



EoSens 4CXP Reference Guide



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About This Reference Guide

This reference guide contains helpful information to install and operate 4CXP cameras of the type MC4082/MC4083 and MC4086/ MC4087. It has been produced with care. Nevertheless, information might be erroneous or incomplete. MIKROTRON cannot be held responsible for any problems resulting from incomplete or erroneous information.

In case you detect errors or need further information, please inform us via mail: info@mikrotron.de or call +49 89 7263420.

We highly recommend, reading this reference guide carefully.

This reference guide is subject to change without notice.

Remarks, Notes and Warnings

This reference guide contains remarks, notes and warnings that are helpful and often important in order to avoid data loss or camera damage. They are emphasized as follows:

Remark	Hints and other helpful information
 Note	Hints concerning frame quality, timeouts, or other
 WARNING	Important information concerning data loss or camera damage

Registered Trademarks

In this reference guide the following products are registered trademarks:

- CoaXPress®
- EoSens®
- GenICam®

In the following, these product names are not specially marked as registered trademarks. Nevertheless, these product names have not to be used in other context without the trade mark sign!

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 reference 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.

Remark: You are herewith cautioned that any changes or modifications not expressly approved in this reference guide could void your authority to operate this equipment.

制造说明:

此设备的生产与测试依照FCC条例第15条条例，符合A类电子设备标准。产品提供在商用使用环境中的合理保护，以防止使用过程中可能涉及到的损害。

此设备会产生、使用并可发射出无线电波，如果未按照本手册中所述安装和使用，可能会对无线通信设备产生干扰。如本设备在居民区操作出现干扰等情况，用户需要自费处理。

备注：请注意，如未按照此使用说明操作而自行更改设备，那么您将无权使用本设备。

規制適合宣言とご使用について (米国FCC)

この機器は、FCC規則のパート15に定められたクラスAデジタル装置に関する規制要件に基づいて所定の試験が実施され、その適合が認証されています。これらの規制要件は、商業環境において機器を使用する際、有害な干渉に対する妥当な保護を提供するために設けられています。この機器は、無線周波数エネルギーを生成かつ利用するとともに、放射することもあります。このリファレンスガイドの指示に従って設置および使用が行われない場合は、無線通信に有害な干渉を引き起こす恐れがあります。この機器を住宅地で利用すると有害な干渉を起こすこともあり、その場合、使用者は自己負担において適切な対策を講じる必要があります。

注意事項： このリファレンスガイドに明示的に承認していない変更や修正を行った場合には、本製品を使用する権利が無効となることがあります。

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 reference guide 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.

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

Declaration of Conformity

Manufacturer: MIKROTRON GmbH
 Address: Landshuter Str. 20-22
 D-85716 Unterschleissheim / Germany
 Product: Cameras **MC4082 / MC4083** and **MC4086 / MC4087**

We herewith declare under our sole responsibility that the dedicated products are in conformity with the following EU directives:

Title	EU Directive
RoHS Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment	2011/65/EU
Approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC	2004/108/EC

During conformity-testing the following standards were consulted:

Title	EU Standard
Information technology equipment - Immunity characteristics - Limits and methods of measurement	EN 55024:1998 + A1:2001 + A2:2003
Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55022:2006 + A1:2007

Unterschleissheim, May 06, 2015

Dipl. Kfm. Christian Pilzer (CEO)

Warranty and Non-Warranty Clause

Warranty is described in §8 of our General Terms and Conditions which can be downloaded on MIKROTRON'S webpage: www.mikrotron.de

In addition, take the following non-warranty clauses into account:



WARNING

- **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 may only be used with a supply voltage according to the camera 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.**
- **MIKROTRON cannot be held responsible for the loss of data. We recommend a backup plan.**



In case of warranty, please, make a note of the camera type and serial number and send the camera back to your distributor. If no distributor is available, send it back to MIKROTRON.

You find all necessary information on the identification plate of the camera.

Before sending back the camera, ask for a RMA number and form either by:

- phone: +49 - 89 - 7263 4250 or
- e-mail: service@mikrotron.de

Scope of Delivery

The following components are part of delivery. Please check whether the delivery is complete, before you start to install the camera:

- Camera MC408x
- F-Mount or C-Mount lens adapter (as ordered)
- MIKROTRON's Support CD

Optional:

- several lenses www.mikrotron.de/en
- DIN 1.0/2.3: four bundle cable KKRDDINDINxx/6Gx4 with DIN 1.0/2.3 connector at both ends (4x); available in lengths of 5, 10, 15 or 20 m



Remark: The triangle on the connector indicates connection 1.

- DIN 1.0/2.3: cable KKRDDINBNCxx/6Gx4 with DIN 1.0/2.3 at one end and 4 BNC connectors at the other; available in cable lengths of 5, 10, 15, 20 or 25m



- 5W5: there are several cables (KKRD5W5BNCxx) for 6 GHz with a length of 5, 10, 15, 20 m or longer available. Please, contact your sales representative



- external power supply unit:
MC3086/MC3087: NTCAM132x (12 V/2.5 A) with 12 pin Hirose connector and 5 m cable
MC3082/MC3083: NTCAM13xx/NTCAM13XX10 with 6 pin Hirose connector and 5/10 m cable
- F-mount adapter

System Requirements

In order to use the MC408x camera you need:

- image processing system, e.g.: PC and software
- completely installed frame grabber (Device Driver, Software,...)
- CoaXPress cable either with DIN 1.0/2.3 or 5W5 connector
- if wanted, an external power supply (NTCAM132x or NTCAM13xx)

All cables, connectors and frame grabber have to be CoaXPress V1.1 compliant. Please, read the application note AN0036 for more information on tested frame grabbers.

Introduction

All cameras of the EoSens 4CXP family are CoaXPress compliant. These high-speed CMOS cameras come with a 4 Megapixel sensor of 2336 (H) x 1728 (V) and are widely configurable and scalable to fit to your needs. They are available in monochrome and color (Bayer Filter).

The CoaXPress high speed interface technology allows transfer rates of up to 6.25 Gbps. Depending on the camera model 4CXP cameras support CoaXPress Link Speeds from 1.25 Gbps to 6.25 Gbps.

In addition they offer a very high frame rate of over 500 fps at full resolution. By defining a Region of Interest (ROI) the frame rate can be increased to several 1000ths of frames.

Another important feature of 4CXP cameras is the high photo sensitivity of 1600 ASA (monochrome) or 1200 ASA (RGB).

Configuring the camera to Full HD resolution at 1920 x 1080 pixels using a frame rate of nearly 1000 fps opens a fascinating field of new applications. Full HD recordings are not only precious in industrial or high-speed applications but also when shooting a scene in high resolution documentary films or commercial clips.

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

4CXP cameras can be equipped with standard C-Mount or F-Mount lenses made for industrial purpose.

Most Important Features

The most important features of the 4CXP camera family are:

- small, compact housing (☞ page 67)
- 4 Megapixel high speed CMOS sensor
- global shutter
- monochrome or color (Bayer Filter)
- CXP connection speed of 1.250, 2.500, 3.125, 5.000 or 6.250 Gbps
- 7 μm^2 pixels
- resolution of 2336 x 1728 pixels
- 10/8 bit pixel output (256 gray levels)
- 4/3" optical format
- up to 563 fps @ full resolution
- sensitivity of up to 1600 ASA monochrome or 1200 ASA RGB
- extended dynamic range of up to 60 dB
- asynchronous trigger
- trigger frequency of 150 (one edge) and 300 kHz in AnyEdge mode
- arbitrary region of interest (ROI)
- more than 17,236 frames/s with reduced resolution
- communication and image transfer via CoaXPress interface (CXP1, CXP2, CXP3, CXP5 and CXP6)
- wide power supply range of 12 – 24V

Hardware

4CXP cameras are available with 5W5 (MC-4082/4086) or DIN connector (MC-4083/4087). All are equipped with the same sensor providing a resolution of 2336 x 1728 pixels. The color versions are equipped with a Bayer color filter at the top of the sensor. This filter will code the color information in the image pixels.

Table A: 4CXP camera features

Camera	Data width [bit]	Mono: m Color: c	Lens adapter	Link speed	Max. frame-rate @ 2336 x 1728	Connector Type
MC4082	8/10	m	C/F	CXP-6	563 fps	5W5
MC4083	8/10	c	C/F	CXP-6	563 fps	5W5
MC4086	8/10	m	C/F	CXP-5	566 fps	DIN1.0/2.3
MC4087	8/10	c	C/F	CXP-5	566 fps	DIN1.0/2.3

Rear Side of the Camera with DIN Connector

At the rear of the cameras MC4086/4087 the DIN1.0/2.3 connector and the power connector are to be found. The DIN connector with four lines is used to connect the camera with a CoaXPress frame grabber and to supply the camera with power (power-over-coax, so called PoCXP).

Alternatively, a 12 pin Hirose power connector is available to connect an external power supply.

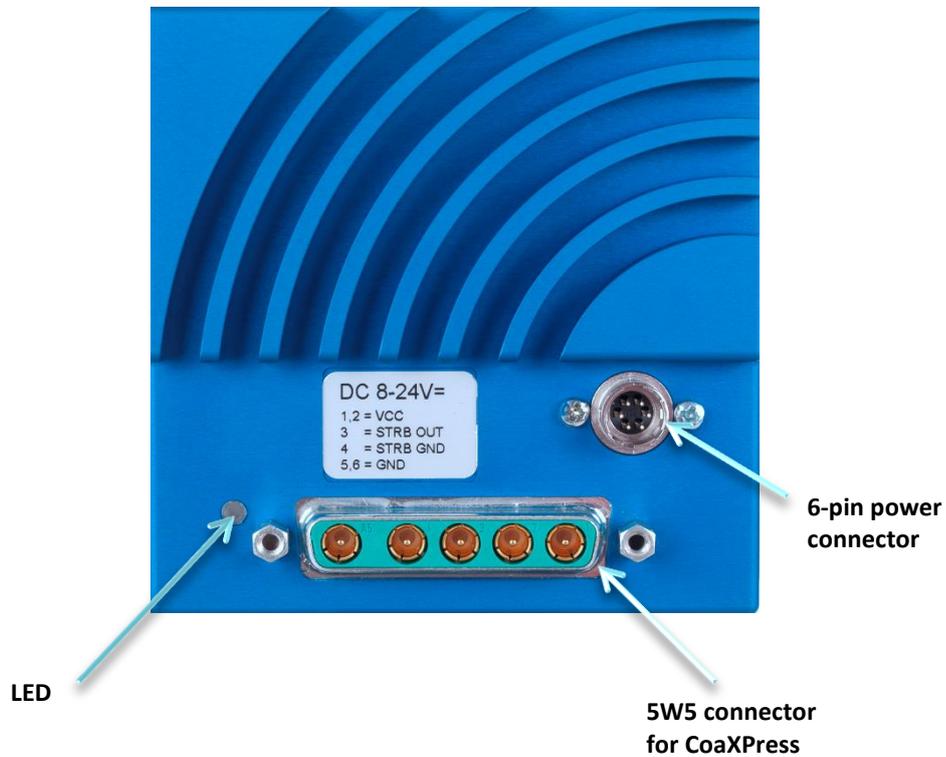


Remark: In order to connect an external trigger take the pinning of the Hirose connector on page 17 into account and read the trigger settings starting on page 39.

Rear Side of the Camera with 5W5 Connector

At the back of the cameras MC4082/4083 the 5W5 connector and power connector are to be found. The 5W5 connector is used to connect the camera via 4 lines with a CoaXPress frame grabber and to supply the camera with power (power-over-coax, so called PoCXP).

Alternatively, a 6-pin Hirose power connector is available to connect an external power supply.



Remark: In order to connect an external trigger take the pinning of the Hirose connector on page 19 into account and read the trigger settings starting on page 39

Connecting a Frame Grabber

At the time being, the CoaXPress standard describes 4 connections for data transmission between camera and frame grabber. The transmission speed of a 4CXP camera can either be set to 1.25, 2.5, 3.125, 5 or 6.25 Gbit/s. The possible cable length depends on the cable type used and the transmission speed. The following table gives examples. These values can only be reached if the signal quality meets the requirements of the CXP-1.1 specification.

Table B: Maximal cable length depending on transmission speed

CXP-Type	Transmission speed	Max. cable length RG59 style
CXP-1	1.25 Gbit/s	up to 130 m
CXP-2	2.5 Gbit/s	up to 110 m
CXP-3	3.125 Gbit/s	up to 100 m
CXP-5	5 Gbit/s	up to 60 m
CXP-6	6.25 Gbit/s	up to 40 m
4x CXP-6	4*6.25 Gbit/s = 25 Gbit/s	up to 40 m

Remark: If several connections are used, all connections will have to be run with the same transmission speed.

DIN Connector

In order to connect a MC4086/4087 camera with a frame grabber, use any compatible CoaXPress cable with DIN connector. MIKROTRON offers cables with the following connectors (☞ page 11):

- DIN<->DIN (KKRDDINDINxx/6Gx4)
- DIN<->BNC (KKRDDINBNCxx/6Gx4)

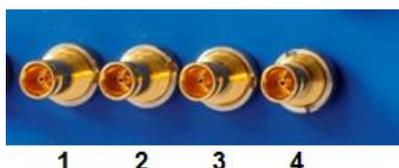


WARNING

Please, carefully connect and release the socket with the DIN1.0/2.3 connector. Connect them precisely to avoid deformation of the connectors or other damages!

If connecting a frame grabber via BNC, keep the order from left to right when making one, two, or four connections. The inner left connector (1) is the master connector and always has to be connected. All connections are hot-pluggable.

No. of connections	Connector combination
1	1
2	1+2 (link)
4	1+2+3+4 (link)



When using the DIN connector with a cable from MIKROTRON (e.g.: KKRDDINDINxx/6Gx4 (☞ page 11)), use the pin with the triangle on the connector housing as pin 1.

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

DIN Connector Pin	Cable Color	Function
1 (triangle)	blue	TX channel 0
2	white	TX channel 1
3	green	TX channel 2
4	red	TX channel 3

5W5 Connector

In order to connect a MC4082/4083 camera with a frame grabber, use MIKROTRON's cable KKR5W5BNC0x for 3 or 6 GHz and different lengths.



WARNING

Please, carefully connect and release the socket with the 5W5 connector. Connect them precisely to avoid deformation of the connectors or other damages!

If connecting a frame grabber via BNC, keep the order from right to left. The outer right connector (1) is the master connector and always has to be connected. All connections are hot-pluggable. Connector 5 is not used.

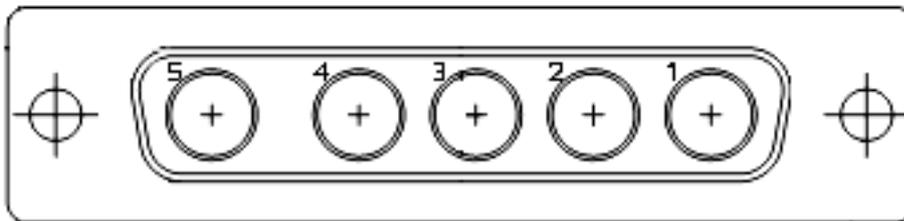


Table 1: Assignment of the cable of the 5W5 connector

5W5 Connector Pin	Cable Color	Function
1	red	TX channel 0
2	green	TX channel 1
3	blue	TX channel 2
4	white	TX channel 3
5	yellow	TX channel 0 (not yet assigned, do not use)

Connecting an External Power Supply

All 4CXP cameras can either be supplied with power over coax (PoCXP) or via the Hirose connector with an external power supply. MC4082/4083 cameras are equipped with a female 6-pin and MC4086/4087 with a female 12 pin Hirose connector.

12 Pin Hirose Connector and I/O Signals

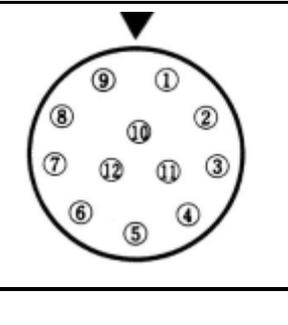
In case you prefer an external power supply for MC4086/4087, connect it with the 12 pin Hirose connector (HR10A-10R-12PB (71)) at the back of the camera. The DC power supply has to deliver 12 - 24 V DC (7 W) (☞ page 11).

The 12 pin connector provides a strobe signal (STRB_{OUT}) which is low during exposure and two inputs for an external trigger (☞ page 39).

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

Table C: Pinning of the Hirose 12 pin power connector

Pin	Signal	Pin	Signal
1 + 12	GND	5	TRIG _{Line0} GND
2 + 11	V _{IN} (8 – 24 V)	6	TRIG _{Line0} IN
3	STRB _{GND}	9	TRIG _{Line1} GND
4	STRB _{OUT}	10	TRIG _{Line1} IN



Remarks:

- The I/O pins 7 and 8 are not in use.
- The I/O standard 3.3V LVTTTL applies to all signal I/Os (STRB + TRIG).



WARNING

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.

6 Pin Hirose and I/O Signals

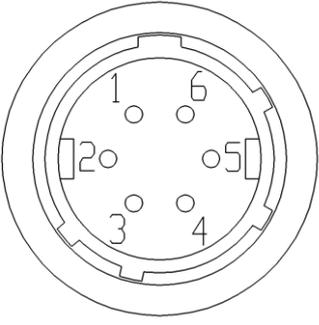
The power connector of the cameras MC4082/MC4083 has to be connected via the 6-pin Hirose connector (HR10A-7P-6S) with a DC supply voltage between 12 and 24 V at a power consumption of 7W max. The DC power supply unit is connected to a dedicated connector at the back side of the camera. Please, take attention to the pin wiring of the connector as described below.

The 6 pin connector provides a strobe signal (STRB_{OUT}) which is low during exposure.

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

Table 2: Pinning of the 6 pin power connector

Pin	Signal	Pin	Signal
1	VCC	6	GND
2	VCC	5	GND
3	STRB _{OUT} (3.3 V LVTTTL I/O standard)	4	GND _{STRB}




WARNING

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.

Status LED

A multi-color LED on the backplane of all 4CXP cameras indicate camera and CXP connection states according to the CXP 1.1 standard.



Table D: LED indications

LED State	Indication
OFF	no power
solid orange	system is booting
slow pulse red	powered, but nothing connected (not applicable to a device reliant on PoCXP power)
fast flash alternate green/orange	connection detection in progress, PoCXP active
fast flash orange	connection detection in progress, PoCXP not in use
slow flash alternate red/green	device incompatible, PoCXP active
slow flash alternate red/orange	device incompatible, PoCXP not in use
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

Remarks: If the LED signals the end of a successfully firmware update (green – slowly pulsating), the camera can be switched off.



WARNING Never switch off the camera during a firmware update. Otherwise the camera might be permanently damaged.

Resolution and Speed

There is a correlation between resolution and transmission speed for an 8 bpp image and 4 connections of 1.25, 2.5, 3.125, 5, or 6.25 Gbit/s.

Please use our camera compare tool under www.mikrotron.de/cameracompare in order to determine the frame rate for a certain link speed and resolution.

Cleaning the Sensor or the Lens

If necessary, clean the window of the sensor and the lens with a dry, soft lens-cleansing tissue.



WARNING

Sensor Damage

- **Unplug the camera before you clean any parts!**
- **In no case open the housing when cleaning the window of the sensor.**
- **If there are coarse particles on the lens or the window of the sensor, use a vacuum cleaner to remove them before cleaning in order to avoid scratches.**
- **Use a dry, soft lens-cleaning tissue to clean the lens and, if necessary, the window of the sensor.**
- **Don't use tools that may harm the sensor/lens.**

First Steps

Before you start, make sure that all components of the camera/host chain like camera, connectors, cable and frame grabber as well as the software are fully CoaXPress V1.1 compliant.

Procedure:

1. **Switch off the image processing system**
2. **Connect the DIN V1.0/2.3 or 5W5 connector with the 4CXP camera**
3. **Connect the other end of the cable with your CoaXPress V1.1 compatible frame grabber**
4. **If an external power supply is needed, connect the power supply (12 - 24 V) via 12 pin Hirose connector with the camera**
5. **Unscrew the dust protection cover of the camera**
6. **Mount the lens**
7. **Switch-on the image processing system**
8. **As soon as the connection is established, connect the external camera power supply with the main supply**

Initial Setup

The MC408x comes with initial parameters and therefore does not have to be configured via the host software. The initial settings include values like sensor resolution or frame rate.

Serial Number and Firmware

Serial number and firmware revision are provided in the non-volatile memory of the MC408x. Use the according GenICam command to read the serial number and firmware revision (☞ Bootstrap registers on page 25). The serial number is also to be found on the identification plate of the camera.

Powering-up the Camera

If the camera is powered-up, the power-up profile, which is permanently stored in the non-volatile memory of the camera, will be loaded. This profile consists of a number of camera settings and is used to bring the camera into a defined operation mode.

Remark: The camera has not to be configured by the host to start operation. The power-up profile will deliver all necessary values like sensor resolution or frame rate, for example.

Configure Your 4CXP Camera

4CXP cameras are based on the CoaXPress V1.1 specification. CoaXPress itself uses elements of the GenICam standard to configure and control a camera. GenICam assumes that the camera uses a flat register layout for configuration. Suppose, you want to change the exposure time, you have to write the according value to the camera register representing the exposure time in hex values (e.g. 0x1100; ↗ page 37).

GenICam Standard

“The goal of GenICam is to provide a generic programming interface for all kinds of cameras. No matter what interface technology the cameras are using or what features they are implementing, the application programming interface (API) should be always the same.” (↗ GenICam Specification)

GenICam consist of three parts:

1. GenAPI
generic API (application programming interface) for cameras
2. SFNC
recommended names and features of compliant devices
3. GenTL
transport layer to be supported by any compliant frame grabber to transport camera data into the application

With CoaXPress, the GenICam standard allows a direct connection between the software layer and the camera. This means any CoaXPress camera and frame grabber can be used with this standardized programming interface.

GenAPI allows the application software to communicate with the camera and read and write values / camera parameters. Every camera has therefore to be equipped with an "electronically readable manual" to provide access and allow the GenAPI to:

- read camera information and establish a connection to the frame grabber (↗ Bootstrap registers on page 25)
- control acquisition of images (↗ Acquisition Control on page 37)
- reset the camera (↗ Device Control on page 43)
- read or set the image format (↗ Image Format on page 44)
- select a user set (↗ User Set Control on page 51)
- configure gain and blacklevel (↗ Analog Control on page 53)
- use custom features of the frame grabber (↗ Custom Features on page 54)

Camera Registers

All camera features are described and summarized in an "electronically readable manual" file. The file is coded in ASCII using the Extensible Markup Language (XML) to describe each feature as a XML feature knot.

Each feature knot consists at least of:

- the feature type (command, string, integer...)
- its access mode (r/w)
- a descriptive name ('friendly name') of the feature
- the corresponding register address
- a short description of the feature in plain ASCII

There are also a number of additional elements that make a complete feature description. For example the minimum and maximum values or its default value. Please, refer to the GenICam documentation for further details.

The features in the XML file are grouped according to their meaning (e.g. Bootstrap registers, Image format...).

The XML file can be saved (compressed or uncompressed) in the camera or as external file on your local computer or a remote host. The file path (URL) can be read in 'XmlUrlAddress'.



Notes

- If not stated otherwise, all integer values will be interpreted as 32 bit unsigned integers.
- All strings are NULL terminated and consist of 8 bit chars.

Bootstrap registers

CoaXPress compliant devices have to support a number of bootstrap registers as defined in this chapter. In contrast to other CXP camera features each bootstrap register is assigned to a fixed camera address which is defined in the CoaXPress specification.

Bootstrap registers are defined for device information and allow frame grabbers to establish and maintain the connection between host and camera in a standardized way. The connection to the camera is handled by the frame grabber in the background and is normally not in the scope of an application developer. That is why registers for establishing and maintaining the grabber/camera connection may not be of interest for most application programmer.

Name	Address	Access	Length [Bytes]	Register Interface	Page
Standard	0x00000000	R	4	Integer	26
Revision	0x00000004	R	4	Integer	27
XmlManifestSize	0x00000008	R	4	Integer	27
XmlManifestSelector	0x0000000C	R/W	4	Integer	27
XmlVersion	0x00000010	R	4	Integer	28
XmlSchemeVersion	0x00000014	R	4	Integer	28
XmlUrlAddress	0x00000018	R	4	Integer	29
lfdc2Address	0x0000001C	R	4	Integer	29
DeviceVendorName	0x00002000	R	32	String	30
DeviceModelName	0x00002020	R	32	String	30
DeviceManufacturerInfo	0x00002040	R	48	String	30
DeviceVersion	0x00002070	R	32	String	31
DeviceSerialNumber	0x000020B0	R	16	String	31
DeviceUserID	0x000020C0	R/W	16	String	31
WidthAddress	0x00003000	R/W	4	Integer	32
HeightAddress	0x00003004	R/W	4	Integer	32
AcquisitionModeAddress	0x00003008	R/W	4	Integer	32
AcquisitionStartAddress	0x0000300C	R/W	4	Integer	32
AcquisitionStopAddress	0x00003010	R/W	4	Integer	32
PixelFormatAddress	0x00003014	R/W	4	Integer	32
DeviceTapGeometryAddress	0x00003018	R/W	4	Integer	32

Name	Address	Access	Length [Bytes]	Register Interface	Page
Image1StreamIDAddress	0x0000301C	R/W	4	Integer	32
ConnectionReset	0x00004000	W/(R)	4	Integer	32
DeviceConnectionID	0x00004004	R	4	Integer	32
MasterHostConnectionID	0x00004008	R/W	4	Integer	33
ControlPacketSizeMax	0x0000400C	R	4	Integer	33
StreamPacketSizeMax	0x00004010	R/W	4	Integer	33
ConnectionConfig	0x00004014	R/W	4	Enumerate	34
ConnectionConfigDefault	0x00004018	R	4	Integer	34
TestMode	0x0000401C	R/W	4	Integer	34
TestErrorCountSelector	0x00004020	R/W	4	Integer	35
TestErrorCount	0x00004024	R/W	4	Integer	35
TestPacketCountTx	0x00004028	R/W	8	Integer	35
TestPacketCountRx	0x00004030	R/W	8	Integer	36
HsUpConnection	0x0000403C	R	4	Integer	36
Start of manufacturer specific register space	0x00006000	-	-	-	

Standard

This register provides a magic number (see OUT) indicating the device implements the CoaXPress standard.

Access	read
Type:	unsigned integer
In:	–
Out:	0xC0A79AE5
Remark:	The magic number is an approximation of CoaXPress.

Revision

This register provides the revision of the CoaXPress specification implemented by this Device.

Access	read							
Type:	unsigned integer							
In:	-							
Out:	<table border="1"> <thead> <tr> <th>Bits</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>31-16</td> <td>major revision</td> </tr> <tr> <td>15-00</td> <td>minor revision</td> </tr> </tbody> </table>	Bits	Description	31-16	major revision	15-00	minor revision	
Bits	Description							
31-16	major revision							
15-00	minor revision							
Remark:	Devices compliant to this revision 1.1 of the specification shall return 0x00010001.							

XmlManifestSize

This register returns the number of available XML manifests. At least one manifest must be available.

Access	read
Type:	unsigned integer
In:	-
Out:	1 ... N

XmlManifestSelector

This register selects the required XML manifest registers.
It holds a number between zero and XmlManifestSize – 1.

Access	read / write
Type:	unsigned integer
In:	0 ... XmlManifestSize-1
Out:	0 ... XmlManifestSize-1
Remark:	A connection reset sets the value to 0x00000000.

XmlVersion[XmlManifestSelector]

This register provides the version number for the XML file given in the manifest referenced by register XmlManifestSelector.

Access	read		
Type:	unsigned integer		
In:	–		
Out:	Bits	Name	Description
	31-24	reserved	shall be 0
	23-16	SchemaMajorVersion	major version number of the XML file
	15-8	SchemaMinorVersion	minor version number of the XML file
	7-0	SchemaSubMinorVersion	sub-minor version number of the XML file

XmlSchemeVersion[XmlManifestSelector]

This register provides the GenICam schema version for the XML file given in the manifest referenced by the register XmlManifestSelector.

Access	read		
Type:	unsigned integer		
In:	–		
Out:	Bits	Name	Description
	31-24	reserved	shall be 0
	23-16	SchemaMajorVersion	major version number of the schema used by the XML file
	15-8	SchemaMinorVersion	minor version number of the schema used by the XML file
	7-0	SchemaSubMinorVersion	sub-minor version number of the schema used by the XML file

XmlUriAddress [XmlManifestSelector]

This register indicates the start of the URL string referenced by register XmlManifestSelector.

Access	read												
Type:	unsigned integer												
In:	-												
Out:	register address												
Remark:	<p>Reading from the returned register address returns n characters representing the name, the register address and the length of the GenICam XML file stored in the flash memory of the camera. The format of the address string is:</p> <table border="1"> <thead> <tr> <th>Field</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Local</td> <td>indicates the XML file is stored in non-volatile memory in the Device</td> </tr> <tr> <td><Filename></td> <td>name of the XML file; the file name has no meaning if the XML file is stored in the camera</td> </tr> <tr> <td><Extension></td> <td>“xml” indicates an uncompressed text XML file “zip” indicates a ZIP format compressed text file</td> </tr> <tr> <td><Address></td> <td>start address of the file in the device memory map, given in hexadecimal form without a leading “0x”. The address string can be read from this address</td> </tr> <tr> <td><Length></td> <td>length of the file in Bytes, given in hexadecimal without a leading “0x”</td> </tr> </tbody> </table> <p>Example: “Local:Mikrotron_GmbH_MC408xS11_Rev1_15_0.xml; 8001000;16C34?SchemaVersion=1.1.0”</p> <p>References a GenICam XML file in the flash memory of the camera. The file can be read starting at address 0xB8000 and has a length of 0x33A Bytes.</p> <p>The returned string could also reference a XML file located on the vendors homepage. This location is not used by our cameras.</p>	Field	Description	Local	indicates the XML file is stored in non-volatile memory in the Device	<Filename>	name of the XML file; the file name has no meaning if the XML file is stored in the camera	<Extension>	“xml” indicates an uncompressed text XML file “zip” indicates a ZIP format compressed text file	<Address>	start address of the file in the device memory map, given in hexadecimal form without a leading “0x”. The address string can be read from this address	<Length>	length of the file in Bytes, given in hexadecimal without a leading “0x”
Field	Description												
Local	indicates the XML file is stored in non-volatile memory in the Device												
<Filename>	name of the XML file; the file name has no meaning if the XML file is stored in the camera												
<Extension>	“xml” indicates an uncompressed text XML file “zip” indicates a ZIP format compressed text file												
<Address>	start address of the file in the device memory map, given in hexadecimal form without a leading “0x”. The address string can be read from this address												
<Length>	length of the file in Bytes, given in hexadecimal without a leading “0x”												

Iidc2Address

Devices that support the IIDC2 protocol (section 2.2 ref. 6). This register shall provide the address of the start of the IIDC2 register space.

Access	read
Type:	unsigned integer
In:	-
Out:	0x00000000
Remark:	not supported

DeviceVendorName

This register provides the name of the manufacturer of the device as a string.

Access	read
Type:	string[0...32]
In:	–
Out:	vendor name
Remark:	Example: MIKROTRON GmbH

DeviceModelName

This register provides the model name of the Device as a string.

Access	read
Type:	string[0...32]
In:	–
Out:	model name
Remark:	Example: MC2586

DeviceManufacturerInfo

This register provides extended manufacturer-specific information about the device as a string.

Access	read
Type:	string[0...48]
In:	–
Out:	manufacturer information
Remark:	Example: "MIKROTRON GmbH"

DeviceVersion

This register provides the version of the camera hardware as a string.

Access	read	
Type:	string[0...32]	
In:	–	
Out:	device version string	
Remark:	Format of the version string (Byte numbers from left to right):	
	Byte	Description
	0	hardware tag
	1-3	hardware version major number
	4	
	5-7	hardware version minor number
	8	
	9-13	hardware version sub minor number
	The sample in the table above results in the device version string: H000.100.00000	

DeviceSerialNumber

This register provides the serial number for the device as a NULL-terminated string.

Access	read
Type:	string[0...16]
In:	–
Out:	serial number of the camera
Remark:	Example: 000000000000157

DeviceUserID

This register provides a user-programmable identifier for the camera as a string.

Access	read/write
Type:	string[0...16]
In:	user ID
Out:	user ID
Remark:	The User ID can be freely defined by the user. It will be saved in the flash memory of the camera. As a result, it will be preserved if the camera is switched off.

Manufacturer-specific Addresses

The following registers provide the address in the manufacturer-specific register space of the use-case feature with the corresponding name.

Image<n>StreamIDAddress is set to 0 for stream numbers that are not supported by the device.

Remark: This allows non-GenICam applications, or black-box format converters, to support the standard use-case and allow continuous acquisition and display of images.

WidthAddress	manufacturer-specific address of Width
HeightAddress	manufacturer-specific address of Height
AcquisitionModeAddress	manufacturer-specific address of AcquisitionMode
AcquistionStartAddress	manufacturer-specific address of AcquistionStart
AcquistionStopAddress	manufacturer-specific address of AcquistionStop
PixelFormatAddress	manufacturer-specific address of PixelFormat
DeviceTapGeometryAddress	manufacturer-specific address of DeviceTapGeometry
Image1StreamIDAddress	manufacturer-specific address of Image1StreamID

ConnectionReset

Writing the value 0x00000001 into this register will reset the Device connection.

Access	read / write
Type:	unsigned integer
In:	0x00000001
Out:	0x00000000
Remark:	<p>A link reset will stop a running image acquisition.</p> <p>A connection reset command via the master connection (connection 0) will reset a connection and activate its discovery connection configuration within 200ms. The camera resets the register to 0x00000000 when it has activated its discovery connection configuration. Writing by the host should be regarded as “fire and forget” without waiting for acknowledgment.</p> <p>In general it is not possible to read this register while it has the value 0x00000001.</p>

DeviceConnectionID

This register provides the ID of the device connection via which this register is read.

Access	read
Type:	unsigned integer
In:	–
Out:	connection ID
Remark:	A connection ID of zero means that the connection is a master connection. This is a static register, but with a different value depending from which connection it is read.

MasterHostConnectionID

This register holds the host connection ID of the host connected to the device master connection.

Access	read/write
Type:	unsigned integer
In:	host link ID
Out:	host link ID
Remark:	The value 0x00000000 is reserved to indicate an unknown Host ID. All writings to device extension connection will be ignored.

ControlPacketSizeMax

This register provides the maximum control packet size the host can read from the device or write to the device. The size is defined in Bytes and will be a multiple of 4 Bytes. The defined size is that of the entire packet, not only the payload.

Access	read
Type:	unsigned integer
In:	–
Out:	control packet size in multiples of 4 bytes
Remark:	the control packet size is at least 128 bytes

StreamPacketSizeMax

This register holds the maximum stream packet size the host can accept. The size is defined in Bytes and will be a multiple of 4 Bytes. The defined size is that of the entire packet, not only the payload.

Access	read / write
Type:	unsigned integer
In:	stream packet data size in multiples of 4 Bytes
Out:	stream packet data size in multiples of 4 Bytes
Remark:	The device can use any packet size it wants to up to this size. A connection reset sets the value to 0x00000000.

ConnectionConfig

This register holds a valid combination of the device link speed and number of active down connections. Writing into this register sets the connection speeds on the specified connections.

Access	read / write	
Type:	enumeration	
In:	connection configuration example (read the electronically readable manual for further information):	
	Enumeration	Description
	CONNECTION4SPEED1250	four connections of 1.250 Gbps per connection
	CONNECTION4SPEED2500	four connections of 2.500 Gbps per connection
	CONNECTION4SPEED3125	four connections of 3.125 Gbps per connection
	CONNECTION4SPEED5000	four connections of 5.000 Gbps per connection
	CONNECTION4SPEED6250	four connections of 6.250 Gbps per connection
Out:	connection configuration	

ConnectionConfigDefault

This register provides the value of the ConnectionConfig register that allows the Device to operate in default mode. This feature is used to start the camera with the default configuration that is stored in the custom profiles.

Access	read
Type:	unsigned integer
In:	–
Out:	0x00000000
Remark:	It allows a simple host (e.g. a basic “closed system” format converter) to automatically set the correct bit rate and obtain images from a device

TestMode

Writing the value 0x00000001 into this register enables a test packet transmission from the camera to the host.

Access	read / write	
Type:	integer	
In:	Value	Description
	0x00000000	normal operation
	0x00000001	sending test packets to host
Out:	same as above	
Remark:	A connection reset sets the value to 0x00000000. If the value is changed from 0x00000001 to 0x00000000, the device will complete the packet of 1024 test words currently being transmitted.	

TestErrorCountSelector

This register selects the required test count [TestErrorCount] register. It holds a valid device connection ID 0 ... n-1, or n for the optional high-speed up-connection.

Access	read / write
Type:	unsigned integer
In:	0x00000000...0x00000003
Out:	0x00000000...0x00000003
Remark:	A connection reset sets the value to 0x00000000.

TestErrorCount[TestErrorCountSelector]

This register provides the current connection error count for the connection referred to by the register TestErrorCountSelector.

Access	read / write
Type:	unsigned integer
In:	0x00000000
Out:	error count
Remark:	Writing 0x00000000 to this register resets the error count for the connector referred to by the register TestErrorCountSelector to zero. A connection reset sets all connection test counters to zero. The error count is the number of incorrect words that have been received in test packets.

TestPacketCountTx[TestErrorCountSelector]

This register provides the current transmitted connection test packet count for the connection referred to by the register *TestErrorCountSelector*.

Access	read / write
Type:	integer
In:	0x0000000000000000
Out:	packet count
Remark:	Writing 0x0000000000000000 into this register will reset to zero the transmitted connection packet count for the connection referred to by the register TestErrorCountSelector. A connection reset sets all connection test counters to zero.

TestPacketCountRx[TestErrorCountSelector]

This register provides the currently received connection test packet count for the connection referred to by the register *TestErrorCountSelector*.

Access	read / write
Type:	integer
In:	0x0000000000000000
Out:	packet count
Remark:	Writing 0x0000000000000000 to this register shall reset to zero the received connection packet count for the connection referred to by register <i>TestErrorCountSelector</i> . A connection reset sets all connection test counters to zero.

HsUpConnection

This register indicates whether the optional high speed up-connection is supported or not.

Access	read		
Type:	integer		
In:	—		
Out:	Bits	Name	Description
	1-30	reserved	shall be 0
	0	HsUpConnectionSupport	shall be 0 if a high speed up-connection is not supported shall be 1 if a high speed up-connection is supported
Remark:	This feature is currently not supported.		

Acquisition Control

Name	Access	Length [Bytes]	Register Interface	Page
AcquisitionMode	R/W	4	Enumeration	37
AcquisitionStart	W	4	Command	37
AcquisitionStop	W	4	Command	38
TriggerSelector	R/W	4	Enumeration	38
TriggerMode	R/W	4	Enumeration	39
TriggerSoftware	W	4	Command	31
TriggerSource	R/W	4	Enumeration	30
TriggerActivation	R/W	4	Enumeration	40
AcquisitionBurstFrameCount	R/W	4	Integer	38
ExposureMode	R/W	4	Enumeration	41
ExposureTime	R/W	4	Integer	41
ExposureTimeMax	R	4	Integer	41
AcquisitionFrameRate	R/W	4	Integer	42
AcquisitionFrameRateMax	R	4	Integer	42
TestImageSelector	R/W	4	Enumeration	43

AcquisitionMode

This feature is used to set the device into a certain acquisition mode.

Access	read / write	
Type:	enumeration	
In:	Enumeration	Description
	Continuous	the camera records continuously a sequence of frames
Out:	see above	
Remark:	frame acquisition can be stopped with the feature AcquisitionStop	

AcquisitionStart

This feature enables the device to send sampled images to the host.

Access	write
Type:	command
In:	0x00000001
Out:	–
Remark:	AcquisitionMode defines how frames will be acquired

AcquisitionStop

This feature stops acquiring frames after the acquisition of the current frame has been completed.

Access	write
Type:	command
In:	x00000001
Out:	–
Remark:	–

AcquisitionBurstFrameCount

This feature defines the number of frames to be acquired after each FrameBurstStart trigger.

Access	read/write
Type:	integer
In:	x00000001
Out:	–
Remark:	If in TriggerSelector FrameBurstStart is selected, ExposureMode will have to be set to Timed. Otherwise, recording will not be possible.

TriggerSelector

This feature is used to select the type of trigger to be configured.

Access:	read / write	
Type:	enumeration	
In:	Enumeration	Description
	FrameStart	the camera will take one picture per trigger signal
	FrameBurstStart	selects a trigger starting the capture of a sequence of frames. The burst length is controlled by the feature AcquisitionBurstFrameCount.
Out:	–	
Remark:	Set AcquisitionBurstFrameCount in order to define the number of frames to be acquired when FrameBurstStart is active. If FrameBurstStart is selected, ExposureMode will have to be set to Timed. Otherwise, recording will not be possible.	

TriggerMode [TriggerSelector]

This feature activates or deactivates the selected trigger type.

Access	read / write	
Type:	enumeration	
In:	Enumeration	Description
	ON	enables the selected trigger type; the camera waits for a trigger signal before acquiring a frame. The trigger signal can be a trigger signal from the frame grabber or a software trigger initiated by a software command. The trigger source has to be set in the feature TriggerSource. In trigger mode, the frame rate of the camera depends on the frequency of the trigger signals
	OFF	disables the selected trigger type; all trigger signals will be ignored. The camera is set into the current acquisition mode
Out:	–	
Remark:	If a trigger is active, ExposureMode defines whether the exposure of the image is defined by the feature ExposureTime (fixed exposure time) or by the duration of the trigger signal itself (variable exposure time). The settings in ExposureMode will only be relevant if the camera is in triggered mode.	

TriggerSource [TriggerSelector]

This feature defines the source of the trigger signal.

Access	read / write	
Type:	enumeration	
In:	Enumeration	Description
	Line0	CXP cameras with DIN connector offer one trigger input with two physical lines via Hirose connector (☞ page 17); the trigger signal can either be sent via line 0 or line 1
	Line1	CXP cameras with DIN connector offer one trigger input with two lines via Hirose connector (☞ page 17); the trigger signal can either be sent via line 0 or line 1
	Software	if SoftwareTrigger is set, the trigger will be generated by the software using the feature TriggerSoftware; no external (hardware) trigger signal is needed
	CXPTrigger	if CXPTrigger is set, the camera will wait for an external trigger signal from the frame grabber before acquiring another frame; exposure time for the next image is the time defined by the feature ExposureTime
Out:	see above	
Remark:	Only one trigger source can be active.	

TriggerActivation [TriggerSelector]

This feature defines the activation mode for a trigger signal.

Access	read / write	
Type:	enumeration	
In:	Enumeration	Description
	RisingEdge	camera will start to acquire frames on the arrival of a CXP 'trigger rising edge' trigger packet; this activator expects a subsequent 'trigger falling edge' trigger packet to finish the trigger sequence
	Falling Edge	camera will start to acquire frames on the arrival of a CXP 'trigger falling edge' trigger packet; this activator expects a subsequent 'trigger rising edge' trigger packet to finish the trigger sequence
	Any Edge	camera will start to acquire frames on the arrival of a CXP 'trigger falling edge' as well as a 'trigger rising edge' trigger packet
Out:	–	
Remark:	Using the activator AnyEdge doubles the maximal trigger frequency. If AnyEdge is selected, only a fixed exposure time (ExposureMode is “timed”) is reasonable.	

TriggerSoftware

This feature generates an internal trigger.

Access	write
Type:	command
In:	0x00000001
Out:	–
Remark:	In order to generate a software trigger signal, TriggerSource has to be set to SoftwareTrigger. The exposure time of the next frame does not depend on the trigger width but will be defined by the feature ExposureTime.

ExposureMode

This feature sets the operation mode of the shutter. It defines how a picture will be exposed if the camera is in triggered mode.

Access	read / write	
Type:	enumeration	
In:	Enumeration	Description
	Timed	camera sends a sequence of images continuously to the frame grabber; exposure time is defined in the feature ExposureTime; frame rate is defined in the feature AcquisitionFrameRate
	TriggerWidth	width of the current trigger signal pulse is used to control the exposure time; if TriggerActivation is set to RisingEdge, it will be the time the trigger stays high; if TriggerActivation is FallingEdge it will last as long as the trigger stays low
Out:	–	
Remark:	ExposureMode is enabled in triggered mode only. It is not advised to use this mode if TriggerActivation is set to AnyEdge. Timed will be mandatory if the TriggerSelector is set to FrameBurstStart.	

ExposureTime

If the exposure mode is set to Timed or no trigger is defined, this feature will define the duration of exposure in [μ s].

Access	read / write
Type:	unsigned integer
In:	1 ... ExposureTimeMax
Out:	exposure time

ExposureTimeMax

This feature returns the maximal possible exposure time for the current camera settings in [μ s].

Access	read
Type:	unsigned integer
In:	–
Out:	max. exposure time
Remark:	The maximal exposure time depends on the current frame rate.

AcquisitionFrameRate

This feature defines the acquisition rate in [Hz] when TriggerMode is set to OFF.

Access	read / write
Type:	unsigned integer
In:	1 ... AcquisitionFrameRateMax
Out:	AcquisitionFrameRate
Remark:	—

AcquisitionFrameRateMax

This feature returns the maximal possible frame rate in [Hz] in dependency of the camera settings.

Access	read
Type:	unsigned integer
In:	—
Out:	max. frame rate
Remark:	The maximal frame rate depends on the defined frame size, on the used link speed, and on the number of CoaXPress lines used for image streaming.

TestImageSelector

This feature selects the type of test image that is sent by the camera. It also activates/deactivates a frame counter that is written into each captured image.

Access	read/write	
Type:	enumeration	
In:	Enumeration	Description
	OFF	TestImageSelector is disabled
	GreyHorizontalRamp Moving	camera will send a test image that shows vertically oriented grayscale bars moving into horizontal direction on the screen
Out:	current test image selector	
Remark:	A connection reset sets the camera into normal operation mode.	

Device Control

There is only one command to reset the device.

DeviceReset

This feature resets the device into power up state.

Access	write
Type:	unsigned integer
In:	0x00000001
Out:	–
Remark:	length of 4 Bytes

Image Format Control

Name	Access	Length(bytes)	Register Interface	Page
RegionSelector	R/W	4	Enumeration	44
RegionMode	R/W	4	Enumeration	45
RegionDestination	R/W	4	Enumeration	45
Width	R/W	4	Integer	45
Height	R/W	4	Integer	46
OffsetX	R/W	4	Integer	46
OffsetY	R/W	4	Integer	47
DecimationHorizontal	R/W	4	Integer	46
DecimationVertical	R/W	4	Integer	47
SensorWidth	R	4	Integer	48
SensorHeight	R	4	Integer	48
WidthMax	R	4	Integer	48
HeightMax	R	4	Integer	48
PixelFormat	R/W	4	Enumeration	49
TapGeometry	R	4	Enumeration	49
Image1StreamID	R	4	Integer	49
DeviceScanType	R	4	Enumeration	49

RegionSelector

This feature selects the Region of interest to be controlled.

Access	read / write
Type:	enumeration
In:	Region 0 = value 0
Out:	
Remark:	

RegionMode

This feature controls whether the selected Region of interest is active and streaming.

Access	read / write
Type:	enumeration
In:	ON: ROI active OFF: ROI inactive
Out:	
Remark:	

RegionDestination

This feature controls the destination of the selected region.

Access	read / write
Type:	enumeration
In:	stream0
Out:	
Remark:	

Width

This feature provides the image width in pixels.

Access	read / write
Type:	unsigned integer
In:	32 ... WidthMax
Out:	image width
Remark:	the maximum value of this feature equals to WidthMax – OffsetX; the minimum value amounts to 128; image width has to be incremented by 32 pixels

Height

This feature provides the image height in lines.

Access	read / write
Type:	unsigned integer
In:	2 ... HeightMax
Out:	image height
Remark:	the maximum value of this feature equals to HeightMax – OffsetY; image height must be incremented by 2 lines

DecimationHorizontal

Horizontal sub-sampling of the image

Access	Read / Write
Type:	Unsigned Integer
In:	1 ... 2
Out:	Current horizontal decimation factor
Remark:	<p>incremented by 1; This value defines that each Nth image pixels in horizontal direction must be sampled to build the image. So the size of the image gets reduced in horizontal direction by the factor of DecimationHorizontal. A decimation factor of 1 means no horizontal decimation. The Width value must be set to the requested number of horizontal pixels. Width * DecimationHorizontal may not exceeds the horizontal sensor size or an error gets returned.</p> <p>Example: To get a sub sampled image which covers the whole horizontal sensor width but uses just the half number of horizontal pixels you have to set the Width parameter to SensorWidth / 2 and the DecimatinHorizontal factor to 2. This will result in an image which is clinched in the horizontal direction by factor 2 but covering the whole horizontal sensor width.</p>

DecimationVertical

Vertical sub-sampling of the image.

Access	Read / Write
Type:	Unsigned Integer
In:	1 ... 255
Out:	Current vertical decimation factor
Remark:	<p>incremented by 1; This value defines that each Nth image line in vertical direction must be sampled to build the image. So the size of the image gets reduced in vertical direction by the factor of DecimationVertical. A decimation factor of 1 means no horizontal decimation. The Height value must be set to the requested number of lines. Height * DecimationVertical may not exceeds the max. vertical sensor size or an error gets returned.</p> <p>Example: To get a sub sampled image which covers the whole vertical sensor height but uses just the half number of lines you have to set the Height parameter to SensorHeight / 2 and the DecimatinVertical factor to 2. This will result in an image which is clinched in the vertical direction by factor 2 but covering the whole sensor in vertical direction.</p>

OffsetX

Horizontal offset from the origin to the region of interest (in pixels).

Access	read / write
Type:	unsigned integer
In:	0 ... OffsetXMax
Out:	horizontal offset
Remark:	The maximal offset equals to WidthMax – width. The offset has to be incremented by 16 pixel increments.

OffsetY

Vertical offset from the origin to the region of interest (in lines).

Access	read / write
Type:	unsigned integer
In:	0 ... OffsetYMax
Out:	vertical offset
Remark:	The maximal offset equals to HeightMax – height. The offset has to be incremented by 2 lines.

SensorWidth

This feature returns the effective width of the sensor in pixels.

Access	read
Type:	unsigned integer
In:	–
Out:	sensor width

SensorHeight

This feature returns the effective height of the sensor in pixels.

Access	read
Type:	unsigned integer
In:	–
Out:	sensor height

WidthMax

This feature returns the maximum width of the image in pixels.

Access	read
Type:	unsigned integer
In:	–
Out:	maximum image width
Remark:	The maximum width of the image (in pixels); the dimension is calculated after a horizontal decimation or any other function changing the horizontal dimension of the image. WidthMax does not take into account the current ROI (Width or OffsetX). Its value must be greater than 0 and less than or equal to SensorWidth (unless an oversampling feature is present).

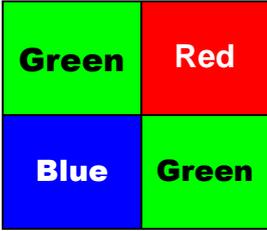
HeightMax

This feature returns the maximum height of the image in pixels.

Access	read
Type:	unsigned integer
In:	–
Out:	max. image height
Remark:	This dimension is calculated after vertical decimation or any other function changing the vertical dimension of the image. HeightMax does not take into account the current ROI (Height or OffsetY). Its value must be greater than 0 and less than or equal to SensorHeight (unless an oversampling feature is present).

PixelFormat

This feature returns the format the camera uses for acquisition.

Access	read/write		
Type:	enumeration		
In:	Enumeration	Description	Available for
	Mono8	monochrome, 8 bit/pixel	monochrome, color
	Mono10p msb	monochrome, 10 bit/pixel packed	monochrome, color
	BayerGR8 / BayerGR10	order of the Bayer pattern in a color image (☞ page 66): 	color
Out:	see above		
Remark:	The available pixel formats depend on the camera connected (monochrome or color).		

TapGeometry

This feature describes the format of the image data transferred from the camera to the host.

Access	read		
Type:	enumeration		
In:	Enumeration	Description	
	Geometry_1X_1Y	single pixel scanning from left to right and single line scanning from top to bottom	
Out:	see above		
Remark:	–		

Image1StreamID

This feature returns the stream ID of the stream 1 of the device.

Access	read
Type:	unsigned integer
In:	–
Out:	0x00000000
Remark:	–

DeviceScanType

This feature returns the value for the camera type (line or area scan).

Access	read
Type:	enumeration
In:	–
Out:	0x00000000 = areascan
Remark:	–

User Set Control

User sets allow you to save the current camera configuration into the camera's internal Flash memory. A user set can be loaded at runtime. If the user set is defined as default, it will be loaded during the start-up of the camera.

Name	Access	Length [Bytes]	Interface	Page
UserSetSelector	R/W	4	Enumeration	51
UserSetLoad[UserSetSelector]	W	4	Command	51
UserSetSave[UserSetSelector]	W	4	Command	52
UserSetDefaultSelector	R/W	4	Enumeration	52

UserSetSelector

This feature selects which user set will be loaded, saved or configured.

Access	read/write											
Type:	enumeration											
In:	<table border="1"> <thead> <tr> <th>Enumeration</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Default</td> <td>selects the factory setting user set</td> </tr> <tr> <td>UserSet1</td> <td>selects the first user set</td> </tr> <tr> <td>UserSet2</td> <td>selects the second user set</td> </tr> <tr> <td>UserSet3</td> <td>selects the third user set</td> </tr> </tbody> </table>	Enumeration	Description	Default	selects the factory setting user set	UserSet1	selects the first user set	UserSet2	selects the second user set	UserSet3	selects the third user set	
Enumeration	Description											
Default	selects the factory setting user set											
UserSet1	selects the first user set											
UserSet2	selects the second user set											
UserSet3	selects the third user set											
Out:	see above											
Remark:	Set the UserSetSelector first to select a user set for further operations (see below).											

UserSetLoad[UserSetSelector]

Loads the user set specified in **UserSetSelector** from the camera flash memory to the camera registers and activates it.

Access	write
Type:	command
In:	–
Out:	
Remark:	If the selected User Set has not been defined previously an error message occurs. The default user set is a set of factory settings predefined by the manufacturer.

UserSetSave[UserSetSelector]

This feature saves the user set specified in **UserSetSelector** into the non-volatile memory of the device.

Access	write
Type:	command
In:	–
Out:	
Remark:	A previously saved user set will be overwritten. The default user set is a set of factory settings and cannot be overwritten.

UserSetDefaultSelector

This feature selects the user set which will be loaded and activated after a device reset.

Access	read/write	
Type:	enumeration	
In:	Enumeration	Description
	Default	selects the factory setting user set
	UserSet1	selects the first user set
	UserSet2	selects the second user set
	UserSet3	selects the third user set
Out:	The default user set selector is preselected.	
Remark:		

Analog Control

Name	Access	Length [Bytes]	Interface	Page
BlackLevel	R/W	4	Integer	53
Gain	R/W	4	Integer	53
Gamma correction	R/W	4	Integer	53

BlackLevel

This feature controls the analog black level (in percent).

Access	read/write
Type:	enumeration
In:	0 ... 500
Out:	see above
Remark:	level can be incremented by 1

Gain

This feature controls the gain of the image.

Access	read/write
Type:	integer
In:	min.: 50; max.: 1000
Out:	see above
Remark:	gain can be incremented by 1

Gamma Correction

This feature is used to control the the gamma correction of pixel intensity. It is only available for monochrome cameras with a resolution of 8 or 10 bit.

Access	read/write
Type:	floating point
In:	min.: 0.1 max.: 3.0 default value: 1.0
Out:	see above
Remark:	gamma correction can be incremented by 0.1

Custom Features

Name	Access	Length [Bytes]	Interface	Page
TxLogicalConnectionReset	W	4	Command	54
PrstEnable	R/W	4	Boolean	55
PulseDrainEnable	R/W	4	Boolean	55
DeviceInformationSelector	R/W	4	Enumeration	55
DeviceInformation	R	4	Integer	56
FixedPatternNoiseReduction	R/W	4	Enumeration	57
CustomSensorClkEnable	R/W	4	Enumeration	57
CustomSensorClk	R/W	4	Enumeration	57
AnalogRegisterSetSelector	R/W	4	Enumeration	58
AnalogRegisterSelector	R/W	4	Integer	58
AnalogValue	R/W	4	Integer	58
InfoFieldFrameCounterEnable	R	4	Boolean	59
InfoFieldTimeStampEnable	R	4	Boolean	60
InfoFieldRoiEnable	R	4	Boolean	61

TxLogicalConnectionReset

This feature resets the next packet transmission to connection 0.

Access	write
Type:	command
In:	-
Out:	-
Remark:	

PrstEnable

This feature enables/disables the Pixel Pulse Reset feature. Additional information is available in Application Note AN033.

Access	read / write
Type:	boolean
In:	-
Out:	-
Remark:	values ON (1) or OFF (0)

PulseDrainEnable

This feature enables/disables the Pulse Drain feature.

Access	read / write
Type:	boolean
In:	-
Out:	-
Remark:	values ON (1) or OFF (0)

DeviceInformationSelector

This feature selects one of the elements from the device information list

Access	read / write	
Type:	enumeration	
In:	Enumeration	Description
	InfoSnr	serial number of the camera (same as feature DeviceID)
	InfoType	camera type / model
	InfoSubType	camera sub type
	InfoHwRevision	camera hardware revision
	InfoFpgaVersion	camera FPGA program version
	InfoSwVersion	microcontroller software version
	InfoPwrSource	returns the source of the camera power supply (external power supply or PoCXP)
	InfoPwrConsumption	actual power consumption of the camera in [µA]
	InfoPwrVoltage	actual voltage of the camera power supply in [mV]
	InfoTemperature	camera temperature in steps of 0.5 degrees Celsius
Out:	see above	
Remark:	First set the selector to define the data you want to read, then read the data by reading the register DeviceInformation (see below).	

DeviceInformation[DeviceInfoSelector]

This feature returns an element of the device information list selected by feature DeviceInfoSelector.

Access	read / write			
Type:	unsigned integer			
In:	–			
Out:	Device information elements:			
	Selector	Description	Sample	
	InfoSnr	serial number of the camera (same as feature DeviceID)	0x00000132	
	InfoType	camera type/model	0x00002582 → Camera model MC2582	
	InfoSubType	sub type number of the camera model; this number describes models with special features or a customized version	0x00000001	
	InfoHwRevision	describes the revision of the camera hardware		0x0103000B → Revision 1.3 Build 11
		Bits	Description	
		31-24	major revision number	
		23-16	minor revision number	
		15-00	build number	
	InfoFpgaVersion	version of the FPGA program of the camera:		0x02050001 → Version 2.5 Build 1
		Bits	Description	
		31-24	major version number	
		23-16	minor version number	
	15-00	build number		
InfoSwVersion	version of the microcontroller software:		0x020F0011 → Version 2.15 Build 17	
	Bits	Description		
	31-24	major version number		
	23-16	minor version number		
	15-00	15-00		
InfoPwrSource	returns the source of the camera power supply			
	Value	Description		
	0	external power supply		
	1	power over CXP line (PoCXP)		
InfoPwrConsumption	returns the actual power consumption value of the camera in [μA]	0x00066580 → 419200 μA = 0.4192 A		
InfoPwrVoltage	returns the actual voltage value of the camera power supply in [mV]	0x2E4A → 11850 mV = 11.85 Volt		
InfoTemperature	returns the current camera temperature in steps of 0.5 degrees Celsius. The value returned is a signed integer.	0x00000040 → 32 degree Celsius 0xFFFFF2C → -2 degree Celsius		
Remark:	Model number, hardware revision, FPGA version, and firmware version are also included in the string of the 'DeviceVersion' Bootstrap feature.			

FixedPatternNoiseReduction

This feature switches the fixed pattern noise reduction feature ON or OFF.

Access	read/write
Type:	enumeration
In:	-
Out:	-
Remark:	values ON or OFF

CustomSensorClkEnable

This feature enables/disables the custom defined sensor clock.

Access	Read / Write	
Type:	Boolean	
In:	Value	Description
	ON	The camera uses the sensor clock defined with feature 'CustomSensorClk'.
	OFF	The camera uses the default sensor clock defined for the current CoaXPress link settings.
Out:	1 = ON; 0 = OFF	
Remark:	<p>The 4CXP camera defines a default sensor clock for each CoaXPress link speed to run the camera in an optimal frame rate / image quality relation.</p> <p>With the custom sensor clock feature this default value can be overwritten by a customer selected value (see feature 'CustomSensorClk' below). Overwriting the default sensor clock by a higher sensor clock may result in substantial higher frame rates (depending on the frame size) but may also downgrade the image quality. It is up to the user to find a setting that fits his needs.</p> <p>This feature may be mainly of use for frame grabber boards with a max. link speed less than CXP6.</p>	

CustomSensorClk

This feature defines the sensor clock to be used if CustomSensorClkEnable = true.

Access	Read/Write	
Type:	Enumeration	
In:	Enumeration	Description
	Clk_50MHz	Set camera sensor clock to 50 MHz
	Clk_75MHz	Set camera sensor clock to 75 MHz (default for CXP1-CXP3)
	Clk_100MHz	Set camera sensor clock to 100 MHz
	Clk_125MHz	Set camera sensor clock to 125 MHz (default for CXP5)
	Clk_150MHz	Set camera sensor clock to 150 MHz (default for CXP6)
Out:	Currently selected sensor clock.	
Remark:	☞ CustomSensorClkEnable	

AnalogRegisterSetSelector

This feature selects one of the analog registers sets for read/write access.

Access	read/write
Type:	enumeration
In:	Analog Register Set 0 Analog Register Set 1
Out:	-
Remark:	

AnalogRegisterSelector

This feature selects one of the analog registers for read/write access.

Access	read/write
Type:	integer
In:	0 ... 15
Out:	-
Remark:	incremented by 1

AnalogValue

This feature holds the analog value to read/write.

Access	read/write
Type:	integer
In:	0 ... 1023
Out:	-
Remark:	incremented by 1

InfoFieldFrameCounterEnable

This feature enables/disables the Frame Counter that can be added into the info field in the image.

Access	read/write											
Type:	boolean											
In:	<table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>info field disabled</td> </tr> <tr> <td>1</td> <td>info field is enabled</td> </tr> </tbody> </table>		Value	Description	0	info field disabled	1	info field is enabled				
	Value	Description										
	0	info field disabled										
1	info field is enabled											
Out:	<p>If this option is set a frame counter is superimposed into each captured frame or ROI. The frame counter occupies 4 pixels in the upper left corner of each frame starting with pixel number 0. After each activation, the counter starts with 0. When reaching the maximal value or after each acquisition start command it will restart with 0.</p>											
	<table border="1"> <thead> <tr> <th>Pixel</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>frame counter LSB part (counter bits 7...0). The values of pixel 0 and 1 are used to build a consecutive running bit frame counter in little-endian notation. If the 24 bit counter overruns, it restarts with 0.</td> </tr> <tr> <td>1</td> <td>frame counter, bits 15 ... 8</td> </tr> <tr> <td>2</td> <td>frame counter, bits 16 ... 23</td> </tr> <tr> <td>3</td> <td>ROI number – For cameras with the Multi-ROI feature the frame counter is inserted into each ROI. This starts with 1 for ROI 1. Because a set of ROIs always belongs to one frame the frame counter in each ROI is the same. For cameras without the Multi-ROI feature or if only one ROI is defined, this value is always 1.</td> </tr> </tbody> </table>		Pixel	Meaning	0	frame counter LSB part (counter bits 7...0). The values of pixel 0 and 1 are used to build a consecutive running bit frame counter in little-endian notation. If the 24 bit counter overruns, it restarts with 0.	1	frame counter, bits 15 ... 8	2	frame counter, bits 16 ... 23	3	ROI number – For cameras with the Multi-ROI feature the frame counter is inserted into each ROI. This starts with 1 for ROI 1. Because a set of ROIs always belongs to one frame the frame counter in each ROI is the same. For cameras without the Multi-ROI feature or if only one ROI is defined, this value is always 1.
	Pixel	Meaning										
	0	frame counter LSB part (counter bits 7...0). The values of pixel 0 and 1 are used to build a consecutive running bit frame counter in little-endian notation. If the 24 bit counter overruns, it restarts with 0.										
	1	frame counter, bits 15 ... 8										
2	frame counter, bits 16 ... 23											
3	ROI number – For cameras with the Multi-ROI feature the frame counter is inserted into each ROI. This starts with 1 for ROI 1. Because a set of ROIs always belongs to one frame the frame counter in each ROI is the same. For cameras without the Multi-ROI feature or if only one ROI is defined, this value is always 1.											
<p>In 10 bit mode the bits 1 ... 0 in each pixel will be set to 0.</p>												
Remark:	Implemented as 'Guru' feature.											

InfoFieldTimeStampEnable

This feature enables/disables the Time Stamp field in the image.

Access	read											
Type:	boolean											
In:	<table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>time stamp is disabled</td> </tr> <tr> <td>1</td> <td>time stamp enabled</td> </tr> </tbody> </table>	Value	Description	0	time stamp is disabled	1	time stamp enabled					
	Value	Description										
	0	time stamp is disabled										
1	time stamp enabled											
Out:	<p>If this feature is enabled, a 32 bit time stamp will be superimposed into each captured frame or ROI. The frequency of the time stamp counter amounts to 25 MHz (period = 40 nanoseconds). The frame counter occupies 4 pixels in the upper left corner of each frame, starting with pixel number 4.</p> <table border="1"> <thead> <tr> <th>Pixel</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>counter bits 0...7 (LSB)</td> </tr> <tr> <td>5</td> <td>counter bits 8...15</td> </tr> <tr> <td>6</td> <td>counter bits 16...23</td> </tr> <tr> <td>7</td> <td>counter bits 24...31 (MSB)</td> </tr> </tbody> </table>		Pixel	Description	4	counter bits 0...7 (LSB)	5	counter bits 8...15	6	counter bits 16...23	7	counter bits 24...31 (MSB)
Pixel	Description											
4	counter bits 0...7 (LSB)											
5	counter bits 8...15											
6	counter bits 16...23											
7	counter bits 24...31 (MSB)											
Remark:	Implemented as 'Guru' feature.											

InfoFieldRoiEnable

This feature enables/disables the ROI info field in the image.

Access	Read/write																			
Type:	boolean																			
In:	Value	Description																		
	0	info field ROI disabled																		
	1	info field ROI enabled																		
Out:	<p>If this option is set, ROI info data will be superimposed into each captured frame or ROI. The ROI info occupies 8 pixels in the upper left corner of each frame, starting with pixel number 8.</p> <table border="1"> <thead> <tr> <th>Pixel number</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>8</td> <td>horizontal offset, LSB, bits 0...7</td> </tr> <tr> <td>9</td> <td>horizontal offset, MSB, bits 8...15</td> </tr> <tr> <td>10</td> <td>width, LSB, bits 0...7</td> </tr> <tr> <td>11</td> <td>width, MSB, bits 8...15</td> </tr> <tr> <td>12</td> <td>vertical offset, LSB, bits 0...7</td> </tr> <tr> <td>13</td> <td>vertical offset, MSB, bits 8...15</td> </tr> <tr> <td>14</td> <td>height, LSB, bits 0...7</td> </tr> <tr> <td>15</td> <td>height, MSB, bits 8...15</td> </tr> </tbody> </table> <p>To get the value for one of the ROI parameters, multiply its MSB with 256 and add the LSB to the multiplied HSB.</p> <p>Example: ROI width = pixel 10 and 11 value of pixel 10 = 224, value of pixel 11 = 1 ROI width = 1 X 256 + 224 = 640</p>		Pixel number	Description	8	horizontal offset, LSB, bits 0...7	9	horizontal offset, MSB, bits 8...15	10	width, LSB, bits 0...7	11	width, MSB, bits 8...15	12	vertical offset, LSB, bits 0...7	13	vertical offset, MSB, bits 8...15	14	height, LSB, bits 0...7	15	height, MSB, bits 8...15
	Pixel number	Description																		
	8	horizontal offset, LSB, bits 0...7																		
	9	horizontal offset, MSB, bits 8...15																		
	10	width, LSB, bits 0...7																		
	11	width, MSB, bits 8...15																		
	12	vertical offset, LSB, bits 0...7																		
	13	vertical offset, MSB, bits 8...15																		
	14	height, LSB, bits 0...7																		
	15	height, MSB, bits 8...15																		
Remark:																				
The ROI info is only defined in 8 bit/pixel mode. This feature is a 'Guru' feature.																				

Firmware and Update

MC408x cameras are based on several programmable logical units. This allows us to modify and update the firmware of the camera with minimal effort and time. As a result our products are always up to date and can easily be equipped with optional functions. Even customizing can be realized this way in order to offer you a camera that fits exactly to your needs.

Firmware Updater

In order to update the firmware it is not necessary to send the camera back to us. Instead we provide an easy to handle Firmware Updater program that will support you during the update process.

Remark: The Firmware Updater communicates via the programming interface of the frame grabber with the camera. Not all CXP frame grabber manufacturers support our 'Firmware Updater' software. In case any problems occur, please do not hesitate to contact us.



WARNING Serious Camera damage

**Never switch off the camera during a firmware update.
Otherwise the camera might be permanently damaged.**

Technical Data

The following technical data apply to the camera types MC4086 and MC4087:

Sensor

Resolution	2336 x 1728 pixels
Sensor type	CMOS; monochrome or color (Bayer color filter)
Pixel depth	8 / 10 bit
Pixel size	7 x 7 μm
Light sensitivity	monochrome 8 V/lux-s RGB-color 11 V/lux-s
Shutter speed	from 1 μs to 1 s in 2 μs steps
Internal dynamics	60 dB
Fill factor x quantum efficiency	50% @ 550 nm
Full well charge	22000 e ⁻

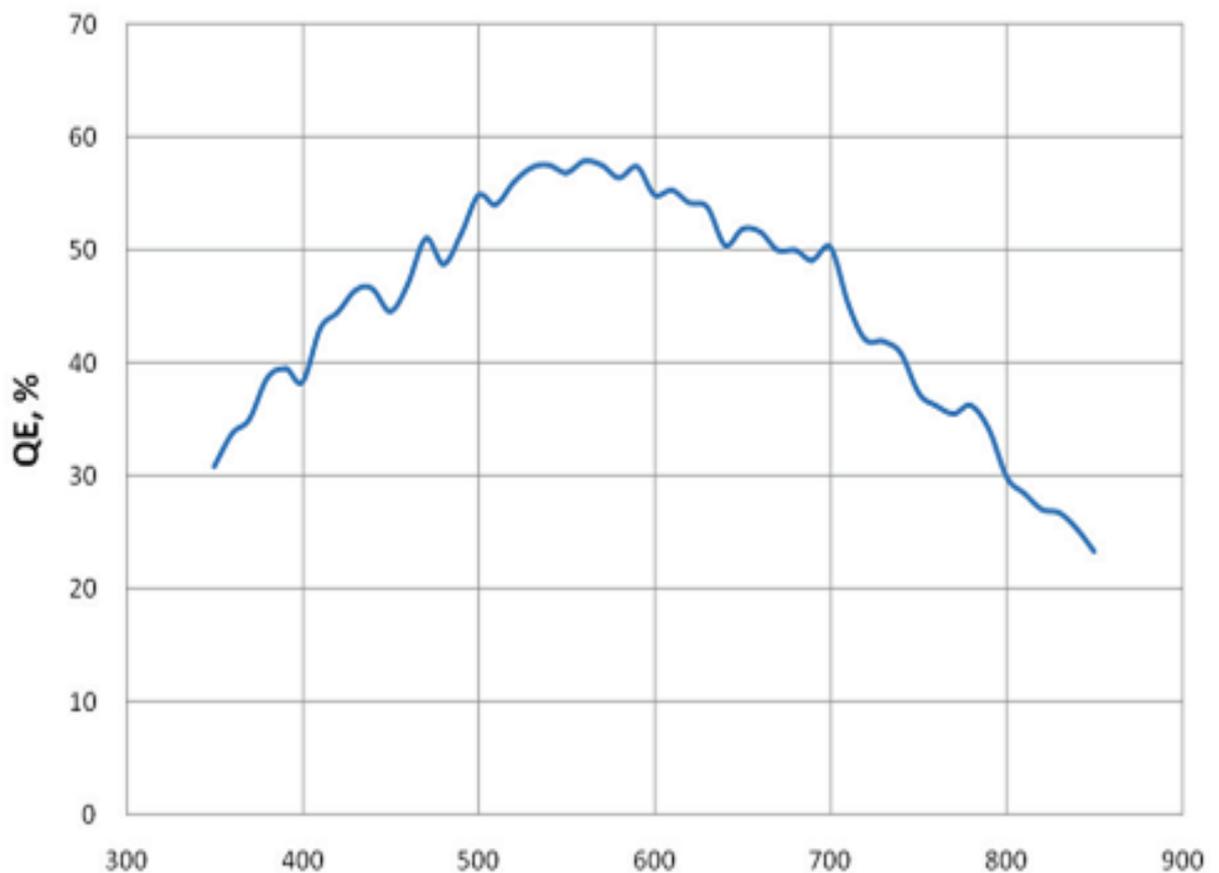
Camera

Video output	CoaXPress CXP-1, CXP-2, CXP-3, CXP-5 and CXP-6
Communication	CoaXPress with Gen<I>Cam based technology
Trigger	asynchronous shutter via CoaXPress interface
Power supply	12 ... 24 V external power supply
Power consumption	10 W @ 12 V
Shock & vibration	70g, 7grms
Dimensions (H x W x D)	80 x 80 x 53 mm (C-Mount)
Case temperature	between +5 and +50 °C
Weight	450 g (C-mount)
Lens mount	C-/F-mount

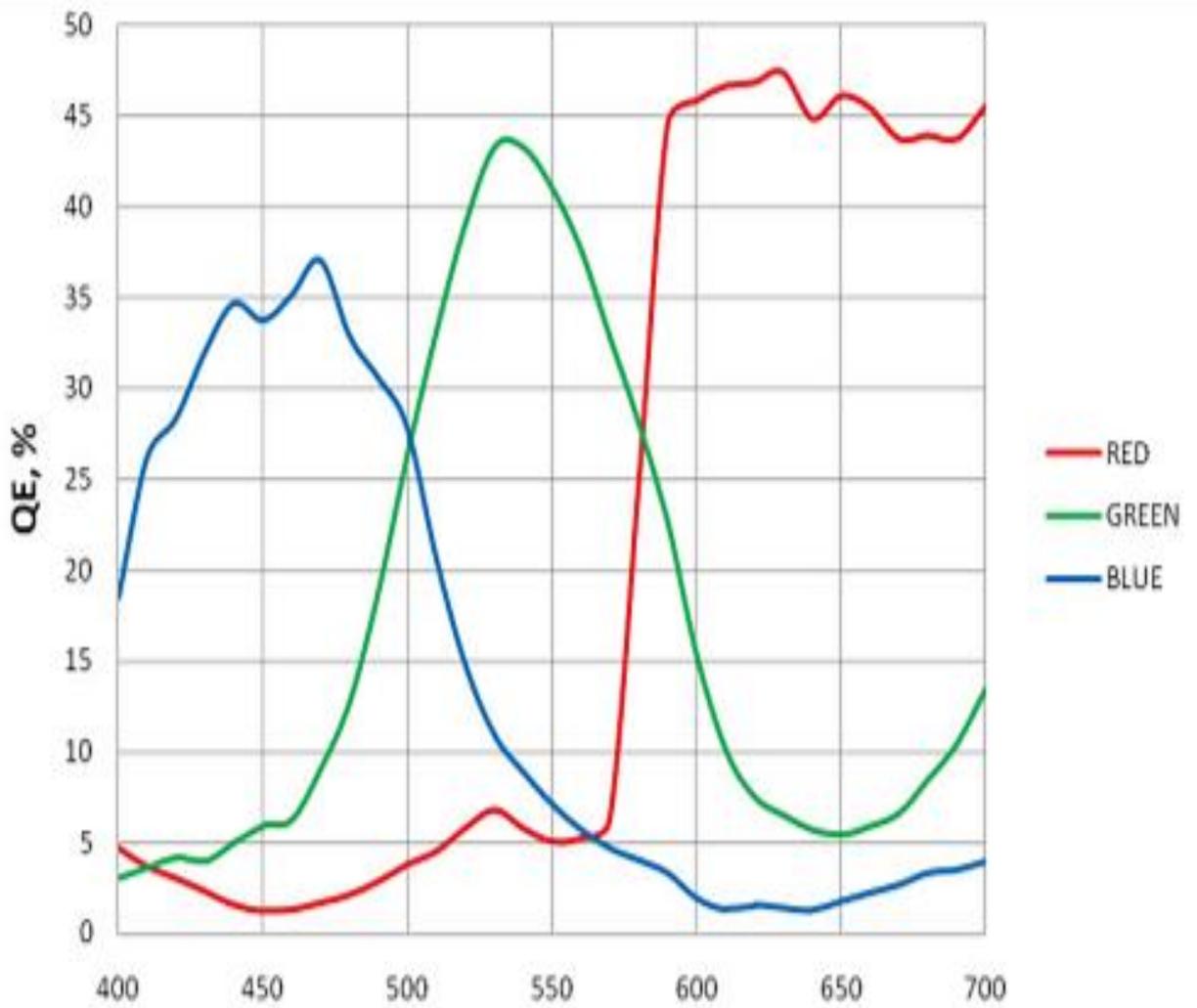
Spectral Response

The charts below show the sensitivity of the monochrome and the color sensor with Bayer pattern filter on the sensor glass lid. Color cameras are by default equipped with a UV/IR cut filter with a transmittance of 370 to 670 nm resulting in a sensitivity shown in the second chart. On request all types of cameras can be delivered with or without UV/IR cut filter.

MC4086 (monochrome)



MC4087 (color)

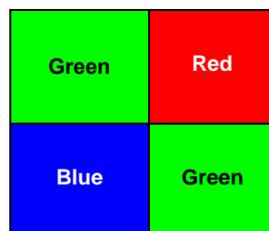


Bayer Color Filter

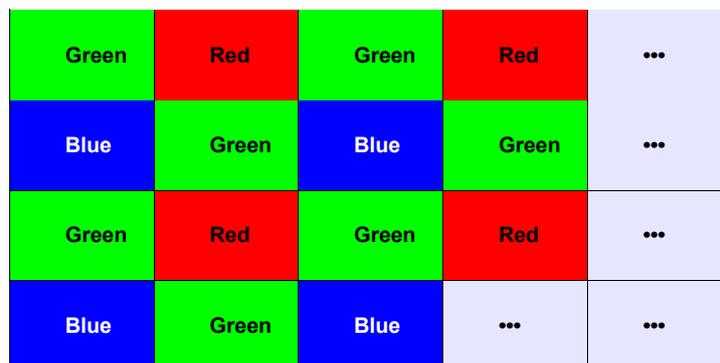
The sensor glass lid of EoSens color cameras are covered with a Bayer color filter. To get the color information the imaging software has to decode the information for one pixel to RGB by using the values of its neighbor pixels. There are a lot of different Bayer color algorithms which differ in speed and quality of the decoded image.

Bayer Pattern

The Bayer color filter of the 4CXP camera consists of small red, green and blue filter elements, each covering exactly one pixel on the sensor. A matrix of 2 x 2 filter elements builds a filter element matrix. The order and the color of the filter elements building a 2 x 2 filter matrix are always the same. The image below shows the colors and the order of a filter matrix as used by our cameras.



The sensor is completely covered by identical 2 x 2 filter matrix elements. As a result, the color pattern of the first line of the matrix is repeated on each mod(2) pixel number in each even line number. The color pattern of the second line is repeated on each (mod2) pixel in each odd line. This means, 2 consecutive lines show exactly the same order of Bayer pattern elements.

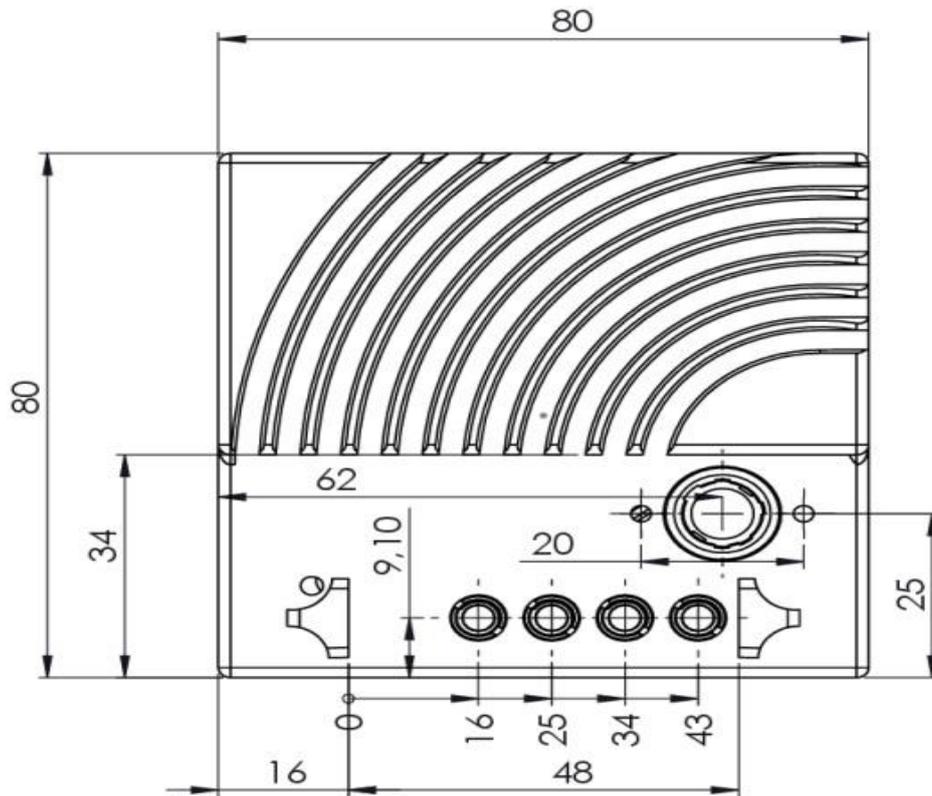


Because of the size and the order of a filter matrix element three facts can be concluded:

- Any (sub) region of a Bayer pattern coded image has always to start with the same color on the top left (0/0) pixel position of the region.
- A Bayer pattern image has to have an even number of pixels and an even number of lines.
- Changing the image size can only be done by steps of 2 in the horizontal **and** in the vertically direction.

Dimensions of MC4086/4087

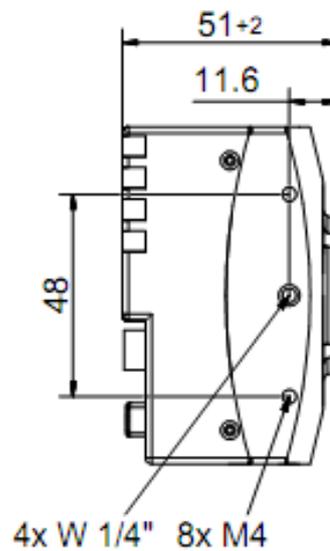
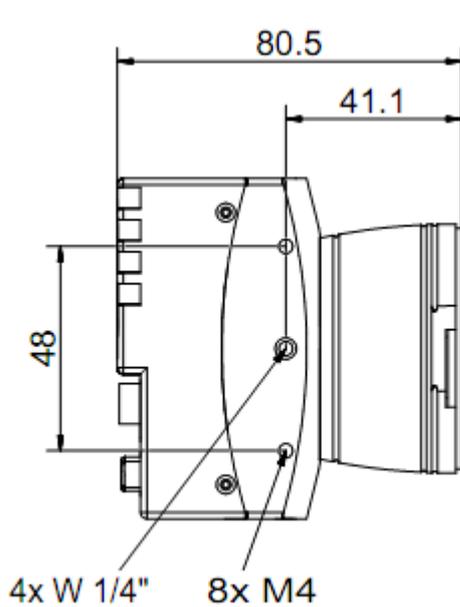
Rear View



Side View

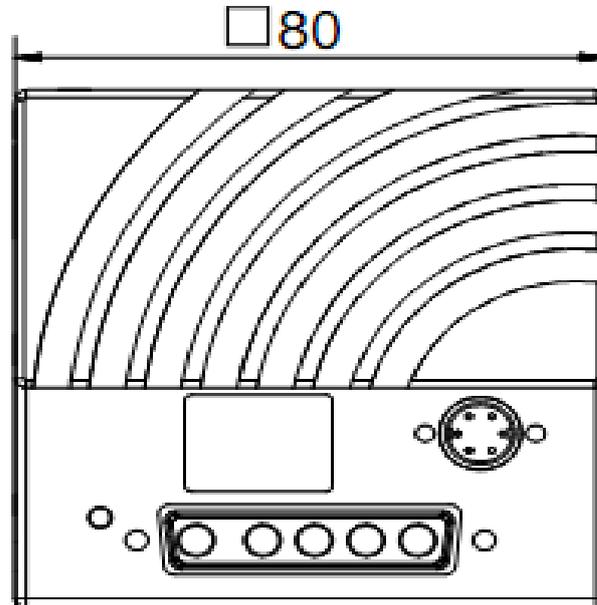
F-mount adapter

C-mount adapter



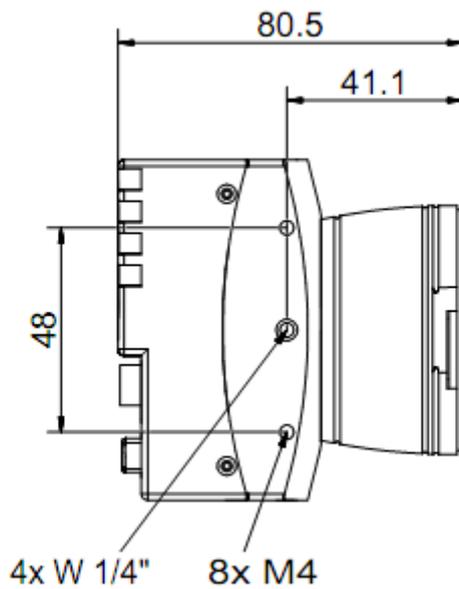
Dimensions of MC4082/MC4083

Rear View

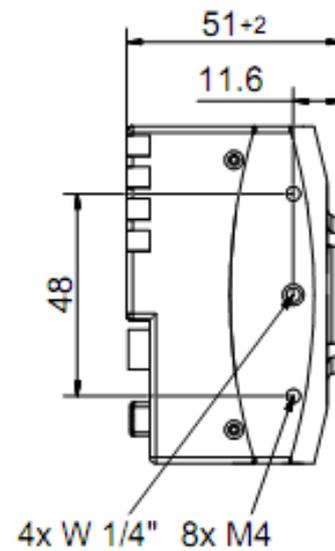


Side View

F-mount adapter



C-mount adapter



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