DEV.0605en

Instruction Manual

MotionBLITZ Cube
MotionBLITZ Eo*Sens*

Digital Motion Analysis Recorder

Version 1.11.28

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1 General

Congratulations! MotionBLITZ is an excellent choice, because MotionBLITZ is a extremely versatile, advanced and self contained digital camera system. Mikrotron Deutschland GmbH has combined progressive camera technology with software which is very easy to operate. Thus MotionBLITZ is the ideal solution for high speed recording. This manual provides information about the features and operating modes of MotionBLITZ.

1.1 Essentials of MotionBLITZ Cube / Eo*Sens*

With the MotionBLITZ – the Digital Motion Analyzer Recorder – rapidly moving or explosive processes can be continuously recorded and stored at up to 190.000 images per second (Cube5) 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. Because of the built-in rechargable battery, the camera can operate up to 30 (60 Cube4/5) minutes in record mode and can store the recorded data in the internal frame memory for up to 2 hours (and more than 20 hours in case of the standby option). Switch on the camera and after a few seconds it is ready for high speed recording at full resolution without any additional components. The MotionBLITZ must be connected to a host PC via fast Ethernet only when downloading recorded sequences or when camera parameters need to be modified or changed.

The Eo*Sens* camera comes with a photosensitivity of at least 10 times better than the Cube1/2 cameras.

1.2 Customer indications

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

1.3 Declaration of conformity

Manufacturer: Mikrotron GmbH

Address: Landshuterstr. 20-22
85716 Unterschleissheim
Germany

Product: High Speed Camera **MotionBLITZ Cube / Eo*Sens***

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 Regulation	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 Side and backside views of MotionBLITZ cameras

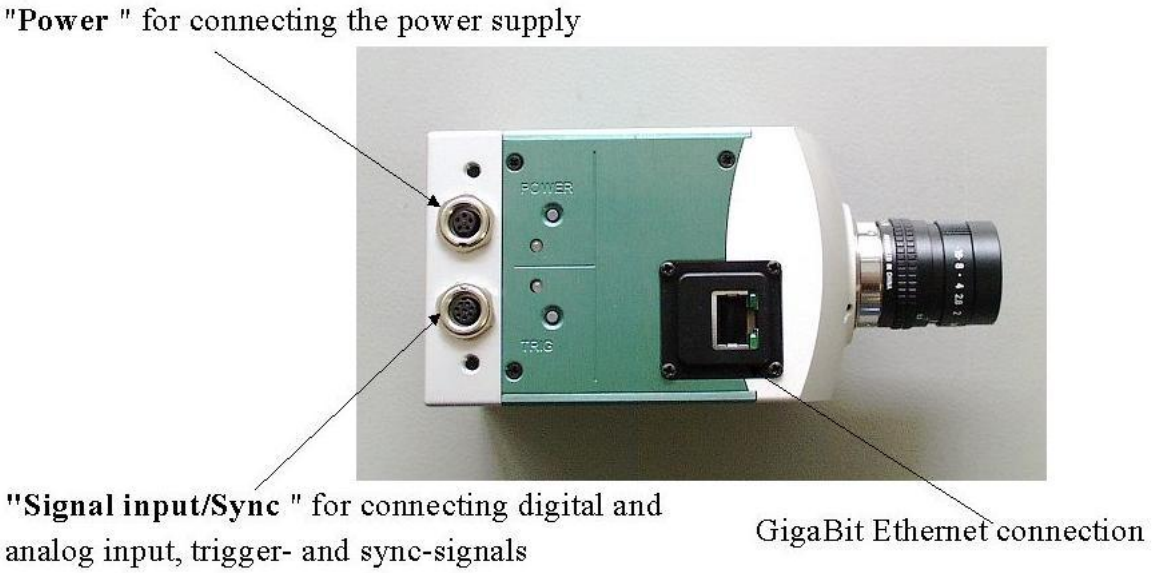
1.6.1 The rear of the camera

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.

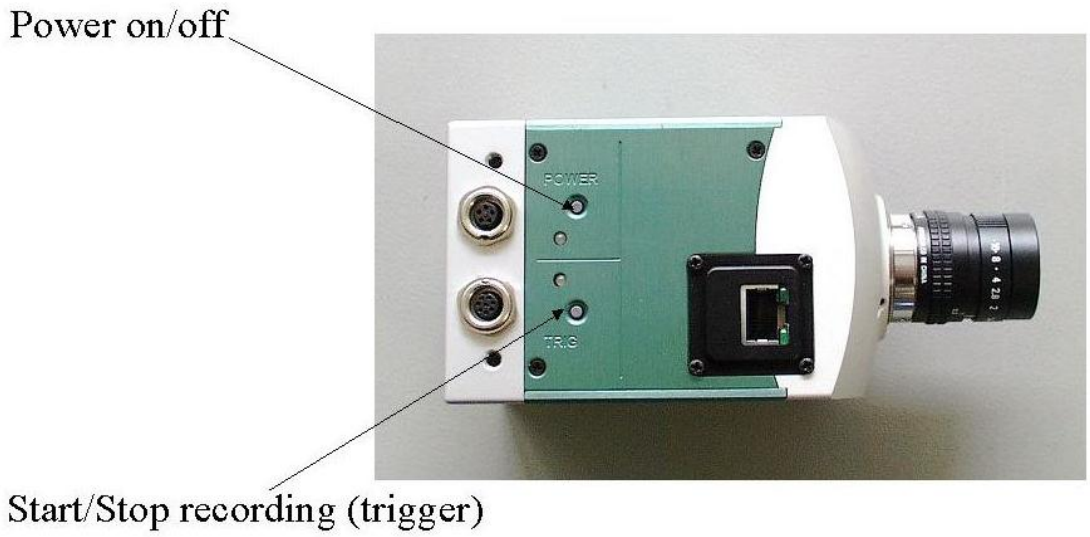
1.6.2 The right side of the camera

1.6.2.1 Connectors

There are 3 connectors, 2 switches and 2 LEDs mounted on the right side of the Camera. The pin assignments of these connectors are described in chapter 8.2 Connector assignments



1.6.2.2 Switches



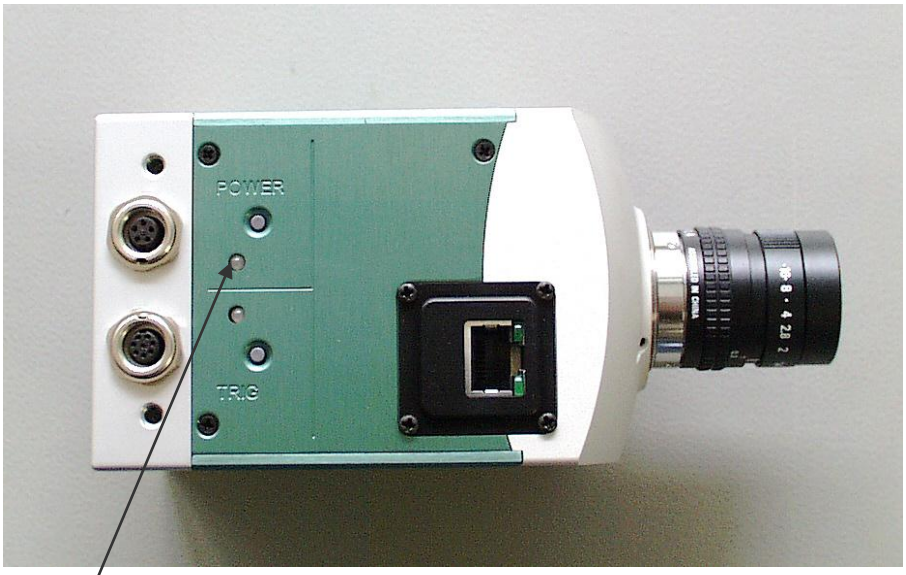
For cameras with standby facility, press the power switch longer than 1 second for swichting off the camera! See chapter 2.1 “Standby (for Cube4/5 and *EoSens* Cube6/7 cameras only)” for details.

1.6.2.3 LEDs

With the color LEDs of MotionBLITZ the actual operating condition is indicated. Three colors are possible (and off-state):

RED
GREEN
ORANGE

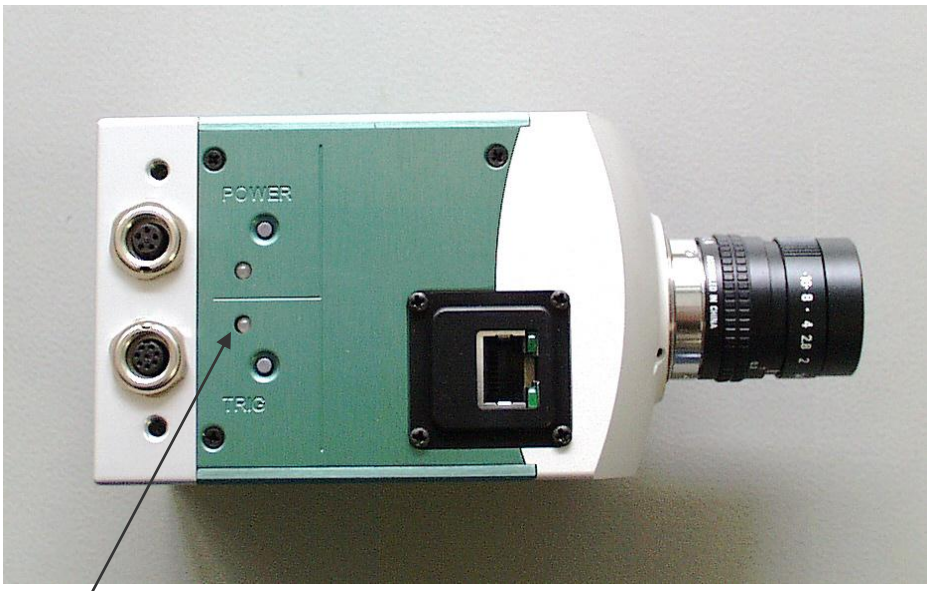
1.6.2.3.1 Upper LED: battery charging and power indication



Color	LED-state	Camera state
OFF	-	Switched off
RED	constant	Switched off, battery charging in progress
GREEN	constant	Switched on, no charging (battery full or no power supply connected)
ORANGE	constant	Switched on, battery charging in progress
In addition for Cube4/5 und *EoSens* with according hardware version supporting the standby facility:		
RED/ORANGE	flashing	Standby mode with external power supply
GREEN/ORANGE	flashing	Swiched on, with internal power supply (battery)

With empty batteries it may take a few minutes of initial charging until the camera can be switched on.

1.6.2.3.2 Lower LED: internal camera state



Color	LED-state	Camera state
RED	constant	Boot procedure failure. Switch off the camera and try again.
ORANGE	after power on Cube1/2: 15 sec Cube3: 7 sec Cube4/5: 0 sec *EoSens*: 0 sec	Power up boot procedure in progress
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

1.6.3 The front of the camera

The c-mount (optional „F-Mount“ für Cube4/5 and Eo*Sens*) 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 MotionBLITZ camera, version as ordered, see selection below
- 1 Interface cable GigaBit Ethernet
- 1 110-220V power supply
- 1 CD with MotionBLITZ operating software
- 1 connector for signal Input

1.8 MotionBLITZ Versions:

Identifier **(1)**	Recording time [s] **(3)**	Max. Reso-lution **(4)**	Max. frame-rate[fps] **(5)**	Lens mount **(6)**
Cube1 M3	3	640x512	1.000	CM
Cube1 M6	6	640x512	1.000	CM
Cube2 M3	3	1280x1024	32.000	CM
Cube2 M6	6	1280x1024	32.000	CM
Cube3 M3	3	512x512	128.000	CM
Cube3 M6	6	512x512	128.000	CM
Cube4	1,5	1280x1024	93.000	CM/FM
Cube4 M3	3	1280x1024	93.000	CM/FM
Cube5	1,5	512x512	190.000	CM/FM
Cube5 M3	3	512x512	190.000	CM/FM
Eo*Sens* Cube6	3	1280x1024	83.500	CM/FM
“ M6	6,5	1280x1024	83.500	CM/FM
“ M13	13	1280x1024	83.500	CM/FM
Eo*Sens* mini1	3	1280x1024	83.500	CM/FM
Eo*Sens* Cube7	1,5	1696x1710	298.000	CM/FM
“ M3	3	1696x1710	298.000	CM/FM
“ M6	6	1696x1710	298.000	CM/FM
Eo*Sens* mini2	1,5	1696x1710	298.000	CM/FM

(1) Additional configuration options:

C	color (otherwise monochrome)
HG	indicates the Hi-G version (ruggedized for crash and vibration)
IB	Camera has ImageBLITZ option
IG	IRIG-B input processing option
MS	Camera has Multi-Sequence option
M3	3 seconds recording time
M6	6 seconds recording time
M13	13 seconds recording time
PB	Phoenix connector
PR	Power on recording

(3)

Cube1	seconds when using 1000 fps and 640x512
Cube2	seconds when using 500 fps and 1280x1024
Cube3	seconds when using 2500 fps and 512x512
Cube4	seconds when using 1000 fps and 1280x1024
Cube5	seconds when using 5000 fps and 512x512
Eo*Sens* Cube6/mini1	seconds when using 500 fps and 1280x1024
Eo*Sens* Cube7/mini2	seconds when using 523 fps and 1696x1710

(4) Width x height

(5)

fps	frames per second
Cube2	reduced resolution when using more than 500 fps
Cube3	reduced resolution when using more than 2500 fps
Cube4	reduced resolution when using more than 1000 fps
Cube5	reduced resolution when using more than 5000 fps
Eo*Sens*	reduced resolution when using more than 500/523 fps

(6)

	Lens mount:
Cube1 / Cube2 / Cube3	CM = „C-Mount“
Cube4 /5, Eo*Sens*	CM = „C-Mount“, optional FM = „F-Mount“

Cube3 / Cube5 have an increased photosensitivity (six times higher than the Cube1 / Cube2).
Eo*Sens* Cube6/mini1 has an increased photosensitivity (mor than 10 times higher than the
Cube1 / Cube2).

1.9 Power supply and charging

MotionBLITZ cameras contain an integrated, rechargable battery, which provides the necessary voltage for operation. Use an external power supply for charging the battery and for external power operation.

	Only voltages in the range from 10,5 to 24 Volts (30 Volts für Cube4/5 and Eo*Sens*) @ 15W max. are permitted. Higher input voltages may seriously damage the camera. Damage of this type is not covered by our warranty.

1.9.1 Battery charging

MotionBLITZ contains an integrated, rechargable battery. Thus the camera can operate as stand alone without any power connection for up to 30 minutes of circular recording with full resolution.
For Cube4/5 and Eo*Sens* cameras this time will be increased to 60 minutes.

Stored images can be retained in the camera up to two hours with a fully charged battery. With the standby option, more than 20 hours are possible.

The battery will be automatically charged when the power supply (10,5 – 24 V DC) is connected to the camera and the camera is switched off. Charging of a completely empty battery will take 3 hours.

If the camera is switched on and a power supply connected, the battery is charged to a fraction of its total capacity, it will operate a few minutes when disconnected from power supply.

If the camera is switched on and a power supply is connected, the battery will be-charged as well.

A fully charged battery will discharge within a few days when not used.

	Always use an external power supply if the battery condition is unknown.

2 Operating Modes

After switching on the camera it is ready for operation within a few seconds.
Cube4/5 and Eo*Sens* cameras with according hardware version have a standby mode available.

2.1 Standby (for Cube4/5 and Eo*Sens* Cube6/7 cameras only)

The intended purpose of the standby mode is to store the camera's recorded images for a longer time (up to ca. 20 hours and more) without any external power supply.
To manage this, in standby mode several components of the camera's electronic will be shutdown and mainly only the the image memory will be provided with power.

In standby mode, there is no access to the camera's image memory.

To get the camera into the standby mode you have to

- press the camera's power switch for a short moment (less than 1 second), when the camera is ready-to-operate or

- configure it with the MotionBLITZ software as described in chapter 5.7.2.3 " Standby after the end of a recording session" or in chapter 5.5 "The Camera menu".

To get the camera out of the standby mode you have to press the camera's power switch for a short moment (less than 1 second).

Please pay attention: If you press the switch longer than 1 second, you will shut down the camera completely and the camera's recording will be lost!

The standby mode will be indicated by the LEDs in the follwing manner:

- the lower LED (TRIGGER) is switched off

- die upper LED (POWER) is flashing:

Power LED color	Power supply	advice
red / orange constant flashing	external	
green flashing 1 .. 5 times every 2 seconds	internal (battery)	If the battery is fully charged, there is a quintuple blinking. If the battery gets emtpy, there is a single blinking.

2.2 Ready-to-operate

By means of the MotionBLITZ 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.

MotionBLITZ holds up to 8 Gbyte 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.

2.2.1 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.

2.2.2 Prepare for recording

When the camera parameters are adjusted according to the users 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.

2.2.3 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 MotionBLITZ control software.

There are 2 methods of starting the recording:

1. Press the Start/Stop recording switch on the right side of 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.

2. Press the red **start recording**  button in the MotionBLITZ control program

2.2.3.1 recording modes

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

2.2.3.1.1 Non circular mode

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

2.2.3.1.2 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 3 methods to stop recording:

1. press the Start/Stop recording switch on the camera
2. apply a trigger signal (rising or falling edge, depends on setting "Trigger edge" in form "Camera Setup") to the appropriate camera input connector
3. press the **Stop** button in the MotionBLITZ control program

2.2.4 Saving frames to SD card

There is a hardware option „SD card“ for MotionBLITZ Cube6 and Cube7 cameras.. Cameras with this option may save all frames of a recording sequence immediately after completion of the sequence. See details in chapter „AutoSave all frames to SD Card“.
Additional copying initiated by the user is possible as well: „Camera“ => „Copy all frames to SD card… “.

3 Installation of MotionBLITZ

3.1 Minimal system requirements (PC)

For error-free operation of MotionBLITZ 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 Gbyte Harddisk
- 8 Mbyte graphic memory
- Display with 1280 x 1024 pixels
- GigaBit Ethernet Adapter

For optimal operation of MotionBLITZ, a PC wth the following minimum specifications is recommended:

- Pentium IV 1.8 GHz
- Windows XP
- 512 Mbyte PC Ram
- 40 Gbyte Harddisk
- 32 Mbyte graphic memory
- Display with 1400 x 1050 pixels / 24 Bit
- GigaBit Ethernet Adapter

3.2 Installation of the software

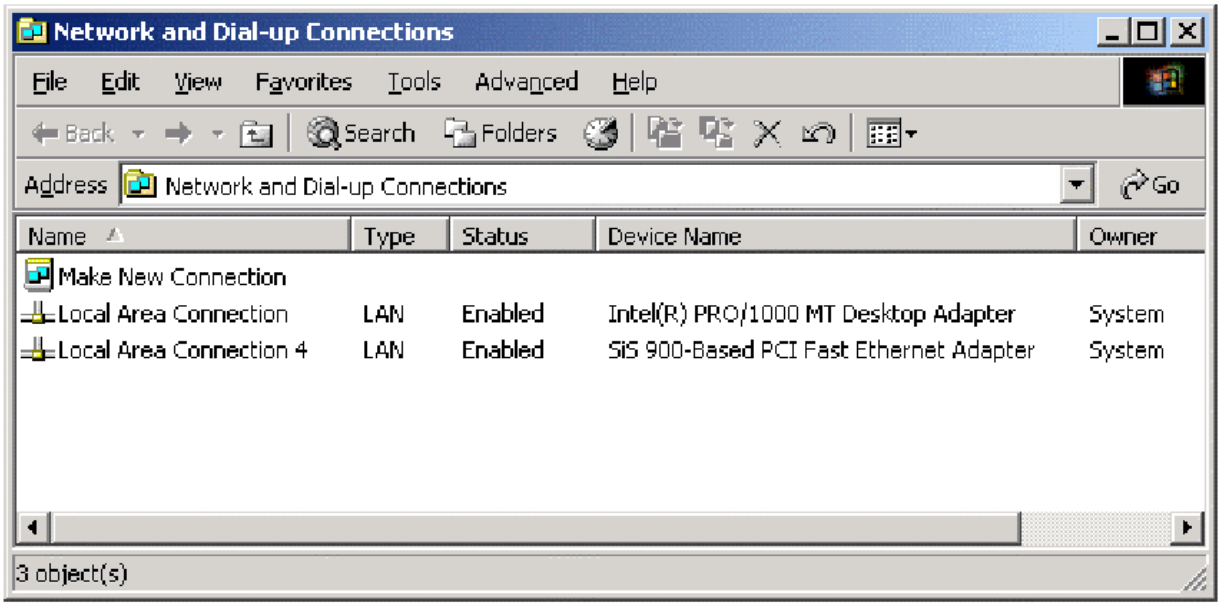
The GigaBit Ethernet adapter and driver should be installed before the MotionBLITZ software is installed. For details see the GigaBit Ethernet adapter manual.

Insert the MotionBLITZ 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.

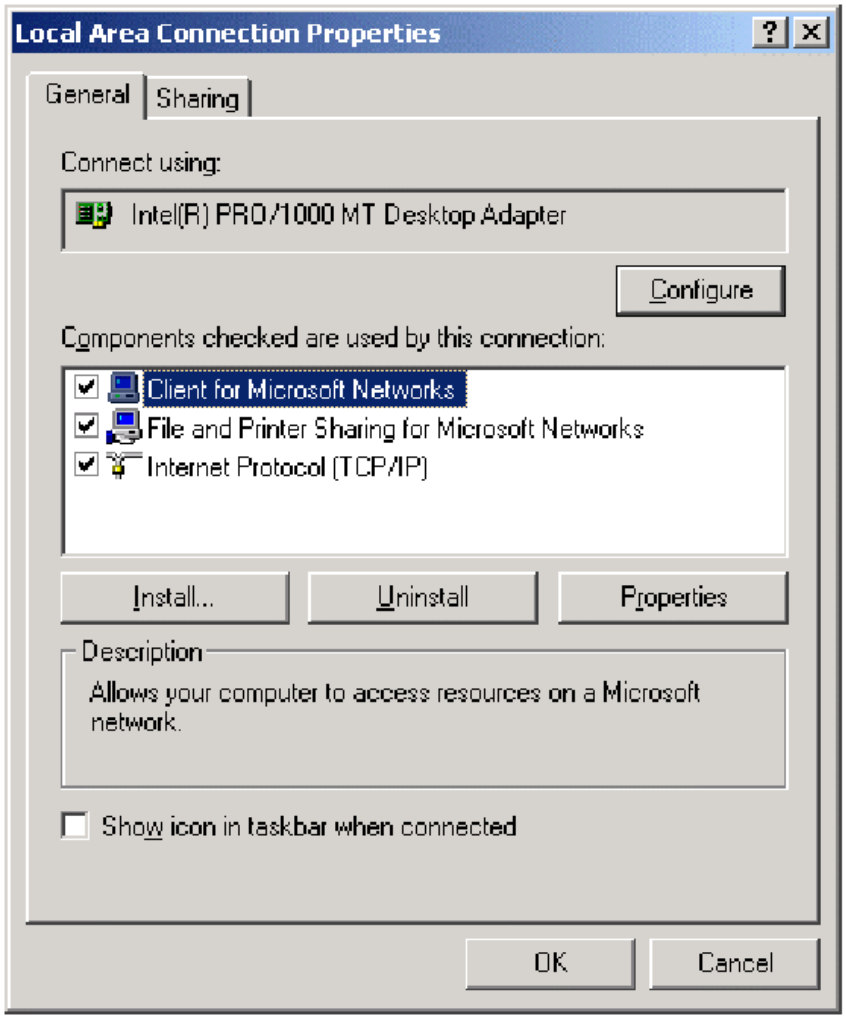
3.2.1 Assigning an IP-address to the GigaBit Ethernet adapter

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 MotionBLITZ applications.
2. Open the “Network and Dial-up Connections” window from the Windows ControlPanel.



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-Adress 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-Adress 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 MotionBLITZ 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 MotionBLITZ camera

The camera-network configuration file "mfggb.ini", which contains a section called [CAMERA_REL] 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 cameras'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 MotionBLITZ 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 Labtop 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 MotionBLITZ to the PC and starting program

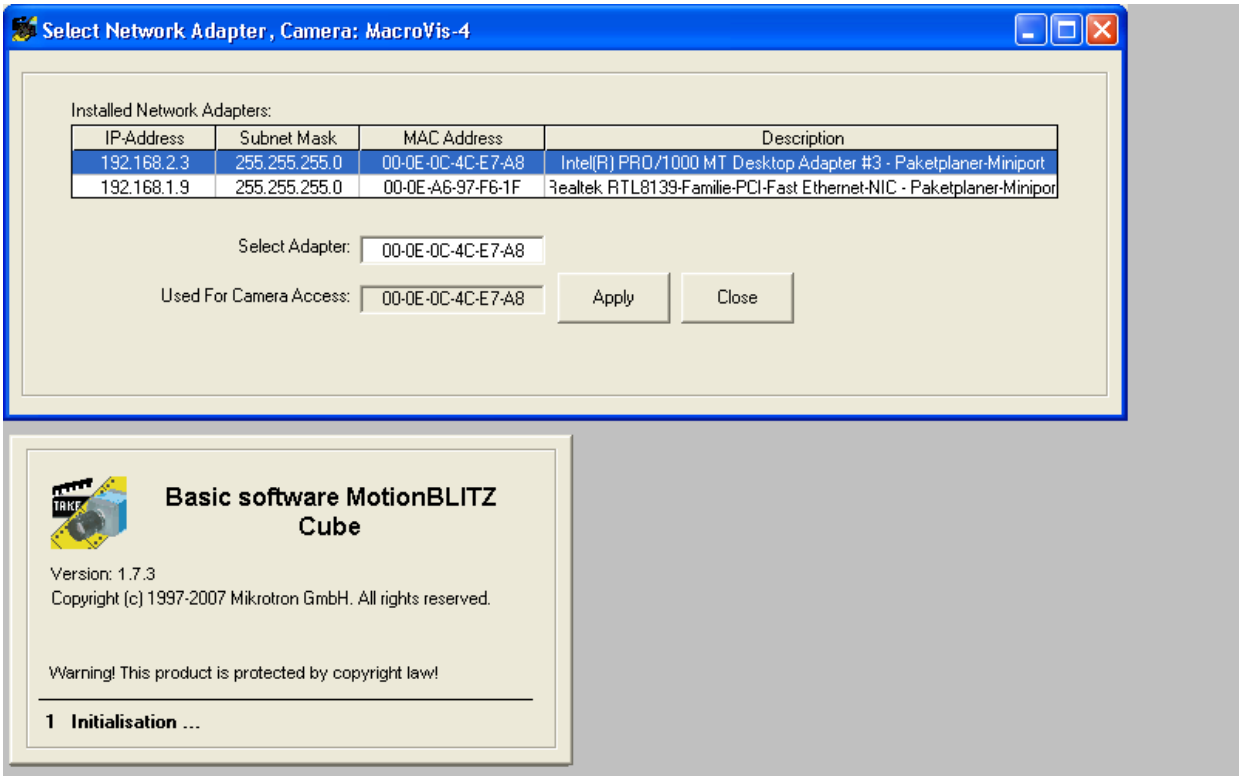
To properly connect the camera to the PC please follow these steps:

1. connect the GigaBit Ethernet cable to the camera and then to the PC
2. connect the power supply to the camera
3. switch on the camera by pressing the power-switch
   (see chapter Switches on page 11)
4. start the MotionBLITZ Control programm. If it's the first start after installation of the MotionBLITZ software, two forms will be displayed for selecting the GigaBit Ethernet adapter and the MotionBLITZ camera. Please select the network adapter, click on "Apply" and select the camera and click on "Apply".

Now the MotionBLITZ is ready to operate.

3.3.1 Selecting the network adapter

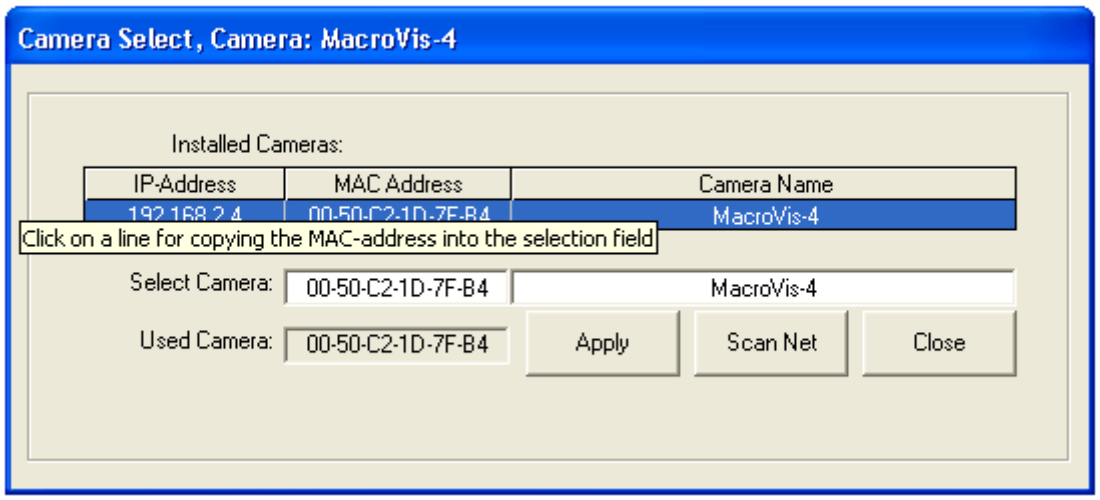
The form for selecting the network adapter willl be shown automatically after the first start of the MotionBLITZ program after its installation. You may load this form in the Camera menu (“Select Network Adapter”) as well.



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 programm start without successfully selecting a camera before:

3.3.2 Selecting the MotionBLITZ camera

The form for selecting MotionBLITZ camera willl be shown automatically after the first start of the MotionBLITZ 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 automatical steps with the initialisations for the hardware the system is ready for use.

3.3.3 Camera name

If you 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 MotionBLITZ program.

3.3.4 Multi camera operation

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

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

3.3.4.1 Synchronizing cameras

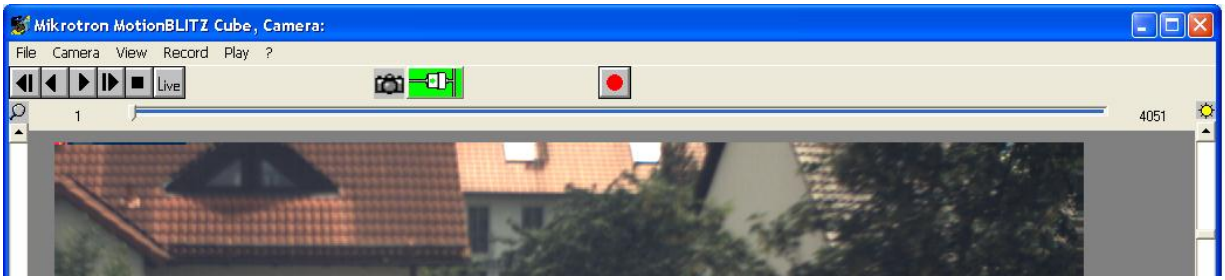
For synchronizing MotionBLITZ cameras you only have to connect the sync output of a master camera to sync input of the slave cameras, as described in detail in “Enable Sync in” and ARM or “Sync out” signal

4 MotionBLITZ in practice

The full range of functions available and all camera parameters may be set by means of the MotionBLITZ 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 MotionBLITZ symbol on the PC. desktop or choose the application in the windows start menu. The following screen mask will appear:

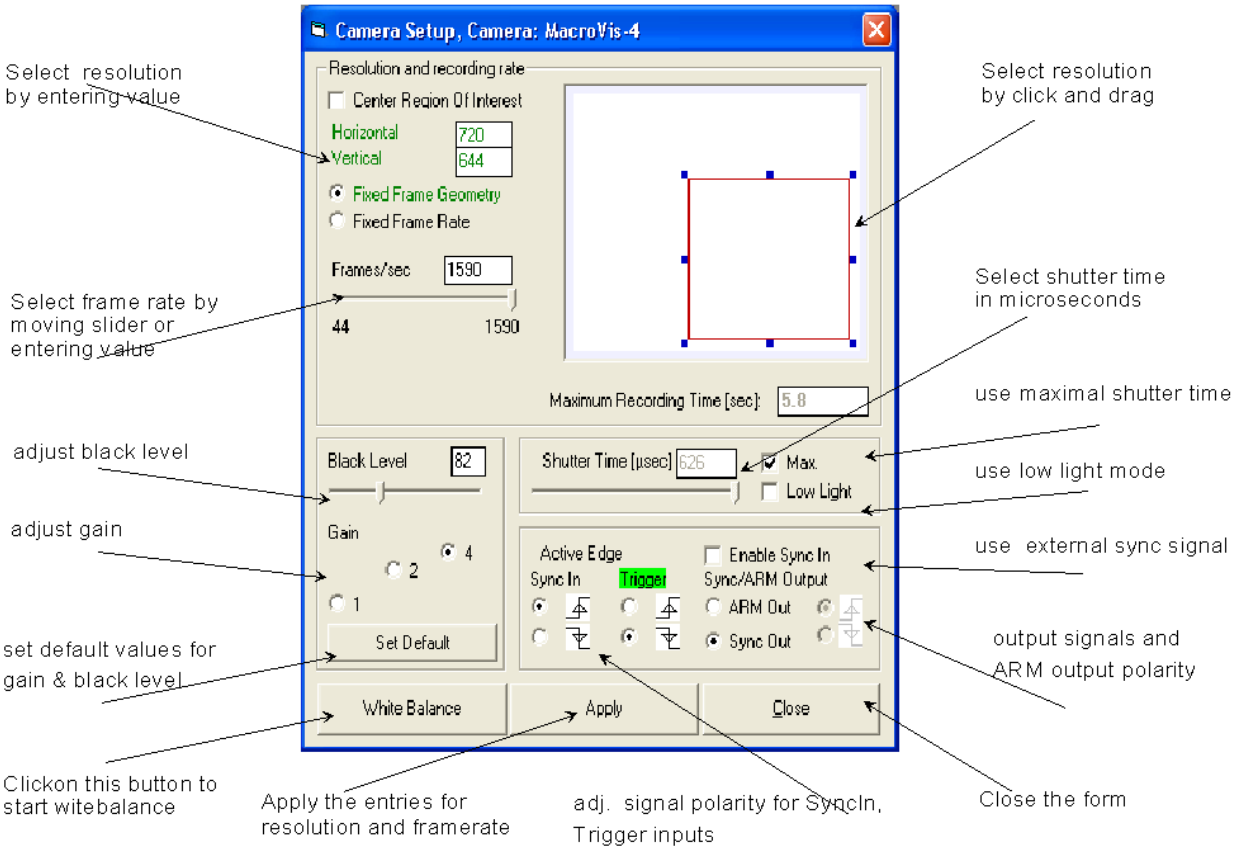


Select modes of operation or change parameters by pressing a command-button or by selecting an item in a pulldown menu. If the mouse cursor is moved slowly over the command buttons and symbols, information about each object will be displayed ("tool tip text").

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

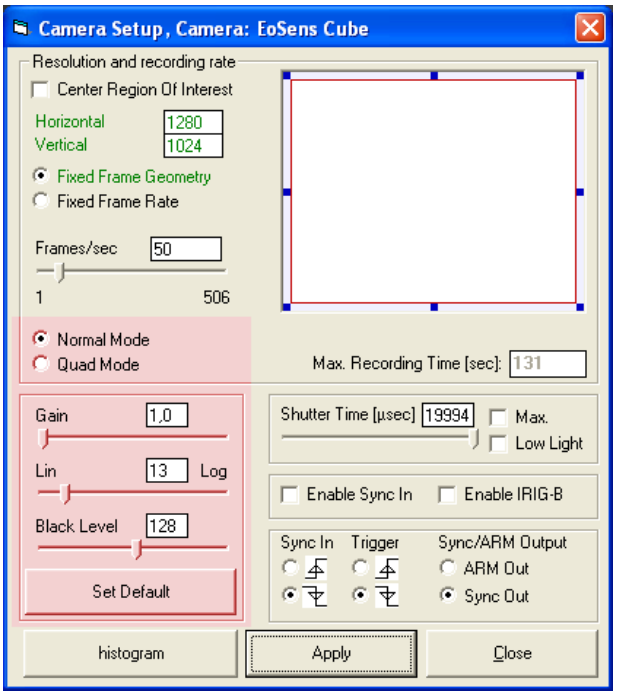
Click on the menu item "Camera" => "Camera Setup". This form will appear:

A) Cube cameras



B) Eo*Sens* cameras

Setup adjustments for Eo*Sens* cameras differ in the colored area of the form:



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

	Changes of resolution or framerate 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. shuttertime or analog gain, will be **sent immediately to the camera** after entering.

If there is no connection to the camera, the following 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 „Normal Mode“ / „Quad Mode“ (for Eo*Sens* Cube6/mini1 cameras only)

Eo*Sens* Cube6 cameras starting from firmware version F2.90 and Eo*Sens* mini1 cameras from version F2.19 provide the „Quad Mode“. In this mode the camera may achieve a nearly quadruple higher frame rate and recording time without changing the image section (width and height of the image). The only drawback is a little decrease in image quality.
The „Normal Mode“ comes with the full quality of the image without the increased frame rate and recording time.

4.2.2 Gain

The gain may be adjusted with the 4 option buttons. You may increase the gain up to 8 (or 4 for Cube3/4/5). But please note: the quality of the image decreases the more you increase the gain.
For Eo*Sens* cameras the gain will be adjusted via a slider or by entering a number in the according input field.

4.2.3 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 whitebalance 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 whitebalance or the histogram touches the "min" border of the chart.

4.2.4 „Lin Log" (for Eo*Sens* cameras only)

With the "Lin Log" parameter you may ajust 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, normal illuminated scenes will be displayed well.
If there are very bright areas in the scene, then the image will be overexposed, details of the motif will be lost. In this case you should move the slider towards "log"(arithmic) whereby details in bright parts of the image will become visible again. The correct set-up value depends on the brightness spreading of your motif.
In normal illuminated scenes you should use "Lin".

4.2.5 Low Light Mode

In low light mode the camera's exposure-time is extended up to 1023 milliseconds in order to increase it's 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.

4.2.6 Enable Sync in

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

- Connect the Sync out of your MotionBLITZ 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 framerate. Thus the slave cameras will be synchronized with the master camera.

4.2.6.1 Framerates of master and slave camera

If you synchronize a slave camera by a master camera, then the framerate 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 framerate as the master camera.

Example:
You want to record with 1000 frames per second. Adjust the master camera to the desired 1000 fps, select 1004 fps for the slave camera. Then the slave camera will deliver the master camera’s framerate (1000 fps)!

	If “Sync in” is enabled and no “sync in” signal is provided, the camera will not record and timeout will occur! The framerate of the slave camera must be slightly above the master camera’s frame rate: Slave camera should be set up to framrate that is at least 2 fps higher than the master’s framerate for Cube1/2/4/5 and Eo*Sens* models and at least 20 fps higher for Cube3 models. **Thus the maximal achievable real framerate will be about 2480 fps @ full image resolution (512 * 512) for Cube3 slave cameras**

4.2.7 Enable IRIG-B input

If the camera was deliverd with the option IRIG-B, the processing of the IRIG-B input signal may be activated with the check box “Enable IRIG-B”. Please see chapters

„Signal input / SYNC” connector, type Lemosa (all Cube models, not mini)” and

“IRIG-B input”

for details.

After activation, the signal will be processed in the following manner:

- decoding of the modulated 1KHz time code that is typically derived from a GPS receiver (connect with Pin 6 of Signal input / sync socket).

- The time code will be displayed in the info line as day of the year and time of day (GMT) in the following format:
  ttt hh:mm:ss, whereas
  ttt = day of the year
  hh = hour
  mm = minute
  ss = second.

- The internal frame rate timebase is then synchronized once per second to the IRIG-B 1sec marker, and therefore phase aligned to the 1KHz IRIG-B signal.

4.2.8 ARM or “Sync out” signal

You may choose between “ARM” or “Sync out” signal for pin 3 of the output connector (see Table 8.2-3)

4.2.8.1 Sync out activated

If you select “Sync out”, it is possible to synchronize other MotionBLITZ 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.

4.2.8.2 ARM activated

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

For Cube4/5 and Eo*Sens* cameras only: With the both 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 Arrange 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 framerate 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.

For Cube4/5 and Eo*Sens* cameras there are firmware versions available for triggering in this mode. See details in chapter “Record settings”

	Recording in non circular mode may only be achieved with MotionBLITZ user interface program and not with the trigger switch or the trigger signal!

4.5 Recording in circular mode

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

- the closing of the camera's trigger switch,
- a trigger signal,
- the ImageBLITZ
- the clicking on the stop button in the MotionBLITZ 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 2 various methods of starting a recording:

1. Press the Start/Stop recording switch of 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.

2. Press the **start** recording button in the MotionBLITZ control program.

The internal camera state LED (see 1.6.2.3.2 on page 13) 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 3 various methods to stop recording

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

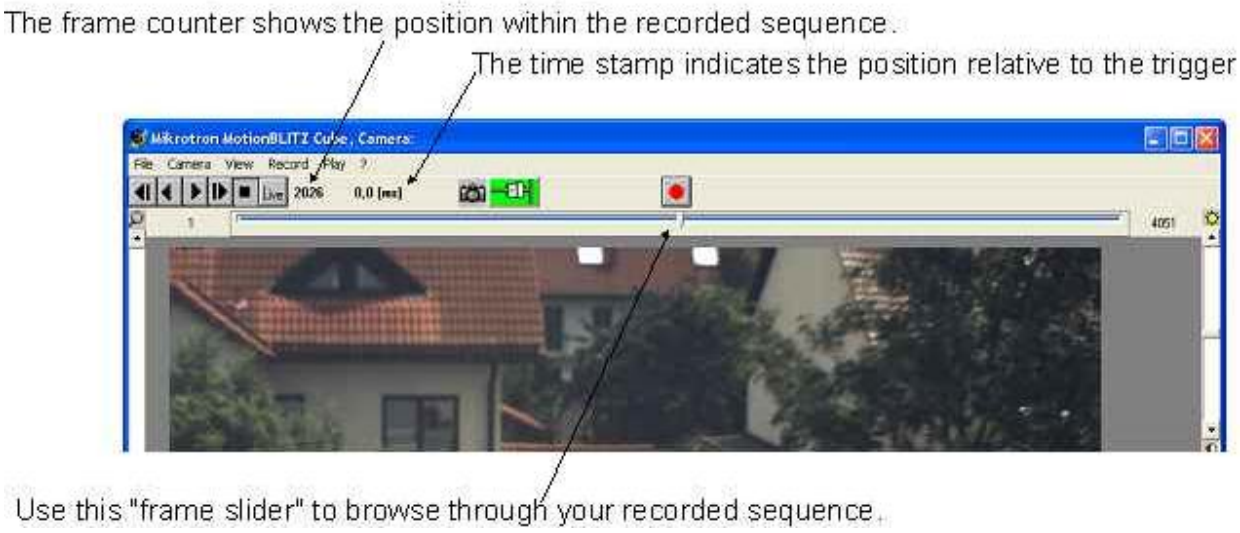
The internal camera state LED (see 1.6.2.3.2 on page 13) stops blinking orange. The sequence is complete after the post-trigger frames have been recorded.

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 Mo-  tionBLITZ 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.



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.

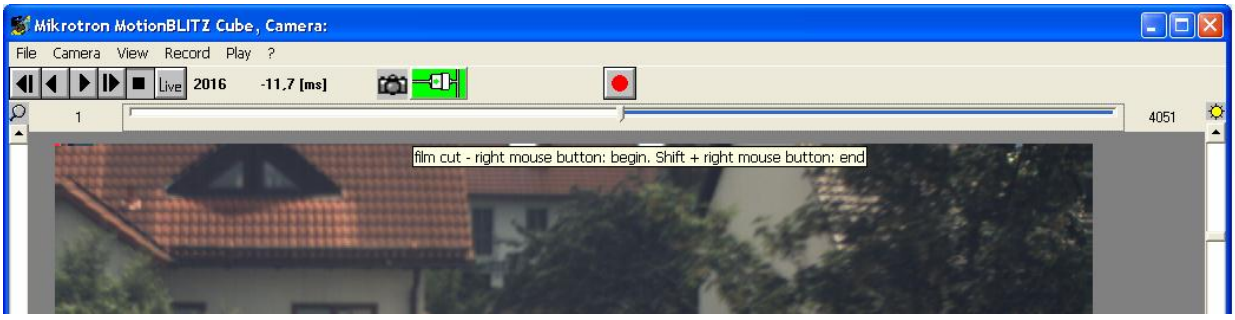
The sequence may now be saved as single bmp-files in the "Save" menu or as an avi-file in the "Make Avi" menu . See chapter 5.4.2 and 5.4.3 on page 49 and page 50 for detais.

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.

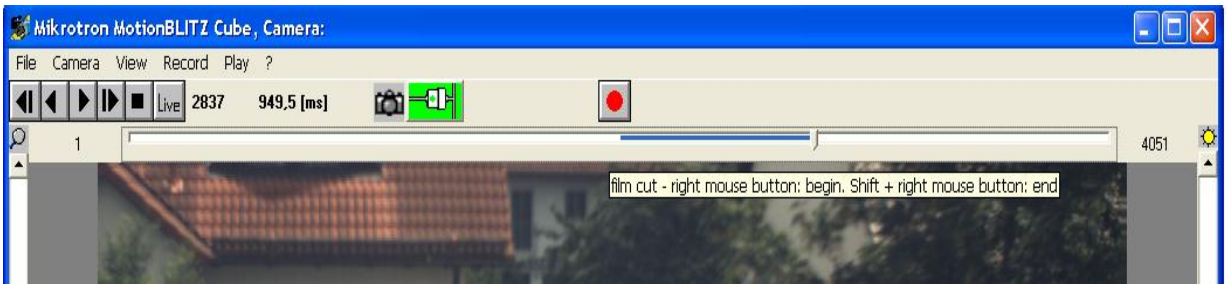
	This method works only if the frame slider has the focus! Click on the frame slider for getting the focus

4.7.1.1 Set the beginning of a sequence



Press the right mouse button or the key “b”. The actual frame number, 2016 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, 2837 in the picture above, will be set as a 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 “I” 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 47). Now the image source for displaying frames is the selected directory with the appropriate files. This is indicated by the symbol 

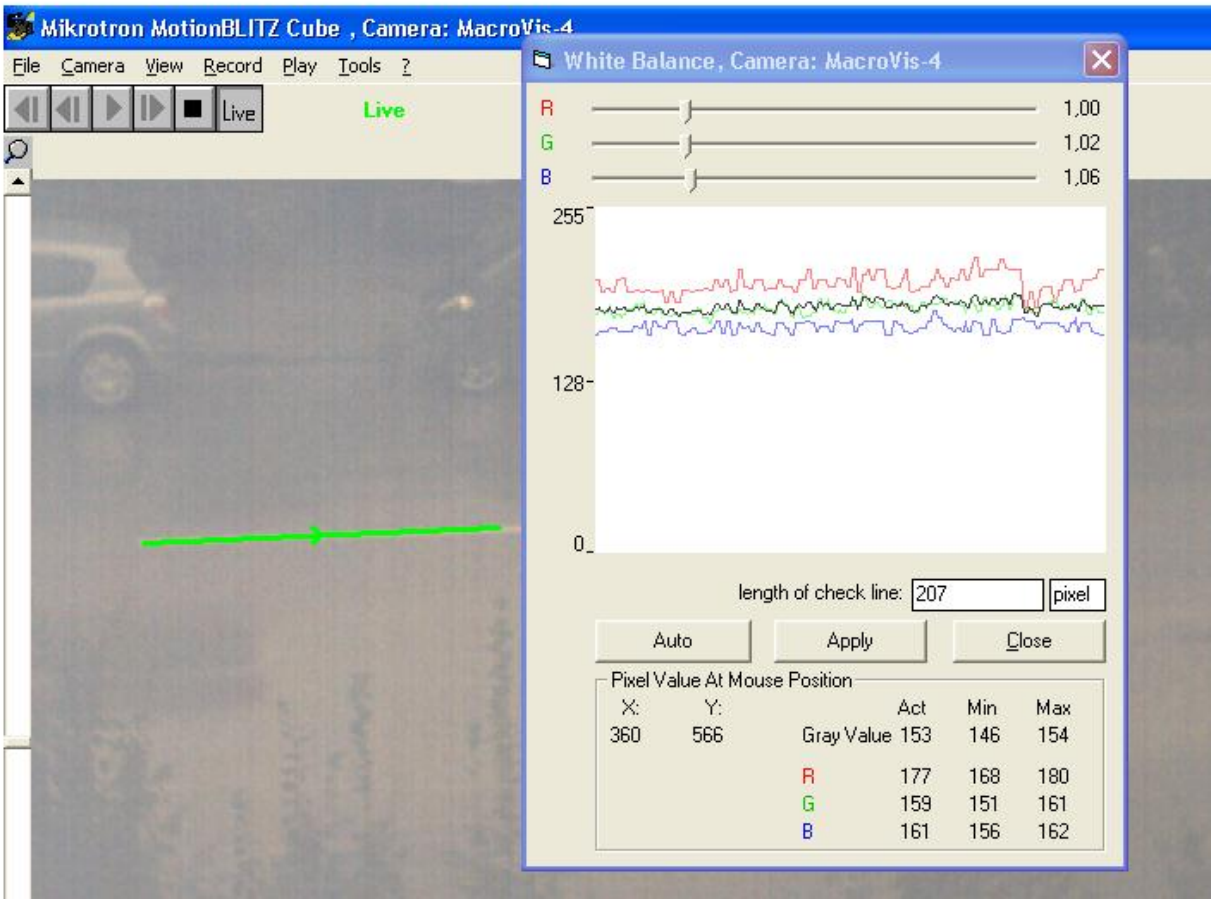
in the status area of the MotionBLITZ control-programm.

The playback buttons or the "Play settings" menu allow navigation through the image files as described in chapter 4.6 on page 39.

The MotionBLITZ 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 Whitebalance / histogram / length of the check line

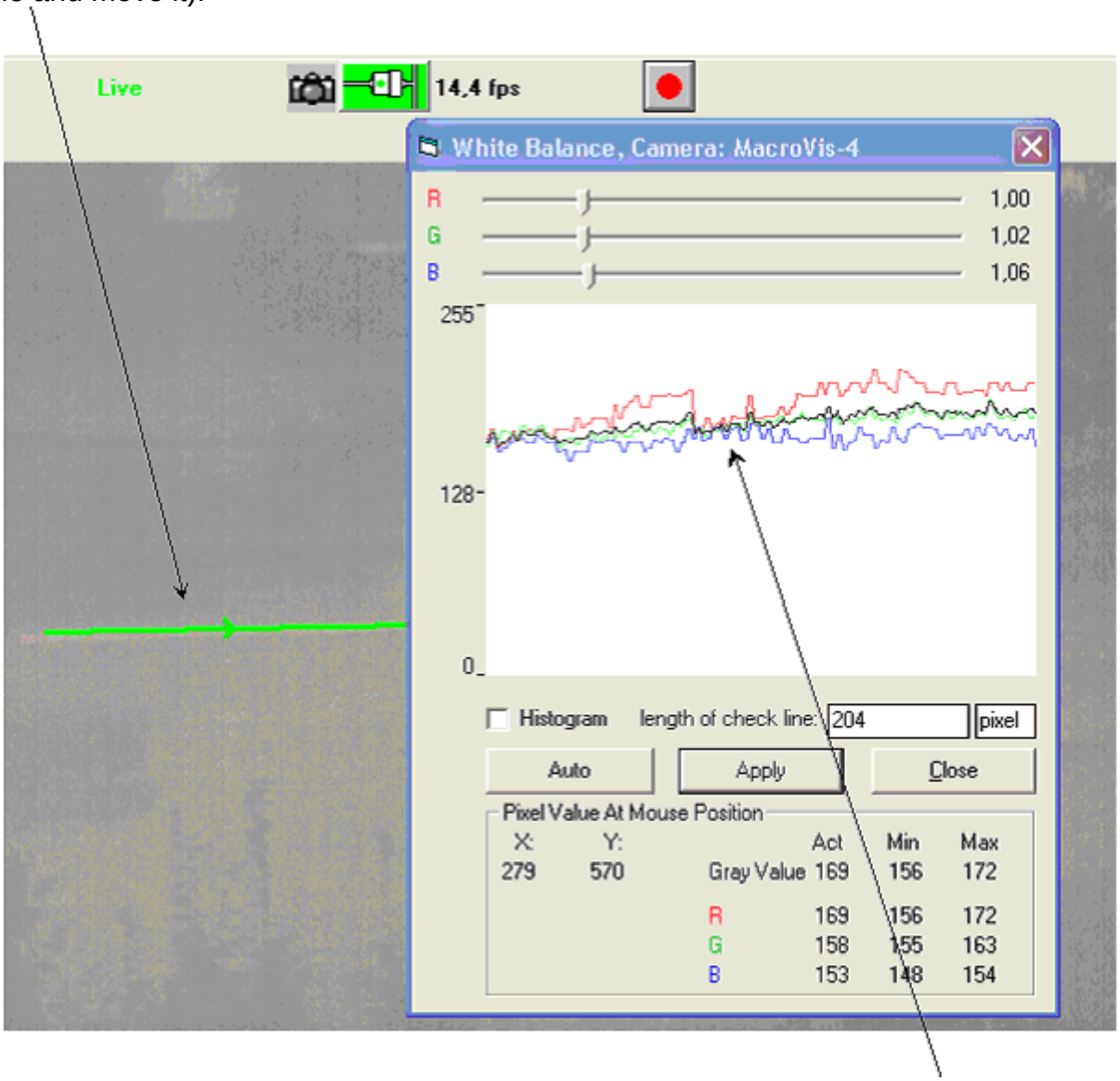
Good illumination is extremley important for optimal true color display. Best results are achieved by using daylight or halogen light. For recalibrating the color correction, click first on "Live" and then in the menu Camera Setup on the button "white balance". The following screen mask will be shown



ⓘ	**White balance is available for color cameras only. For black & white cameras a histogram will be provided instead. The histogramm 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 lenght of the check line

The green check line may be used for approximately determing 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 MotionBLITZ software

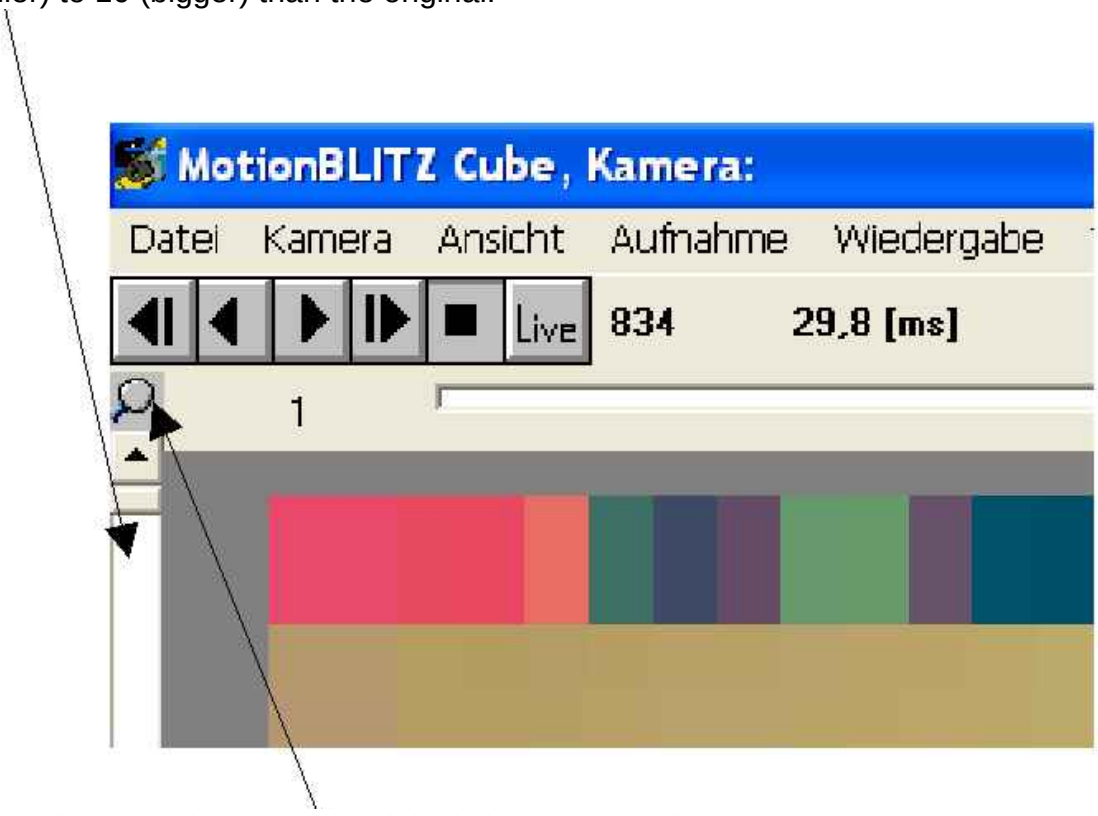
There are several menus and controls in the MotionBLITZ program. Each will be described in the following chapters

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

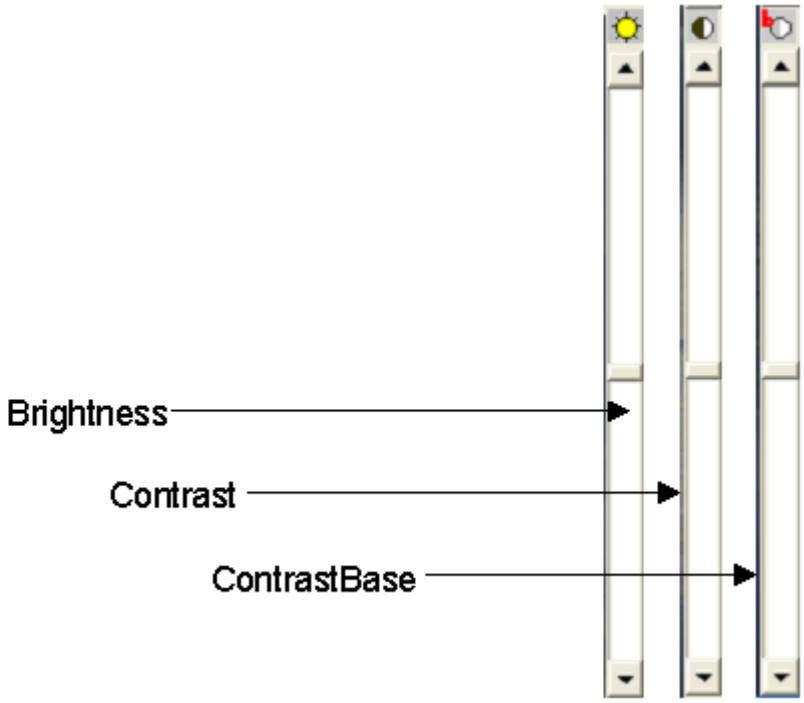
For zooming, use the left vertical scrollbar. The range of the zoom factor is from 0.1 (smaller) to 10 (bigger) than the original.



Click on the zoom icon for the original size. The number next to the zoom icon indicates the actual zoom factor. Doubleclick on the icon to fit the image into the form. The icon gets green to indicate this.

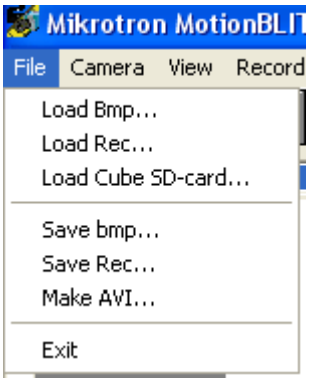
5.3 Brightness and contrast

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



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

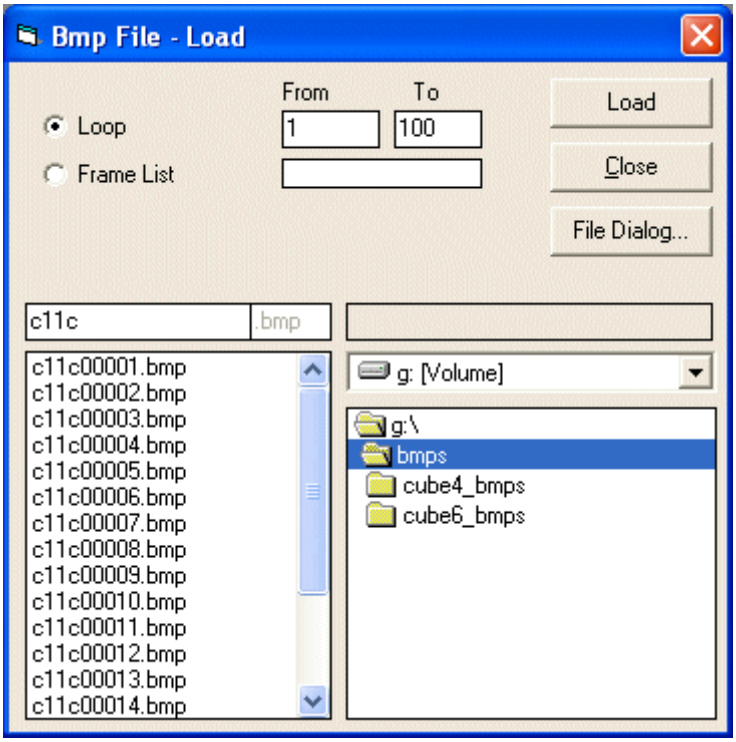
5.4 Menu File



The File menu allows

- reloading bmp, rec-files or Cube SD-card frames for display,
- start saving images as bmp or rec-files,
- create an avi-file and
- exit the program

5.4.1 Reload bmp-files



MotionBLITZ 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 a sequence (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

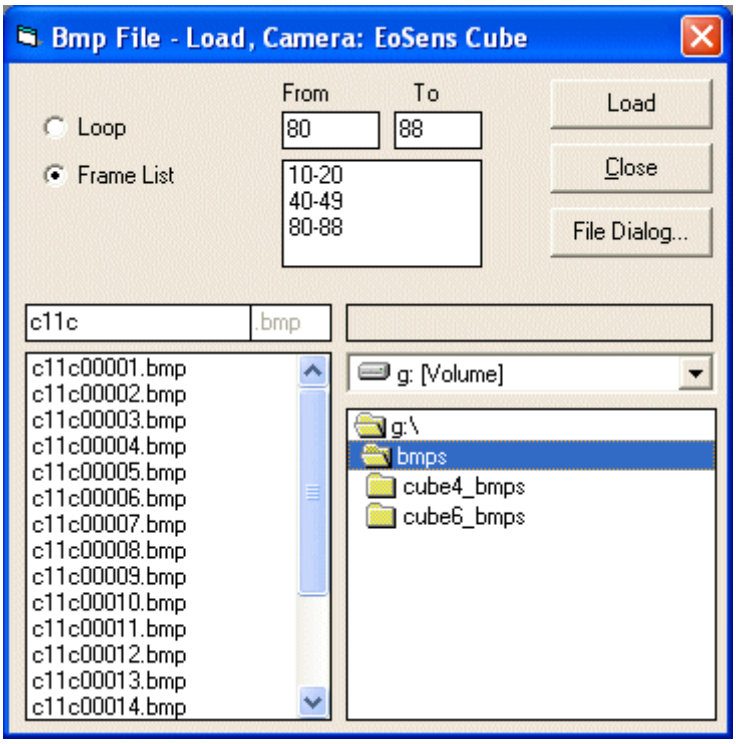
Click on the radio button "Loop".

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“

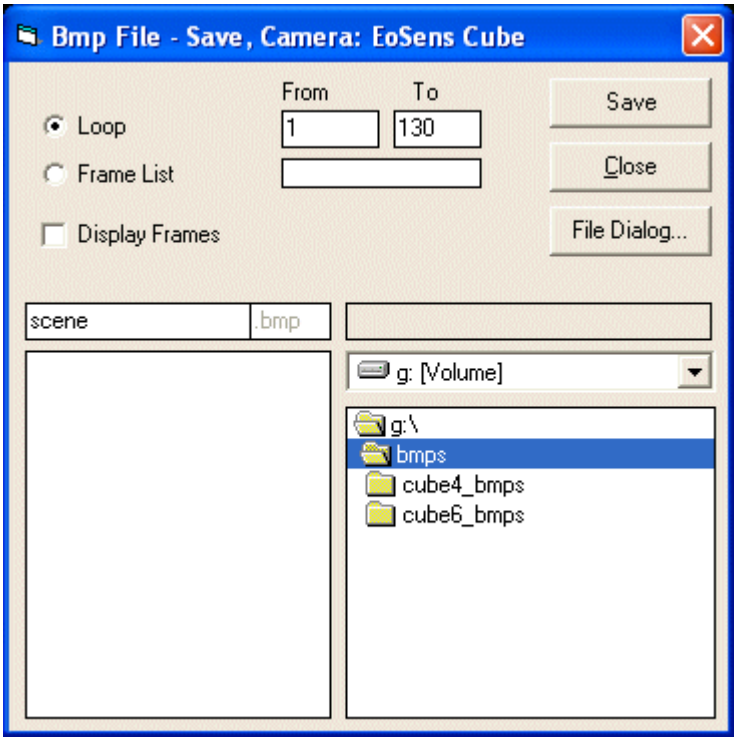
5.4.1.2 Load frame list

Click on the radio button "Load frame list"
The list may be edited in the menu "Play settings" (chapter 5.8 on page 78). Only the files whose numbers are included in the frame list will be loaded and displayed.



By clicking “Load“ the first file is loaded into the main window.
Use the replay buttons as described in 4.6 on page 39 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. MotionBLITZ 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 "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 “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 78.

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 a image caption depending on whether “infoline“ has been switched on or off in the “View“ menu (chapter 5.6.8 on page 62).

5.4.3 Save images to a rec file

Different from saving images to bmp-files, several frames are stored in a single, so called “rec 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 e.g. frames with a bayer pattern, then this 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 Save images to bmp-files

5.4.4 Reload a rec file

For reloading frames, that are stored in a rec file, use the “Load Rec...” 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 “Save images to bmp-files”. To indicate, that frames from a rec file are diplayed, the rec file symbol is diplayed left of the reconnect button:

5.4.4.1 Format of the rec header

All numbers are in decimal format

	example	Number of chars	remark	
[RAWHEADER]		32		
FormatIdentifier=	MRAW	32	A CRLF is included for delimter ,all fields left aligned	
HeaderVersion=	1,0000	32		
OffsetToFirstFrame=	1310720	32		
VendorId=	Mikrotron GmbH	32		
MotionBLITZ=	1.10.6	32		
Firmware=		64		
CameraType=		32		
CameraSerialNumber=		32		
ColorMode=	0	32	1=BAYER 0=MONO	
FrameTopInPixel=		32		
FrameLeftInPixel=		32		
FrameWidthInPixel=	1280	32	1280	
FrameHeightInPixel=	1024	32	1024	
BitsPerPixel =	8	32		
BayerFilterStart=	0/1/2/3	32	0 = GreenRed, 1 = RedGreen, 2 = GreenBlue, 3 = BlueGreen	
BayerFilterRed=	1,00000000	32		
BayerFilterGreen=	1,00000000	32		
BayerFilterBlue=	1,00000000	32		
GammaRed=		32		
GammaGreen=		32		
GammaBlue=		32		
Param_1=		32		
Param_2=		32		
Param_3=		32		
FrameRate=	1000	32		
ShutterTime_µs=	20	32		
TimerBasis_µs=	49,91319444	32	[µs]	
InfoText=	Experiment 26	128		
CompleteFixedInfoPart=	1280x1024, 500 Hz, 564 µs, *1.5, MotionBLITZ EoSens Cube6 #00000, V1.10.6	128		
BaseTime=	2008-12-17 23:50:00	32	Timestamp for value 0 of the absolute timer	

NumberOfSequences=	1	32		
[SEQUENCES]		32		
NumberofFrames_00=	1000	32	First sequence	
FirstFrameNumber_00=	1	32		
TriggerFrameNumber_00=	50 (1…x)	32		
Reftim1_00=	268582,89928164	32	Time of trigger frame in µsec based on BaseTime	
		32		
NumberofFrames_01=		32	Second sequence	
FirstFrameNumber_01=		32		
TriggerFrameNumber_01=	1000	32		
Reftim1_01=	1050 (1…x)	32		
NumberofFrames_02= ...	….		Third and next sequences	

5.4.5 Reload frames from a Cube SD card

With Cube cameras holding a SD card slot you may copy frames on a SD card.

If your PC has a SD card reader, you could read the frames from the SD card with the MotionBLITZ software.

Click on „File“ => „Load Cube SD-card...“.

If a Cube SD card is found in your PC’s card reader, the images will be shown now. You may save them as bmp files or an avi file as well.

To indicate, that frames from a Cube SD card are diplayed, the SD card symbol is diplayed left of the reconnect button:

ⓘ	**You must run MotionBLITZ as administrator on Windows Vista or Windows7 systems, otherwise the frames could not be displayed!**

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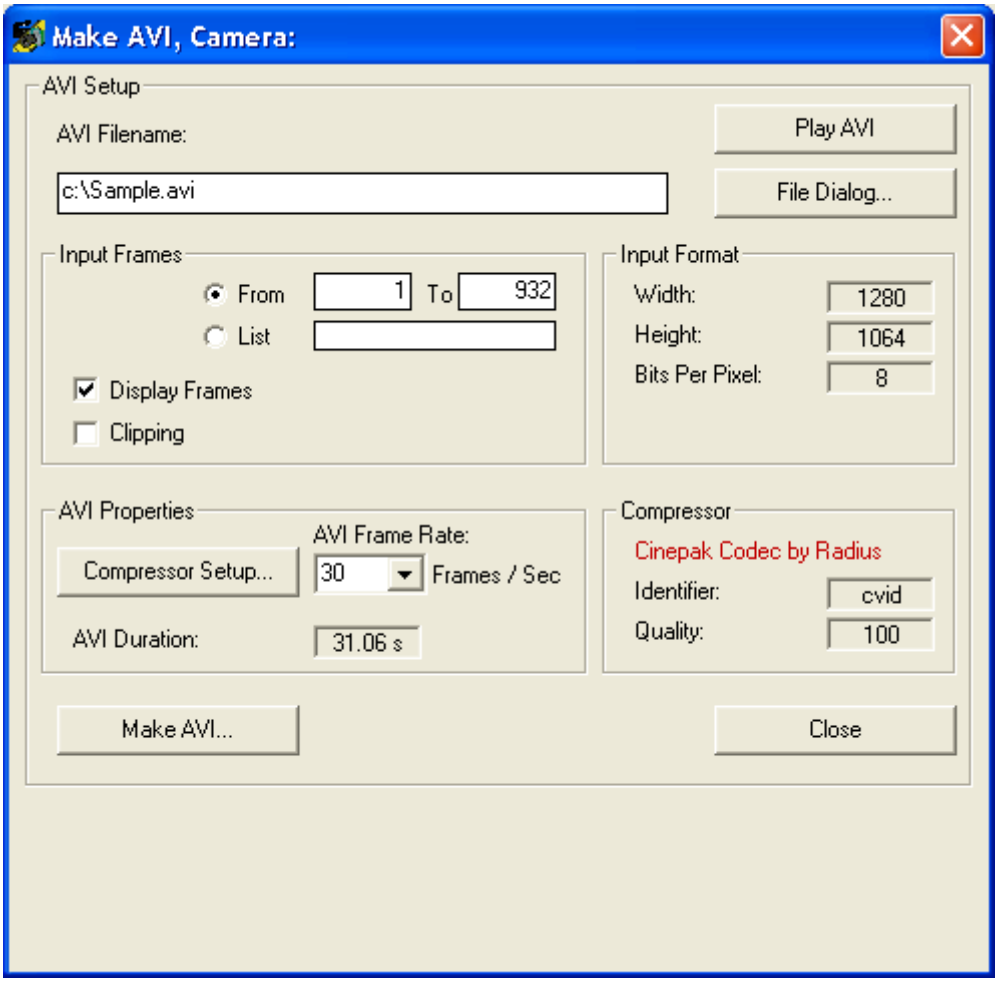
5.4.6 Make Avi File

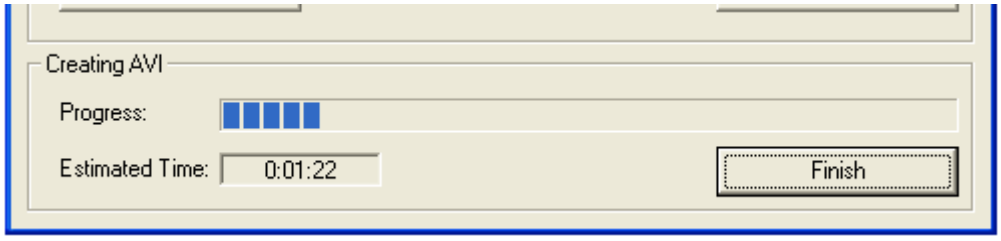
Select the avi-filename, the numbers of the frames to be compressed and the compressor-type by clicking on the "Compressor-setup" button.

ⓘ	Use in the avi-file name or in the directory only Ascii characters. Non Ascii characters (like Chinese, Korean, Japanese) may cause problems when making AVI is started. You should apply only ASCII characters for the directory and filename, e.g. C:\avis\1.avi



If only a special region of the sequence is to be processed, select this region by clicking on the "clipping" check box. An rectangle named "AVI clipping area" will be overlayed 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 MotionBLITZ camera“

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

- with „Load Factory Defaults“ reset the camera’s parameter to a defined original state.

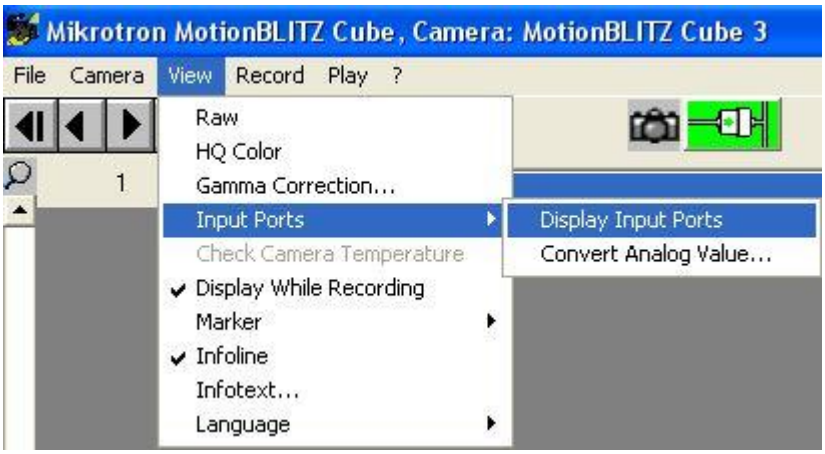
- with “Settings of Last Take…” you may adjust the camera’s frame size, frame rate, gain and compression mode to the values used for the last recording sequence. You could use this settings before uploading the recorded frames in case the camera’s parameters were modfied after the recording sequence.

- with “Donwload Firmware” download a new firmware to the camera. This feature is available only, if the keyword “download” is added to the target line in the properties of MotionBLITZ’s desktop shortcut

- with „Standby“ set the connected camera into the standby mode. More informaton to this topic you will find in chapter 2.1”Standby”

- with „Copy all frames to SD Card...“ save all frames of the last recording session on the Cube’s SD card. The process of copying is accomplished analogously to „AutoSave all frames to SD Card “, i.e. you will be informed about the progress and could abort copying as well.

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.

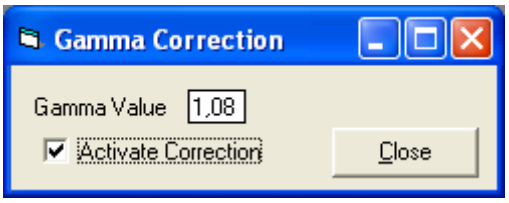
5.6.2 HQ Color

If HQ color is activated, a complex Bayer color calculation will be accomplished leading to better color images at the expense of display speed.

5.6.3 Gamma Correction

If you like to adjust the percental brightness of the camera's images, click on "Gamma Correction…" Thereby a new menu will be opened for putting in the appropriate parameter.

5.6.3.1 Do the correction



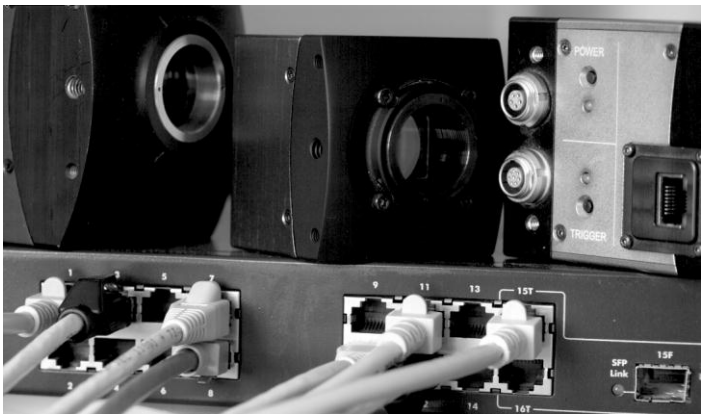
A gamma value of 1 won't change the brightness. Values larger than 1 will brighten up darker parts in the image, values less than 1 will darken brighter parts.
The gamma value may be chosen between 0,20 and 5,00. By clicking on checkbox "Activate Correction" the correction will enabled or disabled.
The correction will be accomplished subsequently with the next image, that will be provided by the camera. Thus recorded sequences may be corrected any number of times.

Examples for the effect of the gamma correction:

5.6.3.1.1.1 Darkened, Gamma = 0,6

5.6.3.1.1.2 Unchanged, Gamma = 1,0

5.6.3.1.1.3 Brightened, Gamma = 2,0



5.6.4 Input Ports

The values of the digital and analog input ports may be displayed, the value of the analog port may be converted to a physical unit like “Volt” or “degree“.
Display Input ports
Convert Analog Values

5.6.4.1 Display Input ports

If “Display Input Ports” is enabled (checked), the 4 Bit digital input and the 8 Bit analog input values of the camera is displayed in the toolbar. If "Infoline" is enabled (checked), the values are inserted in the infoline, too.

5.6.4.2 Convert Analog Values

The camera's A/D converter delivers 0 for an input voltage of 0 Volts and 255 for 2,5 Volts. To convert the A/D value to physical units, use the form "Convert AD Value" and edit the values "A" and "B" of the conversion formula:

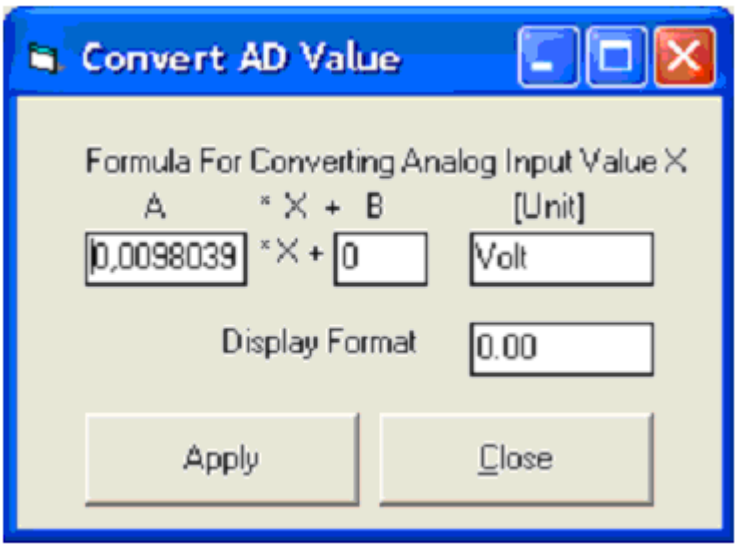
Converted unit = A * X + B, where X is the A/D converters value.

If you want to display Volts, use for the factor A:
2,5 / 255 = 0,0089039 and 0 for B.

With the display format string the number of integer and decimal places of the converted value will be defined.
The number of zeros before the decimal point defines the minimal numer of integer places, the number of zeros after the decinal point defines the number of decimal places.

Example for the format string and the resulting output:

Format string	comment	Values to output: 0,3894	12,532
00.0	At least 2 integer place, 1 decimal places	00,4	12,5
00	At least 2 integer place, no decimal places	00	13
0.00	At least 1 integer place, 2 decimal places	0,39	12,53
0.000	At least 1 integer place, 3 decimal places	0,389	12,532
.00	2 decimal places	,39	12,53
.000	3 decimal places	,389	12,532



5.6.5 Display while recording

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

5.6.6 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 an additional information about the camera’s temperature.

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

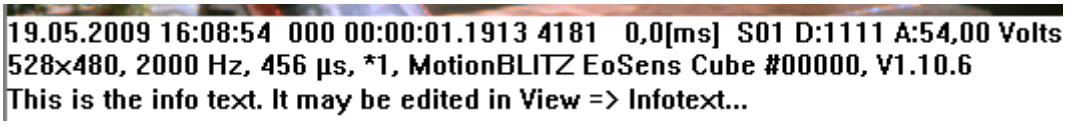
5.6.7 Marker

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!

5.6.8 Infoline

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 MotionBlitz 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:

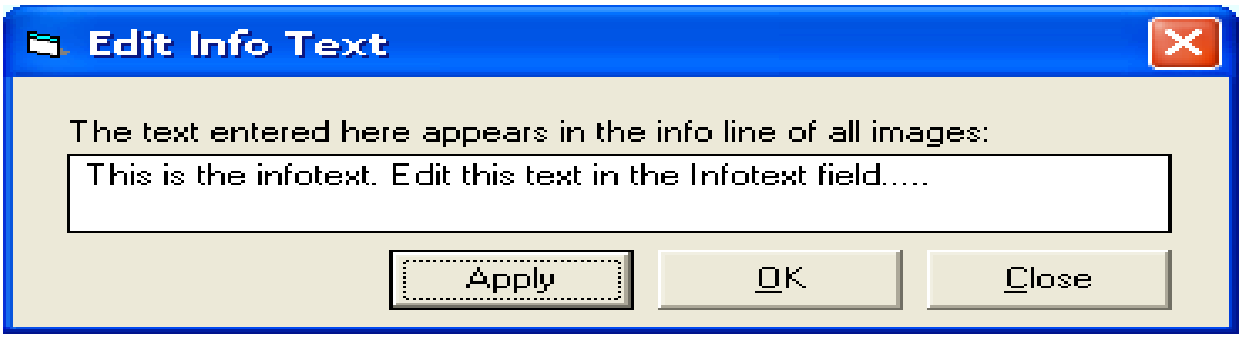
Field:	Content in the example:
Date	19.05.2009
Time	16:08:54
IRIG-B time code (1), contains 3 characters day of the year 6 charcters for time of day, GMT, 4 characters of 100 µsec units	000 00:00:01.1913 (no IRIG-B signal detected)
Frame number	4181
rel. time after trigger [ms]	0,0 [ms]
Sequence number (2)	S01
Digital input (binary representation)	1111
Analog input (decimal format)	54,00 Volts
Resolution, width x height	528x480
Frame rate	2000 Hz
Exposure time	456 µs
Gain	*1
camera type	MotionBLITZ EoSens Cube6
Serial number of camera	#00000
Software version	V1.10.6
Free text to be entered via “Infotext“	This is the info text. It may be edited in View => Infotext

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.

(1) IRIG-B is an optional camera feature
(2) Sequence number is not available for Cube1 camera versions. Sequence number indicates the number of the recorded sequence in multi sequence mode. See “5.7.4.2 Multi sequence ” for details.

5.6.9 “Infotext...“

Open the window “Edit Info Text“:

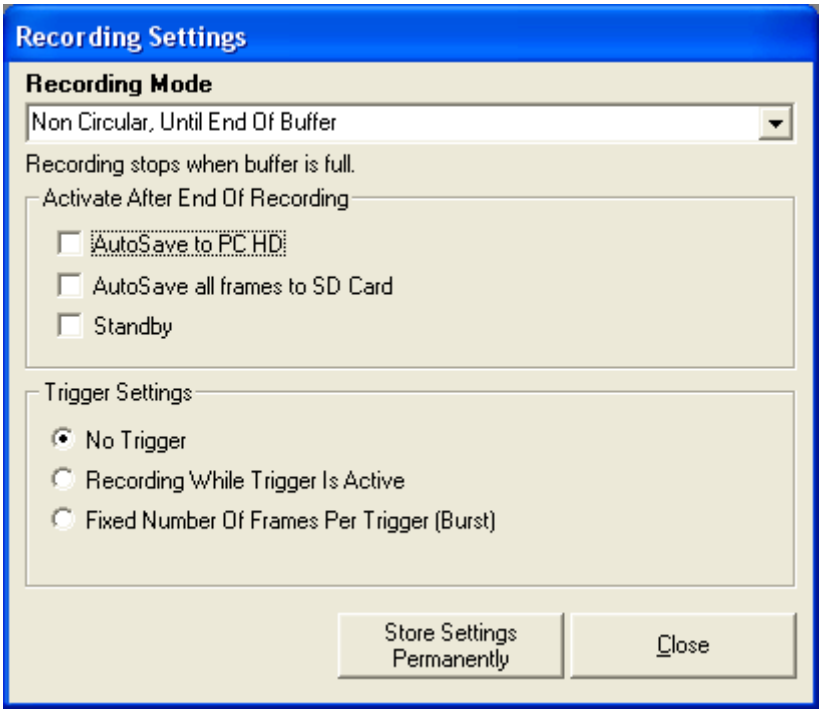


The text entered here and confirmed by clicking “OK“ is added to the information portion in the recording sequence.

5.6.10 Language

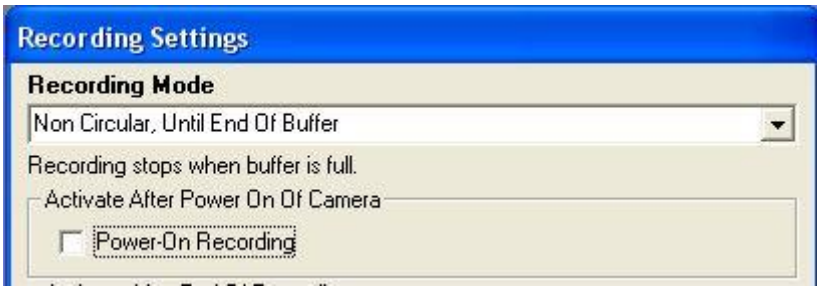
German or English may be selected as language for all texts in the program.

5.7 Record settings



The recording mode may be selected. There are 2 modes:
Non-circular mode
Circular mode

5.7.1 start recording after power on automatically («power on recording »)



If the camera is delivered with the optional feature “power on recording”, the check box “Power-On Recording” will be shown. If the check box is activated, the camera will start a circular recording sequence after power on automatically.

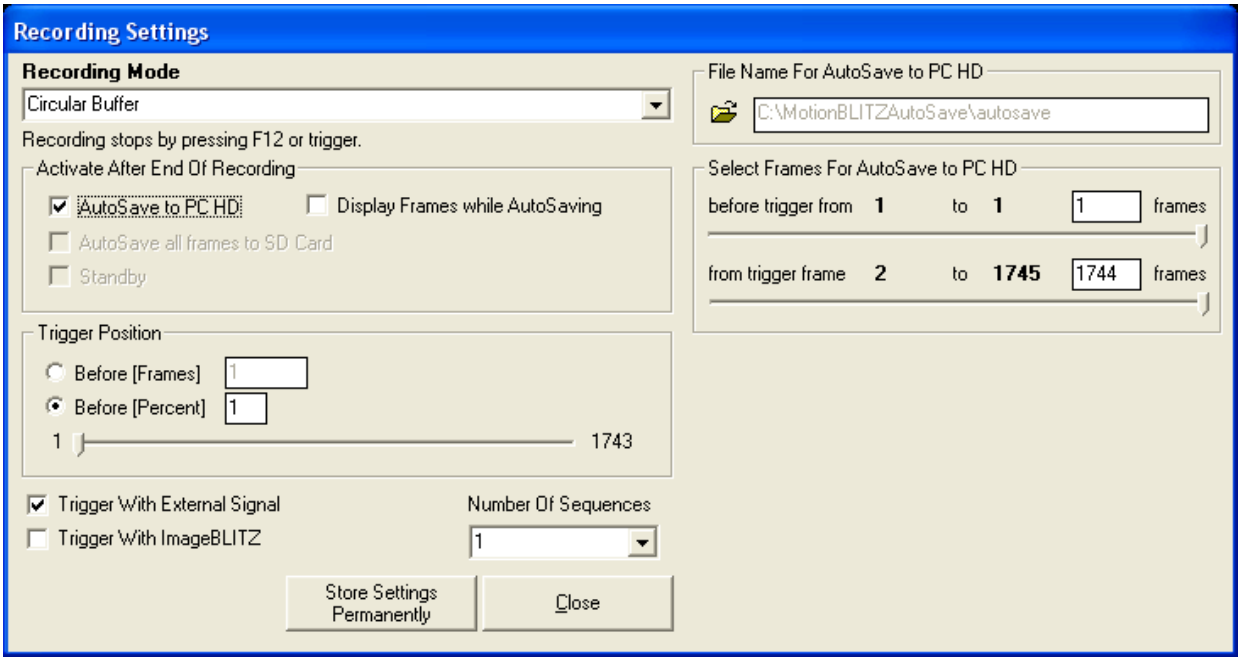
5.7.2 Automatic processing after end of recording

You may select, if after the completion of the recording automatically

- images should be copied to the hard disk of your PC (“AutoSave to PC HD”)
- all images should be copied to the SD-card of the camera (“AutoSave all frames to SD Card”)
- the Standby Mode should be activated.

”AutoSave all frames to SD Card” and “Standby” is available for cameras with appropriate hardware option only!

5.7.2.1 AutoSave to PC HD



If the AutoSave tp PC HD mode is activated, frames will be stored to hard disk in the rec 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. Autosaving 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 right side part of the Record Settings. This part will be shown after clicking on the checkbox “AutoSave to PC HD” in the 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 autosaving started.

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

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

The base name is declared in section “File Name For AutoSave to PC HD”, e.g. in the screen shot above “autosave”, the delimter is the sign “_”, YYMMDD means year, month, day and HHMMSS means hour, minutes, seconds.

An example of the name of file, that contains frames, that were auto saved starting on February 9 th, 2010 at 16:09:27 is:

autosave_100209_160927.rec

AutoSave is designed mainly for circular mode. If you use AutoSave in the Non Circular mode, only as much images will be stored as selected with „from trigger frame“ in the “Select Frames For AutoSave to PC HD” section. The maximal number of frames, that could be saved, depends on “Trigger Position” in circular mode. After saving a recorded sequence AutoSave will be finished automatically.

5.7.2.1.1 Start an Auto Save session

If you click on the checkbox “AutoSave to PC HD” in the form “Recording Settings”, the next recording sequence, that wil 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 PC” next to the start recording button in red letters:

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

5.7.2.1.2 Stop an Auto Save session

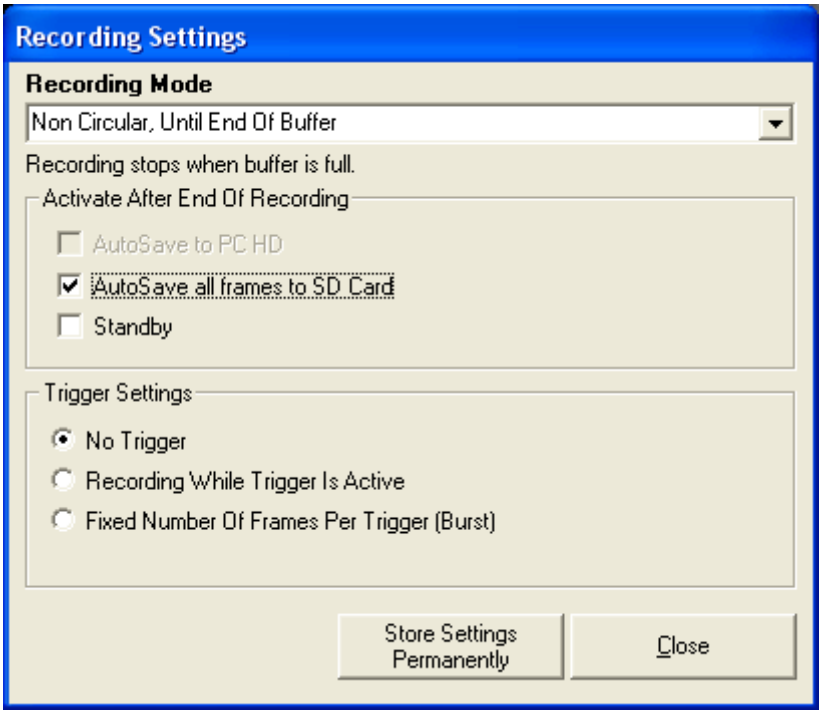
An active auto save session could be stopped by the user: Press the F12 key or click at the stop button. The camera’s recording session will be ended and the frames saved to hard disk. After completion of the saving, the Auto Save session is finished.

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

5.7.2.1.3 Show the saved frames (on PC hard disk)

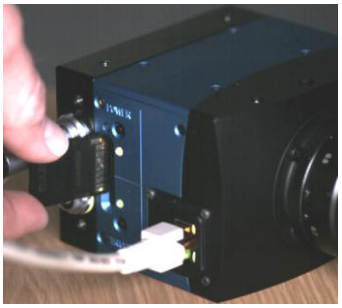
After completion of an Auto Save session, each recording sequence of the camera is stored in a different file. Select the appropriate file in the menu “file” => “Load Rec…”. See chapter “Reload a rec file” for details.

5.7.2.2 AutoSave all frames to SD Card



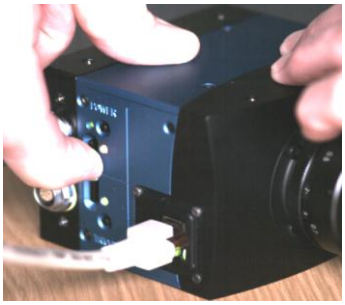
This mode is available for Cube6 and Cube7 cameras with appropriate hardware option only!

.



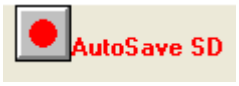
Insert your SD card in the card slot of the camera, the front side facing the power connector, the electric outlet facing the card slot.

Press carefully the upper edging of the card for snapping in.

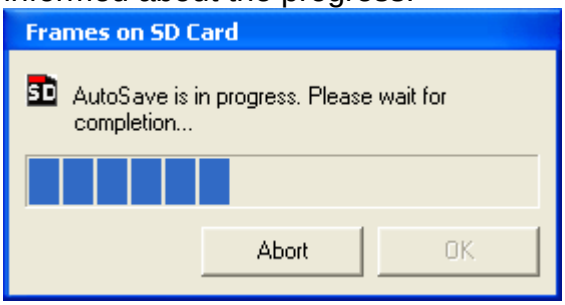


The green SD card LED above the card slot lights up now. Now you may store the images immediately on the Cube's SD card.

If this mode is activated, **all** images will be stored on the SD card automatically after the end of the recording sequence.
The activation of this mode will be shown with “AutoSave SD”:



After completion of AutoSave this mode ends and must be reactivated if after the next recording sequence copying images to SD card should be accomplished. While copying the SD card LED is blinking and the camera is not ready to exposure. You will be informed about the progress:



The amount of time used for the copying depends on the SD card’s data transfer rate and the size of the Cube’s frame buffer. Using a 30MB/s card and a Cube6 in base version you must wait about 150 seconds for completion.
If you abort copying, images will be missing on the SD card. The chronological order may be disturbed as well.
Therefore please abort copying only in case you are sure, that you don’t need the images on the SD card!

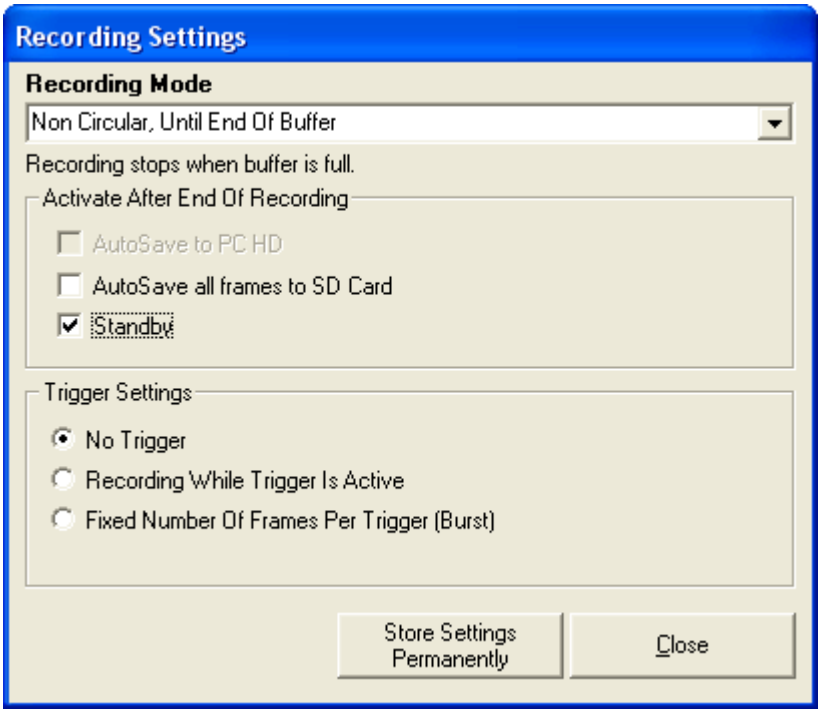
	1. Please keep in mind, that the used SD card has a sufficent memory capacity. SD cards hold about 7% less memory than indicated. That’s why you need SD card with a capacity of 4GB for Cube6, 8GB for Cube6 (6,6 sec), 16 GB Cube6 (13 sec) 8GB for Cube7, 16GB for Cube7 (6 sec) 2. By copying all data on the SD card will be overwritten! 3. The images will be written in the Mikrotron format and could be shown with MotionBLITZ software only! 4. Don’t format the SD card, otherwise the images could be lost!

5.7.2.2.1 Show the saved images (SD card)

After completion of saving all images on the SD card you could show them with the MotionBLITZ sofware. Insert the SD card in the card reader of your PC, use “File” => “Load Cube SD-card…”

See details in chapter „Reload frames from a Cube SD card“

5.7.2.3 Standby after the end of a recording session



If Cube4/5 and Eo*Sens* Cube6/7 cameras have an according hardware version, they may switch to standby mode automatically after the end of a recording session.

If you have activated the check box “Standby” in the category “Activate After End of Recording” in menu “Recording Settings”, the camera will switch to the standby mode automatically after the end of the next recording session.

This activation is valid only for the next recoding session and will be deactivated automatically afterwards.

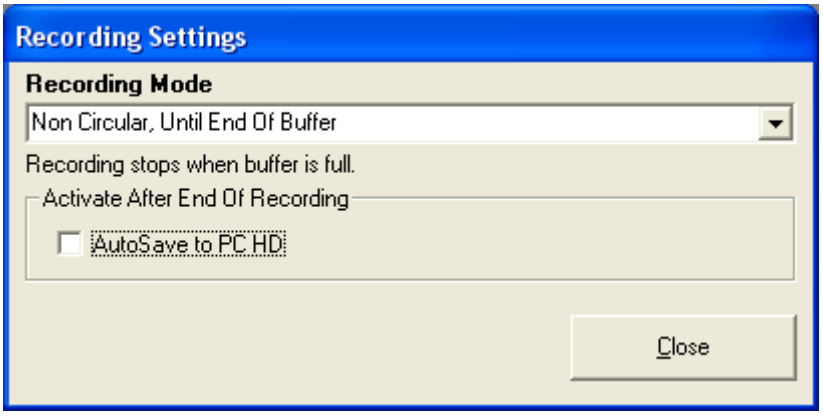
By getting into the standby mode, the camera stops communication with the PC: Timeout could be indicated therefore.

In order to get access to the camera’s image memory again, you must set the camera into the ready-to-operate state: Please press the camera’s power switch for a short moment (less than 1 second) and click at the “reconnect” button

5.7.3 Non-circular mode

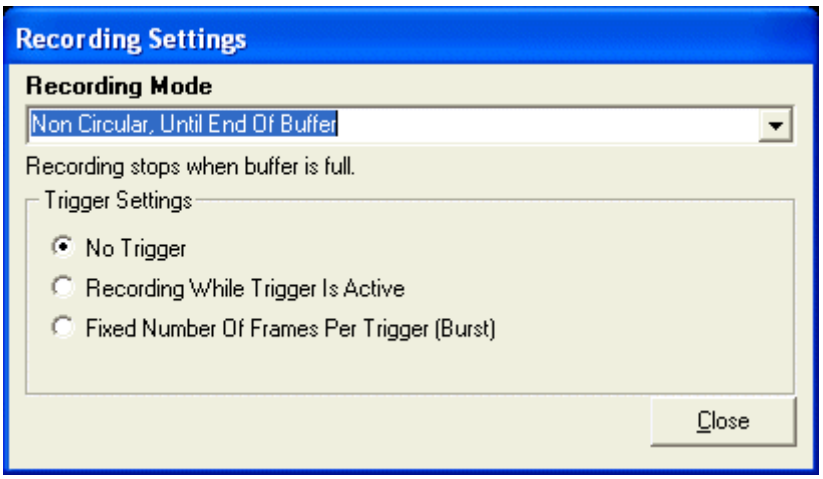
Recording proceeds
- until the end of buffer is reached and stops afterwards or
- until the recording is aborted before by clicking on the “Stop” buttton or presseing key F12.

5.7.3.1 Without trigger



For Cube1, Cube2 and Cube3 there is basically no triggering in the non circular mode, for Cube4/5 and Eo*Sens* it depends on the hardware version, if triggering is possible.

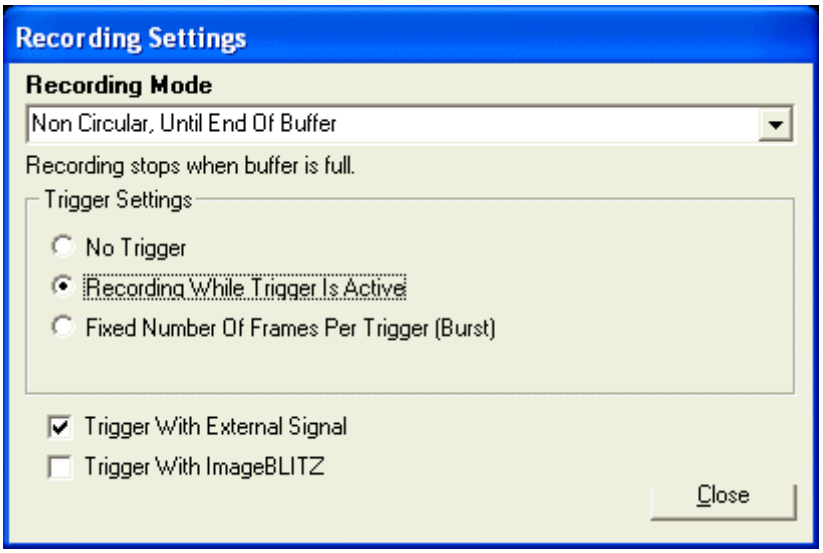
5.7.3.2 With trigger facility



Cube4/5 and Eo*Sens* cameras with an adequate hardware version provide the triggering facility in the non circular recording mode.

ⓘ	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.

5.7.3.2.1 Recording while trigger is active



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

The trigger may be:

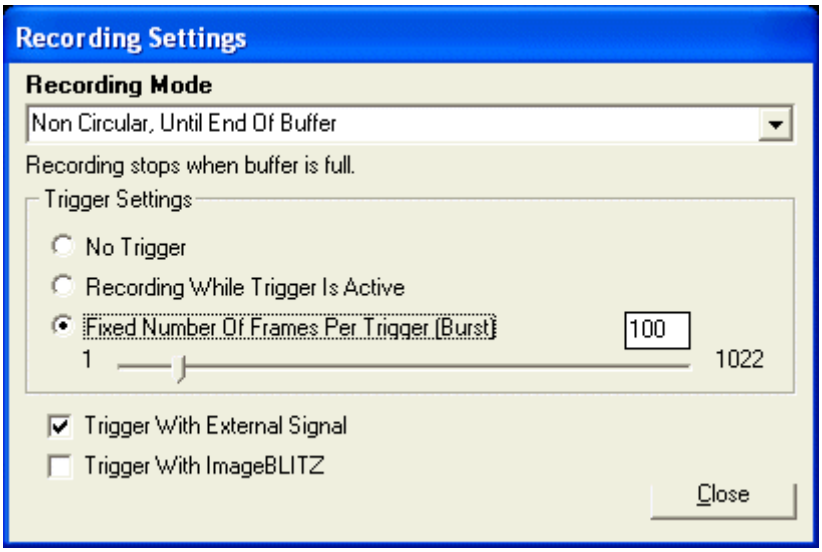
1. the camera’s trigger switch

2. 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)

3. changings 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 5.7.4.1.2 “ImageBLITZ – optional” for details of ImageBLITZ).

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

5.7.3.2.2 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.

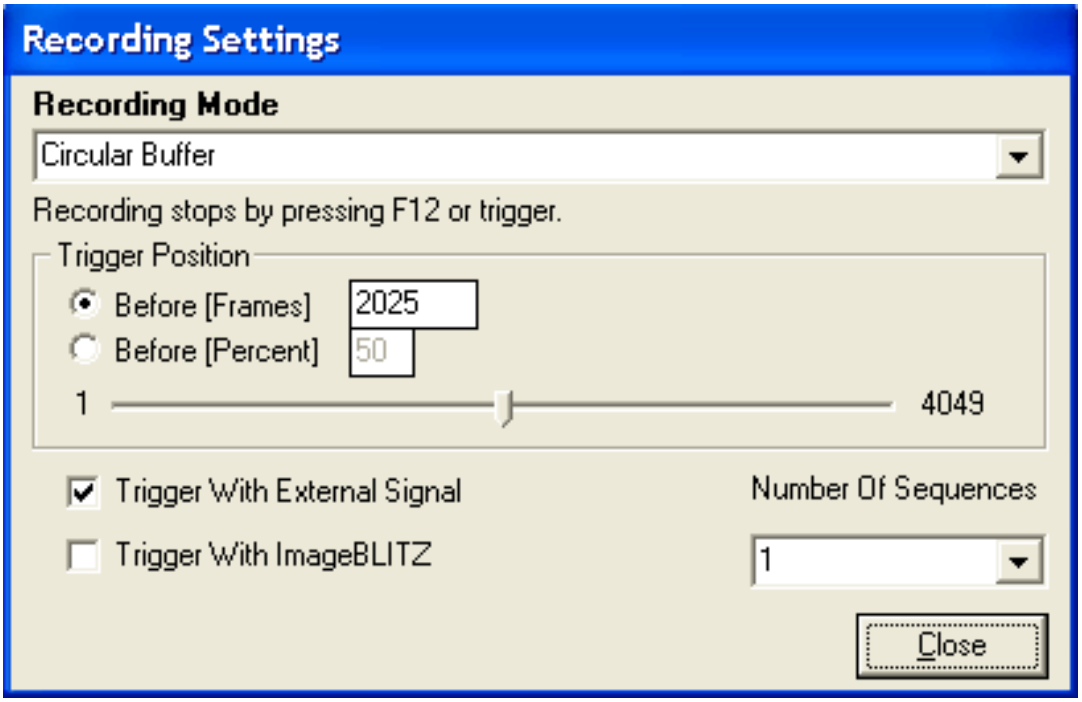
After every recording, which was initiated by the trigger edge, the camera will wait for the next edge as long as the end of the memory is not reached.

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 the camera's trigger switch, an external trigger signal or the ImageBLITZ.

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

5.7.4 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 beed 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 triggerposition 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)

Trigger with ImageBLITZ and number of sequences are not availabel for Cube1 camera versions.

5.7.4.1 Triggermodes

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

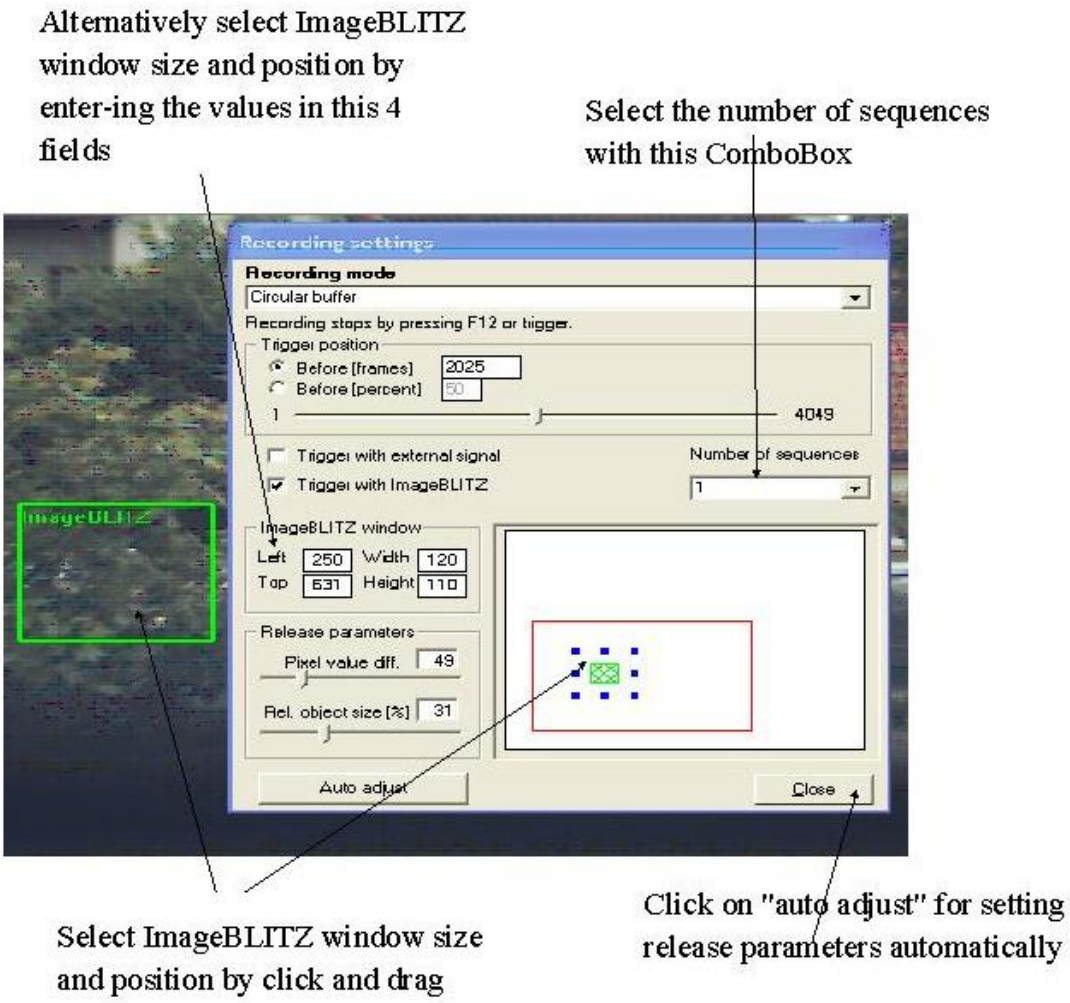
5.7.4.1.1 External trigger

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.

5.7.4.1.2 ImageBLITZ – optional

If ImageBLITZ is selected, changings 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.

ⓘ	ImageBLITZ is an optional camera version



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

5.7.4.1.2.1 ImageBLITZ parameters

If ImageBLITZ is activated, the MotionBLITZ camera compares the image detail of the actual frame with the image detail of the reference frame. If the differences within this image details exceed a limit, ImageBLITZ triggers (“releases”).

This 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”.

5.7.4.1.2.1.1 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 changings 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.

5.7.4.1.2.1.2 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.

5.7.4.1.2.1.3 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 ist the next frame after clicking on “auto adjust”

5.7.4.1.2.1.4 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)

5.7.4.2 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 "Start/Stop recording" switch or the MotionBLITZ control program's Stop button or key F12, MotionBLITZ 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 MotionBLITZ control program. There is no possibility to start a multisequence recording session if the camera is not online.

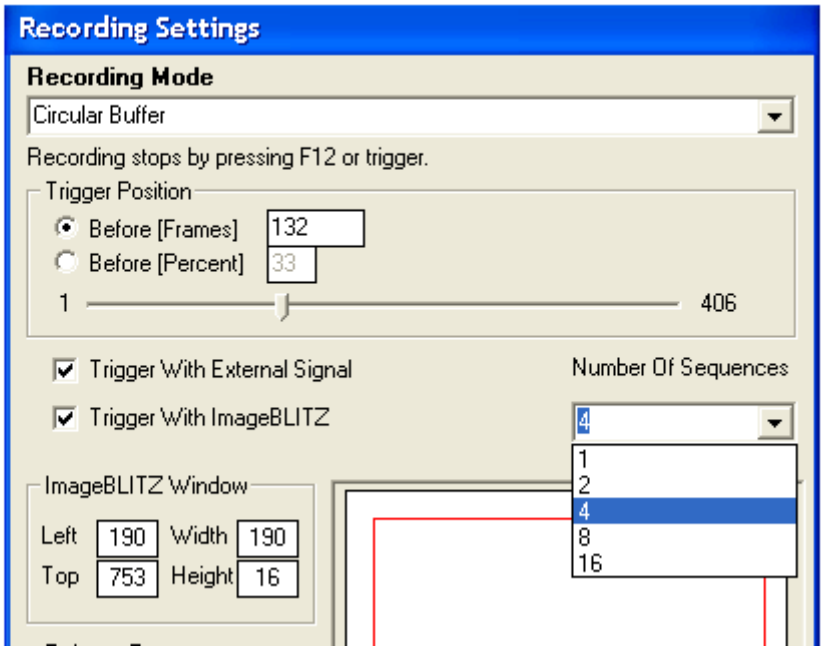
	Multi sequence is an optional camera version

There are 5 different numbers of sequences:

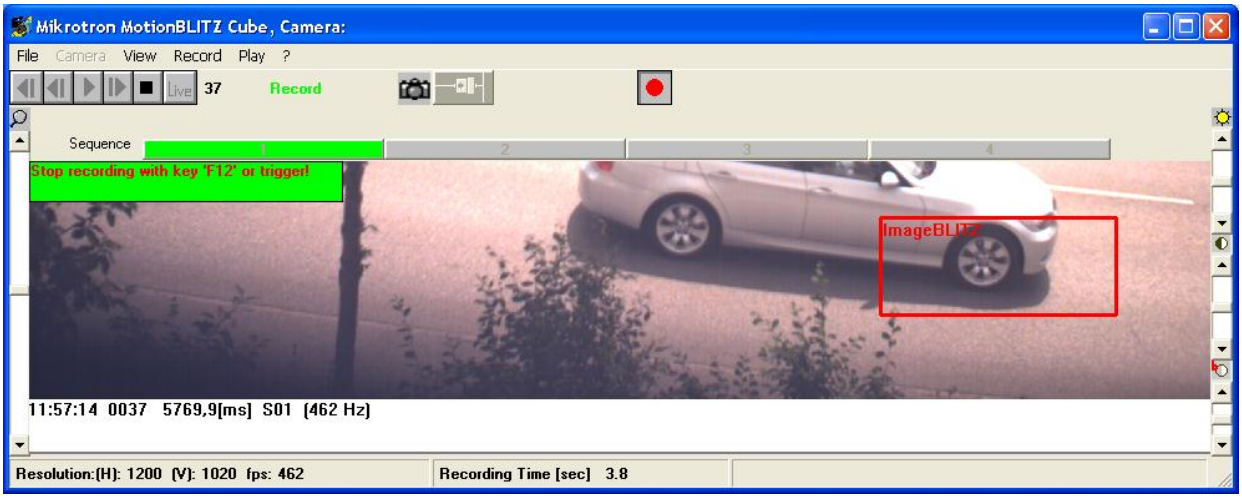
- 1
- 2
- 4
- 8
- 16

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!

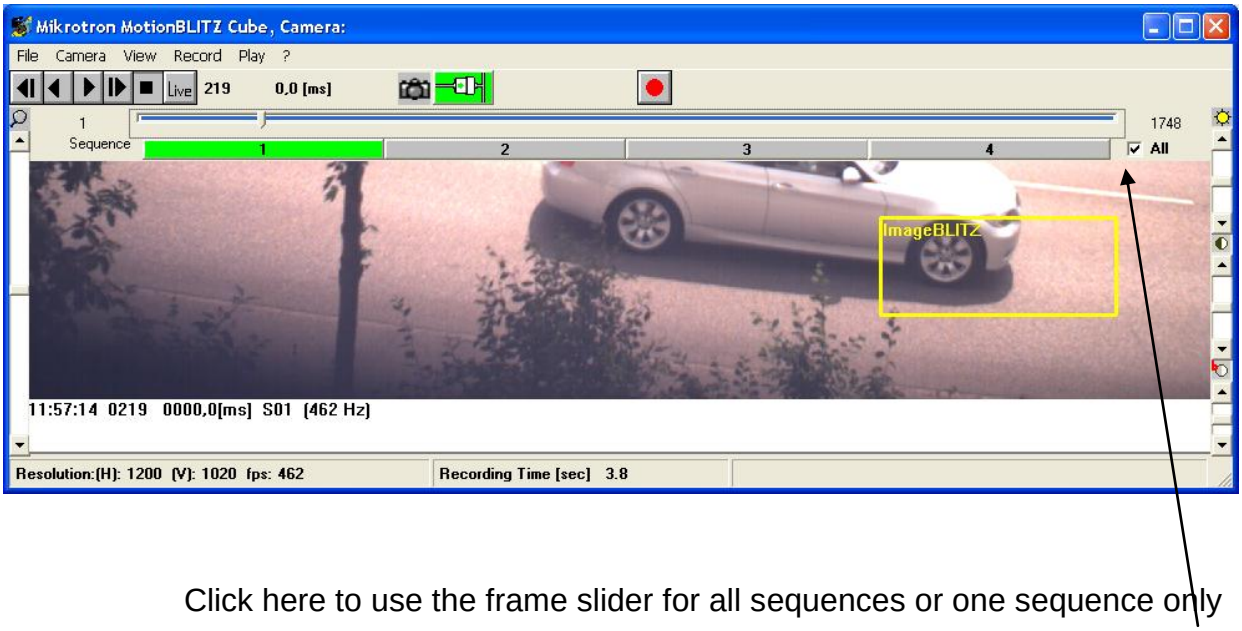


After selecting the number of sequences, during the next recording session the number of sequences will be represented by sequence command buttons, labled with the sequence-number:



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.

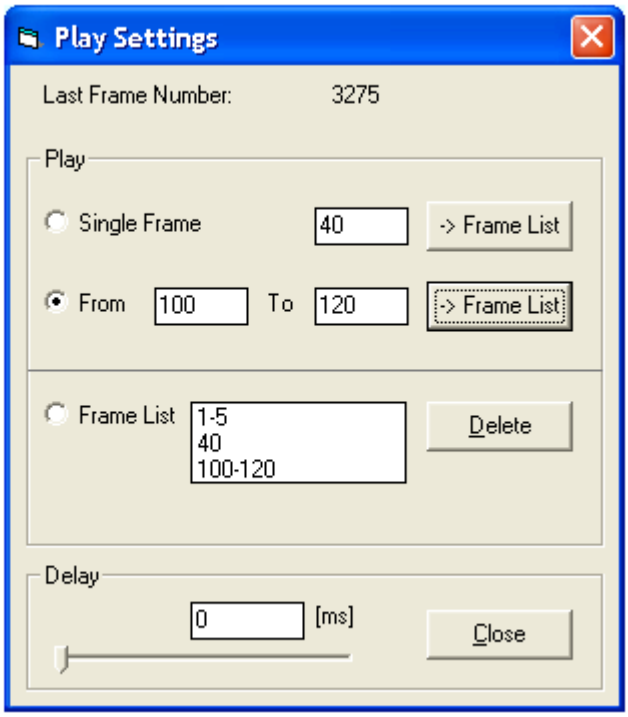
After finishing the recording session, the sequence command buttons are enabled, by clicking on a button you navigate to the frame immediate after the trigger event in the appropriate sequence.



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

5.8 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 MotionBLITZ 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 beginnning and ending of the desired range or select the range by using the “frame slider” and mouse buttons, as decribed 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 MotionBLITZ 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 MotionBLITZ frame memory and displayed.

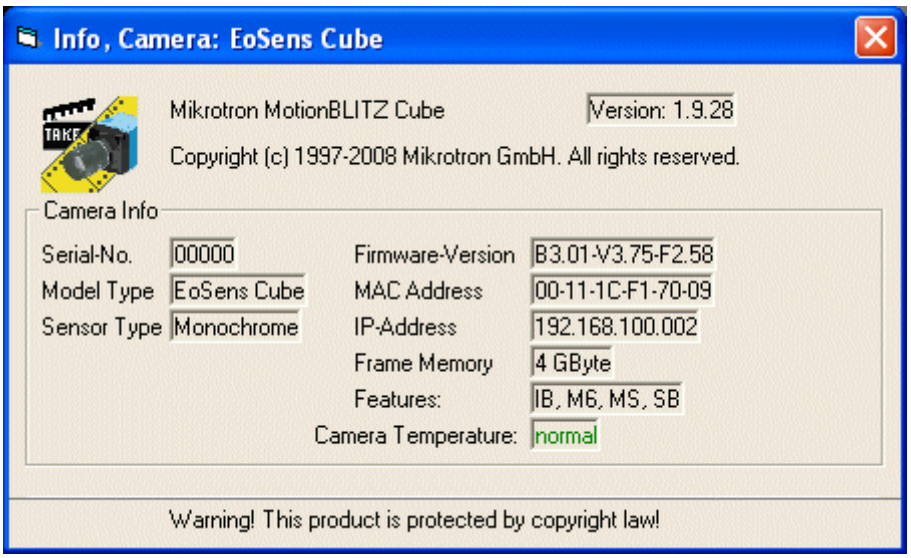
5.8.5 Last frame number

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 MotionBLITZ control software and the firmware of the actually connected camera are displayed.

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

The second part holds information about the connected camera:
- Serial number of the camera
- Model type (Cube1/2/3/4/5, Eo*Sens* Cube6/7, mini1/2)
- Sensor type
- Firmware-Version
- MAC Address
- IP Address
- The size of the frame memory
- Features:

C	Color sensor
M3	3 seconds recording time
M6	6 seconds recording time
M13	13 seconds recording time
HG	Hi-G version (crash proofed)
IB	ImageBlitz
IG	IRIG-B signal processing
MS	Multi-sequence
SB	Standby
SD	Save frames to SD card

- Camera temperature
  visible only if a temperature limit is configured in file CameraTemperatureLimits.ini

normal	Camera operates in the normal temperature range
high, please use cooling option	The internal camera temperature is high, you should use a cooling option for lowering the temperature.
not available	Information about the camera's internal temperature is not available, e.g. if the camera is disconnected from the pc

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 MotionBLITZ infrared filter

MotionBLITZ (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 mud 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.

6.2 Battery

The battery are four AA size NiMh accumulator cells.

	Batteries can be replaced by removing the cameras rear cover

7 Troubleshooting

Any known software errors are listed in the release notes.

Main problems:

Q: The MotionBLITZ establishes no camera link. An error message box appears or “timeout” will be indicated. What to do? – 1-

A: Check, if the camera and the PC are connected via the ethernet. Check if the Camera LEDs are in a state as described in chapter 1.6.2.3 on page 12. Click on the "Reconnect" button in the MotionBLITZ 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 LEDs indicate the ready-to-operate state (both LEDs must be green or orange as described in chapter 1.6.2.3 on page 12)

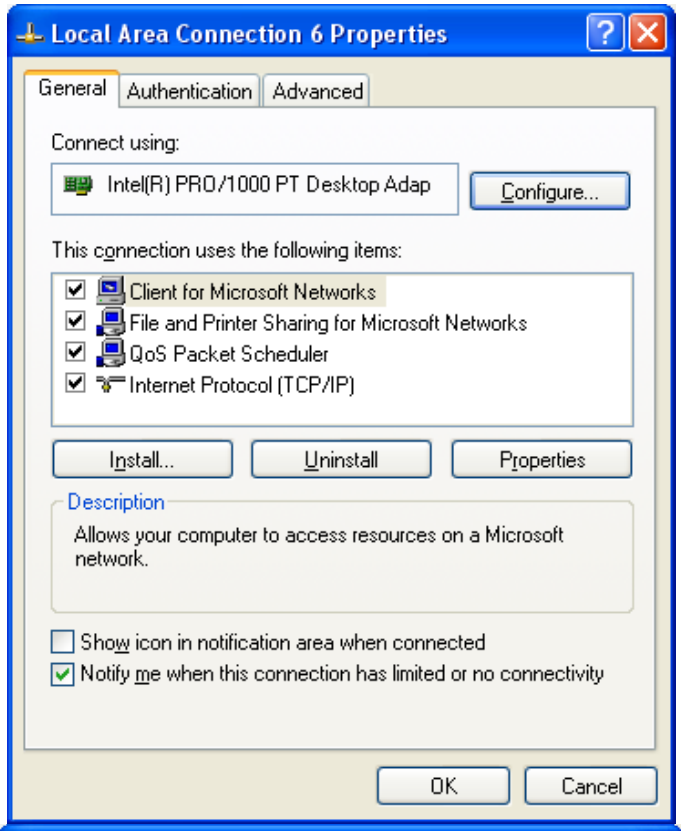
A: Check if the windows firewall allows MotionBLITZ to work! If the firewall is active, set it to inactive, close MotionBLITZ and start it again. If it works now, you may configure MotionBLITZ in the windows firewall as an exceptional program and activate the firewall again.

A: check if the MotionBLITZ user has write-permission in the MotionBLITZ installation directory, e.g. c:\Program Files\Mikrotron GmbH\MotionBLITZ. Write permission in this directory is necessary!

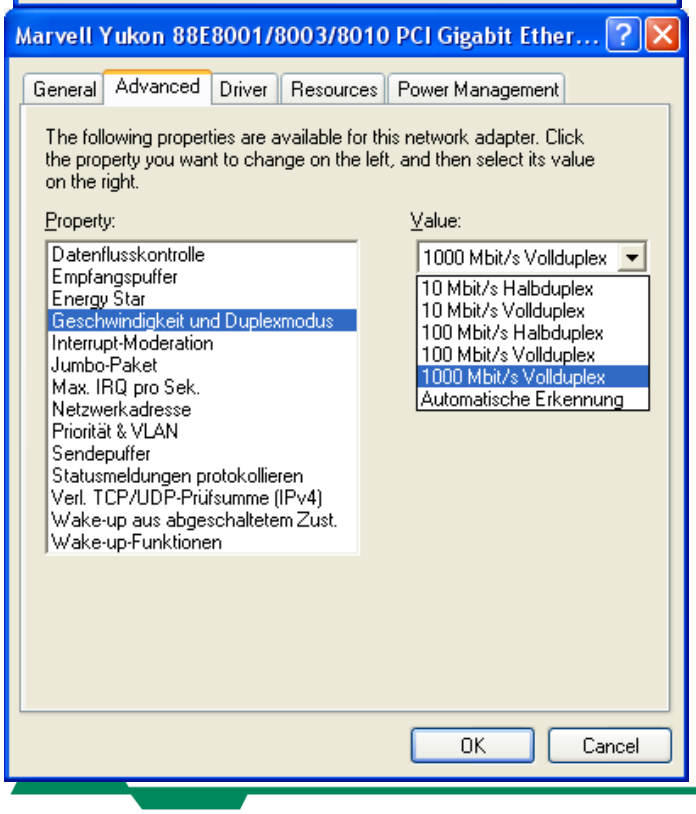
A: If you are using an ethernet switch to establish the data exchange with the camera, it could take several seconds up to minutes, until the camera is detected after power on or after connecting with the switch. In this case you should wait for 1 to 2 minutes before you click at the reconnect or the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

Q: The MotionBLITZ establishes no camera link. An error message box appears or “timeout” will be indicated. What to do? – 2 -

A: check the speed of the Gigabit Ethernet network adapter. It should be 1 Giga Bit/s (1000 Mbit/s). Usually there is a LED in the slot cover of the network card indicating, if the actual transmission speed is 1Gbit/s. If it should be below 1 Gbit, (e.g. 10 Mbit/s, which is much too low), you may configure the speed in:



Control panel => Network and dial-up Connections => properties (of the desired connection) => Configure… =>



Advanced => Property: speed and Duplexmode => Value: 1000 Mbit/s …

Other Adapters may have other menus, e.g. “Link Speed” for configuring the speed!

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.

Q: An error message “AVI file couldn’t be opened …” appears when creating AVI is activated.

A: Use in the avi-file name or in the directory only Ascii characters.
Non Ascii characters (like Chinese, Korean, Japanese) may cause problems when making AVI is started. You should apply only ASCII characters for the directory and filename, e.g. C:\avis\1.avi

8 Appendix

8.1 Technical data

8.1.1 Cube1 / Cube2

Sensor type	Monochrome or color withBayer Filter	
Number of pixel	Cube1 version:640 x 512	other versions:1280 x 1024
Pixel size	12 x 12 µm	
Active area	15,36 (H) x 12,29 (V) mm	
Fill factor	40%	
Sensitivity at 550 nm @ Vref = 1V (a2 = 66h)	1600LSB/lux-sec	
Spectral response	400 … 800nm (color) 400 … 1000 nm (monochrome)	
Shutter	Electronic „Freeze Frame“ Shutter	
Trigger	Asynchronous shutter, shutter time selectable with internal timer	
Internal Dynamic	59 dB	
Power supply	10,5 ... 24 V	
Power consumption max., continuous recording @ 1280x1024 resolution and 500 frames/sec. Thermal resistance typ.	15W 6.25°/W	
Serial data link	GigaBit Ethernet, Baud Rate 19200	
Digital video	GigaBit Ethernet	
Operating temperature	+5..45°C	
Shock & vibration	100g, 10grms	
Dimensions (WxHxD)	94 x 70 x 106 mm	
Weight	ca. 1050 g	
Lens mount	C-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	Cube1 version: Up to 1000	other versions: Up to 45.000
Shutter time	min. 4 µs	
Recording modes	Non circular or circular wih pre- and post trigger.	
Frame buffer	2 Gbyte or 4 Gbyte	
Replay frequency	10 – 30, fps @ 1280 x 1024, depending on the performance of the PC	

8.1.2 Cube3

Sensor type	Monochrome or color withBayer Filter
Number of pixel	512 x 512
Pixel size	16 x 16 µm
Active area	8,19 (H) x 8,19 (V) mm
Fill factor	62 %
Sensitivity at 550 nm @ Vref = 1V (a2 = 66h)	9 V/lux-sec
Spectral response	400 … 800nm (color) 400 … 1.000nm (monochrome)
Trigger	External Signal, ImageBLITZ Trigger (optional)
Internal Dynamic	57 dB
Power supply	10,5 ... 24 V
Power consumption max., continuous recording @ 512 x 512 resolution and 2500 frames/sec.	15W
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	100g, 10grms
Dimensions (WxHxD)	94 x 70 x 106 mm
Weight	ca. 1050 g
Lens mount	C-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 oder bmp
Recording frequency [frames per second = fps]	Up to 120.000
Shutter time	min. 4 µs
Recording modes	Non circular or circular wih pre- an post trigger
Frame buffer [Gbyte]	2 oder 4
Replay frequency	30 – 100 fps @ 512 x 512, depending on the performance of the PC

8.1.3 Cube4

MC134x	Monochrome-Bayer Filter
Number of pixel	1280 x 1024
Pixel size	12 x 12 µm
Active area	15,36 (H) x 12,29 (V) mm
Fill factor	40%
Sensitivity at 550 nm @ Vref = 1V (a2 = 6h)	1600LSB/lux-sec
Spectral response	400..800nm (color) 400..1000nm (monochrome)
Shutter	Electronic „Freeze Frame“ Shutter
Trigger	Trigger and Sync input
Internal Dynamic	59 dB
Power supply	10,5 ... 30 V
Power consumption max., continuous recording @ 1,3 GBytes/sec Thermal resistance typ.	 <10 W 6.25°/W
Serial data link	Thru GigaBit Ethernet, baud rate 19.200 Bd
Digital video MC134x	GigaBit Ethernet
Shock & vibration	100g, 10grms
Dimensions (WxHxD)	93 x 69 x 92 mm (c-mount) 93 x 69 x 128 mm (f-mount)
Case temperature	+5 ... +45° C
Weight	ca. 900 g
Lens mount	C-mount or F-mount

8.1.4 Cube5

Sensor type	Monochrome or color withBayer Filter
Number of pixel	512 x 512
Pixel size	16 x 16 µm
Active area	8,19 (H) x 8,19 (V) mm
Fill factor	62 %
Sensitivity at 550 nm @ Vref = 1V (a2 = 66h)	9 V/lux-sec
Spectral response	400 … 800nm (color) 400 … 1.000nm (monochrome)
Trigger	External Signal, ImageBLITZ Trigger (optional)
Internal Dynamic	57 dB
Power supply	10,5 ... 30V
Power consumption max., continuous recording @ 512 x 512 resolution and 2500 frames/sec.	<10W
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	100g, 10grms
Dimensions (WxHxD)	93 x 69 x 92 mm (c-mount) 93 x 69 x 128 mm (f-mount)
Weight	ca. 900 g
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 oder bmp
Recording frequency [frames per second = fps]	Up to 190.000
Shutter time	min. 2 µs
Recording modes	Non circular or circular wih pre- an post trigger
Frame buffer [Gbyte]	2, 4 or 8
Replay frequency	30 – 100 fps @ 512 x 512, depending on the performance of the PC

8.1.5 Eo*Sens* Cube6 / mini1

Sensor type	Monochrome
Number of pixel	1280 x 1024
Pixel size	14 x 14 µm
Sensitivity at 550 nm @ Vref = 1V (a2 = 66h)	25 V/lux-sec
Active area	17.92 (H) x 14.34 (V) mm
Fill factor	40%
Spectral response	400 … 1.000nm
Trigger	External Signal, ImageBLITZ Trigger (optional)
Internal Dynamic	57 dB
Power supply	10,5 ... 30 V
Power consumption max., continuous recording @ 512 x 512 resolution and 2500 frames/sec.	12W
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	100g, 10grms
Dimensions (WxHxD)	93 x 69 x 92 mm (c-mount) 93 x 69 x 128 mm (f-mount)
Weight	ca. 900 g
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 oder bmp
Recording frequency [frames per second = fps]	Up to 83.500
Shutter time	min. 2 µs
Recording modes	Non circular or circular wih pre- an post trigger
Frame buffer [Gbyte]	2 , 4 or 8
Replay frequency	20 – 50 fps @ 1280 x 1024, depending on the performance of the PC

8.1.6 Eo*Sens* Cube7 / mini2

Sensor type	Monochrome	
Number of pixel	1696 x 1710	
Pixel size	8 x 8 µm	
Sensitivity at 550 nm @ Vref = 1V (a2 = 66h)	13.57 (H) x 13.68 (V) mm	
Active area	36%	
Fill factor	3,81 V/lux-sec	
Spectral response	400..900 nm	
Trigger	External Signal, ImageBLITZ Trigger (optional)	
Internal Dynamic	60 dB	
Power supply	10,5 ... 30 V	
Power consumption max., continuous recording @ 512 x 512 resolution and 2500 frames/sec.	Cube7: 15 Watt	mini2: 7,5 Watt
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	100g, 10grms	
Dimensions (WxHxD)	Cube7: 93 x 69 x 92 (c-mount) 93 x 69 x 128 (f-mount)	mini2: 63 x 63 x 64,5 63 x 63 x 92,5
Weight	ca. 900 g	280 g
Lens mount	C-mount oder 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 / bmp oder rec	
Recording frequency [frames per second = fps]	bis 298.000	
Shutter time	min. 2 µs	
Recording modes	Non circular or circular wih pre- an post trigger	
Frame buffer [Gbyte]	Cube7: 2, 4 oder 8	mini2: 2
Replay frequency	20 - 50, fps @ 1280 * 1024, depending on the performance of the PC	

8.2 Connector assignments

8.2.1 Power / Signal connector, male (mini1/2)

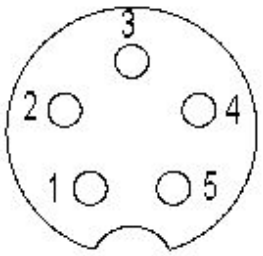
Pinning of Lemosa 6-pin male connector, view: Solder side

EEG.1B.306.CLL

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

Table 8.2-1

8.2.2 „Power“ connector, male, type Binder (Cube1/2/3)



connector (male), view: Solder side

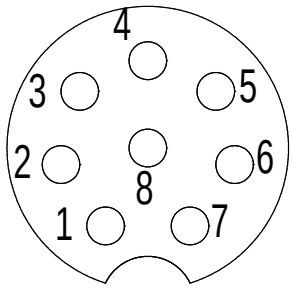
180°; Binder # 99-0413-10-05 (shielded, recommend.)
90°: Binder # 99-0413-75-05 (shielded, recommend.)

www.binder-connector.de

Pin Nr.	Signal Level	Description
1	Power	+10,5..24V=
2	Power	+10,5..24V=
3	n.c.	
4	Power	GND
5	Power	GND

Table 8.2-2

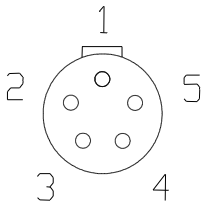
8.2.3 “Signal input / SYNC” connector, male, type Binder (Cube1/2/3)

	connector (male), view: Solder side 180°; Binder # 99-0425-10-08 (shielded, recommend.) 90°: Binder # 99-0425-75-08 (shielded, recommend.) www.binder-connector.de

Pin Nr.	Signal Level	Description
1	GND	GND
2	0..2.5V@ 1MΩ	Analog input voltage, 8-Bit resolution
3	LVTTL	Sync Output / ARM
4	LVTTL	Digital Input 1
5	LVTTL	Digital Input 2
6	LVTTL	Digital Input 3
7	LVTTL	Digital Input 4/ Trigger Input
8	LVTTL	SYNC Input

Table 8.2-3

8.2.4 „Power“ connector, type Lemosa (all Cube models, not mini)

Pinning of matching power plug (male, solder side) 	select the plug according to your requirements (right-angle plug / water-resistant etc.) under http://www.lemosa.com/ e.g. straight plug: FGG.1B.305.CLAD42ZN (Mounted socket in camera: EEG.1B.305.CLL)

Pin Nr.	Signal Level	Description
1	Power	+10,5..24V=
2	Power	+10,5..24V=
3	n.c.	
4	Power	GND
5	Power	GND

Table 8.2-4

8.2.5 „Signal input / SYNC" connector, type Lemosa (all Cube models, not mini)

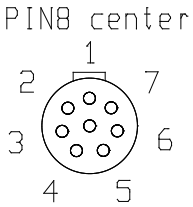
Pinning of matching signal plug (male, solder side)  	select the plug according to your requirements (right-angle plug / water-resistant etc.) under http://www.lemosa.com/ e.g. straight plug FGG.1B.308.CLAD52ZJ (Mounted socket in camera: EEG.1B.308.CLL)	
Pin Nr.	Signal Level	Description
1	GND	GND
2	0..2.5V@ 1MΩ	Analog input votage, 8-Bit resolution
3	LVTTL	Sync Output / ARM
4	LVTTL	Digital Input 1
5	LVTTL	Digital Input 2
6	LVTTL	Digital Input 3/ IRIG-B Input (optional Cube4/5, Eo*Sens* Cube6/7)
7	LVTTL	Digital Input 4/ Trigger Input
8	LVTTL	SYNC Input

Table 8.2-5

Mikrotron GmbH
Landshuter Str. 20-22
D-85716 Unterschleissheim
Germany

Tel.: +49 89 726342 00
Fax: +49 89 726342 99
info@mikrotron.de
www.mikrotron.de

8.2.5.1 IRIG-B input

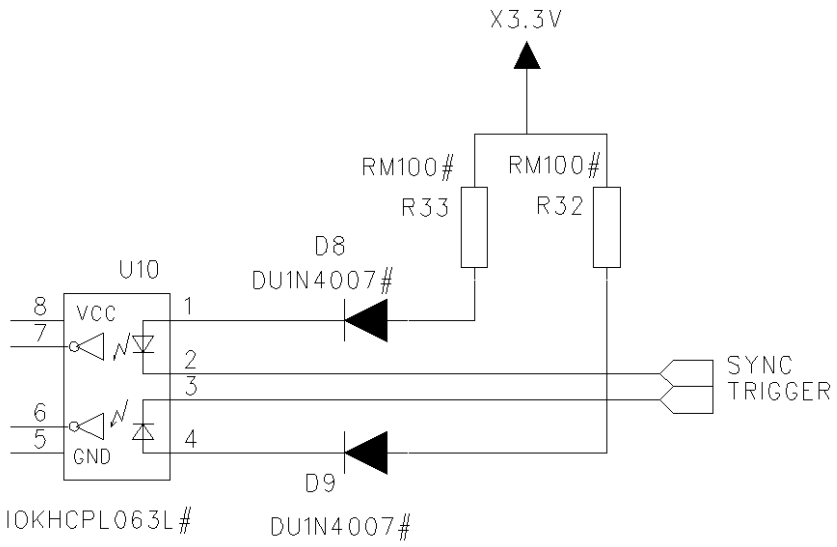
The level of the IRIG-B signal connected at pin nr. 6 should be typically 3V for ‚mark', 1V for ‚space'. Important ist the ratio of the signal level of mark and space of 3 to 1.

8.2.5.2 Trigger/Sync input signal definition

The Digital Input 4/ Trigger and the Sync Input is isolated from the rest of the circuitry by an optocoupler. The pull-up resistors R33/R32 are powered by a internal DC/DC converter (X3.3V). The optocoupler 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 "Sync in 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.

8.2.5.2.1 Sync input timing (for Eo*Sens* cameras)

The rising or falling edge can be selected in the camera menu as the active edge. The frequency of the external signal must be less than the frame rate of the camera.

Cameras with newer firmware ***start exposure*** with the active edge of an external signal.

For cameras up to the follwing firmware versions there was a different external signal processing:

Cube6: up to -F3.00
mini1: up to -F2.27
Cube7/mini2: up to -F0.66

Cameras with these versions act in the follwing manner:

The ***end of the exposure*** of the camera may be synchronized with an external signal. 1/framerate seconds after the active edge of the sync input signal the exposure time of the image is finished, the sync out signal will be deactivated. The exposure (and the active edge of the Sync Out signal) will be started shutter time microseconds before the deactivation of the the Sync Out signal.
The active edge of the the Sync Out signal may jitter 4 µsec referred to the sync input signal.

Example for the timing relationship, shown in the following oscillogram:

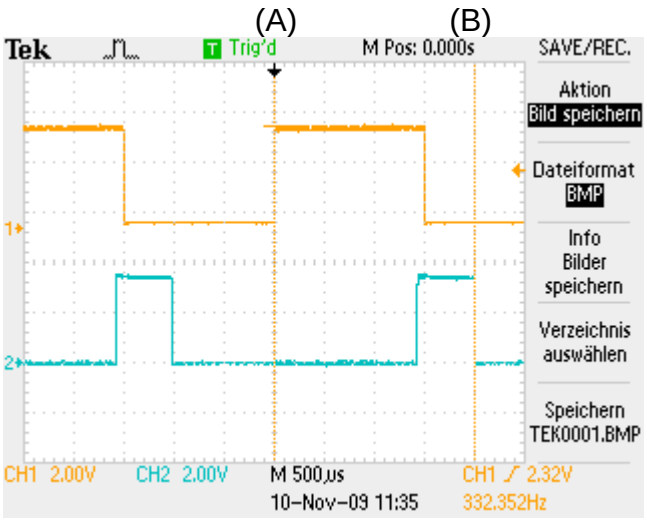
The uper trace (yellow) is the external sync input with 332 Hz (max. 495 would be possible when using 500 frames per second)

The lower trace (blue) is the the Sync Out signal

Frame rate = 500 Hz
External sync in frequency = 332 Hz
Shutter time = 562 µsec (not affected by the sync input signal)

With the active sync input edge (A), the 1/frame rate cycle (2000 µsec) starts.
After 2000 µsec (B) the frame is complete, 562 µsec before exposure did start.

If you want to synchronize external hardware with the start of the exposure, you may use the Sync Out signal for this purpose. Sync Out indicates the exposure of the image.

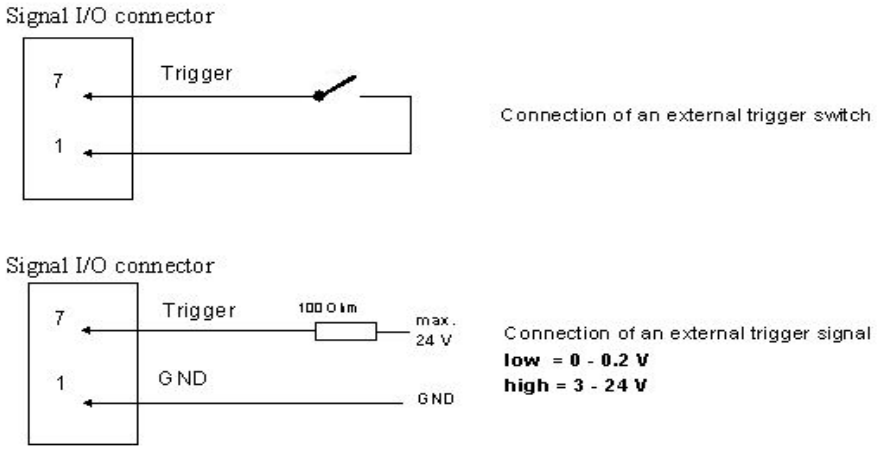


8.2.5.2.2 Trigger signal pulsewidth

The triggersignal is debounced to use an external mechanical switch. Minimum pulse-width according to the cameramodel is given in the following table.

Triggerpolarity selection:	Shape	MotionBLITZ Cube 1-3	MotionBLITZ Cube 4,5, EoSens
rising		50 ns	100 ns
		100 ms	5 ms
falling		100 ms	5 ms
		50 ns	5 us

8.2.5.3 Trigger connection example

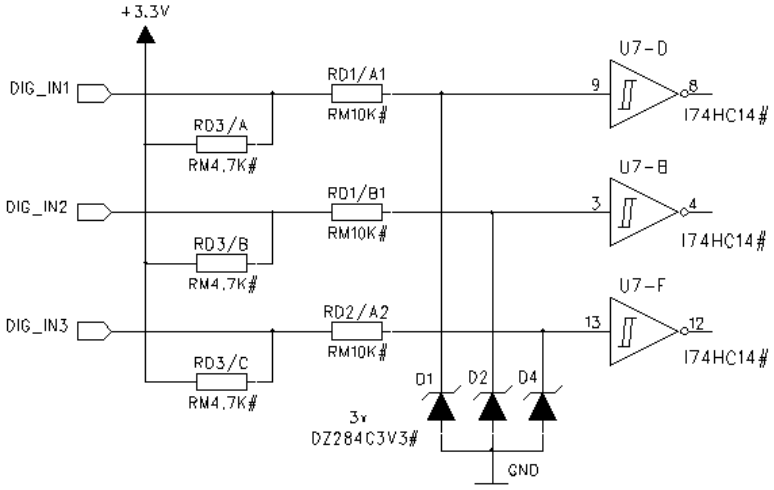


8.2.5.4 Analog input signal definition

The analog input is protected by a 330kΩ series resistor and adjusted to deliver the digital value of 255 for 2.55V input voltage.

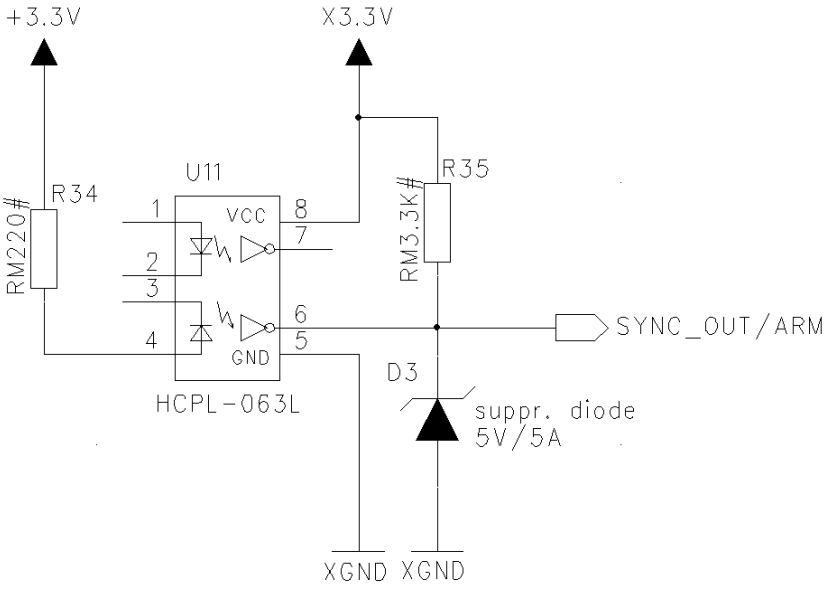
8.2.6 Digital Inputs 1-3 signal definition

The signals DIG IN1-3 are TTL input signals and are used as process signals, which are superimposed to the image.



8.2.6.1 Sync/Arm Output

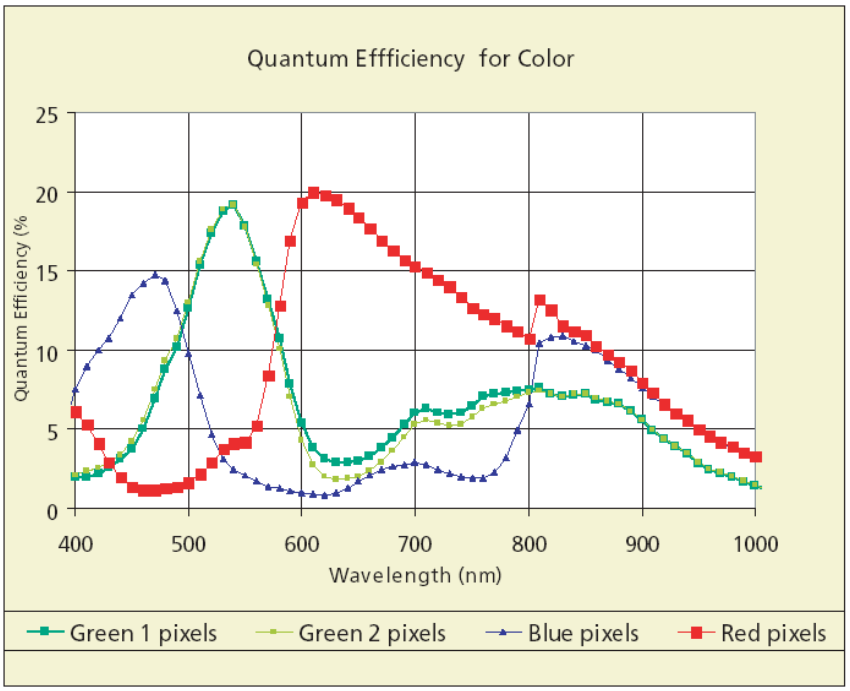
This pin can output a Sync signal or a arm signal, selected by a check box in the camera menu. If Sync out is selected, this output will carry a Strobe that corresponds to the selected exposure time of the camera. If Arm is selelcted, it will be active if the camera runs in circular recording mode.

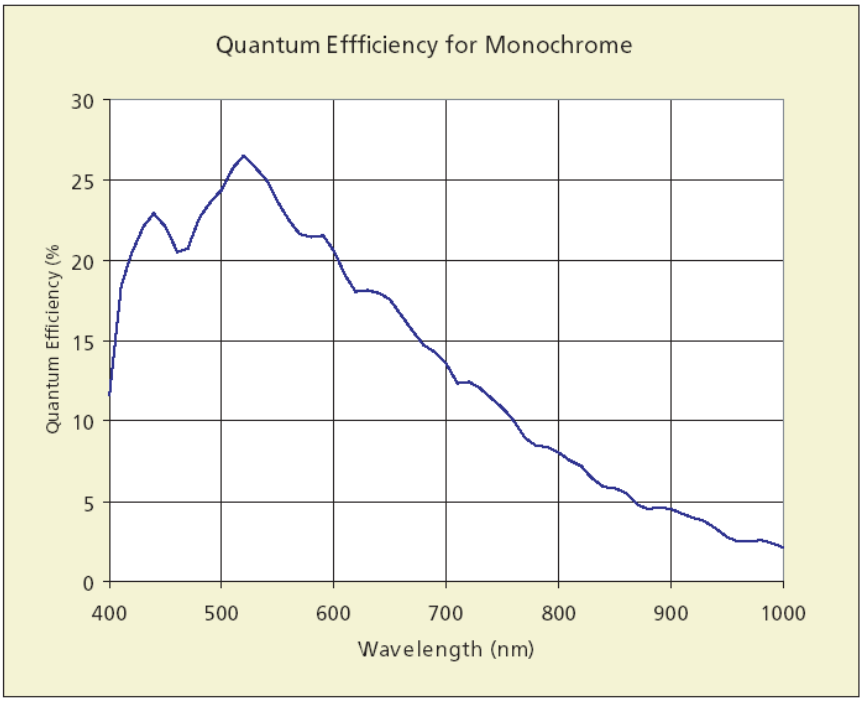


The optocouplers output will sink 13 mA with max. 0.6V output voltage. The output polarity is positive when the selected signal is active. The suppressor diode protects the output against reverse voltages. It starts conducting if the voltage on the output pin is greater 6V.

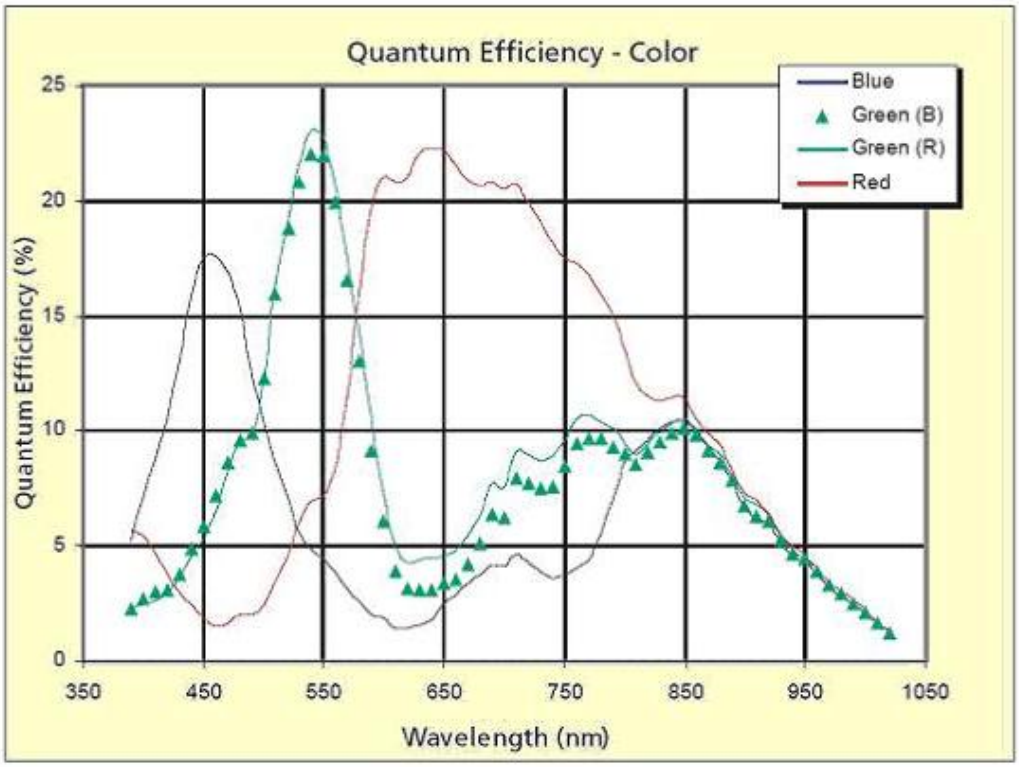
8.3 Spectral response

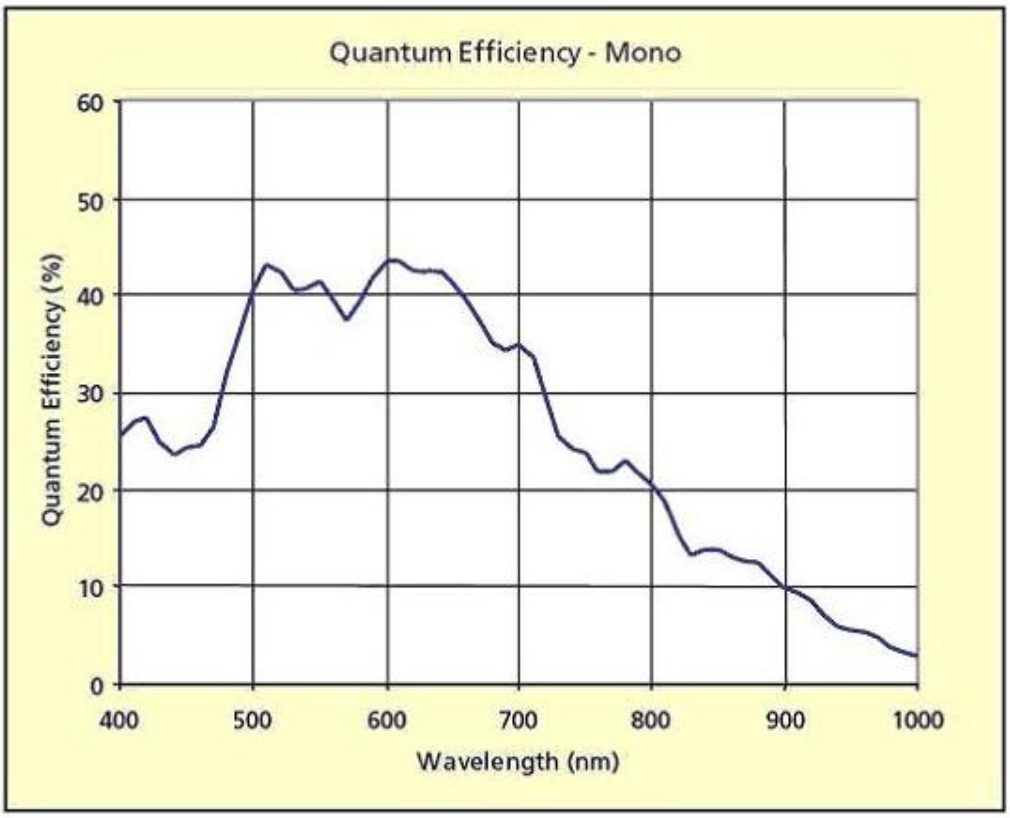
8.3.1 Cube1 / Cube2



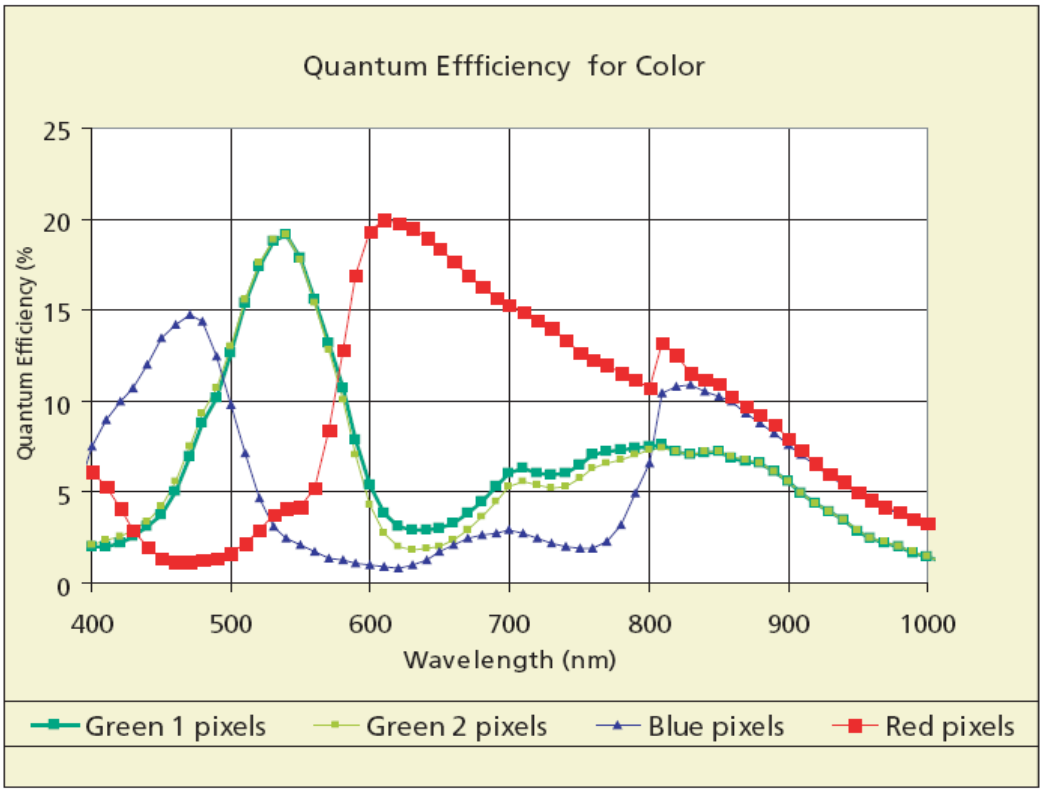


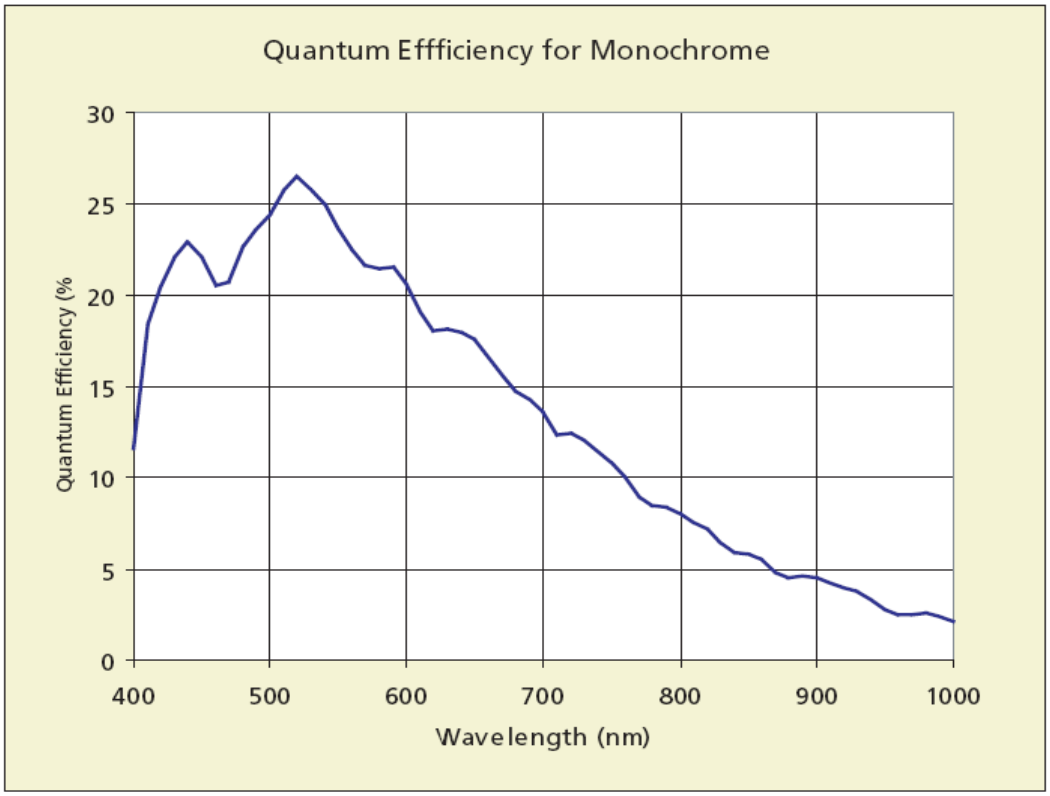
8.3.2 Cube3 / Cube5





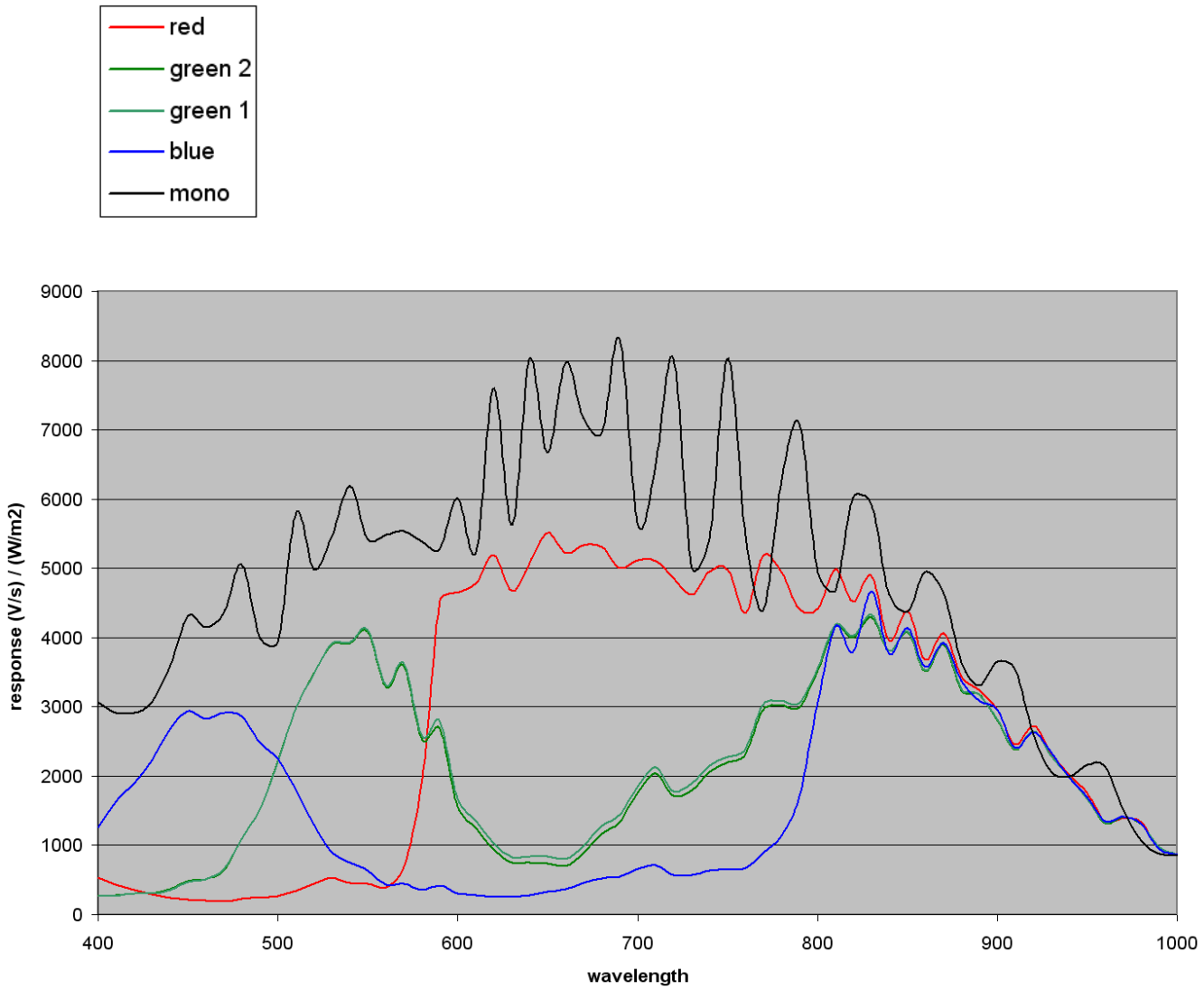
8.3.3 Cube4


Quantum Effficiency for Color
Quantum Efficiency (%
25
20
15
10
5
0
400
500
600
700
800
900
1000
Wavelength (nm)
Green 1 pixels
Green 2 pixels
Blue pixels
Red pixels

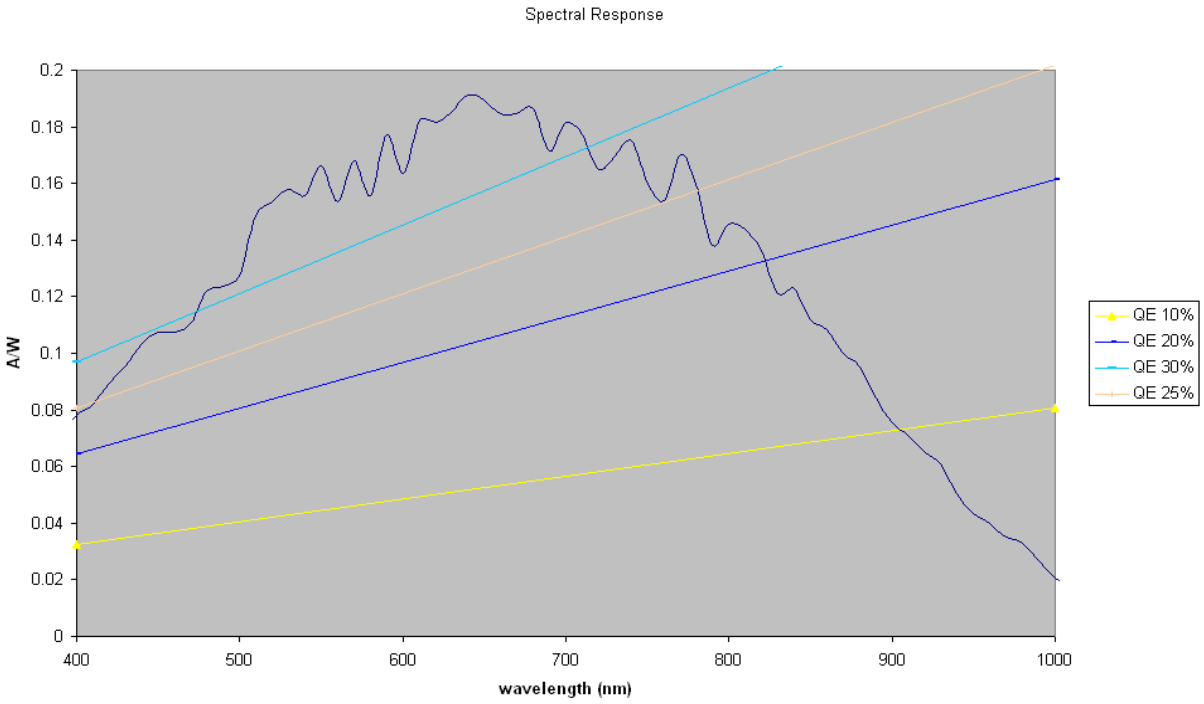

Quantum Effficiency for Monochrome
Quantum Efficiency (%
30
25
20
15
10
5
0
400
500
600
700
800
900
1000
Wavelength (nm)

8.3.4 Eo*Sens* Cube6 / Eo*Sens* mini1

Monochrome and color version with bayer filter



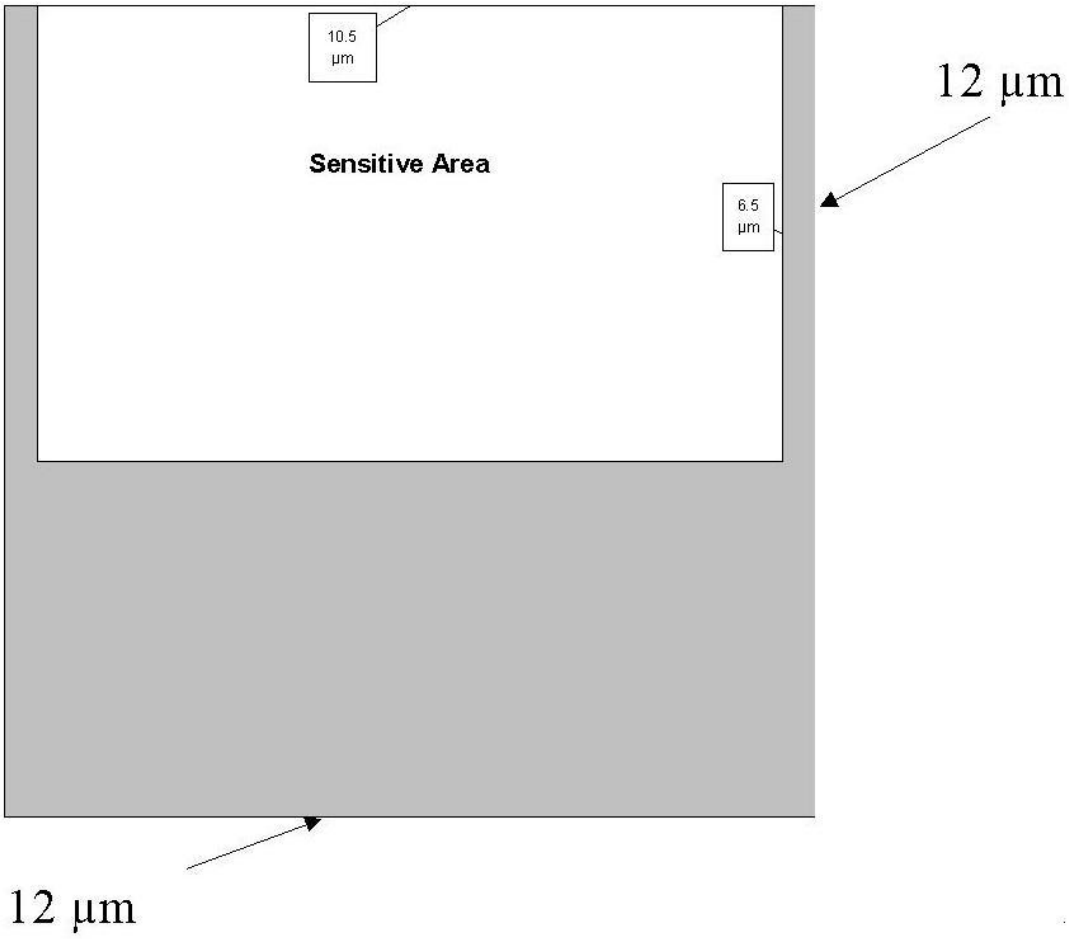
8.3.5 Eo*Sens* Cube7 / Eo*Sens* mini2



8.4 Pixel sensitive area

8.4.1 Cube1 / Cube2

Pixel size: 12 x 12 µm
Fill factor: 40 %
Sensitive area: 10,5 x 6,5 µm



8.4.2 Cube3 / Cube5

Pixel size: 16x 16µm
Fill factor: 62%
Sensitive area: 8.19(V)x 8,19(H)µm

8.4.3 Cube4

Pixel size: 12x 12µm
Fill factor: 40%
Sensitive area: 10,5(V)x 6,5(H)µm

8.4.4 Eo*Sens* Cube6 / Eo*Sens* mini1

Pixel size:	14 x 14µm
Fill factor:	40%
Sensitive area:	17.92 (H) x 14.34 (V) mm

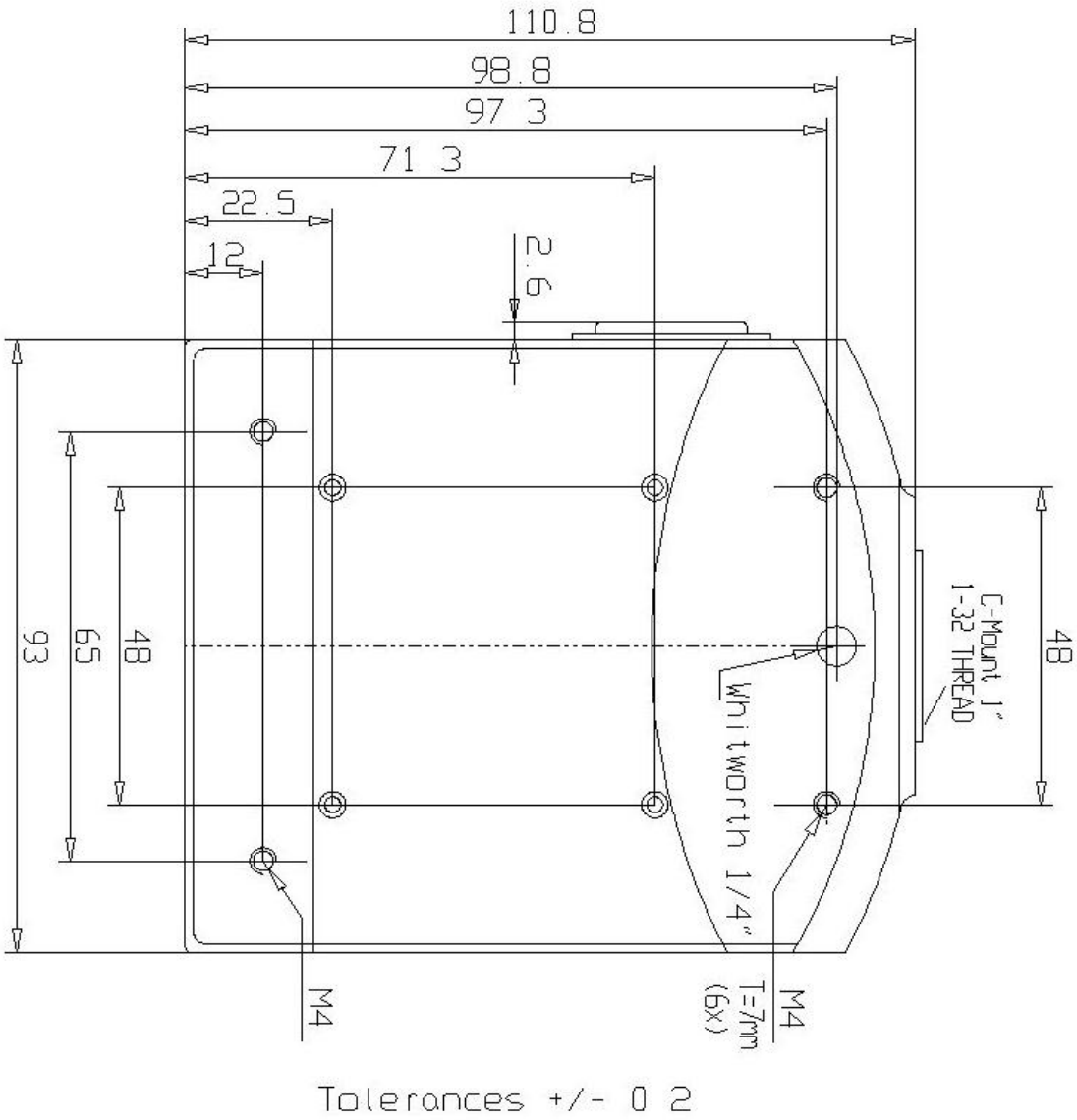
8.4.5 Eo*Sens* Cube7 und Eo*Sens* mini2

Pixel size:	8 x 8µm
Fill factor:	36%
total sensitive area:	13,568(V)x 13,68(H)mm

8.5 Dimensions

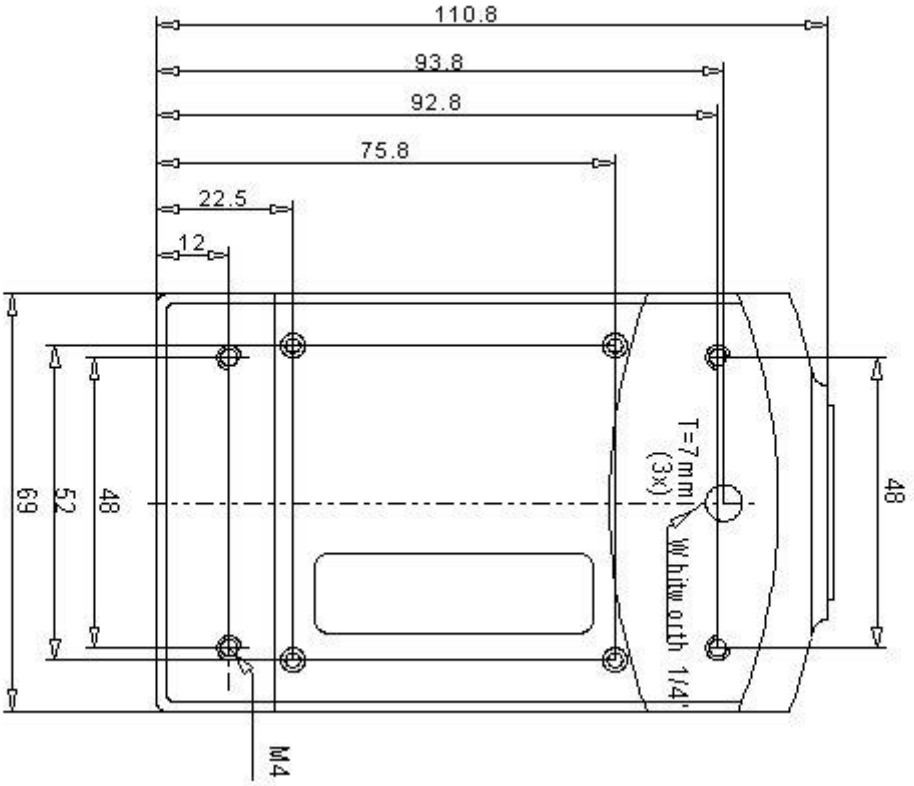
8.5.1 Top/bottom view Cube1/2/3

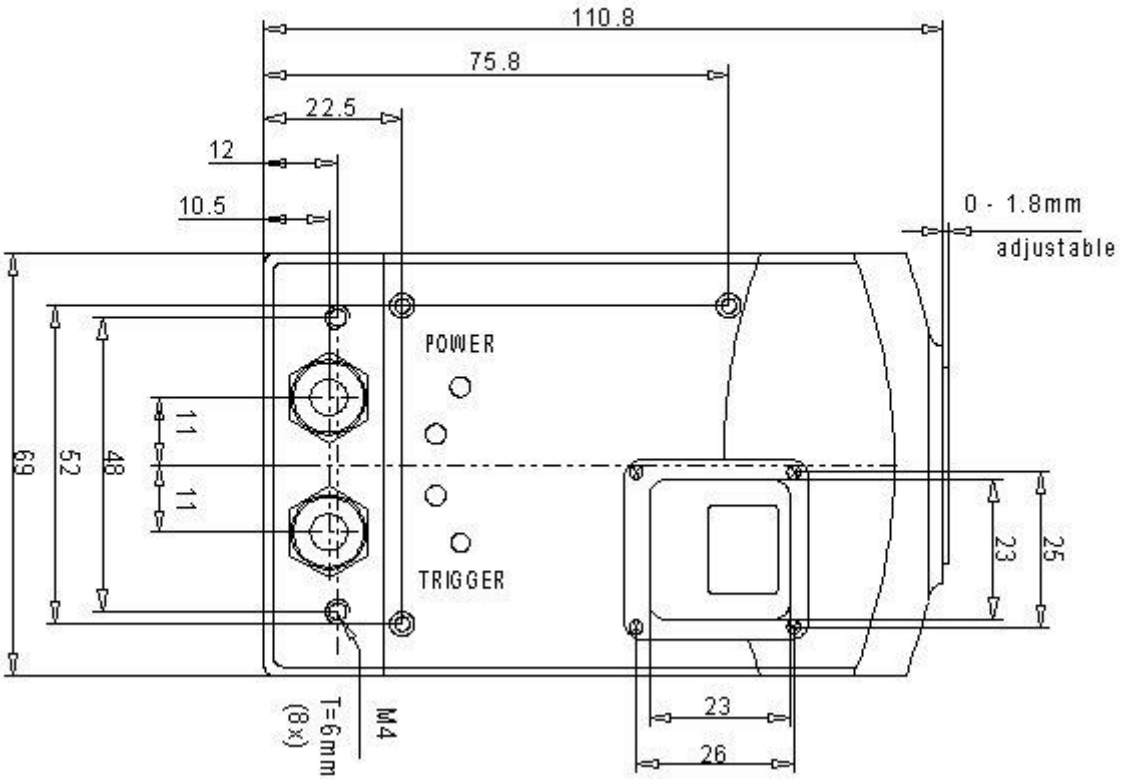
Maximum torque for M4 fastening screws: 2.5 Nm


110.8
98.8
97.3
71.3
22.5
12
2.6
93
65
48
48
C-Mount 1"
1-32 THREAD
Whitworth 1/4"
M4
M4
T=7mm
(6x)
Tolerances +/- 0.2

8.5.2 Side view Cube1/2/3

Maximum torque for M4 fastening screws: 2.5



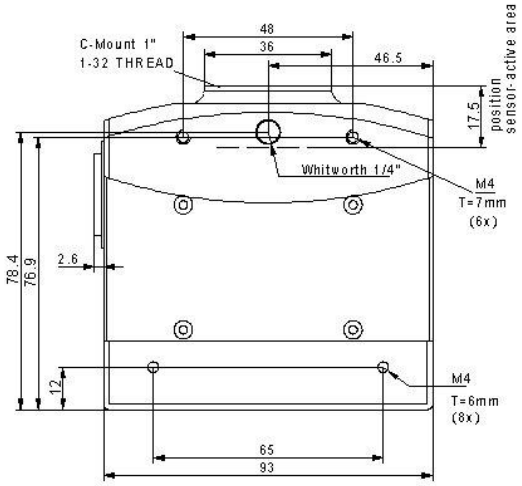


8.5.3 Top/bottom view Cube4/5 and Eo*Sens* Cube6/7

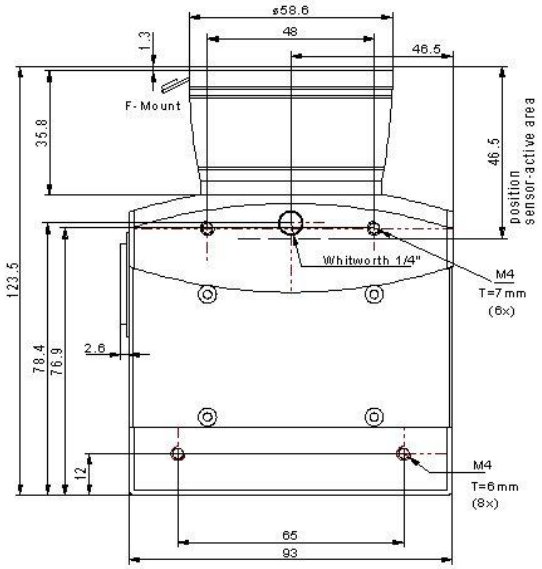
The camera body is with its dimensions of 93 x 69 x 92 mm (WxHxD, c-mount without lens) very compact. To fasten the camera there are two mounting holes M4x7mm and one tripod connection on each side available.

Maximum torque for M4 fastening screws: 2.5 Nm

c-mount

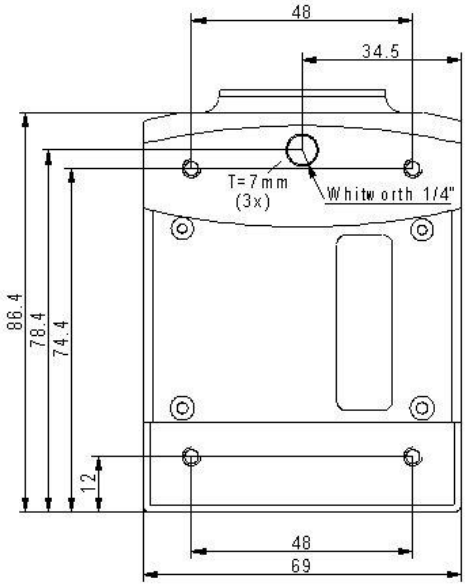


f-mount

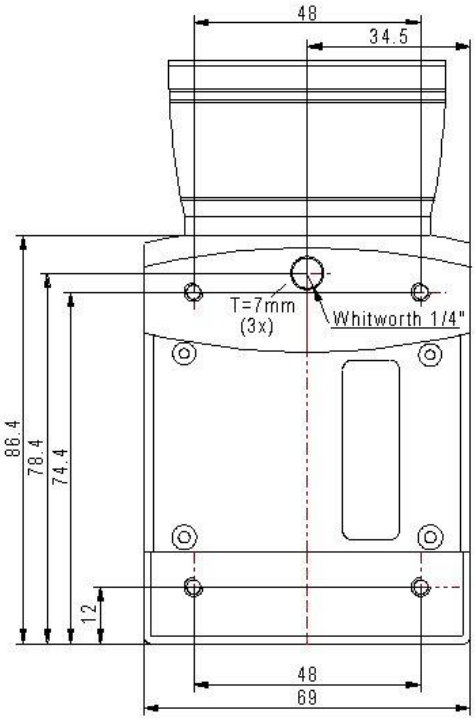


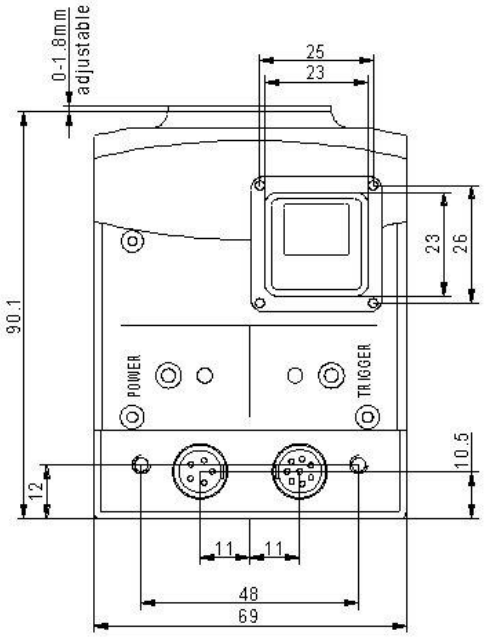
8.5.4 Side view Cube4/5 and Eo*Sens* Cube6/7

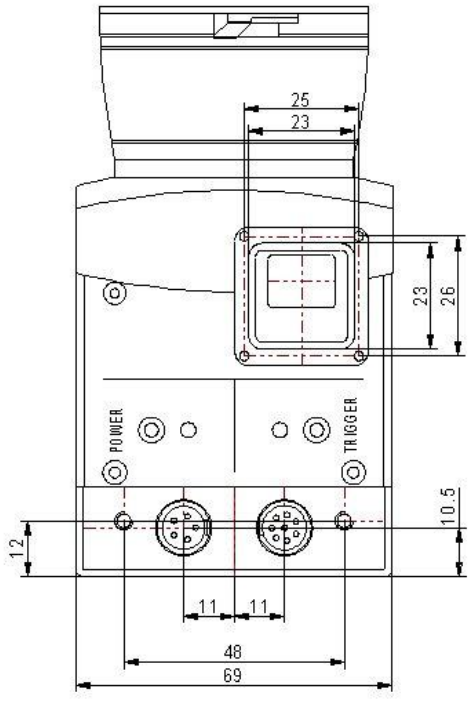
c-mount



f-mount



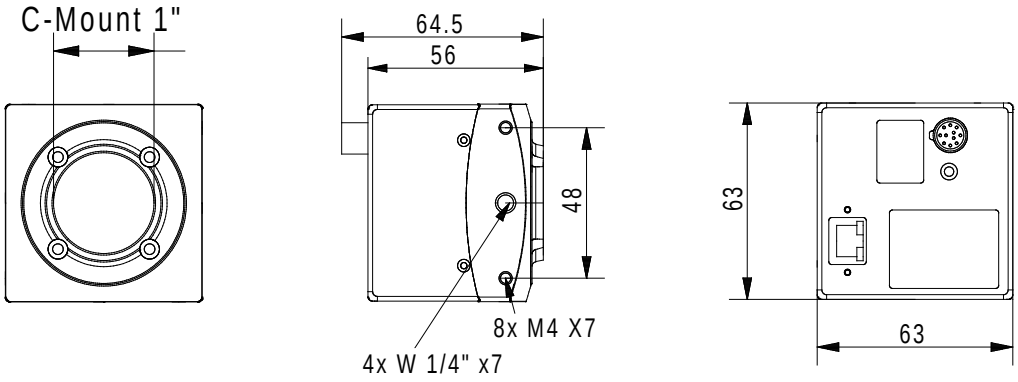




8.5.5 front / side / rear view of MotionBLITZ Eo*Sens* mini1/2

specifications without dimension are in mm

8.5.5.1 c-mount version



8.5.5.2 f-mount version