotate tab.

1. For cropping the frame with the mouse, enable the crop selector or click the crop view icon and move the cropping area to the desired position.
2. For defining the frame using offset and dimensions, enter values into the fields.



3. Exit the Crop View window by clicking or disable *Crop Selector* in the

window.

4. To undo the settings, click *[Reset]*.

FLIPPING AND ROTATING A FRAME

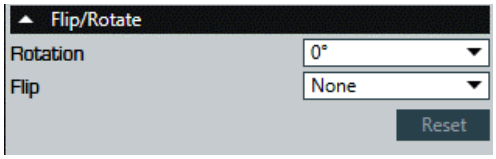


Fig. 5-9: Flipping and rotating a frame

The Resize/Rotate tab displays two input fields. This tab displays the same functions as in the Tool bar (see "Overview" on page 35).

5.5.4 ColourManagement

SMR supports cameras that deliver 10-bit images.

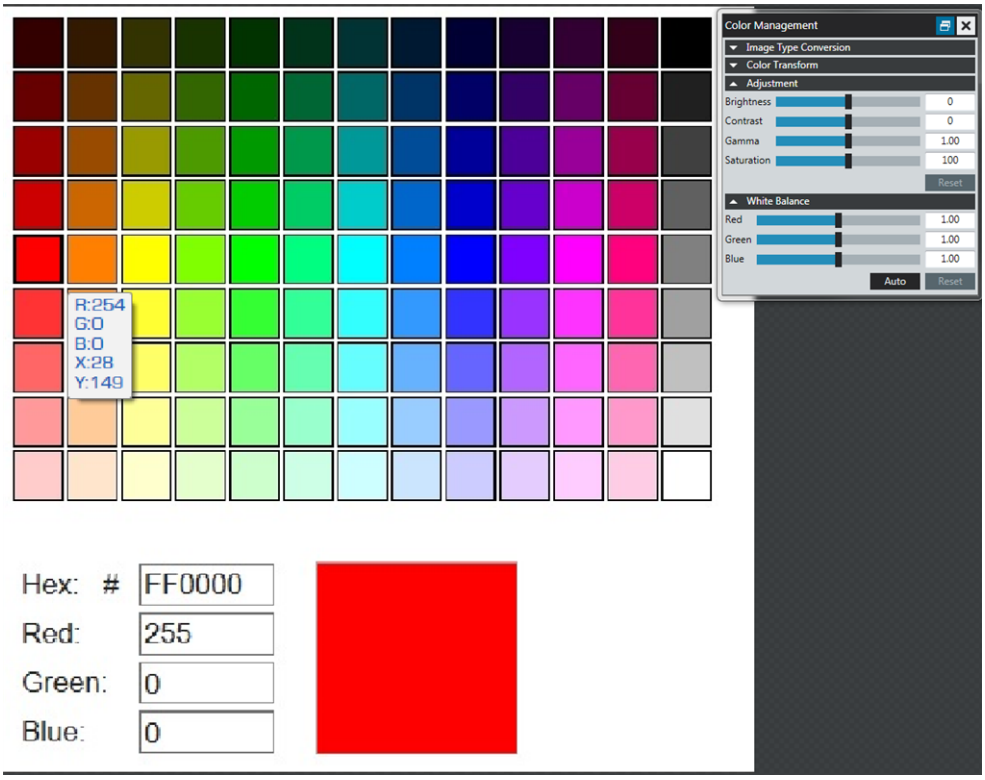
> Some cameras, like the SMR camera series, only support 8-bit images.

> For each pixel the recorded tonal value is stored in the image file along with the color. 8-bit monochrome images consist of 256 tonal values (8 bit per pixel), 10-bit monochrome images consist of 1024 tonal values. 8-bit color images can display 256 different tonal values per color channel (red, green, blue) and 10-bit color images display 1024 tonal values per color channel.

The tab ColourManagement offers several functions to process colour and partially monochrome images.

ADJUST RGB VALUES

To adjust colors, the color picker is used to compare values in the images with measured values of a color chart.



1. Import a color chart and move the color picker to the color field to be measured.
   The color picker returns the RGB value, e.g. 255, 0, 0 for the red field.
2. If the value in the image differs from this value, adjust brightness and saturation in the image.

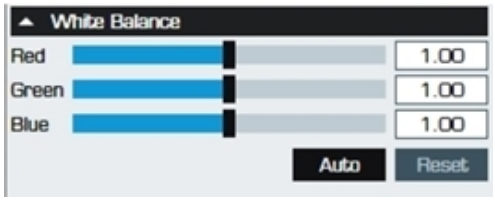
WHITE BALANCE

Good illumination is extremely important to display true colors in recorded frames. Best results are achieved in daylight, using LEDs, or halogen light. If a light source emits relatively warm or cool white light, color casts may appear. The colors in the image of the inspected object differ from the original colors.

White balance allows compensating these color casts by defining a neutral white point relative to the colors of the image.

> Using the white balance function will change the pixel values of the image.

By changing the values for each color channel, white balance can be adjusted manually.



1. Start by holding a white sheet of paper in front of the center of the camera lens.
2. To change the white balance for the red, green, or blue channel, move the slider or enter a value in the text box.
3. Select **Auto** for the automatic white balance adjustment.

Red	Neutral setting of the red channel is 1.00. Check the histogram when changing the value.
Green	Neutral setting of the red channel is 1.00. Check the histogram when changing the value.
Blue	Neutral setting of the red channel is 1.00. Check the histogram when changing the value.
Auto	The software will automatically adjust all pixels by iterative white balancing, using the center area of 256 x 256 px. Using the center area prevents negative impact from vignetting. **Original image**  **Auto white balance applied** 

IMAGE TYPE CONVERSION

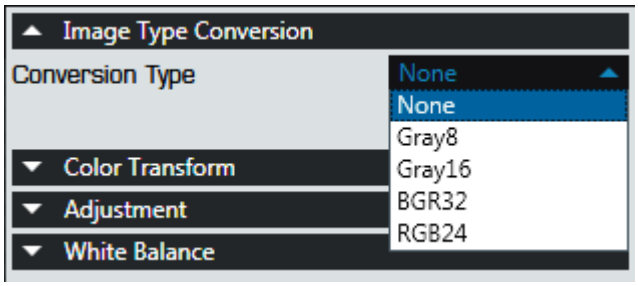


Fig. 5-10: Image type conversion

Recorded images can be converted into another gray or color format. This might be helpful if the software used for processing the recorded images requires BGR32 but recording is done in RGB24 or vice versa. All image formats can be converted in one of the four formats described below.

Gray8	An 8 bit gray scale image consists of 256 gray shades. The higher the pixel value the brighter the pixel which means the value 0 represents black and 255 white. The other 253 values represent shades in between.
Gray16	All 8 and 10 bit images will be interpolated into 16 bit images. E.g. the value 0 of an 8 bit image remains 0 in a 16 bit image and the value 256 of an 8 bit image becomes 65536 in a 16 bit image. All values in between will be interpolated.
BGR24	BGR24 is a RGB format with 24 bits per pixel (BPP). Each color channel (blue, green, and red) provides 8 bit per pixel (BPP). These three channels occupy 3 Bytes. The fourth Byte is a dummy Byte used to improve processing. BGR starts with blue in the first line.
BGR32	BGR32 is a RGB format with 32 bits per pixel (BPP). Each color channel (blue, green, and red) provides 8 bit per pixel (BPP). These three channels occupy 4 Bytes. The fourth Byte is a dummy Byte used to improve processing. BGR starts with blue in the first line.
RGB24	A RGB image consists of the three color channels: red, green and blue. One Byte is reserved for each colourchannel. RGB starts with red in the first line.

COLORTRANSFORM

ColorTransform is an advanced function to edit color images and is only available if a color camera is connected or a colourimage has been imported.

With color transform you can transform pixel values of an image into another color space and/or the colors of the camera sensor can be edited.

When opening the panel, a matrix appears and the values are preset as follows:

Each pixel value of the color is multiplied with the factor in the matrix field and summarized.

$R_{out} = R_{in} \times 1 + G_{in} \times 0 + B_{in} \times 0 + Offset = new\ R\ value$

$G_{out} = R_{in} \times 0 + G_{in} \times 1 + B_{in} \times 0 + Offset = new\ G\ value$

$B_{out} = R_{in} \times 0 + G_{in} \times 0 + B_{in} \times 1 + Offset = new\ B\ value$

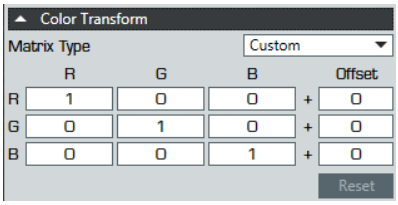


Fig. 5-11: Color transform panel

A positive offset value will increase the pixel value and a negative offset value decrease the pixel value of the correspondent color channel.

Below are two examples that show how to change the pixel values of an image.

EXAMPLE 1

Fig. 5-12: Color transformation, example 1

The Preset combo box offers four different settings:

- Custom (for your definition)
- Invert Red/Blue
- Gray scale
- Sepia

Each setting will change the pixel values of the image according to the factor displayed in the matrix.

$R_{out} = R_{in} \times 0.383 + G_{in} \times 0.769 + B_{in} \times 0.189 + \text{Offset } 0$

$G_{out} = R_{in} \times 0.349 + G_{in} \times 0.686 + B_{in} \times 0.168 + \text{Offset } 0$

$B_{out} = R_{in} \times 0.272 + G_{in} \times 0.534 + B_{in} \times 0.131 + \text{Offset } 0$

In example 1 the colored picture on the previous page was converted into sepia (see picture below).

Each pixel value of the color was multiplied with the factor in the matrix field and summarized in each color channel.

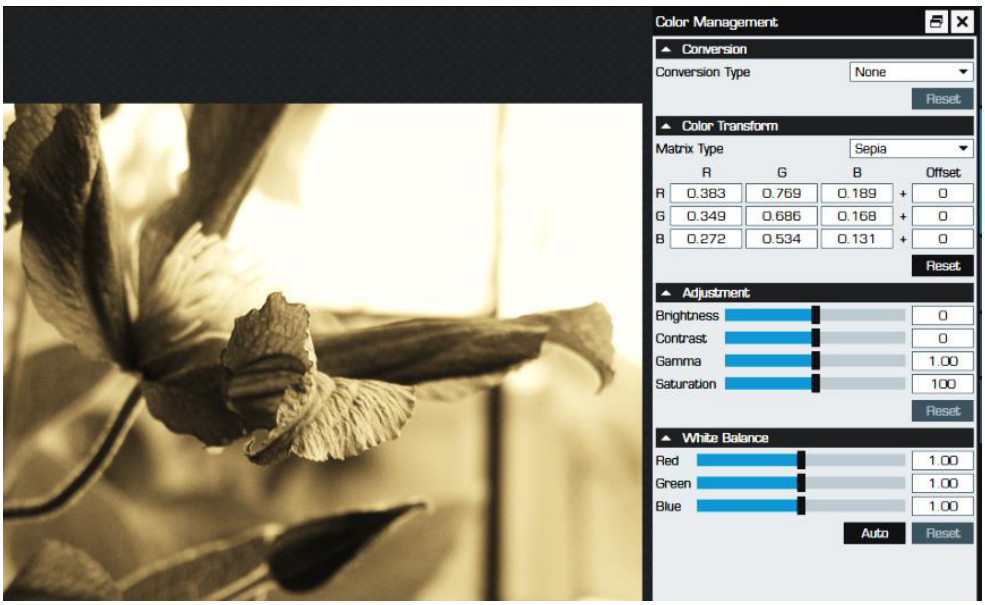


Fig. 5-13: Color transformation to sepia

EXAMPLE 2

This is the original image with the untouched matrix:

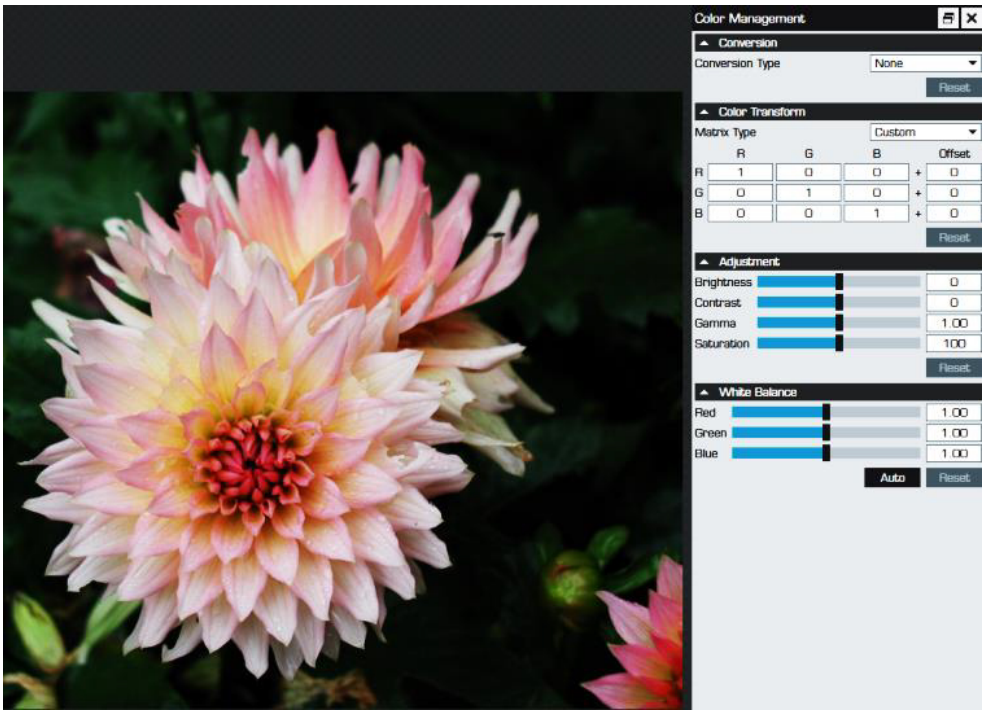


Fig. 5-14: Color transformation, example 2

If the G and the B value in the first and/or second column are increased by the factor 1, the color of the originally pink dahlia changes as follows:

$R_{out} = R_{in} \times 1 + G_{in} \times 0 + B_{in} \times 0 + \text{Offset } 0$

$G_{out} = R_{in} \times 1 + G_{in} \times 1 + B_{in} \times 0 + \text{Offset } 0$

$B_{out} = R_{in} \times 1 + G_{in} \times 0 + B_{in} \times 1 + \text{Offset } 0$

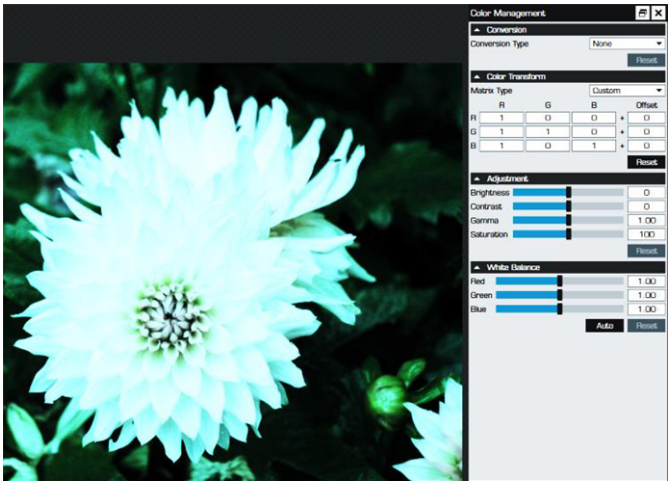


Fig. 5-15: Color transformation applied

ADJUSTMENT

Images can be processed e.g. to increase the visibility of certain details.

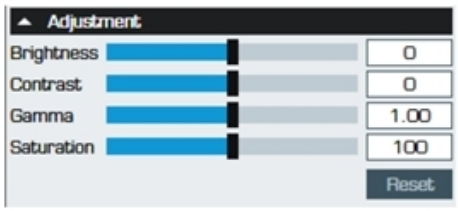
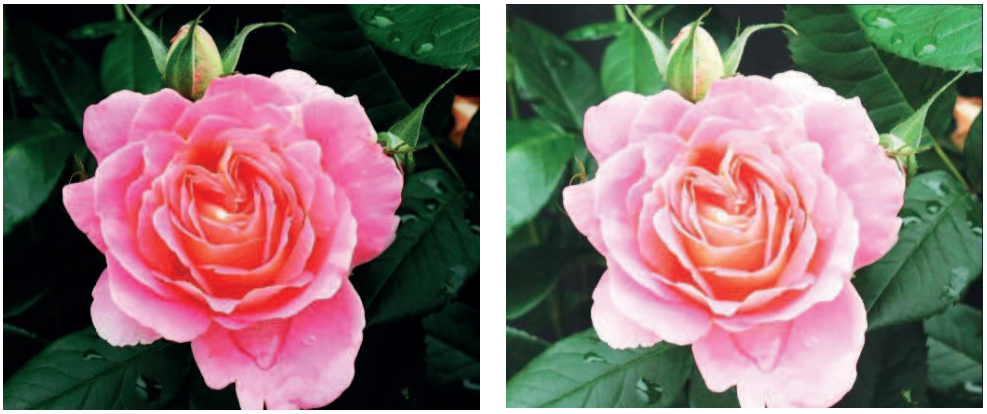


Fig. 5-16: Adjustment panel

1. Move the slider or enter a value.
2. Press [Return].

BRIGHTNESS

Increasing the brightness of an image means increasing all pixel values of an image. This results in a linear increase of brightness.

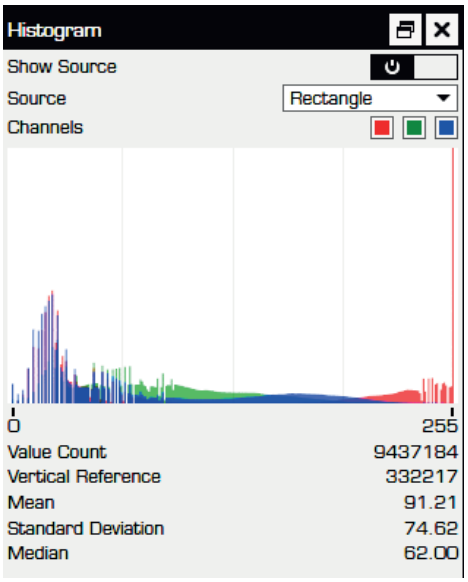


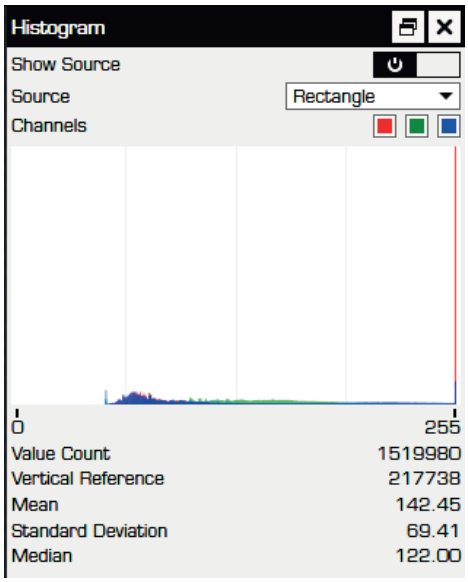
Original image **Linear increased brightness**

Fig. 5-17: Linear brightness

Brightness in the right picture was increased to the value 25.

The left histogram shows the brightness values of the original image, the right one displays the values of the brightened image. In the latter the values on the y-axis are lower than before, i.e. the frequency of most brightness values has been reduced. Mean values as well as median values are increased (also refer to "Histograms" on page 51.)





CONTRAST

Contrast defines the difference between the lightest and darkest pixel in an image. Increasing the contrast helps to distinguish objects but by increasing the contrast, very light and very dark parts of the picture and details are more difficult to recognize.

Original image

Increased contrast

Fig. 5-18: Contrast (example)

Whereas the leaves in the background of the left image are a flat, the higher contrast in the image on the right makes them easier to distinguish. However, the dark leave in the right lower corner and the very light part of the blossom are more difficult to distinguish.

GAMMA CORRECTION

Gamma correction is a non-linear method to adjust the brightness of an image. This method comes close to the manner the human eye perceives light and color.

Increased brightness (linear) **Increased brightness (non-linear)**

Fig. 5-19: Gamma correction (example)

Brightness of the original image was increased linear by the value 22 in the left image. The right image was brightened with a gamma correction value of 2.0 and looks much more natural for the human eye.

SATURATION

For more information see "Histograms" on page 51

Saturation describes the intensity of a color (from 0 to 200 percent). It is determined by a combination of light intensity and the number of pixels of a colourdistributed across the spectrum of different wavelengths. The highest saturation of a color is achieved by using one wavelength at a high intensity. If intensity drops, saturation will drop too. By using this function, the RGB values of the image will be transformed in the colourmodel HSV/HSL (hue-saturation-lightness/hue-saturation-value).

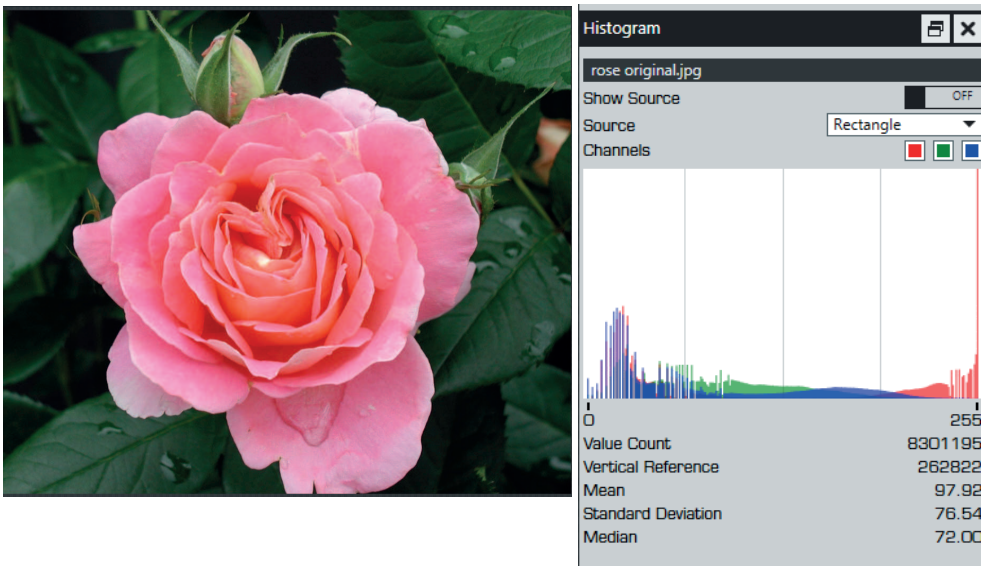


Fig. 5-20: Original image with saturation value 0 and its histogram

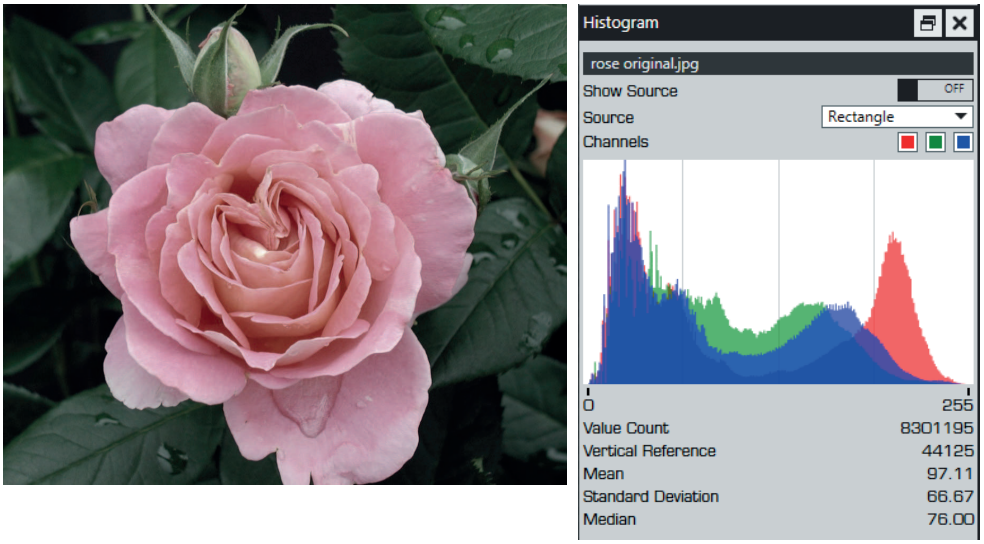


Fig. 5-21: Decreased saturation to 50 with histogram

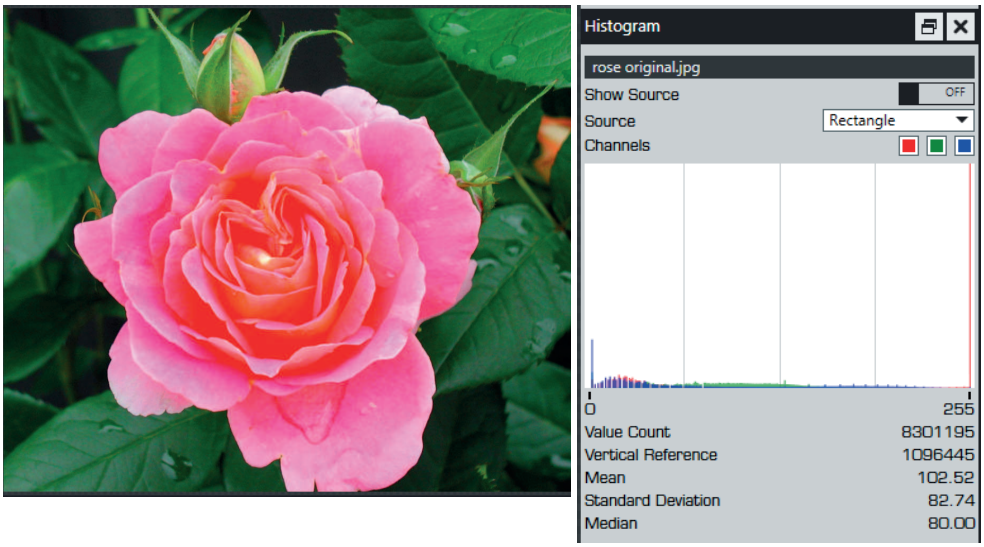


Fig. 5-22: Increased saturation to 190 with histogram

5.5.5 Histograms

Monitoring the histogram is an easy way to understand what happens when changing an image. A histogram shows the available pixel values and its distribution within the image.

GRAY8 AND GRAY16 IMAGES

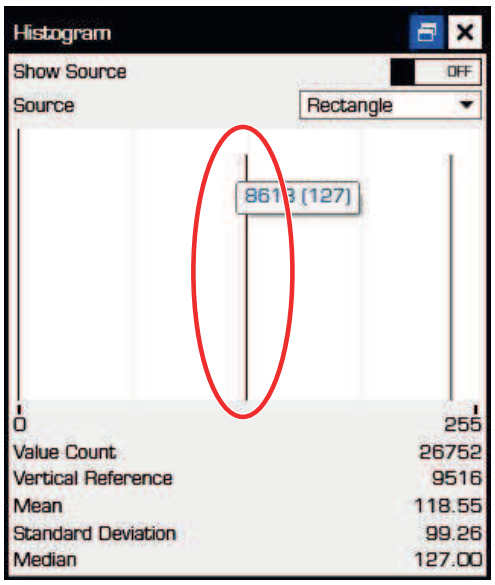
When using a histogram, the file format of an image is important. The color management feature of VisualMARC3 processes images with Gray8, Gray16, BGR32 and RGB24 format. This format decides what you see in a histogram.

For this Gray8-image with three gray values a histogram looks quite simple.

Fig. 5-23: Gray8 ramp

In rectangle view the pixel values from 0 (black) to 255 (white) are displayed along the x-axis. Along the y-axis, the frequency of each pixel value is displayed.

> The height of the y-axis in the histogram will be automatically adjusted to the highest distribution value.



1. To display the RGB values, hover the cursor over the line.

The black field of the image above is represented by the pixel value zero and its frequency amounts to 9516 pixels. The gray field in the middle has the pixel value 127 and its frequency amounts to 8618. Finally, the right field has the pixel value 241 and its frequency amounts to 8618. This shows that each gray tone has its own pixel value.

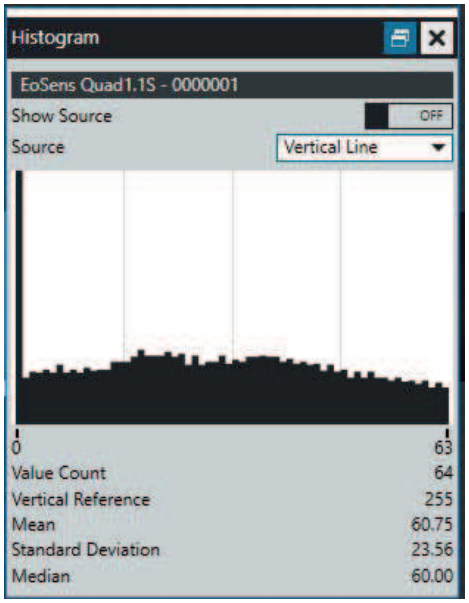
Additionally, the histogram window supplies the following statistical information:

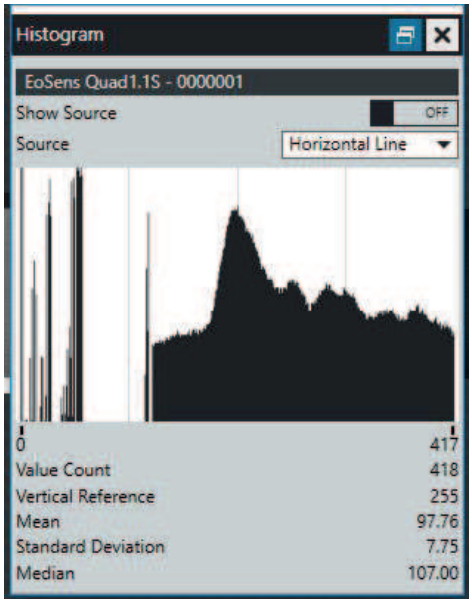
Value Count	number of all values in the image
Vertical Reference	highest value on the y-axis (here frequency of 9516 of the pixel with the no. 0)
Mean	arithmetic average of all pixels, e.g.: 0 x 9516 + 127 x 8618 + 241 x 8618 = 3171424 / 26752 = 118.55
Standard Deviation	deviation from the mean value
Median	the pixel value in the middle of the left histogram has the value 127; as a consequence more than 50 per cent of all pixels are to be found between pixel value 0 and 127 which means there are more dark than light pixels

CHECK LINES, COLUMNS, AND BITS

As the image has a resolution of 418 x 64 px and is saved as Gray8, this resolution of 418 x 64 px results in a total sum of 26752 pixels. According to the settings in the status bar, the resolution of the image is displayed in the bottom line of the VisualMARC3 window.

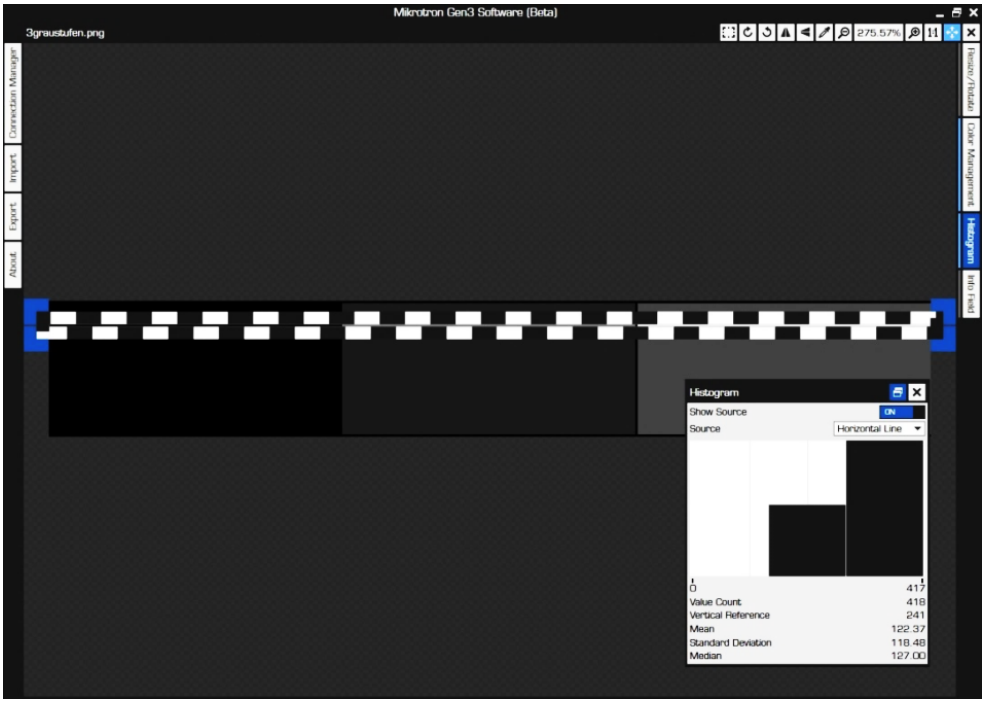
> The resolution can also be found in the vertical and horizontal view.





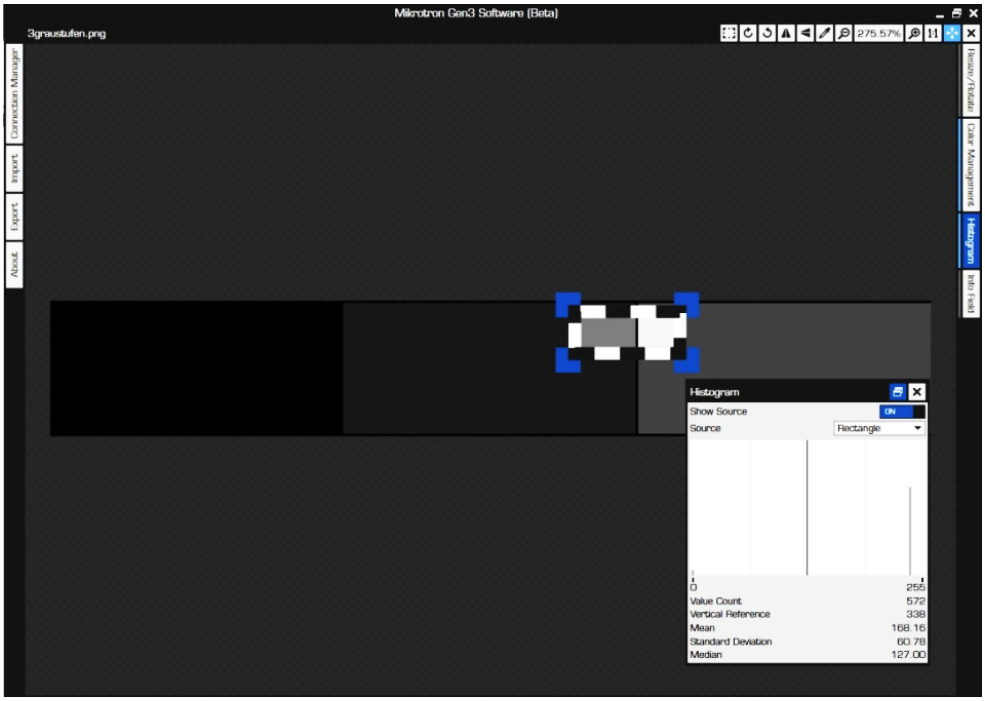
If [Show Source] is disabled, the values of the first vertical line (vertical reference 1), the first horizontal column is highlighted.

1. To check another line or column, disable *Show Source*.
2. In line view, move the line with the mouse to check each line separately.



Click at a color channel in the histogram to switch it off.

1. In rectangle view, resize the field to check each bit of an image.

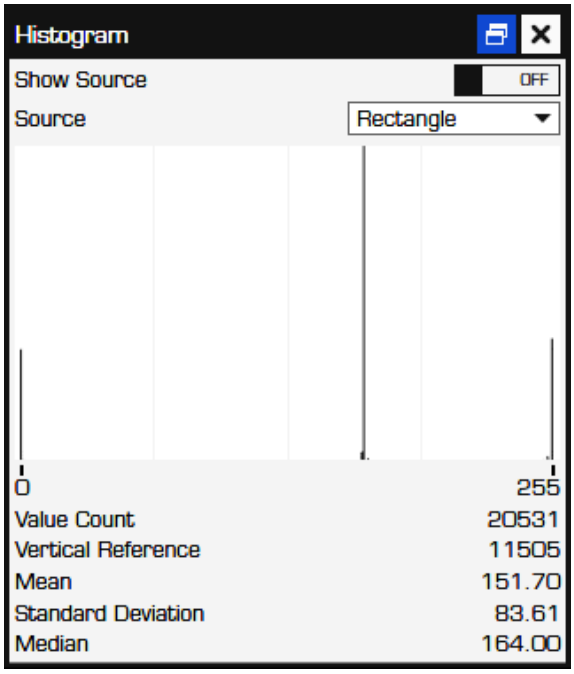


FREQUENCY OF PIXEL VALUES

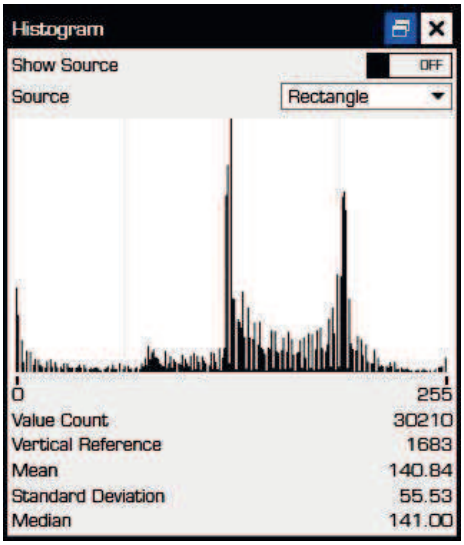
The frequency of the different pixel values is explained in the next image where the gray part in the middle is larger than the black or white part on the sides.

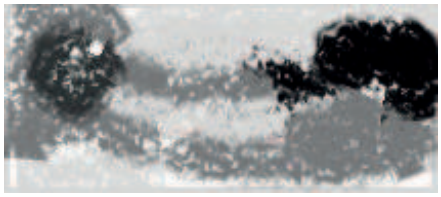
Fig. 5-24: Pixel value frequency

As the gray field in the middle of the image is larger than the other two fields, the frequency peak on the y-axis is higher for this field.



The next image contains much more gray values. They are represented within the histogram accordingly.

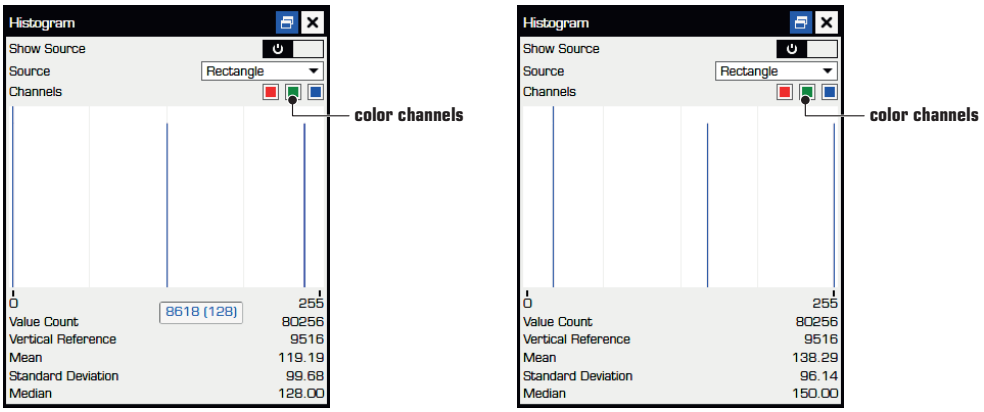




CONVERSION INTO OTHER FORMATS

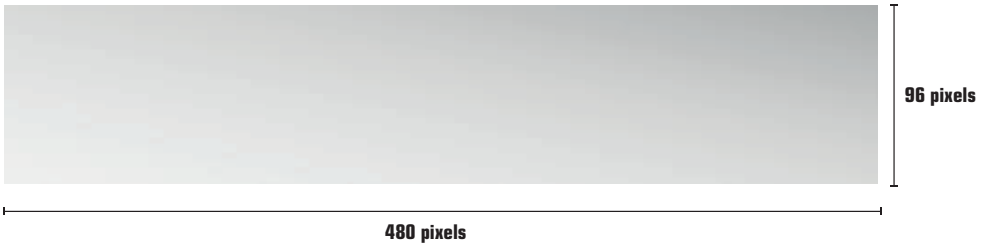
If the image used in the section "Gray8 and Gray16 images" on page 51 with a resolution of 418 x 64 is converted into or saved as BGR24 format, the three pixel values in the histogram remain the same but statistical values will change.

As the file is in BGR24 format, the three color channels red, green, and blue are visible in the histogram. The resolution of 418 x 64 results in 26,752 pixels but each pixel has an 8-bit value for each colourchannel. The value count therefore results in 26,752 x 3 = 80,256 values.



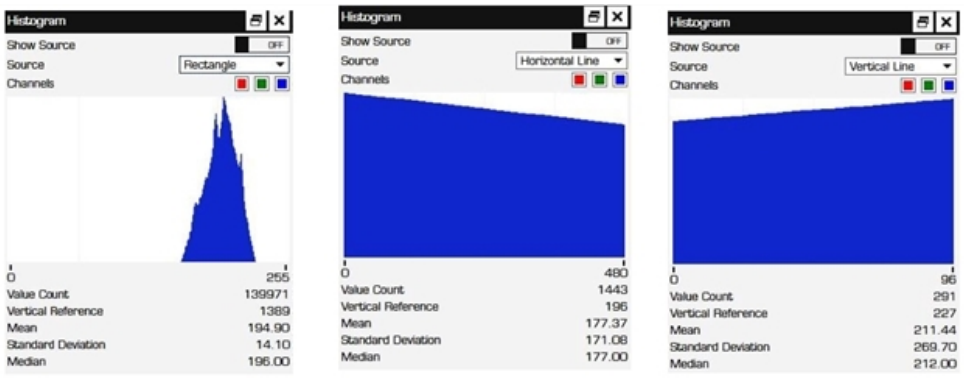
If the brightness of the BGR24 image is changed, the pixel values change (as shown in the histogram on the right). A change in contrast and gamma will also change the pixel values.

A gradient of gray shades results in a completely different histogram.



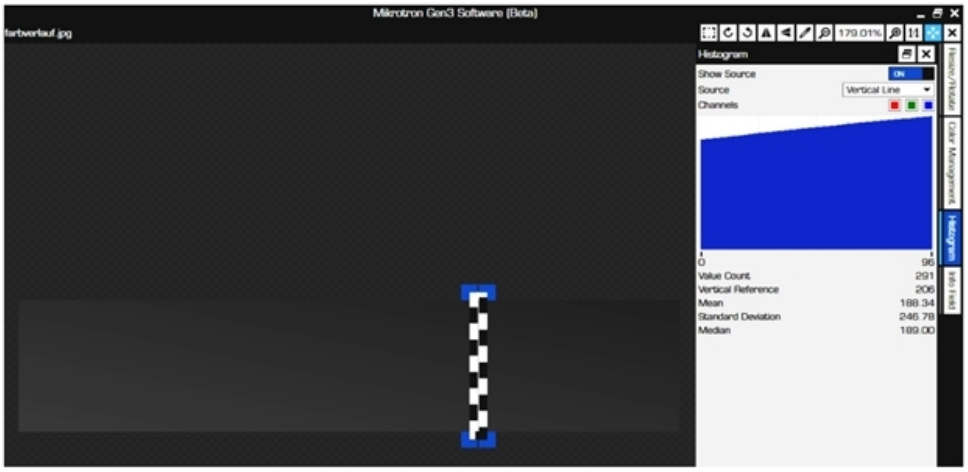
The first histogram below shows all pixel values from the brightest value to the darkest (158 to 227) on the x-axis and their distribution on the y-axis.

The highest peak of the y-axis shows that 1,389 pixels of the value 196 have been counted in the gradient of gray shades above.



The second histogram above shows the distribution on the first horizontal line. The width of the gradient is 480 pixels. Pixel 0 of the first line has the value 196.

The third histogram above shows the distribution on the first vertical column. The height of the gradient is 96 pixels. Pixel 96 has the value 227.



1. To check the distribution of pixels of any other than the first horizontal line, column or a rectangle of another size in the image, enable *Show Source*.
2. Move the line, column, or rectangle accordingly.

ADJUST COLORS IN HISTOGRAMS

What applies to histograms for gray images also applies to histograms for color images. However, the pixel values from 0 to 255 are displayed along the x-axis for each color channel (RGB). With the color picker you can read pixel values.

In the picture below, value R254, G111, B109 represents a sort of pinkish color. This pixel can be found on x = 1012 and y = 886.

Fig. 5-25: Adjusting colors in histograms

Using the histogram allows watching all changes offered by the color management functions.

Changes in brightness or saturation for example will be visible for each color channel.

The picture above shows all color channels red, green, and blue but they can also be watched separately. The next picture shows the red values only.

Fig. 5-26: Adjusting red values

5.5.6 Markers

There are several markers available to emphasize important aspects within a recorded frame and add a description. Additionally, a grid can be displayed.

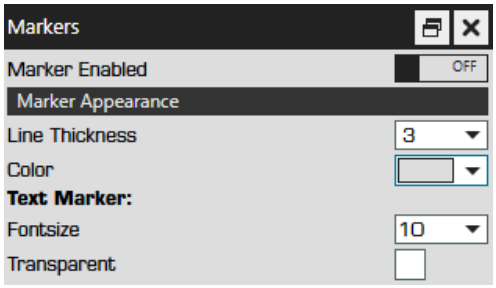
> When inserting text, select **Text** and insert a text box (frame) before writing.

MARKER TYPES

Line	Draws a straight line.
Arrow	Inserts an arrow. The end point is the arrow point.
Rectangle	Draws a rectangular shape.
Ellipse	Draws an elliptical shape.
Text	Inserts a text into a text box.

INSERTING A MARKER

> To use colored markers in monochrome frames, the frame must be converted into a color image, which will increase the file size.



1. Select **Markers** in the image processing and analysis tabs.
2. Enable Markers.
3. Select the marker type and draw the marker into the image.
4. If required, define the marker options:
   - color and line thickness for the marker border appearance
   - Font size for the marker text
   - Transparency for the marker area. When disabled, the background default color is white.

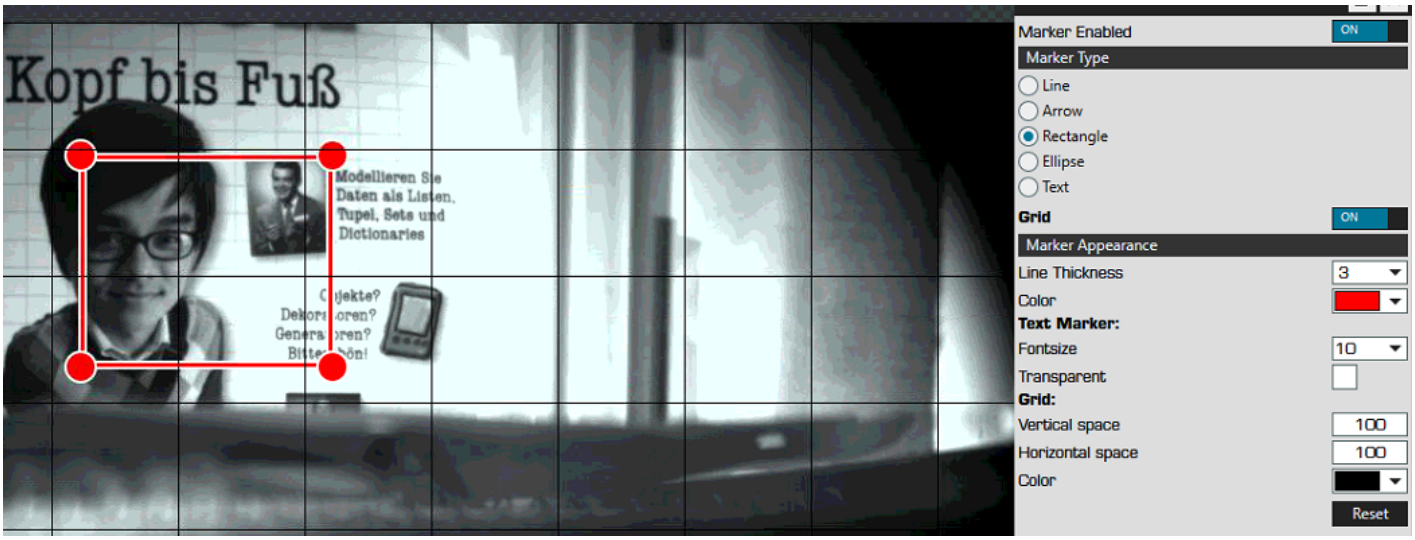
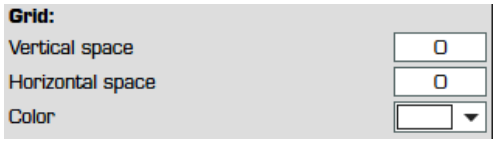


Fig. 5-27: Setting markers

DISPLAYING A GRID

Displaying a grid in the image can make the alignment of marker areas easier.



1. Enable **Grid** to display the grid overlay in the image.
2. Define the vertical and horizontal grid spacing as well as the color of the grid lines.

RESETTING, DESELECTING, AND DELETING MARKERS

- **Reset** returns all settings to the default values.
- Clicking at any point in the image deselects the marker.
- Selecting a marker and pressing [DELETE] deletes the selected marker.

5.5.7 Info field

Information fields can be added to the last line of an image during or after a recording.

The entries correspond to the Status bar entries (see "Status bar entries" on page 30). If the entry is enabled, it will be added to the info field.

1. Select the info field tab.
2. Enable **Include identifiers** to display the term followed by the value, e.g. “Date: 2020/12/12”. If disabled, only the value will be displayed, e.g.

"2020/12/12".

ADDING A SEQUENCE DESCRIPTION

After recording a sequence, a sequence description can be added.

> The information in the info field will not be part of the image information but is saved with each sequence.

The info fields are only available for imported *rec files. The availability of the info fields in imported *rec-files depends on the camera type.

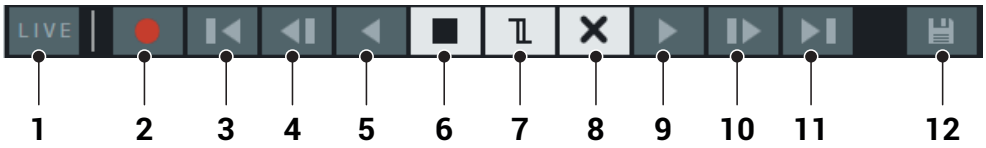
5.6 The Recording and Live View Control bar

5.6.1 Overview

The Recording and Live View Control bar is situated at the bottom of the image view (see "The workspace" on page 28). It provides the functions for starting, stopping a recording and toggling between recorded image sequences (playback mode) and current image sequences (live view) of the active window view.

> The content of the Recording and Live View Control bar is context-sensitive, i.e. it changes according to the functions invoked.

5.6.2 Icons of the Recording and Live View Control bar



No.	Meaning
1	Toggles to live view and starts live image streaming of the selected scene.
2	Starts a recording of the current scene. Optionally, recording can be started pressing **F5**. During recording the bar displays the stop button (6), the software trigger button (7, if configured), and the abort button (8).

No.	Meaning
3	Rewind to the start in playback mode (see "Playback" on page 61)
4	Browse backward frame by frame in playback mode (see "Playback" on page 61)
5	Play backward in playback mode (see "Playback" on page 61)
6	Stop recording. This will stop the recording immediately. In ring mode, no post trigger frames will be recorded. Optionally, recording can be stopped by pressing **F12**. After the recording is stopped, the playback and the export buttons are displayed (see (see "Playback" on page 61).
7	Software trigger. When enabled and invoked, the function selected for software trigger is executed. The function can also be triggered by pressing **F8** (see "Using the software trigger" on page 77).
8	Abort the recording. Optionally, the recording can be aborted by pressing **ESC**. *When aborting, the recording is deleted and no images are saved.* When invoked, it also stops "autosave" if the function is enabled.
9	Play recording in playback mode (see "Playback" on page 61)
10	Browse forward frame by frame in playback mode (see "Playback" on page 61)
11	Move to the end of the recording in playback mode (see "Playback" on page 61)
12	Save and export the recording (see "Exporting frames" on page 63).

5.6.3 Playback

Recorded frames in the camera or saved files can be watched by using the playback functions.

Fig. 5-28: Playback

> If you want to use keys for browsing, see "Assignment of keys" on page 36.

There are four playback options:

1 Browse backward frame by frame	**2** Play backward
3 Play forward	**4** Browse forward frame by frame

5 Displays the number of the current frame during playback or browsing.

- You can also jump directly to a frame by entering the frame index number in the frame index field and pressing [ENTER].

PLAYBACK SETTINGS

1. Open the Playback Settings [⚙].
2. To adjust the playback speed or jump directly to a frame, use one of the following options:
   - Move the slider in the Playback Settings to adjust the playback speed. The Playback Speed panel section of the Trigger Control panel defines

and displays the number of frames per second.

- To jump directly to a frame, click trigger or event (also refer to "Events" on page 65).

5.6.4 Exporting frames

After recording a sequence the recording and live control bar displays the option to export frames.

> Recording cannot be continued during export.

> The values for height and width of a frame (e.g. of a region of interest (ROI) or a resized frame) must be divisible by 2. Otherwise, AVI Movie will not be available.

The following export formats are available:

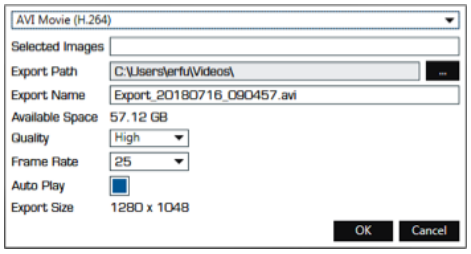
Format	Description
AVI Movie (H264)	Audio Video Interleave (AVI) is Microsoft's multimedia container format. It is compressed according to H.264 standard
AVI Movie (uncompressed)	Uncompressed Audio Video Interleave (AVI) container format
BMP	Uncompressed bitmap
JPEG	Compressed image format; select the quality of the JPEG file by moving the slider
PNG	Bitmap image format that employs loss-free data compression
TIF	Select between uncompressed (none) or LZW compression (loss-free, i.e. Lempel-Ziv-Welch-Algorithm)
REC	REC file format is Allied Vision Gilching GmbH proprietary RAW container format. All raw image data and record information are stored into one file. The REC file is our fastest export format. It is recommended to be used whenever a sequence needs to be read out fast.

Table: 5-4: Export formats

It is possible to export either all recorded frames or only a selection. To select certain frames, see "Selections" on page 64.

> During export, the progress can be monitored at the bottom of the workspace in a progress bar or in the Export tab (see "The Export tab" on page 33).

1. Click the icon to export frames to file. The Export window is displayed.



2. Select a file format.
3. Define your settings according to the output format. The displayed options depend on the selected output format.
   - **Selected Images**: See "Selections" on page 64
   - **Export Path**: the directory path in which the files should be stored. To create a subfolder,
   - **Create Subfolder**: when exporting an image series, select the option "Create Subfolder" to save each image of the series into a separate subfolder.
   - **Export Name**: after entering a name, the frame number will automatically be appended
   - **Available Space** shows how much space is available on the selected drive.
   - **Quality**: when exporting AVI movies or image series, the image quality can be defined by selecting (AVI) or moving the slider (image series).
   - **Frame rate**: when exporting AVI movies, the frame rate can be set. The player used for playback will use this frame rate.
   - **Auto Play**: when exporting AVI movies, automatic playback can be triggered.
4. Click **OK** to start the export.

> It is possible to export several files from two or more connected cameras or recordings (e.g. recorded sections) concurrently.

> If several files or recordings are exported, several progress bars are displayed.

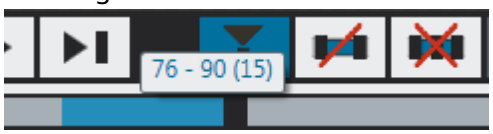
5.6.5 Selections

Exporting or playing back a selection of files will take less time than playing back all recorded frames.

To use keys for browsing, see "Assignment of keys" on page 36.

DEFINING AND EXPORTING SELECTIONS

1. Move the slider to the first frame to be selected.
2. Click [ ] or press [C].
3. Move the slider to the last frame to be selected or toggle the selection button.
4. Click [ ] or press [C].
5. Move the cursor into the blue field or toggle the selection button to check the range of selected frames.



Define a selection by entering frame numbers in the field “Selected Images”.

6. Click to export one or several selection(s). The export process is displayed at the bottom of the workspace.

Recording cannot be continued during export.

NAVIGATING AND DELETING SELECTIONS

- To play the selection forward or backward, select [ ] or [ ].
- To jump between the selections, select [ ] or [ ].
- To delete a single selection, click into the selection and select [ ].
- To delete all selections, select [ ].

5.6.6 Events

Labeling helps to remember important events in a sequence. Events are exported in *.REC format.

1. Make sure the camera is not recording.
2. Select **Events**.

3. Enter an event name into the text box to label the event.
4. Click at the position in the bar where the event has to be labeled.

5. Select + to add the event.
6. Move the cursor over the marker to read the label.

7. To exit, select **Events**.

NAVIGATING AND DELETING EVENTS

- To jump between events backward or forward, select « or ».
- To delete a single event, move the slider to the event and select ×.
- To delete all events, select 🗑.
- To reset the event settings, select **Reset**.

5.7 The device control panels

5.7.1 Overview

The panels in the device control panels are used for camera and recording settings for the camera connected.

- **Camera Info** shows the available data about the connected camera (see "The Camera Info panel" on page 67).
- **Camera Settings** displays the frame sizes and changes frame rate, exposure time or switch low light mode and / or maximal exposure time ON or OFF. In addition, you can define regions of interest (see "The Camera Settings panel" on page 67).
- **Record Settings** displays the sequence size and time per sequence; changes record mode and options, enables or disables Autosave (see "The Record Settings panel" on page 70).
- **ImageBLITZ** configures the trigger settings within a defined region of interest (see "The ImageBLITZ panel" on page 72).
- **Trigger Control** enables or disables the external trigger, frame start, and the trigger button; if enabled, the polarity of both signals can be defined; synchronizing several cameras. Furthermore, two digital output can be set (see "The Trigger Control panel" on page 75).
- **Advance Settings** reads the camera temperature; set black level, digital gain and analog gain (see "The Advanced Settings panel" on page 78).

- **Expert Settings** contains the special settings like Play / Playback or Download throttling; this panel will only be available if “Expert Settings” are enabled in “Settings” of the Global Function Bar (see "The Expert Settings panel" on page 81).

5.7.2 The Camera Info panel

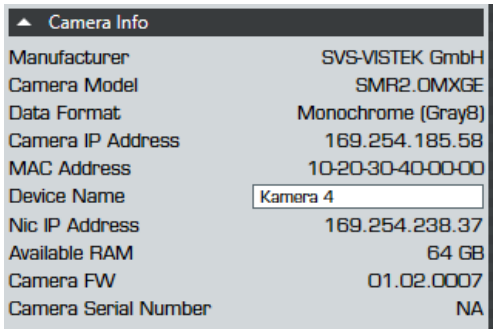


Fig. 5-29: Camera Info panel

The Camera Info panel displays information about the connected camera and allows to name the camera.

- **Manufacturer** displays the camera manufacturer's name.
- **Camera Model** displays the device name.
- **Data Format** displays the colour setting and the Bayer filter of the sensor.
- **Camera IP Address** contains a 32 bit binary number (IPv4), which is used to allocate the interface when communicating via the Internet protocol; this is a dynamic address.
- **MAC Address** shows the unique identifier of the device in the network.
- **Device Name** displays the given name. It can be changed by entering a name and pressing [ENTER].
- **NIC IP Address** contains the unique address of the Network Interface Card (NIC) the camera is connected with.
- **Available RAM** displays the space of the camera’s memory
- **Camera FW** shows the current firmware of the device.
- **Camera Serial Number** displays the serial number of the device.

5.7.3 The Camera Settings panel

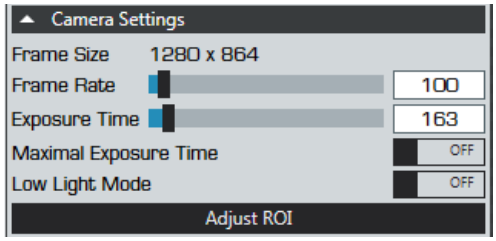


Fig. 5-30: Camera Settings panel

If a camera is connected the settings of the current camera are displayed:

- Frame size: Displays the current frame size.
- Frame rate: Displays the current frame rate (see "Defining the camera settings" on page 68).
- Exposure time: Displays the current exposure time (see "Defining the camera settings" on page 68).
- Maximal Exposure Time: Displays if the maximal exposure time is enabled (see "Defining the camera settings" on page 68).
- Low Light Mode: Displays if the low light mode is enabled. The low light mode improves image quality in poor lighting conditions (see "Defining the camera settings" on page 68).

DEFINING THE CAMERA SETTINGS

For a given frame size, the frame rate, exposure time, maximum exposure time, and the low light mode can be configured.

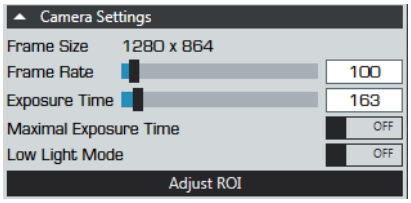


Fig. 5-31: The Camera Settings panel

- The frame rate defines the frequency at which the camera will record frames. It is measured in frames per second (fps). When changing the frame rate the exposure time is automatically adjusted.

> The available frame rate depends on the camera connected and the size of the defined region of interest (ROI, see "Adjusting the ROI" on page 69).

- Exposure time is the period of time the shutter of the camera is open to record a frame. It depends on the frame rate and is set in microseconds (µs). The maximum exposure time is 999999 µs (approx. 1 second).

> The lower the frame rate, the longer the possible exposure time.

- Enabling the **Maximal Exposure Time** always keeps the exposure time at the maximum value for the adjusted frame rate.
- Enabling the **Low Light Mode** sets the frame rate to 10 fps and thereby enables long exposure times. This is suited for setting up a scene in poor lighting conditions. The previous settings are restored as soon as a recording is started.

> Low light mode will automatically be switched off as soon as the camera is armed (recording).

- **Adjust ROI** configures the settings for the region of interest (see "Adjusting the ROI" on page 69).

ADJUSTING THE ROI

If only a part of the frame is supposed to be inspected a certain area within a frame can be defined by setting a ROI (Region Of Interest). The smaller the height of the ROI, the higher the maximum frame rate.

> Before changing the ROI, save all frames to a file. Otherwise all recorded frames will be lost.

1. Select **Adjust ROI**.

The work area displays the following split views:

- Device View displays the raw image of the ROI.
- Output View displays the image with all enabled image processing functions.

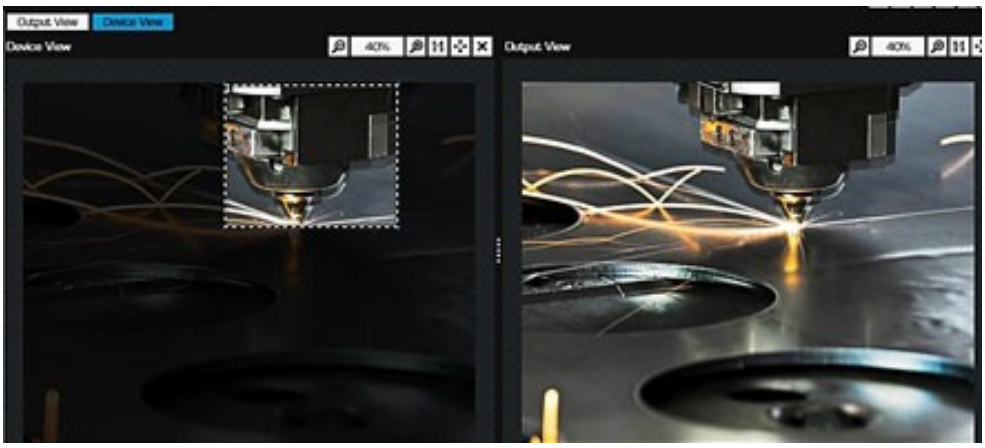
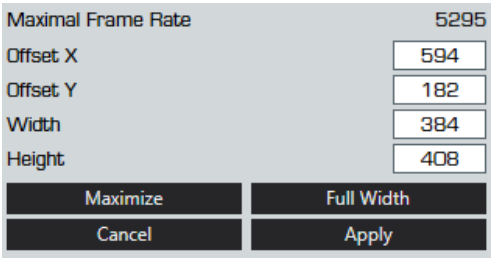


Fig. 5-32: ROI split view

> When changing the size of the ROI with the mouse, the values in the panel are adjusted accordingly.



2. Either move and resize the ROI area in the image with the mouse or change the values in the panel.
   - Offset X starts in the first column and must have a value divisible by 16.
   - Offset Y starts in the first line and must have a value be divisible by 2.

- Width defines the width of the ROI (in px) and must have a value divisible by 16.
- Height defines the height of the ROI (in px) and must have a value divisible by 2.

  > Changing the height of the ROI automatically has an effect on the maximal frame rate.

3. For further settings such as maximizing and full width, select the respective buttons.

Maximize	The complete sensor area is covered, the ROI is maximized.
Full Width	Extends the width of the ROI area to the full sensor width.
Cancel	Deletes the changes and closes the ROI split view.
Apply	Applies the settings and closes the ROI split view.

5.7.4 The Record Settings panel

In the Record Settings panel the number of frames that can be recorded in one sequence and the time needed to record these frames are displayed in the first two lines.

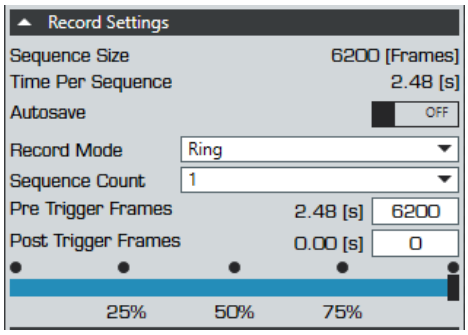


Fig. 5-33: Record Settings panel

SINGLE MODE

In Single mode the camera stops recording when the internal frame buffer is full. Setting record mode to *Single* stops recording as soon as one of the following conditions is met:

- The end of the frame buffer is reached.
- **Stop** in the Recording and Live View Control bar is clicked or the key **F12** is pressed.
- A trigger event occurs, provided it is set in the Trigger Control panel (see "The Trigger Control panel" on page 75).

AUTOSAVE IN SINGLE MODE

The feature Autosave in single mode provides continuous recording and saving. In single mode no settings are available and the complete recorded frame buffer will always be saved. After saving, a new recording starts immediately.

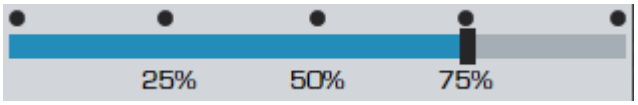
1. To stop Autosave in single mode, press the button **Abort** or the **ESC** key.

> Autosave in single mode also stops if the selected storage space is full.

RING MODE

In ring mode, the camera records continuously. When the internal buffer is full, the oldest frames will be overwritten by the most recent ones until recording is stopped. Additionally, the number of pre-trigger frames to be recorded before the trigger event occurs can be defined or the number of post-trigger frames.

1. Configure the pre- and post-trigger frames using one of the following options:
   - Click on the dots to change the value in 25% increments.



   - Define the pre- and post-trigger frames by moving the slider.
   - Enter a value and press [Return]. The number of pre-trigger frames and post trigger frames is automatically adjusted if one of them is changed.

When recording is stopped, the number of frames in the *Pre-Trigger Frames* is kept and the rest of the frame buffer is filled with frames until the buffer has reached its maximum capacity.

AUTOSAVE IN RING MODE

The feature Autosave in ring mode provides a continuous recording and saving with identical settings. After saving, a new recording starts immediately.

1. To Autosave in ring mode, press the button **Abort** or the **ESC** key.

> Autosave in ring mode will also stop if the selected storage space is full.

Fig. 5-34: Autosave in ring mode

2. Enable **Autosave** for additional settings. The panel is expanded and the settings are displayed.
3. Move the black slider to set the number of pre- and post-trigger frames.
   - Click in the center of the black slider and move to keep the total number of frames constant but vary the pre- and post-trigger frames.
   - Move a handle at the right or left of the black slider to set the number of pre- and post trigger frames separately.

- **Number of frames** defines the number of frames that will be saved.
- **Pre Frames** defines the number of frames that are saved before the trigger event. The number must be at least one frame.
- **Post Frames** defines the number of frames that are saved after the trigger event. The number can be 0 or larger.

> The export settings for export format, export quality, etc. are identical to the exporting of frames (see "Exporting frames" on page 63).

5.7.5 The ImageBLITZ panel

ImageBLITZ is only available as a payed add-on and is not included in the standard camera features.

> This feature is only enabled when ring mode is active (see "Ring mode" on page 71).

The ImageBLITZ feature triggers a recording when within a defined region of interest (ROI) an increase or decrease of gray values or of a certain percentage of pixels occurs.

The deviation is relative to a reference image that is defined.

The ImageBLITZ trigger area works like a software sensor: when ImageBLITZ is activated, a reference image of the current scene is stored. The subsequent changes can be compared with this reference image.

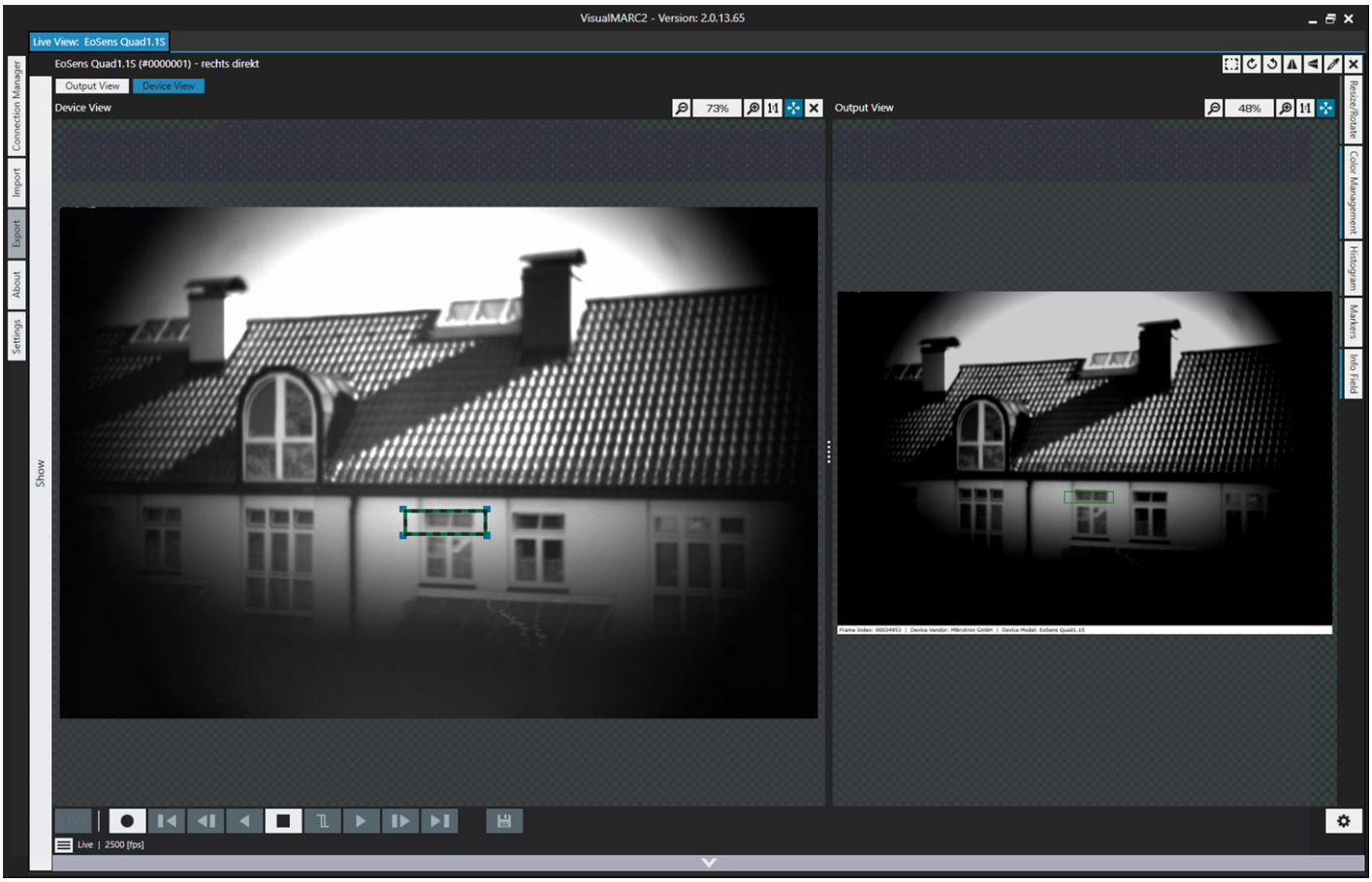


Fig. 5-35: ImageBLITZ split view

- The Device View displays the image as it is seen by the camera. ImageBLITZ is triggered by changes in the device view, e.g. moving objects changes on brightness.
- The Output View displays the image after it has been processed according to the trigger settings.

TRIGGER STATUS

The ROI area is displayed with a border that changes the color in the device view according to its status:

- Not triggered: The ROI area is marked as a rectangle with a green border.
- Triggered: The ROI area is marked as a rectangle with a red border.

NAVIGATING THE SPLIT VIEW

When split view is displayed, one or both views can be brought to the front.

- Clicking on the Output View tab maximizes the output view.
- Clicking on Device View restores the split view (both views are displayed).
- Clicking on the bar between both views restores the size proportions.

- Clicking [170%] reduces or increases the view, or resets it to the original values, respectively. For a specific size, enter the value and press [RETURN].
- Select [✥] to move the image (panning) with the mouse button pressed.
- Clicking [✕] displays only the device view.

SETTING THE TRIGGER VALUES

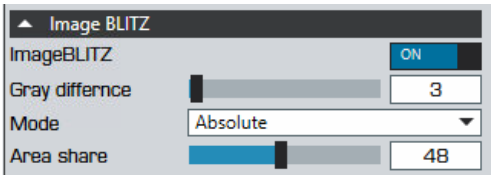


Fig. 5-36: ImageBLITZ panel

1. Enable **ImageBLITZ**.
2. Configure the ImageBLITZ options.
   - Define the **Gray difference** threshold to the reference image (gray values between 0 ... 255). A gray value with a difference of 255 will never trigger a recording, whereas a gray value of 1 will always trigger a recording.
   - Define the **Mode** for the trigger threshold. The threshold can be reached below the defined gray value (i.e. only when the ROI gets darker by the defined value), above the defined threshold (i.e. when the ROI gets lighter by the defined value), or both (absolute).
   - Define the percentage of the **Area share** (ROI) that must be affected by the color change before the trigger is invoked. The higher the percentage, the more pixels in the ROI must be affected before the threshold is reached.
3. To manually create a new reference image, select **Update ImageBLITZ**. This is required when the lighting situation or the camera position has changed.

> The reference images are recreated automatically when moving the ROI or changing its size, or activating ImageBLITZ.

DEFINING THE ROI FOR IMAGEBLITZ

1. Move the rectangle to the part of the frame that is used to trigger the ImageBLITZ.
2. Adjust the size of the rectangle by moving the horizontal and vertical borders. The size of the ROI is limited to 10,000 pixels. The width of the area takes precedence over its height.

> To make use of the available pixels, the ROI should not be too narrow.

5.7.6 The Trigger Control panel

> All connected digital or analog I/Os can be displayed in the Info Field at the bottom of the frame and in the status bar at the bottom of the workspace (see "Info field" on page 59).

Trigger Control panel configures the input and output ports of the camera to start and stop recording by invoking the software trigger and / or an external trigger. It is also used to synchronize multiple cameras.

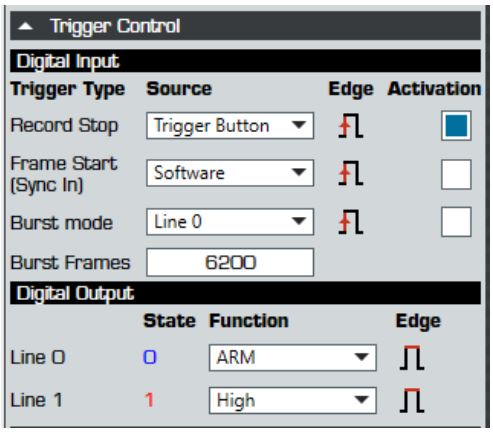


Fig. 5-37: The Trigger control panel

DIGITAL INPUT

The section Digital Input of the Trigger Control panel defines the settings for the input connections of the camera or the software trigger.

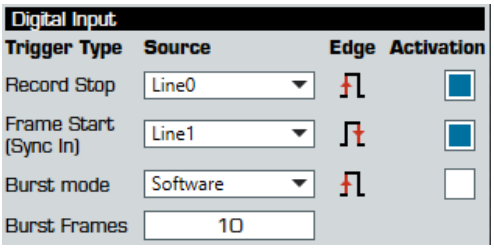


Fig. 5-38: The section Digital Input of the Trigger Control panel

> To connect the external trigger with the adequate input of the I/O connector of the camera, see the manual of the corresponding camera.

- **Record Stop** stops recording at a trigger signal, e.g. when ImageBLITZ is triggered (see "The ImageBLITZ panel" on page 72).
- **Frame Start (Sync In)** starts the recording of one frame.
- In **Burst Mode** a preset number of frames will be recorded for each trigger edge. Apart from the lines invoking a trigger signal, burst mode can also be triggered by the hardware button (trigger button) and the software trigger in the recording control bar (see "The Recording and Live View Control bar" on page 60).

> Burst mode can only be enabled in Single mode, not in Ring mode.

- **Burst Frames** sets the number of frames that are triggered in burst mode, i.e. when triggered, the number of frames entered will be recorded.
- **Edge** defines the signal slope that triggers the event, i.e. a rising slope will trigger when the signal is increasing, a falling slope will trigger when the signal is decreasing.

> When Frame Start (Sync In) or Burst Mode is activated, it will be displayed in the panel header. In Live mode, the image is only displayed when the trigger is invoked (irrespective of the trigger source).

- For each event, one frame will be recorded (except for **Burst Mode**).
- ImageBLITZ can only be activated as a recording stop since it needs a reference image for comparison. The recording will only be stopped for ImageBLITZ after the last burst frame.
- When ring mode is enabled, the defined number of post-trigger frames is recorded (see "The Record Settings panel" on page 70). When single mode is enabled, any trigger will stop the recording.

> When the camera is connected, the software displays the live image. However, if **Burst Mode** or **Frame Start** is enabled, no live image is displayed. To display the live image, disable **Burst Mode** and **Frame Start**. They can be re-enabled after the acquisition has started.

EXAMPLE

If line 1 is connected with a trigger that is used to stop recording as soon as the trigger signal increases, perform the following settings:

- For **Record Stop**, the trigger source and edge must be selected and enabled.
- For **Frame Start**, the trigger source and edge must be selected and enabled.
- For **Burst Mode**, the trigger source and edge must be selected and enabled.

  > Simultaneously enabling the trigger in burst mode and as a trigger for starting the recording will result in a trigger conflict for the camera.

- The number of **Burst Frames** that are recorded in ring mode every time the trigger is invoked can be set (for pre- and post-trigger frames, see "The Record Settings panel" on page 70).

DIGITAL OUTPUT

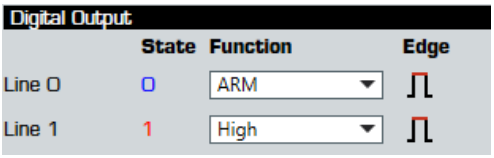


Fig. 5-39: The Digital Output section of the Trigger Control panel

The camera provides multiple digital outputs (refer to the reference guide of the camera for more information). There are four settings available for each digital output:

- Sync-out: The output will carry a strobe corresponding to the exposure time of the camera (exposure active).
- ARM: The output signals that the camera is recording.

  > ARM only works in ring mode.

- Low: The output delivers a low signal (GND).
- High: The output delivers a high signal (5 V).

USING THE SOFTWARE TRIGGER

The functions of the software trigger are defined as trigger source in the Digital input section of the Trigger Control panel and can be used in the Recording and Live View Control bar when enabled.

Depending on the trigger source defined, the software trigger button in the Recording and Live View Control bar can have the following function:

Single mode

- Record Stop: Stops the recording in recording mode, but has no function in live view mode.
- Frame Start: Captures a frame in live view mode and records a frame in recording mode.
- Burst Mode: Captures frames in live view mode and records the defined number of frames in recording mode.

Ring mode

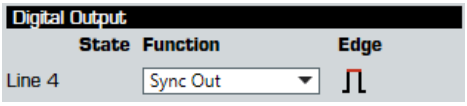
- Record Stop: Sets a trigger and starts recording the post trigger frames, but has no function in live view mode.
- Frame Start: Captures a frame in live view mode and records a frame in recording mode.
- Burst Mode: has no function in burst mode.

SYNCHRONIZING CAMERAS

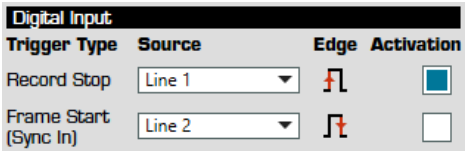
To synchronize several cameras either an external clock generator or one camera is defined as master and the others as slaves. In the latter case, the master camera synchronizes the slave cameras and has therefore to be set to Sync Out. All slave cameras have to be set to Sync In.

> If the frame rate of the slave camera is not at least 2 fps higher than the master camera's frame rate the slave camera will not work with the same frame rate as the master camera. As a result frames will be lost.

1. Connect a digital output of your master camera or clock generator with a digital input of the slave camera (refer to your camera manual for information on the I/O connector).
2. Set the connected digital output of the master camera to Sync Out.



3. Set the connected digital input to Frame Start and activate the line.



4. Select a frame rate for the master camera
5. Select a frame rate for the slave cameras that is at least 2 fps higher than that of the master camera.

USING MASTER AND SLAVE CAMERAS (EXAMPLE)

Slave cameras have to respond more quickly than the master camera. To set 1000 fps, set the master camera to 1000 fps and select 1004 fps for each slave camera.

5.7.7 The Advanced Settings panel

In the Advanced Settings window, digital gain or black level as well as the analog gain is defined and the camera temperature can be displayed.

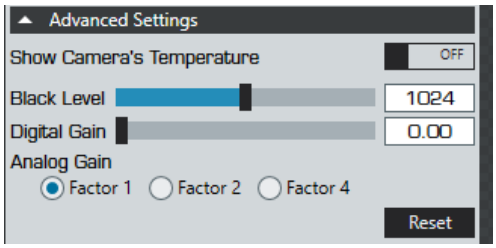


Fig. 5-40: Advanced Settings panel

In the Advanced Settings panel, the following options can be configured:

- **Show Camera's Temperature**: when enabled, shows if the camera temperature is OK (green) or not OK (red). Hovering over the temperature icon with the mouse displays the exact temperature.
- **Black Level** (see "Black level" on page 79)
- **Digital Gain** (see "Digital gain" on page 80)
- **Analog Gain** (see "Analog gain" on page 80)

> Refer to the technical data in the camera user manual for more information on the allowed body temperature of the camera.

BLACK LEVEL

Black level defines the brightness in the darkest part of the image. Possible black level settings are values between 0 and 2047.

If the setting is correct, the sensor will deliver the pixel value “0” for a completely black image. If it is too high, the sensor will deliver a pixel value greater than 0 for black, i.e. a gray tone. If the value is too small, the sensor will deliver a pixel value of “0” for gray.

1. In live mode, close the lens of the camera to get a completely black image.
2. Select the tab **Histogram** in the tab Image Processing and analysis.

EXAMPLE

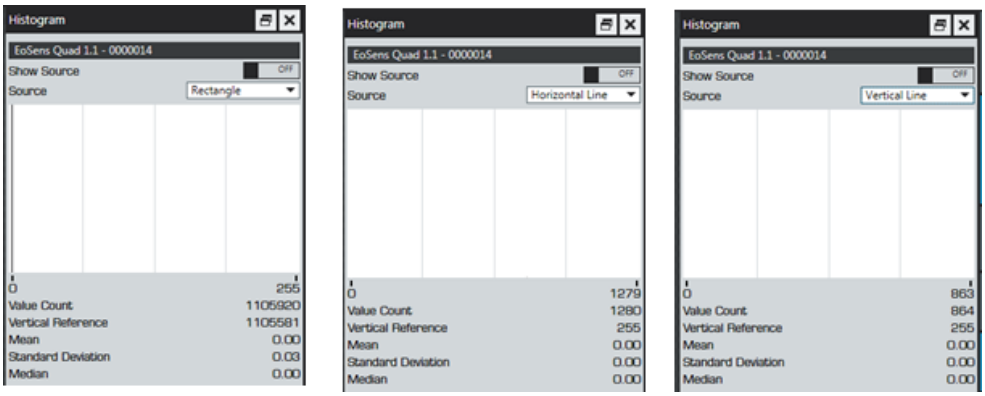


Fig. 5-41: Black level settings (example)

- In rectangular view 2,073,600 pixels are counted: 2,073,600 pixels on the y-axis have the value 0, i.e. the image is black.
- In horizontal and vertical view the resolution of 1920 x 1080 pixels has been measured and the highest value of the y-axis amounts to 255, i.e. black.

DIGITAL GAIN

> Digital gain is only available when the Expert settings are activated (see "The Expert Settings panel" on page 81).

Increasing the digital gain is an alternative to improving the brightness of the image in the following situations:

- The image is too dark and strobe light cannot be used.
- Increasing the exposure time is not possible because the object is moving.
- The object is light-sensitive.

> Before using digital gain, set the exposure time at its maximum with the frame rate needed.

When increasing digital gain, all pixel values of the image will be increased and therefore the complete image becomes brighter.

Digital gain is set in decimal steps from 0.00 to 4.00.

> Increasing gain will increase noise, too. As a result, the quality of the image becomes poorer. Therefore increasing gain is only an alternative if you cannot improve lighting or increasing exposure time.

ANALOG GAIN

In digital imaging, the sensor outputs a voltage proportional to the amount of incident light. If lighting is not sufficient, and the exposure time cannot be increased, all pixel values of the image can be increased by analog gain (voltage gain).

Analog amplification of the read-out pixel values increases overall image brightness.

> Using analog gain usually brings better results than using digital gain.

The analog gain can be defined in three steps:

- Gain factor 1
- Gain factor 2
- Gain factor 4

Setting	Exposure	Signal-to-noise ratio (SNR)
Factor 1	100 ISO	0 dB
Factor 2	200 ISO	6 dB
Factor 4	400 ISO	12 dB

Table: 5-5: Analog gain factors

5.7.8 The Expert Settings panel

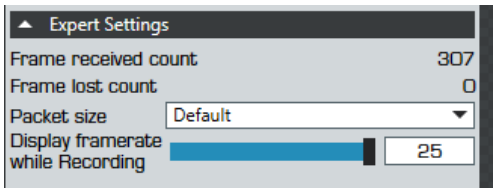


Fig. 5-42: Expert Settings panel

The following information is displayed:

- The **Frame received count** shows the number of received frames
- The **Frame lost count** shows the number of lost frames
- **Packet Size** sets the packet size during download to default, 4088 Bytes, or 9014 Bytes.
- **Display frame rate while Recording** shows the selected frame rate during recording.

Technical data

> For technical data sheets visit Documents and downloads - Technical documentation.

Search for a specific camera, using series and model name or by using the Allied Vision camera selector. The details and download section provides you with manuals, drawings, and certificates.

Allied Vision Gilching GmbH
Ferdinand-Porsche-Str. 3
82205 Gilching
Phone: +49 8105 3987-60
www.alliedvision.com
info@alliedvision.com