User Manual

uEye Cameras

Driver Version 3.32

Status: March 2009

Imaging Development Systems

Dimbacher Str. 6-8

D-74182 Obersulm

Fax: +49-(0)7134-96196-99

E-Mail: sales@ids-imaging.com

Content

1 Introduction

1.1 Copyright

IDS Imaging Development Systems GmbH hereby grants the purchaser the right to use the software.

1.2 Preface

IDS Imaging Development Systems GmbH has taken every possible care in preparing this User Manual. We however assume no liability for the content, completeness or quality of the information contained therein. The content of this manual is regularly updated and adapted to reflect the current status of the software. We furthermore do not guarantee that this product will function without errors, even if the stated specifications are adhered to.

Under no circumstances can we guarantee that a particular objective can be achieved with the purchase of this product.

Insofar as permitted under statutory regulations, we assume no liability for direct damage, indirect damage or damages suffered by third parties resulting from the purchase of this product. In no event shall any liability exceed the purchase price of the product.

Please note that the content of this User Manual is neither part of any previous or existing agreement, promise, representation or legal relationship, nor an alteration or amendment thereof. All obligations of *IDS Imaging Development Systems GmbH* result from the respective contract of sale, which also includes the complete and exclusively applicable warranty regulations. These contractual warranty regulations are neither extended nor limited by the information contained in this User Manual. Should you require further information on this product, or encounter specific problems that are not discussed in sufficient detail in the User Manual, please contact your local *uEye* dealer or system installer.

Status: March 2009

1.3 Safety Information

The product must be connected, taken into operation and maintained only by appropriately qualified personnel.

The error-free and safe operation of this product can only be ensured if it is properly transported, stored, set up and assembled, and operated and maintained with due care.

1.4 Operating Environment

Please comply with the requirements for the proper use of this product. Failure to do so will render the warranty void.

Do not subject this product to direct sunlight, moisture or shock. The environmental conditions specified in chapter Specifications are required.

1.5 Installation and Maintenance

The installation, testing, maintenance and extension of, and any necessary repairs to the system may be performed only by authorized personnel.

1.6 EMC Directives

IDS Imaging Development Systems GmbH hereby confirms that this product has been developed, designed and manufactured in compliance with the EC Directive 89/336/EEC (Electromagnetic Compatibility).
Compliance with the directives is demonstrated by meeting the following standards:

Product type	EMC immunity	EMC emission
USB uEye SE (CMOS sensors) *2)	EN 61000-6-2:2005	EN 61000-6-3:2001 + A11:2004
USB uEye SE (CCD sensors) *1)	EN 61000-6-2:2001	EN 61000-6-4:2001
USB uEye RE (CMOS sensors) *2)	EN 61000-6-2:2001	EN 61000-6-3:2001 + A11:2004
USB uEye RE (CCD sensors) *2)	EN 61000-6-2:2001	EN 61000-6-3:2001 + A11:2004
USB uEye LE (CMOS sensors) *2)	EN 61000-6-2:2005	EN 61000-6-3:2001 + A11:2004
GigE uEye SE (CMOS sensors) *1)	EN 61000-6-2:2005	EN 61000-6-4:2001
GigE uEye SE (CCD sensors) *1)	EN 61000-6-2:2005	EN 61000-6-4:2001
GigE uEye HE (CMOS sensors) *2)	EN 61000-6-2:2005	EN 61000-6-3:2001 + A11:2004
GigE uEye HE (CCD sensors) *2)	EN 61000-6-2:2005	EN 61000-6-3:2001 + A11:2004

*1) 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.
Modifications not expressly approved by the manufacturer could void the user's authority to operated the equipment under FCC rules.

*2) This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Modifications not expressly approved by the manufacturer could void the user's authority to operated the equipment under FCC rules.

1.7 Trademarks

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1.8 Contacting Us

Visit our web site http://www.ids-imaging.com where you will find all the latest drivers and information about our software and hardware products. The latest *uEye* driver is available on our website http://www.ids-imaging.com.

Please contact your local IDS distributors for first level support in your language. For a list of IDS distributors worldwide please go to our website and follow the *Support* link.

Address:	IDS Imaging Development Systems GmbH Dimbacher Str. 6-8 D-74182 Obersulm
Fax:	+49-(0)7134-96196-99
Email:	Sales: sales@ids-imaging.com Support: support@ids-imaging.com
Internet	http://www.ids-imaging.com

2 Welcome

Thank you for purchasing a *uEye* camera from *IDS Imaging Development Systems GmbH*.

This manual describes the functions and features of the different *uEye* camera series.

uEye stands for a range of compact and cost-effective cameras for professional use in industrial, security and non-industrial applications. Equipped with the widely used USB 2.0 and Gigabit Ethernet ports, they can easily be interfaced with a vast variety of systems. The images are digitized in the camera and transmitted digitally to the PC. An additional frame grabber is not required.

uEye cameras have state-of-the-art CMOS and CCD sensors. The CMOS models use either the global or the rolling shutter method; the CCD models use only the global shutter method. *uEye* camera resolutions range from 640 x 480 pixels (VGA) to 2560 x 1920 pixels (QSXGA), depending on the sensor. Further sensor modules will continuously expand the product portfolio. Depending on the individual model, the *uEye* cameras are available either as monochrome and color versions, or as color versions only.

USB uEye SE

The *USB uEye SE* series features a robust metal housing with a standard mini-B USB 2.0 connector. Connection is additionally possible via a screw-mounted micro D-sub connector which also carries the opto-isolated I/O signals. A *USB uEye SE* variant with C-mount front flange has been developed for OEMs. The camera can also be supplied as PCB stack for special applications.

The USB 2.0 interface is meanwhile available in every standard PC and notebook/laptop and provides a gross bandwidth of 480 Mbps. The camera is connected and powered through the USB port by just a single cable.

Figure 1: USB uEye SE CMOS camera

USB uEye RE

Figure 2: USB uEye RE

The *RE* variants of the *USB uEye* cameras are extremely rugged and thus offer an extended area of application. In conjunction with the optional lens tubes, these models meet the requirements of protection classes IP 65 and IP 67. The USB 2.0 and the I/O signals are connected via two ports of the same protection class. The *USB uEye RE* is therefore particularly suited for harsh environments.

USB Eye LE

The *USB uEye LE* series features extremely compact cameras with high-speed CMOS sensors. The *LE* models are designed for professional use in non-industrial applications. Through the use of the widespread USB 2.0 technology, the cameras can easily be interfaced with a vast variety of systems. *USB uEye LE* cameras are available with a plastic housing with CS-mount lens adapter, as a board-level version with M12 or M14 lens holder or without a lens holder.

Figure 3: USB uEye LE variants

GigE uEye HE

Figure 4: GigE uEye HE (standard and 90° variant)

The *GigE uEye HE* offers a rich set of additional features and functions compared to the other *uEye* models. Images can be output at 12 bits per channel. The integrated FPGA allows calculating color images in the camera, and various LUT curves can be applied to the images. An integrated 64 MB image memory and two independent processor cores ensure fast and reliable data transfer. Many of the *GigE uEye HE*'s sensors can be operated at increased frame rates. Additional programmable I/Os and a serial RS232 interface in the camera open up new possibilities for camera integration.

The Gigabit Ethernet interface provides further advantages: More than twice the bandwidth of USB 2.0, cable lengths up to 100 m, and widespread use of this interface. The Gigabit Ethernet interface is meanwhile available in every standard PC and notebook/laptop and provides a gross bandwidth of 1000 Mbps.

GigE uEye SE

Die *GigE uEye SE* is a highly compact Gigabit Ethernet camera. With a housing barely larger than that of the USB *uEye* models, the *GigE uEye SE* offers all the benefits of the Gigabit Ethernet technology: High bandwidth, cable lengths up to 100 m, and widespread use of this interface.

Besides the screw-mounted Gigabit Ethernet port, the camera provides a 6-pin Hirose connector that carries the power supply as well as the trigger and flash signals.

Figure 5: GigE uEye SE

uEye Software

For every *uEye* camera, a comprehensive software package is available as a free download. In addition to the drivers, this software package features the *uEye Camera Manager*, the *uEye Demo* application and a *Software Development Kit (SDK)* for creating your own *uEye* programs under Windows 2000, XP and Vista (32-Bit) as well as Linux. Numerous demo applications make it easy for you to get started with *uEye* programming. For detailed information on programming *uEye* cameras with the *uEye SDK*, please refer to the *uEye Programming Manual* (PDF file).

The latest *uEye* software is available for download from our website at http://www.ueyesetup.com.

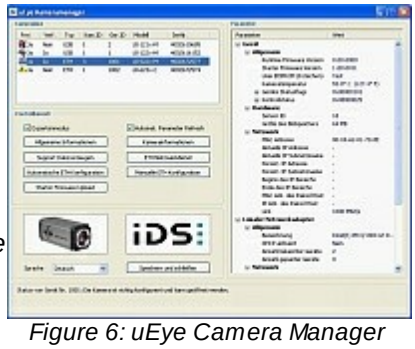


Figure 6: uEye Camera Manager

Enjoy your new uEye camera!

2.1 About this Manual

The *uEye User Manual* contains all the information you need for operating your *uEye* camera. The manual comprises three main parts. The first part provides basic information on USB, Gigabit Ethernet and camera technology. Please read this chapter to become familiar with the general functionality of the *uEye* cameras.
The second part of the manual shows you how to install and use the uEye software.
In the third part, you will find the Specifications: Sensors, which you can use as a reference guide when integrating the cameras.

Please make sure to read the file named *WhatsNew.txt* which you will find in the C:\Program Files\IDS\uEye\Help directory when the installation is completed. This file contains late-breaking information on new functions and fixed issues.

In these boxes, you will find helpful user information.

In these boxes, you will find important notes and warnings.

This symbol indicates interactive graphics. When you click on an active area in a graphic, a chapter containing additional information on that area opens automatically.

2.2 What is New in this Version?

Version 3.32 of the *uEye* software package includes many new features and enhancements. The following table gives you an overview of the major new functions. (For more information, please see the "What is New in this Version" chapter in the *uEye Programming Manual V3.32*.)

New in Version 3.32

New feature	Described in chapter
Extended trigger mode The continuous trigger mode allows triggering the *uEye* repeatedly. The camera no longer has to be made ready for the next trigger before each image capture.	Operating Modes: Trigger Mode

New information in the manual	Described in chapter
Detailed presentation of all *uEye* operating modes	Operating Modes
Updated connected load data on every camera model	Specifications: Sensor Data
Wiring diagrams for the inputs/outputs of the *USB uEye LE*	USB uEye LE: Wiring

New in Version 3.31

New feature	Described in chapter
Support of *GigE uEye SE* The *uEye* driver version 3.31 introduces the new camera series *GigE uEye SE*. This manual provides all the information you need to integrate and use the new camera.	Welcome: GigE uEye SE GigE uEye SE Specifications GigE uEye SE Camera Dimensions
Improved *uEye Camera Manager* features	uEye Camera Manager

New in Version 3.30

New feature	Described in chapter
Serial interface of the *GigE uEye HE* The serial interface (RS232) on the *GigE uEye HE* allows the control of peripherals.	Serial Interface (RS232)
Test image function The camera transmits a selectable test image that you can use for testing the data transmission.	Camera properties: Test image
Color calculation in the camera (*GigE uEye HE* **only).** The *GigE uEye HE* can optionally calculate the color data from raw Bayer format directly in the camera. This reduces the load on the host computer's CPU. Color correction and color saturation are continuously adjustable.	Camera properties: Color
LUT/gamma curves in the camera (*GigE uEye HE* **only).** In addition, the *GigE uEye HE* can apply LUT and gamma curves to the image directly in the camera in order to adjust brightness, contrast and color distribution.	Camera properties: LUT/Gamma
Support of 10 and 12 bit sensor data Some sensors can output images with a color depth of 10 to 12 bits. This data can now be processed by the *uEye* software.	Specifications: Sensors
New color formats	Camera properties: Color

uEye driver version 3.30 supports a wide range of new color formats for all *uEye* cameras. These include: o RGB/BGR 30 o RGBY o Y12 o YCbCr o Enhanced YUV	
Subsampling for GigE uEye HE cameras with CCD sensors The *GigE uEye HE* can also perform binning and subsampling for CCD sensors. Binning and subsampling are supported both in the horizontal and vertical direction, and allow higher frame rates. For CMOS sensors, subsampling takes place directly in the sensor and is supported by all *uEye* models.	Specifications: Sensors
Full support of *Windows Vista* (32 Bit) From driver version 3.30 onwards, all *uEye* cameras will run under Windows Vista 32.	System Requirements
Localization of the *uEye Camera Manager* The *uEye* Camera Manager offers new features and now also supports over 10 languages that can be switched anytime.	Camera Manager

3 General

3.1 System Requirements

For operating the *uEye* cameras, the following system requirements must be met:

USB uEye cameras

	Minimum	Recommended
CPU speed	600 MHz	2.8 GHz
Memory (RAM)	256 MB	512 MB
USB host controller	USB 2.0 high speed (480 Mbps)	USB 2.0 high speed (480 Mbps) Intel® or NVIDIA® nForce mainboard chipset
Graphics card	Onboard graphics chip	PCI/PCIe graphics card with *DirectDraw* support *DirectX 9.0* or higher
Operating system	Windows 2000 (Service Pack 4) Windows XP 32 bit (Service Pack 2) Windows Vista 32 bit Linux (Kernel 2.6)	Windows XP 32 bit (Service Pack 3) Windows Vista 32 bit (Service Pack 1) Linux (Kernel 2.6)

Onboard USB 2.0 ports usually provide significantly better performance than PCI and PCMCIA USB adapters.

GigE uEye cameras

	Minimum	Recommended
CPU speed	600 MHz	2.8 GHz
Memory (RAM)	256 MB	512 MB
Network bandwidth	100 Mbps	1000 Mbps
Network card type	---	Intel Pro/1000 GT (PCI) Intel Pro/1000 PT (PCIe)
Graphics card	Onboard graphics chip	PCI/PCIe graphics card with *DirectDraw* support *DirectX 9.0* or higher
Operating system	Windows 2000 (Service Pack 4) Windows XP 32 bit (Service Pack 2) Windows Vista 32 bit	Windows XP 32 bit (Service Pack 3) Windows Vista 32 bit (Service Pack 1)

To ensure optimum performance of the network connection, you need to install the latest drivers for your network card. We recommend using the drivers of the following versions:

- Intel® chipsets: version 8.8 or higher
- Realtek chipsets: version 5.7 or higher

3.2 USB uEye SE Driver Compatibility

From driver version 3.10 on, only cameras with USB board revision 2.0 or higher are supported.

Only the following CMOS camera models of the *USB uEye SE* series are affected:

- UI-121x
- UI-141x
- UI-144x
- UI-154x
- UI-145x
- UI-146x

You can use the *USB Hardware Check* (see Software Installation) before installing the driver version 3.10 to check whether your camera is supported. In addition, the *uEye Camera Manager* version 3.10 or above provides information about the compatibility (see Camera Manager). An incompatible camera will be displayed as *free* and *not available*.
The LED(s) on the back of the camera housing also indicate the USB board version:

Figure 7: USB revision 1.2 (green LED)

Figure 8: USB revision 2.0 (red/green LED)

Note on the uEye memory board

The optional memory board of the *USB uEye SE* and *USB uEye RE* camera series has been discontinued.

From version 3.30, the functions required to operate the memory board will no longer be supported in the *uEye* driver.
The *uEye* driver version 3.24 that still supports these functions will continue to be available in the download area of our website at http://www.ids-imaging.com.

4 USB Basics

4.1 History and Development

The *Universal Serial Bus* (USB) is an interface which enables you to easily connect various devices to a PC. As all data exchange is controlled by the PC, no additional interface controller is needed. Further advantages of USB are:

- the PC does not have to be shut down when connecting USB devices (*hot plugging*)
- USB devices can be supplied with power from the PC
- High bandwidth for data transmission

The USB standard was developed by a group of companies including Compaq, IBM, Intel, and Microsoft. Version 1.0 was presented in 1995. The slightly faster USB 1.1 standard followed in 1998. At first, the USB interface was designed to connect peripheral devices such as printers, mice, or keyboards. With the introduction of USB 2.0 in 2000, the transfer rate increased to 480 Mbps, making USB 2.0 suitable for connecting devices with higher data volumes (such as mass storage devices, scanners, or cameras).

4.2 Structure and Topology

USB uses a tree topology and is host-controlled. That means that a PC with host functionality is mandatory for using USB. Therefore, it is not possible to directly connect two USB devices (with the exception of USB On-the-go compliant devices). Neither is it possible to connect a camera to a PDA device.
Theoretically, 127 devices can be connected to a host controller. Using external hubs or repeaters, even more devices can be connected, and from a greater distance. Provided that a maximum of 5 hubs/repeaters may be daisy-chained, USB devices can be connected in up to seven levels.

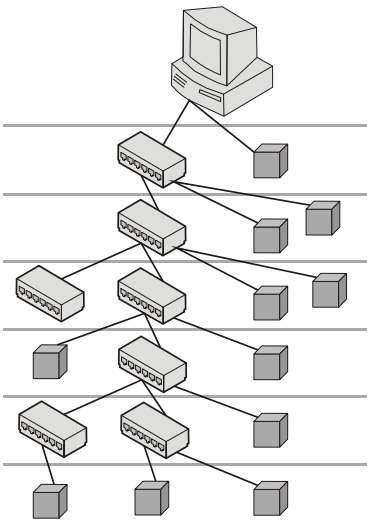


Figure 9: USB Topology

The maximum bandwidth of 480 Mbps per USB 2.0 host cannot be exceeded. Therefore, the maximum possible frame rate will be reduced if image data from multiple USB cameras is transferred simultaneously.
The available bandwidth might also be decreased when you use hubs or repeaters. You can reduce the bandwidth required for each camera by lowering the frame rate or the image size.

4.3 Cabling and Connection

In order to comply with the specifications, the maximum length of USB 2.0 cables is limited to 5 m. Longer cables may be connected if you use high-quality material. For cameras of the *USB uEye RE* series, IDS offers cables with a length of up to 10 m (see also USB uEye RE Accessories).
The USB bus provides power supply with 5 V and 500 mA max. Many USB devices use the bus power and do not need external power supply (*bus-powered* devices).

Cable design

The following illustration shows the basic design of a shielded USB cable:

- D+/D-: data transfer
- +5 V/GND: power supply

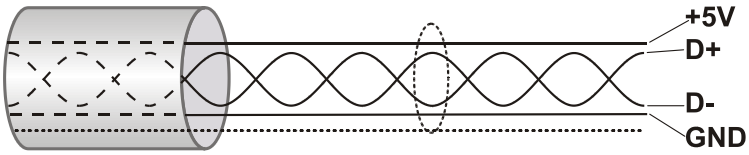


Figure 10: Basic design of a USB cable

Connector types

On the PC side, USB 2.0 cables are equipped with a standard A type plug (four pins) and on the device side either with a standard B plug (four pins) or a mini-B plug (five pins).
In addition, cameras of the *USB uEye SE* series can be connected to IDS camera cables that use a nine-pin micro D-Sub screw connector. Besides the USB 2.0 signals, these connectors can also carry the camera's digital input/output signals.

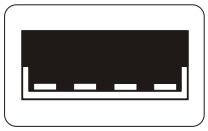


Figure 11: USB standard-A socket (four pins)

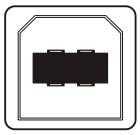


Figure 12: USB standard-B socket (four pins)

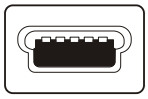


Figure 13: USB mini-B socket (five pins)

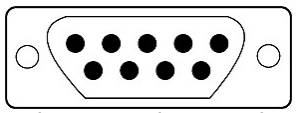


Figure 14: Micro D-Sub (nine pins)

4.4 Data Transmission and Bandwidth

The USB 2.0 standard specifies an overall bandwidth of 480 Mbps shared between different transmission modes. *uEye* cameras use the USB 2.0 *bulk* mode for transmitting images. This mode uses error correction to ensure correct delivery of the image data, but does not guarantee a fixed bandwidth. To ensure error-free communication with all connected devices at all times, the maximum bandwidth for payload data is limited to 416 Mbps.

Theoretically, up to 50 MB/s of data can be transmitted in this mode, but in practice, this value is hardly ever reached. A high-performance desktop PC can transmit about 40 MB/s, most notebooks or embedded PC systems even less than that.
The overall bandwidth can be increased by the use of USB 2.0 expansion cards. These cards are available for the PCI and PCIe buses and have their own host controller chip.

To achieve optimum USB bandwidth, it is important to use a powerful mainboard chipset. The mainboard chipsets from e.g. Intel® or NVIDIA® provide very good results.

If you need recommendations on the most appropriate hardware to use, please contact uEye Support.

5 GigE Basics

5.1 General

Gigabit Ethernet was developed on the basis of the Fast Ethernet (100 Mbps) standard. In June 1999, the IEEE 802.3ab 1000 Mbps standard was defined by the *IEEE* (**I**nstitute of **E**lectrical and **E**lectronics **E**ngineers). Using at least Cat 5e copper cables, transmission rates of 1 Gbps can be obtained. This makes Gigabit Ethernet 10 times faster than Fast Ethernet. The main advantages of Gigabit Ethernet include:

- Higher bandwidth, allowing for better network performance and the elimination of bottlenecks
- Full-duplex capability virtually doubles the effective bandwidth
- Low purchasing and operating costs through the use of common hardware
- Full compatibility with the large number of installed Ethernet and Fast Ethernet nodes
- Fast transfer of large amounts of data over the network

Figure 15: Structure of a Cat 5e cable

For connecting Gigabit Ethernet cables, RJ45 connectors are used. The following illustrations show schematic views of an RJ45 socket (with cable configuration) and of an RJ45 plug.

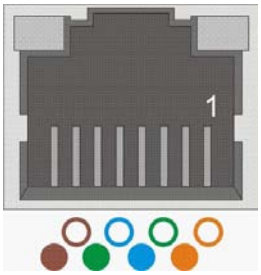


Figure 16: RJ45 socket (EU type acc. to EIA/TIA-568B)

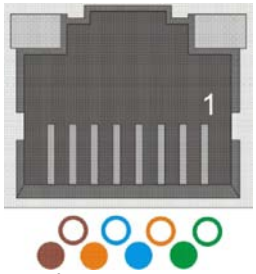


Figure 17: RJ45 socket (US type acc. to EIA/TIA-568A)

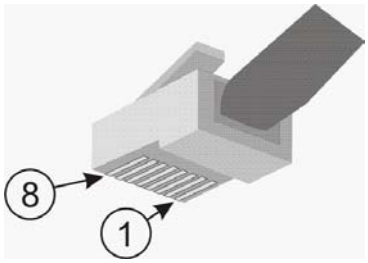


Figure 18: RJ45 plug

The *GigE uEye* camera automatically recognizes whether an Ethernet cable with crossed wiring or straight wiring is connected. The camera adjusts accordingly.

5.2 Glossary

UDP

UDP stands for *User Datagram Protocol* and contains mechanisms that allow applications to easily send messages to each other. UDP is session-oriented and has no protective measures to guard against message loss or duplication. The header contains the sender port, the recipient port, the length of the datagram and a checksum.

Port

Ports are address components used in network protocols to assign data segments to the correct services (protocols).

Firewall

A firewall is a software or hardware shield that protects a local network or a computer from Internet-based attacks.
Among a firewall's main uses are protection from hacker attacks, computer viruses, trojans, worms and spyware.

ARP

The *Address Resolution Protocol* uses network messages, called broadcasts, to determine on which logical segment of the network the recipient of a packet is located.

The responses to the broadcast contain all the IP addresses of the available subnet and the associated MAC addresses. Every IP address is stored in an ARP table together with the associated MAC address. These tables are necessary because the two addresses are independent of each other and therefore cannot be calculated by means of an algorithm.

Subnet

Subnets are small units of a network. Using subnets makes it easier to manage networks and increases performance, as connecting devices such as routers or switches can be used to limit data traffic to specific subnets.
The address is made up of the IP address of the network, the subnet address and the host address.

Switch

The term *switch* refers to the connecting units in a *LAN (**L**ocal **A**rea **N**etwork)*. They are used to connect subnets of the same topology. Contrary to hubs, switches dispatch incoming data packets only to the specific recipients.

Router

Routers are connection units that connect different networks or LANs.

Hub

A hub is a coupling unit that connects several network units on one line (star topology). Contrary to a switch, the message of a network member is dispatched to all other network members.

DHCP

The ***D**ynamic **H**ost **C**onfiguration **P**rotocol* controls the dynamic configuration of IP addresses.
When a workstation which is configured for the use of DHCP is started up on a LAN, it registers with a server running this service. The server then assigns an available IP address, which is stored locally so that reassignment is not necessarily required on the next start-up.

Broadcast

A *broadcast* is a data packet that is transmitted to all stations on a network. This is done by sending a data packet to the reserved IP address .255 of a network or subnet (broadcast address).

Heartbeat

Network devices send a *heartbeat* to signal that they are operational and fully functional. If this heartbeat signal is not detected, the recipient system assumes that the remote device is no longer available.

Paired

Paired describes the logical connection of a network camera and a host PC. When a camera and a host PC are paired, they are exclusively connected. Simultaneous pairing with several host PCs is not possible.
A request for image data is only possible in paired state.

6 Camera Basics

Components of the USB uEye SE/RE cameras

The *USB uEye SE* and *RE* cameras have a modular structure consisting of the following components:

- USB board, including:
  - a USB 2.0 interface which controls data traffic between the camera and the host PC
  - a micro-controller which controls the digital inputs and outputs, the pixel clock and the image size
  - an EEPROM where the camera manufacturer, type, and serial number are stored
    a 64-byte memory area can be used freely by the user
- Sensor board. This board includes:
  - the sensor
  - an EEPROM where the camera type is stored
- Timing board (CCD cameras only)
  - The timing board digitizes the analog output signals of the CCD sensor.

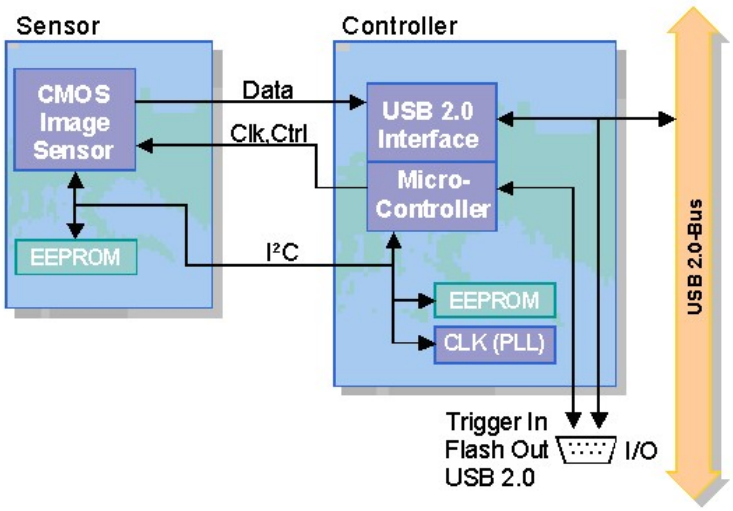


Figure 19: Block diagram of the CMOS USB uEye SE

Components of the USB uEye LE camera

USB uEye LE cameras are equipped with a PCB containing the following components:

- CMOS sensor
- Sensor EEPROM where the camera type is stored.
- USB 2.0 interface which controls data traffic between the camera and the host PC.
- Micro-controller which controls the digital inputs and outputs, the pixel clock and the image size.
- EEPROM where the camera manufacturer, type, and serial number are stored.
  A 64-byte memory area can be used freely by the user.

Components of the GigE uEye HE camera

The *GigE uEye HE* cameras have a modular structure consisting of the following components:

- Gigabit Ethernet board, including:
  - a Gigabit Ethernet interface which controls data traffic between the camera and the host PC
  - an FPGA which controls the camera functions and performs basic image preprocessing
  - a 64-Mbyte memory used for processing image data
- Sensor board. This board includes:
  - the sensor
  - an EEPROM where the camera type is stored
- Timing board (CCD cameras only)
  - The timing board digitizes the analog output signals of the CCD sensor.

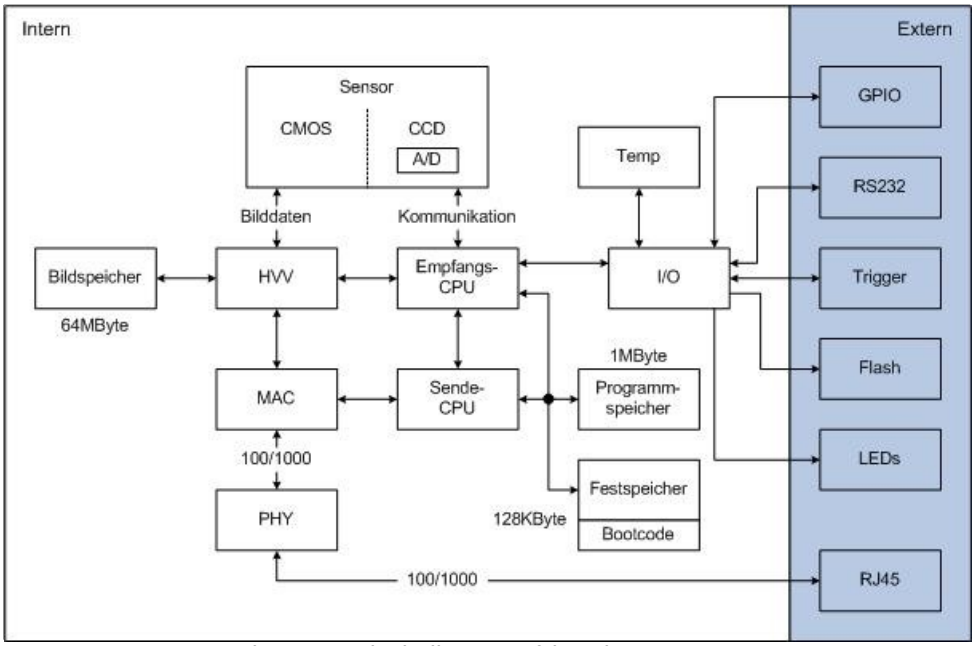


Figure 20: Block diagram of the GigE uEye HE

6.1 Operating Modes

6.1.1 Freerun Mode

In freerun mode, the camera sensor captures one image after another at the set frame rate. Exposure and readout/transfer of the image data are performed in parallel. This allows the maximum camera frame rate to be achieved. The frame rate and the exposure time can be set separately. The captured images can be transferred one by one or continuously to the PC.

If trigger mode is active, you need to disable it before activating freerun mode.

- *Single frame mode (snap mode)*
  The next image exposed by the sensor will be transferred. You cannot use the *uEye* flash outputs in this mode.
- *Continuous mode (live mode)*
  Images are captured and transferred continuously. You can use the *uEye* flash outputs.

The following illustrations show a schematic view of the image capture sequence. The sensor exposure and readout times and the transmission times depend on the camera settings. The pre-processing time depends on the API functions you are using (e.g. color conversion, edge enhancement).

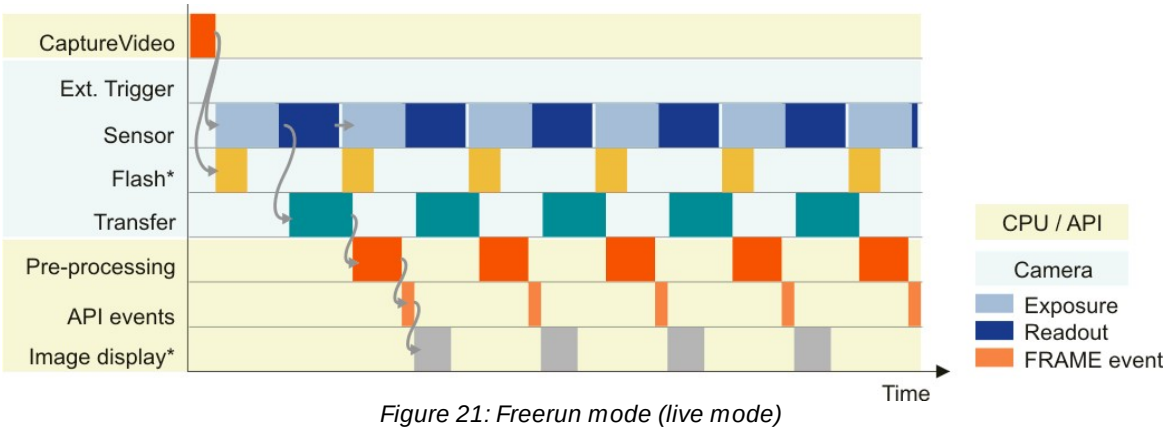


Figure 21: Freerun mode (live mode)

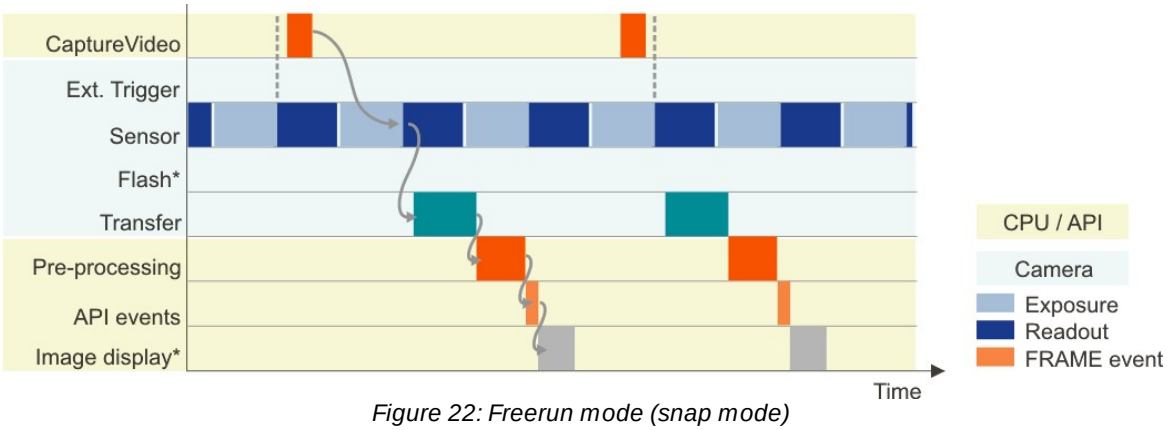


Figure 22: Freerun mode (snap mode)

*) Optional function. The start time and duration of the flash signal are defined by the *Flash delay* and *Duration* parameters (see also Camera Settings: I/O).

6.1.2 Trigger Mode

In trigger mode, the sensor is on standby and starts exposing on receipt of a trigger signal. A trigger event can be initiated by a software command (software trigger) or by an electrical signal via the camera's digital input (hardware trigger). For the specifications of the electrical trigger signals, see the Electrical Specifications chapter.

In the camera properties, choose which trigger mode you want to use:

- *Software trigger mode*
  When this mode is enabled, calling the *Snap* function triggers the capture of an image, which is then transferred to the PC. If you call the *Live* function in this mode, the image capture is triggered continuously and images are transferred continuously.
- *Hardware trigger mode*
  When this mode is enabled, calling the *Snap* function makes the camera ready for triggering just once. When the camera receives an electrical trigger signal, one image is captured and transferred.
  If you call the *Live* function, the camera is made ready for triggering continuously. An image is captured and transferred each time an electrical trigger signal is received; the camera is then ready for triggering again (recommended procedure).
- *Freerun synchronization*
  In this mode, cameras running in freerun mode *(live mode,* see above) can be synchronized with an external trigger signal. The cameras still remain in freerun mode. The trigger signal stops and restarts the current image capture process. You can use this mode to synchronize multiple cameras that you are operating in the fast *live mode*. Not all camera models support this mode.

In trigger mode, the maximum frame rate is lower than in freerun mode because the sensors expose and transfer sequentially. The possible frame rate in trigger mode depends on the exposure time.
Example: At the maximum exposure time, the frame rate is about half as high as in freerun mode; at the minimum exposure time, the frame rate is about the same.

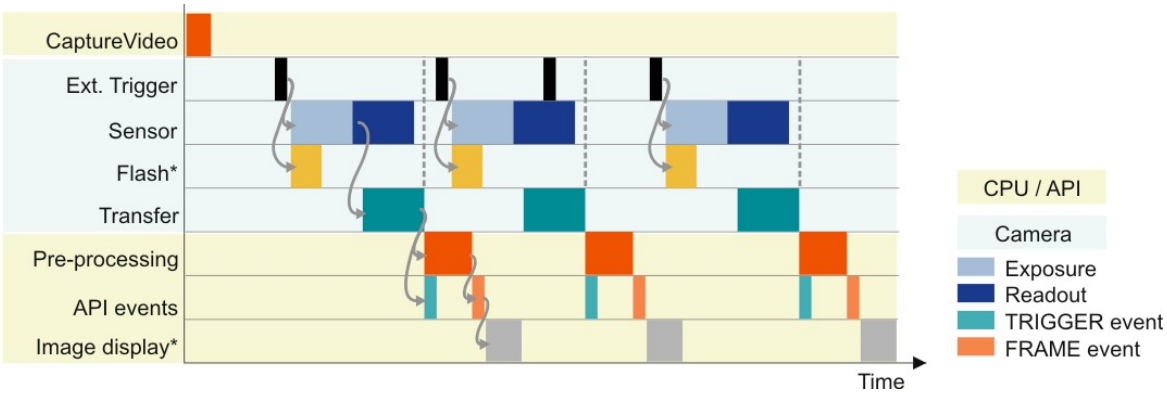


Figure 23: Hardware trigger mode with continuous image capture

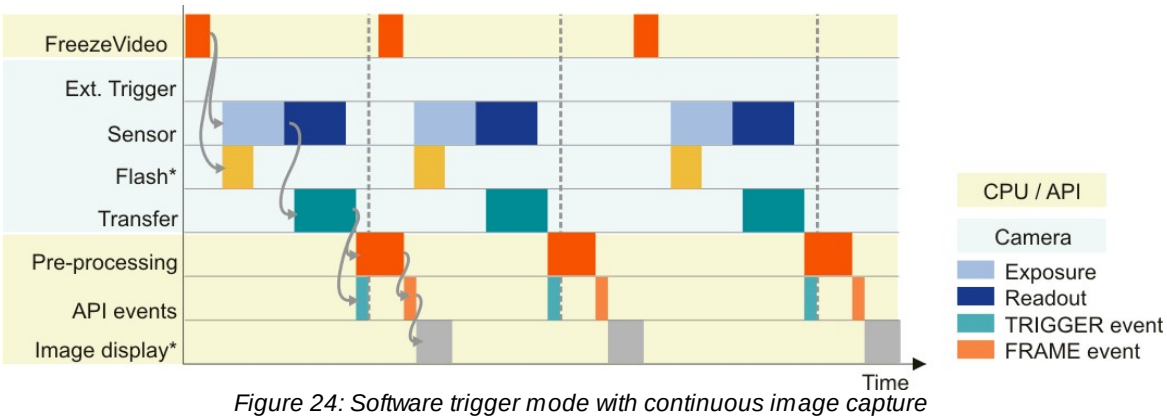


Figure 24: Software trigger mode with continuous image capture

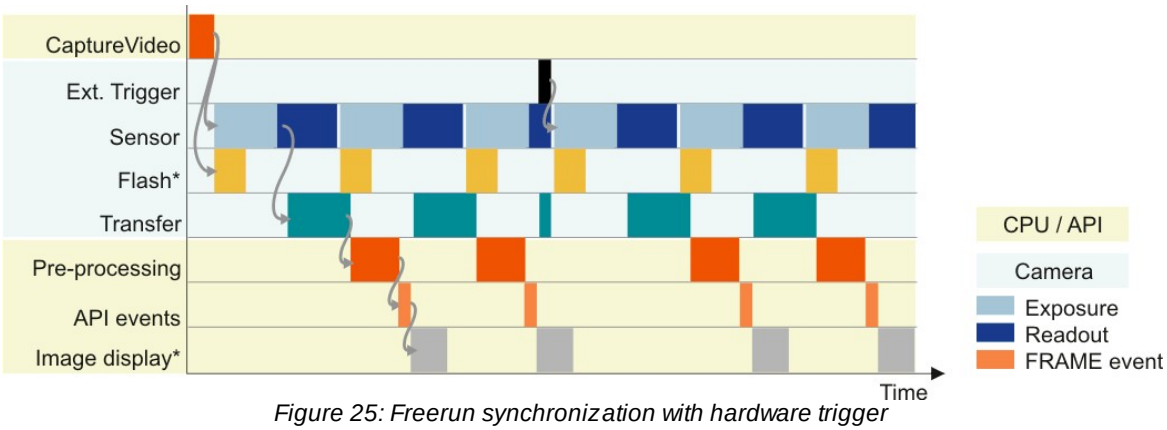


Figure 25: Freerun synchronization with hardware trigger

*) Optional function. The start time and duration of the flash signal are defined by the *Flash delay* and *Duration* parameters (see also Camera Settings: I/O).

6.1.3 Standby

uEye cameras can be set to a power-saving standby mode. Standby mode switches off the sensor of CMOS cameras and the timing board of CCD cameras. The camera remains open in the software. In standby mode, the camera cools down and the number of hot pixels visible when longer exposure times are used is reduced.

Standby is the default state when the camera is not open in the software. When you open the camera or switch to a different mode (*freerun* or *trigger* mode), the camera wakes up from standby mode.

In standby mode, you can continue to use the camera's digital inputs or outputs.

6.1.4 Applying New Parameters

New capture parameters (such as exposure time or gain settings) can be transferred to the camera via software at any time. Depending on the operating mode, these settings will not always be

immediately effective for next image, however.

- Freerun mode
  In freerun mode, the camera is internally busy with capturing the next image while new parameters are transmitted to the camera. Depending on the exact time of transmission, new parameters might only come into effect two or even three images later.
- Trigger mode
  In this mode, the camera reverts to idle state between two images. When you change the camera parameters, the new settings will be applied immediately to the next image (delayed by one additional image for the UI-122x-C/M or UI-522x-C/M cameras due to the sensor).

6.1.5 Image Display Modes

The *uEye* driver provides three different modes for the display of captured images: The device independent Bitmap mode (DIB), DirectDraw BackBuffer mode and DirectDraw Overlay mode.

- Device Independent Bitmap mode (DIB)
  In Bitmap mode, images captured by the *uEye* are written to the random access memory of the PC. The application software initiates the image display by the graphics card. This may result in a slightly higher CPU load as compared to the DirectDraw display.
  The advantage of Bitmap mode is that it is compatible with all graphics cards and that image data in the memory is directly accessible. Since Windows controls the image display, the image may be completely or partly overlapped by any other windows and dialog boxes.
- DirectDraw BackBuffer mode
  In this mode, the *uEye* driver writes the image data to the invisible memory area (back buffer) of the graphics card. This process runs automatically and does not have to be controlled by the application software. It requires an installed DirectDraw driver, sufficient memory on the graphics card and back buffer function support by the graphics card.
  For this purpose, graphics cards generally provide better performance than graphics chips integrated on the mainboard. In DirectDraw mode, the CPU load may be lower than in Bitmap mode.
- DirectDraw Overlay Surface mode
  This mode enables simultaneous display of a live image and overlay data. The video image is digitized and stored in an invisible memory area (back buffer) of the graphics card. Defining a key color and drawing that color to the image output window results in the video image being displayed in all areas of the output window that have this key color. If the key color fills the entire window, the video image is displayed full-screen. Accordingly, graphics/text data is preserved in all areas not filled with the key color. This produces a non-destructive overlay. The display is controlled by the graphics card chip and therefore hardly requires any CPU time. This mode is not supported by all graphics cards, and often, it can only be used in conjunction with the YUV color mode.

6.2 Sensor

6.2.1 Sensor Sizes

The size of a digital camera sensor is usually specified in inches. However, the specified value does not indicate the actual size of the active sensor area. The sensor size specifications date back to the formerly used tube systems: The curvature of the imaging surface of the camera tube caused distortions to the display, reducing the usable capture area of a 1” tube to a rectangle with a diagonal of 16 mm.

With the introduction of the semiconductor sensor technology, the dimensional specifications were taken over from tube systems. For this reason, a sensor whose active area diagonal measures 16 mm is specified as a 1-inch sensor. The following illustrations show the most common sensor sizes.

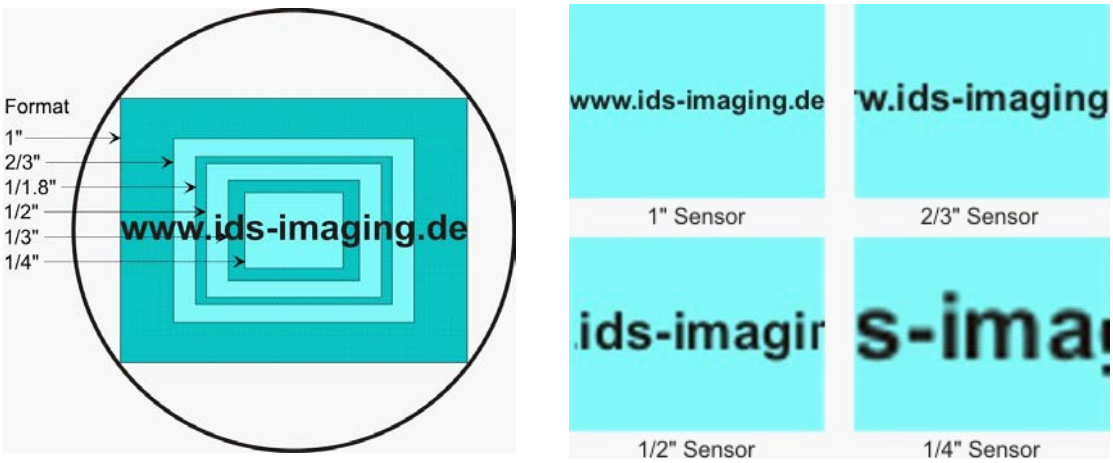


Figure 26: Comparison of different sensor sizes

The size of each single sensor cell (pixel) depends on the size of the active sensor area and the resolution. In general, less pixels over the same sensor area (or a larger sensor area with the same resolution) will result in greater photosensitivity of the sensor.

6.2.2 Fill Factors

The fill factor is the percentage of the pixel area that is exposed to light during exposure. Ideally this would be 100%. Since other elements are located on the sensor surface besides the light-sensitive photodiodes, this value may be reduced to approx. 30 - 50%, depending on the sensor technology. The use of micro lenses compensates for this and increases the fill factor to 90% or more. Micro lenses collect the light that falls onto a photocell, thus increasing the useable sensor area.

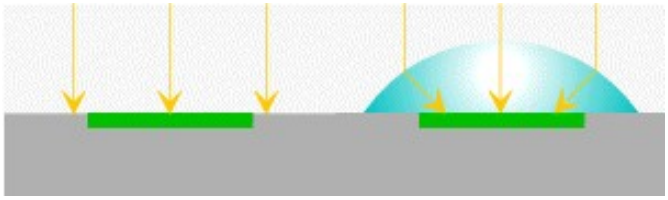


Figure 27: Using micro lenses to increase the effective fill factor

Some CMOS sensors have micro lenses offset to the sensor edge. They compensate for shadows created by obliquely incident light. The use of parallel light causes slight color variations. These may occur if telecentric stops or lenses with large apertures whose last optical element is located at a great distance are used. The following *uEye* models are equipped with CMOS sensors with offset micro lenses:

- 164x-C and 564x-C
- 155x-C and 555x-C
- 148x-M/C and 548x-M/C

6.2.3 Color Filter (Bayer Filter)

For technical reasons, digital image sensors can only detect brightness information, but no color information. To produce color sensors, a color filter is applied to each photocell (pixel). The arrangement of the color filters is illustrated in the following figure. Two out of every four pixels have a green filter, one pixel has a red filter and one has a blue filter. This color distribution corresponds to the color sensitivity of the human eye, and is called the Bayer filter pattern. With the help of the Bayer pattern the correct brightness and color information can be calculated for each pixel. Full sensor resolution is retained.

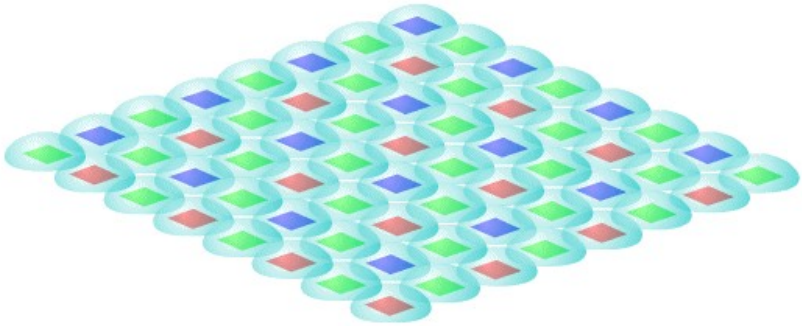


Figure 28: Bayer filter and micro lenses

Bayer conversion

A Bayer conversion, also referred to as de-Bayering, is carried out to determine the color information from the raw sensor data (raw Bayer). By default all *uEye* cameras transmit the image data to the PC in *raw Bayer* format. The PC then uses the functions of the *uEye API* to convert the image data to the color format you need for displaying or further processing the data.

GigE uEye cameras additionally allow de-Bayering in the camera. In this case, the color images are already finished when they are transmitted to the PC. This reduces the load on the computer's CPU and increases the transmission bandwidth required by the camera.

To convert the colors, a filter mask moves over the image and calculates a color value for each pixel from the surrounding pixels. The *uEye API* provides two filter masks that differ in image quality and CPU load:

- 3x3 filter:
  A filter mask of 3x3 pixels is used for conversion. This algorithm has a low load on the CPU. The filter's averaging function may cause a slight blur. Noise is reduced. This filter is recommended for image processing tasks.
- 5x5 filter:
  A filter mask of 5x5 pixels is used for conversion. This algorithm offers very accurate color positioning and an increased level of detail. The CPU load is higher than with the 3x3 filter. This filter is recommended for visualization applications.

6.2.4 Shutter Methods

The image is recorded in the sensor in four phases:

- Reset pixels of the rows to be exposed
- Exposure of pixel rows
- Charge transfer to sensor
- Data readout

The sensor cells must not be exposed during the readout process. The sensors of the *uEye* cameras have no mechanical shutters, but work with electronic shutter methods instead. Depending on the sensor type, either the rolling shutter method or the global shutter method is used.

Global Shutter

On a global shutter sensor, all pixel rows are reset and then exposed simultaneously. At the end of the exposure, all rows are simultaneously moved to a darkened area of the sensor. The pixels are then read out row by row.

Exposing all pixels simultaneously has the advantage that fast-moving objects can be captured without geometric distortions. Sensors that use the global shutter system are more complex in design than rolling shutter sensors.

All *uEye* CCD sensors as well as some CMOS sensors use the global shutter method.

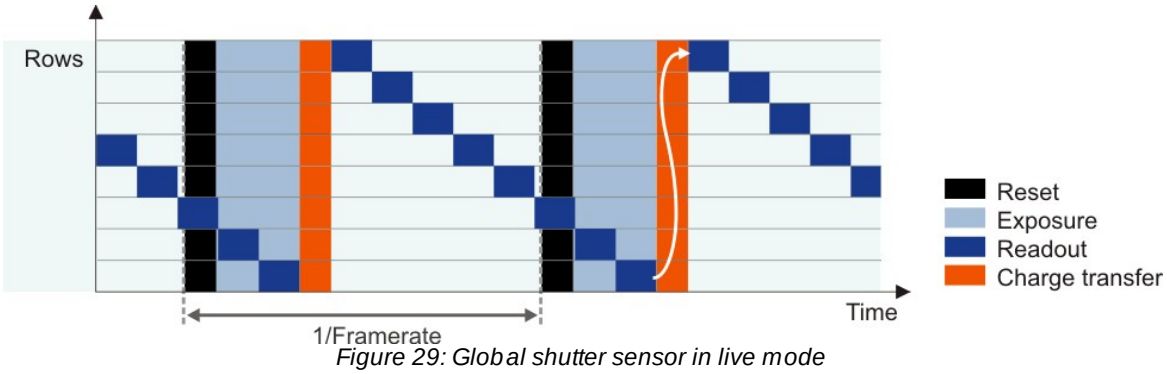


Figure 29: Global shutter sensor in live mode

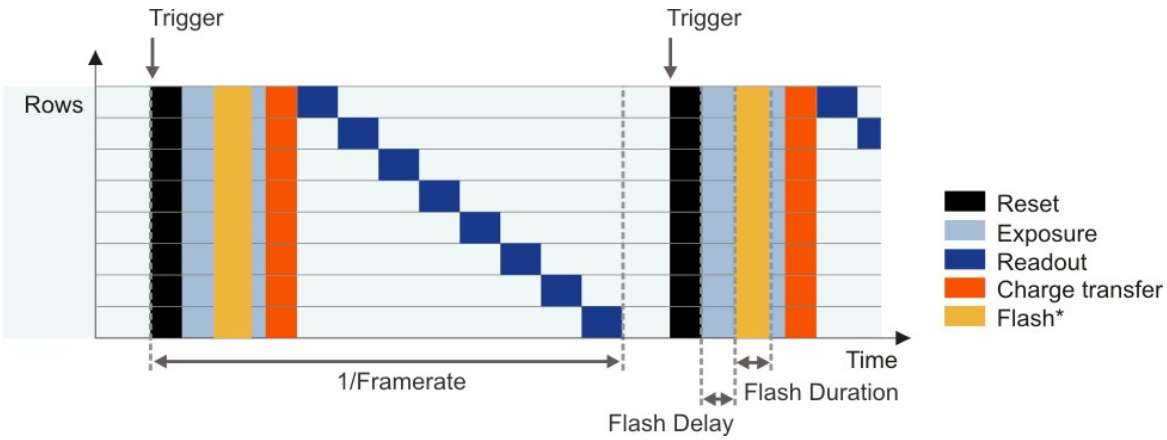


Figure 30: Global shutter sensor in trigger mode

*) Optional flash function. The start time and duration are defined by the *Flash delay* and *Duration* parameters (see also Camera Settings: I/O).

Rolling Shutter

With the rolling shutter method, the pixel rows are reset and exposed one row after another. At the end of the exposure, the lines are read out sequentially. As this results in a time delay between the exposure of the first and the last sensor rows, captured images of moving objects are distorted.

To counteract this effect, the *uEye* software provides a Global Flash window where you set the time by which flash activation is delayed. You can also specify the flash duration. This allows implementing a global flash functionality which exposes all rows of a rolling shutter sensor simultaneously.

Rolling shutter sensors offer a higher pixel density compared to global shutter CMOS sensors. The rolling shutter system is used in *uEye* cameras with high-resolution CMOS sensors.

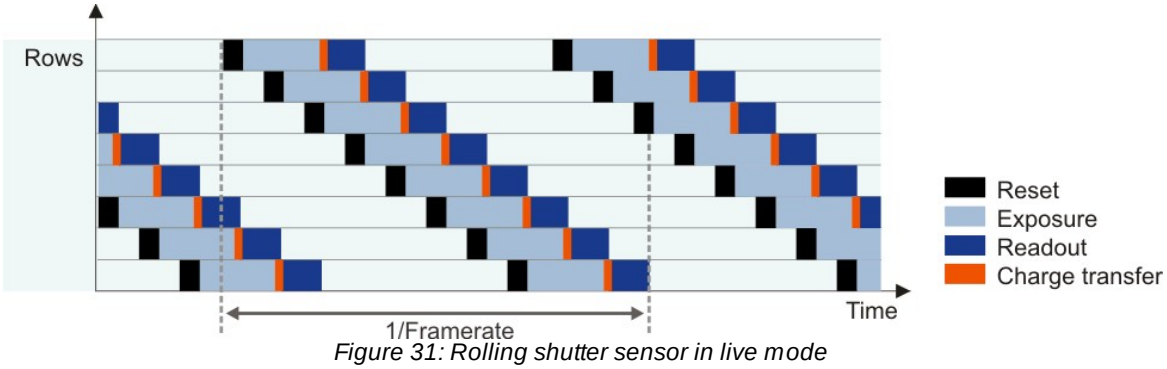


Figure 31: Rolling shutter sensor in live mode

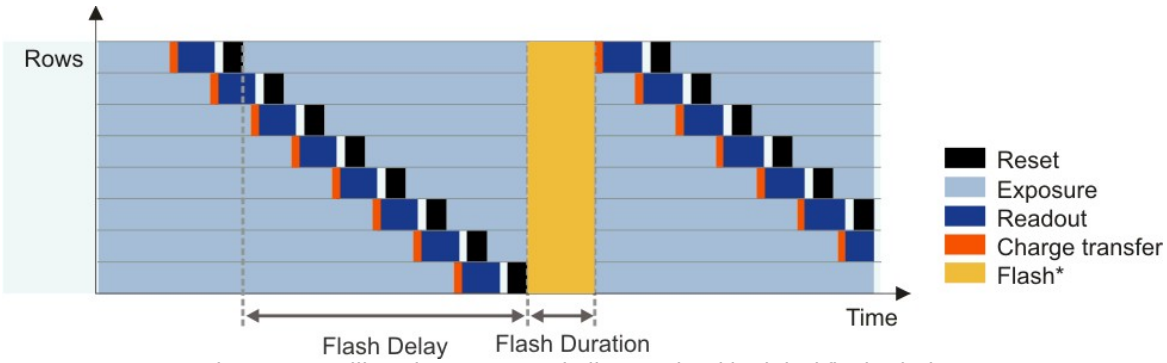


Figure 32: Rolling shutter sensor in live mode with global flash window

*) Optional flash function. The start time and duration are defined by the *Flash delay* and *Duration* parameters (see also Camera Settings: I/O).

Rolling Shutter with Global Start

Some rolling shutter sensors also provide a global start mode, which starts exposure of all rows simultaneously (see illustration). For best results, use a flash for this mode. No light is allowed to fall on the sensor outside the flash period because otherwise the image brightness will be distributed unevenly.

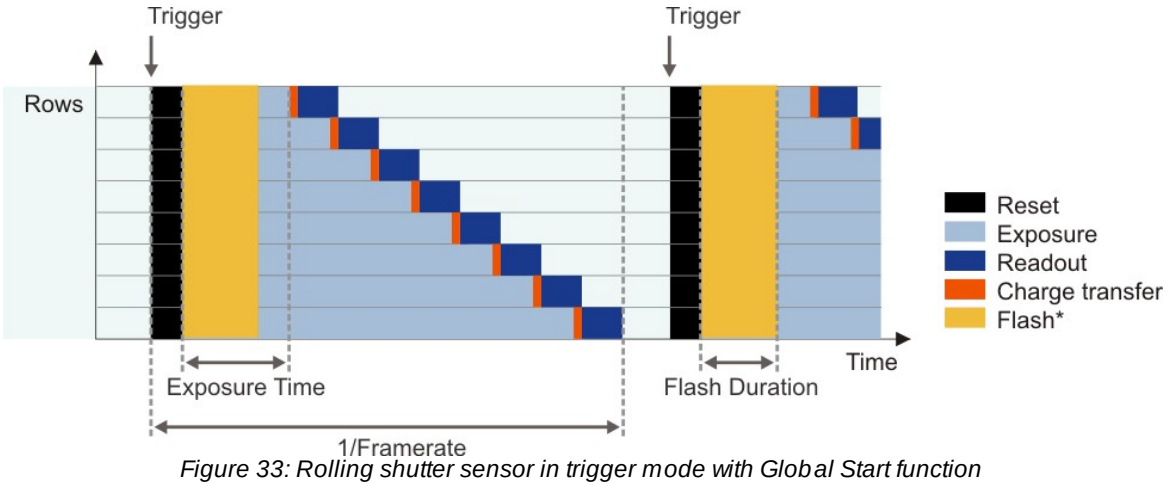


Figure 33: Rolling shutter sensor in trigger mode with Global Start function

*) Optional flash function. The start time and duration are defined by the *Flash delay* and *Duration* parameters (see also Camera Settings: I/O).

6.3 Camera Parameters

6.3.1 Pixel Clock, Frame Rate, Exposure Time

Pixel clock

The basic parameter for camera timing is the pixel clock. It determines the speed at which the sensor cells can be read out.

We recommend not setting the pixel clock any higher than necessary to achieve the desired frame rate.

An excessive pixel clock can cause transmission errors or delays. If the data is read from the sensor at a higher speed (high pixel clock), you will also need a faster transmission over the data connection. Thus, by controlling the pixel clock, you can also influence the bandwidth required for a camera.

The pixel clock influences the connected load and consequently the temperature inside the camera.

Frame rate

The possible range of settings for the frame rate depends on the currently selected pixel clock. You can select a lower frame rate without changing the pixel clock. To set a higher frame rate, however, you need to increase the pixel clock.

Exposure time

The exposure time depends on the currently selected frame rate and is preset to its reciprocal value. You can select a shorter exposure time without changing the frame rate. To set a longer exposure time, however, you need to reduce the frame rate.

6.3.2 Gain and Offset

Gain

In digital imaging, a voltage proportional to the amount of incident light is output by the sensor. To increase image brightness and contrast, this signal can be amplified by an analog gain and offset before the digitizing process. The results of analog signal processing are usually better than the results of digital post-processing.

Analog amplification of the read-out pixel values increases overall image brightness and contrast. Depending on the sensor type, a global gain value for all pixels *(master gain)* or a separate gain value for each color *(RGB gain)* can be set.

A signal gain will also result in a noise gain. High gain settings are therefore not recommended.
We suggest the following gain settings:

1. Enable the *Gain boost function.*
2. If required, adjust the gain setting with the master gain control.

Offset

Every digital image sensor has light-insensitive cells next to the active image area. These dark pixels are used to measure a reference voltage *(black level)* which is subtracted from the image signal. This compensates thermally generated voltages on the sensor which would otherwise falsify the

signals.
Normally, the sensor adjusts the black level automatically. If the environment is very bright or if exposure times are very long, it may be necessary to adjust the black level manually.

6.3.3 Automatic Image Control

The uEye driver provides various options to automatically adjust the image capture parameters to the lighting situation. These include:

- Auto Exposure Shutter (AES)
- Auto Gain Control (AGC)
- Auto White Balance (AWB)
- Auto Frame Rate (AFR)

The auto functions are used to adjust the average brightness and color rendering of the camera image to their setpoint values, while trying to keep the frame rate at the highest possible value.

Auto Exposure Shutter (AES)

The control of the average brightness is preferably achieved by adjusting the exposure, i.e. you set the highest possible exposure time before gain is controlled. Auto Exposure always uses the current exposure range which results from the selected pixel clock frequency and the frame rate. You can set separate control range limits for exposure and gain.

Auto Gain Control (AGC)

The auto gain feature controls the camera master gain in a range from 0-100%. You can set separate control range limits for exposure and gain.

Auto Frame Rate (AFR)

With the exposure control function enabled, you can still change the frame rate manually or automatically to maintain a dynamic exposure control range. A lower frame rate allows for longer exposure times, but then the live image display may exhibit jitter. The objective of the automatic frame rate control is to set the frame rate to an optimum value. This way, in all situations, the automatic exposure control can use the required control range at the highest possible frame rate.

Auto White Balance (AWB)

Depending on the lighting source, light can have different color temperatures so that the images may have a color cast. At low color temperatures (e.g. light from incandescent lamps), the white content is offset towards a red hue. At high color temperatures (e.g. light from fluorescent lamps), the white content is offset towards a blue hue.

The white balance control feature uses the RGB gain settings of the camera to correct the white level. This is achieved by adjusting the gain controls within the 0-100% range until the red or blue channel matches the average brightness of the green channel. In order to manually influence the color rendering, you can adjust the setpoint values for the red and blue channels relative to the green channel by using an offset value.

Automatically Disabling the Control Function

You can disable the control functionality automatically once the target value has been reached. Alternatively, you can keep the control feature enabled so that it responds to deviations from the target value.

Control Speed

You can set the auto function speeds in a 0-100% range. This influences the control response times. High speed (100%) causes a little attenuation of a fast-responding control and vice versa. The control functions for average brightness and for color rendering use separate speeds. In freerun mode, maximum every fifth image is evaluated for adjusting. In trigger mode, every image is evaluated.

6.4 Reading out Partial Images

The camera sensors have defined resolutions which are given as the number of pixels (width x height). However, for some applications it may be necessary to read out only a selected part of the sensor area or to reduce the local resolution. For this purpose, the *uEye* cameras provide various functions:

- Area of Interest (AOI)
- Binning (combining) pixels
- Subsampling (skipping) pixels

These functions reduce the amount of data to be transferred and thus allow you to increase the frame rate considerably, depending on the camera model.

6.4.1 Area of Interest (AOI)

Using this function, you can set the size and position of an area of interest (AOI) within an image. In this case, only data included in this AOI will be read out and transferred to the computer. The smaller partial image enables the camera to use a higher frame rate.

For the maximum frame rates that can be obtained with a specific camera model using AOI, please refer to the Specifications: Sensors chapter.

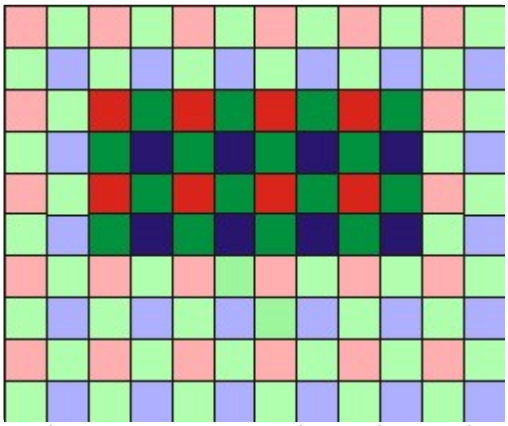


Figure 34: Camera AOI (Area of Interest)

Please note that, after defining an AOI, the resulting image may be darker if the camera cannot maintain the originally set exposure time due to the increased frame rate.

6.4.2 Binning

Binning is a function that averages or adds multiple sensor pixels to obtain a single value. This reduces the amount of data to be transferred and enables higher camera frame rates. The captured image has a lower resolution but still the same field of view compared to the full-resolution image. This mode can be used as a fast preview mode for high-resolution cameras.

Color binning, as performed by most color sensors, combines only pixels of the same color (see also the Color Filter (Bayer Filter) chapter). For some monochrome sensors, the camera also performs color binning, resulting in slight artifacts.
Most monochrome sensors and some color sensors combine neighboring Bayer pattern pixels; in this case, the color information gets lost (mono binning).

With CCD sensors, binning makes the images brighter because the pixel values are added up. With

CMOS sensors, pixel values are usually averaged; this reduces image noise.

Depending on the model, *uEye* cameras support different binning factors. Binning of horizontal and vertical pixels can be enabled independently.

The Specifications: Sensors chapter lists the binning methods and factors the individual camera models support.

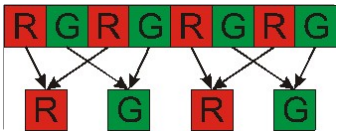


Figure 35: Color binning (2x)

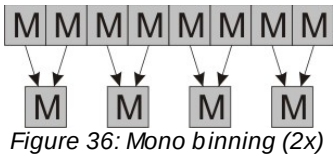


Figure 36: Mono binning (2x)

6.4.3 Subsampling

Subsampling is a technique that skips multiple sensor pixels when reading out image data. This reduces the amount of data to be transferred and enables higher camera frame rates. The captured image has a lower resolution but still the same field of view compared to the full-resolution image. This mode can be used as a fast preview mode for high-resolution cameras.

Color subsampling as performed by most color sensors skips pixels while maintaining colors (see illustration). For some monochrome sensors, the camera also performs color subsampling, resulting in slight artifacts.
Monochrome sensors and some color sensors ignore the Bayer pattern and the color information gets lost (mono subsampling).

Depending on the model, *uEye* cameras support different subsampling factors. Subsampling of horizontal and vertical pixels can be enabled independently.

The Specifications: Sensors chapter lists the subsampling methods and factors supported by each camera model.

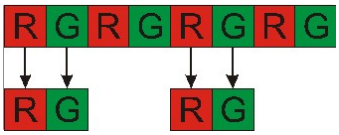


Figure 37: Color subsampling (2x)

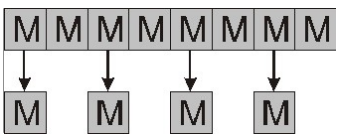


Figure 38: Mono subsampling (2x)

6.5 Digital Input/Output

Depending on the model, *uEye* cameras have one or more digital inputs and outputs designed for different purposes.

Camera model	Digital inputs	Digital outputs	General purpose I/Os (GPIOs), Other
USB uEye SE	1 (opto coupler)	1 (opto coupler)	-
USB uEye RE	1 (opto coupler)	1 (opto coupler)	-
USB uEye LE housing version	-	-	-
USB uEye LE board level version	1 (TTL)	1 (TTL)	2 (TTL)
GigE uEye SE	1 (opto coupler)	1 (opto coupler)	-
GigE uEye HE	1 (opto coupler)	1 (opto coupler)	2 (TTL) 1 RS-232

6.5.1 Digital Input (Trigger)

In trigger mode, image capture by the *uEye* cameras can be controlled through external events. For this purpose, a digital signal must be applied to the camera input.

You can determine whether the camera will respond to the rising or falling edge of the digital signal. After an internal delay, the sensor is exposed for the defined exposure time. The captured image is then transferred to the PC.

The delay is due to internal camera switching times and depends on the sensor type and the parameters that have been set. It is always below 100 µs. You can find the exact values for each camera in the Specifications: Sensors chapter.

You can optionally set an additional delay *(trigger delay).*

In case of a triggered image capture, the camera is only ready to process the next trigger signal after completion of the data transfer to the PC. Trigger events that occur during image exposure or data transfer are ignored. An internal counter records the number of ignored trigger events and can be read out from the PC.

You can query the status of the digital input using the software. This enables you to use the input for other purposes as well.

6.5.2 Digital Output (Flash Strobe)

The digital output can be set statically by software or depending on the exposure time.

In *uEye* models equipped with an opto-coupler output, it is possible to control a DC voltage which is applied to the output. This allows controlling a flash, either directly or via a separate flash controller unit depending on the sensor exposure. In exposure-dependent mode, you can set the *delay* and the *duration* of the flash. By selecting suitable delay and duration settings, you can minimize the rolling shutter effect (see also Shutter Methods).

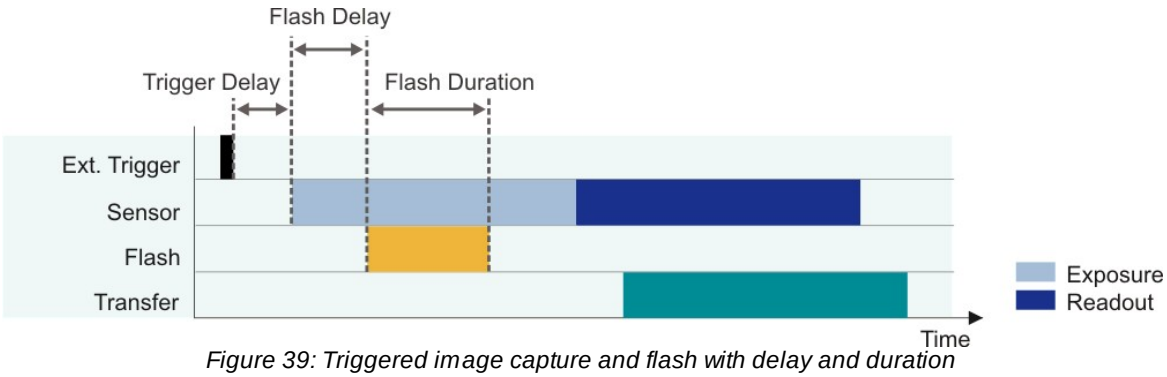


Figure 39: Triggered image capture and flash with delay and duration

The delay is due to internal camera switching times and depends on the sensor type and the parameters that have been set. It is always below 100 µs. You can find the exact values for each camera in the Specifications: Sensors chapter. You can set an additional delay and the duration of the flash signal in the software.

The settings specified for the digital output will be reset in the following situations:

- a *GigE uEye* camera loses its pairing (i.e. it is closed in the software)
- a *USB uEye* camera is disconnected from the PC or the PC is powered down

6.5.3 General Purpose I/O

Some uEye models have freely programmable General Purpose Inputs/Outputs (GPIO) which can be programmed as inputs or outputs using the *uEye SDK* (see also GPIO Specifications).

The GPIO settings will be reset when the camera is closed in the software.

6.5.4 Serial Interface (RS232) of the GigE uEye HE

Cameras of the *GigE uEye HE* series are equipped with a serial interface (RS232). It provides functionality for communication with peripheral devices (e.g. lighting controller, lens controller) or the serial port of a PC. Before you can send data through the camera's serial interface, one or more virtual COM ports have to be defined on the PC. Once defined, they can be used for data communication with appropriate software just like any physical COM port.

To set up and use the serial interface, the *Additional functions dialog box is provided* in the *uEye Camera Manager*. For the serial interface specifications, please refer to the Serial Interface (RS232) chapter.

7 Installation

7.1 Downloading the Software

The latest camera drivers are available for download at www.ueyesetup.com.

Figure 40: uEye Setup - Language selection

Choose your language on the setup start page and follow the download links.

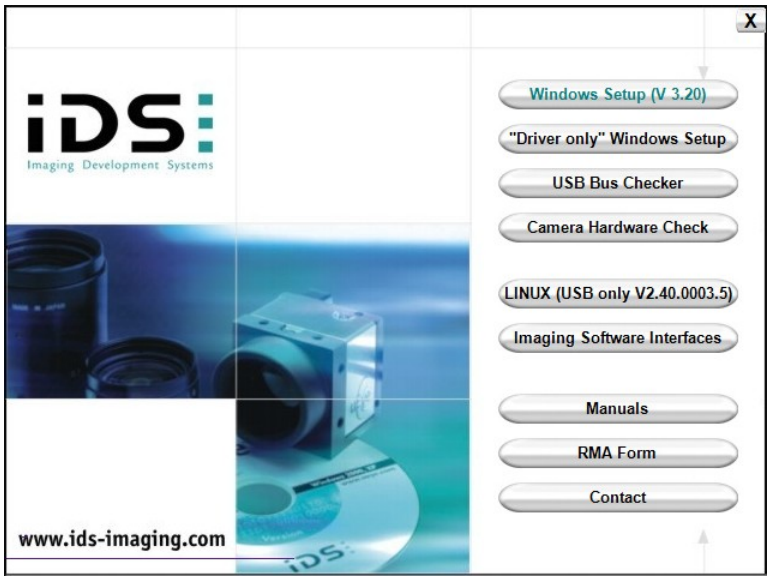


Figure 41: uEye setup menu

The following options are available:

- *Windows Setup (V 3.30)*
  This download contains the complete setup with drivers for all cameras, the *uEye Software Development Kit (SDK)* and the manuals.
- *"Driver only" Windows Setup*

This download contains only the drivers for USB and Gigabit Ethernet cameras. The SDK and manuals are not included.

- *USB Bus Checker*
  The USB bus checker provides information on the USB interfaces available on your system (Windows only).
- *Camera Hardware Check*
  The USB hardware check displays information on whether a connected camera is compatible with the new driver versions (Windows only). To use this feature, a uEye driver has to be installed on your system.

To operate a camera with USB board revision 2.0 or earlier, you will need the uEye driver version 2.40. You can download this driver version from our website at http://www.ids-imaging.com.

For further information, see also USB uEye SE Driver Compatibility.

- *LINUX (USB uEye)*
  This download contains the drivers for the USB uEye cameras for Linux (kernel version 2.6)
- *Imaging Software Interfaces*
  Click this link to download individual software interfaces for using the uEye in conjunction with image processing libraries, such as MVTec HALCON. Please note that all these files are also included in the *Windows Setup (V 3.30)* download (see above).
- *Manuals*
  Click this link to access the camera manuals, the *uEye Programming Manual* and other manuals for components and tools online as PDF files.
- *RMA Form*
  This link displays a form for returning goods to IDS.
- *Support*
  Click this link to display IDS support information and additional contact data.

7.2 Installing the uEye Drivers

You need administrator privileges to install the software.

The files are downloaded in ZIP format. They have to be extracted after the download before you can start installing. Double-click the executable *(uEye_3320.exe)* to start the installation. The *uEye* driver installation is menu-driven. Please follow the instructions of the setup program.

The setup will prompt you to select a setup type. Please choose one of the following options:

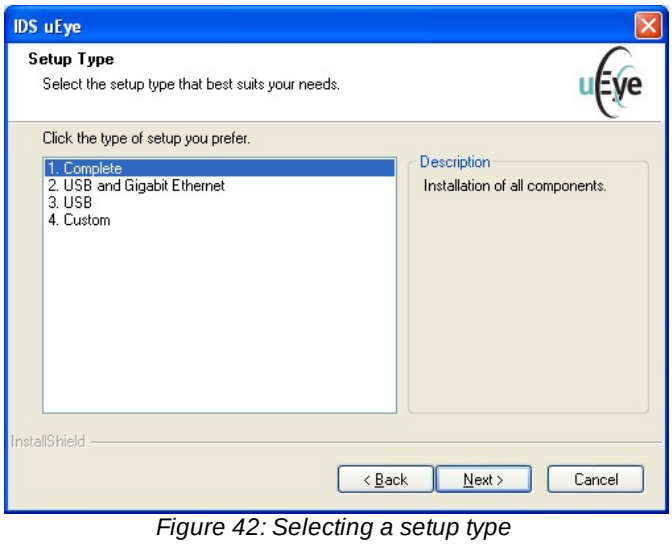


Figure 42: Selecting a setup type

1. *Complete*
   Installs all components (recommended).
2. *USB and Gigabit Ethernet*
   Installs all USB and GigE components except source code and third-party drivers (e.g. DirectShow or imaging libraries)
3. *USB*
   Installs all USB components except source code and third-party drivers
4. *Custom*
   When you choose custom installation, you have to individually select the components you want to install. Custom installation is recommended only for advanced users.
   If you need to make changes to an existing installation, you can do this with the custom installation.

Once the software has been installed, the *GigE uEye* network service is automatically bound to all local network adapters.

We recommend disabling the network service for all network adapters that will not be used with the *GigE uEye* cameras. To disable the network service, open the ETH network service dialog box in the *uEye Camera Manager*.

7.3 Uninstalling the uEye Drivers

To uninstall the *uEye* drivers, you also use the menu-driven *uEye* setup program.

Uninstalling the GigE uEye network service

The *GigE uEye* network service is uninstalled automatically when you uninstall the uEye driver.

After uninstalling the *GigE uEye* driver, you will have to restart your computer.
You can only reinstall the driver after restarting the computer.

7.4 Connecting a USB uEye Camera

Please install the software first as described in the Installing the uEye Drivers section.

Connect the *USBuEye* to the PC, using the USB 2.0 cable. The Windows *Plug and Play Manager* recognizes the new hardware.

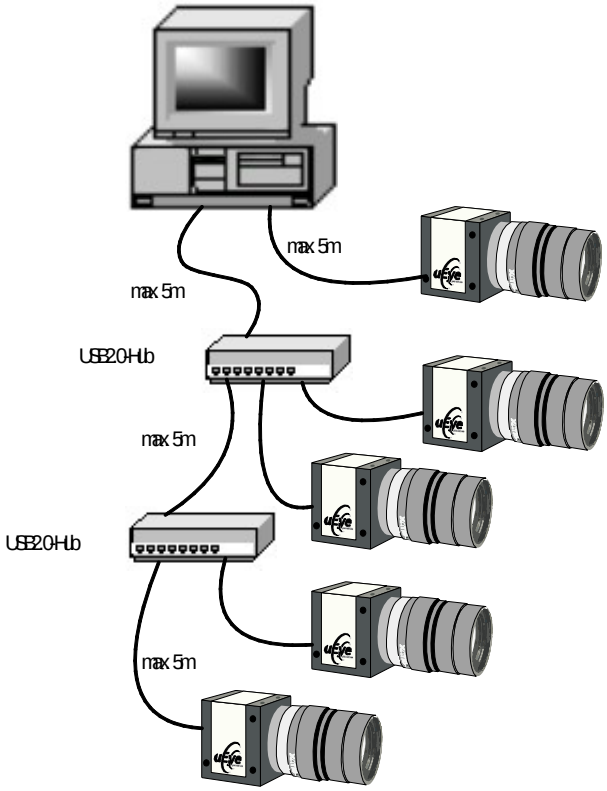


Figure 43: Connecting the uEye cameras to a PC

The *uEye* cameras can be connected to a USB port either directly or via hubs and repeaters. A wide range of different hubs and repeaters are available at computer stores or from IDS. The USB 2.0 hubs being used must be *full powered* hubs that are able to provide 500 mA per USB port. *Low Powered* hubs, in comparison, only supply 100 mA per port, which is not sufficient for uEye cameras.

To use maximum bandwidth, we recommend connecting the cameras directly to the USB 2.0 ports on the mainboard. Many USB 2.0 ports on PCI/PCIe cards and the USB 2.0 ports on the front of the PC mostly supply lower bandwidths.

When the camera has been correctly installed, the LED on the back of the camera lights up green. The camera is added to the camera list in the *uEye Camera Manager.*

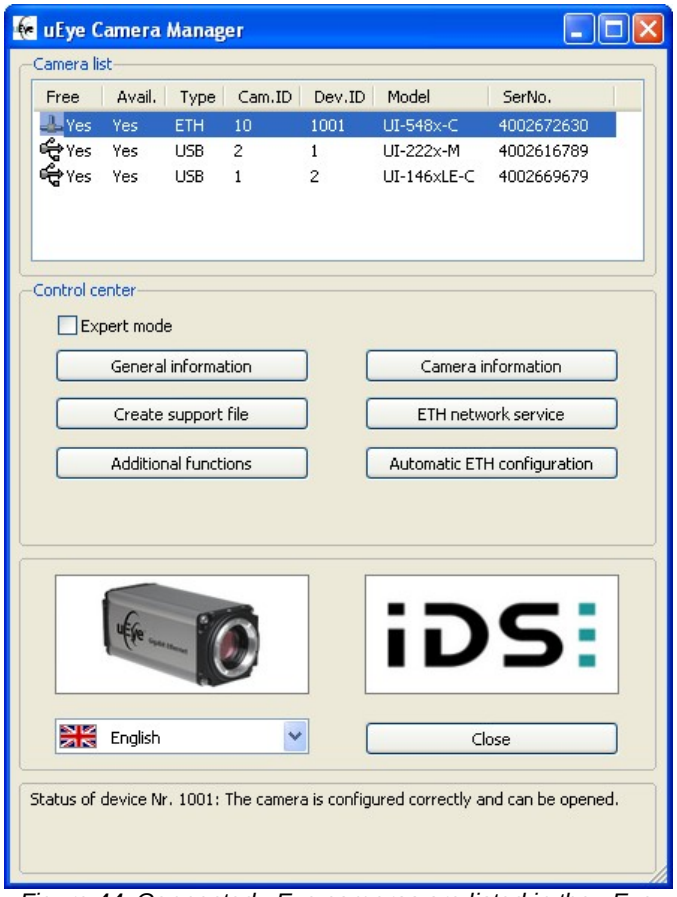


Figure 44: Connected uEye cameras are listed in the uEye Camera Manage

If the camera is not listed in the *uEye Camera Manager*, open the Windows Device Manager to check whether the camera has been correctly recognized. If recognition was successful, you will find an entry in the format “uEye UI-xxxx-xx Series” under “Universal Serial Bus Controllers.” A question mark or exclamation mark before the entry indicates that camera was not correctly recognized. Disconnect and reconnect the camera. The camera should now be correctly recognized.

7.5 Connecting a GigE uEye Camera

Please install the software first as described in the Installing the uEye Drivers section.

Check the power supply to the camera. Suitable AC adapters are available as accessories (see also GigE uEye HE Accessories and GigE uEye SE Accessories). Connect the camera to the PC either directly or using switches.

Connecting the camera directly to the PC

Using a suitable network cable (e.g. Cat 5e), connect the uEye camera directly to a Gigabit Ethernet port on your PC. With this connection type, you need a network card for each camera.

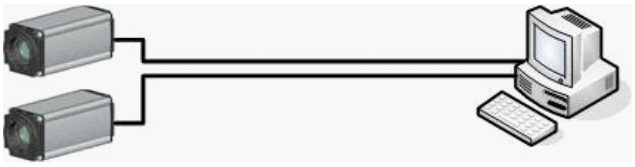


Figure 45: Connecting two cameras directly to a PC

Connecting the camera to a PC via switches

The use of switches allows you to extend the line length, as each switch adds a segment. The maximum cable length for each segment is 100 m.

Using the *GigE uEye* camera through a router is not supported.

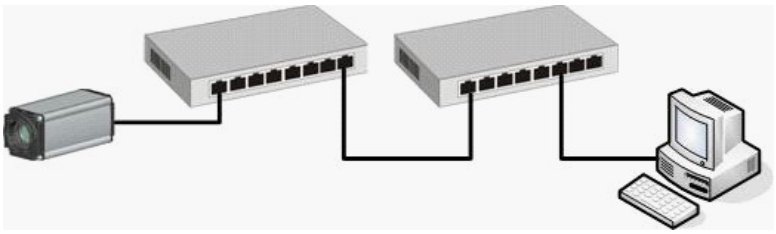


Figure 46: Connecting a camera to a PC, using switches to extend the line length

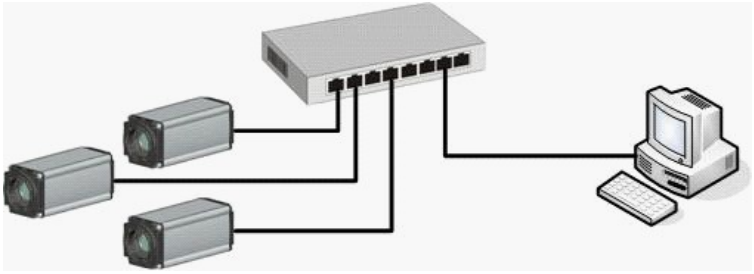


Figure 47: Operating multiple cameras via switch

Connecting multiple cameras to multiple PCs using switches

As soon as one of the cameras is used by a PC, it is visible to other PCs, but no longer available. It can only be used by a different PC when the existing connection to the first PC has been closed.

If the two PCs are on different subnets, each PC can only work with the cameras that have been

configured for the relevant subnet.

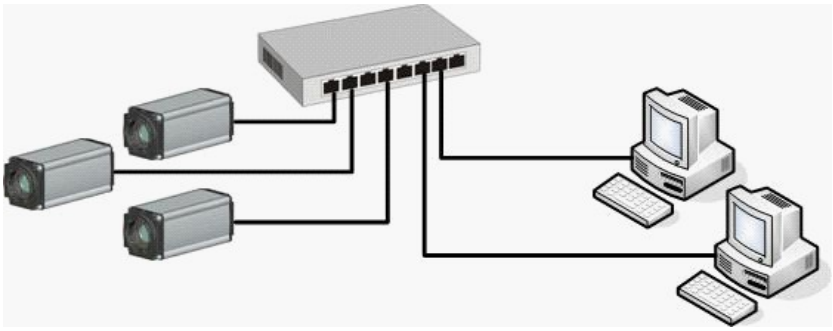
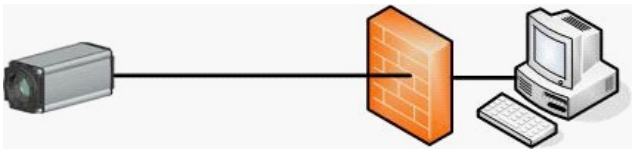
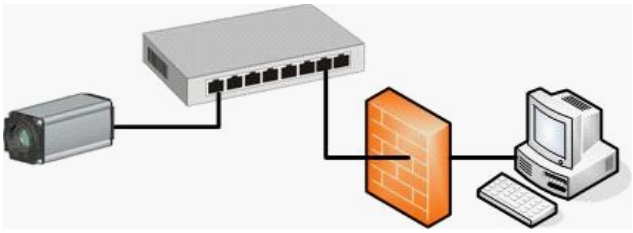


Figure 48: Multiple cameras and PCs networked using a switch

Connecting the camera to a PC behind a firewall





The use of external firewalls between the camera and the host PC is not recommended on image data networks. If you nonetheless want to use a firewall, please ensure that ports 50000, 50001, 50002 and 50003 are open for the UDP protocol.

The built-in Windows Firewall or personal firewalls installed as software in the host PC usually do not cause any problems.

7.5.1 Notes on connecting Gigabit Ethernet cameras

Please read the following notes before setting up *GigE uEye* cameras:

Network interface card

- To ensure optimum performance of the network connection, you need to install the latest drivers for your network card.

Cabling

- The cable length of the individual segments must not exceed 100 m.
- The network must be cabled throughout at either 100 Mbps or 1000 Mbps. The use of 1000 Mbps networks is recommended.
- The data network and the camera network should be cabled separately. We therefore recommend connecting the *GigE uEye* cameras by a separate network card.
- Gigabit Ethernet network adapters for PCI slots do not achieve the maximum transfer rate of 114 MB/sec. In real life conditions, the transfer rate on a PCI bus is approx. 80-90 MB/sec.

IP configuration und DHCP

- Before you can use the *GigE uEye* camera on the network, you need to assign an IP address to the camera. The IP address is assigned in the *uEye Camera Manager* (see also uEye Camera Manager).
- The cameras and the computer must be on the same subnet.
- The network card on the host PC responsible for data transfer to and from the *GigE uEye* cameras requires a persistent (fixed) IP address. It cannot obtain an IP address from a DHCP server.
- If a DHCP server is running on the network, you need to ensure when configuring the network card that the manually assigned address range of the *uEye* driver is outside the DHCP range.

Advanced settings

- For operating *GigE uEye* cameras, we recommend setting the value for the receive descriptors of the network connection to the maximum value. Please note that not all network cards provide this option.
  To set the receive descriptors, select *Start* → *Settings* → *Network Connections*. Right-click on the network connection and choose *Properties*. Switch to the *Advanced* tab in the dialog box and click the *Configure...* button. You can now set the receive descriptors *(Rx/Tx)*.
- The UDP protocol is required for communication between the *GigE uEye* cameras and the computer. Ports 50000 ... 50003 must be open.

7.5.2 Serial Interface (RS232) of the GigE uEye HE

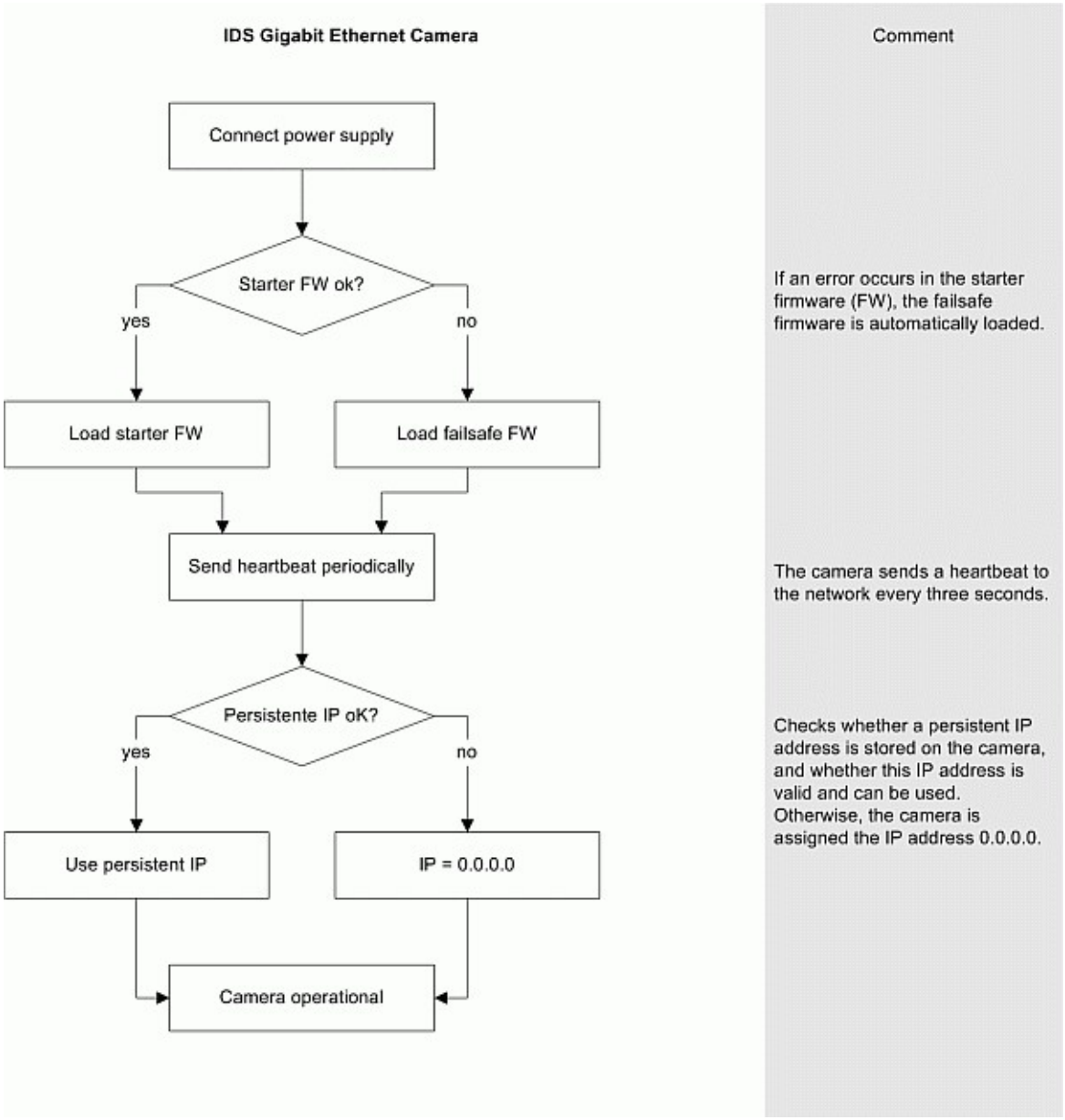
Cameras of the *GigE uEye HE* series are equipped with a serial interface (RS232). It provides functionality for communication with peripheral devices (e.g. lighting controller, lens controller) or the serial port of a PC. Before you can send data through the camera's serial interface, one or more virtual COM ports have to be defined on the PC. Once defined, they can be used for data communication with appropriate software just like any physical COM port.

To set up and use the serial interface, the *Additional functions dialog box is provided* in the *uEye Camera Manager*. For the serial interface specifications, please refer to the Serial Interface (RS232) chapter.

7.5.3 Camera Start-up

When the *GigE uEye* camera has been connected to the power supply and the network, it loads the starter firmware stored in the camera's EEPROM. The starter firmware enables the camera to register on the network and establish a connection to a host PC. As soon as the starter firmware is loaded, the camera sends a heartbeat broadcast to the network once every second.

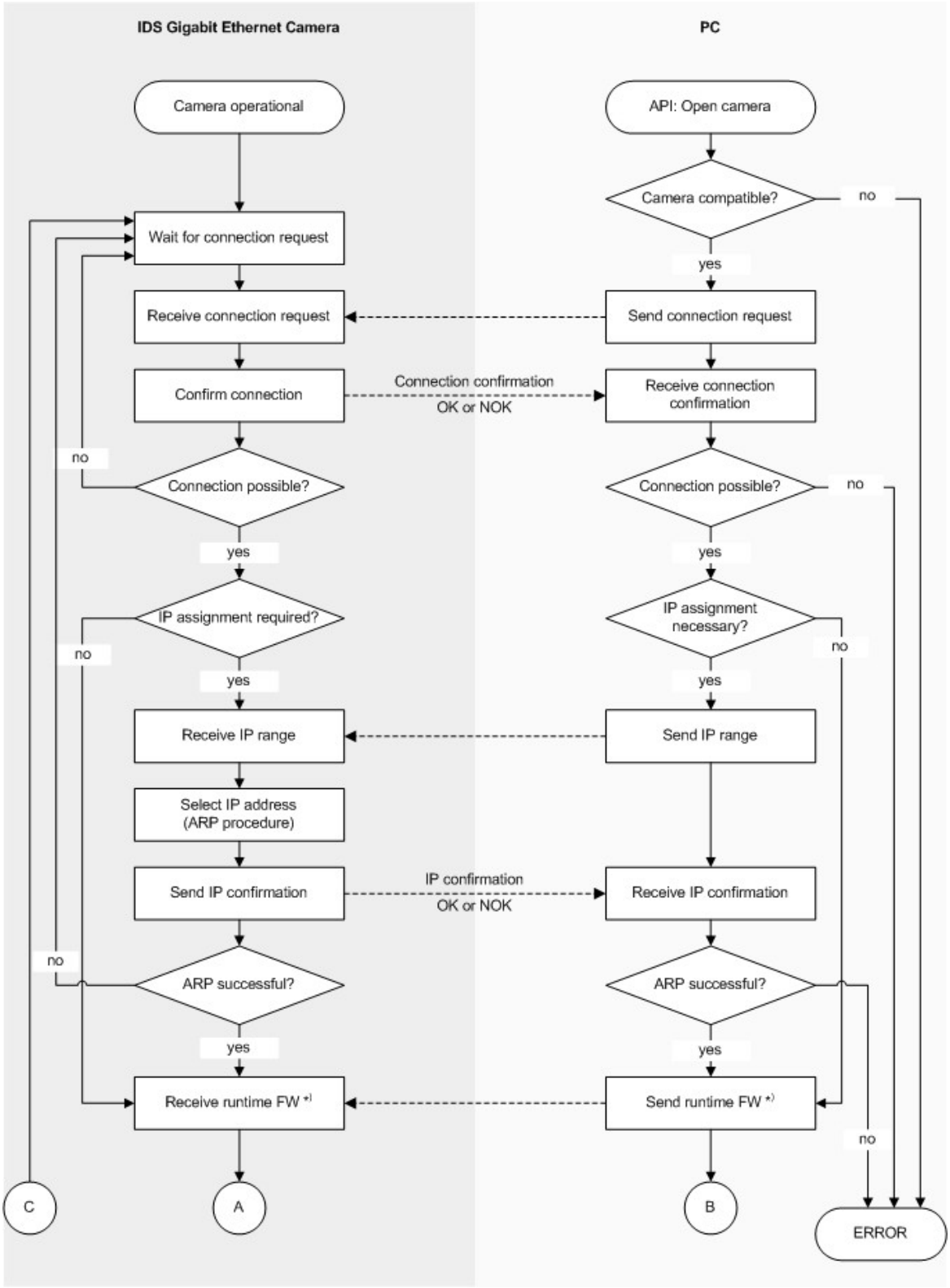
In the next step, the camera checks whether a persistent IP address is stored. If it is, the camera uses the persistent IP address. Otherwise the camera is assigned the IP address 0.0.0.0.



7.5.4 Camera Initialization

As soon as a computer wants to use a camera, it sends a connection request to that camera. When the camera has signaled that it is available, the system first checks whether the camera has a valid IP address. If it does not, the computer sends a range of valid IP addresses to the camera. The camera picks a free IP address, i.e. one that is not yet in use on the network, from these IP

addresses and notifies the computer that the IP address has been assigned. Then the host PC transfers the runtime firmware to the camera and the camera is restarted. Transferring the runtime firmware and restarting the camera may take up to five seconds.



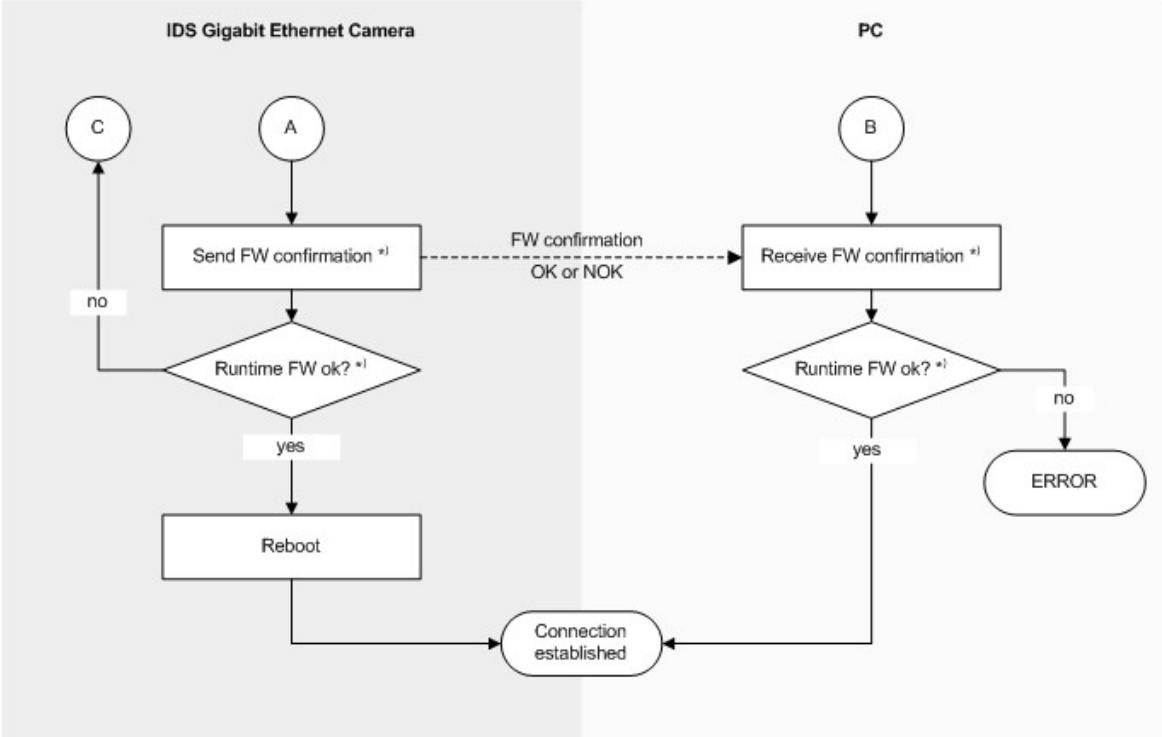


Figure 49: Flowchart of establishing a connection to the GigE uEye HE

*) Only *GigE uEye HE*

7.5.5 Camera Recognition

As soon as the camera is connected to a host PC, it cannot connect to any other computer on the network. When a connection has been successfully established, the host PC also transmits a heartbeat, which is received and evaluated by the camera. If the heartbeat of the host PC cuts out, the camera is restarted and the starter firmware loaded. This allows the camera to connect to another computer on the network.
If the heartbeat of the camera cuts out, the host PC closes the connection and removes the camera from its camera list. Once this has taken place, the camera is no longer displayed in the Camera Manager. This process may take up to three heartbeat periods (see above).

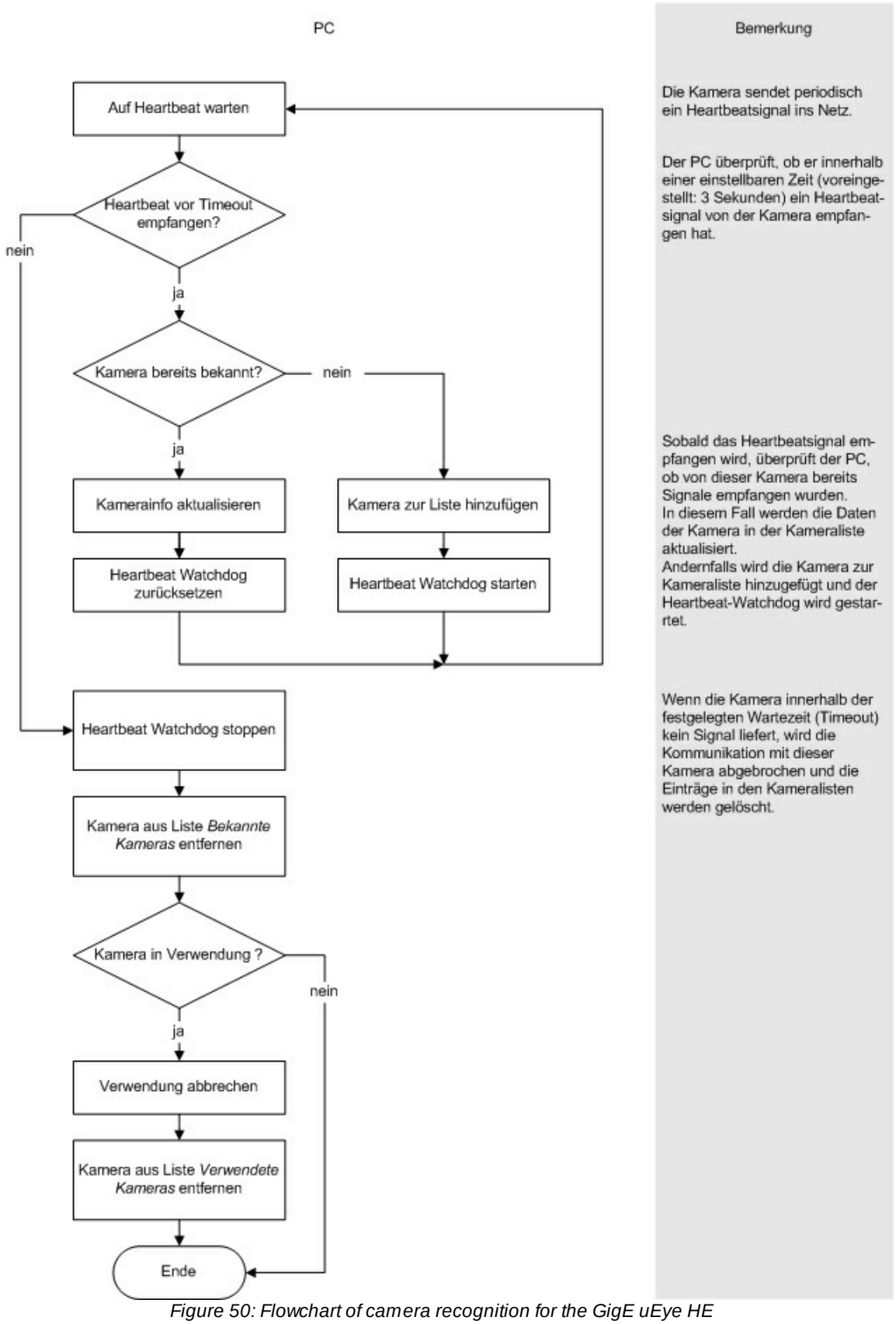


Figure 50: Flowchart of camera recognition for the GigE uEye HE

8 Applications

8.1 uEye Camera Manager

The *uEye Camera Manager* is the central tool for managing all *uEye* cameras. It displays information on the connected *uEye USB* and *GigE uEye* cameras and provides options for configuring them.

The *uEye Camera Manager* is currently only available for Windows operating systems. You can configure the cameras in Linux by using the *uEye SDK*.

The *uEye Camera Manager* can be accessed as follows:

- *Start → All Programs → IDS → uEye → uEye Camera Manager*
- Program icon on the desktop or Quick Launch toolbar
- *Start → Control Panel → uEye Camera Manager*

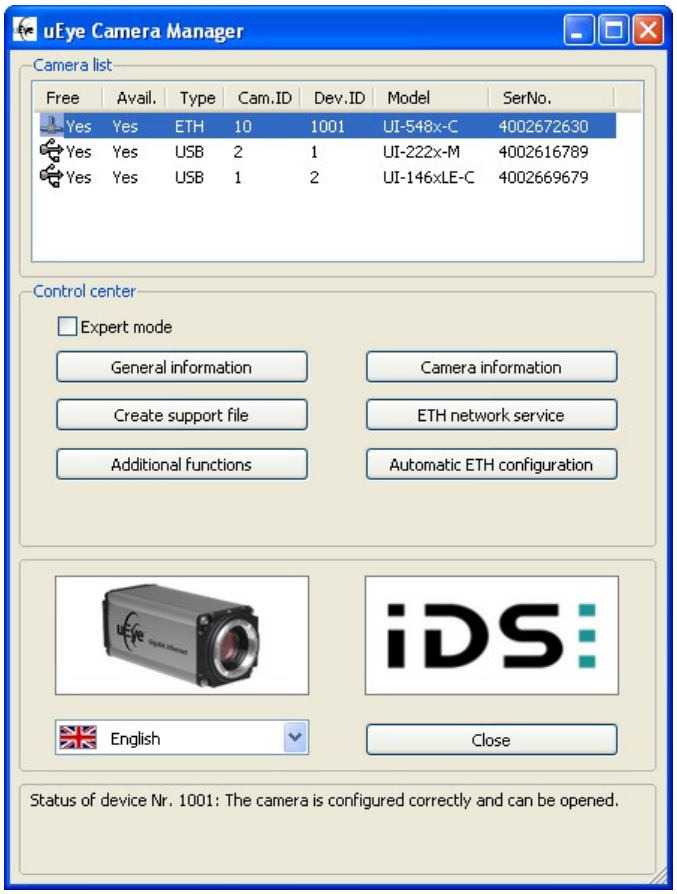


Figure 51: uEye Camera Manager (basic view)

- *Camera list*
  The camera list displays information on the connected *uEye* cameras.
- *Control center*
  In the control center, you can access the configuration and display detailed information on the connected *uEye* cameras.
- In the English drop down box, you can choose the language for the *uEye* Camera Manager. This setting is saved and remains effective even after you close and reopen the program. For proper display of Asian languages, the Windows support for East Asian languages has to be

installed on your system (in *Control Panel → Regional and Language Options*).

- Click Close to close the application; any settings you have made are saved.
- The status box at the bottom of the *Camera Manager window indicates the current status of the selected camera. If it is available, the status message is shown in black. Otherwise, the status message is shown in red.*
  If an error has occurred in a camera, a black exclamation mark on a yellow background is shown next the camera. The status box then indicates the cause of the error and suggests remedies.

8.1.1 Camera List

When a camera is activated (switched on or connected to the PC), it appears in the *camera list* of the *uEye Camera Manager* after a few seconds. A Gigabit Ethernet camera requires a little more time to start up and be detected by the network than a USB camera.
After deactivating a *GigE uEye* camera (switching it off or disconnecting it from the network) it takes approximately three seconds before the camera is removed from the camera list. During this time the computer waits to see whether it receives another heartbeat signal from the camera.

Figure 52: uEye Camera Manager - Camera list

The data shown in the camera list can be sorted in ascending or descending order by left-clicking on the respective column header.

- *Free/Avail.*
  Free indicates whether a camera is currently in use.
  Avail. (Available) indicates whether a camera can be opened by this computer with the current setup (computer and camera).
  Cameras shown with a red x are currently in use *(Free = No)* and are not available *(Avail. = No)*.
  Cameras shown with an exclamation mark are not in use, but are currently unavailable for various reasons, such as:
  - The camera is not compatible with the driver. Please update the *uEye* driver.
  - The IP configuration of the network card is not configured for use of the *GigE uEye* camera. Please enter a valid configuration in the Manual ETH Configuration.
  - DHCP (automatic assignment of an IP address) is activated in the IP configuration of the network card. Please enter a valid configuration in the Manual ETH Configuration.
  - The driver has not properly detected (initialized) the camera. Please disconnect the camera from the PC and then reconnect it.
  - The camera is currently being removed from the Manager.
  - The camera reports that it is *Not operational*.
- *Type*
  This column indicates whether the camera is a Gigabit Ethernet *(ETH)* or a USB camera *(USB)*.
- *Cam.ID*
  The camera ID assigned by the user.
- *Dev.ID*
  Unique device identifier sequentially assigned by the system. Different device IDs are assigned for USB and Gigabit Ethernet cameras. USB cameras are assigned device IDs from 1 upwards, Gigabit Ethernet cameras from 1001. After deactivating a *uEye* camera (switching it off or disconnecting it from the network), the device ID is no longer valid and can be assigned again by the system.
- *Model*
  Model name of the camera
- *SerNo.*
  Serial number of the camera.

8.1.2 Control Center

- *Expert mode*

  When you select the Expert mode check box, the *uEye Camera Manager* additionally displays the Parameters box on the right. There you will find detailed information on the *uEye* camera selected in the camera list. The Manual ETH configuration and Upload starter firmware buttons are only available in Expert mode and are hidden otherwise

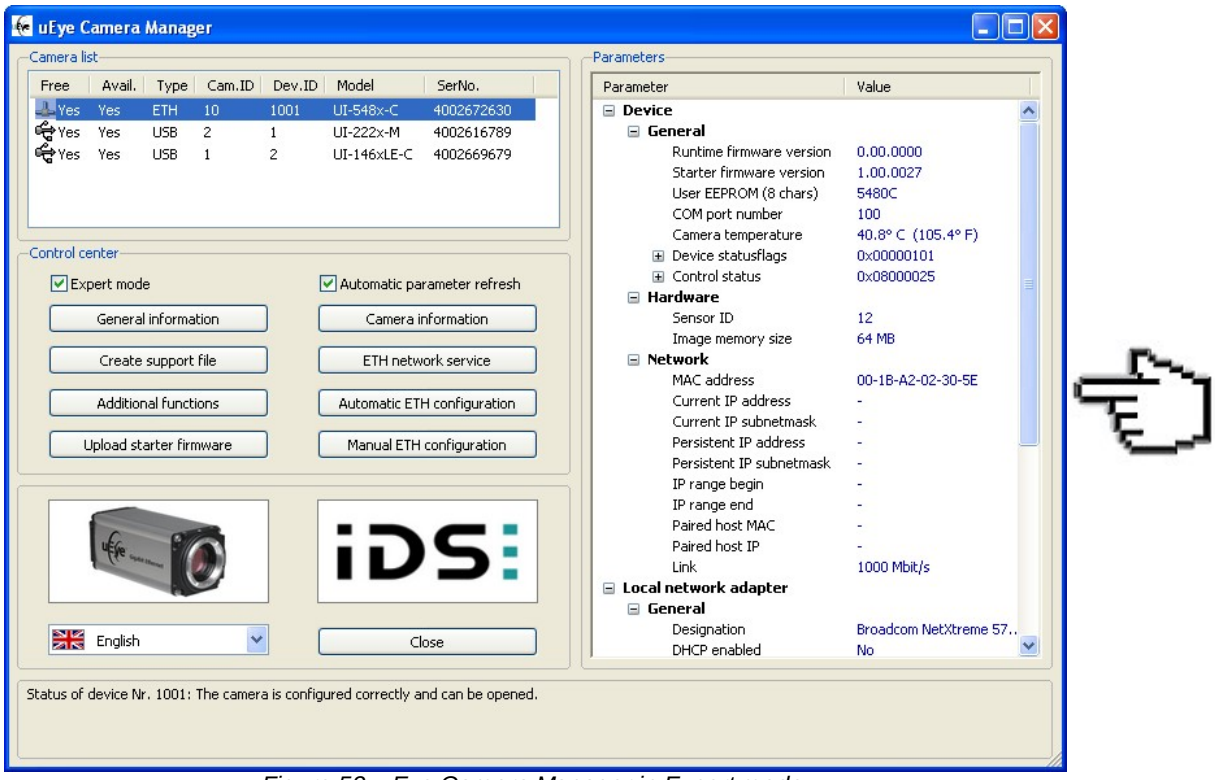


Figure 53: uEye Camera Manager in Expert mode

- *Automatic parameter refresh*

  If you select the Automatic parameter refresh check box, the data shown in the tree structure is updated periodically. If the option is disabled, the data in the tree structure is only updated when a different camera is selected.

All other *Control Center* buttons are described in detail in the following sections.

8.1.3 General Information

This dialog box provides information on the installed *uEye* drivers and the available USB controllers and network adapters.

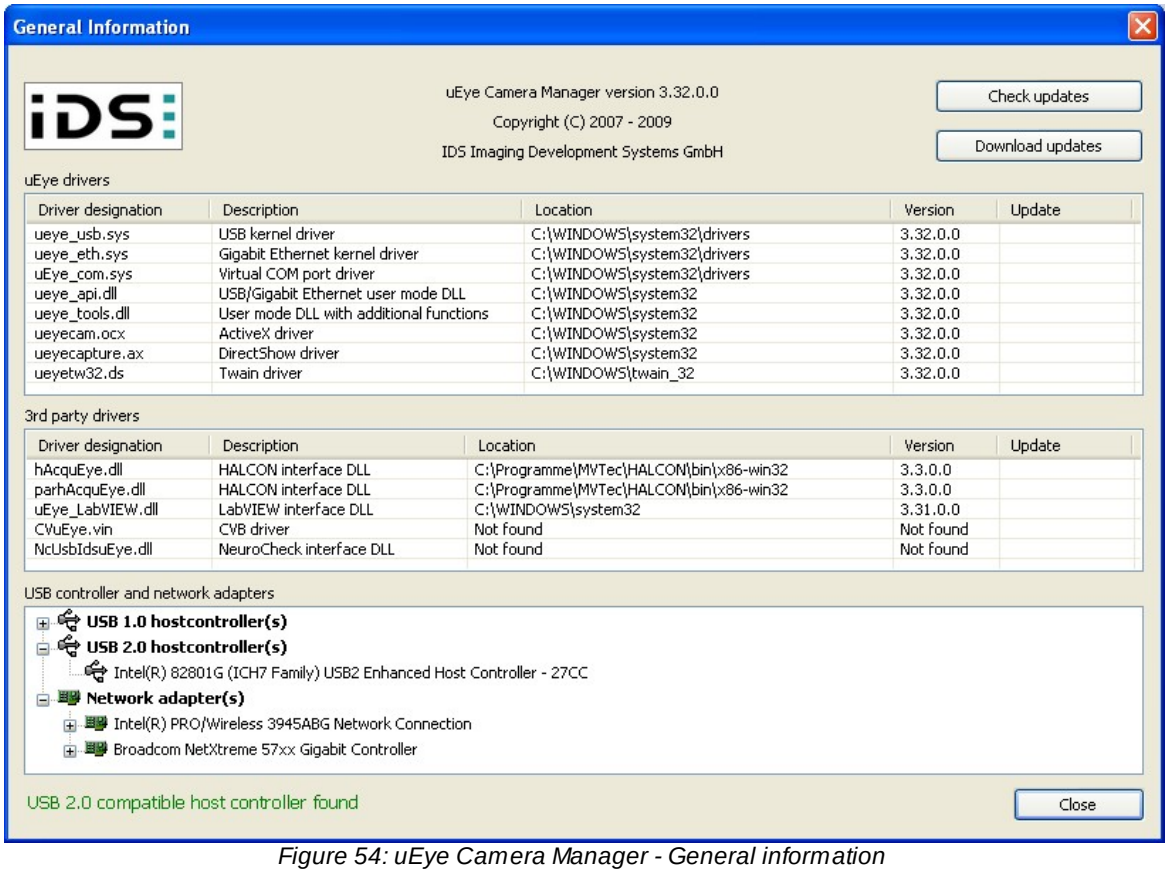


Figure 54: uEye Camera Manager - General information

- 

  Click this button to check whether new drivers are available on the IDS website. You need a connection to the Internet to use this function. After the version check, the individual files are highlighted by different background colors in the *uEye drivers* and *3rd party drivers* lists:

  Red: A new driver version is available. It is recommended that you update the software.

  Green: The installed version is up-to-date.

  Yellow: The installed version is more recent than the version on the website.

  Gray: A file available on the website has not been installed.

- 

  Click this button to go to the http://www.ueyesetup.com website and download the *uEye* software and drivers.
- *uEye drivers*
  This list shows the location and version of the *uEye* driver files installed on your system.
- *3rd party drivers*
  This list shows the location and version of the *uEye* interface files that have been installed on your system for third-party software.
- *USB controller and network adapters*
  All USB controllers and network adapters that are available in your system are shown in a tree structure.

8.1.4 Camera Information

In the *Camera information* dialog box, you can assign a unique *ID* to the selected camera and write to the user area of the EEPROM. The data you enter is retained in the camera memory even when the camera is disconnected from the PC or power supply.

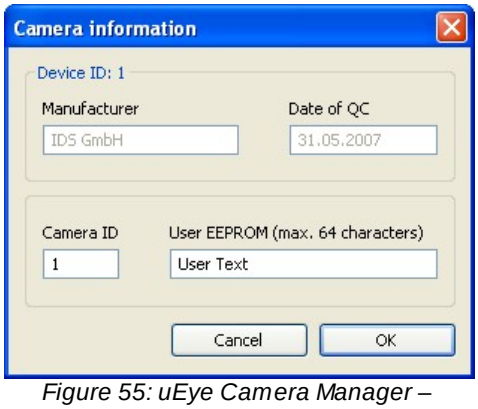


Figure 55: uEye Camera Manager – Camera information

You can only set the camera ID and write to the EEPROM if the camera is marked *Free* and *Available* in the Camera Manager (see also Camera list).

- *Camera ID*
  The camera ID identifies a camera in multi-camera operation. You can assign IDs in a range from 1 to 254. The default value for the camera ID is 1. The same ID can be assigned to multiple cameras. You do not have to assign sequential ID numbers to all connected cameras.

If software accesses the camera through the *uEye DirectShow interface*, the camera ID must be in a range from 1 to 8.

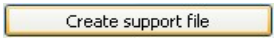
- *User EEPROM (max. 64 characters)*
  Every *uEye* has a 64-byte user area in its EEPROM (Electrically Erasable and Programmable Read Only Memory) to which you can write text of your choice.

The *Camera information* dialog box displays two additional boxes that are for your information only and cannot be edited:

- *Manufacturer* (e.g. IDS GmbH)
- *Date of QC* (date of final camera quality test)

8.1.5 Creating a Support File

A *uEye* support file is a binary file with the extension *.bin*. The file contains camera and driver details that are required for diagnostics by the *uEye* support team. No personal computer data or user data is stored in this file.

The 

button opens the "Save as" dialog box, where you can save the displayed camera information and additional driver information to a file.

8.1.6 ETH Network Service

In this dialog box, you can enable and disable the network service of the *GigE uEye* camera for specific network adapters. In addition, network adapters can be assigned a fixed IP address, which is required for operating the *GigE uEye* camera.

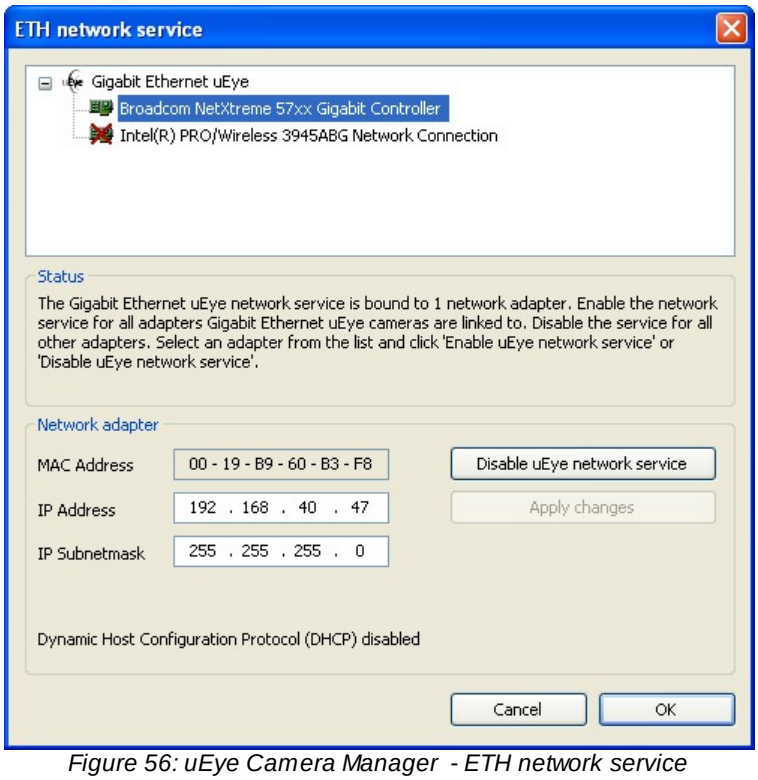


Figure 56: uEye Camera Manager - ETH network service

- *Status*
  Displays information on the status of the *GigE uEye* network service and the connected network adapters.
- *Network adapter*
  - Click the Disable uEye network service button to disable the *GigE uEye* network service for a network adapter. To enable the network service, click the Enable uEye network service button.
    Before you can enable or disable a network adapter, you need to select it in the tree structure of the dialog box.
    We recommend disabling the *GigE uEye* network service for all network adapters that are not being used for *uEye* cameras.
  - In the *IP Address* and *IP Subnetmask* input boxes, you can assign a static IP address and a static IP subnet mask to the selected network adapter. DHCP will be disabled automatically.

8.1.7 Additional Functions (COM Port)

The *Additional functions* dialog box allows installing virtual COM ports for communication through the serial interface of the *GigE uEye HE* camera. The following sections show you how to set up and use the serial interface.

This feature is only available for *GigE uEye HE* cameras.

You need administrator privileges to install a virtual COM port.

The *GigE uEye HE* camera you select in the Camera Manager has to be marked *Free* and *Available*.

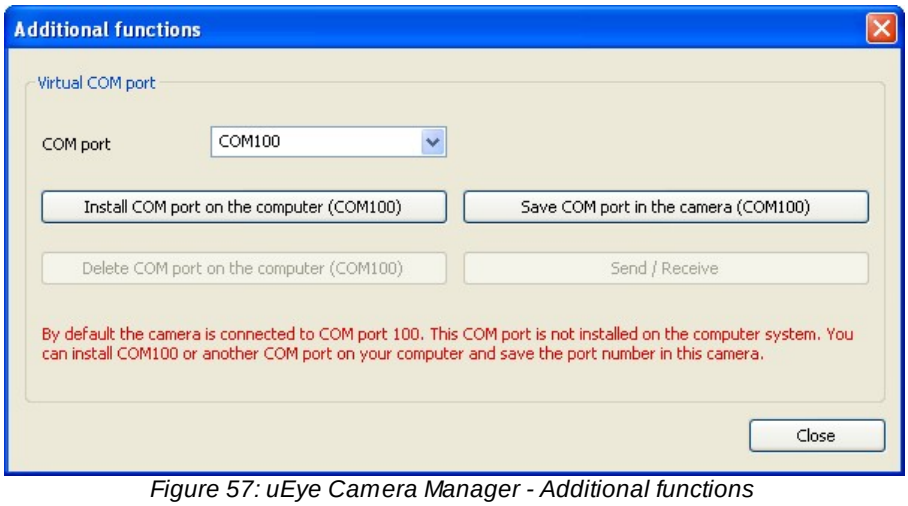


Figure 57: uEye Camera Manager - Additional functions

Setting up the serial interface on the *GigE uEye HE*

Before using the serial interface on the camera, one or more virtual COM ports have to be installed on the PC. Most systems support up to 255 COM ports; COM1 to COM8 are often assigned operating system functions by default. You can check the current port assignment in the *Device Manager* on your computer. Some older systems may not have more than eight ports; in that case you will need to assign the *GigE uEye HE* camera to one of these ports.

- *COM port*
  In the COM100 drop down box, select the number of the port you want to install (default: 100). COM ports in use are marked *(used)* in the list.
- Install COM port on the computer (COM100)
  Click this button to install the selected virtual COM port.
  During the first installation of a virtual COM port, an additional broadcast port with number 255 is installed. Data sent to this port will be forwarded to all paired cameras.
  You can install any number of virtual COM ports on a single system.
- Delete COM port (COM100)
  With this button, you can release a COM port that is marked "used." If the port number has been saved in that camera, it will be deleted in the camera, too. To release a COM port, select it in the drop down box and then click this button.
- Save COM port in the camera (COM100)
  Click this button to assign the selected port number to the camera. The port number is saved in the camera's non-volatile memory and retained even when the camera is switched off. You can look up the assigned port number in the *Camera Manager*'s expert mode. A COM port number can also be saved in a camera without a virtual COM port installed on the PC.

If you want to control more than one *GigE uEye HE* camera from a PC, each camera should be assigned a unique port number. If multiple cameras are assigned the same port number, only the port of the first camera that is opened will be used.

To send data via the serial interfaces of multiple cameras, you can use the broadcast port with number 255. Before connecting to the broadcast port, ensure that all the cameras that are to receive the broadcast have been opened.

Testing the serial interface on the *GigE uEye HE*

Before a camera can exchange data with a PC through the virtual COM port, the camera has to be paired with that PC (see Paired).

To avoid transmission errors, please ensure that both the camera and the receiving end use the same communication parameters (baud rate, data bits, stop bits, parity). Further information on the communication parameters is provided in the Specifications: Serial Interface chapter.

- Send / Receive

  Clicking this button opens a dialog box for transferring data through the COM port. The dialog box is provided as the *uEyeComportDemo.exe* sample program together with the C++ source code and is included in the *uEye SDK*.
  This program allows sending ASCII characters to the COM port assigned to a camera. The characters are output unchanged on the camera's serial port. To check the proper functionality, you can connect a PC to the camera's serial port and read the transmitted characters on the PC's COM port.

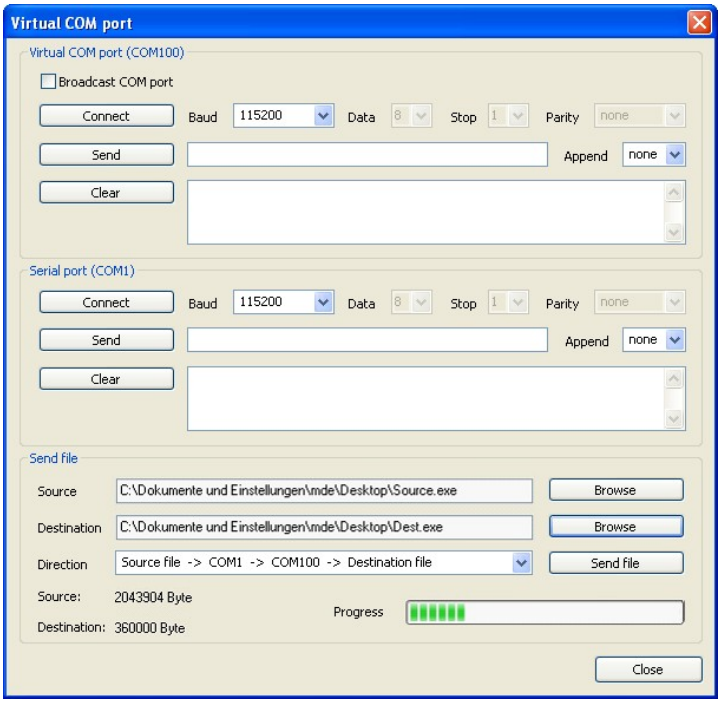


Figure 58: Data transfer through a virtual COM port

- *Baud*
  In this drop down box, you can change the data transfer rate of the serial interface.
- *Append*
  This drop down box allows appending the special characters *CR (Carriage Return)* and *LF (Line Feed)* to the ASCII text you want to transmit. Some devices with serial interface require ASCII strings to be terminated with CR/LF.
- *Send file*
  Using these functions, you can send a file in either direction (output on the camera's virtual COM port or output on the PC's COM port).

Since the sample program has to open the camera, please make sure the selected camera is not used by other applications at the same time.

8.1.8 Automatic ETH Configuration

The Automatic ETH configuration button allows configuring a connected *GigE uEye* camera for automatic IP address assignment. The function defines a suitable IP address range, which you can change in the Manual ETH configuration dialog box, if required.At the same time, it deletes the camera's persistent IP address (i.e. sets it to 0.0.0.0). When the *GigE uEye* camera is opened by an application, the function automatically assigns a free IP address to the camera.

This function is only available for *GigE uEye* cameras.

8.1.9 Starter Firmware Upload

The Upload starter firmware button uploads a new version of the starter firmware to the selected camera. This button is only available in Expert mode and is hidden otherwise.

The starter firmware determines the start-up behavior of the *GigE uEye* camera. We recommend that you do not update the starter firmware unless an older firmware version causes start-up problems. If you have questions on the current starter firmware, please contact our technical support (see Contacting Us).

This function is only available for *GigE uEye* cameras.

8.1.10 Manual ETH Configuration

This dialog box allows you to manually set the IP address and subnet mask of a *GigE uEye* camera. The Manual ETH configuration button is only available in Expert mode and is hidden otherwise.

This function is only available for *GigE uEye* cameras.

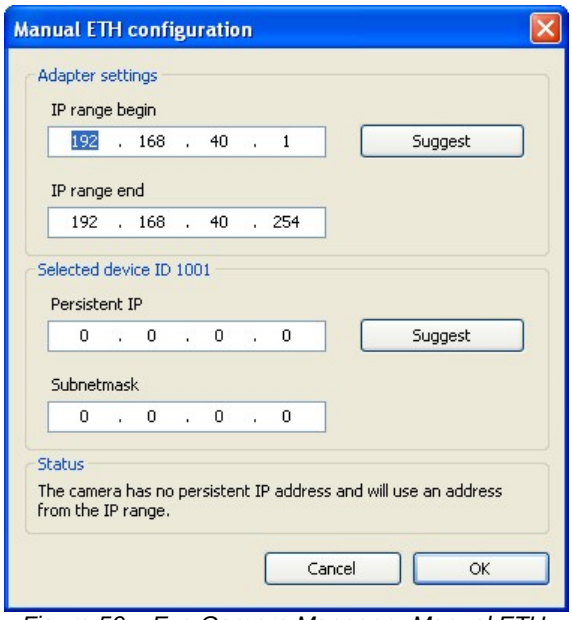


Figure 59: uEye Camera Manager - Manual ETH configuration

- *Adapter settings*
  Here, you can change the IP configuration of the network adapter to which the selected *GigE uEye* camera is connected.
- *IP range begin/end*
  Defines the IP range from which the *uEye* driver chooses an address during *automatic ETH configuration*. The IP range is not effective if the camera is assigned a persistent IP address.
- *Suggest*
  Same as the Automatic ETH configuration function.
- *Selected device ID*
  Here, you can change the IP configuration of the *GigE uEye* camera.
- *Persistent IP*
  The entered IP address is permanently saved in the camera when you close the dialog box. The persistent IP address is retained in the camera memory even when the camera is disconnected from the power supply. If you connect the camera to a different PC, make sure the persistent IP address is valid on that computer, as well.
- *Subnet mask*
  Enter a valid subnet mask for the persistent IP address.
- *Suggest*
  Selects the first free IP address from the network adapter's range of valid IP addresses. The function then enters that address in the *Persistent IP* box and sets the appropriate subnet mask. The settings made for *IP range begin/end* in the Adapter Settings box have no influence on the suggested address.
- *Status*
  This box displays information on the defined IP configuration.

If a DHCP server is running on the network, you need to ensure when configuring the network adapter that the manually assigned address range of the *uEye* driver is outside the DHCP range.

8.1.11 Parameters

This box displays the parameters of the camera you have selected in the camera list. The Parameters box is only shown when Expert mode is active.

The parameters are organized in a tree structure. Only the information that applies to the selected camera is shown. The data displayed in the *camera list* is not repeated in the *Parameters* box. The data shown in the tree structure cannot be changed.

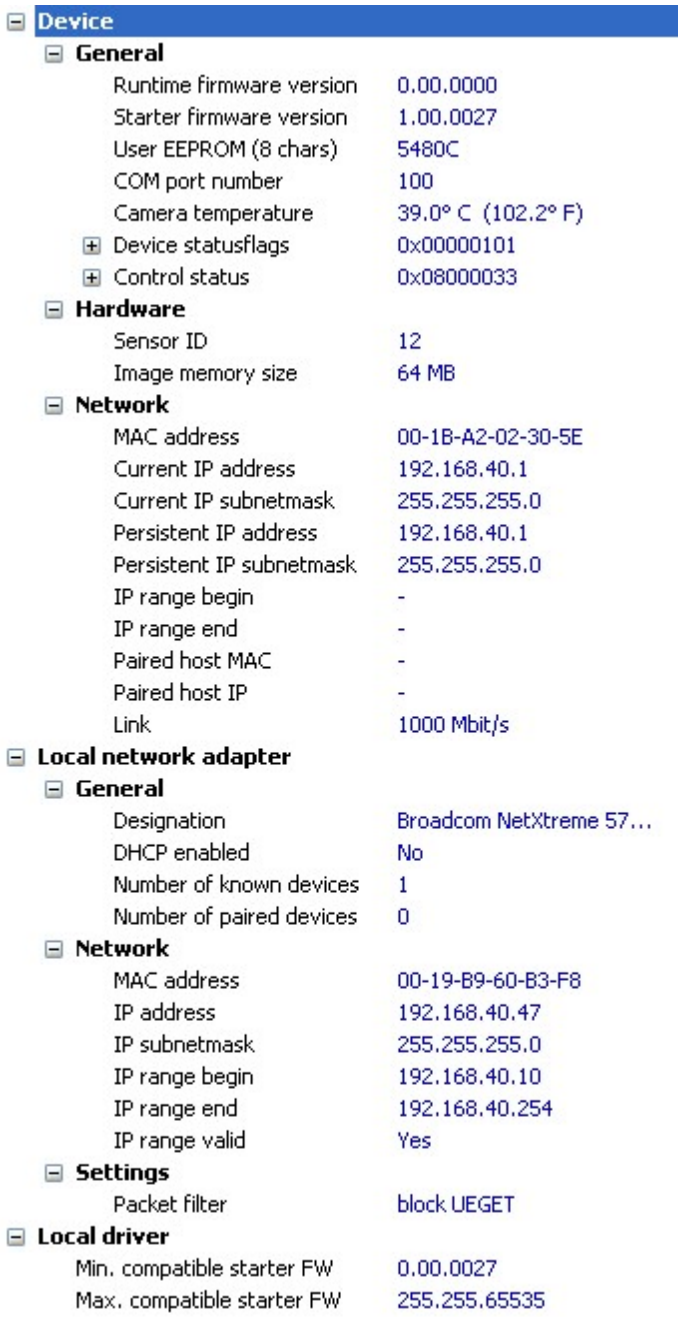


Figure 60: uEye Camera Manager - Parameter list

- *USB* *)
  - *Hub*
    Indicates which hub and port a USB camera is connected to. In addition, the full path through all hubs to the USB controller on the computer is displayed.
  - *Controller*
    Indicates the USB controller to which the camera is connected.
- *Device*
  - *Sensor ID* *)
  - *General*
    - *Runtime firmware version* **)
    - *Starter firmware version* **)
    - *User EEPROM*
      The first 8 characters of the user area in the EEPROM are displayed (see Camera Information).
    - *COM port number* **)
      Number of the virtual COM port stored in the camera's memory (see Serial Interface (RS232)).
    - *Camera temperature* **)
      Indicates the camera temperature in degrees Celsius.
    - *Device statusflags* **)
      Internal camera status flags
    - *Control status* **)
      Internal camera status flags
  - *Hardware* **)
    - *Sensor ID* **)
    - *Image memory size* **)
  - *Network* **)
    - *MAC address*
      Unique MAC network address of the camera
    - *Current IP address/Current IP subnetmask*
      Current IP configuration
    - *Persistent IP address/Persistent IP subnetmask*
      IP configuration stored in the camera's memory
    - *IP range begin/IP range end*
      IP range assigned by the computer. If the IP address is automatically assigned, the camera accesses this IP range and attempts to find an available IP address within this range.
    - *Paired host MAC/Paired host IP*
      Network data of the paired computer
    - *Link*
      Bandwidth of the camera's network connection
- *Local network adapter* **)
  - *General* **)
    - Designation
      Name of the network adapter
    - DHCP disabled/enabled
    - Number of known devices
      Number of devices connected to the computer
    - Number of paired devices

Number of cameras that have been opened by this computer

- *Network* **)
  - *MAC address*
    Unique network address of the computer
  - *IP address/IP subnetmask*
    Network configuration of the computer
  - *IP range begin/IP range end*
    Address range stored on the computer for automatic assignment of the camera IP address (see Automatic ETH Configuration)
  - *IP range valid*
    Checks that the IP range stored on the computer is valid. The addresses of the IP range are valid if they are on the same subnet as the computer.
- *Settings*
  - *Packet filter* **)
    Determines how incoming uEye data traffic is filtered by the network card. Block UEGET is preset and cannot be changed.
- *Local driver*
  - *Min. compatible starter FW* **)
    Minimum required version of the starter firmware
  - *Max. compatible starter FW* **)
    Last supported version of the starter firmware

*) This information is only displayed for USB *uEye cameras*
**) This information is only displayed for *GigE uEye* cameras

8.2 uEye Demo

The *uEye Demo* application demonstrates the functionality and performance of the *uEye* cameras. The application is part of the free *uEye* software package that is available for download from our website.

In *uEye Demo*, you can access all important camera settings and functions of the *uEye* programming library. Apart from controlling and configuring the camera, you can record images as AVI files and save them as BMP or JPEG files.

uEye Demo is currently only available for Windows operating systems. A version with reduced functionality is available for Linux.

Please note that *uEye Demo* does not guarantee completeness and operational reliability in all modes and all computing environments. *uEye Demo* is supplied with source code and is intended solely for demonstrating the *uEye* software library and camera functionality.

uEye Demo can be accessed as follows:

- *Start* → *All Programs* → *IDS* → *uEye* → *uEye Demo*
- Program icon on the desktop or Quick Launch toolbar

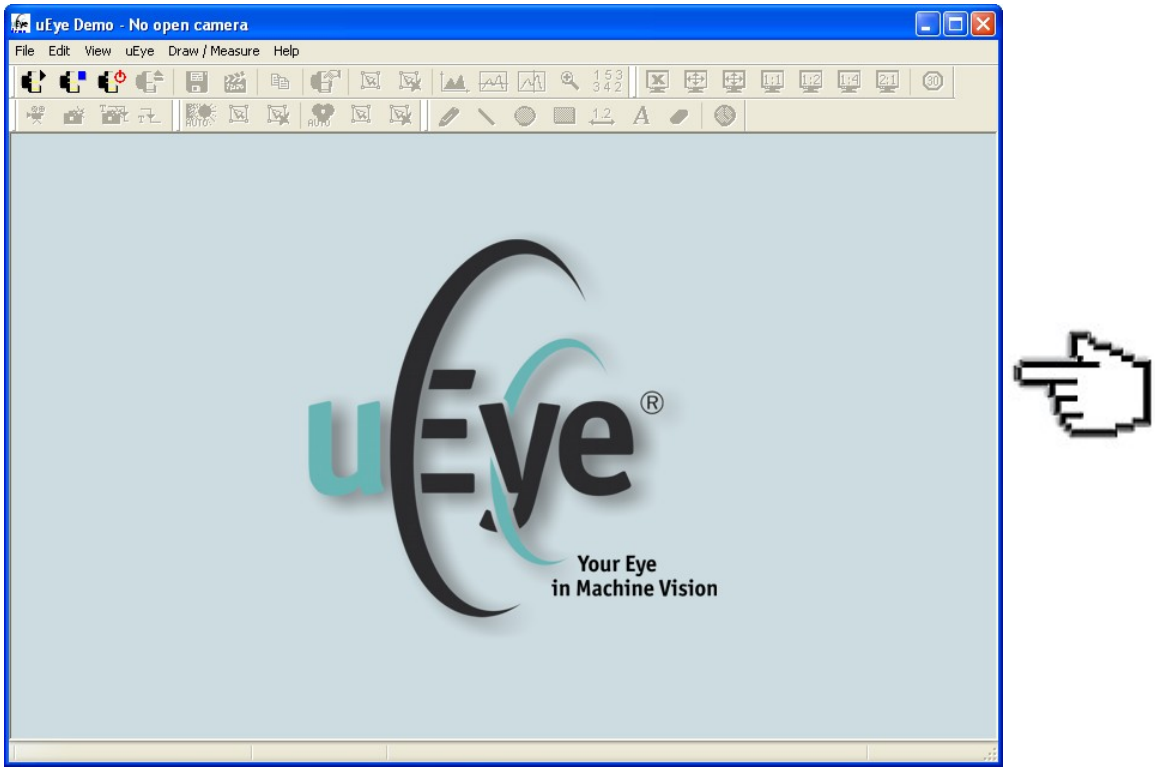


Figure 61: uEye Demo application

8.2.1 Camera Selection

Select *uEye* menu → *Open* or click the corresponding icon on the *General* toolbar to select (open) a connected camera. If only one camera is available, this camera is selected automatically. If more than one camera is connected, the Select Camera dialog box is displayed.

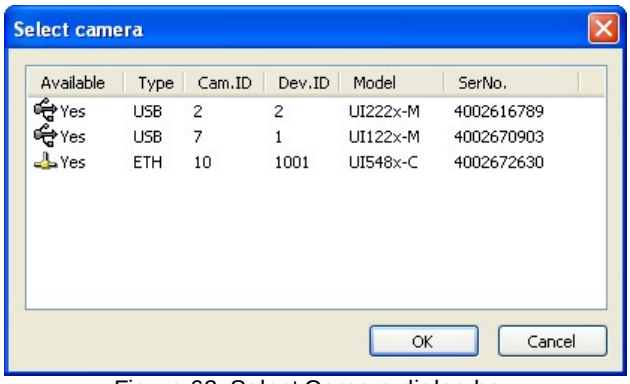


Figure 62: Select Camera dialog box

You can use multiple cameras simultaneously by opening multiple instances of *uEye Demo*. *GigE uEye* cameras that have already been opened or that have not been correctly configured are marked *No* in the *Available* column.

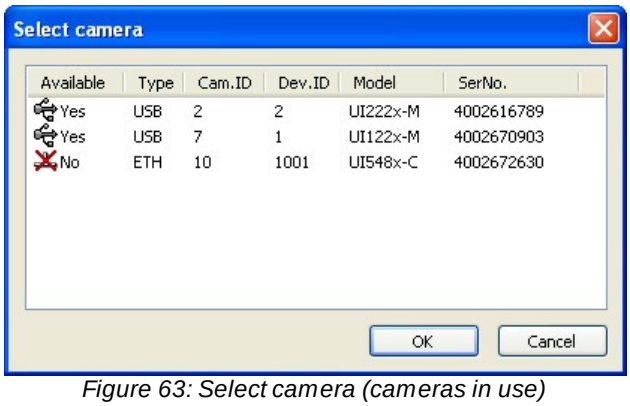
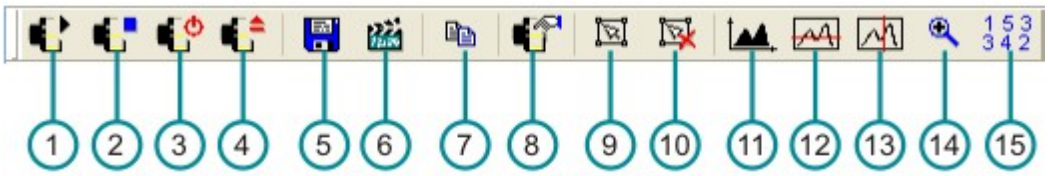


Figure 63: Select camera (cameras in use)

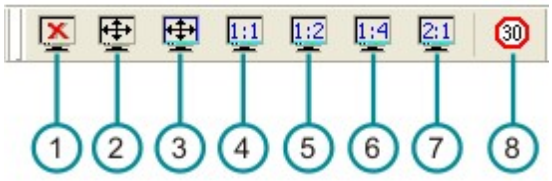
8.2.2 Toolbars

uEye



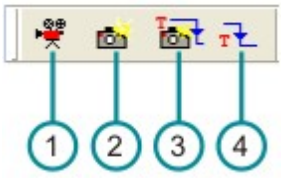
1	Open camera and start in live mode
2	Open camera
3	Close camera
4	Camera changes to standby mode
5	Save image as bitmap
6	Open the dialog box for AVI Recording
7	Copy image to the Clipboard (only in DIB mode)
8	Test the range of camera functions
9	Select AOI (Area Of Interest)
10	Delete selected AOI
11	Open/close Histogram window
12	Open/close Horizontal Line View window Displays the color values of a pixel row
13	Open/close Vertical Line View window Displays the color values of a pixel column
14	Open/close Zoom window
15	Open/close Pixel Peek window

Display



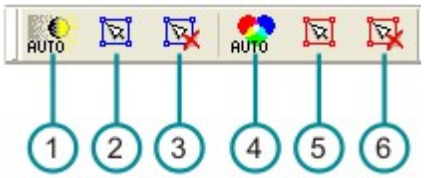
1	Deactivate display
2	Full screen window in overlay or back buffer mode
3	Scale display to window size
4	Display at original size
5	Scale display down to half size
6	Scale display down to quarter size
7	Scale display up to double size
8	Limit max. display frame rate to 30 fps. The image capture frame rate remains unchanged.

Capture



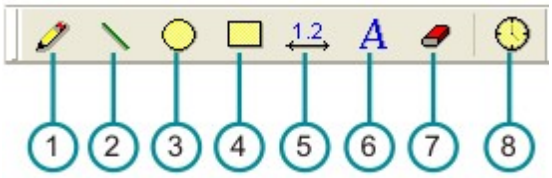
1	Start/stop live video (freerun mode)
2	Snapshot in freerun mode
3	Snapshot in trigger mode
4	Start/stop continuous triggered capture

Auto Features



1	Automatic brightness control (AES/AGC) on/off
2	Set reference area for automatic brightness control
3	Delete reference area for automatic brightness control
4	Automatic white balance (AWB) on/off
5	Set reference area for automatic white balance
6	Delete reference area for automatic white balance

Draw



1	Draw freehand overlay in image
2	Draw overlay line in image
3	Draw overlay circle in image
4	Draw overlay rectangle in image
5	Measure distance
6	Write overlay text in image
7	Clear all drawn elements
8	Timestamp on/off

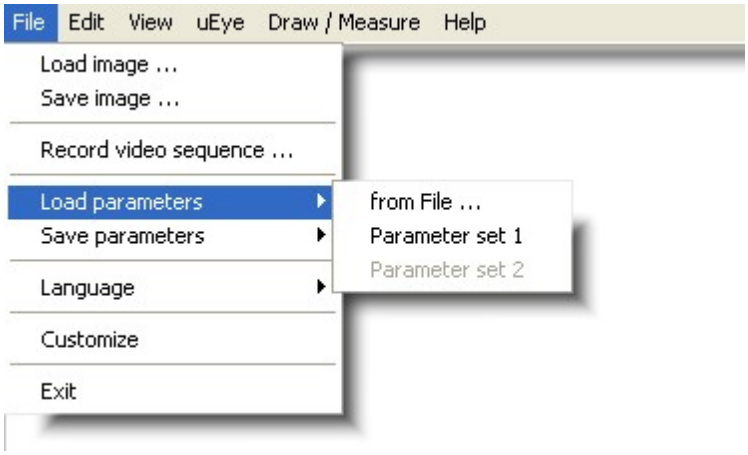
Status Bar

Figure 64: uEye Demo – Status bar

1	Current cursor position in the Zoom/Pixel Peek window and color values at the cursor position
2	Defined color mode and image resolution
3	Counters Frames: Transferred images Display: Displayed images Missed: Hardware trigger events missed. This counter increments each time a hardware trigger is received in trigger mode, but the camera is not ready for image capture Failed: Transmission errors Recon.: This counter increments each time the open camera is removed and reconnected during operation.
4	Status of the current image data transfer (OK/Error)
5	Current frame rate (fps) of the camera

8.2.3 Menus

File

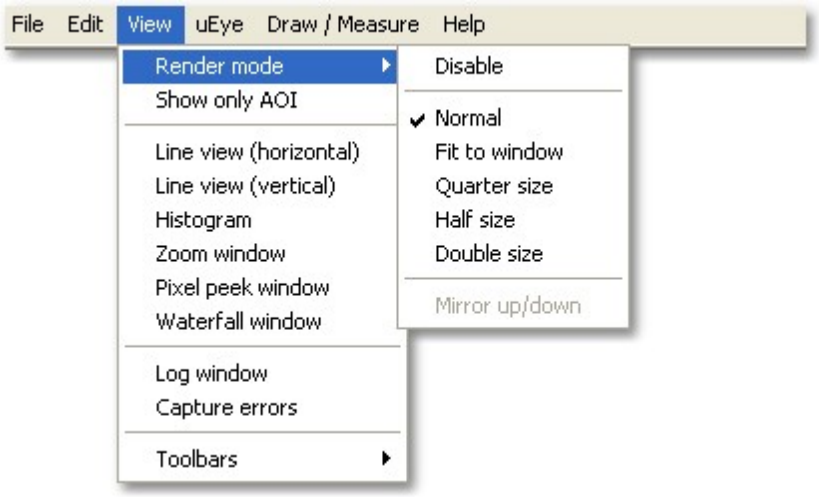


Load image ...	Load bitmap
Save image ...	Save image as bitmap
Record video sequence ...	Opens the Record Dialog box
Load parameters	Load parameters from an ini file or from one of the camera's parameter sets
Save parameters	Save parameters to an .ini file or to one of the camera's internal parameter sets
Language	Select a language for the program. When you change the language, you need to restart *uEye Demo* to apply the new setting.
Customize	Opens a dialog box where you can make various settings for the startup behavior of *uEye Demo*
Exit	Exit the demo program

Edit

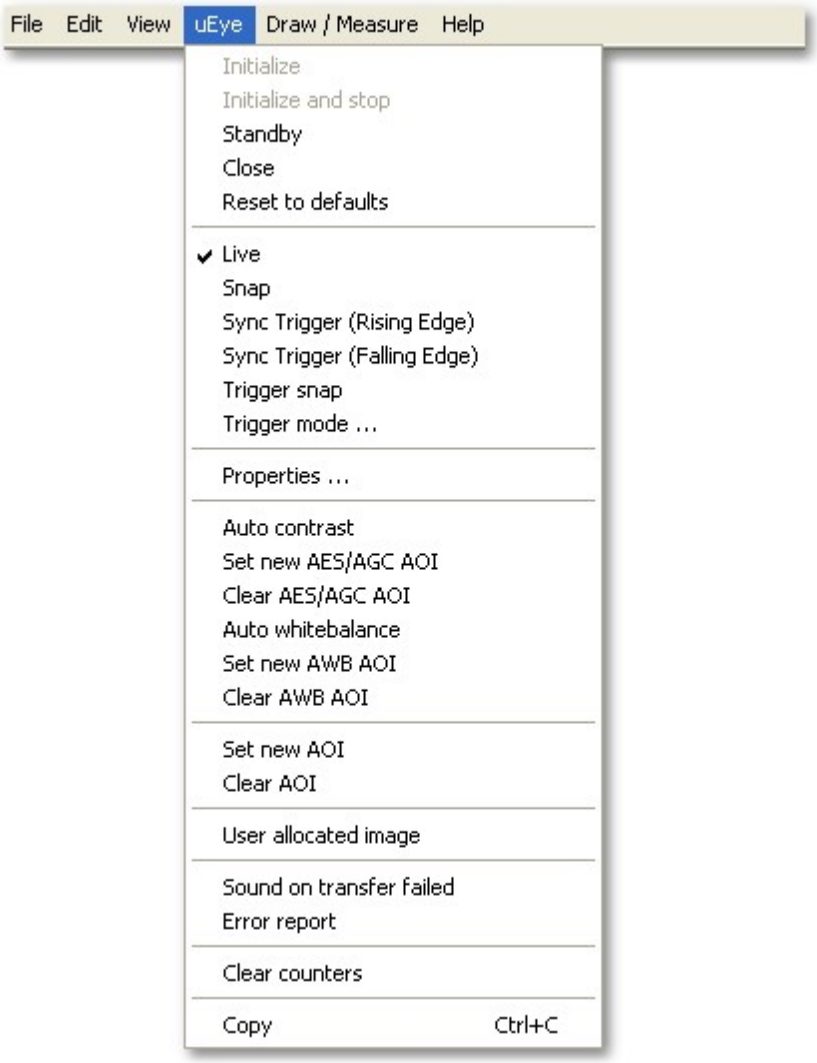
Copy Ctrl+C	Copy the displayed image content to the Clipboard. Overlay data created using the Draw/Measure function is also copied automatically.

View



Render mode	Image display
Disable	Deactivate display
Normal	Display at original size
Fit to window	Scale display to window size
Quarter size	Scale display down to quarter size
Half size	Scale display down to half size
Double size	Scale display up to double size
Mirror up/down	Mirror display on horizontal axis
Show only AOI	AOI is displayed without black border
Line view (horizontal)	Opens the Line view window (row view)
Line view (vertical)	Opens the Line view window (column view)
Histogram	Opens the Histogram window
Zoom window	Opens the Zoom window
Pixel peek window	Opens the Pixel peek window
Waterfall window	Opens the Waterfall window
Log window	Opens the Log window
Capture errors	Opens the Capture errors window
Toolbars	Show/hide toolbars uEye, View, Capture, Auto Features and Draw/Measure

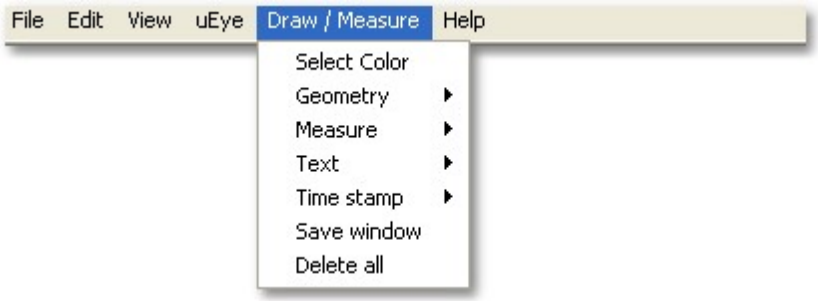
uEye



Initialize	Open camera and show live image
Initialize and stop	Open camera
Standby	The camera changes to standby mode
Close	Close camera
Reset to defaults	Resets all values set in the demo program to the defaults
Live	Live video on/off
Snap	Snapshot from live video
Sync Trigger (Rising Edge)	Triggered snapshot (hardware trigger, rising edge)
Sync Trigger (Falling Edge)	Triggered snapshot (hardware trigger, falling edge)
Trigger snap	Triggered snapshot (software trigger)
Trigger mode ...	Trigger mode on/off; continuous triggered capture
Properties	See Camera Properties
Auto contrast	Activate automatic brightness control
Set new AES/AGC AOI	Define active area for automatic brightness control
Clear AES/AGC AOI	Clear active area defined for automatic brightness control
Auto whitebalance	Activate automatic white balance
Set new AWB AOI	Define active area for automatic white balance
Clear AWB AOI	Clear active area defined for automatic white balance
Set new AOI	After calling *Set new AOI*, you can select the area to be used as

	AOI with the mouse
Clear AOI	Resets the area set with *Set new AOI*
User allocated image	The memory is allocated not via the SDK function *is_SetAllocateImageMem()*, but by the application
Sound on transfer failed	Output an acoustic signal if a transmission error occurs
Error report	Errors are displayed in a dialog box
Clear counters	Reset the counters (see uEye Demo Status Bar)
Copy	Copy the displayed image content to the Clipboard. Overlay data created using the Draw/Measure function is also copied automatically.

Draw/Measure



Select Color	Select color for drawings and text
Geometry	
Select line width	Set line width
Circle	
Show circles	Show/hide circles
New circle	Draw new circles
Delete circles	Delete circles
Freehand	
Show freehand	Show/hide freehand drawings
New freehand	Draw new freehand
Delete freehand	Delete freehand drawing
Line	
Show lines	Show/hide lines
New lines	Draw new lines
Delete lines	Delete lines
Rectangle	
Show rectangles	Show/hide rectangles
New rectangles	Draw new rectangles
Delete rectangles	Delete rectangles
Measure	
Set measuring unit	Set scale
Show measures	Show/hide dimension lines
New measure	New dimension line
Delete measures	Delete all dimension lines
Text	
Select font	Select font
Show texts	Show/hide texts
New text	Write new text
Delete text	Delete text
Time stamp	
Set timestamp position	Timestamp position (top left, top right, bottom left, bottom right)
Show timestamp	Show/hide timestamp
Save window	Opens the Save As dialog box. The image is stored with all drawings, texts, measures and dimension lines
Delete all	Delete all drawings, texts, measures and dimension lines

Help

Hotkeys — Display hotkeys

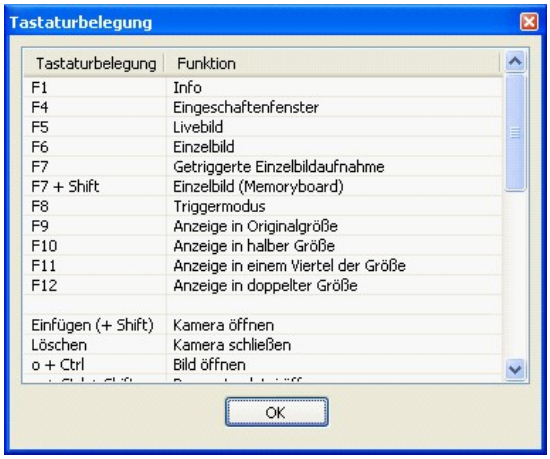


Figure 65: Hotkeys

About *uEye Demo* — Display program information

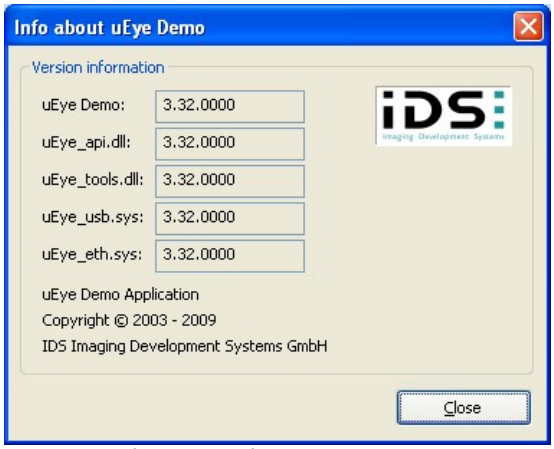


Figure 66: About uEye Demo

8.2.4 Dialog Boxes

Record Dialog

Select *File* menu → *Record video sequence ...* to open the *uEye* Record Dialog box. This dialog box provides all the functions you need to create a video file (.avi) from a sequence of images captured with the uEye. To reduce the file size, the single frames are stored in the AVI container using an adjustable JPEG compression. It is possible to extract single frames from the AVI file.

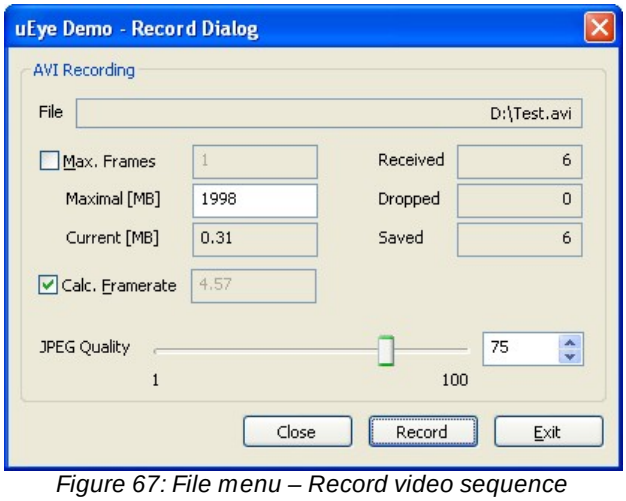


Figure 67: File menu – Record video sequence

AVI capture workflow

Once the AVI file has been created, images transferred from the *uEye* are placed in a buffer. Then, the images are compressed and added to the AVI file which is stored on the hard disk. These operations are not performed in the same thread as the capturing process. If you capture more images while a compression or write operation is in progress, the new images will be discarded.

Supported color formats

The supported input color formats are RGB32, RGB24, Y8 and raw Bayer. The output file will always be in RGB24 format, regardless of the input data format. Once the AVI file has been created, the following parameters of the input image can no longer be changed:

- Color format
- AOI, binning and subsampling
- Show only AOI

AVI recording is only possible in the *Device Independent Bitmap (DIB)* display mode.

Record dialog box

- *File*
  Name of the AVI file opened for recording.

- *Max. Frames*
  If you select this check box, you can set the number of frames after which recording should stop.
- *Maximal [MB]*
  Sets the maximum size for the AVI file. Recording stops when the AVI file reaches the size limit.

You can edit the entry in this box (default: 1998).

- *Current [MB]*
  Indicates the current size of the AVI file.
- *Received*
  Indicates the number of images transferred by the camera.
- *Dropped*
  Indicates the number of images discarded during compression. A image is dropped if it arrives while compression is in progress.
- *Saved*
  Indicates the number of images saved to the AVI file.

- *Calc. Framerate*
  If you select this check box, the frame rate of the AVI file is determined automatically during recording. It can also be set manually. The frame rate value is stored in the AVI file and evaluated by the movie player. The usual value is 25 or 30 frames per second.
  The recording speed of the video depends on the selected color format, the image size and the compression level of the AVI file as well as the PC performance.
- *JPEG Quality*
  This slider sets the JPEG compression level (1 = lowest quality/highest compression, 100 = highest quality/lowest compression, default = 75).

- *Create.../Close*
  Click this button to create a new AVI file for recording, and to close the file again when you are done. If you select an existing AVI file, the file contents will be overwritten during recording.
- *Record/Stop*
  Starts/stops AVI recording.
- *Exit*
  Closes the Record dialog box. A recording in progress is stopped.

Horizontal/Vertical Line View

Select *View* menu → *Line view (horizontal / vertical)* to open the Line View windows, which show the color values of a pixel row or pixel column. The line view always displays 256 values per channel. For color modes with a bit depth of more than 8 bits, the function evaluates the 8 most significant bits (MSBs).

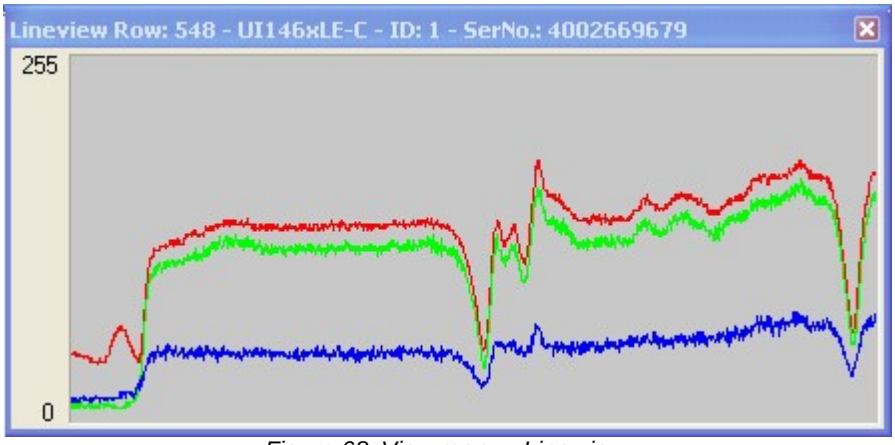


Figure 68: View menu - Line view

Histogram

Select *View* menu → *Histogram* to open the Histogram window. This window graphically displays the frequency distribution of the color values in the image captured by the camera. The histogram always displays 256 values per channel. For color modes with a bit depth of more than 8 bits, the function evaluates the 8 most significant bits (MSBs).

The following options are available:

- *Channel*
  With the *Red*, *Green*, and *Blue* check boxes, you can enable or disable the display for each color channel. *Avg.* displays the average of each color value.
  For monochrome images, the average grayscale value is displayed.
- *Outlined*
  The *Outlined* check box enables you to toggle the color value display between an area diagram and a line diagram.
- *Logarithmic*
  If you select this check box, the values are displayed with logarithmic scaling.
- *Show Bayer RGB*
  This function is only available when a color camera is running in *Direct raw Bayer* mode. If you select this check box, the histogram represents the individual Bayer color components as red, green and blue channels.

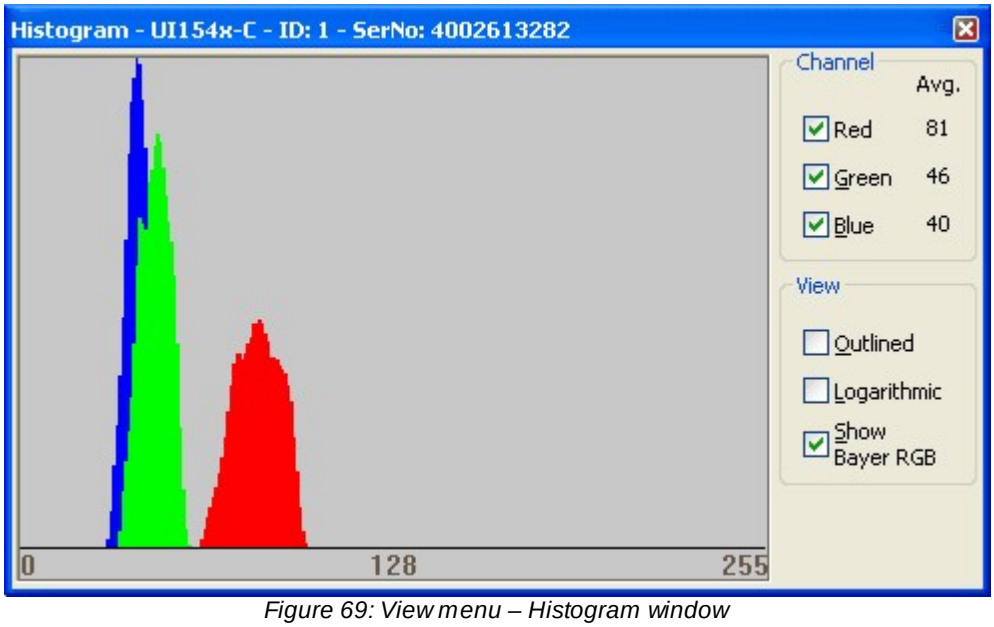


Figure 69: View menu – Histogram window

Zoom Window

Select *View* menu → *Zoom window* to open the Zoomwindow. This window shows an enlarged view of the image area at the selected cursor position. Using the slider at the top of the window, you can set the zoom factor in the range between 0.25 and 20.00. The size of the image area depends on the selected size of the Zoom window.

If you enable the Pixel Peek check box at the top of the zoom window, the color values at the cursor position are displayed (see Pixel Peek Window).

To set the cursor position you want to display in the window, place the cursor at that position in the image, hold the CTRL key and right-click. Alternatively, you can set the image position using the context menu.

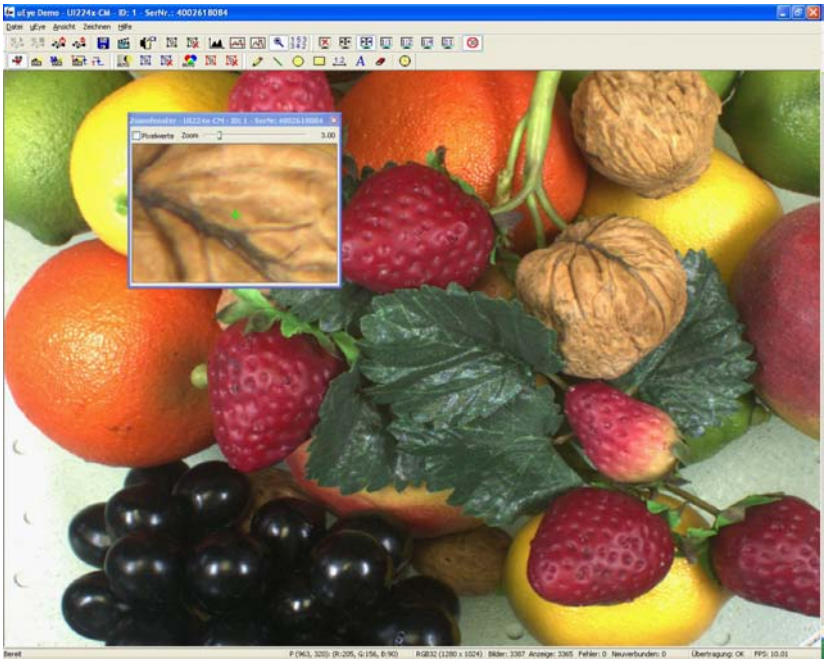


Figure 70: View menu – Zoom window

Pixel Peek Window

Select *View* menu → *Pixel peek window* to open the Pixel peek window. This window displays the color values at the selected cursor position and those of the neighboring pixels. The color values at the cursor position are surrounded by a yellow rectangle. For monochrome images, the grayscale value is displayed. The window always displays 256 values per channel. For color modes with a bit depth of more than 8 bits, the function evaluates the 8 most significant bits (MSBs).

If you disable the *Pixel Peek* check box at the top of the window, the Zoom window is displayed (see Zoom Window).

To set the cursor position you want to display in the window, place the cursor at that position in the image, hold the *Ctrl* key and right-click. Alternatively, you can set the image position using the context menu.

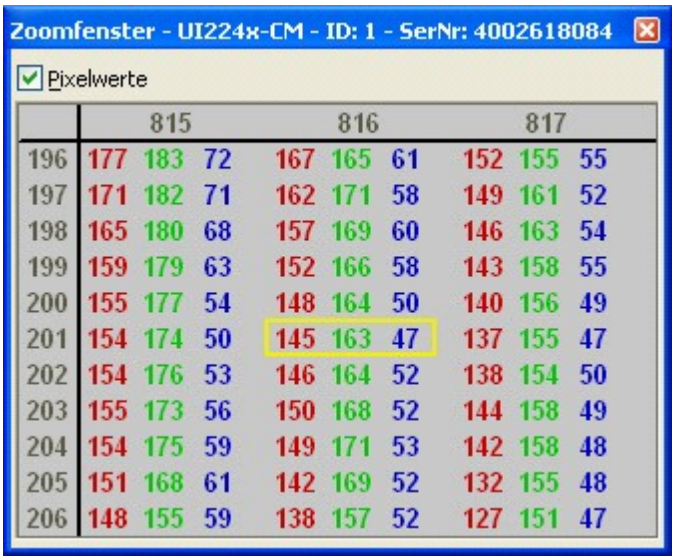


Figure 71: View menu – Pixel Peek window

Waterfall Window

Select *View* menu → *Waterfall window* to display the Waterfall window. This window shows how a selected image line changes over time. For this purpose, the line at the selected cursor position is copied to the new window. With each new frame, all lines in the Waterfall window are moved one pixel down, and the new line is added at the top. This results in an image that flows from top to bottom and is useful for observing short-term image changes.

To set the cursor position you want to monitor in the Waterfall window, place the cursor at that position in the image, hold the *Ctrl* key and right-click. Alternatively, you can set the image position using the context menu.

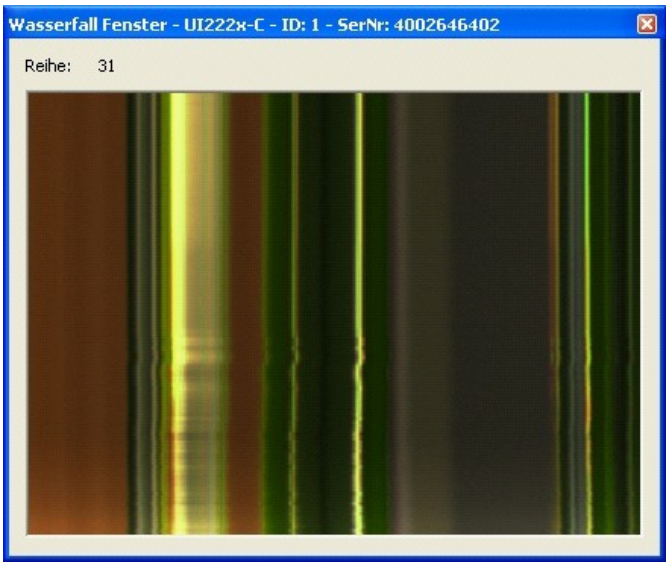


Figure 72: View menu – Waterfall window

Log Window

Select View *menu* → *Log window* to display the logged data. The *uEye* logs events and messages in this window.

Figure 73: View menu – Log window

The following options are available:

- *Level*
  With these radio buttons, you choose the logging level *(Off, Low, Medium, High)*. The last level used is saved when you close the window. The next time you open the log window, logging is performed at that level.
- *Auto Scroll*
  When you select the *Auto Scroll* check box, the display automatically scrolls up when new entries arrive so that the new entries can be read.
- *Log Transfer Failed*
  Select the *Log Transfer Failed* check box if you want to log transfer errors.
- *Clear Window*
  The *Clear Window* button deletes the current messages.
- *Save*
  The *Save* button opens the Windows Save as dialog box, allowing you to save the messages displayed in the log window in ASCII format (.txt file).

Capture Errors

Select *View* menu → *Capture errors* on the main menu to display the Capture Errors dialog box.

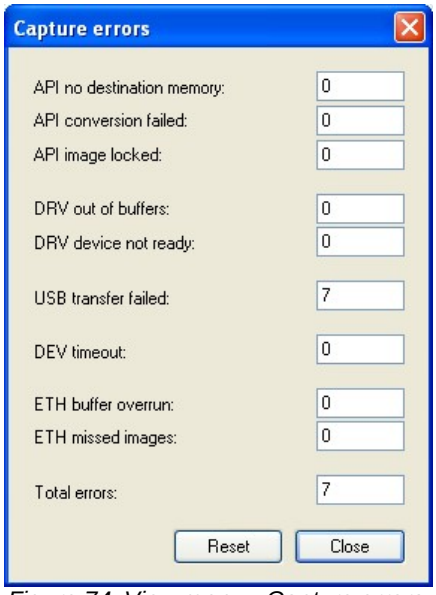


Figure 74: View menu - Capture errors

Error type	Description	#
API no destination memory	There is no destination memory for copying the finished image.	1
API conversion failed	The current image could not be processed correctly.	2
API image locked	The destination buffers are locked and could not be written to.	3
DRV out of buffers	No free internal image memory is available to the driver. The image was discarded.	4
DRV device not ready	The camera is no longer available. It is not possible to access images that have already been transferred.	5
USB transfer failed	The image was not transferred over the USB bus.	6
DEV timeout	The maximum allowable time for image capturing in the camera was exceeded.	7
ETH buffer overrun	The sensor transfers more data than the internal camera memory of the *GigE uEye* can accommodate.	8
ETH missed images	The *GigE uEye* camera could neither process nor output an image captured by the sensor.	9

#	Possible cause	Remedy
1	Not enough destination memory allocated or all destination buffers locked by the application	• Reduce the frame rate so that there is more time to process the filled destination buffers
2	Internal error during internal processing of the image	-
3	All destination buffers locked by the application	• Reduce the frame rate so that there is more time to process the filled destination buffers
4	The computer takes too long to process the images in the *uEye API* (e.g. colour conversion)	• Reduce the frame rate so that there is more time to process the filled image memory of the driver • Disable resource-intensive API image pre-processing functions (e.g. edge enhancement, colour correction, choose smaller filter mask for software colour conversion)
5	The camera was disconnected or closed	-
6	Not enough free bandwidth for image transfer available on the USB bus	• Reduce the pixel clock frequency • Operate fewer cameras simultaneously on a USB bus • Check the quality of the USB cabling and components
7	The selected timeout value is too low for image captre	• Reduce the exposure time • Increase the timeout
8	The data rate of the sensor is too high	• Reduce the pixel clock frequency • Reduce the frame rate • Reduce the AOI
9	The camera's frame rate is too high or the bandwidth on the network is insufficient to transfer the image	• Reduce the frame rate • Increase the value for the receive descriptors in the network card settings

8.2.5 Properties

When you select uEye → *Properties* from the main menu, a dialog box opens where you can set the *uEye* camera parameters. Changes made to camera and image settings here will take effect immediately.

When you close a camera in *uEye Demo*, the current settings are written to the Windows Registry. They will be loaded the next time you open a camera of the same type. To save the settings to the camera or to an ini file, select File → *Save parameters* from the main menu. To load settings, select the *Load parameters* option.

Camera

This tab provides parameters for settings the pixel clock frequency, frame rate and exposure time for your *uEye* camera (see also Pixel Clock, Frame Rate and Exposure Time).

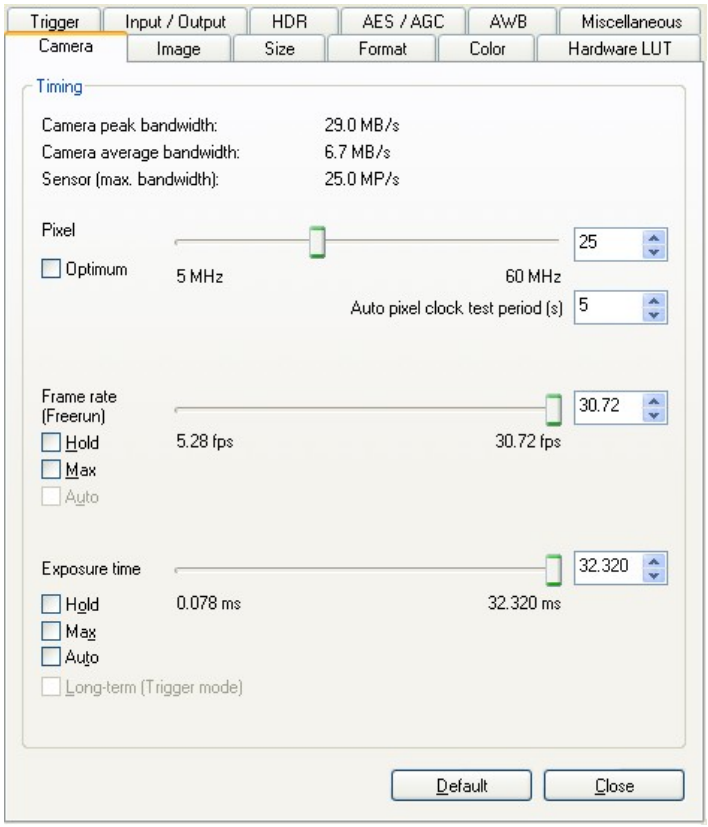


Figure 75: uEye properties - Camera

- *Camera peak bandwidth*
  Maximum required bandwidth in MB/sec (peak load). This value is displayed in red if the available Gigabit Ethernet bandwidth is exceeded.
- *Camera average bandwidth*
  Required average bandwidth in MB/sec. This value is displayed in red if the available Gigabit Ethernet bandwidth is exceeded.
  The average bandwidth is calculated from the following data: Image size, image format, frame rate, and interface-related protocol overhead.
- *Sensor (max. bandwidth)*
  Maximum data volume in Mpixels/sec created by the sensor.

The upper bandwidth limit of a Gigabit Ethernet camera depends on the chipset of the network card and on the network structure. If transfer errors occur, you need to reduce the frame rate.

With USB cameras, the upper limit depends on the USB chipset on the mainboard/USB card and on the number of USB devices connected. If transfer errors occur, reduce the pixel clock frequency.

- *Pixel*
  Sets the clock rate at which the image data is read from the sensor. Changes to this parameter affect the frame rate and the exposure time.
  Many CMOS sensors allow higher pixel clock frequencies in binning/subsampling mode.
  - *Optimum*
    When you select this check box, the highest possible pixel clock is determined and set automatically. The optimum pixel clock is the clock rate at which no transfer errors occur during the time (in seconds) set in the *Auto pixel clock test period* box. The longer you set the test period, the more reliable the determined pixel clock becomes. The total time it takes to automatically set the pixel clock is a bit longer than the test period setting.
- *Frame rate (Freerun)*
  Sets the frame rate in freerun mode. The available frame rate range depends on the pixel clock setting.
  - *Hold*
    When you select this check box, the frame rate will remain constant if the pixel clock changes. If the frame rate cannot be maintained, it is set to the nearest possible value.
  - *Max*
    The camera is operated at the maximum frame rate that is possible at the current pixel clock setting.
  - *Auto*
    Select this check box to activate the Auto Frame Rate function. This function is only available when Auto Exposure Shutter is enabled.
- *Exposure time*
  Sets the exposure time. The available exposure time range depends on the pixel clock setting and the frame rate. A low frame rate setting allows long exposure times. A high frame rate setting reduces the maximum possible exposure time.
  - *Hold*
    When you select this check box, the exposure time will remain constant if the frame rate changes. If the exposure time cannot be maintained, it is set to the nearest possible value.
  - *Max*
    The camera is operated at the maximum exposure time that is possible at the current frame rate.
  - *Auto*
    Select this check box to activate the Auto Exposure Shutter function. If the Auto check box is selected, the exposure time and pixel clock can no longer be adjusted manually. Selecting the *Hold* or *Max* check box deselects the Auto check box.
- *Long-term*
  If you select this check box, you can set an exposure time of up to 10 minutes on many *uEye* CCD cameras. This function is only available in trigger mode.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Image

On this tab you can set the sensor gain parameters for your *uEye* camera (see also Gain and Offset).

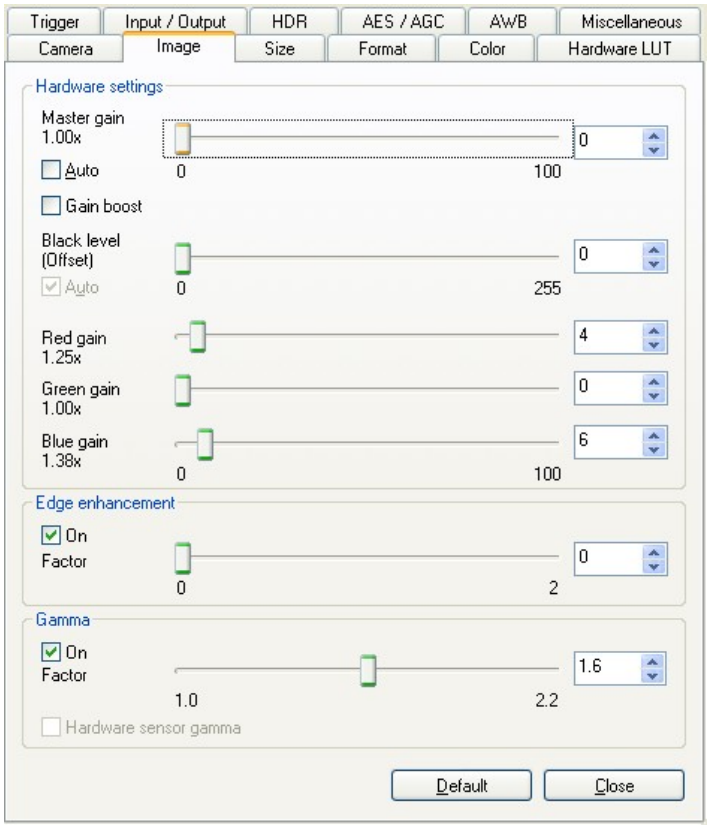


Figure 76: uEye properties - Image

- *Hardware settings*
  The following functions control the analog image signal gain and the black level. The analog adjustments are made directly in the sensor, which achieves better results than image adjustments via software.
  - *Master gain* [0 ... 100]
    Gain for overall image brightness. Some camera models have no master gain.
    Master gain = 100 means maximum gain; the actual factor is displayed. A gain factor of 1x disables master gain. The maximum possible gain factor depends on the model you are using.

  o *Auto*
  Select this check box to activate the automatic gain control function. Manually changing the master gain setting disables the Auto function.

  o *Gain boost*
  Additional analog camera hardware gain. The gain factor ranges between 1.5x and 2x, depending on the camera model.

  - *Black level (offset)* [0 ... 255]
    Offset for the black level of the sensor signal. The sensor adjusts the black level of the pixels automatically by default. If the environment is very bright, it can be necessary to adjust the black level manually. High gain may offset the black level. Only an additive offset is possible (increase of the black level).

  o *Auto*
  The black level is automatically corrected by the sensor (recommended).

  - *Red gain* [0 ... 100]

Amplifies the red color values

- *Green gain* [0 ... 100]
  Amplifies the green color values
- *Blue gain* [0 ... 100]
  Amplifies the blue color values

The RGB gain sliders are only enabled for color cameras.

With cameras featuring both master gain and RGB gain, the two gain factors are multiplied. Very high gain values can be achieved in this way.

If you want to use the RGB sliders for color adjustment, we recommend setting green gain to 0 and using only red and blue gain.

- *Edge enhancement*
  This function activates a software filter that emphasises the edges in the image.
  Enabling the *Edge enhancement* function increases the CPU load during image capture.

- *Gamma*
  This function activates the gamma function and sets the factor for the gamma curve. The gamma function emphasises dark image areas according to a non-linear curve. When you are using a *GigE uEye HE* camera and have activated hardware color calculation, the gamma curve is calculated in the camera. In all other cases, the gamma curve is calculated in the PC.
  - *Hardware sensor gamma*
    Select this check box to enable gamma correction by the hardware, using a fixed factor. This function is currently only available for the UI-122X-X/UI-522X-X.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Size

On this tab, you can set the image size parameters for your *uEye* camera (see also Reading out Partial Images).

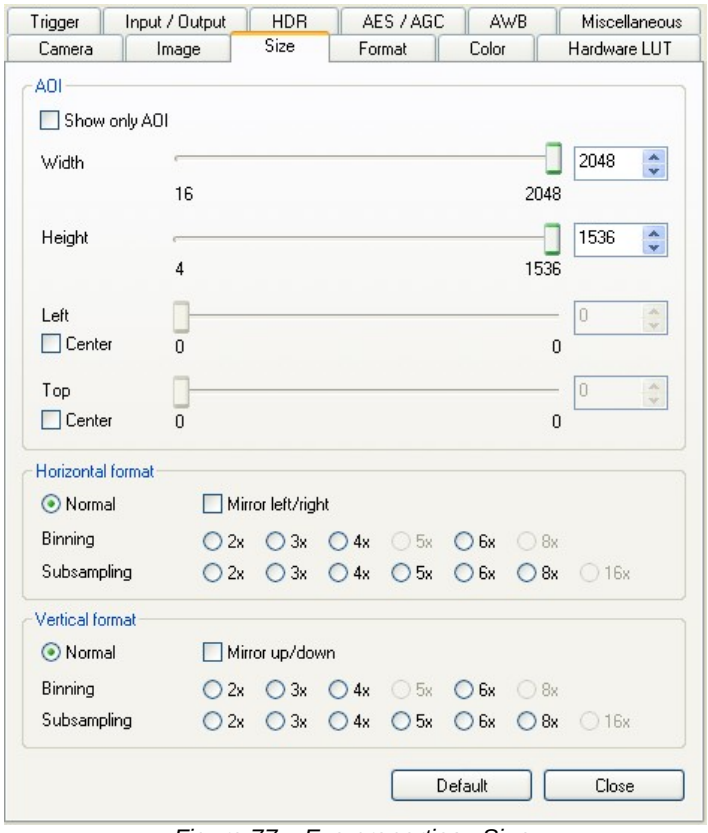


Figure 77: uEye properties - Size

- *AOI*
  These parameters allow selecting the size and position of the area of interest.
- *Show only AOI*
  The AOI is displayed without a black border. Internally, the image is managed at the AOI resolution and not the full sensor resolution. This function saves memory and computing time when rendering the image.
  - *Width*
    Sets the AOI width.
  - *Height*
    Sets the AOI height.
  - *Left*
    Sets the left-hand position of the AOI.
  - *Center*
    Select this check box to center the AOI horizontally.
  - Top
    Sets the top position of the AOI.
  - *Center*
    Select this check box to center the AOI vertically.

- *Horizontal format* / *Vertical format*
  With these check boxes and radio buttons, you can select the binning and subsampling settings for the image.

- *Normal*
  Disables binning and subsampling.
- *Mirror left/right* / *Mirror up/down*
  Select this check box to flip the image horizontally/vertically. On CMOS camera models, vertical mirroring is performed directly in the sensor.
- *2x/3x/4x/5x/6x/8x Binning*
  These radio buttons allow setting the binning factor. The image resolution is then reduced by the selected factor. You can use binning to increase the frame rate.

- *2x/3x/4x/5x/6x/8x/16x Subsampling*
  These radio buttons allow setting the subsampling factor. The image resolution is then reduced by the selected factor. You can use subsampling to increase the frame rate.

The Specifications: Sensors chapter shows you which binning and subsampling factors the individual camera models support.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Some color cameras perform only mono binning/subsampling due to the sensors they use. If mono binning or subsampling is used in a color camera, the color information will be lost.

Some monochrome cameras perform only color binning/subsampling due to the sensors they use. If color binning or subsampling is used in a monochrome camera, image artefacts might become visible.

Format

On this tab you can set parameters for the color format and display mode of your *uEye* camera (see also Color Filter (Bayer Filter)).

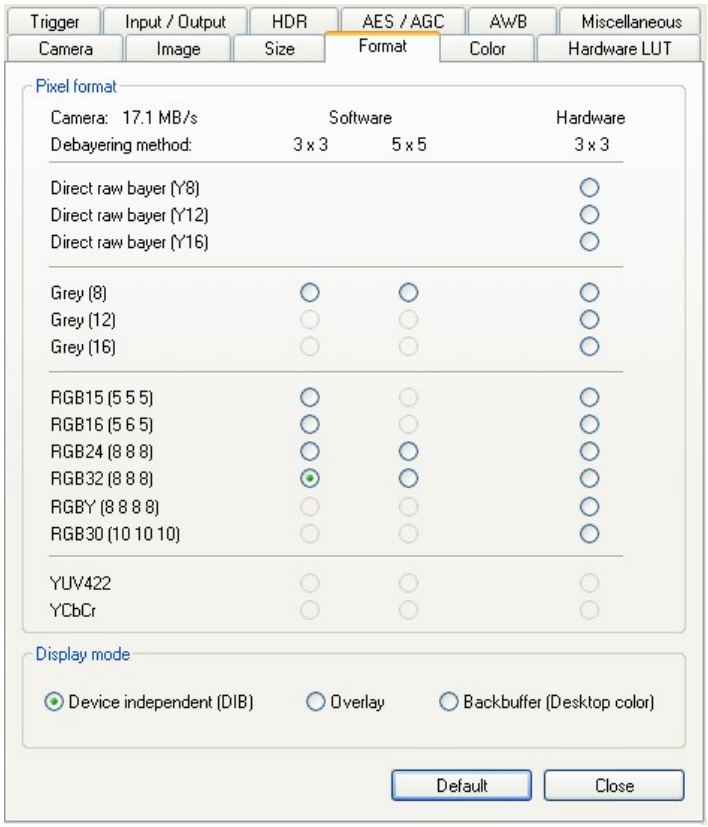


Figure 78: uEye properties - Format

- *Pixel format*
  With these settings you define the target format to which you want to convert the sensor's raw data (raw Bayer). The *Color Formats and Memory Formats* chapter in the *uEye Programming Manual* provides a detailed list of all *uEye* color formats and their representation in the memory.
  - *Debayering method*
    With this setting you select the conversion algorithm.
    - *Software 3x3*
      The conversion is performed by software in the PC. A filter mask of 3x3 pixels is used for the conversion.
    - *Software 5x5*
      The conversion is performed by software in the PC. A filter mask of 5x5 pixels is used for the conversion.
    - *Hardware 3x3*
      The conversion is performed in the camera. A filter mask of 3x3 pixels is used for the conversion. This radio button is only available for *GigE uEye HE* cameras. When you select hardware de-Bayering, you can also perform the LUT, Gamma and Hotpixel correction functions directly in the camera.
- With the format radio buttons you specify the format in which the image data are written to the memory. The following formats are available:
- *Direct raw bayer (8)*
  Direct output of the sensor's raw data (8 bits per pixel). If you are using a color camera, the pattern of the Bayer color filter is visible. With monochrome cameras, *raw Bayer* corresponds to the

grayscale format with the exception of the LUT/gamma curves.

- *Direct raw bayer (12)*
  Direct output of the sensor's raw data (12 bits per pixel, starting from the least significant bit (LSB)).
- *Direct raw bayer (16)*
  Direct output of the sensor's raw data (12 bits per pixel, starting from the most significant bit (MSB)).

- *Grayscale (8)*
  Output of a grayscale image to which the LUT/gamma curve has been applied (8 bits per pixel).
- *Grayscale (12)*
  Output of a grayscale image to which the LUT/gamma curve has been applied (12 bits per pixel, starting from least significant bit (LSB)).
- *Grayscale (16)*
  Output of a grayscale image to which the LUT/gamma curve has been applied (12 bits per pixel, starting from most significant bit (MSB)).

- *RGB15 (5 5 5)*
  Output of an image converted according to RGB 15 (5 bits per pixel for R, G and B)
- *RGB16 (5 6 5)*
  Output of an image converted according to RGB 16 (5 bits per pixel for R and G, 6 bits per pixel for B)
- *RGB24 (8 8 8)*
  Output of an image converted according to RGB 24 (8 bits per pixel for R, G and B)
- *RGB32 (8 8 8)*
  Output of an image converted according to RGB 32 (8 bits per pixel for R, G and B, 8 bit padding)
- *RGBY (8 8 8 8)*
  Output of an image converted according to RGB 24 (8 bits per pixel for R, G and B) and an additional gray channel (8 bits per pixel)
- *RGB30 (10 10 10)*
  Output of an image converted according to RGB 30 (10 bits per pixel for R, G and B, 2 bit padding (MSB = 0))

- *YUV422*
  Output of an image converted according to YUV (8 bits per pixel for U, Y, V and Y)
- *YCbCr (8 8 8 8)*
  Output of an image converted according to YUV (8 bits per pixel for Cb, Y, Cr and Y)

We recommend 32-bit RGB mode for TrueColor applications. Y8 mode is usually used for monochrome applications.

The *General: Color Formats and Memory Formats* chapter in the *uEye Programming Manual* shows you in detail how the color formats are represented in the image memory.

- *Display mode*
  With these radio buttons you select the display mode for the image.
  - *Device independent (DIB)*
    The processor actively renders the image. This color format is supported by all graphics hardware and is recommended for applications that will be used on different PCs.
  - *Overlay*

In this mode the images are written directly to an invisible area of the graphics card, mixed with overlay image data and displayed by the card without load on the CPU. The mode also allows rendering in YUV format and scaling the images in real time.

- *Backbuffer (Desktop color)*
  In this mode the images are written directly to an invisible area *(BackBuffer)* of the graphics card and displayed by the card without load on the CPU.

The display modes *Overlay* and *Backbuffer* are only supported by graphics cards with *DirectDraw* functionality.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Color

This tab provides color rendering settings for your *uEye* camera (see also Color Filter (Bayer Filter)).

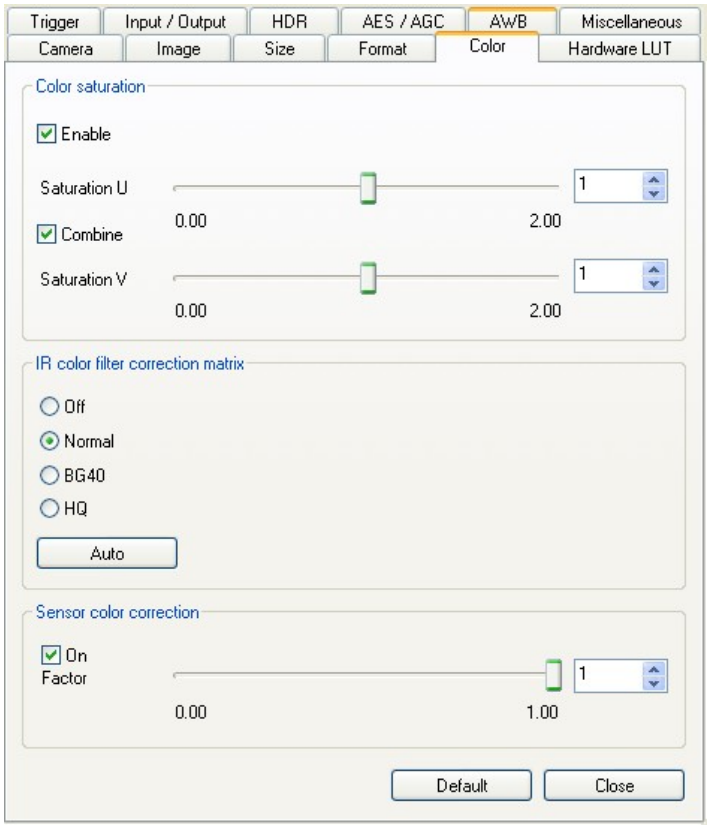


Figure 79: uEye properties - Color

- *Color saturation*
  This function enables and configures color saturation control.
  In the YUV format, color information (i.e. the color difference signals) is provided by the U and V channels. In the U channel they result from the difference between the proportion of blue and Y (luminance), in the V channel from the difference between the proportion of red and Y. For the use in other color formats than YUV, U and V are converted using a driver matrix.
  - *Combine*
    Selecting this check box synchronizes the two *Saturation U* and *Saturation V* sliders.
- *IR color filter correction matrix*
  When using color cameras with IR filter glass, you need to set the appropriate color correction matrix to ensure correct color rendering. The driver detects the IR filter type and sets this value automatically (*Auto button)*. You can also select the correction matrix manually.
- *Sensor color correction*
  This function corrects the color values of a pixel. The colors are rendered more accurately after the color crosstalk of the individual Bayer pattern filters has been eliminated by the color correction. The color correction factor is steplessly adjustable between 0 (no correction) and 1 (full correction).
  Activating the sensor color correction may increase CPU load.
- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Hardware LUT

This tab provides settings for the hardware LUT curve of the *GigE uEye HE* camera. Each look-up table (LUT) for the *uEye* contains modification values for the image brightness and contrast parameters. When a LUT is used, each brightness value in the image will be replaced by a value from the table. LUTs are typically used to enhance the image contrast or the gamma curve.

This feature is only available for *GigE uEye HE* cameras.

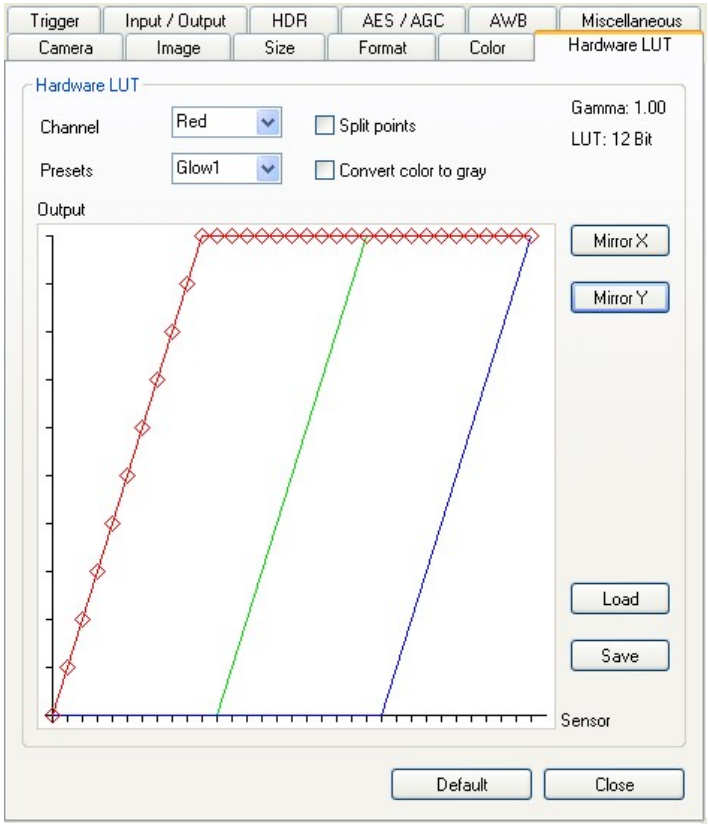


Figure 80: uEye properties - Hardware LUT

- *Channel*
  In this drop down box, you can choose whether you want to display the LUT for all channels or just for red, green or blue.
- *Split points*
  The LUT has 32 knee points by default. Knee points are used for defining the individual sections of the curve. When you select the *Split points* check box, each knee point is split into two separate points. Only the start and end points of each curve section can be defined independently of the adjacent sections.
- *Presets*
  In this drop down box, you can select and load predefined LUT curves. The following LUT curves are available:

Linear	Linear LUT curve without effect
Negative	Predefined LUT, inverts the image
Glow1	Predefined LUT, false-color representation of the image
Glow2	Predefined LUT, false-color representation of the image
Astro1	Predefined LUT, false-color representation of the image
Rainbow1	Predefined LUT, false-color representation of the image
Map1	Predefined LUT, false-color representation of the image
Cold/Hot	Predefined LUT, false-color representation of the image
Sepic	Predefined LUT, uses sepia toning for coloring the image
Only red	Predefined LUT, shows only the red channel of the image
Only green	Predefined LUT, shows only the green channel of the image
Only blue	Predefined LUT, shows only the blue channel of the image

- *Convert color to gray*
  When you are using a *GigE uEye HE* color camera, you can convert the color images to monochrome in the camera before applying the LUT curve. This setting is recommended if you want to use a LUT for false-color representation. The images are transferred in RGB format.

- *Output*
  The diagram shows that part of the LUT curve that is selected in the *Channel* box. You can drag and drop each knee point of the curve. To draw a smooth curve for the selected channel, left-click on a blank space next to the curve.

- *Mirror X/Y*
  These buttons allow mirroring the curve about the X and Y axes.

- *Load/Save*
  Click Save to save the current LUT curve to a text file. With Load, you can load a saved LUT curve from a file.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Trigger

This tab provides the settings for triggered image capture with your *uEye* camera (see also Digital Input (Trigger)).

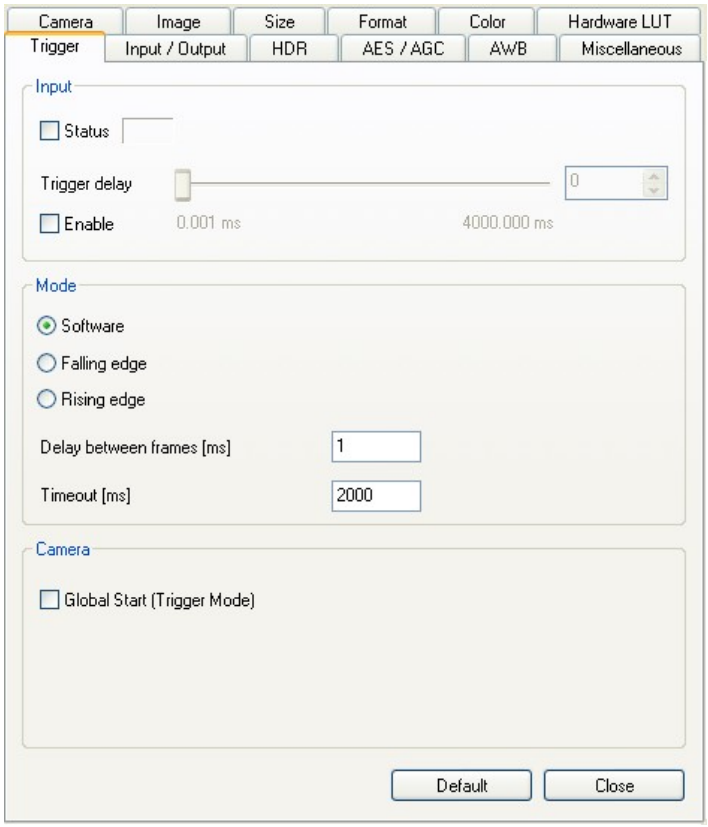


Figure 81: uEye properties - Trigger

- *Input*
  - *Status*
    If you select this check box, the signal level applied at the camera's trigger input is polled and displayed.
  - *Trigger delay*
    Select this check box to set a delay between the arrival of a software or hardware trigger signal and the start of exposure.

- *Mode*
  With these radio buttons, you choose which trigger mode you want to activate in the camera:
  - *Software*
    The camera is running in software trigger mode without a signal applied. The images are captured continuously.
  - *Falling edge*
    The camera captures an image on the falling edge of the signal applied to the trigger input.
  - *Rising edge*
    The camera captures an image on the rising edge of the signal applied to the trigger input.
  - *Delay between frames [ms]*
    In software trigger mode, you can set a time delay between two triggered image captures.
  - *Timeout [ms]*
    Specifies a timeout for the trigger mode. If the camera does not receive a trigger signal within this time, a timeout message is transmitted and the transmission error counter is incremented.

- *Camera*
  - *Global Start (Trigger Mode)*
    If you select this check box, all rows of a rolling shutter sensor are exposed simultaneously. Activating Global Start only makes sense when using a flash. This function is currently supported by the UI-1480/UI-5480 models.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Please note that the frame rate in trigger mode is always lower than in freerun mode. This is due to the sequential transmission. First the exposure takes place, then the transfer. A new exposure can only be performed after the transmission is completed. Therefore, the freerun mode is faster.

High trigger rates are achieved only with short exposure times and a high pixel clock setting.

Input/Output

On this tab, you can set the parameters for the flash output and the GPIOs on your *uEye* camera (see also Digital Output (Flash Strobe) and General Purpose I/O).

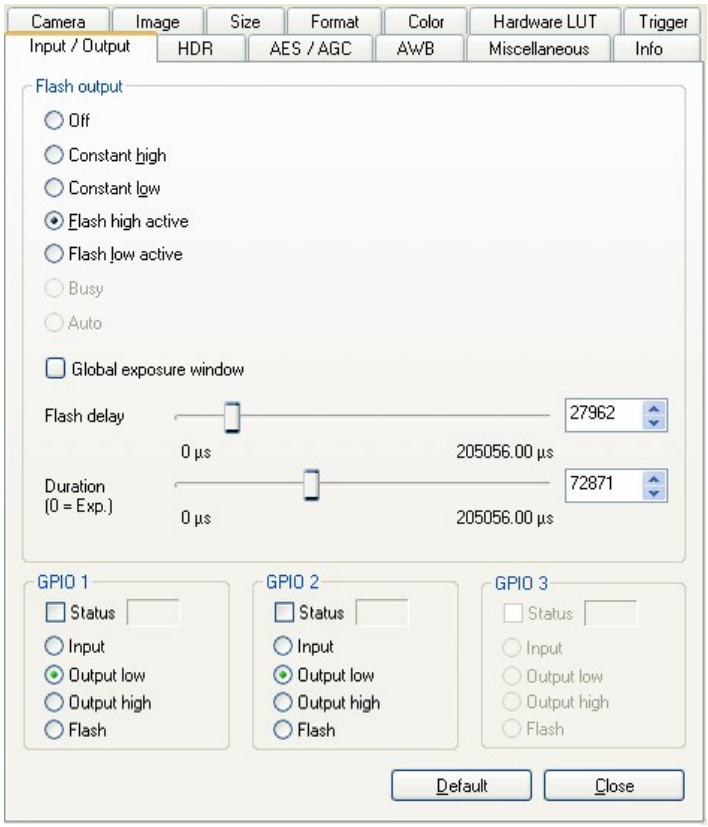


Figure 82: uEye properties - Input/Output

When you are using the *uEye*'s flash function, you need to re-enable the flash (i.e. disable and then activate it again) whenever you change the pixel clock setting or horizontal image geometry. This is necessary to newly synchronize the internal timing settings of the flash output with the start of sensor exposure.

- *Flash output*
  With these radio buttons, you choose which digital output function you want to activate on the camera:
  - *Off*
    The digital output is disabled.
  - *Constant high*
    The digital output is set to High regardless of the exposure.
  - *Constant low*
    The digital output is set to Low regardless of the exposure.
  - *Flash high active* (only in trigger mode)
    The digital output is set to High during the exposure.
  - *Flash low active* (only in trigger mode)
    The digital output is set to Low during the exposure.
  - *Busy*
    The digital output signalizes whether the camera is ready for the next trigger. This function is not

yet implemented.

- *Auto*
  Automatic adjustment of the flash duration when using automatic brightness control. This function is not yet implemented.
- *Global exposure window* (only in trigger mode)
  The values for flash delay and duration are calculated to trigger the flash when all sensor rows are exposed simultaneously for sensors with rolling shutters. If you are using the Global Start function, the flash delay has to be set to 0 (see also Shutter Methods).
- *Flash delay* (only in trigger mode)
  Sets the delay for the digital output. After an exposure has started, actuating the digital output is delayed by the time set in Flash delay.
  For some models, and depending on the operating mode, delays of up to 200 µs must be set in order to exactly hit the beginning of the exposure time of the pixels. You can look up the exact value for each camera under *Sensor delay to exposure start* in the Sensors chapter.
- *Duration* (only in trigger mode)
  Sets the switching time of the digital output. The digital output is actuated for the time set in Duration. The value 0 means that the signal is active over the entire exposure time (default).

- *GPIO 1/2/3* (*USB uEye LE* and *GigE uEye HE* cameras only)
  The GPIOs (General Purpose I/O) of the *uEye* cameras can be used as inputs or outputs.
  - *Status*
    Polls the signal level applied to the GPIO.
  - *Input*
    Sets the *GPIO* as trigger input.
  - *Output low*
    Sets the *GPIO* as output. The output signal is statically set to *low*.
  - *Output high*
    Sets the *GPIO* as output. The output signal is statically set to *high*.
  - *Flash*
    Sets the *GPIO* as flash output. The settings you made in the *Flash output* box are used.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Detailed information on wiring the *uEye* inputs and outputs is provided in the *Electrical Specifications* section of the Specifications chapter.

HDR

On this tab, you can configure the HDR mode settings for your *uEye* camera.

This feature is currently only available for the UI-122x-M/C and UI-522x-M/C *uEye* models.

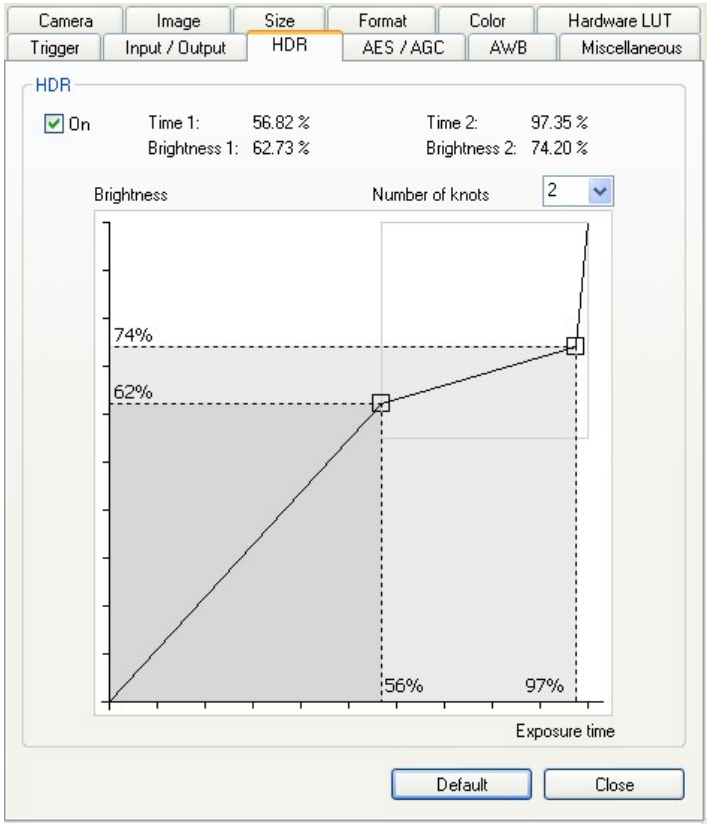


Figure 83: uEye properties - HDR

By exposing the sensor cells in two or three phases, the *HDR (High Dynamic Range)* function enhances dynamics during image capture. This means that very bright and very dark image parts are displayed in one image without causing overexposure.

- *Number of knots*
  In this drop down box, you can choose whether the HDR curve should have one or two definable knee points.
- *Brightness/Time*
  The x value of a knee point indicates the first phase in percent of the currently set exposure time. The y value gives the proportion of maximum pixel intensity for this phase in percent.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Example

A setting of x = 60, y = 80 would therefore produce the following results:
The first exposure phase lasts for 60% of the set exposure time. In this first exposure phase, all pixels are exposed to at most 80% of maximum pixel intensity and remain at 80% until this phase

is over. In the second exposure phase, they are exposed again and may reach the full pixel intensity.

HDR is supported by the UI-122X-X and UI-522X-X models.

For cameras of types UI-122X-C and UI-522X-C, the RGB gain controls must be set to the same values to ensure accurate color rendition in HDR mode.

Using automatic brightness control in HDR mode may lead to short-term brightness fluctuations.

To determine the optimum knee point coordinates, we recommend operating the camera at a medium frame rate. A high frame rate reduces the time frame for post-exposure.

AES/AGC

On this tab, you can set parameters for automatically adjusting the exposure time and sensor gain of your *uEye* camera (see also Automatic Image Control).

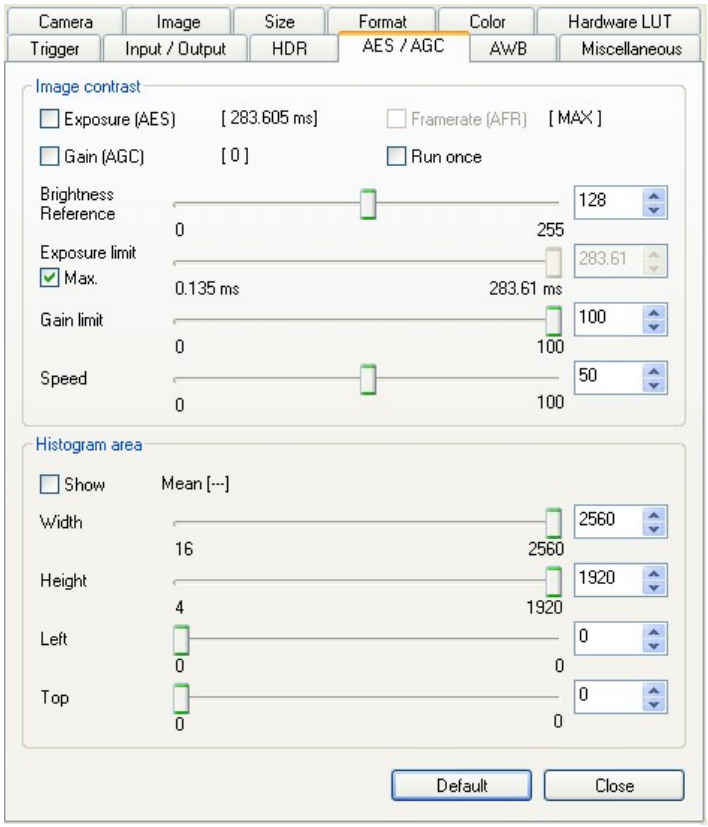


Figure 84: uEye properties - AES/AGC

- *Auto Exposure Shutter (AES)* automatically adjusts image brightness based on the exposure shutter setting. Long exposure times may cause motion blur.
- *Auto Gain Control (AGC)* automatically adjusts image brightness based on the hardware gain control setting of the camera sensor . You can activate this function in addition to *AES* if ambient light conditions are poor. High gain settings may cause artefacting.
- *Auto Frame Rate (AFR)* adjusts the *frame rate* to allow longer exposure times (see also Pixel Clock, Frame Rate and Exposure Time). Selecting this check box might decrease the frame rate substantially. This function is only available when *AES* is active.

- *Image contrast*
  Use the following settings to configure automatic brightness control:
  - *Exposure (AES)*
    Select this check box to automatically adjust the image brightness based on the exposure shutter setting.
  - *Gain (AGC)*
    Select this check box to automatically adjust the image brightness based on the gain setting.
  - *Framerate (AFR)*
    Select this check box to adjust the frame rate in such a way that the exposure shutter is optimized.. This option is only available when *AES* is active.

- *Run once*
  Select this check box to automatically disable the adjustment functionality as soon as the target value is reached.
- *Brightness reference*
  Default average grayscale value (brightness) of the image.
- *Exposure limit*
  Sets the upper limit for the exposure time. Gain control is activated as soon as the upper limit of the exposure time is reached.
  The maximum value for automatic exposure time control is linked to the camera settings. If the maximum possible exposure time value has changed, e.g. through changes in the timing parameters, then this value is applied as the maximum Auto Exposure value. Set values that are less than the maximum value are not affected.
- *Gain limit*
  Sets the maximum gain limit. On reaching the lower limit (gain = 0), the exposure time adjustment range is activated.
- *Speed*
  Sets the adjustment speed. The higher the speed control is set, the faster the adjustment. Setting the speed control to 0 disables the adjustment functionality.

- *Histogram area*
  With the histogram settings, you define the image area you want to use for determining the average grayscale value. The following parameters are available:
  - *Width*
  - *Height*
  - *Left*
  - *Top*
    By default the histogram area always equals the size of the current image. If you change the size of the current image, the image area for determining the grayscale value is automatically adapted to the new image size.
  - *Show*
    Select this check box to display the defined histogram area as an overlay. The currently calculated average grayscale value is also shown.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

AWB (Auto White Balance)

On this tab, you can set parameters for automatically adjusting the white balance of your *uEye* camera (see also Automatic Image Control).

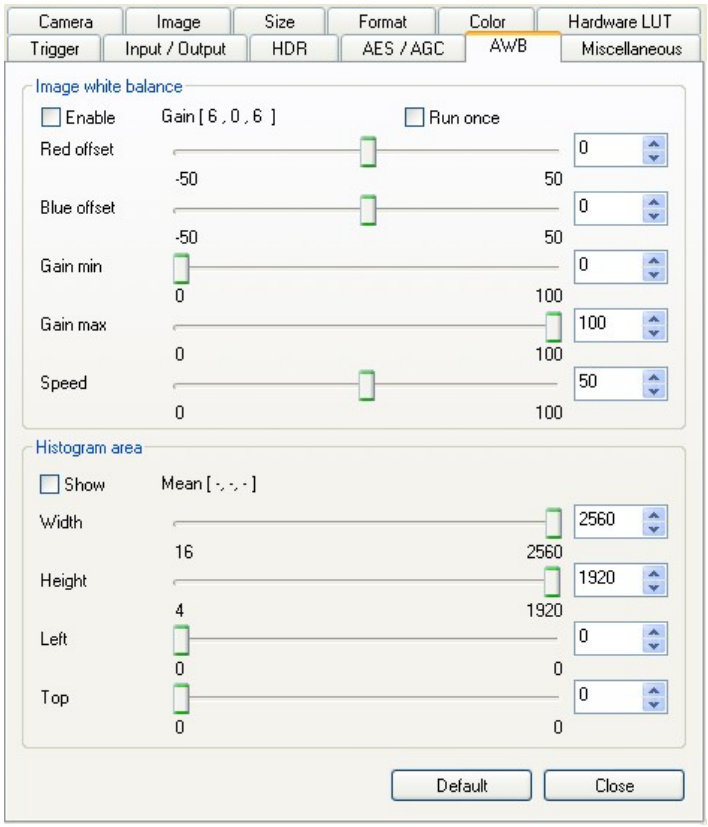


Figure 85: uEye properties - AWB

Every light source has a specific color temperature. Images captured with a camera can have a reddish (low color temperature) or bluish hue (high color temperature), depending on the color temperature of the light. This hue can be corrected by white balancing.

To carry out white balancing, aim the camera at a surface of a uniform gray color. You can perform white balancing either manually with the RGB gain control or by using the *uEye's Auto White Balance (AWB)* function.

- *Image white balance*
  - *Enable*
    Activates automatic white balance.
- *Run once*
  Select this check box to automatically disable the adjustment functionality as soon as the target value is reached.
  - *Red offset/Blue offset*
    With these sliders you can manually adjust the red and blue content of the image.
  - *Gain min*
    With this slider you can set a basic gain value for white balancing. Color cameras without master gain can emulate this base value by using the Gain min value set for AWB.
  - *Gain max*
    Upper adjustment limit.
  - *Speed*

Sets the adjustment speed. The higher the speed control is set, the faster the adjustment. Setting the speed control to 0 disables the adjustment functionality.

- *Histogram area*
  With the histogram settings you define the image area you want to use for determining the average grayscale value. The following parameters are available:
  - *Width*
  - *Height*
  - *Left*
  - *Top*
    By default the histogram area always equals the size of the current image. If you change the size of the current image, the image area for determining the grayscale value is automatically adapted to the new image size.
  - *Show*
    Select this check box to display the defined histogram area as an overlay. The currently calculated RGB values are also indicated.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

Miscellaneous

This tab provides parameters for setting the hotpixel correction and test image function for your *uEye* camera.

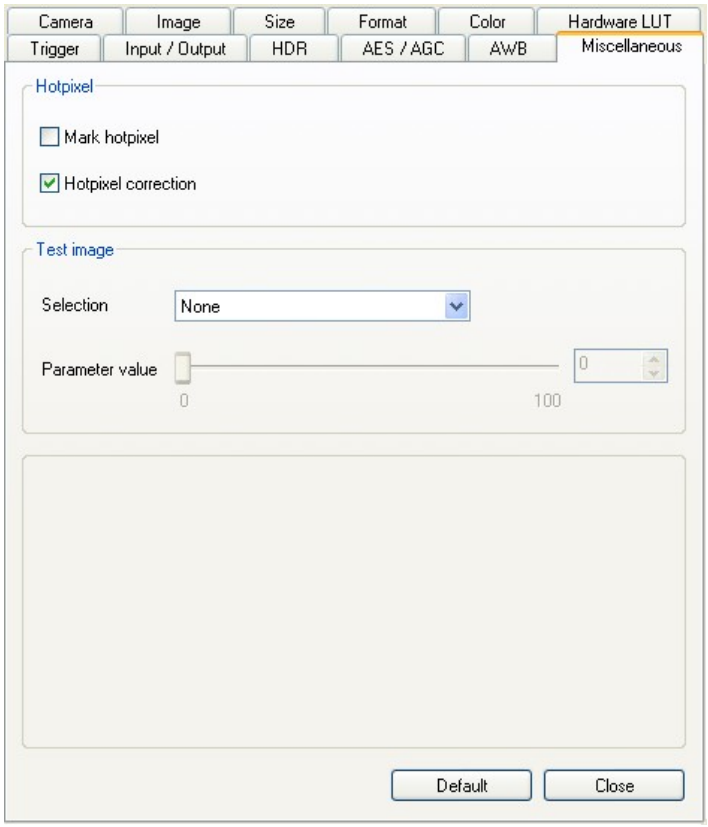


Figure 86: uEye properties - Miscellaneous

- *Hotpixel*
  Hot pixel are sensor pixels whose brightness value deviates significantly from the brightness value of the surrounding pixels in the case of long exposure times or a high gain setting. Basically every sensor has a small number of hot pixels. CCD sensors have less hot pixels than CMOS sensors, which is due to the different sensor systems. The hot pixels are detected during *uEye* camera testing and written to a coordinate list in the camera. If hotpixel correction is enabled, the correction function eliminates these pixels before debayering.
  - *Mark hotpixel*
    If you select this check box, the hot pixel positions stored in the camera are graphically represented in the image.
  - *Hotpixel correction*
    Select this check box if you want to enable a software-based hotpixel correction.

- *Test image*
  The camera transmits a selectable test image that you can use for testing the data transmission. You can choose from different types of test images, depending on the camera type.
  - *Selection*
    Some of the test images (e.g. *Black image* and *White image*) are created by the sensor and are available in both, USB-based and GigE-based*uEye* models.
    With all *GigE uEye HE* cameras (CMOS and CCD sensors) you can also choose moving and stationary test images that are created by the camera hardware (e.g. *Colored wedge, Animated line, Coldpixel/Hotpixel grid*).

Test images marked (RAW) are only properly displayed in raw Bayer mode (see Color).

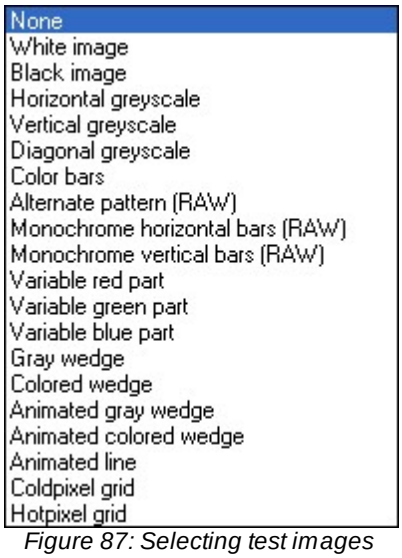


Figure 87: Selecting test images (here: UI-5480-C)

- *Parameter value*
  You can adjust the appearance of some of the test images with the *Parameter value* slider.

Animated test images are ideal for testing recorded sequences.

With some sensors, the sensor gain setting has an influence on the test image.

For USB cameras, you can use a white test image to check the camera's maximum load on the USB bus. Due to the transmission process, completely white camera images require a somewhat more bandwidth on the USB bus than completely black images.

- *Default*
  Click this button to reset all parameters to the model-specific defaults.

8.3 uEye Player

8.3.1 Functionality

Only one instance of the uEye Player can be opened at a time. This means that the player cannot be displayed multiple times on screen.

Using the *uEye Player*, you can open and play back AVI files, e.g. created with the *uEye Demo* program, in MJPEG format. Images stored in JPG/BMP format can also be displayed.

The *uEye Player* can be accessed as follows:

- *Start → All Programs → IDS → uEye → uEye Player*

After program start, the *uEye Player* will display the following dialog box:

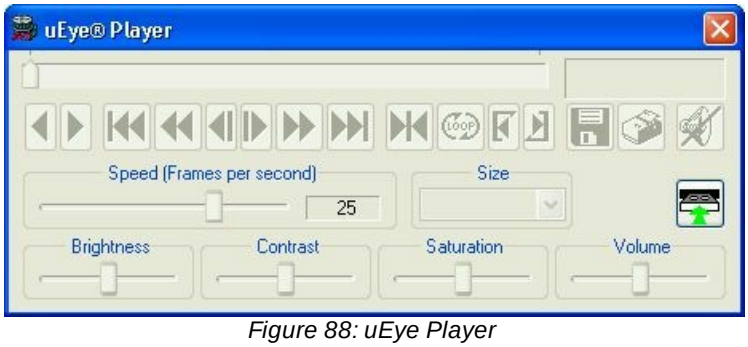


Figure 88: uEye Player

The user interface of the *uEye Player* adjusts to the language of the operating system. After the player has started, only the button for loading a video file is active. How to load a video file will be explained in the following section.

8.3.2 Loading an AVI File

After clicking the  button, the "Open File" dialog box opens where you can select one or more files to be opened. If you select multiple files, they will be played back one after the other in alphabetical order.

Alternatively, AVI files can also be opened and played back simply by drag and drop. To do this, drag the files with the left mouse button pressed into the *uEye Player* dialog box; then, release the mouse button.

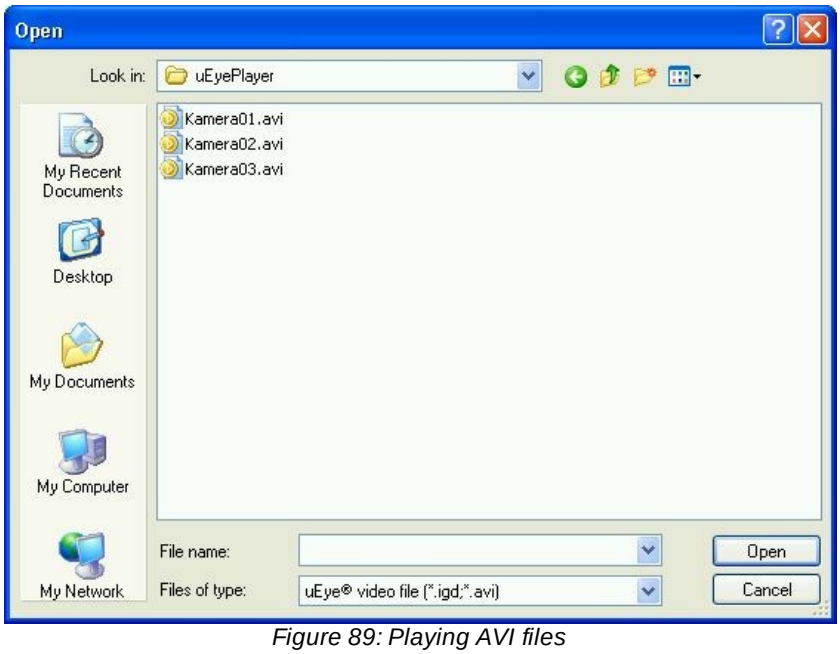


Figure 89: Playing AVI files

Once the required file has been opened, another window for the video film appears on top of the *uEye Player*. You can move this window freely around the screen, independently of the player window.

When you place the mouse pointer inside the video window, its display changes to a small magnifying glass and the zoom function of the *uEye Player* is enabled. Using the left mouse button, you can now select an area within the video image that will be resized to fill the window *(Zoom In)*, even during playback. Double-clicking the left mouse button inside the window will revert the display to its original size *(Zoom Out)*.

Figure 90: uEye Player - Playback

8.3.3 Operation Controls

The buttons in the *uEye Player* user interface are for the most part self-explanatory and are based on the keys and symbols of a standard video recorder.

	Reverse: play video backwards
	Play: play video forwards
	Stop: stop playing the video (symbol appears after you click the Play button). The last frame will be frozen.
	Jump to start of video
	Fast rewind
	One frame back
	One frame forward
	Fast forward
	Jump to end of video
	Go to specific frame. When you click this button, a small dialog box will open where you can enter the frame number.
	Start Loop mode (blue text)
	Stop Loop mode (red text)
	Start of playback loop
	End of playback loop
	Save current frame as BMP file or JPEG file
	Print current frame
	Sound on/off
	Open video file
	Close video file

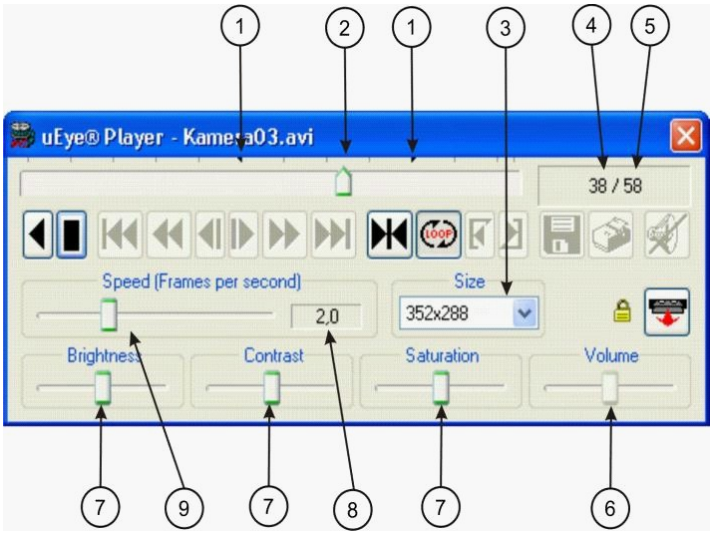


Figure 91: uEye Player operation controls

1	Position markers for the defined playback loop
2	Current position in video file
3	Size of the video display window in pixels
4	Current frame number
5	Number of frames in video file
6	Volume control
7	Frame display parameter settings. Each slider can be reset to its default setting by clicking it with the right mouse button. The settings are also applied to the subsequent files.
8	Current playback speed setting
9	Playback speed in relation to the recording speed from 0.1 to 200 fps. The values are set in increments.

Using the  button, you can jump directly to a specific frame. To do so, enter a numerical value between 1 and the total number of frames in the video sequence.

Figure 92: Jump to specific frame

8.3.4 Loop Mode

When using the *uEye Player*, you can select specific periods of time within the video sequence and play them back in an endless loop. To do this, click the  button. This enables the two icons for

marking the start and end of the playback loop. To select the start position, use the mouse to drag the position marker to the desired start position in the endless loop and then click the button.

Then, set the position marker to the desired end position using the same method. Click the button to complete defining markers.

8.3.5 Video Window and Full Screen Mode

The video window is displayed dynamically. The possible display sizes are determined based on the capture resolution and the screen resolution.

The video is played back at the same aspect ratio that was used for the capture.

To enable full screen mode, press the CTRL + F keys. In this mode, you can use the keyboard for playback control. To quit this mode, press ESC or press CTRL + F again.

Key combinations in full screen mode

CTRL + F	Start/stop full screen mode
ESC	Quit full screen mode
CTRL + O	Open video file
← (left arrow)	One frame back
→ (right arrow)	One frame forward
SPACE (spacebar)	Start/stop video playback

9 Specifications

This chapter lists the specifications of the available *uEye* camera models. In the table below, you will find an overview of all the models in the *Eye* camera range.

UI	–	##	#	#	–	X	–	XX

Short for *uEye*

Sensor and shutter system

12	*USB uEye* CMOS Global Shutter
14/15/16	*USB uEye* CMOS Rolling Shutter
22/23/24	*USB uEye* CCD Progressive Scan
52	*GigE uEye* CMOS Global Shutter
54/55/56	*GigE uEye* CMOS Rolling Shutter
62/63/64	*GigE uEye* CCD Progressive Scan

Resolution

1	VGA	640 x 480 (0.30 Mpixels)
2	WVGA	752 x 480 (0.36 Mpixels)
	PAL	768 x 582 (0.45 Mpixels)
3	XGA	1024 x 768 (0.78 Mpixels)
4	SXGA	1280 x 1024 (1.30 Mpixels)
5	UXGA	1600 x 1200 (2.00 Mpixels)
6	QXGA	2048 x 1536 (3.10 Mpixels)
8	QSXGA	2592 x 1944 (5.00 Mpixels)

Housing

0/0SE	*USB uEye* C-mount with straight housing
0RE	*USB uEye RE* C-mount with IP65/67 housing
1SE	*USB uEye SE* (OEM): C-mount, without housing
2SE	*USB uEye SE* (OEM): PCB stack
5LE	*USB uEye LE* CS-mount with housing
6LE	*USB uEye LE* board level with S-mount M12
7LE	*USB uEye LE* board level with S-mount M14
8LE	*USB uEye LE* board level without lens mount
9	*USB uEye* with housing and angled C-mount

Color format

M	Monochrome sensor
C	Color sensor

Filter glass

HQ	Infrared cut filter, type *HQ* (standard for *uEye* color cameras)
BG	Infrared cut filter, type *BG* (discontinued)
DL	Daylight cut filter (optional)
GL	Plain glass (standard for *uEye* monochrome cameras)

9.1 Specifications

The diagrams shown in the sensor specifications section indicate the *relative* sensitivities of the *uEye* cameras in the spectral range. Therefore, the characteristic curves cannot be compared to each other.

9.1.1 CMOS Cameras

UI-122x / UI-522x

Sensor specification				
Sensor type	CMOS			
Shutter system	Electronic global shutter			
Readout mode	Progressive scan			
Resolution class	WVGA			
Resolution	752 x 480 pixels (0.36 Mpixels)			
Aspect ratio	14:9			
Bit depth	10 bits			
Optical sensor class	1/3 inch			
Exact sensitive area	4.51 mm x 2.88 mm			
Exact optical sensor diagonal	5.4 mm (1/3.0 inch)			
Pixel size	6.0 µm, square			
Sensor name, monochrome	Micron MT9V032C12STM			
Sensor name, color	Micron MT9V022I77ATC			
Sensor name, color (*USB uEye LE*)	Micron MT9V032C12STC			
Gain				
Monochrome model (master gain)	4.0x			
Color model (master/RGB)	4.0x/5.0x (software)			
Offset control, mode	Auto/manual, additive			
Gain boost	1.6x			
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-40 *1)	5-42 *1)	5-46 *1)
Pixel clock range (with subsampling/binning)	MHz	5-60 *1)	5-59 *1)	5-60 *1)
Frame rate (freerun mode)	fps	87 *2)	91.5 *2)	100 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	75 *2)	60 *2)	75 *2)
Exposure time in freerun mode	ms	0.08 *2)-5500 *3)	0.076 *2)-5500 *3)	0.07 *2)-5500 *3)
Exposure time in trigger mode	ms	0.08 *2)-5500 *3)	0.076 *2)-5500 *3)	0.07 *2)-5500 *3)
AOI				
Mode		Horizontal *4) + Vertical *4)		
AOI image width, step width	Pixels	16-752, 4	16-752, 4	16-752, 4
AOI image height, step width	Pixels	4-480, 2	4-480, 2	4-480, 2
AOI position grid horizontal, vertical	Pixels	4, 2	4, 2	4, 2
AOI frame rate, 640 x 480 pixels (VGA)	fps	100	105	115
AOI frame rate, 320 x 240 pixels (CIF)	fps	200	211	231
AOI frame rate, 160 x 120 pixels	fps	344	344	390
Binning				

Mode		Horizontal *4) + Vertical *4)		
Method		H + V: Monochrome binning, averaging		
Frame rate with 2x binning, 376 x 240 pixels	fps	238	234	238
Frame rate with 4x binning, 188 x 120 pixels	fps	407	400	407
Subsampling				
Mode		-	H + V	H + V
Method		-	Mono/color subsampling	Mono/color subsampling
Frame rate w/ 2x subsampling, 376 x 240 pixels	fps	-	91	100
Frame rate w/ 4x subsampling, 188 x 120 pixels	fps	-	91	100
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	19.7 ±0.25	< 5	< 5
Trigger delay with falling edge	µs	38.0 ±0.25	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 200 *2)	< 200 *2)	< 200 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	0.4-1.0	2.3-3.1	2.9-4.2

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

*3) Requires minimum pixel clock frequency.

*4) Use of this function increases the frame rate.

*5) The connected load depends on the sensor model and the pixel clock setting.

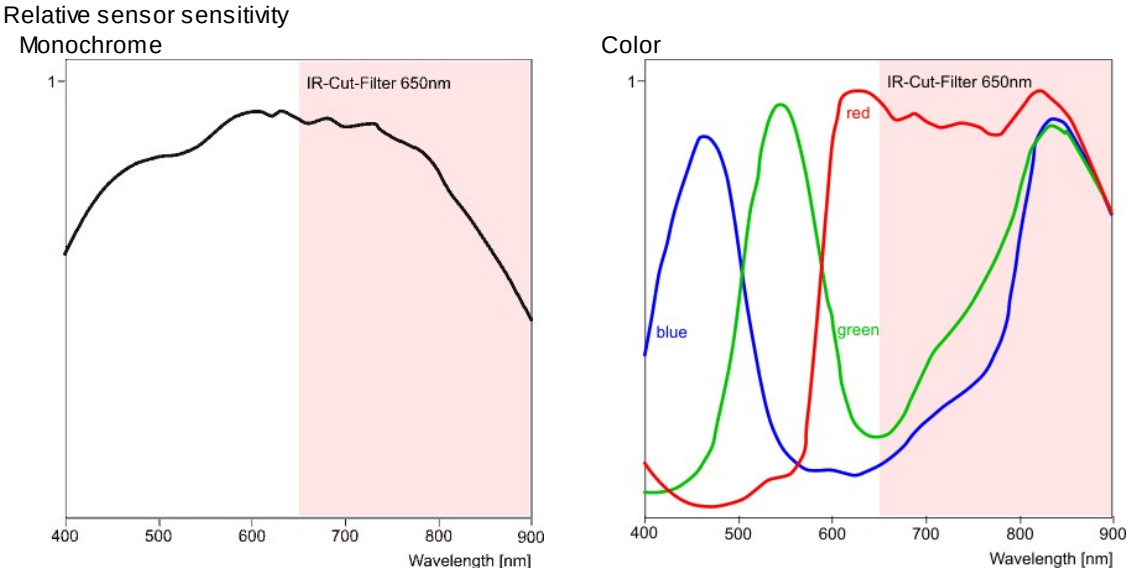


Figure 93: Sensor sensitivity of the UI-122x / UI-522x

Notes on using the UI-122x / UI-522x

- Optimum pixel clock frequency is 27 MHz.
- The color version has no hardware gain controls. The driver simulates these.
- The RGB gain controls have no effect in raw Bayer mode.
- Sensor speed does not increase for AOI width <608 pixels (constant image height).
- The sensor binning works by averaging pixels, so the image will not become brighter when binning is activated.
- The frame rate is not significantly higher with horizontal 4x binning than with 2x binning.
- Extreme overexposure may shift the black level. As an effect, the white level is no longer reached.
- Functions that modify image content (such as exposure or gain) are applied with a delay of one frame time. This is also the case in trigger mode.
- IR illumination with 900 nm causes blooming.
- With horizontal 4x binning, a dark column appears at the right-hand image border, which is caused by the sensor.
- For sensor reasons, the (black level) offset cannot be modified when HDR mode is active.
- Master gain and gain boost should be disabled when using HDR mode.

UI-154x / UI-554x

Sensor specification				
Sensor type	CMOS			
Shutter system	Electronic rolling shutter			
Readout mode	Progressive scan			
Resolution class	SXGA			
Resolution	1280 x 1024 pixels (1.3 Mpixels)			
Aspect ratio	5:4			
Bit depth	10 bits			
Optical sensor class	1/2 inch			
Exact sensitive area	6.66 x 5.32 mm			
Exact optical sensor diagonal	8.5 mm (1/1.9 inch)			
Pixel size	5.2 µm, square			
Sensor name, monochrome	Micron MT9M001			
Sensor name, color	-			
Gain				
Monochrome model (master gain)	13x			
Offset control, mode	Auto/manual, additive			
Gain boost	1.5x			
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-43 *1)	1-46 *1)	1-61 *1)
Pixel clock range (with subsampling/binning)	MHz	5-50 *1)	1-59 *1)	1-61 *1)
Frame rate (freerun mode)	fps	25 *2)	26.7 *2)	35 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	23 *2)	22 *2)	33 *2)
Exposure time in freerun mode	ms	0.035 *2)-980 *3)	0.035 *2)-4900 *3)	0.026 *2)-4900 *3)
Exposure time in trigger mode	ms	0.035 *2)-980 *3)	0.035 *2)-4900 *3)	0.026 *2)-4900 *3)
AOI				
Mode		Horizontal *4) + Vertical *4)		
AOI image width, step width	Pixels	32 - 1280, 4	32 - 1280, 4	32 - 1280, 4
AOI image height, step width	Pixels	4 - 1024, 2	4 - 1024, 2	4 - 1024, 2
AOI position grid horizontal, vertical	Pixels	4, 2	4, 2	4, 2
AOI frame rate, 1024 x 768 pixels (XGA)	fps	39	41	54
AOI frame rate, 640 x 480 pixels (VGA)	fps	84	90	115
AOI frame rate, 320 x 240 pixels (CIF)	fps	231	247	320
Binning				
Mode		-	-	-
Subsampling				

Mode		Horizontal *4) + Vertical *4)		
Method		H + V: Color subsampling		
Frame rate w/ 2x subsampling, 640 x 512 pixels	fps	79	94	110
Frame rate w/ 4x subsampling, 320 x 256 pixels	fps	219	260	305
Frame rate w/ 8x subsampling, 160 x 128 pixels	fps	511	522	623
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	19.7 ±0.25	< 5	< 5
Trigger delay with falling edge	µs	38.0 ±0.25	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 200 *2)	< 200 *2)	< 200 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	0.5-1.0	2.6-3.2	3.0-4.3

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

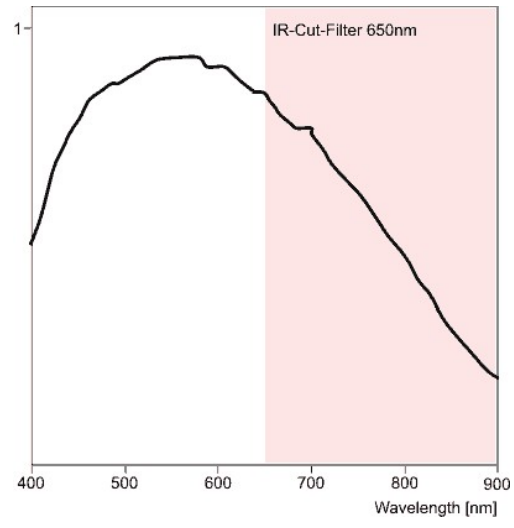
*3) Requires minimum pixel clock frequency.

*4) Use of this function increases the frame rate.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity

Monochrome



Color

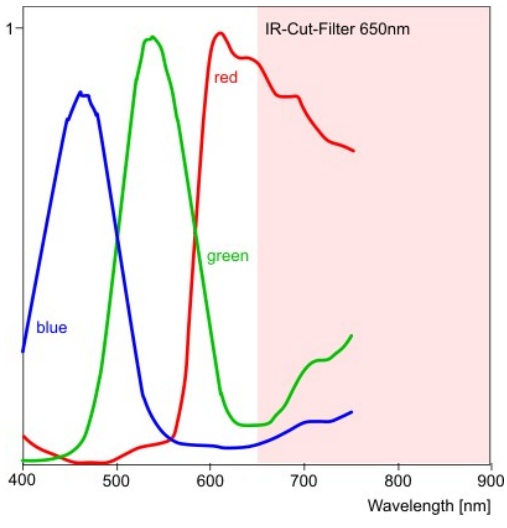


Figure 94: Sensor sensitivity of the UI-154x / UI-554x

Notes on using the UI-154x / UI-554x

- Sensor speed does not increase for AOI width <240 pixels.
- Extreme overexposure shifts the black level. Please deactivate the Auto Offset function in this case.
- At very long exposure times and minimum gain, the white level may not be reached. The gain should be increased by one step in this case.
- Monochrome version only: The sensor internally works like the color version. This might lead to artefacts when subsampling is used.
- The brightness of the first and last line might deviate due to the sensor.
- Gain values between 53 and 99 may lead to image inhomogeneity.
- Cameras with a date of manufacture after Dec. 9, 2008: The offset control has been calibrated internally. The calibration corrects offset errors when gain is used. In calibrated cameras, automatic black level correction is disabled by default. The calibration can only be used with uEye driver version 3.31 or higher.
- Cameras with a date of manufacture before Dec. 9, 2008: If manual offset control is used, fixed pattern noise and horizontal lines may become visible. High gain values may shift the black level and therefore should be avoided.
  Offset increases the black level every 7th step. The steps in-between change the appearance of fixed pattern noise.

UI-164x / UI-564x

Sensor specification				
Sensor type	CMOS			
Shutter system	Electronic rolling shutter			
Readout mode	Progressive scan			
Resolution class	SXGA			
Resolution	1280 x 1024 pixels (1.3 Mpixels)			
Aspect ratio	5:4			
Bit depth	10 bits			
Optical sensor class	1/3 inch			
Exact sensitive area	4.61 x 3.69 mm			
Exact optical sensor diagonal	5.9 mm (1/2.7 inch)			
Pixel size	3.6 µm, square			
Sensor name, monochrome	-			
Sensor name, color	Micron MT9M131			
Gain				
Color model (master/RGB)	3.0x/3.1x			
Offset control, mode	Auto/manual, additive			
Gain boost	2.0x			
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-40 *1)	5-40 *1)	5-40 *1)
Pixel clock range (with subsampling/binning)	MHz	5-40 *1)	5-40 *1)	5-40 *1)
Frame rate (freerun mode)	fps	25 *2)	25 *2)	25 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	23 *2)	23 *2)	23 *2)
Exposure time in freerun mode	ms	0.037 *2)- 10s *3)	0.038 *2)- 10.1s *3)	0.037 *2)- 10s *3)
Exposure time in trigger mode	ms	0.037 *2)- 10s *3)	0.038 *2)- 10.1s *3)	0.037 *2)- 10s *3)
AOI				
Mode		Horizontal *4) + Vertical *4)		
AOI image width, step width	Pixels	32 - 1280, 4	32 - 1280, 4	32 - 1280, 4
AOI image height, step width	Pixels	4 - 1024, 2	4 - 1024, 2	4 - 1024, 2
AOI position grid horizontal, vertical	Pixels	4, 2	4, 2	4, 2
AOI frame rate, 1024 x 768 pixels (XGA)	fps	39	39	40
AOI frame rate, 640 x 480 pixels (VGA)	fps	89	89	90
AOI frame rate, 320 x 240 pixels (CIF)	fps	262	262	265
Binning				
Mode		-	-	-

Subsampling				
Mode		Horizontal *4) + Vertical *4)		
Method		H + V: Color subsampling		
Frame rate w/ 2x subsampling, 640 x 512 pixels	fps	83	83	85
Frame rate w/ 4x subsampling, 320 x 256 pixels	fps	248	248	254
Frame rate w/ 8x subsampling, 160 x 128 pixels	fps	-	-	624
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	19.7 ±0.25	< 5	< 5
Trigger delay with falling edge	µs	38.0 ±0.25	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 200 *2)	< 200 *2)	< 200 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	0.3-0.8	2.3-3.2	2.7-4.1

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

*3) Requires minimum pixel clock frequency.

*4) Use of this function increases the frame rate.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity

Color

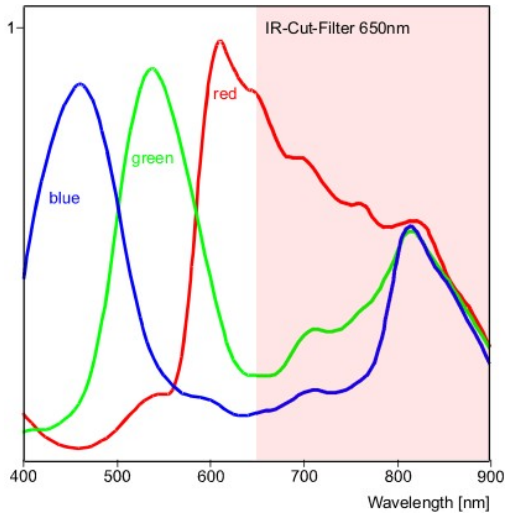


Figure 95: Sensor sensitivity of the UI-164x / UI-564x

Notes on using the UI-164x / UI-564x-X

- At very long exposure times and minimum gain, the white level may not be reached. The gain should be increased by one step in this case.
- The RGB gain controls have no effect for values >90.

UI-155x / UI-555x

Sensor specification				
Sensor type		CMOS		
Shutter system		Electronic rolling shutter		
Readout mode		Progressive scan		
Resolution class		UXGA		
Resolution		1600 x 1200 pixels (1.92 Mpixels)		
Aspect ratio		4:3		
Bit depth		10 bits		
Optical sensor class		1/3 inch		
Exact sensitive area		4.48 x 3.36 mm		
Exact optical sensor diagonal		5.6 mm (1/2.9 inch)		
Pixel size		2.8 µm, square		
Sensor name, monochrome		-		
Sensor name, color		Micron MT9D131		
Gain				
Color model (master/RGB)		3.5x/3.1x		
Offset control, mode		Auto/manual, additive		
Gain boost		2.0x		
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-43 *1)	3-45 *1)	3-60 *1)
Pixel clock range (with subsampling/binning)	MHz	5-50 *1)	3-55 *1)	3-60 *1)
Frame rate (freerun mode)	fps	18 *2)	19 *2)	25 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	17 *2)	16.5 *2)	23 *2)
Exposure time in freerun mode	ms	0.038 *2)- 12.8s*3)	0.036 *2)- 21.4s*3)	0.027 *2)- 21.4s*3)
Exposure time in trigger mode	ms	0.038 *2)- 12.8s*3)	0.036 *2)- 21.4s*3)	0.027 *2)- 21.4s*3)
AOI				
Mode		Horizontal *4) + Vertical *4)		
AOI image width, step width	Pixels	32 - 1600, 4	32 - 1600, 4	32 - 1600, 4
AOI image height, step width	Pixels	4 - 1200, 2	4 - 1200, 2	4 - 1200, 2
AOI position grid horizontal, vertical	Pixels	4, 2	4, 2	4, 2
AOI frame rate, 1280 x 1024 pixels (SXGA)	fps	35	37	49
AOI frame rate, 1024 x 768 pixels (XGA)	fps	40	42	56
AOI frame rate, 640 x 480 pixels (VGA)	fps	88	92	122
Binning				
Mode		Horizontal *4) + Vertical *4)		
Method		H + V: Color binning, averaging		
Frame rate with 2x binning, 800 x 600 pixels	fps	60	60	73

Subsampling				
Mode		Horizontal *4) + Vertical *4)		
Method		H + V: Color subsampling		
Frame rate w/ 2x subsampling, 800 x 600 pixels	fps	71	71	85
Frame rate w/ 4x subsampling, 400 x 300 pixels	fps	252	231	250
Frame rate w/ 8x subsampling, 200 x 150 pixels	fps	627	575	627
Frame rate w/ 16x subsampling, 100 x 74 pixels	fps	870	797	869
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	19.7 ±0.25	< 5	< 5
Trigger delay with falling edge	µs	38.0 ±0.25	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 200 *2)	< 200 *2)	< 200 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	0.5-1.1	2.4-3.4	3.0-4.3

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

*3) Requires minimum pixel clock frequency.

*4) Use of this function increases the frame rate.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity

Color

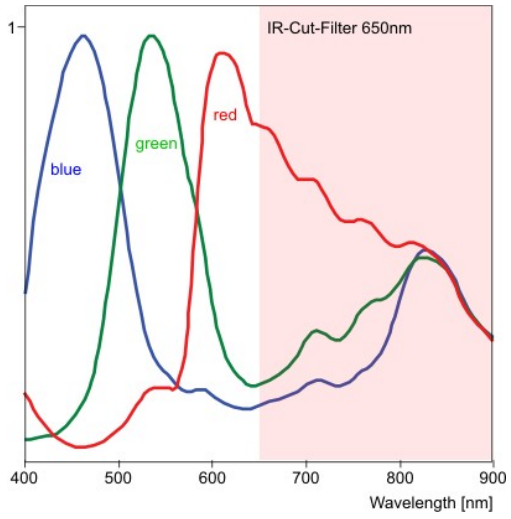


Figure 96: Sensor sensitivity of the UI-155x / UI-555x

Notes on using the UI-155x / UI-555x

- At very long exposure times and minimum gain, the white level may not be reached. Increase the gain by one step.
- For AOI width <160 pixels, the sensor gets slower.
- Horizontal and vertical binning can only be used together.
- The sensor binning works by averaging pixels, so the image will not become brighter when binning is activated.
- Homogeneous images may show color aberrations in the corner areas. This is caused by the way the micro lenses are placed on this sensor. The effect can be minimized by using a large aperture on the lens (small F number).

UI-146x / UI-546x

Sensor specification				
Sensor type	CMOS			
Shutter system	Electronic rolling shutter			
Readout mode	Progressive scan			
Resolution class	QXGA			
Resolution	2048 x 1536 pixels (3.2 Mpixels)			
Aspect ratio	4:3			
Bit depth	10 bits			
Optical sensor class	1/2 inch			
Exact sensitive area	6.55 x 4.92 mm			
Exact optical sensor diagonal	8.2 mm (1/2.0 inch)			
Pixel size	3.2 µm, square			
Sensor name, monochrome	-			
Sensor name, color	Micron MT9T001			
Gain				
Color model (master/RGB)	12.0x/7.25x			
Offset control, mode	Auto/manual, additive			
Gain boost	2.0x			
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-43 *1)	3-46 *1)	3-60 *1)
Pixel clock range (with subsampling/binning)	MHz	5-64 *1)	3-59 *1)	3-64 *1)
Frame rate (freerun mode)	fps	11.2 *2)	12 *2)	15 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	10.7 *2)	10.8 *2)	14 *2)
Exposure time in freerun mode	ms	0.057 *2)-1750 *3)	0.053 *2)-2910 *3)	0.041 *2)-2910 *3)
Exposure time in trigger mode	ms	0.057 *2)-750 *3)	0.053 *2)-1250 *3)	0.041 *2)-1250 *3)
AOI				
Mode		Horizontal *4) + Vertical *4)		
AOI image width, step width	Pixels	16 - 2048, 4	16 - 2048, 4	16 - 2048, 4
AOI image height, step width	Pixels	4 - 1536, 2	4 - 1536, 2	4 - 1536, 2
AOI position grid horizontal, vertical	Pixels	4, 2	4, 2	4, 2
AOI frame rate, 1920 x 1080 pixels (HD 1080)	fps	16	17	23
AOI frame rate, 1280 x 720 pixels (HD 720)	fps	34	36	47
AOI frame rate, 640 x 480 pixels (VGA)	fps	81	86	113
Binning				
Mode		Horizontal *4) + Vertical *4)		
Method		H + V: Color binning, H: additive, V: averaging		
Frame rate with 2x binning, 1024 x 768 pixels	fps	43	35	42

Frame rate with 3x binning, 680 x 512 pixels	fps	56	50	56
Frame rate with 4x binning, 512 x 384 pixels	fps	73	71	73
Frame rate with 6x binning, 340 x 256 pixels	fps	106	104	106
Subsampling				
Mode		Horizontal *4) + Vertical *4)		
Method		H + V: Color subsampling		
Frame rate w/ 2x subsampling, 1024 x 768 pixels	fps	44	44	52
Frame rate with 3x subsampling, 680 x 512 pixels	fps	97	92	101
Frame rate w/ 4x subsampling, 512 x 384 pixels	fps	160	153	156
Frame rate w/ 5x subsampling, 408 x 306 pixels	fps	220	217	220
Frame rate with 6x subsampling, 340 x 256 pixels	fps	283	280	283
Frame rate w/ 8x subsampling, 256 x 192 pixels	fps	410	407	410
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	19.7 ±0.25	< 5	< 5
Trigger delay with falling edge	µs	38.0 ±0.25	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 200 *2)	< 200 *2)	< 200 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	0.4-0.7	2.4-2.9	2.8-3.9

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

*3) Requires minimum pixel clock frequency.

*4) Use of this function increases the frame rate.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity
Color

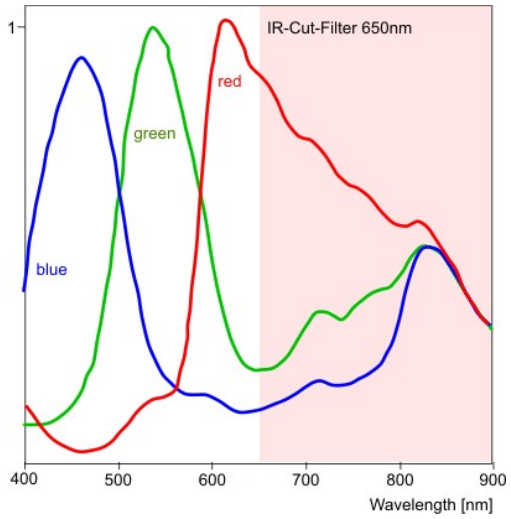


Figure 97: Sensor sensitivity of the UI-146x / UI-546x

Notes on using the UI-146x / UI-546x

- Master gain is digitally calculated on the sensor and may cause artefacts. Instead use RGB gains first (e.g. by setting a minimum value in the Auto White Balance function).
- The sensor does not allow changes of exposure time while in trigger mode. If *is_SetExposureTime()* is called in trigger mode, the sensor will temporarily switch to freerun. This results in a longer delay time (depending on the frame rate) at function call.
- Sensor speed does not increase for effective horizontal resolution <256 pixels.
- Changing the frame rate in trigger mode has no effect. The maximum possible exposure time cannot be increased in this way.
- With horizontal 4x binning, a dark column appears at the right-hand image border, which is caused by the sensor.
- For hardware reasons, the sensor can only perform 3x vertical binning. When 4x or 6x binning is activated in the uEye software, the driver uses a combination of binning and subsampling instead. Therefore, the image will not become brighter when 4x or 6x horizontal binning is activated.

UI-148x / UI-548x

Sensor specification				
Sensor type		CMOS		
Shutter system		Electronic rolling shutter / global start shutter		
Readout mode		Progressive scan		
Resolution class		QSXGA		
Resolution		2560 x 1920 pixels (4.92 MP)		
Aspect ratio		4:3		
Bit depth		10 bits		
Optical sensor class		1/2 inch		
Exact sensitive area		5.63 x 4.22 mm		
Exact optical sensor diagonal		7.0 mm (1/2.3 inch)		
Pixel size		2.2 µm, square		
Sensor name, monochrome		Micron MT9P031		
Sensor name, color		Micron MT9P031		
Gain				
Monochrome model (master gain)		30.0x		
Color model (master/RGB)		12.0x/6.5x		
Offset control, mode		Auto/manual, additive		
Gain boost		1.6x (color model only)		
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-43 *1)	4-48 *1)	4-103 *1)
Pixel clock range (with subsampling/binning)	MHz	5-90 *1)	4-100 *1)	4-128 *1)
Frame rate (freerun mode)	fps	6.3 *2)	7.04 *2)	15 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	6.1 *2)	6.57 *2)	13.8 *2)
Exposure time in freerun mode	ms	0.075 *2)- 2745*3)	0.067 *2)- 3430*3)	0.031 *2)-3430 *3)
Exposure time in trigger mode	ms	0.075 *2)- 2745*3)	0.067 *2)- 3430*3)	0.031 *2)-3430 *3)
AOI				
Mode		Horizontal *4) + Vertical *4)		
AOI image width, step width	Pixels	32 - 2560, 4	32 - 2560, 4	32 - 2560, 4
AOI image height, step width	Pixels	4 - 1920, 2	4 - 1920, 2	4 - 1920, 2
AOI position grid horizontal, vertical	Pixels	4, 2	4, 2	4, 2
AOI frame rate, 1920 x 1080 pixels (HD 1080)	fps	13	15	32
AOI frame rate, 1024 x 768 pixels (XGA)	fps	27	30	65
AOI frame rate, 640 x 480 pixels (VGA)	fps	52	58	126
Binning				
Mode		Horizontal *4) + Vertical *4)		
Method		H + V: Color binning, H: additive, V: averaging		

Frame rate with 2x binning, 1280 x 960 pixels	fps	19	21	43
Color model: Frame rate with 3x binning, 852 x 640 pixels	fps	31	35	59
Color model: Frame rate with 4x binning, 640 x 480 pixels	fps	43	47	68
Color model: Frame rate with 6x binning, 424 x 320 pixels	fps	72	80	103
Subsampling				
Mode		Horizontal *4) + Vertical *4)		
Method		H + V: Color subsampling		
Frame rate w/ 2x subsampling, 1280 x 960 pixels	fps	25	28	55
Frame rate with 3x subsampling, 852 x 640 pixels	fps	57	62	105
Frame rate w/ 4x subsampling, 640 x 480 pixels	fps	100	110	157
Frame rate w/ 5x subsampling, 512 x 384 pixels	fps	147	164	209
Frame rate with 6x subsampling, 424 x 320 pixels	fps	184	204	262
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	19.7 ±0.25	< 5	< 5
Trigger delay with falling edge	µs	38.0 ±0.25	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 200 *2)	< 200 *2)	< 200 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	0.5-0.9	2.6-3.1	3.0-4.4

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

*3) Requires minimum pixel clock frequency.

*4) Use of this function increases the frame rate.

*5) The connected load depends on the sensor model and the pixel clock setting.

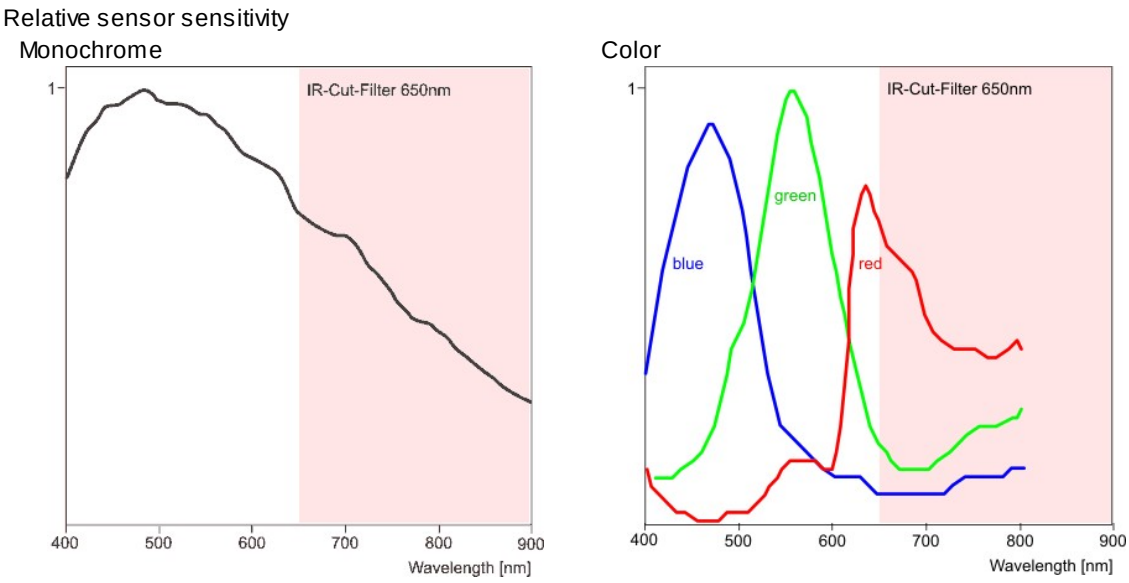


Figure 98: Sensor sensitivity of the UI-148x / UI-548x

Notes on using the UI-148x / UI-548x

- It is recommended to use a high-resolution (megapixel) lens.
- Use of the Global Start function slightly reduces the maximum possible frame rate.
- Color version only: Live color display with color correction and 5x5 de-Bayering results in high CPU load (see Color Filter (Bayer Filter)).
- For hardware reasons, the sensor can only perform 3x vertical binning. When 3x horizontal binning is activated in the uEye software, the driver uses 3x subsampling instead. Therefore, the image will not become brighter when 3x horizontal binning is activated.
- Monochrome version only: No gain boost (factor) available. Use 30x master gain instead.
- Monochrome version only: The sensor internally works like the color version. This might lead to artefacts when binning and subsampling are used. Therefore, the monochrome sensor does not support binning factors higher than 2x.
- Monochrome version only: Gain settings 0...49 use analog signal gain; from 50 up, the stronger digital gain is used. High gain settings may cause visible noise.

9.1.2 CCD Cameras

UI-221x / UI-621x

Sensor specification				
Sensor type		CCD		
Shutter system		Electronic global shutter		
Readout mode		Progressive scan		
Resolution class		VGA		
Resolution		640 x 480 pixels (0.31 Mpixels)		
Aspect ratio		4:3		
Bit depth		12 bits		
Optical sensor class		1/2 inch		
Exact sensitive area		6.34 x 4.75 mm		
Exact optical sensor diagonal		7.9 mm (1/2.0 inch)		
Pixel size		9.9 µm, square		
Sensor name, monochrome		Sony ICX414AL		
Sensor name, color		Sony ICX414AQ		
Gain				
Monochrome model (master gain)		20.78x		
Color model (master/RGB)		12.0x/4.0x		
Offset control, mode		Auto/manual, additive		
Gain boost		2.0x (monochrome model only)		
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Pixel clock range (with subsampling/binning)	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Frame rate (freerun mode)	fps	75 *2)	75 *2)	75 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	65 *2)	65 *2)	65 *2)
Exposure time in freerun mode	ms	0.04 *2)-630 *3)	0.04 *2)-630 *3)	0.04 *2)-630 *3)
Exposure time in trigger mode	ms	0.04 *2)-10 min*3)	0.04 *2)-10 min*3)	0.04 *2)-10 min*3)
AOI				
Mode		Horizontal + Vertical *4)		
AOI image width, step width	Pixels	16 - 640, 4	16 - 640, 4	16 - 640, 4
Mono: AOI image height, step width	Pixels	120 - 480, 1	120 - 480, 1	120 - 480, 1
Color: AOI image height, step width	Pixels	120 - 480, 2	120 - 480, 2	120 - 480, 2
Mono: AOI position grid horizontal, vertical	Pixels	1, 1	1, 1	1, 1
Color: AOI position grid horizontal, vertical	Pixels	2, 2	2, 2	2, 2
AOI frame rate, 320 x 240 pixels (CIF)	fps	122	122	122
Binning				
Mode		Vertical *4)	Horizontal +	Horizontal +

			Vertical *4)	Vertical *4)
Method		V: Monochrome binning, additive	H + V: Monochrome binning, additive	H + V: Monochrome binning, additive
Frame rate with 2x binning, 640 x 240 pixels	fps	135	135	135
Frame rate with 3x binning, 640 x 160 pixels	fps	183	183	183
Frame rate with 4x binning, 640 x 120 pixels	fps	221	221	221
Subsampling				
Mode		-	-	-
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	43.2 ±4	< 5	< 5
Trigger delay with falling edge	µs	61.5 ±4	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 100 *2)	< 100 *2)	< 100 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	1.0-1.9	3.1-4.1	3.4-5.2

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

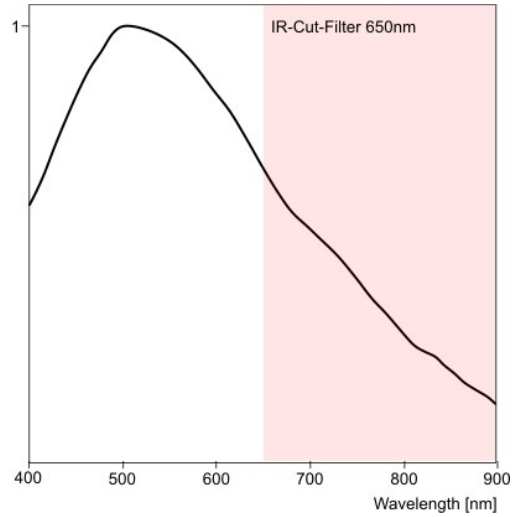
*3) Requires minimum pixel clock frequency.

*4) Use of this function increases the frame rate for monochrome models.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity

Monochrome



Color

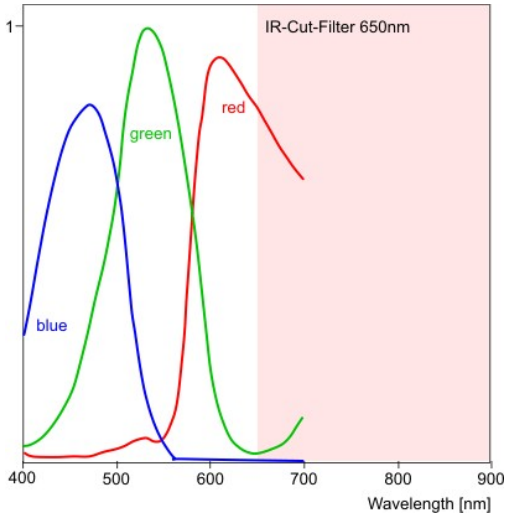


Figure 99: Sensor sensitivity of the UI-221x / UI-621x

Notes on using the UI-221x / UI-621x

- Optimum pixel clock frequency is 24 MHz.
- Recommended pixel clock range 16 - 26 MHz.

UI-231x / UI-631x

Sensor specification				
Sensor type	CCD			
Shutter system	Electronic global shutter			
Readout mode	Progressive scan			
Resolution class	VGA			
Resolution	640 x 480 pixels (0.31 Mpixels)			
Aspect ratio	4:3			
Bit depth	12 bits			
Optical sensor class	1/4 inch			
Exact sensitive area	3.58 x 2.69 mm			
Exact optical sensor diagonal	4.5 mm (1/3.6 inch)			
Pixel size	5.6 µm, square			
Sensor name, monochrome	Sony ICX098BL			
Sensor name, color	Sony ICX098BQ			
Gain				
Monochrome model (master gain)	12.21x			
Color model (master/RGB)	7.3x/4.0x			
Offset control, mode	Auto/manual, additive			
Gain boost	2.0x (monochrome model only)			
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-30 *1)	5-30 *1)	-
Pixel clock range (with subsampling/binning)	MHz	5-30 *1)	5-30 *1)	
Frame rate (freerun mode)	fps	75 *2)	75 *2)	
Frame rate (trigger mode, 1 ms exposure)	fps	62 *2)	62 *2)	
Exposure time in freerun mode	ms	0.04 *2)-640 *3)	0.04 *2)-640 *3)	
Exposure time in trigger mode	ms	0.04 *2)-10 min*3)	0.04 *2)-10 min*3)	
AOI				
Mode		Horizontal + Vertical *4)		-
AOI image width, step width	Pixels	16 - 640, 4	16 - 640, 4	
Mono: AOI image height, step width	Pixels	120 - 480, 1	120 - 480, 1	
Color: AOI image height, step width	Pixels	120 - 480, 2	120 - 480, 2	
Mono: AOI position grid horizontal, vertical	Pixels	1, 1	1, 1	
Color: AOI position grid horizontal, vertical	Pixels	2, 2	2, 2	
AOI frame rate, 320 x 240 pixels (CIF)	fps	140	140	
Binning				
Mode		Horizontal + Vertical *4)		-
Method		V: Monochrome binning, additive		

Frame rate with 2x binning, 640 x 240 pixels	fps	131	131	
Frame rate with 3x binning, 640 x 160 pixels	fps	174	174	
Frame rate with 4x binning, 640 x 120 pixels	fps	208	208	
Subsampling				
Mode		Vertical *4)		-
Method		V: Color subsampling		
Frame rate w/ 2x subsampling, 320 x 240 pixels	fps	131	131	
Hardware trigger				
Mode		Asynchronous	Asynchronous	-
Trigger delay with rising edge	µs	43.2 ±4	< 5	
Trigger delay with falling edge	µs	61.5 ±4	< 5	
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	
Sensor delay to exposure start	µs	< 100 *2)	< 100 *2)	
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	1.0-1.6	3.0-3.8	-

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

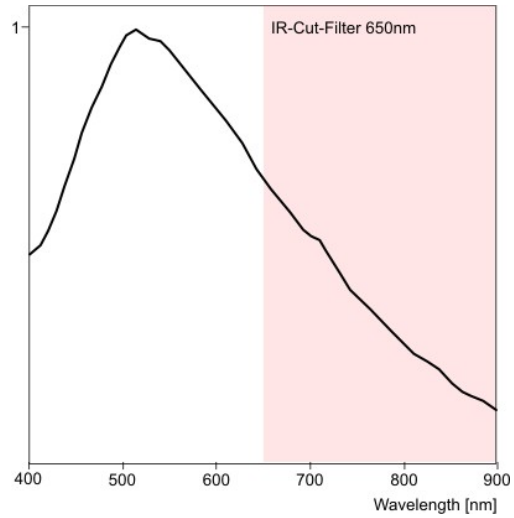
*3) Requires minimum pixel clock frequency.

*4) Use of this function increases the frame rate for monochrome models.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity

Monochrome



Color

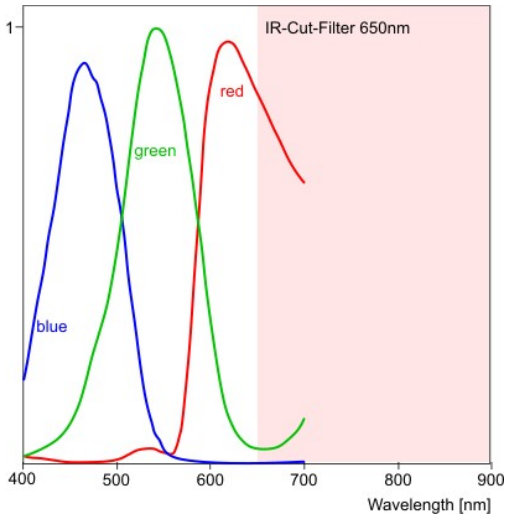


Figure 100: Sensor sensitivity of the UI-231x / UI-631x

Notes on using the UI-231x / UI-631x

- Optimum pixel clock frequency is 12 MHz.
- Recommended pixel clock range 5 - 20 MHz.
- Long exposure times will increase the number of hotpixels.
- High temperatures will increase the black level of individual pixels.

UI-241x / UI-641x

Sensor specification				
Sensor type	CCD			
Shutter system	Electronic global shutter			
Readout mode	Progressive scan			
Resolution class	VGA			
Resolution	640 x 480 pixels (0.31 Mpixels)			
Aspect ratio	4:3			
Bit depth	12 bits			
Optical sensor class	1/3 inch			
Exact sensitive area	4.74 x 3.55 mm			
Exact optical sensor diagonal	5.9 mm (1/2.7 inch)			
Pixel size	7.4 µm, square			
Sensor name, monochrome	Sony ICX424AL			
Sensor name, color	Sony ICX424AQ			
Gain				
Monochrome model (master gain)	18.0x			
Color model (master/RGB)	12.0x/4.0x			
Offset control, mode	Auto/manual, additive			
Gain boost	2.0x (monochrome model only)			
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Pixel clock range (with subsampling/binning)	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Frame rate (freerun mode)	fps	75 *2)	75 *2)	75 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	64 *2)	64 *2)	64 *2)
Exposure time in freerun mode	ms	0.04 *2)-640 *3)	0.04 *2)-640 *3)	0.04 *2)-640 *3)
Exposure time in trigger mode	ms	0.04 *2)-10 min*3)	0.04 *2)-10 min*3)	0.04 *2)-10 min*3)
AOI				
Mode		Horizontal + Vertical *4)		
AOI image width, step width	Pixels	16 - 640, 4	16 - 640, 4	16 - 640, 4
Mono: AOI image height, step width	Pixels	120 - 480, 1	120 - 480, 1	120 - 480, 1
Color: AOI image height, step width	Pixels	120 - 480, 2	120 - 480, 2	120 - 480, 2
Mono: AOI position grid horizontal, vertical	Pixels	1, 1	1, 1	1, 1
Color: AOI position grid horizontal, vertical	Pixels	2, 2	2, 2	2, 2
AOI frame rate, 320 x 240 pixels (CIF)	fps	111	111	111
Binning				
Mode		Vertical *4)	Horizontal + Vertical *4)	Horizontal + Vertical *4)
Method		V: Monochrome	H + V:	H + V:

		binning, additive	Monochrome binning, additive	Monochrome binning, additive
Frame rate with 2x binning, 640 x 240 pixels	fps	133	133	133
Frame rate with 3x binning, 640 x 160 pixels	fps	178	178	178
Frame rate with 4x binning, 640 x 120 pixels	fps	215	215	215
Subsampling				
Mode		-	-	-
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	43.2 ±4	< 5	< 5
Trigger delay with falling edge	µs	61.5 ±4	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 100 *2)	< 100 *2)	< 100 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	1.0-1.9	3.0-4.0	3.5-5.3

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

*3) Requires minimum pixel clock frequency.

*4) Use of the function increases the frame rate for monochrome models.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity

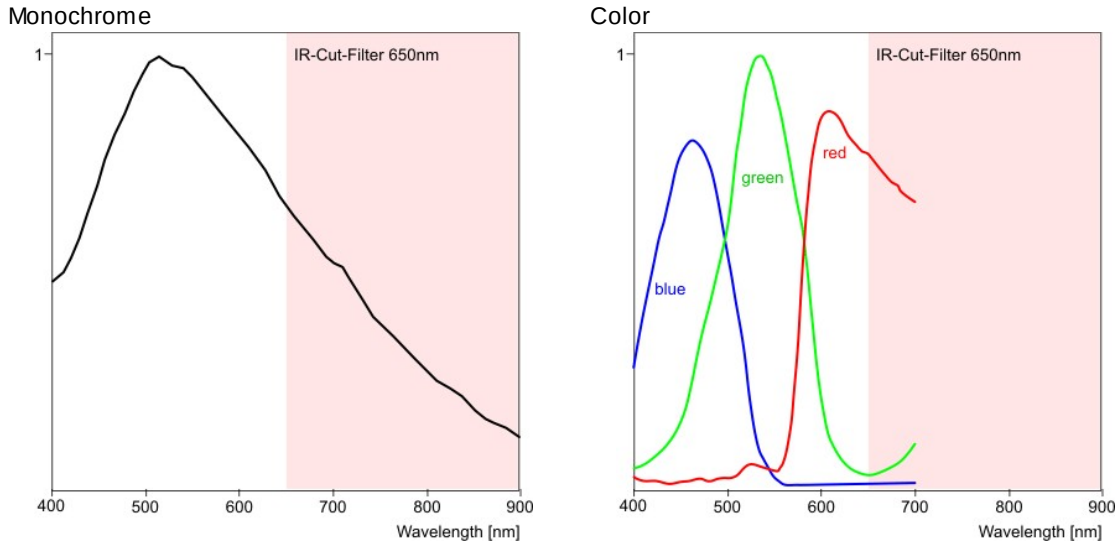


Figure 101: Sensor sensitivity of the UI-241x / UI-641x

Notes on using the UI-241x / UI-641x

- Optimum pixel clock frequency is 25 MHz.
- Recommended pixel clock range 15 - 27 MHz.
- Recommended pixel clock frequency for long term exposure is >10 MHz.

UI-222x / UI-622x

Sensor specification				
Sensor type		CCD		
Shutter system		Electronic global shutter		
Readout mode		Progressive scan		
Resolution class		CCIR/PAL		
Resolution		768 x 576 pixels (0.44 Mpixels)		
Aspect ratio		4:3		
Bit depth		12 bits		
Optical sensor class		1/2 inch		
Exact sensitive area		6.37 x 4.78 mm		
Exact optical sensor diagonal		8.0 mm (1/2.0 inch)		
Pixel size		8.3 µm, square		
Sensor name, monochrome		Sony ICX415AL		
Sensor name, color		Sony ICX415AQ		
Gain				
Monochrome model (master gain)		14.1x		
Color model (master/RGB)		8.9x/4.0x		
Offset control, mode		Auto/manual, additive		
Gain boost		2.0x (monochrome model only)		
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Pixel clock range (with subsampling/binning)	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Frame rate (freerun mode)	fps	52 *2)	52 *2)	52 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	47 *2)	47 *2)	47 *2)
Exposure time in freerun mode	ms	0.05 *2)-770 *3)	0.05 *2)-770 *3)	0.05 *2)-770 *3)
Exposure time in trigger mode	ms	0.05 *2)-10 min *3)	0.05 *2)-10 min *3)	0.05 *2)-10 min *3)
AOI				
Mode		Horizontal + Vertical *4)		
AOI image width, step width	Pixels	16 - 768, 4	16 - 768, 4	16 - 768, 4
Mono: AOI image height, step width	Pixels	120 - 576, 1	120 - 576, 1	120 - 576, 1
Color: AOI image height, step width	Pixels	120 - 576, 2	120 - 576, 2	120 - 576, 2
Mono: AOI position grid horizontal, vertical	Pixels	1, 1	1, 1	1, 1
Color: AOI position grid horizontal, vertical	Pixels	2, 2	2, 2	2, 2
AOI frame rate, 640 x 480 pixels (VGA)	fps	60	60	60
AOI frame rate, 320 x 240 pixels (CIF)	fps	97	97	97
Binning				
Mode		Vertical *4)	Horizontal + Vertical *4)	Horizontal + Vertical *4)

Method		V: Monochrome binning, additive	H + V: Monochrome binning, additive	H + V: Monochrome binning, additive
Frame rate with 2x binning, 768 x 288 pixels	fps	90	90	90
Frame rate with 3x binning, 768 x 192 pixels	fps	121	121	121
Frame rate with 4x binning, 768 x 144 pixels	fps	143	143	143
Subsampling				
Mode		-	-	-
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	43.2 ±4	< 5	< 5
Trigger delay with falling edge	µs	61.5 ±4	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 100 *2)	< 100 *2)	< 100 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	1.0-1.9	3.0-4.0	3.5-5.4

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

*3) Requires minimum pixel clock frequency.

*4) Use of the function increases the frame rate for monochrome models.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity

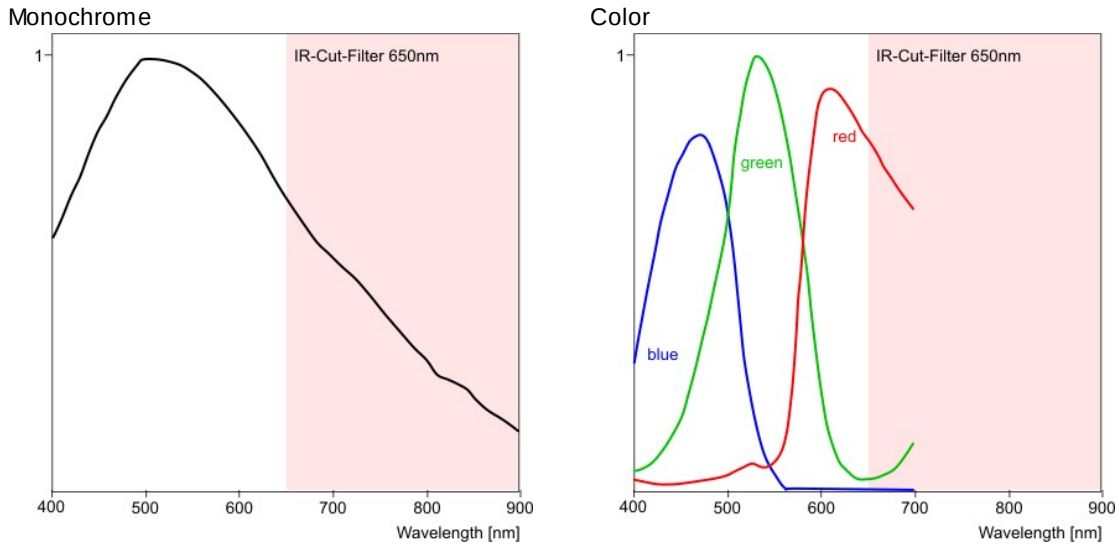


Figure 102: Sensor sensitivity of the UI-222x / UI-622x

Notes on using the UI-222x / UI-622x

- Optimum pixel clock frequency is 28 MHz.

UI-223x / UI-623x

Sensor specification				
Sensor type	CCD			
Shutter system	Electronic global shutter			
Readout mode	Progressive scan			
Resolution class	XGA			
Resolution	1024 x 768 pixels (0.79 Mpixels)			
Aspect ratio	4:3			
Bit depth	12 bits			
Optical sensor class	1/3 inch			
Exact sensitive area	4.76 x 3.57 mm			
Exact optical sensor diagonal	6.0 mm (1/2.7 inch)			
Pixel size	4.65 µm, square			
Sensor name, monochrome	Sony ICX204AL			
Sensor name, color	Sony ICX204AK			
Gain				
Monochrome model (master gain)	10.47x			
Color model (master/RGB)	7.59x/4.0x			
Offset control, mode	Auto/manual, additive			
Gain boost	2.0x (monochrome model only)			
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Pixel clock range (with subsampling/binning)	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Frame rate (freerun mode)	fps	30 *2)	30 *2)	30 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	27 *2)	27 *2)	27 *2)
Exposure time in freerun mode	ms	0.066 *2)-1000 *3)	0.066 *2)-1000 *3)	0.066 *2)-1000 *3)
Exposure time in trigger mode	ms	0.066 *2)-10 min *3)	0.066 *2)-10 min *3)	0.066 *2)-10 min *3)
AOI				
Mode		Horizontal + Vertical *4)		
AOI image width, step width	Pixels	16 - 1024, 4	16 - 1024, 4	16 - 1024, 4
Mono: AOI image height, step width	Pixels	120 - 768, 1	120 - 768, 1	120 - 768, 1
Color: AOI image height, step width	Pixels	120 - 768, 2	120 - 768, 2	120 - 768, 2
Mono: AOI position grid horizontal, vertical	Pixels	1, 1	1, 1	1, 1
Color: AOI position grid horizontal, vertical	Pixels	2, 2	2, 2	2, 2
AOI frame rate, 800 x 600 pixels (SVGA)	fps	37	37	37
AOI frame rate, 640 x 480 pixels (VGA)	fps	45	45	45
AOI frame rate, 320 x 240 pixels (CIF)	fps	78	78	78
Binning				

Mode		Vertical *4)	Horizontal + Vertical *4)	Horizontal + Vertical *4)
Method		V: Monochrome binning, additive	H + V: Monochrome binning, additive	H + V: Monochrome binning, additive
Frame rate with 2x binning, 1024 x 384 pixels	fps	53	53	53
Frame rate with 3x binning, 1024 x 256 pixels	fps	71	71	71
Frame rate with 4x binning, 1024 x 192 pixels	fps	85	85	85
Subsampling				
Mode		-	-	-
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	43.2 ±4	< 5	< 5
Trigger delay with falling edge	µs	61.5 ±4	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 100 *2)	< 100 *2)	< 100 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	1.0-1.7	3.0-3.8	3.5-5.0

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

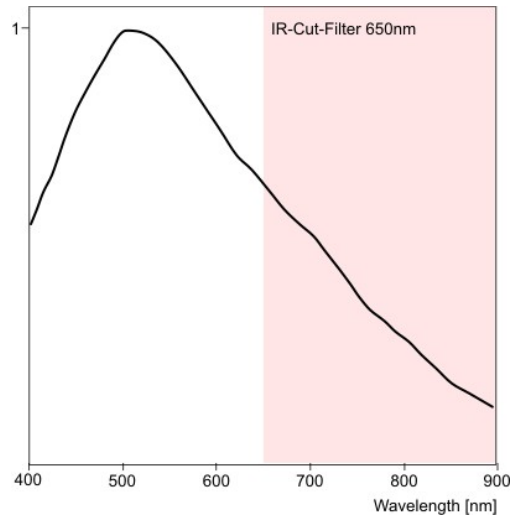
*3) Requires minimum pixel clock frequency.

*4) Use of the function increases the frame rate for monochrome models.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity

Monochrome



Color

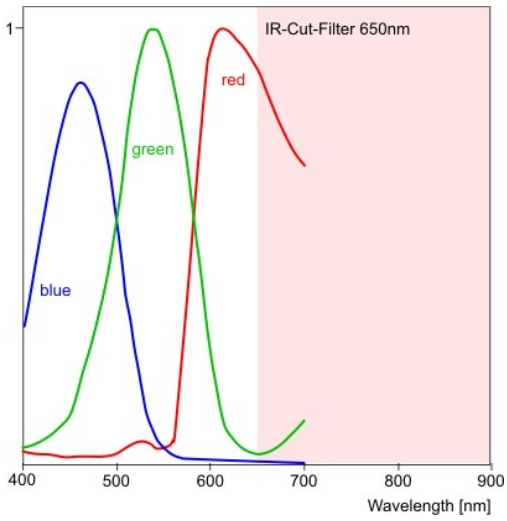


Figure 103: Sensor sensitivity of the UI-223x / UI-623x

Notes on using the UI-223x / UI-623x

- Optimum pixel clock frequency is 15 MHz.
- Recommended pixel clock range 10 - 20 MHz.
- Long exposure times will increase the number of hotpixels.
- High temperatures will increase the black level of individual pixels.

UI-224x / UI-624x

Sensor specification				
Sensor type	CCD			
Shutter system	Electronic global shutter			
Readout mode	Progressive scan			
Resolution class	SXGA			
Resolution	1280 x 1024 pixels (1.3 Mpixels)			
Aspect ratio	4:3			
Bit depth	12 bits			
Optical sensor class	1/2 inch			
Exact sensitive area	5.95 x 4.76 mm			
Exact optical sensor diagonal	7.6 mm (1/2.1 inch)			
Pixel size	4.65 µm, square			
Sensor name, monochrome	Sony ICX205AL			
Sensor name, color	Sony ICX205AK			
Gain				
Monochrome model (master gain)	13.66x			
Color model (master/RGB)	4.0x/8.9x			
Offset control, mode	Auto/manual, additive			
Gain boost	2.0x (monochrome model only)			
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Pixel clock range (with subsampling/binning)	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Frame rate (freerun mode)	fps	15 *2)	15 *2)	15 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	15 *2)	15 *2)	15 *2)
Exposure time in freerun mode	ms	0.083 *2)-1460 *3)	0.083 *2)-1460 *3)	0.083 *2)-1460 *3)
Exposure time in trigger mode	ms	0.083 *2)-10 min *3)	0.083 *2)-10 min *3)	0.083 *2)-10 min *3)
AOI				
Mode		Horizontal + Vertical *4)		
AOI image width, step width	Pixels	16 - 1280, 4	16 - 1280, 4	16 - 1280, 4
Mono: AOI image height, step width	Pixels	120 - 1024, 1	120 - 1024, 1	120 - 1024, 1
Color: AOI image height, step width	Pixels	120 - 1024, 2	120 - 1024, 2	120 - 1024, 2
Mono: AOI position grid horizontal, vertical	Pixels	1, 1	1, 1	1, 1
Color: AOI position grid horizontal, vertical	Pixels	2, 2	2, 2	2, 2
AOI frame rate, 1024 x 768 pixels (XGA)	fps	18	18	18
AOI frame rate, 640 x 480 pixels (VGA)	fps	28	28	28
AOI frame rate, 320 x 240 pixels (CIF)	fps	38	38	38
Binning				

Mode		Vertical *4)	Horizontal + Vertical *4)	Horizontal + Vertical *4)
Method		V: Monochrome binning, additive	H + V: Monochrome binning, additive	H + V: Monochrome binning, additive
Frame rate with 2x binning, 1280 x 512 pixels	fps	23	23	23
Frame rate with 3x binning, 1280 x 340 pixels	fps	28	28	28
Frame rate with 4x binning, 1280 x 256 pixels	fps	31	31	31
Subsampling				
Mode		Vertical *4)	Vertical *4)	Horizontal + Vertical *4)
Method		V: Color subsampling	V: Color subsampling	H + V: Color subsampling
Frame rate w/ 4x subsampling, 1280 x 256 pixels	fps	31	31	31
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	43.2 ±4	< 5	< 5
Trigger delay with falling edge	µs	61.5 ±4	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 100 *2)	< 100 *2)	< 100 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	1.1-2.1	3.1-4.2	3.7-5.6

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

*3) Requires minimum pixel clock frequency.

*4) Use of the function increases the frame rate for monochrome models.

*5) The connected load depends on the sensor model and the pixel clock setting.

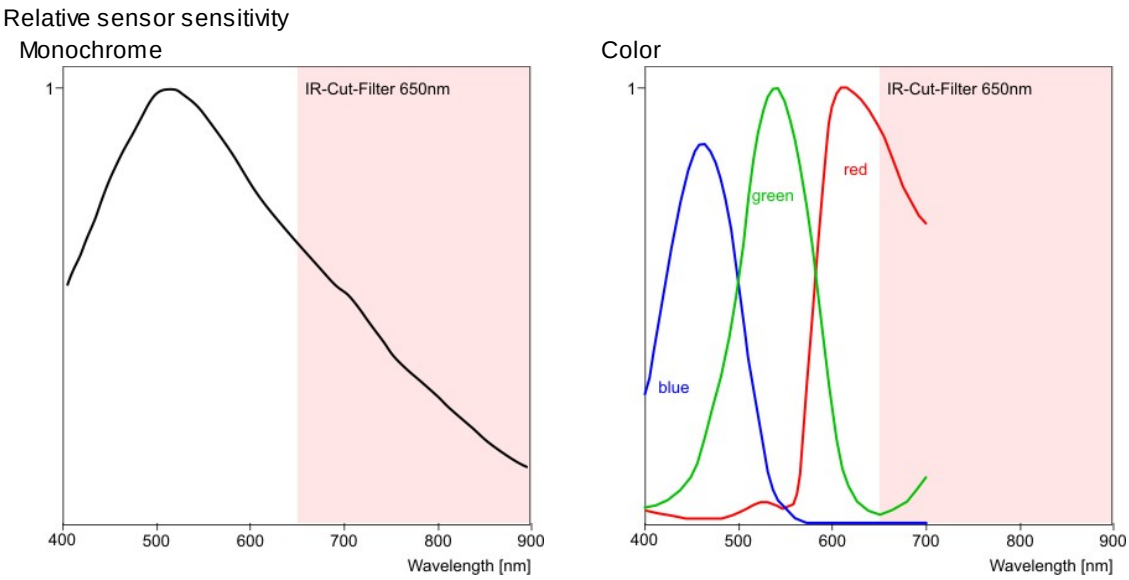


Figure 104: Sensor sensitivity of the UI-224x / UI-624x

Notes on using the UI-224x / UI-624x

- Optimum pixel clock frequency is 14 MHz.
- Recommended pixel clock range 10 - 20 MHz.
- Long exposure times will increase the number of hotpixels.
- High temperatures will increase the black level of individual pixels.
- When vertical 4x binning is activated, the minimum image width increases to 640 pixels.

UI-225x / UI-625x

Sensor specification				
Sensor type	CCD			
Shutter system	Electronic global shutter			
Readout mode	Progressive scan			
Resolution class	UXGA			
Resolution	1600 x 1200 pixels (1.92 Mpixels)			
Aspect ratio	4:3			
Bit depth	12 bits			
Optical sensor class	1/1.8 inch			
Exact sensitive area	7.04 x 5.28 mm			
Exact optical sensor diagonal	8.8 mm (1/1.8 inch)			
Pixel size	4.4 µm, square			
Sensor name, monochrome	Sony ICX274AL			
Sensor name, color	Sony ICX274AK			
Gain				
Monochrome model (master gain)	13.78x			
Color model (master/RGB)	8.9x/4.0x			
Offset control, mode	Auto/manual, additive			
Gain boost	2.0x (monochrome model only)			
Camera timing		USB uEye	GigE uEye SE	GigE uEye HE
Pixel clock range	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Pixel clock range (with subsampling/binning)	MHz	5-30 *1)	5-30 *1)	5-30 *1)
Frame rate (freerun mode)	fps	12.5 *2)	12.5 *2)	12.5 *2)
Frame rate (trigger mode, 1 ms exposure)	fps	12 *2)	12 *2)	12 *2)
Exposure time in freerun mode	ms	0.094 *2)-1570 *3)	0.094 *2)-1570 *3)	0.094 *2)-1570 *3)
Exposure time in trigger mode	ms	0.094 *2)-5000 *3)	0.094 *2)-5000 *3)	0.094 *2)-5000 *3)
AOI				
Mode		Horizontal + Vertical *4)		
AOI image width, step width	Pixels	320 - 1600, 4	320 - 1600, 4	320 - 1600, 4
Mono: AOI image height, step width	Pixels	240 - 1200, 1	240 - 1200, 1	240 - 1200, 1
Color: AOI image height, step width	Pixels	240 - 1200, 2	240 - 1200, 2	240 - 1200, 2
Mono: AOI position grid horizontal, vertical	Pixels	1, 1	1, 1	1, 1
Color: AOI position grid horizontal, vertical	Pixels	2, 2	2, 2	2, 2
AOI frame rate, 1024 x 768 pixels (XGA)	fps	18	18	18
AOI frame rate, 640 x 480 pixels (VGA)	fps	28	28	28
AOI frame rate, 320 x 240 pixels (CIF)	fps	47	47	47
Binning				

Mode		Vertical *4)	Horizontal + Vertical *4)	Horizontal + Vertical *4)
Method		V: Monochrome binning, additive	H + V: Monochrome binning, additive	H + V: Monochrome binning, additive
Frame rate with 2x binning, 1600 x 600 pixels	fps	24	24	24
Frame rate with 3x binning, 1600 x 400 pixels	fps	34	34	34
Frame rate with 4x binning, 1600 x 300 pixels	fps	43	43	43
Subsampling				
Mode		Vertical *4)	Vertical *4)	Horizontal + Vertical *4)
Method		V: Color subsampling	V: Color subsampling	H + V: Color subsampling
Frame rate w/ 2x subsampling, 1600 x 600 pixels	fps	24	24	24
Frame rate w/ 4x subsampling, 1600 x 300 pixels	fps	43	43	43
Hardware trigger				
Mode		Asynchronous	Asynchronous	Asynchronous
Trigger delay with rising edge	µs	43.2 ±4	< 5	< 5
Trigger delay with falling edge	µs	61.5 ±4	< 5	< 5
Additive trigger delay (optional)	µs	15 µs-4 s	15 µs-4 s	15 µs-4 s
Sensor delay to exposure start	µs	< 100 *2)	< 100 *2)	< 100 *2)
Connected load *5)		USB uEye	GigE uEye SE	GigE uEye HE
	W	1.0-2.4	3.0-4.4	3.8-6.2

*1) The maximum possible pixel clock frequency depends on the PC hardware used.

*2) Requires maximum pixel clock frequency.

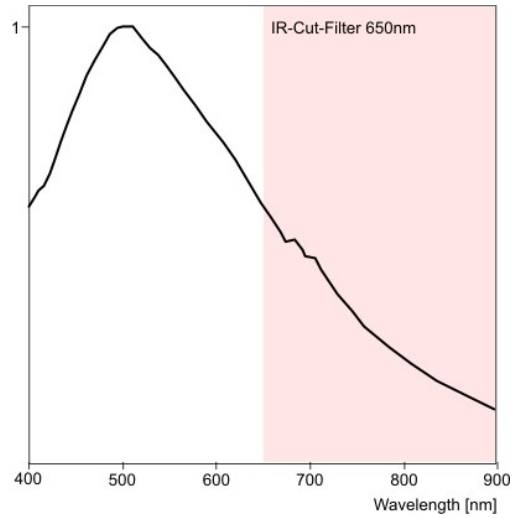
*3) Requires minimum pixel clock frequency.

*4) Use of the function increases the frame rate for monochrome models.

*5) The connected load depends on the sensor model and the pixel clock setting.

Relative sensor sensitivity

Monochrome



Color

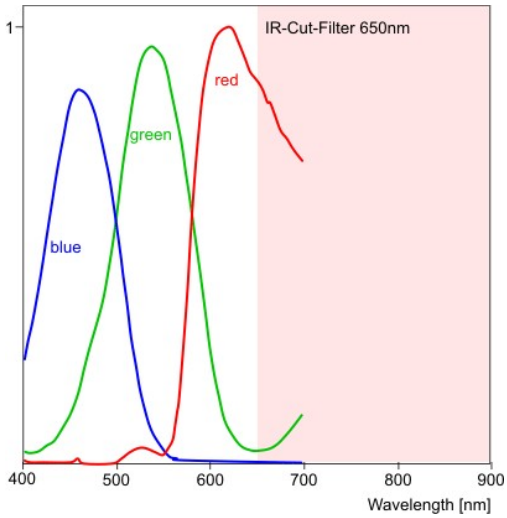


Figure 105: Sensor sensitivity of the UI-225x / UI-625x

Driver versions earlier than 3.30 allow setting an AOI height of less than 256 pixels for UI-225x cameras. An AOI height <256 pixels should be avoided, however, as it increases the camera's current consumption.

Notes on using the UI-225x / UI-625x

- Optimum pixel clock frequency is 29 MHz.
- Recommended pixel clock range 15 - 29 MHz.
- Long exposure times will increase the number of hotpixels.
- High temperatures will increase the black level of individual pixels.

9.2 Mechanical Specifications

9.2.1 USB uEye SE

Housing Version

Lens mount	Enclosure protection class	Weight	
C-mount	IP 30	with camera housing	62 g (CMOS), 74 g (CCD)
		C-mount, without housing	32 g (CMOS), 44 g (CCD)
		Board level version	18 g (CMOS), 30 g (CCD)

For the dimensions of the *USB uEye SE* accessories, please refer to the USB uEye SE Accessories chapter.

CMOS/CCD cameras

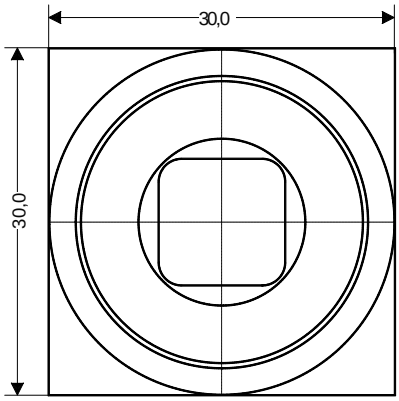


Figure 106: Front view

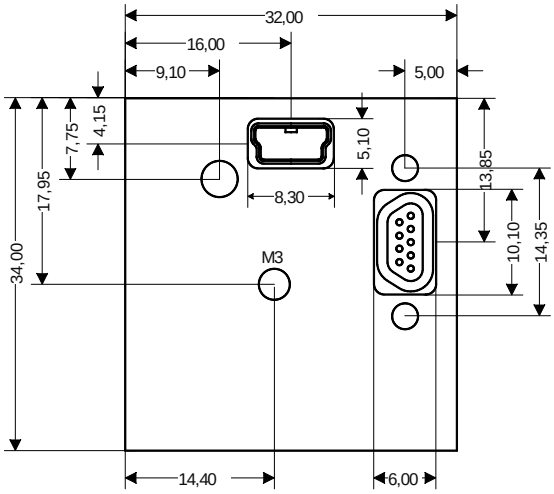


Figure 107: Rear view

CMOS cameras

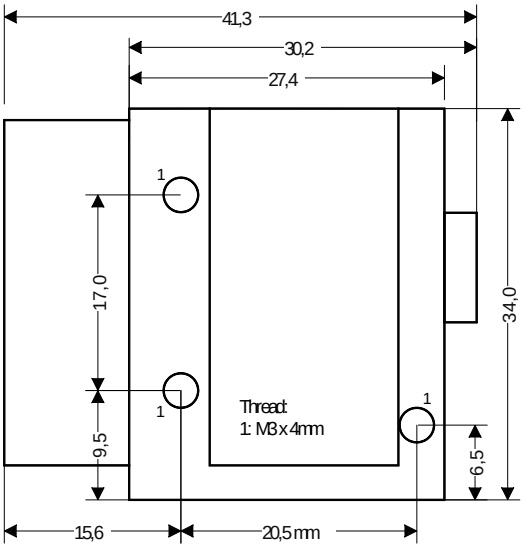


Figure 108: Side view

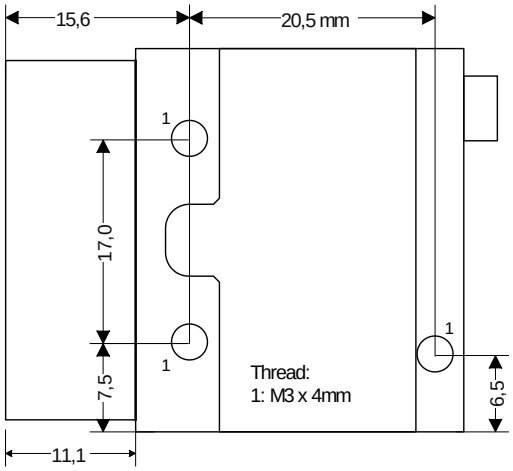


Figure 109: Top view

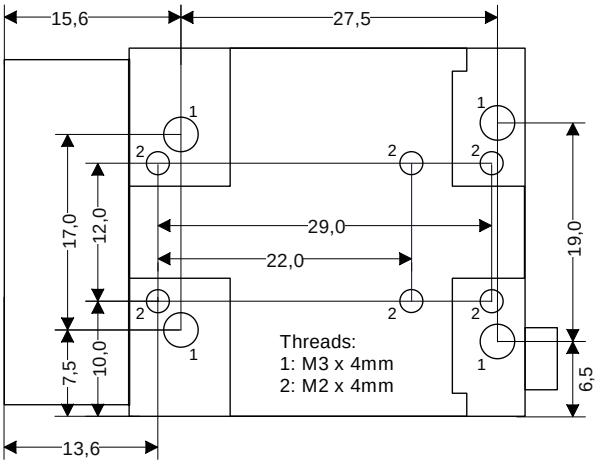


Figure 110: Bottom view

Figure 111: Base - side view

CCD cameras

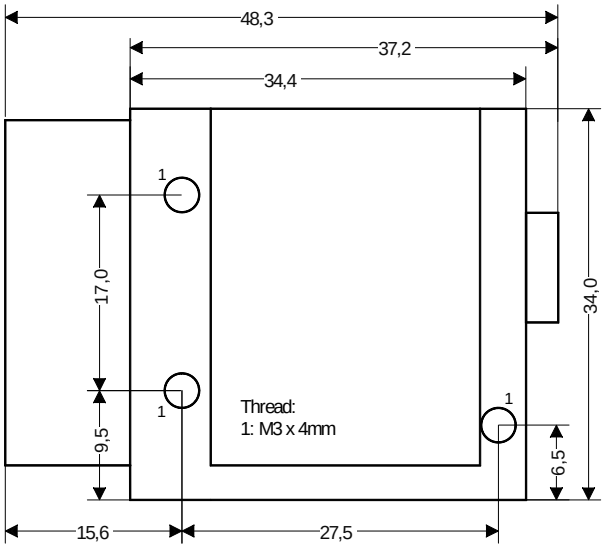


Figure 112: Side view

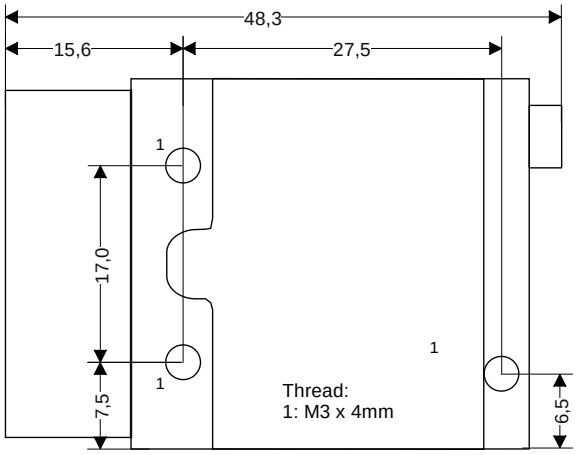


Figure 113: Top view

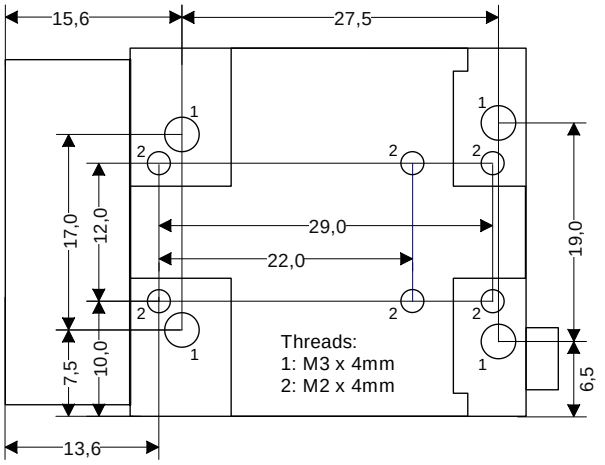


Figure 114: Bottom view

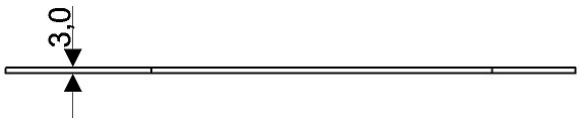


Figure 115: Base - side view

OEM Version (C-Mount without Housing)

CMOS/CCD cameras

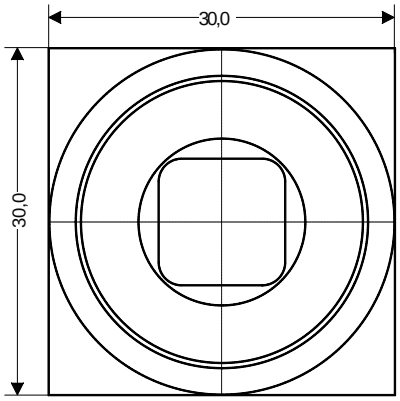


Figure 116: Front view

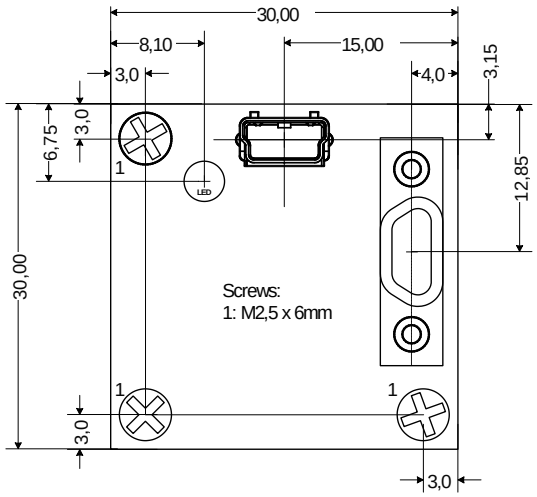


Figure 117: Rear view

CMOS cameras

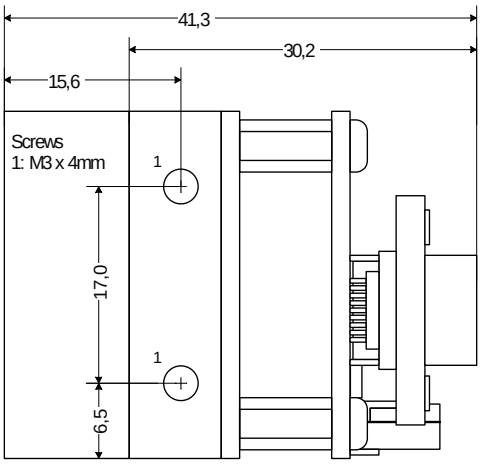


Figure 118: Side view

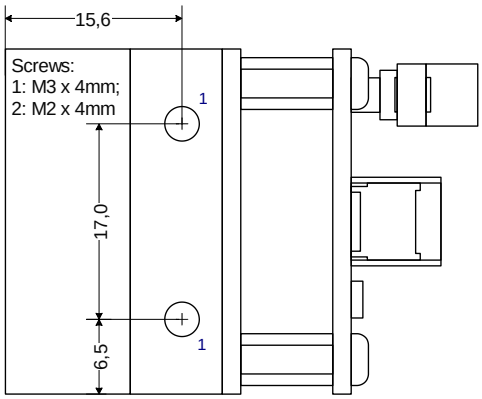


Figure 119: Top view

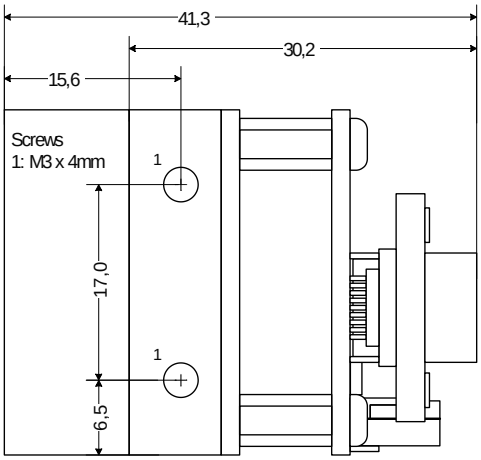


Figure 120: Bottom view

CCD cameras

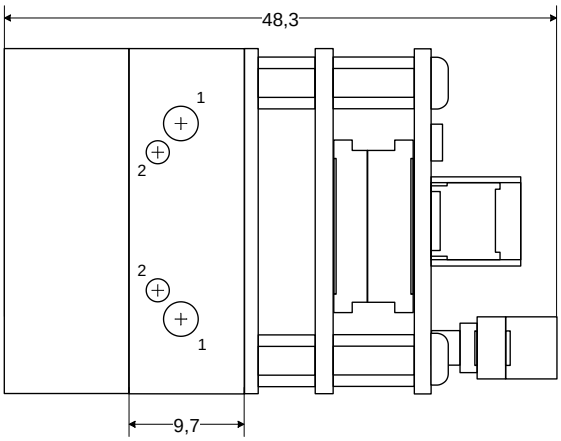


Figure 121: CMOS - bottom view

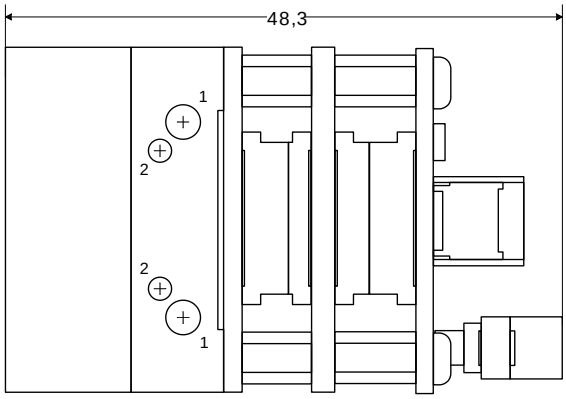


Figure 122: CCD - bottom view

OEM Version (PCB Stack)

CMOS/CCD cameras

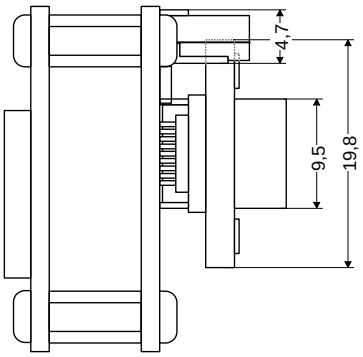


Figure 123: Side view

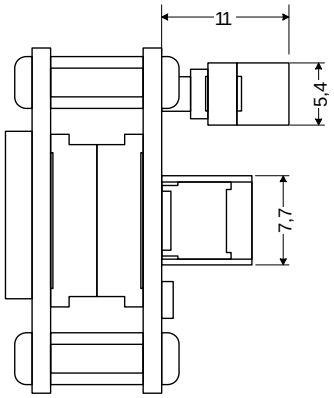


Figure 124: Top view

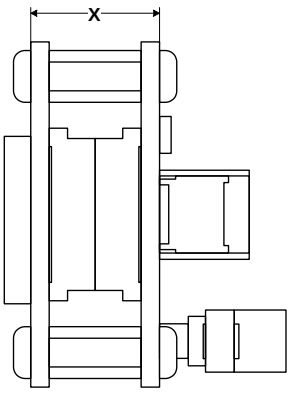


Figure 125: Bottom view

Value of distance X (model-dependent)

Camera model	Distance X
UI-1222 (sensor version V022)	12.3 mm
UI-1222 (sensor version V032)	13.5 mm
UI-1542	13.4 mm
UI-1642	13.1 mm
UI-1552	13.1 mm
UI-1462	13.3 mm
UI-1482	12.8 mm

CCD cameras

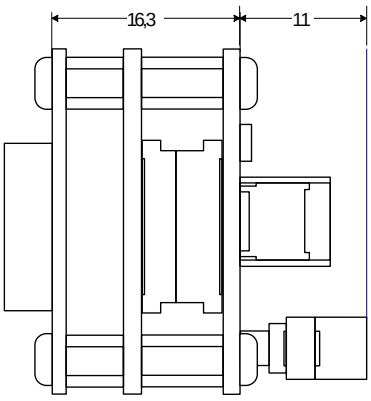


Figure 126: Bottom view

9.2.2 Dimensions

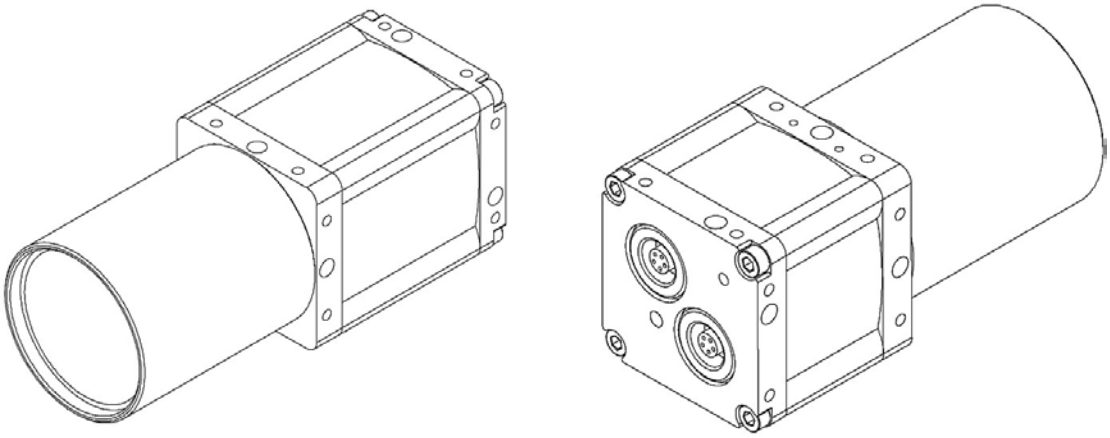


Figure 131: USB uEye RE

Lens mount	Enclosure protection class	Weight	
C-mount	IP 65/IP 67	Camera without tube Tube	145 g (CMOS), 180 g (CCD) max. 70 g

For the dimensions of the *USB uEye RE* accessories, please refer to the USB uEye RE Accessories chapter.

Differences to the USB uEye SE

The *USB uEye RE* features the following modifications compared to the standard *USB uEye SE* models:

- Binders series 712 is used for the connector. This series is approved for the IP 65 and IP 67 standards.
- The housing parts are sealed against each other with O-rings:
  - Rear panel/centerpiece
  - Centerpiece/front panel
  - Front panel/tube
- The LED light conductor is bonded.
- Tubes in different lengths are optionally available for sealing the lens.
- M3 and M5 mounting options are provided on the housing.

The *USB uEye RE* housing variant is IP 65/67 compliant. The following requirements must be met for compliance with the IP 65/67 standards:

- Cables must be attached to both connectors (USB and trigger) during operation. If the trigger connector is not used, it must be closed with the cover.
- A tube must be connected.

Attention: The *USB uEye RE* has not been approved for underwater use.

Housing dimensions

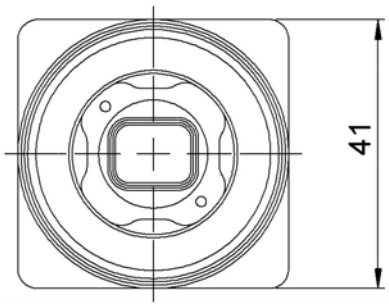


Figure 127: USB uEye RE - front view

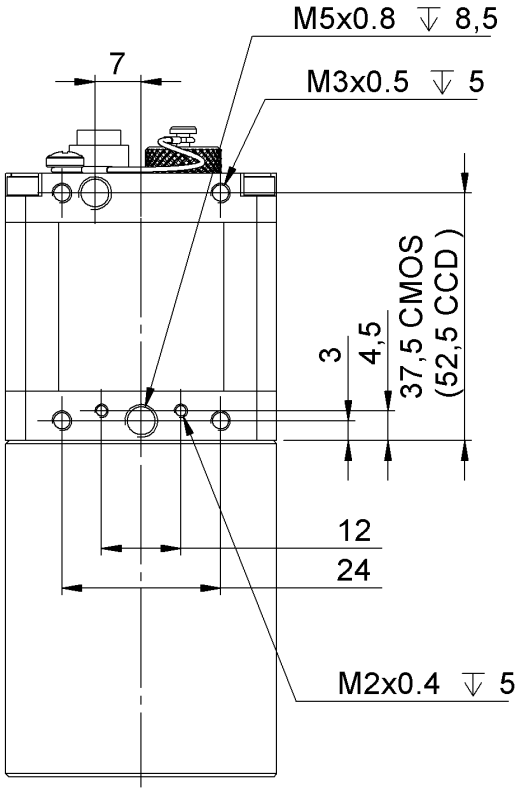


Figure 128: USB uEye RE - bottom view

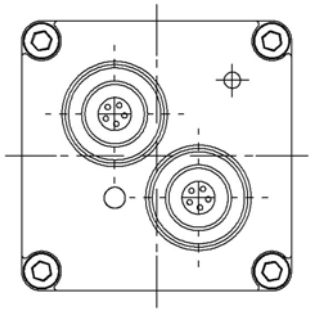


Figure 129: USB uEye RE - rear view

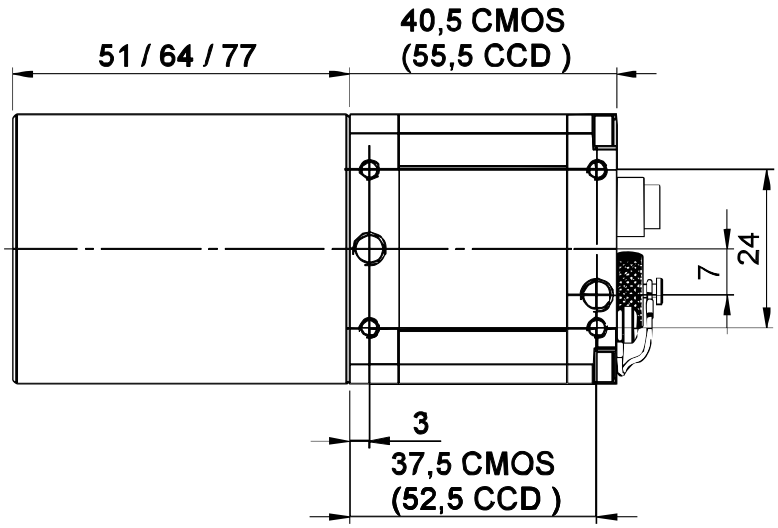


Figure 130: USB uEye RE - top view

9.2.3 USB uEye LE

Housing Version

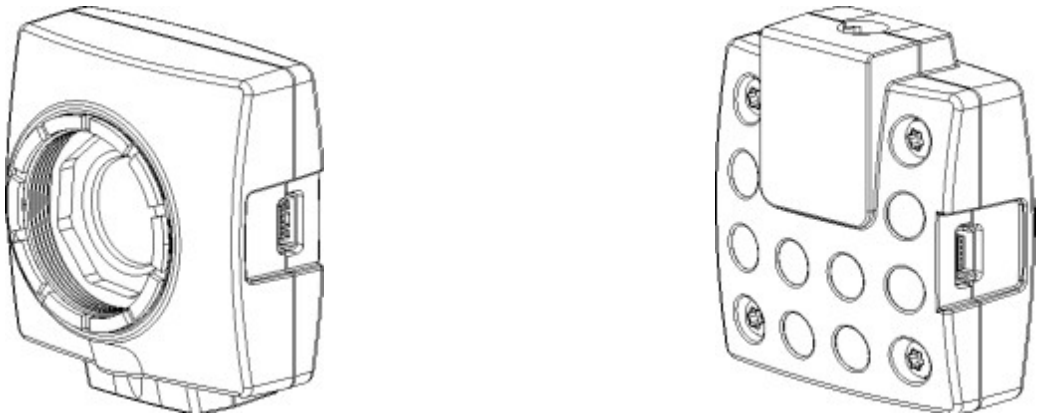


Figure 132: USB uEye LE

Lens mount	Enclosure protection class	Weight
CS-/S-mount	IP30 (with housing)	32 g (with housing) 12 g (S-mount) 8 g (PCB only)

For the dimensions of the *USB uEye LE* accessories, please refer to the USB uEye LE Accessories chapter.

Differences to the USB uEye SE

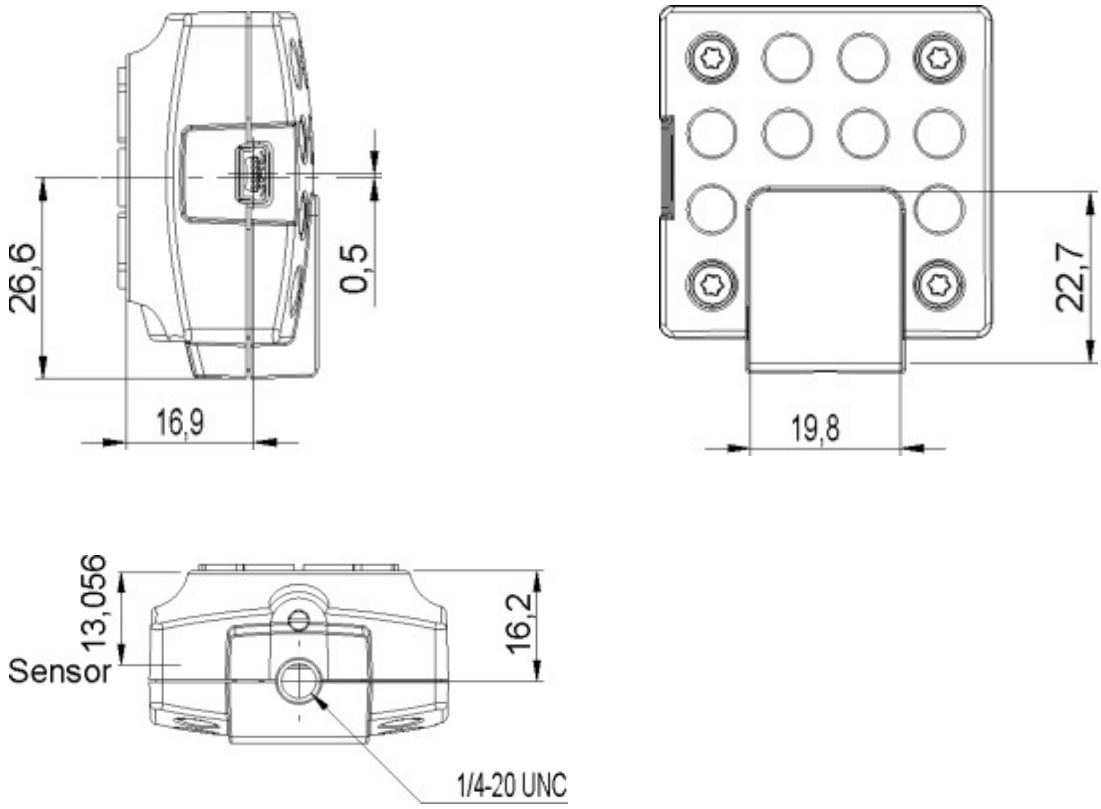
The *USB uEye LE* features the following differences to the *USB uEye SE* models:

- Version with housing: CS-mount (C-mount lenses can be connected using the enclosed adapter, see USB uEye LE Accessories).
- Version with housing: No I/O connector.
- Board level version: Optional I/O connector with all signals.
- Board level version: No opto couplers for the I/Os.
- Board level version: Hardware supports triggering on falling edges only.
- Board level version: Single color LED (orange) that indicates power-on status.

The following sensor/lens combinations are available:

	CS-mount with housing: UI-1xx**5LE**-x	S-mount M12: UI-1xx**6LE**-x	S-mount M14: UI-1xx**7LE**-x	without housing without lens holder: UI-1xx**8LE**-x
UI-122xLE-C	✓	✓		✓
UI-122xLE-M	✓	✓		✓
UI-154xLE-M	✓	✓	✓	✓
UI-164xLE-C	✓	✓		✓
UI-155xLE-C	✓	✓		✓
UI-146xLE-C	✓	✓	✓	✓
UI-148xLE-C	✓	✓	✓	✓

Dimensions of the housing version



PCB Version and Lens Holder

Dimensions of the board level version

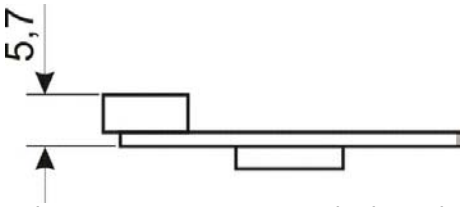


Figure 133: USB connector - horizontal position (default)

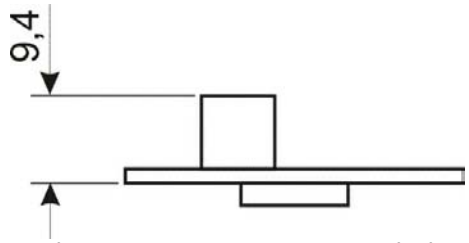
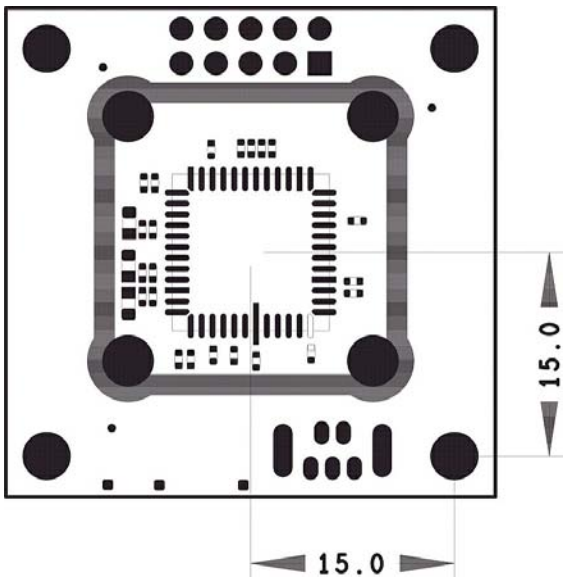
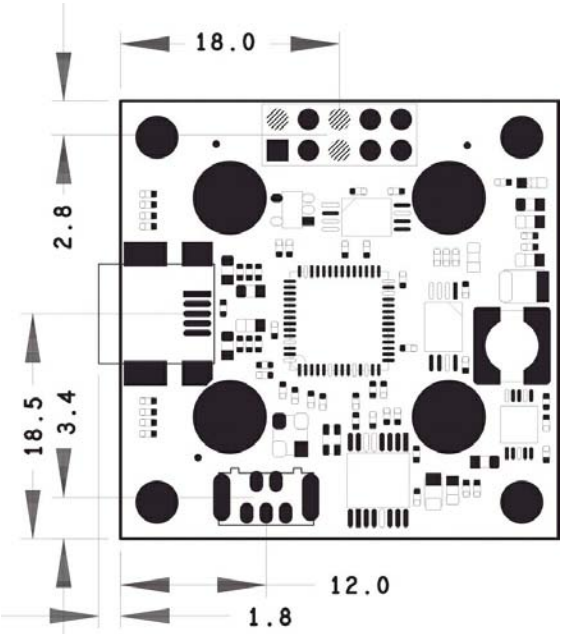
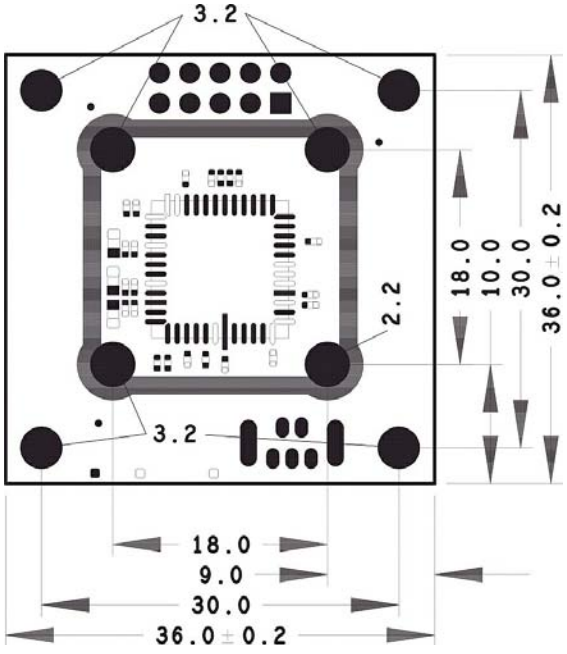


Figure 134: USB connector - vertical position (project-related option)







Dimensions of the S-mount lens holder (only USB uEye LE board level version)

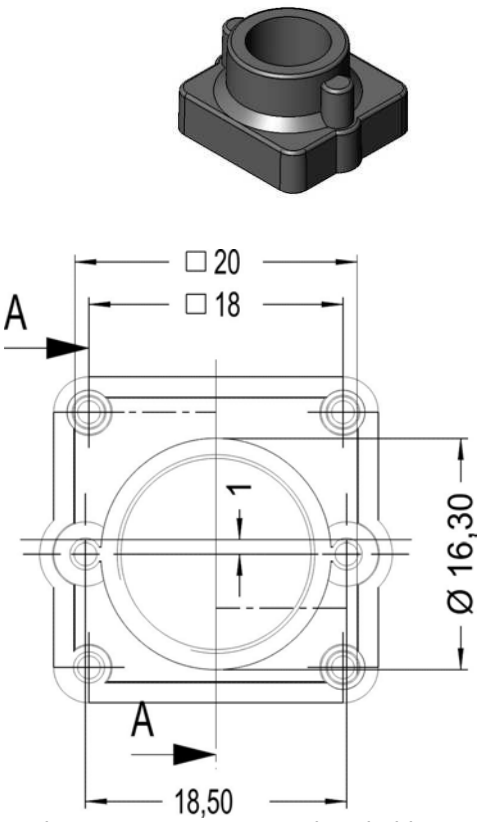


Figure 135: USB uEye LE lens holder - bottom view

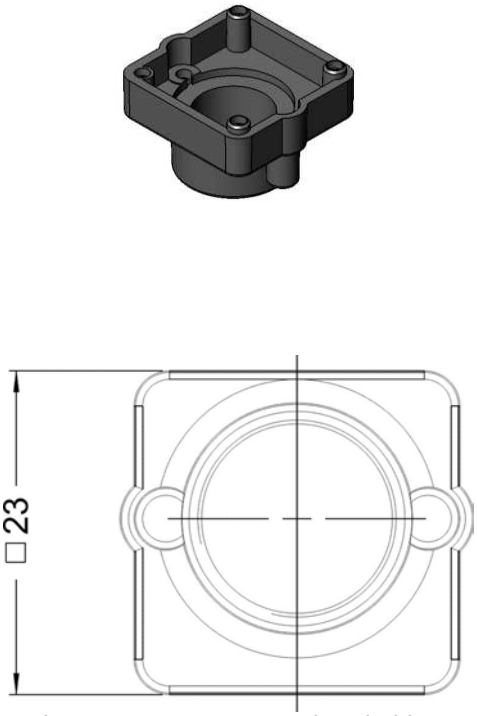


Figure 136: USB uEye LE lens holder - bottom view

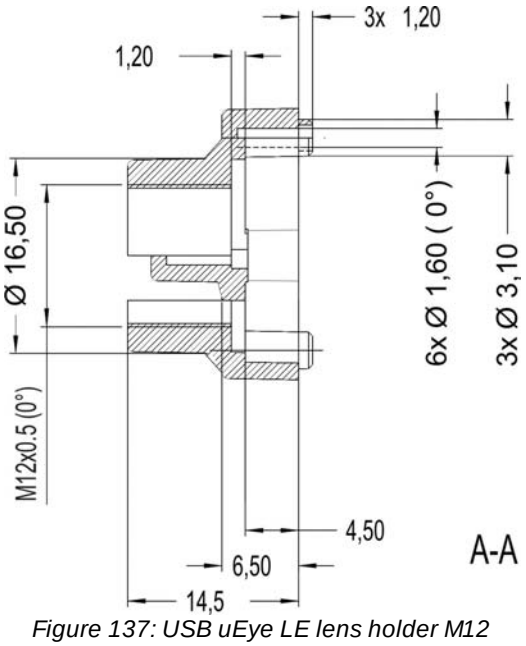


Figure 137: USB uEye LE lens holder M12

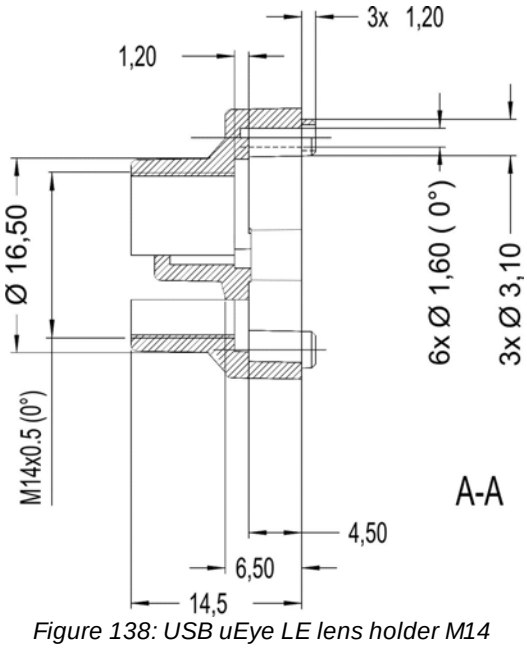


Figure 138: USB uEye LE lens holder M14

9.2.4 GigE uEye SE

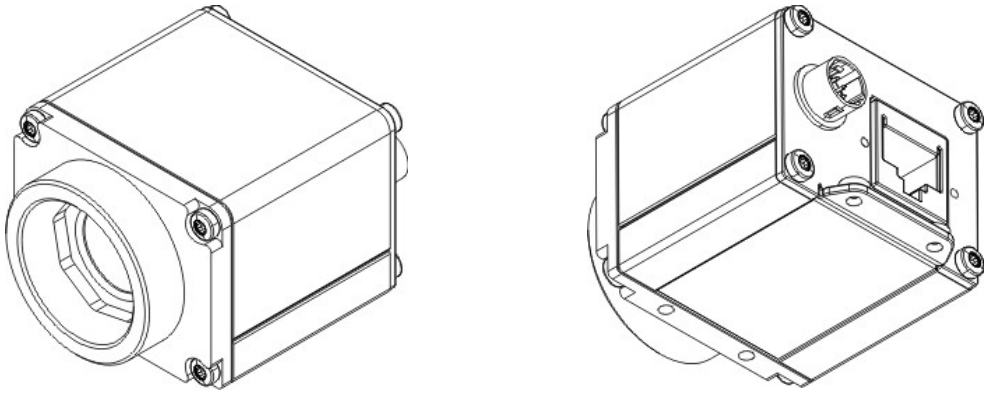


Figure 143: GigE uEye SE

Lens mount	Enclosure protection class	Weight
C-mount	IP 30	approx. 95 g (CMOS) approx. 112 g (CCD)

For the dimensions of the *GigE uEye SE* accessories, please refer to the GigE uEye SE Accessories chapter.

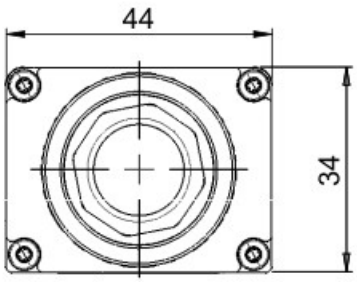


Figure 139: Front view

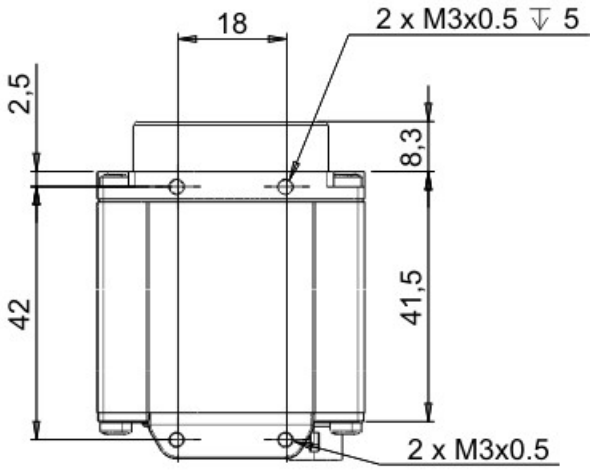


Figure 140: Top view

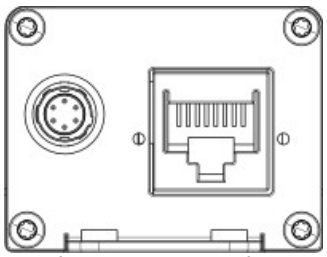


Figure 141: Rear view

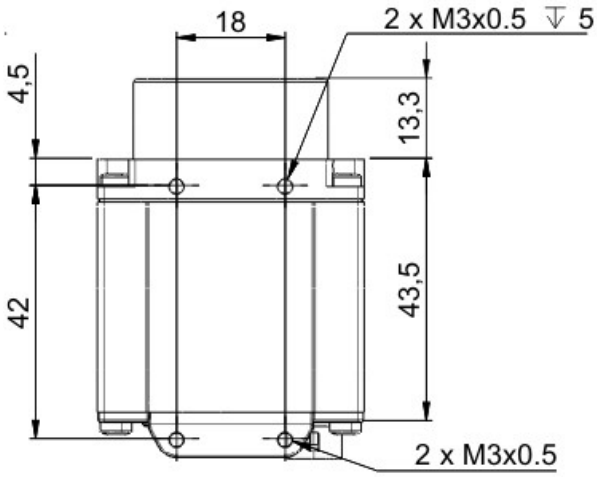


Figure 142: Bottom view

9.2.5 GigE uEye HE

Housing Version

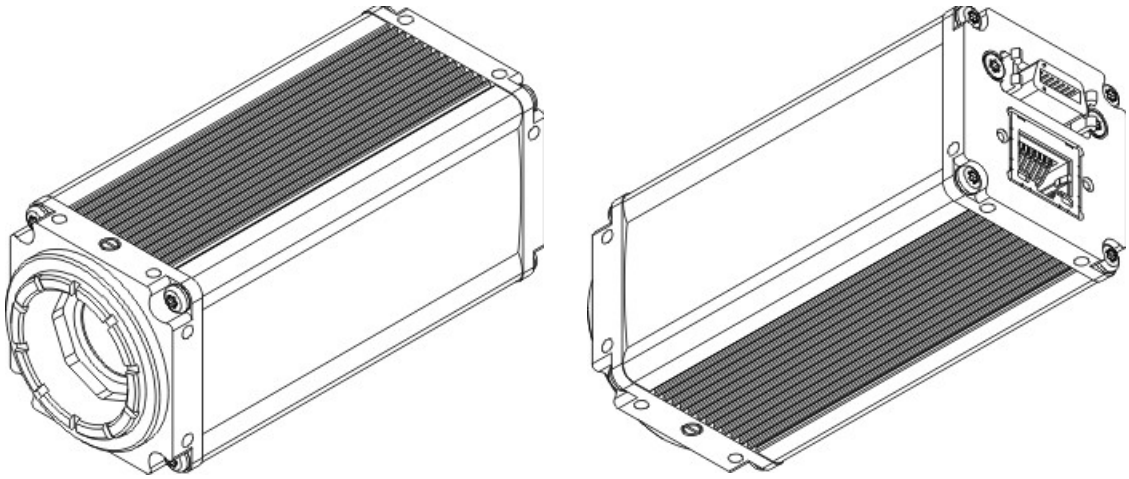


Figure 148: GigE uEye HE

Lens mount	Enclosure protection class	Weight
C-mount	IP 65/IP 67	170 g (CMOS/CCD)

For the dimensions of the *GigE uEye HE* accessories, please refer to the GigE uEye HE Accessories chapter.

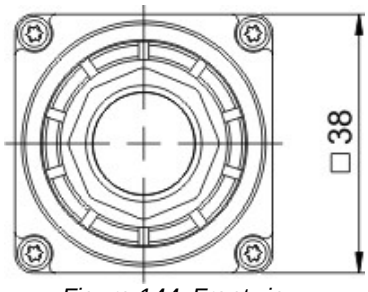


Figure 144: Front view

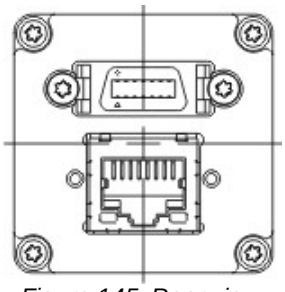


Figure 145: Rear view

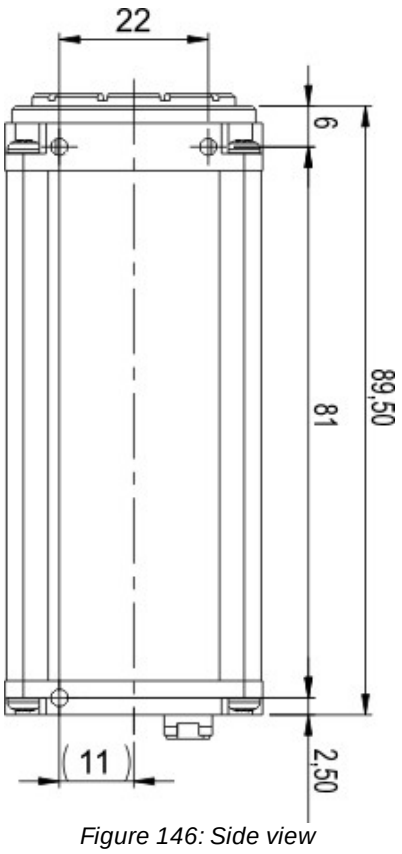


Figure 146: Side view

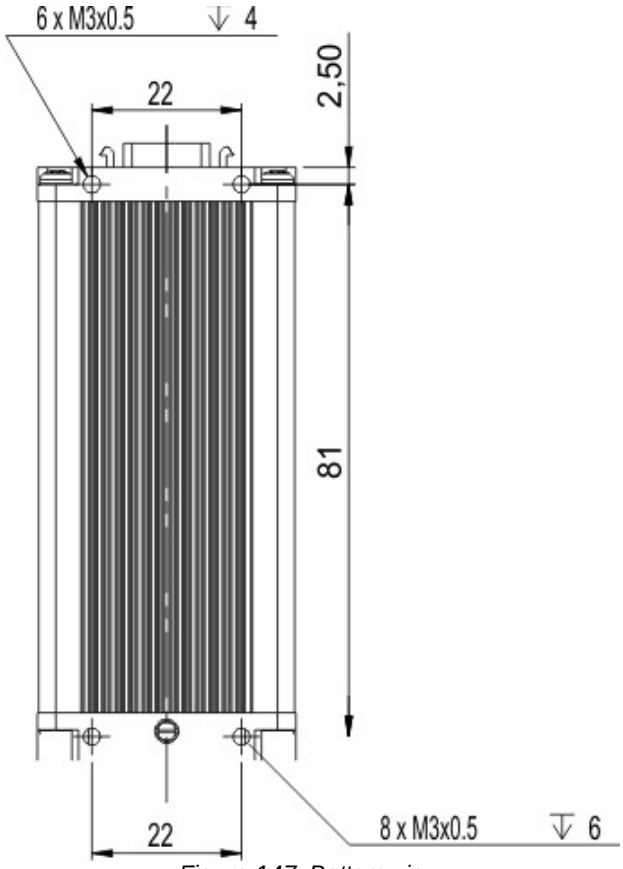


Figure 147: Bottom view

Angled Housing Version

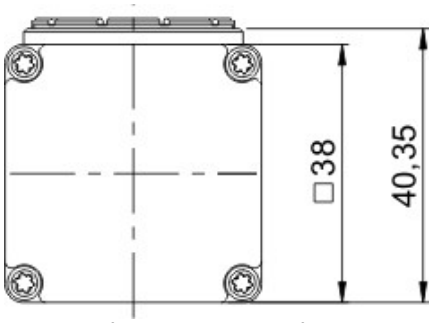


Figure 149: Front view

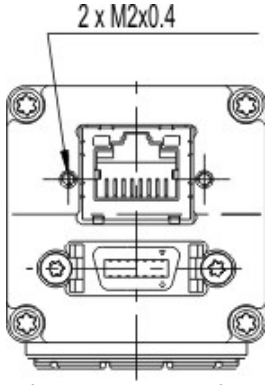


Figure 150: Rear view

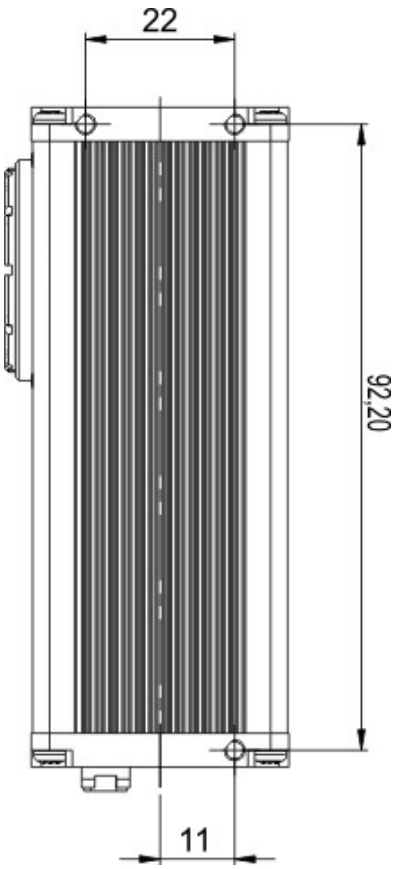


Figure 151: Side view

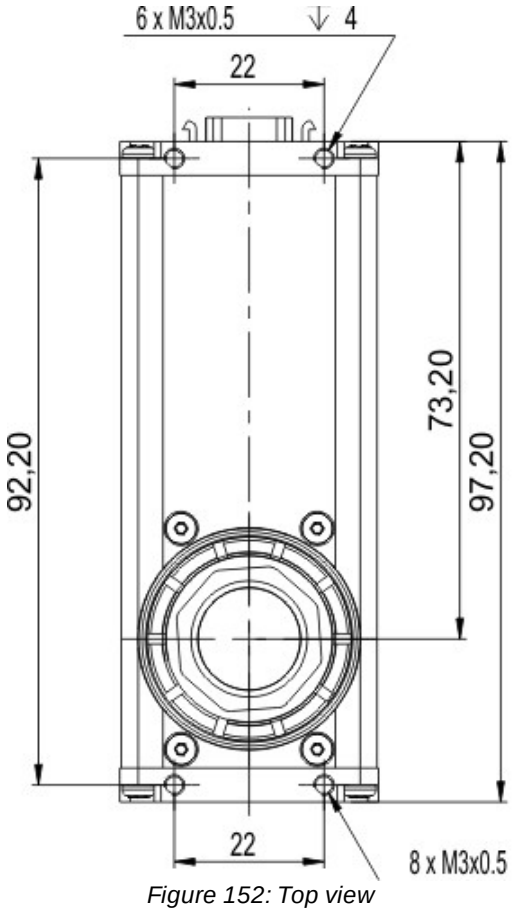


Figure 152: Top view

9.2.6 Flange Back Distance

Calculating the Flange Back Distance

To correctly determine the flange back distance of a *uEye* camera, you need to consider the distance between the lens flange and the active area of the sensor and, additionally, the type and thickness of any materials inserted into the optical path.

The *distance in air* between the threaded flange and the active area is 17.526 mm with C-mount lenses and 12.526 mm with CS-mount lenses.

This *mechanical distance* can change due to the material-specific refractive index of the inserted materials. The glass cover of the sensor and all filters inserted into the optical path must be taken into account in the calculation.

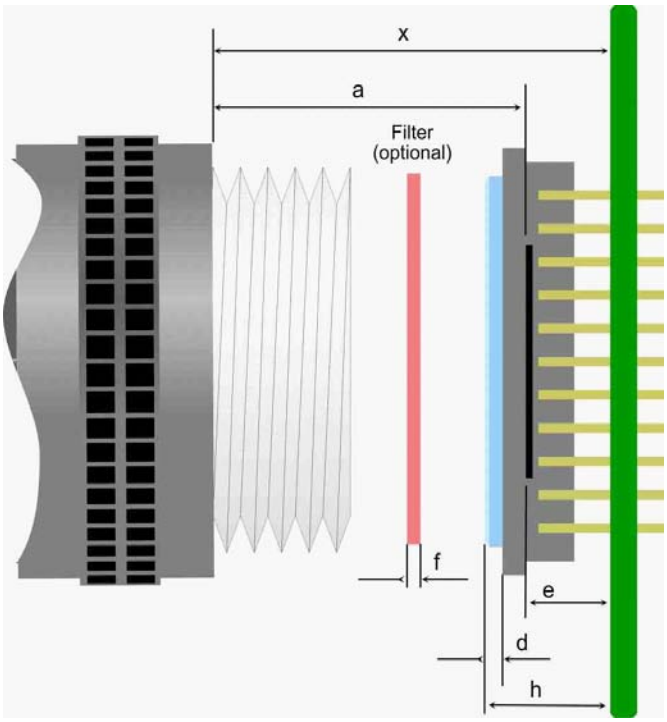


Figure 153: Calculating the flange back distance (schematic illustration)

Designation	Description
a	Distance from threaded flange to active sensor area (flange back distance) 17.526 mm*1) for C-mount 12.526 mm*1) for CS-mount
x	Distance from threaded flange to PCB
e	Distance from active sensor area to PCB
d	Thickness of the glass cover of the sensor
f	Filter thickness (optional)
n	Refractive index
h	Maximum sensor height above the PCB

1) This distance describes the equivalent in air (see introduction above)

You can use the following formula to calculate the mechanical flange back distance:

$$x = a + \frac{d \times (n_{glass} - 1)}{n_{glass}} + \frac{f \times (n_{filter} - 1)}{n_{filter}} + e$$

The tolerances for the position accuracy of uEye camera sensors are given in the Position Accuracy chapter.

Calculating the flange back distance for USB uEye SE cameras

uEye sensor	Sensor glass d [mm]	Refractive index (n_{Glass})	Distance e [mm]	x (no filter glass) [mm]	x (with filter glass) [mm]	Sensor height h [mm]
CMOS						
UI-121x-xx	0.550	1.52	1.225	18.94	19.29	2.460
UI-122x-xx *V022)	0.400	1.49	0.475	18.13	18.48	1.450
UI-122x-xx *V032)	0.550	1.50	1.400	19.46	19.81	2.500
UI-141x-xx	0.640	1.50	1.290	18.99	19.34	2.580
UI-144x-xx	0.640	1.50	1.330	18.99	19.34	2.580
UI-145x-Cx	0.525	1.50	1.270	18.97	19.32	2.480
UI-146x-Cx	0.550	1.49	1.250	18.96	19.31	2.375
UI-148x-xx	0.400	1.50	0.725	18.76	19.11	1.350
UI-154x-xx	0.525	1.50	1.270	18.97	19.32	2.480
UI-155x-Cx	0.550	1.50	1.45	19.16	19.51	2.500
UI-164x-Cx	0.550	1.50	1.45	19.16	19.51	2.500
CCD						
UI-221x-xx	0.75	1.5	2.81	20.59	20.94	4.69
UI-222x-xx	0.75	1.5	2.81	20.59	20.94	4.69
UI-223x-xx	0.75	1.5	2.81	20.59	20.94	4.78
UI-224x-xx	0.75	1.5	2.81	20.59	20.94	4.83
UI-225x-xx	0.5	1.5	2.81	20.59	20.94	4.43
UI-231x-xx	0.75	1.5	2.81	20.59	20.94	4.78
UI-234x-xx	0.5	1.5	2.81	20.59	20.94	4.43
UI-241x-xx	0.75	1.5	2.81	20.59	20.94	4.78

*V022) *Sensor model MT9V022, identified by black housing (BGA package)*

*V032) *Sensor model MT9V032, identified by brown housing (technically identical with V022)*

Calculation example: UI-154x-xx with IR-cut filter

(a = 17.526 mm, d = 0.525 mm, nGlass = 1.50, f = 1mm, nFilter = 1.53; see Filter Types table)

$$x = 17.526\,\text{mm} + \frac{0.525\,\text{mm} \times (1.50 - 1)}{1.50} + \frac{1.00\,\text{mm} \times (1.53 - 1)}{1.53} + 1.27\,\text{mm} = 19.32\,\text{mm}$$

Calculating the flange back distance for USB uEye LE cameras with CS-mount

For *USB uEye LE* cameras with CS-mount, the flange back distance is only 12.526 mm!

USB uEye LE sensor	Sensor glass d [mm]	Distance e [mm]	Sensor height h [mm]
CMOS			
122xLE	0.55	1.45 +/- 0.125	2.35 +/- 0.15
164xLE	0.55	1.45 +/- 0.125	2.35 +/- 0.15
148xLE	0.40	0.725 +/- 0.075	1.25 +/- 0.125
154xLE	0.55	1.27 +/- 0.085	2.21 +/- 0.27
155xLE	0.55	1.45 +/- 0.125	2.35 +/- 0.15

Calculating the flange back distance for GigE uEye cameras

uEye sensor	Sensor glass d [mm]	Refractive index (n_{Glass})	Distance e [mm]	x (no filter glass) [mm]	x (with filter glass) [mm]	Sensor height h [mm]
CMOS						
UI-521x-xx	0.550	1.52	1.225	18.94	19.29	2.460
UI-5220-xx *V022)	0.400	1.49	0.475	18.13	18.48	1.450
UI-5220-xx *V032)	0.550	1.50	1.400	19.46	19.81	2.500
UI-5460-Cx	0.550	1.49	1.250	18.96	19.31	2.375
UI-5480-xx	0.400	1.50	0.725	18.76	19.11	1.350
UI-5540-xx	0.525	1.50	1.270	18.97	19.32	2.480
UI-555x-xx	0.550	1.50	1.45	19.16	19.51	2.500
UI-564x-xx	0.550	1.50	1.45	19.16	19.51	2.500
CCD						
UI-6210-xx	0.75	1.5	2.81	20.59	20.94	4.69
UI-6220-xx	0.75	1.5	2.81	20.59	20.94	4.69
UI-6230-xx	0.75	1.5	2.81	20.59	20.94	4.78
UI-6240-xx	0.75	1.5	2.81	20.59	20.94	4.83
UI-6250-xx	0.5	1.5	2.81	20.59	20.94	4.43
UI-6310-xx	0.75	1.5	2.81	20.59	20.94	4.78
UI-6340-xx	0.5	1.5	2.81	20.59	20.94	4.43
UI-6410-xx	0.75	1.5	2.81	20.59	20.94	4.78

*V022) *Sensor model MT9V022, identified by black housing (BGA package)*

*V032) *Sensor model MT9V032, identified by brown housing (technically identical with V022)*

Calculation example: UI-5540-xx with IR-cut filter

(a = 17.526 mm, d = 0.525 mm, nGlass = 1.50, f = 1 mm, nFilter = 1.53; see Filter Types table)

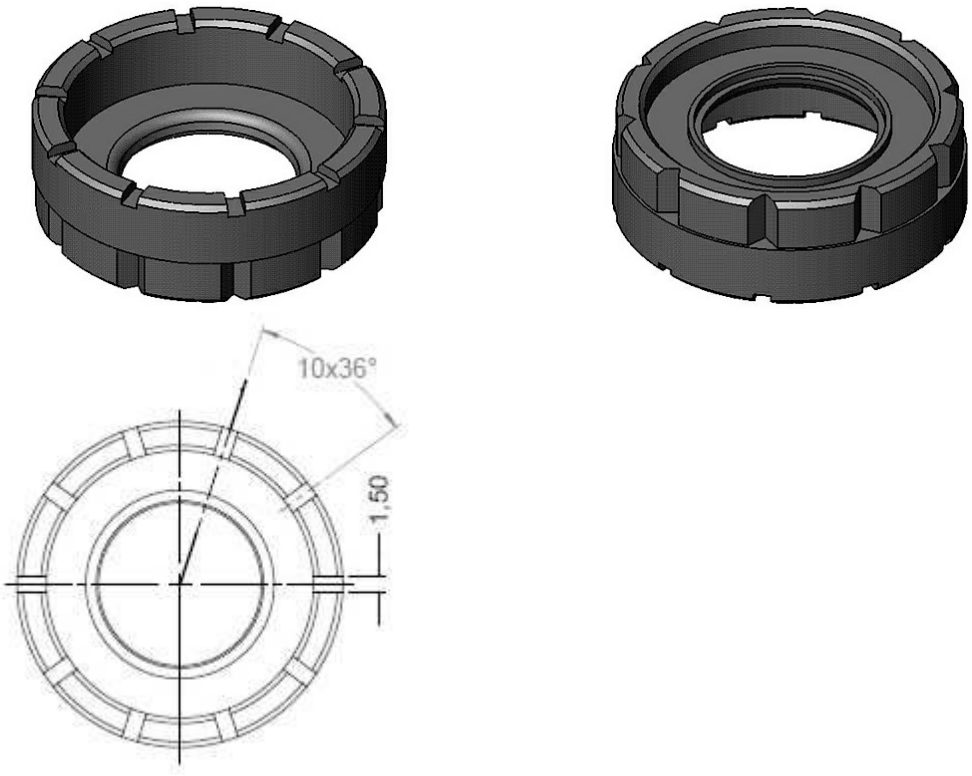
$$x = 17.526\,\text{mm} + \frac{0.525\,\text{mm} \times (1.50-1)}{1.50} + \frac{1.00\,\text{mm} \times (1.53-1)}{1.53} + 1.27\,\text{mm} = 19.32\,\text{mm}$$

Adjusting the Flange Back Distance

Some *uEye* models feature an adjusting ring that allows changing the flange back distance. Please follow the information below to avoid damage to the camera.

USB uEye LE

The adjusting ring of the *USB uEye LE* has 10 adjusting positions. For each adjusting position, the flange back distance is altered by +/- 50 µm.



To change the position of the adjusting ring, please proceed exactly in the following order:

1. Loosen the locking screw (see figure below).
2. Adjust the C-mount ring (IDS special tool required, see USB uEye LE Accessories).

Figure 154: Securing the adjusting ring

GigE uEye HE

The adjusting ring of the *GigE uEye HE* camera has 10 adjusting positions. For each adjusting position, the flange back distance is altered by +/- 50 µm.

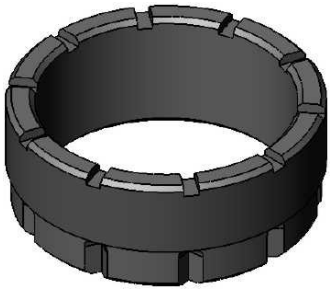


Figure 155: GigE uEye HE adjusting ring - top view

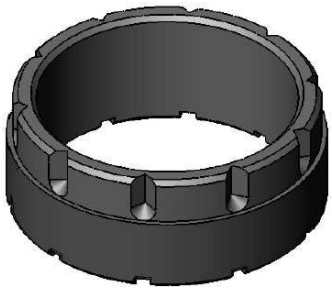


Figure 156: GigE uEye HE adjusting ring - bottom view

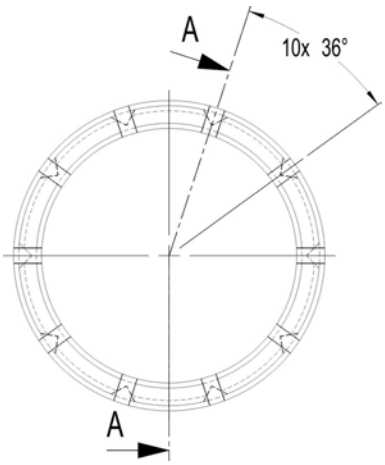


Figure 157: Calculating the flange back distance (schematic illustration)

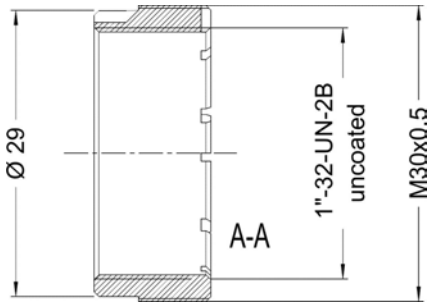


Figure 158: Calculating the flange back distance (schematic illustration)

To change the position of the adjusting ring, please proceed exactly in the following order:

1. Loosen the locking screw on the bottom of the camera (see illustration below).
2. Release the filter holder by turning it two revolutions counterclockwise (IDS special tool required, see also GigE uEye HE Accessories).
3. Adjust the C-mount ring. Ensure that the notch of the C-mount ring is precisely aligned with the locking screw (when viewed from the camera front).
4. Hold the C-mount ring and screw in the locking screw . Do not use excessive force.
5. Turn the filter holder clockwise until tight.

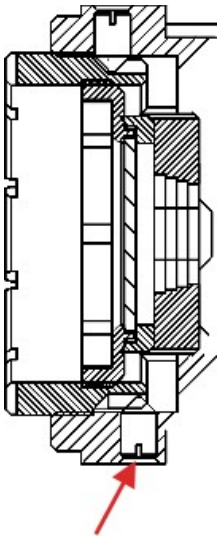


Figure 159: Locking screw for the adjusting ring

Position Accuracy of the Sensor

The following illustration shows the tolerance margins of the sensor position relative to the camera housing. A maximum error in all directions (rotation, translation) cannot occur simultaneously.

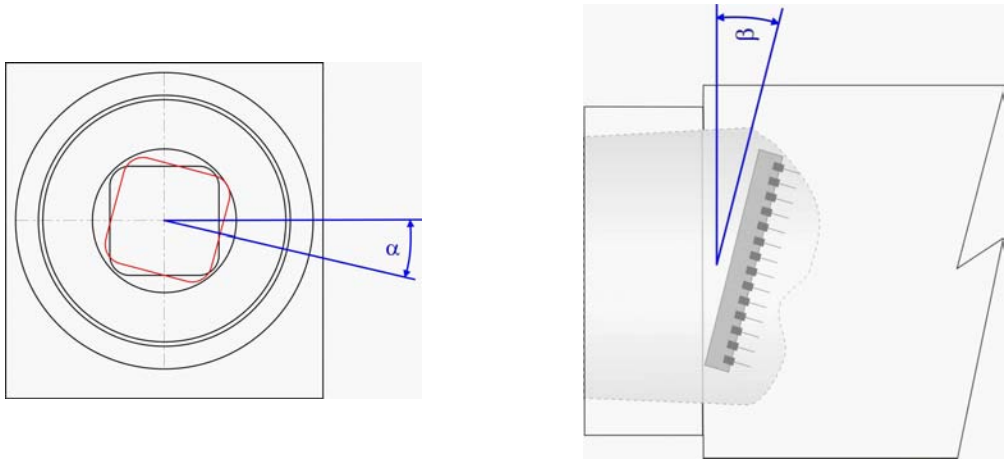


Figure 160: Position accuracy of the sensor

Position accuracy inside the camera housing, in each direction	±0.3	mm
Horizontal/vertical rotation (α)	±1.0	°
Translational rotation (β)	±1.0	°
Flange back distance	±0.05	mm

C-mount lenses can also be subject to inaccuracies of the flange back distance. The tolerance usually is ±0.05 mm. In some cases, however, the inaccuracies of camera and lens might add up, resulting in a total error > 0.05 mm.

Maximum Immersion Depth for Lenses

Some C-mount lenses reach deep into the camera flange. This may cause the lens to push against the back of the filter glass inside the camera or even make it impossible to screw in the lens.

The table below indicates the maximum possible immersion depth for each *uEye* model. The actual immersion depth of a lens is given in the relevant data sheet. As lens parts with a small diameter are allowed to reach deeper into the camera flange, the immersion depths are specified based on the diameter.

Camera	Type	Thread depth	Diameter at lens end (mm)	Max. immersion depth CMOS (mm)	Max. immersion depth CCD (mm)
USB uEye SE	C-mount	5 mm	24.0	9.4	8.4
			17.1	10.2	9.2
			14.1	10.7	9.7
USB uEye RE	C-mount	5 mm	24.0	8.9	7.9
			19.6	9.4	8.4
			17.1	10.2	9.2
			14.1	10.7	9.7
USB uEye LE	CS-mount	4 mm	24.0	6.1	-
			14.6	7.6	-
	C-mount with extension ring	5 mm	22.0 *)	11.1	-
			14.6 *)	12.6	-
GigE uEye SE	C-mount	5 mm	24.0	5.4	5.7
			20.4	8.9	9.2
			14.6	9.9	10.2
GigE uEye HE	C-mount	5 mm	24.0	7.4	6.7
			20.4	9.9	9.2
			14.6	10.9	10.2

*) *May vary depending on the inside diameter of the extension ring used*

The data given in the table include the following tolerances as a safety clearance:

- Immersion depth: 0.2 mm / 0.5 mm for *GigE uEye HE*
- Diameter: 0.2 mm

9.2.7 Filter Glasses

Filter Types

Every *uEye* camera has a filter glass in the front flange to prevent the entry of dust particles. Color cameras by default use an IR cut filter, which is required to ensure correct color rendering. The default filter glass in monochrome cameras has no filter effect. Every camera model is available with different filter variants such as daylight cut filters (type DL). The filter type is given at the end of the uEye model name.

The following table shows an overview of the different optical filters used in the *uEye* cameras:

Filter type	Name	Refractive index (n_{Filter})	Glass type	Thickness (f)	Cut-off frequency	Non-reflective
IR cut filter (old)	BG	1,53	BG40	1 mm	650 nm	-
IRcut filter (new)	HQ	1,53	D263	1 mm	650 nm	On one side
Daylight cut filter	DL	1,53	RG665	1 mm	665 nm	-
Glass	GL	1,53	D263	1 mm	380 nm	On both sides

You can tell the filter type from the outside by its coloration:

- Reddish glass: HQ filter
- Bluish glass: BG filter
- Opaque glass: DL filter
- Plain glass: GL filter

New *uEye* color cameras use an IR cut filter of the type *HQ* by default. This filter offers an improved accuracy of the infrared content. *HQ* filters achieve a higher image brightness and better color rendering.

uEye drivers of version V3.24 and higher determine automatically which the IR filter is used in a camera. The corresponding color correction is selected automatically.

Infrared cut filter (type BG)

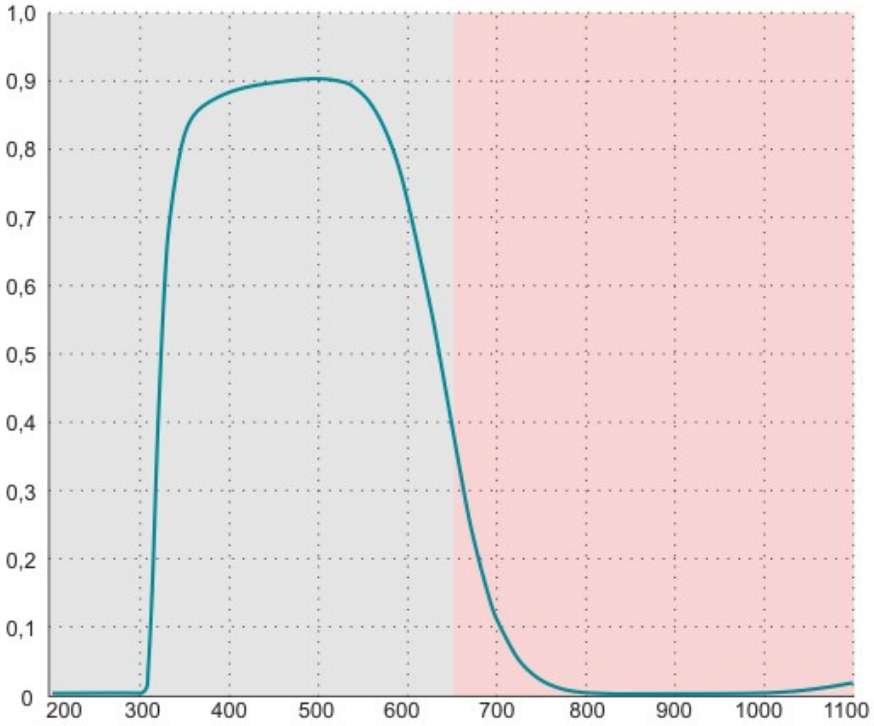


Figure 161: BG filter

Infrared cut filter (type HQ)

Figure 162: HQ filter

Daylight cut filter (type DL)

Figure 163: DL cut filter

Plain glass filter (type GL)

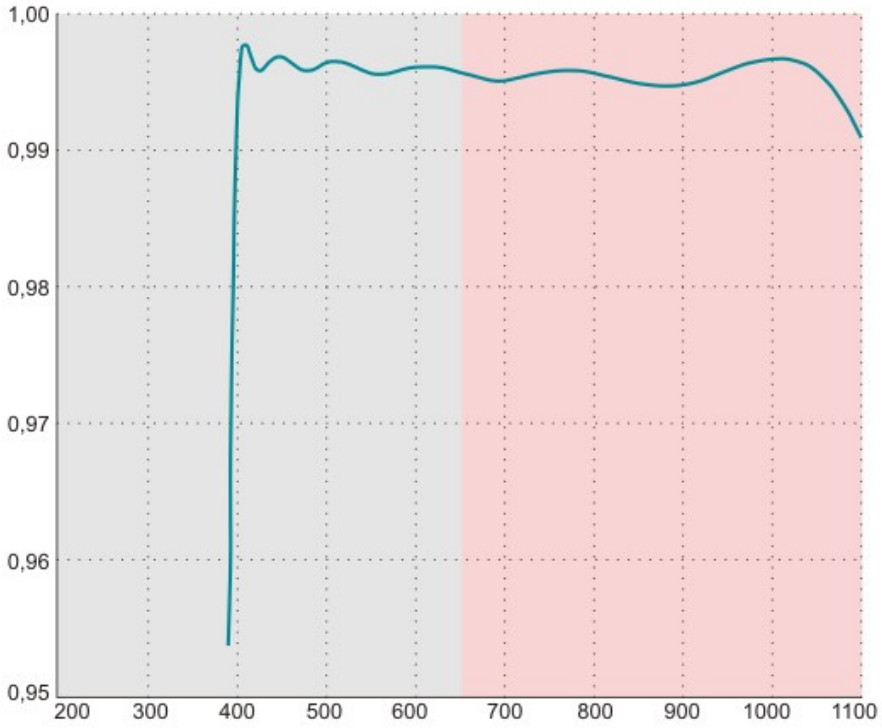


Figure 164: Glass filter

Mounting the Filter

The IR-cut filter of the *USB uEye LE* and *GigE uEye SE/HE* is welded onto the threaded ring and mounted with it.

Figure 165: Threaded ring - top view

Figure 166: Threaded ring - bottom view

The threaded ring is screwed into the adjusting ring from the front with a torque of 0.2 Nm. A properly mounted threaded ring will seal off the sensor.

A special IDS tool is required for adjusting the threaded ring (see GigE uEye HE Accessories).

Cleaning the Filter Glasses

When handling the uEye camera with its lens removed, the filter glass can get soiled from the outside. This might be visible in the images that are captured. The filter glass should therefore be cleaned in that case.

It is strongly recommended to return the cameras to *Imaging Development Systems GmbH* for professional cleaning.

Imaging Development Systems GmbH is not liable for any damage resulting from cleaning the filter glasses. This even applies if the following instructions have been observed.

Instructions for cleaning uEye filter glasses

- **The filter glasses may only be cleaned from the outside.** If you remove the glasses, the sensor might get soiled. *Imaging Development Systems GmbH* is not liable for any damage to the sensor resulting from removal of the filter glasses.
- **First, remove dirt particles on the glass using compressed air.** Do not use compressed air from compressors or spray cans since it often contains oil droplets or droplets of other liquids. For best results, use purified nitrogen from nitrogen bottles.
- **Only use lint-free wipes or cotton-free swabs for cleaning.** Never touch the filter glasses with your bare fingers because often, fingerprints cannot be removed completely afterwards.
- **We recommend to use pure alcohol for cleaning.** 100% isopropyl alcohol evaporates without leaving any residues. Only add small quantities of alcohol to the wipe. Never pour alcohol directly onto the camera.

Never use cleaning agents containing acetone for cleaning the filter glasses!
Acetone may damage the filter glass coating and may deteriorate the optical quality of the glasses.

Cameras with fixed filter glass (USB uEye SE/RE)

Use a wipe to wipe off dirt particles in a single sweep beyond the edge of the filter glass (see figure below).

Figure 167: Cleaning filter glasses - USB uEye SE/RE series

Cameras with replaceable filter glass (USB uEye LE, GigE uEye SE/HE)

Use a wipe to wipe off dirt particles in a circular sweep (see figure below).

Figure 168: Cleaning filter glasses - USB uEye LE and GigE uEye SE/HE

9.2.8 Ambient Conditions

USB uEye SE

	Min.	Max.	°
Ambient temperature	0 32	45 113	°C °F
Storage temperature	-20 -4	60 140	°C °F
Relative humidity *1)	20	80	%

*1) Non-condensing

USB uEye LE

	Min.	Max.	°
Ambient temperature	0 32	45 113	°C °F
Storage temperature	-20 -4	60 140	°C °F
Relative humidity *1)	20	80	%

*1) Non-condensing

USB uEye RE

	Min.	Max.	°
Ambient temperature	0 32	45 113	°C °F
Storage temperature	-20 -4	60 140	°C °F
Relative humidity for *USB uEye RE* *2)	0	100	%

*2) Only if *USB uEye RE* lens tube and IP65/67 cables are used

GigE uEye SE

	Min.	Max.	°
Ambient temperature	0 32	45 113	°C °F
Storage temperature	-20 -4	60 140	°C °F
Relative humidity *1)	20	80	%

*1) Non-condensing

GigE uEye HE

	Min.	Max.	°
Ambient temperature	0 32	45 113	°C °F
Storage temperature	-20 -4	60 140	°C °F
Relative humidity *1)	20	80	%

*1) Non-condensing

Non-condensing means that the relative air humidity must be below 100%. Otherwise, moisture will form on the camera surface. If, for example, air has a relative humidity of 40% at 35°C, the relative humidity will increase to over 100% if the air cools down to 19.5°C; condensation begins to form.

Avoid high air humidity levels and rapid temperature changes when using *uEye* cameras.

Vibration and shock resistance

Vibration and shock resistance of the *uEye* cameras were tested as specified in DIN EN 60068-2-6 (1996-05), DIN EN 60068-2-27(1995-03) and DIN EN 60068-2-29(1995-03). The mechanical shock was at 80 g; the vibration testing was performed with sinusoidal vibration at a frequency between 30 Hz-500 Hz and an amplitude of 10 g.

Definition of IP Protection Classes

The housing of the *USB uEye RE* models complies with the IP *(Ingress Protection)* 65/67 standard. The housings of the other *uEye* models comply with IP 30. These standards are defined as follows:

First digit

3	*Protection against the ingression of small particles (diameter > 2.5 mm)*
6	*Dust-proof* No ingression of dust at a vacuum of 20 mbar in the housing

Second digit

0	*No special protection against liquids*
5	*Protected from jets of water* Test conditions: Using a jet nozzle with an inside diameter of 6.3 mm, a jet of water at a volume flow of 12.5 liters per minute is applied to the housing from all directions at a distance of 2.5 - 3 meters. The testing period is at least 3 minutes.
7	*Protected against the effects of temporary immersion in water* Test conditions: The housing is dipped completely under water in a dip tank. The submerged depth is 30 cm and the testing period is 20 seconds. Water may not intrude in a quantity which causes harmful effects while the housing is dipped in water under standardized pressure and time conditions.

9.3 Electrical Specifications

9.3.1 USB uEye SE

Pin Assignment

9-pin micro D-Sub socket

Pin	Description
1	Digital output (-)
2	Digital input (+)
3	Shielding
4	USB power supply (VCC) 5 V
5	USB ground (GND)
6	Digital output (+)
7	Digital input (-)
8	USB data (+)
9	USB data (-)

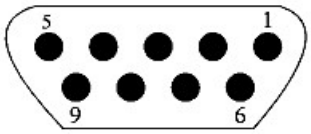


Figure 169: Pin assignment of the micro D-Sub socket

Pin assignment of the uEye special cable for USB 2.0, trigger and flash

Pin	Description	Cable color
1	Digital output (-)	green
2	Digital input (+)	white
6	Digital output (+)	yellow
7	Digital input (-)	brown

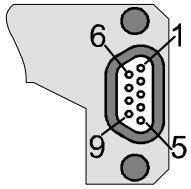


Figure 170: Pin assignment of the trigger cable (D-Sub)

For a comprehensive list of all cables and connectors available for *USB uEye SE* cameras, please refer to the USB uEye SE Accessories section.

Digital Input Wiring (Trigger)

Digital input specifications

USB board revision *)	1.2		2.0 or higher		
	Min.	Max.	Min.	Max.	
Level low	0	2	0	2	V
Level high	9	24	5	24	V
Voltage range	0	30	0	30	V
Trigger pulse width (edge)	100	-	100	-	µs
Trigger edge steepness	35		35		V/ms
Breakdown voltage		50		50	V
Input current	10	-	10	-	mA

*) For information on how to determine the USB board revision, please refer to the USB uEye SE Driver Compatibility chapter.

For interpreting the trigger signal, either the positive or the negative edge can be used. The digital input is galvanically isolated using an opto coupler to protect the camera and the PC against surges. Only DC voltages may be applied to the digital input.

Digital input wiring

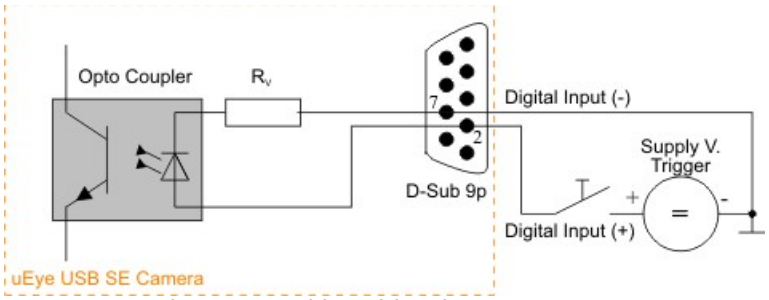


Figure 171: Wiring of the trigger connector

Digital Output Wiring (Flash)

Digital output specifications

USB board revision *)	1.2	2.0 or higher	
	Max.	Max.	
Output current (short-time)	50	500	mA
Output current (permanent)	15	150	mA
Output voltage	30	30	V
Breakdown voltage	50	50	V
Collector power dissipation	100	125	mW

*) For information on how to determine the USB board revision, please refer to the USB uEye SE Driver Compatibility chapter.

The digital input is galvanically isolated using an opto coupler to protect the camera and the PC against surges. Only DC voltages may be applied to the digital input.

The output of the opto coupler can be used as an open collector or open emitter output. This means that the output signal can be connected to ground or to the supply voltage. The output signal is active if the collector-emitter switch is closed (software setting: *Flash high active*, see also the Camera Properties: Input/Output section).

Digital output wiring

The following figures show examples of how the digital output is wired.

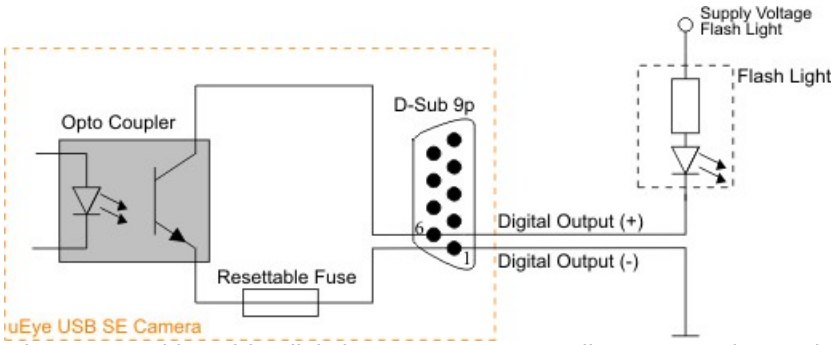


Figure 172: Wiring of the digital output as an open collector output (rev. 1.2)

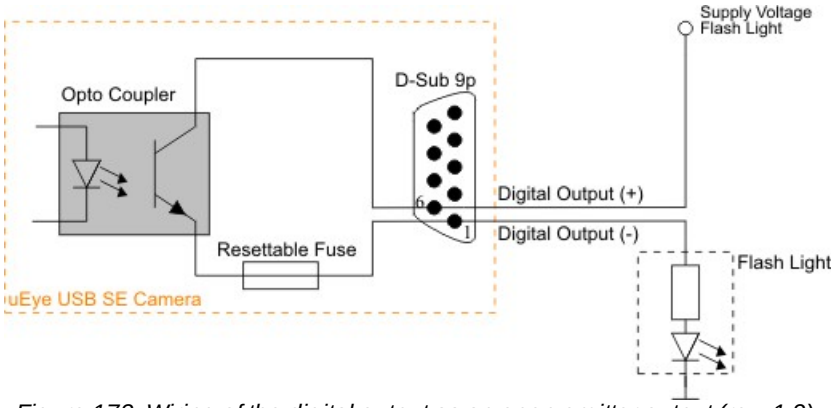


Figure 173: Wiring of the digital output as an open emitter output (rev. 1.2)

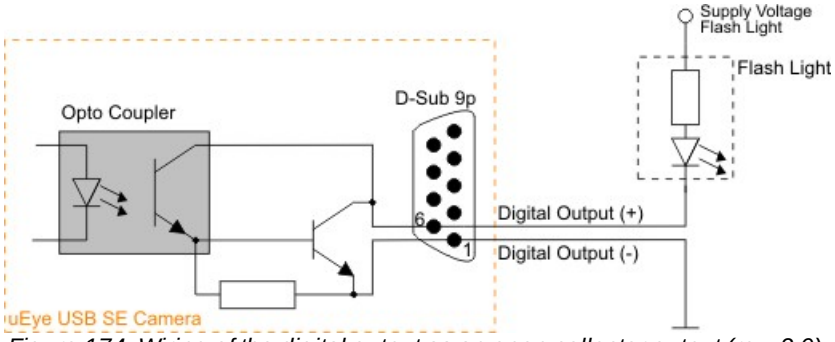


Figure 174: Wiring of the digital output as an open collector output (rev. 2.0)

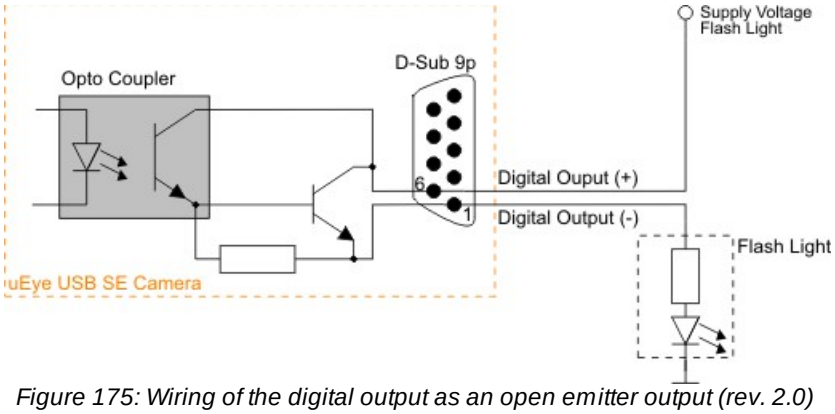


Figure 175: Wiring of the digital output as an open emitter output (rev. 2.0)

9.3.2 USB uEye RE

Pin Assignment of the USB Connector

5 pin Binder plug (USB connector)

Pin	Description
1	USB data (+)
2	USB ground (GND)
3	Shielding
4	USB power supply (VCC)
5	USB data (-)

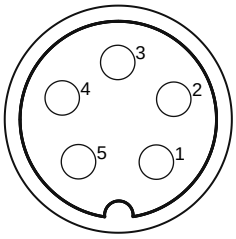


Figure 176: Pin assignment of the USB uEye RE USB connector (Binder)

Pin Assignment of the I/O Connector

4 pin Binder socket (trigger connector)

Pin	Description
1	Digital output (+)
2	Digital output (-)
3	Digital input (+)
4	Digital input (-)

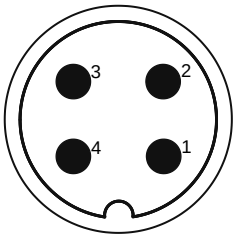


Figure 177: Pin assignment of the USB uEye RE trigger connector (Binder)

Color coding for USB uEye RE trigger cable

Color	Assignment
white	Digital input (+)
brown	Digital input (-)
green	Digital output (-)
yellow	Digital output (+)

For a comprehensive list of all cables and connectors available for *USB uEye RE* cameras, please refer to the USB uEye RE Accessories section.

Digital Input Wiring (Trigger)

Digital input specifications

	Min.	Max.	
Level low	0	2	V
Level high	5	24	V
Voltage range	0	30	V
Trigger pulse width (edge)	100	-	µs
Trigger edge steepness	35		V/ms
Breakdown voltage		50	V
Input current	10	-	mA

For interpreting the trigger signal, either the positive or the negative edge can be used. The digital input is galvanically isolated using an opto coupler to protect the camera and the PC against surges. Only DC voltages may be applied to the digital input.

Digital input wiring

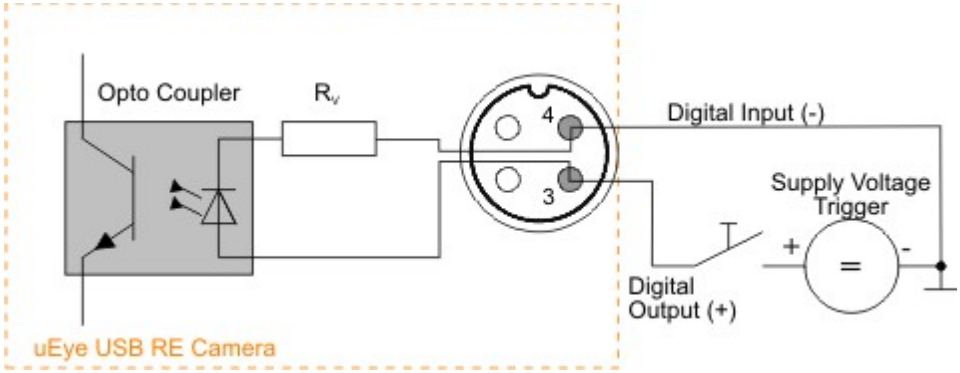


Figure 178: Wiring of the trigger connector

Digital Output Wiring (Flash)

Digital output specifications

	Max.	
Output current (short-time)	500	mA
Output current (permanent)	150	mA
Output voltage	30	V
Breakdown voltage	50	V
Collector power dissipation	125	mW

The digital input is galvanically isolated using an opto coupler to protect the camera and the PC against surges. Only DC voltages may be applied to the digital input.

The output of the opto coupler can be used as an open collector or open emitter output. This means that the output signal can be connected to ground or to the supply voltage. The output signal is active if the collector-emitter switch is closed (software setting: *Flash high active*, see also the Camera Properties: Input/Output section).

Digital output wiring

The following figures show examples of how the digital output is wired.

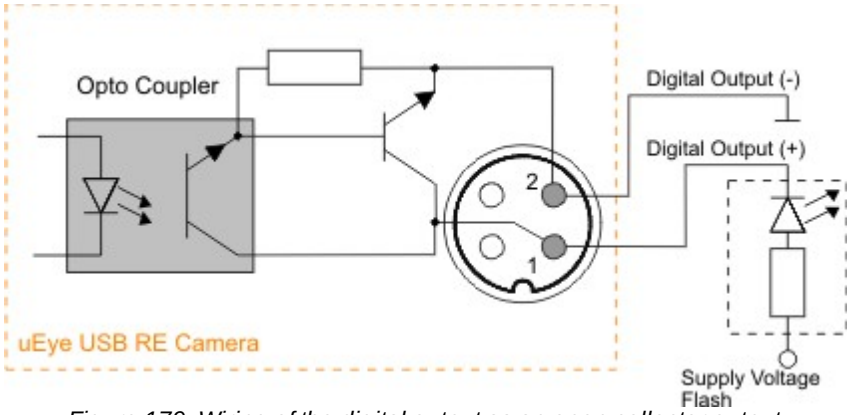


Figure 179: Wiring of the digital output as an open collector output

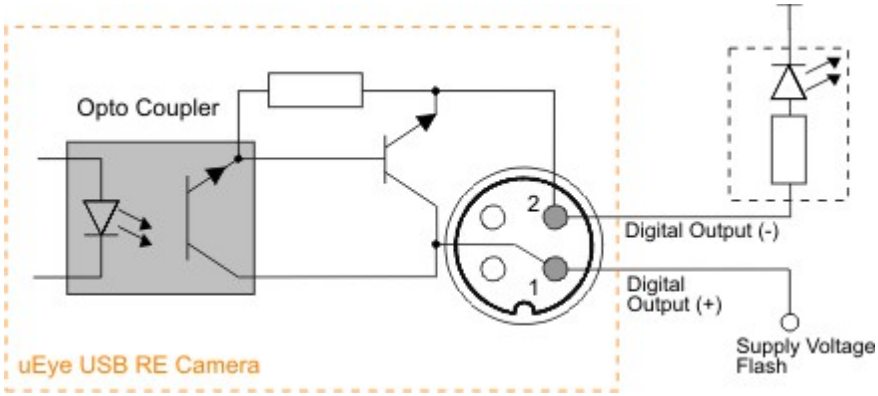


Figure 180: Wiring of the digital output as an open emitter output

9.3.3 USB uEye LE

Pin Assignment of the USB Connector

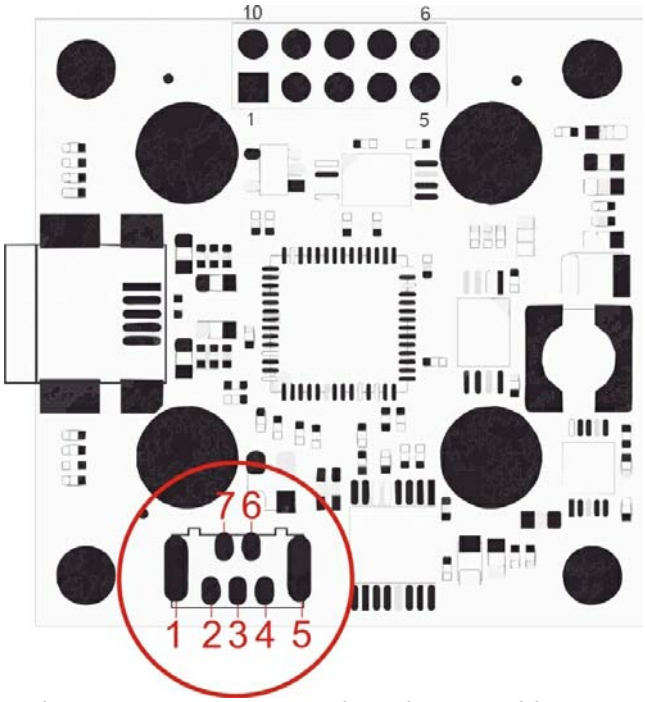


Figure 181: USB uEye LE - Pin assignment of the USB connector

Pin	Description	USB cable (standard color)
1	Shielding	
2	Power supply (VCC)	red
3	Data (+)	green
4	Ground (GND)	black
5	Shield	
6	Not connected	
7	Data (-)	white

Pin Assignment of the I/O Connector

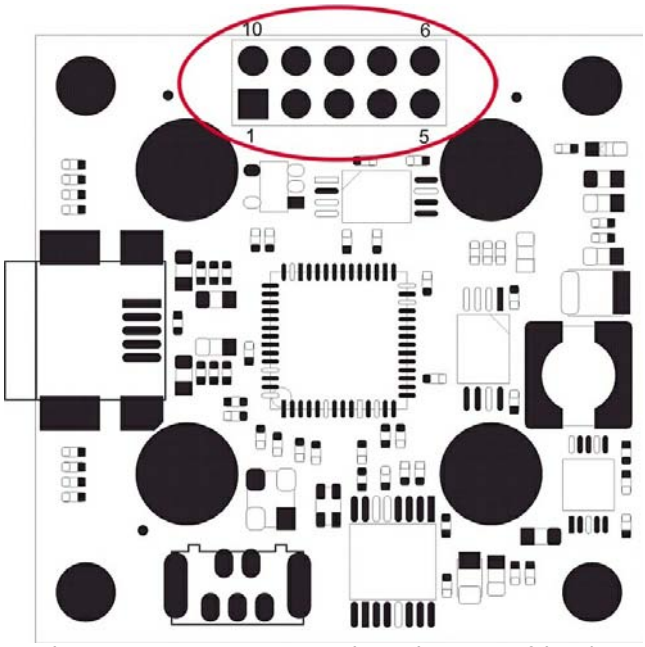


Figure 182: USB uEye LE - Pin assignment of the I/O connector (board-level version only)

Pin		Description
1	5 V	USB power supply (VCC) 5 V Max. admissible current = 500 mA Current consumption of the LE camera itself: 300...350 mA.
2	Trig	Digital input
3	3V3	Power supply of the internal voltage transformer Supply voltage 3.3 V or 3.0 V *1) Max. admissible current 230 mA (3.3 V) or 250 mA (3.0 V)
4	GPIO 1	Programmable input/output (General Purpose I/O) 1
5	SCL	I2C bus clock signal Supply voltage 3.3 V or 3.0 V *1)
6	SDA	I2C bus data signal Supply voltage 3.3 V or 3.0 V *1)
7	GPIO 2	Programmable input/output (General Purpose I/O) 2
8	GND	USB ground (GND)
9	Flash	Digital output
10	GND	USB ground (GND)

**1) This voltage depends on the supply voltage required for the sensor used (see table below)*

The I/O connector of the *uEye LE* can be provided with a 2 x 5-pin connecting plug with a 2.54 mm (0.1") lead spacing.
IDS shall not be liable for any damage to the camera or connected devices arising from installation of the connecting plug.

Internal supply voltage by sensor type

3.0 V	3.3 V
164xLE	122xLE
155xLE	154xLE
148xLE	146xLE

If the 3V3 and the 5V power supplies are used simultaneously, please observe that the maximum power available from the USB bus is 2.5 W.

I2C operation

Multi master mode is not allowed on the I2C bus while the USB uEye LE camera is used.

From driver version 3.20, the I2C bus is operated with an effective clock frequency of approx. 250 kHz. For earlier versions, the clock frequency is 100 kHz.

Digital Input Wiring (Trigger)

Digital input specifications

	Min.	Max.	
Level low	0	0.8	V
Level high	2.0	5.25	V

The digital input of the *USB uEye LE* is not potential-free and has no protective circuits.

Due to hardware limitations, the *USB uEye LE* can only be triggered on the falling edge.

Digital input wiring

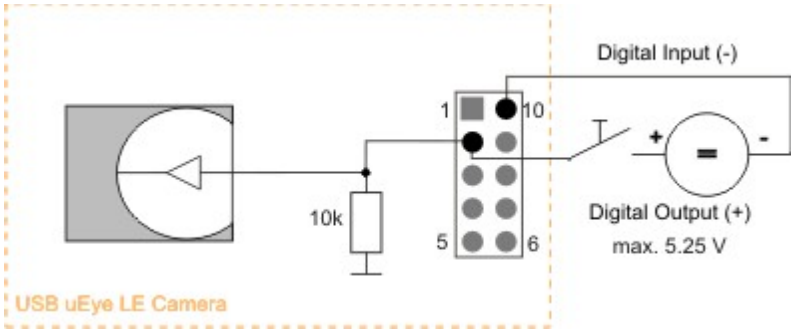


Figure 183: Wiring of the trigger connector

Digital Output Wiring (Flash)

Digital output specifications

Max. signal level *Low*	Min. signal level *High*	Max. signal level *High*	Max. output current
0.4 V	2.4 V	3.0 V or 3.3 V *1)	4 mA

**1) This voltage depends on the supply voltage required for the sensor used (see table below)*

The digital output of the *USB uEye LE* is not potential-free and has no protective circuits.

Internal supply voltage by sensor type

3.0 V	3.3 V
164xLE	122xLE
155xLE	154xLE
148xLE	146xLE

Digital output wiring

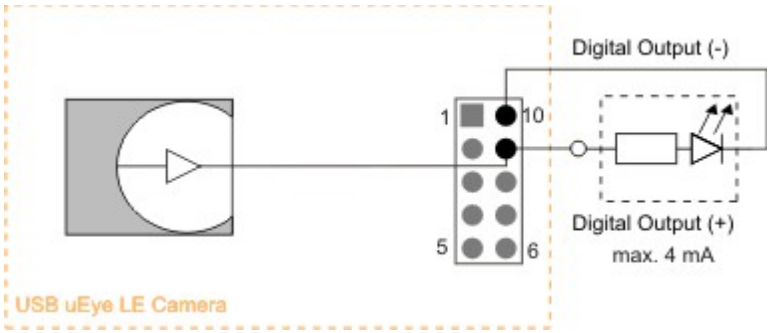


Figure 184: Digital output wiring

General Purpose I/O Wiring

GPIO specifications

The two GPIOs (General Purpose I/O) can be used as inputs or outputs. This selection is made by software using the corresponding SDK API functions. Please observe the following criteria:

- Input: 3.3 V LVTTL, max. 3.3 V input voltage
- Output: 3.3 V LVTTL, max. 4 mA

Max. signal level *Low*	Min. signal level *High*	Max. signal level *High*	Max. output current
0.4 V	2.4 V	3.0 V or 3.3 V *1)	4 mA

**1) This voltage depends on the supply voltage required for the sensor used (see table below)*

The General Purpose I/Os are not potential-free and have no protective circuits.

Internal supply voltage by sensor type

3.0 V	3.3 V
164xLE	122xLE
155xLE	154xLE
148xLE	146xLE

GPIO wiring

The following figures illustrate GPIO wiring examples.

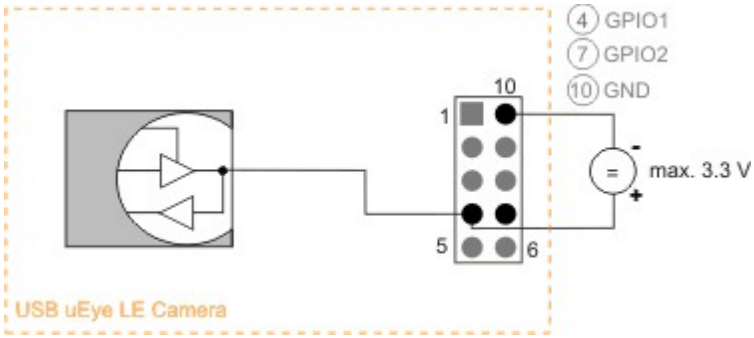


Figure 185: GPIO wired as an input

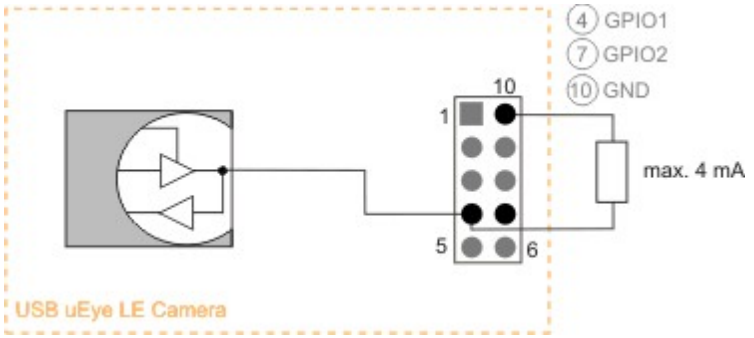


Figure 186: GPIO wired as an output

9.3.4 GigE uEye SE

Pin Assignment of the GigE Connector (RJ45)

8-pin RJ45 socket

Pin	Designation 100BASE-TX	Designation 1000BASE-TX
1	Tx+	Bl_DA+
2	Tx-	Bl_DA-
3	Rx+	Bl_DB+
4		Bl_DC+
5		Bl_DC-
6	Rx-	Bl_DB-
7		Bl_DD+
8		Bl_DD-

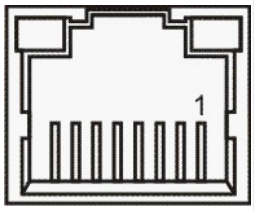


Figure 187: Pin assignment of the GigE uEye SE RJ45 socket (ST2)

The RJ45 socket of the *GigE uEye SE* complies with the IEC 60603-7 standard.

Pin Assignment of the I/O Connector

6-pin Hirose connector

Pin	Description	Cable color
1	Ground (GND)	white
2	Power supply (VCC) 12 V	brown
3	Digital input (-)	green
4	Digital input (+)	yellow
5	Digital output (+)	grey
6	Digital output (-)	pink

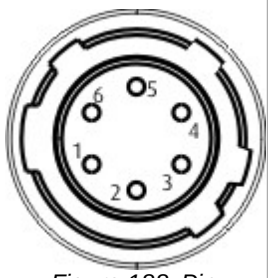


Figure 188: Pin assignment of the Hirose connector (connecting side view)

Pin assignment of the 6-wire connecting cable (6-pin Hirose connector)

Pin	Description	Cable color
1	Ground (GND)	white
2	Power supply (VCC) 12 V	brown
3	Digital input (-)	green
4	Digital input (+)	yellow
5	Digital output (+)	gray
6	Digital output (-)	pink

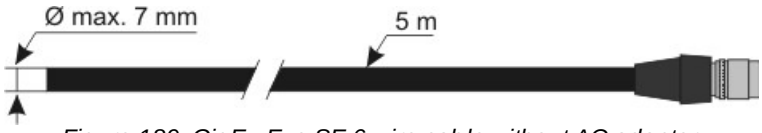


Figure 189: GigE uEye SE 6-wire cable without AC adapter (AD.0040.2.18300.00)

Pin assignment of the 2+4-wire connecting cable (6-pin Hirose connector)

Pin	Cable	Description	Cable color
1	A1	Ground (GND)	white
2	A2	Power supply (VCC) 12 V	brown
3	B1	Digital input (-)	brown
4	B2	Digital input (+)	white
5	B3	Digital output (+)	yellow
6	B4	Digital output (-)	green

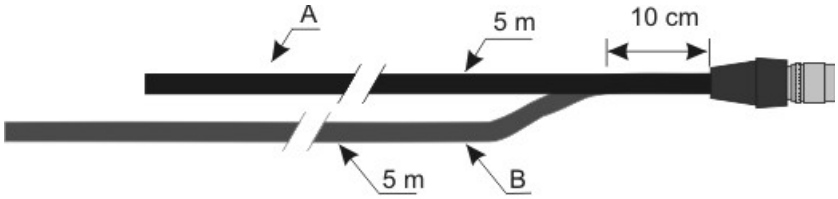


Figure 190: GigE uEye SE 2+4-wire cable without AC adapter (AD.0040.2.18400.00)

Power supply

Voltage	Tolerance	Residual ripple
12 V	+/- 10%	max. 1%

max. 1%

The inrush current of the *GigE uEye SE* cameras may temporarily increase to up to 2 A.

Digital Input Wiring (Trigger)

Digital input specifications

	Min.	Max.	
Level low	0	2	V
Level high	5	24	V
Voltage range	0	30	V
Trigger pulse width (edge)	100	-	µs
Trigger edge steepness	35		V/ms
Breakdown voltage		50	V
Input current	10	-	mA

For interpreting the trigger signal, either the positive or the negative edge can be used. The digital input is galvanically isolated using an opto coupler to protect the camera and the PC against surges. Only DC voltages may be applied to the digital input.

Digital input wiring

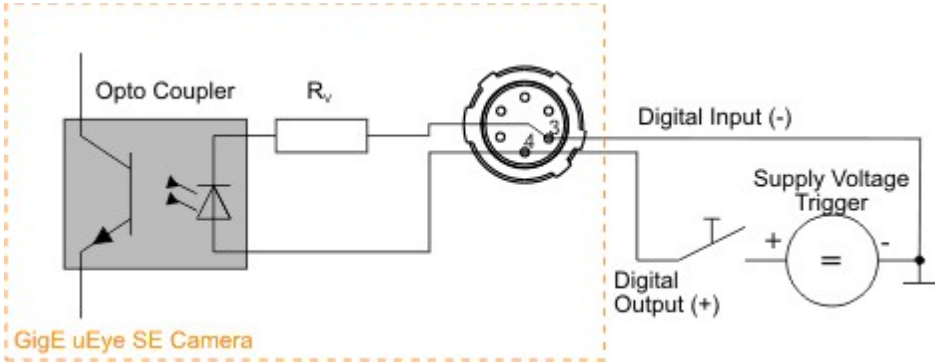


Figure 191: Wiring of the trigger connector

Digital Output Wiring (Flash)

Digital output specifications

	Max.	
Output current (short-time)	500	mA
Output current (permanent)	150	mA
Output voltage	30	V
Breakdown voltage	50	V
Collector power dissipation	125	mW

The digital input is galvanically isolated using an opto coupler to protect the camera and the PC against surges. Only DC voltages may be applied to the digital input.

The output of the opto coupler can be used as an open collector or open emitter output. This means that the output signal can be connected to ground or to the supply voltage. The output signal is active if the collector-emitter switch is closed (software setting: *Flash high active*, see also the Camera Properties: Input/Output section).

Digital output wiring

The following figures show examples of how the digital output is wired.

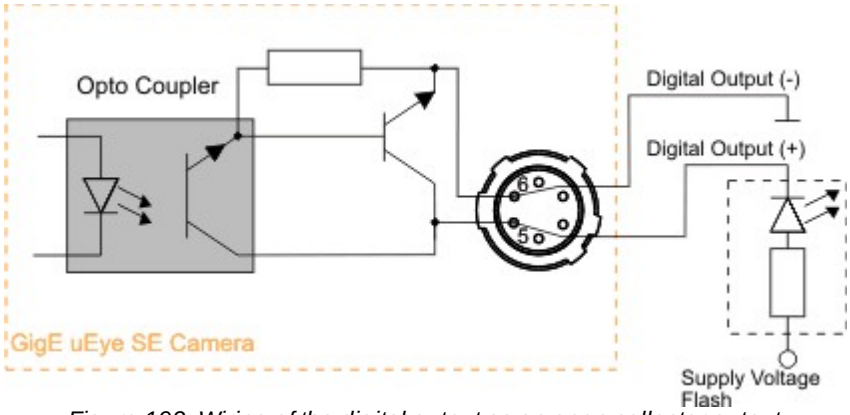


Figure 192: Wiring of the digital output as an open collector output

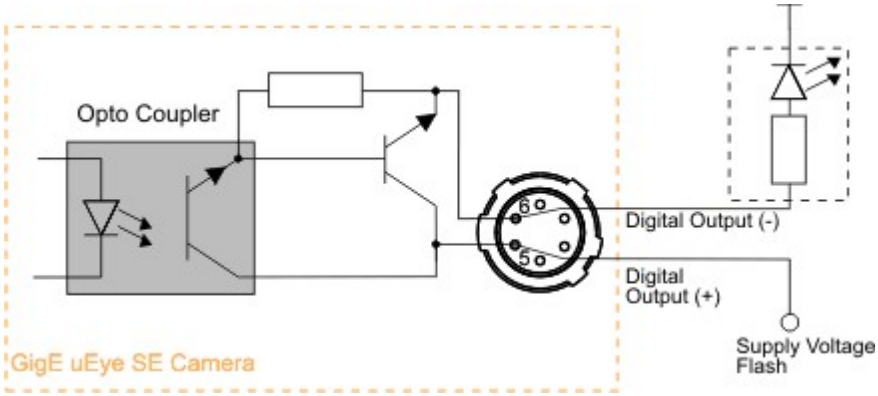


Figure 193: Wiring of the digital output as an open emitter output

9.3.5 GigE uEye HE

Pin Assignment of the GigE Connector (RJ45)

8-pin RJ45 socket

Pin	Designation 100BASE-TX	Designation 1000BASE-TX
1	Tx+	Bl_DA+
2	Tx-	Bl_DA-
3	Rx+	Bl_DB+
4		Bl_DC+
5		Bl_DC-
6	Rx-	Bl_DB-
7		Bl_DD+
8		Bl_DD-

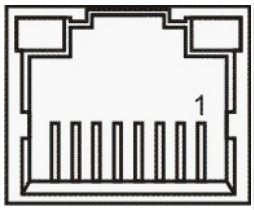


Figure 194: Pin assignment of the GigE uEye HE RJ45 socket (ST2)

The RJ45 socket of the *GigE uEye HE* complies with the IEC 60603-7 standard.

Pin Assignment of the I/O Connector

14-pin MDR 14 socket

Pin	Description
1	Ground (GND)
2	Power supply (VCC)
3	Digital input (-)
4	Digital input (+)
5	Digital output (-)
6	Digital output (+)
7	Ground (GND)
8	Ground (GND)
9	Power supply (VCC)
10	General Purpose I/O 1 (not potential-free)
11	General Purpose I/O 2 (not potential-free)
12	RS232 RxD (not potential-free)
13	RS232 TxD (not potential-free)
14	Ground (GND)

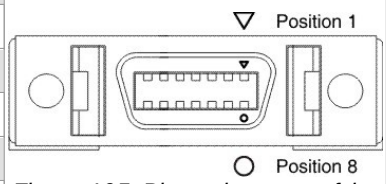


Figure 195: Pin assignment of the GigE uEye HE I/O socket (ST1)

Pin assignment of the 12-wire connecting cable (14-pin MDR 14 plug)

Pin	Designation	Cable color
1, 7, 8, 14	Ground (GND)	black
2, 9	Power supply (VCC)	red
3	Digital input (-)	brown
4	Digital input (+)	white
5	Digital output (-)	green
6	Digital output (+)	yellow
10	General Purpose I/O 1	blue
11	General Purpose I/O 2	pink
1, 7, 8, 14	Ground (GND)	red/blue
12	RS232 RxD	gray
13	RS232 TxD	purple
1, 7, 8, 14	Ground (GND)	gray/pink

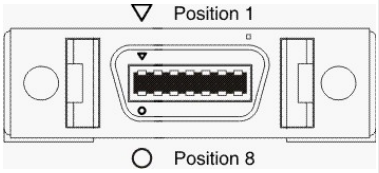


Figure 196: Pin assignment of the GigE uEye HE connecting cable (12 wires)

Pin assignment of the I/O and power cable without AC adapter

Pin	Cable	Designation	Cable color
1, 7, 8, 14	A	Ground (GND)	white
2, 9	A	Power supply (VCC)	brown
3	B	Digital input (-)	brown
4	B	Digital input (+)	white
5	B	Digital output (-)	green
6	B	Digital output (+)	yellow

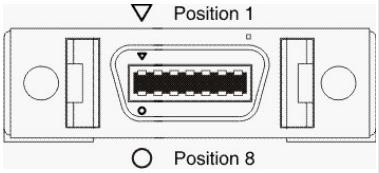


Figure 197: Pin assignment of the GigE uEye HE I/O and power cable (with/without AC adapter)

The power supply (VCC) must be connected to pins 2 and 9. In addition, the power supply ground wire must be connected to all 4 GND pins (pins 1, 7, 8, and 14). If this is not possible due to insufficient space, connect at least pins 1 and 8 to the power supply ground wire.
For EMC reasons, the cable shield must not be connected to the GND wire.

Power supply

Voltage		Tolerance	Residual ripple
Minimum (at camera)	6 V	-10%	max. 1%
Maximum	24 V	+10%	max. 1%
Recommended	12 V	-	-

For information on the camera's connected load, see Specifications: Sensor Data chapter.

To ensure a sufficient voltage (6...24 V) at the camera input, we recommend the following AC adapter voltages:

Power cable length	AC adapter voltage
up to 5 m	9-24 V
5-10 m	12-24 V
10-20 m	15-24 V
20-30 m	18-24 V
30-50 m	24 V

The inrush current of the *GigE uEye HE* may temporarily increase to up to 2 A.

Digital Input Wiring (Trigger)

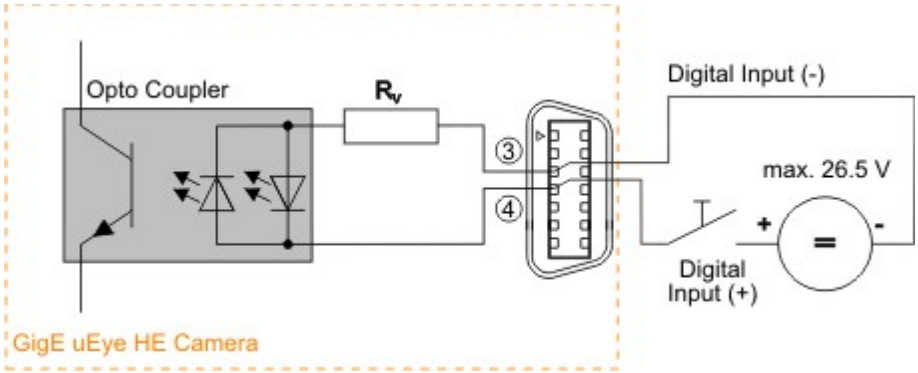
Digital input specifications

	Min.	Max.	
Level low	0	2	V
Level high	5	26,5	V
Trigger pulse width	1	-	µs
Trigger edge steepness	35		V/ms
Breakdown voltage		50	V
Input current	10	-	mA

For interpreting the trigger signal, either the positive or the negative edge can be used. The digital input is galvanically isolated using an opto coupler to protect the camera and the PC against surges. Only DC voltages may be applied to the digital input.

Digital input wiring

The following figures show examples of how the digital input is wired.



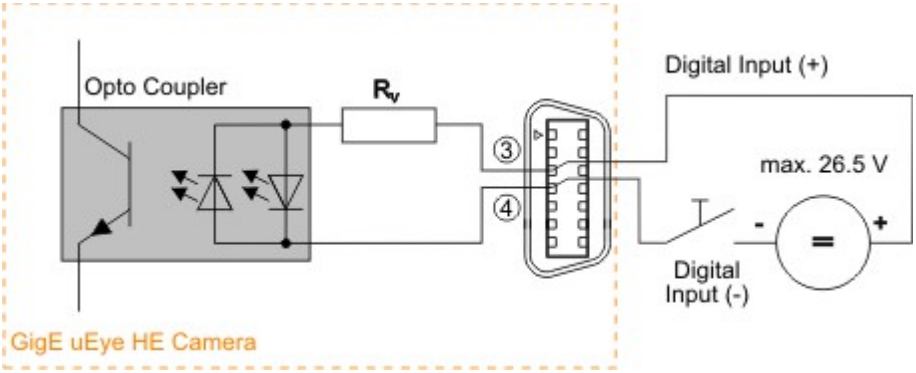


Figure 198: Trigger connector (schematic)

The opto isolated digital input has two LEDs which are not activated in parallel. This way, you can use either positive or negative signals for triggering. The input polarity can be selected as desired. The Trigger+ and Trigger- labeling in the figures above is only used for schematic illustration.

Digital Output Wiring (Flash)

Digital output specifications

	Max.	
Output current (short-time)	500	mA
Output current (permanent)	150	mA
Output voltage	30	V
Breakdown voltage	50	V
Collector power dissipation	125	mW

The digital input is galvanically isolated using an opto coupler to protect the camera and the PC against surges. Only DC voltages may be applied to the digital input.

The output of the opto coupler can be used as an open collector or open emitter output. This means that the output signal can be connected to ground or to the supply voltage. The output signal is active if the collector-emitter switch is closed (software setting: *Flash high active*, see also the Camera Properties: Input/Output section).

Digital output wiring

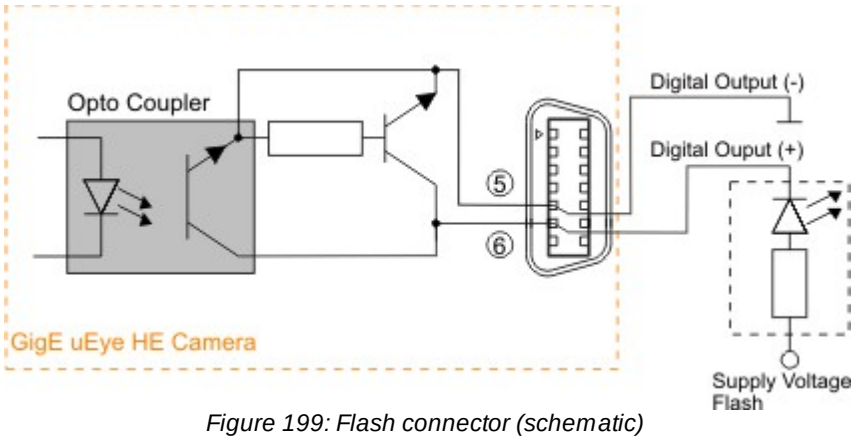


Figure 199: Flash connector (schematic)

General Purpose I/O Wiring

GPIO specifications

The two GPIOs (General Purpose I/O) can be used as inputs or outputs. This selection is made by software using the corresponding SDK API functions. Please observe the following criteria:

- Input: 3.3 V LVTTL, max. input voltage 4.0 V
- Output: 3.3 V LVCMOS, max. 10 mA

The General Purpose I/Os are not potential-free and have no protective circuits.

GPIO wiring

The following figures illustrate GPIO wiring examples.

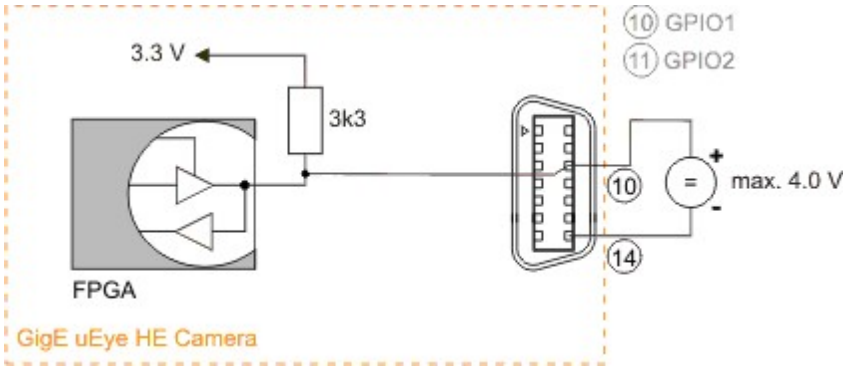


Figure 200: GPIO input

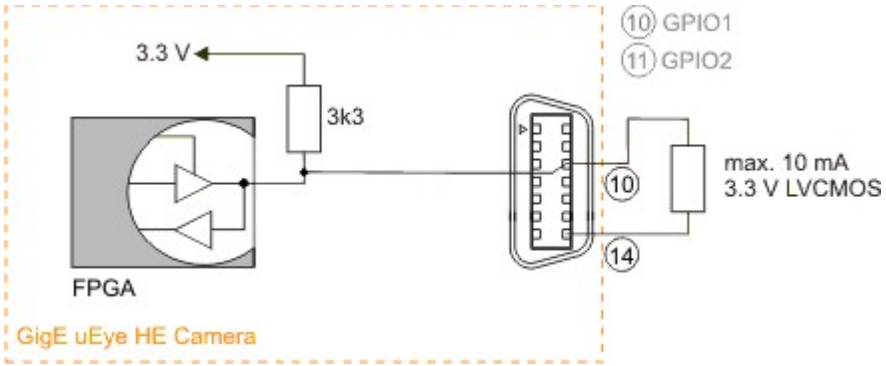


Figure 201: GPIO output

Serial Interface Wiring (RS232)

Serial interface specifications

Minimum output voltage	±33.5	V
Maximum input voltage	±315	V
Supported baud rates	1,200 2,400 4,800 9,600 19,200 38,400 57,600 115,200	baud
Transmission mode	Full duplex, 8N1	
Data bits	8	
Stop bits	1	
Parity	None	

With the 8N1 mode, the maximum payload data rate achievable is 80% of the selected baud rate.

Serial interface wiring

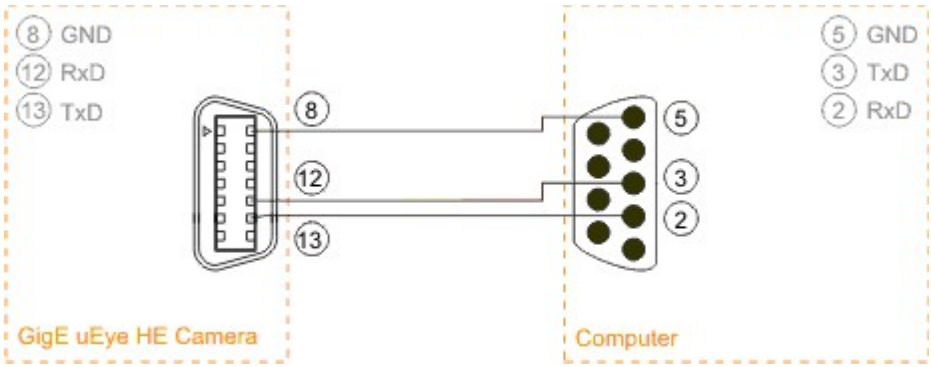


Figure 202: Serial interface connector (schematic)

9.4 Status LED

9.4.1 USB uEye

USB uEye SE/RE

The LED on the rear side of the *USB uEye* camera indicates whether

- the uEye camera is powered on – LED lights up red (only USB board rev. 2.0 or higher).
- the *uEye* driver has been loaded and the camera is operational – LED lights up green
- an error has occurred – green LED flashes:
  - 2x flash: unknown sensor, please contact our support team.

If the LED does not light up green, please check the following:

- Has the camera been connected correctly?
- Have the driver and the camera been installed properly in the uEye Camera Manager on the host PC?
- Does the host PC meet all system requirements?

Figure 203: USB uEye SE status LED (rev. 1.2)

Figure 204: USB uEye SE status LED (rev. 2.0)

USB uEye LE

The *USB uEye LE* camera has a single color status LED. It lights up orange as soon as the camera is supplied with power.

9.4.2 GigE uEye

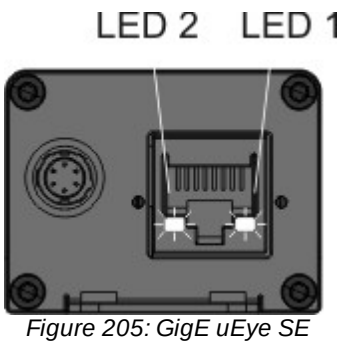


Figure 205: GigE uEye SE status LEDs

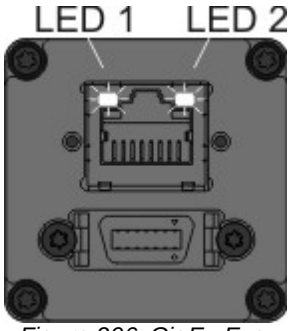


Figure 206: GigE uEye HE status LEDs

The two LEDs indicate the current status of the *GigE uEye* camera.

- LED 1: camera status
- LED 2: network status

Camera status (LED 1)

Camera is booting	
Camera off	
Starter firmware ok, waiting for connection	
Connecting	
Firmware update	
Normal operation	
Freerun mode	
Single trigger mode	
Group trigger mode *)	
Standby mode	
Error	
Camera hardware error	
Configuration error	
Starter firmware not ok, failsafe firmware enabled	
Overtemperature (>65°C)	

Network status (LED 2)

Normal operation

No network connection

Network connection OK

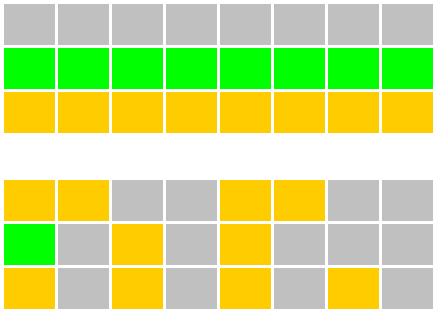
Data transfer

Error

Network error

Camera hardware error

Cable fault *)



*) *This function is not supported yet.*

10 Accessories

Lenses

IDS also supplies a wide variety of lenses from leading manufacturers. Contact our sales department for a detailed quote tailored to your needs.

10.1 USB uEye SE

USB uEye SE USB cables

Purchase Order No.	Description
AD.0040.2.08400.00	USB 2.0 standard cable, 3 m, shielded, USB mini-B to USB-A
AD.0040.2.08500.00	USB 2.0 standard cable, 5 m, shielded, USB mini-B to USB-A
AD.0040.2.10900.00	USB 2.0 special cable, 30 cm
AD.0040.2.08600.00	USB 2.0 special cable, 3 m, shielded, straight micro D-Sub connector for screw-mounting to USB-A
AD.0040.2.08700.00	USB 2.0 special cable, 5 m, shielded, straight micro D-Sub connector for screw-mounting to USB-A
AD.0040.2.10300.00	USB 2.0 special cable with wires for trigger, 3 m, shielded, straight micro D-Sub connector for screw-mounting to USB-A
AD.0040.2.10400.00	USB 2.0 special cable with wires for trigger, 5 m, shielded, straight micro D-Sub connector for screw-mounting to USB-A
AD.0040.2.10000.00	USB 2.0 special cable with wires for trigger and flash, 3 m, shielded, angled micro D-Sub connector for screw-mounting to USB-A
AD.0040.2.10100.00	USB 2.0 special cable with wires for trigger and flash, 5 m, shielded, angled micro D-Sub connector for screw-mounting to USB-A
AD.0040.2.11200.00	USB 2.0 special cable, 3 m, shielded, angled micro D-Sub connector for screw-mounting to USB-A
AD.0040.2.11300.00	USB 2.0 special cable, 5 m, shielded, angled micro D-Sub connector for screw-mounting to USB-A

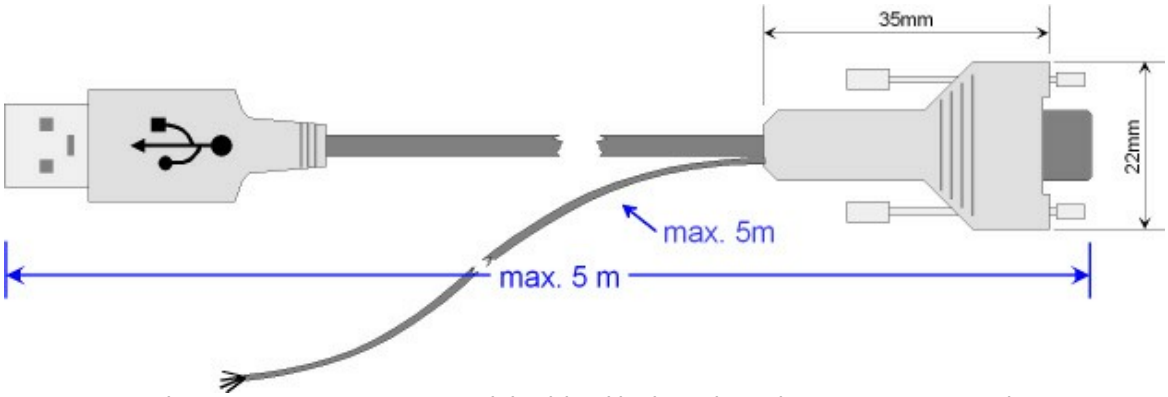


Figure 207: USB uEye SE special cable with trigger input (AD.0040.2.08700.00)

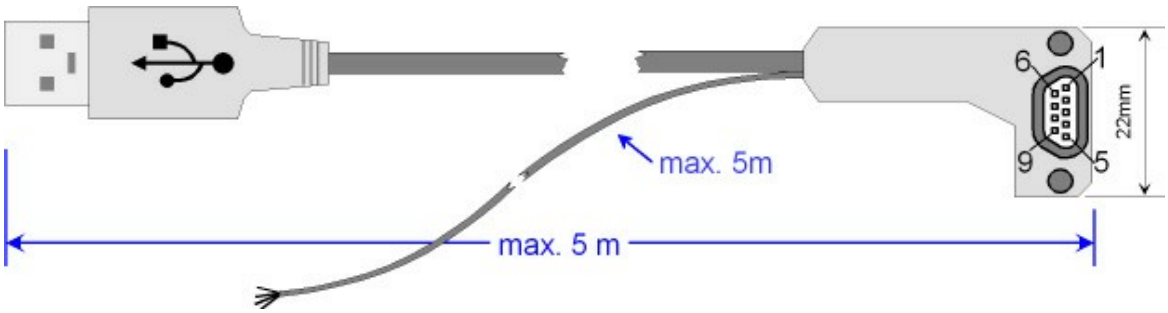


Figure 208: USB uEye SE special cable, angled, with trigger input and digital output (AD.0040.2.10100.00)

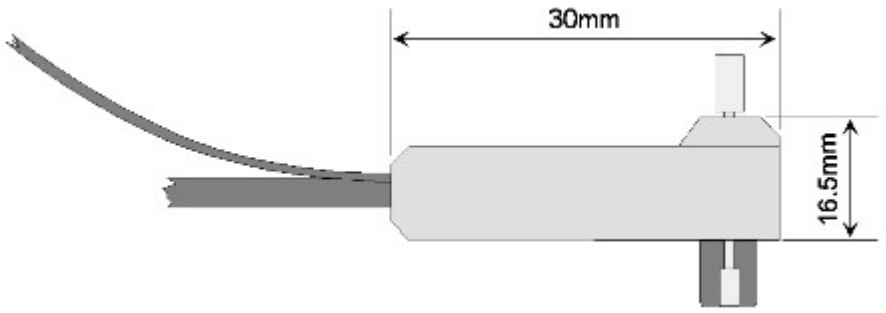


Figure 209: USB uEye SE angled D-Sub connector

USB uEye SE USB accessories

Purchase Order No.	Description
AL.0094.2.01900.00	EX-1200 USB 2.0 high speed PCMCIA card, 2 ports, NEC chipset
AL.0094.2.02500.00	EX-1074 USB 2.0 high speed PCI card, 4 ports, NEC chipset
AL.0094.2.02400.00	EX-1171 USB 2.0 hub, metal housing, 7 ports
AL.0094.2.02100.00	EX-1171 USB 2.0 hub, 7 ports
AL.0094.2.02200.00	EX-1163 USB 2.0 hub, 4 ports
AL.0094.2.02300.00	USB 2.0 active expansion cable, 5 m (single port)

Tripod adapter for USB uEye SE

Purchase Order No.	Description
AL.0012.2.01300.00	Tripod adapter for *USB uEye SE* series (4 screws included)

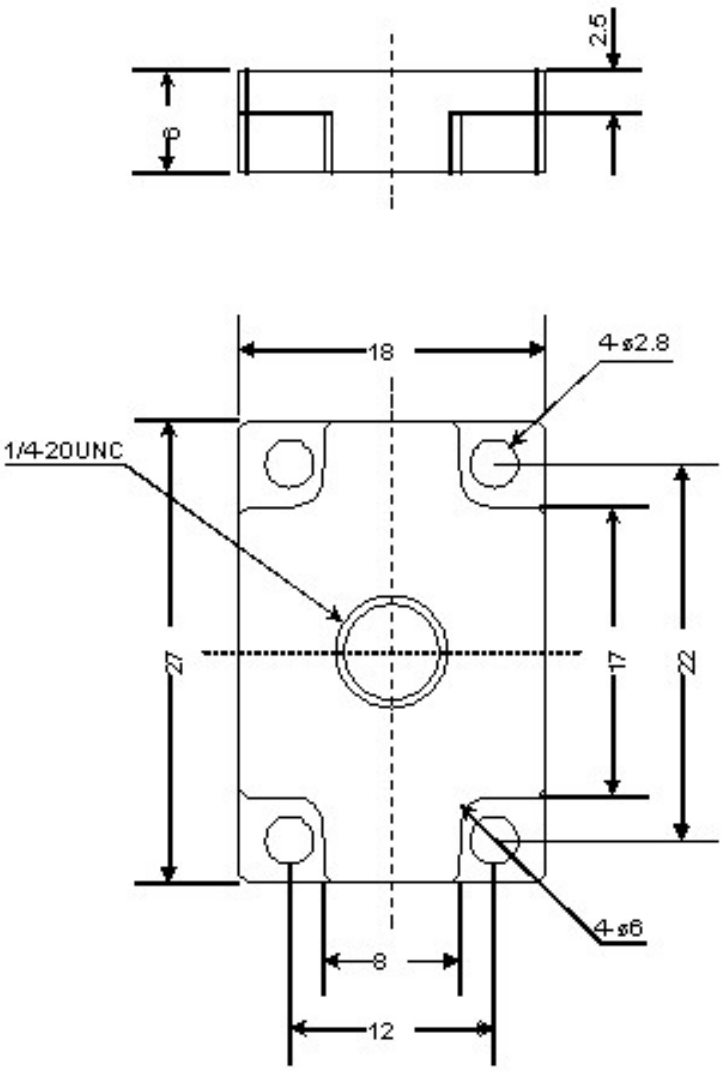


Figure 210: USB uEye SE tripod adapter

10.2 USB uEye RE

USB uEye RE USB cables

Purchase Order No.	Description
AD.0040.2.12100.00	*USB uEye RE* USB cable, 3 m, USB-A to Binder type 712, 5-pin, straight connector
AD.0040.2.12200.00	*USB uEye RE* USB cable, 5 m, USB-A to Binder type 712, 5-pin, straight connector
AD.0040.2.12300.00	*USB uEye RE* USB cable, 3 m, USB-A to Binder type 712, 5-pin, angled connector
AD.0040.2.12400.00	*USB uEye RE* USB cable, 3 m, USB-A to Binder type 712, 5-pin, angled connector
BK.0068.2.01500.00	Binder 712 socket, 5-pin, straight (not fitted)
BK.0068.2.01600.00	Binder 712 socket, 5-pin, angled (not fitted)

Figure 211: USB uEye RE - USB cable with straight connector

Figure 212: USB uEye RE - USB cable with angled connector

USB uEye RE drag-chain compatible USB cables

Purchase Order No.	Description			
	Connector (PC side)	Connector (camera side) Binder type 712, 5-pin	Cable length	Cable type
AD.0040.2.13100.00	USB-A	straight	3 m	Kabelschlepp Life Line Data 700 USB 45688 ø 5 mm
AD.0040.2.13200.00	USB-A	straight	5 m	
AD.0040.2.13300.00	USB-A	angled	3 m	
AD.0040.2.13400.00	USB-A	angled	5 m	
AD.0040.2.13500.00	USB-A	straight	6 m	IGUS Chainflex CFBUS.065 ø 7.5mm
AD.0040.2.13600.00	USB-A	straight	8 m	
AD.0040.2.13700.00	USB-A	straight	10 m	
AD.0040.2.13800.00	USB-A	angled	6 m	
AD.0040.2.13900.00	USB-A	angled	8 m	
AD.0040.2.14000.00	USB-A	angled	10 m	

USB uEye RE USB accessories

Purchase Order No.	Description
AL.0094.2.01900.00	EX-1200 USB 2.0 high speed PCMCIA card, 2 ports, NEC chipset
AL.0094.2.02500.00	EX-1074 USB 2.0 high speed PCI card, 4 ports, NEC chipset
AL.0094.2.02400.00	EX-1171 USB 2.0 hub, metal housing, 7 ports
AL.0094.2.02100.00	EX-1171 USB 2.0 hub, 7 ports
AL.0094.2.02200.00	EX-1163 USB 2.0 hub, 4 ports
AL.0094.2.02300.00	USB 2.0 active expansion cable, 5 m (single port)

USB uEye RE trigger cable

Purchase Order No.	Description
AD.0040.2.12500.00	*USB uEye RE* trigger and flash cable, straight 4-pin connector, 5 m
AD.0040.2.12600.00	*USB uEye RE* trigger and flash cable, angled 4-pin connector, 5 m
BK.0068.2.01700.00	Binder 712 socket, 4-pin, straight (not fitted)
BK.0068.2.01800.00	Binder 712 socket, 4-pin, angled (not fitted)

Figure 213: USB uEye RE trigger cable with straight connector

Figure 214: USB uEye RE trigger cable with angled connector

USB uEye RE lens tubes (optional)

Purchase Order No.	Description				
	Length	Max. usable diameter	Max. usable lens length	Protective glass type	Suitable lenses
CK.0010.1.12100.00	51 mm	35 mm	up to 38 mm	IMPAdur clear glass,heat-strengthened, AR-coating on the inside, thickness 3±0.3 mm	All Pentax megapixel lenses (e.g. H1214M, C1614M, etc.) Tamron 23FM16SP
CK.0010.1.12000.00	64 mm	35 mm	up to 51 mm		Tamron 23FM25SP
CK.0010.1.12200.00	77 mm	35 mm	up to 64 mm		Tamron 23FM50SP

Figure 215: Lens tube for the USB uEye RE

High-resolution lenses suitable for USB uEye RE lens tubes

Focal length	Manufacturer	Type	Aperture angle of lens	Tube length
12 mm	Pentax	H1212B *1)	30.18°	51 mm
12 mm	Tamron	25HA/HB *1)	30°	51 mm
16 mm	Pentax	C1614A	22.48°	51 mm
16 mm	Tamron	17HD/HF	22.5°	51 mm

Megapixel lenses suitable for USB uEye RE lens tubes

Focal length	Manufacturer	Type	Aperture angle of lens	Tube length
12 mm	Pentax	H1214-M	28.91°	51 mm
16 mm	Pentax	C1614-M	22.72°	51 mm
16 mm	Tamron	23FM16SP	23.175°	51 mm
25 mm	Pentax	C2514-M	14.6°	51 mm
25 mm	Tamron	23FM25SP	20°	64 mm
35 mm	Pentax	C3516-M	10.76°	51 mm
50 mm	Pentax	C5028-M	7.32°	51 mm
50 mm	Tamron	23FM50SP	10.1	77 mm

*1) Shadows in corner areas possible with UI-225x-M/C and UI-625x-M/C sensors

10.3 USB uEye LE

USB uEye LE USB cables and accessories

Article number	Description
AD.0040.2.08400.00	USB 2.0 standard cable, 3 m - shielded USB 2.0 cable, USB mini-B to USB-A
AD.0040.2.08500.00	USB 2.0 standard cable, 5 m - shielded USB 2.0 cable, USB mini-B to USB-A
AD.0040.2.10900.00	USB 2.0 special cable, 30 cm
AL.0094.2.01900.00	EX-1200 - USB 2.0 High Speed PCMCIA card, 2 ports, NEC Chipset, Win 2000, ME, XP
AL.0094.2.02500.00	EX-1074 - USB 2.0 High Speed PCI card, 4 ports, NEC Chipset, 480 Mbps, Win 9.x, 2000, ME, XP
AL.0094.2.02100.00	EX-1171 USB 2.0 hub with 7 ports
AL.0094.2.02200.00	EX-1163 USB 2.0 hub with 4 ports
AL.0094.2.02300.00	USB 2.0 active expansion cable, 5 m (single port)
BE.0050.2.01300.00	EX-5, 5 mm CS-/C-mount adapter

Dimensions of the extension ring (only USB uEye LE housing version with CS-mount)

The extension ring increases the flange back distance of the *USB uEye LE* by 5 mm. This way, you can also use lenses with a C-mount thread for the *USB uEye LE*.

Figure 216: USB uEye LE extension ring (top view)

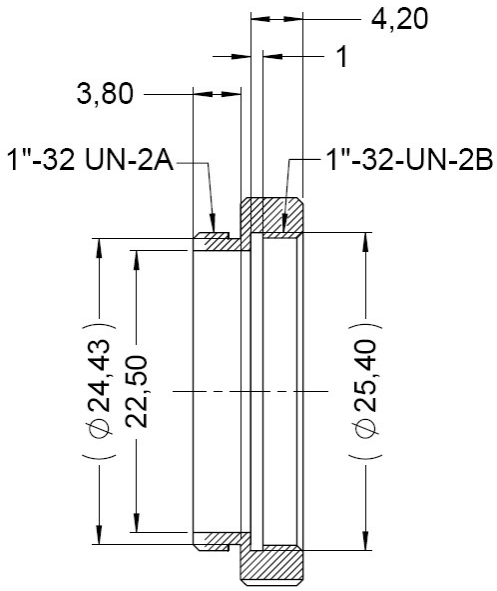


Figure 217: USB uEye LE extension ring dimensions

Special tool for adjusting the flange back distance

Article number	Description
CK.0124.1.28700.00	Positioning plate for the flange back distance

10.4 GigE uEye SE

GigE uEye SE cables

Purchase Order No.	Description
CK.0040.2.18500.00	*GigE uEye SE* power cable, with AC adapter, 1.8 m
AD.0040.2.18300.00	*GigE uEye SE* cable for trigger/flash/power supply, without AC adapter, 5 m
AD.0040.2.18400.00	*GigE uEye SE* Y-cable for trigger/flash/power supply, without AC adapter, 5 m
AD.0040.2.18400.10	*GigE uEye SE* Y-cable for trigger/flash/power supply, without AC adapter, base item for AD.0040.2.18400.11
AD.0040.2.18400.11	Cable for AD.0040.2.18400.10, available by the meter (max. 20 m)
AD.0040.2.18600.00	*GigE uEye SE* Y-cable for trigger/flash/power supply, with AC adapter, 5 m
AD.0040.2.18600.10	*GigE uEye SE* Y-cable for trigger/flash/power supply, with AC adapter, base item for AD.0040.2.18600.11
AD.0040.2.18600.11	Cable for AD.0040.2.18600.10, available by the meter (max. 20 m)

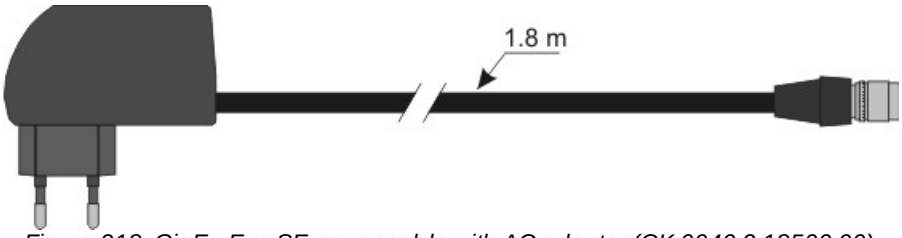


Figure 218: GigE uEye SE power cable with AC adapter (CK.0040.2.18500.00)

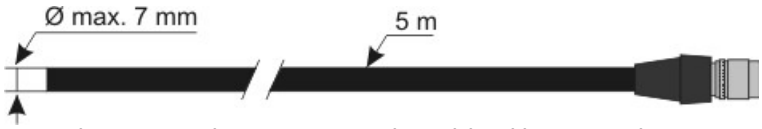


Figure 219: GigE uEye SE 6-wire cable without AC adapter (AD.0040.2.18300.00)

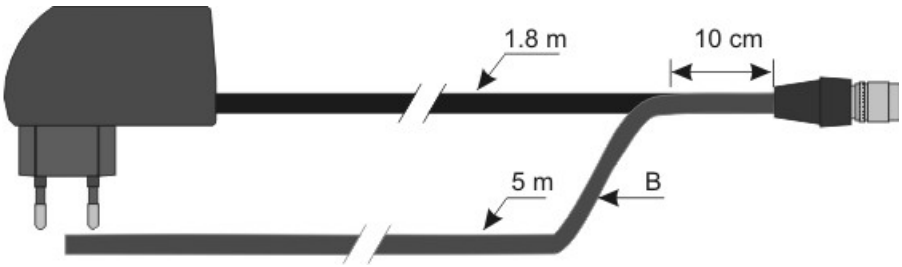


Figure 220: GigE uEye SE 2+4-wire Y-cable with AC adapter (AD.0040.2.18600.00)

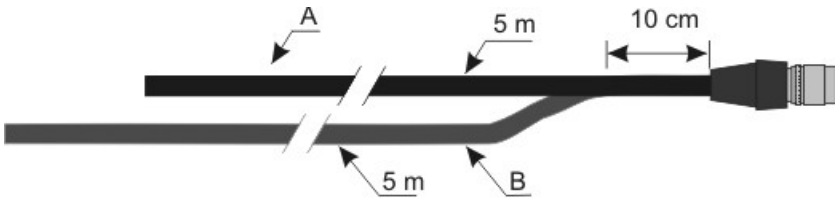


Figure 221: GigE uEye SE 2+4-wire Y-cable without AC adapter (AD.0040.2.18400.00)

Tripod adapter for GigE uEye SE

Purchase Order No.	Description
AL.0113.2.07400.00	Tripod adapter for *GigE uEye SE*

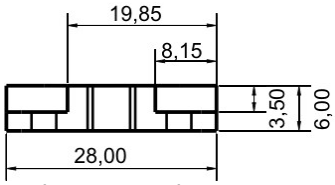


Figure 222: GigE uEye SE stand plate - front view

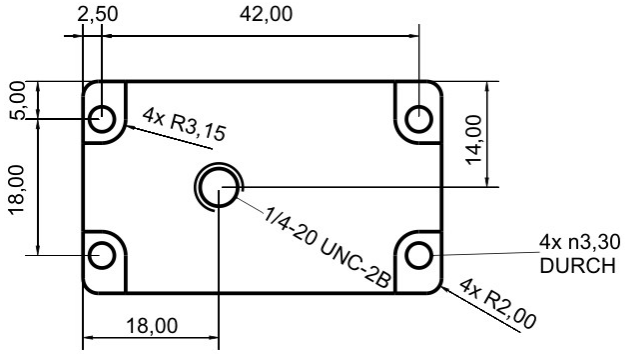


Figure 223: GigE uEye SE stand plate - top view

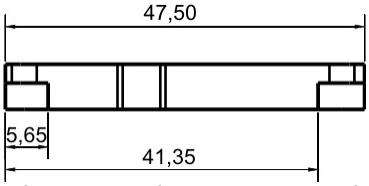


Figure 224: GigE uEye SE stand plate - side view

Special tool for filter glass replacement

Purchase Order No.	Description
CK.0121.2.26900.00	Octagonal Allen key-type tool for filter glasses

10.5 GigE uEye HE

GigE uEye HE Cables

Purchase Order No.	Description
AD.0040.2.17000.00	*GigE uEye HE* Y-cable for trigger/flash/power supply, with AC adapter, 5 m/1.8 m
AD.0040.2.17100.00	*GigE uEye HE* Y-cable for trigger/flash/power supply, without AC adapter, 5 m
AD.0040.2.17700.00	*GigE uEye HE* cable for trigger/flash/power supply, 12 wires, 5 m
BK.0040.2.01900.00	*GigE uEye HE* MDR 14 connector, not fitted

The following cables are available in any desired lengths up to 50 m on request.

To ensure a sufficient voltage (6...24 V) at the camera input, we recommend the following AC adapter voltages:

Power cable length	AC adapter voltage
up to 5 m	9-24 V
5-10 m	12-24 V
10-20 m	15-24 V
20-30 m	18-24 V
30-50 m	24 V

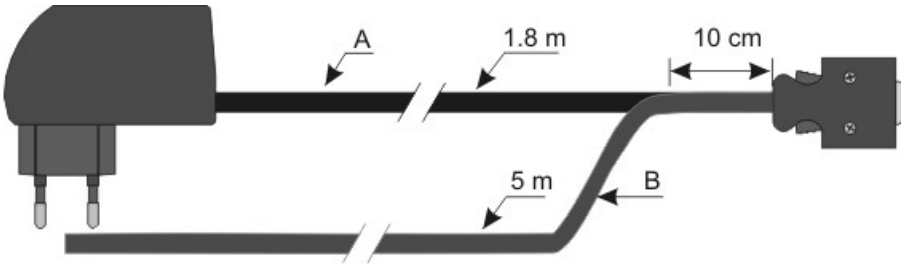


Figure 225: GigE uEye HE trigger and flash cable with AC adapter (AD.0040.2.17000.00)

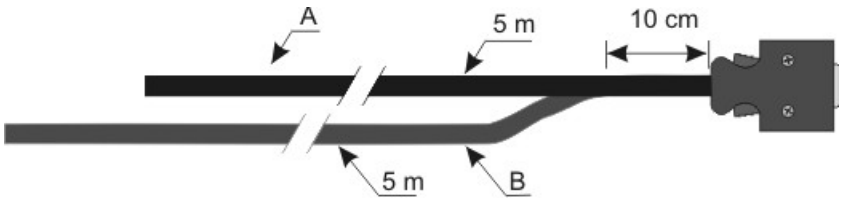


Figure 226: GigE uEye HE trigger and flash cable without AC adapter (AD.0040.2.17100.00)

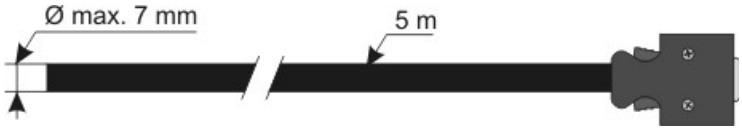


Figure 227: GigE uEye HE connecting cable, 12 wires (AD.0040.2.17700.00)

Tripod adapter for GigE uEye HE cameras

Purchase Order No.	Description
AL.0125.2.07100.00	Tripod adapter for *GigE uEye HE cameras*

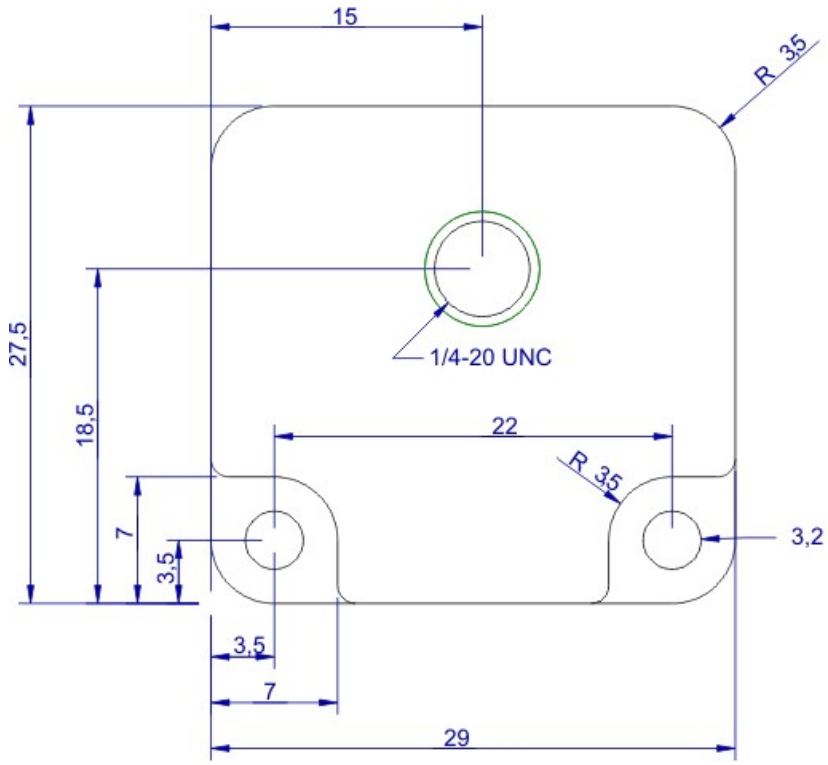


Figure 228: Tripod adapter top view

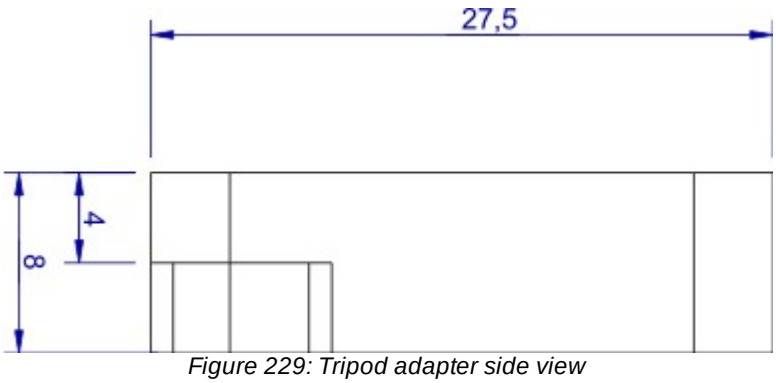


Figure 229: Tripod adapter side view

Special tools for filter change and for adjusting the flange back distance

Purchase Order No.	Description
CK.0121.2.26900.00	Octagonal Allen key-type tool for filter glasses
CK.0124.1.28700.00	Shim for the flange back distance