



2D TOF LiDAR

DLD-50D

USER MANUAL

V1.0.3

WARRANTY AND DECLARATION

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Document No.

DLD-50D-180630-A1

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SAFETY REQUIREMENTS

To avoid potential hazards, always use this product as specified.

GENERAL SAFETY SUMMARY

Carefully read the following safety precautions to avoid damage to this product or to other products connected to it.

Use the specified power cord:

Use only a power cord approved for use in the country where the product is operated.

Check the product ratings:

To prevent damage caused by excessive current, observe all ratings and markings on the product. Before connecting the product, refer to this manual for detailed rating information.

Use appropriate overvoltage protection:

Make sure that no excessively high voltage is applied to the product.

Ground the product:

Ground the grounding conductor of the product's power cable. To avoid electric shock, before connecting any input or output terminal, make sure that the power-cable grounding terminal is securely connected to protective earth.

Do not disassemble the instrument or open its enclosure without authorization:

Users must not disassemble the device without authorization from DAIDISIKE. Never open the product enclosure while the device is operating.

Do not scratch the optical cover with hard objects:

Scratching may damage the optical cover. Surface scratches may reduce the measuring range or increase noise in the measurement data.

Electrostatic discharge protection:

Static electricity may damage the instrument. Whenever possible, perform testing in an ESD-protected area or under properly grounded conditions.

Do not operate the product if a fault is suspected:

If you suspect that the product is faulty, contact DAIDISIKE for inspection. All maintenance, adjustments, and component replacements must be performed by DAIDISIKE.

Do not use the product in corrosive environments:

To prevent corrosion damage, do not use or store the device in a corrosive environment.

Do not operate the product in flammable or explosive environments:

To prevent equipment damage and personal injury, do not operate or store the instrument in a flammable or explosive environment.

Keep the optical surfaces clean:

Keep the optical surfaces of the product clean to prevent dust from affecting ranging performance.

Ensure adequate heat dissipation:

Install the device on a metal heat-sink surface to ensure adequate heat dissipation.

Do not view the emission surface directly at eye level for extended periods:

The device continuously emits infrared laser radiation during operation and complies with Class 1 laser safety requirements. For safety, do not stare directly at the light-emitting surface for extended periods.

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I. PRODUCT INTRODUCTION



The DLD-50D is a high-performance LiDAR developed by DAIDISIKE. It uses the Time of Flight (TOF) principle. By precisely measuring the travel time of reflected laser pulses, it obtains high-accuracy distance information, while a rotating motor enables two-dimensional scanning of the surrounding environment.

The DLD-50D provides reliable measurements over a range of up to 50 m and a scanning angle of 280°. It supports a scan frame rate of up to 100 Hz and an industry-leading laser sampling rate of up to 225 kHz. With 225,000 point-cloud samples per second, it reproduces the surrounding environment in fine detail. An angular resolution as fine as 0.08° significantly improves detection of small targets and reduces missed detections.

The semi-solid-state design and IP67 protection rating support demanding industrial environments and complex outdoor applications. A high-quality, long-life motor and light-load design ensure stable long-term operation. Excellent optical performance supports reliable operation even in strong sunlight. The device uses a 905 nm laser wavelength and meets Class 1 eye-safety requirements.

With the SimiView control software and SDK package provided by DAIDISIKE, users can begin system-level development quickly. The DLD-50D is suitable for robot positioning and navigation, mapping, environmental modeling, security applications, and other fields.

II. OPERATING PRINCIPLE

The DLD-50D is a TOF LiDAR whose core components include optical, mechanical, electronic, and software modules. During operation, the laser emits a beam toward the environment. When the beam strikes an object, it is reflected. The receiver detects the reflected signal, and a time-analysis module measures the time difference between the emitted and reflected signals. This timing information and the speed of light are used to calculate the travel distance and determine the target position, as shown in Figure 1.

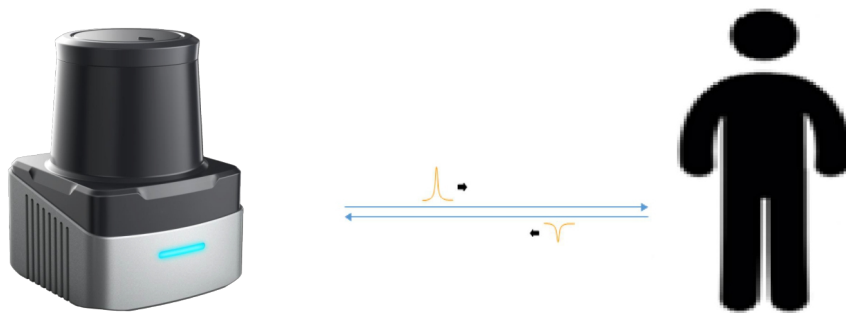


Figure 1. Schematic diagram of the LiDAR ranging principle

A fixed-position, single-point measurement provides only the distance to the target. To obtain information from more angles, the DLD-50D contains a rotating motor. As the motor rotates, distance measurements are collected at different angles and combined to form a contour image of the surrounding environment.

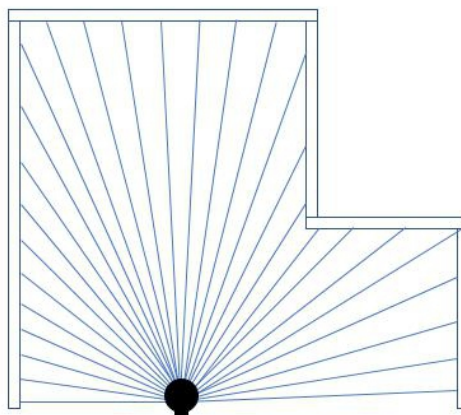


Figure 2. LiDAR scanning image formation

An image measured by the DLD-50D is shown below:

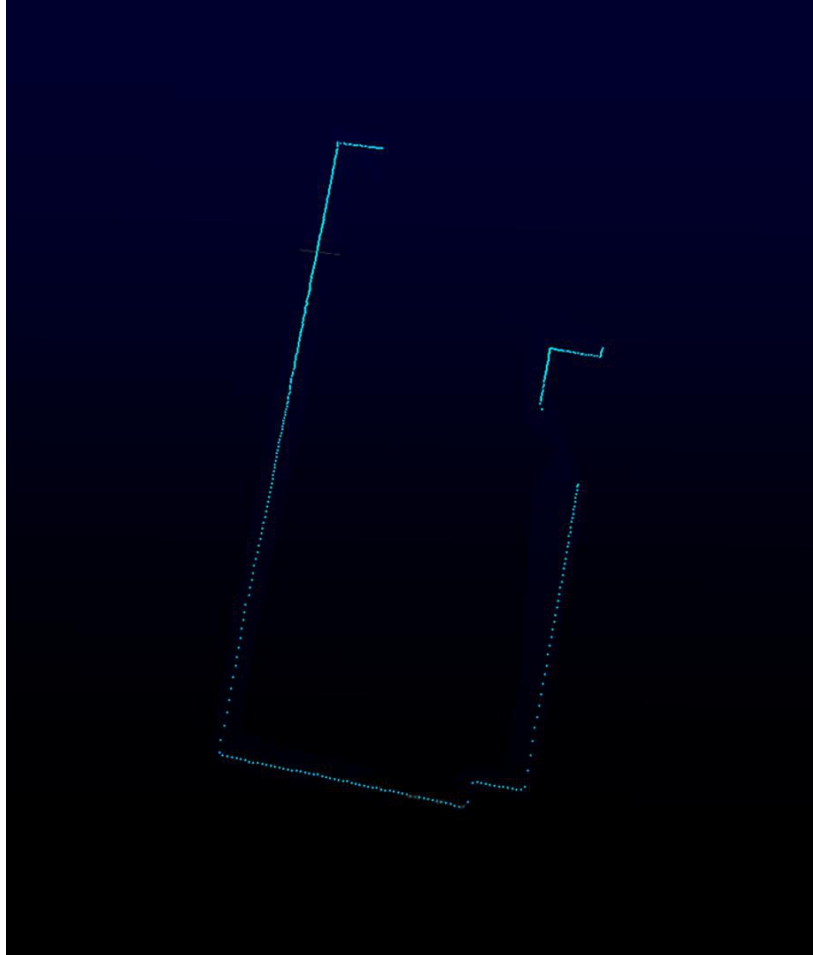


Figure 3. Example of a DLD-50D point-cloud image

III. FEATURES

1. Scanning Range

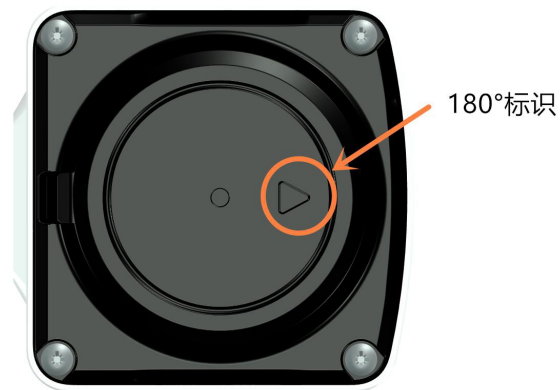


Figure 4(a). The 180° reference mark in a top view of the DLD-50D

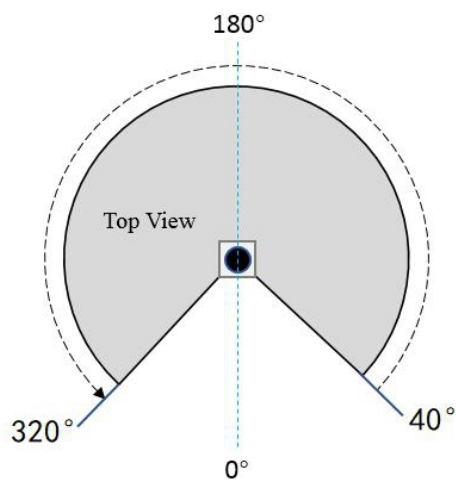


Figure 4(b). Definition of the rotation angle

The DLD-50D provides point-cloud information over a 280° range. The 180° position is directly in front of the sensor and is identified by the triangular mark on the top of the device. When viewed from above, the angle increases counterclockwise. The DLD-50D has an 80° blind sector extending from 320° through 0° to 40°.

2. Optical Characteristics

Laser Emission Position



Figure 5. Schematic diagram of the laser emission position

Using the plane of the sensor base as the reference, the DLD-50D laser emission position is 53.6 mm above the reference plane.

Vertical Laser Emission Angle



Figure 6. Schematic diagram of the vertical laser angle

The vertical emission angle may vary slightly from one DLD-50D unit to another. Relative to the horizontal plane, the vertical emission angle tolerance is $\pm 1^\circ$.

Beam Spot Characteristics

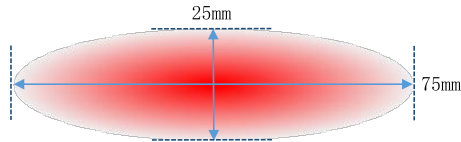


Figure 7. Beam spot characteristics at 10 m

The DLD-50D uses a semiconductor laser as its light source. After beam shaping, the beam divergence is approximately 2.5 mrad vertically and 7.5 mrad horizontally. At a target distance of 10 m, the spot therefore has a vertical width of approximately 25 mm and a horizontal width of approximately 75 mm.

Laser Safety Classification



The DLD-50D uses a low-power 905 nm laser source and pulse modulation to reduce average optical power. It complies with Class 1 laser safety requirements and is safe for the human eye.

3. Interfaces and Indicators

Interfaces

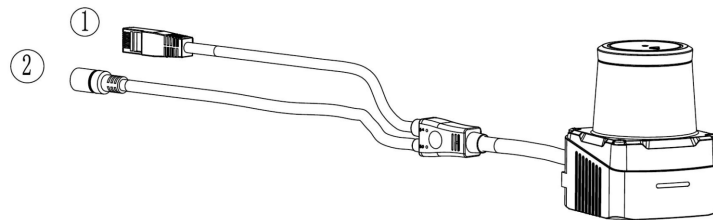


Figure 8. Interface Cables

The DLD-50D is equipped with two cables: cable 1 is the Ethernet cable and cable 2 is the power cable. The Ethernet cable is 0.5 m long and uses a standard RJ45 connector. The pin definitions are shown below.

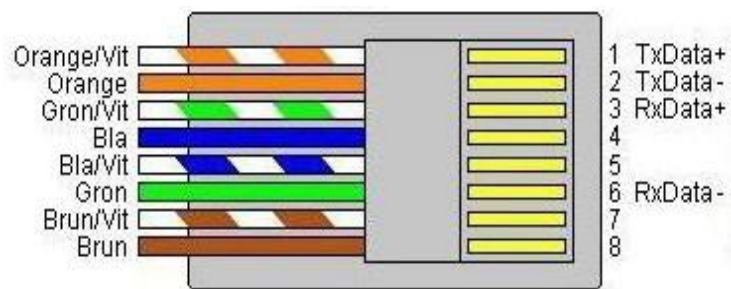


Figure 9. Ethernet Cable Terminal Harness

Pin definitions:

Color	Signal
Orange/White	TX+
Orange	TX-
Green/White	RX+
Green	RX-

The power cable is 0.5 m long and uses a 5.5 mm/2.1 mm DC power connector. Its pin definitions are shown below.



Figure 10. Power Cable Terminal Harness

Pin definitions:

Color	Signal	Typical Value	Range
Red	VCC+	12 V	9 V-36 V
Brown	VCC+	12 V	9 V-36 V
Gray	VCC-	0 V	0 V
Black	VCC-	0 V	0 V

Set the network IP addresses to the following values:

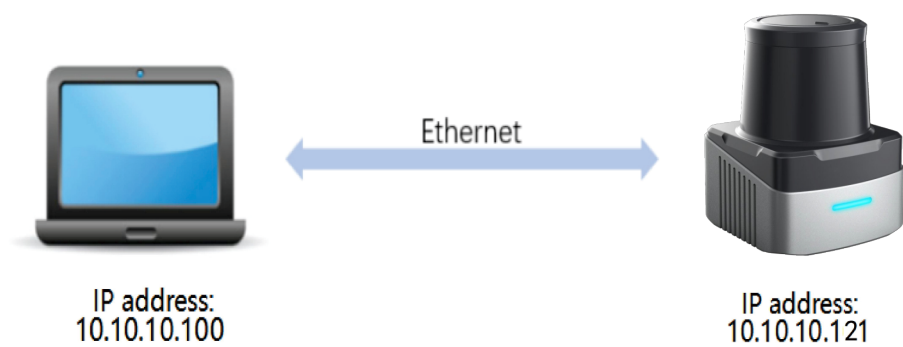


Figure 11. IP Address Settings

4. Software

SimiView software is used to read and configure LiDAR parameters. It also provides a visual interface for viewing and analyzing point-cloud data, making the LiDAR easier to use.

The DLD-50D SDK package provides encapsulation and parsing of LiDAR-related information. Users can rapidly develop custom applications by calling the relevant APIs.

For details, refer to the electronic documents SimiView User Guide and DLD-50D SDK Programming Guide.

5. Data Format

DLD-50D Data Transmission Format

DLD-50D point-cloud data is transmitted over Ethernet in TCP packets. The total length of each TCP packet is automatically negotiated by the network adapter. The data transmission port is 2368. Two packet types are available: packets containing both intensity and distance data (Data Type = 0), and packets containing distance data only (Data Type = 2).

When the packet contains intensity and distance data:

Each revolution of scan data contains $36 + 4N + 8$ bytes. The first 36 bytes consist of an 8-byte packet header marker, a 4-byte protocol version, a 4-byte data length, a 4-byte data flag, a 4-byte data ID, a 4-byte reserved field, a 2-byte data type, a 2-byte angular resolution, a 2-byte start angle, and a 2-byte end angle.

This is followed by $4N$ bytes of point-cloud data. Each point contains 2 bytes of intensity and 2 bytes of distance data. The final 8 bytes consist of a 4-byte timestamp and a 4-byte packet tail marker.

Note: $N = (\text{end angle} - \text{start angle}) / \text{angular resolution}$

The LiDAR output angle range is 40° - 320° . The TCP packet format is shown below.

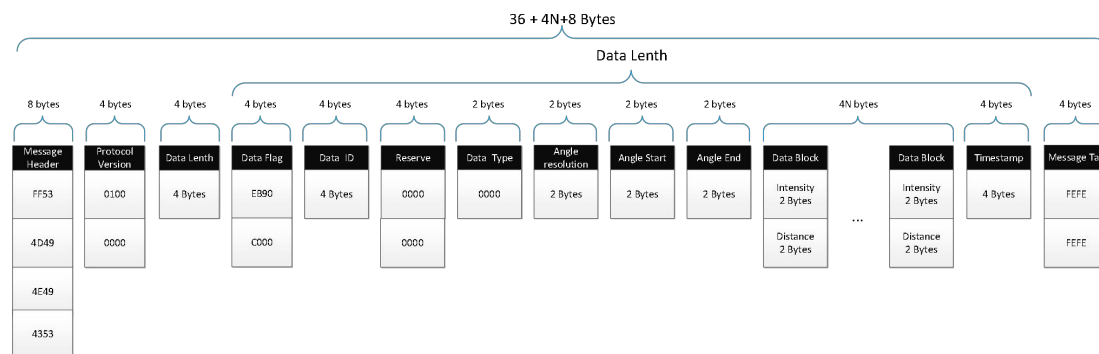


Figure 12. DLD-50D Point-Cloud Data TCP Packet Transmission Format

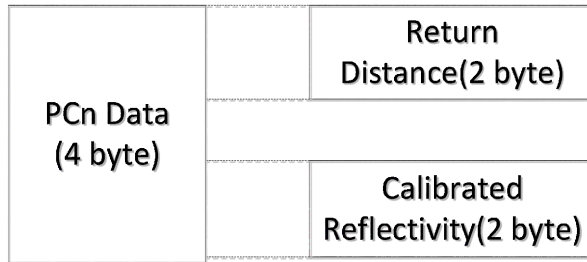


Figure 13. DLD-50D Single Point-Cloud Data Format

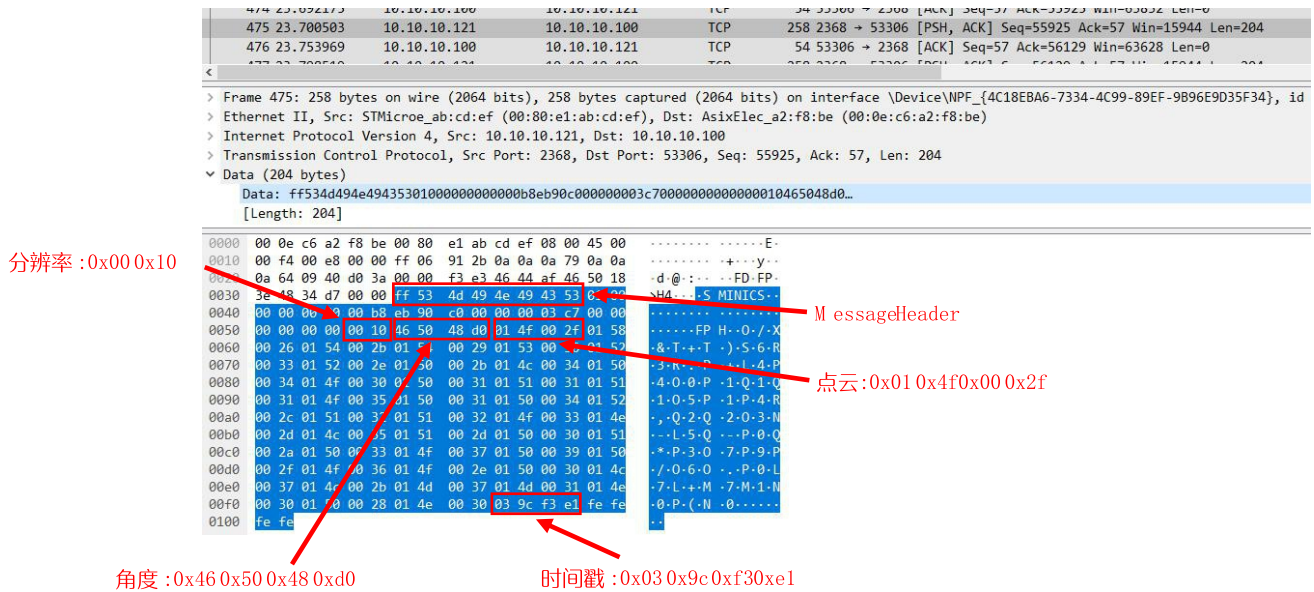


Figure 14. DLD-50D Point-Cloud Data Packet Parsing Example

When the packet contains distance data only:

Each revolution of scan data contains 36 + 2N + 8 bytes. The first 36 bytes consist of an 8-byte packet header marker, a 4-byte protocol version, a 4-byte data length, a 4-byte data flag, a 4-byte data ID, a 4-byte reserved field, a 2-byte data type, a 2-byte angular resolution, a 2-byte start angle, and a 2-byte end angle.

This is followed by 2N bytes of point-cloud data. Each point contains 2 bytes of distance data. The final 8 bytes consist of a 4-byte timestamp and a 4-byte packet tail marker.

Note: $N = (\text{end angle} - \text{start angle}) / \text{angular resolution}$

The LiDAR output angle range is 40°-320°. The TCP packet format is shown below.

6. Data Communication Mode

The DLD-50D discovery process uses UDP broadcast. The host computer broadcasts a LiDAR discovery command. After receiving it, the LiDAR broadcasts its PN, SN, IP address, and port number. The host can also modify the corresponding parameters by sending broadcast commands.

Communication between the LiDAR and host uses passive data upload mode. After normal network communication has been established, the host creates a TCP connection using the LiDAR IP address and sends a data request command to obtain LiDAR data.

Note: For detailed commands, refer to the SDK.

7. Device Physical Parameters

Basic Information			
Product Name	Single-Line TOF LiDAR		
Model	DLD-50DH	DLD-50DC	DLD-50DP
Measurement Characteristics			
Detection Range	0.1-50 m @ 90% reflectivity 0.1-20 m @ 10% reflectivity		
Repeatability	±20 mm	±20 mm	±20 mm
Scanning Range	280°	280°	280°
Angular Resolution	0.08°/0.16°/0.32°	0.08°/0.16°/0.32°	0.32°
Scan Frame Rate	50 Hz	50 Hz	100 Hz
Optoelectronic Characteristics			
Supply Voltage	DC 9 V-36 V		
Operating Current	0.225 A at 12 V, typical		
Laser Source	905 nm, Class 1		

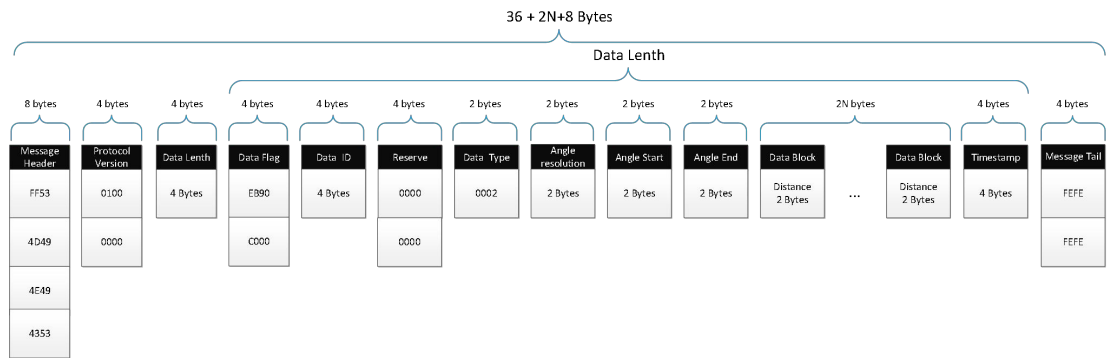


Figure 15. DLD-50D Point-Cloud Data TCP Packet Transmission Format



Figure 16. DLD-50D Single Point-Cloud Data Format

分辨率 : 0x00 0x08

角度 : 0x0f0xa00x11 0x98

时间戳 : 0x06 0x6d 0x53 0x89

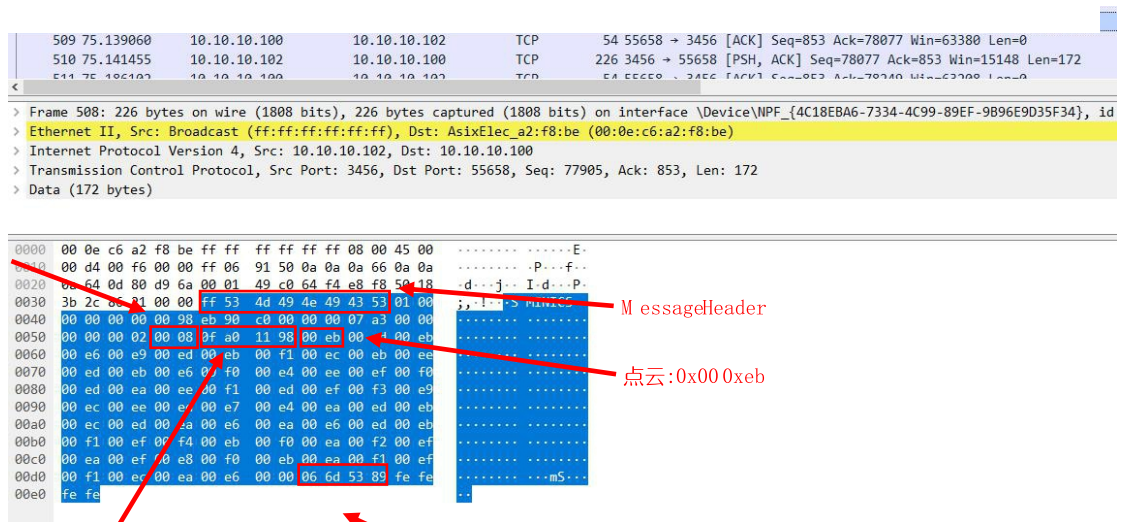


Figure 17. DLD-50D Point-Cloud Data Packet Parsing Example

Extracting and Calculating Angle Information

Each revolution contains one angular-resolution field and two angle fields. The two angle fields have a total length of 4 bytes and a value range of 40°-320°.

The angle is calculated as follows:

1. Extract angular resolution 0x10 and angle bytes 0x46 0x50 0x48 0xd0 from the TCP packet.
2. Convert to decimal: angular resolution 16; angle range 18000-18640.

-
3. Divide by 100 to obtain an angular resolution of 0.16° and an angle range of 180° - 186.40° .

Extracting and Calculating Intensity and Distance Information

Each revolution contains N point-cloud entries. Each entry contains 2 bytes of intensity data and 2 bytes of distance data.

In the point-cloud data field, the first 2 bytes represent intensity. Intensity is a relative value from 0 to 65536. The final 2 bytes represent the distance between the LiDAR and the target. The distance unit is 2 mm.

Intensity and distance are calculated as follows:

1. Extract point-cloud bytes 0x01 0x4f 0x00 0x2f from the TCP packet.
2. Extract intensity bytes 0x01 and 0x4f, and distance bytes 0x00 and 0x2f.
3. Convert to decimal: intensity 335; distance 47.
4. Multiply the distance value by the 2 mm unit to obtain 94 mm.

Extracting and Calculating Timestamp Information

Each TCP packet contains a 4-byte timestamp in the range 0 - $3600 \times 10^6 \mu\text{s}$. It indicates the laser emission time of the final point-cloud entry in the current TCP packet.

The timestamp is calculated as follows:

1. Extract timestamp bytes 0x03 0x9c 0xf3 0xe1 from the TCP packet.
2. Combine the bytes to obtain 0x039cf3e1.
3. Convert to decimal: 60,617,697 μs .

Parameter	Value
Power Consumption, Typical	2.5 W
Other	
Data Interface	Ethernet 100BASE-TX
Startup Time	<20 s
Ambient Light Immunity	>100,000 lx
Operating Temperature	-10°C to 55°C
Storage Temperature	-30°C to 75°C
Service Life	5 years, motor life
Protection Rating	IP67
Dimensions	60 × 60 × 80 mm ³
Weight	148 g, excluding cable

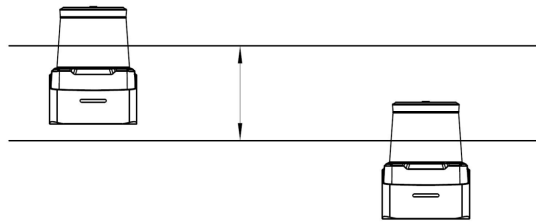


Figure 18. Vertical Installation Diagram (1)

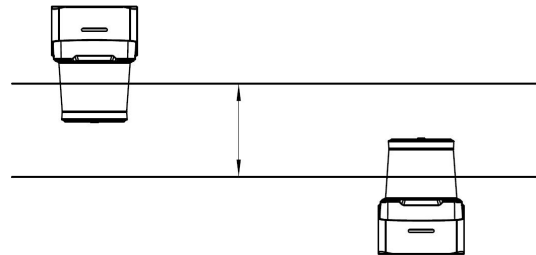


Figure 19. Vertical Installation Diagram (2)

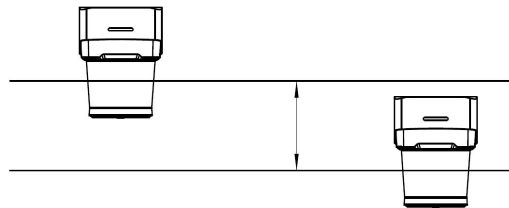


Figure 20. Vertical Installation Diagram (3)

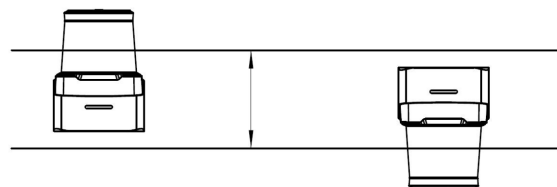
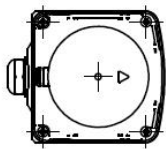
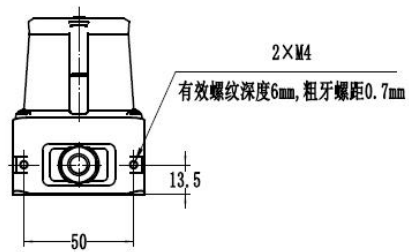
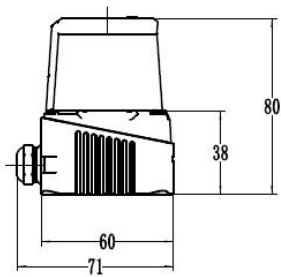
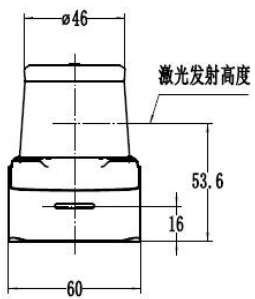
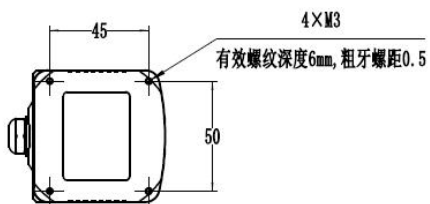
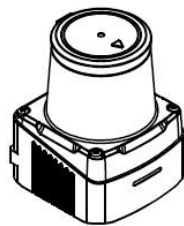
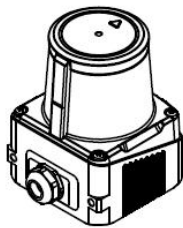


Figure 21. Vertical Installation Diagram (4)

9. Mechanical Dimensions



单位: mm