# HIKROBOT

# SC2000 Series Vision Sensor

## User  Manual

# Legal Information

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The Manual includes instructions for using and managing the Product. Pictures, charts, images and all other information hereinafter are for description and explanation only. The information contained in the Manual is subject to change, without notice, due to firmware updates or other reasons. Please find the latest version of this Manual at the Hikrobot website (*https://en.hikrobotics.com*).
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# Regulatory Information

## FCC Information

Please take attention that changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC compliance: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

## FCC Conditions

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

## EU Conformity Statement

 This product and - if applicable - the supplied accessories too are marked with "CE" and comply therefore with the applicable harmonized European standards listed under the EMC Directive 2014/30/EU, the RoHS Directive 2011/65/EU.

2012/19/EU (WEEE directive): Products marked with this symbol cannot be disposed of as unsorted municipal waste in the European Union. For proper recycling, return this product to your local supplier upon the purchase of equivalent new equipment, or dispose of it at designated collection points. For more information see: ***http://www.recyclethis.info***

2006/66/EC (battery directive): This product contains a battery that cannot be disposed of as unsorted municipal waste in the European Union. See the product documentation for specific battery information. The battery is marked with this symbol, which may include lettering to indicate cadmium (Cd), lead (Pb), or mercury (Hg). For proper recycling, return the battery to your supplier or to a designated collection point. For more information see: ***http://www.recyclethis.info***

# Symbol Conventions

The symbols that may be found in this document are defined as follows.

| Symbol | Description |
|---|---|
| ⚠Danger | Indicates a hazardous situation which, if not avoided, will or could result in death or serious injury. |
| ⚠Caution | Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance degradation, or unexpected results. |
| iNote | Provides additional information to emphasize or supplement important points of the main text. |

# Available Model

This manual is applicable to the SC2000 Series Vision Sensor.

# Safety Instruction

These instructions are intended to ensure that the user can use the device correctly to avoid danger or property loss.

### Laws and Regulations

The device should be used in compliance with local laws, electrical safety regulations, and fire prevention regulations.

## Power Supply

- When wiring or dismounting, make sure that the device power is cut off, and do not operate under electrification.
- Avoid contact with exposed circuit. When the device is powered on, avoid contact with exposed junctions and parts.
- Use the power adapter provided by the regular manufacturer.
- Do not connect multiple devices to one power adapter, to avoid over-heating or fire hazards caused by overload.
- Make sure the plug is properly connected to the power socket.

## Transportation

- The device contains precision optical components and electronic components. During transportation, storage and installation, incorrect operations like heavy pressure and violent vibration should be avoided. Otherwise, the device may be damaged.
- Avoid sudden collision, and pack the device with the accompanied carton and cushioning material or similar package.

## Using Environment

- In order to reduce the risk of fire or electric shock, do not let the device get wet or damp.
- Do not drop objects onto the device and avoid vigorous vibration.
- Keep the device away from magnetic interference.
- Do not use the device in extremely heat, extremely cold, dusty environment, corrosive environment or high humidity environment.
- Do not aim the device lens at objects of strong light, such as the sun and incandescent lamp. Otherwise, the lens may be damaged.
- The device should be stored in dry environment without corrosive gas. Avoid placing the device in direct sunlight and poorly ventilated locations, or near heat sources such as heater or heating (ignoring this warning may lead to fire hazards).
- Do not operate in explosive environment.
- Keep the surrounding area well ventilated to avoid heat accumulation. Do not contact the radiator directly to avoid scald.

## Electrostatic Protection

- Remove all conductive objects (such as jewelry, watch, etc.) on the device body before touching the device, and touch the grounding metal bracket by hand to release the static electricity.
- It is suggested to wear anti-static suit to prevent damage to the equipment caused by static electricity.
- When installing or maintaining the device, please wear anti-static wristband or anti-static gloves. Make sure that the wristband is tightly attached to the skin and is reliably grounded.
- It is forbidden to touch exposed circuit boards with bare hands. Static electricity generated by human body may damage electrostatic sensitive components on circuit boards.
- When touching electrostatic sensitive components or devices, proper grounding measures must be taken.
- Put electrostatic sensitive components into anti-static bags for protection.

● It is suggested to place humidifier in dry environment to maintain suitable humidity and reduce static electricity generation.

## Maintenance

● If the device is not working properly, contact the store or the nearest service center. Do not disassemble or modify the device in any way. (The company does not bear any liability for any problem arising from unauthorized modification or maintenance).
● Properly preserve all the original packaging materials of the device so that when problems arise, the device can be packed with packaging materials and sent to the agent or returned to the manufacturer for processing. The company does not bear any liability for accidental damage during transportation caused by non-original packaging.
● This product is a precision electronic device, no components can be maintained by user, please do not disassemble the device arbitrarily.

## Cleaning

Do not touch the image sensor directly. If the sensor needs to be cleaned, use a clean rag and wet it with alcohol, then gently wipe off the dirt; if the device is not in use, cover the image sensor with dust cover for protection.

## Installation

Please do not install the device on vibrating surface or places that are vulnerable to impact.

## Personnel Requirement

Quality requirements for installation and maintenance personnel: qualification certificate or working experience in weak current system installation and maintenance, and relevant working experience and qualifications. Besides, the personnel must possess the following knowledge and operation skills:
● The basic knowledge and operation skills of low voltage wiring and low voltage electronic circuit connection.
● The ability to comprehend the contents of this manual.

# Contact Information

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# Contents

# Chapter 1 Overview

## 1.1 Introduction

The vision sensor uses the sensor and optical components to acquire object images, and it adopts built-in location and measurement algorithms to detect object's dimension, location, etc. It has multiple vision tools, such as, feature matching, blob, calibration transformation, color extraction, etc., to realize different applications.
The vision sensor is able to acquire, process and output images, and detection results can be output via the UDP, TCP, FTP, Serial, Modbus, Profinet, and other communication methods. You can configure and operate solutions of the vision sensor via web based interface. It is applicable to consumer electronics, food and beverage, pharmaceutical, automobile, and other industries.

## 1.2 Key Feature

- Adopts embedded hardware platform for high-speed image processing.
- Adopts built-in position and measurement algorithm to detect object's position, etc.
- Multiple IO interfaces for input and output signals.
- Multiple indicators for displaying device status.
- Adopts light cup to ensure uniform brightness in the illuminated area.
- Supports multiple communication protocols, including TCP, UDP, Serial, IO, Modbus, PROFINET, Ethernet/IP, FTP, etc.
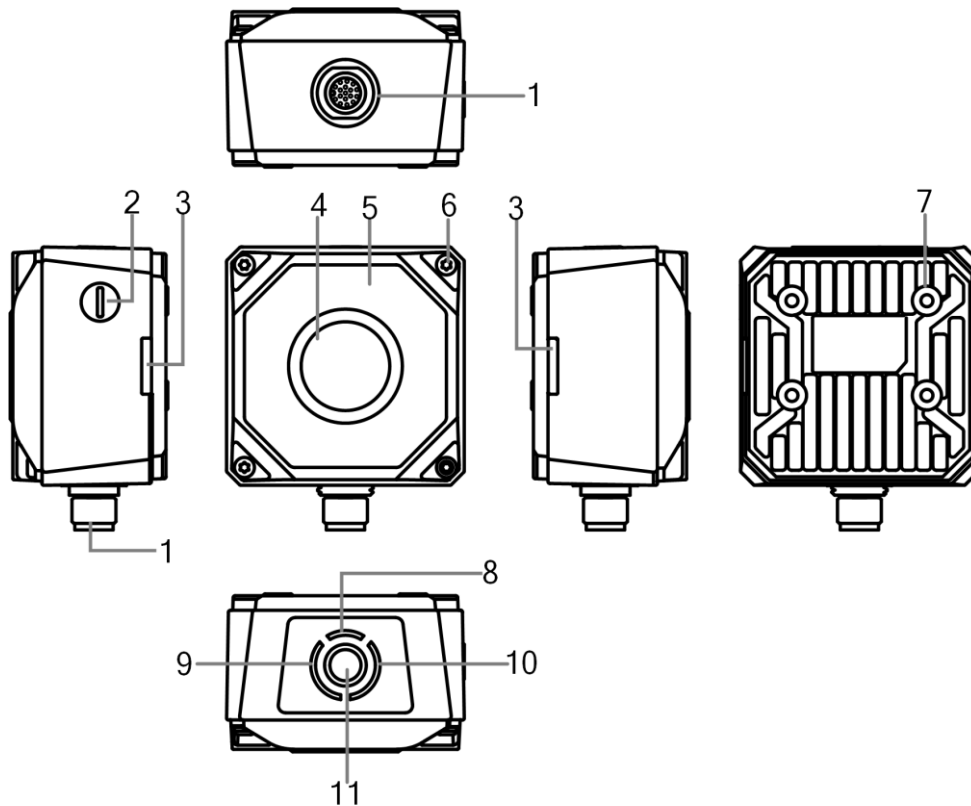
# Chapter 2 Appearance



**Figure 2-1 Appearance**

**Table 2-1 Description**

| No. | Name | Description |
|-----|------|-------------|
| 1 | 17-Pin Interface | It provides power, input/output, Ethernet, and serial port signal. The interface is designed with screw threads to tighten connection between the device and cable, and thus avoiding influence caused by vibration. |
| 2 | Focus Knob | It is used to adjust focal length manually. |
| 3 | OK/NG Indicator | It indicates the result of solution.<br>● The green indicator lights when the solution result is OK.<br>● The red indicator lights when the solution result is NG.<br>● When switching solutions, the indicators both light. After switching, the indicators both are unlit. |
| 4 | Lens Cap | It can be replaced with other lens cap. Polarization lens cap is optional. |

| No. | Name | Description |
|---|---|---|
| 5 | Light Source | The device has 8 LED lamps providing light, and the light source is white spotlight by default. You can select wide-angle or spotlight lamp, and white, red, blue or near-infrared is optional. |
| 6 | Screw | It refers to the screw between device body and lens cap. |
| 7 | Screw Hole | It is used to fix the device to installation position. You should use M4 screw. |
| 8 | PWR Indicator | It is the power indicator. The indicator is green when the device operates normally. Otherwise, it is red. |
| 9 | STS Indicator | It is the status indicator. The indicator is green when the solution operates normally. Otherwise, it is red. |
| 10 | LNK Indicator | It is network status indicator. The indicator is flashing green when the network transmission is normal. Otherwise, it is unlit. |
| 11 | Button | It is used to trigger device solution operation. |

# Chapter 3 17-Pin Interface

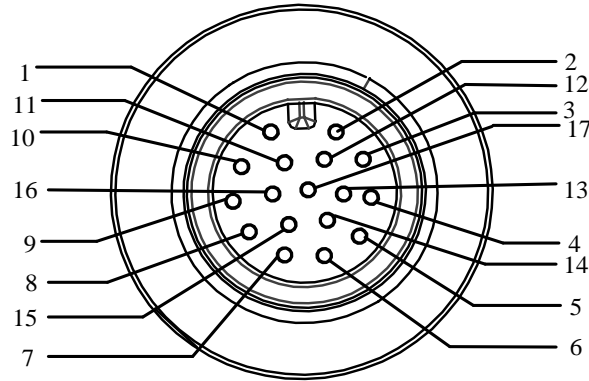Read the following section to get definitions of 17-pin interface.



**Figure 3-1 17-Pin Interface**

**Table 3-1 Pin Definitions**

| No. | Signal | I/O Signal Source | Description |
|-----|--------|-------------------|-------------|
| 1 | POWER_IN | -- | Direct current power supply positive |
| 2 | I/O_1 | Line 3 signal line | Can be configured as input or output |
| 3 | DO_2 | Line 7 signal line | Opto-isolated output |
| 4 | RS-232 TX | -- | RS-232 serial port output |
| 5 | RS-232 RX | -- | RS-232 serial port input |
| 6 | MDI0+ | -- | Fast Ethernet signal MDI0+ |
| 7 | MDI1- | -- | Fast Ethernet signal MDI1- |
| 8 | DO_0 | Line 5 signal line | Opto-isolated output |
| 9 | I/O_0 | Line 2 signal line | Can be configured as input or output |
| 10 | DO_1 | Line 6 signal line | Opto-isolated output |
| 11 | GND | Signal ground | Direct current power supply negative |
| 12 | Reserved | | |
| 13 | I/O_2 | Line 4 signal line | Can be configured as input or output |
| 14 | MDI0- | -- | Fast Ethernet signal MDI0- |
| 15 | MDI1+ | -- | Fast Ethernet signal MDI1+ |

| No. | Signal | I/O Signal Source | Description |
|---|---|---|---|
| 16 | DI_0 | Line 0 signal line | Opto-isolated input |
| 17 | DI_1 | Line 1 signal line | Opto-isolated input |

**Note**

● You should refer to the table above and the label attached to the power and I/O cable to wire the device.
● It is recommended to use the supplied 17-pin cable. The 6th, 7th, 14th, and 15th pin have been made as RJ45 connector. The lines of other pins should be wired according to the actual demands.

# Chapter 4 I/O Wiring

## 4.1 Input

The device's Line 0/1 is input, and Line 2/3/4 are bi-directional I/O(s) that can be set as input. The internal circuit of input signal is as follows.

### ⓘNote

The maximum input current of input signal is 25 mA.
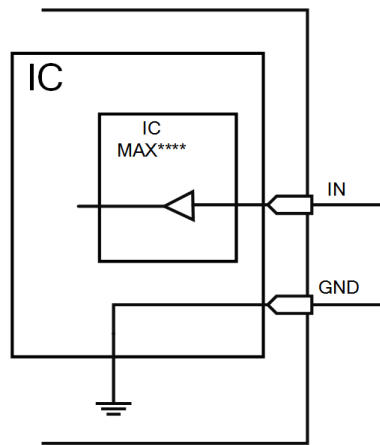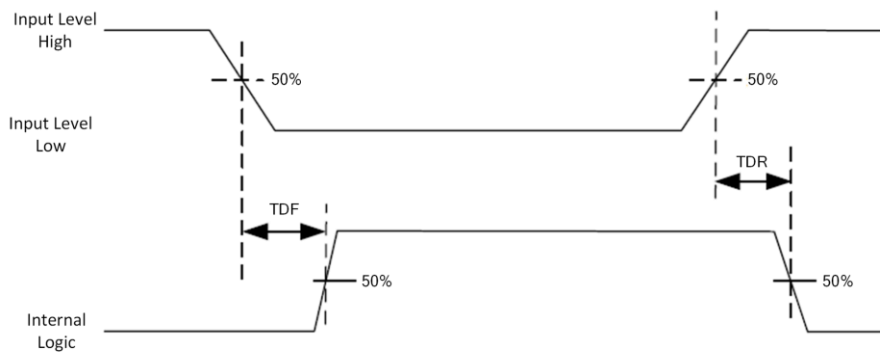


**Figure 4-1 Internal Circuit of Input Signal**



**Figure 4-2 Input Logic Level**

**Table 4-1 Input Electrical Feature**

| Parameter Name | Parameter Symbol | Value |
|---|---|---|
| Input Logic Level Low | VL | 0 VDC to 9 VDC (VCC=24 VDC)<br>0 VDC to 5.4 VDC (VCC=12 VDC) |
| Input Logic Level High | VH | 11 VDC to 24 VDC (VCC=24 VDC)<br>7.56 VDC to 12 VDC (VCC=12 VDC) |
| Input Falling Delay | TDF | 1.3 μs to 3.5 μs |
| Input Rising Delay | TDR | 1.3 μs to 3.5 μs |

☐**Note**

● VCC stands for Volt Current Condenser, and it is the device's input voltage.
● The breakdown voltage is 36 VDC, and keep voltage stable.

# 4.2 Output

The device's Line 5/6/7 are outputs, and Line 2/3/4 are bi-directional I/O that can be set as outputs. The type of output signal can be set as PNP or NPN via web parameter. When the output signal is PNP or NPN, the respective internal circuit is as follows.

☐**Note**

The maximum output current of output signal is 200 mA.

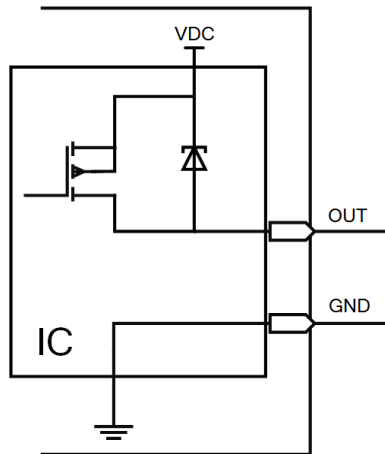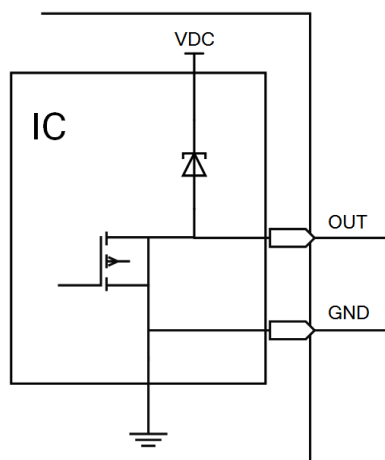**Figure 4-3 Internal Circuit of PNP Output Signal**



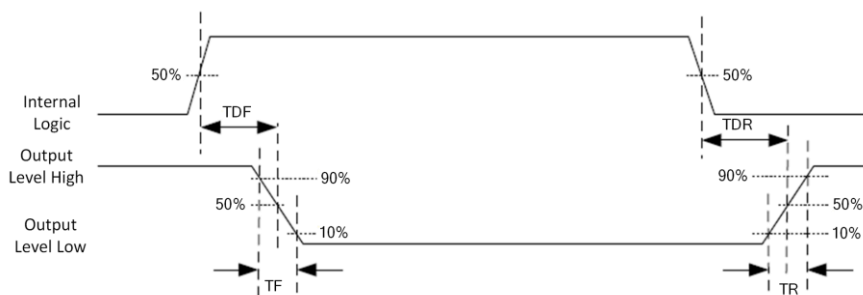**Figure 4-4 Internal Circuit of NPN Output Signal**



**Figure 4-5 Output Logic Level**

When the external voltage and resistance is 12 VDC and 1 KΩ respectively, opto-isolated output electrical feature is as follows.

**Note**

With different external voltage and resistance, the corresponding current and output logic level low may have small change.

**Table 4-2 Output Electrical Feature**

| Parameter Name | Parameter Symbol | Value |
|---|---|---|
| Output Logic Level Low | VL | 212 mV |
| Output Logic Level High | VH | 11.8 VDC |
| Output Falling Delay | TDF | 0.4 μs |
| Output Rising Delay | TDR | 0.4 μs |
| Output Falling Time | TF | 0.4 μs |
| Output Rising Time | TR | 0.4 μs |

# 4.3 Input Wiring

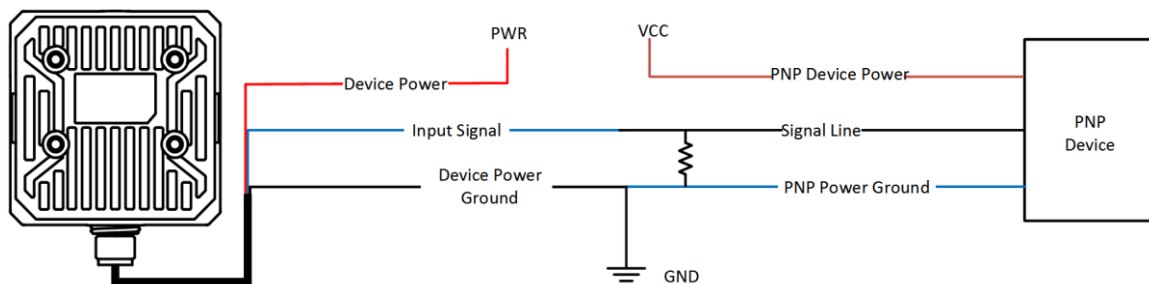The device can receive external input signal via I/O interface, and here we take one line as an example to introduce input signal wiring.

☐**i Note**

Input signal wiring may differ with different types of external devices.

## PNP Device

☐**i Note**

It is recommended to use 1 KΩ pull-down resistor.



**Figure 4-6 Input Signal Connecting to PNP Device**

## NPN Device

☐**i Note**

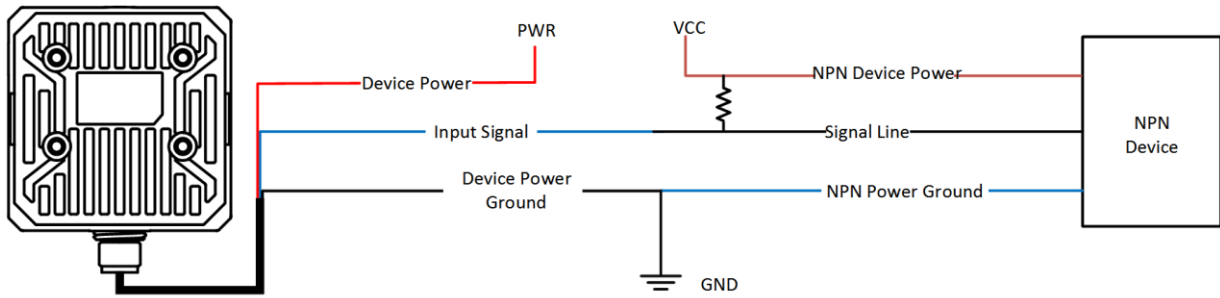If the VCC of NPN device is 12 VDC or 24 VDC, and it is recommended to use 1 KΩ pull-up resistor.

**Figure 4-7 Input Signal Connecting to NPN Device**

## Switch

> **Note**
>
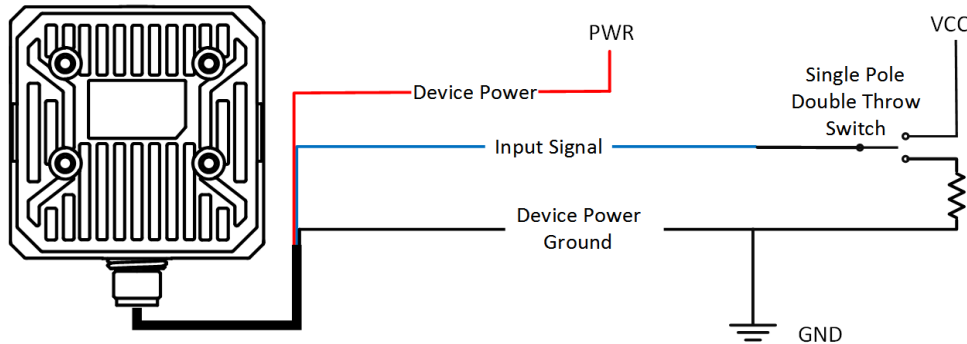> It is recommended to use 1 KΩ pull-down resistor.



**Figure 4-8 Input Signal Connecting to a Switch**

# 4.4 Output Wiring

The device can output signal to external device via I/O interface, and here we take one line as an example to introduce output signal wiring.
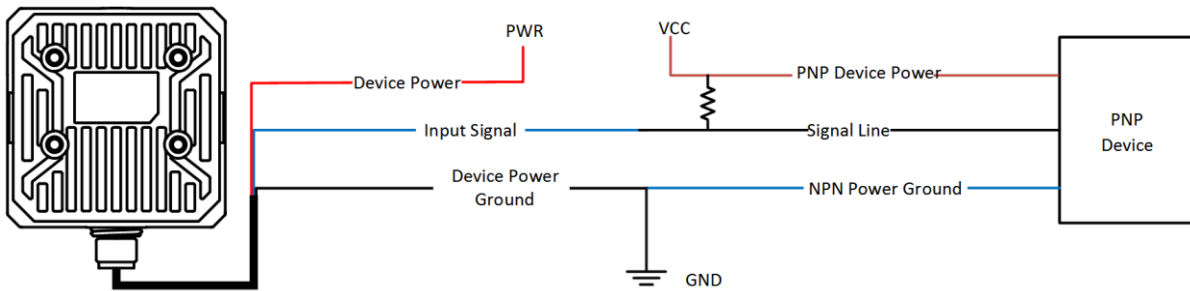
> **Note**
> - Output signal wiring may differ with different types of external devices.
> - You can set device output signal as NPN or PNP via web.

When the device output signal is PNP, it is recommended to use 1 KΩ pull-down resistor if NPN device is connected.
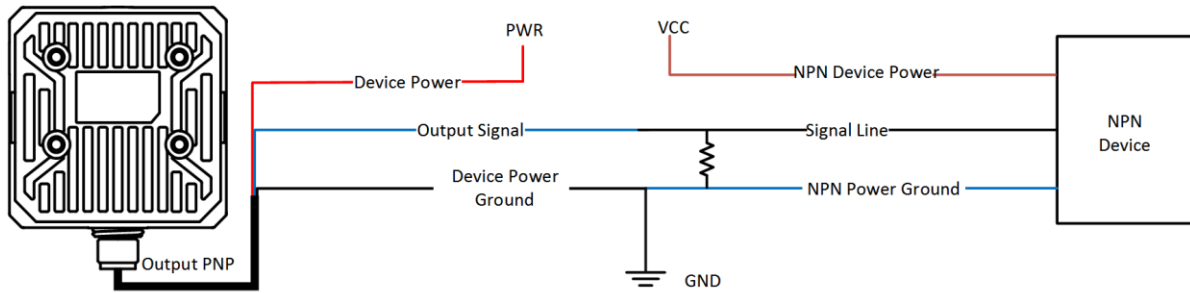
**Figure 4-9 Device Outputs PNP Signal**

When the device output signal is NPN, it is recommended to use 1 KΩ pull-up resistor if PNP device is connected.



**Figure 4-10 Device Outputs NPN Signal**

**⌈i⌉Note**

When the device's output signal is set as NPN, the voltage of VCC should not higher than that of PWR. Otherwise, the device's output signal may have exception.

# 4.5 RS-232 Serial Port

The 9-pin male connector and 25-pin male connector are commonly used serial ports, as shown below. You can refer to the table below for the specific pin name and function.
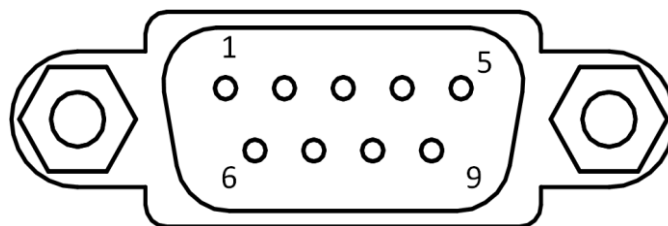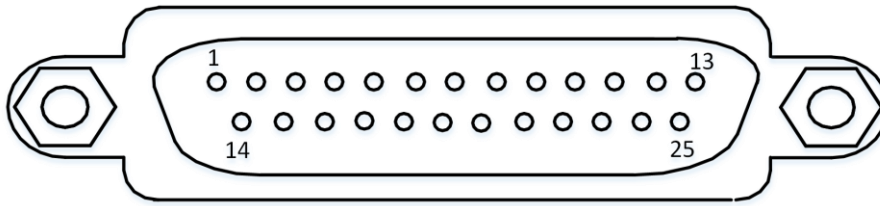


**Figure 4-11 9-Pin Male Connector**

**Figure 4-12 25-Pin Male Connector**

**Table 4-3 RS-232 Interface Description**

| Serial Port Type | Pin No. | Name | Function |
|---|---|---|---|
| 9-Pin Interface | 2 | RX | Receive data |
| | 3 | TX | Send data |
| | 5 | GND | Signal ground |
| 25-Pin Interface | 2 | TX | Send data |
| | 3 | RX | Receive data |
| | 7 | GND | Signal ground |

You can refer to the serial port wiring below to connect the device with an external device.
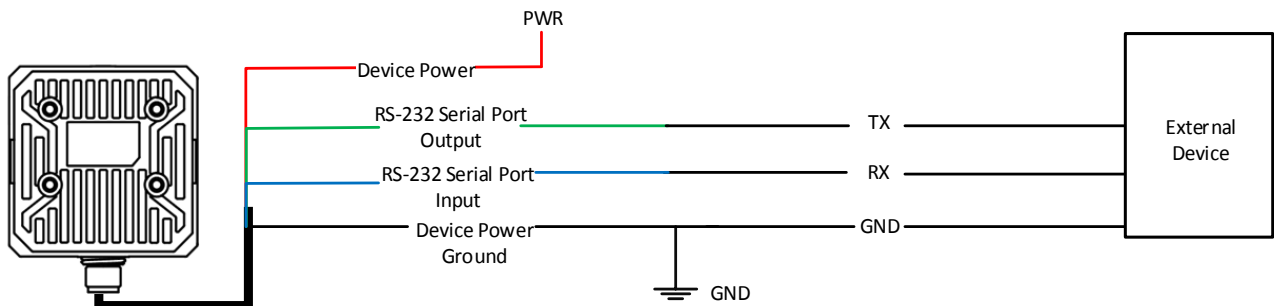


**Figure 4-13 RS-232 Serial Port Wiring**

# Chapter 5 Installation

## 5.1 Installation Preparation

You need to prepare following accessories before installation.

**Table 5-1 Accessories**

| No. | Name | Quantity | Description |
|-----|------|----------|-------------|
| 1 | 17-Pin Cable | 1 | It refers to the supplied 17-pin cable that is included in the package. |
| 2 | Power Adapter or Switch Power Supply | 1 | You should select suitable power adapter or switch power supply according to the device power supply and consumption. You need to purchase separately. |
| 3 | Lens Cap | 1 | It refers to the supplied lens cap. You can also use polarization lens cap that needs to be purchased separately. |
| 4 | Light Source | 1 | It refers to the supplied white light source. You can also use red or blue light source that needs to be purchased separately. |
| 5 | M4 Screw | 4 | It refers to the supplied M4 screw that is used to fix the device to installation position. |

## 5.2 Install Device

**Before You Start**

● Make sure the device in the package is in good condition and all the assembly parts are included.
● Make sure all the related equipment is power-off during the installation.

**Steps**

1. Use M4 screw to fix the device to the installation position.
2. Connect the device to a power adapter or switch power supply via 17-pin cable.
3. Connect the device to a switch via network cable.

# Chapter 6 Access Device via Web Browser

2 ways are available to access the device via the web browser: You can enter the IP address of the device in the web browser to access the device, or use the Camera Search tool to search the device and access it via the web. In web, you can set device parameters, set and operate solutions, enable live view, etc.

## 6.1 Search Device via Camera Search Tool

The Camera Search tool allows you to search the device, view its information like model, serial No., MAC address, IP address, etc., and access the device via the web.

**Note**
- You can download the Camera Search tool from *https://en.hikrobotics.com/*.
- The Camera Search tool is compatible with 32/64-bit Windows 7/10 operating system.
- Only when the device is in the same network segment with the PC where the Camera Search tool is installed, you can search the device via the tool.

## 6.2 Access via Web Browser

You can enter the IP address of the device in the web browser to access the device, or use the Camera Search tool to search the device and access it via the web.

**Steps**

1. Double click the Camera Search tool.
   Devices in the same network segment with the PC will be automatically listed.
2. Select the device in the list.
3. Click **Access** to access the device via the web.

**Figure 6-1 Access via Web Browser**

After the browser is opened, you need to check **Admin**, enter the password, and click **Login**.

⎘**Note**

● The default password of the admin is Abc1234.
● The browser should support HTML5 and the Chrome is recommended.

# Chapter 7 Solution Settings

The vision sensor is able to acquire, process and output images. You can log in the web interface to set camera parameters, tool parameters, output parameters, etc. After competing related settings, you can save and download the solution you configured.

$\boxed{i}$**Note**

The specific parameter names and values may differ by device models and firmware versions.

# 7.1 Camera Settings

## 7.1.1 Set Frame Rate

Go to **Frame Rate** to set frame rate and view actual frame rate.

$\boxed{i}$**Note**

● The actual frame rate is related with the exposure time. If the exposure time is larger than the reciprocal of the device's max. frame rate, the less the exposure time, and the higher the frame rate will be. If the exposure time is smaller than the reciprocal of the device's max. frame rate, and then the exposure time will not influence the actual frame rate.
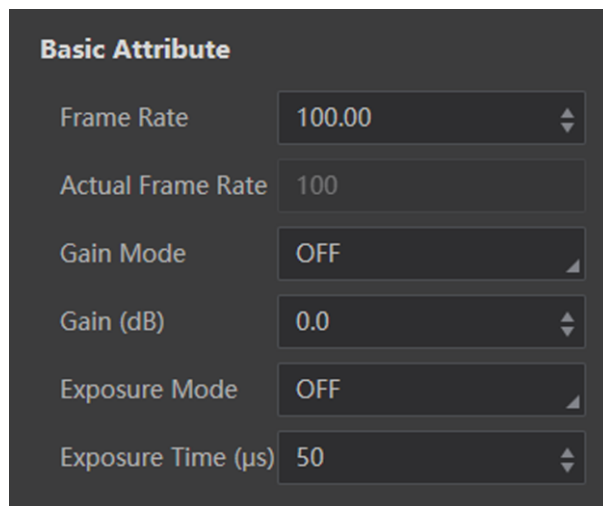


**Figure 7-1 Set Frame Rate**

## 7.1.2 Set Gain

The device supports 3 types of **Gain Mode**, including **OFF**, **ONCE** and **CONTINUOUS**.

**OFF**

When the gain mode is set as **OFF**, you can enter the gain value manually.

**ONCE**

When the gain mode is set as **ONCE**, the device adjusts the gain automatically once according to the image brightness.

**CONTINUOUS**

When the gain mode is set as **CONTINUOUS**, the device adjusts the gain continuously according to the image brightness.

**Note**

● When setting **Gain Mode** as **ONCE** or **CONTINUOUS**, **Gain** parameter does not take effect.
● When increasing the gain, the image noise will increase too, which will influence image quality.

## 7.1.3 Set Exposure Mode

The device supports 3 types of **Exposure Mode**, including **OFF**, **ONCE** and **CONTINUOUS**.

**OFF**

When the exposure mode is set as **OFF**, you can enter the exposure time manually.

**ONCE**

When the exposure mode is set as **ONCE**, the device adjusts the exposure time automatically once according to the image brightness.

**CONTINUOUS**

When the exposure mode is set as **CONTINUOUS**, the device adjusts the exposure time continuously according to the image brightness.

**Note**

When setting **Exposure Mode** as **ONCE** or **CONTINUOUS**, **Exposure Time** parameter does not take effect.

## 7.1.4 Set Brightness

When the gain mode or exposure mode is continuous, you can set brightness. Otherwise, the brightness is not available. The range of the brightness is from 0 to 255.

## 7.1.5 Set Light Source

The device has 8 light bulbs, and you can go to **Light Source Adjustment** to set light direction, flash mode, duration, delay, etc.

**Direction**

The device has 8 light bulbs, which are divided into up, down, left and right groups. You can select **UP**, **DOWN**, **LEFT** and **RIGHT** to control respective light bulbs. By selecting **ALL**, you can control all 8 light bulbs.

**Enable**

After enabling, the light bulbs you selected in **Direction** will turn on.

**Flash Mode**

It includes **FLASH_STROBE** and **FLASH_LONG**.

**Duration**

It refers to the duration time of light source.

**Delay**

The time when light source starts to light is later than that of exposure. It only takes effect when selecting **FLASH_STROBE** as **Flash Mode**.

**Advance**

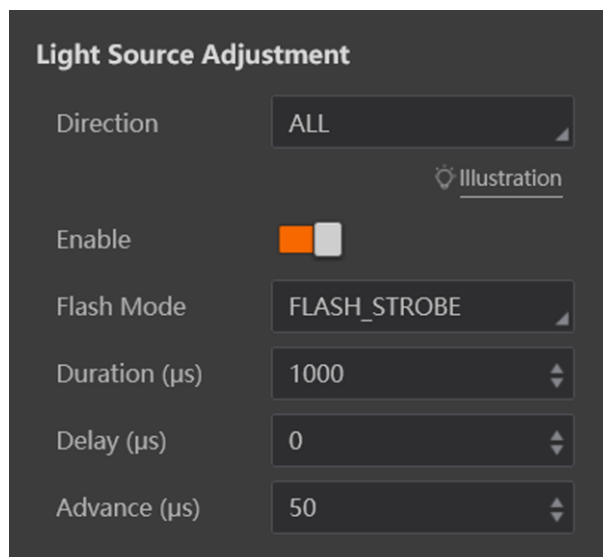It refers to the time when light source starts to light is early than that of exposure.



**Figure 7-2 Set Light Source**

# 7.1.6 Set Image

Go to **Image** to set image related parameters.

**Pixel Format**

The mono device supports Mono 8 only, and the color device supports Mono 8 and RGB.

**Width**

It refers to the image width, and you can adjust it according to actual demands.

**Height**

It refers to the image height, and you can adjust it according to actual demands.

**Width Deviation and Height Deviation**

It indicates the starting location of the upper left corner of the ROI area, that is, the deviation in the X direction and Y direction. This parameter adjusts the location of the ROI frame.

⎕**i̇Note**

Image width + width deviation <= width max. value. Image height + height deviation <= height max. value.

**W-H Conversion**

This parameter is 1 by default, and it sets the relation between image coordinates and physical coordinates, that is, a pixel on the image represents the length in actual physical position.

**Gamma**

Gamma correction provides a non-linear mapping mechanism. When Gamma value is between is 0 and 1, image brightness increases, and dark area becomes brighter. When Gamma value is between 1 and 4, image brightness decreases, and dark area becomes darker.
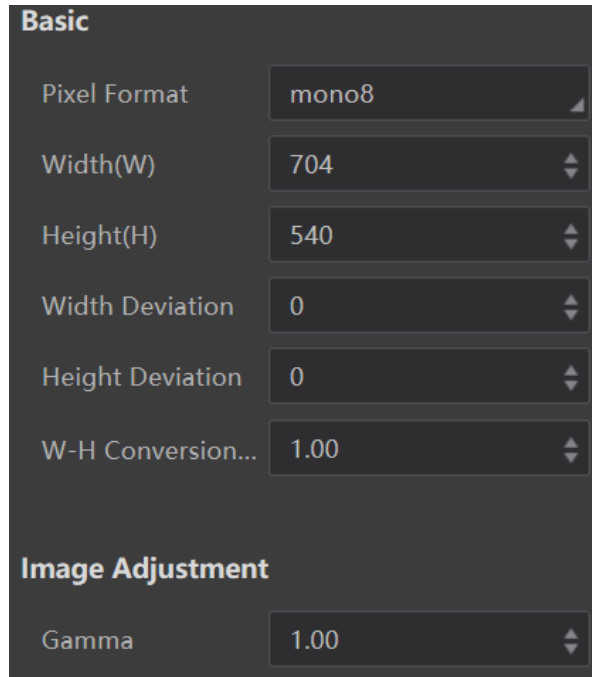
**Figure 7-3 Set Image**

**CCM Reset**

ℹ️**Note**

This parameter is only available for the color device and rgb is selected as pixel format.

CCM stands for Color Correction Matrix, and it is used to help improve inter-instrument agreement in display and light sources measurements.
You can click **Edit** to adjust R, G and B value according to actual conditions, and their range is from -15.99 to +15.99, and click **Apply** to apply. You can click **CCM Reset** to reset parameters.
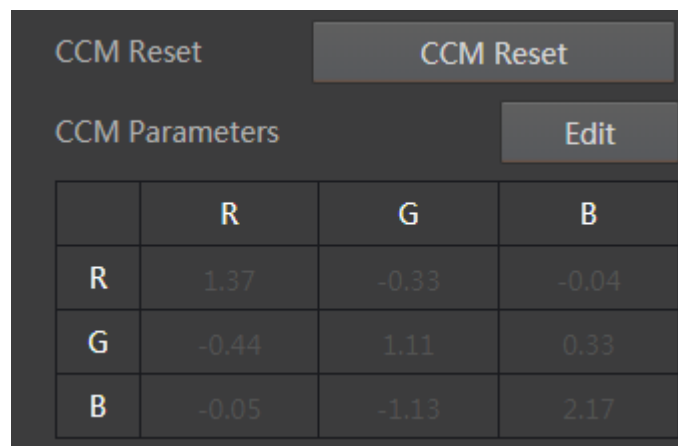


**Figure 7-4 Set CCM**

**AWB Mode**

⬚**Note**

This parameter is only available for the color device and rgb is selected as pixel format.

AWB stands for Automatic White Balance, and the device adjusts color according to different light sources. If you want to use AWB function, you should enable **AWB Enable** first.
There are 2 types of AWB mode, including manual and auto. If **AwbAuto** is selected as **AWB Mode**, the device will automatically adjust AWB parameters according to actual conditions. If **AwbManual** is selected, you can manual edit AWB parameters.
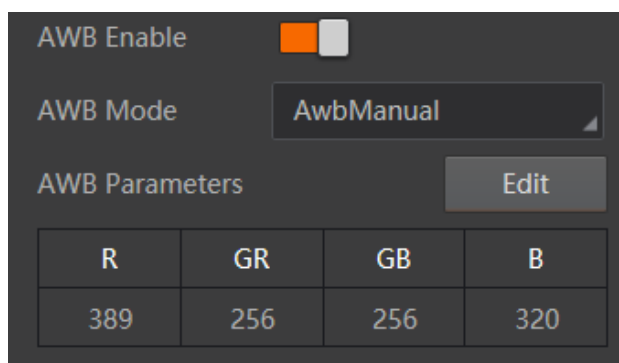


**Figure 7-5 Set AWB Mode**

# 7.2 Image Acquisition Settings

This section introduces how to set image acquisition related parameters, such as acquisition mode, trigger mode, trigger source, etc.

## 7.2.1 Set Trigger Mode

The device has 2 types of trigger mode, including internal trigger mode and external trigger mode. **OFF** refers to internal trigger mode, and **ON** refers to external trigger mode.

**Internal Trigger Mode**

  In this mode, the device acquires images via its internal signals.

**External Trigger Mode**

  In this mode, the device acquires images via external signals like software signal, hardware signal, communication string, etc.

## 7.2.2 Enable Internal Trigger Mode

Go to **Trigger Mode** to select **OFF** as **Trigger Mode**.

📖**Note**

**OFF** refers to the internal trigger mode.

# 7.2.3 Enable External Trigger Mode

Go to **Trigger Mode** to select **ON** as **Trigger Mode**.

📖**Note**

**ON** refers to the external trigger mode.

## Set and Execute Software Trigger Mode

**Steps**

1. Select **ON** as **Trigger Mode**.
2. Select **SOFTWARE** as **Trigger Source**.
3. Click **Software Trigger** to send trigger commands.
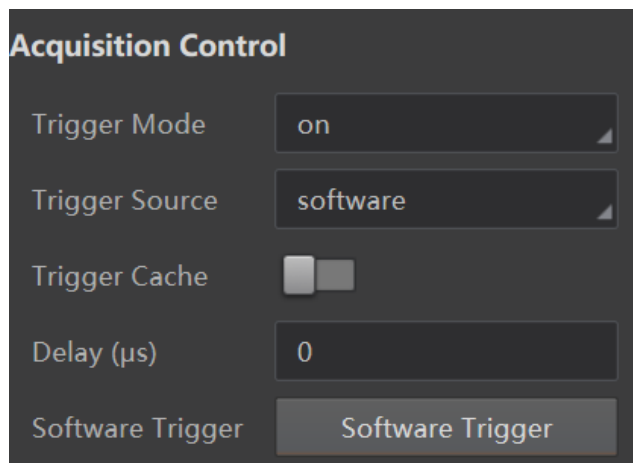4. Enter **Delay** time according to actual demands.



**Figure 7-6 Set and Execute Software Trigger Mode**

## Set and Execute Hardware Trigger Mode

**Steps**

1. Select **ON** as **Trigger Mode**.
2. Select **Hardware** as **Trigger Source**.
3. Select specific line as **IO Control**, and set **Input** as **IO Mode.**
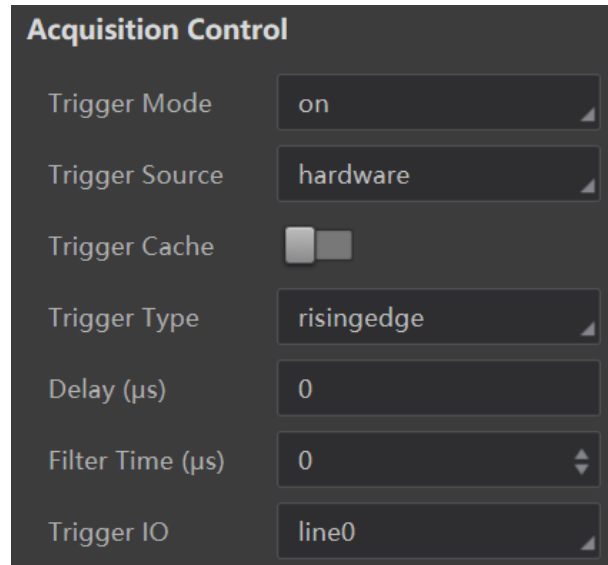4. Select specific line as **Trigger IO**.

**Figure 7-7 Set and Execute Hardware Trigger Mode**

# 7.2.4 Set Related Parameters about External Trigger Mode

⌊i⌋**Note**

Parameter settings may differ when selecting different trigger sources.

In external trigger mode, you can also set related parameters, including trigger cache, trigger type, trigger delay, and filter time.

## Set Trigger Cache

After enable **Trigger Cache**, if the device receives a new trigger signal, it will save and process the signal during the triggering process. Trigger cache can save up to 3 trigger signals.

## Set Trigger Type

The device supports trigger acquisition in the rising edge, falling edge, level high, or level low of the external signal.

**Rising Edge**

It means that when the level signal sent by external device is in rising edge, the device receives trigger signal and starts to acquire images.

**Falling Edge**

It means that when the level signal sent by external device is in falling edge, the device receives trigger signal and starts to acquire images.

**Level High**

The level high of the trigger signal is valid. As long as the trigger signal is in level high, the device is in image acquisition status.

**Level Low**

The level low of the trigger signal is valid. As long as the trigger signal is in level low, the device is in image acquisition status.
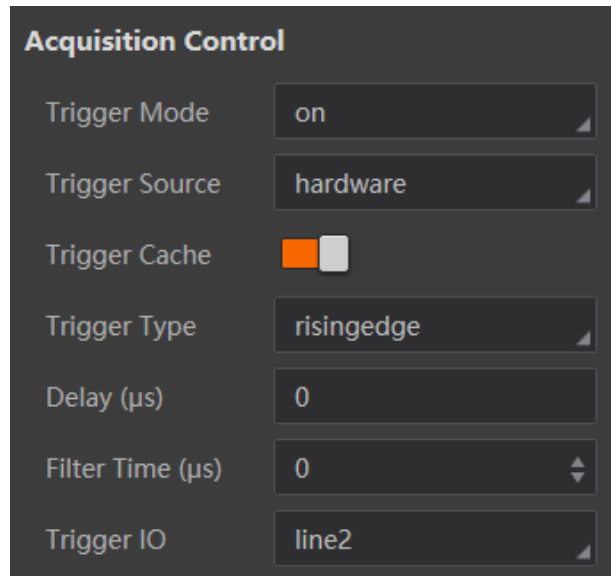


**Figure 7-8 Set Trigger Type**

## Set Trigger Delay

The trigger delay function allows the device to add a delay between the receipt of trigger signal and the moment the trigger becomes active.

⎙**Note**

- This parameter is available only when selecting rising or falling edge as the trigger type. If level high or level low is selected as the trigger type, you can set trigger start delay or end delay according to actual demands.

## Set Filter Time

The external trigger input signal of the device may have signal bounce that may cause false trigger. Thus, it is necessary to set filter time.

## 7.2.5 Enable Communication Trigger Mode

The device also supports triggering by receiving communication string.
Select **ON** as **Trigger Mode**, select **COMMUNICATION** as **Trigger Source**, and enter **String** and **Delay** according to actual demands.
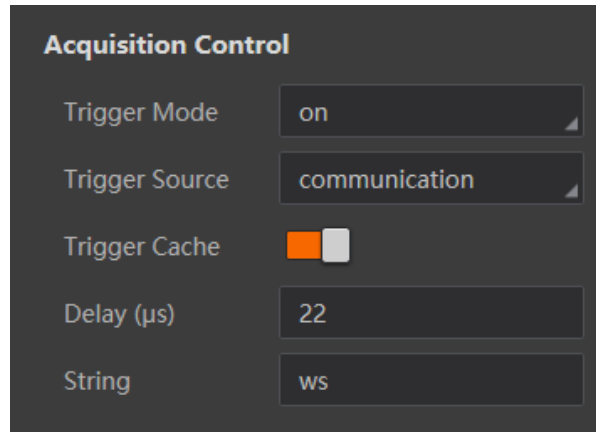
**Figure 7-9 Enable Communication Trigger**

# 7.3 Input and Output (IO) Settings

Digital IO control function allows you to set input or output for specific line.
Go to **Digital IO Control**, select specific lines as **IO Control** according to actual demands, and set **INPUT** or **OUTPUT** as **IO Mode** for the line selected in **IO Control**.
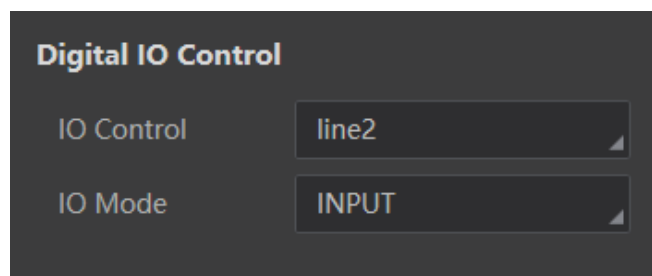


**Figure 7-10 Input and Output (IO) Settings**

# 7.4 Tool Settings

---

☐**Note**
- Available tools may differ by device models.
- The tools of feature matching, finding circle, finding line, brightness measurement, blob, finding edge width require the image sources are mono ones.
- The specific parameter names and values may differ by device models and firmware versions.

---

Tool settings allows you to add different vision tools for measurement, location, counting, calibration, etc. After tool adding, you can set their corresponding parameters, save and download solutions.

## ROI Settings

For most tools, you need to set image source and ROI area in basic parameter interface before setting specific operating parameters.

Image source is the images acquired by the device by default. ROI area allows you to create or reuse certain areas, you can select different shapes to draw directly, or select different reuse methods to determine the ROI.
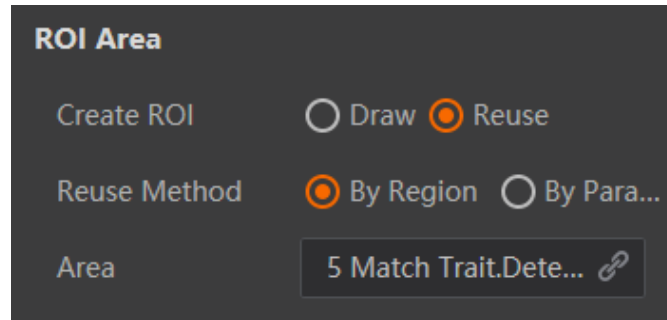


**Figure 7-11 Set ROI Area**

Regarding fixture, you can link the specific information of fixture tool after enabling it. See **Fixture Settings** for details.

# 7.4.1 Feature Matching

This tool uses the edge feature of the image as a template to determine the search space in accordance with the preset parameters, and to search targets that are similar to the template in images.

## Feature Template

There are 2 ways to create feature template for feature matching. Go to **Template**, and click **Upload** to upload local template to create feature template. Or click **Create** to create feature template.

⬚**Note**

For new solution, it is recommended to click **Create** to create feature template.

## Create Feature Template

**Steps**

1. Click **Create** to create template.
2. Click **Select Current** or **Select Others** as template.
3. Click ⬚ to create rectangle mask.

4. Click ⊹ to select the matching point location, and move the blue cross in the image to the ideal location.
5. Click ⊵ to create template.
6. Optional: Click ⬆ to download the current template to the PC.
7. Set **Scale Mode** and **Threshold Mode** according to actual demands.
● **Scale Mode** refers to the fineness level of the feature, and it includes manual and auto modes. Under auto mode, the device will automatically adjust fineness level of the feature. Under manual mode, you can manual set its range between 1 and 20 in Roughly Adjust Scale. The larger the feature scale, the sparser the extracted feature edge points are.
● **Threshold Mode** refers to the gray value difference between the feature point and the surrounding background, and it includes manual and auto modes. Under auto mode, the device will automatically adjust. Under manual mode, you can manual set its range between 0 and 255 in Contrast Threshold.
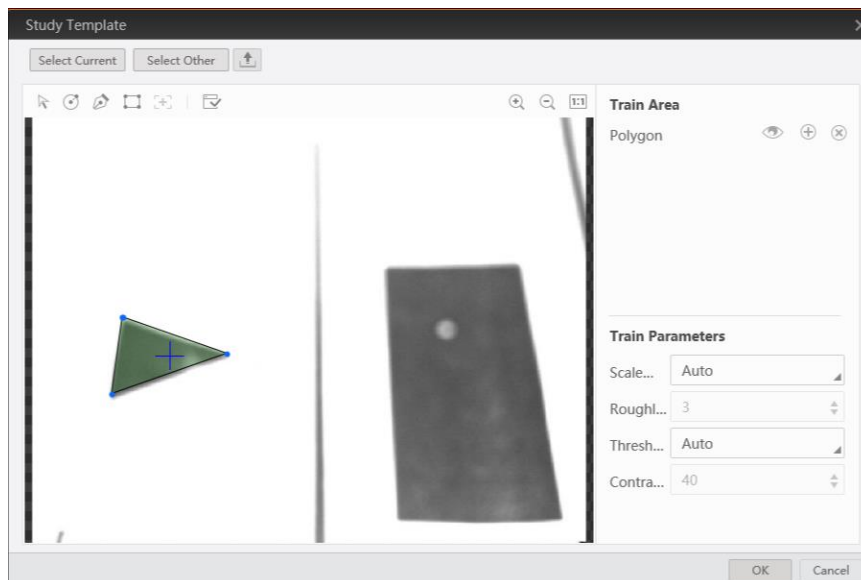8. Click **OK**.



**Figure 7-12 Create Feature Template**

## Parameter Settings

### Min. Match Score

The match score refers to the similarity between feature template and targets in the searched images. The min. match score refers to the similarity threshold. The searched target will be searched when the similarity reaches this threshold. This parameter also affects the search speed.

### Max. Match Quantity

It is the max. target quantity that can be searched.

### Match Polarity

It includes **No Polarity** and **Polarity**.

**Angle**

It is the angle range of searched targets. The edited template is the reference.

**Scale**

Zoom in and zoom out with same scale. It is applied for the target and template with certain percentage.

**Max. Overlap Rate**

The higher the overlap rate, the larger the overlap area that can be tolerated. The increase of overlap rate may reduce the search speed, and introduce false detections.

**Sort**

You can specify the order in which the target is searched.

**Overtime Control**

When the time exceeds the time set by overtime control, the search will stop and no search result will be returned. If it is set as 0, the overtime control function is disabled.

**Threshold Type**

It indicates contrast threshold mode in the matching stage, and it has 3 type, including **Auto**, **Model** and **Manual**. **Auto**: It automatically determines the threshold parameter according to the target image. **Model**: It uses the contrast threshold of the template as the contrast threshold in matching phase .**Manual**: It uses the threshold set by the user as the threshold parameter for searching.
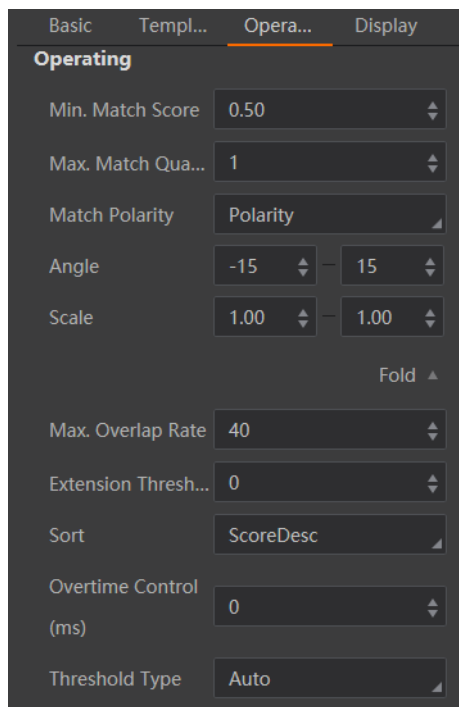


**Figure 7-13 Set Operating Parameters**

**Result Display**

In display area, you can set different judge methods of image detection result, including quantity, angle, scale, etc.

In **Judge Method**, enable **Judge by Quantity**, **Judge by Angle**, **Judge by Scale**, **Judge by Score**, **Judge by Match Point X**, **Judge by Match Point Y**, **Judge by Center Point X**, **Judge by Center Point Y**, and enter corresponding range according to actual demands.

In **Image Display**, click  to display or not display image detection area, fuzzing match results, and fuzzing match point. Click  to edit OK color, NG color, and transparency.

In **OSD**, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

# 7.4.2 Fixture Settings

Fixture is a tool for assisting the positioning and correcting the target motion deviation. The position deviation reference can be set up according to the matching point and the matching frame angle in the template matching result. And then the coordinate and rotation deviation of ROI detection frame can be realized according to the relative deviation of feature matching result and reference position.

**Origin X**

Link the matching point of template to the origin point of position deviation.

**Origin Y**

Link the matching point of template to the origin point of position deviation.

**Reference Angle**

Link the matching frame angle to the angle of position deviation.

**Initialize Reference**

Before creating a reference, you should click it.

**Create Reference**
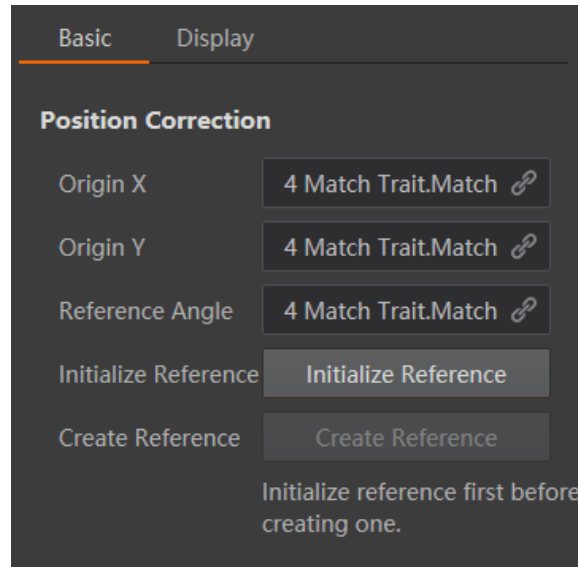
Click **Create Reference** to create reference.

**Figure 7-14 Fixture Settings**

## Result Display

In **Image Display**, click [icon] to display or not display running point and reference point. Click [icon] to edit OK color, NG color, and transparency.

## 7.4.3 Find Circle

This tool detects multiple edge points first, and then fits them into a circle. It is used to locate and measure the circle.

## Parameter Settings

**Search Mode**

It has 3 modes, including **The Best**, **Maximum**, and **Smallest**. **The Best** refers to only edge points of the largest gradient threshold within the scan range is detected and the circle is fitted. **Maximum** refers to only edge points of the longest distance from the circle center within the scan range is detected and the circle is fitted. **Smallest** refers to only edge points of the shortest distance from the circle center within the scan range is detected and the circle is fitted.

**Edge Polarity**

It has three modes, including **White to Black**, **Black to White**, and **All**. **White to Black** refers to the transition from the area with a low gray value to the edge of the area with a high gray value. **Black to White** refers to the transition from the area with a high gray value to the edge of the area with a low gray value. **All** refers to both edges are detected.

**Edge Threshold**

It is also called gradient threshold, and its range is from 0 to 255. The edge point whose gradient

threshold is larger than this value can be detected. The larger the value, the stronger noise resistibility, the smaller the number of edges obtained, and even the target edge points are filtered out.

**Filter Size**

It is used to enhance the edge and suppress noise, and its min. value is 1. When the edge is blurred or there is noise interference, you can increase its value to make the detection result more stable. If the distance between the edge and the edge is smaller than the filter size, it will affect the accuracy of the edge location or even lose edge. This parameter value needs to be set based on the actual situation.

**Caliper Quantity**

It is used to scan ROI area quantity of edge points.

**Removed Point**

It means that the number of minimum points that have high error to be excluded from fitting. In general, if there is a great number of points excluded from fitting, its value should be set higher. For better results, it is recommended to use it in combination with the parameter of distance to remove.

**Removed Distance**

It means that the maximum pixel distance from the outlier to the fit circle. The smaller the value, the more points are excluded.

**Caliper Width**

It is the width of the caliper.

**Initial Locating**

When enabling, the algorithm locates the best circle.

**Subsampling Coefficient**

The larger the subsampling coefficient, the less initial location time will be. It is recommended not to set this parameter value too large.

**Locating Sensitivity**

It is used to eliminate the interference points. The larger the value, the stronger the ability to eliminate noise interference, but it is also easy to cause the initial location of circle failure.

**Initial Fit Type**

It has two types, including **Overall** and **Local**. **Overall** is used to find global feature points and fit circle. **Local** is used to fit the circle according to the local feature points.

**Fit Mode**

It has three types, including **LS**, **huber** and **tukey**. As the number of outliers and the distance from the group increases, it is recommended to use least squares, huber, and tukey successively.
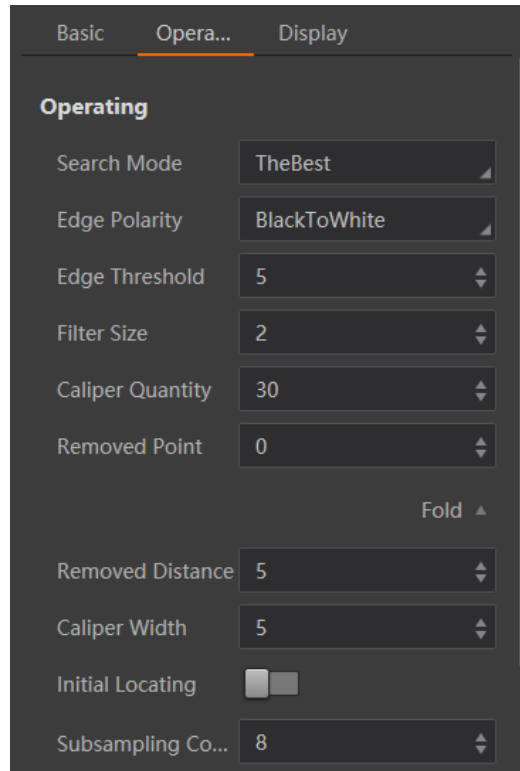
**Figure 7-15 Set Operating Parameters**

## Result Display

In display area, you can set different judge methods of image detection result, including radius, center X, center Y, fit error, etc.

In **Judge Method**, enable **Judge by Radius**, **Judge by Center X**, **Judge by Center Y**, **Judge by Fit Error**, **Judge by Fit Points**, and enter corresponding range according to actual demands.

In **Image Display**, click 🔘 to display or not display circle result, center point, and detection area. Click ✏️ to edit OK color, NG color, and transparency.

In **OSD**, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

## 7.4.4 Find Line

This tool finds a line with certain features in the image, and it uses known feature points to form feature point group, and then fits into a line.

### Parameter Settings

#### Search Mode

It has three modes, including **The Best**, **The First** and **The Last**. **The Best** refers to find the set of edge points with the largest gradient threshold, and then fit them into a line within scan area. **The First** refers to find the set of edge points that have the closest distance with starting point

and them into a line within scan area. **The Last** refers to find the set of edge points that have the closest distance with ending point and them into a line within scan area.

**Edge Polarity**

It has three modes, including **Black to White**, **White to Black**, and **All**. **Black to White** refers to the transition from the area with a high gray value to the edge of the area with a low gray value. **White to Black** refers to the transition from the area with a low gray value to the edge of the area with a high gray value. **All** refers to both edges are detected.

**Edge Intensity**

It is also called gradient threshold, and its range is from 0 to 255. The edge point whose gradient threshold is larger than this value can be detected. The larger the value, the stronger noise resistibility, the smaller the number of edges obtained, and even the target edge points are filtered out.

**Edge Width**

It means the edge span. The larger the span, the slower the edge transition speed will be. It is recommended to set a large value. If the two edges are too close, the large value may result in edge losing.

**Caliper Quantity**

It is used to scan ROI area quantity of edge points.

**Removed Point**

It means that the number of minimum points that have high error to be excluded from fitting. In general, if there is a great number of points excluded from fitting, its value should be set higher. For better results, it is recommended to use it in combination with the parameter of distance to remove.

**Removed Distance**

The max. pixel distance from the outliers to the fit circle. The smaller the value, the more the exclusion points.

**Projection Width**

It means that the area width of edge point ROI. You can increase this parameter value within a certain range to obtain a more stable edge points.

**Initial Fit Type**

It has two types, including **Overall** and **Local**. **Overall** is used to find global feature points and fit circle. **Local** is used to fit the circle according to the local feature points.

**Fit Mode**

It has three types, including **LS**, **huber** and **tukey**. As the number of outliers and the distance from the group increases, it is recommended to use least squares, huber, and tukey successively.
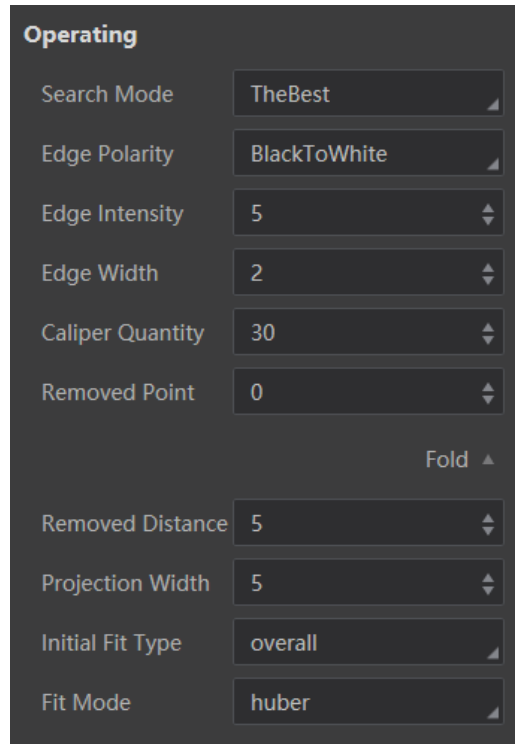
**Figure 7-16 Set Operating Parameters**

## Result Display

In display area, you can set different judge methods of image detection result, including fit points and angle.

In **Judge Method**, enable **Judge by Fit Points**, **Judge by Angle**, and enter corresponding range according to actual demands.

In **Image Display**, click to display or not display line result and detection area. Click to edit OK color, NG color, and transparency.

In **OSD**, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

# 7.4.5 Brightness Measure

This tool returns the gray mean value and the gray standard deviation of all the pixels in the ROI of the object to be measured. When using, the ROI can be drawn at the ideal measurement position.

## Result Display

In display area, you can set different judge methods of image detection result, including max. value, min. value, mean value, standard deviation, etc.

In **Judge Method**, enable **Judge by Max. Value**, **Judge by Min. Value**, **Judge by Mean. Value**, **Judge by Standard Deviation**, **Judge by Contrast**, and enter corresponding range according to actual demands. You can also enable **Reverse Result** to reverse result.

In **Image Display**, click 🖈 to display or not display detection area. Click ✎ to edit OK color, NG color, and transparency.
In **OSD**, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

# 7.4.6 Blob

Blob analysis means that the process of detecting, locating, or analyzing the target object in an image region where the pixel is a finite grayscale. The Blob analysis tool provides certain features of the target object in the image, such as presence, quantity, position, shape, direction, and topological relation between Blobs.

## Parameter Settings

**Threshold Method**

It includes 4 methods, including **No Binarization**, **Single Threshold**, **Double Threshold**, and **Auto Threshold**.

**Polarity**

It has 2 modes, including **Darker than Background**, and **Brighter than Background**. **Darker than Background** means that the feature image pixel value is lower than the background pixel value. **Brighter than Background** means that the feature image pixel value is higher than the background pixel value.

ⓘNote

This parameter takes effect when selecting **Single Threshold** or **Auto Threshold** as **Threshold Method**.

**Searching Quantity**

It searches the quantity of Blob image.

**Min. Size of Hole**

It refers to the min. non-Blob area size in Blob area. If the parameter is not larger than this value, the hole will be filled with Blob.

**Enable Area**

After enabling area, you can set the area range where Blob will be searched.

**Enable Circumference**

After enabling circumference, you can set the circumference range where Blob will be searched.

**Enable Minor Axis**

After enabling it, you can enter the range of short axis.

**Enable Major Axis**

After enabling it, you can enter the range of long axis.

**Enable Circularity**

After enabling circularity, you can set circularity range where Blob will be searched.

**Enable Rectangularity**

After enabling rectangularity, you can set rectangularity range where Blob will be searched.

**Enable Centroid Offset**

It refers to the absolute pixel offset between the Blob centroid and the minimum area of the Blob circumscribed rectangle.

**Axis Range Enable**

After enabling axis range, enter range according to actual demands.

**Sort Feature**

It includes **Area**, **Perimeter**, **Circularity**, **Rect**, **Centroid X**, **Centroid Y**, **Box Angle**, **Box Width**, **Box Height**, etc.

**Sort**

It includes **Grade Up**, **Grade Down**, and **Not Grade**.

**Connectivity**

In image processing, the object we are interested in is usually a combination of interconnected pixels. Therefore, in order to obtain an area, we must calculate all the connected areas that are contained in the area after division. On a rectangular pixel grid, there are two definitions of connectivity. The first one is that the two pixels have a common edge, that is, one pixel is above, below, to the left or to the right of the other pixel, which is called 4-connectivity. The second definition is the extension of the first definition. The adjacent pixels on the diagonal line are also included, which is called 8-connectivity.
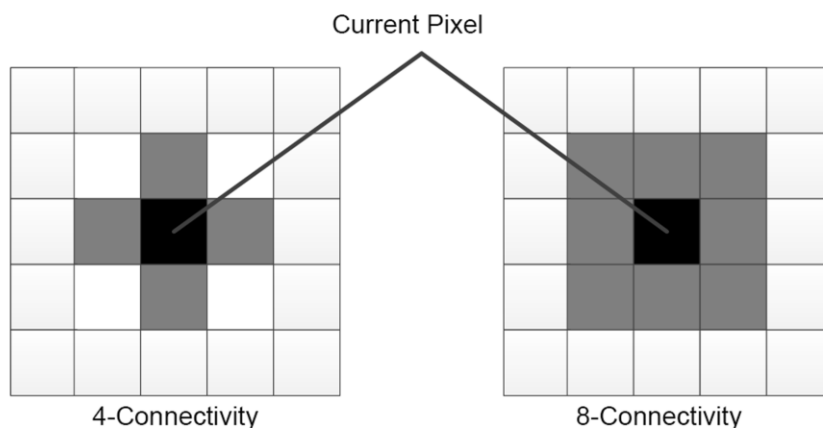


**Figure 7-17 Connectivity**
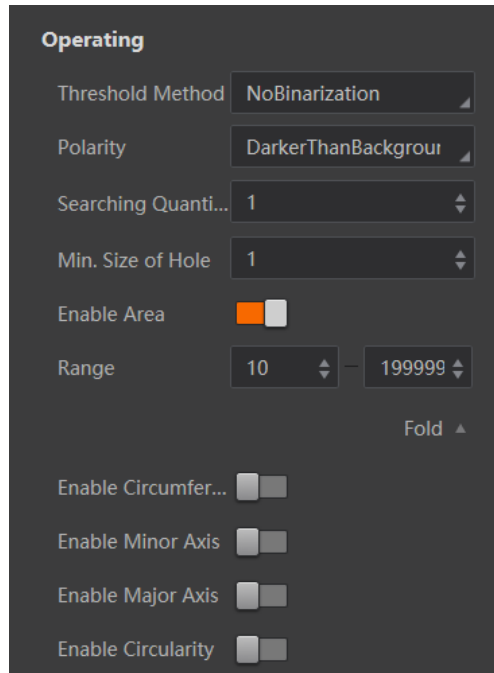
**Figure 7-18 Set Operating Parameters**

## 7.4.7 Find Edge Width

This tool finds edges, and measures spacing between two edges in accordance with ROI direction.

### Parameter Settings

**Filter Kernel Half-Width**

It is used to enhance the edge and suppress noise, and its min. value is 1. When the edge is blurred or there is noise interference, you can increase its value to make the detection result more stable. If the distance between the edge and the edge is smaller than the filter size, it will affect the accuracy of the edge location or even lose edge. This parameter value needs to be set based on the actual situation.

**Contrast Threshold**

It is also called gradient threshold, and its range is from 0 to 255. The edge point whose gradient threshold is larger than this value can be detected. The larger the value, the stronger noise resistibility, the smaller the number of edges obtained, and even the target edge points are filtered out.

**Edge 0 Polarity**

The polarity of the first edge point. It includes **White to Black**, **Black to White**, and **All**.

**Edge 1 Polarity**

The polarity of the second edge point. It includes **White to Black**, **Black to White**, and **All**.

**Searching Mode**

It includes **Widest**, **Narrowest**, **Strongest**, **Weakest**, **First**, **Last**, etc.

**Searching Mode**

It has 9 modes, including **Widest**, **Narrowest**, **Strongest**, **Weakest**, **First**, **Last**, **Closest**, **Least Close**, and **All**. **Widest** means that the edge pair that has the largest spacing within the detection range. **Narrowest** means that the edge pair that has the smallest spacing within the detection range. **Strongest** means that the edge pair that has the largest average gradient within the detection range. **Weakest** means that the edge pair that has the smallest gradient within the detection range. **First** means that the edge pair that its center has closest spacing to the search starting point within the detection range. **Last** edge means the edge pair that its center has farthest spacing to the search starting point within the detection range. **Closest** means that the set of edge pair that has closest width to ideal width within the detection range. **Least Close** means that the set of edge pair that has least closest width to ideal width within the detection range. **All** means that detect all edge pairs within the detection range.

**Max. Result Amount**

It sets the max. quantity for finding edges.

**Ideal Width**

It refers to the pixel distance of outputted edge groups. It is recommended to use this parameter when selecting closest, keep away, or all as searching mode.
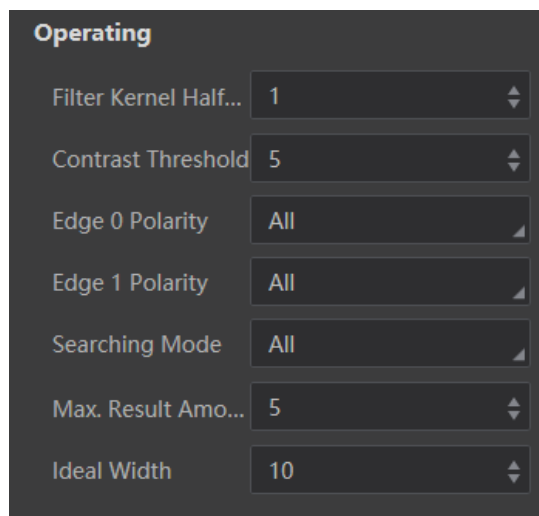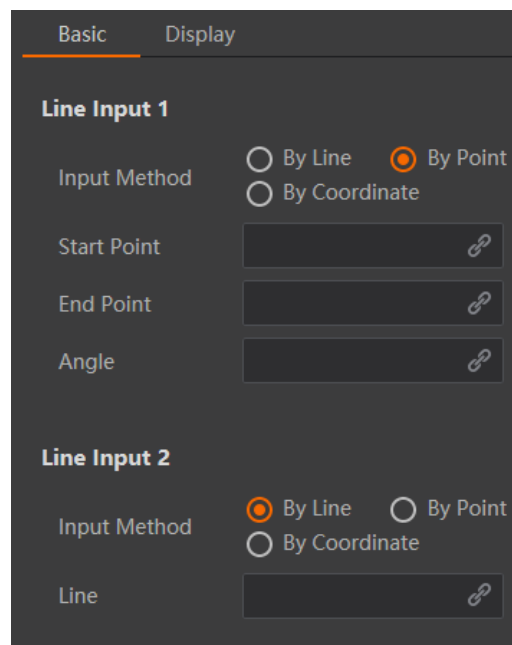


**Figure 7-19 Set Operating Parameters**

## Result Display

In display area, you can set different judge methods of image detection result, including quantity, width, etc.
In **Judge Method**, enable **Judge by Quantity**, **Judge by Width**, **Judge by X Axis of Edge Point 0**, **Judge by Y Axis of Edge Point 0**, **X Judgment of Edge Point 1**, **Y Judgment of Edge Point 1**, and enter corresponding range according to actual demands.

In **Image Display**, click 👁 to display or not display edge 0 result, edge 1 result, edge line result and detection area. Click ✎ to edit OK color, NG color, and transparency.
In **OSD**, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

## 7.4.8 L2L Measure

This tool is used to measure the distance between 2 lines. Generally, 2 lines are not parallel, and this tool measures the average distance between 2 end points of one line to another line to calculate the actual distance.

**Input Method**

It includes by line, by coordinate, and by point. If you select by line as input method, you need to link the result of finding line. If you select by point as input method, you need to enter start point, end point, and angle. If you select by coordinate as input method, you need to link the X and Y coordinates of the line's start point, end point, and angle.



**Figure 7-20 L2L Measure**

## Result Display

In display area, you can set different judge methods of image detection result, including angle, distance, intersection point X, and intersection point Y.
In **Judge Method**, enable **Judge by Angle**, **Judge by Distance**, **Judge by Intersection Point X**, **Judge by Intersection Point Y**, and enter corresponding range according to actual demands.
In **Image Display**, click 👁 to display or not display input line 1, input line 2 and intersection point. Click ✎ to edit OK color, NG color, and transparency.
In **OSD**, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

## 7.4.9 P2L Measure

This tool is used to measure the distance between a pint and a line, and calculate the actual distance between them. You need to enter the specific information like coordinates of the point and line.
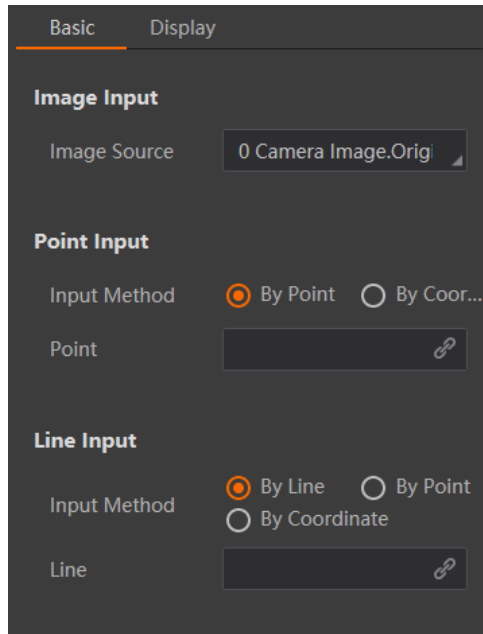


**Figure 7-21 P2L Measure**

### Result Display

In display area, you can set different judge methods of image detection result, including angle, vertical distance, Perpendicular Foot, etc.
In **Judge Method**, enable **Judge by Angle**, **Judge by Vertical Distance**, **Judge by Perpendicular Foot X**, etc, and enter corresponding range according to actual demands.
In **Image Display**, click 🔲 to display or not display input line 1, input line 2 and intersection point. Click ✏ to edit OK color, NG color, and transparency.
In **OSD**, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

## 7.4.10 Image Savings

This tool is used to save image caches into the device, and saved images can be downloaded to the local or be exported to the test library for the device debugging.

**Image Source**

   By default, the image source is the images acquired by the device.

**Input Status**

   Click 🔗 to link the previous module status, and image saving is decided by the linked data result.

After **Image Source** and **Input Status** are linked, you should select the **Save Mode**, **Picture Format** (RAW, BMP, JPG), and **Image Saving** according to actual demands.

You can enable **Frame No.**, **Trigger No.**, and **Result** to save the current image's related information. **Start Tag and End Tag** allows you to set the start and end characters of the image name, and uppercase and lowercase letters, digits, as well as ! @ # ^ & () - _ = + . , ; ' are allowed.

**Delimiter** refers to the content you used to separate the image name, and uppercase and lowercase letters, digits, as well as ! @ # ^ & () - _ = + . , ; ' are allowed.
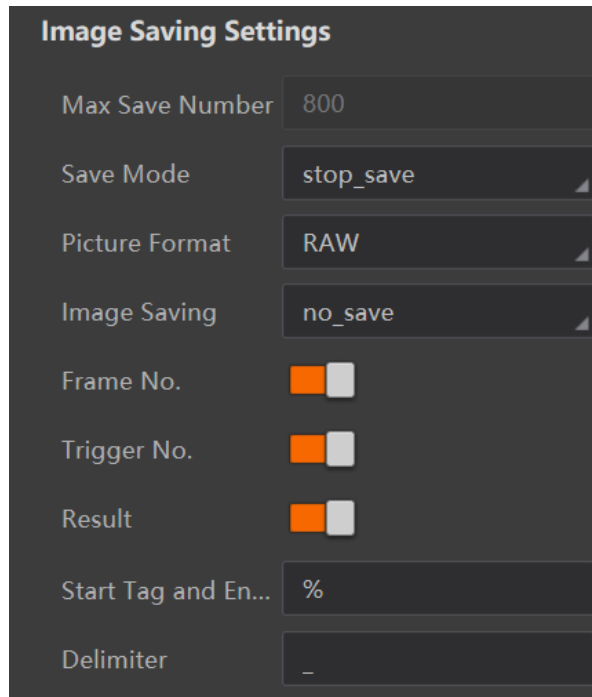


**Figure 7-22 Image Saving Settings**

## 7.4.11 N-Point Calibration

☐i**Note**

The N should be larger than or equal to 4.

The calibration is used to determine the conversion relation between the device's coordinate system and that of the mechanical arm. The N-point calibration realizes the conversion between the camera coordinate system and the executing structure coordinate system, and generates the calibration file.

**Calibration Parameters**

There are 2 ways to get calibration point. If **trigger** is selected as **Get Calibration Point**, you should enter **Image Coordinate X**, **Image Coordinate Y**, **Translation Number** and **Rotation Number** according to actual demands. If **manual** is selected, you should enter **Translation**

**Number** and **Rotation Number**.

You can also click in **Edit Calibration Point** to edit the image coordinate, the physical coordinate and angle information.

**Physical Coordinate Parameters**

**Reference Point X/Y** refers to the physical coordinates of the calibration origin, and it is recommended to set them as (0, 0).

**Deviation X/Y** refers to the mechanical arm's physical deviation towards the X/Y direction.

**Movement Priority** refers to the priority movement direction of the mechanical arm, including **X First** and **Y First**.

**Communication Number** refers to the times of the mechanical arm changing direction after moving.

**Angle Deviation** refers to the specific rotation angle. If it rotates 3 times, and rotation angle is from -10 degrees to 0 degree, and then to +10 degrees. The reference angle is -10 degrees and angle deviation is 10 degrees. For **Calibration Origin**, it is recommended to set as 4.
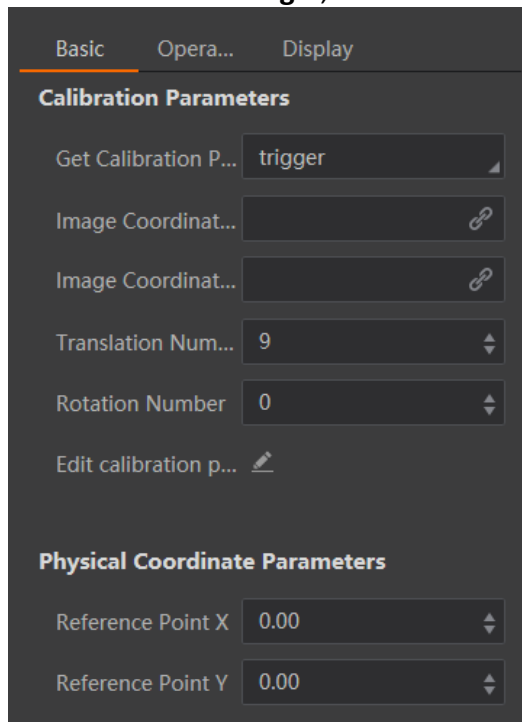


**Figure 7-23 Basic Parameters**

**Operating Parameters**

The operating parameters allow you to set camera mode, degree of freedom, etc.

**Camera Mode** has three types, including camera stationary up, camera stationary down and dynamic camera.

**DOF** includes scale, rotation, aspect ratio, tilt, translation and transmission, and you can select it according to actual demands.

**Weighting Function** includes least squares, Huber, Tukey, and Ransac algorithm functions, and the default one is recommended. If Huber and Tukey are selected as **Weighting Function**, you need to set **Weighting Coefficient**, and the default one is recommended.

If Ransac is selected, you need to set **Distance Threshold** and **Sampling Ratio** according to actual demands. **Distance Threshold** refers to the distance threshold for eliminating the error point. When the point group's accuracy is not high, this threshold can be appropriately increased. When the point group's accuracy is not high, the sampling ratio can be appropriately reduced.
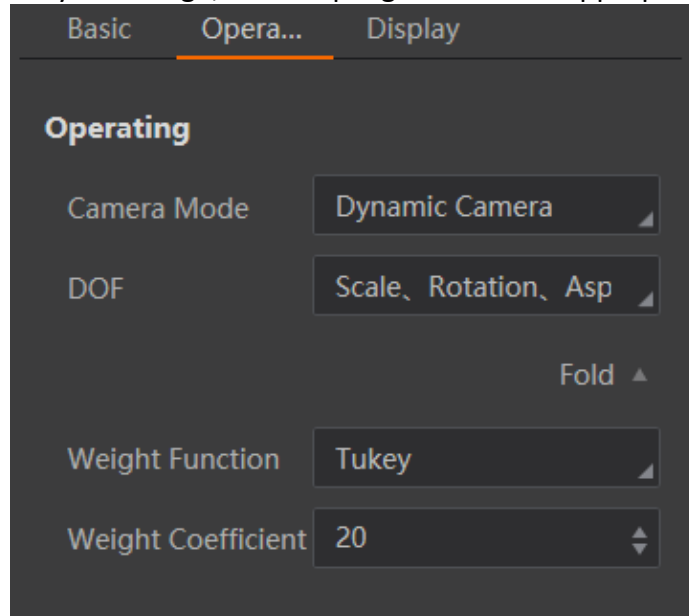


**Figure 7-24 Set Operating Parameter**

## 7.4.12 Coordinate Conversion

After the calibration is completed, you can use the this tool to convert the coordinate systems of the device and the mechanical arm.

Select **Input Source**, enter **Image Point** and **Angle** according to actual demands if you select **By Point** as **Input Method**, or enter **Image Coordinate X**, **Image Coordinate Y** and **Angle** if you select **By Coordinate**.

Click ⬜ to load the created calibration file, enable Single Point Alignment, and click **Initialize Reference** first and then click **Create Reference**.
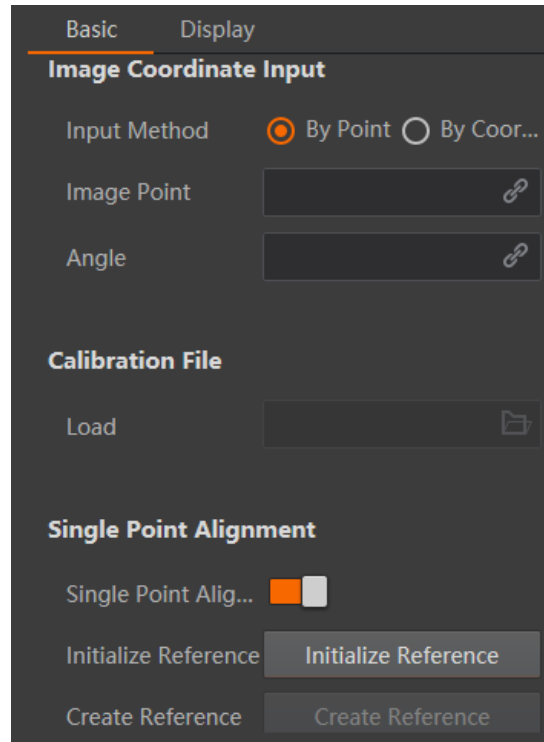
**Figure 7-25 Coordinate Conversion**

## 7.4.13 Color Extraction

> **Note**
> This tool is available for color vison sensors only.

The color space for the color extraction can be RGB, HSV or HSI. According to the brightness of each channel to be extracted, you can set parameter ranges of different channels. This tool extracts the pixel part of the specified color range from the color image, and outputs the 8-bit binary image, which is a binarization process.

**Steps**

1. Click [+] to create the extraction solution.

> **Note**
> There is 1 created extraction solution by default.

2. Select the extraction solution you want to set
3. Select **RGB**, **HSV** or **HSI** as **Color Space**.
4. Select color region in the live view window.
5. Set ranges for each channel according to the **Color Space** you selected.
6. (Optional) Enable **Invert Color** according to actual demands.
7. (Optional) Set Timeout according to actual demands.
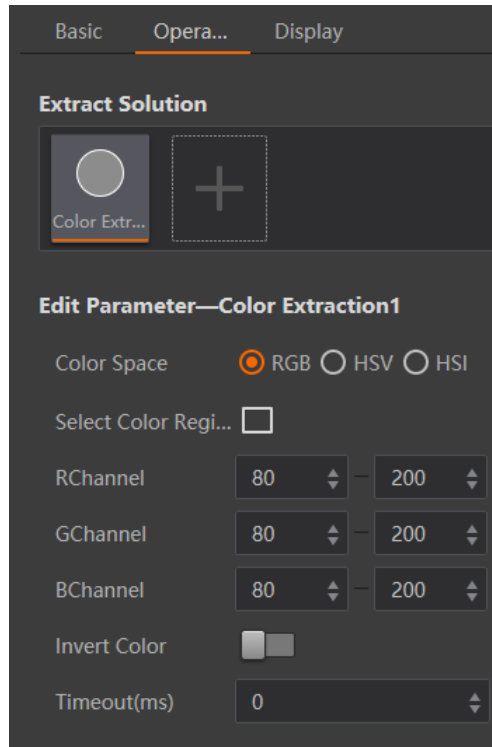
**Figure 7-26 Color Extraction**

## 7.4.14 Color Measurement

> **ⓘNote**
>
> This tool is available for color vison sensors only.

This tool is used to measure the color information in the specified area of the color image, including the max. value, min. value, mean value, and standard deviation of each channel.
You should select **RGB**, **HSV** or **HSI** as **Color Space** when using the color measurement tool.

## 7.4.15 Color Conversion

> **ⓘNote**
>
> This tool is available for color vison sensors only.

This tool is used to convert the color space in the specified area of the color image, and output the gray image of this area after color conversion.
Select **Input Source**, and select **RGB2GRAY**, **RGB2HSV** or **RGB2HSI** as **Conversion Type** according to actual demands. If **RGB2GRAY** is selected as **Conversion Type**, you can set **Conversion Ratio** that includes General Ratio, Average Ratio, Channel Min, Channel Max, User Ratio, R Channel, B Channel, and G Channel.

**Table 7-1 Conversion Type Description**

| Conversion Type | Description |
| --- | --- |
| General Ratio | 0.299r + 0.587g + 0.114b.<br><br>r stands for the gray value of the R channel, g stands for the gray value of the G channel, and b stands for the gray value of the B channel. |
| Average Ratio | (r + g + b) / 3. |
| Channel Min | Min (r, g, b) |
| Channel Max | Max (r, g, b) |
| User Ratio | You can enter R/G/B conversion ratio according to actual demands. |
| R Channel | r + 0*g +0*b. |
| B Channel | 0*r + 0*g +b. |
| G Channel | 0*r + g +0*b. |

If **RGB2HSV** or **RGB2HSI** is selected as **Conversion Type**, you can set **Display Channel** to select the specific channel to display.
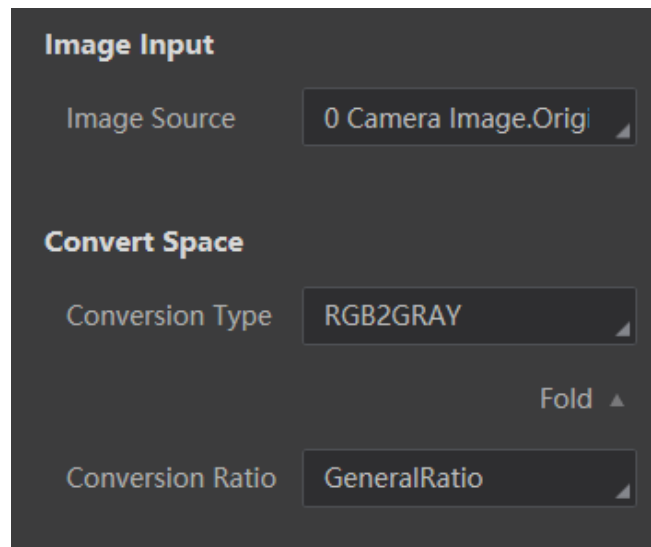


**Figure 7-27 Color Conversion**

## 7.4.16 Color Recognition

🛈**Note**

This tool is available for color vison sensors only.

This tool relies on colors as a template for object classification and recognition. When different types of objects that have obvious color differences, this tool can be used to accurately classify objects, and output related classification information.

**Steps**

1. Click ![+] to create the color recognition model.
2. Click **Select Current** or **Select Others** to load images.
3. Click ![+] to add a label.
4. Click different tool icons to create masks.
5. Click **Add to Label** to add the sample to Label List.
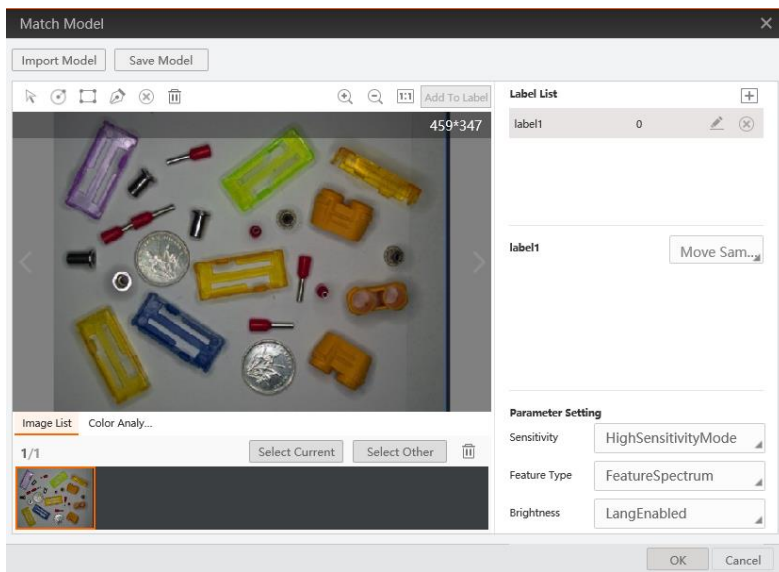


**Figure 7-28 Create Model**

One type of objects can be placed in one label, and the sample can be moved to the correct label list when the sample is incorrectly marked. You can set following parameters according to actual demands.

**Sensitivity** has 3 modes, including low sensitivity mode, medium sensitivity mode, and high sensitivity mode. It is recommended to select high sensitivity mode when the image is sensitive to external environment.

**Feature Type** includes feature histogram and feature spectrum, and feature histogram is more sensitive.

**Brightness** refers to the effect of light on the image. If you need to keep the recognition result more stable under the change of light, it is recommended to disable this parameter.

The operating parameters of color recognition tool includes **K Value** and **KNN Distance**.

**K Value** means that the category with the largest quantity in the first K samples is selected as the best recognition result.

**KNN Distance** includes Euclidean Distance, Manhattan Distance and Intersect Distance. There are slight differences among these distances, and you can select according to actual conditions, and it is recommended to use the default value.
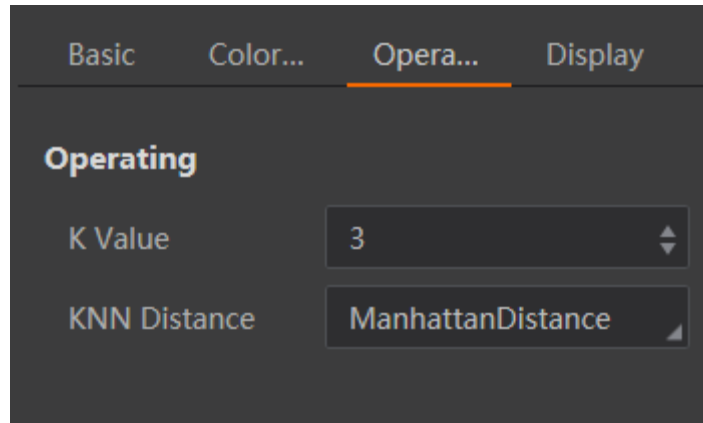
**Figure 7-29 Set Operating Parameters**

## 7.4.17 Format Tool

This tool is used to integrate and format data, and output string. In basic interface, you can click 🔗 to subscribe data that is needed formatting, click A to add text information, click ; to add semicolon, and then click **OK**.

ℹ️**Note**

When configuring multiple data, if one of data cannot be obtained, format exception may occur.

In display interface, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.
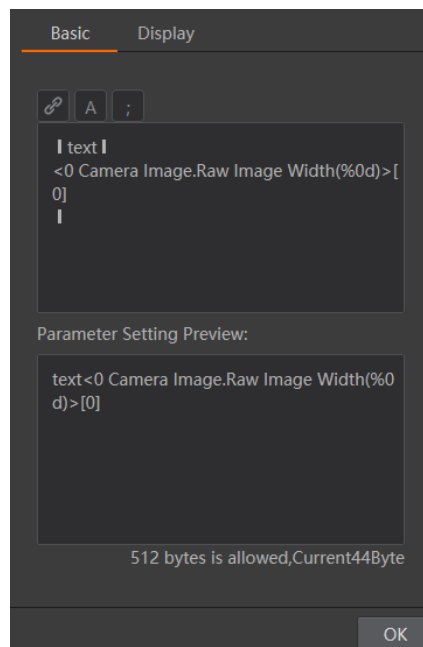


**Figure 7-30 Format Tool**

## 7.4.18 Logic Tool

This tool allows you to select different logical operation types and execute logic operation. Select **AND**, **OR**, **NOT**, **NAND** or **NOR** as **Logical Operation Type**, and click 🔗 to link data source or enter data directly. You can also click ⊞ to add multiple data.

**⌷ᵢNote**

If there is logic module in the solution, you can go to **Solution → Others → Solution Result** to link the result of logic tool to the solution.
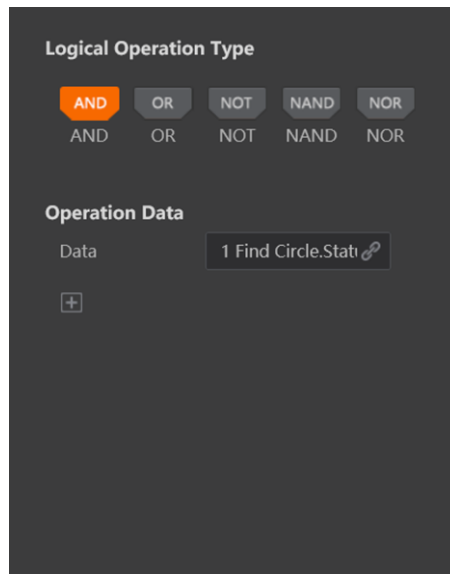


**Figure 7-31 Logic Tool**

# 7.5 Communication Settings

The communication settings determine how the device outputs data, and you can go to **Solution → Output** to select different communication tools according to actual demands.

## 7.5.1 UDP

In basic parameter interface, set output information as **Input Variable**, and enter **Local IP**, **Local Port**, **Target IP** and **Target Port** according to actual solution demands.

**⌷ᵢNote**

**Input Variable** currently supports format result data only.

In display interface, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.
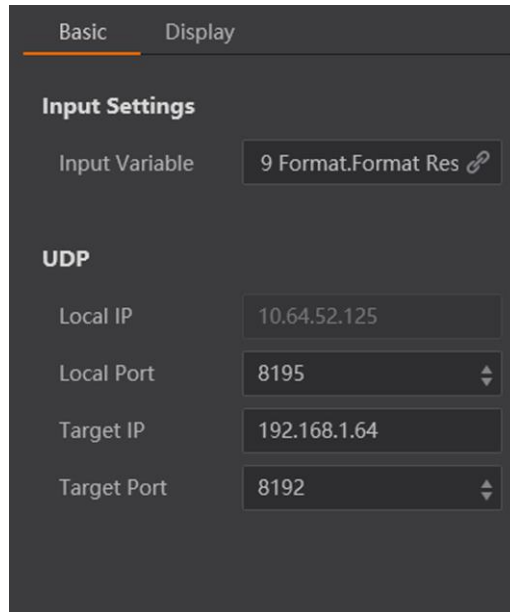
**Figure 7-32 UDP**

## 7.5.2 TCP Client

In basic parameter interface, set output information as **Input Variable**, and enter **Target IP** and **Target Port** according to actual solution demands.

ⓘ**Note**

**Input Variable** currently supports format result data or result of other communication tools.

In display interface, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.
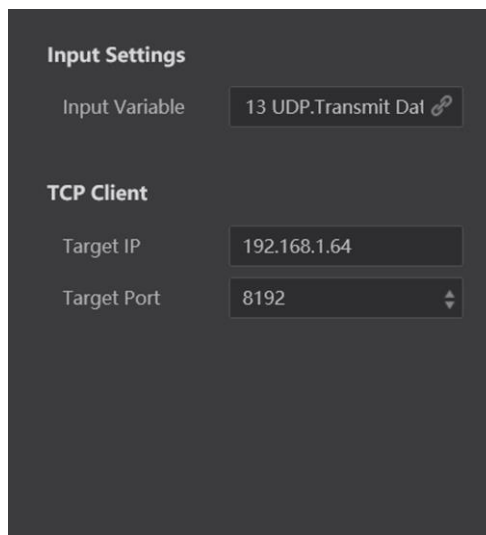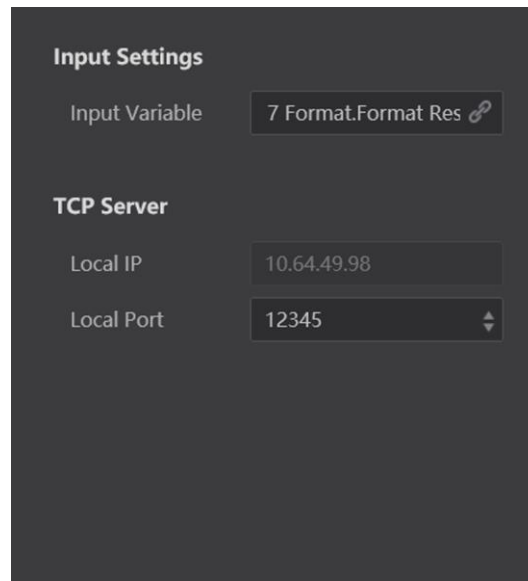


**Figure 7-33 TCP Client**

## 7.5.3 TCP Server

In basic parameter interface, set output information as **Input Variable**, and enter **Local IP** and **Local Port** according to actual solution demands.

⬛ⁱNote

**Input Variable** currently supports format result data or result of other communication tools.

In display interface, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.



**Figure 7-34 TCP Server**

## 7.5.4 Serial

In basic parameter interface, set output information as **Input Variable**, and enter **Serial Port Mode**, **Baud Rate**, **Parity Bit** and **Stop Bit** according to actual solution demands.

⬛ⁱNote

● **Data Bit** is 8 by default, and it can be read only.
● **Input Variable** currently supports format result data or result of other communication tools.

In display interface, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.
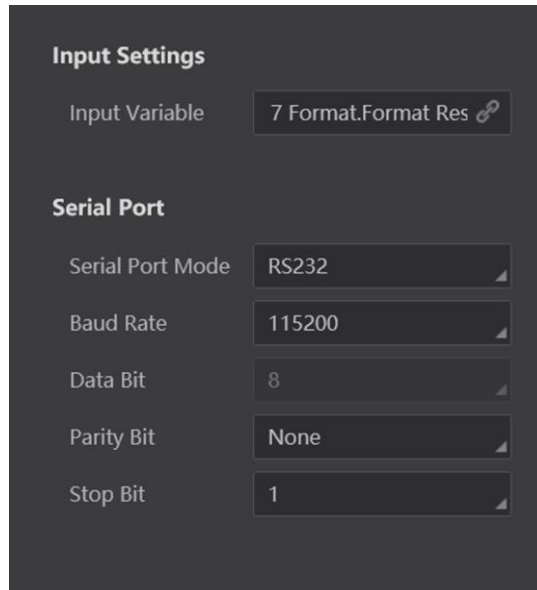
**Figure 7-35 Serial**

## 7.5.5 IO Communication

The IO communication allows you to output solution result via IO. The device has 3 configurable outputs, including IO5, IO6, and IO7. You can also go to **Solution → Camera → Trigger → Digital IO Control**, select **LINE2**, **LINE3**, or **LINE4** as **IO Control**, and select **OUTPUT** as **IO Mode** to add line to IO communication.

ⓘ**Note**

One IO module can set multiple IO statuses, but one solution supports one IO module at most.

**Output Condition**

It links the results of previous module.

**Duration**

It refers to the duration of outputting IO signal.

**Delay Time**

It refers to the waiting time after the vision sensor receives IO output signal.

**Valid Electrical Level**

The default value means the level low. You can select **Reverse** to reverse electrical level.

**Output Type**

It includes **Output (OK)** and **Output (NG)**. **Output (OK)** means when the solution result is OK, the device will output. **Output (NG)** means when the solution result is NG, the device will output.

**NPN/PNP**

It sets output signal as **NPN Mode** or **PNP Mode**.
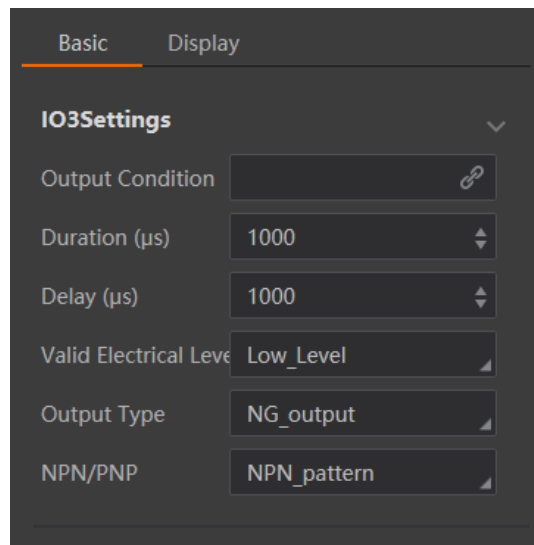


**Figure 7-36 IO Communication**

In display interface, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

## 7.5.6 FTP

In FTP communication, set the image file of the device as **Image Source**, and set the previous module status as **Input Status**.
When using FTP as communication tool, you need to set target IP, target port, user name, password, image saving, frame index, result, start tag and end tag, and separator according to actual solution demands.

**Target IP and Port**

It refers to the IP and Port of FTP server.

**User Name**

Enter user name to log in FTP.

**Password**

Enter password to log in FTP.

**Image Saving**

It sets when to save images. It includes **Not Save Image**, **Save Image (OK)**, **Save Image (NG)**, and **Save Image (OK&NG)**.

**Frame No.**

If you use image saving function, you can enable frame index to save the image frame number.

**Result**

If you use image saving function, you can enable result to link input status result.

**Start Tag and End Tag**

It refers to the start and end tag of image name. You can enter lowercase and uppercase letter, digit, and @ # ^ & () - _ = + . , ; '.

**Delimiter**

It is used to separate each content like image frame number, start and end tag. You can enter lowercase and uppercase letter, digit, and @ # ^ & () - _ = + . , ; '.

**FTP Connection Detection**

You can click **Connection Detection** to detect FTP connection status.



**Figure 7-37 FTP**

# 7.5.7 Modbus

Modbus is a communication protocol developed by Modicon systems. In simple terms, it is a method used for transmitting information over serial lines between electronic devices. The device requesting the information is called the Modbus Master and the devices supplying information are Modbus Slaves.

☐**Note**

The device is Modbus slave, and its port is 502.

Refer to the table below for specific parameter description.

**Table 7-2 Parameter Description**

| Parameter | Description |
|---|---|
| Input Settings | |
| Input Variable | It currently supports format result data or result of other communication tools. |
| Basic Info. | |
| Local IP | It refers to the IP address of the vison sensor. |
| Modbus Port | It is 502 by default. |
| Control Settings | |
| Add. Space | It is holding_register by default. |
| Add. Deviation | It refers to the address deviation, and ranges from 0 to 900. |
| Data Quantity | It is 2 by default. |
| Status Settings | |
| Add. Space | It is input_register by default. |
| Add. Deviation | It refers to the address deviation, and ranges from 0 to 900. |
| Data Quantity | It is 2 by default. |
| PLC Input Settings | |
| Add. Space | It is input_register by default. |
| Add. Deviation | It refers to the address deviation, and ranges from 910 to 2000. |
| Data Quantity | It is 2000 by default. |
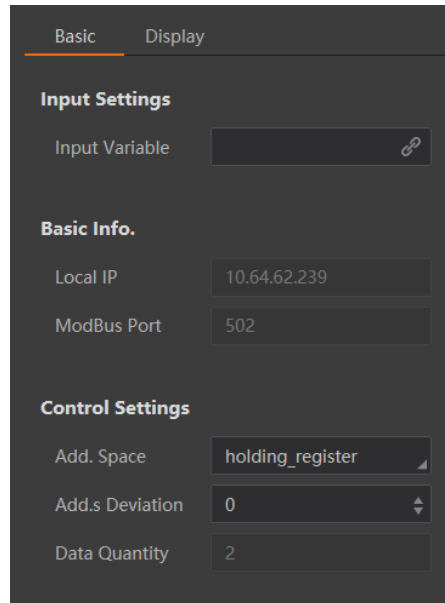
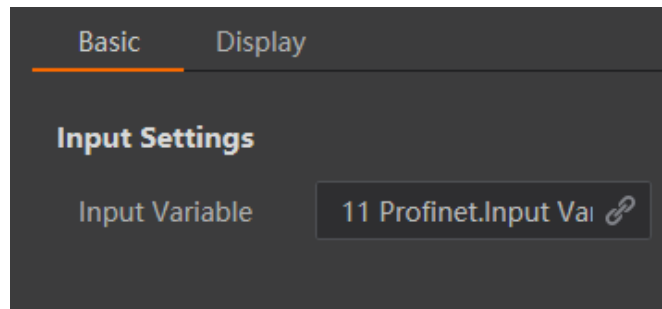**Figure 7-38 Modbus**

In display interface, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

## 7.5.8 Profinet

Profinet is an industry technical standard for data communication over industrial Ethernet, designed for collecting data from, and controlling equipment in industrial systems, with a particular strength in delivering data under tight time constraints.

In basic parameter interface, you should enter **Device Name** according to actual demands.
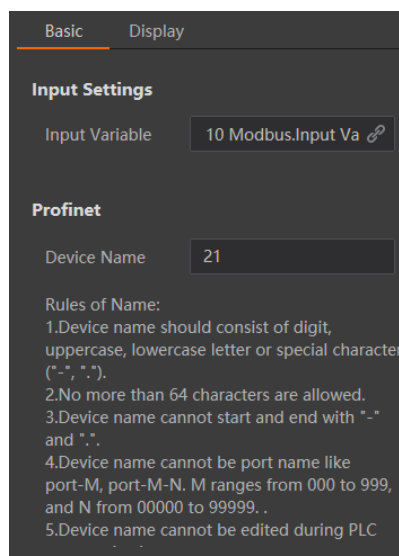


**Figure 7-39 Profinet**

In display interface, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

## 7.5.9 Ethernet/IP

Ethernet/IP is a network communication standard capable of handling large amounts of data at speeds of 10 Mbps or 100 Mbps, and at up to 1500 bytes per packet. It is an an application layer protocol, and is especially popular for control applications.

After completing settings in PLC, you can use the Ethernet/IP communication to link the result data, and run the solution continuously.



**Figure 7-40 Ethernet/IP**

In display interface, enable **Display Text** to set text's color, front size, transparency, position X, and position Y.

# 7.6 Solution Completion

The others module, you can set solution name and save solution, set solution running interval and permission assignment, etc.
In **Save Solution**, you can enter a solution name.

ⓘ**Note**

After creating a new solution, if you do not change the default solution name (Untitled), you cannot save it.

In **Enable Running Items**, you can set the solution continuous running interval.

ⓘ**Note**

It only takes effect when the **Trigger Mode** is **OFF**.

If you have enabled technician permission, you can check **All** in **Permission Assignment** to open all modules to technician, or check specific ones to assign them to technician.

⌐**i**Note

You need to go to **System → User Management → Technician → Technician Permission** to enable technician permission first.

In **Solution Result**, if you have used a logic tool in your solution, you can view and link the result of logic module to the solution.
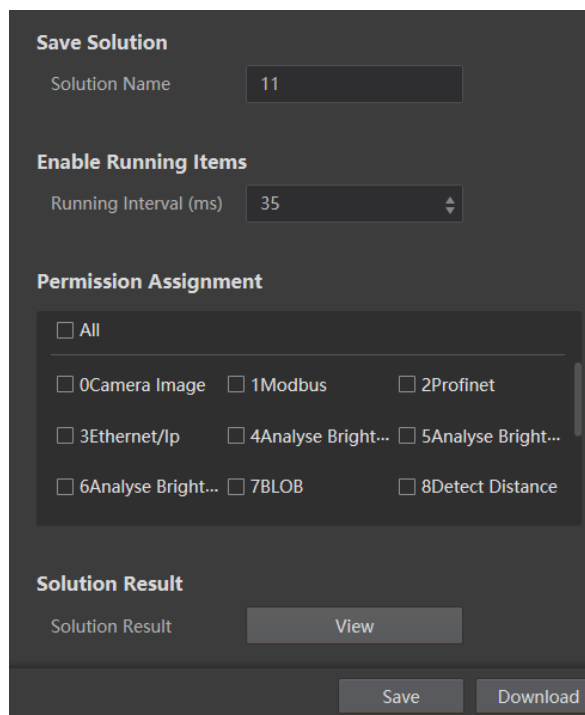
⌐**i**Note

You can link only one logic module result at one time.

After editing solution name, setting continuous running interval, and so on, you can click **Save** to save the solution, or click **Download** to download the solution to the PC.



**Figure 7-41 Solution Completion**

# Chapter 8 Solution Operation

In basic information module, you can operate and switch different saved solutions, view device information, etc.

## 8.1 Control Solution

The solution control is used to control solution operation or not, and display solution result.



**Figure 8-1 Control Solution**

**Table 8-1 Icon Description**

| Icon | Description |
|---|---|
| ⊙ | Click it to start solution operation for once only. |
| ⊙ | Click it to start solution operation continuously. |
| ⊙ | Click it to end solution operation. |
| OK / NG | It displays the operation status of the solution.<br>● When logic tool is not selected, the system displays the result of all modules operation and calculation. If the result is 0, the system displays NG. Otherwise, the system displays OK.<br>● When logic tool is selected, the system displays the result of logic tool you selected. |

## 8.2 View Solution Status

The solution operation information module records and displays the solution name, running time, detection quantity, and NG quantity in real-time.
You can view and edit the solution name. Click ✎ to edit solution name.

---

**ⓘNote**

If it is a newly created solution, the solution name is **untitled** by default. You cannot edit unnamed solution name here.

---

Run time refers to the device running time from powering on to current solution operation. When the solution is not operating, operating time stops. When the solution continues to operate or load other solutions, it continues to operate.

Total refers to the total quantity of detected image from device powering on to now. Click ![icon] to reset total quantity and NG quantity. If the device is acquiring images, and resetting will stop device acquisition.

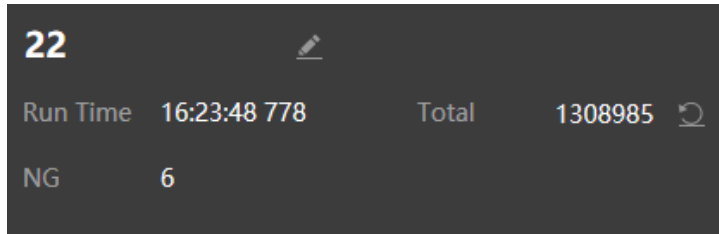NG refers to the total quantity of image with NG result from device powering on to now.



**Figure 8-2 View Solution Status**

# 8.3 Manage Solution

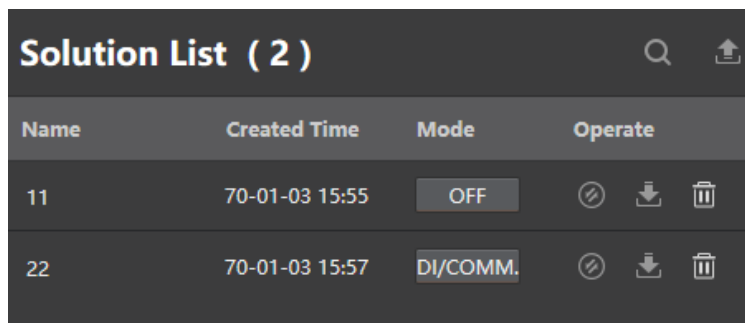The solution management module can set and switch among multiple solutions.



**Figure 8-3 Manage Solution**

**Table 8-2 Icon Description**

| Icon | Description |
| --- | --- |
| Q | You can search the solution here if there are many solutions. |
| ⬆ | Click it to upload local solutions to the device. |
| New | Click it to create a new solution. |
| ⊘ | Click it to execute the selected solution. |
| ⬇ | Click it to download the current solution to the PC. |
| 🗑 | Click it to delete the selected solution. You cannot delete the executing solution. |
| DI / COMM. / DI/CO… / OFF | The device has 4 ways to switch solution, including **DI**, **COMM.**, **DI/COMM.**, and **OFF**. |

The **DI** stands for digital IO, and it switches solution via external trigger signal. The trigger source includes line 0, line 1, line 2, line 3, line 4 and button. After enabling **DI**, set **Trigger Source** and **Trigger Type**, and enter **Filter Time** according to actual demands.

📖ℹ️**Note**

For line 2, line 3, and line 4, go to **Digital IO Control → IO Mode** to set them as input first.
Each trigger source can link one solution only.
If the duration of trigger signal is smaller than filter time, and this trigger signal is ignored.
When specific trigger source is used in DI for switching solutions, you cannot use it as a trigger source for triggering device to acquire images.

**COMM.** stands for communication, and it switches solution via communication string. Go to **Output** to select communication tool to receive strings, and set related parameters. **DI/COMM.** refers to use both digital IO and communication string to switch solution. **OFF** refers to disable solution switch function.

# 8.4 View Camera Info

In device information area, you can view the device serial number, MAC address, subnet mask, firmware, and edit user ID or IP address.

📖ℹ️**Note**

Before editing IP address, you need to stop solution operation first. After editing, the device will reboot automatically, and you may enter new IP address in web browser to log in again.
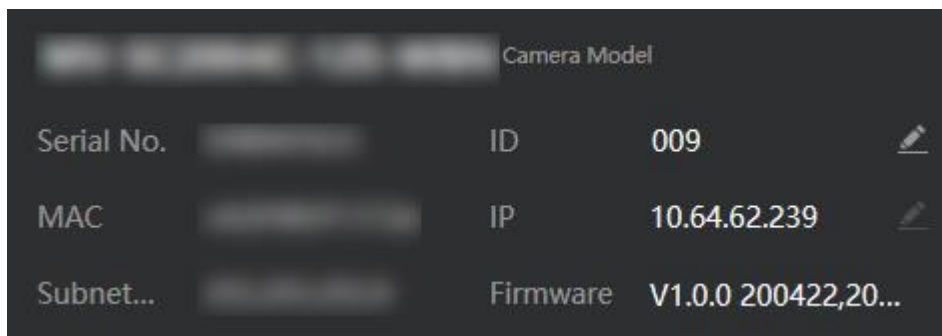


**Figure 8-4 View Camera Info**

# 8.5 Operate Image

After setting device parameters, click ⊙ or ⊙ to run solution, and the device starts to acquire images. The function of different icons in the image display area is shown below.

**Table 8-3 Icon Description**

| Icon | Description |
|------|-------------|
| 📷 | Click it to download the image to the PC. The default format is JPG. |
| 🔍 | Click it to zoom out the displayed image. |
| — 100% — | It displays the current image-scaling ratio. |
| 🔍 | Click it to zoom in the displayed image. |
| 1:1 | Click it to set image size as 1:1. |
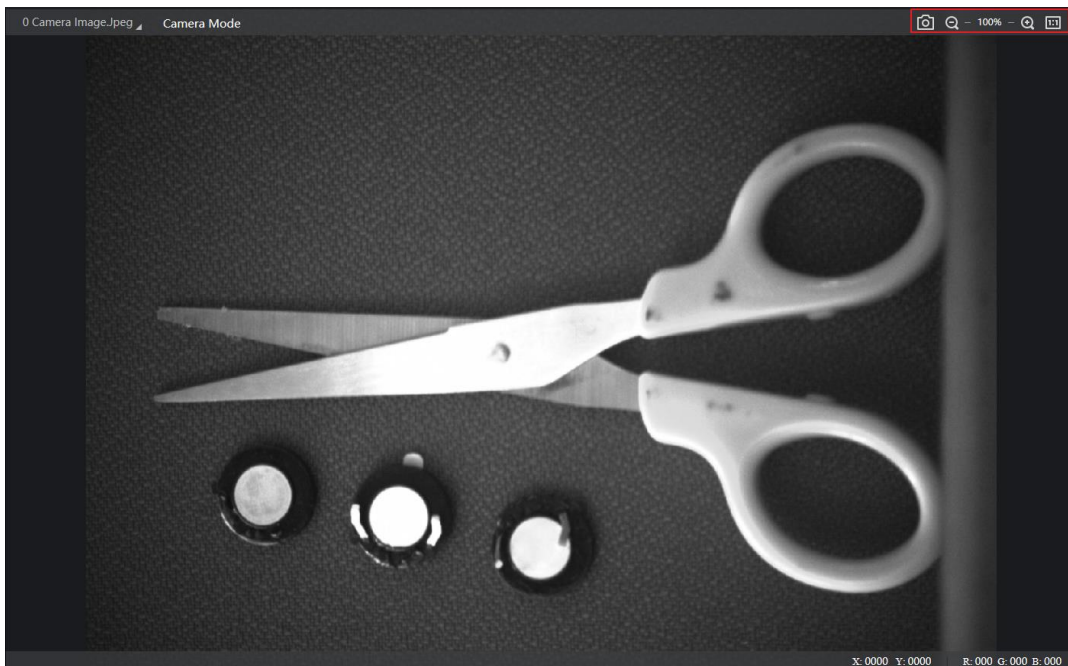


**Figure 8-5 Image Display Area**

# Chapter 9 System and Maintenance

## 9.1 Permission and Password Management

In user management module, you can edit administrator password, set technician password and permission, etc.

### 9.1.1 Set Admin Password

User management module allows you to edit admin password, set technician password and its permission to different operation modules.

ⓘNote
- Only the admin has the permission to access to user management module. If you log in as technician, there is no this module.
- The admin can access to all operation and tool modules via web, and assign module operation permission to technician, while technician can access to and set module parameters assigned by the admin only.
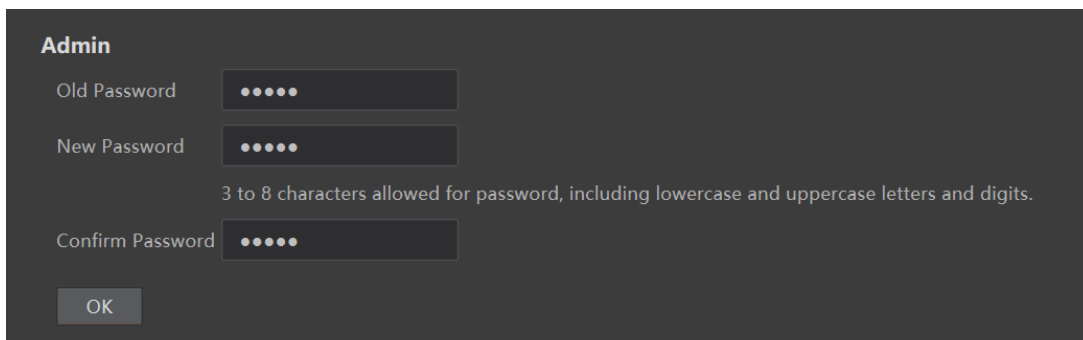- The default admin password is Abc1234.

Click **User Management**, enter **Old Password**, **New Password**, **Confirm Password**, and Click **OK**.

ⓘNote
After editing admin password, you need to log in again.



**Figure 9-1 Set Admin Password**

### 9.1.2 Set Technician Permission and Password

When logging in as admin, you have the permission to set technician password and its permission

to different operation modules.

ℹ️**Note**

● The admin can access to all operation and tool modules via web, and assign module operation permission to technician, while technician can access to and set module parameters assigned by the admin only.
● If the technician permission is not enabled, you cannot log in as technician via web.
● The default technician password is Abc1234.

Click **User Management**, enable **Technician Permission** to enable technician permission, enter **Technician PWD**, and click **OK**.
You can check **Assign Permission to Technician** in respective module to assign module operation permission to technician, or go to **Solution → Others → Permission Assignment** to assign permission to the technician.
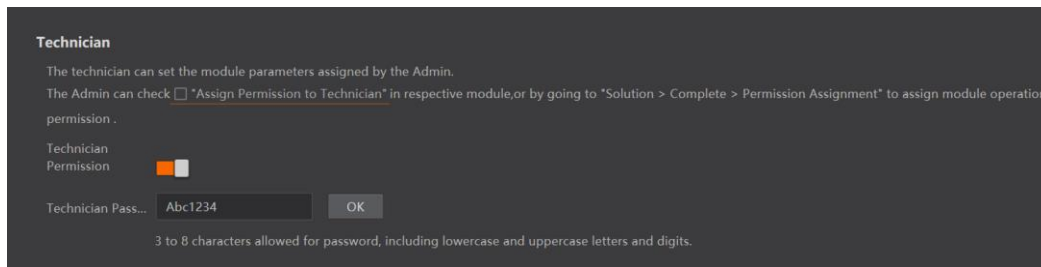


**Figure 9-2 Set Technician Permission and Password**

# 9.2 Image Saving Management

Image saving management allows you to search, delete, download, and import images that are saved via the image saving tool.
You can set specific time range to search images, and click **Search** to search images. If you want to delete, download or import images to test library, check images first, and click **Delete Image**, **Download Image** or **Import to Test Library** correspondingly.
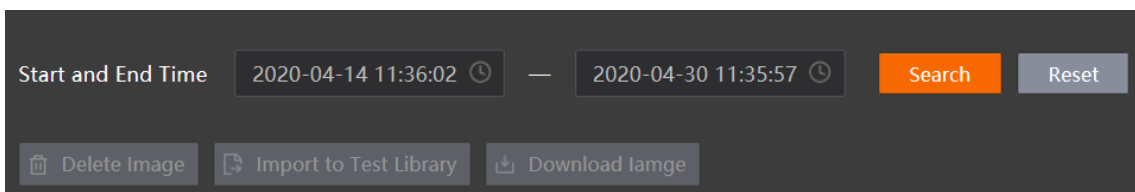


**Figure 9-3 Image Saving Management**

# 9.3 Test Library Management

Test library management allows you to use test images when run different solutions, and set

image related parameters.

There are 2 ways to import test images, uploading local images and importing camera images. Click **Upload Local Image** to upload images from the local PC, and images of RAW, BMP and JPEG format are supported. You can also compress image into ZIP format and upload it. Or click **Import Camera Image** to import camera images into the test library.

After importing images, you can select image types, click **Search** to search images, or click **Reset** to reset image types.

You can enable **All** to let all searched imaged be used as test images, or enable images separately to be used as test images. After that, you should enable **Image Test** and the device will use the images you selected to run solutions.
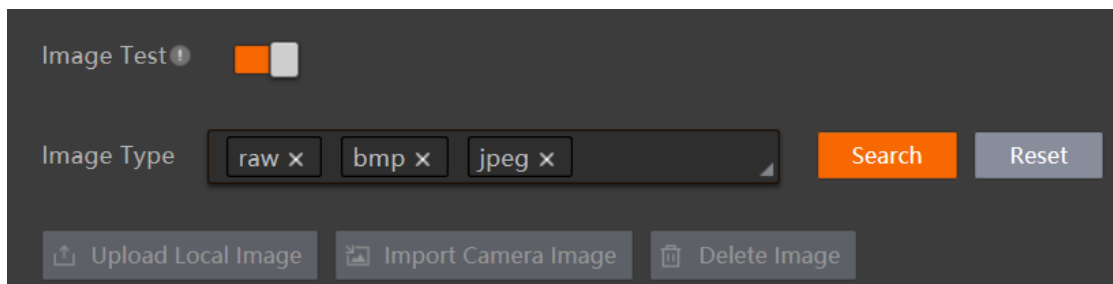


**Figure 9-4 Test Library Management**

# 9.4 Synchronize Time

Time synchronization allows you to synchronize device time with that of local PC or server. It consists of auto mode by Network Time Protocol (NTP) server and manual mode.

**Steps**

1. Click **System → Time Sync.**
2. Select time synchronization method.
   – Click **Manual**, select date and time from the calendar, or check **Sync. With PC** to synchronize the time of the device with that of the local PC.
   – Click **NTP**, enter **Server Add.**, **NTP Port**, and **Interval (Hour)**.
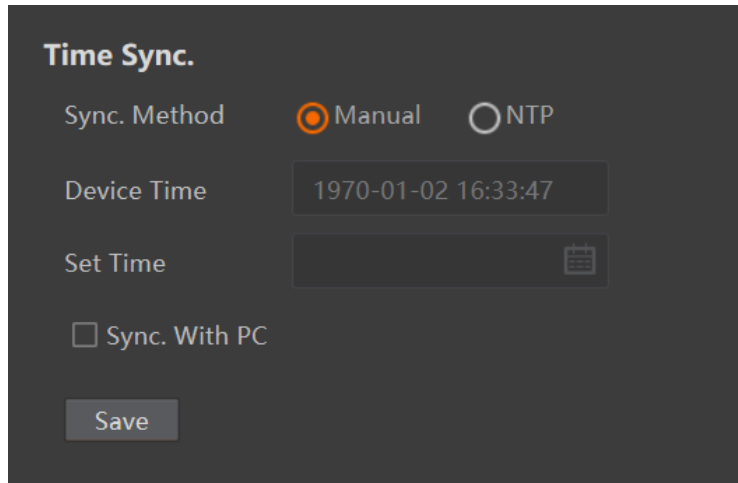3. Click **Save**.

**Figure 9-5 Time Synchronization**

## 9.5 System Maintenance

System maintenance allows you to update firmware, restore factory, and reboot device. Firmware updating allows you to view current device firmware version, and update firmware.

> **⌑ℹNote**
> ● Make sure the device and solution stop operation when updating the firmware.
> ● After updating, the device will automatically reboot, and the web will automatically jump to login interface.
> ● Only the admin can update firmware and restore factory.

You can select update file from the local PC, and click **OK** to update firmware.
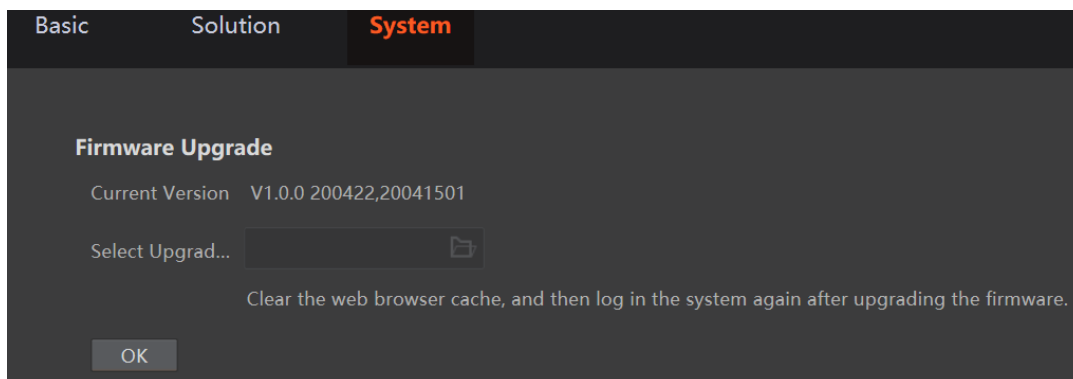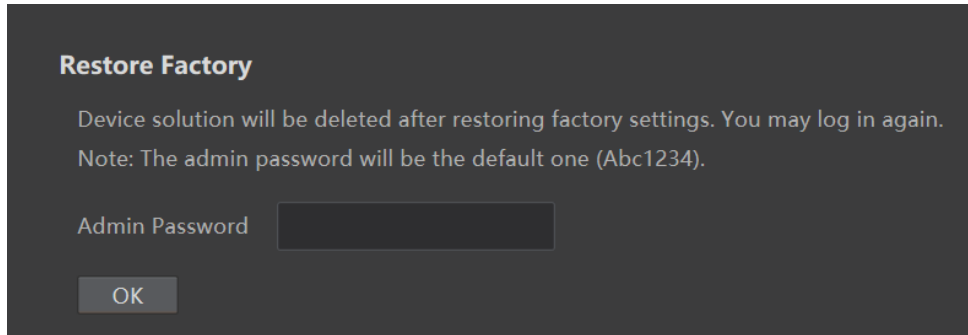


**Figure 9-6 Update Firmware**

If you want to restore the device to factory settings, enter **Admin Password** and click **OK**.
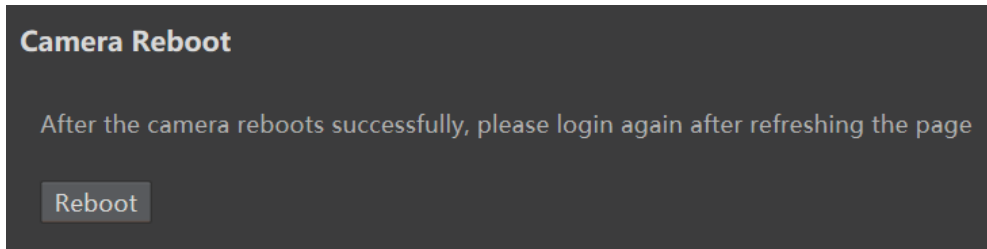
**Note**

Device solutions will be deleted after restoring defaults. You may log in again, and the admin password will be the default one (Abc1234).
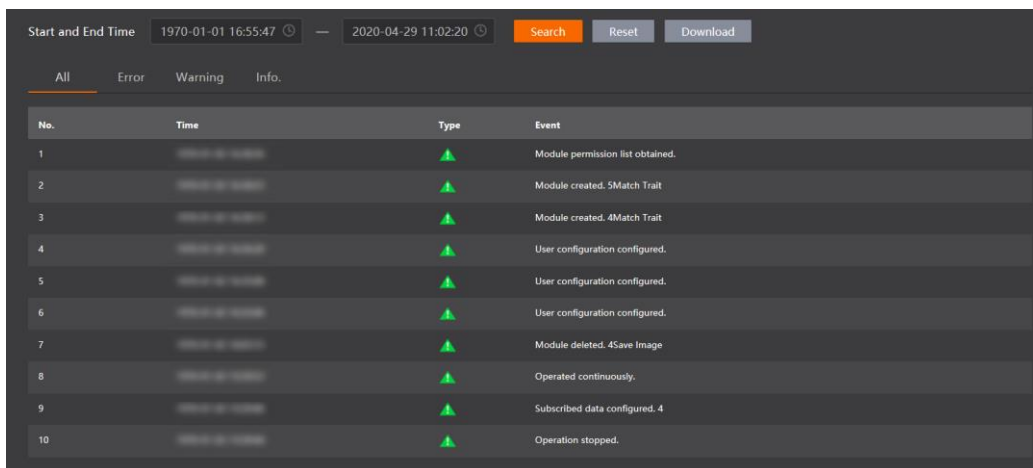


**Figure 9-7 Restore Factory**

You can also click **Reboot** to reboot the device.



**Figure 9-8 Reboot Device**

# 9.6 View Log

Log module allows you to view device and web operation records, and search and download logs.



**Figure 9-9 View Log**

## 9.7 View System Version

About and help module allows you to view the firmware version, and web version.

# Chapter 10 FAQ (Frequently Asked Question)

## 10.1 Why the client software cannot list cameras?

### Reason

- Device is not started up normally.
- Network connection exception occurs.

### Solution

- Check device power wiring (observe PWR indicator).
- Check network connection (observe LNK indicator). Ensure the device and the PC are in the same network segment.

## 10.2 Why the image is not smooth in live view?

### Reason

The network transmission speed is not up to 100 Mbps.

### Solution

Check if the network transmission speed is up to 100 Mbps.

## 10.3 Why the image is very dark?

### Reason

- The brightness of light source is not enough.
- Exposure and gain values are too small.

### Solution

- Increase the brightness of light source, or use brighter lamps.
- Increase exposure and gain values according to actual demands.

## 10.4 Why there is no image in live view?

### Reason

- Although trigger mode is enabled, there is no trigger signal.

● The network transmission speed is not up to 100 Mbps.

**Solution**

● Send trigger signal to device, or disable trigger mode.
● Check if the network transmission speed is up to 100 Mbps.

# 10.5 What can I do if I forget the login password?

**Solution**

Click **Forget Password** in login window to view the device serial No., and mail it to the technical support personnel to get the corresponding resetting file. After that, click **Import** to import the resetting file and reset the admin password.

# Chapter 11 Revision History

**Table 11-1 Description**

| No. | Version No. | Document No. | Date | Revision Details |
|---|---|---|---|---|
| 1 | 3.0.0 | UD19529B | May 8, 2020 | • Modify Section Access Device via Web Browser.<br>• Add Section P2L Measure.<br>• Add Section Image Savings.<br>• Add Section N-point Calibration.<br>• Add Section Coordinate Conversion.<br>• Add Section Color Extraction.<br>• Add Section Color Measurement.<br>• Add Section Color Conversion.<br>• Add Section Color Recognition.<br>• Modify Section Format Tool<br>• Add Section Modbus.<br>• Add Section Profinet.<br>• Add Section Ethernet/IP. |
| 2 | 2.0.2 | UD17329B | Nov. 22, 2019 | Original version. |

See Far, Go Further