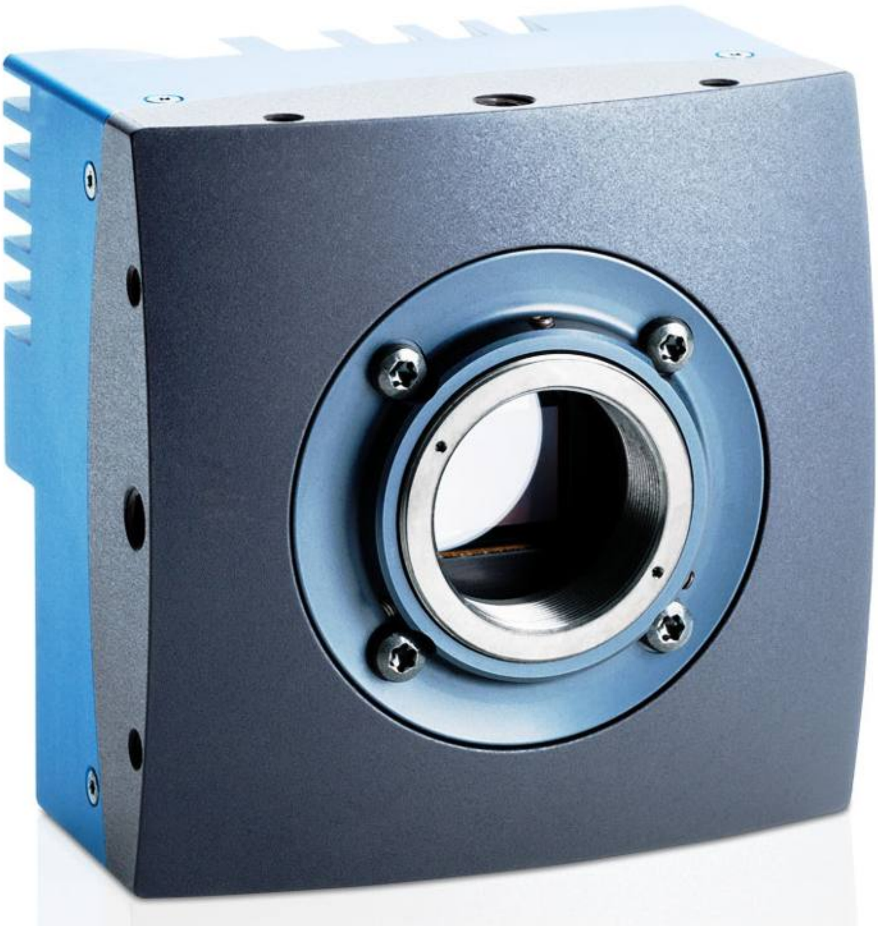
EoSens 2.0CXP2
Reference Guide



Version 1.0
CAMMC2066/67-RG

Contents

1 Before you start

This chapter provides the following information:

1.1 About this manual

This manual contains helpful information to install and operate the here described camera. It has been produced with care. Nevertheless, information might be erroneous or incomplete. MIKROTRON GmbH 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:

service@mikrotron.de or

Call +49- 89-7263-4200

We highly recommend to read this manual carefully.

NOTE	**This manual is subject to change without notice.**

1.1.1 Tips, remarks, and notes

This manual contains tips and notes that help to avoid data loss or camera damage. They are emphasized as follows:

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

NOTE	**Provides information to avoid damage to the system.**

1.1.2 Registered trademarks

In this manual the following registered trademarks are used:

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

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

1.1.3 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.

NOTE	You are herewith cautioned that any changes or modifications not expressly approved in this description 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。

1.1.4 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.

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

1.2 Warranty and non-warranty clause

Warranty is described in §8 of our General Terms and Conditions which can be downloaded on the MIKROTRON web page (www.mikrotron.de/en/terms.html).

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

NOTE	**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.**

NOTE	**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.

INFO	*MIKROTRON cannot be held responsible for the loss of data. We recommend a backup plan.*

In case of warranty, make a note of the camera type and its serial number (S/N).

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

Before sending back the camera, ask for a RMA (return merchandise authorization) number and RMA form either by:

- Phone: +49-89-7263-4200 or
- E-mail: support@mikrotron.de

Send the camera back to your distributor.

If no distributor is available, send it back to MIKROTRON. You find the address on the last page of this guide.

1.3 Technical support

For technical support, carry out the following steps:

STEP 1: Visit the website www.mikrotron.de/en/services/support.html

STEP 2: Fill in the form completely

STEP 3: Send the form.

You will receive an automatic reply from our ticket system.

Our field application engineer will answer your request as soon as possible.

2 Introduction

This chapter provides the following information:

2.1 Configuring the camera

All CXP cameras are compliant to the CoaXPress specification. CoaXPress standardizes down- and uplink protocols, interfaces, cables, and connectors used by CoaXPress compliant cameras and frame grabbers.

All cameras use GenICam, a standardized generic programming interface. It is used to configure and control the camera and supports five main features:

- Camera configuration
- Frame acquisition
- Graphical User Interface (GUI)
- Transfer of camera data but also time stamps, region of interest (ROI) and histogram data
- Transfer of events like a trigger

GenICam for CXP cameras consists of four parts:

- GenAPI
  GenAPI is the application programming interface. It is used to configure and control a camera. All features are written in an XML file. The API is available for several operating systems.
- Standard Features Naming Convention (SFNC)
  SFNC provides standardized names and types for common device features.
- Pixel Format Naming Convention
  PFNC is a pixel format naming convention.
- GenTL
  The GenTL transport layer is supported by CoaXPress compliant frame grabbers and cameras. It allows to read and write into registers and to grab frames.

According to GenICam the camera uses registers for configuration. To change a value, e.g. the exposure time, the hexadecimal value must be written into the camera register representing the exposure time (e.g. 0x1100).

2.2 Reading the XML file

All features of the camera are described in the GenICam XML file. Extensible Markup Language (XML) is used to describe each feature as a XML feature knot. Feature knots are displayed in a tree structure.

A knot consists of a feature knot and a register knot. The feature knot contains the description of the command whereas the register knot shows how it is implemented in the camera. For example the type of the feature (command, string, integer,...), its access mode (R/W), a descriptive name (friendly name), the corresponding register address, and a short description of the feature in plain ASCII text. Some features have min. and max. values or a default value. Each feature corresponds to a camera setting.

Example

```
<Command Name="AcquisitionStart">
<ToolTip>Starts the Acquisition of the device.</ToolTip>
<Description>Starts the Acquisition of the device.</De-
scription>
<DisplayName>Acquisition Start</DisplayName>
<Visibility>Beginner</Visibility>
<pValue>AcquisitionStartReg</pValue>
<CommandValue>0</CommandValue>
</Command>
<IntReg Name="AcquisitionStartReg">
<Address>0x8204</Address>
<Length>4</Length>
<AccessMode>WO</AccessMode>
<pPort>Device</pPort>
<Endianess>BigEndian</Endianess>
</IntReg>
</Group>
<Port Name="Device">
<ToolTip>Port giving access to the device.</ToolTip>
</Port>
```

INFO *All integer values are interpreted as 32 bit unsigned integers, if not other mentioned. All strings are NULL terminated and consist of 8 bit characters.*

The port knot allows the connection to the device.

The features in the XML file or the camera are grouped according to their meaning.

The XML file is an ASCII file which is to be found on the DVD delivered with the camera. It can either be saved (compressed or uncompressed) in the camera or saved as an external file on a local computer or a remote host. The path (URL) of the file can be read from the camera using the feature XmlUrlAddress.

Use the Software delivered by the frame grabber’s manufacturer to configure camera and frame grabber. If you use a frame grabber from Active Silicon, MIKROTRON’s VCAM Software which is part of the delivery too, can be used alternatively.

INFO	*Refer to www.emva.org/standards-technology/genicam for further details on the GenICam standard.*

3 Acquisition control

This chapter provides the following information:

3.1 Overview

NOTE	Settings can only be changed if image acquisition is stopped.

The following commands allow to make settings required for image acquisition and to control an external trigger.

Display name	Access	Length [Bytes]	Register Inter-face
Acquisition Mode	R/W	4	Enumeration
Acquisition Start	W	4	Command
Acquisition Stop	W	4	Command
Trigger Selector	R/W	4	Enumeration
Trigger Mode	R/W	4	Enumeration
Trigger Source	R/W	4	Enumeration
Trigger Activation	R/W	4	Enumeration
Trigger Count	R/W	4	Integer
Trigger Debouncer	R/W	4	Integer
Software Trigger	WO	4	Integer
Test-Image Selector	R/W	4	Enumeration
Exposure Mode	R/W	4	Enumeration
Exposure Time	R/W	4	Integer
Acquisition Frame Rate	R/W	4	Integer
Max. Acquisition Frame Rate	R	4	Integer

3.2 Controls

3.2.1 AcquisitionMode

This feature sets the acquisition mode of the device.

Access	Read / write
Type	Enumeration
In	Continuous: the camera records continuously a sequence

	of frames
Out	Selected mode
Remark	Frame acquisition can be stopped with the feature AcquisitionStop

3.2.2 AcquisitionStart

This feature starts the acquisition of the device.

Access	Write
Type	Command
In	0x00000001
Out	—
Remark	AcquisitionMode defines how frames will be acquired

3.2.3 AcquisitionStop

This feature stops acquiring frames at the end of the current frame.

Access	write
Type	command
In	x00000001
Out	—

3.2.4 TriggerSelector

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

Access	Read / write
Type	Enumeration
In	FrameStart: The camera will take one picture per trigger signal FrameBurstStart: The camera will take as many frames as defined in AcquisitionBurstFrameCount

Out	Trigger selector type
Remark	Set AcquisitionBurstFrameCount in order to define the number of frames to be acquired when FrameBurstStart is active.

INFO *If FrameBurstStart is selected, ExposureMode will have to be set to Timed. Otherwise, recording will not be possible.*

3.2.5 TriggerMode

This feature activates or deactivates the trigger type selected by the feature TriggerSelector.

Access	read / write
Type	enumeration
In	ON: Enables the selected trigger type; the camera waits for a trigger signal before acquiring a frame. The trigger signal can be a signal from the frame grabber, the 12-pin Hirose connector input, 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	active mode
Remark	If a trigger is active, ExposureMode defines whether the exposure of an 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 become effective if triggered mode is ON.

3.2.6 TriggerSource

This feature defines the source of the trigger signal.

Access	read / write
Type	enumeration
In	line0: CL cameras offer one trigger input with two physical lines via the 12 pin Hirose connector; the trigger signal can either be sent via line 0 or line 1 line1: CL cameras offer one trigger input with two lines via the 12 pin Hirose connector; the trigger signal can either be

	sent via line 0 or line 1 CC1, CC2, CC3, CC4: If CCx is set, the camera will wait for an external trigger signal of the CC signal lines of the frame grabber before acquiring another frame; exposure time for the next image is the time defined in the feature ExposureTime
Out	active source
Remark	Only one trigger source can be active.

3.2.7 TriggerActivation

INFO *If AnyEdge is selected, a fixed exposure time (ExposureMode = Timed) has to be set.*

This feature defines the activation mode for a trigger signal defined in TriggerSelector.

Access	read / write
Type	enumeration
In	RisingEdge: The camera will start to acquire frames on the arrival of a 'trigger rising edge' trigger packet
Out	selected activator
Remark	

3.2.8 TriggerCount

This feature counts the incoming trigger signals after a trigger debounce. It allows e.g. to compare the number of frames transferred to the frame grabber with the number of triggers.

Access	Read / Write
Type	Integer
In	min.: “0” max.: “0” (Zero is the only value accepted and is used to reset the trigger counter
Out	number of counted trigger signals
Remark	

3.2.9 TriggerDebouncer

INFO	*The best way to find the appropriate value for the debounce period is to measured it with an oscilloscope.*

In TriggerDebouncer the debounce period is defined. This period starts with the occurrence of a trigger edge. Within the debounce period, a new trigger signal will be ignored. Debouncing might e.g. be necessary if the trigger signal jitters.

Access	read / write
Type	integer
In	min.: 0 μs max.: 430 μs
Out	the set debounce period
Remark	The default value amounts to 1 μs.

3.2.10 TriggerSoftware

This feature generates an internal trigger.

Access	write
Type	command
In	0x00000001
Out	–
Remark	To generate a software trigger signal, “Software” has to be set in TriggerSource.

INFO	*When using TriggerSoftware, the exposure time of the next frame cannot be defined by TriggerWidth of the feature ExposureMode. Instead, it has to be defined by the feature ExposureTime.*

3.2.11 ExposureMode

This feature sets the operation mode of the shutter. It defines how long a picture will be exposed if TriggerMode is activated.

Access	read / write
Type	enumeration

In	Timed: exposure time is defined in the feature ExposureTime; Trigger Width: 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.
Out	set exposure mode
Remark	ExposureMode is enabled in trigger mode only. Timed has to be set if the TriggerSelector is set to FrameBurstStart.

3.2.12 ExposureTime

If the exposure mode is set to Timed or no hardware trigger is defined, this feature allows to define the duration of exposure [µs].

Access	read / write
Type	unsigned integer
In	1 … highest possible exposure time
Out	current exposure time
Remark	incremented by 1

3.2.13 AcquisitionFrameRate

INFO *If TriggerMode = ON, AcquisitionFrameRate will be disabled.*

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

Access	Read / write
Type	Unsigned integer
In	>10... highest possible frame rate
Out	AcquisitionFrameRate
Remark	Incremented by 1; min. 10

3.2.14 AcquisitionFrameRateMax

This feature returns the highest possible frame rate in [Hz].

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

NOTE **This feature will soon expire. Switch to AcquisitionFrameRate to get the highest possible frame rate.**

4 User set control

This chapter provides the following information:

4.1 Overview

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

Display name	Access	Length[Bytes]	Interface
User-Set Selector	R/W	4	Enumeration
User-Set Load	W	4	Command
User-Set Save	W	4	Command
User-Set Default Selector	R/W	4	Enumeration

4.2 Controls

4.2.1 UserSetSelector

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

Access	Read/write
Type	Enumeration
In	▪ Default: selects the factory settings ▪ UserSet1: selects the first user set ▪ UserSet2: selects the second user set ▪ UserSet3: selects the third user set
Out	Active user set
Remark	Set the UserSetSelector first to select a user set for further operations.

4.2.2 UserSetLoad

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 MIKROTRON.

4.2.3 UserSetSave

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 user set "Default" is a set of factory settings and can-not be overwritten.

4.2.4 UserSetDefaultSelector

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

Access	read/write
Type	enumeration
In	■ 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	active default user set
Remark	The user set selector Default is preselected.

5 File access control

This chapter provides the following information:

5.1 Overview

Display name	Access	Length[Bytes]	Interface
File Selector	R/W	4	Enumeration
File Operation Selector	R/W	4	Enumeration
File Operation Execute	W	4	Command
File Open Mode	R/W	4	Enumeration
File Access Buffer	R	4	Integer
File Access Offset	R/W	4	Integer
File Access Length	R/W	4	Integer
File Operation Status	R	4	Enumeration
File Operation Result	R	4	Integer
File Size	R	4	Integer

5.2 Controls

5.2.1 FileSelector

This feature selects the target file in the device.

Access	Read/write
Type	Enumeration
In	Value: DefectPixelMap
Out	-

5.2.2 FileOperationSelector

This feature selects the target operation for the selected file.

Access	Read/write
Type	Enumeration
In	■ Open: Opens the file ■ Close: Closes the file

	■ Read: Reads from the file ■ Write: Writes into the file ■ Delete: Deletes the file
Out	-

5.2.3 FileOperationExecute

This feature executes the operation selected by the „File Operation Selector“ on the selected file.

Access	Write
Type	Command
In	Value of FileOperationSelector
Out	-

5.2.4 FileOpenMode

This feature selects the access mode in which a file is opened.

Access	Read/write
Type	Enumeration
In	■ Read: Reads from the file ■ Write: Writes into the file ■ ReadWrite: Reads from and writes into the file
Out	-

5.2.5 FileAccessBuffer

Defines the read/write access of the selected file in the buffer.

Access	Read
Type	Integer
In	—
Out	File address in the buffer

5.2.6 FileAccessOffset

Defines the offset of the selected file in the buffer.

Access	Read / write
Type	Integer
In	0 ... 4096
Out	File length in bytes

5.2.7 FileAccessLength

Defines the number of bytes to be read from the selected file in the buffer.

Access	Read / write
Type	Integer
In	0 ... 262144
Out	File length in bytes

5.2.8 FileOperationStatus

This feature displays the file operation execution status of the selected file.

Access	Read
Type	Enumeration
In	■ Success: File operation was completed ■ Failure: File operation was not completed
Out	-
Remarks	A failure is displayed when e.g. the length and offset of the file or the file operation have not been defined.

5.2.9 FileOperationResult

Displays the number of bytes successfully read and written.

Access	Read
Type	Integer

In	-
Out	File length in bytes
Remarks	The number of successfully written bytes is only displayed when the file operation is successful.

5.2.10 FileSize

Displays the size of the selected file.

Access	Read
Type	Integer
In	-
Out	File length in bytes
Remarks	The number of successfully written bytes is only displayed when the values for file length and file offset have been defined.

6 Bootstrap CoaxPress control

This chapter provides the following information:

6.1 Overview

CoaXPress compliant devices have to support a number of bootstrap registers. In contrast to other camera features each bootstrap register is assigned to a fixed camera address as it 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. Usually, the connection between camera and frame grabber is running in the background.

Manufacturer-specific addresses allow non-GenICam applications or black-box format converters, to support the standard use-case and allow continuous acquisition and display of images

Display name	Access	Length [Bytes]	Register interface
Feature Width Address	R	4	Integer
Feature Height Address	R	4	Integer
Feature AcquisitionMode Address	R	4	Integer
Feature AcquisitionStart Address	R	4	Integer
Feature AcquisitionStop Address	R	4	Integer
Feature PixelFormat Address	R	4	Integer
Feature DeviceTapGeometry Address	R	4	Integer
Feature Image1StreamIDAddress	R	4	Integer
Maximal Control Packet Size	R	4	Integer
Device Connection-ID	R	4	Integer
LIDC2 Address	R	4	Integer
Connection Configuration	R/W	4	Enumerate
Default Connection Configuration	R	4	Integer
Connection Reset	W/(R)	4	Integer
Master Host Connection-ID	R/W	4	Integer
Revision	R	4	Integer
Standard	R	4	Integer
Stream Packet Size Maximum	R/W	4	Integer
Test Error Count Selector	R/W	4	Integer
Test Error Count	R/W	4	Integer

Display name	Access	Length [Bytes]	Register interface
Test Packet Counter Tx	R/W	8	Integer
Test Packet Counter Rx	R/W	8	Integer
Capability Register	R	4	Integer
Feature Control Register	R/W	4	Integer
Versions Supported	R	4	Integer
Version Used	R/W	4	Enumeration
Test Mode	R/W	4	Integer
XML Manifest Selector	R/W	4	Integer
XML Manifest Size	R	4	Integer
XML Scheme Version	R	4	Integer
XML URL-Address	R	4	Integer
XML Version	R	4	Integer
Device-ID	R	16	String
Device Manufacturer Info	R	48	String
Device Model Name	R	32	String
Device User-ID	R/W	16	String
Device Vendor Name	R	32	String
Device Version	R	32	String

6.2 Controls

6.2.1 WidthAddress

Manufacturer-specific address of the ROI width.

Access	Read
Type	Integer
In	-
Out	-

6.2.2 HeightAddress

Manufacturer-specific address of the ROI height.

Access	Read
Type	Integer
In	-
Out	-

6.2.3 AcquisitionModeAddress

Manufacturer-specific address of the feature AcquisitionMode.

Access	Read
Type	Integer
In	-
Out	-

6.2.4 AcquisitionStartAddress

Manufacturer-specific address of the feature AcquisitionStart.

Access	Read
Type	Integer
In	-
Out	-

6.2.5 AcquisitionStopAddress

Manufacturer-specific address of the feature AcquisitionStop.

Access	Read
Type	Integer
In	-
Out	-

6.2.6 PixelFormatAddress

Manufacturer-specific address of the feature PixelFormat.

Access	Read
Type	Integer
In	-
Out	-

6.2.7 DeviceTapGeometryAddress

Manufacturer-specific address of the feature DeviceTapGeometry.

Access	Read
Type	Integer
In	-
Out	-

6.2.8 Image1StreamIDAddress

Manufacturer-specific address of the feature Image1StreamID.

Access	Read
Type	Integer
In	-
Out	-

6.2.9 ControlPacketSizeMax

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

6.2.10 DeviceConnectionID

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.

6.2.11 Iidc2Address

Meant for devices supporting the IIDC2 protocol (section 2.2 ref. 6) and provides the starting address of the IIDC2 register space.

Access	read
Type	unsigned integer
In	–
Out	0x00000000

6.2.12 ConnectionConfig

Holds a valid combination of the device link speed and the 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):

	■ CONNECTION1SPEED3125: One connection of 3.125 Gbps per connection ■ CONNECTION2SPEED3125: Two connections of 3.125 Gbps per connection ■ CONNECTION4SPEED3125: Four connections of 3.125 Gbps per connection (default) ■ CONNECTION1SPEED5000: One connection of 5.000 Gbps per connection ■ CONNECTION2SPEED5000: Two connections of 5.000 Gbps per connection ■ CONNECTION4SPEED5000: Four connections of 5.000 Gbps per connection ■ CONNECTION1SPEED6250: One connection of 6.250 Gbps per connection ■ CONNECTION2SPEED6250: Two connections of 6.250 Gbps per connection ■ CONNECTION4SPEED6250: Four connections of 6.250 Gbps per connection
Out	connection configuration

6.2.13 ConnectionConfigDefault

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	

6.2.14 ConnectionReset

Writing 0x00000001 into this register will reset the connection of the device.

Access	read / write
Type	unsigned integer

In	0x00000001
Out	0x00000000
Remark	A link reset will stop a running image acquisition. A connection reset command via the master connection (no. 0) will reset a connection and activate its discovery connection configuration within 200 ms. 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. In general it is not possible to read this register while it has the value 0x00000001.

6.2.15 MasterHostConnectionID

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.

6.2.16 Revision

Provides the revision of the CoaXPress specification implemented by this device.

Access	read
Type	unsigned integer
In	–
Out	Bits 31 - 16: major revision Bits 15 - 00: minor revision
Remark	E.g. devices compliant to revision 1.1 of the specification shall return the value 0x00010001.

6.2.17 Standard

Provides a number indicating that the device implements the CoaXPress standard.

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

6.2.18 StreamPacketSizeMax

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.

6.2.19 TestErrorCountSelector

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.

6.2.20 TestErrorCount

Current connection error count selected by the 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.

6.2.21 TestPacketCountTx

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.

6.2.22 TestPacketCountRx

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 TestErrorCountSelector. A connection reset sets all connection test counters to zero.

6.2.23 CapabilityRegister

Indicates which optional features are supported.

Access	read
Type	Integer
In	-
Out	-

6.2.24 FeatureControlRegister

Enables and disables optional device features.

Access	read / write
Type	Integer
In	-
Out	-

6.2.25 VersionsSupported

Indicates which CXP versions are supported.

Access	read
Type	Integer
In	-
Out	-

6.2.26 VersionUsed

Indicates the version of the CoaXPress specification used for communication between device and host.

Access	read
Type	Enumeration
In	
Out	
Remark	CXP_Version_1_1: 0x00010001 CXP_Version_2_0: 0x00020000

6.2.27 TestMode

Enables a test packet transmission from the camera to the host.

Access	read / write
Type	enumeration
In	"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.

6.2.28 XmlManifestSelector

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.

6.2.29 XmlManifestSize

Returns the number of available XML manifests. At least one manifest must be available.

Access	read
Type	unsigned integer
In	–
Out	1

6.2.30 XmlSchemeVersion

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 31 - 24: reserved; shall be 0 Bits 23 - 16: SchemaMajorVersion; major version number of the schema used by the XML file Bits 15 - 8: SchemaMinorVersion; minor version number of the schema used by the XML file Bits 7 - 0: SchemaSubMinorVersion; sub-minor version number of the schema used by the XML file

6.2.31 XmlUrlAddress

Indicates the start of the URL string referenced by the register XmlManifestSelector.

Access	read
Type	unsigned integer
In	–
Out	register address
Remarks	Reading the returned register returns the name, register address, and the length of the GenICam XML file stored in the flash memory of the camera. The format of the address

	string of the following fields is:
	■ Local: Indicates the XML file is stored in the non-volatile memory in the device
	■ <Filename>: Name of the XML file
	■ <Extension>:
	  ■ xml: uncompressed XML file
	  ■ zip: compressed ZIP file
	■ <Address>: Address of the file in the device memory map, given in hexadecimal notation without the first to characters “0x”
	■ <Length>: Length of the file in Bytes, given in hexadecimal without the first to characters “0x”

Example

“Local:Mikrotron_GmbH_MC258xS11 _Rev1_15_0.xml; 8001000;16C34?SchemaVersion=1.1.0”

This expression indicates a GenICam XML file in the flash memory of the camera. The file can be read starting at address 8001000 and has a length of 16C34 Bytes.

INFO	*MIKROTRON does not support strings that reference a XML file located on the vendors homepage.*

6.2.32 XmlVersion

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

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

6.2.33 DeviceSerialNumber

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

6.2.34 DeviceManufacturerInfo

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

6.2.35 DeviceModelName

Provides the model name of the device as a string.

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

6.2.36 DeviceUserID

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.

6.2.37 DeviceVendorName

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

6.2.38 DeviceVersion

This register contains the string with the version number of the connected device.

Access	read
Type	string
In	—
Out	version number of the device
Offset	hex C4

7 Transport layer control

This chapter provides the following information:

7.1 Overview

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

Display name	Access	Length[Bytes]	Interface
TLParamsLocked	R/W	4	Integer
CXP Link Configuration Status	R	4	Enumeration
CXP Link Configuration Pre-ferred		Enumeration	
CXP Link Configuration		Enumeration	
CXP Connection Selector		Integer	
CXP Connection Test Mode		Enumeration	
CXP Connection Test Error Count		Integer	
CXP Connection Test Packet Count		Integer	

7.2 Controls

7.2.1 TLParamsLocked

Access	Read/write
Type	Integer
In	-
Out	-

7.2.2 CxpLinkConfigurationStatus

Current and active link configuration of the device.

Access	read

Type	enumeration
In	■ CXP3_X1 ■ CXP3_X2 ■ CXP3_X4 ■ CXP5_X1 ■ CXP5_X2 ■ CXP5_X4 ■ CXP6_X1 ■ CXP6_X2 ■ CXP6_X4 ■ CXP10_X1 ■ CXP10_X2 ■ CXP10_X4 ■ CXP12_X1 ■ CXP12_X2 ■ CXP12_X4
Out	-

7.2.3 CxpLinkConfigurationPreferred

Provides the default link configuration of the device.

Access	
Type	enumeration
In	■ CXP3_X1 ■ CXP3_X2 ■ CXP3_X4 ■ CXP5_X1 ■ CXP5_X2 ■ CXP5_X4 ■ CXP6_X1 ■ CXP6_X2 ■ CXP6_X4 ■ CXP10_X1 ■ CXP10_X2 ■ CXP10_X4 ■ CXP12_X1 ■ CXP12_X2

	■ CXP12_X4
Out	-

7.2.4 CxpLinkConfiguration

Specifies the link configuration of the device.

Access	
Type	enumeration
In	■ CXP3_X1 ■ CXP3_X2 ■ CXP3_X4 ■ CXP5_X1 ■ CXP5_X2 ■ CXP5_X4 ■ CXP6_X1 ■ CXP6_X2 ■ CXP6_X4 ■ CXP10_X1 ■ CXP10_X2 ■ CXP10_X4 ■ CXP12_X1 ■ CXP12_X2 ■ CXP12_X4
Out	-

7.2.5 CxpConnectionSelector

Selects the CoaXPress physical connection to the control.

Access	
Type	integer
In	0 ... 3, increment by 1
Out	-

7.2.6 CxpConnectionTestMode

Enables the test mode.

Access	
Type	enumeration
In	Off Mode1
Out	-

7.2.7 CxpConnectionTestErrorCount

Current connection error count selected by the CxpConnectionSelector.

Access	
Type	integer
In	Min: 0, representation: linear
Out	-

7.2.8 CxpConnectionTestPacketCount

Returns the 64bit test packet receive counter, selected by CxpConnectionSelector.

Access	
Type	integer
In	Min: 0, representation: linear
Out	-

8 Device control

This chapter provides the following information:

8.1 Overview

Name	Access	Length[Bytes]	Interface
Device Reset	WO	4	Integer

8.2 Controls

8.2.1 DeviceReset

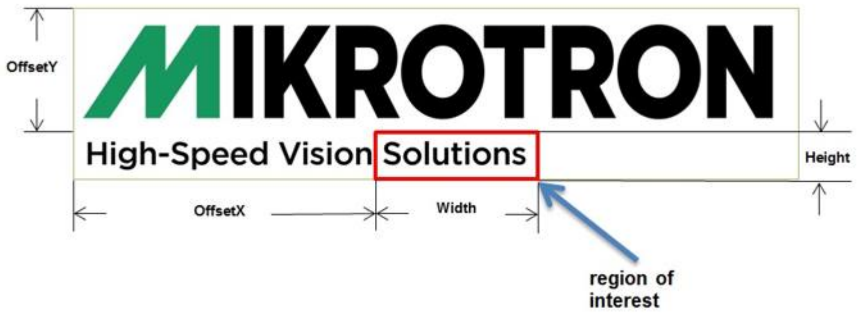
This feature resets the device into power-up state.

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

9 Image format control

This chapter provides the following information:

9.1 Overview



These commands allow to set the size of the image, the so called region of interest (ROI). A ROI - like the red field in the figure below - defines the part of an image to be scanned. It is defined by its Width, Height, OffsetX and OffsetY.

Display name	Access	Length [Bytes]	Register interface
Height	R/W	4	Integer
Offset-X	R/W	4	Integer
Max. Height	R	4	Integer
Image 1 Stream-ID	R	4	Integer
Pixel Format	R/W	4	Enumeration
Tap Geometry	R	4	Enumeration
DeviceScanType	R	4	Enumeration
Sensor Height	R	4	Integer
Sensor Width	R	4	Integer
Region Destination	R/W	4	Enumeration
Width	R/W	4	Integer
Offset-Y	R/W	4	Integer
Max. Width	R	4	Integer

9.2 Controls

9.2.1 Height

Height of the image provided by the device in pixels.

Access	read / write
Type	unsigned integer
In	1 … HeightMax
Out	image height
Remark	The maximum value of this feature equals to SensorHeight; the image height has to be incremented by 1 line

9.2.2 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 SensorWidth. The offset has to be incremented by 64 pixels.

9.2.3 HeightMax

Maximum height of the image in pixels.

Access	read
Type	unsigned integer
In	—
Out	maximum usable sensor height

9.2.4 Image1StreamID

This feature returns the stream ID of the primary image stream of the device.

Access	read

Type	unsigned integer
In	—
Out	0x00000000

9.2.5 PixelFormat

This feature returns the bit format the camera uses for acquisition. The default format is 8 bit. It can be changed to 10 bit. For color cameras, the order of the Bayer pattern can be selected.

Access	read/write
Type	enumeration
In	Mono8 ■ monochrome, 8 bit/pixel (default) ■ monochrome, color camera Mono10pmsb ■ monochrome, 10 bit/pixel packed ■ monochrome, color camera
Out	see above
Remark	the available pixel formats depend on the camera connected (monochrome or color)

9.2.6 TapGeometry

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

Access	read
Type	enumeration
In	Geometry_1X_1Y: Single pixel scanning from left to right and single line scanning from top to button
Out	see above

9.2.7 DeviceScanType

This feature returns the value of the camera type (area scan).

Access	read only
Type	enumeration
In	–
Out	Areascan (0x00000000)

9.2.8 SensorHeight

Effective height of the sensor in pixels.

Access	read only
Type	unsigned integer
In	–
Out	sensor height

9.2.9 SensorWidth

Effective width of the sensor in pixels.

Access	read only
Type	unsigned integer
In	–
Out	sensor width

9.2.10 RegionDestination

Controls the destination of the selected region.

Access	read/write
Type	enumeration
In	–
Out	

9.2.11 Width

This feature provides the image width in pixels.

Access	read / write
Type	unsigned integer
In	320... WidthMax @ 10tap/8 or 10bit 64... WidthMax @ 8tap/8 or 10bit 64... WidthMax @ 2tap/8 or 10bit
Out	image width
Remark	The maximum value of this feature equals to SensorWidth. The image width has to be incremented by 64 pixels in 2 or 8 tap mode and 320 pixels in 10 tap mode.

9.2.12 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 SensorHeight. The offset has to be incremented by 1 line.

9.2.13 WidthMax

Maximum width of the image in pixels.

Access	read only
Type	unsigned integer
In	-
Out	maximally usable sensor width

10 Analog control

This chapter provides the following information:

10.1 Overview

Display name	Access	Length[Bytes]	Interface
Analog Gain	R/W	4	Float
Black Level	R/W	4	Integer

10.2 Controls

10.2.1 AnalogGain

Analog Gain is used to increase the brightness of an image. The available range depends on the camera connected. If you increase the analog gain, all pixel values of the image will be increased which means, the whole image becomes brighter. Unfortunately, noise will increase too. Whereas with gain the brightness of the image is increased by increasing the brightness of each pixel, gamma adjusts the brightness non-linearly.

Access	read/write
Type	integerfloat
In	x1 x2 x4
Out	current analog gain value

10.2.2 BlackLevel

The black level value defines the brightness in the darkest part of an image. An optimal setting means, the pixel value 0 is delivered for a completely black image. If it is too high, it will deliver a pixel value greater than 0 (which is reserved for a shade of gray). It it is too small, it will deliver a pixel value of 0 for a shade of gray. If the value is too small, the sensor will deliver a pixel value of 0 for gray shades.

Access	read/write
Type	enumeration
In	0 to 255

Out	current black level value
Remark	can be incremented by 1

11 I/O control

This chapter provides the following information:

11.1 Overview

Display name	Access	Length [Bytes]	Interface
Line Selector	R/W	4	Enumeration
LineSource	R/W	4	Enumeration
Line Inverter	R/W	4	Enumeration
User Output Selector	R/W	4	Enumeration
User Output Value	R/W	4	Boolean

11.2 Controls

11.2.1 LineSelector

This feature selects the physical output line to be configured with the commands LineSource and LineInverter. Up to now, there are two output lines that can be selected: either OUT0 or OUT1.

Access	read/write
Type	enumeration
In	OUT0 OUT1
Out	selected output of the Hirose connector
Remark	expert feature

11.2.2 LineSource

This feature defines which signal will apply at the output selected with LineSelector.

Access	read/write
Type	enumeration
In	▪ ExposureActive: STRB (0)

	▪ StreamTransferActive: data transmission state (1) ▪ ExtTriggerSignalState: state of the external trigger (2) ▪ UserOutput0: state of the user output bit 0 ▪ UserOutput1: state of the user output bit 1
Out	selected signal
Remark	expert feature All signals can be inverted with LineInverter.

11.2.3 LineInverter

This feature controls whether the level of the output signal will be inverted or not.

Access	read/write
Type	enumeration
In	inverted = 1 not inverted = 0
Out	setting: inverted or not inverted
Remark	default is 0 (not inverted); expert feature

11.2.4 UserOutputSelector

This feature allows to select the variable UserOutput0 or UserOutput1. The level of the here selected variable can be defined by the feature UserOutputValue.

Access	read/write
Type	enumeration
In	UserOutput1 = 1 UserOutput0 = 0
Out	status of the variable
Remark	expert feature

11.2.5 UserOutputValue

This feature allows to define the output level of the variable selected by User-OutputSelector. This static output level can be routed to a physical output with the feature LineSource.

Access	read/write
Type	boolean
In	high = 1 low = 0
Out	status of the bit
Remark	expert feature

12 Digital control

This chapter provides the following information:

12.1 Overview

Name	Access	Length[Bytes]	Interface
Gamma	R/W	4	Integer
Digital Gain	R/W	4	Float

12.2 Controls

12.2.1 Gamma

Gamma correction adjusts the brightness of an image non-linearly which means it does not increase the brightness of all pixels but comes close to the manner the human eye perceives light and color

Access	read/write
Type	integer
In	min: 0.1 max: 3.0
Out	current gain value
Remark	gain can be incremented by steps of 0.1

12.2.2 DigitalGain

When using digital gain the all pixels values of the image will be increased. As a result, the whole image becomes brighter, the dynamic range is decreased, and noise will be increased. It is recommended to be used for 8-bit-images only.

Access	read/write
Type	float
In	min: 1 - 4
Out	max: 1 - 4
Remark	digital gain can be de-/incremented in steps of 0.25

13 Custom features

This chapter provides the following information:

13.1 Overview

Custom features are manufacturer specific camera functions and therefore are not defined in the standard naming convention.

Display name	Access	Length[Bytes]	Interface
Logical Connection Reset	W	4	Command
Device Information	R	4	Integer
Device Information Selector	R/W	4	Enumeration
Analog Register Set	R/W	4	Enumeration
Analog Register Selector	R/W	4	Integer
Analog Value [mV]	R/W	4	Integer
Frame Counter Info Enable	R/W	4	Boolean
Time Stamp Enable	R/W	4	Boolean
ROI Info Enable	R/W	4	Boolean
Fixed Pattern Noise Reduction	R/W	4	Enumeration

13.2 Controls

13.2.1 TxLogicalConnectionReset

This feature resets the next packet transmission to connection „0“.

Access	write
Type	command
In	-
Out	-

13.2.2 DeviceInformation

This feature returns a value of the device information list selected by feature DeviceInfoSelector.

Access	read / write
Type	unsigned integer
In	–
Out	Device information values: ▪ InfoSnr: serial number of the camera (same as feature DeviceID); e.g. 0x00000132 ▪ InfoType: camera type/model; e.g.: 0x00002582 for Camera model MC2582 ▪ InfoSubType: sub type number of the camera model; this number describes models with special features or a customized version; e.g. 0x00000001 ▪ InfoHwRevision: describes the revision of the camera hardware, e.g. 0x0103000B for revision 1.3 Build 11 ◦ bits 31-24: major revision number ◦ bits 23-16: minor revision number ◦ bits 15-00: build number ▪ InfoFpgaVersion: version of the FPGA program of the camera, e.g. 0x02050001 for Version 2.5 Build 1 ◦ bits 31-24: major version number ◦ bits 23-16: minor version number ◦ bits 15-00: build number ▪ InfoSwVersion: version of the microcontroller software, e.g. 0x020F0011 for Version 2.15 Build 17 ◦ bits 31-24: major version number ◦ bits 23-16: minor version number ◦ bits 15-00: 15-00 ▪ InfoPwrSource: returns the source of the camera power supply with value 0: external power supply ▪ InfoPwrConsumption: returns the actual power consumption of the camera in [µA]; e.g: 0x00066580 for 419200 µA = 0.4192 A ▪ InfoPwrVoltage: returns the actual voltage of the camera power supply in [mV]; e.g.: 0x2E4A for 11850 mV = 11.85 Volt ▪ InfoTemperature: returns the current camera temperature in degrees Celsius; the value returned is a signed integer; e.g. 0x00000040 for 32 degree Celsius and 0xFFFFFF2C for -2 degree Celsius
Remark	Model number, hardware revision, FPGA version, and firmware version are also included in the string of the 'DeviceVersion' Bootstrap feature.

13.2.3 DeviceInformationSelector

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

Access	read / write
Type	enumeration
In	■ 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 PoC) ■ InfoPwrConsumption: actual power consumption of the camera in [µA] ■ InfoPwrVoltage: actual voltage of the camera power supply in [mV] ■ InfoTemperature: sensor temperaturine degrees Celsius
Out	see row IN
Remark	First set the selector to define the data you want to read, then read the data by reading the register DeviceInformation (see below).

13.2.4 AnalogRegisterSetSelector

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

Access	read / write
Type	enumeration
In	Analog Register Set 0: “0” Analog Register Set 1: “1” Analog Register Set 2: “2”
Out	see row In

13.2.5 AnalogRegisterSelector

Selects one of the analog registers for access.

Access	read / write
Type	integer
In	0 15 1
Out	see row In

13.2.6 AnalogValue

Analog value [mV] to read/write.

Access	read / write
Type	integer
In	0 4096 1
Out	Linear representation

13.2.7 InfoFieldFrameCounterEnable

This feature switch the camera's Pixel Reset Mode ON or OFF.

Access	read/write
Type	boolean
In	**ON:** pixel reset mode is enabled **OFF:** pixel reset mode is disabled
Out	status (ON/OFF)
Remark	When using frame rates <50 fps the image will show white dots. This is caused by long storage times for the pixel charge. Prevent this effect by deactivating PixelResetMode. If this function is ON, the maximal frame rate for ROIs with a width <3200 pixel is limited. As this mode is not to be used with high frame rates, this usually does not cause any problems.

13.2.8 InfoFieldTimeStampEnable

Enables or disables the time stamp field in the image.

Access	read/write
Type	boolean
In	1: time stamp is enabled 0: time stamp is disabled
Out	status (ON/OFF)

13.2.9 InfoFieldRoiEnable

Enables or disables the ROI info field in the image.

Access	read/write
Type	boolean
In	1: ROI is enabled 0: ROI is disabled
Out	status (ON/OFF)

13.2.10 FixedPatternNoiseReduction

This feature can be used to switch the fixed pattern noise (FPN) reduction ON or OFF. Digital sensors have a noise signature, the so called Fixed Pattern Noise. This feature reduces FPN by subtracting the dark current of pixels.

Access	read/write
Type	enumeration
In	▪ ON: MIKROTRON’s pixel FPN reduction is activated in order to improve the quality of the image ▪ OFF: MIKROTRON’s FPN is deactivated
Out	status (ON/OFF)

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