微图视觉
Vision Datum

LEO Series
Cameralink Line Scan Camera
User Manual

V2.4.7, Jul. 2024

Preface

Purpose

This Manual is a basic description of LEO series Cameralink Line Scan Cameras, which mainly includes the product description, quick installation guide and Simple introduction of SDK(iDatum). This manual may be updated due to product upgrades or other reasons. If you need, please contact the sales engineer for the latest version of this manual.

Disclaimer

The information and specifications described in this manual are subject to change without notice.

Latest Manual Version

For the latest version of this manual, see the Download Center on our web site at:： http://www.visiondatum.com/en/service/005001.html

Technical Support

For technical support, e-mail： support@visiondatum.com.

Warranty

To ensure that your warranty remains in force, adhere to the following guidelines:：

Do not remove the camera's serial number label
If the label is removed and the serial number can't be read from the camera's registers, the warranty is void.

Prevent ingress or insertion of foreign substances into the camera housing
Prevent liquid, flammable, or metallic substances from entering the camera housing. If operated with any foreign substances inside, the camera may fail or cause a fire.

Avoid electromagnetic fields
Do not operate the camera in the vicinity of strong electromagnetic fields. Avoid electrostatic charging.

Clean with care
Avoid cleaning the sensor if possible.

Handle this camera with care
Do not abuse the camera. Avoid striking, shaking, etc. The camera could be damaged by improper handling.

Read the manual
Read the manual carefully before using the camera.

CHAPTER 1 PRODUCT DESCRIPTION

Product Introduction

LEO series industrial cameras compatible with GigE、USB3.0 and Cameralink data bus standards, support GenICam、USB3 Vision® and GigE Vision®, Smoothly connect with third-party software, like HALCON and Vision Pro, not need for secondary development. LEO series cameras with excellent cost performance and very suitable for various inspections measurement and high-speed imaging applications. This series cameras won customers high praise because its outstanding performance in cellphone and tablet PC screen inspection, LED automatic packaging, defect inspection, and electronic components manufacturing, wafer positioning and other applications.

With this variety of sensors and interfaces, combined with the extensive features offered, LEO series cameras are fit for a wide range of vision applications.

Product Features

- High dynamic range, high signal-to-noise ratio and high image quality;
- Supports TDI function to select different image modes;
- Supports software trigger, hardware trigger, free run mode and etc;
- Supports gamma correction, LUT, black level correction, brightness and other ISP function;
- Supports interpolation algorithm, white balance algorithm, color conversion matrix, hue,saturation and etc. for color camera;
- Supports various output formats for image data and supports ROI, binning, mirror and etc.;
- Supports configuration modes of Base, Medium, Full and 80-bit via the Camera Link interface.
- Conforms Camera Link protocol and GenICam standards;
- Supports M58 or F-mount lenses, and can also be transferred to other interfaces through a lens adapter ring.

* The camera functions may differ by camera models,please refer to actual functions.

Mechanical Dimensions

The dimensions is in millimeters:

The Industrial camera contains Cameralink SDR interface, 12pin power, I/O input connector and camera working status indicator light. Camera Housing and Base Mounting Hole Size(mm):

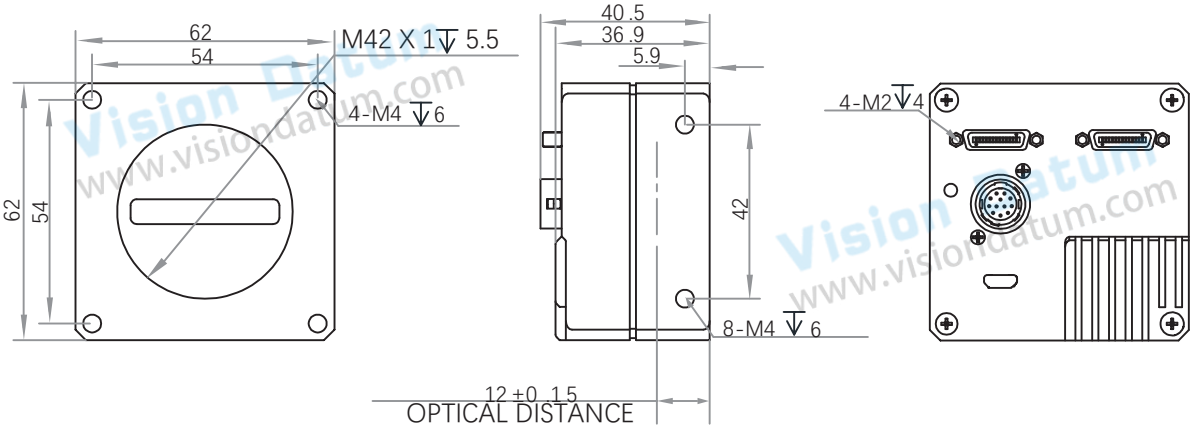

Fig. 1-1: Mechanical Dimensions (in mm) of the M42-mount 4K Cameralink Line Scan Cameras with 62 * 62 * 36.9 mm.

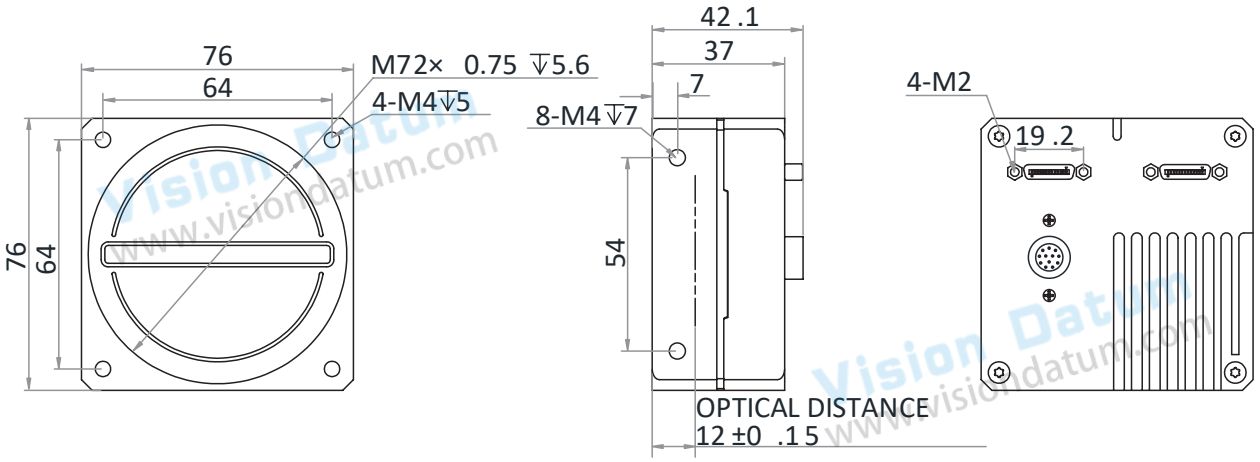

Fig. 1-2: Mechanical Dimensions (in mm) of the M72-mount 8K Cameralink Line Scan Cameras with 76 * 76 * 37 mm.

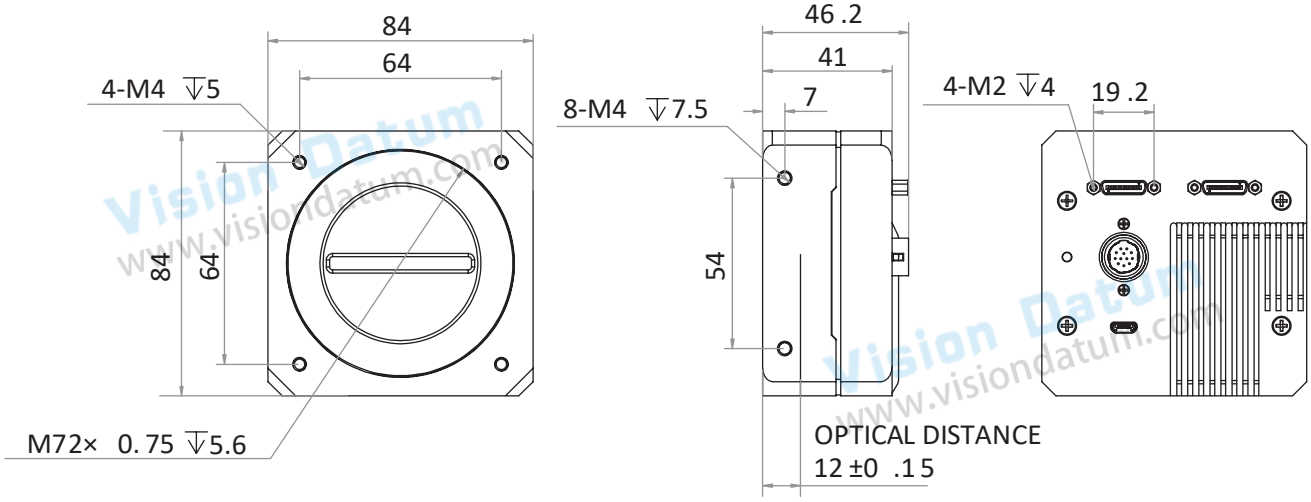

Fig. 1-3: Mechanical Dimensions (in mm) of the M72-mount 8K Cameralink Line Scan Cameras with 84 * 84 * 41 mm.

Mechanical Dimensions

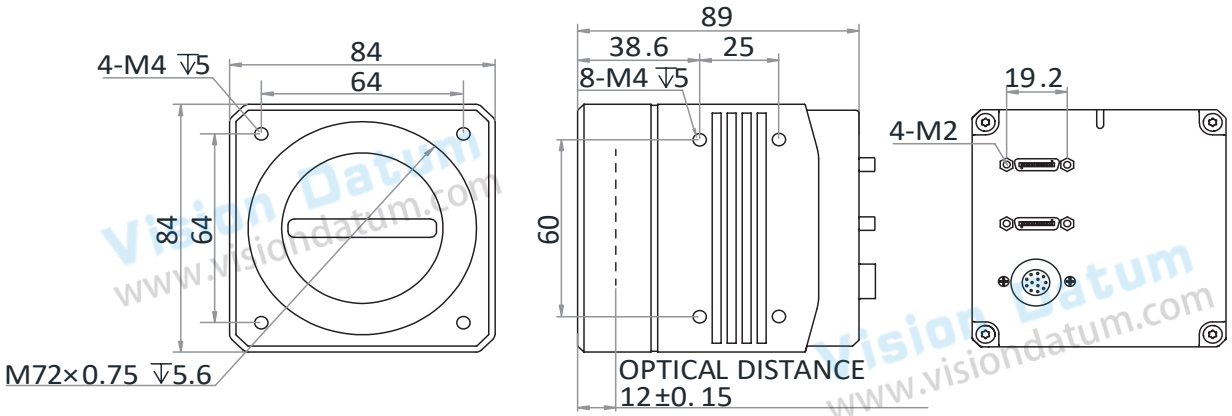

Fig. 1-4: Mechanical Dimensions (in mm) of the M72-mount 8K Cameralink Line Scan Cameras with 84 * 84 * 89 mm.

Figure	Model
Fig. 1-1	LEO 4KT2-100cm；LEO 4K-100cc
Fig. 1-2	LEO 8K-80cm；LEO 8KT2-100cm；LEO 8K-34cc；LEO 16K-50cm；LEO 16KT2-50cm
Fig. 1-3	LEO 8KT4-100cm；LEO 8KT2-34cc
Fig. 1-4	LEO 8KT4S-100cm；LEO 8KT4-34cc

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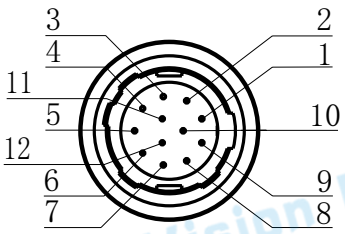
CHAPTER 2 POWER AND I/O IENTERFACE DEFINITION

I/O Connection Definition and Assignments

All Cameralink line scan cameras have a 12-pin power and I/O interface, as shown below, but their pin definitions are different by camera models.



Numbering and assignments for 12Pin Connector:

Color	Pin	Signal	Signal Source	Designation
Black	1	GND	-	Power supply ground
Red	2	DC-PWR	-	DC Power +
Brown	3	LINE0_P	Line0+	Differential output IO 0 +
Orange	4	LINE0_N	Line0-	Differential output IO 0 -
Yellow	5	GND	-	Power supply ground
Green	6	LINE3_P	Line3+	Differential input/output IO 3+
Blue	7	LINE3_N	Line3-	Differential input/output IO 3-
Purple	8	LINE4_P	Line4+	Differential input/output IO 4+
Gray	9	LINE1_P	Line1+	Differential input/output IO 2+
White	10	LINE1_N	Line1-	Differential input/output IO 2-
Pink	11	DC-PWR	-	DC Power +
Light green	12	LINE4_N	Line4-	Differential input/output IO 4-

Status LED Description

Indicator Color	Status	Description
Red	Solid	The device exception occurs.
Blue	Solid	The device is in an idle status.
Blue	Unlit	The device is not powered on.
Blue	Flashing rapidly	The device is acquiring images normally.
Blue	Flashing slowly	The device is acquiring images in trigger mode.
Red and blue	Flash alternatively	The device is updating firmware.

The wire color of this user manual is the color of Vision Datum. If you use other manufacturers' cable color definitions may be different, random connection may cause the camera to burn out, please connect according to the I/O port type and pin definition or contact our technical staff for advise.

CHAPTER 3 INSTALLATION AND SETUP

You should perform the software installation procedure first and the hardware installation procedure second.

Software Installation

■ iDatum Installation

If you use a firewall on your computer, disable the firewall for the network adapter to which your camera is connected.

Close the Firewall

In order to ensure the camera software keep running and image transmission stability, please close the firewall before using the software.

System Requirements

LEO Camera Software Suite for Windows requirements that one of the following operating systems is installed on your computer:

- Windows XP (32 bit)
- Windows 7 (32 bit or 64 bit)
- Windows 10 (32 bit or 64 bit)

Installation Steps

1.You can download the iDatum software（LEO Series Industrial Cameras SDK For xxx）from:

http://www.visiondatum.com/en/service/005001.html

2.Double click iDatum installation package to install the client.

3.Follow the instructions on the screen. The installer will guide you through the installation process.

Hardware Installation

Camera Installation

The installation procedures assume that you will be making a peer-to-peer connection between your camera and a computer.

Steps:

- Mount lens that matches with lens mount of the camera
- Connect the camera to Camera Link frame grabber via Camera Link cable.

The camera interface for connecting Camera Link cable is SDR interface, and you need to select applicable Camera Link cable according to camera interface and frame grabber model you use, and connect camera's Camera Link interfaces to respective interfaces of the frame grabber.

The camera has 2 Camera Link interfaces, and it can transmit data via 1 or 2 Camera Link interface(s). If you need to use 1 interface, the corresponding interface number is CL1, and the Base configuration mode is available. If 2 interfaces are required, the corresponding interface number is CL1 and CL2, and the configuration mode of Base, Medium, Full or 80-bit is available.

- Connect the camera to a suitable power adapter via the power and I/O cable.

Number of ports	Camera interface	Acquisition mode
1	CL1	Base
2	CL1，CL2	Medium、Full、80-bit

i	The configuration mode is decided by the camera, frame grabber, and used Camera Link interface amount.

Frame Grabber Software Installation

The frame grabber software is used to set frame grabber parameters, view and set camera parameters, and acquire images.

Steps:

- Get the installation package of the frame grabber software and drivers from frame grabber supplier.
- Install the frame grabber software and its drivers.

If the frame grabber driver is not installed accordingly, the frame grabber cannot be identified properly or acquire image normally.

i	Refer to the user manual of the frame grabber you purchased for details.

Software Operation

Frame Grabber Software Operation

After installing the camera, you are required to set frame grabber parameters via the frame grabber software. Incorrect parameters or not setting parameters may make the camera fail to output images.

The specific parameter names may differ by frame grabbers.

Here we take Dalsa and Matrox frame grabber as an example.

Frame Grabber Parameters	Parameters of Dalsa Frame Grabber	Parameters of Matrox Frame Grabber
Pixel Clock	Pixel Clock Input Frequency	Pixel Clock Frequency
Configuration Mode	Camera Link configuration	Camera Link config
Tap Number	# of Segment per Line(TAPS)	Taps
Tap Geometry	Camera Sensor Geometry Setting	Device Tap Geometry

- The specific parameter names may differ by frame grabbers.
- Refer to the user manual of the frame grabber you purchased for more operations.

iDatum Operation

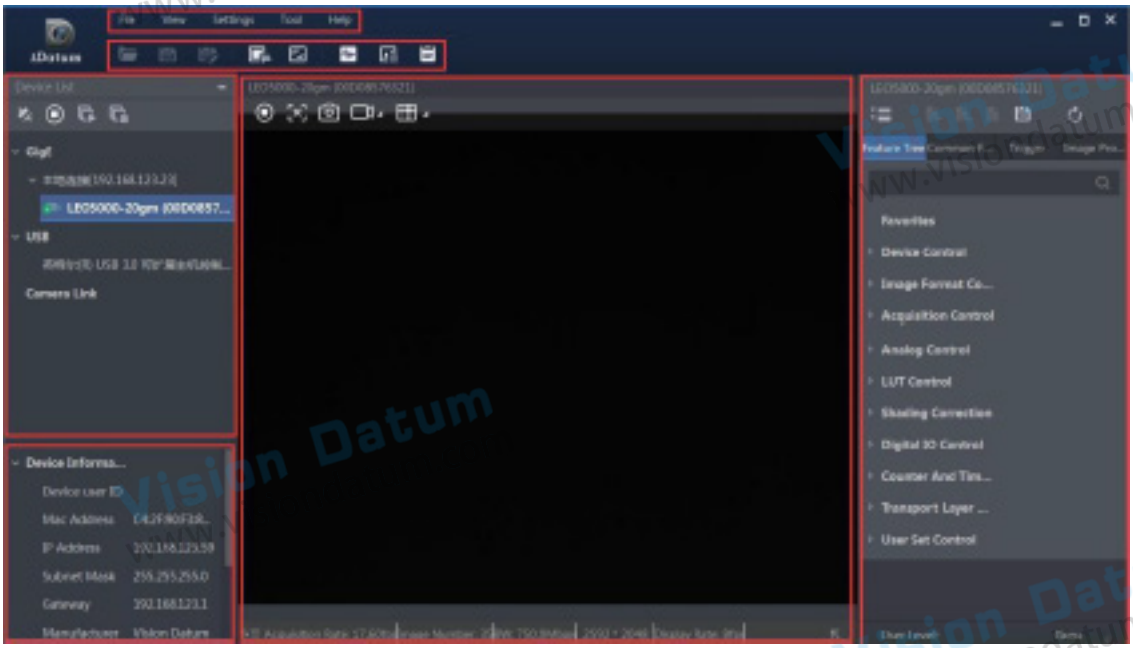
iDatum is used to connect the camera, set its parameters, etc.

iDatum does not support acquiring images for Camera Link cameras, and you can use the frame grabber software instead.

1、Double-click the iDatum shortcut on the desktop to open up the client software.

2、Click in device list  to search the device.

3、Select a device to be connected.

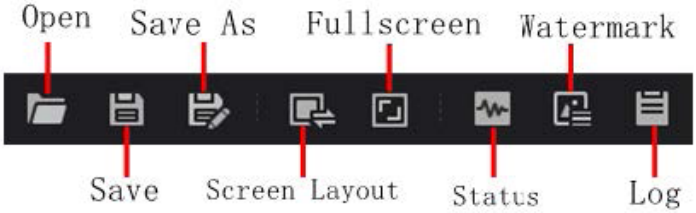


① Menu Bar

The menu bar for iDatum client provides following functions: File, View, Settings, Tool and Help, as shown in the figure below.

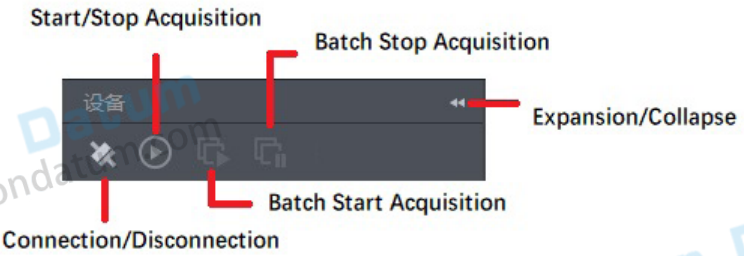
② Control Toolbar

The control toolbar provides quick operations for the device. the icon meaning is shown in the figure below. The operation buttons in the tool bar can quickly and conveniently edit camera images.



Software Operation

The meaning of shortcut icons in Device List is shown as below.



■ Connection/Disconnection: After you selecting the camera, click "Connect" to connect the camera; click "Disconnect "to disconnect the camera.

■ Start/Stop Acquisition: For current connected camera, click "Start Acquisition "to acquire image data; click "Stop Acquisition "to stop image data acquisition.

■ Batch Start Acquisition: click "Batch Start Acquisition "to start image data acquisition for all currently connected camera by iDatum.

■ Batch Stop Acquisition: click "Batch Stop Acquisition "to stop image data acquisition for all currently connected camera by iDatum.

■ Expansion/Collapse: This function can be used to expand or collapse the Device List and Device Information which list on the left side of iDatum, and the default state is expansion. In the"Collapse"state, the iDatum left side only display the searched cameras.

2、Click the refresh icon at the Camera Link interface in the device list. (Camera Link camera enumeration is slow, this is normal.)

3、Select the camera, right-click to open the window to set the camera baud rate.
The recommended baud rate is 115200, and the camera connection speed is faster than the default 9600 baud rate.

4、After the camera is found, double-click to connect the camera.

5、Click ">", in the camera's feature panel to unfold the specific camera parameters, and set them according to actual demands.

Attribute	Description
Device Control	You can view the device information, edit its name, reset the device, etc.
Image Format Control	You can view and set the device's resolution, image reverse function, pixel format, region of interest, test pattern, etc.
Acquisition Control	You can view and set the device's acquisition mode, frame rate, trigger mode, exposure time, etc.
Analog Control	You can view and set the device gain, black level, Gamma correction, etc.
Color Transformation Control	You can view and set the device color transformation related parameters like hue and saturation.
Super Palette Control	You can select different color areas in the image to set customized hue and saturation values.
LUT Control	You can view the Look-Up Table (LUT), and set its index and value.
Encoder Control	You can set encoder control to convert source signal of external trigger into internal signal.
Frequency Converter Control	You can set frequency converter control to convert external signal of different frequencies into internal signal.
Shading Correction	You can set shading correction to correct shade.
Digital IO Control	You can set the different input and output signals.
Counter and Timer Control	You can view and set the counter-related parameters when selecting counter active as line source.
File Access Control	You can view and set the device's file access control related parameters.
Transport Layer Control	You can set the parameters of transport layer of the device.
User Set Control	You can save or load the device's parameters.

i	The camera's attribute tree and parameters may differ by camera models.

6、The camera's tap geometry should match with that of the frame grabber, and inconsistent parameters may lead to image exception.

You can go to Transport Layer Control > Device Tap Geometry to check or set the tap geometry. The CI Configuration displays the mode that the camera adopts currently.

i	The device's supported Device Tap Geometry and CI Configuration may differ by device models.

Software Operation

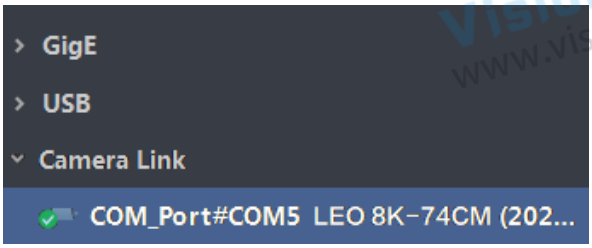
Serial Port Tool

Apart from the iDatum and frame grabber software, the serial port tool can be used to detect camera status, read and set its parameters.

After installing the frame grabber, the PC will distribute a serial port to the frame grabber, and the iDatum client software configures the device's parameters via this serial port. You can view serial port information via the iDatum client software or PC's device manager.

Via iDatum Client Software

After connecting the device, the iDatum client software displays the serial port information in the device list, as shown below.



Via Device Manager

In the PC's device manager, you can check whether the frame grabber driver is installed correctly. If the installation is correct, the device manager will display the installed frame grabber model and the corresponding serial port information. You can use the serial port tool to send commands to the corresponding serial port to check whether the connection is normal. For the specific setting method, refer to the user manual of the corresponding frame grabber.

Set Serial Port Parameters

You can set the device's parameters by connecting Camera Link serial port cable. When accessing the device or using the terminal in the application software, you are required to set the parameters as follows.

Serial Port Parameters	Value
Baud Rate	9600bps
Data Bit	8bit
Parity Bit	None
Stop Bit	1bit
Stream Control	None

- The default value of the device's baud rate is 9600 bps.
- The camera can set parameters through iDatum, frame grabber software or serial port tool, but you cannot use them at same time.

The serial port tool can detect the device status, configure a valid serial port for the detected device, and configure parameters for the detected device.

The commands for setting device's parameters via serial port is sent in the format of ASCII code. The commands are send by user's application. After receiving commands, the device will return a value (success or fail).

The specific command format is shown below.

Command Format: < Command > < Node Name > < Value> <\r>

Command Description	Returned Value
If the writing command has been set	*Success ! <\r> <\n>*
If the reading command has been set	● *Success ! <\r> <\n> <\r> <\n>* ● *get < Note Name >: <Value> <\r> <\n>*
If setting the writing or reading command fails	● *Failed ! <\r> <\n> <\r> <\n>* ● *Wrong input format. <\r> <\n>*

Software Operation

Command for writing:
The following example is to set the exposure as 1000 us.
Command:
w ExposureTime 1000 <\r>
Returned value:
Setting succeeded: Success! <\r> <\n>
Setting failed: Failed! <\r> <\n> <\r> <\n> or Wrong input format. <\r> <\n>

Command for reading:
The following example is to get the exposure as 1000 us.
Command:
r ExposureTime <\r>
Returned value:
Reading succeeded: Success! <\r> <\n> <\r> <\n> or get ExposureTime: 1000 <\r> <\n> Reading failed: Failed! <\r> <\n> <\r> <\n> or Wrong input format. <\r> <\n>

CHAPTER 4 IMAGE ACQUISITION

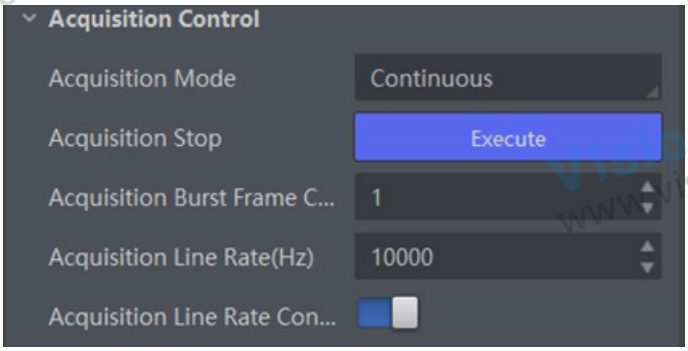
Line Rate

Line rate refers to the image line number that is output by the camera per second. The frame rate of the camera is proportional to the line rate, and is inversely proportional to the height of the image area, that is, Fps=Lps (line rate)/Height (image height).

The following 4 factors determine the maximum line rate:

- Readout time: The less the readout time and the higher the line rate will be.
- Exposure time: The less the exposure time, the higher the line rate will be.
- Pixel format: The more bytes pixel format occupy, the lower the line rate will be.
- Quantity of connected Camera Link cables: The more connected Camera Link cables, the larger transmitted data, and the higher the line rate will be.

In iDatum, click 'Acquisition Control' > 'Acquisition Line Rate (Hz)', enter 'Acquisition Line Rate (Hz)', and enable 'Acquisition Line Rate Control Enable'. You can view real-time line rate and frame rate in 'Resulting Line Rate (Hz)' and 'Resulting Frame Rate (Hz)' respectively.



- If the real-time line rate is smaller than the value you set, the device acquires images by the real-time line rate.
- If the real-time line rate is larger than the value you set, the device acquires images by the value you set.

Scan Mode

The device supports selecting different methods of reading image data, including frame scan and line scan.

Go to 'Acquisition Control' → 'Scan Mode' to select it according to actual demands.

- Frame Scan: The device outputs a frame of image after its outputted line quantity reaches configured image height.
- Line Scan: The device outputs one line of image after each exposure.

- If the Scan Mode selects Line Scan, the Trigger Selector can be Line Start only.
- If the device has no Scan Mode, the default mode is frame scan.

Frame Timeout

The camera supports frame timeout function that affects the camera's acquisition and image output mechanism.

Click 'Acquisition Control', enable 'Frame Timeout Enable', and select 'Partial Image Output Mode' according to actual demands.

i	The frame timeout function may differ be camera models.

There are four image output modes, and the working principle of the corresponding parameters is shown as below:

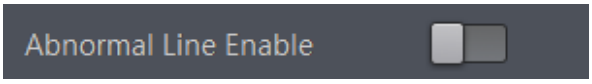
Corresponding Parameter	Parameter	Working Principle
Acquisition Control > Partial Image Output Mode	Image Pending	After the number of lines output by the camera reaches the configured image height (height parameter), one frame of the image will be outputted. If the number of output lines does not reach the image height (height parameter), the SDK will not output the image, and the SDK will wait for the line data until it reaches the image height before outputting the image.
	PartialImageOutput	When the number of lines output by the camera reaches the configured image height (height parameter) within the frame timeout period, and one frame of image will be output. If the number of lines output by the camera does not reach the configured image height (height parameter) within the frame timeout period, the SDK will output the image according to the actual height.
	PartialImageDiscard	When the number of lines output by the camera reaches the configured image height (height parameter) within the frame timeout period, and one frame of image will be output. If the number of lines output by the camera does not reach the configured image height (height parameter) within the frame timeout period, the SDK discards the image.
	PartialImageFilled	When the number of lines output by the camera reaches the configured image height (height parameter) within the frame timeout period, and one frame of image will be output. If the number of lines output by the camera does not reach the configured image height (height parameter) within the frame timeout period, SDK will output the image after filling the black according to the height parameter for the remaining part.

i	If 'Frame Timeout Enable' is not enabled, the image output is related with configured trigger mode. When the 'Trigger Mode' is 'Off', only 'Image Pending' is supported. When the 'Trigger Mode' is 'On' and 'Trigger Activation' is 'Level High' or 'Level Low', all image output modes are supported.

Line Discard Function

Additional trigger signals are required due to multi-line stacking and line frequency mismatched. The line discard function can control the number of external line trigger signals. You can go to 'Acquisition Control', and enable 'Abnormal Line Enable' according to actual demands.

- The external device sends line trigger signal exceeding actual image height if 'Abnormal Line Enable' is disabled.
- The external device sends line trigger signal matching actual image height if 'Abnormal Line Enable' is enabled.



i	The line discard function may differ by camera models.

Trigger Mode

The camera has 4 types of trigger modes, including internal trigger mode, line trigger mode, frame trigger mode, and line + frame trigger mode.The trigger mode is controlled by 'Trigger Selector' and 'Trigger Mode' in 'Acquisition Control'. The trigger mode principle and parameter are shown in the following table:

Trigger Mode	Trigger Selector	Trigger Mode	Principle
Internal trigger	Line Start	Off	The device acquires images per lines via its internal signal and outputs images per frames according to configured parameters.
	Frame Burst Start	Off	
Line trigger	Line Start	On	The device acquires images per lines via the external signal and outputs images per frames according to configured parameters.
	Frame Burst Start	Off	
Frame trigger	Line Start	Off	The device acquires images after receiving the external signal, and acquires images per lines via its internal signal.
	Frame Burst Start	On	
Line + frame trigger	Line Start	On	The device acquires images after receiving the external signal, and acquires images per lines via another external signal.
	Frame Burst Start	On	

■ External Trigger Mode

■ Trigger Source

The device's trigger source includes software trigger, hardware trigger, shaft encoder control, frequency converter control, action command trigger, and free trigger. Go to 'Acquisition Control' → 'Trigger Source', and select 'Trigger Source' according to actual demands.

Trigger Mode	Trigger Selector	Trigger Mode	Principle
Software Trigger	Acquisition Control >Trigger Source	Software	The software sends trigger signal to the camera via Camera Link interface to acquire images. The software trigger is available only when frame trigger is enabled.
Hardware Trigger		Line *	External device connects camera via camera I/O interface. External device sends trigger signal to camera to acquire images.
Shaft encoder control		Encoder Module Out	This trigger source uses shaft encoder module to receive signal A and signal B with phase difference. After internal computing of the module, the outputted signal can be used as camera's trigger signal. The shaft encoder control is available only when line trigger is enabled.
Frequency converter control		Frequency Converter	This trigger source allows different frequency between trigger camera signal and required input signal.
Frame grabber trigger control		CC 1/2/3/4	The frame grabber sends trigger signals to the device to acquire images.
Free trigger		Anyway	Use trigger sources mentioned above to send trigger signal to the device to acquire images.

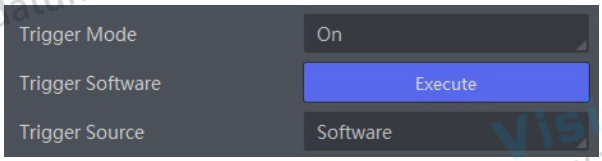
- The specific trigger source may differ by device models.
- Apart from internal trigger, you need to select trigger source if line trigger signal or frame trigger signal comes from external signal.
- Software trigger and action command trigger sources are valid for frame trigger only, and shaft encoder control is valid for line trigger only.
- Make sure to configure corresponding trigger mode before select specific trigger source.
- In line + frame trigger mode, when the trigger source selected by the frame trigger and the line trigger and the trigger-related parameters are the same, the first signal of trigger source will be used as the frame trigger signal to make the device start to acquire images, and the subsequent signals as line trigger signal to acquire images per lines until the processing of one frame of image is completed, and then the processing of the next frame of image is performed.

Trigger Mode

■ Software Trigger

The camera supports software trigger. When the software trigger is selected, the client software sends commands to the camera via Camera Link cable to acquire and transmit images.

1. Click Acquisition Control > Trigger Selector.
2. Select Frame Burst Start as Trigger Selector, and On as Trigger Mode.
3. Select Software as Trigger Source, and click Execute in Trigger Software to send trigger commands.

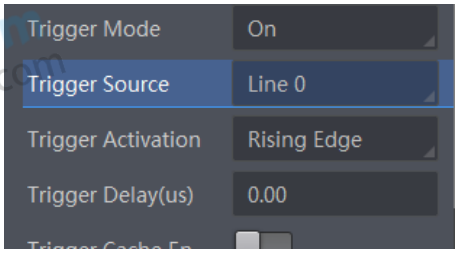


■ Hardware Trigger

If the camera enables the frame trigger or line trigger, you can select specific lines as trigger source to enable hardware trigger. At this time, external devices send commands to the camera to acquire images.

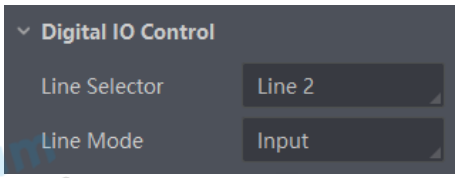
The setting of input signal is as shown below:

1. Click Acquisition Control > Trigger Selector.
2. Select Frame Burst Start or Line Start as Trigger Selector, and On as Trigger Mode.
3. Select specific line as Trigger Source according to actual demands.



When selecting bi-directional configurable line as the hardware trigger source, you need to make sure that its line mode is input. Go to 'Digital IO Control', select specific line as 'Line Selector', and 'Input' as 'Line Mode'.

i	Here we take Line 2 as an example to introduce how to set bi-directional configurable line as the hardware trigger source. Refer to the device you got for the actual condition.



You can also set the signal type for the selected bi-directional configurable line. Go to 'Digital IO Control', and set 'Line Format' according to actual demands.

i	The line format function may differ by device models.

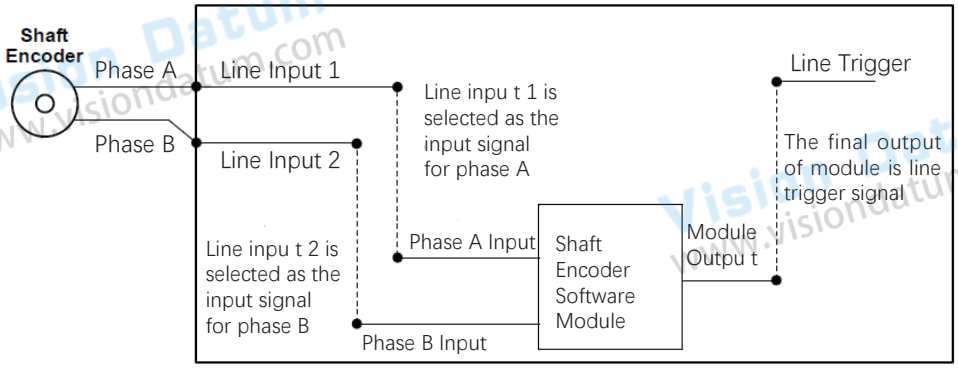
- SingleEnded: It can receive single-ended input signal.
- Differential: It can receive TTL & LVTTL standard input signal.

i	You need to select line format according to the external device connected. Otherwise, I/O may be damaged.

Trigger Mode

■ Shaft Encoder Control

If the camera enables the line trigger, you can select Encoder Module Out as trigger source. At this time, the camera will receive signal A and signal B with phase difference. After internal computing,the outputted signal can be used as camera's trigger signal. The function demonstration of shaft encoder module is shown below.



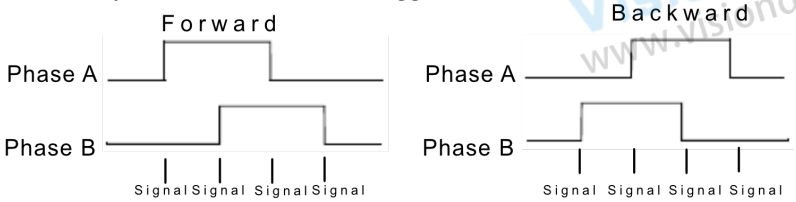
The advantages of shaft encoder are as follows:

- Encoder output pulse frequency is proportional to rotating speed.
- The output pulse acts as a trigger signal for line scan camera.
- Synchronize acquisition speed and sample movement of camera.
- Non-uniform motion can also be a perfect match.
- A trigger signal can be set as acquiring multiple lines or multiple frames with adjustable ratio.

Follow steps below to set shaft encoder control:

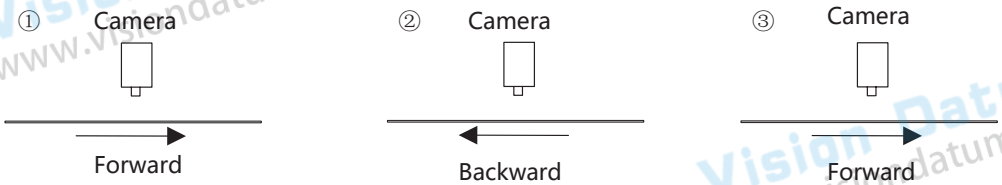
1. Click Encoder Control, and set Encoder Source A and Encoder Source B according to actual demands.
2. Set Encoder Trigger Mode.

- Any Direction: means that both forward and backward direction will trigger.
- Forward Only: mean that only forward direction will trigger.
- Backward Only: mean that only backward direction will trigger.



3. Set Encoder Counter Mode.

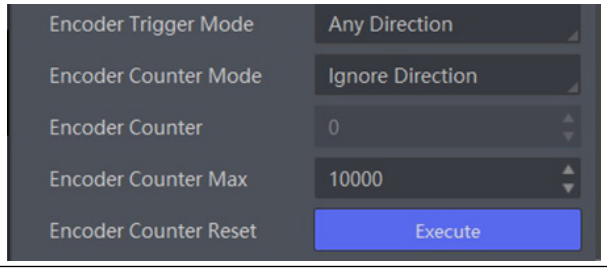
- Ignore Direction: means that both forward and backward direction will count.
- Follow Direction: means that the forward direction is valid, and Encode Counter will increase.
- Backward Direction: means that the backward direction is valid, and Encode Counter will increase.



4. (Optional) Set max. counter value (0 to 32767) in Encoder Counter Max.

After reaching the max. value, it will be cleared automatically or you can clear manually by clicking Encoder Counter Reset.

5. (Optional) Set Encoder Max Reverse Counter to avoid outputting images if the object moves backward accidently during measurement, and click Execute in Encoder Reverse Counter Reset to let the camera to output images again.



Trigger Mode

■ Frequency Converter Control

If the camera enables the frame trigger or the line trigger, you can select Frequency Converter as trigger source. The hardware signal trigger or shaft encoder control signal can be converted into the signal frequency of frame trigger or line trigger by camera's frequency converter module.

The frequency converter module includes PreDivider, Multiplier and PostDivider. The signal after being processed by these 3 modules is the camera's final trigger signal.

● PreDivider

The input signal first enters the PreDivider module, which reduces source signal frequency via integer division, and then the signal is sent to the Multiplier module.

The PreDivider module reduces periodic jitter on the input signal, and signals above 100 kHz must **go through the PreDivider module to reduce the frequency for the Multiplier can only receive signals in the range of 10 Hz to 100 kHz frequency range. The periodic jitter of shaft encoder signal is accepted.**

● Multiplier

After the signal is processed by the PreDivider, it is sent to the Multiplier. The Multiplier multiplies the signal by an integer to increase its signal frequency, and then the signal is sent to the PostDivider.

Parameter can be set as rising or falling edge. If a rising edge is set, each rising edge of the signal coming from the PreDivider will be locked to match the signal of the rising edge, and vice versa.

During this process, make sure do not increase signal frequency via too larger multipliers to avoid trigger signal frequency beyond the max. line rate of the camera. Even if a smaller multiplier is selected, an excessively high frequency may be generated in the frequency adjustment, exceeding the max. line rate of the camera.

● PostDivider

PostDivider reduces signal frequency via an integer factor, and uses the newly generated frequency signal as the camera's trigger signal.

Follow steps below to set frequency converter control.

Steps:

1. Click Acquisition Control > Trigger Selector.
2. Select Line Start or Frame Burst Start as Trigger Selector, and On as Trigger Mode.
3. Select Frequency Converter as Trigger Source according to actual demands.
4. Click Frequency Converter Control, and select specific line, Encoder Module Out or CC1/CC2/CC3/CC4 as Input Source according to actual demands.
5. Set Rising Edge or Falling Edge as Signal Alignment according to actual demands.
6. Set PreDivisder, Multiplier and PostDivider.

Some device models support displaying trigger line rate.

■ View Trigger Line Rate

- Trigger Line Rate: It refers to the external trigger raw line rate after filtering, and it only involves external trigger signals.
- Resulting Trigger Line Rate: It refers to the external trigger frequency cameras received after the external trigger raw line rate is calculated via frequency converter control. It only involves external trigger signals.

You need to select external trigger sources as Input Source to display specific values in Trigger Line Rate and Resulting Trigger Line Rate. If N/A is selected as Input Source, these two parameter values will be 0.

i	● Parameters of trigger line rate and resulting trigger line rate may differ by camera models. ● Make sure that line trigger is enabled and input source value of frequency converter control and trigger source value of acquisition control is the same before viewing trigger line rate.

Trigger Mode

■ Frame Grabber Trigger Control

When selecting CC1/CC2/CC3/CC4 as Trigger Source, the camera is in frame grabber trigger status.

Frame grabber triggers camera to acquire images by sending signal via Camera Link cable.

Steps:

1. Click Acquisition Control > Trigger Selector.
2. Select Frame Burst Start or Line Start as Trigger Selector, and On as Trigger Mode.
3. Select CC1/CC2/CC3/CC4 as Trigger Source.

i	The specific trigger source may differ by camera models.

■ Free Trigger

If the camera enables the frame trigger or line trigger, you can select Anyway as trigger source to enable the free trigger. At this time, the camera can receive signals of all trigger sources.

Steps:

1. Click Acquisition Control > Trigger Selector.
2. Select Frame Burst Start or Line Start as Trigger Selector, and On as Trigger Mode.
3. Select Anyway as Trigger Source.

Trigger Mode

Trigger Related Parameters

If the camera enables the frame trigger or line trigger, you can set trigger related parameters,including acquisition burst frame count, trigger activation, trigger delay, trigger cache, and trigger debouncer. Different trigger modes can set various trigger parameters, and their relation is shown below.

- If the frame trigger is enabled, the relation between trigger source and trigger related parameters is shown below.

Trigger Parameter \ Trigger Source	Software Trigger	Hardware Trigger	Frequency Converter Control	Frame Grabber Trigger	Free Trigger
Burst Frame Count	√	√	√	√	√
Trigger Delay	√	√	√	√	√
Frame Trigger Cache	√	√	√	√	√
Trigger Activation	×	√	√	√	√
Trigger Debouncer	×	√	√	√	√

- If the line trigger is enabled, the relation between trigger source and trigger related parameters is shown below.

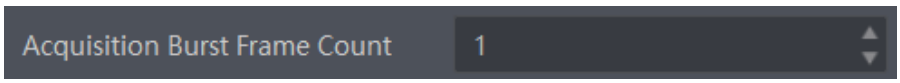
Trigger Parameter \ Trigger Source	Hardware Trigger	Shaft Encoder Control	Frequency Converter Control	Frame Grabber Trigger	Free Trigger
Trigger Delay	√	√	√	√	√
Line Trigger Cache	√	√	√	√	√
Trigger Activation	√	√	√	√	√
Trigger Debouncer	√	×	×	√	√

Whether the frame/line trigger Cache function is supported depends on the camera model and firmware. Please refer to the actual function for details.

Burst Frame Count

If the camera enables the frame trigger, you can set the acquisition burst frame count.

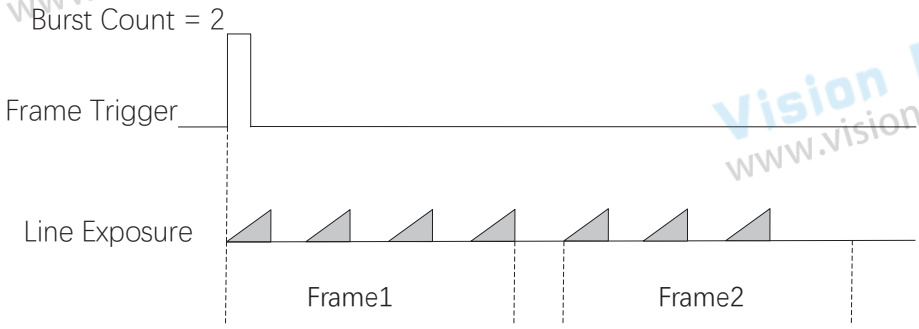
Click Acquisition Control > Acquisition Burst Frame Count, and enter Acquisition Burst Frame Count according to actual demands. Its range is from 1 to 1023.



If Acquisition Burst Frame Count is 1, it is in single frame trigger mode. If Acquisition Burst Frame Count is larger than 1, it is in multi-frame trigger mode.

If Acquisition Burst Frame Count is n and when inputting 1 trigger signal, the camera stops acquiring images after exposing n times and outputs n frame images.

The sequence diagram of burst frame count is shown below. The sequence diagram below uses rising edge as trigger activation, and the camera's height parameter is 4.



Trigger Mode

■ Trigger Activation

The camera supports trigger acquisition in the rising edge, falling edge, any edge, level high or level low of the external signal. The principle and parameter of trigger activation are shown below.

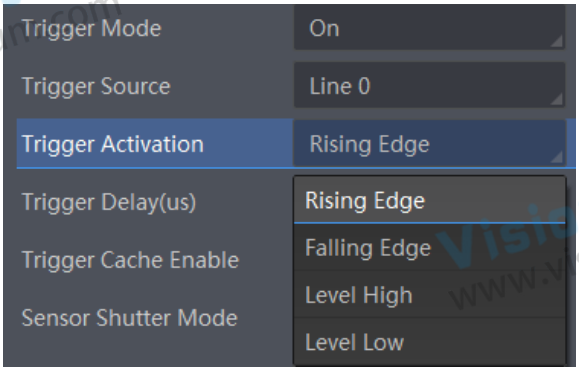
Trigger Activation	Parameter	Parameter Value	Principle
Rising Edge	Acquisition Control > Trigger Activation	Rising Edge	It means that when the level signal sent by external device is in rising edge, the device receives trigger signal and starts to acquire images.
Falling Edge		Falling Edge	It means that when the level signal sent by external device is in falling edge, the device receives trigger signal and starts to acquire images.
Level High		Level High	The level high of the trigger signal is valid. As long as the trigger signal is in level high, the device is in image acquisition status.
Level Low		Level Low	The level low of the trigger signal is valid. As long as the trigger signal is in level low, the device is in image acquisition status.
Any Edge		Any Edge	It means that when the level signal sent by external device is in rising or falling edge, the device receives trigger signal and starts to acquire images.

The setting method for trigger activation is different in frame trigger and line trigger.

- Set Trigger Activation in Frame Trigger

  Go to Acquisition Control, and set Trigger Activation according to actual demands.

  _ When rising edge or falling edge is selected as Trigger Activation, you can set Trigger Delay.
  _ When level high or level low is selected as Trigger Activation, you can set Trigger Partial Close.
  True means that images after complement is outputted after the level trigger ends, and false means that images output according to the settings of the frame timeout after the level trigger ends.



- Set Trigger Activation in Line Trigger

  In the line trigger mode, the trigger activation is related with Exposure Mode.

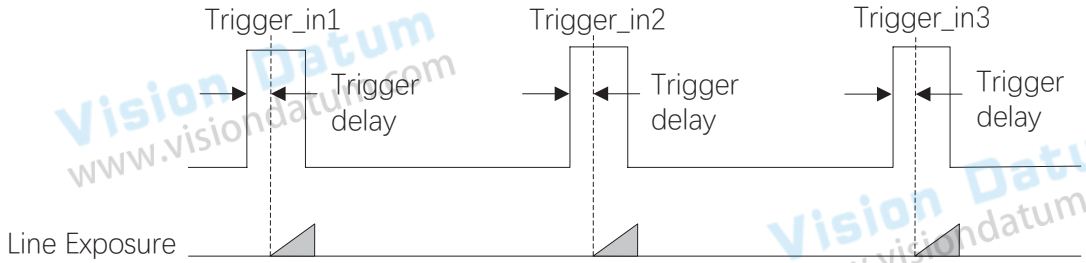
  _ When Timed is selected as Exposure Mode, you can select Rising Edge, Falling Edge or Any Edge as Trigger Activation, and Exposure Auto and Exposure Time determine the exposure time.
  _ When Trigger Width or Timed is selected as Exposure Mode, you can select Level Low or Level High as Trigger Activation, and exposure time is determined by the duration of the level signal only.

> The trigger width function may differ by camera models.

Trigger Mode

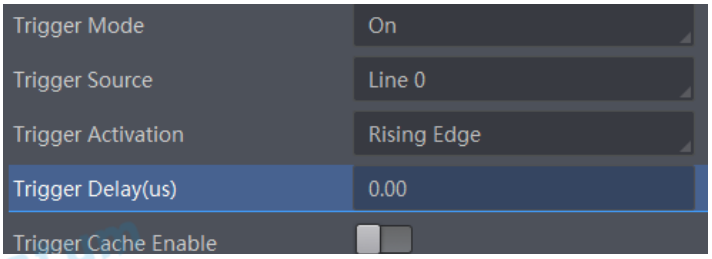
■ Trigger Delay

The trigger delay function allows the camera to add a delay between the receipt of trigger signal and the moment the trigger becomes active. Its sequence diagram is shown below.



Uses rising edge as trigger activation

You can click Acquisition Control > Trigger Delay, and enter Trigger Delay.



■ Frame/Line Trigger Cache

If the camera enables the frame trigger or line trigger, it has the frame/line trigger cache function.

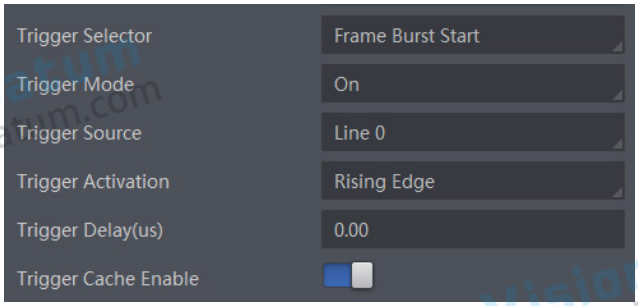
During the triggering process, if the camera receives new trigger signal, it will save and process the signal if you enable this function. Trigger cache enable can save up to 3 trigger signals.

- The frame/line trigger cache function may differ by device models.
- The setting method for trigger cache is different in frame trigger and line trigger.

Set Trigger Cache in Frame Trigger

Steps:

1. Click Acquisition Control > Trigger Selector.
2. Select Frame Burst Start as Trigger Selector, and On as Trigger Mode.
3. Enable Trigger Cache Enable.

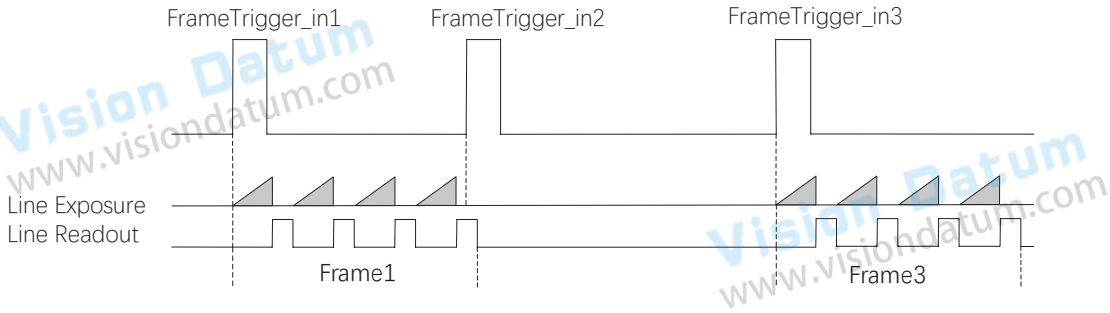


This parameter can be set only when Frame Burst Start is selected as the Trigger Selector.

Trigger Mode

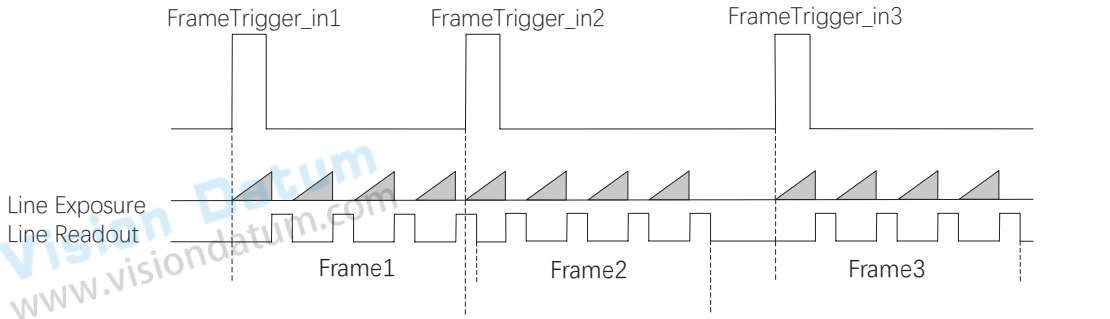
If the camera receives the 1st trigger signal first, and the camera receives the 2nd trigger signal during processing the 1st trigger signal. The three sequence diagrams below use rising edge as trigger activation, and the camera's height parameter is 4.

- Disable Trigger Cache Enable: the 2nd trigger signal will be filtered without processing.

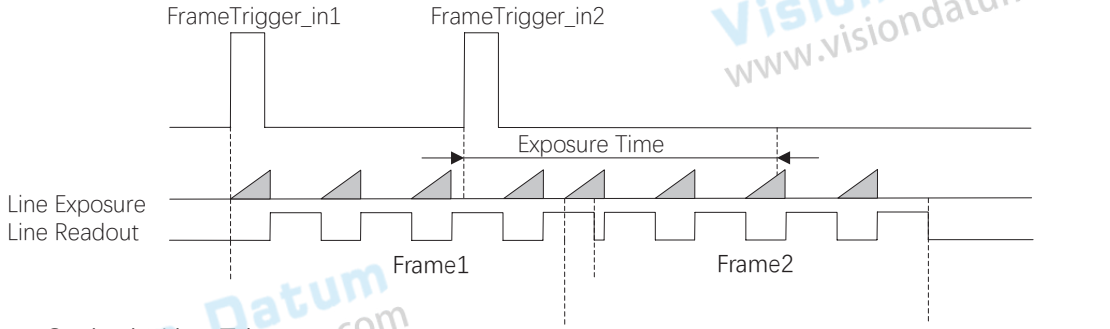


- Enable Trigger Cache Enable: the 2nd trigger signal will be saved.

_ If the 1st frame image's exposure time of the 2nd trigger signal is not earlier than the camera's last frame creation time of the 1st trigger signal, and then the 2nd trigger signal's 1st frame image is created normally.



_ If the 1st frame image's exposure time of the 2nd trigger signal is earlier than the camera's last frame creation time of the 1st trigger signal, and then the camera will delay this exposure time. Thus making sure this exposure time is not earlier than the camera's last frame creation time of the 1st trigger signal.



Set Trigger Cache in Line Trigger

Steps:

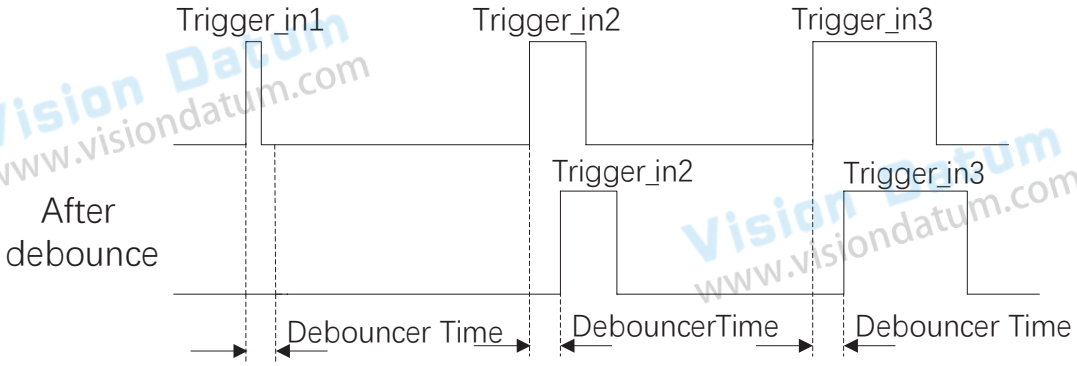
1. Click Acquisition Control > Trigger Selector.
2. Select Line Start as Trigger Selector, and On as Trigger Mode.
3. Enable Line Trigger Cache Enable.

i	This parameter can be set only when the Trigger Selector selects Line Start.

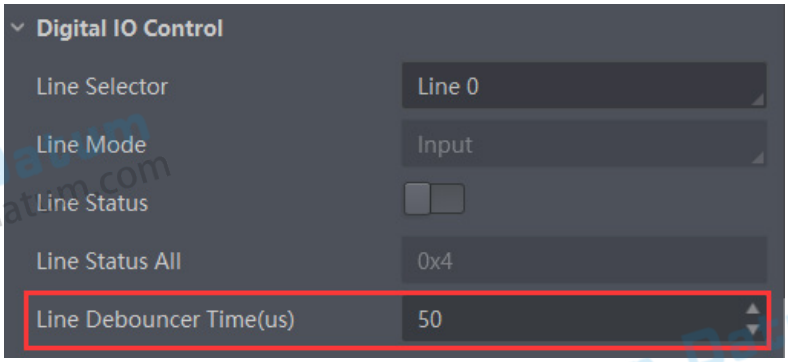
Trigger Mode

■ Trigger Debouncer

The trigger debouncer function allows the camera to filter out unwanted short external trigger signal that is input to the camera. Its sequence diagram is shown below.



Click Digital IO Control > Line Debouncer Time, and set Line Debouncer Time according to actual demands.

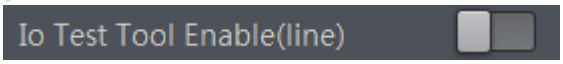


i	● When the configured debouncer time is larger than trigger signal time, and the trigger signal will be ignored. ● The unit of line debouncer time may differ by device models. ● The sequence diagram above uses rising edge as trigger activation.

■ IO Test Tool

For some device models, the device supports checking whether the line or frame signal it received is stable or not via the IO test tool. Go to Digital IO Control, and enable IO Test Tool Enable (Line) according to actual demands.

i	The IO test tool function may differ by device models.



CHAPTER 5 I/O OUTPUT

Select Output Signal

i	The selectable output signal line may differ by camera models.

The device has multiple differential output lines or bi-directional configurable lines. The method of setting bi-directional configurable line as output line as follows:

The camera has four signal lines (Line 0/1/3/4) that can be set as input or output, and you can set them as output as shown below.

Steps:

1. Click Digital IO Control, and select specific line as Line Selector.
2. Set Strobe as Line Mode.
3. (Optional) Set Line Format according to actual demands.

- Differential stands for the differential signal.
- SingleEnded stands for the single-ended signal.

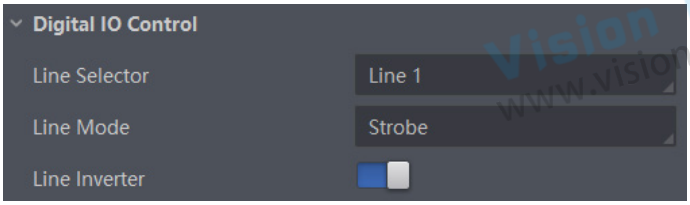
i	● The line format function may differ by device models. ● Differential stands for the differential signal. ● If a bi-directional configurable line signal is selected as Line Selector and Line Mode is Input currently, but you cannot set Strobe as Line Mode. The reason is that the bi-directional configurable line signal is selected as trigger source in one of line trigger/frame trigger/shaft encoder control/ frequency converter control settings. You should set other line signals as trigger source in line trigger/frame trigger/shaft encoder control/ frequency converter control settings all.

Set Output Signal

The output signal of the camera is switch signal, which is used to control external devices such as alarm light, light source and PLC. There are two ways to achieve output signal, including line inverter and strobe signal.

■ Enable Line Inverter

Click Digital IO Control > Line Selector, select line for Line Selector, and enable Line Inverter. The Line Inverter parameter is disabled by default.



Set Output Signal

Enable Strobe Signal

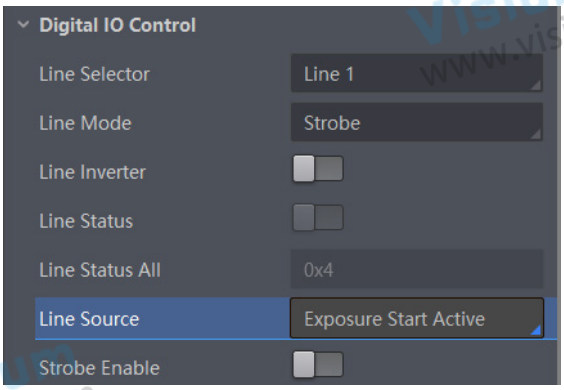
The strobe signal is used to directly output signal to external devices when the camera's event source occurs.

When selected event sources occur, one event information will be created, and the camera will output one strobe signal at the same time. Refer to the table below for detailed event source description.

If you need to let the camera output signals when it outputs one frame image, follow steps below to set it.

Steps:

1. Click Digital IO Control, and select Frame Mode as Strobe Source Selector.
2. Set Line Source according to actual demands.
3. Enable Strobe Enable.



If you need to let the camera output signals when event sources occur that are corresponding to each line image, follow steps below to set it.

Steps:

1. Click Digital IO Control, and select Line Mode as Strobe Source Selector.
2. Set Line Source according to actual demands.
3. Enable Strobe Enable.

After selecting a specific line source, an event information will be generated, and the device will output a Strobe signal at the same time. The supported line sources are as follows:

Line Source	Description
Exposure Start Active	The device outputs signals to external devices when it starts exposure.
Frame Start Active	The device outputs signals to external devices when it starts doing the capture of a frame.
Frame End Active	The device outputs signals to external devices when it stops doing the capture of a frame.
Frame Burst Start Active	The device outputs signals to external devices when the device's frame burst starts.
Frame Burst End Active	The device outputs signals to external devices when the device's frame burst stops.
Soft Trigger Active	The device outputs signals to external devices when it has a software trigger.
Hard Trigger Active	The device outputs signals to external devices when it has a hardware trigger.
Counter Active	The device outputs signals to external devices when it has a counter trigger.
Timer Active	The device outputs signals to external devices when it has a timer trigger.

Set Output Signal

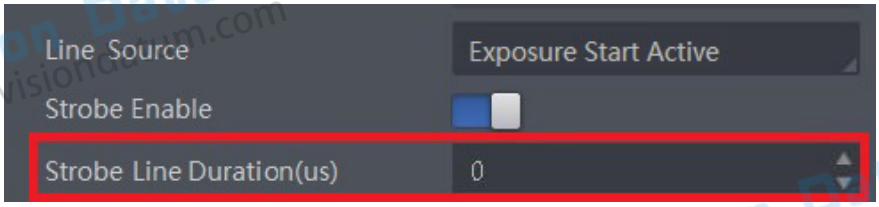
When Counter Active is selected as Line Source, you can go to Counter and Timer Control and set specific parameters according to actual demands.

Parameter	Read/Write	Description
Counter Selector	Read and write	It selects counter source. Counter 0 is available only at present.
Counter Event Source	Read and write	It selects the signal source of counter trigger, and Line 0/1/3/4 or CC 1/2/3/4 is available. It is disabled by default.
Counter Event Activation	Read and write	It selects the activation mode of the selected counter event source, including rising edge, falling edge, and any edge.
Counter Reset Source	Read and write	It selects the signal source of resetting counter. Software is available only. It is disabled by default.
Counter Reset	Write is available under certain condition	It resets counter and it can be executed when selecting Software as Counter Reset Source.
Counter Value	Read and write	It is the counter value with the range of 1 to 4294967295. The specific range of counter value may differ by device models.
Counter Current Value	Read only	It displays the number of executed external trigger.

If Timer Active is selected as Line Source, you can set Strobe Line Duration and Strobe Line Delay, and the device will output signal correspondingly after click Execute in Line Trigger Software.

- Set Strobe Line Duration

After enabling strobe signal, you can set its duration. Click Digital IO Control > Strobe Line Duration, and enter Strobe Line Duration.

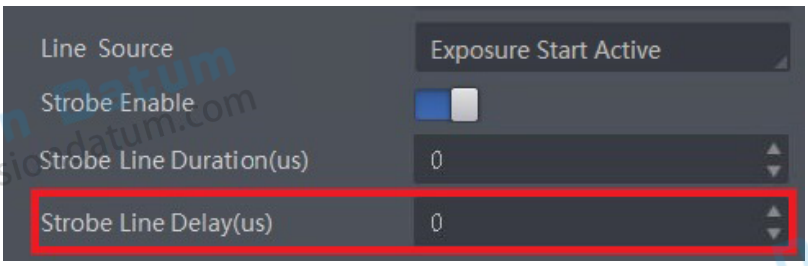


When the Strobe Line Duration value is 0, the strobe duration is equal to the exposure time.
When the Strobe Line Duration value is not 0, the strobe duration is equal to Strobe Line Duration value.

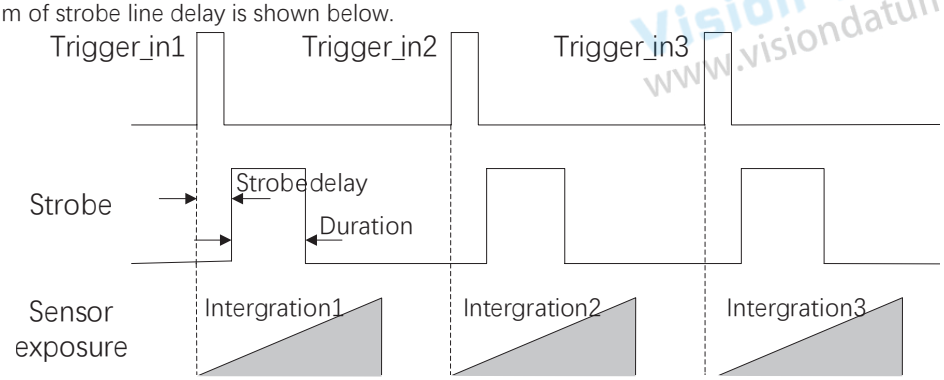
- Set Strobe Line Delay

The camera supports setting strobe line delay to meet actual demands. When exposure starts, the strobe output doesn't take effect immediately. Instead, the strobe output will delay according to the strobe line delay setting.

Click Digital IO Control > Strobe Line Delay, and enter Strobe Line Delay according to actual demands.



The sequence diagram of strobe line delay is shown below.

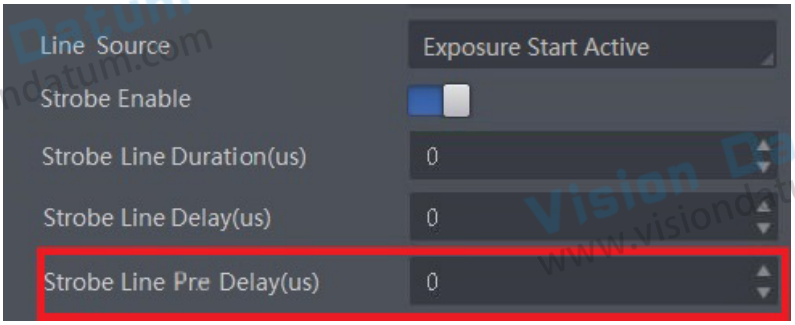


Set Output Signal

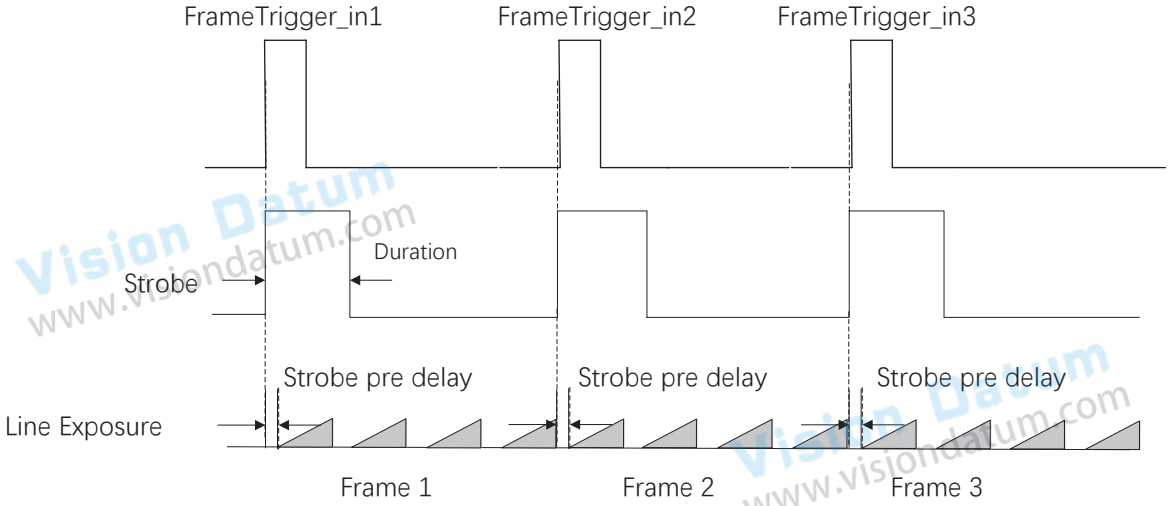
- Set Strobe Line Pre Delay

The camera also supports the function of strobe line pre delay, which means that the strobe signal takes effect early than exposure. This function is applied to the external devices that have slow response speed.

Click Digital IO Control > Strobe Line Pre Delay, and enter Strobe Line Pre Delay according to actual demands.



The sequence diagram of strobe line pre delay is shown below.



CHAPTER 6 I/O ELECTRICAL FEATURE AND WIRING

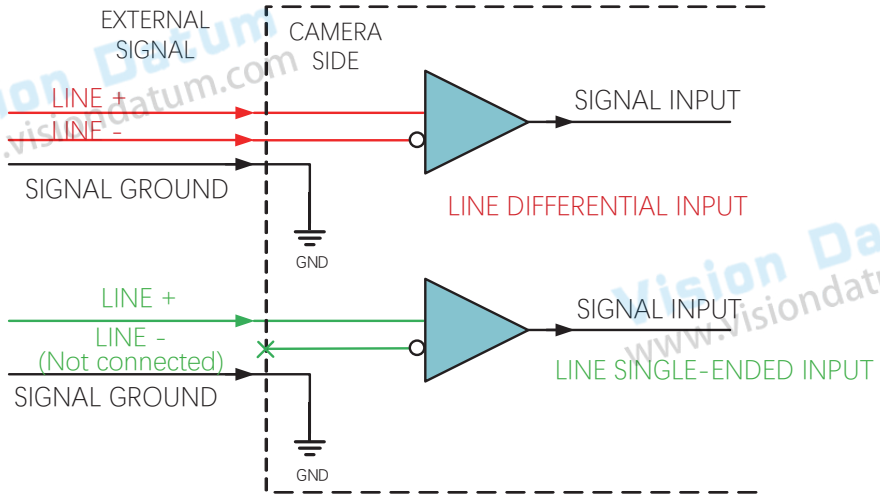
I/O Introduction

The I/O signals of camera are four configurable input or output signals (Line 0/1/3/4). The Line 0/1/3/4 can be set as differential input or differential output according to actual demands.

I/O Electrical Feature

Differential Input Circuit

The differential input signal in I/O signals supports the single-ended input, and its internal circuit is shown below.



The RS-422 standard, RS-644 standard and TTL&LVTTL standard input signal are applied to the differential input.

- RS-422 Standard Input

In order to make sure the normal operation of input circuit, it is required to connect camera's ground signal with external ground signal if the differential input adopts RS-422 standard signal.

RS-422 standard defines the connection of the bus structure, and the inputs of several cameras can be connected to the RS-422. Up to 10 cameras can be connected at the same time, of which only one camera is the master dispenser and other cameras are receivers. The circuit length between the receiver and the bus should be as short as possible. The bus must have a 120 Ω terminal resistance.

When the camera is the last receiver on the bus structure, the camera's terminal resistance needs to be enabled, and the rest camera's terminal resistance need to be disabled. Multiple terminal resistance should not be enabled on the bus structure, which will reduce signal reliability and may cause damage to the RS-422 device.

- RS-644 Standard Input

If the differential input adopts RS-644 standard signal, the input terminal must enable 120 Ω terminal resistance.

- TTL&LVTTL Standard Input

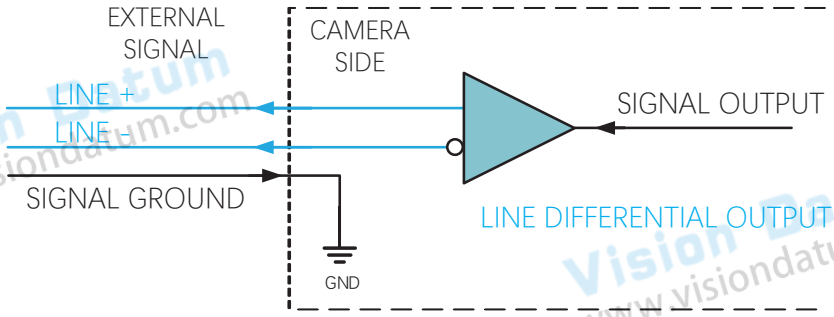
If the differential input adopts TTL&LVTTL standard signal, the input terminal's 120 Ω terminal resistance must be disabled, and its input electrical feature requirement is shown below.

Voltage	Description
0 V-1 V	Level low
1 V-3 V	Unstable voltage, and it is not recommended to use it.
3.3 V-24 V	Level high

I/O Electrical Feature

Differential Output Circuit

The differential input signal in I/O signals supports the single-ended input, and its internal circuit is shown below.



The RS-422 standard and RS-644 standard are applied to the differential output.

- RS-422 Standard Output

In order to make sure the normal operation of output circuit, it is required to connect camera's ground signal with external ground signal. The output interface can be connected to the RS-422 bus structure as a master dispenser.

- RS-644 Standard Output

The camera adopting RS-422 standard output signal cannot directly connect to RS-644 standard. When connecting RS-644 standard output, it is required to add a resistance network in camera's output location. In order to make sure the normal operation of output circuit, it is required to connect camera's ground signal with external ground signal.

I/O Wiring

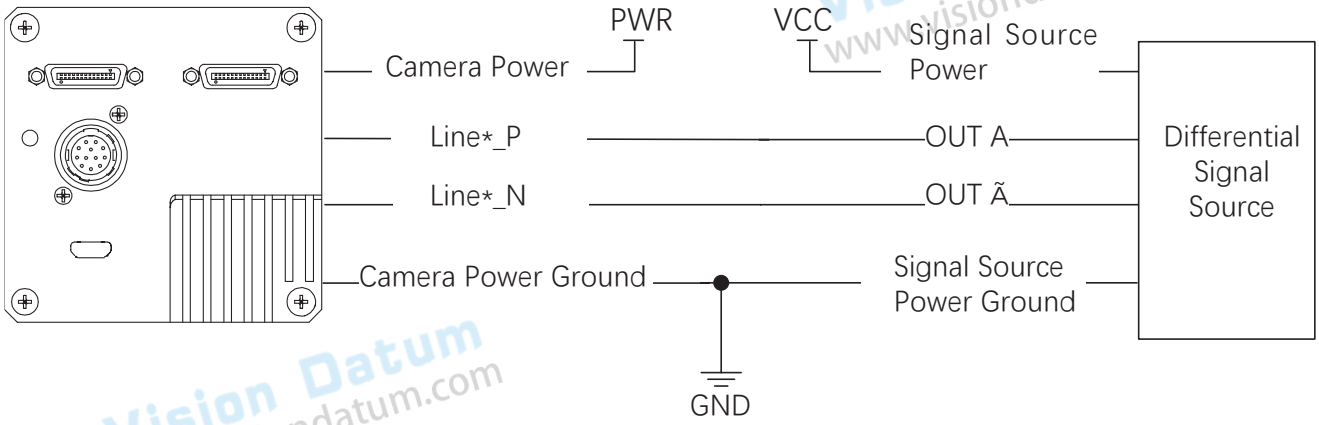
Input Wiring

The camera can receive inputted signals via the hardware trigger to acquire images. The inputted signals include differential signal and single-ended signal.

- Make sure that the hardware trigger signals have been configured as input signal.
- Refer to the actual camera you got for specific appearance.

Differential Input Singal

If the differential signal source provides the trigger signal, and the wiring is shown below.

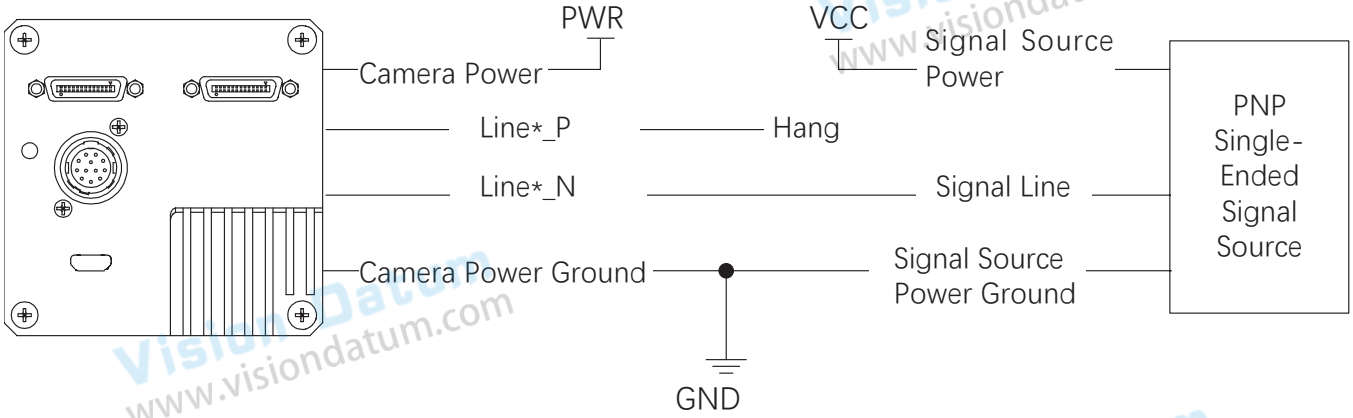


Single-Ended Input Signal

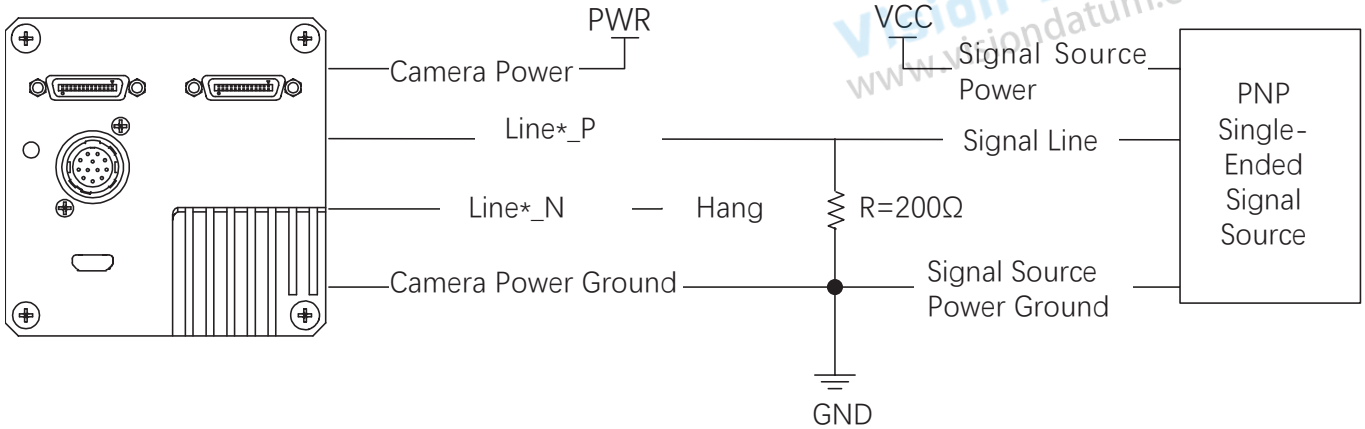
- PNP Single-Ended Signal Source

If the PNP single-ended signal source provides the signal source, there are two wiring methods as shown below.

PNP Single-Ended Input Wiring without Pull-Down Resistor:



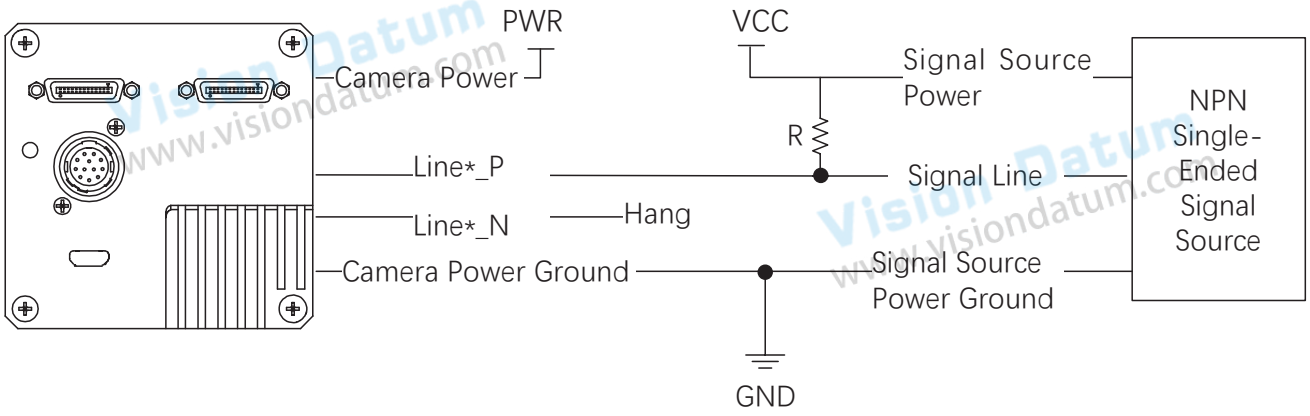
PNP Single-Ended Input Wiring with Pull-Down Resistor,the resistor range is between 1 KΩ and 4.7 KΩ :



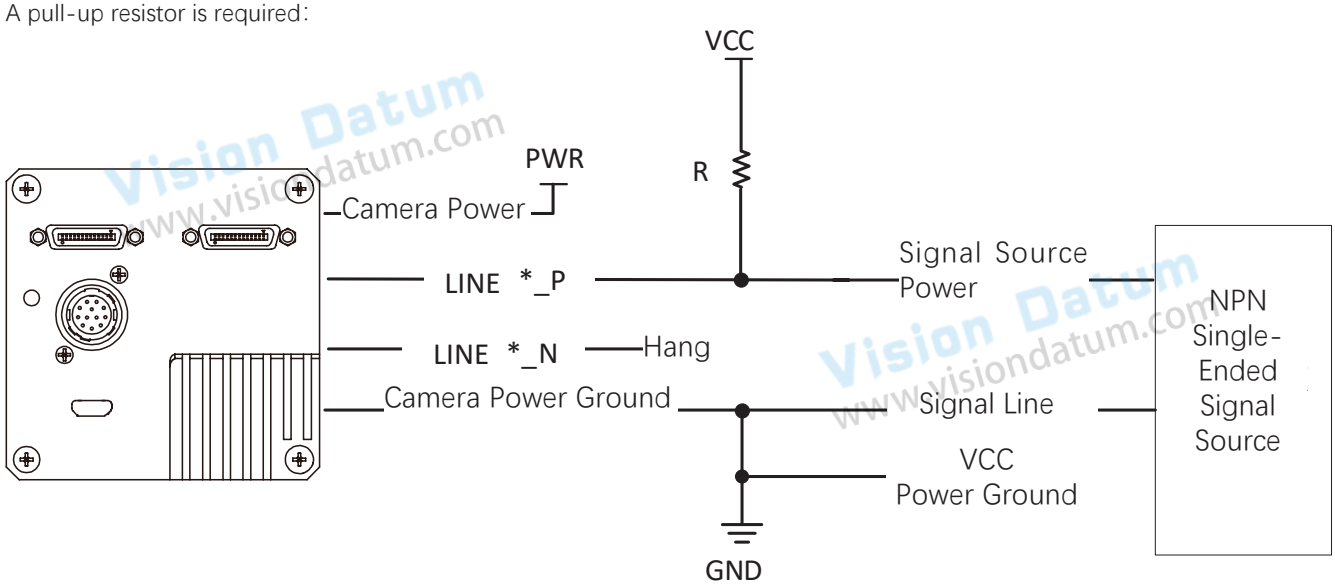
I/O Wiring

- NPN Single-Ended Signal Source

If the NPN single-ended signal source provides the signal source, and the wiring is shown below.



A pull-up resistor is required:



i	With different voltages of differential signal sources, the respective resistance values in wiring are also different, as shown below.R's power range: R ⩾ $^{1}/_{16}$W.

VCC	R	The power of resistor R
5 VDC	1 kΩ	⩾ 1/16W
12 VDC	4.7 kΩ	⩾ 1/16W
24 VDC	10 kΩ	⩾ 1/16W

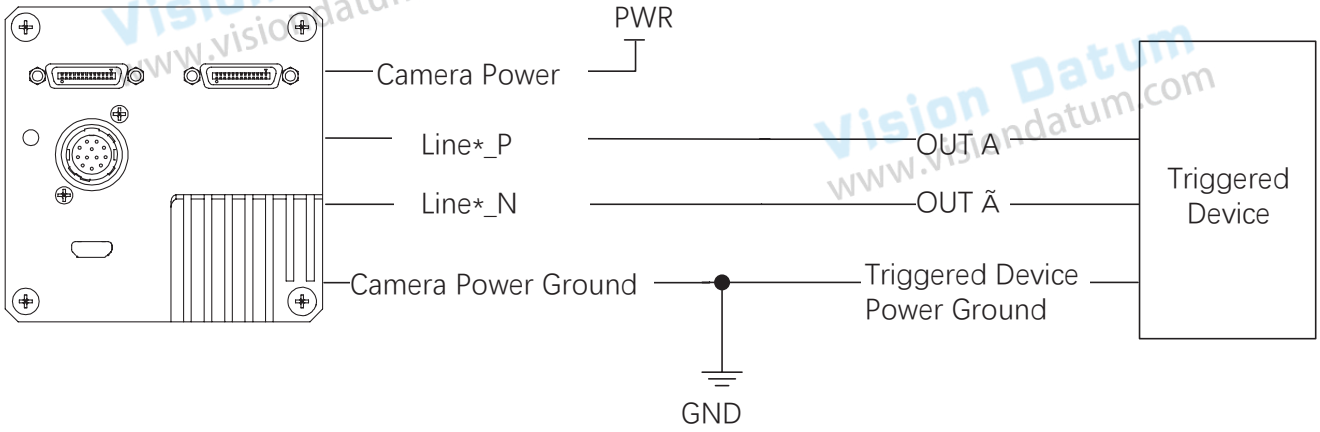
I/O Wiring

Output Wiring

The I/O signal of camera can be configured as output to trigger other devices. Here we take the 4K camera as an example for introducingthe output wiring.

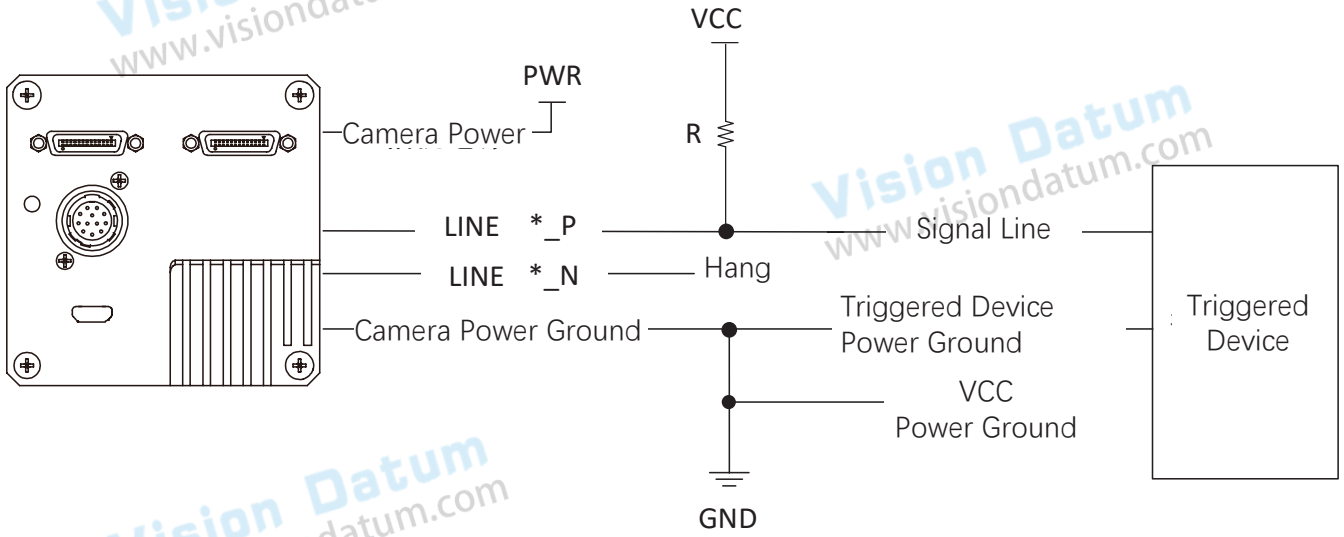
Differential Output Singal

If the camera's I/O signal is set as the differential output signal, and the wiring is shown below.



Single-Ended Output Signal

If the triggered device needs a LVTTL level trigger below 3.3 V, and a pull-up resistor ranging between 1 KΩ and 10 KΩ should be added. The wiring is shown below.



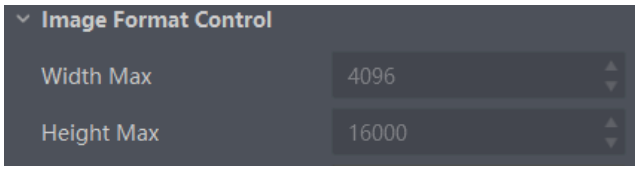
VCC	R	The power of resistor R
5 VDC	1 kΩ	⩾ 1/16W
12 VDC	4.7 kΩ	⩾ 1/16W
24 VDC	10 kΩ	⩾ 1/16W

- R's power range: R ⩾ $^{1}/_{16}$W.
- Generally, it is recommended that the VCC of pull-up resistor use the device's power supply or the triggered device power supply. If a third-party power supply is used, the power ground must be the same as the device's power ground and the triggered device power ground.

CHAPTER 7 IMAGE PARAMETER

Resolution and ROI

The camera displays the image with max. resolution by default. Click Image Format Control, and view Width Max and Height Max. Width Max stands for the max. pixels per inch in width direction and Height Max stands for the max. pixels per inch in height direction.

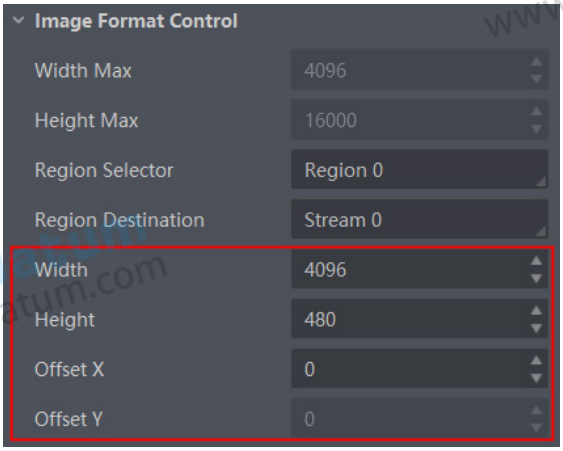


If you are only interested in a certain region of the image, you can set a Region of Interest (ROI) for the camera. Setting Region of Interest can reduce the bandwidth of the image being transmitted. Thus increasing the frame rate to some extent.

i	The camera currently supports 1 ROI only, that is, there is Region 0 for Region Selector parameter only.

Click Image Format Control > Region Selector, and enter Width, Height and Offset X.

- Width: it stands for horizontal resolution in ROI area.
- Height: it stands for vertical resolution in ROI area.
- Offset X: it refers to the horizontal coordinate of the upper left corner of the ROI.
- Offset Y: it refers to the vertical coordinate of the upper left corner of the ROI.



i	● The Width value plus Offset X value should not be larger than Width Max parameter value, Offset Y is 0 by default and it cannot be edited. ● The ROI function may differ by camera models.

Image Reverse

The camera supports horizontal reverse image output. You can click Image Format Control, and enable Reverse X according to actual demands.

i	The image reverse function may differ by camera models.

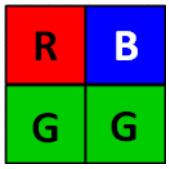
Pixel Format

The camera supports many pixel formats. For specific pixel formats that the camera supports, please refer to the specifications of the camera.

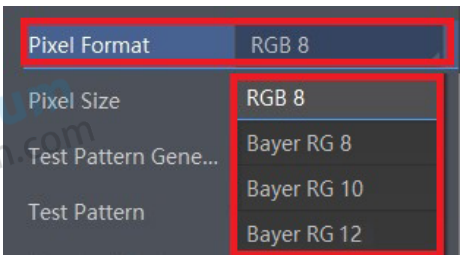
Pixel Format	Pixel Size（Bits/Pixel）
Mono 8, Bayer RGBG 8	8
Mono10	10
Mono12	12
RGB 8	24

The default output data format of color camera is RGB, and the default output data format of mono camera is Mono 8. For different pixel formats, they have varied pixel size.

RGB 8 are shown in the figure below.



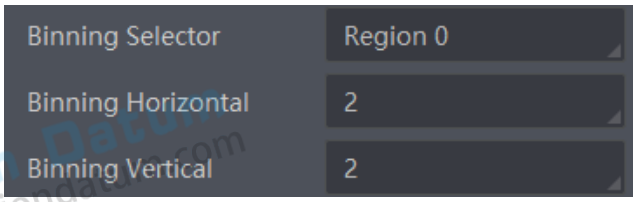
Click Image Format Control > Pixel Format, and set Pixel Format according to actual demands.



Binning

The purpose of setting binning is to enhance sensibility. With binning, multiple sensor pixels are combined as a single pixel to reduce resolution and improve image brightness.

Click Image Format Control, and set Binning Horizontal and Binning Vertical.

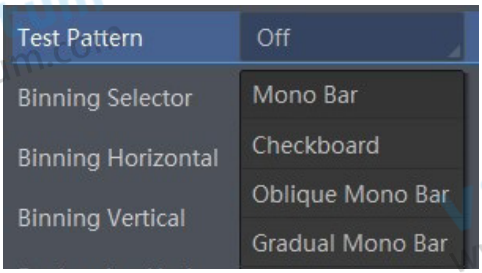


- The binning function may differ by camera models.
- Binning Horizontal refers to the image's width, and Binning Vertical refers to the image's height.
- If the camera's vertical resolution is 1, and there will be Binning Horizontal only.

Test Pattern

The camera supports test pattern function. When there is exception in real-time image, you can check whether image of test mode have similar problem to determine the reason. This function is disabled by default, and at this point, the outputted image by the camera is real-time image. If this function is enabled, the outputted image by the camera is test image.

Click Image Format Control > Test Pattern, and set Test Pattern according to actual demands

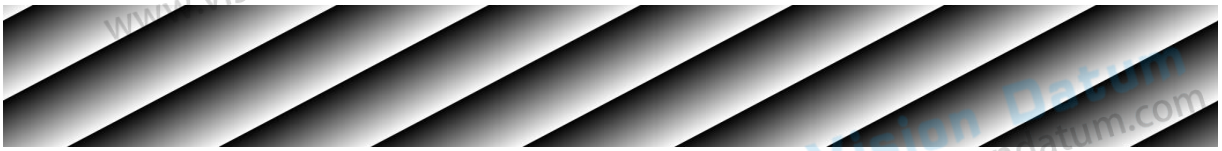


After setting the Test Pattern, the image displayed in the preview window of the frame grabber software is switched to the test image, and the specific test image is determined by the test pattern.

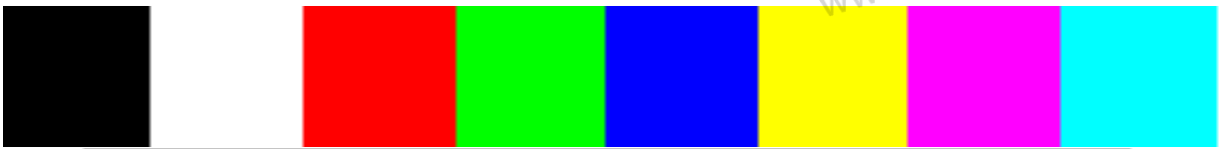
The camera offers 4 test patterns, including Mono Bar、Oblique Mono Bar、Vertical Color Bar、Test Image 1 .

- The mono device does not support Vertical Color Bar.
- The pattern of Mono Bar and Test Image 1 may differ by device models.

Mono Bar



Oblique Mono Bar



Vertical Color Bar

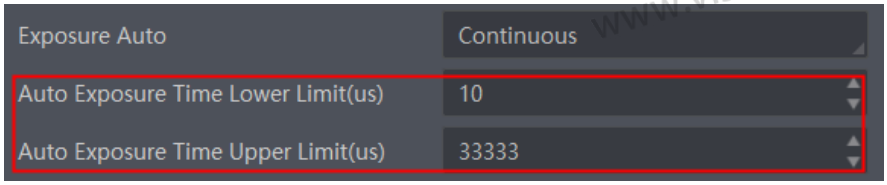
Test Image 1

Exposure Auto

The camera supports 3 types of exposure modes: Off, Once and Continuous. Click Acquisition Control > Exposure Auto, and select Exposure Auto according to actual demands. The exposure method and principle are shown below.

Exposure Method	Parameter	Principle
Off	Acquisition Control > Exposure Auto	The camera exposures according to the value configured by user in Exposure Time.
Once		Adjust the exposure time automatically according to the image brightness. After adjusting, it will switch to Off Mode.
Continuous		Adjust the exposure time continuously according to the image brightness.

When the Exposure Auto is set as Off, you can enter Exposure Time manually. When the Exposure Auto is set as Once or Continuous, the exposure time should be within the range of Auto Exposure Time Lower Limit and Auto Exposure Time Upper Limit.



- If the device is under Continuous exposure mode, once external trigger mode is enabled, the device will automatically switch to Off exposure mode.
- Some models of the device do not support Once or Continuous exposure mode. You can enter Exposure Time (μs) directly.

Gain

The camera has 2 types of gain, including the analog gain and digital gain. The analog gain is applied before the signal from the camera sensor is converted into digital values, while digital gain is applied after the conversion.

When increasing the analog gain, the image noise will increase too, which will influence image quality. If you want to increase image grayscale value, it is recommended to increase the camera's exposure time. If the exposure time reaches its upper limit, and at this point, you can increase analog gain.

Analog Gain

The gain function may differ by camera models.

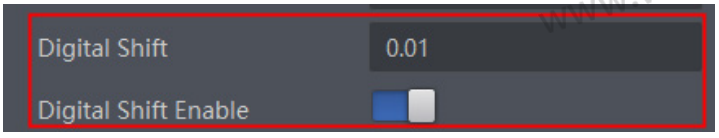
Click Analog Control > Preamp Gain, and enter Preamp Gain according to actual demands.

- The analog gain parameter name may differ by device of different models or firmware. The analog gain parameter name can be Preamp Gain or Gain which have different settings method.
- When the analog gain parameter is Preamp Gain, you can set it manually only.

Digital Gain

Apart from analog gain, the device supports digital gain function. When analog gain reaching its upper limit and the image is still too dark, it is recommended to improve image brightness via digital gain.

Click Analog Control,enable Digital Shift Enable, and enter Digital Shift.



When increasing the digital gain, the image noise will greatly increase too, which will severely influence image quality. It is recommended to use analog gain first, and then to adjust digital gain if the analog gain cannot meet demands.

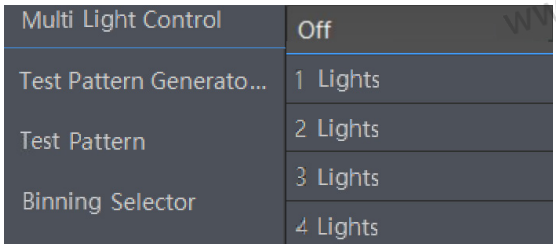
Multiple Lights Control

LEO 8KT4S-100CM supports function of multiple lights control that the device can control four lights installed at different angles to light up in accordance with configured strobe logic, and then get multiple images of the same target illuminated from different angles.

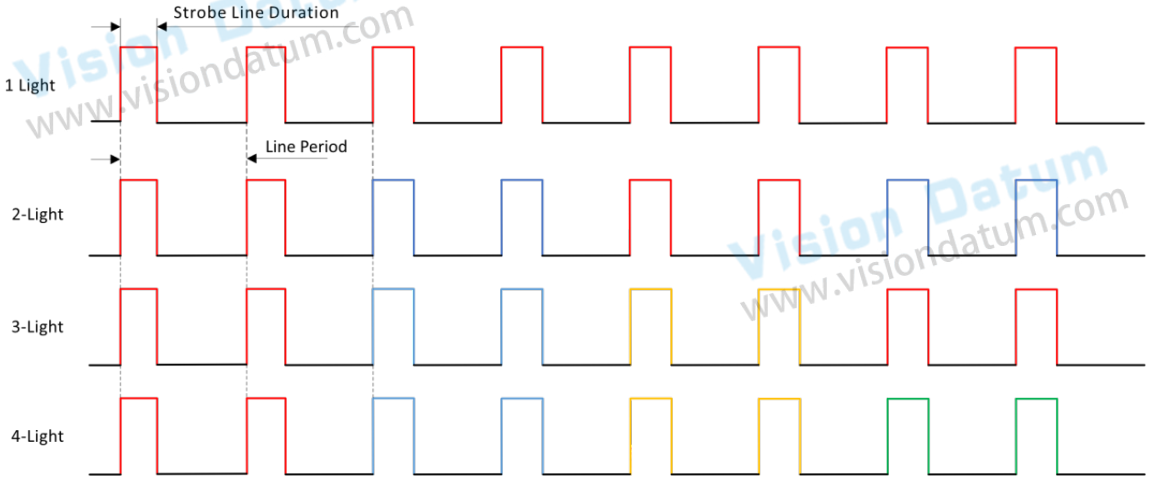
i	Settings for level inverter and strobe signal will be invalid when the function of multiple lights control is enabled.

Click Image Format Control → Multi Light Control, and select Multi Light Control according to actual demands.

- Off: The function of multiple lights control is disabled if Off is selected as Multi Light Control.
- 1 Light: Light 1 is turned on if 1 Light is selected as Multi Light Control.
- 2 Lights: Light 1 and light 2 are turned on if 2 Lights is selected as Multi Light Control.
- 3 Lights: Light 1, light 2 and light 3 are turned on if 3 Lights is selected as Multi Light Control.
- 4 Lights: Light 1, light 2, light 3 and light 4 are turned on if 4 Lights is selected as Multi Light Control.



The device uses four IOs (Line 0/1/3/4) to output trigger signals and light 1 to light 4 are turned on correspondingly. The outputted pulse diagram of four IOs is shown below.



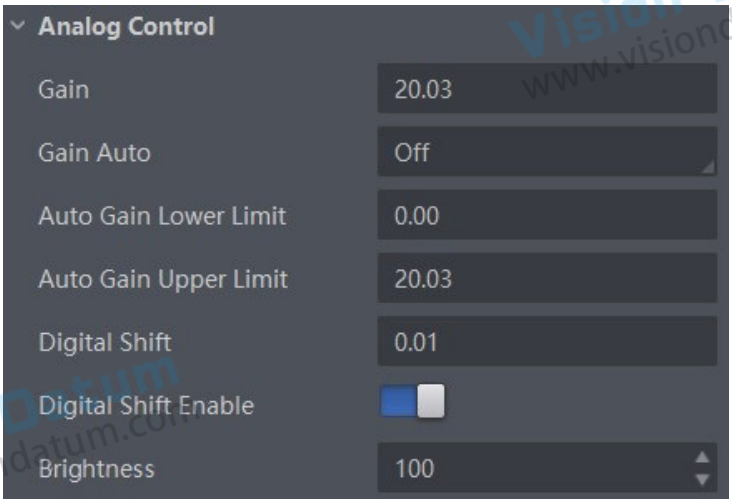
i	● Red, blue, yellow and green colors represent outputted pluses by Line 0, Line 1, Line 3, and Line 4 correspondingly. ● You can set Strobe Line Duration and Strobe Line Delay of Digital IO Control when function of multiple lights control is enabled. The unit of Strobe Line Duration and Strobe Line Delay is μs. ● The sum of Strobe Line Duration and Strobe Line Delay should be smaller than or equal to line period time due to the device's limitation. If the sum is larger than line period time, the device will use max. value instead. ● When the device enables 2 Lights, 3 Light or 4 Lights, if you set Strobe Line Duration and Strobe Line Delay for any I/O, other I/Os will have the same value.

Brightness

The device brightness refers to the brightness when the device adjusts image under Once or Continuous exposure mode, or Once or Continuous gain mode.

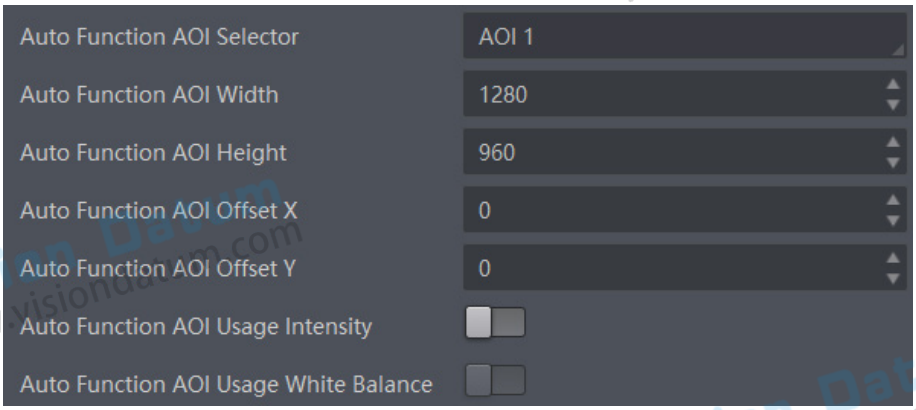
	● You should enable Once or Continuous exposure mode, or Once or Continuous gain mode first before setting brightness. ● After setting brightness, the device will automatically adjust exposure time to let image brightness reach target one. Under Once or Continuous exposure mode, or Once or Continuous gain, the higher the brightness value, the brighter the image will be. ● The range of brightness is between 0 and 255.

Click Analog Control > Brightness, and set Brightness according to actual demand, and its range is from 0 to 255.



AOI

The camera supports AOI function that can adjust the brightness and white balance of the entire image based on the area you selected.



	● The AOI function may differ by device models. ● AOI 1 is used when the device is in once or continuous exposure mode, and AOI 2 is used when the device is in once or continuous white balance mode.

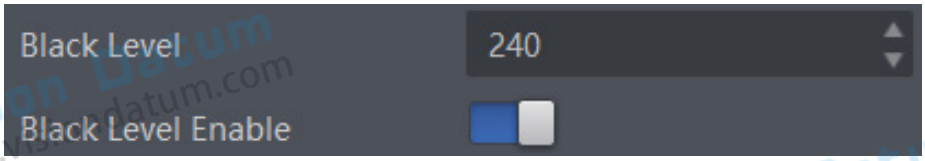
Steps:

1. Click Analog Control > Auto Function AOI Selector, and select AOI 1 or AOI 2 Auto Function AOI Selector.
2. Enter Auto Function AOI Width, Auto Function AOI Height, Auto Function AOI Offset X, and Auto Function AOI Offset Y according to actual demands.
3. Enable Auto Function AOI Usage Intensity if AOI 1 is selected as Auto Function AOI Selector. Or enable Auto Function AOI Usage White Balance if AOI 2 is selected as Auto Function AOI Selector.

Black Level

The camera supports black level function that allows you to change the overall brightness of an image by changing the gray values of the pixels by a specified amount.

Click Analog Control > Black Level Enable, enable Black Level Enable, and enter Black Level according to actual demands.



i	The black level function may differ by camera models.

White Balance

White balance is only available for color cameras.

The white balance refers to the camera color adjustment depending on different light sources. Adjust the Gain Value of the image's R channel and B channel to keep white regions white under different color temperatures. Ideally, the proportion of R channel, G channel and B channel in the white region is 1:1:1.

Click Analog Control > Balance White Auto, and select Balance White Auto according to actual demands.

The camera supports 3 types of white balance modes: Off, Once and Continuous.

White Balance Mode	Parameter	Principle
Off	Analog Control > Balance White Auto	You need to set the R, G, B value manually, between 1 and 4095. 1024 means ratio is 1.0
Once		Automatic white balance once. Adjust the white balance for a certain amount of time then stop. It implements an algorithm that finds possible gray areas in the Bayer data.
Continuous		Continuous automatic white balance. It implements an algorithm that finds possible gray areas in the Bayer data.

It is recommended to correct white balance when there is great difference between the camera's color effect and actual effect. You can correct white balance as shown below.

Steps:

1. Put a white paper in the range of the camera's field of view, and make sure the paper covers the entire field of view.
2. Set exposure and gain. It is recommended to set image brightness value between 120 and 160.
3. Select Once as Balance White Auto, and the camera will automatically adjust white balance for once.

Balance White Auto parameter defaults to Continuous, and AWB Color Temperature Mode is Narrow. If the color effect of the image is still not good after performing automatic white balance in this color temperature mode, you can set the AWB Color Temperature Mode parameter to Wide and then perform automatic white balance correction.

If there is still great difference between correction effect and actual color, it is recommended to correct white balance according to following steps.

Steps:

1. Select Off as Balance White Auto. At this time, Balance Ratio is 1024.
2. Find corresponding R/G/B channel in Balance Ratio Selector. Here we take Green as an example.
3. Find camera's R/G/B value.
4. Take Green as correction standard, and manually adjust other two channels (R channel and B channel) to let these three channels have same value.

i	● Here we take Green as an example. For specific Balance Ratio Selector value, please refer to the actual condition. ● In order to avoid repeated correction after rebooting the camera, it is recommended to save white balance parameter to User Set after white balance correction. You can refer to the Section Save and Load User Set for details. ● If the light source and color temperature in environment change, you need to correct white balance again.

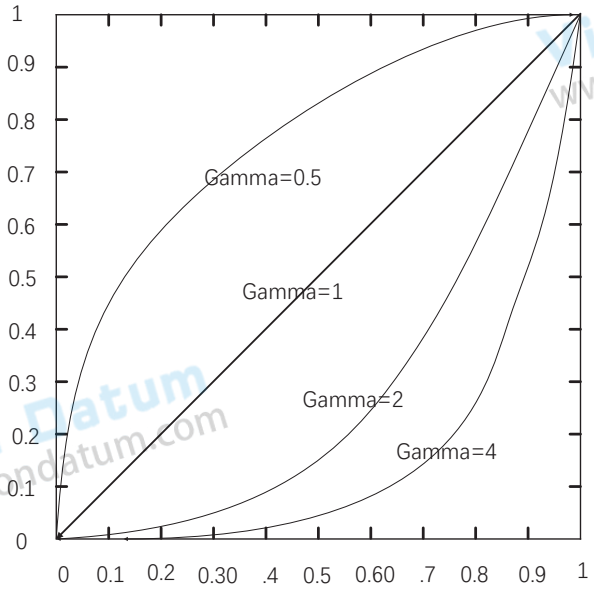
Gamma Correction

The camera supports Gamma correction function. Generally, the output of the camera's sensor is linear with the photons that are illuminated on the photosensitive surface of the sensor. Gamma correction provides a non-linear mapping mechanism as shown below.

- Gamma value between 0.5 and 1: image brightness increases, dark area becomes brighter.
- Gamma value between 1 and 4: image brightness decreases, dark area becomes darker.

i	Gamma correction is not supported under Bayer format for color cameras.

Gamma Curve

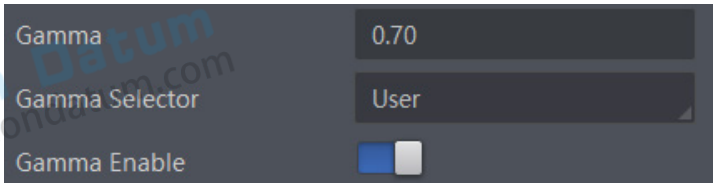


There are 2 types of Gamma correction, including User mode and sRGB mode.

User is a user-defined mode, which can set the value of Gamma; sRGB is a standard protocol mode.

■ You can set User mode as shown below.

1. Click Analog Control > Gamma Selector.
2. Select User as Gamma Selector.
3. Enable Gamma Enable.
4. Enter Gamma according to actual demands, and its range is from 0 to 4.



■ You can set sRGB mode as shown below.

1. Click Analog Control > Gamma Selector.
2. Select sRGB as Gamma Selector.
3. Enable Gamma Enable.

Color Transformation Control

After the image has been processed for white balance, the overall image will appear dim, and multiple colors may deviate from their standard values to varying degrees. At this time, it is necessary to multiply the color of the image by the correction matrix to correct each color to its standard value, so that the overall color of the image is more vivid.

The color transformation control is used to restore color and eliminate the overlap in the color channels.

Two methods are available to set color transformation control.

- Click Color Transformation Control, enable CCM Enable, and set Color Transformation Value according to actual demand.
- Click Color Transformation Control, enable CCM Enable, enable Color Transformation Enable.and set Hue and Saturation to adjust Color Transformation Value according to actual demand.

i	● The function of color transformation control is only available for color devices. ● Currently, RGB to RGB is available for Color Transformation Selector only.

Hue

The hue is the reference hue when the color correction function is enabled in the non-mono format of the color camera, and the overall tendency of the colors in the image can be adjusted.

The hue is set by the Hue parameter under the Color Transformation Control property, and the range is 0 ~ 255.

After setting Hue, the camera will perform color correction according to the Hue value to make the image tone reach the target value. For example, when Hue is set to 128, the red in the image appears as real red; when Hue is 0, the hue is reversed 128 degrees counterclockwise, and red becomes blue; when Hue is 255, the hue rotates clockwise At 128 degrees, red becomes green.

Adjusting the hue shifts the colors of the image.

Steps:

1. Click Color Transformation Control, and enable CCM Enable.
2. Enable Color Transformation Enable.
3. Enable Hue Enable, and enter Hue according to actual demands.

i	● Hue is only available for color cameras. ● Hue setting method may differ by camera models. For some models, go to Analog Control, enable Hue Enable, and enter Hue according to actual demands.

Saturation

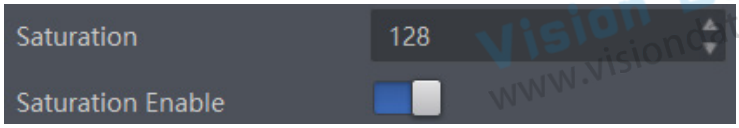
The saturation is the reference saturation when the color correction function is enabled in the non-mono format of the color camera. The brightness of the colors in the image can be adjusted to make the image look fuller, more colorful, and closer to the real thing.

The smaller the set value, the darker the image will look; the larger the set value, the fuller and brighter the image will look.

Adjusting the saturation changes the colorfulness of the colors. A higher saturation, for example, makes colors easier to distinguish.

Steps:

1. Click Color Transformation Control, and enable CCM Enable.
2. Enable Color Transformation Enable.
3. Enable Saturation Enable, and enter Saturation according to actual demands.



i	● Saturation is only available for color cameras. ● Saturation setting method may differ by camera models. For some models, go to Analog Control, enable Saturation Enable, and enter Saturation according to actual demands.

Super Palette Control

The super palette control function allows you to select different color areas in the image to set customized hue and saturation values.

Steps:

1. Find Super Palette in the feature tree, and enable Super Palette Enable.
2. Select Super Palette Selector, and set corresponding Super Palette Hue and Super Palette Saturation according to actual demands.

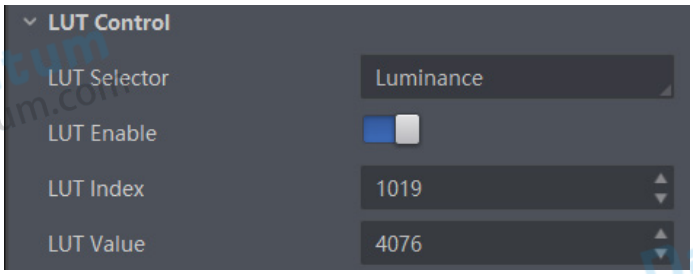
- This function may differ by camera models.
- Only in RGB, BGR and YUV pixel formats, the color device supports this function.

LUT

A Look-Up Table (LUT) is a customizable grayscale-mapping table. You can stretch, amplify the grayscale range that interests you. The mapping can be linear or customized curve.

Steps:

1. Click LUT Control, and enable LUT Enable.
2. Enter LUT Index according to actual demands, and its range is from 0 to 1023.
3. Enter LUT Value according to actual demands, and its range is from 0 to 4095.
4. Click Execute in LUT Save to save it.



- You cannot use Gamma correction function and LUT function at the same time.
- The parameter of LUT Save may differ by device models. If the device has no LUT Save, the settings you configured will be saved in the device in real time.
- For different models of device, the LUT Index and LUT Value range may differ, please refer to the actual one you got.
- After using the TDI function, you need to set LUT again.

Flat Field Correction

The flat field correction (FFC) includes PRNUC correction and FPNC correction, and they are used to improve the image uniformity that may be impacted by the sensor, light sources, external conditions, etc.

i	The flat field correction function and specific setting method may differ by camera models.

■ FPNC

i	The device has completed FPNC correction by default and you do not need to set it again if the device has no FPNC correction function.

Step:

1.Click Shading Correction, and select FPNC Correction as Shading Selector.
2.Select one User FPNC from FPNC User Selector.

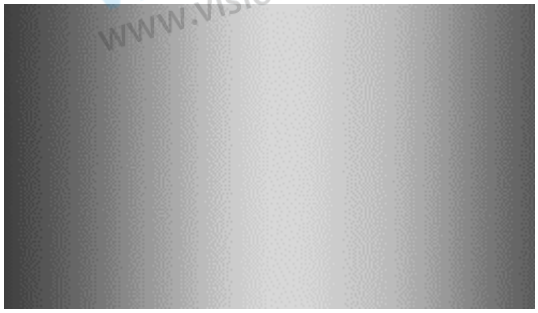
i	Up to three groups of User FPNC can be selected.

3.Click Execute in Activate Shading.
4.Enable FPNC User Enable.

■ PRNUC

i	The PRNUC correction function and specific setting method may differ by device models.

The device supports PRNUC (Photo-response Non-Uniformity Correction) function that eliminates vertical line on the images. Two correction methods are available, including global correction and ROI correction. The effect of PRNUC correction is shown blow.



Before PRNUC Correction

After PRNUC Correction

Global PRNUC Correction

Steps:

1. Click Shading Correction, select PRNUC User Selector, and the device starts to acquire images.
2. Set PRNUC target related parameters according to actual demands.
   - Disable PRNUC Target Enable if you want to use the camera's auto correction standard. At this time, the camera compares and corrects the average R/G/B component value of each column with the average R/G/B component value of the entire image.
   - Enable PRNUC Target Enable if you want to manually correct. For mono cameras, set PRNUC Target, and for color cameras, set PRNUC Target R, PRNUC Target G, and PRNUC Target B according to actual demands. At this time, the camera compares and corrects the average gray value or R/G/B component value of each column with the configured gray value or R/G/B value.
3. Click Execute in Activate Shading, and enable PRNUC User Enable.
4. (Optional) Enable PRNUC Smooth Enable to reduce the dust impact during calibration process.

ROI PRNUC Correction

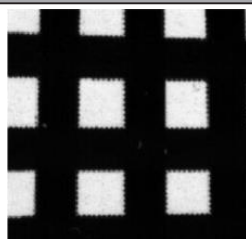
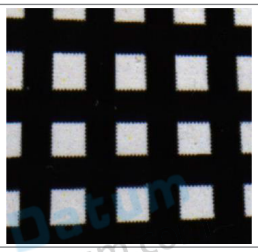
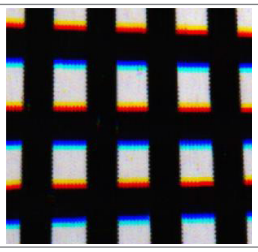
If you want to execute PRNUC correction for specific areas, set PRNUC Width and PRNUC Offset X according to actual demands, and enable PRNUC ROI Enable.

Space Correction

The space correction (SC) includes line rate deviation correction and parallax deviation correction, and they are used to reduce image details deviation caused by line rate deviation or pixel deviation.

Set Line Rate Ratio

You can go to Shading Correction, and set Line Rate Ratio according to actual demands. Line rate ratio is used to adjust the ratio between the device's line rate and that of the actual object to adjust the pixel deviation between upper line and lower line in images. Refer to the table below for effect contrast.

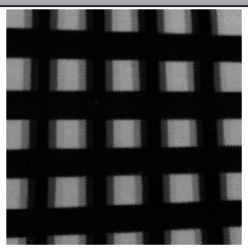
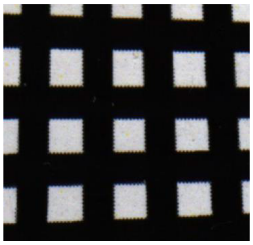
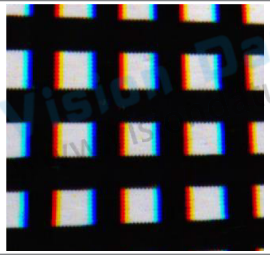
Device Type	Normal Image	Abnormal Image
Mono Device		
Color Device		

- It is recommended to set line rate ratio larger than 1 when the camera's line rate is larger than that of the object.
- It is recommended to set line rate ratio smaller than 1 when the camera's line rate is smaller than that of the object.
- It is recommended to set line rate ratio as 1 when the camera's line rate is equal to that of the object.

Set Pixel Shift and Parallax Direction

When pixel deviation occurs, images of mono devices are vague and images of color devices are dispersive. If you find the image's edge has pixel deviation via observation, follow steps below to alleviate it. Refer to the table below for effect contrast.

i	If the overall image has the phenomenon below, it may be caused by lens optical structure deviation.

Device Type	Normal Image	Abnormal Image
Mono Device		
Color Device		

Steps

1.Set Off as Parallax Direction if the image's edge does not have pixel deviation.

2.Set Parallax Direction according to actual conditions if the image's edge has pixel deviation.

- **For the mono device, if its upper sensor is closer to the measured objects, and select Start Line as Parallax Direction. Otherwise, select End Line instead.**
- **For the color device, if its sensor's B line is closer to the measured objects, and select Blue as Parallax Direction. If its sensor's R line is closer to the measured objects, and select Red instead.**

3. Set Pixel Shift to have a best effect.

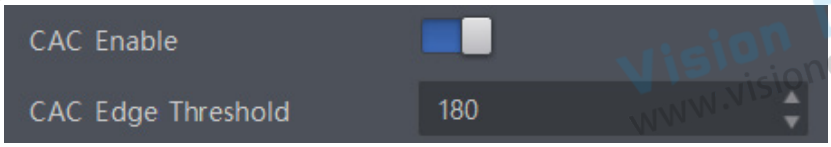
Color Abnormal Correction

The color abnormal correction (CAC) is used to eliminate abnormal color on image edges.

Steps:

1. Click Shading Correction, and find CAC Edge Threshold.
2. Enter CAC Edge Threshold according to actual demands. The range of CAC Edge Threshold is between 0 and 2040.
3. Enable CAC Enable.

i	● This function may differ by camera models. ● The CAC will be performed only when the edge strength is higher than the configured threshold.



CHAPTER 8 OTHER FUNCTIONS

Device Control

In the Device Control attribute, you can view device information, edit device name, reset device, etc. The specific parameters in Device Control attribute are shown below.

Parameter	Read/Write	Description
Device Scan Type	Read only	It is the scan type of the sensor.
Device Vendor Name	Read only	It is the name of device manufacturer.
Device Model Name	Read only	It is the device model.
Device Manufacturer Info	Read only	It is the manufacturer information.
Device Version	Read only	It is the device version.
Device Firmware Version	Read only	It is the device firmware version.
Device Serial Number	Read only	It is the device serial number.
Device User ID	Read and write	Device name and it is empty by default. You can set according to your preference. ● If User ID is empty, the client software displays the device model. ● If you set it, the client software displays the User ID you set.
Maximum Device Response Time	Read only	It is the device's max. response time.
Device Manifest Table Address	Read only	The endianness of image data.
Device SBRM Address	Read only	It is address of the technology specific bootstrap register map.
Device Uptime(s)	Read only	It is the period of time when device is powered up.
Board Device Type	Read only	It is the device type.
Device Command Timeout	Read only	It counts the timeout of command.
Device Reset	Write only	Click Execute to reset the device.
Device Temperature Selector	Read and write	It selects sensor or motherboard to view their temperature.
Device Temperature	Read only	It is the temperature of selected one in Device Temperature Selector.
Device Clock Selector	Read and write	It selects the clock frequency to access from the device.
Device Clock Frequency	Read and write	It sets the frequency of the selected clock.
Device PJ Number	Read only	It is the device's project number.

The specific device control parameters may differ by camera models.

Reverse Scan Function

i	● The reverse scan function may differ by camera models. ● Make sure that the scan direction and the moving direction of objects are matched. Otherwise, acquired images may be abnormal. ● The reverse scan function is related with TDI mode and pixel format. Under certain TDI mode and pixel format, this function may not be available.

The scan direction function is used to change the scan direction of the sensor used on measured objects. The figures below are the actual effects.

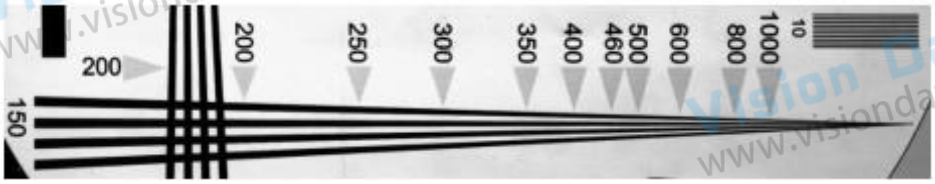


Image when Direction Matched of Mono Device

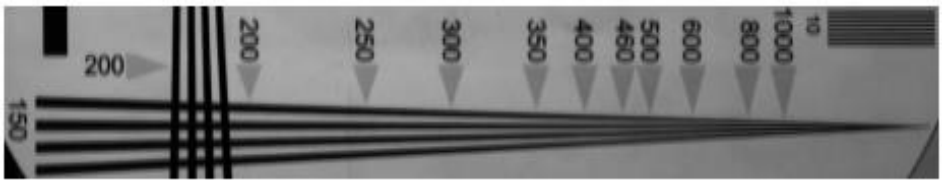


Image when Direction Mismatched of Mono Device

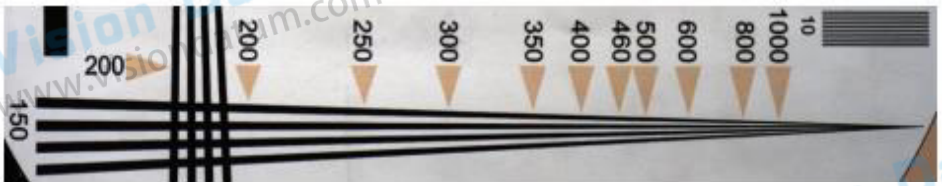


Image when Direction Matched of Color Device

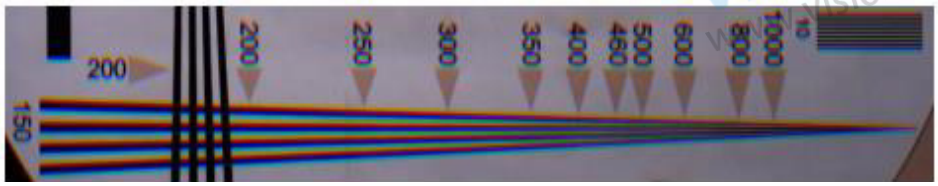


Image when Direction Mismatched of Color Device

The specific method of setting scan direction may differ by device models.

● Regarding type II device, go to Image Format Control → Reverse Scan Direction to enable Reverse Scan Direction to let the device to execute TDI function for backward moving object.

● Regarding LEO 4KT2-100cm, after selecting 2-TDI as TDI Mode, follow steps below to set scan direction.

Steps

1.Go to Image Format Control → Direction Source.

2.Set Direction Source according to actual demand: Select Internal as Direction Source and enable Reverse Scan Direction if you want to use the internal signal to achieve reverse scan function.

3. (Optional) Select CC 3 as Direction Source if you want to use CC 3 as trigger signal to achieve reverse scan function.

● Regarding LEO 4K-100cc device, apart from selecting Bayer RGBG 8 as Pixel Format, you can refer to steps of LEO 4KT2-100cm device above to set scan direction for other pixel formats.

● Regarding LEO 8KT4S-100CM device, when selecting 2-TDI or 4-TDI as TDI Mode or 2 Lights, 3 Lights or 4 Lights as Multi Light Control, you can set scan direction. Refer to steps of LEO 4KT2-100cm device above for details.

TDI Function

TDI refers to Time Delay Integration, and it is a method of line scanning which provides dramatically increased responsivity compared to other video scanning methods. It permits much greater scanning speeds in low light, or allows reduced lighting levels (and costs) at conventional speeds.

In general, there are 3 TDI modes, including 1 line, 2-TDI and 4-TDI.

- 1 line refers to single line mode, and the camera selects 1 line data as output result.
- 2-TDI means that the camera overlaps 2 adjacent line data, and outputs 1 line data as final result.
- 4-TDI means that the camera overlaps 4-line data, and outputs 1 line data as final result.

Go to Image Format Control > TDI Mode, and set TDI Mode according to actual demands.

i	● The TDI function may differ by camera models. ● When switching TDI Mode, the camera may have short period (3 s to 5 s) of image exception, which is a normal phenomenon.

File Access Control

The file access function allows you to export or import the camera's parameters, LUT and user PRNUC, and user FPNC in the mfa format. Currently, the camera supports User Set 1/2/3, LUT Luminance 1/2/3, User PRNUC 1/2/3, and User FPNC.

i	● The file access control function may differ by camera models. ● Make sure that you have stopped acquisition before using this function. ● Make sure that the firmware is same when exporting or importing files between two cameras.

Steps:

1. Select the camera in the device list.Click  to open the File Access interface.

2. Select Device Feature according to actual demands.
3. Click Import or Export to import or export files.

i	The camera has different process approaches when you select different device features. ● If User Set 1/2/3 is selected as device feature, you need to load the corresponding user set you selected to take effect. ● If LUT Luminance 1/2/3 is selected as device feature, and they will take effect only when you select the same parameters in LUT Selector. ● USER PRNUC 1/2/3 has the same mechanism with LUT Luminance 1/2/3 mentioned above. ● If USER FPNC is selected as device feature, and they will take effect immediately when FPNC User Enable is enabled. ● Importing and exporting the device feature among the same model of devices are supported.

Transport Layer Control

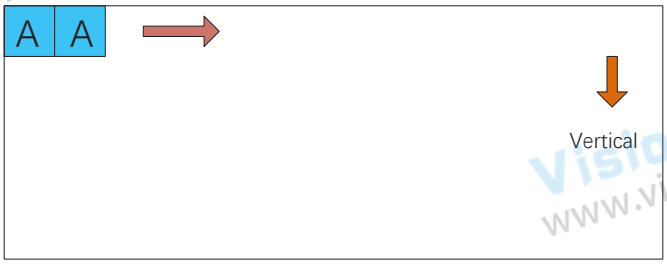
You can go to Transport Layer Control to view the device's payload size, tap geometry, CI configuration, etc.

Parameter	Read/Write	Description
Paylode Size	Read only	It is the camera's load size.
Device Tap Geometry	Read and write	The value of device sensor geometry in the frame grabber software should be the same with that of Device Tap Geometry. Inconsistent parameters may lead to image exception.
CI Configuration	Read only	It is the configuration mode. It switches automatically in accordance with different tap configuration mode.
GenCP Version Major	Read only	It is the major version in GenCP version.
GenCP Version Minor	Read only	It is the minor version in GenCP version.
Supported Baudrates	Read only	It displays the supported baud rates.

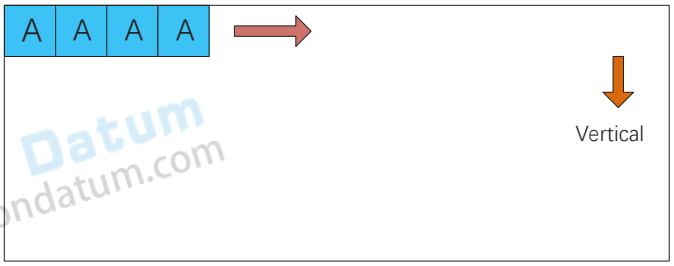
For specific Device Tap Geometry that the camera supports, refer to the actual one you got. Here we take Geometry_1X,Geometry_1X2 and Geometry_1X4 as an example.

_ When Device Tap Geometry is Geometry_1X, the output order of tap is shown below.

_ When Device Tap Geometry is Geometry_1X2 the output order of tap is shown below.



_ When Device Tap Geometry is Geometry_1X4, the output order of tap is shown below.



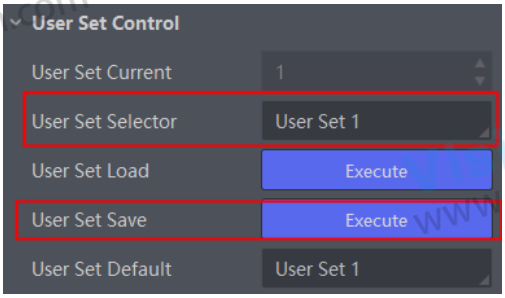
Save and Load User Set

The camera supports 4 sets of parameters, including 1 default set and 3 user sets.

You can save parameters, load parameters and set user default as shown below.

_Save Parameters:

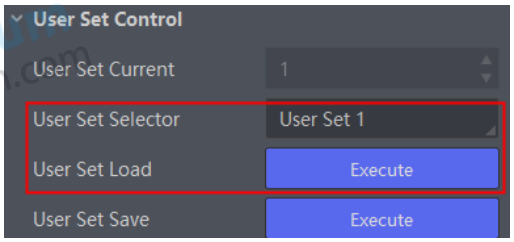
1. Click User Set Control, and select a user set in User Set Selector. Here we take selecting User Set 1 as an example.
2. Click Execute in User Set Save to save parameters.



_Load Parameters:

1. Click User Set Control, and select a user set in User Set Selector. Here we take selecting User Set 1 as an example.
2. Click Execute in User Set Load to load parameters to the camera, as shown below.

i	Loading parameters is available when connecting with camera, but without acquisition.



_Set User Default:

You can also set default parameter by selecting parameter from drop-down list of User Set Default.

Camera Parameter Index

Attribute	Parameter	Section
Device Control	Device Scan Type	Device Control
	Device Vendor Name	
	Device Model Name	
	Device Manufacturer Info	
	Device Family Name	
	Device Version	
	Device Firmware Version	
	Device Serial Number	
	Device User ID	
	Maximum Device Response Time	
	Device Manifest Table Address	
	Device SBRM Address	
	Device Uptime(s)	
	Board Device Type	
	Device Command Timeout	
	Device Reset	
	Device Temperature Selector	
	Device Temperature	
	Device Clock Selector	
	Device Clock Frequency	
	Device PJ Number	
Image Format Control	Width Max	Resolution and ROI
	Height Max	
	Region Selector	
	Width	
	Height	
	Offset X	
	Offset Y	
	Reverse X	Image Reverse
	Direction Source	Scan Direction
	Reverse Scan Direction	
	Pixel Format	Pixel Format
	Pixel Size	
	Multi Light Control	Multiple Lights Control
	Test Pattern Generator Selector	Test Pattern
	Test Pattern	
	Binning Selector	Binning
	Binning Horizontal	
	Binning Vertical	
	TDI Mode	TDI Function
	TDI Direction	

Camera Parameter Index

Attribute	Parameter	Section
Acquisition Control	Acquisition Burst Frame Count	Line Rate
	Acquisition Line Rate (Hz)	
	Acqusition Frame Rate Control Enable	
	Resulting Line Rate (Hz)	
	Resulting Frame Rate (Fps)	
	Scan Mode	Scan Mode
	Trigger Selector	Trigger Source
	Trigger Mode	
	Trigger Software	
	Trigger Source	
	Trigger Activation	
	Line Delay Enable	
	Trigger Delay（μs）	
	Trigger Cache Enable	Trigger Related Parameters
	Line Trigger Cache Enable	
	Exposure Mode	Exposure Auto
	Exposure Time（μs）	
	Exposure Auto	
	Auto Exposure Time Lower Limit （μs）	
	Auto Exposure Time Upper Limit （μs）	
	Frame Timeout Enable	Frame Timeout
	Frame Timeout Time（μs）	
	Partial Image Output Mode	
	Abnormal Line Enable	Line Discard Function
Analog Control	Preamp Gain	Analog Gain
	Gain(dB)	
	Digital Shift	Digital Gain
	Digital Shift Enable	
	Brightness	Brightness
	Black Level	Black Level
	Black Level Enable	
	Balance White Auto	White Balance
	AWB Color Temperature Mode	
	Balance Ratio Selector	
	Balance Ratio	
	Gamma	Gamma
	Gamma Selector	
	Gamma Enable	

Camera Parameter Index

Attribute	Parameter	Section
Analog Control	Auto Function AOI Selector	AOI
	Auto Function AOI Width	
	Auto Function AOI Height	
	Auto Function AOI Offset X	
	Auto Function AOI Offset Y	
	Auto Function AOI Usage Intensity	
	Auto Function AOI Usage White Balance	
Color Transformation Control	CCM Enable	Color Transformation Control
	Color Transformation Selector	
	Color Transformation Enable	
	Color Transformation Value Selector	
	Color Transformation Value	
	Hue	Hue
	Hue Enable	
	Saturation	Saturation
	Saturation Enable	
Super Palette	Super Palette Enable	Super Palette Control
	Super Palette Selector	
	Super Palette Hue	
	Super Palette Saturation	
LUT Control	LUT Selector	LUT
	LUT Enable	
	LUT Index	
	LUT Value	
	LUT Save	
Encoder Control	Encoder Selector	Shaft Encoder Control
	Encoder Source A	
	Encoder Source B	
	Encoder Trigger Mode	
	Encoder Counter Mode	
	Encoder Counter	
	Encoder Counter Max	
	Encoder Counter Reset	
	Encoder Max Reverse Counter	
	Encoder Reverse Counter Reset	
Frequency Converter Control	Input Source	Frequency Converter Control
	Signal Alignment	
	Trigger Line Rate(Hz)	
	PreDivider	

Camera Parameter Index

Attribute	Parameter	Section
Frequency Converter Control	Multiplier	Frequency Converter Control
	PostDivider	
	Resulting Trigger Line Rate(Hz)	
Shading Correction	Shading Selector	Shading Correction
	Activate Shading	
	PRNUC ROI Enable	
	PRNUC Width	
	PRNUC Offset X	
	FPNC User Enable	
	FPNC User Selector	
	PRNUC User Enable	
	PRNUC User Selector	
	PRNUC Target Enable	
	PRNUC Target	
	PRNUC Target R	
	PRNUC Target G	
	PRNUC Target B	
	PRNUC Smooth Enable	
	Line Rate Ratio	
	Pixel Shift	
	Parallax Direction	
	CAC Enable	
	CAC Edge Control	
Digital IO Control	Line Selector	Trigger Output
	Line Mode	
	Line Format	
	Line Inverter	
	Line Status	
	Line Status All	
	Line Source	
	Strobe Enable	
	Strobe Source Selector	
	Strobe Line Duration（μs）	
	Strobe Line Delay（μs）	
	Strobe Line Pre Delay（μs）	
	Line Debouncer Time（μs）	

Camera Parameter Index

Attribute	Parameter	Section
Counter And Timer Control	Counter Selector	Enable Strobe Signal
	Counter Event Source	
	Counter Event Activation	
	Counter Reset Source	
	Counter Reset	
	Counter Value	
	Counter Current Value	
File Access Control	File Selector	File Access Control
	File Operation Selector	
	File Operation Excute	
	File Open Mode	
	File Operation Status	
	File Operation Result	
	File Size(B)	
Transport Layer Control	Payload Size(B)	Transport Layer Control
	Device Tap Geometry	
	CI Configuration	
	GenCP Version Major	
	GenCP Version Minor	
	Supported Baudrates	
User Set Control	User Set Current	Save and Load User Set
	User Set Selector	
	User Set Load	
	User Set Save	
	User Set Default	

Command List

Parameter	Read/ Write	Command	Value	Description
DeviceModelName	R	r DeviceModelName		
DeviceReset	R	r DeviceFirmwareVersion		
DeviceClockSelector	R	r DeviceSerialNumber		
DeviceUserID	W	w DeviceUserID	x: Value	Read customized name. E.g.,w DeviceUserID abc
DeviceReset	W	w DeviceReset x	x: 1 -- Reboot	Reboot device. E.g.,w DeviceReset 1
DeviceClockSelector	R	r DeviceClockSelector	0—CameraLink	Select the clock frequency to access from the device.
DeviceClockFrequency	W	w DeviceClockFrequency x	x: 0 -- 85M 1 -- 70M 2 -- 60M 3 -- 40M 4 -- 66M 5 -- 80M	Set the clock frequency. E.g.,w DeviceClockFrequency 1
	R	r DeviceClockFrequency		Read the clock frequency.
Width	W	w Width x	Value	Set width.E.g.,w Width 4096
	R	r Width		Read width.
Height	W	w Height	Value	Set the height.E.g.,w Height 2000
	R	r Height		Read the height.
OffsetX	W	w OffsetX x	Value	Set horizontal offset from the origin to the region of interest (in pixels). E.g.,w OffsetX 200
	R	r OffsetX		Read horizontal offset from the origin to the region of interest (in pixels).
OffsetY	W	w OffsetY x	Value	Set vertical offset from the origin to the region of interest (in pixels). E.g.,w OffsetY 200
	R	r OffsetY		Read vertical offset from the origin to the region of interest (in pixels).
ReverseX	W	w ReverseX x	x: 0—disable 1—enable	Set image reverse X. E.g.,w ReverseX 1
	R	r ReverseX		Read image reverse X.
DirectionSource	W	w DirectionSource x	x: 0—Internal (internal control) 1—CC 3 (external control)	Set control source of scan direction. E.g.,w DirectionSource 1
	R	r DirectionSource		Read the scan direction control source
ReverseScanDirection	W	w ReverseScanDirection x	x: 0—forward direction 1—reverse direction	Set scan direction (internal control). E.g.,w ReverseScanDirection 1
	R	r ReverseScanDirection		Read scan direction.
PixelFormat	W	w PixelFormat x	x: 0x1080001 -- momo8 0x1100003 -- mono10 0x1100005 -- mono12 0x02180014 -- RGB 8 0x02180015 -- BGR 8	Set pixel format. E.g.,w PixelFormat 0x1080001
	R	r PixelFormat		Read pixel format. Note: the returned value is decimal system and it needs to be converted to hexadecimal.

Command List

Parameter	Read/ Write	Command	Value	Description
PixelSize	R	r PixelSize		Read pixel size.
MultiLightControl	W	w MultiLightControl x	0—off 1—MLC_1_Light 2—MLC_2_Light 3—MLC_3_Light 4—MLC_4_Light	Set multiple lights control E.g.,w MultiLightControl 1
	R	r MultiLightControl		Read multiple lights control
TestPattern	W	w TestPattern x	x: 0—off 9—ColorBar 11—MonoBar 14—ObliqueMonoBar 16—GradualMonoBar 17—TestImage1	Set test pattern. Eg.w TestPattern 14
	R	r TestPattern		Read test pattern.
Binning	W	w Binning X	0x20004 (2 stands for vertical and 4 stands for horizontal)	Read combined pixel number.
	R	r Binning X		Set combined pixel number. E.g., w Binning 0x20002.
TDIMode	W	w TDIMode x	x: 0—Line 1 1—TDI_2	SetTDI mode. E.g., w TDIMode 0.
	R	r TDIMode		Read TDI mode.
AcquisitionBurstFrameCount	W	AcquisitionBurstFrameCount x		E.g., w AcquisitionBurstFrameCount 100
	R	r AcquisitionBurstFrameCount		Number of frames to acquire for each FrameBurstStart trigger.
AcquisitionLineRate (ControlEnable)	W	w AcquisitionLineRate x or y	x: it refers to the written line rate value and enable line rate. y: it refers to the line rate value you want to set (you can write directly, and disable line rate when writing) . x=y+1073741824	Set line rate (enable). E.g., w AcquisitionLineRate 1073841824, it means setting line rate as 100000, and enabling line rate. E.g., w AcquisitionLineRate 100000, it means setting line rate as 100000, and disabling line rate.
	R	r AcquisitionLineRate	When value is larger than 10737441824, line rate is enabled	Read line rate: If line rate is enabled, you reading and writing x are available, and line rate is y=x-1073741824. If line rate is disabled, the reading value is y.
ResultingLineRate	R	r ResultingLineRate		Read final (actual) line rate.
ResultingFrameRate	R	r ResultingFrameRate	x=read value y=value shown in iDatum y= x/10000	Read final (actual) line rate.
ScanMode	W	w ScanMode x	x: 0—FrameScan 1—LineScan	Select frame scan mode or line scan mode. E.g., w ScanMode 0.
	R	r ScanMode		Read scan status.
TriggerSelector	W	w TriggerSelector	X: 9—Line Start 6—Frame Burst Start	Set line trigger or frame trigger. E.g., w TriggerSelector 9
	R	r TriggerSelector		Read the current selected trigger mode.

Command List

Parameter	Read/ Write	Command	Value	Description
TriggerMode	W	w TriggerMode x	X: 0—Disable line trigger and frame trigger 64—Enable frame trigger mode 512—Enable line trigger mode 576—Enable frame trigger and line trigger mode	Set trigger mode. Note: Write operation cannot operate frame trigger and line trigger at the same time. If w TriggerMode 576 command is used, you must enable frame trigger or line trigger. Eg: First w TriggerMode 64, and then w TriggerMode 576, and frame trigger and line trigger can be enabled at the same time.
	R	r TriggerMode		Read trigger mode.
TriggerSource	W	w TriggerSource+6 x	X: 7—software (frame trigger supported only) 0—Line0 1—Line1 3—Line3 5—Line4 6—EncoderModuleOut (line trigger supported only) 8—FrequencyConverter 9—CC1 11—CC2 12—CC3 13—CC4 25—anyway	Set the frame trigger source E.g., w TriggerSource+6 7.
	W	w TriggerSource+9 x		Set the line trigger source E.g., w TriggerSource+9 3.
	R	r TriggerSource+6		Read the frame trigger source.
	R	r TriggerSource+9		Read the line trigger source.
TriggerActivation	W	w TriggerActivation+6 x	x: 0—Rising edge 1—Falling edge	Set rising trigger edge. Eg.w TriggerActivation+6 0
		w TriggerActivation+9 x		Eg.w TriggerActivation+9 0
	R	r TriggerActivation+6		Read trigger edge setting.
		r TriggerActivation+9		
LineDelayEnable	W	w LineDelayEnable x	x: 0 -- Disable 1 -- Enable	Eg: w LineDelayEnable 0
	R	r LineDelayEnable		
TriggerDelay	W	w TriggerDelayAbsVal+6	Value	Set trigger delay. Eg: w TriggerDelayAbsVal+6 100.
		w TriggerDelayAbsVal+9 x		Eg: w TriggerDelayAbsVal +9 100
	R	r TriggerDelayAbsVal+6		Read trigger delay time.
		r TriggerDelayAbsVal+9		
TriggerSoftware	W	w TriggerSoftware x	x: 6	Software trigger once. Eg: w TriggerSoftware 6.
TriggerCacheEnable	W	w TriggerCacheEnable x	X: 0—Off 65—On	Enable trigger cache or not. E.g., w TriggerCacheEnable 65.
	R	r TriggerCacheEnable		Read trigger cache status.
LineTriggerCache Enable	W	w LineTriggerCacheEnable x	x: 1 -- 0ff 513 -- on	E.g., w TriggerCacheEnable 513
	R	r TriggerCacheEnable		Read trigger cache status.

Command List

Parameter	Read/ Write	Command	Value	Description
ExposureAuto	W	w ExposureAuto x	x: 0 -- off 1 -- once 2 -- auto	Set the auto exposure. Eg.w ExposureAuto 2
	R	r ExposureAuto		Read the exposure mode.
ExposureTime	W	w ExposureTime	Value	Set the exposure time. Eg.w ExposureTime 1000
	R	r ExposureTime		Read the exposure time.
AutoExposureTime LowerLimit	W	w AutoExposureTime LowerLimit x	x: The device supports min. exposure time. AutoExposureTimeLowerLimit	Set auto exposure lower limit. Eg.w AutoExposureTimeLowerLimit 50
	R	r AutoExposureTime LowerLimit		Read auto exposure lower limit.
AutoExposureTime UpperLimit	W	w AutoExposureTime UpperLimit x	x: The device supports max. exposure time. AutoExposureTimeUpperLimit	Set auto exposure upper limit. Eg.w AutoExposureTimeUpperLimit 100
	R	r AutoExposureTime UpperLimit		Read auto exposure upper limit.
FrameTimeoutTime	W	w FrameTimeoutTime x	x: 33-10000	Set frame timeout time. Eg. w FrameTimeoutTime 34
	R	r FrameTimeoutTime		Read frame timeout time.
PartialImageOutput Mode	W	w PartialImageOutputMode x	x: 0 -- ImagePending 1 -- PartialImageOutput 2 -- PartialImageDiscard 3 -- PartialImageFilled	Eg. w PartialImageOutputMode 0
	R	r PartialImageOutputMode		
FrameTimeoutEnable	W	w FrameTimeoutEnable x	x: 0--disable 1--enable	Set frame timeout enable. E.g., w FrameTimeoutEnable 0.
	R	r FrameTimeoutEnable		Read frame timeout enable.
AbnormalLineEnable	W	w AbnormalLineEnable x	x: 0--disable 1--enable	E.g., w AbnormalLineEnable 1
PreampGain	W	w PreampGain x	X: Gain multiple value x 1000	Set gain value. E.g., w PreampGain 2700 (set the gain as 2.7 x)
	R	r PreampGain		Read gain value.
DigitalShift (Enable)	W	w DigitalShift y or z	x: the value you want to set y: write serial port value and disable digital shift z: write serial port value and enable digital shift y=x × 511 /6 +511 z=x × 511/6+66047	Set digital shift (enable). Note: the range of digital shift is -6 to 6. E.g., w DigitalShift 512. It means setting gain as 0.01, and disabling digital shift. E.g., w DigitalShift 66048. It means setting gain as 0.01, and enabling digital shift.
	R	r DigitalShift	When value is larger than 65536, digital shift is enabled.	Read digital shift. If digital shift is enabled, read z and x =(z-66047) × 6/511. If digital shift is disabled, read y, and x=y × 6/511-6.

Command List

Parameter	Read/ Write	Command	Value	Description
BalanceWhiteAuto	W	w BalanceWhiteAuto	x: 0 -- off 1 -- continue 2 -- once	Set white balance mode. Eg: w BalanceWhiteAuto 2.
	R	r BalanceWhiteAuto		Read white balance mode.
BlackLevel	W	w BlackLevel x	x: 0-4095	Set black level. E.g., w BlackLevel 5.
	R	r BlackLevel		Read black level.
BlackLevelEnable	W	w BlackLevelCtrl x	x: 0--disable 1--enable	Set black level enable. E.g., w BlackLevelCtrl 1.
	R	r BlackLevelCtrl		Read black level enable.
GammaAbsVal	W	w GammaAbsVal x ×100+y	x: gamma value y: 0x20000--represents sRgb 0x10000--represents User	Set Gama value, and GamaEnable on is availabe. Eg. w GammaAbsVal 2 × 100+0x10000
	R	r GammaAbsVal		Read Gamma value. x=Read value/100
GammaEnable	W	w GammaCtrl x	x: 1--on 0--off	Enable Gamma Eg.w GammaCtrl 1
	R	r GammaCtrl		Read Gamma status.
Brightness	W	w Brightness x	x: 0-255	Set brightness value. Eg.w Brightness 66
	R	r Brightness		Read brightness.
BalanceRatio	W	w BalanceRatio+x y	x: 0 -- Red 1 -- Green 2 – Blue y: 1 ~ 16376	Eg.w BalanceRatio+1 800
	R	r BalanceRatio+x		
AutoFunctionAOIWidth	W	w AutoAOIWidth x	x: 32-1024	Set the width of auto function AOI (in pixels). E.g., w AutoAOIWidth 1024.
	R	r AutoAOIWidth		Read the width of auto function AOI (in pixels).
AutoFunctionAOIHeight	W	w AutoAOIHeight x	x: 64-5000	Set the height of auto function AOI (in pixels). E.g., w AutoAOIHeight 240.
	R	r AutoAOIHeight		Read the height of auto function AOI (in pixels).
AutoFunctionAOIOffset X	W	w AutoAOIOffsetX x	x: 0	Set the start columnof auto function AOI. E.g., w AutoAOIOffsetX 0.
	R	r AutoAOIOffsetX		
AutoFunctionAOIOffset Y	W	w AutoAOIOffsetY x	x: 0-4760	Set the start row of auto function AOI. E.g., w AutoAOIOffsetY 100.
	R	r AutoAOIOffsetY		
AutoFunctionAOIUsage Intensity	W	w AutoAOIUsage x	x: 1 -- off 0x80000001 -- on	Read AOI 1. E.g. w AutoAOIUsage 0x80000001.
	R	r AutoAOIUsage		Read parameter value.

Command List

Parameter	Read/ Write	Command	Value	Description
AutoFunctionAOIUsage WhiteBalance	W	w AutoAOIUsage+1 x	x: 0 -- off 0x04000000 -- on	E.g., w AutoAOIUsage+1 0x04000000
	R	r AutoAOIUsage+1		
CCMEnable	W	w CCMEnable x	x: 0—Off 1—On	Enable/disable Color Correction Matrix. E.g., w CCMEnable 1.
	R	r CCMEnable		Read the status of Color Correction Matrix.
ColorTransformationEnable	W	w ColorTransformationEnable x	x: 0—Off 1—On	Set the status of color transformation module. E.g., w ColorTransformationEnable 1.
	R	r ColorTransformationEnable		Read the selected status of color transformation module.
ColorTransformationValue	W	w ColorTransformationValue x	y: desired value x=y*1024	Represents the value of the selected Gain factor or Offset inside the Transformation matrix. E.g., w ColorTransformationValue 855.
	R	r ColorTransformationValue		Read the value of the selected Gain factor or Offset inside the Transformation matrix.
HueAbsVal	W	w HueAbsVal x	x: 0-255	Set hue. E.g., w HueAbsVal 128.
	R	r HueAbsVal		Read hue.
HueCtrl	W	w HueCtrl x	x: 0—Off 1—0x1000000	Enable hue or not. E.g., w HueCtrl 0x1000000.
	R	r HueCtrl		Read enable status of hue.
SaturationAbsVal	W	w SaturationAbsVal x	x: 0-255	Set saturation. E.g., w SaturationAbsVal 128.
	R	r SaturationAbsVal		Read saturation.
SaturationCtrl	W	w SaturationCtrl	x: 0—Off 1—0x1000000	Enable saturation or not. E.g., w SaturationCtrl 0x10000.
	R	r SaturationCtrl		Read enable status of saturation.
LUTEnable	W	w LUTEnable x	x: 0—Off 1—On	Activate selected LUT. E.g., w LUTEnable 1
	R	r LUTEnable		
LUTSelector	W	w LUTSelector x	x: 0—Luminance1 1—Luminance2 2—Luminance3	Select LUT. E.g., w LUTSelector 0.
	R	r LUTSelector		
LUTValue	W	w LUTValue x	y: desired value x=262144+y	Returns the Value at entry LUTIndex of the LUT selected by LUTSelector. E.g., Set 100, w LUTValue 262244.
	R	r LUTValue		
LUTSave	W	w LUT Save x	x: 1—save	Save selected LUT. E.g., w LUT Save 1
EncoderSourceA	W	w EncoderSourceA x	x: 0 -- line0; 1 -- line1; 2 -- line2; 3 -- line3; 128 -- NA	Set encoder source A. Eg.w EncoderSourceA 3
	R	r EncoderSourceA		Read encoder source A.

Command List

Parameter	Read/ Write	Command	Value	Description
EncoderSourceB	W	w EncoderSourceB x	x: 0 -- line0; 1 -- line1; 2 -- line2; 3 -- line3; 128 -- NA	Set encoder source B. Eg.w EncoderSourceB 0
	R	r EncoderSourceB		Read encoder source B.
EncoderOutputMode	W	w EncoderOutputMode x	x: 0 -- AnyDirection 1 -- ForwardOnly 2 -- BackwardOnly	Set encoder's trigger mode. E.g., w EncoderOutputMode 1
	R	r EncoderOutputMode		Read encoder's trigger mode.
EncoderCounterMode	W	w EncoderCounterMode x	x: 0 -- AnyDirection 1 -- ForwardOnly 2 -- BackwardOnly	Set encoder counter mode. Eg: w EncoderCounterMode 1.
	R	r EncoderCounterMode		Read encoder counter mode.
EncoderCounter	R	r EncoderCounter		Read encoder counter.
EncoderCounterMax	W	w EncoderCounterMax x	x: 0-32767	Set encoder max. counter. Eg.w EncoderCounterMax 1
	R	r EncoderCounterMax		Read encoder max counter.
EncoderCounterReset	W	w EncoderCounterReset x	x: 1	Reset encoder counter. Eg. w EncoderCounterReset 1
EncoderMax ReverseCounter	W	w EncoderMaxReverseCounter x	x: 0-32767	Set encoder max. reverse counter. Eg.w EncoderMaxReverseCounter 1
	R	r EncoderMaxReverseCounter		Read encoder max. reverse counter.
EncoderReverse CounterReset	W	w EncoderReverseCounterReset x	x: 1	Reset encoder reverse counter. Eg. w EncoderReverseCounterReset 1
InputSource	W	w InputSource x	x: 0/1/3 -- Line0/1/3 7 – EncoderModuleOut 8/9/10/11 – CC1/2/3/4 128 -- NA	Set input source. Eg.w InputSource 7
	R	r InputSource		Read input source.
SignalAlignment	W	w SignalAlignment x	x: 0--RisingEdge 1--FallingEdge	Set signal alignment. Eg.w SignalAlignment 1
	R	r SignalAlignment		Read signal alignment.
TriggerLineRate (Hz)	R	r TriggerLineRate		It refers to the external trigger raw line rate after filtering.
PreDivider	W	w PreDivider x	x: 1-128	Set PreDivider. Eg.w PreDivider 1
	R	r PreDivider		Read PreDivider.
Multiplier	W	w Multiplier x	x: 1-32	Set Multiplier. Eg.w Multiplier 1
	R	r Multiplier		Read Multiplier.
PostDivider	W	w PostDivider x	x: 1-128	Set PostDivider. Eg. w PostDivider 1
	R	r PostDivider		Read PostDivider.
ResultingTriggerLine Rate(Hz)	R	r ResultingTriggerLineRate		It refers to the external trigger frequency devices received after the external trigger raw line rate is calculated via frequency converter control. It only involves external trigger

Command List

Parameter	Read/ Write	Command	Value	Description
ShadingSelector	W	w ShadingSelector x	x: 0—FPNCCorrection 1—PRNUCCorrection	Select shading correction type. E.g., w ShadingSelector 1.
	R	r ShadingSelector		Read shading correction type.
ActivateShading	W	w ActivateShading x	x: 0 -- FPNCCorrection 1 -- PRNUCCorrection y: 1—enable	Activate selected correction. E.g., W ActivateShading+1 1
PRNUCROIEnable	W	w PRNUCROIEnable x	x: 0—disable 1—enable	Enable user PRNUC ROI. E.g. w PRNUCROIEnable 1.
	R	r PRNUCROIEnable		Read status of PRNUC ROI.
PRNUCROIExtensionEnable	W	w PRNUCROIExtensionEnable x	x: 0—disable 1—enable	Enable PRNUC ROI extension correction. E.g. w PRNUCROIExtensionEnable 0
	R	r PRNUCROIExtensionEnable		Read PRNUC ROI extension correction status.
PRNUCWidth	W	w PRNUCWidth x	x: 32-4096	Set image width used by PRNUC. E.g., w PRNUCWidth 4096.
	R	r PRNUCWidth		Read image width used by PRNUC.
PRNUCOffset X	W	w PRNUCOffsetX x	x: 0-3896	Set image offset used by PRNUC. E.g., w PRNUCOffset 0.
	R	r PRNUCOffsetX		Read image offset used by PRNUC.
FPNCUserEnable	W	w FPNCUserEnable x	x: 0—disable 1—enable	Enable FPNUC's user set. E.g., w FPNCUserEnable 1.
	R	r FPNCUserEnable		Read FPNUC's user set.
PRNUCUserEnable	W	w PRNUCUserEnable x	x: 0—disable 1—enable	Enable PRNUC's user set. E.g., w PRNUCUserEnable 1.
	R	r PRNUCUserEnable		Read PRNUC's user set.
PRNUCUserSelector	W	w PRNUCUserSelector x	x: 0—UserPRNUC1 1—UserPRNUC2 2—UserPRNUC3	Select PRNUC's user set. E.g., w PRNUCUserSelector 0.
	R	r PRNUCUserSelector		Read PRNUC's user set.
PRNUCTargetEnable	W	w PRNUCTargetEnable x	x: 0—with correction standard 1—set correction manually	Enable correction manually. E.g., w PRNUCTargetEnable 1.
	R	r PRNUCTargetEnable		Read the status of correction.
PRNUCTarget	W	w PRNUCTarget x	x: 0-4095	Set PRNUC's correction value. E.g., w PRNUCTarget 2048.
	R	r PRNUCTarget		Read PRNUC's correction value.
PRNUCTargetR/G/B	W	w PRNUCTargetR/G/B x	x: 0-4095	E.g., w PRNUCTargetR 2048
	R	r PRNUCTargetR/G/B		
PRNUCSmoothEnable	W	w PRNUCSmoothEnable x	x: 0—disable 1—enable	Enable PRNUC Smooth function or not. E.g, w PRNUCSmoothEnable 1.
	R	r PRNUCSmoothEnable		Read the status of PRNUC Smooth function.

Command List

Parameter	Read/ Write	Command	Value	Description
LineRateRatio	W	w LineRateRatio x	y: configured value (0-1.99) x=y*1024	Set line rate ratio. E.g., w LineRateRatio 1024.
	R	r LineRateRatio		Read line rate ratio.
PixelShift	W	w PixelShift	y: configured value (0-63.99) x=y*1024	Set pixel shift. E.g., w PixelShift 1024.
	R	r PixelShift		Read pixel shift.
ParallaxDirection	W	w ParallaxDirection x	x: 0 -- Off; 1 -- Red; 2 -- Blue; 3 -- StartLine; 4 -- EndLine	Set the direction of parallax. E.g., w ParallaxDirection 0.
	R	r ParallaxDirection		Read the direction of parallax.
LineMode	W	w LineMode+x y	x: 5--CC1 0—Line0 1—Line1 3—Line3 4—Line4 y: 0—In 8—Strobe	Set I/O input and output mode. Eg: w LineMode+5 0 (Set CC1 as input).
	R	r LineMode+x		Read I/O input and output mode.
LineFormat	W	w LineFormat +x y	x: 5--CC1 0—Line0 1—Line1 3—Line3 4—Line4 y: 0—SingleEnded 2—Differential	Set line format of selected IO. E.g., w LineFormat +1 0.
	R	r LineFormat +x		Read line format of selected IO.
LineInverter	W	w LineInverter	x: 0 -- enable Line0 only ; 1 -- enable Line1 only ; 2 -- enable Line2 only ; 3 -- enable Line3 only ; 4 -- enable Line4 only ; 12 -- enable Line5 only ; 13 -- enable Line6 only ; 14 -- enable Line7 only ; 15 -- enable Line8 only ; 9 -- enable Line9 only ; 10 -- enable Line10 only ; 11 -- enable Line11 only; 5 -- enable CC1 only; 6 -- enable CC2 only; 7 -- enable CC3 only; 8 -- enable CC4 only;	Enable Line1 or Line4. Eg: w LineInverter 2 (enable Line1's inverter).
	R	r LineInverter		Read LineInverter status.

Command List

Parameter	Read/ Write	Command	Value	Description
LineStatusAll	R	r LineStatusAll	Device input/output signal status: 1 level high, 0 level low. Bit[0]: line0 input Bit[1]: line3 input Bit[4]: line1 input Bit[5]: line4 input Bit[8]: line1 output Bit[9]: line4 output Bit[12]: line0 output Bit[13]: line3 output Bit[20]: CC1 input Bit[21]: CC2 input	Read the status of LineStatusAll E.g, The value read is decimal 514, Hexadecimal is 0x202, The conversion to binary should be 1000000010, Represents line3 as input and line4 as Output (unidirectional IO).
LineSource	W	w LineSource+ x y	x: 1—Line1 3—Line3 4—Line4 y: 0—ExposureStartActive 5—SoftTriggerActive 6—HardTriggerActive	Selects which internal acquisition or I/O source signal to output on the selected Line. E.g, w LineSource+1 0
	R	r LineSource+ x	x: 0—ExposureStartActive 5—SoftTriggerActive 6—HardTriggerActive	Read internal acquisition or I/O source signal to output on the selected Line.
LineStrobe	W	w LineStrobe x	x: 0—disable all 2—enable Line1 only 8—enable Line4 only	Enable Line1 or Line4. Eg: w LineInverter 2 (enable Line1's inverter).
	R	r LineStrobe		Read LineStrobe status.
StrobeSourceSelector	W	w StrobeSourceSelector+ x y	x: 1—Line1 3—Line3 4—Line4 (x is the IO channel, 1/3/4 corresponds to channel 1/3/4) y: 0—LineMode 2—FrameMode	Select strobe source according to the trigger method. E.g., w StrobeSourceSelector+1 0.
	R	r StrobeSourceSelector+ x		Read strobe source.
StrobeLineDuration	W	w StrobeLineDuration+ x y	x: 3—Line3 y: 0—10000	Set the duration of strobe, and the unit is μs. E.g., w StrobeLineDuration +3 100.
	R	r StrobeLineDuration+ x		Read the duration of strobe. E.g., r StrobeLineDuration+3
StrobeLineDelay	W	w StrobeLineDelay+ x y	x: 3—Line3 y: 0—10000	Set the delay of strobe, and the unit is μs. E.g., w StrobeLineDuration +3 200.
	R	r StrobeLineDelay+ x		Read the delay of strobe.
StrobeLinePreDelay	W	w StrobeLinePreDelay x	x: 0 -- 5000	Set the value of strobe line pre-delay, and the unit is μs. E.g., w StrobeLinePreDelay300
	R	r StrobeLinePreDelay		Read the value of strobe line pre-delay. E.g., r StrobeLinePreDelay
LineDebouncerTimeNs	W	w LineDebouncerTimeNs+x y	x: 5—CC1 0—Line0 3—Line3 y: value	Set trigger debouncer, input is available. Eg: w LineDebouncerTimeNs+5 100.
	R	r LineDebouncerTimeNs+x		Read trigger debouncer. Eg: r LineDebouncerTimeNs+3

Command List

Parameter	Read/ Write	Command	Value	Description
CounterSelector	W	w CounterSelector x	x: 0 -- Counter 0	The associated node is controlled by XML, and you do not need to set the device. Eg: w CounterSelector 0
CounterEventSource	W	w CounterEvent Source x	x: 0 -- Off 11/12/15/20 -- line0/1/3/4 14/16/17/18 -- cc1/2/3/4	Sets the signal source triggered by the counter Eg: w CounterEventSource 0
CounterEvent Activation	W	w CounterEventActivation x	x: 0 -- Rising Edge 1 -- Falling Edge	Set how counters are triggered. Eg: w CounterEventActivation 0
	R	r CounterEventActivation		Read the counter to trigger the response mode Eg: r CounterEventActivation
CounterResetSource	W	w CounterReset Source x	x: 0 -- Off 3 -- Software	Sets the signal source for the reset counter Eg: w CounterResetSource 0
CounterReset	W	w CounterReset x	x: Execute	It resets counter and it can be executed when selecting Software as Counter Reset Source.
CounterValue	W	w CounterValue x	x: 1 ~ 4294967295	Set counter values Eg: w CounterValue 500
CounterCurrentValue	R	r CounterCurrentValue	/	It cannot be configured. Read only.
SuperPaletteEnable	W	w SuperPaletteEnable 1	x: 0 -- Off	Set Super Palette Enable
SuperPaletteSelector	W	w SuperPalette Selector x	x: 0--Red; 1--Green; 2--Blue; 3--Cyan ; 4--Magenta ; 5--Yellow	The associated node is controlled by XML, and you do not need to set the device.
SuperPaletteHue	W	w SuperPaletteHue+x y	x: SuperPaletteSelector y: 0-255	Set the Super Palette Hue parameter value
SuperPaletteSaturation	W	w SuperPalette Saturation x	/	/
CACEnable	W	w CACEnable x	x: 0—Off 1—On	Enable/disable Color Correction Matrix. E.g., w CCMEnable 1.
	R	r CCMEnable	/	Read the status of Color Correction Matrix.
CACEdgeThreshold	W	w CACEdgeThreshold x	x: 0 ~ 2040	Set the Edge Detection Threshold parameter E.g., w CACEdgeThreshold 200
PayloadSize	R	r PayloadSize		Provides the number of bytes transferred for each data buffer or chunk on the stream channel.
DeviceTapGeometry	W	w DeviceTapGeometry x	x: 0x01020181 Geometry_1X2 0x02010181:Geometry_2X 0x04010181:Geometry_4X 0x08010181:Geometry_8X 0x0a010181:Geometry_10X	Set the device's transmission mode. Eg: w DeviceTapGeometry 0x02010181.
	R	r DeviceTapGeometry		Read the device's transmission mode (the returned value is decimal system and it needs to be converted to hexadecimal).

Command List

Parameter	Read/ Write	Command	Value	Description
CIConfiguration	R	r CIConfiguration	x: 0—Base 1—Medium 2—Full 3—DualBase 4—EightyBit	The device's configuration.
SupportedBaudrates	R	r SupportedBaudrates		Read supported Baudrates.
UserSetSelector	W	w UserSetSelector x	x: 0—default 1--userset1 2—userset2 3--userset3	Set selected user parameter. Eg.w UserSetSelector 2
	R	r UserSetSelector	x: 0—default 1--userset1 2—userset2 3--userset3	Read selected user parameter.
UserSetLoad	W	w UserSetLoad 1	Execute	Load UserSetDefault parameter.
UserSetSave	W	w UserSetSave 1	Execute	Save parameters setting to UserSetSelector.
UserSetDefaultSelector	W	w UserSetDefaultSelector x	x: 0—default 1--userset1 2—userset2 3--userset3	Select default loaded parameter. Eg.w UserSetSelector 2
	R	r UserSetDefaultSelector		Read default loaded parameter.

Trouble Shooting

Trouble:

- No camera found when running the iDatum

  Possible Reason1: Camera is not started up normally
  Solution1: Check camera power wiring (observe the indicator)
  Possible Reason2: Incorrect Camera Link cable connection.
  Solution2: Check Camera Link cable connection.

- Camera indicator shows solid blue, but frame grabber software cannot generate image.

  Possible Reason1: Incorrect parameter settings of frame grabber software.
  Solution1: Check whether parameter settings of frame grabber software are set correctly.
  Possible Reason2: Camera is in trigger mode.
  Solution2: Disable trigger mode.

- Live view is black

  Possible Reason1: Aperture is closed
  Solution1: Open the aperture
  Possible Reason2: Camera exception occurs
  Solution2: Reboot the camera.

- Live view is normal, but the camera cannot be triggered.

  Possible Reason1: Trigger mode is not enabled
  Solution1: Check whether the camera trigger mode and related trigger signal input are normal in the current environment.
  Possible Reason2: Incorrect wiring
  Solution2: Check whether the wiring is correct under corresponding triggering mode.

- Live view and trigger signal are normal, but camera cannot get the image required by the algorithm.

  Possible Reason: The image output format does not match.
  Solution: Confirm the image format required by the algorithm and adjust the image output format of the camera in client software.

CHAPTER 9 TECHNICAL SUPPORT

If you need advice about your camera or if you need assistance troubleshooting a problem with your camera, it's highly recommended to describe your issue in details and contact us via E-mail at support@visiondatum.com

It would be helpful if you can fill-in the following table and send to us before you contact our technical support team.

Camera Model:		Camera's SN:	
Describe the issue in as much detail as possible:			
If known, what's the cause of the issue?			
How often did/does the issue occur?			
How severe is the issue?			
Parameter set	Please connect the camera directly to PC and use iDatum to make note of the parameter when the issue occurred.		

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