



SRI Series 3D Camera

——Hardware User Manual

V2.0

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Forewords

Please make sure to read this user manual before use.

After reading, please keep it safe for future reference.

This manual uses the following symbols to highlight important information.

Please make sure to read and understand the meanings of these symbols.

	It indicates that personal injury or death probably occur if not followed.
	It indicates that personal injury or death likely occur if not followed.
	It indicates that minor or moderate personal injury may occur if not followed.
	It indicates that damage of this product or property loss of any kind might occur if not followed.
	It indicates that usage restrictions or something important to know.

The contents of this manual have been prepared with the aim of accuracy and precision. However, if you find any unclear, incorrect or ambiguous content, please contact our sales department. Any manual with missing pages or binding errors will be replaced by us.

Thank you for choosing SinceVision's products related to machine vision.

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The Purpose of the User Manual

By reading this manual, users can understand the basic structure of the SRI-series 3D Camera, correctly install the SRI-series 3D Camera, connect the machine vision sensing system with the image processing system, motor control system, and motion control system, and complete the basic debugging of the machine vision sensing system.

Users of the Manual

This user manual is suitable for engineering personnel with basic hardware knowledge and a certain understanding of machine vision and mechanical automation.

The Main Contents of the User Manual

This manual consists of five chapters, which provide a detailed introduction to the composition, installation, wiring, technical parameters, and troubleshooting of the SRI-series 3D Camera.

Relevant Documents

For software debugging of the SRI-series 3D Camera, please refer to the "Edge-Imaging Software User Manual" and "SRI-series 3D Camera Communication Library Reference Manual" that come with this product.

Document Version

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Chapter 1 Overview

1.1 Introduction

SRI series 3D cameras integrate light source, automatically optimize brightness setting, do not need external light source and user's adjustment of light source, and all measurements can be realized by using blue laser, with ultra-high speed: 10,000 contours per second and 32,000,000 points per second.

SRI series 3D cameras have ultra-high dynamic range and can measure accurately from black plane with low reflectivity, to inclined plane or metal plane with high reflectivity at the same time.

It's integrated design and easy to be installed, no need technicians for on-site adjustment or calibration. The factory settings have been optimized to the optimal state.

1.2 Features

- Measure width, position, height, height difference and inclination simultaneously, and detect area and volume according to 3D contour data.
- Integrated blue laser, without external light source, automatic optimization of brightness setting, automatic adjustment of optical power, exposure time and camera gain.
- Ultra-high speed: 10,000 contours per second and 32,000,000 points per second.
- With ultra-high dynamic range, it can measure accurately from black plane with low reflectivity, to inclined plane or metal plane with high reflectivity at the same time.
- Support differential encoder input.
- Easy installation, integrated design, no need technicians for on-site adjustment.
- The factory settings have been optimized to the optimal state, so there is no need for on-site calibration.
- Easy to set, anyone can easily set it up in a short time.
- The measurement accuracy is guaranteed after calibration with standard instruments that comply with international standards.
- Equipped with position offset correction function, it can deal with the position deviation of the target closely related to the measurement error and solve the problem instantly.
- Non-contact laser measurement, which will not scratch the target object and will not cause deviation from individuals.
- Equipped with IP67 shell protection level, good impact resistance, and using high toughness cables, you can use it with confidence.

1.3 Model Naming Description

SRI7 140

①

②

① **Product series symbol:**

SRI7: SRI7000 series

SRI8: SRI8000 series

② **Best working distance:**

20: Best working distance 20mm

50: Best working distance 50mm

60: Best working distance 60mm

80: Best working distance 80mm

140: Best working distance 140mm



240: Best working distance 240mm

Chapter 2 Precautions


- *Please read the manual before use.
- *Do not tear off the label.
- *Do not disassemble the camera.
- *Incorrect operation may cause camera damage.

2.1 Safety Precautions

2.1.1 General Precautions

 DANGEROUS	<ul style="list-style-type: none">• Do not use this product to protect the human body or any part of the body.• This product is not intended for use in explosion-proof areas and should not be used in such areas.
 CAUTION	<ul style="list-style-type: none">• When starting work or operation, please confirm that the function and performance of this product are running normally.• In case of any malfunction of this product, please implement comprehensive safety measures to prevent various damages.• Do not place this product and its accessories in an environment with rapid temperature changes. Otherwise, condensation may occur, leading to equipment failure.
BE CAREFUL	<ul style="list-style-type: none">• Please note that we do not guarantee any function or performance for products that have been modified or used beyond the specifications.• When used in combination with other devices, the function and performance of this product may decrease depending on the usage conditions and surrounding environment.



2.1.2 Safety Precautions for Laser Products

 WARNING	<ul style="list-style-type: none">• If not used, controlled, adjusted, or executed according to the following cautions, it may cause harmful radiation damage on human body (eyes, skin, etc.). Be sure to comply with the following options: For Class 2M laser products:<ul style="list-style-type: none">◆ Do not stare at the laser or its reflected light.◆ Do not aim the laser beam at the human body.◆ Pay attention to the optical path of the laser beam. Laser is subject to specular and diffuse reflection. If there is a risk of being illuminated by reflected light, please use a shield or other material to cover the reflected light.◆ Ensure that the laser beam path is away from human eye height when installing laser products.◆ Do not allow the laser beam to enter areas where telescopic optical instruments (such as telescopes and binoculars) may be used. Using such optical instruments to observe laser may harm the eyes.For Class 2 laser products:<ul style="list-style-type: none">◆ Do not stare at the laser or its reflected light.◆ Do not aim the laser beam at the human body.◆ Pay attention to the optical path of the laser beam. Laser is subject to specular and diffuse reflection. If there is a risk of being illuminated by reflected light, please use a shield or other material to cover the reflected light.◆ Ensure that the laser beam path is away from human eye height when installing laser products.• This product does not have a mechanism to turn off laser irradiation during disassembly. Do not disassemble it.
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2.2 Precautions for Use

To ensure proper use and avoid malfunctions in SRI series 3D camera products, please observe the following precautions.

2.2.1 Safe Operation

 WARNING	<ul style="list-style-type: none"> • Please use the power supply correctly according to regulations. Otherwise, it may cause fire, electric shock, or malfunction. • Do not disassemble or modify this device without authorization. Otherwise, it may cause fire, electric shock, or malfunction.
 CAUTION	<p>Please install the camera on a metal plate, otherwise, the surface temperature of the camera will rise, which may cause burns.</p>
BE CAREFUL	<ul style="list-style-type: none"> • Before unplugging or plugging in the camera I/O BUS power cable, be sure to cut off the power supply of any scattered I/O cables, otherwise, it may cause damage. • Please do not plug or unplug the camera I/O power cord while the camera is powered on. Otherwise, it may cause damage. • Please do not cut off the power during the process of writing data to memory when setting parameters. Otherwise, it may result in partial or complete loss of set data. • To prevent any malfunctions, it is recommended to backup the settings on the software in advance. • Changes in ambient temperature can lead to measurement errors. Please always ensure that the ambient temperature is constant. When there is a change of 10℃ in the ambient temperature, it takes about 60 minutes for this device to achieve a uniform internal temperature distribution. • After connecting the power, please wait for about 30 minutes for the circuit to run stably before starting to use this product. The measured values during unstable circuits may have deviations. • Please avoid using this device near lighting equipment. If unavoidable, please use a light shielding plate or other means to ensure that the device is not affected. • If the measured object vibrates, it may lead to deviation of the measured value. In this case, increasing the average number of contour measurements or the average number of measured values can improve the accuracy of measurement. • Due to the slow flow of air, measured values may deviate. In this case, the following measures can be taken: <ul style="list-style-type: none"> ◆ Use a protective cover to protect the measured part. ◆ Use a fan to stir the air between the measured section and the working section.

2.2.2 Malfunction Handling

BE CAREFUL	<p>When the following phenomena occur, please immediately turn off the power. If it continues to be used under abnormal conditions, it possibly causes equipment failure. Please contact our company's maintenance department for equipment repair.</p> <ul style="list-style-type: none">• Water or foreign objects enter the interior of the device.• The outer case is damaged.• The device emits smoke or abnormal odor.
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2.2.3 Installation Environment

BE CAREFUL	<ul style="list-style-type: none">• To ensure normal and safe use of this product, please do not install it in the following environment. Otherwise, it may cause malfunctions.<ul style="list-style-type: none">◆ Environment with heavy humidity, high levels of dust, and poor ventilation.◆ Environment with high temperatures such as direct sunlight.◆ Environment with flammable or corrosive gases.◆ Environment that will be directly affected by vibration or impact.◆ Environment where droplets such as water, oil, and chemicals may splash.◆ Environment that are prone to generating static electricity.• If this equipment is installed near interference sources such as power plants or high-voltage lines, it may cause incorrect operation or malfunction of the equipment due to interference. Please use a noise filter and lay the cables in separate conduits or ducts, or take insulation measures for the controller and sensor head. In addition, please use a single core shielded cable for analog output cables. <p>Under the following circumstances, the measured error may be caused by the influence of dirt, dust, water or oil.</p> <ul style="list-style-type: none">• Something attached to the glass cover: Please use clean air to blow off any dirt. When the dirt is severe, please use a soft cloth soaked in alcohol to wipe it clean.• Something attached to the surface of the object: Please blow off the dirt with clean air or wipe it off.• Floating dust or droplets entering the optical path range: Please install protective covers or take measures such as air purification.
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2.2.4 Maintenance

BE CAREFUL	<p>Do not use damp cloths, volatile oils, benzene or diluents to wipe this device. Otherwise, it may cause discoloration or deformation of this product. When the dirt is severe, please use a cotton cloth dipped in diluted neutral cleaning agent, wring it out, then clean the device with the cotton cloth.</p>
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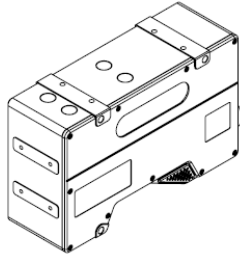
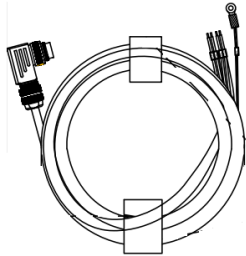
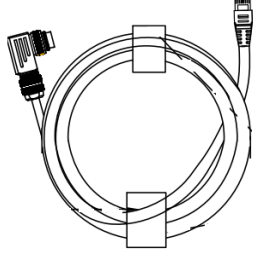


Chapter 3 Quick Start Guide

3.1 Unpacking Inspection

Before unpacking, please check whether the product model indicated on the outer packaging matches the ordered product. After opening the package, please wear anti-static gloves first, and then carefully check whether the accessories are complete according to the Packing List or purchase contract. Check if there is any mechanical damage on the surface of the camera. If you find any damage on the surface of the camera, or if the product does not match the packing list or purchase contract, please do not use it and immediately contact SinceVision.

Please visit SinceVision's official website <http://www.sincevision.com> to download User Manuals.

Table 3-1 Packing List

S/N	Name	Diagram	Quantity	Remarks
1	SRI series 3D camera		1	
2	3-merter cable SCB-HCAM-HIO-3m		1	
3	3-merter cable SCB-HCAM-HNET-3m		1	
4	M4x60 Cap head inner hexagon screw		3	
5	M4 flat gasket		3	
6	Quick Start Guide for SRI series 3D camera		1	
7	Inspection-passed card for SRI Series 3D camera		1	
8	Warranty card for SRI Series 3D camera		1	

3.2 Installation Environment

- Stay away from strong electromagnetic interference environments and high-power electrical appliances.
- Avoid sharing power with high-power electrical appliances.
- Avoid laying cables of the 3D camera parallel to power lines switched frequently of strong currents or voltages.

3.3 Preparation

Before installation, please prepare the following tools:

- Multimeter
- M4 screw with 4 gaskets
- A set of hex wrenches

3.4 Description of Camera Component

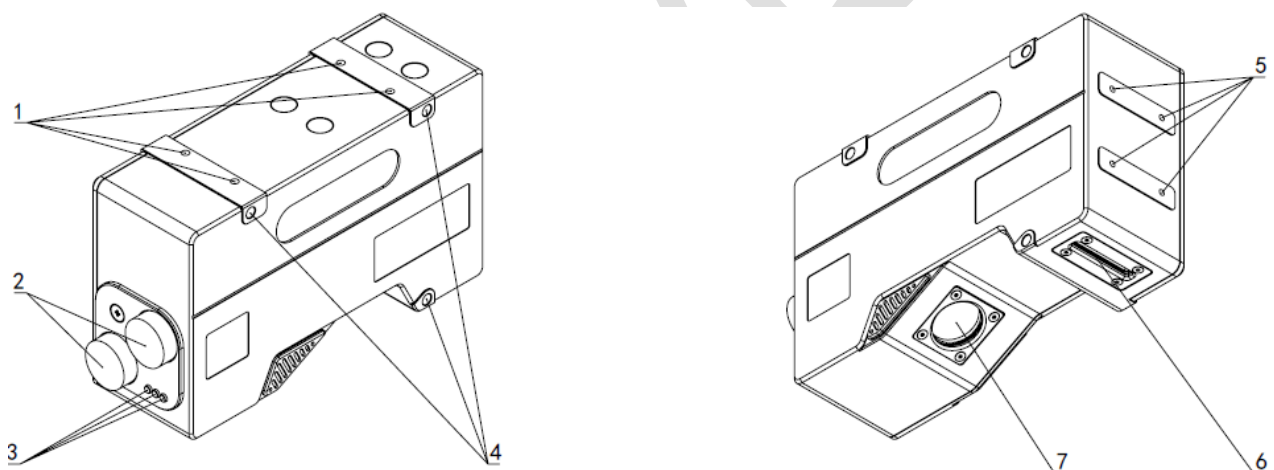


Figure 3-1 Schematic diagram of the camera components

Table 3-2 Description of the camera components

No.	Name	Function description
1	Special screw holes for installation	This screw hole can be used when installing the camera.
2	Camera cable connection interface	Connect the camera cable. Please refer to " 4.2 Connecting the Camera ".
3	Camera status LED indicator	Please refer to " below ".
4	Mounting Hole	Install the camera using the included cap head inner hexagon screws. Please refer to " 3.5 ".
5	Installation hole for metal light shielding plate	Used to install the light shielding metal plate onto the camera. Please do not use it to secure the camera.

6	Laser emission window of the camera	Emit laser for measurement. Protected by a glass cover.
7	Photosensitive window of the camera	Receive laser for measurement. Protected by a glass cover.

3.5 Camera Installation

Please install the camera correctly after confirming the precautions before installation.

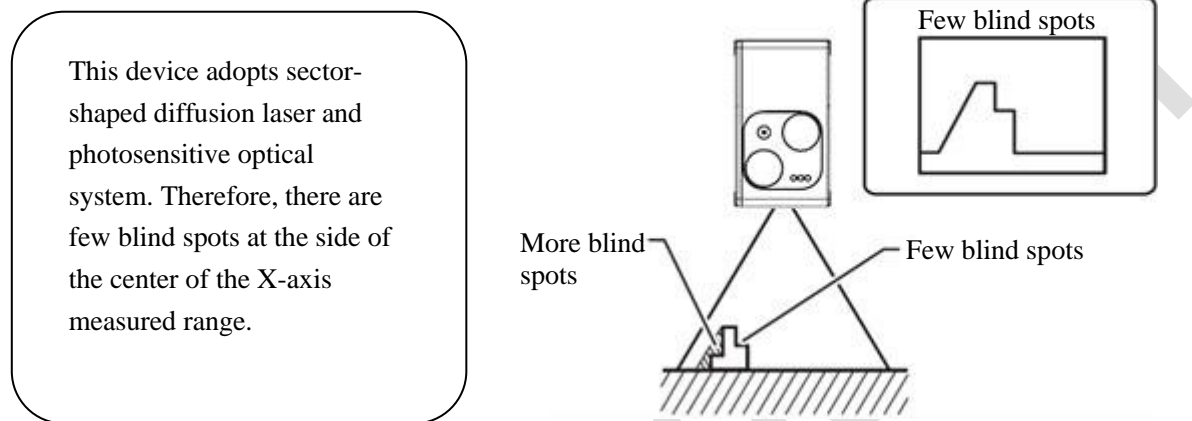


Figure 3-2 Schematic diagram of blind spots

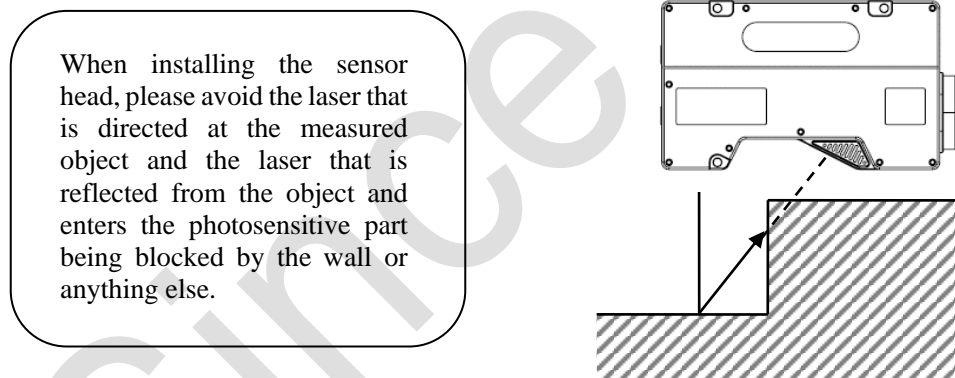


Figure 3-3 Schematic diagram of the laser path obstructed

The laser reflected on the wall or other surfaces will become stray light. Please confirm if it has any impact on the measurement before use.

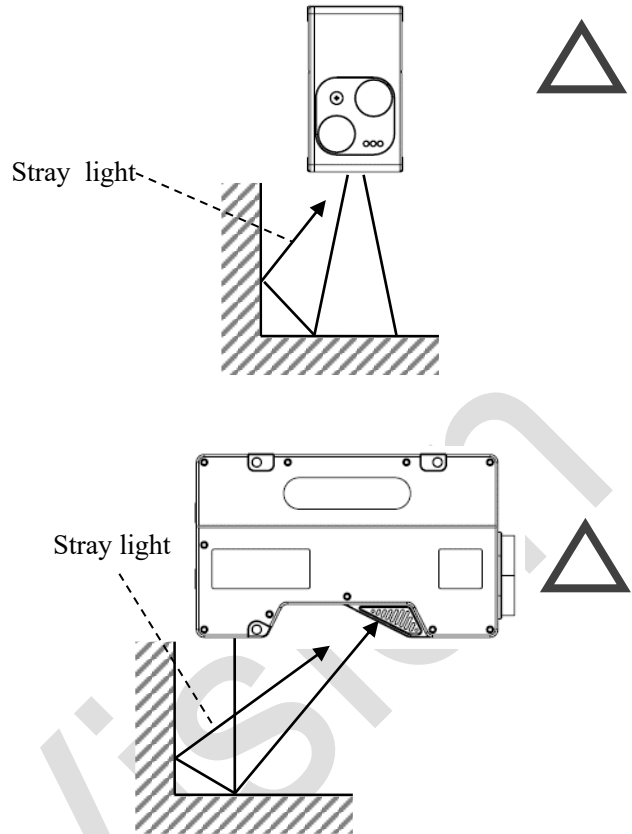


Figure 3-4 Schematic diagram of stray light

Adjust the distance between the sensor head and the object and fix it with screws. The tightening torque for installing screws should be within the following range:
M4 screw: 1.2-1.8 N · m

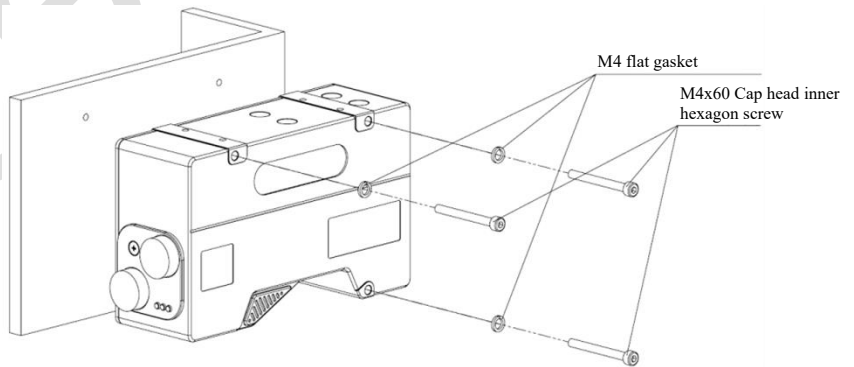
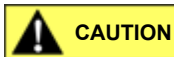


Figure 3-5 Schematic diagram of camera installation



If the sensor head is mounted on a flat plate with poor heat dissipation such as resin, the surface temperature of the sensor head will rise, which may cause burns. To facilitate heat dissipation of the sensor head, please install the sensor head on a metal plate.

Chapter 4 Hardware Connection

4.1 Wiring Diagram of the System

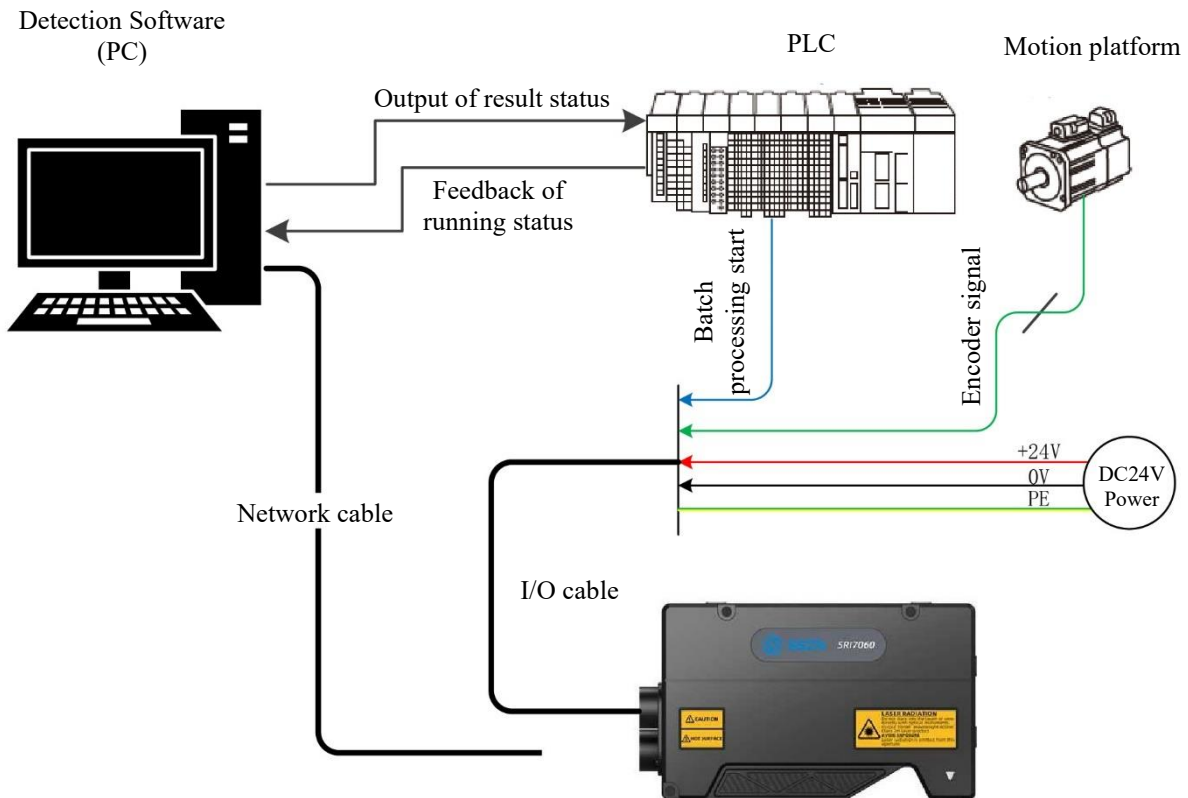


Figure 4-1 Wiring Diagram of the System

IMPORTANT

- Be sure to connect and remove cables after turning off the power to the controller. Connecting and removing with the power turned on will result in a malfunction.
- Please confirm the orientation of the connector before connecting. If the connection is not correct, the pins of the connector may be bent, resulting in a malfunction.

4.2 Connecting the Camera

The following is a description of the connection steps of the camera.

BE CAREFUL

- Do not supply power before connecting the camera cable. Connecting the camera cable under power supply will cause damage to the sensor head.
- Please ensure that the minimum bending radius of the sensor head cable is more than 30mm.
- When using drag chains, if it is not specified, please choose products above R100.

Step 1: Connect the camera and camera cable.

Align the orientation of the connector and slowly rotate it to insert it to the bottom. The tightening torque of the screw is $1-1.5 \text{ N} \cdot \text{m}$.

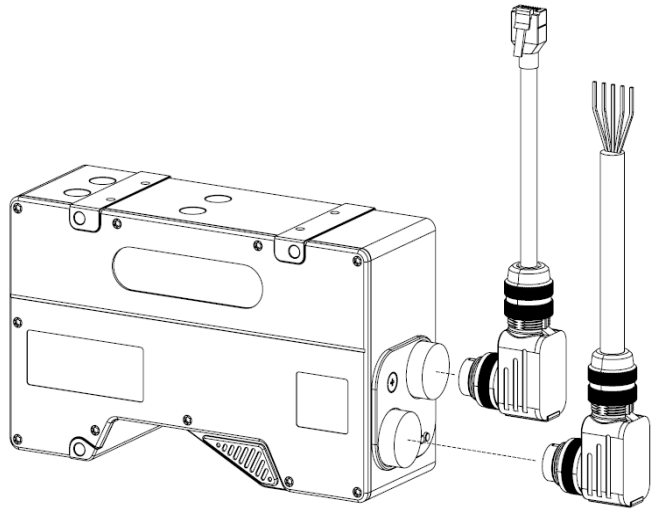


Figure 4-2 Schematic diagram of connecting camera cables to the camera

<p>BE CAREFUL</p>	<ul style="list-style-type: none"> ● Check the orientation of the connector and connect it correctly. If the connection is not correct, the pins may be bent, resulting in a malfunction. ● Insert the connector without tilting it and tighten it. If it is not tightened, the connector will loosen due to vibration, etc., which may cause poor contact. ● As the standard procedure for tightening, first tighten it by hand, and then further tighten it by about $45^\circ \sim 60^\circ$ with tools, such as wrench.
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4.3 Connect the Camera and Power Supply

The steps for connecting the power supply are described as follows:

<p>BE CAREFUL</p>	<ul style="list-style-type: none"> ● The power cord is the soldered wire of AWG22 on the IO cable, with red +24V and black 0V. ● When connecting to a DC24V power supply, if the power supply end is a terminal block, you can directly insert the power cord into the terminal block and tighten the screw. ● The power for DC24V is greater than or equal to 30W.
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Step 1: Connect the red+24V and black 0V leads from the I/O cable (SCB-HCAM-HIO) to the DC24V power supply.

4.4 I/O Wiring

I/O wiring is described as follows

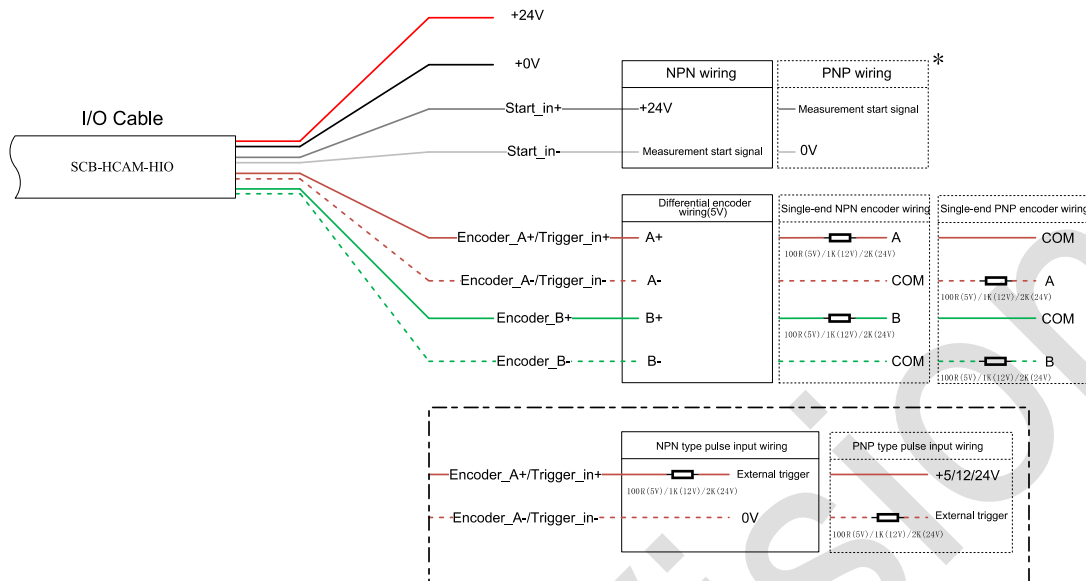


Figure 4-3 Camera cable wiring

Note:

There are three working modes for the measurement start signal (Start_in):

- Mode 0 – Edge mode: Start batch processing at the edge of the signal input. The signal timing diagram is shown in [Figure 4-4 Timing diagram in edge mode](#).



Figure 4-4 Timing diagram in edge mode

- Mode 1 – Level mode: Batch processing starts when there is signal input and stops when there is no input. The signal timing diagram is shown in [Figure 4-5 Timing diagram in level mode](#).



Figure 4-5 Timing diagram in level mode

- Mode 2 - Level continuation mode: After calling the API to start batch processing, batch processing will be performed when the signal is input, and batch processing will be suspended when there is no input. Automatically stop batch processing after collecting the specified number of rows, or call the API to stop batch processing. The signal timing diagram is shown in [Figure 4-6 Level continuation mode](#).

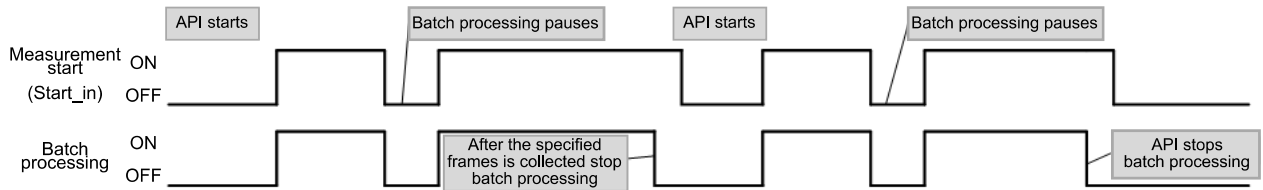


Figure 4-6 Level continuation mode

- To set different modes, please follow the steps: EdgeImaging software ->Real time settings ->Trigger settings ->IO batch processing mode settings, as shown in [Figure 4-7 Set the working mode of Start_in signal](#).

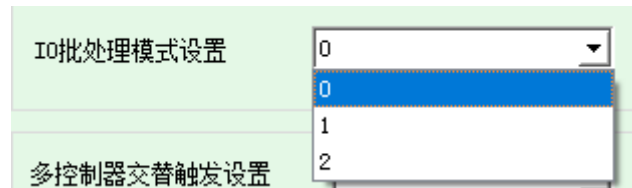


Figure 4-7 Set the working mode of Start_in signal

Definition of Wiring		
	Color	Tag
Twisted pair	Orange/white	Encoder_A+/Trigger_in+
	Orange	Encoder_A-/Trigger_in-
Twisted pair	Green/white	Encoder_B+
	Green	Encoder_B-
Twisted pair	Blue/white	Out_1+
	Blue	Out_1-
Twisted pair	Brown/white	Out_2+
	Brown	Out_2-
	White	Start_in+
	Gray	Start_in-
	Red	24V
	Black	0V
	Shielded (Outer+inner)	PE

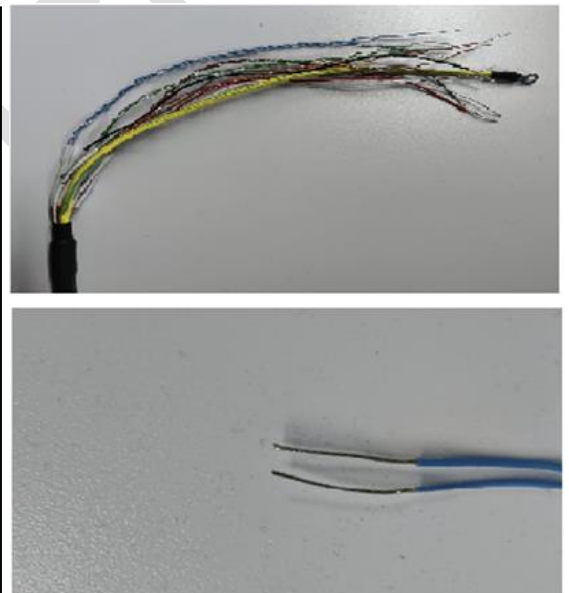


Figure 4-8 Definition of camera wiring

Each line on the I/O cable has a defined tag and a 15mm tin plated metal lead at the end, which can be directly connected to the desired port using the most suitable method.

Metal ring twisted wire is used as PE wire and it is recommended to connect it to a screw (on PLC case).

BE CAREFUL

- When wiring I/O cable, do not operate with power on. Please do not power the camera and ensure that the PLC and servo drive are in a power-off state. Hot plugging and unplugging I/O cables can cause damage to the camera.

4.5 Definition of I/O Interface Signals

The I/O interface is located on the M16 aviation plug of 14PIN, and defined labels can be seen on the scattered cables: including input interface, output interface, encoder input interface, and power input. The pin definitions are as follows:

Table 4-1 Definition of I/O interface signals

Lead	Signal (Label)	Description	Reference
1	24V	Power supply (+24V) input positive pole.	
2	0V	Power supply (0V) input negative pole.	
3	Start_in+	General digital signal input positive pole, optical isolation.	
4	Start_in-	General digital signal input negative pole, optical isolation.	
5	OUT1+	General digital signal output positive pole, optical isolation.	
6	OUT1-	General digital signal output negative pole, optical isolation.	
7	OUT2+	General digital signal output positive pole, optical isolation.	
8	OUT2-	General digital signal output negative pole, optical isolation.	
9	Encoder_A+/Trigger_in+	A-phase input positive pole of differential encoder, optical isolation, differential input of RS-422 (built-in AM26LS32 equivalent), 5V differential pressure; A-phase input positive pole of single-ended encoder.	
10	Encoder_A-/Trigger_in	A-phase input negative pole of differential encoder, optical isolation, differential input of RS-422 (built-in AM26LS32 equivalent), 5V differential pressure; A-phase input negative pole of single-ended encoder.	
11	Encoder_B+	B-phase input positive pole of differential encoder, optical isolation, differential input of RS-422 (built-in AM26LS32 equivalent), 5V differential pressure; B-phase input positive pole of single-ended encoder.	
12	Encoder_B-	B-phase input negative pole of differential encoder, optical isolation, differential input of RS-422 (built-in AM26LS32 equivalent), 5V differential pressure; B-phase input negative pole of single-ended encoder.	
13	PE	PE is an all-in-one metal shell.	

Note: When the voltage of "Encoder_A+/Trigger_in+" and "Encoder_B+" is 5V/12V/24V, a resistor (100R/1K/2K) needs to be connected in series.

Chapter 5 Definition of the LED Indicator

Table 5-1 Definition of the Controller LED Indicator

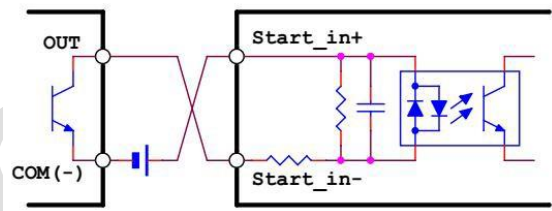
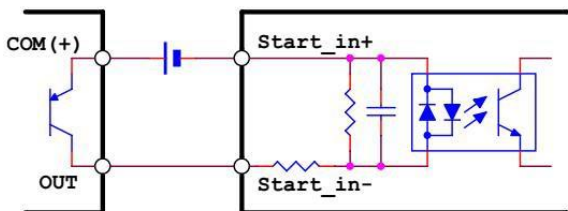
LED indicator	Description	Status	Running description
PWR	Power indicator, blue	On	Powered on and the power supply is normal
		Off	No power or abnormal power supply
RUN	Running status indicator, green	Flashing	Normal operating
		Off	Abnormal
ERR	Error status indicator, red	On	Error occurred
		Off	Normal

Chapter 6 Appendix

6.1 Technical Parameters

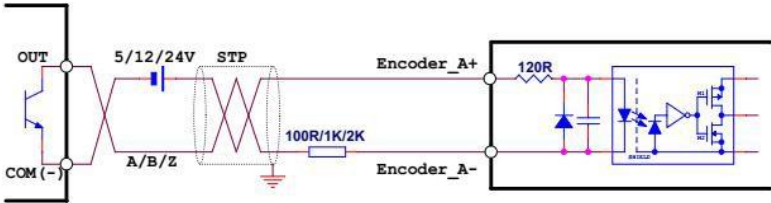
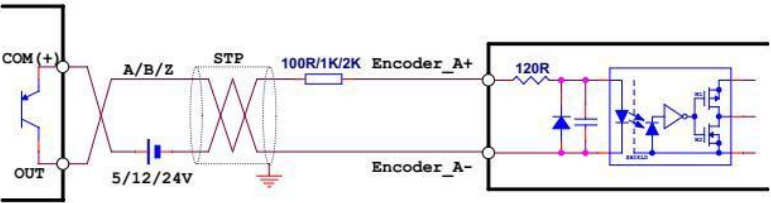
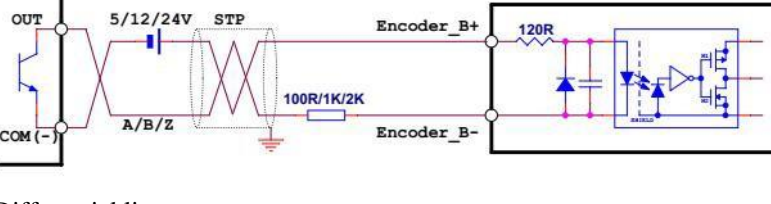
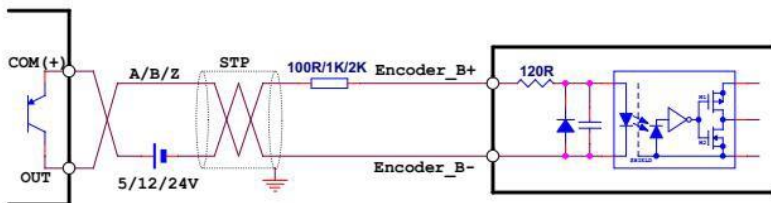
6.1.1 Electrical Parameters of Digital Input Signals

Table 6-1 Electrical parameters of universal digital input signals

Parameter	Symbol	Nominal value
High logic level input voltage	V_{IH}	$> 22V^{\text{Note 1}}$ and $< 26.4V$
Low logic level input voltage	V_{IL}	$< 7V^{\text{note 1}}$
Low logic level input current	I_{IL}	$> 4.5mA$
Isolation voltage	BV_s	$3750V_{rms}$ (Test conditions: AC for 1 minute)
Isolation resistor	R_s	$> 10^{12}\Omega$ (Test condition: 500VDC is added at both ends of isolation)
Pulse width of minimum input	T_s	1ms
Internal circuit and wiring diagram	 <p>PLC drain output (NPN) Input circuit of this device</p>	
	 <p>PLC source output (PNP) Input circuit of this device</p>	

Note 1: The voltage level between 7 and 22V is uncertain status and the logic level cannot be accurately determined.

Table 6-2 Electrical parameters of the input signal of the differential encoder

Parameter	Symbol	Nominal value (built-in AM26LS32 equivalent)
Input range of common mode voltage for differential signals	V_{IC}	-7V~+7V
Logic "1" differential voltage input	V_{IT+} (V_{ID+})	>0.2V
Logic "0" differential voltage input	V_{IT-} (V_{ID-})	<-0.2V
Pulse width of minimum input	T_s	1us
Internal circuit and wiring diagram	 <p>Differential linear drive output of encoder</p> <p>Input circuit of this device</p>	
	 <p>Differential linear drive output of encoder</p> <p>Input circuit of this device</p>	
	 <p>Differential linear drive output of encoder</p> <p>Input circuit of this device</p>	
	 <p>Differential linear drive output of encoder</p> <p>Input circuit of this device</p>	

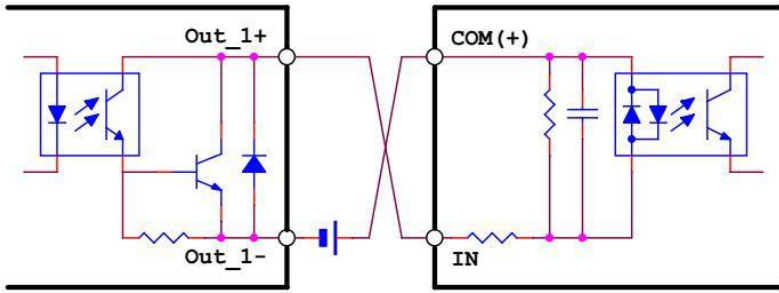
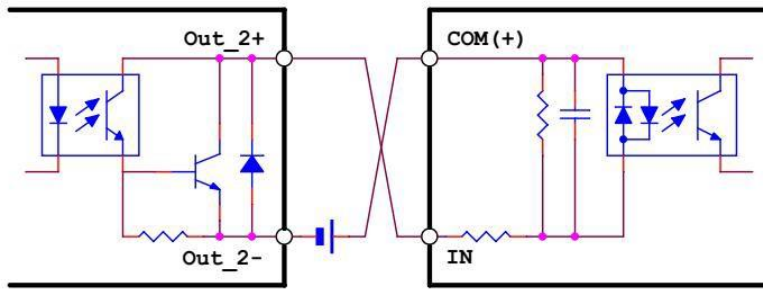
Note 2: The voltage level between 3.6 and 22V is uncertain status and cannot be accurately determined.

When the input voltage is 5/12/24V, a series resistor (100R/1K/2K) is required.

Trigger_in+/Trigger_in- and Encoder_A+/Encoder_A- are multiplexed.

6.1.2 Electrical Parameters of Digital Output Signals

Table 6-3 Electrical parameters of universal digital output signals

Parameter	Symbol	Nominal value
Maximum output Sink current	I_{OL}	20mA (continuous)
Maximum leakage current in turning off state	I_L	0.5uA (Test condition: V_o plus 24VDC)
Low logic level output voltage	V_{OL}	< 0.3V (test condition: $I_{OL}=20mA$)
Isolation voltage	BV_s	2500V _{rms} (Test condition: AC for 1 minute)
Isolation resistor	R_s	> $10^{11}\Omega$ (Test condition: 1kVDC is added at both isolated ends)
Maximum switching frequency	f_s	1KHz
Internal circuit and wiring diagram		
	Output circuit of this device	PLC input circuit (common anode)
		
	Output circuit of this device	PLC input circuit (common anode)