Smart Code Reader(4000 Series)

User's Manual

V1.3.1

Foreword

Overview

This manual introduces the product information, basic parameters and quick operations of the smart code reader of 4000 series (hereinafter referred to as "the Reader"). Read carefully before using the Reader, and keep the manual safe for future reference.

Safety Instructions

The following categorized signal words with defined meaning might appear in the manual.

Signal Words	Meaning
DANGER	Indicates a high potential hazard which, if not avoided, will result in death or serious injury.
WARNING	Indicates a medium or low potential hazard which, if not avoided, could result in slight or moderate injury.
CAUTION	Indicates a potential risk which, if not avoided, could result in property damage, data loss, reductions in performance, or unpredictable results.
TIPS	Provides methods to help you solve a problem or save time.
NOTE	Provides additional information as a supplement to the text.

Revision History

Version	Revision Content	Release Time
V1.1.0	First release.	
V1.2.0	Updated some functions and operations.	2022.6.1
V1.3.0	Content Optimization	2023.4.12
V1.3.1	Client manual stripping	2024.6.17

Important Safeguards and Warnings

This section introduces content covering the proper handling of the Reader, hazard prevention, and prevention of property damage. Read carefully before using the Reader, and comply with the guidelines when using it.

Operating Requirements

- Do not install or place the Reader in a location that exposes it to sunlight or heat sources. Make sure that the shell temperature is below 60 ℃.
- Keep the Reader away from dampness, dust or soot. If the Reader is not connected to a lens, close the lens cap to avoid dust.
- Install the Reader horizontally on a stable surface to prevent it from falling.
- Do not drip or splash liquid onto the Reader, and make sure that there is no object filled with liquid on the Reader to prevent liquid from flowing into it.
- Install the Reader in a well-ventilated place, and do not block the ventilation of the Reader.
- Operate the Reader within the rated range of power input and output.
- Do not dissemble the Reader.
- Transport, use, and store the Reader under the allowed humidity and temperature conditions.
- The Reader is a class I electrical appliance. Make sure that the power supply is connected to a power socket with protective earthing.

Power Requirements

- Use the power cords that are recommended for the region and conform to the rated power.
- Use the standard power adapter. We assume no responsibility for any issues caused by the use of a non-standard power adapter.
- Make sure the power supply meets the SELV (Safety Extra Low Voltage) requirements, and rated voltage conforms to the IEC60950-1 standard. The requirements of the power supply are subject to the controller label.
- Before you connect the device to its power supply, make sure the power supply is connected to an earthed power socket

Table of Contents

1 Overview

1.1 Product Introduction

The product is a fixed code reader that features high reliability and cost efficiency. The product adopts up-to-date optical design and features excellent imaging capability. It can decode one- and two-dimensional codes with high recognition rate and fast recognition speed. It also supports multiple industrial communication protocols, which meets the data transmission requirements in most industrial applications. In addition, it can work stably in harsh environments.

1.2 Product Features

- Light sources in multiple colors (red, white, and blue). You can separately control each light source or control multiple light sources at a time.
- Multiple focal lengths. Supports electronic focus and focus with one click.
- 100M industrial Ethernet port with IP65 protection.
- Various I/O ports, Ethernet, RS-232, and GPIO ports, and multiple communication protocols.
- Decoding of various types of codes and code quality evaluation.
- Deep-learning algorithms and parameter polling ensure recognition effects in complex scenarios.

1.3 Product Structure

1.3.1 Product Dimensions

The following figures show the dimensions of the product.

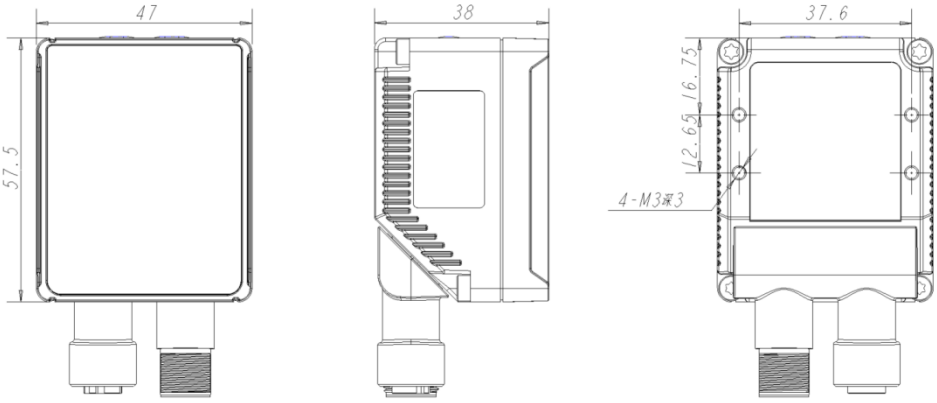


Figure 1-1 Product with vertical port (excluding port height, unit: mm)

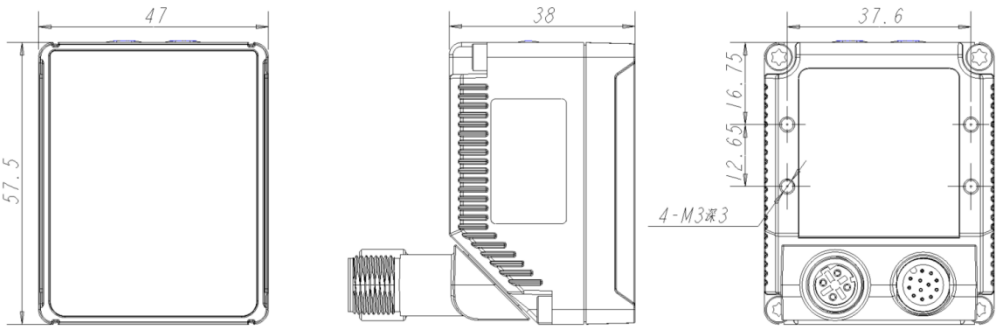


Figure 1-2 Product with rotated port (excluding port height, unit: mm)

1.3.2 Product Appearance

The following figure shows the appearance of the product.

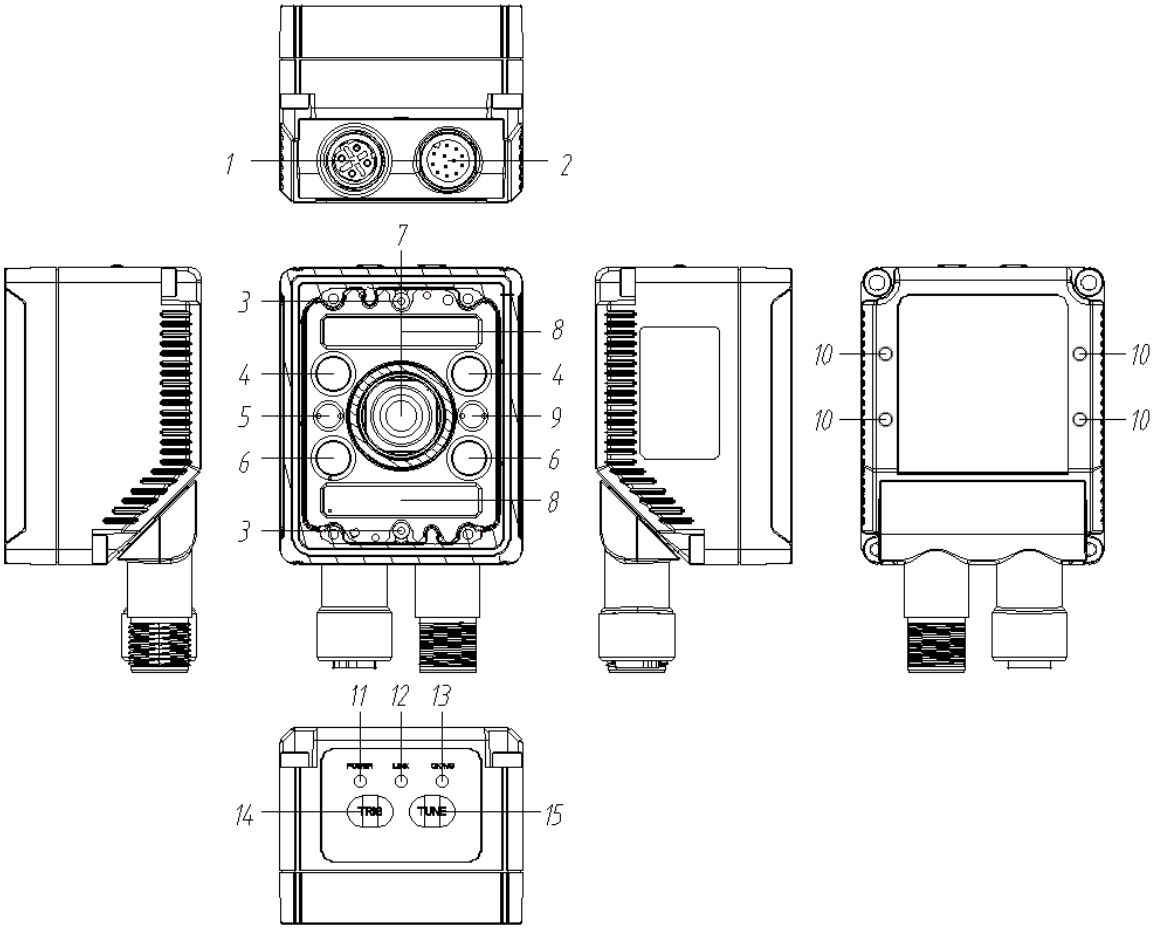
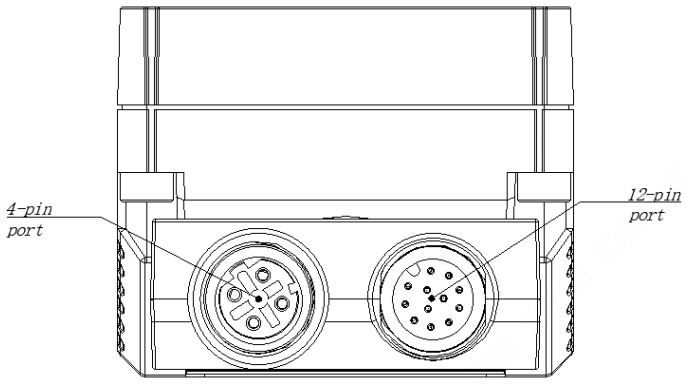


Figure 1-3 Appearance

Table1-1 Component description

No.	Port	Description
1	Network port	4-pin 100M network port
2	Power port.	12-pin I/O ports, including power supply, I/O, RS-232 serial ports, and more.
3	Sighting device	Used for positioning.
4	Polarized or non-polarized illuminator	You can turn on or turn off the illuminator based on the actual scenario.
5	Red indicator	You can configure indicator settings to control the indicator status. By default, the indicator keeps on for 3 seconds after decoding failed.
6	Polarized or non-polarized illuminator	The illuminator type varies with product models. You can turn on or turn off the illuminator based on the actual scenario.
7	Image sensor	Used to collect image data.
8	Diffuse reflection illuminator	You can turn on or turn off the illuminator based on the actual scenario.
9	Green indicator	You can configure indicator settings to control the indicator status. By default, the indicator keeps on for 3 seconds after decoding succeeded.
10	Installation hole	Used for fixing the device through M3 screws.
11	Power indicator	The indicator is in solid green if the power supply is normal. Otherwise, the indicator is off.
12	LINK Indicator	Network connection indicator. The indicator is in solid green if the network connection is normal. The indicator flashes green during data transmission.
13	Decoding indicator	The green indicator is on and the red indicator is off after decoding failed. The red indicator is on and the green indicator is off after decoding failed.
14	Trigger button	When the device is in trigger mode, you can press the button to trigger decoding.
15	Intelligent parameter setting button	Press the hold the button for 3 seconds. After the device beeps, you can start setting the parameter.

1.3.3 Description

<table>
<tr>
<td> 
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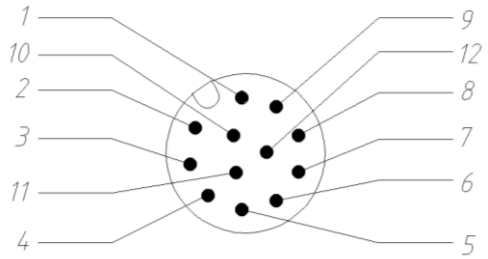
<td> 
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<tr>
<td>4-pin port: M12 D-CODE female connector, 100M network port
12-pin port: M12 A-CODE male connector, power port + trigger I/O + RS-232 serial port</td>
<td>12-pin port</td>
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</table>

Figure 1-4 Device port

The following table describes the pins of the 12-pin port.

Table1-2 Pin signal description

No.	Name	Description	Cable description	Cable color	
1	OPT_OUT2	Opto-isolated output 2	Brown or white cable		Brown and white
2	RS232_TXD	Sender of RS-232 serial port	Serial port of DB9 female connector		Gray
3	RS232_RXD	Receiver of RS-232 serial port	Serial port of DB9 female connector		Purple
4	SIGNAL_GND	Grounding of RS-232 serial port	Serial port of DB9 female connector		Black and white (bushing)
5	OPT_IN1	Opto-isolated input 1	Yellow cable		Yellow
6	OPT_IN_GND	Grounding of opto-isolated input	Purple or white cable		Purple and white
7	POWER	Power supply of the camera	DC 5.5 female connector		Red
8	POWER_GND	Grounding of camera power supply	DC 5.5 female connector		Black
9	OPT_OUT_GND	Grounding of opto-isolated output	Green cable		Green
10	OPT_IN0	Opto-isolated input 0	Orange cable		Orange
11	OPT_OUT0	Opto-isolated output 0	Blue cable		Blue
12	OPT_OUT1	Opto-isolated output 1	Brown cable		Brown
–	–	Block	–		White (bushing)

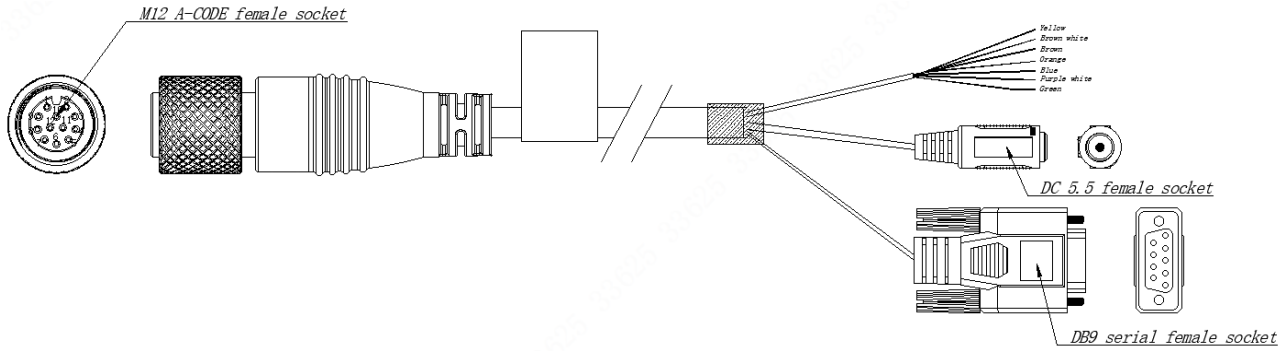


Figure 1-5 I/O cable for the code reader (4000 series)

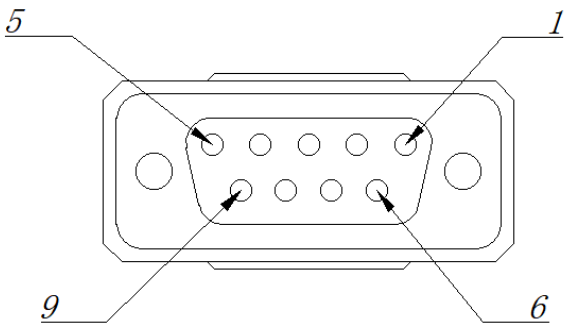


Figure 1-6 Female connector of the serial port

Table1-3 Pin signal description

No.	Name	Description	Cable color
2	RS232_TXD	Sender of RS-232 serial port	Gray
3	RS232_RXD	Receiver of RS-232 serial port	Purple
5	SIGNAL_GND	Grounding of RS-232 serial port	Black and white (bushing)

- We recommend you use the cable shown in the preceding cables.
- The pin 7 and pin 8 for power supply has been turned into a DC 5.5 female connector, so no wiring is required.
- The pin 2, 3, and 4 for the RS-232 serial port has been turned into a DB9 female serial port, so no wiring is required.
- For other pins, you can connect them to cables as needed.

2 Electrical Specifications

2.1 Electrical specifications of power supply and network port

Table2-1 Electrical specifications of power supply and network port

Parameter	Description
Power supply specifications	DC +9V～+26V, ＜ 1% ripple, connected to the 12-pin connector for power supply. At least 24 AWG cable is required.
Data output port	100M Ethernet
I/O port	1 RS-232 serial port (non-isolated) 2 opto-isolated input （LINE0 to LINE1） 3 opto-isolated output (LINE2 to LINE4)
Certifications	CE and FCC

2.2 Electrical Specifications of I/O Ports

2.2.1 Opto-isolated Inputs

Table2-2 Voltage parameters of opto-isolated input

Input voltage	Description
+26 VDC	Maximum voltage, which must be not exceeded. Otherwise, the device might be damaged.
+0~+24 VDC	Safe operating voltage input range
+0~+6 VDC	Indicates logic 0
+6~+9 VDC	The input status changes within this range, within which the logic status is unsteady.
＞+9 VDC	Indicates logic 1

Typical circuit of opto-isolated input:

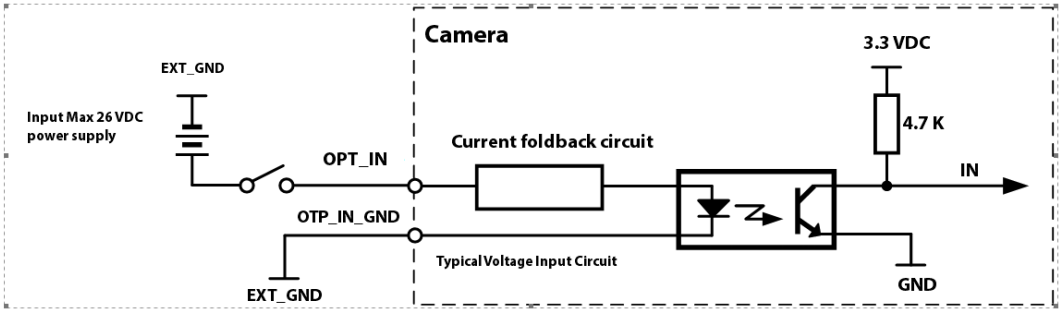


Figure 2-1 Typical circuit of opto-isolated input

The relationship between sink current and input voltage:

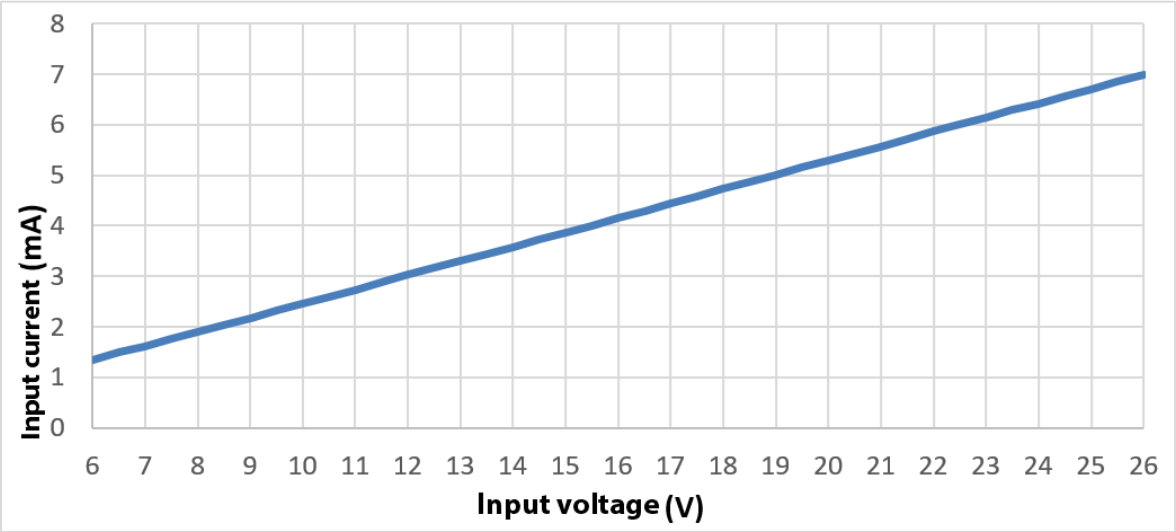


Figure 2-2 Characteristic curve of optocoupler input

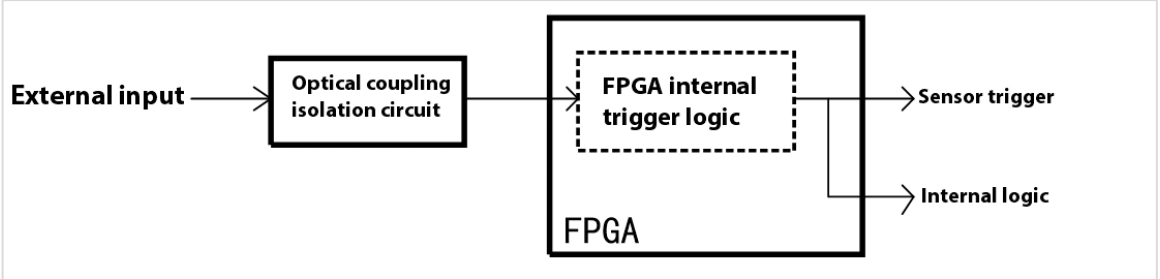
- The maximum sink current for the opto-isolator input is 7 mA.
- The values above are typical values measured at an ambient temperature of 25 ℃, and there are individual differences between different cameras.

The relationship between the input signal amplitude and trigger delay is as follows:

Table2-3 The relationship between the Optical coupling input signal amplitude and trigger delay is as follows:

Input signal Amplitude (Vp-p)	Rising Edge Rising Edge Trigger Delay tDR (us)	Falling Edge Falling Edge Trigger Delay tDF (us)
9	18.80	23.70
12	7.20	31.30
20	3.00	38.40
24	2.40	40.10
26	2.20	41.40

- The trigger delay refers to the delay input from the external opto-coupler input port to FPGA pin input, without taking the internal logic delay of FPGA in to account.



The minimum input pulse width requirements for triggering input signals are shown in the table below:

Table2-4 The minimum input pulse width requirements

Input signal Amplitude (Vp-p)	Minimum positive pulse width(us)	Minimum negative pulse width(us)
9	36.00	90.00
12	10.10	90.00
20	3.10	90.00
24	2.40	90.00
26	2.10	90.00

2.2.2 Opto-isolated Output

Table2-5 Opto-isolated Output

Voltage	Description
+26 VDC	Maximum voltage, which must be not exceeded. Otherwise, the device might be damaged.
<+3.3 VDC	The I/O output may be faulty
+3.3~+24 VDC	I/O output safe operating voltage range

Typical circuit of opto-isolated output:

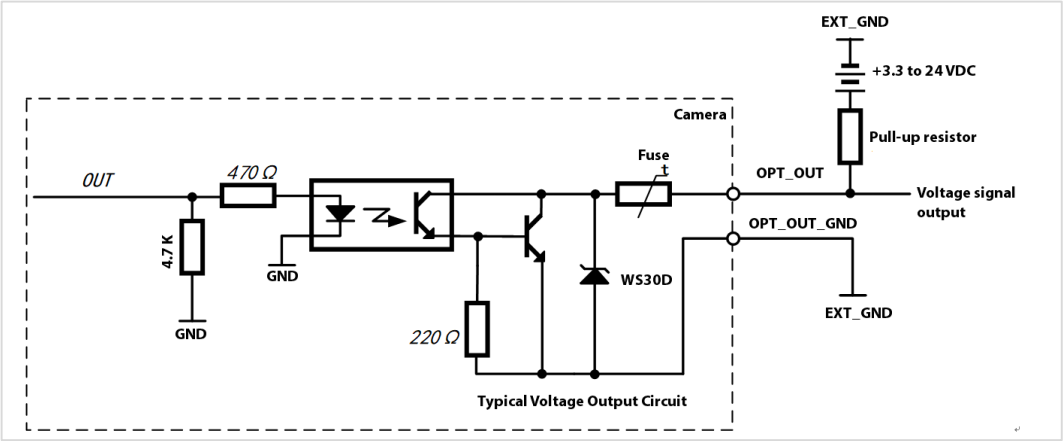


Figure 2-3 Typical circuit of opto-isolatedoutput

As shown in Table 2-6, When the 1kΩ pull-up resistor is used, the rise/fall time and rise/fall edge delay time of the output under different external power supply voltages are specified.

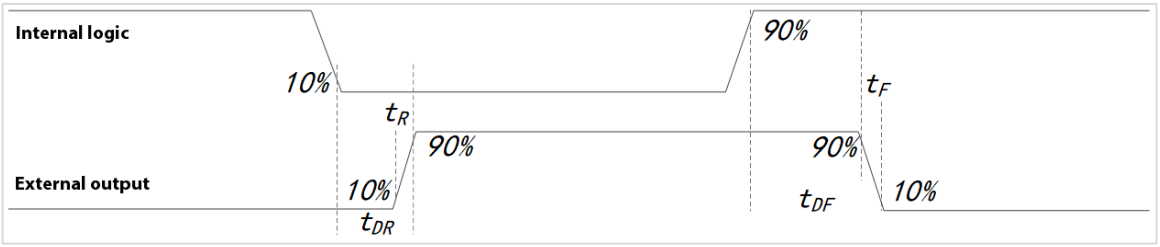


Table2-6 The relationship between the Opto-coupler output signal amplitude and trigger delay is as follows:

External Power Voltage (V)）	Rising Time tR（us）	Falling Time tF（us）	Rising Edge Rising Edge Trigger Delay tDR (us)	Falling Edge Falling Edge Trigger Delay tDF (us)
5	19.70	3.20	39.9	8.06

12	24.06	5.22	44.8	11.8
24	30.11	8.10	44.8	53.2

- The output delay refers to the delay from the internal logic output of the FPGA to the external opto-isolator output pin, without taking into account the internal logic delay of FPGA.
- The values above are typical values measured at an ambient temperature of 25 ℃, and there are individual differences between different cameras.

Relationship between opto-coupler output voltage drop and output current is shown in the following figure:

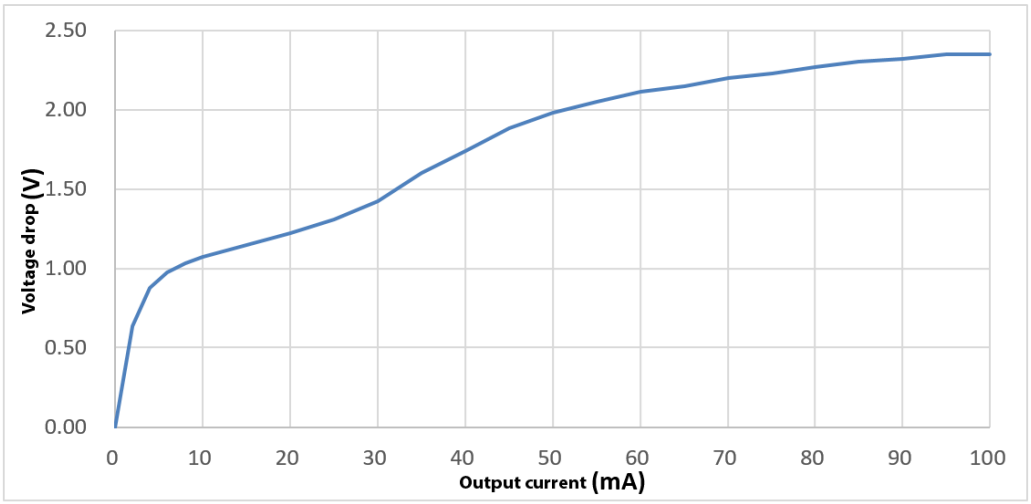


Figure 2-4 Characteristic Curve of Optocoupler Input

- The maximum on-voltage drop at the optocoupler output is 2.35 V (measured at the maximum output current of 100 mA).
- The values above are typical values measured at an ambient temperature of 25 ℃, and there are individual differences between different cameras.

2.3 I/O external cable connection

2.3.1 Opto-isolated Input

Optocoupler isolated inputs support sensors with NPN/PNP/ push-pull structure outputs.

2.3.1.1 NPN output sensor

Method1: A pull-up resistor is not added (Recommended).

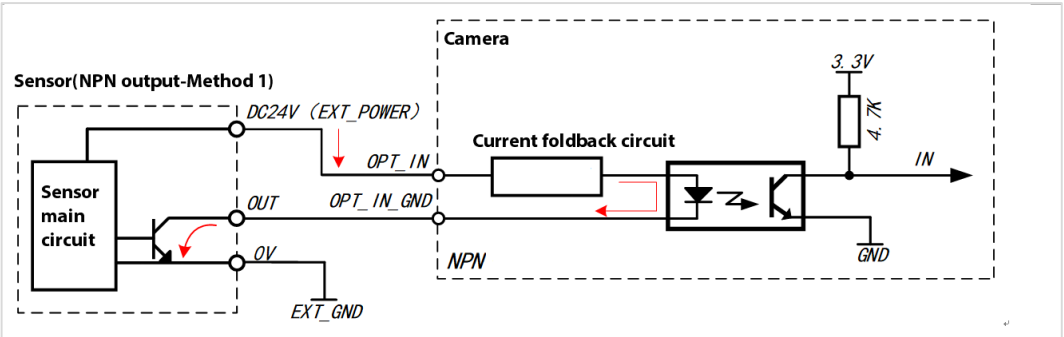


Figure 2-5 **NPN Wiring Method1:**

Method 2 :Add pull-up resistor is added.

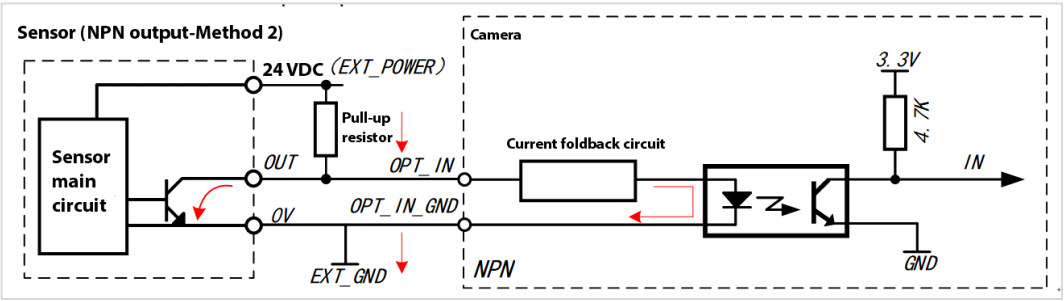


Figure 2-6 **NPN Connection mode2**

- EXT_POWER refers to the positive value of the external power supply connected to the user, and EXT_GND refers to the ground where the external power supply connected to the user is connected. They can be a single switching power supply or a sensor power supply.
- This method is suitable for the sensor with NPN open collector output structure.
- The recommended value for pull-up resistor are as follows: 1 kΩ at 3.3 V, 1 kΩ at 5 V, 2.4 kΩ at 12 V, and 4.7 kΩ at 24 V. When the output current capacity needs to be improved, the resistor can be selected below 1kΩ, but the rated power should be used above 1W.
- In some models, OPT_IN_GND and OPT_OUT_GND share the name OPT_GND.

2.3.1.2 PNP Output Sensor

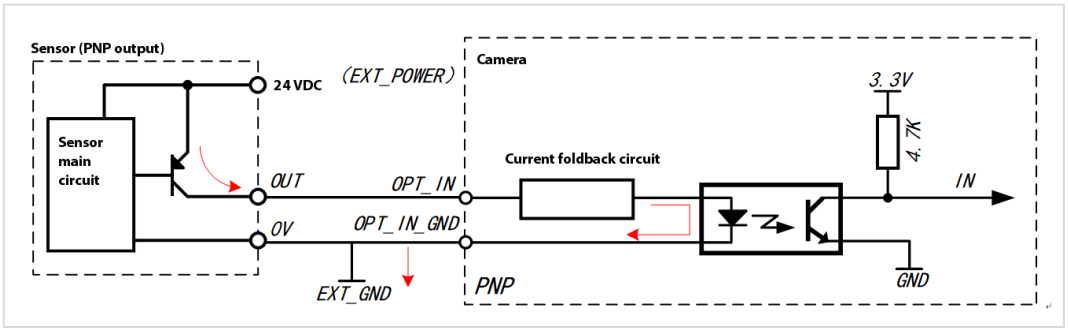


Figure 2-7 **Patch Wiring Method**

2.3.1.3 TTL outputs or push-pull outputs sensor

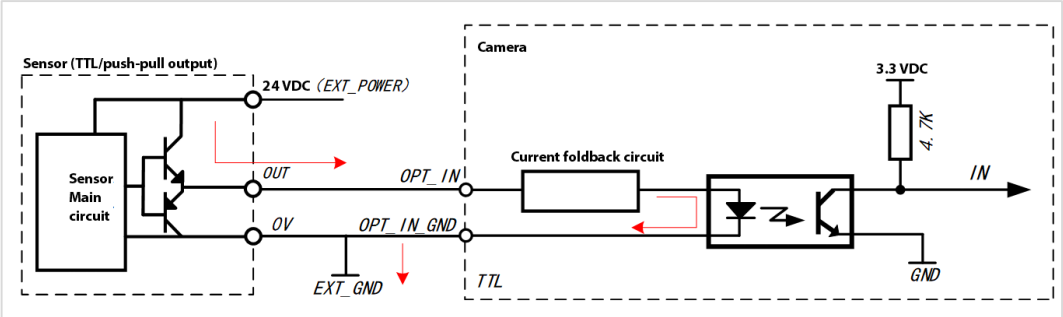


Figure 2-8 TTL/push-pull wiring method

2.3.2 Opto-isolated output

The transistor output of camera is separated from the internal loop by an opto-isolator. Therefore the transistor output can be used as NPN output or PNP output.

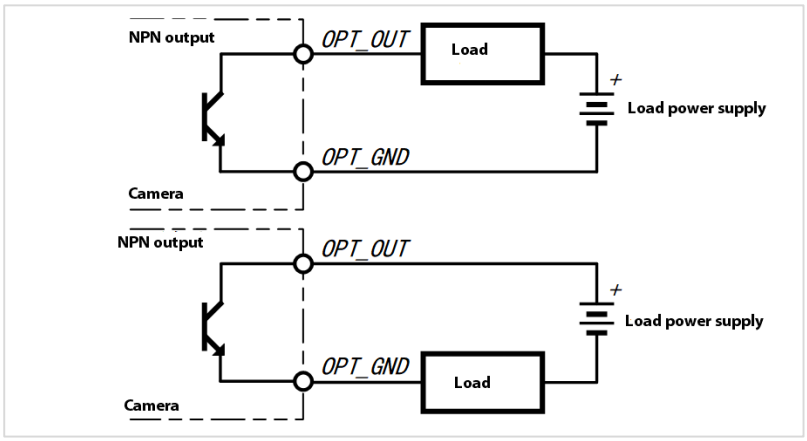


Figure 2-9 Opto output Topology

2.3.2.2 Code reader as NPN output

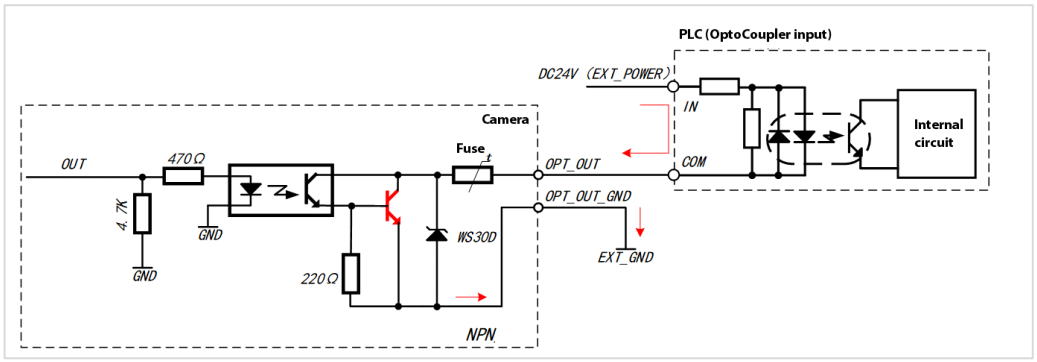


Figure 2-10 NPN Output Wiring Method

2.3.2.3 GPIO is used as an output port

When GPI0 is used as output, it is similar to optocoupler output. The main difference is that GPI0 is connected in non-isolated mode and the GPI0 signal ground is in common with the camera power supply ground.

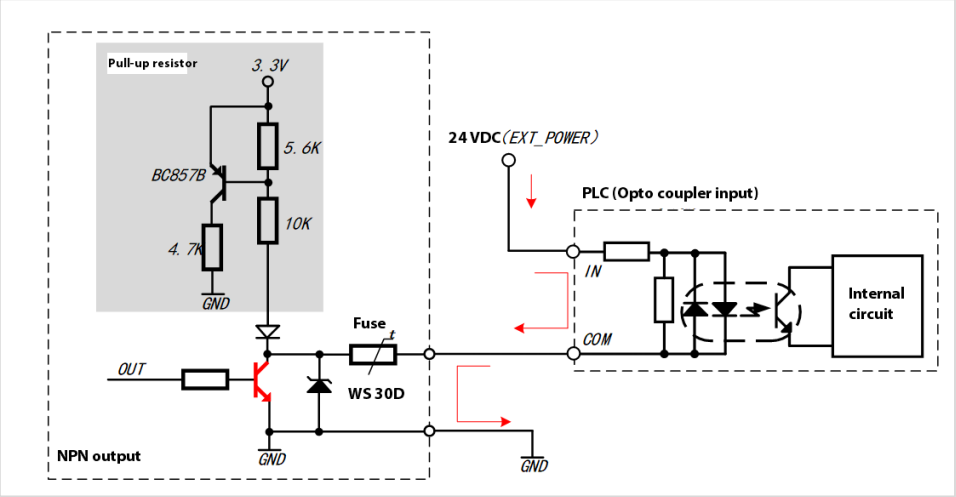


Figure 2-11 GPI0 Output Wiring Method

- Please do not apply voltage that exceeds the maximum switching capacity to the output terminal or connect a load.
- The port fuse is not a user-replaceable part. If the fuse is blown due to overcurrent such as short circuit, please contact the after-sales service.
- GPIO is a bidirectional port that must be set in the correct direction (input or output) before a external circuit is connected. Do not change the direction setting during the operation of the camera. Incorrect direction setting will damage the GPIO port circuit.
- The GPIO port is non-isolated and has poor anti-interference performance. Please do not use it in a place with serious electrical interference. You are advised to preferentially use optically-isolated input-output ports.
- The recommended resistor for the optocoupler is 1 kΩ at 3.3 V, 1 kΩ at 5 V, 2.4 kΩ at 12 V, and 4.7 kΩ at 24 V. When the output current capacity needs to be improved, the resistor can be selected below 1kΩ, but the rated power should be used above 1W.

2.3.2.4 Inductive load wiring method for relays

If the output of the camera is connected to an inductive load such as an relay, the model with a built-in fly-wheel diode must be used (or an external fly-wheel diode); otherwise, this may lead to the damage of the output port due to instantaneous overvoltage.

The following image shows an example of a DC inductive load suppressor circuit. For most applications, an additional diode A is enough, but for applications requiring rapid make-and-break, a voltage-regulator diode is recommended. Ensure that a voltage-regulator diode can meet the current requirements of the output circuit.

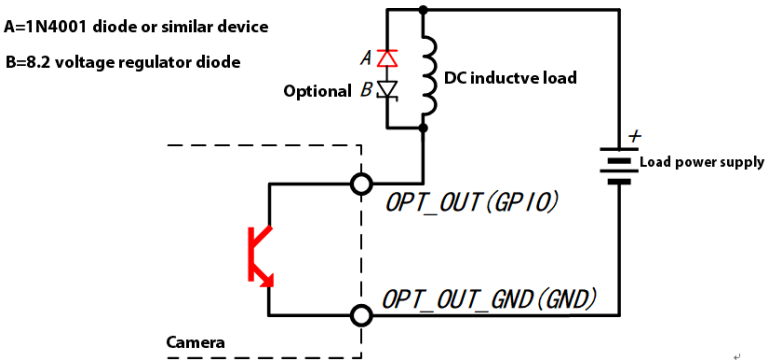


Figure 2-12 **Inductive Load Wiring Method**

2.4 How to avoid EMI and ESD?

Cameras are installed in industrial sites where equipment that generates EMI (electromagnetic interference) may exist, and are themselves susceptible to ESD (electrostatic discharge). Serious EMI and ESD can lead to false triggering or sudden stop of current sampling. EMI and ESD can also adversely affect image quality of cameras and the reliability of data transmission between camera and PC.

In order to avoid the problems mentioned above caused by EMI and ESD, customers are recommended to take the following precautions:

(1) Use high quality shielded cables, which can play a good effect on shielding EMI and ESD;

(2) Choose a cable with right length. Do not coil the excessive camera cable into a loop. If the cable is really excessively long, bend it back and forth instead of coiling into a loop.

(3) The power cord of the camera is routed in parallel with data cable;

(4) Do not route the camera cable in parallel with other high current and voltage switching cables (such as stepper motor drive and solenoid valve); Do not place the camera cable near the interference sources mentioned above;

(5) You are advised to connect all the grounding (GND) wires to a single point, i.e. single point grounding. For example, a distribution board can be used to connect the grounding wires of the whole system to a single point. This is done to avoid plenty of ground circuits (which are a major cause of EMI problems).

(6) Use a line filter for the main power supply of the camera, or use a separate power supply;

(7) Install the camera and cables as far away from spark generating equipment as possible, such as brush motor and relay. A metal shielding enclosure can be additionally used if necessary;

(8) The following measures can be taken to reduce the risk of ESD:

(8.1) The mounting surface is made of conductive material;

(8.2) The humidity in the installation environment is properly controlled. Dry air is easy to produce ESD;

3 Installation

3.1 Camera InstalltiaonInstallation Precautions

When installation, pay attention to static electricity, electromagnetic interference, lightning strike and surge as well as heat dissipation of the cameras.

3.1.1 Safety ProtectionConditions

Although the interior of the camera is designed to protect against lightning, surge, EMI and ESD, from the perspective of safety, it is necessary to avoid or reduce these effects from the installation environment and installation method.

The following is the basic protection method, please refer to methods as much as possible.

- Use shielded network cables in SSTP mode. When meeting the requirements of use, there are no requirements for the network cable, because in order to achieve good softness, the thickness of copper wire, shielding aluminum foil thickness, shielding net density, PVC outer protective performance and other aspects are not good enough.
- The network cable should be as short as possible If the cable is too long and has too much left over, use a snake pattern of wiring instead of winding the cable. This reduces the coupling of electromagnetic interference.
- The power control wire can be used with a shielded wire, and it should avoid winding. Power cables and network cables can wire in parallel. Do not intertwine.
- Power cables and network cables should be kept away from equipment with high current, high voltage, and frequent on-off and stop-start, such as stepper motors, especially the cables of such equipment and walk the line. These devices have strong electromagnetic radiation that is easily coupled to the camera's transmission line.
- The protective ground of all devices should be connected together and connected to the protective ground at a single point to avoid multiple grounding points. Multipoint grounding tends to cause voltage differences between devices and form a loop, which is prone to electromagnetic interference coupling.
- The AC power supply terminal of the switch power supply for the camera and that of the PC must come from the same AC bar. In this way, their protection ground can be connected together to avoid multi-point grounding. Do not directly use this AC power source for high-power mechanical and electrical equipment.
- Add a magnetic ring to the camera's power control line to absorb electromagnetic interference signals.
- Ensure a certain humidity, You need to wear an ESD bracelet, ESD clothes and shoes to reduce ESD damage.

3.1.2 Heat Dissipation Requirements

Environmental Requirements.

- Temperature and humidity.
  - ✧ The ambient temperature cannot exceed 50 ℃, and it is best to for the Reader to work in an air-conditioned environment.
  - ✧ The ambient humidity when the camera is working: 20%–80%, non-condensing.
  - ✧ Storage Temperature –30°C to +80°C (–30 ℉ to +185 ℉)
  - ✧ Storage humidity: 20%–80%. non-condensing.

- Do not coil the excessive camera cable into a loop. If the cable is really excessively long, bend it back and forth instead of coiling into a loop to ensure the performance of EMI.
- During transportation and assembly, it is necessary to pay attention not to bump the keys and prevent damage to the pot cover.

3.2 Hardware Installation

3.2.1 Packing list

After unpacking the box, check if there is obvious damage to the appearance of the equipment, and make sure the components are complete against the packing list, for details, seeTable3-1.

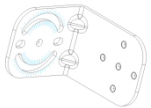
Table3-1 Parts list.

Parts List		
1	Code Reader	1
2	M3×6 cross flat tail nickel plated screw	4

3.2.2 INSTALLATION

To use the device normally, you need to prepare for the items in Table 1-3 before installation.

Table3-2 Matching Part No.

No.	Item Name	Figure	Quantity	Description
1	Smart Quick-hand Code Reader Complete machine		1	Device the manual referred to
2	Power I/O Interface Cable		1	Need to buy independently
3	Network cable		1	Need to buy independently
4	Switched-mode Power Supply or Power adapter		1	Select an appropriate power adapter or switching power supply based on the power supply and power consumption of the device. For details, see the technical specifications of the corresponding device and purchase them separately
5	Mounting Bracket		1	This device is used for fixing devices. For installation results, see Figure 3-1 and 3-2. You need to purchase the device separately
6	Switching bracket		1	Used for fixing device, combined with a fixed bracket to achieve multi-angle adjustment of the reader fixing mode.

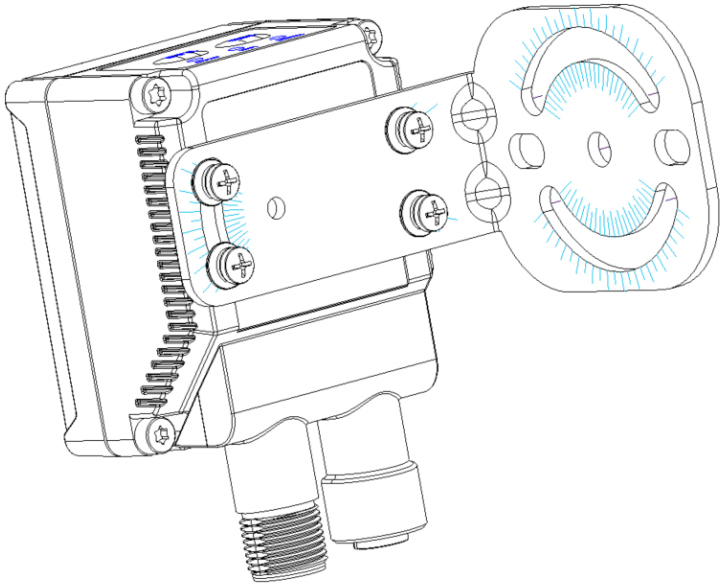


Figure 3-1 **Mounting method 1**

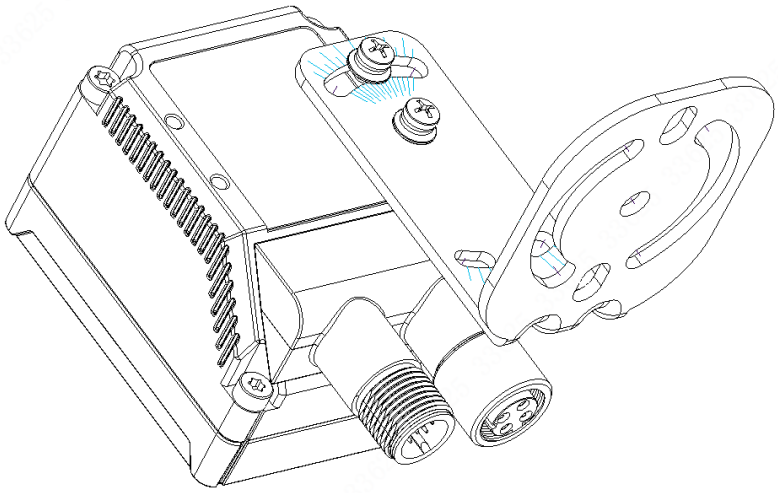


Figure 3-2 **Mounting method 2**

3.3 Network settings of computer

Select Control Panel > Network and Internet > Network and Sharing Center > Change Adapter Configuration. Select the corresponding network port and right-click Properties. The following dialog box is displayed:

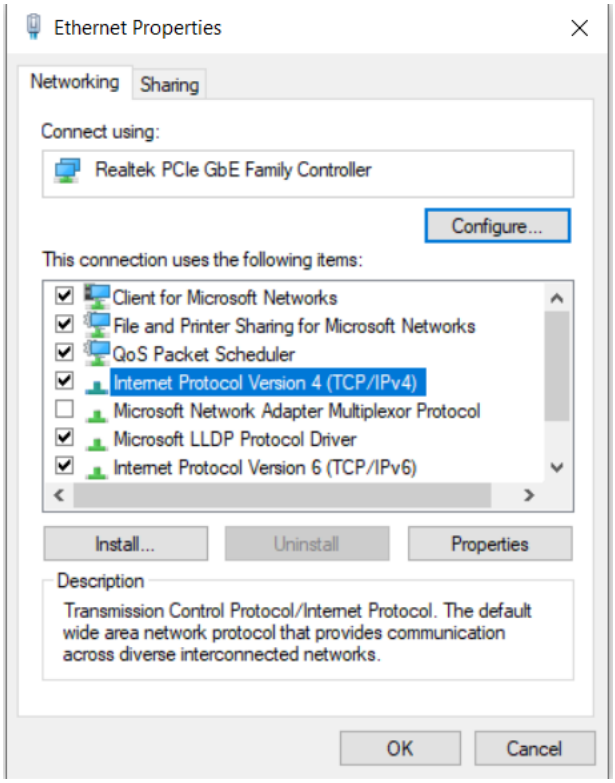


Figure 3-3 Configure network properties

Double-click Internet Protocol Version 4 in the red box in the figure. The IP address setting page is displayed. Configure the network port to automatically obtain an IP address or a static IP address, as shown in the following figure Make sure that PC and the device are on the same network (LAN)

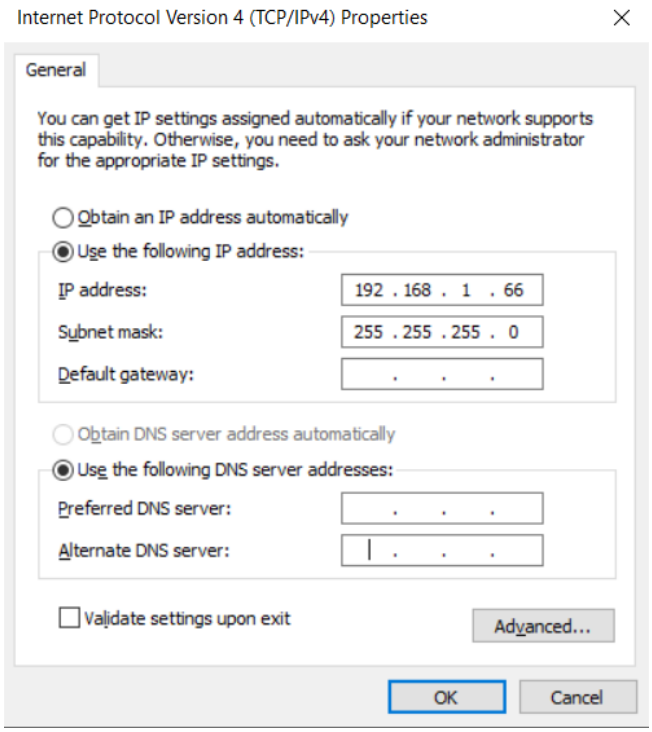


Figure 3-4 Network Card Configuration of Windows

4 Frequently Asked Questions

4.1 The application cannot detect the camera device.

Possible reasons:

- ✧ Camera failed to start properly. The power supply does not meet the product requirements.
- ✧ Network Cable connection Exception.
- ✧ The camera and the client are not on the same Local Area Network (LAN).
- ✧ Is it a non-standard Protocol camera?

Solution:

- ✧ Check Power Supply: Make sure to use the appropriate power supply and wire.
- ✧ Check network connection: Check if the indicator lights of the code reader are normal, and ensure that the camera and client are on the same local network.

4.2 The application can detect the camera device, but the connection fails.

Possible reasons:

- ✧ Camera failed to start properly.
- ✧ The camera and the client are not in the same network segment.
- ✧ Other clients have already connected to this camera.

Solution:

Restart the camera and try changing the IP to match the client on the same network segment; or disconnect other connected clients and connect to this client.

4.3 Camera disconnected

Possible reasons:

- ✧ Hardware issues, such as a faulty Network Adapter or Network Cable.
- ✧ Software settings, such as Network Adapter settings and camera settings, do not match.

Solution:

- ✧ Cross Check the hardware and replace any defective components.
- ✧ Check Network Adapter settings.

4.4 The algorithm did not achieve the expected results.

Possible reasons:

- ✧ Image Field of view or lighting does not meet the requirements.
- ✧ Algorithm not enabled or Parameter settings are not reasonable.
- ✧ Is there any defect in the code itself?

Solution:

- ✧ Check the Image Field of View or lighting-related solutions; the main camera parameters include Trigger Mode, Trigger Delay, Enter Filtering, Exposure Gain, lighting parameters, etc.
- ✧ Check if Algorithm is enabled; Check Algorithm Parameters, especially the type, specification, timeout, quantity, filtering, Symbol Error Rate (SER), etc.

4.5 Unable to enable external trigger

Possible reasons:

- ✧ External trigger connection error.
- ✧ Trigger Mode is not selected for external triggering.

Solution:

- ✧ Choose the correct Trigger Mode and ensure that the external connections are correct.

5 Cleaning and Maintenance

This chapter mainly explains the cleaning and replacement of Color Filters.

We have installed a fully transparent Protective Glass on the Black & White camera to prevent dust from falling on the surface of the Image Sensor. The color camera is equipped with a low-pass Color Filter that can cut off near-infrared wavelengths. If the user has special requirements, such as not using a Color Filter or using a different transmittance curve Color Filter, they can replace the entire Filter holder outside the Image Sensor (without dismantling the casing) for replacement.

If there is dust on the surface of the Color Filter, we recommend using a specialized optical cleaning agent to clean it, which can effectively remove the dust without leaving any stains.