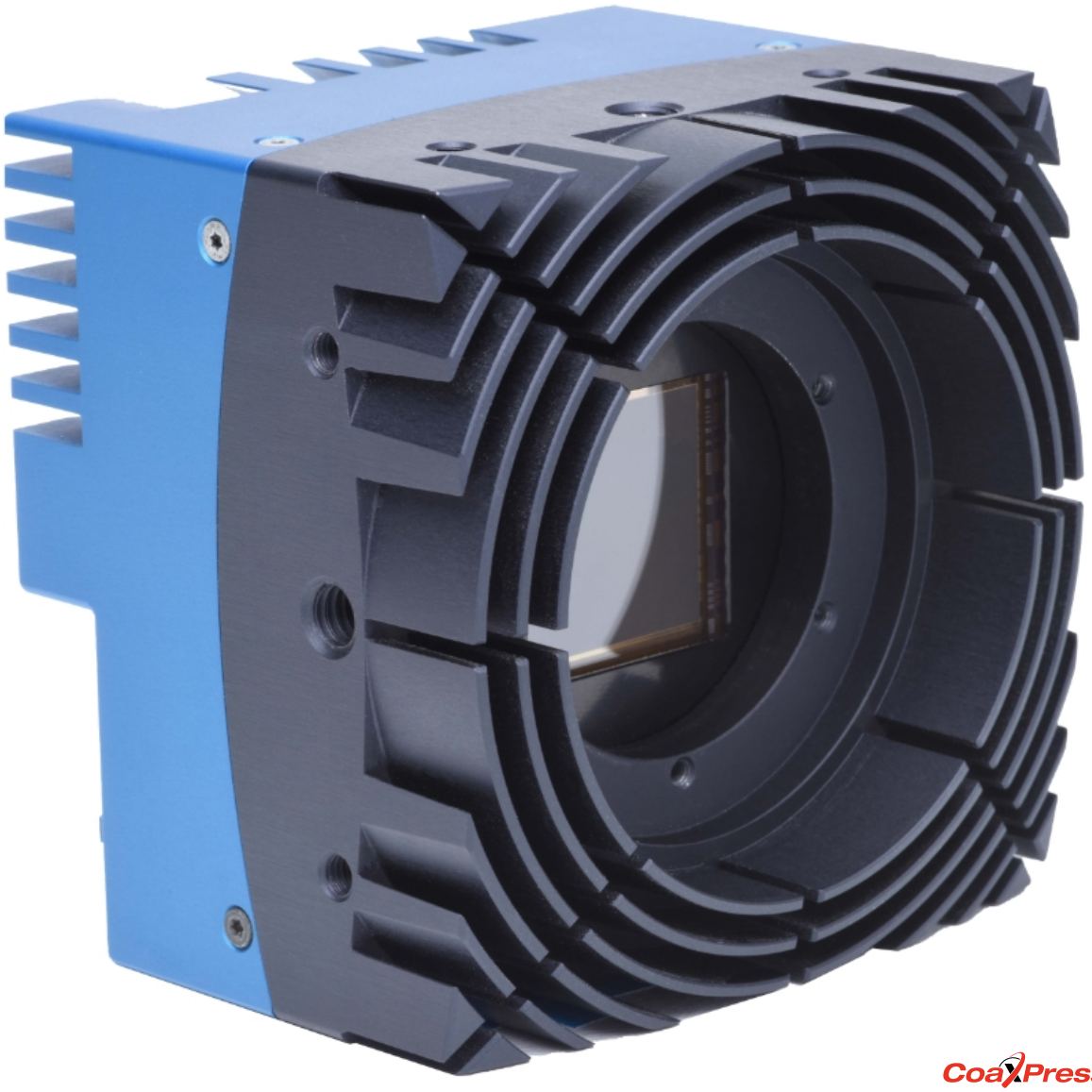
SVS-VISTEK



CoaXPress®

# EoSens® 10CXP2

## Reference Guide

A TKH TECHNOLOGY COMPANY

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# 1 Before you start

## 1.1 About this manual

This manual contains helpful information to install and operate the described camera. It has been produced with care. Nevertheless, information might be erroneous or incomplete. SVS-Vistek GmbH cannot be held responsible for any problems resulting from incomplete or erroneous information.

Read this manual carefully.

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

It is intended for staff with technical qualifications who have been specially trained and have the appropriate knowledge in the field of automation technology, electrical and optical devices.

*INFO* *Keep this manual for future use.*

### 1.1.1 Tips and notes

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

Tips

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

Notes

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

### 1.1.2 Registered trademarks

In this manual the following registered trademarks may be used:

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

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

### 1.1.3 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.

NOTICE 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.

NOTICE

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

## 1.2 Warranty and non-warranty clause

NOTICE

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.

NOTICE

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*

*SVS-Vistek GmbH cannot be held responsible for the loss of data. We recommend a backup plan.*

## 1.3 Support

1. In case of support or a warranty claim, 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.
2. Contact us by visiting our support website
   https://www.svs-vistek.com/de/support/svs-support-anfrage.php

# 2 Introduction

## 2.1 Configuring the camera

All CXP cameras are compliant to the CoaXPress specification. CoaXPress standardizes downlink 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.</Description>
            <DisplayName>Acquisition Start</Dis-
playName>
            <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 USB storage device 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.

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

# 3 Bootstrap CoaXPress control

## 3.1 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 blackbox format converters to support the standard use case and allow continuous acquisition and display of images

| Display name | Address | Access | Length [Bytes] | Register interface |
|---|---|---|---|---|
| Standard | 0x00000000 | R | 4 | Integer |
| Revision | 0x00000004 | R | 4 | Integer |
| XML Manifest Size | 0x00000008 | R | 4 | Integer |
| XML Manifest Selector | 0x0000000C | R/W | 4 | Integer |
| XML Version | 0x00000010 | R | 4 | Integer |
| XML Scheme Version | 0x00000014 | R | 4 | Integer |
| XML URL Address | 0x00000018 | R | 4 | Integer |
| LIDC2 Address | 0x0000001C | R | 4 | Integer |
| Device Vendor Name | 0x00002000 | R | 32 | String |
| Device Model Name | 0x00002020 | R | 32 | String |
| Device Manufacturer Info | 0x00002040 | R | 48 | String |
| Device Version | 0x00002070 | R | 32 | String |
| Device Serial Number | 0x000020B0 | R | 16 | String |
| Device User ID | 0x000020C0 | R/W | 16 | String |
| Width Address | 0x00003000 | R | 4 | Integer |
| Height Address | 0x00003004 | R | 4 | Integer |
| Acquisition Mode Address | 0x00003008 | R | 4 | Integer |
| Acquisition Start Address | 0x0000300C | R | 4 | Integer |
| Acquisition Stop Address | 0x00003010 | R | 4 | Integer |

| Display name | Address | Access | Length [Bytes] | Register interface |
|---|---|---|---|---|
| Pixel Format Address | 0x00003014 | R | 4 | Integer |
| Device Tap Geometry Address | 0x00003018 | R | 4 | Integer |
| Image 1 Stream ID Address | 0x0000301C | R | 4 | Integer |
| Image 2 Stream ID Address | 0x00003020 | R | 4 | Integer |
| Connection Reset | 0x00004000 | W/(R) | 4 | Integer |
| Device Connection ID | 0x00004004 | R | 4 | Integer |
| Master Host Connection ID | 0x00004008 | R/W | 4 | Integer |
| Max. Control Packet Size | 0x0000400C | R | 4 | Integer |
| Max. Stream Packet Size | 0x00004010 | R/W | 4 | Integer |
| Connection Configuration | 0x00004014 | R/W | 4 | Enumerate |
| Default Connection Configuration | 0x00004018 | R | 4 | Integer |
| Test Mode | 0x0000401C | R/W | 4 | Integer |
| Test Error Count Selector | 0x00004020 | R/W | 4 | Integer |
| Test Error Count | 0x00004024 | R/W | 4 | Integer |
| Test Packet Counter Tx | 0x00004028 | R/W | 8 | Integer |
| Test Packet Counter Rx | 0x00004030 | R/W | 8 | Integer |
| Capability Register | 0x0000403C | R | 4 | Integer |
| Feature Control Register | 0x00004040 | R/W | 4 | Integer |
| Versions Supported | 0x00004044 | R | 4 | Integer |
| Version Used | 0x00004048 | R/W | 4 | Enumeration |

## 3.2 Controls

### 3.2.1 Standard

This register provides a magic 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. |

### 3.2.2 Revision

This control returns the revision of the CoaXPress specification implemented by this device.

| | |
|---|---|
| Access | Read |
| Type | Unsigned integer |
| In | - |
| Out | ■ Bits 31 - 16: major revision<br>■ Bits 15 - 00: minor revision |
| Remark | Example: Devices compliant to revision 1.1 of the specification shall return the value 0x00010001. |

### 3.2.3 XmlManifestSize

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

| | |
|---|---|
| Access | Read |
| Type | Unsigned integer |
| In | - |
| Out | 1 |

### 3.2.4 XmlManifestSelector

This control 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. |

### 3.2.5 XmlVersion

This control 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<br>■ Bits 23 - 16: SchemaMajorVersion; major version number of the XML file<br>■ Bits 15 - 8: SchemaMinorVersion; minor version number of the XML file<br>■ Bits 7 - 0: SchemaSubMinorVersion; sub-minor version number of the XML file |

### 3.2.6 XmlSchemeVersion

This control 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<br>■ Bits 23 - 16: SchemaMajorVersion; major version number of the schema used by the XML file<br>■ Bits 15 - 8: SchemaMinorVersion; minor version number of the schema used by the XML file<br>■ Bits 7 - 0: SchemaSubMinorVersion; sub-minor version number of the schema used by the XML file |

### 3.2.7 XmlUrlAddress

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

| | |
|---|---|
| *INFO* | *SVS-Vistek GmbH does not support strings that reference a XML file located on the vendor's homepage.* |

| | |
|---|---|
| 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:<br>■ Local: Indicates the XML file is stored in the non-volatile memory in the device<br>■ <Filename>: Name of the XML file<br>■ <Extension>:<br>■ xml: uncompressed XML file<br>■ zip: compressed ZIP file<br>■ <Address>: Address of the file in the device memory map, given in hexadecimal notation without the first to characters "0x"<br>■ <Length>: Length of the file in Bytes, given in hexadecimal without the first to characters "0x"<br>**Example:**<br>*"Local:Mikrotron_GmbH_MC258xS11 _Rev1_15_0.xml; 8001000;16C34?SchemaVersion=1.1.0"*<br>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. |

### 3.2.8 Iidc2Address

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

| INFO | *This feature is currently not supported.* |
|---|---|

| | |
|---|---|
| Access | Read |
| Type | Unsigned integer |
| In | - |
| Out | 0x00000000 |

### 3.2.9 DeviceVendorName

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

| | |
|---|---|
| Access | Read |
| Type | String [0 ... 32] |
| In | - |
| Out | Vendor name |
| Remark | Example: SVS-Vistek GmbH |

### 3.2.10 DeviceModelName

This control provides the model name of the device as a string.

| | |
|---|---|
| Access | Read |
| Type | string [0 ... 32] |
| In | - |
| Out | Model name |
| Remark | Example: MC1066 |

### 3.2.11 DeviceManufacturerInfo

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

| | |
|---|---|
| Access | Read |
| Type | String [0 ... 48] |
| In | |
| Out | Manufacturer information |
| Remark | Example: SVS-Vistek GmbH |

### 3.2.12 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 |

### 3.2.13 DeviceSerialNumber

This control 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 |

### 3.2.14 DeviceUserID

This control 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. |

### 3.2.15 WidthAddress

Manufacturer-specific address of the ROI width.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.16 HeightAddress

Manufacturer-specific address of the ROI height.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.17 AcquisitionModeAddress

Manufacturer-specific address of the feature AcquisitionMode.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.18 AcquisitionStartAddress

Manufacturer-specific address of the feature AcquisitionStart.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.19 AcquisitionStopAddress

Manufacturer-specific address of the feature AcquisitionStop.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.20 PixelFormatAddress

Manufacturer-specific address of the feature PixelFormat.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.21 DeviceTapGeometryAddress

Manufacturer-specific address of the feature DeviceTapGeometry.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.22 Image1StreamIDAddress

Manufacturer-specific address of the feature Image1StreamID.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.23 Image2StreamIDAddress

Manufacturer-specific address of the feature Image2StreamID.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.24 ConnectionReset

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

| NOTE | It is not possible to read this register while it has the value 0x00000001. |
|---|---|

| | |
|---|---|
| Access | Read / write |
| Type | Unsigned integer |
| In | 0x00000001 |
| Out | 0x00000000 |
| Remark | A link reset will stop a running image acquisition.<br>A connection reset command via the master connection (no. 0) will reset a connection and activate its discovery connection configuration within 200 ms.<br>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. |

### 3.2.25 DeviceConnectionID

This control 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. |

### 3.2.26 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. |

### 3.2.27 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 | The control packet size in multiples of 4 Bytes |
| Remark | The control packet size is at least 128 Bytes. |

### 3.2.28 StreamPacketSizeMax

This control 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. |

### 3.2.29 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 examples:<br>■ CONNECTION1SPEED3125: One connection of 3.125 Gb/s per connection<br>■ CONNECTION2SPEED3125: Two connections of 3.125 Gb/s per connection<br>■ ...<br>■ CONNECTION4SPEED12500: Four connections of 12.5 Gb/s per connection (default) |
| Out | Connection configuration |

### 3.2.30 ConnectionConfigDefault

This control 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 |

### 3.2.31 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 | ■ "0x00000000": Normal operation<br>■ "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. |

### 3.2.32 TestErrorCountSelector

This control 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. |

### 3.2.33 TestErrorCount

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 |
| Remarks | Writing 0x00000000 to this register resets the error count for the connector referred to by the register TestErrorCountSelector to zero.<br>A connection reset sets all connection test counters to zero.<br>The error count is the number of incorrect words that have been received in test packets. |

### 3.2.34 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. |

### 3.2.35 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. |

### 3.2.36 CapabilityRegister

Indicates which optional features are supported.

| | |
|---|---|
| Access | read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.37 FeatureControlRegister

Enables and disables optional device features.

| | |
|---|---|
| Access | read / write |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.38 VersionsSupported

Indicates which CXP versions are supported.

| | |
|---|---|
| Access | read |
| Type | Integer |
| In | - |
| Out | - |

### 3.2.39 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<br>CXP_Version_2_0: 0x00020000 |

# 4 Acquisition control

## 4.1 Overview

NOTICE **Some 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 Interface |
|---|---|---|---|
| Acquisition Mode | R/W | 4 | Enumeration |
| Acquisition Start | W | 4 | Command |
| Acquisition Stop | W | 4 | Command |
| Acquisition Burst Frame Count | R/W | 4 | Enumeration |
| Acquisition Frame Rate | R/W | 4 | Integer |
| Trigger Selector | R/W | 4 | Enumeration |
| Trigger Mode | R/W | 4 | Enumeration |
| Trigger Software | WO | 4 | Integer |
| Trigger Source | R/W | 4 | Enumeration |
| Trigger Activation | R/W | 4 | Enumeration |
| Trigger Count | R/W | 4 | Integer |
| Trigger Debouncer | R/W | 4 | Integer |
| Exposure Mode | R/W | 4 | Enumeration |
| Exposure Time | R/W | 4 | Integer |

## 4.2 Controls

### 4.2.1 AcquisitionMode

Sets the acquisition mode of the device. It defines mainly the number of frames to capture during an acquisition and the way the acquisition stops.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ Continuous: Frames are captured continuously until stopped with the AcquisitionStop command. |
| Out | Selected mode |
| **Remark** | **Frame acquisition can be stopped with the feature AcquisitionStop** |

### 4.2.2 AcquisitionStart

Starts the Acquisition of the device. The number of frames captured is specified by AcquisitionMode.

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

### 4.2.3 AcquisitionStop

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

| | |
|---|---|
| Access | Write |
| Type | Command |
| In | x000000001 |
| Out | - |

### 4.2.4 AcquisitionBurstFrameCount

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

*INFO* *If FrameBurstStart is selected in TriggerSelector, ExposureMode has to be set to "Timed" to make recording possible.*

| | |
|---|---|
| Access | Read / write |
| Type | Integer |
| In | x00000001 |
| Out | The number of frames to be acquired |
| 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. |

### 4.2.5 AcquisitionFrameRate

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

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

| | |
|---|---|
| Access | Read / write |
| Type | Unsigned integer |
| In | Lowest to highest possible frame rate<br>*For frame rates, refer to the technical data sheet in the User Guide.* |
| Out | AcquisitionFrameRate |
| Remark | Incremented by 1; min. 1 |

### 4.2.6 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 |
| Out | Trigger selector type |

### 4.2.7 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<br>■ 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 | When a frame is initiated with a trigger, the exposure is started after a shutter delay of 8 µs.<br>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. |

### 4.2.8 TriggerSoftware

This feature generates an internal trigger.

| | |
|---|---|
| *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.* |

| | |
|---|---|
| Access | Write |
| Type | Command |
| In | 0x00000001 |
| Out | - |
| Remark | To generate a software trigger signal, “Software” has to be set in TriggerSource. |

### 4.2.9 TriggerSource

This feature defines the source of the trigger signal.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ line0 / line1: CXP 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.<br>■ Software: if TriggerSoftware is set, the trigger will be generated by the software using the feature Trigger- Software; no external (hardware) trigger signal is needed.<br>■ Trigger: if Trigger 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 in the feature ExposureTime. |
| Out | Active source |
| Remark | Only one trigger source can be active. |

### 4.2.10 TriggerActivation

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

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

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ RisingEdge: The camera will start acquiringe 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.<br>■ FallingEdge: The camera will start acquiring 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.<br>■ AnyEdge: The camera will start acquiring frames on the arrival of a CXP 'trigger falling edge' as well as a 'trigger rising edge' trigger packet. |
| Out | Selected activator |
| **Remarks** | **Using the activator AnyEdge doubles the maximal trigger frequency.** |

### 4.2.11 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"<br>■ Max: "0" |
| Out | The number of counted trigger signals |
| Remarks | Zero is the only value accepted and is used to reset the trigger counter. |

### 4.2.12 TriggerDebouncer

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.

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

| | |
|---|---|
| Access | Read / write |
| Type | Integer |
| In | ■ min.: 0 s<br>■ max.: 430 µs |
| Out | The set debounce period |
| Remark | The default value amounts to 1 µs. |

### 4.2.13 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: The exposure time is defined in the feature ExposureTime.<br>■ Trigger Width: The 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 set to FallingEdge it will last as long as the trigger stays low. |
| Out | Set exposure mode |
| Remark | ExposureMode is enabled in trigger mode only. When AnyEdge in TriggerActivator is selected, "Timed" has to be set. |

### 4.2.14 ExposureTime

If the exposure mode is set to "Timed" or no hardware trigger is defined, this feature defines the duration of exposure [$\mu$s].

| | |
|---|---|
| Access | Read / write |
| Type | Unsigned integer |
| In | 1 … highest possible exposure time |
| Out | Current exposure time |
| Remark | Incremented by 1 |

# 5 Transport layer control

## 5.1 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 |
|---|---|---|---|
| **Tap Geometry** | **R/W** | **4** | **Enumeration** |
| TLParamsLocked | R/W | **4** | **Integer** |
| CXP Link Configuration Status | R | **4** | **Enumeration** |
| CXP Link Configuration Preferred | | | **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** |

## 5.2 Controls

### 5.2.1 TapGeometry

The tap geometry uniquely describes with a standardized name, the geometrical properties characterizing the different taps of a multi-tap camera.

| | |
|---|---|
| Access | read/write |
| Type | enumeration |
| In | ■ Geometry_1X2_1Y: 2 taps<br>■ Geometry_1X8_1Y: 8 taps<br>■ Geometry_1X10_1Y: 10 taps |
| Out | see above |
| Remark | The available number of taps depends on the selected pixel format. |

### 5.2.2 TLParamsLocked

| | |
|---|---|
| Access | Read/write |
| Type | Integer |
| In | - |
| Out | - |

### 5.2.3 CxpLinkConfigurationStatus

Current and active link configuration of the device.

| | |
|---|---|
| Access | read |
| Type | enumeration |
| In | ■ CXP3_X1<br>■ CXP3_X2<br>■ CXP3_X4<br>■ CXP6_X1<br>■ CXP6_X2<br>■ CXP6_X4<br>■ CXP12_X1<br>■ CXP12_X2<br>■ CXP12_X4 |
| Out | - |

### 5.2.4 CxpLinkConfigurationPreferred

Provides the default link configuration of the device.

| | |
|---|---|
| Access | |
| Type | enumeration |
| In | ■ CXP3_X1<br>■ CXP3_X2<br>■ CXP3_X4<br>■ CXP6_X1<br>■ CXP6_X2<br>■ CXP6_X4<br>■ CXP12_X1<br>■ CXP12_X2<br>■ CXP12_X4 |
| Out | - |

### 5.2.5 CxpLinkConfiguration

Specifies the link configuration of the device.

| | |
|---|---|
| Access | |
| Type | enumeration |
| In | ■ CXP3_X1<br>■ CXP3_X2<br>■ CXP3_X4<br>■ CXP6_X1<br>■ CXP6_X2<br>■ CXP6_X4<br>■ CXP12_X1<br>■ CXP12_X2<br>■ CXP12_X4 |
| Out | - |

### 5.2.6 CxpConnectionSelector

Selects the CoaXPress physical connection to the control.

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

### 5.2.7 CxpConnectionTestMode

Enables the test mode.

| | |
|---|---|
| Access | |
| Type | enumeration |
| In | Off<br>Mode1 |
| Out | - |

### 5.2.8 CxpConnectionTestErrorCount

Current connection error count selected by the CxpConnectionSelector.

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

### 5.2.9 CxpConnectionTestPacketCount

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

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

# 6 Device control

## 6.1 Overview

| Display name | Access | Length [Bytes] | Interface |
|---|---|---|---|
| Device Reset | WO | 4 | Integer |

## 6.2 Controls

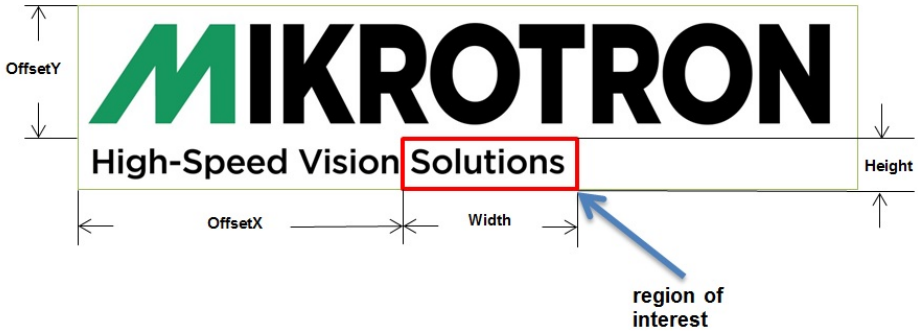
### 6.2.1 DeviceReset

This feature resets the device into power-up state.

| | |
|---|---|
| Access | Write |
| Type | Unsigned integer |
| In | 0x00000001 |
| Out | - |
| Remark | Length of 4 Bytes |

# 7 Image format control

## 7.1 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, offset X, and offset Y.

| Display name | Access | Length [Bytes] | Interface |
|---|---|---|---|
| Sensor Width | R | 4 | Integer |
| Sensor Height | R | 4 | Integer |
| Max. Width | R | 4 | Integer |
| Max. Height | R | 4 | Integer |
| Region Destination | R/W | 4 | Enumeration |
| Width | R/W | 4 | Integer |
| Height | R/W | 4 | Integer |
| Offset X | R/W | 4 | Integer |
| Offset Y | R/W | 4 | Integer |
| Binning | R/W | 4 | Enumeration |
| Pixel Format | R/W | 4 | Enumeration |
| Test Pattern | R/W | 4 | Enumeration |
| Image 1 Stream-ID | R | 4 | Integer |
| Image 2 Stream-ID | R | 4 | Integer |

## 7.2 Controls

### 7.2.1 SensorWidth

Effective width of the sensor in pixels.

| | |
|---|---|
| Access | Read only |
| Type | Unsigned integer |
| In | - |
| Out | Sensor width |

### 7.2.2 SensorHeight

Effective height of the sensor in pixels.

| | |
|---|---|
| Access | Read only |
| Type | Unsigned integer |
| In | - |
| Out | Sensor height |

### 7.2.3 WidthMax

Maximum width (in pixels) of the image.

| | |
|---|---|
| Access | Read only |
| Type | Unsigned integer |
| In | - |
| Out | Maximum usable sensor width |

### 7.2.4 HeightMax

Maximum height (in pixels) of the image.

| | |
|---|---|
| Access | Read only |
| Type | Unsigned integer |
| In | - |
| Out | Maximum usable sensor height |

### 7.2.5 RegionDestination

This control selects the destination of the image stream.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | stream0 |
| Out | Region destination |

### 7.2.6 Width

This feature provides the image width in pixels.

| | |
|---|---|
| Access | Read / write |
| Type | Unsigned integer |
| In | ■ Min: 128 px<br>■ Max: Sensor width |
| Out | Image width |
| Remark | Incremented by 32 px |

### 7.2.7 Height

This feature provides the image height in pixels.

| | |
|---|---|
| Access | Read / write |
| Type | Unsigned integer |
| In | ■ Min: 32 px<br>■ Max: sensor height |
| Out | Image height |
| Remark | Incremented by 32 px |

### 7.2.8 OffsetX

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

| | |
|---|---|
| Access | Read / write |
| Type | Unsigned integer |
| In | ■ Min.: 0 px<br>■ Max.: Sensor width -128 px |
| Out | Horizontal offset |
| Remark | Incremented by 32 px |

### 7.2.9 OffsetY

Vertical offset from the origin to the region of interest in pixels.

| | |
|---|---|
| Access | Read / write |
| Type | Unsigned integer |
| In | ■ Min.: 0 px<br>■ Max.: Sensor height -32 px |
| Out | Vertical offset |
| Remark | Incremented by 32 px |

### 7.2.10 Binning

Enables or disables horizontal and vertical pixel binning of the sensor.

| | |
|---|---|
| Access | read / write |
| Type | Boolean |
| In | 0 = OFF<br>1 = ON |
| Out | |
| **Remarks** | **Expert feature** |

### 7.2.11 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 or 12 bit, respectively. For colourcameras, the order of the Bayer pattern can be selected.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | Mono8<br>■ monochrome, 8 bit/pixel (default)<br>■ monochrome, colourcamera<br>Mono10<br>■ monochrome, 10 bit/pixel packed<br>■ monochrome, colourcamera<br>Mono12<br>■ monochrome, 12 bit/pixel packed<br>■ monochrome, colourcamera<br>Bayerxx8 / Bayerxx10 / Bayerxx12<br>■ order of the Bayer pattern in a colourimage<br>■ colourcamera |
| Out | See above |
| Remark | The available pixel formats depend on the camera connected (monochrome or color) |

### 7.2.12 Testpattern

Selects the type of test pattern that is generated by the device as image source.

| | |
|---|---|
| Access | read / write |
| Type | enumeration |
| In | ■ Off<br>■ GreyHorizontalRampMoving<br>■ Test pattern |
| Out | Test pattern |

### 7.2.13 Image1StreamID

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

| | |
|---|---|
| Access | Read only |
| Type | Unsigned integer |
| In | - |
| Out | 0x00000000 |

### 7.2.14 Image2StreamID

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

| | |
|---|---|
| Access | Read only |
| Type | Unsigned integer |
| In | - |
| Out | 0x00000000 |

# 8 Analog control

## 8.1 Overview

| Display name | Access | Length [Bytes] | Interface |
|---|---|---|---|
| Gain Selector | R/W | 4 | Enumeration |
| Gain | R/W | 4 | Float |
| Black Level | R/W | 4 | Integer |
| Gamma | R/W | 4 | Float |

## 8.2 Controls

### 8.2.1 GainSelector

Selects which gain is controlled by the various gain features. After selecting, the settings for the corresponding gain can be defined.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | 0: Analog gain<br>1: Digital gain |
| Out | **Selected gain** |

### 8.2.2 Gain

Gain is used to increase the brightness of the image. When gain is increased, all pixel values of the image will be increased, i.e. the whole image becomes brighter.

| | |
|---|---|
| Access | Read / write |
| Type | Float |
| In | ■ Analog gain<br>◦ 0 (= 1x)<br>◦ 1 (= 1.2x)<br>◦ 2 (= 1.6x - default gain)<br>◦ 3 (= 3.9x)<br>◦ 4 (= 8.2x)<br>■ Digital gain - The values are incremented by "0.25".<br>◦ 1 ... 4 |
| Out | **The current gain value** |

### 8.2.3 BlackLevel

Black level defines the brightness in the darkest part of the image. Possible black level settings are values between 0 and 255. If the setting is correct, the sensor will deliver the pixel value 0 for a completely black image. If it is too high, the sensor will deliver a pixel value greater than 0 for black which means 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 | Integer |
| In | 0 ... 255 |
| Out | The current black level value |
| Remark | The values are incremented by "1" |

### 8.2.4 Gamma

Controls the gamma correction of pixel intensity.

| | |
|---|---|
| Access | Read / write |
| Type | Float |
| In | Min: 0.1<br>Max.: 3.0 |
| Out | **Selected gamma** |
| Remark | Incremented in steps of 01. |

# 9 Digital I/O control

## 9.1 Overview

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

## 9.2 Controls

### 9.2.1 LineSelector

This feature selects the physical output line to be configured with the commands LineSource and LineInverter.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ OUT0<br>■ OUT1 |
| Out | Selected output of the Hirose connector |
| **Remark** | **Expert feature** |

### 9.2.2 LineSource

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

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ ExposureActive: STRB (0)<br>■ StreamTransferActive: data transmission state (1)<br>■ ExtTriggerSignalState: state of the external trigger (2)<br>■ UserOutput0: state of the user output bit 0<br>■ UserOutput1: state of the user output bit 1 |
| Out | Selected signal |
| Remark | Expert feature |

### 9.2.3 LineInverter

Controls the inversion of the signal of the selected line.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ ON: inverted = 1<br>■ OFF: not inverted = 0 |
| Out | According to setting |
| Remark | Default is 0 (not inverted); expert feature |

### 9.2.4 UserOutputSelector

This feature selects the variable UserOutput0 or UserOutput1. The level of the selected variable can be defined by the feature UserOutputValue.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ UserOutput1 = 1<br>■ UserOutput0 = 0 |
| Out | Status of the variable |
| **Remark** | **Expert feature** |

### 9.2.5 UserOutputValue

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

| | |
|---|---|
| Access | Read / write |
| Type | Boolean |
| In | ■ high = 1<br>■ low = 0 |
| Out | Status of the bit |
| **Remark** | **Expert feature** |

# 10 User set control

## 10.1 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 |

## 10.2 Controls

### 10.2.1 UserSetSelector

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

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

### 10.2.2 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.<br>The default user set is a set of factory settings. |

### 10.2.3 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.<br>The user set “Default” is a set of factory settings and cannot be overwritten. |

### 10.2.4 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<br>■ UserSet1: selects the first user set<br>■ UserSet2: selects the second user set<br>■ UserSet3: selects the third user set |
| Out | Active default user set |
| Remark | The user set selector "Default" is preselected. |

# 11 File access control

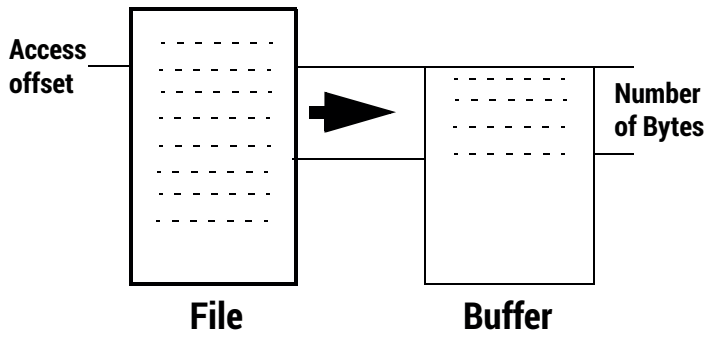
## 11.1 Overview

| 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 |

### Defining the access

When reading or writing data into or from the camera, the following options must be defined:

- Where the access buffer gets mapped to the file
- The length of the file by the number of bytes to be read or written




1. Select the file to be accessed.
2. Call the "open" command.
3. Execute the "open" command.
4. Define the data section that will be loaded into the buffer (the file length is displayed in "file size").
5. Define the operation ("write", "read", "delete", ...).

6. Execute the operation.
7. Close the file.

Starting with the access offset, the defined number of bytes will be written into the buffer.

## 11.2 Controls

### 11.2.1 FileSelector

This command selects one of the available files stored in the camera flash memory.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | File name: DefectPixelMap |
| Out | - |
| **Remark** | **Only the file "defect pixel map" is available.** |

### 11.2.2 FileOperationSelector

This feature selects the target operation for the selected file.

| | |
|---|---|
| Access | Read / write |
| Type | Unsigned integer |
| In | ■ Open: Opens the file, 0x00000004<br>■ Close: Closes the file, 0x00000008<br>■ Read: Reads from the file, 0x00000001<br>■ Write: Writes into the file, 0x00000002<br>■ Delete: Deletes the file, 0x00000020 |
| Out | - |

### 11.2.3 FileOperationExecute

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

| | |
|---|---|
| Access | Write only |
| Type | Unsigned integer |
| In | 0 |
| Out | - |
| **Remark** | **Each operation has to be executed.** |

### 11.2.4 FileOpenMode

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

| | |
|---|---|
| Access | Read / write |
| Type | Unsigned integer |
| In | ■ Read: Reads from the file, 0x00000001<br>■ Write: Writes into the file, 0x00000002<br>■ ReadWrite: Reads from and writes into the file, 0x00000010 |
| Out | - |

### 11.2.5 FileAccessBuffer

Address of the access buffer Byte array.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | Any existing file |
| **Out** | **-** |
| Remark | The buffer size amounts to up to 0x40000 Bytes.<br>■ Start address: 0x30000000<br>■ End address: 0x30040000 or max. file length |

### 11.2.6 FileAccessOffset

Defines where the start of the access buffer gets mapped to the file.

| | |
|---|---|
| Access | Read / write |
| Type | Integer |
| In | Start address in the selected file |
| Out | - |
| **Remark** | ■ Min.: 0<br>■ Max.: file length |

### 11.2.7 FileAccessLength

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

| | |
|---|---|
| Access | Read / write |
| Type | Integer |
| In | Number of Bytes to be read/written to or from the file |
| Out | - |
| **Remark** | **access length ≤ file length - access offset** |

### 11.2.8 FileOperationStatus

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

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

### 11.2.9 FileOperationResult

Displays the number of bytes successfully read and written.

| | |
|---|---|
| Access | Read |
| Type | Integer |
| In | - |
| Out | Number of successfully operated Bytes |
| Remarks | The number of successfully written bytes is only displayed when the file operation is successful. |

### 11.2.10 FileSize

Displays the size of the selected file after the file is opened.

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

# 12 Custom features

## 12.1 Overview

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

| Display name | Access | Length [Bytes] | Interface |
|---|---|---|---|
| Device Information Selector | R/W | 4 | Enumeration |
| Device Information | RO | 4 | Integer |
| Frame Counter Info Enable | R/W | 4 | Boolean |
| Time Stamp Enable | R/W | 4 | Boolean |
| ROI Info Enable | R/W | 4 | Boolean |
| Line FPN Reduction | R/W | 4 | Enumeration |
| Number of Connections | R/W | 4 | Integer |
| Defect Pixel Correction | R/W | 4 | Enumeration |
| Mark Defect Pixel | R/W | 4 | Integer |
| Fan Speed | R/W | 4 | Integer |
| Fan RPM | RO | 4 | Integer |

## 12.2 Controls

### 12.2.1 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)<br>■ InfoType: camera type / model<br>■ InfoSubType: camera sub type<br>■ InfoHwRevision: camera hardware revision<br>■ InfoFpgaVersion: camera FPGA program version<br>■ InfoSwVersion: microcontroller software version<br>■ InfoPwrSource: returns the source of the camera power supply (external power supply or PoC)<br>■ InfoPwrConsumption: actual power consumption of the camera in [µA]<br>■ InfoPwrVoltage: actual voltage of the camera power supply in [mV]<br>■ InfoTemperature: sensor temperature in 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. |

### 12.2.2 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:<br>■ InfoSnr: serial number of the camera (same as feature DeviceID); e.g. 0x00000132<br>■ InfoType: camera type/model; e.g.: 0x00001066 for camera model MC1066<br>■ InfoSubType: sub type number of the camera model; this number describes models with special features or a customized version; e.g. 0x00000001<br>■ InfoHwRevision: describes the revision of the camera hardware, e.g. 0x0103000B for revision 1.3 Build 11<br>◦ bits 31-24: major revision number<br>◦ bits 23-16: minor revision number<br>◦ bits 15-00: build number<br>■ InfoFpgaVersion: version of the FPGA program of the camera, e.g. 0x02050001 for Version 2.5 Build 1<br>◦ bits 31-24: major version number<br>◦ bits 23-16: minor version number<br>◦ bits 15-00: build number<br>■ InfoSwVersion: version of the microcontroller software, e.g. 0x020F0011 for Version 2.15 Build 17<br>◦ bits 31-24: major version number<br>◦ bits 23-16: minor version number<br>◦ bits 15-00: 15-00<br>■ InfoPwrSource: returns the source of the camera power supply with value 0: external power supply<br>■ InfoPwrConsumption: returns the actual power consumption of the camera in [µA]; e.g: 0x00066580 for 419200 µA = 0.4192 A<br>■ InfoPwrVoltage: returns the actual voltage of the camera power supply in [mV]; e.g.: 0x2E4A for 11850 mV = 11.85 Volt<br>■ 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. |

### 12.2.3 InfoFieldFrameCounterEnable

This feature enables or disables the Frame Counter that can be added to the info field in the image. If this option is enabled, a frame counter will be superimposed upon 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".

| | |
|---|---|
| Access | Read / write |
| Type | Boolean |
| In | ■ ON: 1<br>■ OFF: 0 |
| Out | ■ Pixel 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".<br>■ Pixel 1: frame counter, bits 15 ... 8<br>■ Pixel 2: frame counter, bits 16 ... 23<br>■ Pixel 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". |
| **Remark** | **In 10 bit mode the bits 1 ... 0 in each pixel will be set to "0"; guru feature.** |

### 12.2.4 InfoFieldTimeStampEnable

This feature enables or disables the time stamp filed in the image. If this feature is enabled, a 32 bit time stamp will be superimposed on 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.

| | |
|---|---|
| Access | Read / write |
| Type | Boolean |
| In | ■ ON: time stamp is enabled (1)<br>■ OFF: time stamp is disabled (0) |
| Out | ■ Pixel 4: counter bits 0 ... 7 (LSB)<br>■ Pixel 5: counter bits 8 ... 15<br>■ Pixel 6: counter bits 16 ... 23<br>■ Pixel 7: counter bits 24 ... 31 (MSB) |
| **Remark** | **Guru feature** |

### 12.2.5 InfoFieldRoiEnable

This feature enables or disables the ROI info field in the image. If this option is enabled, ROI info data will be superimposed upon each captured frame or ROI. The ROI info occupies 8 pixels in the upper left corner of each frame, starting with pixel number 8.

| | |
|---|---|
| Access | Read / write |
| Type | Boolean |
| In | ■ ON: ROI info field is enabled (1)<br>■ OFF: ROI info field is disabled (0) |
| Out | ■ Pixel 8: horizontal offset, LSB, bits 0 … 7<br>■ Pixel 9: horizontal offset, MSB, bits 8 … 15<br>■ Pixel 10: width, LSB, bits 0 … 7<br>■ Pixel 11: width, MSB, bits 8 … 15<br>■ Pixel 12: vertical offset, LSB, bits 0 … 7<br>■ Pixel 13: vertical offset, MSB, bits 8 … 15<br>■ Pixel 14: height, LSB, bits 0 … 7<br>■ Pixel 15: height, MSB, bits 8 … 15 |
| **Remark** | Guru feature; to get the value for one of the ROI parameters, multiply its MSB with 256 and add the LSB to the multiplied HSB.<br>Example<br>ROI width = pixel 10 and 11;<br>value of pixel 10 = 224,<br>value of pixel 11 = 1<br>ROI width = 1 x 256 + 224 = 640 |

### 12.2.6 LineFPNReduction

This feature switches the Line FPN reduction on or off.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ ON: FPN reduction is enabled<br>■ OFF: FPN reduction is disabled |
| Out | Status (ON/OFF) |

### 12.2.7 NumberOFConnections

This feature displays the number of available CXP connections.

| | |
|---|---|
| Access | Read/write |
| Type | Integer |
| In | |
| Out | Number of connections |

### 12.2.8 DefectPixelCorrection

This feature switches the defect pixel correction on or off.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ **ON:** defect pixel correction is enabled<br>■ **OFF:** defect pixel correction is disabled |
| Out | Status (ON/OFF) |
| Remark | Only available with binning disbled |

### 12.2.9 MarkDefectPixel

This feature marks defective pixels.

| | |
|---|---|
| Access | Read / write |
| Type | Enumeration |
| In | ■ **ON:** defect pixel marking is enabled<br>■ **OFF:** defect pixel marking is disabled |
| Out | status (ON/OFF) |

### 12.2.10 FanSpeed

This feature defines the speed of the camera fan in percent. The default setting is 100%.

| | |
|---|---|
| *INFO* | *This setting only applies to cameras with an attached fan, i.e cameras with an "F" in the model name ("MC1066F").* |

| | |
|---|---|
| Access | Read / write |
| Interface | Integer |
| Range | 50% … 100% |
| Out | The current fan speed |
| Remark | The values are incremented by "1" |

### 12.2.11 FanRpm

This feature displays the speed of the camera fan in rotations per minute.

| | |
|---|---|
| *INFO* | *This setting only applies to cameras with an attached fan, i.e cameras with an "F" in the model name ("MC1066F").* |

| | |
|---|---|
| Access | Read |
| Interface | Integer |
| **Range** | **0 … 12000** |
| Out | The current fan speed in rpm |

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