DADISICK®

LDS2030B5-5S User Manual

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1. Document Description

1.1 Reminder

This manual provides methods and precautions for proper use of the LDS TYPE LiDAR product. In order to use this product safely, users should also pay attention:

- Obey the necessary safety production guidelines.
- Follow the LDS TYPE workplace safety regulations and general safety regulations. This manual is intended for electrical and electronics professionals.

Important note	Before operating the LDS TYPE, please read this manual carefully to familiarize yourself with the features and functions of the LDS TYPE. This manual does not cover the use of other equipment and equipment in the installation and use of the LDS TYPE. If you need this information, please read the documentation for such equipment.

1.2 Content Description

This manual is intended to provide technicians with information on the installation, electrical connections, equipment configuration, and maintenance of the LDS TYPE. Please read the sections of this manual in order. The contents of this manual (in order include:

- Basic operation and precautions
- Product manual
- Product application
- Device installation
- Electrical Installation
- Device Configuration
- Equipment maintenance
- Troubleshooting
- Specifications

Table 1.1 Product basic information

Working environment	Indoor / outdoor
Light source	Infrared laser (905nm)
Laser safety Class	Class 1 (GB 7247.1-2012, human eye safety)
Scan angle range	300° (-60°~+240°)
Scanning frequency	25Hz
Scan angle resolution	0.5°

Measuring range	0.1m~20m
10% reflectance range	15m
Built-in application	Regional monitoring
Operating Voltage	10V~30V DC
Power consumption	3.4W (measurement), 7.6W@DC12V / 6W@DC24V (Heating)
Shell Protection Class	IP67 (GB 4208-2008)
Weight	0.6Kg
Dimension (L × W × H)	80×85×102(mm)
Working temperature range	-25℃~+50℃
Storage temperature range	-30℃~+70℃
Ambient illumination range	0lux – 80,000lux

Important note	For complete technical information, please read "10 Technical Specifications." Please use the "LiDAR Diagnostic and Configuration Software (FILPS)" to diagnose and configure the LDS TYPE. How to use FILPS Please read the "LiDAR Diagnostic and Configuration Software (FILPS) User's Manual".

1.3 Pattern symbol description

This manual uses the following pattern symbols to identify various important precautions. Pay special attention when reading to avoid personal injury and equipment damage.

Danger	**Meaning:** Urgent and dangerous situations, if not guarded, may cause serious personal injury.

Caveat	**Meaning:** Potentially dangerous situations, if not prevented, may cause serious personal injury.

Cautious operation	**Meaning:** Potentially dangerous situations, if not prevented, may result in general personal injury.

Note	**Meaning:** Potentially harmful conditions, if not prevented, may result in equipment damage.
Important note	**Meaning:** Helpful advice and tips for efficient and smooth use of the device.
Main point	**Meaning:** Information about important features of the device.
Explain	**Meaning:** Technical background knowledge.
Instructions	**Meaning:** Can provide more information related documents.
Related Reading	**Meaning:** You need to use the FILPS software to complete the equipment inspection and configuration.

1.4 Extended reading

- Dadisick LiDAR Product Guide: Users can get Dadisick LiDAR product's contrast information, help users complete product selection.
- LDS TYPE Product Manual: Users can obtain complete information about the technology and application of LDS TYPE.
- LDS TYPE Concise User Manual: Users can get basic information about LDS TYPE and how to quickly test LDS TYPE.
- LiDAR Diagnostic and Configuration Software (FILPS): Windows installation package and user manual for FILPS software.
- LiDAR Application Development SDK: The basic C++ code library, Windows dynamic library, demo program, and SDK user's manual for LiDAR application development.

2. Basic operation and precautions

This chapter explains the basic operations and precautions involving personal safety and equipment safety. Please read it carefully before using the LDS TYPE.

2.1 Correct method of use

LDS TYPE is an optical sensor for non-contact distance measurement. It can be used alone, or it can be used on the network. It is mainly used to accurately measure the surrounding environment and target contour, and it can also be used to build safety precautions. Security protection, positioning and navigation applications.

The LDS TYPE can only be operated by professionals and used in a compliant environment.

Important note For the requirements of the LDS TYPE use environment, please read "10.1 Data Book".

2.2 Incorrect usage warning

- LDS TYPE can only be used for safety warning purposes and cannot physically protect personal safety in hazardous environments.
- LDS TYPE cannot be used in hazardous environments with explosive hazards.
- The use of accessories not provided by Dadisick is at the user's own risk.

2.3 Networking instructions

The LDS TYPE uses standard TCP/IP technology for device networking. When actual networking, you need to ensure the following prerequisites:

- Users need to ensure the integrity and confidentiality of the data transmitted on the network.
- Necessary network security measures, such as network isolation, firewalls, and anti-virus software, need to be planned and implemented by users themselves.

2.4 Disclaimer of equipment damage

Dadisick is not liable for equipment damage due to the following reasons:

- Did not read the manual carefully.
- Failure to properly use the equipment as required.
- Operated by unqualified personnel.
- Equipment dismantling without Dadisick approval.
- Modification of equipment without Dadisick approval.
- Technical transformation of the equipment.
- Use self-made accessories.

2.5 Laser radiation instructions

LDS TYPE is measured with an infrared laser with a wavelength of 905 nm. The laser beam is invisible to the naked eye.

Cautious operation	LDS TYPE meets the requirements of a class of laser safety levels as specified in GB 7247.1-2012. Under normal conditions of use, it is harmless to the human eye and the skin. However, incorrect use of the LDS TYPE may bring security risks. The matters are as follows: ● Do not open the cover of the LDS TYPE. The powered LDS TYPE will not stop laser firing when the cover is opened. ● Do not look directly into the laser output side of the LDS TYPE for a long time, especially children, and may cause blindness.

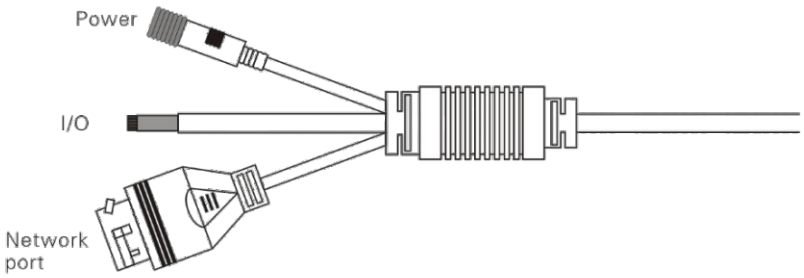
The laser output surface of LDS TYPE is an optical transmissive cover. The laser warning mark is located on the top cover of the device, as shown in "Figure 2.1 Laser output surface and laser warning sign".

Figure 2. 5Laser light output surface and laser warning sign

2.6 Power supply and quick start and stop

The LDS TYPE is powered by the DC002-type circular waterproof power socket in the interface cable on the side of the device, as shown in the “Figure 2.2 Power Outlet”. the power supply voltage is 9V~28V DC, and the power is in normal operation. The power consumption is 5W and the maximum power consumption is 6W. Please use the above standard to provide power when using.

Figure 2. 6 Power Outlet



Important note	Please read "10.1 Data Sheet" for the complete requirements of LDS TYPE for power supply. The user shall comply with local regulations and perform necessary protection of the power supply cable of LDS TYPE to avoid short circuit or overload of the power supply. In addition, an emergency circuit breaker shall be installed on the power supply cable for emergency use. Cut off the power supply quickly.

- Shutdown method: Turn off the power, or unplug the power cable from the power outlet.
- Power on method: Connect the power cable of the power outlet and turn on the power switch.

The device configuration information of LDS TYPE is stored in a non-volatile storage medium. Starting and stopping the device will not cause the loss of this information.

2.7 Maintain

Note	LDS TYPE must be maintained by Dadisick or Dadisick designated agency staff. If repaired by other personnel, it may cause damage to the equipment. Under such circumstances, Dadisick will not be responsible for subsequent maintenance.

3. Product description

3.1 Deliveries

LDS TYPE's product deliverables are shown in Table 3.1 product deliverables list. Table 3. 1 Product deliverables list

Deliverables	qty	unit	Description
Certificate	1	piece	
Warranty Card	1	piece	
 LDS2030B5-5S	1	piece	LiDAR
 LDS-4	1	piece	Side-mounted/sitting composite bracket
 Power Interface	1	piece	Power cable
	1	piece	Standard RJ45 cable
 LDS-1	1	piece	Network cable crystal head waterproof jacket
Hexagonal M4*8 screws, Gasket	1	set	

3.2 Product characteristics

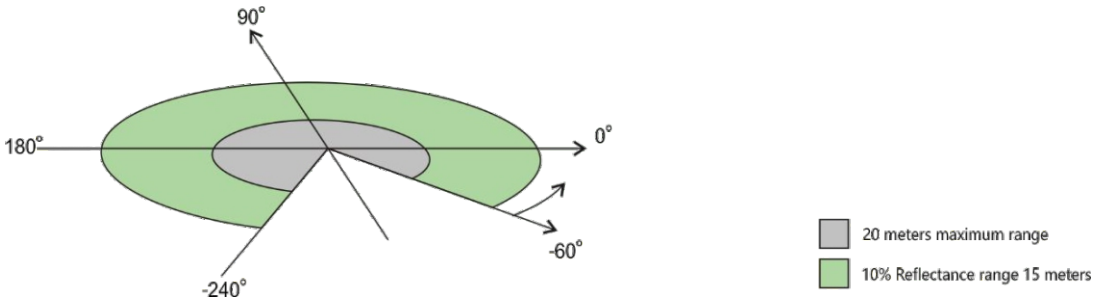
Table 3. 2 Product characteristics

Working environment	● Supply voltage range: 10V~30V DC. ● Low power consumption: 5W.

	● Comprehensive outdoor work ability: anti-dirty, anti-sunlight, support rain and fog penetration. ● IP67 shell protection class ; ● -25°C~+50°C operating temperature range ;
Distance measurement	● Pulsed flight time measurement technology system ; ● 905nm infrared laser measurement, class 1 safety laser (GB 7247.1-2012, human eye safety) ; ● Maximum range is 20 meters, and the 10% reflectance range is 15 meters. ;
Scanning	● Mechanical scanning ; ● 300° scan range, 0.5° scan angle resolution ; ● 25Hz scanning frequency ;
Device interface	● Ethernet interface Function: device configuration / measurement data output / monitoring signal output ● I/O interface Function: peripheral control, area monitoring function operation control and monitoring signal output, Device ready indication
Built-in application	Regional monitoring ● Monitoring mode: point monitoring / target width monitoring / contour monitoring ; ● 16 modifiable preset area groups, support background contour self-learning ; ● Up to 16 concurrent work area groups ; ● Can detect targets of any shape and support normal target self-learning ; ● Disarming and forced alarms via I/O input terminals ; ● Monitor the signal through the I/O output terminal and Ethernet (TCP

	message) output area ; ● Guided network cameras (IPC) for video location and tracking of alarm locations and alarm targets via Ethernet and ONVIF protocols ; ● Support without PC configuration.
Availability reliability	● Anti-sunlight, anti-dirty, with rain and fog penetration ability (optional) ; ● Self-checking capability of equipment failure, including transparent cover, dirty cover, temperature over-standard ; ● Output device self-test information through indicators and TCP packets.

Figure 3.1 Measuring Coordinate System/Scan Range/Range

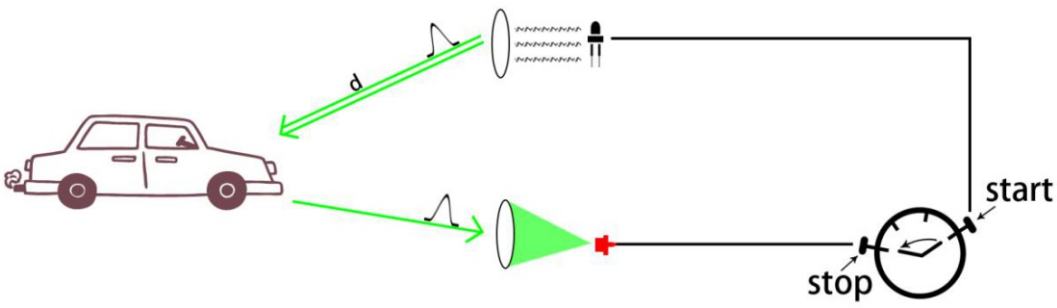


3.3 Operational principle

3.3.1 Distance measurement

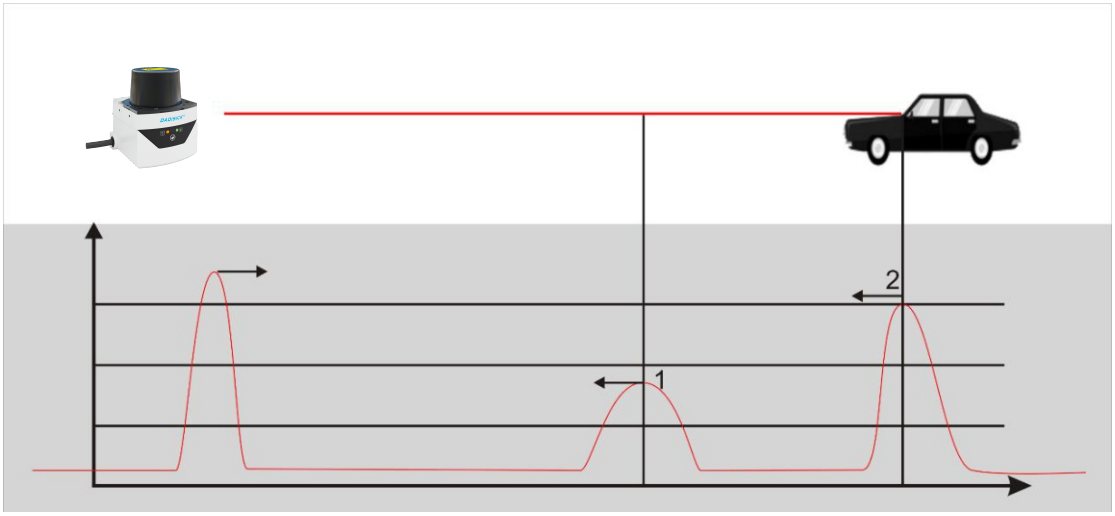
The basic operating principle of the LDS TYPE distance measurement is based on time-of-flight laser ranging. The LDS TYPE emits a laser pulse and measures the time it takes for the pulse to return after being reflected by the surface of the measured target, and then converts it into distance data, as shown in "Figure 3.2 operating principle of time of flight measurement"

Figure 3.2 operating principle of time of flight measurement



LDS TYPE has multiple echo analysis capabilities. In the rain and fog and soot working environment, atmospheric impurities will also reflect the distance measuring laser pulse, forming a reflected echo pulse, and together with the reflected echo pulse of the measured target, reach the photoelectric receiving system. The LDS TYPE analyzes all received reflected echo pulses, rejects interfering pulses, and outputs true measured target distance data, as shown in Figure 3.3 Reflected Echo Filter.

Figure 3. 1 Reflected Echo Filter



3.3.2 Two-dimensional scanning

LDS TYPE passes a 90degree deflection to the range laser pulse through a reflector with an angle of 45 degrees with the original emitter path. The mirror is driven by the motor, and the rotation axis is parallel to the original emitter path, so that the actual distance path is distributed on the scanning plane perpendicular to the axis of rotation, and the azimuth angle of the range is rotated with the motor. The azimuth angle is the same, thus the two-dimensional optical scanning is realized, and the distance between the points on the cross section of the range scanning plane can be obtained, such as "Figure 3.4 scanning measuring mechanism" and "figure 3.5 two-dimensional cross section scanning". LDS TYPE uses a specific TCP network message to provide users with two-dimensional scanning data with fixed scan frequency through Ethernet port.

Figure 3.4 scanning measuring mechanism

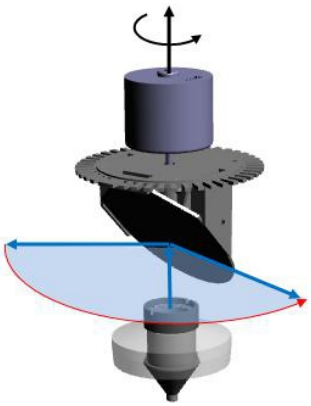
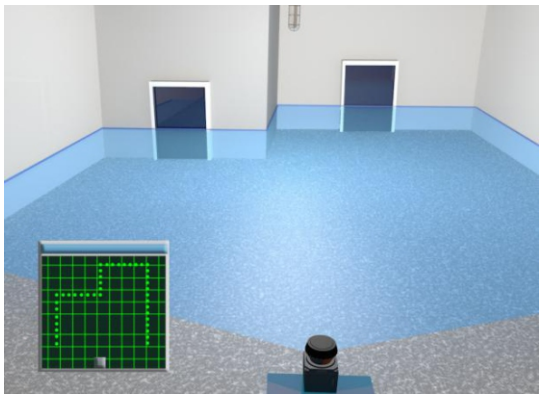


Figure 3.5 two-dimensional cross section scanning



3.3.3 Scene measurement and regional monitoring

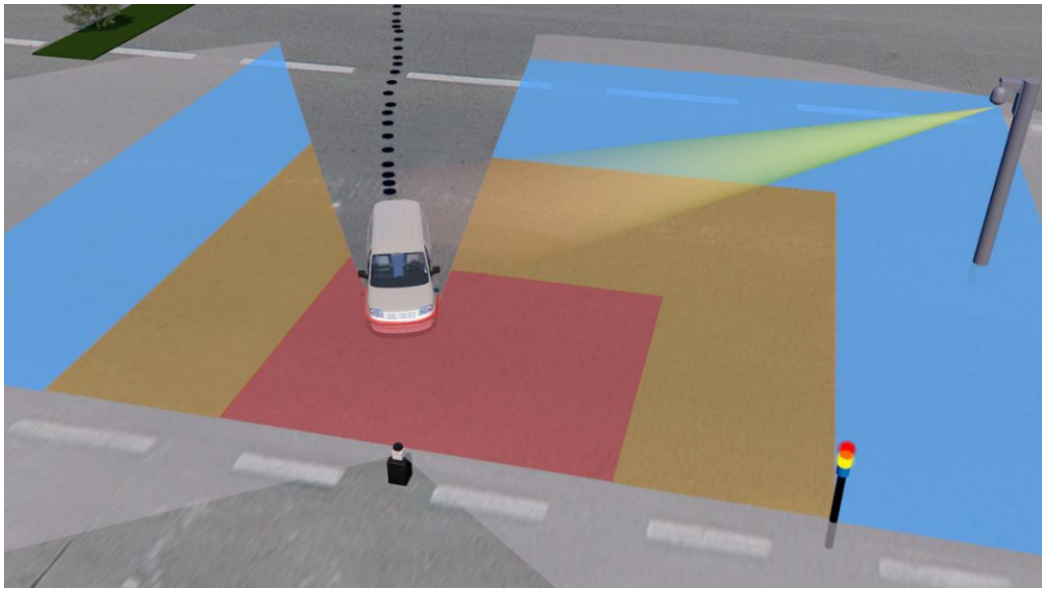
By analyzing and processing the distance data obtained from two-dimensional scanning, the application system can measure and monitor the scene, detect and locate various targets in the scene, measure its appearance, and implement scene analysis through intelligent algorithms. The target is subject to spatio-temporal domain tracking, type identification, and behavior analysis. Finally, the analysis results are output according to application requirements, such as alarm, sorting, and guidance.

The LDS TYPE has a built-in area monitoring function that enables perimeter protection, intrusion detection, contour monitoring and other functions, as shown in "Figure 3.6 Area Monitoring Function". The area monitoring function can be configured via the "LiDAR Diagnostic and Configuration Software (FILPS)"or the monitoring arming conditions can be set via the I/O input terminals. The monitoring results are output via TCP network messages and also through the LDS TYPE. -300 I/O output terminals for real-time output.

The LDS TYPE incorporates an IPC control module that supports the ONVIF protocol. It can directly guide the IP camera through the Ethernet port to perform video positioning and tracking of alarm locations or monitored targets.

The LDS TYPE's built-in zone monitoring also supports PC-less configuration mode. You can use the I/O input terminals to select built-in monitoring area groups of different shapes and sizes. You can also execute the background self-learning function through the front panel operation buttons to automatically adapt the LDS TYPE to the current use environment. Equipment configuration can be completed and put into use. The no-PC configuration mode provides flexibility in use for security applications in mobile applications and industrial sites.

Figure 3.6 Area Monitoring Function



3.4 Device interface

The interface cable on the side of the LDS TYPE is a composite cable with a length of 1 meter. There are three external interfaces, including “power interface”, “Ethernet interface” and “I/O interface”, such as “Figure 3.7 Device interface. "The type of each interface is as shown in "Table 3.3 Device Interface", and the interface signal definition is as shown in "Table 3.4 Device Interface Signal Definition".

Figure 3.7 Device interface

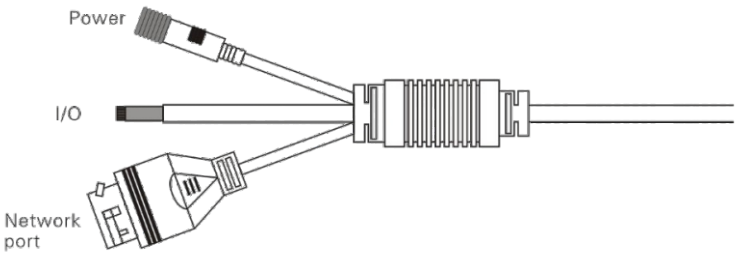


Table 3. 3 Device Interface

Outlet	Type	Core qty
Power interface	DC002 type, Female	2
Ethernet interface	RJ45 socket	4
I/O interface	9-core lead	9

Related Reading Please read "10.1 Data Sheet" for the electrical characteristics of each socket.

Table 3. 4 Device Interface Signal Definition

Interface	Signal	Explanation
Power interface	Vs	Power
	GND	GND
Ethernet interface	RX+	Data reception positive end
	RX-	Data receiving negative end
	TX+	Data reception positive end
	TX-	Data receiving negative end
I/O interface	IN1	Universal input 1# positive end
	IN2	Universal input 2# positive end
	IN3	Universal input 3# positive end
	IN4	Universal input 4# positive end
	GND IN	Universal input GND
	OUT1	Universal output 1# positive end
	OUT2	Universal output 2# positive end
	OUT3	Universal output 3# positive end
	OUT4	Universal output 4# positive end

Related Reading For signal definitions for each outlet, read "6.3 Device Interface Signal Definitions."

3.5 Equipment control and operating status display

3.5.1 Equipment control method

After the LDS TYPE is powered on, it automatically enters the operating state according to the current configuration of the system without intervention. If you need to control, configure, or query the running status of LDS TYPE, there are three ways:

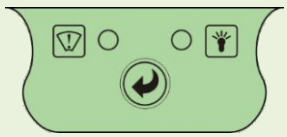
- Diagnostic and Configuration Software (FILPS): FILPS interacts with the LD STYPE using TCP messages via the Ethernet interface for comprehensive configuration and operational control of the LDS TYPE. Please read "7 Device Configuration" for details. And test run test".
- Front panel SLR operation button : Use SLR operation button to start the background self-learning and delete the background two functions, please read "3.6.3 front panel operation button" for details.
- I/O input terminal: By entering an effective control level to the I/O input terminal, control functions such as area monitoring disarming and forced alarming can be realized. For details, please read “4.5 I/O Interface Operation Instructions and

Application Development".

3.5.2 Indicator light Indicator

After the LDS TYPE starts working, the basic operating status is displayed by the indicator on the front panel. The meaning of each indicator is shown in Table 3.5 Indicator Description.

Table 3. 5 Indicator Description

		Description
	ERR	Work fault indicator ◆ startup status: bright (About 27s) ◆ Off: No fault ◆ Steady light: Internal fault ◆ Long flicker (0.5 Hz): High temperature / low temperature alarm ◆ Short flicker (1Hz): Transmissive cover is dirty/occluded
	HTR	Work status indicator ◆ Startup state: off ◆ Off: The device does not start measurement/ready to reboot ◆ Bright: Normal measurement of equipment ◆ Flashing 1 (0.5Hz): Monitor signal output ◆ Flashing 2 (1Hz): Self-learning* ◆ Flashing 3 (2.5Hz) : Ready for self-learning*

* : Including "background self-learning" and "normal goal self-learning".

3.5.3Front panel operation buttons

After the LDS TYPE starts working, the self-learning function can be realized through the SLR operation button on the front panel. The definition of each operation is shown in "Table 3.6 Front Panel Operation Button Operation Instructions".

Figure 3.9 Front Panel SLR Operation Buttons

Table 3. 6 Front Panel Operation Button Operation Instructions

Press duration	Functional definition	Operating	Device status	Indicator

1s - 5s	Start background self-learning	Press (1s — 5s)	Ready to start background self-learning	Flicker 3
		Release (0s — 6s)	Ready to start background self-learning	Flicker3
		Release (6s — 12s)	Background self-learning	Flicker2
≥5s	Delete background	Press (≥5s)	Prepare to restart the device	Light off
		Release	Device restart	No influence

Main point	After the LDS TYPE enters the "Ready to start background self-learning" and "Start self-learning" states, if the SLR operation button is pressed, the background self-learning will continue until completion, and the button operation will not work.

4. Applications

4.1Technical Application

In practical applications, the measurement range and measurement effect of LDS TYPE are affected by many environmental factors. Special attention must be paid to these factors and effects, and appropriate measures must be taken to deal with them.

4.1.1Actual range

The actual measurement of a specific target by the LDS TYPE is affected by the following factors:

- Actual diffuse reflectance: The actual diffuse reflectance of the portion of the target surface that is illuminated by the measuring laser spot emitted by the LDS TYPE. The actual diffuse reflectance is not only related to the material but also related to the surface orientation. The higher the actual diffuse reflectance, the farther the actual range becomes.
- Reflection area: The area of the target surface covered by the laser spot. The larger the coverage area, the farther the actual measurement distance is.
- Transmissive cover contamination degree: LDS TYPE's translucent cover will cause the light transmission performance to decline, the more light transmission performance will decrease, the worse the measurement capability, the light transmission rate will drop to 60%. The ability may completely fail.
- Atmospheric conditions: The actual measurement capability of the LDS TYPE is also affected by atmospheric conditions, especially when working outdoors. The worse the light transmission capability of the atmosphere, the lower the actual measurement capability of the LDS TYPE. In extreme weather conditions (such as dense fog), the measurement capability completely fails.

Main point

When using LDS TYPE to set up an application system, it is necessary to set the working range of LDS TYPE based on a comprehensive consideration of various application requirements. These factors include:

- The minimum actual diffuse reflectance and minimum size of the target that needs to be found.
- The cleanliness of the LDS TYPE work environment, and whether it can be maintained in a timely manner, such as cleaning the translucent cover.

4.1.2 The relationship between spot diameter and target size

The laser beam emitted by the LDS TYPE has a certain divergence angle. The

relationship between the spot diameter r and the measurement distance d of the LDS TYPE at a specific measurement distance is:

$r = r_0 + \alpha \cdot d$

among them:

r_0 is the spot exit aperture, for LDS TYPE , r_0 = 0.008m .

α is the divergence angle of the spot, for LDS TYPE, α = 0.0125

Instructions	The farther the measurement distance is, the larger the spot diameter is. For a specific target, the probability of the spot completely hitting the target surface is lower, and the effective reflective area ratio of the target surface is lower. Therefore, for a target with the same actual surface diffuse reflectance, the smaller the target size, the closer the actual range will be.

4.1.3 Rain fog and dust penetration

When the fog and dust penetration function is turned on, the LDS TYPE will filter the weak reflection measurement data within a certain distance so as to avoid the measurement result triggered by the mist and dust to replace the measurement result of the real target over a longer distance, such as Figure 3.3 Reflected Echo Filtering, but this also makes the LDS TYPE target with a very low overall reflectivity (eg, less than 5%) at close range (eg, 2-4 meters)or The ability to measure small targets (such as flying insects, linear targets drops or fails.

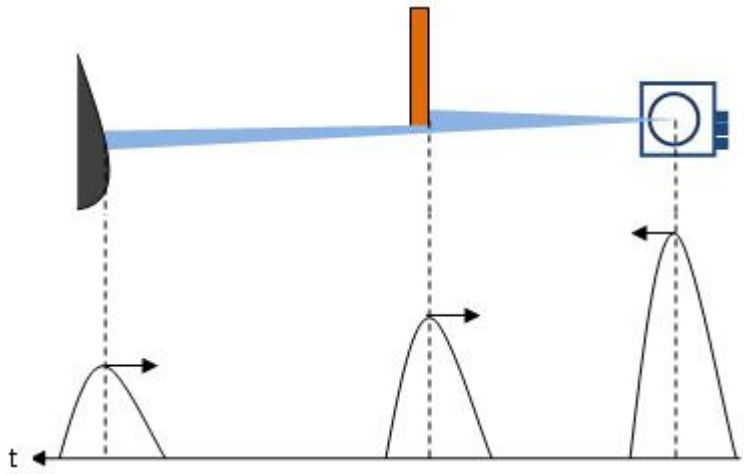
Software operation	For the opening and closing of the fog and dust, please read the manual of "laser LiDAR diagnosis and configuration software (FILPS)" section 6.3 "running configuration parameters".

Main point	It is necessary to choose carefully according to the application requirements if the rain fog and dust penetration function is started.

4.1.4 Pseudo edge point

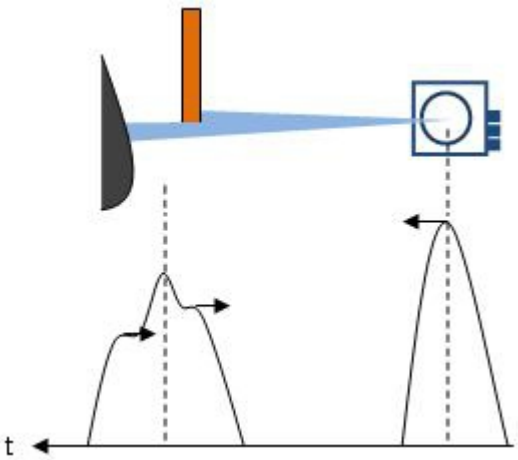
When the laser spot hits the target edge, LDS TYPE also receives two reflection echoes, one from the target surface and the other from the same angle, as shown by the "figure 4.1 edge point measurement".

Figure 4.1 edge point measurement



If the distance between the target and the background is close, the two echo echoes will overlap each other, which will lead to the inaccuracy of the measurement and the "pseudo edge point", which is far farther away than the actual distance from the target edge, as shown by the "Figure 4.2 pseudo edge point". The difference between the measured values and the real values of the pseudo edge points may reach 15cm.

Figure 4.2 pseudo edge point



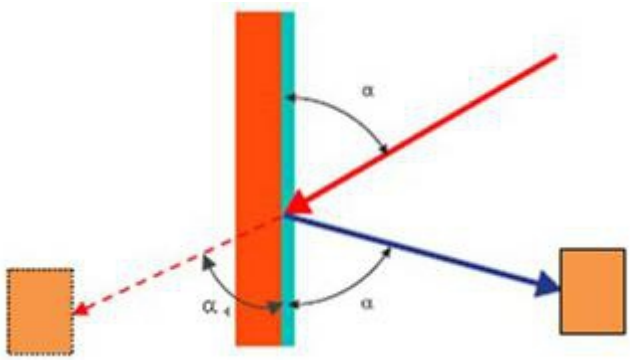
Main point	The false edge points will have a certain influence on the accurate location of the target. In a class of applications that need accurate positioning of the target, special treatment should be done to the target edge points.

4.1.5 Mirror target

When measuring the mirror target, only when the target surface is perpendicular to the incident laser can be measured effectively. If the incident angle of the laser is not vertical and the diffuse reflectance is very low, it can not be effectively measured. The actual measurement result is the mirror target distance of the mirror reflecting light path,

as shown in "Figure 4.3 mirror measurement".

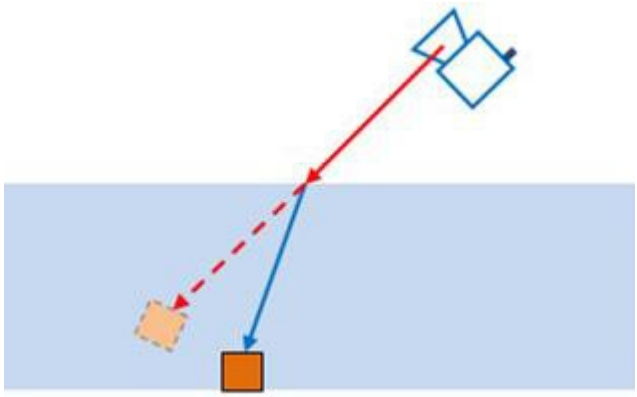
Figure 4.3 mirror measurement



4.1.6 Transparent medium

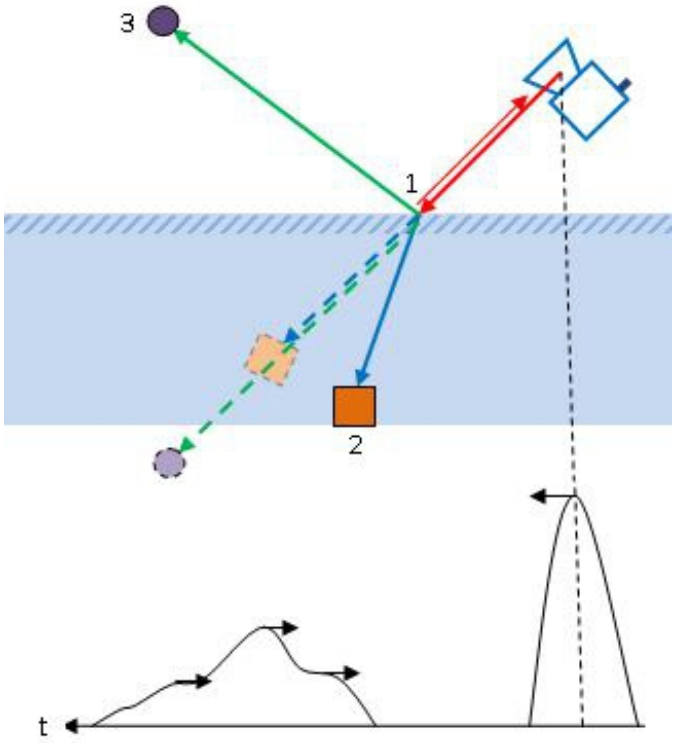
When there is a transparent medium in the surrounding environment (such as clean water), the target located inside or behind the transparent medium can be measured. Due to the refraction of light in the transparent medium, the measured target is in the light path of refraction, and the measurement result is on the straight line. The measured target position will be deviated, such as "Figure 4.4 transparent medium measurement".

Figure 4.4 transparent medium measurement



In addition, the LDS TYPE may also receive two reflected echoes, one from the actual target surface inside or behind the transparent medium, and the other from the diffuse reflection from the surface of the incompletely clean transparent medium. The measurement results at this time are indefinite and may be the surface of the medium or the actual target. If the surface of the transparent medium is close to a mirror (for example, glass), a third reflected echo may be generated because the measuring laser pulse emitted by the LDS TYPE may be reflected and hit other targets on the reflected light path. Echoes may form complex mutual overlapping relationships based on the length of the actual optical path, resulting in indeterminate measurement results, as shown in "Figure 4.5 Specular Transparent Media Measurement."

Figure 4.5 Specular Transparent Media Measurement.



Main point	In practical use, transparent media in the environment, especially transparent media with a mirror-like surface, need to be specially treated to avoid unstable or erroneous measurement results. The specific processing method may be to do diffuse reflection semi-transparent treatment on the surface of the media, to reduce the transparency and reflection ability, or to shield these positions when processing the measurement data.

4.1.7 Strong light interference

Main point	If the transmissive cover of the LDS TYPE is continuously illuminated by a strong light source parallel to the scanning surface, the target reflection echo within the illuminated scanning range may be flooded by the incident light, and the incident strong light may also trigger. Measurements that produce erratic, incorrect measurement results that can lead to measurement failures, may also cause false alarms for devices that “transparent masks are dirty”. In the actual deployment, such situations should be avoided.

4.2 Application System Development Overview

The LDS TYPE is a measurement single-layer scanning laser LiDAR that combines cost-effectiveness and ease-of-use. It is designed for indoor applications and can also support low-degree outdoor applications. For AGV obstacle avoidance under moving installation conditions, collision avoidance applications for work vehicles, and safety protection applications under static installation conditions, the technical specifications of LDS TYPE can ensure that the application requirements are met. At the same time, the small device size and targeted interface design of the LDS TYPE also facilitates integration in application systems.

When using LDS TYPE to develop the application system, the application system and LDS TYPE interact mainly through the Ethernet interface in the way of UDP broadcast message and TCP message, use the acquired information to carry on the follow-up processing, and control the LDS TYPE to complete the application requirement. The functions that can be accomplished include:

- Get the configuration information of LDS TYPE.
- Get distance measurement data and equipment operating status.
- Read and control the I/O port.
- Regional monitoring functions, monitoring information, etc.
- According to the application requirements, the measurement data and monitoring information are processed by applying an algorithm.

The network messages used by the LDS TYPE are shown in Table 4.1 Application Development Network Messages. These messages are defined in detail in the LiDAR Application Development SDK.

Related Reading	For more information on network message, please read Section 4, “LIM Overview” of the Lidar Application Development SDK User's Manual.

Main point	For applications with high real-time requirements, the LDS TYPE I/O interface input/output terminals can be used directly to complete alarm control, alarm warning and peripheral control. for AGV and industrial field safety protection applications, it is also possible The built-in monitoring area group is selected through the I/O interface input terminals to achieve no PC configuration. For the function and application development of the I/O interface, please read "4.5 I/O Interface User's Guide and Application Development."

Table 4. 1 Application Development Network Packets

Function	Message type code	Initiator	Response message
Heartbeat	LIM_CODE_HB	Application client	LIM_CODE_HBACK
Heartbeat reply	LIM_CODE_HBACK	LDS TYPE	none
Measurement data	LIM_CODE_LMD	LDS TYPE	none
Request measurement data	LIM_CODE_START_LMD	Application client	LIM_CODE_LMD
Stop measuring data	LIM_CODE_STOP_LMD	Application client	none
Query area monitoring signal	LIM_CODE_FMSIG_QUERY	Application client	LIM_CODE_FMSIG
Regional monitoring signal	LIM_CODE_FMSIG	LDS TYPE	none
Query I/O status	LIM_CODE_IOREAD	Application client	LIM_CODE_IOSTATUS
Set the I/O output status	LIM_CODE_IOSET	Application client	LIM_CODE_IOSTATUS
Release I/O settings	LIM_CODE_IOSET_RELEASE	Application client	LIM_CODE_IOSTATUS
I / O state	LIM_CODE_IOSTATUS	LDS TYPE	none
Equipment alarm	LIM_CODE_ALARM	LDS TYPE	none
Device cancel alarm	LIM_CODE_DISALARM	LDS TYPE	none
Device configuration information	LIM_CODE_LDBCONFIG	LD STYPE	none
Start device configuration information	LIM_CODE_START_LDBCONFIG	Application client	LIM_CODE_LDBCONFIG

broadcast			
Stop device configuration information broadcast	LIM_CODE_STOP_LDBCONFIG	Application client	none
Get device configuration information	LIM_CODE_GET_LDBCONFIG	Application client	LIM_CODE_LDBCONFIG

4.3 Network configuration and device detection

4.3.1 Device configuration information broadcast

After LDS TYPE starts up, it will automatically broadcast its own configuration information to the following broadcast address and UDP port number: 237.1.1.200:2111

The type code of the device configuration information broadcast message is: LIM_CODE_LDBCONFIG

The application system can listen to the device configuration information broadcast message at this address and port, obtain the configuration information of the LDS TYPE that has gone online, and establish a TCP connection with it. After the TCP connection is established, a "Stop Device Configuration Information Broadcast" message (type code LIM_CODE_LDBCONFIG_STOP) can be sent to the LDS TYPE, Meanwhile, the LDS TYPE stops the configuration information broadcast, and it can also send a "Startup device configuration information broadcast" message (type code: LIM_CODE_LDBCONFIG_START) to the LDS TYPE. and LDS TYPE Start the configuration information broadcast again.

Related Reading

For more information about configuring the broadcast message, see Section 9 “Device Configuration Messages” of the Lidar Application Development SDK User Manual.

Software operation

FILPS automatically listens to the online LDS TYPE and lists all online Dadisick lidar devices in the "Online Device" form. After double-clicking the device entry to establish a TCP connection with LDS TYPE, you can modify the Ethernet configuration on the "Device Configuration" tab.

4.4 Regional monitoring function and application development

The LDS TYPE has a built-in area monitoring function that can independently perform some common area monitoring applications such as AGV obstacle avoidance, intrusion detection, and target care. Correctly using the built-in area monitoring function of LDS TYPE can effectively reduce the system complexity and reduce the cost of system construction.

This section explains the concepts, working principles, methods of use, and application development of the regional monitoring function.

4.4.1 Operating principle

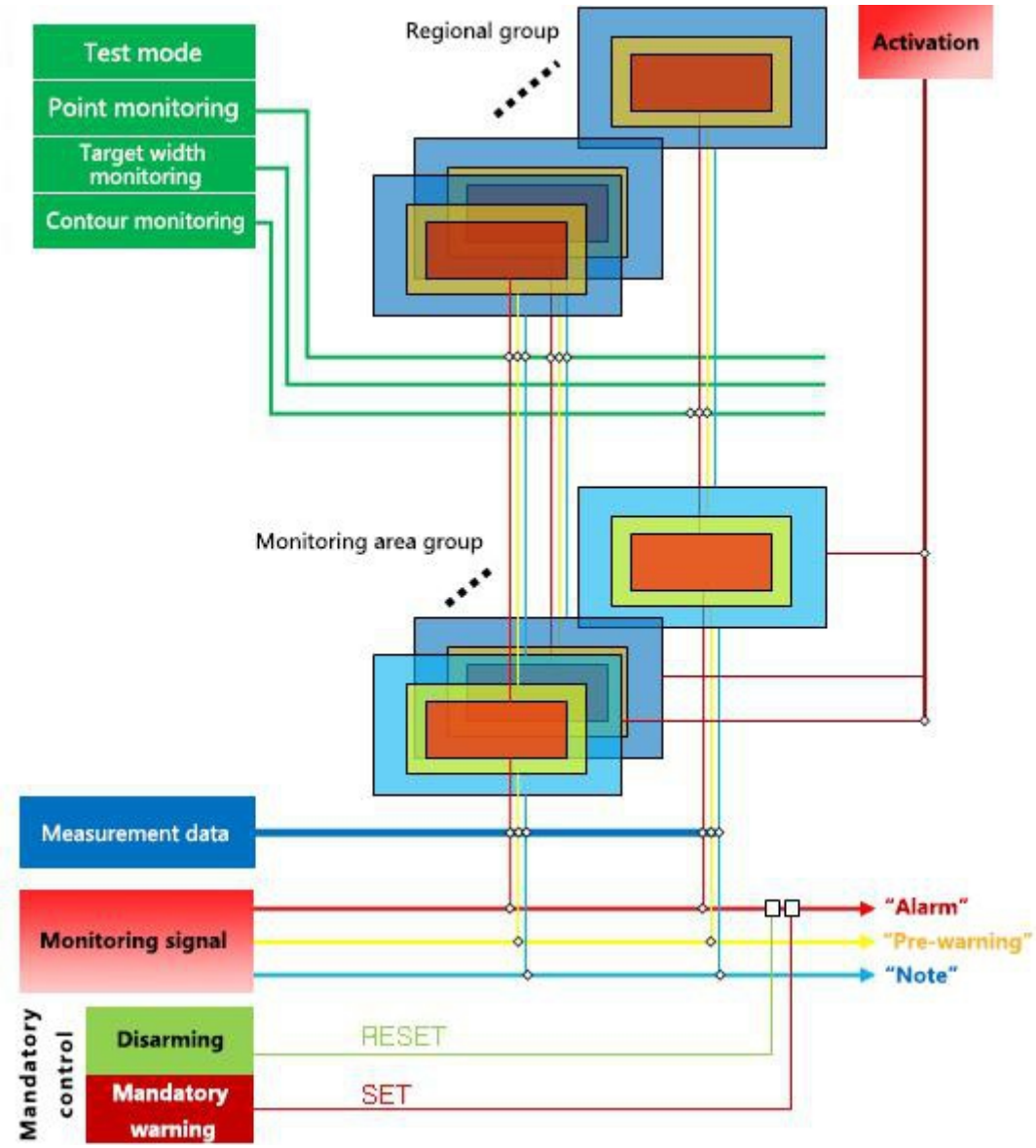
The basic mode of regional monitoring function is "regional group + monitoring mode": binding a monitoring model in a regional group to form a "monitoring regional group". After the monitoring zone group is "activated", it starts to work, processes the scene measurement data, generates different "monitoring signals", and outputs them through TCP messages and I/O output ports. multiple activated monitoring zone groups can work simultaneously. The final output of the monitoring signal can also be forced to control. As shown in "Figure 4.6 Area Monitoring Function Operation".

Software operation	You can use the FILPS software to configure the LDS TYPE's area monitoring function. For usage, please read Chapter 8 “Zone Monitoring Configuration” of the “Lidar Diagnostic and Configuration Software (FILPS) User's Manual”.

Main point	In the factory setting, the area monitoring function is activated.

Related Reading	For details on the TCP packets for the area monitoring function, please read Section 6 “Region Monitoring Packets” of the “Lidar Application Development SDK User's Manual”.

Figure 4.6 Area monitoring function operating principle



4.4.2 Regional groups and monitoring regional groups

Instructions

The LDS TYPE's area monitoring function is based on regional group work, Each regional group consists of three regions, which are the “attention zone”, “pre-warning zone” and “alarm zone”, Produce "attention", "pre-warning" and "alarm" monitoring signals respectively, And output through TCP messages and I/O output terminals. In general, the "attention zone" contains the "pre-warning zone" and the "pre-warning zone" contains the "alarm zone," as shown in "Figure 4.7 Zone group".

In the area group shown in "Figure 4.7 Zone Group", The rectangular area group and

the sector area group are the area groups of the system's built-in shape. The user can use FILPS software to adjust the shape parameters and fine-tune the edge to obtain the desired area group. The custom area group is a group of polygon regions that are manually drawn by the user using the custom zone group function of the FILPS software, and can also finely tune the edges after drawing.

Related Reading

For the editing and drawing methods of the zone group, please read Section 8.5 “Region Editing” of “Lidar Diagnostic and Configuration Software (FILPS) User's Manual”.

The LDS TYPE incorporates four preset groups of zones with different shapes, sizes, and locations, such as "Table 4.2 Preset Zone Groups" and "Table 4.3 Preset Zone Group Basic Parameters". When it is actually used, you can select from these four groups of regional groups as needed, use the FILPS regional group shape edit function to edit and modify, or you can create new desired area groups.

Figure 4.7 Regional Groups

Instructions

After binding one monitoring mode to each regional group, a monitoring zone group is formed and can be activated and put into operation. The LDS TYPE can have up to 16 monitoring zone groups that work concurrently.

Related Reading

You can use the FILPS software to activate the LD TYPE's monitoring zone group. For usage, read "Lidar Diagnostic and Configuration Software (FILPS) User's Manual," Section 8.6, "Regional Monitoring Function Operation Configuration".

Table 4. 2 Preset zone groups

Regional group No.	shape	Alarm area shape parameters		
		Central location	Alarm area length / radius	Angle range
0	rectangle	(0, 50)	100cm x100cm	

1	sector		100cm	[0°, 180°]
2	Polygonal		Pentagon	
3	Circular		100cm	

Table 4. 3 Preset Zone Group Basic Parameters

Parameter Name		Setting value	Explanation
Shielding radius		20cm	The minimum radius of the close-proximity zone. Targets smaller than this distance do not generate monitoring signals.
Warning area buffer distance	rectangle (0#)	50cm(up) / 0(down) / 20cm(left) / 20cm(right)	The buffer distance from the edge of the warning zone to the edge of the alarm zone.
	sector(1#)	50cm	
	Circular (3#)	50cm	
Attention area buffer distance	rectangle (0#)	100cm(up) / 0(down) / 40cm(left) / 40cm(right)	The buffer distance from the edge of the attention zone to the edge of the alarm zone.
	sector(1#)	100cm	
	Circular (3#)	100cm	

4.4.3 Monitoring area group selection mode

There are two modes for selecting and activating LDS TYPE monitoring area group , they are :

- I/O input: Use IN1~IN4 to select one of the 16 monitoring area groups and activate them. Please read "4.5.1 I/O Input Terminal Function Definitions" for usage.
- FILPS: Use FILPS software to select one or more of the 16 monitoring zone groups and activate them. For usage, read “Lidar Diagnostic and Configuration Software (FILPS) User's Manual” in Section 8.6 “Regional Monitoring Function

Operation Configuration".

Main point	In the factory setting, the monitor area group selection mode of the area monitoring function of the LDS TYPE is "I/O input".
Software operation	You can use the FILPS software to set the monitor zone set selection mode of the LDS TYPE. For usage, read "LiDAR Diagnostic and Configuration Software (FILPS) User's Manual" in Section 8.6 "Regional Monitor Function Operation Configuration".

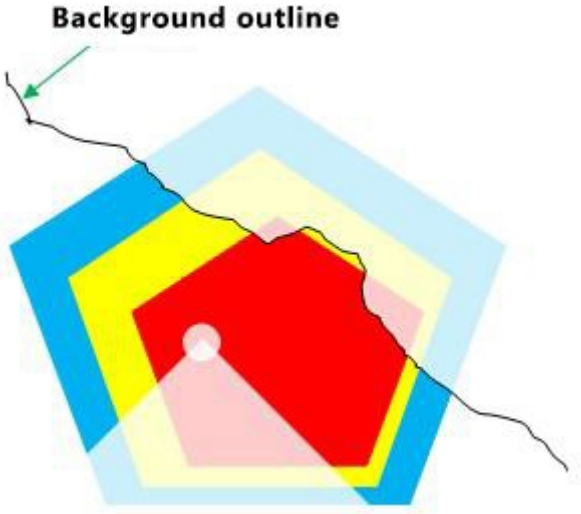
4.4.4 Background self-learning and zone group background tailoring

In the actual application of the area monitoring function, it is necessary to edit and draw the specific shape of the area group according to the use scene, so as to avoid triggering the monitoring signal of the fixed background target entering the monitoring area. This work is the largest part of the regional monitoring function configuration workload. It also has a great influence on the use of regional monitoring.

The LDS TYPE's area monitoring function has "background self-learning" function and "regional group background tailoring" function. Using these two functions can significantly reduce the workload of drawing area groups and improve system configuration efficiency.

Instructions	• Background self-learning: The current scene is measured for a period of time, and a stable, referenceable background profile is generated based on the accumulated measurement data. the generated background can be deleted. • Regional group background tailoring: The activated monitoring area group can enable the "Region group background trimming" function, and use the background outline to trim the edited shape area group to generate the final used area group, such as "Figure 4.8 Background self-learning and area group background trimming". Shown. • After "background self-learning" is completed, the "background trimming function" function can be enabled for all activated monitoring area groups.

Figure 4.8 Background self-learning and area group background trimming



Main point	When the monitoring zone group selection mode is set to "I/O input", the "background trimming" function of the activated monitoring zone group is automatically enabled.

Related Reading	How to use the “background self-learning”, “deleting background” and “background trimming” functions please read “Lidar Diagnostic and Configuration Software (FILPS) User's Manual” in Section 8.7 “Background Learning” and Section 8.6 “Regional Monitoring Function Operation”. Configuration".

4.4.5 Monitoring mode

The LDS TYPE has three built-in monitoring modes. Their respective functions, conditions of use, monitoring signals output, and parameters used are shown in "Table 4.4 Monitoring Modes and Parameters."

Table 4. 4 Monitoring Modes and Parameters

Monitoring Mode	Function Description	Monitoring signal	Parameter Description		
			Parameter	Unit	Default value
Point monitoring	Count the number of target points entering the area. If the number of target points exceeds the set number threshold and the time exceeds the set	Attention Pre-warning Alarm	Number of points	pcs	6
			duration	Scan cycle	0

	response time threshold, the monitoring signal is output.				
Target width monitoring	Detecting the target of the entering area, if there is a target whose width exceeds the set width threshold, and the existence time exceeds the set response threshold, the monitoring signal is output.	Attention Pre-warning Alarm	Target width	cm	6
			Existence time	Scan cycle	0
Contour monitoring	Detect the integrity and stability of the background contour lines obtained from the self-learning in the monitoring area group. If the background contour line exceeds a change in the set fluctuation distance threshold, and the total length of the fluctuation exceeds the set variation length threshold, and the duration exceeds the set response threshold, an alarm signal is output.	Alarm	Change distance	cm	20
			Change length	cm	6
			Existence time	Scan cycle	0

Main point	In the factory setting of LDS TYPE, the preset monitoring mode for each zone group is "Target Width Monitoring".

Software operation	For monitoring mode selection and parameter adjustment methods, please read “LiDAR Diagnostic and Configuration Software (FILPS) User's Manual” in Section 8.6 “Regional Monitoring Function Operation Configuration”.

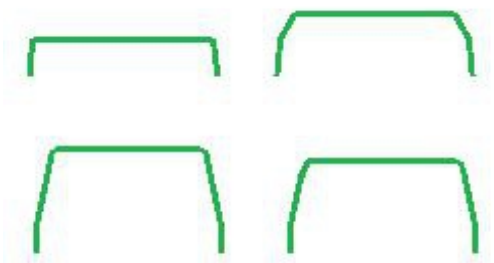
4.4.6 Normal target self-learning and exclusion

If the monitoring mode of a monitoring area group is “target width monitoring”, the “normal target self-learning” function of the area monitoring function can be enabled for the normal objects of a specific shape appearing in a specific position in the “attention” monitoring area. Exclude normal targets and avoid unnecessary monitoring and control actions.

Description	● “Normal target self-learning”: The current scene is measured for a period of time, and the normal target that enters the specific location of the monitoring area and the specific shape is detected, and a normal target contour database is generated based on the accumulated normal target contour measurement data, as shown in FIG. 4.9. Normal target self-learning is shown. ● **“**Normal Target Exclusion**”**: After the “Normal Target Self-learning” is completed, whenever the intrusion target is detected in the monitoring area, the position and contour of the intrusion target are compared with the normal target database. If it is found to be a normal target, then Does not generate monitoring signals. ● All activated monitoring zone groups can be enabled with "normal target self-learning" and "normal target exclusion" functions.

Figure 4.9. Normal target self-learning

Normal target



Normal target profile database

4.4.7 Forced control

If the monitoring area group selection mode is set to “FILPS”, the area monitoring function can be controlled through the I/O input terminal of LDS TYPE. The control modes include:

- Disarming: Temporarily disable the area monitoring function. The I/O terminal is IN1 and the high level is valid. At this time, the “alarm” monitoring signal output of the area monitoring function is shielded, and the “alarm” monitoring signal continues to be invalid. When IN1 goes low, the output of the "alarm" monitor signal is restored. Can be used to shield the "alarm" monitoring signal output in a safe condition by an external identification device, such as an RFID reader. "Disarming" control has no effect on the "alarm" and "Pre-warning" monitoring signals.
- Forced alarm: Forcibly outputting the "alarm" monitoring signal. The I/O terminal is IN2. The high level is valid. At this time, the "alarm" monitoring signal output of the area monitoring function is shielded, and the "alarm" monitoring signal continues to be effective. When IN2 goes low, the output of the "alarm" monitor signal is restored. Can be used to connect emergency alarm buttons or to monitor cascades. The "forced alarm" control has no effect on the "attention" and "Pre-warning" monitoring signals.

Related Reading	For the I/O port TCP messages related to the forcible control, read "4.5 I/O Interface Usage Description and Application Development."

4.4.8 Monitor signal output

When the activated monitoring area group works on-line, the generated monitoring signals are output through the TCP message output, and are also output through the output end of the I/O interface for directly controlling external control devices (such as audible and visual alarms and brakes). Institutions, etc., have stronger real-time performance than TCP message output methods.

The definition of the TCP message monitoring signal and the signal output from the output of the I/O terminal is shown in "Table 4.5 Monitoring Signal Network Message". In TCP messages, the status of the monitoring signal (0/1) is given in bit0 – bit5 of Data[1], respectively. Whenever the status of a certain monitoring signal changes, including when the state of the monitoring signal changes due to the forced control being activated or released, the LDS TYPE will automatically send a monitoring signal TCP message to the application system.

Table 4. 5 Monitoring Signal Network Messages

Monit	Monitori	Network message	I/O output

oring area	ng signal	Message code	Regional group number	Statue[2]	terminal
Alarm area	Area	LIM_ CODE_FMSIG	Data[0][1]	Data[1]:bit0 Data[1]:bit1[3]	OUT2
Pre-warning area	Pre-warning	LIM_ CODE_FMSIG	Data[0] [1]	Data[1]:bit2 Data[1]:bit3[3]	OUT3
Attention area	Attention	LIM_CODE_FMSIG	Data[0] [1]	Data[1]:bit4 Data[1]:bit5[3]	OUT4

1：Zone group number starts from 0

2："0" indicates that the signal is invalid and "1" indicates that the signal is valid.

3：The total status of the corresponding monitoring signals for all monitoring area groups that are activated ("or" for all states).

Related Reading For the definition of the output monitoring signal through the I/O output terminal, read "4.5 I/O Interface User's Guide and Application Development."

The status of IN1 / IN2 of the I/O interface can be read by TCP messages to determine whether the change of the monitoring signal status is forced control. In addition, the application system can send LIM_CODE_FMSIG_QUERY to the LDS TYPE at any time. The message is used to query the status of the monitoring signal. The LDS TYPE answers with the LIM_CODE_FMSIG message defined in Table 4.5 Monitoring Signal Network Messages.

Related Reading Read the TCP messages of the I/O interface status. Please read “4.5 I/O Interface Operation Instructions and Application Development”. For details of TCP messages monitoring the signal, please read Section 6 “Region Monitoring Messages” in the “Lidar Application Development SDK User's Manual”.

4.5 I/O interface usage instructions and application development

4.5.1 I/O input terminal function definition

If the monitoring zone group selection mode is set to "FILPS", the preset function of the I/O input terminal is defined as disarming and forced alarm control of the zone monitoring function, if the monitoring zone group selection mode is set to "I/O input", The preset function of the I/O input terminal is defined as the monitoring zone group selection, as

shown in “Table 4.6 Input terminal preset function definition”.

Table 4. 6 Input terminal preset function definition

"FILPS" monitoring area group selection mode						
Function		IN1		IN2		Signal requirements
Disarm		High level				Effective immediately
Forced alarm				High level		Effective immediately
"I/O input" monitoring area group selection mode						
Function		IN1	IN2	IN3	IN4	Signal requirements
Select and activate monitoring area groups	0#	Low level	Low level	Low level	Low level	duration≥1s
	1#	High level	Low level	Low level	Low level	duration≥1s
	2#	Low level	High level	Low level	Low level	duration≥1s
	3#	High level	High level	Low level	Low level	duration≥1s
	4#	Low level	Low level	High level	Low level	duration≥1s
	5#	High level	Low level	High level	Low level	duration≥1s
	6#	Low level	High level	High level	Low level	duration≥1s
	7#	High level	High level	High level	Low level	duration≥1s
	8#	Low level	Low level	Low level	High level	duration≥1s
	9#	High level	Low level	Low level	High level	duration≥1s
	10#	Low level	High level	Low level	High level	duration≥1s
	11#	High level	High level	Low level	High level	duration≥1s
	12#	Low	Low	High	High	duration≥1s

		level	level	level	level	
	13#	High level	Low level	High level	High level	duration≥1s
	14#	Low level	High level	High level	High level	duration≥1s
	15#	High level	High level	High level	High level	duration≥1s

4.5.2 I/O output terminal function definition

The preset function of the I/O output terminal is defined as the monitor signal output of "equipment ready" and area monitoring function, as shown in "Table 4.7 Output Terminal Preset Function Definition".

Table 4. 7 Output Terminal Preset Function Definition

Function		OUT1	OUT2	OUT3	OUT4	Mode
Equipment ready		connect				
Regional monitoring signal	Attention		connect			Repeatedly effective , duration≥2s
	Pre-warning			connect		
	Alarm				connect	

Main point

After the device is ready, the status of the I/O terminal can be read via TCP messages or the output status of the output terminal can be controlled at any time. You can also use the FILPS software to disable the area monitoring function according to the actual configuration of the application system. The functions of the I/O terminals are defined and the application software controls the I/O terminals completely through TCP messages.

4.5.3 I/O interface network message

The I/O terminals can be read and set via TCP messages. The message type codes are:

- Read I/O terminal status: LIM_CODE_IOREAD
- Set I/O Terminal Status: LIM_CODE_IOSET (Output Terminals Only)

After receiving the above message, LDS TYPE will complete the reading or setting of I/O terminal and reply a reply message. The message type code is LIM_CODE_IOSTATUS.

The TCP message used by the I/O interface are shown in Table 4.8 I/O Interface Network Message.

Table 4. 8 I/O Interface Network Message

Function	Network Message			Initiator	Reply message
	Type code	Data[0]	Data[1]		
Read	LIM_CODE_IOREAD	0	0	Application side	LIM_CODE_IOSTATUS
Set	LIM_CODE_IOSET	0/1[1]	0 :OUT1[1] 1 :OUT2[1] 2 :OUT3[1] 3 :OUT4[1]	Application side	LIM_CODE_IOSTATUS
Unset	LIM_CODE_IOSET_RELEASE	0	0	Application side	LIM_CODE_IOSTATUS
I/O statue	LIM_CODE_IOSTATUS	bit0 : OUT1[1] bit1 : OUT2[1] bit2 : OUT3[1] bit3 : OUT4[1] bit4 : IN1[2] bit5 : IN2[2] bit6 : IN3[2] bit7 : IN4[2]	0	LDS TYPE	none

1 : "0" means "off", "1" means "pass".

2 : "0" indicates Low level, and "1" indicates High level.

Main point

When the area monitoring function is enabled, using the LIM_CODE_IOSET message to set the output state of the output terminal, its operation priority is higher than that of the area monitoring signal. In the subsequent time, the area monitoring signal output is masked. If you want to restore the output of the area monitoring signal, you need to send a "Release I/O Terminal Status" message to LDS TYPE. The message code is LIM_CODE_IOSET_RELEASE and the reply message code of LDS TYPE is LIM_CODE_IOSTATUS. When the LDS TYPE receives the LIM_CODE_IOSET_RELEASE message and restores the monitoring signal output of the area monitoring function, the LDS TYPE will also send the application system if the ON/OFF status of the I/O output terminal changes. LIM_CODE_FMSIG message.

Related Reading	For more information about I/O interface TCP packets, please read Section 7 “I/O Packets” in the Lidar Application Development SDK User's Manual.

4.6 Static Application and Movement Application Mode

The measurement data output of LDS TYPE has two modes, namely static application mode and mobile application mode. In the static application mode, the original measurement data is filtered by a space-time domain filter before being output. At this time, the measured data of the target that remains stationary in the scene has a small statistical error, and at the same time, the measurement data of the moving target can be ensured in real time. In the movement application mode, the raw measurement data is directly output to ensure the real-time measurement data of the entire scene.

In actual use, the correct application mode should be selected according to the application requirements.

Main point	In the factory setting, the application mode of LDS TYPE is "Mobile Application Mode".

Software operation	The application mode of the LDS TYPE can be set using FILPS software. For usage, please read the "Lidar Diagnostic and Configuration Software (FILPS) User's Manual" section 8.3 "Operational Parameter Configuration".

5. Device installation

Note

LDS TYPE has a sealing label at the seam of the device housing. If this label is damaged or the housing is disassembled, Dadisick will no longer be responsible for the warranty of the product. The shell of the LDS TYPE can only be disassembled by Dadisick approved personnel.

5.1 Installation preparation

5.1.1 Basic requirements for installation

The total weight of LDS TYPE is 0.6Kg. The basic requirements when installing LDS TYPE are:

- Fastening.
- Keep away from vibration sources or take shock absorption measures.
- Avoid being hit.

For outdoor work LDS TYPE, necessary protective equipment should be installed to avoid the translucent cover from being contaminated, damaged or exposed to direct sunlight. The standard protective cover PT22@LDS TYPE of the LDS TYPE can be installed, or it can be designed by itself.

5.1.2 Mounting material

- Aside from Dadisick, the LDS TYPE-AT side mount/seat mount bracket (supplied), as well as the necessary mounting equipment.
- Select the set of side-mounted/seat-mounted composite stand HD111@FIT-201 provided by Dadisick and necessary installation equipment as required.
- Select one set of protective cover PT22@FIT-201 provided by Dadisick and necessary installation equipment as required.
- Or a user-designed mounting bracket with mounting angle rotation adjustment capability, and two M4 screws of appropriate length.

5.1.3 Installation location selection

Note

- Avoid direct sunlight of the LDS TYPE, which may cause the internal temperature of the LDS TYPE to become too high and fail.
- Avoid direct collision of the LDS TYPE. This can cause the translucent cover to be worn or broken.
- Avoid direct exposure of LDS TYPE to dirt, grease, dust, and other contaminants. This can cause the translucent cover to be covered with opaque material and cause

measurement failure.

If this is possible, install an appropriate protective cover for the LDS TYPE.

5.1.4 Special reminder

Note

When installing the LDS TYPE, pay special attention to:

- Make sure that the entire translucent cover's field of view is not obstructed by the mounting parts within the 300 degree scanning range of the LDS TYPE.
- If the installation condition is limited, the 300 degree scanning range of LDS TYPE cannot be ensured by the mounting parts or the mounting surface. The effective scanning angle of LDS TYPE needs to be adjusted. For details, see "5.5. Adjust the scan range".
- To be able to more easily see the two lights on the LDS TYPE front panel.
- To be able to easily operate the LDS TYPE front panel SLR operation buttons.
- There should be enough space on the left side of the LDS TYPE to facilitate the connection of the interface cable.
- Avoid excessive vibration of the LDS TYPE.
- If LDS TYPE is installed in a vibrating environment, loosening measures should be taken for the mounting screws.
- Check the tightening of the mounting screws regularly.
- Regularly check the contamination of the translucent cover.

5.2 Mounting height and pitch angle

5.2.1 Mounting height and effective working distance

The spot laser spot emitted by LDS TYPE is circular, and the divergence angle in the vertical direction is the same as the horizontal divergence angle, which is 12.5mrad. As the detection distance increases, the spot gradually increases and the spot size increases. Stepping down gradually, if you hit the ground or install the surface, you will not be able to measure a farther target. Therefore, there is a certain relationship between the effective working distance and installation height of LDS TYPE, as shown in "Figure 5.1 Effective working distance and installation height".

Taking the horizontal floor installation as an example, the relationship between the bottom installation height h of the LDS TYPE and the effective working distance d'_{max} is:

$d'_{max} = 2(h+h_0-r_0) / \alpha$

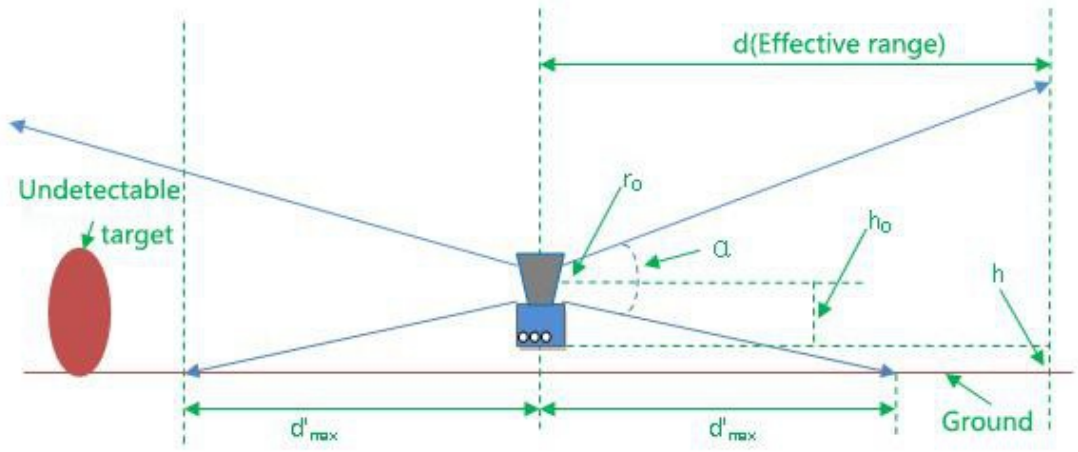
among them:

h_0 is the height of the light axis of the LDS TYPE relative to the bottom surface, h_0 0.081m.

r_0 is the spot exit diameter, r_0 = 0.008m.

α is the divergence angle of the spot, α = 0.0125.

Figure 5.1 Effective working distance and installation height



Important note

The actual installation height of the LDS TYPE is to be determined based on the relative height between the ground or reference work surface at the work site and the installation position, and the working range requirements.

5.2.2 Multi-LiDAR Height and Angle Adjustment at the Same Time

If there are multiple Dadisick lidars working in the environment at the same time, the laser beam emitted by one Lidar should be prevented from directly entering the other laser Lidar. Otherwise, the measurement of the two lidars may be interfered with each other. Mismeasurement data is generated at each specific scan angle. If there is such a possibility, the height or pitch angle of the laser scanning surface of the Lidar should be adjusted to avoid the mutual interference, as shown in “Figure 5.2 Scanning surface height adjustment” and “Figure 5.3 Scanning surface tilt angle adjustment”.

Figure 5.2 Scanning surface height adjustment

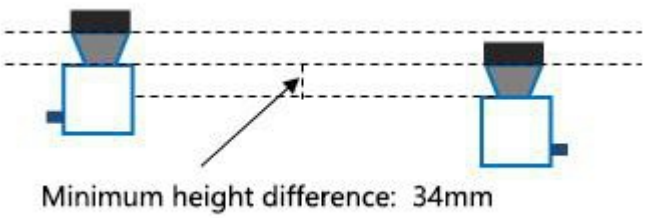
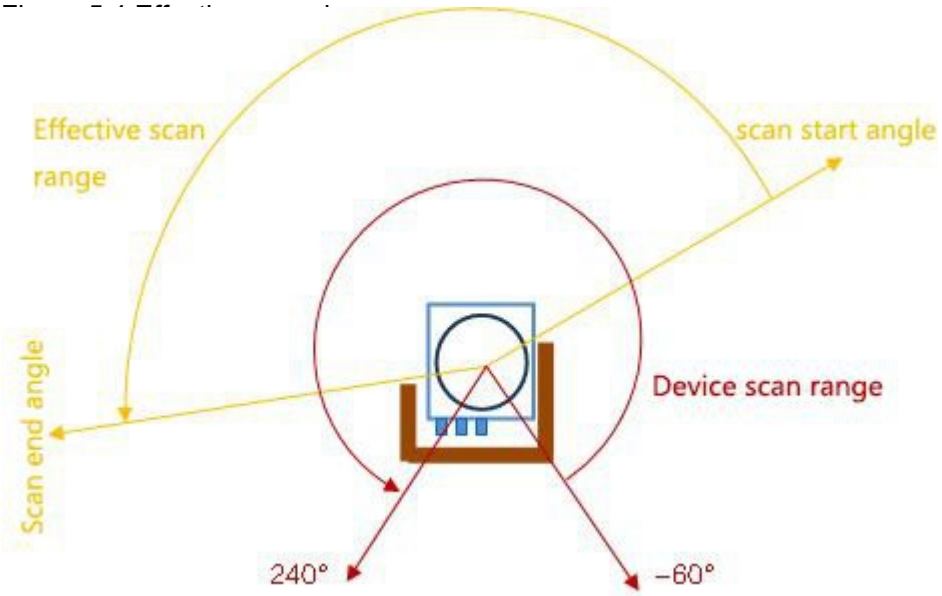


Figure 5.3 Adjustment of pitch angle of scanning surface

Important note	If the above installation adjustment cannot be achieved, you can try to power off and re-power the misfired laser radar until the mismeasured data disappears. Once the mismeasurement disappears, it will not reappear in a short time.

5.3 Adjust the scan range

In the factory setting, the original working scan range of the LDS TYPE is a device scan range of 300°, the scan start angle is -60°, and the scan end angle is 240°, as in "Figure 10.1 Measurement Coordinate System/Scan Range/range is shown. When using the LDS TYPE, if there is an object at a height of the laser scanning surface within the original working scanning range, if there is an object at a position not exceeding 5 cm from the transmissive cover, for example, a self-designed protective cover structure, Or the non-detachable objects or walls in the installation environment will cause the device to block alarms, and may also trigger the output monitoring signals of the area monitoring function. In order to avoid this, the scanning start angle and the scanning ending angle need to be adjusted according to the actual effective scanning range of the LDS TYPE in the working environment, as shown in “Figure 5.7 Effective scanning range”.



You can use FILPS software to adjust the LDS TYPE's scan start angle and scan end angle as follows:

- Use FILPS to connect LDS TYPE through Ethernet to configure the device of LDS TYPE. Please refer to "7.3 Device Configuration" for detailed operation procedures.
- Open the "Operation Status" tab in the device window, then you can observe the measurement data of the LDS TYPE on the use of the scene. Use the mouse to magnify the measured scene depth image to the maximum level, then use the “Special Angle Measurement Data” function to check the occlusion angle of the occluder and determine the effective scanning range of the LDS TYPE, as shown in “Figure 5.8. Effective scanning range"
- On the “Device Configuration” tab page of the Device window, in the “Running

Configuration Parameters" column, enter the correct starting and ending angle values in the "Valid Angle Range" to edit box, as shown in Figure 5.9. "Software Operation Interface" shows that FILPS will adjust the input value according to the current scanning angle resolution of LDS TYPE.

- Press the "Upload to Device" button to send the configuration data to LDS TYPE. At this time, LDS TYPE will restart automatically.

AAfter the reboot of LDS TYPE, the new set of work scan range parameters start to work. At this time, LDS TYPE only outputs the measured data within the scope of the work scan, and the regional monitoring function only deals with the data in the scope of the work scan.

Related Reading

For details on the adjustment of the scanning angle range, please read "Lidar Diagnostic and Configuration Software (FILPS) User's Manual", Section 7.11 "Specific Angle Measurement Data" and Section 6.3 "Operation Configuration Parameters".

Figure 5.5 Determination of Effective Scanning Range by Measured Data

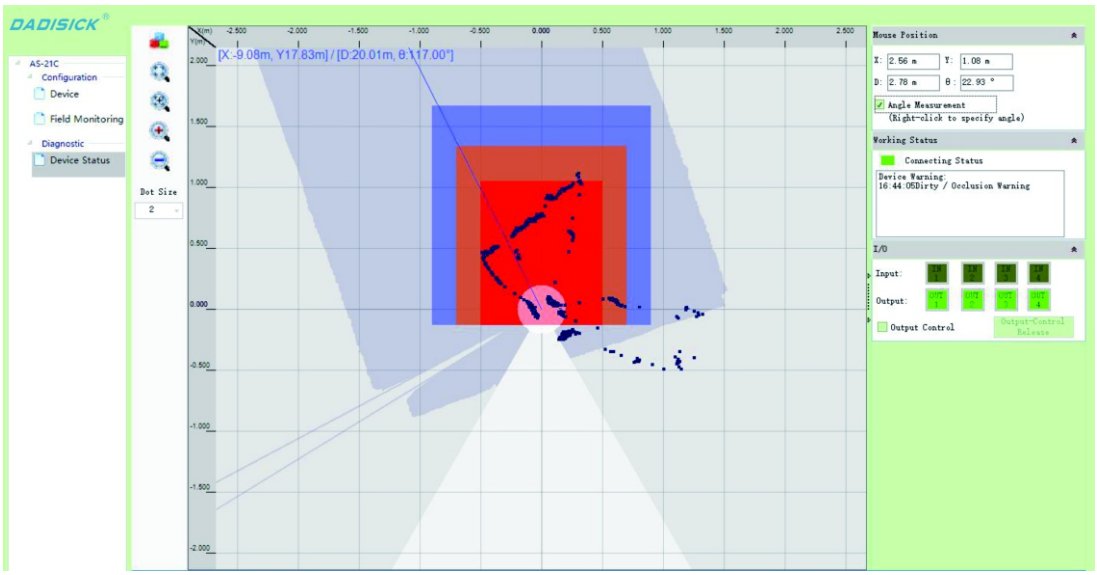
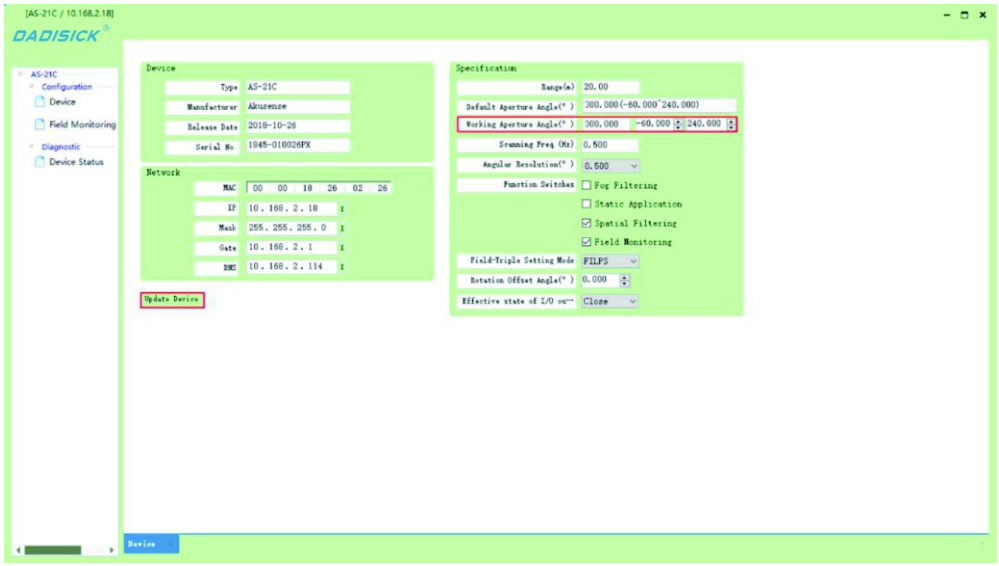


Figure 5.6 Effective Scan Range Adjustment Software Operation Interface



6. Electrical Installation

Note	When installing the LDS TYPE electrically, pay special attention to: ● Select personnel with electrical installation qualifications to operate. ● Avoid electrified installation, otherwise the equipment may be damaged.

6.1 Installation steps

For the electrical installation of LDS TYPE, please follow the following basic steps:

- Prepare the appropriate power supply for the LDS TYPE and complete the wiring of the power interface.
- According to the needs of the application to complete the I / O interface wiring.
- Connect to PC via Ethernet interface, ready to configure LDS TYPE.
- Connect the power connector and prepare for power-up operation.

6.2 Installation preparation

6.2.1 Power supply

The power supply voltage requirement of LDS TYPE is 10V~30V DC. The power consumption under normal operation is 3.4W (measurement), 7.6W@DC12V / 6W@DC24V (Heating).

Important note	Please read "10.1 Data Sheet" for the complete requirements of LDS TYPE for power supply. The user shall comply with local regulations and perform necessary protection of the power supply cable of LDS TYPE to avoid short circuit or overload of the power supply. In addition, an emergency circuit breaker shall be installed on the power supply cable for emergency use. Cut off the power supply quickly.

6.2.2 Grounding requirements

Caveat

It must be ensured that the ground of the mounting surface of the LDS TYPE is in the equipotential state with the earth of the remote device. Otherwise, the current generated by the potential difference of the earth will flow through the casing of the LDS TYPE and generate the following Potential dangers:

- Contact voltage generated on the casing of LDS TYPE and cause personal injury.
- Caused LDS TYPE not to work properly.
- Heats the cable and creates a fire hazard.

6.2.3 Wire requirements

Please use copper wires to complete the wiring. The cross-section of the wires is as shown in “Table 6.1 Wire Requirements”.

Table6. 1 Wire Requirements

interface	Wire cross-section area requirements
Power	Power supply installation: minimum 0.25mm^2 The power supply is not installed nearby: for a DC24V power supply with a transmission distance of 20 meters, a minimum of 1mm^2
Ethernet	CAT5 standard network cable
I/O lead	Min 0.25mm^2 50m transmission distance, minimum 0.5mm^2

6.2.4 Connect PC

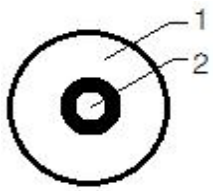
Please use RJ45 standard network cable to connect to PC through Ethernet port.

6.3 Device interface signal definition

6.3.1 Power interface signal definition

The composite interface cable of LDS TYPE is prefabricated with DC002 power interface socket, which can be used by users directly. The signal definition of power interface and the internal thread color of the composite interface cable are shown in “Table 6.2 Power Interface Signal Definition”.

Table6. 2 Power Interface Signal Definition



No.	Signal	Interface cable internal thread color	
		Stainless steel nut outlet seat	Plastic nut outlet seat
1	GND	Black	**Bold black line**
2	Vs	Red	**Bold red line***

* : The normal red wire inside the composite interface cable of the product whose outlet seat is a **plastic nut** is **not used**. If the user directly uses the internal wire of the composite interface cable for wiring, do not use this signal cable.

6.3.2 Network interface signal definition

The composite interface cable of LDS TYPE is prefabricated with RJ45 network interface socket, which can be directly used by the user. The signal definition of the network interface and the internal thread color of the composite interface cable are shown in "Table 6.3 Network Interface Signal Definition".

Table6. 3 Network Interface Signal Definition

Signal	Function	Interface cable internal thread color		Network cable color	Network line sequence
		Stainless steel nut outlet seat	Plastic nut outlet seat		
RX+	Positive data reception	dark green	White green	White green	3
RX-	Negative data reception	green	green	green	6
TX+	Positive data transmission	Black red	White orange	White orange	1
TX-	Negative data transmission	Orange	Orange	Orange	2

6.3.3 I/O interface signal definition

The I/O interface of the LDS TYPE is the wiring of the composite interface cable. The signal definition and wire color are shown in "Table 6.4 I/O Interface Signal Definition".

Table6. 4 I/O Interface Signal Definition

Signal	Function	Lead color
IN1	Universal input 1# positive	Blue
IN2	Universal input 2# positive	Grey
IN3	Universal input 3# positive	Yellow
IN4	Universal input 4# positive	White
GND IN	Universal input GND	purple
OUT1	Universal output 1# positive	Black brown
OUT2	Universal output 2# positive	Black blue
OUT3	Universal output 3# positive	Brown
OUT4	Universal output 4# positive	Black yellow

Explanation:

- The input signal of the universal input positive terminal "IN1...4" is a level input (vs. common input common ground "GND IN") and the logic states are "High level" and "Low level".
- The Universal output "OUT1...4" is the PNP switch output (vs. power "Vs") and the logic states are "on" and "off".

Related Reading For the electrical characteristics of the I/O signal, read "10.1 Data Sheet."

6.4 Interface cable wiring

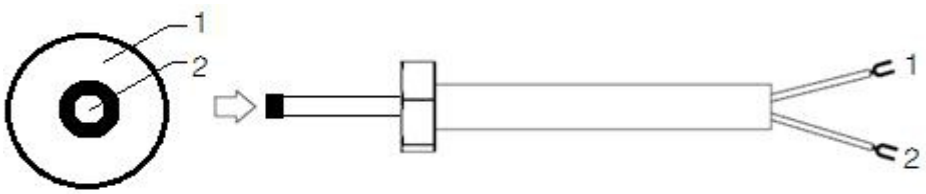
Note

The LDS TYPE has an IP67 protection rating. When connecting cables, pay attention to:

- If you use the supplied LDS TYPE-EC power cable for power wiring, you should pay attention to tighten the waterproof thread between the plug of the power cable and the DC outlet of the LDS TYPE.
- If you use a user-made power cable, you should pay attention to the waterproof connection between the cable and the DC outlet of the LDS TYPE.
- When RJ45 Ethernet cable is used to connect the RJ45 Ethernet socket of LDS TYPE, waterproof protection must be provided using the supplied LDS TYPE-WJ waterproof jacket.
- If you do not use the LDS TYPE's RJ45 Ethernet socket or I/O interface leads, waterproof protection is required. Do not expose.

The deliverables of LDS TYPE have a LDS TYPE-EC finished power cable with a DC002 type plug. Normally, they can be used directly. The wiring is defined as “Table 6.5 Power Cable (LDS TYPE-EC) Lead Signal Definition "Shown.

Table6. 5 Power Cable (LDS TYPE-EC) Lead Signal Definition



No.	Signal	Function	Lead color
1	GND	Power ground	Black
2	Vs	power supply	White

Note

The wiring of the power interface must be completed in strict accordance with the correct wiring sequence, otherwise it may cause permanent damage to the device.

6.5 I/O interface external reference circuit

Figure 6.1 I/O Interface Input Terminal External Circuit (Ref. GND Level)

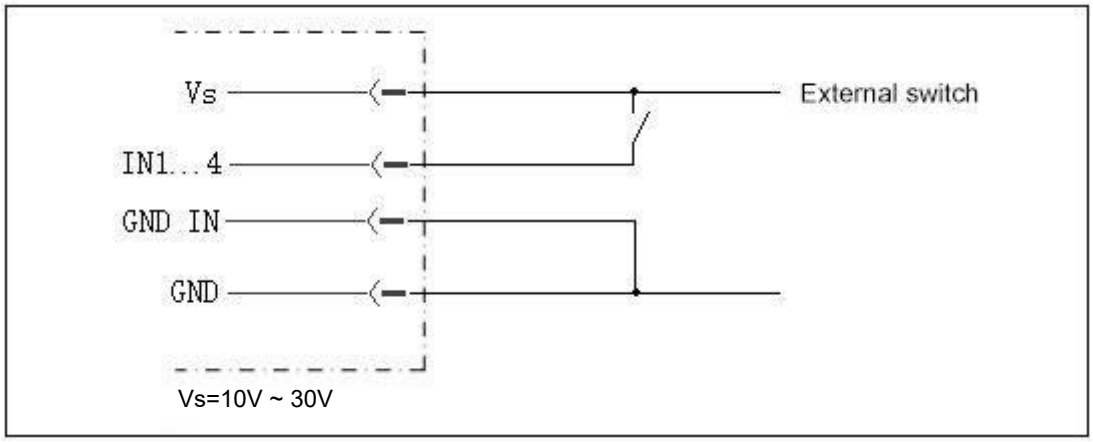
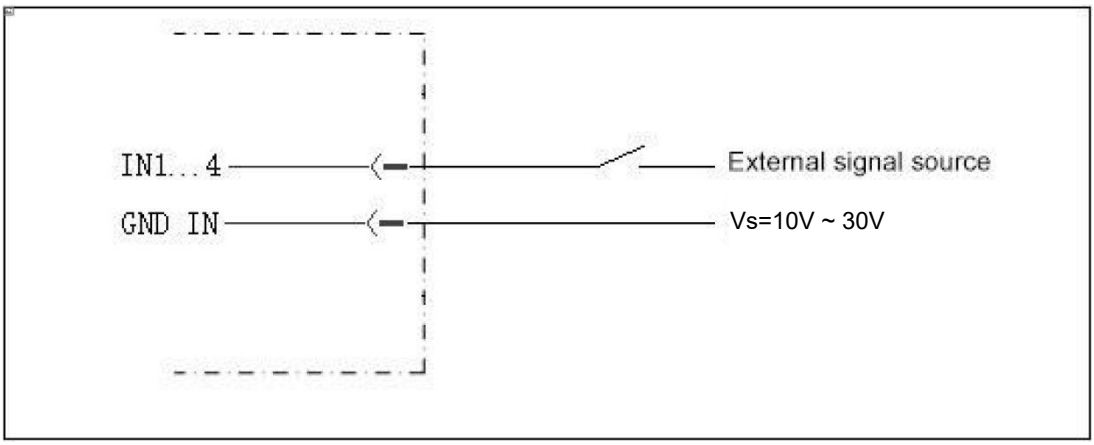


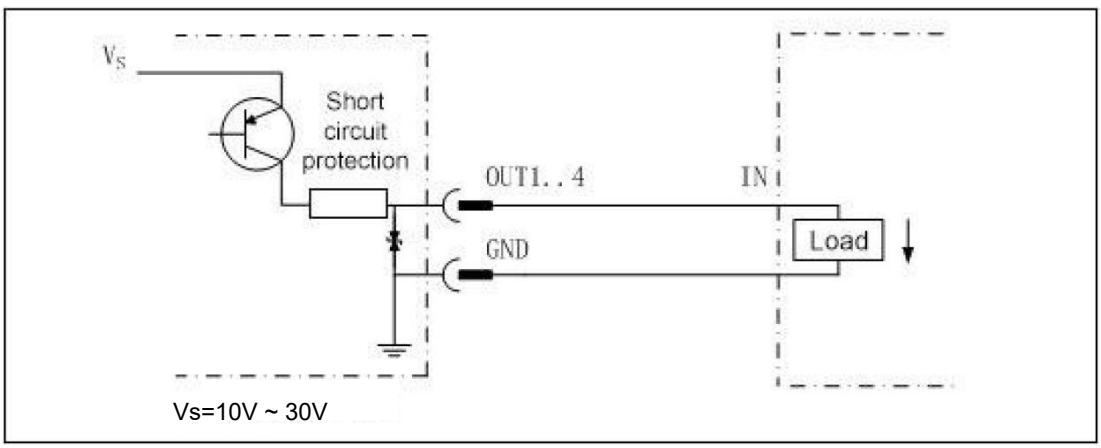
Figure 6.2 I/O Interface Input Terminal External Circuit (Floating)



Important note

In the input connection mode shown above, the voltage of the external signal power supply must be 9V~28V DC.

Figure 6.3 I/O Interface Output Terminal External Circuit (PNP Mode)



7. Equipment configuration and commissioning test

Caveat	Incorrect device configuration can result in equipment damage or abnormal operation. Before configuring the LDS TYPE, make sure that the equipment has been fully inspected. Please carefully read "2 basic operations and precautions" and make necessary preparations.

The device configuration and commissioning tests of the LDS TYPE require the use of "Lidar Diagnostic and Configuration Software (FILPS)". FILPS is used to configure the operating parameters of LDS TYPE according to the application requirements, obtain and display measurement data, and test the area monitoring function and I/O interface input and output functions.

Related Reading	For detailed usage of FILPS, please read "Lidar Diagnostic and Configuration Software (FILPS) User's Manual".

7.1 Configuration and Test Procedures

- Install FILPS software on the PC.
- Establish a TCP connection between PC and LDS TYPE through the Ethernet port.
- According to the requirements of the application, the equipment parameters and function parameters of LDS TYPE are adjusted and saved.
- Perform functional tests on the LDS TYPE.

7.2 Software and equipment preparation

- Install FILPS software on the PC using the "FILPS Installation Package" in "Lidar Diagnostic and Configuration Software (FILPS)".
- Turn off the power of the LDS TYPE.
- Directly connect the Ethernet port between PC and LDS TYPE.
- On the PC, in addition to the network adapter connected to the LDS TYPE, disable the other network adapters and configure "192.168.1.25x / 255.255.255.0" for the network adapter connected to the LDS TYPE. IP address, x takes 1...4 can be, does not conflict with the IP address of other network adapter.
- According to LDS TYPE I/O lead signal definition and I/O interface input and output external circuit requires connecting external devices such as switches, indicator lights, ready to test the area monitoring function and I/O interface control function .

7.3 Basic test

In the factory setting of LDS TYPE, the area monitoring function is set to the start state, the monitoring area group selection mode is set to "I/O input", and AKU-LS can be used

without the PC. - The D20-300's area monitoring function performs basic tests.

- Disconnect the IN1...4 input of the I/O interface of the LDS TYPE. At this time, the activated monitoring area group is 0#. The alarm area is a circular area with a radius of 2 meters.
- After powering on the LDS TYPE, the "HTR" indicator  is off and the device enters the initialization state. After about 12 seconds, the device is turned on and the device has started normal measurement.
- Press the front panel SLR operation button of LDS TYPE, keep it until the “HTR” indicator enters the fast flash mode (2.5Hz), release the button, and retreat to the position outside the 0# alarm zone, wait 12 seconds At the time of bell, LDS TYPE has completed background self-learning and automatically enabled “Background tailoring” for the 0# monitoring area group.
- If there is a target entering the alarm zone of the 0# monitoring zone group, the LDS TYPE will output an “alarm” monitoring signal on the OUT2 of the I/O interface, and the output can be observed by an external indicator on OUT2.

7.4 Device Configuration

- Power up the LDS TYPE and the device enters the initial state. After about 12 seconds, the “HTR” indicator lights up, and the device has started normal measurement.
- Run FILPS on the PC.
- Find the LDS TYPE that is being configured in the "Online Device" form on the FILPS screen, as shown in "Figure 7.1 Online Device Form". double-click on the LDS TYPE device icon to place the LDS TYPE is added to the "New Project" form. Double-click the LDS TYPE device icon in the project form to establish the TCP connection with the LDS TYPE. At this time, it is configured. The LD TYPE's device form will appear as shown in the "Figure 7.2 Device Form and Device Configuration Tab".
- In the device form of the LDS TYPE, open the “Device Configuration” tab, as shown in Figure 7.2 Device Form and Device Configuration Tab, Modify the Ethernet configuration of the LDS TYPE according to the requirements of the application system and enable the area monitoring function. Press the "Upload to Device" button to send the configuration data to the LDS TYPE. In this case, the LDS TYPE will restart automatically.

Figure 7.1 Online Device Form

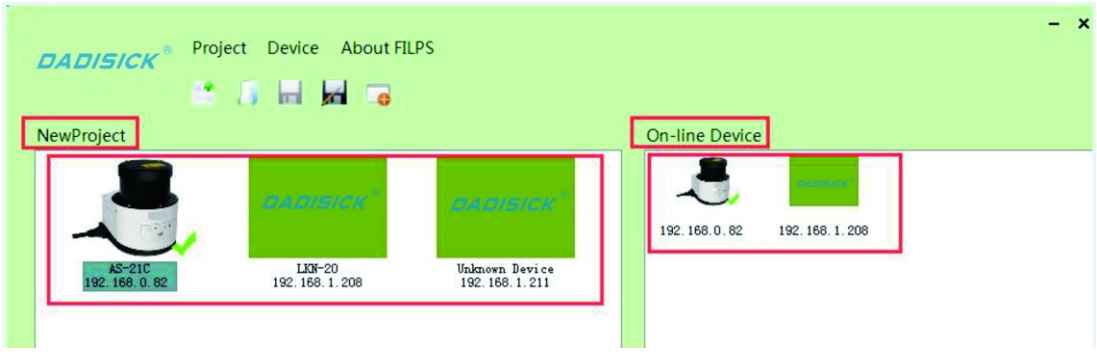
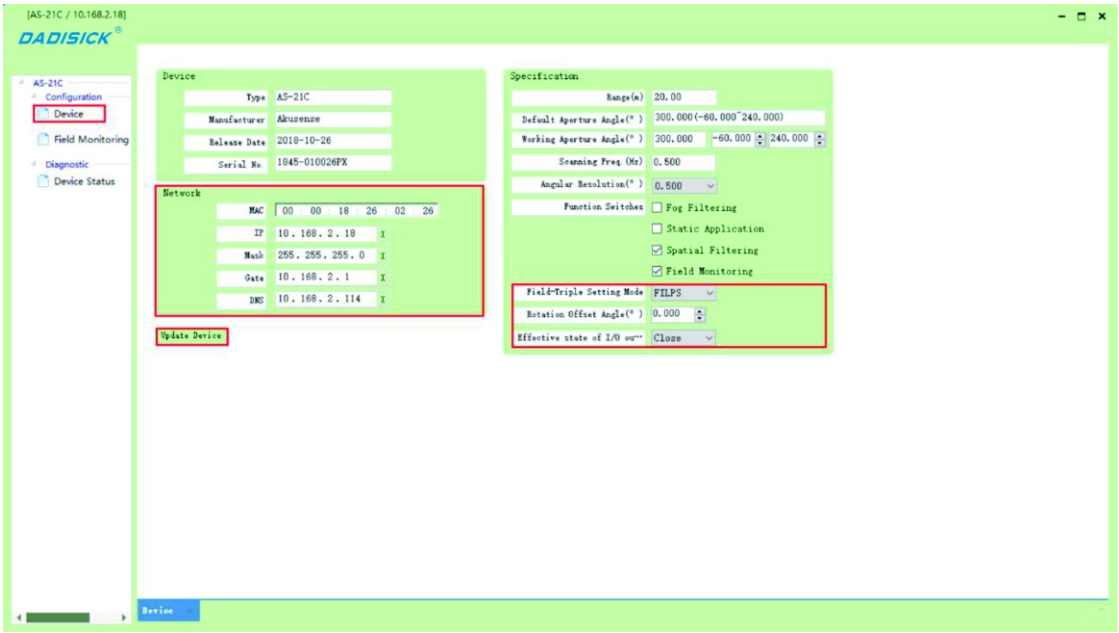


Figure 7.2 Device Form and Device Configuration Tab



7.5 Try running the test steps

When the LDS TYPE is restarted, and the "HTR" indicator turns to the usual light state, the FILPS is reconnected to the LDS TYPE to start the test run test on the device. The steps are as follows:

- Open the “Run Status” tab in the device window, as shown in “Figure 7.3 Operation Status Tab”, then you can observe the measurement results of the LDS TYPE on the use of the site, and observe the output of the monitoring signal. At the same time, the output of the I/O interface output of the LDS TYPE can be observed through an external indicator, and the forced control function (disarm/force alarm) can also be tested through an external switch.
- Open the "Operation Status" tab, in the "I/O Interface" column, as shown in "Figure 7.4 I/O Interface Status" and "Figure 7.5 Output Terminal Status Control", Use external switches and indicators to test functions such as I/O reading, I/O output setting, and releasing I/O output settings.

Related Reading Please read the "Test Run Test" section of the "LDS TYPE Concise User's Manual" for test preparation and basic test procedures, and design other test methods as needed.

Figure 7.3 Operation Status Tab

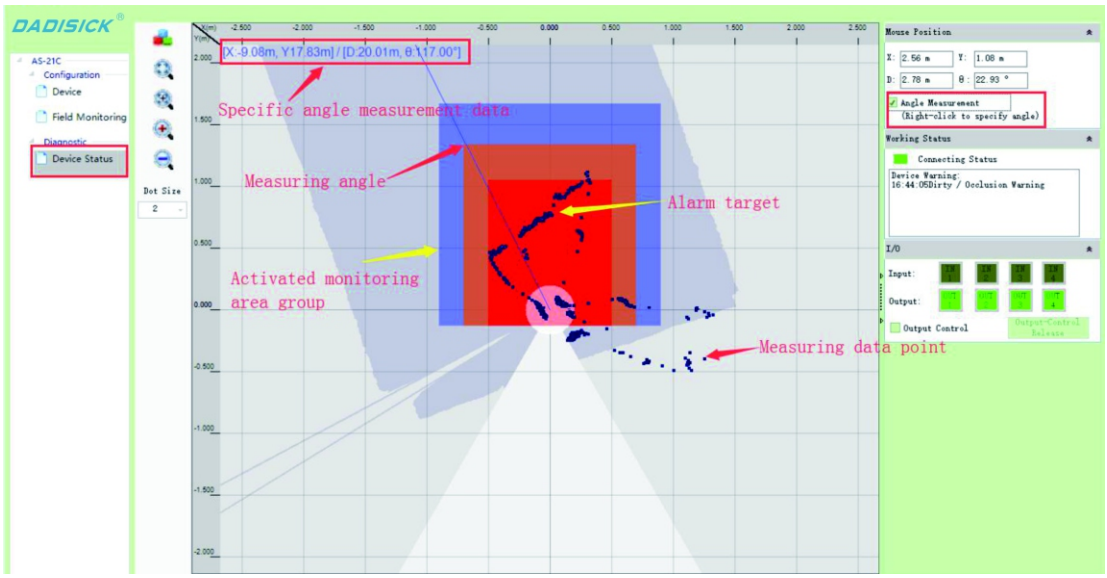


Figure 7.4 I/O Interface Status

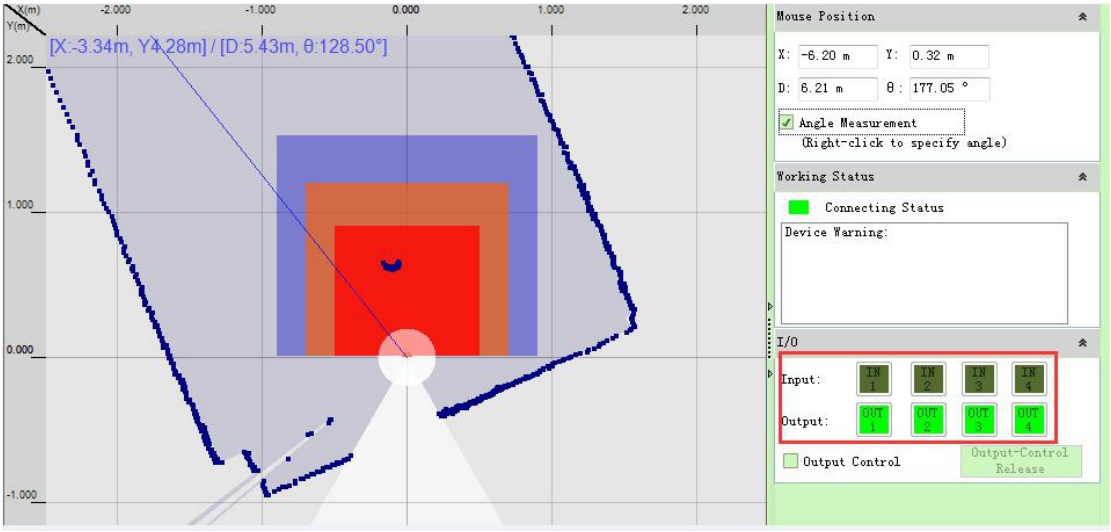
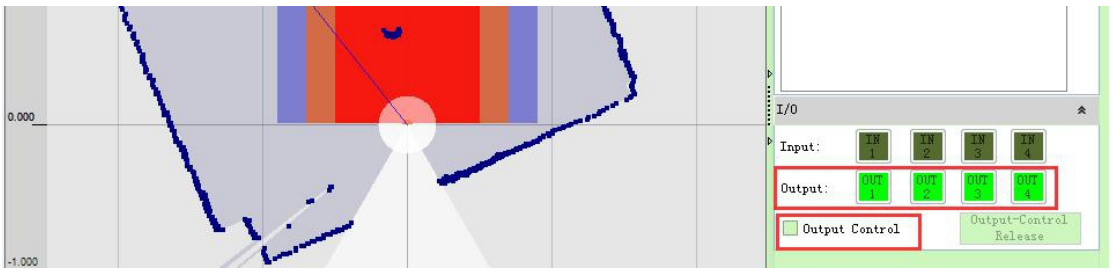


Figure 7.5 Output Terminal Status Control



8. Equipment maintenance

Note	LDS TYPE has a sealing label at the seam of the device housing. If this label is damaged or the housing is disassembled, Dadisick will no longer be responsible for the warranty of the product. The shell of the LDS TYPE can only be disassembled by Dadisick approved personnel.

8.1 Operation and Maintenance

The LDS TYPE working in a clean environment does not require maintenance. When working in an environment that may be contaminated by dirt, the main maintenance work is to clean the translucent cover. When cleaning the translucent cover, pay attention:

- Do not use corrosive or solid-containing cleaning agents.
- Do not use hard cleaning materials.

The static electricity on the translucent cover will cause the dust particles to attach easily and cause the measurement capability to decline. At this time, the lens cover should be wiped with a lens cloth with the ability to eliminate static electricity.

8.2 Replace equipment

When the failed LDS TYPE is replaced, if the original equipment's cables and plugs are not damaged, they do not need to be replaced. Only the failed LDS TYPE can be replaced. The replacement procedure is as follows:

- Turn off the power switch of the replaced LD TYPE.
- Remove all connected cables.
- Install LDS TYPE for replacement (see "5 equipment installation" and "6 electrical installation").
- Connect all cables.
- Open the power switch.
- Configure the replacement LDS TYPE by PC (see "7.4 device configuration"). After the LDS TYPE is restarted, the system can be reused.

9. Troubleshooting

Note	There is a seal label on the joint of the equipment shell of LDS TYPE. If the label is damaged or the shell is disassembled, Dadisick is no longer responsible for the warranty of the product. The shell of LDS TYPE can only be dismantled by Dadisick authorized personnel.

1. The "HTR" indicator keeps off:
   After LDS TYPE is powered off and restarted after power failure, if multiple restarts still fail to return to normal, you need to return to the factory for maintenance.
2. The "ERR" indicator is on or blinking continuously:

Table 9. 1 "ERR" Indicators Troubleshooting

Indicator status	reason	disposal method
Bright	internal error	After the power is turned off, the power is turned on again. If the power is turned on more than once, it cannot be returned to normal.
Short flash (1Hz)	Transmissive cover dirty / cover	Clean the translucent cover or remove the shield.
Long flicker (0.5Hz)	High and low temperature alarm	High temperature: power-off cooling, installation of insulation or protective cover. Low temperature: Continue to operate. If it does not return to normal for a long time, you need to add heating devices to the equipment.

3. FILPS cannot find the configured LDS TYPE / Unable to connect directly to the LDS TYPE with a PC:
   See Chapter 10, “Troubleshooting,” in the Lidar Diagnostic and Configuration Software (FILPS) User's Manual.

10. Specifications

10.1 Data sheet

Table 10. 1 Data Sheet

Function parameter	Min value	Typical value	Max value
Scan angle range		300°	
Scan angle	-60°		240°
Scan angle resolution		0.5°	
scanning frequency		25Hz	
Target reflectance	3%		1000% (reflector)
Measuring range	0.1m		20m
18% reflectance range			20m
10% reflectance range			15m
Measurement delay [1]	3.3ms	40ms	76.7ms
Measurement error			
System error		±2cm (1m~20m)	
Statistical error (1σ)		±1cm (1m~20m)	
Temperature drift	0cm/℃		0.4cm/℃
Power on startup delay	12s	15s	18s
Regional monitoring function			
Monitoring mode	Point Monitoring / Target Width Monitoring / Contour Monitoring		
Number of regional groups		16	
Number of concurrent work area groups	1		16
TCP response delay[2]	13.3ms	60ms	106.7ms
I/O response delay[3]	13.3ms	50ms	86.7ms
General parameters	**Min value**	**Typical value**	**Max value**
Laser transmitter		Pulsed laser diode	
Laser wavelength	895nm	905nm	915nm
Laser Level		Class 1 (GB 7247.1-2012 , Eye safety)	
Laser outlet caliber		8mm	

Laser divergence angle	11.6mrad	12.5mrad	12.8mrad
Distance from emission axis to Rear side	45mm		
Height from scanning surface optical axis to underside	75mm		
Ambient light intensity	0lux - 80,000lux		
Housing protection degree	IP67（GB 4208-2008）		
Insulation resistance	1MΩ（GB 16796-2009, 5.4.4）		
Dielectric strength	0.5KV （GB 16796-2009, 5.4.3）		
EMC Test			
Electrostatic discharge	6KV（GB/T17626.2-2006，Class 3）		
Fast burst	1KV（GB/T17626.4-2008，Class 2）		
Electromagnetic radiation immunity	GB/T17626.3-2006，Class 2		
Surge immunity	GB/T17626.5-2008 Power interface：1.2/50us, 2KV/1KA（Class 3） Ethernet interface：10/700us, 1KV/25A（Class 2） I/O interface：1.5/50us, 0.5KV/0.25KA（Class 1）		
Impact	GB/T 2423.5		
Single impact	15g，11ms		
Continuous impact	10g，16ms		
Vibration	GB/T 2423.10		
Frequency Range	10Hz		150Hz
Magnitude	5g		
Temperature	GB/T 2423.1，GB/T 2423.2		
Operating temperature	-25℃		+50℃
Storage temperature	-30℃		+70℃

Humidity	93%RH，+40℃，2h（GB/T 2423.3）		
Altitude			5000m
Housing			
Material	Al		
Color	White/Yellow		
Translucent cover			
Material	PC		
Dimension[4]			
Length	80mm		
Width	85mm		
Height	102mm		
Interface cable length	1m		
Weight	0.6Kg		
Electrical parameters	**Min value**	**Typical value**	**Max value**
Measuring power			
Type	DC power supply		
Supply voltage	10V		30V
Starting current[5]			0.25A
Operating current[5]	0.2A	0.21A	0.25A
Power consumption[5]	3.4W (measurement), 7.6W@DC12V / 6W@DC24V (Heating)		
heating power supply	None		
Electrical Interface	**Min value**	**Typical value**	**Max value**
Power interface	DC002 Round Socket, Female, 2 Core		
Ethernet interface	RJ45 socket, Female, 8-core		
Rate	10/100 Mbps		
I/O interface	9-core lead		
I/O interface input terminal	IN1 / IN2 / IN3 / IN4		
Quantity	4		
Type	Level input (vs. universal input common ground "GND IN")		
High level input impedance		10KΩ	
High level	10V		28V
Low level	0V	0V	5V
Input capacitance		10nF	
Static input current	1.2mA	2.4mA	3.6mA
Preset function	Monitoring area group selection (IN1...4)		

	Regional Monitoring Disarm (IN1) / Forced Alarm (IN2), Effective Level: High level		
I/O interface output terminal	OUT1 / OUT2 / OUT3 / OUT4		
Quantity	4		
Type	PNP switch output		
Switch status	off		
Switch voltage	Power supply voltage		
Output current			200mA
Output capacitance			300pF
Preset function	Equipment ready (OUT1), valid state: On Area Monitoring Signal Output (OUT2...4), Active State: On		

1：Do not include TCP network transmission delay.

2：Do not include TCP network transmission delay.

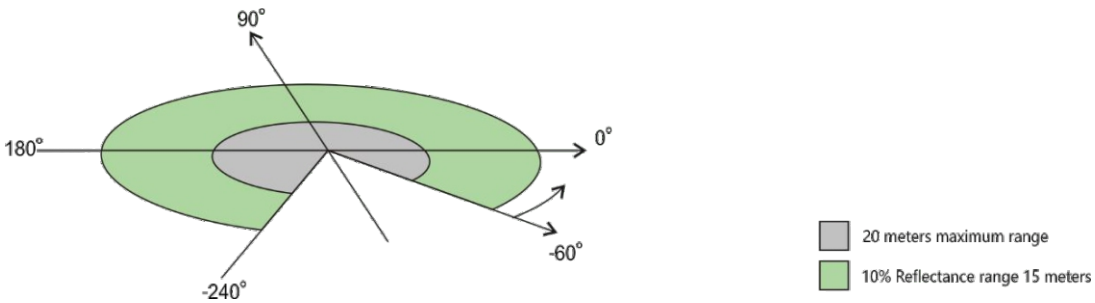
3：Delay in sensitive parameter mode conditions.

4：No interface cable.

5：Operating parameters under DC24V power supply conditions.

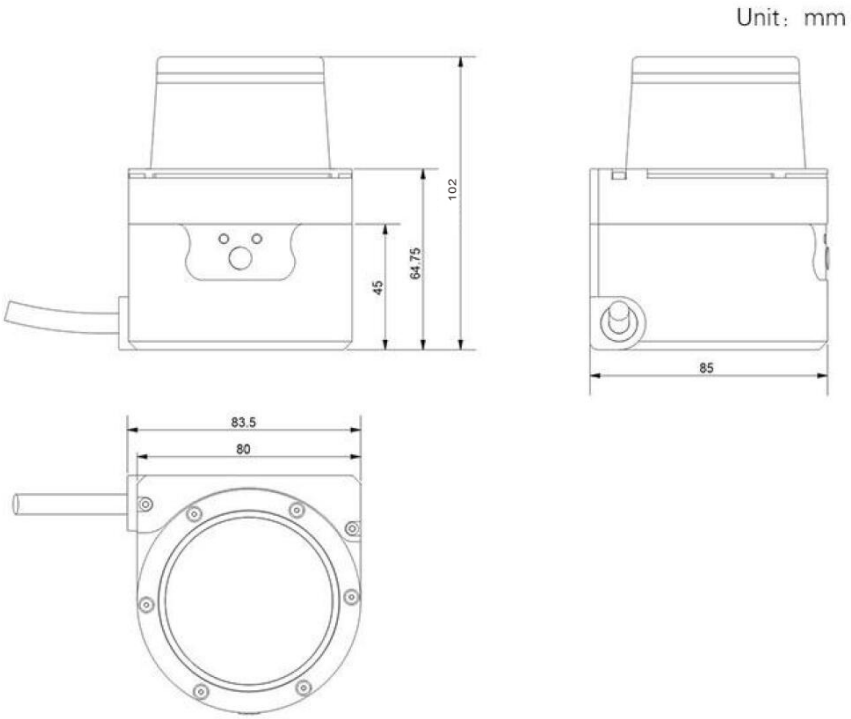
10.2 Measuring coordinate system/scan range/range

Figure 10.1 Measurement Coordinate System/Scan Range/Range



10.3 Equipment outline drawings

Figure 10.2 Equipment outline drawing



10.4 Accessories outline drawings Figure 10.3

LDS TYPE-AT Outline Drawing

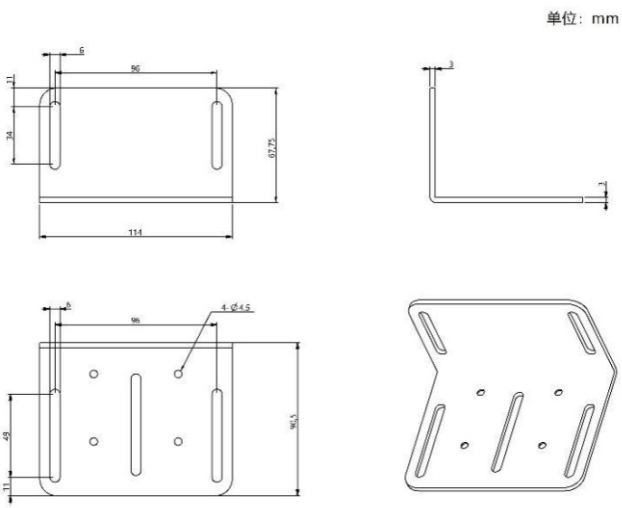
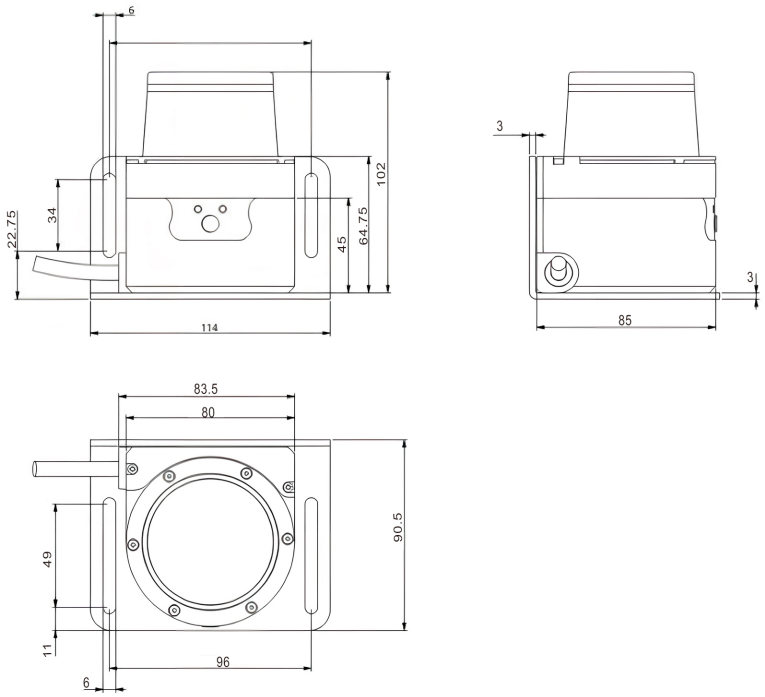


Figure 10.4 Assembly Drawing of LDS TYPE-AT

Side loading	

11. Update

November 3, 2018

1. Table 1.1, Figure 3.1, Table 10.1, Figure 10.1: The range of the 10% diffuse reflectance target for products is updated to 15 meters, instead of 10 meters.
2. Table 10.1 " Data Sheet ": fixed time data for measuring delay and regional monitoring output delays.
3. 4.5.2 "I/O output terminal function definition", 4.5.3 "I/O interface network message": add "setting the active state of the I/O output signal of the area monitoring function", and so on.
4. 6.3 " device interface signal definition ": I/O outlet line color definition for " plastic nut " removed.

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