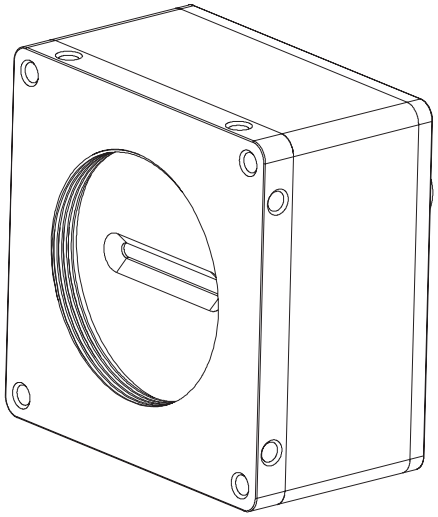
CONTRASTECH

Mars Line Scan Cameras User Manual



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PREFACE

Purpose of This Manual

This Manual is a basic description of Mars Line Scan Cameras, which mainly includes the product description, quick installation guide and Simple introduction of SDK(iCentral).

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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.

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CHAPTER 1 Product Description

Product Introduction

Mars series line scan industrial cameras have high-performance sensitive sensors and transmit image data via GigE interface/CameraLink interface. It is compatible to any application development tools which follow the GigE Vision, CameraLink protocol and GenICam standard. And it could work stably in a variety of harsh envi-ronment. It's distinguished itself by high reliability and high cost-performance.

Product Features

CameraLink Interface Line Scan Camera

- Support Deca, Full, Medium, Base, maximum 6.8GB/S theoretical bandwidth
- Supports API trigger, external trigger, free run mode and etc.;
- Supports various output formats for image data;
- Conforms to CameraLink protocol and GenICam standard;
- Support DC12V~24V wide-range power supply.

GigE Interface Line Scan Camera

- Provides 256MB on-board buffer for image data retransmission under burst mode;
- Supports API trigger, external trigger, free run mode and etc.;
- Supports various output formats for image data;
- Conforms to GigE Vision protocol and GenICam standard;
- Support DC12V~24V wide-range power supply.

Applications

Widely used in agriculture sorting;

PCB inspection;

Paper surface inspection;

UVS;

Railway inspection;

Post sorting;

Textile surface inspection and TFES etc.

Mechanical Dimensions

The dimensions is in millimeters

- E2V Sensor Cameras with 62 * 62 * 35mm housing are as shown in Figure 1-1.
- CMOSIS Sensor Cameras with 62 * 62 * 35.3mm housing are as shown in Figure 1-2.
- Gpixel Sensor Cameras with 62 * 62 * 43.5mm housing are as shown in Figure 1-3.
- 8K GigE Cameras with 80 * 80 * 48mm housing are as shown in Figure 1-4.
- 8K CL Cameras with 80 * 80 * 48mm housing are as shown in Figure 1-5.

Figure 1-1: E2V Sensor Cameras with 62 * 62 * 35mm housing。

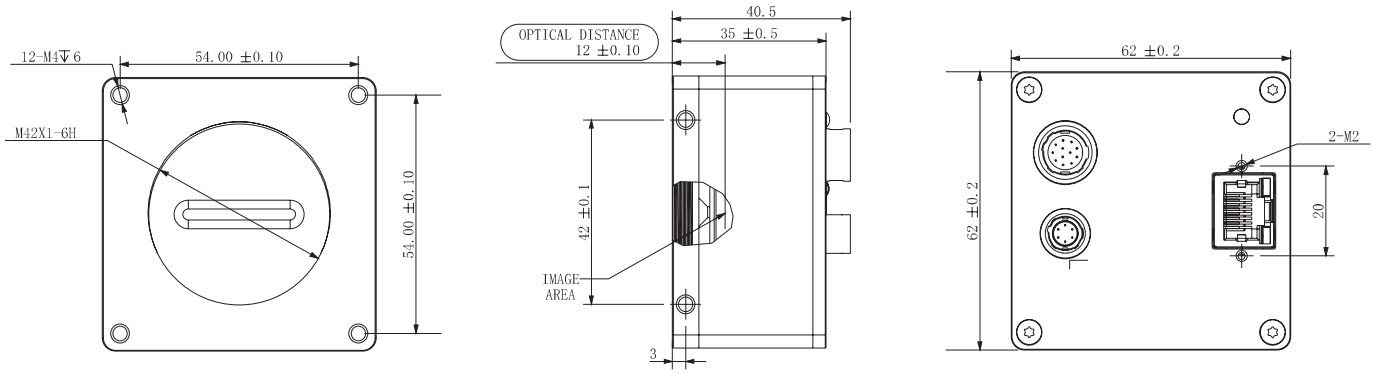


Figure1-2: CMOSIS Sensor Cameras with 62 * 62 * 35.3mm housing。

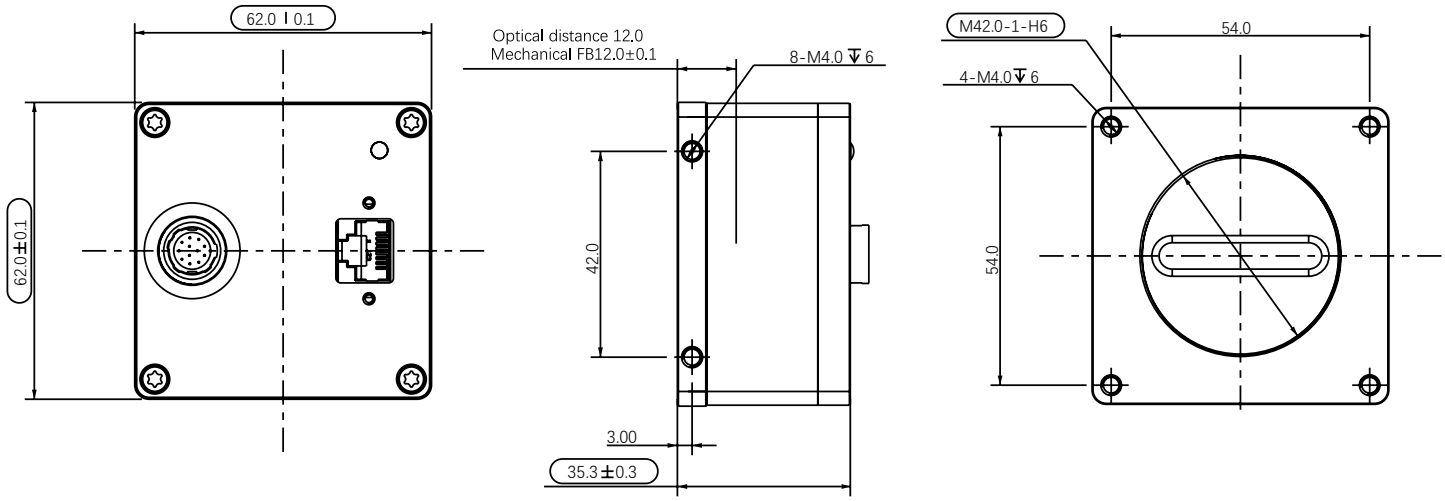
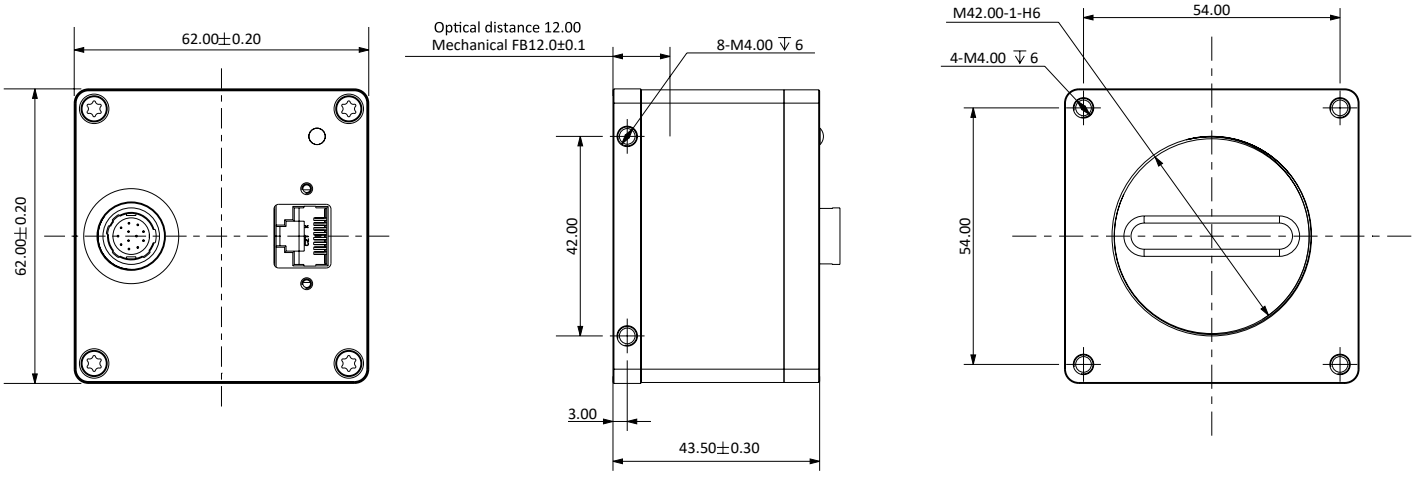


Figure1-3: Gpixel Sensor Cameras with 62 * 62 * 43.5mm housing。



Mechanical Dimensions

Figure1-4: 8K GigE Cameras with 80 * 80 * 48mm housing。

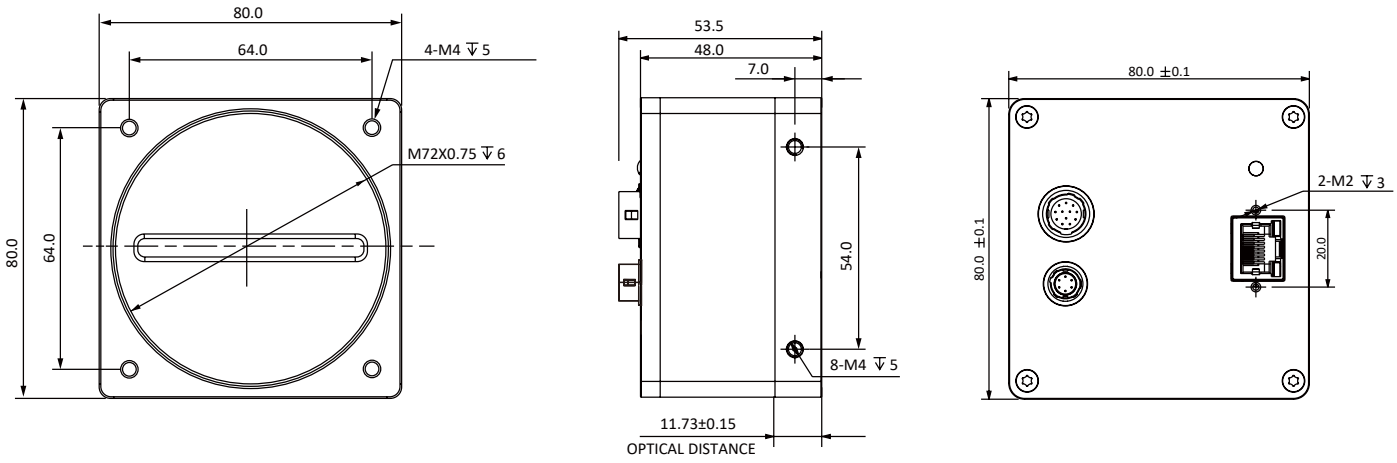
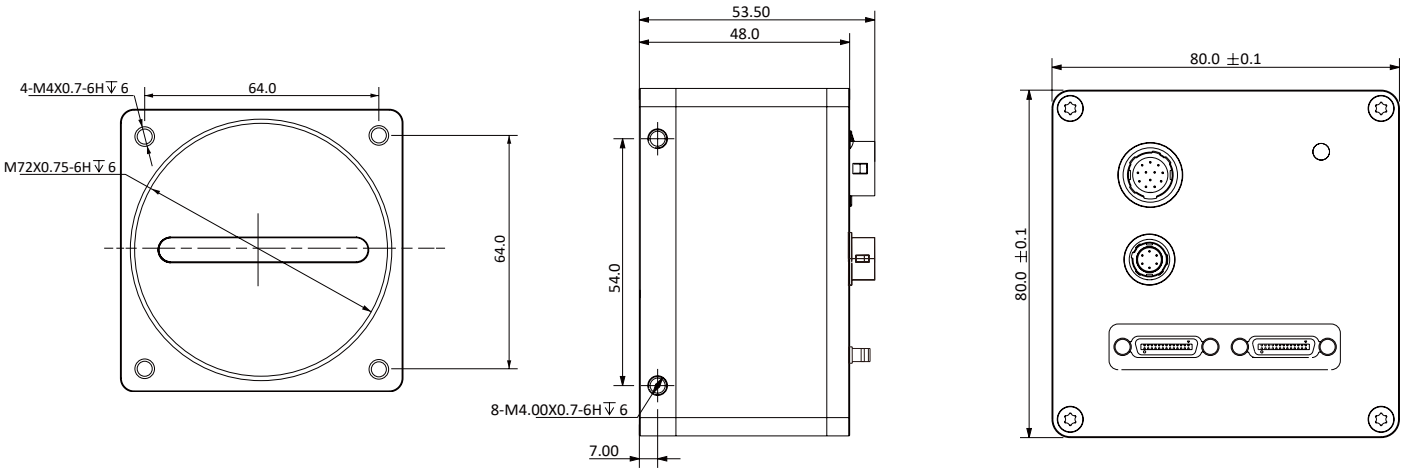


Figure1-5: 8K CL Cameras with 80 * 80 * 48mm housing。



Status LED Description

Mode	Status LED		Description
Normal	Red	Fast Flashing Red	The device is starting.
	Blue	Low-light Blue	IP has been assigned, Software API is not connected with the device.
		High-light Blue	API is connected with the device, free mode, No image transmission
		Fast Flashing Blue	API is connected with the device, free mode, with image transmission
		Slow Flashing Blue	Using trigger mode.
	Red ↔ Blue	Flashing Alternately Red and Blue	Firmware is upgrading.
Abnormal	Red	Steady Red	Device malfunction
		Slow Flashing Red	The Network is disconnected.

Electrical Standard

Wire Color of VT-Hirose6-7	Pin	Signal	Function
Red	1	Power	+12 VDC (- 10 %) to +24 VDC (+ 5 %), < 1 % ripple, Camera Power
Green	2		
White	3	-	-
Blue	4	-	-
Brown	5	GND	DC Camera Power Ground
Black	6		

Table 1: E2V 4K GigE、CMOSIS 8K GigE Camera

Pin	Signal	Function	Remarks
1	line1_in-	RS422 input-	Connects the encoder (frame trigger)
2	line1_in+	RS422 input+/single-end input	Connects the encoder (frame trigger)
3	line3_inout-	RS422 input/output-	-
4	line3_inout+	RS422 input and output+/single-ended input and output	-
5	Signal Ground	Signal ground (SGND)	Encoder power ground (0 V)
6	Line5_out-	RS422 output–	Reserved
7	Line5_out+	RS422 output+/single-ended output	Reserved
8	Line2_in-	RS422 input-	Connects the encoder (frame trigger)
9	Line2_in+	RS422 input+/single-ended input	Connects the encoder (frame trigger)
10	Line4_GPIO	Single-ended input/output	Connects the photoelectric switch (line trigger)
11	Line6_out-	RS422 output-	Reserved
12	Line6_out+	RS422 output+/single-ended output	Reserved

Table 2: CMOSIS 4K GigE Camera

Pin	Signal	Function	Remarks
1	Power GND	Camera power ground (Also work as the signal ground SGND)	Camera power supply ground (0 V)
2	Camera Power	Camera power	Camera power VCC
3	IN Line5+	RS422 input Line5+	Connects the encoder (frame trigger)
4	IN Line5-	RS422 input Line5–	Connects the encoder (frame trigger)
5	OPT GND	Opto-isolated ground	-
6	OPT IN Line1	Optocoupler input 1	Connects the photoelectric switch (line trigger)
7	OPT IN Line2	Optocoupler input 2	Connects the photoelectric switch (line trigger)
8	GPIO Line4	Bidirectional GPIO Line4	-
9	OUT Line6+	Output Line6+	Reserved
10	OUT Line6-	Output Line6–	Reserved
11	IN Line3+	Input Line3+	Connects the encoder (frame trigger)
12	IN Line3-	Input Line3-	Connects the encoder (frame trigger)

Electrical Standard

Table 3: Gpixel Sensor Camera

Pin	Signal	Function	Remarks
1	Power GND	Camera power ground	Camera power supply ground (0 V)
2	Camera Power	Camera power	Camera power VCC
3	IN Line1+	Input Line1+	Connects the encoder (frame trigger)
4	IN Line1-	Input Line1-	Connects the encoder (frame trigger)
5	Signal GND	Signal ground (SGND)	Signal ground
6	IN Line2	Input Line2+	Connects the encoder (frame trigger)
7	IN Line2-	Input Line2-	Connects the encoder (frame trigger)
8	IN Line4	Bidirectional GPIO Line4	-
9	IN/OUT Line3+	Input and output with Line3+	-
10	IN/OUT Line3-	Input and output with Line3-	-
11	OPT_IN Line5	Optocoupler input Line5	Connects the photoelectric switch (line trigger)
12	OPT GND	Opto-isolated ground	-

- Use RS-422 input to connect to the encoder, and provide line trigger signal.
- Use optocoupler input to connect photoelectric switch or PLC output to provide frame trigger signal. If there is no optocoupler input, use GPIO input instead.

Avoiding EMI and ESD Problems

The cameras are frequently installed in industrial environments. These environments often include devices that generate electromagnetic interference (EMI) and they are prone to electrostatic discharge (ESD). Excessive EMI and ESD can cause problems with your camera such as false triggering or can cause the camera to suddenly stop capturing images. EMI and ESD can also have a negative impact on the quality of the image data transmitted by the camera.

To avoid problems with EMI and ESD, you should follow these general guidelines:

- Always use high quality shielded cables. The use of high quality cables is one of the best defenses against EMI and ESD.
- Try to use camera cables that are only as long as necessary and try to run the camera cables and power cables parallel to each other. Avoid coiling camera cables. If the cables are too long, use a meandering path rather then coiling the cables.
- Avoid placing camera cables parallel to wires carrying high-current, switching voltages such as wires supplying stepper motors or electrical devices that employ switching technology. Placing camera cables near to these types of devices can cause problems with the camera.
- Attempt to connect all grounds to a single point, e.g., use a single power outlet for the entire system and connect all grounds to the single outlet. This will help to avoid large ground loops. (Large ground loops can be a primary cause of EMI problems.)
- Use a line filter on the main power supply.
- Install the camera and camera cables as far as possible from devices generating sparks. If necessary, use additional shielding.
- Decrease the risk of electrostatic discharge by taking the following measures:
  - Use conductive materials at the point of installation (e.g., floor, workplace).
  - Control the humidity in your environment. Low humidity can cause ESD problems.

Precautions

NOTICE

Cleaning of the sensor and the housing

Sensor

Avoid cleaning the surface of the camera's sensor if possible. If you must clean it:

- Before starting, disconnect the camera from camera power and I/O power.
- Use a soft, lint-free cloth dampened with a small amount of high-quality window cleaner.
- Because electrostatic discharge can damage the sensor, you must use a cloth that won't generate static during cleaning (cotton is a good choice).
- Make sure the window cleaner has evaporated after cleaning, before reconnecting the camera to power.

Housing

To clean the surface of the camera housing:

- Do not use solvents or thinners; they can damage the surface.
- Use a soft, dry cloth that won't generate static during cleaning (cotton is a good choice).
- To remove tough stains, use a soft cloth dampened with a small amount of neutral detergent; then wipe dry.

NOTICE

Using a wrong pin assignment for the 6-pin/12-pin receptacle can severely damage the camera.

Make sure the cable and plug you connect to the 12-pin receptacle follows the correct pin assignment.

In particular, there is also a 6-pin receptacle in the line scan cameras. So, please keep in mind that do not use a pin assignment that would be correct for Mars area scan cameras. The 6-pin receptacles of Mars line scan cameras are electrically incompatible.

NOTICE

Avoid dust on the sensor.

The camera is shipped with a protective plastic seal on the camera front. To avoid collecting dust on the camera's sensor, make sure that you always put the protective plastic seal in place when there is no lens mounted on the camera.

Also, make sure to always point the camera downward when there is no protective seal on the camera front or no lens mounted.

CHAPTER 2 Installation and Setup

Software Installation

System Requirements

The Mars Camera Software Suite for Windows requires 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)

Brief Introduction of Mars Camera Software Suite

The options available with the Mars Camera Software Suite let you change parameters and control the camera by using a stand-alone GUI (known as iCentral) or by accessing the camera from within your software application using the API.

The Mars Camera Software Suite is designed for use with all Mars cameras with both the GigE and USB 3.0. The ICentral offers reliable, real-time image data transport into the memory of your computer at a very low CPU load.

The Mars Camera Software Suite includes several tools that you can use to change the parameters on your camera, including ICentral and API for different programming languages (C#/C++/.NET).

Installation Steps:

1. Download the iCentral from the ContrasTech website:

http://www.contrastech.com/en/service.html

2. Launch the downloaded installer.

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

During installation, you can choose whether to install the software for use with a GigE camera or a USB 3.0 camera.

Hardware Installation

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

■ Installing a Cameralink Lian Scan Camera

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:

- A Mars Cameralink Line Scan camera;
- As applicable, a power supply and a Cameralink frame grabber;
- As applicable, a suitable lens for the camera;
- A computer with a Cameralink frame grabber installed; (The computer must be equipped with an appropriate operating system.);
- A standard Cameralink cable(CAT 6 or better).

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

Steps:

1. Mount a lens with adapter onto your camera. For lenses, make sure that the lens is screwed into the camera's lens adapter as far as it will go;
2. Connect the camera to the computer and power.

   If you are using PoCL：

   a. Connect one end of a CL cable to the CL1 connector of the Cameralink frame grabber and connect the other end of the cable to the CL connector of the camera.If you need to connect 2 interfaces, the corresponding Cameralink cable interface also corresponds to the camera interface.

   b. Connect the power supply plug of the Cameralink frame grabber to the power supply port of the PC motherboard. (Cameralink frame grabber needs to support PoCL)

   If you are using 6-Pin Hirose cable:

   a. Connect one end of a CL cable to the CL1 connector of the Cameralink frame grabber and connect the other end of the cable to the CL connector of the camera.If you need to connect 2 interfaces, the corresponding Cameralink cable interface also corresponds to the camera interface.

   b. Plug the 6-pin/12-pin connector of the cable from your power supply into the 6-pin/12-pin connector of the camera.

   c. Switch on the power supply.

■ Installing a GigE Lian Scan Camera

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:

- A Mars GigE Line Scan camera.
- A power supply.
- As applicable, a C-mount, M42-mount or F-mount lens for the camera.
- A computer with a GigE network adapter installed. The computer must be equipped with an appropriate
- A standard Ethernet patch cable(CAT 6 or better).

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

Steps:

1. Mount a C-mount lens, M42-mount or F-Mount lens with adapter, as applicable onto your camera.

   Please make sure that you are using the right adapter for lens with different mount.

2. Connect the camera to the computer and power.

   If you are using PoE： Connect one end of the network cable to the computer's Gigabit Ethernet port or switch, and the other end to the camera's Ethernet port.

   If you are using E2V Sensor and 8K Cameras with Hirose cable:

   a. Plug one end of an Ethernet cable into the network adapter in your computer and the other end of the cable into the GigE connector of the camera.

   b. Plug the 6-pin connector of the cable from your power supply into the 6-pin connector of the camera.

   c. Switch on the power supply

   If you are using CMOSIS and Gpixel Sensor Cameras with Hirose cable:

   a. Plug one end of an Ethernet cable into the network adapter in your computer and the other end of the cable into the GigE connector of the camera.

   b. Plug the 12-pin connector of the cable from your power supply into the 12-pin connector of the camera.

   c. Switch on the power supply

CHAPTER 3 Features

line Rate

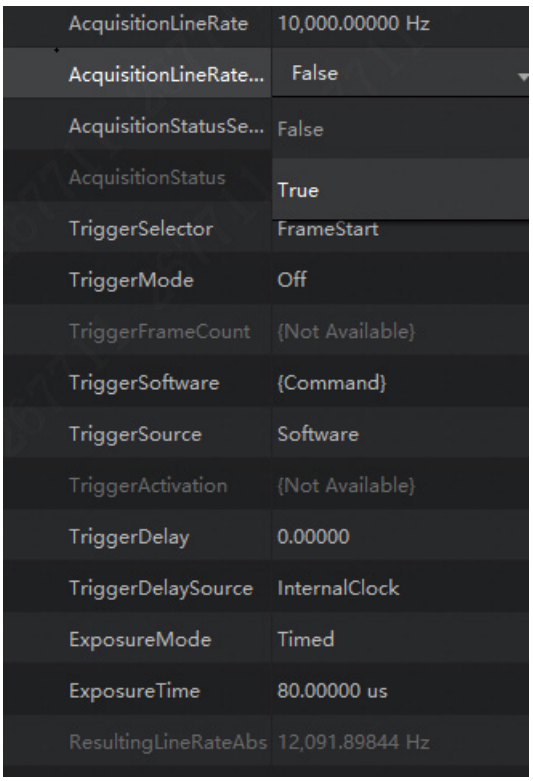
■ Factors

- Bandwidth: The larger the bandwidth of the camera, the more data can be transmitted per second, and the higher the line scan rate.
- Pixel format: In the same conditions, the more bytes the pixel format occupies, the lower the line scan rate.
- Exposure: The shorter the exposure time, the higher the line scan rate.
- Image transmission mode: When the camera works with the optimum SDK, the image data is transmitted to your PC in different image transmission modes, and the PC analyzes the original image data through our SDK. This can further improve the line scan rate, such as the lossless compression function.

i	The image lossless compression functions supported by different cameras are different.

■ Configuring Line Scan Rate

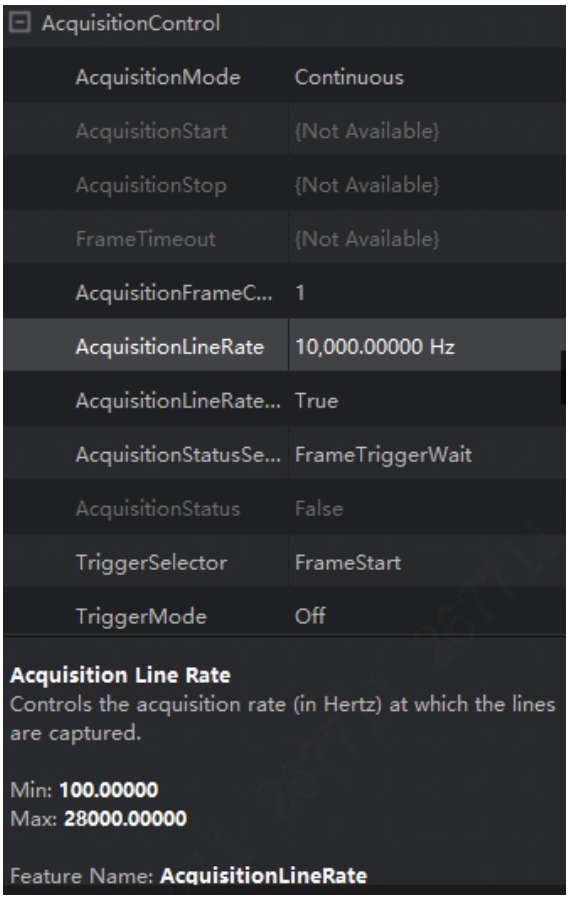
By setting **AcquisitionLineRateEnable**, you can give priority to line scan rate, thereby adjusting the aspect ratio of the detected object.



- Step 1 : Connect the camera through iCentral, and then select **Features > AcquisitionControl**.
- Step 2: Select **AcquisitionLineRate**, and then you can view the maximum and minimum line scan rate, and also adjust the rate.

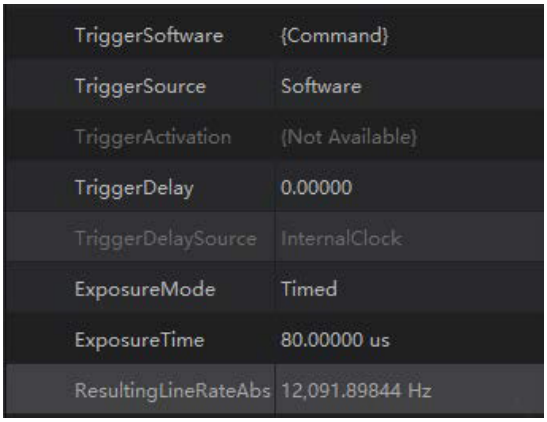
i	● If the maximum line scan rate of the camera is lower than the defined rate, the camera captures images at the actual rate. ● If the maximum line scan rate of the camera is greater than the defined rate, the camera captures images at the defined rate.

line Rate



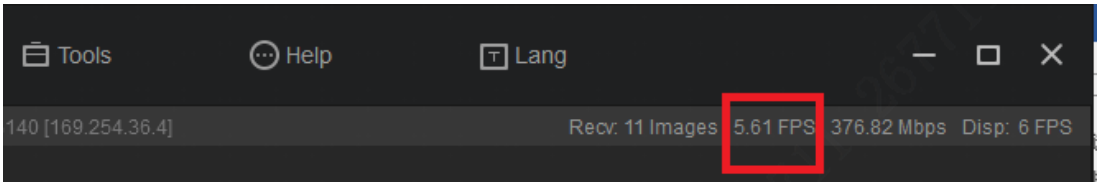
Capture frequency

- Step 3: You can view the real-time streaming frequency of the camera through **ResultingLineRateAbs**.



View the streaming frequency

- Step 4: (Optional) You can view the real-time frame rate of the line scan camera at the upper-right corner.



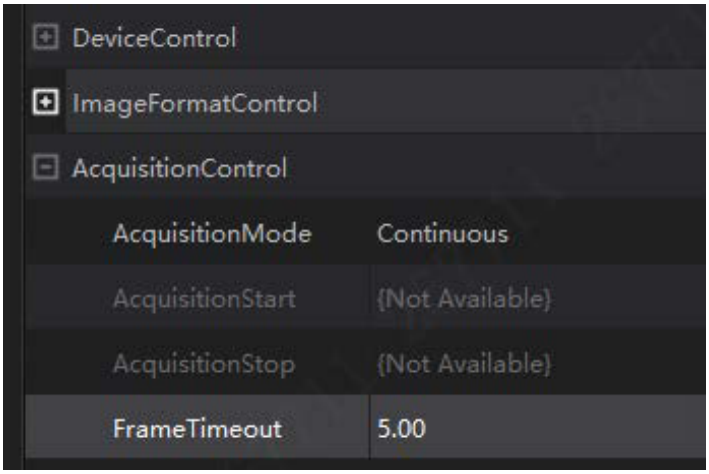
line Rate

■ Frame Timeout

In the frame + line mode, when the number of line signals has not reached the defined line height, the image will be displayed only after the subsequent line signals reach the defined line height.

In special circumstances, if the line signal does not reach the defined line height, the camera will wait for the subsequent line signal. At this time, the frame signal will be filtered out and frame loss will occur. After turning on frame timeout, set the duration of one frame. If there are no enough line signals within this time, the camera will blacken the remaining lines and output a frame of image.

Select **AcquisitionControl**, and then configure time of **FrameTimeout**.

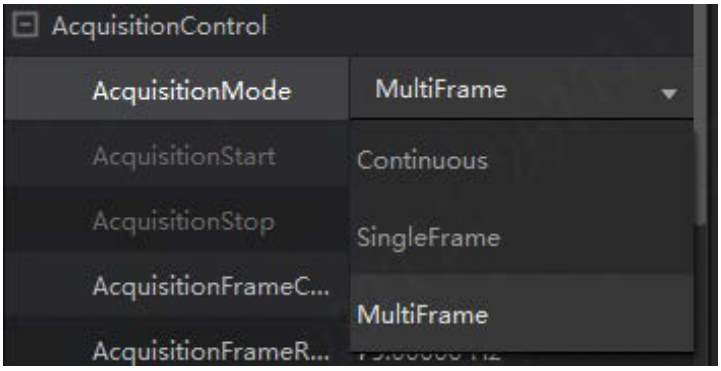


Frame timeout

i	This function needs to enable frame + line trigger at the same time.

Acquisition Mode

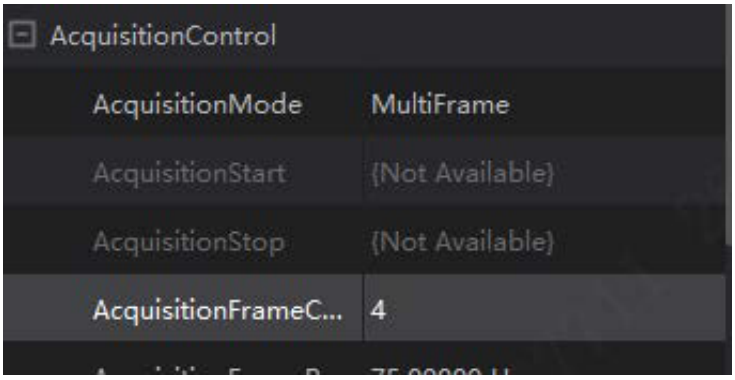
Three acquisition modes are available: Continuous acquisition, single frame acquisition, and multi-frame acquisition.



Multi-frame acquisition

Step 1: Click **Acquisition Mode** to select the corresponding mode. Select **MultiFrame**, that is, multi-frame acquisition.

Step 2: Select **AcquisitionFrameCount**, and then configure the parameters.



Number of acquisition frame

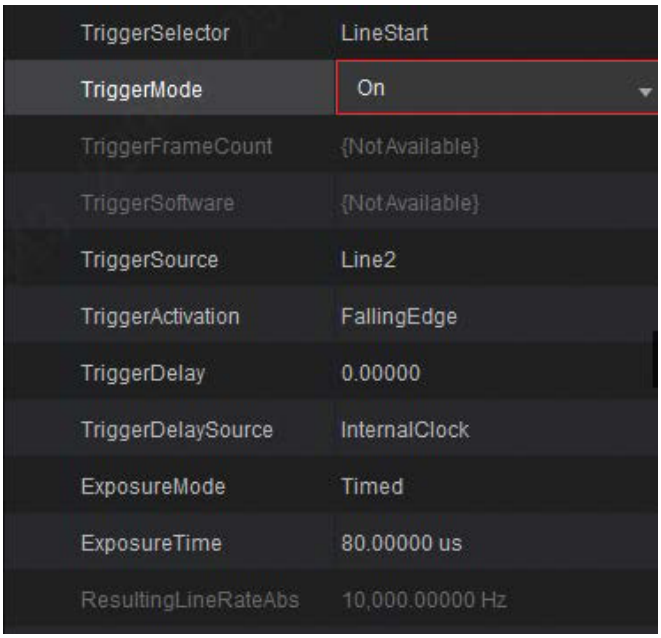
Parameter	Description
SingleFrame	After starting acquisition, the camera only captures one image.
Continuous	● After starting acquisition, the camera captures images consecutively. ● When the number of acquisition lines reaches the height of the image, one image will be generated, and then the images will be continuously generated in this mode.
MultiFrame	Configure the frame rate (1–255) in **AcquisitionFrameCount**. ● After starting acquisition, the camera captures images consecutively. ● When the number of acquisition lines reaches the height of the image, one image will be generated, and then the images will be continuously generated in this mode, until the generated images reaches the value defined in **AcquisitionFrameCount**.

Trigger Mode

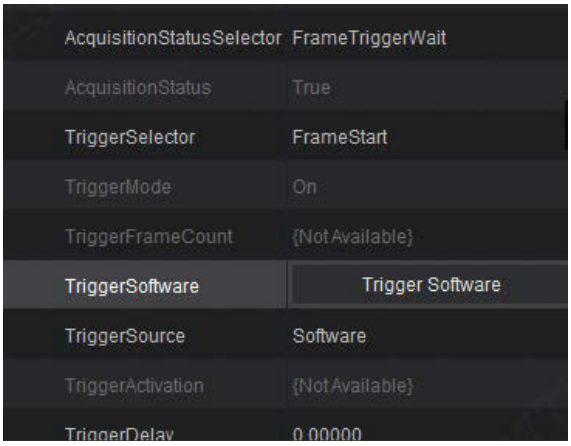
A line scan camera is generally triggered by line, frame, and line + frame. The trigger mode is determined by **Trigger Selector** and **Trigger Mode** in **Acquisition Control**.

■ Trigger Type

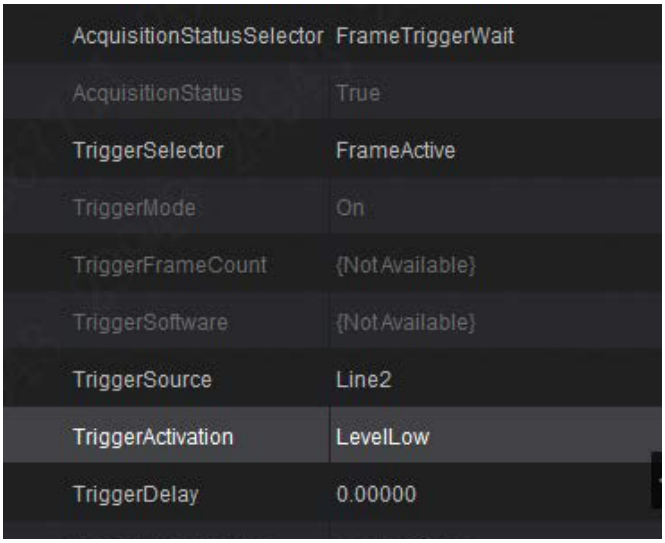
● Line trigger (**LineStart**): Outputs one line after receiving a trigger signal (rising edge or falling edge), and outputs a frame of image when the received signals meet the defined image height.



● Frame trigger (**FrameStart**): Outputs a frame of image after receiving a trigger signal (rising edge or falling edge).



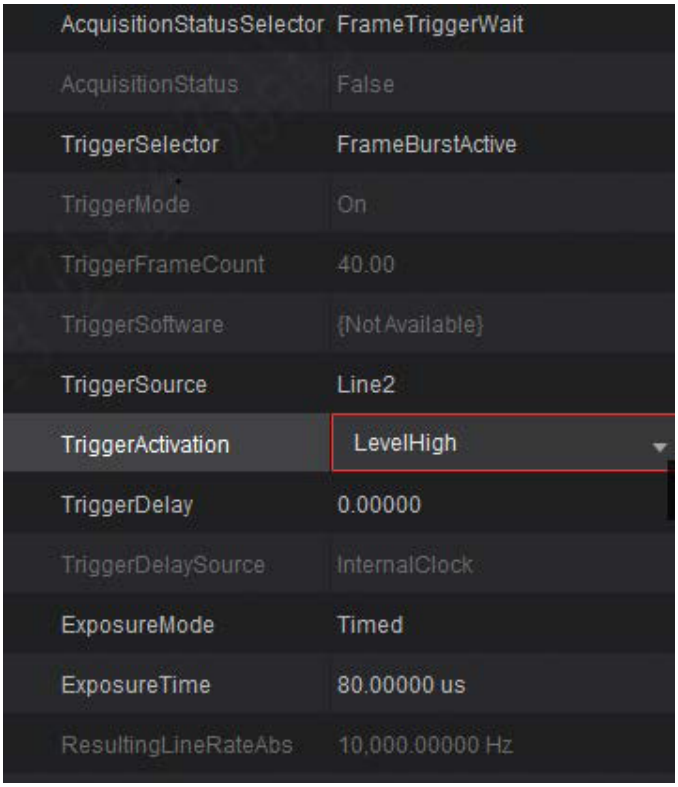
● **FrameActive**: A high-level (low-level) area captures multiple lines, and an image will be generated until meeting the defined line height. If the defined line height is not met, the image will be directly generated according to the captured line height.



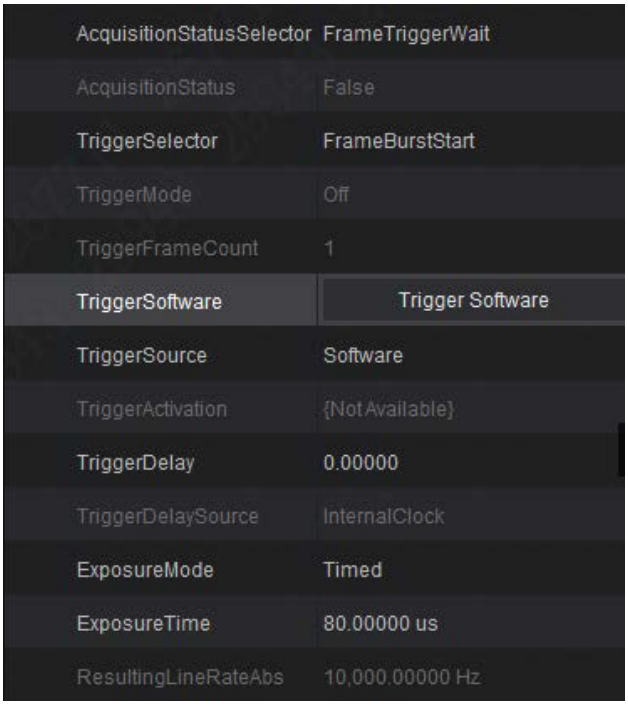
Trigger Mode

- **FrameBurstActive**: Multiple images can be outputted within a trigger signal high level (low level). When the adaptive line height is greater than the defined line height, you can set **TriggerFrameCount** to increase the number of frames captured by the camera.

	Adaptive line height: The maximum line height that can be continuously captured in a high-/low-level area of the camera after configuring other camera parameters. ● When the adaptive line height is smaller than the defined line height, the height of the captured image is the adaptive line height. In this case, **FrameBurstActive** is the same as **FrameActive**. ● When the adaptive line height is greater than the defined line height, the height of the captured image is the defined line height, and multiple frames can be output at the same time. If the line height of the last frame is less than the set line height, the image will be displayed according to the actual last frame line height.



- **FrameBurstStart**: Multi-frame mode of frame trigger mode. Outputs multiple images according to the define line height after receiving a trigger signal rising edge (falling edge). The number of images depends on the value defined in **TriggerFrameCount**.



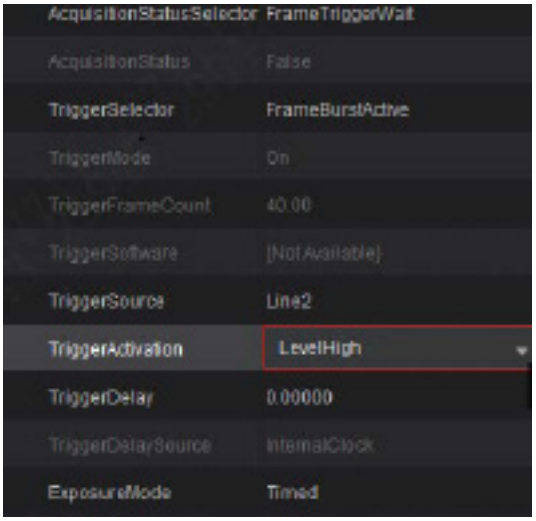
- Line + frame trigger: When there are multiple trigger signals, you can enable frame trigger and line trigger at the same time, so that the images fit the application environment and the law of object motion.

Trigger Mode

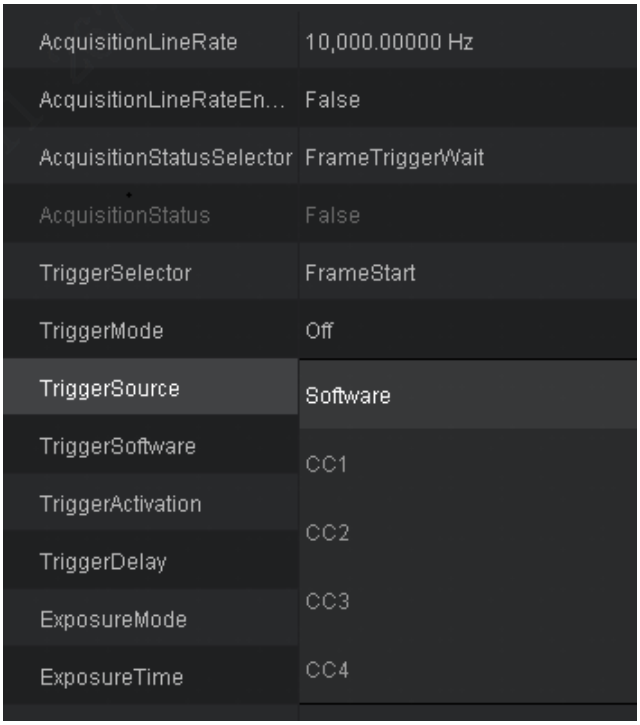
■ Trigger Source

● Software trigger: Select **Trigger Software** from **AcquisitionControl** > **TriggerSoftware** to send trigger signals manually through the software.

● I/O trigger: The trigger signal enters the camera from external devices through the I/O interface.For the specific wiring of the camera I/O interface, see the electrical specifications of the camera.As shown in the figure below, set **TriggerSelector** to **FrameBurstActive**, **TriggerMode** to **On**, **TriggerSource** to **Line2**, and **TriggerActivation** to **LevelHigh**. After completing the configuration, wire line 2 according to the cable specifications. After that, images can be generated after receiving signals.



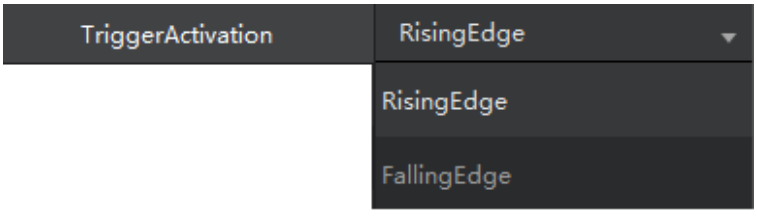
● Frame grabber trigger: A unique trigger mode of CameraLink line scan cameras. External signals enter the camera through the capture card, and the capture card sends the signals to the camera through the CameraLink cable for triggering detection.



1. Trigger signal includes **RisingEdge** and **FallingEdge**.

2. After selecting the trigger signal source, select the trigger signal from **RisingEdge** (rising edge) and **FallingEdge** (falling edge).

3. When setting the trigger, you also need to configure corresponding parameters on the software of the capture card that the camera actually connects.



Trigger Mode

- Encoder trigger: The encoder can convert electrical signals by angular displacement or linear displacement of the object, and then the camera can be triggered by these signals, and finally acquire stream and output images.

i	For example, if Line1 is used as the input source of direction A, then connect A+ to the red line (Line1+), connect A- to the black line (Line1-). If Line2 is used as the input source of direction B, then connect B+ to the blue line (Line2+), and connect B- to the orange line (Line2-).

Step1: Select signal source from **RotaryEncoderLineSource**.

Select rotary encoder line input source. For **PhaseA** and **PhaseB**, you need to select different input sources. The input source is Line1–6.

Step2: Click **RotaryEncoderSelector** to select an encoder.

Step3: Click **RotaryEncoderLineSelector** to select the encoder phase.

Select line of rotary encoder. You can select from PhaseA and PhaseB. This parameter influences the forward and reverse direction of the movement platform.

Step4: Click **RotaryEncoderMode** to set the encoder direction.

ForwardOnly and **AnyDirection** are available. When the trigger signal reaches the defined line height, a frame of image will be triggered.

- **ForwardOnly**: Images will be generated when the encoder rotates forward. When it rotates in reverse, the number of reverse signals will be displayed in **RotaryEncoderReverseCounter**. When it rotates forward continuously, the reverse count will decrease, and an image will be generated when the count reduces to zero, eliminating dithering.
- **AnyDirection**: Images will be generated when the encoder rotates in any direction.

i	The value of **RotaryEncoderReverseCounterMax** must be greater than the maximum of actual reverse signals; otherwise, the dithering will fail.

RotaryEncoderControl	
RotaryEncoderSelector	RotaryEncoder0
RotaryEncoderLineSelector	PhaseA
RotaryEncoderLineSource	Line1
RotaryEncoderMode	ForwardOnly
RotaryEncoderCounterMode	FollowDirection
RotaryEncoderCounter	0
RotaryEncoderCounterMax	1,000
RotaryEncoderCounterReset	{Command}
RotaryEncoderReverseCounter	1
RotaryEncoderReverseCounterMax	1,000
RotaryEncoderReverseCounterReset	{Command}

Advantages of encoder trigger:

- The output signal frequency of the encoder is proportional to the speed of the object, ensuring that the signal frequency is synchronized with the speed of the object's movement.
- The output pulse is used as the trigger signal of the line scan camera to synchronize the acquisition frequency of the camera with the movement speed of object.
- Images can be captured normally in the scene of non-uniform motion.
- When objects jitter in the application environment, set **RotaryEncoderMode** to **ForwardOnly** to eliminate the image impact caused by jitter.

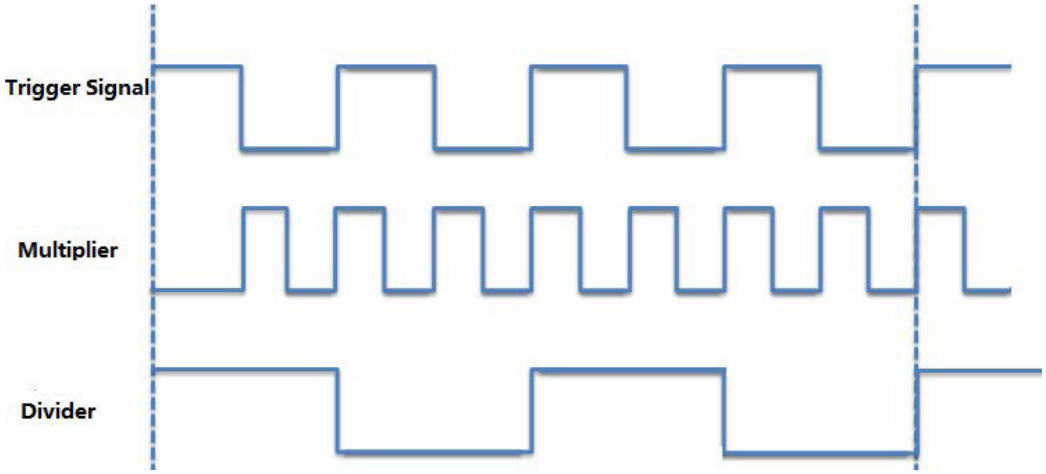
Trigger Mode

■ Frequency Division and Multiplication Control

● Introduction

You can manage the frequency division and multiplication function of the signal source. For signal sources after frequency division, the frequency will become slow. For signal sources after frequency multiplication, the frequency will become faster. When external signals trigger the camera to start working, the image effect might be poor, or the image might be severely stretched or compressed.

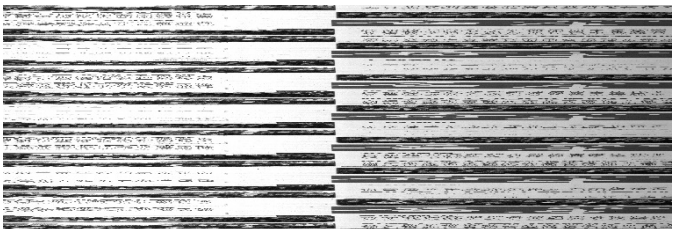
The frequency division and multiplication function can be used to adjust signal frequency to increase or decrease line scan rate.



● Operation

The image line height is 2048, the theoretical line frequency is 28000, and the frame rate is 0.5 fps.

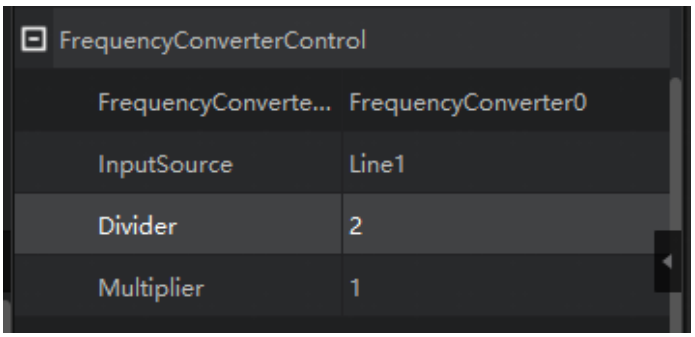
The image is severely compressed. The line scan rate (2048) of trigger signal is lower than movement speed of object, and cannot be changed. You can adjust the image by adjusting the frequency multiplication index.



Step 1: Select frequency controller from **FrequencyConverterSelector**.

Step 2: Select signal source from **InputSource**.

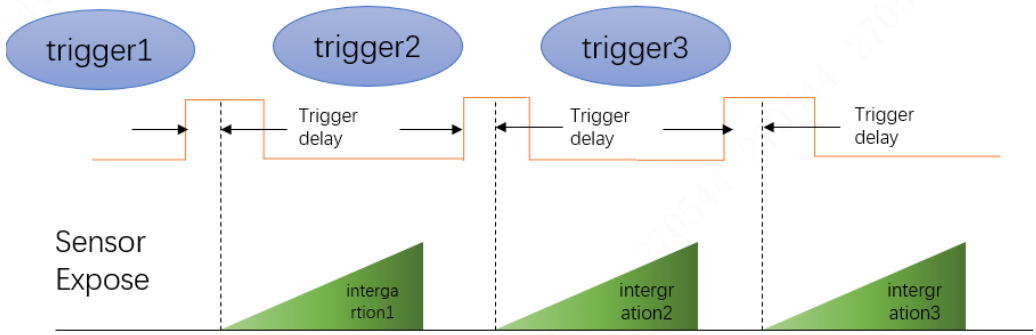
Step 3: Set **Divider** value (frequency division index) and **Multiplier** value (frequency multiplication index).



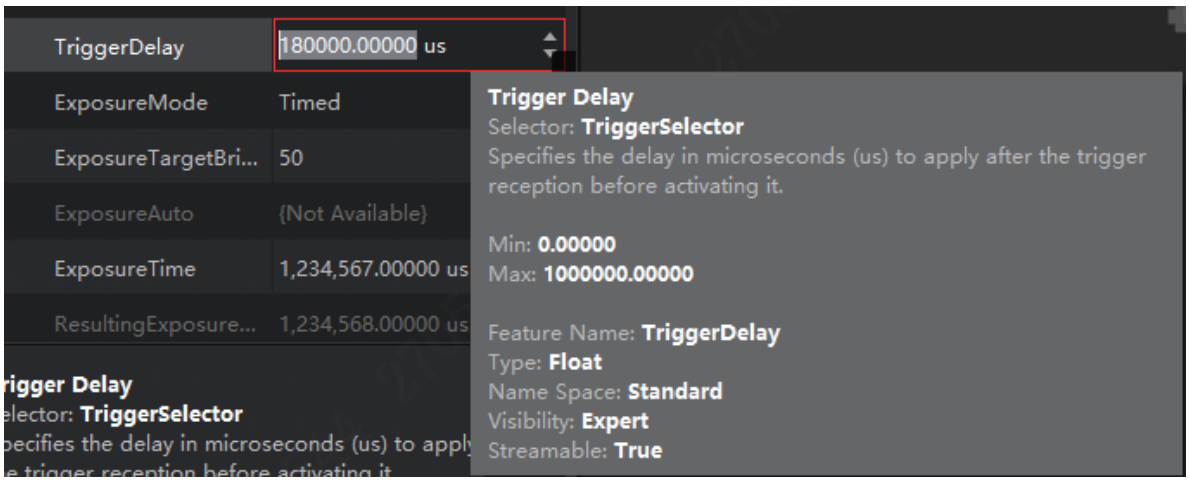
Step 4: Set a proper multiplier value (13) to increase the trigger line scan rate 26624 (2048 × 13).Similarly, when the image is stretched, you can adjust the divider value.

Trigger Delay

Delay time can be set between the time that the camera receives trigger signal and the time that the camera captures an image. The camera captures an image after the defined trigger delay.



You can configure **Trigger Delay**. The unit is μs, and the range is 0 μs–10000000 μs, that is, 0 s–10 s.



I/O Control

The external trigger input of the line scan camera supports three signal interfaces: Non-isolated differential signal, non-isolated single-ended signal, and isolated single-ended signal.

■ Non-isolated Differential Signal

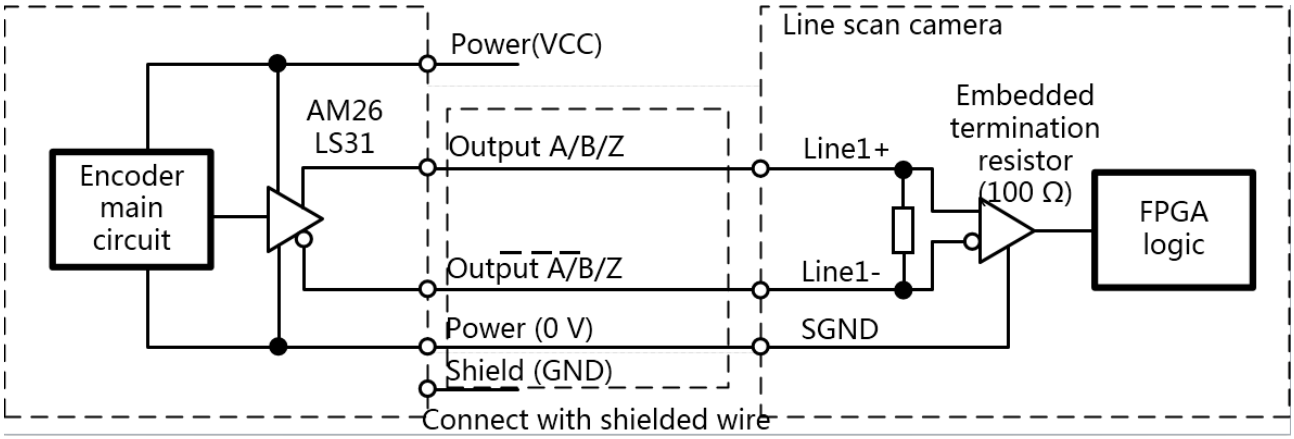
Connected to incremental rotary encoder with differential output. Often used as a line trigger signal input. We recommend using a differential output (linear drive output) encoder for long-distance transmission.

Step 1: Connect the A/B phase output of the encoder to the Line+ pin of the camera, and then to the Line– pin of the camera. Connect A/A or B/B to the Line pin of the same number label. For example, connect A to Line1+, and then A to Line1–.

Step 2: Connect the power ground (0 V) of the encoder to the signal ground (SGND) of the camera.

Step 3: Connect a power supply with a suitable voltage between the power supply (VCC) and the power ground (0 V) according to the power supply voltage requirements of the encoder.

Step 4: Set the camera IO to a differential input, and then enable the termination resistor.



- Line1 in the figure can also be Line2 or any other external signal input pin that supports non-isolated differential input.
- Use a shielded twisted pair (generally, the lead of the encoder is a shielded wire) to connect the encoder and the camera. If you need to extend the wiring, use a shielded twisted pair too, and connect the new shield to the metal braid of the original shielded wire.

■ Non-isolated Single-ended Signal

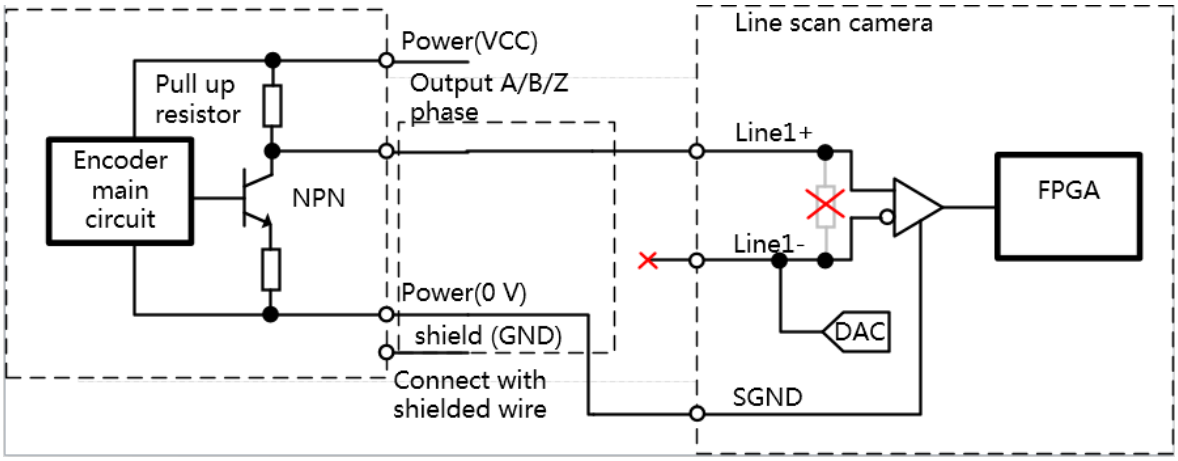
Connected to incremental rotary encoder with single-ended output signal. Often used as a line trigger signal input. The encoder is cost-effective when used in scenarios of short-distance transmission or minor interference. The encoder can be divided into three types: Complementary output, NPN collector output, and PNP collector output.

Step 1: Connect the A/B phase output of the encoder to the Line+ pin of the camera. Line– pin remains connected.

Step 2: Connect the power ground (0 V) of the encoder to the signal ground (SGND) of the camera.

Step 3: Connect a power supply with a suitable voltage between the power supply (VCC) and the power ground (0V) according to the power supply voltage requirements of the encoder.

Step 4: Set the camera IO to single-ended input, and set an appropriate comparison level according to the encoder supply voltage.

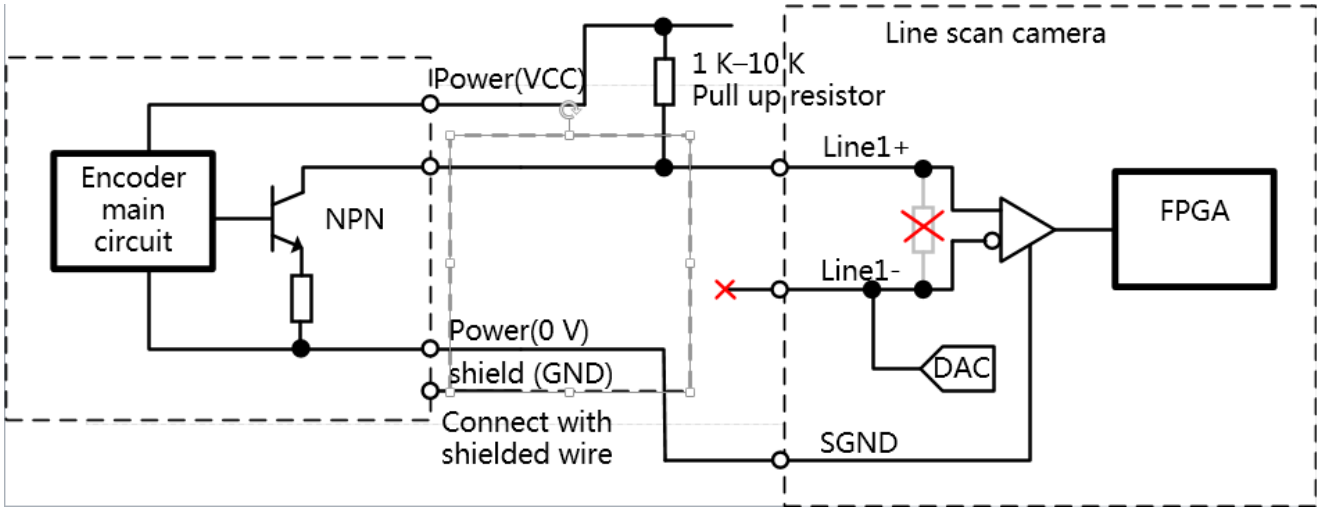


For NPN collector output, it is required to connect a pull-up resistor between the encoder power supply (VCC) and the signal cable. For PNP collector output, connect a pull-down resistor between the encoder power ground (0 V) and the signal cable. The resistance value is generally between 1–10 K, depending on the power supply voltage of the encoder. The resistance can be 1/8 W metal film in-line resistance. See Table below for the recommended values.

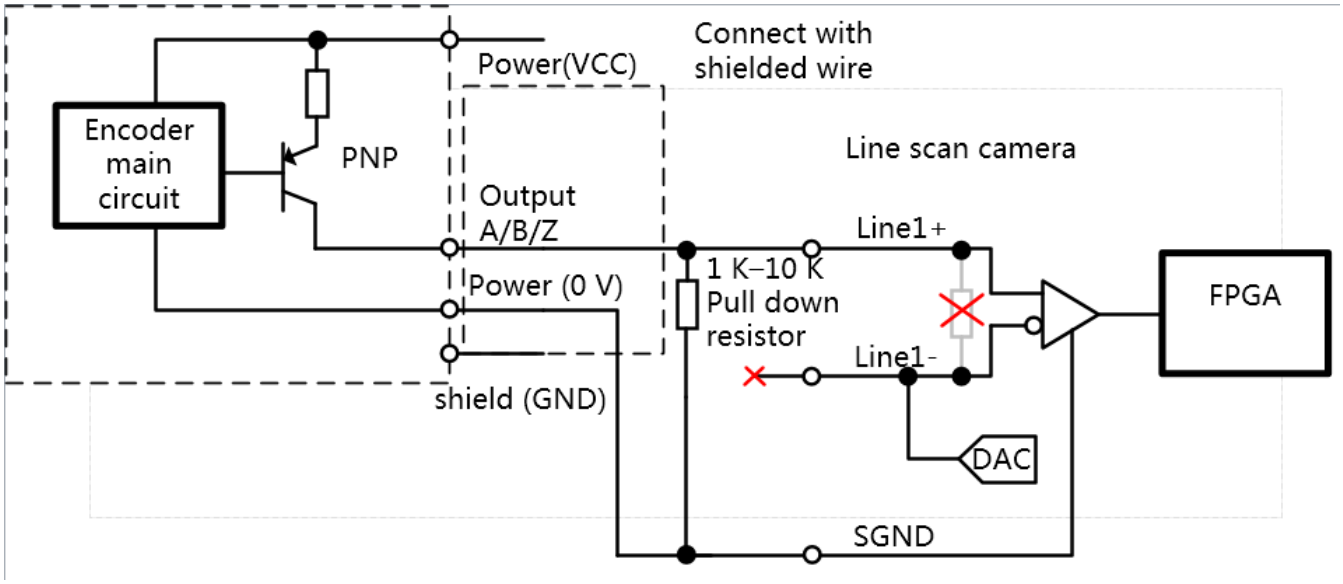
I/O Control

Encoder supply voltage (V)	Encoder pull-up and pull-down resistance
5V	1K
12V	2.7K
24V	4.7K

Connect non-isolated single-ended signal interface to NPN collector output encoder:



Connect non-isolated single-ended signal interface to PNP collector output encoder:



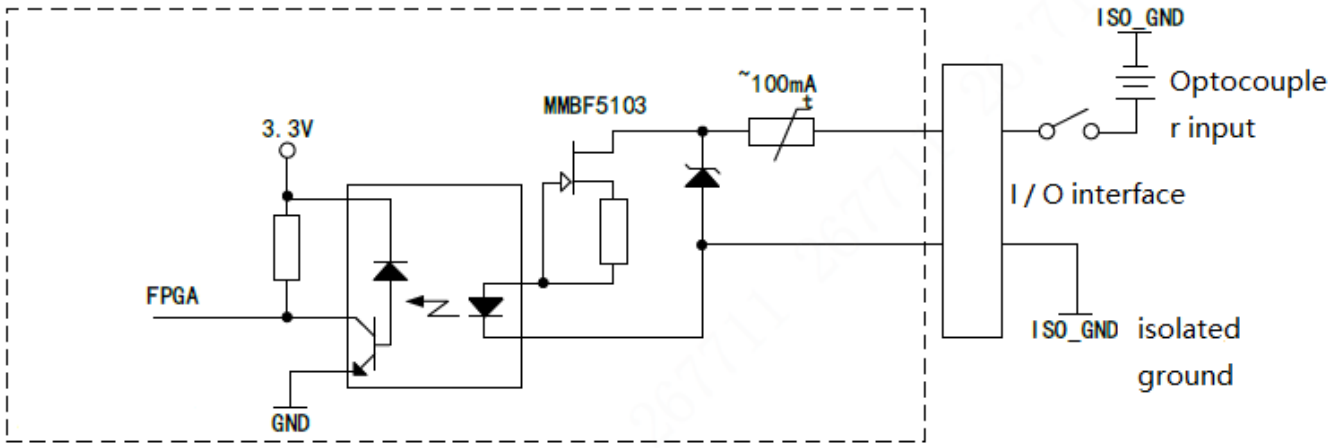
I/O Control

■ Isolated Single-ended Signal

It is used to connect the output of photoelectric sensor or other general PLC switch. It often used as frame trigger signal input.

Step 1 Connect the output interface of signal source to the optocoupler input, and connect the other end to the optocoupler isolation ground.

Step 2 Set the camera IO to single-ended input, and select the corresponding Line. Select appropriate power supply according to the power requirements in camera electrical specifications.



■ Configuring I/O Output Signal

The camera trigger output signal is a switch signal, and it can be used to control external devices such as alarm lights, light sources, and PLCs. The trigger output signal can be realized in two ways:

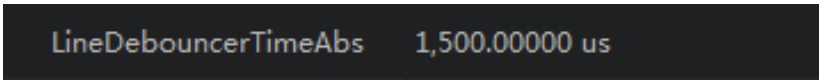
Level inversion and output signal. You can set the relevant parameters in Digital IO Control. For specific connection method, see the camera electrical specifications. The connection method is similar to that of the external trigger interface.

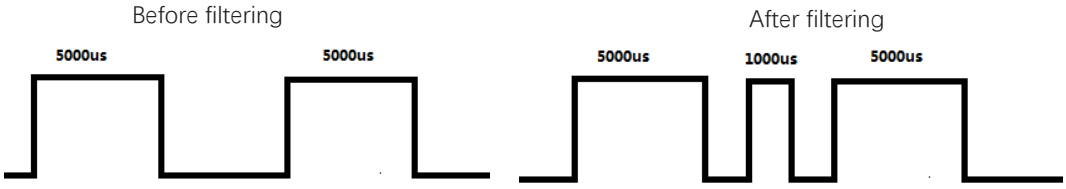
I/O Filtering

Line Debouncing Period: Signal debouncer, also known as filtering, is only supported in input mode.

The level signal of the corresponding interface line is filtered according to the defined value. Signal will be filtered out when the signal value is smaller than the debounce value.

For example, set **LineDebouncingPeriod** to 1500 us.





When the value of **LineDebouncingPeriod** is greater than the value of high and low levels, as shown in the example above, if the filtering level is greater than 5000 us, the camera will not generate streams. Therefore, when setting **LineDebouncingPeriod**, make sure that its value is smaller than the high and low level.

FPN Correction

FPN correction is applied to ensure image uniformity of line scan cameras.

Step 1 Turn on **FPNEnable**.

Step 2 Cover the camera with the lens cap, and then click **FPNBlackCalibration**.

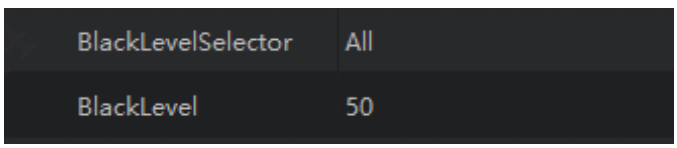
Step 3 Remove the lens cap, place an even plate to cover your field of view (use a piece of white paper instead if plate is unavailable), and adjust the exposure so that the gray value of the image is between 160 and 200.

Step 4 Click **FPNBrightCalibration**, and then set **FPNenable** to **On**. FPN takes effect.

Black Level

Black level helps you adjust the gray value offset of the output data. The gray value offset determines the average gray value when the sensor is not sensitive. For different ADC bit depth modes, the black level parameter ranges of the camera are different.

To configure black level, set the **Black Level** value.



Gain

The camera gain is divided into analog gain and digital gain. The analog gain can amplify the analog signal, and the digital gain can amplify the signal after converting analog signals to digital signals.

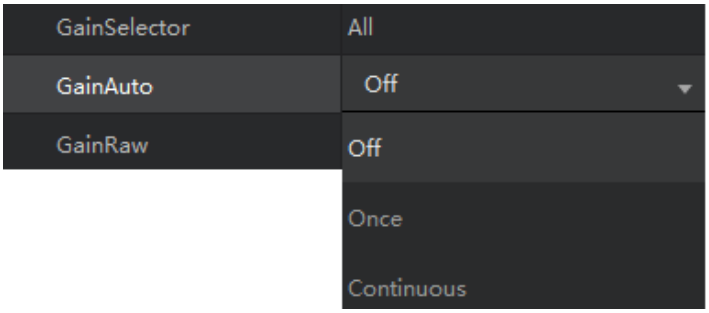
Analog gain amplifies and enhances the signal. The larger the parameter, the stronger the gain, the brighter the image, and the more the noise. The digital gain can amplify the signal after analog-to-digital conversion. Similar to analog gain, the larger the parameter, the stronger the gain, the brighter the image, and also more noise (more noise than analog gain).

■ Analog Gain

You can set gain parameters in three ways: Off, once, and continuous.

Analog Gain Mode	Parameter	Working Mode
Manual	Off	Adjust the analog gain according to the value defined in **GainRaw**.
Automatic once	Once	Automatically run analog gain for a period of time according to the scenario, and then stop.
Continuous	Continuous	Automatically and continuously adjust the analog gain according to the scenario.

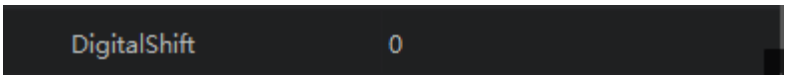
Select GainAuto mode:



GainAuto is only available for certain models. For details, see the specifications of the corresponding product.

■ Digital Gain

Configure DigitalShift. The range is 0–4. The larger the value, the stronger the gain, the brighter the image and the more the noise.



White Balance

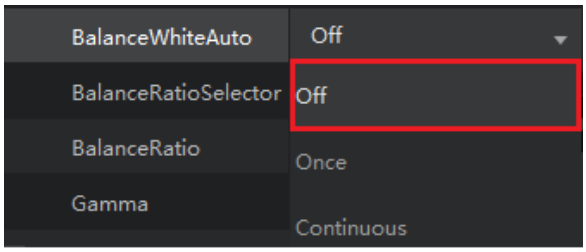
White balance allows you to adjust the corresponding R/G/B values to compensate for color cast that occurs when capturing images in different light sources. It aims to keep the white areas of the image white at different color temperatures.

White balance is divided into three modes: Off, once, and continuous.

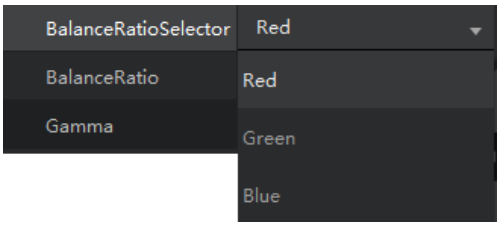
WB Mode	Parameter	Working Mode
Manual	Off	Manually set the values of red, green and blue color in **BlackRatioSelector** and **BalanceRatio** (white balance).
Automatic once	Once	Automatically run white balance for a period of time according to the scenario, and then stop.
Continuous	Continuous	Automatically and continuously adjust the white balance according to the scenario.

When the color effect of the camera image is much different from the actual situation, you can solve the problem through white balance calibration.

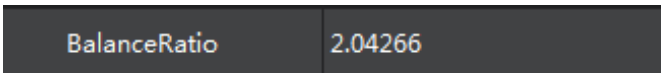
Step 1: Set **BalanceWhiteAuto** to **Off**.



Step 2: Select **BlackRatioSelector**, and then adjust the value of **Red**, **Green**, and **Blue**.



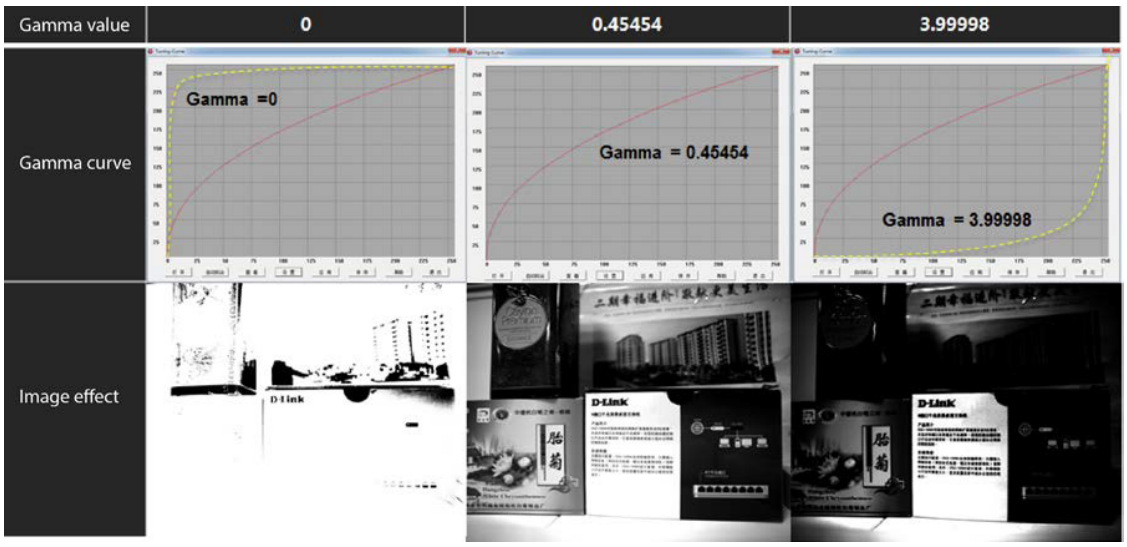
Step 3: Adjust **BalanceRatio** to a proper value. The range is 0–15. Similar to red, green, and blue values.



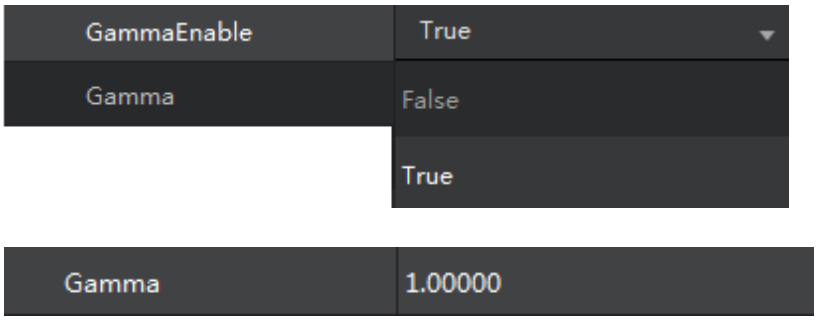
- We recommend that after calibration, you can save the parameters, to prevent recalibration after the camera is powered off and restarted.
- When the light source and the color temperature of the camera location change, you need to calibrate the white balance again.

Gamma

It is a non-linear correction of the image data due to non-linear response of the display. The larger the Gamma value, the darker the image. The range is 0–3.99998.



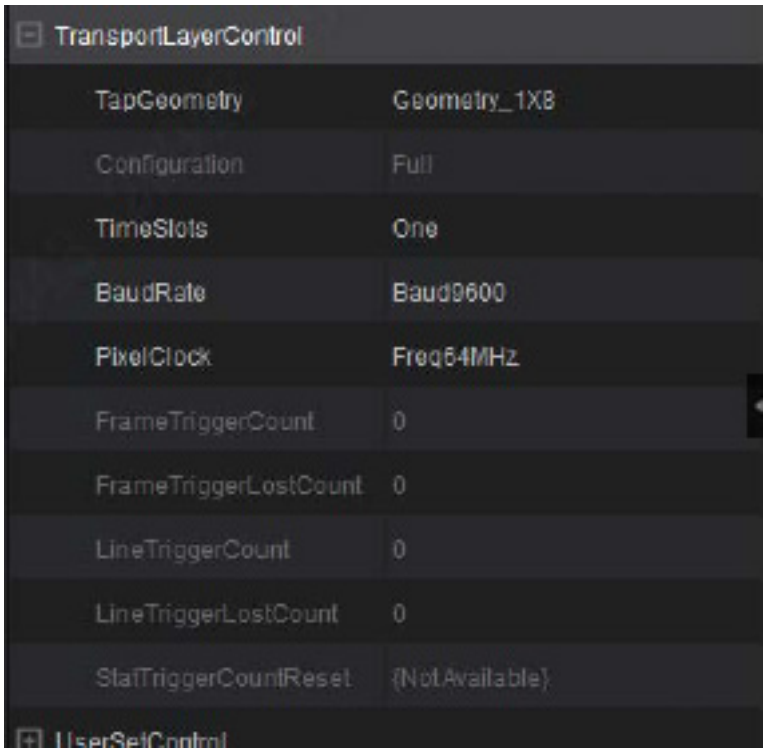
Adjust the Gamma value to make the image brightness meet the requirements.



i	Gamma and LookUpTable cannot be enabled at the same time. If Gamma is enabled, LookUpTable will not be effective. If LookUpTable is enabled, you need to set Gamma to 1.

Transmission Layer Management (TAP Settings)

■ CameraLink Line Scan Camera Transmission Layer



Parameter	Description
TapGeomety	Arrangement format of camera output images.
Configuration	Output type, which includes **Base**, **Medium**, **Deca** and **Full**.
TimeSlots	It is **One** by default.
BaudRate	Baud rate.
PixelClock	The clock frequency of pixel transmission. The larger the value, the faster the transmission.
FrameTriggerCount	Statistics of the camera's external trigger frame signals.
FrameTriggerLostCount	Statistics of the camera's external trigger frame signal loss.
LineTriggerCount	Statistics of the camera's external trigger line signals.
LineTriggerLostCount	Statistics of the camera's external trigger line signal loss.
StatTriggerCountReset	Clearance of statistics.

Transmission Layer Management (TAP Settings)

■ GigE Line Scan Camera Transmission Layer

Parameter	Description
PayloadSize	The length of each message.
GevActiveLinkCount	The number of logical channels currently connected.
GevInterfaceSelector	The number of device network ports. It is 0 by default.
GevLinkSpeed	The negotiated rate of the current network port.
GevMACAddress	Device MAC address.
GevCurrentIPconfigurationLLA	Enable LLA function. When setting **GevCurrentIPconfigurationLLA** to **True**, you can set the IP address in LLA mode after the device is powered on.
GevCurrentIPconfigurationDHCP	Enable DHCP function. When setting **GevCurrentIPconfigurationDHCP** to **True**, you canset the IP address in DHCP mode. In this case, the IP address can be automatically obtained.
GevCurrentIPconfigurationPersistentIP	Static IP function. When setting GevCurrentIPconfigurationPersistentIP to True, you can set the IP address in static mode after the device is powered on. **Notes:** Priority: Static IP > DHCP > LLA.
GevCurrentIPAddress	IP address of the current device.
GevCurrentSubnetMask	Subnet mask of the current device.
GevCurrentDefaultGateway	Gateway of the current device.
GevIPConfigurationStatus	Displays the method that the IP address is allocated: LLA, DHCP or static IP.
GevFirstURL	Acquires the first URL address of GenICam XML.
GevSecondURL	Acquires the second URL address of GenICam XML.
GevNumberOfInterface	Displays the number of logic channels that the device supports.
GevPersistentIPAddress	Static IP address of the device.
GevPersistentSubnetMask	Subnet mask of device static IP.
GevPersistentDefaultGateway	Gateway of device static IP.
GevMessageChannelCount	Displays the number of message channels that the device supports.
GevStreamChannelCount	Displays the number of streaming channels that the device supports.
GevHeartbeatTimeout	Heartbeat timeout period.
GevTimestampTickFrequency	Frequency of timestamp.
GevTimestampControlLatch	Latch the current timestamp into **GevTimestampValue**.
GevTimestampControlReset	Used to reset the internal timestamp.
GevTimestampValue	Used to store the latched timestamp.
GevGVCPExtendStatusCodesSelector	The version of **GigE Vision** for extended status code output.
GevGVCPExtendStatusCodes	Outputs extended status code or not.
GevGVCPPendingAck	Reports to Pending_ACK or not when command timed out.
GevGVCPHeartbeatDisable	Disable heartbeat detection of GVCP.
GevGVCPPendingTimeout	Timeout period of GVCP command execution.
GevGVSPExtendedIDMode	Enable GVSP extended ID code.
GevCCP	Controls the permissions of applications to access the camera. ExclusiveAccess: The application that connected to the camera can modify the register. ControlAccess: The application that connected to the camera can read the register, but cannot modify it.
GevPrimaryApplicationSocket	Displays the UDP source port of the application that connected to the camera.
GevPrimaryApplicationIPAddress	Displays the IP address of the application that connected to the camera.

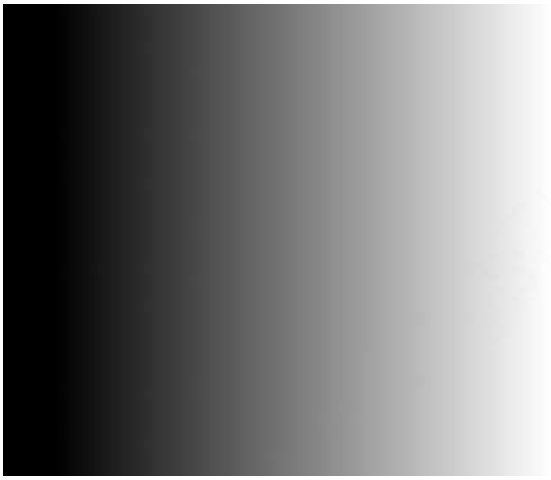
Transmission Layer Management (TAP Settings)

Parameter	Description
GevMCPHostPort	The destination port of the camera message channel.
GevMCDA	The destination address of the camera message channel.
GevMCTT	Timeout period of message channel.
GevMCRC	The maximum number of message channel retransmissions.
GevMCSP	Displays the source port of message channel.
GevStreamChannelSelector	Select the streaming channel number if the camera supports multiple streaming channels.
GevSCPinterfaceIndex	Displays the logic channel of device.
GevSCPHostPort	Port of the camera streaming channel.
GevSCPSFireTestPacket	Sends a test message.
GevSCPSDoNotFragment	If the message is too long, whether to send the message in fragments and add fragmentation position 1 in the IP header.
GevSCPSPacketSize	Message length of the streaming channel.
GevSCPD	Controls the interval between messages. **Notes:** Modifying the value can reduce the requirements on the network card, but the maximum bandwidth will be affected. Acquiring a single frame requires more time.
GevSCDA	The destination address of the streaming channel.
GevSCSP	The destination port of the streaming channel.
FrameTriggerCount	The number of signals from frame trigger.
FrameTriggerLostCount	The number of lost signals from frame trigger.
LineTriggerCount	The number of signals from line trigger.
LineTriggerLostCount	The number of lost signals from line trigger.

Testimage (Test Mode)

You can set the test mode of the camera. When the camera is in test mode, the camera will not capture images in real time, but images defined in the camera program. When the real-time image is abnormal, you can almost know the reason of the image anomaly by checking whether the image in the test mode has similar problems. This function is disabled by default. In this case, the image output by the camera is the data collected in real time.

- You can configure test mode from TestImageSelector > Image Format Control. The test mode is Off by default.
- After enabling test mode, the image displayed in the live window of the capture card software switches to test image. The specific test image depends on the test mode.



Different models support different test images.

Configuration Sets

The camera can store three user sets. They serve as convenient storage locations for the camera user and have no impact on the operation of the camera.

The values are designated as Default, UserSet1 and UserSet2.

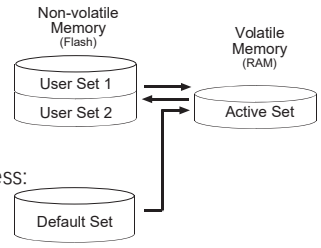
You can use iCentral application to easily set the parameters.

Active Set: The active set is the camera's current parameter settings. It is located in the camera's volatile memory and the settings are lost if the camera is reset or if power is switched off.

Default Set: The default set is the camera's factory optimized configuration. It is saved in a permanent file in the camera's non-volatile memory. It is not lost when the camera is reset or switched off.

User Sets: There are two reserved areas in the camera's non-volatile memory available for saving configuration sets. A configuration set saved in a reserved area is commonly referred to as a "user set" .

The two available user sets are called User Set 1 and User Set 2.



■ Saving User Sets

Saving the current active set into a user set in the camera's nonvolatile memory is a three step process:

- Make changes to the camera's settings until the camera is

operating in a manner that you would like to save.

- Set the UserSetSelector parameter to UserSet1, or UserSet2.
- Execute a UserSetSave command to save the active set to the selected user set.

Saving an active set to a user set in the camera's non-volatile memory will overwrite any parameters that were previously saved in that user set.

You can set the UserSetSelector parameter and execute the UserSetSave command via iCentral. You can also set the parameters from within your application software by using the API that we provide.

■ Loading Saved Set or the Default Set into the Active Set

If you have saved a configuration set into the camera's non-volatile memory, you can load the saved set from the camera's non-volatile memory into the camera's active set.

When you do this, the loaded set overwrites the parameters in the active set. Since the settings in the active set control the current operation of the camera, the settings from the loaded set will now be controlling the camera.

You can also load the default set into the camera's active set.

To load an UserSet or the default set into the active set:

- Set the UserSetSelector parameter to UserSet1, UserSet2, or Default.
- Execute a UserSetLoad command to load the selected set into the active set.

You can set the UserSetSelector parameter and execute the UserSetLoad command via iCentral. You can also set the parameters from within your application software by using the API that we provide.

i	Loading a user set or default set into the active set is only allowed when the camera is idle, i.e. when it is not acquiring images continuously or does not have a single image acquisition pending. Loading the default set into the active set is a good course of action, if you have grossly misadjusted the settings in the camera and you are not sure how to recover. The default set is optimized for use in typical situations and will provide good camera performance in most cases.

CHAPTER 4 Technical Support

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 iCentral to make note of the parameter when the issue occurred.		

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