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LEO Series
10GigE Area Scan Camera
User Manual

V2.5.8, Aug. 2025

Preface

Purpose

This Manual is a basic description of LEO series 10GigE Area 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.

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Hangzhou Contrastech Co., Ltd.
Tel.: +86-571-89712238
Add.:C-5F, No. 8 Xiyuan 9th Road, West Lake District Hangzhou Zhejiang 310030 China.

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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:： www.contrastech.com

Technical Support

For technical support, e-mail： support@contrastech.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.

Do not open the camera housing
Do not open the housing. Touching internal components may damage them.

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、10GigE、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

- 10 Gigabit Ethernet interface, compatible with Gigabit Ethernet, with maximum 100m transmission;
- 1024MB on-board frame buffer for data transmission and image retransmission;
- Supports software trigger, hardware trigger, free run mode and etc;
- Supports sharpness, gamma correction, LUT, black level correction 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;
- Conforms GigE Vision protocol and GenICam standards;
- Support third-party software connection.

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

Status LED Description

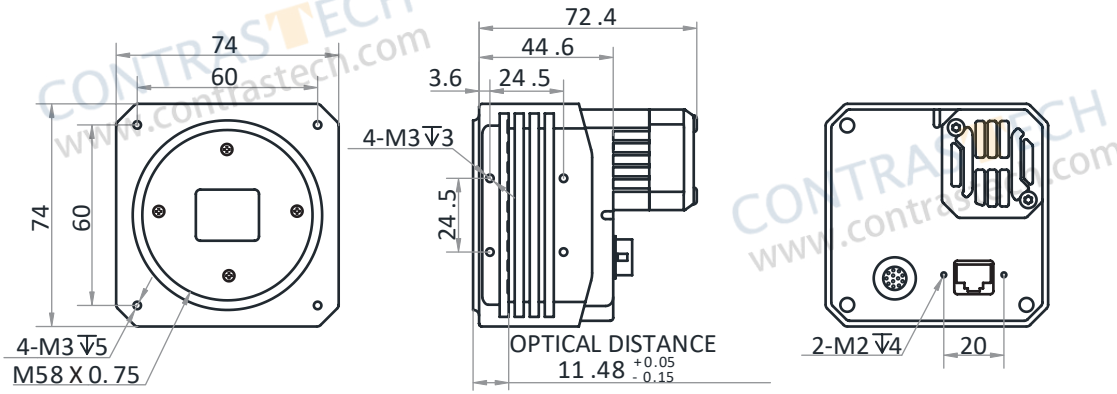
Status LED	Description
Slow Flashing Red (the interval between on and off is 2000 milliseconds)	The camera wiring exception occurs.
Red light is always on	The camera exception occurs.
Blue light is always off	The camera is in idle status.
Fast Flashing Blue (the interval between on and off is 200 milliseconds)	The camera is acquiring images normally.
Slow Flashing blue (the interval between on and off is 1000 milliseconds)	The camera is acquiring images in trigger mode.
Flashing Alternately Red and Blue	_The firmware is updating. _The function of finding me is executed,

Mechanical Dimensions

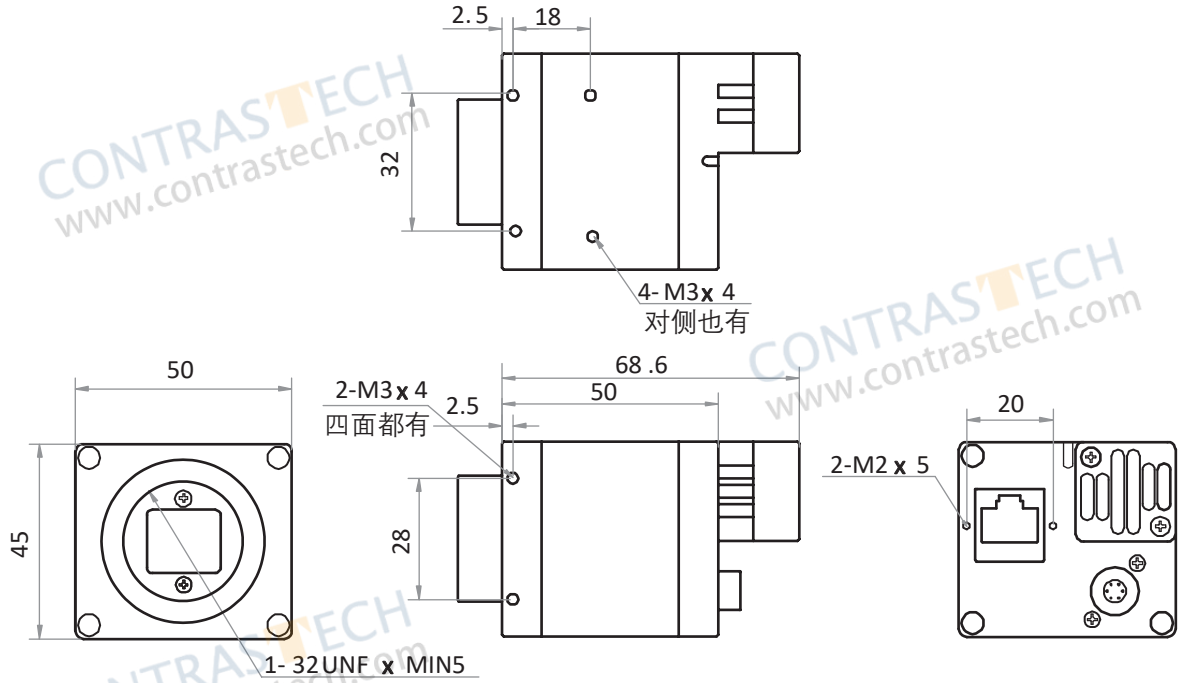
The dimensions is in millimeters:

The cameras are interfaced to an external circuity via connectors located on the back of the housing.

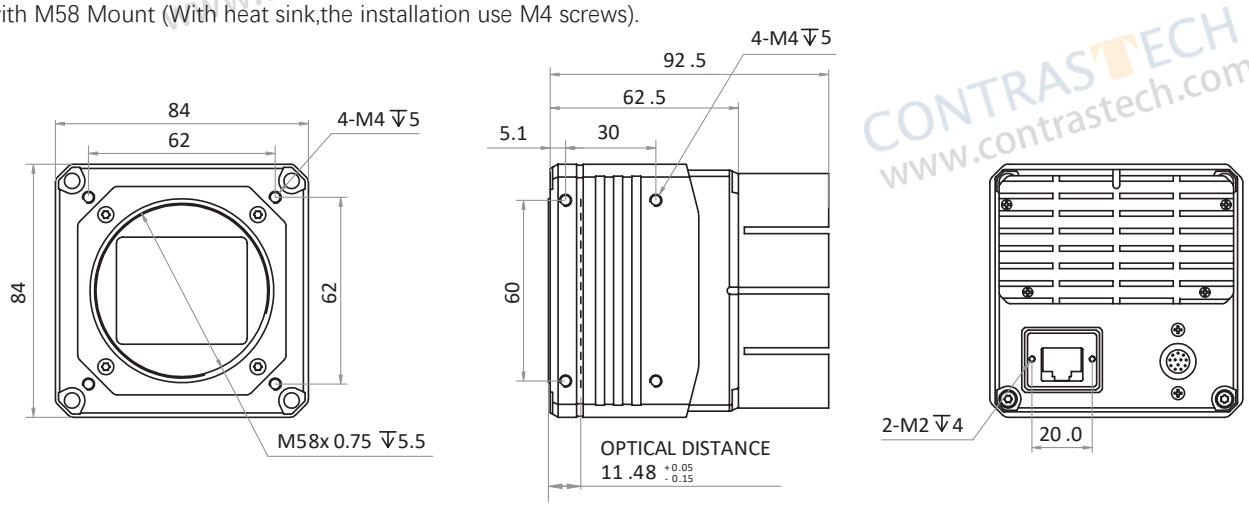
■ Mechanical Dimensions (in mm) of LEO 12MS-68tgm(V2) 10GigE Cameras with M58 Mount (With fan,the installation use M3 screws).



■ Mechanical Dimensions (in mm) of LEO 12MG-65Tgm/LEO 25MG-42Tgm 10GigE Cameras with C-mount (With fan,the installation use M3 screws).

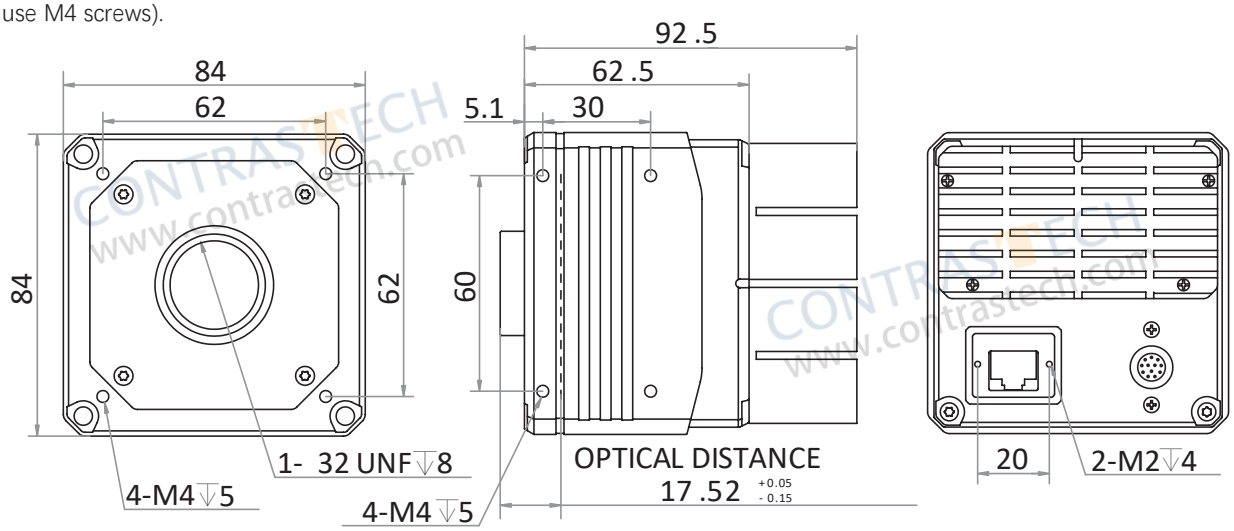


■ Mechanical Dimensions (in mm) of LEO 24MS-35Tgm; LEO 32MD-30Tgm/Tgc; LEO 103MG-11Tgm/Tgc 10GigE Cameras with M58 Mount (With heat sink,the installation use M4 screws).

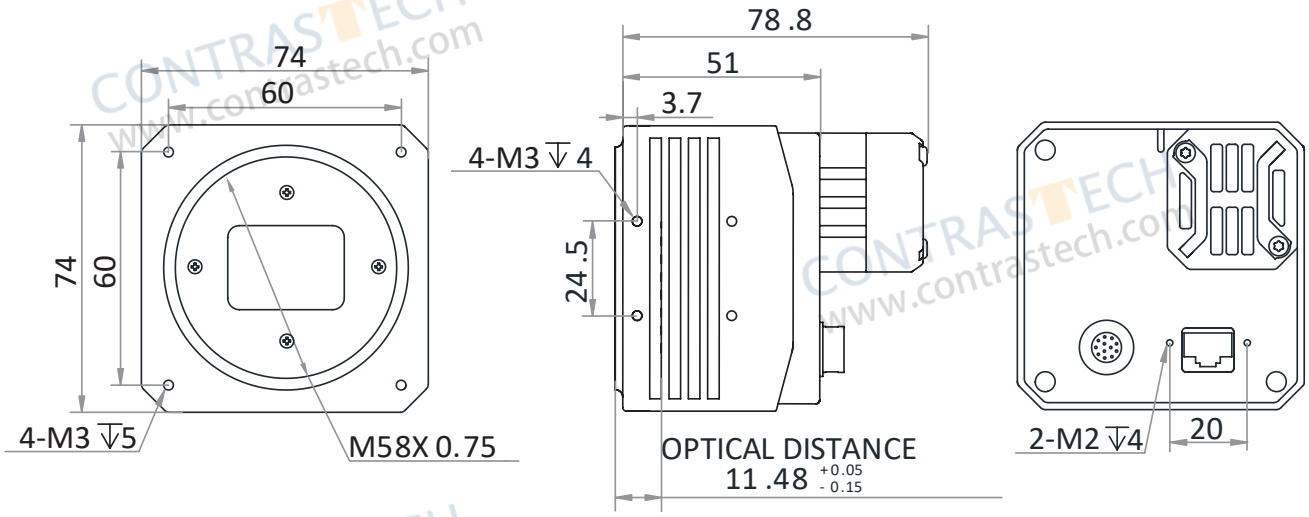


Mechanical Dimensions

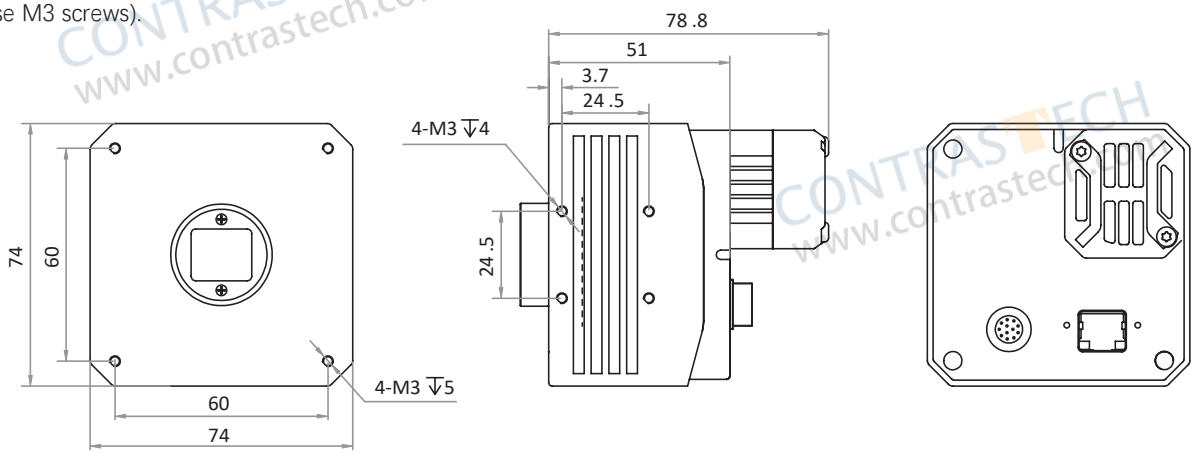
■ Mechanical Dimensions (in mm) of LEO 24MS-35Tgm 10GigE Cameras with C-mount (With heat sink,the installation use M4 screws).



■ Mechanical Dimensions (in mm) of LEO 25MD-30Tgm; LEO 25MG-40Tgm/Tgc/TgNIR; LEO 50MG-15Tgm/Tgc; LEO 65MG-15tgm/tgc 10GigE Cameras with M58-mount (With fan,the installation use M3 screws).

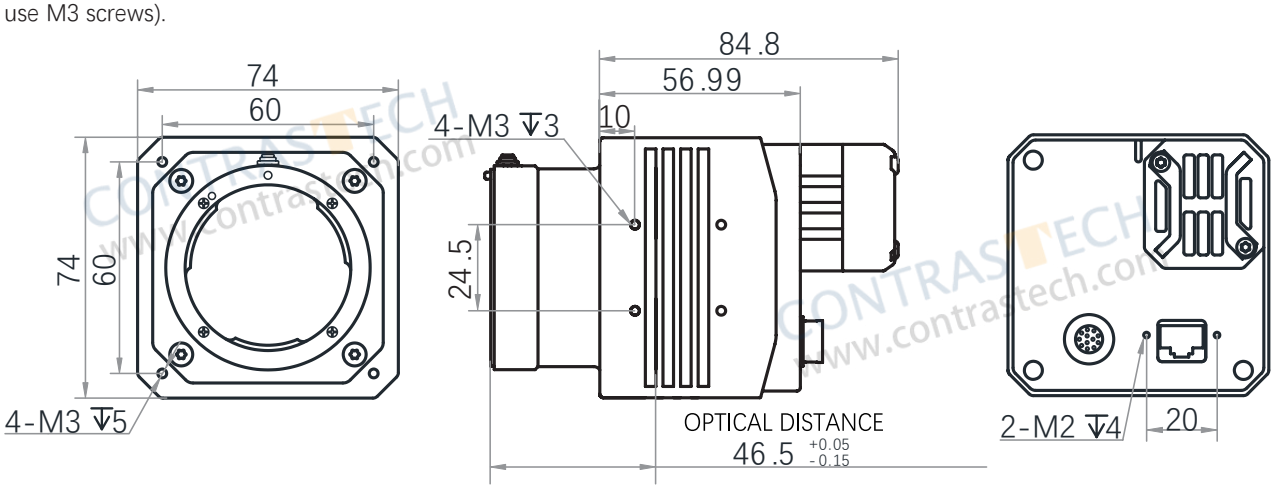


■ Mechanical Dimensions (in mm) of LEO 25MG-40Tgm/Tgc 10GigE Cameras with C-mount (With fan,the installation use M3 screws).

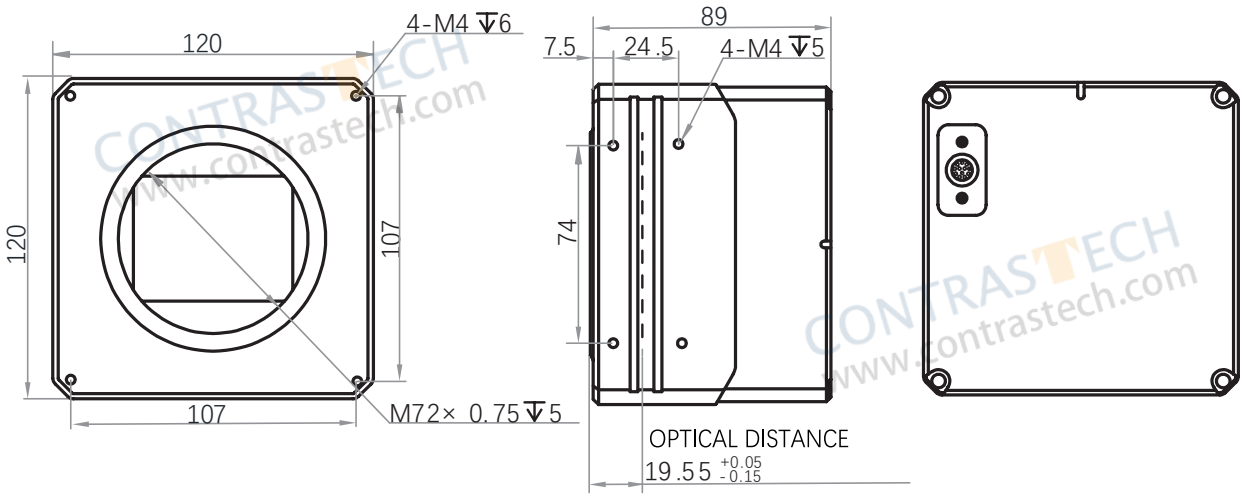


Mechanical Dimensions

■ Mechanical Dimensions (in mm) of LEO 50MG-15Tgm/Tgc; LEO 65MG-15tgm/tgc with F Mount (With fan,the installation use M3 screws).



■ Mechanical Dimensions (in mm) of LEO 150MSC-6Tgm 10GigE over Fiber interface Cameras with M72 Mount (TEC cooling,the installation use M4 screws).



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CHAPTER 2 POWER AND I/O IENTERFACE DEFINITION

I/O Connection Definition and Assignments

Read the followings to get pin definitions.Refer to the pin definitions and labels attached to the power and I/O cable to wire the device.

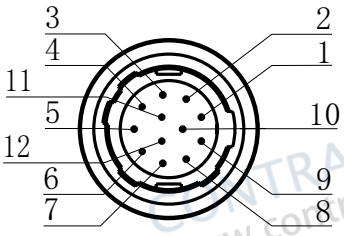

Table 2-1:
Numbering and assignments for 12pin Power and I/O Input Connector: (C/M58/F-mount 10GigE camera)

Color	Pin	Signal	I/O Signal Source	Designation
Black	1	GND	DC ground	Camera Power Supply Ground
Red	2	DC_PWR	DC_PWR +	DC Camera Power
Brown	3	-	-	-
Orange	4	-	-	-
Yellow	5	GND_IO	Line 0/1-	Opto-isolated Signal Ground
Green	6	-	-	-
Blue	7	-	-	-
Purple	8	RS232_RX	232 serial port input	RS232 Received Data
Gray	9	RS232_TX	232 serial output	RS232 Transmitted Data
White	10	GPIO	Line 2+	Can be Configured as Input or Output
Pink	11	OPTO_OUT	Line 1+	Opto-isolated OUT
Light green	12	OPTO_IN	Line 0+	Opto-isolated IN

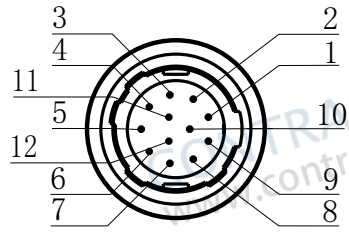

Table 2-2:
Numbering and assignments for 12pin Power and I/O Input Connector: (M72-mount 10GigE over Fiber interface camera)

Color	Pin	Signal	I/O Signal Source	Designation
Black	1	GND	Line 2-	Camera Power Supply Ground
Red	2	DC_PWR	-	DC Camera Power
Brown	3	DC_PWR	-	DC Camera Power
Orange	4	OPT_IN-	Line 0-	Opto-isolated IN Signal Ground
Yellow	5	OPT_OUT-	Line 1-	Opto-isolated output signal ground
Green	6	GND	-	DC Camera Power
Blue	7	GND	-	DC Camera Power
Purple	8	232_RXD	-	RS232 Received Data
Gray	9	232_TXD	-	RS232 Transmitted Data
White	10	GPIO2	Line 2+	Can be Configured as Input or Output
Pink	11	OPTO_OUT+	Line 1+	Opto-isolated OUT
Light green	12	OPTO_IN+	Line 0+	Opto-isolated IN

The I/O definitions in this manual apply only to ContrasTech standard cables for LEO cameras. Connect according to the I/O types and pinout. Using cables with different color codes from other manufacturers may cause incorrect connections and damage the camera. Always use ContrasTech standard cables.

I/O Connection Definition and Assignments

Cable

Recommendations for using Network cables:

- 10 Gigabit RJ-45 port camera,It refers to CAT-6e network cable or above. You need to purchase separately.
- 10 Gigabit optical fiber port camera,It refers to the optical fiber and you should select it according to the camera's optical module. You need to purchase separately.

10 GigE NIC: RJ-45-port camera needs to be equipped with 10 GigE NIC;It refers to the 10 GigE network interface card. You need to purchase separately.

Optical Module: 10 Gigabit optical fiber port camera needs to be equipped with optical module for photoelectric signal conversion,It includes single module or multiple modules, and you should purchase it separately according to actual demands.

Recommendations for using I/O cables:

- I/O cables must be shielded.
- Use twisted pair cables.
- Recommended maximum cable length: 10 m.
- Pin assignments (refer to Tables 2-1/2-2).
- Avoid strong magnetic fields.

Depending on the particular application, using different cables may lead to voltage drops, signal distortion, and EMI/ESD problems which in turn may cause the camera to malfunction.

i	Note that direct-coupled GPIO lines have the advantage of working with very short delays compared to opto-isolated I/O lines. Note also that the direct-coupled GPIOs are distinctly more susceptible to EMI than the opto-isolated I/Os. Under harsh EMI conditions, GPIOs can turn out not to be usable at all. Accordingly, use of the GPIOs in an environment with elevated risk of EMI calls for taking additional measures like, e.g. using shorter cables.

NOTICE

An incorrect plug can damage the I/O connector.

The plug on the cable that you attach to the camera's I/O connector must have 12 female pins. Using a plug designed for a smaller or a larger number of pins can damage the connector

i	ContrasTech offers suitable plugs and cables. Contact your sales representative to order connectors or cables.

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CHAPTER 3 INSTALLATION AND SETUP

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 7 (32 bit or 64 bit)
- Windows 10 (32 bit or 64 bit)
- Linux 32 Bit/64 Bit : Ubuntu 14.04(32/64)、Ubuntu 16.04(32/64)、Redhat7(64)、Centos7(32/64)、gcc/g++ version requires 4.6.3 and above
- ARM: NVIDIA TX2、RaspberryPiB3.0+

Installation Steps

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

Environment Testing

After successful installation, please connect the camera and turn on iDatum client software to check the result of camera connection and image preview. You can start secondary development base on the SDK when all environment testing is normal. You should notice follow items when using GigE Camera:

- FrameRate Whether the frame rate is consistent with the actual set frame rate.
- Errors If not 0, it means there is a frame skip, it is abnormal.
- Lost Packets If not 0, it is abnormal.

Hardware Installation

Camera Installation

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

Make sure that the following items are available before starting the installation:

- LEO 10GigE Area scan camera
- Applicable power supply or a 10Gigabit Ethernet Switch
- It refers to the lens that matches with lens mount of the camera.
- The computer with a GigE network adapter installed
- The computer must be equipped with appropriate operating system
- Use a suitable network cable to connect the camera to a 10 GigE or a 10 GigE NIC or a 10 GigE optical NIC.

Steps:

- Mount lens that matches with lens mount of the camera
- Connect the camera to the computer and power
- Use a network cable to connect the camera to a network interface card.

12-pin:

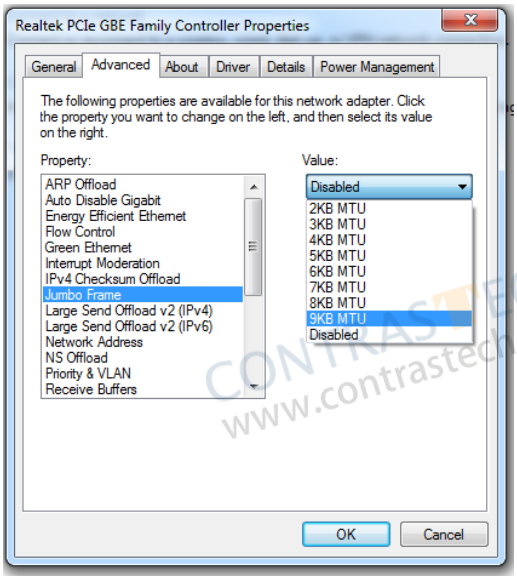
- The device provides power supply via external DC power supply.
- Connect the external DC power supply to the camera through the I/O cable to power the device.

Network Settings

Before using the camera, you need to configure IP is in the same network segment with the computer. You can modify it in"Local Connection" to ensure network communication is normal.

Local Network Configuration

- Click "Control Panel"> "Network and Internet"> "Network and Sharing Center"> "Change Adapter Configuration." Then select corresponding network card to configure it automatically obtain IP address or manually assign it as same network segment address with the camera. Shown as below:
- Open "Advanced" in the properties, set "Jumbo Frame" as its maximum value:9014bytes, both of transmit buffer and receive buffer set as 2048bytes, the Interrupt Throttle Rate set as extremum value. These maximum values mentioned above depend on the specific network card. Shown as below:



Software Operation

iDatum Operation

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.

4、Right click the device, and click Modify IP.

5、Set the IP address of the device in the same network segment with the PC

6、Click OK.

Click ">" in the camera's feature panel to unfold the specific camera parameters, and set them according to actual demands. Please see the table below for the introduction of each attribute classification.

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's gain, black level, Gamma correction, sharpness, etc.
Color Transformation Control	You can view and set the device's color transformation related parameters like hue and saturation.
LUT Control	You can view the Look-Up Table (LUT), and set its index and value.
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.
File Access Control	You can view and set the device's file access control related parameters.
Event Control	You can view and set the device's event control related parameters to let the device generate an event and transmit a related event message to the computer.
Transport Layer Control	You can view and set the parameters of the device's transport layer.
User Set Control	You can save or load the device's parameters.

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

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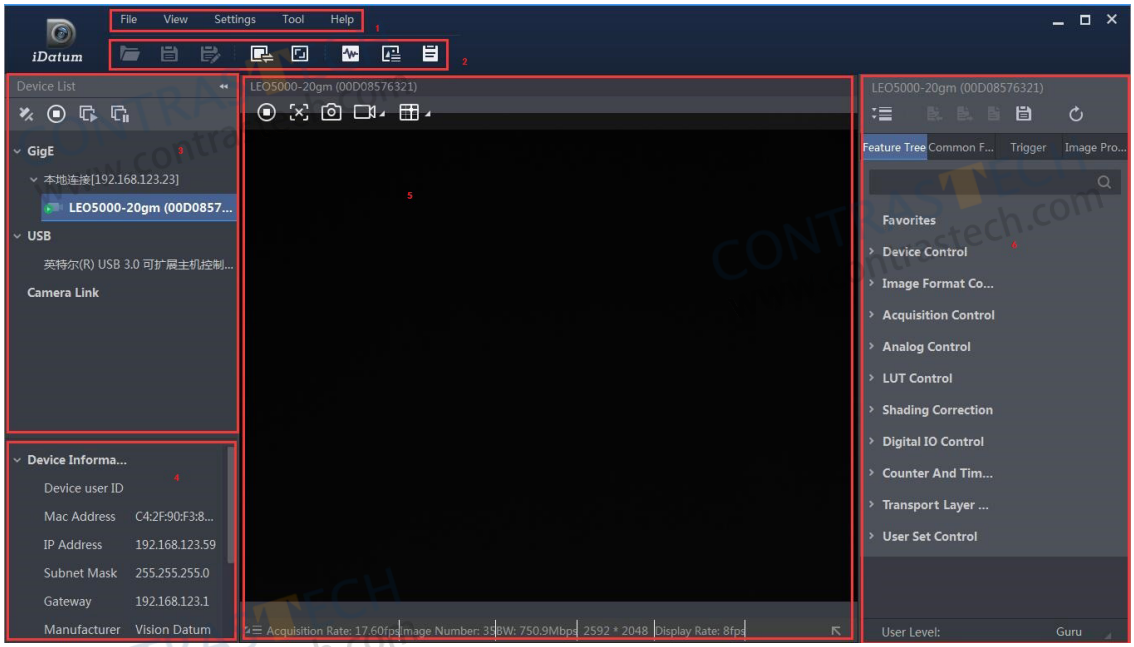
Software Operation

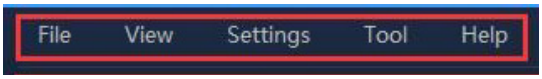
Main interface

For specific main window of the client software, please refer to the actual one you got.



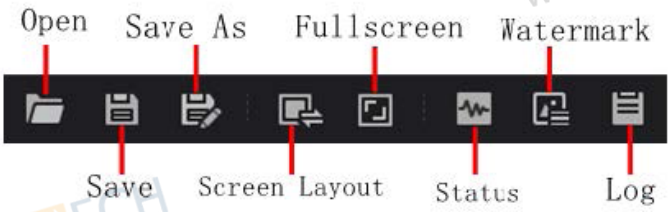
Menu Bar

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

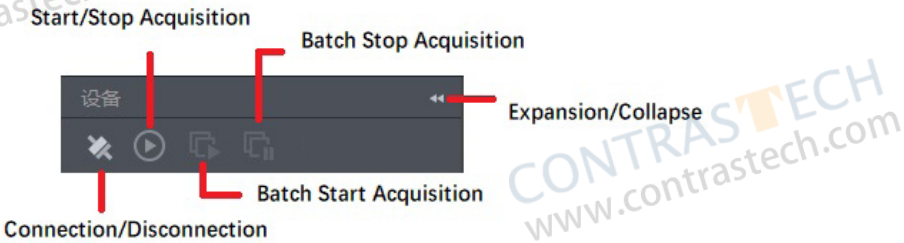


Control Toolbar

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.



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.

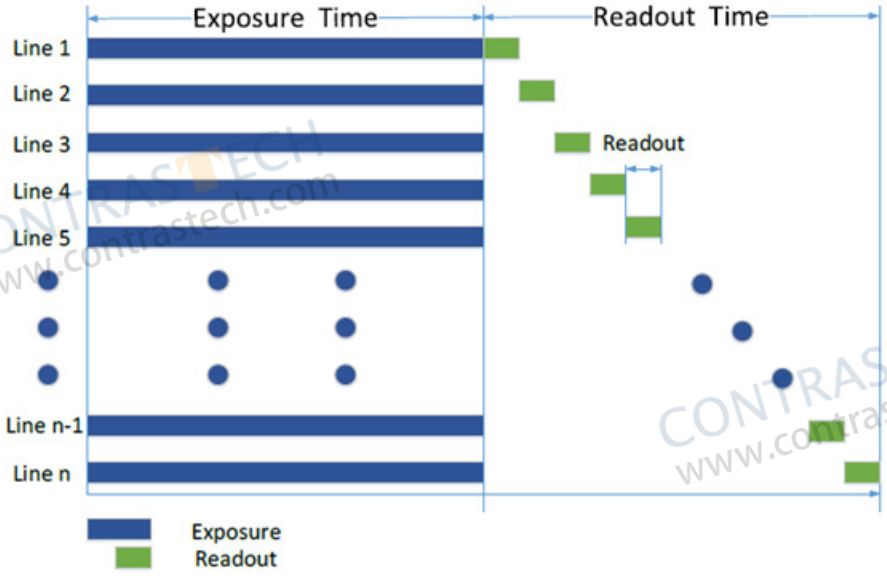
■ Expansion/Collapse: This function can be used to expand or collapse the Device List and Device Information which list on the left side of iDatum, and the default state is expansion. In the"Collapse"state, the iDatum left side only display the searched cameras.

CHAPTER 4 CAMERA FEATURES

Shutter

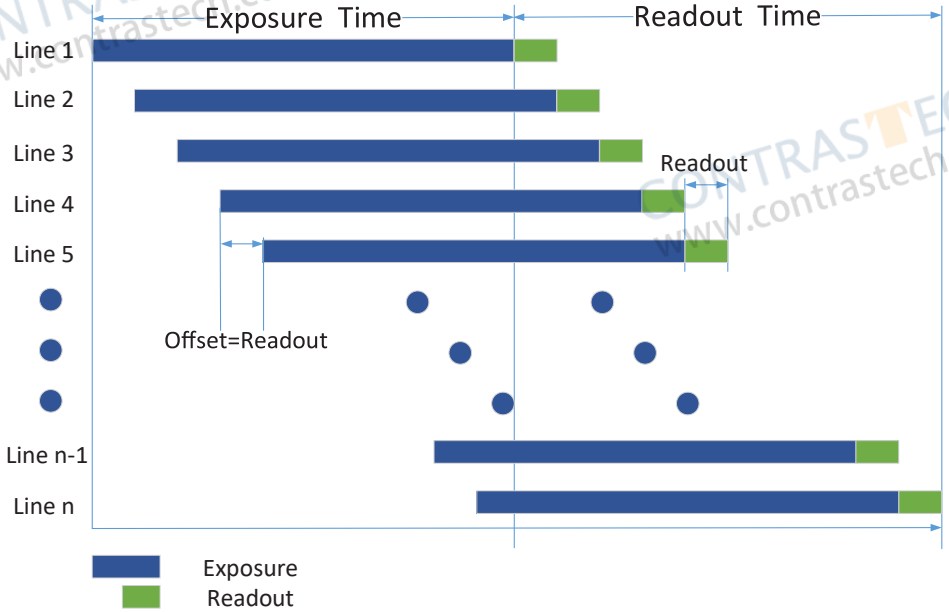
Global Shutter

For camera that supports global shutter, its exposure starts and ends in each line simultaneously. After the exposure, data readout starts line by line. All pixels expose at the same time, then readout at different time, as shown below.



Rolling Shutter

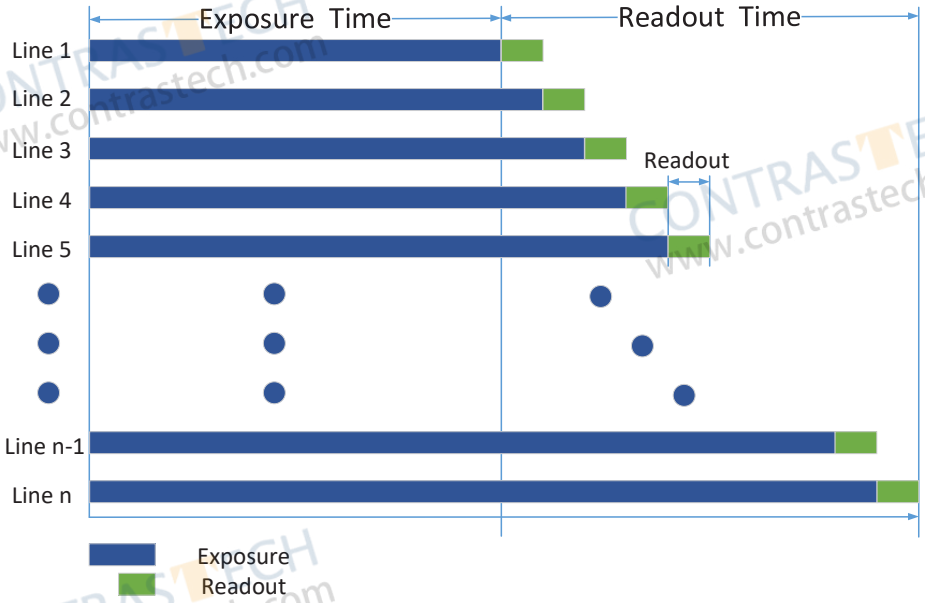
For cameras that support rolling shutter, after the first line of exposure starts, and the next line starts to exposure after the time interval, and so on, and the exposure time of each line is the same. After the exposure of each line ends, the camera will immediately read out the data, and the readout time for each line is readout, as shown below.



Shutter

Global Reset

Only some models of cameras with rolling shutter support the Global Reset function.Global reset means that all of the sensor's pixels start exposing at the same time, but stop exposing at different time.



When you need to use the Global Reset function, You can go to Acquisition Control > Sensor Shutter Mode, and select Sensor Shutter Mode to Global Reset.

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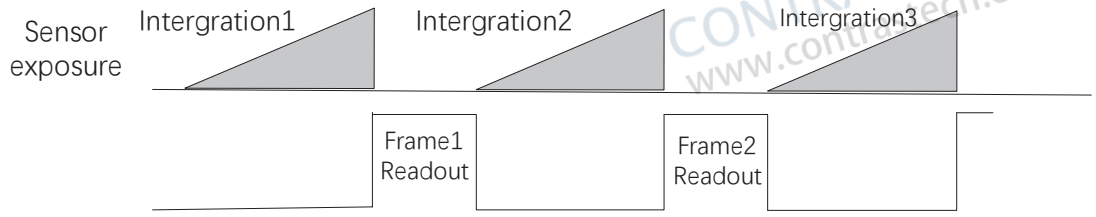
Non-Overlap Exposure and Overlap Exposure

The process that camera captures one frame of image includes two stages, exposure and readout. According to the overlap relation between the exposure time and the readout time, cameras with different sensors can be divided into overlap exposure and non-overlap exposure. Compared with non-overlap exposure, overlap exposure can reduce the influence of exposure time on grabbing time.

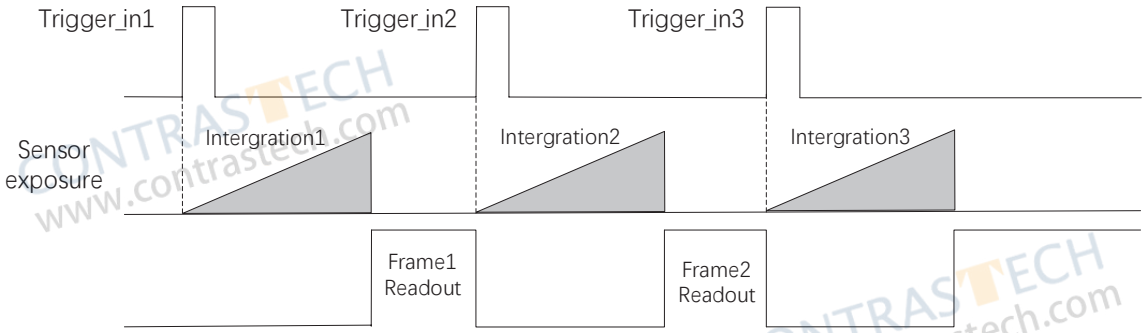
The products mentioned in this manual use overlap exposure to process image data.

Non-Overlap Exposure

After completing the current frame's exposure and readout, the next frame starts to expose and read out. This process is called non-overlap exposure. The non-overlap exposure's frame period is larger than the sum of the exposure time and the readout time, as shown below.



Internal Trigger Non-Overlap Exposure



External Trigger Non-Overlap Exposure

The camera will ignore the external signal in the readout section under this mode.

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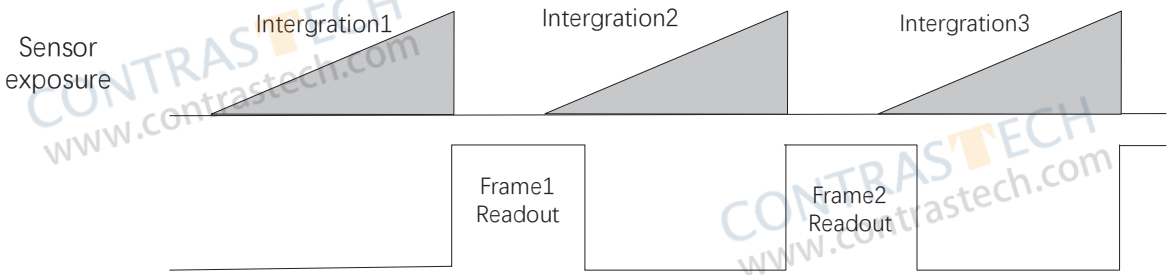
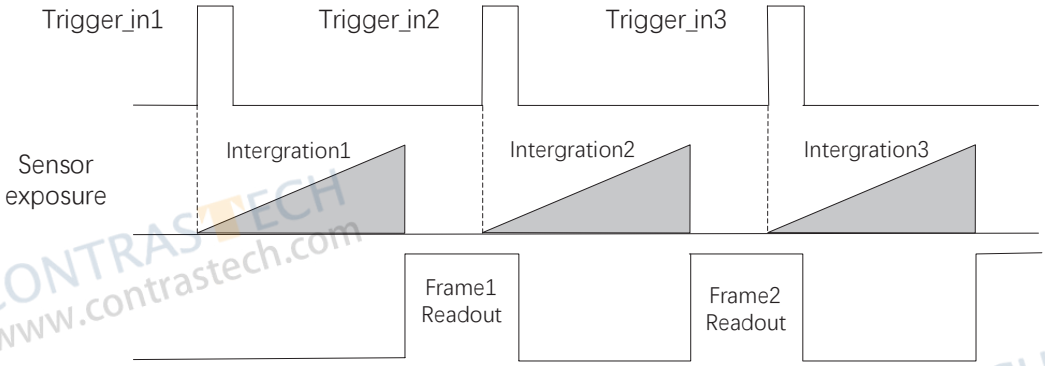
Non-Overlap Exposure and Overlap Exposure

Overlap Exposure

Overlap exposure refers to the overlap between the current frame exposure and the previous frame readout. In other words, when the previous frame starts to read out, the current frame starts to expose simultaneously, as shown below.



Internal Trigger Overlap Exposure



External Trigger Overlap Exposure

The camera will ignore the external signal in the readout section under this mode.

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CHAPTER 5 IMAGE ACQUISITION

Frame Rate

Frame rate refers to the image number that is acquired by the camera per second. The higher frame rate, and shorter time used for image acquisition will be.

The following 4 factors determines the camera's frame rate in real-time.

■ Frame readout time: The frame readout time is related with camera's sensor performance and image height. The lower the image height and less the frame readout time, and the higher the frame rate will be.

■ Exposure time: If the reciprocal of max frame rate that the camera supports is t, and when the configured exposure time is larger than t, the less the exposure time, the higher the frame rate will be. When the configured exposure time is less than or equal to t, exposure time will not influence the frame rate.

■ Bandwidth: The larger the bandwidth, the higher the frame rate will be.

■ Pixel format: The more bytes pixel format occupy, the lower the frame rate will be.

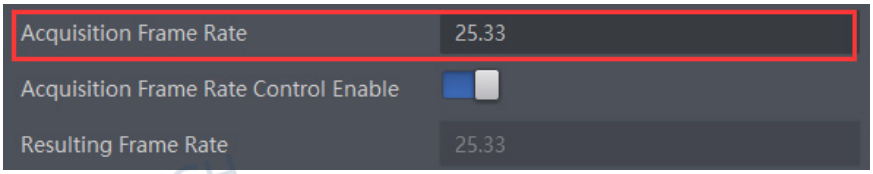
The camera can also manually control the real-time frame rate.

The specific steps are as follows:

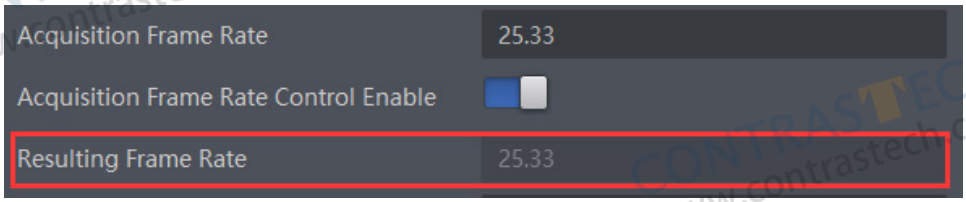
Click Acquisition Control > Acquisition Frame Rate, enter Acquisition Frame Rate according to actual demands, and enable Acquisition Frame Rate Control Enable.

_If the current real-time frame rate is smaller than configured frame rate, the camera acquires images according to the real-time frame rate.

_If the current real-time frame rate is larger than configured frame rate, the camera acquires images according to the configured frame rate.

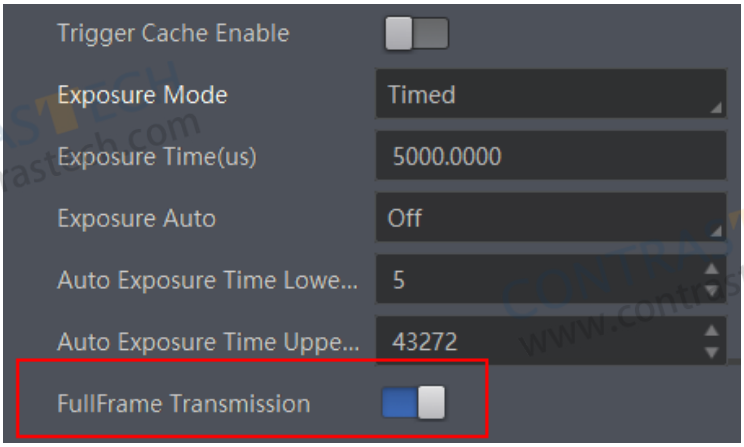


3.You can refer to Resulting Frame Rate to view the camera's resulting frame rate.



FullFrame Trasmission

The FullFrame function ensures the integrity of a frame and can be enabled by enabling the FullFrame Trasmission parameter under the Acquisition Control property.

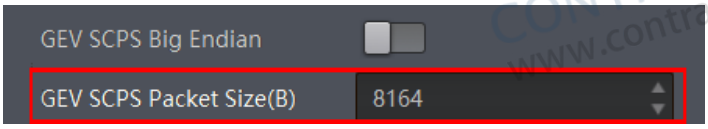


- When the FullFrame function is enabled, the current frame will be output in its entirety when acquisition is started or stopped;
- When the FullFrame function is disabled, the current frame will be truncated and the unoutputted part will be discarded when the acquisition is started or stopped.

i	The FullFrame function may differ by camera models.

Packet Size

Packet Size is the network packet size, in bytes, in which the imager transmits flow channel data to the host side. This includes the IP header, UDP header, and GVSP header totaling 36 bytes in length, so by default the payload in a flow channel network packet is 1464 bytes. This can be set using the GEV SCPS Packet Size(B) under the Transport Layer Control property, as shown below, and is recommended to be set to 8164 bytes to improve network transmission performance.

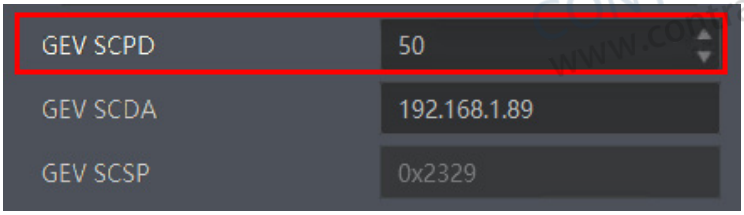


i	• For settings greater than 1500 packet size, network devices such as network cards and switches are required to support jumbo frames. • When changing the packet size, the packet size and packet spacing parameters will jointly affect the network transmission performance.

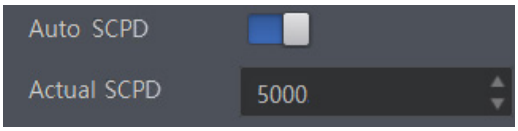
GEV SCPD

GEV SCPD is used to control the bandwidth used by the camera to transmit image stream data.GEV SCPD is the number of idle clocks inserted between neighboring network packets transmitted in the stream channel. Increasing the GEV SCPD reduces the camera's usage of network bandwidth and potentially reduces the camera frame rate.

The camera's GEV SCPD can be set using GEV SCPD under the Transport Layer Control property, as shown below.



The SCPD value can also be adjusted automatically to optimize the data transmission process by turning on Auto SCPD enable, when the Actual SCPD parameter shows the actual SCPD value of the device.



Trigger Mode

The camera has 2 types of trigger mode, including internal trigger mode and external trigger mode.

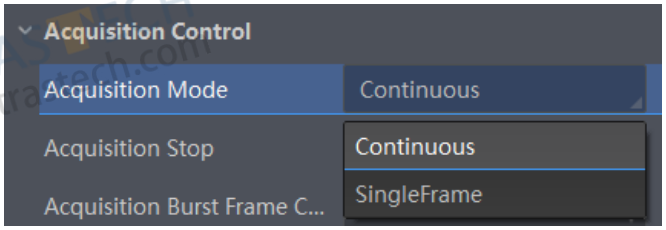
Internal trigger mode(acquisition modes), including SingleFrame mode and Continuous mode;external trigger mode, including software trigger, hardware trigger.

Trigger Mode	Parameter	Parameter Value	Principle
Internal trigger mode	Acquisition Control > Trigger Mode	Off	The camera acquires images via its internal signals.
External trigger mode		On	The camera acquires images via external signals. These signals can be software signal and hardware signal, including software trigger, hardware trigger, counter trigger, etc..

■ Internal trigger mode

Their principle and parameter setting are shown below.

Internal trigger mode	Parameter	Parameter Value	Principle
SingleFrame mode	Acquisition Control > Acquisition Mode	SingleFrame	When camera starts image acquisition, it acquires one image only, and then stops.
Continuous mode		Continuous	When camera starts image acquisition, it acquires images continuously. Real-time frame rate decides the acquisition frame number per second. You can stop camera image acquisition manually.



■ External trigger mode

The external trigger signals types of trigger camera acquisition can be given by software or external device. Under external trigger signal mode, the camera output image via following several working modes: SingleFrame Trigger mode, Burst Trigger mode and Long Exposure Trigger mode.

■ External Trigger Source

There are 4 types of external trigger sources, including software trigger, hardware trigger, counter trigger and anyway.

Their principle and parameter setting are shown below.

External trigger mode	Parameter	Parameter Value	Principle
Software Trigger	Acquisition Control >Trigger Source	Software	The software sends trigger signal to the camera via GigE interface to acquire images.
Hardware Trigger		Line 0 / Line 2	External device connects camera via camera I/O interface. External device sends trigger signal to camera to acquire images.
Counter Trigger		Counter 0	The counter sends trigger signal to the camera to acquire images.
Action Command Trigger		Action 1	This trigger source is used in the PTP function, see the Action Command section.
Software Trigger, Hardware Trigger and Counter		Anyway	Use software trigger, hardware trigger, counter or action command to send trigger signal to the camera to acquire images.

i	These 5 external trigger sources are valid only when the Trigger Mode is On

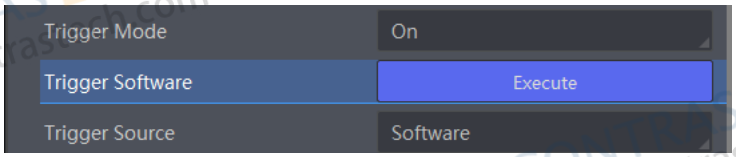
Trigger Mode

■ Software Trigger

For the camera support software trigger mode, when user set software trigger, the client software can send commands to camera to acquires and transfer images via Gigabit Ethernet.

1.Click Acquisition Control > Trigger Mode, and select On as Trigger Mode.

2.Select Software as Trigger Source, and click Execute in Trigger Software to send trigger commands.



■ Hardware Trigger

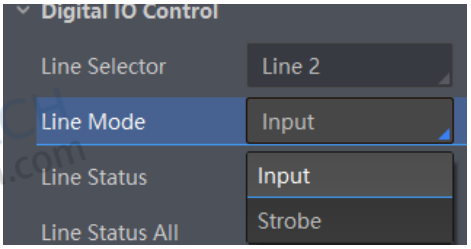
If set"Hardware"as"Trigger Source"can switched to hardware external trigger mode.

The camera has 1 Opto-isolated input (Line 0), and 1 bi-directional I/O (Line 2) that can be configured as input signal,

The setting of Line 2 as input signal is as shown below:

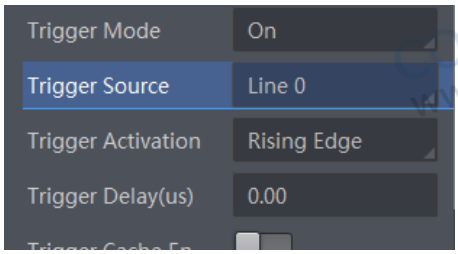
1.Click Digital IO Control.

2.Select Line 2 as Line Selector, and Input as Line Mode to set line 2 as input signal.



3.Click Acquisition Control, select On as Trigger Mode, select Line 0 or Line 2 as Trigger Source.as shown in the figure below.

The command to trigger the photo is given to the camera by the external device.



i	For details about the electrical characteristics and wiring of the IO interface, please refer to Chapter 6 I/O Electrical Characteristics and Wiring.

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Trigger Mode

■ Counter Trigger

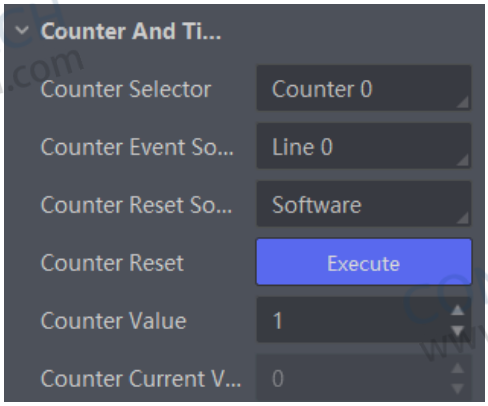
The counter trigger provides frequency division to the external trigger signal. The camera performs an external trigger after receiving multiple hardware trigger signals.

1. Click Acquisition Control > Trigger Mode, and select On as Trigger Mode.
2. Select Counter 0 as Trigger Source.

When using counter as trigger source, you need to set relevant parameters under Counter And Timer Control.

For specific parameter function and setting, please refer to the following table.

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. Line 0 and Line 2 are available. It is disabled by default.
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 1023. For example, if the parameter is set to n, then the trigger signal n times can execute the counter trigger once to obtain 1 frame of image.
Counter Current Value	Read only	It displays the number of executed external trigger.



■ Anyway Trigger

In the free trigger mode, the camera can receive signals from software trigger, hardware trigger, action command trigger, and counter trigger.

1.Click Acquisition Control > Trigger Mode, and select On as Trigger Mode.

2.Select Anyway as Trigger Source.

Trigger Mode

■ Trigger Related Parameters

Under external trigger mode, you can set burst frame count, trigger delay, trigger cache enable, trigger activation and trigger debouncer. Different trigger sources can set various trigger parameters, and their relation is shown below.

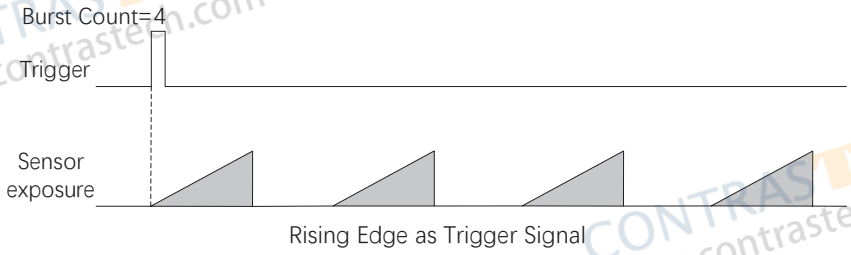
Trigger Source / Trigger Parameter	Software Trigger	Hardware Trigger	Counter Trigger	Anyway Trigger
Burst Frame Count	√	√	√	√
Trigger Delay	√	√	√	√
Trigger Cache Enable	√	√	√	√
Trigger Activation	×	√	√	√
Trigger Debouncer	×	√	√	√

■ Burst Frame Count

Under external trigger mode, you can set burst frame count as shown below.

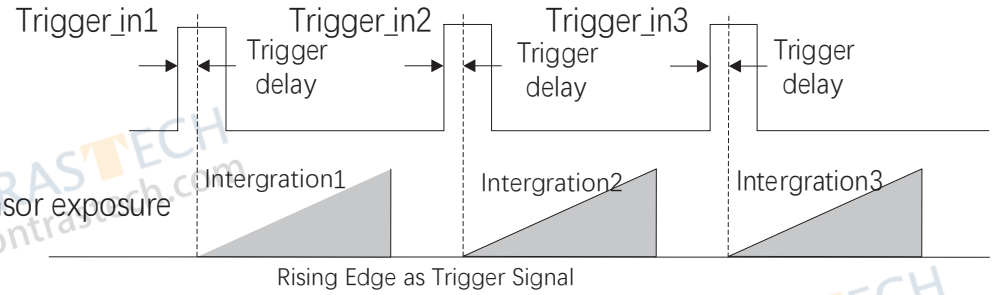
Click Acquisition Control > Acquisition Burst Frame Count, and enter Acquisition Burst Frame Count according to actual demands. Its range is from 1 to 1023.

When Acquisition Burst Frame Count is 1, it is in single frame trigger mode. When 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.

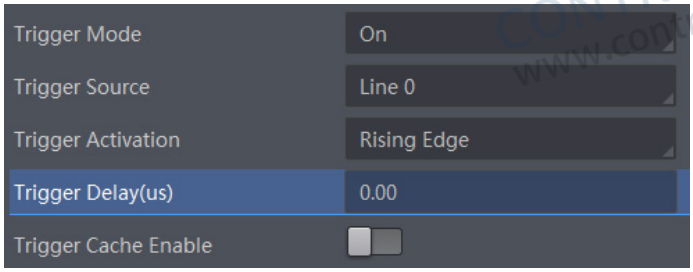


■ Trigger Delay

From camera receiving signal and responding, this period is trigger delay. Its sequence diagram is shown below.



You can set proper value in Trigger Delay, and its range is from 0 μs to 16000000 μs.

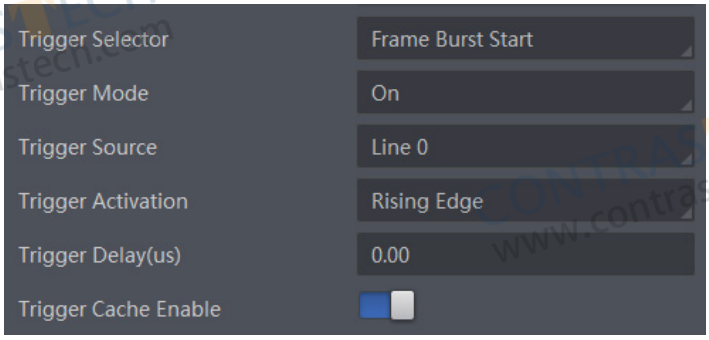


Trigger Mode

■ Trigger Cache Enable

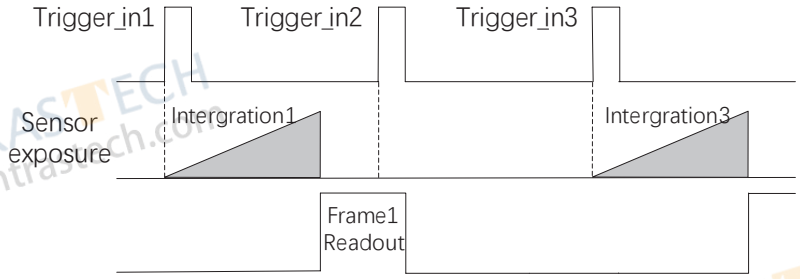
The camera has the function of Trigger Cache Enable. During the triggering process, if the camera receives new trigger signal, it will save and process the signal if you enable this function. Trigger cache enable can save up to 2 trigger signals.

Click Acquisition Control > Trigger Cache Enable, and enable Trigger Cache Enable.



If the camera receives the 1st trigger signal first, and the camera receives the 2nd trigger signal during processing the 1st trigger signal.

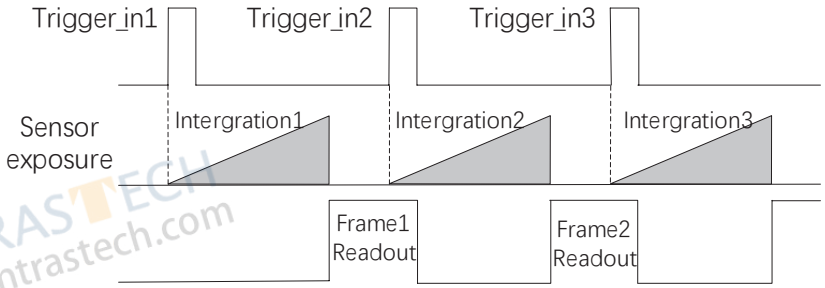
- Disable Trigger Cache Enable: the 2nd trigger signal will be filtered without processing.



Rising Edge as Trigger Signal

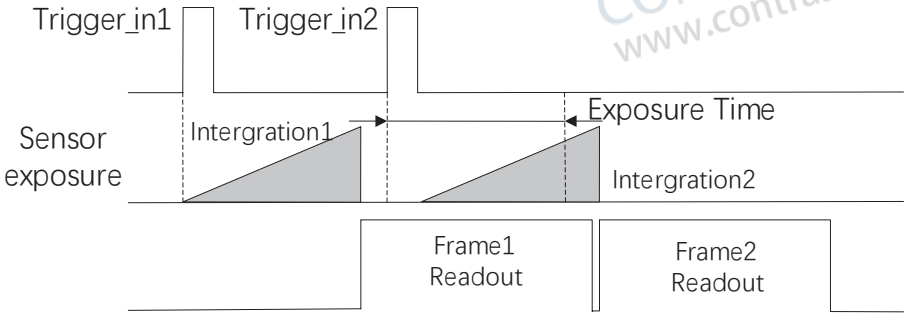
- Enable Trigger Cache Enable: the 2nd trigger signal will be saved.

_ 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.



Rising Edge as Trigger Signal

_ 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.



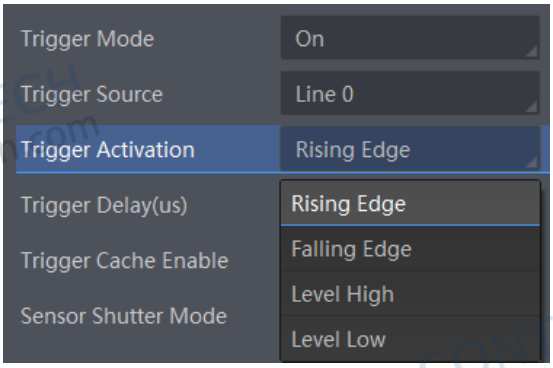
Rising Edge as Trigger Signal

Trigger Mode

■ Trigger Activation

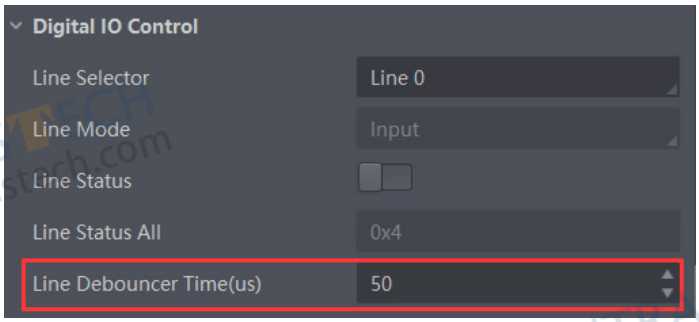
The camera supports trigger acquisition in the rising edge, falling edge, level high, or level low of the external signal. The principle and parameter of trigger activation are shown below.

Trigger Activation	Parameter	Parameter Value	Principle
Rising Edge	Acquisition Control > Trigger Activation	Rising Edge	Rising Edge refers to the rising edge of the trigger signal is valid, that is camera exposure and acquisition at the beginning of the rising edge of the trigger signal.
Falling Edge		Falling Edge	Falling Edge refers to the falling edge of the trigger signal is valid, that is camera exposure and acquisition at the beginning of the falling edge of the trigger signal.
Level High		Level High	Level High refers to the level high of the trigger signal is valid. As long as trigger signal is in level high, the camera keeps exposure and acquisition status.
Level Low		Level Low	Level Low refers to the level low of the trigger signal is valid. As long as trigger signal is in level low, the camera keeps exposure and acquisition status.
Any Edge		Any Edge	Any Edge refers to the Any Edge of the trigger signal is valid. As long as trigger signal is in Any Edge, the camera starts acquisition.

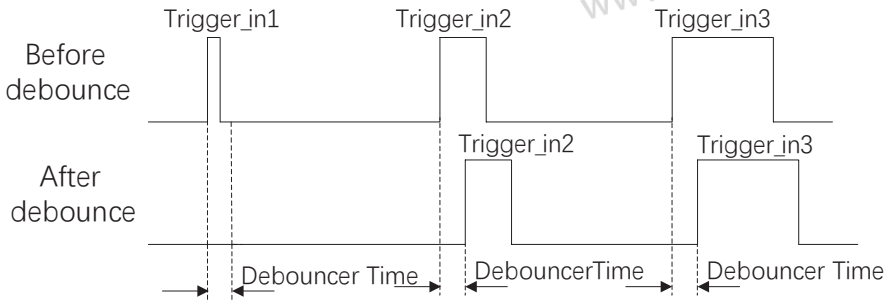


■ Trigger Debouncer

The external trigger input signal of the camera may have signal bounce that may cause false trigger. Thus, it is necessary to debounce the external trigger signal, and its sequence diagram is shown below. Click Digital IO Control > Line Debouncer Time, enter Line Debouncer Time, and its range is from 1 μs to 1000000 μs.



When the set Debouncer time is greater than the trigger signal time, the trigger signal is ignored.



Rising Edge as Trigger Signal

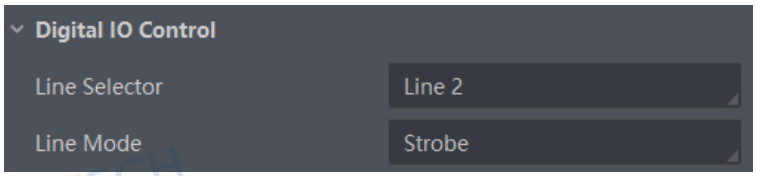
CHAPTER 6 I/O OUTPUT

Select Output Signal

The camera has 1 opto-isolated output (Line 1), and 1 bi-directional I/O (Line 2) that can be configured as output signal.

Here we take Line 2 as an example.

Click Digital IO Control, select Line 2 as Line Selector, and select Strobe as Line Mode to set line 2 as output signal.



For details about the electrical characteristics and wiring of the IO interface, please refer to Chapter 7 I/O Electrical Characteristics and Wiring.

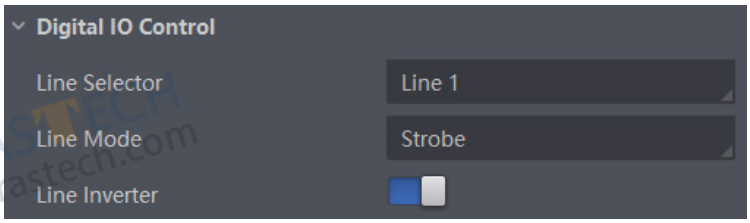
Set Output Signal

The output signal of the camera is switch signal that can be used to control external devices such as light source, PLC, etc.

Enable Level Inverter

The line inverter function allows the camera to invert the electrical signal level of an I/O line, and meets requirements of different devices for high or low electrical signal level. All high signals are converted to low signals and vice versa.

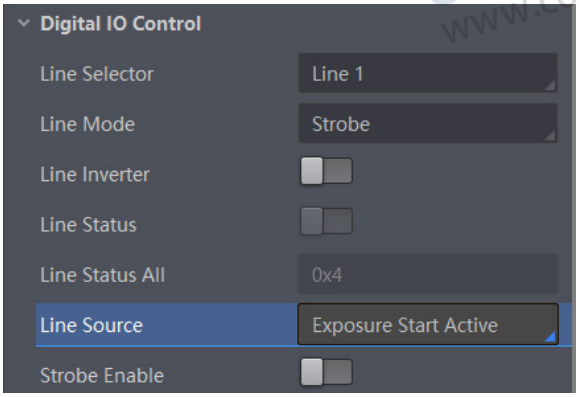
Click Digital IO Control > Line Selector, select line for Line Selector, and enable Line Inverter. The Line Inverter parameter is disabled by default.



Enable Strobe Signal

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

Click Digital IO Control, select different output events as Line Source, and enable Strobe Enable.

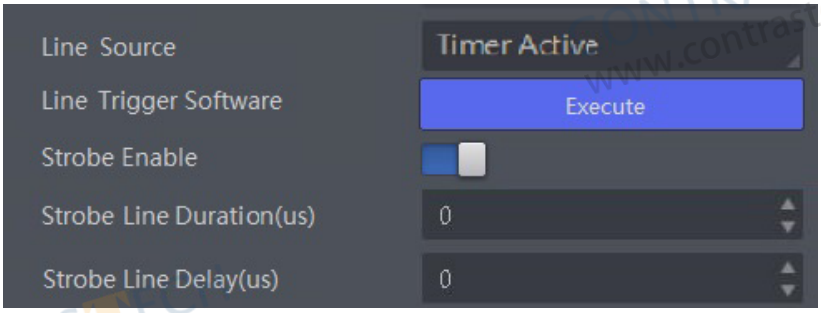


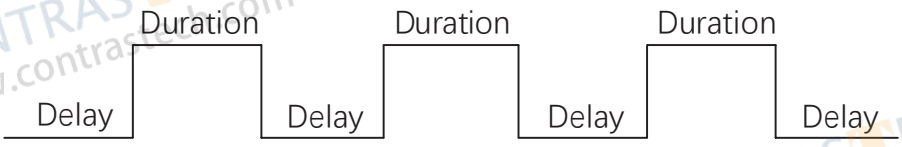
Set Output Signal

For specific Line Source, please refer to following table for details.

Name	Description
Exposure Start Active	It refers to output one I/O edge signal when starting exposure.
Acquisition Start Active	It refers to output one I/O edge signal when starting acquisition.
Acquisition Stop Active	It refers to output one I/O edge signal when stopping acquisition.
Frame Burst Start Active	It refers to output one I/O edge signal when starting triggering and acquiring images under Burst mode.
Frame Burst End Active	It refers to output one I/O edge signal when stopping triggering and acquiring images under Burst mode.
Soft Trigger Active	It refers to output one I/O edge signal when software trigger acquisition.
Hard Trigger Active	It refers to output one I/O edge signal when hardware trigger acquisition.
Counter Active	It refers to output one I/O edge signal when counter output is enabled.
Timer Active	It refers to output one I/O edge signal when timer output is enabled.
Exposure End Active	It refers to output one I/O edge signal when camera exposure is stop.
Frame Trigger Wait	It refers to responds to one I/O edge signal when timer output is enabled. Avoid excessive triggering when the camera trigger frequency is too high.
Frame Start Active	It refers to output one I/O edge signal when the camera starts grabbing a single frame.
Frame End Active	It refers to output one I/O edge signal when the camera stops grabbing a single frame.

Select Line Source as Timer Active. After the Line Trigger Software parameter is executed, the camera will output a signal of Strobe Line Duration every time the Strobe line Delay is set.





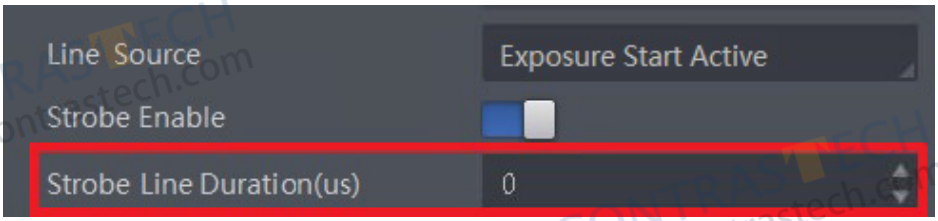
Regarding strobe signal, you can also set its duration, delay and pre delay.

■ The specific line source may differ by camera models.
■ 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.

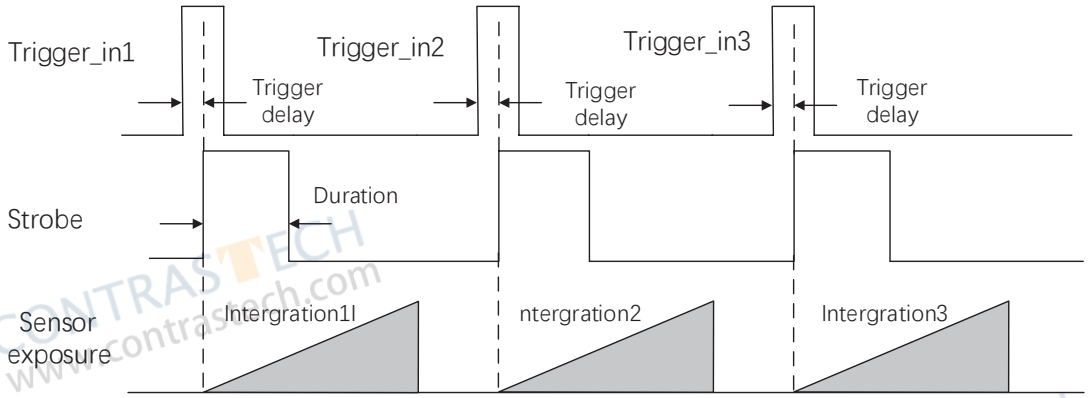
Set Output Signal

Strobe Line Duration

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



For example, select Line Source as Exposure Start Active. When the camera starts to expose, Strobe outputs immediately.
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.

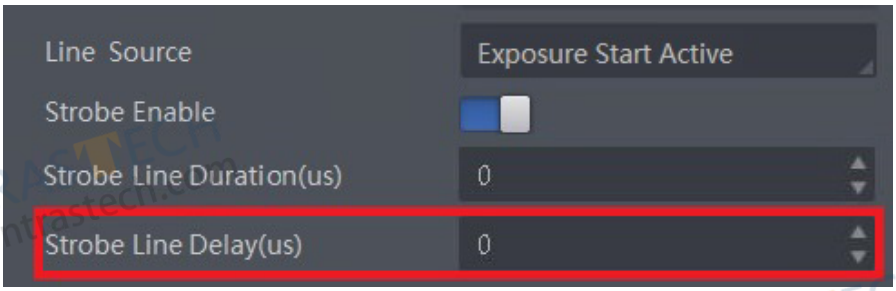


Strobe Line Delay

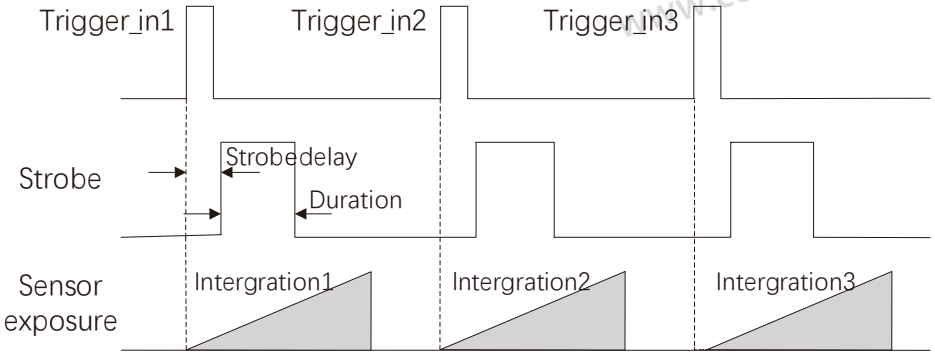
The camera supports setting strobe line delay to meet actual demands. When exposure starts, the strobe output doesn't take effect immediately. Instead, the strobe output will delay according to the strobe line delay setting.

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

The unit is μs and the range is 0~10000, that is, 0~10 ms.



For example, select Line Source as Exposure Start Active.
When the camera starts to expose, the Strobe output does not take effect immediately, but delays the output according to the value set by Strobe Line Delay. The sequence diagram of strobe line delay is shown below.

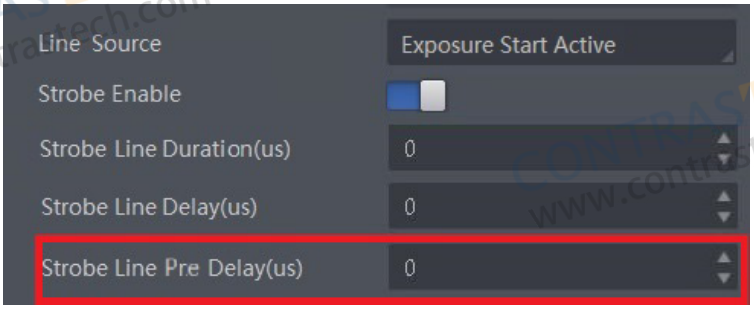


Set Output Signal

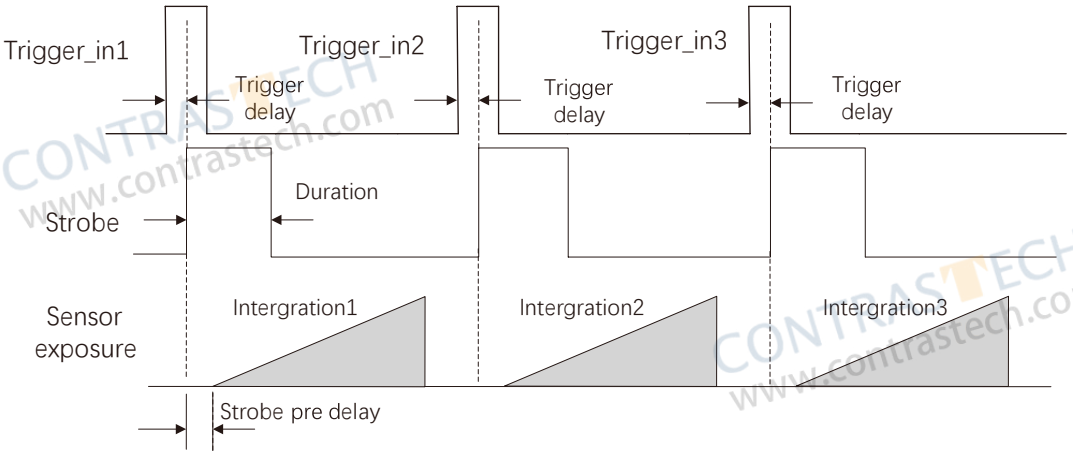
Strobe Line Pre Delay

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 unit is μs and the range is 0~5000, that is, 0~5 ms.



For example, select Line Source as Exposure Start Active.
The camera will delay the exposure according to the value set by Strobe Line Pre Delay.The sequence diagram of strobe line pre delay is shown below.



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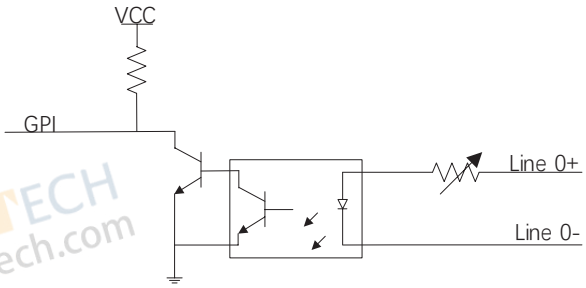
CHAPTER 7 I/O ELECTRICAL FEATURE AND WIRING

I/O Electrical Feature

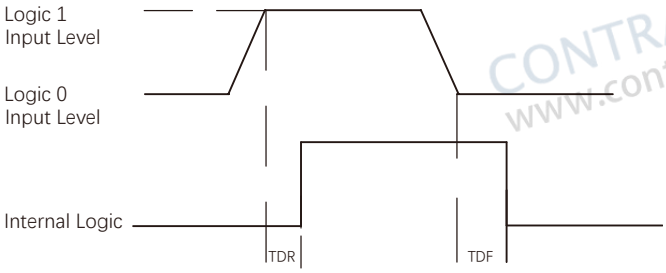
■ Line 0 Opto-isolated Input Circuit

The Line 0 opto-isolated input circuit in camera I/O control is shown below.



The maximum input current of Line 0 is 25 mA.

Input Logic Level:



When the external voltage is 12 VDC and the external pull-up resistor is 1 KΩ, the electrical features of opto-isolated input is shown below.

Parameter Name	Parameter Symbol	Value
Input Logic Level Low	VL	0 ~ 1 VDC
Input Logic Level High	VH	3.3 ~ 24 VDC
Input Rising Delay	TDR	1.28 ~ 2.04 μs
Input Falling Delay	TDF	25.6 ~ 28 μs

When the external voltage is 24 VDC and the external pull-up resistor is 4.7 KΩ, the electrical features of opto-isolated input is shown below.

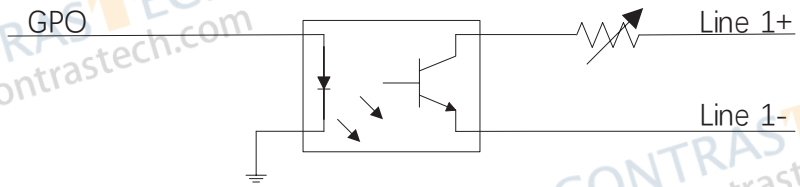
Parameter Name	Parameter Symbol	Value
Input Logic Level Low	VL	0 ~ 1 VDC
Input Logic Level High	VH	3.3 ~ 24 VDC
Input Rising Delay	TDR	2.32 ~ 3.08 μs
Input Falling Delay	TDF	22.6 ~ 27.2 μs

■ Make sure the input voltage is not from 1 VDC to 3.3 VDC as the electric status between these two values are not stable.
■ The breakdown voltage is 30 VDC, and keep voltage stable.

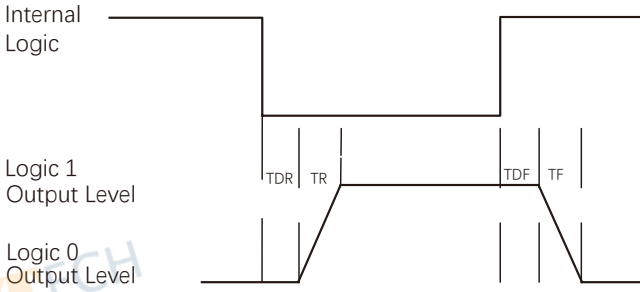
I/O Electrical Feature

Line 1 Opto-isolated Output Circuit

The Line 1 opto-isolated output circuit in camera I/O control is shown below.



The maximum input current of Line1 is 25 mA.
Output Logic Level:



When the external voltage is 12 VDC and the external pull-up resistor is 1 KΩ, the electrical features of opto-isolated input is shown below.

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	1.1 ~1.46 V
Output Logic Level High	VH	2.54 ~ 11.3 V
Output Rising Time	TR	17.6 ~ 104 μs
Output Falling Time	TF	0.4 ~ 2 μs
Output Rising Delay	TDR	26.8 ~ 72 μs
Output Falling Delay	TDF	0.44 ~ 1.92 μs

When the external voltage is 24 VDC and the external pull-up resistor is 4.7 KΩ, the electrical features of opto-isolated input is shown below.

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	0 ~ 1.3 V
Output Logic Level High	VH	2.26 ~ 22.4 V
Output Rising Time	TR	21.6 ~ 144 μs
Output Falling Time	TF	0.4 ~ 1.6 μs
Output Rising Delay	TDR	22.4 ~ 96 μs
Output Falling Delay	TDF	0.44 ~ 1.12 μs

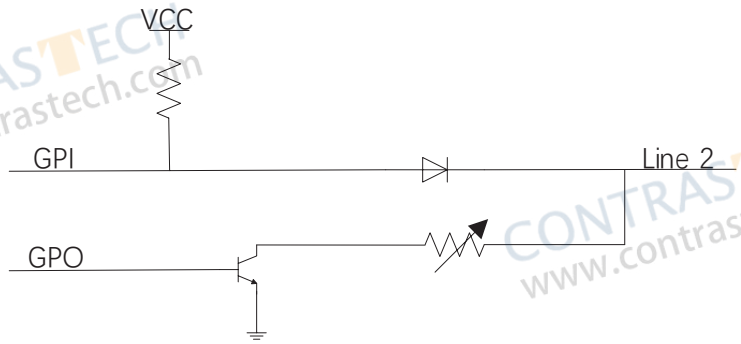
With different external voltage and resistance, the corresponding current and the parameter of output logic level low are shown below.

External Voltage	External Resistance	VL	Output Current
3.3 V	1 KΩ	575 mV	2.7 mA
5 V	1 KΩ	840 mV	4.1 mA
12 V	2.4 KΩ	915 mV	4.6 mA
24 V	4.7 KΩ	975 mV	4.9 mA

I/O Electrical Feature

Line 2 Bi-direction I/O Circuit

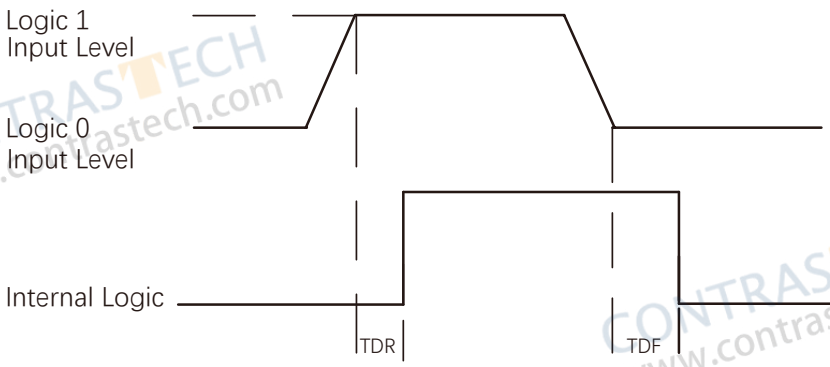
The Line 2 bi-direction I/O circuit in camera I/O control is shown below. The Line 2 can be configured as input signal or as output signal.



Line 2 Configured as Input

With the condition of 100 Ω and 5 VDC, the logic level and electrical feature of configuring Line 2 as output are shown below.

Input Logic Level:



When the external voltage is 12 VDC and the external pull-up resistor is 1 KΩ, the electrical features of input is shown below.

Parameter Name	Parameter Symbol	Value
Input Logic Level Low	VL	0 ~ 0.5 VDC
Input Logic Level High	VH	3.3 ~ 24 VDC
Input Rising Time	TDR	1.28 ~ 2.04 μs
Input Falling Time	TDF	25.6 ~ 28 μs

When the external voltage is 24 VDC and the external pull-up resistor is 4.7 KΩ, the electrical features of input is shown below.

Parameter Name	Parameter Symbol	Value
Input Logic Level Low	VL	0 ~ 1 VDC
Input Logic Level High	VH	3.3 ~ 24 VDC
Input Rising Time	TDR	2.32 ~ 3.08 μs
Input Falling Time	TDF	22.6 ~ 27.2 μs

- Make sure the input voltage is not from 0.3 VDC to 3.3 VDC as the electric status between these two values are not stable.
- The breakdown voltage is 30 VDC, and keep voltage stable.
- To prevent damage to the GPIO pin, please connect GND first and then input voltage in Line 2.

I/O Electrical Feature

Line 2 Configured as Output

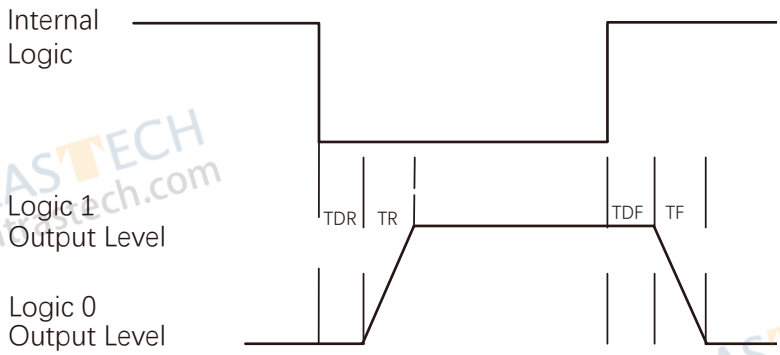
The maximum current is 25 mA and the output impedance is 40 Ω.

The relation among external voltage, resistance and the output level low is shown below.

External Voltage	External Resistance	VL (GPIO2)
3.3 V	1 KΩ	160 mV
5 V	1 KΩ	220 mV
12 V	1 KΩ	460 mV
24 V	1 KΩ	860 mV
30 V	1 KΩ	970 mV

When the voltage of external resistance (1 KΩ) is pulled up to 5 VDC, the logic level and electrical feature of configuring Line 2 as output are shown below.

Output Logic Level:



When the external voltage is 12 VDC and the external pull-up resistor is 1 KΩ, the electrical features of output is shown below.

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	0 V
Output Logic Level High	VH	7.8 ~ 11.8 V
Output Rising Time	TR	0.46 ~ 0.9 μs
Output Falling Time	TF	42 ~ 70 ns
Output Rising Delay	TDR	500 ~ 600 ns
Output Falling Delay	TDF	24 ~ 42 ns

When the external voltage is 24 VDC and the external pull-up resistor is 4.7 KΩ, the electrical features of output is shown below.

Parameter Name	Parameter Symbol	Value
Output Logic Level Low	VL	0 ~ 0.2 V
Output Logic Level High	VH	5 ~ 23.2 V
Output Rising Time	TR	0.44 ~ 4.48 μs
Output Falling Time	TF	34 ~ 88 ns
Output Rising Delay	TDR	0.54 ~ 1.52 ns
Output Falling Delay	TDF	34 ~ 232 ns

I/O Wiring

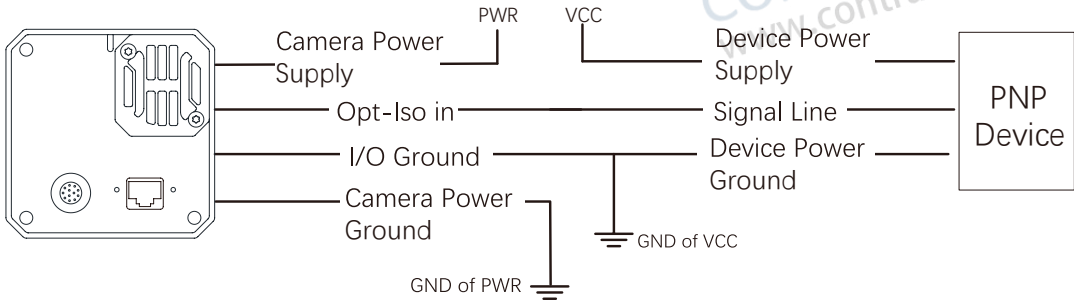
The camera has different appearance with varied models. Here we take type with Fan camera as an example to introduce I/O wiring. Other cameras can be analogized according to the cable definition in the wiring diagram, combined with the power supply and I/O interface definition chapter in Chapter 2.

i	For specific camera appearance, cable color and I/O wiring, please refer to the actual one you got.

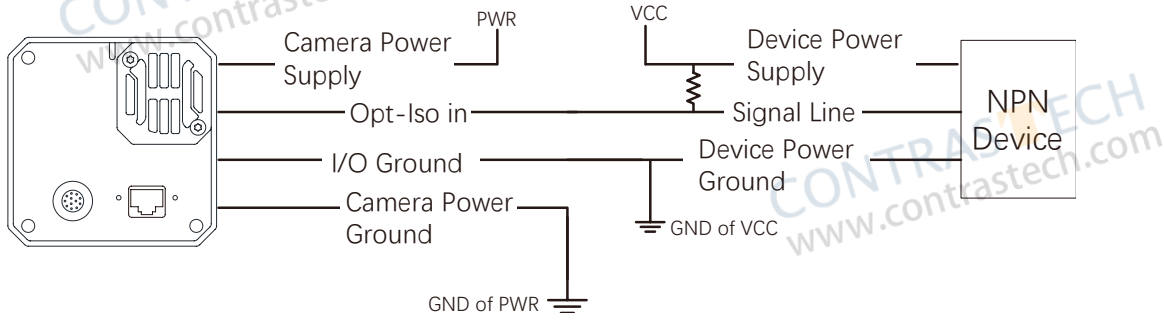
Line 0 Wiring

When the camera uses Line 0 as hardware trigger source, wirings are different with different external devices of input signal.

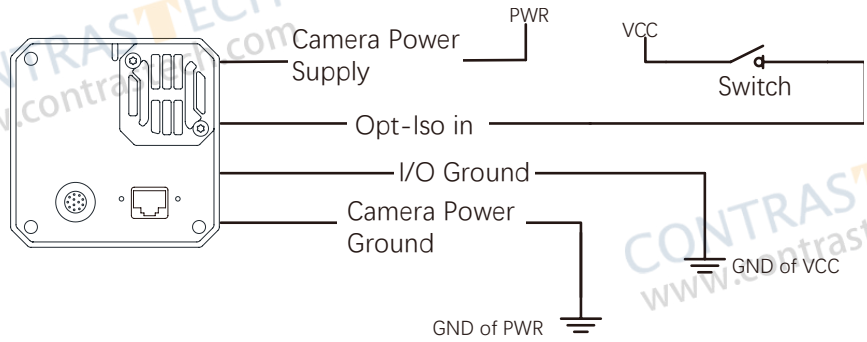
The input signal is PNP Device, that is, Line 0 Connecting to PNP Device:



The input signal is NPN Device, that is, Line 0 Connecting to NPN Device:
_If the VCC of NPN device is 24 VDC, it is recommended to use a 4.7 KΩ pull-up resistor.
_If the VCC of NPN device is 12 VDC, it is recommended to use a 1 KΩ pull-up resistor.



The input signal is Switch, that is, Line 0 Connecting to Switch:
If the VCC of switch is 24 VDC, it is recommended to connect a 4.7 KΩ resistor in series with the switch to protect circuit.

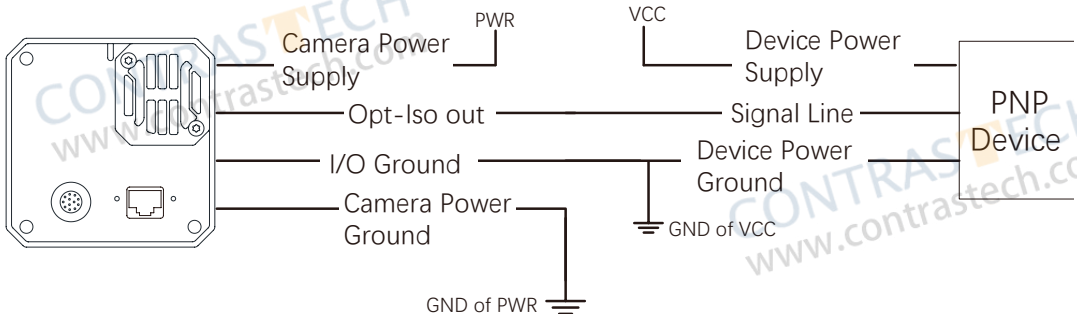


I/O Wiring

Line 1 Wiring

When the camera uses Line 1 as output signal, wirings are different with different external devices.

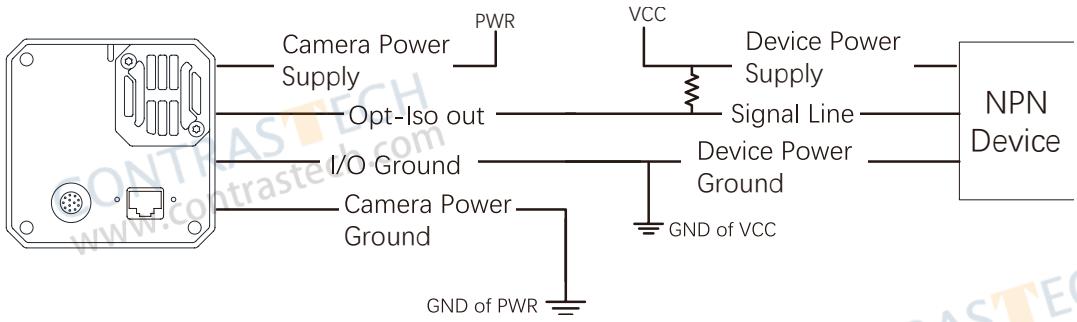
The external devices is PNP Device, that is, Line 1 Connecting to PNP Device:



The external devices is NPN Device, that is, Line 1 Connecting to NPN Device:

_If the VCC of NPN device is 24 VDC, it is recommended to use a 4.7 KΩ pull-up resistor.

_If the VCC of NPN device is 12 VDC, it is recommended to use a 1 KΩ pull-up resistor.



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I/O Wiring

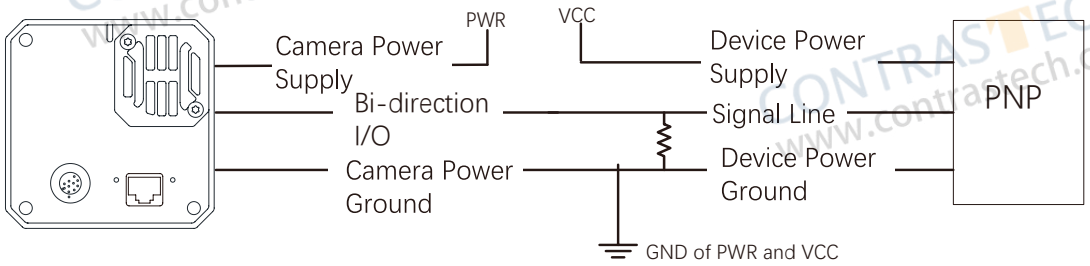
Line 2 Wiring

As bi-direction I/O Circuit, Line 2 can be used as both input signal and output signal.

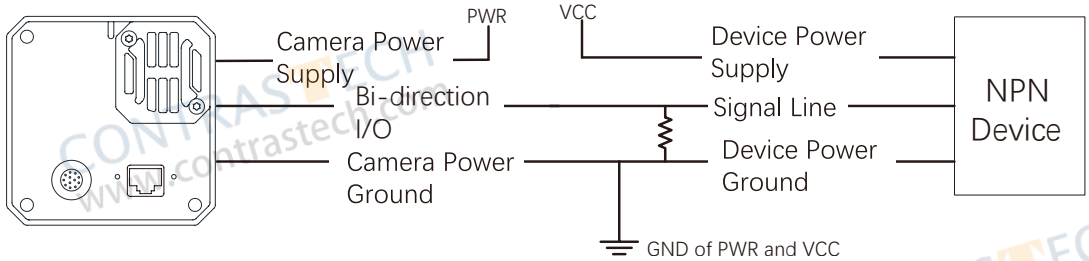
Line 2 Configured as Input :

When the camera uses Line 2 as hardware trigger source, wirings are different with different external devices of input signal.

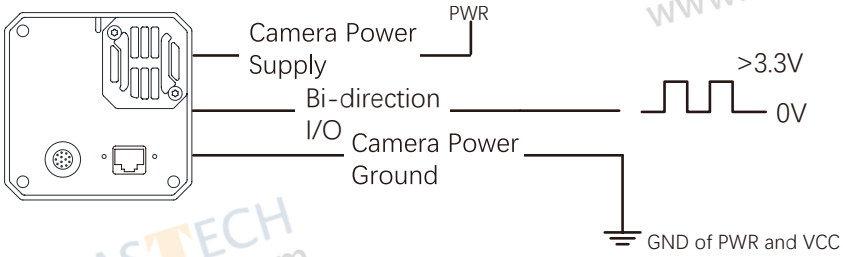
The input signal is PNP Device, that is, Line 2 Connecting to PNP Device as Input:
It is recommended to use 330 Ω pull-down resistor.



The input signal is NPN Device, that is, Line 2 Connecting to NPN Device as Input:
_If the VCC of NPN device is 24 VDC, it is recommended to use a 4.7 KΩ pull-up resistor.
_If the VCC of NPN device is 12 VDC, it is recommended to use a 1 KΩ pull-up resistor.



The input signal is Switch, that is, Line 2 Connecting to a Switch as Input:
The switch value can provide low electrical level to trigger line 2.



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I/O Wiring

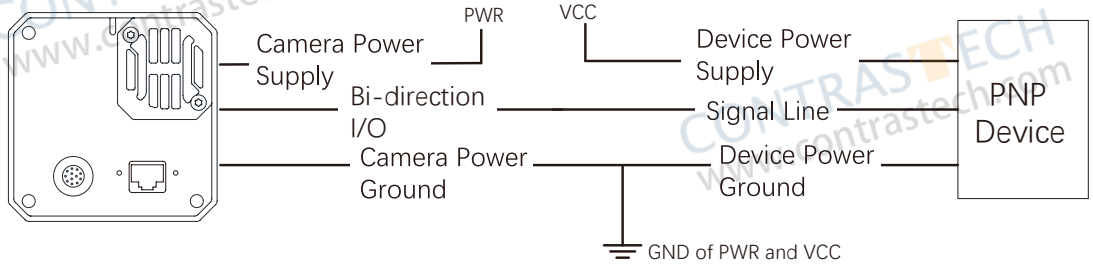
Line 2 Wiring

As bi-direction I/O Circuit, Line 2 can be used as both input signal and output signal.

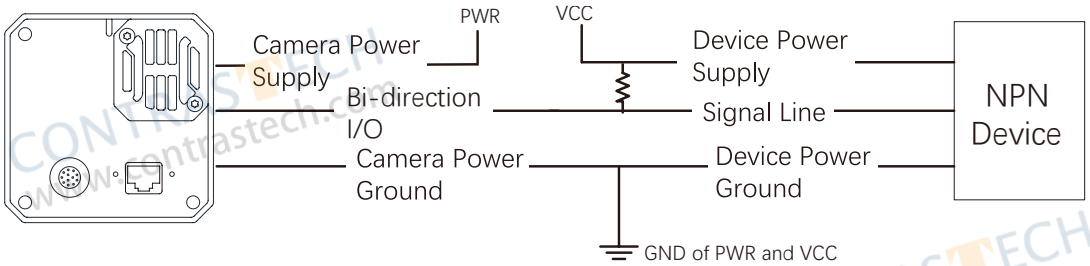
Line 2 Configured as Output:

When the camera uses Line 2 as output signal, wirings are different with different external devices.

The external devices is PNP Device, that is, Line 2 Connecting to PNP Device as Output:



The external devices is NPN Device, that is, Line 2 Connecting to NPN Device as Output:
_If the VCC of NPN device is 24 VDC, it is recommended to use a 4.7 KΩ pull-up resistor.
_If the VCC of NPN device is 12 VDC, it is recommended to use a 1 KΩ pull-up resistor.



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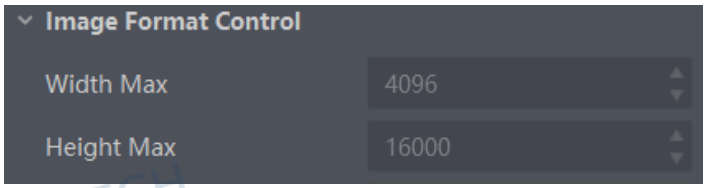
CHAPTER 8 IMAGE PARAMETER

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.

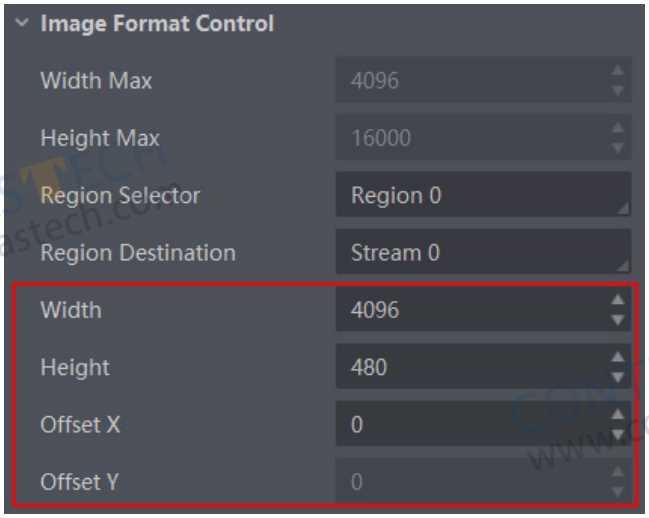


If you are only interested in a certain region of the image, you can set a Region of Interest (ROI) for the camera. Setting Region of Interest can reduce the bandwidth of the image being transmitted. Thus increasing the frame rate to some extent.

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, Offset X, and Offset Y.

- 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.



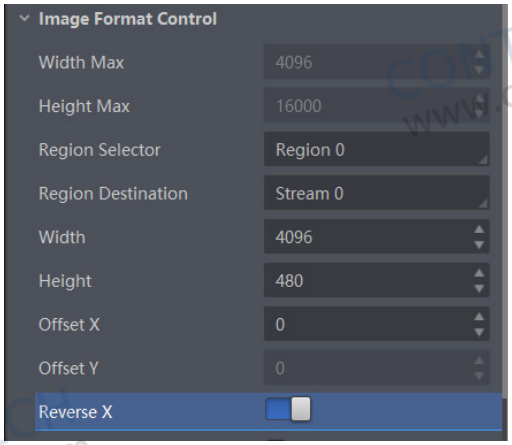
i	■ The Width value plus Offset X value should not be larger than Width Max parameter value, Height value plus Offset Y value should not be larger than Height Max parameter value. ■ The ROI function may differ by camera models.

Image Reverse

There are two types of Image Reverse, Reverse X and Reverse Y. The principle and parameter of Image Reverse are shown below.

Image Reverse	Parameter	Principle
Reverse X	Image Format Control > Reverse X	the image reverses in a horizontal way
Reverse Y	Image Format Control > Reverse Y	the image reverses in a vertical way

You can click Image Format Control, and enable Reverse X or Reverse Y according to actual demands.



The image reverse function may differ by camera models.

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Pixel Format

相机支持多种像素格式，用户可自行设置像素格式。The pixel format may differ by camera models. The maximum frame rate is different for different ADC bit depth modes and pixel formats, please refer to the actual test.

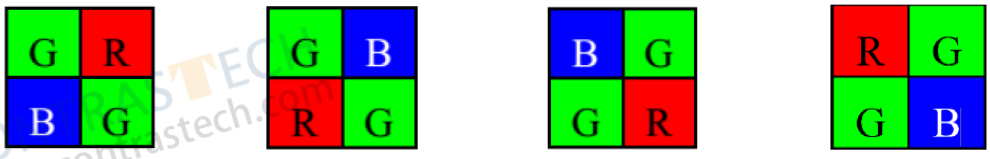
ADC 位深可在 Image Format Control 属性下设置，不同位深对应的像素格式与像素位数请见下表：

ADC Bit Depth	Pixel Format	Pixel Size（Bits/Pixel）
8	Mono 8、Bayer 8	8
	Mono 10 Packed、Mono 12 Packed、Bayer 10 Packed、Bayer 12 Packed	12
	Mono 10/12、Bayer 10/12、 YUV422Packed、YUV 422 (YUYV) Packed	16
	RGB 8、BGR 8	24
10	Mono 8、Bayer BG 8	8
	Mono 10 Packed、Mono 12 Packed、Bayer BG 10 Packed、Bayer BG 12 Packed	12
	Mono 10/12、Bayer BG 10/12、 YUV422Packed、YUV 422 (YUYV) Packed	16
	RGB 8、BGR 8	24
12	Mono 8、Bayer 8	8
	Mono10 Packed、Mono 12 packed、Bayer 10 Packed、Bayer 12 Packed	12
	Mono 10/12、Bayer 10/12、YUV422Packed、YUV 422 (YUYV) Packed	16
	RGB 8、BGR 8	24
16	Mono 8、Bayer 8	8
	Mono10 Packed、Mono 12 packed、Bayer 10 Packed、Bayer 12 Packed	12
	Mono 10/12/16、Bayer 10/12/16、YUV422Packed、 YUV 422 (YUYV) Packed	16
	RGB 8、BGR 8	24

The higher the value of ADC Bit Depth, the higher the relative image quality, but the lower the frame rate. Please set the ADC Bit Depth parameter according to your actual needs. If the exposure range of the camera is required, please set the ADC Bit Depth parameter according to the description in the technical specifications of the corresponding model.

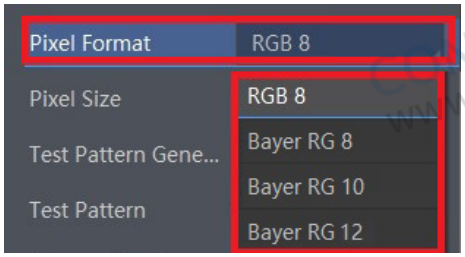
The original data of monochrome cameras is in Mono 8 format; the original data of color cameras is in Bayer 8 format. Among them, the color camera completes the conversion of the original data to RGB8 through the camera's internal pixel interpolation algorithm. The RGB format can be converted to YUV format through the algorithm, YUV Under the format, the value of Y component can be output as Mono 8 format.

Bayer GR, Bayer GB, Bayer BG, Bayer RG, etc. are shown in the figure below.



Bayer GR　Bayer GB　Bayer BG　Bayer RG

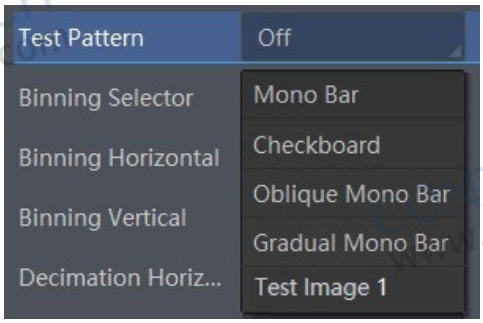
Click Image Format Control > Pixel Format, and set Pixel Format according to actual demands.



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



The mono camera offers 5 test patterns, including Mono Bar, Checkboard, Oblique Mono Bar, Gradual Mono Bar, and Test Image 1.

The color camera offers 7 test patterns, including Mono Bar、Checkboard、Oblique Mono Bar、Gradual Mono Bar、Vertical Color Bar、Horizontal Color Bar、Test Image 1.

i	The pattern of the test image 1 may differ by camera models.

Fig:Mono Bar

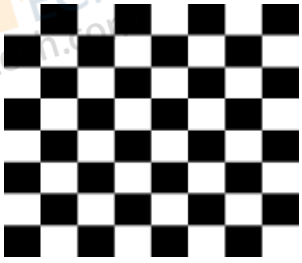


Fig:Checkboard

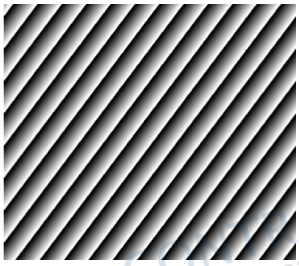


Fig:Oblique Mono Bar

Fig:Gradual Mono Bar

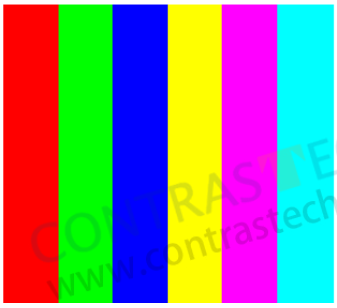


Fig:Vertical Color Bar

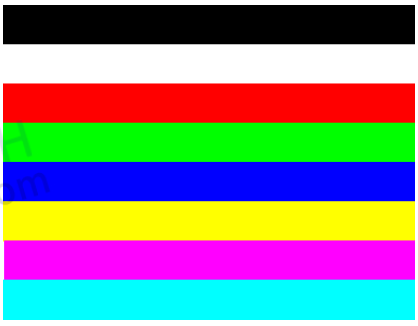


Fig:Horizontal Color Bar

Fig:Test Image 1

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.

Color Camera Binning Horizontal Set to 2

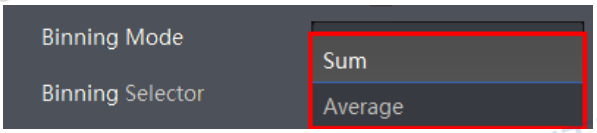
Color Camera Binning Vertical Set to 2

When the Horizontal Binning Coefficient and Vertical Binning Coefficient of the color camera are both set to 2, the camera combines four neighboring subpixels of the same color according to the corresponding positions and outputs the combined pixel value as a subpixel, as shown below.

When you need to use the Binning function, you can set the Binning Horizontal and Binning Vertical parameters under the Image Format Control property, as shown in the following figure. The Binning Horizontal parameter corresponds to the horizontal coordinate of the image, and the related parameters are Width and Offset X. The Binning Vertical parameter corresponds to the vertical coordinate of the image, and the related parameters are Height and Offset Y.

The binning function may differ by camera models,which can be selected by the Binning Mode parameter, and two modes can be selected, Sum and Average, as shown below.

- Sum: Default mode. In Sum mode, the values of neighboring pixels are summed, and the output image is brighter than the original image.
- Average: In Average mode, the values of the neighboring pixels are averaged, and the brightness of the output image is smaller than that of the original image.



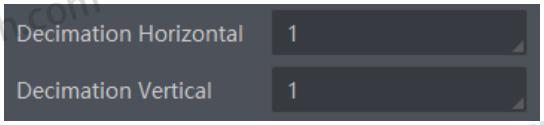
The Binning Mode parameter is displayed only when 2 or 4 is selected for both the Binning Horizontal parameter and Binning Vertical parameter values.

Decimation

The decimation feature allows you to reduce the number of sensor pixel columns or rows that are transmitted by the camera. This procedure is also known as "subsampling". It reduces the amount of data to be transferred and may increase the camera's frame rate.

Click Image Format Control, and set Decimation Horizontal and Decimation Vertical according to actual demands.

Decimation Horizontal refers to the image's width, and Decimation Vertical refers to the image's height.



i	The decimation function may differ by camera models.

Exposure Time

The exposure time mode may differ by camera models.

Exposure can be controlled by both Timed and Trigger Width under Exposure Mode.

- When Timed is selected for the Exposure Mode parameter, the exposure time is controlled by the Exposure Auto and Exposure Time parameters.
- When Trigger Width is selected for the Exposure Mode parameter, the exposure time and the duration of the level signal remain the same, and the Exposure Auto and Exposure Time parameters are invalid.

i	When On is selected for the Trigger Mode parameter, Line 0 or Line 2 is selected for the Trigger Source parameter, and Level High or Level Low is selected for the Trigger Activation parameter, Trigger Width can be selected for the Exposure Mode parameter.

The device offers 3 types of exposure time modes, including Ultrashort mode, Standard mode, and Bulb mode.

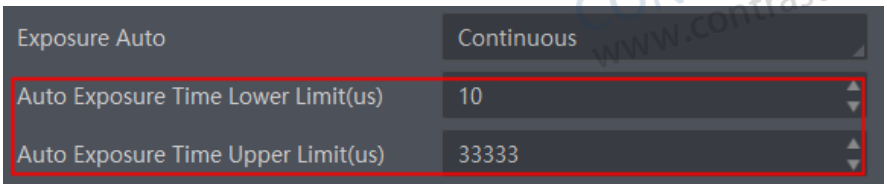
Standard Mode

Under the standard exposure time mode, the camera supports 3 types of exposure methods: 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.

i	Exposure adjustments have an effect on camera brightness, see the Brightness chapter for details.

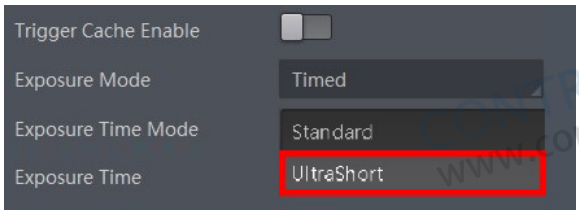
When the Exposure Auto is set as Off, you can enter Exposure Time manually. When the Exposure Auto is set as Once or Continuous, the exposure time should be within the range of Auto Exposure Time Lower Limit and Auto Exposure Time Upper Limit.



Exposure Time

UltraShort Mode

In Ultra Short Exposure mode, the camera exposes for a very small amount of time, which can only be adjusted manually, i.e. according to the value set by the user in the Exposure Time (μs) parameter. Due to the small exposure time, it needs to be used with a light source.
Since the camera defaults to the Standard exposure mode, to set the Exposure Time Mode to UltraShort, the parameter Exposure Time Mode should be set to UltraShort, UltraShort to UltraShort, and Standard to Standard, which is the camera's default mode. As shown below.

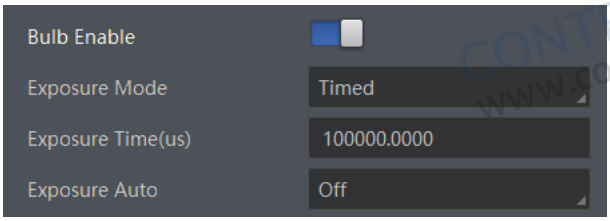


- If UltraShort exposure mode is supported, the Exposure Time Mode parameter can be set via the drop-down, UltraShort is UltraShort exposure mode, Standard is Standard mode, and the camera defaults to Standard mode.
- If UltraShort exposure mode is not supported, there is no Exposure Time Mode parameter and the camera defaults to Standard mode.

i	• If the camera does not support ultra-short exposure modes, the Exposure Time Mode parameter is not present in the properties. • Whether the camera supports ultra-short exposure modes depends on the camera model and firmware program.

Bulb Mode

In bulb mode, the device only powers the exposure-related circuits, reducing power supply noise and improving image quality. At this point, the device's exposure lower limit will be automatically set to a fixed value, and after each exposure, a certain waiting time is required before the next exposure is processed.
You can go to Acquisition Control → Bulb Enable, and enable Bulb Enable according to actual demands.



i	• The bulb mode may differ by device models. • The value of exposure lower limit may differ by device models.

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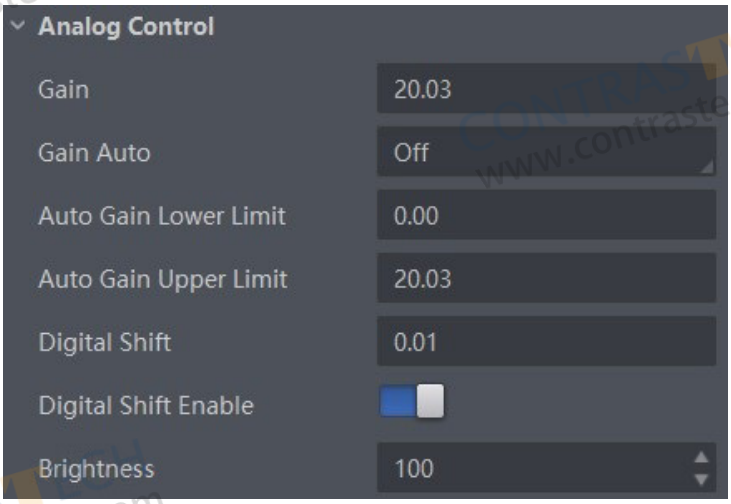
Brightness

The camera brightness refers to the brightness when the camera adjusts image under Once or Continuous exposure mode, or Once or Continuous gain mode. You can set brightness as shown below.

You should enable Once or Continuous exposure mode, or Once or Continuous gain mode first before setting brightness.

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

After setting brightness, the camera 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.

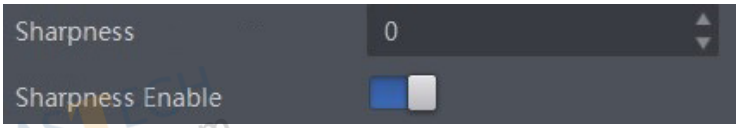


Sharpness

The camera supports sharpness function that can adjust the sharpness level of the image edge, and this function is disabled by default.

i	The sharpness function is available when the camera is in Mono and YUV pixel format.

Click Analog Control > Sharpness Enable, enable Sharpness Enable, and enter Sharpness according to actual demands. The range of the brightness is from 0 to 100.



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.

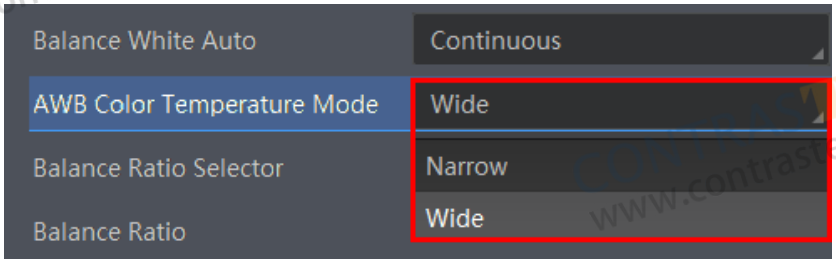
White Balance Mode	Parameter	Principle
Off	Analog Control > Balance White Auto	You need to set the R, G, B value manually, between 1 and 4095. 1024 means ratio is 1.0
Once		Automatic white balance once. Adjust the white balance for a certain amount of time then stop. It implements an algorithm that finds 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. The Balance White Auto parameter is Continuous by default, and the color temperature mode is Narrow, i.e. AWB Color Temperature Mode is Narrow. If the color effect of the image is still poor after auto white balance is performed in this color temperature mode, you can set the AWB Color Temperature Mode If the color effect of the image is still not good after auto white balance is performed in this color temperature mode, you can set the AWB Color Temperature Mode parameter to Wide and perform auto white balance correction again.



If the calibration still differs greatly from the actual color after the above operation, manual white balance correction can be performed.

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.

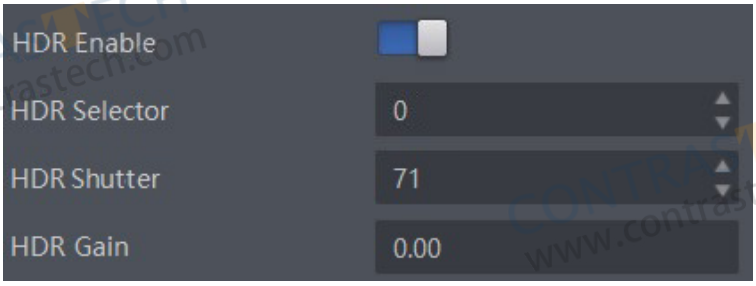
- Here we take Green as an example. For specific Balance Ratio Selector value, please refer to the actual condition.
- In order to avoid repeated correction after rebooting the camera, it is recommended to save white balance parameter to User Set after white balance correction. You can refer to the Section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

HDR

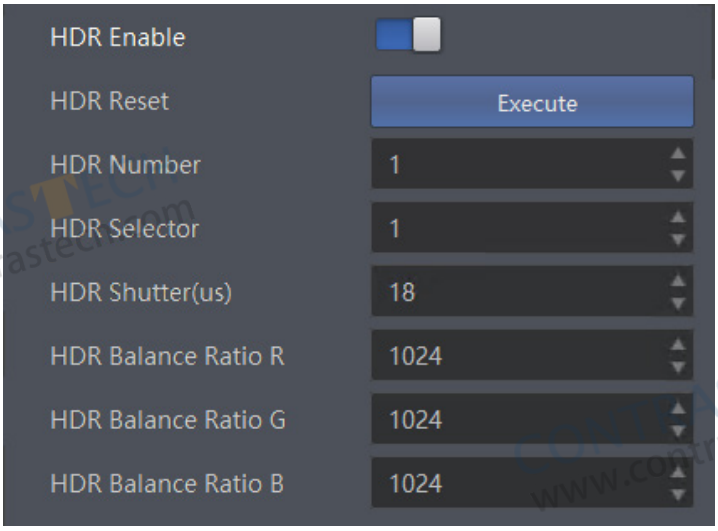
The camera supports HDR (High Dynamic Range) function that the camera acquires images based on 4 sets of settings, and each with its own exposure time and gain.

Step:

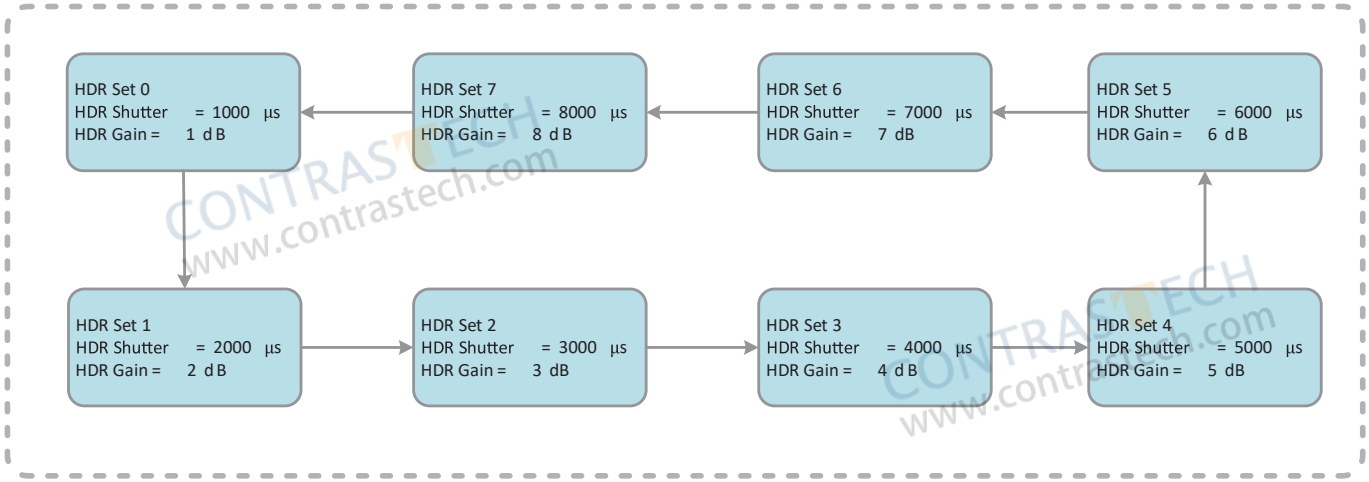
Click Acquisition Control, enable HDR Enable, select 0, 1, 2 or 3 as HDR Selector, and set corresponding HDR Shutter and HDR Gain.



For color cameras, adjust the HDR Shutter parameter and the HDR Balance Ratio R/G/B values as shown below.



The polling diagram between the eight groups of HDR parameters is shown in the figure below.



- The HDR function may differ by camera models.
- When the Acquisition Burst Frame Count parameter value is set greater than 8, polling of the eight sets of parameters is rounded.

Gain

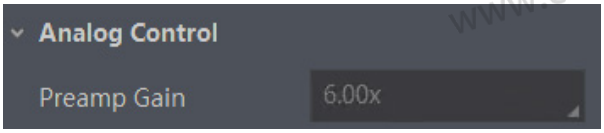
The camera has 2 types of gain, including the analog gain and digital gain. The analog gain is applied before the signal from the camera sensor is converted into digital values, while digital gain is applied after the conversion.

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 analog gain parameter of the camera varies with different models and firmware programs, the parameter name is Preamp Gain or Gain, please refer to the actual parameters of the camera. Please refer to the actual parameters of the camera. The different names of the parameters mean different settings.

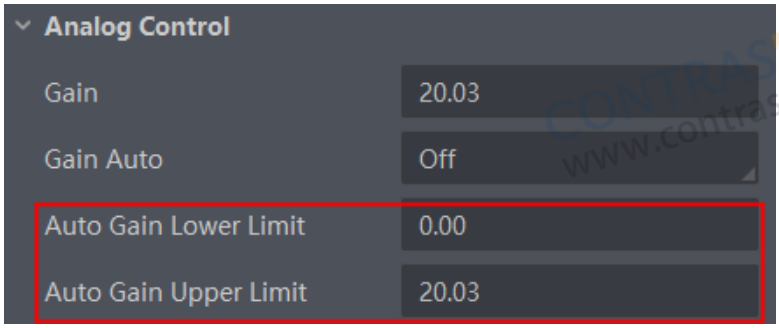
● Preamp Gain: Set through the Preamp Gain parameter under the Analog Control property, you can view the current analog gain size supported by the camera, and only support manual way to set, as shown below.



● Gain: The camera supports 3 types of analog gain modes: Off, Once and Continuous. Click Analog Control, and select Gain Auto according to actual demands.

Gain Mode	Parameter	Principle
Off	Analog Control > Gain Auto	The camera adjusts gain according to the value configured by user in Gain.
Once		Adjust the gain automatically according to the image brightness. After adjusting, it will switch to Off Mode.
Continuous		Adjust the gain continuously according to the image brightness.

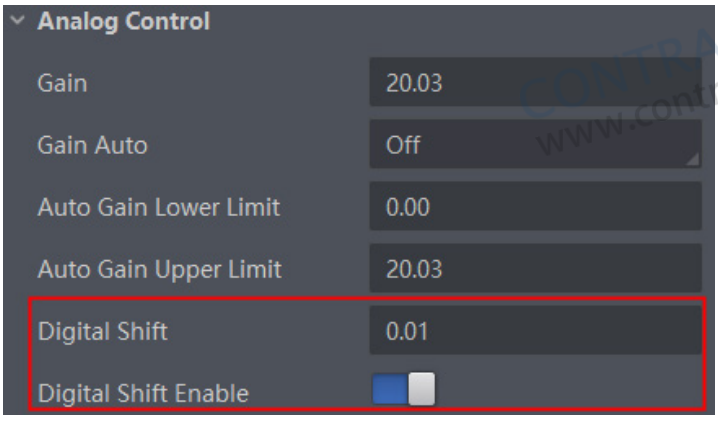
When the analog gain is set as Once or Continuous, the gain should be within the range of Auto Gain Lower Limit and Auto Gain Upper Limit.



Digital Gain

Apart from analog gain, the camera 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 according to actual demands. The range of Digital Shift is from -24 to 24.



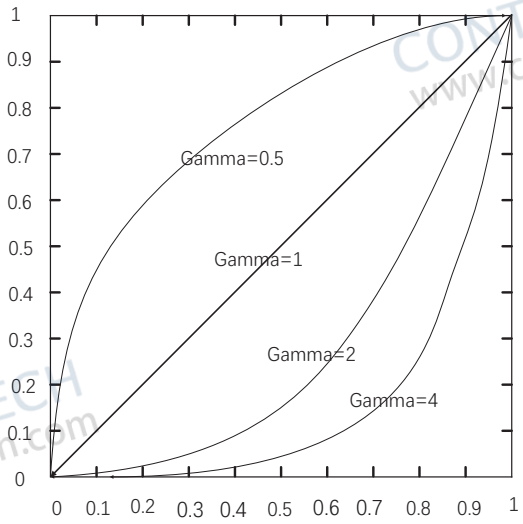
Gamma Correction

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

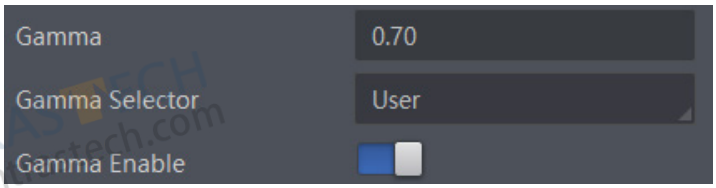


There are 2 types of Gamma correction, including User mode and sRGB mode.

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

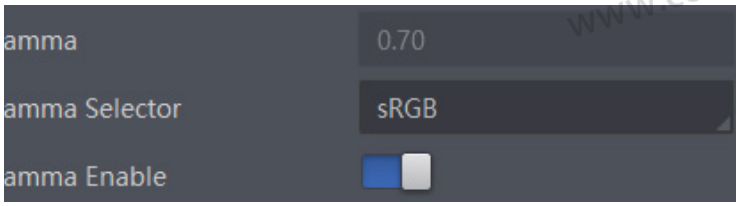
■ You can set User mode as shown below.

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.

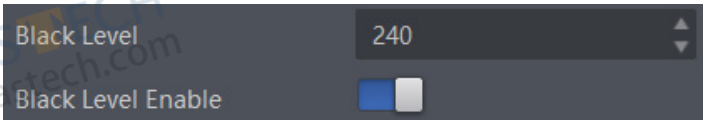


Black Level

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.

The range of black level is from 0 to 4095.

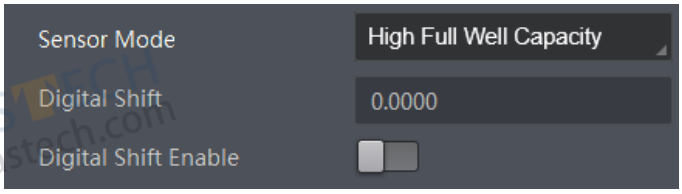


The black level function may differ by camera models.

Sensor Mode

The device supports high full well capacity mode. It greatly improves the overall brightness of images and is applicable to low-light environment.

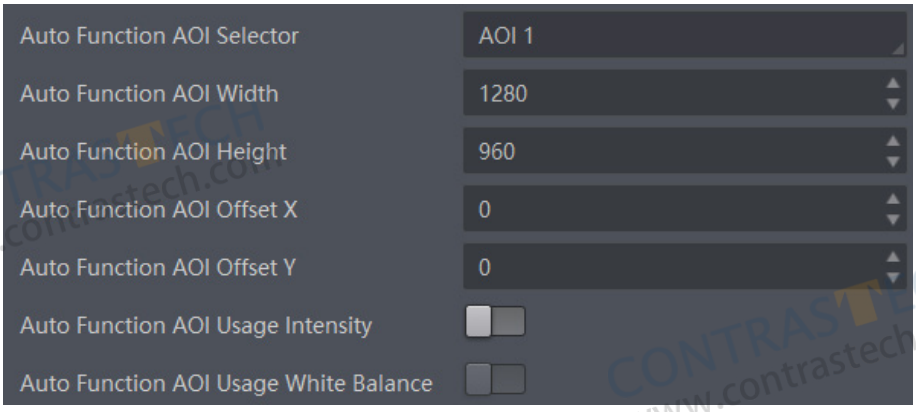
Go to Analog Control → Sensor Mode, and select High Full Well Capacity according to actual demands.



The sensor mode function may differ by device models.

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 1 function needs to be used in the camera's Auto Exposure Time Mode, and the AOI 2 function needs to be used in the camera's Auto 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.

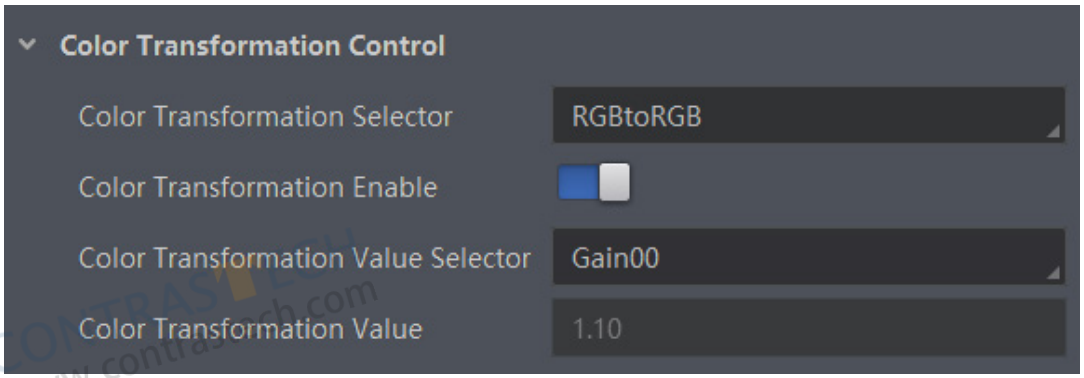
Color Transformation Control

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.

- When the Color Transformation Enable parameter is not enabled, you can select Color Transformation Value Selector, and set Color Transformation Value according to actual demand.
- When the Color Transformation Enable parameter is enabled, set Hue and Saturation to adjust Color Transformation Value.

- The color transformation control function may differ by camera models and is only available for color cameras.
- Currently, RGB to RGB is available for Color Transformation Selector only.
- Color correction is achieved by adjusting the value of each parameter in the Color Transformation Value Selector. Gain00, Gain01 and Gain02 adjust the R component of the red pixel, Gain10, Gain11, and Gain12 adjust the G component of the green pixel, and Gain20, Gain21, Gain22 adjust the Is the B component of the blue pixel.



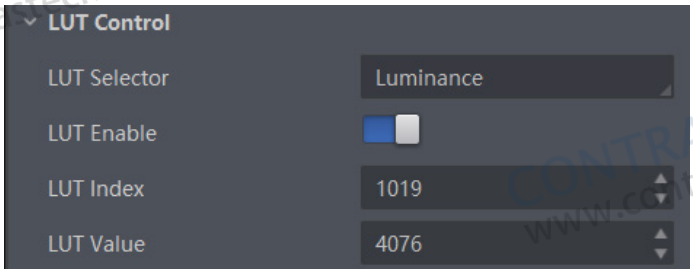
LUT

A Look-Up Table (LUT) is a customized grayscale-mapping table. The LUT allows you to replace the pixel values in your images by values defined by you.

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.

- If the imager does not contain LUT Save parameters, the set LUT parameters are saved to the selected LUT table in real time.
- If the imager contains LUT Save parameters, after setting the LUT Index and LUT Value parameters for different LUT user lookup tables, you need to click "Execute" at the LUT Save parameter to save the set parameters.



- The LUT Value parameter setting range of the camera varies with different ADC bit depth modes, so please refer to the actual situation.
- You cannot use Gamma correction function and LUT function at the same time.
- The LUT setting is not supported in the Bayer format of the color camera.

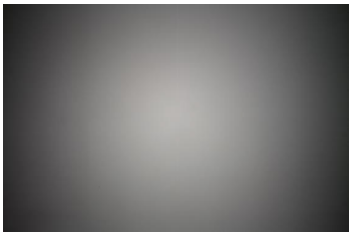
Shading Correction

The camera supports shading correction function that improves the image uniformity when you acquire a non-uniformity image due to external conditions. The shading correction type includes LSC correction, FFC correction, FPNC correction, and PRNUC correction.

- The specific shading correction type that cameras support may differ by camera models.
- The steps for LSC correction may differ by camera models.

LSC Correction

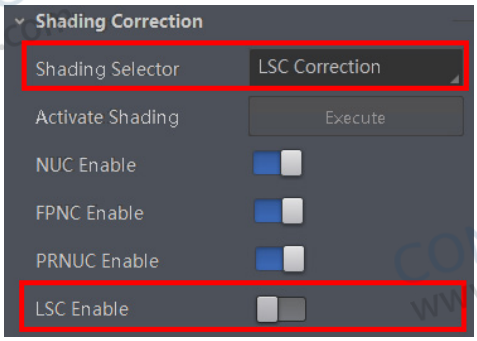
LSC correction stands for Lens Shading Correction that eliminates non-uniform illumination brought by lens. The effect before and after correction is shown in the figure below. The LSC correction supports two correction methods, including auto image correction or correcting image via setting parameters.



■ Auto Image Correction

Steps:

1. Click Shading Correction, select LSC Correction as Shading Selector.
2. Click Execute in Activate Shading.
3. Enable LSC Enable.



■ Correcting Image via Setting Parameters

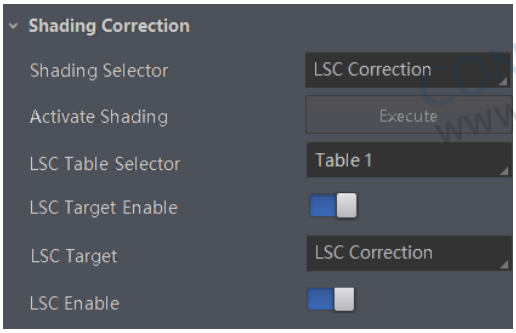
Some camera models support correcting image via setting parameters to adjust the image brightness according to different scenarios.

Steps:

1. Click Shading Correction, select LSC Correction as Shading Selector.
2. Select tables from LSC Table Selector ranging from Table 0 to Table 7 according to actual demands.
3. Enable LSC Target Enable and set LSC Target R/G/B according to actual demands.

- For color cameras, the larger value configured in LSC Target R/G/B, and brighter the image is.
- The function of LSC Target Enable and LSC Target is only valid before executing Activate Shading.

4. Click Execute in Activate Shading, and enable LSC Enable.



- If LSC Target Enable is not enabled, after executing “Execute” at the Activate Shading parameter and then enabling LSC Enable, the image will be corrected according to the maximum value of the current image brightness.
- The LSC correction can be done only when the camera is in full resolution. If you are only interested in certain details in the image, you can use the ROI function.

Shading Correction

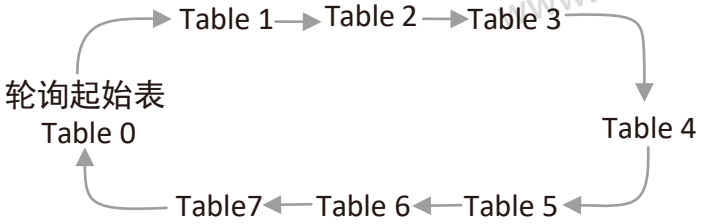
LSC Sequencer

Without stopping camera's image streams, LSC sequencer function can periodically take pictures of collected images via setting multiple groups of brightness parameter tables according to the default sequencer parameter group or manually setting sequencer parameter group. Therefore,the camera can process images of inconsistent uniformity due to different light sources.

i	The LSC sequencer function may differ by camera models.

Steps:

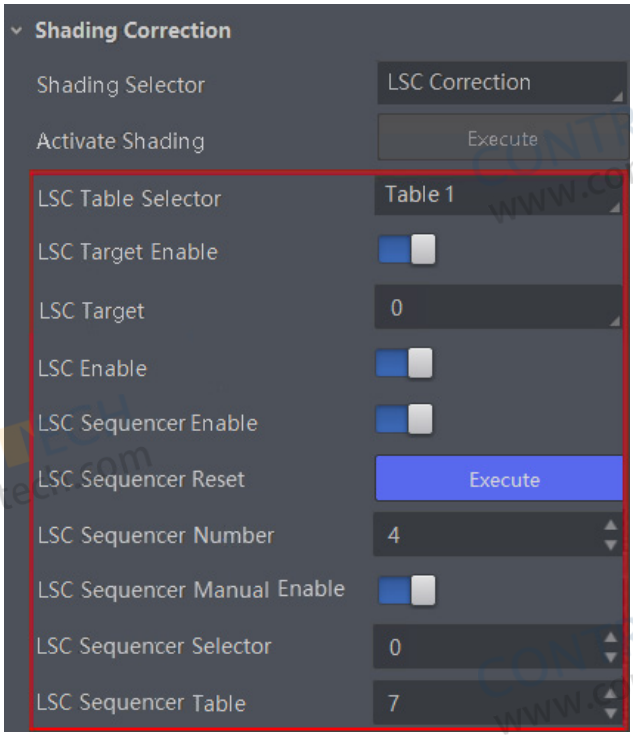
1. Click Shading Correction, select LSC Correction as Shading Selector.
2. Select tables from LSC Table Selector ranging from Table 0 to Table 7 according to actual demands.When using eight tables, the default polling order for the eight tables is shown below.



3. Enable LSC Target Enable and set LSC Target.

i	• The larger value configured in LSC Target, and brighter the image is. • The function of LSC Target Enable and LSC Target is only valid before executing Activate Shading.

4. Click Execute in Activate Shading, and enable LSC Sequencer Enable.



i	If LSC Sequencer Enable is not enabled, LSC polling is not performed and images are generated based on the set LSC Target value.

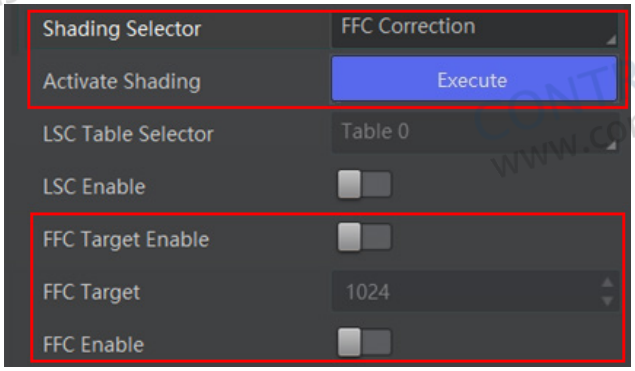
5. Set LSC Sequencer Number to configure how many tables to participate the sequencer.
6. (Optional) Click Execute in LSC Sequencer Reset to reset the sequencer.
7. (Optional) Enable LSC Sequencer Manual Enable if you need to set the sequencer order manually, and set LSC Sequencer Selector and LSC Sequencer Table according to actual demands.

Shading Correction

FFC Correction

The fat field correction (FFC) is used to improve the image uniformity that may be impacted by the sensor, light sources, external conditions, etc. The FFC correction supports two correction methods,including auto image correction or correcting image via setting parameters.

i	The FFC correction can be done only when the camera is in full resolution.



■ Auto Image Correction

Steps:

1. Click Shading Correction, select FFC Correction as Shading Selector.
2. Click Execute in Activate Shading, and enable FFC Enable.

■ Correcting Image via Setting Parameters

Steps:

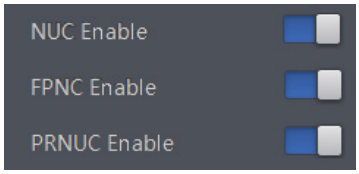
1. Click Shading Correction, select FFC Correction as Shading Selector.
2. Enable FFC Target Enable and set FFC Target according to actual demands.
3. Click Execute in Activate Shading, and enable FFC Enable.

i	● The larger the FFC Target value, the brighter the image; the smaller the FFC Target value, the darker the image. ● Due to the long time required for FFC calibration, if power is lost in the middle of the calibration process, the camera needs to be restarted and the FFC calibration operation needs to be performed again. ● FFC calibration can only be performed at full resolution.

Other Corrections

Other corrections include FPNC (Dark Field Correction) and PRNUC (Bright Field Correction), which focus on removing regular vertical lines in the column direction, before and after correction as shown in the figure below. This can be set via the Shading Correction property.

Under the Shading Correction property, enable the NUC Enable parameter. When the correction function is enabled, the parameters FPNC Enable and PRNUC Enable are automatically turned on or off depending on the camera's support. When the imager supports both dark-field correction and bright-field correction, the parameters FPNC Enable and PRNUC Enable will be enabled at the same time, as shown below.



i	The specific setting steps of other corrections may differ by camera models.

CHAPTER 9 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 Type	Read only	It is the device type.
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 ID	Read only	It is the device ID.
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.
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.
TEC Enable	Read and write	It enables TEC function.
TEC Temperature	Read and write	It sets the max. temperature of sensor. ● If actual sensor's temperature is lower than this parameter, and TEC function is not enabled. ● If actual sensor's temperature is higher than this parameter and TEC enable is enabled, and then TEC function is enabled.
Fan Control Mode	Read and write	It sets the fan mode. ● In auto mode, it includes three-level fan speed: 70, 85 and 100. According to the difference between the configured sensor temperature (TEC Temperature parameter) and the actual temperature, adjustment is made every 30 seconds. If actual temperature - configured temperature > 2 degrees, fan speed will increase. Otherwise, fan speed will decrease. ● In manual mode, the fan speed is decided by value set in Fan Speed.
Fan Speed	Read and write	It sets the fan speed, and its range is from 40 to 100.
Device Connection Selector	Read and write	It is the ID of GenICam XML.
Device Connection Speed(Mbps)	Read only	It is the device connection speed.
Device Link Selector	Read and write	It selects device link.
Device Link Speed(Mbps)	Read only	It is the link speed.
Device Link Connection Count	Read only	It is the link connection quantity.
Device Link Heartbeat Mode	Read and write	It enables heartbeat mode or not.

Device Control

Parameter	Read/Write	Description
Device Stream Channel Count	Read only	It counts data packet quantity.
Device Stream Channel Selector	Read and write	It is the character set used in register.
Device Stream Channel Type	Read only	It is the stream channel type.
Device Stream Channel Link	Read only	It is the stream channel link quantity.
Device Stream Channel Endianness	Read only	It is the image data endianness.
Device Stream Channel Packet Size(B)	Read and write	It is the data packet size.
Device Event Channel Count	Read only	It is the channel quantity that the device supports.
Device Character Set	Read only	It is the character set used in register.
Device Reset	Read and write	Click Execute to reset the device.
Device Temperature Selector	Read and write	It selects device component temperature.
Device Temperature	Read only	It displays the real-time temperature of the device component you selected in Device Temperature Selector.
Find Me	Read and write	Click Execute to let red indicator flash once, and find device.
Device Max Throughput(Kbps)	Read only	It is the maximum flow of device operation.
Device PJ Number	Read only	It is the device's project number.

The specific device control parameters may differ by camera models.

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Transport Layer Control

You can go to Transport Layer Control attribute to view the camera's load size, GEV version, etc.

Parameter	Read/Write	Description
Paylode Size(B)	Read only	It is the camera's load size.
GEV Version Major	Read only	It is the major version in GEV version.
GEV Version Minor	Read only	It is the minor version in GEV version.
GEV Device Mode Is Big Endian	Read only	It is the endianness in device's register.
GEV Device Mode Character Set	Read only	It is the character set in device's register.
GEV Interface Selector	Read only	It sets which physical network interface to be controlled.
GEV MAC Address	Read only	It is the MAC address of the network interface.
GEV Supported Option Selector	Read and write	It selects the GEV option to interrogate for existing support.
GEV Supported Option	Read only	It indicates whether the selected GEV option is supported or not.
GEV Current IP Configuration LLA	Read only	It indicates whether the Link Local Address IP configuration scheme is activated on the given network interface.
GEV Current IP Configuration DHCP	Read and write	It indicates whether the DHCP IP configuration scheme is activated on the given network interface.
GEV Current IP Configuration Persistent IP	Read and write	It indicates whether persistent IP configuration scheme is activated on the given network interface.
DEV PAUSE Frame Reception	Read and write	It controls whether incoming pause frames are handled on the given logical link.
GEV Current IP Address	Read only	It is the current IP address for the given network interface.
GEV Current Subnet Mask	Read only	It is the current subnet mask of the given interface.
GEV Current Default Gateway	Read only	It is the default gateway IP address to be used on the given network interface.
GEV First URL	Read only	It is the first choice of URL for the XML device description file.
GEV Second URL	Read only	It is the second choice of URL to the XML device description file.
GEV Number Of Interfaces	Read only	It indicates the number of physical network interfaces supported by this device.
GEV Persistent IP Address	Read and write	It indicates the persistent IP address for this network interface. It is only used when the device boots with the persistent IP configuration scheme.
GEV Persistent Subnet Mask	Read and write	It indicates the persistent subnet mask associated with the persistent IP address on this network interface. It is only used when the device boots with the persistent IP configuration scheme.
GEV Persistent Default Gateway	Read and write	It indicates the persistent default gateway for this network interface. It is only used when the device boots with the persistent IP configuration scheme.
GEV Link Speed	Read only	It indicates the speed of transmission negotiated by the given network interface in Mbps.
GEV Message Channel Count	Read only	It indicates the number of message channels supported by this device.
GEV Stream Channel Count	Read only	It indicates the number of stream channels supported by this device.
GEV Heartbeat Timeout(ms)	Read and write	It indicates the current heartbeat timeout in milliseconds.
GEV Heartbeat Disable	Read and write	It disables the GEV Heartbeat.
GEV Timestamp Tick Frequency (Hz)	Read only	It indicates the number of timestamp ticks in 1 second (frequency in Hz).
Timestamp Control Latch	Read and write	It latches the current timestamp value of the device.
Timestamp Control Reset	Read and write	It resets the timestamp value for the device.
Timestamp Control Latch Reset	Read and write	It resets the timestamp control latch.
Timestamp Value	Read only	It is a read only element. It indicates the latched value of the timestamp.
GEV CCP	Read and write	It controls the device access privilege of an application.
GEV MCP Host Port	Read and write	It controls the port to which the device must send messages. Setting this value to 0 closes the message channel.
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Transport Layer Control

Parameter	Read/Write	Description
GEV MCDA	Read and write	It controls the destination IP address for the message channel.
GEV MCTT(ms)	Read and write	It provides the transmission timeout value in milliseconds.
GEV MCRC	Read and write	It controls the number of retransmissions allowed when a message channel message times out.
GEV MCSP	Read only	It indicates the source port for the message channel.
GEV Stream Channel Selector	Read only	It selects the stream channel to control.
GEV SCP Interface Index	Read only	It is the Index of network interface to be used.
GEV SCP Host Port	Read and write	It is the host port of the channel
GEV SCP Direction	Read only	It transmits or receives the channel.
GEV SCPS Fire Test Packet	Read only	It sends a test packet.
GEV SCPS Do Not Fragment	Read and write	The state of this feature is copied into the “do not fragment” bit of the IP header of each stream packet.
GEV SCPS Big Endian	Read only	It is the Endianness of multi-byte pixel data for this stream.
GEV SCPS Packet Size(B)	Read and write	It specifies the stream packet size (in bytes) to send on this channel.
Bandwidth Reserve	Read and write	**When enabled, the SCPD value can be automatically adjusted to optimize the data transfer process**
Auto SCPD	Read only	**Displays the actual SCPD value of the device**
GEV SCPD	Read and write	It indicates the delay (in timestamp counter units) to insert between each packet for this stream channel.
GEV SCDA	Read and write	It indicates the destination IP address for this stream channel.
GEV SCSP	Read only	It indicates the source UDP port address for this stream channel.
Gev IEEE 1588	Read and write	**Enable IEEE 1588 Precision Time Protocol to control timestamp registers**
Gev IEEE 1588 Status	Read only	**Current IEEE 1588 Precision Time Protocol status**
GEV GVSP Extended ID Mode	Read and write	It enables the extended ID mode.

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Embedded Information in Image

The camera supports adding and embedding the collection information to the image data. You can set in the client software and define which information to be embedded in the image data.

Embedded information includes following categories. Each category of embedded information has its unique data format.

Information Type	Byte	Data Format Description
Timestamp	4	4 bytes are used to transfer the timestamp information.
Gain	4	4 bytes are used to transfer the gain information. Each low 8 bits of the 4 valid data are combined to transfer the gain information. Value Range: 0 to 1023. Note: High bits will be complemented with 0 automatically.
Exposure	4	4 bytes are combined to show the exposure time, and the unit is μs.
Brightness Info	4	4 bytes are used to transfer the brightness information. Value Range: 0 to 4095. Note: High bits will be complemented with 0 automatically.
White Balance	8	R/G/B occupies 2 bytes each. Value Range: 0 to 4095.
Frame Counter	4	Value Range: 0 to 2^{32}-1
Ext Trigger Count	4	Value Range: 0 to 2^{32}-1
Line Input Output	4	4 bytes are used to transfer the line input and output information.
Pixel Format	4	Value Range: 0 to 2^{32}-1
ROI Position	8	The column coordinate occupies 2 bytes, and the row coordinate occupies 2 bytes. The column coordinate information comes first. The length and width occupy 2 bytes respectively, and the length information comes first.

■ The specific embedded information categories may differ by camera models.
■ Color cameras have the white balance only. Embedded information types, inducing width, height, offset X, offset Y and pixel format, are for cameras that support the chunk data function only.
■ The camera embeds category that you select into the image data. The ROI area do not influence collection information embedding. If the ROI area is small and there is not enough space in first line image, and then the collection information will be embedded into the second line image.
■ The low 8-bit of each valid data storages image embedded information.

Following way to set

● Embedded Information Set: Click Image Format Control > Embedded Image Info Selector, select specific parameters as Embedded Image Info Selector, and enable Frame Spec Info.

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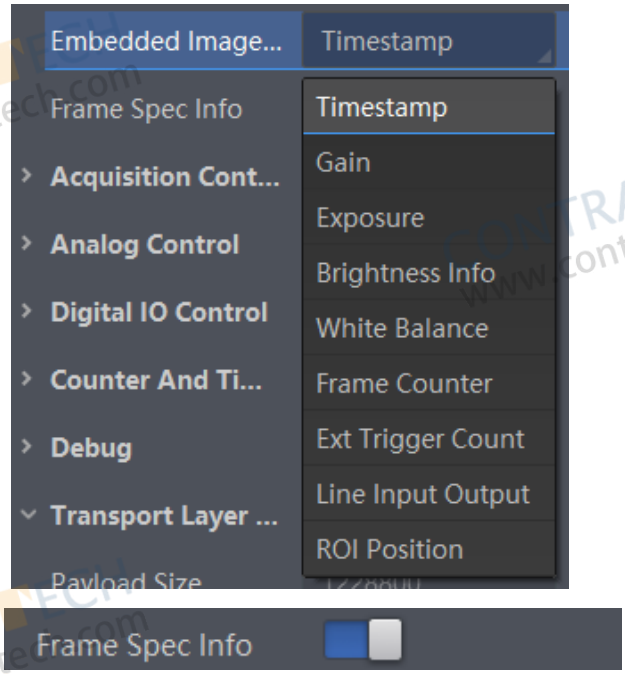
Embedded Information

Steps:

1. Click Image Format Control > Embedded Image Info Selector, select specific parameters as Embedded Image Info Selector, and enable Frame Spec Info.



2. When multiple information needs to be embedded, just repeat the above steps.

3. You can view related information through Embedded Information Tool in the iDatum shortcut toolbar, and the specific values will only be displayed after the camera starts previewing.

i	When the Embedded Information tool sets the image embedded information, it is not affected by ROI. If the ROI area is small and the first line of image is not enough to embed information, it will be embedded in the second line of image.

File Access Control

The file access control allows you to export or import the camera's feature configuration (including User Set 1, User Set 2, or User Set 3) or DPC (Defective Pixel Correction) data to or from the local PC as the mfa format.

Steps:

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

2. Select a User Set (User Set 1, User Set 2, or User Set 3) or DPC from the drop-down list.

3. Click Import or Export to import or export the camera's feature configuration or DPC data according to actual demands.

i	■ The file access control function may differ by camera models. ■ Importing and exporting the camera's feature configuration or DPC data among the same model cameras are supported. ■ DPC represents the bad pixel data corrected by the camera.

Action Command

The action command allows you to execute actions on multiple cameras at roughly the same time by using a single broadcast protocol message.

i	If you want to send action commands that are executed in multiple cameras at exactly the same time, it is recommended to enable Gev IEEE 1588 first by clicking Transport Layer Control > Gev IEEE 1588.

Steps:

1. Click Tool > GigE Vision Action Command.
2. Select Network Interfaces to set the subnet that the command to be sent to.
3. Enter the Device Key, Group Key, and Group Mask.

i	The specific contents entered in Device Key and Group Key should be the same with those in Action Device Key and Action Group Key of the Action Control feature. The bitwise AND operation of the Group Mask against the Action Group Mask feature should results in non-zero.

4. Enable Scheduled.
5. Click connect icon in Benchmark Camera to select one camera as benchmark camera. Once benchmark camera is selected, other cameras keep time synchronization with it.
6. (Optional) Enter Delay Time according to actual demands.

i	● The delay time should NOT be shorter than the maximum time required to transmit the command across the network. ● When the benchmark camera receives the command, all the cameras will trigger certain actions simultaneously after the specified delay time.

7.(Optional) Enable Periodically Send to enable the client to send commands periodically, and enter Sending Interval according to actual demands.

i	The default value of sending interval is 1000 ms, and its range is from 1 ms to 3600000 ms.

8. (Optional) Enable Request Acknowledgement to display the acknowledgement messages.

i	Up to 50 messages can be displayed. Once the message quantity exceeds 50, the earliest message will be automatically deleted.

9. Click Start Sending.

Event Control

The event control can record events happen to the device and allow you to view them.

i	● The event control function may differ by device models or firmware. ● The specific events may differ by device models.

Steps:

1. Go to Event Control → Event Selector, and select Event Selector according to actual demands.
2. Select Notification On as Event Notification to output event.
3. Right click the connected device and click Event Monitor.
4. Check Messaging Channel Event, and view the specific event after the device starts live view.

File Access Control

The file access control allows you to export or import the camera's feature configuration (including User Set 1, User Set 2, or User Set 3) or DPC (Defective Pixel Correction) data to or from the local PC as the mfa format.

Steps:

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

2. Select a User Set (User Set 1, User Set 2, or User Set 3) or DPC from the drop-down list.
3. Click Import or Export to import or export the camera's feature configuration or DPC data according to actual demands.

	■ The file access control function may differ by camera models. ■ Importing and exporting the camera's feature configuration or DPC data among the same model cameras are supported. ■ DPC represents the bad pixel data corrected by the camera.

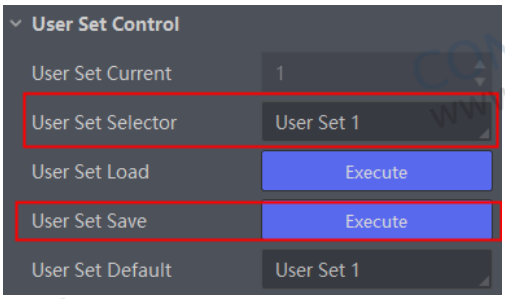
Save and Load User Set

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:

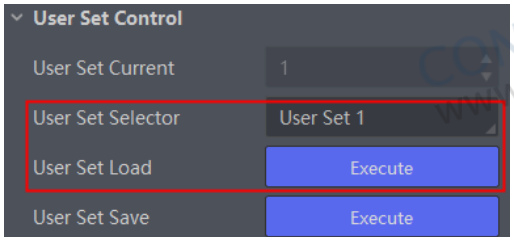
1. Click User Set Control, and select a user set in User Set Selector. Here we take selecting User Set 1 as an example.
2. Click Execute in User Set Save to save parameters.



_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.

	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.

Multicast

The multicast function allows you to access the same camera via multiple PCs, The same camera can be connected to only one iDatum via the controller and data receiver or the controller mode at the same time, while in the data receiver mode, the same camera can be connected to multiple client software,and it has 3 modes as follows.

Modes	Description
Controller and Data Receiver	This mode allows you to read and edit the camera's parameters, and get its image data.
Controller	This mode allows you to read and edit the camera's parameters, but you cannot get its image data.
Data Receiver	This mode allows you read the camera's parameters and get its image data, but you cannot edit the camera's parameters.

When the multicast function is enabled, the camera icon on the iDatum of other PCs will become  ,and you can connect the camera via the data receiver mode.

When you connect the camera via the data receiver mode, the camera icon on the iDatum of your PC will become  , and at this time, you can read its parameters only.

You can set multicast function for both the available camera and connected camera, but the specific settings are different.

Enable Multicast（Available）

For the available camera, you can set multicast function as follows.
1. Right click the available camera, and click Multicast Settings.
2. Select Role
_The camera in the available state can start the multicast function in two roles: control and receiving mode and control mode.
3. Enter the IP Address
_If the IP address is invalid, the system will prompt "Please check if the IP address is valid".
_The multicast IP address should be a class D IP address.
4. Enter the Port
_The valid value of the multicast port number is 0~65535, and the port number used should be an unused port number.
5. Click OK.

Enable Multicast（Connected ）

For the connected camera, you can set multicast function as follows.
1. Right click the connected camera, and click Multicast Settings.
2. Enable the multicast function, and edit the IP Address and Port.
3. Click OK.

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Camera Parameter Index

Attribute	Parameter	Section
Device Control	Device Type	Section Device Control
	Device Scan Type	
	Device Vendor Name	
	Device Model Name	
	Device Manufacturer Info	
	Device Version	
	Device Firmware Version	
	Device Serial Number	
	Device ID	
	Device User ID	
	Device Uptime(s)	
	Board Device Type	
	Device Connection Selector	
	Device Connection Speed(Mbps)	
	Device Link Selector	
	Device Link Speed(Mbps)	
	Device Link Connection Count	
	Device Link Heartbeat Mode	
	Device Stream Channel Count	
	Device Stream Channel Selector	
	Device Stream Channel Type	
	Device Stream Channel Link	
	Device Stream Channel Endianness	
	Device Stream Channel Packet Size(B)	
	Device Event Channel Count	
	Device Character Set	
	Device Reset	
	Device Temperature Selector	
	Device Temperature	
	Find Me	
	Device Max Throughput(Kbps)	
	Device PJ Number	
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Camera Parameter Index

Attribute	Parameter	Section
Image Format Control	Width Max	Section Resolution and ROI
	Height Max	
	Region Selector	
	Region Destination	
	Width	
	Height	
	Offset X	
	Offset Y	
	Reverse X	Section Image Reverse
	Reverse Y	
	Pixel Format	Section Pixel Format
	Pixel Size	
	Image Compression Mode	Section Image Compression Mode
	High Bandwidth Mode	
	Test Pattern Generator Selector	Section Test Pattern
	Test Pattern	
	Binning Selector	Section Binning
	Binning Horizontal	
	Binning Vertical	
	Decimation Horizontal	Section Decimation
	Decimation Vertical	
	Embedded Image Info Selector	Section Embedded Information in Image
	Frame Spec Info	
Acquisition Control	Acqusition Mode	Section Frame Rate
	Acqusition Start	
	Acqusition Stop	
	Acquisition Burst Frame Count	
	Acqusition Frame Rate(Fps)	
	Acqusition Frame Rate Control Enable	
	Resulting Frame Rate(Fps)	
	Reference Frame Rate	
	Trigger Selector	Section External Trigger Mode
	Trigger Mode	
	Trigger Software	
	Trigger Source	
	Trigger Activation	
	Trigger Delay(μs)	
	Trigger Cache Enable	
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Camera Parameter Index

Attribute	Parameter	Section
Acquisition Control	Bulb Enable	Section Exposure Time Mode
	Exposure Mode	
	Exposure Time(μs)	
	Exposure Auto	
	Auto Exposure Time Lower Limit(μs)	
	Auto Exposure Time Upper Limit(μs)	
	HDR Enable	Section HDR
	HDR Reset	
	HDR Number	
	HDR Selector	
	HDR Shutter(μs)	
	HDR Gain	
	FullFrame Transmission	Section Full Frame Transmission
Analog Control	Preamp Gain	Section Gain
	Gain	
	Gain Auto	
	Auto Gain Lower Limit(dB)	
	Auto Gain Upper Limit(dB)	
	Digital Shift	
	Digital Shift Enable	
	Sensor Mode	Section Sensor Mode
	Brightness	Section Brightness
	Black Level	Section Black Level
	Black Level Enable	
	Balance White Auto	Section White Balance
	AWB Color Temperature Mode	
	Balance Ratio Selector	
	Balance Ratio	
	Gamma	Section Gamma Correction
	Gamma Selector	
	Gamma Enable	
	Sharpness	Section Sharpness
	Sharpness Enable	
	Auto Function AOI Selector	Section 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	

Camera Parameter Index

Attribute	Parameter	Section
Color Transformation Control	Color Transformation Selector	Section Color Transformation Control
	Color Transformation Enable	
	Color Transformation Value Selector	
	Color Transformation Value	
LUT Control	LUT Selector	Section LUT
	LUT Enable	
	LUT Index	
	LUT Value	
	LUT Save	
Shading Correction	Shading Selector	Section Shading Correction
	Activate Shading	
	LSC Table Selector	
	LSC Target Enable	
	LSC Target	
	LSC Enable	
	LSC Sequencer Enable	
	LSC Sequencer Reset	
	LSC Sequencer Number	
	LSC Sequencer Manual Enable	
	LSC Sequencer Selector	
	LSC Sequencer Table	
	NUC Enable	
	FPNC Enable	
	PRNUC Enable	
	FFC Target Enable	
	FFC Target	
	FFC Enable	
Digital IO Control	Line Selector	Section I/O Output
	Line Mode	
	Line Inverter	
	Line Status	
	Line Status All	
	Line Debouncer Time(μs)	
	Line Source	
	Strobe Enable	
	Strobe Line Duration(μs)	
	Strobe Line Delay(μs)	
	Strobe Line Pre Delay(μs)	

Camera Parameter Index

Attribute	Parameter	Section
Action Control	Action Device Key	Section Action Command
	Action Queue Size	
	Action Selector	
	Action Group Mask	
	Action Group Key	
Counter And Timer Control	Counter Selector	Section Counter Trigger
	Counter Event Source	
	Counter Reset Source	
	Counter Reset	
	Counter Value	
	Counter Current Value	
File Access Control	File Selector	Section File Access Control
	File Operation Selector	
	File Operation Excute	
	File Open Mode	
	File Operation Status	
	File Operation Result	
	File Size(B)	
Event Control	Event Selector	Section Event Control
	Event Notification	
Transport Layer Control	Payload Size(B)	Section Transport Layer Control
	GEV Version Major	
	GEV Version Minor	
	GEV Device Mode Is Big Endian	
	GEV Device Mode Character Set	
	GEV Interface Selector	
	GEV MAC Address	
	GEV Supported Option Selector	
	GEV Supported Option	
	GEV Current IP Configuration LLA	
	GEV Current IP Configuration DHCP	
	GEV Current IP Configuration Persistent IP	
	GEV PAUSE Frame Reception	
	GEV Current IP Address	
	GEV Current Subnet Mask	
	GEV Current Default Gateway	
	GEV First URL	
	GEV Second URL	
	GEV Number Of Interfaces	
	GEV Persistent IP Address	

Camera Parameter Index

Attribute	Parameter	Section
Transport Layer Control	GEV Persistent Subnet Mask	Section Transport Layer Control
	GEV Persistent Default Gateway	
	GEV Link Speed	
	GEV Message Channel Count	
	GEV Stream Channel Count	
	Gev GVCPPending ACK	
	Gev GVCPPending Timeout	
	GEV Heartbeat Timeout(ms)	
	GEV Heartbeat Disable	
	GEV Timestamp Tick Frequency(Hz)	
	Timestamp Control Latch	
	Timestamp Control Reset	
	Timestamp Control Latch Reset	
	Timestamp Value	
	GEV CCP	
	GEV MCP Host Port	
	GEV MCDA	
	GEV MCTT(ms)	
	GEV MCRC	
	GEV MCSP	
	GEV Stream Channel Selector	
	GEV SCP Interface Index	
	GEV SCP Host Port	
	GEV SCP Direction	
	GEV SCPS Fire Test Packet	
	GEV SCPS Do Not Fragment	
	GEV SCPS Big Endian	
	GEV SCPS Packet Size(B)	
	Bandwidth Reserve	
	Auto SCPD	
	Actual SCPD	
	GEV SCPD	
	GEV SCDA	
	GEV SCSP	
	GEV IEEE 1588	
	GEV IEEE 1588 Status	
	Gev GVSP Extended ID Mode	

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Camera Parameter Index

Attribute	Parameter	Section
User Set Control	User Set Current	Section Save and Load User Set
	User Set Selector	
	User Set Load	
	User Set Save Status	
	User Set Save	
	User Set Default	

The specific parameter s may differ by camera models.

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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: Network cable connection error
Solution2: Check network connection

■ Camera connection error

Possible Reason1: Camera and client software are not in the same network segment
Solution1: Edit its IP address
Possible Reason2: The camera has been connected by another program
Solution2: Reconnect after disconnecting the camera from other programs

■ 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.

■ The gigabit Ethernet becomes the fast Ethernet.

Possible Reason: The network cable is damaged.
Solution : Check whether the network cable is damaged.

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CHAPTER 10 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@contrastech.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.		

Hangzhou Contrastech Co., Ltd

C-5F, No.8 Xiyuan 9th Road, West Lake District Hangzhou Zhejiang 310030 China
Tel: +86-571-89712238
www.contrastech.com

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