Dhyana 6060/Dhyana 6060BSI Camera User Manual

Catalog

1. Read Before Use

● This camera instruction document contains basic information about the camera, product features, function introduction, and care and maintenance, which is TUCSEN's internal document and published content to make it easier for users to use TUCSEN cameras.

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2. Cautions

Operation and 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 in the specified temperature range. Otherwise, the equipment may be damaged by extreme temperatures.

Installation and 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. 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.
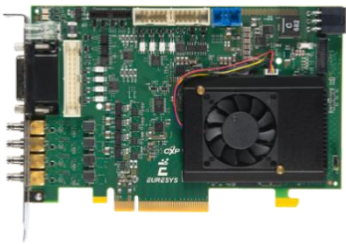
Power Supply

	• Please use the original power adapter of the camera, using a mismatched power supply will damage the camera.
⚠️ Note	• If the voltage applied to the imager is greater or less than the nominal voltage of the imager, the imager 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.

3. Packing List

Item name	Specification / Model	Quantity	Pictures
sCMOS Camera	Dhyana 6060/ Dhyana 6060BSI	1 ×	
Power Cord	DC 4m	1 ×	
Power Adaptor	12V/10A	1 ×	
USB Flash Drive	Including software and driver	1 ×	
CoaXPress Frame Grabber (Optional)	Euresys / KAYA	1 ×	

CoaXPress Cable (Optional)	3m	4×	
External Trigger Cable	3m, SMA	4×	
Water Pipe - Water Cooler (Optional)	2m, inner diameter 5mm, outer diameter 8mm Material PU, MCD1703 (female end) Pressure resistance 10 bar	2×	

4. Product Specifications

4.1 Camera Introduction

The Dhyana 6060/Dhyana 6060BSI is a very large format camera with a front-illuminated/back-illuminated high sensitivity image sensor with an image element size of 10 μm x 10 μm and a resolution of 37.7 MP. The Dhyana 6060 has a full resolution frame rate of up to 44fps@12bit, and the Dhyana 6060BSI also achieves 26fps@12 bit. It is suitable for demanding scientific imaging applications such as research-grade astronomy and x-ray.

4.2 Main Features

● Super large format: light-sensitive area of 61.44mm*61.44mm, diagonal length of 86.9mm

● High sensitivity: Dhyana 6060 QE reaches 72%@550nm, Dhyana 6060BSI is

95%@580nm

- Large full-well capacity: LG mode full-well capacity of 123ke- for Dhyana 6060 and 100ke- for Dhyana 6060BSI

- High dynamic range: >90dB

- Deep TEC cooling to suppress dark noise: cooling depth over 45°C

- With air-cooling & water-cooling cooling methods

- CXP12 high-speed interface

- Support GPS high precision synchronization

- GenICamTM compliant

- Comply with CoaXPress standard, support the mainstream frame grabber on the market

- Support ROI

- Support Binning

- Flat field correction

- Dark field correction

- Support test image output

- Camera temperature monitoring

- Optional CXP to fiber optic adapter

4.3 Parameter Specifications

Parameters	Properties	
Camera Model	Dhyana 6060	Dhyana 6060BSI
Sensor Type	Front-illuminated sCMOS	Back-illuminated sCMOS
Shutter Type	Rolling shutter	
Color /Mono	Mono	
Effective Area	61.4mm x 61.4mm	
Resolution	6144(H) x 6144(V)	
Pixel Size	10 μm x 10 μm	
Quantum Efficiency	72%@550nm	95%@580nm
Full-well Capacity	123ke-	100ke-
Dynamic Range	91dB	90dB
Frame Rate	44fps @ 12-bit STD 19fps @ 12-bit HDR 14fps @ 14-bit STD	26.4fps @ 12-bit STD 11.3 fps @ 12-bit HDR 8.6 fps @ 14-bit STD

| Readout Noise	3e-(median)	3e-(median)
Exposure Time	7μs-300s	12μs-300s
DSNU	1.5e-	1.5e-
PRNU	0.20%	0.20%
Cooling Method	Air-cooling & Water-cooling	
Max. Cooling	Air-cooling: -35℃, water-cooling: -45℃	
Cooling Temperature	Air-cooling: -15℃@20℃ room temperature. Water cooling: -25℃@20℃ water temperature	Air-cooling: -15℃@20℃ room temperature. Water cooling: -25℃@20℃ water temperature
Dark Current	Air-cooling: 0.25e-/pixel/s Water-cooling: 0.15e-/pixel/s	Air-cooling: 0.25e-/pixel/s Water-cooling: 0.15e-/pixel/s
Binning	2x2, 4x4	
ROI	Support	
Timestamp	Accuracy 1μs	
GPS	Support	
Trigger mode	Hardware & Software & GPS Trigger	
Output Trigger Signal	Exposure Start signal, Global Exposure signal, Readout End signal, High level, Low level	
External Trigger Interface	SMA	
Data Interface	CXP12	
Bit Depth	12bit, 14bit, 16bit	
Optical Interface	Customizable	
Power supply	12V/10A	
Power consumption	<100W	
Dimensions	φ160 (diameter) x 164mm (length)	
Weight	~4kg	
Software	Samplepro/Labview/Matlab/EPICS	
SDK	C/C++/C#	
Compatible Systems	Windows/Linux	
Operating Environment	Working：Temperature-35~45℃/Humidity0~95% Storage: Temperature -35~60℃/Humidity 0~95%	

4.4 Spectral Response

Dhyana 6060

Spectral Response
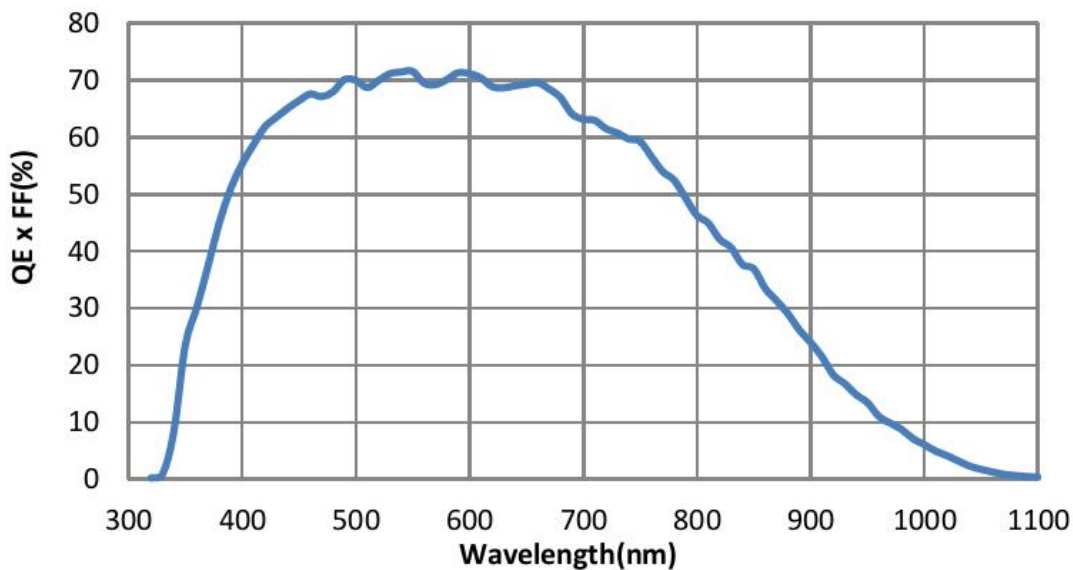
Dhyana 6060BSI
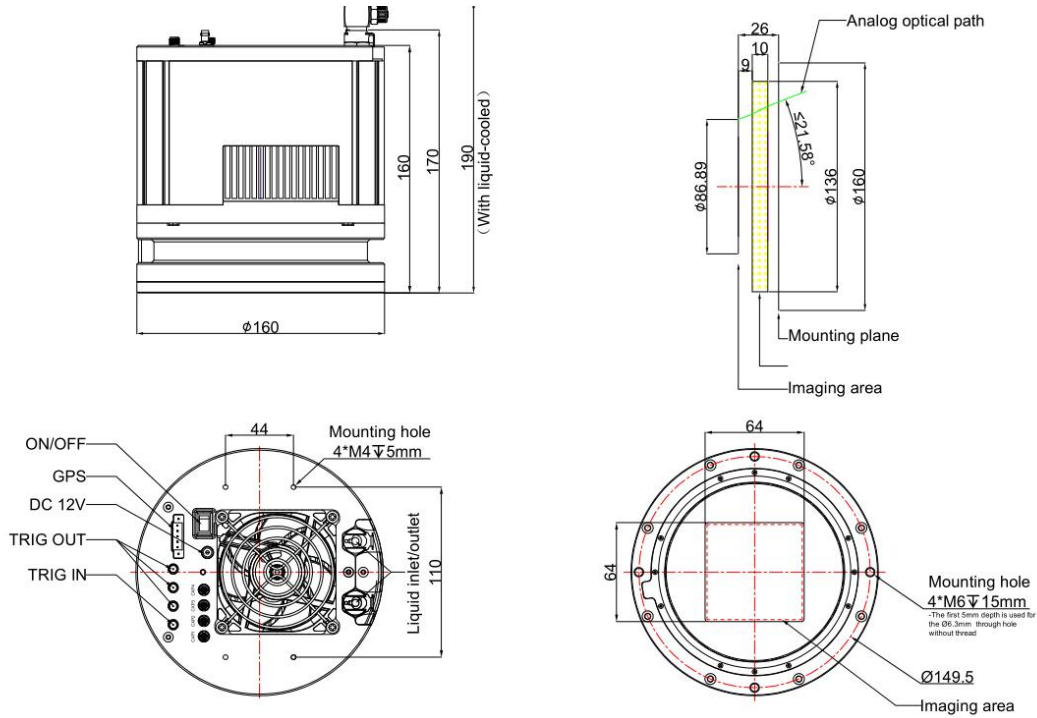
Spectral Response
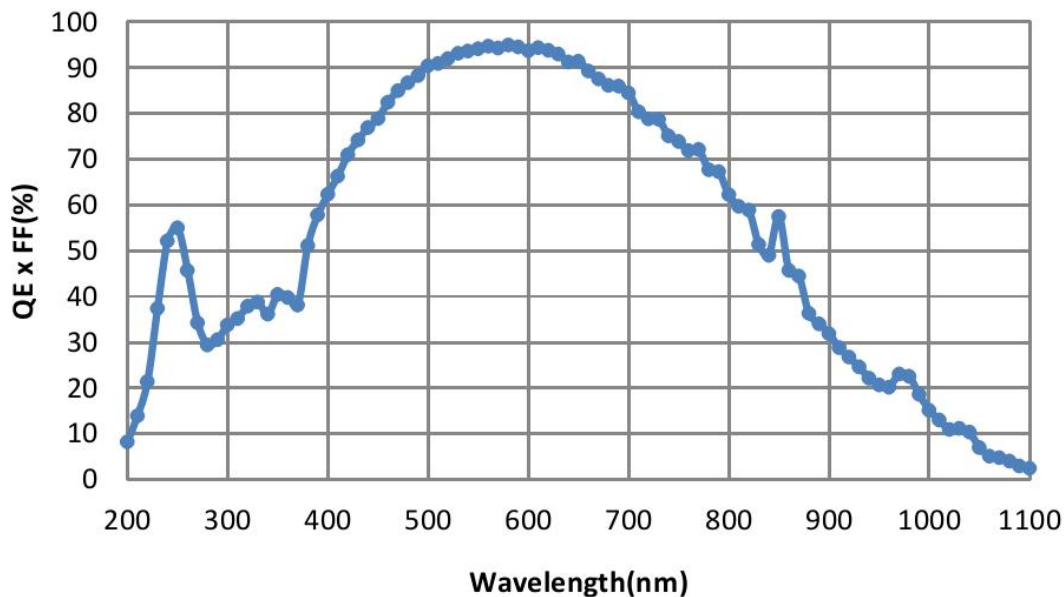
4.5 Mechanical Structure Specifications

Unit: mm, Diameter: ø.

Dhyana 6060
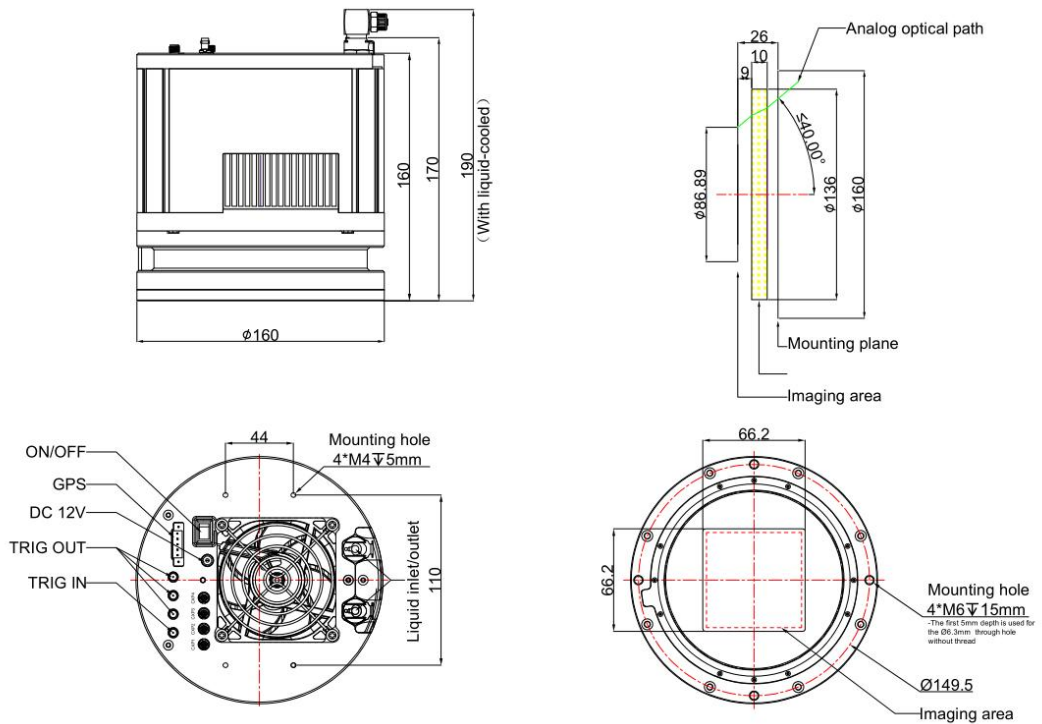
Dhyana 6060BSI

5. Installation

5.1 Camera Components and Features

The functions corresponding to each interface and interface of the Dhyana 6060/Dhyana 6060BSI camera are shown in Figure 5-1 and Table 5-1 below.
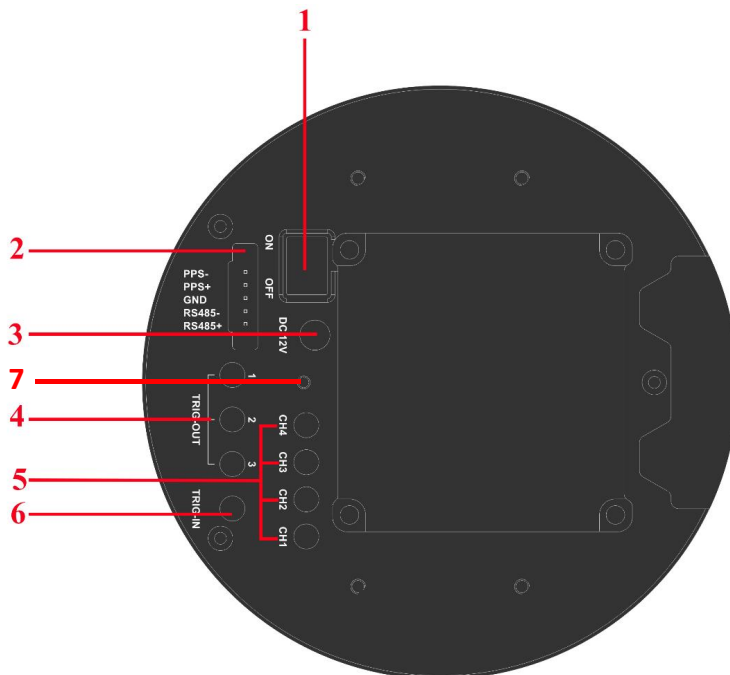
Figure 5-1 Dhyana 6060/Dhyana 6060BSI camera interface location diagram

Table 5-1 Dhyana 6060/Dhyana 6060BSI camera interface correspondence menu

Serial	Part Name	Function
1	Switch	Control camera on/off
2	GPS interface	Connecting GPS external devices
3	DC 12V	Power connector
4	TRIG.OUT 1, 2, 3	Trigger output
5	CXP12 CH1, 2, 3, 4	Camera data transfer
6	TRIG.IN	External trigger input (SMA interface)
7	Indicator light	Indicates if the camera is working properly

Note: When the camera is connected to the power supply and the switch is turned on,

the indicator lights up and the color is red; when the software is opened and the camera works normally, the color of the indicator changes from red to orange.

5.2 Camera Installation
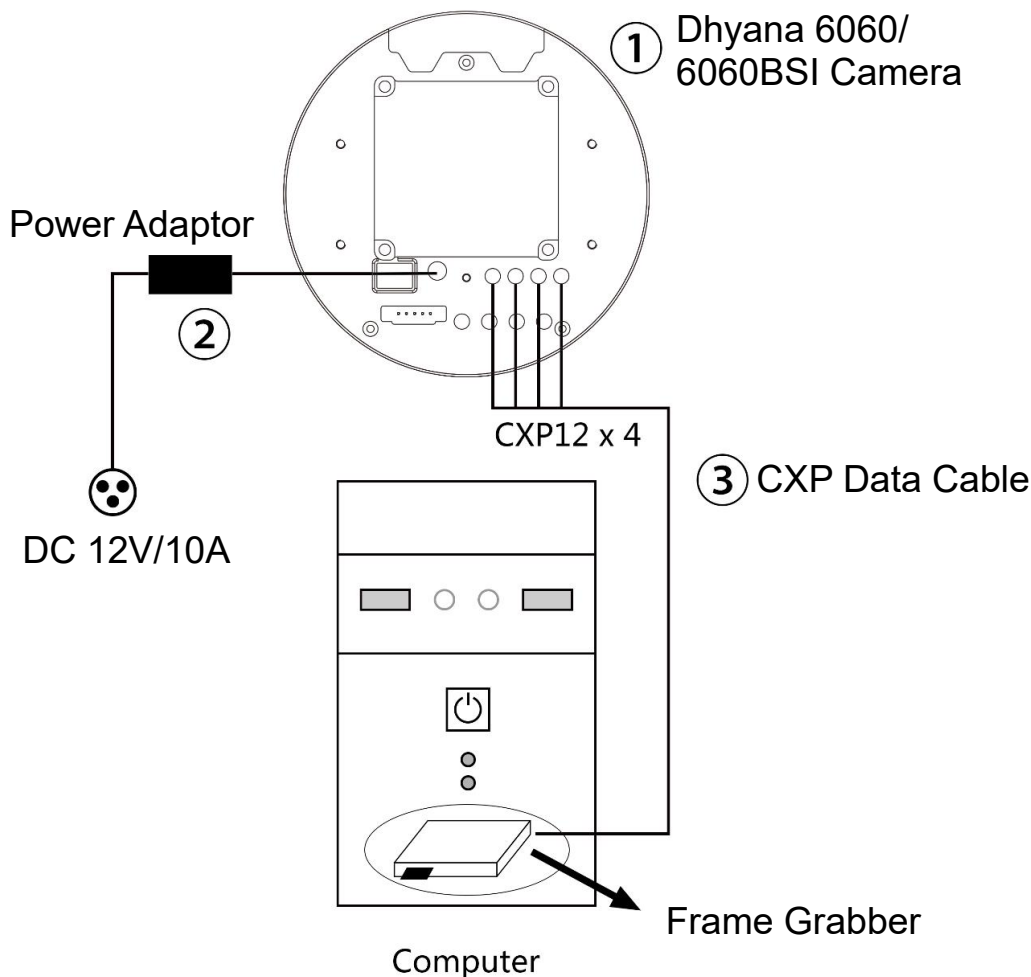
Figure 5-2 Dhyana 6060/Dhyana 6060BSI connection diagram

1. **Power connection**: Use the factory-supplied 12V/10A power supply, open the power switch at the end of the camera to power the camera.

2. **Water-cooling system connection (if the camera is air-cooling working mode, please omit this step)**: Use the recommended supporting water circulation system to connect the camera two water ports, open the water circulation heat dissipation and ensure that the water circuit is smooth and does not leak, the recommended water temperature 25 ℃, 20 ℃.

3. **Frame grabber driver installation**: Support KAYA and Euresys two frame grabbers, installa the frame grabber to computer (recommended to install to PCIE 3.0 x16 slot) and install the frame grabber driver, see section 5.3 for details.

   KAYA_Vision_Point_Setup_2020.3_Windows_64 (Win10 only)

   KAYA_Vision_Point_Setup_2020.3_Ubuntu_18.04_x64.tar (Linux)

   egrabber-win10-x86_64-12.8.1.54 (Euresys card burning firmware for 1-Camera)

   egrabber-win7-x86_64-14.0.1.170 (Euresys card burning firmware for 1-Camera)

4. **CXP-12 connection**: Use the factory-supplied four CXP-12 cables to connect the camera side and the frame grabber side, as shown in the figure below, and lock the wiring port of each cable

<div align="center">

CH1<-> CH1/A

CH2<-> CH2/B

CH3<-> CH3/C

CH4<-> CH4/D

</div>

Camera

KAYA frame grabber

Euresys frame grabber

➤ Camera power on and turn on the power switch, waiting for the camera to start,

and open the supporting software; if water cooling is used alone, the water circulation system must be turned on and run normally before turning on the camera to avoid overheating of the camera.

➢ Camera imaging positive direction: 6060 water-cooling interface towards the left, the display image is positive; 6060BSI water-cooling interface towards the right, the display image is positive.

➢ **Cautions**

(1) CH1 at the camera side is the main control, and CH1 must be connected when the CXP cable is connected to a single or multiple, and only three modes of CH1, CH1+CH2, CH1+CH2+CH3+CH4 are identified.

(2) KAYA frame grabbers CH1~CH4 are fully independent and equivalent, and can be connected in any order to support multi-camera connection.

(3) Euresys frame grabbers need to be connected to multiple CXP cables in a continuous and one-to-one sequence; Euresys frame grabbers need to switch firmware to support multi-camera 4-Camera, 2-Camera, 1-Camera.

(4) A computer with one frame grabber (Euresys card firmware needs to be burned into 4-Camera) can be used to connect four cameras, each with one CH1 cable, and four cameras running simultaneously.

(5) After Euresys frame grabber switches CXP ConnectionConfig, the software

side needs ConnectionReset to make the configuration items of CXP connection normal.

(6) Euresys frame grabber for 4-Camera, 2-Camera mode, the camera side can only be connected to the corresponding number of CXP cables, otherwise other cables will produce interference, not out of the image.

(7) The connection establishment time is about 16s for KAYA acquisition cards and about 1s for Euresys acquisition cards.

(8) Not support sleep wake up, the computer sleep after the frame grabber light will go out indicates that the CXP disconnected, need to reopen the software or CXP ConnectionReset.

(9) Not support CXP hot-swapping, need to reopen the software or CXP ConnectionResetl.

(10) Euresys frame grabber switch firmware mode steps: open Coaxlink Firmware Manager under the driver installation directory -> select firmware -> burn successfully -> computer shutdown->computer boot->firmware takes effects.
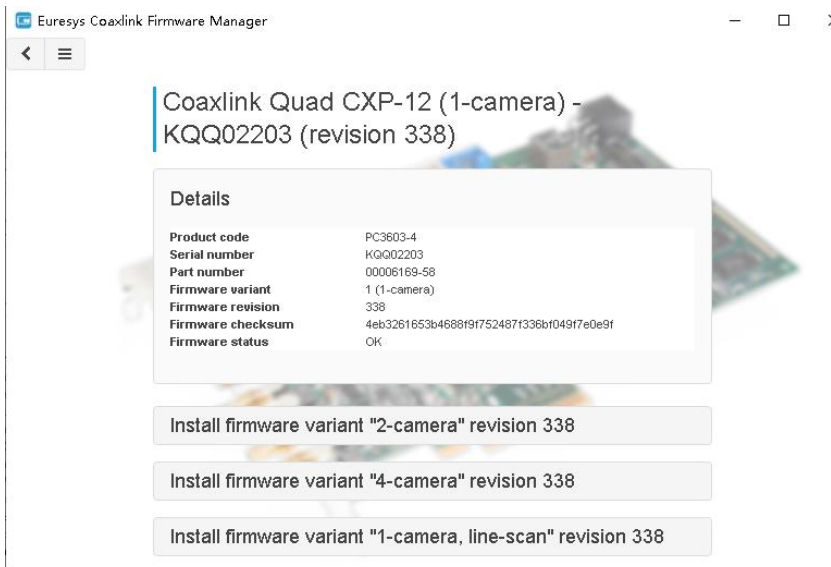
5. GPS connection

Camera side GPS server side

The camera side is connected to the GPS server side using a balanced twisted pair cable in the following manner.

(1) Camera "RS485+" terminal - GPS server "serial (RS422) +" terminal

(2) Camera "RS485-" terminal - GPS server "serial port (RS422) -" terminal

(3) Camera "GND" terminal - GPS server "GND" terminal

(4) Camera "PPS+" terminal - GPS server "PPS(RS422) +" terminal

(5) Camera "PPS-" terminal - GPS server "PPS(RS422) -" terminal

Note: If the serial side is not connected properly, the GPS signal cannot be acquired normally. If the PPS side is not connected properly, the GPS signal can be acquired, but the trigger cannot be responded.

5.3 Frame Grabber Installation

Turn off the computer and open the cover of the computer host as shown in the figure below. Select the PCIe slot with a transfer bandwidth greater than 850MB/s to plug the frame grabber in. Secure it with screws and then restart the computer.

Note: If there is a compatibility problem with the frame grabber, please confirm whether the firmware of the frame grabber is the latest version, please upgrade the firmware of the frame grabber in time.
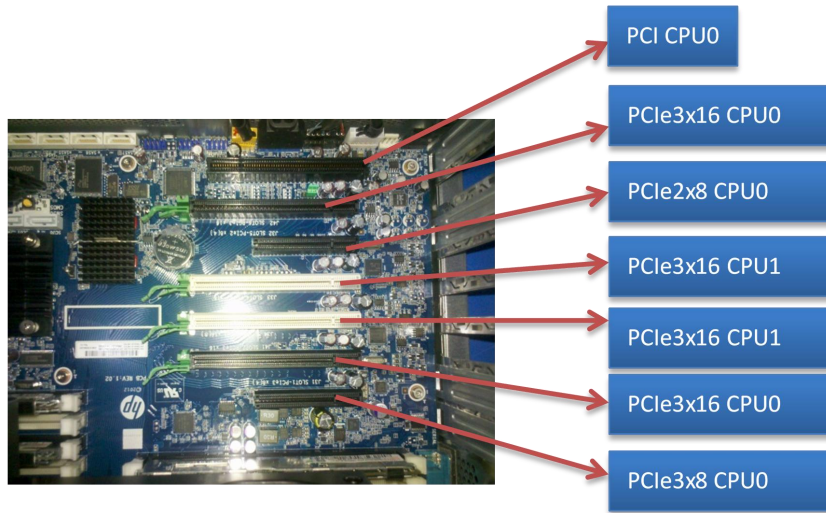
Figure 5-3 Computer motherboard diagram

Table 5-2 Maximum transfer rates corresponding to 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

5.4 Driver installation

1. Kaya frame grabber driver installation

Note: Kaya frame grabber in Windows only supports Win10 (x64)

1.1 Double-click the KAYA frame grabber driver to start installation

KAYA_Vision_Point_Setup_2020.3_Windows_64.exe

1.2 Click "Next" to proceed to the next step of installation

1.3 Select the driver installation location, according to the default configuration can be, click "Next"
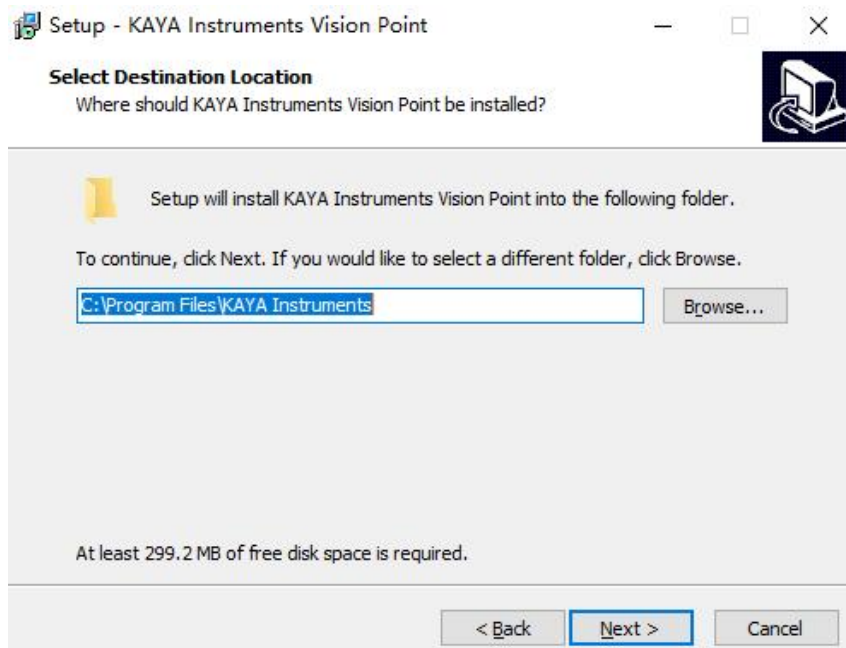
1.4 Follow the instructions and continue to click "Next".
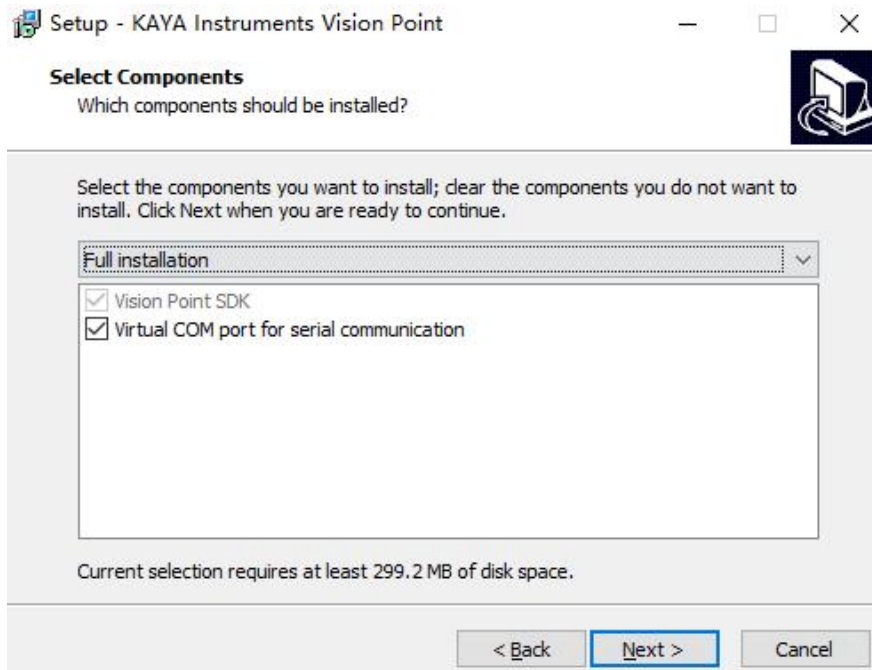
1.5 Continue with "Next".
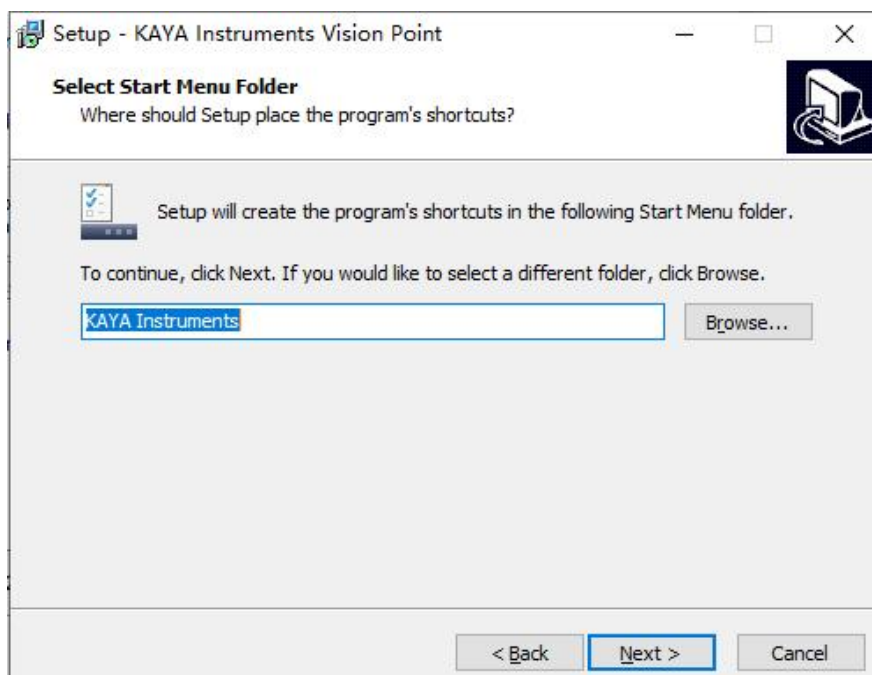
1.6 Click "Install" to upgrade
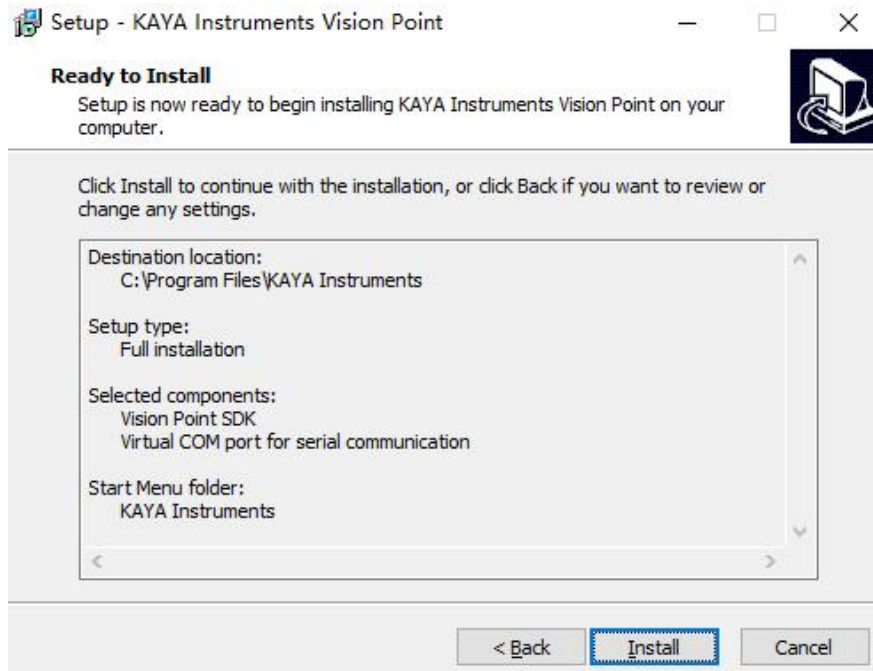
1.7 Click "Install" to continue the installation after the upgrade process by clicking "Next".
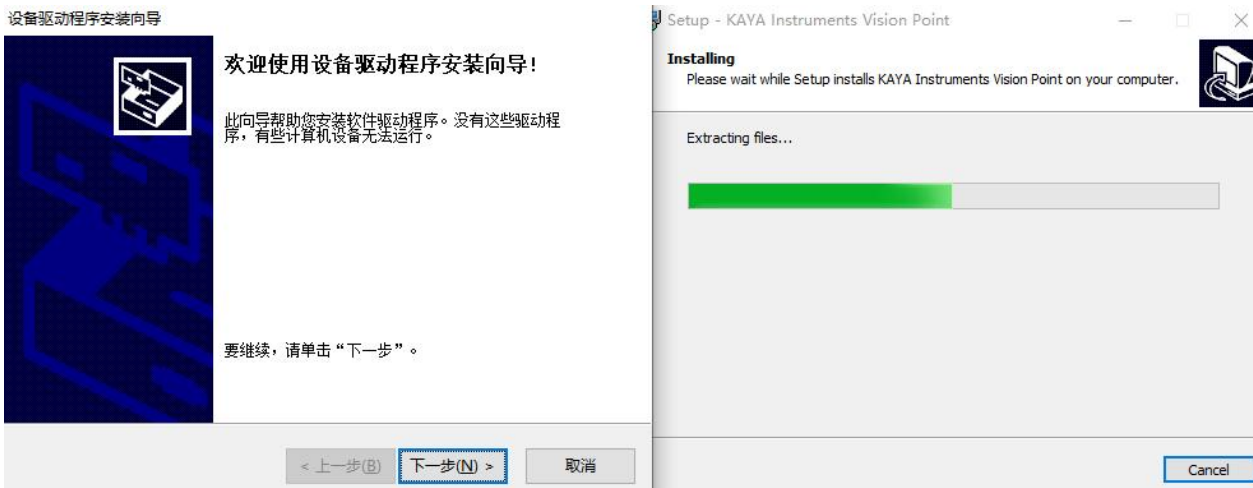
1.8 Click "Finish" to proceed to the next step

1.9 Select Restart your computer now and click "Finish" to restart your computer to complete the installation.
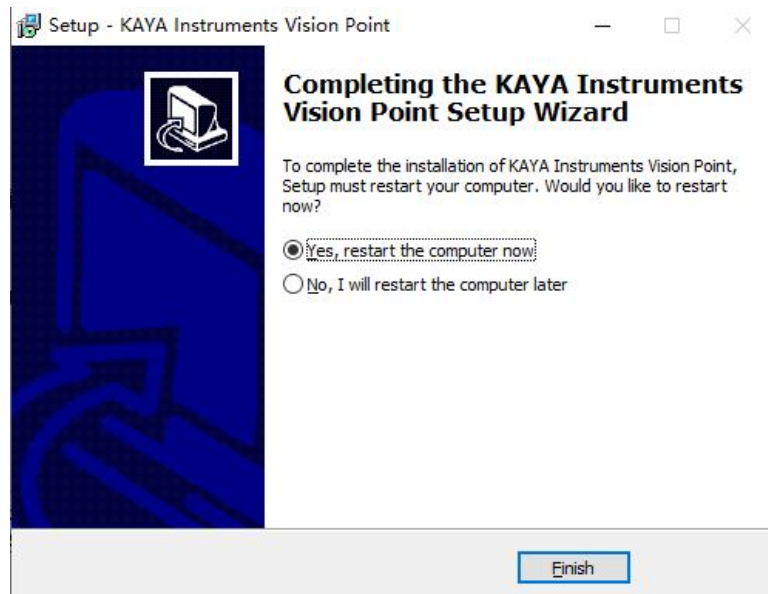
2. Euresys frame grabber driver installation

Description: Euresys frame grabber for Windows supports both Win7/Win10 systems

egrabber-win10-x86_64-14.0.1.170.exe

egrabber-win-x86_64-14.0.1.170.exe

2.1 Take the installation under Win10 as an example, double click the corresponding driver to start the installation, click "Next" for the next step
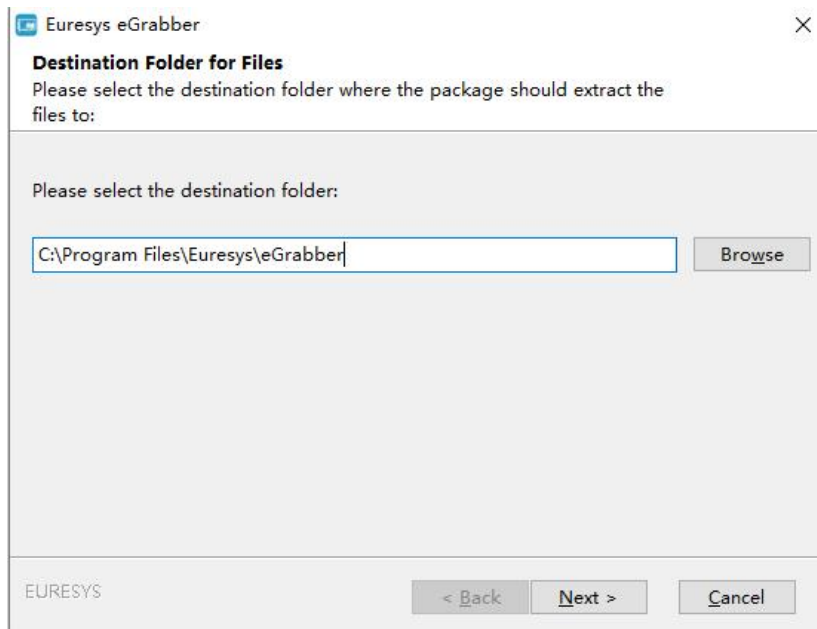
2.2 Wait for the installation to complete
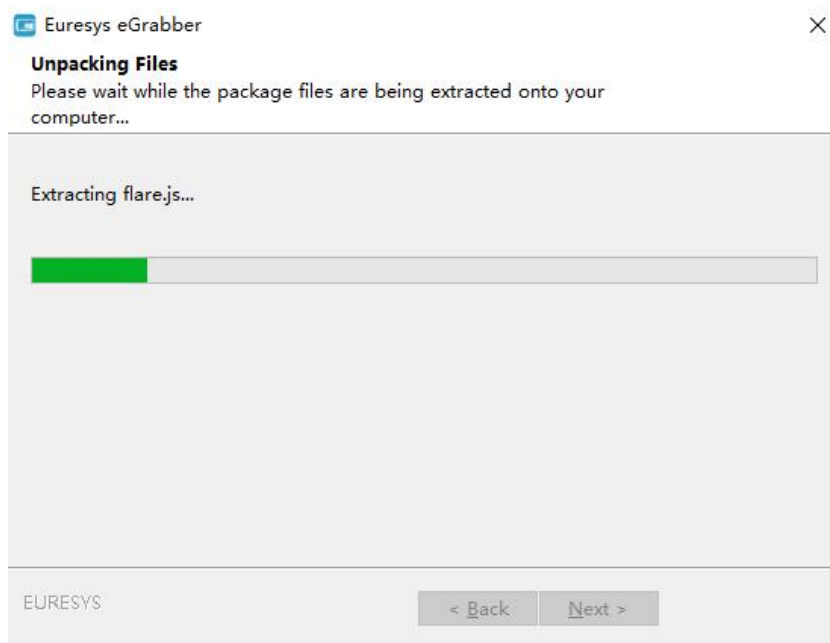
2.3 Click Confirm when installation is complete
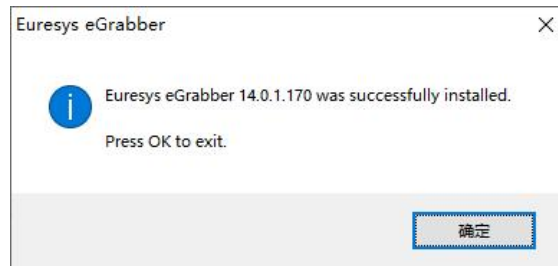
5.5 Software Installation

Samplepro software is included with the USB flash drive and can be used by unzipping it directly.

Precautions are shown below:

1. When you start Samplepro for the first time, run it as administrator with a right-click, and double-click it directly when you use the software later;

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

3. The orange light is always on when the camera is working normally. If there is a start-up software NO Camera, please check whether the order of the camera and frame grabber connection matches, or reboot the computer and reinstall the frame grabber driver to try. (KAYA frame grabber is not compatible with some computers Win7 system).

5.6 Connecting the water cooler

Please read the official instruction manual of the water cooler carefully before connecting it to the water cooler.

Notes:

1、Cooling water selection

It is recommended to use <u>pure water</u>, if the water cooler works in sub-zero temperature conditions, please use <u>antifreeze</u>.

2、Cooling water temperature

It is recommended toset the water temperature in the cooling water circulator to <u>20℃.</u>

3、Environment

Improper environmental conditions can cause condensation in the water valve as well as the water pipe, which has the potential to damage the equipment. To ensure normal operation of the equipment, it is recommended that the temperature difference between the ambient temperature and the water temperature should not exceed 5°C. For details, please refer to the appendix of this section.

4、Proper use of the cooling water circulator (refer to the manual of the cooling water circulator)

5、Installation of water cooling lines

Note: The camera water-cooling port does not distinguish between the "in" and "out" directions.

6、Camera cooling process

① Before running the camera, ensure that the cooling water circulator and the camera water valve are installed correctly, and turn on the cooling water circulator. Observe that there is no water overflow and the water flows smoothly before running the camera.

② Guaranteed water flow rate: 1L/min.

③ During camera operation, do not turn off the cooling water circulator and stop cooling.

Note: If the water overflow is not guaranteed to be 1L/min due to the aging of the water pipe, please replace the water pipe in time.

7、Camera off

① Cut off the power to the camera and turn off the cooling water circulator and other related equipment.

② Discharge the water from the cooling water circulator.

Note: 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°C and the relative humidity is 70%, then the water temperature should not be lower than 19°C.

Temperature / ℃	湿 度 Humidity / %							
	20%	30%	40%	50%	60%	70%	80%	90%
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

Figure. Temperature and humidity corresponding to dew point

6. Software Instructions

6.1 Startup Interface

Double click SamplePro to open the camera software, the software opens the interface asFigure 6-1. The software opens as shown in the screen, waiting for the loading to complete.
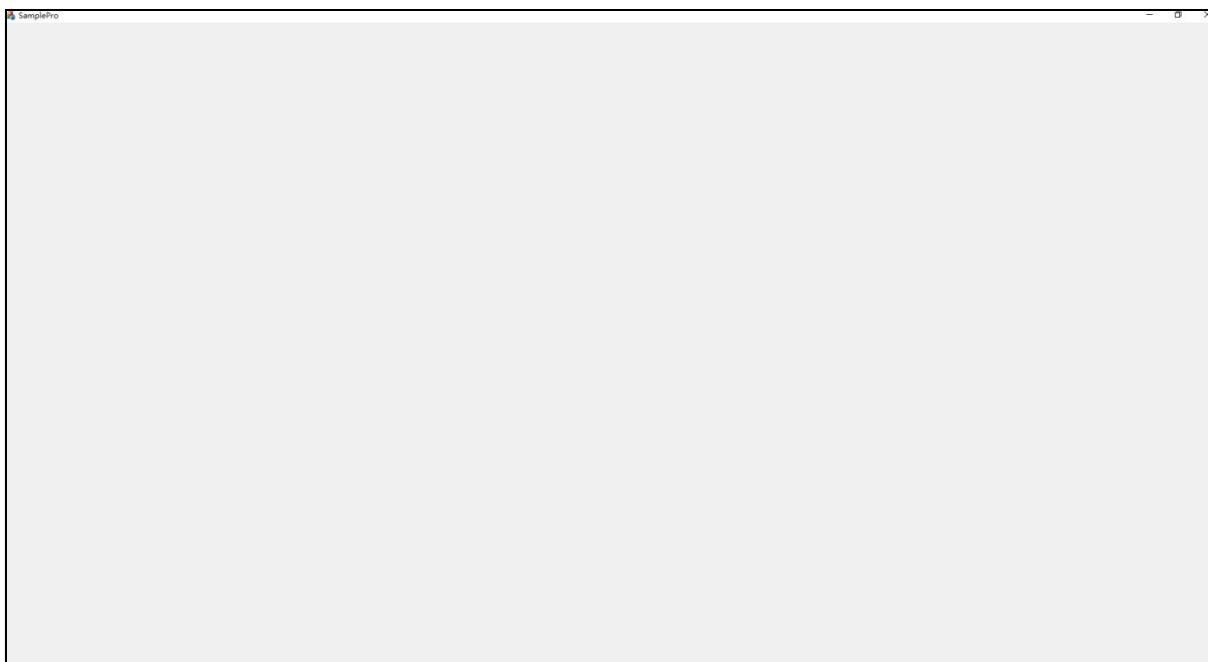
Figure 6- 1 Software startup interface

Note: When you start SamplePro software for the first time, run it as right-click administrator, and double-click it directly for subsequent use of the software.

6.2 ImageCapture

 As shown in the figure, the image camera module supports the basic image and video recording functions of the camera.
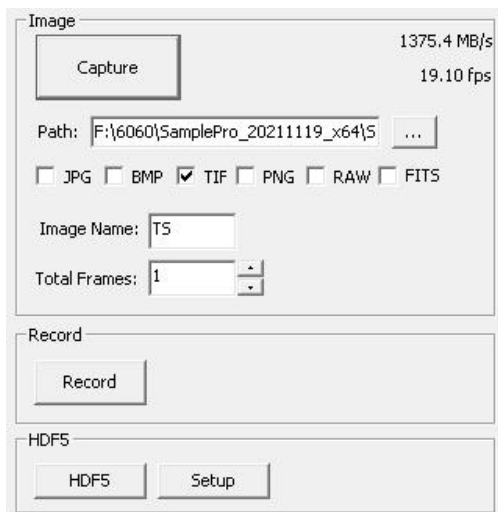
> Current CXP real time bandwidth, camera real time frame rate can be displayed.

> You can take images and videos, customize the file save path, image name, number of images and image format.

> HDF5 format data can be saved and HDF5 data parameters can be set.
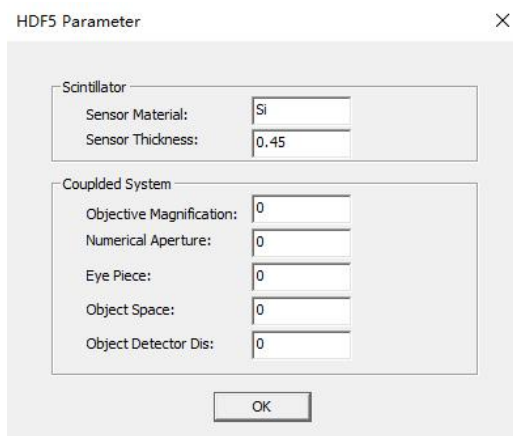
6.3 DeviceProperties

When the camera has been successfully connected, open the Samplepro

software, it will get all the parameters of the camera to configure Device Properties, which mainly configures all the functions related to the camera. Samplepro software needs to be opened with administrator privileges.

➢ Live/Stop: you can turn on and off the live preview screen

Some parameters need to stop the preview before they can be set: Binning, ROI, FrameSplit, UserSelect, FactoryDefault, ConnectionConfig, ConnectionReset.

6.4 DeviceControl

Property	Value
☐ **DeviceControl**	
DeviceVendorName	Tucsen
DeviceModelName	Dhyana 6060
DeviceManufacturer...	Tucsen CXP Vision Ca...
DeviceVersion	0801211124
DeviceID	RBSIO8221002
DeviceUserID	
DeviceScanType	Areascan
DeviceInitStatus	3855
DeviceWorkingTime(h)	138
DeviceReset	DeviceReset
DeviceLED	ON
☐ **DeviceTemperatureControl**	
DeviceTemperature	35.6
DeviceWarningTe...	70.0
SensorTemperature	-20.0
SetSensorTemper...	-20.0
SensorCoolType	FanCool
SensorCooling	ON
FanAuto	ON
FanSpeed	100
AutoFanSpeed	97
AntiDew	OFF
AmbientTemperature	0.0
Humidity(%)	0.0

➢ DeviceVendorName: Get the device vendor name

➢ DeviceModelName: Get the device model number

➢ Device Manufacturer Info: Get device manufacturer information

➢ DeviceVersion: Get the device firmware version

➢ DeviceID: Get the device serial number

➢ DeviceUserID: Customizable user ID

➢ DeviceScanType: Get the device scan type

➢ DeviceInitStatus: Get the device initialization status code

➢ DeviceWorkingTime: Get the accumulated working time of the device, unit: hours

➢ DeviceReset: Reset sensor data

➢ DeviceLED: Set the switch LED indicator state, standby state shows red, software on the running state shows yellow, default on

➢ DeviceTemperatureControl:

◆ DeviceTemperature: Real-time access to display device temperature

◆ DeviceWarningTemperature: Get the device high temperature warning temperature, default 70 ℃. The camera supports FPGA high temperature protection mechanism, when the FPGA temperature exceeds 70℃, the camera automatically turns off the cooling and turns on the fan at the highest speed to dissipate heat

◆ SensorTemperature: Get the temperature of the sensor in real time

◆ SetSensorTemperature: Customizable sensor temperature target value

◆ SensorCoolingType: Set the sensor cooling type, support fan cooling and water cooling

◆ SensorCooling: Set the sensor cooling switch

◆ FanTuto: Set the fan control type, support automatic and manual

◆ FanSpeed: Set the fan speed gear, support 0~100, default 100, 0 means the fan is off; when enabling water-cooling cooling, it is best to decide whether the fan is on according to the outside ambient temperature, it is generally not recommended to enable the fan (if the outside ambient temperature is greater than the water temperature, the fan will blow away the cold and bring in heat, making the cooling temperature rise and not achieving the best effect of water cooling).

◆ Auto FanSpeed: Get the fan speed gear, when the cooling type is water cooling, the speed is 0

◆ AntiDew: Defogging switch enable, the default Off means that according to the external input temperature and humidity value automatically switch, when the set temperature ≥ 30 ℃ and humidity ≥ 85%, automatically

open, On means forced to open

◆ AmbientTemperature: Set the external ambient temperature for automatic

defogging function

◆ Humidity: Set the external ambient humidity for automatic defogging

function

6.5 ImageFormatControl

ImageFormatControl	
SensorWidth	6144
SensorHeight	6144
SensorPixelSize	10umx10um
SensorShutterType	Rolling
GainMode	HDR_16bit
TestPattern	Normal
SensorADWidth	12bit
SensorPGAHighGain	6.6x
SensorPGALowGain	1.4x
PixelFormat	Mono16
ROIWidth	6144
ROIHeight	6144
ROIOffsetX	0
ROIOffsetY	0
Binning	BinOff
BlackLevel	100
DSNU	ON
PRNU	ON
DefectPixelCorrection	High
HorizontalFlip	OFF
TimeStamp	OFF

➢ SensorWidth: Obtains the width of the sensor, which cannot be set, i.e. the

horizontal resolution of the image.

➢ SensorHeight: Obtains the height of the sensor, which cannot be set, i.e. the

vertical resolution of the image.

➢ SensorPixelSize: Get the image sensor size

➢ SensorShutterType: Get the camera shutter type, the rolling shutter

➢ GainMode: Switch sensor gain mode, support HDR_16bit, HG_12bit, LG_12bit,

HG_14bit, HG_HS_12bit, LG_HS_12bit, default HDR_16bit, HS means high

speed mode

➢ TestPattern: Test image, providing several sets of fixed images for detecting

whether the sensor output is normal, including normal image, horizontal slope,

vertical slope, stationary diagonal slope, rolling diagonal slope.

➤ SensorADWidth: Get the original data bits of the sensor, 14bit, 12bit

➤ SensorPGAHighGain: Get the original high gain multiplier of the sensor

➤ SensorPGALowGain: Get the original low gain multiplier of the sensor

➤ PixelFormat: Image output data format, fixed black and white 16bit

➤ ROIWidth: Set the ROI (Region of Iinterest) width

➤ ROIHeight: Set the ROI (Region of Iinterest) height

➤ ROIOffsetX: Set the starting horizontal coordinate of ROI (Region of Iinterest)

➤ ROIOffsetY: Set the starting vertical coordinate of ROI (Region of Iinterest)

➤ Binning: Resolution support Bin 2x2Sum, Bin 4x4Sum

➤ BlackLevel: Support setting the background value bias, range 0~1023, default 100

➤ DSNU: Support dark field correction, correction of the dark field image uniformity, default on.

➤ PRNU: Support bright field correction, correction of bright field image uniformity, default on.

➤ DefectPixelCorrection: Supports bad pixels correction, removes fixed bad pixels on the image, supports Off, Low, Medium and High, default High.

➤ HorizontalFlip: Support image horizontal mirroring, default off

➤ TimeStamp: Support timestamp, default off, the first 16 pixels of the first line of each image for the timestamp information, record each frame of the frame split starting line coordinates, frame sequence number, exposure time (precision 1us), starting exposure time (precision 1us), UTC (GPS) time (precision 8ns)

```
usLineCnt = 0, nIndex = 106, nExp(us)=10001, nStartTime(us)=51257465485, nUTC=1208001138087704376
usLineCnt = 0, nIndex = 107, nExp(us)=10001, nStartTime(us)=51257565487, nUTC=1208001138187706984
usLineCnt = 0, nIndex = 108, nExp(us)=10001, nStartTime(us)=51257665489, nUTC=1208001138287709600
usLineCnt = 0, nIndex = 109, nExp(us)=10001, nStartTime(us)=51257765491, nUTC=1208001138387712216
usLineCnt = 0, nIndex = 110, nExp(us)=10001, nStartTime(us)=51257865485, nUTC=1208001138487706296
usLineCnt = 0, nIndex = 111, nExp(us)=10001, nStartTime(us)=51257965487, nUTC=1208001138587708904
```

6.6 AcquisitionControl

- ➢ AcquisitionMode: Continuous output mode, not configurable

- ➢ AcquisitionStart: Start fetching stream

- ➢ AcquisitionStop: Stop fetching stream

- ➢ AcquisitionFrameRate: Customizable frame rate, each resolution corresponds to a different maximum frame rate, but cannot exceed the maximum frame rate

- ➢ AcquisitionExpTime: Set the camera's exposure time, the default 10ms, the range of 7us ~ 3600s, support the input of any value adjustment, the minimum unit: us

- ➢ AcquisitionFrameSplit: Frame splitting enable switch, need to disable the data stream to configure it.

    After entering frame splitting the current resolution is no longer supported to be changed, only the number of lines per transfer can be changed by specifying the number of frames to be split. If you want to change the resolution, you need to exit frame splitting mode. Support frame rate, exposure and other parameters that do not interfere with regular functions.

    In frame split mode, ROIWidth is automatically added by 16, indicating that 32 bytes (16 pixels) more data length will be used to mark the information (line headers). Exiting frame split mode the information is marked on the first valid line and a switch is used to control whether to transmit this information. The marker

information is as follows.

8byte UTC time (reserved ns), 6byte start exposure time (us), 2byte (reserved), 4byte exposure time (us), 4byte current frame count, 2byte line count, 6byte (reserved)

Support for saving frame splitting parameters.

➢ AcquisitionFrameSplitNum: Number of frame splits, indicating that each frame will be divided into several average output, default 1 means full resolution, range 1~6144, configure the number of frame splits need to be able to divide by the current resolution

➢ AcquisitionTrigMode: Set the trigger mode, the default FreeRunning mode, support standard hardware trigger mode, soft trigger mode, GPS trigger mode

➢ AcquisitionTriggerIn: Configure the parameters of the hardware trigger input Standard mode

◆ TrigEdge: Set the trigger signal effective edge, RisingEdge means the trigger signal is effective for the rising edge; FallingEdge means the trigger signal is effective for the falling edge.

◆ TrigExpType: Set the trigger exposure type, TrigTimed that the exposure time set by the software; TrigWidth that the exposure time set by the input level width;.

◆ TrigDelay: Trigger delay, indicates that after receiving a trigger signal, you can set how long the delay time before the camera to trigger the exposure. Can be set 0us ~ 10s, the default 0, precision 1us.

◆ TrigSoftwareSignal: Software trigger mode button, click once, the software will send a command to the camera, and only one image will be output at a time.

Note: The triggered image will be displayed in the software interface in real

time. If you want to save the images, you need to set the number of images in the image acquisition module and click Capture to save.

➢ AcquisitionTriggerOut: Configure the parameters of the trigger output signal

◆ TrigOutputPort: Trigger output signal has 3 ports Port1, Port2, Port3, three signals can work independently and output to different devices at the same time; can be configured for 3 ports, trigger output is always on, and the 3 ports do not interfere with each other, can be configured separately to take effect

◆ TrigOutputKind: supports 5 output level types

● High: Always output with a high level signal.

● Low: Always output with a low level signal.

● Exposure Start: The signal output by the Exposure Start will be the level signal from the first line starts to exposure and the width could be customized. Exposure Start is the default mode of Port 3.

● Readout End: The signal output by the Readout End will be the level signal from the last line starts to readout and the width could be customized. Readout End is the default mode of Port 1.

● Global Exposure: The signal output by the Global Exposure will be the level signal from the last line starts to be exposure to the end of the first line starts to readout (The exposure time need to greater than the frame time). Global Exposure is the default mode of Port 2.

◆ TrigOutputEdge: Polarity of the trigger output signal is configured, Rising means the trigger signal is a rising edge; Falling means the trigger signal is a falling edge.

◆ TrigOutputDelay: Delay time of the level signal output can be set, the default time is 0.

◆ TrigOutputWidth: Settable pulse high level width, default time 5ms.

Note:

1. When Global Exposure signal output is selected, the pulse width configuration is invalid and the actual pulse width is output.

2. When High and Low signal output is selected, all other configurations are invalid.

3. Delay and Width signals in stream mode should not be too long, otherwise the next frame signal will be lost.

4. configuration accuracy of Delay and Width signals to us level, Delay range 0~10s, Width range 1us~10s.

6.7 GPSControl

➢ GPSStatus: GPS connection status, A - normal signal, V - abnormal signal, NoGPS - no signal

➢ GPSLatitudeRef: Latitude identifier, N-North, S-South

➢ GPSLatitude: Get the current latitude, once per second, in degrees

➢ GPSLongitudeRef: Longitude identifier, E-East, W-West

➢ GPSLongitude: Get the current longitude, once per second, in degrees

➢ GPSDate(yyMMdd): Get the current UTC date, once per second, format yyMMdd

➢ GPSTime(Hmmss): Get the current UTC time, once per second, format Hmmss

➢ GPSTrigStartTime(Hmmss): Set the start time of GPS trigger, the camera will start to capture images when the set start time has elapsed. Only support setting hour, minute and second. For example, if the UTC time is 23:50 pm, and the set start

time is at 0:10 pm, the acquisition will start after 20 minutes. The default is 0.

(1) GPSTrigStartTime > GPSTime

Wait until the set trigger start time is reached and the camera starts triggering out the image.

(2) GPSTrigStartTime≤GPSTime

Wait until the next day's trigger start time is reached before the camera starts triggering out the image.

Note: Since the camera is a single line output mechanism, the first image may be delayed by up to 1 line cycle time + 1 line jitter time + a few microseconds reset time after the trigger start time is reached. There will be a period of level jitter time and PPS signal filtering time when the GPS interface is hot-plugged, so the time synchronization will be delayed by about 15s.

➤ GPSTrigFrameNumber: set the number of images captured by the camera each time, default 0, can be set to a maximum of 2 to the 32nd power-1=4294967295, which means enter the infinite loop trigger mode, set less than the maximum, when the number of trigger sheets reaches the specified number of sheets will stop triggering

➤ GPSTrigIntervalTime(us): set the interval time between images with microsecond precision. The trigger frame interval must be greater than the time period of the maximum frame rate. The interval time range can be set to a maximum of 2 to the 32nd power-1=4294967295. when the trigger mode is switched to GPS, it will be automatically calculated to the minimum frame cycle time according to the current frame rate.

Note:

1. Set in different GPS trigger interval time, the actual interval time of each two maps are not consistent with the set interval time, the interval time of two maps are within 20us error;

2. Since the GPS server will have a period of instability when it is turned on, and

there will be a period of level jitter when the GPS interface is hot-plugged, so the camera side does a delay control to filter out the unstable signal, and when the GPS interface is hot-plugged, the camera will receive Date and Time information slower than the latitude and longitude information by about 15 seconds.

3. Switching GainMode will stop GPS triggering and need to trigger again.

6.8 UserControl

> UserParameterControl user parameter control

◆ UserSelect: User parameter group selection, support Factory mode and two groups of parameters save User0, User1; camera power on, the firmware save is the last time the parameters shutdown (except frame rate, external input temperature and humidity, GPS trigger interval time); two groups of parameters switch independently to take effect, the interface set parameters after the need to click ParameterSave to save to the camera; default Factory mode, i.e. all parameters are factory default values, does not support power-off parameter saving.

◆ ParameterSave: Parameter saving function, when the parameters are set, click ParameterSave, the new parameters will take effect and be saved in the camera, and the new parameters saved will be loaded in the next power-up; if ParameterSave is not clicked, the original parameters will remain in the next power-up.

◆ FactoryDefault: Click the button to restore all parameters of the current

parameter group to the factory parameters, without clicking ParameterSave, which will take effect immediately.

➢ GenerateMapControl (It's not recommended for users to correct themselves)

For the camera factory for background DSNU\PRNU\DPC correction, first set the gain mode and exposure time that need to be corrected for background, and then generate a background file automatically saved in the camera internal.

If the button is clicked by mistake, the calibration process can be stopped immediately by clicking on GenerateStop.

◆ GenerateDSNUMap: Dark field, generate DSNU backgrounds, save one for each gain, exposure time 50ms.

◆ GeneratePRNUMap: Integrating sphere brightfield, generating PRNU backgrounds, one saved per gain, exposure time 10ms (not supported by HS HG and HS LG).

◆ GenerateDPCMap: Dark field, generate DPC background, only one can be saved, HG 12bit, exposure time 5s.

◆ GenerateStop: Stop the generation, click during the generation of the background to stop the background correction.

◆ GenerateStatus: The process of generating backgrounds has several statuses: GenFree, GenBusy, CalBusy, WRBusy, and GenDone

◆ GenerateGrayValue: Displays the average gray value of the current image.

6.9 Support

Support	
Standard	3232209637
Revision	65537
XmlManifestSize	1
XmlManifestSelector	0
XmlVersion	65540
XmlSchemaVersion	65537
XmlUrlAddress	24672

Obtaining the version information related to the CXP protocol, this module does not support adjustment parameters.

6.10 CoaXPress
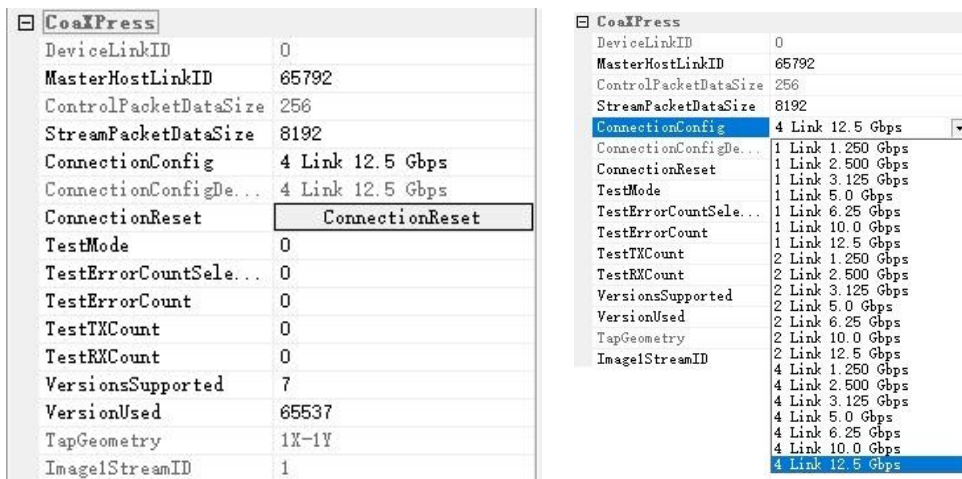
Set the parameters related to the CXP protocol, generally only the following two are allowed to be configured, other parameters are not recommended to be changed

➢ ConnectionConfig: Selection of the number of connections and bandwidth.

➢ ConnectionReset: Resets the CXP and re-establishes the connection.

6.11 Image Adjustment

The image adjustment function is shown in Figure.
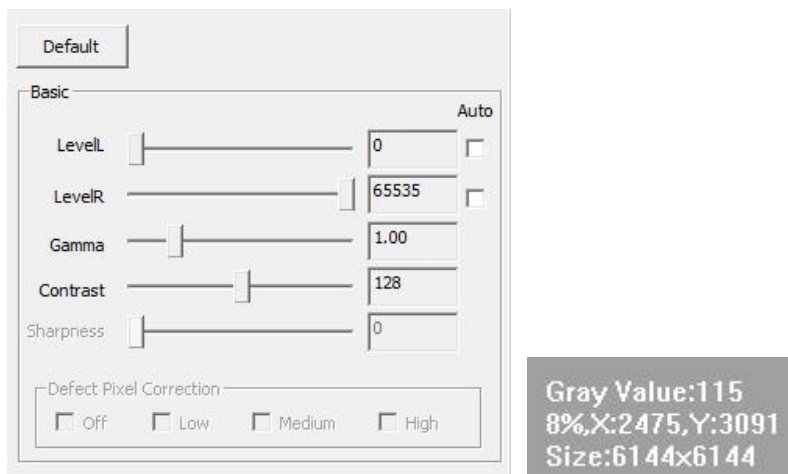
➤ Color scale: Support manual adjustment of the left and right color scale values, check Auto to support automatic adjustment of color scale values; image display 16bit range 0~65535.

➤ Gamma: Support Gamma adjustment, default 1.00.

➤ Contrast ratio: Support contrast ratio adjustment, default 128.

➤ Default: Restoration of all functions under the module only.

➤ Gray Value: Displays the gray value of the current pixel point where the mouse is placed.

➤ Display ratio: Support mouse wheel to zoom in and out the image display ratio, range 4%~530%.

➤ current coordinates: Displays the coordinates of the current pixel point where the mouse is placed.

➤ Size: Displays the resolution of the current image.

7. After Sales

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

2. Warranties.

(1) 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.

(2) 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 professional staff for technical support:

tel: 400-075-8880 0591-88194580-811

Email: service@tucsen.com

Or visit Tucsen's website to leave a message: http://www.tucsen.net.

Please prepare the following information in advance:

1) Camera model and S/N (product serial number);

2) Software version number and computer system information;

3) A description of the problem and any images related to the problem.