Dhyana 9KTDI
User Manual

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Technical Support Email: service@tucsen.com TEL: +86-591-28055080-818 Fax: +86-591-28055080-826

Catalogs

1. Before You Start

1.1. About This Manual

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1.2. Cautions

Operation & Usage

 **Note**	● Do not drop, disassemble, repair or replace the internal components by yourself. Failure to do so may damage the camera device or cause electric shock. ● If liquids such as water, beverages or chemicals enter the equipment, stop using it and contact the nearest distributor or manufacturer for technical assistance. ● Do not touch the device with wet hands as this may result in electric shock. ● Do not allow children to touch the equipment without supervision.

	● Make sure that the camera is used at the specified temperature range. Otherwise the equipment may be damaged due to extreme temperatures.

Installation & Maintenance

 Note	● Do not install it in a dusty and dirty area or near an air conditioner or heater to reduce the risk of damage to the camera. ● Avoid installation and operation in extreme environments where vibration, high temperatures, humidity, dust, strong magnetic fields, explosive/corrosive gases or gases are present. ● Do not apply excessive vibration and shock to the equipment. This may damage the equipment. ● Avoid direct exposure to high intensity light sources and UV irradiation, etc. This may damage the image sensor. ● Do not install the equipment under unstable lighting conditions. Severe lighting variations can affect the quality of the images produced by the equipment. ● Do not use solvents or thinners to clean the surface of the equipment, as this can damage the surface of the housing.

Power Supply

 Note	● Please use the original power adapter of the camera, using a mismatched power supply will damage the camera. ● If the voltage applied to the camera is greater or less than the nominal voltage, the camera may be damaged or not work properly. ● Please refer to the specification sheet for the nominal voltage of the camera. ● Make sure the power is turned off before connecting the power cord to the camera. Otherwise, the camera may be damaged.

2. Product Specifications

This section will introduce the Dhyana 9KTDI specifications including chip characteristics, camera parameters, form factor, interface features and accessory list.

2.1. Introduction

The Dhyana 9KTDI is a high-speed TDI camera, it works with CoaXPress frame grabber, it uses a back-illuminated highly sensitive image sensor, it can respond to the UV band. The image element size is 5 μm×5 μm, the horizontal resolution reaches 9072, and supports up to 256 TDI levels, and the line frequency can reach 510kHz@8bit, 345kHZ@10bit, 299kHZ@12bit with full resolution output. Dhyana 9KTDI camera can be programmed and updated in the field, supporting GenICam standard, users can quickly drive the camera to acquire images to meet the needs of different application scenarios.

2.2. Main Features

- High sensitivity, QE reaches 82.4%@550nm, 38%@800nm, 38%@266nm*, 51%@355nm*;
- Wide response spectrum with good response in the UV and IR bands
- Deep TEC cooling to suppress dark currents: chip temperatures as low as -15°C
- Line frequency can reach 510kHz@8bit, 345kHZ@10bit, 299kHZ@12bit
- GenICam™ compliant
- CoaXPress compliant, support the mainstream frame grabber
- Support 4~256 levels of TDI level output
- 8/10/12-bit pixel format output
- Support ROI
- Support Binning

- Flat field correction
- Dark field correction
- Support Offset adjustment
- Support digital and analog gain adjustment
- Horizontal Mirroring
- TDI scan direction support inversion
- Support test image output
- Multiple configurable user parameter storage spaces
- Camera temperature monitoring
- Online firmware upgrade

*Value inferred from the QE curve.

2.3. Parameter Specifications

	Dhyana 9KTDI
Sensor	BSI sensor
Color/Mono	Mono
Resolution	9072 (H) x256 (V)
Pixel Size	5μm x 5μm
Effective Area	45.36 mm x 1.28 mm
Quantum Efficiency	82.4%@550nm 、 38%@800nm 、 38%@266nm* 、 51%@355nm*
TDIStages	4/8/16/32/64/128/192/256
Max.Line Rate	299kHZ@12bit; 345kHZ@10bit; 510kHZ@8bit
Scan Direction	Forward/Reverse/Trigger Control
Dynamic Range	Typ.68.7dB@12bit; 63.6dB@10bit
CTE	≥0.99993

Full-Well Capacity	Typ.15.5ke-@12bit; 14ke-@10bit
Readout Noise (Median Value)	Typ.7.2e-@12bit; 11.4e-@10bit
Analog Gain	x2 ~ x8 step 0.5
Digital Gain	x0.5 ~ x10 step 1
DSNU	1.5e-@12bit; 3.5e-@10bit(Typ.)
PRNU	0.3% (Typ.)
Cooling Method	AIr & liquid cooling
Temperature Differences	Air 20 ℃ (ambient temperature 25 ℃); Water 35 ℃ (water temperature 20 ℃)
Dark Current	950e-/s/pixel@Chip temperature 10℃
Binning	1x1; 2x1; 4×1; 8×1
ROI	Support
Trigger Mode	Trigger Input, Scan Direction Input
Output Trigger Signal	Strobe out
Trigger interface	Horison, HR10A-7R-4S
TimeStamp Accuracy	8 ns
Data Interface	CoaxPress2.0 (CXP-12)
SDK	GenICamTM
Bit Depth	8bit; 10bit; 12bit
Optiona Interface	M72 x1
Power Supply	12V±1V/5A
Dimensions	86mm*86mm*109mm
Software	SamplePro; Matlab
Operating System	Windows; Linux
Operating Environment	Temperature: 0-40°C，Humidity: 0%-90%

*Value inferred from the QE curve.

2.4. Spectral Response Curve

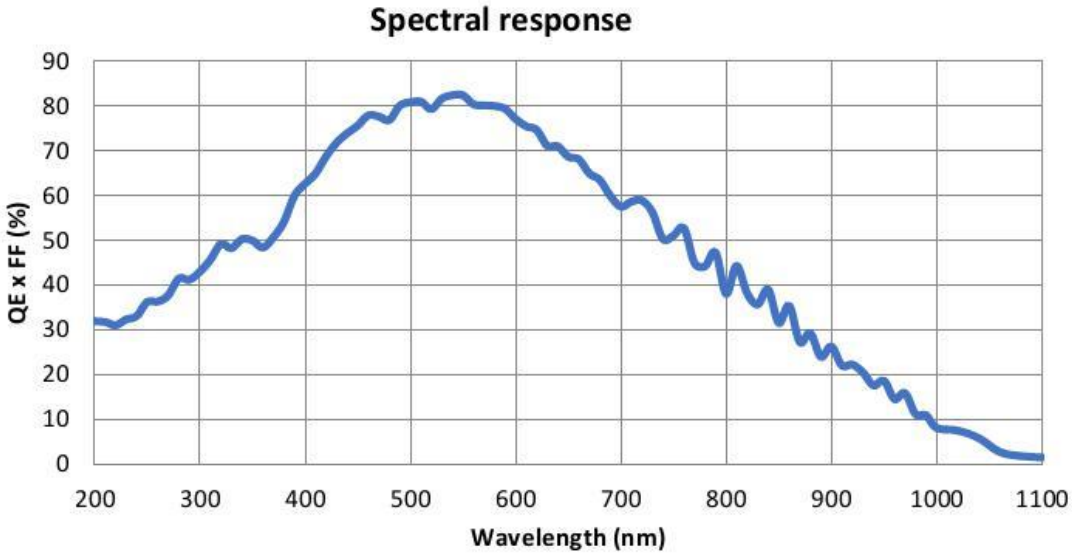
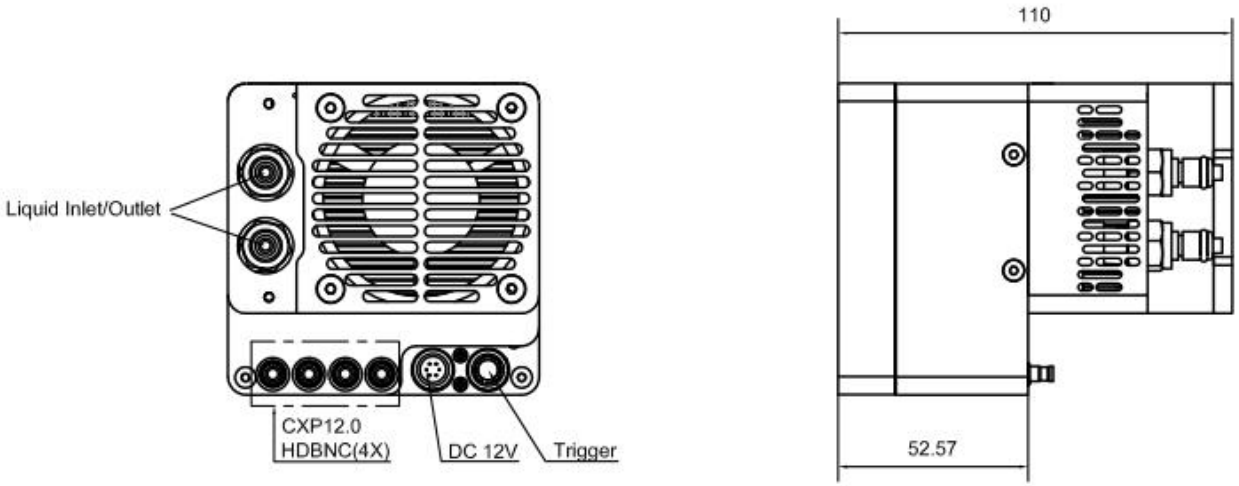
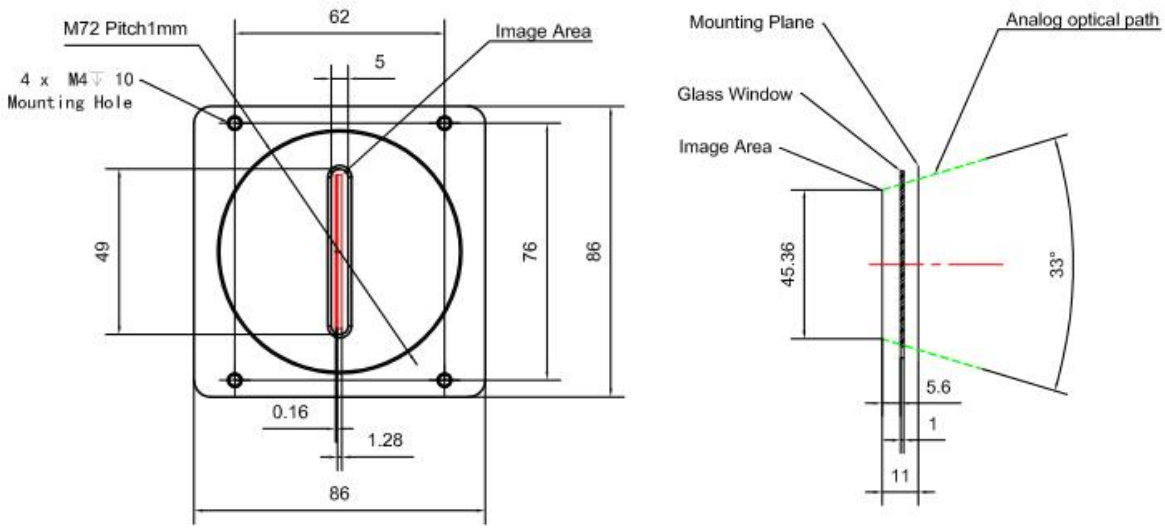


Figure 2-1

2.5. Mechanical Specification





2.6. Components & Features

The interfaces of the Dhyana 9KTDI camera are shown in Figure 2-2 and the corresponding functional descriptions are shown in Table 2-1. The pin definitions for the power and trigger interfaces are shown in Figure 2-3 and the trigger input and output circuit diagrams are shown in Figure 2-4 and Figure 2-5.

Note: The trigger level is 3.3V and must not exceed 5V.

Figure 2-2 Dhyana 9KTDI interface

Tab 2-1 Function of the Dhyana 9KTDI interface

No.	Interface	Functions		
1	Indicator	Indicates the camera status	Red ON	The camera is not initialized
			Red flashing	CXP connection configuration not completed
			Orange flashing	Check the configuration status of the CXP connection
			Green ON	CXP connection configuration complete
			Alternating orange and green	Checking the configuration status of the CXP connection and transferring data is being done simultaneously
			Green flashing	The camera is transmitting data
2	Trigger	External trigger input, HR10A-7P-4P. The trigger level is 3.3V and must not exceed 5V.		
3	DC12V	Power connector, 12V/8A,The pin definitions for the power and trigger interfaces are shown in Figure 2-3.		
4	CXP12	HDBNC x4, 4 interface serial numbers must correspond to the frame grabber interface one by one		

Description of the trigger interface

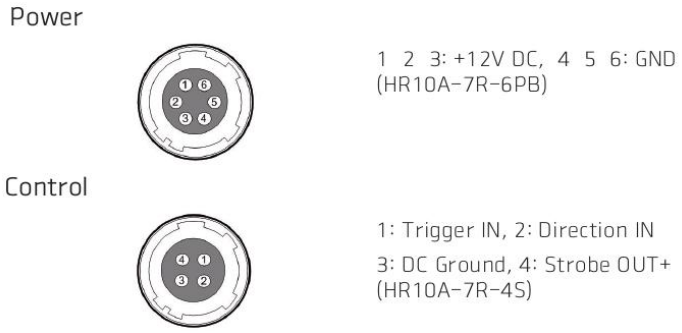


Figure 2-3 Power and trigger pin definitions

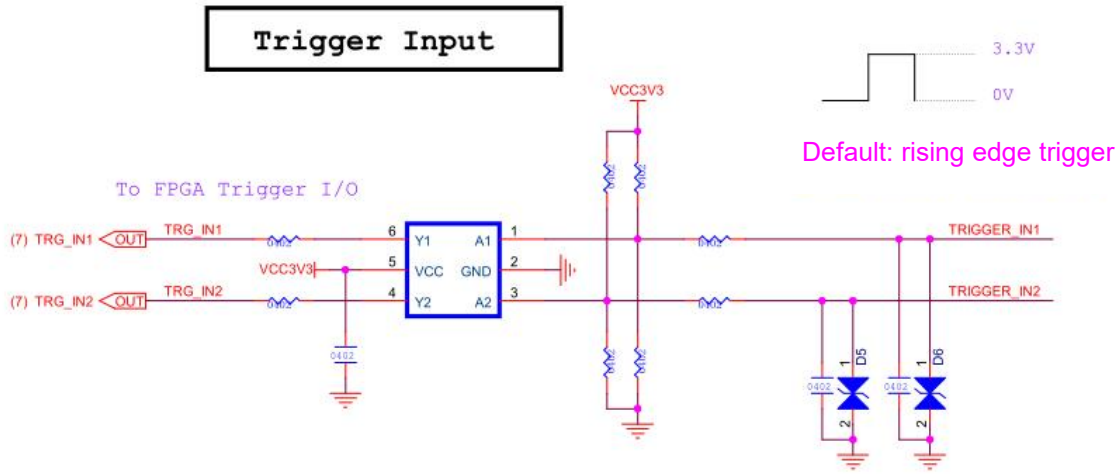


Figure 2-4 Trigger input circuit diagram

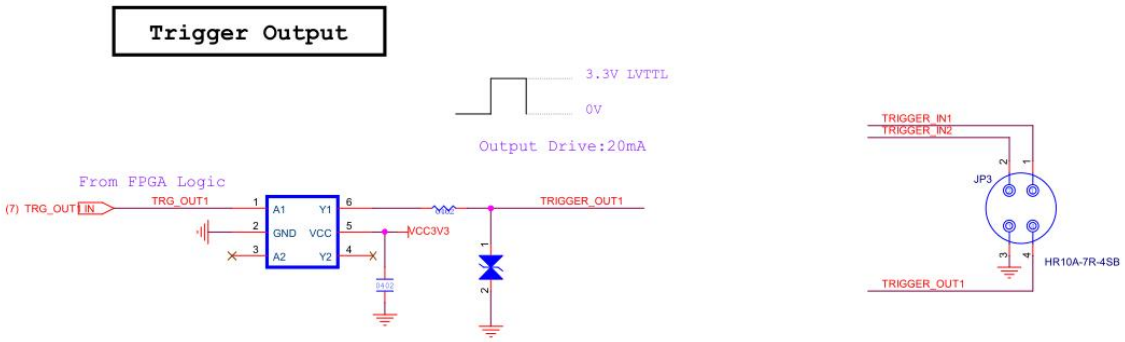
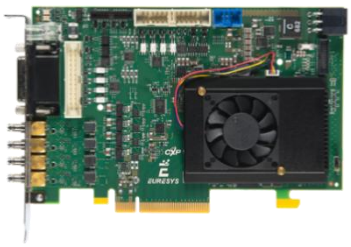


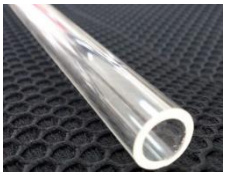
Figure 2-5 Trigger output circuit diagram

1) The trigger level is 3.3V and must not exceed 5V;
2) The trigger level is judged to be high when it is higher than 2.6V, low when the trigger level is lower than 0.6V, and indeterminate from 0.6 to 2.5V, with possible erroneous trigger states;

2.7. Package List

Items	Specification/ Model	QTY	Pictures
TDI Camera	Dhyana 9KTDI	1	
Power cables	DC12V/HR-10A-6P-PB	1	
USB Flash disk	Included Software & Drivers	1	

Optional Items	Specification/ Model	QTY	Pictures
M72 to F-port adapter	M72x1	1	
CoaXPress frame grabber	Euresys /KAYA / Matrox	1	

CoaXPress cable	3m	4	
External trigger cable	HR10A-7P-4P	1	
Disassembly tools	installation/removal of CXP cables	1	
Water pipe	Length: 2m; Material: PU, transparent O.D: φ8mm, I.D: φ5mm pressure resistance 10 bar	2	

3. Installation

This chapter will introduce the installation of the camera, the frame grabber, and the software, and how to connect the water-cooled camera to the water cooler.

3.1. Camera Installation

Connect one end of the CXP cable to the frame grabber and the other end to the Dhyana 9KTDI camera (it is recommended to use a removal tool to assist in installing the CXP cable). Lock the retaining ring, then plug in the power cable and turn on the power switch to see the light come on.

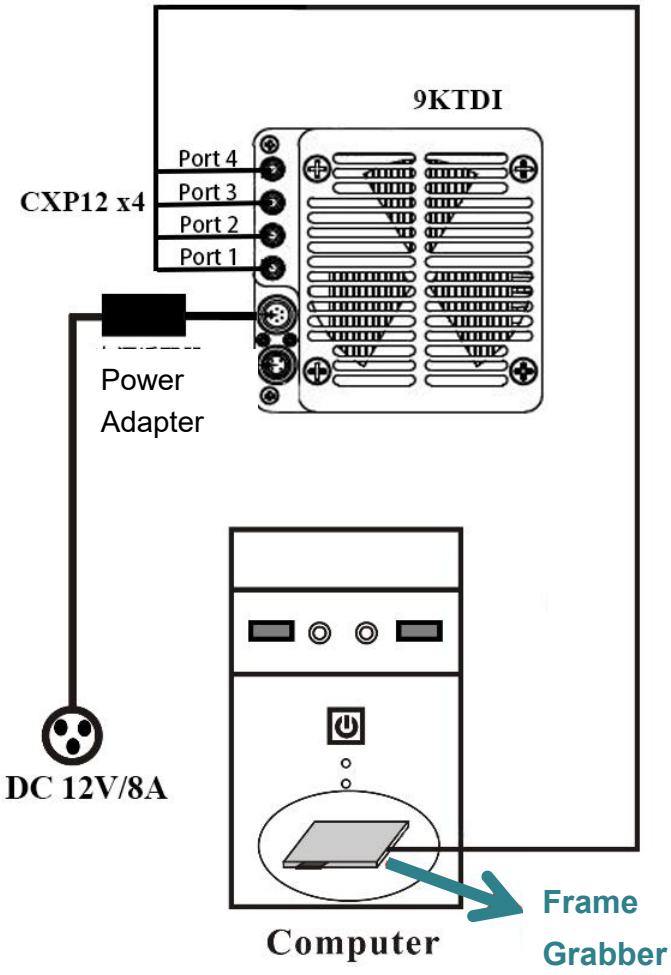


Figure 3-1 Dhyana9KTDI Connection Diagram

Note:

When wiring, please ensure that the serial numbers of the 4 CXP ports on the camera should correspond to the serial numbers of the frame grabber ports.

3.2. Frame Grabber Installation

Power off the computer and open the cover of the host as shown in Figure 3-2. Install the frame Grabber into a PCIe slot with a transfer bandwidth greater than 850MB/s, secure it with screws and then power on the computer. The maximum transfer frame rate for different PCIe slots is shown in Table 3-1.

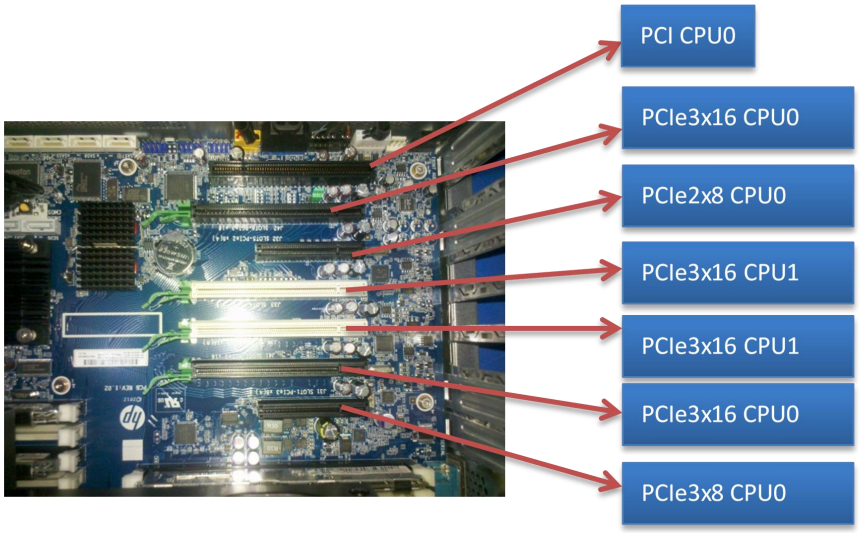


Figure 3-2 Motherboad

Tab 3-1 Maximum transfer rates for different PCIe slots

PCIe	X1	X4	X8	X16
1.0	250MB/s	1GB/s	2GB/s	4GB/s
2.0	500MB/s	2GB/s	4GB/s	8GB/s
3.0	985MB/s	3.9GB/s	7.8GB/s	15.7GB/s

The brands and models of frame currently supported by the test are shown in Table

3-2

Tab 3-2 Supported Frame Grabber

Brand	Model	Note
KAYA	KY-FGK-II-CXP Komodo II 4CH CoaXPress 12G Frame Grabber CXP12x4	Firmware: 4.2.52 (2020-11-04-18-59-49)
Euresys	Coaxlink Quad CXP-12	Firmware: 1-camera, line-scan
Matrox	Matrox--RAP 4G 4C12	

Note:

If there is a compatibility problem with the frame grabber, please confirm the firmware version and use the correct version.

3.3. Frame Grabber Driver Installation

This section describes the driver installation for the three brands of frame Grabbers currently supported.

3.3.1. KAYA

Kaya frame grabber in Windows only supports Win10 (x64), currently it is recommended to install the following version of 2020.3 with better compatibility: KAYA_Vision_Point_Setup_2020.3_Windows_64.exe.

Operating Procedure

1) Double-click the KAYA frame grabber driver to start installation;

2) Click "Next" to proceed to the next step of installation;

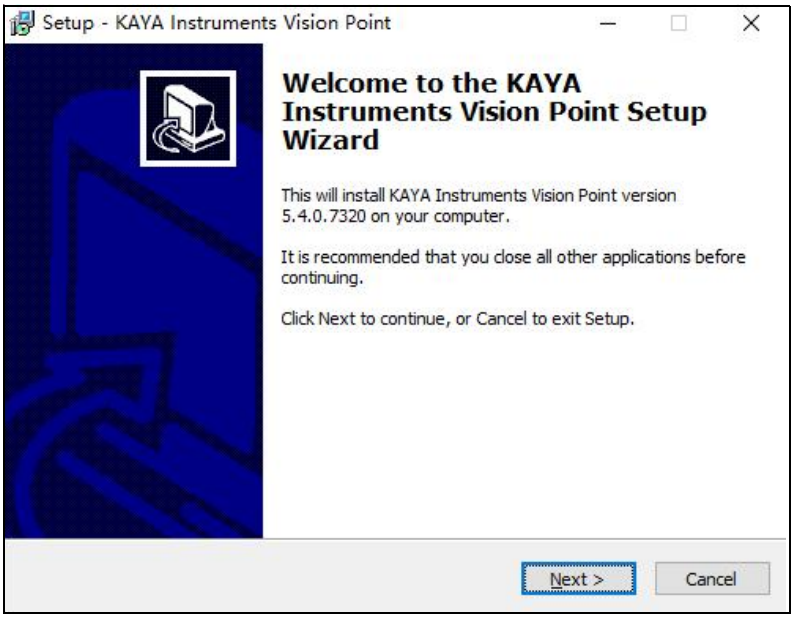


Figure 3-3

3) Select the driver installation location, according to the default configuration can be, click "Next";

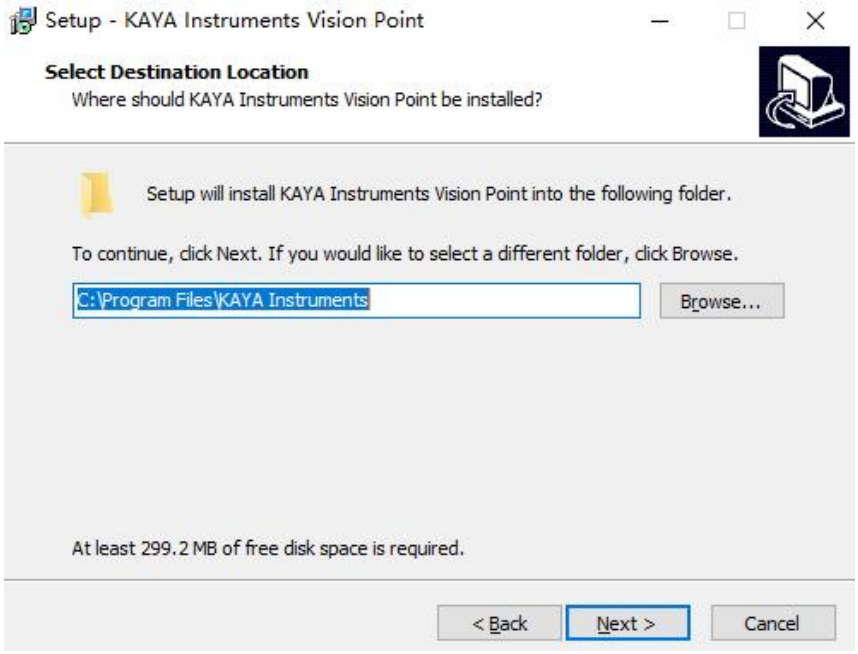


Figure 3-4

4) Select the components to install and click "Next" to proceed to the next step;;

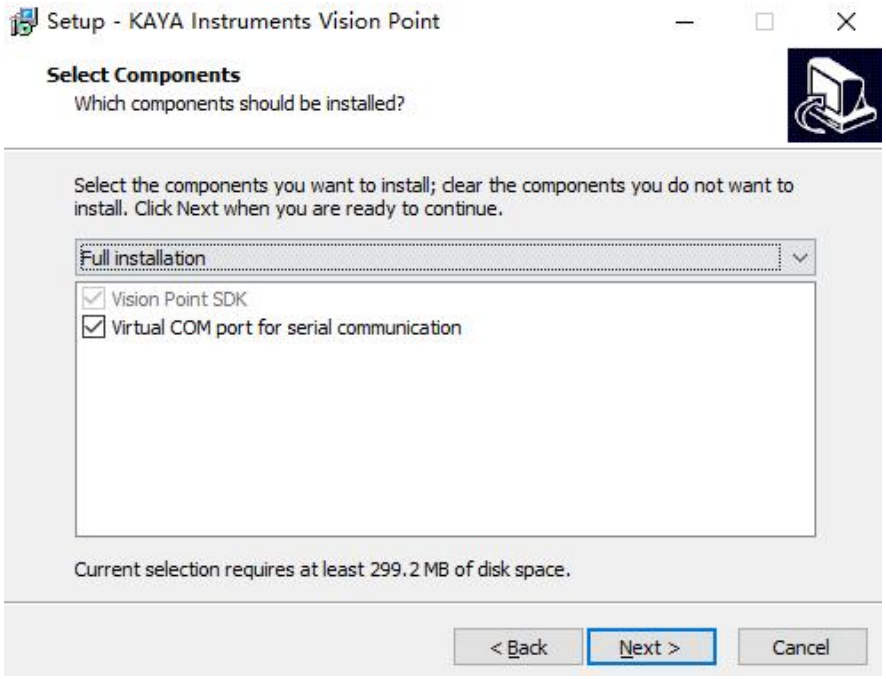


Figure 3-5

5) Create a folder to the start menu, it is recommended to use the default settings, users can also choose other folders according to their needs, click "Next>" to enter the next step;

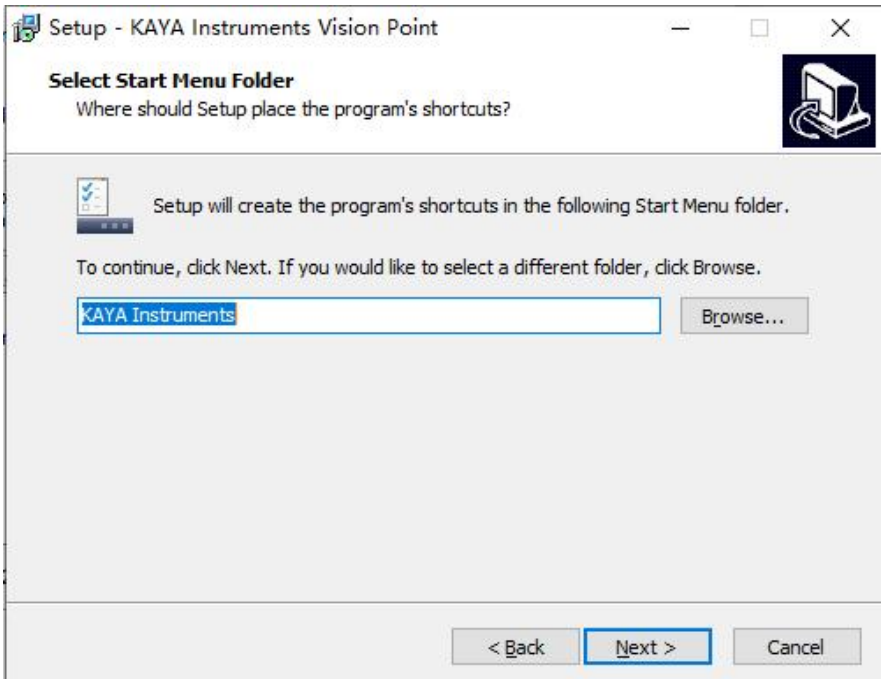


Figure 3-6

6) Confirm that all settings are correct and click "Install" to start the driver installation

process;

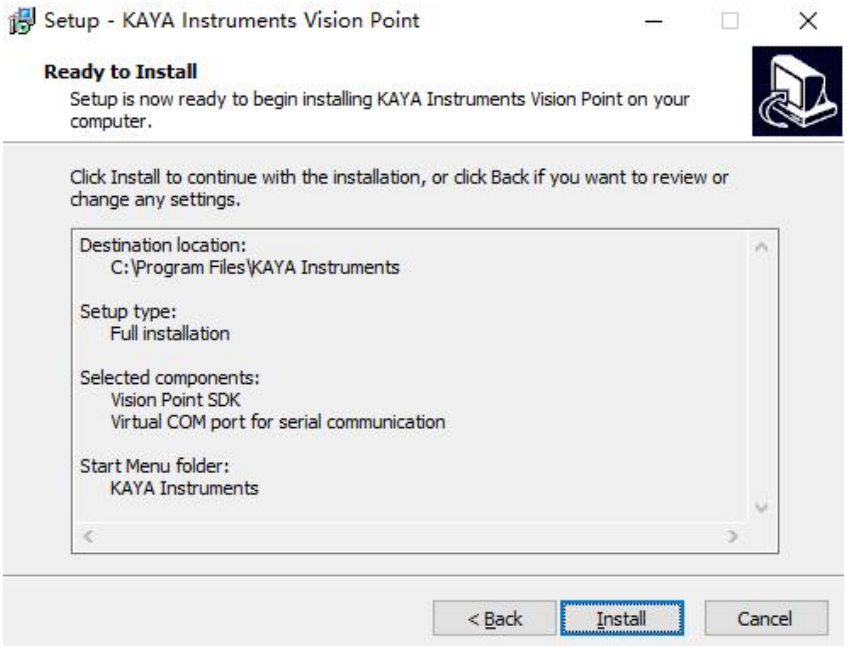


Figure 3-7

7) During the installation process, click on "Next" when prompted to continue the installation;

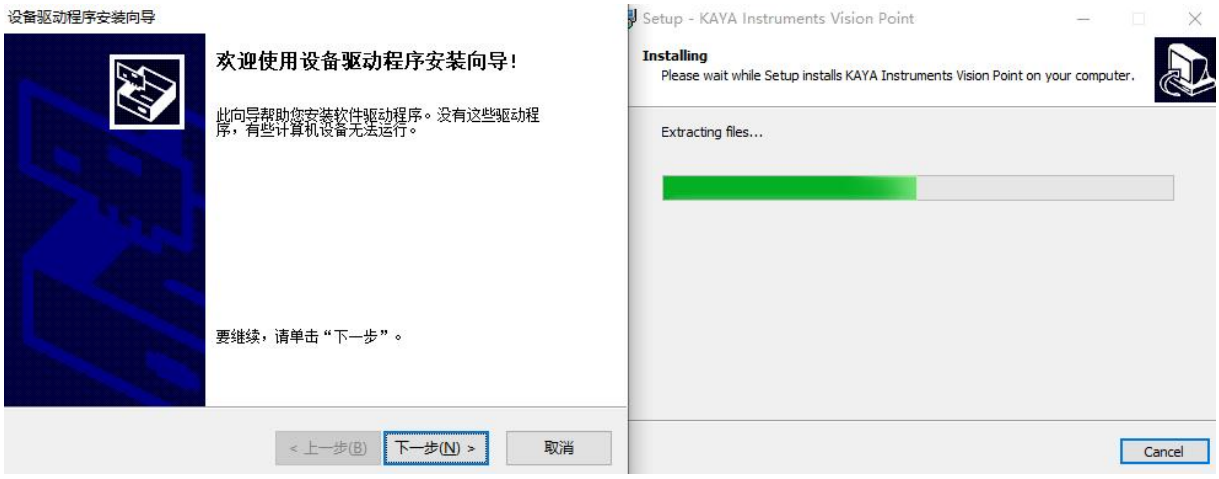


Figure 3-8

8) Click "Finish" to proceed to the next step;

Figure 3-9

9) The need to reboot the computer system after the installation is complete for the driver to take effect;

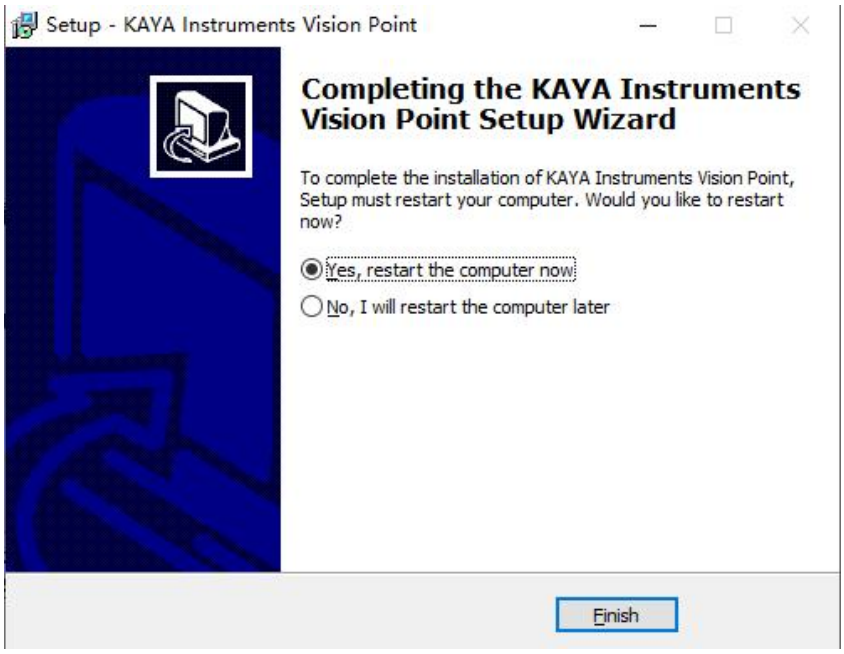


Figure 3-10

3.3.2. Euresys

Euresys frame grabbers require different driver installation packages for Win7/Win10 systems respectively, the following instructions take Windows 10 system as an example.

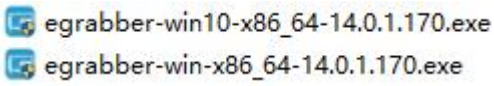


Figure 3-11

Operating Procedure

1) Double click on the driver to start the installation, select the path and click "Next" to proceed to the next step;

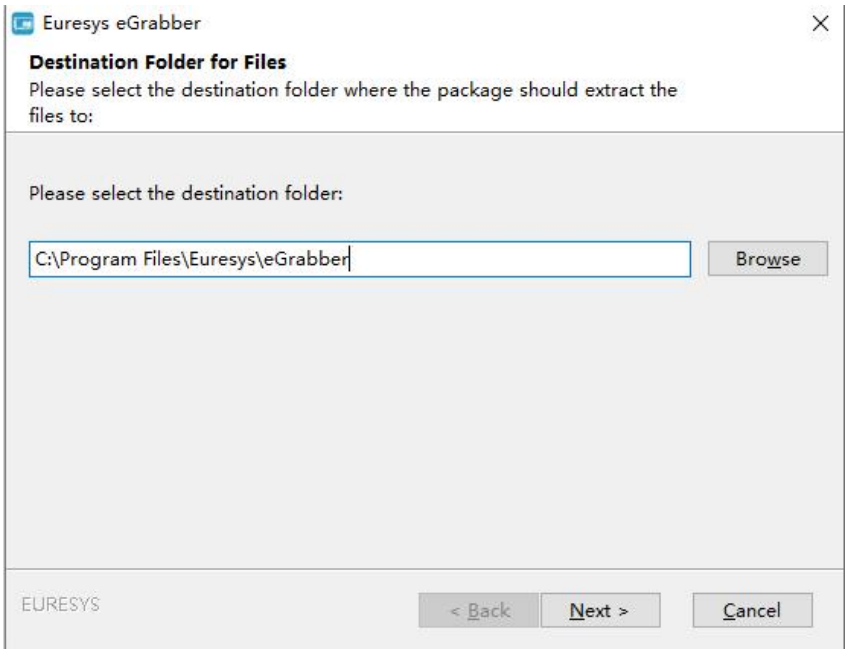


Figure 3-12

2) Wait for the installation to complete, and then click "OK";

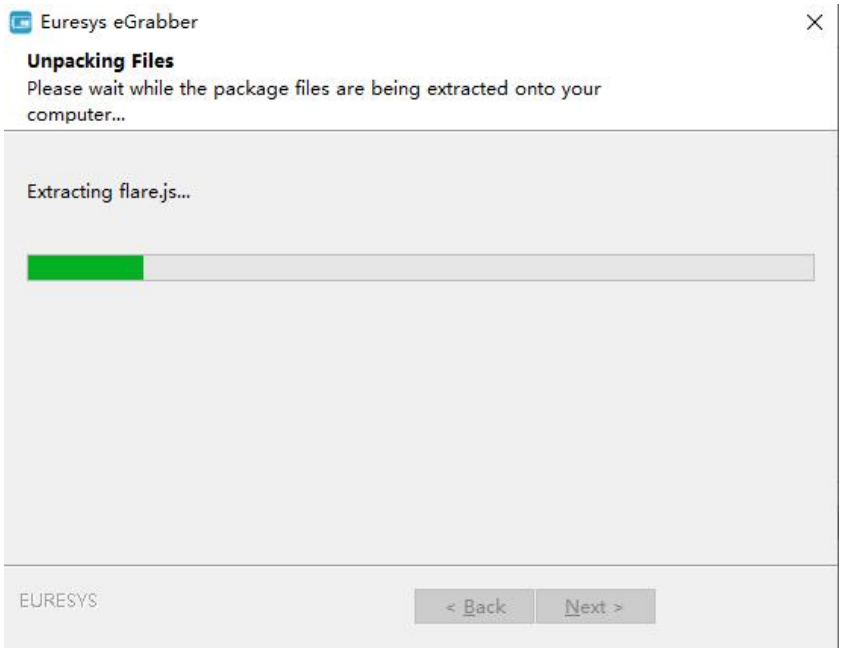


Figure 3-13

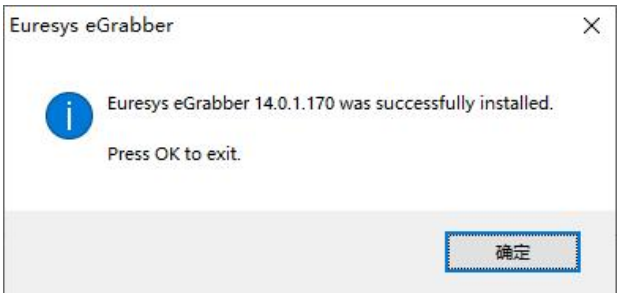


Figure 3-14

3.3.3. Matrox

Mytronica U118 only supports Windows 10 system and cannot be installed in Win10 Home Edition, we recommend using Win10 Professional Edition. The following operation instructions take Windows 10 system as an example.

Overall installation sequence:

1) mlxv2102x64_fic.exe
2) MLiteXSP5B728EAx64
3) MXU118B11EAx64_Signed_with_Expiry

Operating Procedure

1) Double click the corresponding driver to start the installation, select the installation path, click "Install" for the next step;

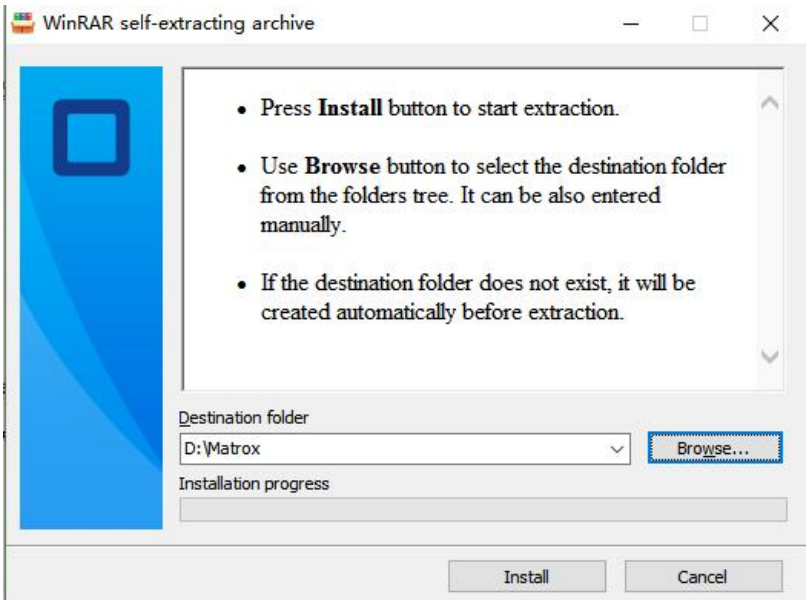


Figure 3-15

2) Wait for Install to complete, click OK as shown in the picture to proceed to the next step;

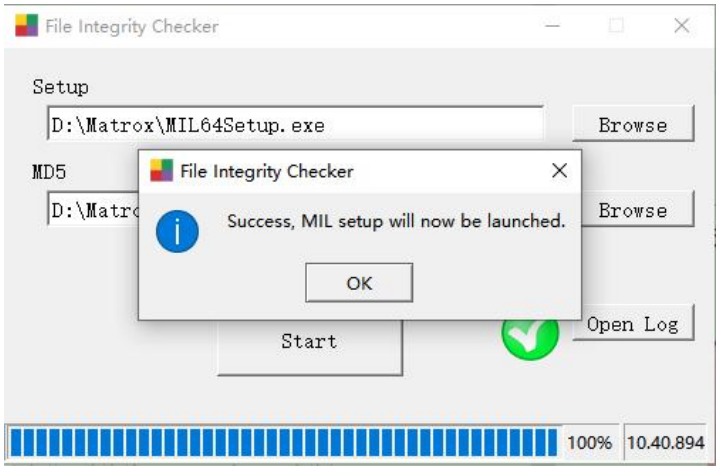


Figure 3-16

3) Select Matrox Rapixo CXP and click "Next" to wait for the installation to complete;

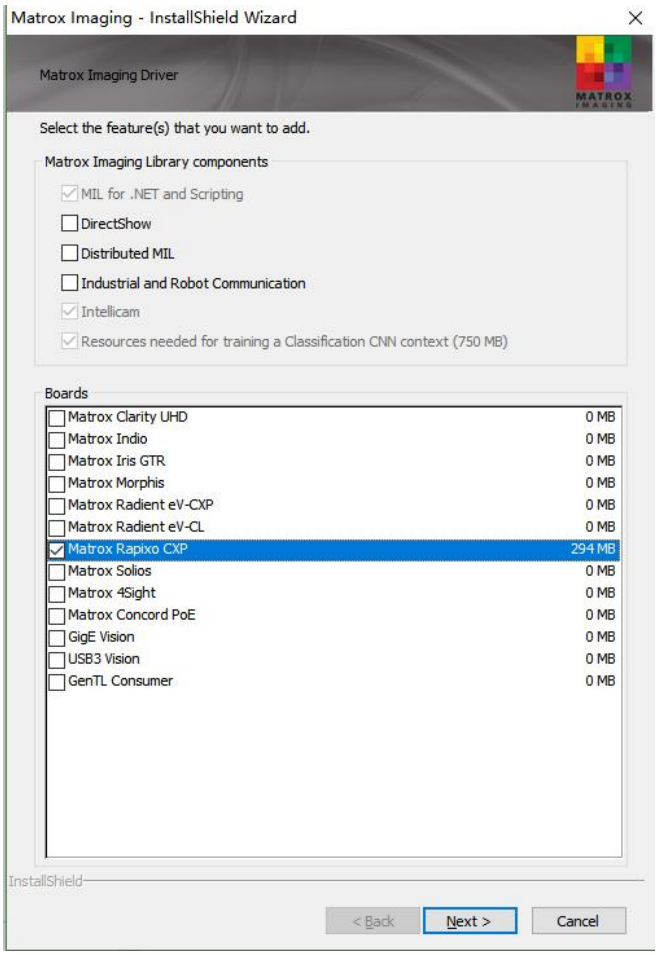
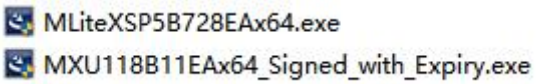


Figure 3-17

4) Select U118 for installation and open the frame grabber software to update the firmware after completion, and restart the computer;



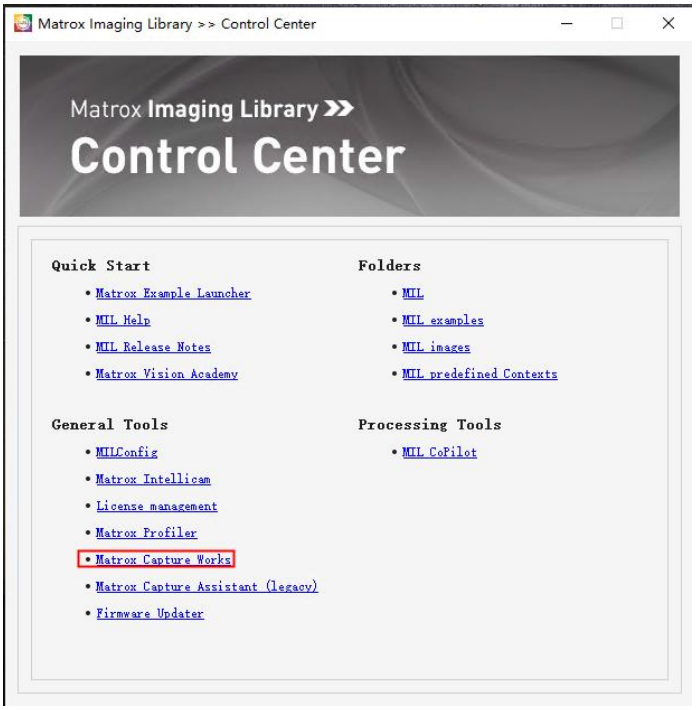


Figure 3-18

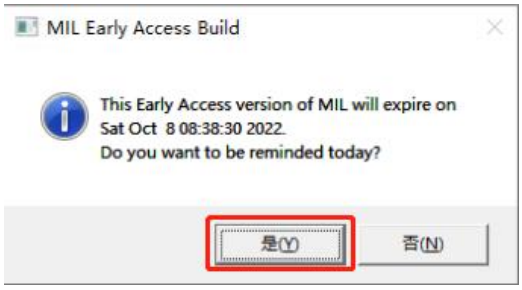


Figure 3-19

3.4. Software Installation

The camera software SamplePro is included on a USB stick, it is a green version of the software, decompress and use it directly without installation.

For software features and operating instructions, please refer to Chapter 5.

Note:

1) When you start SamplePro for the first time, run it as administrator (right-click and select "Run as administrator" in the pop-up menu);

2) Opening the frame grabber software and Samplepro software at the same time will cause the software to fail to recognize the camera;

3) When the camera works normally, it flashes green, and when it is abnormal, it flashes red.

4) If there is “NO Camera” tips , please try the below steps:

① Check if the order of the camera and frame grabber connection matches;

② Reinstall the frame grabber driver;

③ Reboot the computer;

④ Confirm the computer system version, some frame grabbers only support Windows 10 system.

3.5. Connecting the Water Cooler

1) Loosen the 2*M3 screws shown below to remove the water cooling pipe protection cover.

Figure 3-20

Figure 3-21

2) Press the round handle on the left side of the water hose connector to the state shown below, then connect to the camera water hose connector, and hear a crunching sound is a successful connection. At the end of use, also press the left-hand side of the round handle to remove the water pipe.

Figure 3-22

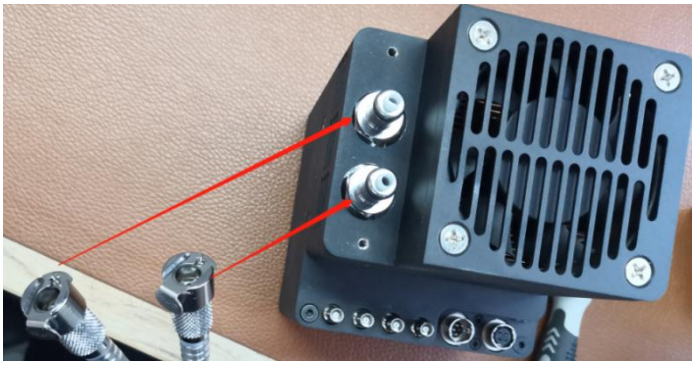


Figure 3-23

3) Connect to the water cooler with the connector shown below;

Figure 3-24

Water temperature and flow rate recommendations

1) Minimum water flow: 1L/Min;
2) Recommended water temperature 15~20℃, water temperature too low will lead to fogging, which may lead to chip damage;

The water temperature of the water cooler needs to be selected according to the

temperature and humidity of the actual environment, you can refer to the table of temperature and humidity corresponding to the dew point, as shown below. The recommended water temperature should be higher than the dew temperature value in the table, such as when the ambient temperature is 25℃ and the relative humidity is 70%, then the water temperature should not be lower than 19℃.

		Humidity							
		20%	30%	40%	50%	60%	70%	80%	90%
Temperature	5							1.8	3.5
	6							2.8	4.5
	7						1.9	3.8	5.5
	8						2.9	4.8	6.5
	9					1.6	3.8	5.7	7.4
	10					2.6	4.8	6.7	8.4
	11					3.5	5.7	7.7	9.4
	12				1.9	4.5	6.7	8.7	10.4
	13				2.8	5.4	7.7	9.6	11.4
	14				3.7	6.4	8.6	10.6	12.4
	15			1.5	4.7	7.3	9.6	11.6	13.4
	16			2.4	5.6	8.2	10.5	12.6	14.4
	17			3.3	6.5	9.2	11.5	13.5	15.3
	18			4.2	7.4	10.1	12.4	14.5	16.3
	19		1.0	5.1	8.4	11.1	13.4	16.4	18.3
	20		1.9	6.0	9.3	12.0	14.4	16.4	18.3
	21		2.8	6.9	10.2	12.9	15.3	17.4	19.3
	22		3.6	7.8	11.0	13.9	16.3	18.4	20.3
	23		4.5	8.7	12.0	14.8	17.2	19.4	21.3
	24		5.4	9.6	12.9	15.8	18.2	20.3	22.3
	25	0.5	6.2	10.5	13.9	16.7	19.1	21.3	23.2
	26	1.3	7.1	11.4	14.8	17.6	20.1	22.3	24.2
	27	2.1	8.0	12.3	15.7	18.6	21.1	23.3	25.2
	28	3.0	8.8	13.2	16.6	19.5	22.0	24.2	26.2
	29	3.8	9.7	14.0	17.5	20.4	23.0	25.2	27.2

4. Camera Features

This chapter will introduce the main functional modules of the camera, the test images of the camera, how to update the operation of the firmware version of the camera, etc.

4.1. Operation Mode and TDI Stages

Dhyana 9KTDI has two different modes of operation: Area and TDI.

If the "Operation Mode" parameter is set to "Area", the camera will operate as a surface array camera using a two-dimensional pixel array. Using the surface array mode makes it easier for the camera to focus. If the "Operation Mode" parameter is set to "TDI", the camera will operate as a high-sensitivity line scan camera and provide 256 times more sensitivity than existing line scan cameras.

The "TDI Stages" parameter is used to determine the height of the Dhyana 9KTDI in the Area mode. By setting the "Operation Mode" to "Area" and setting the "TDI Stages" parameter to 256, the camera will acquire an image with a resolution of 9072 x 256. images.In TDI mode, the "TDI Stages" parameter is used to determine the number of integrations used by the imager. For example, if the "TDI Stages" parameter is set to 256, the camera will acquire images at a high sensitivity of 256 times.

4.2. Scan Direction

In TDI mode, the "Scan Direction" is used to set the scanning direction of the Dhyana 9KTDI. Forward is the defualt, the directions are shown in Figure 4-1. Users can adjust the camera's mounting direction according to the usage environment. The camera can support three types of direction control.

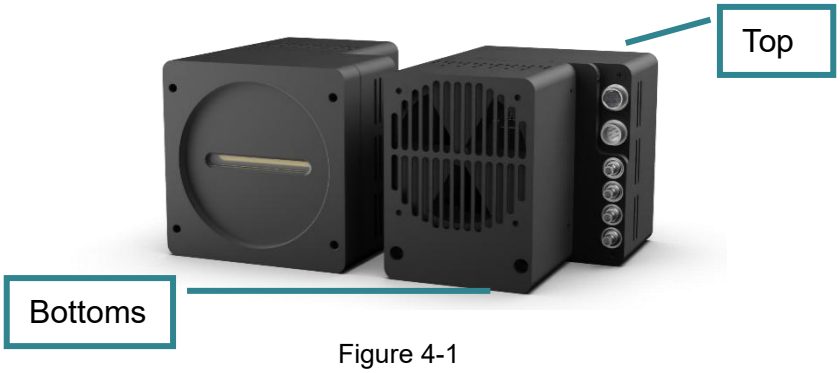


Figure 4-1

1) Forward: The subject will pass from the bottom of the camera to the top of the camera;
2) Reverse: The subject is to pass from the top of the camera to the bottom of the camera;
3) LineIn1: the scan direction is controlled by an external trigger signal (low = forward, high = reverse);

Note:

1) In the area mode, you can acquire a vertically flipped image when the "Scan Direction" is "Reverse";
2) The trigger signal that controls the scanning direction is connected to Pin2 of the trigger port, please refer to Figure 2-3 for specific information;

4.3. Pixel Format

You can set the "Pixel Format" to determine the format of the image data output from the camera.

1) Mono8 sets the pixel format to 8-bit;
2) Mono10 sets the pixel format to 10 bits;
3) Mono12 sets the pixel format to 12-bit;

Note: When Mono10 and Mono12 are selected, the images are displayed in 16 bits (high complementary zero).

4.4. Horizontal Flipped

Use "Reverse X" to get a horizontal flipped image, and this function can be used for both TDI and Area modes.

Figure 4-2 Original image

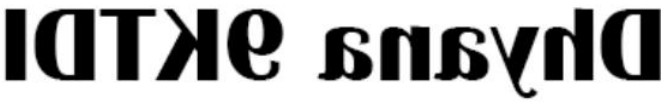


Figure 4-3 “Reverse X” image

4.5. Region of Interest(ROI)

In imaging applications, a ROI (Region of interest) is defined as a sub-region of interest within the resolution range of the camera sensor, and only images within this ROI are read out. During operation, only the pixel information of the specified area is read from the sensor and transferred from the camera to the frame grabber.

The ROI points to the left end of the sensor array. The position and size of the ROI is defined by setting the "Offset X" and "Width" settings. For example, if the Offset X parameter is set to 99 and the Width parameter is set to 256, the camera will read and transmit pixel values from 100 to 355 pixels. The ROI is set by default to use the full resolution of the camera's imaging sensor. You can set the size and position of the ROI by changing the values of the parameters "Offset X" and "Width".

Note:

1) The sum of the "Offset X" and "Width" parameter values must not exceed the width of the camera's imaging sensor;
2) The value of the "Offset X" setting can be set to 0 and an integer multiple of 16.

The "Width" setting must be at least 256 and an integer multiple of 16;

3) The CXP image frame grabber may have other restrictions on ROI location and size. Please consult the user manual of the CXP frame grabber you are using for more information;

4.6. Binning

"Binning" is an image readout mode in which neighboring pixels are combined and read out in a one-pixel. The binning increases the sensitivity and frame rate, but also reduces the resolution of the image.

The Dhyana 9KTD implements the binning function through FPGA. Horizontal Binning supports x1, x2, X4, X8, and Vertical Binning supports ×1, X2, X4, X8. When set to x2 Binning, the resolution of the camera output image is reduced by half, and the gray value of the image is doubled.

4.7. Gain & Black Level

The "Gain" parameter changes the slope of the Dhyana 9KTDI's light response curve, thereby enhancing or diminishing the grayscale value of the camera's output image.

When it is impossible to see the subject under weak signal conditions, you can increase the "Gain" parameter value to see the details of the dark part; when the output image is too bright in a scene with strong signal, you can avoid overexposure by lowering the "Gain" value.

The two gain modes are shown below:

1) AnalogGain: Analog Gain , supports 2 to 8 switching, in steps of 0.5;
2) DigitalGain: Digital gain, supports switching to 0.5~10， in steps of 1;
3) BlackLevel: The black level, which increases or decreases the grayscale value of the background. 8-bit background gray value: 6,10-bit background gray value: 25,12-bit background gray value: 100;

4.8. Lookup table (LUT)

The Lookup Table (LUT) transformation is a basic image processing function that highlights details and contains important information. These functions include histogram equalization, gamma correction, logarithmic correction, and exponential correction.The grayscale values of the output image will be mapped one-to-one with the grayscale values of the original image.Users can set the corresponding value according to the application situation.

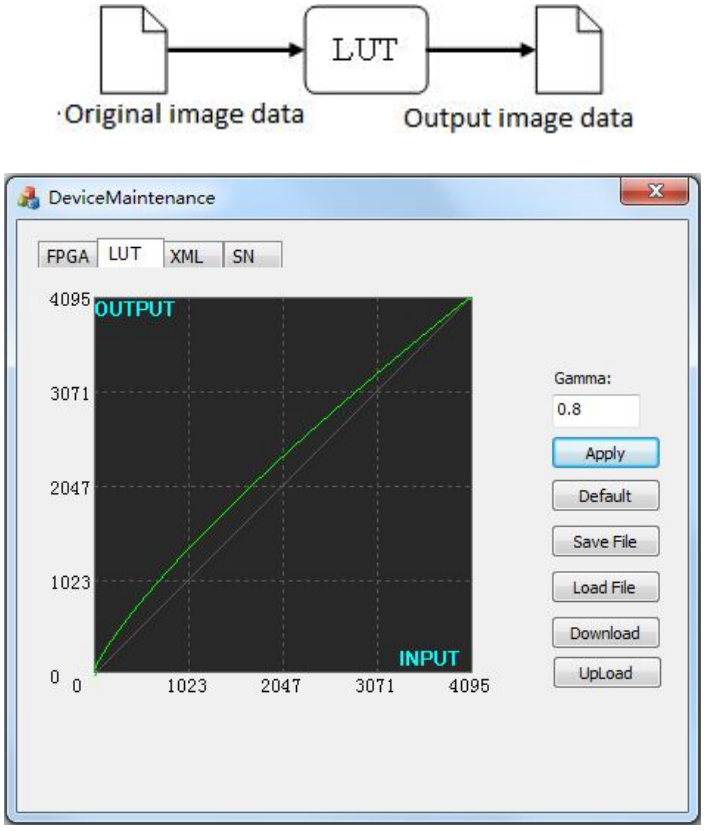


Figure 4-4. LUT at Gamma=0.8

4.9. Dark Field Correction (DSNU)

The Dhyana 9KTDI provides DSNU correction function and storage of DSNU correction values.

When the camera acquires images in complete darkness, in an ideal image, all pixel grayscale values should be close to zero and should be equal. However, in practice,

when the camera shoots in the dark, a slight difference in the performance of each pixel in the sensor will cause some change in the pixel grayscale value output from the camera. This variation is called dark signal non-uniformity(DSNU) .

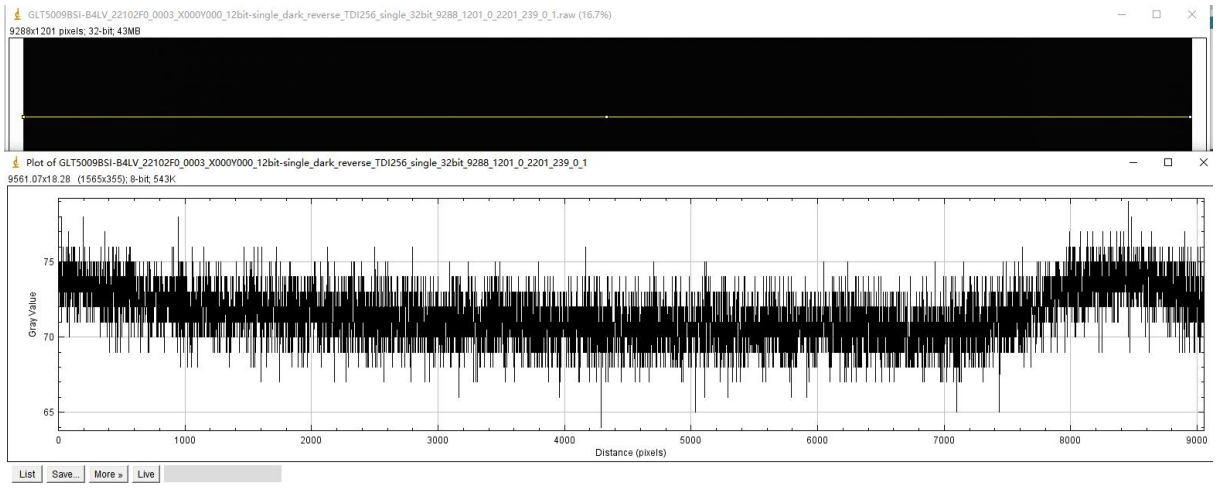


Figure 4-5. dark field gray value without corrected

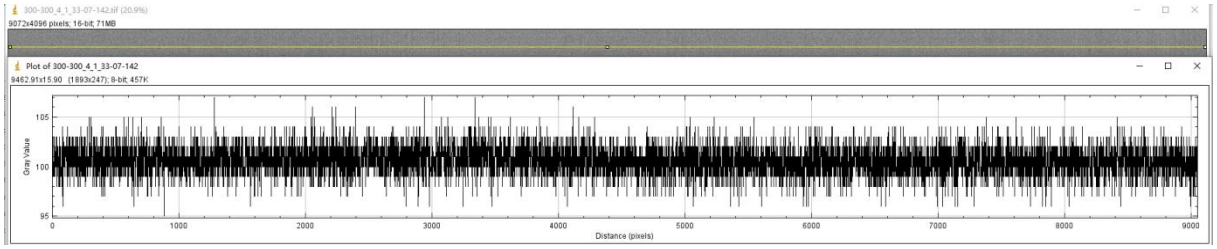


Figure 4-6. dark field gray value with corrected

4.10. Bright field correction (PRNU)

Dhyana 9KTDI provides PRNU correction function and storage of PRNU correction values.

When the camera shoots uniform, light-colored targets in bright light, all pixel gray values should be close to the maximum gray value and equal in an ideal image. However, in practice, there are subtle differences in the performance of the pixel in the camera, so that changes in the lens or illumination will cause changes in the grayscale values of the pixels output from the camera. This variation is called light response heterogeneity (PRNU).

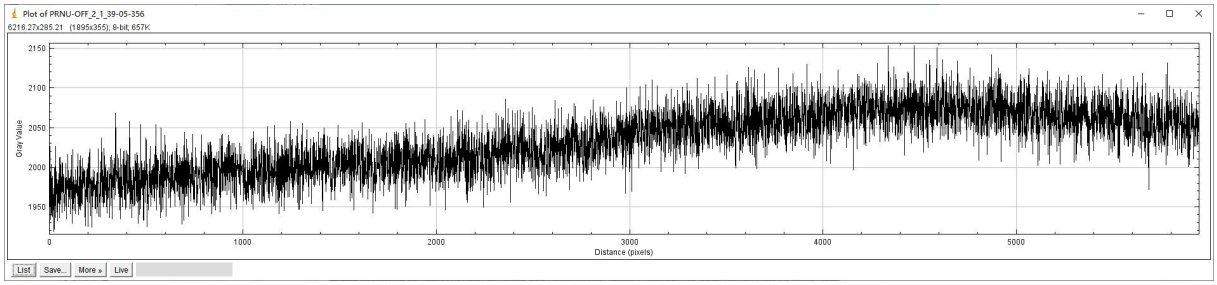


Figure 4-7. bright field gray value without corrected

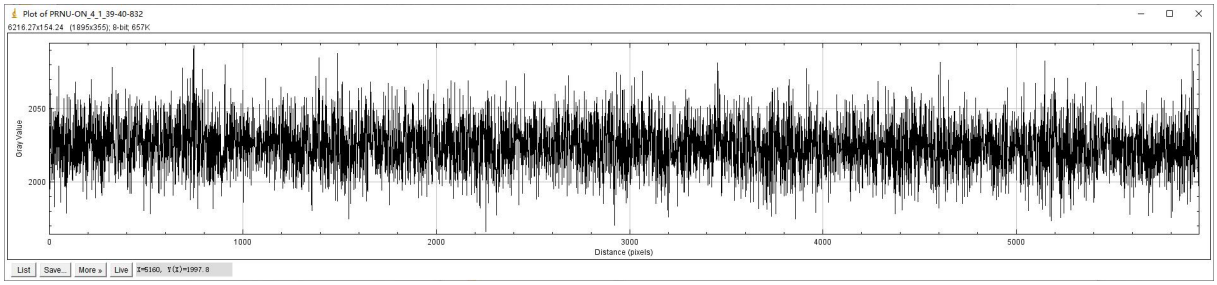


Figure 4-8. bright field gray value with correct

4.11. Digital I/O Control

When a source signal needs to be supplied to an external device, the Dhyana 9KTDI can output a pulse signal through the control I/O socket. You can select the trigger output gear through "Strobe Mode", including On, Timed, Pulse Width; You can also flip the high and low levels of the output signal, set the output signal delay time and the high output signal time (effective at Timed).

4.12. Test patterns

To check the status of the camera, the Dhyana 9KTDI can output a test pattern created internally. There are three types of test modes:

- Grey Horizontal Ramp: the preview is a static grayscale gradient in the horizontal direction.

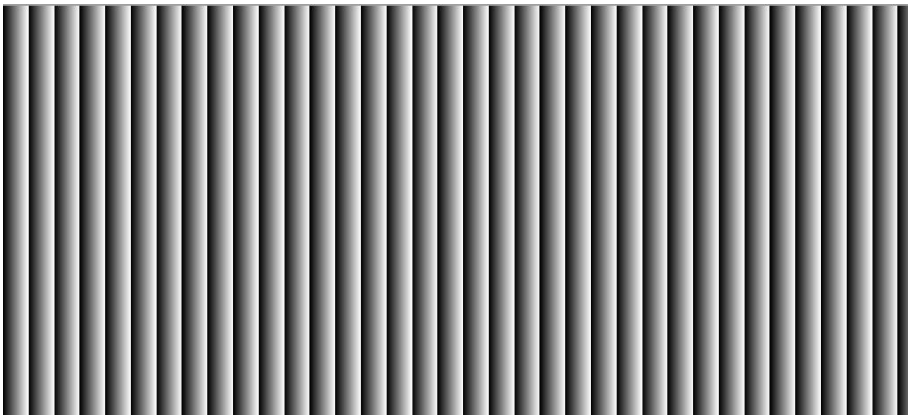


Figure 4-9 Horizontal grayscale gradient test pattern

- Grey Diagonal Ramp: preview as a static grayscale gradient in the horizontal diagonal direction.

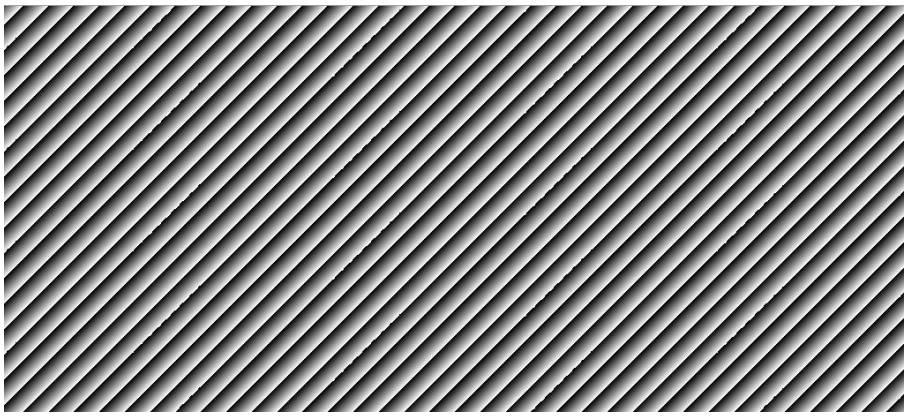


Figure 4-10 Horizontal grayscale diagonal gradient test pattern

- Grey Diagonal Ramp Moving: preview as a grayscale gradient map of the movement in the horizontal diagonal diagonal direction.

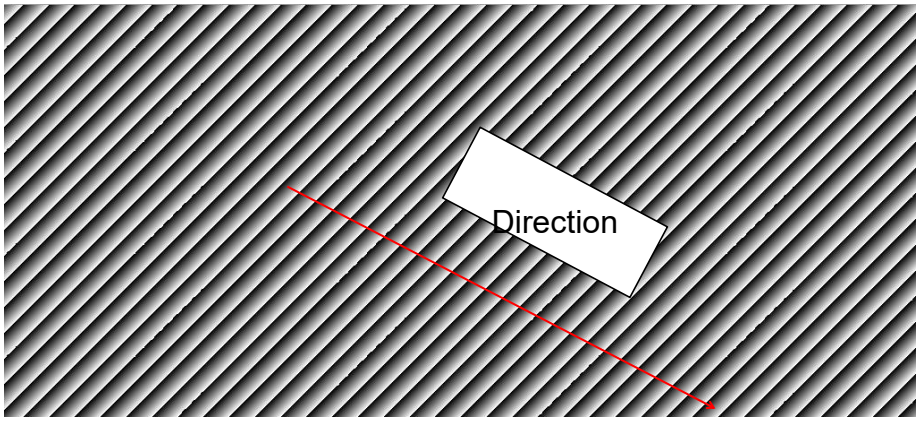


Figure 4-11 Horizontal grayscale diagonal moving gradient test pattern

4.13. Firmware update

Dhyana 9KTDI camera can use The "UpdateTool" software enables online firmware upgrades.

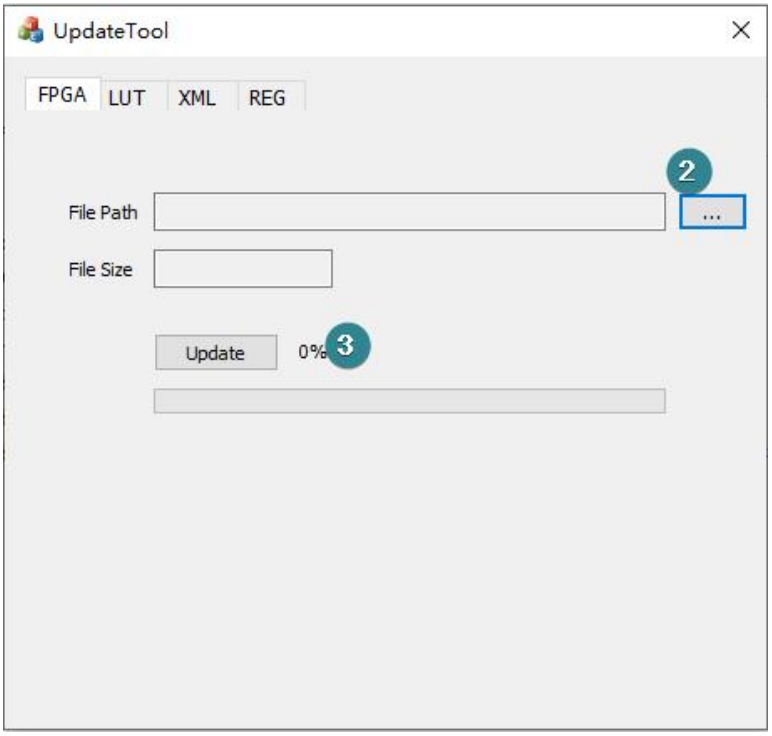


Figure 4-12 Update Tool interface

Prepare materials:

UpdateTool software;

Firmware file, .bin format;

Procedure:

1) Double-click to run the UpdateTool tool, and the interface is shown in Figure 4-12;
2) Select the firmware file path;
3) Click the "Update" button and wait for the update completed;
4) After the update is completed, restart the camera after the power is turned off, and the new firmware takes effect;

5. Camera software description

SamplePro is the camera's control software, through which users can set, preview and acquire camera parameters.

Double-click SamplePro to open the camera software, the software opening interface is shown as Figure 5-1, wait for the loading to complete, the function will be displayed on the left side of the screen;

Figure 5-1 Startup Interface

Note:

Please run the SamplePro as administrator;

5.1. Compositions

The main interface of SamplePro consists of "Preview", "Window Control", "Image Capture", "Parameters" and "Image Adjustment", as shown in Figure 5-2.

This section briefly describes the functionality of each window.

Figure 5-2 Compositions

5.1.1. Preview

The preview window displays live camera images under the stream module. The preview window supports real-time zooming, so users can zoom in and out of the preview window with the mouse wheel according to their actual needs.

The bottom left corner of the preview window displays the grayscale value of the image element where the mouse position is located, the coordinates and the image resolution size according to the mouse in the live screen, as shown in Figure 5-3.

Figure 5-3

5.1.2. Window Control

The functions of window Control are common to minimize, maximize and close windows.

5.1.3. Image Capture

The Image Capture module is the basic functions of the camera. Users can choose different image formats for capturing images and customizing the duration of video recording according to their needs, which will be saved in the img folder under the root directory of the software by default.

5.1.4. Parameters

The main functions and parameters of the camera are expanded under this module, and the camera's output mode is controlled here. The user can use the corresponding function module according to their needs.

5.1.5. Image adjustment

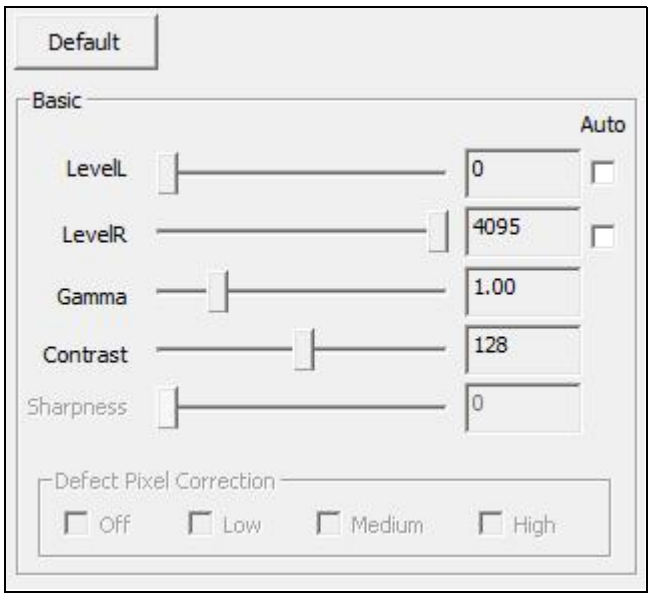


Figure 5-4

In the image adjustment interface, users can adjust the image gamma value, contrast value, and set the left and right color gradation to achieve the desired image effect

according to the difference between the real-time preview effect and the actual sample.

5.2. Image capture

This section introduces the functions of the image capture module in detail, including the operation steps of some functions;

As shown in Figure 5-5, the image capture module supports the basic image shooting and recording functions of the camera.

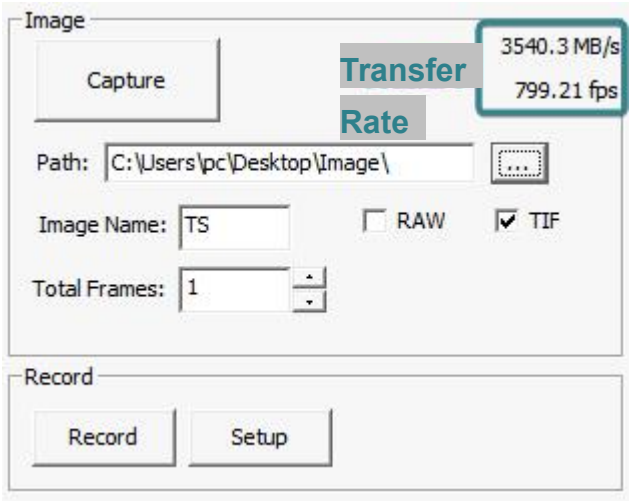


Figure 5-5 Image Capture

1) **Capture:** Click the button to cature the image;
2) **Transfer rate:** Displays the camera's transfer and frame rate, updated in real time;
3) **Path:** Set the default save path for images and videos,click ... to modify the path;
4) **Image Name:** Defualt name, support for customization;
5) **RAW/TIF:** Image format, RAW and TIF formats are supported, default is TIF, support simultaneous check;
6) **Total Frames:** Set the number of capturing images, the defualt is 1;
7) **Record:** Start of recording;

8) **Stop Record:** Stopping of recording;

9) **Setup:** Video compression format selection, only supports Full Frame (No compression) lossless compression.

5.3. Parameters

This function module contains all the setting parameter interfaces of the camera and the Frame Grabber, and the preview switch of the camera is also reflected in this module. "Device Properties" is the camera parameter setting module, and "Steam Properties" is the Frame Grabber parameter setting module.

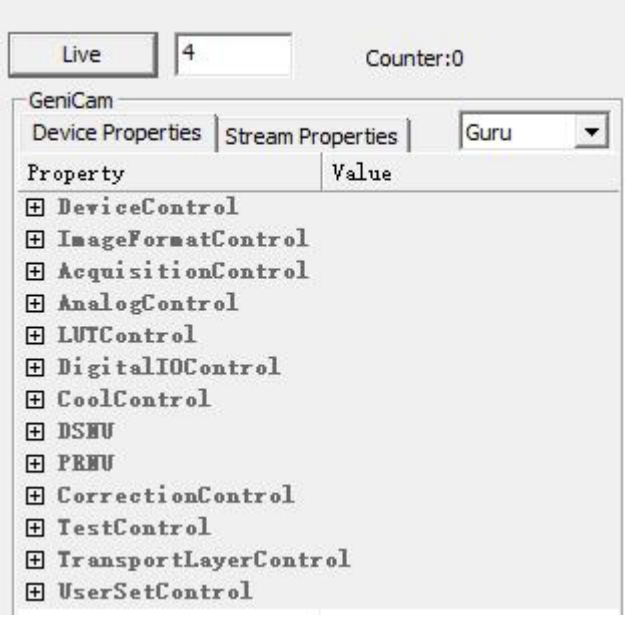


Figure 5-6

1) **Live/Stop:** Camera preview switching window, when "Live" is displayed, the camera is connected normally, but the preview is not turned on, when "Stop" is displayed, it means that the camera is connected normally and the preview has been turned on;

2) **Numeric value:**The value box next to Live/Stop indicates the number of buffer areas for memory allocation, the larger the value, the less frame will be lost when saving the image, but the software runs slower; The smaller the value, frame drops may occur at high rates, but the software runs smoothly. It is recommended that the value of high frame rate be set to large when saving the image, and set

the value to 4 when not saving the image preview.

Note: The SamplePro memory allocation setting for Matrox frame grabbers is limited to a maximum of 14 for 8bit and 7 for 10/12bit at full resolution, so the frame rate is limited.

3) **Counter:**Displays the number of camera shots. **Note:** It means the number of camera shots simplely.

5.3.1. Device Control

Used to display camera parameter information settings and display, including basic information (read-only), UserID settings, camera reset, Device and Sensor temperature display, timestamp display, reset, etc. This is shown in Figure 5-7.

Device Scan Type: Include “Linescan” and “Areascan”;

Linescan: The camera outputs data using the CXP protocol of line scanning. The computer receives 1 line of image and generates an interrupt signal, so that the frequency of interrupt is very high, and the resource occupation of CPU is high. The interrupt response frequency can be reduced by setting the Buffer of Frame Grabber. The larger the Buffer is set, the lower the interrupt frequency and the less likely to lose frames, but the more memory is needed.

Areascan: The camera outputs data using the CXP protocol of area scanning. The computer receives Hight line image and generates an interrupt signal. Therefore, in Areascan mode, the interrupt response frequency can be reduced by setting the Height of the camera. The larger the Height, the lower the interrupt frequency, the less likely to lose frames, but the more memory space is needed;

Note:

Whether it is "Linescan" or "Areascan" mode, there is only a difference in the packing format of the image when it is transmitted through CXP, and there is no difference in the captured image. Compared with Linescan mode, Areascan mode doesn't need to transmit image resolution and other parameter information in every line, so the effective bandwidth will be increased, and it can support higher trigger frequency under the same resolution.

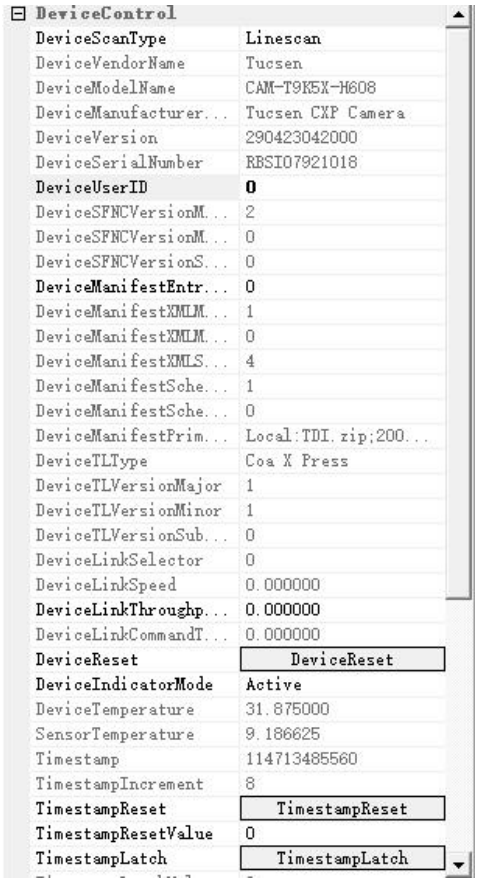


Figure 5-7

DeviceUserID: User-defined input editing;

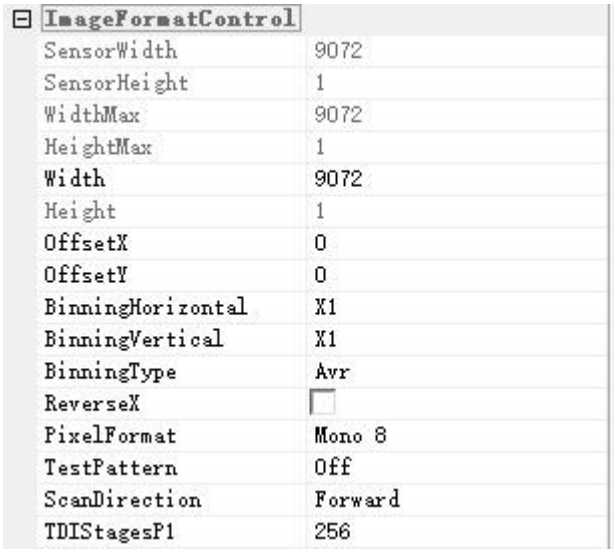
DeviceReset: Device reset button, click to restart the camera online, and restore the default configuration parameters of the camera;

DeviceTemperature: Display the camera's real-time temperature (read-only);

SensorTemperature: Display Sensor's real-time temperature (read-only);

5.3.2. Image Format Control

The camera's image width, offset, horizontal Binning, horizontal mirroring, bit depth, test pattern, scan direction, and TDI stages adjustment modules.



ImageFormatControl	
SensorWidth	9072
SensorHeight	1
WidthMax	9072
HeightMax	1
Width	9072
Height	1
OffsetX	0
OffsetY	0
BinningHorizontal	X1
BinningVertical	X1
BinningType	Avr
ReverseX	
PixelFormat	Mono 8
TestPattern	Off
ScanDirection	Forward
TDIStagesP1	256

Figure 5-8

SensorWidth: Displayed the width information of the camera sensor;

SensorHight: Displayed the hight information of the camera sensor;

WidthMax: The maximum width that the camera can set;

HeightMax: The maximum height that the camera can set;

Width: Image horizontal width setting, allowable input range: 256-9072, minimum step 16. The maximum value after Binning will change, please refer to "WidthMax.""。

Height: Image height setting, not settable under Linescan fixed to 1. The vertical resolution of the actual image is Height*BufferHeight; Areascan can be set;

OffsetX: Image horizontal start point selection, Offset+Width≤9072, minimum input 0, step 16;

OffsetY: The vertical start position of the image, that is, how many lines the image starts to output, for example, OffsetY=256 means that the first 256 signal filtering of the scan does not count the data, the input range is 0~32768, step 1, only the TDI mode setting takes effect;

BinningHorizotal: Horizontal Binning, support X1, X2, X4, X8 mode, the resolution is reduced after binning, you can select the image output is Sum or Avr through "BinningType";

BinningVertical: Vertical binning, support X1, X2, X4, X8, the resolution is reduced after binning, and the image output can be selected as Sum or Avr through

"BinningType";

BinningType: Binning type switching, support Sum and Avr, Sum is to sum several rows or columns of Binning pixels as the output of Binning pixels; Avr means averages rows or columns of pixels as the output of Binning pixels;

ReverseX: The image is flipped horizontally;

PixelFormat: Bit depth switching, supporting 8bit, 10bit and 12bit. When 8bit is selected, the image output bit depth is 8bit, and when 10bit and 12bit are selected, the picture output bit depth is 16bit;

TestPattern: Test mode, support "horizontal grayscale gradient" see Figure 4-5, "horizontal grayscale bevel gradient" see Figure 4-6, "horizontal grayscale bevel movement gradient" see Figure 4-7, 8/10/12bit respectively set the image height to 256/1024/4096 to open the normal test mode;

ScanDirection: Select the camera line sweep square, support Forward, Reverse, LineIn (external trigger control); Users can switch according to the actual usage scenario to match the line sweeping direction;

TDIStagesP1: TDI stage P1 array switching, support 4, 8, 16, 32, 64, 96, 128, 160, 192, 124, 240, 248, 252, 256 stages, in TDI mode, under the same illumination, the larger the TDI stage, the longer the integration time, the greater the image brightness. TDI stage P1 array switching, support 4, 8, 16, 32, 64, 96, 128, 160, 192, 124, 240, 248, 252, 256 stages, TDI mode, under the same illumination, the larger the TDI stage, the longer the integration time, the greater the image brightness.

Note:

1) Only when the preview is stopped, you can set Width, OffsetX, bit depth, Binning switching;
2) Set Width, OffsetX must be a multiple of 16, if the setting is wrong, the software will automatically return to the last set correct value;

5.3.3. Acquisition Control

This module is used to control the camera's motion mode, line frequency setting, external trigger mode, trigger readjustment, drawing mode selection, trigger statistics

display, etc., and the setting interface is shown in Figure 5-9.

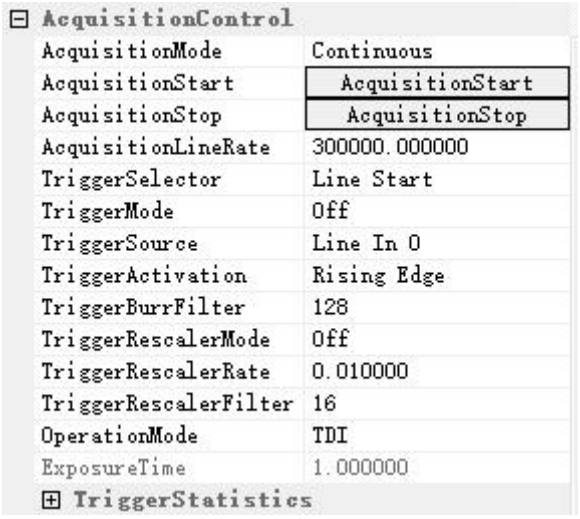


Figure 5-9

AcquisitionStart: In stream mode, the scan start button;

AcquisitionStop: In stream mode, the scan pause button;

AcuqisitionLineRate: line frequency settings, TDI mode set effective, Area mode does not support the input, line frequency and exposure time conversion relationship is as follows, exposure time = TDI stage / line frequency (seconds), the maximum exposure time 256ms;

TriggerMode: Trigger mode switch, start trigger mode in the On state. In TDI mode, a pulse triggers a line of data, and in Area mode, a pulse triggers a frame of image, the height of which is determined by TDIStagesP1;

TriggerSource: Trigger channel selection, supports two trigger methods: Line In0 external trigger and CXPin frame grabber trigger ; Line In0 (**recommended**), the trigger source through the Hirose line connected to the camera trigger port to trigger; CXPin, the trigger source through the frame grabber trigger line connected to the frame grabber to trigger.;

TriggerActivation: rigger type selection, supporting rising edge, falling edge and double edge triggering (doubling the trigger frequency);

TriggerBurrFilter: If the trigger filter is set to a larger value than the width of the trigger pulse, then the pulse will be filtered out and no trigger will occur, unit ns, can input 32~100000000 default 128, such as external trigger frequency 256kHz, duty

cycle 50%, BurrFiter setting does not exceed 1s÷256000×50%=1,953.125ns can be triggered normally;

TriggerRescalerMode: Trigger retuning mode, which amplifies or reduces the frequency of the external trigger signal.;

TriggerRescalerRate: Trigger rescaler coefficient, set the rescaler coefficient to adjust the external trigger signal frequency, can input 0.01~100;

TriggerRescalerFilter: Trigger retune filter coefficient, reduce the external trigger signal jitter after trigger retune, the larger the value, the more stable the frequency after retune, can choose to switch 16, 32, 64, 128, 256, 512.;

OperationMode: Operation mode selection, support TDI and Area mode, Area mode is recommended for focusing fixed object distance of still images;

ExposureTime: exposure time adjustment in the Area mode, can be entered from 1 to 10000ms;

TirggerStatistics: The statistical function module is triggered, and the function interface is shown in Figure 5-10;

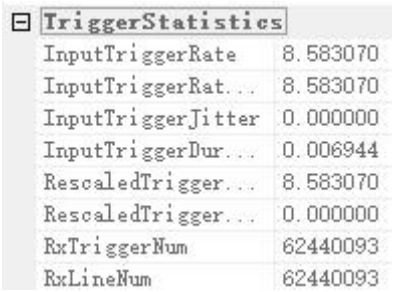


Figure 5-10 Trigger the statistics function module

InputTriggerRate: Displays the frequency Hz of the trigger input;

InputTriggerRateHighest: Displays the maximum frequency Hz of the trigger input.;

InputTriggerJitter: Shows the % jitter of the trigger input signal, the smaller the value, the better the signal quality;

InputTriggerDuration: Shows the time us when the trigger input signal is high;

RescaledTriggerRate: Shows the signal jitter % after trigger input retuning;

RescaledTriggerJitter: Shows the signal jitter % after trigger input returning;

RxTriggerNum: Input statistics of the number of trigger pulses;

RxLineNum: Statistics of the number of trigger pulses received;

5.3.4. Digital IO Control

This module is used to set the camera's external trigger output function, and the function interface is shown in Figure 5-11.

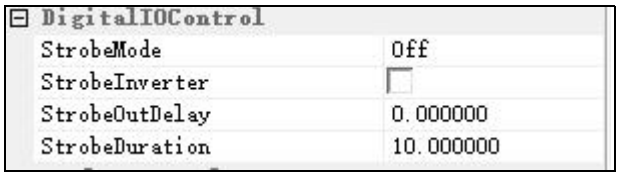


Figure 5-11

StrobeMode: Trigger output gear selection, supporting Off/On/Timed/PulseWidth;

StrobeInverter: Output signal high and low level flipping;

StrobeOutDelay: Output signal delay time μs;

StrobeDuration: High level output signal time μs (effective under Timed);

5.3.5. Analog Control

This function block is used to set the camera's analog and digital gain, as well as black level adjustment, as shown in Figure 5-12.

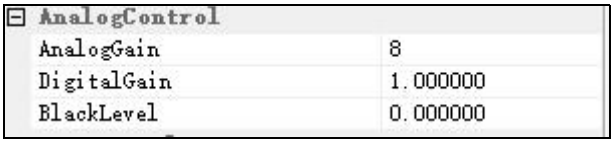


Figure 5-12

AnalogGain: Analog gain, supporting 2 to 8 switching, in steps of 0.5;

DigitalGain: Digital gain, support 0.5~10 switching,in steps of 1;

BlackLevel: Black level, increase or decrease the gray value of the image, adjustable -255~255, 10bit and 12bit proportional conversion;

5.3.6. LUTControl

This module is used to set the LUT function, and the setting interface is shown in Figure 5-13

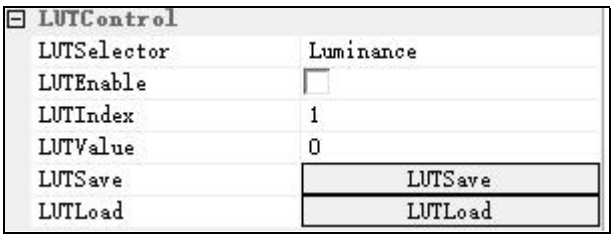


Figure 5-13

LUTEnable: LUT control switch, not enabled by default;

LUTIndex: INPUT value, which is automatically loaded with the output value corresponding to the applied curve after input, in the range 0 to 4095;

LUTValue: OUTPUT value, loaded according to the input LUTIndex value, can be manually modified and saved, range 0 to 4095;

LUTSave: Saving of the modified curve.;

LUTLoad: Loading of LUT curves written by the application;

Note:

Before using the LUT function, users need to open the UpdateTool software to write LUT configuration according to actual use.

LUT settings on UpdateTool

The software operation interface is shown in Figure 5-14.

Gamma: The corresponding INPUT-OUPUT curve is adjustable after inputting the value;

Apply: Applies the current call to the LUT curve;

Default: Restores the state of the LUT curve when the default is Gamma=1;

Save File: Saves the current LUT curve to the specified file path;

Load File: Loads the saved LUT curve file;

DownLoad: Configuration of the currently applied LUT curve into the camera;

UpLoad: Loading and reading the applied LUT curve from the camera (the LUT curve needs to be saved in SamplePro before it can be loaded and read);

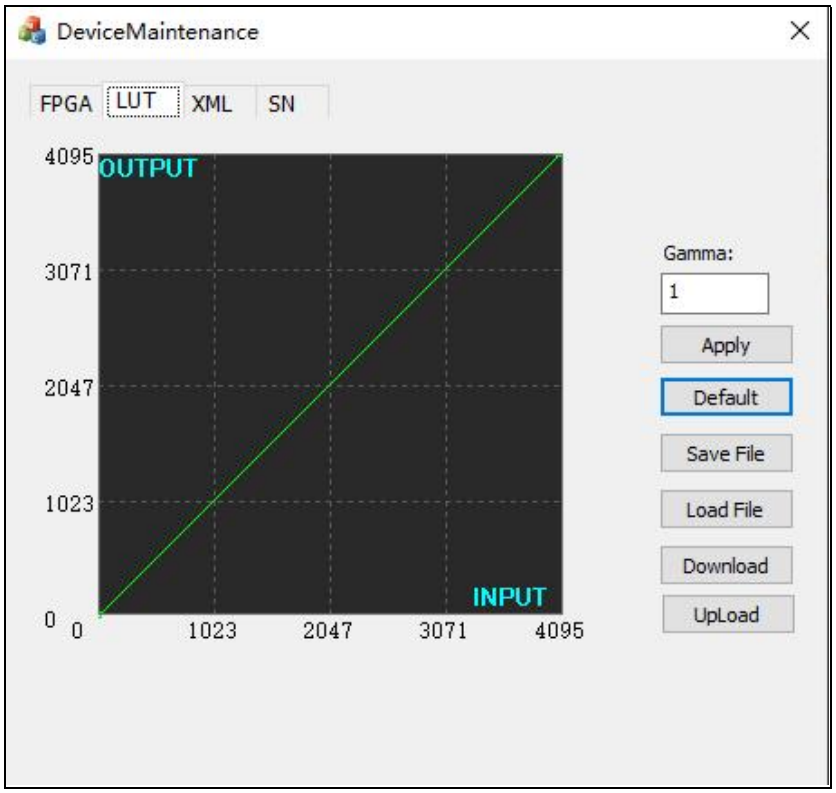


Figure 5-14

the procedure of The LUT configuration writing

1) Open the "UpdateTool" tool and select the "LUT" interface as shown;
2) At first enter the required Gamma value;
3) Click Apply to apply the currently selected curve;
4) Click DownLoad to configure the curve into the camera.

5.3.7. Cool Control

For setting the camera's cooling function, the setting interface is shown in Figure 5-15.

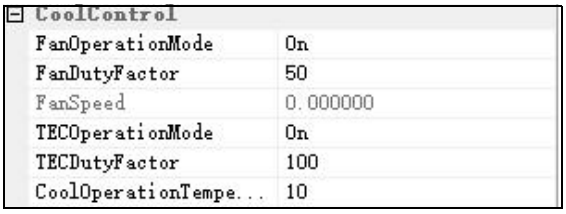


Figure 5-15

FanOperationMode: Fan mode gear, Off (fan off), On (fan on), Temperature (thermostat mode).

FanDutyFactor: Fan speed gear, adjustable from 20 to 100%;

TECOperationMode: TEC mode, Off (fan off), On (fan on), Temperature (thermostat mode);

TECDutyFactor: TEC power level, adjustable from 0 to 100%;

CoolOperationTemperature: Cooling target temperature, adjustable range -30~50°C, default 10°C;

Note:

1) The target of temperature control is the sensor temperature;
2) When the sensor temperature exceeds 75℃, the TEC will be forced to shut down and the fan will run at 100%; when the cooling is resumed to below 75℃, if the user selects the "Temperature" mode, it will be switched to the "Temperature" mode, and in other modes, the fan will continue to run at 100% and the TEC will continue to be shut down until the parameters are reset;
3) When "Temperature" mode is set, the settings of "FanDutyFactor" and "TECDutyFactor" are invalid;

5.3.8. DSNU

DSNU is used to calibrate the camera's darkfield heterogeneity, and the setup interface is shown in Figure 5-16.

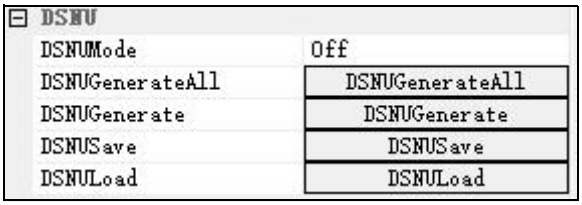


Figure 5-16

DSNUMode: DSNU correction enable switch, Off position turns off DSNU, ON position turns on DSNU;

DSNUGenerateAll: Camera short exposure time in a dark field without light environment, click to do online DSNU correction in analog gain mode;

DSNUGenerate: Camera short exposure time in dark field without light environment, click to do online DSNU correction in the current analog gain mode ;

DSNUSave: Saves the current DSNU results to memory, and next time the saved DSNU data can be loaded directly from memory for use;

DSNULoad: Loading the saved DSNU data from memory;

Procedure of DSNU :

1) Set the camera parameters actually;
2) The camera is placed in darkfield and no light conditions;
3) Turn on Camera preview;
4) Click "DSNUGenerateAll" to perform DSNU correction for all analog gain modes and automatically save the calibration results; Or click "DSNUGenerate" to perform DSNU calibration on the currently set gain mode, you need to click "DSNUSave" to save the result, otherwise the calibration data will be lost after the power failure;

Note:

1) DSNU should be performed in darkfield and no light conditions;
2) The background data is different under different line rates, different TDI stages, and different temperatures, and needs to be re-calibrated;
3) If DSNUGenerate is selected, the DSNU calibration needs to be re-performed

when switching gain modes;

5.3.9.PRNU

The PRNU calibration module is shown in Figure 5-17.

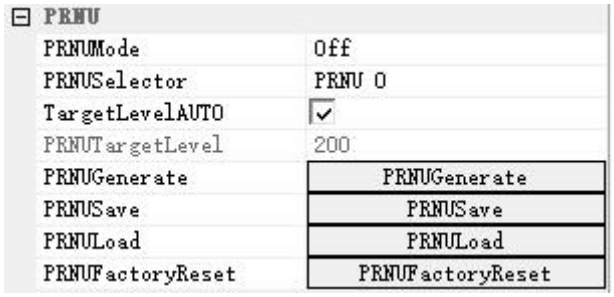


Figure 5-17

PRNUMode: PRNU correction enable switch, Off position turns off PRNU, ON position turns on PRNU;

PRNUSelector: Select the location where PRNU data is saved, supporting a total of 5 groups of data from PRNU0 to PRNU4;

TargetLevelAUTO: Automatic PRNU mode (the system automatically calculates the average value of the current image brightness), after checking enable, click PRNUGenerate in bright field uniform light, automatically generate PRNU;

PRNUTargetLevel: Manual PRNU mode, uncheck the automatic PRNU mode, by setting the PRNU gray value, adjust the bright field uniform light brightness to the set gray value, click PRNUGenerate, automatically generate PRNU correction data; (example: set PRNUTargetLevel to 128, then you need to adjust the bright field uniform light to (Example: if PRNUTargetLevel is set to 128, the bright field uniform light should be adjusted to roughly half-saturated state, and then one click online PRNU correction);

PRNUGenerate: Click to do online PRNU correction;

PRNUSave: Saves the current PRNU results to the selected PRNU0 to PRNU4;

PRNULoad: Loading the saved PRNU data from the selected PRNU0 to PRNU4;

PRNUFactoryReset: Restore the selected PRNU0~PRNU4 to factory backup parameters;

Procedure of PRNU :

1) PRNU enabled;
2) Use PRUNSelector to select which group to save the parameters;
3) To set the Target, you can choose either automatically or manually. The manually set grayscale value should match the grayscale of the actual light source, that is, the grayscale of the actual uniform light environment is 100, and the target should be set to 100;
4) Click "PRNUGenerate" to perform PRNU correction, the preview screen will flicker during the correction process, and when the preview screen is stable, it means that the correction is complete;
5) Click "PRUNSave" to save the correction results to the group selected by "PRUNSelector";

Note:

1) PRNU correction needs to be done after DSUN correction;
2) This needs to be done in preview mode;
3) Correction should be performed in a brightfield uniform brightness environment;
4) PRNU does not take effect in Gain mode;

5.3.10. CorrectionControl

The Correction module is shown in Figure 5-18

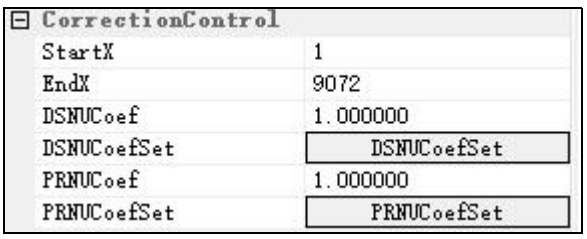


Figure 5-18

StartX: Selects the X coordinate of the starting pixel and can be entered in the range 1 to 9072;

EndX: elects the X coordinate of an ending pixel, which can be entered in the range 1 to 9072;

DSNUCoef: Set an additional DSNU correction value for the selected area gray value minus the set value (example: under DSNU, the average gray value of the image is 100, set DSNUCoef=100, then after Correction, the average gray value of the image is 0);

DSNUCoefSet: Configuration according to the set DSNUCoef value;

PRNUCoef: Set an additional PRNU correction value, multiplying the gray value of the selected area by the set value (example: under PRNU, the average gray value of the image is 2000, set PRNUCoef=1.024, then after Correction, the average gray value of the image is 2048);

PRNUCoefSet: Configuration according to the set PRNUCoef value;

Note:

1) When doing PRNUCoefSet and DSNUCoefSet, switch DSNU and PRNU to the On gear to see the effect of CoefSet;
2) Correction parameters are not saved after the camera is powered off;
3) Corrections for multiple areas can be made;

5.3.11. CoaXPress

The CoaXPress module is shown in Figure 5-19.

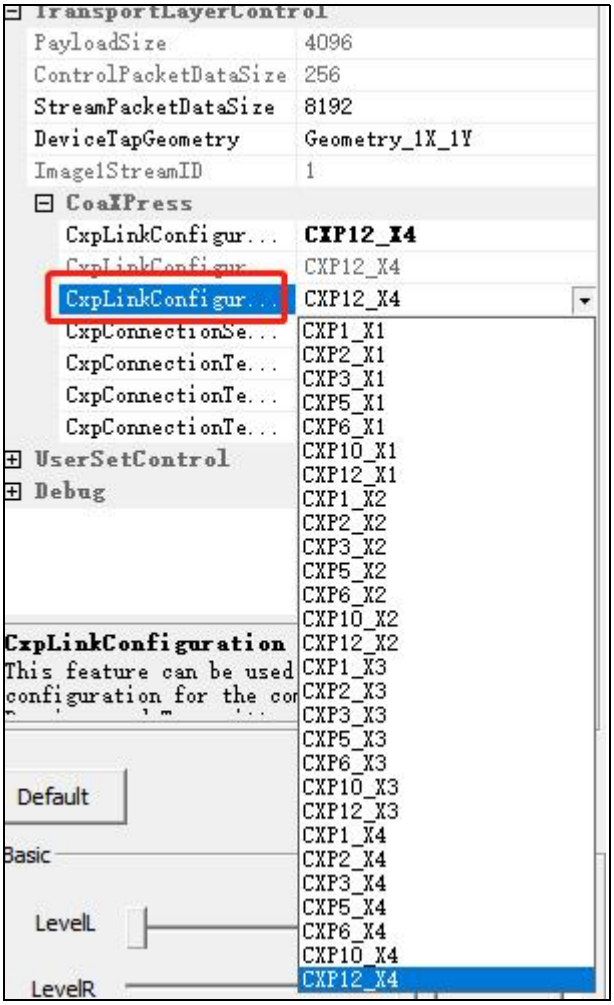
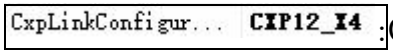


Figure 5-19



:CXP default startup connection selection;

: CXP mode switch, default CXP12_X4, need to be in the live state, stream mode Stop state gray can not be switched;

5.3.12. UserSetControl

The user configuration module is shown in Figure 5-20.

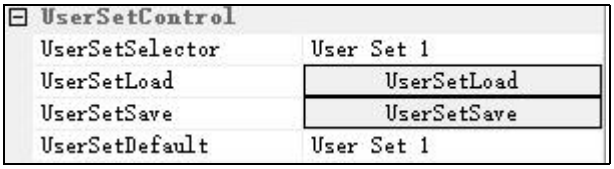


Figure 5-20

UserSetSelector: User set storage, providing Default, User Set1 and User Set2 configurations;

UserSetLoad: The camera loads a set of parameters selected by Default, User Set1, User Set2;

UserSetSave: The configuration of the modified parameters is saved in the selected User Set1, User Set2 groups;

UserSetDefault: The default set of user configurations loaded after camera reset or power-off reboot, as shown in Figure 6-20, the default loaded setting of the User Configuration module is User Set1, and the parameters loaded after camera reset or power-off reboot are User Set1.

5.3.13. Steam Properties

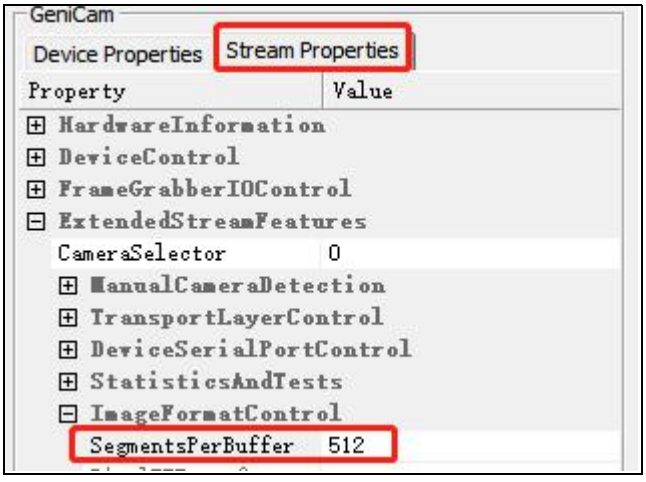


Figure 5-21 KAYA Frame Grabber

This module is used to set theframe grabber connected to the camera, and the vertical resolution of the acquired image needs to be set at this setting. Different frame grabber setting interfaces are different, the setting interface of the KAYA frame grabber is shown in Figure 5-21, the interface of the Euresys frame grabber is shown in Figure

5-22, and the vertical resolution of the Matrox frame grabber is fixed at 1024 and cannot be modified. The maximum BufferHeight can be set to 65535. When the camera mode is set to "Area", the BufferHeight value is recommended to be set to an integer multiple of 256.

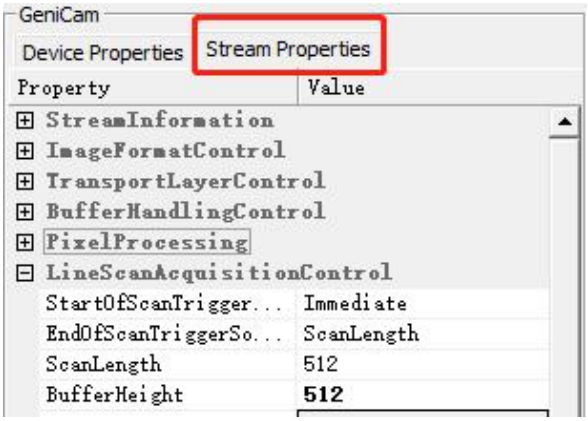


Figure 5-22 Euresys Frame Grabber

When the trigger mode CXPin is enabled, the setting interface and Pins definition of the two frame grabbers are also different.

KAYA frame grabber

Tab 5-1 KAYA frame grabber pin definition

J18	Signal Name	I/O Standard	Description
1	Din[0]	LVDS	Pin 1 of this header is the positive signal and pin 2 in the negative signal of this LVDS. The differential pair is converted to a single input on the FPGA.
2			
3	Din[1]	LVDS	Pin 3 of this header is the positive signal and pin 4 in the negative signal of this LVDS. The differential pair is converted to a single input on the FPGA.
4			
5	Rout[0]	LVDS	Pin 5 of this header is the positive signal and pin 6 in the negative signal of this LVDS. The differential pair is converted to a single input on the FPGA.
6			
7	Rout[1]	LVDS	Pin 7 of this header is the positive signal and pin 8 in the negative signal of this LVDS. The differential pair is converted to a single input on the FPGA.
8			
9	io_out[0]	3.3-V LVTTL	Optically isolated outputs
10	io_out[1]	3.3-V LVTTL	Optically isolated outputs

11	io_out[2]	3.3-V LVTTL	Optically isolated outputs
12	io_out[3]	3.3-V LVTTL	Optically isolated outputs
13	io_in[0]	3.3-V LVTTL	Optically isolated inputs
14	io_in[1]	3.3-V LVTTL	Optically isolated inputs
15	io_in[2]	3.3-V LVTTL	Optically isolated inputs
16	io_in[3]	3.3-V LVTTL	Optically isolated inputs
17	OptoCoupled GND	-	Ground signal for opto-isolated signals on this connector
18	GND	-	Reference ground signal - Board GND
19	gpio_vt[0]	TTL	General Purpose IO
20	gpio_vt[1]	TTL	
21	gpio_vt[2]	TTL	
22	gpio_vt[3]	TTL	
23	gpio[0]	3.3-V LVTTL	
24	gpio[1]	3.3-V LVTTL	
25	gpio[2]	3.3-V LVTTL	
26	gpio[3]	3.3-V LVTTL	

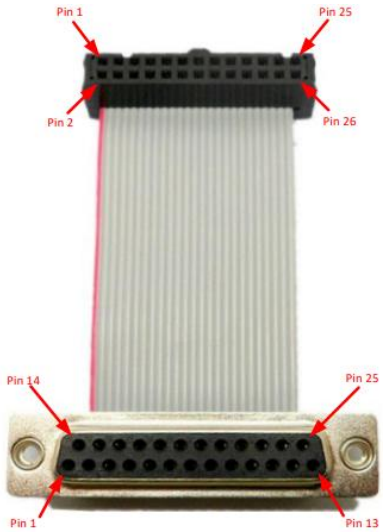


Figure 5-23 KAYA Frame Grabber Interface

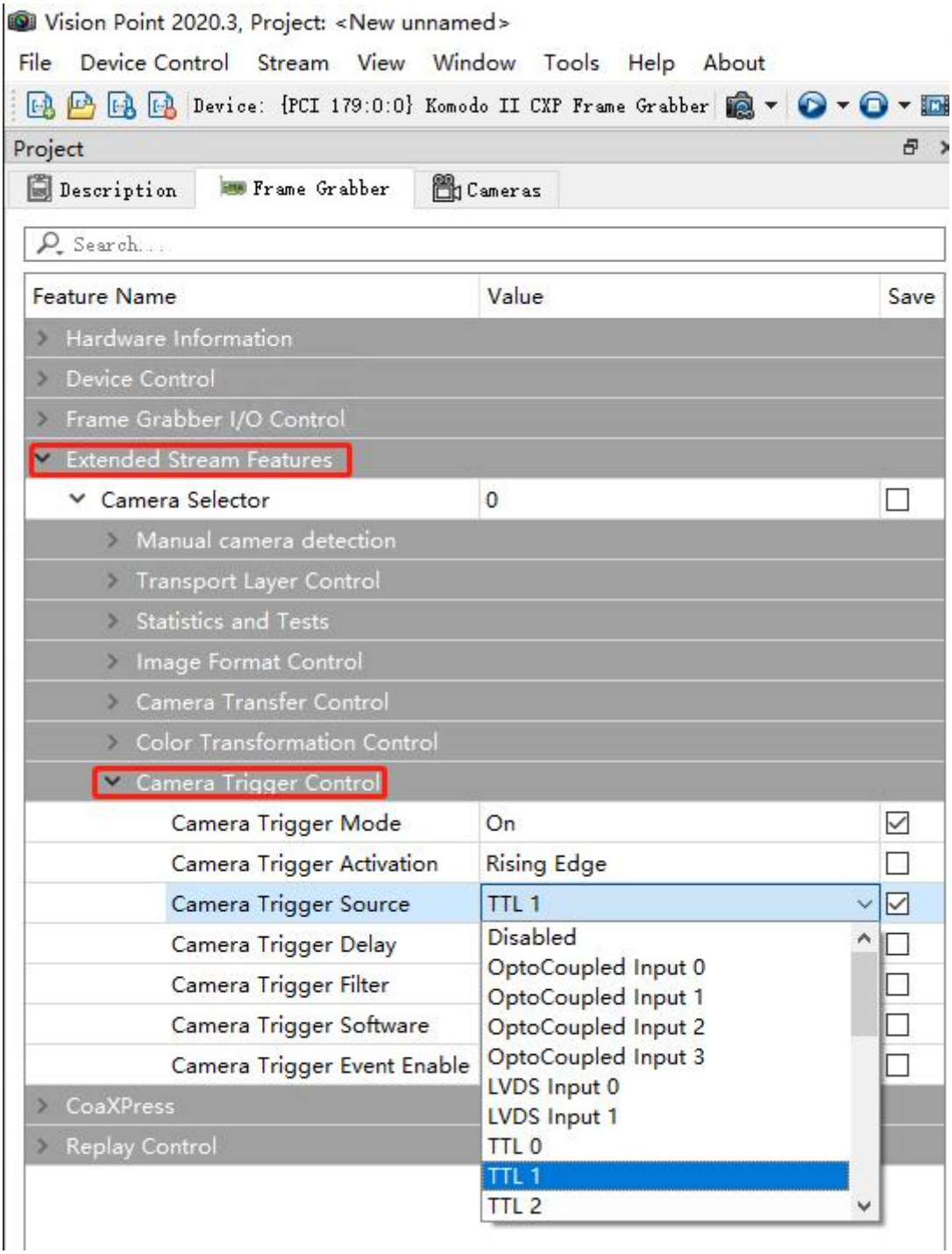


Figure 5-24

1) Under Camera Trigger Activation, select the trigger polarity RisingEdge, FallingEdge, and AllEdge according to the trigger needs;

2) Select according to interface definition under Camera Trigger Source (TTL1 is

recommended).

Figure 5-25 Euresys Frame Grabber Interface

Tab 5-2 Euresys frame grabber pin definition

Pin	Signal	Usage
1	GND	Ground
2	DIN12+	High-speed differential input #12 - Positive pole
3	IIN11+	Isolated input #11 - Positive pole
4	IIN13-	Isolated input #13 - Negative pole
5	IIN14-	Isolated input #14 - Negative pole
6	IOUT12-	Isolated contact output #12 -Negative pole
7	GND	Ground
8		Not connected
9	GND	Ground
10	GND	Ground
11	DIN12-	High-speed differential input #12 - Negative pole
12	IIN11-	Isolated input #11 - Negative pole
13	IIN12+	Isolated input #12 - Positive pole
14	IIN13+	Isolated input #13 - Positive pole
15	IIN14+	Isolated input #14 - Positive pole
16	IOUT12+	Isolated contact output #12 - Positive pole
17	TTLIO12	TTL input/output #12
18	GND	Ground
19	DIN11-	High-speed differential input #11- Negative pole
20	DIN11+	High-speed differential input #11 - Positive pole
21	IIN12-	Isolated input #12 - Negative pole
22	IOUT11-	Isolated contact output #11 - Negative pole
23	IOUT11+	Isolated contact output #11 - Positive pole

24	GND	Ground
25	TTLIO11	TTL input/output #11
26	+12V	+12V Power output

The interface settings are as follows

1) Find CycleTriggerSource under Frame Grabber Demo Software Device and select LIN1;

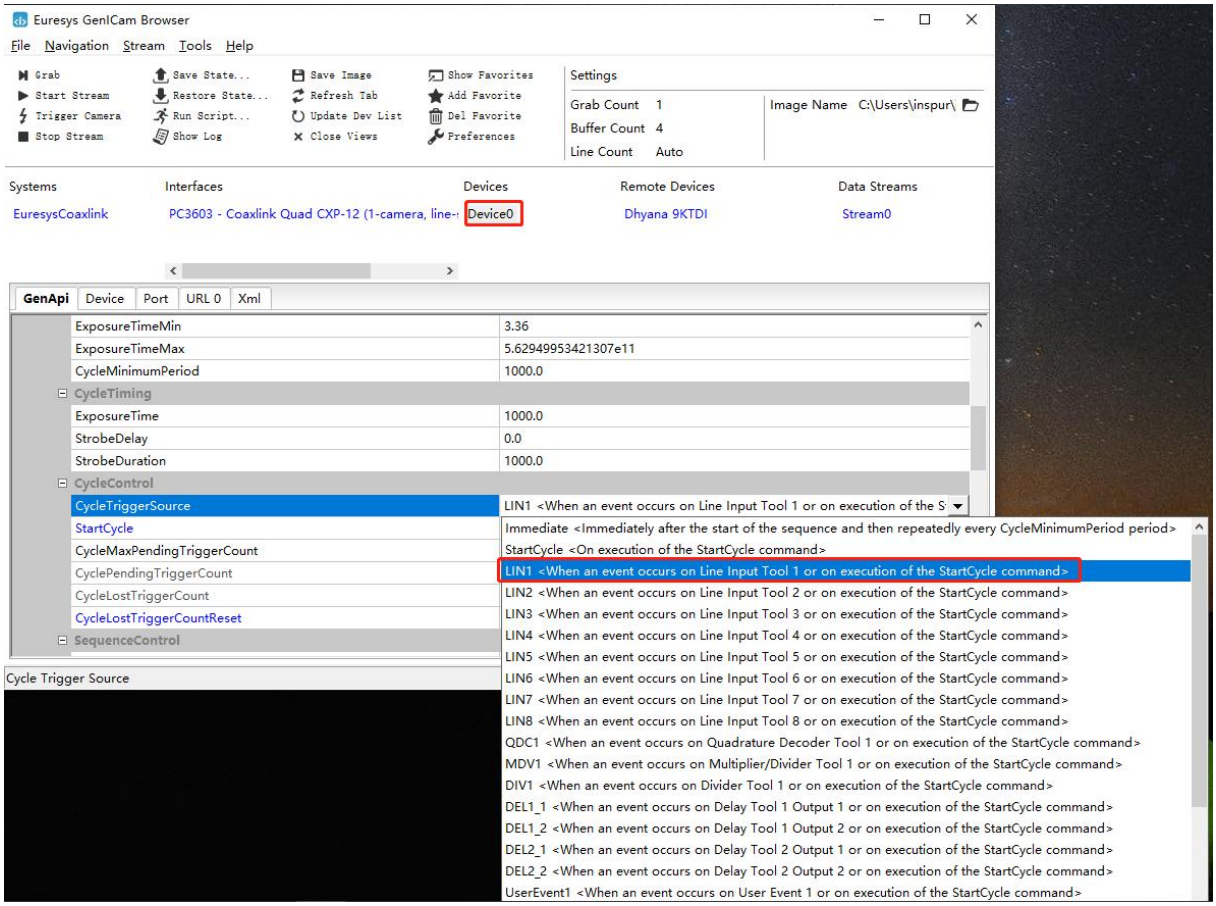


Figure 5-26

2) Find IOToolbox under the second column of the Frame Grabber Demo software;

3) Select LIN1 under LineInputToolSelector (corresponds to "CycleTriggerSource Select LIN1" in step 1, not necessarily LIN1);

4) Under LineInputToolsource, select the interface that triggers the input according to the interface definition of the frame grabber (TTLIO11 is recommended);

5) Under LineInputToolActivation, select the trigger polarity RisingEdge, FallingEdge,

and AllEdge according to the trigger needs;

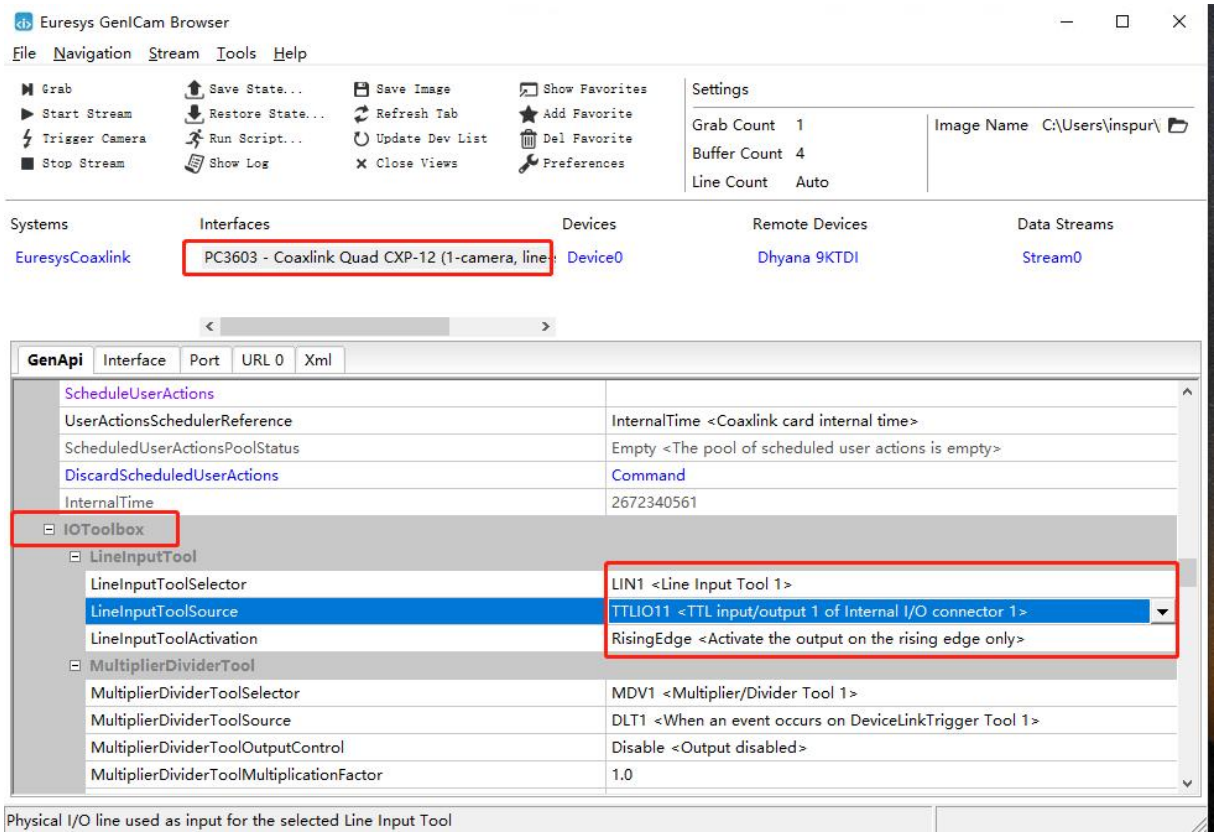


Figure 5-27

5.4. Image adjustment

The image adjustment function is shown in Figure 5-28.

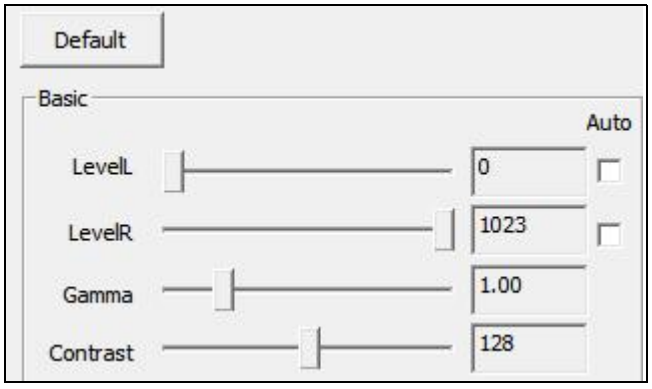


Figure 5-28

LevelL: The user can change the left color level value by manual input or by dragging

the color level slider;

LevelR: The user can change the right color level value by entering it manually or by dragging the color level slider;

Auto: Automatically defines the brightest and darkest pixels in each channel as white and black, and then redistributes the pixel values between them proportionally;

Gamma: Gamma value can change the picture light and dark, increase contrast, the larger the value, the greater the gray scale, the higher the brightness range 0.64 ~ 2.55, the default 1.00;

Contrast: The difference of different brightness levels between the brightest white and the darkest black in a bright and dark area of an image, range 0~255, default 128;

Default: Click on the button to restore the parameters of the image adjustment module to the default values set by the software;

6. FAQs

How to calculate the readout time?

The readout time of a frame of an image can be calculated according to the "row period multiplied by the number of lines",row period is the reciprocal of the line frequency.

How to calculate the line frequency?

Line rate (Hz) = sample movement speed (mm/s) / pixel interval width (mm)

For example:

The width of 386 pixels is 10mm, the width of one single pixel is 0.026mm, and the sample speed is 100mm/s.

Then the line frequency = 100/0.026 = 3846Hz

Then the trigger signal frequency needs to be set to 3846Hz

What factors affect the camera line speed (line frequency)?

BufferHeight : affects the frame rate and does not affect the line speed;

When the width is larger, the line frequency become lower;

Binning: The vertical 2bin line speed is halved compared to the original, and the horizontal 2bin has nothing to do with the line speed;

Transmission bandwidth: The default is CXP12_X4, and the software will automatically reduce the bandwidth when the bandwidth is insufficient, and the line speed will be limited.

What is the difference between the each modes of

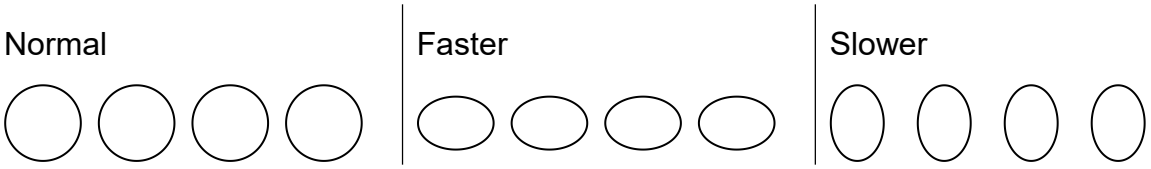
triggering?

3 output moduels of TriggerOut :

1) On, High level 3.3V;
2) Timed, Configured pulse period by StrobeDuration with 50% duty cycle;
3) PulseWidth, Equivalent to copying the signal of TriggerInput1, adjusting the delay time through StrobeOutDelay;

Why the preview image is stretched or compressed?

The camera line frequency does not match the motion speed of the object. If compression occurs, the motion speed is greater than the scan speed, and if stretching occurs, the motion speed is less than the scan speed.



Why is the drag worse the shorter the exposure time in Area mode?

This is normal, because the Area mode of the line scan camera is different from the real area scan camera, it is processed from single-line data, only for focusing use, normal image acquisition, TDI mode is recommended.

What is the maximum length of CXP cable?

The recommended maximum distance is 20 meters. For longer distances, consider the Dhyana 9KTDI PRO, which uses a fiber optic port to support longer distances.

7. After-sales

1) Login to the official website and click on the [Technical Support] module to get the FAQ.

2) Warranties.

- The product warranty period is 24 months from the date of shipment. We will repair any damage during this period free of charge if it meets the warranty requirements.
- The scope of the warranty is limited to defects in the materials and manufacture of the product. Self-disassembly, water, throwing and other man-made damage and damage caused by natural disasters are not covered by the warranty.

3) Contact a professional for technical support:

- Tel: 400-075-8880 0591-88194580-811
- Email: service@tucsen.com
- Tucsen's website to leave a message: http://www.tucsen.com .

4) Please prepare the following information in advance:

- Camera model and S/N (product serial number);
- Software version number and computer system information;
- A description of the problem and any images related to the problem.

8. Logs

版本	日期	修改内容
V1.0	20230131	Create a document
V1.1	20230630	1. Added FAQ chapter; 2. Added water flow rate recommendation; 3. Added DSNU, PRNU, LUT operation steps and precautions; 4. Added the communication protocol schedule; 5. Adjust the order of some chapters; 6. Modify "Area mode, one pulse triggers one frame image", 2904 version firmware begins to support; 5. Change to new external document format;
V1.2	20230807	1. Added Temperature Control Description; 2. Added CXP line distances; 3. Added linescan and areascan details;