FASTEC IMAGING™

HiSpec 1 through 5 Series High-Speed Cameras

Operator's Manual

(Director 1 Version 1.11.9)

FASTEC IMAGING™

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1 General

Congratulations! A camera in the Fastec HiSpec high-speed camera series is an excellent choice, because HiSpec's are extremely versatile, advanced and self contained digital camera systems.

This manual provides information about the features and operating modes of HiSpec cameras.

1.1 Essentials of HiSpec

With HiSpec cameras, high-speed processes and events can be continuously recorded and stored at up to more than 100,000 images per second and can be displayed and analyzed in detail immediately after the end of a sequence. The images are always initially stored in the internal frame memory of the camera. HiSpec cameras must be connected to a host PC via fast Ethernet for camera set-up, downloading and image playback.

1.2 Certifications

1.2.1 For customers in the U.S.A.

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 limits 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 instruction manual, 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 be required to correct the interference at his own expense. You are cautioned that any changes or modifications not expressly approved in this manual could void your authority to operate this equipment. The shielded interface cable recommended in this manual must be used with this equipment in order to comply with the limits for a computing device pursuant to Subpart J of Part 15 of FCC Rules.

1.2.2 For customers in Canada

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

1.2.3 Pour utilisateurs au Canada

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

1.2.4 Life Support Applications

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Fastec Imaging customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Fastec Imaging for any damages resulting from such improper use or sale.

1.3 Declaration of conformity

Manufacturer: For Fastec Imaging by Mikrotron GmbH
Address: Landshuterstr. 20-22
85716 Unterschleissheim
Germany

Product: High Speed Cameras – HiSpec Series

The dedicated products conform to the requirements of the Council Directives 2004/108/EG for the approximation of the laws of the Member States relating to electromagnetic consistency. The following standards were consulted for conformity testing with regard to electromagnetic consistency.

EC Régulation	Description
EN 61000-6-3	Electromagnetic compatibility
EN 61000-6-1	Immunity

Unterschleissheim, August 1th 2008

Mikrotron GmbH
Bernhard Mindermann
Managing Director, Mikrotron GmbH

1.4 Warranty Note

Do not open the body of the camera. The warranty becomes void if the camera body is opened.

1.5 Remarks, Warnings

This document contains important remarks and warnings. See the corresponding symbols:

	**Important remark**

	**Attention, Warning**

1.6 Backside view of HiSpec 1 and HiSpec 4 cameras

1.6.1 The rear of the camera

The identification type plate is to be found at the rear of the camera. It contains the serial number and the MAC-address for identifying the device in a network.

1.6.1.1 Connectors

There are 2 connectors and 1 LED mounted on the rear of the Camera. The pin assignments of these connectors are described in chapter 8.2 Connector assignments.

1.6.1.2 LED's

The color LED of HiSpec the actual operating condition is indicated. Three colors are possible, (and off-state):

RED
GREEN
ORANGE

1.6.1.2.1 LED: internal camera state

Color	LED-state	Camera state
RED	constant	Boot procedure failure. Switch off the camera and try again.
GREEN	constant	Ready for the first recording after power up.
ORANGE	blinking	Circular recording in progress, waiting for stop.
ORANGE	steady	Circular recording stopped. Wait for next start signal.

1.6.2 The front of the camera

The C-mount, (optional „F-Mount"), for the lens is located at the front of the camera.

1.7 Scope of delivery

The following components are included as part of the delivery:

- 1 ea. HiSpec camera, version as ordered, see selection below
- 1 ea. 110-220V power supply
- 1 ea. USB thumb drive with HiSpec Director 1 software

- 1 connector for signal Input

1.8 Power supply

Use an external power supply for external power operation.

	Only voltages in the range from 10.5 to 30 Volts @ 7.5W are permitted. Higher input voltages may seriously damage the camera. Damage of this type is not covered by our warranty.

1.9 HiSpec Models:

Model	Color /B&W	Standard Record time	Max. Resolution	Max. frame-rate [fps]	Lens Mount
HiSpec 1	Both	3.2	1280x1024	112,183	C or F
HiSpec 2	Both	6.5	1280x1024	112,183	C or F
HiSpec 3	Both	3.0	1280x1024	83,500	C C or F
HiSpec 4	Both	1.4	1696 x 1710	298,851	C or F
HiSpec 5	Both	2.8	1696 x 1710	298,851	C or F

2 Operating Modes

2.1 Ready-to-operate

By means of the HiSpec software, (control program), the camera can be set up for recording in different operating modes.

If the camera is disconnected from the PC, reconnect it and press the reconnect button in order to establish the GigaBit Ethernet link.

ⓘ	It is very important to press the reconnect button after the camera is reconnected with your system. If this button is not pressed after reconnection the chronology of a meanwhile recorded sequence may be lost! The same applies to a completed recording session that has been started with the camera's trigger switch.

HiSpec holds 2 GBytes internal frame memory. From this memory, a very small part, (only as much as required by one frame), is used for storing the frames for the live mode. The remaining memory is used for sequence recording.

2.1.1 Live mode

The camera images are continuously recorded and displayed. This mode is optimal for defining image detail, adjusting the focus and setting up the various camera parameters. Switch the camera to live mode by pressing the "Live" button.

2.1.2 Prepare for recording

When the camera parameters are adjusted according to the user's needs while the camera is connected to the PC, the camera can be disconnected now from the PC and recording can be started via the trigger switch on the camera.

2.1.3 Start recording

After power up, the camera starts with the last used settings. If you need another resolution/frame speed, the new parameters must be entered via the HiSpec control software.

To start the recording, press the red **start recording** button in the HiSpec control  program

2.1.3.1 Recording modes

HiSpec has 2 recording modes. The difference is the usage of the camera's image memory.

2.1.3.1.1 Non-circular recording mode

The camera stops recording when the internal frame buffer is full.

2.1.3.1.2 Circular recording mode

The camera records frames in a circular mode, (i.e., the oldest frames are always overwritten by the newest), and waits for a signal to stop. There are 2 methods to stop recording:

1. Apply a trigger signal, (rising or falling edge, depends on setting "Trigger edge" in form "Camera Setup"), to the appropriate camera input connector.
2. Press the **Stop** button in the HiSpec control  program

3 Installation of HiSpec

3.1 Minimal system requirements (PC)

For error-free operation of HiSpec the following minimum PC specifications are required:

- Pentium III 1GHz CPU with MMX-technology
- Windows 2000 or XP operating system
- 256 MByte PC Ram
- 10 GBytes Hard disk
- 8 MByte graphic memory
- Display with 1280 x 1024 pixels
- GigaBit Ethernet Adapter

For optimal operation of HiSpec, a PC with the following minimum specifications is recommended:

- Pentium IV 1.8 GHz

- Windows XP / Vista
- 1Gbyte PC Ram
- 40 GBytes Hard disk
- 32 MByte graphic memory
- Display with 1400 x 1050 pixels24 Bit
- GigaBit Ethernet Adapter

3.2 Installation of the software

The GigaBit Ethernet adapter and driver should be installed before the HiSpec software is installed. For details see the GigaBit Ethernet adapter manual.

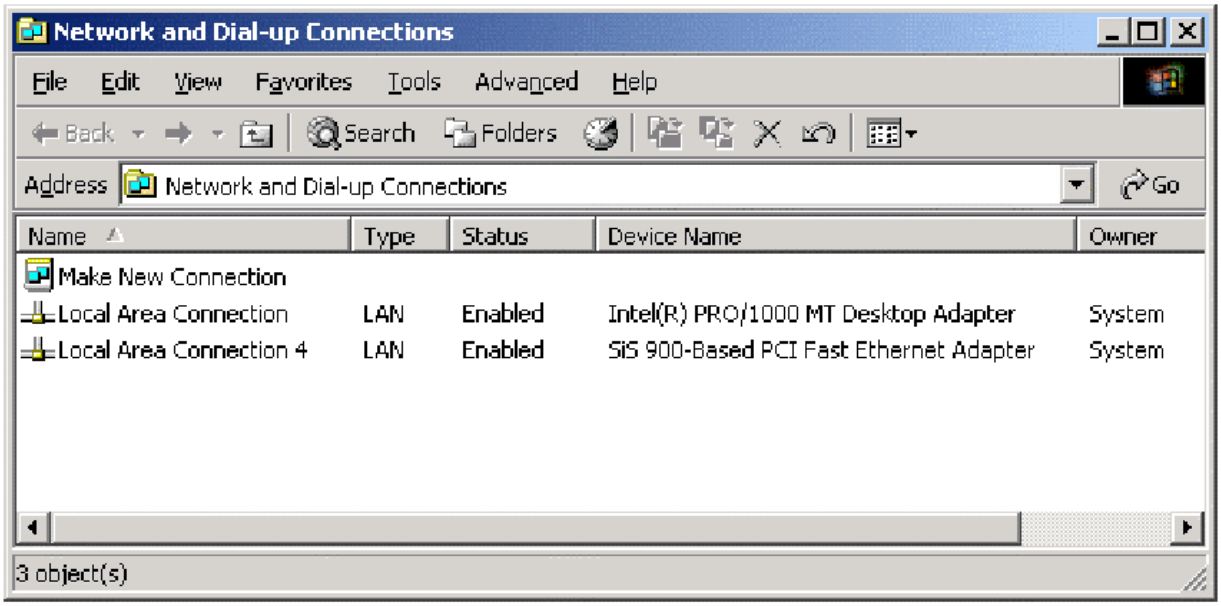
Insert the HiSpec Setup-CD in the CD-Rom drive on the PC. Start the setup.exe program and follow the instructions through the rest of the installation process. After successful installation some network settings may be necessary, depending on the actual network configuration. These settings are needed for assigning an IP-address to the GigaBit Ethernet adapter and to the camera and described in the next chapters.

3.2.1 Assigning an IP-address to the GigaBit Ethernet adapter

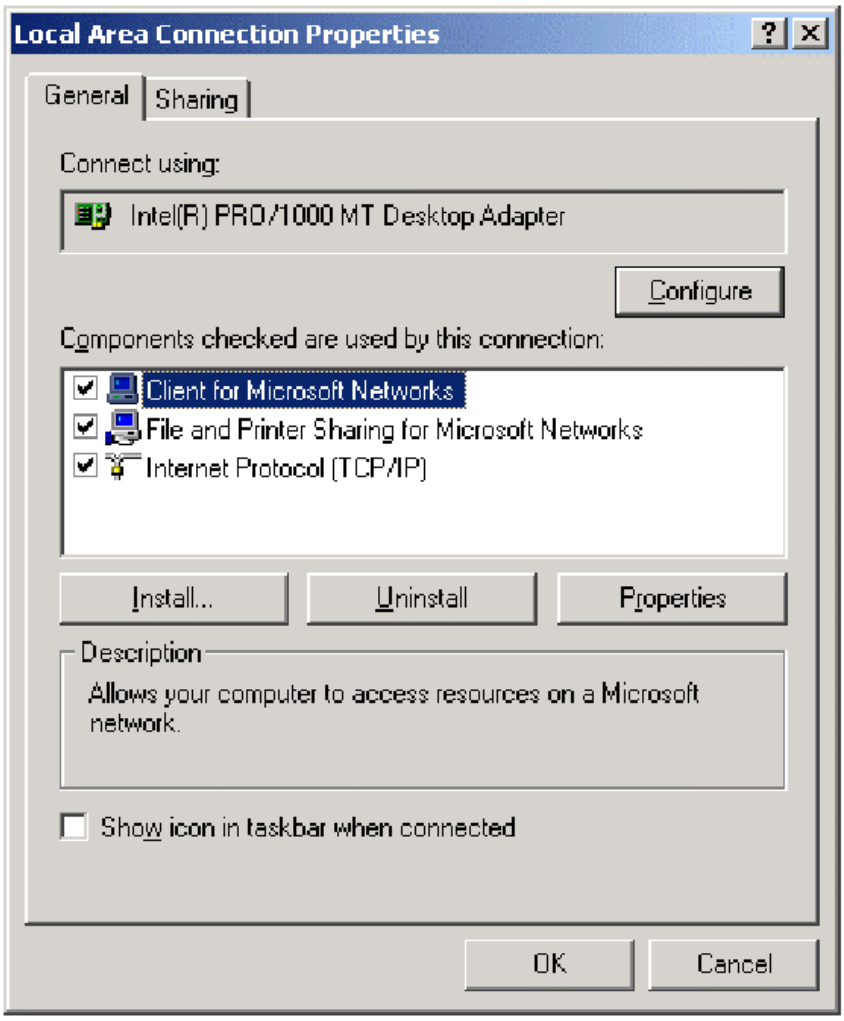
Assigning an IP-address to the adapter is only necessary, if no bootp-server is installed in your network.

To assign an IP-address, perform the following steps:

1. Close all HiSpec applications.
2. Open the "Network and Dial-up Connections" window from the Windows Control Panel.



Right click on the desired connection in the panel and click the "Properties" item. The properties dialog for the connection, shown in the next figure on the next page, will be displayed.



- Highlight the Internet Protocol (TCP/IP) by clicking on the text-part, not on the check-box.
- Click the "Properties" button. The next dialog will allow you to assign an IP-Address and the subnet-mask of the Gigabit network-adapter. See details on next page in chapter "3.2.2.2.1 Assign IP-Address 192.168.2.1 to the Gigabit Network adapter".

3.2.2 IP-Address of the camera

Some settings are required depending on the Ethernet configuration.

3.2.2.1 Bootp-server installed

The IP-address for the camera is assigned by the server. No other settings are necessary.

3.2.2.2 No bootp-server installed

3.2.2.2.1 Assign IP-Address 192.168.2.1 to the Gigabit Network adapter

After assigning the IP-Address 192.168.2.1 to the network adapter, set the subnet-mask to 255.255.255.0.

Later on, in the HiSpec program, the IP-address 192.168.2.2 will be automatically assigned to the first camera used. No other settings are necessary.

3.2.2.2.1.1 Assigning a different IP-Address to the HiSpec camera

The camera-network configuration file "mfggb.ini" contains a section called [CAMERA_REL] which resides in the installation directory.

The entry:

##CameraIP00=192.168.2.2

Can be found in this section. Delete the comment characters '##' and change the address "192.168.2.2." to the desired address.

Example:

The Network adapter has the IP-address **193.122.3**.9. An IP-address for the camera should be assigned, where the network part of the network adapter's address and the part of the camera's address must be the same. How many octets cover this part depends on the network address class:

Class A (beginning with 0…127) the first octet,
Class B (beginning with 128…191) the first and the second octet,
Class C (beginning with 192…223) the first, second and third octet.

In our example, **193.122.3**.10, which is Class C, would be OK, because **192.122.3** are the same in both addresses.

The entry in "mfggb.ini" could be:

CameraIP00=193.122.3.10

Be aware of address conflicts with other devices in the network!

3.2.3 The network configuration file "mfggb.ini".

As mentioned in the paragraph above, "mfggb.ini" resides in the installation-directory and contains 2 sections.

3.2.3.1 Section [CAMERA_REL]

This Section contains the MAC Address of the used camera and network adapter. The addresses will be registered by the HiSpec control program; no changes are to be done by the user.

Example:

```
AdapterMAC=00-0E-0C-4C-E2-F0
CameraMAC00=00-50-C2-1D-7E-20
```

Beside this, the camera's IP-Address may be defined here. See above for details.

3.2.3.2 Section [IPORT_PARAMS]

```
##InterPacketDelay=2000          // single camera on a Laptop computer
##InterPacketDelay=6000          // camera is connected to an existing LAN
##InterPacketDelay=100           // Default
InterPacketDelay=3000       // Ethernet-switch
PacketSize=1440
RequestTimeOut=1000
PacketTimeOut=1000
AnswerTimeOut=1000
FirstPacketTimeOut=0
TabQuantity=2
COMDelay = 100                  // in us
```

Depending on the system, use the appropriate parameter for the InterPacketDelay.

3.3 Connecting the HiSpec to the PC and starting program

To properly connect the camera to the PC please follow these steps:

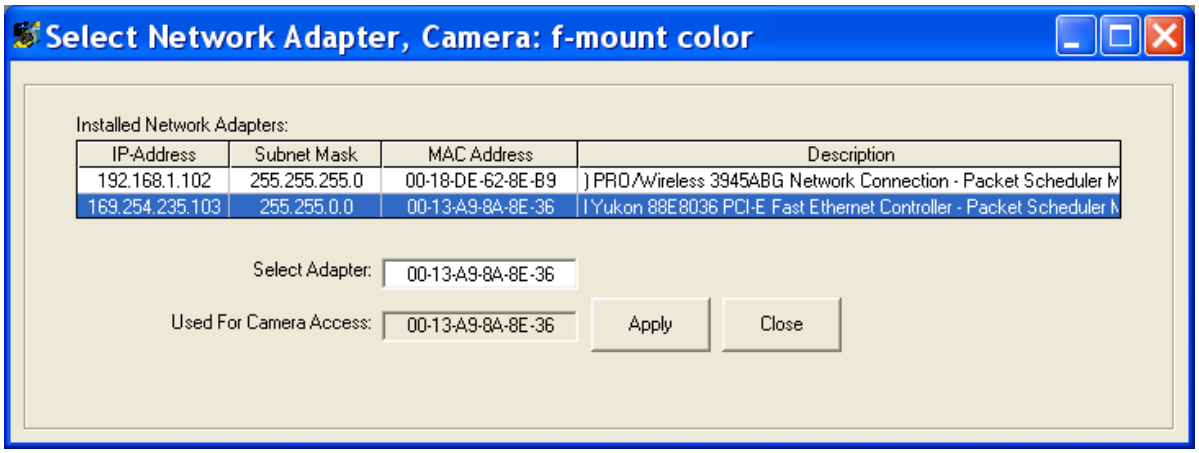
1. Connect the GigaBit Ethernet cable to the camera and then to the PC.
2. Connect the power supply to the camera.
3. Start the HiSpec Control program. If it's the first start after installation of the HiSpec software, two forms will be displayed for selecting the GigaBit Ethernet adapter and the HiSpec camera. Please select the net-

work adapter, click on "Apply" and select the camera and click on "Apply".

The HiSpec is now ready to operate.

3.3.1 Selecting the network adapter

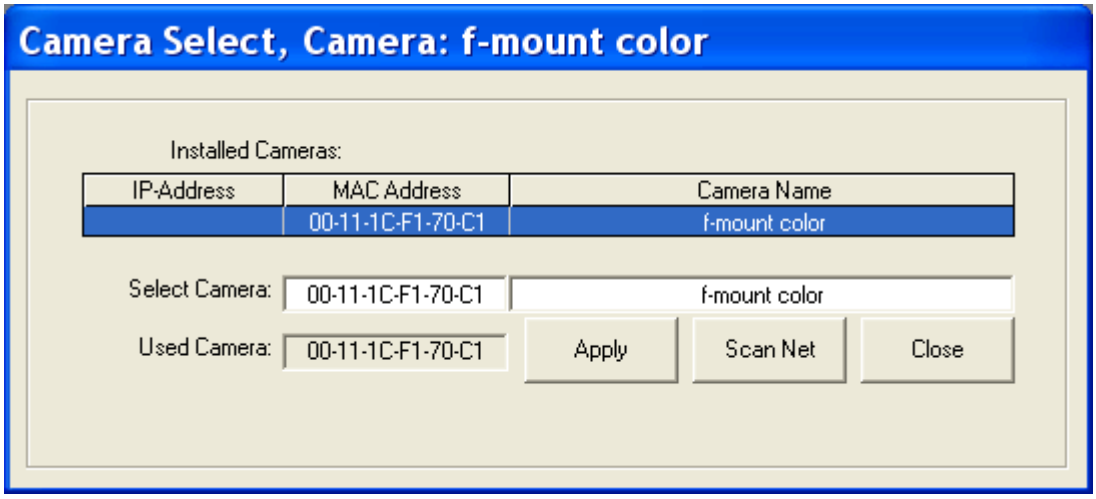
The form for selecting the network adapter will be shown automatically after the first start of the HiSpec program after its installation. You may load this form in the Camera menu, ("Select Network Adapter") as well.



Assign the network adapter for use with the program by clicking on the appropriate line in the "installed network adapters" list and clicking on "Apply and proceed". In the next step, the form for selecting the camera will be shown automatically, if it's a program start without successfully selecting a camera before:

3.3.2 Selecting the HiSpec camera

The form for selecting a HiSpec camera will be shown automatically after the first start of the HiSpec camera control program after its installation. You may load this form in the Camera menu, ("Camera Select"), as well, if you want to switch to another camera.



Assign a camera for use with the program by clicking on the appropriate line in the installed cameras list and clicking on "Apply (and proceed)". After the next automatic steps with the initializations for the hardware the system is ready for use.

3.3.3 Camera name

If you would like to use a name for your camera, you may enter this name in the "camera name" field of the ""Select Camera" line of the "Camera select"-form. By clicking on "Apply" this name will be used in the title of all other forms of the HiSpec program.

3.3.4 Multi camera operation

If you want to use two cameras simultaneously, you have to copy the contents of your HiSpec installation directory into a new directory and start HiSpec.exe in this new directory as a second instance of the HiSpec control program. By copying the HiSpec directory contents into another, separate directories and starting HiSpec.exe in this new directory, you may use up to four cameras simultaneously.

For connecting the cameras with your PC you should use a Gigabit-Ethernet switch. The following switches are recommended for use with the HiSpec cameras:

- SMC TigerSwitch 86xxT family
- 3COM 3C1740x (3800 famliy)
- Dlink DGS-10xxTx 10/100/1000 family
- SMC 8505 or SMC 8508
- NETGEAR ProSafe 16 Port Gigabit Smart Switch GS716T

3.3.4.1 Synchronizing cameras

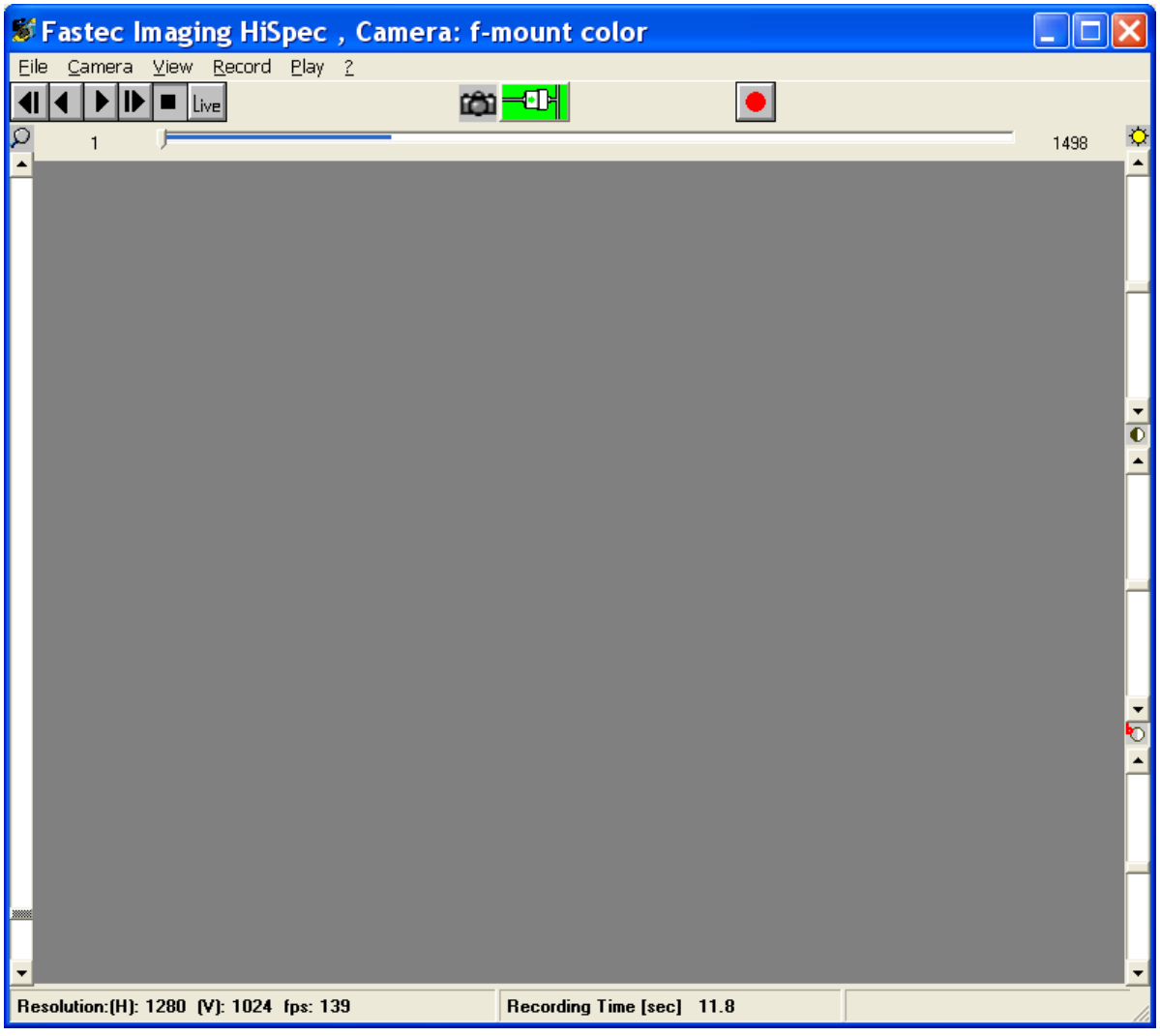
For synchronizing HiSpec cameras you only have to connect the sync output of a master camera to sync input of the slave cameras, as described in detail in “4.2.5 Enable Sync in” and “ARM or “Sync out” signal”.

4 HiSpec Operation

The full range of functions available and all camera parameters may be set by means of the HiSpec software.

4.1 The user interface

The camera is completely controlled through the user interface. All parameters of the camera for recording, playback and saving the frames after recording may be adjusted here. After recording, stored sequences of images maybe subsequently edited. Start the software by double clicking on the appropriate HiSpec symbol on the PC desktop or choose the application in the windows start menu. The following screen mask will appear:



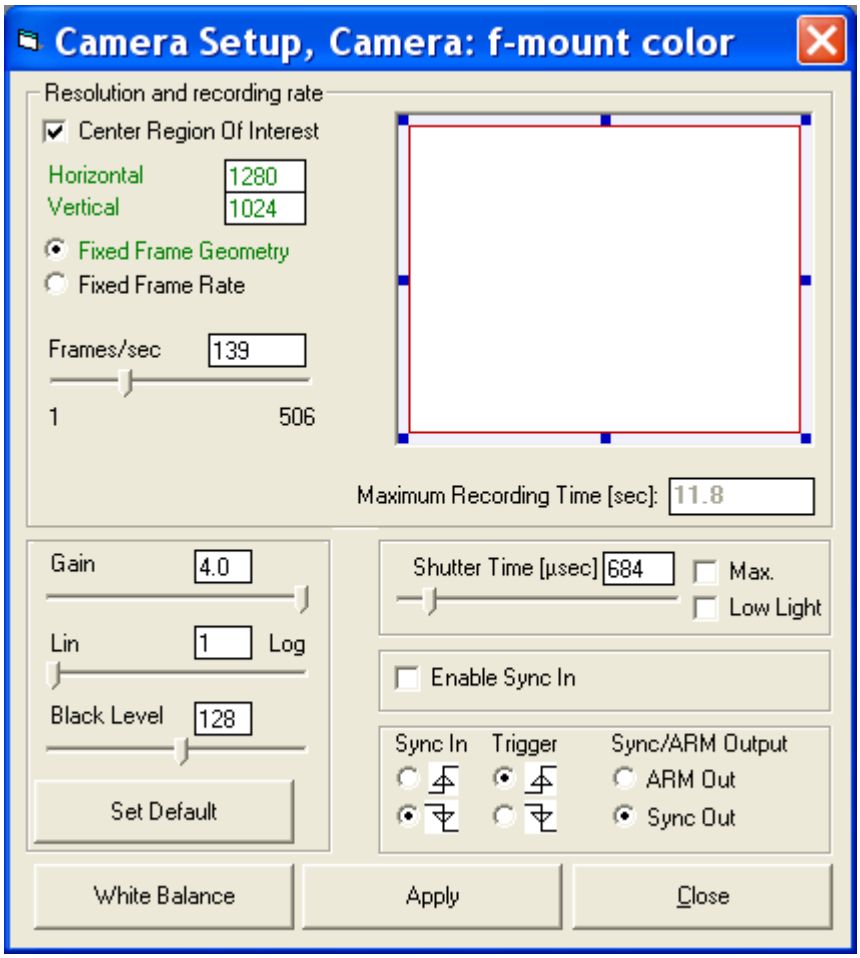
Select modes of operation or change parameters by pressing a command-button or by selecting an item in a pull down menu. If the mouse cursor is moved slowly over the command buttons and symbols, information about each object will be displayed ("tool tip text").

4.2 Selecting resolution, speed, gain, trigger, sync, ARM and white balance

Click on the menu item "Camera" => "Camera Setup". This form shown below will appear:

HiSpec cameras

Setup adjustments for HiSpec cameras in the following form:



Once the changes to the parameters for **resolution and frame rate** are set, click on "**Apply**".

	Changes of resolution or frame rate may alter the quality of recorded images. Be sure that you have saved your recorded images to file before applying these changes because afterwards the images may be destroyed or lost!

Now the new parameters will be sent to the camera. **All other parameters**, e.g. shutter time or analog gain, will be **sent immediately to the camera** after entering.

If there is no connection to the camera, an error message will appear. Please make sure the camera is connected correctly. If a link is not established by clicking on the reconnect button, read more in chapter "7, Troubleshooting".

4.2.1 Gain

The gain may be adjusted with a slider up to 4. But please note: the quality of the image decreases the more you increase the gain.

4.2.2 Black level

With the black level parameter, (controlled with slider or text field), you may adjust the camera's image sensor base black level. The base black level must be set to a value between 0 and 255. Setting to the correct value, the sensor will deliver the pixel value 0, (which means totally black), for a complete black image.

If the value is too small, the sensor will deliver a pixel value above 0, (which means gray).

If the value is too big, the sensor will deliver a pixel value 0, (totally black) for images that are gray and not completely black.

The white balance form, (for color cameras), or the histogram form, (for monochrome cameras), is a good tool for adjusting the black level:

In live mode, close the lens of the camera for getting a completely black image, adjust the black level until the black line in the white balance or the histogram touches the "min" border of the chart.

4.2.3 „Lin Log" (for colour cameras only)

With the "Lin Log" parameter you may adjust the sensor's characteristic in order to avoid overexposure of very bright parts in the image.

If the slider is moved to 1, („Lin"), the sensor's characteristic is linear and normal illuminated scenes will be properly displayed.

If there are very bright areas in the scene, then the image will be overexposed and details may be lost. In this case you should move the slider to-

wards “log”(arithmic) whereby details in bright parts of the image will become visible again. The correct setup value depends on the brightness spreading of your motif. In normal illuminated scenes you should use “Lin”.

4.2.4 Low Light Mode

In low light mode the camera's exposure-time is extended up to 1023 milliseconds in order to increase its sensitivity. This mode is good for setting up the frame size and the focus in live-mode. Select your exposure-time with the slider "shutter time" or input it directly in the appropriate number-field. Low light mode will be automatically finished if a recording is started.

4.2.5 Enable Sync in

With “Sync in” enabled it is possible to synchronize a HiSpec camera with other HiSpec cameras.

- Connect the Sync out of your HiSpec master camera to the slave cameras,
- Connect the ground of the master camera with the ground of the slave cameras,
- Select a frame rate for the slave cameras that is slightly above the master cameras frame rate. Thus the slave cameras will be synchronized with the master camera.

4.2.5.1 Frame rates of master and slave camera

If you synchronize a slave camera by a master camera, then the frame rate of the slave camera must be slightly above the master camera's frame rate, (as mentioned before), otherwise the slave camera will not provide the same frame rate as the master camera.

Example:

You want to record with 500 frames per second. Adjust the master camera to the desired 500 fps, select 506 fps for the slave camera. Then the slave camera will deliver the master camera's frame rate (500 fps)!

ⓘ	If "Sync in" is enabled and no "sync in" signal is provided, the camera will not record and timeout will occur! The frame rate of the slave camera must be slightly above the master camera's frame rate: Slave camera should be set up to frame rate that is at least 2 fps higher than the master camera's frame rate.

4.2.6 ARM or "Sync out" signal

You may choose between "ARM" or "Sync out" signal for pin 3 of the output connector, (see 8.2.1 Power Signal Connector of HiSpec Page 63).

4.2.6.1 Sync out activated

If you select "Sync out", it is possible to synchronize other HiSpec cameras. The rising edge of the signal provided on pin 3 shows the beginning of the exposure of the master camera's image, the falling edge the end.

4.2.6.2 ARM activated

If you select "ARM", you get a signal if the camera is ready for triggering in the circular recording mode.

With the two check-boxes on the right side of the Sync out/ARM you may define if ARM is active high or low. Please note: this does not apply to the "Sync out" signal.

4.3 Set up a scene

Click on the "Live"-Button to get a live image from the camera. The camera may now be focused and aligned for the details of the scene. You may use low light mode to increase the camera's sensitivity, (available only in live mode because on the other side the frame rate will be decreased!).

4.4 Recording in non-circular mode

Non-circular mode is selected in menu "Record" => "record setting" => "non circular..". To start, click on the red button. Now the camera starts recording and stops when the internal buffer is full. During recording, the recorded frames are displayed simultaneously. After recording, the first, (oldest), recorded frame will be displayed.

4.5 Recording in circular mode

Circular mode should be used if a trigger is applied. The trigger may be:

- a TTL trigger signal,
- the ImageBLITZ software,
- the clicking on the stop button in the HiSpec control software.

A trigger is necessary if images are needed before and/or after an event. The trigger defines the point of time of your event.

Circular mode is selected with menu "Record" => "record setting" => "circular..". There are 2 methods to start and 3 various methods to stop the circular recording as described in the next chapters of this manual. In circular recording mode the recorded frames are displayed simultaneously. The number of frames that will be recorded before the trigger, called "**pre-trigger frames**", is determined in menu "Record" => "record setting" => "circular.."=> "Trigger Position ,Before [Frames]".

After recording, the frame immediately after the trigger will be displayed, the timestamps will be set in relation to the point of time of the trigger-moment, i.e. the first frame after the trigger is set to 0 ms. Negative values indicate that the displayed frame was recorded before the trigger, positive values indicate frames after the trigger, called "**post-trigger frames**"

4.5.1 Start recording

There are two ways of starting a recording:

1. Press the Start/Stop recording switch on the camera.

   In this case, a reconnect has to be accomplished after the completion of the recording sequence in order to save the chronology of the pictures.

   Press the **start** recording button in the HiSpec control program.

The internal camera state LED, (see 1.6.1.2.1 on page 11), will start flashing orange. This indicates that recording is in progress and the camera is waiting for the trigger to complete the sequence.

4.5.2 Stop recording

There are three ways to stop recording:

1. Press the Start/Stop recording switch of the camera.
2. Apply a trigger signal to the appropriate camera input connector.
3. Press the **stop** button in the HiSpec control program.

The internal camera state LED, (see 1.6.1.2.1 on page 11), stops blinking orange. The sequence is complete after the post-trigger frames have been recorded.

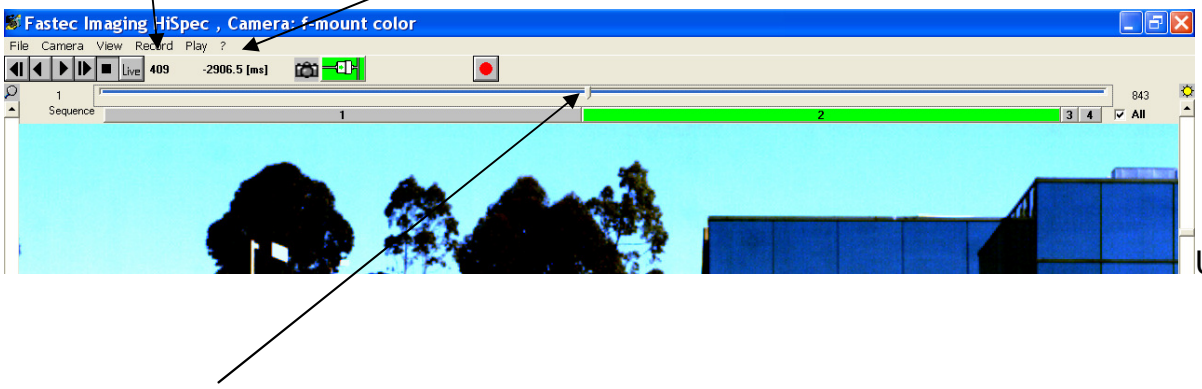
4.6 Playback of a sequence

The frames in the camera may be accessed after recording. If the camera has been disconnected from the PC's GigaBit Ethernet it must now be reconnected and the reconnect  button in the HiSpec control program must be clicked on.

ⓘ	It is very important to press the reconnect button after the camera is reconnected with your system. If this button is not pressed after reconnection, the chronology of a meanwhile recorded sequence may be lost! The same applies to a completed recording session that has been started with the camera's trigger switch.

Click on one of the forward or backward buttons. Now the frames will be displayed. Alternatively the play settings menu may be used for selecting the frames.

The frame counter shows the position within the recorded sequence.
The time stamp indicates the position relative to trigger.



Use this "frame slider" to browse through your recorded sequence.

4.7 Editing and saving a sequence

In high speed recordings usually only a portion of the frames contain relevant information. Therefore, it is useful to save only that range of frames which contains this essential information.

There are 2 methods of selecting the essential range of frames for saving:

- Enter the range of the frame numbers in the "from" and "to" input field of the "Save" or the "Make AVI" menu.
- Alternatively you may enter the frame range by means of mouse-button and control keys as described in the next chapter.
- The selected range will be shown as a blue bar in the frame slider.
- Create a list of frames in the "Play settings" menu.
-

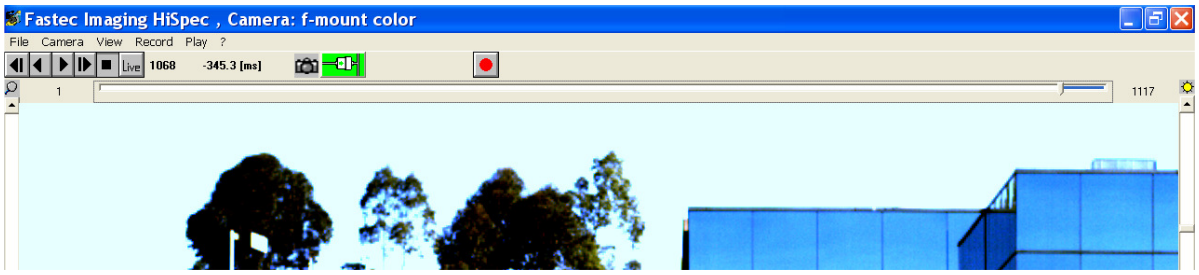
The sequence may now be saved as single bmp-files in the "Save" menu or as an AVI-file in the "Make AVI" menu. See chapter 5.4.2 and 5.4.3 on page 41 and page 43 for details.

4.7.1 Editing a sequence by using frame slider or keys

If the frame slider has the focus you may use the mouse buttons or the key "b", "e" and "l" for editing a sequence.

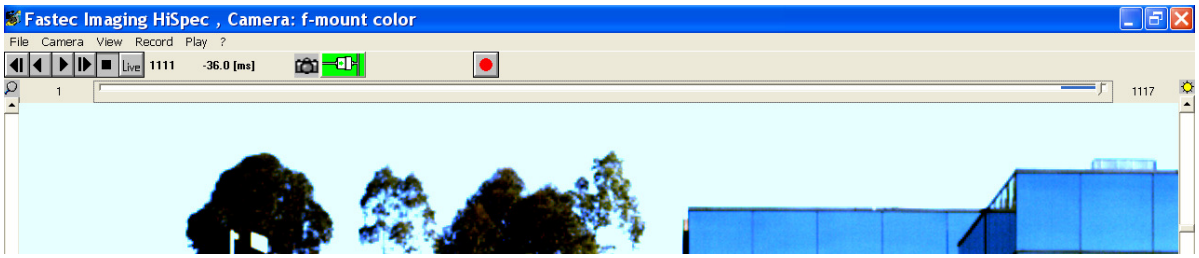
ⓘ	This method works only if the frame slider has the focus! Click on the frame slider for getting the focus

4.7.1.1 Set the beginning of a sequence



Press the right mouse button or the key "b". The actual frame number, 1068 in the picture above, will be set as a start value for the range of frames. The selected range will be shown as a blue bar in the frame slider.

4.7.1.2 Set the end of a sequence



Press the shift key and the right mouse button or the key "e". The actual frame number, 1117 in the picture above, will be set as an end value for the range of frames. The selected range will be shown as a blue bar in the frame slider.

4.7.1.3 Copy the selected range into the frame list

Press the key "l" for copying the selected range into the frame list.

4.8 Retrieving saved bmp-files

If the saved bmp-files are to be viewed, select the directory, the filename and the desired frame numbers in the "File" => "Load" menu (chapter 5.4.1 on page 39). Now the image source for displaying frames is the selected directory with the appropriate files.

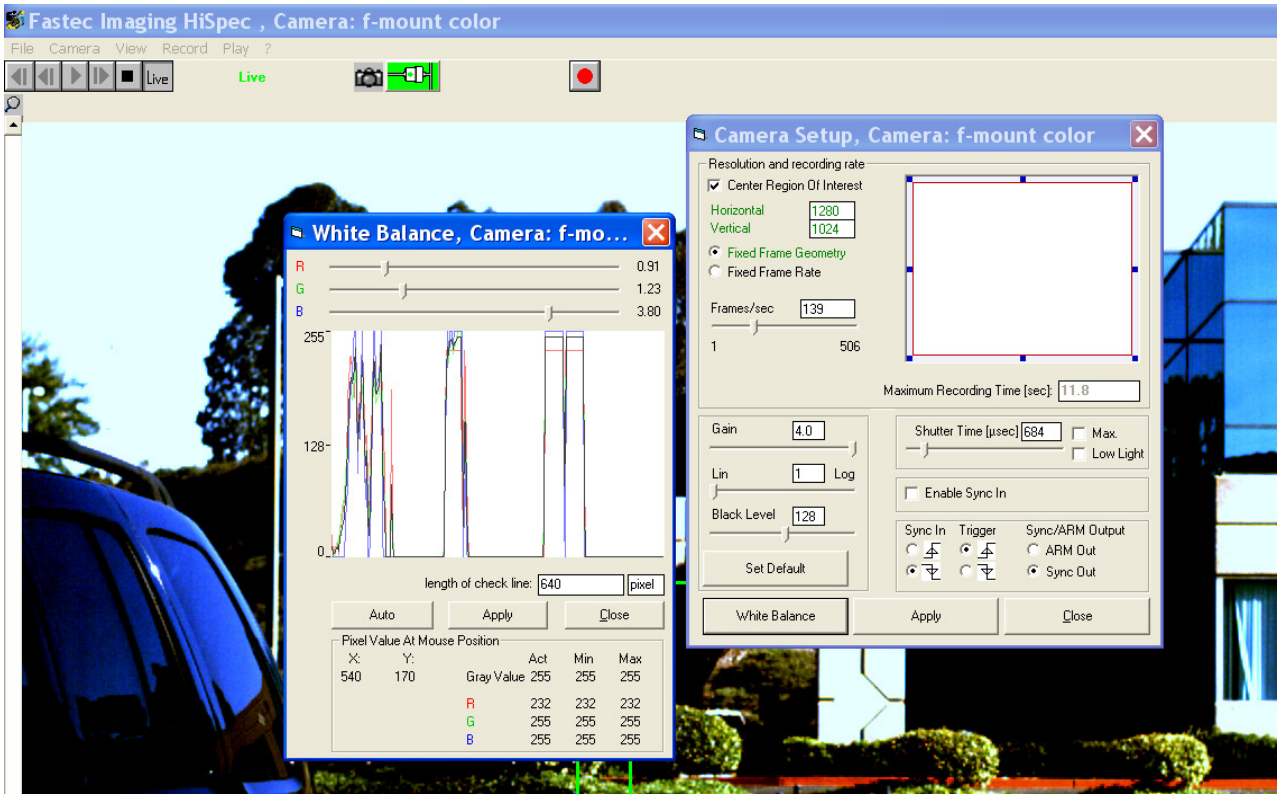
This is indicated by  the symbol in the status area of the HiSpec control-program.

The playback buttons or the "Play settings" menu allow navigation through the image files as described in chapter 4.6 on page 30.

The HiSpec camera is set as image source by clicking on the "Live" button or the red "Start Recording" button. This is indicated by the  camera symbol.

4.9 White balance / histogram / length of the check line

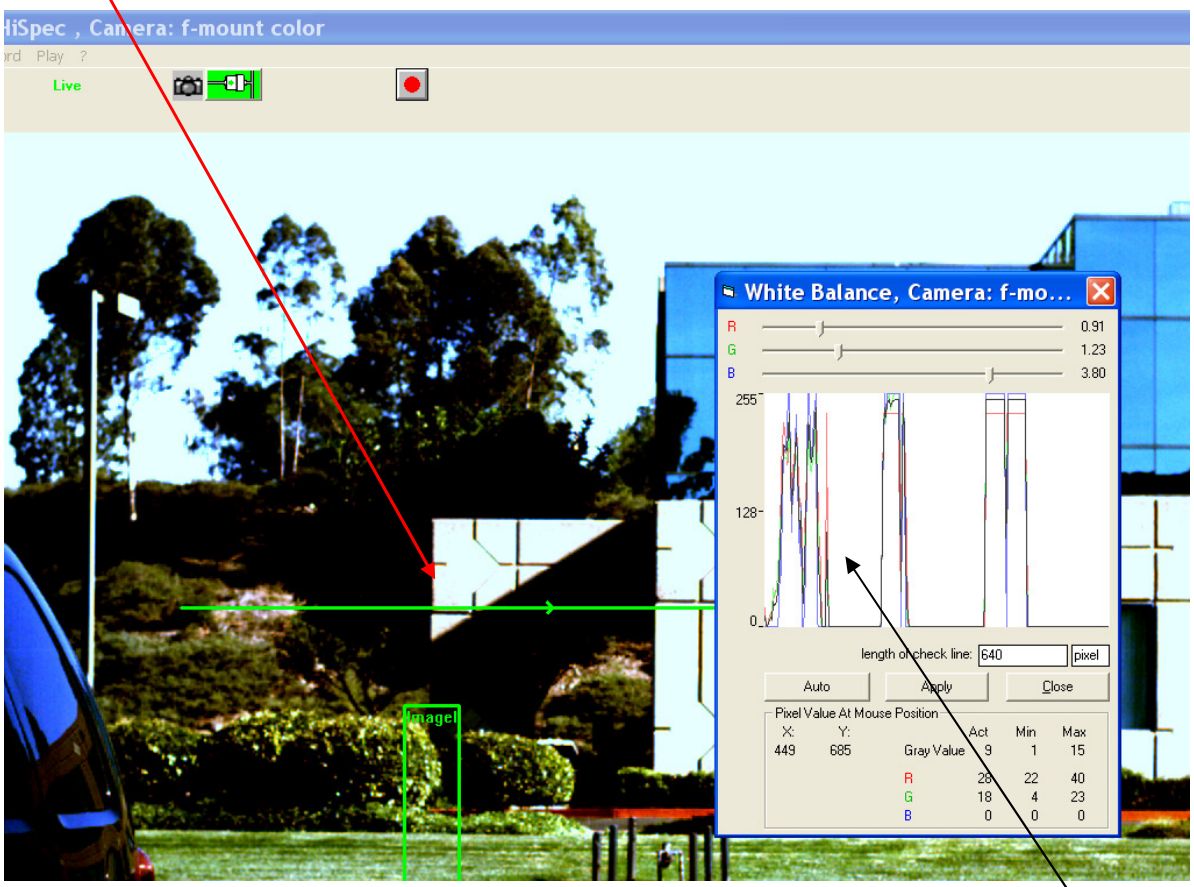
Good illumination is extremely important for optimal true color display. Best results are achieved by using daylight or halogen light. For recalibrating the color correction, click first on "Live" and then in the menu Camera Setup on the button "white balance". The following screen mask will be shown:



ⓘ	**White balance is available for color cameras only. For black & white cameras a histogram will be provided instead. The histogram contains only a chart without red, green and blue.**

4.9.1 Do the white balance manually

Adjust the size of the green check-line, which is automatically displayed in the camera image, and move this line over a white area using the mouse. (Click and hold on the line and move it).



The values of the pixels along this line will be shown as three curves – red, green and blue. Using the "R", "G" and "B"-sliders, move the three curves until they are nearly congruent as shown in the figure above.

4.9.2 Automatic white balancing

Take a picture of a scene that contains in its middle area mostly white. Click on the "Auto" button.

4.9.3 Save the white balance values in the camera

Click on "Apply" to assume these values and to save them in the camera. Click on "Close" to close the form.

ⓘ	Multiple white balancing adjustments may be performed. If the images are saved to a file, it is no longer possible to correct the color of these image-files. Only frames downloaded from the camera are correctable before saving.

4.9.4 Provide the length of the check line

The green check line may be used for approximately determining the length of distances between the starting point and the endpoint of the line. The value will be shown in the field "length of the check line". This value and its physical unit may be calibrated by entering your values in both fields.

If you know e.g. in the upper example, („204 pixel"), that this corresponds to 1.5 inch, then input 1.5 inch. From now on the pixel will be converted into inch.

5 Controls and menus in the HiSpec software

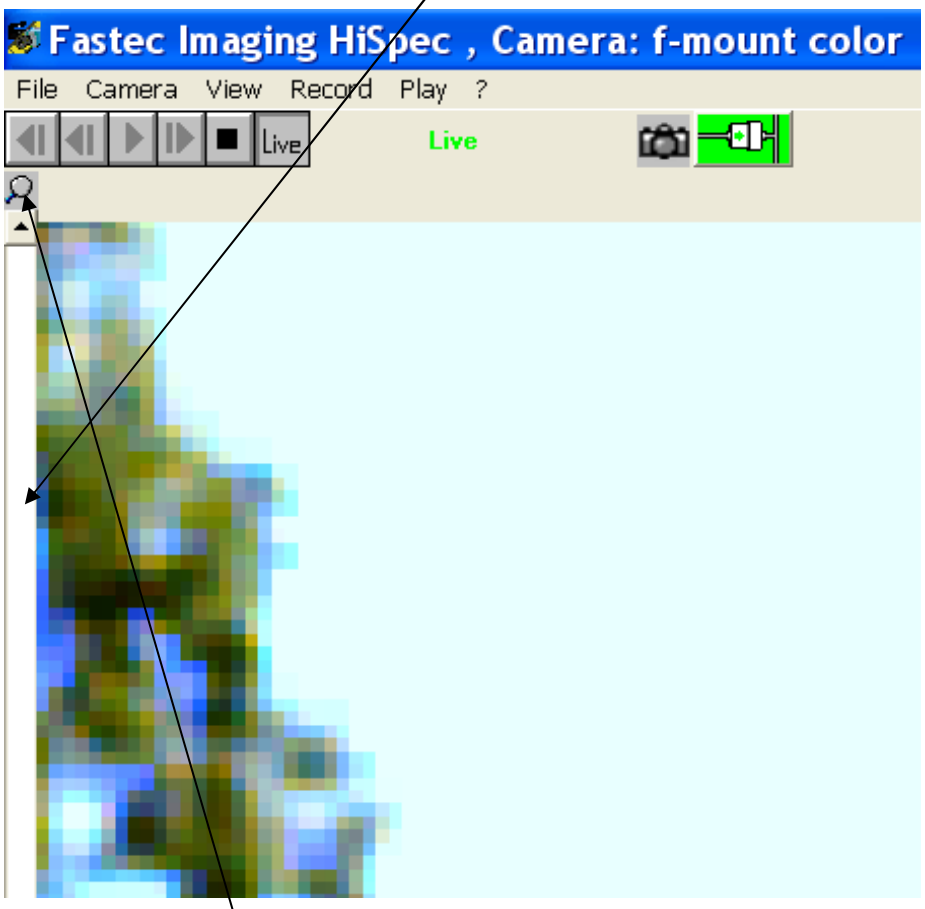
There are several menus and controls in the HiSpec program. Each will be described in the following chapters

5.1 Moving the camera image

Click with the left mouse button on the camera image. Hold the button and move the mouse. The image will move in the desired direction.

5.2 Zoom in and zoom out

For zooming, use the left vertical scrollbar. The range of the zoom factor is from 0.1 (smaller) to 10 (bigger) than the original.

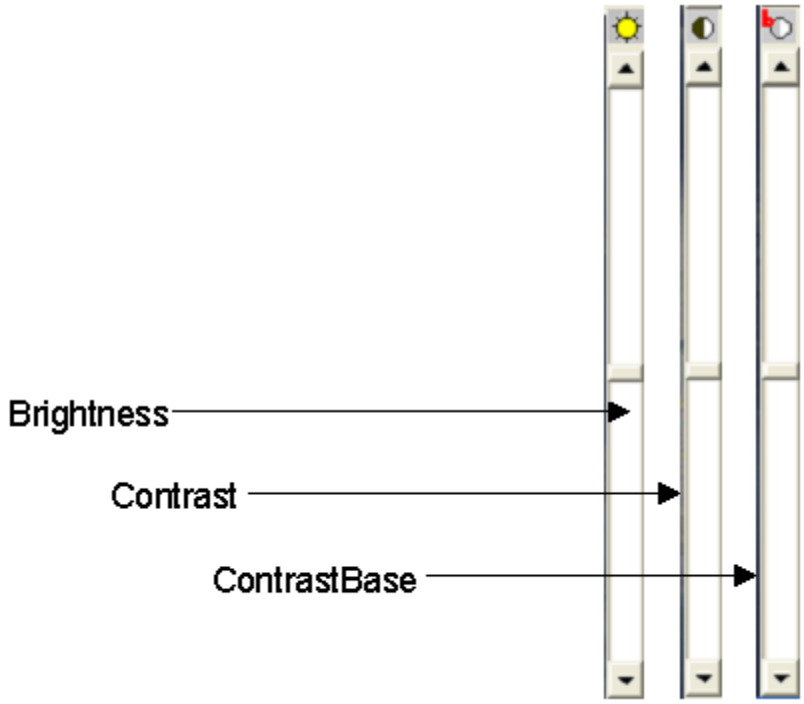


Click on the zoom icon for the original size. The number next to the zoom icon

indicates the actual zoom factor. Double-click on the icon to fit the image into the form. The icon gets green to indicate this.

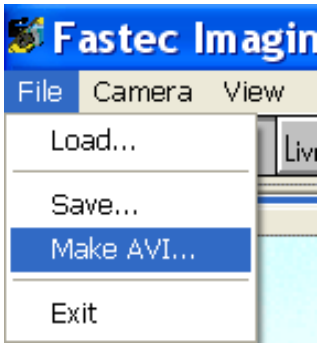
5.3 Brightness and contrast

The brightness of the image, (right top vertical scroll bar), and the contrast, (right middle vertical scroll bar), are set. By clicking the scroll bar symbols with the left mouse button, the initial state of the appropriate parameter is set. Adjust the base value for the contrast computation using Contrast Base. This is needed only in special light conditions.



ⓘ	Changes to contrast and brightness are relevant for the saved frames!

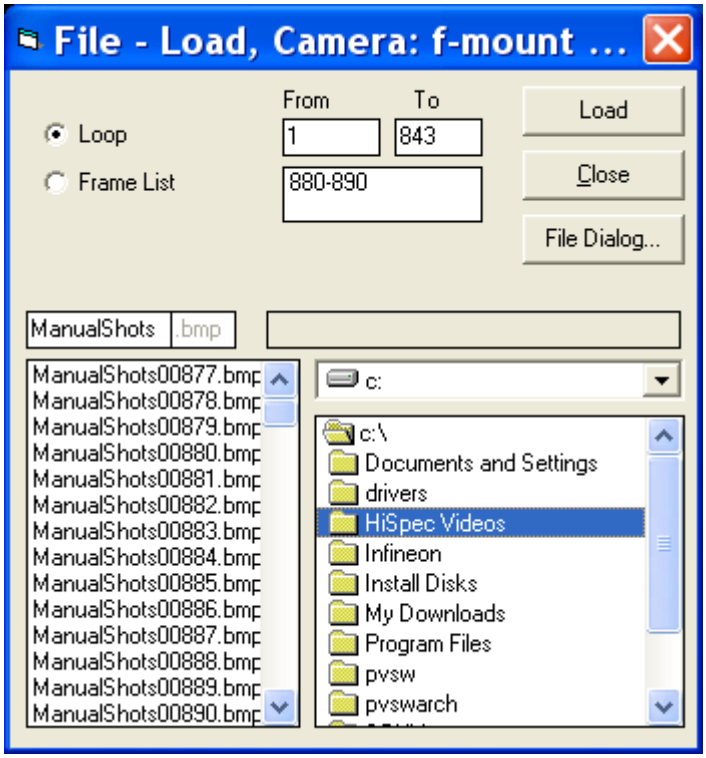
5.4 Menu File



The File menu allows:

- reloading bmp-files for display,
- start saving images as bmp-files,
- create an AVI-file and
- exit the program

5.4.1 Reload bmp-files



HiSpec loads only bmp-files with 5 digit name endings. Files with the same part before these 5 digits are assumed to be from the same saved sequence. To reload sequences, (or a part of it), select the volume, the directory and the filename without the digits.

There are 2 methods of selecting the single files to be loaded:

Load loop
Load frame list

5.4.1.1 Load loop

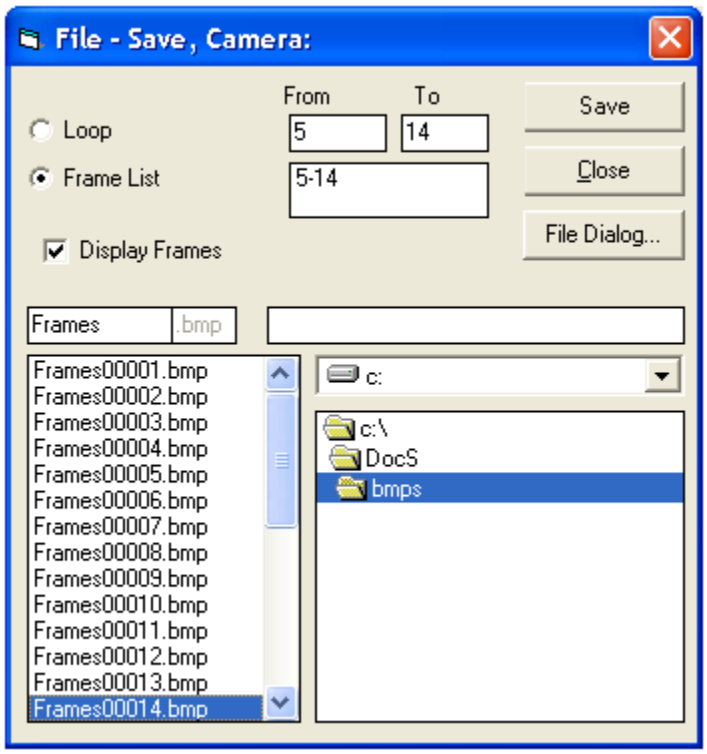
Click on the radio button "Load loop".

Entries can be made in the fields "From" and "To" by clicking on files on the file list with the mouse:

- Click the contents of the "From" field with the left mouse button, (number 1 in our example). The background of the figure is blue.
- Click on the desired image file with the left mouse button, e.g. frames.bmp. "14" is added to the "From" field. The blue background disappears.
- Proceed in the same manner for the field "To".

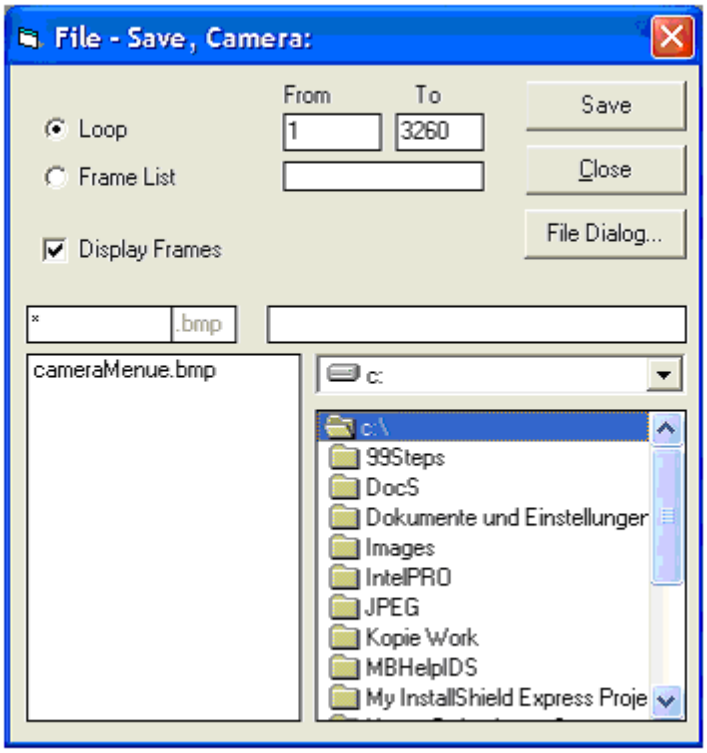
5.4.1.2 Load frame list

Click on the radio button "Load frame list". The list may be edited in the menu "Play settings", (chapter 5.8 on page 61). Only the files whose numbers are included in the frame list will be loaded and displayed.



By clicking "OK" the first file is loaded into the main window. Use the replay buttons as described in 4.6 on page 30 for displaying the whole sequence.

5.4.2 Save images to bmp-files



Select a name from the file list below the bmp name field by clicking on it or by entering a name on the keyboard. On the right side of the window it is possible to set the hard disk drive and the path with the mouse.

It is essential to remember that if more than of 2 characters for the name are used, the performance may decrease. Nevertheless, any name may be used which conforms to Windows. HiSpec extends these characters by a 6-digit figure which corresponds to the frame number. At present only "bmp" data is supported, i.e. the name suffix is permanently set to ".bmp".

5.4.2.1 Save Loop

Click on "Save Loop".

The numbers of the images in the range of "From" and "To" fields, (including the values themselves), are written to a file by clicking "OK". The frame numbers may be also entered by using the frame slider and mouse-buttons or keys as described in "4.7.1 Editing a sequence by using frame slider or keys".

5.4.2.2 Save frame list

Click on "Save frame list".

The numbers of the images shown in the list are written to a file by clicking "OK". This list may be edited in the pull down menu "Play Settings", described in chapter 5.8 on page 61.

In both cases, ("from ... to" and "Frame list"), each image and its file name are displayed while being stored. If the "display frames" check box is NOT active, the frames will not be displayed. In this case the saving procedure will be faster.

If a file with the same name already exists, a response to a message box is required.

Click on:

Yes	The file and all the following files will be overwritten.
No	The image will not be stored and, if possible, the procedure continues with the next image.
Cancel	The image is not stored and no further images will be processed.

The recording will be written to a file either with or without an image caption depending on whether "info line" has been switched on or off in the "View" menu.

5.4.3 Save images to a RAW file

Different from saving images to bmp-files, several frames are stored in a single, so called "raw file". This file contains a header, which describes the frames that are stored in the file as well as the frames themselves. The frames are raw, i.e. they are stored in the same format as they were uploaded from the camera, without any conversion and filtering. If the camera holds frames with a Bayer pattern, then these frames will be stored without any Bayer filtering.

The selection of the frames to store operates in the same manner as described in chapter 5.4.2.1.

5.4.4 Reload a RAW file

For reloading frames, that are stored in a RAW file, use the "Load RAW.." in the files menu. The raw frames will be extracted from the file, converted to color and white balanced if necessary and displayed. You may export the frames to an AVI-file or bmp-files as well, see chapter **Error! Reference source not found.**5.4. To indicate, that frames from a RAW file are displayed, the RAW file symbol is displayed left of the reconnect button:

5.4.5 Format of the RAW header

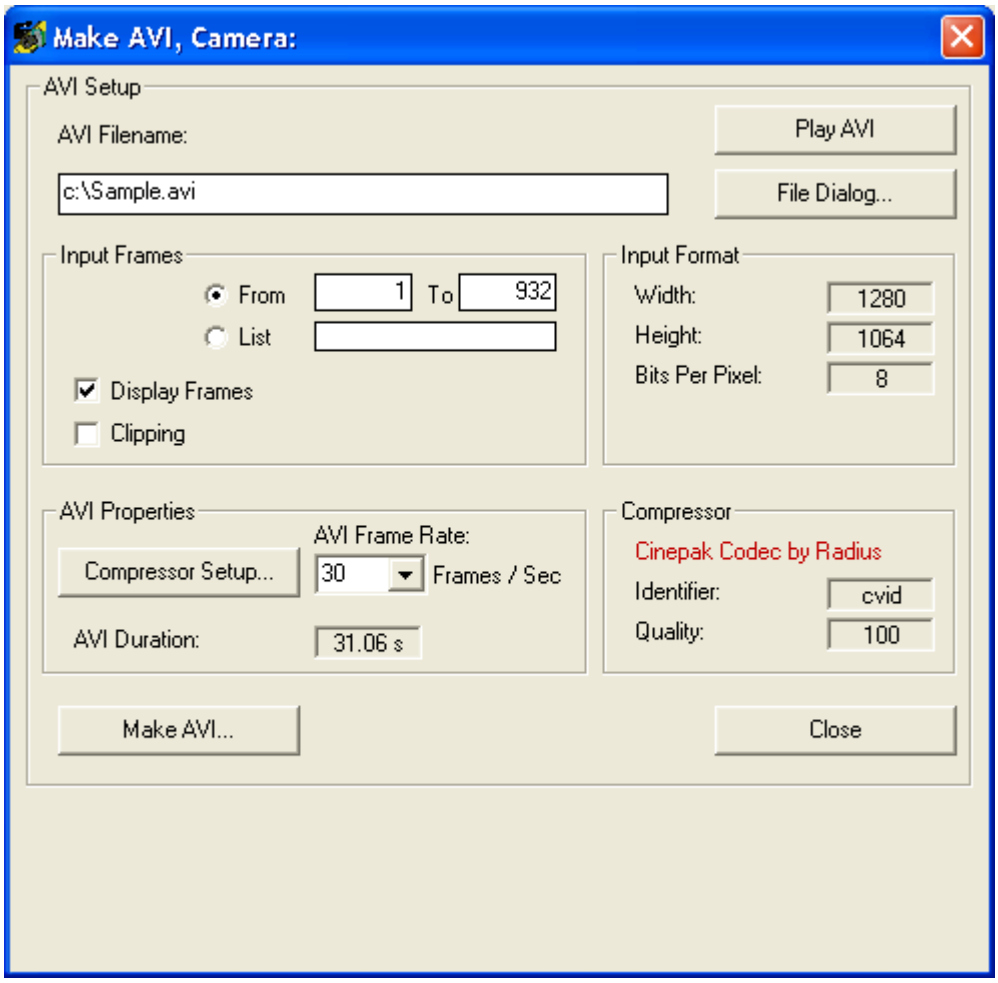
All numbers are in decimal format

	Example	**Number of chars**	**Remark**	
[RAWHEADER]		32		
Format_Identifier=	MRAW	32	A CRLF is included for delimiter ,all fields left aligned	
Version=	00001.00000	32		
Vendor_id=	Mikrotron GmbH	32		
Offset to first frame=	1310720	32		
Colour mode=	0	32	1=BAYER 0=MONO	
Frame_width_in_pixel=	01280	32	1280	
Frame_height_in_pixel=	01024	32	1024	

Bits per pixel=	24	32		
Bayer Filter Start=	GR/RG/BG/GB	32		
Bayer Factor Red=	1.00000000	32		
Bayer Factor Green=	1.00000000	32		
Bayer Factor Blue=	1.00000000	32		
GammaRed=		32		
GammaGreen=		32		
GammaBlue=		32		
Param_1=		32		
Param_2=		32		
Param_3=		32		
Frame rate=	00000100.0	32		
Absolute timer basis=	49,9131944	32	[µs]	
Comments=	Experiment 26	96		
CompleteFixedInfoPart=	1280x1024, 500 Hz, 564 µs, *1.5, MotionBLITZ Eo-Sens Cube #00000, V1.9.28	96		
RecFreeInfoTexte=	-"Infotext..."	96		
Local Basetime=	2008-12-17 23:50:00	32	Timestamp for value 0 of the absolute timer	
NumberofSequences=	00001	32		
[SEQUENCES]		32		
NumberofFrames_00=	00000001000	32	First sequence	
TriggerFrameNum-ber_00=	00000000050 (1…x)	32		
Reftim1_00=	0000023111	32		
		32		
NumberofFrames_01=		32	Second sequence	
TriggerFrameNum-ber_01=	00000001000	32		
Reftim1_01=	00000001050 (1…x)	32		
NumberofFrames_02= ...	….		Third and next sequences	

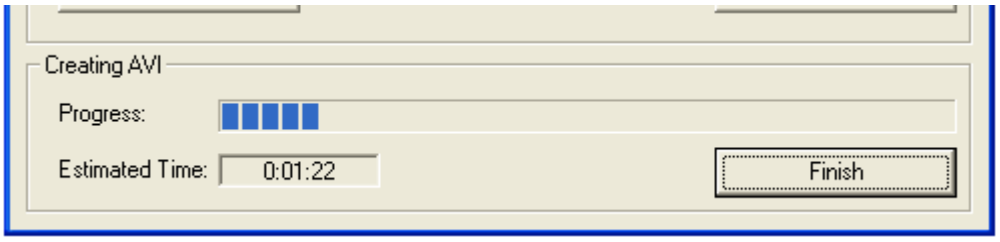
5.4.6 Make AVI File

Select the AVI-filename, the numbers of the frames to be compressed and the compressor-type by clicking on the "Compressor-setup" button.



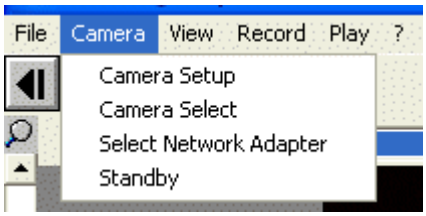
If only a special region of the sequence is to be processed, select this region by clicking on the "clipping" check box. A rectangle named "AVI clipping area" will be overlaid in the camera image. Adjust the size as needed and move the rectangle over the region of interest with the mouse. Once all parameters have been set, click on "Make AVI.."

The AVI progress bar and the estimated time to completion will appear.



If you click on "Cancel" while an AVI is created, the AVI will hold only the frames up to the point of time of your cancellation.

5.5 The Camera menu



Within this menu, you may:

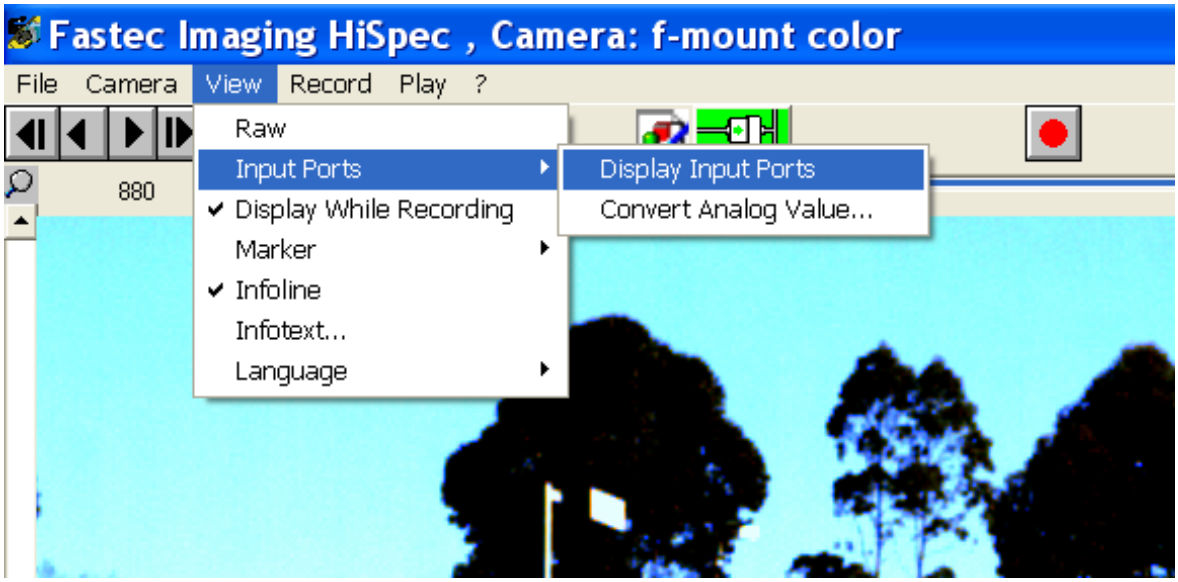
- with „Camera Setup" check and change the camera's parameter. See chapter 4.2 „Selecting resolution, speed, gain, trigger, sync, ARM and white balance" for details.

- with „Camera Select" connect with the camera via the Ethernet. See chapter 3.3.2 „Selecting the HiSpec camera".

- with „Select Network Adapter" select the adapter as described in chapter 3.3.1 "Selecting the network adapter".

- with „Standby" set the connected camera into the standby mode. More information to this topic you will find in chapter **Error! Reference source not found.**"

5.6 The View menu



5.6.1 Raw

The image is displayed as delivered from the camera without any modification and no Bayer color-calculations. Thus in Raw mode always a black and white image will be seen.

5.6.2 Display while recording

Disable this point if the images are not to be displayed during recording.

5.6.3 Check camera temperature

This menu is visible, if the configuration file "CameraTemperatureLimits.ini" contains a temperature limit unlike zero for the currently used camera. After activating this point, in intervals of 1 minute the internal camera temperature will be measured and checked against the limit. If the temperature is in the normal range, the word „Temp" next to the reconnect button will be shown in green letters, if the temperature is high in red letters. In this case the camera should be cooled. In the form "info" there is additional information about the camera's temperature.

After starting the MotionBLITZ program, this menu point is always deactivated.

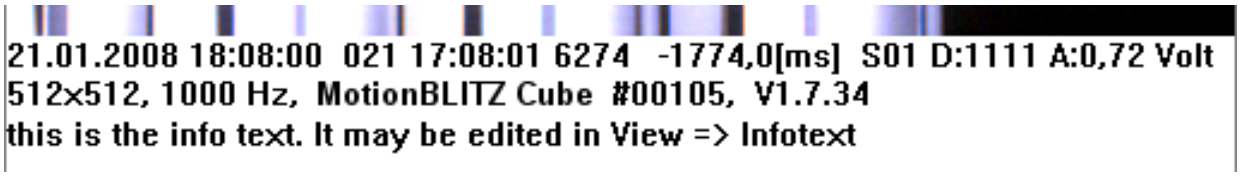
5.6.4 Marker

Up to 4 markers may be enabled. Markers are magenta colored lines that overlay the camera image. The size may be adjusted and moved with the mouse. Markers are used for tagging the position of an interesting part in the replayed sequence.

ⓘ	Markers have no relevance for the saved frames!

5.6.5 Info line

Attaching information to the recorded images is switched on or off. The information portion is displayed as follows:



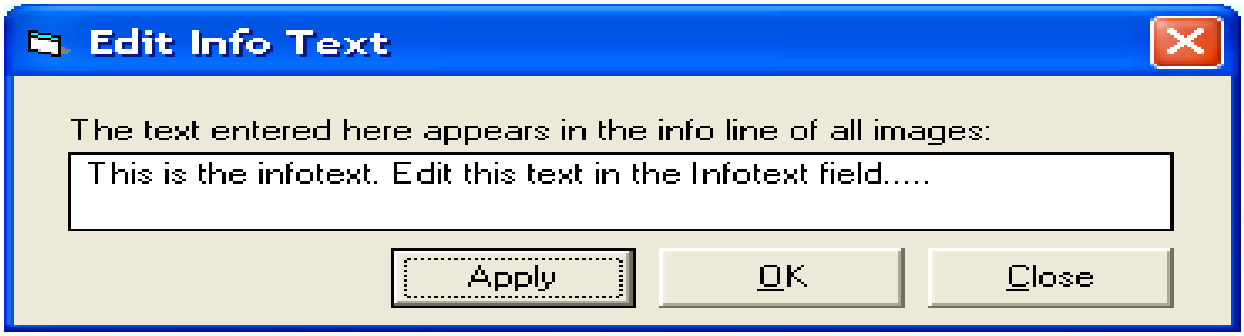
The upper part of this section taken from the HiSpec main window shows the remaining part of a recording and the information portion. It contains the following fields with information at the time of recording:

Field:	Content in the example:
Date	21.01.2009
Time	18:08:01
IRIG-B time code (1), contains 3 characters day of the year 6 characters for time of day, GMT	Not implemented
Frame number	6274
rel. time after trigger [ms]	-1774,0 [ms]
Sequence number (2)	S01
Digital input (binary representation)	Not implemented
Analog input (decimal format)	Not implemented
Resolution, width x height	512x512
Frame rate	1000 Hz
camera type	HiSpec
Serial number of camera	#00105
Software version	V1.7.34
Free text to be entered via "Info text"	This is the info text. It may be edited in View => Info text

This information portion is stored along with the frames while recording in the image information block in the first image-line to save on frame memory. It is interpreted from that structure for playback and then attached to the images.

5.6.6 "Info text..."

Open the window "Edit Info Text":

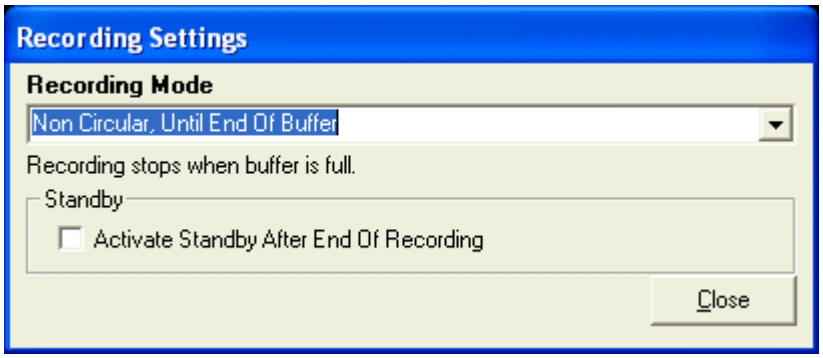


The text entered here and confirmed by clicking "OK" is added to the information portion in the recording sequence.

5.6.7 Language

English or German may be selected as language for all texts in the program.

5.7 Record settings



The recording mode may be selected. There are 2 modes:

Non-circular mode
Circular mode

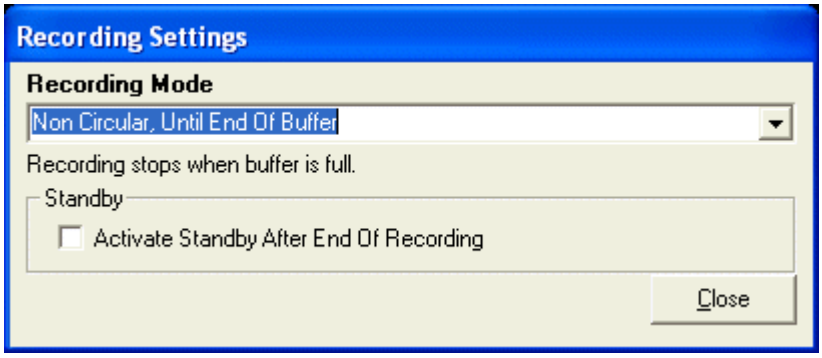
5.7.1 Non-circular mode

Recording proceeds

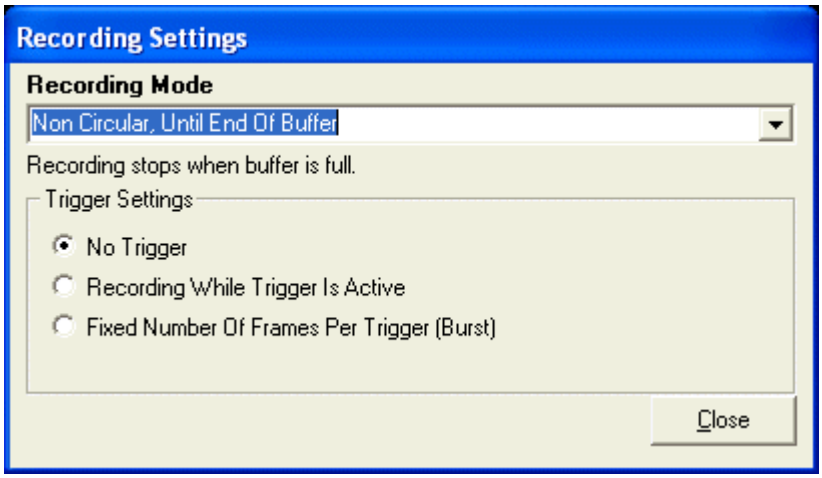
- until the end of buffer is reached and stops afterwards or,

- until the recording is aborted before by clicking on the "Stop" button or pressing key F12.

5.7.1.1 Without trigger

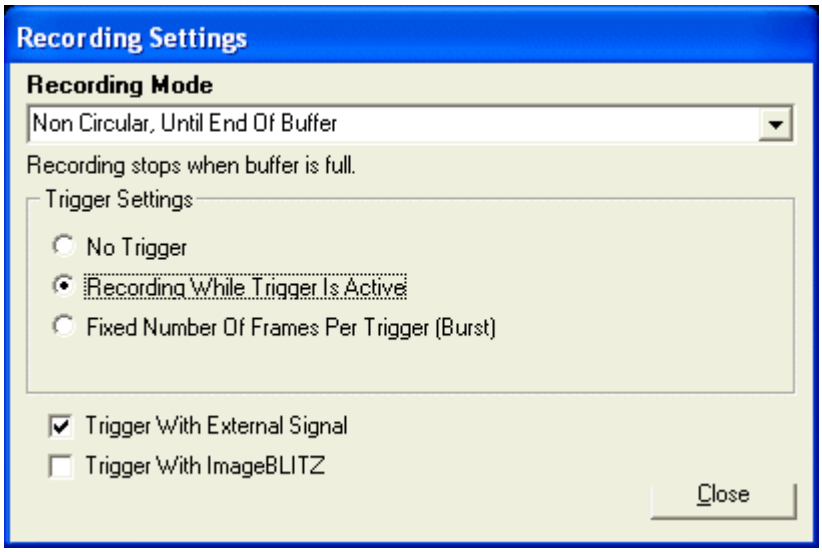


5.7.1.2 With trigger facility



ⓘ	During a non circular recording session with triggering actual images are shown as long as the camera provides them on account of the active trigger. While waiting for the next trigger there are now images shown.

5.7.1.2.1 Recording while trigger is active



As long as the trigger is active, recording will proceed. When the trigger is made inactive before the image buffer is full, the camera will wait for the next trigger. Not until the end of the buffer is reached does the recording end, (or if the recording was aborted before by clicking on the "stop" button or pressing the F12 key).

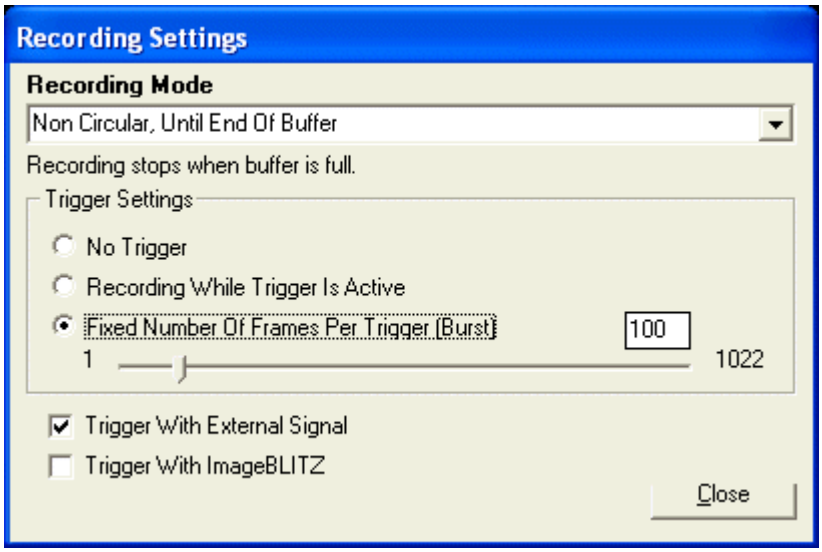
The trigger may be:

1. An external trigger signal connected with the camera's trigger input, provided that „Trigger With External Signal" in „Record Settings" is activated. The active edge or the active state of the signal may be selected in the menu "Camera Setup", (Selecting resolution, speed, gain, trigger, sync, ARM and white balance).

2. Changing of the contents in a specific part of the actual recorded image if ImageBLITZ is used, i.e., "Trigger With ImageBLITZ" is activated, (see chapter 5.7.2.1.2 "ImageBLITZ" for details of ImageBLITZ).

With this trigger setting, the active state of the trigger is essential, not the edge.

5.7.1.2.2 Fixed number of frames per trigger (burst trigger)



For each trigger edge a preset number of frames will be recorded. The number may be chosen between 1 and 1022.

Enter the number in the input field or move the slider into the desired position. In the figure above 100 frames per trigger edge are selected.

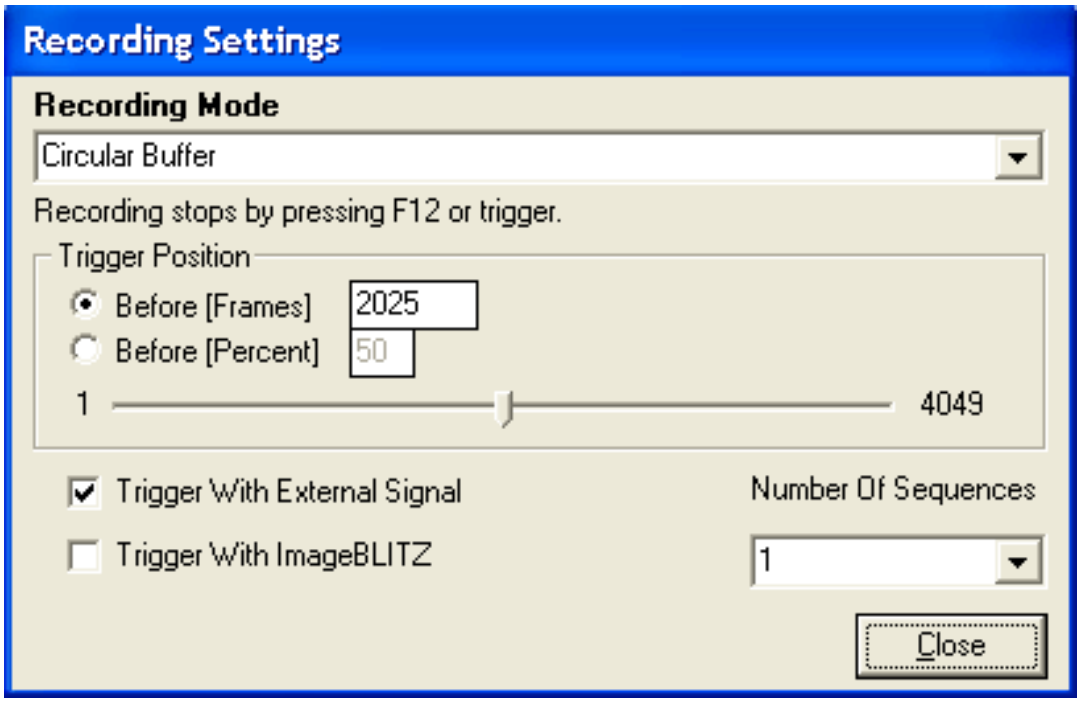
After every recording, which was initiated by the trigger edge, the camera will wait for the next edge as long as the end of the memory is not reached.

After reaching the end of the memory, the recording is completed. Alternatively the recording may be aborted via the Stop button or F12.

As described in the chapter before, the trigger could be an external trigger signal or the ImageBLITZ software.

With this trigger setting, the active edge of the trigger is essential, not the state.

5.7.2 Circular mode



The camera will record in a circular mode, i.e., the oldest frame is overwritten by the newest. After triggering or the circular recording has been stopped by clicking the stop button or pressing the key F12 as many frames as defined in the input-field "Trigger Position, **Before [Frames]**", (2025 in our example), will be kept and the rest of the frame buffer will be filled up with frames. With the slider you may vary the trigger position from the first frame, ("1"), to the last possible frame, ("4049"), as well.

If you select "**Before [Percent]**" the before frames to total frames ratio will be retained if the total number of frames is changed, (e.g. by changing the frame size).

5.7.2.1 Trigger modes

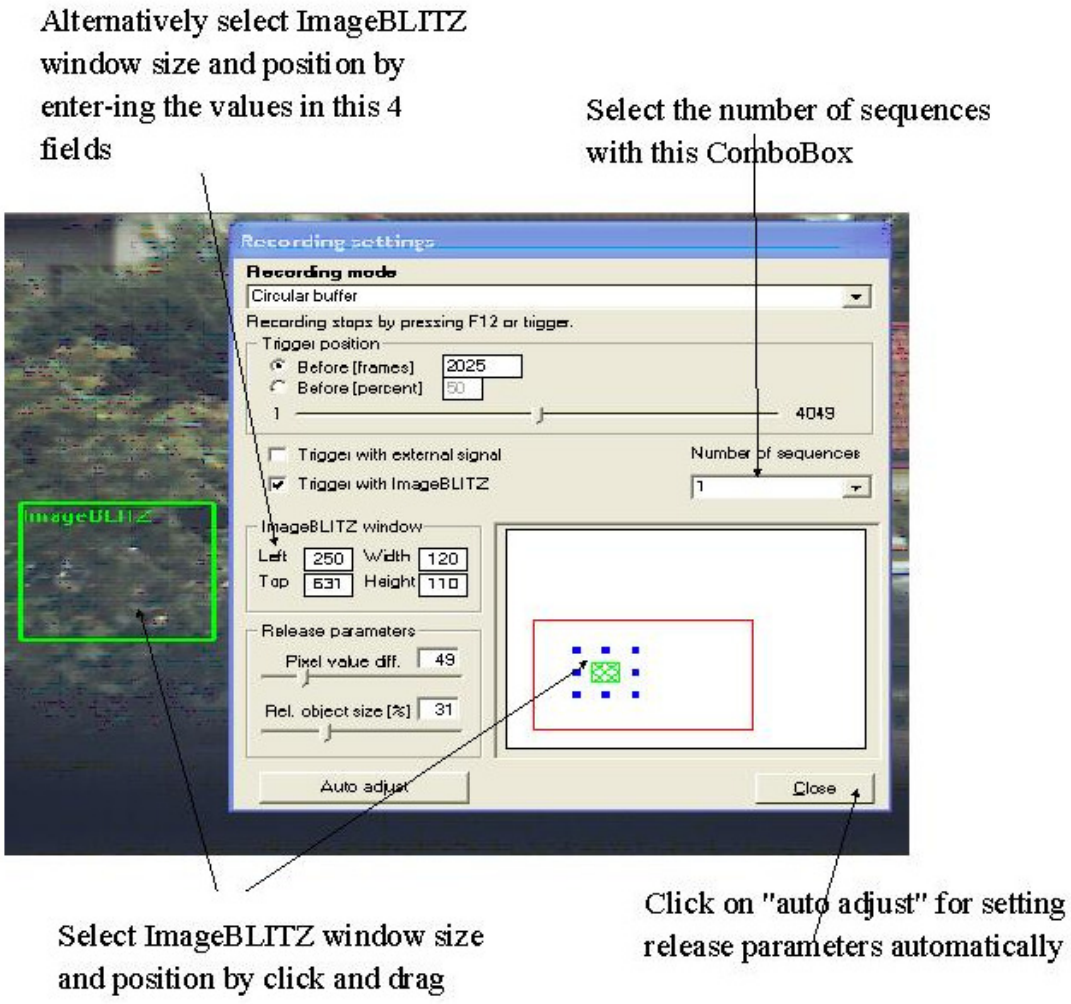
HiSpec comes with two trigger modes, which may be selected independently. Select an external signal and/or ImageBLITZ by clicking on the appropriate checkbox.

5.7.2.1.1 External trigger

If external trigger is selected, a rising or a falling edge, depending on the settings in the menu "camera setup", will bring the recording to completion.

5.7.2.1.2 ImageBLITZ

If ImageBLITZ is selected, changing of the contents in a specific part of the actual recorded image will bring the recording to completion. This specific part is called the "ImageBLITZ window". The parameters of ImageBLITZ are adjusted in the "Recording settings" menu in "Live" mode. The ImageBLITZ window is shown as a green, red or yellow rectangle in the displayed frames.



Don't move or alter the ImageBLITZ window while recording. Movements while recording have no effect.

5.7.2.1.2.1 ImageBLITZ parameters

If ImageBLITZ is activated, the HiSpec camera compares the image detail of the actual frame with the image detail of the reference frame. If the differ-

ences within this image details exceed a limit, ImageBLITZ triggers ("releases").

These two parameters for adjusting the ImageBLITZ may be set manually by entering the values in the release parameters fields or automatically by clicking on "auto adjust".

5.7.2.1.2.1.1 Pixel value difference

This parameter defines the absolute limit for the difference in the gray values within the image details. The value range is 1 to 255.

With a small value small changing in the image detail let the ImageBLITZ trigger, with a big value the ImageBLITZ trigger gets less sensitive. Under normal conditions, this value should be between 10 and 70.

5.7.2.1.2.1.2 Relative object size

This parameter defines the relative size of the area within the ImageBLITZ window that must be different from the reference frame before ImageBLITZ triggers. The value range is 1 to 100 percent. If you use a small value, e.g. 5, then ImageBLITZ triggers when 5% of the image details are different.

5.7.2.1.2.1.3 ImageBLITZ Reference frame

The ImageBLITZ reference frame is the first frame of a recording sequence, i.e. in Live mode the first frame after starting Live, in record mode the first frame after starting the recording. Using the auto adjust feature, the reference frame is the next frame after clicking on "auto adjust"

5.7.2.1.2.1.4 ImageBLITZ window colors

The color of the ImageBLITZ window borderlines is used for indicating the state of ImageBLITZ:

Color	Meaning
Green	ImageBLITZ is active and waiting for a trigger situation.
Red	ImageBLITZ is active and has triggered.
Yellow	ImageBLITZ is not active, (the system is not in Live- or recording mode).

5.7.2.2 Multi sequence - optional

The frame memory may be divided into up to 16 same-sized memory ranges for sequences, called multi sequence mode. Each memory range is then filled by a trigger event, i.e., by the occurrence of the external trigger signal or the ImageBLITZ trigger. After a trigger event the post-trigger frames will be recorded and the camera switches to the next sequence, beginning the recording of the pre-trigger frames. Thus the recording proceeds till all sequences are complete.

If a trigger event occurs before the predefined number of pre-trigger frames are recorded, the number of pre-trigger frames will be less than predefined, whereas the number of post-trigger frames will be as expected.

If a multi sequence recording will be stopped with the camera's HiSpec control program's Stop button or key F12, HiSpec fills the rest of the sequences that are not yet recorded, with the number of post-trigger frames and brings the recording to an end.

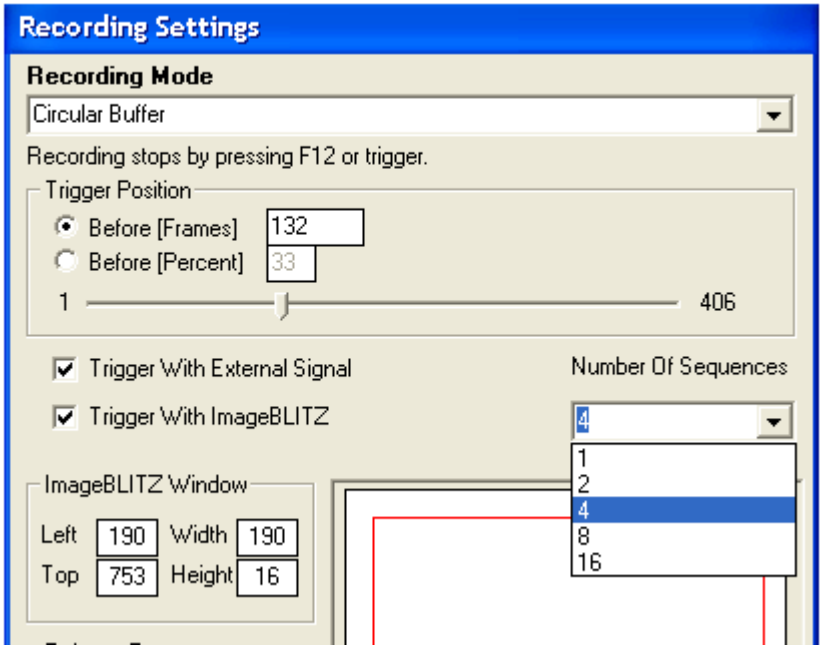
Multi sequence mode is provided only by means of the HiSpec control program. There is no possibility to start a multi-sequence recording session if the camera is not online.

There are 5 different numbers of sequences:

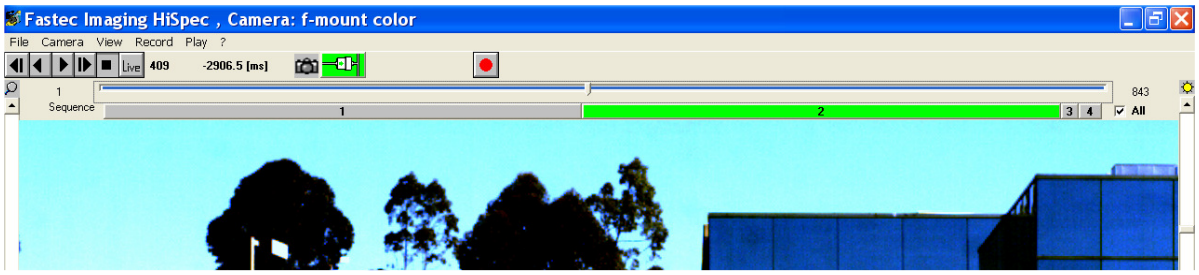
- 1
- 2
- 4
- 8
- 16

For establishing the multi sequence mode, click on the ComboBox "number of sequences" in the form "record settings" with the left mouse button and select the number of sequences you would like to record.

Please note: This ComboBox is only available in the "circular buffer" recording mode!

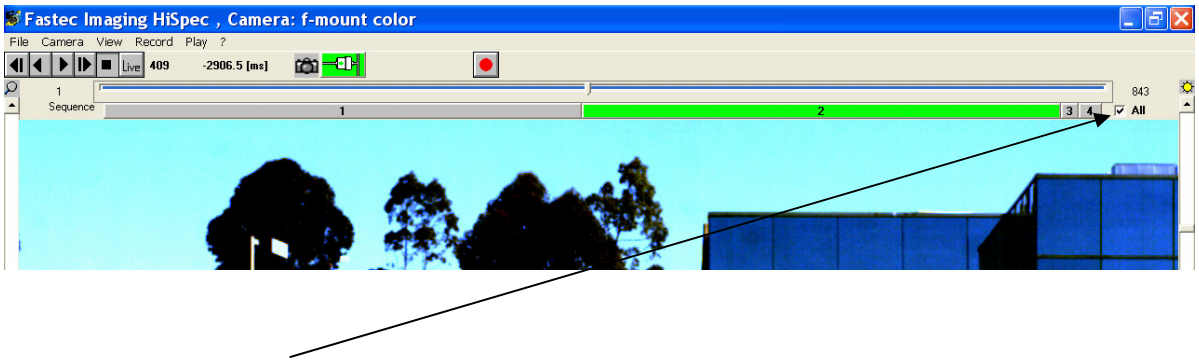


After selecting the number of sequences, during the next recording session the number of sequences will be represented by sequence command buttons, labeled with the sequence-number:



The number of the sequence, that will be recorded actually, is represented by the green color of the sequence command button. In the example above, ImageBLITZ had triggered while recording the first sequence. The command buttons are disabled during the recording session.

After finishing the recording session, the sequence command buttons are enabled, by clicking on a button you navigate to the frame immediate after the trigger event in the appropriate sequence.



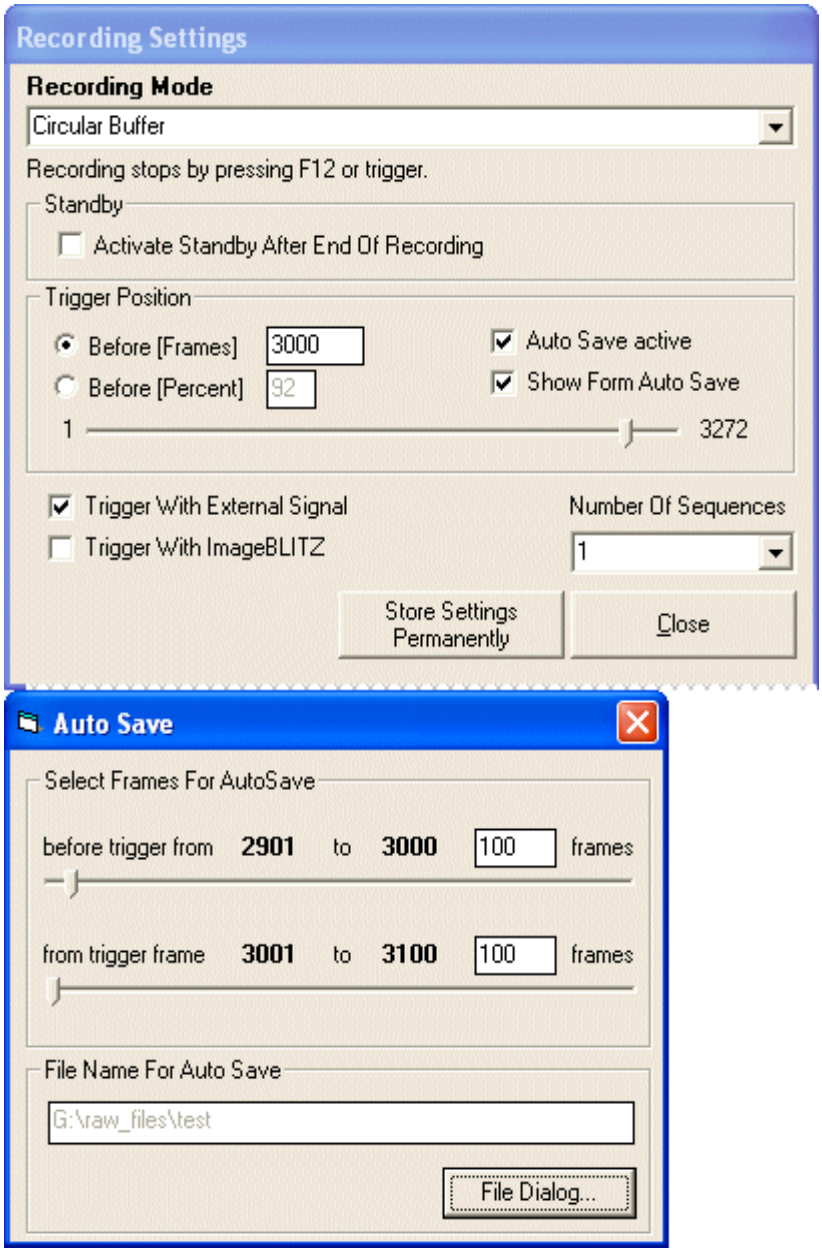
Click here to use the frame slider for all sequences or one sequence only

5.7.2.3 Auto Save

If the Auto Save mode is activated, frames will be stored to hard disk in the RAW data format automatically after the end of a triggered circular recording sequence. After completion of storing the frames, a new recording sequence will be started. Auto saving will be ending when the user stops the recording sequence, (by pressing the F12-key or clicking on the stop button), or if the disk runs out of space.

Parameters for Auto Save could be adjusted in the form Auto Save. You may start the form by clicking on the checkbox "Show Form Auto Save" in the Recording Settings form.

The number of frames before the trigger point of time and the number of frames from the trigger point of time on could be adjusted as well as the file name for the saved frames. The selected file name will be extended by a time stamp, that holds the instant of time, when auto saving started:



The name of the file, that contains the automatically saved frames, has the following format:

Base name / Delimiter / YYMMDD / Delimiter / HHMMSS / .rec

The base name is declared in form Auto Save, e.g. in the screen shot above "test", the delimiter is the sign "_", YYMMDD means year, month, day and HHMMSS means hour, minutes, seconds.

An example of the name of file, which contains frames, which were auto saved starting on February 9th, 2009 at 16:09:27 is:

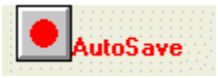
test_090209_160927.rec

5.7.2.3.1 Start an Auto Save session

If you click on the checkbox "Auto Save active" in the form "Recording Sessions", the next recording sequence, that will be started (either by clicking on the red

Start Recording button or by pressing the key F5), will be an Auto Save session.

This will be indicated by the word "AutoSave" next to the start recording button in red letters:



When the Auto Save session is stopped, the checkbox "Auto Save active" will be deactivated automatically and the "AutoSave" indication next to the start recording button disappears. If you like to start another Auto Save session, you must click at the check box "Auto Save active" again.

5.7.2.3.2 Stop an Auto Save session

An active Auto Save session can be stopped by the user: Press the F12 key or click the stop button. The camera's recording session will be ended and the frames saved to hard disk. After completion of the saving, the Auto Save session is finished.

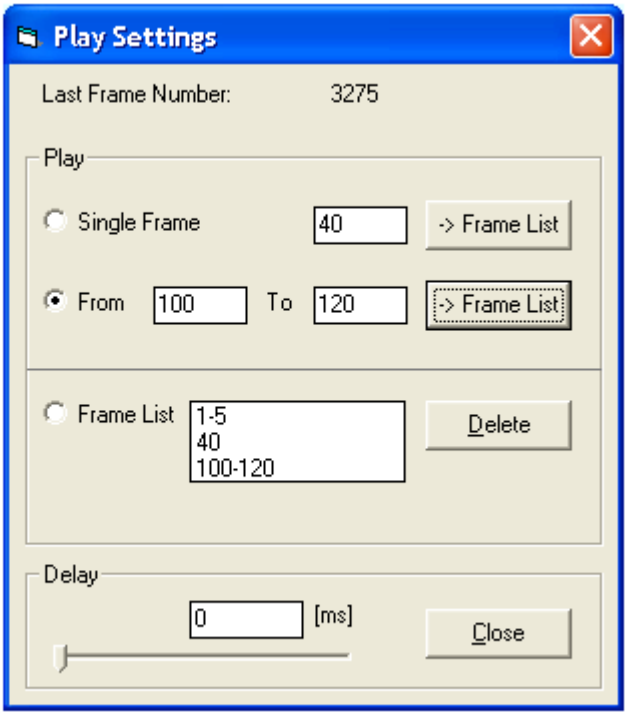
If the hard disk runs out of space, an Auto Save session will be stopped by the system automatically.

5.7.2.3.3 Show the saved frames

After completion of an Auto Save session, each recording sequence of the camera is stored in a different file. Select the appropriate file in the menu "file" => "Load raw..". See chapter "Reload a RAW file" for details.

5.8 Play settings

In this form the number of the images that shall be displayed is defined. This is valid for frame selection in the "file save" and "file Make AVI" form as well.



The behavior during playback in forward and reverse sequences is influenced by the radio buttons; it is possible to set a time delay between the display of individual frames.

5.8.1 Display of individual frames

Click on the radio button "Single frame". The frame with the number shown in the entry field "Single frame" is retrieved from the HiSpec frame memory and displayed. Any image desired may be loaded from the memory by entering the frame number into the entry field or by operating the "frame slider" in the main form.

5.8.2 Display loop "from ... to"

Click on "from". Enter the frame number of the beginning and ending of the desired range or select the range by using the "frame slider" and mouse buttons, as described in 4.7.1 "Editing a sequence by using frame slider or keys". By clicking  "Forward playback" or  "Reverse playback" the frames within the selected range will be loaded from the HiSpec frame memory and displayed in an infinite loop.

5.8.3 Frame List

The frame numbers selected via "Single frame" or "from … to" can be added to the frame list by pressing the "=> frame list" button.

By pressing "Delete" the numbers which were marked previously with the mouse can be removed.

The contents of this list can be used for saving loading images from files, (in the "File" window), for saving frames as an AVI, (in the "File" -> "Make AVI…" menu), or for defining a playback sequence.

5.8.4 Display loop with frame numbers from frame list

Click on "frames list". By clicking  "Forward playback" or  "Reverse playback" all frame numbers are processed on the list in an infinite loop, i.e. the recorded images are loaded from the HiSpec frame memory and displayed.

5.8.5 Last frame number

Depending on the size of the frame memory and the current frame size, (line length and number of lines), the last permissible frame number xxx is determined and displayed in "Last frame number". It is not possible to exceed this number in the display loop or when displaying individual frames.

5.8.6 Slow motion (time delay in display)

To playback a sequence in slow motion, select the desired time delay in milliseconds in the entry field "Delay [ms]:". The time value may be entered in the field directly or changed by using the appropriate horizontal scrollbar.

5.9 Info form

In the Info form details about the HiSpec control software and the firmware of the actually connected camera are displayed.

The first part holds the HiSpec control software version number and the copyright statement.

The second part holds information about the connected camera:

- Serial number of the camera
- Model type (HiSpec)
- Sensor type
- Firmware-Version
- MAC Address
- IP Address
- The size of the frame memory
- Features

C	Colour sensor
MS	Standard recording time
HG	Hi-G version (crash proofed)
IB	ImageBlitz
MS	Multi-sequence

6 Maintenance

During normal use an occasional cleaning of the optical path is necessary. Information about cleaning the lens is provided by the respective manufacturers.

6.1 Cleaning of the HiSpec infrared filter

HiSpec, (color), contains a filter to suppress infrared light. Dust and dirt, which may deposit on this filter is best removed by means of an oil free air pressure spray or with a lens cleaning tissue. Sticky residue and fingerprints may be cleared away with medical alcohol.

	Improper cleaning agents may damage the filter. Such damage may alter the quality of the images.

	Infrared light is part of the visible light spectrum and warps the color in the camera images. Therefore it is necessary to illuminate infrared light with the filter.

7 Troubleshooting

Any known software errors are listed in the release notes.

Main problems:

Q: The HiSpec establishes no camera link. An error message box appears or "timeout" will be indicated. What to do?

A: Check if the camera and the PC are connected via the Ethernet. Check if the Camera LED's are in a state as described in chapter 1.6. Click on the "Reconnect" button in the HiSpec control program. If the color of this button does not change to green (=connected), switch the camera off, switch the camera on, wait until the lower LED turns green and try again.

A: Check if the camera LED's indicating the ready-to-operate state (both LED's must be green or orange as described in chapter 1.6.1.2.

A: Check if the windows firewall allows HiSpec to work! If the firewall is active, set it to inactive, close HiSpec and start it again. If it works now, you may configure HiSpec in the windows firewall as an exceptional program and activate the firewall again.

A: Check if the HiSpec user has write-permission in the HiSpec installation directory, e.g. c:\Program Files\Fastec Imaging\HiSpec. Write permission in this directory is necessary!

A: If you are using an Ethernet switch to establish the data exchange with the camera, it could take several seconds up to minutes, until the camera is detected after power on or after connecting with the switch. In this case you should wait for 1 to 2 minutes before you click at the reconnect or the "scan net" button

Q: In Live-mode and record-mode timeouts occur while "Sync In" is enabled.

A: If "Sync in" is enabled and no "sync in" signal is provided, the camera will not record and timeouts will occur! In this case you must supply the "sync in" signal to avoid timeouts.

8 Appendix

8.1 Technical data

Sensor type	Monochrome / Color
Number of pixel	1280 x 1024
Pixel size	14 x 14 µm
Sensitivity at 550 nm @ Vref = 1V (a2 = 66h)	25 V/lux-sec
Spectral response	400 … 1.000nm
Trigger	External Signal, ImageBLITZ Trigger
Internal Dynamic	57 dB
Power supply	10,5 ... 30 V
Power consumption max., continuous recording @ 512 x 512 resolution and 2500 frames/sec.	7.5W
Thermal resistance typ.	6.25°/W
Serial data link	GigaBit Ethernet, Baud Rate 19200
Digital video	GigaBit Ethernet
Operating temperature	+5..45°C
Shock & vibration	tbd
Dimensions (WxHxD)	63 x 63 x 64.5 mm (c-mount) 63 x 63 x 92.5 mm (f-mount)
Weight	ca. 280 g (without lens)
Lens mount	C-mount or F-mount
Software	"click, drag and drop" for Windows XP
Computer requirement	Min. Pentium III 650 MHz, 1024 * 768 Pixel, 256 MB RAM, 10 GByte Hard disk, GigaBit Ethernet
File format	AVI or bmp
Recording frequency [frames per second = fps]	Up to 113.000
Shutter time	min. 2 µs
Recording modes	Non circular or circular with pre- and post trigger
Frame buffer [GBytes]	2
Replay frequency	20 – 50 fps @ 1280 x 1024, depending on the performance of the PC

8.1.1

8.2 Connector assignments

8.2.1 Power Signal Connector of HiSpec

Pinning of Lemo 6-pin female connector

EEG.1B.306.CLL
www.lemo.com

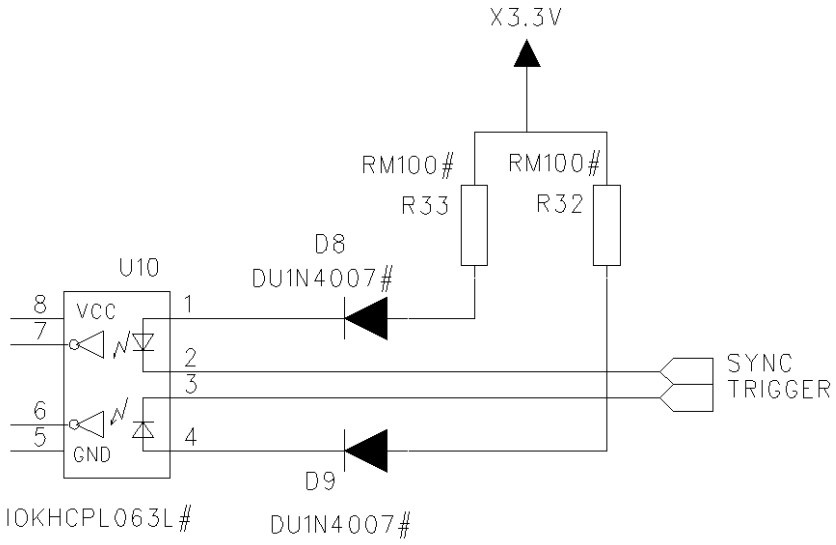
Pin Nr.	Level Description
1	Pwr GND
2	=10..30V Pwr Voltage
3	Opto In Sync
4	Opto In Trigger
5	Opto GND
6	Opto out STRB/ARM

8.2.1.1 Trigger/Sync input signal definition

The Digital Input 4/ Trigger and the Sync Input are isolated from the rest of the circuitry by an opt coupler. The pull-up resistors R33/R32 are powered by an internal DC/DC converter, (X3.3V). The opto coupler will switch if the input is connected to the common GND signal. (Pin 1 on Signal I/O connector).

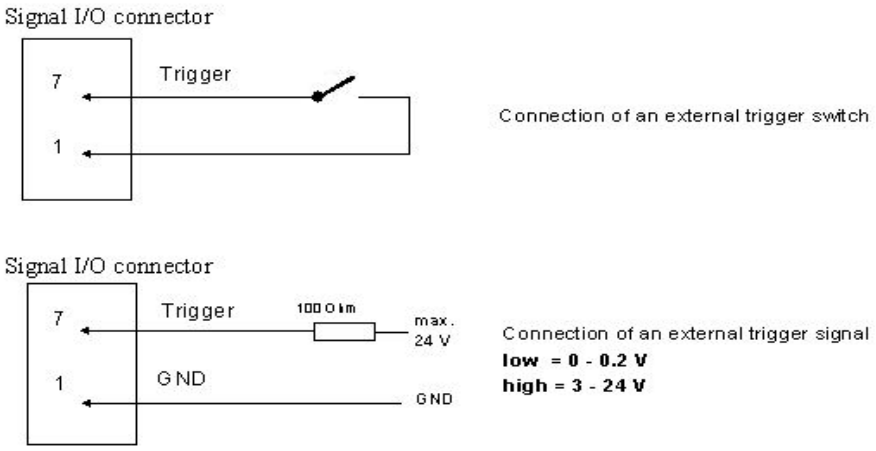
A positive edge on the Sync input will output the next image if the positive "Trigger edge" is selected in the camera menu.

A positive edge on the Trigger input will stop a circular recording if the positive "Trigger edge" is selected in the camera menu.



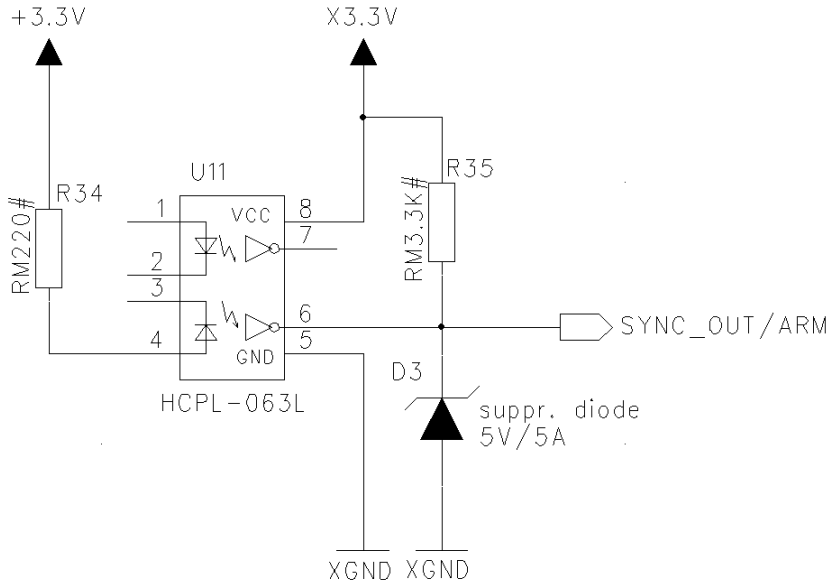
The minimum diode current for an active signal is 5mA.

Trigger connection example



8.2.1.2 Sync/Arm Output

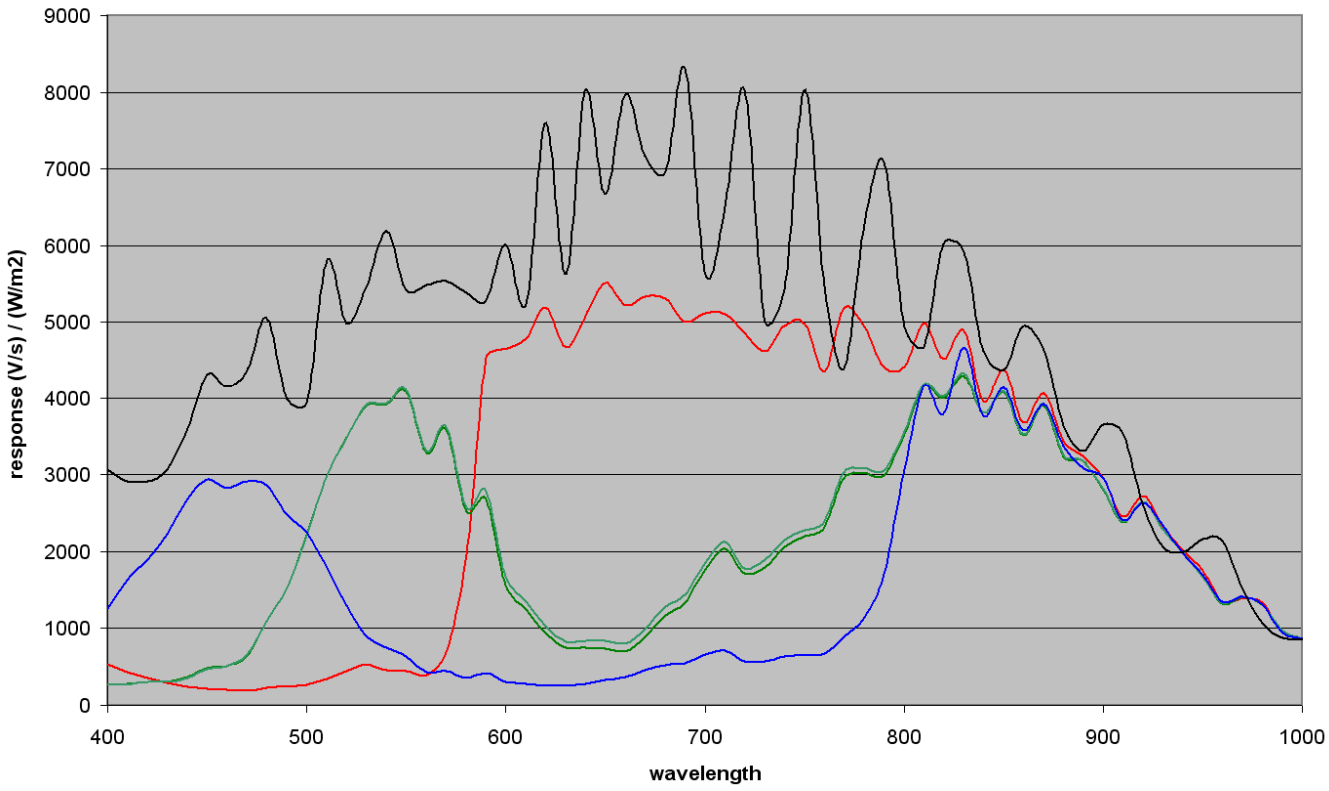
This pin can output a Sync signal or an arm signal, selected by a check box in the camera menu. If Sync out is selected, this output will carry a Strobe that corresponds to the selected exposure time of the camera. If Arm is selected, it will be active if the camera runs in circular recording mode.



The opt couplers output will sink 13 mA with max. 0.6V output voltage. The output polarity is positive when the selected signal is active. The suppressor diode protects the output against reverse voltages. It starts conducting if the voltage on the output pin is greater 6V.

8.3 Spectral response

8.3.1 Monochrome & Color Sensor with Bayer Filter

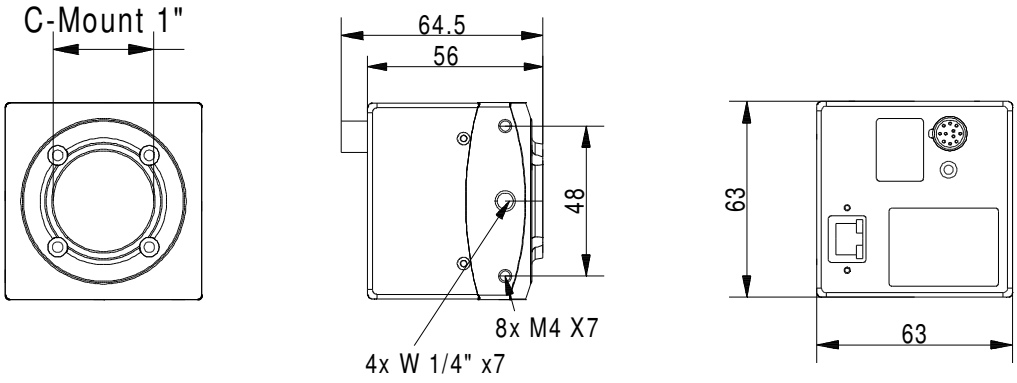


8.4 Dimensions

8.4.1 Front / Rear

Specifications without dimension are in mm.

C-mount version:



F-mount version: