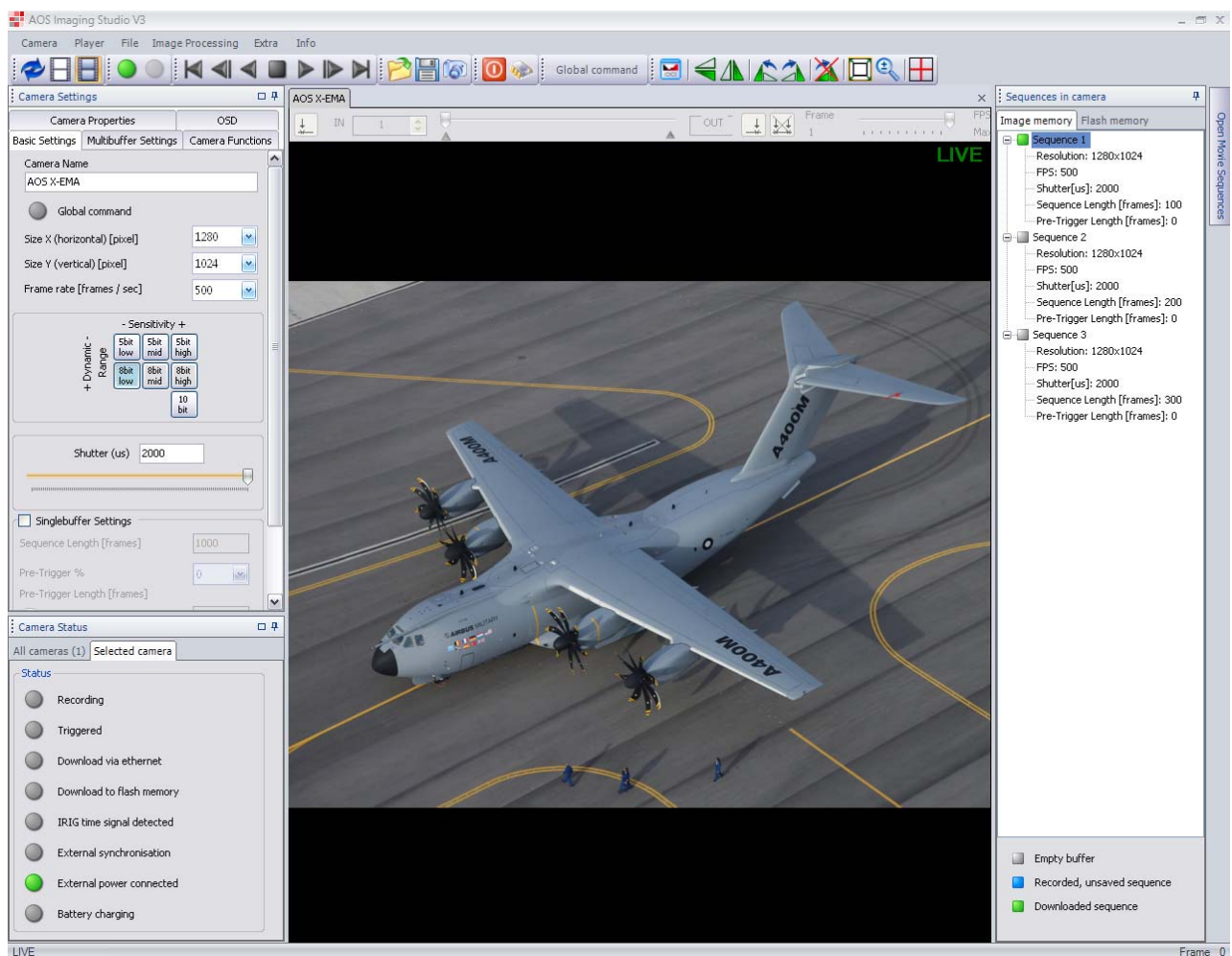# Manual
AOS Imaging Studio v3

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Manual AOS Imaging Studio v3 Version 1.3.0

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Please also refer to your AOS Technologies representative in your area.

List of manual revisions

Rev	Date	Release notes
1.0.0	26.8.2009	Initial document
1.1.0	9.11.2009	First release
1.1.1	26.3.2010	New features of v3.2.4 added
1.2.0	11.8.2010	Manual tracking, measurements and motion detection of v3.3.0 added
1.3.0	9.12.2011	New features of v3.5.2 added

Congratulations! With purchase of an AOS Technologies AG high speed camera system you have acquired a versatile, reliable product allowing you to record high speed sequences in a very convenient way. The advanced and self contained digital camera system provides a maximum in user friendliness and assists you in getting the results while others try.

1 Installation of Imaging Studio

With your camera, a CD containing all necessary information about the camera (hardware manual, quick start guide, etc.) is supplied. On this CD you also find the installer file for Imaging Studio.

📁 Aladdin Dongle Driver Setup
📁 DotNetFX
📁 vcredist_x86
🔧 AOS Imaging Studio setup.exe
📄 AOS Quick Start Guide AISv3.pdf
📄 Camera manual X&S v2.12.pdf
📄 Manual AOS Imaging Studio v3 v1.1.1.pdf
🔧 v3.3.0.msi
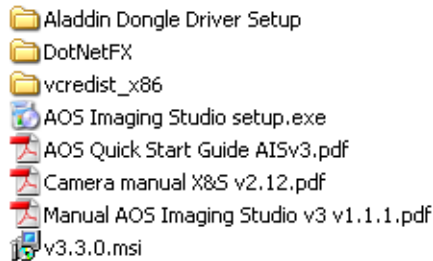
⚠️ Make sure that you have administrator rights on the PC you install Imaging Studio.

Make sure that all previous versions of Imaging Studio are removed from your PC. If you have another version on your PC use the "Add/remove program" feature of Windows to remove this version.

Make sure that all cameras are disconnected from your PC when installing Imaging Studio.

To install Imaging Studio double click "AOS Imaging Studio setup.exe" and follow the instructions on the screen. Once the software is installed you may start working with your camera(s).

1.1 Working with Gigabit Ethernet cameras

Make sure you have the rights to set an IP-address for the PC you are connecting the camera to. In case of doubt contact your IT-department.

ℹ️ When you connect a Gigabit Ethernet camera to your PC follow the guidelines in the "Quick start guide". This document is supplied with your camera(s). It can be found on the CD as well.

1.2 Start up the application

Switch the camera on (push button on the back of the camera) and wait for the LED start up sequence to finish. Start Imaging Studio and wait until the cameras are automatically recognized.

In case your cameras are not automatically recognized by Imaging Studio click on the refresh button to recognize the cameras.

ℹ️ For a proper start up sequence of your camera please refer to the camera manual which can be found on the CD.

2 General description of AOS Imaging Studio
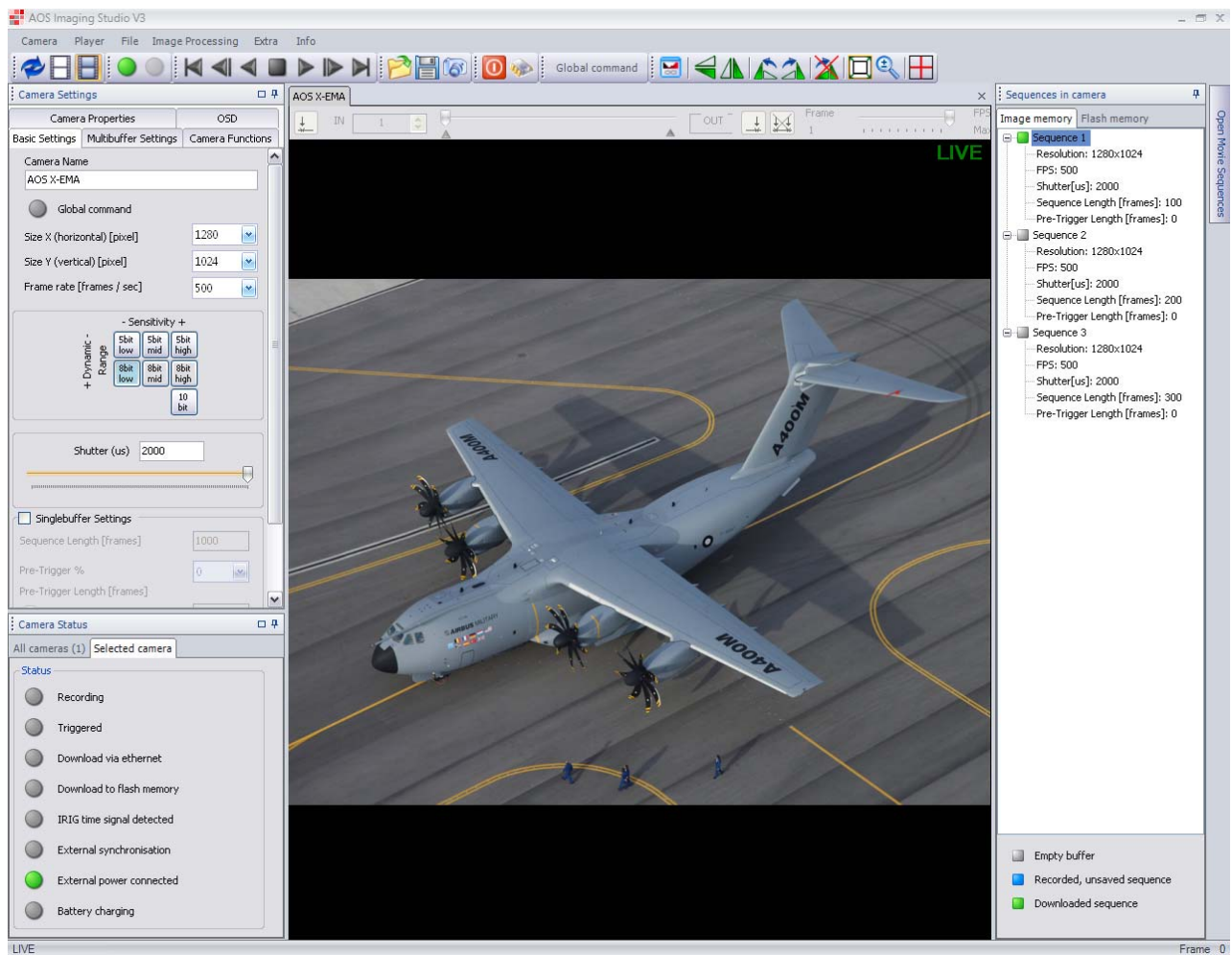
The user interface allows control of the connected camera(s), processing of sequences and exporting data for extended analysis. Imaging Studio allows parameterizing the camera for recording, to play back and store sequences after the recording and to adjust image and sequence information.

To start the software double click on your icon on the desktop or use the standard Windows command to start the program.

> The user interface allows performing all necessary operation to acquire sequences in high quality with the camera. There are numerous other image processing and/or motion analysis packages for extended analysis.

3 Preparing the camera to record a sequence

After starting Imaging Studio the camera is initialized with the parameters stored permanently in the camera. How to permanently store parameters in the camera see chapter 3.4.1.2.

If no change of the parameters is required you may directly arm the camera and record a sequence.

3.1 Set Parameters of the Camera

Enter the "Camera Settings" window by clicking on the button on the left hand side of the application. Here you can adjust all necessary parameters for the recording.
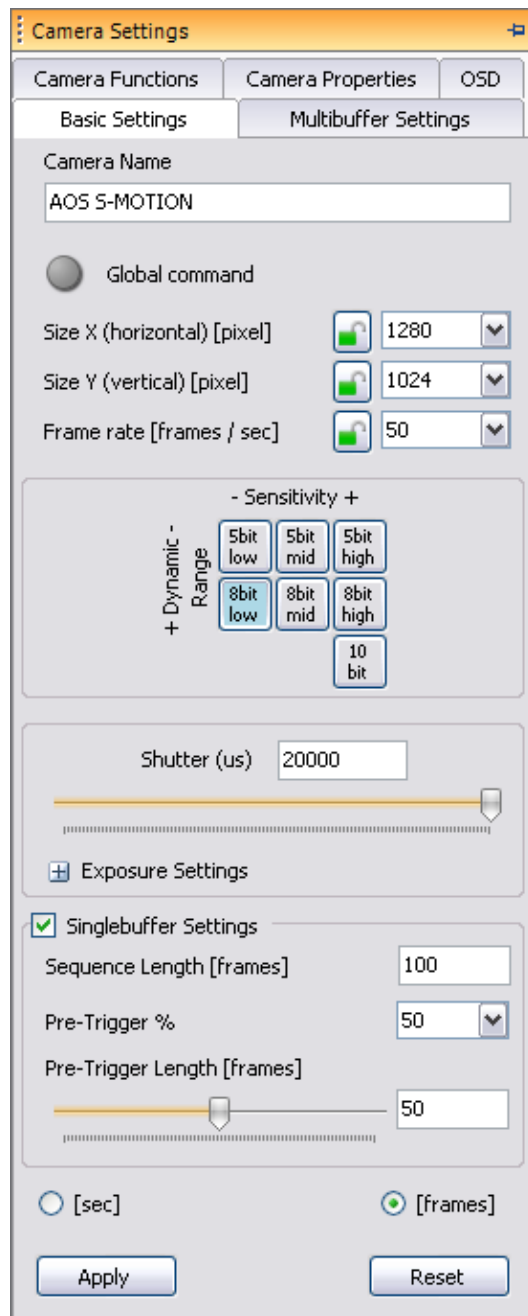
3.1.1 Basic Settings tab

If „Global command" is activated, „All cameras" is displayed in the „Camera Name" field.
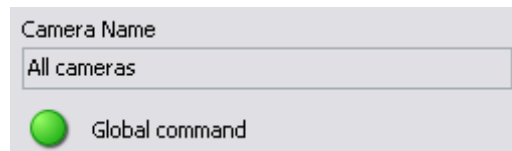
The parameters in the "Basic Settings" tab are the following

Parameter	Values
Camera Name	Changeable text, max. 40 char
Size X (horizontal)	Select number of pixel/line in X direction from drop down list or type in the desired number of pixel/line
Size Y (vertical)	Select number of lines in Y direction from drop down list or type in the desired number of lines
Frame rate	Frames per second, adjustable in steps of 1
Sensitivity / Dynamic Range	Choose which bits of each pixel of the sensor should be read out. 5bit low/mid/high, 8bit low/mid/high or full 10bit
Shutter	Move the slider or enter a number to choose the shutter time. Adjustable in steps of 1usec from 1 usec to 1/framing speed For auto shutter see 3.1.2.5
Singlebuffer - Sequence Length	Adjustable in steps of 0.01 seconds or 1 frame (choose [s] or [frames] below)
Singlebuffer - Pre-Trigger %	Select number from drop down list or type in the desired percentage value. Adjustable in steps of 1%
Singlebuffer - Pre-Trigger Length	Adjustable in steps of 0.01 seconds or 1 frame (choose [s] or [frames] below)

After having changed the parameters according your needs press the "Apply" button to transfer the settings to the camera and display a Live image with the new settings.

Transferring new parameters to the camera will erase the camera memory!

Alternatively you can also click one of the camera command buttons on the main toolbar. In this case a warning message is displayed to confirm erasing the memory.
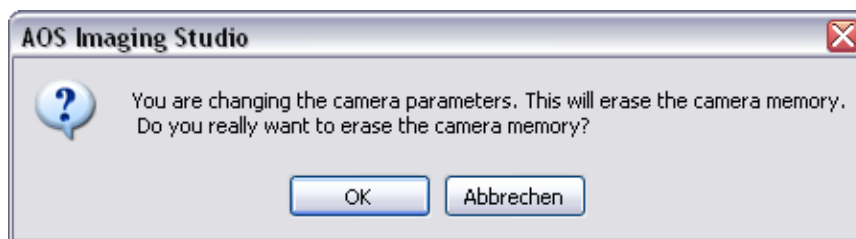
If you do not want to change the parameters and go back to the previous settings press the "Reset" button in the "Basic Settings" tab.

3.1.2 Camera parameters explained

3.1.2.1 Camera name
Each camera may be named differently by the user.

3.1.2.2 Resolution and frame rate

The "Basic Settings" dialog allows individual setting of valid configurations in regards of resolution vs. framing speed. A longer recording time can be obtained when using a lower resolution and setting the framing speed to a lower value than the max. value for this resolution. Alternatively, reduce the horizontal resolution to achieve longer recording time.

- Select the horizontal resolution using the "Size X" drop down menu and the vertical resolution using the "Size Y" drop down menu or type in the desired number of pixels.

- Select the framing rate using the FPS drop down menu or type in the desired frame rate.

- If one of the values should remain unchanged, regardless what you choose for the other parameters, press the lock button next to the value. This value will then be locked. (only available for S-series cameras)

Only valid settings are accepted. Fields with invalid settings are marked in red. Change the values in red fields to valid settings. If red fields are ignored and the "Apply" button is pressed, invalid settings are automatically corrected by the software.

3.1.2.3 Dynamic range and gain mode setting

Your camera offers a unique feature allowing to record with full 10 Bit dynamic range, or selecting either the 8 Bit or 5 bit mode.
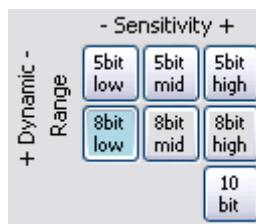
Taking sequences in 8 Bit mode results in 24Bit color images. This is the standard dynamic range most monitors offer. The 5 Bit mode is useful to extend the recording time, 10 Bit offers an even better dynamic range than 8 Bit but the files are 20% bigger.

These bit mode settings are not available for the TRI-VIT and Q-series cameras. The Q-series however has a similar gain function which can be activated by a checkbox. This function achieves results similar to 8bit mid.

3.1.2.4 Adjusting shutter time

In Live mode the shutter slider may be used to adjust shutter time of the camera. Looking at a scene, drag the slider from the right to the left side. The shutter time is displayed above the slider.
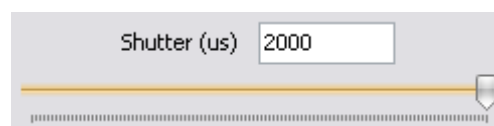
Drag the bar while observing the live image on the screen. When the image looks satisfying let the slider go. The shutter value is now set for the recording.
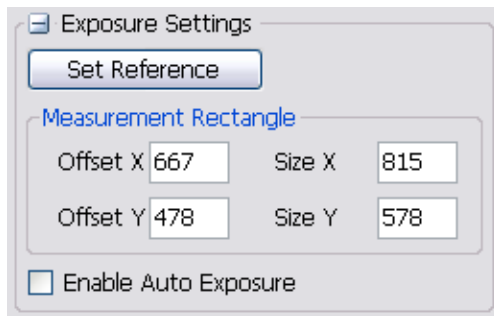
3.1.2.5 Auto Exposure (optional)

The Imaging Studio software does offer an Auto Exposure feature.

Set the camera to the image section you would like to film and adjust the aperture (make sure the "Enable Auto Exposure" tick box is not selected yet). Set the shutter value to a level that gives the desired image brightness. Make sure that the shutter value chosen is not too close to the maximum value possible. Otherwise the adjustment process is resulting in too dark images.

To set the Auto Exposure function open the "Exposure Settings" subtab. The camera image is now surrounded by a green frame. With your mouse pointer you can grab and drag the borders of this frame and adjust it to the area of interest. The Auto Exposure function will only take this area into account when calculating the adjusted exposure.

If everything looks ok click the "Set Reference" button and select the "Enable Auto Exposure" tick box. The Auto Exposure function is now ready and working in live and recording mode.
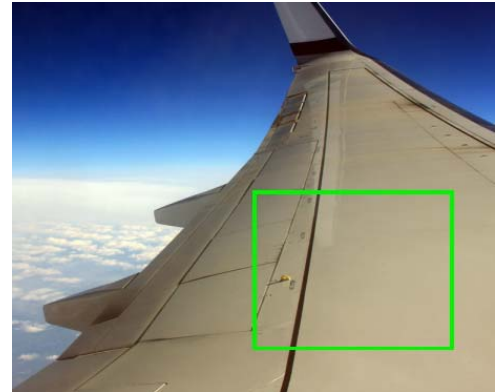
If the camera should run at a pre-defined shutter speed it is not possible to use the Auto Exposure feature! The Auto Exposure feature uses the shutter to adjust image brightness.

Do not forget to use the "Save parameters permanently in camera …" function (see 3.2) if the Auto Exposure function should still be running with the same parameters when restarting the camera.

3.1.2.6 Singlebuffer - Sequence Length

Enter the desired number of seconds or frames for the first buffer in the "Sequence Length" text field.

3.1.2.7 Singlebuffer - Pre-Trigger %

Enter the Pre-Trigger % by typing the desired percentage into the "Pre-Trigger %" text field. The Pre-Trigger Length text field displays the resulting number of pre-trigger seconds/frames.

3.1.2.8 Singlebuffer - Pre-Trigger Length

Select the Pre-Trigger Length by typing the desired value in seconds or frames in the text field. The "Pre-Trigger %" text field displays the resulting pre-trigger % of the recording.

The [sec] and [frames] radio buttons allow changing between seconds and frame units for all input fields and displays.

3.1.3 How to create a multi-sequence recording

Open the "Multibuffer Settings" tab in the "Camera Settings" window and press the "Add a buffer" button.

The following "Buffer Settings" window will appear:
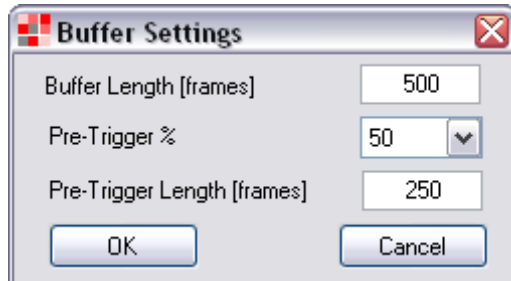
The parameters in the "Buffer Settings" window are the following

Parameter	Values
Buffer Length	Adjustable in steps of 0.01 seconds or 1 frame (choose [s] or [frames] on main window)
Pre-Trigger %	Adjustable in steps of 1%
Pre-Trigger Length	Adjustable in steps of 0.01 seconds or 1 frame (choose [s] or [frames] in main window)

3.1.3.1 Buffer Length

Enter the desired number of seconds or frames for the first buffer in the "Buffer Length" text field.

3.1.3.2 Pre-Trigger %

Enter the Pre-Trigger % by typing the desired percentage into the "Pre-Trigger %" text field. The Pre-Trigger Length text field displays the resulting number of pre-trigger seconds/frames.

3.1.3.3 Pre-Trigger Length

Select the Pre-Trigger Length by typing the desired value in seconds or frames in the text field. The "Pre-Trigger %" text field displays the resulting pre-trigger % of the recording.

By clicking "Ok" the first buffer is added to the memory.

To add more buffers click the "Add a buffer" button again. To delete a buffer select the buffer and press "Delete selected buffer" or choose "Delete all buffers".

The bar below the buffer buttons shows how much of the memory is occupied by the buffers programmed. If there is no more memory left, it is not possible to add additional buffers.

After having set up the buffers according your needs press the "Apply" button to transfer the settings to the camera.
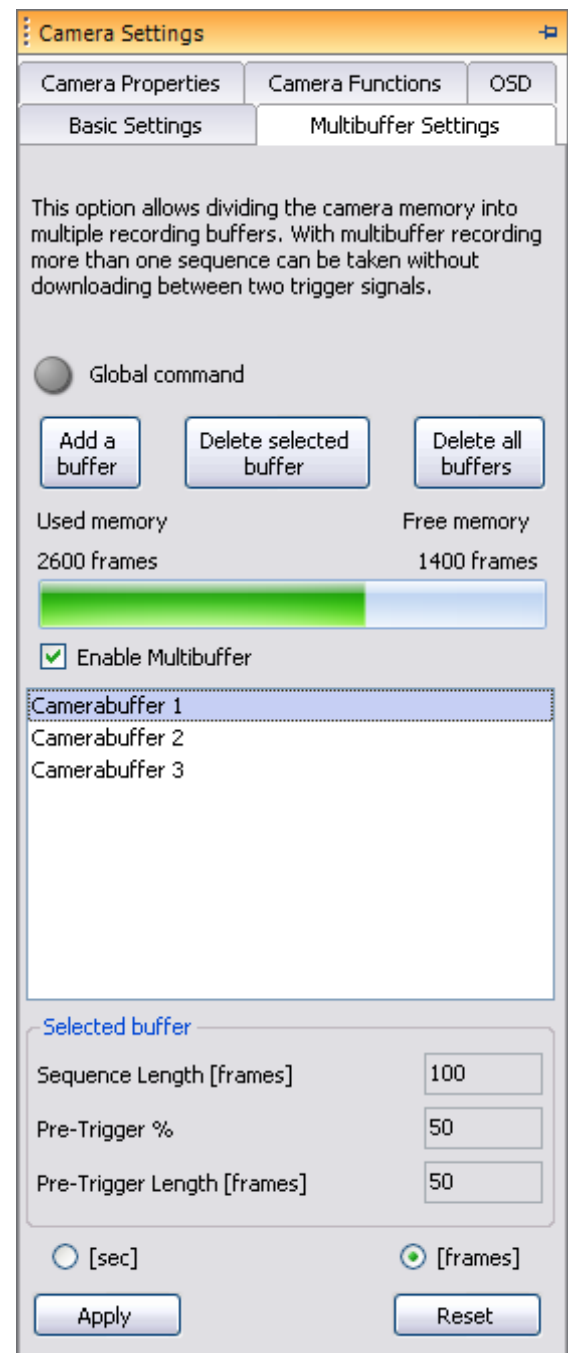
Transferring new parameters to the camera will erase the camera memory!

Alternatively you can also click one of the camera command buttons on the main toolbar. In this case a warning message is displayed to confirm erasing the memory (see 3.1.1).

If you do not want to change the memory setup and go back to the previous settings press the "Reset" button.

When selecting a programmed buffer the settings of this buffer are displayed below the buffer list.

The [sec] and [frames] radio buttons allow changing between seconds and frame units for all input fields and displays.

3.1.4 Sequences window

To see the status and the parameters of the buffers programmed open the "Sequences in camera" window on the right hand side of the application.

3.1.4.1 Image memory

In the "Image memory" tab you see all the buffers which have been programmed. Each sequence has a unique identification number. When initializing the camera the sequences are numbered 1, 2, 3, etc. When a sequence is deleted the next number available is assigned to this buffer. This numbering is only reset when re-initializing the camera.

The blue icon in front of the sequence indicates a recorded but not yet downloaded buffer. As soon as the sequence was downloaded successfully the icon turns green. A gray icon indicates an unused or deleted buffer.

In this example the memory contains 3 sequences. Sequence No. 1 has been recorded but not downloaded yet (blue). Sequence No. 4 has been recorded and successfully downloaded (green). Sequence No. 5 has been deleted (grey).

The camera is right now playing back sequence No. 1 (highlighted). If the camera would be set into "Pre-Triggered mode" now, it would automatically start filling the next empty buffer, in this case No. 5. The other buffers are not affected by this recording.

If there are no unused or deleted buffers left, it is not possible to set the camera into "Pre-Triggered mode". The user has to delete one or more sequences first.

When closing and restarting the software the memory configuration is recovered from the camera and displayed (unused buffers, recorded buffers, etc.).

3.1.4.2 Downloading and deleting buffers

A right-click on one of the sequence titles opens a context menu to erase or download buffers.

- "Play selected sequence": Plays back the selected sequence.

- "Download selected sequence": Downloads sequence which is selected to the hard disk.

- "Download all recorded sequences": Downloads all sequences which have been recorded but not downloaded yet (green) to the hard disk.

- "Erase selected sequence": Erases only sequence which is selected. The other sequences are not affected by this command.

- "Erase all sequences": Erases all sequences.
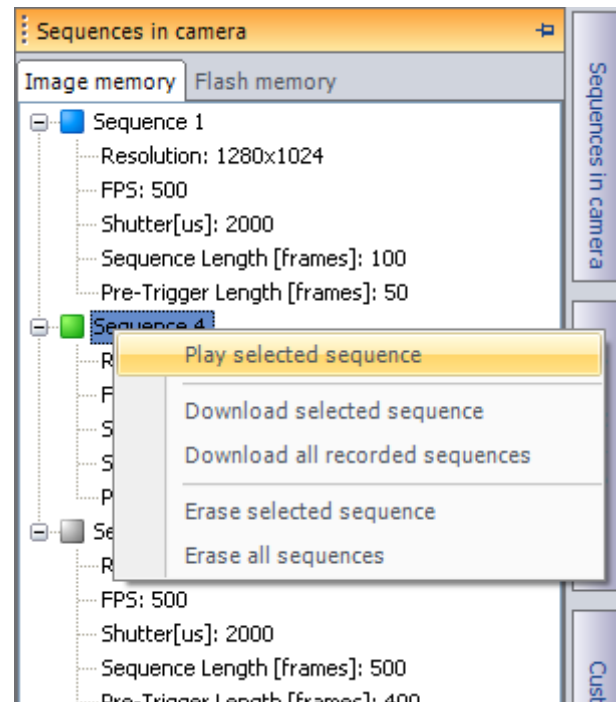
When downloading there is no file name dialog, the download is started immediately displaying a progress bar.
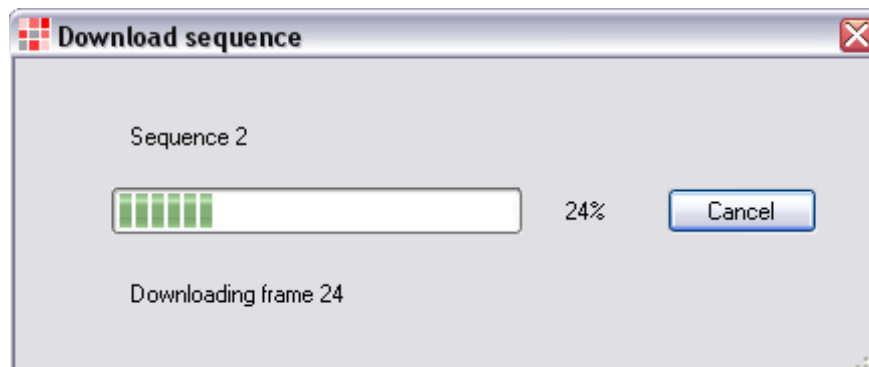
The filename for each sequence is generated automatically. See 3.4.2 for directory and filename structure.

When erasing there is a confirmation message asking "Do you really want to erase this/all sequence(s)?" if the selected sequence (or one sequence in "all" mode) has not been downloaded yet (blue).

3.1.4.3 Flash memory

In the "Flash memory" tab all files which are stored in the flash memory are listed. These files can also be played back or downloaded to the hard disk via Ethernet. To playback or download a file, right-click on the name and choose one of the options listed.

The file names displayed are composed of the default file name (see 3.4.2), the camera name (see 3.1.2.1), and the number of the sequence in the image memory.

If global command is activated the sequences are always downloaded from all cameras connected.

At the bottom of the tab the used and free amount of memory is displayed.

Keep in mind that new files can only be written to the flash memory if sufficient storage space is available. It is not possible to delete a single sequence from the flash memory; it can only be formatted as a whole. To format the flash memory, choose the option "Format flash memory". A warning message will be displayed asking whether you really want to format the Flash memory.
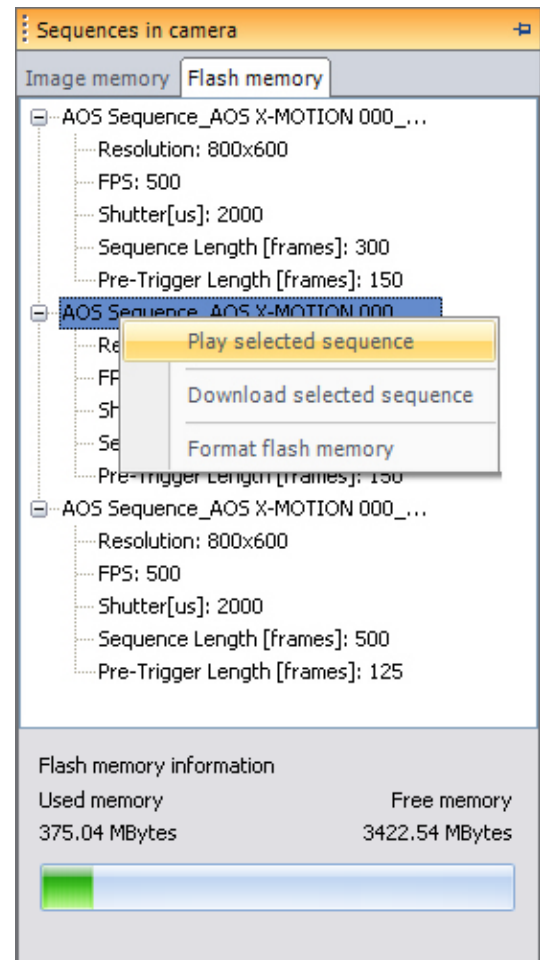
3.1.4.4 AOS file format (optional)

On selected camera systems the flash memory can be formatted with the proprietary "AOS file format".

The standard FAT32 file system is not optimized for writing speed but flash cards with FAT32 are recognized by every standard consumer card reader. This is not the case for cards formatted with the "AOS file system". These cards can only be accessed in the high speed camera's card interface. To download sequences from the card you have to insert the card into your high speed camera and open the sequences stored on it via the AOS Imaging Studio software.

The advantage of the "AOS file format" is a faster writing speed and also writing time is constant while writing time with FAT32 can vary from one sequence to another.
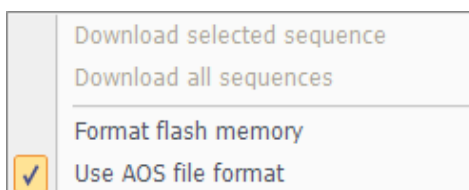
To change the file system from FAT32 to "AOS file format" and vice versa, right click the flash memory window and select "Use AOS file format".

Changing the file format on the flash memory will require formatting the card. All information stored on the card will be lost!

The FAT32 file system cannot store files bigger than 4GB. In case your sequence is bigger than 4GB you will see mutiple files when reading the card with a card reader (xxx.raw3, xxx_split.raw3, etc.).
See 6.1.1 on how to merge the files into one again with Imaging Studio.
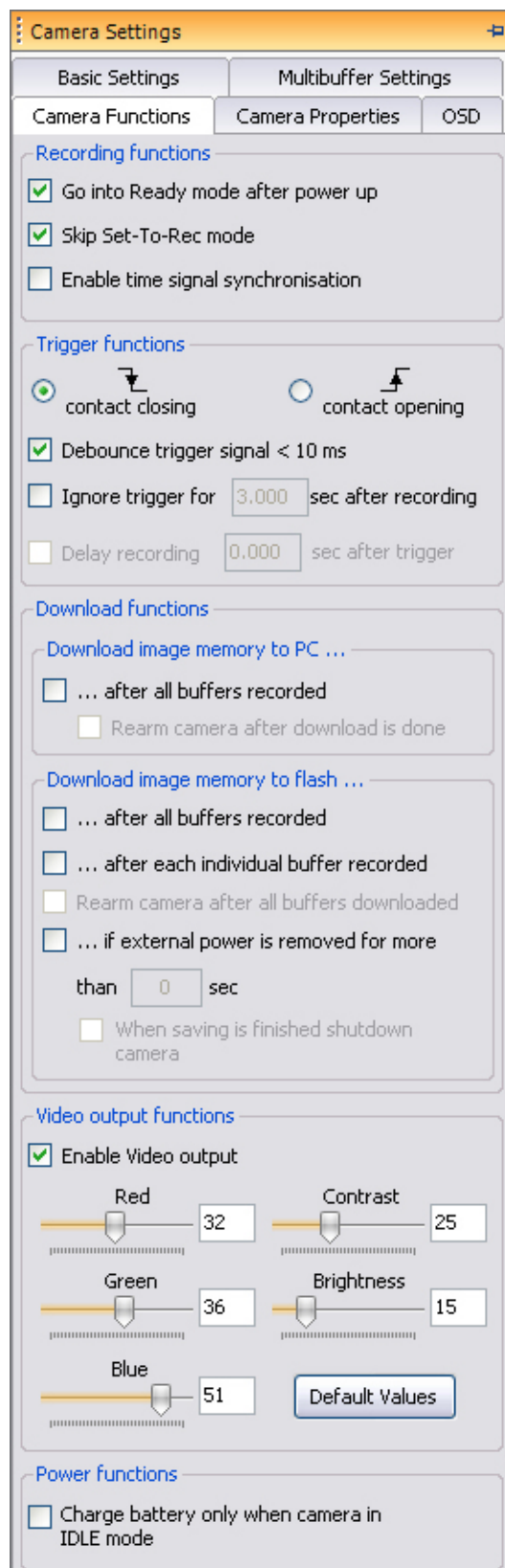
3.1.5 Camera Functions tab

Open the "Camera Functions" tab to change recording functions of the camera.

3.1.5.1   Recording functions

Using "Go into Ready mode after power up" sets the camera automatically into ready mode when powering it up. It is then ready to receive the "Set-To-Rec" command and "Trigger" without any further software interaction. To activate this feature tick the box.

When "Skip Set-To-Rec mode" is activated the camera does not wait for a "Set-To-Rec" signal in Ready mode. The camera is instantly in recording mode and can be triggered.

If an IRIG-B time signal is connected to the camera (optional – not available on all camera models) it is possible to synchronize the recording with the carrier signal of the time source. To activate this function, tick "Enable time signal synchronization". Time signal synchronization is only possible for 100fps, 200fps, 500fps and 1'000fps.

3.1.5.2   Trigger Functions

Choose whether your hardware trigger signal is a "contact closing" (falling edge) or "contact opening" (rising edge).

The "Debounce trigger signal < 10 ms" option (optional – not available on all camera models) activates an RC filter of 10ms at the Trigger Input to prevent the camera from triggering when receiving a spike from an external disturbance (only available on 24–36 VDC cameras). The minimum time a trigger signal must be active is 10ms in this case.

If the camera should not accept any triggers right after a recording was finished the function "Ignore trigger for XX sec after recording" can be activated. Enter the desired number of seconds in the corresponding text field.

"Delay recording XX sec after trigger" allows postponing the recording for the entered number of seconds. When a trigger signal is received the camera will start a timer and trigger only when the chosen time is up.

3.1.5.3   Download functions

If the software should automatically download all buffers recorded to the PC as soon as they are finished check "Download image memory to PC… … after all buffers recorded".

Should the camera go into recording mode again when download is finished check "Rearm camera after download is done".

Similar functions are available for the flash memory (optional). As soon as all programmed recording buffers are triggered and completed, all images will be copied to the camera flash memory if the option "Download image memory to flash… … after all buffers recorded" is activated.

If "… after each individual buffer recorded" is ticked (optional), each buffer will be downloaded to the flash memory as soon as it has been triggered and recording is finished. The camera will not wait for all buffers to complete. During download to the flash memory it is not possible to do a new recording; the camera is busy and does not accept additional triggers.

> Make sure this option is not selected if the camera needs to do multiple recordings within a short period of time.

Should the camera go into recording mode again when all buffers are completed and downloaded check "Rearm camera after download is done".

In case of a power loss from the external power source, the camera can copy the images from the image memory to the flash memory after a given number of seconds. To activate this function tick "Save image memory if external power is removed for more than XX sec" (optional) and enter the desired number of seconds.

If the camera should shutdown itself after the download is completed, tick "When saving is finished shutdown camera" too. This will allow saving battery capacity for the next recordings in case of a power loss.

3.1.5.4   Video output functions (optional)

Activate or deactivate the video output by clicking "Enable Video output". Choose whether the output signal should be according PAL or NTSC standard.

Refer to the camera hardware manual for instructions on how to connect the video output signal.

The video output on the camera displays the same image as in the software. In Live and recording mode the image displayed on the video output is live. When playing back a sequence in the software, the sequence is also played back on the video output. The video output does display every single frame of a sequence at the native speed of 25fps.

The "Red", "Green", "Blue", "Contrast" and "Brightness" sliders allow adjusting the image on the video output. These settings do not affect the image in the Imaging Studio software. To reset the values press the "Default Values" button.

3.1.5.5   Power functions

If "Charge battery only when camera in IDLE mode" the camera's internal battery will not be charged except in IDLE mode.

3.1.5.6   Refresh rate

Depending on the computer performance and the Ethernet connection quality the live image refresh rate may be slow. A stuttering live view may be inconvenient to setup the camera and adjust the lens.
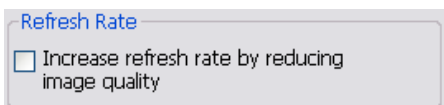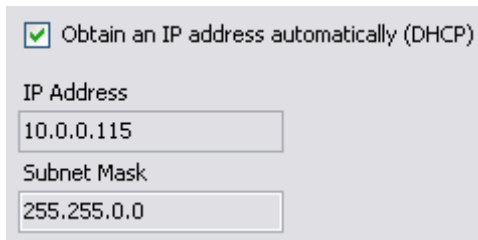
In this case the live image quality can be reduced by ticking the above checkbox in order to achieve a faster refresh rate. This function does only reduce image quality for live images and has no effect on the images recorded into the camera memory or stored to the computer's hard drive.

3.1.6 Camera Properties tab

Select the "Camera Properties" tab to change the IP address of the camera.

3.1.6.1 Camera IP Settings
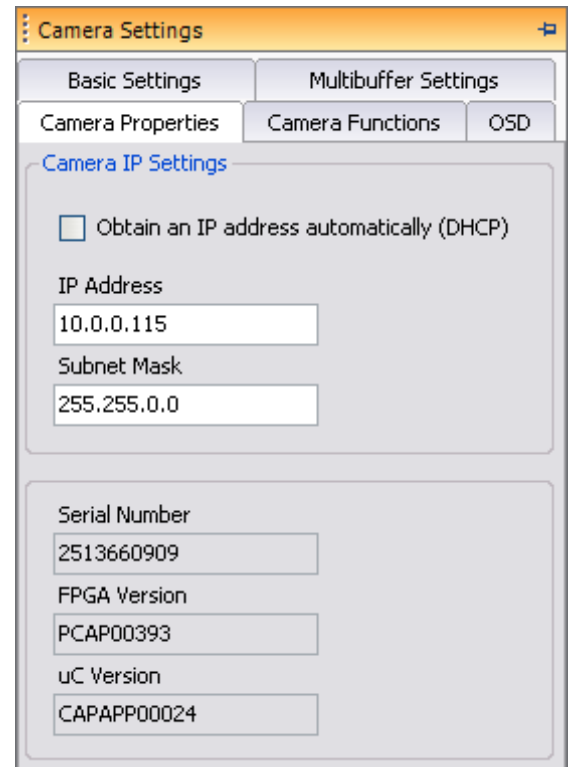
If DHCP is enabled, the IP address of the camera is received automatically from a DHCP server when the camera is starting up. If DHCP is not checked the IP address and a subnet mask set in the two fields are used.

When changing the IP address manually switch off the camera afterwards. The new address will then be valid for one reboot only. If you can no longer connect to the camera switch it off again. The old address is being reused then.

To permanently store the new IP-address in the camera set it again and choose "Save Parameters to Camera" (3.2).

Also refer to the "Quick Start Guide" for more information on IP addresses.

When multiple cameras are connected to the PC make sure every camera has its own unique IP-address. Setting the same IP-address in multiple cameras may result in loss of data and improper system configuration.

3.1.7 OSD tab

Select the "OSD" tab to choose which information should be displayed on screen together with the video or software output.

3.1.7.1 User Interface OSD

Information about parameters selected in the camera or stored in the sequence can be displayed as an overlay to the software image. Select which information should be displayed:

- *Logo*: a small image, e.g. a company logo can be displayed with the image

- *Text*: a custom text which can be displayed

- *Camera name*

- *Size X * Size Y / Frame rate / Shutter time* of the sequence taken

- *Frame number / Frame time*

- *System time*

- *IRIG time signal* (optional)

and define the position (top left, top right, bottom left or bottom right corner) and the font of the OSD.

3.1.7.2 Enable event markers (optional)

Your camera can display up to 4 event markers, depending on the hardware module installed. The events can be applied to the I/O pins 11 – 14 on the LEMO connector as a TTL signal (0…24VDC) or a closing/opening contact (see camera manual for more details).
When the tick box is activated the event markers show up at the top left corner of the image displayed as colored empty squares. The orientation of these markers can be set to the top, the left side, the bottom side and the right side.
As soon as an event is detected on one of the IO's the corresponding Marker changes to a filled square.
When activating negative polarity the markers behavior is inverse meaning that the colored square is filled when no event is applied and gets empty when an event occurs.

Cameras with IRIG-B option as well as the X-PRI camera (without "Extended I/O channel" option) only allow using one event marker.
The X-PRI camera with "Extended I/O channel" option allows using all 4 Event Markers.

3.1.7.3 Video output OSD

The On Screen Display of the video output can be enabled or disabled. Choose the position of the OSD by pressing one of the buttons (top left, top right, bottom left or bottom right corner).
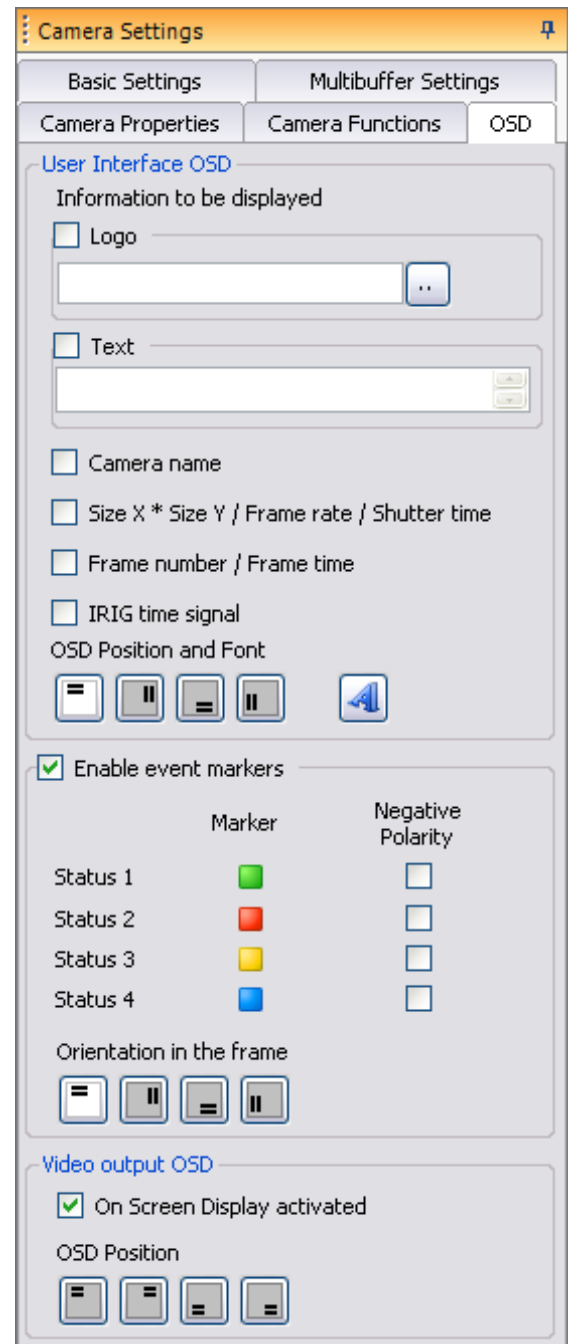
The video output OSD can display the following information:

REC: Camera recording in Pre-Triggered mode and waiting
                for trigger
TRIG'D: Camera has been triggered and is recording
LIVE: Camera is in live mode
IDLE: Camera is in idle mode
PLAY: Sequence playback is in progress
LO BAT: Camera has low battery
D'LOAD: Download over Ethernet is in progress
TIME DET: IRIG-B time signal is detected and decoded correctly
MEM FULL: No more empty buffers left in camera memory
FLASH FULL: Flash card is full, no more downloads to the flash card possible

3.2   How to save the settings in the camera

After having changed all necessary camera and recording
parameters this information may be stored in the camera
permanently. Choose "Save parameters permanently in camera" from the "Camera" menu.
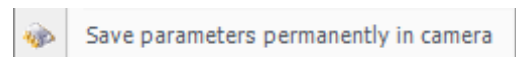
Make sure that you have a
fully charged battery or
external power connected to
the camera when
programming the parameters.
Never disconnect the Ethernet
link from the camera while
programming is in process.

3.3   Remote shutdown

If the camera is no longer used it can be shut
down remotely to save battery power. To
shutdown the camera, click on the
"Remote shutdown" button.

3.4   Application Options

Imaging Studio allows setting options regarding
when to save parameters, what to do with
unsaved sequences, warnings, etc. These options
can be set in the menu "Extra" – "Application
options".
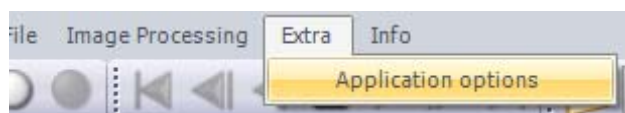
3.4.1 Global settings

3.4.1.1 Global command

Imaging Studio allows controlling multiple
cameras by just one click, sending the command
to all connected cameras. Check the "Global
Command" box to send the following commands
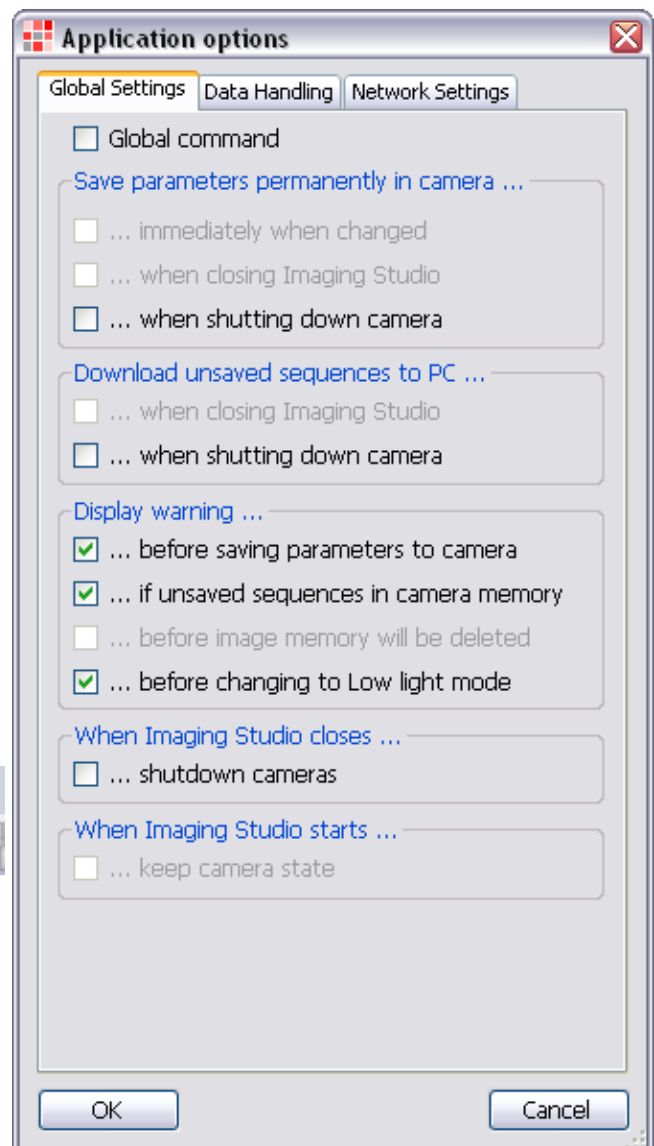
to all of the cameras:

- Camera settings
- Multi buffer configuration
- Set for Pre-trigger Mode
- Trigger
- Jump to beginning of sequence
- Playback/Stop
- Step one frame back/forward
- Jump to frame 0
- Jump to end of sequence

If "Global command" is activated all operations on the camera memory slider and the "Sequences in camera" window like erasing or downloading sequences do apply to all cameras connected.

"Global command" can also be activated and deactivated by clicking the corresponding button in the main toolbar.

3.4.1.2   Save parameters permanently in camera …

- "… immediately when changed": When you press the "Apply" button in the camera settings tab the parameters will immediately be saved to the camera.
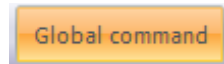- "… when closing Imaging Studio": When Imaging Studio is closed the set parameters are stored in the camera.
- "… when shutting down camera": When the "Remote shutdown" button is pressed, the parameters will be stored in the camera before shutting it down.

3.4.1.3   Download unsaved sequences to PC …

- "… when closing Imaging Studio": When Imaging Studio is closed all unsaved sequences will be downloaded to the PC before executing the closing command.
- "… when shutting down camera": When the "Remote shutdown" button is pressed, all unsaved sequences will be downloaded to the PC before shutting the camera down.

3.4.1.4   Display warning …

- "… before saving parameters to camera": If activated a message box will be displayed before saving the parameters to the camera.
- "… if unsaved sequences in camera memory": When Imaging Studio is closed or the camera shut down remotely a warning is displayed if unsaved sequences are in the camera memory.
- "… before image memory will be deleted": When hitting the "Apply" button a warning message will be displayed before deleting the camera memory.
- "… before changing to Low light mode": When hitting the "Show live image low light" button a warning message will be displayed when switching to Low light mode.

3.4.1.5   When Imaging Studio closes …

- "… shutdown cameras": All connected cameras will be shut down before executing the close command for Imaging Studio.

3.4.1.6   When Imaging Studio starts ...

- "… keep camera state": If this option is not activated, the camera will automatically be set to "Normal Preview" mode when starting Imaging Studio. With this option set, the camera will keep the state (e.g. Pre-Triggered).

3.4.2 Data handling

3.4.2.1   Default download parameters

- "Default download path": Path where the sequences will be stored per default in manual download ("Sequences in camera" tab not floppy-disk-button).

- "Default filename": Filename and file format which is used per default in manual download ("Sequences in camera" tab not floppy-disk-button).
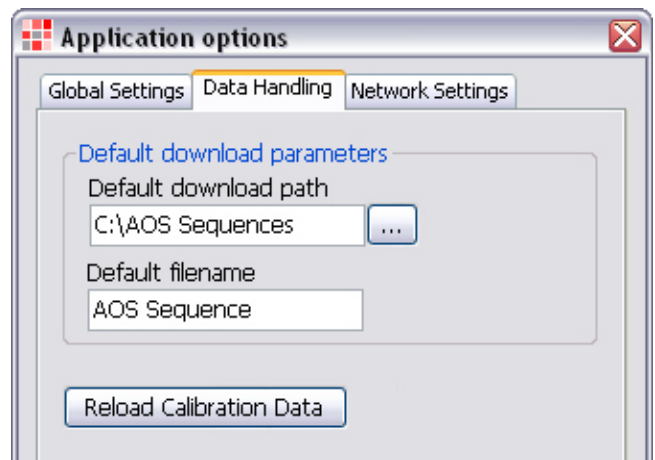
3.4.2.2   Reload Calibration Data

If the image quality of your camera is not good you can reload the calibration data from the camera to the computer by pressing this button.

3.4.3 Network Settings

This list shows all network cards available on your computer. Select the card(s) where your cameras are connected to in order to establish a connection.

3.4.3.1   Datatransfer package size

Bigger Ethernet packages allow a faster data transfer from your camera to the PC. Some network cards however cannot handle big data packages. If you are experiencing a slow live image refresh rate or download speed on your system, try reducing the Datatransfer package size to 32k, 16k or even 8k.

3.4.3.2   Multicamera download

If you have multiple cameras connected to your PC, you can download the data from the memory serial (one camera after each other) or parallel (all cameras simultaneously).

Depending on your system setup one or the other selection will be faster for downloading. AOS is suggesting giving both options a try and using the one which works better.
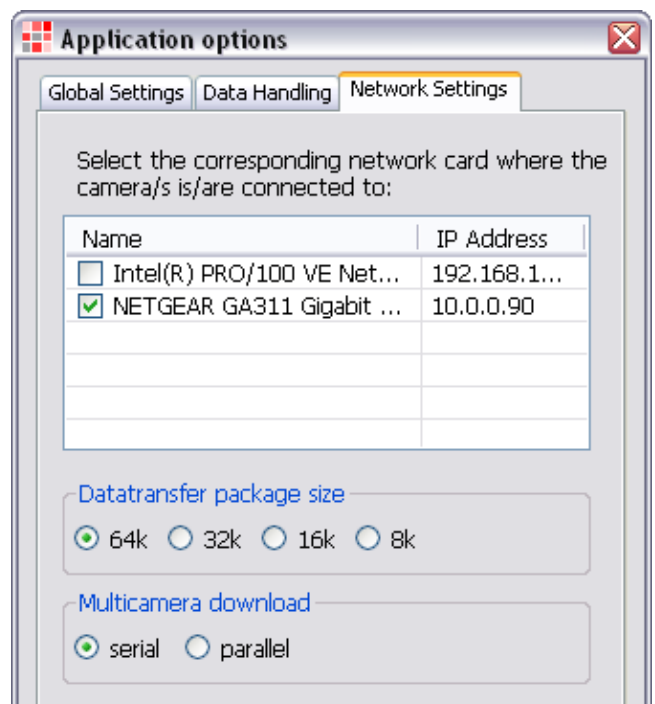
4   Setting of a scene and start a recording

Once the camera is connected to Imaging Studio, the camera is automatically set to "Live Mode" (see also 3.4.1.6).

4.1   Show live image low light

In order to view the correct scene and adjust focus and the field of view the cameras may be set into a low light preview. In this mode the camera records at a low speed, which results in a brighter image display.

> In order to avoid taking "dark sequences" the user can not arm the camera out of this mode but must first go to the normal preview mode in order to assure correct f-stop setting and exposure setting.

4.2   Show live image

This mode displays the scene using the selected framing speed, gain mode and/or shutter time. Set the proper f-stop to adjust brightness of the recording.

4.3   Take a recording – standard operation
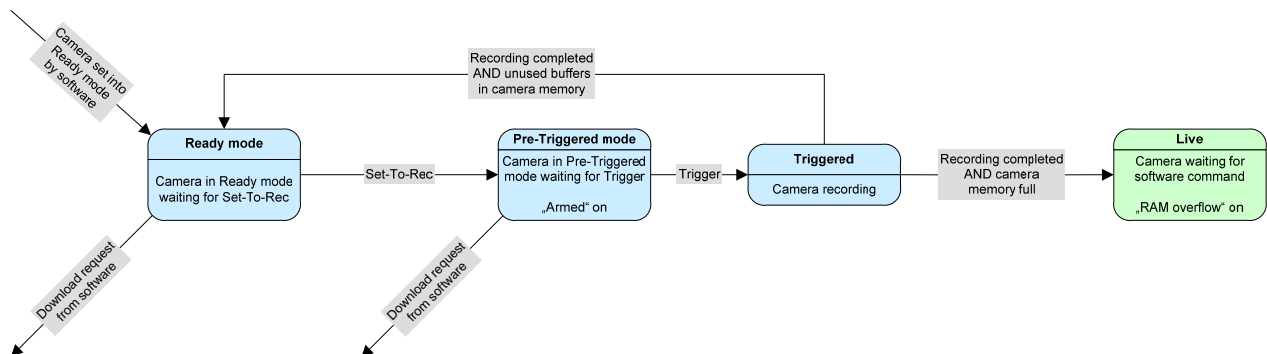
4.3.1   Ready mode

To set the camera into Ready mode press the green button on the toolbar. The camera is then ready to receive the Set-To-Rec command.

4.3.2   Pre-Triggered mode

From every camera mode (Live, Playback, etc.) the camera can receive the "Set-To-Rec" command either by software (white button) or hardware which leads to the "Pre-Triggered mode", if there are unused buffers in the memory left. From now on recording into the circular buffer is started. The hardware output pin "Armed", the indication in the software ("Recording") and the video overlay ("REC" see 3.1.7.3) is on.

> If 0% Pre-Trigger was chosen for the sequence settings (see 3.1.2.7) or "Skip Set-To-Rec mode" is activated in the recording settings (see 3.1.5.1) the white "Set-To-Rec" button is not displayed in the software.

4.3.3 Triggered

As soon as a hardware "Trigger" command is received (or red button by software, or F12 on the keyboard) the recording is being completed. During this time the hardware output pin "Triggered", the indication in the software ("Triggered") and the video overlay ("TRIG'D" see 3.1.7.3) is on.

If there are unused recording buffers left in the memory, the camera automatically returns to "Ready mode".

It is always possible to leave "Pre-Trigger mode" by software, to playback or download a sequence.

If all programmed buffers have been completed the camera returns to "Show live image" mode awaiting a command from the user. In this case the indication in the software ("Image memory full") and the video overlay "MEM FULL" (see 3.1.7.3) is on.

4.4 Camera Status

To display the status of the cameras open the "Camera Status" window on the left hand side of the application. There are two different tabs, one showing the status of the selected camera, one displaying the status of all cameras.

4.4.1 "All cameras" Tab

The tab for all cameras displays the following signals:

- Status "Recording", green if all cameras are in recording mode (AND combination)

- Status "Triggered", green if all cameras have triggered (AND combination)

- Status "Downloading via ethernet" green if all cameras are downloading (AND combination)

- Status "IRIG time signal detected" green if all cameras are decoding the IRIG time source correctly (AND combination). Red if at least one camera does not decode the IRIG-B signal correctly (OR combination), off if at least one camera does not receive an IRIG time signal.

- Status "External synchronisation" green if all cameras are receiving a correct synchronisation signal (AND combination). Red if at least one camera cannot handle the synchronisation signal connected (OR combination), off if at least one camera does not receive a synchronisation signal.

- Status "External power connected" green if all cameras have external power connected (AND combination), red if at least one camera has no external power connected (OR combination).

- Alert "Image memory full" red if at least one camera has no free memory buffer left (OR combination)

- Alert "No Ethernet link" red if at least one camera lost Ethernet connection (OR combination)
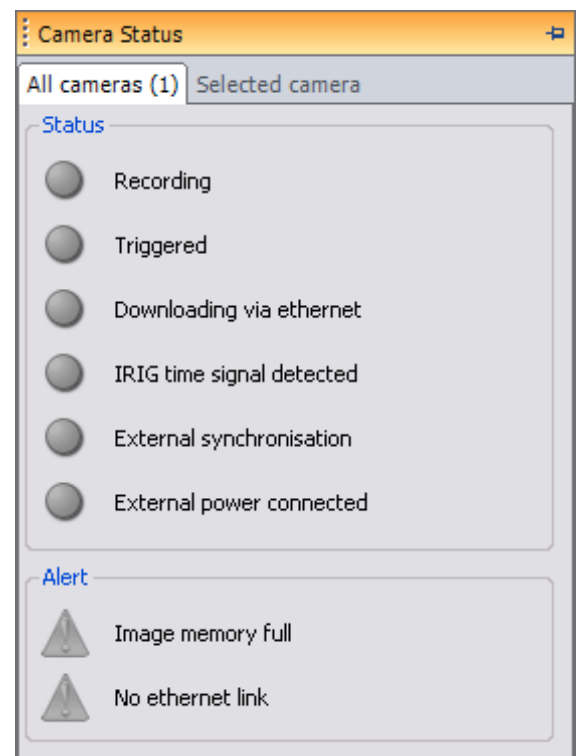
4.4.2 "Selected camera" Tab

The tab for the selected camera displays the following signals:

- Status "Recording", green if camera is armed and waiting for the trigger

- Status "Triggered", green if camera has triggered

- Status "Download via ethernet" green if download is in progress

- Status "Download to flash memory" green if transfer of sequences to flash memory is in progress

- Status "IRIG time signal detected" green if camera is decoding the IRIG time source correctly, red if camera cannot decode the IRIG-B signal, off if camera does not receive an IRIG time signal.

- Status "External synchronisation" green if camera is receiving a correct synchronisation signal, red if camera cannot handle the synchronisation signal connected, off if camera does not receive a synchronisation signal.

- Status "External power connected" green if camera has external power connected

- Status "Battery charging" green if internal battery is charging

- Alert "Image memory full" red if camera has no free buffer left

- Alert "Flash memory full" red if there is no more storage capacity on the flash memory left

- Alert "No Ethernet link" red if camera lost Ethernet connection

- Alert "Low battery" red if battery capacity is low
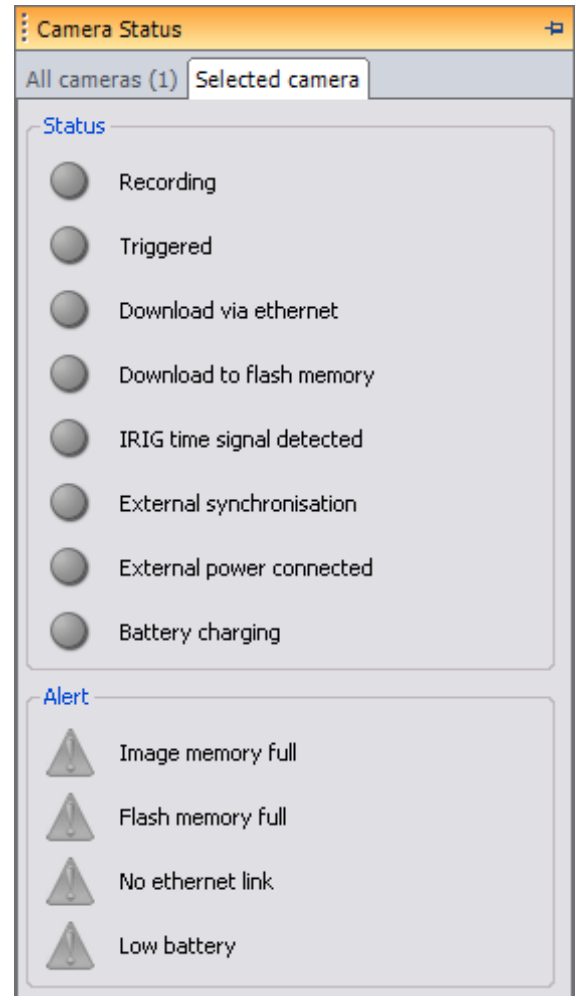
5 Edit and store a sequence after recording

This function works for both, sequences played back out of the camera memory and sequences played back from hard disk.

5.1 Download, store and playback images

Besides standard download (see 3.1.4.2), the sequence in the camera memory can also be downloaded manually in multiple formats to any non volatile medium.

5.1.1 Playing back images out of camera memory

After recording, images may be accessed out of the camera memory.
Use the following buttons to play the sequence:

|	
▷|	Single frame forward
◁|	Single frame backwards
▷	Play forward
◁	Play backwards
▷|	Go to last frame (end of buffer)
|◁	Go to first frame (start of buffer)
T0 ▷|	Go to trigger frame (T0)

5.1.2 Adjusting the Playback Speed

The Playback Speed slider adjusts the playback speed. This function works for both, sequences played back out of the camera memory and sequences played back from the hard disk of the PC.

5.1.2.1 Playback ratio

Use "Playback Ratio" to further accelerate the playback speed. The "Playback Ratio" can be set with the two up- and down-arrows. To reset the "Playback Ratio" to 1:1 click the red cross button.
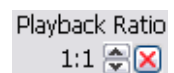
> ℹ The limiting factor in the playback speed is the data transfer speed from the camera memory as well as your PC performance.

5.1.3 Browsing through the recorded sequence using the frame slider

After finishing recording the frame slider can be used to browse through the recorded sequence.
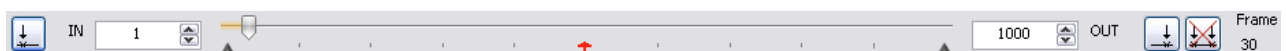
The red arrow below the frame slider marks the trigger frame.

5.1.4 Color correction

Proper lighting will yield the best color results. Testing reveals the best choice is cold light such as HMI or direct daylight. Color correction may be preformed on live or recorded images.

To enable color correction make sure the option "Enable Image Processing" in the "Image Processing" menu is enabled. Then click on the "Color correction" icon and the following screen will appear.
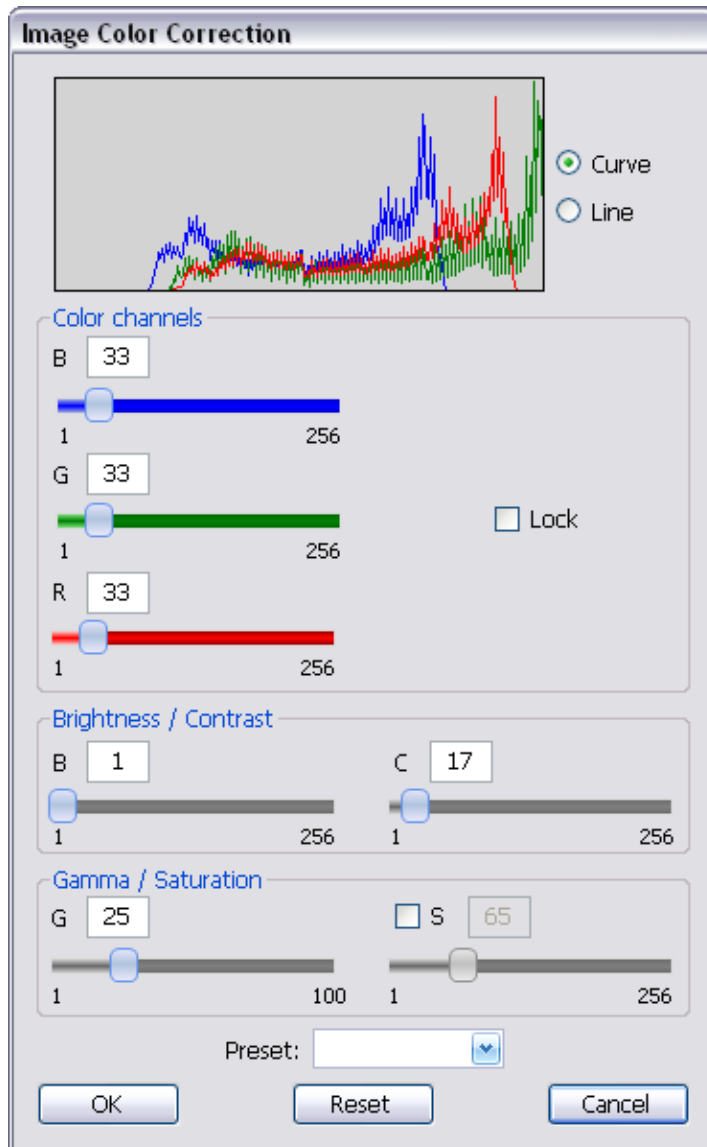
On top the histogram for each color channel is displayed.

This histogram can be displayed in "Curve" or "Line" style.

The software allows changing the RGB channels of the image individually. If all sliders should move simultaneously tick the "Lock" box.

The other four sliders change "Brightness", "Contrast", "Gamma" and "Saturation" (if corresponding tickbox checked).

All values can also be changed by entering numbers into the corresponding text fields.

To store the selected values as a preset, click on the "Preset" dropdown-list. This will display six different presets. Choosing one will open a message box which asks to overwrite this preset with the current values, load the values stored in this preset or cancel the operation.
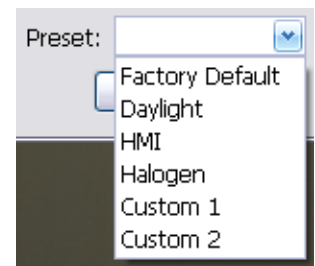
The "Factory Default" preset cannot be overwritten.

If the color correction looks ok click "Ok", otherwise "Cancel".
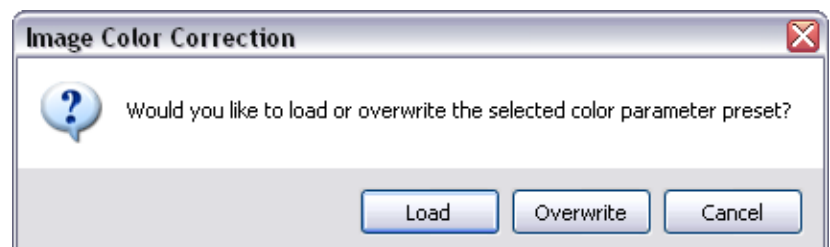
5.1.5 Change orientation of images

Sometimes the camera must be mounted in a position where the image does not have the correct position. Imaging Studio allows setting the orientation properly.

Click on one of the buttons in the toolbar to flip the image vertical or horizontal, to rotate it 90° left or 90° right.

The image on the video output is orientated in the same direction as in the software. Observe that the frame refresh rate on the video output does vary depending on the orientation chosen. The fastest refresh rate is achieved for 180° rotation for any resolution which is dividable by 10 and 4.

To undo all flip/rotate functions click on the last button in the list.

5.1.6 Zoom functions

5.1.6.1 Fit zoom

In fit zoom mode the image is stretched to the window size so the whole image is visible. Per default fit zoom is activated, it can be deactivated by clicking this button.

5.1.6.2 Mouse zoom

When activating the mouse zoom function the image displayed can be zoomed. Clicking with the left mouse button zooms in, clicking with the right mouse button out. In the lower right corner an overview of the whole image is displayed. The zoomed part is marked with a red rectangle. This rectangle can be moved with the mouse pointer to select a different region of the image.
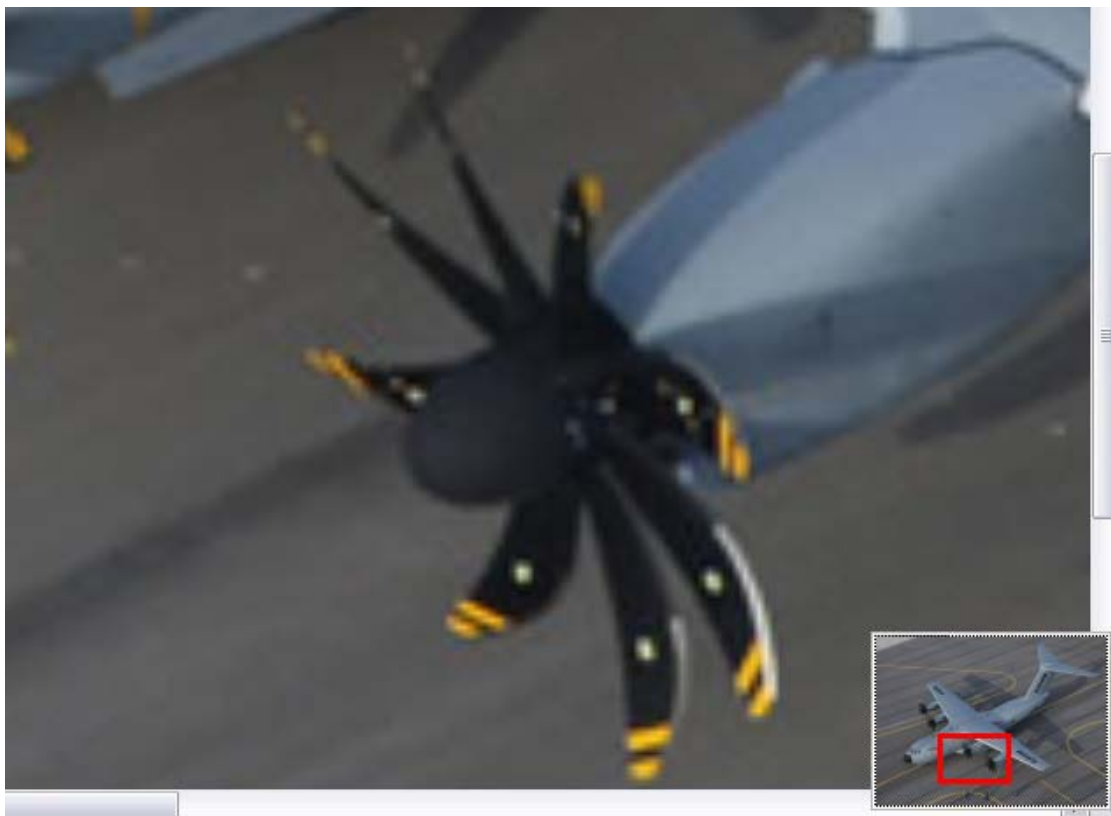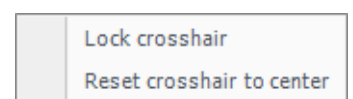

5.1.7 Cross-hair

The following button allows activating a red cross-hair in the image. This cross-hair can be moved with the mouse pointer.

Right-clicking the cross-hair lines opens a menu to reset the cross-hair to the image center or to lock it in the current position. When the cross-hair is locked it is not possible to move it. Click this menu item again to unlock it.

5.1.8 Select a sub-sequence for playback and storage

Most high-speed recordings do not show pertinent information in all frames. Therefore, it may be convenient to store only the portion of the sequence that contains the required frames.

1. Move the frame slider to the position where the action starts.

2. Click on the "Mark IN" icon to mark the beginning of the sequence or type in the start frame in the "IN" box below the frame slider.

3. Play forward to where the action ends and then click on the "Mark OUT" icon. Alternatively, type the end frame number of the sequence in the "OUT" box.

4. Click on the "Go to IN mark" or "Go to OUT mark" icons, to position the slider to the beginning or end of your selected sequence.
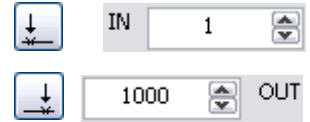
The IN and OUT frames are marked by a black arrow below the frame slider.

You may reset your selection by clicking the reset icon

5.1.9 Manually save a sequence to hard disk

The selected portion of the sequence or the entire sequence may be downloaded to a non volatile media such as a hard disk, a flash card etc. There are several movie file formats available as well as single image files to store sequences or single frames.

5.1.9.1 Save sequences in RAW3 format

The native raw file format allows storing the image data in its most native format without loss due to compression or image processing algorithms. Storing data in raw format is the most efficient and safest way to permanently store your data for long term and archiving use.

Note: The .RAW3 file is a binary format allowing converting images into the formats supported by Imaging Studio. It is not possible to convert generic image formats such as AVI, JPEG to .RAW3 file due to the nature of the generic image format. It is strongly recommended to always store the sequence in .RAW3 and convert to the generic formats later.

Besides downloading with a right-click on a sequence in the "Sequences in camera" tab you can also use the save icon on the toolbar for manual download.

1. Click on the Save icon on the toolbar or select "File" – "Save movie/image files" from the menu.

2. Select a folder, file type and filename

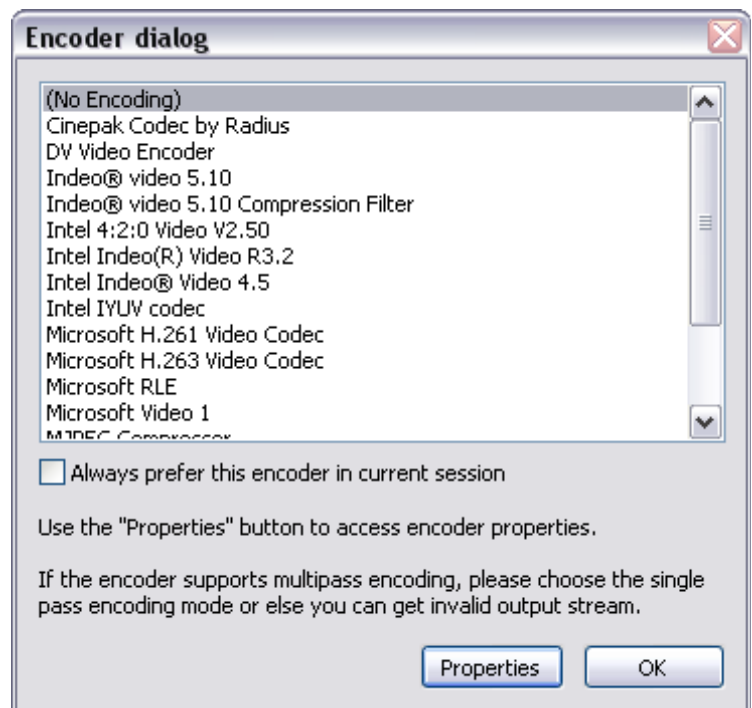3. If desired, change the "IN Frame" and "OUT
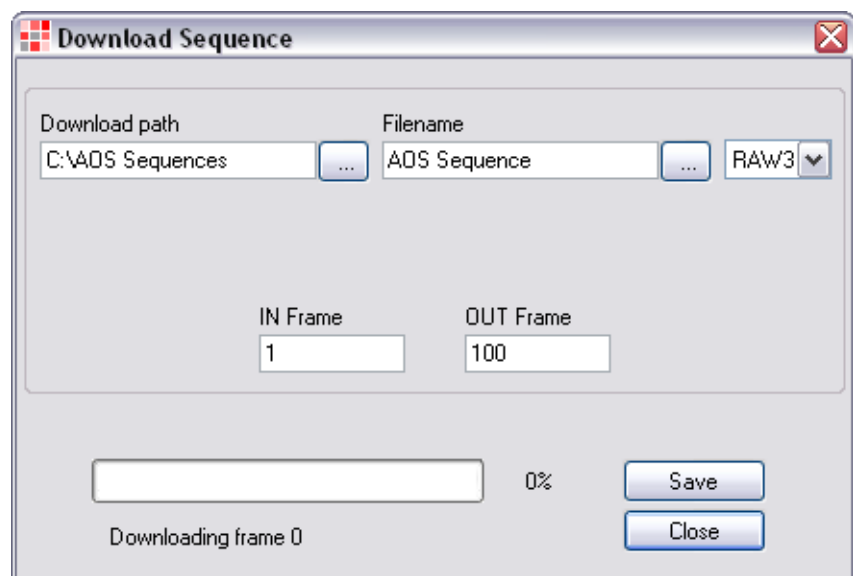
Frame" markers to reduce or lengthen the selected sequence. Click on the OK button.

4. While downloading the sequence the progress bar is active and the video overlay "D'LOAD" (see 3.1.7.3) is on.

5. To stop the download click on the cancel button.

5.1.9.2 Save sequences in AVI format

1. Select the AVI format from the drop down list.

2. Select a folder and filename

3. Set the playback speed by typing the number in the "AVI Fps" text box. The playback speed may be set to a speed such as 10fps to work with standard video players such as Windows Media Player.
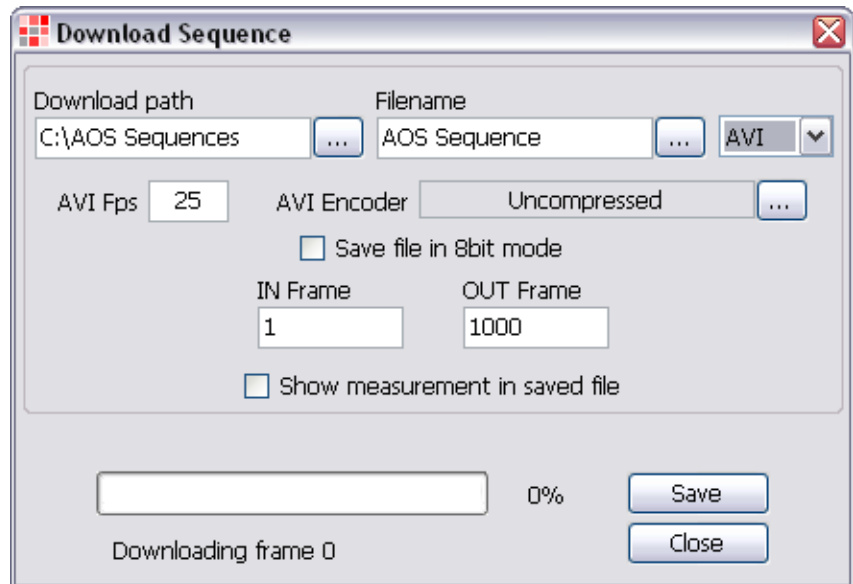
4. Select the "AVI Encoder" for the AVI file and change the properties if needed.

5. If the sequence is monochrome and the file should be saved in 8bit tick the corresponding checkbox.

6. If desired, change the "IN Frame" and "OUT Frame" markers to reduce or lengthen the selected sequence.

7. If the measurement points and lines (see 7) should be saved as an overlay to the AVI file check "Show measurement in saved file". Click on the OK button.

8. While downloading the sequence the progress bar is active and the video overlay "D'LOAD" (see 3.1.7.3) is on.

9. To stop the download click on the cancel button.

Note: Overlays like measurement points and lines or OSD text can not be removed from an AVI, BMP, JPEG or PNG file once saved. To have the possibility of showing and hiding these overlays always keep the original RAW3 file.

5.1.9.3 Save sequences in TIF format

1. Select the TIF format from the drop down list.
2. Select the compression method (LZW compression or uncompressed).
3. Select a folder and filename
4. If desired, change the "IN Frame" and "OUT Frame" markers to reduce or lengthen the selected sequence. Click on the OK button.
5. If the measurement points and lines (see 7) should be saved as an overlay to the file check "Show measurement in saved file". Click on the OK button.
6. While downloading the sequence the progress bar is active and the video overlay "D'LOAD" (see 3.1.7.3) is on.
7. To stop the download click on the cancel button.

5.1.9.4 Save sequences in JPG format

1. Select the JPG format from the drop down list.
2. Select the image quality between 1% and 100%. 1% results in poor quality but best compression, 100% in best quality and low compression.
3. Select a folder and filename
4. If desired, change the "IN Frame" and "OUT Frame" markers to reduce or lengthen the selected sequence. Click on the OK button.
5. If the measurement points and lines (see 7) should be saved as an overlay to the AVI file check "Show measurement in saved file". Click on the OK button.
6. While downloading the sequence the progress bar is active and the video overlay "D'LOAD" (see 3.1.7.3) is on.
7. To stop the download click on the cancel button.

5.1.9.5 Save sequences in BMP or PNG format

1. Select the file format from the drop down list.
2. Select a folder and filename
3. If the sequence is monochrome and the file should be saved as an 8bit BMP tick the corresponding checkbox (not available for PNG).
4. If desired, change the "IN Frame" and "OUT Frame" markers to reduce or lengthen the selected sequence. Click on the OK button.
5. If the measurement points and lines (see 7) should be saved as an overlay to the AVI file check "Show measurement in saved file". Click on the OK button.
6. While downloading the sequence the progress bar is active and the video overlay "D'LOAD" (see 3.1.7.3) is on.
7. To stop the download click on the cancel button.

5.1.10 Capture an image

With the snapshot button the image currently displayed in the application can be copied to the clipboard. This image can then be copied to other applications like Microsoft Word or any other program.

6   Retrieve and view sequences from the hard disk

6.1   Opening movie sequences

Once stored, sequences may be retrieved, played back, edited and stored again in the same or any other format.

1.   Click on the Folder Icon or select "File" – "Open a movie/image file" from the menu
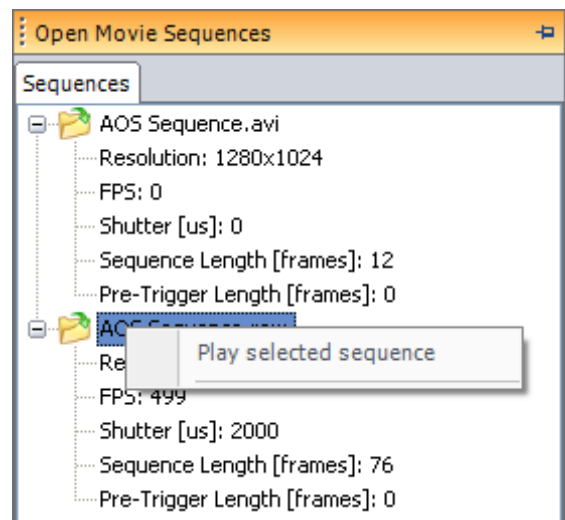2.   Select the file
3.   Open the file

Every sequence opened is attached as an additional tab. Camera tabs are gray, file tabs blue.
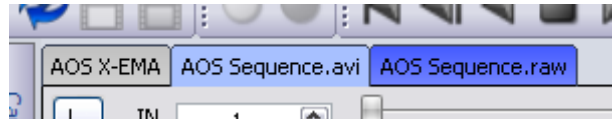
To see the properties of the files opened click on the "Open Movie Sequences" window on the right hand side of the application.

A right-click on one of the file titles opens a context menu to play the sequence.

6.1.1   Merging split flash card files

The FAT32 file system on the flash card cannot store files bigger than 4GB. In case your sequence is bigger than 4GB you will see multiple files when reading the card with a card reader (xxx.raw3 and xxx_split.raw3).

To merge the files open all of them by holding the Ctrl-Key while selecting the files. The merged sequence will be presented like a standard sequence. However it may be possible that the individual parts of the sequence are not arranged properly. To change the arrangement of the files right click the sequence title in the "Open Movie Sequences" tab and choose "Show list of images".
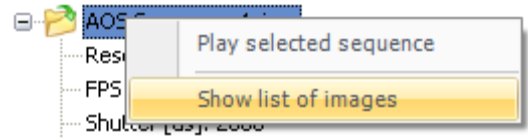
This opens a window where you can move individual parts up or down by selecting an file name and clicking "Move up" or "Move down" or resort the whole list alphabetically with the buttons "Sort ascending" and "Sort descending".
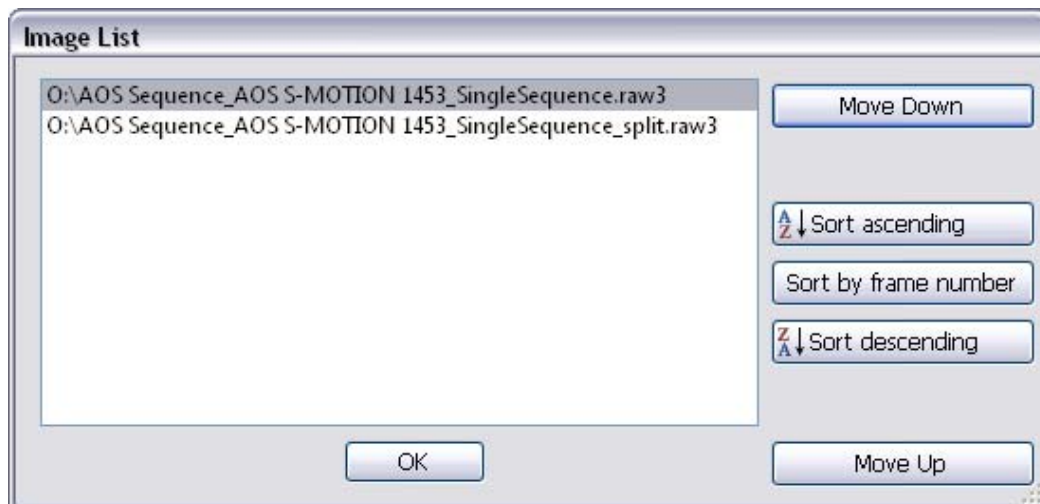

6.2   Opening single image sequences

To open a sequence consisting of multiple single images select the last image of the sequence you would like to open, hold the Shift key and click the first image then.

To rearrange the images opened right-click on the title of the single image sequence and choose "Show list of images".

In this window you can move individual images up or down by selecting an image and clicking "Move up" or "Move down" or resort the whole list alphabetically with the buttons "Sort ascending" and "Sort descending".
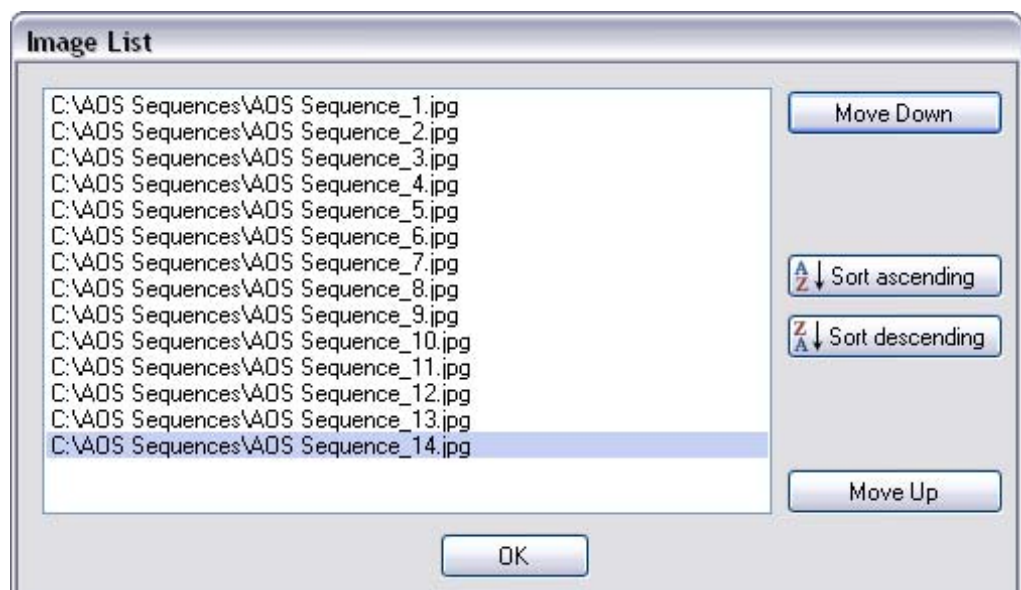
7   Point and click measurement

Imaging Studio provides easy to use motion analysis tools to track moving objects or to measure distances and angles in the image. These measurements can be stored as an overlay with the image and exported to a CSV file for further calculation of speed, acceleration, etc.

To use these functions open the "Point and click measurement" window on the right hand side of the application.

At the bottom of the tab the coordinates of the mouse pointer are displayed. "Display Points" and "Display Lines" selects which image overlay to display together with the measurement points.

7.1   Calibration

To perform a measurement or tracking the first step is to calibrate the plane in which the measurements will take place. Select an object for which the distance is known and follow these steps:

1.   Click the Calibration button.

2.   In the image, place the cursor on the starting point of the distance and click the left mouse button. Move the cursor to the end of the known distance and left click the mouse again.

3.   Type the calibration distance in the "is equal to" text box and use the drop down list to select the unit of measurement.

7.2   Distance Measurement

The "Distance Measurement" allows the measurement of any distance in the frame. To do a measurement follow these steps:

1.   Click on the "Distance" button.

2.   Place the cursor on the image and select a reference point by clicking the left mouse button. All measurements are in reference to the reference point "R".

3.   Select another point as your measurement distance "D" by clicking the left mouse button again.

The length of this distance from "R" to "D" is displayed in ΔX, ΔY and X-Y next to the "Distance" button.

7.2.1 Measure multiple distances – manual tracking

To measure multiple distances or get coordinates of points click the "Add points" button. Now use the left mouse button to add more points to the image.

To move a point, just use the mouse pointer and drag the point.

The table below the "Add points" button shows all points with their coordinates and the distance to the reference point.

7.3 Angle Measurement

The "Angle Measurement" allows the measurement of an angle in the frame. To do a measurement follow these steps:

1. Click on the "Angle" button.

2. Place the cursor on the image and select three or four points by clicking the left mouse button.

The angle is displayed in degrees next to the "Angle" button. To move a point, just use the mouse pointer and drag the point.
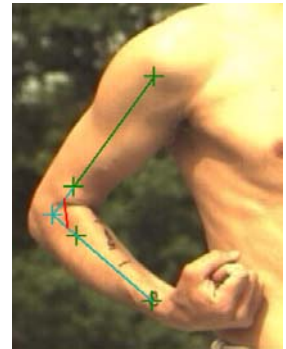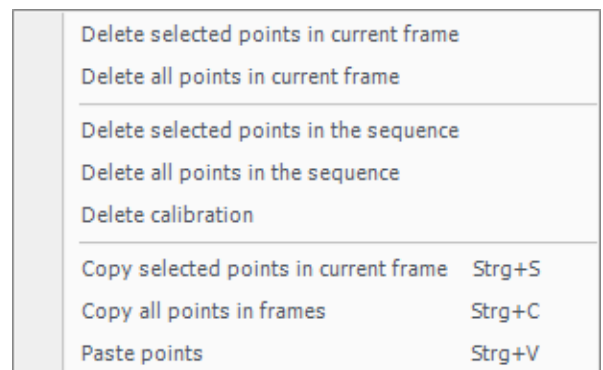
7.4 Switching between frames, copying and deleting points

Use the following shortcut keys to select, copy and paste points between frames:

Shift + left mouse button: **Select** points

Ctrl + left mouse button: **Copy selected** points and **jump to previous** frame

Ctrl + right mouse button: **Copy selected** points and **jump to next** frame

Ctrl + Alt + left mouse button: **Copy all** points and **jump to previous** frame

Ctrl + Alt + right mouse button: **Copy all** points and **jump to next** frame

Ctrl + S: **Copy selected** points

Ctrl + C: **Copy all** points

Ctrl + V: **Paste** points

A click in the image with the right mouse button opens the following menu to delete, copy and paste points:

Delete selected points in current frame	
Delete all points in current frame	
Delete selected points in the sequence	
Delete all points in the sequence	
Delete calibration	
Copy selected points in current frame	Strg+S
Copy all points in frames	Strg+C
Paste points	Strg+V

7.5 Exporting and importing measurements

All points and measurements can be exported to a CSV file for further calculation of speed, acceleration, etc.

To export the measurements click the "Export to CSV" button. This CSV file can be opened in Microsoft Excel and does look similar to the following:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	camera name	save date	fps	width	height	frametime frame 1	filesize							
2	AOS X-Motion 727	12.08.2010 12:37	500	1280	1024	12.08.2010 12:33	0							
3	calibration from X	calibration from Y	calibration to X	calibration to Y	calibration distance	calibration unit								
4	1079	145	1000	326	20	cm								
5	frame number	delta-t	time elapsed	frametime	IRIG day	IRIG time	status 1	status 2	status 3	status 4	Point R X [px]	Point R Y [px]	Point D X [px]	Point D Y [p>
6	2	0.002	0.002	Thursday, August 12th 2010 12:33:41.954			0	0	0	0	880	264	648	35
7	3	0.002	0.004	Thursday, August 12th 2010 12:33:41.956			0	0	0	0	880	264	648	35
8	4	0.002	0.006	Thursday, August 12th 2010 12:33:41.958			0	0	0	0	880	264	670	38
9	5	0.002	0.008	Thursday, August 12th 2010 12:33:41.960			0	0	0	0	878	249	656	40
10	6	0.002	0.01	Thursday, August 12th 2010 12:33:41.962			0	0	0	0	934	229	664	38
11	7	0.002	0.012	Thursday, August 12th 2010 12:33:41.964			0	0	0	0	939	211	693	45

Use standard Excel commands for further calculations.

To import a CSV file which was generated earlier to the original RAW3 file use the "Import from CSV" button.

8 Motion detection

The Imaging Studio software does offer an optional motion detection feature. With this feature activated the camera can generate an event when a specified area of the image changes in brightness, e.g. when a part passes this area. This event can be fed to the trigger input to release a recording.

To enable motion detection open the window on the right hand side of the application. Check "Enable Measurement" and drag a rectangle into the image with the mouse pointer.

The brightness of the chosen rectangle is shown as a red triangle below the slider in the motion detection window. The brightness of the rectangle is also displayed as a value between 0 and 100 in the text box below the slider.

The two handles in the slider define the upper and lower threshold. Drag the handles to define the range of brightness where the motion detection event will be active. As long as the red arrow is between the two handles the motion detection event is not active (green rectangle in image), as soon as it is outside the event is active (red rectangle in image).

In the "Measurement Window" section of the "Motion detection" tab the coordinates and size of the measurement window are shown. The size and position of the measurement window can be changed by entering values to these text boxes or by dragging or resizing the window with the mouse pointer.

The "Measurement Rate" defines how often the brightness measurement is performed in the chose area. Available values are 90ms, 120ms and 150ms.

The motion detection event can be applied to the TRIGGERED output pin 10 or the STATUS 1 output pin 11. To apply the event, tick the corresponding checkbox and choose one of the outputs "TRIGGERED" or "STATUS 1".

If the output signal of "TRIGGERED" or "STATUS 1" is connected to the TRIGGER input pin 7 the camera will trigger as soon as the motion detection event is fired.