FEELTEK 菲镭泰克	Document Name	Version
APPROVED	LenMark Software---Visual Positioning	2017.2.0

LenMark

1 Software/Hardware Installation

1.1 Software Installation Environment

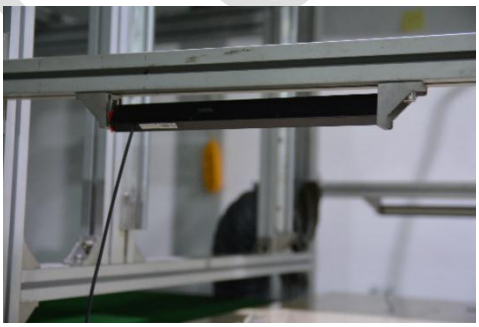
Operating System: Windows Series

1.2 Device Used

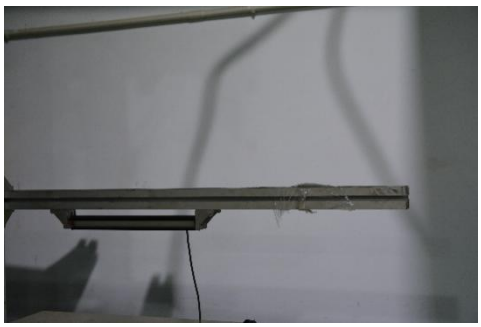
1) Light source: power adapter, LED lamp, power line
2) Camera: power line, signal line, camera, lens, camera power supply
3) Computer: software, key dog, Gigabit NIC
4) Mark: Dynamic Focus System

1.3 Device Installation

1) Fixed LED at the operating table, shown as pic 1-3-1 below.



LED left



LED right

Pic 1-3-1 Light Line Fixed

Shown as Pic Above, we use LED band light, fixed it at the table with Al frame.

2) After power on, you can adjust the power supply knob to adjust the lightness. The light source power interface is shown as Pic 1-3-2 below.



Pic 1-3-2 Light Source Power

As shown above, the power supply can take 4 road lights, connect the two LED lights' power line to CH3 and CH4 interface respectively. Through adjusting the corresponding CH3 and CH4 knobs, we can change brightness, the larger the corresponding number is, the brighter the light LED.

3) Fix the camera on the operating platform, due to its direct photo taken, thus, when installing the camera, lens should be kept vertical to the platform. The installation interface is as shown in Pic 1-3-3.



Pic 1-3-3 Camera、Lens Setting

4) Insert Gigabit Ethernet card (data acquisition card) to computer host, as shown in Pic 1-3-4.



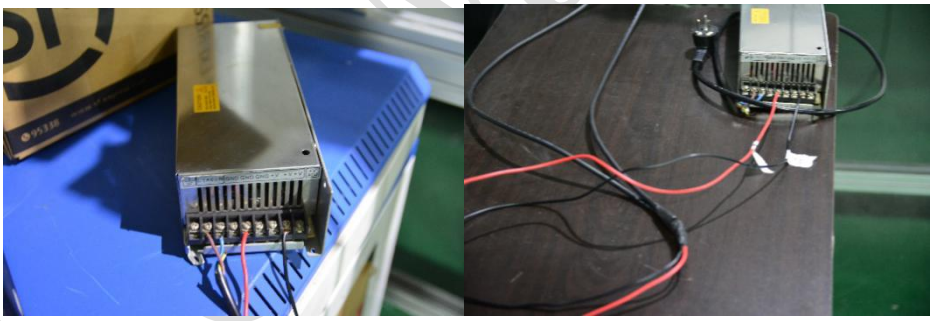
Pic 1-3-4 Network Installation

5) Connect the camera's signal line to the computer host, as shown in Pic 1-3-5.



Pic 1-3-5 Camera Signal Line Installation

6) Connect camera power line to its camera power supply, as shown in Pic 1-3-6.



Pic 1-3-6 Camera Power Supply Installation

As shown in Pic 1-3-3 above, the installation of camera and lens are in two groups. The power lines are mounted to the ground and the 12V position respectively. (In order to facilitate the installation, two camera power lines are combined together in the pic.).

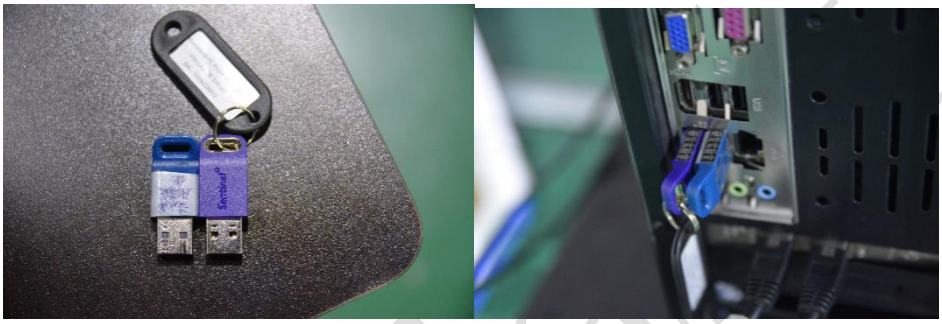
The sequence of black power lines (06-PF-BF-A-2M) are provided, as shown in Pic 1-3-7 below.

Diagram	Pin	Function	Description
	1	Power	+12 V DC Camera Power
	2	Opto Input 1	Opto-isolated input
	3	NC / +3.3 V	Firmware controlled +3.3 V output. Current limited.
	4	Opto Output 1	Opto-isolated output
	5	Opto GND	Ground for opto-isolated I/O, not connected to camera ground
	6	GND	DC camera power ground

Pic 1-3-7 Camera Power Line Sequence Pic

White: 1 camera power supply cathode (5-16V, regular 12V)
Brown:2 trigger positive (light isolation)
Green: 3 +3.3V (the default is off output, open a register can output 3.3V constant pressure)
Yellow:4 light isolated output
Grey: 5 trigger grounding
Pink: 6 power supply ground

7) After installing the camera, insert the key dog to the host USB interface, as shown in Pic 1-3-8, and proceed to camera driver installation.



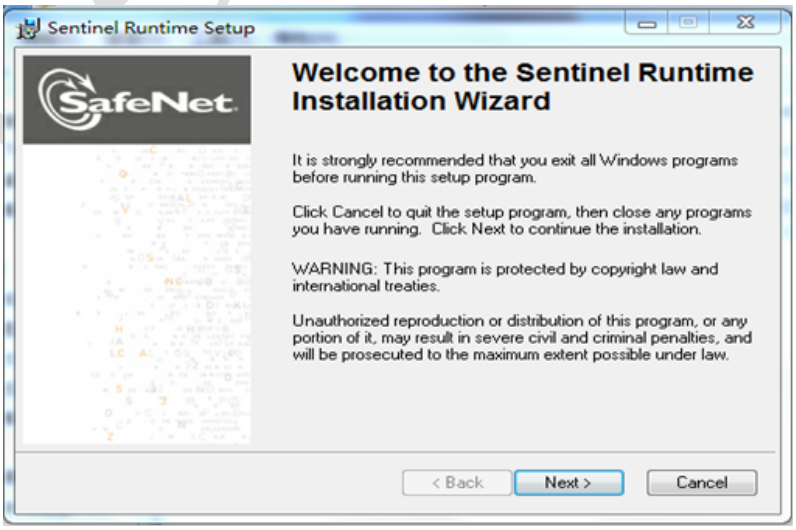
Pic 1 Pic 2

Pic 1-3-8 Key Dog Installation

As shown in Pic 1, in the use of visual positioning function, a total of 2 dogs, visual positioning function of the key dog is on the left side, the camera function of the key dog is on the right side.

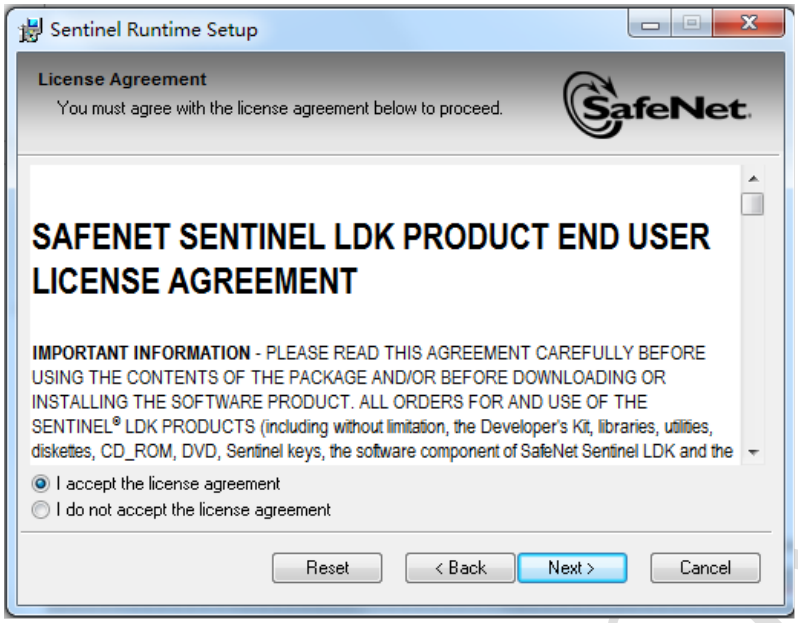
1.4 Key Dog Drive Installation

1) Double-click the "HASPUserSetup" in the "HASP" folder, open the installation interface, and click “Next”, as shown in Pic 1-4-1.



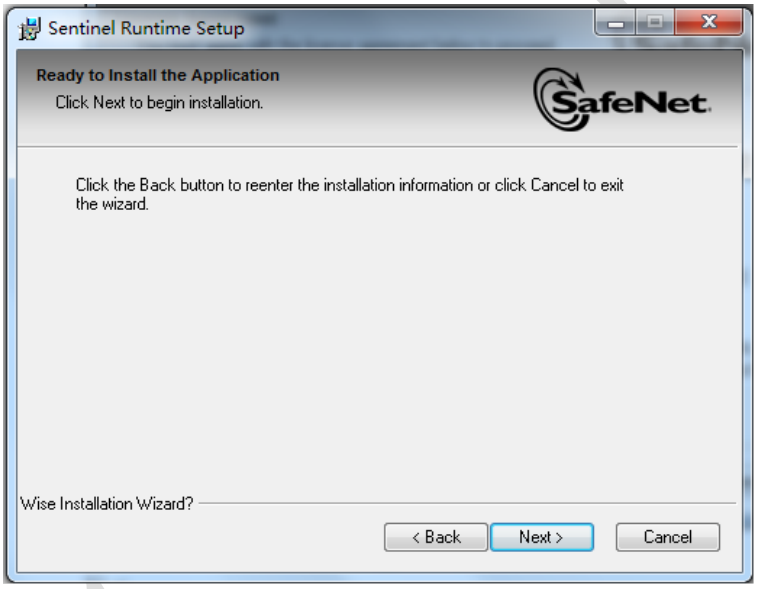
Pic 1-4-1 Installation Interface 1

2) Select "I accept the license agreement" and click Next, as shown in Pic 1-4-2.



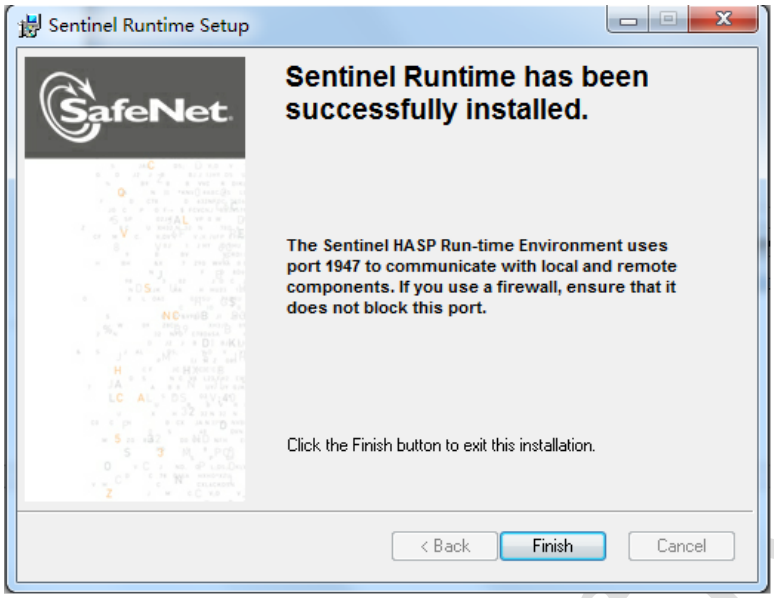
Pic 1-4-2 Installation Interface 2

3) Click “Next”, as shown in Pic 1-4-3.



Pic 1-4-3 Installation Interface 3

4) Click “Finish” to complete the installation, as shown in Pic 1-4-4.



Pic 1-4-4 Installation Interface 4

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After you install the camera, you need to install the FlyCapture 32 bit version of the software first, otherwise the visual positioning function is not available.

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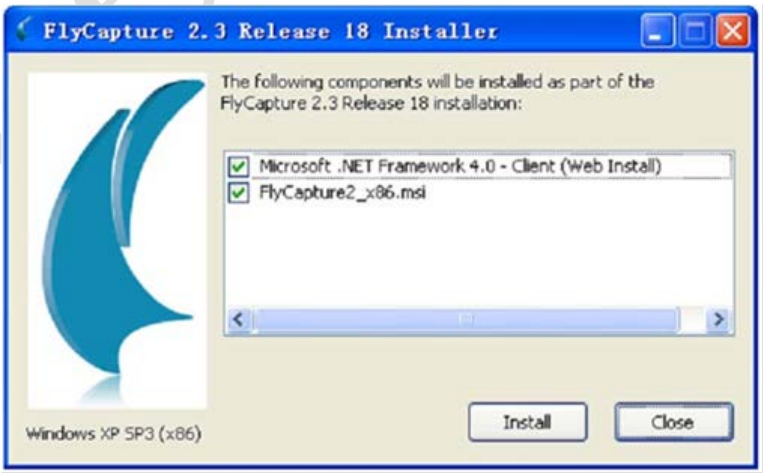
1.5 FlyCapture2 Installation

Since the FlyCapture2 interface is based on.Net FrameWork development, in order to run FlyCapture2 successfully, you need to install the version above Microsoft.NET Framework4.0 version.

1) Run FlyCapture2.3.3.18_x86.exe (in this version as an example for introduction) the interface as shown in Pic 1-5-1.



Pic 1-5-1 FlyCapture2 Running Interface

During the camera driver installation of this version, it will automatically detect whether the Microsoft.NET Framework4.0.has been installed If it is not installed, it will be prompted by online installation. It is recommended uncheck the first selection, download the

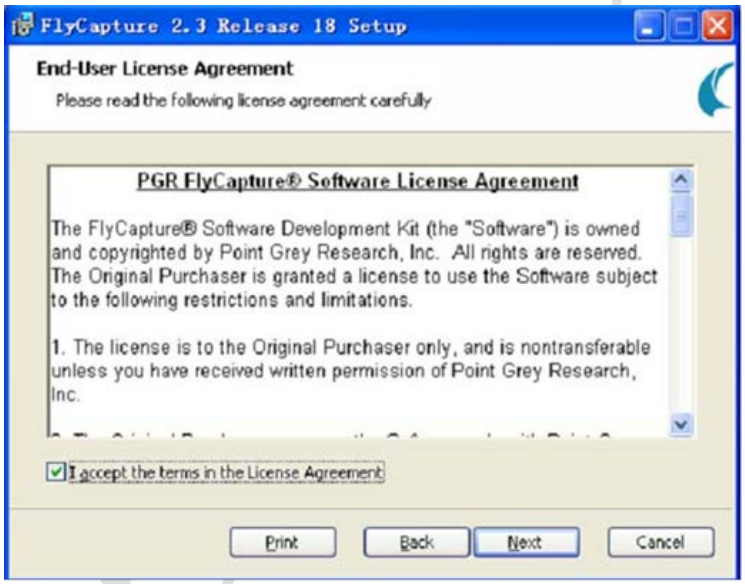
Microsoft.NET Framework4.0 separately and install it.

2) Click “Next”, shown as Pic 1-5-2 below.



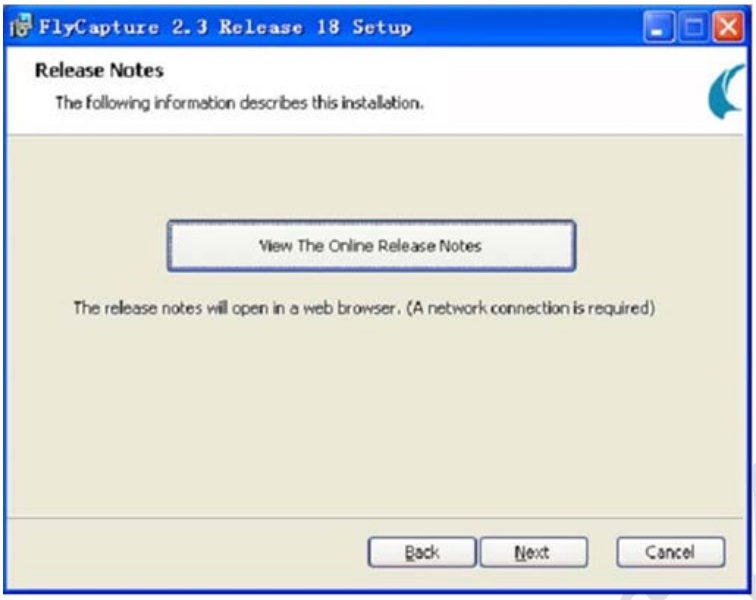
Pic 1-5-2 FlyCapture2 Setup Interface 1

3) Select the "I accept the terms in the License Agreement", click "Next", as shown in Pic 1-5-3.



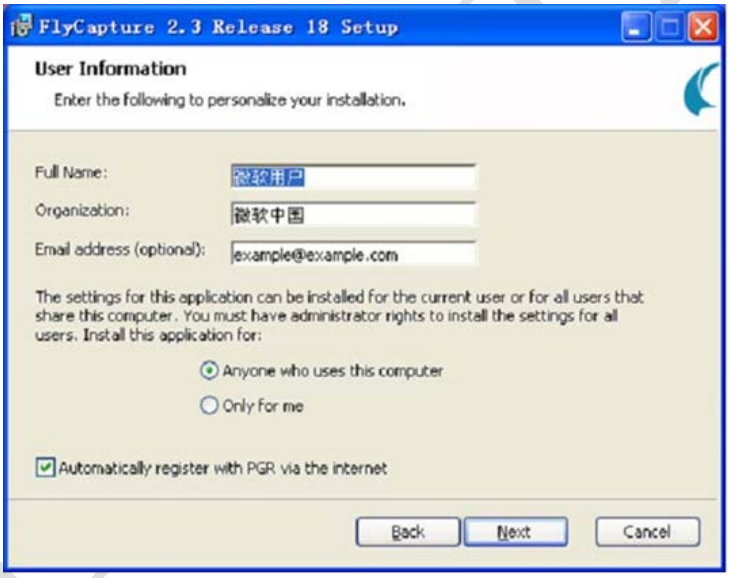
Pic 1-5-3 FlyCapture2 Setup Interface 2

4) Click the "Next" interface, as shown in Pic 1-5-4.



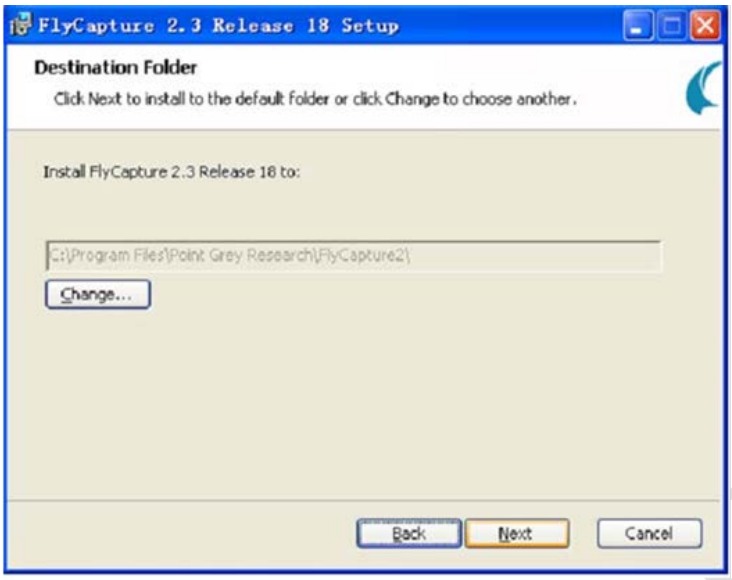
Pic 1-5-4 FlyCapture2 Setup Interface 3

5) Fill in the user name and other information, click on the "Next" interface, as shown in Pic 1-5-5.



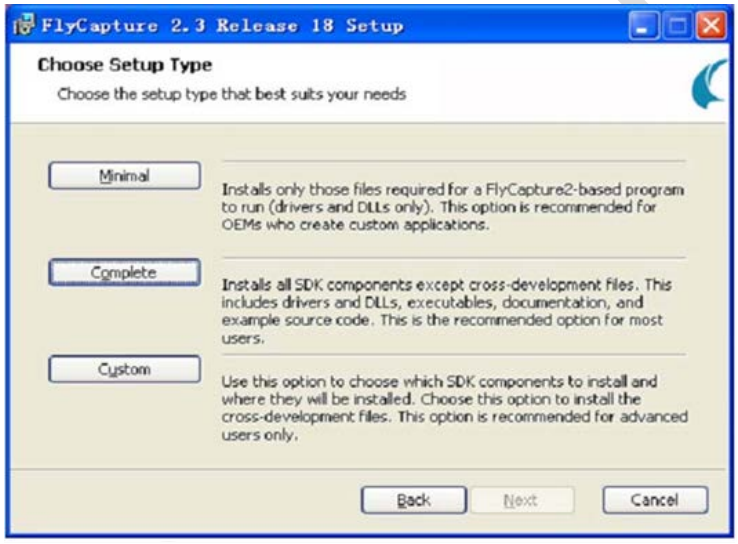
Pic 1-5-5 FlyCapture2 Setup Interface 4

6) Select the installation path, click the "Next" interface, as shown in Pic1-5-6.



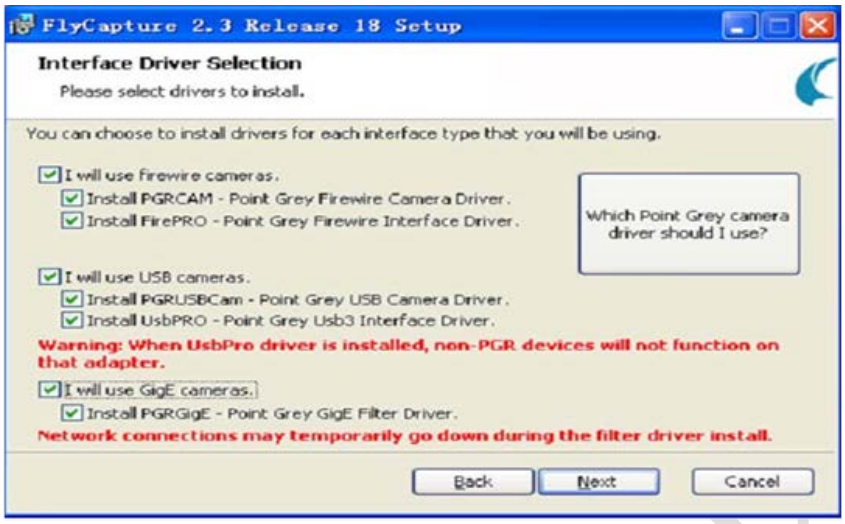
Pic 1-5-6 FlyCapture2 Setup Interface 5

7) Select the type of installation, and in accordance with the default (Complete, fully installed), click "Complete", as shown in Pic 1-5-7.



Pic 1-5-7 FlyCapture2 Setup Interface 6

8) Select the type of drive installation according to the actual situation, here we choose all installed, click "Next", as shown in Pic 1-5-8.



Pic 1-5-8 FlyCapture2 Setup Interface 7

Note: Firmware:1394 camera driver

USB: USB camera driver

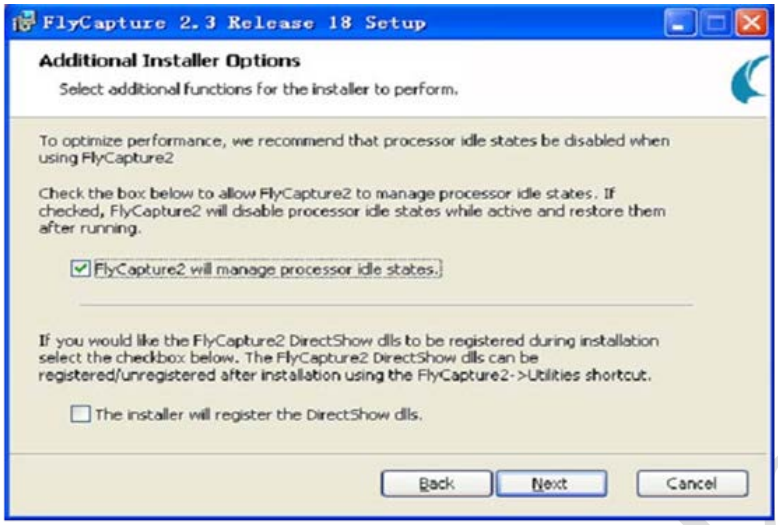
GigE: GigE camera driver.

9) Check the "Click to confirm", click "Next", as shown in Pic 1-5-9.



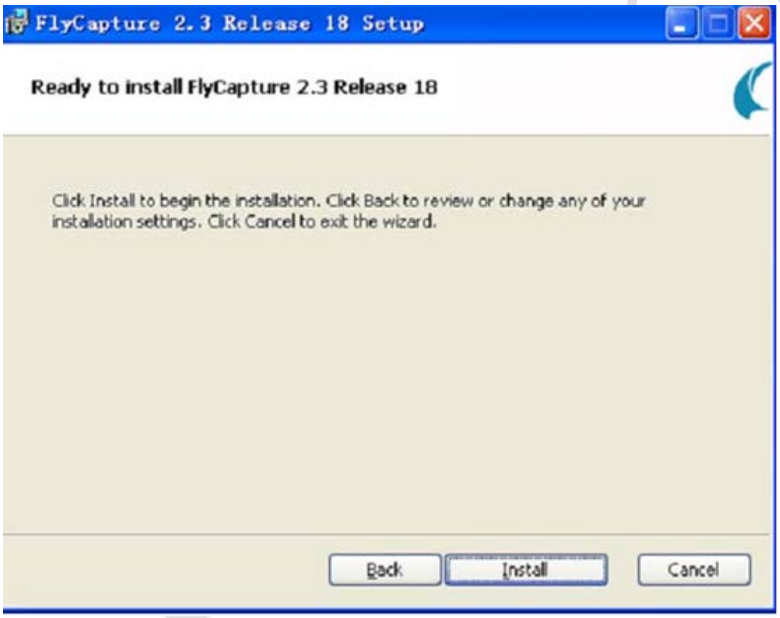
Pic 1-5-9 FlyCapture2 Setup Interface 8

10) Click "Next", as shown in Pic 1-5-10.



Pic 1-5-10 FlyCapture2 Setup Interface 9

11) Click "Install" to start the installation, as shown in Pic 1-5-11.



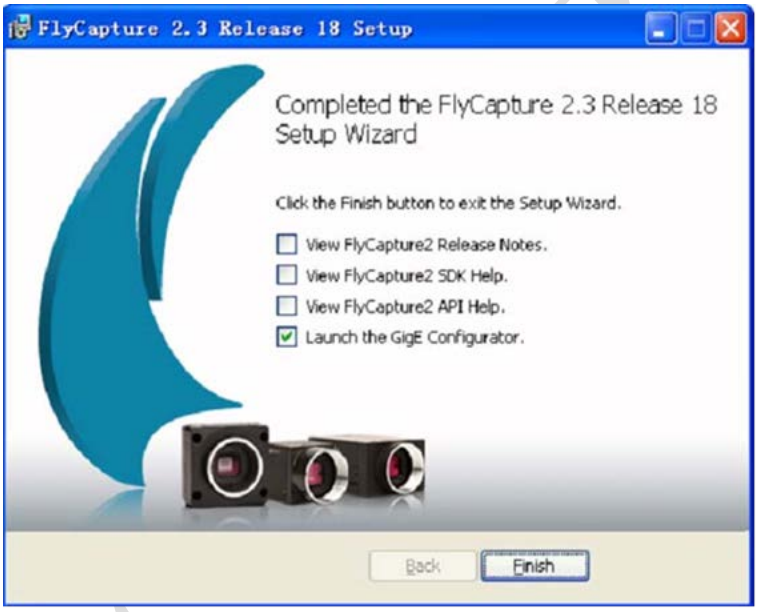
Pic 1-5-11 FlyCapture2 Setup Interface

12) Installation interface as shown in Pic 1-5-12.



Pic 1-5-12 Installation Interface

As shown in Pic 1-5-13 interface dialog box and click "Finish" button to complete the installation.



Pic 1-5-13 Installation Complete Interface

Note: "Launch the GigE Configurator" is used to configure the network camera properties, if you use the network camera, it can be configured in the tool.

1.6 Preparation of Camera Connection

1) Install the camera driver Flycapture, please noted it needs to choose "I will Use GigE Camera", after that the software will automatically install the PGR Filter driver, as shown in Pic 1-6-1.



Pic 1-6-1 Driver Installation Interface

2) It is recommended that please set the network card IP either to automatically obtained or 192.168 segments when doing first time camera connection. Since the default IP setting of camera is 192.168.0.2, it can customize camera IP in GigE Configurator after the first succeed connection.

3) Close Windows firewall, or release PGR related collection procedures related to in the firewall.

4) Change the settings in the advanced property of the network card to the optimum performance, as shown in Pic 1-6-2. (Note: Set the jumbo frame as maximum)



Pic 1-6-2 Network Card Setting Interface

1.7 Notes

1) It is recommended to use Gigabit Ethernet and Gigabit network, so that the camera can work at the highest frame.

2) The PacketSize has relationship with the network card Jumbo frames, camera PacketSize setting should be smaller than Jumbo frames.

3) When the camera cannot take image, choose to reduce the size of PacketSize, to reduce the bandwidth.

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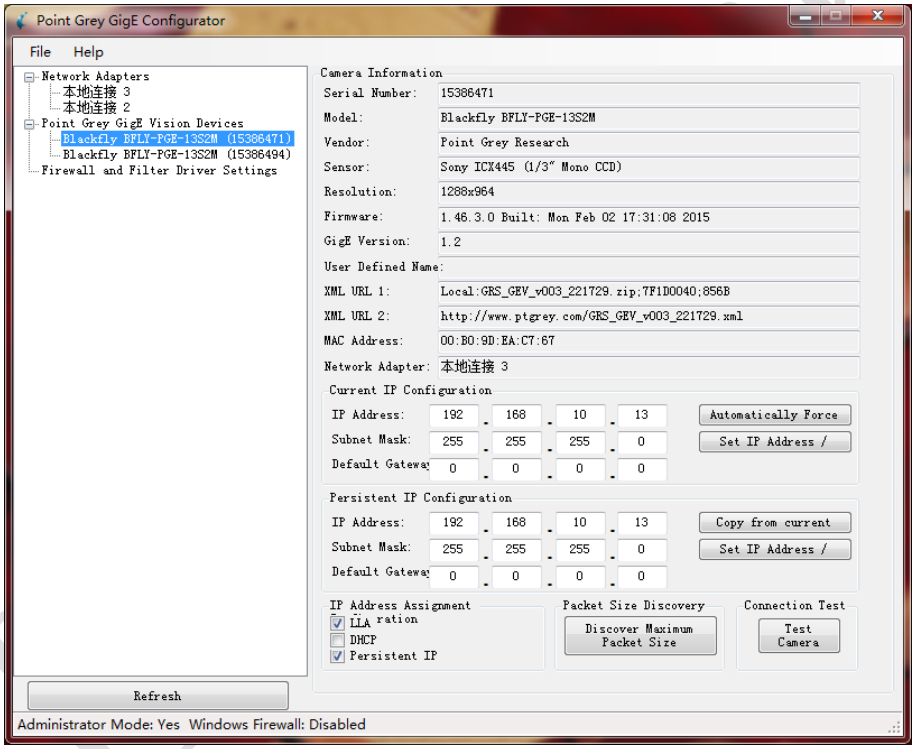
2 FlyCapture2 Software Installation

2.1 IP setting

1) First set the local connection of the IP address, and then through the FlyCapture configuration tool GigE Configurator to portion camera IP address, it is better to fix IP, otherwise it might be a problem of finding the camera appear. (The recommended IP address segment is 192.168.10.XXX).

2) IP setting procedure: Local IP configuration - > 192.168.10.11、192.168.10.12->GigE Configurator ->camera selection ->set Current IP configuration, click automatically force ->click Copy from current and set fixed IP address-> remove DHCP->check Persistent IP->set IP Address

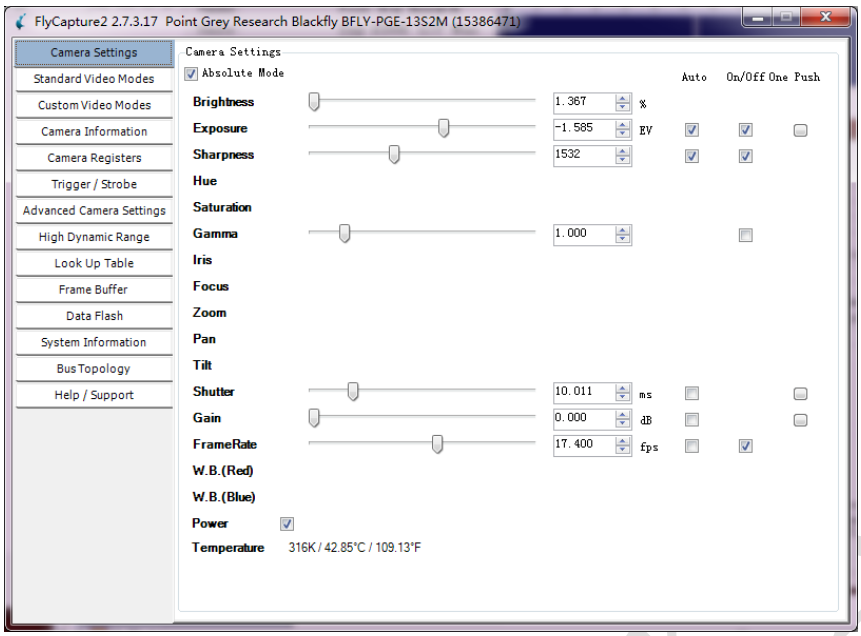
Operating Interface is as pic 2-1-1 below.



Pic 2-1-1 IP Setting

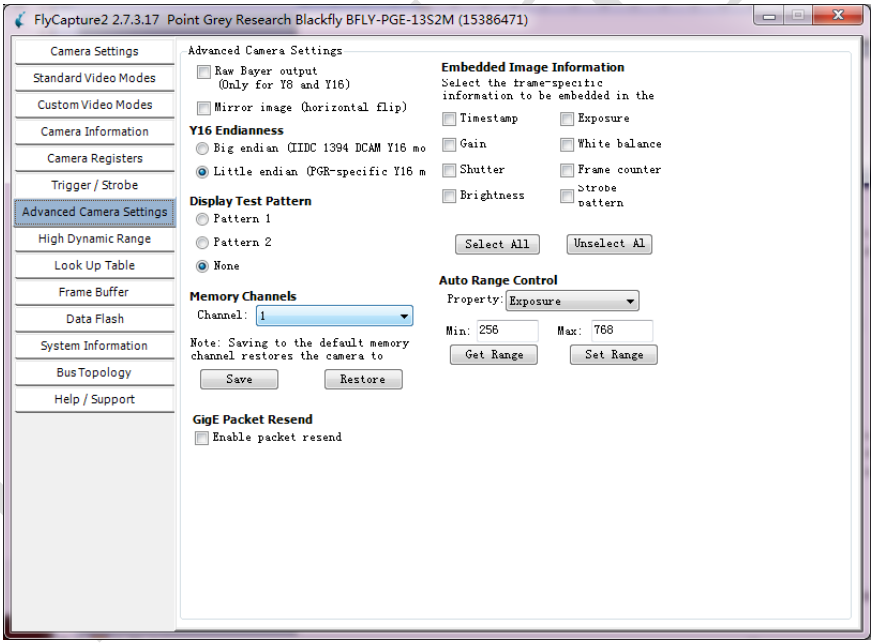
2.2 Camera Parameter Setting

1) FlyCapture set camera parameters: Camera setting - > Shutter exposure time is cancelled automatically- > Gain exposure time to cancel the automatic gain is generally set to 0, only in the adjustment of the aperture, exposure time also cannot meet the requirements of the brightness, jump gain coefficient, as shown in Pic 2-2-1.



Pic 2-2-1 Camera Parameters Setting

2) Advance - > Memory channels is normally set to "1", as shown in Pic 2-2-2.



Pic 2-2-2 Advance Setting

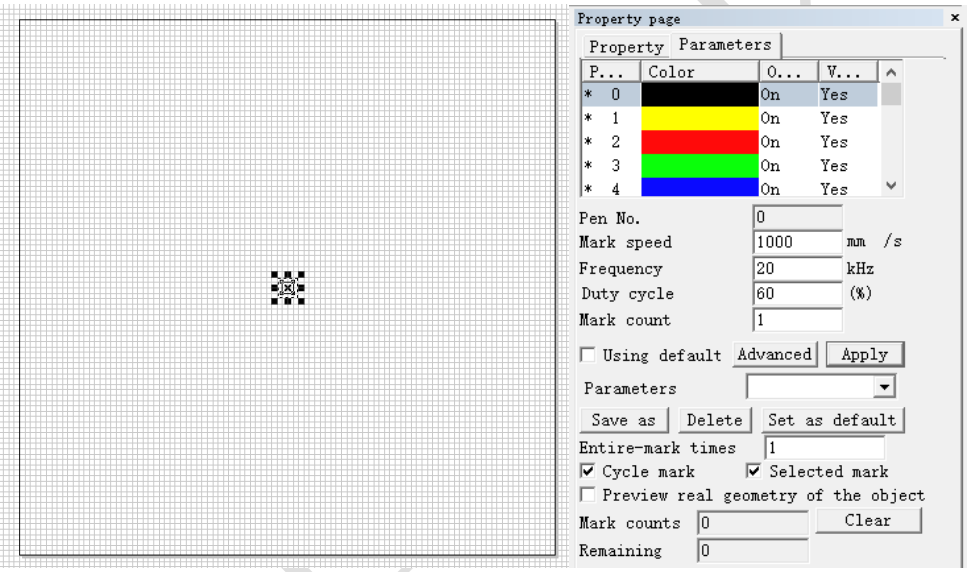
3 Visual Positioning

3.1 Equipment Adjustment

1. Adjustment of focal length

1) Adjustment of central position

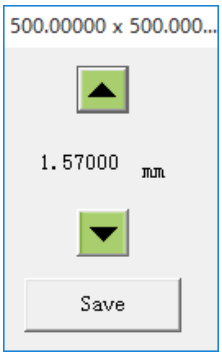
Double click and open the LenMark software, according to marking field size, adjust the focal length of laser. Draw a 20*20mm rectangle box in the center of the software mapping area. As shown pic 3-1-1.



Pic 3-1-1 Adjustment of Focal Length

Adjust the marking parameters and then do cycle markings on stainless steel plate or other metal plate. Move the Z axis motor manually to adjust the light intensity to the strongest, and then fix the position of Z axis.

The dynamic axis fine tuning can be realized by using the dynamic axis fine tuning function. As Pic 3-1-2:



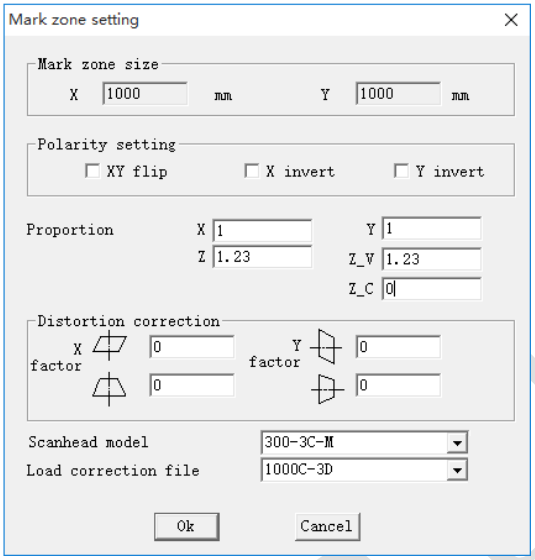
Pic 3-1-2 the Dynamic axis fine tuning Interface

Click “▲”、“▼” button or press “shift+”、“shift+” to do adjustment, until find the best position for the laser. Adjust the focal length can ensure that the laser light will not scattered

at the time of marking and the graphic line of marking is proper.

2) Adjustment of the edge and angle position

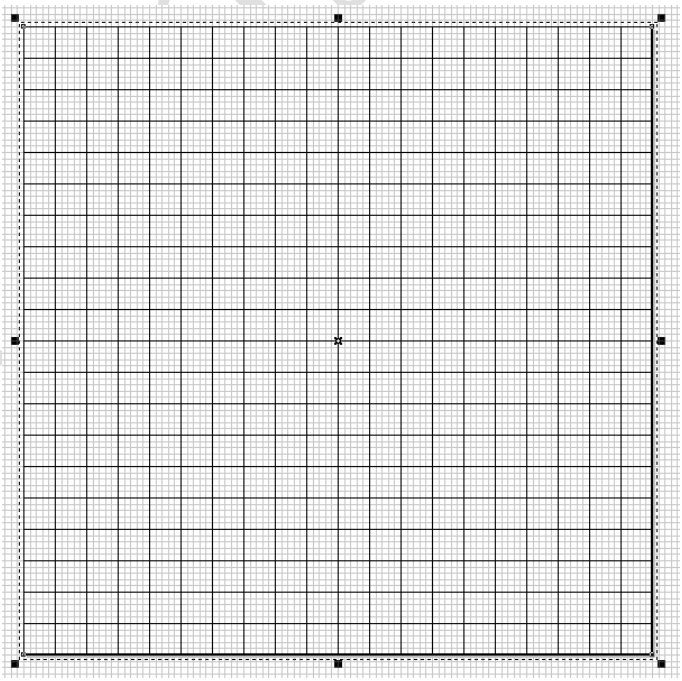
After adjusting the central focal length, place the rectangle box to the edge and corner, and do the focal length adjustment for the four edges and corners in turn. As shown in pic 3-1-3.



Pic3-1-3 the Setting Interface of Edge and Angle Z axis

Modify the ratio of transverse Z, vertical Z and angular point Z in the “marking field setting”. After click the “OK” for marking operation, check the light intensity and repeat the operation, until the light intensity of the edge and angle position is the same as the center position.

2. Draw a full-scale rectangle in LenMark software drawing area and do the hatching operation. As shown in pic 3-1-4.

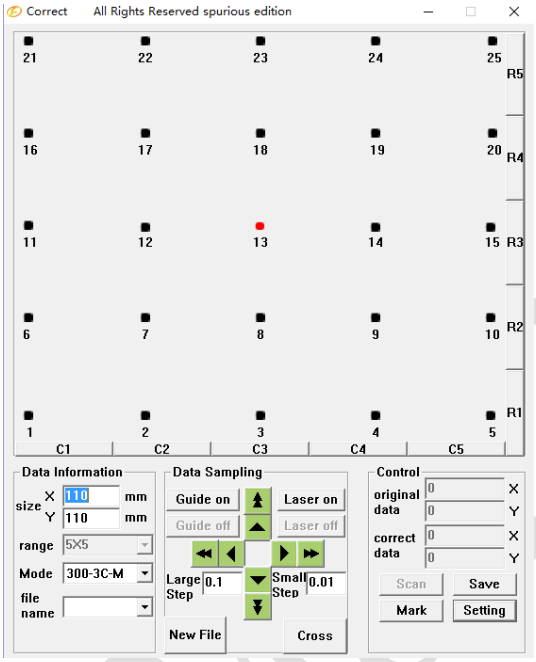


Pic 3-1-4 the Rectangle Box Interface

For example, use the marking size of 1000mm, draw a full rectangle box, set the fill spacing to 50mm, select the “second angle filling” and set the filling angle is 90°, do not select

"uniform distribution filling line". When marking is completed, you can use a ruler to measure the length of the filling line. If error precision is less than or equal to 0.5 mm, it meets the requirement.

If the error is more than 0.5mm, you can use the correct correction software to check, check whether the library file is standard. As shown in pic3-1-5.



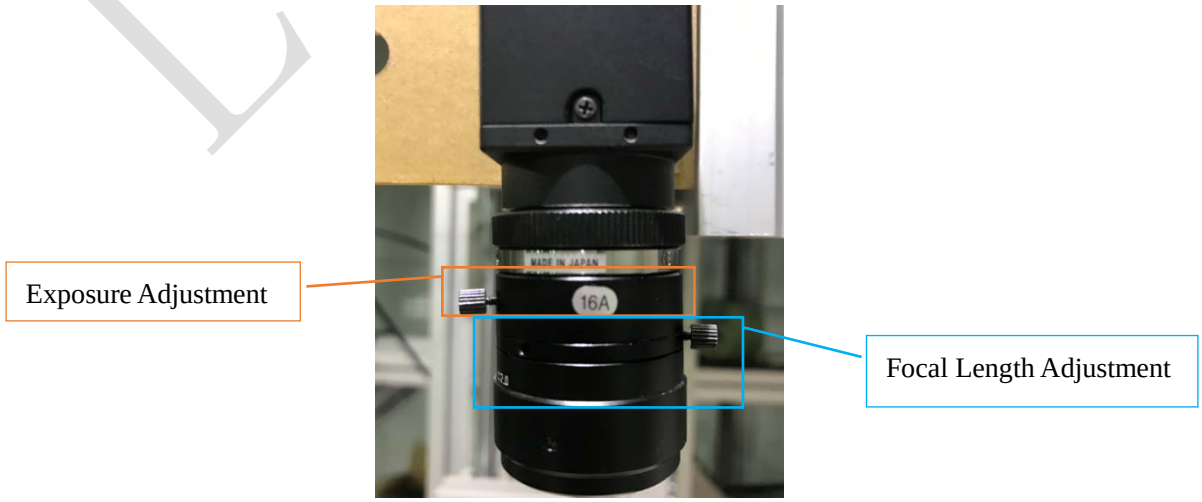
Pic 3-1-5 the Correct Correction Software Interface

Select the type of scanner and library file, click "Mark" to marking, after completing the marking, you can use measurement tools such as a ruler to measure whether the length of line is standard and the interval between each two points are equal, and the marking line is straight, etc.

Note: detailed operation refer to "Correct Software Operation Manual".

3. Focal length of camera and exposure effect adjustment: adjust through the adjusting ring of the camera.

As shown in pic 3-1-6, the camera has two control rings.

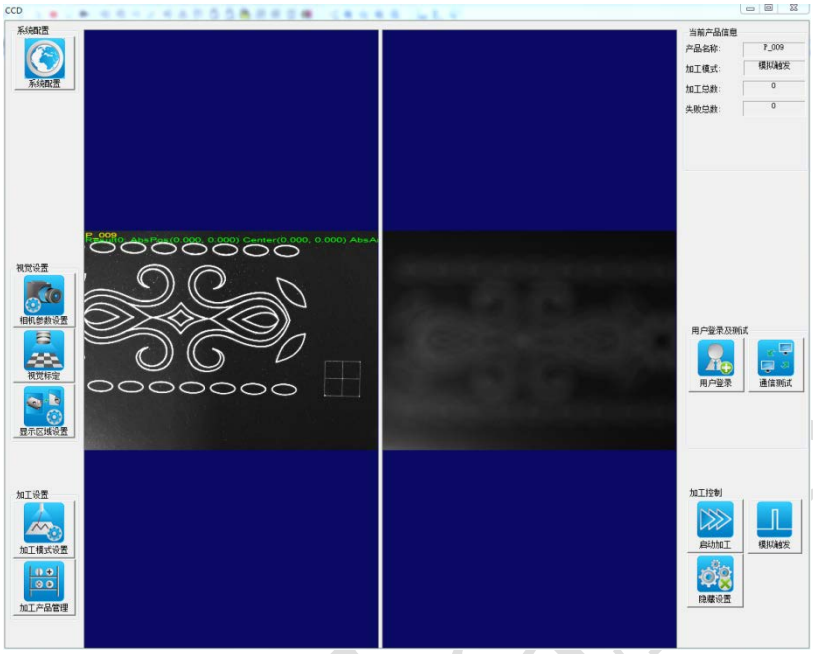


Pic 3-1-6 the Camera Adjustment Ring

Adjust the exposure and focal length of camera, the following is an example of a CH10

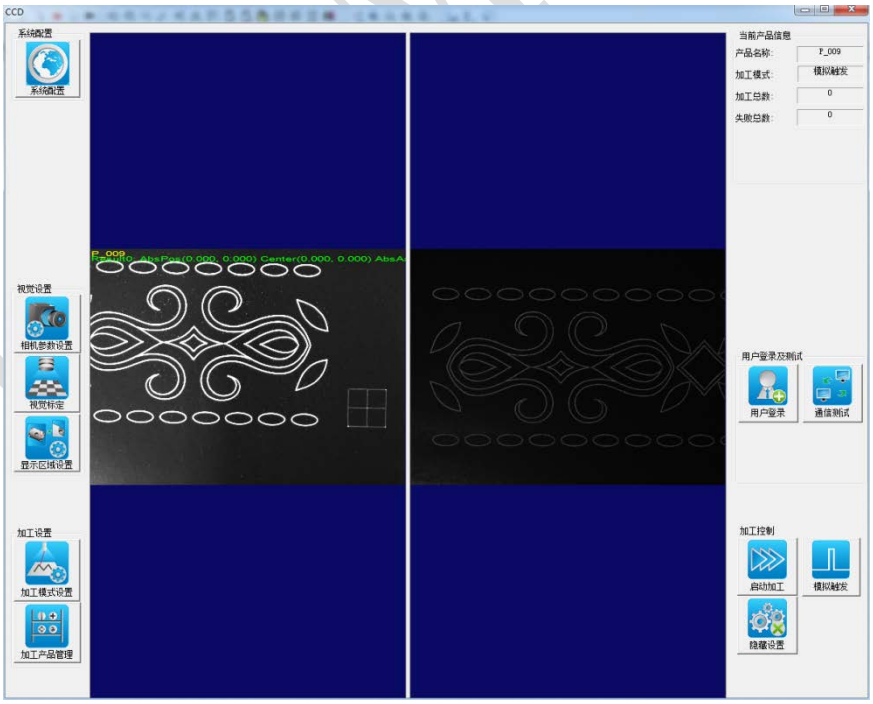
camera, introduce the adjustment of camera:

1) When the camera is turned on for the first time, the unadjusted camera imaging interface is observed as shown in the right side image in pic 3-1-7:



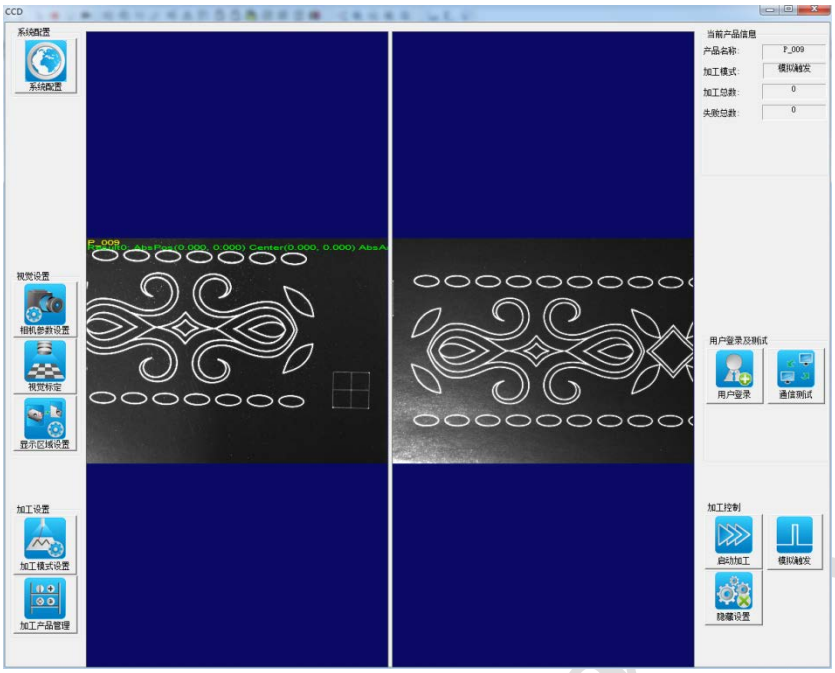
Pic3-1-7 the Interface of Unadjusted the Camera

2) Turn the camera's focal length adjustment ring back and forth until the image is clear, tighten the right side knob to fix the adjustment ring, the effect is shown in pic 3-1-8:



Pic3-1-8 Focal Length Adjustment Effect

3) In the above pic3-1-8, the camera is clearly visible, but the image is darker, which can be brighter by adjusting the camera's exposure. The exposure control ring of the left and right side of the camera makes the image brightness moderate, and tighten the left knob to fix the ring. The adjustment effect is shown in pic 3-1-9.



Pic 3-1-9 Exposure Adjustment Effect

3.2 System Configuration

1. Language selection: select simplified Chinese or English.
2. Image saving configuration: save images from various periods.

Process image data: when configured, select “all not selected”.

Result image configuration:

save all, save all images.

save the error, locate the image that was saved when it failed.

Do not save, do not save the image;

select “not save” when configured.

3. Set the coordinate system of scanner: align coordinate system of scanner.
4. Others: the project that needs to be checked when configured is shown in pic3-2-1. (check out "camera work independently" to achieve the position of the location of the two cameras)
5. Data logging configuration: select all options when configured.

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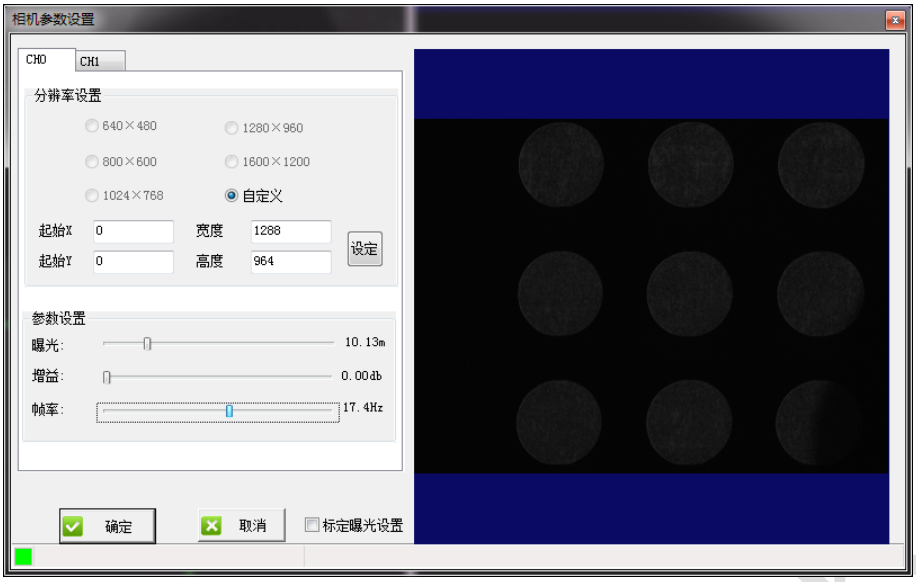
Pic3-2-1 Image Saving Configuration Diagram

3.3 Camera Parameter Setting（CH0/CH1）

1. Adjust the camera aperture size. As small as possible, the smaller the aperture, the deeper the camera's depth of field, the higher the fault tolerance.
2. Adjust the internal exposure time of the software. Affect clarity.
3. Adjust the camera focus.
4. Gain: generally not use, maintain 0.00db.
5. Frame rate: refresh number, select 17.4Hz.
6. Resolution Settings: select "customize".
7. Check "calibration exposure Settings" and click "OK" to exit the camera parameter settings. The operating interface is shown in the pic3-3-1.

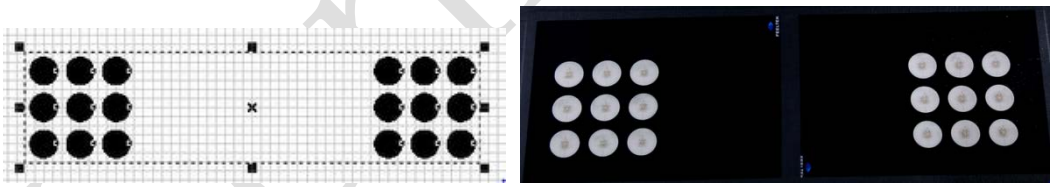


Pic 3-3-1 Camera Parameter Setting Interface

3.4 Visual Marking Position

The visual calibration is divided into two cameras, CH0 and CH1, the step of two camera's visual calibration are the same.

1. Images pre-treatment: refer to the direction of camera installation, adjust the images for rotation or horizontal and vertical images.
2. Use the scanner system to mark nine circles, images related processing, align coordinate system. The software interface and the marking effect are shown in the pic 3-4-1.



the Interface of Setting Software Marking　　the Marking Effect Image

Pic3-4-1 Nine Point Position Setting Interface

3. Image-scanner association

1) Select "manual extraction", select “nine points”, select "white auxiliary points".

2) Click the "image collection", "stop the collection," positioning coordinates (9 point), and adjust the alignment tool size position, below the pic 3-4-2. (Please pay attention to sequence when do adjustment tool, it needs in according with the order of 123, 456, 789).

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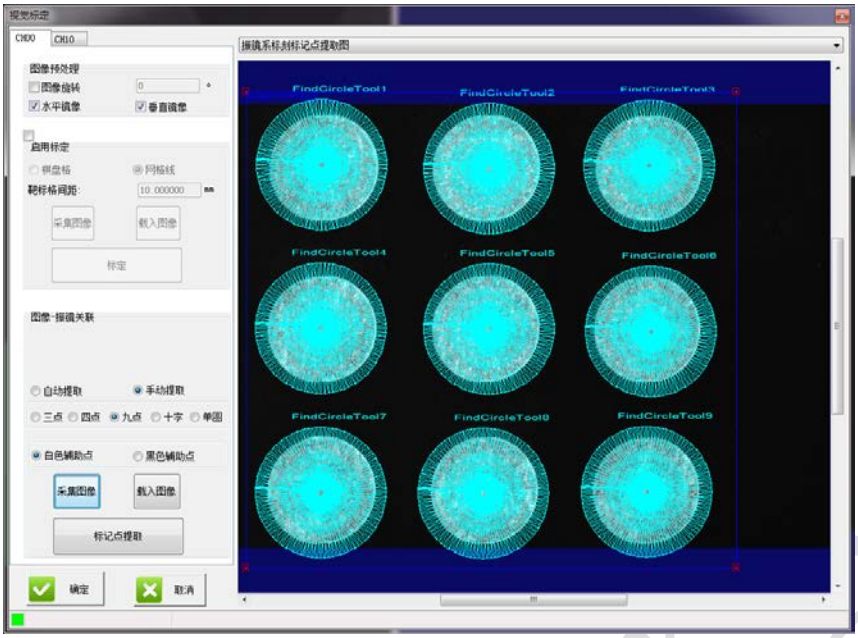
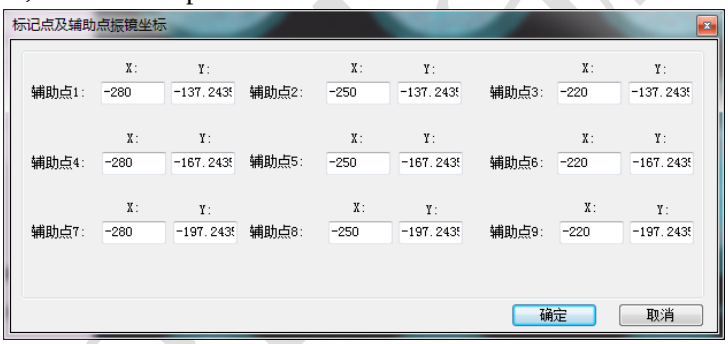


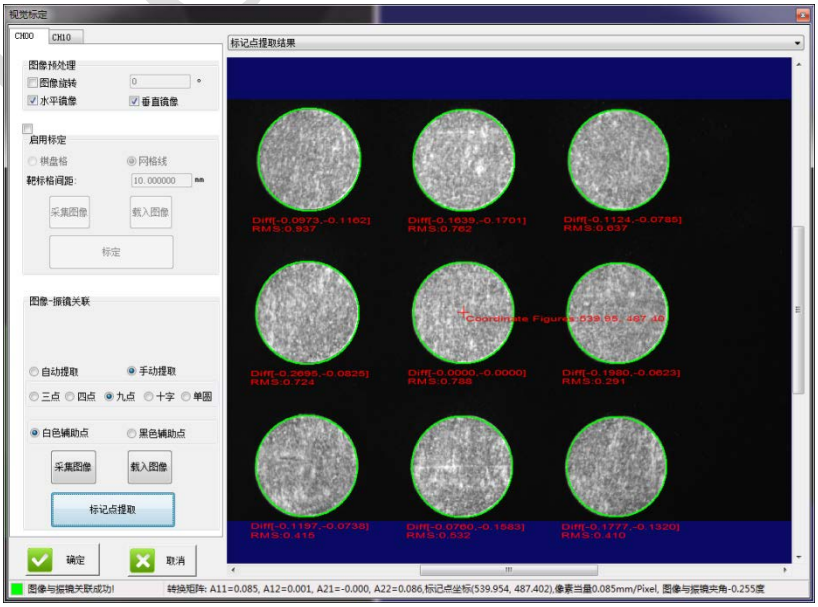
Pic 3-4-2 Extract the Images Interface

3) Click "mark point extraction", and fill in the corresponding coordinate number in the pop-up dialog box, as shown in pic3-4-3.



Pic 3-4-3 the Scanner Coordinate Dialog Box of Mark Point and Auxiliary Point

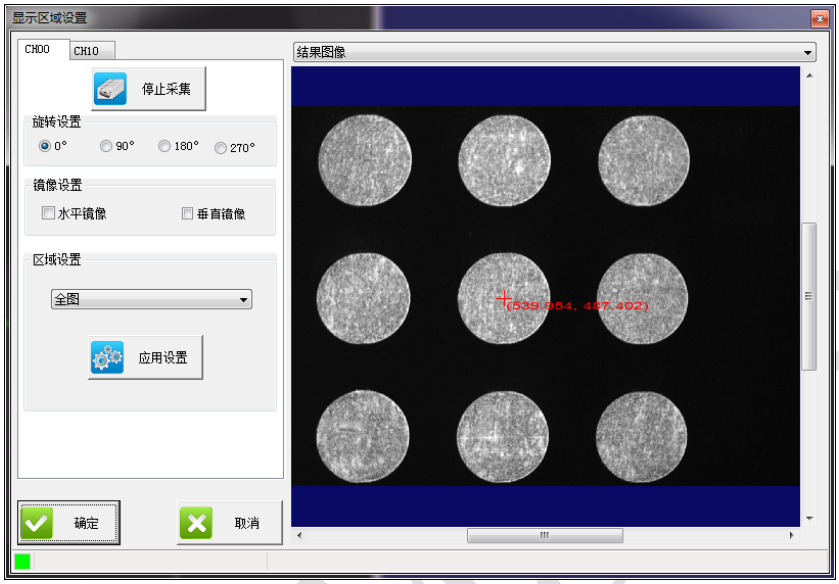
4) After completion, click "OK" and the effect is shown in pic 3-4-4.



Pic3-4-4 the Effect Image of Mark Point Extraction

3.5 Display Area Setting

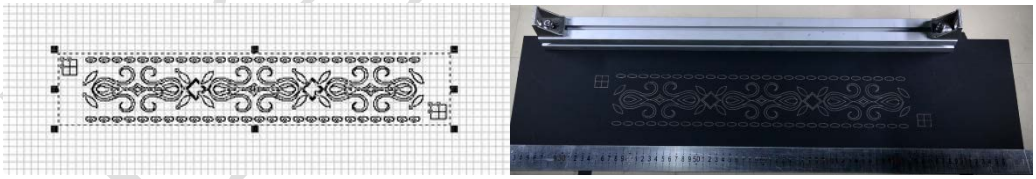
After the visual calibration completion for CH0 and CH1, click "OK", the system will automatically pop up "Display Area Settings" interface, below the pic3-5-1, directly click on the "Application Setting", then click "OK" button.



Pic 3-5-1 "Display Area Settings" Interface

3.6 Process Products Management

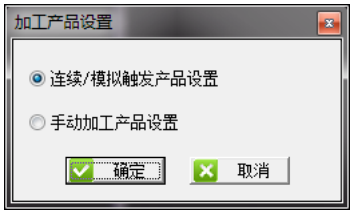
1. In the software drawing area, you can import the marking object for the marking, or place the prepared sample within the scope of the camera, as shown in pic3-6-1 below.



the Software Interface of Importing Object Workbench Sample Interface Image

Pic 3-6-1 Position Point Collect the Sample Image

2. Click on the "processed product management" in the lower left corner of the interface, and the processing product settings mode select dialog box, as shown in pic 3-6-2.



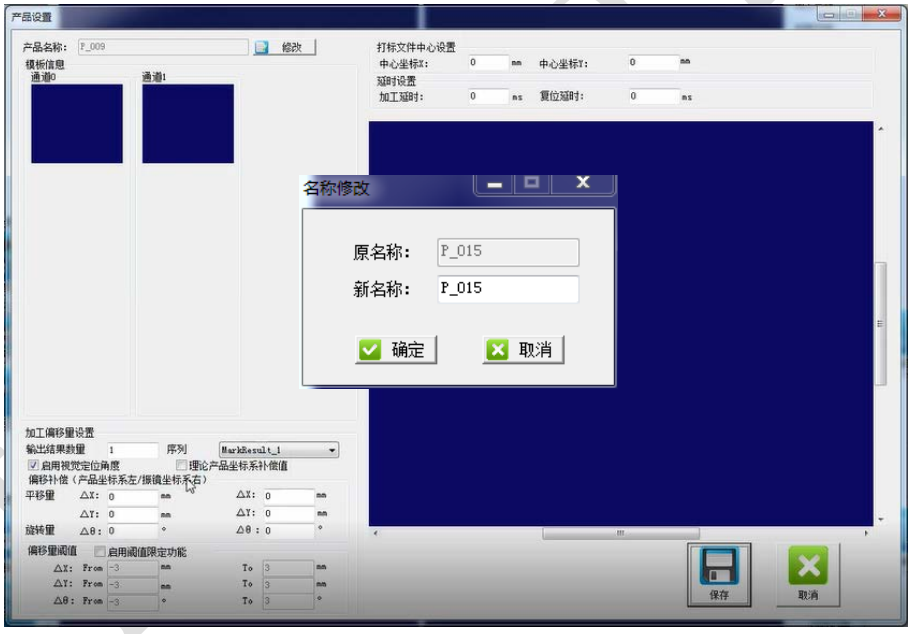
Pic 3-6-2 Process Products Management Mode Selection Box

3. Select "continuous/simulated trigger product settings" and click "OK" to enter the "product management" interface, as shown in pic3-6-3.



Pic 3-6-3 Product Management Interface Image

4. Click the "Add" button in the lower left corner to enter the product setting interface, as shown in pic 3-6-4. Click the "modify" button after the "product name" to rename the product name.



Pic3-6-4 Product Setting Interface

Note:

Compensation: the image deviation or software can be set when you need.

Position result: X: the characteristic points horizontal axis identified in the scanner coordinate system

Y: the characteristic points vertical axis identified in the scanner coordinate system

θ: the angle of two center points in the coordinate system

Two points to the bit-data points: the position of the line tool to locate the intersection, the location characteristic point of the geometry tool.

5. Double click the "channel 0" and "channel 1" in "template information" and enter the

template edit interface, as shown in pic 3-6-5, 3-6-6.



Pic 3-6-5 Channel0 Template Edit Interface



Pic3-6-6 Channel1 Template Edit Interface

6. In the above images of 3-6-5, 3-6-6, edit the template:

1) Select the template scope on the image, click the "continuous collection" button, and then click the "stop collection" button.

2) Click "get the training image" in the "training settings" box.

3) As the case, you can modify the template granularity (according to the positioning area

size to set this value, the area is larger, the greater the granularity search area, the area is smaller, the smaller the granularity setting), after finishing the modification, click on the "training" button to update training images.

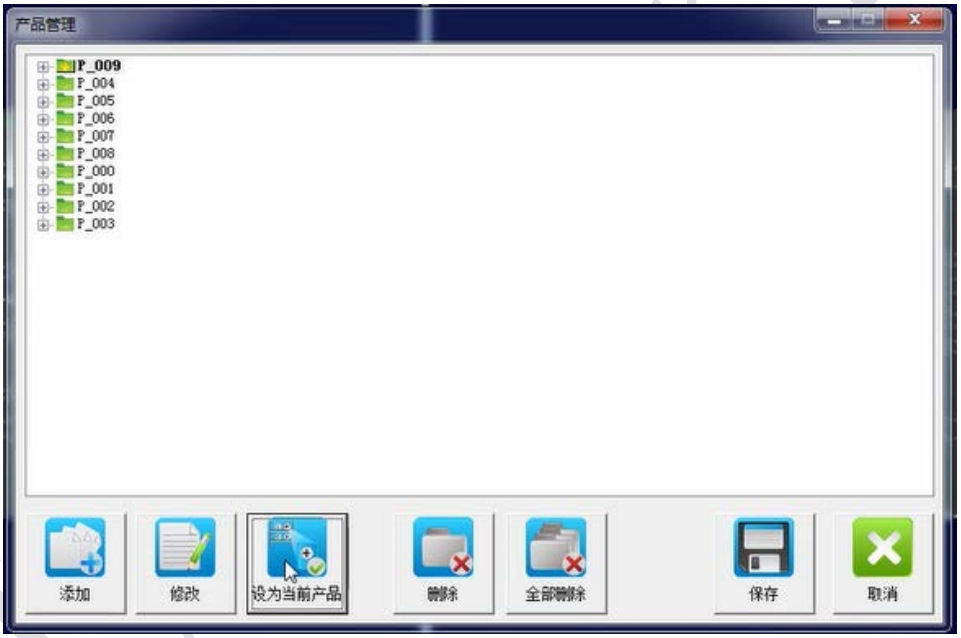
4) The model is only valid when it is in the area template, and blocks away the area that is not needed.

5) Set the number and angle of search in "search settings" and set a threshold value of 1-0.6.

6) When the settings are completed, click the "search" button to see in "search results", which can be searched multiple times to compare search results.

7) When the search results are confirmed, click the "OK" button in the lower right corner to complete the template editing.

7. In pic of the 3-6-4 "product settings" interface, click the "save" button in the lower right corner, and then return to the "product management" interface, in the "product management" interface, select the name of adding product management, click "set the current product" button, as shown in the pic below the 3-6-7.

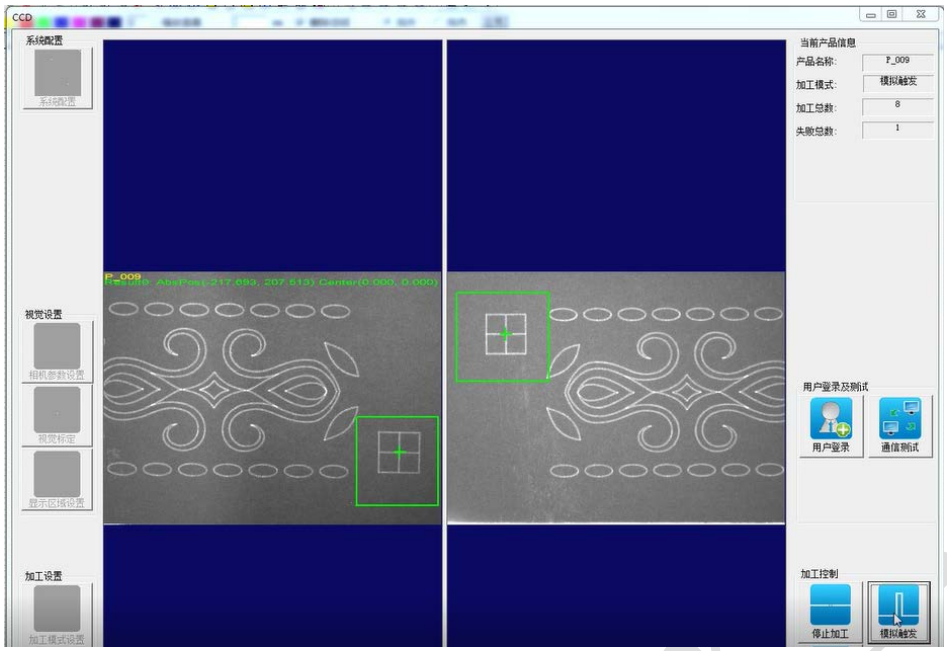


Pic 3-6-7 Set the Current Product Interface

Then click “Save” button and finish the edit of process product management.

3.7 Processing Control

Click the "start processing" button in the lower right corner of the screen and click the "simulate trigger" button to view Mark points, as shown in the pic 3-7-1.



Pic 3-7-1 Simulate Trigger Effect Image

Note: In the process of products management and control do not move the template, until the camera will locate data back to the software, then click on "take the photo and apply" button in the "visual localization" interface.

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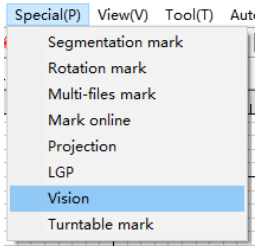
4 Marking Step

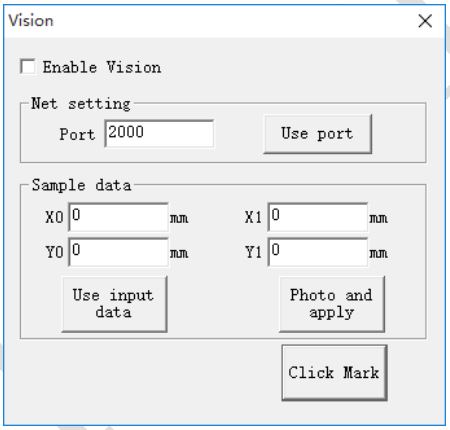
There are two ways of visual positioning:

1. The original image contrast, after camera calibration, you can make the characteristics point position according to “3.6processing product management”, after adjusting the location point, you can mark according to the following steps:

1) Select the "visual position" in the "special" menu bar, as shown in Pic 4-1-1, visual position is shown in Pic 4-1-2.

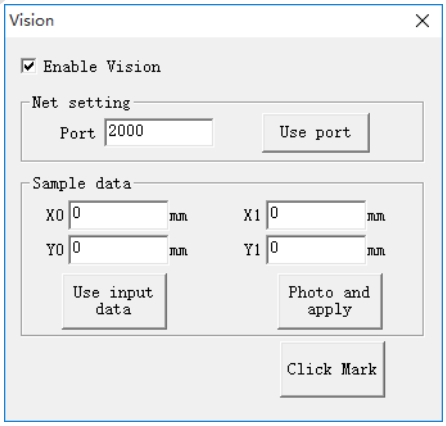


Pic 4-1-1 Menu Bar Select Image



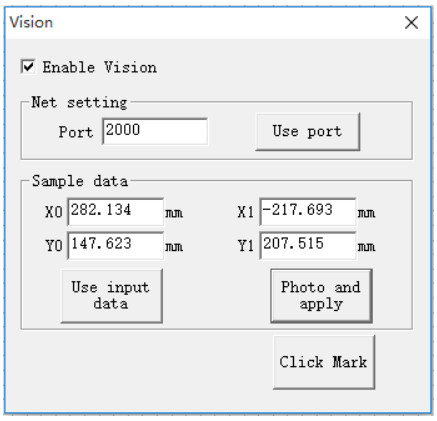
Pic 4-1-2 Visual Position Interface Image

2) Check the "enable visual position", as shown in Pic 4-1-3.



Pic 4-1-3 Start the Function of Visual Position Image

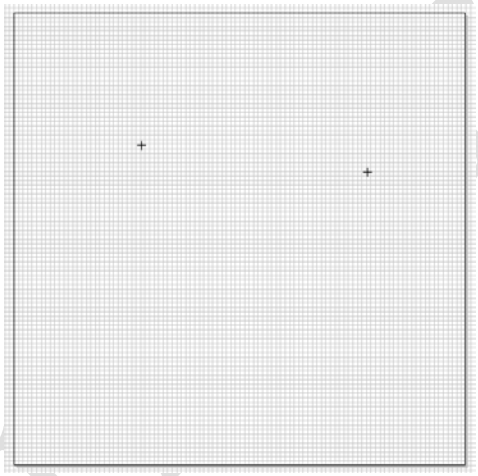
3) Click "take the photo and apply" at the bottom right, as shown in Pic 4-1-4, and see the location of the position point.



Pic 4-1-4 Photo Position Image

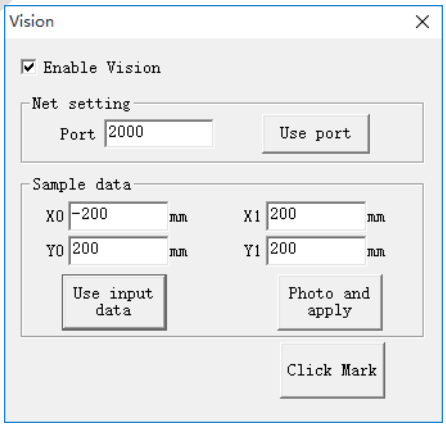
If there is slight difference between the location and figure, please select “mark” to do positioning point adjustment.

4) Click the "exit" button and the software main interface is shown in Pic 4-1-5.



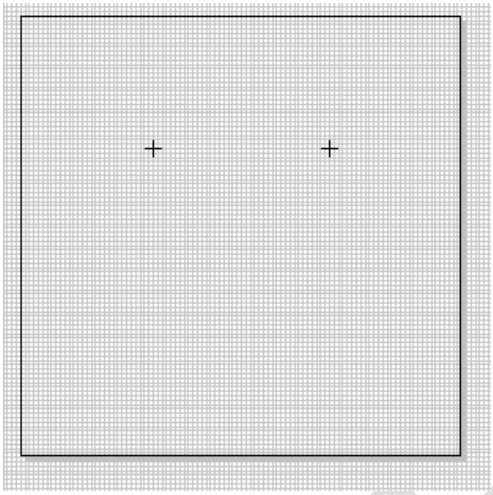
Pic4-1-5 Software Main Interface Image 1

5) Enter the values in the "sample position site" text box, and click "use the input value" to determine the position point, as shown in Pic 4-1-6.



Pic 4-1-6 Input Value Position Image

6) Click the "exit" button, the software interface is shown in Pic 4-1-7.



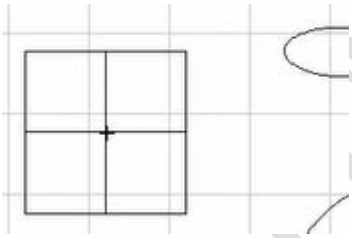
Pic4-1-7 Software Interface Image 2

7) Import the marking object between the position points, as shown in Pic 4-1-8.

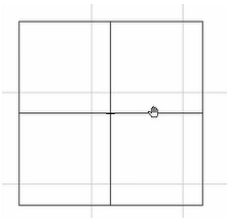


Pic 4-1-8 Marking Object

8) Zoom in and watch on the location of the square, and you can observe that the location of the set is basically overlapping with the cross position on the object, as shown in Pic 4-1-9.



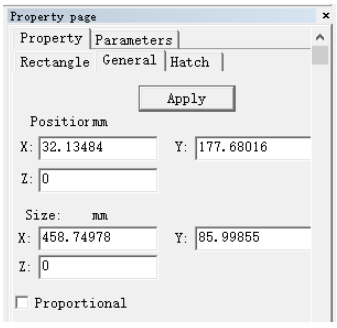
Position Effect Image in the Top Left Corner



Position Effect Image in the Top Right Corner

Pic 4-1-9 Position Effect Image

9) Modify the object properties and the marking parameters in the properties page, as shown in Pic 4-1-10, 4-1-11.



Pic 4-1-10 Modify the Object Properties

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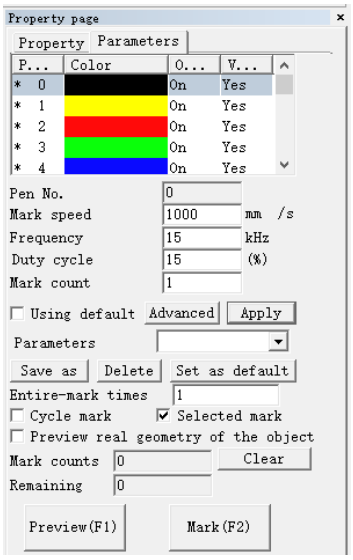


Pic 4-1-11 Modify the Marking Parameters

10) Click the "mark" button or "F2" on the shortcut key.

11) Move the marking object within the camera's field of vision, as shown in Pic 4-1-12.



(The First Movement)



(The Second Movement)



(The Third Movement)



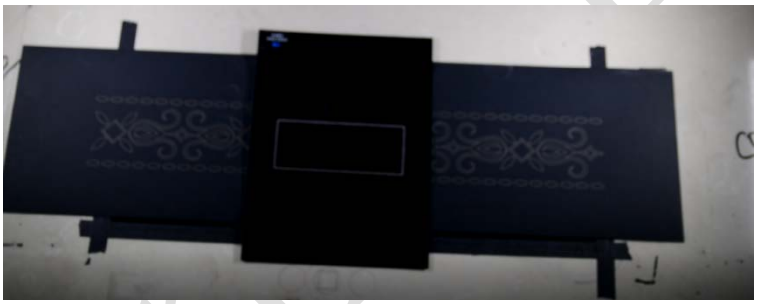
(The Fourth Movement)

Pic 4-1-12 Position Marking Effect Image

Move the template in the visual range of the camera and then mark it to observe the same location.

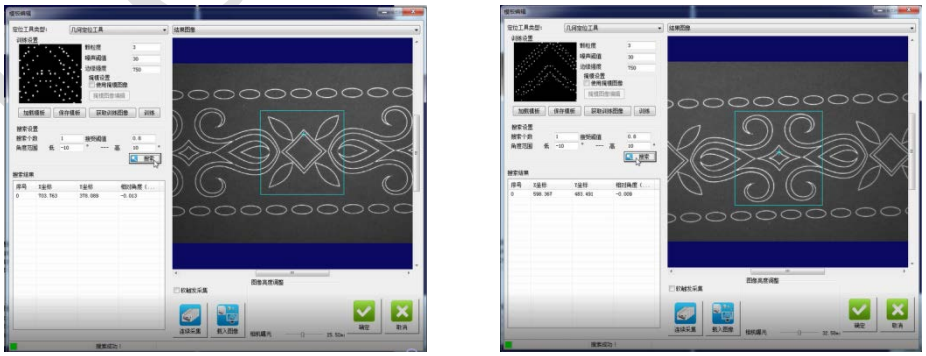
2. Mark the graphic without feature points, as follows:

1) Manually adjust the marking position of the first object, which can be shown by indicator light preview, as shown in Pic 4-2-1 below.



Pic 4-2-1 First Marking Effect Image

2) After the completion of the marking, the sample collection is carried out by the process of 3.6 processing product management, and the position site is determined, as shown in Pic 4-2-2 below.



Pic 4-2-2 Characteristics Point Position Image

As shown above, locate the characteristics points in the pattern at the bottom.

3) Put the remaining marking work piece in order to mark, as shown in Pic 4-2-3 below.



Pic 4-2-3 Second Marking Effect Image

5 Accessories List

The software and hardware used in the visual position process is shown in table 5-1.

表 5-1

Name	Description	Number
Light source	white line light	2
light power supply	four path 24V light control	1
power line	The standard is 0.9 meters, and the extra length needs to be matched	2
camera power supply	DC 12 v power supply	1
camera power line	The length is 3 m	2
camera	Mono,1.3 MP, Sony ICX445 CCD, 1/3", 3.75 μm, Global shutter ,1280 x 964 at 22 FPS, PoE GigE, CS-Mount	2
lens	f25mm, F2.0, 2/3", C Mount, Millions of ultra-low distortion	2
ring	C - CS by circle	1
Gigabit Ethernet cable	3 meters of wire, special	2
Gigabit nics	Intel's EXPI9402PT gigabit network card, Intel 82517 chip pci-ex4 interface with blue marks	1
software	FlyCapture2，LenMark_3D visual customized version	1
camera key dog	visual module key dog	1
software key dog	visual position function key dog	1

6 Software Usage Attention

1) Please confirm that there are no special functions in the "special" menu.
2) In camera system configuration, confirm to check "camera work independently".