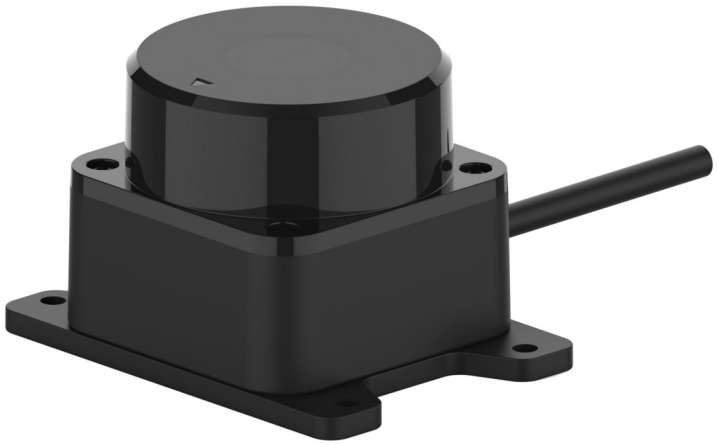
Parakeet Mini
Version: Ver 1.2



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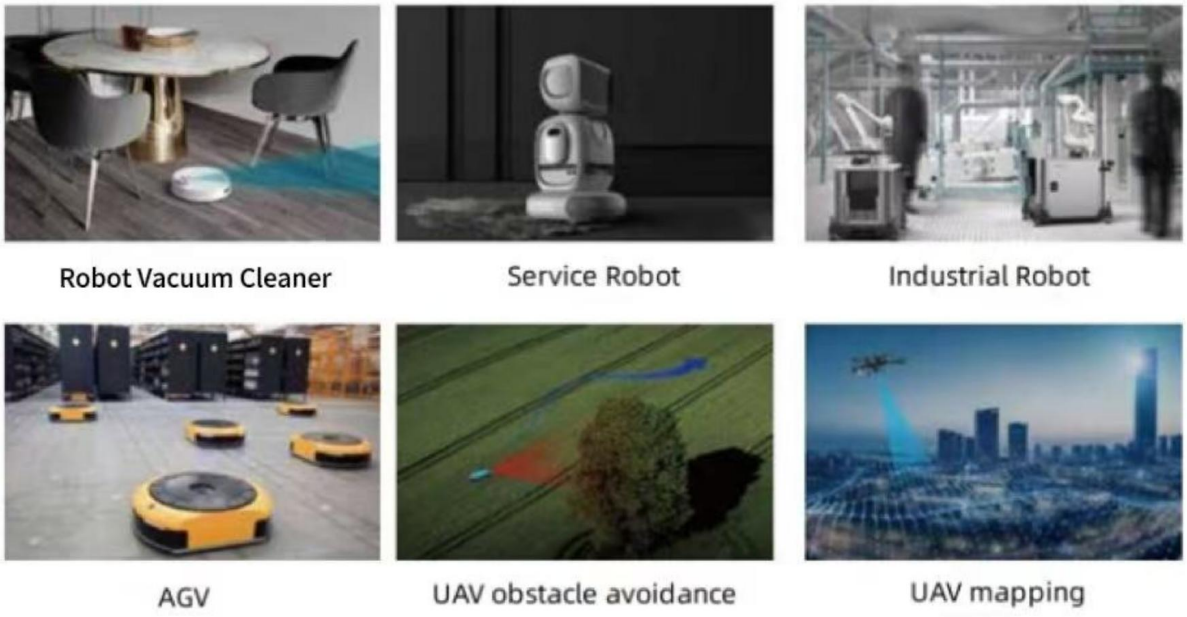
Parakeet Mini

Content

I. Introduction



The typical rotation frequency of Parakeet Mini is 10Hz (600RPM). At this rotational speed, the angular resolution is 0.2°. Customers can switch it to 15Hz (900RPM) according to their needs, and the angular resolution at this frequency is 0.3°. The Parakeet Min Lidar uses a near-infrared pulsed laser as a light source, and the laser pulses are emitted only in nanoseconds. This ensures safety for humans and pets and meets FDA Class 1 laser safety standards. The application of near-infrared pulsed laser combined with filter can effectively avoid light interference, so it can be used for normal indoor and outdoor environment.

II. Operating Principle

The Parakeet Mini is designed based on the principle of Time Of Flight (TOF) and can conduct ranging up to 18,000 times per second. The ranging data is sent to the power supply and processing module through high-speed optical communication for calculation, and then the distance values and intensity information of the target object from the Lidar are output through the communication interface. As shown in Figure 2-1, when in the working state, the laser emits a beam of laser light outward. When this laser light shines on an obstacle, it will be reflected. The receiver detects the reflected light signal. The time difference between the reflected light and the emitted light is measured by the time analysis module. By multiplying the time by the speed of light, the flight distance of the light can be obtained, and thus the position information of the obstacle can be calculated.

In order to obtain the target information at different angles, the Lidar rotates internally through a motor to obtain the distance and intensity information at different angles, so as to obtain a complete 2D point cloud map. The internal motor drive of the Parakeet Mini is designed to rotate counterclockwise by default.

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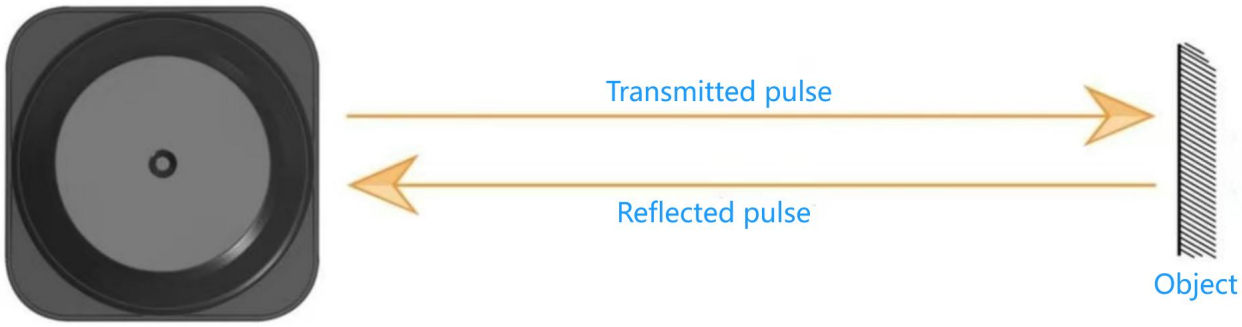


Fig. 2-1 Operating principle

Ⅲ. Product Advantage

- The Lidar has the functions of hardware filtering and removing trailing points, which can effectively avoid the interference caused by some noise points.
- It can output the reflection intensity of target synchronously, which can be used for algorithm judgment.
- The range accuracy can be ±3cm, and the linear consistency of targets with different reflectance is good.
- Photoelectric wireless data transmission, brushless motor design, long service life.
- Special optical design, effectively improve the anti-fouling ability.

Ⅳ. Mechanical Dimensions and Optical Windows

4.1 Mechanical Dimensions

Unit: mm

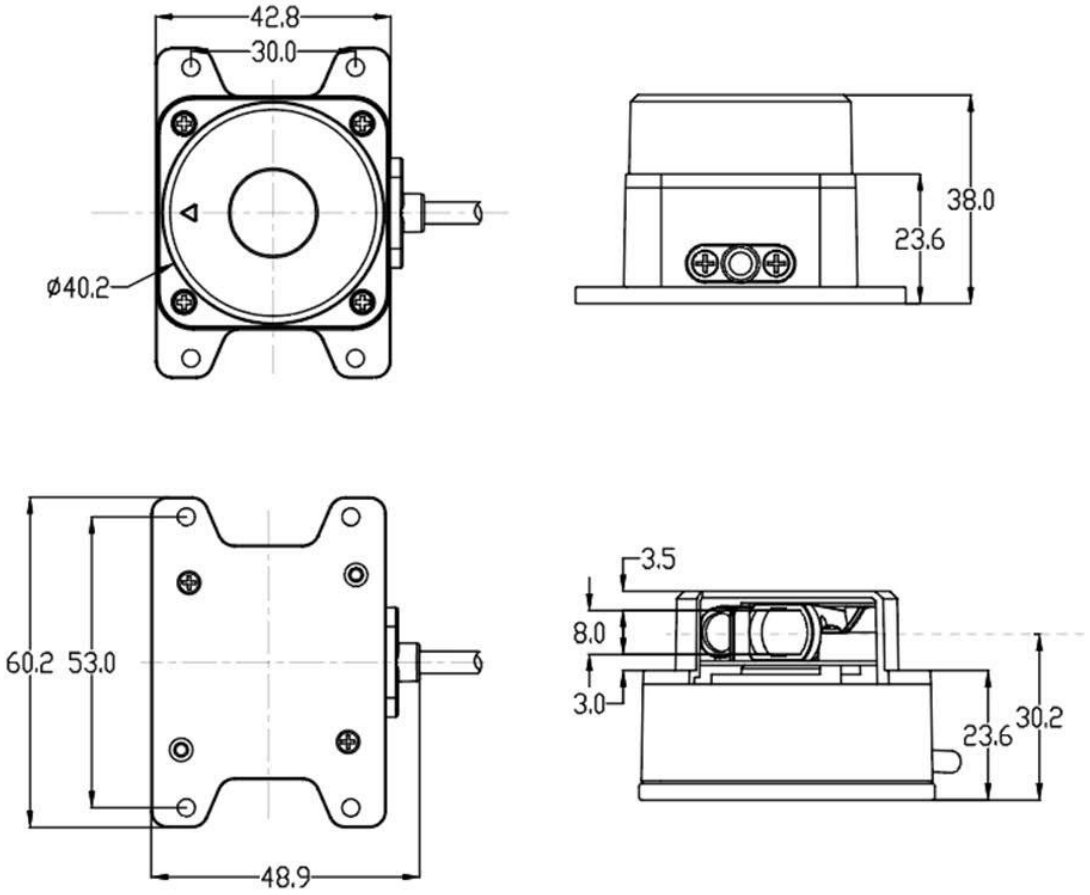


Fig. 4-1 Exterior and internal structure dimensions

4.2 Optical Windows

The obstruction of the optical window by the outer cover can affect the ranging performance and accuracy. Therefore, when designing The Paraekeet Mini LE reasonably arranged the laser emission and reception window. If there are special needs or transparent covers need to be used to protect this sensor, please refer to this document for information on the size of the optical ranging window and contact Lidar Engineering to understand the feasibility of the solution design.

As shown in Fig. 4-2, the vertical Angle of the laser emitted by each device will have a slight deviation. Taking the horizontal plane as a reference, the vertical Angle deviation is within 0~0.6°.

As shown in Fig.4-3, the center of the default device window coincides with the

optical axis of the device transmitting and receiving system. Assuming that the assembly Angle error is θ and the device pitch Angle is α, the window distance from the device is L. The window size formula is 2*(L*Tan(2θ+α)+4mm).

For example, the assembly Angle error is 1°, the device pitch Angle is 0.5°, and the window distance from the device is 200mm. According to the formula, the suggested window size is 2*(200*Tan(2.5°)+ 4)mm=25.5mm.

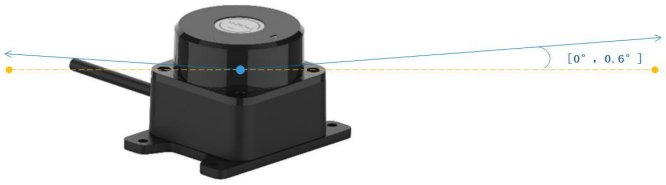


Fig. 4-2 Laser vertical Angle

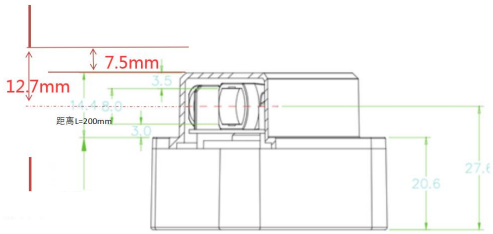


Fig. 4-3 Window Dimensions

4.3 Recommendations for Installation

In order to avoid any impact on the Lidar caused by the interference between Lidars, it is recommended to install the Lidars as follows:

As shown in Fig 4-4, when two or more Lidars are installed in the same height plane, it is recommended to tilt the Lidars down to avoid shooting.

As shown in Figure 4-5, 4-6, 4-7 and 4-8, when two or more Lidars are installed on different planes, it is recommended to adjust the Lidar optical Windows to different heights to avoid shooting.

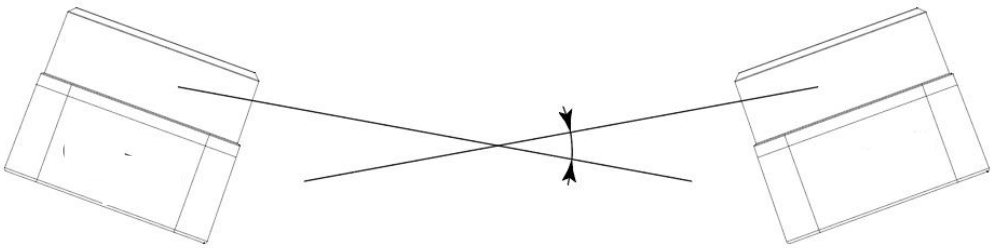


Fig 4-4 The Lidar is placed horizontally at the same height

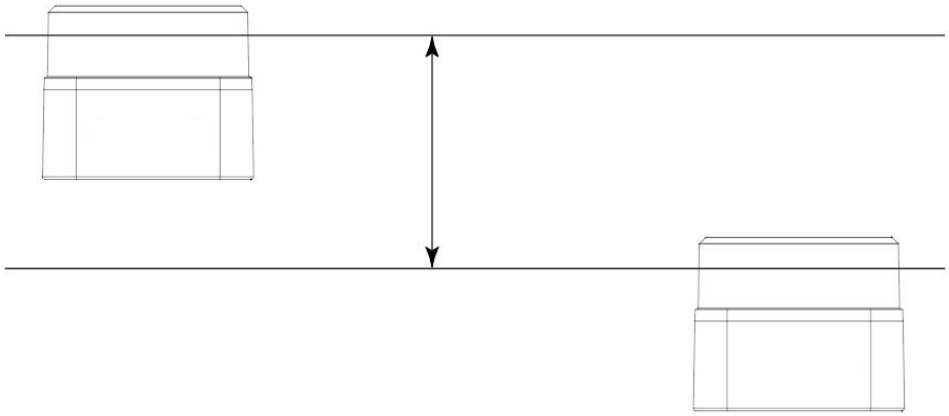


Fig 4-5 Formal installation of Lidar at different heights

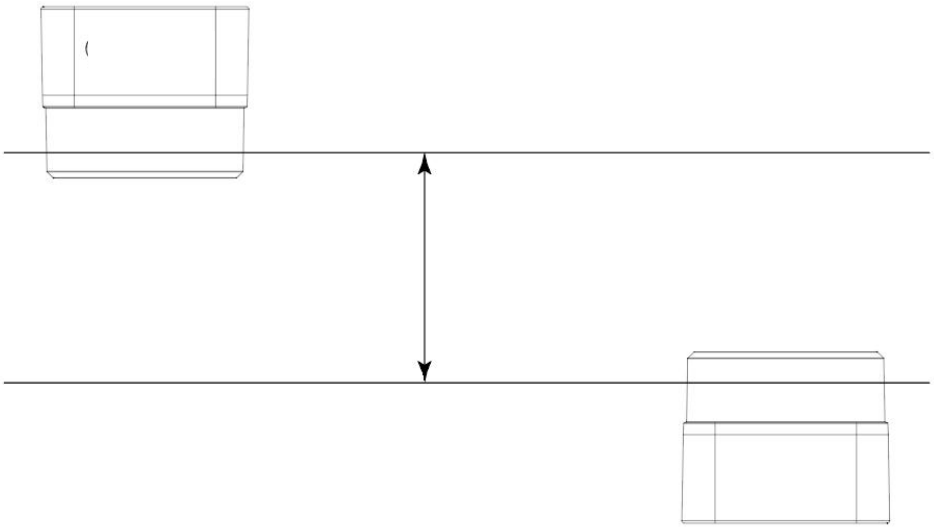


Fig 4-6 Lidar placed at different heights, one of which is inverted

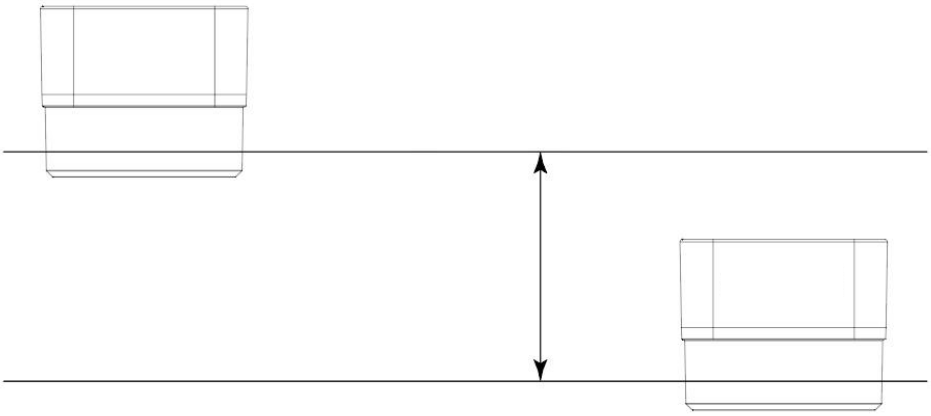


Fig 4-7 Reverse installation of Lidar at different heights

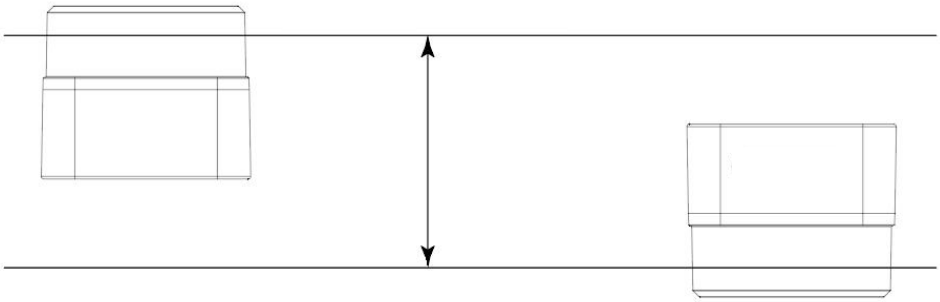


Fig 4-8 Lidar placed at different heights, one of which is inverted

Ⅴ. Parameter Performance

5.1 Device Physical Parameters

Model	Parakeet Mini
Laser wavelength	905nm±15nm
Ranging distance	0.1-20m@90% reflection
	0.1-7m@10% reflection
Laser divergence angle	<8.5 mrad
Laser horizontal parallelism	0-0.6°
Rotation direction	Anticlockwise
Scanning area	360°
Scanning Frequency	10Hz，15Hz
Angle resolution	0.2°， 0.3°
Speed measurement	18000 measured value/s
Ranging accuracy	±30mm（The ranging accuracy is ±30mm under the reflection condition of 10%~ 90% within 7m, and the reliability is 90%）
Range resolution	10mm
Light spot	14mm×92mm(10m)

Interface	“I/O”& “USB to RS232”
Power consumption	<2.5W
Power supply	10~26VDC
I/O	Input *4 , Ouput *4 ;(PNP or NPN)
Defense Zone	0.01~20m
Zone Group	16 (0~F)
Type of area per group	Observe / Alert / Alarm
Working temperature	-10°C ~50°C
Storage temperature	-20°C ~60°C
Light Interference Resistance	>80000LX
Size	60.2mm*42.8mm*38mm (Length * Width * Height）

5.2 Communication and Interface

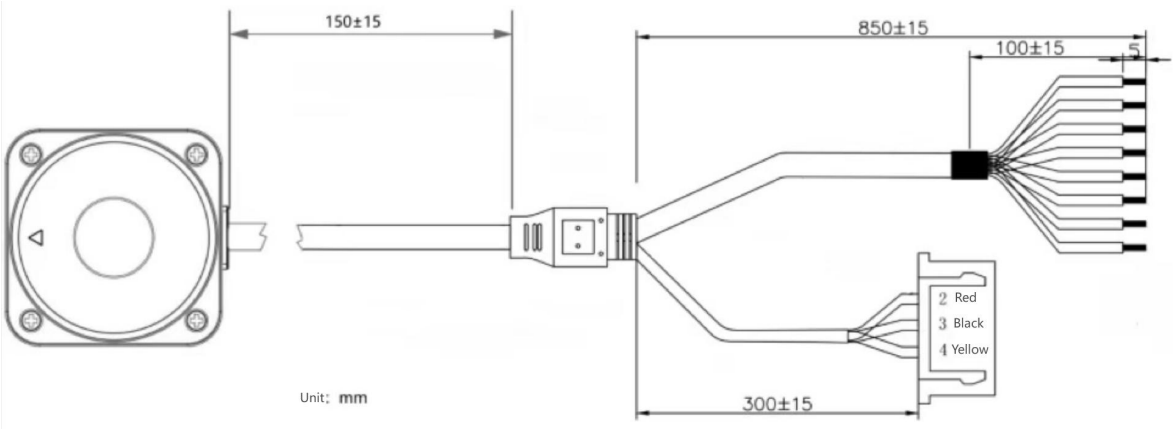


Fig 5-1 Interface Definition

The Parakeet Mini is powered by a 10V-26V power supply, providing power simultaneously to the ranging module and the motor control system. The signal VCC requires a separate input power supply. The output pin 01-04 has the same high level output voltage as the signal VCC voltage in PNP state.

Parakeet Mni PIN Definitions			
No.	Color	Definition	Remark
1	Black	GND	Ground
2	Red	VCC	10~26V DC
3	Yellow	IN1	The area selects the input bits 1
4	Orange	IN2	The area selects the input bits 2
5	Light Green	IN3	The area selects the input bits 3
6	Yellow and White	IN4	The area selects the input bits 4
7	Blue	OUT1	When they are connected to OUTPUT_COM-(NPN is normally on) When they are disconnected from OUTPUT_COM-（NPN is normally closed） When they are connected to OUTPUT_COM+（NPN is normally on） When they are disconnected from OUTPUT_COM+（ NPN is normally closed）
8	Purple	OUT2	
9	White	OUT3	
10	Red and White	OUT4	
11	Green	Signal VCC	10~26V DC
12	Brown and White	Switch quantity GND	Ground
13	Red	232-TX	Send Data
14	Black	232-RX	Receive Data
15	Yellow	232-GND	Ground
16	Pink	NC	Reserved

Serial communication parameters			
Item	Unit	Parameter value	Remark
	bps	230400/460800 /921600	Adjust according to output data requirements
Operating mode	-	8 - bit data bits, 1 - bit stop bit, no check bit.	
High Level Output Current	VOLT (V)	≥2.4V	
Low Level Output Current	VOLT (V)	≤0.4V	
High Level Input Current	VOLT (V)	≥2V	
Low Level Input Current	VOLT (V)	≤0.8V	

The Mini can be configured with a total of 16 area groups, marked as area groups 0, 1... F; Each region group contains three area types. The default area group of the Lidar is F, and the combination of lowering the input signals can be used to select the current working area group. The corresponding relationship between the input signal and the selection of the working area group is shown in the following table:

Input and Area groups selection				
Area group number	Input4	Input3	Input2	Input1
Area group 1 (0)	0	0	0	0
Area group 2 (1)	0	0	0	1
Area group 3 (2)	0	0	1	0
Area group 4 (3)	0	0	1	1
Area group 5 (4)	0	1	0	0
Area group 6 (5)	0	1	0	1
Area group 7 (6)	0	1	1	0
Area group 8 (7)	0	1	1	1
Area group 9 (8)	1	0	0	0
Area group 10 (9)	1	0	0	1
Area group 11 (A)	1	0	1	0
Area group 12 (B)	1	0	1	1
Area group 13 (C)	1	1	0	0
Area group 14 (D)	1	1	0	1
Area group 15 (E)	1	1	1	0
Area group 16 (F)	1	1	1	1

5.3 Coordinate system Definition

The center in front of the Parakeet Mini Lidar is defined as the x-axis of the coordinate system (i.e. the 0 angle position), and the origin of the coordinate system is the rotation center of the ranging unit. The rotation angle increases counterclockwise. As shown in the following Fig 5-2:

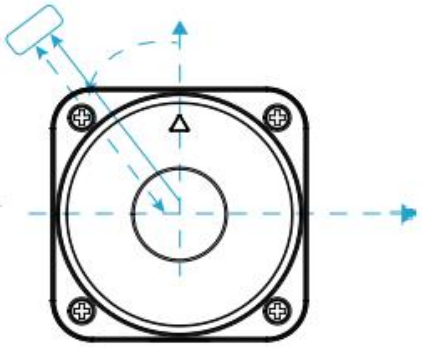


Fig 5-2 Schematic diagram of Lidar zero position and rotation direction

5.4 Test device

The Mini connects to the host through the USB-to-RS232 module, as shown in Figure 5-3.

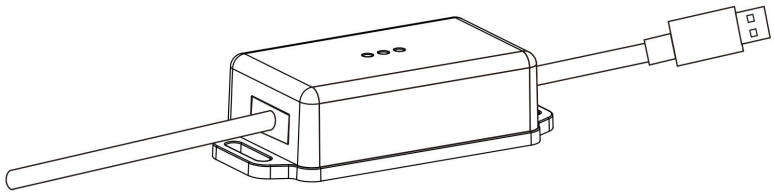


Fig. 5-3 USB-to-UART module

When connecting the lidar through the computer, first insert the USB-to-RS232 serial port module into the USB port of the computer. To ensure sufficient power supply, choose the USB3.0 port as far as possible. After the power is turned on, the blue indicator on the converter will be on, as shown in Figure 5-4. Then insert the UART cable into the Lidar data port. Wait 1 to 4 seconds until the green indicator of the converter is on, indicating that lidar data is output normally, as shown in Figure 5-5

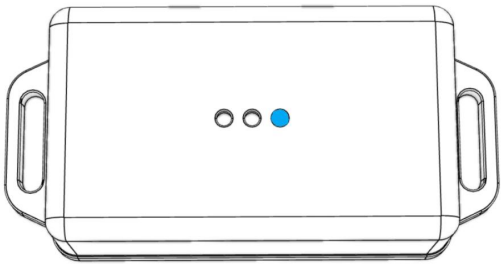


Fig5-4 Power status of the USB-to-RS232 module

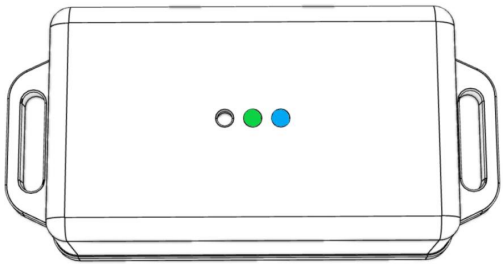
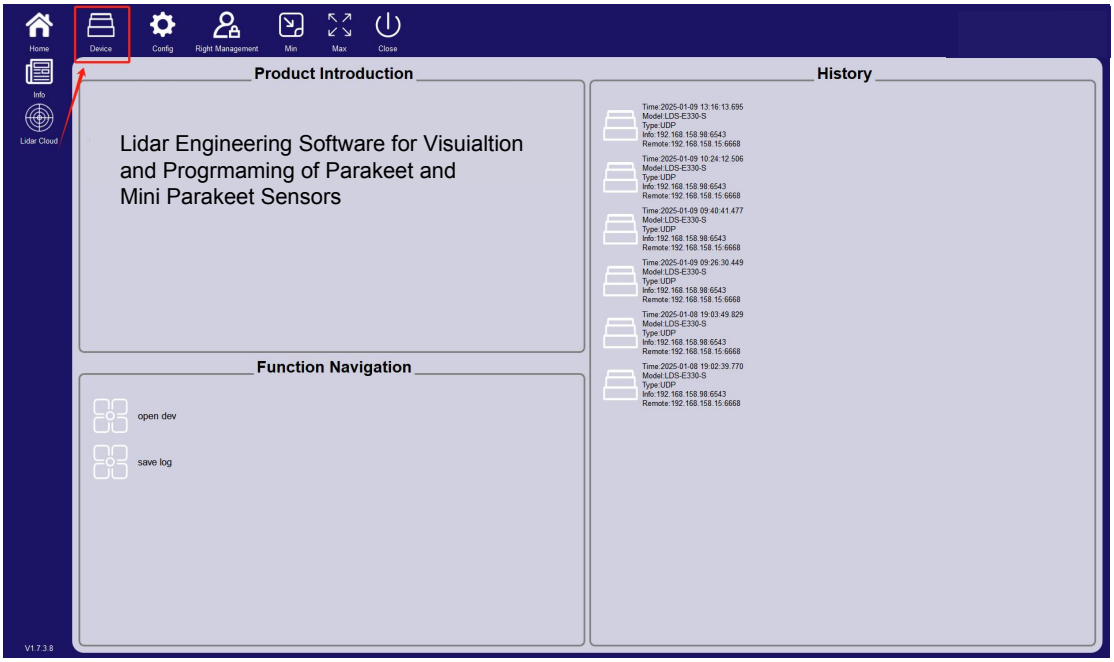


Fig. 5-5Working status of the USB-to-RS232 module

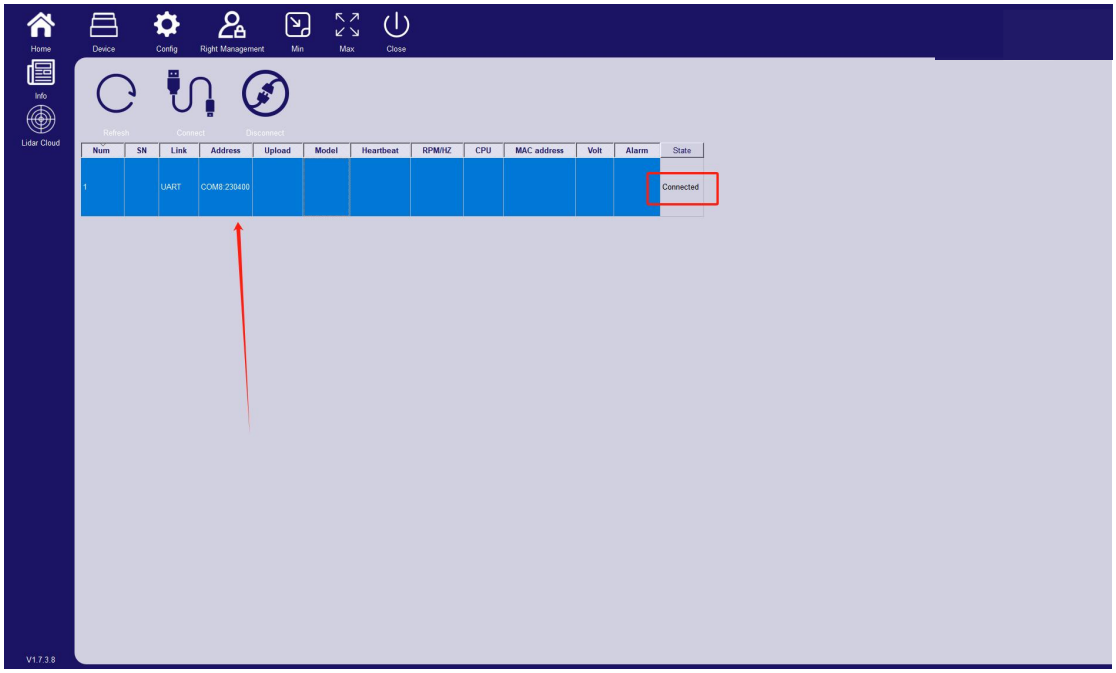
VI. Upper Computer Software Tutorial

Double-click the Lidar Engineering.exe installation package, install the host computer, and open LidarEng.exe host computer; Select 'Device'

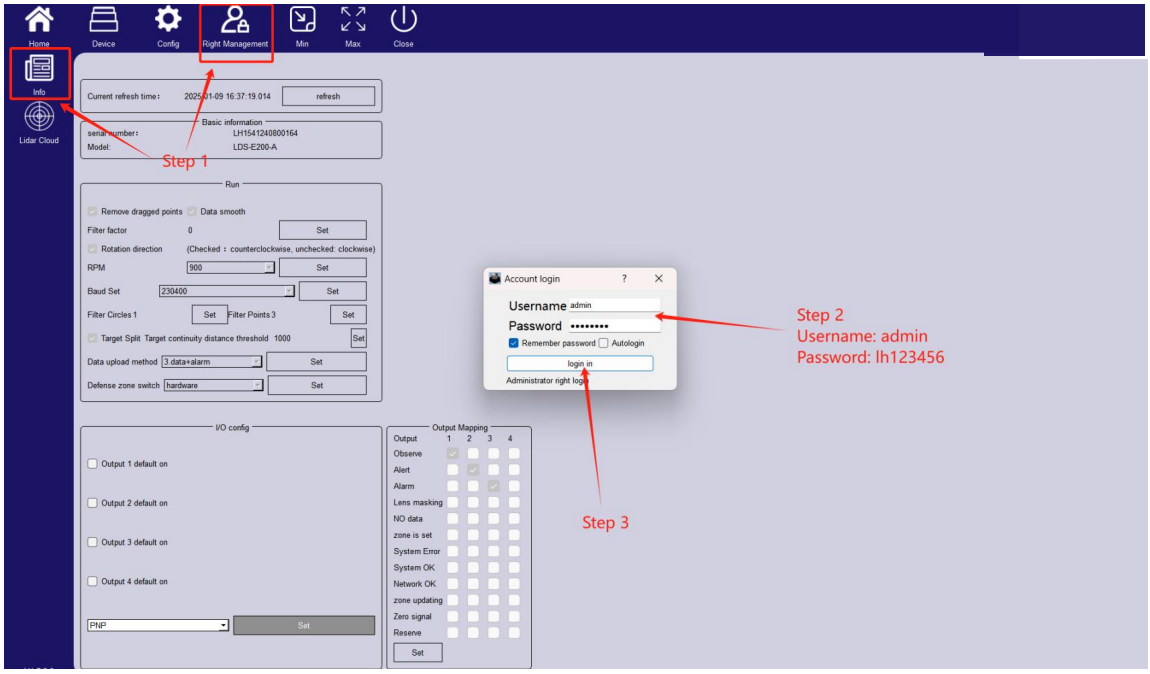


Lidar Eng View main page

Select the lidar to be connected and double click will shows “Connected”.



Click on "Info", and then click on "Right Management". Enter the content in Step 2 and select "Log in".After logging in, users can set some parameters. After setting, they can click on "Refresh" to confirm whether the Lidar has been set successfully. If the setting fails, the Lidar will return to the state before setting after refreshing.

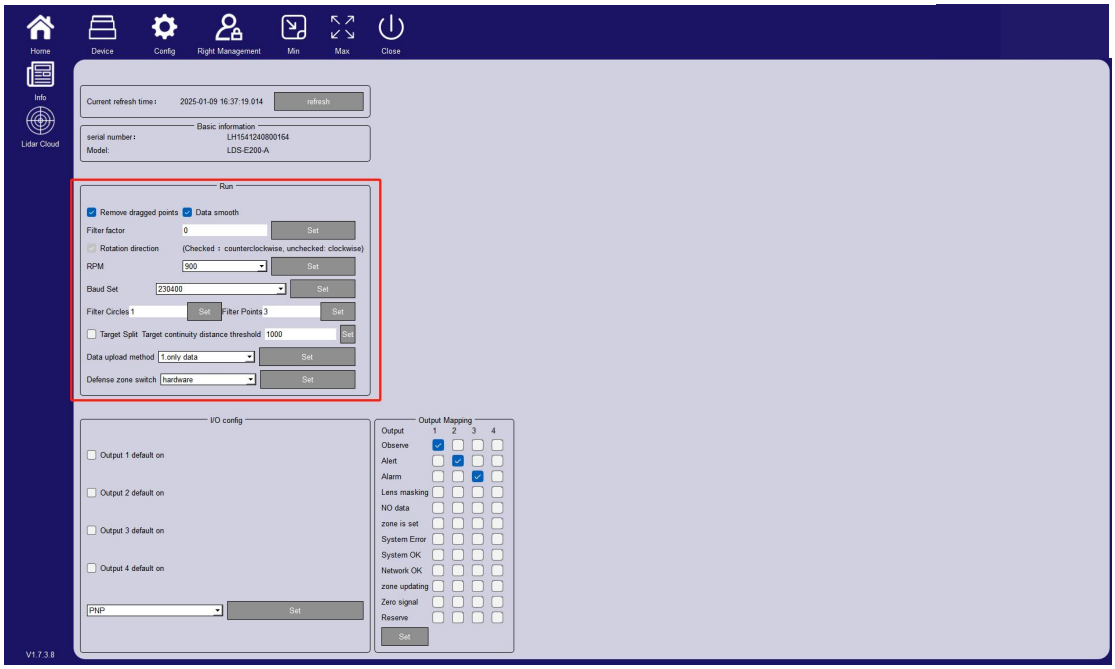


Settings for Run

① "Filter Points" is the judgment threshold for the number of points within the defense zone, which can be used to screen the size of the target. As shown in the figure, when the set value is 3, there must be at least 3 consecutive points within the defense zone before the program will determine that there is a target in the defense zone and trigger an alarm.

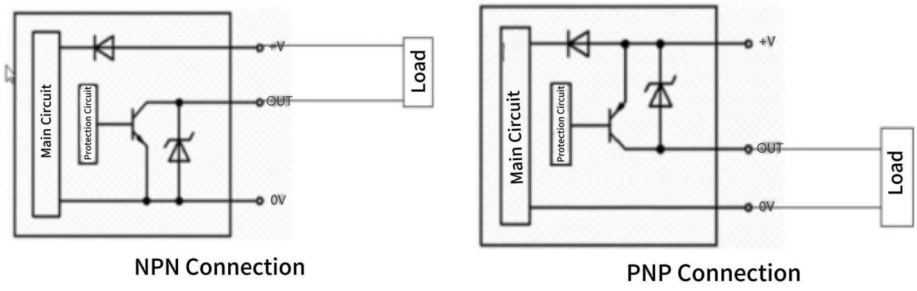
② "Filter Circles" is the judgment threshold for the number of scanning circles, which can be used to screen the duration of the target. As shown in the figure, when the set value is 1, the Lidar scanning needs to have no less than 3 consecutive points within the defense zone for 1 consecutive circle before the program will determine that there is a target in the defense zone and trigger an alarm. The settings of "Filter Points" and "Filter Points" can reduce the occurrence of false alarms.

③ "Target continuity distance threshold" is the limit distance threshold for points that can be judged as consecutive points (unit: mm). After checking the "Target Split" option, the default limit distance threshold is 200 mm.



Taking the PNP mode as an example, when Output 1 to Output 4 are not checked by default, it means that a high level will be output when there is an object in the defense zone, and a low level will be output when there is no object in the defense zone. When Output 1 to Output 4 are checked, it means that a low level will be output when there is an object in the defense zone, and a high level will be output when there is no object in the defense zone；

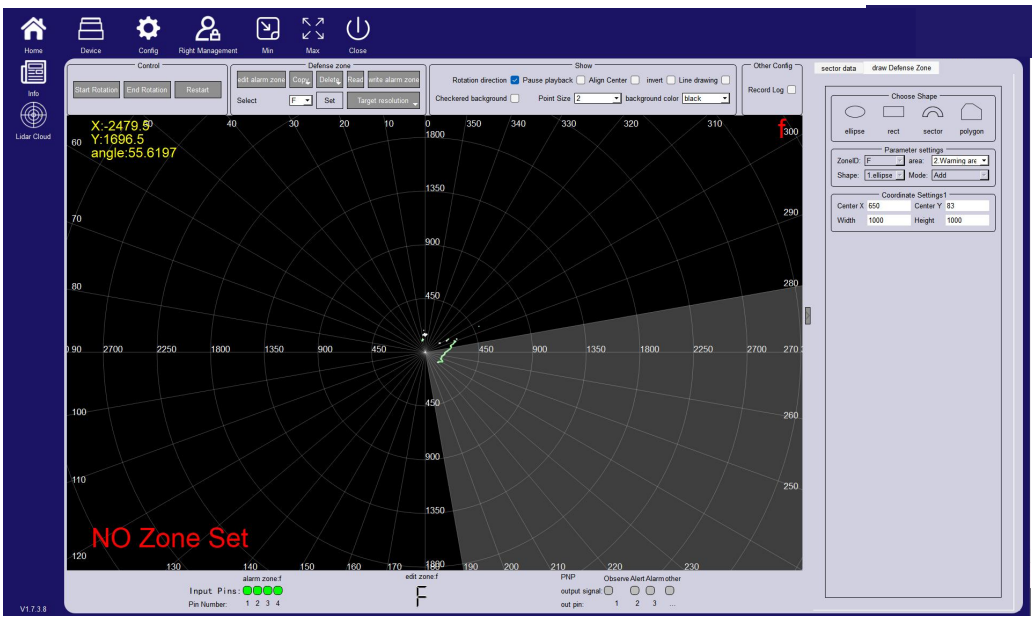
The Output type can be switched between NPN mode and PNP mode, which takes effect immediately after the mode is switched. Users can switch based on requirements.



The defense zone is divided into three areas, which are Observe area, Alert area and Alarm area, and there is no priority level between the three defense zones

IN1--IN4 indicates the enable switch numbered 1-4. The enable switch selects the corresponding area group.

OUT1--OUT4 is the external load, the user can connect the indicator or buzzer, when there is an obstacle in the defense zone, it can realize the sound alarm and light alarm in the defense zone; You can configure the configuration based on actual requirements.



Lidar Engineering Lidar point cloud

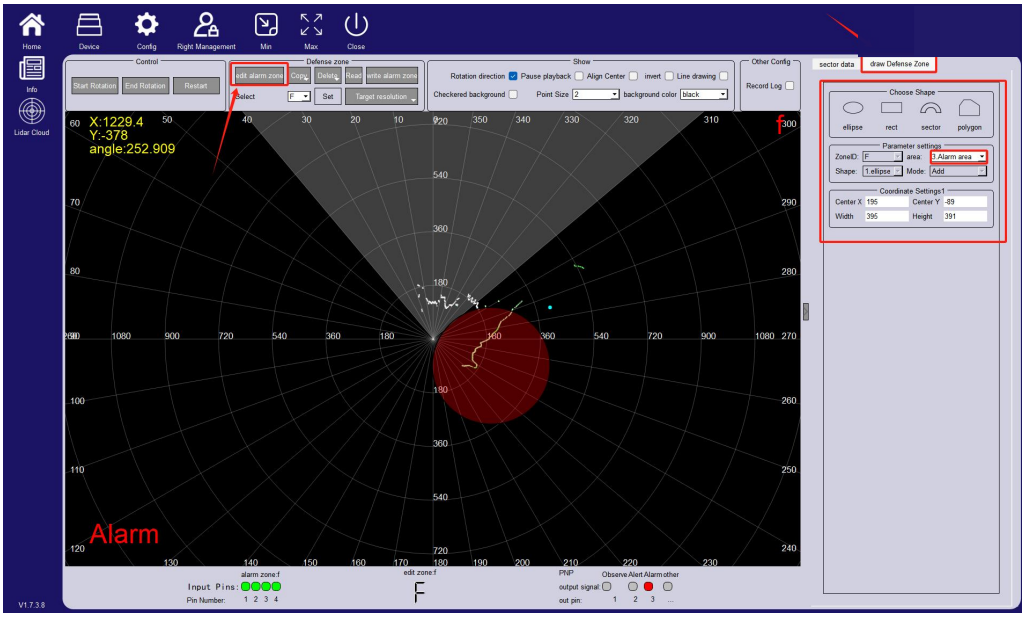
Click "LiDAR Cloud" to view Lidar point cloud interface;

The “Control” area can be controlled by buttons to Start Rotation, End Rotation and Restart the Lidar ;

The “Defense zone” can Edit the alarm zone(Lidar defense zone), Copy the defense zone, Delete the defense zone, Read the defense zone, Write the defense zone , and display the current area group.

The “Show” area can control the display mode, background and size of the point cloud and so on.

The “sector data” can output the data of each packet point, including the Degree, Distance and Energy Value;



Click “Edit Alarm Zone/Draw Defense Zone” and the window for drawing the Defense Zone will be displayed on the right side.

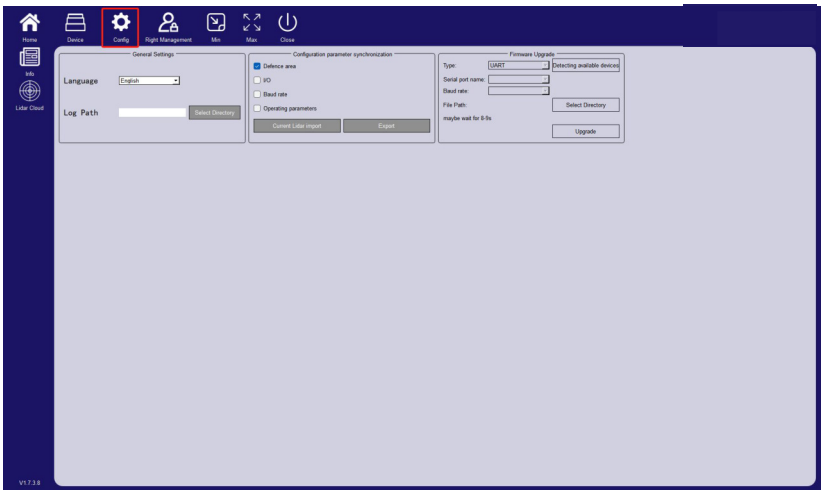
The “draw Defense Zone” allows you to select the shape of the defense zone that needs to be drawn, such as ellipse, rect, or sector. If you need to draw a defense zone with an unconventional shape, you can choose polygon. Use the left mouse button to draw the desired shape on the point cloud interface. After completion, click the right mouse button to form a complete polygonal figure;

In the “Parameter settings”, you can make a selection for the area: the areas include the observation area, the warning area, and the alarm area, and the corresponding colors of the defense zone areas are blue, yellow, and red respectively.

The size and position of the figure can be adjusted by modifying the parameter values in the coordinate settings, or directly adjusted by stretching and moving with the mouse;

When the defense zone is drawn incorrectly or there are redundant defense zone areas, you can select the defense zone area figure with the mouse, click the right mouse button, and choose "Delete" to remove the redundant defense zone areas;

Select the defense zone area with the mouse and click the right button to select the “filter” function. Filter is to eliminate some unnecessary parts on the basis of the original defense zone diagram. The drawing method of the filtered area is the same as that of polygon drawing;

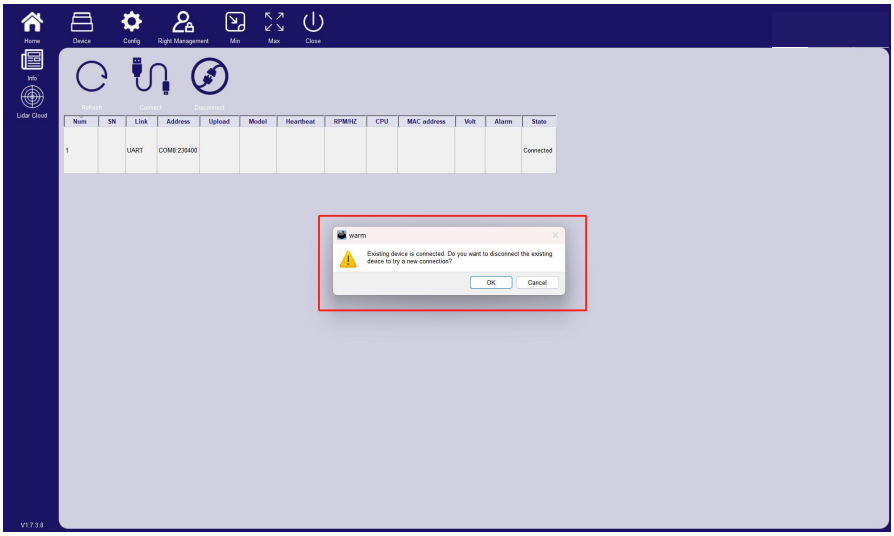


Users can switch languages and choose whether to save data in the "Config" interface.

In the “configuration parameter synchronization”, it supports exporting and saving the current Lidar parameters and defense zone information. When other Lidars need the same defense zone configuration, you can directly import the parameter package.

The “Firmware Upgrade” function needs to be carried out when the Lidar is not connected to the host computer software. After the Lidar is connected the serial port, directly click on "Detecting available devices", and the corresponding serial port name and baud rate of the Lidar can be detected. Just select the correct upgrade file path and click on the "Upgrade" button to start the upgrade. Generally, the upgrade process takes about 5 to 10 seconds. After the upgrade is completed, a pop-up window will prompt "Firmware Upgrade Successful".

If you want to reconnect to other Lidars, just double-click the Lidar you want to connect to in the "Devices" interface.



VII. Development Tools and Supports

To facilitate users to quickly use the Parakeet Mini model laser Lidar for product development, LE provides the following development tools: SDK, ROS, ROS2

Please contact info@lidarengineering.com or visit the website for links to appropriate downloads