AVS series
Visual positioning system

Introduction

This manual prepared by ADTECH (Shenzhen) Technology Co., Ltd organization. This manual is written by Mr. Tian Kui. This specification was first published on 6th of August 2016. Version: V3.0.5， Project Code: BZ001B182A.

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Notice

※The Transportation and Storage:

The product box cannot stack more than six layers
Do not climb, stand or place heavy objects on the product box
Do not use a cable connected to the product to drag or remove the product do not allow collision, scratch panel and display
Product packaging should avoid moisture, exposure and rain

※Check out of the box

After opening the package, please confirm whether you purchased the product
Check if the product is damaged during transport
Check the list to confirm whether the parts are complete, with or without
Damage Such as the existence of product model does not match, the lack of accessories or transport damage, etc., please contact with my company

※Wiring

Those who participate in wiring and inspection must be qualified professionals
The product must be reliably grounded, the grounding resistance should be less than 4 ohms, cannot use the neutral line (zero line) instead of ground
Wiring must be correct and secure to avoid product failure or unexpected consequences the surge absorber connected to the product must be connected in the specified direction; otherwise it will damage the product
Before plugging the plug or opening the product chassis, the product must be switched off

※**Maintenance**

The power supply must be switched off before servicing or replacing components

In the event of a short circuit or overload, check the fault and restart it before troubleshooting

Not frequently power off on the product, after power failure to re-power, separated by at least 1 minute

※Other

Do not open the case without permission.

Do not turn off the power for a long time.

Pay special attention not to let the dust, iron powder into the controller.

If a non-solid state relay is used, the freewheeling diode must be connected in parallel to the relay coil. Check whether the connected power supply meets the requirements and prevent the controller from burning out. The life of the controller has a great relationship with the ambient temperature. If the processing site temperature is too high, install the cooling fan. The controller allows the operating ambient temperature range from 0 ° C to 60 ° C. Avoid use in high temperature, humidity, dusty or corrosive atmospheres. In the strong place of vibration, should be added rubber shock pad to cushion.

※Maintenance

Under normal conditions of use (environmental conditions: daily average 30 ℃, load Rate 80%, operating rate 12 hours per day), please carry out routine inspection and regular inspection as follows.

Daily check	Daily	Confirm the ambient temperature, temperature, dust foreign matter Whether there is abnormal vibration, sound Whether the ventilation holes are caught by yarn or the like
Periodic	1 year	Whether the rugged parts are loose Whether the terminal block is damaged

inspection		

Catalogue

Chapter 1 Product Introduction

1.1 Overview

The main function of the AVS series vision system is positioning, using the self-developed upper computer software ADTvision, you can quickly build your own visual positioning system through a simple configuration of several parameters. And can be through the most popular Ethernet, serial and I / O interface output way to quickly return the positioning results to the PLC and various types of controllers. It can be used in a variety of industrial equipment and robot systems that require high-precision location information.

The entire system mainly includes hardware and software in two parts:

Hardware: Vision Controller + Camera + Lens + Light Source

Software section: ADTVision

1.2 Hardware performance description

★ Compact, easy to install and integrate

★Fanless design, low power consumption, good heat dissipation

★ Support for domestic and foreign brands camera

★Using surface array CCD camera with stable performance and high imaging quality

★ Powerful processor can effectively reduce system positioning time

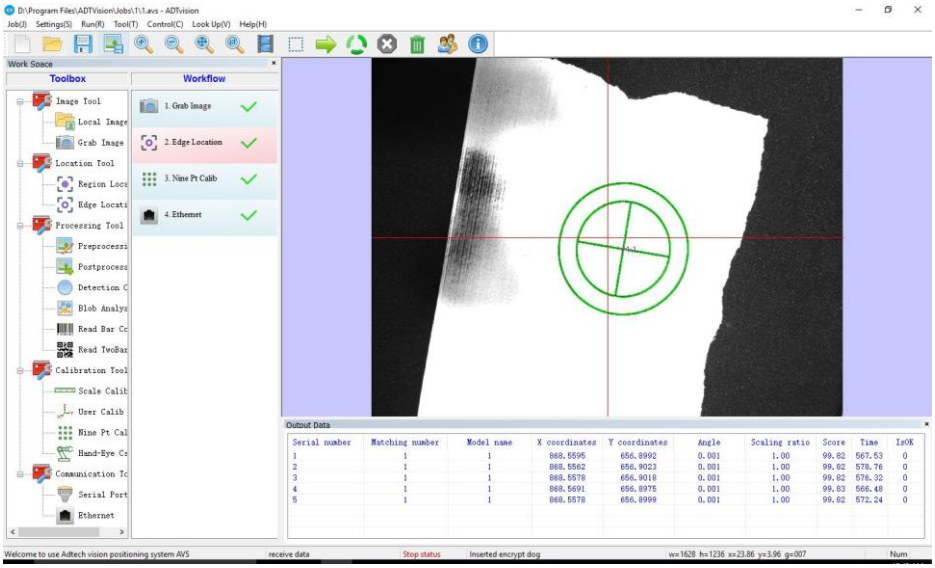
★ Stable operating system provides online or offline detection

★ Support RS232, Ethernet and other common communication interfaces

★ Provides 1 optocoupler isolated input, 1 optocoupler isolated output, 2 GPIO

★ Easy to integrate into factory environment, conform to OPC standard

1.3 Software performance description



★ The image positioning algorithm used has high precision and strong stability

★ Positioning algorithm can achieve 1/64 pixel accuracy

★Support multi-camera solution

★ Support multi-template positioning, can output multiple positioning results at the same time

★ Cameras with different resolutions and different interfaces

★ Support offline design and verification positioning scheme

★ Provide a variety of positioning tools, you can output the position, rotation angle and scaling information

★ Provide a variety of calibration tools, support for automatic calibration, no calibration needle and calibration plate

★ Build your own visual positioning system quickly with just a few steps

★ Rich communication interface, support network, serial port, I/O interface

★ Support self-startup after power-on, configure it once and for all

1.4 Software support

★ Operating System: XP, WIN7, WIN8

★ Programming Environment: Does not support secondary development temporarily

1.5 Application area

★ Dynamic grabbing of industrial robot lines, automatic sorting, loading and unloading;

★ visual dispensing industry;

★ Semiconductor Packaging Industry: Solid Crystal Machines;

★ Packaging and printing equipment: printing presses, pad printers;

★ Automatic assembly equipment;

★ PCB processing, SMT and other industries;

★ Notebook, mobile phone assembly industry

★ Cosmetics loading and unloading industry

Chapter 2 Hardware Installation

2.1 Typical shipping configuration

Typical application 1: robot dynamic capture visual configuration

Name	Model	Description	Unit	Quantity	Note
Visual controller	AVS2300	Product Composition: IPC + Vision Software (BZ001B182A) (WIN7 System, CPU: Intel® CeleronTM J1900, 2.0 GHz, 4G RAM, 64G HDD, 4 Gigabit Ethernet Ports, 2 Serial Ports, 3 USB2.0 Interfaces)	set	1	
Industrial Camera (choose 1 from 3)	CM-130-90 GM-J1	1.3 megapixel black and white camera, Gigabit camera, global exposure, 90fps@1280(H)×1024(V), 1/2" CCD, pixel size 4.8 μm×4.8 μm, mechanical size 29mm×29mm×42mm, weight 68g , Accessories: 1 power adapter, 3m trigger line	set	1	**Low pixel, high frame rate**
	CM-500-60 UM-J1	5MP black-and-white camera, USB3.0 interface, global exposure, 60fps@2592(H)×2048(V), 1" CMOS, needs large lens, pixel size 4.8μm×4.8μm, mechanical size 29mm×29mm ×30mm, weight 56g, accessories: 1 power adapter, 3m trigger cable	set	1	**High pixel, high frame rate**
	CM-600-17 GM-J1	6 megapixel black and white camera, Gigabit camera, shutter	set	1	**High pixel, low**

		exposure, 17fps@3072(H)×2048(V), 1/1.8" CMOS, pixel size 2.4 μm×2.4 μm, mechanical size 29mm×29mm×42mm, weight 68g, Accessories: One power adapter, one 3m trigger cable			**frame rate**
CCD data line	GE-HighFlex-5m-T1	5M，HighFlex	piece	1	
Lens	TC-12-6MP-J1	Fixed focus lens, focal length 12mm, maximum support target 1/1.8", minimum object distance 60mm, size 35.36mm x 29mm, C interface, 6 megapixels	piece	1	
Bar light source	**SR-21230L-W-B1**	**White, 24V input, dimensions 212mm×30mm×20mm, light emitting size 200mm×25mm, fittings: 3m extension cable**	**piece**	**2**	for reference only
Light source controller	SRC-24AC-2-B2	Analog controller, 220V input, 24V output, two channels, accessories: power cord	piece	1	

Typical application two: robot static capture visual configuration

Name	Model	Description	Unit	Quantity	Note
Visual controller	AVS2300	Product Composition: IPC + Vision Software (BZ001B182A) (WIN7 System, CPU: Intel® CeleronTM J1900, 2.0 GHz, 4G RAM, 64G HDD, 4 Gigabit Ethernet Ports, 2 Serial Ports, 3 USB2.0 Interfaces)	set	1	
Industrial Camera	CM-600-17GM-J1	6 megapixel black and white camera, Gigabit camera, shutter exposure, 17fps@3072(H)×2048(V), 1/1.8" CMOS,	set	1	

		pixel size 2.4 μm×2.4 μm, mechanical size 29mm×29mm×42mm, weight 68g, Accessories: 1 power adapter, 8m trigger cable			
CCD data line	GE-HighFlex-5m-T1	5M，HighFlex	piece	1	
Lens	TC-25-6 MP-J1	Fixed focus lens, focal length 25mm, maximum support target 1/1.8", minimum object distance 150mm, size 34.34mm x 29mm, C interface, 6 megapixels	piece	1	
Ring light source	**SR-12000 R-R-B1**	**Red, 24V input, direct type, outer diameter 120mm, inner diameter 40mm, accessories: diffuse reflector, 3m extension cable**	**piece**	**1**	for reference only
Light source controller	SRC-24A C-2-B2	Analog controller, 220V input, 24V output, two channels, accessories: power cord	piece	1	

Typical application three: visual dispensing visual configuration

Name	Model	Description	Unit	Quantity	Note
Visual controller	AVS2300	Product Composition: IPC + Vision Software (BZ001B182A) (WIN7 System, CPU: Intel® CeleronTM J1900, 2.0 GHz, 4G RAM, 64G HDD, 4 Gigabit Ethernet Ports, 2 Serial Ports, 3 USB2.0 Interfaces)	set	1	
Industrial Camera	CM-600-17GM-J1	6 megapixel black and white camera, Gigabit camera, shutter exposure, 17fps@3072(H)×2048(V), 1/1.8" CMOS, pixel size 2.4 μm×2.4 μm, mechanical size 29mm×29mm×42mm, weight 68g, Accessories: One power adapter, one 3m trigger cable	set	1	

CCD data line	GE-HighFlex-5m-T1	5M，HighFlex	piece	1	
Lens	TC-MT0.5×110-B1	C interface, non-coaxial, magnification 0.5, object distance 110mm, support more than 100W resolution	piece	1	
Coaxial light source	**SR-45C-R-B1**	**Red, 24V input, external dimensions 78mm×45mm×44mm, light emitting size 39.5mm×37mm, fittings: 3m extension cable**	**piece**	**1**	for reference only
Light source controller	SRC-24AC-2-B2	Analog controller, 220V input, 24V output, two channels, accessories: power cord	piece	1	

Please note: The list of typical application configurations is not standard.

The vision configuration list is mainly composed of six parts: 1 AVS vision system 2 cameras 3 lens 4 light source 5 light source controller 6 dongle

The configuration of different projects is the same as that of the dongle, and others may be different. Need to select the appropriate camera, lens, light source according to the characteristics of the workpiece, positioning accuracy, positioning speed and other indicators.

Specifically how to choose to communicate with the engineer, it is best to confirm the configuration list after testing the sample.

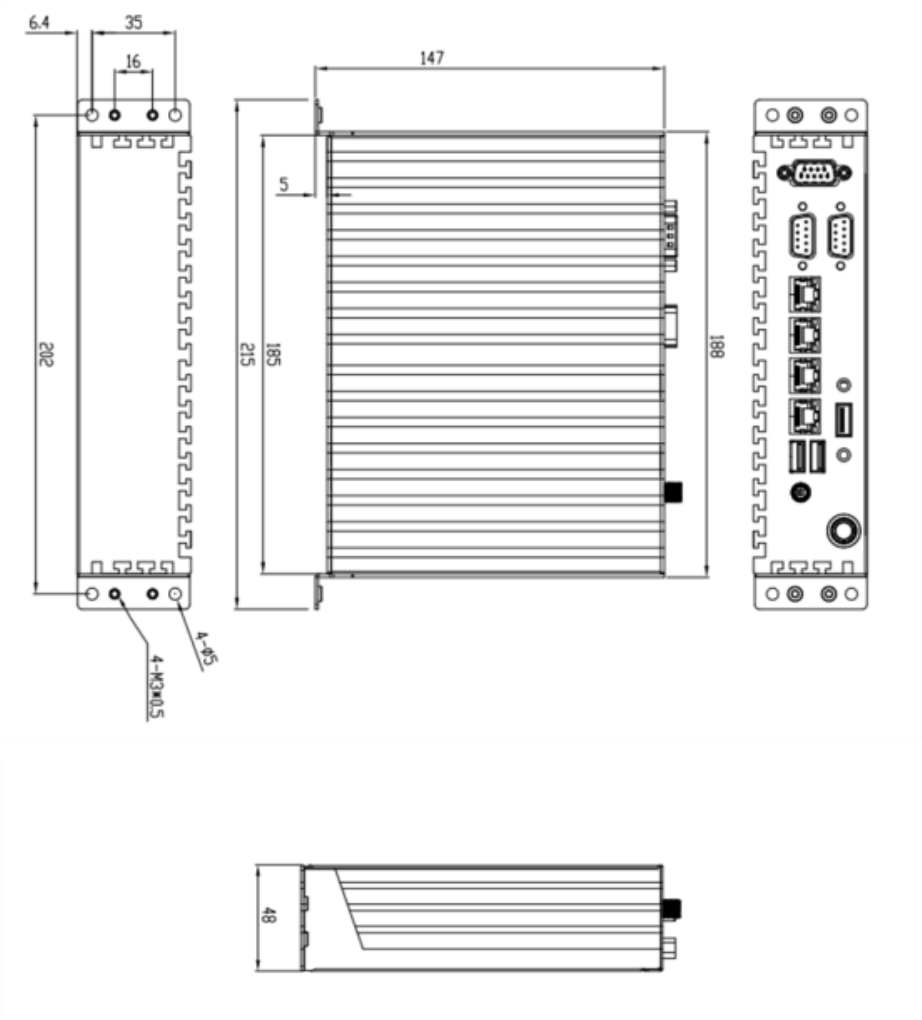
2.2 Product Features

	Standard model	AVS2300	AVS3200
Image unit	characteristic	Supports dual cameras	Supports four cameras
communication	USB	4 USB2.0 interfaces	4 USB2.0 interfaces
	Ethernet	2 thousand trillion, 2 hundred trillion	4 Gigabit (extensible)
	Serial port	2 RS232	4 RS232
	LED	1 status indicator light	2 status indicator light
display	local	24bit LVDS & VGA Interface Synchronous or Asynchronous Output	

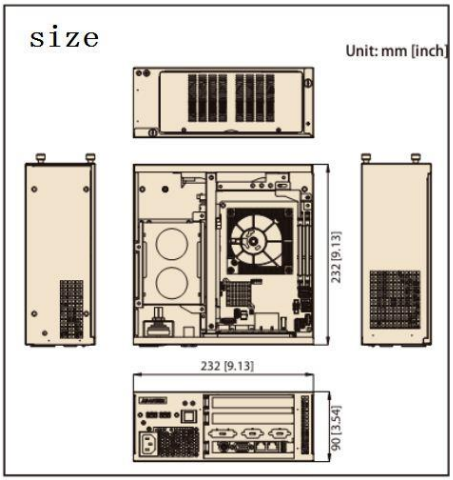
General purpose I/O	enter	None	
	Output	None	
Vision Software	ADTVision	Image Processing Software, Version 3.6.0	
camera Image unit communication display General purpose I/O Vision Software Image unit	Digital camera	GIGE Gigabit Ethernet port, D1 series, G1 series, J1 series	
	enter	One optically isolated input interface, one optically isolated output interface, and two bidirectional GPIOs	
	format	Face scan	
	Pixel/resolution	1.3 megapixel CCD, 1280 (H) × 1024 (V)	6 million pixels CMOS, 3072(H)×2048(V)
	Frame rate	90fps	17fps
	Synchronously	External triggering, soft triggering	
	shutter	20μs～1s	
	rated power	<3W	
	Lens interface	C	
	Mechanical Dimensions	29mm*29mm*42mm	
	weight	68g	
	Certified	RoHS ， CE ， GigE Vision，GenICam	
communication	CPU	Intel@Celeron J1900,2.0GHz	Core i5-3550S 3.0GHz
	RAM	2G	4G
	hard disk	32G Solid State Drive	500G mechanical hard disk
	material	h High-strength aluminum alloy	
	size	(length * width * height) 188mm*147mm*48mm	(length * width * height) 232mm*90mm*232mm
	weight	2.7kg	4.5kg

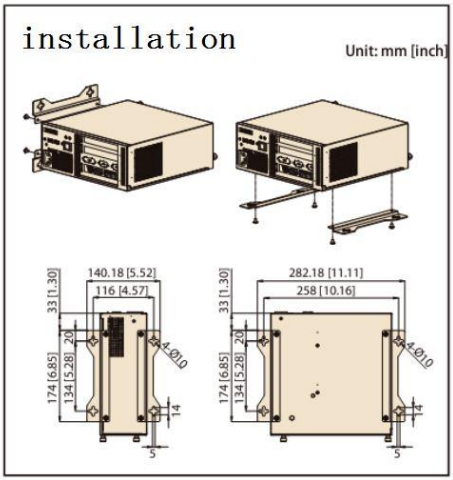
2.3 Installation size

2.3.1 Vision Controller Installation Size

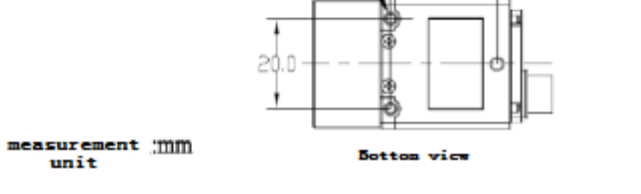


AVS2300 Installation size

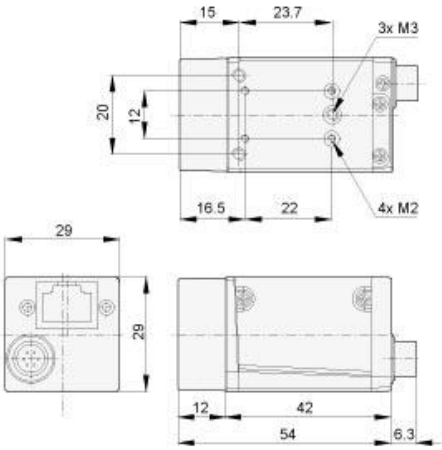




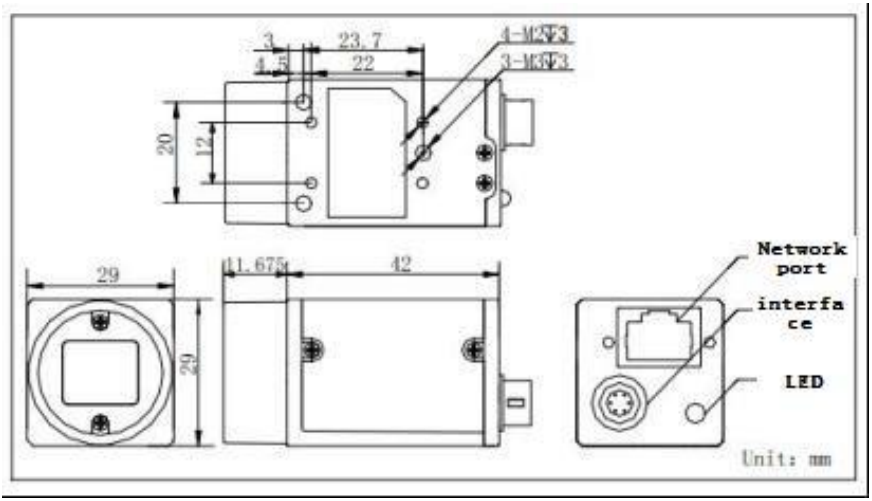
AVS3200 Installation size



D1 series



G1 series



J1 series

2.4 working environment

2.4.1 Visual Controller Operating Environment

Voltage	100 VAC ~ 240 VAC
Operating temperature	-10°C~60°C @10%~80%RH (non-condensing state)
Storage temperature	-40℃~80℃(non-condensing state)
Anti-vibration	1Grms 5~500Hz 3 axis - 1 hour/axis, random vibration
Impact resistance	10G (11ms interval, half sine wave)

AVS2300

Voltage	100 VAC ~ 240 VAC
Operating temperature	-20℃~80℃ @10%~80%RH（non-condensing state）
Storage temperature	-20℃~80℃（non-condensing state）
Anti-vibration	1Grms 5~500Hz 3 axis - 1 hour/axis, random vibration
Impact resistance	10G (11ms interval, half sine wave)

AVS3200

2.4.2 CCD Camera working environment

Voltage	12V DC
Operating temperature	0～45 ℃
Storage temperature	-20 ～70 ℃
Working humidity	10 ～80%

D1 series

Voltage	12V DC
Operating temperature	0～50 ℃
Storage temperature	-20 ～80 ℃

Working humidity	20 ～80%

G1 series

Voltage	12V DC
Operating temperature	0～50 ℃
Storage temperature	-30 ～70 ℃
Working humidity	20 ～80%

J1 series

Chapter 3 Electrical Connections

3.1 Vision Controller Electrical Interface

AVS2300

AVS3200

3.2 D1 series camera electrical interface

The electrical interface consists of three parts: network ports, LEDs, and IO interfaces. The camera exchanges data with the host through the network port; the input and output of the control signal and the power supply of the camera are all realized by the IO interface; the indicator light is used to indicate the working status of the camera.

3.2.1 Network port

The network port connector is a standard RJ45 socket and the pin definition complies with the Ethernet standard.

The network port supports 100m Cat5e or Cat6 cable.

3.2.2 Indicator

The rear shell of the camera is equipped with an LED indicator to indicate the status of the camera. The LED indicator can display 3 colors, which are red, yellow and green.

LED status	Indicates camera status
Extinguished	Camera is not powered
Green light	The network is connected but no data is transmitted
Green flashing	Network port has data transmission
other	Camera internal status

Table 3-1 Camera Status Display

3.2.3 IO interface

The IO interface uses Hirose's 8-pin round male socket.

Schematic	Pin	Definition	Instructions
	1 (green)	Line0+	Optocoupler input is positive
	2（blue）	GND	Camera power ground, GPIO ground
	3（gray）	Line0-	Optocoupler input negative
	4（purple）	POWER_IN	External camera power supply, +12V DC
	5（orange）	Line2	GPIO input/output
	6（pink）	Line3	GPIO input/outputv
	7（white green）	Line1-	Optocoupler output negative
	8(white blue)	Line1+	Optocoupler output positive

Table 3-2 IO Interface Definitions (from the back of the camera)

The D1 series digital camera input power must use +12V (±10%) DC power supply and power through the IO interface.

Note: The positive and negative polarities of the power supply cannot be reversed, otherwise the camera or other devices connected to the camera may be damaged. The positive and negative polarities of the GPIO cannot be reversed. Otherwise, the camera or other devices connected to the camera may be damaged.

Line0 (optocoupler isolated input) circuit

Optocoupler isolated input circuit schematic shown in Figure 3-1, an external circuit in the dotted line

box.

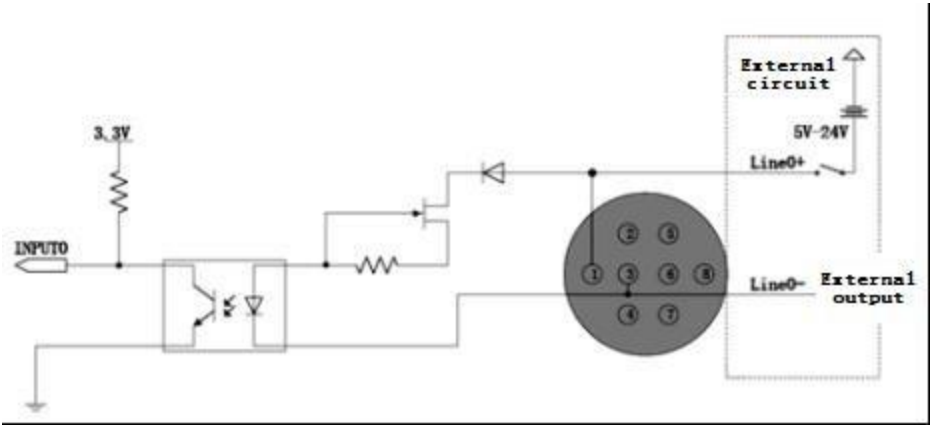


Figure 3-1 Optocoupler Isolated Input Circuit

- Logic 0 input voltage: 0V~+2.5V (Line0+ terminal voltage)
- Logic 1 input voltage: +5V~+24V (Line0+ terminal voltage)
- Maximum input current: 7mA
- The input voltage is indefinite between 2.5V~5V, and the input voltage in this range should be avoided.
- Rising delay time: <50μs (0°C~45°C). See Figure 3-2 for parameter description.
- Falling edge delay time: <50μs (0°C~45°C). See Figure 3-2 for parameter description.
- Different ambient temperatures and input voltages have an effect on the delay time. The delay time in a typical application environment at an ambient temperature of 25°C is shown in the following table:

Parameter	**Test Conditions**	**Value (us)**		
Rising edge delay	VIN=5V	3.02	~	6.96
	VIN=12V	2.46	~	5.14
Falling edge delay	VIN=5V	6.12	~	17.71
	VIN=12V	8.93	~	19.73

Table 3-3 Optocoupler Isolated Input Circuit Delay Time in Typical Application Environment

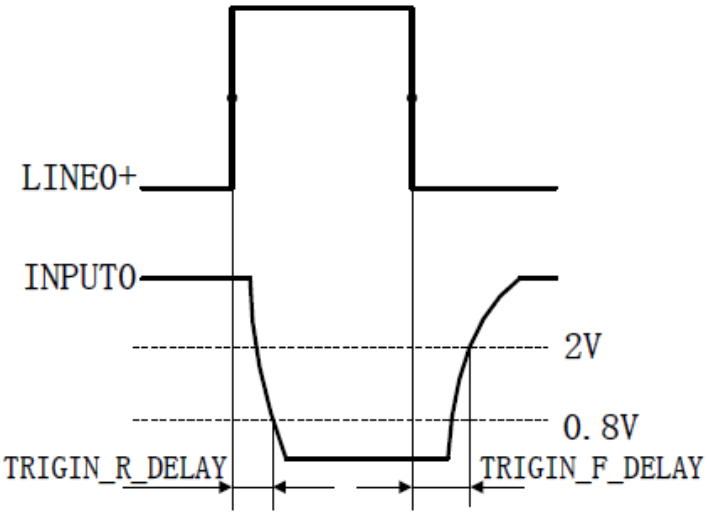


Figure 3-2 Optocoupler Isolated Input Circuit Parameters

● Rising edge delay TRIGIN_R_DELAY: The time from LINE0+ up to half the amplitude to the time when INPUT0 falls to 0.8V

● Falling edge delay TRIGIN_F_DELAY: the time from LINE0+ to half the amplitude to the time when INPUT0 rises to 2V

Line1 (optocoupler isolated output) circuit

The schematic diagram of the optocoupler isolated output circuit is shown in Figure 3-3. The dotted line box is an external circuit.

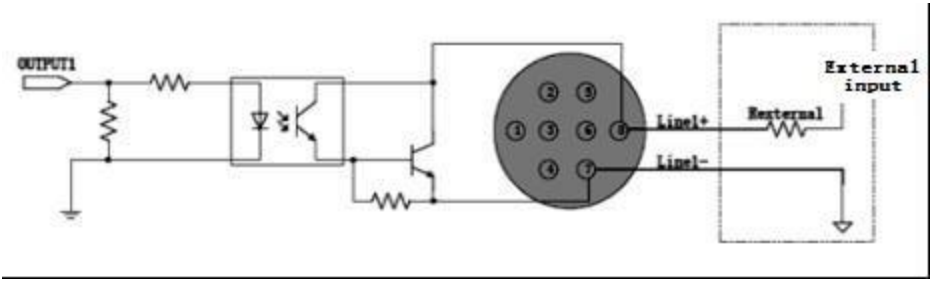


Figure 3-3 Photocoupler isolated output circuit

● External voltage EXVCC range is 5~24V

●Line1's maximum output current 25mA

● The output voltage and output current in a typical application environment at an ambient temperature of 25℃ are shown in Table 3-4:

External voltage (EXVCC)	**External resistance Rexternal**	**Output voltage drop (V)**	**Output current (mA)**
5V	1KΩ	0.9	4.16
12V	1KΩ	0.97	11.11
24V	1KΩ	1.04	23.08

Table 3-4 Output Voltage and Output Current of Opto-Isolated Output Circuit in Typical Application Environment

● Rising edge delay = tr+td: <50μs (0°C~45°C). Parameter description is shown in Figure 3-4:

● Falling edge delay = ts+tf: <50μs (0°C~45°C). Parameter description is shown in Figure 3-4:

● The delay time under the typical application environment at 25°C ambient temperature is shown in Table 3-5:

Parameter	**Test Conditions**	**Value (us)**		
Storage time ts	External power supply 5V, pull-up resistor 1kΩ	6.16	～	13.26
Delay time td		1.9	～	3.16
Rise time tr		2.77	～	10.6
Falling time tf		7.6	～	11.12
Rising delay=tr+td		4.7	～	13.76
Falling edge delay = tf+ts		14.41	～	24.38

Table 3-5 Optocoupler Output Circuit Delay Time in Typical Application Environment

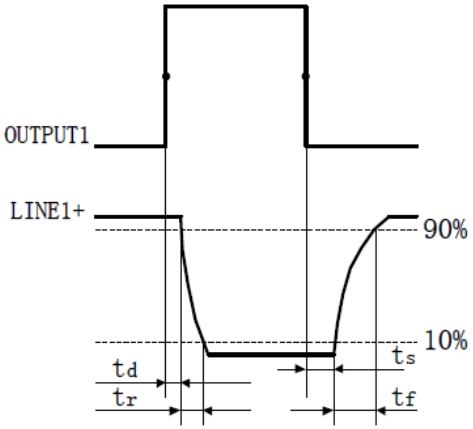


Figure 3-4 Optocoupler isolated output circuit parameters

● Delay time td: The time from half of OUTPUT1 amplitude to LINE1+ to LINE1+ amplitude of 90%.

● The fall time tf:LINE1+ decreases from 90% to 10%.

● Storage time ts: The time from the half of OUTPUT1 amplitude to LINE1+ to LINE1+ amplitude 10%.

● Rise time tr:LINE1+ The time from 10% to 90%.

GPIO2/3 (bidirectional)

circuit

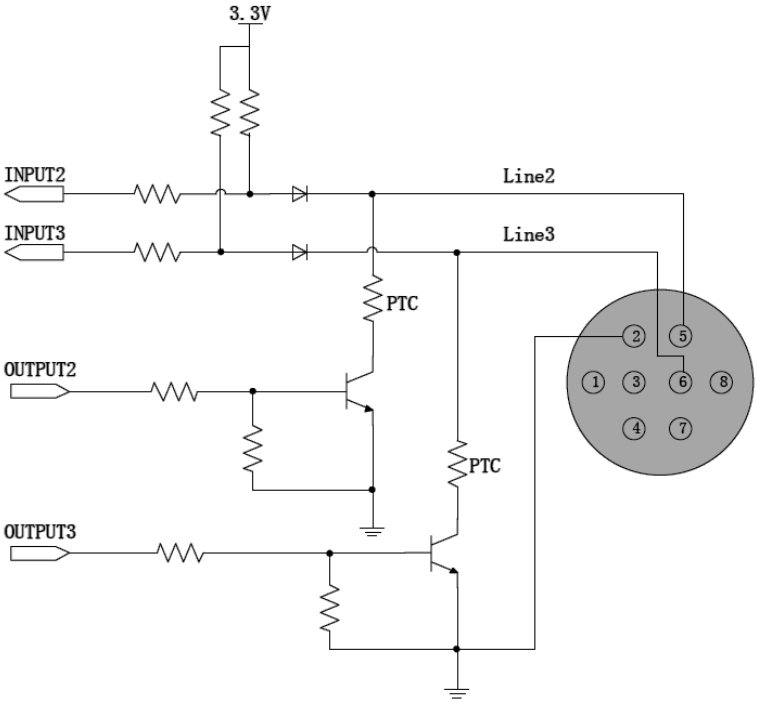


Figure 3-5 GPIO2/3 (Bidirectional) Circuitry

Line 2/3 is configured as an input pin:

● Input voltage of logic 0: 0V~+0.6V (Line2/3 terminal voltage)

● Logic 1 input voltage: +1.9V~+24V (Line2/3 terminal voltage)

● The input voltage is indefinite between 0.6V~1.9V, and the input signal should avoid entering this voltage range.

● When the Line2/3 input is high, the input current is less than 100uA; when the Line2/3 input is low, the input current is less than -1mA.

● When LINE2/3 is used as the input, if the corresponding output device is a common anode connection, the pull-down resistor should not exceed 1K. Otherwise, the LINE2/3 input voltage will exceed 0.6V and it will not be identified as logic 0.

● Input rising edge delay: <2μs (0°C~45°C). Parameter description is shown in Figure 3-2.

● Input falling edge delay: <2μs (0°C~45°C). Parameter description is shown in

Figure 3-2.

● When the Line2/3 is configured as an input pin, the camera's internal equivalent circuit is shown in Figure 3-6 and Line2 is used as an example:

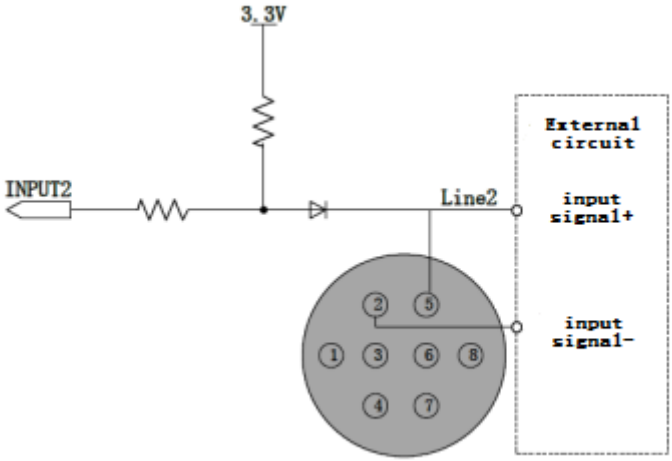


Figure 3-6 The camera's internal equivalent circuit when Line2 is configured as an input pin

To prevent the GPIO pin from being damaged, first connect the ground (GND) pin and then input the voltage to the Line2/3 pin.

Line2/3 is configured as an output pin:

● External voltage EXVCC range is 5~24V

●Line 2/3 has a maximum output current of 25mA and an output impedance of 40Ω

● Table 3-6 shows the output voltage and output current in a typical application environment with an ambient temperature of 25°C:

External Voltage (EXVCC)	**External resistor(Ω)**	**Output Voltage(V)**	**Output Current(mA)**
5V	1KΩ	0.19	4.8
12V		0.46	11.6
24V		0.92	23.1

Table 3-6 Line 2/3 Voltage and Output Current Values in a Typical Application Environment

● Rising edge delay = tr+td: <20μs (0°C~45°C). Parameter description is shown

in Figure 3-4

● Falling edge delay=ts+tf:<20μs (0°C~45°C). See Figure 3-4 for parameter description.

● The delay parameter is affected by the external power supply voltage and external pull-up resistors, and is affected by the temperature. The output delay time under the typical application environment at 25°C ambient temperature is shown in Table 3-7:

Parameter	**Test conditions**	**Value（us）**		
Storage time ts	External power source 5V， On Pull Resistor 1kΩ	0.17	～	0.18
Delay time td		0.08	～	0.09
Rise time tr		0.11	～	0.16
Fall time tf		1.82	～	1.94
Rise and delay Time =tr+td		0.19	～	0.26
Fall and delay time=tf+td		1.97	～	2.09

Table 3-7 Delay time of GPIOs configured as output pins in a typical application environment

● When the Line2/3 is configured as an output pin, the equivalent circuit in the camera is shown in Figure 3-7. Line2 is used as an example:

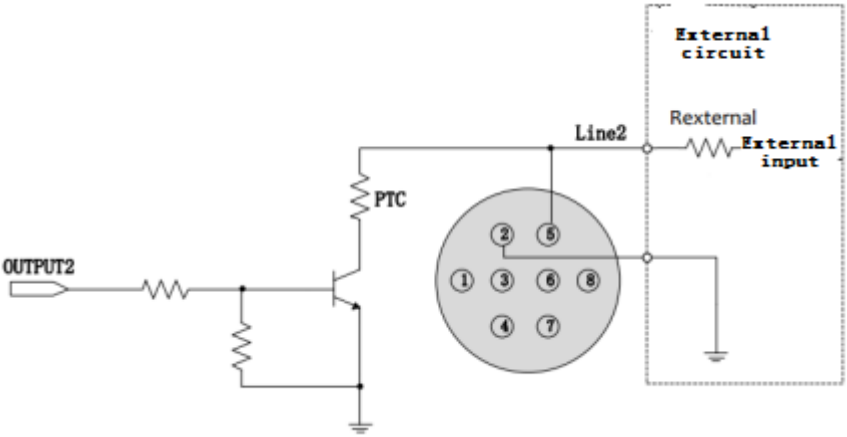


Figure 3-7 The camera's internal equivalent circuit when Line2 is configured as an output pin

3.3 G1 series camera electrical interface

G1 series camera mainly has two electrical interfaces, one is 6pin I/O interface, one is 8pin RJ45 network interface:

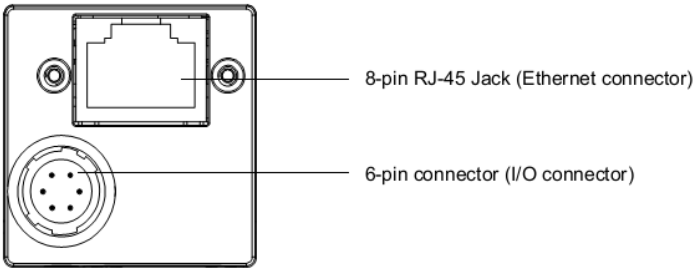
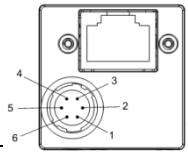


Figure 3-8 G1 Series Camera Electrical Interface

The following table shows the I/O connector pin assignments:

	Pin	Definition	Description
	1	-	+12VDC camera power source
	2(yellow)	Line1	Optical coupling Isolation input

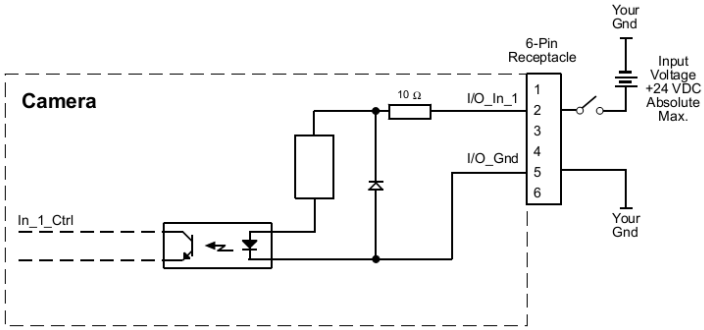
	3	-	NC
	4(green)	Out1	Optical coupling Isolation output
	5(white)	-	Optical coupling isolated Ground
	6	-	DC Camera Current

Table 3-8 G1 Series camera I/O connector pin assignment

The mesh connector is a standard RJ45 socket, and the PIN definition complies with the Ethernet standard.

The network port supports 100m CAT5e or CAT6 cables.

Line1 typical wiring diagram is as follow



F 3-9 Line1 Typical Wiring

Out1 typical wiring ：

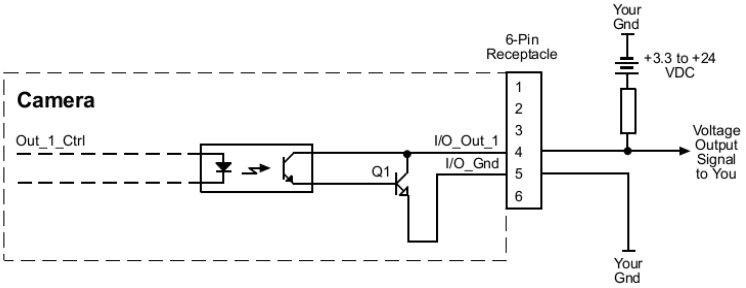


Figure 3-10 Out1 Typical Wiring

3.4 J1 series camera electrical interface

3.4.1 Interface introduction

The appearance of the back of the industrial camera is shown in the figure below. It includes a standard RJ45 Gigabit Ethernet cable jack, 6-pin power and I/O input ports, and a camera status indicator. There are two M2 size locking screw holes on both sides of the network port to fix the network cable to reduce the loosening of the network cable.

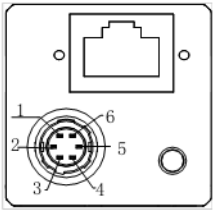
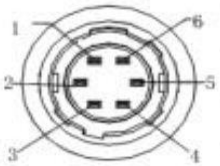


Figure 3-11 Rear Interface

3.4.2 Power and I/O Interface Definitions

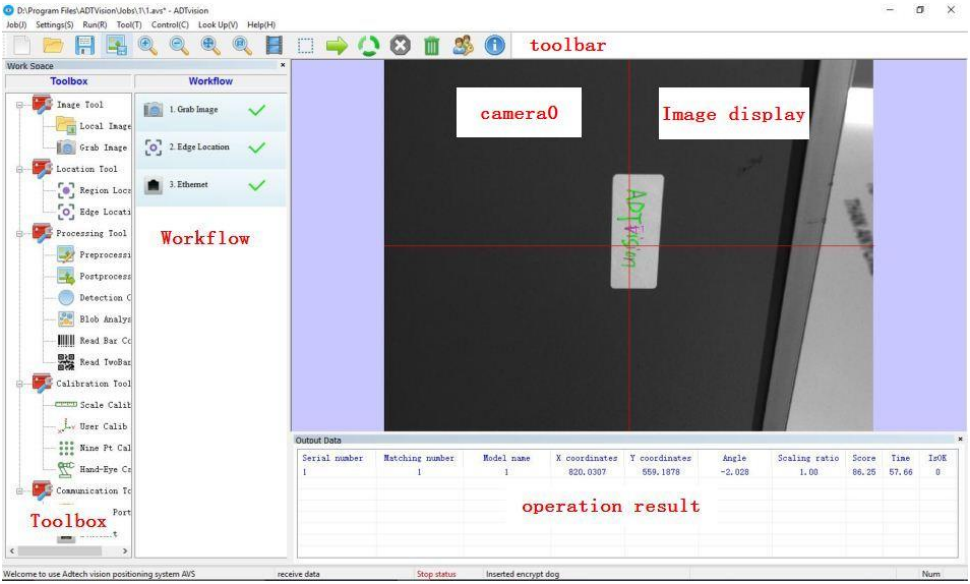


pin	signal	I/0 Types	Instructions
1	12V	input	+12V DC power
2	Opt-Iso In	input	Optocoupler isolated inputs
3	GPIO	input or output	Can be configured as input or output
4	Opt-Iso Out	output	Optocoupler isolated output
5	I/O Ground	input	Signal ground
6	Gnd	input	Power ground

3-12 Interface Definition Diagra

Chapter 4 ADTVision Interface Description

4.1 Main interface



4.2 Toolbar

 Creat a new job

 Open a job

 Save current job

 Save image

 Enlarge image

 Shrink image

 Maximize image by original image scale

 Display images by actual size

 Switching continuous acquisition and triggering acquisition mode

 Set up an image search area

 Manually perform the job process once

 Run job, can only receive external trigger signal in run state, cannot edit job

 Stop job, only manual positioning in stop state, can edit job

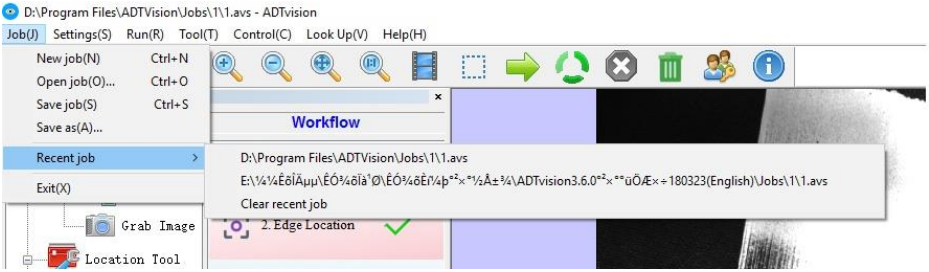
 Clear running result

 User Login

 Display software version and copyright information

4.3 Menu Bar

4.3.1 Job menu



New job: create a new job flow

Open Job: Open a Job Process

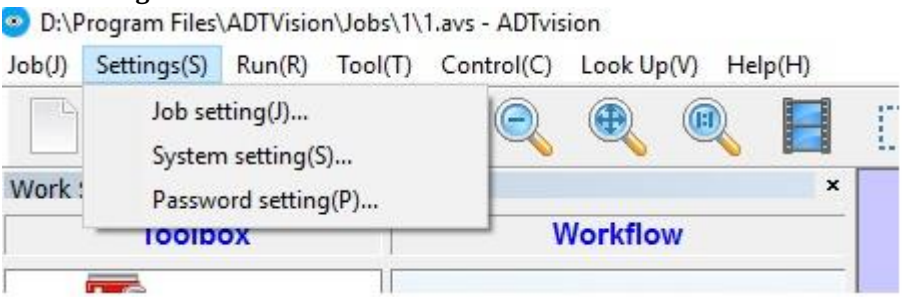
Save job: save the current job flow to the file

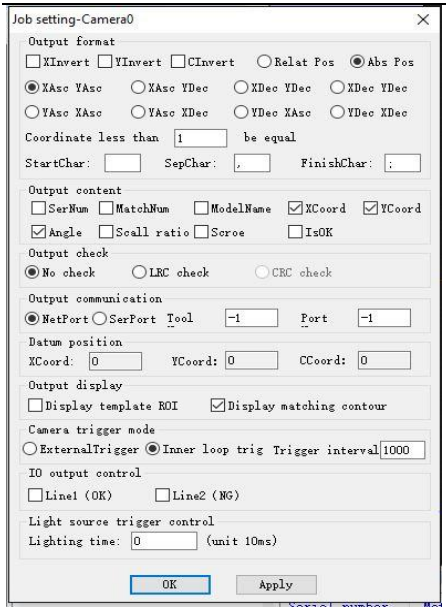
Save As: save the current job process with a different name

Recent Jobs: Displays the path of the most recently opened 4 job processes. Click to open the corresponding job flow. Click Clear Job to clear the list of recent job processes.

Exit: Exit the application

4.3.2 Setting menu





Job Settings: Set the job's attribute parameters. The settings are as follows:
X, Y, C are negated: Negative numbers are added before the output results. When the visual coordinate system and the robot coordinate system are in different directions, you can use the inverse function to ensure that the coordinate directions of the two are consistent.
Relative position: coordinate offset from the reference position
Absolute position: Absolute position in user coordinate system
X liters Y lit: When there are multiple positioning results, priority is given to output in ascending order of X coordinate. If the X coordinate is less than the set value, press Y coordinate ascending output
X rise Y drop: When there are multiple positioning results, priority is given to output in ascending order of X coordinate. If the X coordinate difference is less than the set value, output in descending order of Y coordinate.
X drop Y rise: When there are multiple positioning results, priority will be output in descending order of X coordinate. If the X coordinate difference is less than the set value, press Y coordinate ascending output
X drop Y down: When there are multiple positioning results, the X coordinate will be output in descending order first. If the X coordinate is less than the set value, it will be output in descending order of Y coordinate.
Y liters X liters: When there are multiple positioning results, priority is given to output in ascending Y-coordinates. If the difference between Y-coordinates is less than the set value, press the X coordinate ascending output
Y rise X drop: When there are multiple positioning results, priority is given to

output in ascending order of Y coordinate. If the difference of Y coordinate is less than the set value, then output in descending order of X coordinate.

Y drop X liters: When there are multiple positioning results, priority will be output in descending order of Y coordinate. If the difference of Y coordinate is less than the set value, press X coordinate ascending output

Y down X down: When there are multiple positioning results, the Y coordinate will be output in descending order first. If the Y coordinate is less than the set value, it will be output in descending order of X coordinate.

Start character: what character the output starts with

Delimiter character: What character is the output content separated by?

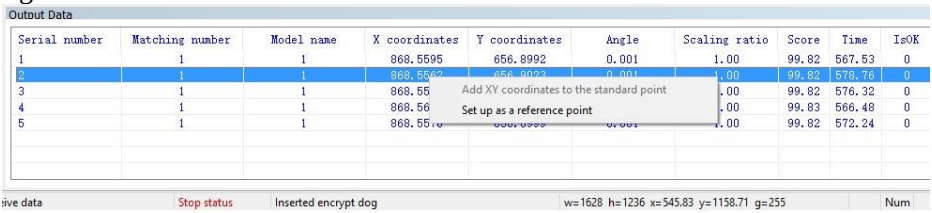
End character: what character the output ends with

Output content: set the data that needs to be output

Output check: Currently supports LRC character verification

Output communication: You can specify the network port or serial port, you can also specify the tool number and port number

Base position: Available when relative position is used, the base position can only be set in the output information list via “Set as base point” in the right mouse button menu, as shown in the following figure:



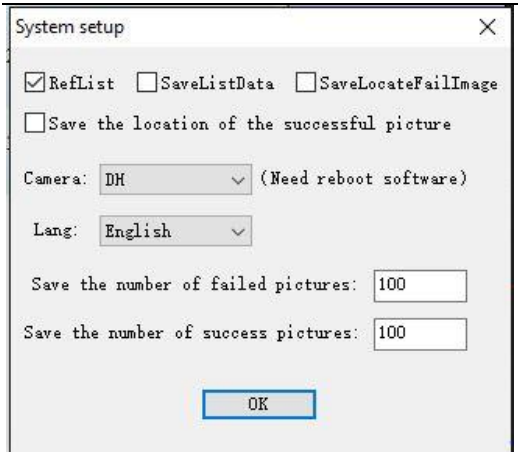
Output display: Choose whether to display template ROI or matching profile

Camera trigger mode: support external soft trigger and IO trigger, internal cycle trigger can also be used

IO output control: Checking Line1 means that when the result is OK, a signal will be output through Line1. Checking Line2 means that when the result is NG, a signal will be output through Line2.

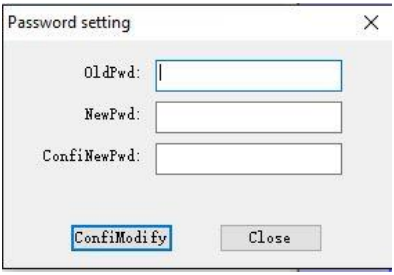
Light source trigger control: When using the trigger command with template number, if the trigger time is non-zero value, then the light source brightness will automatically extinguish after the set time, and the light source will be always on when it is 0.

System Settings: System Settings Attributes parameters, settings as shown below:



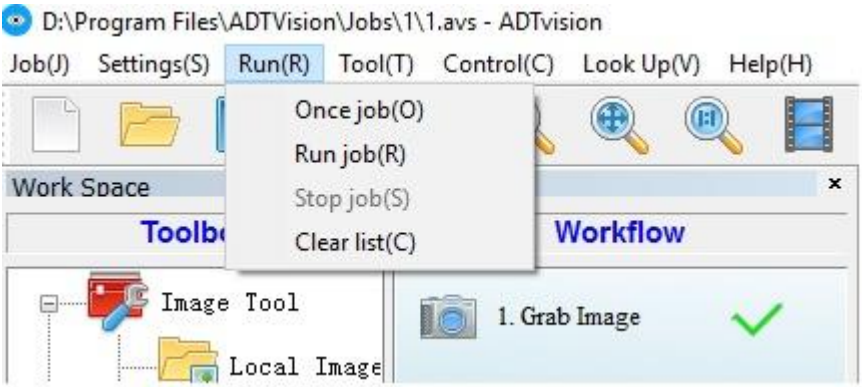
Refresh list: whether to display the positioning result in the output information list
Save the list data: Save the positioning result in the TXT file
Save location failed image: save the image where the location failed to local
Camera: The type of camera you are using, you must restart the software to take effect
Language: Support Chinese and English
Failed to save the number of pictures: When the positioning fails, the number of failed pictures can be saved, and specific values can be set.
Number of pictures saved successfully: The number of saved pictures can be set when the positioning is successful.

Password setting: password setting attribute parameters, setting content as shown below:



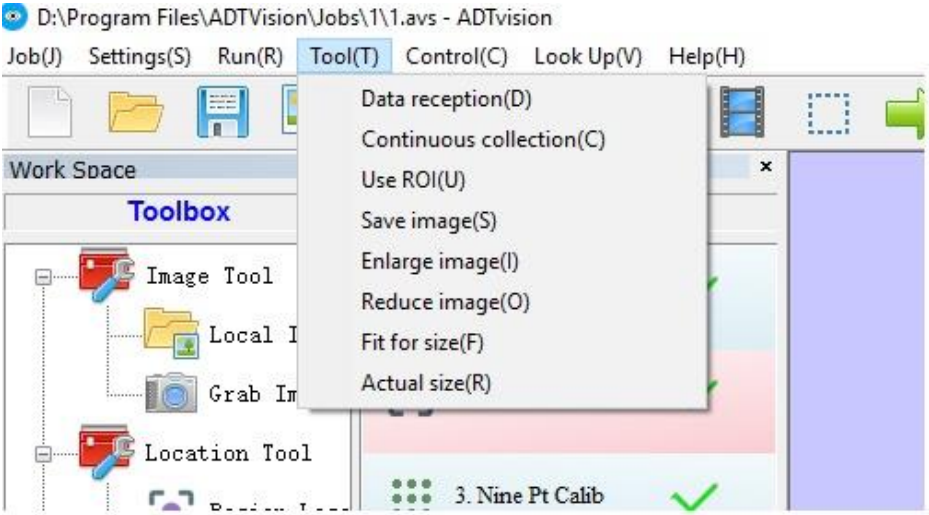
Can set the operation permissions, the default password is empty, anyone can operate

4.3.3 Run menu



Single job: manually perform a positioning
Running a job: camera positioning can only be triggered by an external signal and job flow cannot be edited
Stop job: You can only manually trigger camera positioning, you can edit the job flow
Empty operation data: Clear the positioning result in the output information list

4.3.4 Tool menu



Data Receiving: Open Data Receiving dialog box, you can view the data received by communication

Continuous Acquisition: Switching Continuous Acquisition and Triggering Acquisition Mode

Use ROI: Limit the scope of the search template in the image, can reduce the positioning time

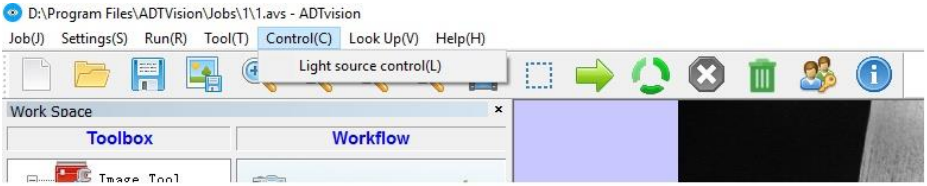
Save Image: Save the image captured by the camera to a file in BMP format

Magnify, reduce image: Zoom image

Fit to Size: The original aspect ratio of the saved image is maximized in the window

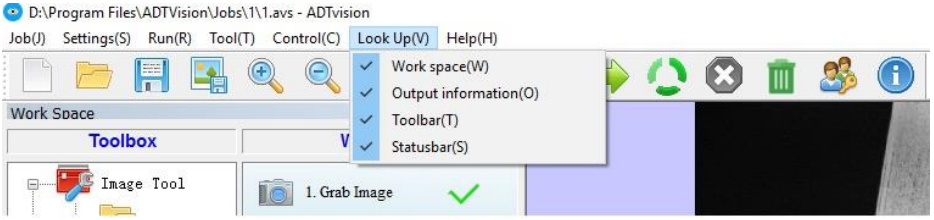
Actual size: displayed in the actual size of the image

4.3.5 Control menu



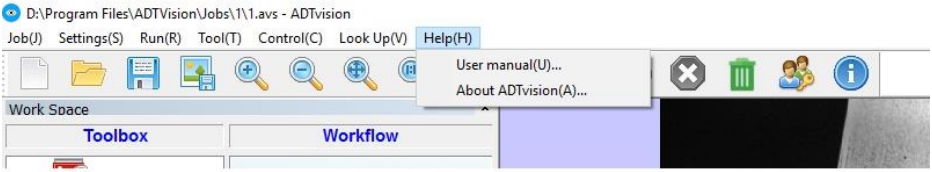
Light source control: Open the light source control dialog box, you can adjust the light source brightness through software

4.3.6 View menu



Workspace: Show or close the workspace
Output information: display or close the output result list
Toolbar: Show or Close Toolbar
Status bar: Display off status bar

4.3.7 Help menu



User's Manual: Click to open the AVS User's Manual if you want to install the PDF Reader

4.4 Image display area

The image display area is used to display images and positioning results. The image can be zoomed and dragged. At the same time, the image search ROI is also displayed and set here. When multiple cameras are working, multiple camera images are displayed at the same time. If you need to operate which camera, you need to first click the left mouse button in the corresponding image, and then make corresponding The operation.

4.5 Workflow area

The currently used tool is displayed in the job flow list. You can drag it directly from the toolbox. Double-click the corresponding tool to populate the tool's attribute information. After configuring the tool's attribute parameters, click the OK button. At the same time right click on the tool can pop up the right-click menu, you can also set the property parameters of the tool, and you can delete the corresponding tool, use the mouse to drag the tool can adjust the order between the tools.

4.6 Toolbox

The Toolbar lists the currently available tools. There are 5 categories:

Image Tools: Functions for Image Acquisition, Storage, and Camera Parameter Settings

Processing tools: Image processing before positioning and result processing after positioning

Positioning tool: used for template operation and setting positioning algorithm parameters

Calibration Tool: Convert Pixel Coordinates to User Coordinates

Communication tool: Set serial port and network port parameters, communicate with external devices

4.7 Output information

Used to display the positioning results for each time, whether the display can be set in the menu settings -> system settings, in the absence of calibration, the XY coordinates displayed in the list are in pixels, after the calibration is in millimeters.

Chapter 5 ADTVision Operation Instructions

5.1 Hardware Connection

●Connect the power cable of the vision controller and connect the camera's power cable, IO control cable (needed for external hard triggering) and Gigabit Ethernet cable.

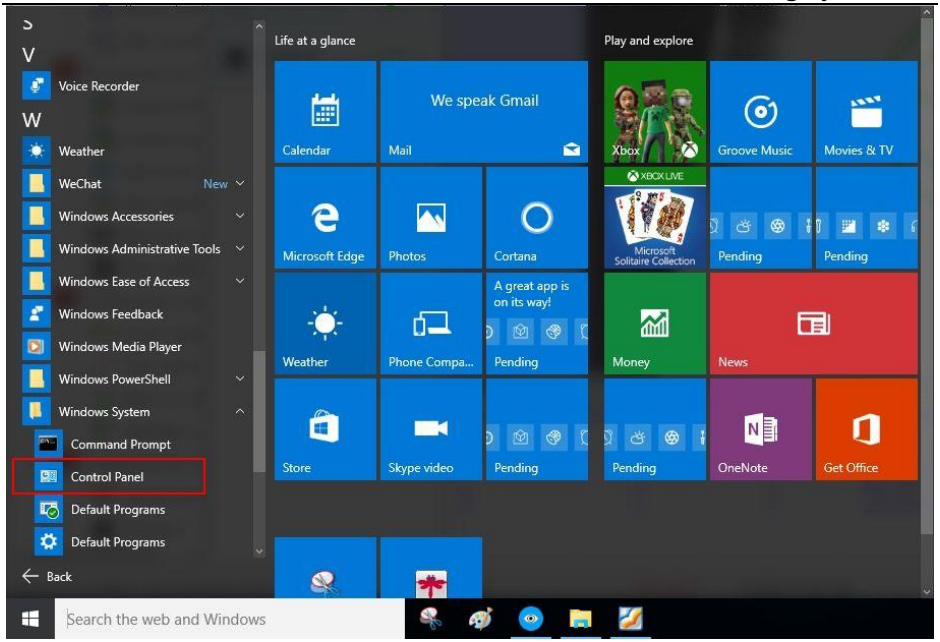
● Connect the mouse, keyboard, and monitor, and plug in the matching dongle.

● If you use hardware signal triggering, you need to connect the I/O input signal. The green line of the D1 series camera is Line0 positive, connected to the positive pole of 24V power supply, and the gray line is Line0 negative. It is connected to an output point of an external control device; the G1 series camera is yellow The signal line is Line1 positive, connected to the positive pole of 24V power supply, and the negative line is Line1. It is connected to an output point of the external control device. J1 series camera is Line0 positive optocoupler input, it is connected to the positive pole of 12V power supply, and green is the Line0 negative optocoupler signal. Ground, received an output point of an external control device.

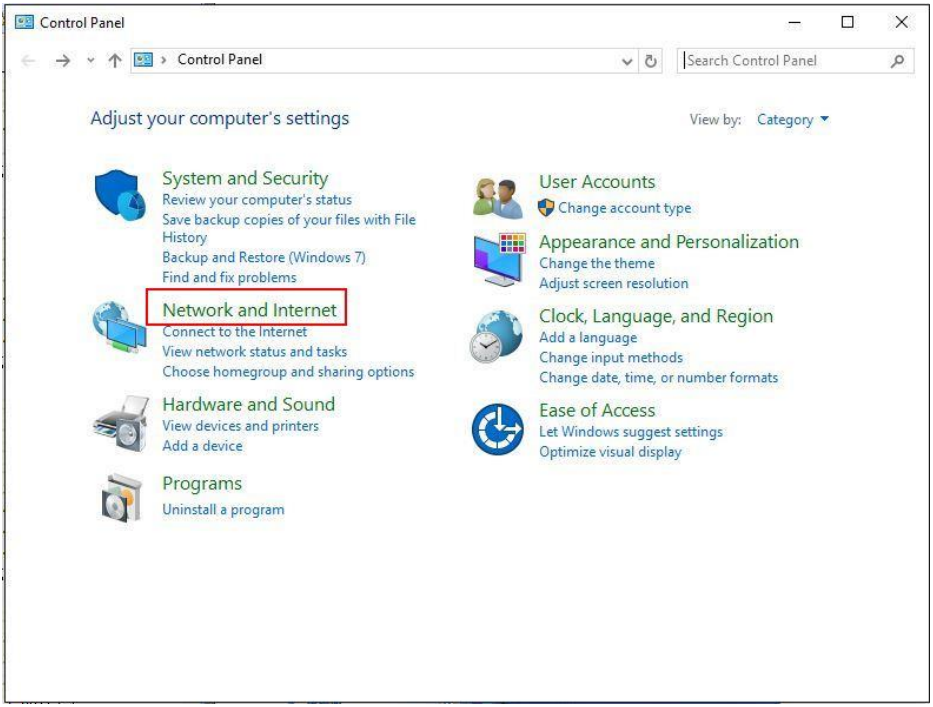
5.2 Software installation and configuration

● Configure the local controller IP address of the vision controller

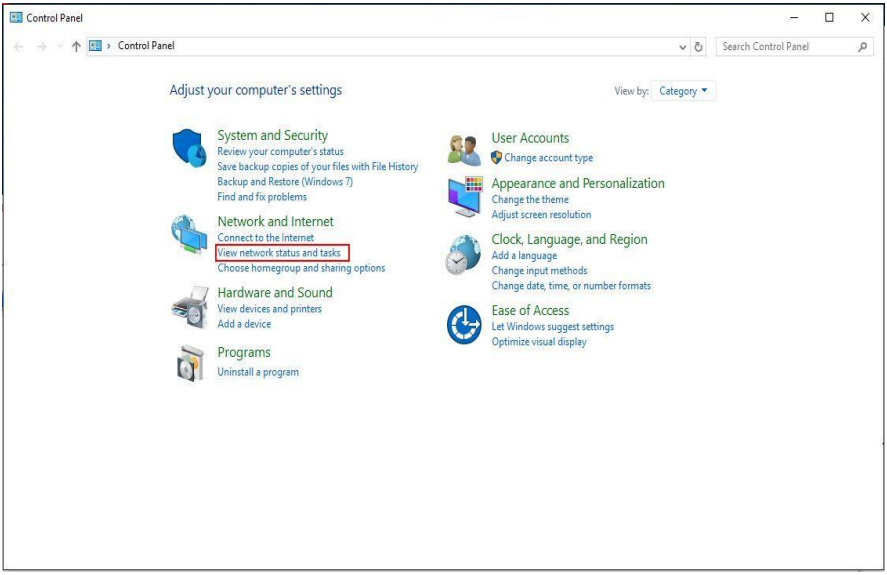
If it is an XP system, the configuration steps are as follows:



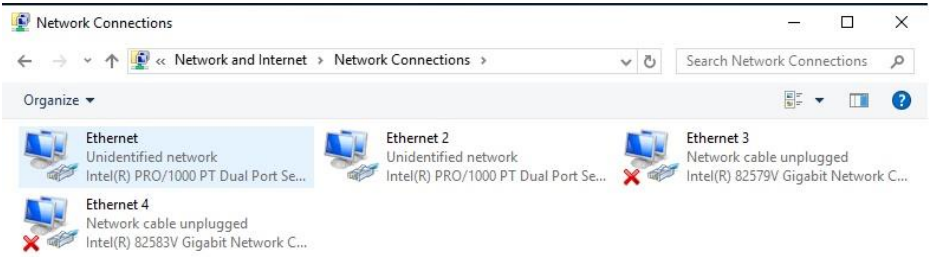
Click "Control Panel" in the Start Menu



In the Control Panel click "Network and Internet Connections"

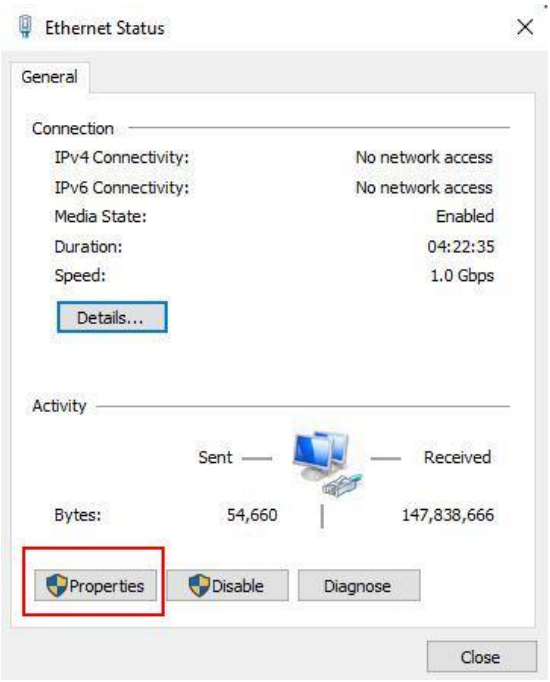


Click "Network Connections" in Network and Internet Connections

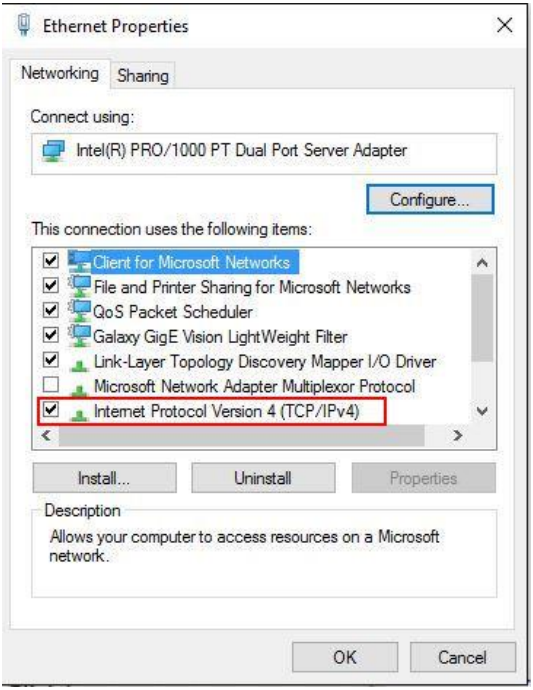


The figure above shows two local connections connected, one with the camera and the other with the robot

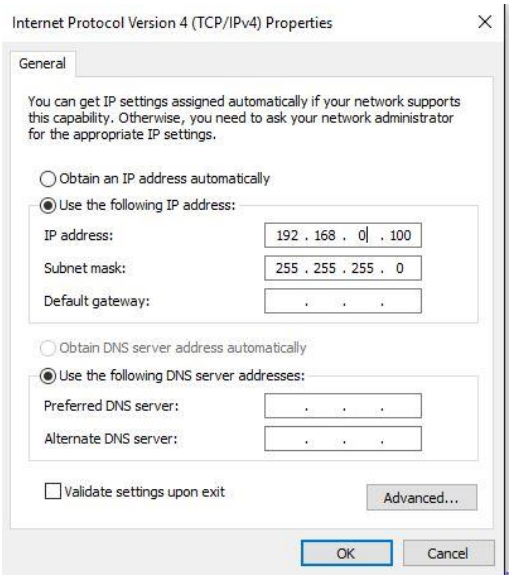
If you do not know whether a local connection corresponds to a camera or a robot, you can unplug one of the network connections. For example, if I unplugged the network cable from the camera, then the remaining connected local connection is definitely corresponding to the machine. , and then double-click this local connection to open the following dialog box



Click on "Properties"

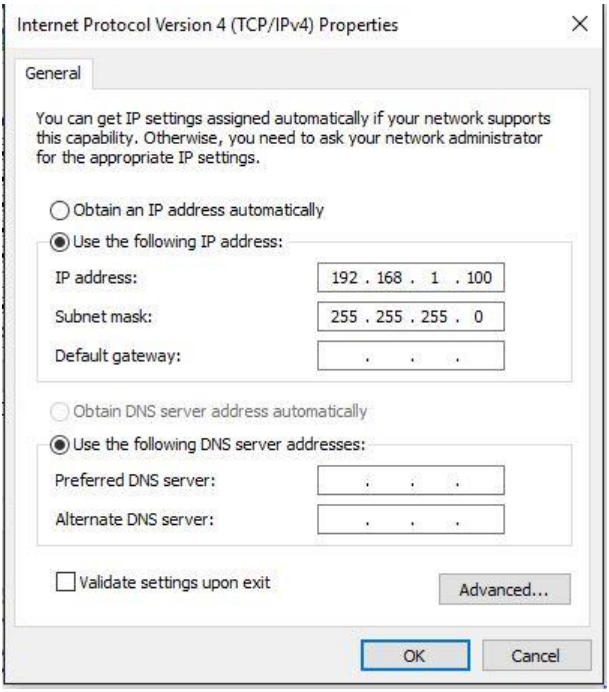


Double-click "Internet Protocol (TCP/IP)" to open the IP configuration dialog



After configuring the IP address of the network card that communicates with the robot, click OK

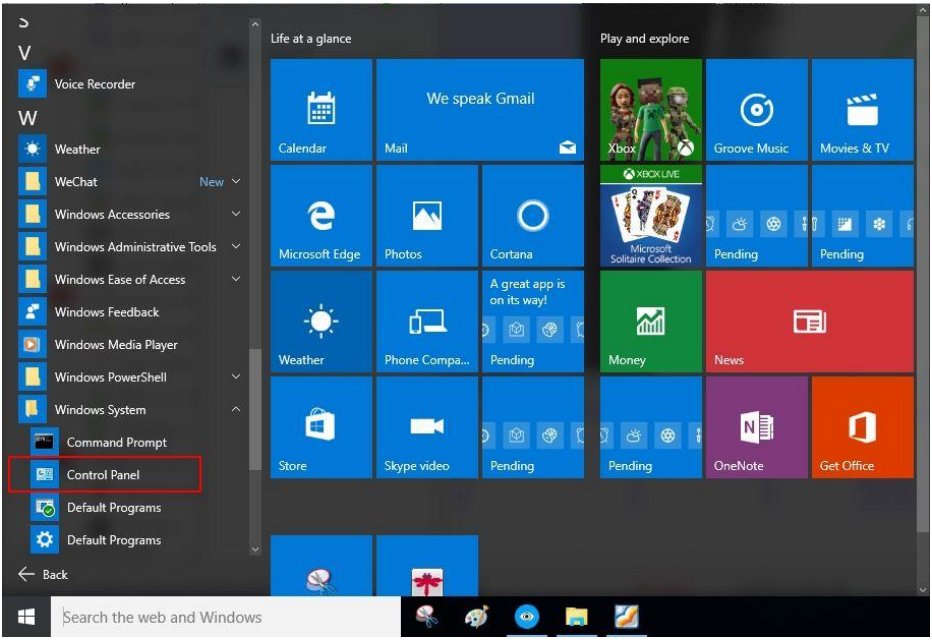
Connect the camera network cable, double-click the local connection to the camera, and configure the local connection's IP address in the same way as below.



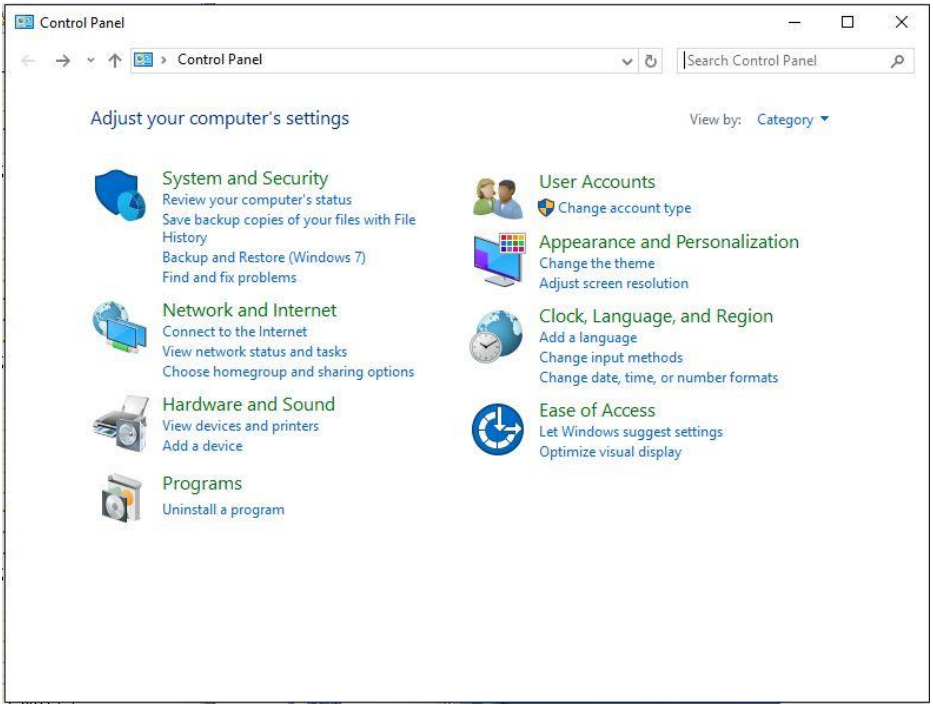
After configuring the IP address of the network card that communicates with the camera, click OK

Note: The IP address of the network card that communicates with the robot and the IP address of the network card that communicates with the camera need to be configured on different network segments.

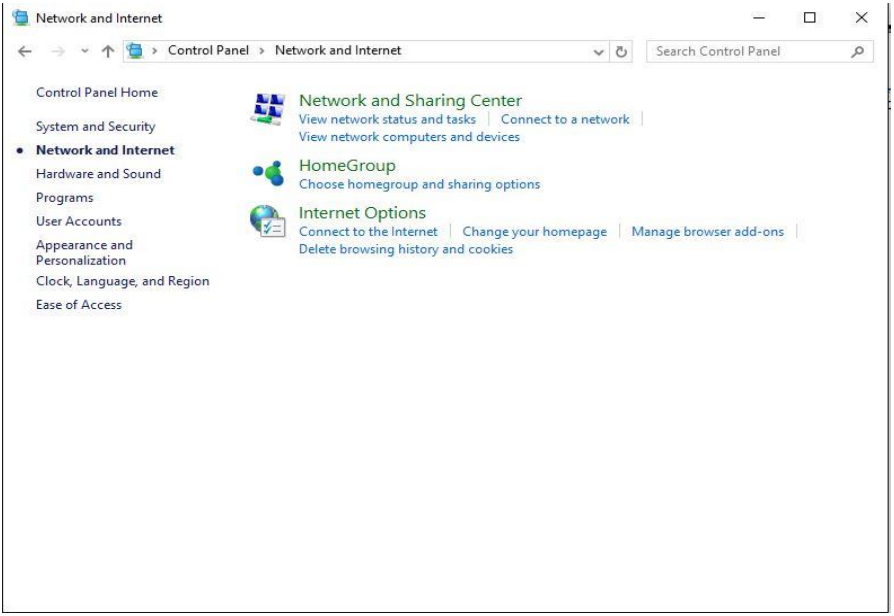
If it is a WIN7 system, the configuration steps are as follows:



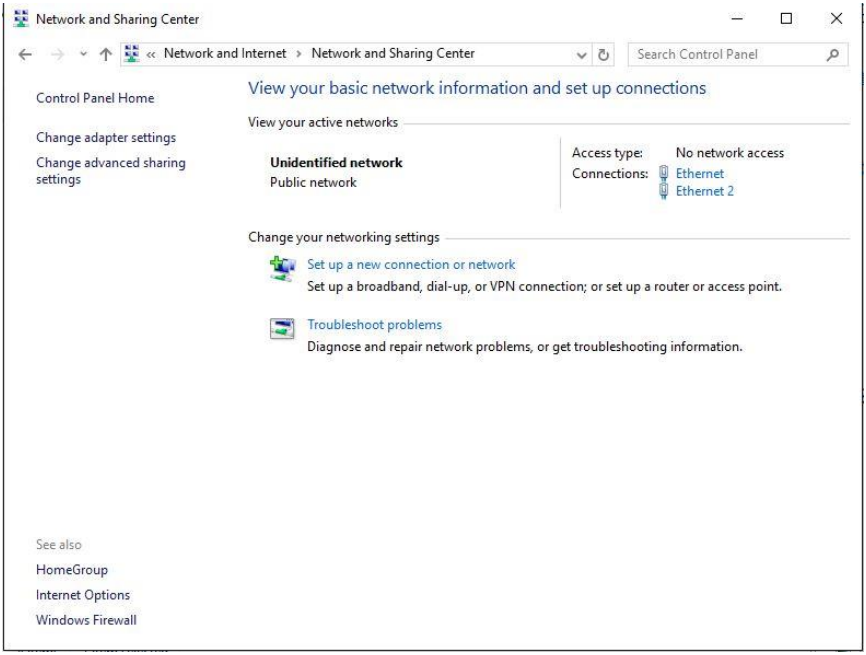
Click on the Start menu to open the Control Panel



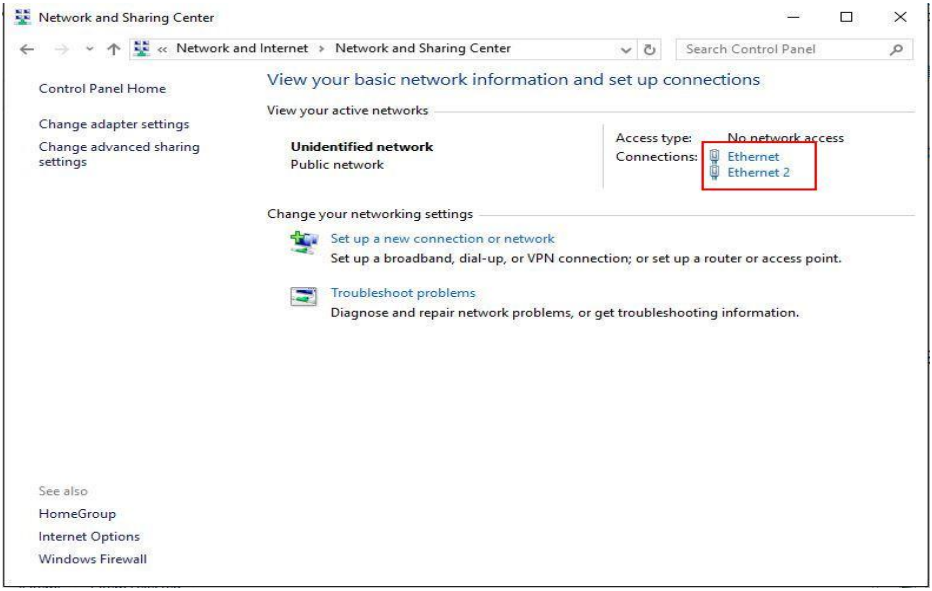
Click Network and Internet



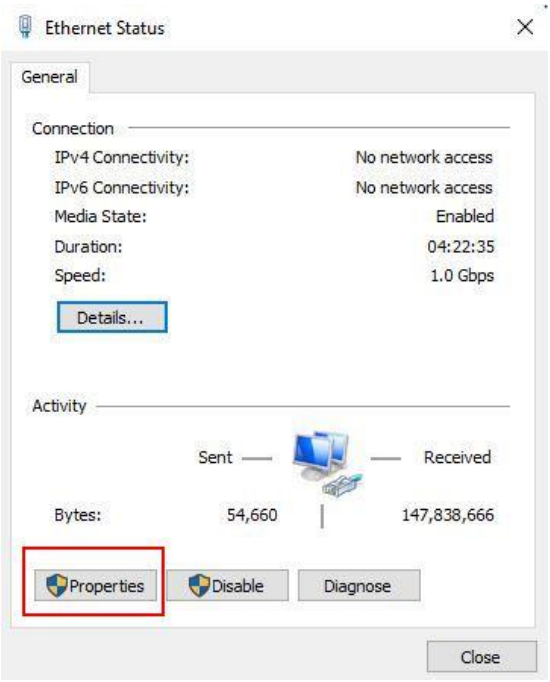
Click to view network status and tasks



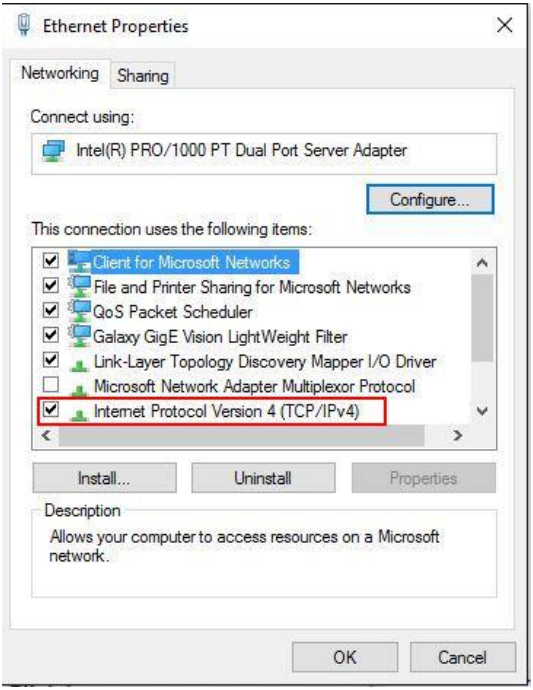
Two local connections are shown, one is the connection to the camera and the other is the connection to the robot



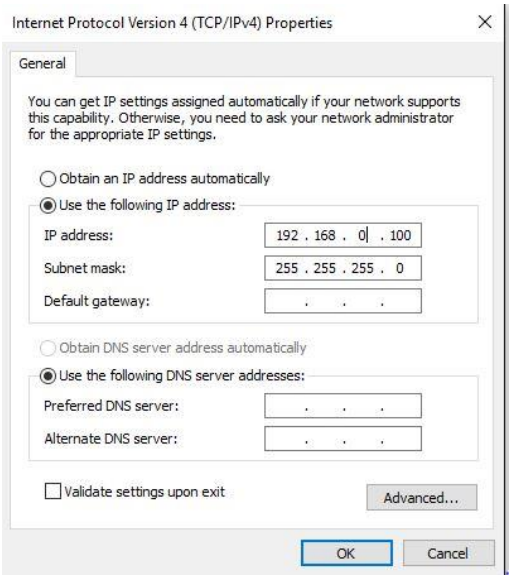
If you do not know whether a local connection corresponds to a camera or a robot, you can unplug one of the network connections. For example, if I unplugged the network cable of the camera, then the remaining local connection is definitely the corresponding to the machine. Click on the local connection.



Click on the attribute

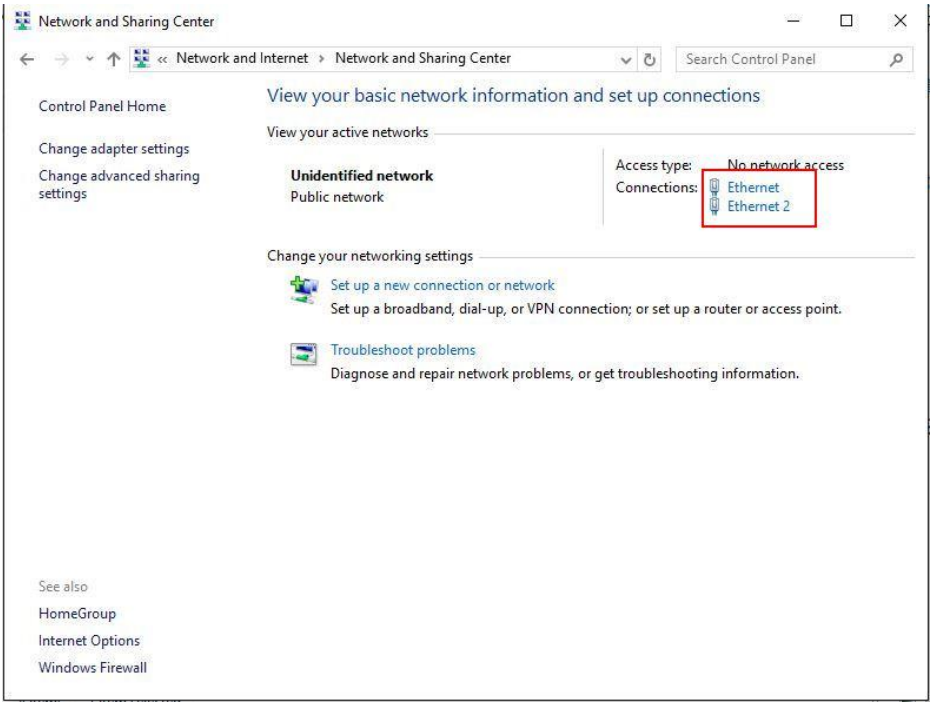


Double click on Internet Protocol 4 (TCP/IPv4)

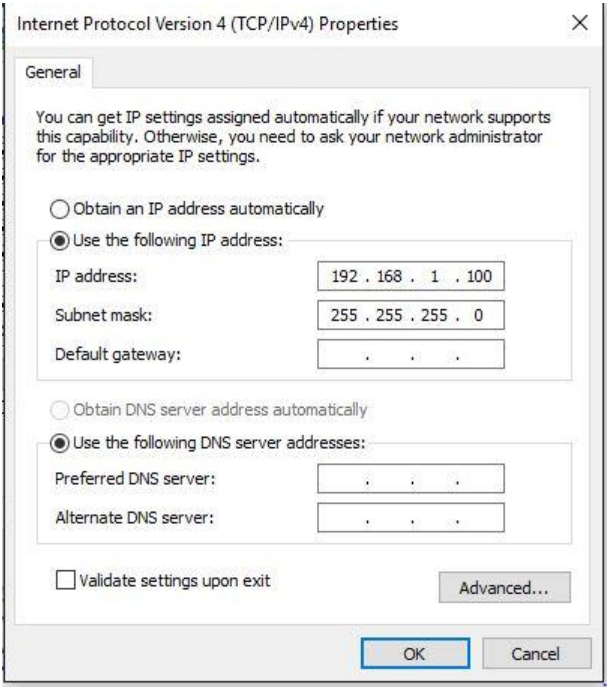


After configuring the IP address of the network card that communicates with the

robot, click OK



Connect the camera network cable, click on the local connection 3 connected to the camera, and configure the locally connected IP address in the same way



After configuring the IP address of the network card that communicates with the camera, click OK

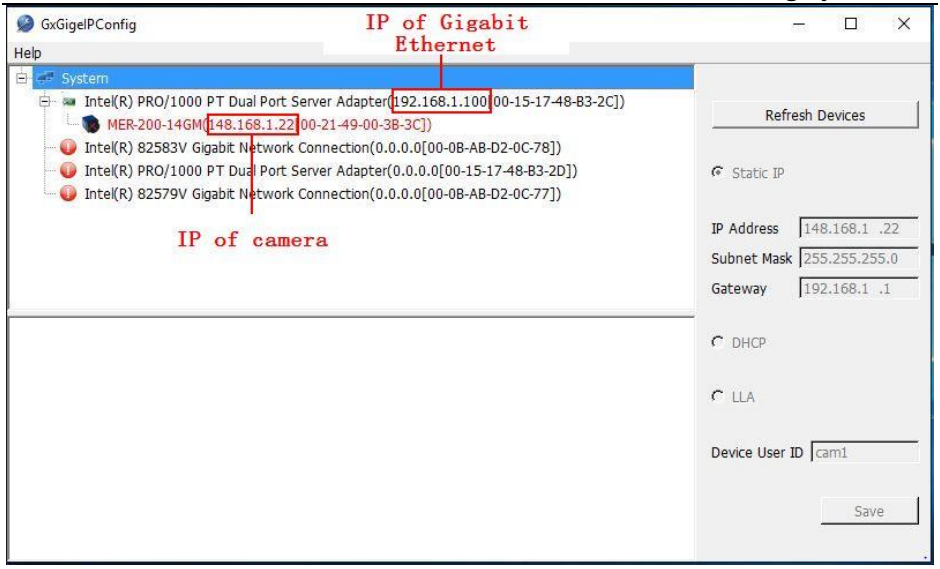
Note: The IP address of the network card that communicates with the robot and the IP address of the network card that communicates with the camera need to be configured on different network segments.

● Install camera driver and configure camera IP address

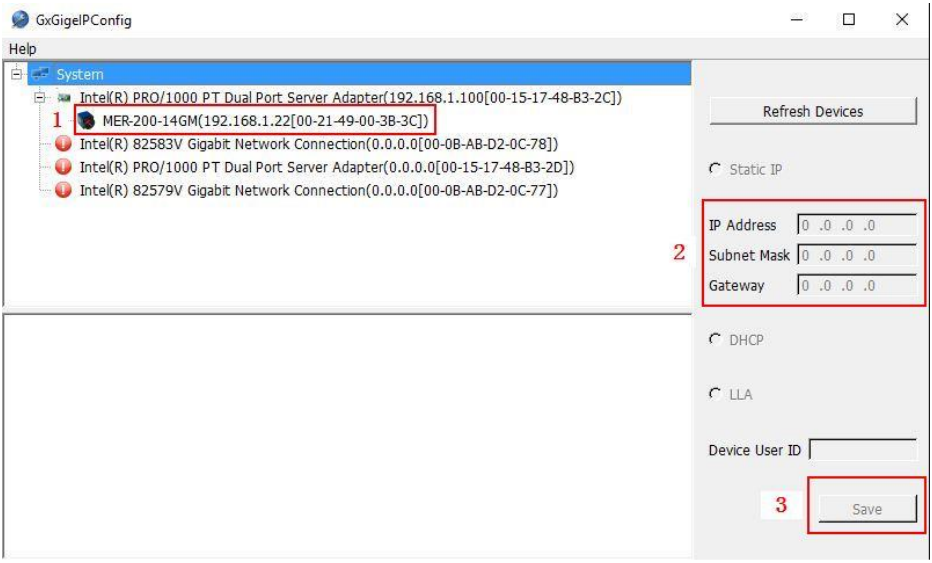
If it is a D1 series camera, the steps are as follows:

D1_Series_Cam_Driver_1609.rar

Unzip and run the camera driver installer shown above. After installation is complete, double-click the "GigE IP Configurator" icon on the desktop.  , The popup interface is as follows:



As shown in the above figure, when the camera IP and the corresponding network card IP are not in the same network segment, the font of the camera name line will turn red, indicating that the connection is unsuccessful. In this case, you need to modify the camera IP address.

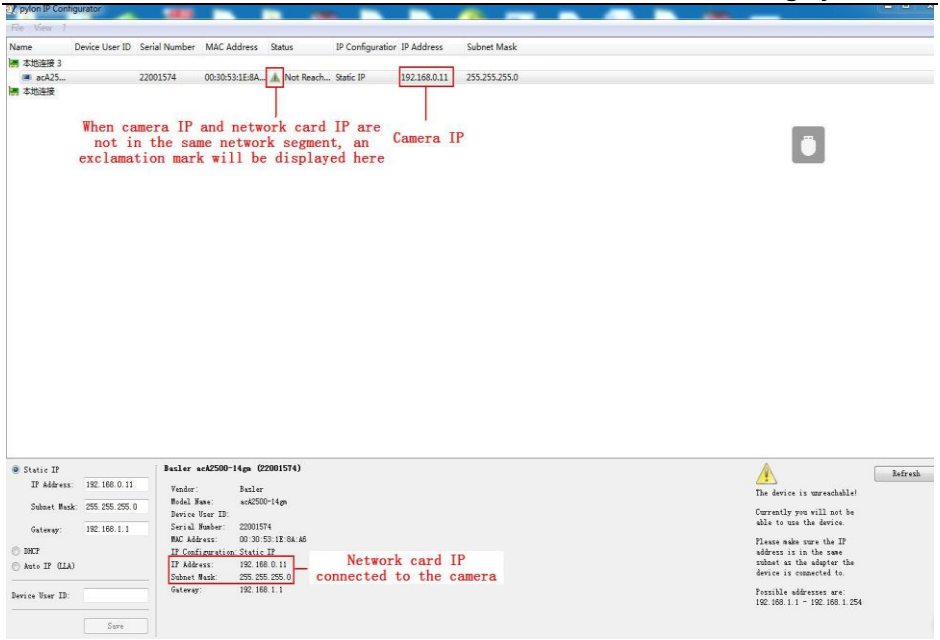


Click on the 1 part of the line, this time 2 parts become editable, modify the IP address of the 2 part, make it with the IP address of the network card above the 1 part on the same network segment, and then click the 3 part of the save settings, success After the first part of the font will become normal black, indicating that the camera and network card is connected properly.

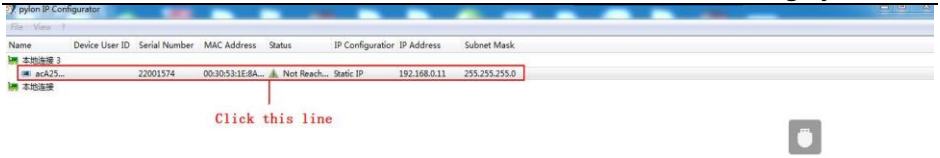
If it is a G1 series camera, the steps are as follows:

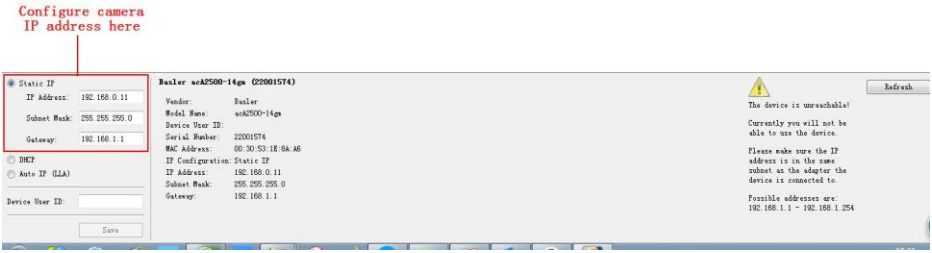
G1_Series_Cam_Driver_5.0.5.8999.rar

Unzip and run the camera driver installer shown above. After the installation is complete, double-click the "pylon IP Configurator" icon on the desktop. , The popup interface is as follows:

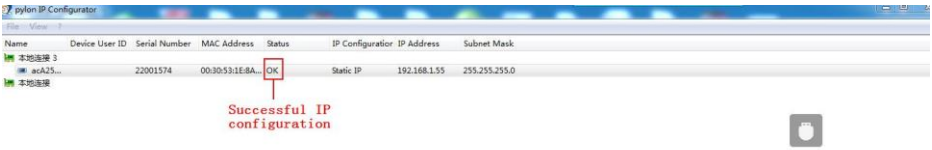


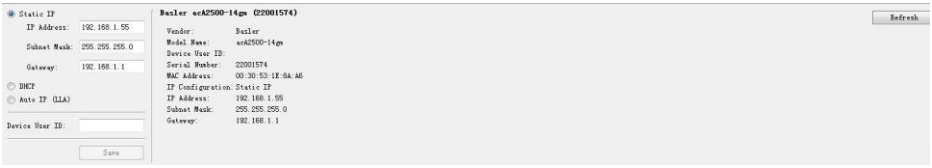
As shown in the above figure, you can see that the IP address of the camera and the IP address of the network card connected to the camera are not in the same network segment. Therefore, a yellow exclamation mark appears. In this case, you need to modify the IP address of the camera. The camera IP configuration method is shown in the following figure:





Click on the line where the camera is located. On the lower left side, select “Static IP” and enter the IP address of the camera. For example, if the IP address of the network adapter is 192.168.1.124, then the IP address of the camera must also be 192.168.1.x. x represents 2 to 254. A number between the "Subnet Mask" subnet mask must be 255.255.255.0, the default gateway is generally set to 192.168.1.1, you can not set. After the setting is complete, click the "Save" button on the lower left side. The result of the successful configuration is shown in the following figure:





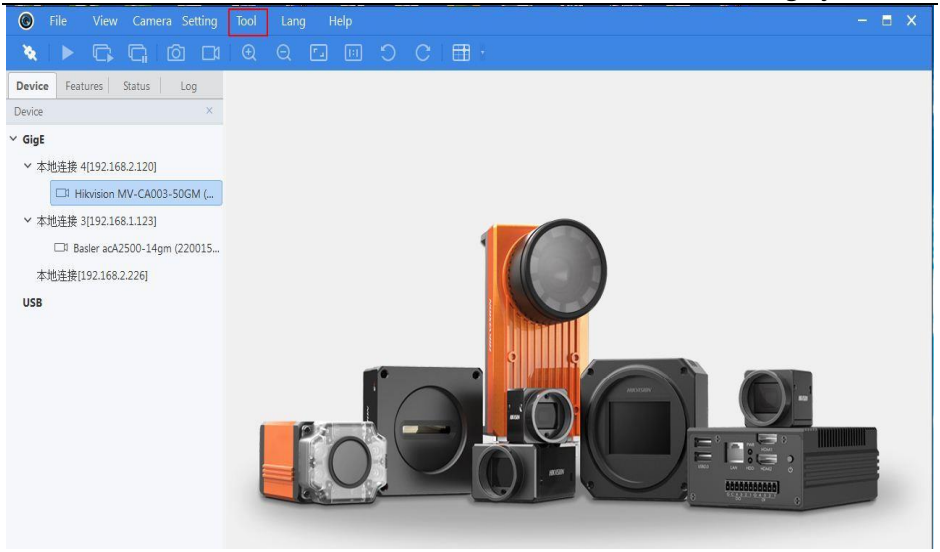
Note: After the camera IP address is configured, do not modify the IP address. When using the G1 series multi camera, be sure to configure the camera IP address on different network segments, that is, the third digit of the IP address is different.

If it is a J1 series camera, the steps are as follows:

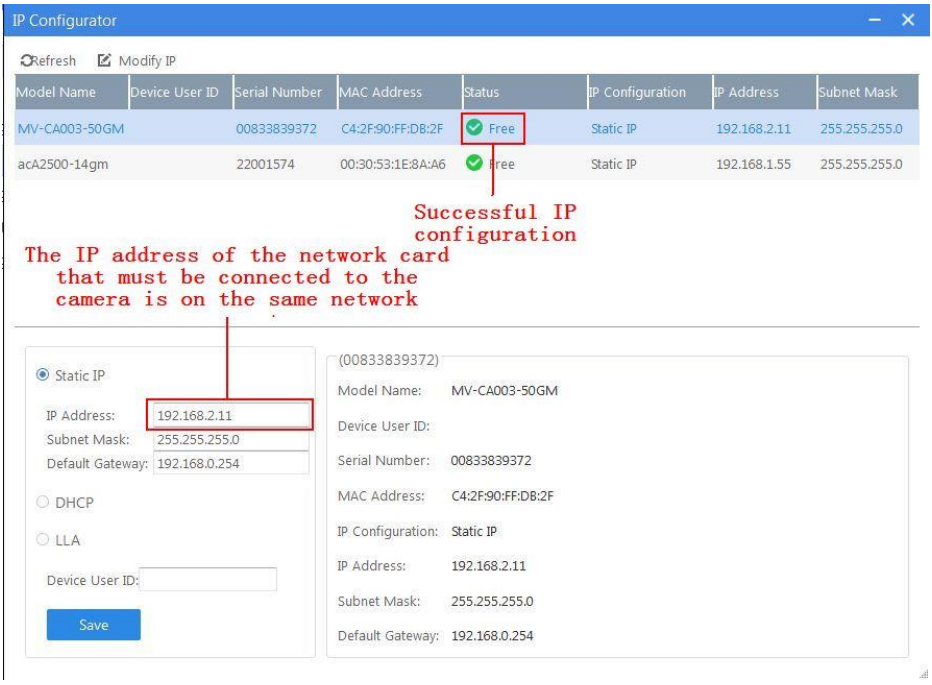
J1_Series_Cam_Driver_2.3.1_171129.rar

Unzip and run the camera driver installer shown above. After the installation is complete, double click to launch the "MVS" icon on the desktop. 

, The popup interface is as follows:



As shown above, click the "Tools" menu, then click "IP Configuration Tool" to open the following interface



Select “Static IP” and enter the IP address of the camera. For example, if the IP

address of the network adapter is 192.168.1.124, then the IP address of the camera must also be 192.168.1.x. x represents a number between 2 and 254. “Subnet Mask” The netmask must be 255.255.255.0. The default gateway is generally set to 192.168.1.1, and it may not be set. After setting, click the "Save" button on the lower left side.

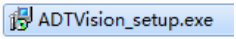
● Install the dongle driver

MicroDog_Driver_4.0.16.4.rar

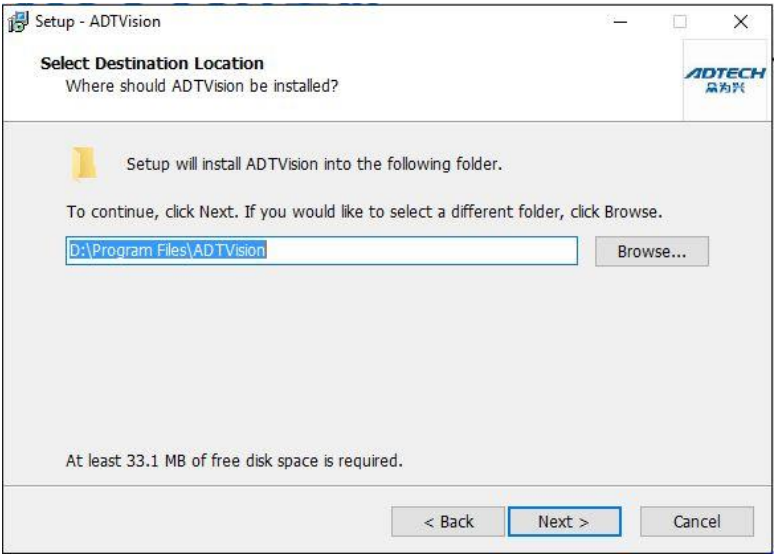
After decompression, directly run MicroDogInstdrv.exe software. The interface after startup is as follows:

Just select the USB dongle driver, click Install to install the dongle driver that corresponds to the operating system.

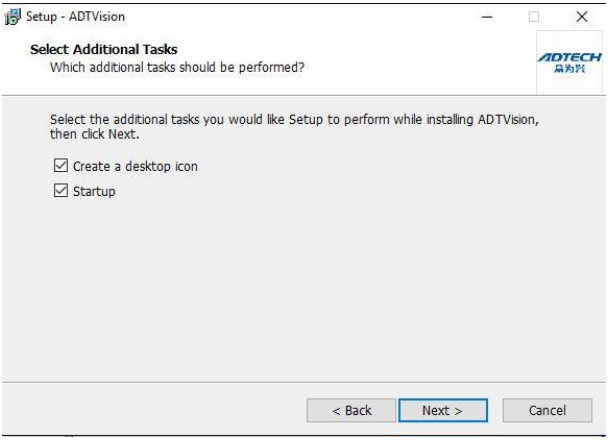
● Install vision software ADTvision



Before the installation, it is recommended to exit 360 anti-virus software, double-click to run ADTvision installation program, the installation interface is as follows:

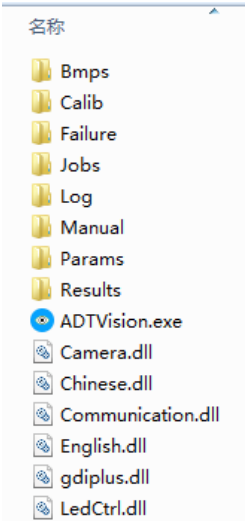


Installation location It is recommended to install a disk other than the C drive to prevent information loss due to system failure.



Choose whether to create a desktop shortcut and start up.

The installation is complete.



Installation directory main folder description:

Bmps: When saving a picture, the default popup save path will point to the folder, and the user can also specify the save path.

Calib: Stores the calibration board description file and the pdf file that can be used to print the calibration board.

Failure: store the image when the positioning fails

Jobs: Store job files and template and calibration parameters

Log: Stores the system log.

Manual: Storage Software Instruction Manual

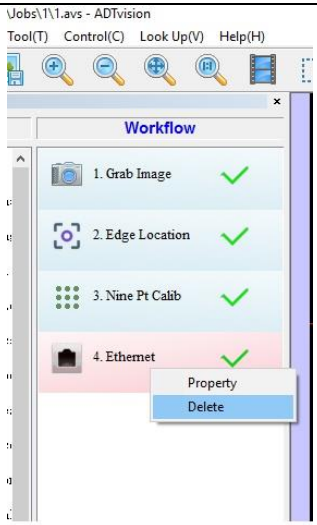
Params: store system settings parameters, the default path, the user can not be changed.

Results: Stores the positioning result, the default path, which cannot be changed by the user.

5.3 New job flow

Click the "New Job" button in the toolbar to create a new blank job flow. If the current job that has been modified at the time of creation is not saved, it will prompt whether to save the current job. Click the "Save" button in the toolbar to save the current job to a file. The software will automatically record the path of the last 4 job flow files. When the software is started, the latest one will be automatically loaded by default. If the latest job flow list is cleared, an empty job flow will be opened after the software starts. .

When creating a job flow, you can use the left mouse button to drag the corresponding tool from the toolbox to the process list according to the actual work needs. You can delete unnecessary tools in the right-click menu. Under normal circumstances only need to collect images, edge location, user coordinates and Ethernet four tools, for example, as shown below.

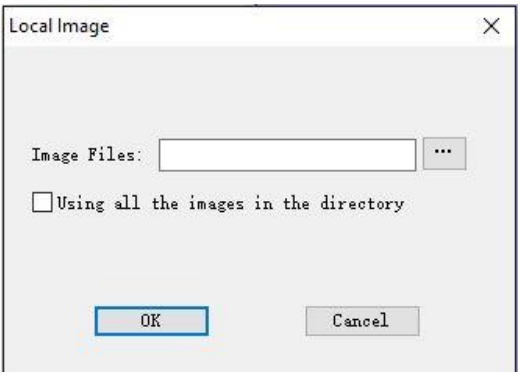


If the tool attribute parameters in the workflow are incorrectly configured, an error message will appear when the navigation button is clicked, and the icon behind the misconfigured tool will have a red cross.

5.4 Set tool parameters

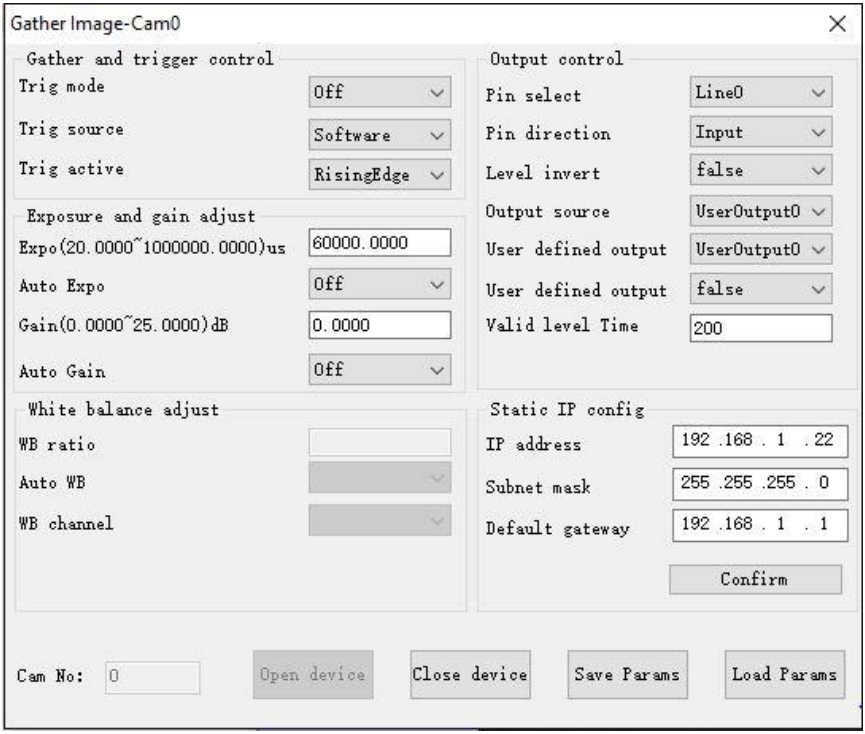
Double-click on the corresponding tool, or click "Properties" in the context menu to open the parameter setting interface of the corresponding tool.

5.4.1 Local image tools



The local image tool loads the BMP format image from the local file for positioning. In the absence of the camera, it can be used instead of the camera's image capture function to perform positioning operations. It can be used to verify the feasibility of the program and the positioning of the demonstration software. Features. If “Use all images in the directory where the image file is used” is checked, all images in the corresponding directory will be used for positioning during positioning, otherwise only the currently selected image will be positioned.

5.4.2 Collecting Image Tools



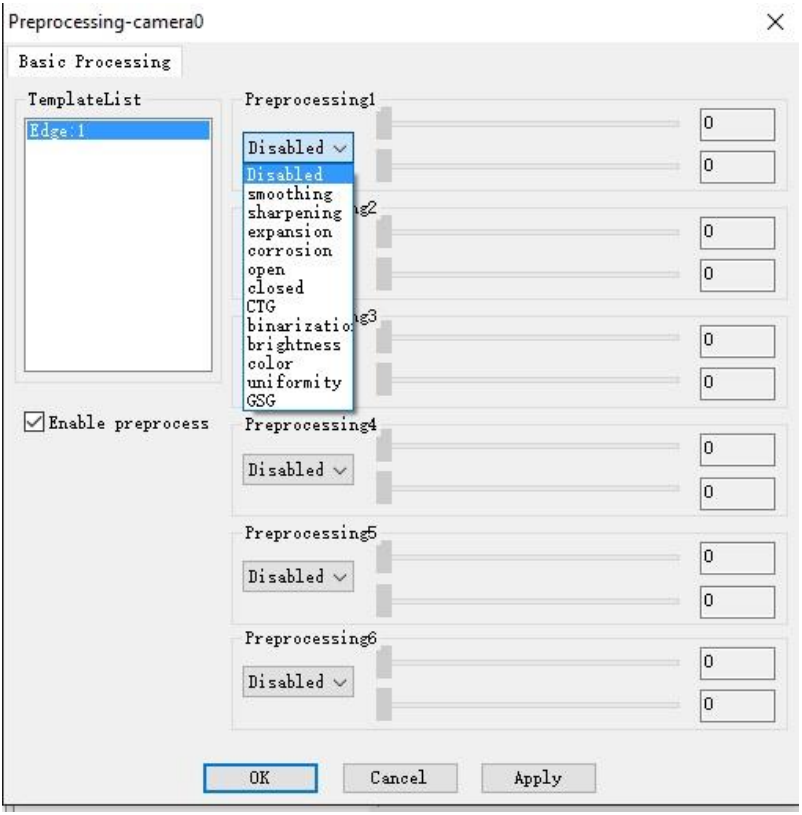
The Acquisition Image tool collects images from the camera as a data source. The main operations under this interface are:

- Camera No.: The camera number of the current operation
- Turn on the device: Open the currently selected camera
- Turn off the device: Turn off the currently selected camera
- Save parameters: Save camera parameters to a file
- Load parameters: Load camera parameters from file

The capture image tool can also configure some basic camera parameters. The most important ones are the trigger mode, trigger source, and exposure. Other parameters can be kept at their default values when used. When the trigger mode is set to on, the camera needs to complete the image acquisition through the trigger signal; when it is set to off, the camera is in the continuous acquisition mode, and the captured screen can be displayed in real time. The setting effect of the trigger mode is equivalent to the operation toolbar. On the button. When the trigger source is set to software, you can trigger the camera acquisition and positioning through the network and serial port commands; when set to Line0, you need to trigger the camera acquisition and positioning through the input signal Line0, and you need to connect the output point of the external control device to the camera. For the specific wiring method, see section 3.2.3. The longer the exposure time is, the brighter the image is, and the more suitable it is for shooting a stationary object. Shooting the moving object will produce a ghost phenomenon. The exposure time is short and the image is dark. It is suitable for shooting moving objects. In static positioning, it is recommended to keep the default exposure value. During dynamic positioning, the exposure time can be reduced, and the brightness loss of the image can be compensated by increasing the brightness of the external light source. **Note: "Capture image - Camera 0" on the title bar in the upper left corner of the dialog box indicates that camera 0 is currently being operated. You can use the left mouse button in the image display area to click the camera's corresponding window to switch the currently operating camera.**

5.4.3 Preprocessing tools

In general, no preprocessing tools are needed unless the image quality is very poor.



Smooth: can suppress the noise of the image, but it will lose the details of the image

Sharpening: Contrary to smoothing, it enhances the details of the image, but it amplifies the noise

Swell: Makes the image brighter and reduces or eliminates dark details

Corrosion: Makes the image darker and can reduce or eliminate bright details

On: removes small bright details, keeping the overall grayscale and larger bright areas unchanged

Closed: Removes darker details, leaving relatively bright parts unaffected

Color-to-gray: Available when using a color image, it is possible to convert a color image into a single-channel grayscale image

Binarization: The image is binarized. Only keep the black and white parts.

Brightness adjustment: The brightness value of the image is enhanced by a

software algorithm.

Reverse color: Whites the dark part and blackens the bright part.

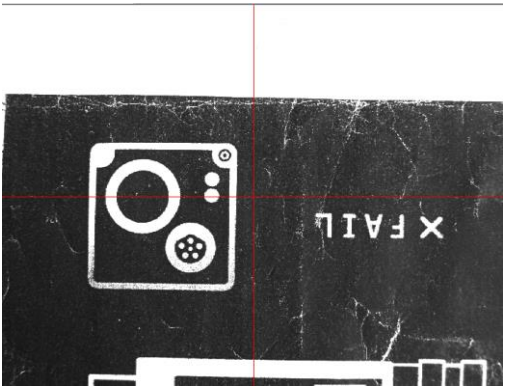
Uniform: Equalizes the image grayscale, making the overall brightness of the image more uniform.

Grayscale Stretching: Use grayscale stretch to enhance contrast when image contrast is not noticeable.

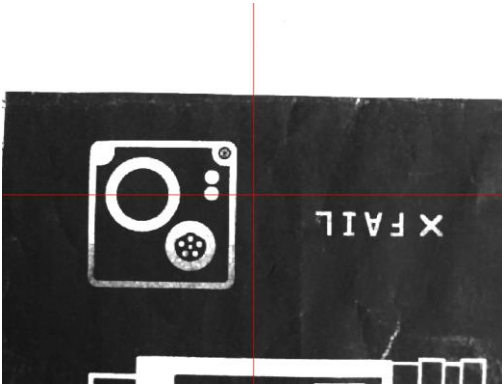
Gradient: Images that are represented by edge gradient values can enhance the edges.

Enable preprocessing: check to enable preprocessing

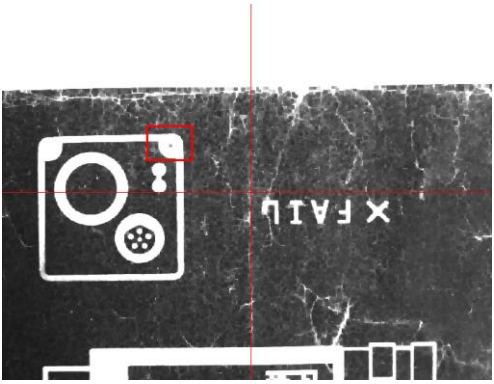
The leftmost digits indicate the order in which the preprocessors are executed, and different combinations of sequences can achieve different image processing effects.



Original image

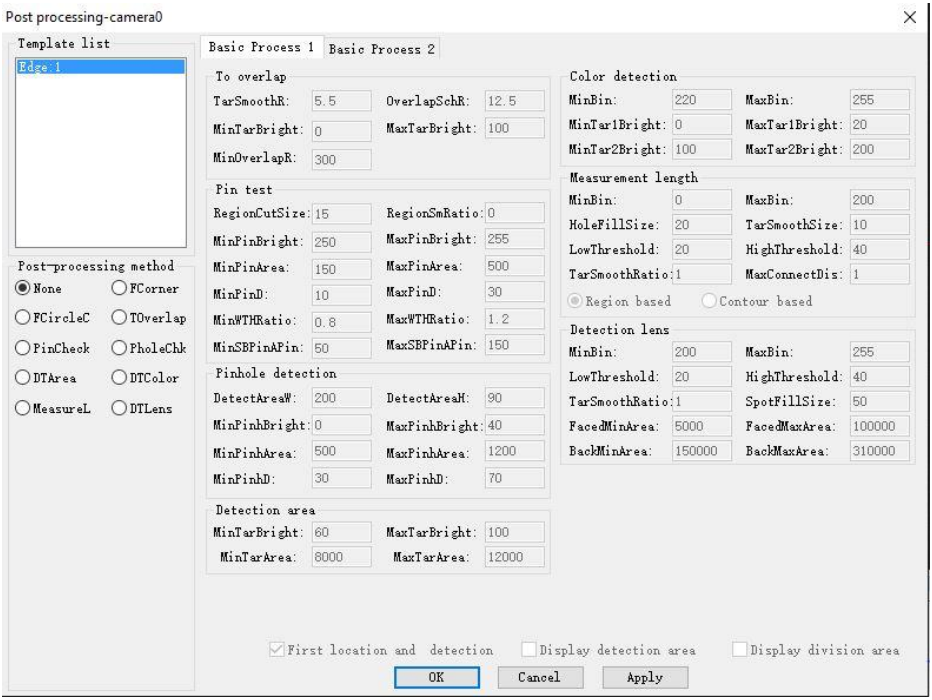


Turn on, filter out small bright details



Close, filter out small dark details

5.4.4 Post processing tools



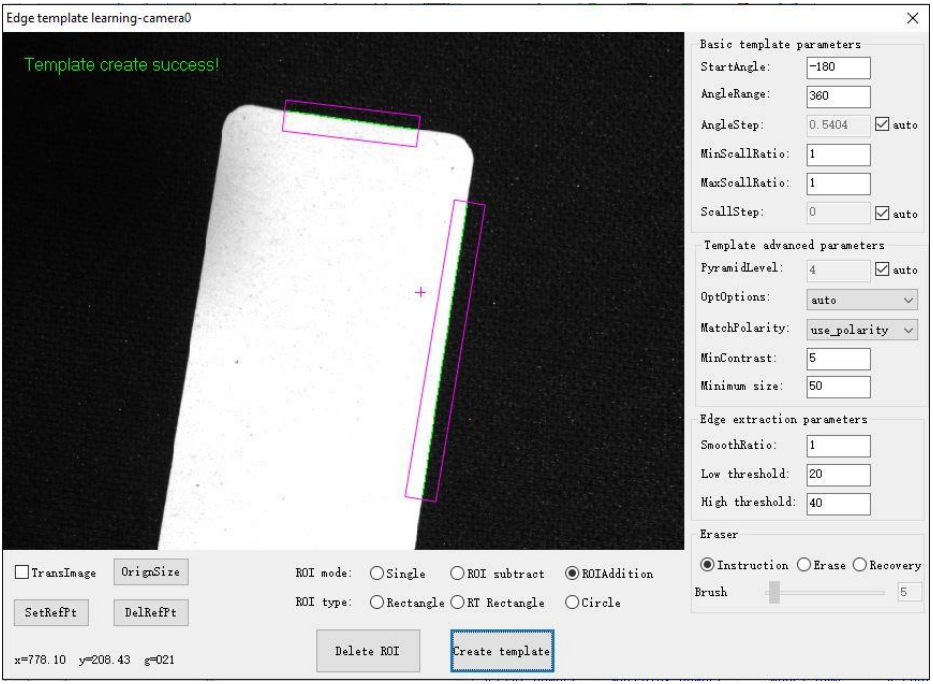
Template list: Displays the name of the template learned and loaded in the "Edge Positioning" and "Region Positioning" tools. The post-processing parameters are

at the template level and can be set separately for each template.

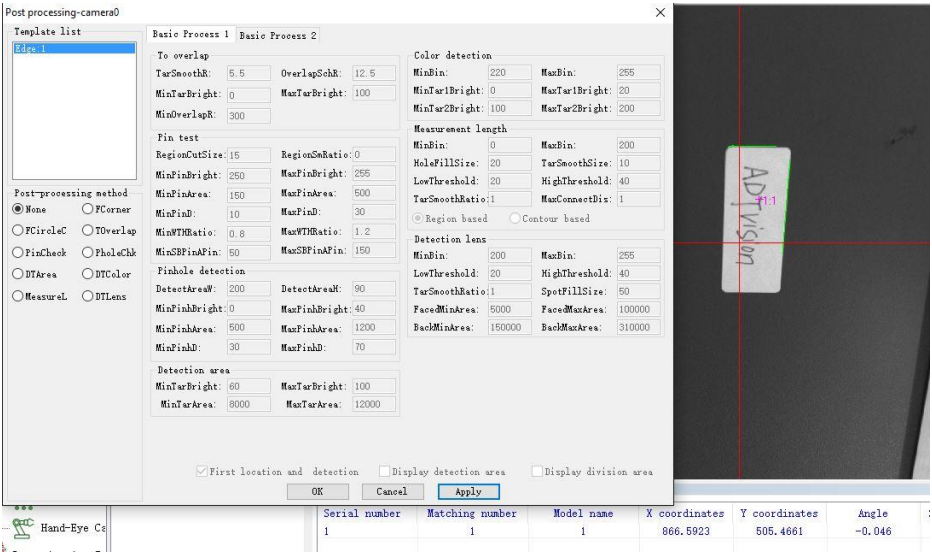
Post-processing method: None, indicating no post-processing; seeking corners, means that the template contours are straight-lined, and the intersection of the fitted lines is used as the positioning result. When it is necessary to accurately know the coordinates of a corner point of an object, You can choose this method; find the center of the circle, indicate the circle fit to the edge contour that is located, and use the center of the circle as the positioning result. When the target is a circular object and the contour is incomplete, you can use this method; de-overlap, when the target overlaps. When the overlapping target cannot return a result, this method can be selected; the area is detected, and when the positioning is completed, the pixel area of the gray value is set in the area.

De-overlapping parameters: These parameters can be set when the de-overlapping method is selected. Smooth Radius: Default 5.5, generally no setting, overlapping search radius: how far apart the two targets are considered to overlap; the target minimum and maximum brightness, the minimum brightness and maximum brightness in the pixels included in the target object; the minimum overlap area: two target overlaps The area is considered to overlap;

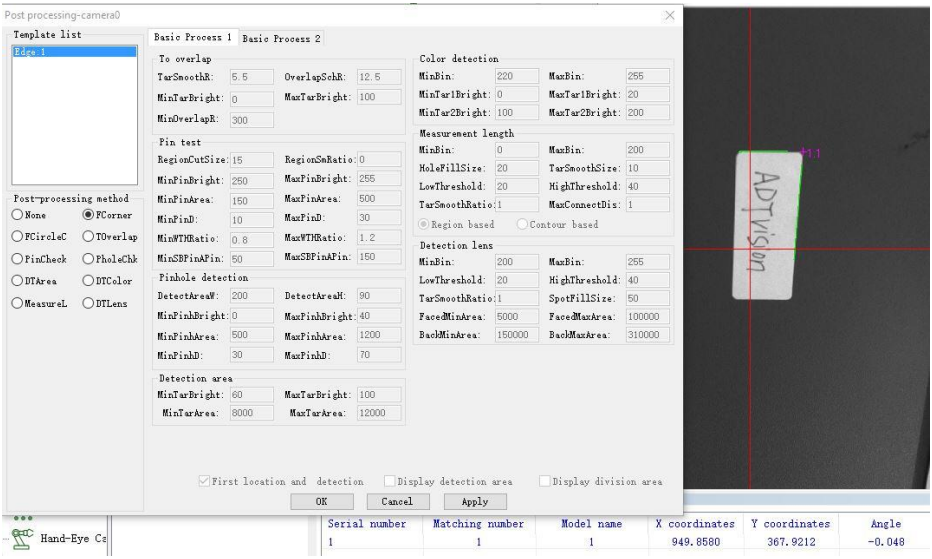
Display target area: contains the pixel area from the minimum brightness to the maximum brightness, displayed in red



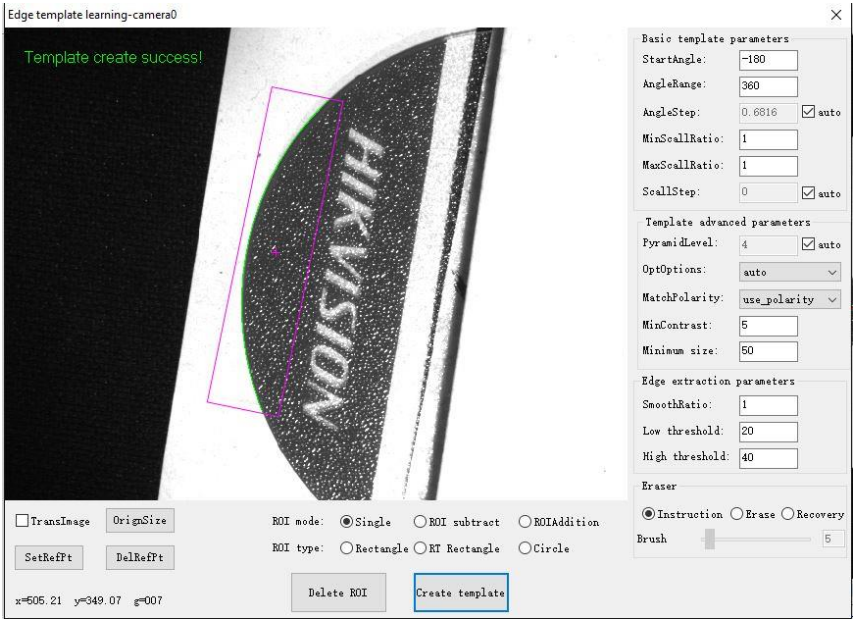
Finding points of intersection, template learning



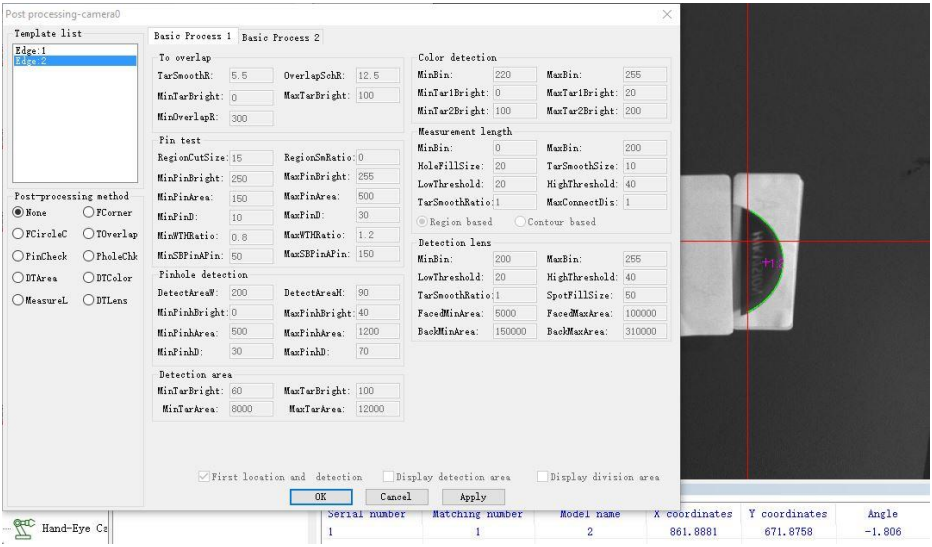
Do not enable the corner



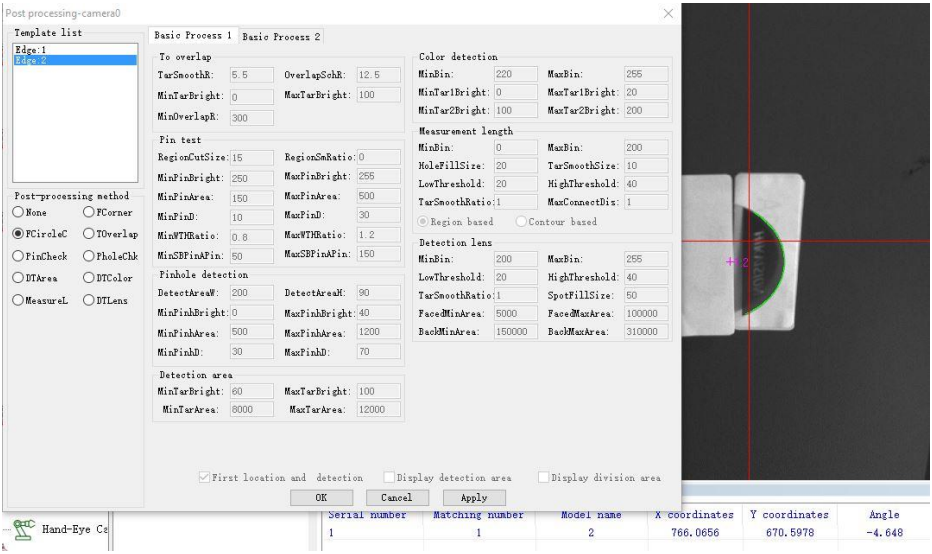
Enable the chamfer point



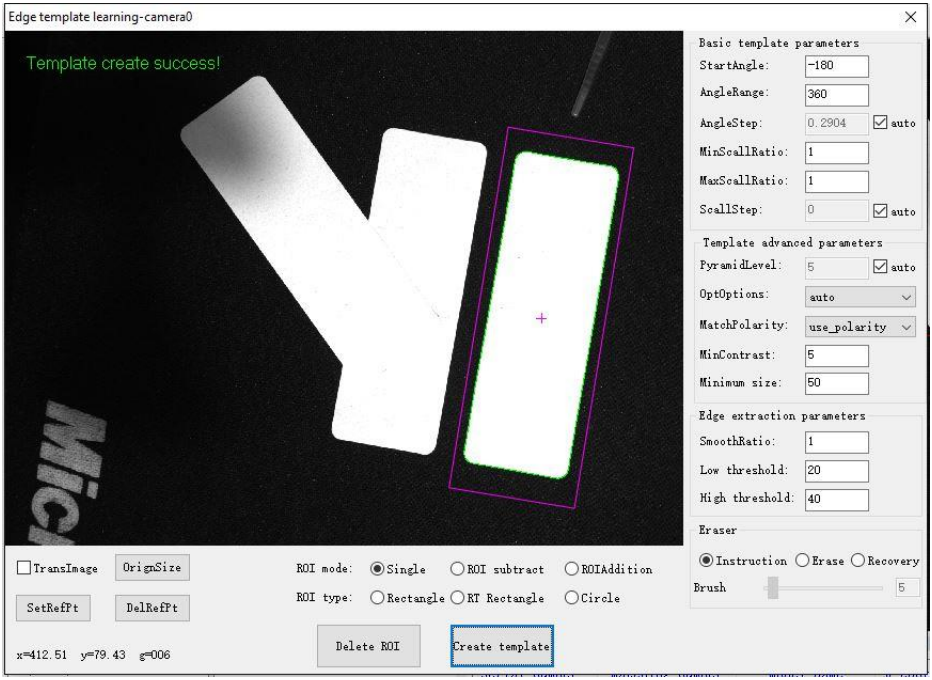
Circular objects, with only partial outlines, template learning



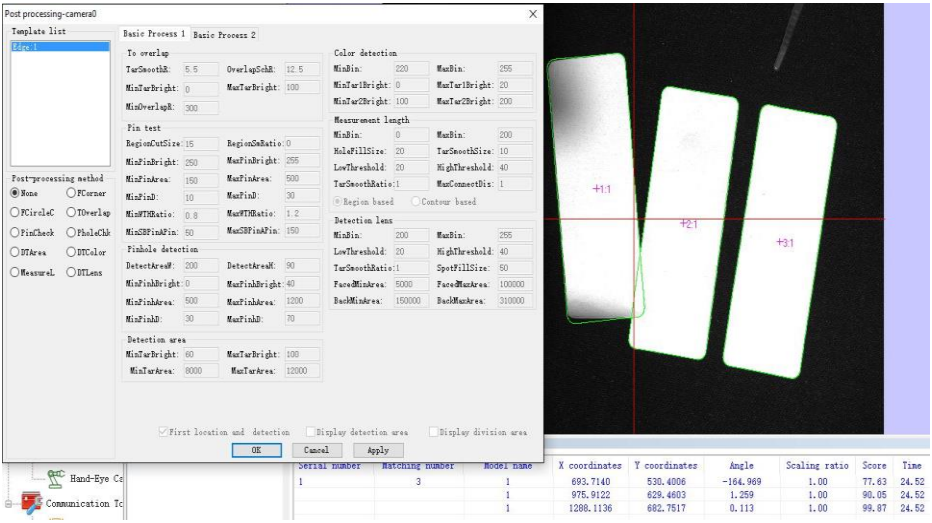
Do not enable finding the center of the circle



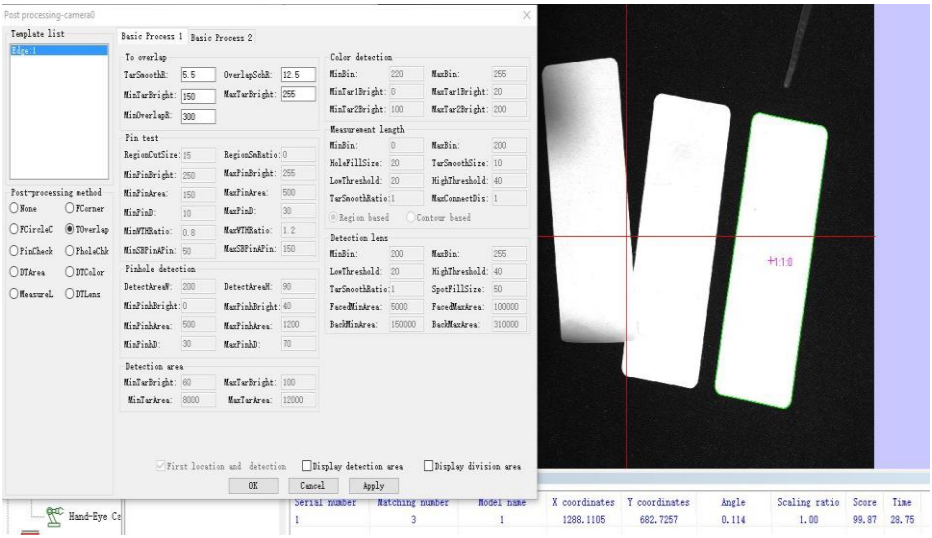
Enable finding center



To overlap, template learning



Do not enable to overlap

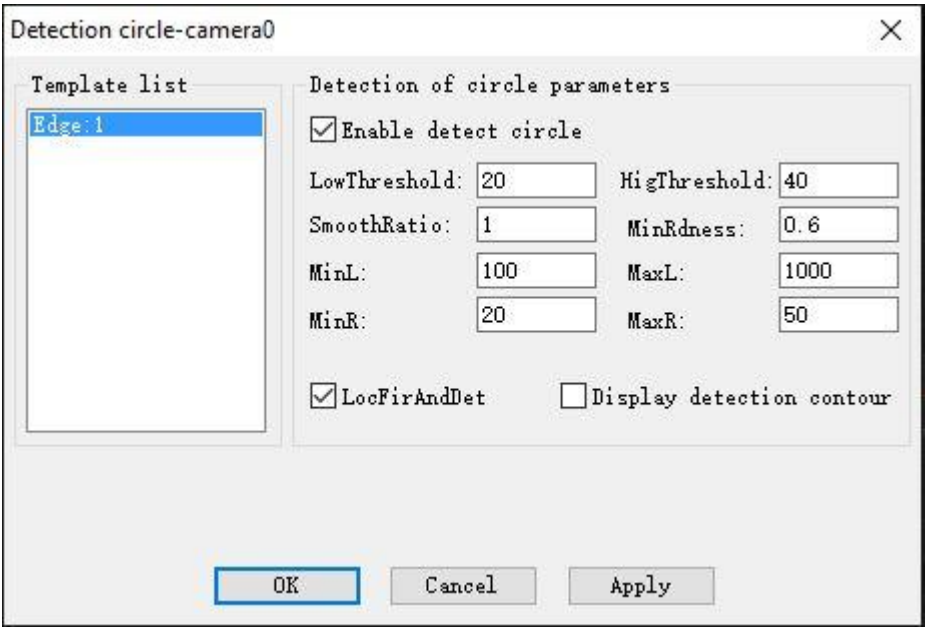


Enable to overlap

5.4.5 Detect circle tool

The detection circle tool is mainly used to detect whether the located image satisfies the set circle parameters and is used to reject materials that do not meet the conditions. Set the parameters as shown

below.



Template list: Select the template that needs to detect the circle function.

Enable detection circle: Check the Enable detection circle to indicate that the currently selected template uses the function of detecting a circle.

Low-amplitude threshold: The minimum setting for the minimum sub-pixel precision is extracted when detecting a round contour.

High Amplitude Threshold: When detecting a round outline, the minimum setting for the sub-pixel precision is extracted.

Smoothing coefficient: Select whether to smooth the circle contour. Used for contour discontinuities.

Minimum circularity: When you select to detect the circular contour, the circularity is 1 at the maximum and 0 at the minimum. The greater the value is, the closer to the circle is, and the value less than the value is not extracted.

Minimum length: Select the minimum value of the perimeter when detecting the circle contour. Less than this value will not be extracted.

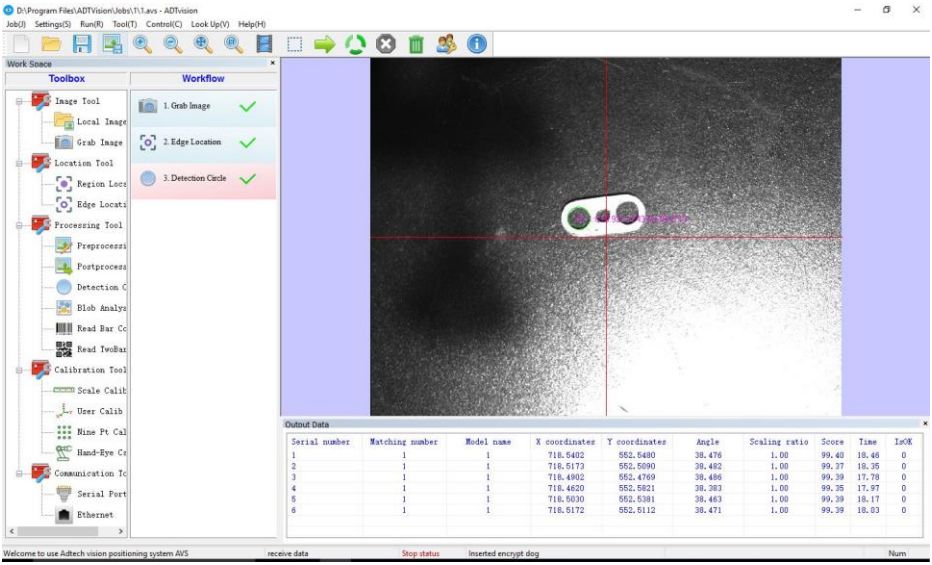
Maximum length: Select the maximum value of the perimeter when detecting the circle contour. If it is greater than this value, it will not be extracted.

Enable detection after positioning first: After checking this function, the template

will be positioned first and the circle parameters will be detected.

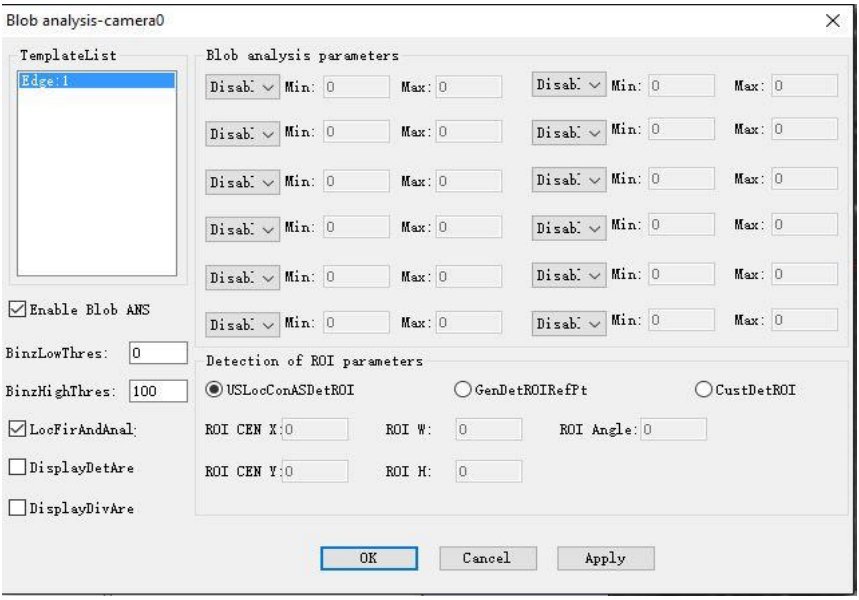
Display detection profile: After checking this function, the detected circle parameters will be displayed in red.

The circle detection parameters are shown in the figure below:



5.4.6 Blob analyzing tool

The Blob analysis tool is mainly used to detect relatively subtle features or irregular features or regions where the grayscale changes are relatively large. Commonly used places are scratch detection of glass or defect detection of drugs and mechanical parts. The parameter settings are as shown below.



Template list: Select the template for which you want to enable the Blob analysis tool.

Enable blob analysis: Check Enable blob analysis to indicate that the currently selected template uses the blob analysis tool.

Binary Low Threshold: When the blob analysis tool is enabled, the binarization minimum value is less than the value is not extracted.

Binarization High Threshold: When the blob analysis tool is enabled, the binarization maximum value is greater than the value is not extracted.

First Position after Analysis: Select this function to indicate whether to perform positioning template analysis first or not.

Display detection area: Check this function to indicate that the positioning detection result will be displayed after a single job. Light green.

Display split area: Check this function to indicate that the split binarized area will be displayed.

Blob Analysis Parameters: The analysis parameters include 12 parameters that can be analyzed such as area, roundness, center X, center Y, squareness, etc. Different parameters can be combined to achieve different results.

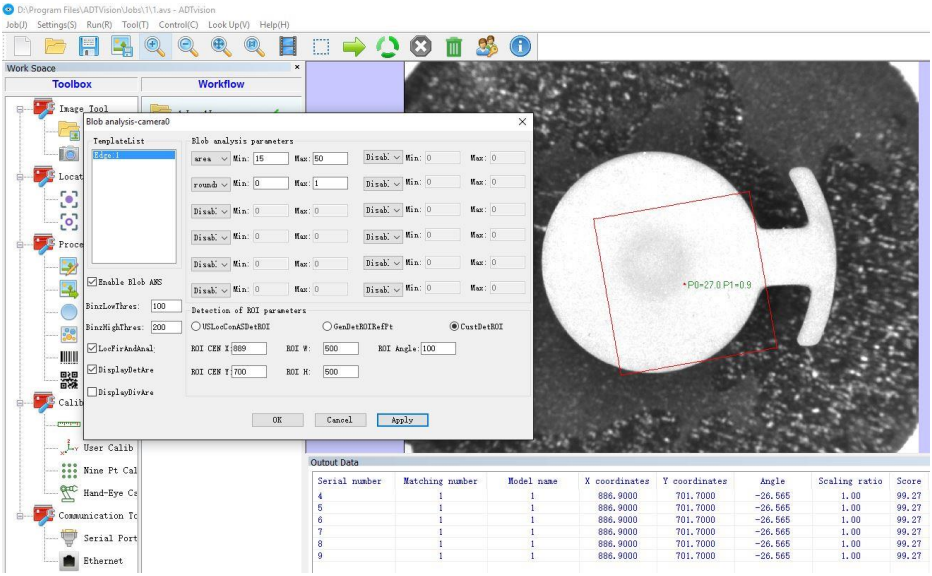
Use position contour as detection ROI: Indicates that blob analysis will be

performed after positioning the template image.

Generate detection ROI from the reference point: The reference point is used as the center, the appropriate width and height, and angle are selected, and the rectangular area is used as the area for detecting the ROI.

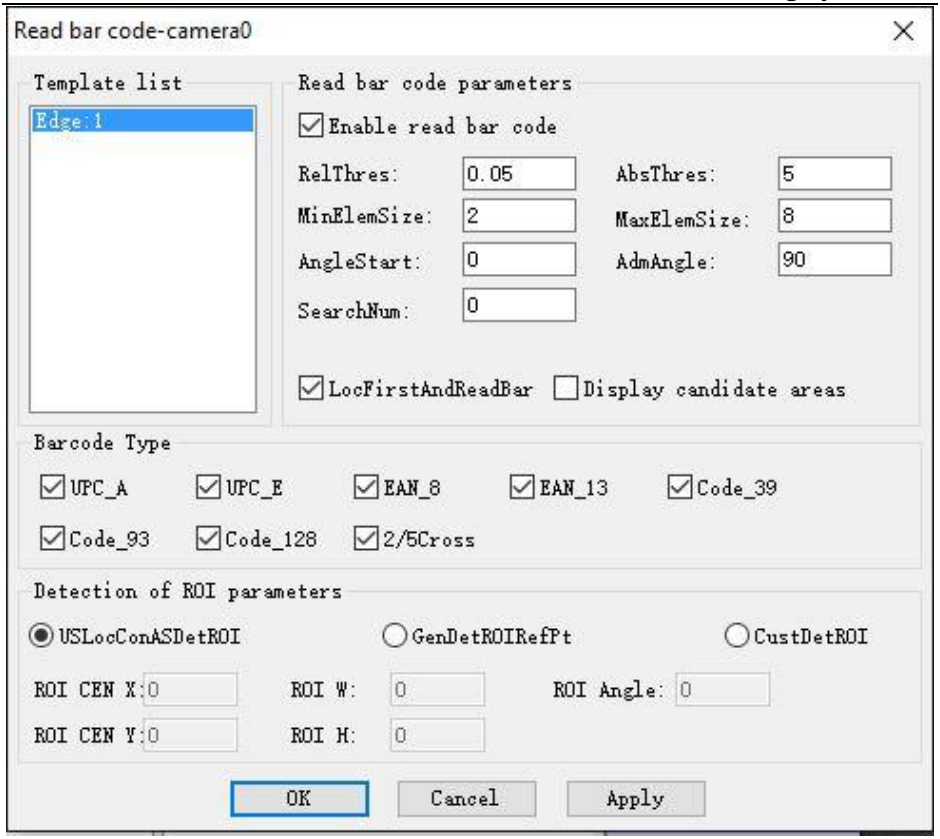
Select Custom Detection ROI: This means centering on the custom coordinates, selecting the appropriate width and height and angle, and using the rectangular area as the area for detecting the ROI.

Blob analysis tool renderings as shown below



5.4.7 Reading bar code tools

Reading bar code tools are mainly used for some items that need to identify bar codes, and currently support identification of eight bar code types. The parameter settings are as shown below.



Template list: Select the template for which the barcode tool needs to be enabled.

Enable Read Barcode: Check Enable Read Barcode to indicate that the currently selected template uses the function of reading a barcode.

Relative threshold: When the black and white bar code contrast is not obvious, the relative threshold needs to be set small.

Absolute threshold: When the contrast between the black and white bar code and the background is not obvious, the absolute threshold needs to be set small.

Minimum element size: refers to the minimum width of the black bar code, if you can not identify it can be set to a small value.

Maximum element size: refers to the maximum width of the black barcode. If it is not recognized, it can be set to a large value.

Start Angle: This value is generally set to 0, which means to start searching from the horizontal direction when identifying the barcode.

Permissible Angle: The range of the bar code search, set to 90 for a range of plus or minus 90 degrees.

Search Number: Indicates the number of barcodes that can be recognized at one time.

Positioning after reading: Check this function to indicate that positioning will be performed before reading.

Display candidate areas: Check this function to display all areas that may be bar codes, different areas are distinguished by different colors.

Types of barcodes: Currently, eight types of barcodes are supported for identification. If you do not know which type of barcode you are using, you can keep identifying eight barcodes by default.

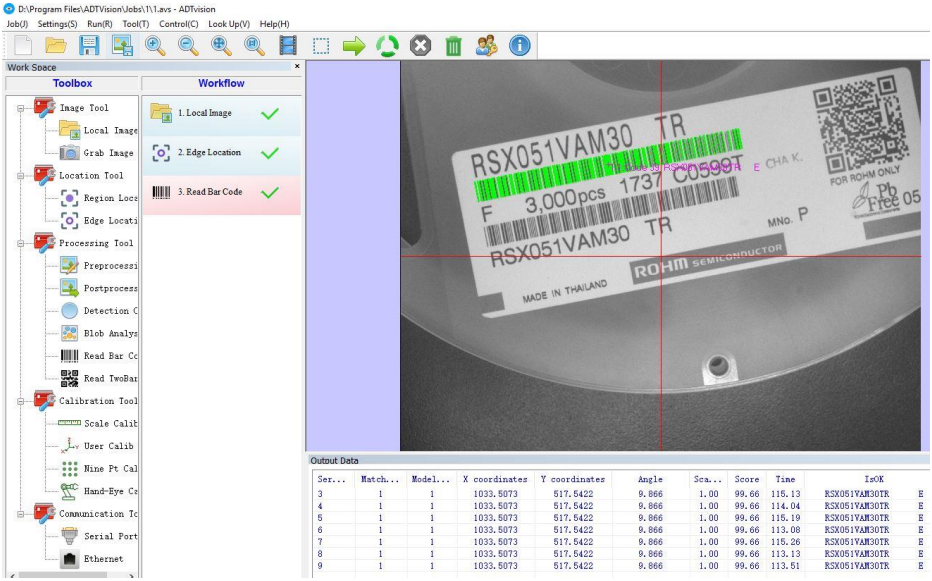
Use position contour as detection ROI: Indicates that blob analysis will be performed after positioning the template image.

Generate detection ROI from the reference point: The reference point is used as the center, the appropriate width and height, and angle are selected, and the rectangular area is used as the area for detecting the ROI.

Select Custom Detection ROI: This means centering on the custom coordinates, selecting the appropriate width and height and angle, and using the rectangular area as the area for detecting the ROI.

Read the bar code effect diagram as shown below.

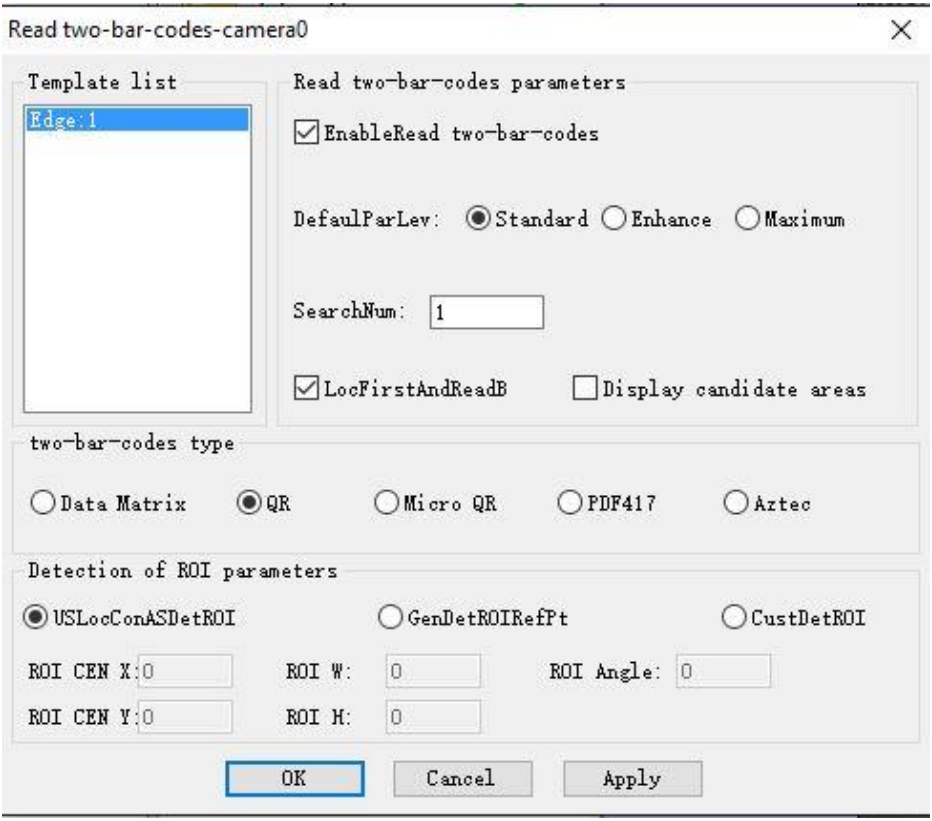
Click icon to download App



Note: The result of the detection is saved in IsOK. You can check IsOK to output the result to the external device in Job Settings.

5.4.8 Read the QR code tool

Reading QR code tools is mainly used for some items that need to identify two-dimensional codes. At present, it supports the recognition of five kinds of two-dimensional code types. The parameter settings are as shown below.



Template list: Select the template for which you want to enable the QR Code tool.

Enable Reading QR Code: Check Enable to read the QR code to indicate that the currently selected template uses the function of reading the QR code.

Default parameter level: Normally set to standard type. Enhanced indicates that the internal will be carefully searched with enhanced parameters. The maximum internal expression will be carefully searched using the largest parameter. When the general standard parameters are not recognized, the enhanced and maximum functions are used.

Search Number: Indicates the number of one-time identification of the largest two-dimensional code.

Positioned after reading: indicates that the positioning will be performed before reading.

Display candidate areas: Check this function to display all areas that may be

two-dimensional codes. Different areas are distinguished by different colors.

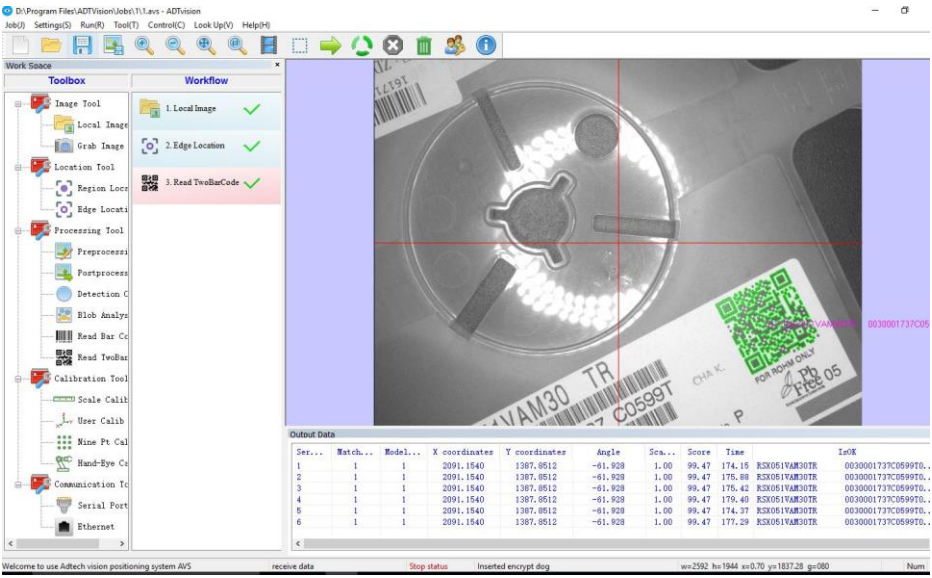
Two-dimensional code type: currently supports 5 kinds of two-dimensional code type recognition, if you do not know what kind of two-dimensional code, you can keep the default recognition of five kinds of two-dimensional code.

Use a positioning profile as the detection ROI: Indicates that the positioning of the template image will be followed by a two-dimensional code operation.

Generate detection ROI from the reference point: The reference point is used as the center, the appropriate width and height, and angle are selected, and the rectangular area is used as the area for detecting the ROI.

Select Custom Detection ROI: This means centering on the custom coordinates, selecting the appropriate width and height and angle, and using the rectangular area as the area for detecting the ROI.

The effect of reading the QR code is shown in the figure below.

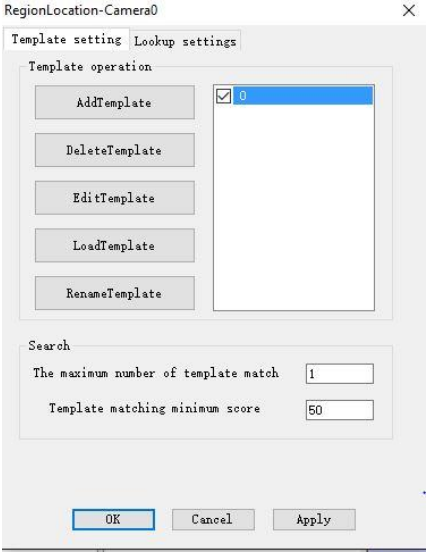


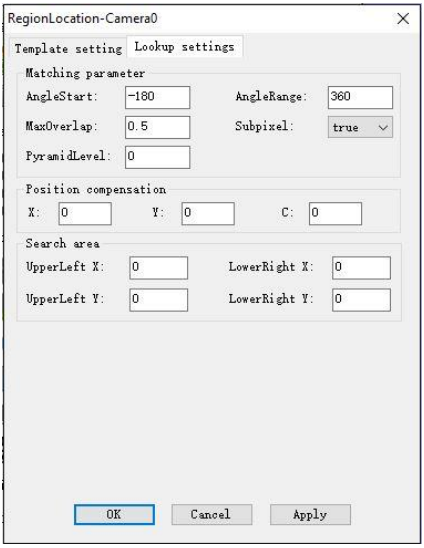
Note: The result of the detection is saved in IsOK. You can check IsOK to output the result to the external device in Job Settings.

5.4.9 Regional positioning tools

According to the pixel gray value of the target area to find the positioning target, suitable for the situation of linear illumination changes, suitable for slight

deformation of the object, suitable for edges of unclear, textured or fuzzy images. Double-click to open the settings window of the area location tool as follows:





The main operations of the template settings page include adding, deleting, editing, loading templates, and setting matching numbers and matching scores.

Add a template: Learn a new template from the image

Delete Template: Delete the selected template from the list of templates

Edit Template: Reset Template

Load a template: Load a template from a file

Number of matches: The maximum number of templates found in the image

Matching score: indicates the degree of similarity between the target found in the image and the template. The found template is returned only when the degree of similarity is higher than the set value. The value range is 0 to 100.

The search setting interface is mainly used to configure some parameters for the template search, as follows:

Starting angle: start to find the angle

Angle range: Angle range of search

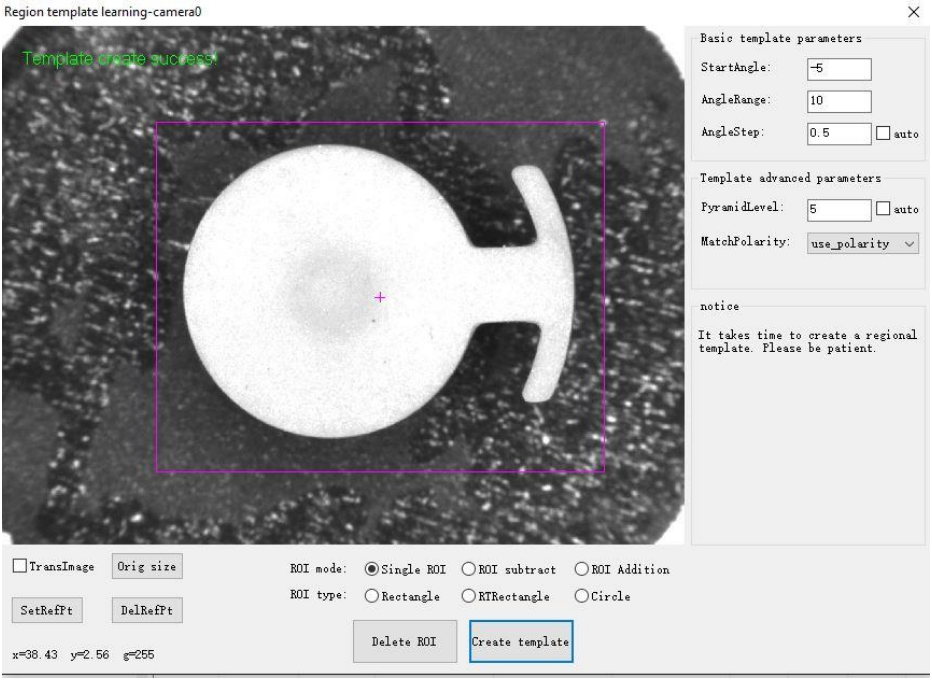
Maximum overlap: When 0, there is no overlap in the returned target. When it is 1, all targets found (including overlap) are returned.

Sub-pixel: When true, positional accuracy can reach sub-pixels, false when pixel level

Number of pyramid layers: when it is 0, the value when the template was created is automatically taken; otherwise, the value is set.

Note: The search parameters are generally kept as default, users do not need to set.

Click the Add Template button to enter the template creation window, as shown below:



In this interface, the image can be zoomed by using the mouse wheel, and the image can be panned by dragging the image after selecting “Pan image”.
ROI mode: In the single ROI mode, only one ROI can be created; the ROI section drawn in the ROI subtraction mode will be removed from the previous ROI; the ROI section drawn in the ROI addition mode will be added to the previous ROI.
ROI type: rectangle, ROI is a rectangle with no angle, rotation rectangle: ROI is an angled rectangle, circle: ROI is a circle

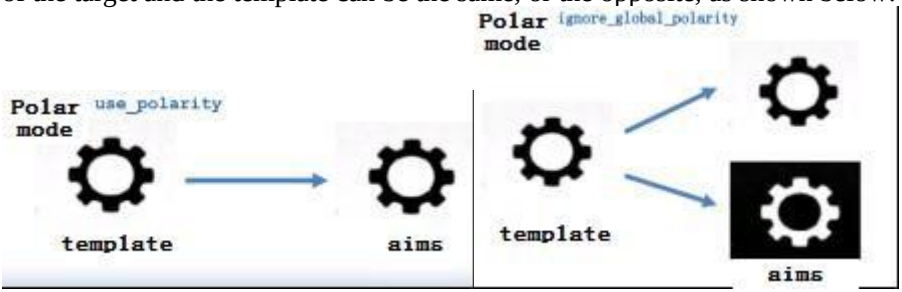
Template basic parameters:
Start angle: Start angle of template generation
Angle range: Angle range generated by the template
Angle step: the angular spacing generated by the template

Template advanced parameters:
Number of pyramid layers: The greater the number, the shorter the time for creating a template and the less time for searching the template, but the poorer the accuracy of the position of the found template; vice versa, 0 is equivalent to automatic, and it is determined automatically by the algorithm when automatic Suitable value, generally suitable value is between 3~5

Match polarity: use_polarity, the black and white brightness of the target and the template must be the same; ignore_global_polarity, the black and white brightness of the target and the template can be the same, or the opposite, as shown below: In this interface, the image can be zoomed by using the mouse wheel, and the image can be panned by dragging the image after selecting “Pan image”.
ROI mode: In the single ROI mode, only one ROI can be created; the ROI section drawn in the ROI subtraction mode will be removed from the previous ROI; the ROI section drawn in the ROI addition mode will be added to the previous ROI.
ROI type: rectangle, ROI is a rectangle with no angle, rotation rectangle: ROI is an angled rectangle, circle: ROI is a circle

Template basic parameters:
Start angle: Start angle of template generation
Angle range: Angle range generated by the template
Angle step: the angular spacing generated by the template

Template advanced parameters:
Number of pyramid layers: The greater the number, the shorter the time for creating a template and the less time for searching the template, but the poorer the accuracy of the position of the found template; vice versa, 0 is equivalent to automatic, and it is determined automatically by the algorithm when automatic Suitable value, generally suitable value is between 3~5
Match polarity: use_polarity, the black and white brightness of the target and the template must be the same; ignore_global_polarity, the black and white brightness of the target and the template can be the same, or the opposite, as shown below:

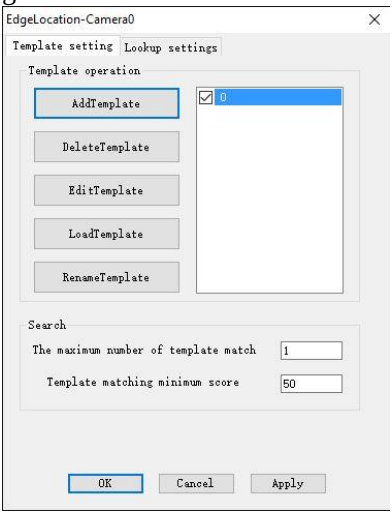


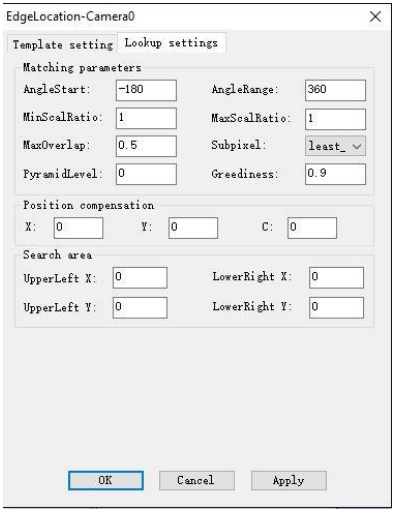
After setting the parameters, use the left mouse button to draw a suitable ROI, and then click the "Create Template" button. The message indicating whether the template is successfully created will be displayed in the upper left corner of the image.

5.4.10 Edge locator

According to the target shape contour to find the positioning target, suitable for finding any rotation angle, any scaling ratio, any contrast contrast and partial occlusion target, support nonlinear light changes, the tool's parameter setting

dialog box is as follows:





The operation of the template setting page is the same as that of the area positioning tool. The meanings of the parameters of the search setting page are as follows:

Starting angle: Start looking for the angle.

Angle range: The range of angles to find.

Minimum scale: The minimum scale of template scaling.

Maximum zoom: The maximum scale of the template zoom.

Maximum overlap: When 0, there is no overlap in the returned targets. When it is 1, returns all found targets (including overlaps).

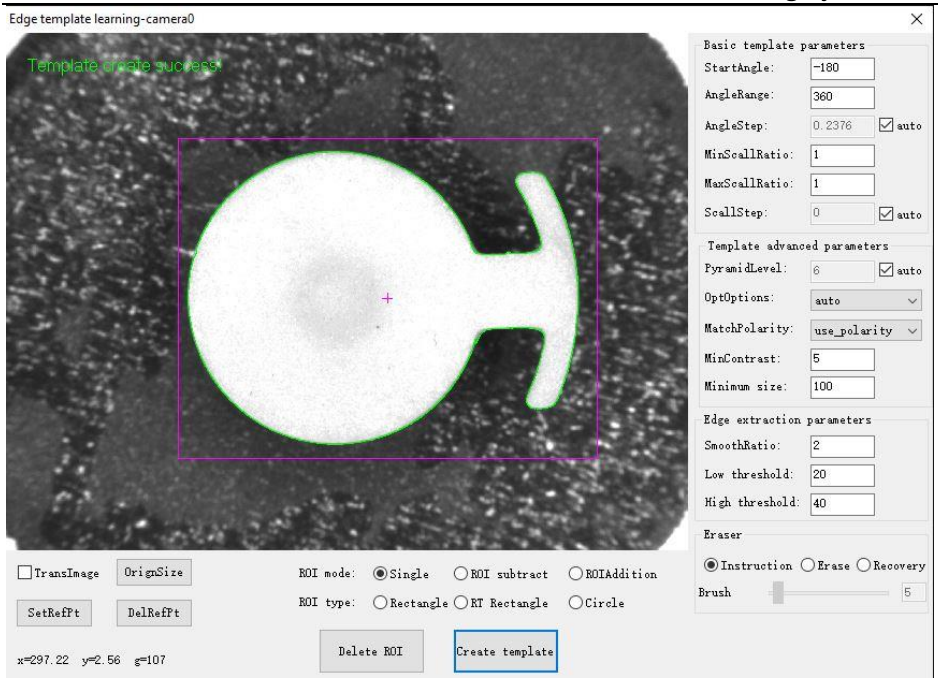
Sub-pixel: none, no sub-pixel, maximum error is half a pixel; interpolation, sub-pixel precision of interpolation; least_squares, least_squares_high, least_squares_very_high, least squares sub-pixel precision. The none and interpolation times are the same, and the least squares method takes a long time. In general, least_squares can meet the requirements of speed and precision.

The number of pyramid layers: when it is 0, the value when creating the template is automatically taken; otherwise, it is the set value.

Greediness: This parameter is used to perform positioning acceleration. The smaller the value is, the slower the speed is. The higher the value is, the faster the speed is. The greater the possibility of missing the target, the recommended value is: 0.7~0.9.

Note: The search parameters are generally kept as default, users do not need to set.

Click the Add Template button to enter the template creation window, as shown below:



In this interface, the image can be zoomed by using the mouse wheel, and the image can be panned by dragging the image after selecting “Pan image”.

ROI mode: In the single ROI mode, only one ROI can be created; the ROI section drawn in the ROI subtraction mode will be removed from the previous ROI; the ROI section drawn in the ROI addition mode will be added to the previous ROI.

ROI type: rectangle, ROI is a rectangle with no angle, rotation rectangle: ROI is an angled rectangle, circle: ROI is a circle.

Set reference point: If the point you want is not the center of the template ROI, you can set a reference point so that the output position is offset from the center of the template ROI, similar to the coordinates of the tool in the robot.

Template basic parameters:

Starting angle: The starting angle of the template generation.

Angle range: Angle range generated by the template.

Angle step: The angular spacing generated by the template.

Minimum scale: The minimum scale generated by the template.

Maximum Scale: The maximum scale generated by the template.

Zoom step: the template generated zoom pitch

Template advanced parameters:

Number of pyramid layers: The greater the number, the shorter the time for creating a template and the less time for searching the template, but the poorer the accuracy of the position of the found template; vice versa, 0 is equivalent to automatic, and it is determined automatically by the algorithm when automatic Suitable values are generally suitable values between 3 and 5.

Optimization options: Some templates contain too many pixels, which leads to large templates, increased execution time, increased memory requirements, and optimization options to reduce these points. None does not reduce pixels; point_reduction_low is reduced to approximately half; point_reduction_medium is reduced to approximately 1/3

Point; point_reduction_high reduced to about 1/4 point. Points that may be caused by the reduction of points: It may be impossible to create high-level pyramids, which may reduce the accuracy and accuracy of the results. In addition to the reduction of pixels, this parameter can also control how the template is created to choose whether to prioritize memory or speed: the pregeneration template is pre-created, at the expense of memory in exchange for the lookup speed, and no_pregeneration.

Only necessary data is created when searching, and it takes up less memory. It is recommended to select auto.

Matching polarity: use_polarity, the black and white brightness of the target and the template must be the same; ignore_global_polarity, the black and white brightness of the target and the template can be the same, or the opposite, ignore_local_polarity does not require the template and the black and white brightness of the image correspond to allow changes.

Contrast: Pixels less than this value are ignored directly.

Hysteresis Contrast: Points above this value are directly extracted as edges, and points in between will automatically select some potential points as edge points according to the algorithm.

Minimum size: The minimum length of the extracted edge.

Minimum Contrast: Determines the minimum contrast of the template, that is, this parameter separates the template from the noise in the image. Generally, auto can be selected.

Smoothing coefficient: Smoothing the image to a certain degree, the larger the value is, the greater the degree of smoothness is, and the better the edge continuity is, some interferences can be removed, and some edge details are also lost, which will affect the true position of the edge to some extent. .

Low-amplitude threshold: similar to contrast.

High-amplitude threshold: similar to lag contrast.

Template type: The line template uses the edge of the ROI region as a template, and the image template uses the image of the ROI region as a template. The biggest difference between the two is that when the line template is positioned, the geometric center of the edge is output, and when the image template is positioned. The output is the ROI center.

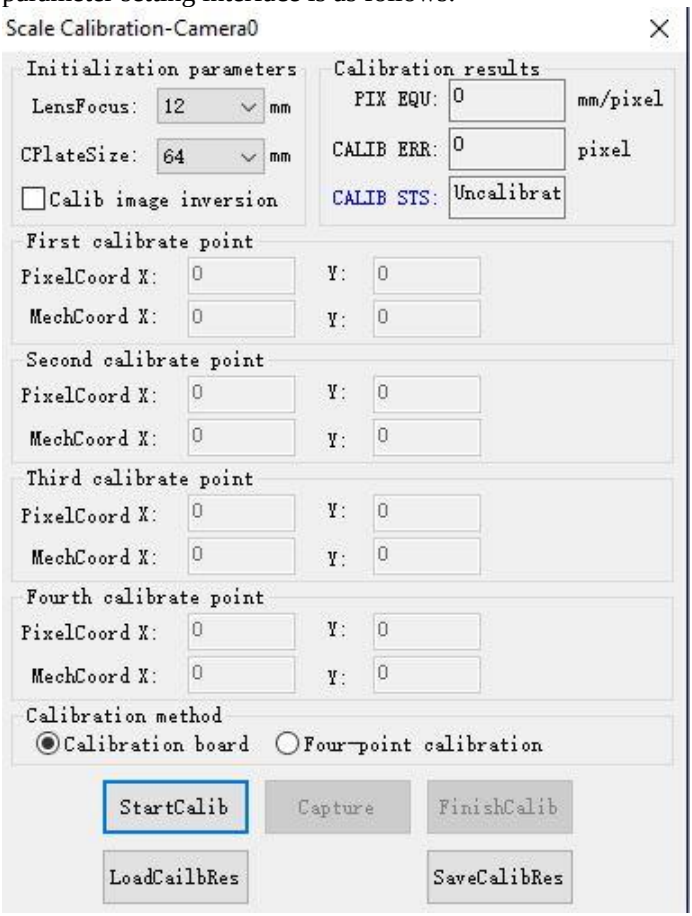
After setting the parameters, use the left mouse button to draw a suitable ROI, and then click the "Create Template" button. The message indicating whether the template is successfully created will be displayed in the upper left corner of the image.

Note: After the template parameters are modified, you must click Create Template to take effect.

5.4.11 Scale calibration tool

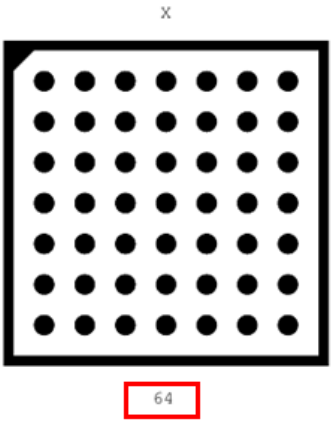
The scale calibration tool calculates the actual length represented by the unit pixel. After the calibration is completed, the coordinates given by the vision are relative to the center of the camera. That is, the center of the image is used as the origin, and the horizontal direction is the X-axis positive direction and the vertical

direction is the Y-axis. Positive, if you know the camera center to the center of the Z axis offset (the camera is mounted on the Z axis) or the physical coordinates of the camera center (camera stationary installation), then you can calculate the physical coordinates of the positioning target position, this calibration method Generally used in screw-based XYZ rectangular coordinate system platform, the parameter setting interface is as follows:

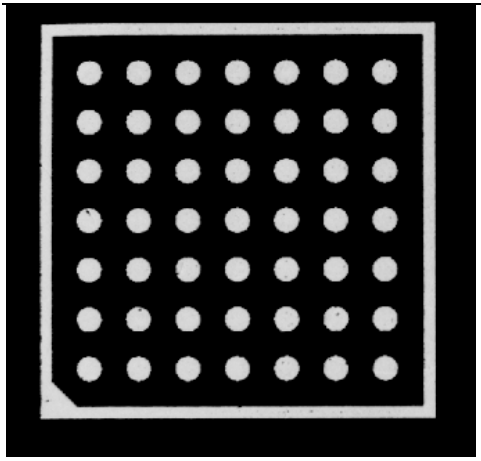


Lens Focal Length: This parameter is marked on the lens. If it is a telecentric lens, choose 100000 focal length

Calibration plate size: the size of the calibration plate using, the size of the black frame outside the target plate, and the label below.



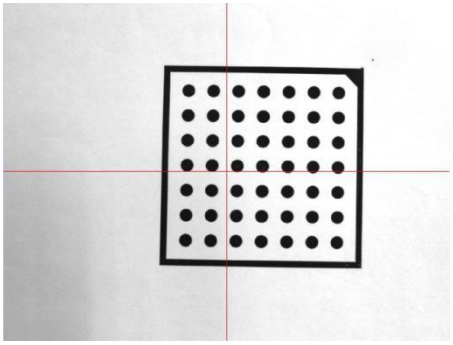
The calibration image is reversed: the black in the image is turned into white, and the white is black. The standard calibration plate is black and white. If the coaxial light illuminates the calibration plate, the calibration plate image acquired is a white point and black matrix. When you need to check the calibration board to reverse, as shown in the figure.



Pixel equivalent: The actual distance represented by each pixel after calibration.
Calibration error: The smaller the value is, the higher the calibration accuracy is, and generally it should not exceed 0.5.
Calibration status: indicates whether calibration is performed, pixel coordinates are not output at regular time, and physical coordinates have been calibrated.
Calibration method: based on the calibration plate and based on the calibration point.

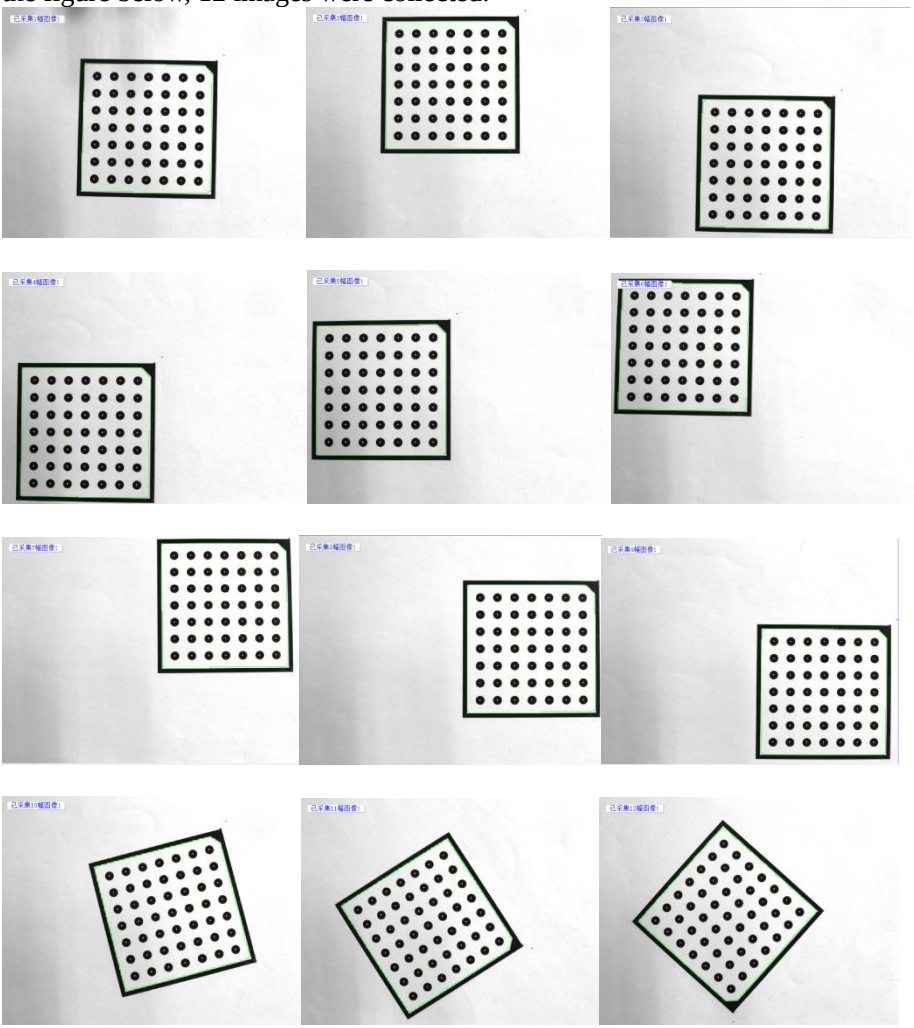
(1) Calibration based on calibration plate:

Find the calibration board pdf print file with the required size in the calib directory under the directory where the software is located. For example, caltab_64mm.pdf indicates that the calibration board has a black frame size of 64x64mm. The calibration board is printed on A4 paper and placed under the camera as shown in the figure. :

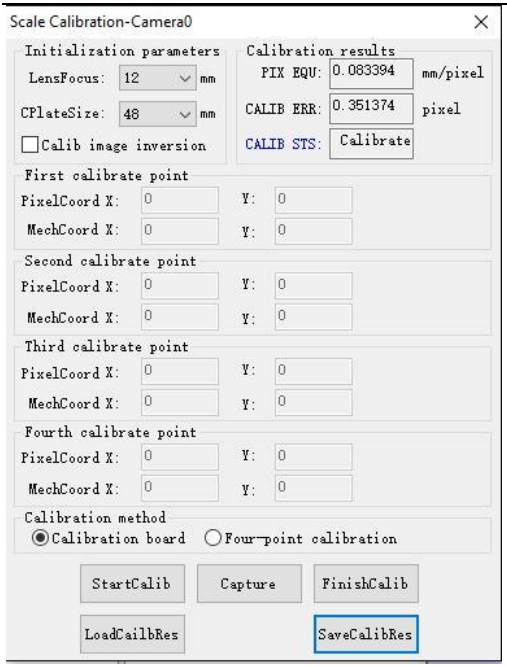


Click the "Start Calibration" button to move the calibration plate with different postures but not out of the camera field of view. Each time you move a position, click the "Acquire" button to acquire a calibration plate image, and then after 11 images are acquired analogically, "End calibration The button is available. At this point, calibration can be completed or the image can be acquired continuously.

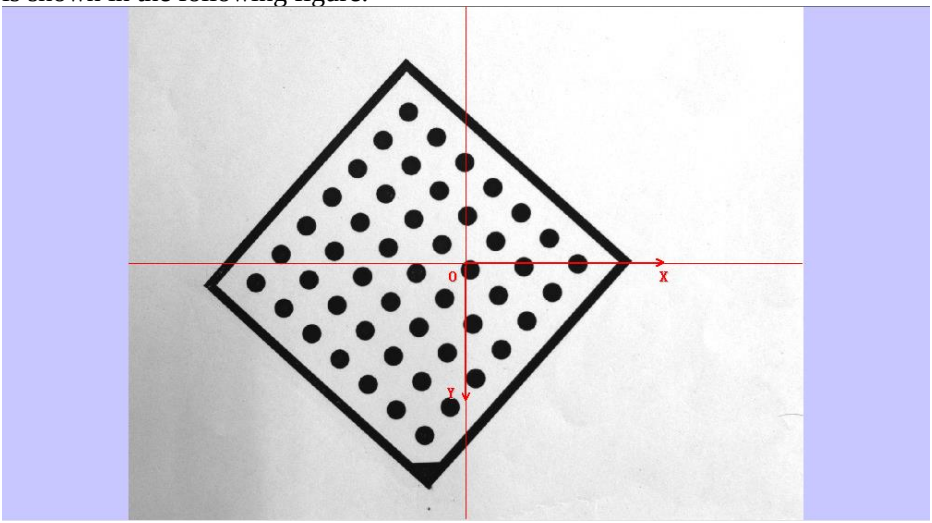
The recommended number of captured images is preferably 12-15. As shown in the figure below, 12 images were collected:



Click the "end calibration" button, the calibration results are as follows:



After the calibration is completed, remember to click the "Save calibration results" button to save the results to a file. The next time the software is started, the calibration results will be automatically loaded, eliminating the need for repeated calibration. After the scale calibration, the output unit of the vision software is no longer a pixel but a millimeter. The reference coordinate of the output coordinate is shown in the following figure:



The origin O is at the center of the camera, that is, the center of the image, horizontally to the right is the positive X-axis direction, and vertically downward is the positive Y-axis.

Note: In order to obtain a better calibration effect during the calibration board image acquisition process, the following basic principles must be followed:

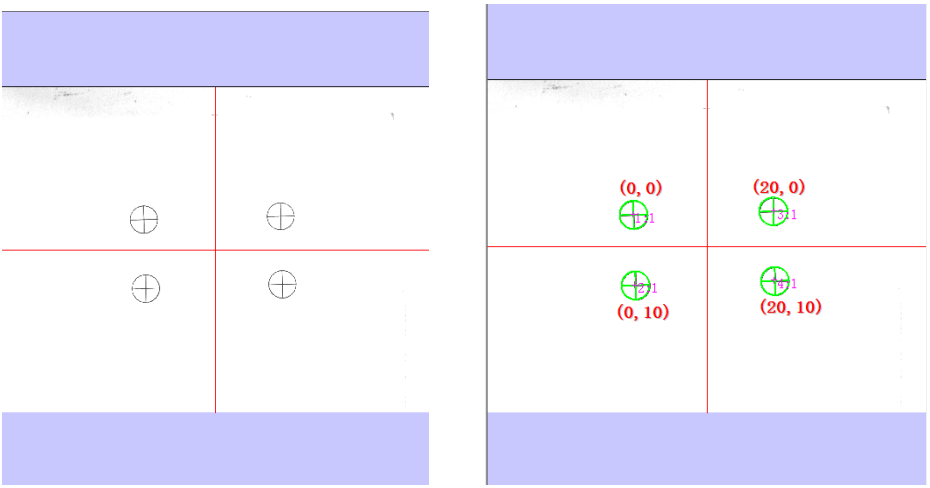
- The calibration board image is best in 12~15 frames.
- In order to obtain more accurate camera parameters, the position of the calibration plate in all images should cover the four corners of the image, mainly because the lens distortion at the corners of the image is large, so that a more accurate distortion coefficient k can be obtained. The calibration plate should try to Covers various rotation angles.
- The effective area (black box area) of the calibration plate used should be large enough to be as much as 1/4 of the field of view but not more than 1/2 of the field of view.
- The minimum diameter of the center mark point can not be less than 10 pixels.
- The calibration board must have a white background, a black center mark, and a black border.
- The gray value of the white background of the calibration plate must not be less than 100.
- The contrast ratio between the gray and white borders and the white background is better than 100.
- Use even light source lighting.
- After calibration, the camera and lens can no longer be moved. If you adjust the camera and lens and adjust the aperture and focal length of the lens, you need to recalibrate after adjustment.

(2) Calibration based on calibration points:

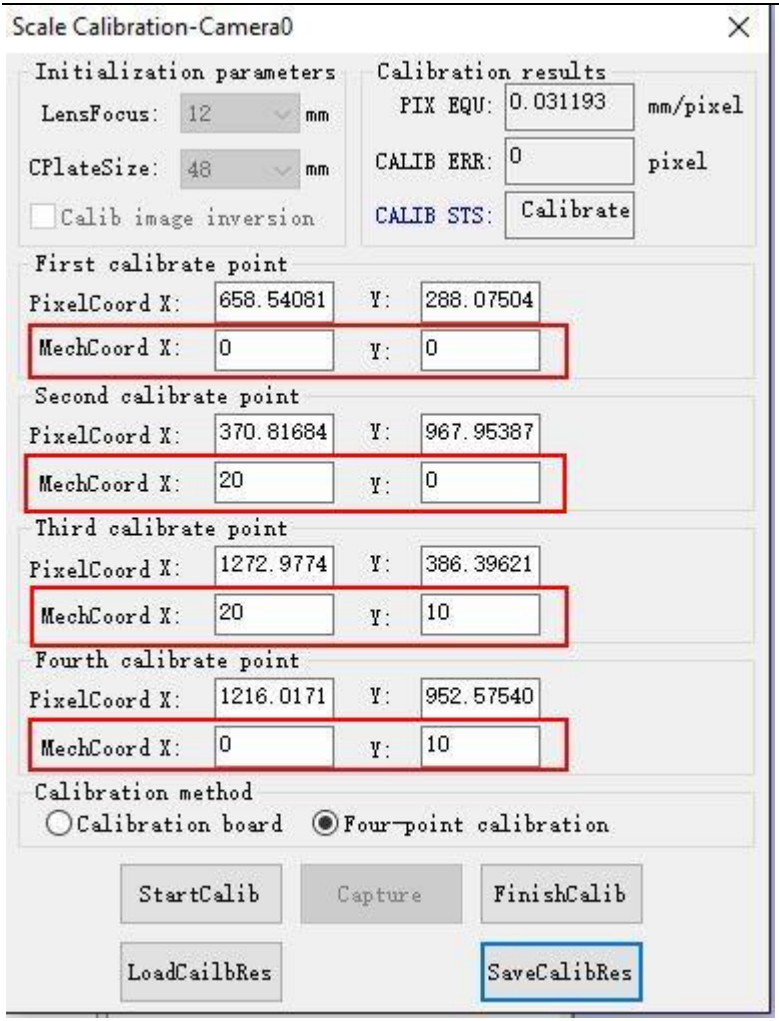
In some applications where the field of view is relatively small, a calibration plate with a smaller size is required for calibration. When the calibration plate is less than 30 mm, the printed accuracy is relatively poor and the accuracy cannot be satisfied. At this time, the calibration based on the calibration point can be used. Methods:

When the camera can be accurately moved (or the product can be accurately moved relative to the camera), first use a product or MARK point to learn a template, and then use the control system to control the camera to walk four points to form a rectangle, each one point, manually locate, The pixel coordinates will be automatically obtained, manually input the mechanical coordinates of the control system at this time, click the end calibration after the input is completed.

When the camera is not moving accurately relative to the product, you can use a known relative position of the four MARK points to complete the calibration, as shown below.



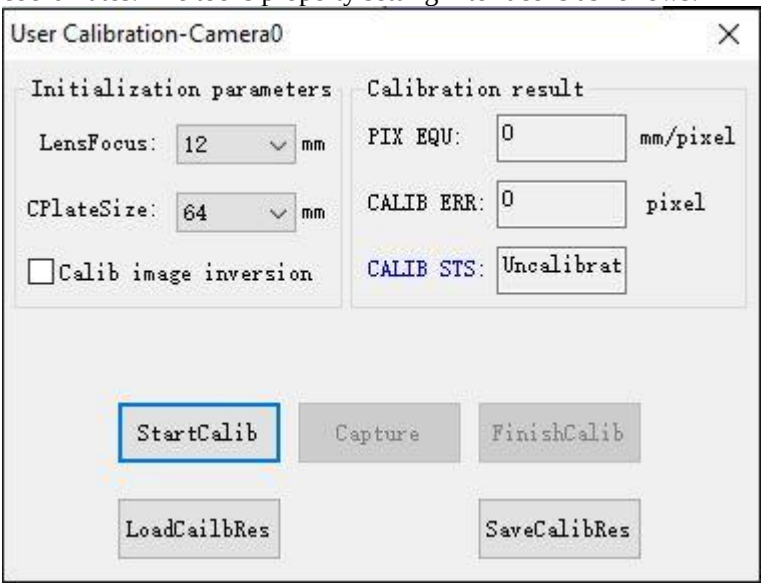
Knowing that the horizontal distance of the MARK point is 20mm and the vertical distance is 10mm, it can be assumed that a reference coordinate system is established on the MARK point 1, and the coordinates of the remaining three points can also be obtained. The input of these four coordinate points corresponds to In the machine coordinates, click to end the calibration.



Note: For multi-camera calibration, be sure to note the "Scale Calibration - Camera 0" displayed on the title bar of the dialog box to distinguish which camera is currently calibrated.

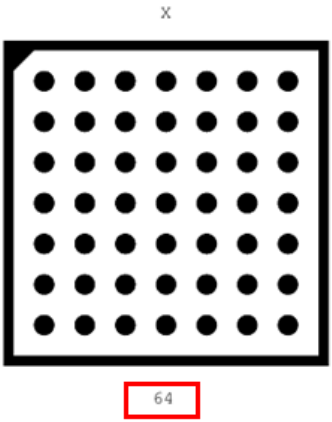
5.4.12 User calibration tool

The user calibration tool can convert the pixel coordinates to the robot's user coordinates. The tool's property setting interface is as follows:

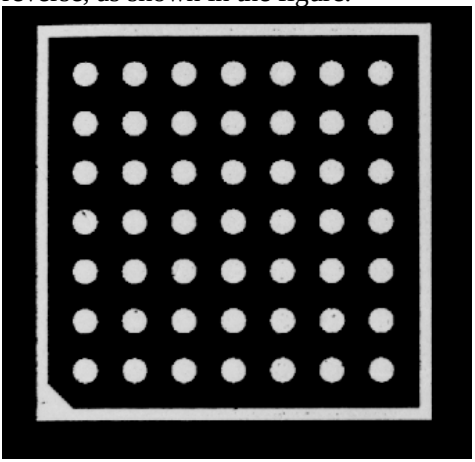


Lens Focal Length: This parameter is marked on the lens. If it is a telecentric lens, choose 100000 focal length

Calibration plate size: the size of the calibration plate using, the size of the black frame outside the target plate, and the label below.



The calibration image is reversed: the black in the image is turned into white, and the white is black. The standard calibration plate is black and white. If the coaxial light illuminates the calibration plate, the calibration plate image acquired is a white point and black matrix. When you need to check the calibration board to reverse, as shown in the figure.



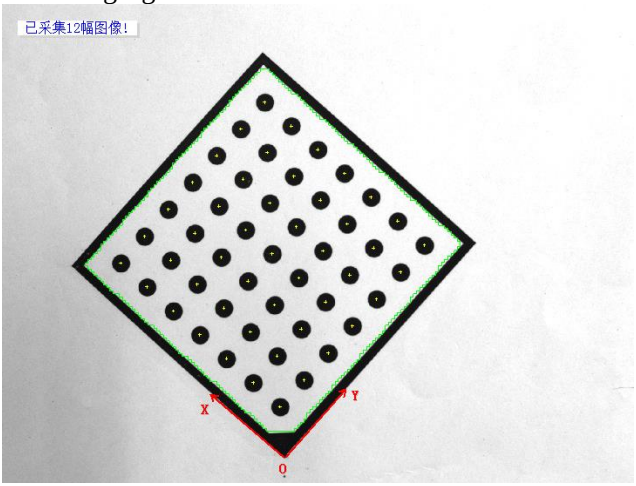
Calibration error: The smaller the value is, the higher the calibration accuracy is, and generally it should not exceed 0.5.

Calibration status: indicates whether calibration is performed, pixel coordinates are not output at regular time, and physical coordinates have been calibrated.

Click the "Start Calibration" button to acquire 12 calibration plate images in turn. The method and the calibration method based on the calibration plate in the scale calibration tool are the same, and will not be repeated here. Here

mainly explain the difference between the two:

- The user calibration tool calibration results are no longer pixel equivalent, but the camera's internal and external parameters, a total of 18 parameters, for the simple interface considerations, calibration parameters are not displayed here, the user does not need to know these parameters The exact value.
- The reference coordinate system of the coordinate output after calibration by the user calibration tool is determined by the last captured image. Before the last image is acquired in the calibration process, the calibration board is placed in the approximate position where the user coordinate system needs to be established. After the “Acquisition” and “End calibration” buttons, it is determined that the origin of the reference coordinate is on the corner of the calibration plate with a small triangle. The X-axis and Y-axis are the two sides of this angle, as shown in the following figure. Show:

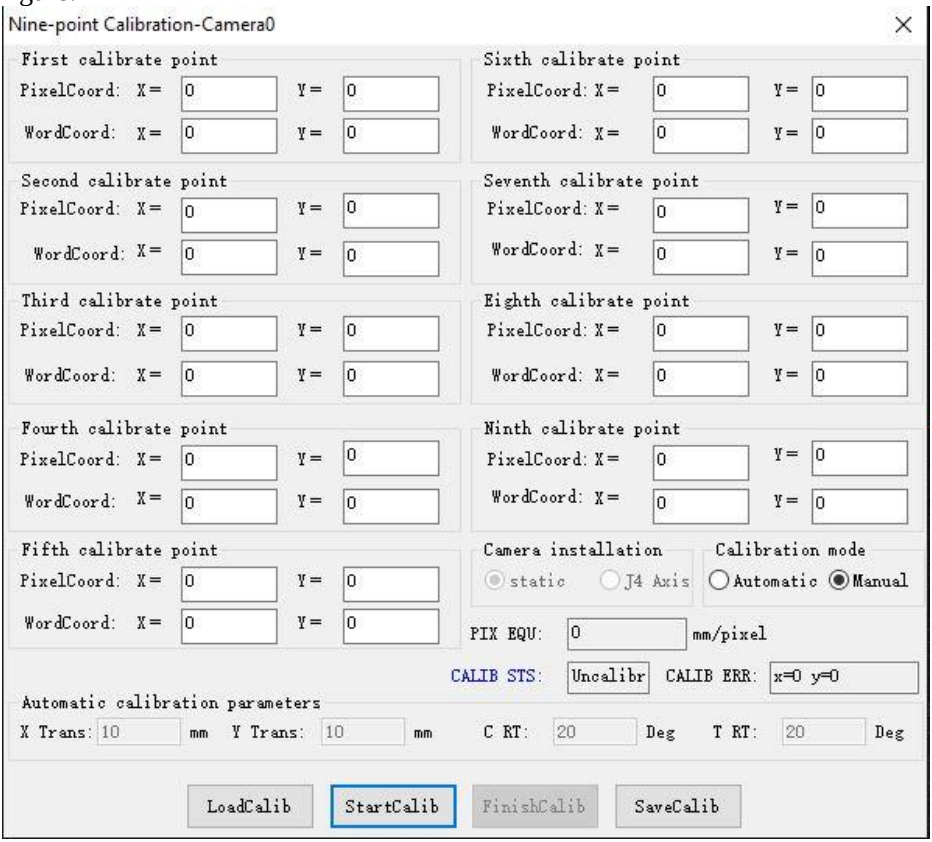


- Be sure to keep the position of the calibration plate after the last calibration plate image is captured. The robot needs to use O point as the origin. The user coordinate system is established by the X and Y axis directions in the above figure, and then the coordinates of the positioning target output by the camera are also It is equivalent to the coordinates in the robot user coordinate system, and the robot can be further converted into the base coordinates according to this coordinate.
- Since the robot's user coordinates are in the right-handed system and are opposite to the Y coordinate of the vision coordinate system, you need to click “Job Settings” in the “Settings” menu and check “Y inversion”.

Note: For multi-camera calibration, be sure to note the "User Calibration - Camera 0" displayed on the dialog title bar to distinguish which camera is currently calibrated.

5.4.13 Nine point calibration tool

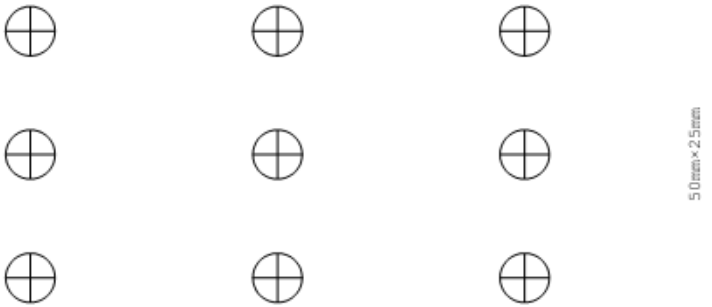
The nine-point calibration tool interface is shown in the following figure:



The nine-point calibration tool needs to calculate the calibration mapping relationship according to the pixel coordinates of the Mark point and its corresponding world coordinates.

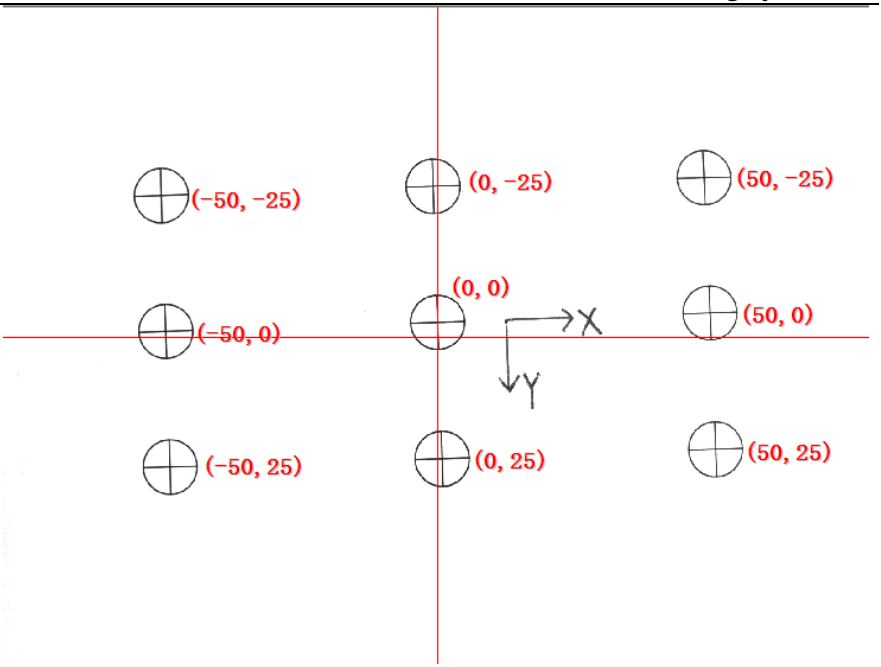
(1) Manually calibrate the camera on the following nine points:

 Find the pdf file of the required size in the calib folder under the software installation directory and print it out 1:1. The calibration board pdf file used for the nine-point calibration is a pdf file beginning with “Nine-point circle”, as follows:

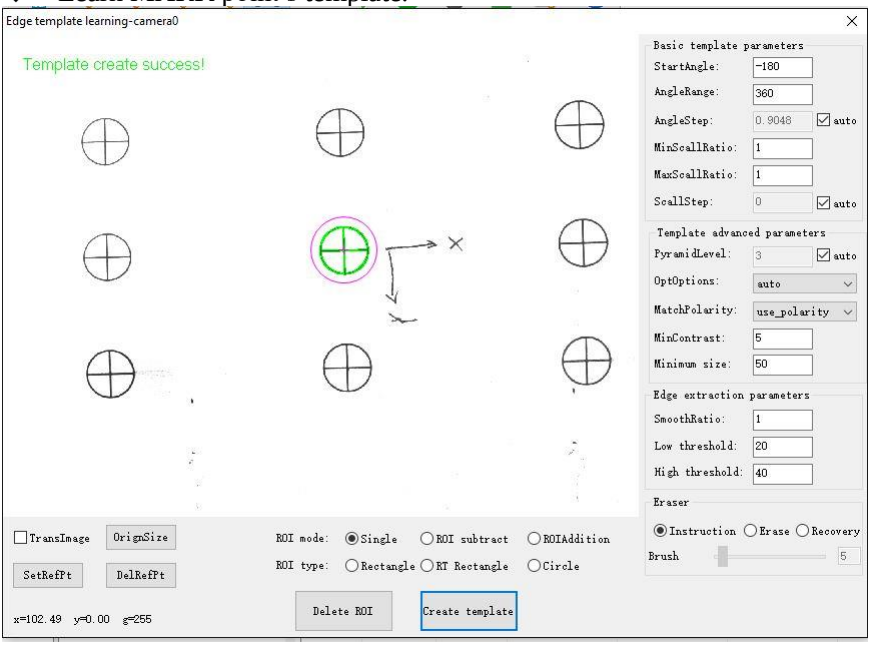


The size 50mmX25mm below the pattern means that the vertical distance between two adjacent dots is 50mm and the horizontal distance is 25mm. It is best to use a ruler to measure the correct size after printing.

- On the calibration paper, use the middle MARK point as the origin, the middle horizontal (vertical) three-point line as the X-axis, and the middle vertical (horizontal) three-point line as the Y-axis to establish the camera reference coordinate system. And mark the direction of the reference coordinate system on the paper. After labeling, place the calibration paper under the camera. When the calibration paper should be photographed with the actual camera, the height of the plane where the camera target is located should be the same.
  As shown
  below.

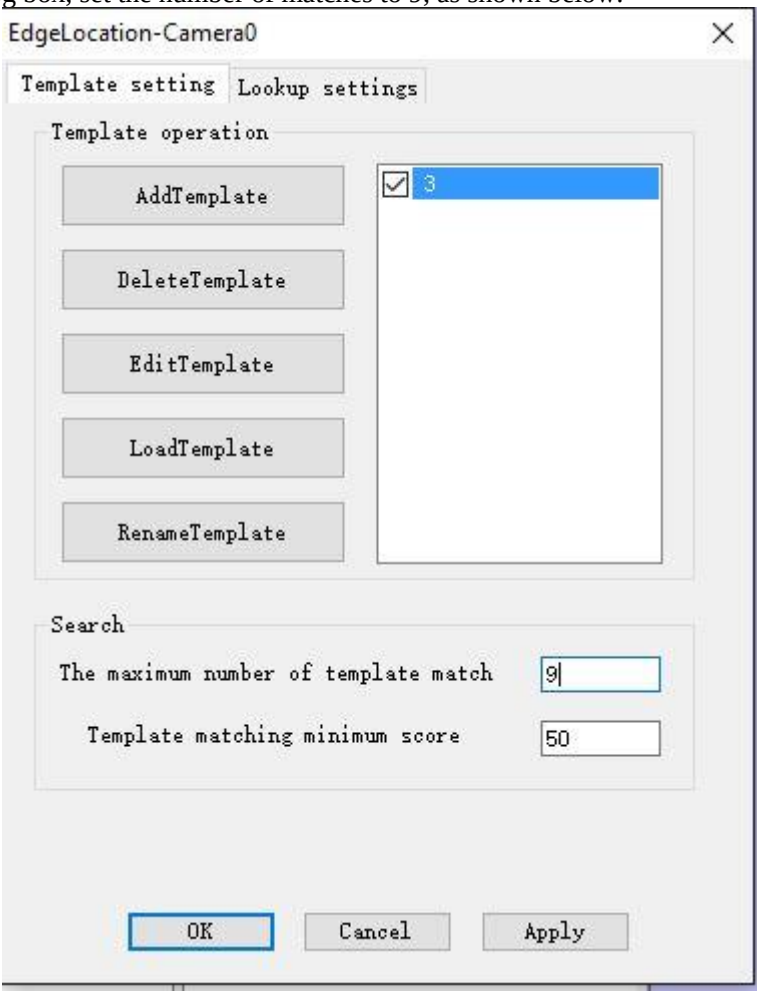


◆ Learn MARK point's template.



Try to learn the template of the middle MARK point. Select "Line template" as

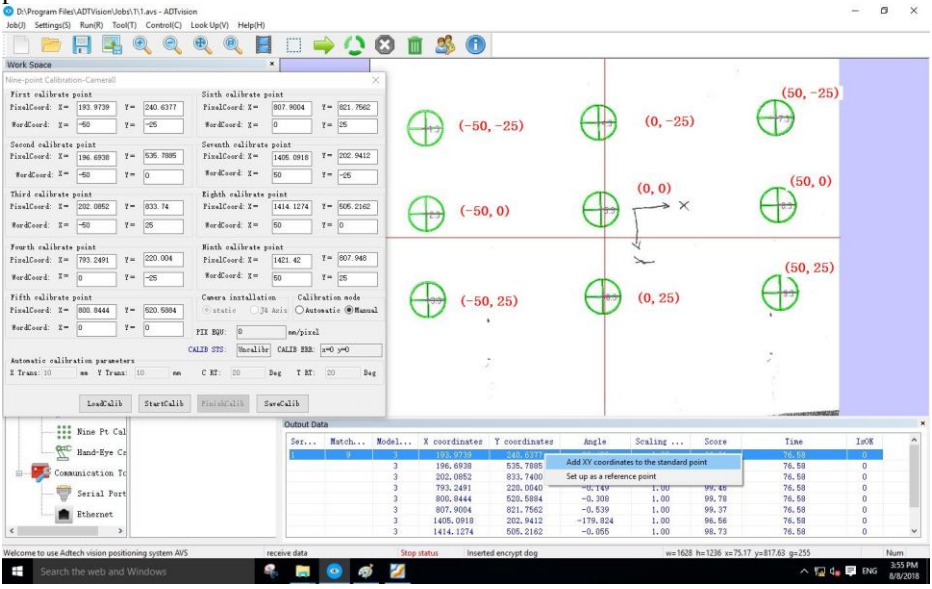
the template type. If the value of the pyramid is small, the positioning time will be longer. You can manually remove it to 4 or 5, and click again to create the template. After closing the template learning dialog box, go to the template setting dialog box, set the number of matches to 9, as shown below:

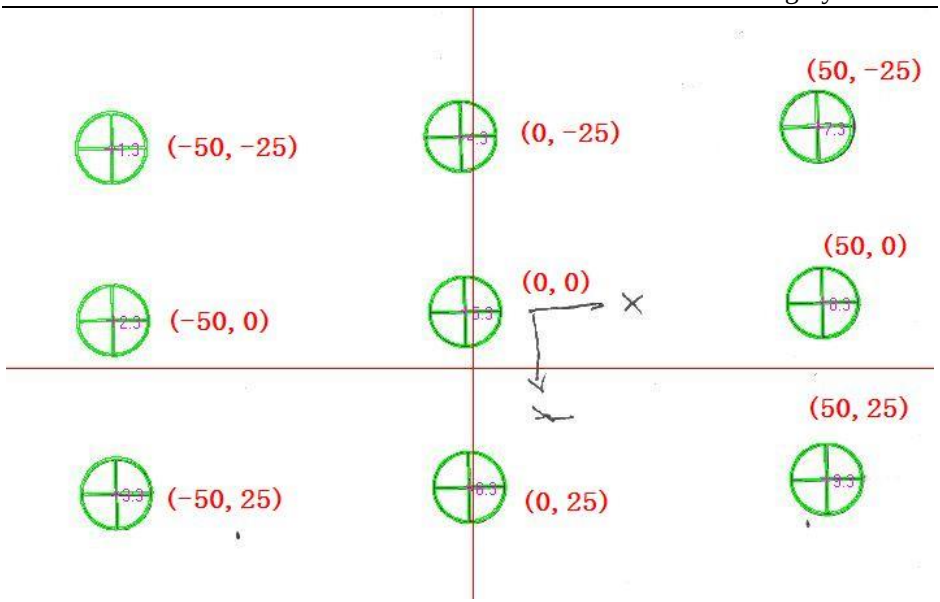


◆

◆ Position the MARK point template. After the template learning is completed, double-click to open the "Nine point calibration" tool setting dialog box, click the "start calibration" button, this time the calibration status is displayed as "uncalibrated". Before manually positioning, ensure that the calibration status is "uncalibrated". In the toolbar, click the "single job" button, the output list will display the positioning results in the bottom of the software, a total of 9 rows,

right click on the first row, in the pop-up submenu, click "Add “XY coordinate to calibration point”, the XY coordinates of the 9 points in the list can be added to the pixel coordinates in the 9-point calibration dialog box. The world coordinates of each point are based on the size distance between the MARK points and the selected origin The direction of the reference coordinate system can be easily determined and needs to be manually entered into the world coordinates of each point. It must be noted that adding pixel coordinates is added to 9 calibration points in sequence according to the order in the list. The correspondence between the order of the 9-point coordinates in the list and the MARK points in the image is the number next to the small cross. decided. For example, the position of the most intermediate MARK point in the image is displayed as 5:bd, 5 indicates that the result corresponding to the MARK point is in the fifth row in the output list, bd is the name of the MARK point template, so when inputting the world coordinates, it must be To enter the reference coordinates of each point in the world coordinate in the nine-point calibration dialog box in the order of the numbers next to the small cross in the image positioning result. After the input is completed, click the “End calibration” button to complete the calibration. After the calibration is successful, click “Save calibration” to save the result to a file. The next time the software starts, it will automatically load the calibration parameters.





◆ After the visual calibration, the robot needs to use the center of MARK point 5 as the origin, MARK points 5 and 8 as X positive, and MARK points 5 and 6 as Y to establish the user coordinate system.

(2) The manual camera calibration under nine points is as follows:

◆ When the camera is flipped, it is inconvenient to use the calibration pin to build the user. Therefore, it is not possible to calibrate the camera directly. However, it is possible to use the robot's calibration pin or screw to directly calibrate the robot's base coordinates. Take the calibration needle as an example, install a calibration needle, gently wipe the needle tip two or three times in the vertical Z-axis direction of the tissue paper, adjust the camera parameters and the height of the robot's Z-axis, use the needle tip to clearly image, learn an edge template of the needle tip, click "Start calibration" button.

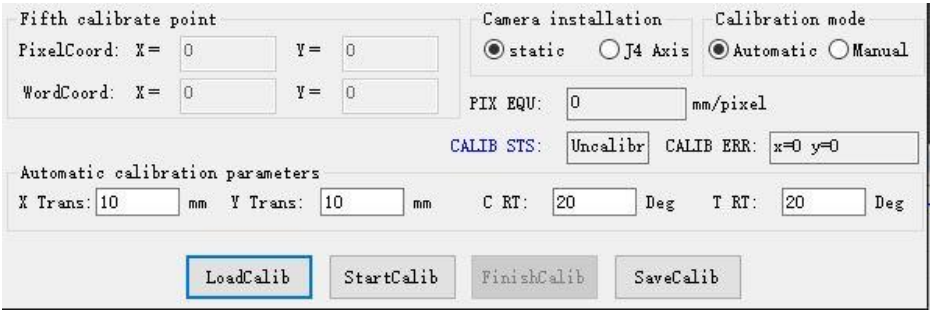
◆ Move the robot one by one in the image so that the needle tip moves 9 points of 3X3. Manually position each point once to get the pixel coordinates, add it to the pixel coordinates of the calibration point, and input the current robot's current base coordinates at this time. In the world coordinates of the calibration point, click the “Complete Calibration” button after the input is complete, and click “Save Calibration” to save the result to a file.

◆ Or you can also take a circular edge template on the bottom surface of the screw, and then go through 9 rows of 3 rows and 3 columns. Try to ensure

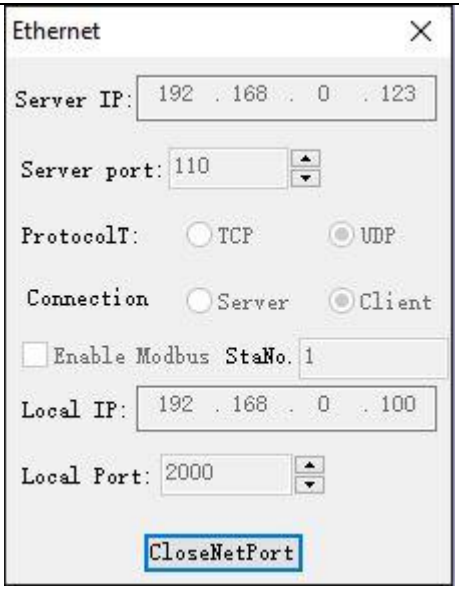
that the middle point of the 9 points is in the center of the camera image. The coverage of the 9 points should be in the field of view. Between 1/4 and 1/2 of the range.

- After the calibration is completed, the vision gives the position of the positioning target in the robot's base coordinates.

(3) The automatic nine-point calibration method is as follows:

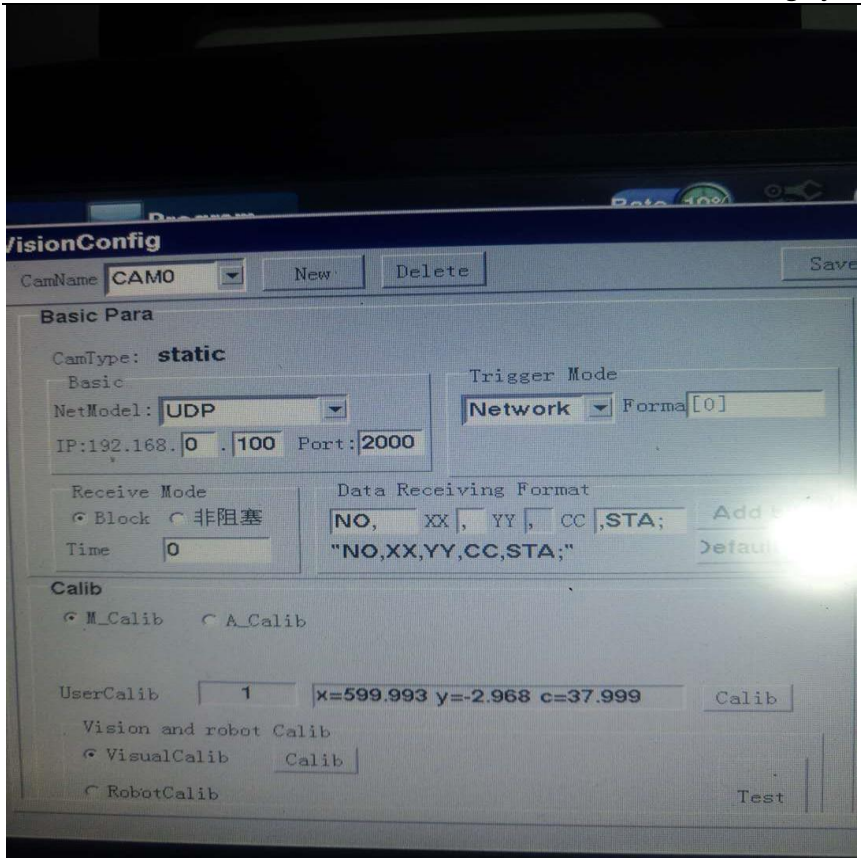


- The advantage of automatic nine-point calibration is that it does not require calibration pins or calibration plates. It is easy to operate and currently only supports automatic nine-point calibration with SCARA robots. First learn a product or MARK point edge template, double-click the "Nine point calibration" tool to open the settings dialog box, the calibration mode selection is automatic, the camera installation mode is selected according to the actual situation, and the translation and rotation parameters are generally kept as default, if the calibration process In the meantime, if the robot has an “area unreachable” error, it can reduce the amount of translation or rotation. If the camera is mounted on the J4 axis, the product or MARK point remains stationary during the calibration. The robot moves with the camera in the position where it was visually sent. If the camera is mounted statically, the robot must carry the product or the MARK. Click to move (you can use robotic tools to hold or clamp objects). It should be noted that the distance from the camera to the product or MARK should be the same as the distance from the camera to the actual camera.
- Configure visual communication. First configure the visual side of the communication, as shown below.



The IP address and port number of the robot are filled in with the server IP and port number, and the IP address of the network card connected with the robot in the vision controller is filled in with the local IP address. The port number is generally 2000 by default.

◆ Configure robot communication, create a new project in the robot teach pendant, add a visual module, configure the following:



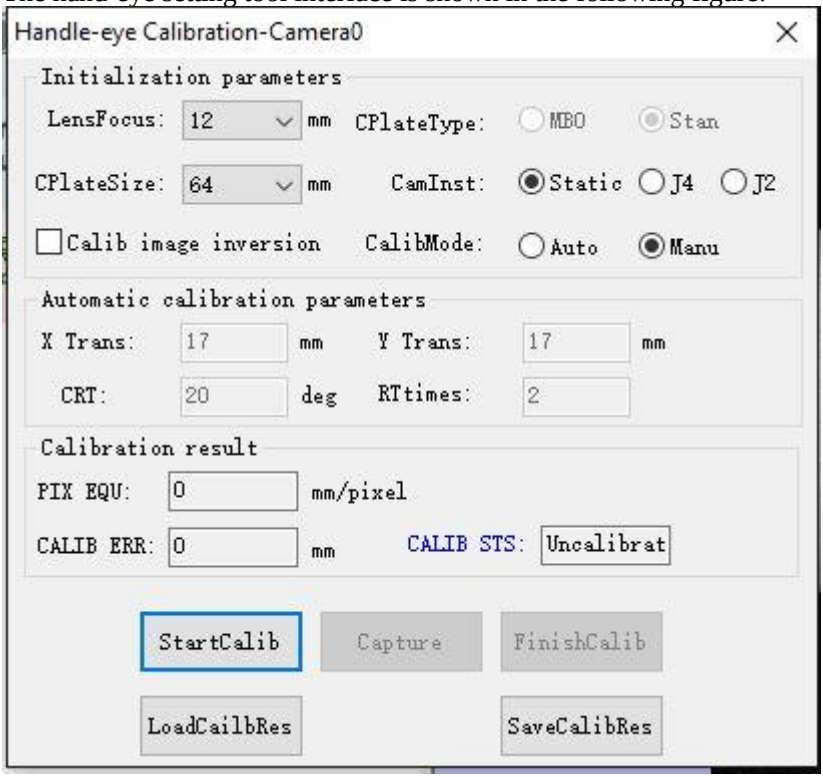
After configuration, load the AOTO_CAMER.AR script and manually move the robot so that the product or MARK point is roughly at the center of the image field of view. Record the robot position at user point 0 and tool 0 at point p19 and save the robot position. Run status and start.

- Click the “Start Calibration” button in the visual nine-point calibration dialog box. After this, the vision will send a position command to the robot. After the robot reaches the position, it will send its current position to the visual and trigger the visual camera positioning. After that, the automatic calibration process can be completed. After the robot stops motion, you can verify whether the calibration is correct. Click the “Single job” button and compare the coordinates of the visual positioning output with the coordinates in the robot teach pendant. Under normal circumstances, the difference between the two within 5 wires, after determining the calibration is correct, click on the "Save calibration" button to save the calibration results to a local file.
- See Appendix II for the contents of AOTO_CAMER.AR.

Note: For multi-camera calibration, be sure to note the "Nine-point calibration - Camera 0" displayed in the title bar of the dialog box to distinguish which camera is currently calibrated.

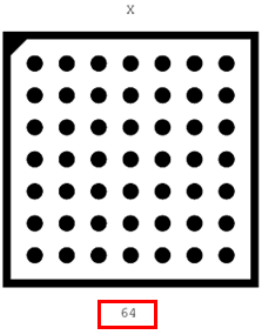
5.4.14 Hand-eye calibration tool

The hand-eye setting tool interface is shown in the following figure:

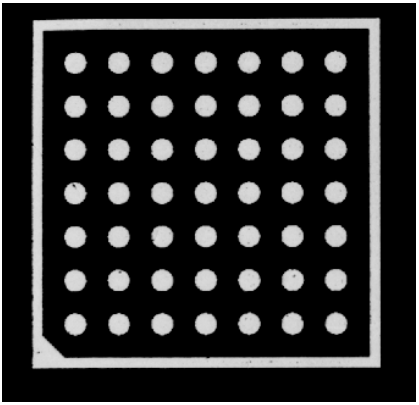


- Hand-eye calibration can only be performed using a calibration plate. Whether the camera is mounted stationary or mounted on the J2 axis, the J4 axis can be calibrated automatically. The specific method is as follows:
- Parameter settings. Lens Focal Length: This parameter is marked on the lens. If it is a telecentric lens, choose 100000 focal length

Calibration plate size: the size of the calibration plate using, the size of the black frame outside the target plate, and the label below.



The calibration image is reversed: the black in the image is turned into white, and the white is black. The standard calibration plate is black and white. If the coaxial light illuminates the calibration plate, the calibration plate image acquired is a white point and black matrix. When you need to check the calibration board to reverse, as shown in the figure.



◆ Calibration error: The smaller the value is, the higher the calibration accuracy is, and generally it should not exceed 0.5.

◆ Calibration status: indicates whether calibration is performed, pixel coordinates are not output at regular time, and physical coordinates have been calibrated.

◆ Automatic calibration parameters: generally keep the default, if the robot movement area cannot be reached during calibration; reduce the translation amount and rotation angle properly.

◆ Prepare the calibration plate. The calibration plate can be printed from the

calib folder under the software installation directory. The size should be between 1/4 and 1/2 of the field of view. The accuracy of the calibration plate printed below 30 mm is poor, and the accuracy is guaranteed. If you need to use the calibration plate below 30mm, it is recommended to use glass or ceramic calibration plate for calibration. In particular, hand-eye calibration does not require learning templates. If the camera is mounted on the J2 or J4 axis, the calibration plate remains stationary during calibration, and the robot moves with the camera in the position where it was visually sent. If the camera is mounted statically, then the robot is to carry the calibration plate. Move (can use the robot's tool to hold or clamp the calibration plate). It should be noted that the distance between the calibration camera and the calibration plate should be the same as the distance from the camera to the product when actually taking pictures.

◆ Configure visual communication. The method is the same as automatic nine points.

◆ Configure robot communication. The method is the same as automatic nine points. Move the calibration plate image so that it is approximately at the center of the image field of view. Record the robot position at user point 0 and tool 0 at point p19 and save the robot position. Turn the robot into automatic operation and start it.

◆ Click on the “Start Calibration” visual to perform the automatic calibration process. After the calibration is complete, click the “Save Calibration” button to save the results to a file.

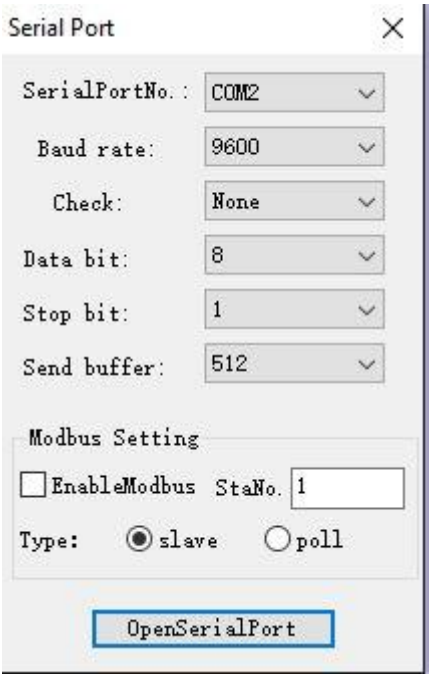
◆ In addition to hand-eye calibration, which can be calibrated using the AOTO_CAMER.AR script, you can also use the AOTO_CAMER_TEACH.AR script to calibrate. The difference between the two is AOTO_CAMER.AR. The point where the robot walks is to send the robot visually by the translation amount and the rotation angle. , and the point in the AOTO_CAMER_TEACH.AR script is taught directly in the robot. When the camera is mounted on the J2 axis, it may appear if the robot moves directly according to the visual translation and rotation angle. The calibration board runs out of the field of view because the position the robot uses with vision is moved with reference to the Z axis end, but when the camera is mounted on the J2 axis, the actual camera movement distance and angle and the movement of the Z axis end It is not a linear relationship, so directly use the AOTO_CAMER_TEACH.AR script to teach 11 points directly in the robot to ensure that the calibration board will appear in the camera's proper field of vision during the automatic calibration process.

◆ AOTO_CAMER_TEACH.AR content, please refer Appendix II.

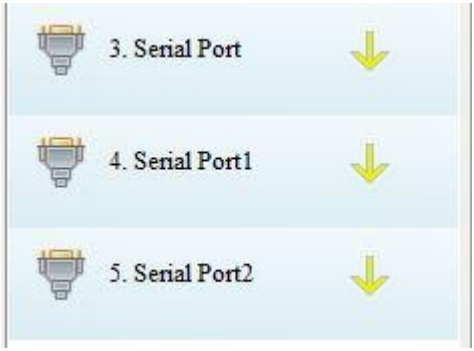
Note: For multi-camera calibration, be sure to note the "hand-eye calibration - camera 0" displayed on the title bar of the dialog box to distinguish which camera is currently calibrated.

5.4.15 Serial port tools

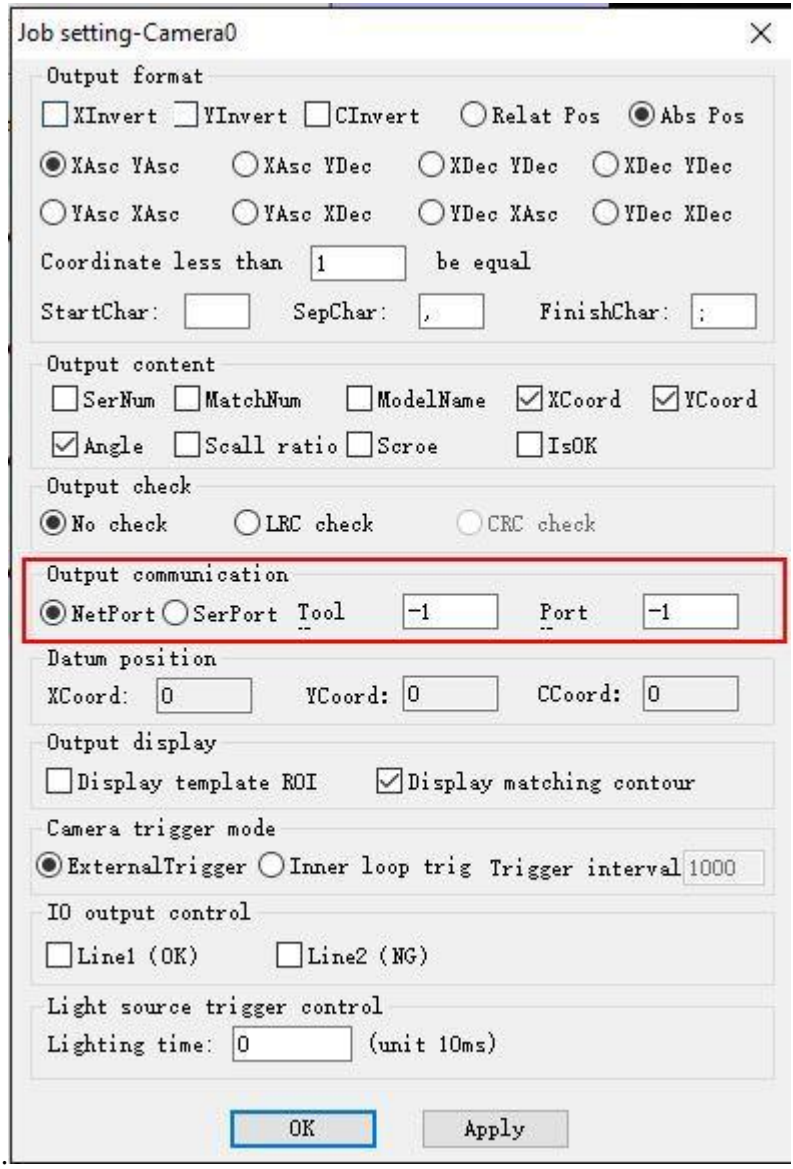
Through the RS232 interface to communicate with external devices, the main parameters are set as follows:



The serial port tool uses standard string communication by default, and also supports modbus protocol communication. A serial port tool can open a serial port. If you need to open multiple serial ports, you can drag multiple serial port tools into the workflow, as shown below.



When multiple serial tools are used, you can configure which camera's positioning results to send through the serial port in the job settings.



As shown in the figure above, from the “Job Settings - Camera 0” in the title bar of the dialog box, the current configuration is the camera 0 communication, the

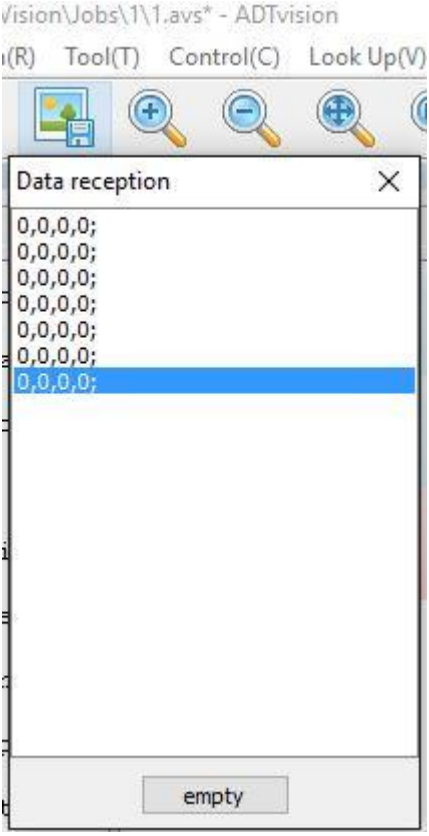
output communication selects the serial communication, the tool number represents the serial port tool in the workflow, if -1 means the camera 0 The positioning result will be sent from all open serial port tools. If it is 0, the camera 0's positioning result will only be sent from the “serial port” tool. If it is 1, it means the camera 0 positioning result will only be from “string”. The "port 1" tool is sent out. If it is 0, 1 means that the positioning result of camera 0 will be sent from the "serial port" and "serial port 1" tools. In serial communication, the port number parameter is meaningless and can be set.

In serial communication, the visually received valid trigger command must be in the form of a string of "0,0,0,0;" The first three digits are reserved as the robot's x, y, c numbers after the camera number, if If the robot wants to trigger the camera 0 to take a photo, it is 0. If you want to trigger the camera 1 to take a photo, it is 1. In general, the vision does not need to know the current position of the robot, so the first three bits can all be 0, that is, the robot sends “0, 0,” 0,0;” means trigger camera 0 to take a photo, send “0,0,0,1;” means trigger camera 1 to take a photo, the template that is enabled when taking a picture after positioning is determined according to the template checked in the template setting dialog box. Several templates are ticked to locate which template to search for. If you need to use the trigger command to dynamically enable which template to locate, you can add the template name after the standard trigger command. For example, to trigger template positioning with the name q in camera 0, you can send “0,0,0,0,q;” If you want to trigger template positioning with the name q and w in camera 0, you can send “0” ,0,0,0,q,w;"In addition to the external trigger command can automatically control the visual switching template, you can also control the visual automatic switching operation, the command format is "JOB, job name;" For example, send "JOB, 123;" Indicates that the vision software is switched to a job with the job name "123". The command "EP, camera number, exposure time;" can set the camera exposure time. For example, sending "EP, 0,60000;" means setting the camera 0 exposure time to 60000us

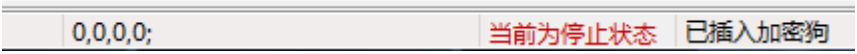
It is important to note that when the camera is mounted on the J4 or J2 axis and the auto-calibration function is used, the robot's trigger command must be accompanied by its current position, not all 0s. If the camera is mounted on the J2 axis, only hand-eye calibration can be used to achieve

automatic calibration. After calibration, the trigger command sent by the robot must be "x,y,c,0;" where x and y are the current Cartesian coordinates of the robot, c It is the value of the robot J1+J2. If the robot is mounted on the J4 axis, it can use hand-eye calibration or nine-point calibration to complete the automatic calibration. At this time, the trigger command sent by the robot is "x,y,c,0;" x,y is the robot's current Cartesian coordinates, c is the robot's current Cartesian c, which is the value of J1+J2+J4. If the camera is installed statically, x,y,c can all be 0.

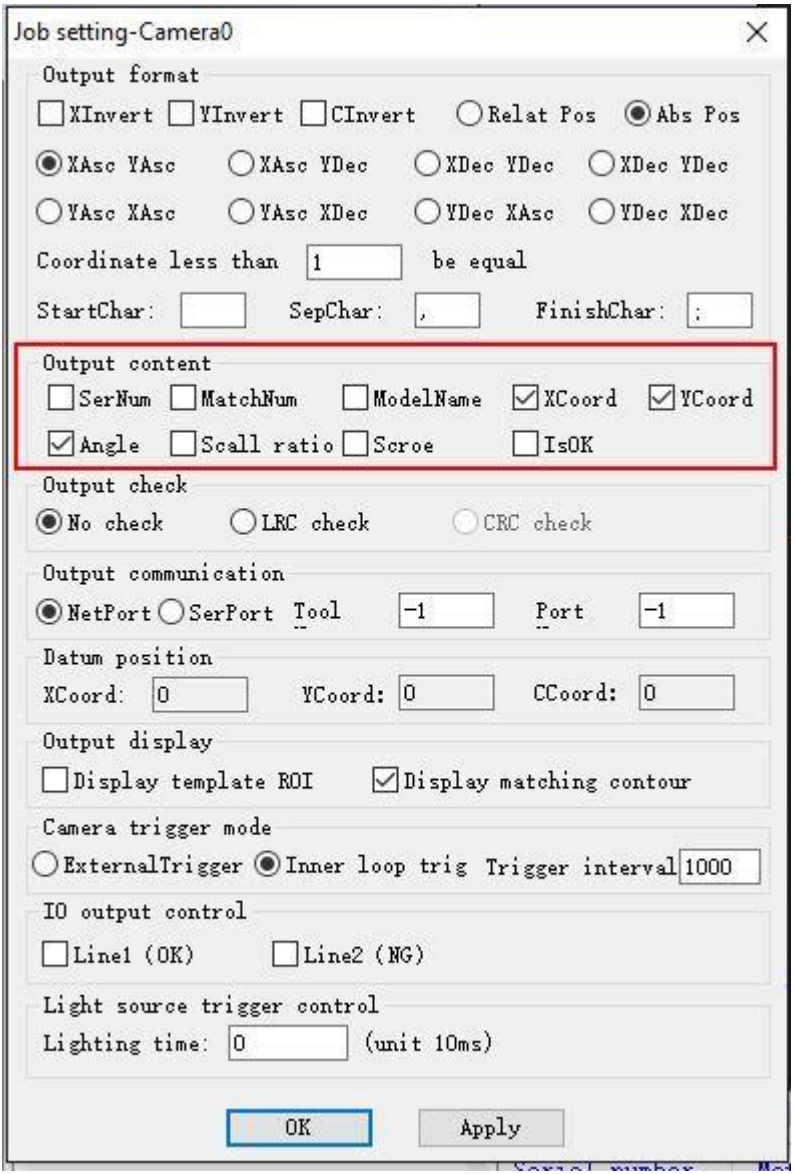
You can open the Data Receiving dialog box in the Tools menu to see the visually received data.



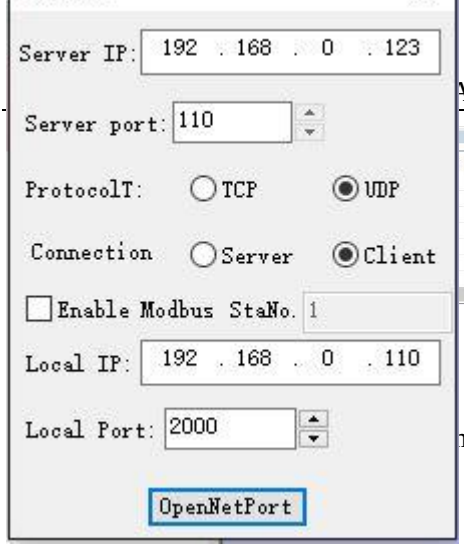
You can also view the visually received data from the status bar, as shown below

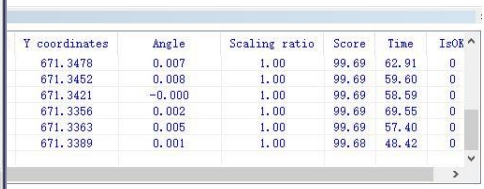


The data format returned to the robot after visual positioning is defaulted to “x, y, c;” where x and y represent the coordinate values that are located. If the robot coordinates are calibrated, the x and y indicate that the target is The position in the coordinates of the robot user, if it is calibrated to the robot's base coordinates, then x, y is the position of the target in the robot's base coordinates, c is the angle of the positioning, is the angle of the target relative to the posture when doing the template. If there are multiple positioning results, the format is "x1, y1, c1; x2, y2, c2; x3, y3, c3;" In addition to the visual output coordinates and angles, it can also output other information, which can be set in the job settings. Check it, as shown below:



The output content item corresponds to the output list item.

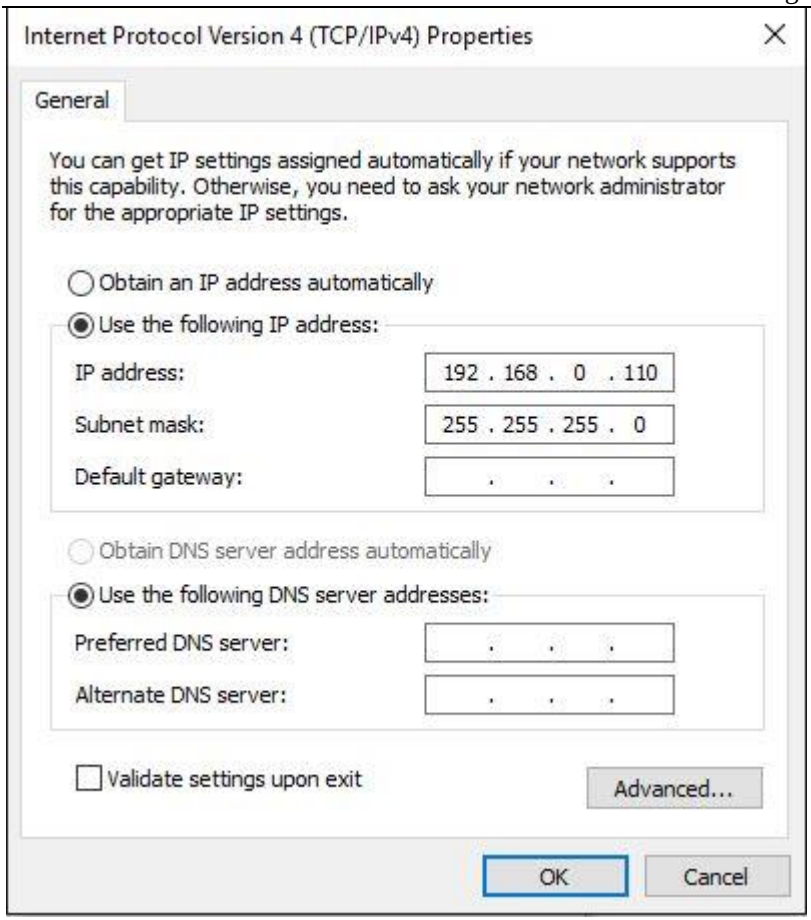




Y coordinates	Angle	Scaling ratio	Score	Time	IsOK
671.3478	0.007	1.00	99.69	62.91	0
671.3452	0.008	1.00	99.69	59.60	0
671.3421	-0.000	1.00	99.69	58.59	0
671.3356	0.002	1.00	99.69	69.55	0
671.3363	0.005	1.00	99.69	57.40	0
671.3389	0.001	1.00	99.68	48.42	0

unicate with external devices, the main

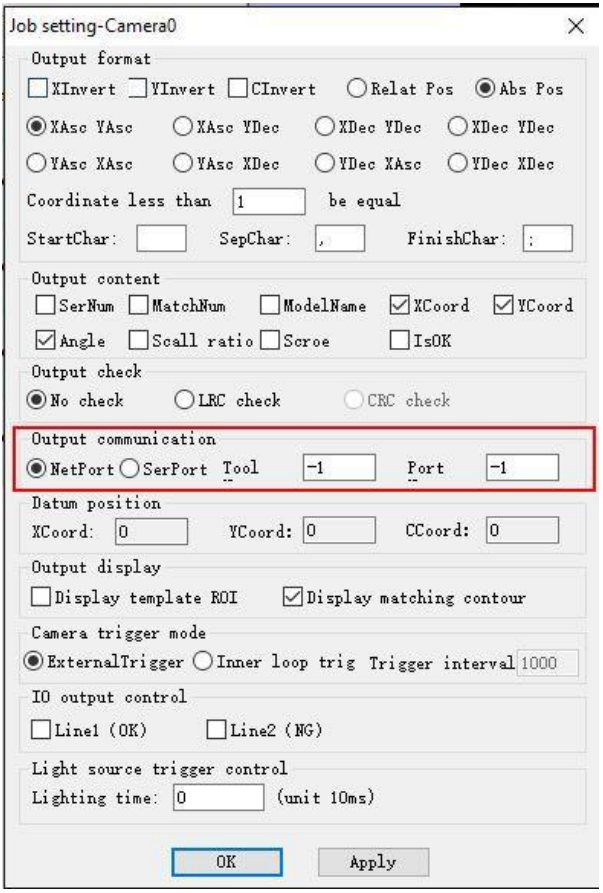
The first thing to note is that the IP address of the network adapter to which the vision controller and the robot are connected should not be set to “obtain the IP address automatically”. Be sure to set “Use the following IP address” and enter a fixed LAN IP address manually, as shown below Shown:



When the visual software acts as a server, it is necessary to set the correct server IP address. At this time, the server IP is the IP address of the vision controller. Since the vision controller has multiple network cards, the network adapter IP card that is connected to the robot in the vision controller needs to be used. The address is set here. When vision is used as a client, the server IP is the IP address of the robot, and the local IP address is the IP address of the network adapter that represents the vision controller and the robot, that is, which network port the vision controller uses to communicate with the robot.

Ethernet tools use standard string communication by default and also support modbus protocol communication. An Ethernet tool can open a network connection. If you need to open multiple network connections, you can drag

multiple Ethernet tools into the workflow, as shown below.



When multiple Ethernet tools are used, you can configure which Ethernet

camera the positioning result of each camera passes through in the job settings.

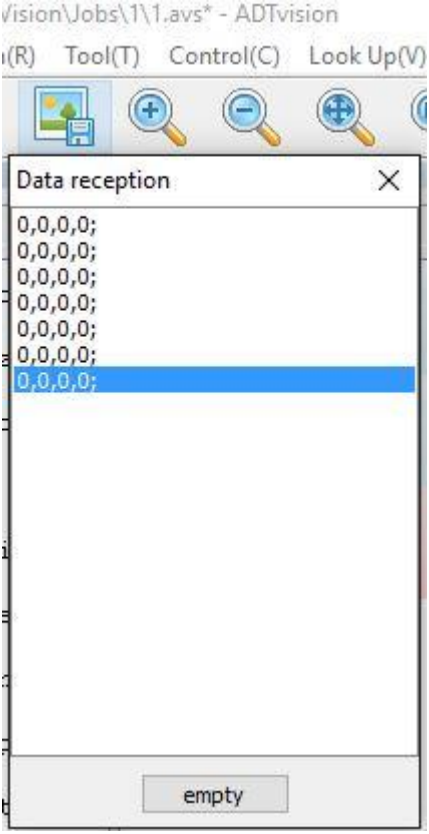
As shown in the figure above, from the “Job Settings - Camera 0” in the title bar of the dialog box, the current configuration is the camera 0 communication, the output communication selects the network port communication, and the tool number represents the Ethernet tool in the workflow. If -1 is displayed, Camera 0's positioning result will be sent from all open Ethernet tools. If it is 0, the camera 0's positioning result will only be sent from the "Ethernet" tool. If it is 1, the camera 0's positioning result will only be from The "Ethernet 1" tool is sent out. If it is 0, 1 means that the camera 0's positioning result will be sent from the "Ethernet" and "Ethernet 1" tools. When vision is used as a server, an Ethernet tool can establish connections with multiple external clients. In this case, different connections in the same tool can be distinguished based on the port number. When -1, the positioning result is sent to all connections. For 2000, the positioning result is sent from the port number 2000 in the Ethernet tool specified in the tool number. In 2000, 2001, the positioning result indicates the port number in the Ethernet tool specified in the tool number. Send out for the 2000 and 2001 connections. When visual is used as a client, the port number parameter is meaningless and don’t need to set.

When the network port communicates, the visually received valid trigger command must be a string of “0, 0, 0, 0;” The first three digits are reserved as the robot's x,y,c numbers after the camera number. If the robot wants to trigger the camera 0 to take a photo, it is 0, if you want to trigger the camera 1 to take a photo, it is 1. Generally, the vision does not need to know the current position of the robot, so the first three bits can all be 0, that is, the robot sends “0,0” ,0,0;" means triggering camera 0 to take a photo, sending "0,0,0,1;" means triggering camera 1 to take a photo. After the photo is taken, the template that is enabled during positioning is determined according to the template checked in the template setting dialog box. Which template is ticked to locate which template to search for, if you need to use the trigger command to dynamically enable which template is located; you can add the template name after the standard trigger command. For example, to trigger template positioning with the name q in camera 0, you can send “0,0,0,0,q;” If you want to trigger template positioning with the name q and w in camera 0, you can send “0” ,0,0,0,q,w;"In addition to the

external trigger command can automatically control the visual switching template, you can also control the visual automatic switching operation, the command format is "JOB, job name;" For example, send "JOB, 123;" Indicates that the vision software is switched to a job with the job name "123". The command "EP, camera number, exposure time;" can set the camera exposure time. For example, sending "EP, 0,60000;" means setting the camera 0 exposure time to 60000us.

It is important to note that when the camera is mounted on the J4 or J2 axis and the auto-calibration function is used, the robot's trigger command must be accompanied by its current position, not all 0s. If the robot is mounted on the J2 axis, only hand-eye calibration can be used to achieve automatic calibration. After calibration, the trigger command sent by the robot must be "x,y,c,0;" where x and y are the current Cartesian coordinates of the robot, c It is the value of the robot J1+J2. If the camera is mounted on the J4 axis, you can use the hand-eye calibration or the nine-point calibration to complete the automatic calibration. At this time, the trigger command sent by the robot is "x,y,c,0;" x,y is the robot's current Cartesian coordinates, c is the robot's current Cartesian c, which is the value of J1+J2+J4. If the camera is installed statically, x,y,c can all be 0.

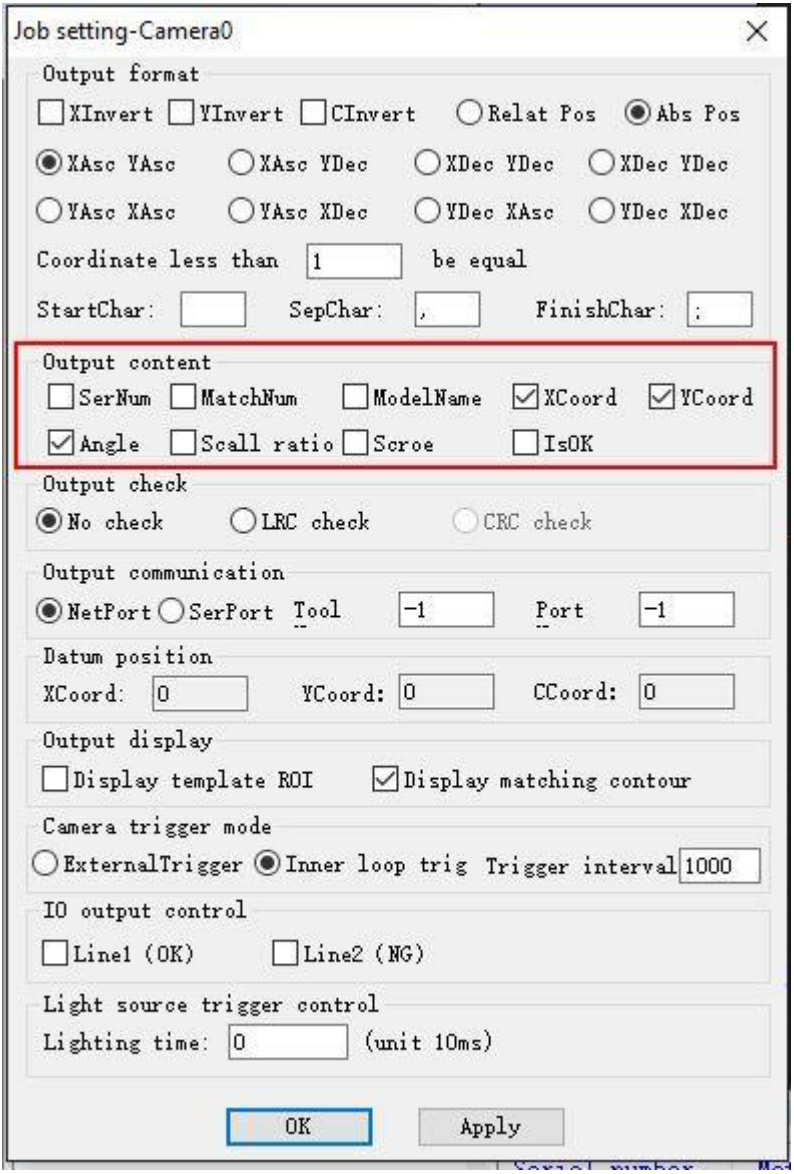
You can open the Data Receiving dialog box in the Tools menu to see the visually received data.



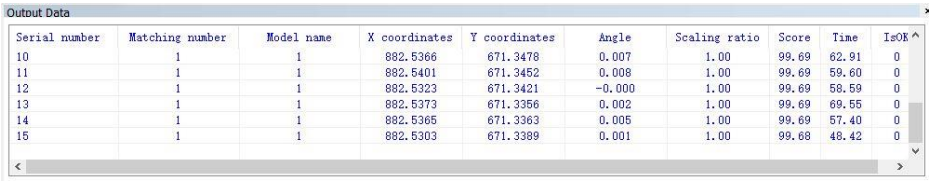
You can also view the visually received data from the status bar, as shown below

The data format returned to the robot after visual positioning is defaulted to “x,y,c;” where x and y represent the coordinate values that are located. If the robot coordinates are calibrated, the x and y indicate that the target is The position in the coordinates of the robot user, if it is calibrated to the robot's base coordinates, then x, y is the position of the target in the robot's base coordinates, c is the angle of the positioning, is the angle of the target relative to the posture when doing the template . If there are multiple positioning results, the format is "x1, y1, c1; x2, y2, c2; x3, y3, c3;" In addition to the visual output coordinates and angles, it can also

output other information, which can be set in the job settings. Check it, as shown below:



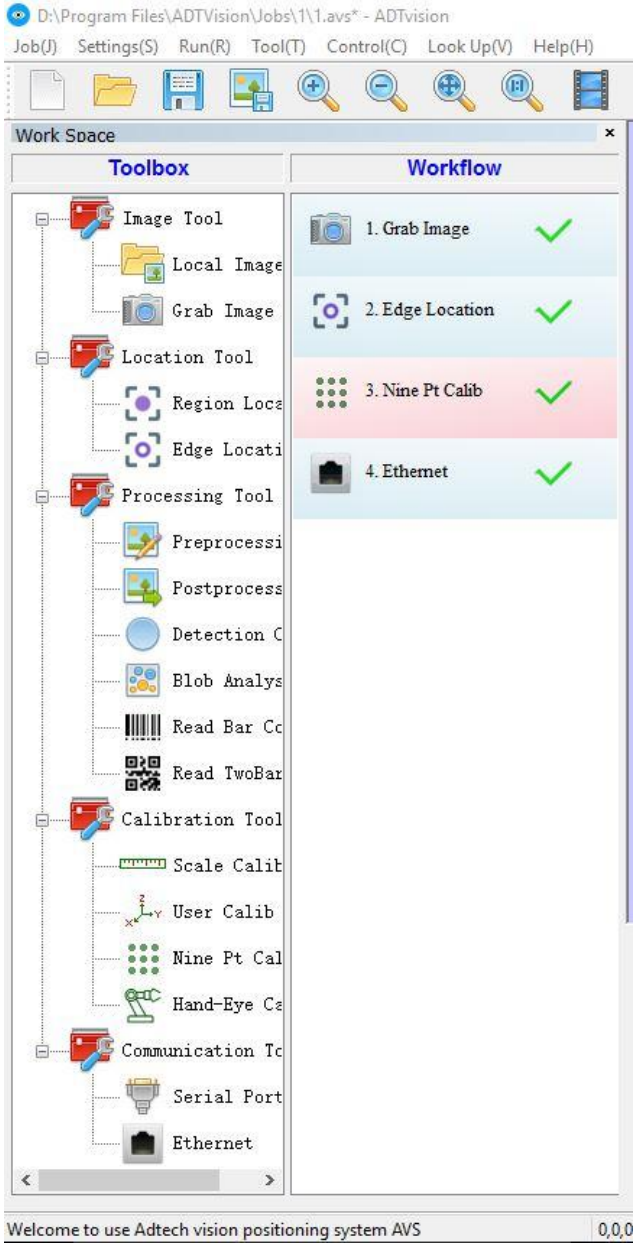
The output content item corresponds to the output list item.


Output Data

Serial number	Matching number	Model name	X coordinates	Y coordinates	Angle	Scaling ratio	Score	Time	IsOK
10	1	1	882.5366	671.3478	0.007	1.00	99.69	62.91	0
11	1	1	882.5401	671.3452	0.008	1.00	99.69	59.60	0
12	1	1	882.5323	671.3421	-0.000	1.00	99.69	58.59	0
13	1	1	882.5373	671.3356	0.002	1.00	99.69	69.55	0
14	1	1	882.5365	671.3363	0.005	1.00	99.69	57.40	0
15	1	1	882.5303	671.3389	0.001	1.00	99.68	48.42	0

Chapter 6 ADTVision Operation Example

6.1 Creat a new job

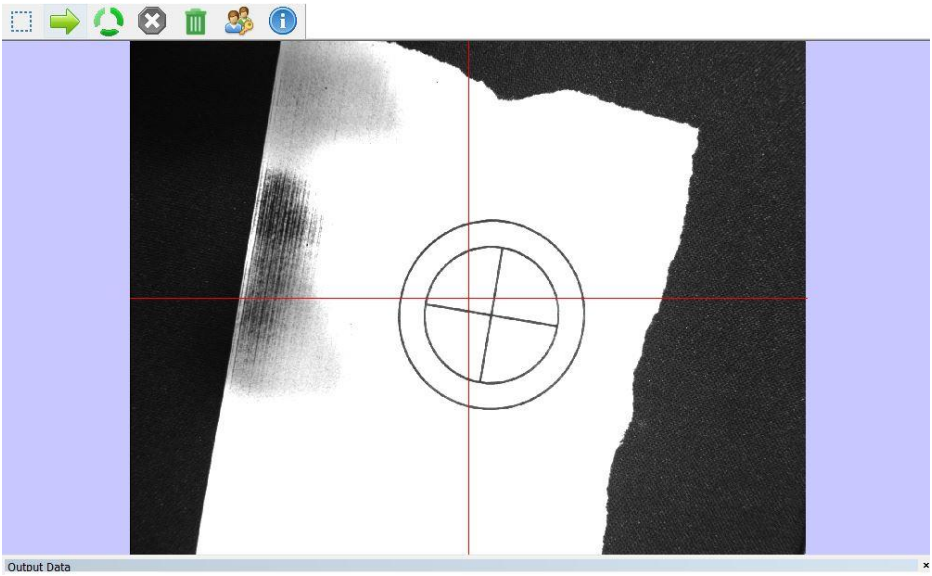


From the toolbox, drag the "Sampling Image", "Edge Positioning", "Nine Point

Calibration" and "Ethernet" tools to the job flow list, and click the "Save Job" button in the toolbar to save the job to a file Medium, as shown in the figure below.

6.2 Collecting images

Double-click the Capture Image tool. In the pop-up setting interface, click Open Device and exit the setting interface. After returning to the main window, adjust the camera height, camera aperture, focal length, and external light source until you see a clear-cut product image, as shown in the figure below.



6.3 Light source adjustment

The role of the external light source is to enhance the outline of the object and reduce the interference of external environmental factors. The brightness of the light source will affect the depth of field of the lens. The greater the brightness of the external light source, the smaller the aperture of the lens must be adjusted, resulting in a greater depth of field and a larger depth of field. The advantage is that the image can be clearly imaged when the height of the object changes. If the height of the object is fixed, it is recommended to reduce the brightness of the external light source and increase the aperture to reduce the depth of field, which makes it easier to adjust the image to the clearest state.

If you are using an analog light controller, simply adjust the brightness to the

clearest state using the rotary knob as shown below.

C1 series analog light source

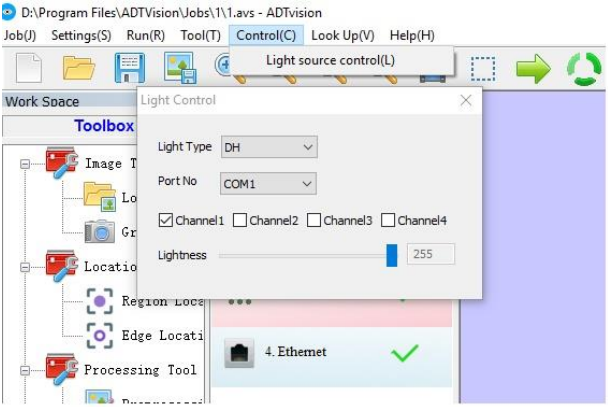
B1 series analog light source

If you are using a digital light controller, you can use the software to adjust the light source brightness, as shown below.

C1 series digital light source

B1 series digital light source

Connect the power cable of the digital light controller. Connect one end of the light source extension to the light source connector. Connect one end of the RS232 serial cable to the serial port of the light source controller and connect the other end to the serial port of the vision controller. After the connection is completed, open the vision software, click on "Control" in the menu bar, and then click on "Light Source Control" to open the light source adjustment dialog box, as shown below.



Select the type of light source, serial port number according to the serial port connection in the visual controller which port to choose, the channel corresponding to the four light source interface, check which channels, adjust the brightness of these channels, after adjusting the brightness The learning template, the brightness of the template and the channel information are saved in the template parameters. When the template is enabled during positioning, the brightness of the light source is automatically adjusted to the brightness value saved in the parameters.

C1 series digital light controller can also adjust the brightness by pressing the key. The operation method is: press the MODE key shortly, press the up and down arrow keys to select the parameter as P.01, long press the SET key to enter the channel selection, press the up and down arrow keys to select the corresponding channel , Press the SET button to enter the brightness adjustment, press the up and down arrow keys to adjust the brightness, note that after setting the brightness through the button, when the light source controller power off and restart, you need to set it again.

The B1 series digital light controller can also adjust the brightness by pressing keys. The operation method is:

1) Press the "SET" key to select the brightness adjustment mode for the

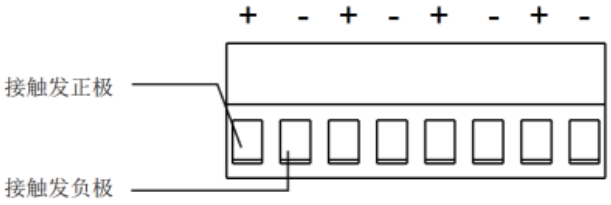
channel to be set. The first digit of the nixie tube shows the channel number, and the last three digits show the brightness value of the channel.

such as:  “1.123” indicates the first channel, brightness value 123.

2）The "+" button increases the brightness level and 255 indicates the highest level. The key "-" is to decrease the brightness level and 000 is the lowest level. The brightness level changes rapidly when long-pressed, suitable for coarse adjustment of brightness.

After setting the brightness of the B1 series digital light controller, the power failure will be automatically saved, and the brightness will be automatically restored to the set brightness at the next power-on, without the need to repeat the setting.

B1 series digital light sources can also be triggered by external IO. The relevant descriptions are as follows:



Trigger input terminal

Controller Triggered Wiring As shown in the figure above, there are a total of eight wiring ports. Each of the two wiring ports forms a pair of trigger controllers. From left to right, the compliance is from channel 1 to channel 4.

The user can control the light source trigger by outputting a logic level signal of a certain voltage to a controller trigger terminal through a relay, a logic gate, and the like.

正触发

	光源亮	光源灭
触发逻辑	上升沿	下降沿

负触发

	光源亮	光源灭
触发逻辑	下降沿	上升沿

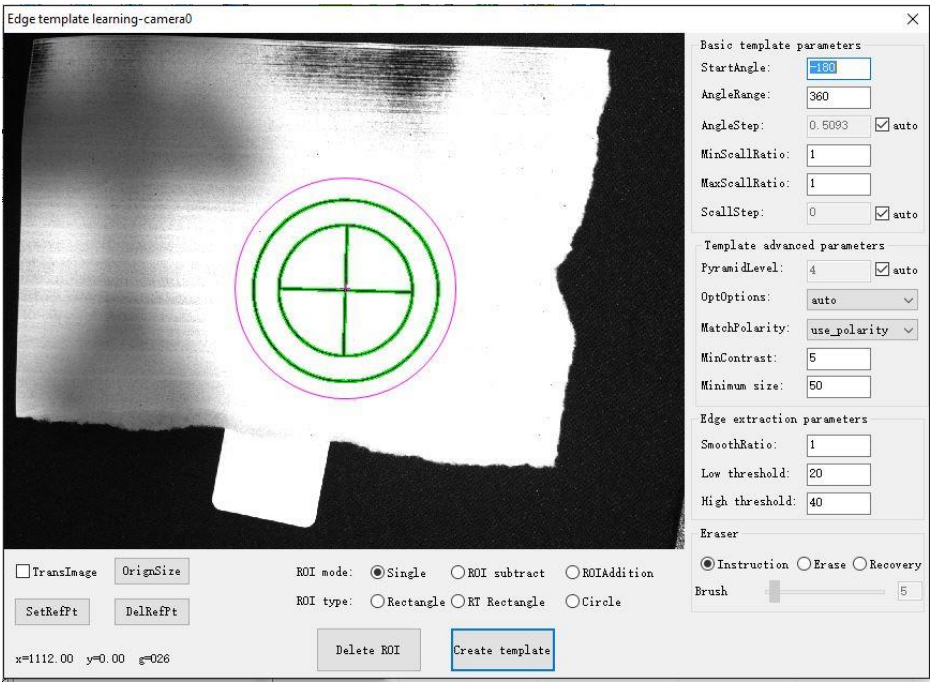
Note: Low level (0~1.6V), high level (3.3~24V), when it is not touching the

line, the default is low level, and the rising edge is from low level to high level. The falling edge is The process from high level to low level.

Note: Before adding a template, you must first adjust the light source brightness value.

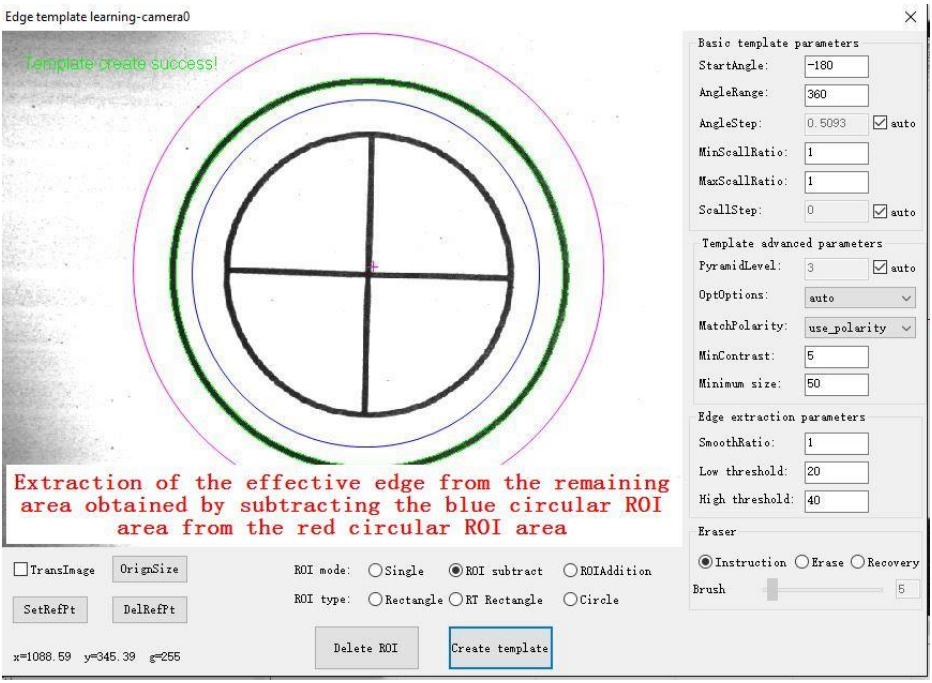
6.4 Add a template

Double-click the Edge Positioning tool. In the displayed interface, click the Add Template button. After entering the template name, the following dialog box is displayed:

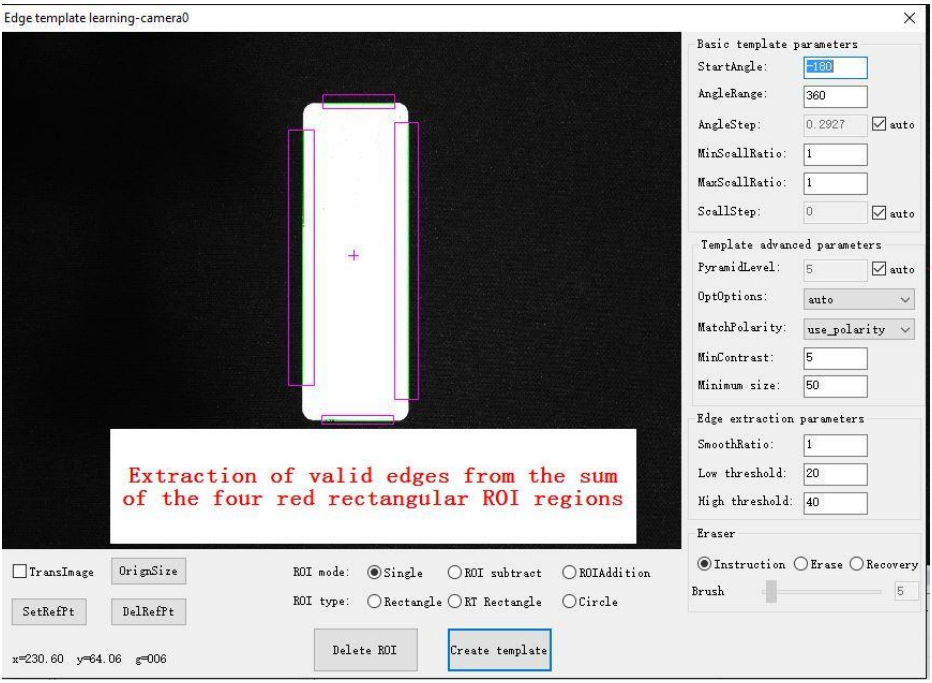


In this dialog box, select the appropriate ROI type based on the shape of the product, and drag the left mouse button to draw the ROI. The size of the ROI is appropriate to include the product as much as possible. Click the Create Template button to complete the creation of the template and the template is created. The successful tip will be displayed in the upper left corner of the image. The ROI is shown in red. The edge of the template is indicated by a green line. The green edge line and the contour of the object match and the continuity is good, indicating that the template creation effect is good. The meaning of the right

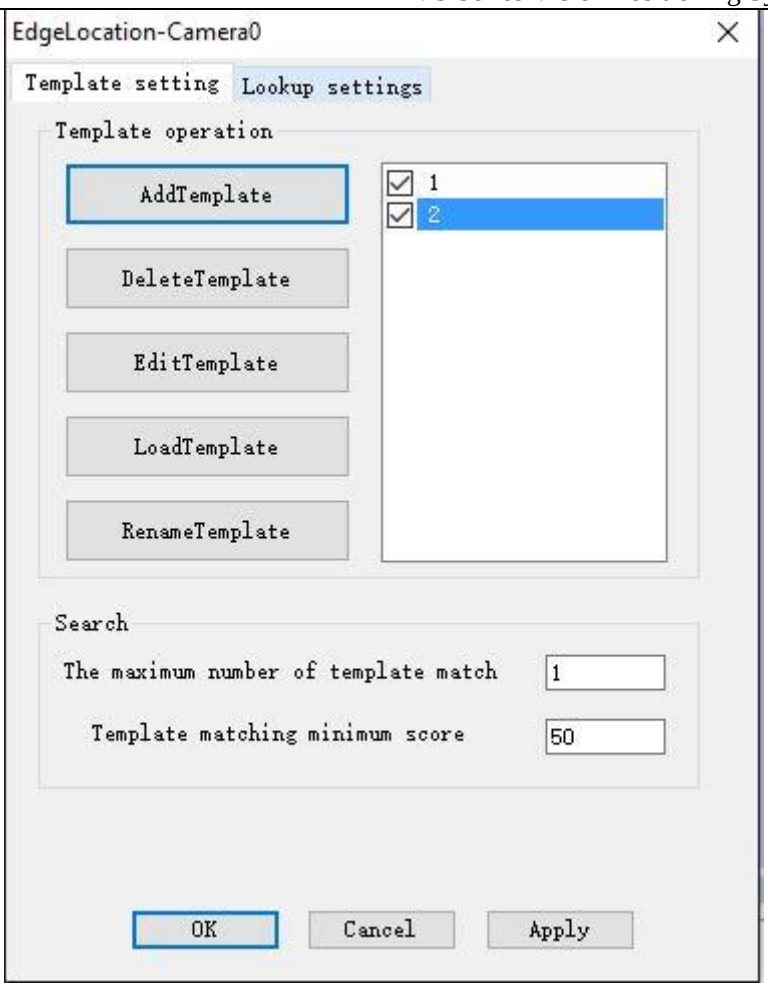
parameter can be found in Section 5.4.4 edge positioning tools, generally keep the default. During the template creation process, if you want to get rid of some unwanted edges, as shown above in the middle of the circular product, you can select the ROI mode as "subtract ROI". Draw an ROI at the edge where you want to remove the edge. After creating the template, create a template. The edge of the generated template will no longer contain the edge of the ROI segment, as shown in the following figure.



If you have already created a ROI during the template creation process, and you also need to include the edge contours in an area outside the ROI, you can use the "ROI Addition" mode. For example, the first ROI in the product contains only On the left side of the rectangular edge profile, if you want to include the top, bottom, and right side of the rectangular outline of the product without changing the size of the first ROI, you can select "ROI addition" in addition. After drawing an ROI on each side, click Create Template. The extracted edges will be the outlines of the total area obtained by adding the four areas, as shown in the following figure:



After the template is added successfully, it returns to the template setting and search setting interface. For the meaning and setting method of these two interface parameters, see 5.4.4 Edge Positioning Tool. Note that when multiple templates are used, each template corresponds to a matching number and matching score need to be set separately. After setting these two parameters of a template, you need to click the "Apply" button to take effect. The blue highlighted in the list is the template currently being set, as follows Picture:

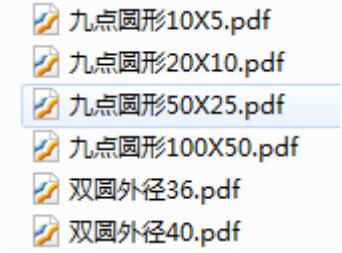


The Pyramid parameter of the template is reasonable in most cases, but in some cases manual settings are required. After finishing the template, if you find the positioning time is long, you can return to the template learning dialog box, remove the "automatic" behind the pyramid parameters, add 1 or 2 on the basis of the current value and manually enter it, and then click Create Template. If you have just finished the template and positioned it immediately, but it is not positioned, you need to return to the template learning dialog box to remove the “automatic” behind the pyramid parameters, and then decrease it by 1 or 2 after the current value. Enter it and click Create Template.

6.5 Calibration camera

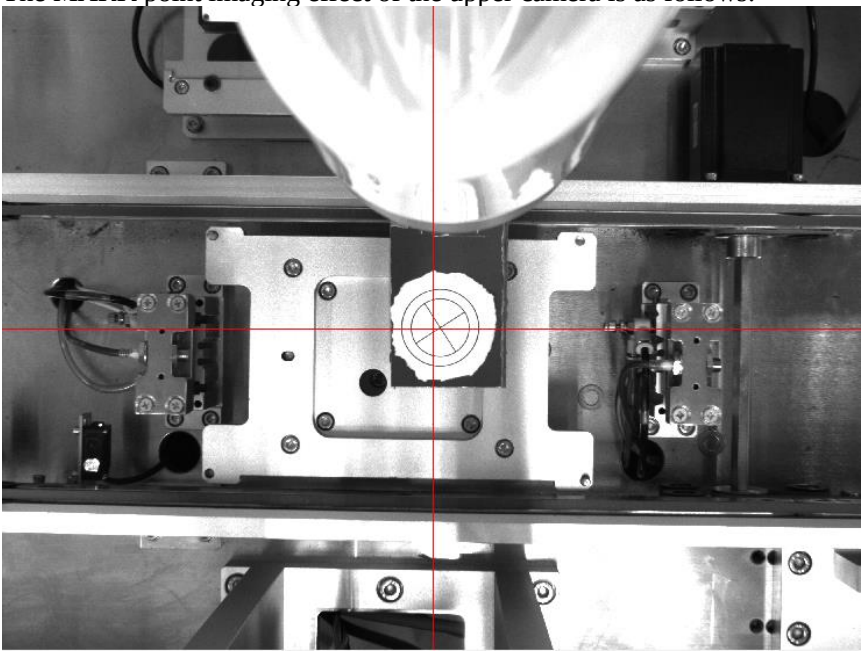
Vision provides a variety of calibration tools. Normally, the automatic calibration mode in the “Nine Point Calibration” tool is preferred. This method requires neither a calibration pin nor a calibration plate. It is very simple and efficient to perform automatic calibration with a robot.

- First, learn the edge template of a product or MARK point. It is recommended to use the MARK point first to learn the template. In the calib folder under the software installation directory, find the PDF file used to print the MARK point, as shown below:



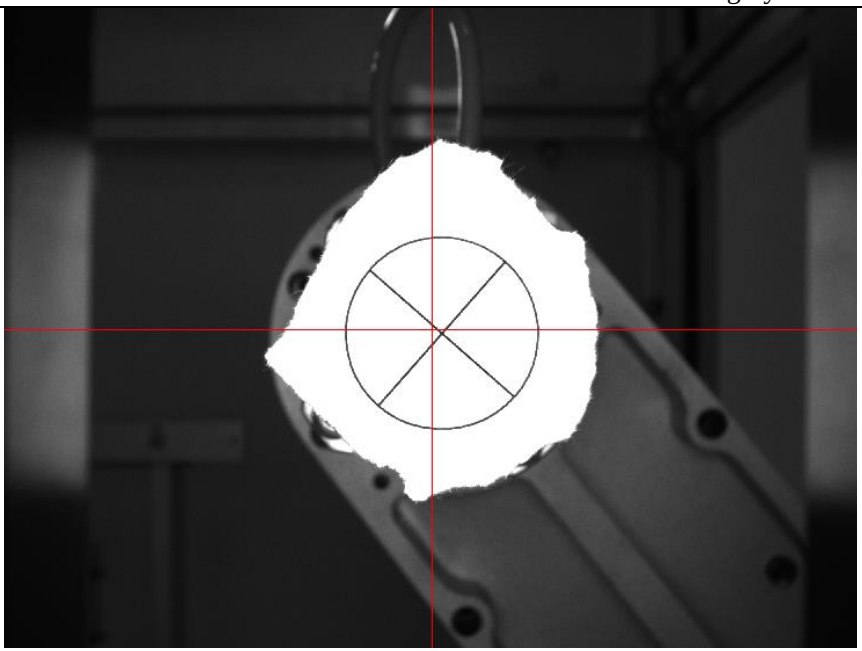
After printing out, crop a MARK point. If the camera is mounted in a stationary position, suck or stick the MARK spot on the robot's tool. If the camera is mounted on the robot's J4 axis, fix the MARK on the picture plane. No matter what kind of method, we must ensure that the height of MARK to the camera is the same as the actual camera. The camera is mounted at the top of the product at rest. The method for pasting the MARK points is as follows:

The MARK point imaging effect of the upper camera is as follows:

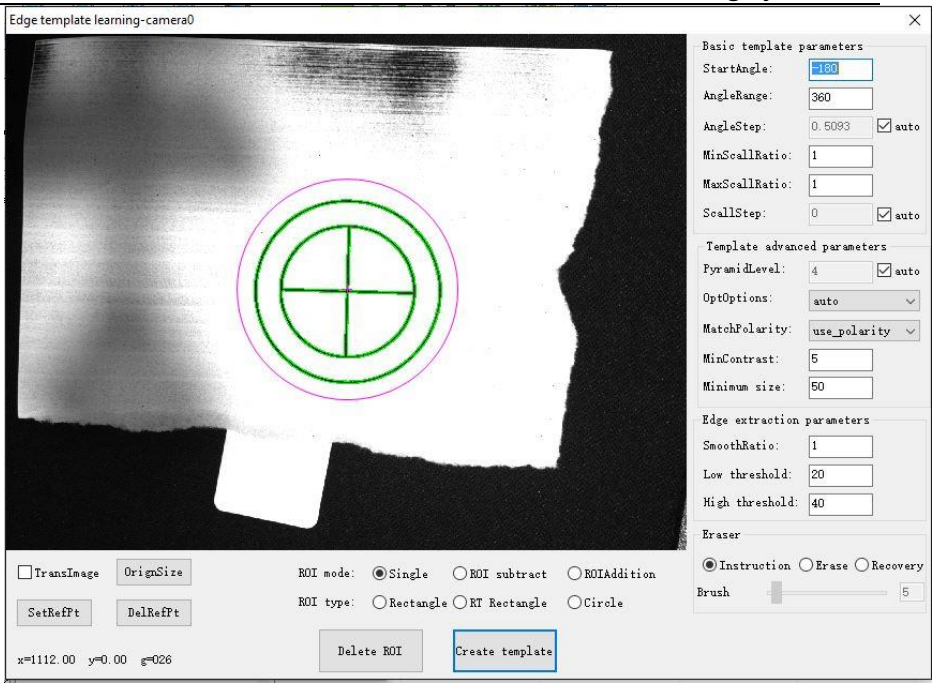


The camera is installed at the bottom of the product. The MARK dot is pasted as follows:

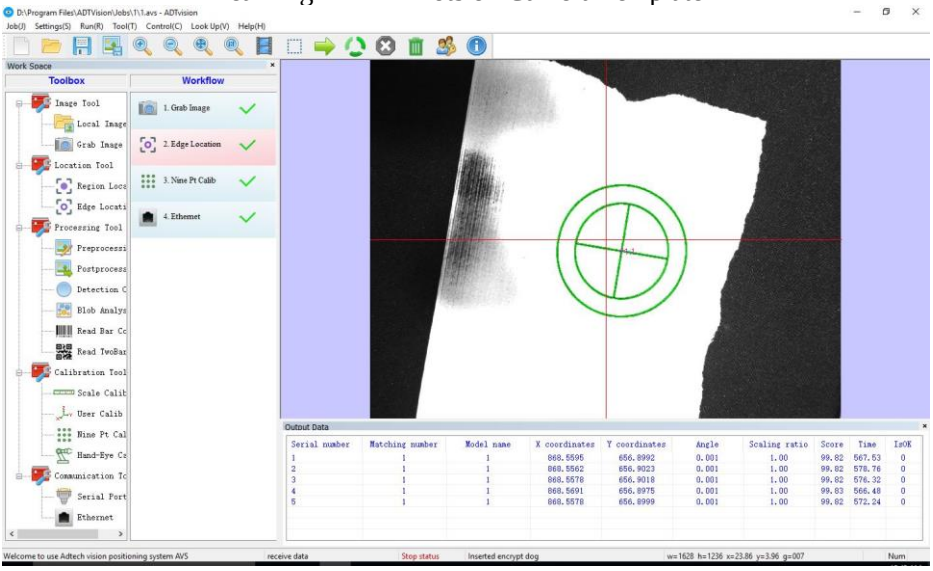
Under the camera MARK point imaging results are as follows:



The size of the MARK points should not be too large or too small. The size of the MARK points in the image above is appropriate. Double-click the "edge positioning" tool to open the template settings dialog box, click the "add template" button, enter the template name and enter the template learning dialog box to learn MARK point template, as shown below.

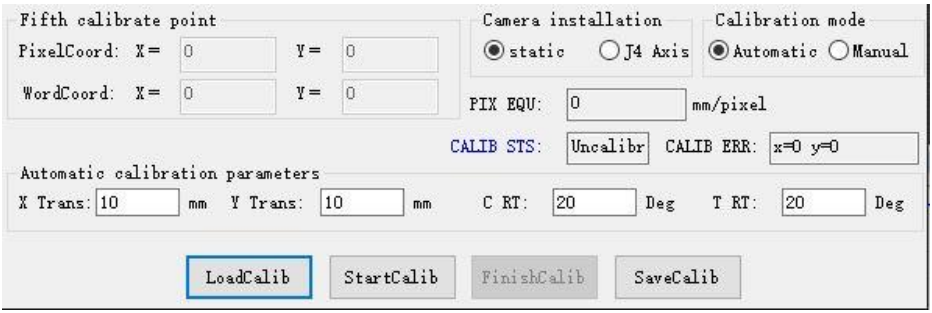


Learning MARK Dots on Camera Template



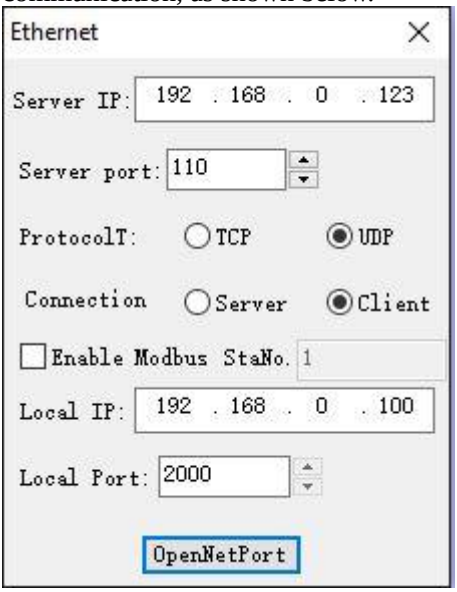
Under camera learning MARK dot template

◆ Double-click on the "9 point calibration" tool to open the settings dialog box, as shown below:



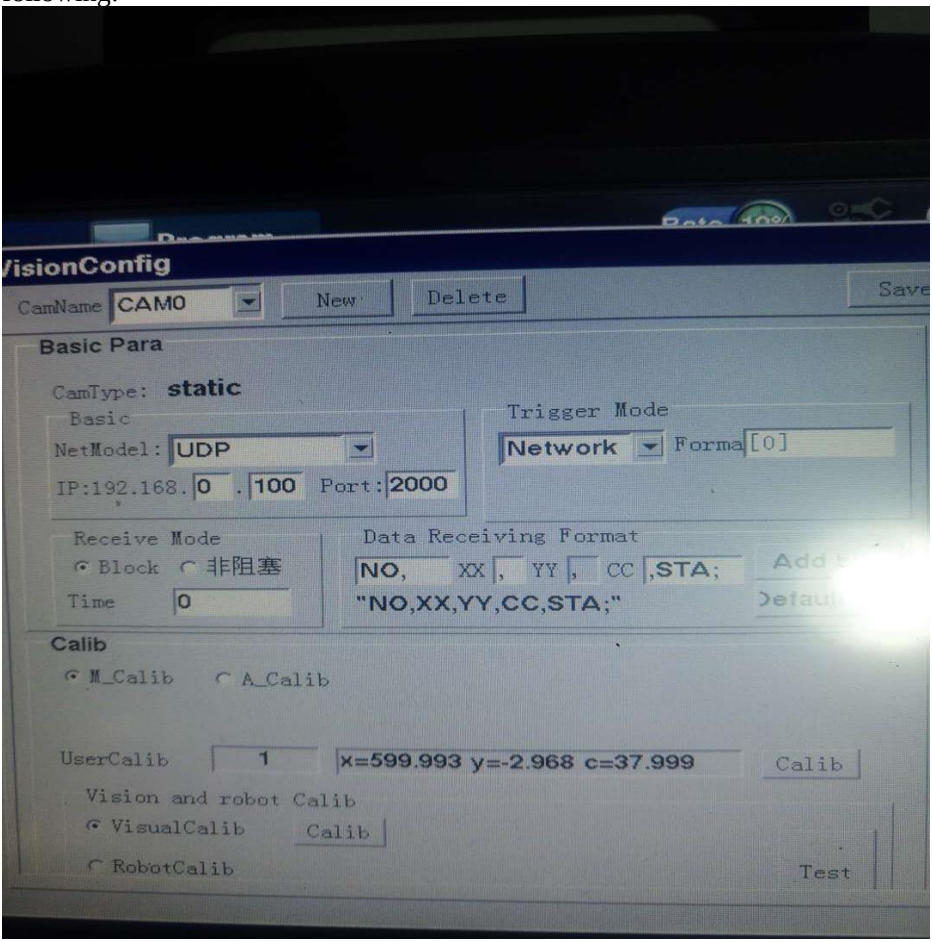
The camera installation mode is selected to be static, the calibration mode is selected to be automatic, and the parameters of translation and rotation are generally kept as default. If the robot displays an “area unreachable” error in the calibration process, the translation amount or the rotation angle can be reduced accordingly. It should be noted that the distance of the camera from the MARK point should be the same as the distance from the camera to the product when the camera was actually photographed.

◆ Configure visual communication. First configure the visual side of the communication, as shown below.

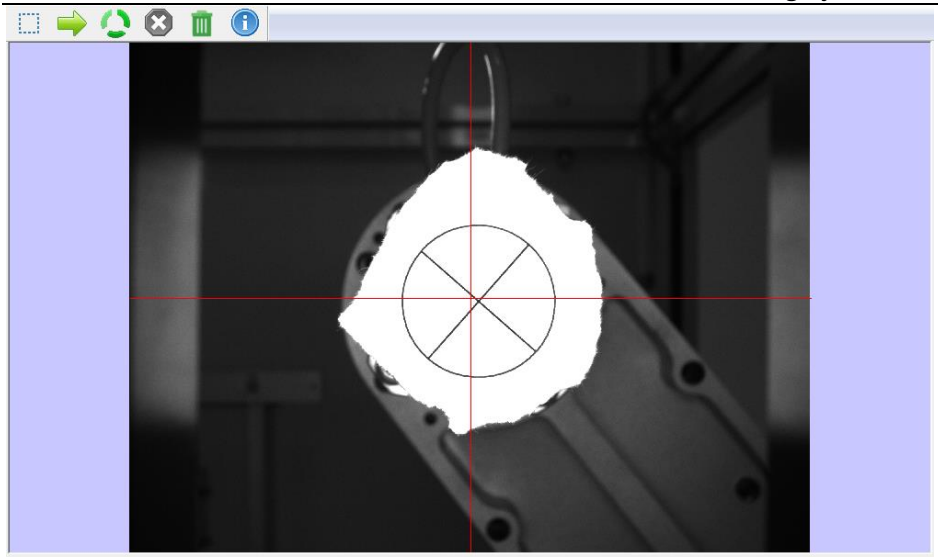


The IP address and port number of the robot are filled in with the server IP and port number, and the IP address of the network card connected with the robot in the vision controller is filled in with the local IP address. The port number is generally 2000 by default.

◆ Configure robot communication, create a new project in the robot teach pendant, add a visual module, configure the following:



After loading the AOTO_CAMER.AR script, manually move the robot so that the MARK point is approximately in the center of the image field, as shown in the following figure:



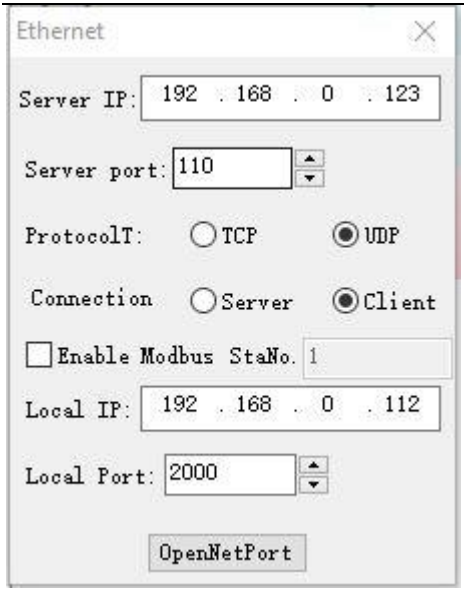
Under user 0 and tool 0, the position of the robot at this time is recorded in point p19 and saved, and the robot is brought into automatic operation and started.

◆ Click the “Start Calibration” button in the visual nine-point calibration dialog box. After this, the vision will send a position command to the robot. After the robot reaches the position, it will send its current position to the visual and trigger the visual camera positioning. After that, the automatic calibration process can be completed. After the robot stops motion, you can verify whether the calibration is correct. Click the “Single job” button and compare the coordinates of the visual positioning output with the coordinates in the robot teach pendant. Under normal circumstances, the difference between the two within 5 wires, after determining the calibration is correct, click on the "Save calibration" button to save the calibration results to a local file.After the calibration is completed, the visual coordinates sent to the robot are the base coordinates of the target in the robot system.

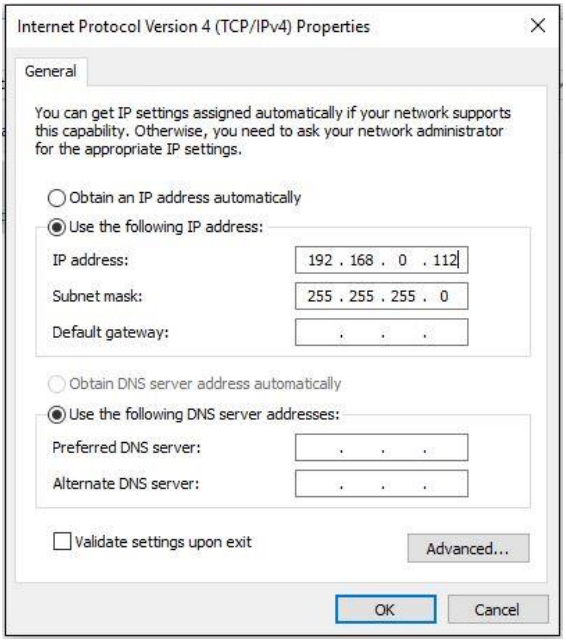
◆ See Appendix II for the contents of AOTO_CAMER.AR.

6.6 Establish communication

Take network port communication as an example. Double-click the Ethernet tool to open the settings window as follows:



The first thing to note is that the IP address of the network adapter to which the vision controller and the robot are connected should not be set to “obtain the IP address automatically”. Be sure to set “Use the following IP address” and enter a fixed LAN IP address manually, as shown below Shown:

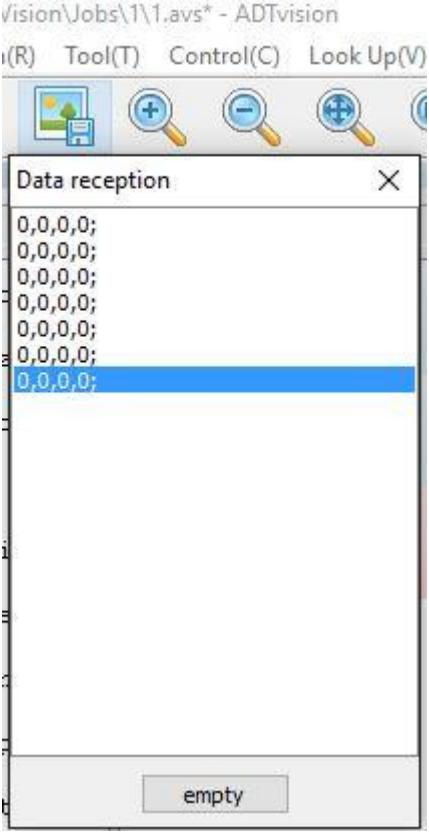


The IP of the server is filled in the IP address of the robot. The default is 192.168.0.123. The server port is used to fill in the port number of the robot. The default is 110. Local IP Fill in the IP address of the network adapter that the vision controller and robot are connected to. This is the IP address configured in the figure above. This is 192.168.0.112. The default local port number is 2000. After the configuration is complete, click the "Open Network Port" button.

When the network port communicates, the visually received valid trigger command must be a string of “0,0,0,0;” The first three digits are reserved as the robot's x,y,c numbers after the camera number. If the robot wants to trigger the camera 0 to take a photo, it is 0, if you want to trigger the camera 1 to take a photo, it is 1. Generally, the vision does not need to know the current position of the robot, so the first three bits can all be 0, that is, the robot sends “0,0” ,0,0;" means triggering camera 0 to take a photo, sending "0,0,0,1;" means triggering camera 1 to take a photo. After the photo is taken, the template that is enabled during positioning is determined according to the template checked in the template setting dialog box. Which template is ticked to locate which template to

search for, if you need to use the trigger command to dynamically enable which template is located, you can add the template name after the standard trigger command. For example, to trigger template positioning with the name q in camera 0, you can send “0,0,0,0,q;” If you want to trigger template positioning with the name q and w in camera 0, you can send “0” ,0,0,0,q,w;"In addition to the external trigger command can automatically control the visual switching template, you can also control the visual automatic switching operation, the command format is "JOB, job name;" For example, send "JOB, 123;" Indicates that the vision software is switched to a job with the job name "123". The command "EP, camera number, exposure time;" can set the camera exposure time. For example, sending "EP, 0,60000;" means setting the camera 0 exposure time to 60000us. **It is important to note that when the camera is mounted on the J4 or J2 axis and the auto-calibration function is used, the robot's trigger command must be accompanied by its current position, not all 0s. If the robot is mounted on the J2 axis, only hand-eye calibration can be used to achieve automatic calibration. After calibration, the trigger command sent by the robot must be “x,y,c,0;” where x and y are the current Cartesian coordinates of the robot, c It is the value of the robot J1+J2. If the camera is mounted on the J4 axis, you can use the hand-eye calibration or the nine-point calibration to complete the automatic calibration. At this time, the trigger command sent by the robot is “x,y,c,0;” x,y is the robot's current Cartesian coordinates, c is the robot's current Cartesian c, which is the value of J1+J2+J4. If the camera is installed statically, x,y,c can all be 0.**

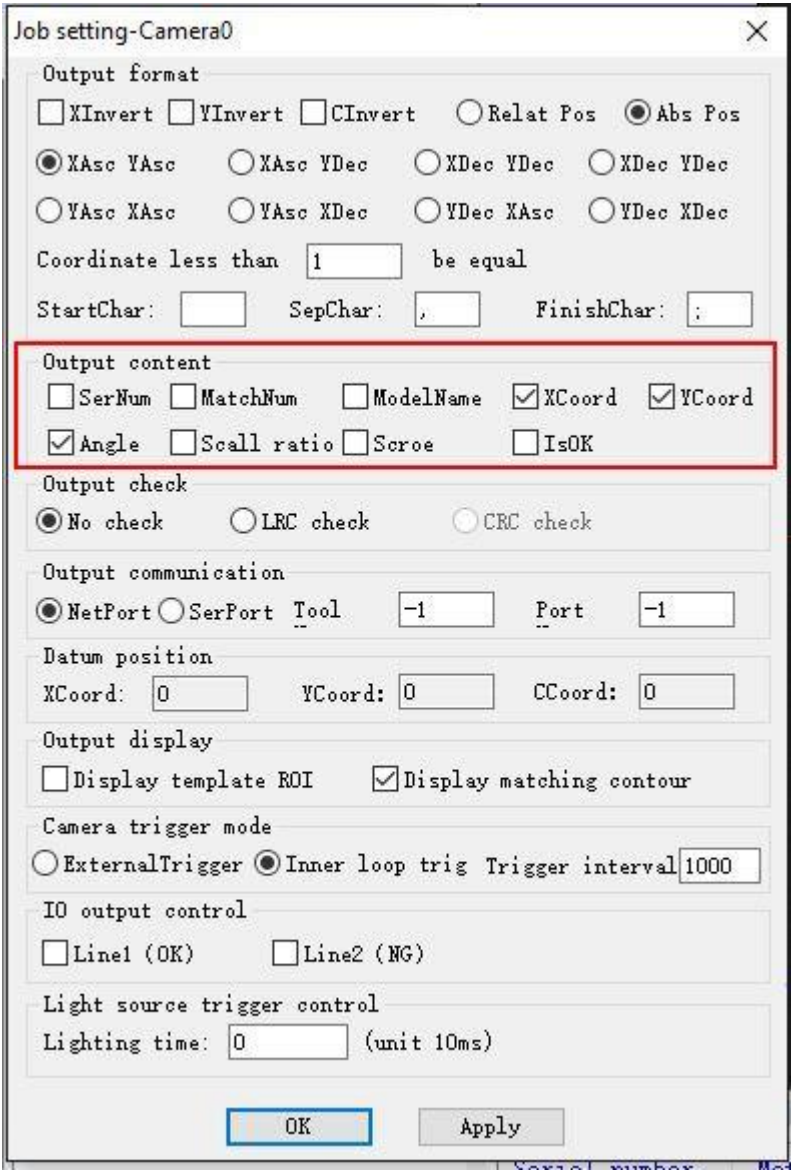
You can open the Data Receiving dialog box in the Tools menu to see the visually received data.



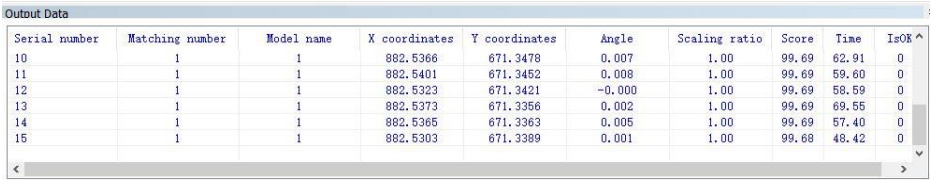
You can also view the visually received data from the status bar, as shown below

The data format returned to the robot after visual positioning is defaulted to “x,y,c;” where x and y represent the coordinate values that are located. If the robot coordinates are calibrated, the x and y indicate that the target is The position in the coordinates of the robot user, if it is calibrated to the robot's base coordinates, then x, y is the position of the target in the robot's base coordinates, c is the angle of the positioning, is the angle of the target relative to the posture when doing the template . If there are multiple positioning results, the format is "x1, y1, c1; x2, y2, c2; x3, y3, c3;" In addition to the visual output coordinates and angles, it can also

output other information, which can be set in the job settings. Check it, as shown below:



The output content item corresponds to the output list item.

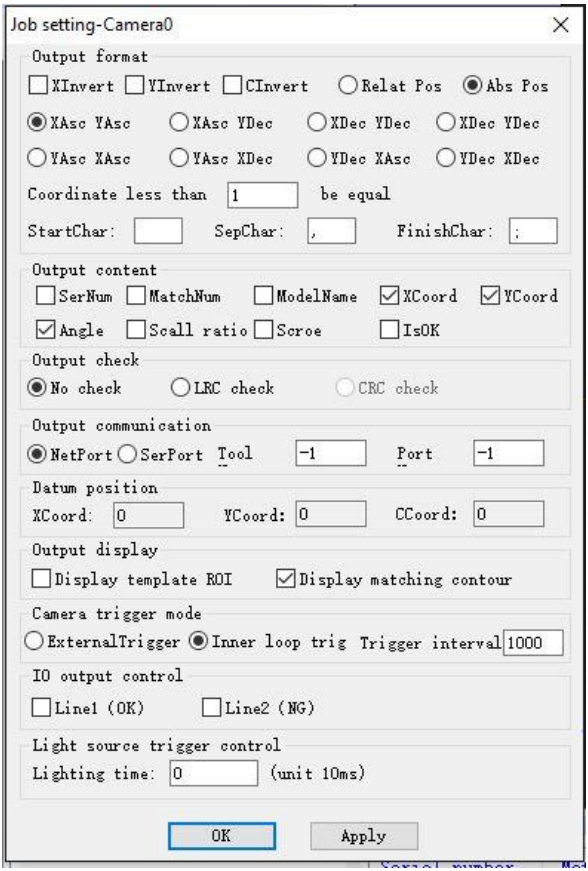

Outout Data

Serial number	Matching number	Model name	X coordinates	Y coordinates	Angle	Scaling ratio	Score	Time	IsOK
10	1	1	882.5366	671.3478	0.007	1.00	99.69	62.91	0
11	1	1	882.5401	671.3452	0.008	1.00	99.69	59.60	0
12	1	1	882.5323	671.3421	-0.000	1.00	99.69	58.59	0
13	1	1	882.5373	671.3356	0.002	1.00	99.69	69.55	0
14	1	1	882.5365	671.3363	0.005	1.00	99.69	57.40	0
15	1	1	882.5303	671.3389	0.001	1.00	99.68	48.42	0

To use the modbus protocol, check the "Enable modbus" check box. The station number defaults to 1. Note that ADTvision software can only be used by Slave in Modbus communication!

6.7 Job settings

In the "Settings" menu, click "Job Settings" to open the job settings dialog box, where you can set the job level parameters, can be set according to actual needs. Generally keep the default, as shown:



X, Y, θ are negated: the negative sign is added before the output result. When the vision coordinate system and the robot coordinate system are in different directions, the inverse function can be used to ensure that the two coordinate directions are consistent. Under normal circumstances, the user calibration tool is used to mark the time. , need to check “Y negation”, when the camera is flipped, you need to check “θ negation”

Relative position: The coordinate offset from the reference position can make the visual output relative coordinate

Absolute position: the absolute position of the visual output in the user or base coordinate system

X liters Y lit: When there are multiple positioning results, priority is given to output in ascending order of X coordinate. If the X coordinate is less than the set value, press Y coordinate ascending output

X rise Y drop: When there are multiple positioning results, priority is given to

output in ascending order of X coordinate. If the X coordinate difference is less than the set value, output in descending order of Y coordinate.

X drop Y rise: When there are multiple positioning results, priority will be output in descending order of X coordinate. If the X coordinate difference is less than the set value, press Y coordinate ascending output

X drop Y down: When there are multiple positioning results, the X coordinate will be output in descending order first. If the X coordinate is less than the set value, it will be output in descending order of Y coordinate.

Y liters X liters: When there are multiple positioning results, priority is given to output in ascending Y-coordinates. If the difference between Y-coordinates is less than the set value, press the X coordinate ascending output

Y rise X drop: When there are multiple positioning results, priority is given to output in ascending order of Y coordinate. If the difference of Y coordinate is less than the set value, then output in descending order of X coordinate.

Y drop X liters: When there are multiple positioning results, priority will be output in descending order of Y coordinate. If the difference of Y coordinate is less than the set value, press X coordinate ascending output

Y down X down: When there are multiple positioning results, the Y coordinate will be output in descending order first. If the Y coordinate is less than the set value, it will be output in descending order of X coordinate.

Start character: what character the output starts with

Delimiter character: What character is the output content separated by?

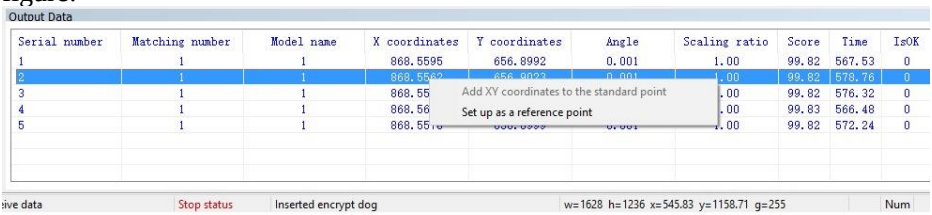
End character: what character the output ends with

Output content: set the data that needs to be output

Output check: Currently supports LRC character verification

Output communication: You can specify the network port or serial port, you can also specify the tool number and port number

Base position: Available when relative position is used, the base position can only be set in the output information list via “Set as base point” in the right mouse button menu, as shown in the following figure:



Output display: Choose whether to display template ROI or matching profile

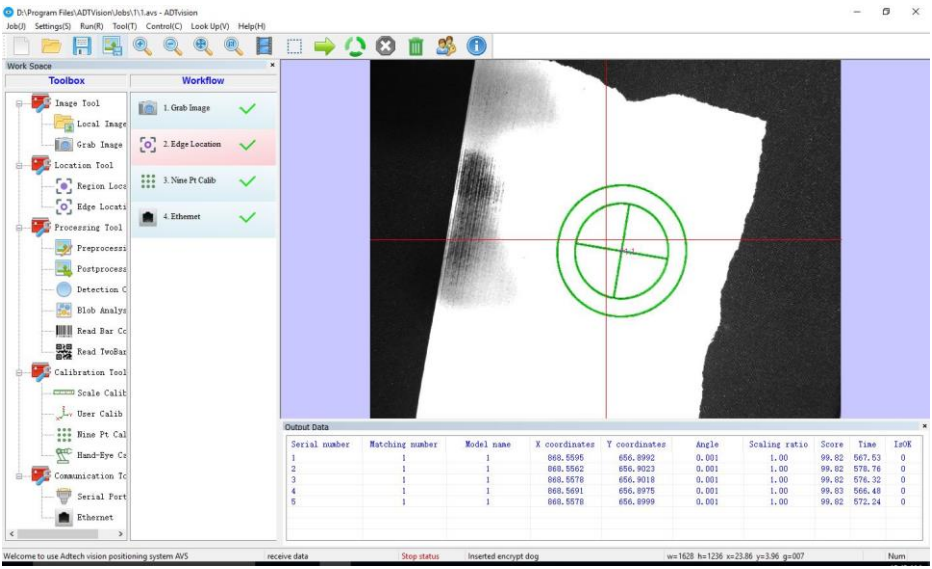
Camera trigger mode: support external soft trigger and IO trigger, internal cycle trigger can also be used

IO output control: Check Line1 to indicate that the result is OK, output through Line1, and check Line2 to indicate that the result is NG and output through Line2.

Light source trigger control: When using the trigger command with template number, if the trigger time is non-zero value, then the light source brightness will automatically extinguish after the set time, and the light source will be always on when it is 0.

6.8 Search area settings

If you know in advance the range of possible objects in the image, you can set a search area in the image, that is, search for ROI. This can effectively reduce the template matching time and improve the positioning speed. Click the "use ROI" button on the toolbar, use the left mouse button to draw a rectangular area containing the positioning target in the image, click the right mouse button to confirm, and then only match the target in the drawn search ROI. . If you want to cancel the use of ROI, you need to click the "Use ROI" button again in the toolbar, as shown in the figure below. The blue dotted line indicates the search ROI.



6.9 Start Operation

After all the tool parameters and job parameters have been set, click the "Save Job" button, and then click the "Run Job" button. The vision software can receive external trigger signals to locate and send the results.

Appendix I camera FAQ handling

NO	Fre Question	The solution
1	No equipment found	(1) confirm that the camera power is on; (2) confirm that the camera network is connected; (3) open the GigE IP Configurator program and confirm that the network card IP and camera IP are in the same network segment;
2	Failed to open the camera	(1) if the camera number is shown to be NULL, it shall be processed according to the method of serial number 1;

		(2) if the camera number is not NULL, unplug the camera power and plug it in after 5 seconds of power loss, and then start the software;
3	Positioning time is too long	（1) increase the number of pyramid layers in the template learning dialog box (2) reduce the Angle range in the search Settings (3) improve template matching score (4) use search ROI to reduce the search scope
4	The calibration error is too large	（1) check whether the imaging quality of the template or calibration plate is clear (2) check whether the size of the calibration plate is input error (3) check whether the position of the robot itself is accurate (4) check whether the size of the template or calibration plate is appropriate
5	Abnormal communication	(1) check whether the network line, network port and other equipment are normal (2) check whether the IP and port Numbers are configured correctly (3) check whether the output communication in the job Settings is configured correctly
6	Can't locate	(1) check whether the incoming material itself is too different from the template (2) check whether the position of the camera has been moved, and whether the focal length and aperture have been changed (3) check whether the brightness of the light source has been adjusted (4) check whether the matching score is set too high, and whether the Angle range is set too low (5) check whether the search ROI is used, and

		the target is not within the ROI range
7	Location errer	(1) improve matching scores (2) use search ROI to limit the search scope (3) the brightness and focal length may have changed, and the template needs to be re-learned
8	Light is not bright	(1) check whether the light source power cord is connected normally (2) check whether the serial port line of the light source is normal, whether the serial port can be opened successfully, and check whether the connection between the light source and the light source controller is loose (3) check whether the light source controller is normal and whether the light source is damaged

Appendix II Automatic Robot Calibration Script

----------aoto_camer.AR----------

```
function main()
    initTCPnet("CAM0")
    local camera_id=0
    local ready_pos=p19
    print("run\n")
    MotOn()
    while true do
        local pos,joint=getcart()
        local cpos,buff
        local n,data=CCDrecv("CAM0")
        if data[1].NO == "START" then
            SetT(0)
```

```
                SetU(0)
                MovP(ready_pos,"Spd=10")
                camera_id = data[1].x
                buff=string.format("START_OK,0,0,0,%d;",camera_id)
            elseif data[1].NO == "J4" then  --Fourth axis or stationary calibration
                print( pos.x,pos.y,pos.c)
                pos.x=pos.x+data[1].x
                pos.y=pos.y+data[1].y
                pos.c=pos.c+data[1].c
                cpos=pos.c
                print( pos.x,pos.y,pos.c)
                MovP(pos,"Spd=10")
                buff=string.format("CAM,%.3f,%.3f,%.3f,%d;",pos.x,pos.y,cpos,camera_id)
                elseif     data[1].NO == "J2" then--Second axis calibration
               print( joint.x,joint.y,joint.c)
                pos.x=pos.x+data[1].x
                pos.y=pos.y+data[1].y
                print( pos.x,pos.y,pos.c)
                MovP(pos,"Spd=10")
                pos,joint=getcart()
                joint.y = joint.y+data[1].c
                print( joint.x,joint.y,joint.c)
                MovJ(J2,joint.y,"Spd=10")
                pos,joint=getcart()
                cpos=joint.x+joint.y
                buff=string.format("CAM,%.3f,%.3f,%.3f,%d;",pos.x,pos.y,cpos,camera_id)
            elseif     data[1].NO == "TOOL1" then--Nine-point calibration, setting the first
calculation tool
                SetT(0)
                SetU(0)
                MovP(ready_pos,"Spd=10")
                Delay(100)
                WrT(4,data[1])
```

```
                SetT(4)
                buff=string.format("TOOL1_OK,0,0,0,%d;",camera_id)
            elseif     data[1].NO == "TOOL2" then--Nine-point calibration, set the second
calculation tool, and verify the accuracy
                SetT(0)
                SetU(0)
                MovP(ready_pos,"Spd=10")
                Delay(100)
                pos,joint=getcart()
                buff=string.format("CAM,%.3f,%.3f,%.3f,%d;",pos.x,pos.y,pos.c,camera_id)
                CCDsent("CAM0",buff)
                Delay(500)
                WrT(4,data[1])
                SetT(4)
                pos,joint=getcart()
             buff=string.format("TOOL2_OK,%.3f,%.3f,%.3f,%d;",pos.x,pos.y,pos.c,camera_id)
            end
        Delay(200)
          CCDsent("CAM0",buff)
        Delay(500)
      end
end



----------aoto_camer_teach.AR----------
function main()
      initTCPnet("CAM0")
      local camera_id=0
      print("run\n")
     MotOn()
      while true do
            local pos,joint=getcart()
```

```
local cpos,buff
local n,data=CCDrecv("CAM0")
if data[1].NO == "START" then
      camera_id = data[1].x
      buff=string.format("START_OK,0,0,0,%d;",camera_id)
      CCDsent("CAM0",buff)
elseif data[1].NO == "J4" then  -- Fourth axis or stationary calibration
      for photo_pos = 31,41 do
            MovP(photo_pos)
            Delay(200)
            pos,joint=getcart()
         buff=string.format("CAM,%.3f,%.3f,%.3f,%d;",pos.x,pos.y,pos.c,camera_id)
      ::PHOTO::
            CCDsent("CAM0",buff)
            Delay(500)
            local n,data=CCDrecv("CAM0")
            if data then  -- Data is valid
                  if data[1].x == 0 and data[1].y == 0 and data[1].c == 0 then
                        goto PHOTO
                  end
            else  -- Invalid data
                  goto PHOTO
            end
      end
 -- break
elseif     data[1].NO == "J2" then-- Second axis calibration
      for photo_pos = 20,30 do
            MovP(photo_pos)
            Delay(200)
            pos,joint=getcart()
            cpos=joint.x+joint.y
       buff=string.format("CAM,%.3f,%.3f,%.3f,%d;",pos.x,pos.y,cpos,camera_id)
      ::PHOTO::
```

```
                    CCDsent("CAM0",buff)
                    Delay(500)
                    local n,data=CCDrecv("CAM0")
                    if data then  -- Data is valid
                        if data[1].x == 0 and data[1].y == 0 and data[1].c == 0 then
                            goto PHOTO
                        end
                    else  -- Invalid data
                        goto PHOTO
                    end
                end
            --break
            end
        end
    end
```

Modify the resume

NO	Revision number	changes	The release date
1	V1.0.0	The initial release	2016-03-06
2	V2.0.0	The visual software version was upgraded to 3.0 and modified accordingly	2016-08-06
3	V2.0.1	Add G1 camera support	2016-08-16
4	V2.0.2	Add network card IP configuration method and AVS2100 related conten	2016-09-28
5	V2.0.3	Add color instructions for camera trigger line	2016-10-12
6	V2.0.5	The communication module updates modbus related content	2016-11-01
7	V2.0.6	Update AVS1100 dimensions	2017-01-06
8	V3.0.0	Software version upgrade, add the	2017-07-05

		corresponding functional description	
9	V3.0.1	Add processing tool and B1 series light source operation method description	2017-07-25
10	V3.0.2	Add multicamera IP configuration considerations	2017-09-01
11	V3.0.3	Add network instructions for setting exposure time and switching jobs, and modify the appendix robot calibration script	2017-11-02
12	V3.0.4	Add J1 series camera hard trigger wiring instructions;Add instructions for using circle and code reading tools	2018-03-28
13	V3.0.5	Camera related description update	2018-04-19