



GigE Line Scan Camera User's Manual

CAM-CIC-4KL-28-G-1

CIC-L042-CG-28-G

V1.2

Abstract

The document briefly describes GigE Line Scan Industrial Camera, including product introduction, networking, basic parameters and applications for quick operation.

Symbol Convention

The following symbols may appear in this document, and their meanings are as follows:

Symbol	Description
 Danger	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 Warning	Indicates a moderate or low level of potential danger which, if not avoided, could result in minor or moderate injury.
 Caution	Indicates a potential risk that, if ignored, could result in damage to device, loss of data, degraded performance, or unpredictable results.
 Tips	It can help you solve a problem or save you time.
 Instructions	Indicates additional information to the text, which is to emphasize or supplement.

Important Safety Instructions

Here is the proper use of the product and prevention of dangers as well as loss of property, etc. Be sure to follow the instructions when using.



Caution

- Please do not place or install the device in the location with strong sunlight or near the heat-generating equipment, make sure the cover temperature is controlled below 60°C.
- Please do not install the device in a humid place with dust or soot, please make sure the lens cover is locked if the camera is not connected to the lens, which is to avoid dust entering the camera.
- Please install the device in a stable location, pay attention to prevent the device falling.
- Please do not allow water or other liquid dripping or splashing on the device and make sure there is no object which is full of liquid placed on the device, which is to avoid liquid flowing into the device.
- Please install the device in a location with good ventilation, do not block the ventilation opening of the device.
- Use the device only within the rated input and output range.
- Please do not dismantle the device at will.
- Please transport, use and store the device within the allowable range of humidity and temperature.

Special Announcement

- Please be noted that the manual is for reference only.
- The manual will be regularly updated according to the product update; the updated content will be added in the manual without prior announcement.
- The company is not liable for any loss caused by the operation which is not implemented according to the manual.
- There may be some technical deviation, errors which are not consistent with the product function and operation or misprint, please refer to the company's final explanation if there is any doubt or dispute.

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1 Product Overview

1.1 Product Introduction

The device is a highly reliable and cost-effective camera for industrial use. The device uses high-performance photosensitive chip and supports real-time transmission of image data through Gigabit Ethernet. It is compatible with all application development tools (such as Genicam2.0, and GigE Vision 2.1) that comply with GigE Vision and GenICam standards. The max. transmission rate can reach 1000 Mbps, meeting the needs of most industrial applications. It can work stably in various harsh environments. The device transmits images through Gigabit Ethernet and allows you to use images and set camera parameters through the client or SDK.

1.2 Product Features

Easy installation, convenient operation, support:

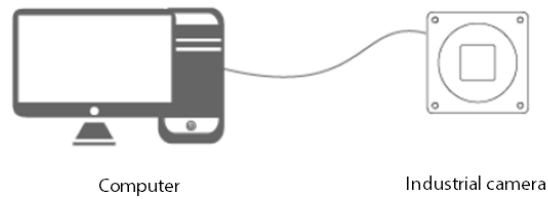
- Simple installation and easy operations.
- Max. transmission distance of 100 m. We recommend you use CAT5e cables or cables of higher specifications.
- Multiple trigger modes such as external trigger, free-run, multi-frame trigger, and more.
- Multiple image data formats.
- Compatible with GigE protocol and GenICam standard.
- 12-24 VDC wide range voltage.
- Complies with CE and FCC certification standards.
- Bright field uniformity correction and multiple ISP functions.

1.3 Typical Networking

The most typical networking method for industrial cameras is point-to-point connection. One host can also connect multiple industrial cameras through multiple Ethernet ports or switches. After connection, you can configure and use the device for detection through software platform.

Networking of the device: Connect the host and the industrial camera through a network cable.

Figure 1-1 Typical Networking



1.4 Main Technical Parameters

Main technical parameters of GigE Line Scan Industrial Camera are as follow:

Sheet 1-1 CAM-CIC-4KL-28-G-1 & CIC-L042-CG-28-G Technical Parameters

4K GigE Mono/Color Line Scan Industrial Camera		
Sensor	Sensor Model	GPixel GL0402
	Sensor Type	CMOS
	Mono/Color	Mono/Color
	Shutter	Global
	Resolution	4096 x 2
	Pixel Size [μm]	7 x 7
	Bit Depth	12bit
	Frame Rate	28K
Image	Dynamic Range	66dB
	Signal to Noise Ratio [SNR]	39.4dB
	Gain	0~30dB
	Exposure Time	8μs~100ms
	Image Format	Mono: Mono8/10/12/10Packed/12Packed; Color: mono8, BayerRG8/10/12/10P/12P, RGB8, YUV422Packed;
Physical Interface	Data Interface	GigE
	IO Interface	12-pin Hirose connector: 2 differential/single-ended inputs, 1 differential configurable input or output, 1 high-speed optocoupler single-ended input, 1 GPIO configurable input or output
	Lens Mount	M42×1
Power/Weight Dimension/ Certification	Power Supply	DC power through 12-pin Hirose connector with voltage range of 12V~24V
	Power Consumption	12V≈4.5W
	Temperature	Storage Temperature: -30℃ ~ +80℃; Operating Temperature: -30℃~+50℃
	Dimensions	62mm×62mm×44mm(Excluding the lens mount and the

4K GigE Mono/Color Line Scan Industrial Camera		
		rear case connectors)
	Weight	260g
	Certification	Conforms to CE, FCC, RoHS, GigE Vision V2.0 and GenICam
	Software	GenICam and GigE Vision supported devices

1.5 Spectral Curve

The following spectral curve data are derived from the manual of the selected chip.

Figure 1-2 GPixel GL0402 Color Spectral Response

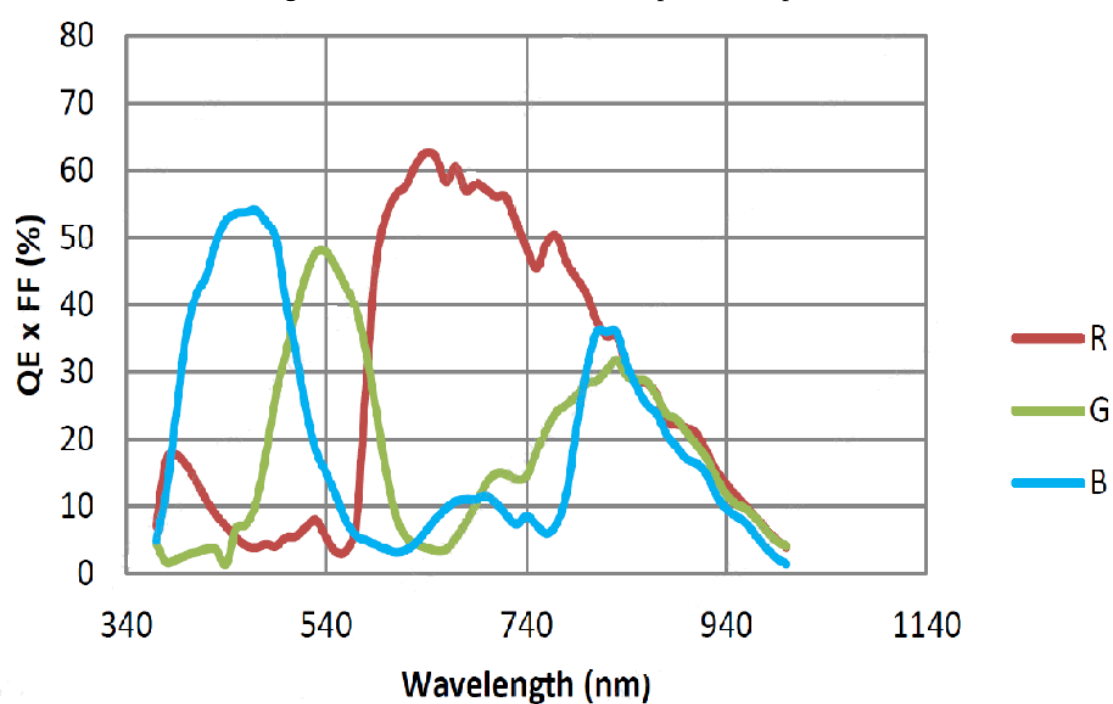
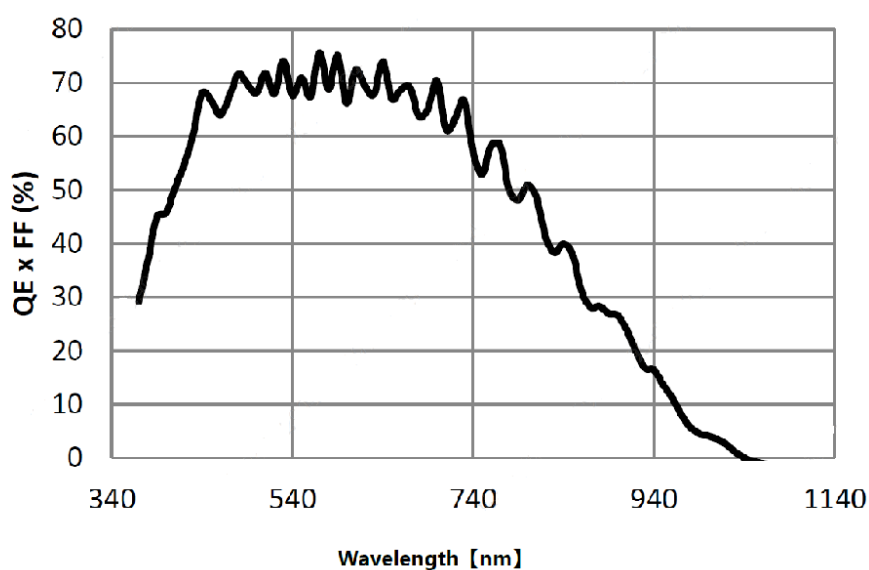


Figure 1-3 GPixel GL0402 Mono Spectral Response



1.6 Environmental Requirements

The following are the environmental requirements for GigE Line scan industrial camera:

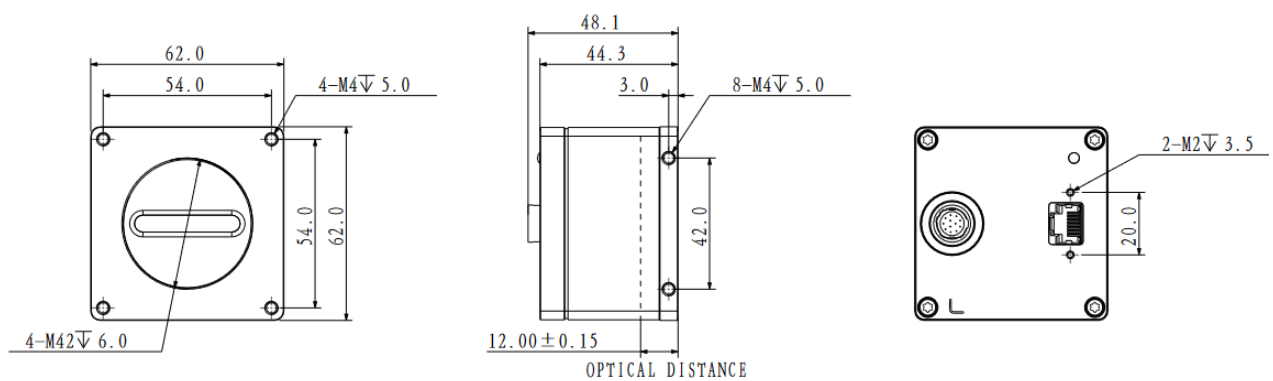
- Temperature and humidity
 - Ambient temperature should not exceed 50°C, it is best to work in an air-conditioned environment.
 - ◇ Operating cover temperature: -30°C~50°C.
 - ◇ Operating ambient humidity: 20%~80% no condensation.
 - ◇ Storage temperature: -30°C~+80°C.
 - ◇ Storage humidity: 20%~80% no condensation.
- Please install the device in a stable location indoors, with enough heat dissipation space.
- Please keep certain ventilation.

2 Interface Description

2.1 Product Dimensions

The product dimensions are as follows:

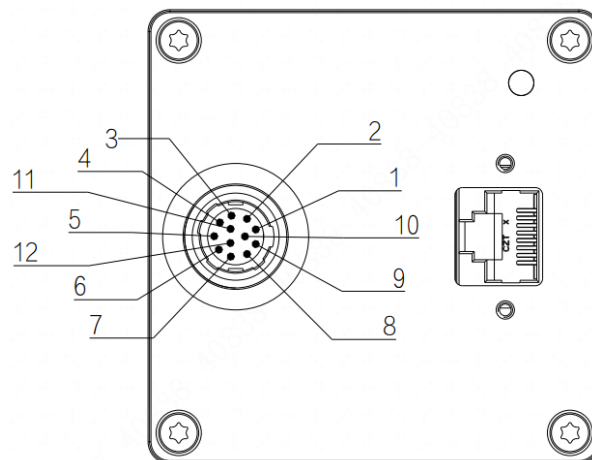
Figure 2-1 62mm×54mm×44.3mm (Unit: mm)



2.2 Interface Description

The back of the device has two interfaces, the network interface and 12pin power as well as I/O interface, as shown below:

Figure 2-2 CAM-CIC-4KL-28-G-1 & CIC-L042-CG-28-G Interface Description



2.2.1 Network Interface

Network interface, RJ45 Ethernet port, three-speed Ethernet 10M / 100M / 1000Mbps transmission interface for camera control, data transmission and power supply (POE function).

It is best to use shielded twisted-pair Category 6 cable in order to ensure the transmission quality, as well as to prevent too much data retransmission and packet loss phenomenon.

2.2.2 12pin Power and I/O Interface

Sheet 2-1 lists the pin signal definition of the I/O interface.

Sheet 2-1 Pin Signal Definition

Pin	Description	Function
1	Power GND	Camera power ground
2	Camera Power	Camera power
3	IN Line1+	Input Line1+
4	IN Line1–	Input Line1-
5	Signal GND	Signal ground
6	IN Line2+	Input Line2+
7	IN Line2–	Input Line2-
8	IN Line4	Bidirectional GPIO Line4
9	IN/OUT Line3+	Input/output Line3+
10	IN/OUT Line3-	Input/output Line3-
11	OPT_IN Line5	Optocoupler input Line5
12	OPT GND	Opto-isolated ground

Instructions

An output signal pin not in use must be hanged. Connect an unused input pin to Signal ground (recommended) or leave it hanging, instead of connecting it to the power supply to avoid camera damage.

2.3 Electrical Specification

2.3.1 Power Supply and Network Port Electrical Specifications

Sheet 2-2 Power Supply and Network Port Electrical Specifications

Parameter	Description
Power specification	12–24 VDC, < 1% texture ripple, powered by the Hirose 12-pin connector of the camera. The cable must be at least 26 AWG.
EMS Standard	ESD (GBT17626.2/IEC61000-4-2): 6 KV for contacting with a metal surface Surge (IEC61000-4-5): 2 KV in common mode/1 KV in differential mode through the Ethernet port (10/700 μs) Power port: 500 V in common mode (1.2/50 μs)
EMC Standard	Class A

2.3.2 IO Port Electrical Specification

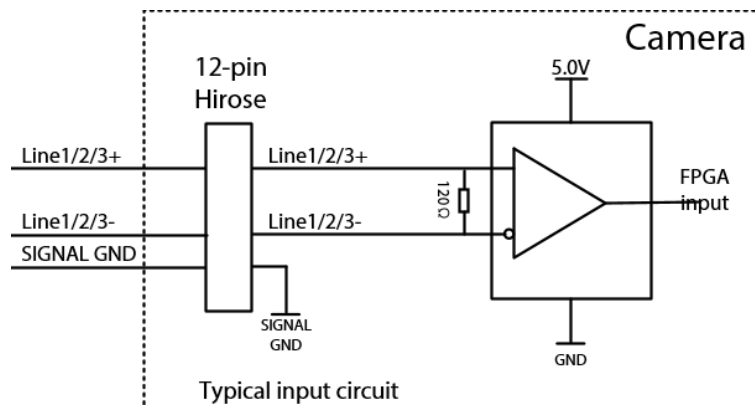
2.3.2.1 Differential Input

Sheet 2-3 Differential input

Input voltage		Description
Vcm	± 25.0 V	Input common-mode voltage range
VID	200 mV	Input differential voltage (A-B). It represents logic 1 when the value is exceeded.
	-200 to +200 mV	The input status reverses, and the logic status inside the voltage range is unsure.
	-200 mV	Input differential voltage (A-B). It represents logic 0 when the value is not exceeded.

- here are 2 differential inputs, i.e. Line1/Line2/Line3, which can be configured as differential encoder phase A or B by software, respectively, among which Line1/Line2 can only be configured as trigger input, while Line3 can not only be configured as input but also output.
- When Line1/Line2/Line3 is configured as input, the terminal resistor is disabled by default. Instead, it is enabled when the RS422 mode is selected. To ensure good quality of the common-mode signal, connect the input to the signal ground when using.

Figure 2-3 Connection of differential input



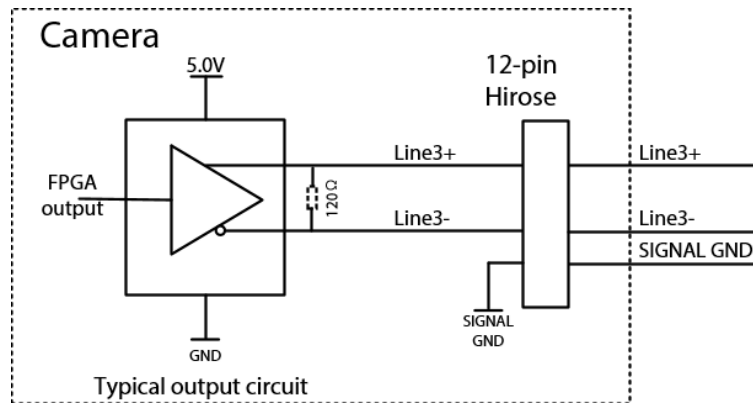
2.3.2.2 Differential Output

Sheet 2-4 Differential Output

Output voltage		Description
Voc	± 3.0 V	Max. output voltage
VOD	+200 mV	Differential output voltage (A-B). It represents logic 1 when the value is exceeded.
	-200 to +200 mV	The output status reverses, and the logic status inside the voltage range is unsure.
	-200 mV	Differential output voltage (A-B). It represents logic 0 when the value is not exceeded

For GEN.3 linear array cameras, the differential output contains only Line3.

Figure 2-4 Connection of differential output

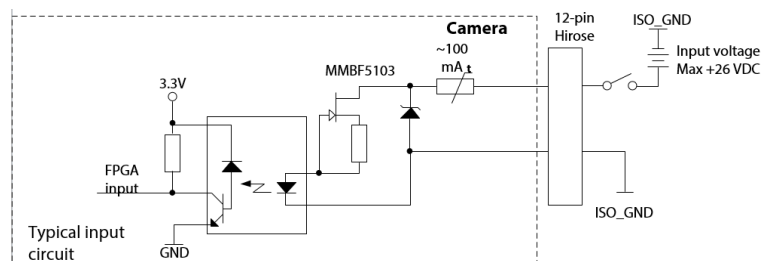


2.3.2.3 Opto-isolated Input

Sheet 2-5 Opto-isolated Input

Input voltage	Description
26.0 VDC	Max. voltage input, which must be not exceeded. Otherwise, the device might be damaged.
0-24 VDC	Safe operating voltage input range
0-1.4 VDC	Logic 0
> 1.4-2.2 VDC	The input status reverses, and the logic status inside the voltage range is unsure.
> 2.2 VDC	Logic 1

Figure 2-5 Connection of Opto-isolated Input



2.3.2.4 GPIO Input

Sheet 2-5 GPIO Input

Voltage	Description
26.0 VDC	Max. voltage input, which must be not exceeded. Otherwise, the device might be damaged.
0-24.0 VDC	Safe operating voltage input range (min. 3.3 VDC when an external pull-up adapter exists)
0-0.8 VDC	Logic 0
> 0.8-2.0 VDC	The input status reverses, and the logic status inside the voltage range is unsure.
> 2.0 VDC	Logic 1

When GPIO is used as an input port, the sink current from an external circuit must not be lower than 2

mA at low input level. In this case, the voltage must not be greater than 0.8 VDC. The sink current must not be greater than 100 μ A at high input level.

Figure 2-6 GPIO Input Circuit

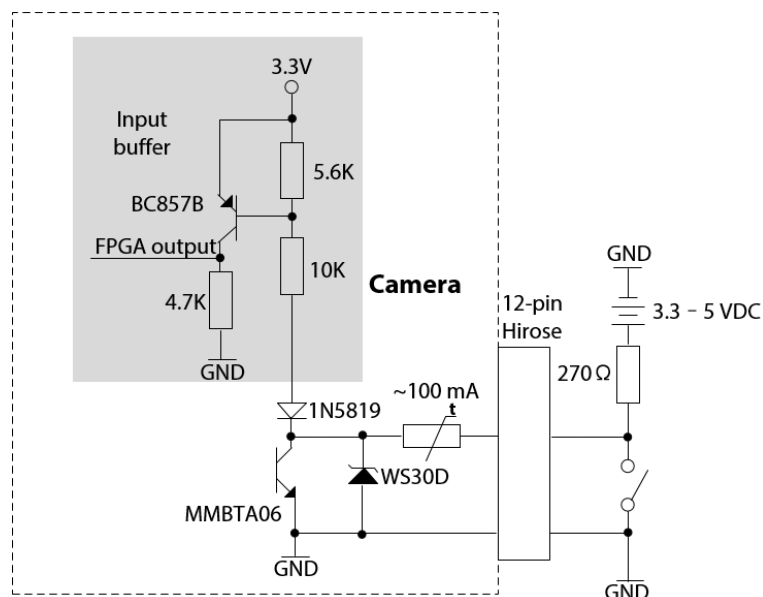
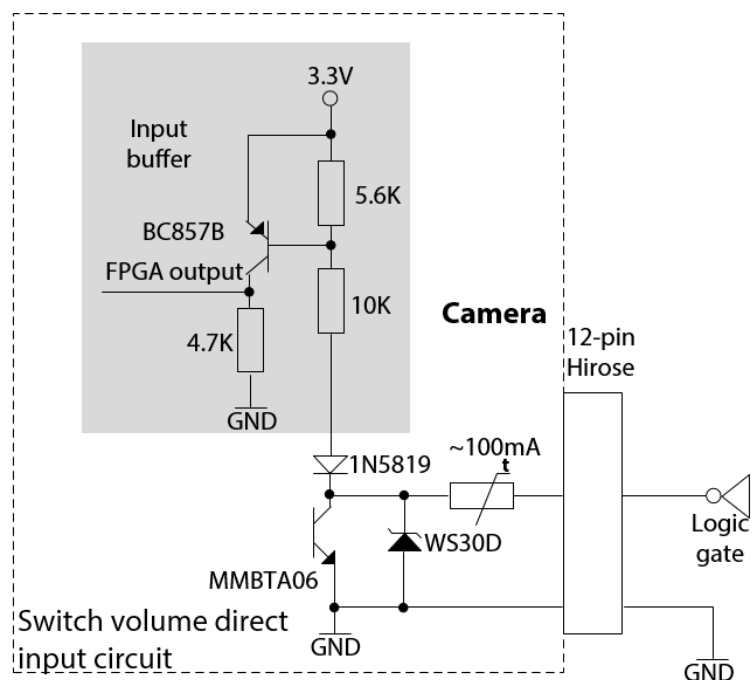


Figure 2-7 Input Circuit of 5V TTL Logic Level



2.3.2.5 GPIO Output

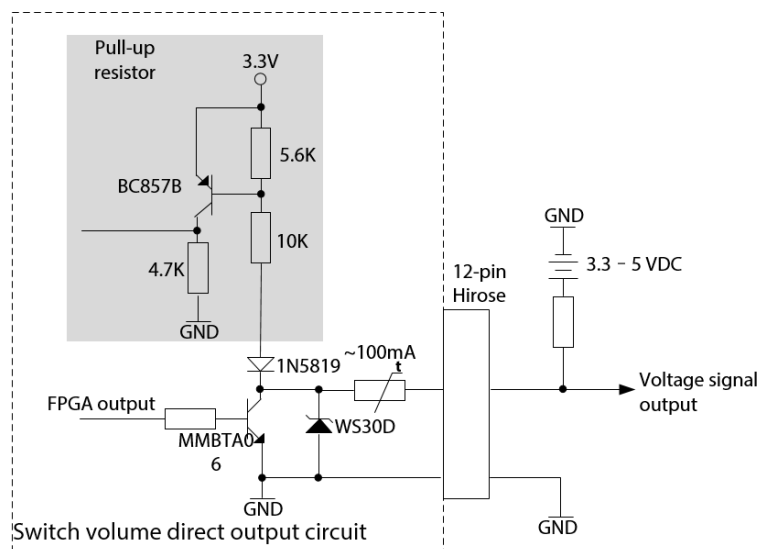
Sheet 2-6 GPIO Output

Voltage	Description
+30.0 VDC	Max. voltage. Output voltage cannot exceed the value.
3.3-24 VDC	Safe operating voltage output range
< 3.3 VDC	I/O output may be incorrect



Up to 100mA sink current when the IO port is used as output.

Figure 2-8 GPIO Output



2.4 Indicator Light Description

The indicator light description of the device is shown in Sheet 2-7.

Sheet 2-7 Indicator Light Description

Status	Indicator		Description
Normal	Red	Flashes quickly	The device is starting.
	Blue	Low light	The address has been allocated, but the application API is not connected to the device.
		High light	The application API is connected to the device and the device is in free-run mode, but there is no image transmission.
		Flashes quickly	The application API is connected to the device, the device is in free-run mode, and there is image transmission.
		Flashes slowly	The device is in trigger mode.
	Red ↔ Blue	Flashes alternately	The firmware is being upgrading.
Abnormal	Red	Solid on	The device is abnormal, such as no bit stream, firmware upgrade failure.
		Flashes slowly	The network is disconnected

3 Main Function Description

This chapter mainly introduces function parameters related to industrial camera.

Instructions

- Grayed out parameters cannot be changed under the current running mode.
- The software pages in this manual are for reference only, and might be different from actual product.
- The properties of different models of cameras are different, and the specific property parameters can be viewed in software.

Functions of ISP module for different image formats are shown in Sheet 3-1:

Sheet 3-1 Functions of ISP Module for Different Image Formats

Format	Exposure	Gain	Blacklevel	WhiteBalance	Gamma
Mono	Y	Y	Y	Y	Y
Bayer	Y	Y	Y	Y	Y
RGBxxx	Y	Y	Y	Y	Y
YUVxxx	Y	Y	Y	Y	Y
Disable Function	/	Set GainRaw to 1	set BlackLevel to 14	Set BalanceWhiteAuto to Off; select Red, Green or Blue in BalanceRatioSelector and set BalanceRatio to 1	Set Gamma to 1
Format	LUT	ColorTransformation	Sharpness	Hue	Saturation
Mono	Y	N	/	N	N
Bayer	Y	Y	/	Y	Y
RGBxxx	Y	Y	/	Y	Y
YUVxxx	Y	Y	/	Y	Y
Disable Function	Set LUTEnable to False	Select ColorTransformationSelector as RGBtoRGB and set ColorTransformationEnable to False	/	Set HUE to 50	Set Saturation to 50
Format	Denoising	Contrast	DigitalShift	LineSpatialCorrection	
Mono	/	/	Y	Y	
Bayer	/	/	Y	Y	
RGBxxx	/	/	Y	Y	
YUVxxx	/	/	Y	Y	
Disable Function	/	/	Set DigitalShift to 0	LineSpatialCorrectionEnable to on and set LineSpatialCorrection to 1	

3.1 Device Control

You can check the device information and change the device name in Property; please refer to Sheet 3-2 for parameter setting details.

Sheet 3-2 Device Control—Parameter Explanation

Parameter	Description
DeviceType	The device type defined by GigE Vision.
DeviceScanType	The scanning type of the sensor, such as area scan and line scan.
DeviceVendorName	The vendor of the device.
DeviceModeName	The model of the device.
DeviceManufacturerInfo	The manufacturer of the device.
DeviceVersion	The software version of the device, including date and SVN number.
DeviceFirmwareVersion	The firmware version of the device, including date and SVN number. The number next to the semicolon indicates the hardware version.
DeviceSerialNumber	The serial number of the device.
DeviceUserID	The custom name of the device.
DeviceTLType	The protocol type used by the device in the transmission layer. Supports GigE Vision, CameraLink, CameraLinkHD, CoaXPress, and USB3 Vision. The preceding figure indicates that the device uses the GigE protocol. The software automatically recognizes the protocol of the device and the protocol cannot be modified.
DeviceTLVersionMajor	The main version of the transmission layer protocol that is compatible with the device.
DeviceTLVersionMinor	The sub version of the transmission layer protocol that is compatible with the device.
DeviceMaxThroughput	The max. transmission speed of the device.
DeviceCharacterSet	The character set used by the index register. The default character set is UTF-8.
DeviceReset	The restart button of the device. You can also an API to restart the device.
DeviceTemperatureSelector	Allows you view the temperature of the motherboard or sensor board. In general, only the temperature of the motherboard can be viewed.
DeviceTemperature	The temperature of the motherboard or sensor board.
DeviceRegisterIsBigEndian	Displays the big end or small end of the device register. The big end is supported by default.
DeviceTLVersionSelector	The compatible version of the transmission layer protocol. GigE cameras support switching between V2.0 and V1.0.
DeviceUpTime	The total running time of the device. The unit is s.
DeviceDevelopData	The parameter is reserved for debugging.

3.2 ImageFormatControl

In this property, you can change image size, image pixel format, region of interest(ROI) and test image mode etc. ; please refer to Sheet 3-3 for more details about parameter settings.

Instructions

The image output formats supported by the industrial camera are shown in sheet 3-3.
Specific supported formats are subject to the formats supported by the camera.

Sheet 3-3 Image Format Control – Parameter Explanation

Parameter	Descriptions
SensorWidth	The original image width of the sensor, in pixels.
SensorHeight	The original image height of the sensor, in pixels.
ReverseScanDirection	If the moving direction of the object captured by the color line scan camera is not perpendicular to the direction of the camera label, the color camera will have a different color at the edge of a line, which can be corrected by inverting the difference.
WidthMax	The max. image width, in pixels.
Width	The actual width of output images, in pixels. Each camera has the max. width, min. width and step size, which are displayed under the property bar. You can modify the ROI of the camera according to the step size and the min. width.
Height	The actual height of output images, in pixels. Each camera has max. height, you can set a height as instructed.
OffsetX	The horizontal offset of the image, starting from the upper-left corner. The max. value is determined by the value of Width .
ReverseX	The horizontal flipping of images. The flip is based on the original size of the sensor, not images after the ROI.
PixelFormat	The format of output images. The supported formats differ depending on the models.
PixelSize	The number of bits that a pixel occupies in different image formats.
PixelColorFilter	The filter model used during image processing in the current image output format.
PixelDynamicRangeMin	The min. value of pixel brightness.
PixelDynamicRangeMax	The max. value of pixel brightness.

Parameter	Descriptions
TestImageSelector	Test image type 1: Off, TestImage1 (static image), and TestImage2 (dynamic image). Test image type 2: GradualMonoBar (gradient image from black to white), MonoBar (multiple gradient images from black to white), and ObliqueMonoBar (rhombic image)  Test images are only used for tests. We recommend you keep the default width of a test image when you use it.
SensorColorType	The color type of the sensor: Color or Mono (black and white).
PixelSizeInput	The bit depth of the images output by the sensor.

3.3 AcquisitionControl

In this property, you can set the image acquisition mode, trigger mode and exposure time etc.; please refer to Sheet 3- for detailed parameter settings.

Sheet 3-4 Acquisition Control - Parameter Explanation

Parameter	Description
AcquisitionMode	- SingleFrame: The camera captures a frame at a time and stops pulling stream after capture. - MultiFrame: The camera captures multiple frames specified by AcquisitionFrameCount and stops pulling stream after capture. - Continue: The camera keeps capturing until AcquisitionStop is called.
AcquisitionStart	The SDK starts or stops pulling stream.
AcquisitionStop	
FrameTimeout	Under the frame and line trigger, set a period, when the frame signal comes, if not enough lines are acquired within the period, the camera fills in the remaining lines as black and outputs a whole image.
AcquisitionFrameCount	The number of images captured at a time.  The parameter is available only when you set AcquisitionMode to MultiFrame.
AcquisitionFrameRate	The frame rate of images. The parameter is available when you set AcquisitionFrameRateEnable to True .
AcquisitionFrameRateEnable	
AcquisitionStatusSelector	Select a trigger state to view.

Parameter	Description
AcquisitionStatus	Select AcquisitionTriggerWait or FrameTriggerWait from AcquisitionStatusSelector , and then check AcquisitionStatus . True means image capture waits to be triggered, and False means image capture has been triggered.
TriggerSelector	The type of the trigger. Select FrameStart or FrameActive from TriggerSelector , working with LineStart , and then select On or Off from TriggerMode to enable or disable the trigger mode. TriggerFramesCount: The upper limit of captured images.  Burst means that the camera can capture multiple images after a single signal is triggered.
TriggerMode	
TriggerFramesCount	
TriggerSoftware	The trigger method. Includes SoftwareTrigger and lineN (hardware trigger). • If you select SoftwareTrigger, you can generate a software trigger by clicking TriggerSoftware or calling an API. • If you select lineN, and set TriggerActivation to RisingEdge, FallingEdge or AnyEdge (available on select models), a hardware trigger is generated when external cables generate signals of rising or falling edges.  You can separately select trigger sources for AcquisitionStart and FrameStart .
TriggerSource	
TriggerActivation	
TriggerDelay	The trigger delay, which is the period between the time when the camera receives a trigger signal and the time when the trigger takes effect. The parameter is available for both software trigger and hardware trigger.
TriggerDelaySource	The source of trigger delay. LightTriggerDelay is used to set the delay time from when the camera receives the trigger signal to when LightTrigger outputs the conduction of the optocoupler. The conduction time of the optocoupler is from the start of LightTrigger to the end of the exposure.  During the delay, the camera cannot receive new triggers. Otherwise, the camera needs to stop and acquire the stream again to return to normal.
ExposureMode	The mode exposure time, including Timed and TriggerWidth . • For Timed, the exposure time is the value of ExposureTime. • For TriggerWidth, the exposure time is the pulse width of hardware trigger.  TriggerWidth is only available for select models.

Parameter	Description
ExposureTime	The exposure time.
ExposureAuto	The automatic exposure, including Off , Once , and Continuous . You can set a target value of brightness, and then apply exposure once or continuously to increase it. The value ranges from 0–100.
ExposureTargetBrightness	
ResultingframeRateAbs	The theoretical frame rate of the camera. The theoretical frame rate of the camera depends on network bandwidth, pixel format, image resolution and exposure time. The exposure time takes priority by default. When the exposure time is larger than the reciprocal of frame rate, the frame rate will be decreased priorly, instead of limiting the maximum exposure time.

3.4 DigitalIOControl

In this property, you can control different I/O input or output signals; please refer to Sheet 3- for detailed parameter settings.

Sheet 3-5 Digital IO Control - Parameter Explanation

Parameter	Descriptions
LineSelector	The IO cable to be configured.
LineMode	The output mode of the selected IO cable, including Input and Output .
LineInverter	Specifies whether to reverse signals. True : Reverse signals. False : Not reverse signals.
LineStatus	Indicates the status of the selected physical input or output cables.
LineStatusAll	Returns the status of all usable cables.
LineSource	You can select a trigger source if the IO cable set as output. The following trigger sources are supported: ● ExposureActive: Outputs signal when exposure starts. ● FrameTriggerWait: Outputs waiting status signals of frame trigger. ● Timer0Active: Outputs signals when the timer0 reached its limit. ● UserOutput0: Output the value of UserCustom0. ● AcquisitionTriggerWait: Outputs waiting status signals of acquisition trigger. ● LightTrigger: Outputs the signal of light source control. ● FrameActive: Signals of starting frame output.  1 means the opto-coupler is connected, and 0 means disconnected.
LineFormat	The trigger type of the selected IO cable. For differences between differential and single-end cable connection, see IO electrical specifications.

Parameter	Descriptions
LineDebouncingPeriod	The length of debouncing. You can set the parameter if the IO cable is set as input.  Pulse widths smaller than the set value will not be considered as an effective trigger input.
LineDetectionLevel	The threshold voltage for single-end signal.
LineEncoderType	The signal type, including Pnp , Npn , and NoPull .
UserOutputSelector	The output group.
UserOutputValue	The output value of the output group.
UserOutputValueAll	Set the output value of all output groups to 0 or 1.

3.5 EventControl

In this property, you can control the event; please refer to Sheet 3- for detailed parameter settings.

Sheet 3-6 Event Control - Parameter Explanation

Parameter	Description
EventSelector	Event setting. Selects the type of event, including: • ExposureEnd (Exposure end event) • FrameTrigger (Event for frame trigger sending signal to sensor) • FrameStart (Receiving frame trigger event) • AcquisitionTrigger (Acquisition trigger event) • AcquisitionStart (Acquisition start event) • ReadOut (Category that contains all the data features related to the ReadOut Event)
EventNotification	Specifies whether to notify upper-level software after the preceding event types are selected. ON: yes. OFF: no.

3.6 AnalogControl

In this property, you can adjust the acquired analog signals, including gain , black balance, white balance and gamma correction etc.; please refer to Sheet 3- for detailed parameter settings.

Sheet 3-7 Analog Control - Parameter Explanation

Parameter	Description
GainSelector	Not available. Leave it as default.
GainRaw	The larger the value, the brighter the image. The available setting range is different depending on the models. The default value is 1.  Analog gain takes priority.
BlackLevelSelector	The channel for which black level is configured.
BlackLevel	Black level is used to eliminate the impact caused by the dark current of the sensor. For example, under fully dark conditions, the image brightness is larger than 0, which is the dark current of the sensor. You can adjust the black level to make the channel brightness closer to that of the actual image. The value ranges from 0 to 255.
BlackLevelAuto	- Off: Set BlackLevel to the black level calculated by the algorithm. - Once: The algorithm sets BlackLevel for once according to the return value of the sensor, and then BlackLevelAuto changes to Off. - Continues: The algorithm continuously sets BlackLevel according to the return value of the sensor.  The black level changes along with the temperature. We recommend you obtain the value when the temperature is constant.
BalanceRatioSelector	Select the Red, Green or Blue channel to set the white balance.
BalanceRatio	Adjust the image color by setting R, G and B to make the image more vivid.
BalanceWhiteAuto	- If BalanceWhiteAuto is set to Off, and you can set the value of Red, Green and Blue channels. - If BalanceWhiteAuto is set to Once, the camera performs auto white balance for a period and then stops it based on the current situation. - If BalanceWhiteAuto is set to Continues, the camera continuously performs white balance.  White balance correction is only applicable for color cameras. The white balance of black and white cameras is 1 by default.
Gamma	Gamma is a non-linear correction of the image data due to non-linear response of the display. The larger the Gamma value, the darker the image. The range is 0–3.99998. 1 means no gamma process.

Parameter	Description
SensorBOC	Specifies whether to enable auto black level correction for the sensor. If the function is enabled, the black level output by the sensor is a constant value instead of changing with the temperature. This helps adjust the brightness change of images and eliminate the impact of black blocks on white blocks.

3.7 LUTControl

In this property, you can stretch and highlight the gray-level range of the region of interest. The operation applies to linear curve as well as customized mapping curve; please refer to Sheet 3- for detailed parameter settings.

Instructions

- LUT: short for Look-Up Table.
- LUT and Gamma are mutually exclusive. If Gamma is enabled, LUT will not take effect. If LUT is enabled, Gamma needs to be set to 1.

Sheet 3-8 LUT Control - Parameter Explanation

Parameter	Descriptions
LUTSelector	The channel of LUTControl.  Only Luminance is supported.
LUTEnable	Specifies whether to enable LUTControl.
LUTIndex	The number points in the lookup table. The value range is 0-4095.
LUTValue	The value of LUTIndex.
LUTValueAll	Change the value of all indexes to the same one.

3.8 TransportLayerControl

In this property, you can set parameters related to camera's transport layer protocol; please refer to Sheet 3- for detailed parameter settings.

Sheet 3-9 Transport Layer Control - Parameter Explanation

Parameter	Description
PayloadSize	The length of each message.
GevActiveLinkCount	The number of logical channels currently connected.
GevInterfaceSelector	The number of Ethernet ports. It is 0 by default.
GevLinkSpeed	The negotiated rate of the current Ethernet port.
GevMACAddress	Device MAC address.

Parameter	Description
GevCurrentIPconfigurationLLA	Enable LLA function. When setting GevCurrentIPconfigurationLLA to True , you can set the IP address in LLA mode after the device is powered on.
GevCurrentIPconfigurationDHCP	Enable DHCP function. When setting GevCurrentIPconfigurationDHCP to True , you can set the IP address in DHCP mode. In this case, the IP address can be automatically obtained.
GevCurrentIPconfigurationPersistentIP	Static IP function. When setting GevCurrentIPconfigurationPersistentIP to True , you can set the IP address in static mode after the device is powered on.  Priority level of 3 IP configurations is static IP > DHCP > LLA.
GevCurrentIPAddress	The IP address of the device.
GevCurrentSubnetMask	Subnet mask of the current device.
GevCurrentDefaultGateway	Gateway of the current device.
GevIPConfigurationStatus	Displays the assigning method of the current IP address, including LLA, DHCP and static IP.
GevFirstURL	Acquires the first URL address of GenICam XML.
GevSecondURL	Acquires the second URL address of GenICam XML.
GevNumberOfInterface	Displays the number of logic channels that the device supports.
GevPersistentIPAddress	Static IP address of the device.
GevPersistentSubnetMask	Subnet mask of device static IP.
GevPersistentDefaultGateway	Gateway of device static IP.
GevMessageChannelCount	Displays the number of message channels that the device supports.
GevStreamChannelCount	Displays the number of streaming channels that the device supports.
GevHeartbeatTimeout	Heartbeat timeout period.
GevTimestampTickFrequency	Frequency of timestamp.
GevTimestampControlLatch	Latch the current timestamp into GevTimestampValue .
GevTimestampControlReset	Used to reset the internal timestamp.
GevTimestampValue	Used to store the latched timestamp.
GevGVCPExtendStatusCodesSelector	The version of GigE Vision for extended status code output.
GevGVCPExtendStatusCodes	Outputs extended status code or not.
GevGVCPPendingAck	Reports to Pending_ACK or not when command timed out.
GevGVCPHeartbeatDisable	Disable heartbeat detection of GVCP.
GevGVCPPendingTimeout	Timeout period of GVCP command execution.
GevGVSPExtendedIDMode	Enable GVSP extended ID code.

Parameter	Description
GevCCP	Controls the permissions of applications to access the camera. - ExclusiveAccess: The application that connected to the camera can modify the register. - ControlAccess: The application that connected to the camera can read the register, but cannot modify it.
GevPrimaryApplicationSocket	Displays the UDP source port of the application that connected to the camera.
GevPrimaryApplicationIPAdress	Displays the IP address of the application that connected to the camera.
GevMCPHostPort	The destination port of the camera message channel.
GevMCDA	The destination address of the camera message channel.
GevMCTT	Timeout period of message channel.
GevMCRC	The max. number of message channel retransmissions.
GevMCSP	Displays the source port of message channel.
GevStreamChannelSelector	Select the streaming channel number if the camera supports multiple streaming channels.
GevSCPInterfaceIndex	Displays the logic channel of device.
GevSCPHostPort	The port number used by the streaming channel of the camera.
GevSCPSFireTestPacket	Sends a test message.
GevSCPSDoNotFragment	If the message is too long, whether to send the message in fragments and add fragmentation position 1 in the IP header.
GevSCSPPacketSize	The message length of the streaming channel.
GevSCPD	The interval between messages.  Changing the value can reduce the pressure on the NIC, but the max. bandwidth will be affected and the time to get a single frame will be prolonged.
GevSCDA	The destination address of the streaming channel.
GevSCSP	The destination port of the streaming channel.

3.9 UserSetControl

In this property, you can save or load the parameter scheme set by user and set the default parameter configuration when opening the client; please refer to Sheet 3- for detailed parameter settings.

Sheet 3-10 User Set Control - Parameter Explanation

Parameter	Description
UserSetSelector	The user group. User groups include Default , UserSet1 , and UserSet2 .  FPN coefficient cannot be saved or copied to other cameras.
UserSetLoad	Loads user settings as camera settings.
UserSetSave	Saves the current settings to a user group. The settings cannot be saved to the Default user group.
UserSetDefault	The default settings that take effect after the camera is powered on. For UserSet1 and UserSet2 , you must set UserSetSave first.
UserSetLoadLastUserSet	The last used settings.
UserSetLoadStatus	The loading status of user settings.

3.10 ColorTransformationControl

In this property, you can transform the image color; please refer to Sheet 3- for detailed parameter settings.

 Instructions

Only the color camera has this property.

Sheet 3-11 Color Transformation Control - Parameter Explanation

Parameter	Description
ColorTransformationSelector	Select a color transformation module to configure. RGBtoRGB and RGBtoYUV are supported.
ColorTransformationEnable	Specifies whether to enable the color transformation module. You can set RGBtoRGB and RGBtoYUV separately.
ColorTransformationValueSelector	The type of the enhancement factor.
ColorTransformationValue	The value of the enhancement factor.

3.11 CounterAndTimerControl

In this property, the counter can divide the frequency of the external input trigger signal and execute exposure control according to the user's logic; please refer to Sheet 3- for detailed parameter settings.

 Instructions

Please set TriggerSource in 0

Parameter	Descriptions
SensorWidth	The original image width of the sensor, in pixels.
SensorHeight	The original image height of the sensor, in pixels.
ReverseScanDirection	If the moving direction of the object captured by the color line scan camera is not perpendicular to the direction of the camera label, the color camera will have a different color at the edge of a line, which can be corrected by inverting the difference.
WidthMax	The max. image width, in pixels.
Width	The actual width of output images, in pixels. Each camera has the max. width, min. width and step size, which are displayed under the property bar. You can modify the ROI of the camera according to the step size and the min. width.
Height	The actual height of output images, in pixels. Each camera has max. height, you can set a height as instructed.
OffsetX	The horizontal offset of the image, starting from the upper-left corner. The max. value is determined by the value of Width .
ReverseX	The horizontal flipping of images. The flip is based on the original size of the sensor, not images after the ROI.
PixelFormat	The format of output images. The supported formats differ depending on the models.
PixelSize	The number of bits that a pixel occupies in different image formats.
PixelColorFilter	The filter model used during image processing in the current image output format.
PixelDynamicRangeMin	The min. value of pixel brightness.
PixelDynamicRangeMax	The max. value of pixel brightness.
TestImageSelector	Test image type 1: Off, TestImage1 (static image), and TestImage2 (dynamic image). Test image type 2: GradualMonoBar (gradient image from black to white), MonoBar (multiple gradient images from black to white), and ObliqueMonoBar (rhombic image)  Test images are only used for tests. We recommend you keep the default width of a test image when you use it.
SensorColorType	The color type of the sensor: Color or Mono (black and white).
PixelSizeInput	The bit depth of the images output by the sensor.

AcquisitionControl before using.

Sheet 3-12 Counter and Timer Control - Parameter Explanation

Parameter	Description
CounterSelector	- If you select Counter0, CounterEventSource is set to FrameTrigger. - If you select Counter1, CounterEventSource is set to FrameStart.
CounterResetSource	Select the signal source to reset the counter: Off (no reset), SoftwareSignal0 (software signal reset) and Line1 (hardware signal reset).
CounterEventSource	Displays the event sources that will be added to the counting: FrameTrigger and FrameStart .
CounterReset	Reset the counter.
TimerSelector	The counter to be set. The default is Timer0.
TimerTriggerSource	The trigger source for starting the timer. The default is ExposureStart .
TimerTriggerActivation	The trigger mode for starting the timer, including RisingEdge , FallingEdge and AnyEdge (rising edge or falling edge).
TimerDelay	The delay between receiving the trigger signal and starting the timer.
TimerDuration	The duration of the timed pulse.

3.12 ISPControl

In this property, you can adjust the image sharpness, brightness, saturation, contrast and so on; please refer to Sheet 3- for detailed parameter settings.

Instructions

Hue and saturation are only available for the color camera.

Sheet 3-13 ISP Control - Parameter Explanation

Parameter	Description
Hue	Adjusts the chrominance component in HSV color space, the default value is 50.
Saturation	Adjusts the saturation component in HSV color space, the default value is 50. The higher the value, the higher the saturation and the more flamboyant the color.
DigitalShift	Increase the value of DigitalShift by one, and the image brightness is doubled.
FPNCalibrationStatus	The status of the FPN calibration. True means the image has been corrected, false means not.
FPNRoiCount	The number of effective FPN areas.
FPNRoiSetSelector	Switch effective FPN areas.
FPNRoiStart	The start point of effective FPN areas.

Parameter	Description
FPNRoiWidth	The end point of effective FPN areas.
FPNEnable	Specifies whether to enable FPN. During FPN, when the analog gain value is that of the actual sensor, the FPN effect is the best. For details, see 5.8.2 Gain Raw.
FPNOnceEnable	Apply the FPN effects of different analog levels to other levels. Evenly apply the FPN coefficient of the level with the analog gain of 1 to the other analog gain levels (available on select models.)
FPNBlackCalibration	Specifies whether to enable dark field correction.
FPNBrightCalibration	Specifies whether to enable bright field correction.
FPNCalibrationModel	Select the FPN effect from Maximum , Average and User (custom). Average is recommended.
FPNTargetValue	Custom effect value: 50–240. The higher the value, the stronger the correction.
RestoreDefaultCalibration	Restores default FPN data. This covers FPN performed by users after FPN is enabled.

3.13 RotaryEncoderControl

In this property, you can set the RotaryEncoder; please refer to Sheet 3-14 for detailed parameter settings.

Instructions

The value of RotaryEncoderReverseCounterMax must be greater than the max. reverse signals. Otherwise, debouncing will fail.

Sheet 3-14 RotaryEncoder Control - Parameter Explanation

Parameter	Descriptions
RotaryEncoderSelector	The rotary encoder.
RotaryEncoderLineSelector	The encoder phase.
RotaryEncoderLineSource	The signal source of the rotary encoder phase.
RotaryEncoderMode	The frame output mode of the encoder.
RotaryEncoderCounterMode	The counting mode of the encoder.
RotaryEncoderCounter	The current value of the rotary encoder.
RotaryEncoderCounterMax	Specifies that counting restarts when the counter cleared.
RotaryEncoderCounterReset	Clear the counter.
RotaryEncoderReverseCounter	The number recorded by the reverse counter.
RotaryEncoderReverseCounterMax	Specifies that counting restarts when the reverse counter cleared.
RotaryEncoderReverseCounterReset	Clear the reverse counter.

3.14 ChunkDataControl

In this property, you can set the ChunkData; please refer to Sheet 3-15 for detailed parameter settings.

 Instructions

Only color cameras support **ChunkDataControl**.

Sheet 3-15 ChunkDataControl - Parameter Explanation

Parameter	Description
ChunkModeActive	Activates the chunk data in images.
ChunkSelector	Select the chunk data function.
ChunkEnable	Specifies whether to enable chunk data.
ChunkCounter0Value	Returns the value of PLC controller 0.
ChunkCounter1Value	Returns the value of PLC controller 1.

You can solve problems that you may encounter with following instructions:

4.1 No Cameras Detected

Reason:

- The camera is not started as expected.
- Abnormal network cable connection.
- The camera and the client are not one the same network segment.

Solution: Restart the camera. Check whether the network connection is correct and indicator status is normal. Make sure that the camera and the client are on the same network segment.

4.2 Cameras Detected but Failed to Connect

Reason:

- The camera is not started as expected.
- The camera and the client are not on the same network segment.
- The camera is connected to other clients.

Solution: Restart the camera, try modifying IP to make it in the same LAN with the client. You can also try disconnect other connected clients and connect the current client again.

4.3 Black Live View

Reason:

- The lens aperture is closed.
- The camera is working abnormally.

Solution: Open the aperture or restart the camera.

4.4 Unavailable External Trigger

Reason:

- Incorrect cable connection of external trigger.
- The trigger mode is not set to external trigger.

Solution: Select a right trigger mode and make sure that the external cable connection is correct.

4.5 Images Are Upside Down

Reason: The installation direction of the camera is wrong.

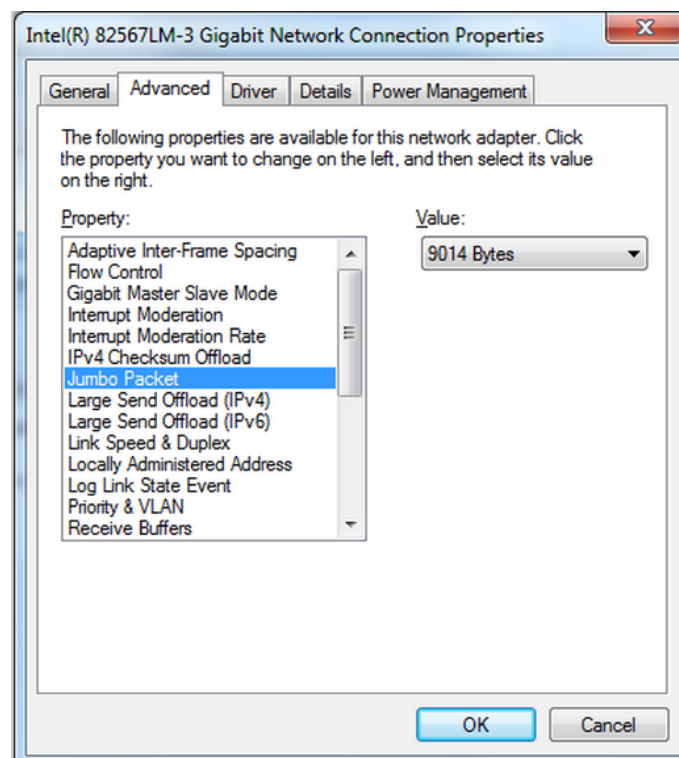
Solution: Go to **Settings > ImageFormatControl > ReverseX** in the client to correct images.

4.6 Issues Related to Image Acquiring

4.6.1 FailedStream Acquiring

The port is not a GigE port and Jumbo is disabled. Trigger is disabled for the camera.

Figure 4-1 Network connection



4.6.2 Test Image

We recommend you keep the default width of a test image when you use it.

Meaning of multiple test images: gradient image from black to white > multiple gradient images from black to white > rhombic image.

4.6.3 Stretched or Compressed Images

This section introduces a formula for adjusting line frequency to make sure that captured are not stretched or compressed.

View MM: S

ROI width: X

Speed: V

Line frequency: $K=V/(S/X)$

Make sure that the units of speed and view are the same. (recommended: cm/s, view unit: cm, line frequency unit: /s)

4.7 Invalid Trigger

- **IO issues**

When one IO trigger fails, you can avoid the issue by using another IO as the trigger cable, or checking whether the attribute settings of the IO management terminal conform to actual signal conditions: single-end or differential filter, signal, and signal level.

- **Encoder issues**

There are many types of encoders in the market, including single-end encoders, differential encoders, incremental encoders, and absolute encoders. Therefore, you must select an appropriate encoder. In addition, the transmission distance is very important.

After the encoder is connected and a channel is selected, you can perform the following steps if the camera does not generate images:

1. Perform frame trigger for 2 lines of the encoder to check whether there is signal output.
2. Check whether the cable connection of the encoder is A+ A- B+ B-, and select lines based on Phase and PhaseB.

- **Check the encoder**

Check whether the value of **RotaryEncoderCounterMax** changes.

Check whether the debouncing counter changes when the encoder is reversed, and whether the value is set too large.

4.8 Issue Related to Camera Upgrade and Version

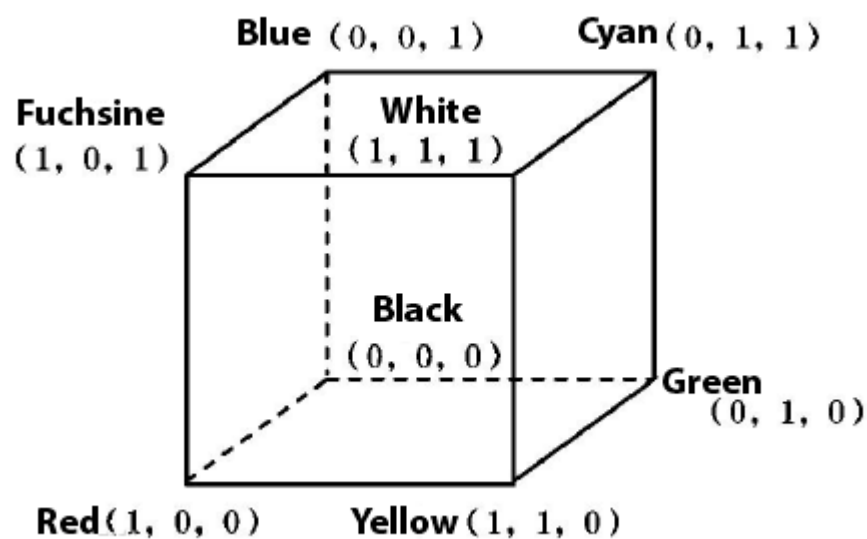
You do not need to take actions if the camera is offline during upgrade. Because the upgrade requires disconnection between Visiontool (or capture card) and the camera. If the upgrade fails, check whether the firmware matches with the internal model of the camera. For details, contact technical support. Do not power off the camera to stop upgrade. Instead, you can close Visiontool to stop upgrade.

4.9 Issues Related to White Balance and FPN

4.9.1 How to Do White Balance

Before the delivery of cameras, we adjust the RGB uniformity response of the camera, so that the response of the RGB of the camera is 1:1:1 under pure white light source. This way, images captured by cameras have uniform colors. The proportion of RGB affects the color of images, as shown in the following figure.

Figure 4-2 RGB



Due to the difference in the light source in each scene, the actual response of camera

to RGB is different from the image capture by eyes, we need to do the white balance again.

Place a white paper in the view of the camera.

Click **AnalogControl**, and then set **BalanceWhiteAuto** to **Once**. White balance is completed if **Once** changes back to **Off**. If the color of images is greenish, try increase exposure value (exposure time).

During white balancing, images can not be overexposed. Click the image to view the gray value, and adjust the exposure value to make sure that the gray value is between 100 and 200.

4.10 FPN

In ISPControl, set **FPNEnable** to **Off**.

In a dark environment, completely cover the lens, and then click **{Command}** next to **FPNBlackCalibration.**; Wait for the command to take effect, and then click to capture images.

In a bright environment, place white paper in the view of the camera. The focus of the lens must be blurred to blur the overall image. Images can not be overexposed. Click the image to view the gray value, and adjust the exposure value to make sure that the gray value is between 100 and 200.

Click **{Command}** next to **FPNBrightCalibration**. Wait for the command to take effect, and then click to capture images.

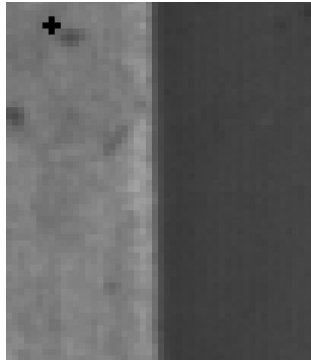
Set **FPNEnable** to **On** to complete correction. If the effect is abnormal, it is possible that the edge of the dark/bright environment is bright or dark, or the lens is not blurred and the paper has much texture.

Images must not be overexposed.

4.11 Issues Related to Debugging and Installation

1. **Only a line is captured by the camera:** It is possible that the sensor and the scan line is not in parallel.
2. **Focus issue:** Use an object (without burrs) with a clear border between the bright side and dark side to make the camera focus on the border.

Figure 4-3 Focus issue



3. **Images of the same type of products have huge differences:** The light source is not in parallel with the captured object. We recommend you install the line scan camera horizontally. If the camera is installed slantly, you can install a fixed part to unify the installation angle.

Figure 4-4 Light source not in parallel with the camera



4. **Errors are reported when exporting or importing camera attributes:**
MV only traverses the attribute tree of the current XML page when saving camera settings. When you modify the hidden attribute tree, such as time-sharing strobing, 4 groups of polling exposure and gain setting, MV only saves the exposure gain value of the polling group on the current XML page. When you import the settings to other cameras, the hidden 3 sets of polling parameters cannot be imported.

Similarly, some XML attributes might be deleted or added after the upgrade of camera firmware. If you import the settings saved in the old firmware to a camera upgraded with the new firmware, an XML import error might be reported. The impact will not be significant. However, the attributes in the imported MCF configuration that are different from the actual camera will not be processed. If your firmware versions are inconsistent and attribute trees are inconsistent, import errors will be reported. However, it will not affect the use of cameras. The inconsistent attributes will be set to default values.

5. **Images stretched or compressed:** Check whether lostcount has lost lines, and make sure that the external trigger frequency is less than or equal to the theoretical line frequency of the camera. After eliminating line loss, enable frequency division.
6. **Line loss issue:** When line trigger is enabled, the stream packet timeout needs to be set to 0. Otherwise, when the line signal interval is too large, lines will be lost.

Abnormal images during debugging: When changing the gain, there is a transition zone in the middle of the image. This is because the modification of the gain involves the synchronous modification of sensor level and FPGA gain. The switching speed of sensor level is less than that of FPGA gain modification, so there is a certain delay. We recommend you stop pulling streams when changing camera attributes.

5 Cleaning and Maintenance

This chapter mainly introduces cleaning and replacement of color filter.

We have installed a fully transparent protective glass for the mono camera with the main purpose to prevent dust falling on the surface of image sensor. The color camera is equipped with a low-pass filter that cuts off to the near-infrared band. If you have special requirements, such as not using a color filter or using another light-transmitting filter, you can replace the entire filter mount of the image sensor (no need of removing the cover) .

If the surface of the filter needs to clean, We recommend using the special cleaning agent for optical devices that can clean the surface without leaving a mark.