欧镭激光

Sensing Reality!

2D 270°

LiDAR Sensors
LR-1BS2 Series
User Manual

Please read this user manual for best product performance before using the product.
Be sure to keep this manual properly for future reference.

OMEN-1BS2-202012

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1. About this document

This document summarizes supplementary information on mounting and electrical installation as well as measured value output format of the LR-1BS2. It is aimed at sufficiently qualified personnel for the purposes of installation, commissioning and further data processing. Notes on commissioning, configuration and maintenance can be found in the LR-1BS2 operating instructions

2. Safety information

- Read the notes on mounting and electrical installation before carrying out these tasks.;
- Read additionally the LR-1BS2 operating instructions to familiarize yourself with the device and its functions;
- The LR-1BS2 complies with laser class 1.
- Only use the device in permissible ambient conditions (e.g. temperature, ground potential). Any applicable legal regulations or regulations of other authorities will have to be observed during operation.
- Opening the screws of the LiDAR housing will invalidate any warranty claims against OLEI.
- Repairs may only be performed on the LiDAR by trained and authorized OLEI service personnel

3. Product introduction

The LR-1BS2 is an opto-electronic laser scanner that electro-sensitively scans the perimeter of its surroundings at a single plane with the aid of laser beams. The LR-1BS2 measures its surroundings using two-dimensional polar coordinates based on its measurement origin. It can output both point cloud data output and safety signal (I/O port).

Thus LR-1BS2 has been widely applied to industries such as robot obstacle avoidance, safety monitoring, industrial automation, and intelligent logistics.

4. Installation and operation

4.1. Mechanical interface

The LiDAR can be installed in two ways: back-mounted and bottom-mounted.

- **Back-mounted**

There are two M3 screw holes (hole depth is 3mm) at the back of the LiDAR.

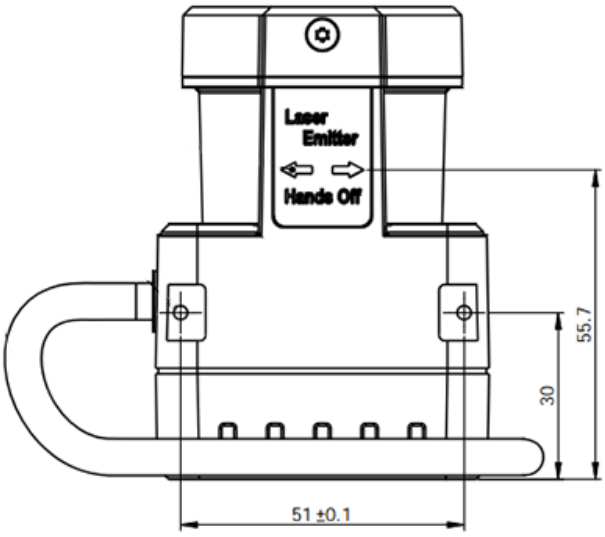


Figure 1: Back mounting interface of LR-1BS2

- **Bottom-mounted**

  There are two M3 screw holes (hole depth is 3mm) at the bottom of the LiDAR.

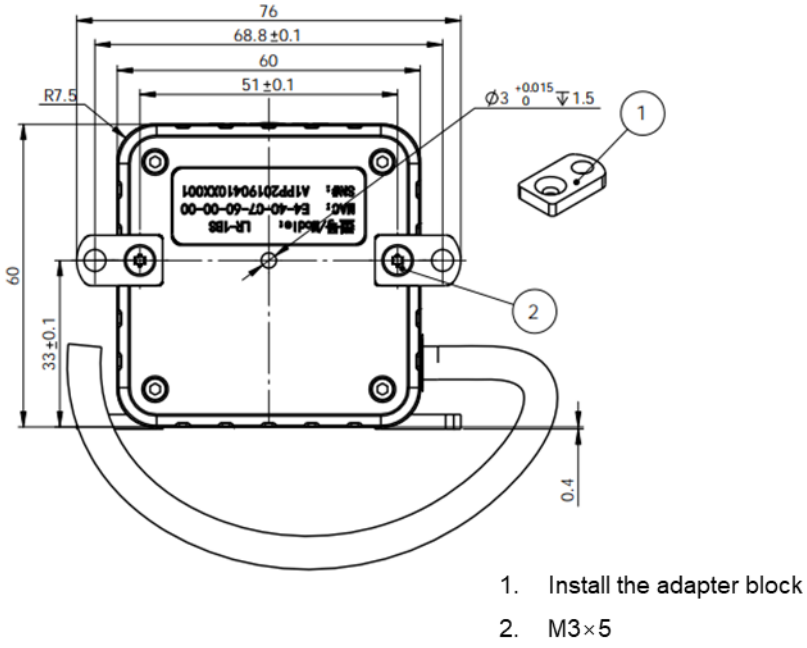


Figure 2: Bottom mounting interface of LR-1BS2

4.2. Pin and wire color assignments

LR-1BS2 is equipped with a 2-meter **"Power/IO"** cable and an **"Ethernet"** connection.

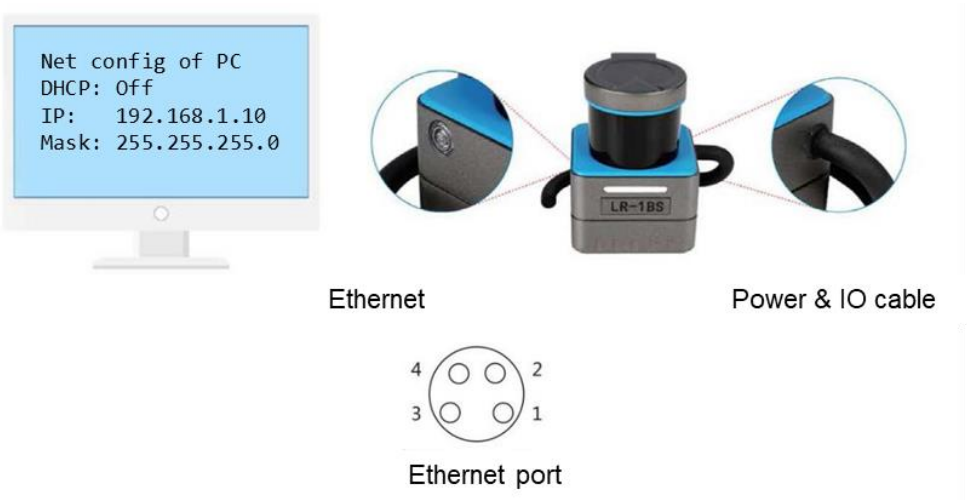


Figure 3 Diagram of electrical interface

- 4.2.1 **"Power/IO"** cable

NO.	Definition	Cable color
1	LiDAR power_VCC (12~32VDC)	red
2	LiDAR power_GND	black
3	Input 0: Input port 0	orange
4	Input 1: Input port 1	white
5	Input 2: Input port 2	light blue
6	Input 3: Input port 3	dark blue
7	Output 0: output port 0 (LiDAR error output)	brown
8	Output 1: Output port 1 (Corresponding to the software Level 1 area)	yellow
9	Output 2: Output port 2 (Corresponding to the software Level 2 area)	green
10	Output 3: Output port 3 (Corresponding to the software Level 3 area)	purple
11	I/O power_VCC (12~32VDC)	pink
12	I/O power_GND	gray

Table 1 Definition of **"Power/IO"** cable

Note: When "**Output0**" outputs a high-level signal, it means that the LiDAR is abnormal, please suspend using.

- 4.2.2 Ethernet connection

NO.	definition
1	TxData+: Send+
2	TxData-: Send-
3	RxData+: Receive+
4	RxData-: Receive-

Table 2 Definition of Ethernet connection

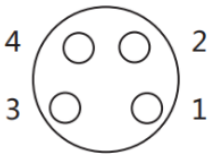


Figure 4 Diagram of Ethernet connection

4.3. Communication interface

The LR-1BS2 is connected to the computer by a RJ-45 Ethernet interface. The computer IP address should be set up before communication. The LiDAR and computer IP must be set up in the same subnet without any conflict. The host port is 2368 by default.

The factory default settings are as follows

- Computer IP：192.168.1.10
- Computer subnet mask：255.255.255.0

The default factory settings of LiDAR are as follows

- LiDAR IP：192.168.1.100
- LiDAR subnet mask：255.255.255.0

The operation steps are as follows

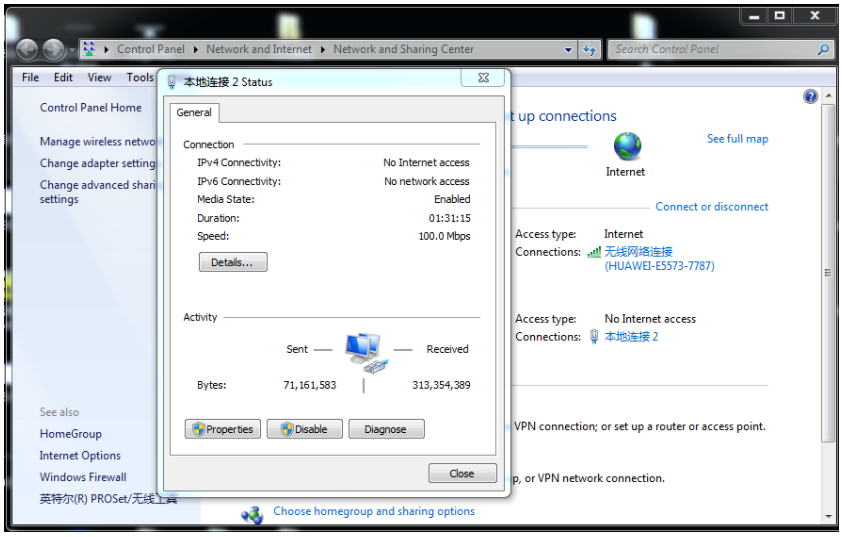


Figure 5: Step 1 of computer IP setting

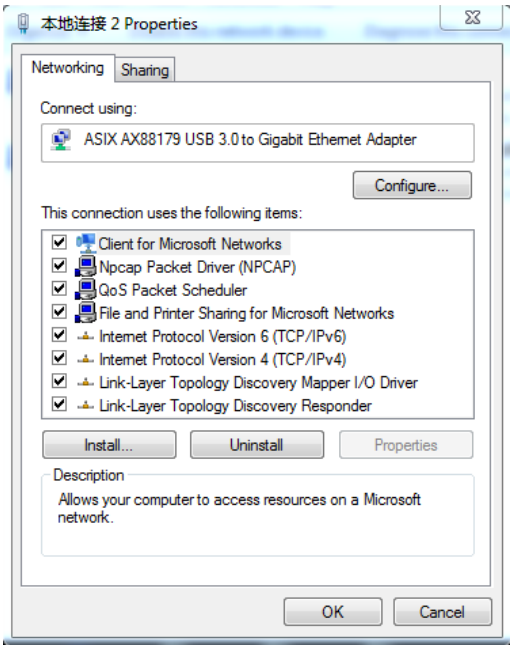


Figure 6: Step 2 of computer IP setting

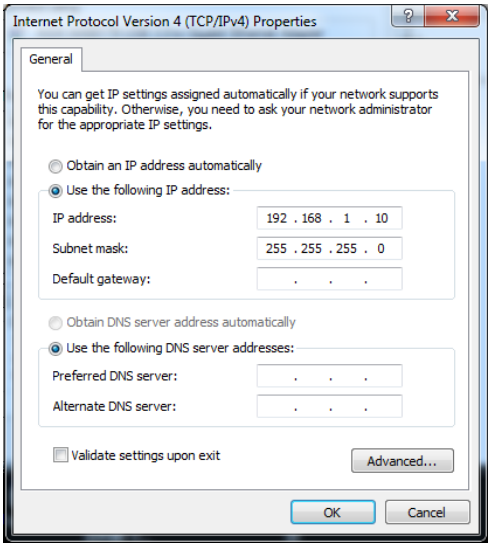


Figure 7: Step 3 of computer IP setting

5. Measurement principle

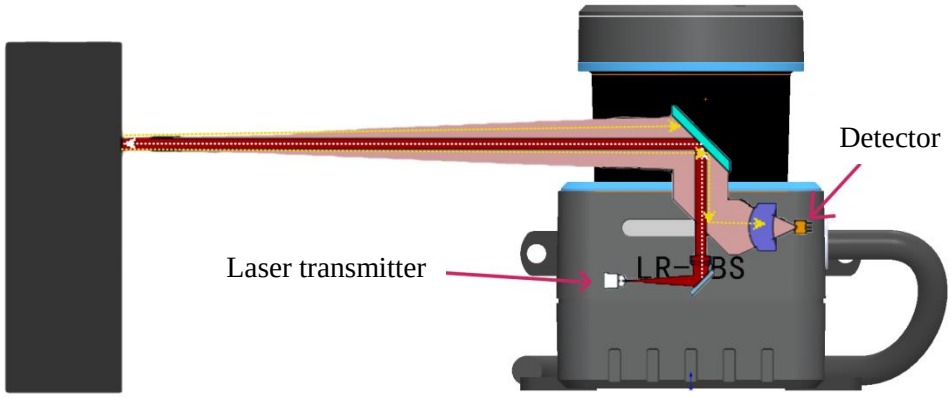


Figure 8 Diagram of LR-1BS2 LiDAR work principle

As is shown in the figure above, LR-1BS2 measures distance by using the time-of-flight principle. The LiDAR emits pulsed laser beams using a laser diode. If one of these laser pulses hits an object or a person, this is reflected at its surface. The reflection is detected in the LiDAR's receiver by a photodiode. The LiDAR calculates the distance to the object from the transit time required by the light from emission of the beam to receipt of the reflection. The calculation method is as follows:

$$D = \frac{CT}{2}$$

D —Detection range
T —Flight time
C —Speed of light

6. Parameter configuration

6.1. Parameter configuration of web page

Web page parameter configuration method of LR-1BS2 is as follows:

- Open the browser (please use **Chrome,Firefox, Edge** or other standard browsers), and enter the LiDAR IP address;
- "**Model**" and "**Version**" at the top of the UI indicate the product model and firmware version;
- "**Temperature**", "**Voltage**" and "**SafeAre**a" on the right side of the UI are the LiDAR parameters displayed in real time, indicating the temperature, voltage and current active Bank. When the font color of parameter turns red, please check whether the LiDAR is malfunctioning;
- Automatically read the current settings of LiDAR by refreshing the page;
- Select the desired speed through "**Motor RPM**": 600/900/1200/1500 (The corresponding scanning frequency is 10/15/20/25HZ), and click "**Set Configs**" to confirm;

- Set the LED indicator **ON** and **OFF** through "**Led Marquee**", and click "**Set Configs**" to confirm;
- Set the **ON** and **OFF** of the LiDAR safety function through "**Safe Area**", and click "**Set Configs**" to confirm;
- Select input mode of "**safe bank**" trough "**Safe bank input**";
- Set the mode of the LED indicator through "**Led Mode**";
- Select current Bank through "**Safe bank config**" when "**Safe bank input**" is "**Software**";
- Set receiving computer IP and port through "**Host IP & Port**".Up to 3 groups can be set. Click⊕ to add a group, click⊖ to delete a group.
- Enable/disable the **DHCP** function: the LiDAR dynamically obtains an IP address from the **DHCP** server (ON), and the LiDAR needs to set up a static IP address (OFF);
- Modification of LiDAR IP: Enter the new IP into the LiDAR IP column (must be in the same network segment as the local IP), click the "**Set Network**" to confirm, and the modification is complete after the LiDAR is powered on again

Figure 9 Parameter configuration of web page

6.2. Parameter configuration of filter level

The web page parameter configuration method is as follows:

- Open the browser (please use **Chrome, Firefox, Edge** or other standard browsers), enter http://LIDAR IP/advanced.html; (the factory default address is:192.168.1.100)
- Over range as: Select the point that exceeds the range to output as the maximum range or display as 0;
- Weak points filter: set the strength of weak point filter ;

- Tail points filter: set the strength of tail points filter;

Figure 10 Parameter configuration of filter level

6.3. Description of indicator light

When the Led Mode is Mode1, the light style is shown as the following table

Indicator light	Description
White light (flashing)	Initialization
Red light (flashing)	Abnormality occurs, please check the internal voltage or temperature through the web page
Green light (rolling)	Operates normally
Red light (rolling)	Level 1 area is triggered, still only the red light is displayed if both Level 2 and Level 3 areas are triggered,
Yellow light (rolling)	Level 2 area is triggered, still only the yellow light is displayed if the Level 3 area is triggered
Blue light (rolling)	Level 3 area is triggered.

Table 3 Description of indicator light

6.4. Description of field

Security field group

The corresponding relationship between the security field group (BANK) and the switch value of the input (Input) port of LR-1BS2 is shown in the following table.

☐indicating low level, ☑indicating high level.

Field group	Input Signal	Bank code
BANK 0	Input：☐3☐2☐1☐0	0000
BANK 1	Input：☐3☐2☐1☑0	0001
BANK 2	Input：☐3☐2☑1☐0	0010
BANK 3	Input：☐3☐2☑1☑0	0011
BANK 4	Input：☐3☑2☐1☐0	0100
BANK 5	Input：☐3☑2☐1☑0	0101
BANK 6	Input：☐3☑2☑1☐0	0110
BANK 7	Input：☐3☑2☑1☑0	0111
BANK 8	Input：☑3☐2☐1☐0	1000
BANK 9	Input：☑3☐2☐1☑0	1001
BANK 10	Input：☑3☐2☑1☐0	1010
BANK 11	Input：☑3☐2☑1☑0	1011
BANK 12	Input：☑3☑2☐1☐0	1100
BANK 13	Input：☑3☑2☐1☑0	1101
BANK 14	Input：☑3☑2☑1☐0	1110
BANK 15	Input：☑3☑2☑1☑0	1111

Table 4 The relationship between field group and input port switch

Note:Only one group of BANK is valid at any time；

Bank 0 is activated if I/O port is not connected;

BANK 15 is activated if I/O port is only connected to VCC and GND;

After the I/O port is connected to VCC and GND, connect the input port to signal access by referring to above table, and the corresponding Bank group is activated.

Safety field

The corresponding relationship between the safety field of LR-1BS2 and the output port is shown in the following table.

Safety field	Output port	Trigger output signal
Level 1	Output 1	High level
Level 2	Output 2	High level
Level 3	Output 3	High level

Table 5 The relationship between field group and input port switch

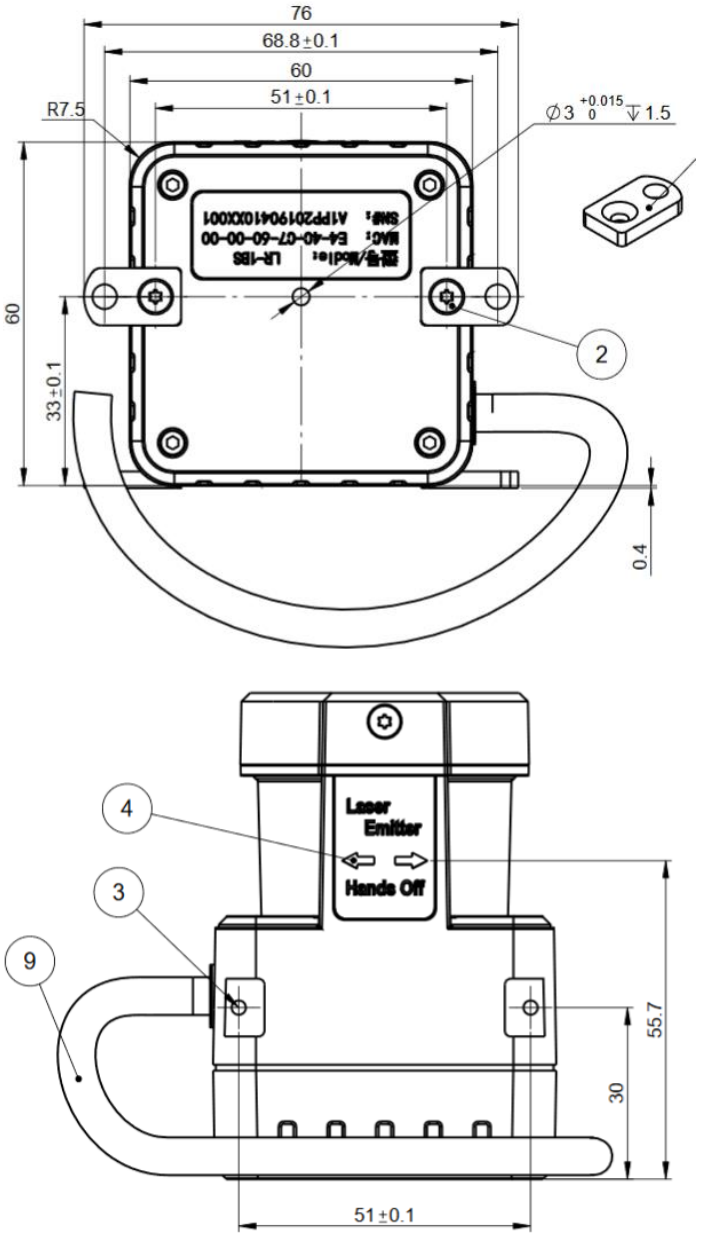
Note: Output 0 is the error output port. When the LiDAR is abnormal, this port outputs a high level signal.

7. Troubleshooting

Problem	Method
LiDAR fails to scan	● Verify whether the power supply is properly connected ● Verify whether the power voltage meets 12~32VDC ● Please contact OLEI if the above conditions are normal.
LiDAR scan produces no data	● Verify whether the network connection is normal ● Verify whether the IP and Port settings on the data receiver are correct. ● Try to use third-party data scraping software to verify whether data could be obtained normally ● Verify whether only one LiDAR software is enabled. ● Verify whether firewall of the data receiver is disabled or if there are other security software or processes blocking data transmission. ● Please contact OLEI if the above conditions are normal.
LiDAR can not respond when obstacle is detected	● Check if the software configuration is correct and if the configuration file is successfully downloaded. ● Verify whether the wiring at the I/O port is correct. ● When the I/O port is not connected , Bank 0 is the effective field group by default. ● The I/O port is only connected to VCC and GND. When other PIN are not connected, Bank 15 is considered to be the valid field group by default. ● Please contact OLEI if the above conditions are all normal.

Table 6 Troubleshooting

Appendix A Mechanical Dimensions



Appendix B Example for electrical connection

INPUT:

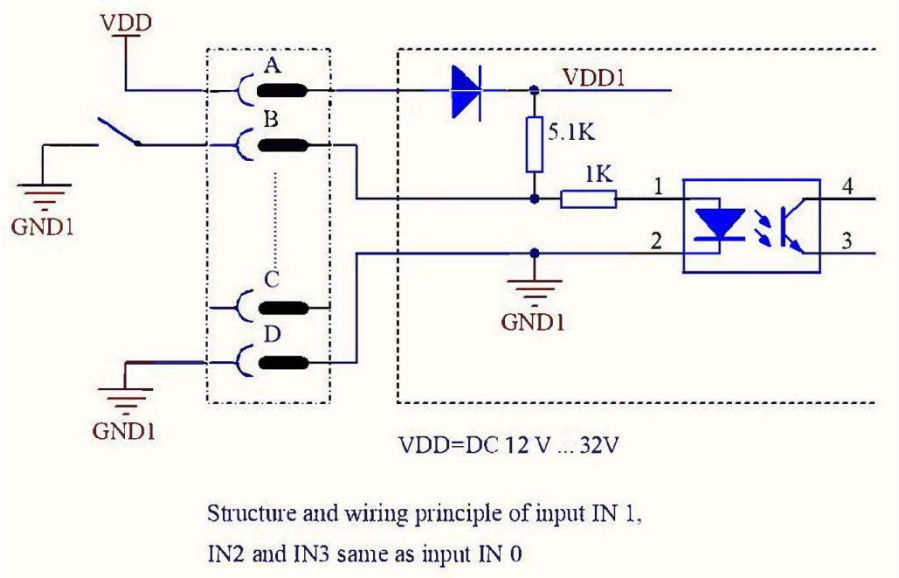


Figure 11 INPUT

- Input and GND connection is valid.
- The input signal is isolated by optocoupler, which is much safer.
- Power supply could be identical to IO power supply or different from it

Note:When the Input is not connected:

- Bank 0 is activated if VDDIO is not connected
- Bank 15 is activated if VDDIO is connected to the power supply

OUTPUT:

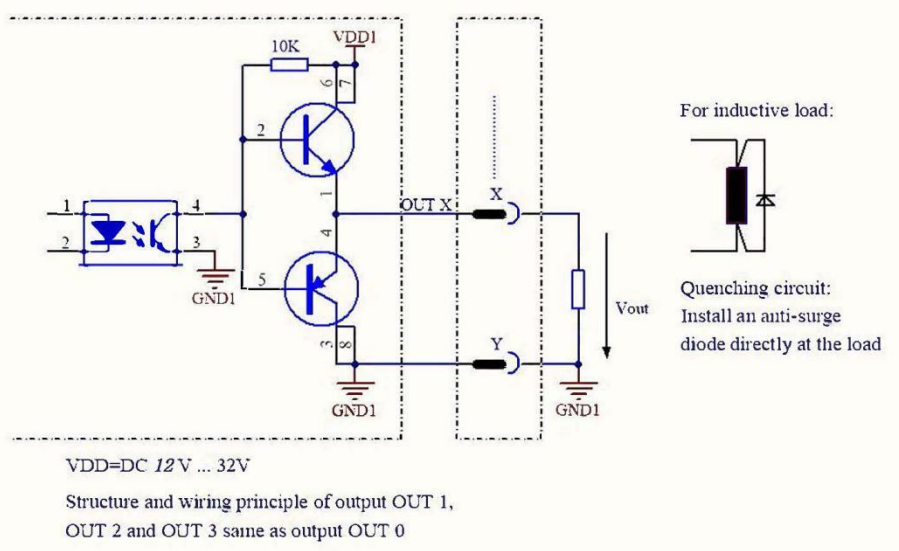


Figure 12 OUTPUT

- The outputs use push-pull circuits and support both PNP and NPN modes
- High level output is effective.
- The output signal is isolated by optocoupler, which is much safer

- Power supply could be identical to IO power or different from it
- Current limiting resistors are used on each Output.
- The current of each output port should not exceed 20mA. If you need to drive the relay, it is recommended to add an additional drive circuit.

Typical electrical connection

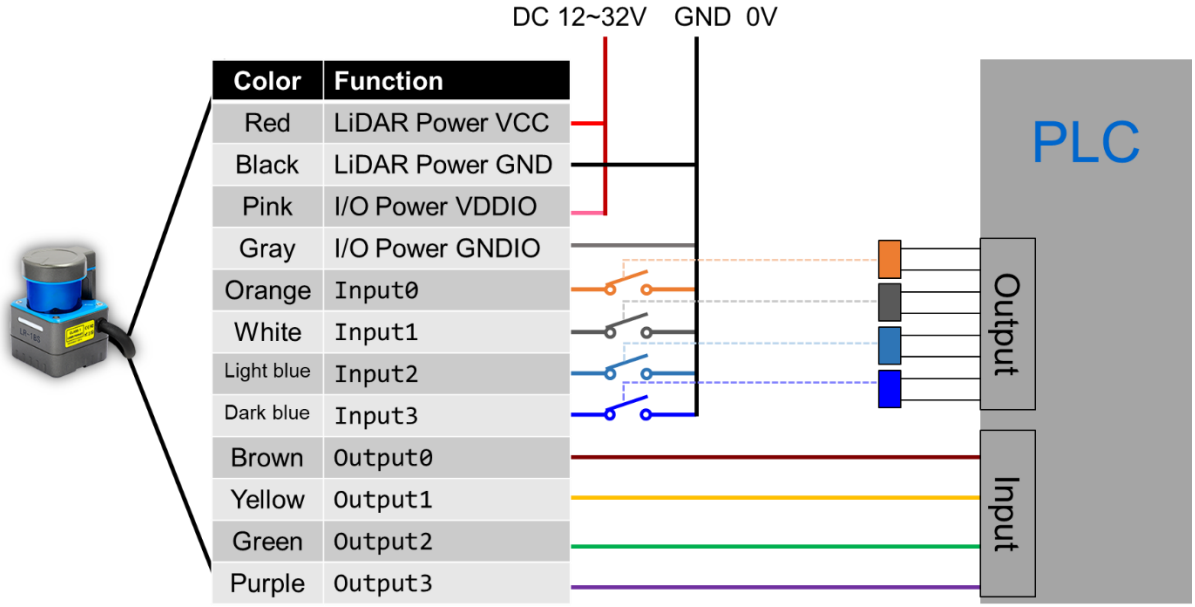
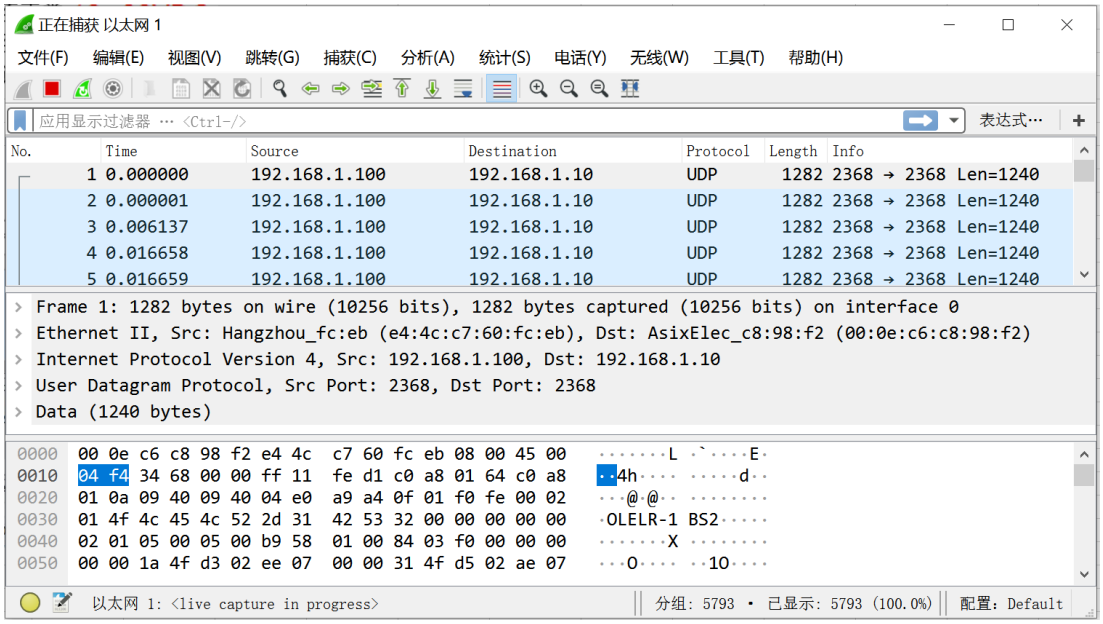


Figure 13 Typical electrical connection

Appendix C Data Packet



Appendix D Firmware Upgrade

This appendix will explain how to use **LiDARUpgrade2D** to upgrade the firmware version of the LR-1BS series LiDAR.

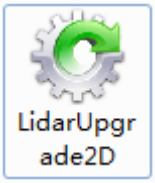


Figure 14 Icon

D.1 Software features

For 2D LiDAR LR-1BS series firmware upgrade

D.2 Surroundings for software

- Windows 7,8,10
- .Net framework 4.5.2

D.3 Software operation

-1. Connect the LiDAR correctly. Check whether the LiDAR communication is normal.

-2. Click the File Information box or drag the firmware file in. The relevant information of the corresponding firmware is prompted after the firmware file is correctly loaded .

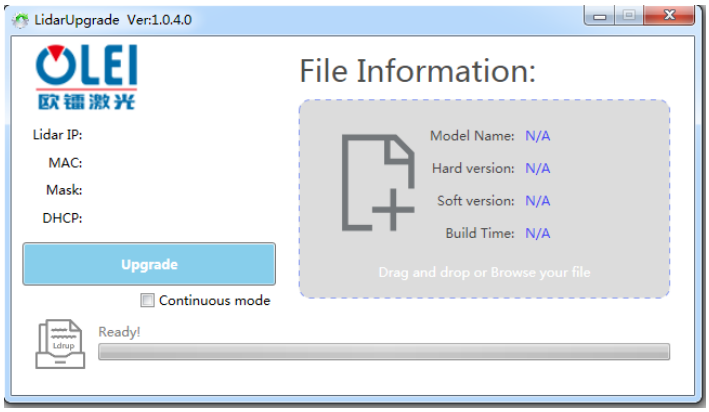


Figure 15 Interface of software upgrade

-3. Clicking "**Upgrade**" , restart the LiDAR power, the file will be downloaded to the LiDAR automatically.

-4. Check the "**Continuous mode**", after the upgrade, it will automatically wait for the next upgrade, which can be used to upgrade LiDAR firmware in batches

Appendix E Oforge

E.1 Software Installation

Software operating environment:

- Windows 7, Windows 8 or Windows 10
- No less than 2G memory capacity
- At least 100M free hard disk space

Points for attention：

1. The Windows OS firewall must authorize the UDP communication of Oforge
2. Make sure that all English characters are in the installation path to avoid software adaptation failures caused by non-ASCII characters

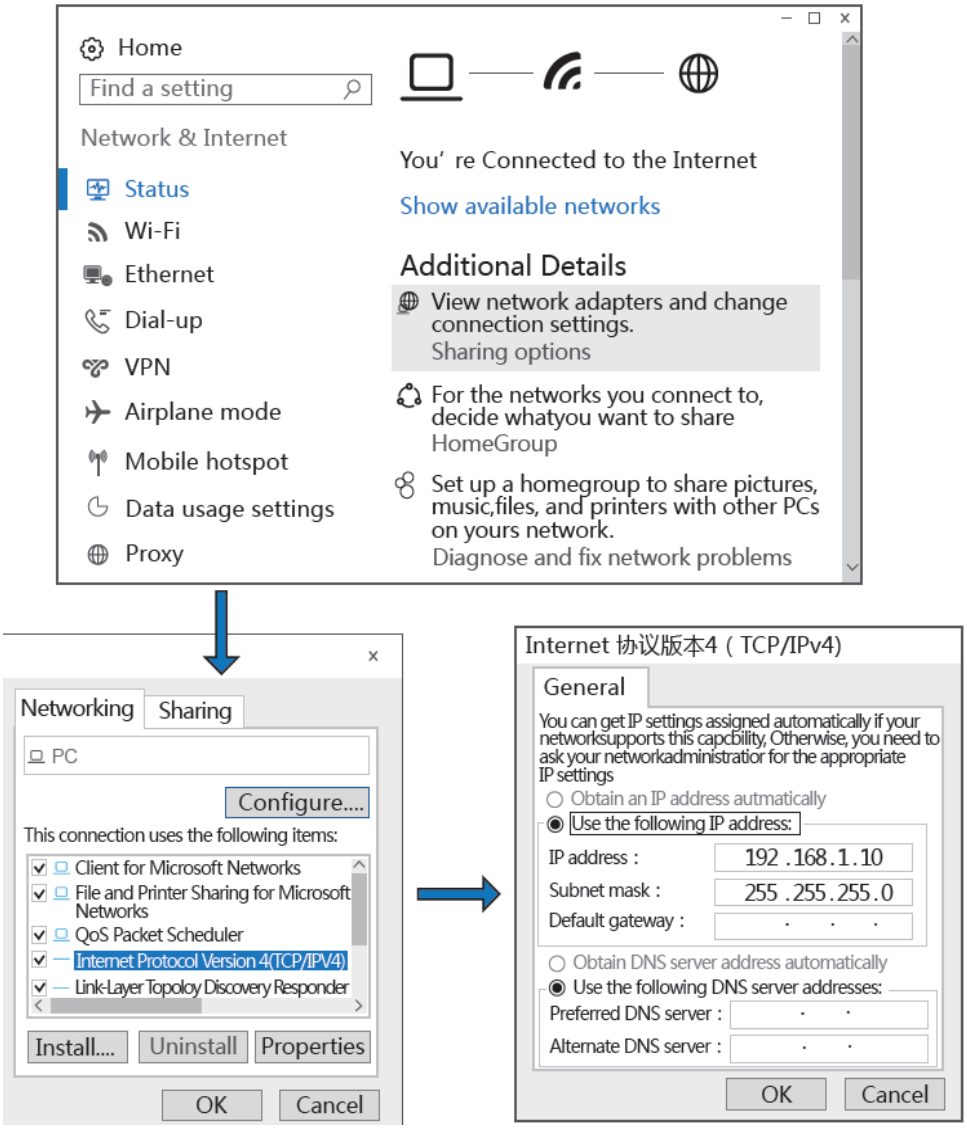
Figure 16 Installation interface

E.2 Network Configuration

The communication between LiDAR and computer adopts Ethernet medium; Using UDP protocol; The factory default is static IP and port.

Basic communication parameters:

LiDAR IP	192.168.1.100(default)	Allow editing
Host IP	192.168.1.10(default)	Allow editing
Host Port	2368(default)	Allow editing
Netmask	255.255.255.0	Allow editing
Gateway	192.168.1.1	Allow editing


Home
Find a setting
Network & Internet
Status
Wi-Fi
Ethernet
Dial-up
VPN
Airplane mode
Mobile hotspot
Data usage settings
Proxy
You' re Connected to the Internet
Show available networks
Additional Details
View network adapters and change connection settings.
Sharing options
For the networks you connect to, decide whatyou want to share
HomeGroup
Set up a homegroup to share pictures, music,files, and printers with other PCs on yours network.
Diagnose and fix network problems
Networking
Sharing
PC
Configure....
This connection uses the following items:
Client for Microsoft Networks
File and Printer Sharing for Microsoft Networks
QoS Packet Scheduler
Internet Protocol Version 4(TCP/IPV4)
Link-Layer Topoloy Discovery Responder
Install....
Uninstall
Properties
OK
Cancel
Internet 协议版本4（TCP/IPv4）
General
You can get IP settings assigned automatically if your networksupports this capcbility, Otherwise, you need to ask your networkadministratior for the appropriate IP settings
Obtain an IP address autmatically
Use the following IP address:
IP address :
192 .168.1.10
Subnet mask :
255 .255.255.0
Default gateway :
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server :
Alternate DNS server :
OK
Cancel

E.3 Software interface

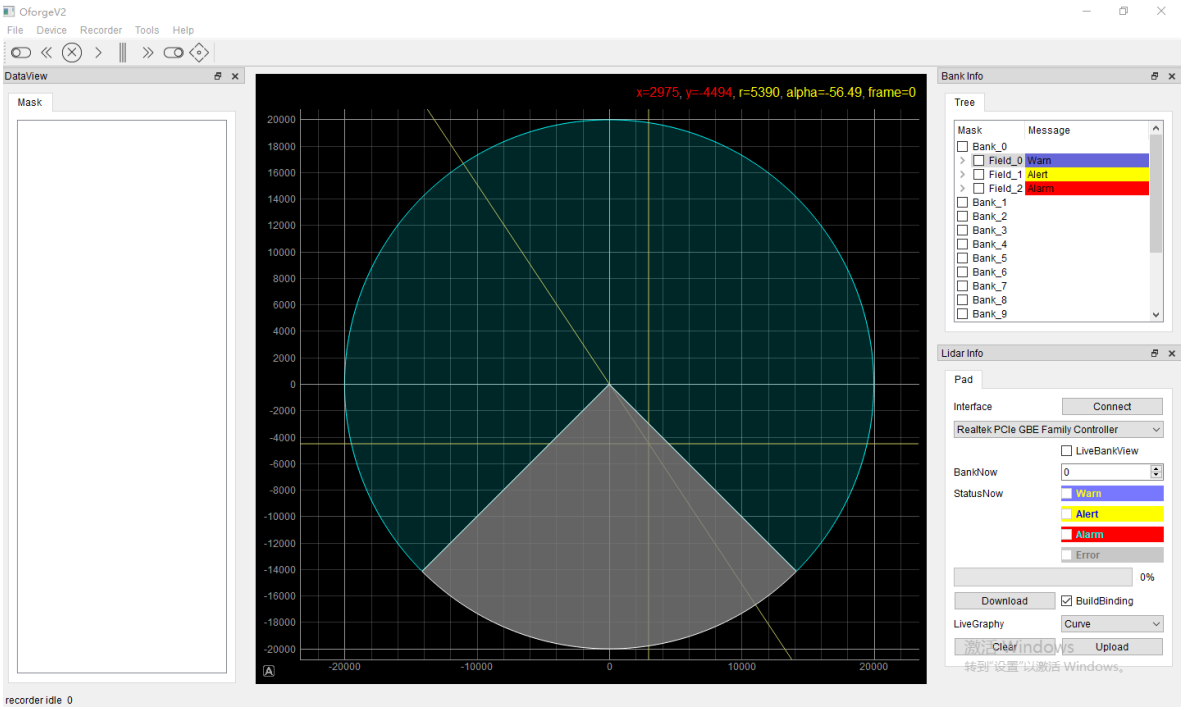


Figure 17 Software interface

E.4 Menu composition and menu options

File	
OpenMaskFile	Open the “Bank Mask File“ of LiDAR
SaveMaskFile	Save the “Bank Mask File” of local disk
Device Select LiDAR device model	
Add	Add new LiDAR device model
Remove	Remove LiDAR device model
LiDAR-1, LiDAR-2, LiDAR-3, Preinstall LiDAR model	
Tools	
Editing Table	Show the data table currently being editing
BankInfo	Show the Bank info
LiDARInfo	LiDAR basic information
LiDARParameter	LiDAR Parameter , **After modifying the IP, you need to restart the LiDAR to take effect**
LiDARIPdiscover	Get the IP address of the initialization radar. Firmware support is required.
Help	
About	About software version
Language	Switch language

Table 7 Help

E.5 Software usage

Connect the LiDAR

1. Select the local network adapter connected to the LiDAR
2. Click "**connect**"

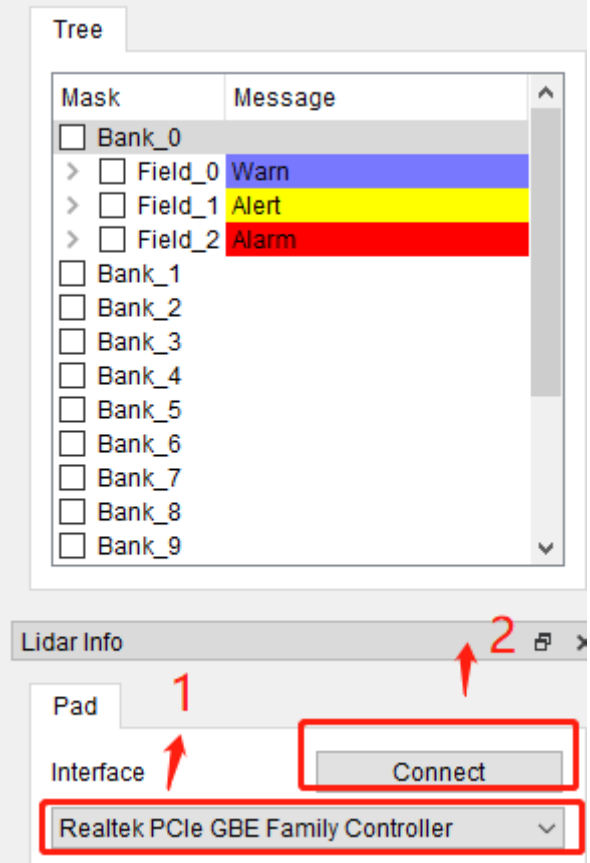


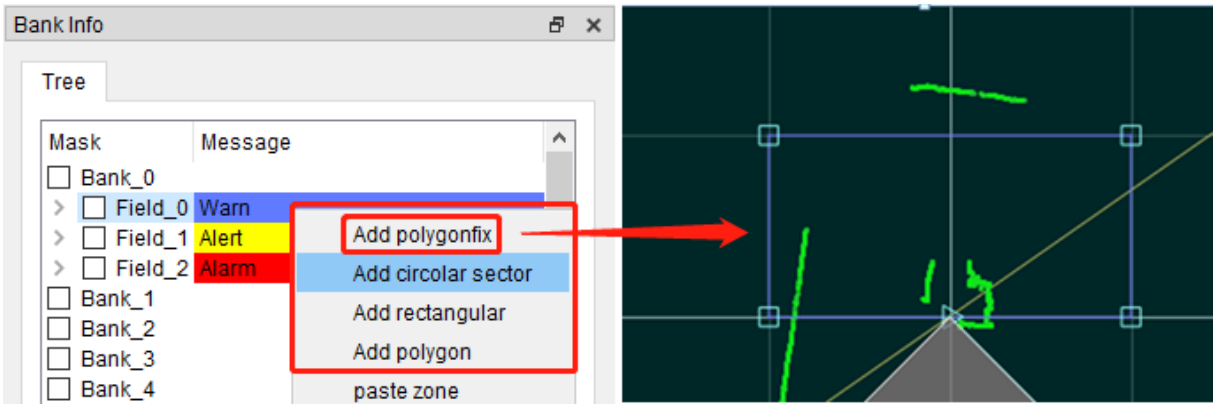
Figure 18 Connecting the LiDAR

Define Bank collision avoidance area

LiDAR can define 16 Bank records. Using one of 16 default field sets, each with 3 predefined field. Which can be actived by checking.

1. How to create a Bank records
   Select a Bank, Right-click on field will shown below; In the right-click menu, select the new Bank field graphic style.
   Predefined area graphic styles:

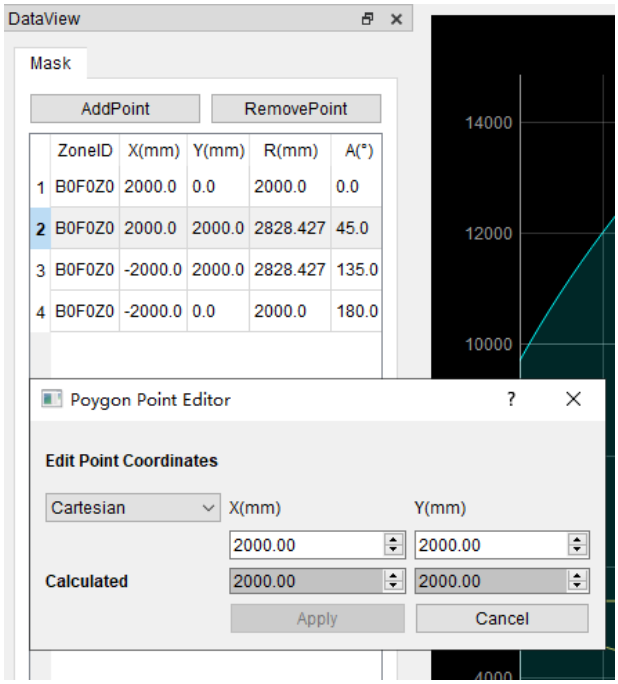
Polygonfix	A polygon fixed starting point is the LiDAR origin
Circolar Sector	A Circolar Sector fixed starting point is the LiDAR origin
ectangular	A Rectangula fixed starting point is the LiDAR origin
Polygon	Freeform polygon with unlimited start point



2. Edit Bank field graphic style

Any Bank field graphic style has several field points and connected lines. Drag and drop field points to change the size, shape and location of the graph.

1. Double click on the line to add an field point
2. Right click "**Remove handle**" on the field point -- delete the point
3. In the "**DataView**" view on the right, the specific values of all current anchor points are displayed. Double click the record to fine tune the values



E.6 Introduction of LiDAR Info interface

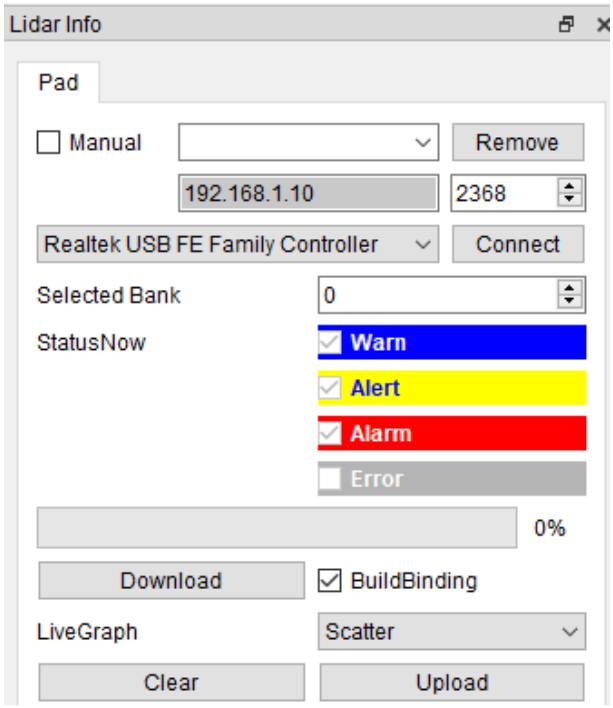
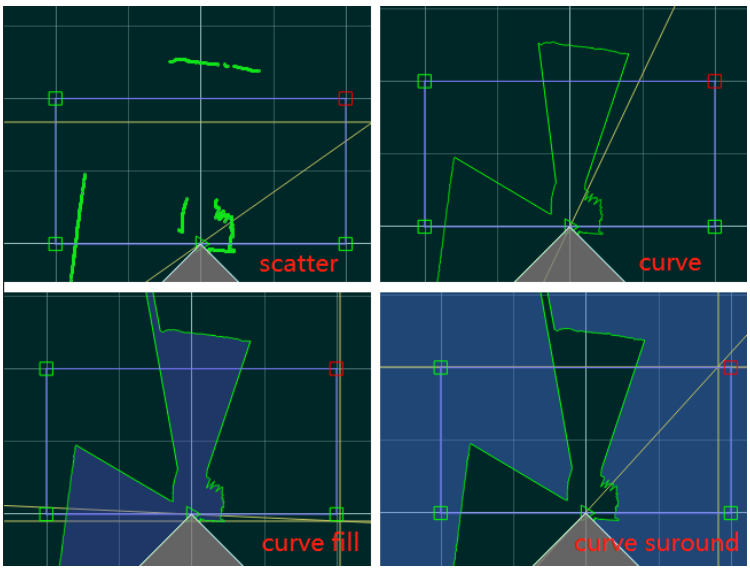


Figure 19 LiDARInfo interface

1. Selected Bank
   Displays the bank field area number currently in effect.
2. StatusNow
   Displays the status of the security level area in effect
3. Download
   Download the currently set bank area graphic style to the LiDAR internal memory
4. BuildBinding
   When downloading, build the basic data of the bank area
5. LiveGraph
   Display point cloud styles in real time (scatter , curve, curve fill,curve surround)



6. Upload
   Upload the graphic data of Bank area in the internal memory of LiDAR to the Oforge interface for display.

Appendix F Notes on mounting

When installing LiDAR, pay attention to the following points:
1. Please remove the transparent protective film on the window when using it on site.
2. Make it as immune to shock and vibration as possible..
3. So that it is not exposed to any direct sunlight (window, skylight) or any other heat sources. to prevent the internal temperature of the device from rising.
4. It is recommended that the mounting base used to fix the LiDAR be as flat as possible.
5. The positioning column on the mounting base should strictly follow the depth of the positioning column at the bottom of the LiDAR, and should not be higher than 4mm. It is recommended to use aluminum alloy mounting base for better heatdissipation .
6. When installing the LiDAR, if the LiDAR has contact mounting surfaces on both top and bottom, please make sure that the distance between the mounting surfaces is greater than the height of the LiDAR to avoid squeezing.
7. The tilt angle should not exceed 90 degrees when the LiDAR is installed.Excessive tilt angle will affect the life of the LiDAR.
8. When arrange the wiring of the LiDAR, wiring on the LiDAR should not be too tight; keep the wiring loose.

In order to avoid any influence to the measurement accuracy due to mutual interference between LiDARs, we recommend the following installation. (A≥6°, H≥200mm, the position of the line segment in the diagram represents the LiDAR emission position)

Figure 20 Placement of two LiDARs opposed to each other

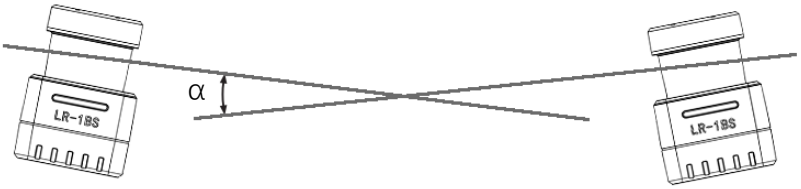


Figure 21 Crosswise placement of two LiDARs

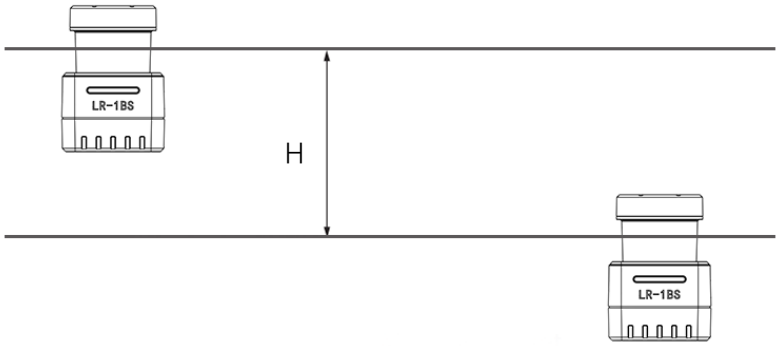


Figure 22 Placement of two LiDARs with parallel offset

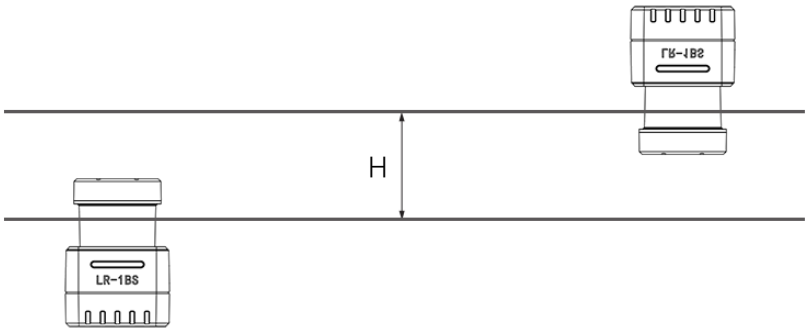


Figure 23 Placement of two LiDARs with parallel offset, one of these upside down

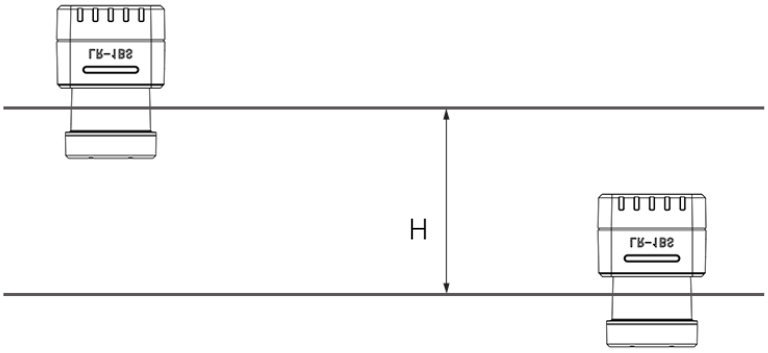


Figure 24 Placement of two LiDARs upside down, parallel offset

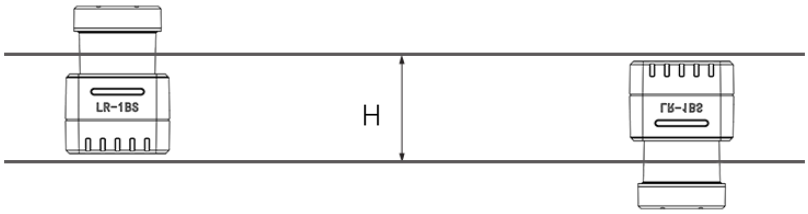


Figure 25 Placement of two LiDARs with parallel offset, one of these upside down

The emission position of the 2D LiDAR from the reference plane is as follows:

Figure 26 Light emission position of LR-1BS, LR-1B, LR-1F

Appendix G Cleaning of sensor

OLE-LiDAR, especially the ring-shaped protective cover, should be kept clean in order toaccurately sense the surrounding environment.

G.1 Notice

Please read Appendix F thoroughly and carefully before cleaning OLE-LiDAR, otherwise improper operation may damage the equipment.

G.2 Materials required

1. Clean fiber cloth
2. Neutralsoap spray
3. Clean water spray
4. Isopropanol solvent
5. Clean gloves

G.3 Cleaning method

If there is only some dust on the surface of LiDAR, directly use a clean fiber cloth with a small amount of isopropyl alcohol solution to gently wipe the surface of the LiDAR, and then wipe it with a dry and clean fiber cloth.

If there are mud or other blocky foreign matter on the surface of LiDAR, first spray clean water on the surface of the dirty part on the LiDAR to remove the mud and other foreign matter (**Note:**please do not wipe off the mud directly with a fiber cloth, as this may scratch the surface, especially the surface of the protective cover). Then spray with soapy water on the dirty parts, since the lubricating effect of soapy water could accelerate the separation of foreign materials. Gently wipe the surface of the LiDAR with a fiber cloth, be careful not to scratch the surface. Finally, clean the soap residue on the LiDAR surface with clean water (if there are still residues stains on the surface, use an isopropyl alcohol solution to clean it again), and wipe it with a dry microfiber cloth.

Official WeChat

Regarding changes in specifications, etc., without notice!

MorpheusTEK Inc
Exclusive OLEI Distributor Partner
sales@morpheustek.com
+1-610 883 6026

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