Industrial Grade 2 LIDAR

Introduction and Operation Guidelines

Product Model: LGA10

1.Specification

1.1Technical Parameters

Model	LGA10
Ranging principle	Pulsed TOF
Laser wavelength	905nm
Maximum detection distance	≥20m (90% reflectivity) ≥8m (10% reflectivity)
Detection range	270°
Data sampling rate	20KHz
Scanning frequency	10/20Hz
Angle resolution	0.18°/0.36°
Ranging accuracy	±3cm
Response time	50/100ms
Startup time	< 8s
Number of region groups	15 (each channel contains 3 detection regions)
Digital input	4
Digital output	4 (2 regional alarm signals, 1 pair of OSSD safety output signals) NPN OR PNP output
Indicator lights	4 (3 regional signals, 1 fault signal)
Communication interface	(USB or RS232 or RS485) &Ethernet
Power supply	DC 9 V - 28 V
Power consumption	Rated power: < 2W (no load) Startup power: < 3W (no load)
Operating temperature	-10 ℃ to 55 ℃
Storage temperature	-20℃ to 70℃, condition: no condensation, no freezing
Ambient humidity	Below 85%RH, condition: no condensation, no freezing
Protection level	IP65
Resistance to ambient light	100kLux
Weight	171 g
Size	62mm(L)*62mm(W)*83mm(H)

Sine vibration	Frequency 10Hz~1000Hz, acceleration 5g, three axes, 10 cycles per axis
Random vibration	Frequency 5Hz~250Hz, G r.m.s = 4.24g, three axes, 5 hours per axis
Impact resistance	196m/ (20G) X, Y, Z directions, 10 times each
Electromagnetic compatibility	EN IEC 61000-6-2:2019 EN IEC 61000-6-4:2019

Table1: Technical parameters

Note: 1. The angular resolution is affected by the scanning frequency. At a low rotation speed, the angular resolution is smaller, and the point cloud data is more and denser.

2. The measurement accuracy refers to the measurement of 90% reflectivity (Kodak white) under standard environment.

3. The angle difference between the scanning plane of the LIDAR and the strong light incident angle needs to be greater than 5°.

1.2 Product Selection

Product model	Description
LGA10N1	NPN、USB output interface
LGA10N2	NPN、RS232 output interface
LGA10N3	NPN、RS485output interface
LGA10P1	PNP、USB output interface
LGA10P2	PNP、RS232 output interface
LGA10P3	PNP、RS485 output interface

2.LIDAR Picture

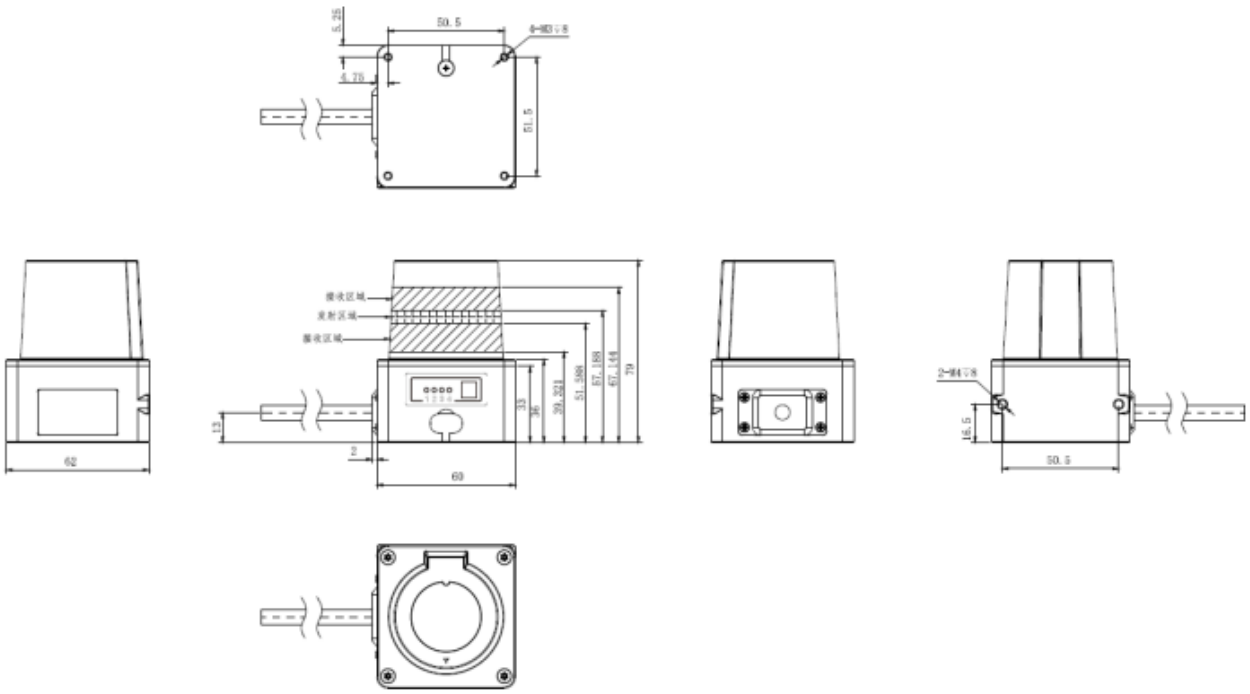

Figure 1: Mechanical dimension diagram

Note: The lidar includes a digital tube and 4 LED indicator lights.
Digital tube: used to indicate the specific effective region group.
Green light: light on indicates that the lidar is running normally, and light off indicates that the lidar is abnormal.
Red light: light on indicates that there is no object in the safety zone, and light off indicates that there is an object in the safety zone.
Blue light: light on indicates that there is no object in the warning zone 1, and light off indicates that there is an object in the warning zone 1.
Yellow light: light on indicates that there is no object in the warning zone 2, and light off indicates that there is an object in the warning zone 2.

3. Operation Mode

3.1 Fix Equipment

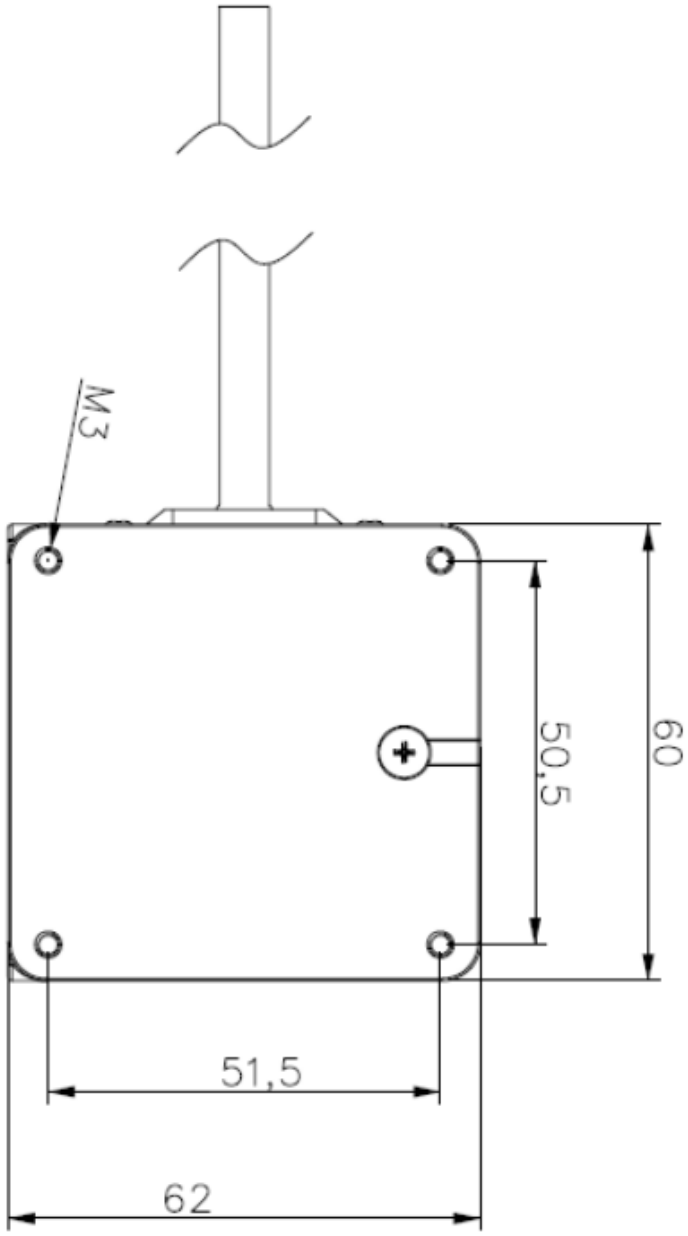

Figure 2: Schematic diagram of bottom fixation

The installation at the bottom of the equipment is fixed with M3 screws, with a depth of about 6mm at the bottom.

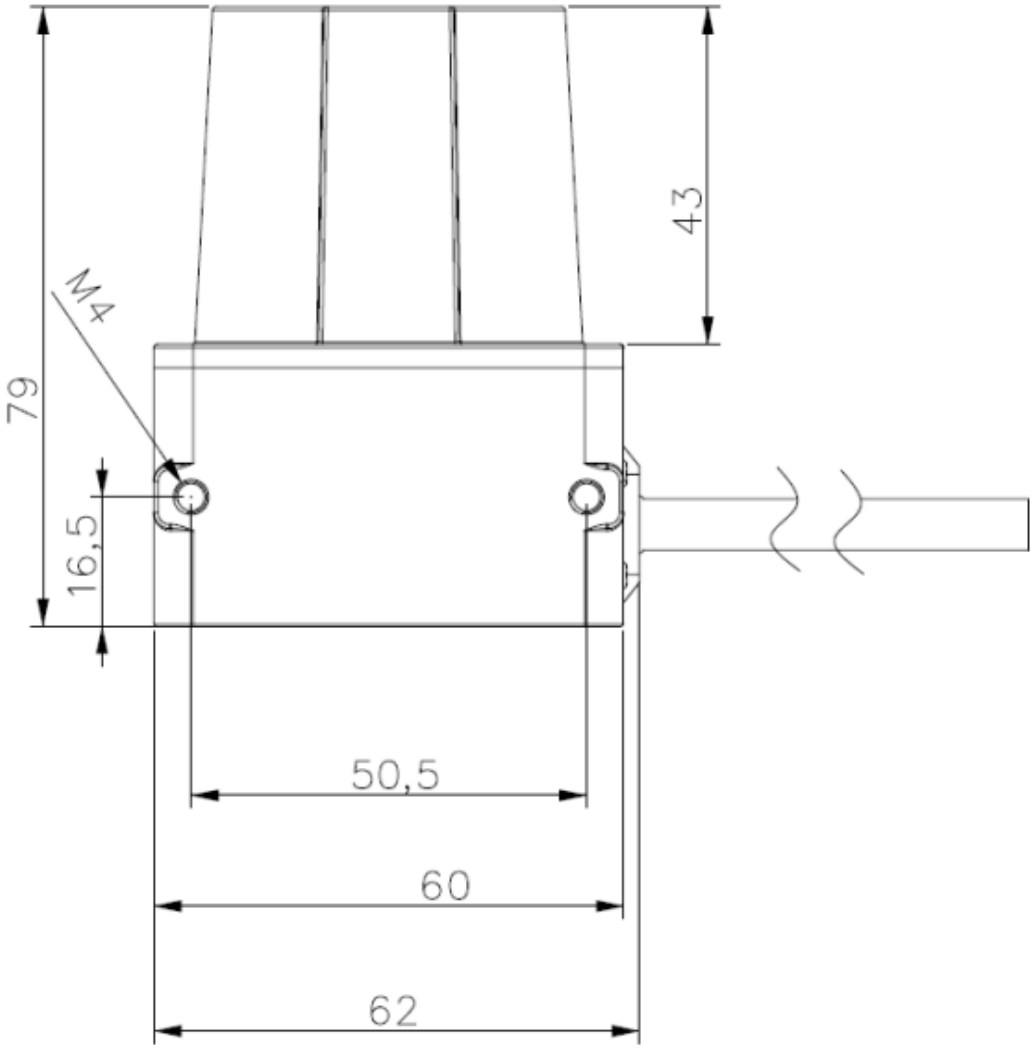

Figure 3: Schematic diagram of side fixation

The installation on the side of the equipment is fixed with M4 screws, with a depth of about 6mm at the bottom.

3.2 Schematic Diagram of Detection Range

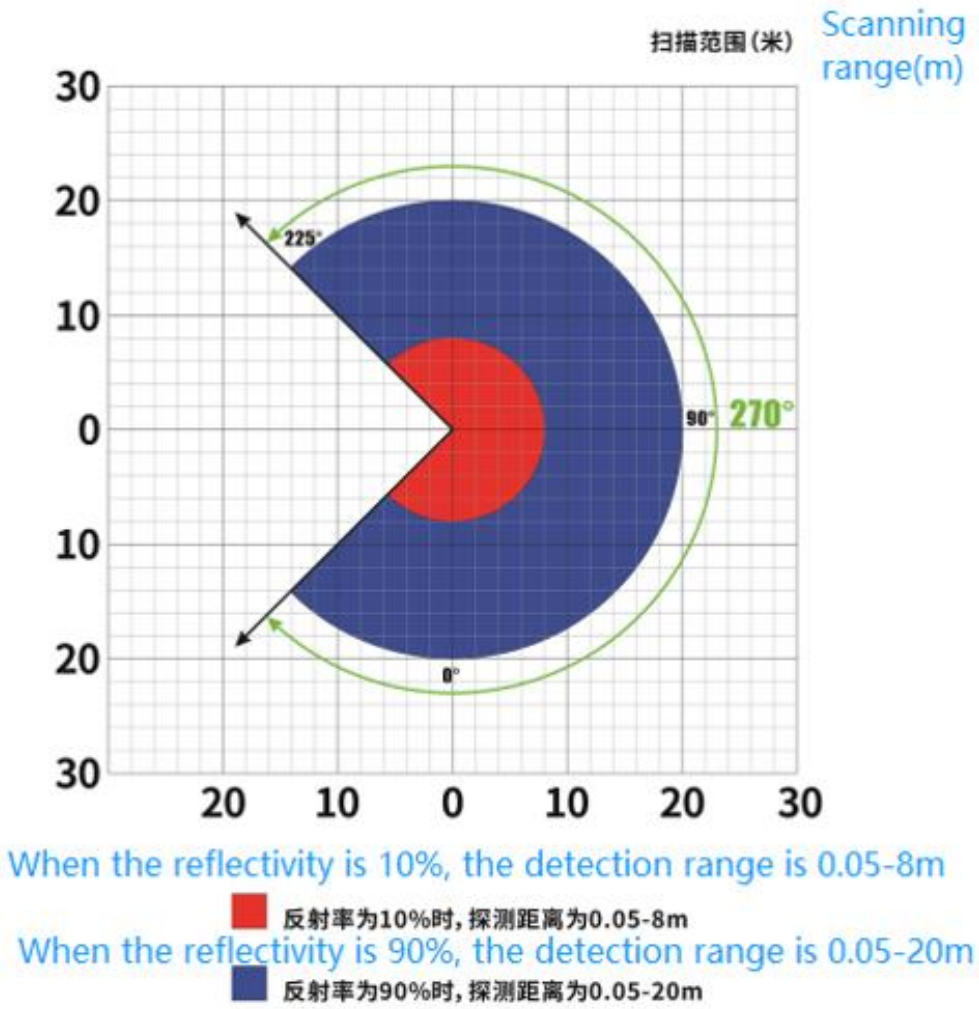

Figure 4: Schematic diagram of the detection range

As shown in the schematic diagram, the detection range is from -45° to 225°, and the azimuth angle definition is consistent with the angle definition in the host computer software. Among them, there is a detection blind zone between 225° and 315°, and no detection data is output. (-45° to 225° is the sum of 315°~360° and 0° ~225°).

3.3 Connecting the Equipment

3.3.1 Wiring

The function correspondence table of the LGA10 wire sequence is shown in Table 2. There are a total of 16 wires, and the connection schematic diagram is shown in Figure 5. Meanwhile, TYPC-C USB cable can be connected to a computer or other machine through the USB cable for area setting and point cloud display. It can also be connected to a computer or other machine through the network cable for area setting and point cloud display.

Lidar Wire Sequence Function Correspondence Table			
Number	Color	Signal definition	Signal description
1	Red 26A WG	VCC	Working Voltage VCC
2	Black 26A WG	GND	Working Voltage GND
3	Pale red	ALARM2	Two independent NPN outputs. In the ON state: the maximum IOUT = 200 mA, VOUT ≥ COM_IN + -2 V. In the OFF state: IOUT < 1 mA, and VOUT is less than 2 V. When there is no obstacle in the alarm area, it is in the ON state; when there is an obstacle, it is in the OFF state.
4	Black	ALARM1	
5	Yellow	OSSD2	Two independent NPN outputs. In the ON state: the maximum IOUT = 200 mA, VOUT ≥ COM_IN + -2 V. In the OFF state: IOUT < 1 mA, and VOUT is less than 2 V. When there is no obstacle in the protection area, it is in the ON state; when there is an obstacle, it is in the OFF state.
6	Dark green	OSSD1	
7	Dark blue	IN4	Area group selects signal, and the switching between multiple sets of protected areas is realized through the change of input signals of IN1, IN2, IN3, and IN4.
8	White	IN3	
9	Orange	IN2	
10	Brown	IN1	
11	Grey	COM_GND	Protective input and output GND
12	Purple	COM_IN+	Protective input and output power supply
13	Pink	OUT_RX+	Network port input +
14	Transparent	OUT_RX-	Network port input -
15	Light green	OUT_TX+	Network port input +
16	Light blue	OUT_TX-	Network port input -

Table 2: Lidar Wire Sequence Function Correspondence Table

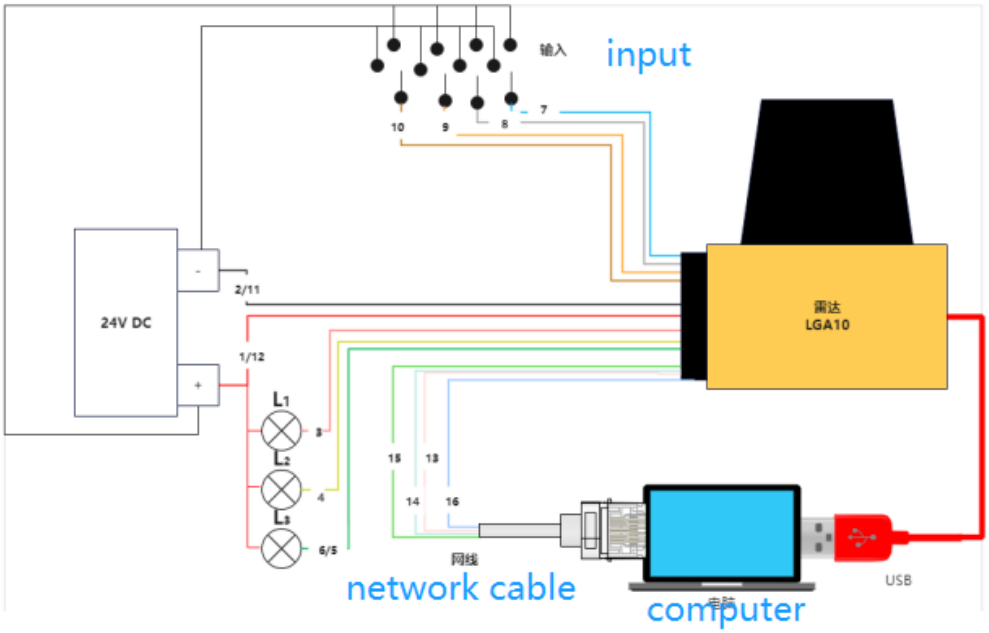

Figure 5: Schematic Diagram of NPN Wiring

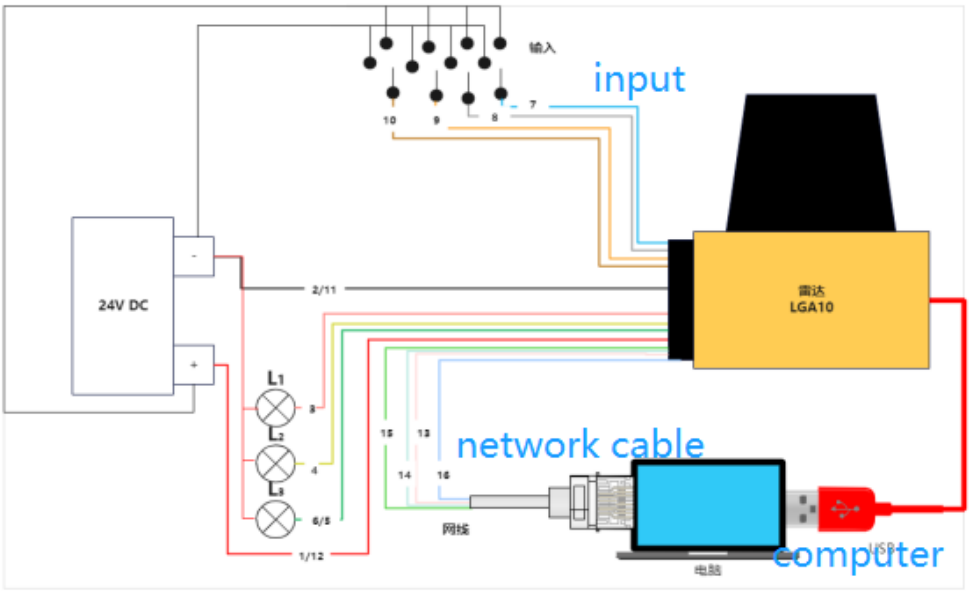

Figure 6: Schematic Diagram of PNP Wiring

3.3.2 Area Group Configuration

The corresponding relationship between the input signal and the area group				
Area group	IN4	IN5	IN2	IN1
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1

4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

Table 3: The corresponding relationship between the input signal and the area group

3.3.3 Input and Output Schematic Circuit Diagram

The external voltage range of I/O is 12V-24V, and the power ground and I/O ground are not internally common ground. The input schematic circuit diagram is shown in Figure 7. When connecting I/O INPUT, it is necessary to connect I/O power supply and IO ground, as well as the corresponding I/O port. Similarly, the output schematic circuit diagrams are shown in Figures 8 and 9. When connecting I/O OUTPUT, it is necessary to connect I/O power supply and IO ground, as well as the corresponding I/O port. Special attention, I/O output mainly outputs a level signal, and the driving capability is ≤ 200mA.

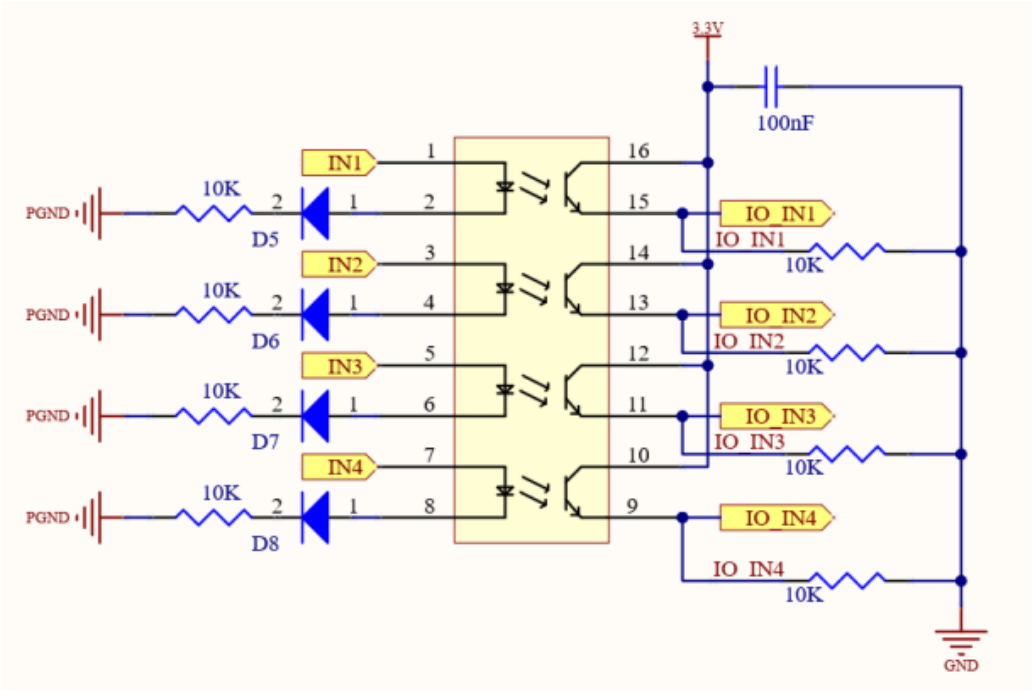

Figure 7: Schematic diagram of the input pin

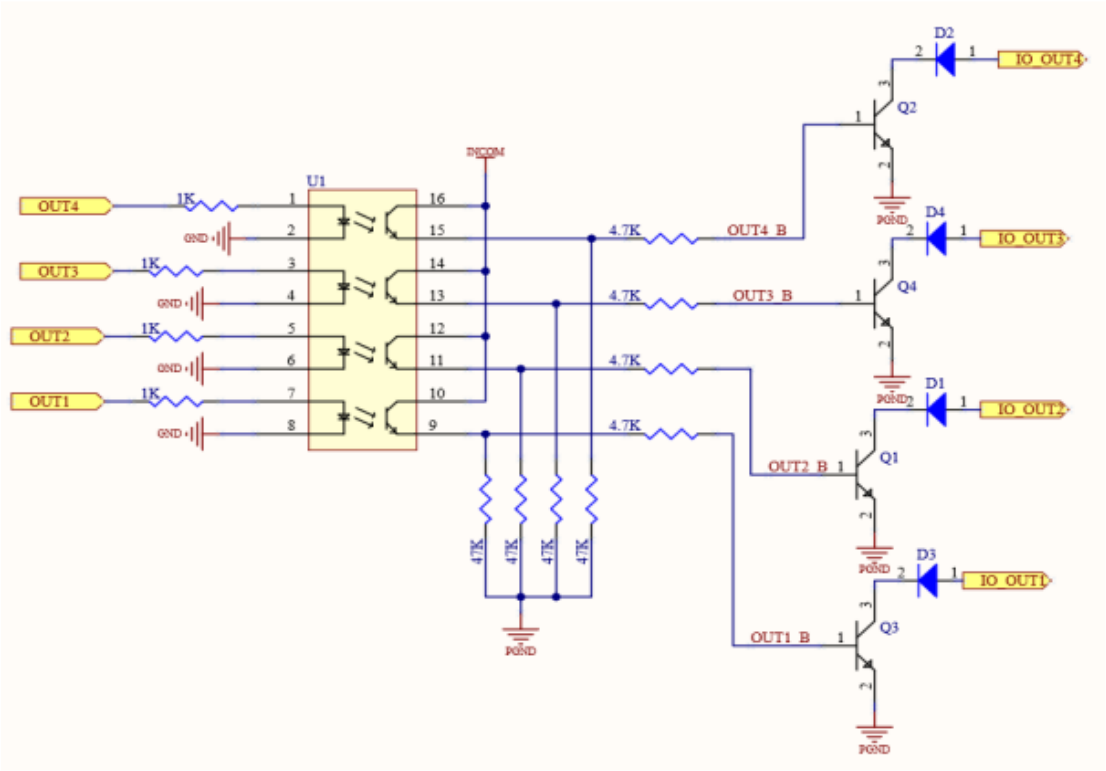

Figure 8: Schematic diagram of the NPN input pin

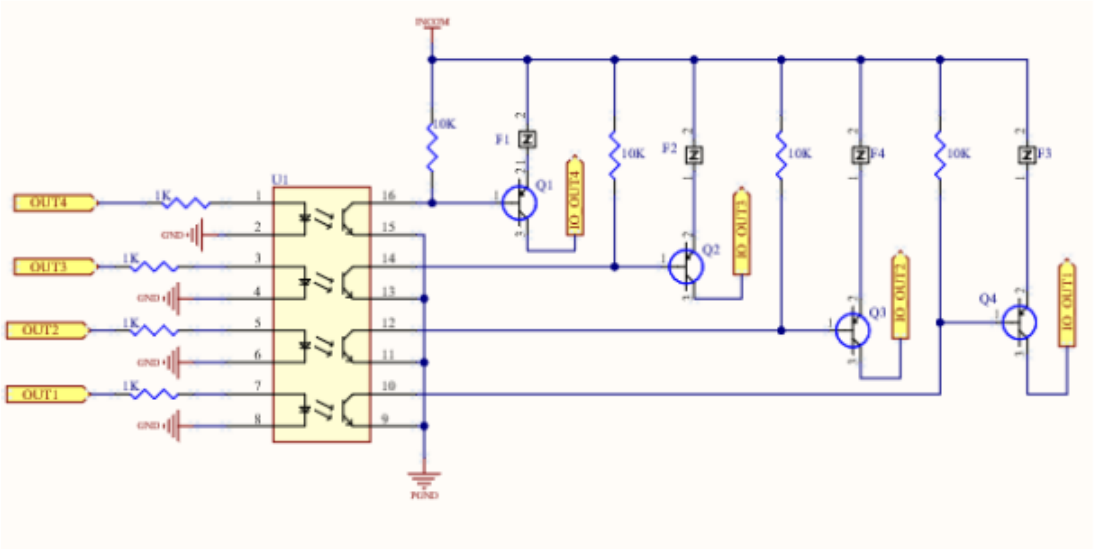

Figure 9: Schematic diagram of the PNP input pin

4.Host Computer Software

4.1 Connect the Host Computer

4.1.1 Serial Port Connection

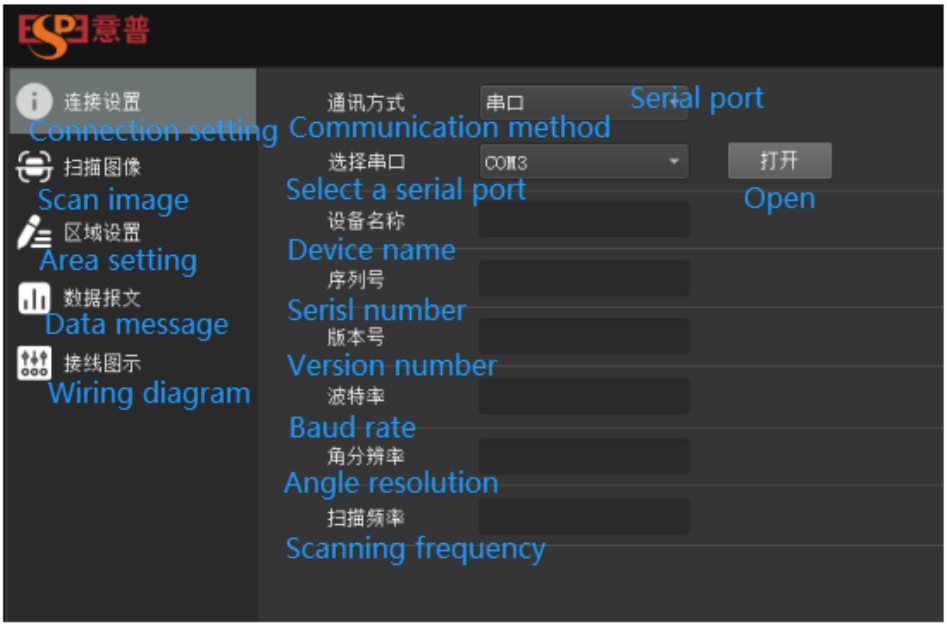

Figure 10: Diagram 1 of Serial Port Connection Settings

Figure 11: Diagram 2 of Serial Port Connection Settings

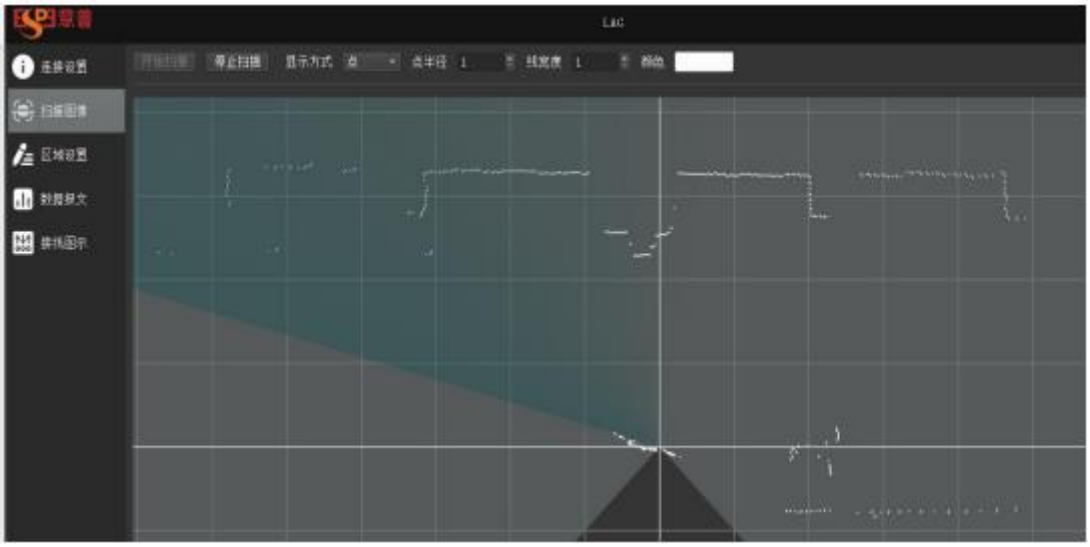

Figure 12: Point cloud rendering effect diagram

Serial port connection steps:

1. Power the lidar and connect the computer and the lidar well with a TYPEC-USB cable.
2. Open the host computer APP on the computer.
3. In the interface in Figure 10, select the serial port in the box on the right side of "Communication Mode", and select the serial port number corresponding to the lidar in the box on the right side of "Select Serial Port", and then click Connect.
4. Click "Scan Image", and then click Start Scan to generate point cloud data, as shown in Figure 12.

Note: Before using the serial port, it is necessary to install the serial port driver.

Method for installing the serial port driver:

1. Download the CP210x_Windows_Drivers installation package and extract it.
2. After powering on the lidar, connect it to the computer through a TYPEC-USB cable.
3. Open the Device Manager and click Ports.
4. Select Update Driver, and select the CP210x_Windows Drivers folder.
5. After the installation is successful, the serial port number will be displayed at the port, as shown in Figure 13.

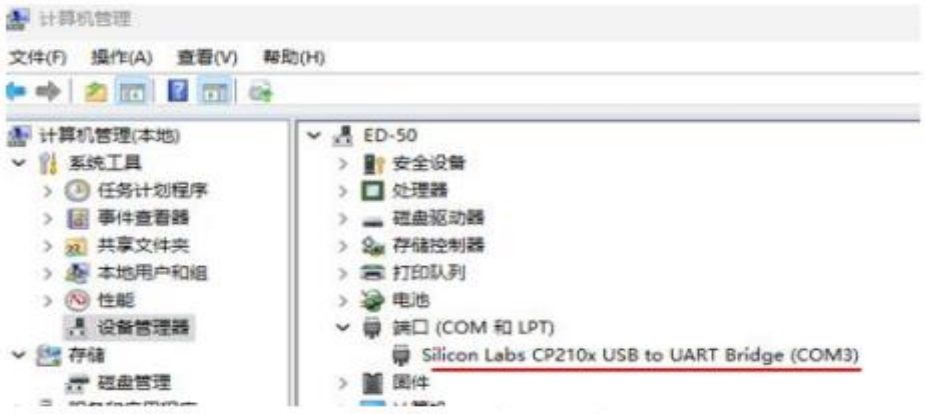

Figure 13: Query of Serial Port Number

4.1.2 Network Port Connection

Figure 14: Network port connection setting

Network port connection steps:

1. Power the lidar and connect the computer and the lidar well with an Ethernet cable;
2. Open the host computer APP on the computer;
3. In the interface in Figure 14, select the network port for the communication mode, set the local IP to 192.168.1.100, and set the local port to 502, then click Open;
4. Click Scan Image, and then click Start Scan to generate point cloud data, as shown in Figure 12.

Note: Before using the network port connection, it is necessary to configure the computer to be in the same local area network as the lidar. The specific steps are as follows:

1. Click the Control Panel and find the Local Area Connection;
2. Right-click on the Local Area Connection, and open the properties of Ethernet;
3. Find and select the Internet IPv4 version protocol, click to enter, and configure the IP address (as shown in the figure, configure the IP address). Since the lidar's own address is 192.168.1.102, the IP address on the computer needs to be set to any one from 192.168.1.1 to 192.168.1.255 (except 192.168.1.102). The subnet mask and default gateway can be selected as default.

Figure 15: Network port IP setting

4.2 Host Computer Interface

4.2.1 Connection Setting

As shown in Figures 11 and 14, after connecting to the lidar via the network port or serial port, information such as the device name, serial number, version number, baud rate, angular resolution, and scanning frequency will be displayed.

4.2.2 Scanning Image

As shown in Figure 16, it is the scanning image interface, which includes information such as start scanning, stop scanning, display mode, point radius, line width, color, as well as scale, X-axis coordinate, Y-axis coordinate, distance, and angle.

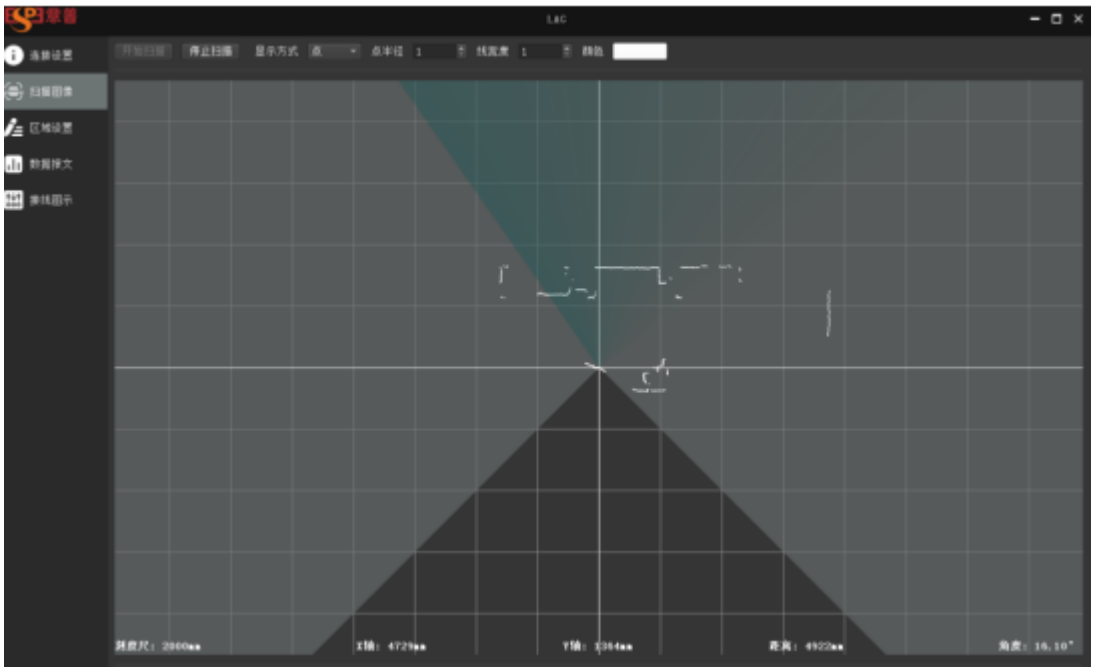

Figure 16: Point cloud interface diagram

4.2.3 Area Setting

As shown in Figure 17, the area setting interface includes the selection of protected area groups, the setting of three area parameters, the setting of display space, opening configuration, saving configuration, alarm setting, downloading, and uploading, and other contents.

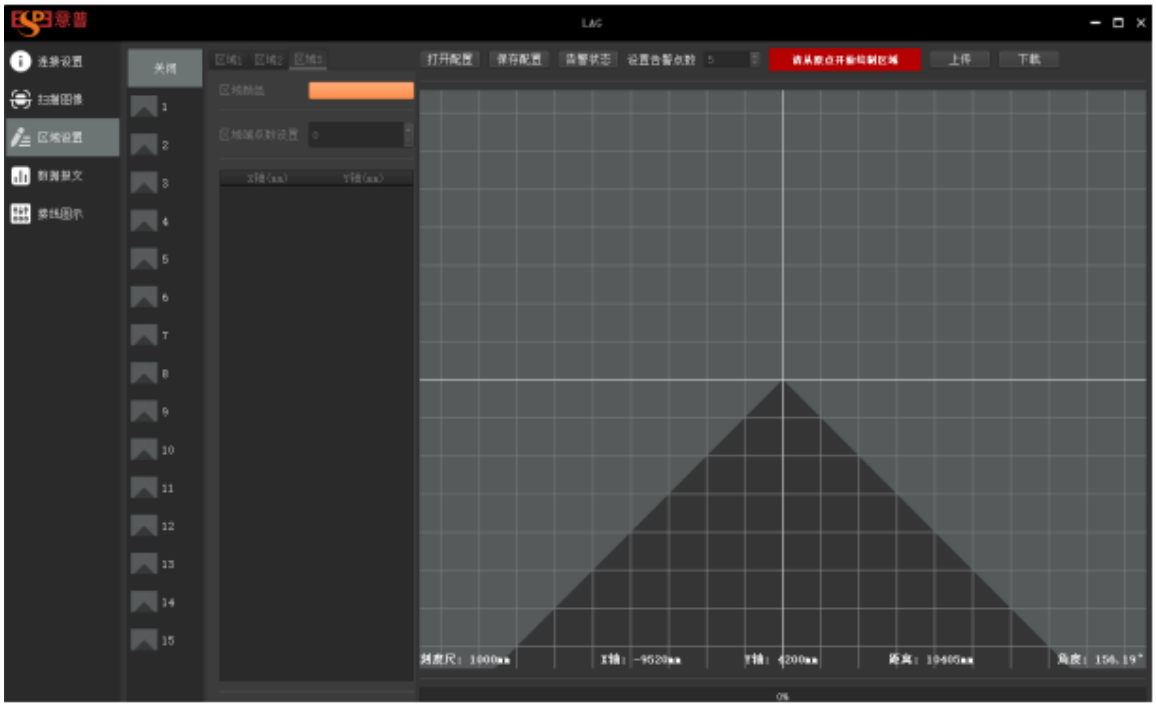

Figure 17: Area setting

Detailed steps for area setting:

1. Set a specific effective area group. The setting method is explained in detail in the wiring part. Here, set the 15th group to be effective. Click on 15, as indicated by the arrow.

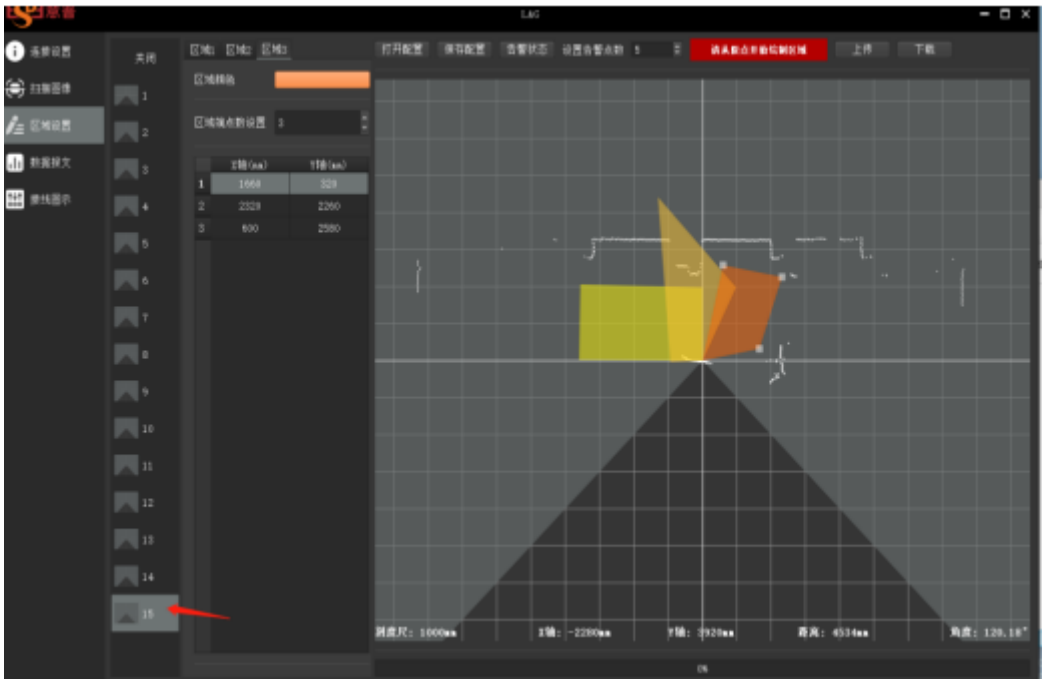

Figure 18: Select the area group

2. Set the three areas in area group 15, and each area can be set with up to 30 points at most. And for each point, the coordinates can be inputted or directly pulled with the mouse in the display area, as shown in Figure 19.

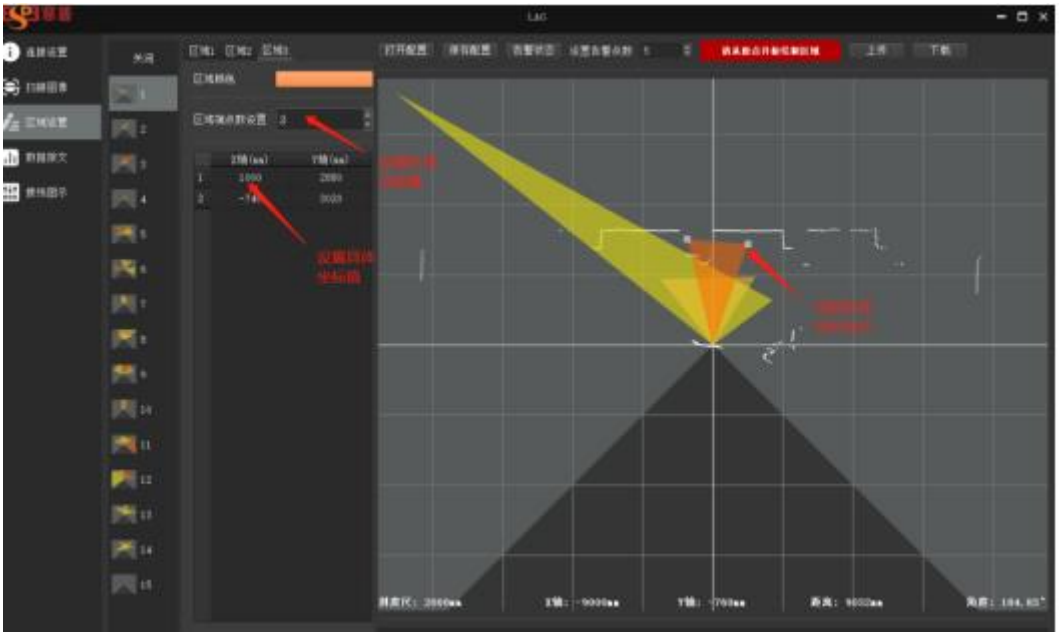

Figure 19: To set the area

3. After setting the area parameters, click "Download" to download all parameters into the lidar;

4. Click "Upload" to export and display the existing area setting parameters of the lidar;
5. In the scanning image interface, click "Stop Scan", then go back to the area setting, and click "Save Configuration" to save the area setting parameters to the computer;
6. In the scanning image interface, click "Stop Scan", then go back to the area setting, and click "Open Configuration" to import the previously saved area setting parameters into the lidar.

4.2.4 Data Message

As shown in Figure 20, it is the data message printed by the radar, the actual content of the point cloud data.

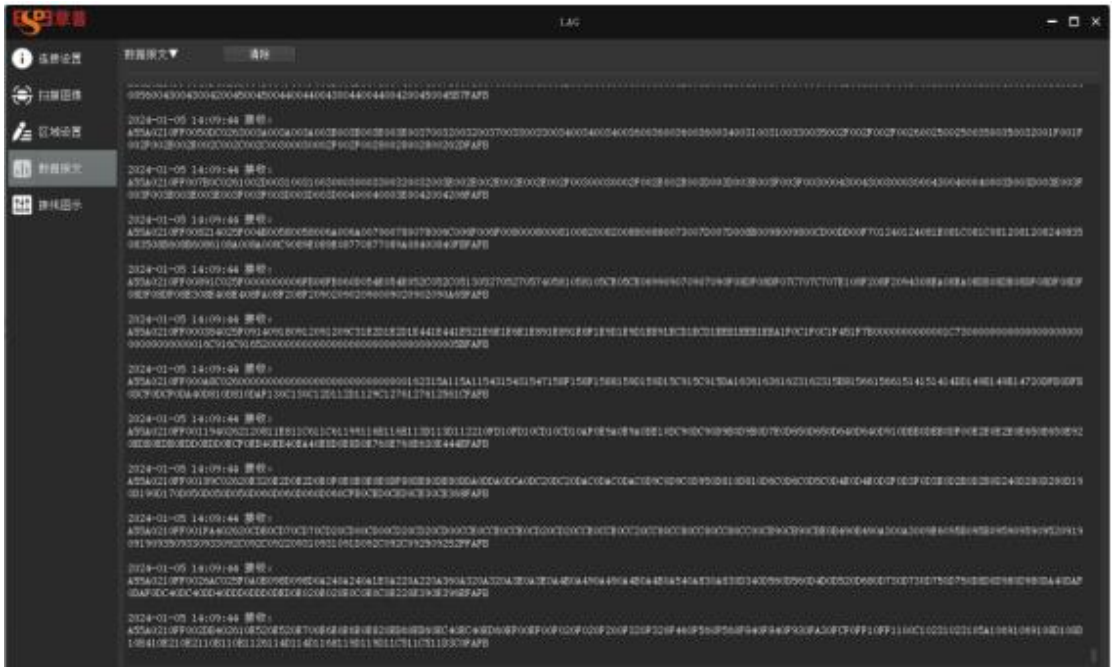

Figure 20: Data message

5. Communication Protocol

5.1 Serial Communication

5.1.1 Serial Communication Protocol

Baud rate: 460800 (adjustable).
Parity: NONE.
Data bits: 8.

Stop bits: 1.
Data format: HEX.

5.1.2 Network Port Communication Protocol

Multicast Mode

MAC	Each network port box is different	cannot be modified
Local IP	192.168.1.102 (default)	cannot be modified
The local port number data packet	502 (default)	cannot be modified
The destination IP	192.168.1.100 (default)	can be modified in the same network segment
The destination port number data packet	502 (default)	cannot be modified

5.1.3 Radar and Host Computer Data Transmission Protocol

Byte_0	Byte_1	Byte_2	Byte_3	Byte_4	Byte_5
A5	5A	02	10	0XFF	_____
Byte_6	Byte_7	Byte_8	Byte_9	Byte_10	Byte_11
Angle _H	Angle _L	SPEED_H	SPEED_L	Distance_1_H	Distance_1_L
……	Byte_108	Byte_109	Byte_110	Byte_111	Byte_112
……	Distance_50_H	Distance_50_L	SUM&0XFF	0XFA	0XFB

Explanation:
1: A5 5A are the frame headers.
2: Byte_2 is a one-byte frame type, 02.
3: Byte_3 is the lidar model number, 10.
4: Byte_4 is a one-byte collision avoidance area, 0XFF.
5: Byte_5, output 00.
6: From Byte_6 to Byte_9 are the angle and rotational speed, and starting from the 10th byte, the following 100 bytes are the distance parameters.
7: Checksum: The sum of all data starting from the frame header, only taking the lower 8 bits. 8: 0XFA 0XFB are the frame tail.
9: Data byte description:
(I) Angle _H, Angle _L are the angle parameters, representing the starting angle of

this data frame, with a total of two bytes, with the high byte in front and the low byte in the back, starting from 315 degrees (-45 degrees) and ending at 225 degrees, increasing by 18 degrees for each piece of information, for example: 0X7B 0X0C, that is, decimal 31500, indicating an angle of 315.00 degrees.

(II) Speed _H, Speed _L are the rotational speed parameters, with a total of two bytes, with the high byte in front and the low byte in the back, representing the count value of the time required for the lidar to rotate from one tooth to the next tooth. The calculation formula for its various rotational speeds is: rotational speed = 2500000 / speed. For example: 0X10 0X68, that is, decimal 4200, then the rotational speed is 595.239 revolutions per minute, which is 10 Hz.

(III) Distance: The distance parameter, with a total of two bytes, with the high byte in front and the low byte in the back, represents the distance value corresponding to the angle after 18-degree differentiation and 50 points, in millimeters. For example: 0X13 0X88, that is, decimal 5000, indicates that the distance value corresponding to this angle is 5 meters. If the distance parameter is 0XFFFF or 0X0000, it means this point is invalid and this point is not output.

(IV) The angle difference between every two point clouds is 0.36 degrees.

5.1.4 Operating Instructions

5.1.4.1 The Lidar Stops Sending Data

To stop the lidar from sending data through instructions			
Format	Format description	Occupied length (bytes)	Hex code
Text start	Start header	2	0x5A, 0xA5
Text length	The number of bytes of all data from the checksum to before the tail	2	0X04, 0X9C
Checksum	The sum of all data from the instruction number to the tail	None	None
Instruction number	None	None	None
Parameters	None	None	None
Text end	Tail	2	0XFA, 0XFB

The lidar responds with a command to stop sending data.			
Format	Format description	Occupied length (bytes)	Hex code
Text start	Start header	2	0x5A, 0xA5
Text length	The number of bytes of all data from the checksum to before the tail	2	0X00, 0X98
Checksum	The sum of all data from the instruction number to the tail	None	None
Instruction number	None	None	None
Parameters	None	None	None
Text end	Tail	2	0XFA, 0XFB

For example: The lidar stops sending data

Send: (HEX code)
A5 5A 04 9C FA FB
Reply: (HEX code)
A5 5A 00 98 FA FB

5.1.4.2 Lidar Send Data

Send a command to the lidar to start sending data.			
Format	Format description	Occupied length (bytes)	Hex code
Text start	Start header	1	0xFF
Text length	The number of bytes of all data from the checksum to before the tail	3	0X00, 0X00, A1
Checksum	The sum of all data from the instruction number to the tail	None	None
Instruction number	None	None	None
Parameters	None	None	None
Text end	Tail	1	0X00

The lidar responds to the command for the lidar to send data			
Format	Format description	Occupied length (bytes)	Hex code
Text start			Output the distance and angle data of
Text length			
Checksum			

Instruction number			the perimeter at 270° according to the lidar data transmission protocol.
Parameters			
Text end			

For example: require the lidar to send data.

Send: (HEX code)
FF 00 00 A1 00
Reply: (HEX code)
Output the distance and angle data of the perimeter at 270 degrees in accordance with the lidar data transmission protocol.

5.1.4.3 Change the Baud Rate of the Lidar

Change the baud rate of the lidar through instructions.			
Format	Format description	Occupied length (bytes)	Hex code
Text start	Start header	1	0xFF
Text length	The number of bytes of all data from the checksum to before the tail	2	0X00, 0X00, 0XA1
Checksum	The sum of all data from the instruction number to the tail	None	None
Instruction number	None	None	None
Parameters	None	None	None
Text end	Tail	1	0X00

Respond to changing the baud rate of the lidar through instructions.			
Format	Format description	Occupied length (bytes)	Hex code
Text start			None
Text length			
Checksum			
Instruction number			
Parameters			
Text end			

For example: Change the baud rate of the lidar.

Send: (HEX code)	
FF 00 00 A1 00: baud rate 460800	FF 02 00 A1 00: baud rate 921600

Reply: (HEX code)
None

5.1.4.4 Instruction to Change the Rotation Speed of the Lidar

Change the rotation speed of the lidar by instructions			
Format	Format description	Occupied length (bytes)	Hex code
Text start	Start header	1	0xFF
Text length	The number of bytes of all data from the checksum to before the tail	2	0X00, 0X00, 0XA1
Checksum	The sum of all data from the instruction number to the tail	None	None
Instruction number	None	None	None
Parameters	None	None	None
Text end	Tail	1	0X00

Respond to changing the baud rate of the lidar through instructions.			
Format	Format description	Occupied length (bytes)	Hex code
Text start			None
Text length			
Checksum			
Instruction number			
Parameters			
Text end			

For example: Change the rotation speed of the lidar by instructions

Send: (HEX code)
FF 00 00 A1 00: Rotation speed 10Hz FF 00 01 A1 00: Rotation speed 20Hz FF 00 02 A1 00: Rotation speed 15Hz
Reply: (HEX code)
None

5.1.4.5 Read the Internal Temperature of the Lidar and the APD High Voltage

Read the internal temperature and APD high voltage of the lidar through instructions			
Format	Format description	Occupied length (bytes)	Hex code
Text start	Start header	1	FF
Text length	The number of bytes of all data from the checksum to before the tail	3	00 00 A1
Checksum	The sum of all data from the instruction number to the tail	None	None
Instruction number	None	None	None
Parameters	None	None	None
Text end	Tail	1	04

The lidar responds with the content of reading the internal temperature and APD high voltage.			
Format	Format description	Occupied length (bytes)	ASCII
Text start			Display the current internal temperature and APD high voltage values in the form of floating-point numbers.
Text length			
Checksum			
Instruction number			
Parameters			
Text end			

For example: Read the internal temperature and APD high voltage of the lidar.

Send: (HEX code)
FF 00 00 A1 04
Reply: (ASCII code)
It is detected that the APD high voltage inside the lidar is 145V, and the temperature is 50℃. Standard _RXHV= 145 TEMP_VALUE= 50

6.Standard and Optional Configurations

Number	Name	Quantity	Comment
1	Lidar mainframe	1 set	Including cables
2	Original factory packaging	1 set	Optional
3	TYPE-C USB cable	1 set	Optional
4	Bottom fixed mounting bracket	1 set	Optional
5	Side fixed mounting bracket	1 set	Optional