Industrial safety system

Sensors and I / O modules

新达 CYNDAR

Safety laser scanner

AGV obstacle avoidance / Regional monitoring

XD-TOF-05D / XD-TOF-20D

User's manual

Efficient solution to applications

GZ Cyndar Co., Ltd.

GZ Cyndar Co., Ltd.

Catalogue

Chapter 1. Basic information of the safety laser scanner

Chapter 2 Configuration Software Basic operation

Chapter 3: Configuration Cases

Chapter 4: Equipment Inspection and Maintenance

Revise the history

Edition	Content
1.0.0	First release
1.0.1	1. Increase the support for the adjustable motor speed 2. Increase the support for the shielding size
1.0.3	Updates the response time parameters
1.0.4	1. The problem of point clouds flashing during self-learning 2. Support for starting self-learning through software mode 3. After the scanner is powered on, the area will give an alarm signal, that is, the output is in an alarm state before the radar is not working normally 4. The alarm output signal level can be matched
1.0.5	1. Add the logging function 2. Add the write Flash protection 3. Solve the problem of abnormal upper computer in the process of serial port device identification 4. Solve the problem of abnormal host machine caused by power failure when the program is running
1.1.0	1. Add the output level configuration function
1.1.1	1. Detailed PNP voltage reference line
1.1.2	1. Modify the COM + and COM-marking errors in the file
1.1.3	1. Adjust the scanner mechanical dimension
1.1.4	1. Increase the stent and outer cover dimensions 2. Merge software package insert
1.1.5	1. Change OUPUT1~3 to OSSD 1 ~ 3 2. Modify and add the cases

Chapter 1. Basic information of the safety laser scanner

1 Safety instructions

1.1 General precautions

Safety profile

Please read the following safety precautions carefully to avoid damage to this product or other products connected to the product.

Do not open the instrument and open the cover without authorization:

Without the permission of CYNDAR, users can not open the equipment without authorization, and it is strictly prohibited to open the product when the equipment is running;

Do not use hard objects to scrape the optical cover:

Foreign body scraping may cause scratches of the optical outer cover, and the surface scratches will affect the measurement distance, or lead to the increase of noise data;

When a product fault is suspected, the operation is strictly prohibited:

If you suspect this product failure, please contact CYNDAR for testing. Any maintenance, adjustment, or part replacement must be performed by the CYNDAR;

Prolonged horizontal viewing is prohibited:

The equipment has continuous infrared laser emission, reaching the Class I level laser safety standard. To ensure safety, do not look directly at the luminous surface for a long time.

1.2 Use environment

Do not use in a corrosive environment:

In order to avoid corrosion damage of equipment, it is strictly prohibited to use or place equipment in corrosive environment;

Do not operate in a flammable and explosive environment:

In order to avoid equipment damage and personal safety, it is strictly prohibited to operate or place instruments in a flammable and explosive environment;

Keep the optical surface of the product clean:

In order to avoid dust affecting the ranging performance, please keep the optical surface of the product clean;

Maintain good heat dissipation:

Please install the equipment on the metal hot sink surface to maintain good heat dissipation.

Avoid operation in the steam, smoke and dust environment:

Steam, smoke, dust and other visible particles in the air will have adverse effects on the laser propagation, which may make the sensor judgment wrong, resulting in inaccurate ranging.

1.3 Electrical access

Check the product rating before access:

To avoid the impact of excessive current, please check the rating value and mark instructions marked on the product. Please consult the product manual for the details of the rating before connecting the product;

Use the specified power cord:

Only the power lines approved by the home country are allowed;

Be sure to use a suitable overpressure protection:

Ensure that no too high voltage is connected to the product.

Ground this product to earth:

Ground the power cable grounding wire of this product. To avoid electric shock, before connecting any input or output end of the product, please ensure that the ground end of the power cable of the product is reliably connected to the protective ground end;

Anti-static protection: static electricity may cause damage to the instrument, should be tested as far as possible in the anti-static area or good grounding premise.

2 Product parameters

Model	XD-TOF-05DP	XD-TOF-05DN	XD-TOF-20DP	XD-TOF-20DN
Output signal	PNP	NPN	PNP	NPN
Product characteristics				
Work space	0.05~5m		0.05~20m	
Laser light source	The 905 nm (Class I) is in accordance with EN 60825-1:2014			
Scan the angle range	270°			
Scan frequency	15 Hz/30 Hz			
Angular resolution	0.1°/0.3°			
Protection distance, 10% reflectivity	2.5m		10m	
Self-learning function	The environment is automatically scanned to generate areas			
Monitor the area / total area number simultaneously	3 regions / 16 group * 3 regions			
Identifiable object shape	Almost any shape			
Measurement error	±30 mm			
Mechanical / electronic parameters				
Electrical connection	Terminal scatter cable 12P + power supply 2P			
Service voltage	DC 9 V ~ 28 V			
power dissipation	2 W Max			
Switch drive	DC30V, 50mA MAX			
Shell color	Nattier blue			
Levels of protection	IP65			
Weight	150 g, without the cable			
Size (length x width x height)	50 mm x 50 mm x 76 mm			
Joggle				
USB	Micro-USB			
Connect to a personal computer	OS: Windows 7 and Windows 10 CPU: Intel i5 dual-core 2.7G, and above			
Import — Area selection	GND/NC x 4			
Import — Await the opportune moment	GND x 1			
Switch Volume Output (OSSD)	The NPN / PNP transistor, x 3			
Warning output (non-safe output)	Equipment operating status indication (fault detection) x 1			
Signal output retention time	10 ms ~ 10,000 ms (adjustable) Typical value of 330ms			
Response time	15Hz: 67 ms ~ 29,949 ms (adjustable) Typical value of 134ms 30Hz: 33 ms ~ 29,997 ms (adjustable) Typical value of 66ms			
Status indicator light	Power supply indicator x 1, area group indicator x 4; operation indicator (green), intrusion indicator (red)			
enviromental parameter				
Anti vibration	10-55Hz, amplitude of 0.75mm, XYZ triaxial direction, 2 hours per axis; 50-200Hz, 196 m/s² (20G), scan speed of 2min / cycle, XYZ triaxial orientation, 2 hours per axis			
operating ambient temperature	–10 °C ~ +55°C			
Storage temperature range	–30 °C ~ +75 °C			
Anti-environmental light ability	<15,000 lux		<50,000 lux	
Accord with	EN IEC 61496-1 AC:2015,			

	EN IEC 61496-3, EN IEC 61508-1/2/3/4, ISO 13849-1, EN IEC 62061 A2:2015, ISO 13855, EN IEC 60204-1, EN IEC 61140, EN IEC 60068-2-6, EN IEC 60068-2-64, EN IEC 60721-3-5, EN IEC TR 60721-4-5, EN IEC 60068-2-27, EN IEC TR 60721-4-5, EN 55022 (CLASS AITE):2010, EN 60825-1:2014 (CLASS 1)

3 Working principle

3.1 The ranging principle

The 05D / 20D is a TOF, scanner, and its core components include optical, mechanical, circuit, and software parts. Work, the laser to emit a beam of laser, when exposure to the object reflection, receiver to reflect light signal detection, and then through the time analysis module to measure the time difference between the reflected light and emitted light, with time multiplied by the speed of light is the light flight distance, to calculate the position of the object, as shown in the figure:

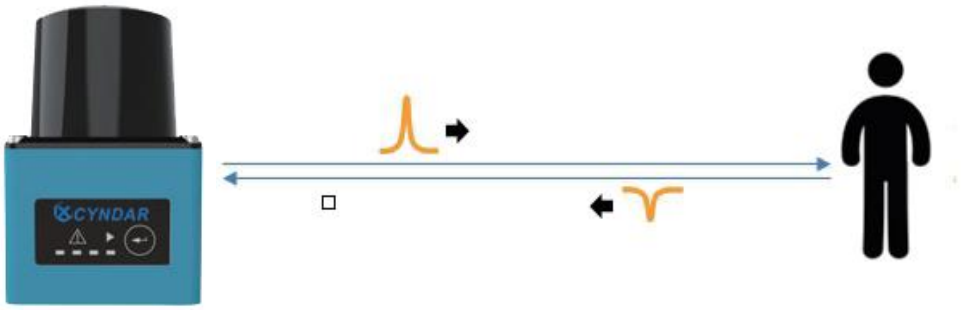


Figure 31 Schematic diagram of the ranging principle of the laser scanner

The object size calculation principle is shown in the following figure:

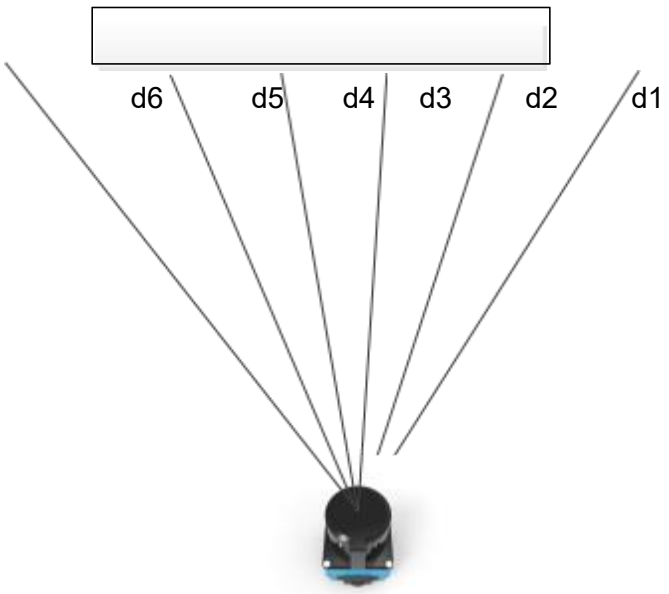


Figure 3-2 Calculation method of object size

And d1, d2... d6: represents the distance between the object and the laser scanner, and the angular difference between them is the angular resolution of the scanner.

The size calculation formula of the object is follows:

$$W = (d2 + d3 + d4 + d5) * \theta$$

θ = (2 π / 360) at the angular resolution

Where: the angular resolution is related to the rotation speed, and it is set by the customer through the software.

3.2 Scanner early warning

In coordination with the pre-set alarm area by the user, the laser scanner detects the object invading into the alarm area, and the alarm signal is processed by the system using the scanner, so as to achieve the purpose of obstacle avoidance.

A typical alarm scenario is as follows:

Alarm area

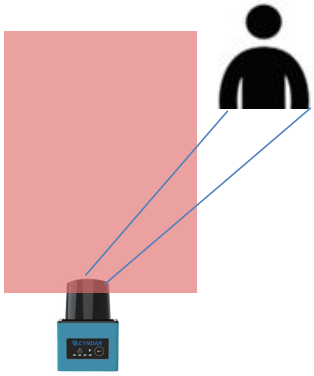
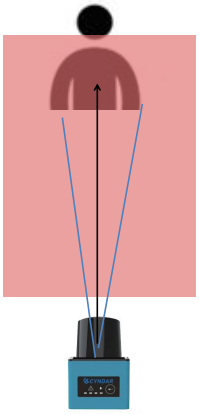


Figure 3-3 No invasion in object detection

In this scene, someone enters the detection range of the scanner, which is detected by the scanner. Personnel does not enter the alarm area, and the scanner has no alarm signal.

Regional invasion



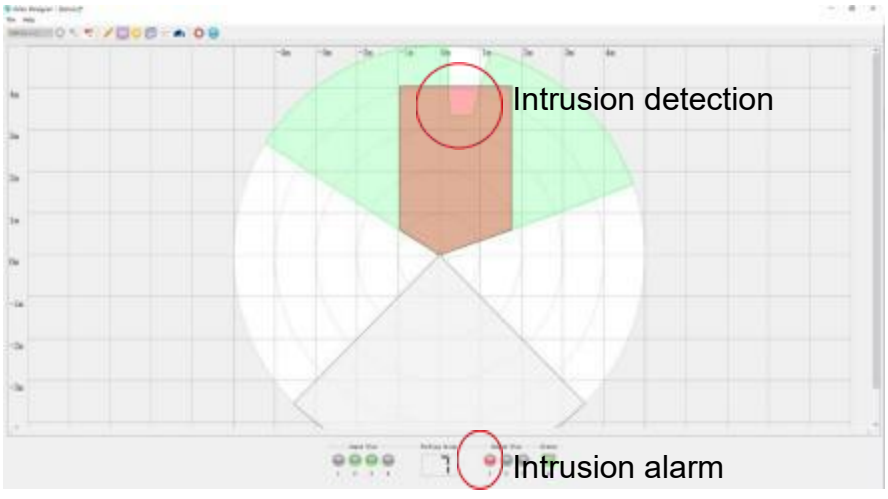


Figure 3-4 Object detection and intrusion alarm

In similar scenarios, someone enter the alarm area. The scanner detects that the personnel position invades into the user predefined area, that is, the alarm signal is sent to the control system through the signal line, and the alarm signal is displayed on the upper computer software.

3.4 Apply the scanner to the fixed-mounted equipment

In this case, the scanner is the main protective device, and a horizontal protection zone is set to achieve area protection.
On the tire forming machine, a high degree of interaction between man and machine. Because the machine has many dangerous movements, the dangerous area must be protected. The safety laser scanner monitors the area without any wear. The XD-TOF-20D safe laser scanner can be used for larger protected areas, while the XD-TOF-05D can meet the needs of smaller areas, and the safe laser scanner uses protected areas simultaneously, because it can monitor multiple protected areas simultaneously

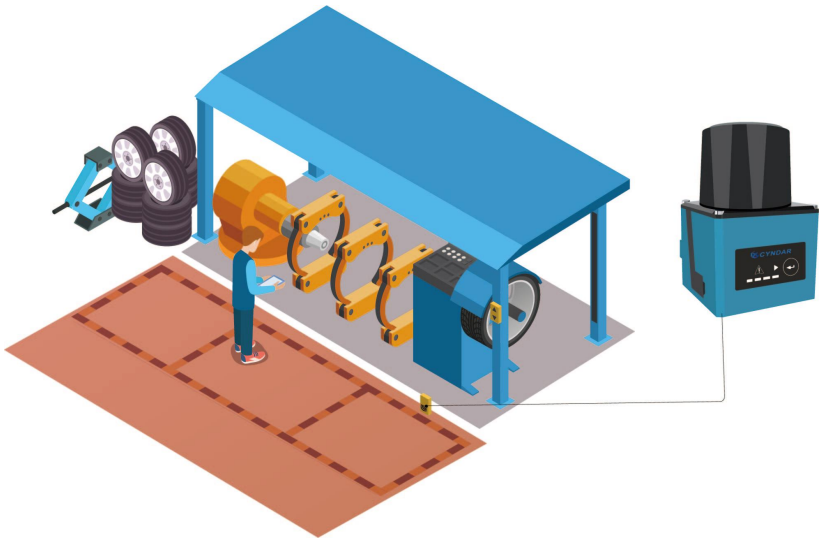


Figure 3-5 Detection intrusion alarm in fixed position

3.4 Application of the scanner to the automatic guide vehicle (AGV)

Monitoring automatic vehicle (AGV)
Monitoring the Avehicle can prevent the AGV from collision with other objects in the container yard. When an object is detected in the monitoring area, the safety output will send a tight stop signal to the automatic guide vehicle (AGV) to make the vehicle completely stopped.

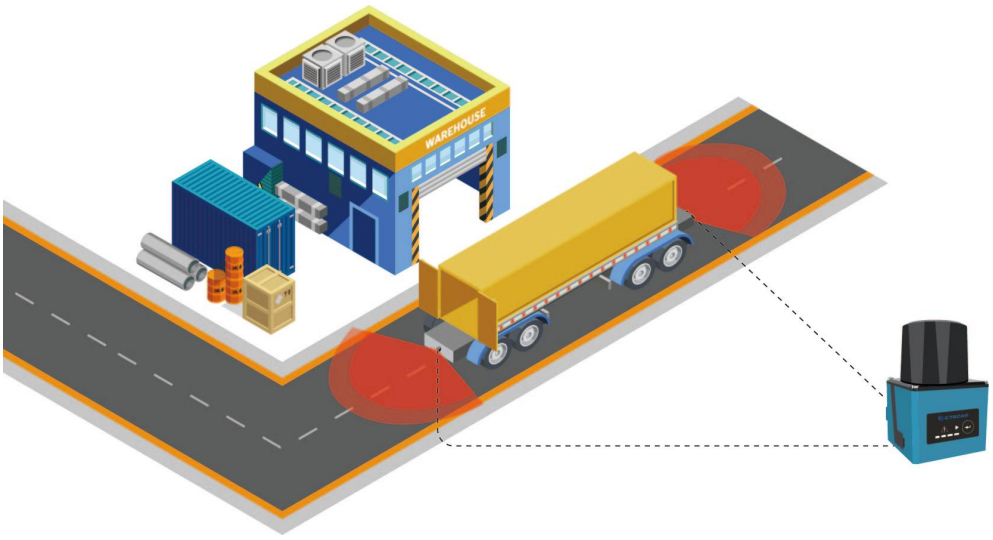


Figure 3-6 Automatic guide vehicle detects intrusion alarm

4 Equipment debugging

4.1 Scanner components

The appearance of the scanner is as shown below:

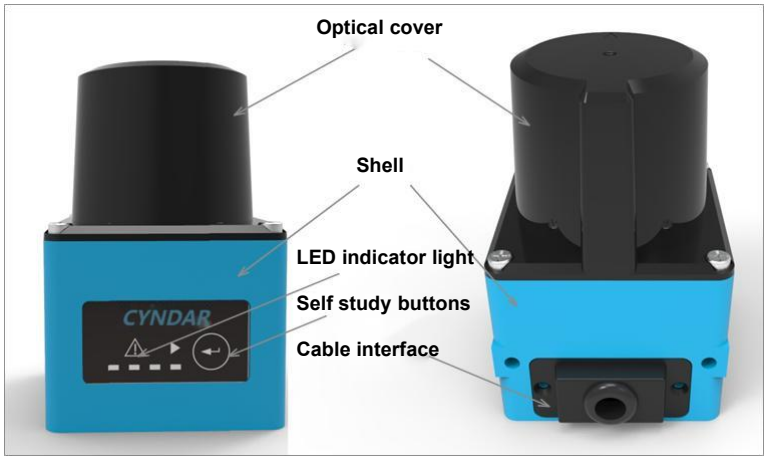


Figure 41 scanner appearance 1

Pour:

1. Optical cover: The optical cover is made of plastic. Please be careful that the cover is scratched by the sharp device, which affects the optical performance.
2. LED indicator light: The indicator light has two functions
   A) When the scanner is working, if an object invades the working area, alarm through the LED indicator.
   B) Indicate whether the scanner is working properly.
3. Self-learning button: The scanner has the self-learning function, and builds the regions and region groups by scanning the surrounding environment.

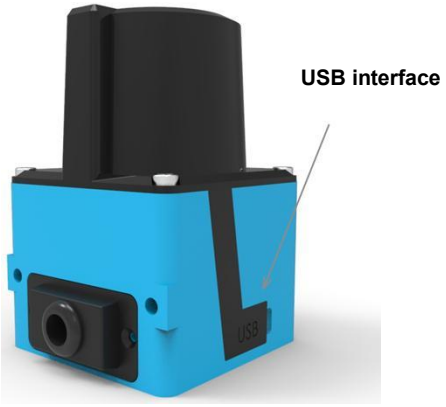


Figure 4-2, Scanner appearance 2

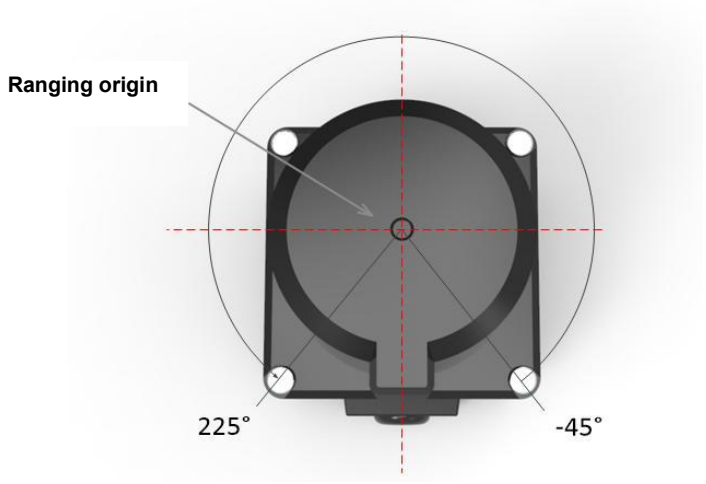


Figure 4-3 The scanner scan angle

Pour:

USB interface: The scanner is connected to the upper computer through the MicroUSB.

The angular scan range of the scanner was 270°, from-45° to 225°.

In the actual display, due to the angular resolution limit, the actual value of the angle range varies at different motor speeds:

Motor speed 15Hz (angular resolution 0.1°): actual value of angular range, minimum-45°, maximum 224.9°.

Motor speed 30Hz (angular resolution 0.3°): actual value of angular range, minimum-45°, maximum 224.7°.

4.2 Connect to the computer

If you purchase a scanner, you should receive the following accessories:

1. One scanner.
2. Micro USB line one.
3. Model B01 L bracket.
4. M3 \ M4 screws and gaskets

The connection process is as follows:

1. Follow the instructions to access the power supply (please refer to the "Electrical Connection" section).
2. Connect the scanner to the computer via the Micro USB.
3. Install the driver and the software, and start the Designer software to connect with the scanner.
4. View the point cloud output through the software, and debug the alarm function.
5. Set the working area group, set normally closed or often open and download to the scanner.
6. Prepare to install the scanner.

5. Scanner is installed

5.1 Mechanical dimensions

Unit:mm

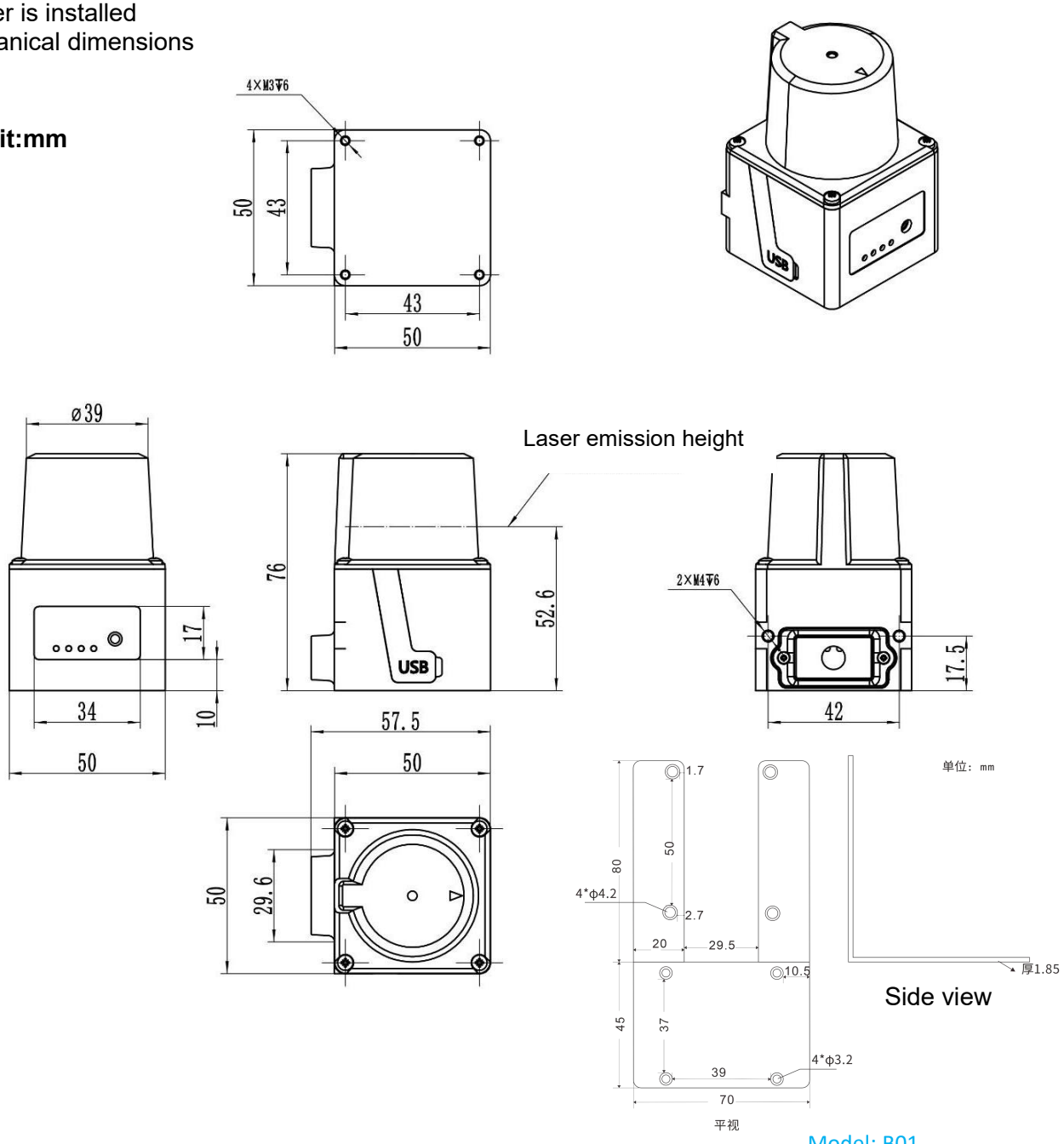
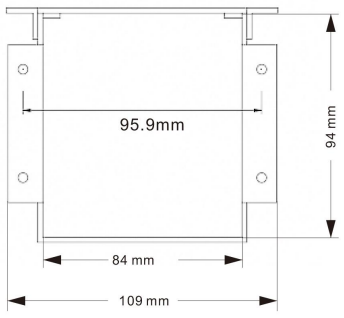


Figure 51 Mechanical / L-type stent dimensions

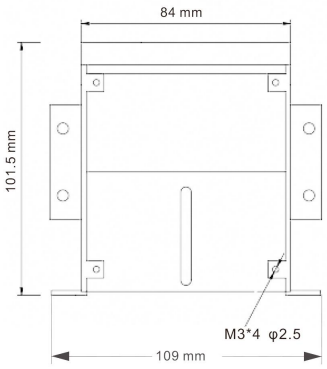
Model: B01
Standard configuration

Metal cover (optional)
Model number: B03J

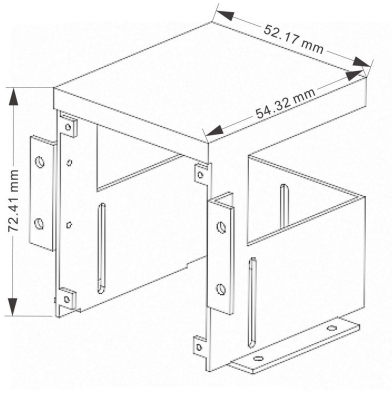
Unit:mm



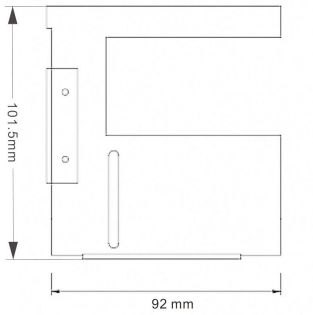
Vertical view



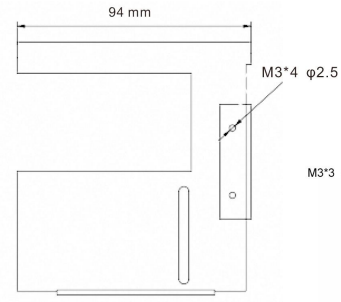
Front view



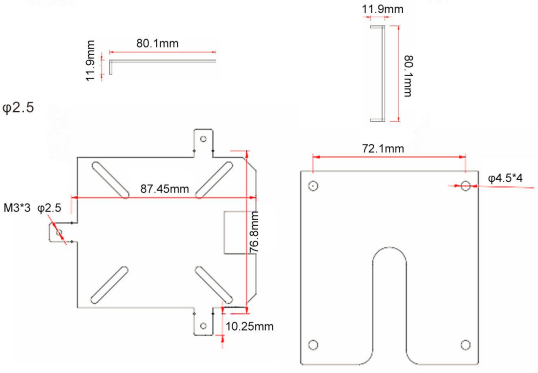
Overall size



Left view



Right view



Bottom size

5.2 Fixed with the scanner

There are mounting screw holes at the bottom and sides, and the user can secure the scanner with M3 screws.as shown in the figure:

Figure 5-2, The scanner is basically installed

5.3 Optical environment

The scanner uses the laser pulse to detect the surrounding objects. If there is a interference light source in the working range, its detection ability will be affected, and even lead to false alarm.

If the user cannot remove the interfering light source from the working environment, at least place the light source outside the scanner ± 3° range.

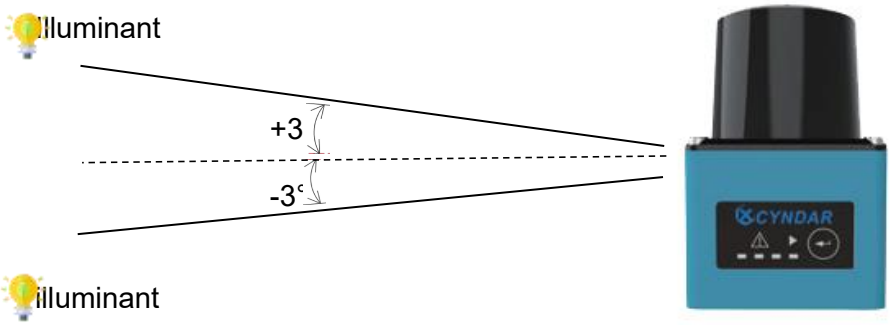


Figure Figure 5-33 for Interference

5.4 Installation method

If two or more laser scanners work together, they can interfere with each other. The following figure provides an installation method to avoid such interference.

1. Vertical installation

By changing the installation height of the scanner to keep the scanner laser scanning plane at different heights.

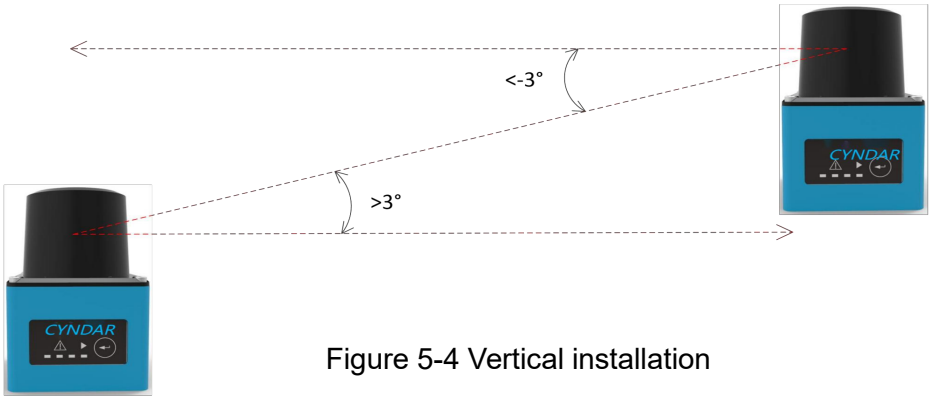


Figure 5-4 Vertical installation

2. Parallel installation

tilt the scanner slightly during installation to avoid mutual interference.

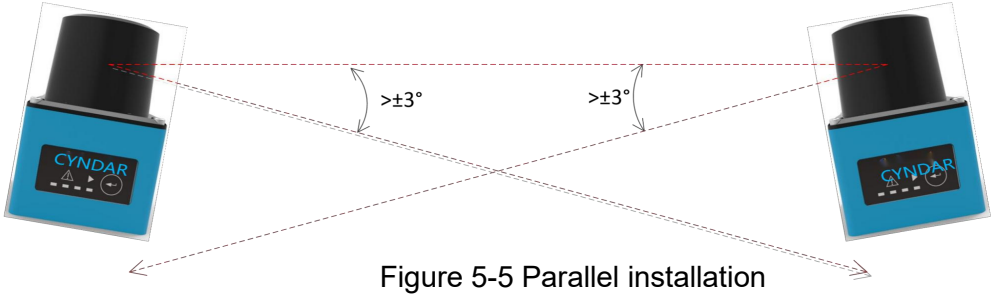


Figure 5-5 Parallel installation

3. Isolation and installation

By adding occlusion between scanners, the laser pulse will not be received by other scanners, thus avoiding interference.

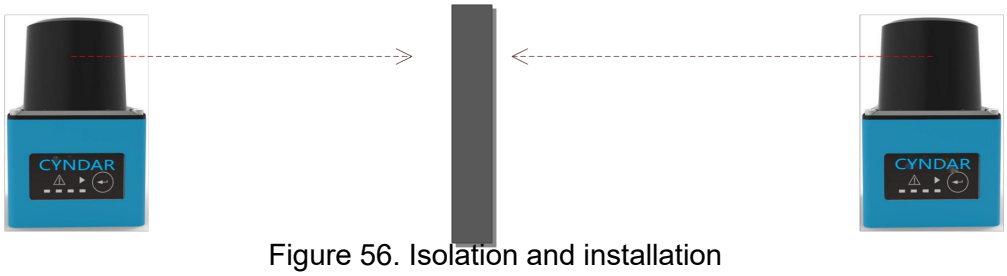


Figure 56. Isolation and installation

6 Electrical connection

There are two models of scanner, respectively corresponding to NPN and PNP wiring mode. Please select the model compatible with the target system according to the needs of the project by the user.

Scanner model annotation and equipment side, the naming rules are as follows:

1. NPN type: The scanner name ends with "DN", such as: XD-TOF-05DN.
2. PNP type, the scanner is named and named ending with "DP", such as: XD-TOF-05D P.

6.1 NPN wiring

6.1.1 Wiring port

The scanner (NPN) provides an electrical connection: 14-Pin loose cable (standard) with cable diameter of 6mm and length of 1.9m.

The meaning of the line is shown in the figure:

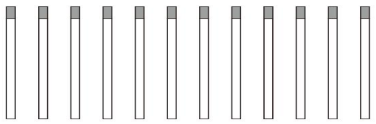


Figure 61 14-Pin Interface (NPN)

14-Pin description（NPN）		
1	DC 9-28V	RED RED AND WHITE
2	GND	BLACK BLUE AND WHITE
3	（OUT1）OSSD 1	PURPLE
4	（OUT2）OSSD2	GRAY
5	（OUT3）OSSD 3	LIGHT GREEN
6	ERROR_OUT	YELLOW
7	OUTPUT-COM-	PINK
8	INPUT1	GREEN
9	INPUT2	WHITE
10	INPUT3	BLUE
11	INPUT4	ORANGE
12	INPUT5/STANDBY	BROWN AND WHITE
13	shielded wire	YELLOW AND WHITE
14	N.C.	N.C.

pay attention to:

1. The input signal shall be high resistance (Hi-Z) or ground state
2. The maximum driving capacity of the output signal is DC30V 50mA

6.1.2 Typical NPN connections

The typical connection given here is only used as a wiring reference and may not adapt to all situations. Please design it according to the actual application.

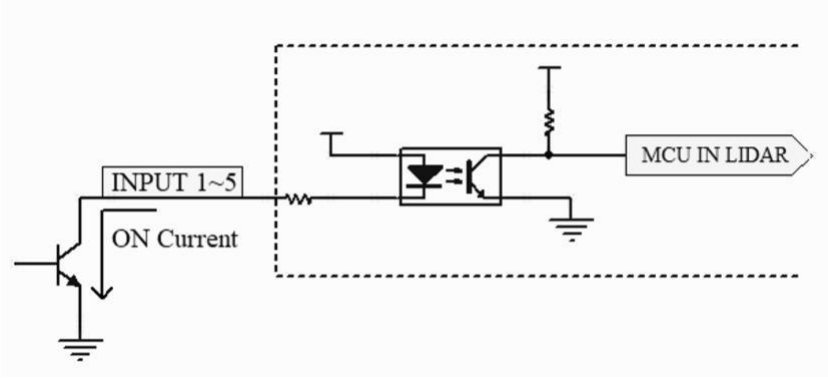


Figure 6-2 Typical connection of input signal (NPN)

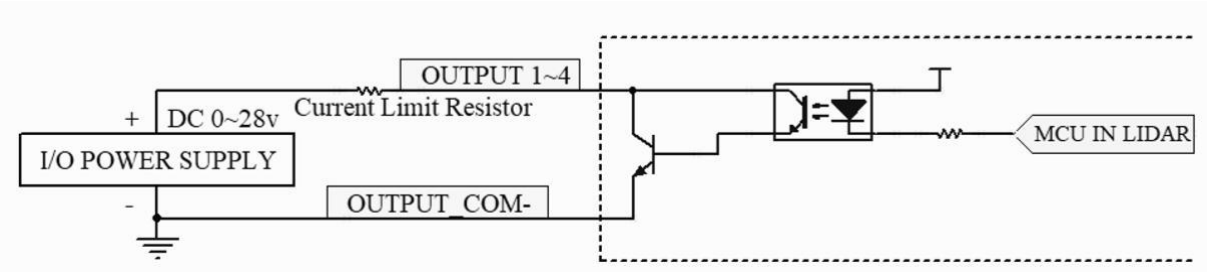


Figure 6-3 Typical Output Signal Connect (NPN)

6.1.3 NPN normally open / normally closed

There are two types of NPN signal output (OUT 1 ~ OUT 4):

1. NPN often open: that is, when there is no alarm output, NPN and OUT _ COM-remain disconnected state, when there is alarm output, it is the same as OUTPUT_COM level.
2. NPN is often closed: that is, when there is no alarm output, NPN maintains the same level with OUT _ COM-, and when there is an alarm output, it is disconnected from OUTPUT_COM-.

6.2 PNP wiring

6.2.1 Wiring port

The scanner (PNP) provides an electrical connection: 14-Pin loose cable (standard) with cable diameter of 6mm and length of 1.9m.

The meaning of the line is shown in the figure:

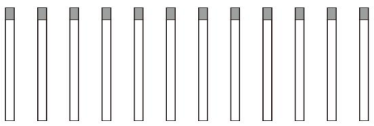


Figure 61 14-Pin Interface (PNP)

14-Pin description（PNP）		
1	DC 9-28V	RED RED AND WHITE
2	GND	BLACK BLUE AND WHITE
3	（OUT1）OSSD 1	PURPLE
4	（OUT2）OSSD2	GRAY
5	（OUT3）OSSD 3	LIGHT GREEN
6	ERROR_OUT	YELLOW
7	OUTPUT-COM+	PINK
8	INPUT1	GREEN
9	INPUT2	WHITE
10	INPUT3	BLUE
11	INPUT4	ORANGE
12	INPUT5/STANDBY	BROWN AND WHITE
13	shielded wire	YELLOW AND WHITE
14	N.C.	N.C.

pay attention to:
1. The input signal shall be high resistance (Hi-Z) or ground state
2. The maximum driving capacity of the output signal is DC30V 50mA

2 6.2 Typical PNP connections

The typical connection given here is only used as a wiring reference and may not adapt to all situations. Please design it according to the actual application.

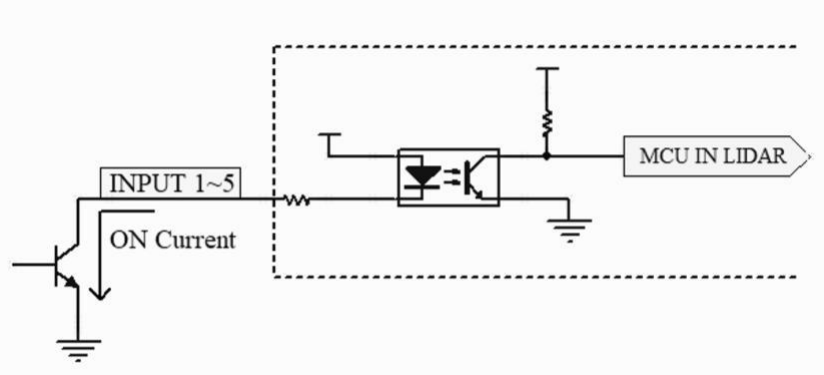


Figure 6-2 Typical connection of input signal (PNP)

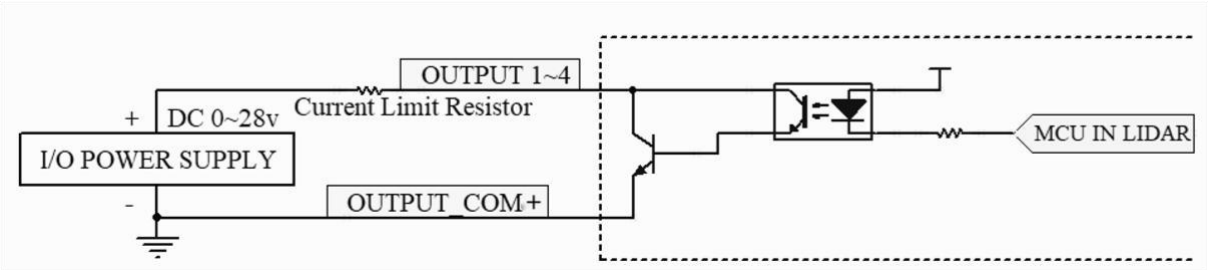


Figure 6-3 Typical Output Signal Connect (PNP)

3 6.2 PNP normally open / normally closed

There are two types of PNP signal output (OUT 1 ~ OUT 4):

1. PNP is normally open: that is, when there is no alarm output, PNP is disconnected from OUT _ COM +, and it is the same as OUTPUT_COM + level.
2. PNP is often closed: that is, when there is no alarm output, PNP and OUT _ COM + remain at the same level, and when there is an alarm output, it is disconnected from OUTPUT_COM +.

6.3 Input / output

For the obstacle-avoidance scanner,

1. The system selects the current working area group of the scanner through the input signal.
2. The scanner informs the system of the current alarm status through the output signal.
3. The system can make the scanner enter into the standby state through the STANDBY signal.
4. OUTPUT_COM-, providing a reference voltage for the output signal of the NPN type scanner.
5. OUTPUT_COM + to provide reference voltage for output signal of PNP scanner.

The user can use the software to modify the scanner output signal level to change its behavior:

1. Modify the output level of the NPN type scanner to change it from low level to high level effective.
2. Modify the output level of the PNP scanner to make it effective from high level to low level.

as shown in the figure:

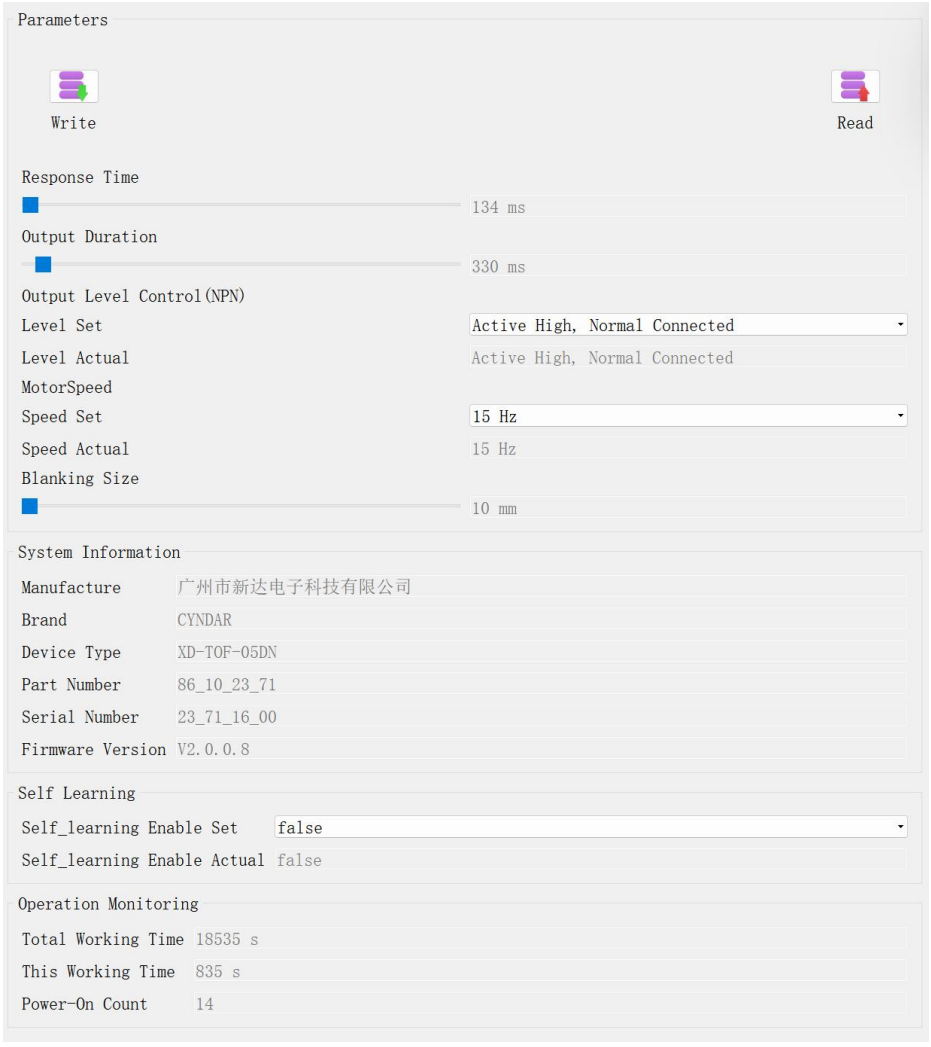


Figure 6-4 Scanner output level modification

Table 6-1 Description of the scanner signal function

The interface name	function	explain
VCC	Source	DC 9 ~ 28V
GND	Source	Receive 0V
INPUT1	Import	The Region selects the input bit 1
INPUT2	Import	Region selection input bit 2
INPUT3	Import	Region selects the input bit 3
INPUT4	Import	Region selects the input bit 4
INPUT5/STANDBY	import	Connect to 0V to bring the equipment into the standby state
OSSD 1	Output	When an obstacle is detected within area 1: The pin and OUTPUT_COM-short (NPN normally open) the pin and OUTPUT_COM-off (NPN normally closed) the pin and OUTPUT_COM + short (PNP normally open). The pin and OUTPUT_COM + (PNP normally closed).
OSSD 2	Output	When an obstacle is detected within area 2: The pin and OUTPUT_COM-short (NPN normally open) the pin and OUTPUT_COM-off (NPN normally closed) the pin and OUTPUT_COM + short (PNP normally open). The pin and OUTPUT_COM + (PNP normally closed).
OSSD 3	Output	When an obstacle is detected within area 3: The pin and OUTPUT_COM-short (NPN normally open) the pin and OUTPUT_COM-off (NPN normally closed) the pin and OUTPUT_COM + short (PNP normally open). The pin and OUTPUT_COM + (PNP normally closed).
OUT4/ERROR_OUT	Output / error indication	When a functional failure occurs within the product: The pin and OUTPUT_COM-short (NPN normally open) the pin and OUTPUT_COM-off (NPN normally closed) the pin and OUTPUT_COM + short (PNP normally open). The pin and OUTPUT_COM + (PNP normally closed).
SHIELD	shield	Wire body shield and metal shell short circuit
OUTPUT_COM-	Output common end (negative)	Output signal common terminal, providing the reference voltage (for the NPN product)
OUTPUT_COM+	Output common end (positive)	Common end of output signal, providing reference voltage (for PNP product)

The scanner can set a total of 16 region groups, marked as region group 1,2... 16; each region group contains 3 regions. The combination of input signals is used to select the current working area group, and the correspondence between the input signals and the working area group selection is shown in the following table:

Table 6-2 Input and Region Group Selection

Area group serial number	Input 4 / input 4	Input 3 / input 3	Input 2 / input 2	Input 1 / input 1
Area Group 1	0	0	0	0
Region Group 2	0	0	0	**1**
Region Group 3	0	0	**1**	0
Region Group 4	0	0	**1**	**1**
Area group 5	0	**1**	0	0
Region Group 6	0	**1**	0	**1**
Area group 7	0	**1**	**1**	0
Area group 8	0	**1**	**1**	**1**
Region Group 9	**1**	0	0	0
Region group 10	**1**	0	0	**1**
Region Group 11	**1**	0	**1**	0
Region group 12	**1**	0	**1**	**1**
Region Group 13	**1**	**1**	0	0
Region group 14	**1**	**1**	0	**1**
Region Group 15	**1**	**1**	1	0
Region group 16	**1**	**1**	1	**1**

When an object invades an area, the corresponding output signal is triggered. If multiple areas are invaded, then multiple input signals are triggered. For example, OSSD 3 triggers when the object invades area 3, OSSD 2 triggers if the object continues close to approach the scanner and enters area 2, and OSSD 1 also triggers when the object enters area 1.

When the scanner to alarm the intrusion through the OSSD signal line, the LED indicator light on the machine will also issue the corresponding alarm signal. For example, Led 3 shines when the object invades area 3; Led 2 shines when the object continues to approach the scanner and enters area 2, and Led 1 shines when the object enters area 1.

The relationship between output signal, LED lamp indication and area invasion is shown in the following table:

Table 6-3 Output signals and regional invasion

Invasion detection			Signal output			Pilot lamp		
Region 1	**Region 2**	**Region 3**	**OSSD 1**	**OSSD 2**	**OSSD 3**	**Led1**	**Led2**	**Led3**
0	0	0	0	0	0	OFF	OFF	OFF
1	0	0	1	0	0	ON	OFF	OFF
0	1	0	0	1	0	OFF	ON	OFF
1	1	0	1	1	0	ON	ON	OFF
0	0	1	0	0	1	OFF	OFF	ON
1	0	1	1	0	1	ON	OFF	ON
0	1	1	0	1	1	OFF	ON	ON
1	1	1	1	1	1	ON	ON	ON

pour:

1. Area is "1", which indicates object invasion in this area and "0", indicating no invasion.
2. OSSD is "1", indicating the output signal indicates object intrusion; "0", indicating no intrusion.
3. LED indicator ON indicates that the indicator light is on and the corresponding area is invaded.

7 Equipment operation

7.1 Working mode

Scanner, there are 4 working modes:

A. Monitoring mode

This mode is the normal operating mode of the scanner. When an object invades, the scanner alarms through the LED light and the corresponding output signal.

When the scanner is powered up, it automatically enters the monitoring mode.

B. Edit mode

This mode is the working mode when the user edthe scanner working area group.

The user uses software to edit regions and region groups to bring the scanner into edit mode.

C. Self-learning mode

The user scans the surroundings through the scanner to generate the work area group pattern.

Long press the " self-learning button on the scanner shell to get the radar into the self-learning mode, as shown in the figure:

Figure Figure 81 Self-learning button

D.Standby pattern

The scanner is in standby mode in Standby mode. The main characteristics are:

(1) The motor stops turning.

(2) Point cloud stops uploading.

(3) Area group normal upload and download.

The user enters the signal (0v) to bring the scanner into the standby state.

7.2 self-taught learning

Users can set up the working area through the software. However, for some practical work scenarios, the user needs to accurately measure them before drawing the region.

The scanner provides the self-learning function. When the user presses the "self-learning" button for 3 seconds, and the scanner enters the self-learning mode. In self-learning mode, the scanner will automatically scan the surrounding environment, and the outline of the environment is the boundary of the area.

The scanner represents the current working status of the scanner by the change of the LED indicator light. The details are shown in the following table:

Table 81 Operating status of the LED lamp and the scanner

Led	Monitoring mode	editing pattern	Self-learning mode	Standby pattern
Led4	Abnormal indicator light: normal often bright, abnormal when 1s flash once	Abnormal indicator light: positive Often often bright, abnormal When 1s flash once	Abnormal indicator light: normal often bright, abnormal when 1s flash once	1s flash once
Led3	Area 3 intrusion mark As to Out3 (yellow area)	Often bright	Often destroyed	Often bright
Led2	Zone 2 intrusion standard As to Out2 (orange area)	Often bright	Often destroyed	Often bright
Led1	Area 1 invasion sign, same as Out1 (red area)	Often bright	Enter the self-learning state: press LED 1 and flash once; Flash mob: enter the flash mob (0.25s once, the hand does not release the button, the hand can release) means that you can enter the self-learning state (release the hand to enter the self-learning); Self-learning stage: 60 seconds (60 * 15 laps) is always bright; Self-learning self-learning: flash mob (0.25s once) indicates the completion of self-learning and the storage of self-learning data;	Often bright

7.3 Working Parameters
7.3.1 Variable parameters

Motor speed
The motor speed of the laser transmitter has two values: 15Hz and 30Hz. When the rotation speed changes, the angular resolution of the machine also changes. The specific value is:
15Hz: angular resolution of 0.1°
30Hz: angular resolution of 0.3°

Shield size
If the invading object is less than that size, the scanner does not alarm.
Value range: 10mm~1,000mm, the default value: 10mm.

Response time
When the scanner detects an invading object, how long after the alarm. According to the angular resolution (different speed), the response time value range is different.
At 15Hz: Value range: 67ms~29,949ms (30s), default value 134ms (two turns).
At 30Hz: Value range: 33ms~29,997ms (30s), default value 66ms (two turns).

Retention time
The time when the output signal remains the alarm state when the intrusion leaves the protected area.
Value range: 10ms~10,000ms (10s), the default value: 330ms.

7.3.2 Equipment Parameters

Only the parameters related to the distance calculation are listed here, see the appendix for other parameters.

Angular resolution

The angular difference between two adjacent laser pulses is the angular resolution of 0.1° at 15Hz and the motor speed at 30Hz
And at 0.3°.

Scan the angle range

The minimum angle and the maximum angle range of the laser pulse.
At 15Hz: the angle range is-45° to 224.9°.
At 30Hz: the angle range is-45° to 224.7°.

Traffic rate

USB transfer serial port communication was used between the scanner and the upper computer, with a port rate of 2941176bps.

The number of electric

The total number of times the scanner is powered on.

This working time

How long has the scanner been working since this time.

Net cycle time

The scanner starts on the first time, a total of working time.

Chapter 2
Configure the software basic operation

1 Overview

1.1 Document purpose

This document describes the use method and precautions of the software produced by GZ Cyndar Co., Ltd. (CYNDAR).

The software is mainly used to control the obstacle avoidance type single-line scanner produced by CYNDAR.

1.2 System requirements

CPU: Intel i5 dual-core 2.7G, and above

OS: Windows 7 / Windows 10 / Windows 11

Program type: GUI application, supports Windows message loop

Data transfer: USB3.0

2 Software interface composition

2.1 Software working mode

There are two working modes of the software: editing mode and monitoring mode.

Eiting mode is used to edit the scanner working area (group); monitoring mode the user monitors the working state of the scanner.

2.2 Interface style

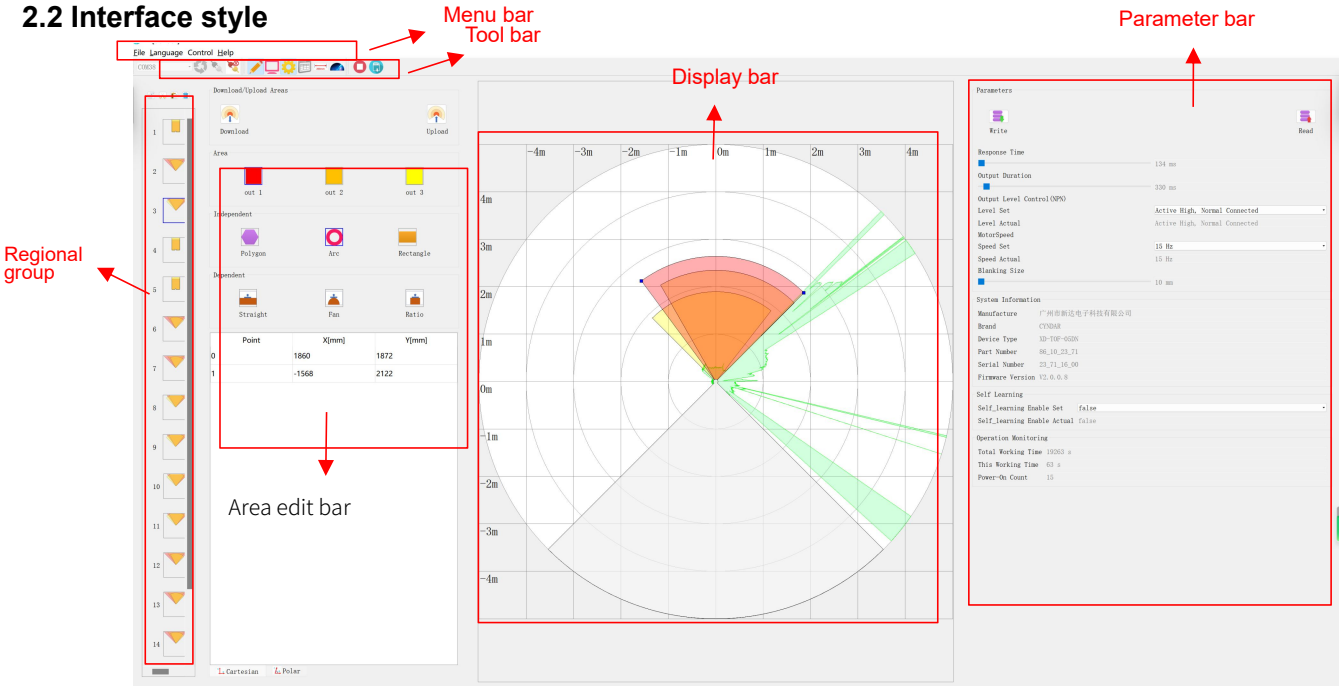


Figure 9-1 The editing interface

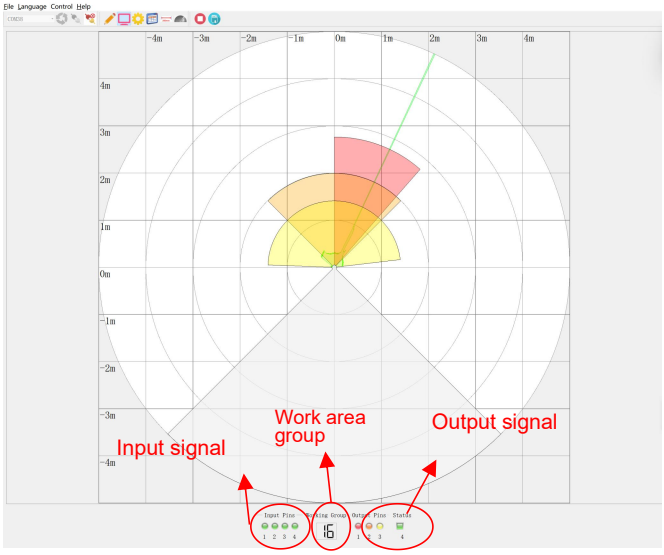


Figure 9-2 Monitoring interface

Edit Bar: Eits regions and region groups to meet user needs.
Display bar: It displays the effects of area editing and point cloud data.
Input selection signal: Display the input selection signal status on the device.

3 Detailed instructions for the use

This section details the various functional modules of the software and explains their physical meaning corresponding to the scanner.

3.1 Coordinate system

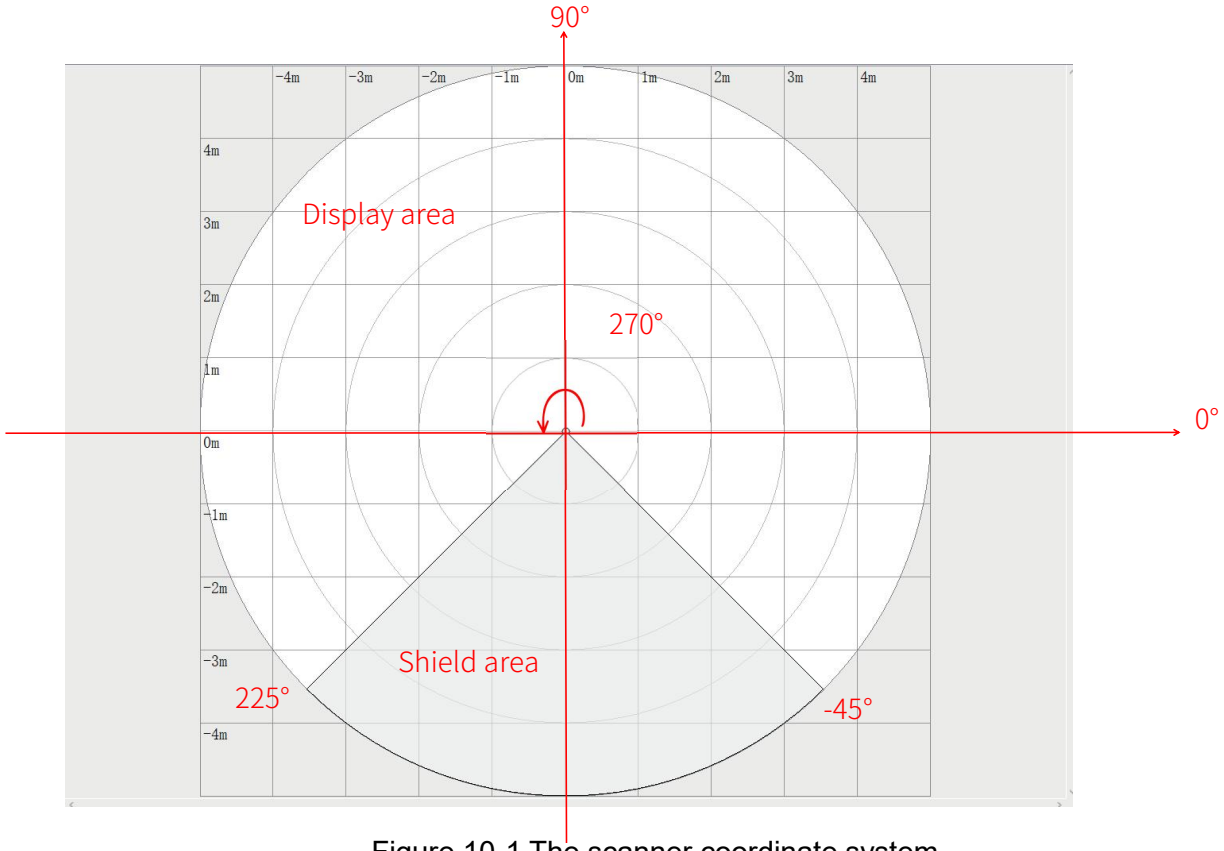


Figure 10-1 The scanner coordinate system

Angle range: a scanner with an angle scan range of 270 °, from-45° to 225°.
Distance range: The scan distance range defined by the scanner is from 5 cm to 5 m (05D) and 5 cm to 20 m (20D).
Display area: Due to the scanning scope of the scanner angle and the distance range, both the boundary range defined by the scanner and the area are only meaningful within a specific range, and this range is defined as the "display area".
Mask area: All mask area outside the display area.

3.2 Menu bar

The software can edit the area groups used by the scanner, including:
1. Save the area group to the file to form an engineering file. The suffix name is: *.apf
2. Load the area groups from the engineering file, and edit them.
3. Load the region groups from the scanner.
4. Download the region group data to the scanner.
5. Create a new project to edit the area group.

The main purpose of the File project on the menu bar is to edit the area group files.

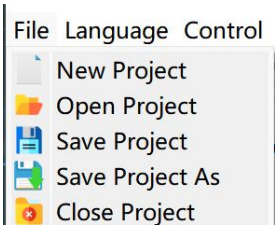


Figure 10-2 Menu bar File

3.3 Toolbar

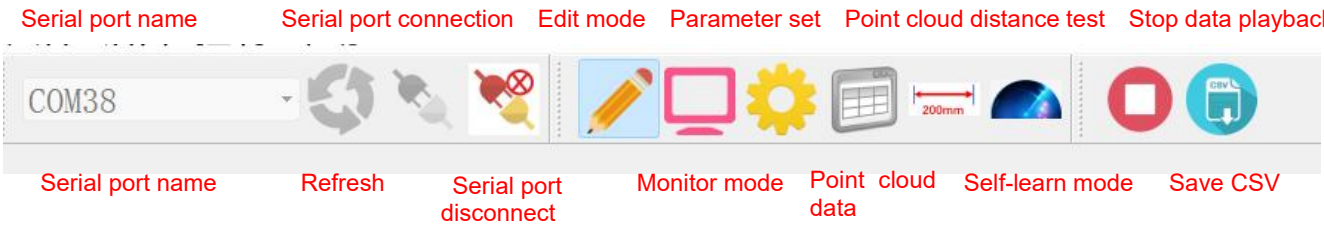


Figure 10-3 Toolbar

The software performs a data connection with the scanner through a serial port.

Serial Name: Serial name that will be connected.

Serial port refresh: When the scanner is just connected to the device, the refresh is used to discover the device.

Edit mode: Make the software work in the editing mode.

Monitoring mode: Make the software work in the monitoring mode.

Parameter settings: Users can set the working parameters of the scanner through the parameter setting interface.

Point cloud data view: In the monitoring state, the user views the point cloud data by the form.

Point cloud distance test: Test the currently selected point cloud distance.

Self-learning mode: Software starts the scanner into the automatic learning surrounding environment mode.

Point cloud playback: Start or stop playing the point cloud.

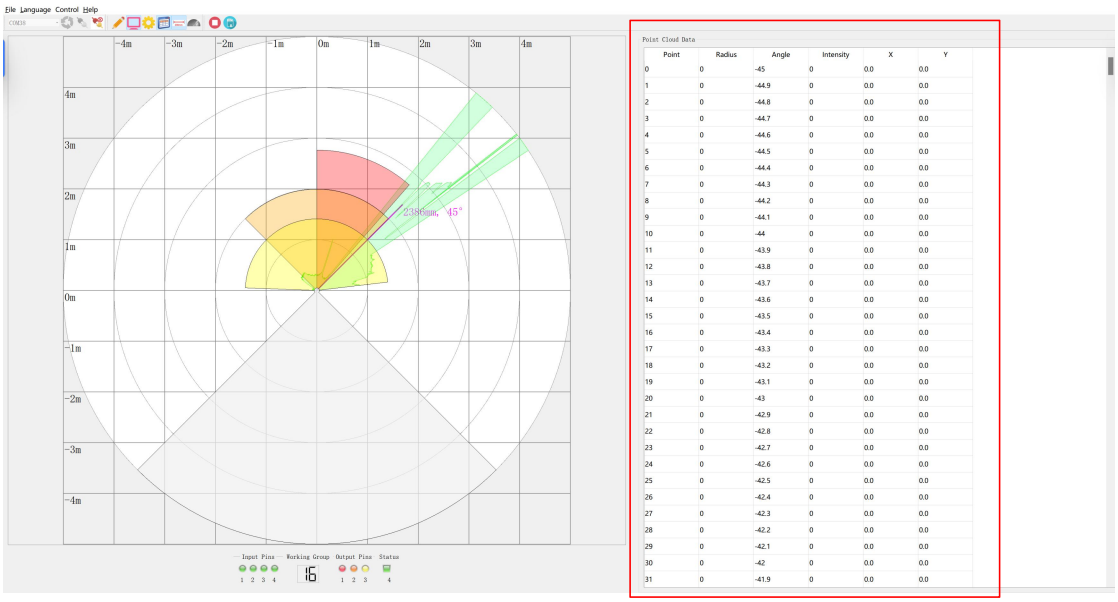
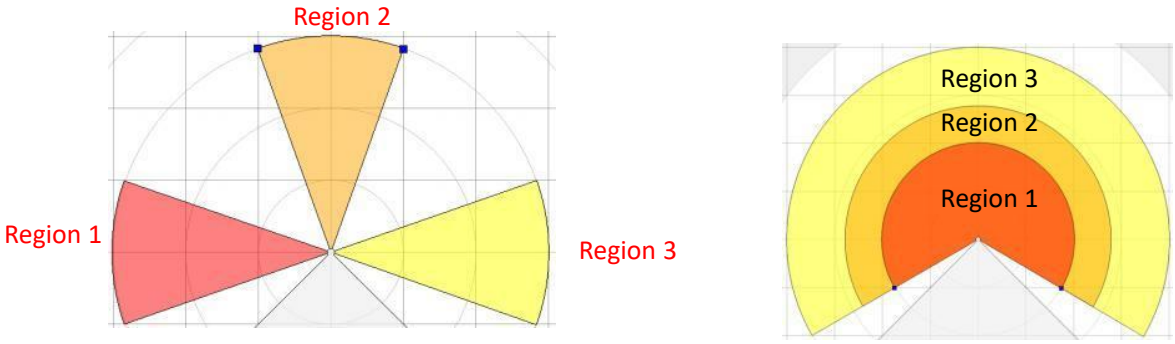


Figure 10-4 point cloud data view

3.4 Edit the area (group)

The scanner monitors the range specified by the user. When an object enters the range, the scanner alarms the system, and the defined range is "area";

A region group consists of three regions, namely region 1 (red), region 2 (orange), and region 3 (yellow). Regions within a group can be independent of each other or related to each other, and users can set them as needed.as shown in the figure:



When an object invades into an area, the corresponding LED light will be lit, and its corresponding OSSD output signal will be triggered.

The definition and setting of regions and region groups are implemented through the software. Refer to the "Electrical Connection / Connect => Input / Output" section for the relationship between input / output and region groups.

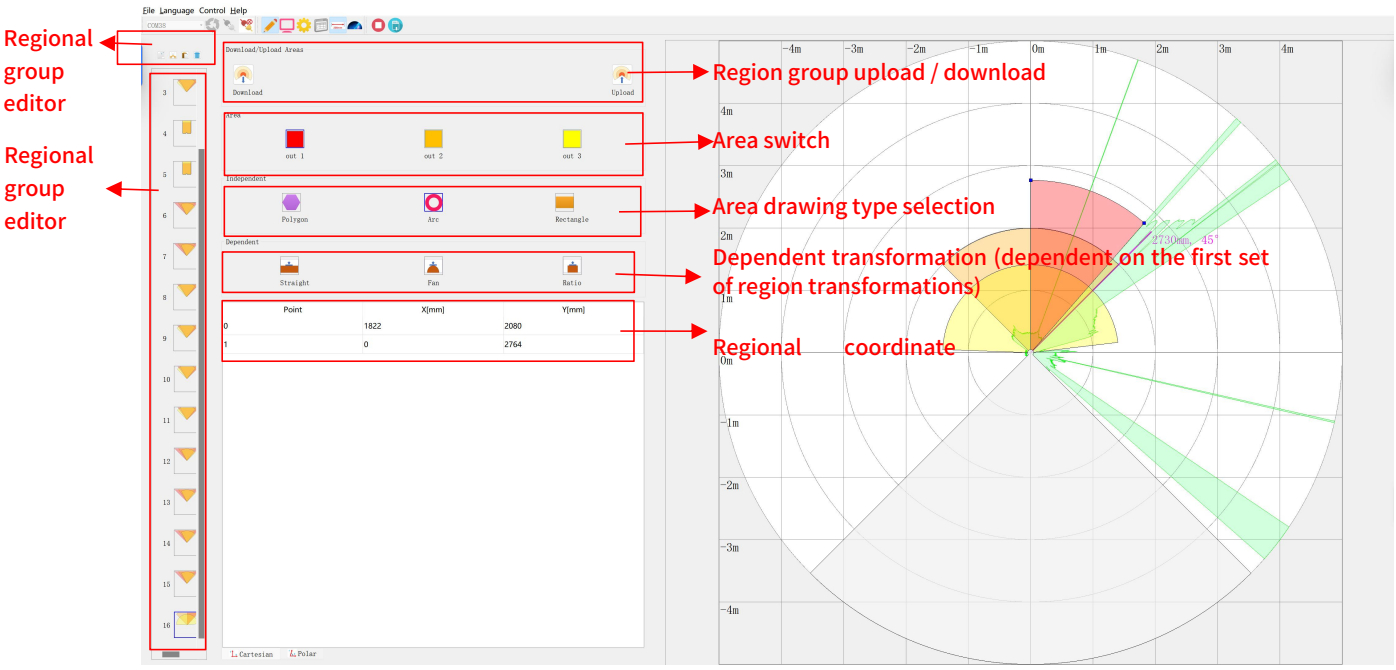


Figure 10-6 Regional group (group) editing

A. Regional group editing

The editing function includes 4 operation buttons, which are:

a) Copy: Copy the region group that is currently being edited.

b) Cut: Cut the area group that is currently editing.

And c) Paste: paste the copy or Cut region group to the region group, and the original region group will be replaced.

c) Delete: Delete the current region group.

B. Regional group preview

Software can be managed

The 16 region groups, and a graphical preview of each region group is presented here. The user, by clicking on the corresponding

Preview the pattern, you can switch to the corresponding working group to edit.

C. Regional group upload / download

A) Upload: upload the area groups in the scanner to the software.

And b) Download the software-managed area groups to the scanner. These area groups may come from files or may be loaded from this scanner or other scanner.

D. Area Switching
Each region group contains three regions, red, orange, and yellow with regions numbered 1,2,3. With these three buttons, users can switch between different regions.

E. Area type transformation
The software and the scanner can handle the region types in the 6, respectively:
a) Polygonal region, example:

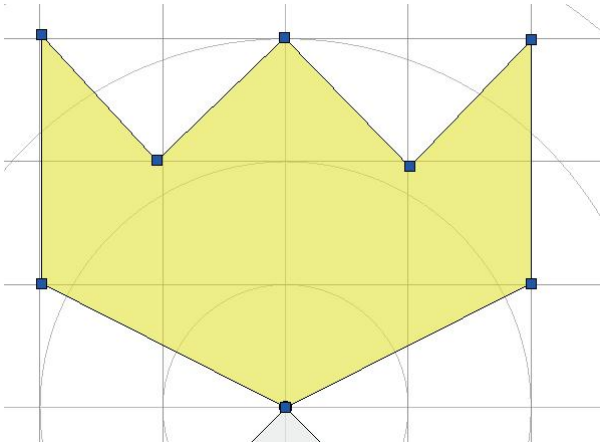


Figure 10-7 Example of the polygonal region

b) rectangular area, Example:

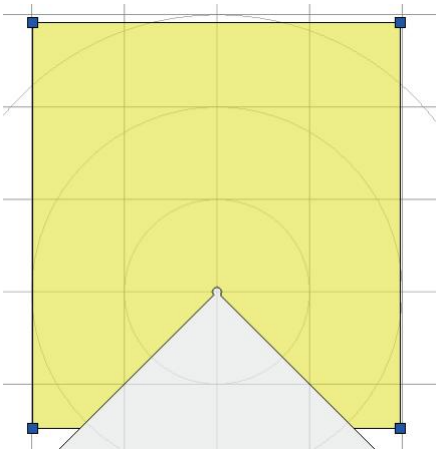


Figure 10-8 Example of the rectangular area

c) curved area, Example:

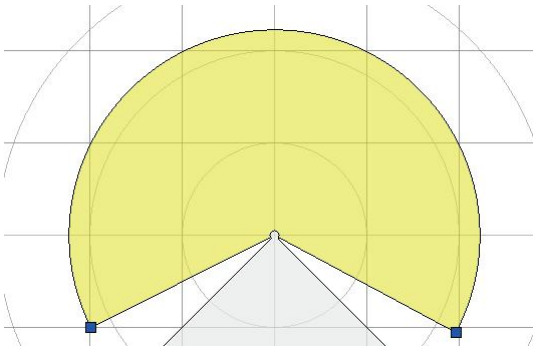


Figure 10-9 Example of the arc area

d) Line scale area, example:

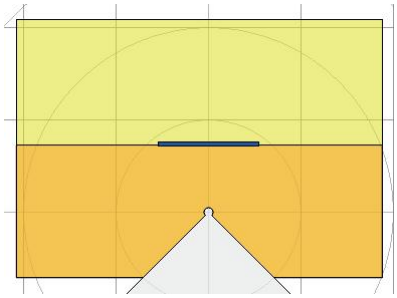


Figure 10-10 straight line scale region

e) sector scale area, example:

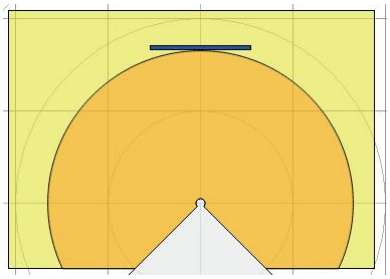


Figure 10-11 Example of the sector-proportional area

f) Full-scale area, Example:

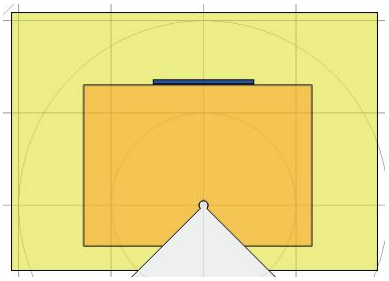


Figure 10-12 Example of the full-scale area

By clicking the corresponding button, the area group becomes the area type marked by this button.

F. Regional characteristic points

Geometrically, each region can be expressed by the connection between points and points. For example, the polygon area can be represented as a series of points; the rectangular area is defined by the upper left and lower right points; the arc area is composed of the beginning and the end of the arc. These points are characteristic points for the region.

The coordinates of regional characteristic points are displayed in two ways: Cartesian coordinates and polar coordinates, as shown in the figure:

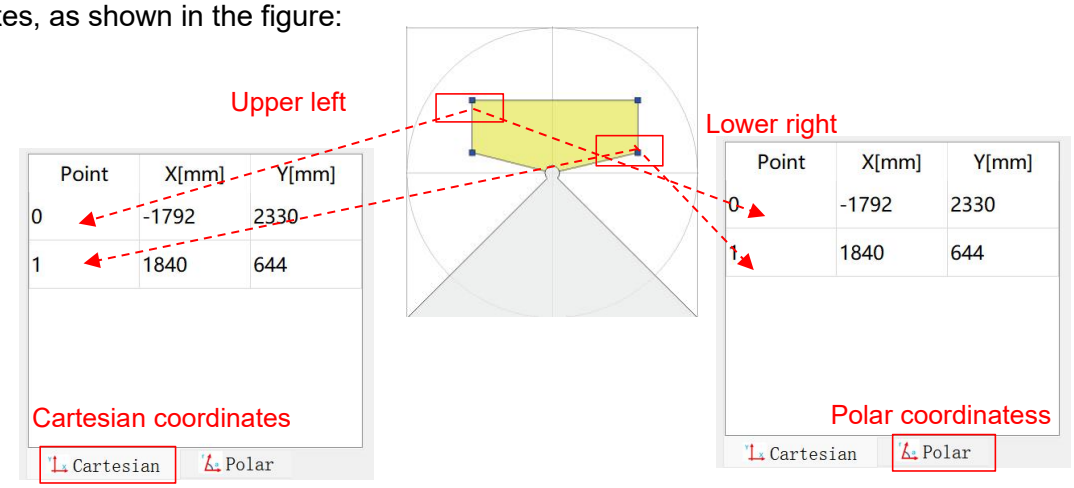


Figure 10-13 Coordinates of the feature points

3.5 Area editing and display

3.5.1, the polygonal region

Move the coordinate origin out to add a vertex to the polygon.

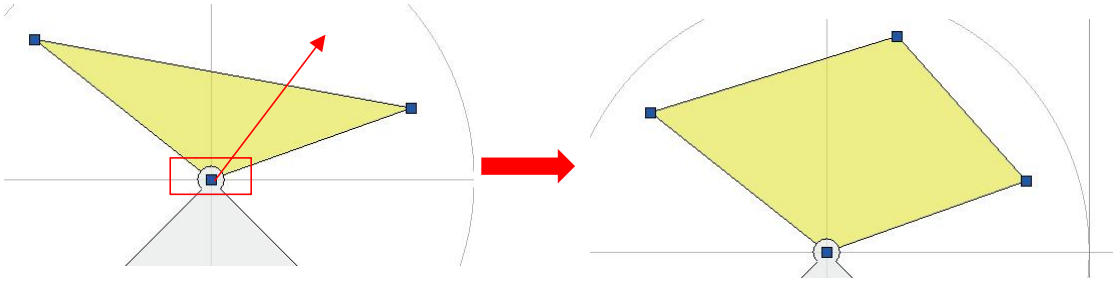


Figure 1014 Polygon area edit 1

Move the polygon shape by moving the polygon vertex

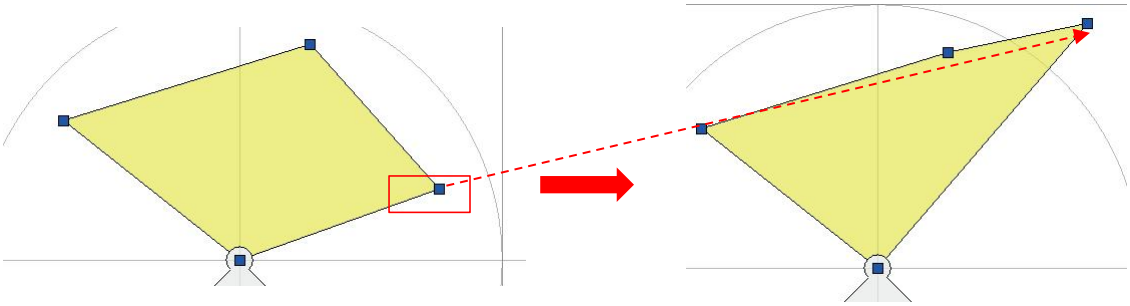


Figure 1015 Polygon region edit 2

Press the DEL key to delete a vertex of the polygon, and when all the vertices are deleted, the polygon is deleted.

The user can also edit the shape of the region by directly modifying the coordinates of the vertices, as shown:

Figure 1016 Polygon region edit 3

3.5.2 Rectangular area

Due to the limitation of the scanner scanning angle range, the rectangular area defined by the scanner is actually a geometric pattern composed of the intersection of the rectangular area defined by 4 points and the scanned area of the scanner, as shown in the figure:

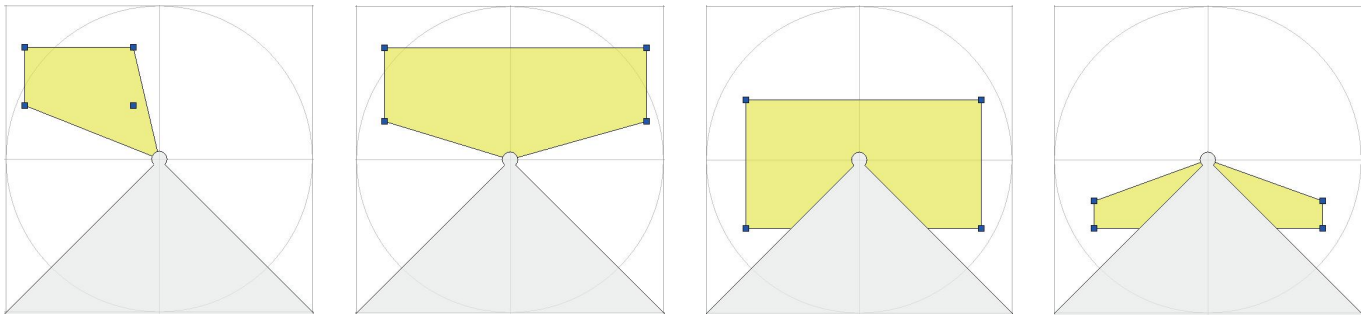


Figure 10-17 Rectangular area shape

Drag any rectangle vertex to change the rectangular shape.

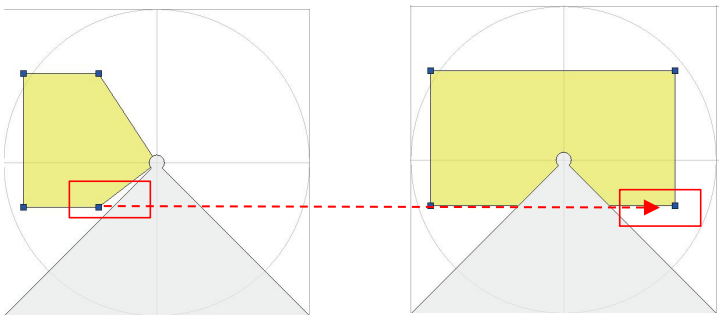


Figure 10-18 Rectangle area variation

Rectangular area cannot be deleted. You need to change its type to a polygon and then delete it.

Like the polygon region, the rectangular area can also change its moments by editing its "TopLeft" and "BottomDown" points

The shape of the area.

3.5.3 Arc area

A sector area is a user-defined arc start point, end point, and a fan centered on the scanner.

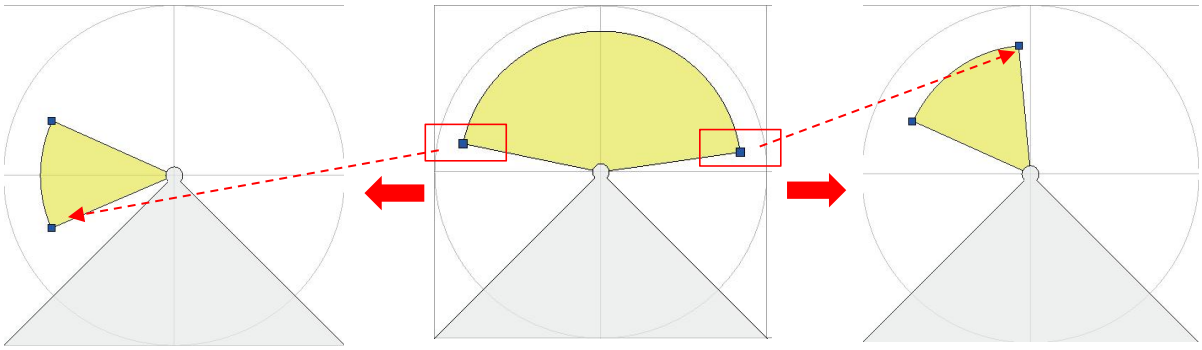


Figure 10-19 Arc area editing

The arc area start is always the less angular point in the two points.

When the sector area is changed, the sector topology remains unchanged if the start point angle is still less than the end point, and if the start point exceeds the end point

The end becomes the beginning, and the beginning becomes the end.

Like the polygonal area and the rectangular area, the curved area can also change the curved area by editing the coordinates of its arc endpoints.

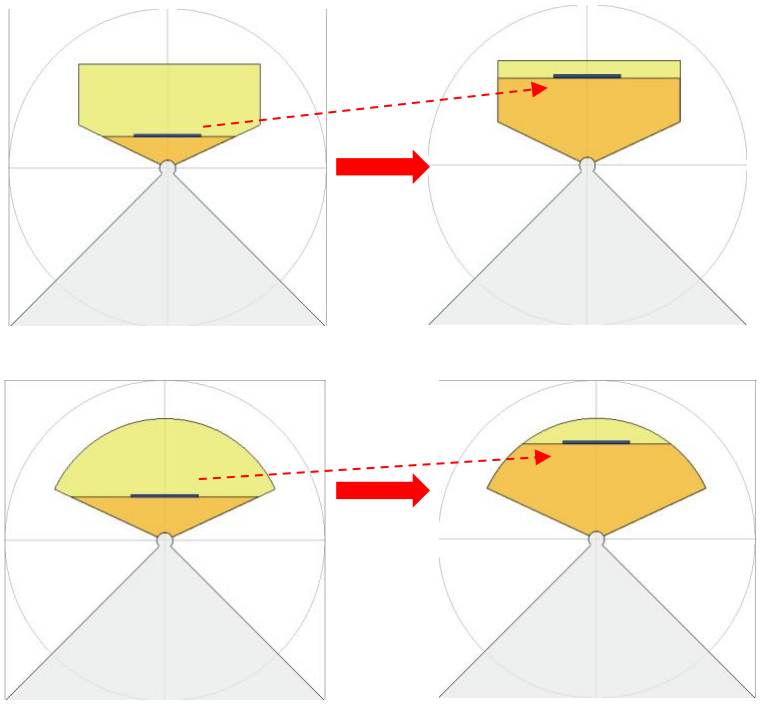
3.5.4 Line proportional area

The line scale area takes a line as a ruler, and the area where the upper layer area is less than this ruler constitutes a line scale area. By changing this

Position of the straight line, thereby changing the region shape.

Region 1 is the lowest layer, region 2 is the middle layer, and region 3 is the upper layer.

Region 2 has no corresponding upper layer area, so it cannot be converted into a straight line proportional area.



Figures 10-20 Edit 1 of the line scale region

The shape of the line scale area can also be changed by editing the coordinates of "ChangeBar", as shown below:

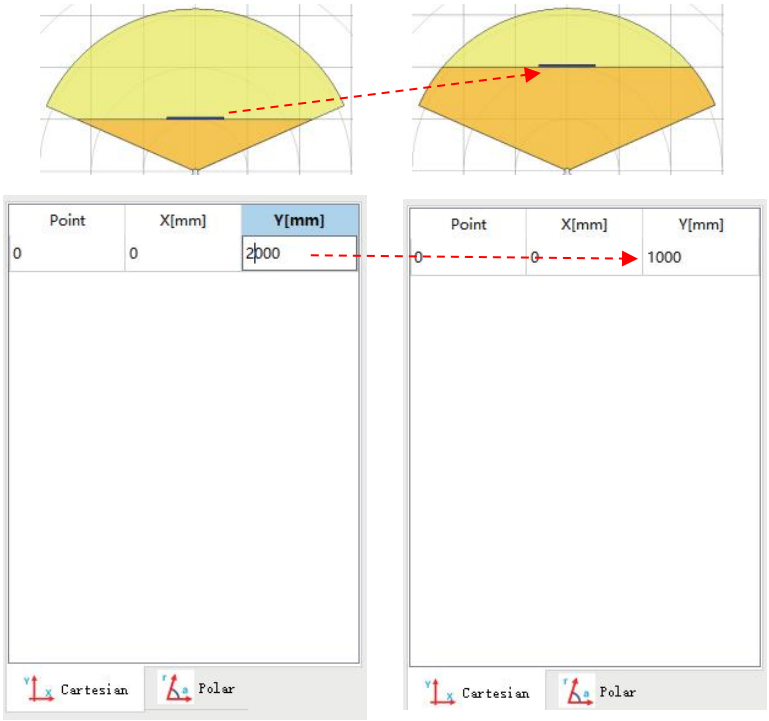
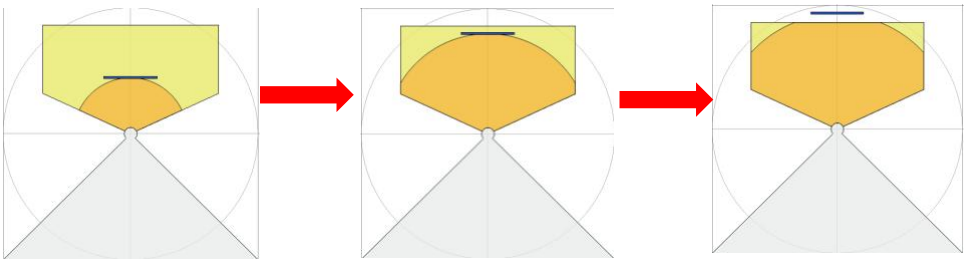


Figure 10-21 Edit of the straight-line ratio region 2

3.5.5 The sector ratio area

The fan scale area is formed by crossing the circle. The radius of the circle is specified by the user dragging the corresponding control.

As stated in the above section, region 2 cannot be converted to a fan-scale region.



3.5.6, full proportional area

The area above one layer as a reference is a similar shape of the area of the upper layer. The user changes the similar proportion by dragging the corresponding control.

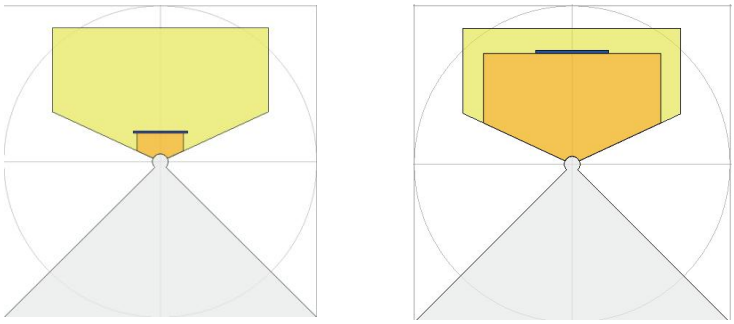


Figure Figure 10 – 23 Editing of the full-scale region

- None of the regions were defined between-225 ° and-45°.
- The proportional area is located within the upper layer area.

3.6 Parameter settings

When the scanner is connected to the software through a serial port, the operating parameters can be viewed and edited.

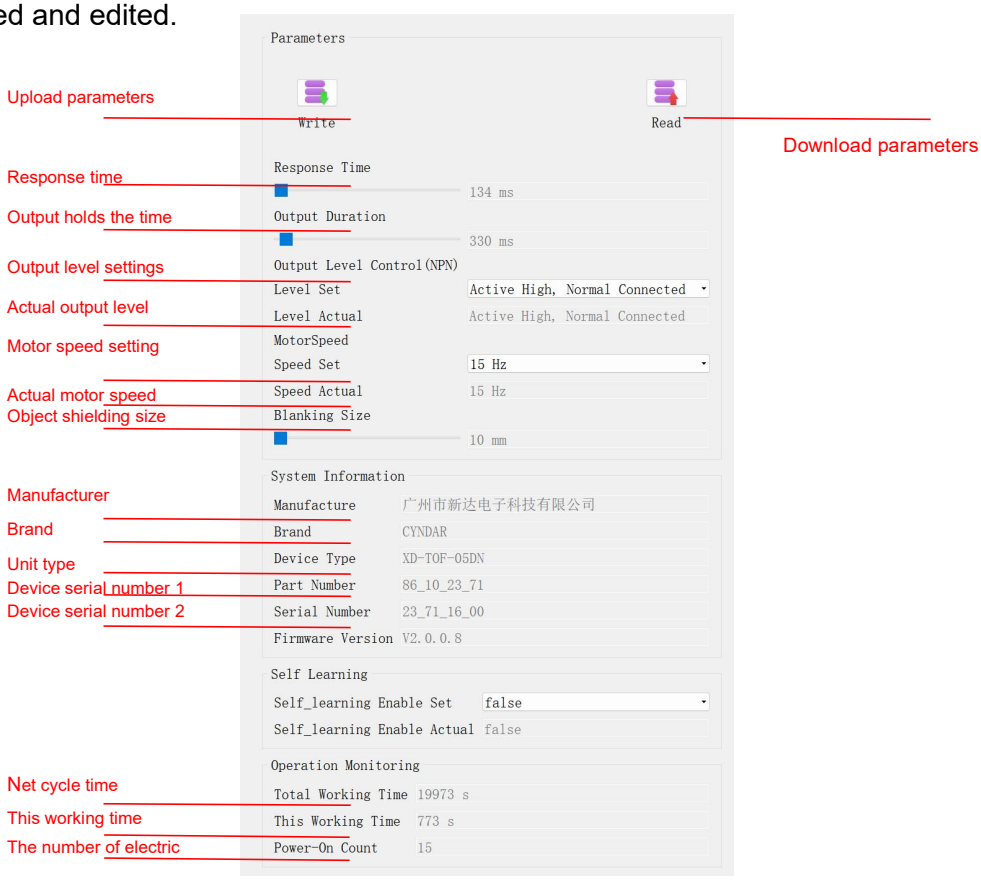


Figure 10-24 Equipment parameter setting

"Upload Parameters" button: Download all parameters to the scanner.
"Download Parameters" button: Read the parameters of the scanner.

"Response time": the time from the object invading the area to the area corresponding the output signal response.
"Output hold time": the time when the invading object leaves the area and the corresponding output signal is invalid.
"Output level setting": the output level can be NC, NO
"Actual output level": the actual output level is set.
Motor Speed Setting: Set the motor speed of the scanner.
"Actual motor rotational speed": the actual rotational speed of the motor.

"Total working hours": How long the scanner is connected to the software.
"This working time": connected to the software, how long the scanner has worked this time.
"Number of times": connected to the software, the scanner powers up several times.

3.7 point cloud view
3.7.1 Point cloud image
Whether in editing mode or in monitoring mode, users can view the point cloud of the scanner through the "software". There are two differences here
A. In editing mode, the software displays all the point clouds.
B. In monitoring mode, the software will only display point cloud data within the angles defined by the working area group.

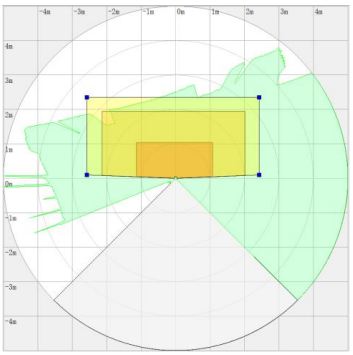


Figure 10-25 Point cloud display in editing mode

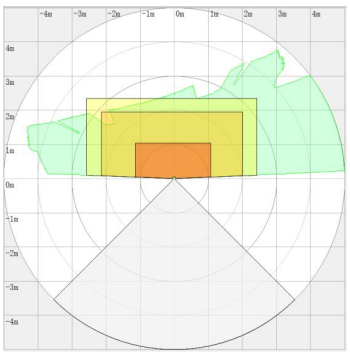


Figure 10-26 Point cloud display in monitoring mode

Point cloud view refers to view the specific value of point cloud data.
In the monitoring mode, click the following button to view the point cloud data:

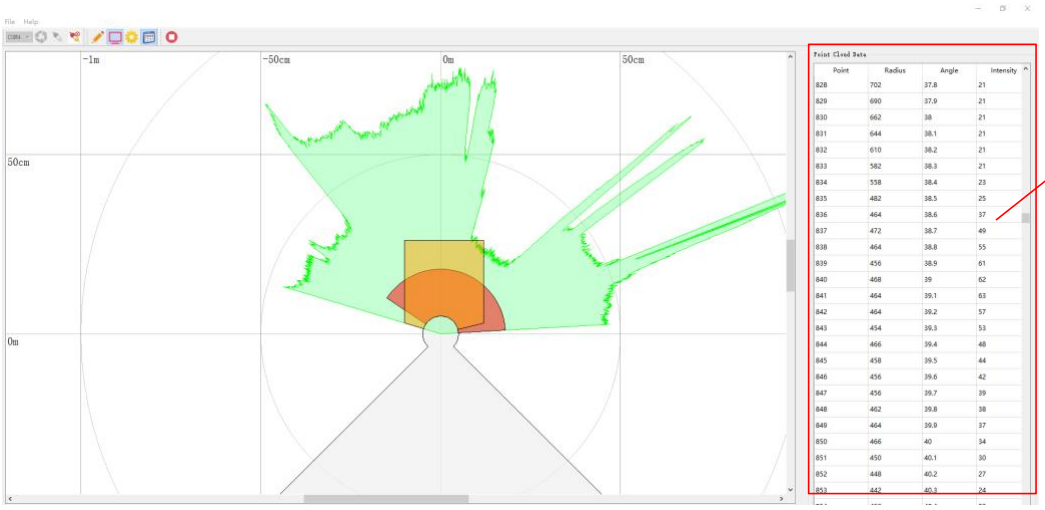


Figure 3-28 Point cloud data view

3.7.2 Point cloud measurement

The software provides distance and angle measurement tools to measure point clouds, as shown in the figure:

Users can simply turn on and move the ruler to measure the point cloud:

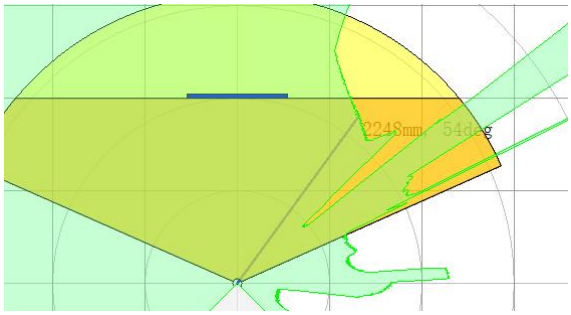


Figure Figure 10 – 30 for point cloud measurements

3.8 Input / output signal

The input signal of the scanner is determined by the user wiring and is the selection of the scanner working area group.

The output signal indicates the scanner alarm status (OSSD 1~OSSD 3) and operating status (ERROR _ OUT).

Through the software, the user can know the input signal status, output signal status and operating status of the scanner.

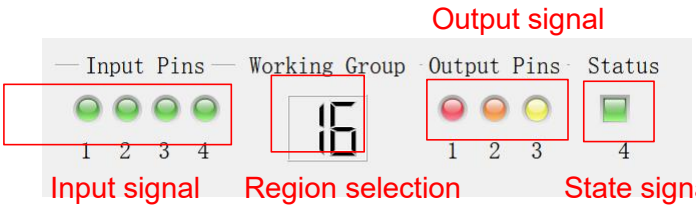


Figure 3-31 Input / output signal

For the specific meaning of the signal, see "Inputs and Outputs" in Section 6.

Chapter 2
Configuration Cases

Chapter 3 Config cases

1 Typical case

This chapter will list several typical application cases of the scanner, which users can be used as a reference to modify combined with their own applications. Before formally assigning the scheme, the following issues are generally considered

A. What is the purpose of the program.
B. Where is the suitable installation location for the scanner.
C. How is the locale set up and how many region groups are required.
D. How do the region groups switch during the system operation.
E. When the scanner alarms, how to process the alarm signal.

1.1 Protection of dangerous areas

In the passage of the danger area, the use of a safety laser scanner can protect the movement of the automatic processing unit is stopped by the external area, while the movement of the upper part of the mold is stopped by the internal protection area. The result is a productivity improvement because the processes can operate independently of each other.

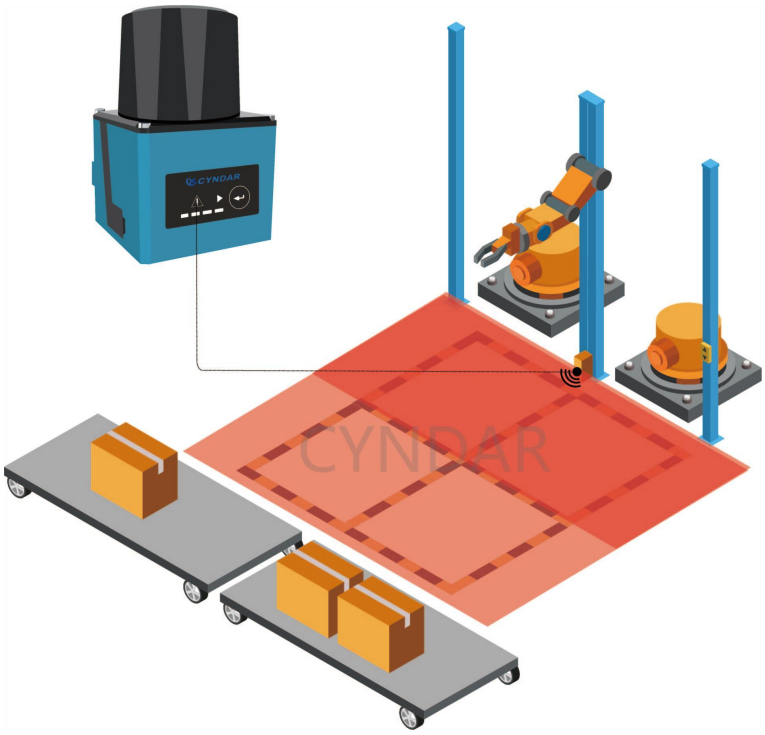


Figure 111 Protection and control equipment in the dangerous area

In this case, area 1 to area 3 in the working area group can initiate the protection simultaneously, and the main points of the protection strategy can be as follows:

A. When area 1 fails, zones 2 and 3 can still be protected. The system control equipment stops working.
B. When areas 1 and 2 fail, area 3 can still be protected. The system control equipment stops working.

According to the different user needs, the scanner installation position and height can be adjusted appropriately. Changes to the shape and type of the area can also be made depending on the device environment.

1.2 Dangerous point protection on the handling door

To reduce the complexity of automation, workers can manually load interconnected CNC machine tools. To this end, they use a slide platform to enter the processing area. A safe light screen prevents intrusion. The XD-TOF-05D secure laser scanner can be used as an alternative, thus simplifying the installation and commissioning. Given the flexible configuration of the warning and protected areas, the safety device can accommodate the openings discussed. The safety laser scanner can also be mounted under the drum conveyor to protect the danger area below.

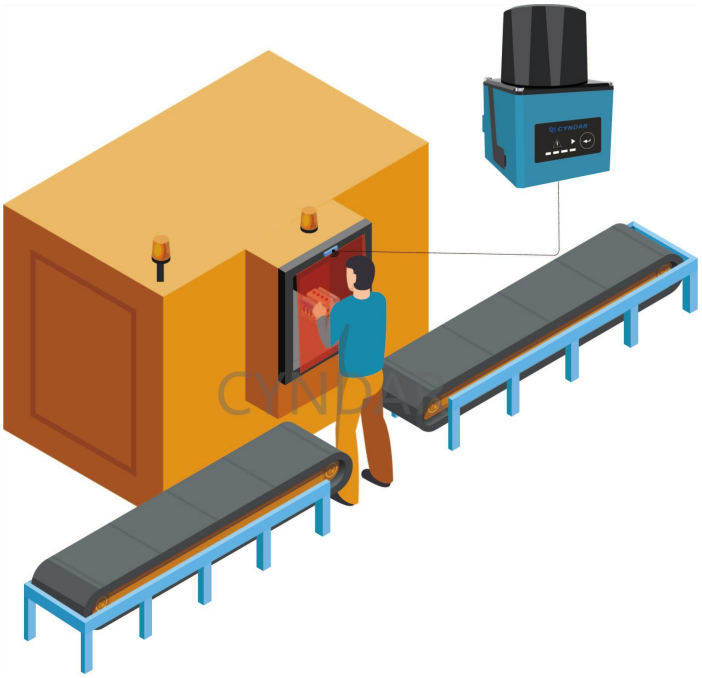


Figure 112 Dangerous point protection on the handling door

1.3 Safety protection of forklift truck

Regional protection has large-scale applications in the protection of mobile systems, one of which is the AGV or vehicle obstacle avoidance.

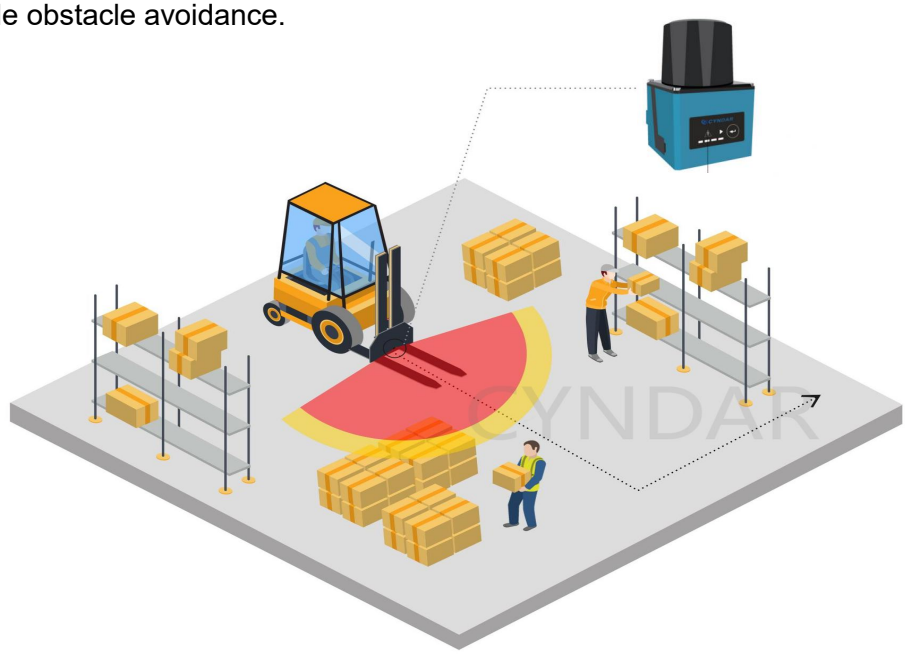


Figure 11-3, obstacle avoidance trolley

The safety laser scanner is mounted on the AGA trolley. The AGV car runs according to the fixed line. When an object enters the area 3, the car starts to alarm; when entering the area 2, the car slows down, and when entering the area 3, it stops driving.

In the AGV driving path, due to the different environment, the car needs to change the range of its protection area, that is, to change the shape of the area. The user can load a preset area group in the scanner and replace the working area group when the cart travels to a specific node on the path to accommodate the different environment.

Chapter 4
Equipment Inspection and Maintenance

Chapter 4 Equipment Inspection and Maintenance

Equipment inspection and maintenance are important to the safe use of the equipment. Users must inspect and maintain the equipment as required.

1.1 Inspection before use

After the equipment is installed and configured, the equipment must be examined at least as listed in the following table.

NO	Inspection item	Whether through	Remarks
1	The equipment is correctly installed in the specified position without loosening phenomenon		
2	All of the signal lines are correctly connected		
3	When the test obstacle enters the defined area, the corresponding signal Line trigger, corresponding to the LED, the light is on		
4	When the test obstacle leaves the designated area, the corresponding signal Line failure, corresponding to LED, light off		
5	When the input signal changes, the corresponding working area also changes		

10.2, daily inspection

NO	Inspection item	Whether through	Remarks
1	The equipment is correctly installed in the specified position without loosening phenomenon		
2	All of the signal lines are correctly connected		
3	When the test obstacle enters the defined area, the corresponding signal Line trigger, corresponding to the LED, the light is on		
4	When the test obstacle leaves the designated area, the corresponding signal Line failure, corresponding to LED, light off		
5	When the input signal changes, the corresponding working area also changes		
6	The system where the equipment is located works normally		

1.2 Irregular inspection

NO	Inspection item	Whether through	Remarks
1	The equipment is correctly installed in the specified position without loosening phenomenon		
2	The device is still in the original installed position and is not moved		
3	The optical cover of the equipment is free of dust and no scratches		
4	Equipment cables are properly connected		
5	When the input signal changes, the corresponding working area also changes		
6	The system where the equipment is located works normally		
7	When the test obstacle enters the defined area, the corresponding signal Line trigger, corresponding to the LED, the light is on		
8	When the test obstacle leaves the designated area, the corresponding signal Line failure, corresponding to LED, light off		
9	When the input signal changes, the corresponding working area also changes		
10	The system where the equipment is located works normally		

When the optical cover is covered with dust or oil, the detection ability of the scanner will be affected and the user shall clean in the correct method:

- Wipe it with a clean cotton cloth
- Use a soft burbrush to clean up
- Use a hair dryer to blow the dust off
- Use a neutral cleaner to remove the surface oil stains

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