



SG-Series Laser Displacement Sensor —— Hardware User Manual

V1.1.1



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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.

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The Purpose of the User Manual

By reading this manual, users can understand the basic structure of the SG-series point laser displacement sensor, correctly install the SG-series point laser displacement sensor, 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 SG-series point laser displacement sensors.

Relevant Documents

For software debugging of the SG-series point laser displacement sensor, please refer to the "SG-Imaging Software User Manual" and "SG-series Point Laser Displacement Sensor Communication Library Reference Manual" that come with this product.

Document Version

Version Number	Revision Date	Revised contents
1.0.0	July 20, 2020	
1.1.0	June 4th, 2021	1. Modified "4.2.1 Definition of I/O Terminals" and added descriptions for encoder ports and analog output ports. 2. Modified "5.1.3 Controller Parameters".
1.1.1	December 31, 2021	1. Revised "Table 1-1 Controller Parameters" and modified the description of the analog interface.

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Chapter 1 Overview

1.1 Introduction

The SG series laser displacement sensor with ultra-high speed/precision CMOS. It automatically optimizes brightness settings without the need for external light sources or adjusted light sources by users. All measurements can be achieved using red laser, with ultra-high speed at 590KHz, ultra-high accuracy of $\pm 0.02\%$, and ultra-high repeatability of $0.02\mu\text{m}$.

The SG series laser displacement sensor with ultra-high speed/precision CMOS. It has an ultra-high dynamic range, which is 100 times that of ordinary displacement sensors. Adapted to various measurement targets such as different color, material, and surface condition, it has a variety of measurement distance sensing heads to be chosen, with high accuracy and excellent performance.

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

- Ultra-high speed/precision, industry's fastest sampling rate of 590KHz, up to $0.02\mu\text{m}$ accuracy of repeatability.
- Integrated red laser, no external light source required, automatically optimizes brightness setting, automatically adjusts light power, exposure time, and gain.
- Ultra-high dynamic range, suitable for various measured targets such as different colors, materials, surface conditions, etc.
- 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.
- 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

SG5 02 5
① ② ③

① **Product series symbol:**

SG3: SG3000 series

SG5: SG5000 series

② **Best working distance:**

02: Best working distance 20mm

15: Best working distance 150mm

③ **Laser spot type:**

0: Narrow spot, recommended for small and thin object measurement

5: Wide spot, recommended for object measurement with rough surface

Chapter 2 Precautions

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

2.1 General Precautions

 DANGEROUS	• 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.
 WARNING	• Do not place this product and its accessories in an environment with rapid temperature changes. Otherwise, condensation may occur, leading to equipment failure.
 CAUTION	• Please be sure to monitor the function and performance of this product during startup or operation. • Please take effective safety measures to prevent any damage caused by any malfunction of this product.
BE CAREFUL	• Please note that for use beyond the product specifications and for modified products, our company does not guarantee any function or performance. • When used in combination with other devices, the function and performance of this product may decrease depending on the usage conditions and surrounding environment.

2.2 Precautions for Use

To avoid malfunctions and ensure proper use of SG-series laser displacement sensor products, please read the following precautions.

2.2.1 Safe Operation

 WARNING	• 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.
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BE CAREFUL	• Before connecting or disconnecting data cables, be sure to first cut off the power to the controller and its peripheral interconnect devices. Otherwise, it may cause product damage. • Do not cut off the power during the process of writing data to memory, such as setting operation. Otherwise, it may result in partial or complete loss of setting data. • To prevent any malfunctions, it is recommended to backup the settings on the software in advance.
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2.2.2 Malfunction Handling

 WARNING	• 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. ◆ Water or foreign objects enter the interior of the controller. ◆ Falling or damaged casing. ◆ The controller emits smoke or abnormal odor.
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2.2.3 Installation Environment

BE CAREFUL	• To ensure normal and safe use of this product, please do not install it in the following environment. Otherwise, it may cause malfunctions. ◆ 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.
-------------------	--

2.2.4 Noise Control

BE CAREFUL	• 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.
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2.2.5 Preheating during Startup

BE CAREFUL	• 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.
-------------------	---

2.2.6 The Impact of Ambient Temperature

BE CAREFUL	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 °C in the ambient temperature, it takes about 60 minutes for this device to achieve a uniform internal temperature distribution.
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2.2.7 The Impact of Ambient Light

BE CAREFUL	Do not use this product near a lighting equipment frequently switched on/off. If unavoidable, please use light barriers or other devices to ensure that they are not affected.
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2.2.8 Vibration Impact

BE CAREFUL	If the measured object vibrates, it will cause deviations in the measured values. In this case, increasing the average number of contours or measured value can relatively improve the accuracy of the measurement.
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2.2.9 The Impact of Dirt or Dust

BE CAREFUL	- In the following situations, measurement errors may occur due to the interference of dirt, dust, water, or oil. - 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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2.2.10 The Impact of Air Flow

BE CAREFUL	- Sometimes, due to the slow flow of air, measurement values may deviate. In this case, the following measures can be taken. - Use a protective cover to protect the measured section. - Use a fan to stir the air between the measured section and the working section.
------------	---

2.2.11 The Impact of Individual Differences in the Measured Targets

BE CAREFUL	The shape or surface condition of the target varies from individual object, the measured values may be incorrect. In this case, errors can be corrected by measuring known targets and using calibration functions.
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2.2.12 Maintenance

BE CAREFUL	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.
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2.3 Safety Precautions for Laser Products

If not used, controlled, adjusted, or executed according to the following cautions, it may cause harmful radiation damage.

 WARNING	About Class I Laser Products - Please follow the instructions in this manual, otherwise it may harm the human body (eyes, skin, etc.). - Do not stare at the laser beam. - Do not disassemble this product. The laser that runs on this product will not automatically stop during disassembly.
--	---

 WARNING	About Class II/2 Laser Products - Please follow the instructions in this manual, otherwise it may harm the human body (eyes, skin, etc.). - Do not stare at the laser beam. - Do not aim the laser beam at the human body or personnel activity areas unrelated to laser operations. - 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 disassemble this product. The laser that runs on this product will not automatically stop during disassembly.
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 WARNING	About Class IIIa/3R/3A Laser Products - Please follow the instructions in this manual, otherwise it may harm the human body (eyes, skin, etc.). - Do not look directly or come into contact with the laser beam and its
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	specular reflection. ◆ Do not use optical instruments such as microscopes or telescopes to observe the laser beam. ◆ Do not aim the laser beam at the human body or personnel activity areas unrelated to laser operations. ◆ Prevent laser beam diffusion. (Shorten the laser path as much as possible and ensure that a diffuse emitter or diffuse reflection absorber with appropriate reflectivity and thermal characteristics is used to terminate the laser path. It is recommended to install a protective cover.) ◆ When installing laser products, be careful not to accidentally point the laser beam towards mirror like surfaces. ◆ Ensure that the laser beam path is away from human eye height when installing laser products. ◆ It is recommended to wear protective goggles. ◆ Do not disassemble this product. The laser that runs on this product will not automatically stop during disassembly.
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 WARNING	About Class IIIB/3B Laser Products ● Please follow the instructions in this manual, otherwise it may harm the human body (eyes, skin, etc.). ◆ Do not look directly or come into contact with the laser beam and its specular reflection. ◆ Do not use optical instruments such as microscopes or telescopes to observe the laser beam. ◆ Do not aim the laser beam at the human body or personnel activity areas unrelated to laser operations. ◆ Prevent laser beam diffusion. (Shorten the laser path as much as possible and ensure that a diffuse emitter or diffuse reflection absorber with appropriate reflectivity and thermal characteristics is used to terminate the laser path. It is recommended to install a protective cover.) ◆ When installing laser products, be careful not to accidentally point the laser beam towards mirror like surfaces. ◆ Ensure that the laser beam path is away from human eye height when installing laser products. ◆ It is recommended to wear protective goggles.
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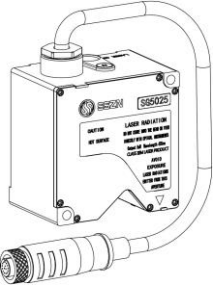
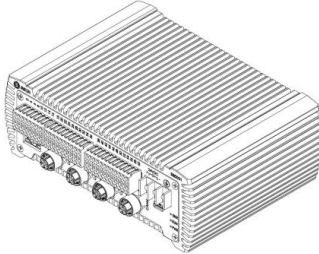
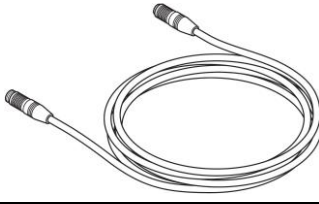
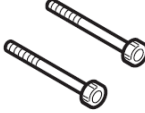
Chapter 3 Quick Start Guide

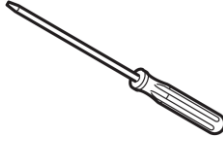
3.1 Unpacking Inspection

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 sensor. If you find any damage on the surface of the sensor, or if the product does not match the packing list or purchase contract, please do not use it and immediately contact SinceVision.

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Table 3-1 Packing List

S/N	Name	Diagram	Quantity	Remarks
1	SG-series sensor head		1	
2	Controller SG5001		1	
3	3-meter cable SCB-GCAM-HA1-3m		1	Male to male connector
4	5-meter extension cable SCB-GCAM-HAY-5m		□	(Optional) Male to female connector
5	M4 × 55mm Cap head inner hexagon screw		2	

6	M4 Flat gasket		2	
7	Y-shaped crimp terminal		3	
8	Flat-head screwdriver		1	Used for terminal block wiring
9	Quick Start Guide for SG-Series Laser Displacement Sensors		1	
10	Inspection-passed card for SG-Series Laser Displacement Sensors		1	
11	Warranty card for SG-Series Laser Displacement Sensors		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 parallel to power lines switched frequently of strong currents or voltages.

3.3 Preparation

Before installation, please prepare the following tools:

- Ethernet cables (Cat-7 or above cables or cables supported 10GBASE-T)
- Multimeter
- Stripping pliers
- Crimping pliers
- M4 screw with 2 gaskets
- A set of flat-head screwdrivers
- A set of cross screwdrivers
- A set of hex wrenches

3.4 Description of Each Component

3.4.1 Description of Sensor Head Components

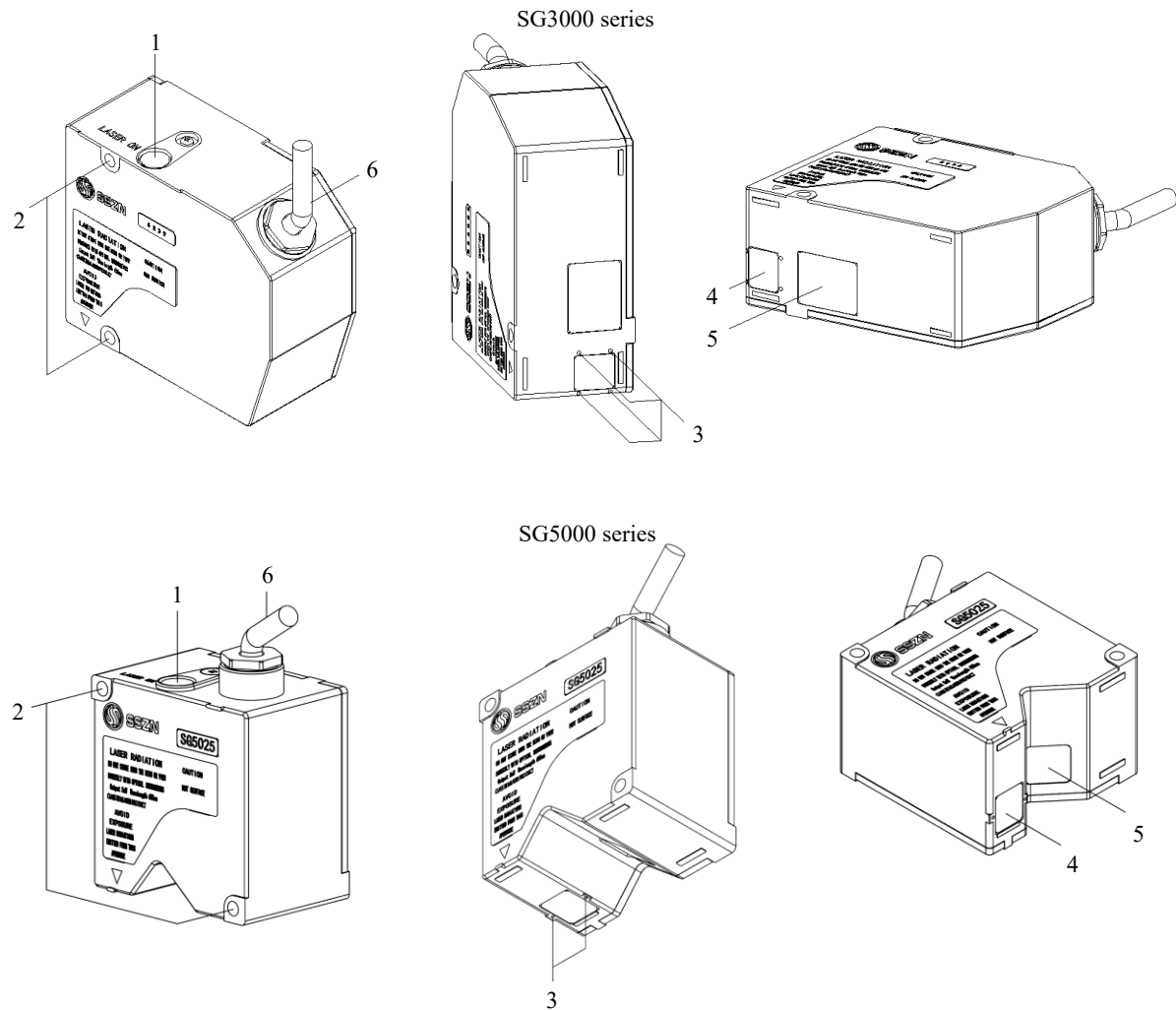


Figure 3-1 Schematic diagram of sensor head components

Table 3-2 Description of sensor head components

No.	Name	Function description	
1	Laser emission LED	Solid green light	The object is near the center of the measurement range ($\pm 5\%$ range)
		Solid yellow light	The object is within the measurement range
		Blinking yellow light	The object is outside the measurement range
		Yellow or green light is on	The laser device is working
		The light is off	No power or power supply anomaly
		Red light is on	Sensor head failure alarm
2	Mounting hole	Install the sensor head with the supplied hex eye bolt. Please refer to " 3.5.1 Precautions for Sensor Head Installation ".	
3	Neutral density attenuator optical filter accessory hole	It is used to fix the additional neutral density attenuator optical filter. Decide whether to add it or not according to the actual application.	
4	Sensor head laser emission window	Laser used for emission measurement. Protected by a glass cover.	
5	Sensor head photosensitive window	Laser used for receiving measurement. Protected by a glass cover.	
6	Cable with high flexibility	Connect the sensor head cable. Please refer to " 4.3 Connect the Controller and Sensor Head ".	

3.4.2 Description of Controller Components

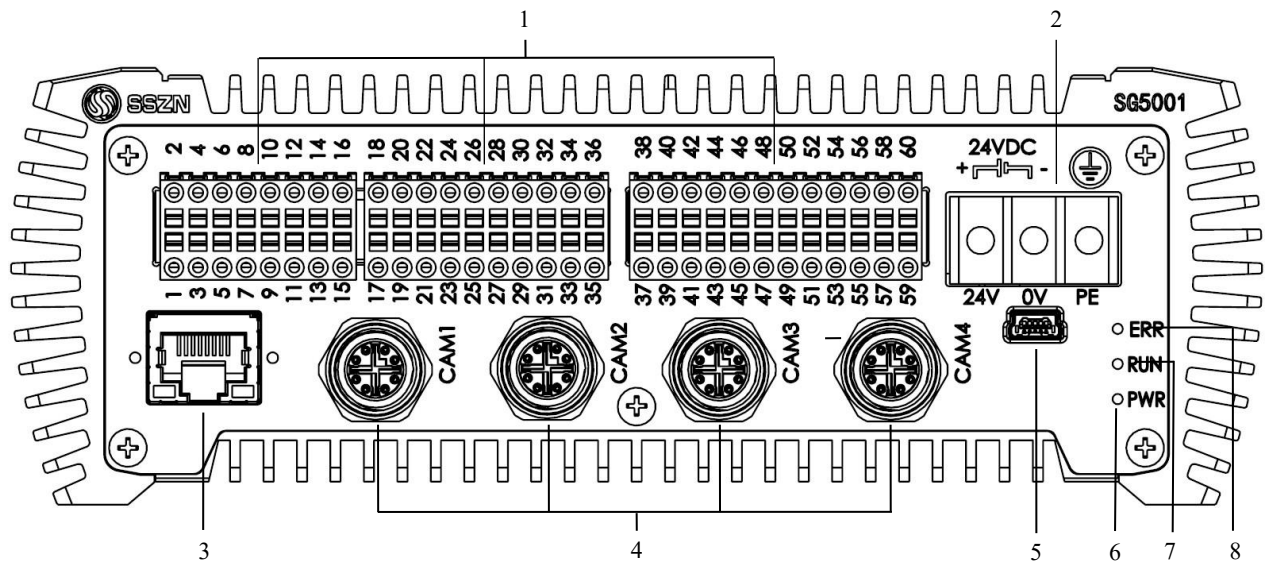


Figure 3-2 Schematic diagram of controller components

Table 3-3 Description of controller components

No.	Name	Function description		
1	IO, encoder input, RS232 interface terminal block	It is used for controlling the input and output of signal, and IO isolated power supply. It is used to input the pulse signal of the encoder. It is used for RS232 serial port connection. Please refer to " 4.2.1 Definition of I/O Pins ".		
2	24V power terminal block	It is used for controller power supply (DC24V). Left: +24V, middle: 0V, right: earth (PE and case).		
3	Ethernet interface RJ45 connector	Connect to PC or switch via Ethernet cable.		
4	Sensor head cable interface connector	It is used to connect the sensor head. Include sensor head 1/2/3/4 connectors. Please refer to " 4.3 Connect the Controller and Sensor Head ".		
5	Reserve	Do not use, otherwise it may cause damage of the device.		
6	Power indicator	Blue	On	Power supply is normal
			Off	Power-off, or abnormal power supply
7	Controller running status indicator	Green	Flashing	Normal operation
			Off	Anomaly
8	Controller error status indicator	Red	On	Error status
			Off	Normal

3.5 Equipment Installation

3.5.1 Precautions for Sensor Head Installation

Target distance measurement

Please choose to use the sensor head closest to the reference distance, thereby ensuring the most stable inspection.

Target shape

The sensor head is recommended to be installed in the direction indicated by the circle in the figure below.

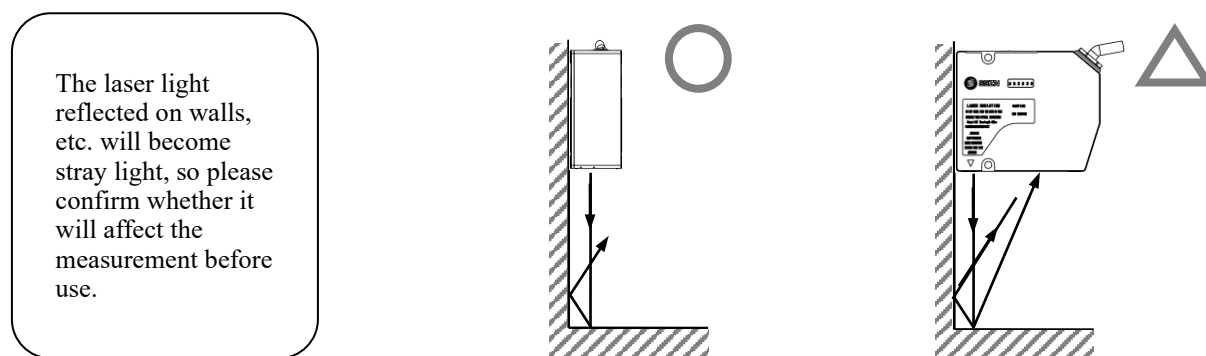


Figure 3-3 Schematic diagram of the correct installation for measuring close to the wall surface

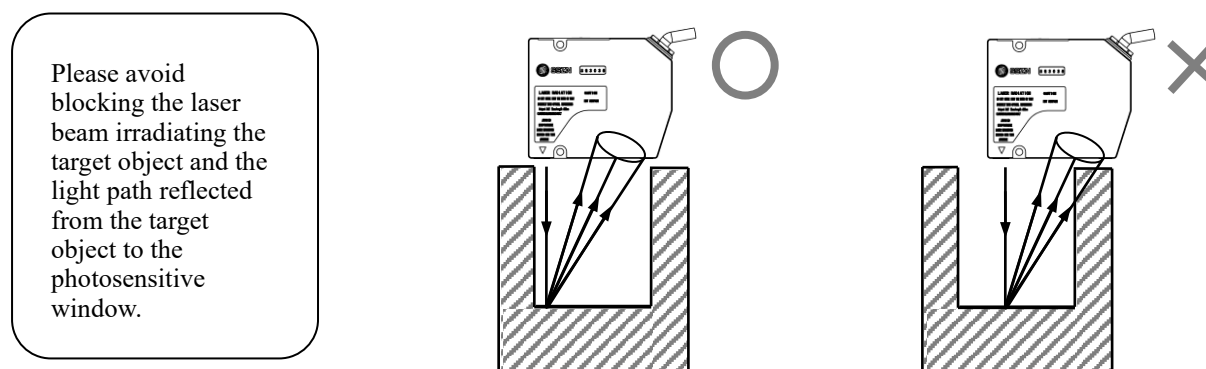


Figure 3-4 Schematic diagram of correct installation for displacement measurement in the hole

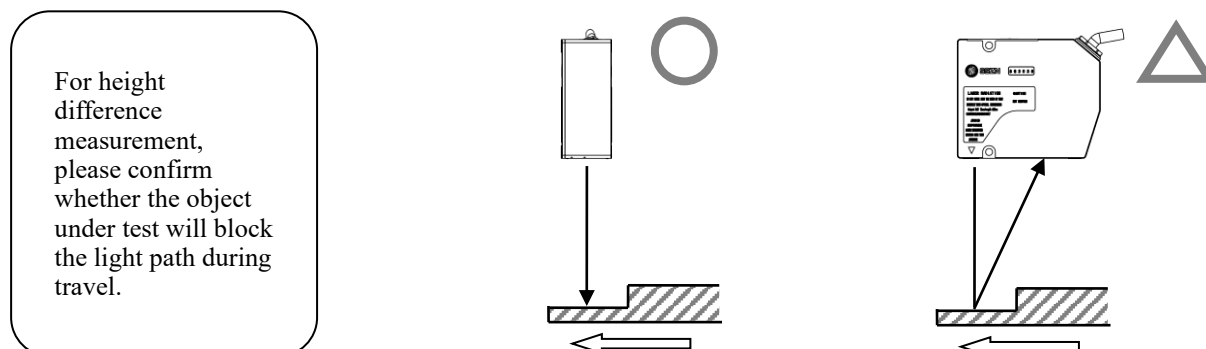
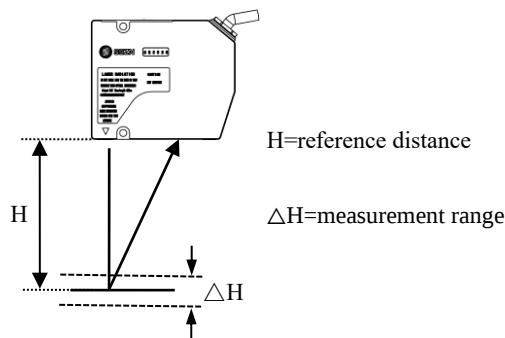


Figure 3-5 Schematic diagram of correct installation for height difference measurement

Installation Method

Diffuse reflection installation method



Mirror reflection installation method

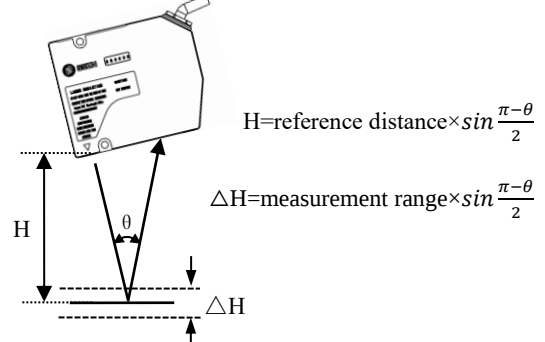


Figure 3-6 Schematic diagram of diffuse reflection and mirror reflection

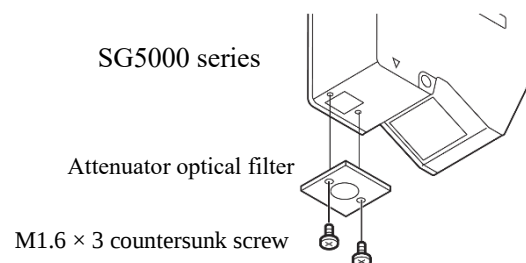
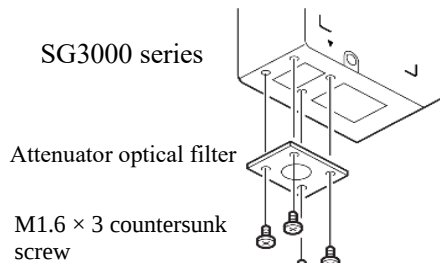


Figure 3-7 Schematic diagram of optical filter installation

Adjust the distance between the sensor head and the target object, and fix it with screws.
 Please refer to "[5.3 Dimensional Diagram](#)" for installation dimensions.
 The tightening torque for the installation screws should be within the following range.
 M4 screw: 1.2 to 1.8N · m

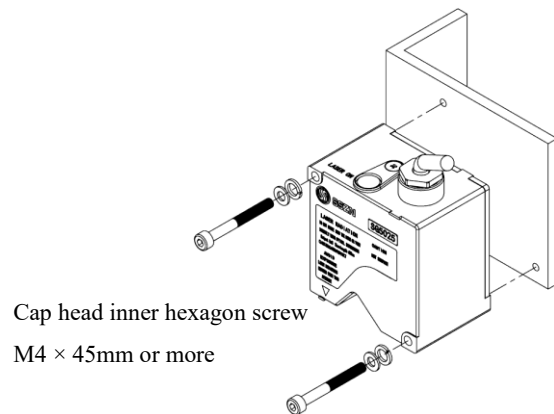


Figure 3-8 Schematic diagram of sensor head installation



- 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 the heat dissipation of the sensor head, please install the sensor head on a metal plate.

When using 2 or more sensor heads, pay attention to the mutual interference area to prevent mutual interference.
 Please refer to *SG Series Laser Displacement Sensor Software User Manual*.

3.5.2 Installation of Controllers

Please confirm the installation precautions before installing the controller correctly.

Please install the controllers in the correct orientation shown in the following diagram. Please do not install in any other incorrect orientation.

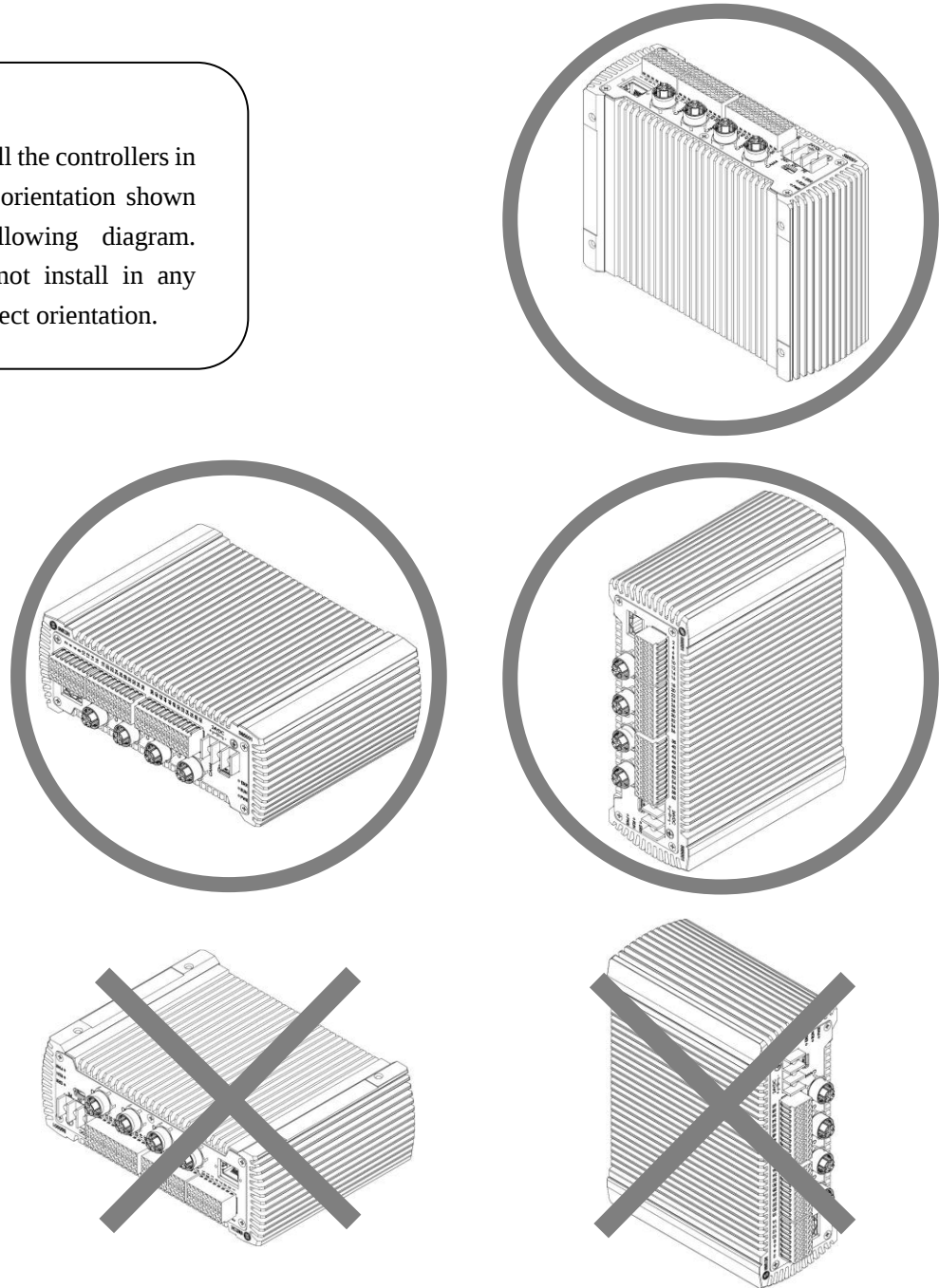


Figure 3-9 Schematic diagram of the correct direction for controller installation

For ventilation purposes, please leave at least 50mm above the controller body and 30mm or more on both sides.

In addition, to ensure safe cable connection, please leave a space of more than 90 mm in front of the terminal surface.

When you install controllers in parallel, please leave at least 30 mm between the controllers and at least 50 mm above them.

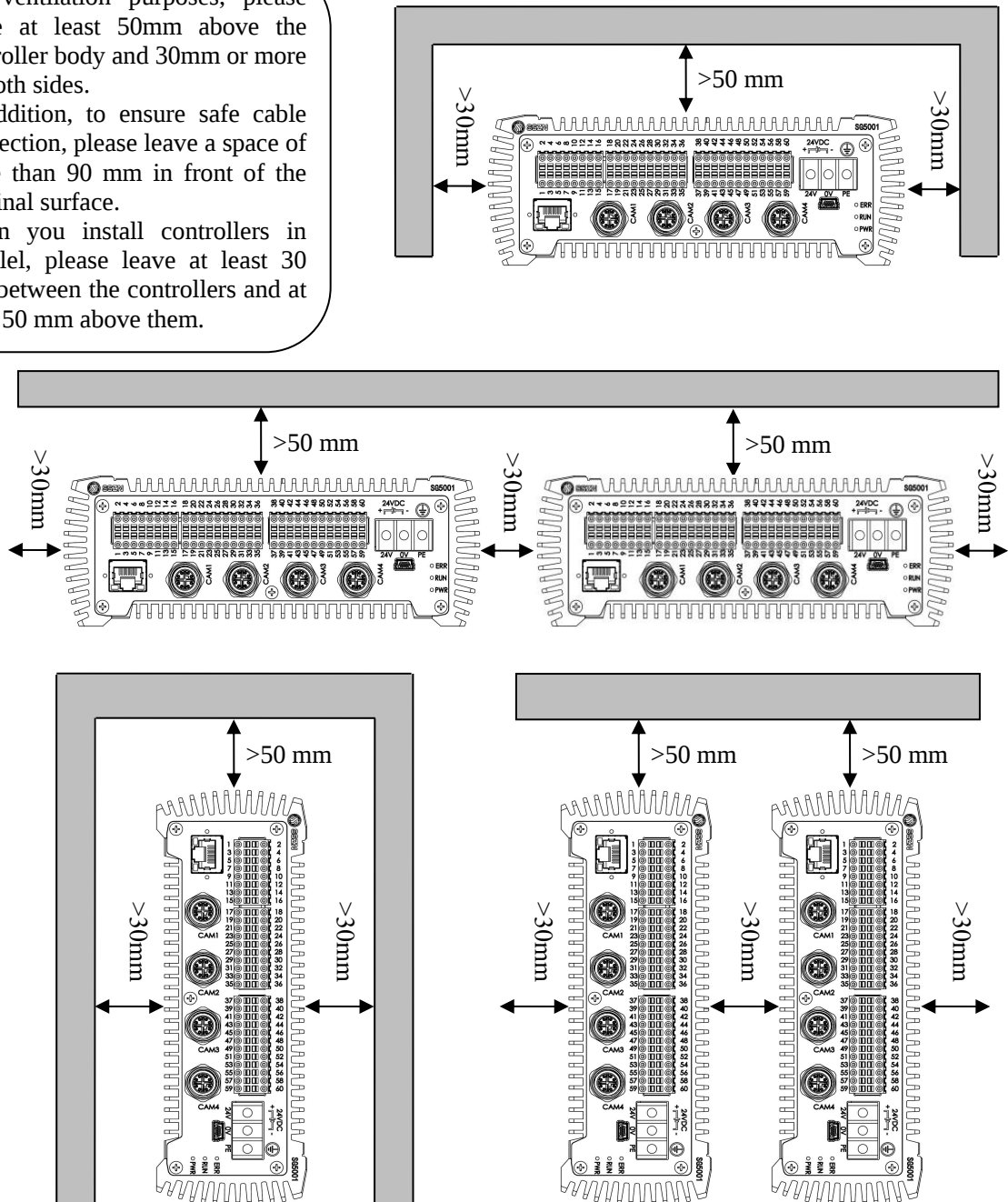


Figure 3-10 Schematic diagram of controller installation requirements

IMPORTANT

- Please do not block the ventilation openings above and at the bottom of the controller. Otherwise, the accumulated heat inside can cause malfunctions.
- When the temperature inside the control board exceeds the rated value of the operating environment temperature (50°C), please take measures such as forced air cooling or increasing the distance between controllers and surrounding objects for ventilation to lower the ambient temperature below the rated value.

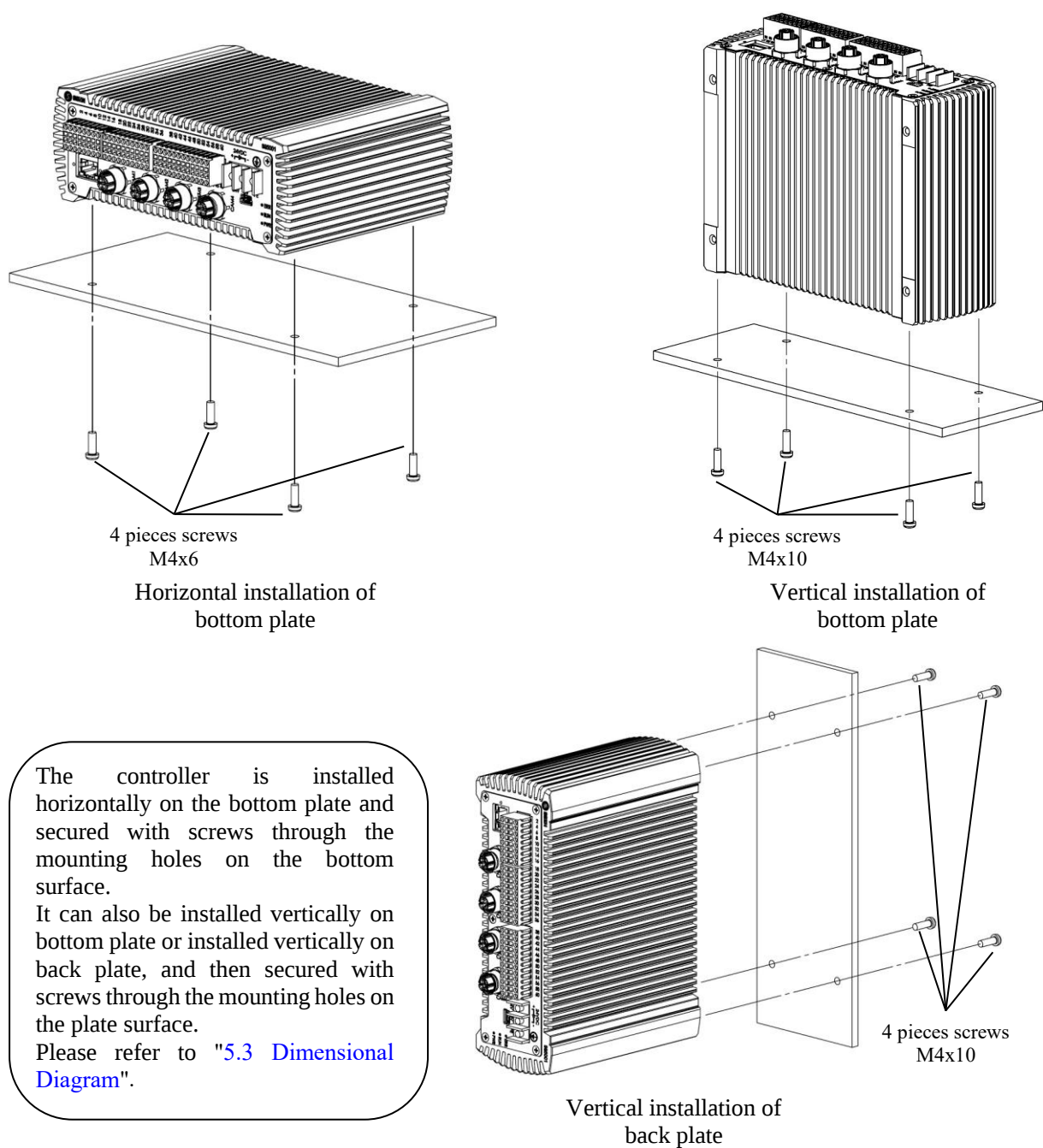


Figure 3-11 Schematic Diagram of Controller Installation

Chapter 4 Hardware Connection

4.1 System Wiring Diagram

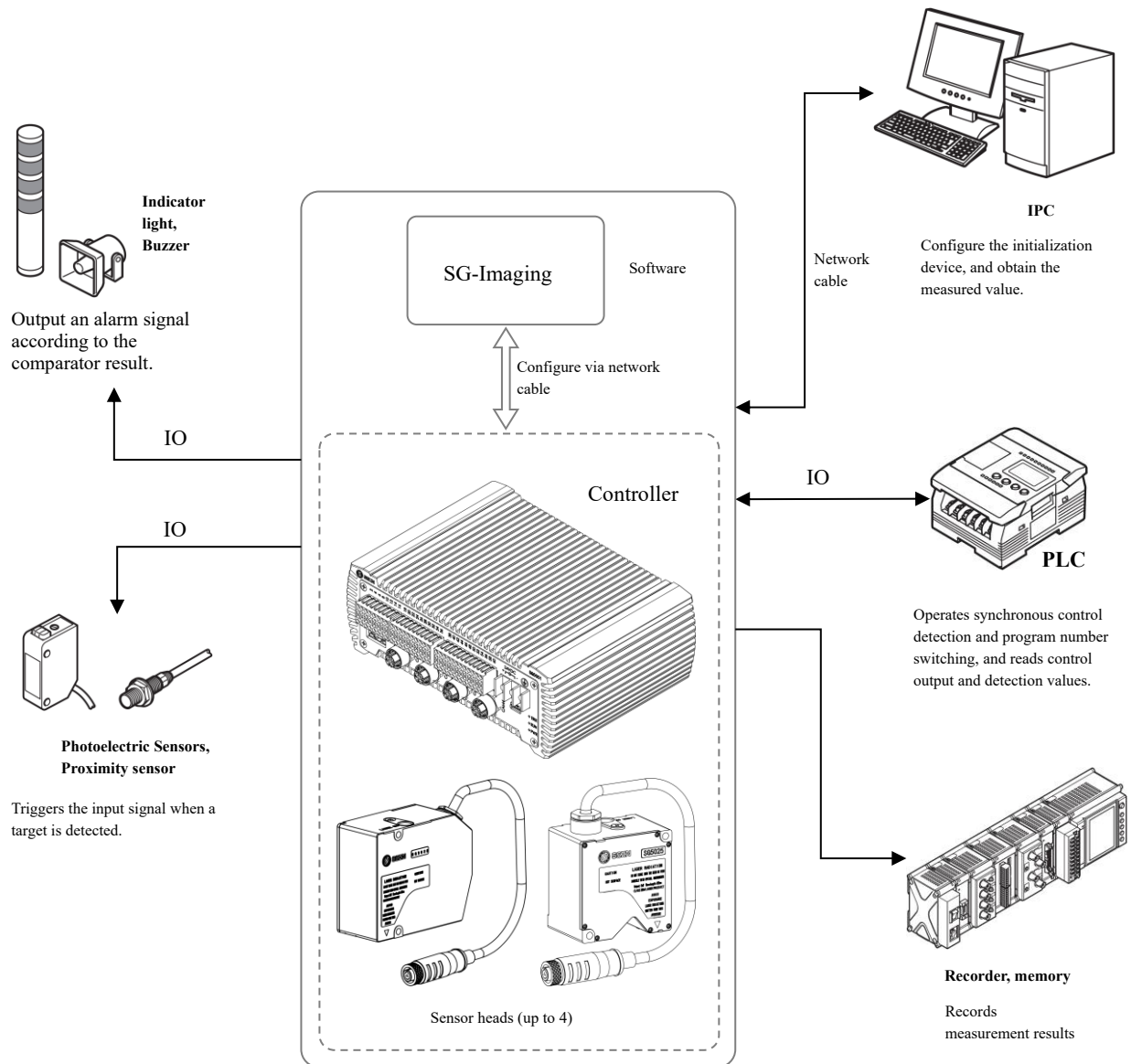


Figure 4-1 System composition diagram



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 Names and Functions of I/O Pins

4.2.1 Definition of I/O Pins

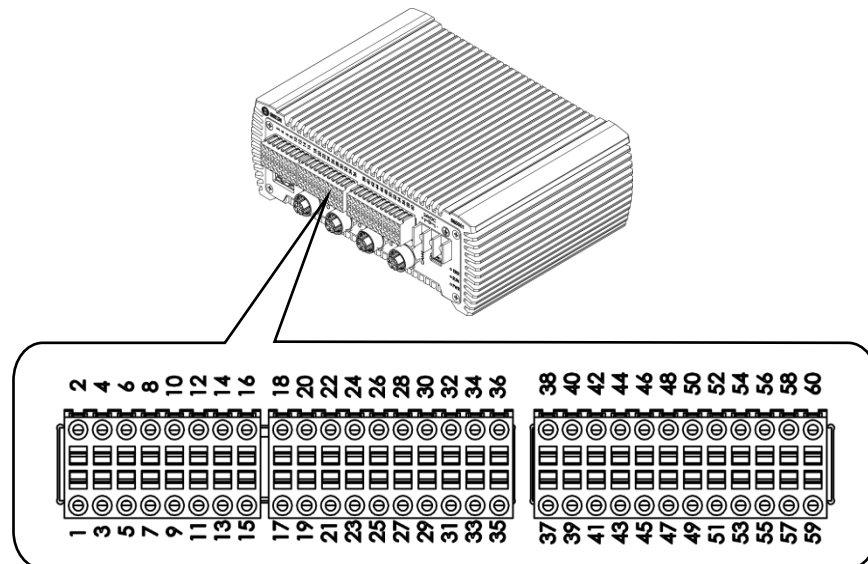


Figure 4-2 Schematic diagram of Pin Number

1. Common Terminal

Pin No.	Signal name	Description
1	COM_IN	COM for input
19		
2	COM_OUT	COM for output
20		
48		

2. Input Terminal

Pin No.	Signal name	Description
1	COM_IN	COM for input
3	TIMING_SYNC	Timing (Sync.) input
4	ZERO_SYNC	Auto-zero (Sync.) input
5	RESET_SYNC	Reset (Sync.) input
6	TIMING	Timing input (binary selection)
7	ZERO	Auto-zero input (binary selection)
8	RESET	Reset input (binary selection)
9	LASER_CTRL1	Laser control input 1
10	LASER_CTRL2	Laser control input 2
11	B_IN1	Binary selection input
12	B_IN2	
13	DEC_IN	Binary selection confirmation input
14	Reserve	None
15	P1	Program number switching input

16	P2	
17	P3	
18	Reserve	None
19	COM_IN	COM for input

3. Output Terminal

Pin No.	Signal name	Description
52	OUT1_HI	OUT1 comparator HI output
51	OUT1_GO	OUT1 comparator GO output
50	OUT1_LO	OUT1 comparator LO output
49	OUT1_STROBE	OUT1 strobe output
48	COM_OUT	COM for output
47	Reserve	No
46	OUT2_HI	OUT2 comparator HI output
45	OUT2_GO	OUT2 comparator GO output
44	OUT2_LO	OUT2 comparator LO output
43	OUT2_STROBE	OUT2 strobe output
[42:37]	Reserve	None
36	OUT3_HI	OUT3 comparator HI output
35	OUT3_GO	OUT3 comparator GO output
34	OUT3_LO	OUT3 comparator LO output
33	OUT3_STROBE	OUT3 strobe output
32	OUT4_HI	OUT4 comparator HI output
31	OUT4_GO	OUT4 comparator GO output
30	OUT4_LO	OUT4 comparator LO output
29	OUT4_STROBE	OUT4 strobe output
[28:21]	Reserve	None
20	COM_OUT	COM for output

4. Analog Output

Pin No.	Signal name	Description
21	ANALOG_OUT1	Analog voltage output of OUT1 (0~10V)
22	AGND	Analog reference ground
23	ANALOG_OUT2	Analog voltage output of OUT2 (0~10V)
24	AGND	Analog reference ground
25	ANALOG_OUT3	Analog voltage output of OUT3 (0~10V)
26	AGND	Analog reference ground
27	ANALOG_OUT4	Analog voltage output of OUT4 (0~10V)
28	AGND	Analog reference ground

5. Encoder Interface

Pin No.	Signal name	Description
37	ENC_A+	Encoder Phase A input positive pole, optical isolation, RS-422 standard differential input (built-in AM26LS32 equivalent).

38	ENC_A-	Differential encoder Phase A input negative pole, optical isolation, RS-422 standard differential input (built-in AM26LS32 equivalent).
39	ENC_B+	Encoder Phase B input positive pole, optical isolation, RS-422 standard differential input (built-in AM26LS32 equivalent).
40	ENC_B-	Differential encoder Phase B input negative pole, optical isolation, RS-422 standard differential input (built-in AM26LS32 equivalent).
41	ENC_Z+	Encoder Phase Z input positive pole, optical isolation, RS-422 standard differential input (built-in AM26LS32 equivalent).
42	ENC_Z-	Differential encoder Phase Z input negative pole, optical isolation, RS-422 standard differential input (built-in AM26LS32 equivalent).

6. RS-232 Terminal

Pin No.	Signal name	Description
55	RS232_TX	Send signals to external devices
56	RS232_RX	Receive signals from external devices
57	RS232_GND	Earth wire
[58:60]	Reserve	None

4.2.2 Function and Use of I/O Terminals

Please refer to the *SG-Series Laser Displacement Sensor Software User Manual* that comes with this product for the usage method of the universal digital input interface function. The universal digital input interface adopts optocoupler isolation, which is effective at low levels. For detailed parameters and wiring diagrams, please refer to Table "[Table 5-4 Electrical parameters of universal digital input signal](#)".

For instructions on using the high-speed digital input interface function, please refer to the *SG-Series Laser Displacement Sensor Software User Manual* that comes with this product. The high-speed digital input interface adopts high-speed optocoupler isolation, which is effective at low logic levels. For detailed parameters and wiring diagrams, please refer to "[Table 5-5 Electrical parameters of high-speed digital input signals](#)".

Please refer to the *SG-Series Laser Displacement Sensor Software User Manual* that comes with this product for the usage method of the universal digital output interface function. The universal digital output interface adopts optocoupler isolation, MOSFET drain open circuit output, with a maximum current limit of 20mA. For detailed parameters and wiring diagrams, please refer to Table "[Table 5-6 Electrical parameters of universal digital output signal](#)".

For instructions on using the high-speed digital output interface function, please refer to the *SG-Series Laser Displacement Sensor Software User Manual* that comes with this product. The high-speed digital output interface adopts high-speed optocoupler isolation, MOSFET drain open circuit output, with a maximum current limit of 20mA. For detailed parameters and wiring diagrams, please refer to Table "[Table 5-7 Electrical parameters of high-speed digital output signals](#)".

4.3 Connect the Controller and Sensor Head

The steps for connecting the controller and sensor head are described as follows:

BE CAREFUL	- Do not supply power to the controller before connecting the sensor head cable. If the data communication sensor head cable is connected while the power is on, the sensor head or controller will be damaged. - 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.
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Step 1 Connect the sensor head cable to the data communication interface connector of the controller.

If only 1 sensor head is used, it should be connected to the CAM 1 connector. After tightening the aviation plug by hand, use a wrench and other tools to further tighten it by a quarter turn to confirm that it is firmly fixed.

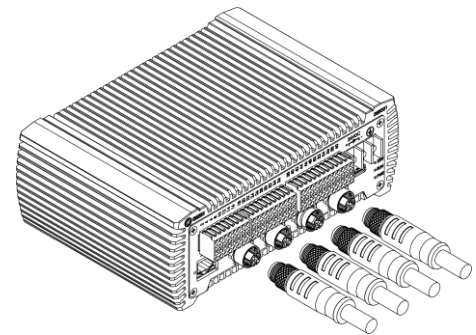


Figure 4-3 Schematic diagram for connecting the sensor head cable to the controller

Step 2 Connect the sensor head and sensor head cable.

Align the orientation of the connectors, and slowly rotate to insert them to the bottom. The tightening torque of the screws is 1 to 1.5 N·m.

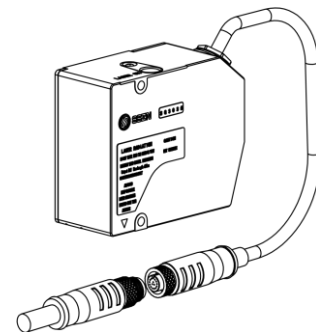


Figure 4-4 Schematic diagram of connecting the sensor head cable to the sensor head

BE CAREFUL	- 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° ~60° with tools, such as wrench.
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4.4 Connect the Controller and Power Supply

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

BE CAREFUL	• Please use the electric wires from AWG14 to AWG20. • When the terminal is a crimp one, use a product with the following size that fits M3 screws.  Y-shaped crimp terminal • The tightening torque of the screw is from 0.5 to 0.75N·m, please tighten it. • The power of DC24V power supply is required to be greater than or equal to 36W.
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Step 1 Connect the DC24V power supply to the 24V power terminal of the controller.

4.5 How to Use the Terminal Block

The method to use the terminal is described as follows.

▶ IMPORTANT

- Please use the wires from AWG16 ~ AWG28.
- The stripping length of the front end of the wire is about 8mm.
- Do not treat the front end of the electric wire with soldering (pre-solder and solder).
- The electric wires should solidly be inserted to the bottom of the terminal block.

Step 1 Use a flat-head screwdriver to press Part a of the terminal block, and insert the electric wire into Part b.

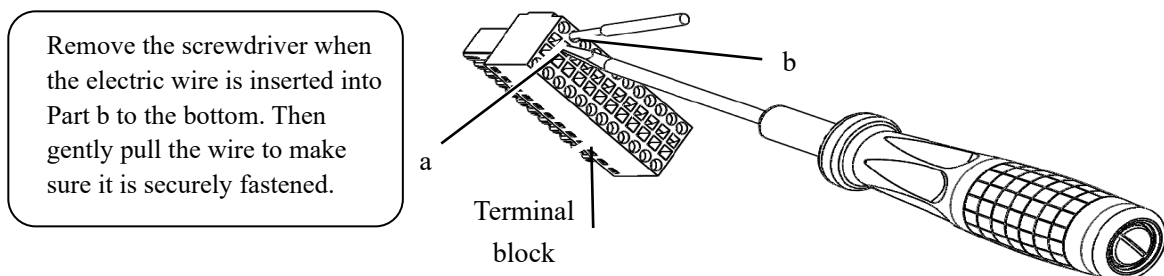


Figure 4-5 Schematic diagram of terminal block wiring

Step 2 After inserting it to the bottom, remove the screwdriver, and then gently pull the wire to confirm that it is securely fastened.

Chapter 5 Specifications

5.1 System Parameters

5.1.1 SG3000-Series Parameters

Table 5-1 SG3000-Series Parameters

Parameters		SG3000-Series Laser Displacement Sensor		
Model	Note 1	SG3030 / SG3035	SG3080 / SG3085	SG3150 / SG3155
Reference distance		30mm	80mm	150mm
Measuring distance		25mm~35mm	65mm~97mm	115mm~197mm
Repeatability	Note 2	0.05μm	0.2μm	0.5μm
Linearity		±0.05% of full scale (F.S. = 10mm)	±0.05% of full scale (F.S. = 32mm)	±0.05% of full scale (F.S. = 82mm)
Temperature characteristics		±0.01%/°C of full scale (F.S. = 10mm)	±0.01%/°C of full scale (F.S. = 32mm)	±0.01%/°C of full scale (F.S. = 82mm)
Sampling frequency		88/50/20/10/5/2/1KHz (7 levels are optional)		
Light source	Emitter	Red semiconductor laser		
	Wavelength	655nm		
	Laser class	Class 2 (IEC60825-1:2014), Class IIIa (FDA CDRH Part 1040.10)		
	Output power	5mW		
	Spot size (μm)	Φ60 (SG3030)/ 60×400 (SG3035)	Φ110 (SG3080)/ 110×720 (SG3085)	Φ190 (SG3150)/ 190×1300 (SG3155)
Ambient brightness		Incandescent or fluorescent lamp: 10,000 lux Max.		
Operating temperature		0~50°C		
Storage temperature		-20~70°C		
Operating humidity		35%-85% no condensation		
ESD protection		Contact discharge 4kV, air discharge 8kV, in line with IEC 61000-4-2		
EFT protection		Power port 2kV/5 or 100kHz, signal port 1kV/5 or 100kHz, in line with IEC 61000-4-4		
Bumps		15Gs/6ms per axis, in line with IEC 68-2-27 Ea		
Vibrations		10 ~ 100Hz total amplitude of 1.5mm, each direction, namely X, Y, Z for 2 hours, in line with IEC 68-2-6 Fc		
Enclosure protection level		IP67, in line with IEC 60529		
Case material		Aluminum alloy		
Dimensions (mm)		90x76x39	85x77x47	85x76x47
Weight (g)		324	376	370
Data cable model		SCB-GCAM-HA1-3m / SCB-GCAM-HAY-5m		

Note 1: SG3xx0 laser spot is narrow spot type, which is recommended to be used for fine object measurement, while SG3xx5 laser spot is wide spot type, which is recommended to be used for rough object measurement.

Note 2: At the reference distance, take the average of 4096 measurements.

Note 3: Standard dimensions at the reference distance.

5.1.2 SG5000-Series Parameters

Table 5-2 SG5000-Series Parameters

Parameters		SG5000 Series Laser Displacement Sensor			
Model ^{Note 1}		SG5020 / SG5025	SG5050 / SG5055	SG5080 / SG5085	SG5150 / SG5155
Reference distance		20mm	50mm	80mm	150mm
Measuring distance		17mm~23mm	42mm~59mm	64mm~99mm	115mm~197mm
Repeatability ^{Note 2}		0.02μm	0.025μm	0.1μm	0.25μm
Linearity		±0.02% of full scale (F.S. = 6mm)	±0.02% of full scale (F.S. = 17mm)	±0.02% of full scale (F.S. = 35mm)	±0.02% of full scale (F.S. = 82mm)
Temperature characteristics		±0.01%/°C of full scale (F.S. = 6mm)	±0.01%/°C of full scale (F.S. = 17mm)	±0.01%/°C of full scale (F.S. = 35mm)	±0.01%/°C of full scale (F.S. = 82mm)
Sampling frequency		590/400/200/88/50/20/10/5/2/1KHz (10 levels are optional)			
Laser source	Emitter	Red semiconductor laser			
	Wavelength	655nm			
	Laser class	Class 2 (IEC60825-1:2014), Class IIIa (FDA CDRH Part 1040.10)			
	Output power	5mW			
	Spot size ^{Note 3} (μm)	Φ45 (SG5020)/ 45×400 (SG5025)	Φ75 (SG5050)/ 75×480 (SG5055)	Φ110 (SG5080)/ 110×720 (SG5085)	Φ190 (SG5150)/ 190×1300 (SG5155)
Ambient brightness		Incandescent or fluorescent lamp: 10,000 lux Max.			
Operating temperature		0~50°C			
Storage temperature		-20-70°C			
Operating humidity		35%-85% no condensation			
ESD protection		Contact discharge 4kV, air discharge 8kV, in line with IEC 61000-4-2			
EFT protection		Power port 2kV/5 or 100kHz, signal port 1kV/5 or 100kHz, in line with IEC 61000-4-4			
Bumps		15Gs/6ms per axis, in line with IEC 68-2-27 Ea			
Vibrations		10 ~ 100Hz total amplitude of 1.5mm, each direction, namely X, Y, Z for 2 hours, in line with IEC 68-2-6 Fc			
Enclosure protection level		IP67, in line with IEC 60529			
Case material		Aluminum alloy			
Dimensions (mm)		61x62x41	69x71x47	75x70x47	85x76x47
Weight (g)		324	323	339	370
Data cable model		SCB-GCAM-HA1-3m / SCB-GCAM-HAY-5m			

Note 1: SG5xx0 laser spot is narrow spot type, which is recommended to be used for fine object measurement, while SG5xx5 laser spot is wide spot type, which is recommended to be used for rough object measurement.

Note 2: At the reference distance, take the average of 16384 measurements.

Note 2: Standard dimensions at the reference distance.

5.1.3 Controller Parameters

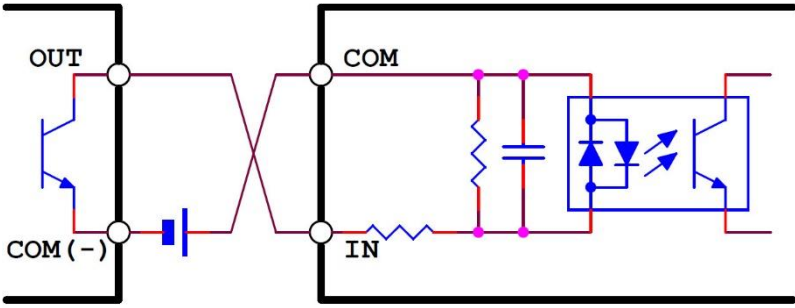
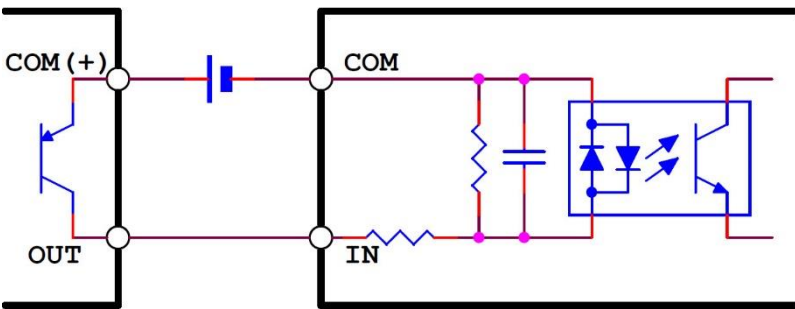
Table 5-3 Controller parameters

Parameters		Controller
Model		SG5001
Sensor head interface		4
I/O interface		16 input interfaces, 16 output interfaces
Encoder input		Support differential encoders
Analog output port		4 (current type/voltage type multiplexing ports)
Analog output	Electric current	Output 4~20mA, allowable load resistance below 300Ω
	Voltage	Output 0~10V, output impedance 100Ω
I/O		1 RS232 interface, 1 100Base-TX/1000Base-T Ethernet interface
Operating temperature		0~50°C
Storage temperature		-20-70°C
Operating humidity		35%-85% no condensation
ESD protection		Contact discharge 4kV, air discharge 8kV, in line with IEC 61000-4-2
EFT protection		Power port 2kV/5 or 100kHz, signal port 1kV/5 or 100kHz, in line with IEC 61000-4-4
Vibrations		10-100Hz total amplitude of 1.5mm, each direction, namely X, Y, Z for 3 hours, in line with IEC 68-2-6 Fc
Dimensions (mm)		182x139x64
Weight (g)		1583

5.2 Electrical Parameters of I/O Signals

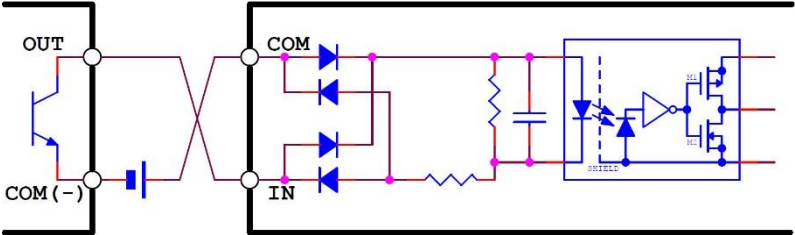
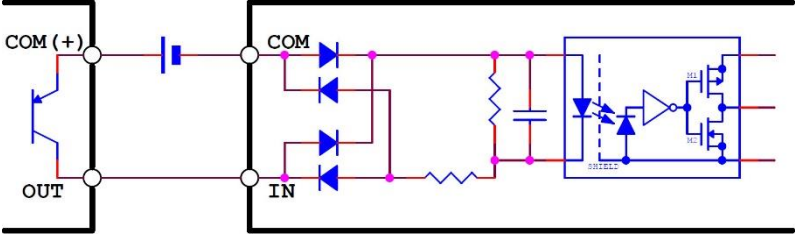
5.2.1 Electrical Parameters of Digital Input Signals

Table 5-4 Electrical parameters of universal digital input signal

Parameter	Symbol	Nominal value
High level input voltage	V_{IH}	$> 22V^{Note1}$ and $< 26.4V$
Low level input voltage	V_{IL}	$< 7V^{Note1}$
Low level input current	I_{IL}	$> 4.5mA$
Isolation voltage	BV_s	$3750V_{rms}$ (Test conditions: AC power for 1 minute)
Isolation resistor	R_s	$> 10^{12}\Omega$ (Test conditions: apply 500VDC to both ends)
Minimum input pulse width	T_s	1ms
Internal circuit and wiring diagram	 PLC Open drain output (NPN type) The input circuit of this machine	
	 PLC source output (PNP type) The input circuit of this machine	

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

Table 5-5 Electrical parameters of high-speed digital input signals

Parameter	Symbol	Nominal value
High level input voltage	V_{IH}	$> 22V$ ^{Note 1} and $< 26.4V$
Low level input voltage	V_{IL}	$< 3.6V$ ^{Note 1}
Low level input current	I_{IL}	$> 7.5mA$
Isolation voltage	BV_s	$3750V_{rms}$ (Test conditions: AC power for 1 minute)
Isolation resistor	R_s	$> 10^{12}\Omega$ (Test conditions: apply 500VDC to both ends)
Minimum input pulse width	T_s	0.5us
Internal circuit and wiring diagram	 PLC Open drain output (NPN type) The input circuit of this machine	
	 PLC source output (PNP type) The input circuit of this machine	

Note 1: The voltage level between 3.6 and 22V is uncertain and cannot be accurately determined.

5.2.2 Electrical Parameters of Digital Output Signals

Table 5-6 Electrical parameters of universal digital output signal

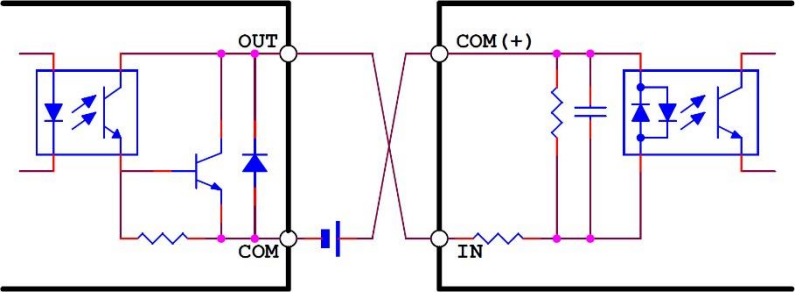
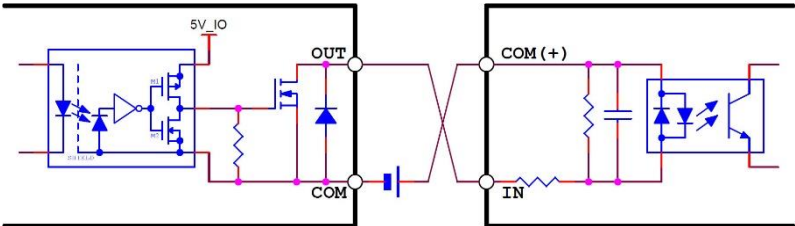
Parameter	Symbol	Nominal value
Maximum output Sink current	I_{OL}	20mA (Continuously)
Maximum leakage current in closed state	I_L	0.5uA (Test conditions: apply 24VDC to V_O)
Low level output voltage	V_{OL}	< 0.3V (Test conditions: $I_{OL}=20mA$)
Isolation voltage	BV_s	2500V _{rms} (Test conditions: AC power for 1 minute)
Isolation resistor	R_s	> $10^{11}\Omega$ (Test conditions: apply 1kVDC to both ends)
Maximum switching frequency	f_s	1KHz
Internal circuit and wiring diagram	 The output circuit of this machine PLC input circuit (common-source)	

Table 5-7 Electrical parameters of high-speed digital output signals

Parameter	Symbol	Nominal value
Maximum output Sink current	I_{OL}	20mA (Continuously)
Maximum leakage current in closed state	I_L	1uA (Test conditions: apply 24VDC to V_O)
Low level output voltage	V_{OL}	< 0.4V (Test conditions: $I_{OL}=20mA$)
Isolation voltage	BV_s	3750V _{rms} (Test conditions: AC power for 1 minute)
Isolation resistor	R_s	> $10^{12}\Omega$ (Test conditions: apply 500VDC to both ends)
Maximum switching frequency	f_s	1MHz
Internal circuit and wiring diagram	 The output circuit of this machine PLC input circuit (common-source)	

5.3 Dimensional Diagram

5.3.1 SG3030/5 Sensor Head Dimensional Diagram

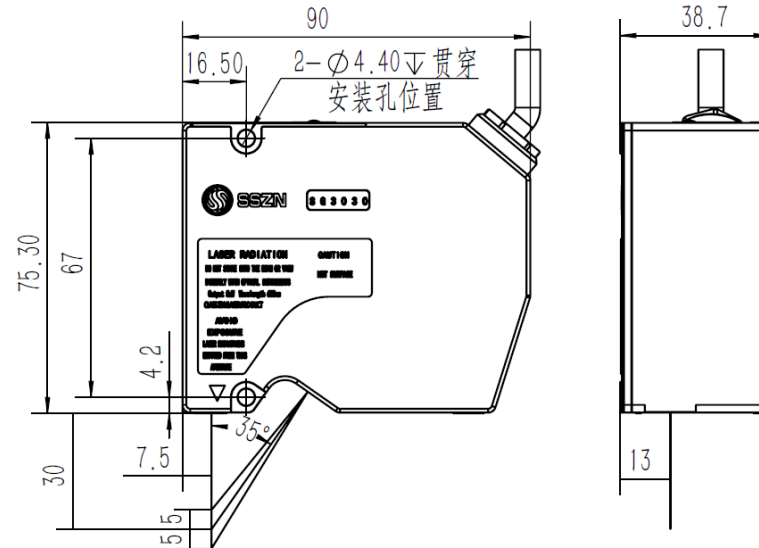


Figure 5-1 SG3030/5 Sensor Head dimensional diagram Unit (mm)

5.3.2 SG3080/5 Sensor Head Dimensional Diagram

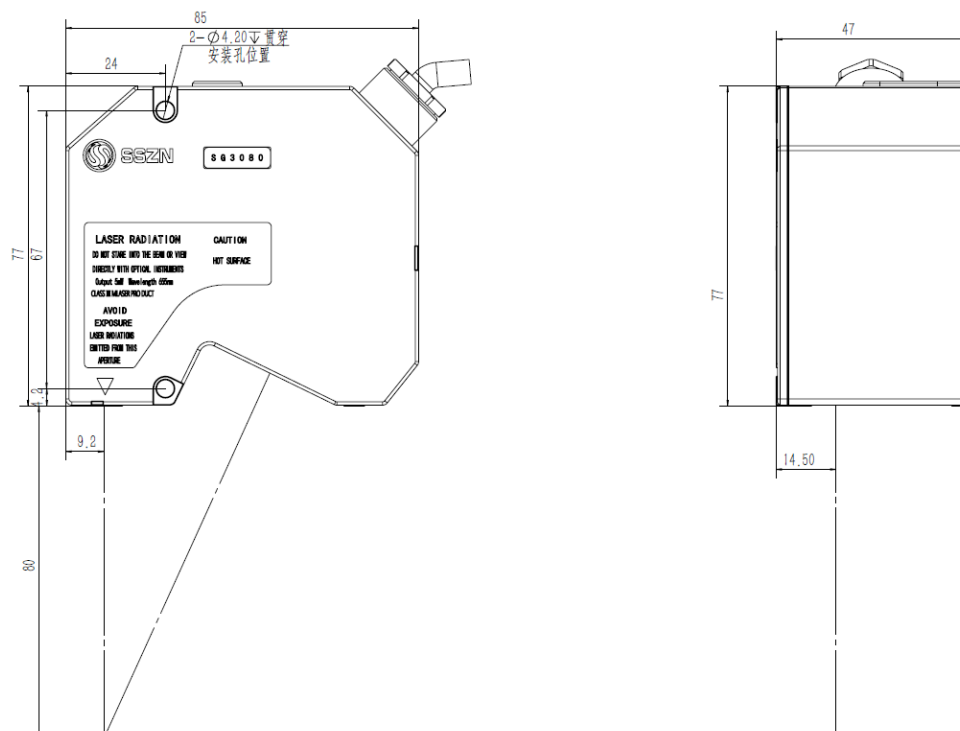


Figure 5-2 SG3080/5 Sensor Head dimensional diagram Unit (mm)

5.3.3 SG3150/5 Sensor Head Dimensional Diagram

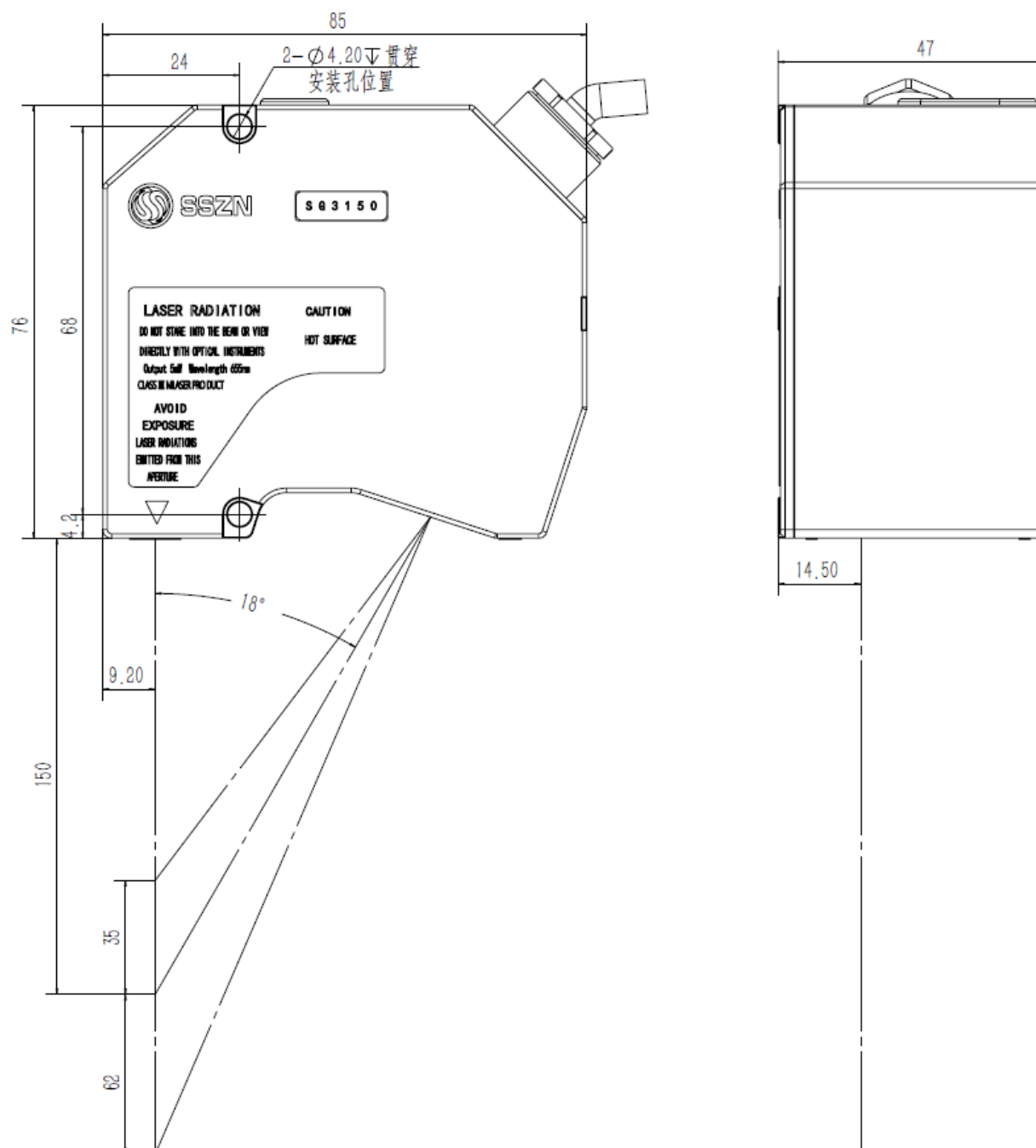


Figure 5-3 SG3150/5 Sensor Head dimensional diagram Unit (mm)

5.3.4 SG5020/5 Sensor Head Dimensional Diagram

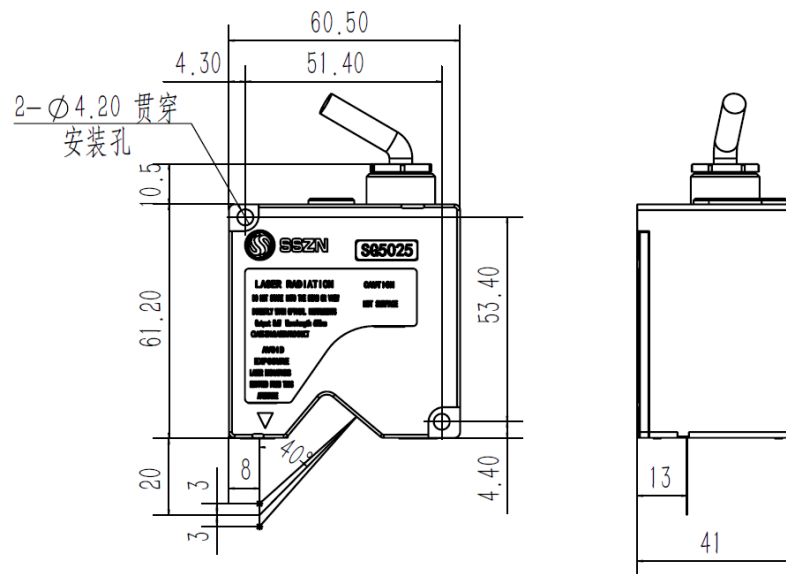


Figure 5-4 SG5020/5 Sensor Head dimensional diagram Unit (mm)

5.3.5 SG5050/5 Sensor Head Dimensional Diagram

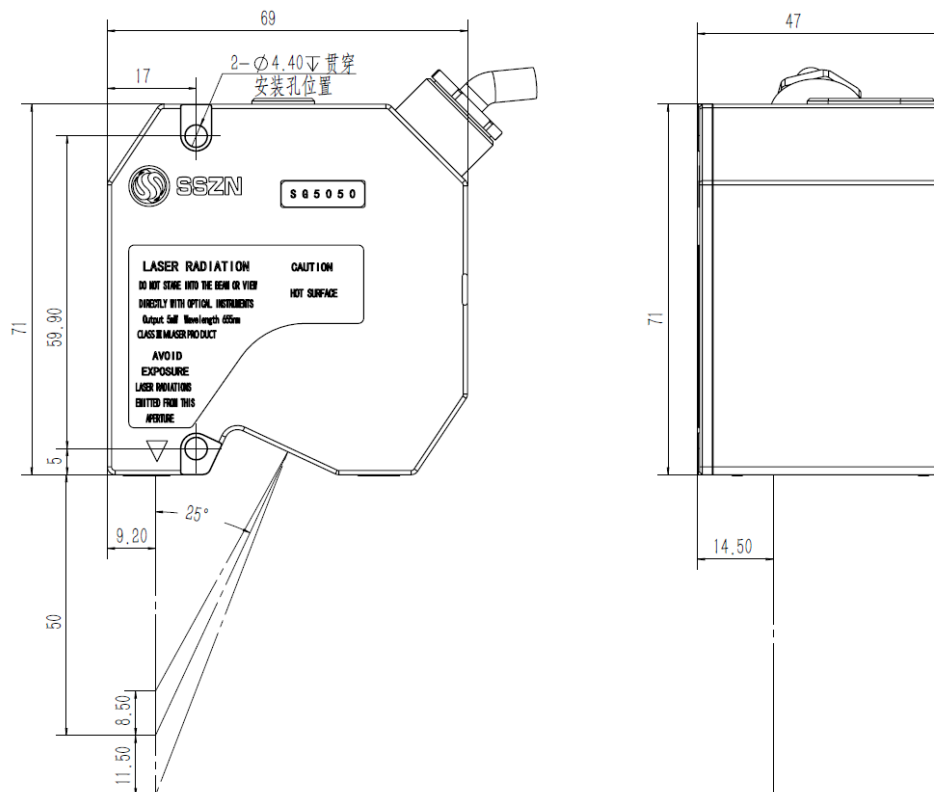


Figure 5-5 SG5050/5 Sensor Head dimensional diagram Unit (mm)

5.3.6 SG5080/5 Sensor Head Dimensional Diagram

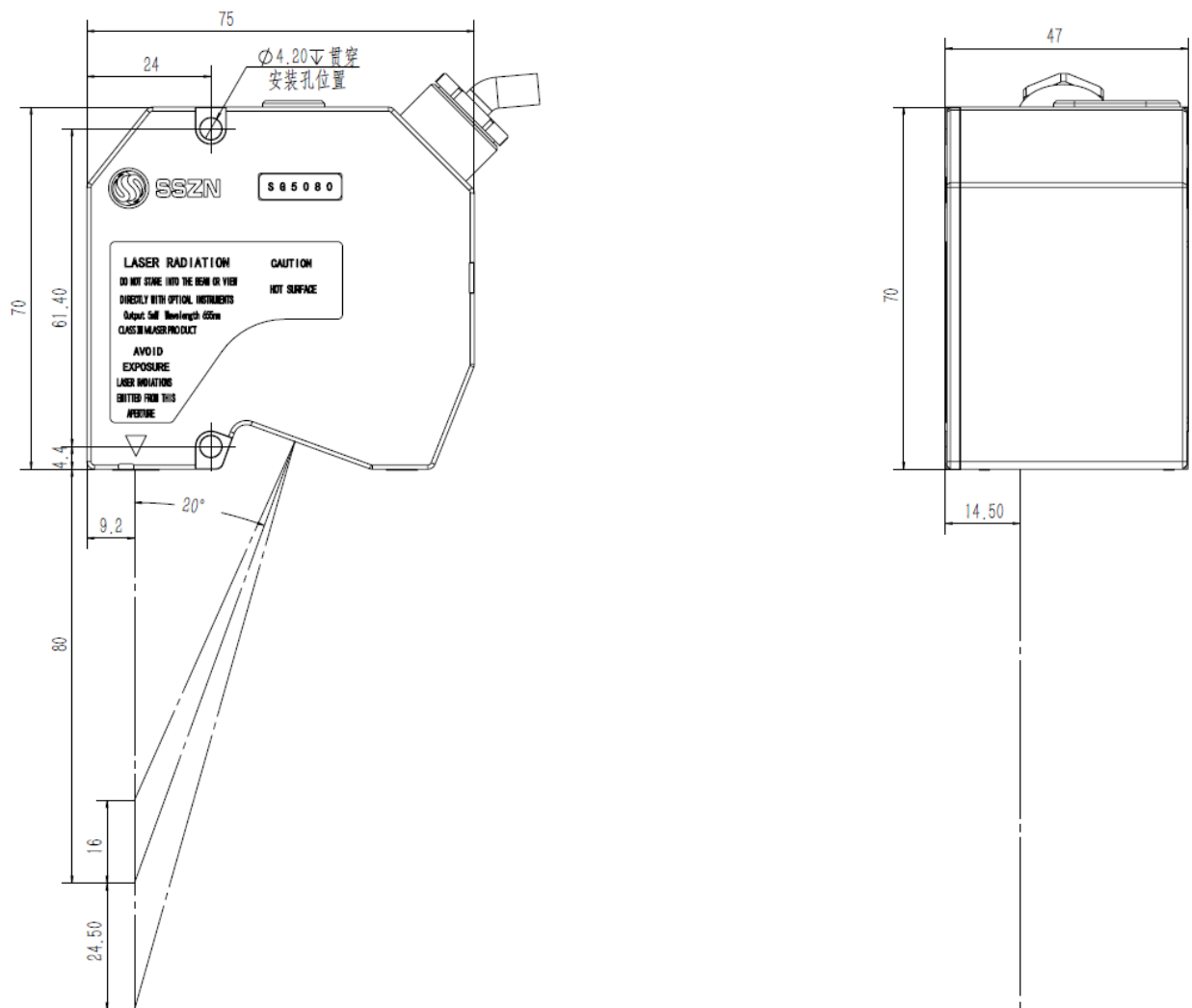


Figure 5-6 SG5080/5 Sensor Head dimensional diagram Unit (mm)

5.3.7 SG5150/5 Sensor Head Dimensional Diagram

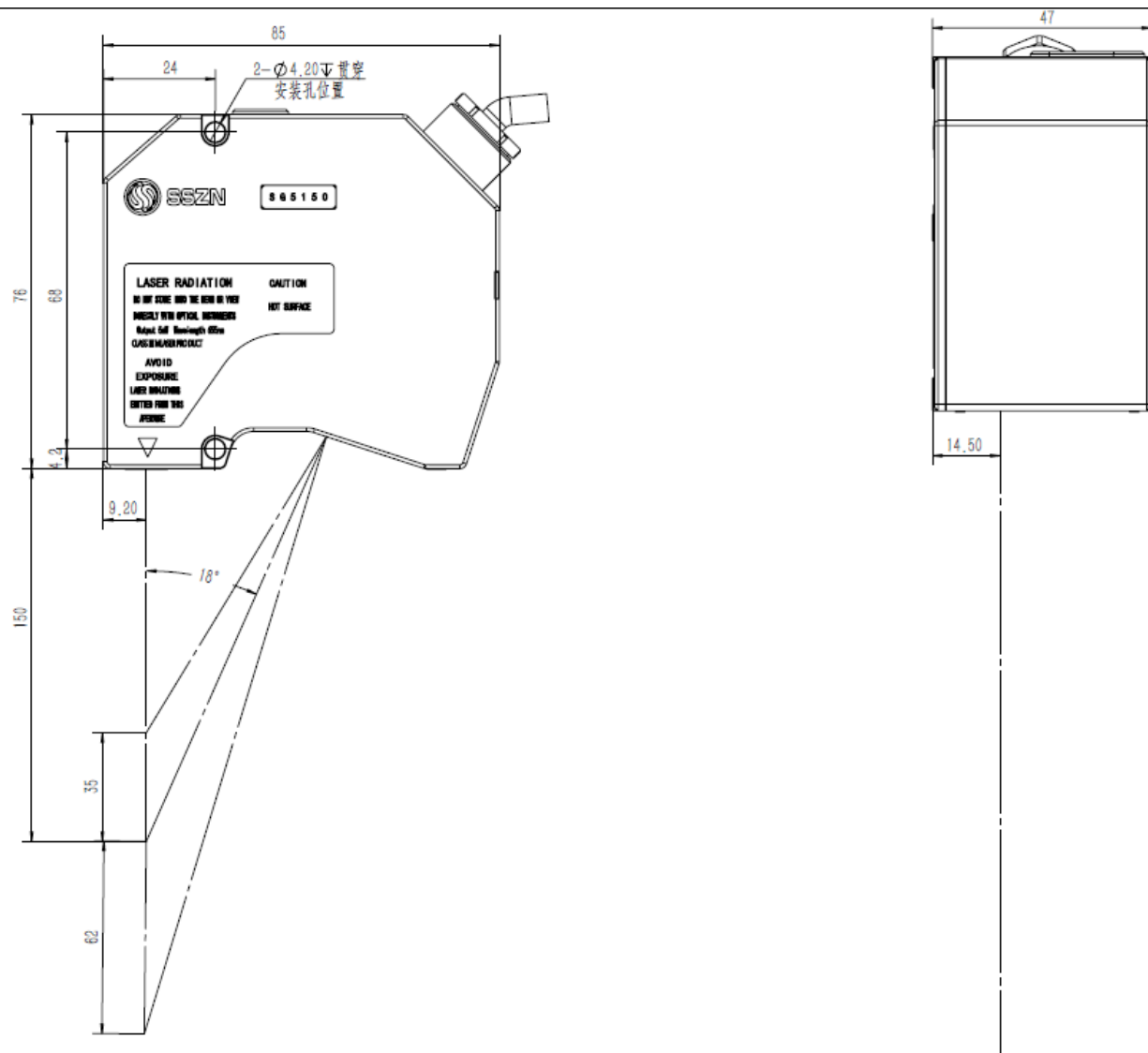


Figure 5-7 SG5150/5 Sensor Head dimensional diagram Unit (mm)

5.3.8 SG5001 Controller Dimensional Diagram

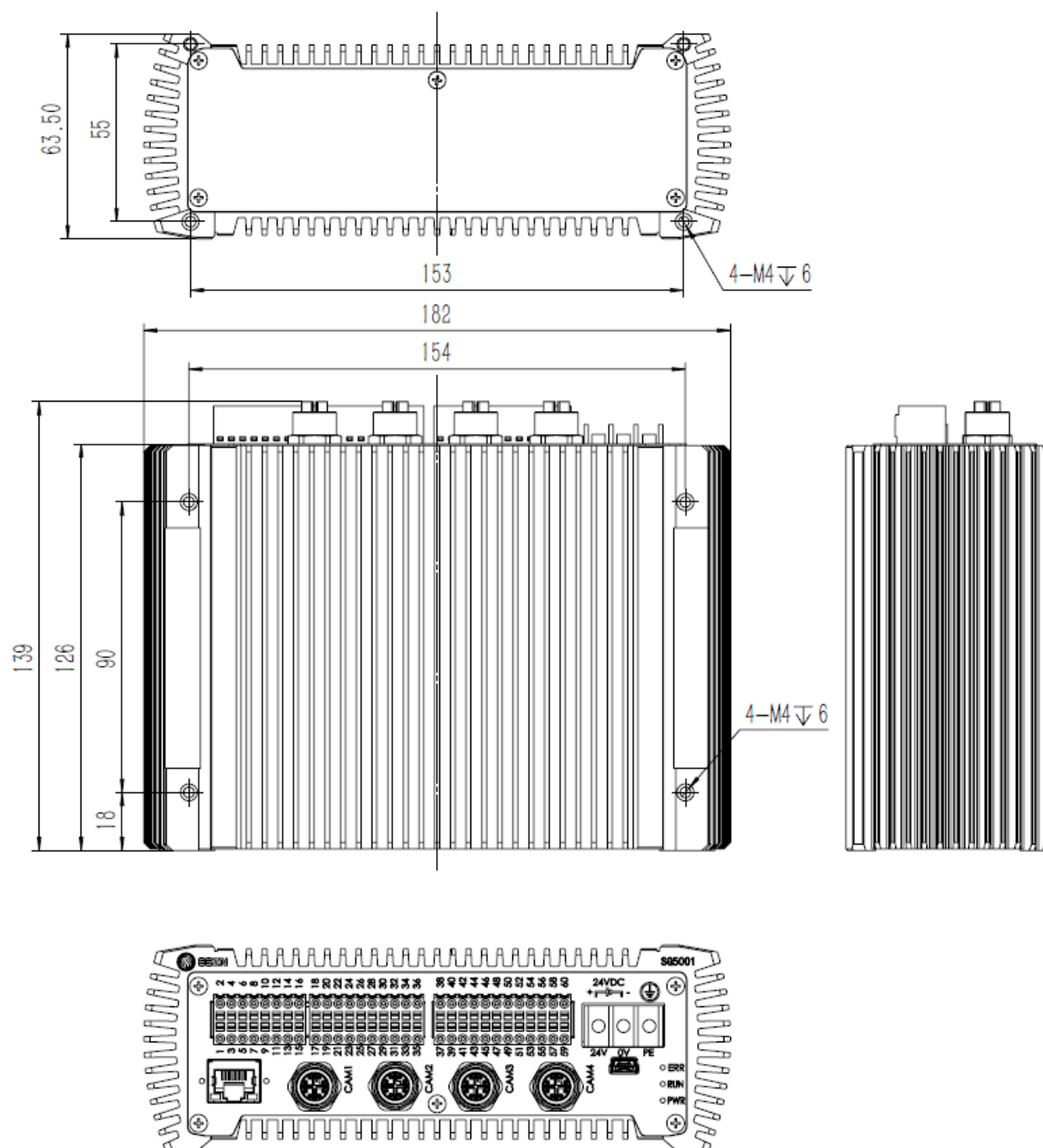


Figure 5-8 SG5001 Controller Dimensional Diagram Unit (mm)