TECHNICAL REFERENCE

FLIR FIREFLY®

FFY-U3-16S2M-DL

USB3 VISION™

Revised
9/26/2019

FLIR® The World's Sixth Sense®

FCC Compliance

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesirable operation.

Korean EMC Certification

The KCC symbol indicates that this product complies with Korea's Electrical Communication Basic Law regarding EMC testing for electromagnetic interference (EMI) and susceptibility (EMS). This equipment has received a conformity assessment for use in a business environment, and it may cause radio frequency interference if it is used in a home environment.

Hardware Warranty

The warranty for the Firefly camera is 3 years. For detailed information on how to repair or replace your camera, please see the terms and conditions on our website.

Export Control

The ECCN for this product is EAR099.

WEEE

The symbol indicates that this product may not be treated as household waste. Please ensure this product is properly disposed as inappropriate waste handling of this product may cause potential hazards to the environment and human health. For more detailed information about recycling of this product, please contact us.

Trademarks

Names and marks appearing on the products herein are either registered trademarks or trademarks of FLIR Systems, Inc. and/or its subsidiaries.

Licensing

To view the licenses of open source packages used in this product please see What open source packages does firmware use?

Table of Contents

1 Firefly Technical Reference

Welcome to the Firefly camera. We offer a number of resources to assist you with the Firefly.

- **Spinnaker SDK**—software development kit that provides GenICam-compliant controls to create applications for the camera. Spinnaker is available for download. Each installation includes API documentation for C, C++, and C#.
- **Release Notes**—information about the current firmware release including feature additions or changes, bug fixes, and known issues.
- **Specifications**—information about the camera model as it performs with the current firmware.
- **Getting Started**—quick start guide for installing the camera and software.
- **Installation Guide**—information about installing the camera and SDK, the physical interface and mechanical properties, troubleshooting and how to get help. This document is available as a PDF for download or as a webpage included in the firmware release package.
- **Technical Reference**—information about the features supported by the camera model with the current firmware, including: image format control, acquisition control, sequencing, binning/decimation, and others. This document is available as a PDF for download or as a webpage included in the firmware release package.
- **Firmware**—programming inserted into the programmable ROM of the camera that can be updated in-field. New firmware packages are available for download and include both the firmware file and documentation.

These resources as well as knowledge base articles and application notes can be found on the Support page for the product.

Firefly S Support Articles
Firefly DL Support Articles
Firefly S Resources
Firefly DL Resources

2 Specifications and Frame Rates

2.1 General Specifications

	Firefly FFY-U3-16S2M-DL
Firmware Version	1905.4.49.0
Model Name	Firefly FFY-U3-16S2M-DL
Resolution	1440x1080
Frame Rate	60 FPS
Megapixels	1.6 MP
Sensor	Sony IMX296, CMOS, 1/2.9"
Readout Method	Global shutter
Pixel Size	3.45 µm
Lens Mount	S-mount
ADC	10-bit
Minimum Frame Rate	1 FPS
Gain Range	0.0 to 48.0 dB
Exposure Range	29.0 µs to 30.0 S
Acquisition Mode	Continuous, Single Frame, Multi Frame
Partial Image Modes	Pixel binning, ROI
Image Processing	Gamma, lookup table, and sharpness
Image Buffer	32 MB
User Sets	2 user configuration sets for custom camera settings
Flash Memory	24 MB non-volatile memory
Opto-isolated I/O	N/A
Non-isolated I/O	4 bi-directional
Serial Port	1 (over non-isolated I/O)
Auxiliary Output	3.3 V, 120 mA maximum
Interface	USB 3.1
Power Requirements	5 V via USB 3.1 interface
Power Consumption	2.2 W
Dimensions/Mass	27 mm x 27 mm x 14.5 mm / 20 g
Machine Vision Standard	USB3 Vision v1.0

	Firefly FFY-U3-16S2M-DL
Compliance	CE, FCC, KCC, RoHS, REACH. The ECCN for this product is: EAR099
Temperature	Operating: 0°C to 85°C (case) Storage: -30°C to 60°C (ambient)
Humidity	Operating: 20% to 80% (no condensation) Storage: 20% to 95% (no condensation)
Warranty	3 years

2.2 Firefly FFY-U3-16S2M-DL Supported Pixel Formats

8-bit	16-bit
mono8	mono16

2.3 Firefly FFY-U3-16S2M-DL Frame Rate Table

Width	Height	Mono8 (8-bit)	Mono16 (16-bit)	ISP	Binning Horizontal	Binning Vertical	Decimation Horizontal	Decimation Vertical	ADC
1440	1080	60	60	Off	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
800	600	107	107	Off	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
600	800	81	81	Off	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
640	480	132	132	Off	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
480	640	100	100	Off	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
320	240	199	199	Off	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
240	320	192	192	Off	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
1440	1080	60	60	On	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
800	600	107	107	On	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
600	800	81	81	On	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
640	480	132	132	On	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
480	640	100	100	On	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
320	240	199	199	On	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
240	320	192	192	On	1xSensor/1xISP	1xSensor/1xISP	1xSensor	1xSensor	10-bit
720	540	121	121	On	2xSensor/1xISP	2xSensor/1xISP	1xSensor	1xSensor	10-bit

3 Acquisition Control

3.1 Acquisition and Frame Rate

There are three acquisition modes:

Continuous - acquires images continuously. This is the default mode.

Multi Frame - acquires a specified number of images before stopping acquisition.

Single Frame - acquires 1 image before stopping acquisition.

Use AcquisitionMode to select your mode. If you select MultiFrame, use AcquisitionFrameCount to specify the number of images to acquire.

Use AcquistionStart and AcquisitionStop to start and stop acquiring images with the selected mode.

The Acquisition Frame Rate can be manually or automatically controlled. Use AcquisitionFrameRateEnable to set this On (manual control) or Off (automatic control). By default, this is Off. If you select manual control, use AcquisitionFrameRate to specify a frame rate.

The ResultingFrameRate reports the actual frame rate at which the camera is streaming. If this does not equal the Acquisition Frame Rate it is because the Exposure Time is greater than the frame time.

3.2 Exposure Time Modes

There are two exposure time modes:

Timed - exposure time is a specified value.

TriggerWidth - exposure time is controlled by the trigger signal.

Use ExposureMode to make a selection.

When ExposureMode is set to Timed, exposure time can be manually or automatically controlled.

For manual control, set ExposureAuto to Off (this is the default mode). Use the ExposureTime control to set the exposure time in microseconds.

For automatic control, set ExposureAuto to Once or Continuous. The camera automatically adjusts the exposure to maximize the dynamic range. Once briefly enables automatic exposure to adapt the device and then sets exposure to manual control (Off). Continuous constantly adapts the device. Continuous is the default setting.

Note: For the Auto Exposure feature, gain and/or exposure time must be set to Continuous.

3.2.1 Trigger Features

Triggering allows you to acquire images at specific times when an event occurs. Triggering works with the acquisition modes and settings. By default, triggering is set to Off. To enable triggering, set TriggerMode to On.

Trigger Type - three options to control the start of triggering. Use TriggerSelector to select an option.

Acquisition Start - A trigger starts acquisition in the selected AcquisitionMode.

In Single Frame mode, the trigger acquires one image.

In Multi Frame mode, the trigger acquires the specified number of images.

In Continuous mode, the trigger acquires images until you stop acquisition.

Frame Start - A trigger is required for each individual image that is acquired.

In Single Frame mode, the trigger acquires one image. For each subsequent trigger you first must use AcquisitionStart to receive more images.

In Multi Frame mode, the trigger acquires the specified number of images. For each subsequent trigger you first must use AcquisitionStart to receive more images.

In Continuous mode, the trigger acquires one image. You do not have to start acquisition again for subsequent triggers.

Trigger Source - Use TriggerSource to specify the source that can signal the acquisition to acquire images. A trigger source can be one of the physical Line Inputs or Software.

Trigger Activation - Use TriggerActivation to specify what voltage level or transition that activates a trigger. Trigger activation can be Level Low, Level High, Falling Edge, or Rising Edge.

Trigger Software - If your trigger source is set to Software, use TriggerSoftware to perform a software trigger.

3.3 Summary Table

Name	Interface	Access	Visibility	Description
AcquisitionMode	IEnumeration		Beginner	Sets the acquisition mode of the device. Continuous: acquires images continuously. Multi Frame: acquires a specified number of images before stopping acquisition. Single Frame: acquires 1 image before stopping acquisition.
AcquisitionStart	ICommand		Beginner	This command starts the acquisition of images.
AcquisitionStop	ICommand		Beginner	This command stops the acquisition of images.
AcquisitionFrameCount	IInteger		Beginner	Number of images to acquire during a multi frame acquisition.
ExposureMode	IEnumeration	RW	Beginner	Sets the operation mode of the Exposure.
ExposureTime	IFloat		Beginner	Exposure time in microseconds when Exposure Mode is Timed.
ExposureAuto	IEnumeration		Beginner	Sets the automatic exposure mode
AcquisitionFrameRate	IFloat		Beginner	User controlled acquisition frame rate in Hertz

Name	Interface	Access	Visibility	Description
Resulting Frame Rate	IFloat	RO	Beginner	Resulting frame rate in Hertz. If this does not equal the Acquisition Frame Rate it is because the Exposure Time is greater than the frame time.
Acquisition Frame Rate Enable	IBoolean	RW	Beginner	If enabled, AcquisitionFrameRate can be used to manually control the frame rate.
Acquisition Line Rate	IFloat		Beginner	Controls the rate (in Hertz) at which the Lines in a Frame are captured.
Trigger Selector	IEnumeration	RW	Beginner	Selects the type of trigger to configure.
Trigger Mode [Trigger Selector]	IEnumeration	RW	Beginner	Controls whether or not trigger is active.
Trigger Software [Trigger Selector]	ICommand	WO	Beginner	Generates an internal trigger if Trigger Source is set to Software.
Trigger Source [Trigger Selector]	IEnumeration	RW	Beginner	Specifies the internal signal or physical input line to use as the trigger source.
Trigger Activation [Trigger Selector]	IEnumeration	RW	Beginner	Specifies the activation mode of the trigger.
Sensor Shutter Mode	IEnumeration	RW	Guru	Sets the shutter mode of the device.

3.4 Acquisition Control Features

3.4.1 Acquisition Mode

Sets the acquisition mode of the device. Continuous: acquires images continuously. Multi Frame: acquires a specified number of images before stopping acquisition. Single Frame: acquires 1 image before stopping acquisition.

Property	Value
Name	AcquisitionMode
Interface	IEnumeration
Access	
Visibility	Beginner

Enumeration Values
Continuous
SingleFrame
MultiFrame

3.4.2 Acquisition Start

This command starts the acquisition of images.

Property	Value
Name	AcquisitionStart
Interface	ICommand
Access	
Visibility	Beginner

3.4.3 Acquisition Stop

This command stops the acquisition of images.

Property	Value
Name	AcquisitionStop
Interface	ICommand
Access	
Visibility	Beginner

3.4.4 Acquisition Frame Count

Number of images to acquire during a multi frame acquisition.

Property	Value
Name	AcquisitionFrameCount
Interface	IInteger
Access	
Unit	
Visibility	Beginner

3.4.5 Exposure Mode

Sets the operation mode of the Exposure.

Property	Value
Name	ExposureMode
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values
Timed
TriggerWidth

3.4.6 Exposure Time

Exposure time in microseconds when Exposure Mode is Timed.

Property	Value
Name	ExposureTime
Interface	IFloat
Access	
Unit	us
Visibility	Beginner

3.4.7 Exposure Auto

Sets the automatic exposure mode

Property	Value
Name	ExposureAuto
Interface	IEnumeration
Access	
Visibility	Beginner

Enumeration Values
Off
Once
Continuous

3.4.8 Acquisition Frame Rate

User controlled acquisition frame rate in Hertz

Property	Value
Name	AcquisitionFrameRate
Interface	IFloat
Access	
Unit	Hz
Visibility	Beginner

3.4.9 Resulting Frame Rate

Resulting frame rate in Hertz. If this does not equal the Acquisition Frame Rate it is because the Exposure Time is greater than the frame time.

Property	Value
Name	AcquisitionResultingFrameRate
Interface	IFloat

Property	Value
Access	RO
Unit	Hz
Visibility	Beginner

3.4.10 Acquisition Frame Rate Enable

If enabled, AcquisitionFrameRate can be used to manually control the frame rate.

Property	Value
Name	AcquisitionFrameRateEnable
Interface	IBoolean
Access	RW
Visibility	Beginner

3.4.11 Acquisition Line Rate

Controls the rate (in Hertz) at which the Lines in a Frame are captured.

Property	Value
Name	AcquisitionLineRate
Interface	IFloat
Access	
Unit	Hz
Visibility	Beginner

3.4.12 Trigger Selector

Selects the type of trigger to configure.

Property	Value
Name	TriggerSelector
Interface	IEnumeration

Property	Value
Access	RW
Visibility	Beginner

Enumeration Values
AcquisitionStart
FrameStart

3.4.13 Trigger Mode

Controls whether or not trigger is active.

Property	Value
Name	TriggerMode [Trigger Selector]
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values
Off
On

3.4.14 Trigger Software

Generates an internal trigger if Trigger Source is set to Software.

Property	Value
Name	TriggerSoftware [Trigger Selector]
Interface	ICommand
Access	WO
Visibility	Beginner

3.4.15 Trigger Source

Specifies the internal signal or physical input line to use as the trigger source.

Property	Value
Name	TriggerSource [Trigger Selector]
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values
Software
Line0
Line1
Line2
Line3
UserOutput0
UserOutput1
UserOutput2
UserOutput3
InferenceReady

3.4.16 Trigger Activation

Specifies the activation mode of the trigger.

Property	Value
Name	TriggerActivation [Trigger Selector]
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values
LevelLow
LevelHigh
FallingEdge
RisingEdge

3.4.17 Sensor Shutter Mode

Sets the shutter mode of the device.

Property	Value
Name	SensorShutterMode
Interface	IEnumeration
Access	RW
Visibility	Guru

Enumeration Values
Global

4 Analog Control

4.1 Gain

Gain is the amount of amplification that is applied to a pixel by the A/D converter. An increase in gain can result in a brighter image but also an increase in noise.

Gain can be manually or automatically controlled.

Use the Gain Selector to choose which gain to control. The All selection is a total amplification across all channels (or taps).

For manual control, set GainAuto to Off. Use the Gain control to set the amplification in dB.

For automatic control, set GainAuto to Once or Continuous. The camera automatically adjusts the gain to maximize the dynamic range. Once briefly enables automatic gain to adapt the device and then sets gain back to manual control (Off). Continuous constantly adapts the device.

Note: For the Auto Exposure feature, gain and/or exposure time must be set to Once or Continuous.

4.2 Black Level

The Black Level feature controls the offset applied to the video signal. It determines the image average when there is no light reaching the sensor.

There are two methods of applying black level: **Analog** and **Digital**. The analog black level controls the offset applied during analog-to-digital (A/D) conversion. The digital black level is an offset applied after the image has been digitized.

The sum of the analog and digital black levels can be set and read by setting Black Level Selector to **All** and then using the Black Level feature to enter or view the percentage offset.

Only the total black level (All) can be set by the user. Based on the value of black level All, the analog and digital black levels are automatically set to achieve the requested total black level.

4.3 Gamma

The Gamma feature controls the gamma correction applied to pixel intensity. The equation used is:

$$P' = P^{\text{Gamma}}$$

where P is the input pixel value and P' is the pixel value after gamma correction. Note that the value for Gamma is defined as the power applied to the pixel value, and not the gamma of the display. If a display with a gamma of 2.0 is used, the image gamma can be set to 0.5 to compensate. For sRGB output, Gamma should be set to 0.4545 (1/2.2).

If linear output data is required, disable gamma by setting GammaEnable to 0.

4.4 Sharpening

The sharpening features control how sharp the image looks.

Sharpening can be enabled (On) or disabled (Off). By default sharpening is disabled. Use Sharpening Enable to switch on or off.

When sharpening is enabled, the remaining sharpening features take effect. When it is disabled, the image is not sharpened.

Sharpening is applied only to an intensity gradient change that is above a specified threshold. This prevents sharpening from amplifying subtle intensity variances in what are otherwise smooth patches, but allows significant edges to be more pronounced.

The threshold is specified as a fraction of the total intensity range, and ranges from 0 to 0.25. A threshold higher than 25% produces little to no difference than 25%. High thresholds sharpen only areas with significant intensity changes. Low thresholds sharpen more areas.

The sharpening threshold can be controlled manually or automatically.

For manual control, set Sharpening Auto to Off. Then set a Sharpening Threshold value to indicate the minimum intensity gradient change to invoke sharpening.

For automatic control, set Sharpening Auto to On. With automatic control, the value of the Sharpening Threshold is set based on the noise level of the camera.

Adjust the sharpening amount with the Sharpening control. This value controls how much to amplify the edges above the Sharpening threshold. A value of 0 does not apply any sharpening. A negative value smooths the image. A positive value amplifies the edges of the image. You can boost by a maximum of 8x, but smoothing is limited to 1x. The default value is 2.0.

4.5 Summary Table

Name	Interface	Access	Visibility	Description
Gain Selector	IEnumeration		Beginner	Selects which gain to control. The All selection is a total amplification across all channels (or taps).
Gain [Gain Selector]	IFloat		Beginner	Controls the amplification of the video signal in dB.
Gain Auto	IEnumeration		Beginner	Sets the automatic gain mode. Set to Off for manual control. Set to Once for a single automatic adjustment then return to Off. Set to Continuous for constant adjustment. In automatic modes, the camera adjusts the gain to maximize the dynamic range.
Black Level Selector	IEnumeration		Beginner	Selects which black level to control. Only All can be set by the user. Analog and Digital are read-only.
Black Level [Black Level Selector]	IFloat		Beginner	Controls the offset of the video signal in percent.

Name	Interface	Access	Visibility	Description
Black Level Clamping Enable	IBoolean	RW	Guru	Enable the black level auto clamping feature which performs dark current compensation. This feature is not supported by rolling shutter sensors.
Gamma	IFloat		Beginner	Controls the gamma correction of pixel intensity.
Gamma Enable	IBoolean		Beginner	Enables/disables gamma correction.
Sharpening Enable	IBoolean	RW	Beginner	Enables/disables the sharpening feature. Sharpening is disabled by default.
Sharpening	IFloat	RW	Beginner	Controls the amount to sharpen a signal. The sharpened amount is proportional to the difference between a pixel and its neighbors. A negative value smooths out the difference, while a positive value amplifies the difference. You can boost by a maximum of 8x, but smoothing is limited to 1x (in float). Default value: 2.0
Denoise Enable	IBoolean		Beginner	Enables/disables the denoise feature. Denoising is disabled by default.
Denoising	IInteger		Beginner	Controls the amount to denoise a signal.

4.6 Analog Control Features

4.6.1 Gain Selector

Selects which gain to control. The All selection is a total amplification across all channels (or taps).

Property	Value
Name	GainSelector
Interface	IEnumeration
Access	
Visibility	Beginner

Enumeration Values

All

4.6.2 Gain

Controls the amplification of the video signal in dB.

Property	Value
Name	Gain [Gain Selector]
Interface	IFloat
Access	
Unit	dB
Visibility	Beginner

4.6.3 Gain Auto

Sets the automatic gain mode. Set to Off for manual control. Set to Once for a single automatic adjustment then return to Off. Set to Continuous for constant adjustment. In automatic modes, the camera adjusts the gain to maximize the dynamic range.

Property	Value
Name	GainAuto
Interface	IEnumeration
Access	
Visibility	Beginner

Enumeration Values
Off
Once
Continuous

4.6.4 Black Level Selector

Selects which black level to control. Only All can be set by the user. Analog and Digital are read-only.

Property	Value
Name	BlackLevelSelector
Interface	IEnumeration
Access	
Visibility	Beginner

Enumeration Values
All
Analog
Digital

4.6.5 Black Level

Controls the offset of the video signal in percent.

Property	Value
Name	BlackLevel [Black Level Selector]
Interface	IFloat
Access	
Unit	%
Visibility	Beginner

4.6.6 Black Level Clamping Enable

Enable the black level auto clamping feature which performs dark current compensation. This feature is not supported by rolling shutter sensors.

Property	Value
Name	BlackLevelClampingEnable
Interface	IBoolean
Access	RW
Visibility	Guru

4.6.7 Gamma

Controls the gamma correction of pixel intensity.

Property	Value
Name	Gamma
Interface	IFloat

Property	Value
Access	
Unit	
Visibility	Beginner

4.6.8 Gamma Enable

Enables/disables gamma correction.

Property	Value
Name	GammaEnable
Interface	IBoolean
Access	
Visibility	Beginner

4.6.9 Sharpening Enable

Enables/disables the sharpening feature. Sharpening is disabled by default.

Property	Value
Name	SharpeningEnable
Interface	IBoolean
Access	RW
Visibility	Beginner

4.6.10 Sharpening

Controls the amount to sharpen a signal. The sharpened amount is proportional to the difference between a pixel and its neighbors. A negative value smooths out the difference, while a positive value amplifies the difference. You can boost by a maximum of 8x, but smoothing is limited to 1x (in float). Default value: 2.0

Property	Value
Name	Sharpening
Interface	IFloat

Property	Value
Access	RW
Unit	%
Visibility	Beginner

4.6.11 Denoise Enable

Enables/disables the denoise feature. Denoising is disabled by default.

Property	Value
Name	DenoiseEnable
Interface	IBoolean
Access	
Visibility	Beginner

4.6.12 Denoising

Controls the amount to denoise a signal.

Property	Value
Name	Denoise
Interface	IInteger
Access	
Unit	%
Visibility	Beginner

5 Image Format Control

5.1 Region Of Interest

An image region of interest (ROI) lets you specify a portion of the image so that after each image is acquired only the pixel information from the specified portion is processed.

Use the following features to specify the location and size of the ROI. All values are in pixels.

OffsetX - Horizontal offset from the origin to the ROI.

Width - Width of the image provided by the device. This reflects the current ROI. The maximum value of this feature takes into account horizontal binning, decimation, or any other function changing the maximum horizontal dimensions of the image and is typically equal to WidthMax minus OffsetX.

OffsetY - Vertical offset from the origin to the ROI.

Height - Height of the image provided by the device. This reflects the current ROI. The maximum value of this feature takes into account vertical binning, decimation, or any other function changing the maximum vertical dimensions of the image and is typically equal to HeightMax minus OffsetY.

5.2 Binning

Binning refers to the act of combining the signal from groups of photo-sensitive cells into a larger logical pixel. This is achieved by adding (additive). Binning is implemented in analog by the sensor.

Note: Changes to binning features can only be made while the camera is not streaming.

Use the BinningSelector to choose the binning engine. This affects both horizontal and vertical binning. The choices are:

All - the total amount of binning. In this mode, the camera adjusts the sensor/ISP binning to achieve the best image quality with the fastest frame rate.

Sensor - the portion of binning implemented in analog by the sensor. Binning done by the sensor usually results in a higher frame rate. Unless otherwise specified, or unsupported, binning is done by the sensor by default.

ISP - the portion of binning implemented digitally by the ISP. Unless otherwise specified, binning is done by the ISP if sensor binning is is unsupported or compromises image quality.

Use BinningHorizontalMode and BinningVerticalMode to choose the algorithm to perform the combination. The choices are:

Additive - The response from the combined cells are added, resulting in increased sensitivity (a brighter image).

Average - The response from the combined cells are averaged, resulting in increased signal to noise ratio. Some sensors do not support average binning.

Use BinningHorizontal and BinningVertical to set the number of cells to combine. Binning values reduce the resolution of the image by a corresponding factor. A value of 1 indicates no binning. This must be set to 1 for decimation to be active.

5.3 ADC Bit Depth

All camera sensors incorporate an analog to digital converter (ADC) to digitize the images.

The camera's ADC is configured to a fixed bit output. This is not the same as pixel bit depth. If the pixel format selected has fewer bits per pixel than the ADC output, the least significant bits are dropped. If the pixel format selected has greater bits per pixel than the ADC output, the least significant bits are padded and can be discarded by the user. Image data is left-aligned across a 2-byte format.

For example, for a 12-bit output, the least significant 4 bits are padded in order to fill 2 bytes (0xFFF0).

A 10-bit conversion produces 1,024 possible values between 0 and 65,472.

A 12-bit conversion produces 4,096 possible values between 0 and 65,520.

A 14-bit conversion produces 16,384 possible values between 0 and 65,532.

Some image sensors support multiple ADC bit depths. (Not all ADC bit depths are supported on all cameras.) A higher ADC bit depth results in better image quality but slower maximum frame rate. Stop acquisition then use the ADC Bit Depth control to make a selection. Supported ADC bit depths are also listed in the camera's specification table.

5.4 Test Pattern

The camera is capable of outputting continuous static images for testing and development purposes.

Use the TestPatternGeneratorSelector feature to choose which test pattern to control.

Sensor produces a test pattern that varies based on the image sensor.

Set the TestPattern feature to Off to disable the selected test pattern generator.

When Sensor is selected, create a test pattern by setting the TestPattern feature to Sensor Test Pattern.

The Variable Frame Sequence option generates a sequence of frames containing varying test patterns. The sequence resets at the start of acquisition.

Most image processing features (such as Gamma, Balance Ratio, and others) are still available when the test pattern is on and can alter the test pattern image. Some features for controlling the sensor do not affect the test pattern image, such as Exposure Time, Gain, and analog Black Level. It is recommended to turn Exposure Auto and Gain Auto Off when using a test pattern, as those features do not function properly when the test pattern is on.

Note that the test pattern generators must be set to Off to get the actual image data from the sensor.

5.5 Pixel Format

Format of the pixel provided by the camera. Use PixelFormat feature to select from a list of supported formats. (Not all formats are supported on all cameras.) Once a format is selected, the following values are derived:

PixelSize provides the total size in bits of the image's pixel. Note: the pixel size is limited by the pixel format, not the sensor.

PixelDynamicRangeMin is the minimum value that can be returned during the digitization process. This corresponds to the darkest value of the camera. For color cameras, this returns the smallest value that each color component can take.

PixelDynamicRangeMax is the maximum value that can be returned during the digitization process. This corresponds to the brightest value of the camera. For color cameras, this returns the largest value that each color component can take.

5.5.1 Single Channel 8-bit and 16-bit Formats

8-bit Formats Mono8 8-bit monochrome packed format

16-bit Formats Mono16 16-bit monochrome packed format

Note: For Mono16 - when ISP is off, the lower n bits of each pixel contain actual image data (where n is the ADC bit depth). For example, on FFY the ADC bit depth is 10-bit so when selecting mono16 on the lower 10 bits contain the image data. This may result in a slightly darker image.

When ISP is on, the bits in each pixel always use the full range of the selecting output pixel format so when selecting mono16 all 16 bits potentially contain image data.

5.6 Reverse X

When Reverse X is enabled, it horizontally flips the image sent by the camera. The region of interest is applied after flipping.

For color cameras, the bayer pixel format may be changed after flipping. For example, BayerRG16 is changed to BayerGR16.

5.7 Reverse Y

When Reverse Y is enabled, it vertically flips the image sent by the camera. The region of interest is applied after flipping.

For color cameras, the bayer pixel format may be changed after flipping. For example, BayerRG16 is changed to BayerGB16.

5.8 Summary Table

Name	Interface	Access	Visibility	Description
Sensor Width	IInteger	RO	Expert	Effective width of the sensor in pixels.
Sensor Height	IInteger	RO	Expert	Effective height of the sensor in pixels.
Width Max	IInteger		Expert	Maximum width of the image (in pixels). The dimension is calculated after horizontal binning. WidthMax does not take into account the current Region of interest (Width or OffsetX).
Height Max	IInteger		Expert	Maximum height of the image (in pixels). This dimension is calculated after vertical binning. HeightMax does not take into

Name	Interface	Access	Visibility	Description
				account the current Region of interest (Height or OffsetY).
Width	IInteger		Beginner	Width of the image provided by the device (in pixels).
Height	IInteger		Beginner	Height of the image provided by the device (in pixels).
Offset X	IInteger		Beginner	Horizontal offset from the origin to the ROI (in pixels).
Offset Y	IInteger		Beginner	Vertical offset from the origin to the ROI (in pixels).
Pixel Format	IEnumeration		Beginner	Format of the pixel provided by the camera.
Pixel Size	IEnumeration	RO	Expert	Total size in bits of a pixel of the image.
Pixel Color Filter	IEnumeration	RO	Expert	Type of color filter that is applied to the image. Only applies to Bayer pixel formats. All others have no color filter.
Pixel Dynamic Range Min	IInteger	RO	Expert	Minimum value that can be returned during the digitization process. This corresponds to the darkest value of the camera. For color cameras, this returns the smallest value that each color component can take.
Pixel Dynamic Range Max	IInteger	RO	Expert	Maximum value that can be returned during the digitization process. This corresponds to the brightest value of the camera. For color cameras, this returns the biggest value that each color component can take.
ISP Enable	IBoolean	RW	Expert	Controls whether the image processing core is used for optional pixel format mode (i.e. mono). Enabling ISP consumes more power but is required for auto algorithms (such as exposure and gain) to work. Pixel format bit depths that are greater than the sensor ADC bit depth utilize the full value range per pixel. When ISP is disabled, raw sensor data is LSB aligned in each pixel.
Binning Selector	IEnumeration		Beginner	Selects which binning engine is controlled by the BinningHorizontal and BinningVertical features.
Binning Horizontal Mode [Binning Selector]	IEnumeration		Expert	
Binning Vertical Mode [Binning Selector]	IEnumeration		Expert	

Name	Interface	Access	Visibility	Description
Binning Horizontal [Binning Selector]	IInteger		Beginner	Number of horizontal photo-sensitive cells to combine together. This reduces the horizontal resolution (width) of the image. A value of 1 indicates that no horizontal binning is performed by the camera. This value must be 1 for decimation to be active.
Binning Vertical [Binning Selector]	IInteger		Beginner	Number of vertical photo-sensitive cells to combine together. This reduces the vertical resolution (height) of the image. A value of 1 indicates that no vertical binning is performed by the camera. This value must be 1 for decimation to be active.
Reverse X	IBoolean	RW	Expert	Horizontally flips the image sent by the device. The region of interest is applied after flipping. For color cameras the bayer pixel format is affected. For example, BayerRG16 changes to BayerGR16.
Reverse Y	IBoolean	RW	Expert	Vertically flips the image sent by the device. The region of interest is applied after flipping. For color cameras the bayer pixel format is affected. For example, BayerRG16 changes to BayerGB16.
Test Pattern Generator Selector	IEnumeration			Selects which test pattern generator is controlled by the TestPattern feature.
Test Pattern [Test Pattern Generator Selector]	IEnumeration			Selects the type of test pattern that is generated by the device as image source.
Injected Image Width	IInteger		Beginner	Width of the injected image pattern.
Injected Image Height	IInteger		Beginner	Height of the injected image pattern.
ADC Bit Depth	IEnumeration		Beginner	Selects which ADC bit depth to use. A higher ADC bit depth results in better image quality but slower maximum frame rate.

5.9 Image Format Control Features

5.9.1 Sensor Width

Effective width of the sensor in pixels.

Property	Value
Name	SensorWidth
Interface	IInteger
Access	RO
Unit	
Visibility	Expert
Value	1456

5.9.2 Sensor Height

Effective height of the sensor in pixels.

Property	Value
Name	SensorHeight
Interface	IInteger
Access	RO
Unit	
Visibility	Expert
Value	1098

5.9.3 Width Max

Maximum width of the image (in pixels). The dimension is calculated after horizontal binning. WidthMax does not take into account the current Region of interest (Width or OffsetX).

Property	Value
Name	WidthMax
Interface	IInteger
Access	
Unit	
Visibility	Expert

5.9.4 Height Max

Maximum height of the image (in pixels). This dimension is calculated after vertical binning. HeightMax does not take into account the current Region of interest (Height or OffsetY).

Property	Value
Name	HeightMax
Interface	IInteger
Access	
Unit	
Visibility	Expert

5.9.5 Width

Width of the image provided by the device (in pixels).

Property	Value
Name	Width
Interface	IInteger
Access	
Unit	
Visibility	Beginner

5.9.6 Height

Height of the image provided by the device (in pixels).

Property	Value
Name	Height
Interface	IInteger
Access	
Unit	
Visibility	Beginner

5.9.7 Offset X

Horizontal offset from the origin to the ROI (in pixels).

Property	Value
Name	OffsetX
Interface	IInteger
Access	
Unit	
Visibility	Beginner

5.9.8 Offset Y

Vertical offset from the origin to the ROI (in pixels).

Property	Value
Name	OffsetY
Interface	IInteger
Access	
Unit	
Visibility	Beginner

5.9.9 Pixel Format

Format of the pixel provided by the camera.

Property	Value
Name	PixelFormat
Interface	IEnumeration
Access	
Visibility	Beginner

Enumeration Values
Mono8

Enumeration Values
Mono16
RGB8Packed
BayerGR8
BayerRG8
BayerGB8
BayerBG8
BayerGR16
BayerRG16
BayerGB16
BayerBG16
Mono10Packed
BayerGR10Packed
BayerRG10Packed
BayerGB10Packed
BayerBG10Packed
Mono12Packed
BayerGR12Packed
BayerRG12Packed
BayerGB12Packed
BayerBG12Packed
YUV411Packed
YUV422Packed
YUV444Packed
Mono10p
BayerGR10p
BayerRG10p

Enumeration Values
BayerGB10p
BayerBG10p
Mono12p
BayerGR12p
BayerRG12p
BayerGB12p
BayerBG12p
YCbCr8
YCbCr422_8
YCbCr411_8
BGR8
BGRa8

5.9.10 Pixel Size

Total size in bits of a pixel of the image.

Property	Value
Name	PixelSize
Interface	IEnumeration
Access	RO
Visibility	Expert

Enumeration Values
Bpp1
Bpp2
Bpp4
Bpp8

Enumeration Values
Bpp10
Bpp12
Bpp14
Bpp16
Bpp20
Bpp24
Bpp30
Bpp32
Bpp36
Bpp48
Bpp64
Bpp96

5.9.11 Pixel Color Filter

Type of color filter that is applied to the image. Only applies to Bayer pixel formats. All others have no color filter.

Property	Value
Name	PixelColorFilter
Interface	IEnumeration
Access	RO
Visibility	Expert

Enumeration Values
None
BayerRG
BayerGB
BayerGR
BayerBG

5.9.12 Pixel Dynamic Range Min

Minimum value that can be returned during the digitization process. This corresponds to the darkest value of the camera. For color cameras, this returns the smallest value that each color component can take.

Property	Value
Name	PixelDynamicRangeMin
Interface	IInteger
Access	RO
Unit	
Visibility	Expert
Value	0

5.9.13 Pixel Dynamic Range Max

Maximum value that can be returned during the digitization process. This corresponds to the brightest value of the camera. For color cameras, this returns the biggest value that each color component can take.

Property	Value
Name	PixelDynamicRangeMax
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

5.9.14 ISP Enable

Controls whether the image processing core is used for optional pixel format mode (i.e. mono). Enabling ISP consumes more power but is required for auto algorithms (such as exposure and gain) to work. Pixel format bit depths that are greater than the sensor ADC bit depth utilize the full value range per pixel. When ISP is disabled, raw sensor data is LSB aligned in each pixel.

Property	Value
Name	IspEnable
Interface	IBoolean

Property	Value
Access	RW
Visibility	Expert

5.9.15 Binning Selector

Selects which binning engine is controlled by the BinningHorizontal and BinningVertical features.

Property	Value
Name	BinningSelector
Interface	IEnumeration
Access	
Visibility	Beginner

Enumeration Values
All
Sensor

5.9.16 Binning Horizontal Mode

Property	Value
Name	BinningHorizontalMode [Binning Selector]
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values
Sum
Average

5.9.17 Binning Vertical Mode

Property	Value
Name	BinningVerticalMode [Binning Selector]
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values
Sum
Average

5.9.18 Binning Horizontal

Number of horizontal photo-sensitive cells to combine together. This reduces the horizontal resolution (width) of the image. A value of 1 indicates that no horizontal binning is performed by the camera. This value must be 1 for decimation to be active.

Property	Value
Name	BinningHorizontal [Binning Selector]
Interface	IInteger
Access	
Unit	
Visibility	Beginner

5.9.19 Binning Vertical

Number of vertical photo-sensitive cells to combine together. This reduces the vertical resolution (height) of the image. A value of 1 indicates that no vertical binning is performed by the camera. This value must be 1 for decimation to be active.

Property	Value
Name	BinningVertical [Binning Selector]
Interface	IInteger

Property	Value
Access	
Unit	
Visibility	Beginner

5.9.20 Reverse X

Horizontally flips the image sent by the device. The region of interest is applied after flipping. For color cameras the bayer pixel format is affected. For example, BayerRG16 changes to BayerGR16.

Property	Value
Name	ReverseX
Interface	IBoolean
Access	RW
Visibility	Expert

5.9.21 Reverse Y

Vertically flips the image sent by the device. The region of interest is applied after flipping. For color cameras the bayer pixel format is affected. For example, BayerRG16 changes to BayerGB16.

Property	Value
Name	ReverseY
Interface	IBoolean
Access	RW
Visibility	Expert

5.9.22 Test Pattern Generator Selector

Selects which test pattern generator is controlled by the TestPattern feature.

Property	Value
Name	TestPatternGeneratorSelector
Interface	IEnumeration

Property	Value
Access	
Visibility	

Enumeration Values
Sensor
PipelineStart

5.9.23 Test Pattern

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

Property	Value
Name	TestPattern [Test Pattern Generator Selector]
Interface	IEnumeration
Access	
Visibility	

Enumeration Values
Off
SensorTestPattern
InjectedImage

5.9.24 Injected Image Width

Width of the injected image pattern.

Property	Value
Name	InjectedWidth
Interface	IInteger
Access	
Unit	

Property	Value
Visibility	Beginner

5.9.25 Injected Image Height

Height of the injected image pattern.

Property	Value
Name	InjectedHeight
Interface	IInteger
Access	
Unit	
Visibility	Beginner

5.9.26 ADC Bit Depth

Selects which ADC bit depth to use. A higher ADC bit depth results in better image quality but slower maximum frame rate.

Property	Value
Name	AdcBitDepth
Interface	IEnumeration
Access	
Visibility	Beginner

Enumeration Values

Bit10

6 Device Control

Device Control provides you with device information and allows you to control some device parameters.

6.1 General Information

Use Device User ID to enter a unique device name. This information is retained over power cycles. For example, when setting up a multi-camera system, you can assign unique IDs names to each device to differentiate the cameras in your application.

Use Device Indicator Mode to control the status LED. The LED can be active, inactive, or in error mode.

6.2 Bandwidth

Information about the bandwidth usage and link speed is provided.

Use Device Link Throughput Limit to specify what bandwidth is used for the streaming of data. This affects the maximum frame rate. This must be less that the Device Max Throughput.

6.3 Timestamp

Use Timestamp Latch to capture the current timestamp of the device. The timestamp starts when the camera is powered up and is measured in nanoseconds incrementing by the TimeStamp Increment node's value (480)

6.4 Device Reset

Use Device Reset to soft reboot the camera. Use Factory Reset to clear any user tables loaded and perform a soft reboot of the camera.

6.5 Summary Table

Name	Interface	Access	Visibility	Description
Device Vendor Name	IStringReg		Beginner	Name of the manufacturer of the device.
Device Model Name	IStringReg		Beginner	Model name of the device.
Sensor Description	IStringReg		Guru	Returns Sensor Description
Device Firmware Version	IStringReg		Beginner	Firmware version of the device.

Name	Interface	Access	Visibility	Description
Device Serial Number	IStringReg		Expert	Device serial number. This string is a unique identifier of the device.
Device User ID	IStringReg		Beginner	User Defined Name. This can be used to enter a unique device name. This information is retained over power cycles.
Device TL Type	IEnumeration	RO	Beginner	Transport Layer type of the device.
Device Gen CP Version Major	IInteger	RO	Beginner	Major version of the GenCP protocol supported by the device.
Device Gen CP Version Minor	IInteger	RO	Beginner	Minor version of the GenCP protocol supported by the device.
Device Max Throughput	IInteger	RO	Expert	Maximum bandwidth of the data that can be streamed out of the device. This can be used to estimate if the physical connection(s) can sustain transfer of free-running images from the camera at its maximum speed.
Device Link Speed	IInteger	RO	Guru	Link Speed
Device Link Throughput Limit	IInteger	RW	Expert	Limits the maximum bandwidth of the data that will be streamed out by the device on the selected Link. If necessary, delays will be uniformly inserted between transport layer packets in order to control the peak bandwidth.
Device Link Bandwidth Reserve	IFloat	RW	Expert	Percentage of streamed data bandwidth reserved for packet resend.
Device Link Current Throughput	IInteger	RO	Expert	Current bandwidth of streamed data.
Device Reset	ICommand	WO	Guru	This is a command that immediately resets and reboots the device.
Device Indicator Mode	IEnumeration		Expert	Controls the LED behaviour: Inactive (off), Active (current status), or Error Status (off unless an error occurs).
Device Temperature Selector	IEnumeration		Expert	Selects the location within the device, where the temperature will be measured.
Device Temperature [Device	IFloat	RO	Expert	Device temperature in degrees Celsius (C).

Name	Interface	Access	Visibility	Description
Temperature Selector]				
Timestamp Latch	ICommand	WO	Expert	Latches the current timestamp counter into TimestampLatchValue.
Timestamp Latch Value	IInteger	RO	Expert	Returns the latched value of the timestamp counter.
Timestamp Increment	IInteger	RO	Expert	Indicates the timestamp increment in ns/tick.
Device Uptime	IInteger	RO	Expert	Total time since the device was powered up in seconds.
Link Uptime	IInteger	RO	Expert	Time since the last phy negotiation (enumeration).
Enumeration Count	IInteger	RO	Expert	Number of enumerations since uptime.
Factory Reset	ICommand	WO	Guru	Returns all user tables to factory default
Max Device Reset Time	IInteger	RO	Expert	Time to wait until device reset complete (ms).

6.6 Device Control Features

6.6.1 Device Vendor Name

Name of the manufacturer of the device.

Property	Value
Name	DeviceVendorName
Interface	IStringReg
Access	
Visibility	Beginner

6.6.2 Device Model Name

Model name of the device.

Property	Value
Name	DeviceModelName
Interface	IStringReg
Access	
Visibility	Beginner

6.6.3 Sensor Description

Returns Sensor Description

Property	Value
Name	SensorDescription
Interface	IStringReg
Access	
Visibility	Guru

6.6.4 Device Firmware Version

Firmware version of the device.

Property	Value
Name	DeviceFirmwareVersion
Interface	IStringReg
Access	
Visibility	Beginner

6.6.5 Device Serial Number

Device serial number. This string is a unique identifier of the device.

Property	Value
Name	DeviceSerialNumber
Interface	IStringReg
Access	

Property	Value
Visibility	Expert

6.6.6 Device User ID

User Defined Name. This can be used to enter a unique device name. This information is retained over power cycles.

Property	Value
Name	DeviceUserID
Interface	IStringReg
Access	
Visibility	Beginner

6.6.7 Device TL Type

Transport Layer type of the device.

Property	Value
Name	DeviceTLType
Interface	IEnumeration
Access	RO
Visibility	Beginner

Enumeration Values

GigEVision
CameraLink
CameraLinkHS
CoaXPress
USB3Vision
Custom

6.6.8 Device Gen CP Version Major

Major version of the GenCP protocol supported by the device.

Property	Value
Name	DeviceGenCPVersionMajor
Interface	IInteger
Access	RO
Unit	
Visibility	Beginner

6.6.9 Device Gen CP Version Minor

Minor version of the GenCP protocol supported by the device.

Property	Value
Name	DeviceGenCPVersionMinor
Interface	IInteger
Access	RO
Unit	
Visibility	Beginner

6.6.10 Device Max Throughput

Maximum bandwidth of the data that can be streamed out of the device. This can be used to estimate if the physical connection(s) can sustain transfer of free-running images from the camera at its maximum speed.

Property	Value
Name	DeviceMaxThroughput
Interface	IInteger
Access	RO
Unit	Bps
Visibility	Expert

6.6.11 Device Link Speed

Link Speed

Property	Value
Name	DeviceLinkSpeed
Interface	IInteger
Access	RO
Unit	
Visibility	Guru

6.6.12 Device Link Throughput Limit

Limits the maximum bandwidth of the data that will be streamed out by the device on the selected Link. If necessary, delays will be uniformly inserted between transport layer packets in order to control the peak bandwidth.

Property	Value
Name	DeviceLinkThroughputLimit
Interface	IInteger
Access	RW
Unit	Bps
Visibility	Expert

6.6.13 Device Link Bandwidth Reserve

Percentage of streamed data bandwidth reserved for packet resend.

Property	Value
Name	DeviceLinkBandwidthReserve
Interface	IFloat
Access	RW
Unit	%
Visibility	Expert

6.6.14 Device Link Current Throughput

Current bandwidth of streamed data.

Property	Value
Name	DeviceLinkCurrentThroughput
Interface	IInteger
Access	RO
Unit	Bps
Visibility	Expert

6.6.15 Device Reset

This is a command that immediately resets and reboots the device.

Property	Value
Name	DeviceReset
Interface	ICommand
Access	WO
Visibility	Guru

6.6.16 Device Indicator Mode

Controls the LED behaviour: Inactive (off), Active (current status), or Error Status (off unless an error occurs).

Property	Value
Name	DeviceIndicatorMode
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values
Inactive
Active
ErrorStatus

6.6.17 Device Temperature Selector

Selects the location within the device, where the temperature will be measured.

Property	Value
Name	DeviceTemperatureSelector
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values
Cpu0
Mainboard
Sensor

6.6.18 Device Temperature

Device temperature in degrees Celsius (C).

Property	Value
Name	DeviceTemperature [Device Temperature Selector]
Interface	IFloat
Access	RO
Unit	C
Visibility	Expert

6.6.19 Timestamp Latch

Latches the current timestamp counter into TimestampLatchValue.

Property	Value
Name	TimestampLatch
Interface	ICommand
Access	WO

Property	Value
Visibility	Expert

6.6.20 Timestamp Latch Value

Returns the latched value of the timestamp counter.

Property	Value
Name	TimestampLatchValue
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

6.6.21 Timestamp Increment

Indicates the timestamp increment in ns/tick.

Property	Value
Name	TimestampIncrement
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

6.6.22 Device Uptime

Total time since the device was powered up in seconds.

Property	Value
Name	DeviceUptime
Interface	IInteger
Access	RO

Property	Value
Unit	s
Visibility	Expert

6.6.23 Link Uptime

Time since the last phy negotiation (enumeration).

Property	Value
Name	LinkUptime
Interface	IInteger
Access	RO
Unit	s
Visibility	Expert

6.6.24 Enumeration Count

Number of enumerations since uptime.

Property	Value
Name	EnumerationCount
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

6.6.25 Factory Reset

Returns all user tables to factory default

Property	Value
Name	FactoryReset
Interface	ICommand

Property	Value
Access	WO
Visibility	Guru

6.6.26 Max Device Reset Time

Time to wait until device reset complete (ms).

Property	Value
Name	MaxDeviceResetTime
Interface	IInteger
Access	RO
Unit	ms
Visibility	Expert

7 Transport Layer Control

The Transport Layer control provides the following information:

Payload Size - the number of bytes transferred for each image (including chunk data).

USB3 Vision Tab - Message Channel - Channel ID used for the Message Channel.

U3v Version Major/Minor - USB3 Vision standard version.

U3V Capabilities - what the camera supports (SIRM, EIRM and IIDC2).

Max Command Transfer Length - the maximum supported commands that can be sent to the camera.

Max Ack Transfer Length - the maximum supported ack that can be sent to the camera.

Number of Stream Channels - the number of stream channels the camera supports.

Current Speed - the speed of the camera's interface (Super Speed, High Speed).

7.1 Summary Table

Name	Interface	Access	Visibility	Description
Payload Size	IInteger		Expert	Provides the number of bytes transferred for each image or chunk on the stream channel.
USB3 Vision	ICategory	RO	Beginner	Category that contains the features pertaining to the USB3 Vision transport layer of the device.

7.2 Transport Layer Control Features

7.2.1 Payload Size

Provides the number of bytes transferred for each image or chunk on the stream channel.

Property	Value
Name	PayloadSize
Interface	IInteger
Access	
Unit	
Visibility	Expert

7.2.2 USB3 Vision

Category that contains the features pertaining to the USB3 Vision transport layer of the device.

Property	Value
Name	USB3Vision
Interface	ICategory
Access	RO
Visibility	Beginner

7.3 USB3 Vision

Category that contains the features pertaining to the USB3 Vision transport layer of the device.

7.3.1 Summary Table

Name	Interface	Access	Visibility	Description
Message Channel	IInteger	RW	Guru	Channel ID Used For The Message Channel.
U3V Version Major	IInteger	RO	Expert	U3V Version.
U3V Version Minor	IInteger	RO	Expert	U3V Version.
U3V Capability	IInteger	RO	Expert	Indicates additional features on the control channel.
U3V SIRM Available [U3V Capability]	IBoolean	RO	Expert	Set if the device supports at least one device streaming interface.
U3V EIRM Available [U3V Capability]	IBoolean	RO	Expert	Set if the device supports at least one device event interface.
U3V IIDC2 Available [U3V Capability]	IBoolean	RO	Expert	Set if the device supports IIDC2 register map.
Max Command Transfer Length	IInteger	RW	Expert	Specifies the max suuported command transfer length of the device.
Max Ack Transfer Length	IInteger	RO	Expert	Specifies the max suuported ack transfer length of the device.
Number of Stream Channels	IInteger	RO	Expert	Number of Stream Channels and its Corresponding Streaming Interface Register Maps.
Current Speed	IEnumeration	RO	Expert	Specifies the current speed of the USB link.

7.3.2 USB3 Vision Features

7.3.2.1 Message Channel

Channel ID Used For The Message Channel.

Property	Value
Name	U3VMessageChannelID
Interface	IInteger
Access	RW
Unit	
Visibility	Guru

7.3.2.2 U3V Version Major

U3V Version.

Property	Value
Name	U3VVersionMajor
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

7.3.2.3 U3V Version Minor

U3V Version.

Property	Value
Name	U3VVersionMinor
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

7.3.2.4 U3V Capability

Indicates additional features on the control channel.

Property	Value
Name	U3VCPCapability
Interface	IInteger
Access	RO
Unit	
Visibility	Expert
Value	0

7.3.2.5 U3V SIRM Available

Set if the device supports at least one device streaming interface.

Property	Value
Name	U3VCPSIRMAvailable [U3V Capability]
Interface	IBoolean
Access	RO
Visibility	Expert

7.3.2.6 U3V EIRM Available

Set if the device supports at least one device event interface.

Property	Value
Name	U3VCPEIRMAvailable [U3V Capability]
Interface	IBoolean
Access	RO
Visibility	Expert

7.3.2.7 U3V IIDC2 Available

Set if the device supports IIDC2 register map.

Property	Value
Name	U3VCPIIDC2Available [U3V Capability]
Interface	IBoolean
Access	RO
Visibility	Expert

7.3.2.8 Max Command Transfer Length

Specifies the max suuported command transfer length of the device.

Property	Value
Name	U3VMaxCommandTransferLength
Interface	IInteger
Access	RW
Unit	
Visibility	Expert

7.3.2.9 Max Ack Transfer Length

Specifies the max suuported ack transfer length of the device.

Property	Value
Name	U3VMaxAcknowledgeTransferLength
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

7.3.2.10 Number of Stream Channels

Number of Stream Channels and its Corresponding Streaming Interface Register Maps.

Property	Value
Name	U3VNumberOfStreamChannels

Property	Value
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

7.3.2.11 Current Speed

Specifies the current speed of the USB link.

Property	Value
Name	U3VCurrentSpeed
Interface	IEnumeration
Access	RO
Visibility	Expert

Enumeration Values

LowSpeed
FullSpeed
HighSpeed
SuperSpeed

8 Auto Algorithm Control

8.1 Auto Exposure (AE)

Auto exposure (AE) control is designed to automatically determine the exposure time and gain of the camera so that the resulting image looks as bright as expected. In general, the camera supports various auto exposure features, and these features produce different results in the final image. In addition, the camera allows users to control how fast the exposure and gain get settled.

Note that for AE to work, Exposure Auto and/or Gain Auto must be set to Once or Continuous and ISP must be enabled.

8.1.1 Auto Exposure Features

To enable AE, Exposure Auto and/or Gain Auto must be set to Once or Continuous. AE automatically determines the exposure time and/or gain according to the target image average.

The target image average can be manually or automatically controlled.

For **manual** control, set Target Grey Value Auto to Continuous and then set the desired image average in Target Grey Value. This value is a percentage of the maximum pixel value.

For **automatic** control, set Target Grey Value Auto to Off. The target image average is then automatically determined according to user-defined AE modes and other AE features.

By default, AE uses an exposure range of 100 to 15000 µs and/or gain range of 0 to 18 dB and target grey value, but these can be limited.

Exposure Time Lower Limit / Exposure Time Upper Limit - the lower and upper values in microseconds (µs) that the exposure time may reach when exposure is set to Once or Continuous.

Gain Lower Limit / Gain Upper Limit - the lower and upper values in decibels (dB) that the gain may reach when gain is set to Once or Continuous.

Target Grey Value Lower Limit / Target Grey Value Upper Limit - the lower and upper values in percent (%) that the target image average may reach.

Auto Exposure Damping controls how fast the exposure and gain get settled. A small damping value may result in the system being unstable. The range is from 0.0 - 1.0. The default value is 0.5.

If both exposure time and gain are set to Once or Coninuous AE determines which to adjust first by the Auto Exposure Control Priority.

If **gain** priority is selected, the camera sets the gain to 0 dB, and the exposure is adjusted according to the target grey level. If the maximum exposure is reached before the target grey level is hit, the gain starts to change to meet the target. This mode is used to have the minimum noise.

If **exposure** priority is selected, the camera sets the exposure to a small value (default is 5 ms). The gain is adjusted according to the target grey level. If maximum gain is reached before the target grey level is hit, the exposure starts to change to meet the target. This mode is used to capture fast motion.

AE Lighting Mode can compensate for strong light sources in front or behind an object. The options are: Backlight, Frontlight, or Normal. The default lighting mode is Normal. Use the Lighting Mode feature to select depending on your conditions.

8.1.1.1 Backlight Compensation

The backlight compensation mode isused when a strong light is coming from the back of the object. For example, people standing in the shade with the bright sky at the back. A regular auto exposure algorithmmakes the object underexposed in such lighting conditions. Backlight compensation is able to properly expose the object when a strong backlight occurs, regardless of the locations of the object relative to the frame.

8.1.1.2 Frontlight Compensation

The frontlight compensation mode is used when a strong light is shining in the front of the object while the background is dark. For example, a parking spot that has lights on at night while its surrounding areas are very dark. A regular auto exposure algorithm makes the object overexposed in such lighting conditions. Frontlight compensation is able to properly expose the object when a strong front light and a dark background appear, regardless of the locations of the object relative to the frame.

8.1.1.3 Normal Lighting

If the object of interest in the frame is not under backlight or frontlight conditions, then normal lighting should be used. Select Normal lighting mode to make Metering Mode available.

AE Metering Mode is available only if Lighting Mode is set to Normal. The options are: Average, Spot, and Partial. The default AE metering mode is Average. Use the Metering Mode feature to select depending on your conditions.

8.1.1.4 Average Metering

This mode measures the light from the entire scene uniformly to determine the final exposure value. Every portion of the exposed area has the same contribution.

8.1.1.5 Spot Metering

This mode measures the light from a small area (about 3%) in the center of the scene while the rest of the scene is ignored. This mode isused when the scene has a high contrast and the object of interest is relatively small.

8.1.1.6 Partial Metering

This mode measures the light from a larger area (about 11%) in the center of the scene. This mode is used when very dark or bright regions appear at the edge of the frame.

A **region of interest** (ROI) can be applied to the auto exposure features. This AE ROI can be equal to or smaller than the area of the captured ROI. To use AE ROI:

1. Set the ROI Selector to Auto Exposure.
2. Turn on ROI Enable.
3. Set the horizontal and vertical offsets (relative to the ROI being captured) with ROI Offset X and ROI Offset Y.
4. Set the width and height with ROI Width and ROI Height.

8.2 Summary Table

Name	Interface	Access	Visibility	Description
Target Grey Value Auto	IEnumeration		Beginner	This indicates whether the target image grey level is automatically set by the camera or manually set by the user. Note that the target grey level is in the linear domain before gamma correction is applied.
Target Grey Value	IFloat	RW		This is the user-specified target grey level (image mean) to apply to the current image. Note that the target grey level is in the linear domain before gamma correction is applied.
Lighting Mode	IEnumeration	RW	Beginner	Selects a lighting mode: Backlight, Frontlight or Normal (default). a. Backlight compensation: used when a strong light is coming from the back of the object. b. Frontlight compensation: used when a strong light is shining in the front of the object while the background is dark. c. Normal lighting: used when the object is not under backlight or frontlight conditions. When normal lighting is selected, metering modes are available.
Exposure Time Lower Limit	IFloat	RW		The smallest exposure time that auto exposure can set.
Exposure Time Upper Limit	IFloat	RW		The largest exposure time that auto exposure can set.
Gain Lower Limit	IFloat	RW		The smallest gain that auto exposure can set.
Gain Upper Limit	IFloat	RW		The largest gain that auto exposure can set.
Target Grey Value Lower Limit	IFloat	RW		The lowest value in percentage that the target mean may reach.
Target Grey Value Upper Limit	IFloat	RW		The highest value in percentage that the target mean may reach.

Name	Interface	Access	Visibility	Description
Auto Exposure Damping	IFloat	RW	Beginner	It controls how fast the exposure and gain get settled. If the value is too small, it may cause the system to be unstable. Range is from 0.0 to 1.0. Default = 0.2.
Auto Exposure Control Priority	IEnumeration	RW	Beginner	Selects whether to adjust gain or exposure first. When gain priority is selected, the camera fixes the gain to 0 dB, and the exposure is adjusted according to the target grey level. If the maximum exposure is reached before the target grey level is hit, the gain starts to change to meet the target. This mode is used to have the minimum noise. When exposure priority is selected, the camera sets the exposure to a small value (default is 5 ms). The gain is adjusted according to the target grey level. If maximum gain is reached before the target grey level is hit, the exposure starts to change to meet the target. This mode is used to capture fast motion.

8.3 Auto Algorithm Control Features

8.3.1 Target Grey Value Auto

This indicates whether the target image grey level is automatically set by the camera or manually set by the user. Note that the target grey level is in the linear domain before gamma correction is applied.

Property	Value
Name	AutoExposureTargetGreyValueAuto
Interface	IEnumeration
Access	
Visibility	Beginner

Enumeration Values

Off
Continuous

8.3.2 Target Grey Value

This is the user-specified target grey level (image mean) to apply to the current image. Note that the target grey level is in the linear domain before gamma correction is applied.

Property	Value
Name	AutoExposureTargetGreyValue
Interface	IFloat
Access	RW
Unit	%
Visibility	

8.3.3 Lighting Mode

Selects a lighting mode: Backlight, Frontlight or Normal (default). a. Backlight compensation: used when a strong light is coming from the back of the object. b. Frontlight compensation: used when a strong light is shining in the front of the object while the background is dark. c. Normal lighting: used when the object is not under backlight or frontlight conditions. When normal lighting is selected, metering modes are available.

Property	Value
Name	AutoExposureLightingMode
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values
AutoDetect
Backlight
Frontlight
Normal

8.3.4 Exposure Time Lower Limit

The smallest exposure time that auto exposure can set.

Property	Value
Name	AutoExposureExposureTimeLowerLimit
Interface	IFloat

Property	Value
Access	RW
Unit	us
Visibility	

8.3.5 Exposure Time Upper Limit

The largest exposure time that auto exposure can set.

Property	Value
Name	AutoExposureExposureTimeUpperLimit
Interface	IFloat
Access	RW
Unit	us
Visibility	

8.3.6 Gain Lower Limit

The smallest gain that auto exposure can set.

Property	Value
Name	AutoExposureGainLowerLimit
Interface	IFloat
Access	RW
Unit	dB
Visibility	

8.3.7 Gain Upper Limit

The largest gain that auto exposure can set.

Property	Value
Name	AutoExposureGainUpperLimit

Property	Value
Interface	IFloat
Access	RW
Unit	dB
Visibility	

8.3.8 Target Grey Value Lower Limit

The lowest value in percentage that the target mean may reach.

Property	Value
Name	AutoExposureGreyValueLowerLimit
Interface	IFloat
Access	RW
Unit	%
Visibility	

8.3.9 Target Grey Value Upper Limit

The highest value in percentage that the target mean may reach.

Property	Value
Name	AutoExposureGreyValueUpperLimit
Interface	IFloat
Access	RW
Unit	%
Visibility	

8.3.10 Auto Exposure Damping

It controls how fast the exposure and gain get settled. If the value is too small, it may cause the system to be unstable. Range is from 0.0 to 1.0. Default = 0.2.

Property	Value
Name	AutoExposureControlLoopDamping
Interface	IFloat
Access	RW
Unit	
Visibility	Beginner

8.3.11 Auto Exposure Control Priority

Selects whether to adjust gain or exposure first. When gain priority is selected, the camera fixes the gain to 0 dB, and the exposure is adjusted according to the target grey level. If the maximum exposure is reached before the target grey level is hit, the gain starts to change to meet the target. This mode is used to have the minimum noise. When exposure priority is selected, the camera sets the exposure to a small value (default is 5 ms). The gain is adjusted according to the target grey level. If maximum gain is reached before the target grey level is hit, the exposure starts to change to meet the target. This mode is used to capture fast motion.

Property	Value
Name	AutoExposureControlPriority
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values

Gain
ExposureTime

9 Defective Pixel Correction

The camera supports table-based defective pixel correction, where a list of defective pixel coordinates is specified, and the values of those pixels are replaced based on the values of their neighbors. The camera comes with a list of defective pixels calibrated during manufacturing (the factory default table), but you can update or replace this list.

Defect Correct Static Enable turns table-based defective pixel correction On or Off.

Defect Correction Mode controls the method used for replacing the value of pixels within the table. The options are Average or Highlight. Average replaces defective pixels with the average of their neighbors. Highlight is used for debugging purposes and sets pixels within the table to the maximum possible pixel value to highlight them.

9.1 Modifying the List of Defective Pixels

Defect Correct Pixel Count controls the number of defective pixels in the table.

Defect Table Index selects an individual pixel within the table. This is a zero-based index, so if there are *N* pixels in the table, the index range is from 0 to *N*-1. Defect X Coordinate and Defect Y Coordinate define the (X,Y) coordinates of the defective pixel selected by the index. These values can be changed. These (X,Y) coordinates are relative to the full image ROI, when Offset X and Offset Y are both zero.

Changes made to the defective pixel table using these controls do NOT take effect immediately. When you have finished making a series of changes to the table, execute the command Defect Table Apply for the changes to affect images captured by the camera. This writes the table to volatile memory, so changes are lost if the camera loses power.

Defect Table Save saves the table to persistent storage within the camera, so that the modified table is loaded whenever the camera boots up. Saving overwrites the existing table stored in memory.

Defect Table Factory Restore resets the table to its factory default state. This completely overwrites any changes made to the table, both the active table used in images being captured by the camera and the table saved in memory.

Important Note: Because it takes time to download a full defect table, if the camera is streaming when a table is either applied or restored to factory default, the results may appear momentarily corrupted until the complete table is written to the FPGA.

9.1.1 Example: Adding a location to the Defective Pixel Table

These steps illustrate how to add a pixel to the table:

1. Set Offset X and Offset Y to zero, and Width and Height at least large enough so that the defective pixel falls within the image ROI.
2. Note the X and Y coordinates of the defective pixel under these ROI settings.
3. Increase Defect Correct Pixel Count by 1 to add a new defective pixel to the list.
4. Set Defect Table Index to the new value of Defect Correct Pixel Count minus 1, to control the last defective pixel in the table, which is the one that was just added.
5. Set the values of Defect X Coordinate and Defect Y Coordinate to the coordinates of the pixel being added.

6. Click Defect Table Apply to have the change affect images being captured.
7. Use Defect Table Save to save the modified table so that it is loaded every time the camera boots up.

9.2 Summary Table

Name	Interface	Access	Visibility	Description
Defect Correct Static Enable	IBoolean		Guru	Enables/Disables table-based defective pixel correction.
Defect Correct Dynamic Enable	IBoolean		Guru	Enables/Disables table-based defective pixel correction.
Defect Correction Mode	IEnumeration		Guru	Controls the method used for replacing defective pixels.
Defect Table Pixel Count	IInteger		Guru	The number of defective pixel locations in the current table.
Defect Table Index	IInteger		Guru	Controls the offset of the element to access in the defective pixel location table.
Defect X Coordinate [Defect Table Index]	IInteger		Guru	Returns the X coordinate of the defective pixel at DefectTableIndex within the defective pixel table. Changes made do not take effect in captured images until the command DefectTableApply is written.
Defect Y Coordinate [Defect Table Index]	IInteger		Guru	Returns the Y coordinate of the defective pixel at DefectTableIndex within the defective pixel table. Changes made do not take effect in captured images until the command DefectTableApply is written.
Defect Table Apply	ICommand	RW	Guru	Applies the current defect table, so that any changes made affect images captured by the camera. This writes the table to volatile memory, so changes to the table are lost if the camera loses power. To save the table to non-volatile memory, use DefectTableSave.
Defect Table Save	ICommand		Guru	Saves the current defective pixel table non-volatile memory, so that it is preserved when the camera boots up. This overwrites the existing defective pixel table. The new table is loaded whenever the camera powers up.

9.3 Defective Pixel Correction Features

9.3.1 Defect Correct Static Enable

Enables/Disables table-based defective pixel correction.

Property	Value
Name	DefectCorrectStaticEnable
Interface	IBoolean
Access	
Visibility	Guru

9.3.2 Defect Correct Dynamic Enable

Enables/Disables table-based defective pixel correction.

Property	Value
Name	DefectCorrectDynamicEnable
Interface	IBoolean
Access	
Visibility	Guru

9.3.3 Defect Correction Mode

Controls the method used for replacing defective pixels.

Property	Value
Name	DefectCorrectionMode
Interface	IEnumeration
Access	
Visibility	Guru

Enumeration Values

Average

Enumeration Values
Highlight
Zero

9.3.4 Defect Table Pixel Count

The number of defective pixel locations in the current table.

Property	Value
Name	DefectTablePixelCount
Interface	IInteger
Access	
Unit	
Visibility	Guru

9.3.5 Defect Table Index

Controls the offset of the element to access in the defective pixel location table.

Property	Value
Name	DefectTableIndex
Interface	IInteger
Access	
Unit	
Visibility	Guru

9.3.6 Defect X Coordinate

Returns the X coordinate of the defective pixel at DefectTableIndex within the defective pixel table. Changes made do not take effect in captured images until the command DefectTableApply is written.

Property	Value
Name	DefectTableCoordinateX [Defect Table Index]
Interface	IInteger

Property	Value
Access	
Unit	
Visibility	Guru

9.3.7 Defect Y Coordinate

Returns the Y coordinate of the defective pixel at DefectTableIndex within the defective pixel table. Changes made do not take effect in captured images until the command DefectTableApply is written.

Property	Value
Name	DefectTableCoordinateY [Defect Table Index]
Interface	IInteger
Access	
Unit	
Visibility	Guru

9.3.8 Defect Table Apply

Applies the current defect table, so that any changes made affect images captured by the camera. This writes the table to volatile memory, so changes to the table are lost if the camera loses power. To save the table to non-volatile memory, use DefectTableSave.

Property	Value
Name	DefectTableApply
Interface	ICommand
Access	RW
Visibility	Guru

9.3.9 Defect Table Save

Saves the current defective pixel table non-volatile memory, so that it is preserved when the camera boots up. This overwrites the existing defective pixel table. The new table is loaded whenever the camera powers up.

Property	Value
Name	DefectTableSave
Interface	ICommand
Access	
Visibility	Guru

10 Inference Control

10.1 Inference

Inference is the act of using a trained neural network to infer things about data fed into it. A Firefly camera use a convolutional neural network (CNN) to infer things in images that it captures. Depending on the network that is uploaded onto a Firefly, it can either classify or detect objects.

Use the FileSelector to upload an **Inference Network** onto a Firefly.

Use the following features to configure and enable inference.

Inference Enable - enable inference processing on the camera.

Network Type - the type of network on the camera being used for inference. This is either a **Classification** or **Detection** network.

Bounding Box Format - the data format of the bounding boxes being output by a detection network on the camera.

Bounding Box Threshold - minimum confidence threshold for a bounding box to be sent from the camera to the host.

Training Bit Depth - the bit depth and number of input channels of the network during training.

Channel Mean - mean value of the data for a given input channel of the network during training.

Channel Scalar - scalar value of the data for a given input channel of the network during training.

Use ChunkSelector to send inference results to the host via chunk data.

Use EventSelector to send inference results to the host via events.

10.2 Summary Table

Name	Interface	Access	Visibility	Description
Inference Enable	IBoolean	RW	Expert	Enable on-camera inference processing.
Network Type	IEnumeration	RW	Beginner	Type of network currently loaded on camera. This is used to determine the output data format when sending results to the host.
Bounding Box Format	IEnumeration	RW	Beginner	Data format of the bounding boxes output by the network. This format will be converted to a generic type when transmitted to the host.
Bounding Box Threshold	IFloat	RW	Beginner	Confidence threshold for bounding boxes to be sent to the host. Any bounding boxes below this threshold will not be sent.

Name	Interface	Access	Visibility	Description
Inference Time	IFloat		Beginner	Total time it takes for the last inference in milliseconds. This includes time for preprocessing.
Inference Preprocessing	ICategory	RW	Beginner	
Inference Properties	ICategory	RO	Beginner	
Inference Network Name	IStringReg		Beginner	User-defined name of the network currently on the device.
Max Network Size	IInteger	RO	Expert	The maximum network size that can be loaded to the camera.

10.3 Inference Control Features

10.3.1 Inference Enable

Enable on-camera inference processing.

Property	Value
Name	InferenceEnable
Interface	IBoolean
Access	RW
Visibility	Expert

10.3.2 Network Type

Type of network currently loaded on camera. This is used to determine the output data format when sending results to the host.

Property	Value
Name	InferenceNetworkTypeSelector
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values
Classification
Detection

10.3.3 Bounding Box Format

Data format of the bounding boxes output by the network. This format will be converted to a generic type when transmitted to the host.

Property	Value
Name	InferenceNetworkOutputFormatSelector
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values
SSD

10.3.4 Bounding Box Threshold

Confidence threshold for bounding boxes to be sent to the host. Any bounding boxes below this threshold will not be sent.

Property	Value
Name	InferenceBoundingBoxThreshold
Interface	IFloat
Access	RW
Unit	
Visibility	Beginner

10.3.5 Inference Time

Total time it takes for the last inference in milliseconds. This includes time for preprocessing.

Property	Value
Name	InferenceTime
Interface	IFloat
Access	
Unit	ms
Visibility	Beginner

10.3.6 Inference Preprocessing

Property	Value
Name	InferencePreprocessing
Interface	ICategory
Access	RW
Visibility	Beginner

10.3.7 Inference Properties

Property	Value
Name	InferenceProperties
Interface	ICategory
Access	RO
Visibility	Beginner

10.3.8 Inference Network Name

User-defined name of the network currently on the device.

Property	Value
Name	InferenceNetworkName
Interface	IStringReg
Access	

Property	Value
Visibility	Beginner

10.3.9 Max Network Size

The maximum network size that can be loaded to the camera.

Property	Value
Name	MaxNetworkSize
Interface	IInteger
Access	RO
Unit	Bytes
Visibility	Expert

10.4 Inference Preprocessing

10.4.1 Summary Table

Name	Interface	Access	Visibility	Description
Training Pixel Format	IEnumeration	RW	Beginner	The bit depth and number of input channels of the images used during training of the network that is on the camera. This is used when doing image normalization of the captured images before performing inference.
Network Input Channel	IEnumeration	RW	Beginner	Input channel of loaded network.
Training Mean	IFloat	RW	Beginner	Mean value of the data used during network training. This is used when doing image normalization of the captured images before performing inference. If the selected network type has only one input channel then the channel 1 mean is used.
Training Scalar	IFloat	RW	Beginner	Standard deviation of the data used during network training. This is used when doing image normalization of the captured images before performing inference. If the selected network type has only one input channel then the channel 1 mean is used.

10.4.2 Inference Preprocessing Features

10.4.2.1 Training Pixel Format

The bit depth and number of input channels of the images used during training of the network that is on the camera. This is used when doing image normalization of the captured images before performing inference.

Property	Value
Name	InferencePreprocessBppSelector
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values

Mono8
RGB8
BGR8

10.4.2.2 Network Input Channel

Input channel of loaded network.

Property	Value
Name	InferencePreprocessChannelSelector
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values

Channel1
Channel2
Channel3

10.4.2.3 Training Mean

Mean value of the data used during network training. This is used when doing image normalization of the captured images before performing inference. If the selected network type has only one input channel then the channel 1 mean is used.

Property	Value
Name	InferencePreprocessChannelMean
Interface	IFloat
Access	RW
Unit	
Visibility	Beginner

10.4.2.4 Training Scalar

Standard deviation of the data used during network training. This is used when doing image normalization of the captured images before performing inference. If the selected network type has only one input channel then the channel 1 mean is used.

Property	Value
Name	InferencePreprocessChannelScalar
Interface	IFloat
Access	RW
Unit	
Visibility	Beginner

10.5 Inference Properties

10.5.1 Summary Table

Name	Interface	Access	Visibility	Description
Max Input Width	IInteger	RO	Expert	Maximum supported input horizontal resolution.
Max Input	IInteger	RO	Expert	Maximum supported input vertical resolution.

Name	Interface	Access	Visibility	Description
Height				
Max Bounding Boxes	IInteger	RO	Expert	Maximum supported output bounding boxes for detection networks. If a network that supports more bounding boxes is loaded onto the camera then only the first n boxes will be sent to the host (where n is the value specified here).
Network Size	IInteger	RO	Expert	Total size of network (in bytes).
Network Total Layers	IInteger	RO	Expert	Total number of layers that uploaded network contains.
Network Input Width	IInteger	RO	Expert	Input layer horizontal resolution (in pixels).
Network Input Height	IInteger	RO	Expert	Input layer vertical resolution (in pixels).
Network Input Channels	IInteger	RO	Expert	Number of channels used in input layer (e.g colour channels).
Output Classes	IInteger	RO	Expert	Total number of output classes from the network.

10.5.2 Inference Properties Features

10.5.2.1 Max Input Width

Maximum supported input horizontal resolution.

Property	Value
Name	InferenceMaxInputSizeX
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.5.2.2 Max Input Height

Maximum supported input vertical resolution.

Property	Value
Name	InferenceMaxInputSizeY
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.5.2.3 Max Bounding Boxes

Maximum supported output bounding boxes for detection networks. If a network that supports more bounding boxes is loaded onto the camera then only the first n boxes will be sent to the host (where n is the value specified here).

Property	Value
Name	InferenceMaxBoundingBoxes
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.5.2.4 Network Size

Total size of network (in bytes).

Property	Value
Name	InferenceNetworkSize
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.5.2.5 Network Total Layers

Total number of layers that uploaded network contains.

Property	Value
Name	InferenceNetworkNumStages
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.5.2.6 Network Input Width

Input layer horizontal resolution (in pixels).

Property	Value
Name	InferenceInputSizeX
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.5.2.7 Network Input Height

Input layer vertical resolution (in pixels).

Property	Value
Name	InferenceInputSizeY
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.5.2.8 Network Input Channels

Number of channels used in input layer (e.g colour channels).

Property	Value
Name	InferenceInputSizeChannels
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.5.2.9 Output Classes

Total number of output classes from the network.

Property	Value
Name	InferenceOutputSizeChannels
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.6 Event Inference Data

Category that contains all the data features related to the Inference Event.

10.6.1 Summary Table

Name	Interface	Access	Visibility	Description
Event Inference	IInteger	RO	Expert	Returns the unique identifier of the Inference type of Event.
Event Inference Timestamp	IInteger	RO	Expert	Returns the Timestamp of the Inference Event.
Event Inference Result	IInteger	RO	Expert	Returns the classification result of the Inference Event.
Event Inference Confidence	IFloat	RO	Expert	Returns the classification confidence of the Inference Event.
Event Inference Frame	IInteger	RO	Expert	Returns the associated frame ID of the Inference

Name	Interface	Access	Visibility	Description
ID				Event.

10.6.2 Event Inference Data Features

10.6.2.1 Event Inference

Returns the unique identifier of the Inference type of Event.

Property	Value
Name	EventInference
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.6.2.2 Event Inference Timestamp

Returns the Timestamp of the Inference Event.

Property	Value
Name	EventInferenceTimestamp
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

10.6.2.3 Event Inference Result

Returns the classification result of the Inference Event.

Property	Value
Name	EventInferenceResult
Interface	IInteger
Access	RO

Property	Value
Unit	
Visibility	Expert

10.6.2.4 Event Inference Confidence

Returns the classification confidence of the Inference Event.

Property	Value
Name	EventInferenceConfidence
Interface	IFloat
Access	RO
Unit	
Visibility	Expert

10.6.2.5 Event Inference Frame ID

Returns the associated frame ID of the Inference Event.

Property	Value
Name	EventInferenceFrameID
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

11 User Set Control

Features in the User Set Control category allow you to save camera settings to non-volatile memory so that they can be restored to a known state at any time (after the camera has been restarted).

11.1 Types of User Sets

You can select which user set to configure, save, or load with the UserSetSelector feature. There are two classes of user sets.

- User-defined settings
- Factory-defined settings. A factory-defined Default user set is always available. It represents a typical use case for the camera.

If the factory-defined settings must be changed for your application, they can be used as a starting point. From there, only a few features may need to be modified to achieve the desired configuration. The UserSetSave feature saves the current camera settings so that they can be recreated later. Once saved, these new custom settings can be loaded at any time.

The UserSetLoad feature loads the specified user set. Note that one can load a set without first saving. In this situation, the user set contents are the factory-defined default settings.

11.2 Start-up User Set

The UserSetDefault feature is used to configure a camera automatically at start-up. This loads the selected user set at start-up time. By default, it applies the factory-defined Default settings. However, you can change it to any user set so that the next time the camera restarts, it comes up with the selected user set.

11.3 User Set Managed Features

Due to limited on-board non-volatile memory, not all features are supported by user sets. See UserSetFeatureSelector for the list of all features that are supported. Features that are not listed are either of single session nature or are managed explicitly via other features, such as Defect Table Save.

11.4 User Set Conversion

The exact list of features managed by user sets may change between different versions of firmware. Consequently, there may not be a perfect match between the set of features saved to non-volatile memory and the set of features handled by the current version of firmware. In this situation, the camera performs any necessary conversions on all saved user sets. This happens automatically the first time the camera is restarted after a firmware update. The conversion performed depends on the nature of the feature discrepancy:

- Obsolete features - Saved features that are no longer supported in the current firmware. These features are ignored and removed from all subsequently saved user sets.

- Missing features - Saved user sets do not have features that are supported in the current firmware. These missing feature values are filled in using one of the factory-defined sets. If UserSetDefault points to a user-defined set, then the missing feature values are copied from the factory-defined Default set.

11.5 Summary Table

Name	Interface	Access	Visibility	Description
User Set Selector	IEnumeration	RW	Beginner	Selects the feature User Set to load, save or configure.
User Set Load [User Set Selector]	ICommand	RW	Expert	Loads the User Set specified by UserSetSelector to the device and makes it active.
User Set Save [User Set Selector]	ICommand	RW	Beginner	Saves the User Set specified by UserSetSelector to the non-volatile memory of the device.
User Set Default	IEnumeration	RW	Beginner	Selects the feature User Set to load and make active by default when the device is restarted.
User Set Feature Selector	IEnumeration	RW	Expert	List of features that are saved to user sets.
User Set Feature Enable	IBoolean	RO	Expert	Whether or not the selected feature is saved to user sets.

11.6 User Set Control Features

11.6.1 User Set Selector

Selects the feature User Set to load, save or configure.

Property	Value
Name	UserSetSelector
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values

Default
UserSet0
UserSet1

11.6.2 User Set Load

Loads the User Set specified by UserSetSelector to the device and makes it active.

Property	Value
Name	UserSetLoad [User Set Selector]
Interface	ICommand
Access	RW
Visibility	Expert

11.6.3 User Set Save

Saves the User Set specified by UserSetSelector to the non-volatile memory of the device.

Property	Value
Name	UserSetSave [User Set Selector]
Interface	ICommand
Access	RW
Visibility	Beginner

11.6.4 User Set Default

Selects the feature User Set to load and make active by default when the device is restarted.

Property	Value
Name	UserSetDefault
Interface	IEnumeration
Access	RW
Visibility	Beginner

Enumeration Values

Default
UserSet0
UserSet1

11.6.5 User Set Feature Selector

List of features that are saved to user sets.

Property	Value
Name	UserSetFeatureSelector
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values

AcquisitionFrameCount
AcquisitionFrameRate
AcquisitionFrameRateEnable
AcquisitionLineRate
AcquisitionMode
AdcBitDepth
AutoExposureControlPriority
AutoExposureExposureTimeLowerLimit
AutoExposureExposureTimeUpperLimit
AutoExposureGainLowerLimit
AutoExposureGainUpperLimit
AutoExposureGreyValueLowerLimit
AutoExposureGreyValueUpperLimit
AutoExposureLightingMode
AutoExposureTargetGreyValue
AutoExposureTargetGreyValueAuto
BinningHorizontalAll
BinningVerticalAll

Enumeration Values

BlackLevelAll
ChunkEnableAll
ChunkModeActive
DefectCorrectStaticEnable
DefectCorrectionMode
DeviceIndicatorMode
DeviceLinkBandwidthReserve
DeviceLinkThroughputLimit
EventNotificationError
EventNotificationExposureEnd
EventNotificationInference
EventNotificationSerialPortReceive
ExposureAuto
ExposureMode
ExposureTime
GainAll
GainAuto
GainRawAll
Gamma
GammaEnable
Height
InferenceEnable
IspEnable
LUTEnable
LineInferenceTargetLine0
LineInferenceTargetLine1

Enumeration Values

LineInferenceTargetLine2
LineInferenceTargetLine3
LineInverterLine0
LineInverterLine1
LineInverterLine2
LineInverterLine3
LineModeLine0
LineModeLine1
LineModeLine2
LineModeLine3
LineSourceLine0
LineSourceLine1
LineSourceLine2
LineSourceLine3
OffsetX
OffsetY
PixelFormat
ReverseX
ReverseY
SensorShutterMode
SerialPortBaudRateSerialPort0
SerialPortDataBitsSerialPort0
SerialPortParitySerialPort0
SerialPortSourceSerialPort0
SerialPortStopBitsSerialPort0
Sharpening

Enumeration Values
SharpeningEnable
TestPatternPipelineStart
TestPatternSensor
TransferBlockCount
TransferControlMode
TransferOperationMode
TriggerActivationAcquisitionStart
TriggerActivationFrameStart
TriggerModeAcquisitionStart
TriggerModeFrameStart
TriggerSourceAcquisitionStart
TriggerSourceFrameStart
UserOutputValue
UserOutputValueAll
V3_3Enable
Width

11.6.6 User Set Feature Enable

Whether or not the selected feature is saved to user sets.

Property	Value
Name	UserSetFeatureEnable
Interface	IBoolean
Access	RO
Visibility	Expert

12 Chunk Data Control

Chunk Data allows you the ability to send additional information with the image data. This can be helpful when debugging issues or looking at what settings have been applied to the acquired image.

Use ChunkModeActive to enable chunk data for images.

The following information is available as chunk data:

Image - enabled by default and cannot be disabled.

FrameID

OffsetX

OffsetY

Width

Height

Exposure Time

Gain

Black Level

Pixel Format

ImageTimestamp

Use ChunkSelector to select a chunk then use ChunkEnable to enable or disable it. Image and ImageCRC cannot be disabled.

Once acquisition has started Chunk data can not be altered. To enable or disable chunks acquisition must be stopped.

12.1 Summary Table

Name	Interface	Access	Visibility	Description
Chunk Mode Active	IBoolean	RW	Expert	Activates the inclusion of Chunk data in the payload of the image.
Chunk Selector	IEnumeration	RW	Expert	Selects which chunk data to enable or disable.
Chunk Enable [Chunk Selector]	IBoolean	RW	Expert	Enables the inclusion of the selected Chunk data in the payload of the image.
Chunk Image	IInteger	RO	Expert	Returns the image payload.
Chunk Frame ID	IInteger	RO	Expert	Returns the image frame ID.
Chunk Offset X	IInteger	RO	Expert	Returns the Offset X of the image included in the payload.

Name	Interface	Access	Visibility	Description
Chunk Offset Y	IInteger	RO	Expert	Returns the Offset Y of the image included in the payload.
Chunk Width	IInteger	RO	Expert	Returns the width of the image included in the payload.
Chunk Height	IInteger	RO	Expert	Returns the height of the image included in the payload.
Chunk Pixel Format	IEnumeration		Expert	Format of the pixel provided by the camera
Chunk Exposure Time	IFloat	RO	Expert	Returns the exposure time used to capture the image.
Chunk Gain Selector	IEnumeration		Expert	Selects which gain to retrieve
Chunk Gain [Chunk Gain Selector]	IFloat	RO	Expert	Returns the gain used to capture the image.
Chunk Black Level Selector	IEnumeration		Expert	Selects which black level to retrieve
Chunk Black Level [Chunk Black Level Selector]	IFloat	RO	Expert	Returns the black level used to capture the image.
Chunk Timestamp	IInteger	RO	Expert	Returns the Timestamp of the image.
Chunk Inference Result	IInteger	RO	Expert	Returns the most recent inference classification result.
Chunk Inference Frame ID	IInteger	RO	Expert	Returns the frame ID associated with the most recent inference result.
Chunk Inference Bounding Box Result	IRegister		Expert	Returns the bounding boxes of the most recent inference result.
Chunk Inference Confidence	IFloat	RO	Expert	Returns the most recent inference confidence result.
Chunk Serial Data Length	IInteger	RO	Expert	Returns the length of the received serial data that was included in the payload.
Chunk Serial Data	IStringReg		Expert	Returns the serial data that was received.
Chunk Serial Receive Overflow	IBoolean	RO	Expert	Returns the status of the chunk serial receive overflow.

12.2 Chunk Data Control Features

12.2.1 Chunk Mode Active

Activates the inclusion of Chunk data in the payload of the image.

Property	Value
Name	ChunkModeActive
Interface	IBoolean
Access	RW
Visibility	Expert

12.2.2 Chunk Selector

Selects which chunk data to enable or disable.

Property	Value
Name	ChunkSelector
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values

Image
FrameID
OffsetX
OffsetY
Width
Height
ExposureTime
Gain
BlackLevel
PixelFormat

Enumeration Values
Timestamp
SerialData
InferenceResult
InferenceConfidence
InferenceFrameId
InferenceBoundingBoxResult

12.2.3 Chunk Enable

Enables the inclusion of the selected Chunk data in the payload of the image.

Property	Value
Name	ChunkEnable [Chunk Selector]
Interface	IBoolean
Access	RW
Visibility	Expert

12.2.4 Chunk Image

Returns the image payload.

Property	Value
Name	ChunkImage
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.5 Chunk Frame ID

Returns the image frame ID.

Property	Value
Name	ChunkFrameID
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.6 Chunk Offset X

Returns the Offset X of the image included in the payload.

Property	Value
Name	ChunkOffsetX
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.7 Chunk Offset Y

Returns the Offset Y of the image included in the payload.

Property	Value
Name	ChunkOffsetY
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.8 Chunk Width

Returns the width of the image included in the payload.

Property	Value
Name	ChunkWidth
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.9 Chunk Height

Returns the height of the image included in the payload.

Property	Value
Name	ChunkHeight
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.10 Chunk Pixel Format

Format of the pixel provided by the camera

Property	Value
Name	ChunkPixelFormat
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values
Mono8
Mono12Packed
Mono16

Enumeration Values
RGB8Packed
YUV422Packed
BayerGR8
BayerRG8
BayerGB8
BayerBG8
YCbCr601_422_8_CbYCrY

12.2.11 Chunk Exposure Time

Returns the exposure time used to capture the image.

Property	Value
Name	ChunkExposureTime
Interface	IFloat
Access	RO
Unit	us
Visibility	Expert

12.2.12 Chunk Gain Selector

Selects which gain to retrieve

Property	Value
Name	ChunkGainSelector
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values
All

12.2.13 Chunk Gain

Returns the gain used to capture the image.

Property	Value
Name	ChunkGain [Chunk Gain Selector]
Interface	IFloat
Access	RO
Unit	dB
Visibility	Expert

12.2.14 Chunk Black Level Selector

Selects which black level to retrieve

Property	Value
Name	ChunkBlackLevelSelector
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values
All

12.2.15 Chunk Black Level

Returns the black level used to capture the image.

Property	Value
Name	ChunkBlackLevel [Chunk Black Level Selector]
Interface	IFloat
Access	RO
Unit	%
Visibility	Expert

12.2.16 Chunk Timestamp

Returns the Timestamp of the image.

Property	Value
Name	ChunkTimestamp
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.17 Chunk Inference Result

Returns the most recent inference classification result.

Property	Value
Name	ChunkInferenceResult
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.18 Chunk Inference Frame ID

Returns the frame ID associated with the most recent inference result.

Property	Value
Name	ChunkInferenceFrameId
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.19 Chunk Inference Bounding Box Result

Returns the bounding boxes of the most recent inference result.

Property	Value
Name	ChunkInferenceBoundingBoxResult
Interface	IRegister
Access	
Visibility	Expert

12.2.20 Chunk Inference Confidence

Returns the most recent inference confidence result.

Property	Value
Name	ChunkInferenceConfidence
Interface	IFloat
Access	RO
Unit	
Visibility	Expert

12.2.21 Chunk Serial Data Length

Returns the length of the received serial data that was included in the payload.

Property	Value
Name	ChunkSerialDataLength
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

12.2.22 Chunk Serial Data

Returns the serial data that was received.

Property	Value
Name	ChunkSerialData

Property	Value
Interface	IStringReg
Access	
Visibility	Expert

12.2.23 Chunk Serial Receive Overflow

Returns the status of the chunk serial receive overflow.

Property	Value
Name	ChunkSerialReceiveOverflow
Interface	IBoolean
Access	RO
Visibility	Expert

13 LUT Control

Category that contains the features related to the look-up-table (LUT) control.

13.1 Summary Table

Name	Interface	Access	Visibility	Description
	IEnumeration		Expert	
[]	IBoolean		Expert	
[]	IInteger		Guru	
[] []	IInteger		Guru	

13.2 LUT Control Features

13.2.1

Property	Value
Name	LUTSelector
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values

LUT1

13.2.2

Property	Value
Name	LUTEnable []

Property	Value
Interface	IBoolean
Access	
Visibility	Expert

13.2.3

Property	Value
Name	LUTIndex []
Interface	IInteger
Access	
Unit	
Visibility	Guru

13.2.4

Property	Value
Name	LUTValue [] []
Interface	IInteger
Access	
Unit	
Visibility	Guru

14 Event Control

14.0.1 Event Features

Events allow you to get notified when the camera has performed something you might find interesting. Events are similar to the asynchronous communication but the difference is the initiator is the device.

Once an event is turned on, it has its own XML area where it outputs the event's ID, timestamp, and any applicable event data.

Use EventSelector to choose an event, then use EventNotification to set the event On or Off.

The possible events to choose are:

Exposure End - Event is sent every image when exposure end occurs. Event data includes: the event ID, timestamp, and frame ID.

Error - Event is sent every time an error occurs internally in the device. Event data includes: the event ID, timestamp, frame ID, and error code.

In order to verify that events are working, there is a Test Event Generate command which allows you to trigger the camera to send a test event out.

Event Test - Event you can trigger to verify events are working properly. This is always enabled. Event data includes: exposure end ID and exposure end timestamp.

14.1 Summary Table

Name	Interface	Access	Visibility	Description
Event Selector	IEnumeration	RW	Expert	Selects which Event to enable or disable.
Event Notification [Event Selector]	IEnumeration	RW	Expert	Enables/Disables the selected event.
Event Exposure End Data	ICategory	RO	Expert	Category that contains all the data features related to the Exposure End Event.
Event Error Data	ICategory	RO	Expert	Category that contains all the data features related to the Error Event.
Event Serial Port Receive Data	ICategory	RO	Expert	Category that contains all the data features related to the Serial Port Receive Event.
Event Inference Data	ICategory	RO	Expert	Category that contains all the data features related to the Inference Event.
Event Test Data	ICategory	RO	Expert	Category that contains all the data features related to the Test Event.

14.2 Event Control Features

14.2.1 Event Selector

Selects which Event to enable or disable.

Property	Value
Name	EventSelector
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values

Error
ExposureEnd
SerialPortReceive
Inference

14.2.2 Event Notification

Enables/Disables the selected event.

Property	Value
Name	EventNotification [Event Selector]
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values

On
Off

14.2.3 Event Exposure End Data

Category that contains all the data features related to the Exposure End Event.

Property	Value
Name	EventExposureEndData
Interface	ICategory
Access	RO
Visibility	Expert

14.2.4 Event Error Data

Category that contains all the data features related to the Error Event.

Property	Value
Name	EventErrorData
Interface	ICategory
Access	RO
Visibility	Expert

14.2.5 Event Serial Port Receive Data

Category that contains all the data features related to the Serial Port Receive Event.

Property	Value
Name	EventSerialPortReceiveData
Interface	ICategory
Access	RO
Visibility	Expert

14.2.6 Event Inference Data

Category that contains all the data features related to the Inference Event.

Property	Value
Name	EventInferenceData

Property	Value
Interface	ICategory
Access	RO
Visibility	Expert

14.2.7 Event Test Data

Category that contains all the data features related to the Test Event.

Property	Value
Name	EventTestData
Interface	ICategory
Access	RO
Visibility	Expert

14.3 Event Exposure End Data

Category that contains all the data features related to the Exposure End Event.

14.3.1 Summary Table

Name	Interface	Access	Visibility	Description
Event Exposure End	IInteger	RO	Expert	Returns the unique identifier of the Exposure End type of Event.
Event Exposure End Timestamp	IInteger	RO	Expert	Returns the Timestamp of the Exposure End Event.
Event Exposure End Frame ID	IInteger	RO	Expert	Returns the unique identifier of the frame (or image) that generated the Exposure End Event.

14.3.2 Event Exposure End Data Features

14.3.2.1 Event Exposure End

Returns the unique identifier of the Exposure End type of Event.

Property	Value
Name	EventExposureEnd
Interface	IInteger
Access	RO
Unit	
Visibility	Expert
Value	0x9C43

14.3.2.2 Event Exposure End Timestamp

Returns the Timestamp of the Exposure End Event.

Property	Value
Name	EventExposureEndTimestamp
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

14.3.2.3 Event Exposure End Frame ID

Returns the unique identifier of the frame (or image) that generated the Exposure End Event.

Property	Value
Name	EventExposureEndFrameID
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

14.4 Event Error Data

Category that contains all the data features related to the Error Event.

14.4.1 Summary Table

Name	Interface	Access	Visibility	Description
Event Error	IInteger	RO	Expert	Returns the unique identifier of the Error type of Event.
Event Error Timestamp	IInteger	RO	Expert	Returns the Timestamp of the Error Event.
Event Error Frame ID	IInteger	RO	Expert	Returns the unique identifier of the frame (or image) that generated the Error Event.
Event Error Code	IInteger	RO	Expert	Returns the error code for the error that happened.

14.4.2 Event Error Data Features

14.4.2.1 Event Error

Returns the unique identifier of the Error type of Event.

Property	Value
Name	EventError
Interface	IInteger
Access	RO
Unit	
Visibility	Expert
Value	0x9C40

14.4.2.2 Event Error Timestamp

Returns the Timestamp of the Error Event.

Property	Value
Name	EventErrorTimestamp
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

14.4.2.3 Event Error Frame ID

Returns the unique identifier of the frame (or image) that generated the Error Event.

Property	Value
Name	EventErrorFrameID
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

14.4.2.4 Event Error Code

Returns the error code for the error that happened.

Property	Value
Name	EventErrorCode
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

14.5 Event Serial Port Receive Data

Category that contains all the data features related to the Serial Port Receive Event.

14.5.1 Summary Table

Name	Interface	Access	Visibility	Description
Event Serial Port Receive	IInteger	RO	Expert	Returns the unique identifier of the Serial Port Receive type of Event.
Event Serial Port Receive Timestamp	IInteger	RO	Expert	Returns the Timestamp of the Serial Port Receive Event.
Event Serial Data	IStringReg		Expert	Returns the serial data that was received.
Event Serial Data Length	IInteger	RO	Expert	Returns the length of the received serial data that was included in the event payload.

Name	Interface	Access	Visibility	Description
Event Serial Receive Overflow	IBoolean	RO	Expert	Returns the status of the event serial receive overflow.

14.5.2 Event Serial Port Receive Data Features

14.5.2.1 Event Serial Port Receive

Returns the unique identifier of the Serial Port Receive type of Event.

Property	Value
Name	EventSerialPortReceive
Interface	IInteger
Access	RO
Unit	
Visibility	Expert
Value	0x9C45

14.5.2.2 Event Serial Port Receive Timestamp

Returns the Timestamp of the Serial Port Receive Event.

Property	Value
Name	EventSerialPortReceiveTimestamp
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

14.5.2.3 Event Serial Data

Returns the serial data that was received.

Property	Value
Name	EventSerialData

Property	Value
Interface	IStringReg
Access	
Visibility	Expert

14.5.2.4 Event Serial Data Length

Returns the length of the received serial data that was included in the event payload.

Property	Value
Name	EventSerialDataLength
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

14.5.2.5 Event Serial Receive Overflow

Returns the status of the event serial receive overflow.

Property	Value
Name	EventSerialReceiveOverflow
Interface	IBoolean
Access	RO
Visibility	Expert

14.6 Event Test Data

Category that contains all the data features related to the Test Event.

14.6.1 Summary Table

Name	Interface	Access	Visibility	Description
Event Test	IInteger	RO	Expert	Returns the unique identifier of the Test type of Event.
Event Test Timestamp	IInteger	RO	Expert	Returns the Timestamp of the Test Event.

14.6.2 Event Test Data Features

14.6.2.1 Event Test

Returns the unique identifier of the Test type of Event.

Property	Value
Name	EventTest
Interface	IInteger
Access	RO
Unit	
Visibility	Expert
Value	0x4FFF

14.6.2.2 Event Test Timestamp

Returns the Timestamp of the Test Event.

Property	Value
Name	EventTestTimestamp
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

15 Test Control

Test Control provides functionality to allow certain features to be exercised.

There are two features available in Test Control:

TestEventGenerate - This feature allows you to generate test events. Executing sends a single TestEvent, which then populates the Event Test Data selector with the ID and the timestamp of when the event occurred.

TestPendingAck - This feature allows you to test the device's pending acknowledge feature. When this feature is written, the device waits for the corresponding time period in milliseconds before acknowledging the write.

Test0001 - This feature is for internal testing only.

If a test fails, an error is produced for the log.

15.1 Summary Table

Name	Interface	Access	Visibility	Description
Test Pending Ack	IInteger	RW	Guru	Test PENDING_ACK feature.
Test Event Generate	ICommand	WO	Guru	This command generates a test event and sends it to the host.
Test 0001	IInteger	RW	Expert	Reserved for testing only.

15.2 Test Control Features

15.2.1 Test Pending Ack

Test PENDING_ACK feature.

Property	Value
Name	TestPendingAck
Interface	IInteger
Access	RW
Unit	
Visibility	Guru

15.2.2 Test Event Generate

This command generates a test event and sends it to the host.

Property	Value
Name	TestEventGenerate
Interface	ICommand
Access	WO
Visibility	Guru

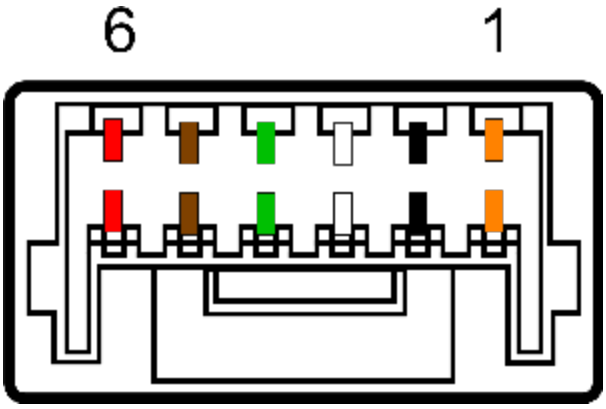
15.2.3 Test 0001

Reserved for testing only.

Property	Value
Name	Test0001
Interface	IInteger
Access	RW
Unit	
Visibility	Expert

16 Digital IO Control

The camera is equipped with a 6-pin GPIO connector. The connector is a JST BM06B-NSHSS-TBT (LF)(SN), the mating connector is a JST NSHR-06V-S.



Color	Pin	Line	Function	Description	Parameters	Min	Max	Unit
Orange	1	0	GPIO0	Non-isolated Input/Output TXD (output) for 1.8 V UART	Input Low Level	0	1.4	V
					Input High Level	2.6	24	V
					Propagation Delay		1	µs
					Output Low Current		25	mA
					Output High Level	0	24	V
Black	2	1	GPIO1	Non-isolated Input/Output RXD (input) for 1.8 V UART	Input Low Level	0	1.4	V
					Input High Level	2.6	24	V
					Propagation Delay		1	µs
					Output Low Current		25	mA
					Output High Level	0	24	V
White	3	2	GPIO2	Non-isolated Input/Output	Input Low Level	0	1.4	V
					Input High Level	2.6	24	V
					Propagation Delay		1	µs
					Output Low Current		25	mA
					Output High Level	0	24	V

Color	Pin	Line	Function	Description	Parameters	Min	Max	Unit
Green	4	3	GPIO3	Non-isolated Input/Output	Input Low Level	0	1.4	V
					Input High Level	2.6	24	V
					Propagation Delay		1	µs
					Output Low Current		25	mA
					Output High Level	0	24	V
Brown	5	N/A	GND	Camera Power Ground				
Red	6	N/A	Vout	Camera Power Output	Output Voltage	3.05	3.35	V
					Output Current		120	mA

This section describes how to configure the camera's general purpose digital input and outputs (sometimes referred to as GPIO).

Use LineSelector to choose which of the 4 lines to configure. All the features listed beneath it are controllable on a per line basis.

Use Line Mode to control the direction - either **Input** or **Output** - of the selected I/O line.

Use LineInverter to control a logic inverter on the selected line.

LineStatus indicates the current status of the selected line. A checked status (enabled) indicates logic high. An unchecked status (disabled) indicates logic low. Since this node must be polled to get its status it should not be used as a real time control for reading internal signals.

LineStatusAll is a hexadecimal representation of all the line status bits (Line 0 status corresponds to bit 0, Line 1 status with bit 1, etc). This allows simultaneous reading of all line statuses at once.

Use LineSource to control what signal is output on the line when the Line Mode is set to output. The choices are:

Other Lines - creates a loop back

Exposure Active - indicates when the image sensor is exposing

Frame Trigger Wait - indicates when the camera is ready to accept a new Frame Start trigger

16.1 Summary Table

Name	Interface	Access	Visibility	Description
Line Selector	IEnumeration		Expert	Selects the physical line (or pin) of the external device connector to configure
Line Mode [Line Selector]	IEnumeration		Expert	Controls if the physical Line is used to Input or Output a signal.

Name	Interface	Access	Visibility	Description
3.3V Enable	IBoolean	RW	Guru	Internally generated 3.3V rail. Enable to supply external circuits with power. This is different than standard logic outputs in that it is comparatively slow to switch but can supply a more significant amount of power. This is only available on some pins.
Line Inverter [Line Selector]	IBoolean	RW	Expert	Controls the inversion of the signal of the selected input or output line.
Line Status [Line Selector]	IBoolean	RO	Expert	Returns the current status of the selected input or output Line
Line Status All	IInteger	RO	Expert	Returns the current status of all the line status bits in a hexadecimal representation (Line 0 status corresponds to bit 0, Line 1 status with bit 1, etc). This allows simultaneous reading of all line statuses at once.
Line Source [Line Selector]	IEnumeration		Expert	Selects which internal acquisition or I/O source signal to output on the selected line. LineMode must be Output.
Line Inference Target [Line Selector]	IInteger	RW	Beginner	Inference classification result to trigger GPIO outputs.
Line Inference Threshold [Line Selector]	IFloat	RW	Beginner	Inference confidence threshold to trigger GPIO outputs.
User Output Selector	IEnumeration		Expert	Selects which bit of the User Output register is set by UserOutputValue.
User Output Value [User Output Selector]	IBoolean	RW	Expert	Value of the selected user output, either logic high (enabled) or logic low (disabled).
User Output Value All	IInteger		Expert	Returns the current status of all the user output status bits in a hexadecimal representation (UserOutput 0 status corresponds to bit 0, UserOutput 1 status with bit 1, etc). This allows simultaneous reading of all user output statuses at once.

16.2 Digital IO Control Features

16.2.1 Line Selector

Selects the physical line (or pin) of the external device connector to configure

Property	Value
Name	LineSelector
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values

Line0
Line1
Line2
Line3

16.2.2 Line Mode

Controls if the physical Line is used to Input or Output a signal.

Property	Value
Name	LineMode [Line Selector]
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values

Input
Output

16.2.3 3.3V Enable

Internally generated 3.3V rail. Enable to supply external circuits with power. This is different than standard logic outputs in that it is comparatively slow to switch but can supply a more significant amount of power. This is only available on some pins.

Property	Value
Name	V3_3Enable
Interface	IBoolean
Access	RW
Visibility	Guru

16.2.4 Line Inverter

Controls the inversion of the signal of the selected input or output line.

Property	Value
Name	LineInverter [Line Selector]
Interface	IBoolean
Access	RW
Visibility	Expert

16.2.5 Line Status

Returns the current status of the selected input or output Line

Property	Value
Name	LineStatus [Line Selector]
Interface	IBoolean
Access	RO
Visibility	Expert

16.2.6 Line Status All

Returns the current status of all the line status bits in a hexadecimal representation (Line 0 status corresponds to bit 0, Line 1 status with bit 1, etc). This allows simultaneous reading of all line statuses at once.

Property	Value
Name	LineStatusAll
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

16.2.7 Line Source

Selects which internal acquisition or I/O source signal to output on the selected line. LineMode must be Output.

Property	Value
Name	LineSource [Line Selector]
Interface	IEnumeration
Access	
Visibility	Expert

Enumeration Values

Off
Line0
Line1
Line2
Line3
UserOutput0
UserOutput1
UserOutput2
UserOutput3
ExposureActive
FrameTriggerWait

Enumeration Values
InferenceOutput
SerialPort0

16.2.8 Line Inference Target

Inference classification result to trigger GPIO outputs.

Property	Value
Name	LineInferenceTarget [Line Selector]
Interface	IInteger
Access	RW
Unit	
Visibility	Beginner

16.2.9 Line Inference Threshold

Inference confidence threshold to trigger GPIO outputs.

Property	Value
Name	LineInferenceThreshold [Line Selector]
Interface	IFloat
Access	RW
Unit	
Visibility	Beginner

16.2.10 User Output Selector

Selects which bit of the User Output register is set by UserOutputValue.

Property	Value
Name	UserOutputSelector
Interface	IEnumeration

Property	Value
Access	
Visibility	Expert

Enumeration Values

UserOutput0
UserOutput1
UserOutput2
UserOutput3

16.2.11 User Output Value

Value of the selected user output, either logic high (enabled) or logic low (disabled).

Property	Value
Name	UserOutputValue [User Output Selector]
Interface	IBoolean
Access	RW
Visibility	Expert

16.2.12 User Output Value All

Returns the current status of all the user output status bits in a hexadecimal representation (UserOutput 0 status corresponds to bit 0, UserOutput 1 status with bit 1, etc). This allows simultaneous reading of all user output statuses at once.

Property	Value
Name	UserOutputValueAll
Interface	IInteger
Access	
Unit	
Visibility	Expert

17 Serial Port Control

17.1 Serial Port

The serial port can be used to transmit and receive serial data through the device using the transport layer. The serial data can be sent through the transport layer in image data (via the SerialData Chunk Data), in control data (via the File Access Control), or in event data (via the SerialPortReceive Event).

The serial port to configure is selected using the SerialPortSelector. The physical line on which to receive serial data is set using the SerialPortSource. The physical line on which to transmit serial data is set using the LineSource in the Digital IO Control. The serial port settings for both the receive and transmit can be set using the SerialPortBaudRate, SerialPortDataBits, SerialPortStopBits, and SerialPortParity.

Serial data can be transmitted and received through the File Access Control. Once the serial port file is opened, data can be transmitted via Write operations and received via Read operations. Received serial data can also be obtained through the SerialPortReceive Event which will be generated when data is available or through the SerialData Chunk Data which is appended into each image payload.

The total number of characters in the serial port transmit and receive queues can be monitored using the SerialTransmitQueueMaxCharacterCount and the SerialReceiveQueueMaxCharacterCount. The current number of characters in the queues can be monitored using the SerialTransmitQueueCurrentCharacterCount and SerialReceiveQueueCurrentCharacterCount. The SerialReceiveQueueCurrentCharacterCount reports the maximum number of characters that can be obtained using the File Access Control. The receive queue can be emptied by executing the SerialReceiveQueueClear.

Serial port framing and parity errors are reported using the SerialRecieveFramingErrorCount and the SerialReceiveParityErrorCount. Overflow errors are reported within the SerialData Chunk Data, the SerialPortReceive Event, or in the FileOperationStatus after executing a Read.

17.2 Summary Table

Name	Interface	Access	Visibility	Description
Serial Port Selector	IEnumeration	RW	Expert	Selects which serial port of the device to control.
Serial Port Source [Serial Port Selector]	IEnumeration	RW	Expert	Specifies the physical input Line on which to receive serial data.
Serial Port Baud Rate [Serial Port Selector]	IEnumeration	RW	Expert	This feature controls the baud rate used by the selected serial port.
Serial Port Data Bits [Serial Port Selector]	IInteger	RW	Expert	This feature controls the number of data bits used by the selected serial port. Possible values that can be used are between 5 and 9.
Serial Port Stop Bits [Serial Port Selector]	IEnumeration	RW	Expert	This feature controls the number of stop bits used by the selected serial port.

Name	Interface	Access	Visibility	Description
Serial Port Parity [Serial Port Selector]	IEnumeration	RW	Expert	This feature controls the parity used by the selected serial port.
Transmit Queue Max Character Count [Serial Port Selector]	IInteger	RO	Expert	>Returns the maximum number of characters in the serial port transmit queue.
Transmit Queue Current Character Count [Serial Port Selector]	IInteger	RO	Expert	Returns the number of characters currently in the serial port transmit queue.
Receive Queue Max Character Count [Serial Port Selector]	IInteger	RO	Expert	>Returns the maximum number of characters in the serial port receive queue.
Receive Queue Current Character Count [Serial Port Selector]	IInteger	RO	Expert	Returns the number of characters currently in the serial port receive queue.
Receive Queue Clear [Serial Port Selector]	ICommand	WO	Expert	This is a command that clears the device serial port receive queue.
Receive Framing Error Count [Serial Port Selector]	IInteger	RO	Expert	Returns the number of framing errors that have occurred on the serial port.
Receive Parity Error Count [Serial Port Selector]	IInteger	RO	Expert	Returns the number of parity errors that have occurred on the serial port.

17.3 Serial Port Control Features

17.3.1 Serial Port Selector

Selects which serial port of the device to control.

Property	Value
Name	SerialPortSelector
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values
SerialPort0

17.3.2 Serial Port Source

Specifies the physical input Line on which to receive serial data.

Property	Value
Name	SerialPortSource [Serial Port Selector]
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values
Line0
Line1
Off

17.3.3 Serial Port Baud Rate

This feature controls the baud rate used by the selected serial port.

Property	Value
Name	SerialPortBaudRate [Serial Port Selector]
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values
Baud300
Baud600
Baud1200

Enumeration Values
Baud2400
Baud4800
Baud9600
Baud14400
Baud19200
Baud38400
Baud57600
Baud115200

17.3.4 Serial Port Data Bits

This feature controls the number of data bits used by the selected serial port. Possible values that can be used are between 5 and 9.

Property	Value
Name	SerialPortDataBits [Serial Port Selector]
Interface	IInteger
Access	RW
Unit	
Visibility	Expert

17.3.5 Serial Port Stop Bits

This feature controls the number of stop bits used by the selected serial port.

Property	Value
Name	SerialPortStopBits [Serial Port Selector]
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values
Bits1
Bits1AndAHalf
Bits2

17.3.6 Serial Port Parity

This feature controls the parity used by the selected serial port.

Property	Value
Name	SerialPortParity [Serial Port Selector]
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values
None
Odd
Even
Mark
Space

17.3.7 Transmit Queue Max Character Count

>Returns the maximum number of characters in the serial port transmit queue.

Property	Value
Name	SerialTransmitQueueMaxCharacterCount [Serial Port Selector]
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

17.3.8 Transmit Queue Current Character Count

Returns the number of characters currently in the serial port transmit queue.

Property	Value
Name	SerialTransmitQueueCurrentCharacterCount [Serial Port Selector]
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

17.3.9 Receive Queue Max Character Count

>Returns the maximum number of characters in the serial port receive queue.

Property	Value
Name	SerialReceiveQueueMaxCharacterCount [Serial Port Selector]
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

17.3.10 Receive Queue Current Character Count

Returns the number of characters currently in the serial port receive queue.

Property	Value
Name	SerialReceiveQueueCurrentCharacterCount [Serial Port Selector]
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

17.3.11 Receive Queue Clear

This is a command that clears the device serial port receive queue.

Property	Value
Name	SerialReceiveQueueClear [Serial Port Selector]
Interface	ICommand
Access	WO
Visibility	Expert

17.3.12 Receive Framing Error Count

Returns the number of framing errors that have occurred on the serial port.

Property	Value
Name	SerialReceiveFramingErrorCount [Serial Port Selector]
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

17.3.13 Receive Parity Error Count

Returns the number of parity errors that have occurred on the serial port.

Property	Value
Name	SerialReceiveParityErrorCount [Serial Port Selector]
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

17 File Access

17.1 File Access

The file access interface allows access to the cameras file system.

It provides access to the cameras user set files, LUT files and a user definable file.

Usage of the file access features and registers should not be attempted directly. Instead access the file system through the file access interface of the host application.

There are three user set files (UserSetDefault, UserSet0, and UserSet1). The user set files are treated differently than the other files in the system. When uploaded these files modify the user set setting within the camera. If the user set file is from an older version of the camera or a different model, the user sets within the file are converted to the appropriate user sets for the new firmware. The file is then replaced with the updated user set file. If the file contains user sets that are not appropriate for the firmware version on the camera, they are ignored and discarded. If the file has been modified in any way, the file is discarded and regenerated. UserSetDefault is read-only and cannot be modified.

The UserFile1 is a user definable file.

The SerialPort0 is a file that can be transferred via the serial port.

While a file is open within the file access interface, the camera is not able to start acquisition. Also, the FileAccessExecute command is disabled when the camera is in acquisition mode. Care should be taken to not leave any file open within the camera's file system as it disables the start acquisition register without any feedback as to why.

17.2 Summary Table

Name	Interface	Access	Visibility	Description
File Selector	IEnumeration	RW	Guru	Selects which file is being operated on. This must be set before performing any file operations.
File Operation Selector	IEnumeration	RW	Guru	Sets operation to execute on the selected file when the execute command is given.
Save File To Camera	IBoolean		Guru	
File Operation Execute	ICommand	WO	Guru	This is a command that executes the selected file operation on the selected file.
File Open Mode	IEnumeration	RW	Guru	The mode of the file when it is opened. The file can be opened for reading, writting or both. This must be set before opening the file.
File Access Buffer	IRegister	RW	Guru	Defines the intermediate access buffer that allows the exchange of data between the device file storage and the application.

Name	Interface	Access	Visibility	Description
File Access Offset	IInteger	RW	Guru	Controls the Offset of the mapping between the device file storage and the FileAccessBuffer.
File Access Length	IInteger	RW	Guru	Controls the Length of the mapping between the device file storage and the FileAccessBuffer.
File Operation Status	IEnumeration	RO	Guru	Represents the file operation execution status.
File Operation Result	IInteger	RO	Guru	Represents the file operation result. For Read or Write operations, the number of successfully read/written bytes is returned.
File Size	IInteger	RO	Guru	Represents the size of the selected file in bytes.
File System Command	IEnumeration	RW	Guru	Specifies the low level file system command to execute.
File System Command Execute	ICommand	WO	Guru	This is a command that executes the selected file system command.
File System Command Result	IStringReg			

17.3 File Access Features

17.3.1 File Selector

Selects which file is being operated on. This must be set before performing any file operations.

Property	Value
Name	FileSelector
Interface	IEnumeration
Access	RW
Visibility	Guru

Enumeration Values

UserSetDefault

Enumeration Values
UserSet0
UserSet1
UserFile1
InjectedImage
SerialPort0
InferenceNetwork
InferenceLabels

17.3.2 File Operation Selector

Sets operation to execute on the selected file when the execute command is given.

Property	Value
Name	FileOperationSelector
Interface	IEnumeration
Access	RW
Visibility	Guru

Enumeration Values
Open
Close
Read
Write
Delete

17.3.3 Save File To Camera

Property	Value
Name	FileWriteToFlash

Property	Value
Interface	IBoolean
Access	
Visibility	Guru

17.3.4 File Operation Execute

This is a command that executes the selected file operation on the selected file.

Property	Value
Name	FileOperationExecute
Interface	ICommand
Access	WO
Visibility	Guru

17.3.5 File Open Mode

The mode of the file when it is opened. The file can be opened for reading, writting or both. This must be set before opening the file.

Property	Value
Name	FileOpenMode
Interface	IEnumeration
Access	RW
Visibility	Guru

Enumeration Values

Read
Write
ReadWrite

17.3.6 File Access Buffer

Defines the intermediate access buffer that allows the exchange of data between the device file storage and the application.

Property	Value
Name	FileAccessBuffer
Interface	IRegister
Access	RW
Visibility	Guru

17.3.7 File Access Offset

Controls the Offset of the mapping between the device file storage and the FileAccessBuffer.

Property	Value
Name	FileAccessOffset
Interface	IInteger
Access	RW
Unit	B
Visibility	Guru

17.3.8 File Access Length

Controls the Length of the mapping between the device file storage and the FileAccessBuffer.

Property	Value
Name	FileAccessLength
Interface	IInteger
Access	RW
Unit	B
Visibility	Guru

17.3.9 File Operation Status

Represents the file operation execution status.

Property	Value
Name	FileOperationStatus
Interface	IEnumeration
Access	RO
Visibility	Guru

Enumeration Values
Success
Failure
Overflow

17.3.10 File Operation Result

Represents the file operation result. For Read or Write operations, the number of successfully read/written bytes is returned.

Property	Value
Name	FileOperationResult
Interface	IInteger
Access	RO
Unit	
Visibility	Guru

17.3.11 File Size

Represents the size of the selected file in bytes.

Property	Value
Name	FileSize
Interface	IInteger
Access	RO
Unit	B

Property	Value
Visibility	Guru

17.3.12 File System Command

Specifies the low level file system command to execute.

Property	Value
Name	FileSystemCommand
Interface	IEnumeration
Access	RW
Visibility	Guru

Enumeration Values
NoCommand
SaveDdrToFlash

17.3.13 File System Command Execute

This is a command that executes the selected file system command.

Property	Value
Name	FileSystemCommandExecute
Interface	ICommand
Access	WO
Visibility	Guru

17.3.14 File System Command Result

Property	Value
Name	FileSystemCommandResult
Interface	IStringReg

Property	Value
Access	
Visibility	

18 Transfer Control

The Transfer Control category contains features that control the transferring of image data to the host.

An acquisition generates frames that are optionally processed and may have extra data appended (chunk data) before being placed in the transfer queue for transmission out of the device. Once the image data has gone through any processing and had the appropriate data appended it is referred to as a block. These blocks are then handed to the transfer module to be sent out of the device on data streams. The transfer module then transmits these blocks externally on stream channels.

This can be manually or automatically controlled. Use the Transfer Control Mode to select the control method. There are three options: **Basic**, **Automatic**, and **User Controlled**.

In both **Basic** and **Automatic** mode the camera starts transmitting data as soon as there is enough data to fill a link layer packet. This reduces the latency between when the image was acquired and when it is available to the user. As long as the link layer is able to transfer data blocks faster than they are being generated the camera continuously sends one image after another on the stream channel.

There is a **Transfer Queue** which starts to fill up if the link slows down.

> The Transfer Queue Max Block Count indicates the transfer queue's maximum capacity.
>
> The Transfer Queue Current Block Count indicates the number of blocks currently in the transfer queue.
>
> The Transfer Queue Overflow Count indicates the number of blocks that have been lost before being transmitted.
>
> The Transfer Queue Mode indicates the mechanism for transmitting and overwriting blocks in the transfer queue. It is First In First Out, which means the oldest block in the queue is always sent next on the stream channel.

Once the transfer queue is full the camera overwrites the oldest block in the queue with the new block arriving from the acquisition and processing modules that has not already begun being transmitted. At this point the Queue Overflow is incremented. Once the image that is currently being transmitted finishes, the transmission module transmits the next oldest image in the transfer queue.

In **User Controlled** mode you can directly control the transfer of blocks. Use the Transfer Operation Mode to select an operation mode. There are two options: **Continuous** and **Multi Block**.

> **Continuous** sends images without stopping in the same manner as Basic/Automatic, but you can use Transfer Start and Transfer Stop to control the streaming while acquisition runs independently.
>
> **Multi Block** transmits a specified number of blocks and then stops. Use the Transfer Block Count to specific the number of blocks. Use the Transfer Start command to initiate a multi block transfer.

Note: Acquisition can be started and stopped without affecting the transfer queue or transfer state however closing the stream channel clears both the queue and any pending transmissions.

18.1 Summary Table

Name	Interface	Access	Visibility	Description
Transfer Control Mode	IEnumeration	RW	Expert	Selects the control method for the transfers. Basic and Automatic start transmitting data as soon as there is enough data to fill a link layer packet. User Controlled allows you to directly control the transfer of blocks.
Transfer Operation Mode	IEnumeration	RW	Expert	Selects the operation mode of the transfer. Continuous is similar to Basic/Automatic but you can start/stop the transfer while acquisition runs independently. Multi Block transmits a specified number of blocks and then stops.
Transfer Block Count	IInteger	RW	Expert	Specifies the number of data blocks (images) that the device should stream before stopping. This feature is only active if the Transfer Operation Mode is set to Multi Block.
Transfer Queue Max Block Count	IInteger	RO	Expert	Returns the maximum number of data blocks (images) in the transfer queue
Transfer Queue Current Block Count	IInteger	RO	Expert	Returns number of data blocks (images) currently in the transfer queue.
Transfer Queue Overflow Count	IInteger	RO	Expert	Returns number of images that have been lost before being transmitted because the transmit queue hasn't been cleared fast enough.
Transfer Queue Mode	IEnumeration	RW	Expert	Specifies the operation mode of the transfer queue.
Transfer Start	ICommand	WO	Expert	Starts the streaming of data blocks (images) out of the device. This feature is available when the Transfer Control Mode is set to User Controlled.
Transfer Stop	ICommand	WO	Expert	Stops the streaming of data block (images). The current block transmission is completed. This feature is available when the Transfer Control Mode is set to User Controlled.

18.2 Transfer Control Features

18.2.1 Transfer Control Mode

Selects the control method for the transfers. Basic and Automatic start transmitting data as soon as there is enough data to fill a link layer packet. User Controlled allows you to directly control the transfer of blocks.

Property	Value
Name	TransferControlMode
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values

Basic
Automatic
UserControlled

18.2.2 Transfer Operation Mode

Selects the operation mode of the transfer. Continuous is similar to Basic/Automatic but you can start/stop the transfer while acquisition runs independently. Multi Block transmits a specified number of blocks and then stops.

Property	Value
Name	TransferOperationMode
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values

Continuous
MultiBlock

18.2.3 Transfer Block Count

Specifies the number of data blocks (images) that the device should stream before stopping. This feature is only active if the Transfer Operation Mode is set to Multi Block.

Property	Value
Name	TransferBlockCount
Interface	IInteger
Access	RW
Unit	
Visibility	Expert

18.2.4 Transfer Queue Max Block Count

Returns the maximum number of data blocks (images) in the transfer queue

Property	Value
Name	TransferQueueMaxBlockCount
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

18.2.5 Transfer Queue Current Block Count

Returns number of data blocks (images) currently in the transfer queue.

Property	Value
Name	TransferQueueCurrentBlockCount
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

18.2.6 Transfer Queue Overflow Count

Returns number of images that have been lost before being transmitted because the transmit queue hasn't been cleared fast enough.

Property	Value
Name	TransferQueueOverflowCount
Interface	IInteger
Access	RO
Unit	
Visibility	Expert

18.2.7 Transfer Queue Mode

Specifies the operation mode of the transfer queue.

Property	Value
Name	TransferQueueMode
Interface	IEnumeration
Access	RW
Visibility	Expert

Enumeration Values

FirstInFirstOut

18.2.8 Transfer Start

Starts the streaming of data blocks (images) out of the device. This feature is available when the Transfer Control Mode is set to User Controlled.

Property	Value
Name	TransferStart
Interface	ICommand
Access	WO
Visibility	Expert

18.2.9 Transfer Stop

Stops the streaming of data block (images). The current block transmission is completed. This feature is available when the Transfer Control Mode is set to User Controlled.

Property	Value
Name	TransferStop
Interface	ICommand
Access	WO
Visibility	Expert

Contacting Us

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