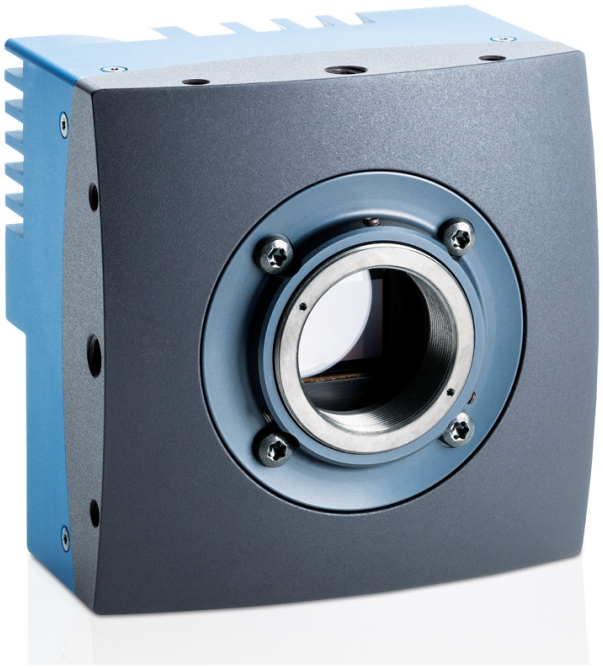
Allied Vision



CoaXPress®

Manual EoSens4.0 CoaXPress

EoSens4.0MCX6-CM, EoSens4.0MCX6-FM

A TKH TECHNOLOGY COMPANY

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General information

1.1 Company information

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1.1.1 Disclaimer

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

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

Accident prevention guidelines and general safety regulations should be applied.

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

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

1.1.2 Copyright notice

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

1.2 Legal information

Errors and omissions excepted.

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

1.2.1 Registered trademarks

In this manual the following registered trademarks may be used:

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

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

1.2.2 Conformity and use

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

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

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

1.2.3 Rules and regulations for Europe

This device is CE tested, the following rules apply:

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

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

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

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

1.2.4 Warranty and non-warranty clause

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

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

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

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

1.3 Supplements

For customers in Canada

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

Pour les utilisateurs au Canada

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

Life support applications

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

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

1.4 Tips and notes

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

Tips

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

Notes

> Provides information to avoid damage to the system.

1.5 Support

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

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

Introduction

2.1 Intended use

The camera EoSens4.0 CoaXPress belongs to the product class of so-called high-speed machine vision (MV) cameras that are integrated into test or measurement systems.

High-speed MV cameras are designed to capture images with high frame rate for various purposes in an industrial or scientific environment to deliver image data for further analysis. The images are transmitted to a frame grabber on a connected computer where they can be evaluated with the help of a software.

Other uses

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

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

2.2 Scope of delivery

Check if the delivery is complete before installing the camera.

The firmware can be updated remotely via a special updating software. For firmware updates, inform Allied Vision Gilching Gmbh by creating a support request: Support & Repair (RMA).

2.3 Optional accessories

Lenses

For lenses or other accessories, visit Lens Selector.

Cables

- The four bundle cable KKRDDINDINxx/6Gx4 with DIN 1.0/2.3 connector at both ends (4x) is available in lengths of 5 m, 10 m, 15 m, or 20 m. It is used to connect the frame grabber and camera when both are equipped with DIN 1.0/2.3 connectors.
- The cable KKRDDINBNCxx/6Gx4 with DIN 1.0/2.3 at one end and 4 BNC connectors at the other is available lengths of 5 m, 10 m, 15, m 20 m, or 25 m. It is used to connect a frame grabber with BNC sockets with the camera.

> The triangle on the connector indicates connection number 1.

Power supply

When not using power over CXP (PoCXP), an external power supply unit is needed, e.g.:

- NTCAM132X (12 V/2.5 A) with 12 pin Hirose connector (HR10A-10P-12S(73)) and 5 m cable

2.4 System requirements

The PC or image processing system that is connected with the camera must be equipped with:

- An image processing system, i.e. PC and operating system according to the requirements of the frame grabber
- A fully installed frame grabber with device driver and software
- CoaXPress cable with DIN 1.0/2.3 connector
- Optional an external power supply (NTCAM132x or NTCAM13xx)

> All cables, connectors and the frame grabber must be CoaXPress V1.1 compliant.

The camera

3.1 Camera description

All cameras of the EoSens CXP family are CoaXPress compliant. The high-speed CMOS cameras come with a 4.0 Megapixel sensor of 2336 x 1728 (H x V). They are widely configurable and scalable to fit your needs and are available in monochrome and color (Bayer filter).

The CoaXPress high speed interface technology allows transfer rates of up to 6.25 Gb/s. The camera supports CoaXPress Link Speeds from 3.125 Gb/s to 6.25 Gb/s.

In addition the camera offers a very high frame rate of over 563 fps at full resolution. By defining a Region of Interest (ROI) the frame rate can be increased to several thousand frames per second. An important feature of CXP cameras is the high photo sensitivity for low-light conditions.

The camera electronic is enclosed in a compact and solid full metal housing robust enough to comply with the requirements in heavy industrial surroundings. Shielded coaxial cables as recommended by the CoaXPress standard will support this.

CXP cameras can be equipped with standard C-mount or F-mount lenses made for industrial purpose.

The color and monochrome cameras EoSens4.0 CoaXPress are supplied with the following features:

- 3x3 image smoothing filter
- Analog gain
- Decimation mode (subsampling)
- Firmware update in the field
- FPN correction
- Gamma correction (monochrome only)
- LUT
- Pixel reset mode
- PRNU correction (Photo Response Non-Uniformity correction)
- Sequencer mode - if ordered
- Skipping

- Trigger debouncer
- 3 user profiles

Bayer filter

The sensor of the EoSens4.0 CoaXPress colour cameras is supplied with a Bayer colour filter. In order to get the colour information, the imaging software has to decode the information of each pixel into red, green, and blue (RGB) by using the values of its neighbouring pixels. Each red, green and blue filter element covers exactly one pixel on the sensor. A matrix of 2 x 2 filter elements builds a filter element matrix. A Bayer pattern image therefore must have an even number of pixels and an even number of lines.

3.2 Operating temperature

Despite of its high performance, the fanless 4CXP camera is compact and works silently. If the camera is mounted on mechanical parts, the heat generated during operation will be dissipated by the cooling fins at the rear of the camera and the mechanical parts.

> The camera body temperature must not exceed the values specified in the technical data (see "Technical data" on page 23).

In case of overheating, the camera will automatically be switched off and the communication between camera and PC will be interrupted.

> Durability of the camera will be reduced when being operated in an environment that is constantly exceeding the maximum permissible operating temperature. In this case, take additional cooling measures as described below.

> The camera is not intended for use on an isolated mounting plate or in a closed housing because the temperature of the camera will rise continuously.

3.3 Cooling

During operation, the heat from the camera’s sensor dissipates to the housing. To maintain reliable performance, it is crucial to

adhere to the operating temperature range specified in the camera's technical data.

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

Additional cooling

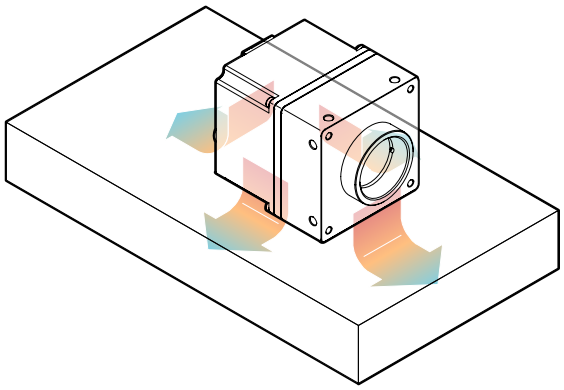


Fig. 3-1: Camera mounted to a heat sink (example)

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

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

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

3.4 Interfaces of the camera

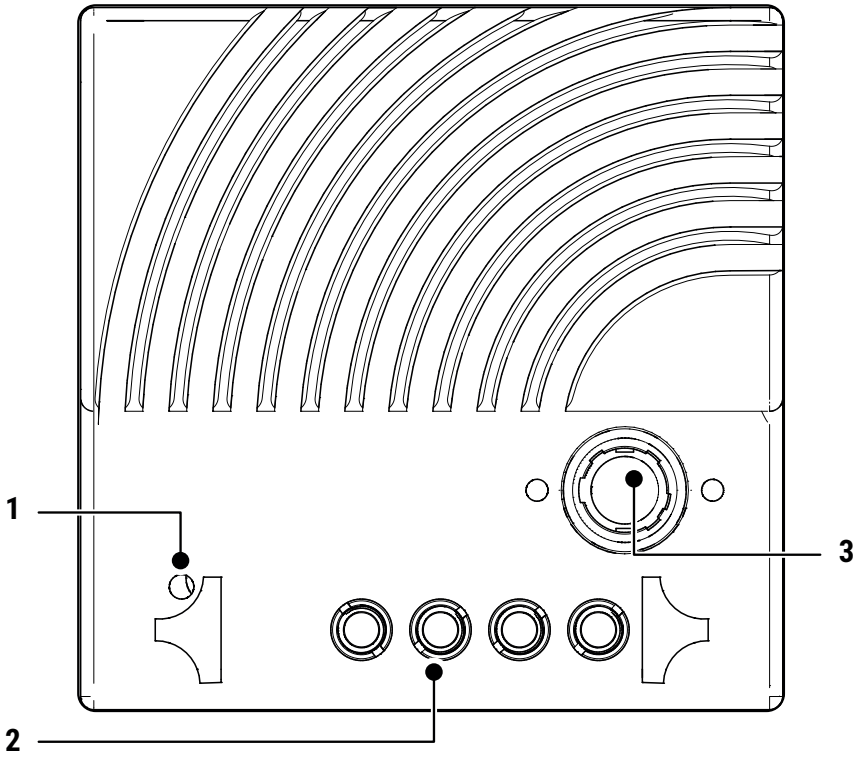


Fig. 3-2: Interfaces of the camera EoSens4.0 CoaXPress

1	Status LED to verify the operating status of the camera
2	CoaXPress DIN1.0 / 2.3 connector used to connect the camera with a CoaXPress compliant frame grabber.
3	12 pin Hirose power connector used when an external power supply (12 ... 24 V) has to be connected, an external trigger is connected and / or an output signal is used.

3.5 Status LED

The multi-color status LED indicates camera and connection states.

LED State	Indication
OFF	No power
Solid orange	System is booting
Slow pulse red	Powered, but nothing connected
Fast flash alternate green/orange	Connection detection in progress, PoCXP active
Fast flash orange	Connection detection in progress
Slow flash alternate red/green	Device incompatible, PoCXP active
Slow flash alternate red/orange	Device incompatible
Solid green	Device connected but no data being transferred
Slow pulse orange	Device connected, waiting for event (e.g. trigger)
Fast flash green	Device connected, data being transferred
Slow flash alternate green/orange	Connection test packets being sent
Red - 500 ms pulse	Error during data transfer
Slow flash alternate red/-green/orange	Compliance test mode enabled
Fast flash red	System error

Setting up

4.1 Connecting a frame grabber

The CoaXPress standard describes seven connections for data transmission between camera and frame grabber.

The transmission speed of the camera can either be set to 3.125, 5, or 6.25 Gb/s. The possible cable length depends on the cable type used, its quality, and the selected transmission speed. The following table provides examples. These values will only be reached if the signal quality meets the requirements of the CXP1.1 specification.

> The maximal cable length depends also on the quality of the cables. We recommend CXP cables from Allied Vision Gilching Gmbh.

All lines have to be of the same length.

CXP-Type	Transmission speed [Gb/s]	Max. cable length RG59 style [m]
CXP-1	1.25	up to 130
CXP-2	2,5	up to 110
CXP-3	3.125	up to 100
CXP-5	5	up to 60
CXP-6	6.25	up to 40
4*CXP-6	4*6.25 (= 25)	up to 40

DIN Connector

To connect the camera with a frame grabber you can use any CoaXPress compatible cable with DIN connector. Allied Vision Gilching Gmbh offers cables with the following connectors.

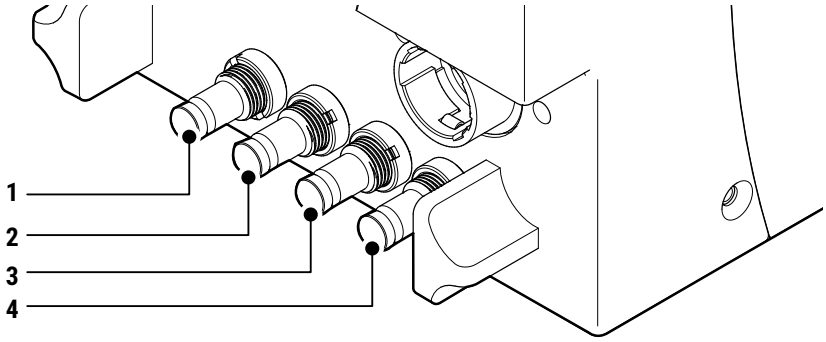
- DIN ←→DIN
  (cable KKRDDINDINxx/6Gx4)
- DIN ←→BNC
  (cable KKRDDINBNCxx/6Gx4)

Carefully connect and release the socket with the DIN1.1/2.3 connector. Connect them precisely to avoid deformation of the connectors or other damages!

If connecting a frame grabber via DIN ←→BNC, keep the order from left to right when connecting one, two, or four BNC connectors.

Pin 1 always has to be connected.

The master connector (1) is marked by a triangle. Connect it with channel one of the frame grabber (refer to the frame grabber documentation).



All connections are hot-pluggable.

The assignment of the DIN cables KKRDDINDINxx/6Gx4 and KKRDDINBNCxx/6Gx4 connector pins is as follows:

DIN connector pin	Frame grabber	Cable color
1 (triangle)	TX channel 0	**Red**
2	TX channel 1	**Green**
3	TX channel 2	**Blue**
4	TX channel 3	**Yellow**

4.2 Connecting an external power supply or I/O signals

If you prefer an external 12 - 24V DC power supply (min. 18 W), connect it with the 12-pin Hirose connector at the rear of the camera.

The power connector of the camera has to be connected with a DC power supply providing 12 to 24 V DC. Connecting a lower or higher supply voltage, an AC voltage, reversal polarity or using wrong pins of the power connector may damage the camera and will void warranty!

Allied Vision Gilching Gmbh offers the power supply unit NTCAM132xx with cables of 5 or 10 meters.

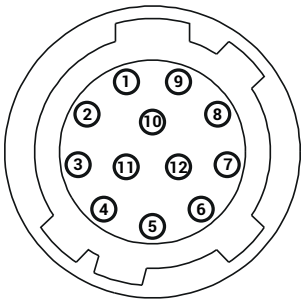
If you assemble your own cable, pay attention to the pinning described below.

12-pin connector and I/O signals

1. Connect the external power supply with the 12-pin connector of the camera.

The DC power supply must deliver 12-24 V DC (18.4 W). It must be equipped with a HR-10A-10P-12S plug.

The 12 pin connector provides two inputs for an external trigger and two output signals. The output signal can be controlled.



Pin	Signal	Pin	Signal
1 + 12	GND	6	IN0
2 + 11	VCC (12 - 24 V)	7	IO_{GND}
3	IO_{GND}	8	OUT1
4	OUT0	9	IO_{GND}
5	IO_{GND}	10	IN1

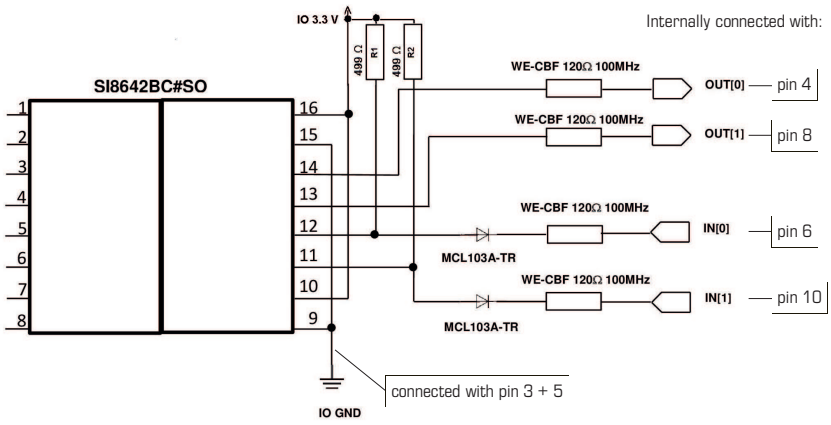


Fig. 4-1: Connecting input and output signals with the internal circuit

All inputs accept 3.3 V LVTTL signals. They are also 5 V TTL compatible.

All inputs can also accept signals with 12 V and 24 V.

> An open (not connected) input will be interpreted as low level from the camera. For high level an input voltage of >0.8 V must be connected.

The following circuit can be used for the input signals of the camera:

- At low input voltages (0 V, 3 V)
  - The Zener diode does not conduct (< 6.2 V).
  - The transistor is blocked.
  - INx = INPUT_USER.
- At high input voltages (24 V)
  - When the voltage across R1 exceeds the Zener voltage (6.2 V) + base-emitter voltage (0.7 V).
  - The transistor begins to conduct and limits the voltage.
- D1: BZX84C4V3 (4.3 V)
- Q1: BC547 or 2N2222 (Standard NPN)
- R2: 10 kΩ, 0.25 W
- R1: 22 kΩ, 0.25 W

4.3 Connecting camera and image processing system

To make use of the full performance, all cables, connectors and the frame grabber must be CoaXPress V1.1 compliant.

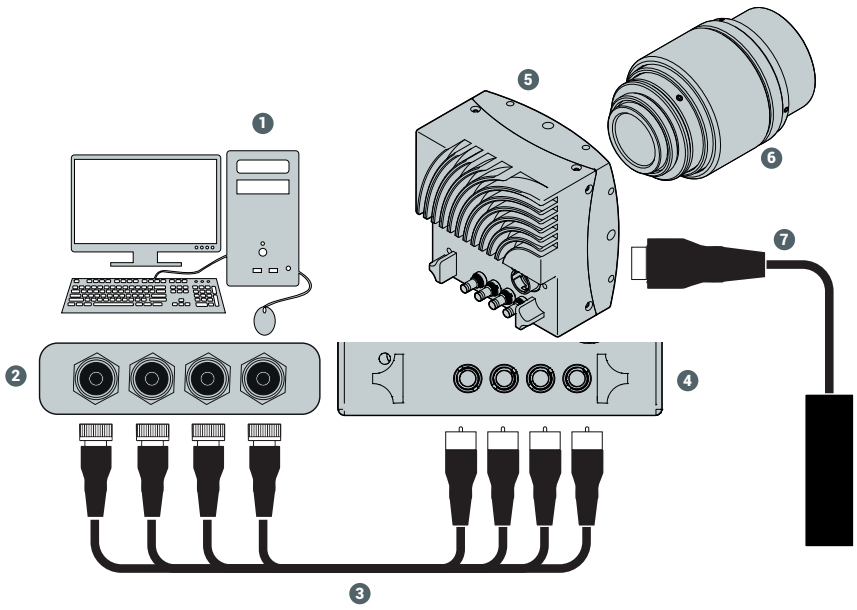


Fig. 4-2: Connecting camera and image processing system

1. Install the frame grabber software on the image processing system (see the documentation of the frame grabber board).
2. Switch off the image processing system (1).
3. Unscrew the dust protection cover of the camera.
4. Mount the lens (6).
5. Connect the cable (3) with the camera connectors (4).
6. Connect the other end of the cable with the frame grabber board (2).
7. Connect the power supply via the 12-pin connector with the camera (5), if required.

> If connecting an external trigger, take the pinning into account.

8. If an external power supply (7) is used, connect the power supply with the main supply.
9. Switch on the image processing system (1).
10. Check the status LED of the camera to verify that the camera is ready for use.

4.4 The power-up profile

If the camera is powered-up, the power-up profile permanently stored in the non-volatile memory of the camera will be loaded. This profile consists of a number of camera settings such as sensor

resolution and frame rate. It is used to set the camera into a defined operation mode.

> The camera has NOT to be configured by the host to start operation. The power-up profile will deliver all necessary values.

Serial number and firmware version are provided in the non-volatile memory of the camera. Use the GenICam feature “DeviceSerialNumber” to read the serial number and the firmware revision.

> Read the chapter on Bootstrap Registers in the Reference Guide for more information. For the serial number, see the identification plate at the side of the camera.

4.5 Cleaning sensor and lens

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

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

4.6 Updating the camera firmware

This section describes how to carry out a firmware update for a MIKROTRON camera from Allied Vision Gilching Gmbh using the software “CXPUpdater”.

Prerequisites

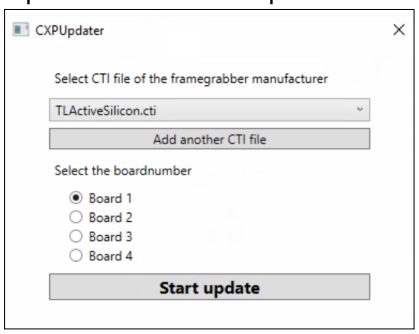
> The updater software requires the Microsoft Redistributables for Visual Studio 2015-2019 (vcredist_x64.exe) that can be downloaded from Microsoft for free.

Procedure

The updater process requires frame grabber specific components. The program assumes that there is a "Data" folder containing the following files:

- FlashData.ibf
- fpga_app_firmware.ibf

1. Open the tool “CXP Updater.exe” in the folder “Firmware”.



2. Select the CTI file that corresponds to the frame grabber board. If unsure, consult the Device Manager.
3. To add a CTI file that is not in the list, select **Add another CTI file** and navigate to the file.
4. Select the board for updating.
5. Start the update process. The progress bar displays the current update status.

> Do not switch off the camera during the update process.

6. When the update is finished, restart the camera.

Technical data

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

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

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