N301-P

User Manual

V5.0.2 2022.11

LeiShen Intelligent System Co., LTD **http://www.lslidar.com/**

Safety Instruction

Before using the product, please read and follow the instructions of this manual carefully, and refer to relevant national and international safety regulations.

ΔAttention

Please do not disassemble or modify the Lidar privately. If you need special instructions, please consult our technical support staff.

ΔLaser Safety Level

The laser safety of this product meets the following standards:

- IEC 60825-1:2014
- 21 CFR 1040.10 and 1040.11 standards, except for the deviations (IEC 60825-1, third edition) stated in the Laser Notice No. 56 issued on May 8, 2019. Please do not look directly at the transmitting laser through magnifying devices (such as microscope, head-mounted magnifying glass, or other forms of magnifying glasses).

Eye Safety

The product design complies with Class 1 human eye safety standards. However, to maximize self-protection, please avoid looking directly at running products.

ΔSafety Warning

In any case, if the product is suspected to have malfunctioned or been damaged, please stop using it immediately to avoid injury or further product damage.

Housing

The product contains high-speed rotating parts, please do not operate unless the housing is fastened. Do not use a product with damaged housing in case of irreparable losses. To avoid product performance degradation, please do not touch the photomask with your hands.

Operation

This product is composed of metal and plastic, which contains precise circuit electronic components and optical devices. Improper operations such as high temperature, drop, puncture or squeeze may cause irreversible damage to the product.

Power Supply

Please use the connecting cable and matching connectors provided with the lidar to supply power. Using cables or adapters that are damaged or do not meet

the power supply requirements, or supply power in a humid environment may cause abnormal operation, fire, personal injury, product damage, or other property loss.

Light Interference

Some precise optical equipment may be interfered with by the laser emitted by this product, please pay attention when using it.

Vibration

Please avoid product damage caused by strong vibration. If the product's mechanical shock and vibration performance parameters are needed, please contact us for technical support.

Radio Frequency Interference

The design, manufacture and test of this product comply with relevant regulations on radiofrequency energy radiation, but the radiation from this product may still cause other electronic equipment to malfunction.

Deflagration and Other Air Conditions

Do not use the product in any area with potentially explosive air, such as areas where the air contains high concentrations of flammable chemicals, vapours or particles (like fine grains, dust or metal powder). Do not expose the product to the environment of high-concentration industrial chemicals, including near evaporating liquefied gas (like helium), so as not to impair or damage the product function.

Maintenance

Please do not disassemble the Lidar without permission. Disassembly of the product may cause its waterproof performance to fail or personal injury.

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1 Product Profile

1.1 Overview

Based on TOF (time of flight), the N301-P series can two-dimensionally scan and detect the environment across 360°. The lidar series uses wireless power supply and wireless communication internally, and the pulse repetition frequency (PRF) is 20KHz. The lidar reaches a measurement accuracy of ±3 cm with a maximum range from 10m to 70m. With such high performance, the lidar mainly applies to scenarios that require precise location and obstacle avoidance, including indoor service robots, AGV, cleaning and sterilization robots, drones, and so on.

1.2 Mechanism

1.2.1 Time of Flight

Based on the TOF (time of flight) methodology, the N301-P series measures the distance between a target object and the sensor, by calculating the difference between the emission and return times of modulated laser. The laser emitter sends out the modulated pulse laser, and an internal timer starts timing(t1). The laser encounters the target object, part of the energy returns. When the lidar receives the return laser signal, the timer will stop timing(t2). The formula for distance between the lidar and the target object:

Distance = Speed of Light*(t2 – t1)/2

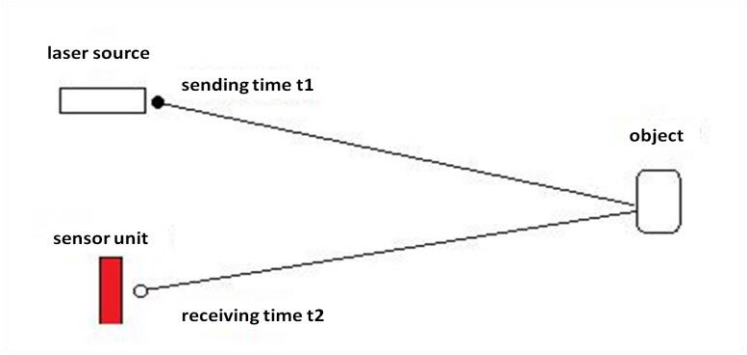


Figure 1-1 Mechanism of N301-P

1.2.2 Grid Map Presentation

You can get the 2D grid map information of the surrounds across 360° within

the detecting distance, based on the combination of the distance value calculated in real-time by the signal processing unit embedded in the N301-P series and the angle information output by the highly accurate self-adjusted angle measuring module.

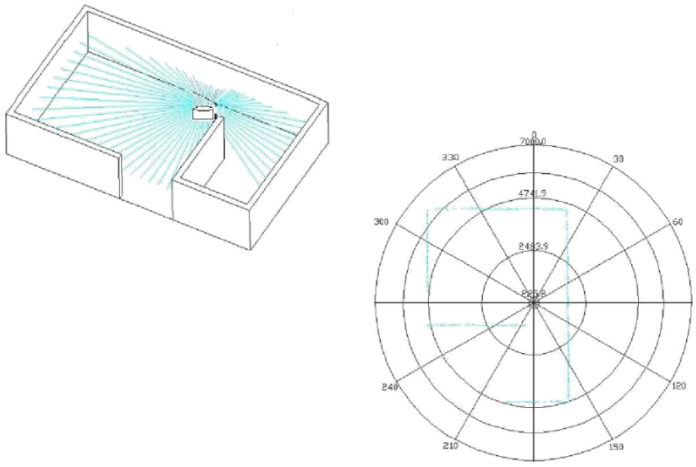


Figure 1-2 Demonstration of Ranging Function

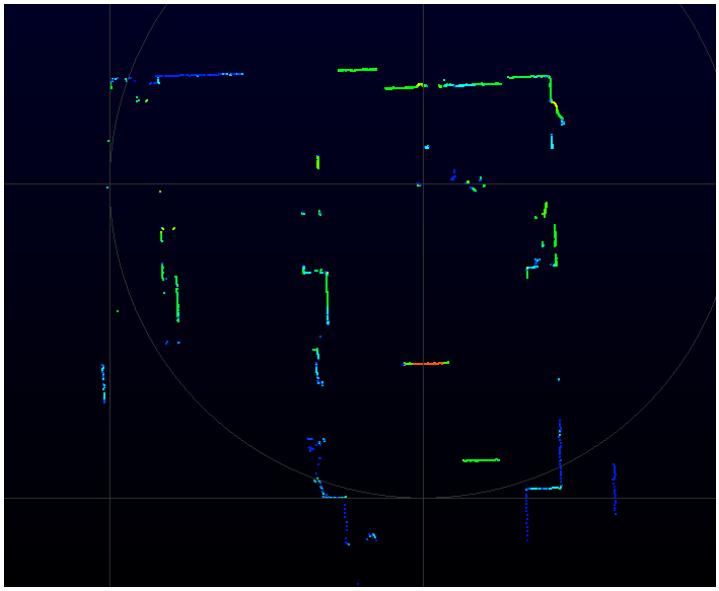


Figure 1-3 Example of N301-P Grid Map Image

*__Note:__ The figures only demonstrate the function of the distance measuring system. They are not proportional.

1.3 Specifications

Table 1-1 Specifications of 20K-PRF Models

Model	N301-P
scanning angle	360°
PRF	20KHz
Scanning Rate	20Hz/10Hz/5Hz

Angular Resolution	20Hz: 0.36°; 10Hz: 0.18°; 5Hz: 0.09°
Measurement Accuracy	±3cm
Output Data Resolution	Communication Protocol 1.6: 2mm; Communication Protocol 1.7: 4mm
Wavelength	905nm
Detection Range	10m/20m/30m/40m/50m/70m
Data Content	Azimuth, Distance
Power Supply	9~32VDC (Recommended: 12/24VDC)
Operating Temperature	-20℃ ~ 60℃
Noise	Starting-up: <60 dB, Operating:<50 dB
Motor	Brushless Motor
Communication Interface	Fast Ethernet
Dimensions	Φ80*79.1mm
Weight	About 406g

1.4 Connection

The lidars of the N301-P series mainly are composed of laser emitting and receiving modules, a signal processing module, a data/command transmission interface, power module, etc. All N301-P lidars are externally powered by a power supply of 9~32VDC (recommended: 12/24 VDC). You can use commands to configure the lidar in terms of output model, scan frequency, scanning frequency, angular resolution, and other parameters. Through the transmission interface, you can directly interface with control boards such as FPGA/DSP/ARM, so that commands and data can achieve fast and real-time interaction. After the system is properly powered up, you can get the scanning and ranging data of the lidar by calling the driver program of N301-P. Based on the speed stabilization function of the N301-P lidar system, you can set the scanning frequency by command, and the system automatically obtains the speed information in real-time. The internal speed stabilization system will adjust the torque according to the real-time speed, making the system work stably at the set scanning frequency, with strong adaptability to changes in external conditions such as temperature fluctuations, vibration, and altitude.

The mounting dimension and mechanical dimension are as follows:

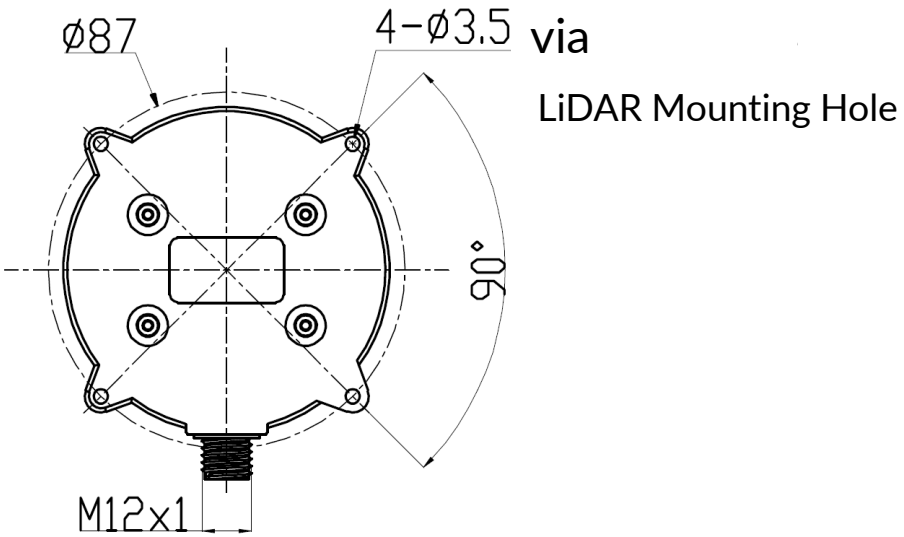


Figure 1-4 N301-P Mounting Dimension (unit: mm)

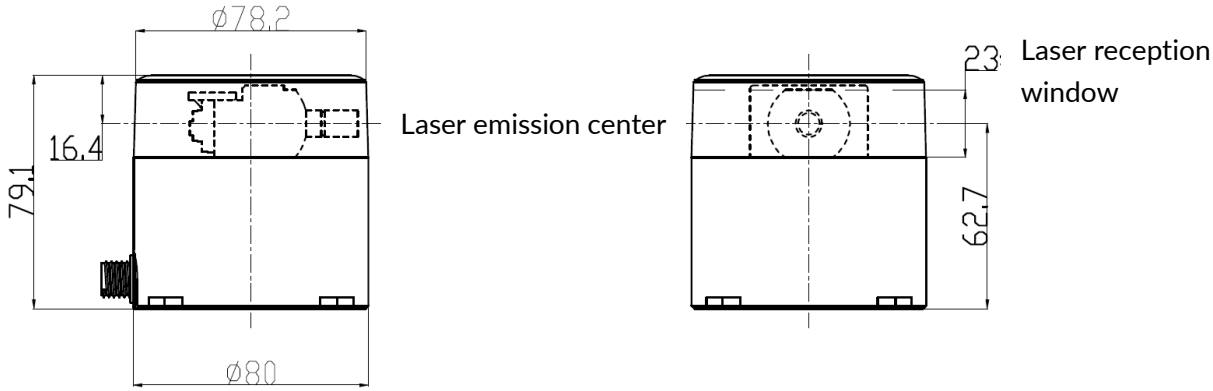


Figure 1-5 N301-P Mechnical Dimension (unit: mm)

1.5 Interface Definition

The side of N301-P lidar base has an 8-pin aviation plug. You can use an extension cable with a socket or an interface box to lead the function cable out.

1.5.1 LiDAR Base Connector

The external physical interface on the N301-P base is L102-M12-Z08A13, an 8-pin plug, to realize system power supply and data communication. The N301-P series supports GPS.

Looking at the lidar interface L102-M12-Z08A13 from the direction as shown by the below figure, you can see the connector.

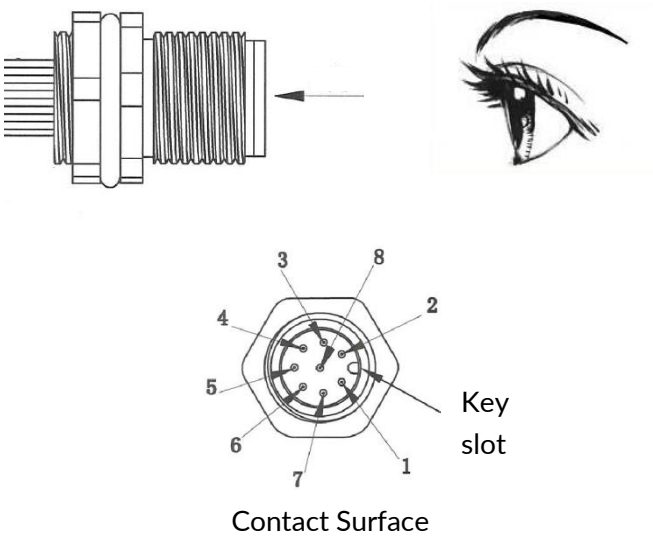


Figure 1-6 Lidar Base Connector

Table 1-2 Interface Definition

Pin	Definition	Level	Description
1	VIN	9~32V	Power+
2	TD_N	-1~1V	Ethernet Data Stream: LiDAR → External Device
3	TD_P	-1~1V	Ethernet Data Stream: LiDAR → External Device
4	RD_N	-1~1V	Ethernet Data Stream: External Device → LiDAR
5	RD_P	-1~1V	Ethernet Data Stream: External Device → LiDAR
6	GPS_PPS	3.3/5V	GPS PPS/External Sync PPS(TTL)
7	GPS_Rec	-13 ~ 13V	GPS (latitude/longitude, hour/minute/second) (RS232)
8	GND	0V	Power-

1.5.2 Extension Cable

You must be careful not to hot plug or unplug the connecting cable. Otherwise, it will cause irreversible damage. Before connecting, you should align the keys, then insert it, and rotate the coat for fixing to ensure that it cannot be loosened to ensure good contact. To separate it, you should reverse the operation which means first rotating the coat to be loose and then pulling it out. Please do not

be forceful to avoid the deformation of terminals or even short circuits. If the connector is damaged, please promptly contact technical support for a replacement.

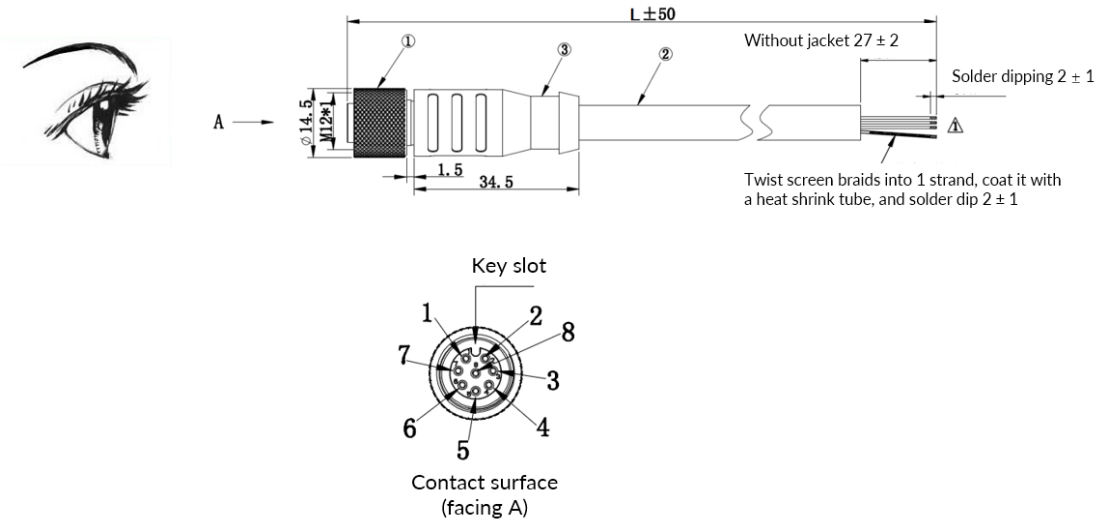


Figure 1-7 Extension Cable

Table 1-3 Extension Cable Pin Definition

S/N	Color and Specification	Definition	Description
1	Red (20AWG)	VCC	Power+
2	Light Blue (24AWG)	TD_N	Ethernet TX-
3	Blue (24AWG)	TD_P	Ethernet TX+
4	Light Orange (24AWG)	RD_N	Ethernet RX-
5	Orange (24AWG)	RD_P	Ethernet RX+
6	Yellow (20AWG)	GPS_PPS	GPS PPS/External Sync PPS
7	White (20AWG)	GPS_Rec	GPS (latitude/longitude, hour/minute/second) (RS232)
8	Black (20AWG)	GND	Power-

1.5.3 Interface Box

An interface box is sent to you with the Lidar to facilitate the testing and connection. Please note that the interface box is not a necessary accessory for Lidar operation. The interface box includes a 5.5*2.1mm DC socket, an indicator light, an RJ45 network connector, and a 6-pin GPS port.

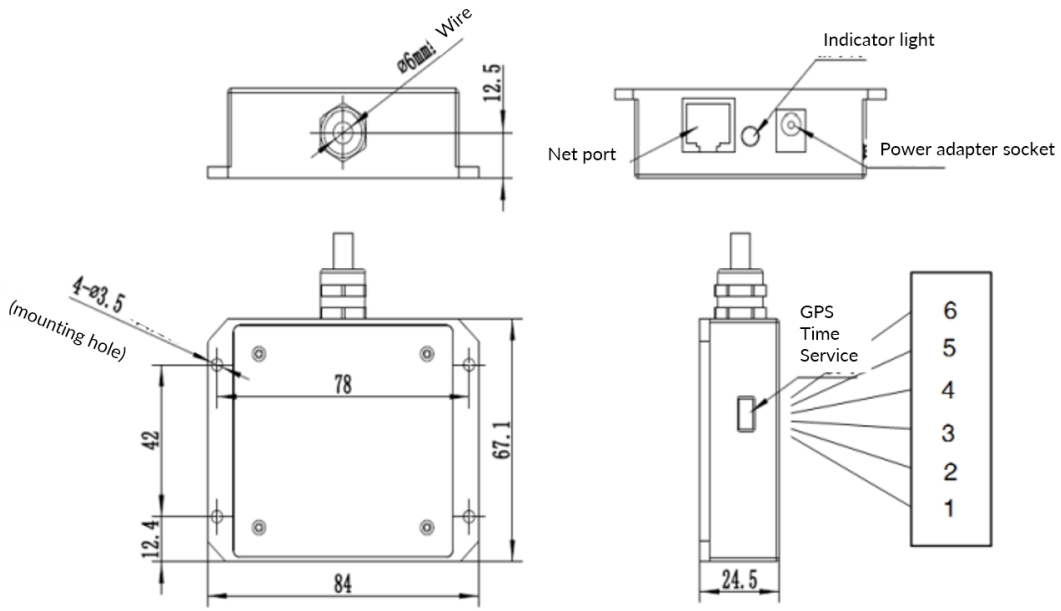


Figure 1-8 Interface Box

The GPS port of the interface box is the SM06B-SRSS-TB presented by JST, and the recommended plug interface for the external GPS module is SHR-06V-S-B presented by JST.

Table 1-4 Interface Box GPS Port Definition

S/N	Definition	I/O	Description
1	PPS Sync Signal	I	TTL level range from 3.3V to 12V; its cycle is 1 second, and the recommended pulse width is more than 5 ms
2	GPS Power Supply 5V	O	No hot plug or unplug
3	GPS_GND	O	Good contact
4	GPS (latitude/longitude, hour/minute/second)	I	RS232 level, baud rate 9600 bps
5	GPS_GND	O	Good contact
6	NC	-	-

1.5.4 Interface Box Connection

Note: Make sure the lidar is powered down when plugging or unplugging the GPS module from the GPS port of the interface box, or when connecting or disconnecting the signal from the GPS pin of the cable. If it is necessary to plug or unplug the interface box in the power-on state, please first release static electricity and avoid direct hand contact with the GPS interface or pins.

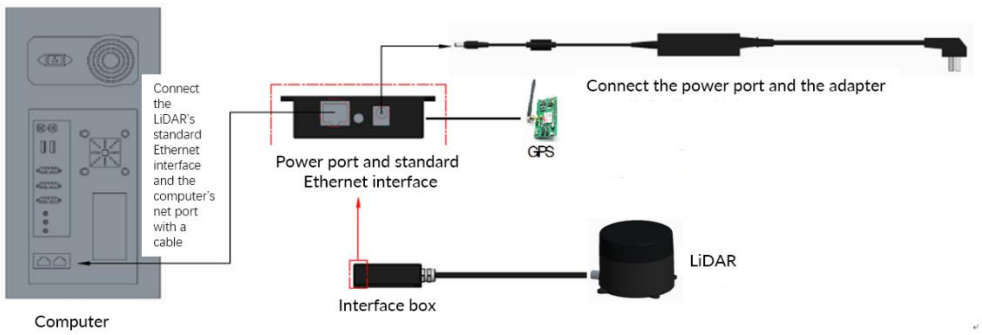


Figure 1-9 Interface Box Connection

2 Electrical Parameters

The N301-P series communicate with Fast Ethernet. An N301-P lidar is made of a high frequency ranging core, a wireless transmission system, and a rotating subsystem. The rotating subsystem is driven by a brushless DC motor spinning inside the system. The signal cable of N301-P can be connected to FPGA/DSP/ARM/SCM via Ethernet. You connect an external system and the lidar and follow the communication protocol of the lidar system to obtain the scanned point cloud data, device information and status, and set the working mode in real-time. The lidar does not have a power switch. Therefore, once powered on, the lidar will start and transmit data according to the factory default parameters.

Table 2-1 Electrical Parameters

Item	Min.	Recommended	Max.	Note
Power Supply Voltage	9V	12V/24V	32V	The power supply not in the range may lead to inaccurate ranging or irreversible damage. The output of external power supply should be at least 10W. You should not use power supplies below 9V or above 32V in a long term.
Voltage Ripple	-	-	80mV	Too much ripple can cause irreversible damage to the hardware. Therefore, the smaller the ripple, the better.
Operating Current	-	320mA/12V	400mA/12V	
GPS PPS	3V	-	13V	Its cycle is 1 second, and the recommended pulse width is more than 5 ms
GPS REC	-13V	-	13V	RS232 level, baud rate 9600 bps

Note: If due to unavoidable factors, the cable needs to supply power over a long distance, you should consider the undervoltage situation resulting from the line loss caused by the cable. To solve the problem, it is required to raise the voltage at the supply end to meet the supply voltage demand. For a 5m cable, the power supply voltage should be more than 19V. If the cable is longer than 10m, the voltage should be 24V.

For many situations where the lidar is powered by a battery, although the lidar adopts certain anti-surge measures inside, the solutions should be different from case to case. In some harsh situations, you should take some external anti-surge measures. Or you can use the interface box presented by LSLiDAR, which has been improved inside in terms of the problem.

3 Communication Protocol

When the N301-P is working, each set of data is output through the communication interface. The output data has uniform message formats. If you need the detailed communication protocol, N301-P LiDAR Communication Protocol V1.6, or N301-P LiDAR Communication Protocol V1.7, please contact LSLiDAR support.

4 Optical Features

4.1 Laser

Dependent on a 905nm laser, N301-P emits high-frequency pulsed lasers through the optical assembly, receives the laser signal through the optical assembly, and completes the photoelectric conversion by the receiver board. The distance value calculation is completed by the master control chip and the laser optical parameters are as follows:

Table 4-1 Laser Optical Parameters

Item	Minimum	Recommended	Maximum	Note
Wavelength	895nm	905nm	915nm	-
Peak Power	-	25W	-	-
Average Power	-	0.8mW	-	-
FDA	Class I			IEC 60825-1:2014

4.2 Light Spot

The light spot of N301 lidar is a vertical oval. Its vertical divergence angle is 6.8mrad, and the horizontal divergence angle is 2.5mrad. The spot size at any distance can be calculated by multiplying the divergence angle by the distance.

For example, the calculation of a spot at 10m is as follows:

Vertical direction at 10m: $10*6.8*10^{-3}=0.068m$

Horizontal direction at 10m: $10*2.5*10^{-3}=0.025m$

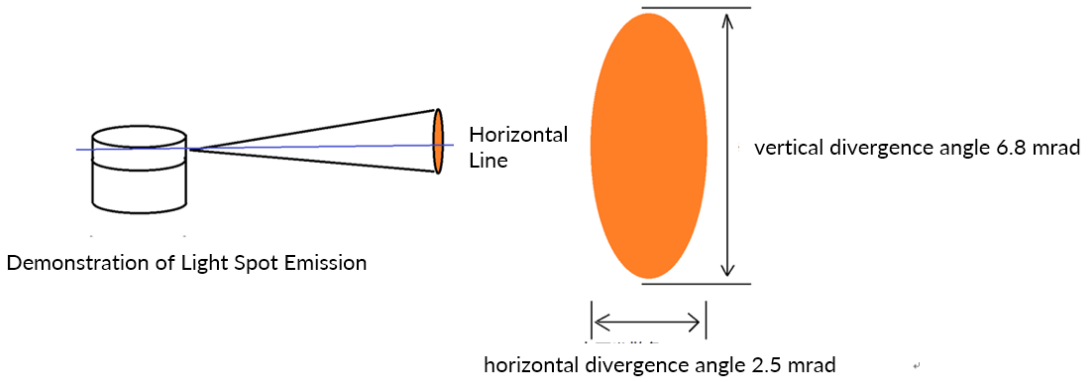


Figure 4-1 Light Spot Demonstration

4.3 Optical Structure

The N301-P series uses a telescopic optical structure with the receiver and transmitter placed horizontally side by side. When designing the lidar installation and robot system integration, it is necessary to focus on the internal optical structure of the LiDAR so that the effective detection angle of the LiDAR can be designed accurately. To facilitate your use, especially in terms of the calculation of geometric relationships, LSLiDAR defines a polar coordinate system with the center point of the lidar as the pole, clockwise as positive, and the opposite direction of the cable outlet as the zero-degree angle.

The internal optical structure (unit: mm) and the polar coordinates of the N301-P series as shown in the figure below (top view):

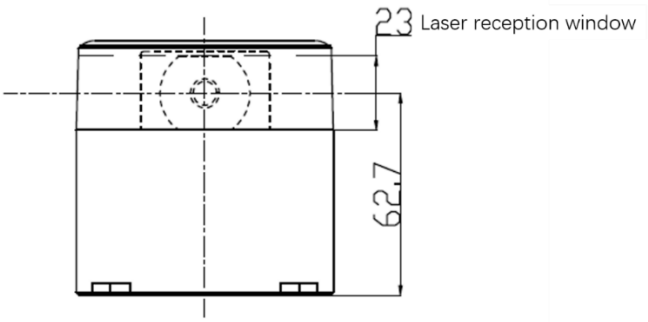


Figure 4-2 Internal Optical Structure

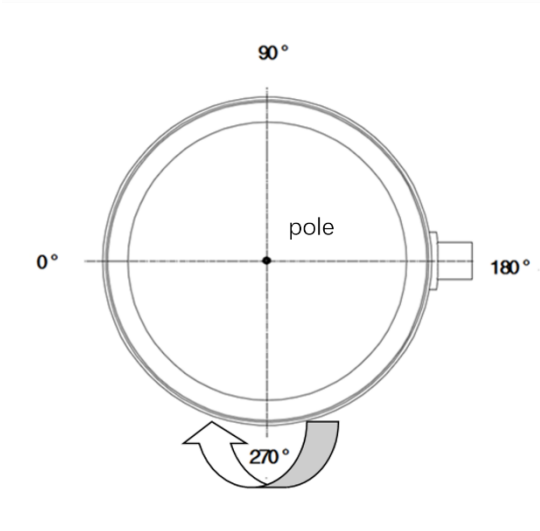


Figure 4-3 Lidar's Polar Coordinate

5 Development tool and supports

Made for the N301-P series, LSLiDAR provides you with the SDK capable of processing scan data in real-time and displaying it as an image. This SDK facilitates you to get familiar with the lidar and helps to shorten the project development cycle. At present, LSLiDAR only provides SDK for Linux, ROS, and Windows X86. We will release versions for Android, Mac OS, and other platforms later. Please follow the official website of LSLiDAR for the latest information.

5.1 Point Cloud Display Software on Windows

This section introduces the point cloud display and software usage of LSLiDAR N301-P LiDAR on Windows OS. The N301-P LiDAR point cloud display software is for N301-P LiDAR point cloud display, parameter configuration, simple radar testing, etc.

5.1.1 Software Interface Introduction

The software interface contains a menu area, a toolbar area, a 3D view area, a data table area, a company website link, etc.

Double-click the shortcut icon on the desktop:  the initial interface is shown below

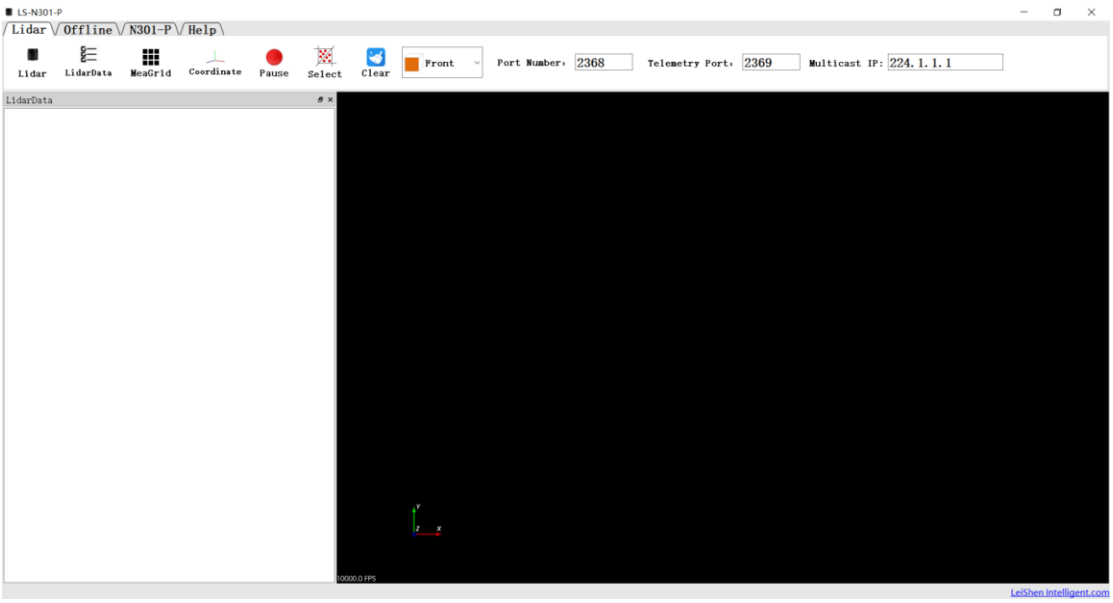
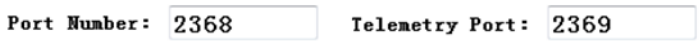


Figure 5-1 Software Interface

5.1.2 Software Operation

- Set the data packet port number (default: 2368), and the device (or telemetry in the picture below) packet port number (default: 2369)



- After connecting the lidar to the power and network cables, click the button  for real-time lidar data reception.
- The data table contains PointID, Points_m_XYZ, Azimuth, Distance, Intensity, Laser_id, and timestamp. PointID is the point number and Points_m_XYZ is the spatial x, y, and z coordinates. Azimuth indicates the azimuth angle, Distance indicates the distance between the lidar and the measured target, Intensity indicates the reflection intensity of the measured target, Laser_id indicates which laser channel, and timestamp indicates the time.

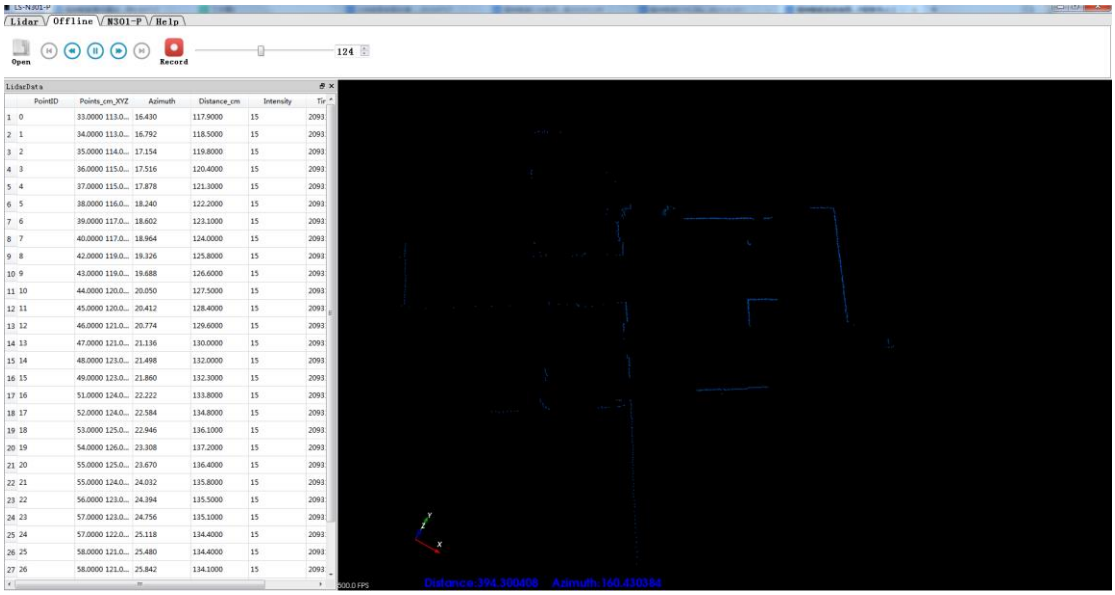


Figure 5-2 Software Operation Demonstration

5.1.3 Software Interface Introduction

■ Introduction to Point Cloud Display

A 50*50 grid with 25 circles. A unit in the gird is 2m*2m. The radius difference between every two adjacent circles is 2m, and the radius for the outermost circle is 50m. The grid and circles make it easy for you to view the location of the point cloud. The direction of the coordinate axes on the 3D display interface is the same as the direction of the X-Y axis on the frame of reference of the point cloud system.

The point cloud display interface supports the following actions:

- Scroll the mouse wheel to zoom in/out the display image; you can also hold the right mouse button and drag the image up/down to zoom in/out the display image.
- Hold the left mouse button and drag the display image to adjust the viewing angle.
- Hold the mouse wheel and drag the image to move the display image; you can also hold both the shift key on the keyboard and the left mouse button to move the display image.

Introduction to Menu Bar Buttons

LiDAR Menu

Table 5-1 Lidar Menu Button Description

Button	Description
	Click to start receiving and displaying data
	Show/hide the measurement grid
 Select	Mark the selected points in the point cloud image
 Pause	Pause the live point cloud image and data
 SelectRange	Select point clouds from different angles
	Clear screen
	Show/hide the coordinate
	Show/hide the data column on the left
	Three-view option: set the observation angle from top, front, and left. 

Offline Menu

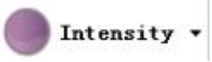
Table 5-2 Offline Menu Button Description

Button	Description
	Open offline data
	Start/Stop saving data, available only when the lidar receives data in real-time

	Skip to the beginning	
	When paused, view the previous frame; When playing, rewind (click multiple times to select 2x, 3x, 1/2x, 1/4x and 1x speed)	
	Click to start playing after the point cloud file is loaded; When playing, click to pause	
	When paused, view the next frame; When playing, fast forward (click multiple times to select 2x, 3x, 1/2x, 1/4x and 1x speed)	
	Skip to the end	
	Drag the progress bar or enter the frame number to skip to the specified position	

- **Parameter Menu (N301-P)**

Table 5-3 Parameter Menu Button Description

Button	Description	
	Open lidar parameter form	The upper part of the form shows the lidar configuration. The parameters include local IP, destination IP, subnet mask, gateway, data port, destination port, and motor speed setting (5Hz/10Hz/20Hz are available under the combobox), whether to obtain the local time, MAC address, and device packet sending interval. The lower part shows the real-time status information. According to the DIFOP status packet sent out regularly by the lidar, the current status information is displayed, including GPS position information, satellite time information, motor speed, current lidar IP, and the current Lidar port number.
	Save the data in .csv format	
	Set the display mode of the point cloud	Intensity, laser ID, azimuth angle, etc.

5.2 Notes

■ Notice about the Lidar setting and usage：

1) It is not possible to use the N301-P Windows client to receive data in two processes (open twice at the same time) on the same computer. The port

occupancy of the PC is generally exclusive, so after a process is bound to a specified port number, the other software using the same process or the same port number cannot work normally. When the N301-P Windows client detects that the port is occupied, it will prompt that the communication network port configuration has failed, and automatically close the software. You need to close the software process that occupied the port, and reopen the N301-P Windows client to use it normally.

2) At the same time, since Qt is adopted in the low-level software development, please create English paths when naming files and path folders.

3) Since the port number of the N301-P lidar can be modified through user configuration, the lidar sends data to the Windows client through the preset destination IP and port. When the local laptop or desktop computer and other devices are receiving data, their IP addresses should be the same as the destination IP, and the port bound to the Windows client needs to be the same as the destination port number, as shown in the figure below (these are the data packet parameters captured and analyzed by Wireshark software).

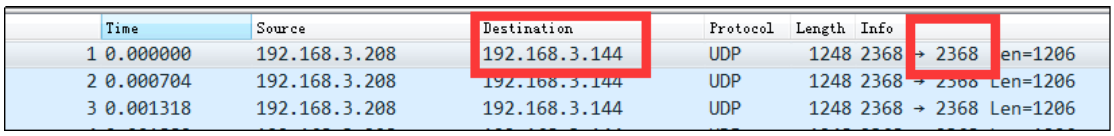


Figure 5-3 Data Packet Captured by Wireshark

The data in the red boxes indicate the destination IP and port number of the lidar.

The steps are as follows:

a) In the Control Panel > All Control Panel Items > Network Connections, click the “Ethernet” button.

b) Click “Properties” in the pop-up status box, and click “Internet Protocol Version 4 (TCP/IPv4)” in the pop-up properties box, as shown in the figure below.

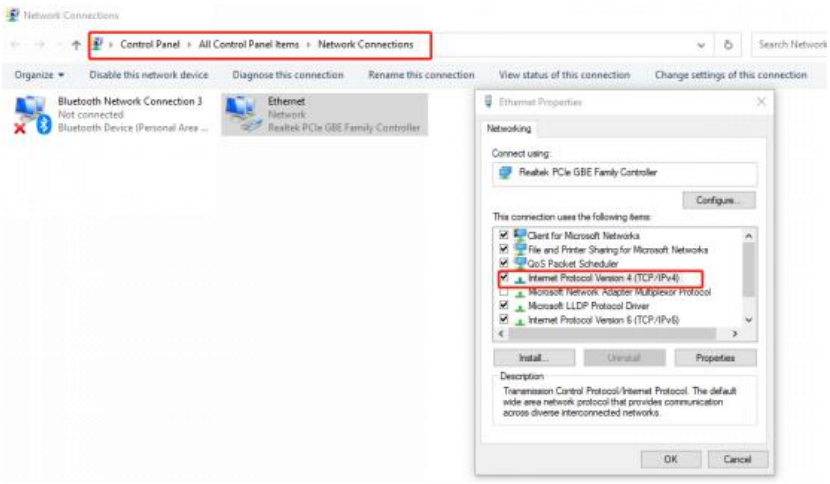


Figure 5-4 Network Connection

c) In the TCP/IPv4 property settings, set the IP address to the lidar's destination IP (The lidar's default factory IP and port are described in the lidar communication protocol), and the subnet mask is set to 255.255.255.0.

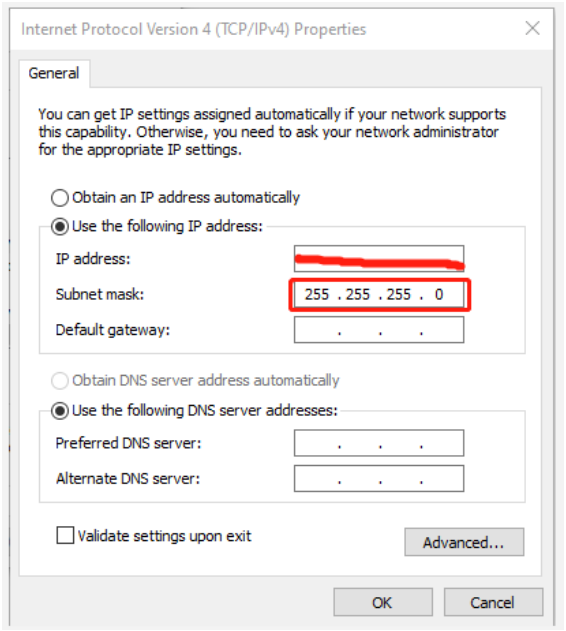


Figure 5-5 IP Address and Subnet Mask Setting

3) Since the Windows client needs to obtain a large number of data packets through the network in a short time, it may be considered a malicious program by the network firewall and be prohibited.

Therefore, there may be a situation in which the data packet has been sent to the computer and the Wireshark can capture the data, but the Windows client cannot display it. As shown by the figure below:

a) In Control Panel > System and Security > Windows Defender Firewall, click “Allow an app or feature through the Windows Defender Firewall.”

b) Browse to find the software installation path, select it and click OK.

c) Tick the part marked in the red box according to the nature of your network, and click OK to see the data.

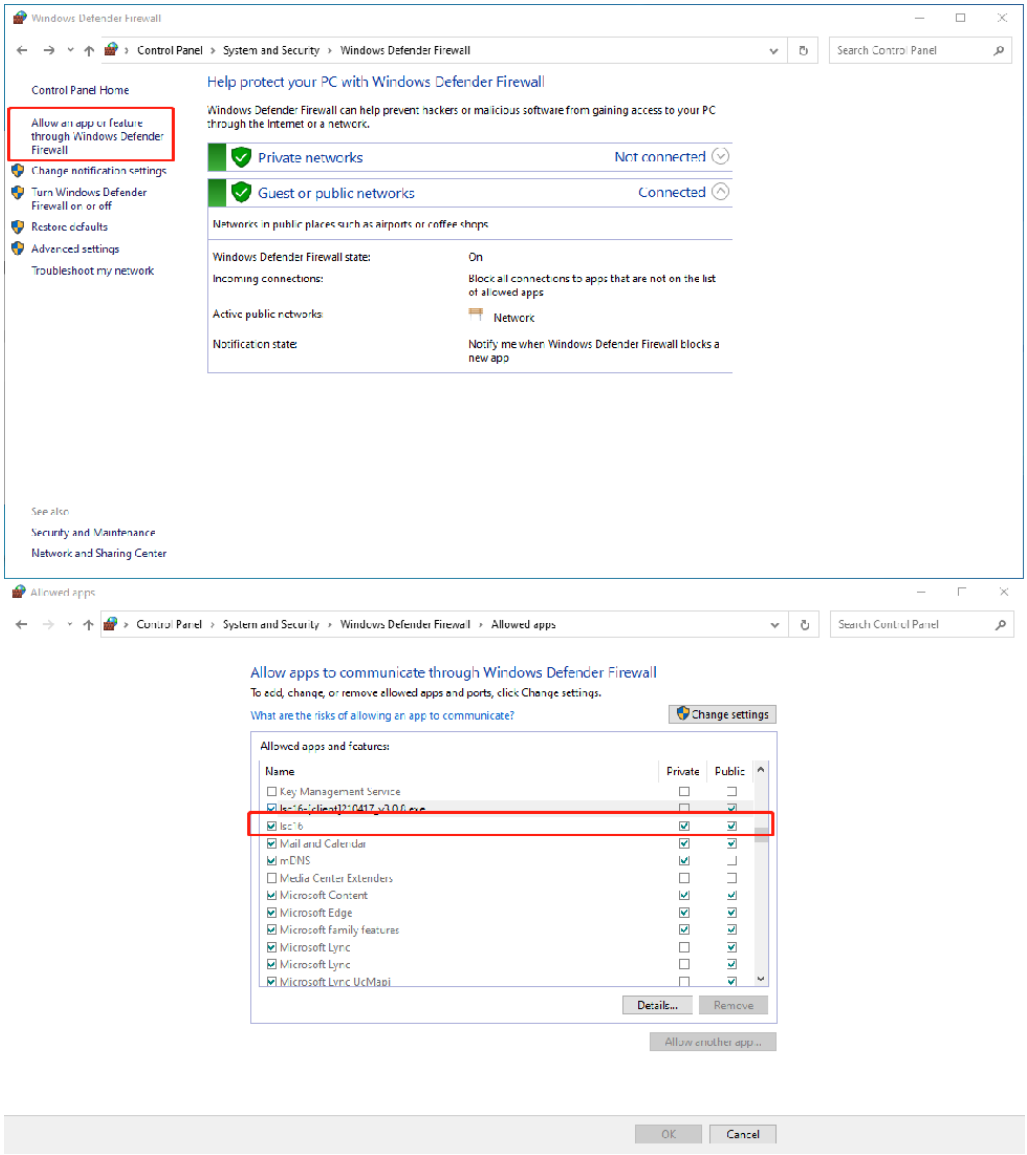


Figure 5-6 Windows Defender Firewall Setting

■ Notice about computer graphics settings

The information about dual graphics cards can be viewed in the computer configuration. In My Computer > Right Click > Properties > Device Manager, you can see the computer's display adapter information:

You need to manually set a high-performance discrete graphics card as the applicable graphics card of the software. The setting steps are as follows:

a) Take a laptop with Intel(R)HD Graphics 530 integrated graphics and NVIDIA GeForce GTX 960 discrete graphics as an example. Right-click on a blank space on the desktop to pop up a right-click menu and select “NVIDIA

Control Panel".

b) Select the "Manage 3D Settings" in the NVIDIA Control Panel interface.

c) Click the "Program Settings" button in the Manage 3D Settings interface.

d) Click the "Add" button on the Manage 3D Settings interface.

e) Click the "Browse" button in the pop-up interface.

f) Find the application file (.exe file) of the software according to its installation path in the pop-up browsing interface.

g) Click "OK" to automatically return to the NVIDIA control panel, select the high-performance NVIDIA processor in the combo box of the preferred graphics processor for this program in Option -2., and click "Apply" in the lower right corner. After the computer application is set, close the NVIDIA Control Panel to complete the setting.

6 ROS Driver Operation Under Linux OS

This section introduces the point cloud display and driver usage of LSLiDAR N301-P LiDAR on Linux. You can acquire the ROS driver from LSLiDAR technical support. The LSLiDAR N301-P ROS driver is applicable for N301-P point cloud display, parameter configuration, etc.

6.1 Hardware Connection and Test

1) Connect the lidar to the internet and power supply

2) Set the computer wired IP according to the destination IP of the lidar (you can use the ifconfig command to check whether the computer wired IP is set successfully. As shown in the figure, the destination IP is 192.168.1.125)

Figure 6-1 ifconfig Command Feedback

Note: The default destination IP of the lidar is 192.168.1.125, and the computer must be configured according to the actual Lidar destination IP. After setting the IP for the first time, please restart the lidar.

3) After the lidar is powered on and restarted, check the wired connection icon of the computer to see whether it is connected properly.

4) Open the terminal: ping the lidar IP, and test whether the hardware is connected normally. If the ping is successful, then the data is received, otherwise check the hardware connection.

5) Use “sudo tcpdump -n -i eth0” (here eth0 is the name of the wired network device, see the device name of ifconfig wired connection display for details) to view the data packets sent by the lidar (as shown in the figure, there are 1206-byte data packets sent by the Lidar to the destination, which means that the lidar data is sent normally).

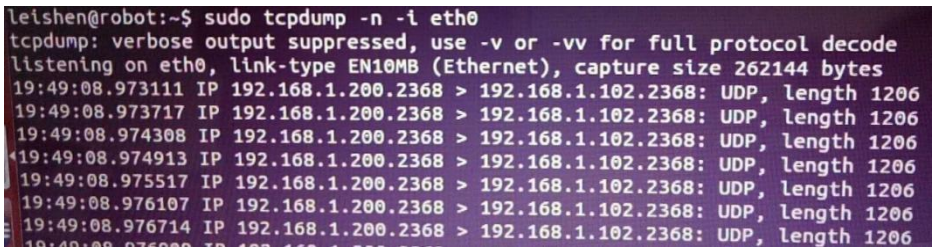


Figure 6-2 sudo tcpdump -n -i eth0 Command Feedback

6.2 Software Operation Example

a) Establish a workspace and build a compilation environment

mkdir -p ~/leishen_ws/src

Note: The workspace can be named arbitrarily. (The path of workspace shall be in English only.) For example, “leishen_ws” can be changed to any name.

b) Download the LiDAR ROS driver

The ROS driver can also be obtained directly from our website or customer service. Copy the obtained driver file to the newly created workspace “src”, and decompress it.

c) Compile and package

cd ~/leishen_ws

catkin_make

d) Run the program

source devel/setup.bash

roslaunch lslidar_n301_decoder lslidar_n301.launch

Figure 6-3 ROS Program Running

Note: If timeout appears, it means that the driver has no data reception. Please check whether the IPs and terminals of the hardware connection and the launch file are the same.

Open a new terminal and execute the command: rviz

e) Display the data detected by the LiDAR

In the “Displays Window” that pops up, modify the value of "Fixed Frame" to “laser_link”. Click the “Add” button at the same time, and click “LaserScan ” under “By topic” to add a single-beam point cloud node.

f) Set parameters

In /src/lslidar_n301/lslidar_n301_decoder/launch/lslidar_n301.launch file, you can set the IP port, the GPS switch and maximum and minimum distance values, etc.

7 LiDAR Care

7.1 Transportation

LSLiDAR has customized the package for the N301-P series to withstand a certain amount of vibration and impact. Special packages must be used for long-distance transportation to avoid irreversible damage during transportation.

7.2 Installation

Fix the lidar to the base using screws that meet the specifications, and pay attention to the base heat dissipation. Wear powder-free and clean gloves when installing, so as not to cause the optical window to be dirty, and not to cause mechanical damage to the optical window.

7.3 Cleaning

When using the lidar, if the optical window is polluted by fingerprints, mud, leaves, insect corpses, etc., it will affect the lidar ranging effect. Please follow the following steps for cleaning.

Tools: PVC gloves, dust-free cloth, anhydrous ethanol (99%)

Environment: ventilated and dry, away from fire sources

1) Wear the PVC gloves and secure the lidar base with your fingers; For a stain that is not stubborn, use a dust-free cloth to gently wipe it off or dry air to blow it off.

2) For a stubborn stain, fill the spray bottle with ethanol, spray evenly on the stain, wait for a while until the stain is dissolved, and then use a dust-free cloth dipped in ethanol to gently wipe the optical window. If the dust-free cloth is polluted, replace it immediately. After cleaning off the stain, use a new dust-free cloth to wipe off the remaining liquid.

Revision History

Rev.	Release Date	Revised Content	Issued/Revised By
V5.0.0	2022-04-06	Initial version	LS1453
V5.0.1	2022-05-31	Specifications, lidar base connector, electrical parameters, light spot calculation formula modified; 1.2.3 reflector positioning deleted	LS1286
V5.0.2	2022-11-17	Specifications, 0° position modified	LS1286

Make Safer Driving, Smarter Machine, and Better Life!

Headquarters

LeiShen Intelligent System Co., Ltd.

Floor 4-5, Yunhua Times Building,

Shajing Street, Bao'an District

Shenzhen City, Guangdong Province

China

TEL: +86-0755-23242821

Factory

Building R, Dongbao Industrial Zone

Shasi Community, Shajing Street, Bao'an District

Shenzhen City, Guangdong Province

China

TEL: +86-0755-27190511

French Office

60 Rue Saint Antoine

75004 Paris,

France

TEL: 0033-(0)749044832

Eric Chen

Sales Email: sales@lslidar.com

After-Sales Mailbox: support@lslidar.com

Company Website: www.lslidar.com

*This product information is subject to change without notice.