ZEBEX
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# User's Manual

Intelligent Vision Camera



**Revision History**

Changes to the original manual are listed below:

| Version | Date | Description of Version |
|---|---|---|
| 1.0 | 06/20/2026 | Initial release |

# Important Notice

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## Printing Instructions

This manual is **A5 size**. Please verify your printer settings before printing.

## Adjustments

Do not attempt to make any adjustments or modifications to this product. **Do not remove the scanner housing**; there are no user-serviceable parts inside.

## Optical Safety

The use of optical instruments with this product will increase the risk of eye injury. Optical instruments include binoculars, magnifying glasses, and microscopes, but do not include standard prescription eyeglasses.

## Caution

Use of controls, adjustments, or performance of procedures other than those specified herein may result in hazardous **radiation exposure**.

## For CE Countries

This scanner complies with **CE standards**. To maintain CE compliance, please ensure you use a certified power supply marked with the **CE log**

# Table of Contents

Important Notice....ii
Product Introduction....1
Product Description....1
Product Overview....2
Control Panel Description....3
Interface Definition....4
Accessories....5
Product Dimensions....5
Vision Camera Setup Workflow....6
Device Installation and Connection....7
Mounting Distance and Field of View (FOV)....7
Black and White Camera....7
Device Installation....8
Hardware Installation Instructions....8
Power Connection Specifications....9
Communication Settings....10
Ethernet Connection....11
I/O Electrical Characteristics & Wiring....12
I/O Electrical Characteristics....12
Input Specifications....12
Output Specifications....12
Input Internal Wiring Diagram....13
Output Signals....14
Output External Wiring Diagram....15
RS-232 Port....16
Client Installation & Operation....17
Client Software....17
Minimum PC OS & Hardware Requirements....17
Software Installation Procedure....17
Check Software Version....18
Supported Languages....18
Connecting the Vision Camera....19
Search and Connect....19
Vision Camera IP Settings....20
Change PC IP Address....21
Firmware Update....22
Update Single Device....22
Batch Firmware Update (Update multiple devices)....23
Software Function Overview....24

Main Interface....24
Quick Start Workflow....26
Solution Creation Steps....27
Basic Camera Settings....34
Image Orientation Example....35
Security Settings - Enabling Password Lock....36
Project Management....38
Create New Project....38
Project Configuration....39
Edit Project....39
Configure Project Name....40
Camera Debugging....41
Adjusting Imaging Parameters....41
Project Trigger Settings....44
Coordinate Calibration....45
Set Template....46
Add Template Image:....46
Position Correction (Optional)....47
Tool Configuration....49
Presence Detection Tools....49
Counting Tools....50
Recognition Tools....50
Geometric Tools....51
Detection Tool....51
Output Configuration....52
Project Status Definitions....53
Communication Output....55
Physical I/O Output....57
Value Ranking....60
Custom Image Naming Rules....63
Project Operation & Testing....65
Online Operation/Testing....65
Offline Mode/Testing....66
Project Management....68
Access Project Management....68
Project Export & Import....70
Export Project (Single/Batch)....70
Import Project (Single/Batch)....71
Switch Project....73
Manual Switching....73
External Switching....74
Communication Protocol Overview....76

Communication Settings ..... 76
External Communication ..... 76
Using Communication Settings ..... 77
Serial Port Mode (RS232) ..... 79
TCP/IP Communication ..... 80
Modbus TCP Communication ..... 81
MC Protocol Communication (Mitsubishi) ..... 82
Modbus RTU Communication ..... 83
EtherNet/IP Communication ..... 84
Fins Communication (Omron) ..... 85
Profinet Communication ..... 86
Image Saving Settings ..... 87
Storage Path & Naming ..... 89
Tool Debugging ..... 90
Presence Detection Tools ..... 90
Pattern Presence Detection ..... 90
Blob Presence Detection ..... 93
Masking Area Settings ..... 98
Reference Circle Settings ..... 99
Edge Presence Detection ..... 100
Counting Tools ..... 101
Pattern Counting ..... 101
Edge Counting ..... 103
Blob Counting ..... 104
Identification Tools ..... 106
Code Reading ..... 106
Geometry Tools ..... 110
Circle Search ..... 110
Line Search ..... 112
Measurement Tools ..... 115
Width Measurement ..... 115
Edge Settings ..... 116
Pattern Inspection ..... 117
Grayscale Area / Color Area Inspection ..... 118
Blob Inspection ..... 120
Troubleshooting (FAQ) ..... 122
Device Connection Issues ..... 122
External Trigger Failure ..... 123
Key Checkpoints ..... 123
Software Startup Abnormalities ..... 123

# Product Introduction

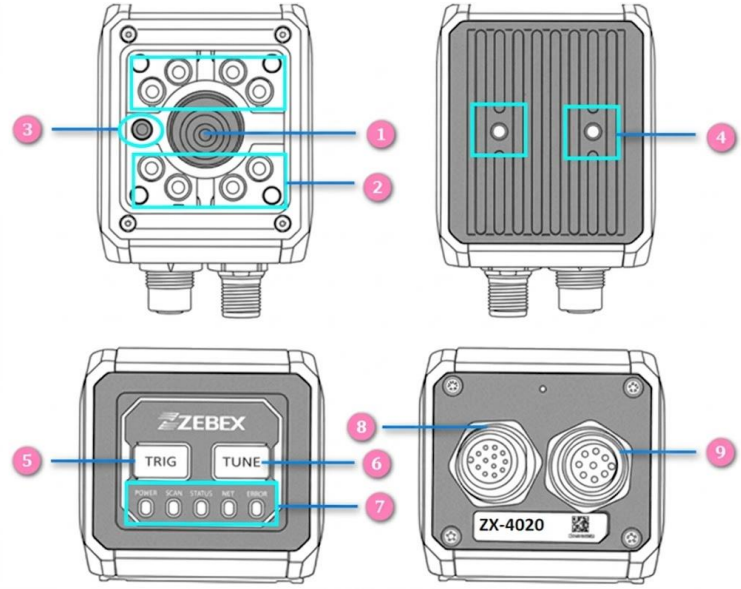
## Product Description

The ZX-4020 Intelligent Vision Camera is specifically designed for industrial automation and is widely applied in sectors such as automotive components, 3C electronics, food and pharmaceutical packaging, and semiconductors. By combining a high-resolution image camera with built-in AI algorithms, the device efficiently performs inspection tasks including presence detection, orientation judgment, counting, code reading, and object classification. It supports a variety of I/O and network communication protocols, allowing for seamless integration with external control systems.

### Key Features

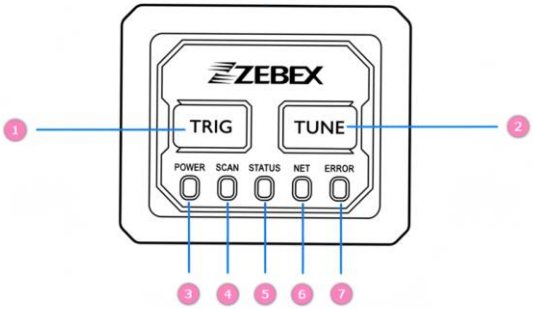
- **Smart Tuning**: One-click **auto-focus**, exposure, and gain for rapid setup.
- **AI Engine**: Deep learning algorithms perform complex tasks with minimal samples.
- **Flexible Optics**: Multiple lens options supporting distances from **100mm to 1000mm**.
- **Integrated Lighting**: Independent Red/White LEDs with **polarization** for reflective surfaces.
- **Industrial Grade**: Multiple **I/O** channels with **IP67** durability.

# Product Overview




| # | Component | Function |
|---|---|---|
| 1 | **Lens** | Captures images |
| 2 | **Standard Light Source** | Provides fill light for image acquisition; optional Red/White LEDs |
| 3 | **Targeting Light** | Indicates the center of the image for easy target aiming |
| 4 | **Mounting Holes** | Used for camera installation |
| 5 | **TRIG Button** | Manual trigger key |
| 6 | **TUNE Button** | Smart parameter auto-tuning key |
| 7 | **Indicator Lights** | Indicator display panel |
| 8 | **M12-12PIN Interface** | Provides power, Serial (RS-232), and I/O functions |
| 9 | **M12-8PIN Interface** | Provides network transmission functions |

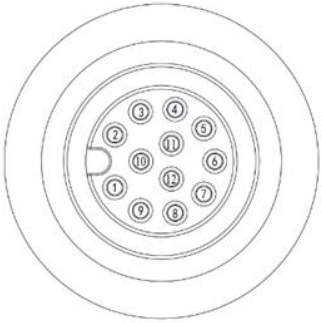
# Control Panel Description




| # | Component | Function |
|---|---|---|
| 1 | **TRIG Button** | Manual trigger key |
| 2 | **TUNE Button** | Smart parameter auto-tuning key |
| 3 | **POWER LED** | Solid green when the device is operating normally |
| 4 | **SCAN LED** | Solid green upon successful trigger or button press |
| 5 | **STATUS LED** | Green for "Pass" (OK), Red for "Fail" (NG) |
| 6 | **NET LED** | Solid green for normal communication; flashes during data transmission |
| 7 | **ERROR LED** | Off by default; solid red if a device fault occurs |

# Interface Definition

M12-12 Pin Male Interface



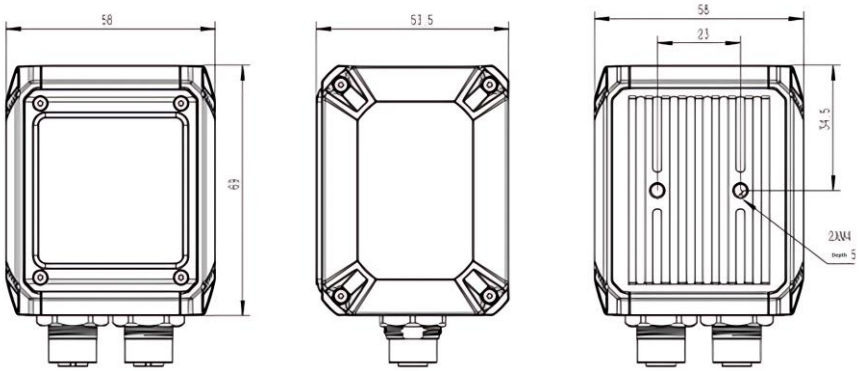

| Pin | Signal Name | Cable Color |
|---|---|---|
| 1 | **RS232_TXD** | Green/White |
| 2 | **LINE_OUT2** | Yellow |
| 3 | **OUT_COM** | Green |
| 4 | **DGND** | Black |
| 5 | **VIN 24V** | Red |
| 6 | **IN_COM** | White |
| 7 | **LINE_IN1** | Purple |
| 8 | **RS232_GND** | Brown |
| 9 | **RS232_RXD** | Blue/White |
| 10 | **LINE_IN0** | Orange |
| 11 | **LINE_OUT1** | Gray/White |
| 12 | **LINE_OUT0** | Blue |
| 13 | **Shield (GND)** | Transparent |

## Accessories

Please prepare the following items before installation:

- **Dedicated Cable (M12-12PIN)**: Provides power, RS-232, and I/O functions. Length options: 3m.
- **Dedicated Ethernet Cable (M12-8PIN)**: Provides network transmission. Length options: 3m.
- **Power Supply**: 24V DC power adapter (optional).
- **L-shaped Mounting Bracket**: Includes fixing screws.

## Product Dimensions



# Vision Camera Setup Workflow

1. **Device Installation & Wiring**: Complete the physical mounting of the camera and all electrical connections.
2. **Configure Camera Parameters**: Adjust **Exposure**, **Gain**, and **Focus** to ensure clear images with distinct contrast between "Pass" and "Fail" items.
3. **Register Master Sample**: Capture an image of a confirmed **OK** product to serve as the **Master Image** (inspection baseline).
4. **Set Up Inspection Tools**: Configure algorithm tools on the image (e.g., **Area**, **Count**, etc.) and define the judgment threshold values.
5. **Output Settings**: Configure result output via **I/O** signals or communication protocols.
6. **Testing & Deployment**: Perform live testing before officially starting production line operation.

# Device Installation and Connection

## Mounting Distance and Field of View (FOV)

Please select the appropriate model and mounting distance based on your inspection requirements. The following table provides the Field of View (FOV) specifications for various focal length lenses (Unit: mm):

### Black and White Camera

| Lens Focal Length | Working Distance (WD) | 1MP Field of View (FOV) | 2.3MP Field of View (FOV) |
|---|---|---|---|
| **8 mm** | 100 ~ 1000 | 48×30 ~ 480×300 | 72×45 ~ 720×450 |

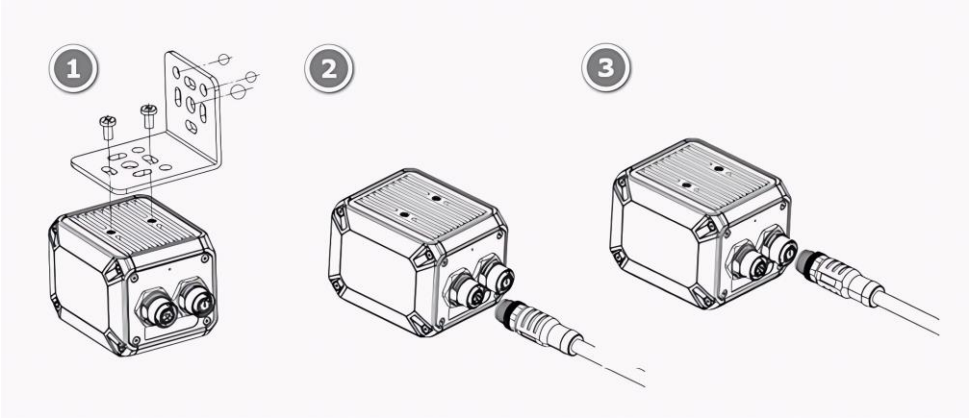
# Device Installation

## Hardware Installation Instructions

1. **Bracket Mounting**: Secure the **ZX-4020** main body to the **L-shaped bracket** using **M4 screws**, then firmly lock the other end of the bracket onto the automation mechanism.

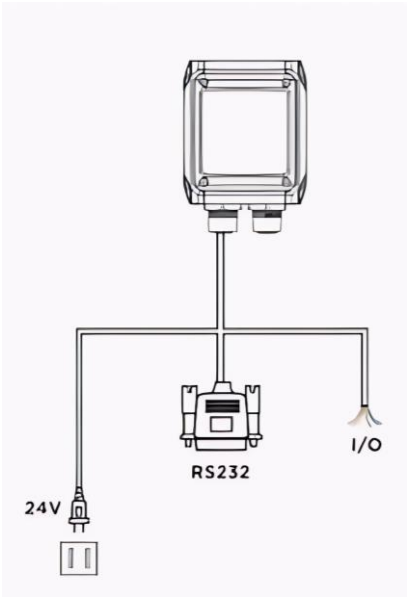
2. **Power Wiring**: Referring to the **Pin Definition** in the previous chapter, connect the **M12-12PIN cable set** to a suitable switching power supply (24V DC / 3A recommended).

3. **Network Connection**: Use the dedicated **M12 to RJ45 Ethernet cable** to connect the camera to a **Switch** or a computer's network interface card (NIC).

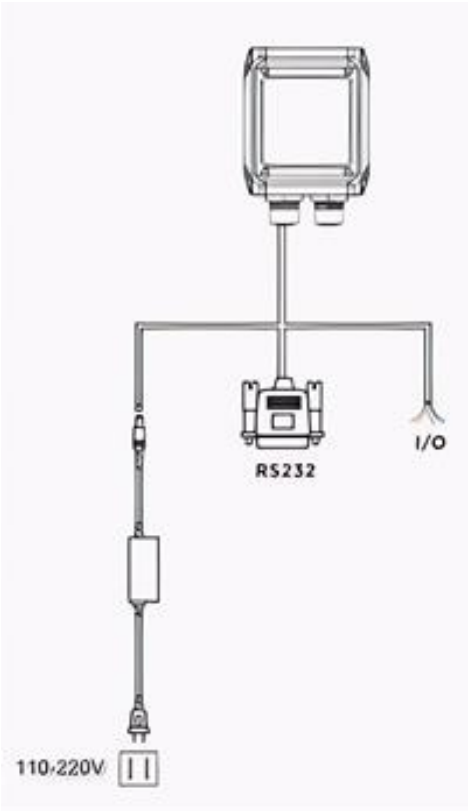


# Power Connection Specifications

- **Rated Input**: 24V DC (3A Max).
- **Power Options**: 24V DC direct wiring or 220V AC via dedicated power adapter




**Direct External DC Power**: 24V DC



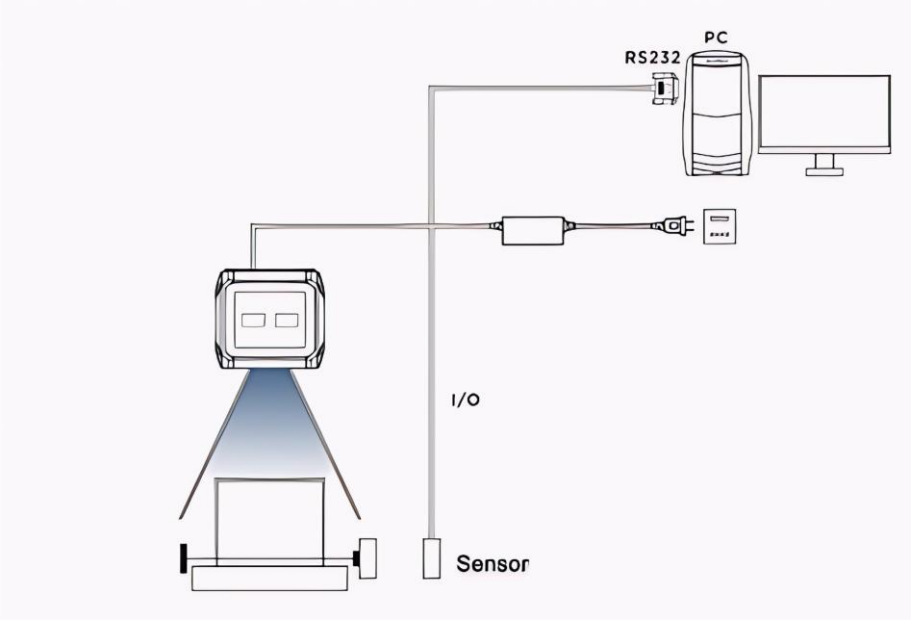

**Direct External AC Power**: 110–220V AC (Converted to 24V DC via included power adapter)

# Communication Settings

## RS-232 Connection

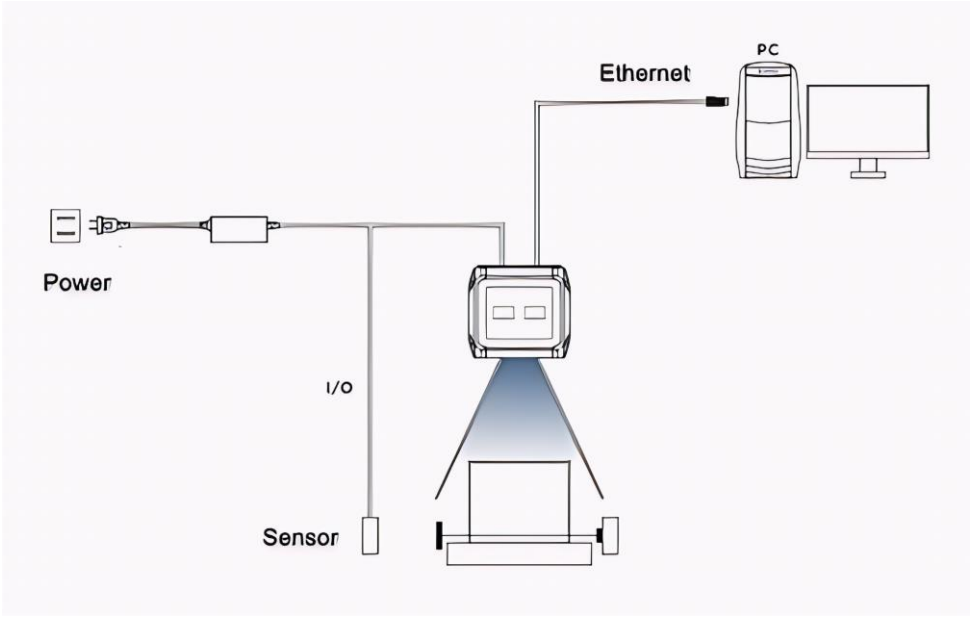
**Default Parameters**：

- **Baud rate**: 9600
- **Data bits**: 8
- **Stop bits**: 1
- **Parity**: NONE
- **Modification**: All parameters above can be modified via the client software.



# Ethernet Connection

- **Default IP Address**: 169.254.153.0
- **Default Port**: 15000
- **Suggestion**: If the device is not found, ensure the computer and camera are on the same network segment.



# I/O Electrical Characteristics & Wiring

## I/O Electrical Characteristics

Among the device I/O signals, LINE_IN 0/1 are optocoupler isolated inputs, and LINE_OUT 0/1/2 are optocoupler isolated outputs.

### Input Specifications

| Parameter | Symbol | Specification |
|---|---|---|
| **Input Low Level Limit** | $V_{OL}$ | 6V |
| **Input High Level Limit** | $V_{OH}$ | 12V |
| **Fall Time Delay** | $T_{DF}$ | 1.3 μs |
| **Rise Time Delay** | $T_{DR}$ | 35 μs |

### Output Specifications

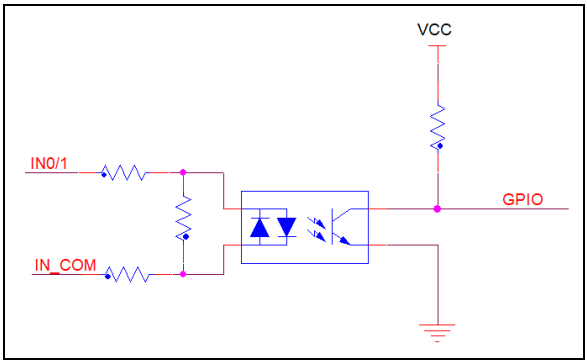
| Parameter | Symbol | Specification |
|---|---|---|
| **Output Logic Low Level** | $V_{OL}$ | 0.7V (Max) |
| **Output Logic High Level** | $V_{OH}$ | Dependent on Pull-up Resistor |
| **Output Fall Time Delay** | $T_{DF}$ | 7.5 μs |
| **Output Rise Time Delay** | $T_{DR}$ | 141 μs |
| **Output Fall Time** | $T_F$ | 12.6 μs |
| **Output Rise Time** | $T_R$ | 157.8 μs |

**Note**: Logic High/Low represent input voltage thresholds; Rise/Fall delay represent response performance.

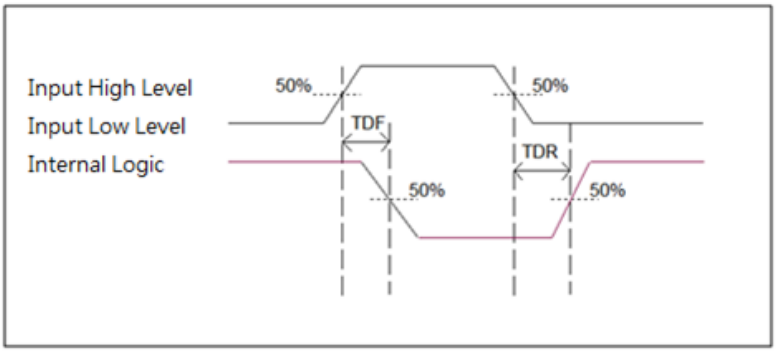
# Input Internal Wiring Diagram

## Input Signals

- **LINE_IN 0/1** are optocoupler isolated inputs.
- **Input Voltage Range**: 0–24V DC.



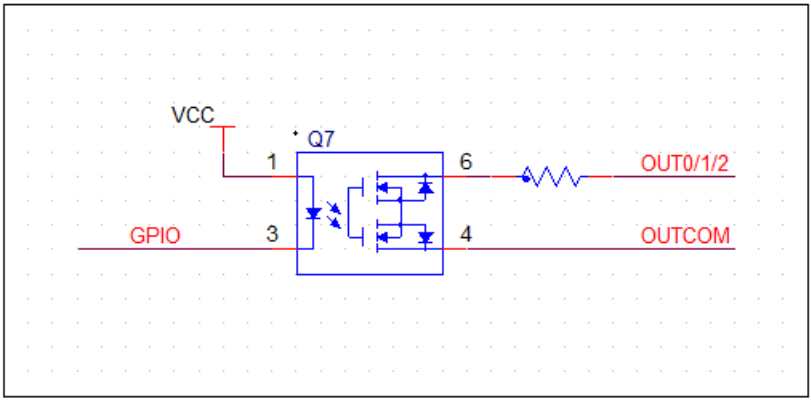

Input Circuit Diagram



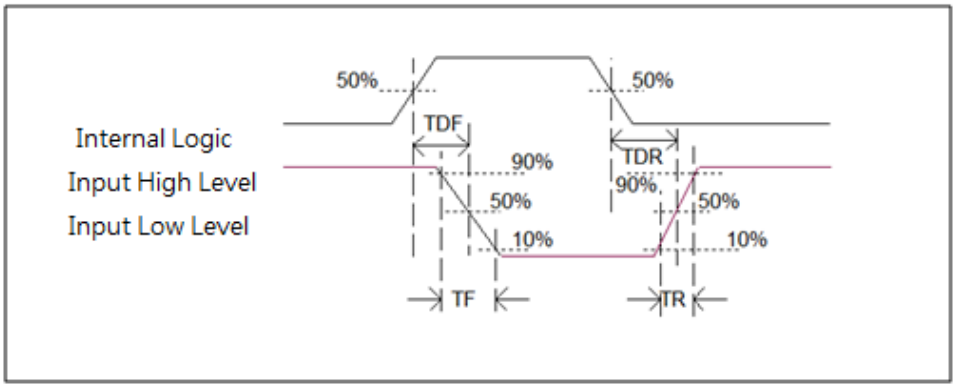

Input Logic Level Diagram

# Output Signals

- LINE_OUT 0/1/2 are optocoupler isolated outputs. Maximum VCC driving voltage: 28V. Output current: Must not exceed 30mA.
- Note: Inductive loads are not supported. ◦




Device Output Circuit Diagram

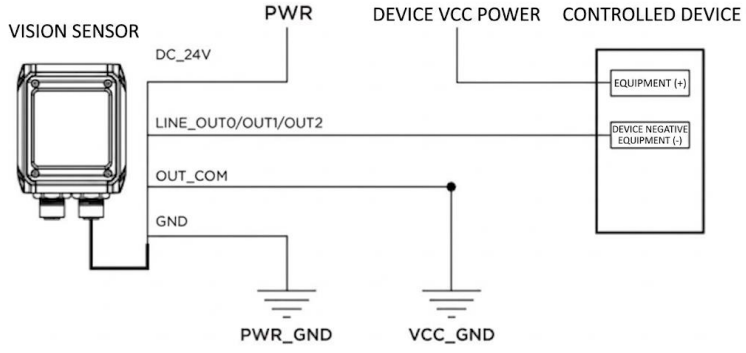



Output Logic Level Diagram

# Output External Wiring Diagram

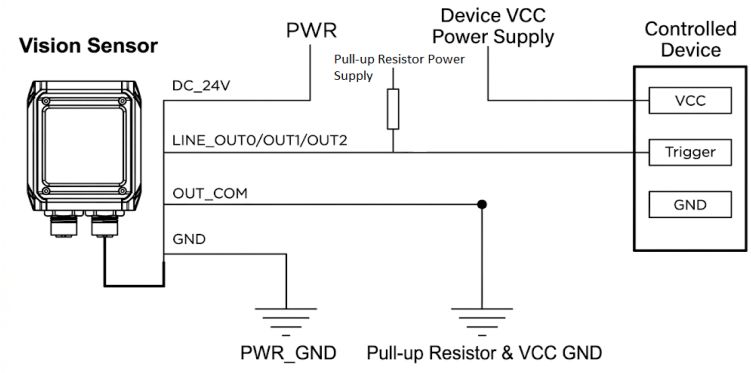
Wiring methods vary depending on the type of external device connected.

- External devices requiring direct circuit control: Such as optocouplers, alarms, or indicator lights.




Note: Driving inductive loads (e.g., relays, motors) is strictly prohibited. The output load current must meet product specifications (use series current-limiting resistors if necessary).

- External devices responding to logic high/low levels.



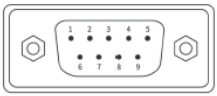
**Notes:**

1. TRIGGER Pin Voltage: Measure the device TRIGGER Pin. If voltage is present, an internal pull-up resistor exists; no external resistor is needed. Ensure this voltage is ≤ 28V.
2. External Pull-up: If no voltage is present, confirm the target device's input range. The pull-up supply must be ≤ the target's max input and strictly < 28V to avoid hardware damage.
3. Resistor Calculation: Select resistance based on P=U2/R. Ensure actual power is below the resistor's rated power to prevent burnout.

# RS-232 Port

The device supports RS-232 serial output. The pin definitions for a standard 9-pin Male RS-232 connector are shown below.

9-pin Male Connector Pinout




| Pin | Function | Description |
|---|---|---|
| 2 | **RX** | Data Receive |
| 3 | **TX** | Data Transmit |
| 5 | **GND** | Signal Ground |

**Note**: The above definitions are for the male connector. Ensure orientation is correct during wiring.

# Client Installation & Operation

## Client Software

### Minimum PC OS & Hardware Requirements

Please run the client software on a PC meeting or exceeding the following specifications:

| Item | Requirement |
|---|---|
| **OS Version** | Windows 7 or later |
| **System Architecture** | 64-bit OS |
| **Memory (RAM)** | 4GB minimum |
| **Disk Space** | 64GB minimum |

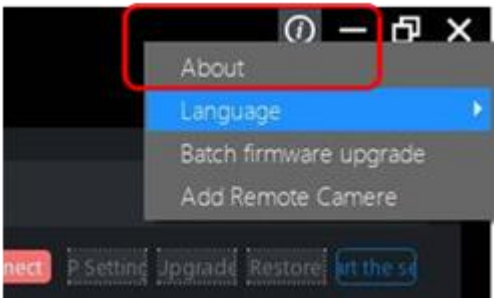
### Software Installation Procedure

- Decompress the software package, locate the corresponding executable ( .exe), and run to start.

**Note**: If a missing .dll error occurs on first launch, locate and install vc_redist.x64.exe in the software installation path, then restart the application.

## Check Software Version

- Click the "Info" icon in the top-right corner to display software details in a pop-up window.




## Supported Languages

The client software supports Chinese, English, and Japanese.

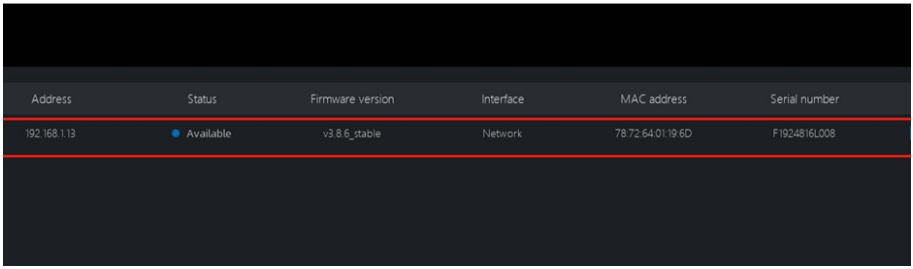
- Click the "Info" icon in the top-right corner to select and switch the language.



# Connecting the Vision Camera

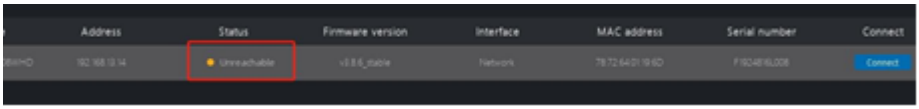
## Search and Connect

1. Launch Software: Open the host application.
2. Device Management: Upon startup, the Device Management page appears. If the vision camera is correctly wired, connected to the PC, and the network is stable, the device will appear in the list.
3. Connected Status: If the camera and PC are on the same subnet, the status will show as "Idle." Click "Connect" to establish communication.
4. Unreachable Status: If the camera and PC are on different subnets, the status will show as "Unreachable." Modify the camera's IP settings or the PC's IP address to ensure they are on the same subnet.



# Vision Camera IP Settings

1. Select IP Settings: Locate the corresponding vision camera in the device list and select "IP Settings."




2. Configuration Modes: The camera supports DHCP (Auto-obtain IP) and Static IP (including "One-Click Match" functionality).






# Change PC IP Address

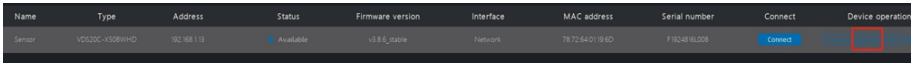
Steps (Windows 10 example):

1. Navigate: Go to Start > Settings > Network & Internet > Ethernet > Change adapter options.
2. Select Adapter: Right-click the relevant network adapter (e.g., "Ethernet 3") and select Properties > Networking > Internet Protocol Version 4 (TCP/IPv4).
3. Configure: Modify the IP address settings to ensure the PC is on the same subnet as the vision camera.

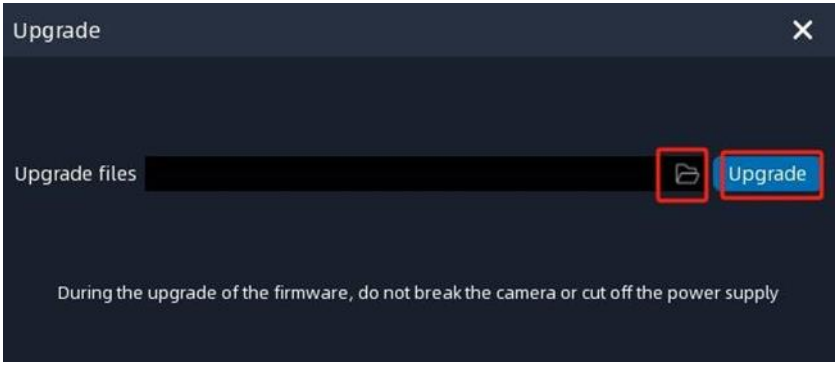
# Firmware Update

## Update Single Device

1. Select Firmware Update: Locate the target device in the device list and select "Firmware Update."

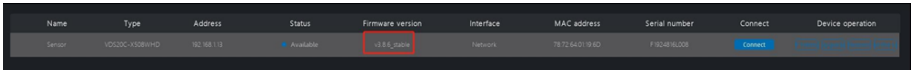



2. Select & Update: Click the folder icon to select the firmware file, then click "Update."




3. Reboot: The device will automatically restart upon completion. Wait a moment for the upgrade to finish.

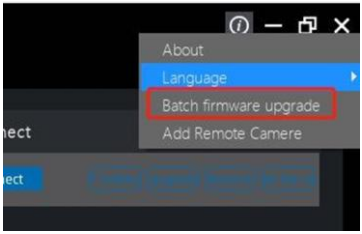
4. Verify: Confirm the "Firmware Version" in the "Device Management" interface has been updated.



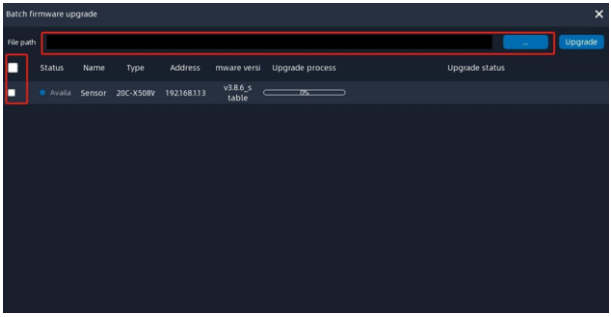
**Note:** Host software and vision camera firmware are version-dependent. Mismatched versions may cause instability. Ensure software and firmware versions are synchronized after any update.

## Batch Firmware Update (Update multiple devices)

1. Open Batch Update: Click the icon in the top-right corner and select "Batch Firmware Update."




2. Execute Update: In the batch update interface, select the "File Path" of the firmware, check the devices to be updated, and click "Update." The interface will display real-time upgrade progress and status.



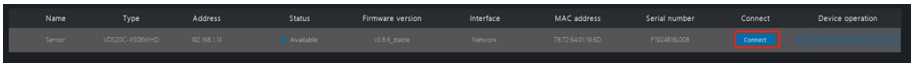

**Note:** Host software and vision camera firmware are version-dependent. Mismatched versions may cause instability. Ensure software and firmware versions are synchronized after any update.

# Software Function Overview

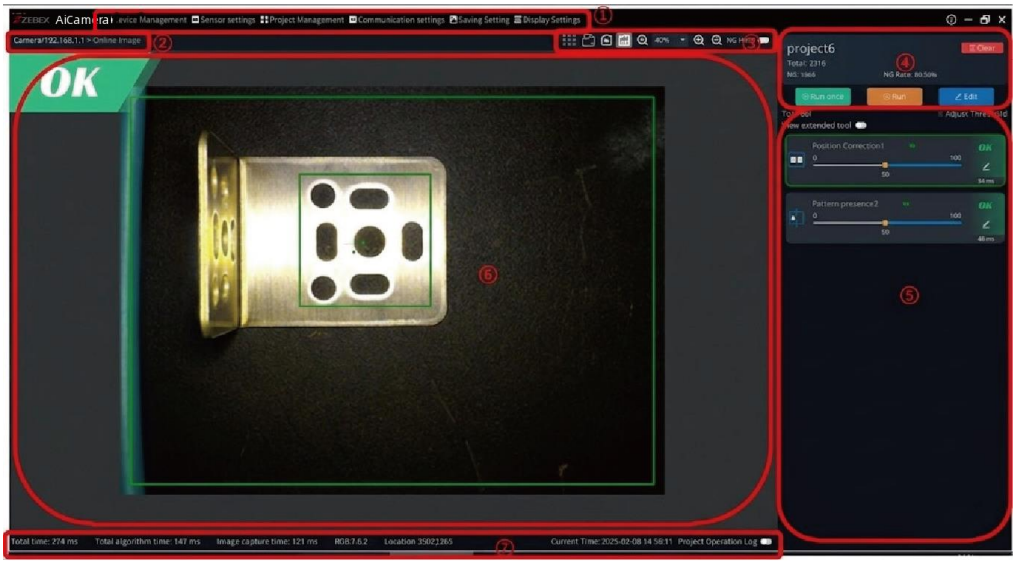
## Main Interface

The ZX-4020 is operated via the host PC software. Follow these steps:

1. Connect Device: In the Device Management interface, locate your device and click "Connect" to establish communication.




2. Access Main Interface: Once connected, the device's Main Interface will appear (as shown below). Refer to the following sections for detailed module descriptions.



| # | Functional Module | Description |
|---|---|---|
| 1 | **Menu Bar** | Controls basic camera settings. |
| 2 | **IP Address** | Displays the network address of the connected device. |
| 3 | **View Toolbar** | Controls image zoom, saving, offline testing, and display functions. |
| 4 | **Current Solution** | Displays solution name and status; controls start, stop, and editing. |
| 5 | **Tool List** | Displays operational status and all configuration tools in the solution. |
| 6 | **Preview Window** | Previews image acquisition and algorithm results; used for ROI drawing. |
| 7 | **Execution Time Bar** | Displays solution execution time, RGB values, and pixel coordinates at mouse position. |

# Quick Start Workflow

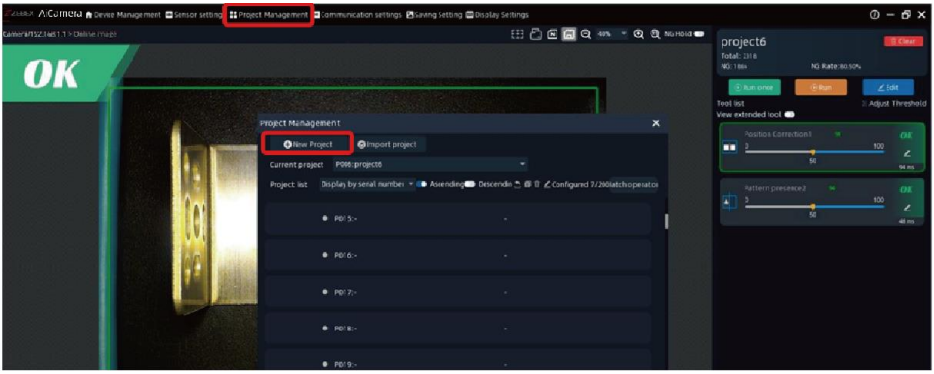
To fully configure an inspection solution, the vision camera must be set up via the client software following these steps:

| # | Step | Description |
|---|---|---|
| 1 | **New Solution** | Create a new inspection solution. |
| 2 | **Solution Configuration** | Configure the following based on inspection needs:<br>• Set imaging effects and trigger modes.<br>• Configure the master template image.<br>• Select and configure algorithm tools.<br>• Set result output methods. |
| 3 | **Communication Setup** | Use I/O or network communication to link the camera with external devices for triggers or data output:<br>• **I/O Mode**: Complete physical I/O wiring.<br>• **Network Mode**: Configure communication parameters.<br>Perform joint debugging with external hardware after setup. |
| 4 | **Test & Debug** | Run live inspections to verify if detection results meet expectations. |
| 5 | **Image Saving/Offline Test** | (Optional) Use the image saving function to record captures during errors or anomalies for later solution optimization. |
| 6 | **Export & Import** | (Optional) Export the verified solution and import it into other vision cameras for deployment. |

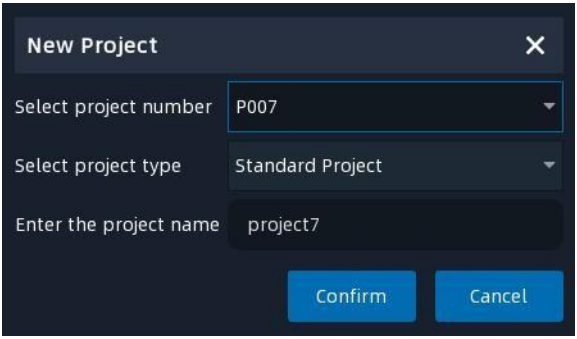
# Solution Creation Steps

Using "Presence/Absence Detection" as an example:

1. Enter Management Interface: Click "Solution Management" and select "New Solution."

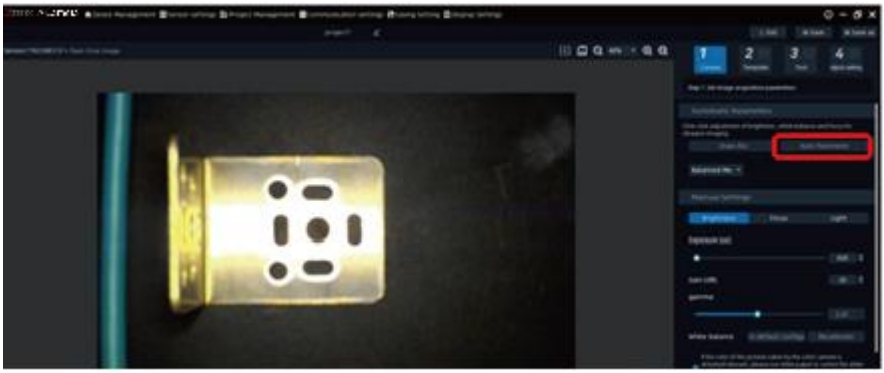



2. Name the Solution: In the pop-up window, select a solution number, enter a name, and click Confirm to enter the configuration interface.

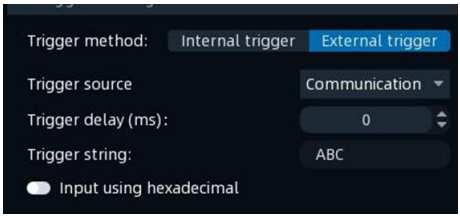


3. **Image Tuning:**

- Place the target object within the field of view (FOV).
- Click "One-Click Tune" to automatically optimize focus, exposure, and white balance.



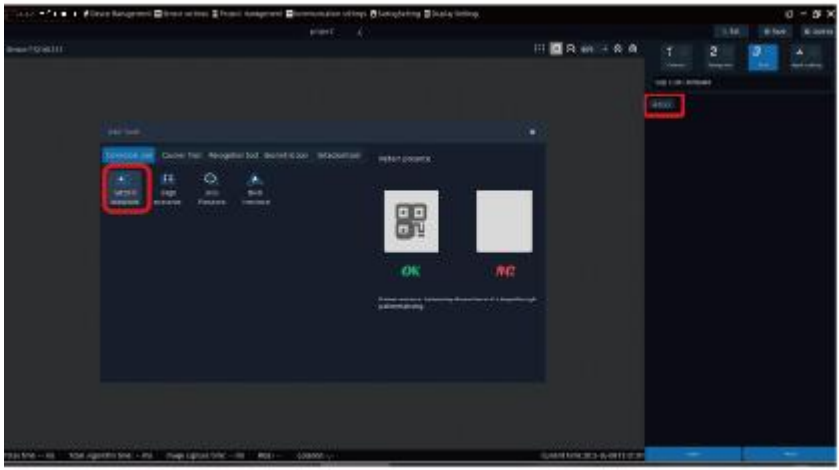
4. Set Trigger: Select the trigger mode (e.g., External Communication), and set the corresponding trigger string (e.g., default value "ABC").




5. Register Template: In configuration step 2, click the "+" icon to register the current qualified sample image as the reference benchmark, then click Next.



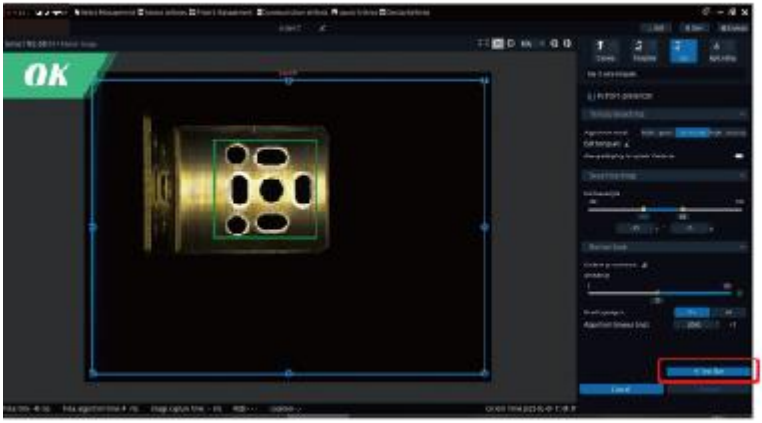
6. In step 3 of the solution configuration, click the "+" icon and select the required tool from the tool list. This example uses the "Pattern Recognition (Presence Detection)" tool. Upon selection, the system enters the tool configuration interface.



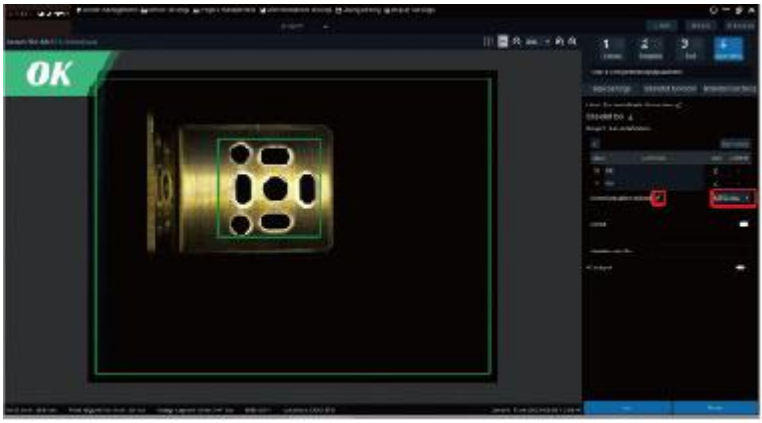
7. Within the "Presence Detection" configuration interface, drag the orange ROI frame in the Preview Window to select the target pattern for detection.



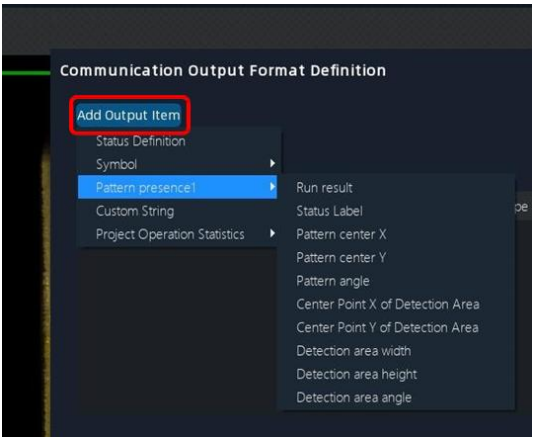
8. In the Parameter Configuration interface, adjust settings as needed, then click "Test Run" to verify results. Click "Confirm" once the tool configuration is complete.



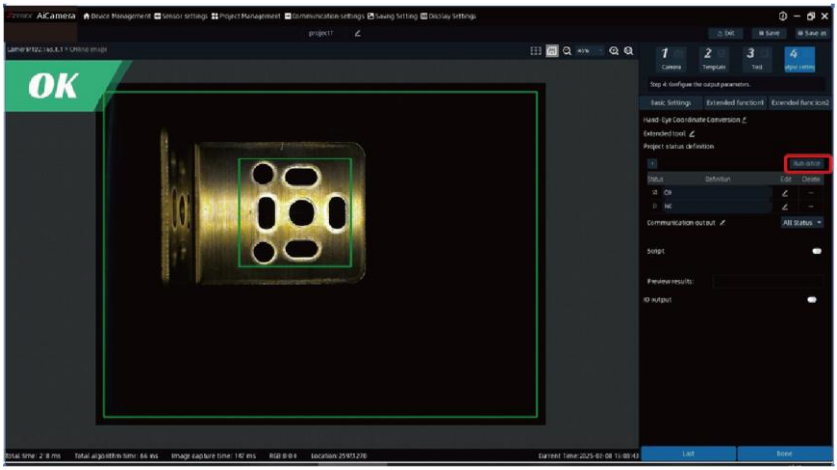

9. After setting up the "Presence Detection" tool, click "Next" to proceed to step 4 for output configuration. This example uses Network Communication for data output. Select "All Status" under "Communication Output," then click "Edit" to define specific output content.



10. In the Communication Output interface, click the "+" icon to select the items for external output.

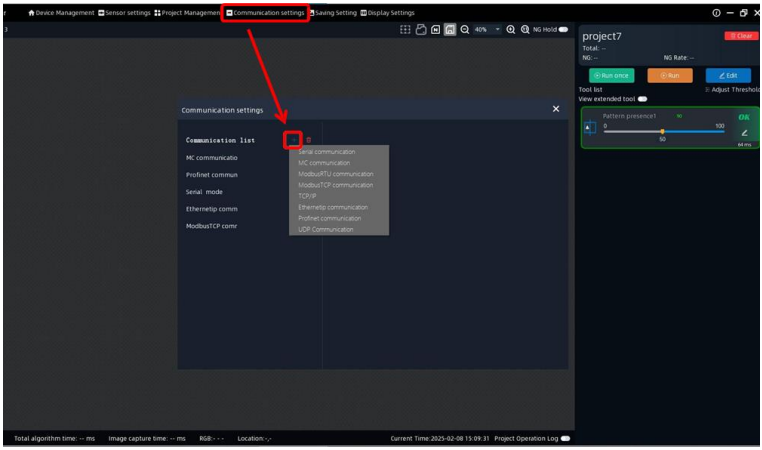



11. After configuring the output, debug the solution results. Click "Run Once"; the corresponding result will appear in the bottom-left corner of the image. Once verified, click "Finish" to exit the configuration.

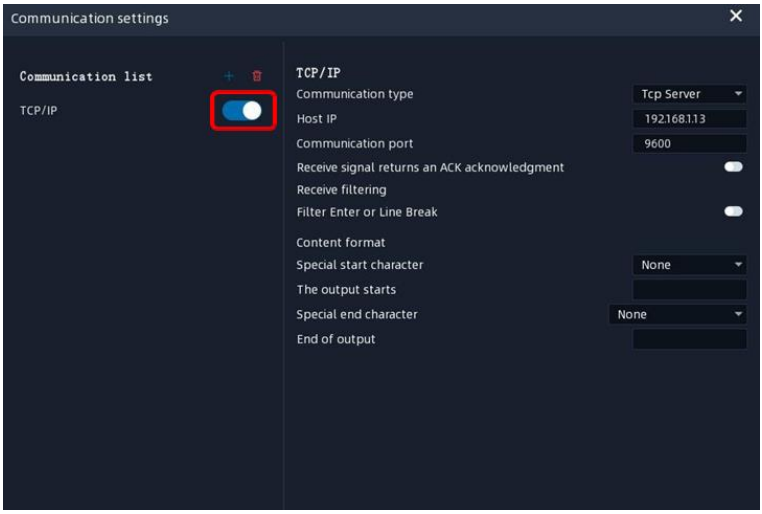



**Note**: Internal configuration is now complete. The following steps cover external communication setup and debugging.

12. Return to the Main Interface and click "Communication Settings" on the toolbar. Click the "+" icon; this example uses the TCP/IP protocol.




13. Select TCP/IP and configure it according to the specifications. After setup, click "Start" to enable communication with external devices.

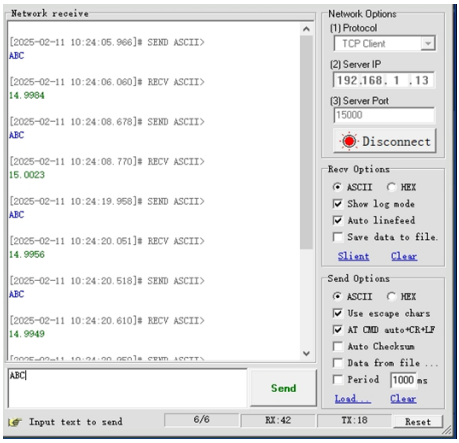



**Note**: For detailed communication settings, refer to the subsequent chapters.

14. Click "Start Run" on the Main Interface. The solution will enter the operating state and await a trigger signal.



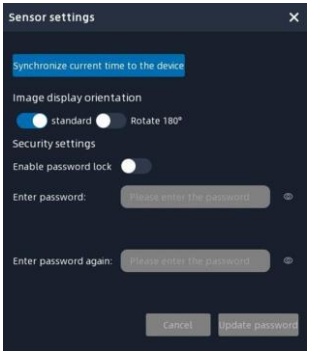

15. Connect an external device (e.g., PLC, IPC) to the vision camera. Use communication debugging software to connect and send the trigger command. As shown below, sending the trigger string "ABC" executes the solution and retrieves the inspection results. This concludes the solution configuration and debugging process.



# Basic Camera Settings

Click "Camera Settings" in the menu bar to adjust the following device parameters:




- Time Sync: Click "Sync Current Time to Camera" to ensure the device system time matches real-time, essential for logging production timestamps.
- **Image Orientation:**
    - Options: "Standard" and "Rotate 180°".
    - Note: The coordinate system (algorithm origin) is fixed at the top-left of the image and does not change with the display orientation.

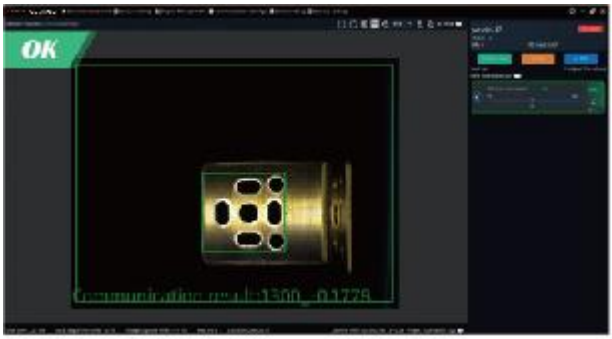
- **Security Settings (Password Lock):**
    - Enable to set a user password.
    - When locked, functions like "Clear Data" and "Edit Solution" are disabled to prevent accidental modifications by operators.
    - Click the unlock icon and enter the password to restore editing permissions.

## Image Orientation Example

1. Standard: Captured image appears in default orientation.



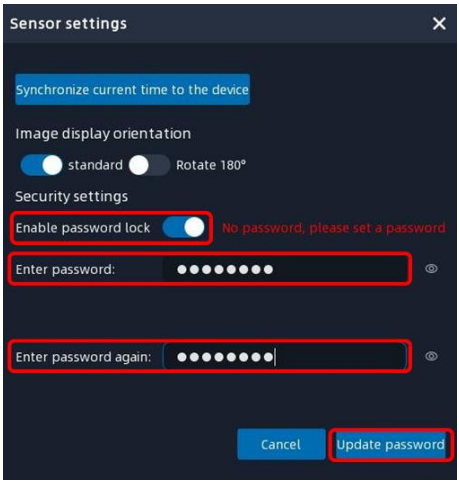

2. Rotate 180°: With the camera and target fixed, the image flips 180°.



**Note**: Regardless of orientation settings, the coordinate origin (0,0) for tool calculations and position output always remains at the top-left of the image.

## Security Settings - Enabling Password Lock

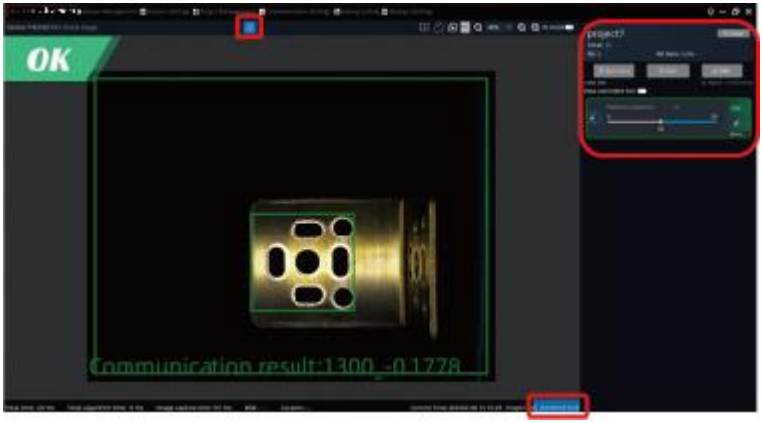
1. Enable: Toggle "Enable Password Lock," set a password, and click "Update Password."



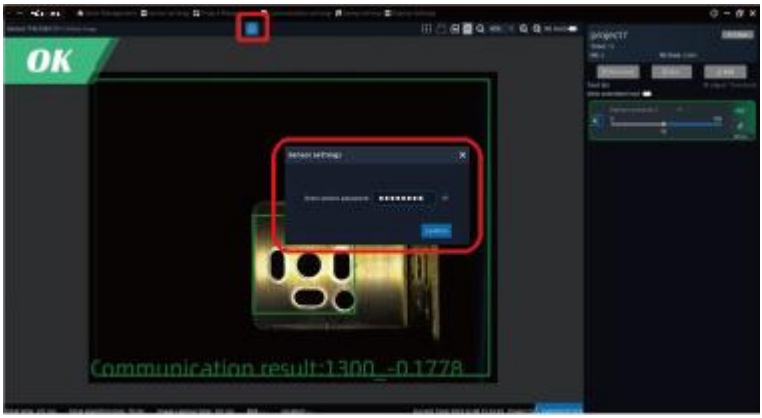

2. Lock Icon: Once enabled, a lock button appears in the view toolbar.



3. Locked State: Clicking the lock button switches the interface to "Password Locked." Configuration functions (e.g., "Clear Data" or "Edit Solution") are disabled.




4. Unlock: Click the unlock button, enter the password, and confirm to restore access.



# Project Management

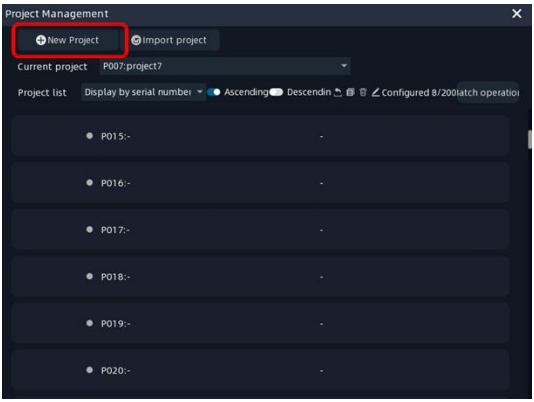
## Create New Project

The first step in establishing an inspection task to distinguish between different production lines or products.

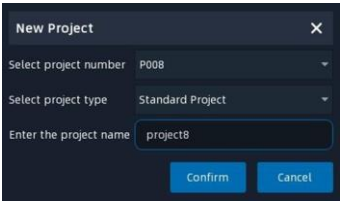
1. Open the "Project Management" menu in the software.




2. Click "New Project" and select an empty slot (IDs 1–200).




3. Enter a custom name (e.g., project8) and confirm.



# Project Configuration

The core setup stage that determines what the camera "sees" and how it "judges."

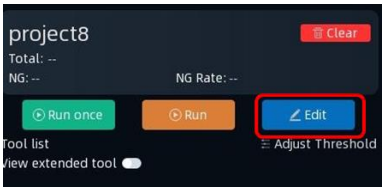
- Image Tuning: Place the workpiece and click "One-Click Tune" for auto-focus and auto-exposure to ensure image clarity.
- Set Trigger: Define image acquisition timing (e.g., continuous capture or single shot upon signal).
- Base Template: Frame a "qualified sample" area as the comparison benchmark.
- Tool Selection: Drag tools like "Pattern Presence," "Code Reading," or "Measurement" from the toolbox and adjust judgment thresholds.

After confirming the new project name, the software enters the "Project Configuration" interface.

# Edit Project

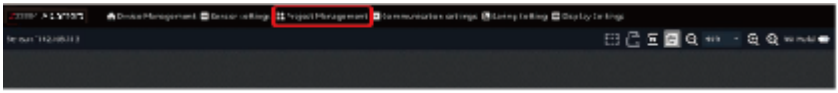
**Method 1:**

- On the main interface, click the "Edit" button next to the "Current Project."

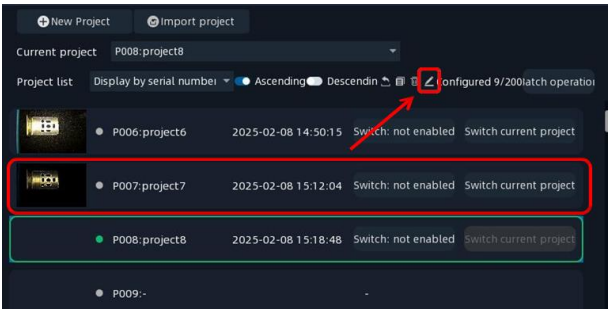



**Method 2:**

1. Click "Project Management."



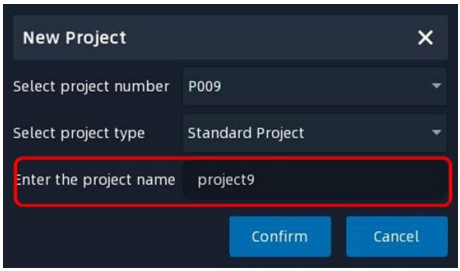
2. In the pop-up window, select the target project and click "Edit."



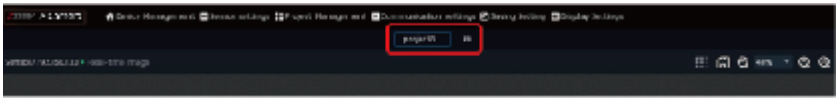

## Configure Project Name

**Note**: Duplicate project names are not allowed on a single device. A prompt will appear if the entered name conflicts with an existing project.

- You can specify the name when creating a new project.




- The name can also be modified during the editing process.

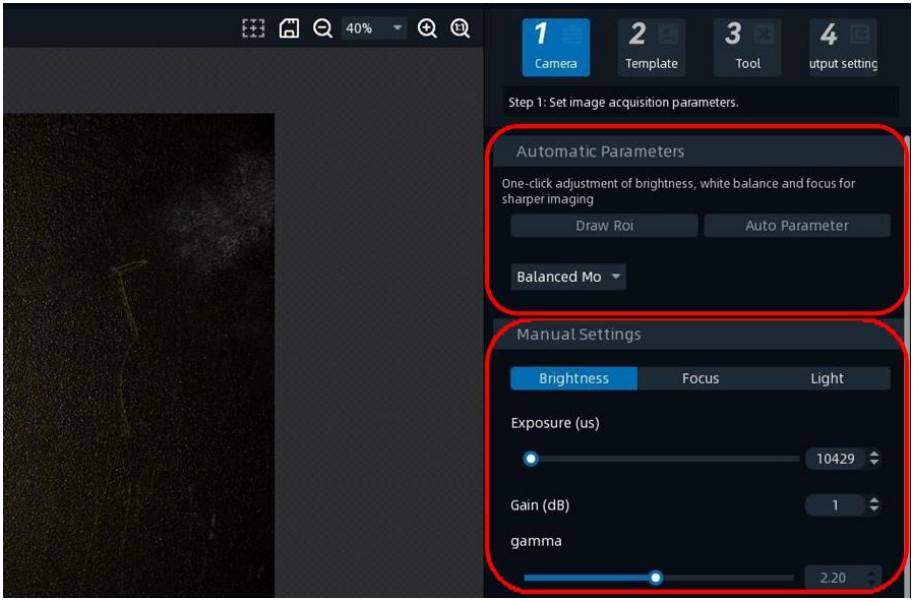


# Camera Debugging

The first configuration step is "Camera Debugging," which involves two tasks:

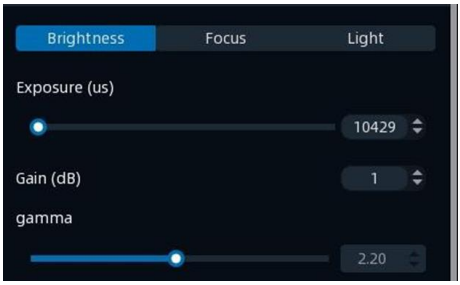
- One-Click Tune: Analyzes the full FOV to optimize focus and imaging.
- ROI Drawing: Optimizes parameters specifically for a selected local area.

**Adjusting Imaging Parameters**

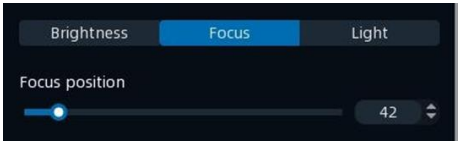



- **Auto Adjustments:**
    - One-Click Tune: Analyzes the full FOV to optimize focus and imaging.
    - ROI Drawing: Optimizes parameters specifically for a selected local area.

- **Manual Settings:**
  - Brightness: Adjust Exposure (us), Gain (dB), and Gamma.




  - Focus: Manually fine-tune focus via the slider.




  - Lighting Control:

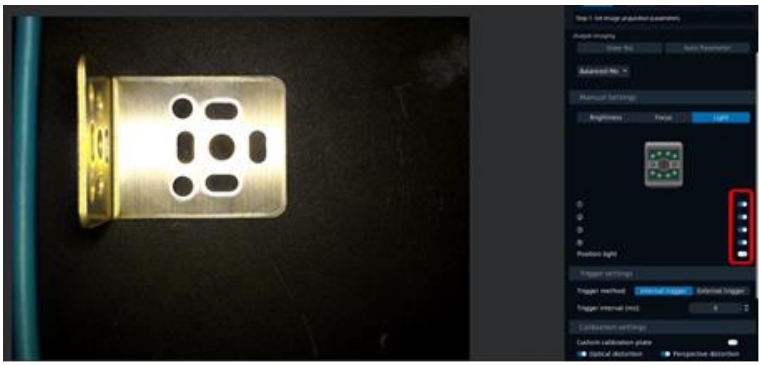



    - Supports four independent light groups.
    - Polarization: On semi-polarized models, Groups 1 & 2 are non-polarized; Groups 3 & 4 are polarized. To reduce glare on reflective surfaces, turn off Groups 1 & 2 and use only Groups 3 & 4. (Manual

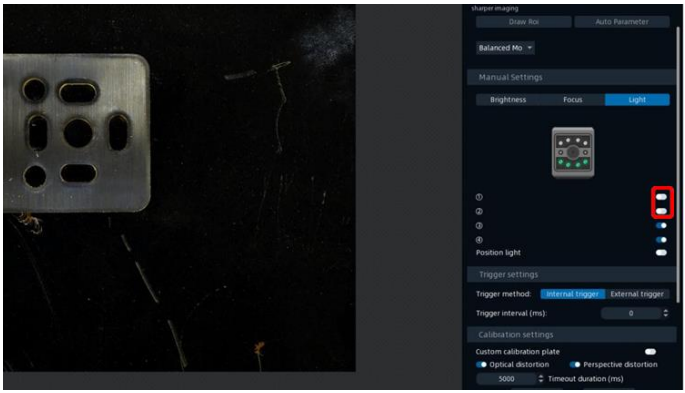
brightness adjustment may be required after disabling groups).

**Note:** For "semi-polarized" models, Groups 1 & 2 are non-polarized, while Groups 3 & 4 are polarized. To reduce overexposure on reflective surfaces, turn off Groups 1 & 2 and use only Groups 3 & 4 (manual brightness adjustment may be required).

- All Lights On: Reflective background causes overexposure.



- Groups 1 & 2 Off: Overexposure is reduced after disabling non-polarized lights and increasing brightness.



# Project Trigger Settings

Set image acquisition timing in Camera Debugging:

- Internal Trigger: Auto-triggers without external signals. Set Trigger Interval (rest time between runs, default 0ms).




- External Trigger: Runs on external signals.
- I/O Trigger: Signals from photo-cameras or PLCs via physical wiring.



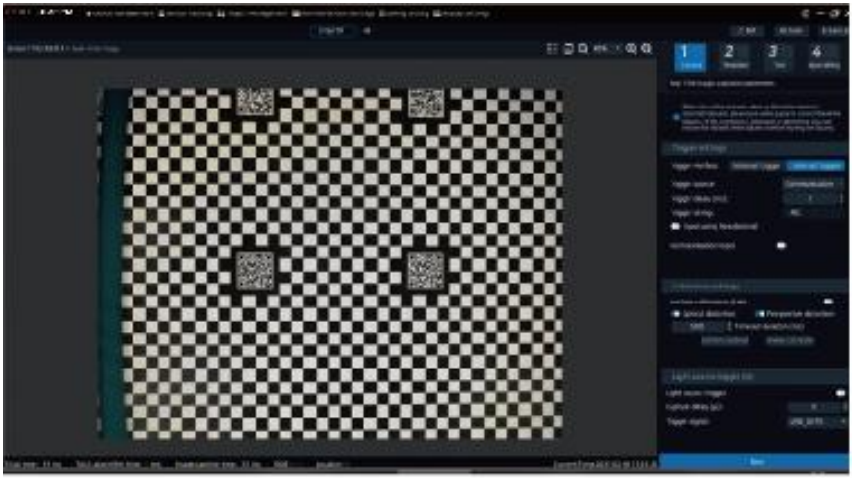

- Communication Trigger: Network commands from PC/PLC. Supports custom Trigger Strings (e.g., "ABC") and Trigger Delay.



# Coordinate Calibration

Converts pixels to physical units for high-precision tasks:

- Calibration Plate: Uses checkerboard; input row/column counts and grid size.
- **Distortion Correction:**
    - Optical Distortion: Fixes image offset between the lens center and edges.
    - Perspective Distortion: Fixes deformation (e.g., keystone effect) from non-perpendicular mounting angles.
    - Preview: Click calibrate to verify results and coordinate accuracy.

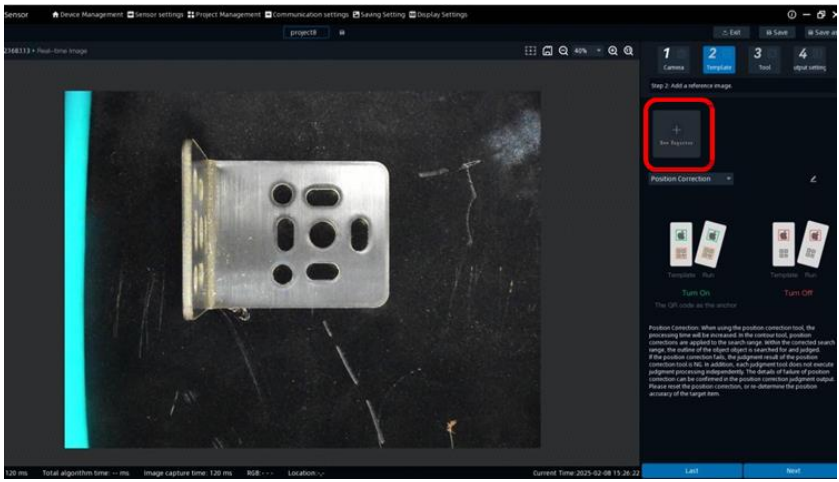


# Set Template

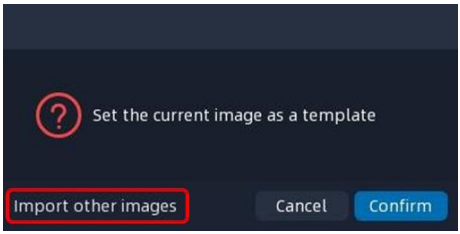
Template Addition is the second step of project configuration:

**Add Template Image:**

- Click "+" to register the live image as the reference benchmark. Supports deletion and replacement.



- Supports Importing Offline Images (resolution must match the camera).




**Note**: Only one template image is allowed per project.

## Position Correction (Optional)

Adapts to target shifting within the FOV. When enabled, it controls the detection areas of all tools in the project. Setup follows the Pattern Presence Detection workflow.



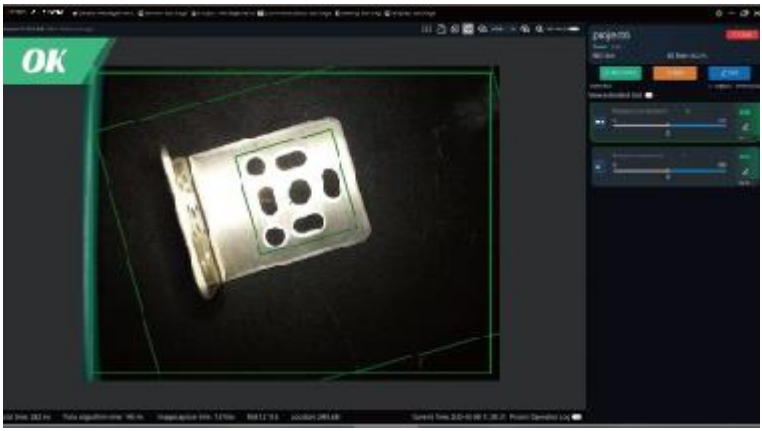

**Note**: Only one template image is allowed per project.

**Usage Examples:**

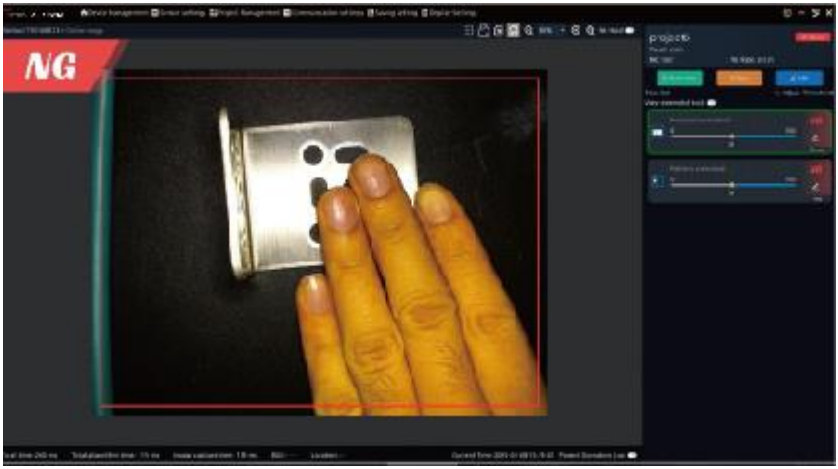
- Combining Tools: Position Correction can be used in combination with other inspection tools within a single project.




Feature Description 1: Pairing with Blob Counter. Position Correction locates the character; the Blob Counter counts black dots.



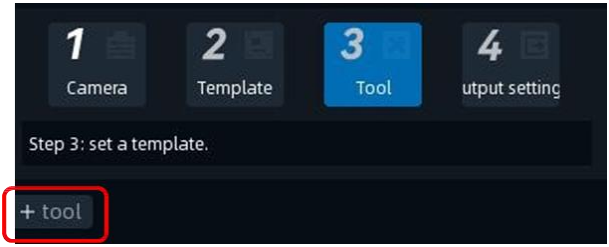

Feature Description 2: When the target shifts, Position Correction first locates the feature, then re-aligns the Blob Counter's detection area to follow the target.




Feature Description 3: If Position Correction is unconfigured or returns NG, subsequent tools (e.g., Width Detection) fail to shift, causing misalignment and incorrect results.

# Tool Configuration

The third step of project configuration is "Tool Configuration." A single project supports up to 32 inspection tools. Click "+ Tool" to open the tool list and select the algorithm that matches your application requirements.

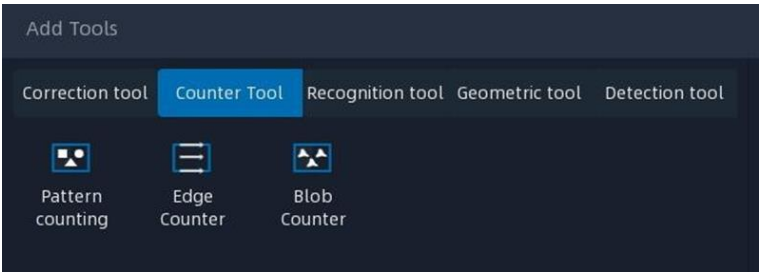



## Presence Detection Tools



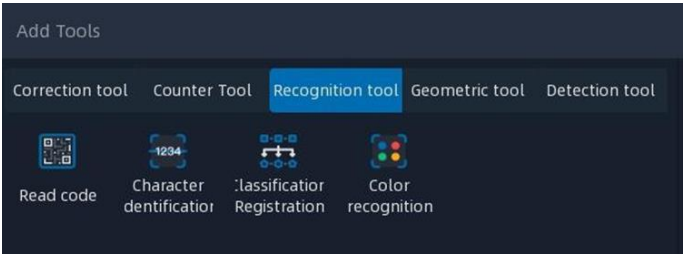

| Tool Name | Description |
|---|---|
| **Pattern Presence** | Uses **Template Matching** to search for a target pattern within a defined area. |
| **Blob Presence** | Uses **Blob Analysis** to detect if a region meeting threshold criteria exists; ideal for high-contrast scenarios. |
| **Circle Presence** | Detects the presence of circular features within the search area. |
| **Edge Presence** | Detects the presence of specific edges within the search area. |

## Counting Tools



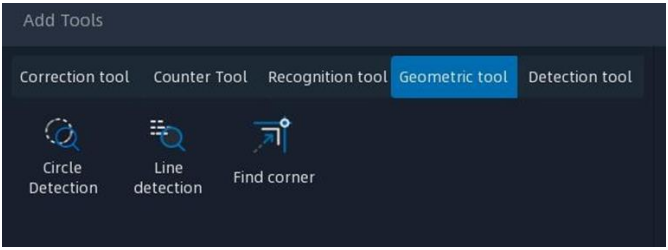

| Tool Name | Description |
|---|---|
| **Pattern Counting** | Searches and counts targets using pattern matching. |
| **Edge Counting** | Detects and counts edges based on contrast settings. |
| **Blob Counting** | Detects and counts all blobs within a specified area range. |

## Recognition Tools



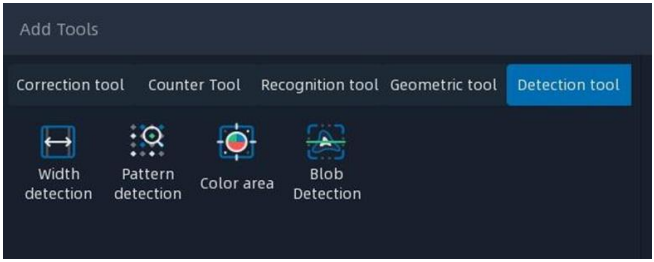

| Tool Name | Description |
|---|---|
| **Read Code** | Reads 1D or 2D codes (e.g., QR, DM); supports simultaneous multi-code reading. |
| **Color recognition** | Compares target to a reference color and calculates similarity (Color models only). |

## Geometric Tools




| Tool Name | Description |
|---|---|
| **Circle Detection** | Uses edge calipers to locate circle center coordinates and output diameter. |
| **Line Detection** | Uses edge calipers to precisely locate lines and output line angles. |

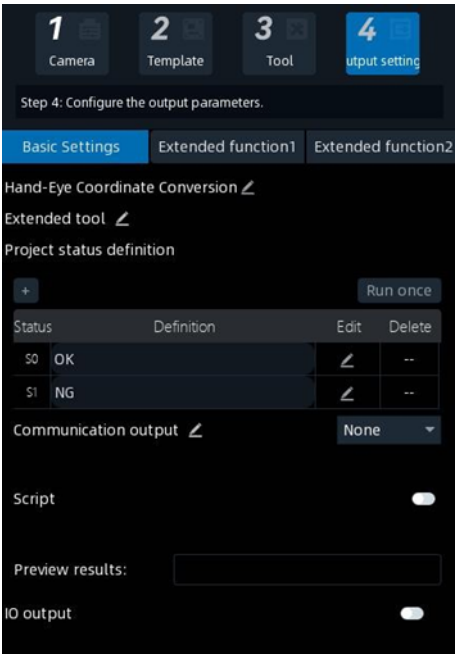
## Detection Tool




| Tool Name | Description |
|---|---|
| **Width Detection** | Measures target width based on edge contrast settings. |
| **Pattern Detection** | Uses pattern matching to detect target position and rotation angle. |
| **Grayscale Area** | Calculates target area by counting pixels within a specific grayscale range. |
| **Color Area** | Calculates target area by counting pixels within a specific color range. |
| **Blob Detection** | Detects all blobs within an area range and returns their position and angle. |

# Output Configuration

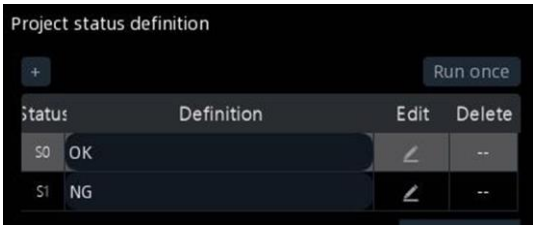
The fourth step of project configuration is "Output Configuration," where you define the content and format of results sent to external devices. Click "Finish" once complete to return to the main interface.



## Project Status Definitions

Integrate individual tool results into distinct project-level statuses:

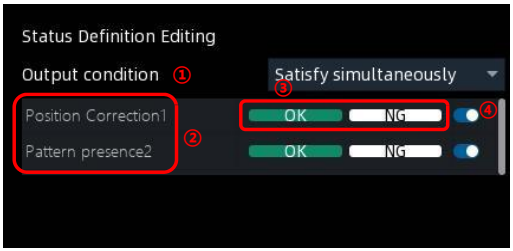
- Default Statuses: S0 (OK) and S1 (NG).




- Modify Status: You can customize the status string (label) for each definition.




- Logic Configuration: Click "Edit" to enter the status editor and configure the specific "Achievement Conditions" (logic) required to trigger that status.



## Status Editor Functional Overview

| # | Configuration Item | Purpose | Details |
|---|---|---|---|
| 1 | **Output Condition** | Logic for triggering the current status. | Select **"All Met" (AND)** or **"Any Met" (OR)**. |
| 2 | **Tool List** | Displays all configured inspection tools. | Lists all active tools in the project. |
| 3 | **Tool Result** | The required result for a tool to meet the status. | Options: **OK** or **NG**. |
| 4 | **Tool Enable** | Determines if a tool is included in the logic. | Enabled by default; all tools participate in judgment. |

## Example: Project Status Definitions (Default S0 & S1)

The following table shows the default system configurations:

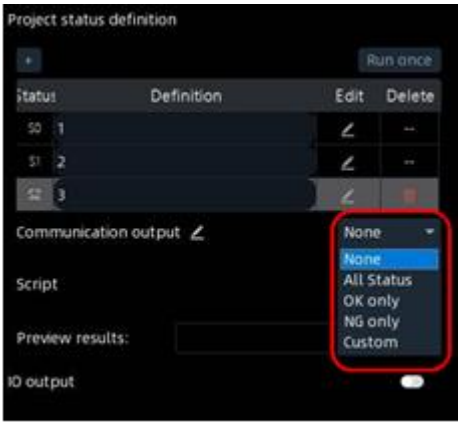
| Status | Definition | Output Condition | Tool Result | Tool Enable |
|---|---|---|---|---|
| **S0** | OK | All Met (AND) | All tools must be **OK** | All Selected |
| **S1** | NG | Any Met (OR) | Any tool is **NG** | All Selected |

**Note**: Click the "+" icon to create and configure additional custom statuses if needed.

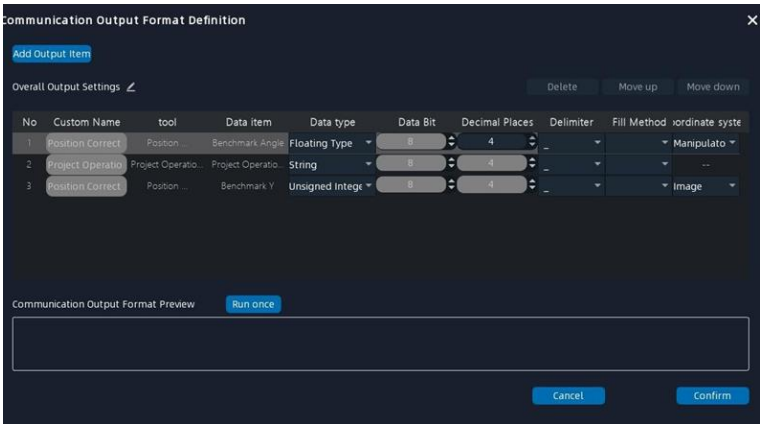


## Communication Output

- Format Configuration: Define the format for results sent via communication protocols. Ensure communication parameters are set before use.




- Trigger Status: Specify which status triggers an output. Click "Edit"  to select specific items (e.g., coordinates, statistics, custom strings).

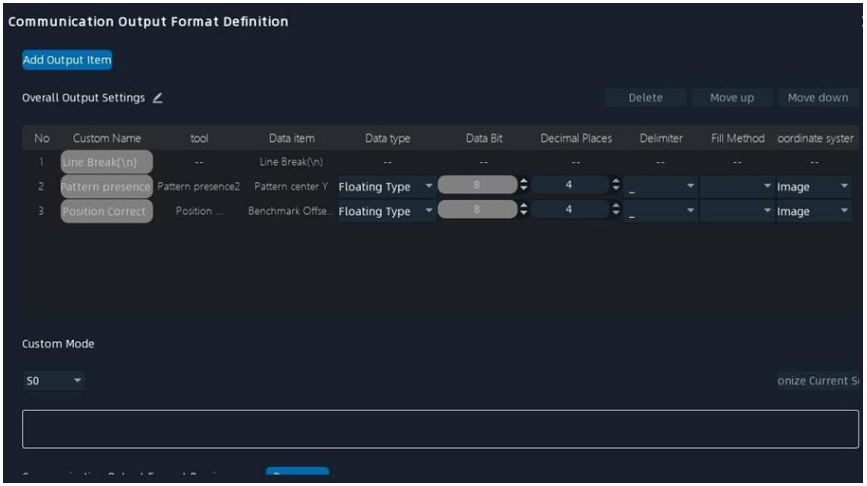


- Output Preview: Preview the configured result format at the bottom of the interface.




- State-Based Output: Output content and format are independently configurable for each Project Status (e.g., S0, S1).



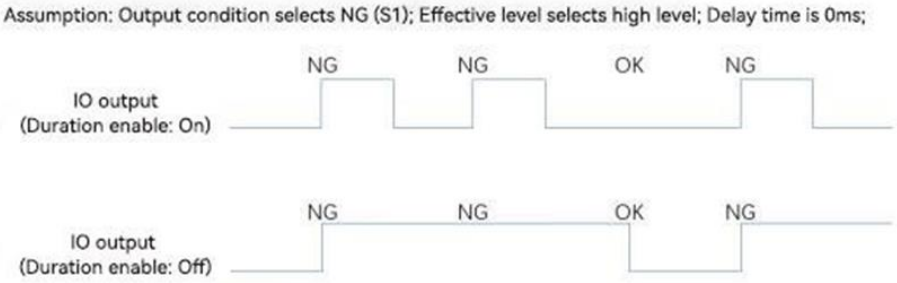



**Physical I/O Output**

Outputs OK/NG results via I/O cables. Requires the corresponding I/O cable connection.



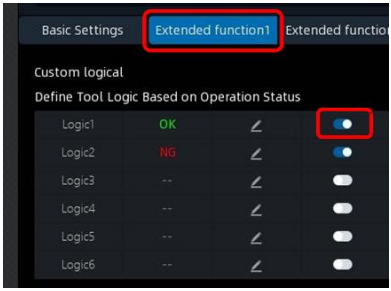

- Line Configuration: Independently configure LINE_OUT0/1/2.
- Signal Settings: Set the Active Level (High/Low), Delay Time, and Duration (default 10ms).



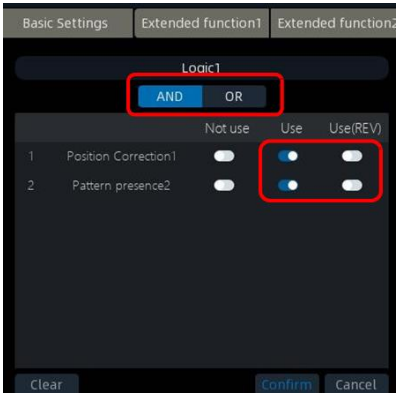
## Custom Logic

Combines multiple tool results into a new value using configurable logic. Supports up to 4 groups. Results can be sent via Communication Output or I/O Output.

- Enable: Turn on "Custom Logic" in Step 4: Output Configuration > Extension Function 1.




- Logic Configuration: Click the edit button  to choose AND or OR operations.



Tool Assignment: All project tools appear in the list. Click "Use" or "Use (Inverse)" to include a tool's result in the logic calculation.

### Custom Logic Example

Below is an example of an AND logic configuration involving three tools, illustrating how the "Inverse" (NOT) function affects the final result.

### Logic Configuration

| Included Tool | Mode |
|---|---|
| **Tool 1** | Use |
| **Tool 2** | Use |
| **Tool 3** | **Use (Inverse)** |

### Truth Table (Calculation Results)

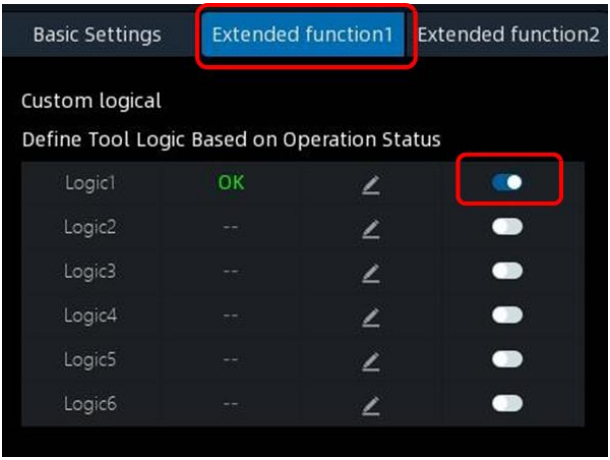
The logic result is OK only when Tool 1 is OK, Tool 2 is OK, and Tool 3 is NG.

| Tool 1 | Tool 2 | Tool 3 | Logic Result |
|---|---|---|---|
| OK | OK | OK | **NG** |
| NG | OK | OK | **NG** |
| OK | NG | OK | **NG** |
| NG | NG | OK | **NG** |
| **OK** | **OK** | **NG** | **OK** |
| NG | OK | NG | **NG** |
| OK | NG | NG | **NG** |
| NG | NG | NG | **NG** |

## Value Ranking

Value Ranking sorts numerical results from various tools and compares the actual rank against a user-defined Expected Rank to determine an OK/NG result. You can configure up to 4 groups, and results can be sent via Communication Output.

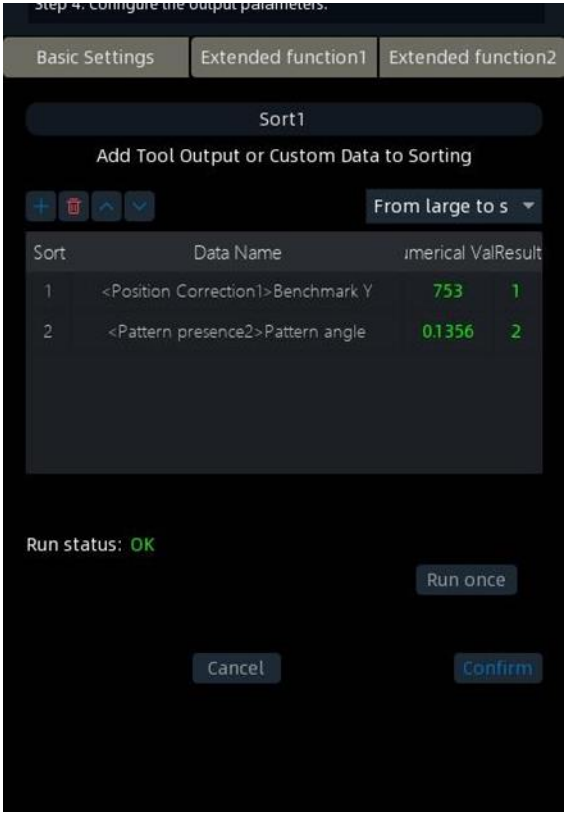
- Enable: In Step 4: Output Configuration > Extension Function 1, toggle "Value Ranking."




- Access Interface: Click the edit button for a specific ranking group to enter the configuration screen.

**Configure Ranking:**

- Click "+" to add specific numerical outputs from configured tools.
- Sort Order: Choose either "Ascending" (Small to Large) or "Descending" (Large to Small).
- Judgment: Enter the Expected Rank. If the actual sorted position matches this value, the result is OK; otherwise, it is NG.



### Value Ranking Examples

Below is an example using Ascending order (Small to Large) with three tools and an Expected Rank of "1, 2, 3."

| Tools Included | Numerical Item |
|---|---|
| Grayscale Area 1 | Area |
| Grayscale Area 2 | Area |
| Grayscale Area 3 | Area |

### Scenario 1: Actual Rank matches Expected Rank

The result is OK because the sorted area values match the predicted 1st, 2nd, and 3rd positions.

| Tool | Area | Actual Rank | Ranking Result |
|---|---|---|---|
| Grayscale Area 1 | 0 | 1 | **OK** |
| Grayscale Area 2 | 100 | 2 | |
| Grayscale Area 3 | 200 | 3 | |

### Scenario 2: Actual Rank does not match Expected Rank

The result is NG because the actual rank of the areas (based on size) differs from the "1, 2, 3" sequence assigned to the tools.

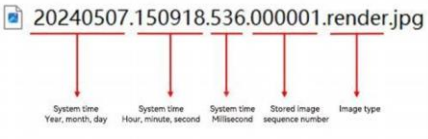
| Tool | Area | Actual Rank | Ranking Result |
|---|---|---|---|
| Grayscale Area 1 | 0 | 1 | **NG** |
| Grayscale Area 2 | 400 | 3 | |
| Grayscale Area 3 | 200 | 2 | |

## Custom Image Naming Rules

The image saving function (refer to the Image Saving chapter) allows you to store captured images and tool rendering results as files on your PC.

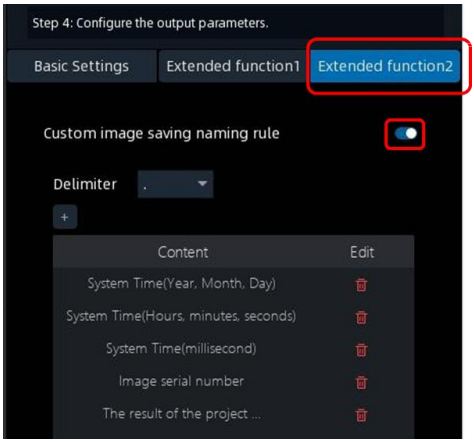
- Custom Naming: Enable this to define specific naming conventions based on site requirements or project content. Results from specific tools can be incorporated into the filename. This is Disabled by default.

- Default Naming: If custom rules are off, the system uses a standard default format.

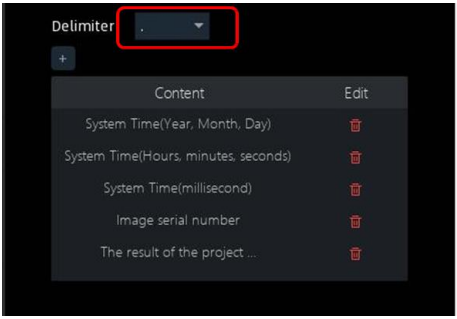



**Note:** Filename components are separated by a delimiter (e.g., a period).

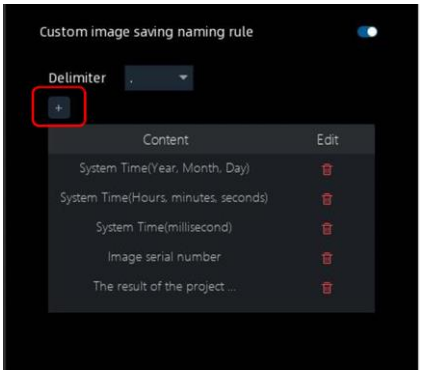
- Enable Feature: In Step 4: Output Configuration > Extension Function 2, toggle "Custom Image Naming Rules."

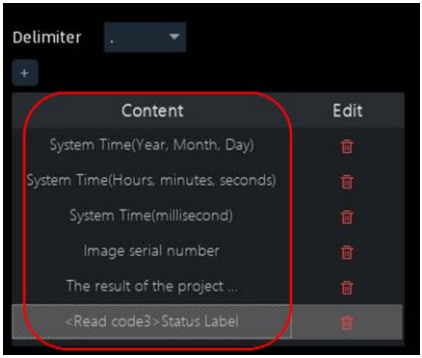


- Configure Delimiter: Define the separator (e.g., period or underscore) used between filename components.




- Configure Content: Click "+" to add tool results or custom strings to the filename. Click the Delete button to remove an item.

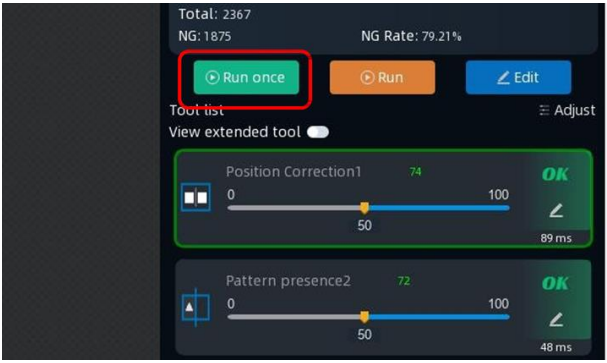


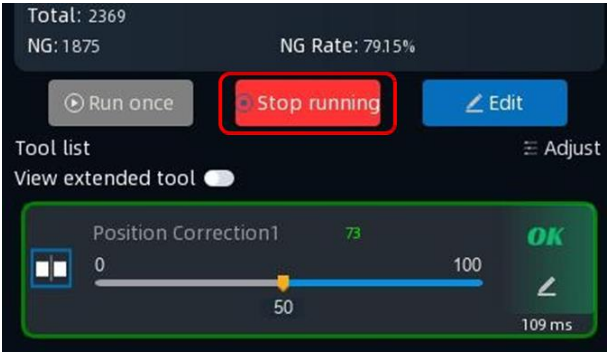
# Project Operation & Testing

## Online Operation/Testing

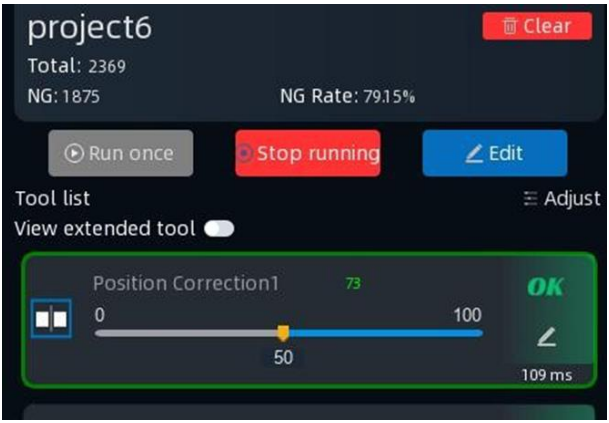
- Run Once: Manually triggers a single inspection cycle.




- Start Run: Enters the Active state; the camera awaits internal or external trigger signals.



- Stop: Manually halts operation. The device state persists after software restart.

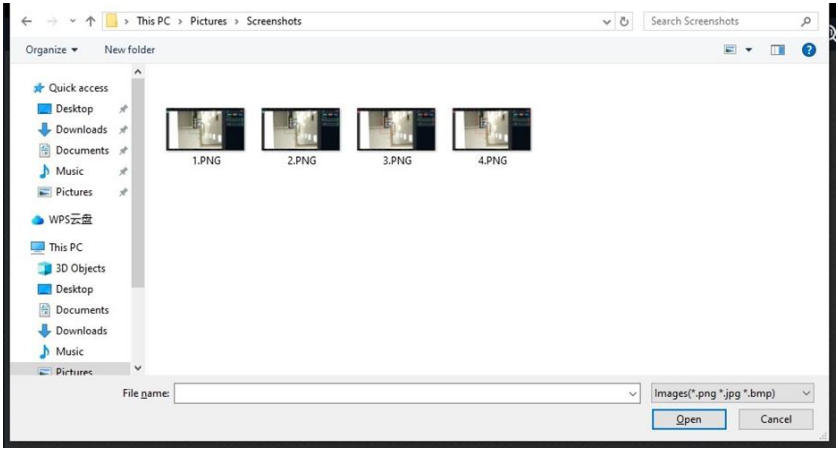



## Offline Mode/Testing

- Algorithm Testing: Click "Offline Mode" while standby to import local PC images for testing.
- Import Requirements: Resolution of imported images must match the current camera.



- File Import: You must import image files from your computer before entering "Offline Mode."
- Batch Addition: You may click the button multiple times to add additional images.



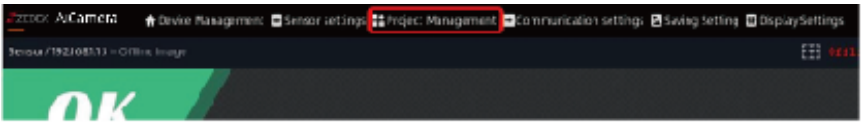

**Note:** For compatibility, it is recommended to use images previously saved by the current device (see the Image Saving chapter).

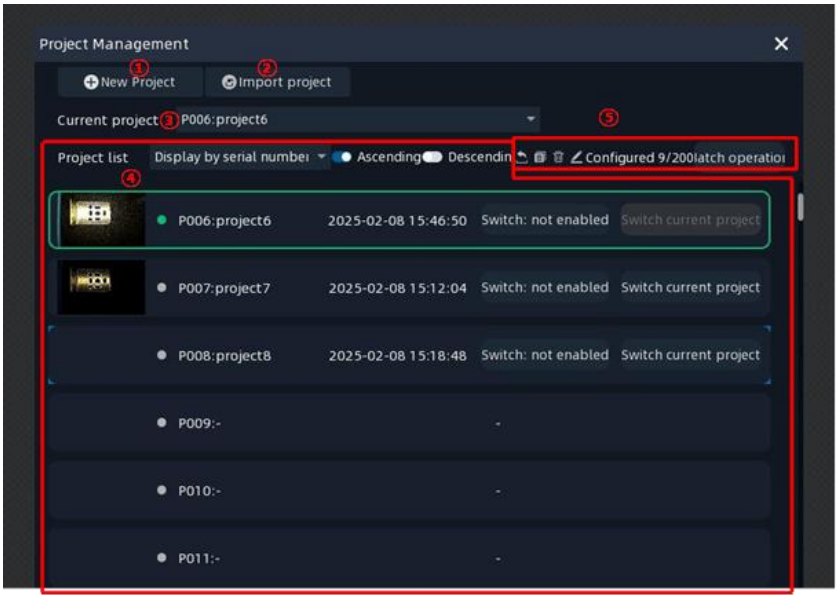
# Project Management

Vision cameras can store multiple projects tailored to different inspection targets. A single device supports up to 200 projects.

## Access Project Management

- Click "Project Management" in the menu bar to open the management interface.



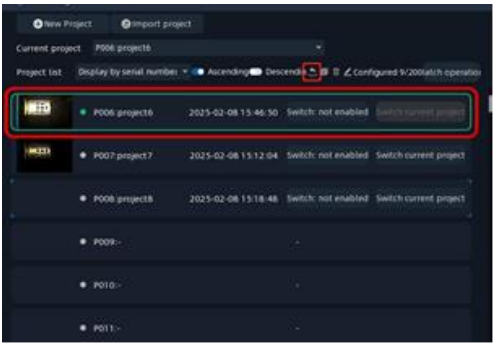
## Project Management Interface Overview

| # | Function | Description | Details |
|---|---|---|---|
| 1 | **New Project** | Create a new project. | Refer to the **New Project** chapter. |
| 2 | **Import Project** | Load project files into the device project list. | Supports single or batch imports. |
| 3 | **Current Project** | Displays the active project; use the dropdown for manual switching. | Only fully configured projects can be selected. |
| 4 | **Project List** | Displays ID, Name, and Creation Time for all projects. | Supports storage for up to 200 groups. |
| 5 | **Operations** | Access for Export, Copy, Delete, Edit, and Batch actions. | Select a specific project to execute management tasks. |

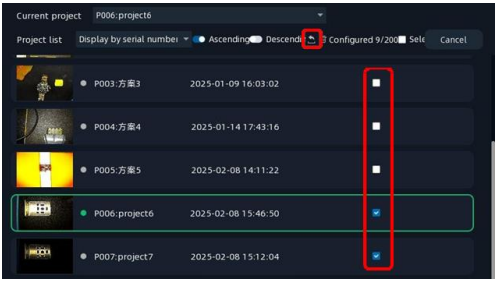
# Project Export & Import

## Export Project (Single/Batch)

- Export Single: Select a project from the Project List and click the export button.




- Export Multiple: Click "Batch Operation," select multiple projects, and click export.




- File Format: Projects are saved as .projs files. This allows for rapid deployment across multiple cameras at the same inspection station.



## Import Project (Single/Batch)

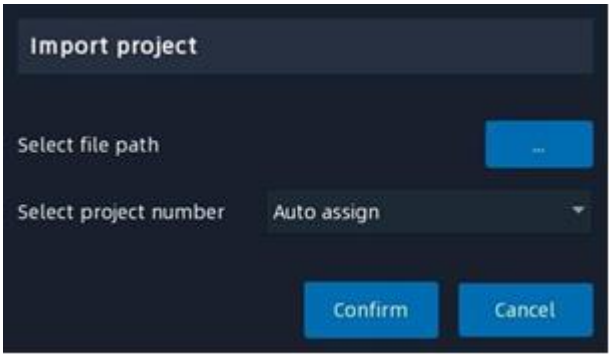
**Note:**

1. Cross-series project imports are not allowed.
2. Resolution mismatch (e.g., 1MP to 2.3MP) will cause import failure.
3. Large firmware version gaps between export and import devices may lead to failure.

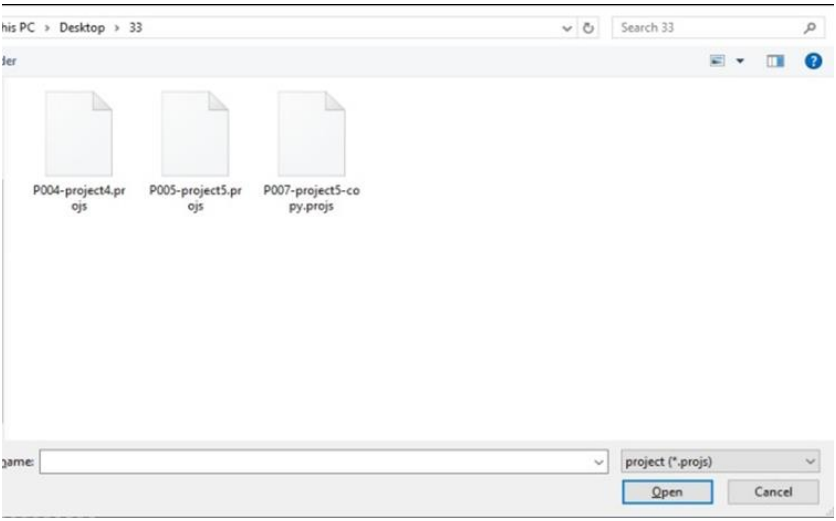
**Import Process:**

1. Click "Import Project" in the Management Interface and select "Choose File Path."

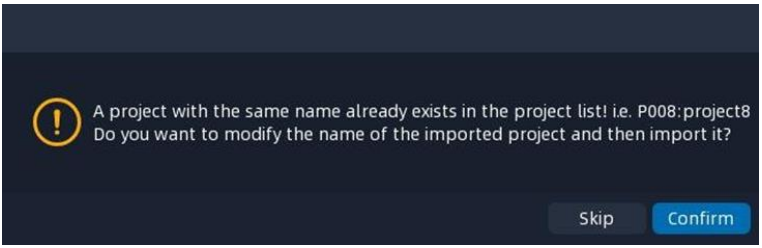


2. Select one or more .projs files and click Open.



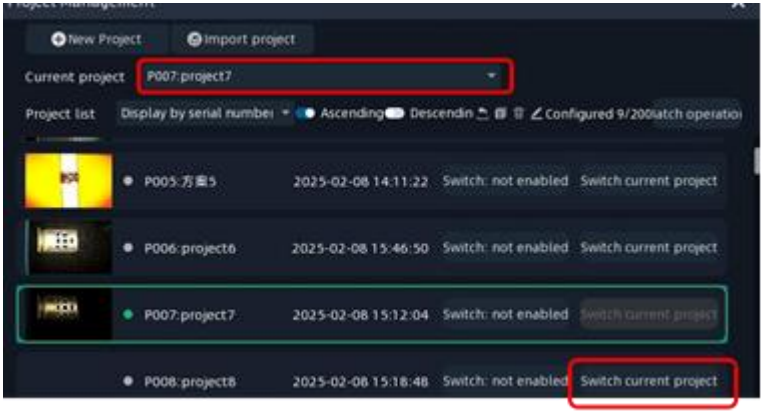

3. If a name conflict occurs, the system will prompt for a rename.



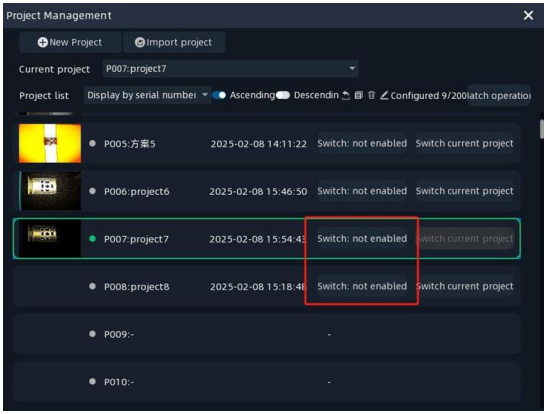
# Switch Project

## Manual Switching

- Use the dropdown menu next to "Current Project."




- Click the "Switch to Current" button next to a project in the Project List.



## External Switching

The camera supports automatic switching via external signals. Switching Configuration must be set independently for each project.



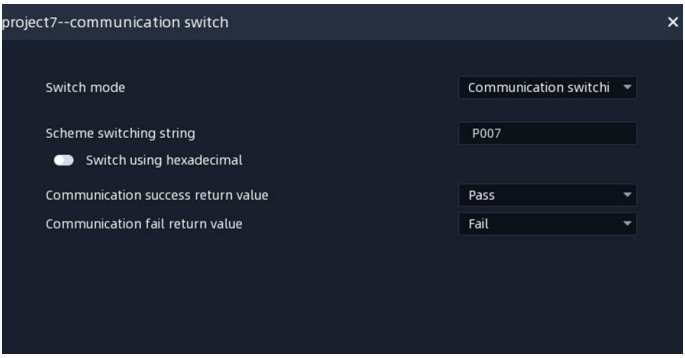

- **I/O Switch Mode:**

  Specify the Trigger Source (e.g., LINE_IN0 or LINE_IN1). The camera switches to the project upon detecting a signal (Rising or Falling Edge).



- **Communication Switch Mode:**

  External devices send a "Project Switch String" via network communication. The camera switches automatically based on the received string content.




## Configuration Item Overview

| Configuration Item | Purpose | Details |
|---|---|---|
| **Project Switch String** | Enter specific identification content for switching. | User-defined custom string. |
| **Use Hexadecimal** | Enables input in hexadecimal format. | Supports ASCII special characters (e.g., Enter, Newline, STX, ETX). |
| **Return Value (Success/Fail)** | Status message sent to external devices after switching. | **Success**: Pass, OK; **Failure**: Fail, NG. |

**Example:** If the communication protocol requires messages to end with an "Enter" (CR) symbol, and the switch string is P001 + Enter, enable "Use Hexadecimal" and input the hex code 503030310D.

# Communication Protocol Overview

Transmit inspection results to PLCs, robotic arms, or databases.

- Protocol Selection: Choose RS232, TCP/IP, or industrial protocols (e.g., Modbus, Profinet) based on electrical control requirements.
- Data Format: Define the output string content (e.g., OK/NG status, barcode text).
- Hardware Linking: For I/O triggering, verify the input/output signal logic and electrical levels here.

## Communication Settings

External Communication

The vision camera workflow typically involves multiple data exchange stages with external systems, including Project Triggering, Project Switching, and Result Output. Select the appropriate protocol based on your specific application and onsite equipment.

| Workflow | Description |
|---|---|
| **Project Trigger - External** | The camera executes a single inspection cycle upon receiving an external trigger signal. |
| **Project Switch - External** | The camera switches the active project based on commands received via external communication. |
| **Communication Output** | Inspection results are transmitted to the upper-level computer or control equipment. |

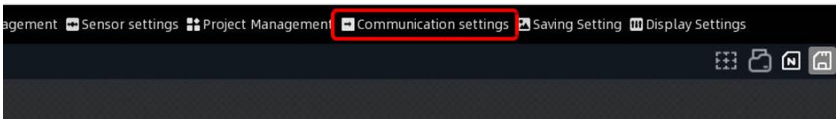
**Note:**

- **Prerequisites**: Ensure hardware wiring is complete and the network environment is stable. The corresponding communication protocol must be enabled and correctly configured on the camera.
- **Protocol Limit**: Only one communication protocol can be active at a time.
- **I/O Communication**: For physical I/O synchronization, refer to the **Project Trigger (I/O)** and **I/O Output** chapters.
- **Feature Support**: Some protocols currently do not support project switching. See the table below:

| Communication Protocol | Project Trigger | Project Switch | Result Output |
|---|---|---|---|
| **Serial Port (RS232)** | Supported | Supported | Supported |
| **TCP/IP** | Supported | Supported | Supported |
| **Modbus TCP** | Supported | Not Supported | Supported |
| **MC Protocol (Mitsubishi)** | Supported | Not Supported | Supported |
| **Modbus RTU** | Supported | Not Supported | Supported |
| **EtherNet/IP** | Supported | Supported | Supported |
| **Fins (Omron)** | Supported | Not Supported | Supported |
| **Profinet** | Supported | Supported | Supported |

## Using Communication Settings

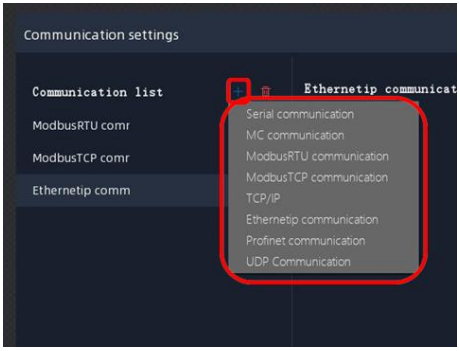
1. Click "Communication Settings" in the menu bar to open the configuration interface.



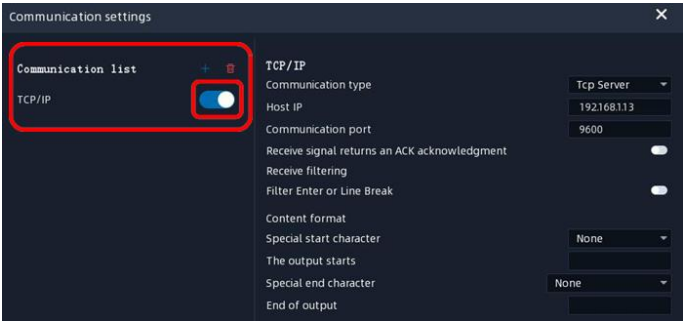
2. Click the "+" icon to select and add a communication protocol. Each protocol features independent parameter settings.




3. The Communication List will display all added protocols.

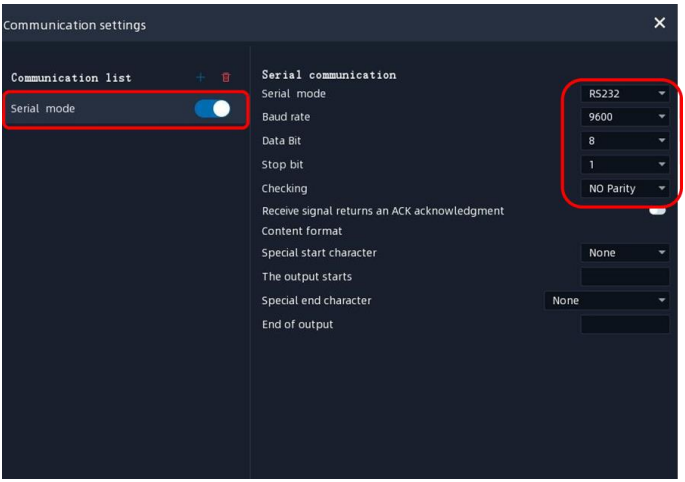



4. Toggle the Enable Switch to activate the desired communication function.



# Serial Port Mode (RS232)

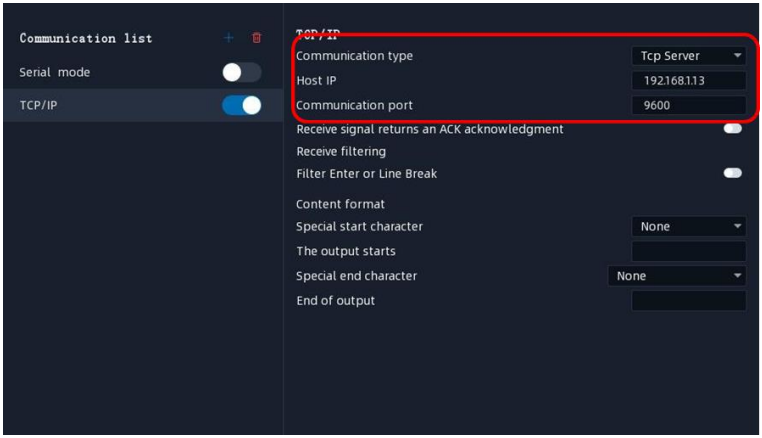
When the communication protocol is set to "Serial Port Mode," the following parameters can be configured:



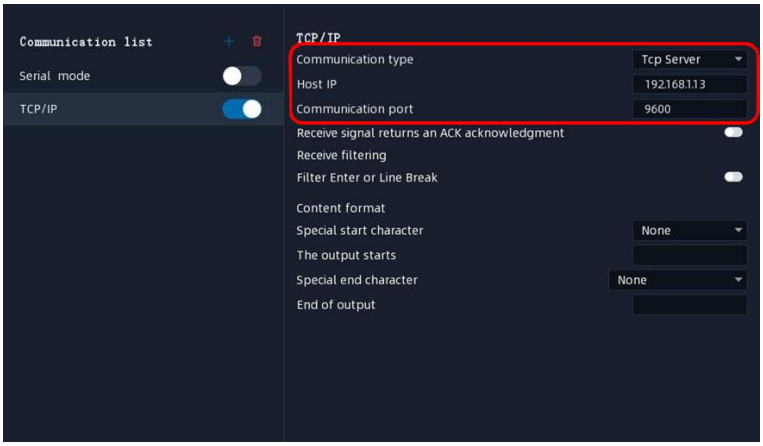

| Configuration Item | Description | Configuration Item | Description |
|---|---|---|---|
| **Port** | Select the physical serial port (e.g., COM1) used for connection. | **Port** | Select the physical serial port (e.g., COM1) used for connection. |
| **Baud Rate** | Set the data transmission speed (e.g., 9600, 115200). | **Baud Rate** | Set the data transmission speed (e.g., 9600, 115200). |
| **Data Bits** | Define the number of bits per character (typically 8). | **Data Bits** | Define the number of bits per character (typically 8). |
| **Stop Bits** | Specify the end of a character (typically 1). | **Stop Bits** | Specify the end of a character (typically 1). |
| **Parity** | Error-checking method (None, Odd, or Even). | **Parity** | Error-checking method (None, Odd, or Even). |

# TCP/IP Communication

- TCP Server: The camera acts as the server. Set the Port; the default value is 15000.

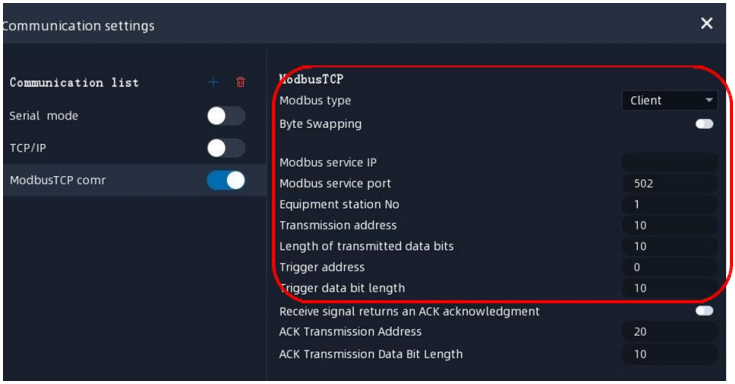



- TCP Client: The camera acts as the client. You must configure both the Host IP and the Port parameters.



# Modbus TCP Communication

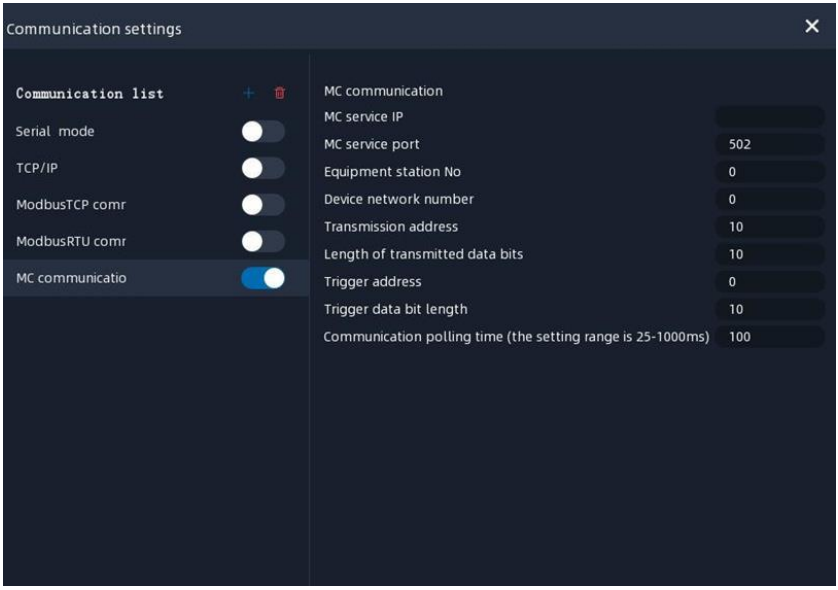
When selecting the Modbus TCP protocol, configure the Service IP and Service Port as follows:




| Configuration Item | Description | Default | Details |
|---|---|---|---|
| **Modbus Type** | Set Master/Slave mode | **Server** | Options: **Server**, **Client** |
| **Modbus Service IP** | Configure Host IP | — | Visible in **Client** mode only |
| **Modbus Service Port** | Set service connection port | **502** | |
| **Byte Swap** | High/Low byte swap | **Off** | Enable based on data alignment needs |
| **Device Station ID** | Connected device station number | **1** | |
| **Transfer Address** | PLC data transfer address | **10** | |
| **Transfer Length** | Data byte length | **10** | |
| **Trigger Address** | Address for PLC to trigger camera | **0** | |
| **Trigger Data Length** | Length of trigger signal bits | **10** | |

# MC Protocol Communication (Mitsubishi)

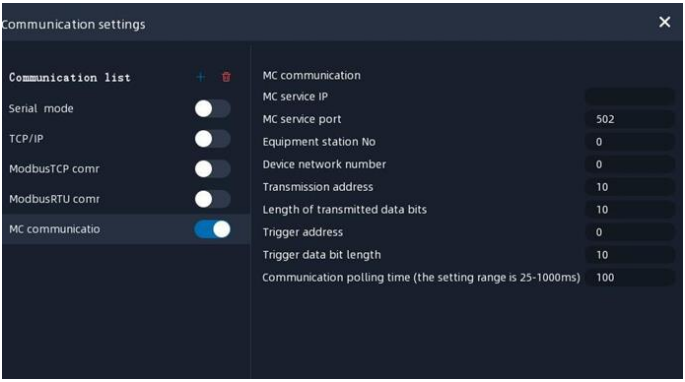
When selecting the MC Protocol, configure the following settings to connect with a Mitsubishi PLC:




| Configuration Item | Description | Default |
|---|---|---|
| **MC Service IP** | The IP address of the PLC device. | — |
| **MC Service Port** | The connection port of the PLC device. | **502** |
| **Device Station ID** | The station number corresponding to the device. | **0** |
| **Device Network No.** | The network number corresponding to the device. | **0** |
| **Transfer/Trigger Addr** | The memory addresses used for data exchange. | **10 / 0** |

# Modbus RTU Communication

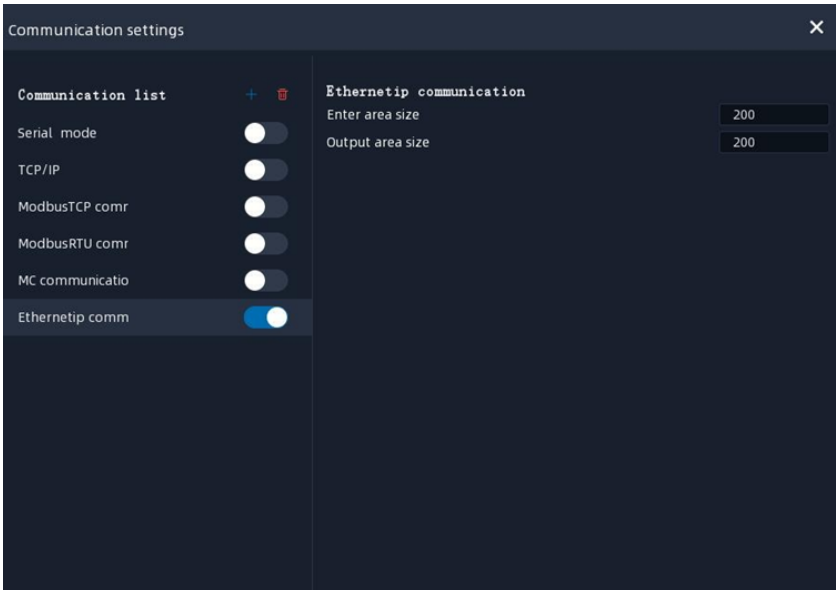
When using Modbus RTU, configure the following parameters to ensure proper data synchronization with your controller:




| Configuration Item | Description | Default | Details |
|---|---|---|---|
| **Comm Type** | Sets the Modbus RTU mode. | **Client** | Options: **Server** or **Client**. |
| **Byte Swap** | Enables High/Low byte swapping. | **Disable** | Adjust based on PLC data format. |
| **Device Station ID** | The station ID of the connected device. | **2** | |
| **Transfer Address** | PLC memory address for data transfer. | **10** | |
| **Transfer Length** | Length of the data in bytes. | **10** | |
| **Trigger Address** | Memory address for the PLC to trigger the camera. | **0** | |
| **Trigger Length** | Length of the trigger data bits. | **10** | |

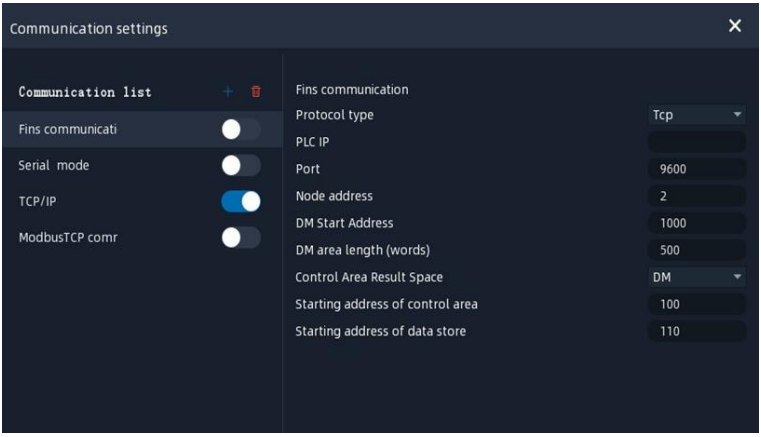
# EtherNet/IP Communication

When selecting the EtherNet/IP protocol, configure the input and output data sizes for cyclic communication.



# Fins Communication (Omron)

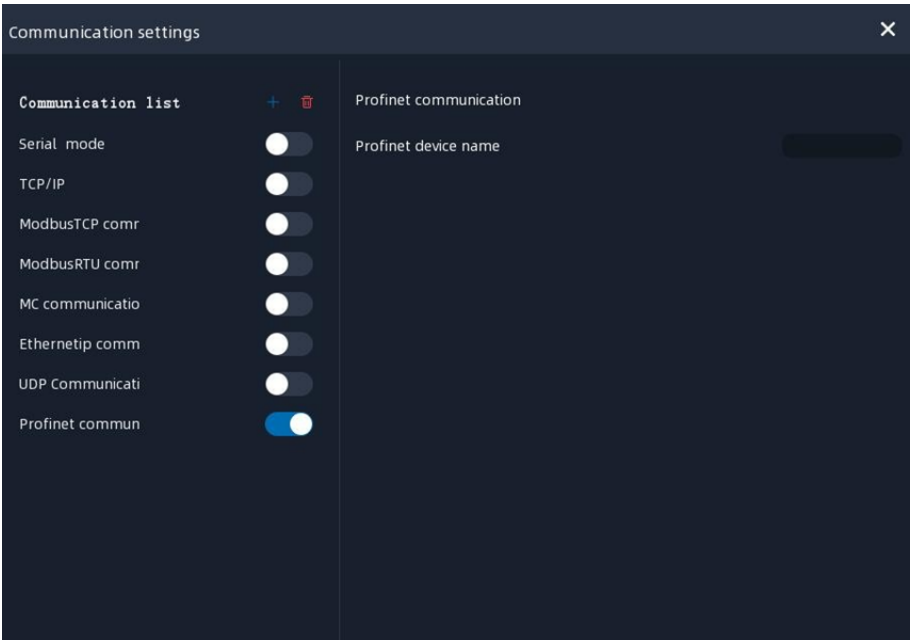
When selecting the Fins protocol, configure the following parameters to establish communication with an Omron PLC:




| Configuration Item | Description | Default | Details |
|---|---|---|---|
| **Protocol Type** | Selects the Fins communication type. | **UDP** | Options: **UDP** or **TCP**. |
| **PLC IP** | The IP address of the connected PLC. | — | |
| **Port Number** | The communication port of the PLC. | **9600** | |
| **Node Address** | The node ID for sending commands. | **2** | |
| **DM Start Addr** | Starting address for inspection results. | **1000** | |
| **DM Area Length** | Total storage length for results. | **500** | Measured in **Words**. |
| **Control Area** | Storage type for the control area. | **DM** | Options: **DM** or **CIO**. |
| **Control Start Addr** | Starting address for control commands. | **0** | |
| **Data Start Addr** | Starting address for the data area. | **0** | |

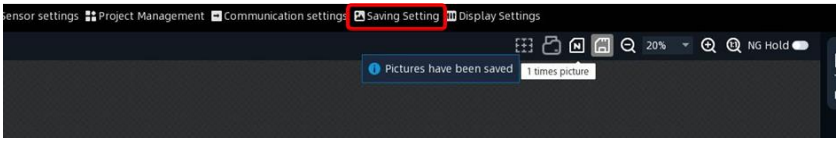
# Profinet Communication

When using Profinet, configure the unique identification for the camera on the industrial network:

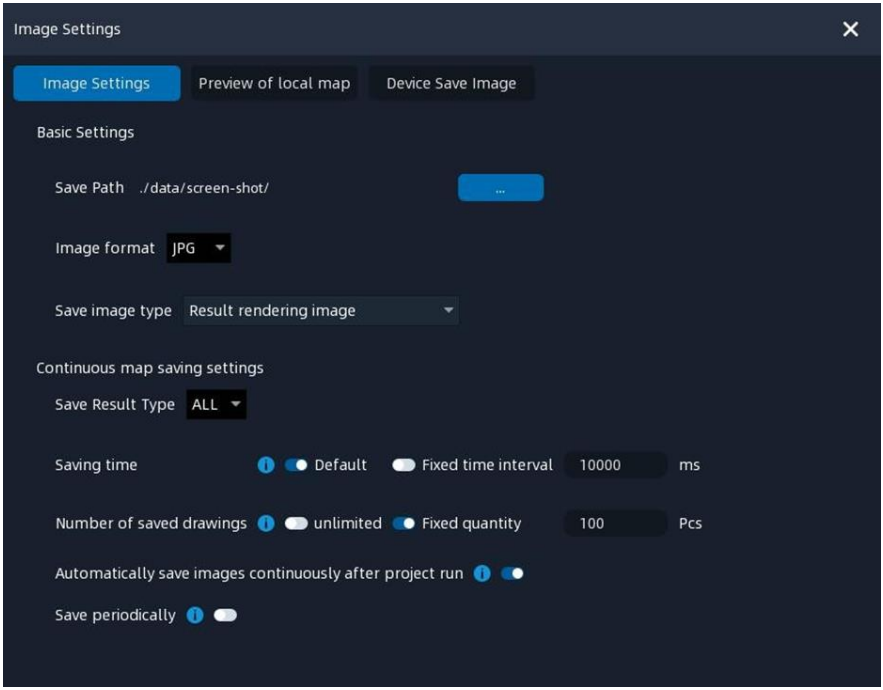


# Image Saving Settings

- Click "Image Saving Settings" in the menu bar.




- The "Image Saving Settings" configuration window will appear.



## Image Saving Configuration Table

| Category | Configuration Item | Details |
|---|---|---|
| **Basic Settings** | **Storage Path** | Specifies the save location on the PC. Default: ./data/screen-shot. |
| | **Image Format** | Sets the file format. Default: **JPG**. Options: **PNG**, **BMP**, **JPG**. |
| | **Image Type** | Selects content: **Raw Image**, **Rendered Result**, or **Both**. |
| **Continuous Save** | **Result Type** | Save based on outcome. Default: **ALL**. Options: **ALL**, **OK**, **NG**. |
| | **Save Timing** | Save per execution or at fixed time intervals. |
| | **Save Quantity** | Limits total images. Default: **Unlimited** or a fixed count. |
| | **Auto-Save on Run** | Automatically begins saving when the project starts running. |
| | **Cycle-Based Save** | Auto-clears history. Options: **1 Hour**, **1 Day**, **7 Days**, **30 Days**. |

# Storage Path & Naming

### Directory Structure

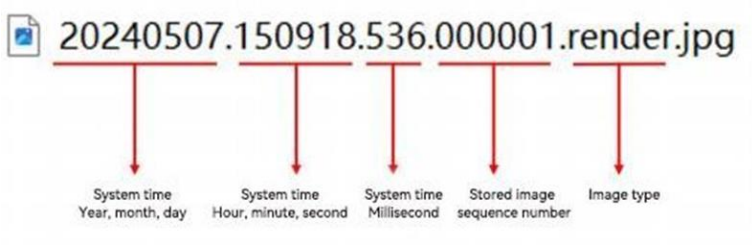
- The system automatically creates sub-directories based on the "Date" and "Inspection Result" to organize saved images.




**Note**: The root "Storage Path" can be modified in the Image Saving Settings.

### Default Naming Convention

By default, filenames include the Project Name, Timestamp, and Result.




- **Note 1**: The period (.) is used as a standard delimiter within the filename.
- **Note 2**: If "Custom Image Naming Rules" are enabled, you can tailor filenames to specific site requirements. For example, you can dynamically include data from tools, such as the text decoded by a Code Reading tool, directly in the filename.

# Tool Debugging

In Step 3: Tool Settings of the project configuration, you can add one or more tools of various types to your project.

## Presence Detection Tools

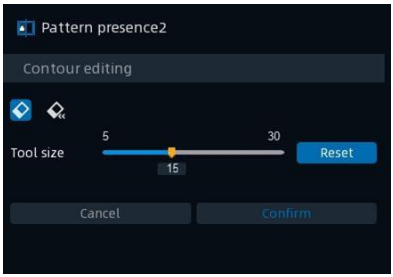
### Pattern Presence Detection

Click "Add Tool," navigate to the "Pattern" section, and select "Pattern" to enter the template editing interface and configure your pattern template.

**Functions & Parameters**

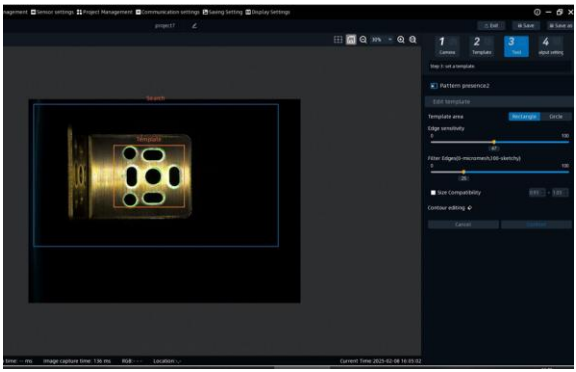
| Function / Parameter | Purpose / Details |
|---|---|
| **Preview Window** | The left preview window displays the template image.<br>• **Blue Box**: Search box (search range); supports translation and scaling.<br>• **Orange Box**: Pattern template box; supports translation, scaling, and rotation.<br>• **Green Outlines**: Recognized pattern template features. |
| **Template Area** | Select a **Rectangular** (default) or **Circular** template box. Selecting circular changes the image template frame accordingly. |
| **Contour Editing** | Accesses the contour editing interface. Click the button to enter. |

## Contour Editing




| Function | Purpose / Details |
|---|---|
| **Erase** | Click to activate. An orange circle cursor appears over the image; press and hold the left mouse button to remove specific green contour features. |
| **Erase Rollback** | Click to activate. A green circle cursor appears; use this to undo erasures and restore the original green contour features. |
| **Tool Size** | Adjusts the diameter of the erase/rollback cursor. Choose a size based on the detail level of your template. **Default: 15**. |
| **Reset** | Discards all manual edits and restores the template contours to their original detected state. |

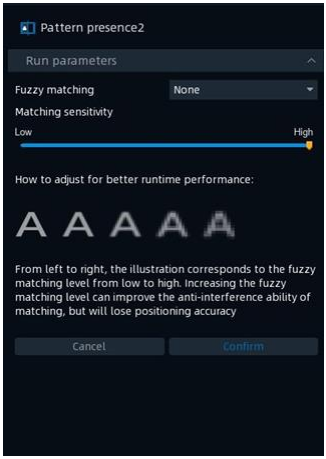
- Once editing is complete, click OK to return to the Tool Configuration interface.



## Tool Configuration Interface

| Function / Parameter | Purpose / Details |
|---|---|
| **Preview Window** | Adjust the **Blue Box** (Search ROI) by scaling or moving it. The **Green Dashed Box** indicates the actual pattern matching result. |
| **Algorithm Mode** | • **High Speed**: Optimized for short cycle times; ideal for high-speed lines.<br>• **Standard**: Balanced speed and precision; suitable for most applications.<br>• **High Precision**: Maximizes accuracy and stability for complex features. |
| **Template Edit** | Refer to the **Template Editing** section above. |
| **Tracking Angle** | Sets the allowable rotation range ($-180^\circ$ to $180^\circ$). Default: **-45 to 45**. |
| **Custom Parameters** | Default is **OFF**. Enable this to access advanced tool configurations. |
| **Similarity** | Sets the matching threshold (0–100). Default: **50**. If the detected similarity exceeds this value, the result is **OK**. |
| **Result Logic** | • **OK**: Result is Pass if the pattern is detected.<br>• **NG**: Result is Pass if the pattern is **not** detected. |
| **Timeout** | Sets the maximum execution time. If exceeded, the tool returns **NG**. Default: **2000ms**. |

- Custom Parameters Interface: For detailed settings, refer to the software UI documentation as shown in the interface layout.

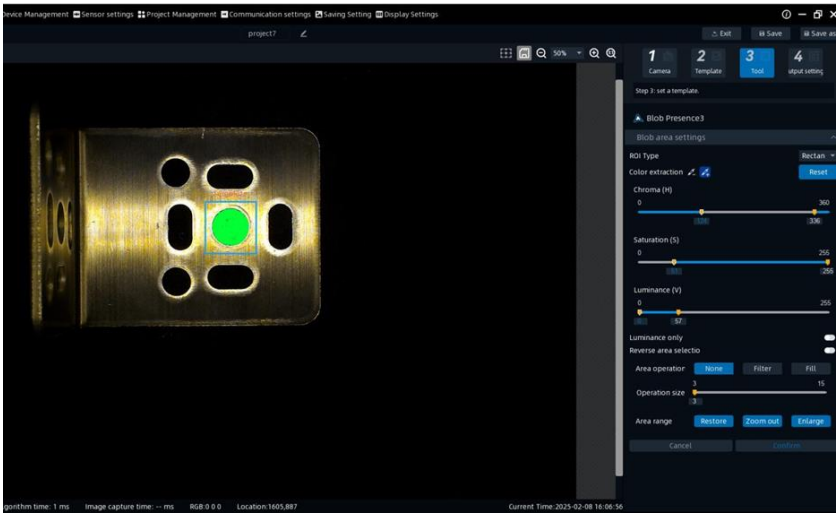



**Test Run**: Click **"Test Run"** to enter online testing mode.

- **Locked Features**: Search ROI, Template Editing, and Algorithm Mode cannot be changed.
- **Visual Feedback**: Successful detections (**OK**) appear in **Green**; failures (**NG**) appear in **Red**.
- **Live Adjustments**: Other parameters (like Similarity) remain editable for real-time fine-tuning.

## Blob Presence Detection

- Click **"Add Tool"** and select **"Blob"** to enter the region configuration interface.



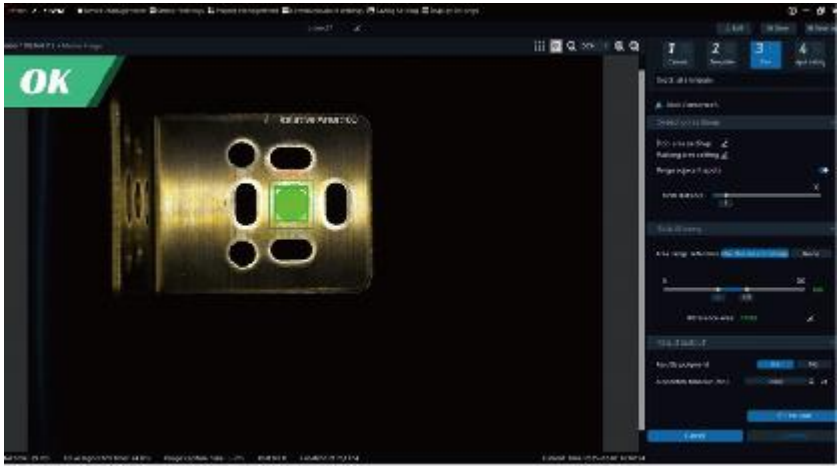
## Configuration Items

| Function / arameter | Purpose / Details |
|---|---|
| **ROI Region** | The blue detection area in the preview window; supports translation, scaling, and rotation. |
| **Color Extraction** | Click the **Green "+" Picker** then click pixels in the ROI to sample colors. Use the **Red "-" Picker** to exclude specific pixels. The **Green Shading** indicates the detected blob. **Reset** clears all samples and restores HSV thresholds. |
| **Color Threshold** | Separates **Hue (H)**, **Saturation (S)**, and **Value (V)** dimensions. Supports threshold fine-tuning for precise sampling range determination. |
| **Grayscale xtraction** | Functions identically to Color Extraction, but for grayscale values. |
| **Grayscale Threshold** | Adjusts the threshold specifically for the grayscale dimension. |
| **Use Brightness Only** | Default: **OFF**. When enabled, Hue and Saturation thresholds are disabled, leaving only the **Value (V)** threshold adjustable. |
| **Invert Region** | Default: **OFF**. When enabled, non-blob areas become blob areas and vice versa. |
| **Region Operation** | **None**, **Filter**, or **Fill**.<br>• **Filter**: Removes blobs smaller than "Size * Size".<br>• **Fill**: Fills holes smaller than "Size * Size". |
| **Operation Size** | Sets the filter/fill diameter (Range: 3–15). Default: **3**. |

| Function / arameter | Purpose / Details |
|---|---|
| **Area Range** | Use **Shrink/Expand** buttons to decrease or increase the blob area by 1 pixel per click. Click **Restore** to undo these changes. |
| **Result Logic** | • **OK**: Pass if a matching blob is detected.<br>• **NG**: Pass if **no** matching blob is detected. |
| **Timeout** | Max execution time. Returns **NG** if exceeded. Default: **2000ms**. |

**Note:** Color Extraction, HSV Threshold, and "Use Brightness Only" are available on Color Models only. Grayscale Extraction and Thresholds are available on Monochrome Models only.

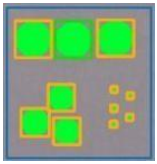
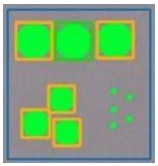
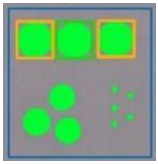
- Once the blob region is configured, proceed to the Tool Settings interface.



## Functions & Parameters

| Function / Parameter | Purpose / Details |
|---|---|
| **ROI Region** | Choose between **Rectangular** or **Circular**; supports translation, scaling, and rotation. |
| **Blob Settings** | Refer to the **Blob Region Configuration** section above. |
| **Merge Adjacent** | Default: **OFF**. When enabled, multiple blobs within the specified "Blob Distance" will be merged into one. |
| **Blob Distance** | Adjustable range: **1–15**. |
| **Area Range (Single)** | Filters blob results based on size. The **Green Box** indicates the largest blob (the reference blob for the tool); **Orange Boxes** indicate other detected blobs. |
| **Result Logic** | • **OK**: Pass if a matching blob is detected.<br>• **NG**: Pass if **no** matching blob is detected. |
| **Timeout** | If execution time exceeds this value, the result returns **NG**. Default: **2000ms**. |

## Example: Adjusting the Single Blob Area Range

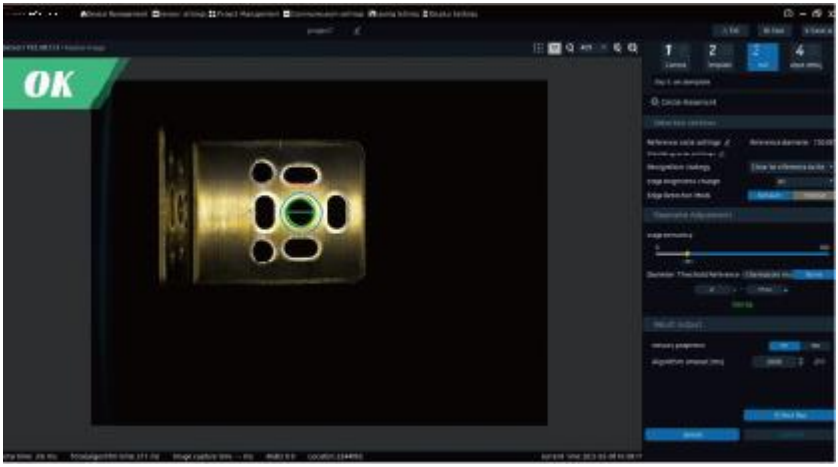
| Area Range | 9-15000 | 5000-15000 | 10000-1500 |
|---|---|---|---|
| **Blob Area in ROI** |  |  |  |

Test Run: Click "Test Run" to enter online testing mode.

- Locked: Blob settings, ROI type, and ROI position are non-editable.
- Feedback: Green indicates OK; Red indicates NG.

# Circle Presence Detection

- Click **"Add Tool"** and select **"Circle"** to enter the configuration interface.

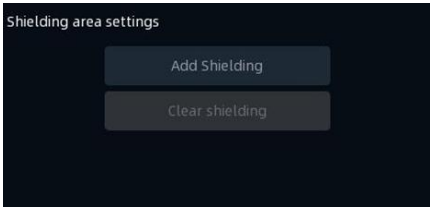


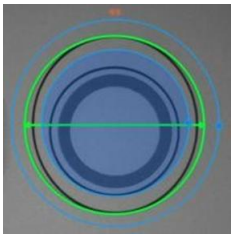
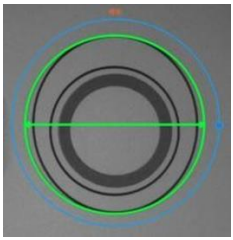

## Functions & Parameters

| Function / Parameter | Purpose / Details |
|---|---|
| **ROI Region** | Circular blue ROI in the preview window; supports translation and scaling. |
| **Masking Settings** | Click to configure masked areas; see **"Masking Area Settings"** below. |
| **Ref. Circle Settings** | Click to configure the reference; see **"Reference Circle Settings"** below. |
| **Recognition Strategy** | Four priority options: **Closest to Reference**, **Strongest Edge**, **Max Diameter**, or **Min Diameter**. |
| **Edge Polarity** | Transition types: **All**, **White to Black**, or **Black to White**. |
| **Edge Settings** | Adjusts detection precision. Use **Fine Mode** if the gap between circles is very small. |
| **Edge Sensitivity** | Range: **0–100**; Default: **80**. |
| **Diameter Logic** | Set the **Maximum** and **Minimum** diameter constraints for judgment. |

| Function / Parameter | Purpose / Details |
|---|---|
| **Result Logic** | **OK**: Pass if diameter meets criteria. **NG**: Pass if diameter does not meet criteria. |
| **Timeout** | Returns **NG** if execution exceeds this limit. Default: **2000ms**. |

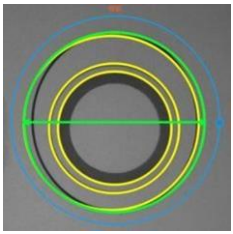
## Masking Area Settings




| Function / Parameter | Purpose / Details |
|---|---|
| **Add Mask** | Click to add a solid blue circle (concentric with the ROI) within the preview window. This area supports scaling; detection results inside this circle will be masked/filtered.  |
| **Clear Mask** | Click to remove the masking area; the solid blue circle will disappear.  |

## Reference Circle Settings




| Function / Parameter | Purpose / Details |
|---|---|
| **ROI Region** | All circles identified within the ROI are rendered. The Green circle is the reference circle, while other candidates are shown in Yellow.  |
| **Detection Sensitivity** | Options: High, Medium, Low. Higher sensitivity detects circles with lower contrast. |
| **Switch Ref. Circle** | Use the Larger/Smaller buttons to select the appropriate reference circle; the selected circle turns Green. |

**Test Run**: Click **"Test Run"** to enter online testing mode.

- **Locked**: The Search ROI and detection settings (including Masking and Reference Circle settings) are non-editable.
- **Feedback**: The Search ROI and detected circle turn **Green** for **OK** and **Red** for **NG**.

# Edge Presence Detection

- Click "Add Tool" and select "Edge Detection" from the Presence Detection toolbar to enter the tool configuration interface.

### Functions & Parameters

| Function / Parameter | Purpose / Details |
|---|---|
| **Edge Polarity** | Select transition type based on contrast: **All**, **White to Black**, or **Black to White**. |
| **Recognition Strategy** | Select edge priority: **Strongest Edge**, **Closest to Center**, or **Closest to Start**. |
| **Edge Sensitivity** | Range: **0–100**; Default: **80**. |
| **Result Logic** | •**OK**: Pass if a valid edge is detected.<br>•**NG**: Pass if no valid edge is detected. |
| **Timeout** | Returns **NG** if execution exceeds this limit. Default: **2000ms**. |

- **Test Run**: Click **"Test Run"** to enter online testing mode.
    - **Locked**: The ROI region is non-editable in this mode.
    - **Feedback**: The tool status displays in **Green** for **OK** and **Red** for **NG**.
- **Recognition Strategy**: You may choose between **Strongest Edge**, **Closest to Center**, or **Closest to Start**. The tool returns **OK** when a matching edge is identified.

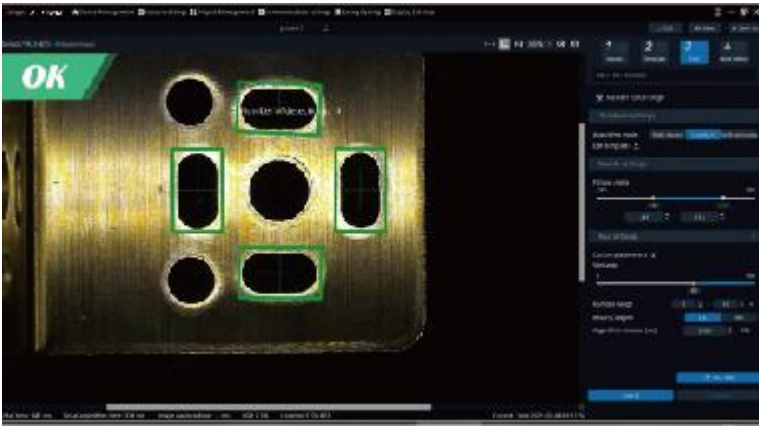
# Counting Tools

The configuration process for counting tools is similar to Presence Detection. Its primary function is to identify all targets within the matching area and judge the outcome based on the detected quantity. Users must define a Quantity Range as the condition for OK/NG results.




## Pattern Counting

- Click Add Tool and select Pattern Counting. For template editing methods, please refer to the Pattern Presence Detection section.




### Tool Parameter Configuration

| Function / Parameter | Description & Details |
|---|---|
| **Preview Window** | Adjust the **Blue Box** (Search ROI) via scaling and translation; the **Green Dashed Boxes** represent feature matching results. |
| **Algorithm** | **High Speed**: Shortest cycle time for high-speed lines. |

| Function / Parameter | Description & Details |
|---|---|
| **Mode** | **Standard**: Balanced speed and precision for most scenarios.<br>**High Precision**: Maximizes stability and accuracy for complex identification. |
| **Template Edit** | Refer to the **Pattern Presence Detection** section. |
| **Tracking Angle** | Sets the allowable rotation range ($-180^\circ$ to $180^\circ$). Default: **-45 to 45**. |
| **Custom Parameters** | Refer to the **Pattern Presence Detection** section. |
| **Similarity** | Comparison threshold between targets and the template. Default: **50**.<br>Only targets exceeding this value are identified. |
| **Quantity Range** | Sets the required number of results for a Pass condition. |
| **Result Logic** | Determines the final result (OK/NG) based on the defined conditions. |
| **Timeout** | Directly returns **NG** if execution exceeds this value. Default: **2000ms**. |

Online Testing: After configuration, click "Test Run" to enter online testing mode.

- Locked Items: Template editing interface, Algorithm Mode, and ROI cannot be modified.
- Visual Presentation:
    - Detected features are rendered with Green Boxes.
    - The Detected Quantity is displayed in the upper-left corner of the interface.
    - Tool status displays in Green for OK and Red for NG.

# Edge Counting

- Click "Add Tool" and select "Edge Counting" from the counting tools category to enter the configuration interface.

### Edge Counting Parameter Configuration

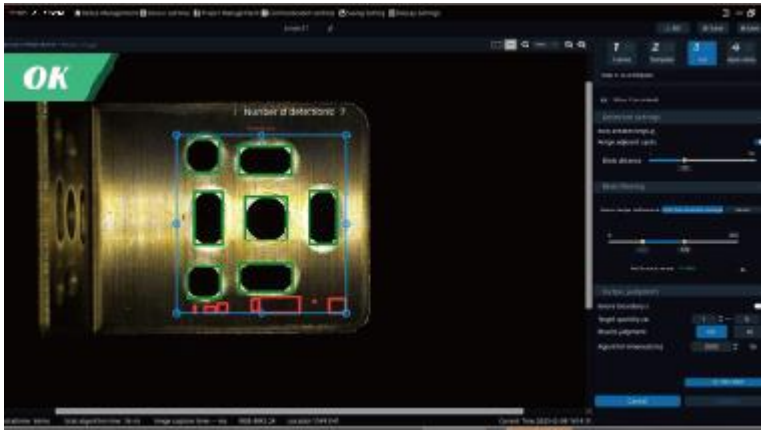
| Function / Parameter | Description & Details |
|---|---|
| **Edge Polarity** | Select based on contrast transitions. Options: **All**, **White to Black**, **Black to White**. |
| **Edge Sensitivity** | Range: **0–100**; Default: **80**. |
| **Target Quantity Range** | Set the specific range of results required for a valid detection. |
| **Result Logic** | • **OK**: Pass if the detected count is **within** the target range.<br>• **NG**: Pass if the detected count is **outside** the target range. |
| **Algorithm Timeout** | Returns **NG** if execution exceeds this value. Default: **2000ms**. |

**Online Testing:** After setting parameters, click **"Test Run"** to enter online testing mode.

- **Locked**: The ROI region is non-editable in this mode.
- **Feedback**: The tool status displays in **Green** for **OK** and **Red** for **NG**.
- **Display**: The current count of detected edges is shown in the upper-left corner of the interface.

# Blob Counting

1. Click "Add Tool" and select "Blob Counting" to enter the blob region configuration interface (refer to the Blob Presence Detection section for setup methods).
2. Once the blob region is configured, proceed to the Blob Counting tool configuration interface.



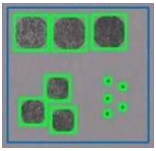
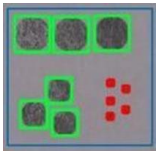
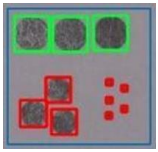

### Blob Counting Parameter Configuration

| Function / Parameter | Description & Details |
|---|---|
| **Type** | The ROI detection area type (Rectangular or Circular); supports translation, scaling, and rotation. |
| **Blob Settings** | Refer to the **Blob Presence Detection** section. |
| **Merge Adjacent** | Default: **OFF**. When enabled, blobs within the "Blob Distance" will be merged. |
| **Blob Distance** | Range: **1–15**. |
| **Area Threshold** | Filters blob results. The **Green Box** represents the largest blob (reference); **Orange Boxes** represent other detected blobs. |

| Function / Parameter | Description & Details |
|---|---|
| **Target Quantity Range** | Defines the count required for an OK result. |
| **Result Logic** | • **OK**: Pass if count is **within** range.<br>• **NG**: Pass if count is **outside** range. |
| **Timeout** | Returns **NG** if execution exceeds this value. Default: **2000ms**. |

### Area Threshold Example

Area Threshold refers to the area ratio between a specific blob and the largest (reference) blob. You can filter for specific blobs by defining an area range:

| **Area Range** | **0-110** | **20-110** | **65-110** |
|---|---|---|---|
| **Blobs in ROI** | Retain All  | Filter Tiny Blobs  | Retain Large Blobs Only  |

**Online Testing:** After clicking **"Test Run"**, the Blob Region Settings, ROI Type, and ROI Region become non-editable.

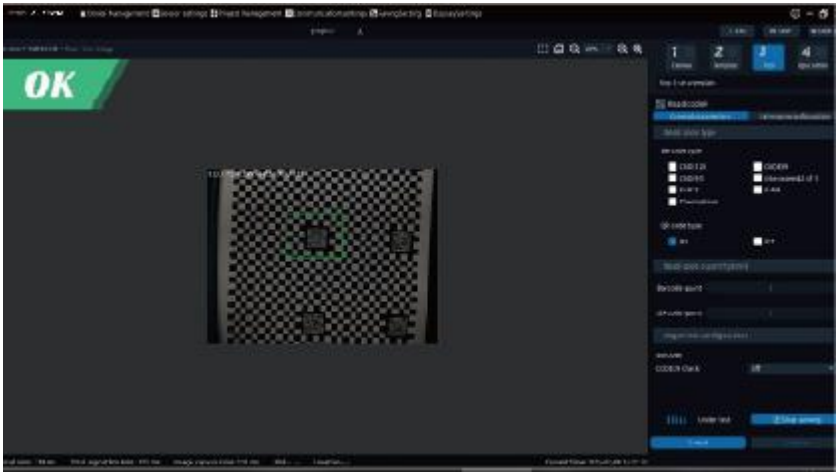
- **Visuals**: Detected blobs are highlighted with **Green Boxes**.
- **Display**: The current count is shown in the upper-left corner of the interface.
- **Status**: **Green** indicates **OK**; **Red** indicates **NG**.

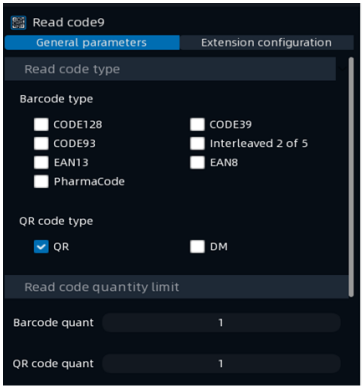
# Identification Tools

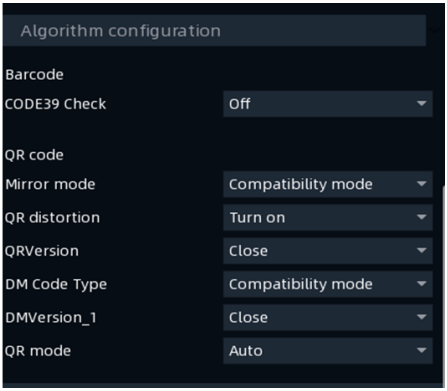
## Code Reading

**Note:** A single project can contain a maximum of **one** Code Reading tool.

- Operating Steps: Click "Add Tool," navigate to the Identification tab, and select "Code Reading" to enter the configuration interface.



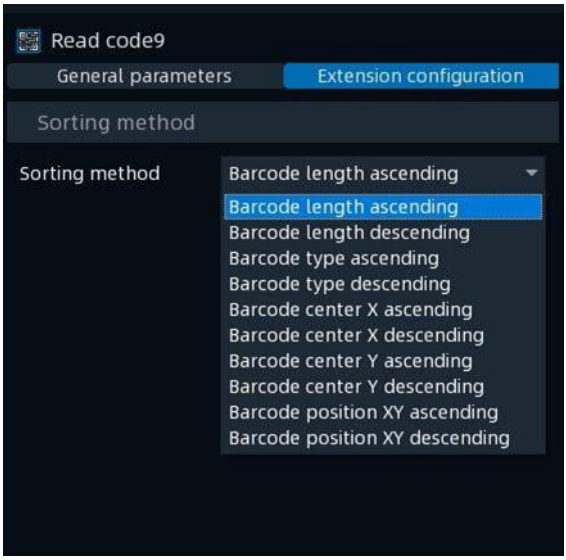



## Code Reading Parameter Configuration Table

| Category | Parameter | | Description & Details |
|---|---|---|---|
| **ROI Region** | | | The blue rectangular area in the preview window; supports translation, scaling, and rotation. It can read single or multiple 1D/2D codes within the area. |
| **General** | **Code Type** | | Supports 7 types of 1D codes and 2 types of 2D codes. Selecting more types increases processing time; choose only necessary types for optimal performance. |
| | **Reading Limits** | | Set the maximum number of 1D and 2D codes to be read and output. |
| | **1D Code Algorithm** | **Polarity** | Select based on bar and background color. Options: **Black on White**, **White on Black**, or **Compatibility Mode**. |
| | | **CODE39 Check** | When enabled, the output result is validated; failure to pass the check results in **NG**. |
| | **2D Code Algorithm** | **Polarity** | Options: **Black on White**, **White on Black**, or **Compatibility Mode**. |
| | | **Mirror Mode** | Used to identify mirrored codes. Options: **Mirror**, **Non-Mirror**, or **Compatibility Mode**. |
| | | **QR Distortion** | Select based on actual conditions. Options: **Distortion**, **Non-Distortion**, or **Compatibility Mode**. |
| | | **DM Code Type** | Data Matrix supports square and rectangular shapes. Priority options: **Square**, **Rectangular**, or **Compatibility Mode**. |
| | | **QR Mode** | Options: **Auto**, **Model 1**, or **Model 2**. Default is **Auto**. |
| **Judgment Criteria** | | | Sets the range for the number of codes. If the count is within range, the result is **OK**; otherwise, **NG**. |
| **Algorithm Timeout** | | | If execution exceeds this value, the result returns **NG**. Default: **2000ms**. |
| **Extended Config** | **Sorting Method** | | Sets the sorting rules for code output results. Supports multiple rule combinations (see the Sorting Rules Table below). |

## Sorting Rules Table

| Sorting Condition | Order | Description of Output Sequence |
|---|---|---|
| **Code Length** | **Ascending** | Sorted by character length from shortest to longest. |
| | **Descending** | Sorted by character length from longest to shortest. |
| **Code Type** | **Ascending** | Priority: **1D Codes** (Code39 > 93 > 128 > ITF25 > EAN) > **2D Codes** (QR/DM). |
| | **Descending** | Priority: **2D Codes** (DM/QR) > **1D Codes** (EAN > ITF2/5 > Code128 > 93 > 39). |
| **Code Center X** | **Asc/Desc** | Sorted by the X-coordinate of the code's center (Small to Large / Large to Small). |
| **Code Center Y** | **Asc/Desc** | Sorted by the Y-coordinate of the code's center (Small to Large / Large to Small). |
| **Code Position XY** | **Asc/Desc** | Sorted primarily by X-axis (Small to Large), then by Y-axis (Small to Large). Reversed for Descending. |




- After setting parameters, click **"Test Run"** to enter testing mode.
- **Locked**: The ROI region is non-editable in this mode.
- **Visual Feedback**: **Green** indicates **OK**; **Red** indicates **NG**.
- **Output**: Decoded results are displayed in the upper-left corner, listed from top to bottom according to the configured sorting rules.

# Geometry Tools

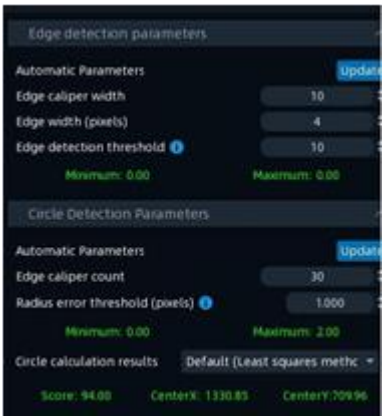
# Circle Search

- Click "Add Tool" and select "Circle Search" from the Geometry Tools category to enter the editing interface.

### Functions & Parameters

| Function / Parameter | Purpose / Details |
|---|---|
| **Use Ring** | Default: **ON**. Allows independent scaling of the inner and outer circular ROI frames. The annular area between them defines the **Search ROI**. |
| **Edge Polarity** | Select transition type based on contrast: **Bipolar**, **White to Black**, or **Black to White**. |
| **Recognition Strategy** | Select edge priority: **Closest to Default**, **Strongest Edge**, **Closest to Start**, or **Closest to End**. |
| **Advanced Parameters** | Enter advanced configuration; see the detailed description below. |
| **Circle Score** | Default: **80**. Circles with a matching score lower than this value will be filtered out. |
| **Diameter Logic** | Select **"Image"** mode to set maximum and minimum diameter limits. Results within this range are **OK**. |
| **Roundness Threshold** | Range: **0–100**. When enabled, circles above this threshold are **OK**; those below are **NG**. |
| **Timeout** | Returns **NG** if execution exceeds this value. Default: **2000ms**. |

Advanced Parameter Settings

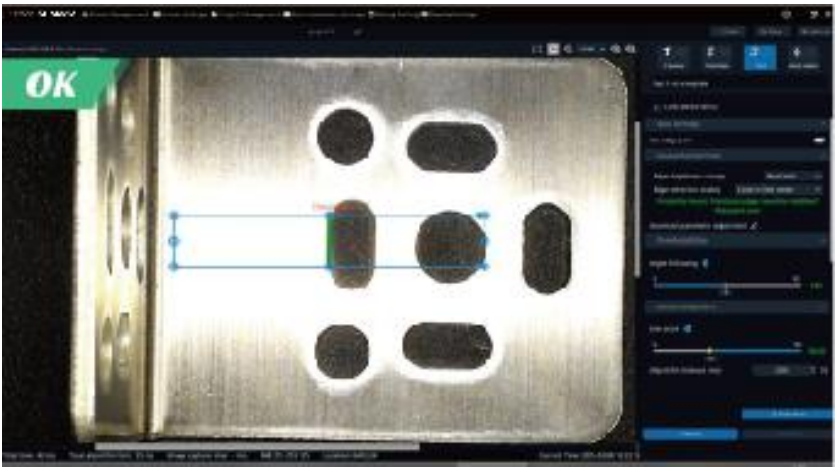



| Function / Parameter | Purpose / Details |
|---|---|
| **Edge Width** | **Higher values**: Easier to detect blurred edges.<br>**Lower values**: Higher precision for edge point positioning. |
| **Edge Threshold** | **Higher values**: Better noise resistance for edge detection.<br>**Lower values**: Easier to detect low-contrast edges. |
| **Radius Error Threshold** | **Higher values**: Reduces fluctuations in detection results.<br>**Lower values**: Increases the positioning accuracy of the detected circle. |
| **Calculation Results** | Displays the detected circle's **Score**, **Center X**, and **Center Y** coordinates. |

- Test Run: Click "Test Run" to enter online testing mode.
- Interface Behavior: The blue Search ROI becomes non-editable, and only the outer circle is displayed. Parameters can still be adjusted during execution.
- Visual Feedback: When the result is OK, the outer ROI circle and the detected circle turn Green. If the result is NG, they turn Red.

# Line Search

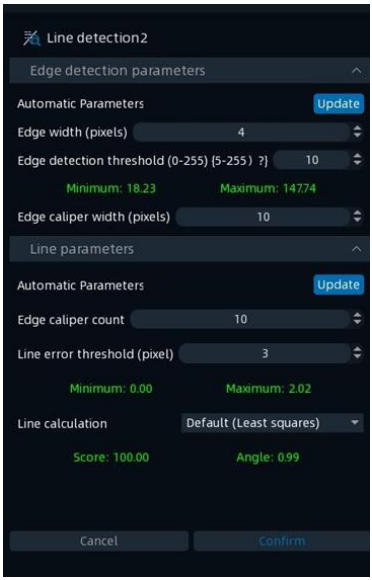
- Click "Add Tool" and select "Line Search" from the Geometry Tools category to enter the configuration interface.




### Functions & Parameters

| Function / Parameter | Purpose / Details |
|---|---|
| **ROI Region** | The blue search area in the preview window. Adjust via translation, scaling, and rotation to define the search range. The **Blue Arrow** indicates the search direction. |
| **Use Edge Pair** | Default: **OFF**. Enable this for dual-edge detection; once active, you can configure edge pair strategies and distance ranges. |
| **Edge Polarity** | Select based on contrast transitions. Options: **Bipolar**, **White to Black**, or **Black to White**. |
| **Recognition Strategy** | Select edge priority: **Closest to Default**, **Strongest Edge**, **Closest to Start**, or **Closest to End**. Descriptions appear below the selection. |
| **Advanced Config** | Access advanced parameter adjustments; see the section below for details. |
| **Angle Tracking** | Range: **0–30°**; Default: **10°**. The detected line must be within 10 degrees of the search ROI's perpendicular direction. |
| **Line Score** | Range: **0–100**; Default: **40**. Lines with a score lower than this threshold will be filtered out. |
| **Timeout** | Returns **NG** if execution exceeds this limit. Default: **2000ms**. |

## Advanced Parameter Settings



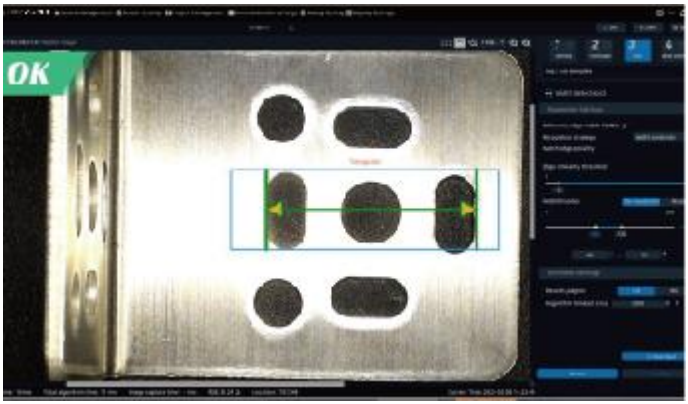

| Function / Parameter | Sub-item | Purpose / Details |
|---|---|---|
| **Detection ROI** | | - |
| **Edge Parameters** | **Auto Parameters** | Enabled by default; the system automatically calculates optimal values. |
| | **Edge Width** | **Higher**: Easier to detect blurred edges.<br>**Lower**: Increases position accuracy of edge points. |
| | **Edge Threshold** | **Higher**: Better noise resistance.<br>**Lower**: Easier to detect low-contrast edges. |
| | **Caliper Width** | **Higher**: Stronger noise suppression.<br>**Lower**: Higher position precision. |
| **Line Parameters** | **Auto Parameters** | Enabled by default; automatically calculates values. |
| | **Caliper Count** | Number of edge points used for line calculation.<br>**Higher**: More stable; **Lower**: Faster execution. |
| | **Error Threshold** | **Higher**: Reduces result fluctuations.<br>**Lower**: Increases the location accuracy of the line. |
| | **Fitting Method** | **Default (Least Squares)**: Best for noise-only scenarios.<br>**Anti-Interference (RANSAC)**: Best for scenarios with competing edge lines. |

- Test Run: Once parameters are set, click "Test Run" to enter online testing mode.
- Interface Behavior: The blue Search ROI becomes non-editable. However, parameters can still be adjusted during the test execution.
- Visual Feedback:
    - OK: The Search ROI and the detected line turn Green.
    - NG: The Search ROI and the line (if detected but failing criteria) turn Red.

# Measurement Tools

## Width Measurement

- Click "Add Tool" and select "Width Detection" from the Measurement Tools category to enter the configuration interface.




### Functions & Parameters

| Function / Parameter | Purpose / Details |
|---|---|
| **ROI Region** | The blue area in the preview window; the **Blue Arrow** indicates the detection direction. Supports translation, scaling, and rotation. |
| **Recognition Strategy** | Select edge pair priority: **Similar Width**, **Closest to Center**, or **Closest to Sides**. |
| **Edge Settings** | Access detailed edge configurations; see the section below. |
| **Edge Sensitivity** | Range: **0–100**; Default: **80**. |
| **Width Settings** | The width threshold represents the ratio of the **"Current Detected Width"** to the **"Master Image Width."** Range: **0–200**. Set Max/Min values as judgment conditions. |
| **Result Logic** | **OK**: Pass if the detected width falls within the threshold range.<br>**NG**: Pass if the detected width falls outside the threshold range. |
| **Timeout (ms)** | Returns **NG** if execution exceeds this limit. Default: **2000ms**. |

## Edge Settings

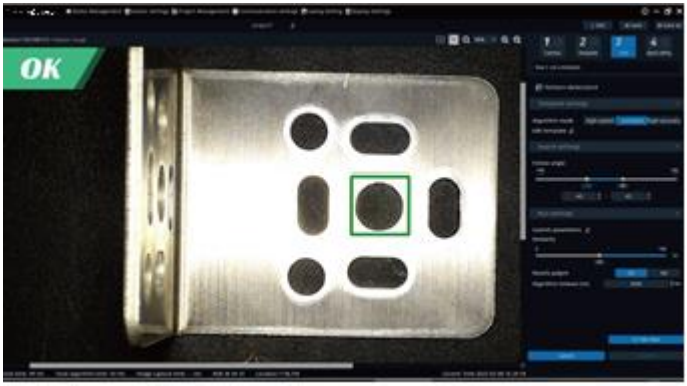



| Function / Parameter | Purpose / Details |
|---|---|
| **Edge Sensitivity** | Options: Low, Medium, High. Higher sensitivity enables the detection of edges with lower contrast. |
| **Edge Selection** | Zoom into the preview window and hover over the green edges detected by the interface. The screen will display "Edge 1" and "Edge 2," which can then be selected in the right-hand panel.  |

- Test Run: Click "Test Run" to enter online testing mode once parameters are configured.
- Mode Restrictions:
  - The ROI Region becomes non-editable.
  - Recognition Strategy and Edge Settings are locked and cannot be modified.
- Visual Feedback:
  - OK Status: The tool and indicators are displayed in Green.
  - NG Status: The tool and indicators are displayed in Red.

# Pattern Inspection

- Click "Add Tool" and select "Pattern Inspection" from the Measurement Tools category to enter the template editing interface.
- The template setup process is identical to the Pattern Presence Detection tool. Once the template is defined, you will proceed to the tool configuration interface.




### Functions & Parameters

| Function / Parameter | Purpose / Details |
|---|---|
| **ROI Region** | In the preview window, the **Blue Search Box** supports rotation and translation. The **Green Dashed Box** represents the pattern matching result. |
| **Algorithm Mode** | **High Speed**: Optimized for short cycle times in high-speed scenarios. **Standard**: Balanced speed and precision, suitable for most detection applications. |
| **Template Edit** | Refer to the **Pattern Presence Detection** section for detailed instructions. |
| **Tracking Angle** | Sets the allowable rotation range ($-180^\circ$ to $180^\circ$). Default: **-45 to 45**. |

| Function / Parameter | Purpose / Details |
|---|---|
| **Custom Parameters** | Access advanced configuration settings; see the "Custom Parameters" interface description. |
| **Similarity** | Comparison threshold between the searched pattern and the template. Default: **50**. Results above this value are judged **OK**. |
| **Timeout** | Returns **NG** if execution exceeds this limit. Default: **2000ms**. |

- Click "Test Run" to enter online testing mode after tool configuration is complete.
- In this mode, the Search ROI, Template Editor, and Algorithm Mode cannot be edited.
- OK results are displayed in Green, while NG results are displayed in Red. Other parameters remain editable.

## Grayscale Area / Color Area Inspection

Click "Add Tool":

- Color Camera: Select "Color Area" in Measurement Tools.
- Mono Camera: Select "Grayscale Area" in Measurement Tools.



### Functions & Parameters

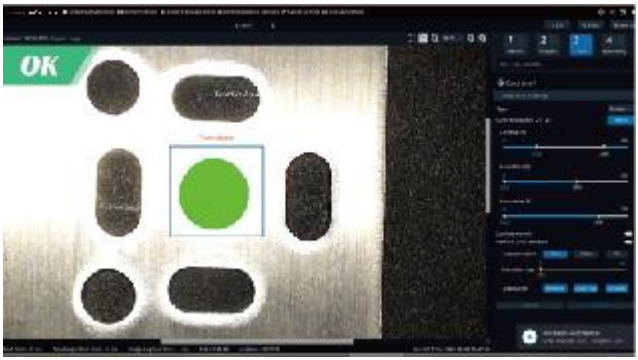
| Function / Parameter | Purpose / Details |
|---|---|
| **ROI Region** | In the preview window, the **Blue Search Box** supports rotation and translation. The **Green Dashed Box** represents the pattern matching result. |
| **Algorithm Mode** | **High Speed**: Shortest cycle time for high-speed scenarios.<br>**Standard**: Balanced speed and precision for most scenarios.<br>**High Precision**: For high-accuracy requirements; improves matching and stability. |
| **Template Edit** | Refer to the **Pattern Presence Detection** section for detailed instructions. |
| **Tracking Angle** | Sets the allowable rotation range ($-180^\circ$ to $180^\circ$).<br>Default: **-45 to 45**. |
| **Custom Parameters** | Default: **OFF**. When enabled, enter the custom parameter configuration interface. |
| **Similarity** | Comparison threshold between the searched pattern and the template.<br>Default: **50**. Results above this value are judged **OK**. |
| **Timeout** | Returns **NG** if execution exceeds this limit. Default: **2000ms**. |

- Click "Test Run" to enter online testing mode after parameters are set.
- In this mode, Blob Settings and Area Reference Mode are non-editable; the ROI Region cannot be moved or scaled.
- The current Relative Area or Absolute Area is displayed in the upper-left corner.
- OK status is displayed in Green, while NG is displayed in Red.

**Note**: Color cameras only support the "Color Area" tool; mono cameras only support the "Grayscale Area" tool.

# Blob Inspection

Click "Add Tool" and select "Blob Inspection" from the Measurement Tools category to enter the blob area configuration interface.




- Refer to the **"Blob Presence Detection"** for setup. Once configured, you will enter the **Blob Inspection** tool editing interface.

### Functions & Parameters

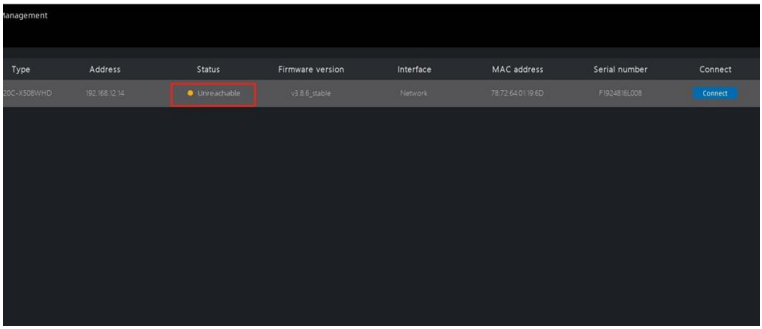
| Function / Parameter | Purpose / Details |
|---|---|
| **ROI Region** | Choose between **Rectangular** or **Circular**; supports translation, scaling, and rotation. |
| **Blob Settings** | Refer to the **Blob Presence Detection** section for detailed instructions. |
| **Merge Adjacent** | Default: **OFF**. When enabled, two or more blobs within the defined **"Blob Distance"** will be merged. |
| **Blob Distance** | Range: **1–15**. |
| **Area Threshold** | Filters blobs based on size. Refer to the **"Pattern Counting"** tool for details. |
| **Angle Threshold** | Filters targets based on orientation. Range: **-90° to 90°**; Default: **-10° to 10°**. |
| **Boundary Blobs** | Defines how to handle blobs touching the search box edge. Default: **"Do Not Ignore"** (includes boundary blobs in detection). |
| **Quantity Range** | Sets the required number of target blobs for a Pass condition. |
| **Timeout** | Returns **NG** if execution exceeds this limit. Default: **2000ms**. |

- Click "Test Run" after setting parameters to enter online testing mode.
- Mode Restrictions: In this mode, the Blob Settings interface and ROI Type are non-editable. The ROI cannot be moved or scaled.
- Visual Feedback: The tool status displays in Green for OK and Red for NG.

# Troubleshooting (FAQ)

## Device Connection Issues

- **Software Status "Unreachable"**: Usually indicates that the camera IP and the computer's network card are not on the same subnet.




  - **Solution**: Modify the device IP or the computer's IP settings. Alternatively, run netsh winsock reset with administrator privileges and restart the computer.

- **Unstable Connection**: May be caused by interference from Windows Firewall or antivirus software.

  - **Solution**: Add the ZX-4020 host software to the firewall whitelist.

# External Trigger Failure

## Key Checkpoints

- Ensure the project has been manually set to **"Start Running."**
- Verify that the **Trigger Source** (IO or Communication) in the project is configured correctly.
    1. **IO Trigger Wiring**: Confirm whether the wiring is **NPN** or **PNP** and check the **IN_COM** potential reference.

## Software Startup Abnormalities




- **Missing DLL Files**: Execution environments may be missing due to differences in Windows versions.
    - **Solution**: Install vc_redist.x64.exe found in the software installation path.