



Safety LiDAR Instructions

XD-TOD-50H

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广州市新达电子科技有限公司

Warranty and Statement

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Document number

[XD-TOF-50H -180630-A 1](#)

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Safety requirements (to avoid possible hazards, always use the product as specified)

A General Safety Summary

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

Use the specified power cord:

Only country-approved power cables are allowed;

View the product ratings:

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

Always use suitable overpressure protection:

Make sure that there is no too high voltage access to the product.

Ground the product:

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

It is strictly prohibited to open the instrument and open the cover without authorization:

Users cannot open the equipment without CYNDAR permission, 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 on the optical cover, surface scratches will affect the measurement distance, or increase the noise data;

Antistatic protection:

Electrostatic electricity may cause damage to the instrument and should be tested in anti-static area or good ground.

No operation on suspected product fault:

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

Do not use it in a less corrosive environment:

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

No operating in 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 product's optical surface clean:

To avoid dust affecting the ranging performance, please keep the optical surface of the product clean;

Maintain good heat dissipation:

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

Long-term horizontal direct viewing is prohibited

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

catalogue

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I. Product Brief introduction



The XD-TOF-50H is a high-performance lidar product developed by CYNDAR Technology (CYNDAR). Using the time of flight (TOF, Time Of Flight) principle design, through the precise time measurement of the laser pulse reflection process, to obtain the high-precision distance information, and to complete the two-dimensional scanning of the surrounding environment with the motor rotation.

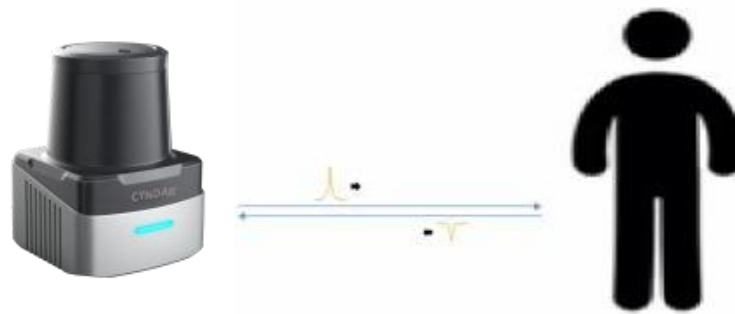
XD-TOF-50H enables reliable measurement of 280° scan angles over a 50 m range, a maximum scan frame rate of 100Hz and a 225 kHz laser sampling rate ahead of the industry. 225,000 point cloud data per second enables XD-TOF-50H to make fine restoration of the surrounding environment. Corresponding to the high sampling rate, XD-TOF-50H provides an angular resolution of up to 0.08°, which greatly enhances its ability to identify tiny targets and effectively reduces the leakage rate.

XD-TOF-50H adopts semi-solid design in structure, and the whole machine reaches the protection level of IP67, meeting the harsh industrial environment or complex outdoor scene applications. High quality, long life motor and light load design ensure that the radar can work stably for a long time, and excellent optical performance ensures that the XD-TOF-50H can still perform well in the sunny outdoor. A laser band of 905 nm was used, and the Class I human eye safety level was satisfied.

With the control software Designer and SDK software package provided by CYNDAR, users can easily start the system-level development, and XD-TOF-50H can be used in the fields of robot positioning and navigation, mapping, environmental modeling and security.

2, The working principle

The XD-TOF-50H is a TOF radar with core components including optics, machinery, circuitry and software. Work, the laser emitted a laser, reflected when irradiation to the object, the receiver to reflect light signal, 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 light flight distance, so as to calculate the position of the measured object, as shown in Figure 1.



. Figure 1 Schematic diagram of lidar ranging principle

The fixed position measurement of a single point can only get the distance information of the target. To get more angle information, XD-TOF-50H is installed with a rotating motor, which rotates the distance at different angles, thus stitching into a contour image of the surrounding environment.

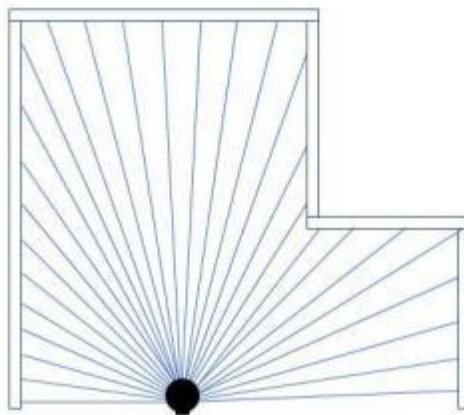


Figure 2. Lidar scanning and imaging

The measured images by XD-TOF-50H are as follows:

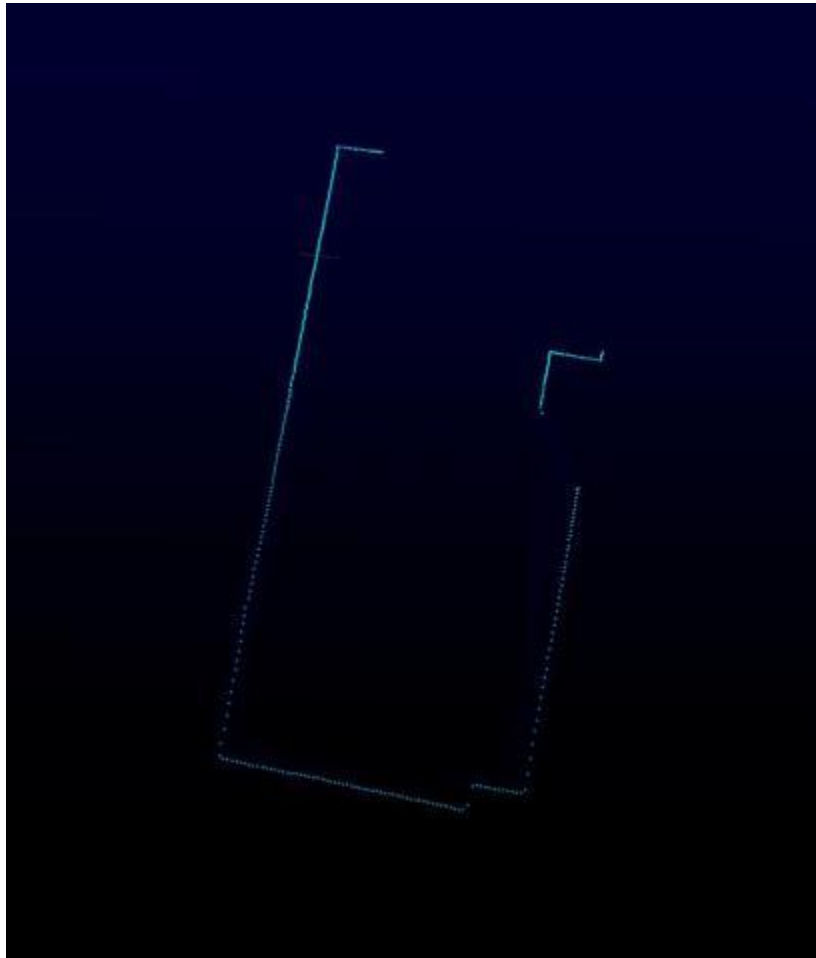
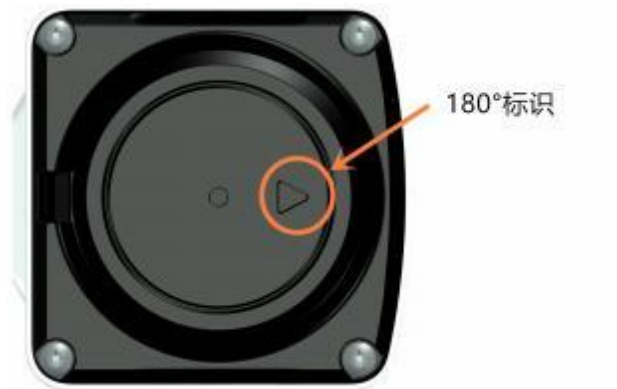


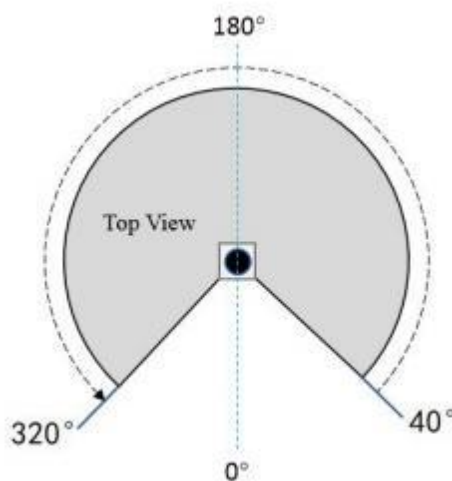
Figure 3. XD-TOF-50H point cloud

3. Characteristics

1. Scan range



graph 4(a).The 180° identification under the XD-TOF-50H top view



graph 4(b).Rotation angle definition

The XD-TOF-50H provides point cloud information at 280°, with the 180° position directly in front of the sensor and identified by the triangle sign at the top. In an overlooking perspective, the angle is increasing counterclockwise. An 80° blind zone is present at 50H for XD-TOF and is located in the interval up to 320° - 0° - 40°.

2. Optical characteristics

Out of the light position



Figure 5. Schematic diagram of light output position

With the base plane of the sensor base as the reference surface, the laser emission position of XD-TOF-50H is 53.6 mm from the reference surface.

Laser emission, at the vertical Angle



Figure 6. Schematic diagram of the vertical laser angles

Each XD-TOF-50H machine that leaves the factory will have a slight deviation in the vertical angle of the emitted laser. Taking the horizontal plane as a reference, the vertical angle deviation range of the emitted laser from XD-TOF-50H is $\pm 1^\circ$.

Spot characteristics

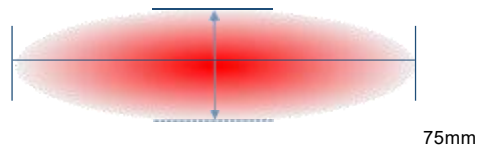


Figure 7. Spot Characteristics (at 10 m)

XD-TOF-50H uses a semiconductor laser as the light source. After beam shaping, the divergence angle of the entire light spot is about 2.5mrad in the vertical direction and about 7.5mrad in the horizontal direction; that is, the shape of the light spot on a target 10 m away is shown in the figure. As shown, the vertical width is about 25 mm and the horizontal width is 75 mm.

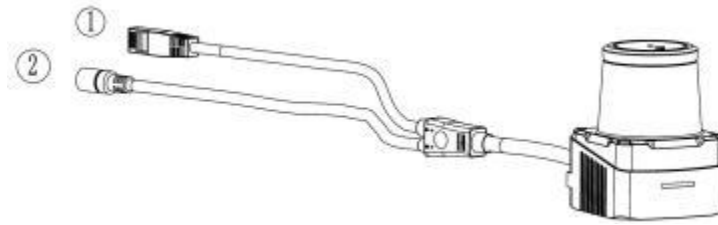
Laser safety level



The XD-TOF-50H uses a low-power 905 nm laser light source and reduces the average power using pulse modulation. Meeting the Class I level of laser safety standards, can ensure the safety for the human eye.

3. Interfaces and instructions

joggle



. Figure 8. Interface cable

As shown in the figure, XD-TOF-50H has two cables, ① cable is network port cable; ② cable is power cable.among

Network cable length is 0.5m, standard RJ45 interface, defined as follows:

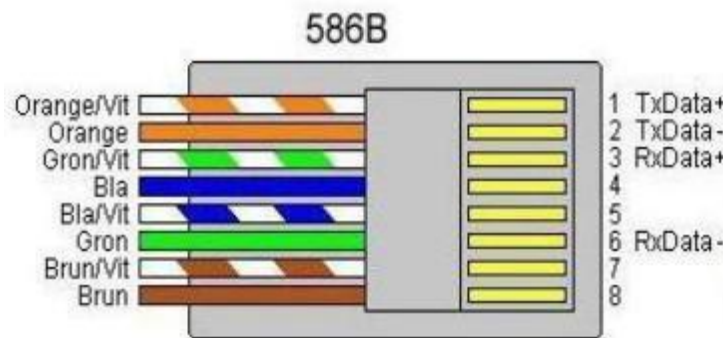


Figure 9. Network wire terminal wire harness

The Definition is as follows:

Pigment	signal
Orange white	TX+
Orange	T X -
Green white	R X+
Greenn	R X-

The power supply cord length is 0.5m, and the power supply head is 5.5mm / 2.1mm.Definition is as follows

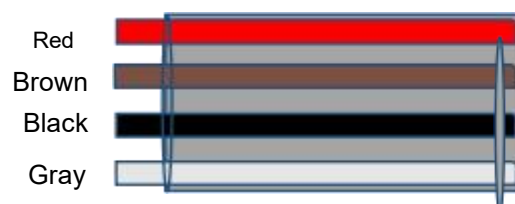


Figure 10. Power cord terminal wiring harness

The Definition is as follows:

pigment	signal	Typical value	scope
red	V CC +	12V	9V ~36V
palm	V CC +	12V	9V ~36V
ash	V CC -	0V	0V
black	V CC -	0V	0V

The network I P address is set at the following values:

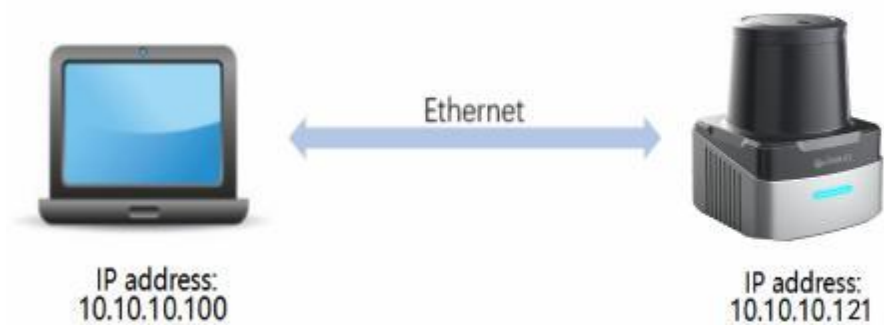


Figure 1 1. IP Address Settings

4. Software

Lidar can read and configure the relevant parameters of the radar through the "Designer" software, view the radar point cloud data in a visual way, and analyze the point cloud data, which is convenient for users to use.

The XD-TOF-50H SDK package realizes the encapsulation and analysis of radar-related information, and users can conduct rapid secondary development by calling related APIs.

For details, please refer to the electronic document Designer User Guide and XD-TOF-50HSDK Programming Guide.

5. Data format

XD-TOF-50H data transfer format

The XD-TOF-50H point cloud data is transmitted based on the Ethernet TCP protocol package, and the total length of each TCP package is automatically negotiated by the network card. Packet Transport port number 2368. Data packets are divided into two categories: intensity and distance information (Data Type =0) and only distance information (Data Type =2).

When the packet contains the strength and the distance:

Each lap of data contains $36 + 4N + 8$ Byte, The 36 Byte contained header flags of 8 Byte, protocol version numbers of Byte, 4 Byte data lengths, 4 Byte data flags, data ID of 4 Byte, retention length of 4 Byte, 2 of 2 Byte data types, angular resolution of 2 Byte, starting angles of 2 Byte, end angles of 2 Byte, and $4N$ Byte point cloud information (each point contains 2 Byte intensity information and 2 Byte distance information and 4 Byte distance information), 8 Byte contains 4 Byte timestamps and 4 Byte flags in Byte.

Note: N represents (end angle-starting angle) / resolution

The angular range of the radar output is $40^\circ - 320^\circ$.

The specific TCP package format is as follows:

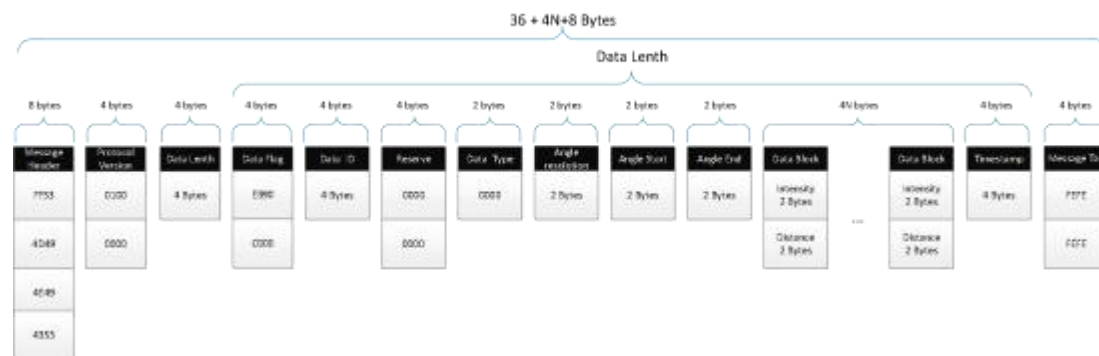
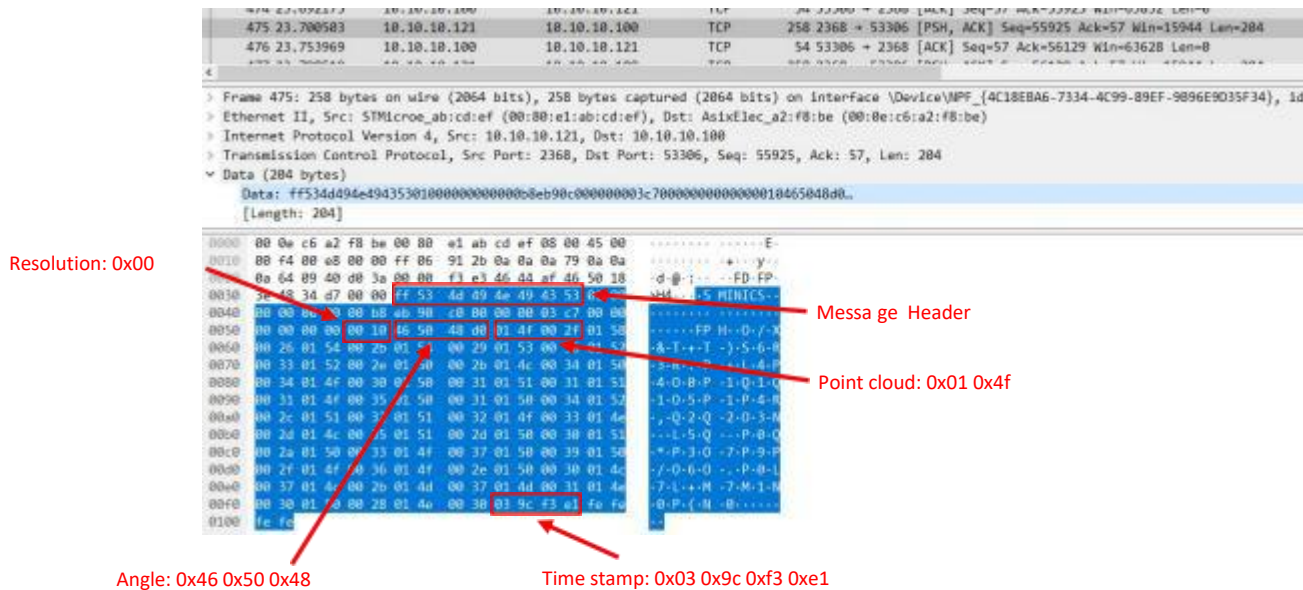


Figure 12XD-TOF-50H point cloud data TCP packet transmission format



Figure 13. XD-TOF-50H single point cloud data format



. Figure 14 Example of the X D-TOF-50H point cloud packet resolution

When the packet contains only the distance:

Each lap of data contains $36 + 2N + 8$ B yte, The 36 B yte contain header flags of 8 B yte, 4 Byte protocol version numbers, 4 Byte data lengths, 4 Byte data flags, data ID of 4 Byte, 4 Byte retention lengths, 2 Byte data types, angular resolution of 2 Byte, starting angles of 2 Byte, end angles of 2 Byte angles, and $2N$ Byte's point cloud information (each point contains two Byte distance information), four Byte timestamps in eight Byte, and four Byte message flags.

Note: N represents (end angle-starting angle) / resolution

The angular range of the radar output is 40° -320°.

The specific TCP package format is as follows:

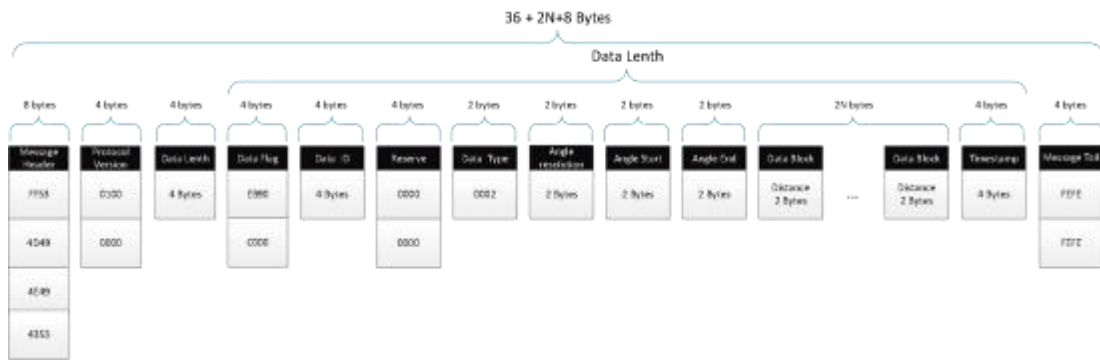


Figure 15 XD-TOF-50H point cloud data TCP packet transmission format



Figure 16. XD-TOF-50H single point cloud data format

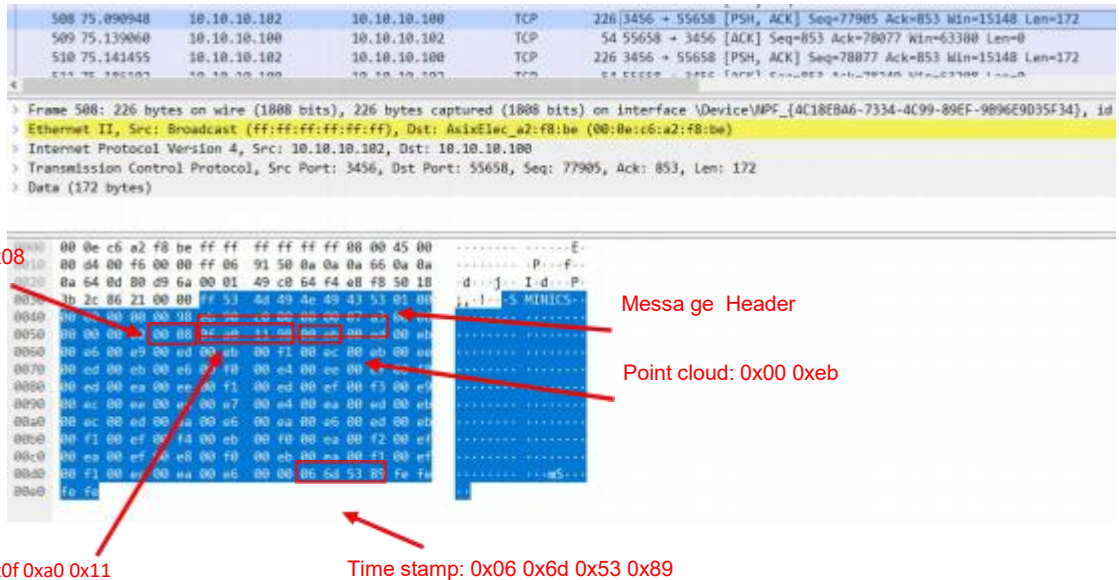


Figure 17 Example of the XD-TOF-50H point cloud packet resolution

Angle information extraction and calculation:

Each circle contains 1 resolution information and two angular information (4 byte from 40° -320°).

The Angle is calculated as follows:

- 1 Resolution information 0x10, angle information 0x46 0x50 0x48 0xd0 were extracted from the TCP packet;
2. After conversion to decimal system is: resolution 16 Angle 18000~18640;

3. Divide by 100 to obtain a resolution of 0.16° angle from 180° to 186.40° ;

Intensity and distance information were extracted and calculated

Each circle of data contains N point cloud data information, and each point cloud data contains 2 Byte intensity information and 2 Byte distance information.

In the packet, the point cloud data information field, the first two Byte are used to represent the intensity information, the intensity information is a relative value, the value range of 0-65536; the last two Byte are used to transmit the distance information between the lidar and the object in units of 2mm.

Strength and distance information is calculated as follows:

1. Extract the point cloud information from the T C P data package: 0x01 0x4f 0x00 0x2f;
2. Extract the intensity information is 0x 01 & 0x 4f, and the distance information is 0x00 & 0x 2f;
3. After conversion to decimal system is: intensity information 335 distance information 47;
4. Multiply by the distance unit (2mm) to get: 94 mm;

Time-stamp information extraction and calculation:

Each TCP package contains a timestamp information of 4 Byte in length, with values ranging from 0 to 3600×10^6 s, The current timestamp information indicates the time the last point cloud data of the current T CP package sends the laser.

The time information is calculated as follows:

1. Remove the time information from the TCP package: 0x03 0x9c 0xf3 0xe1;
2. The combination gets 0x039c f3e1;
3. The decimal: 60,617,697s;

6. Data communication mode

XD-TOF-50H search radar adopts the form of UDP broadcast, the upper computer broadcasts the discovery radar command, after the radar receives the command, it broadcasts its own P N, S N code and IP and port number information. At the same time, the upper computer can modify the corresponding parameters by broadcasting instructions.

Data communication is conducted in passive upload data mode.

Radar passive data uploading mode refers to that in the case that the upper computer and the radar can conduct normal communication on the network, the upper computer establishes a TCP connection according to the radar IP, and then directly sends the data request command, so as to obtain the radar data.

Note: Refer to the SDK for specific instructions.

7. Physical parameters of the equipment

essential information		
product name	XD-TOF-50H lidar	
model	XD-TOF-50H	XD-TOF-50H P
Measuring properties		
detection zone	0.1-50 m @ 90% reflectivity 0.1-20 m @ 10% reflectivity	
repeatability precision	±20 mm	
scanning scope	280°	
angular resolution	0.08°/0.16°/0.32°	0.32°
Scan frame rate	50 H z	100 H z
current-illumination characteristic		
supply voltage	DC 9V -36 V	
working current	0.225A / 12 V (typical)	
laser light source	905 nm class I	

	Power consumption (typical)	2.5 W
Other		
interface	data transmission	E t h e r n e t 100BA SE -T X
	start time	< 20 s
	ambient light	> 100000 l x
	working temperature	-10°C ~55°C
	storage temperature	-30°C ~75°C
	working life	5 Years (motor life)
	levels of protection	IP67
	size	60 × 60 × 80 m m ³
	weight	148 g (excluding cable)

8. Installation guide

When installing XD-TOF-50H:

1. Make it free from impact and vibration as much as possible;
2. Keep it exposed to any direct sunlight (windows, skylight) or any other heat source. This prevents the temperature inside the device from rising.

To avoid interference between radars and any impact on measurement accuracy, we recommend the following installation:

1. When two or more radars are installed in parallel, it is recommended to tilt the radar down at a certain angle to avoid shooting, as shown in Figure 16 and Figure 17;
2. When two or more radars are installed vertically, it is recommended to stagger the radar light position at a certain distance to avoid shooting, such as

FIG. 18,19,20, FIG. 21.

* Note: The light position of XD-TOF-50H is lower in the middle of the radar cover, see optical properties 2 for details.

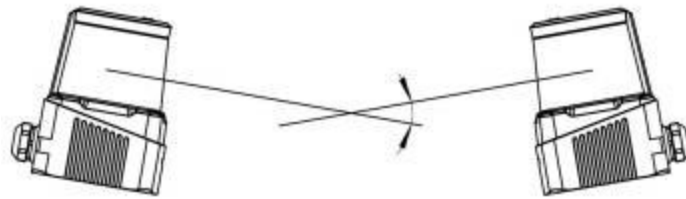


Figure 16. Schematic diagram of parallel installation (1)



Figure 17. Schematic diagram of parallel installation (2)

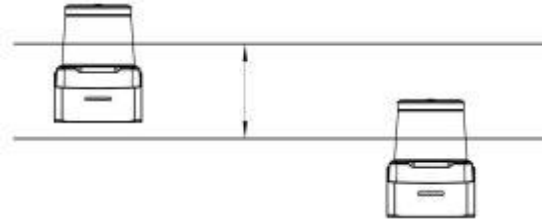


Figure 18. Vertical installation schematic diagram (1)

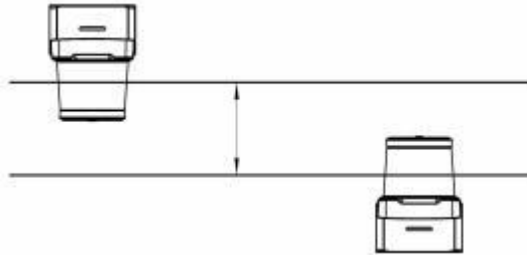


Figure 19. Vertical Installation Schematic Drawing (2)

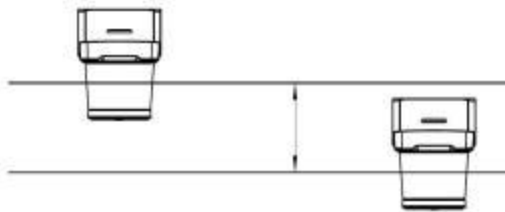


Figure 20. Vertical installation schematic diagram (3)

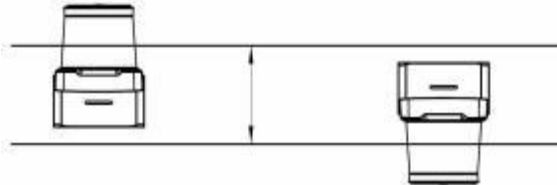
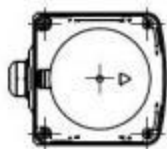
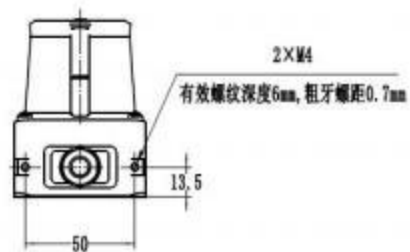
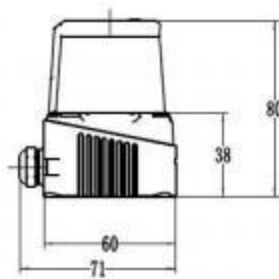
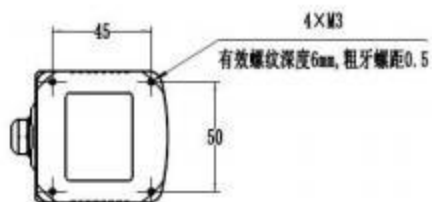


Figure 21. Vertical installation schematic diagram (4)

9. Mechanical dimensions



单位: mm

CYNDAR

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