LGS-N25

USER MANUAL

Compact LiDAR Scanner for Guidance, Measuring and Object Profiling

DATASENSING

Datasensing S.r.l.
Strada S. Caterina 235
41122 Modena
Italy
Tel. +39 059 420411
Fax +39 059 253973

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ORIGINAL INSTRUCTIONS (ref. 2006/42/EC)

CONTENTS

PREFACE

ABOUT THIS MANUAL

This User Manual (UM) is provided for users seeking advanced technical information, including connection, programming, maintenance and specifications.

Manual Conventions

The following conventions are used in this document:

The symbols listed below are used in this manual to notify the reader of key issues or procedures that must be observed when using the reader:

NOTE

Notes contain information necessary for properly diagnosing, repairing and operating the reader.

CAUTION

The CAUTION symbol advises you of actions that could damage equipment or property.

WARNING

The WARNING symbol advises you of actions that could result in harm or injury to the person performing the task.

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CHAPTER 1
DOCUMENT DESCRIPTION

In order to maintain the normal performance of the product and prevent damage to the device, please do not try to open the sensor.

- Read the description: please read all the safety and operation information before using this product.
- Keep the description: please keep all the safety and operation information properlyfor future reference.
- Pay attention to the warnings: please read all the warnings in the manuals and on the product carefully.
- Follow the instructions: please follow all the operation instructions in this manual.
- Maintenance instructions: please follow the instructions for troubleshooting, do not try to repair the equipment by yourself. Contact our technicians promptly to solve the problems.
- Any equipment damage caused by violating the above safety regulations shall not be covered by the warranty.

CHAPTER 2
SAFETY INSTRUCTIONS

HANDLE LASER DEVICE PROPERLY

This product emits an invisible laser beam with a laser safety rating of Class 1.

Please do not open the LiDAR cover without authorization because the laser might be still on after the cover is removed and the operator would be exposed to laser.

It is not guaranteed that the laser remains Class 1 safety status after opening the cover.

HANDLE ELECTRICAL CONNECTION PROPERLY

Disconnect the power supply when connecting or disconnecting electrical cables.

The power supply connected with the device must comply with the requirements included in the operation instructions.

Please connect the reference potential properly when using the device to avoid injury caused by equal potential current.

CHAPTER 3
WORKING PRINCIPLES

The LGS-N25 is a 2D LiDAR that scans the surrounding area in a single plane with the help of an infrared invisible laser beam. The LGS-N25 uses 2D polar coordinates to characterize the surrounding environment based on its measurement origin.

With a scanning angle range of 360°, the LGS-N25 can detect and output information of the angle, distance and signal strength of the target, which facilitating better target identification by SLAM systems.

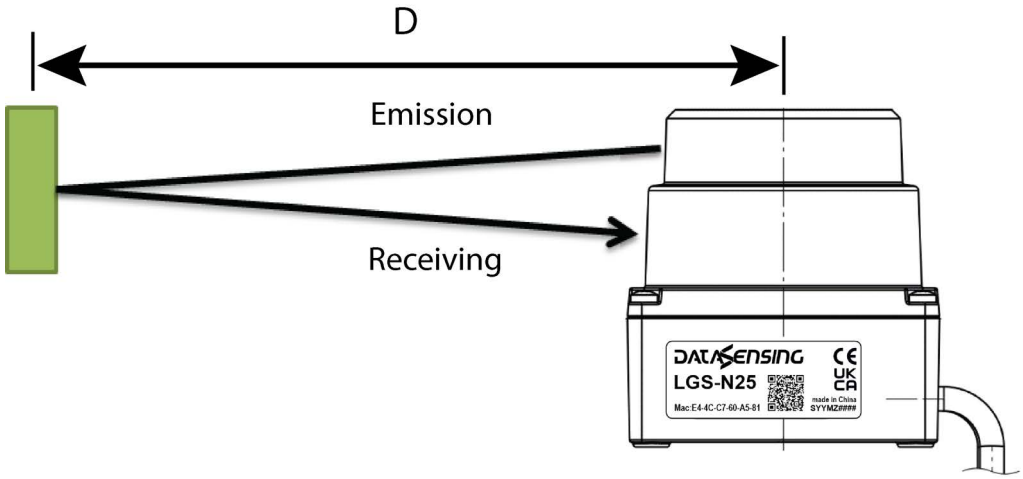


Figure 1 - LGS-N25 working principle

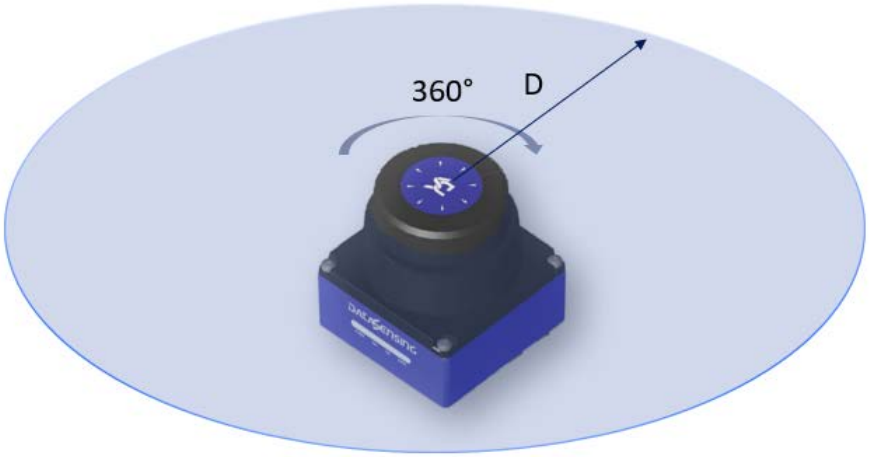


Figure 2

The LGS-N25 measurement principle is shown in the figure above, and it uses the time-of-flight principle to measure distance. LiDAR emits laser pulses at uniform and very short intervals, and the laser light is reflected back when it encounters an obstacle. The LiDAR receives the reflected light signal and calculates the distance information between the object and the LiDAR based on the time difference (i.e., the time of flight of the laser) T between the emission and reception and the speed of light C. The calculation method is shown below.

$$D=c*T/2$$

Where:

D = distance

T = flying time

c = speed of light

CHAPTER 4
INSTALLATION AND USAGE

MECHANICAL CONNECTION

The LGS-N25 LiDAR can be mounted thanks to the four M3 screw holes located on the bottom side of the device, we suggest to use M3 x 8 screws.

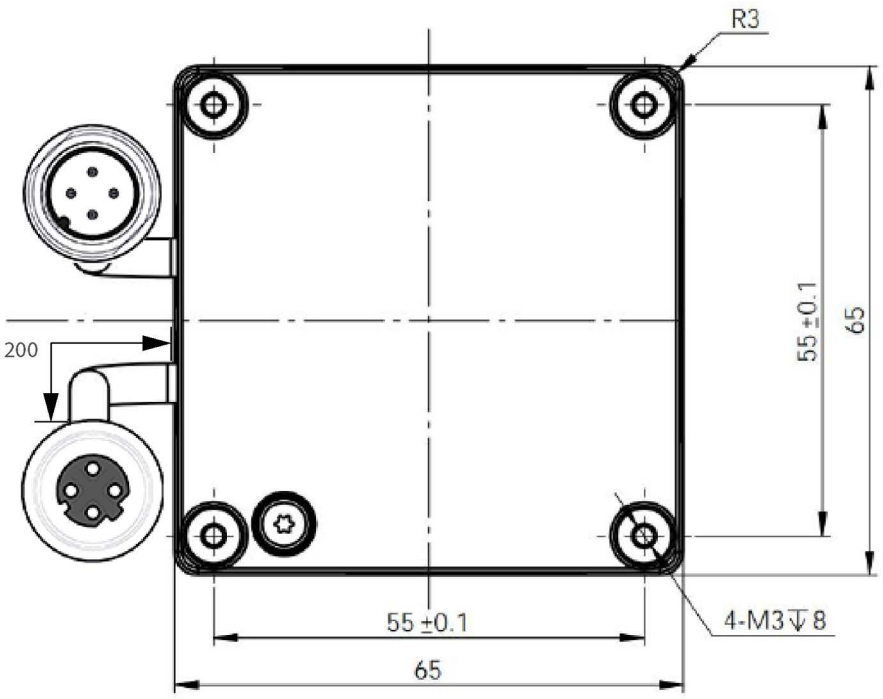


Figure 1 - LGS-N25 Mounting interface

ELECTRICAL CONNECTION

The LGS-N25 has 2 pig tail connectors, a 4-pole M12 male connector for power supply and a 4-pole M12 D-coded female connector for Ethernet communication. As shown in the figure below.

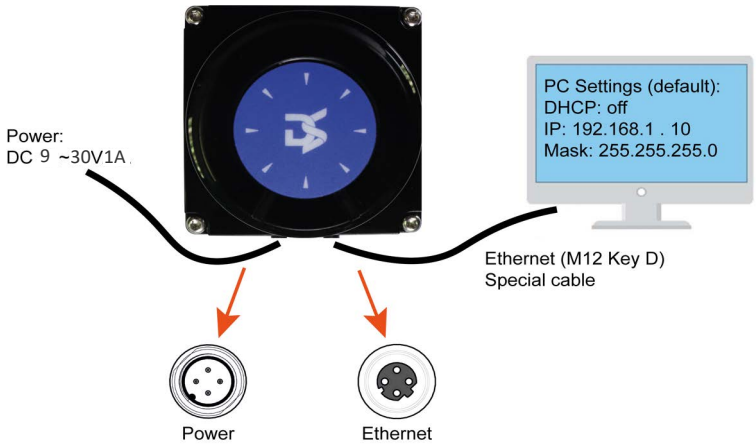


Figure 2 - LGS-N25 Connection

Power connector

M12-4 Poles Male - pig tail. Length of pig tail cable = 200mm

The supply voltage must be between 9 and 30Vdc. Here below the connector pinout.

No.	DEFINITION	WIRING COLOR
1	+VCC	Brown
2	NC	White
3	GND	Blue
4	NC	Black

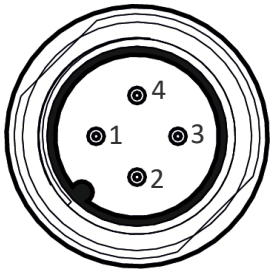


Figure 3 - Power connector

Ethernet connector

M12-4 Poles Female - pig tail. Length of pig tail cable = 200 mm

The pin definitions of Ethernet connector are as follows:

No.	DEFINITION
1	Transmit data +
2	Receive data +
3	Transmit data -
4	Receive data -

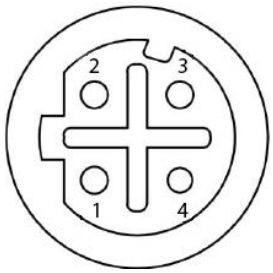


Figure 4 - Ethernet connector

COMMUNICATION

The standard Ethernet RJ-45 connector is used to connect the LGS-N25 to the computer.

The computer IP address needs to be set before communication, the first three segments of the computer IP address must be set the same as the LiDAR (192.168.1.X) and be in the same subnet. The last segment of the computer IP cannot be set to 100 to prevent conflict with the LiDAR default IP.

Port number of the point cloud packet is 2368

The default factory settings for LiDAR are shown below:

- LiDAR IP:192.168.1.100
- LiDAR subnet mask: 255.255.255.0

The recommended computer IP settings are shown below:

- Computer IP: 192.168.1.10
- Computer subnet mask: 255.255.255.0

The setting process in the computer is shown below:

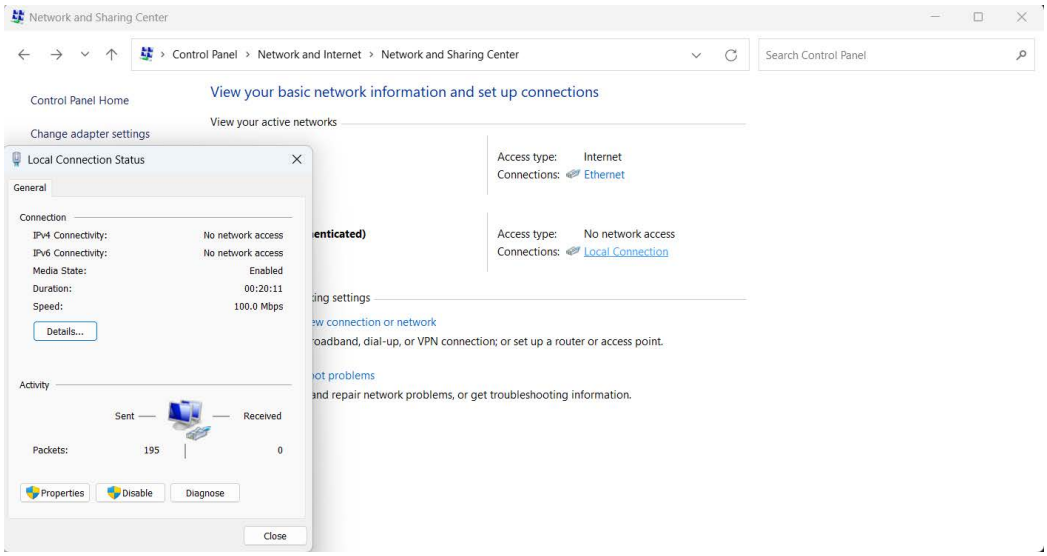


Figure 5 - Computer IP Setting: Step 1

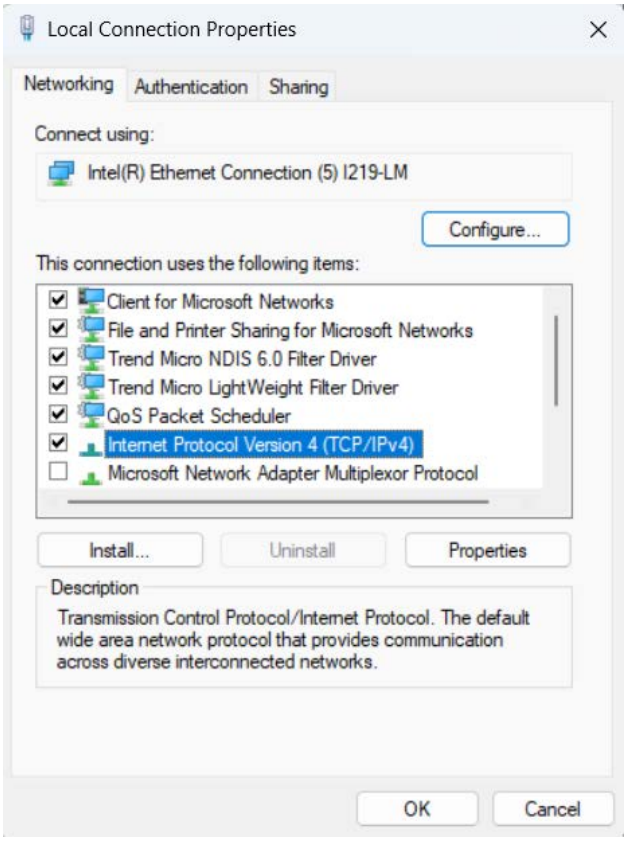


Figure 6 - Computer IP Setting: Step 2

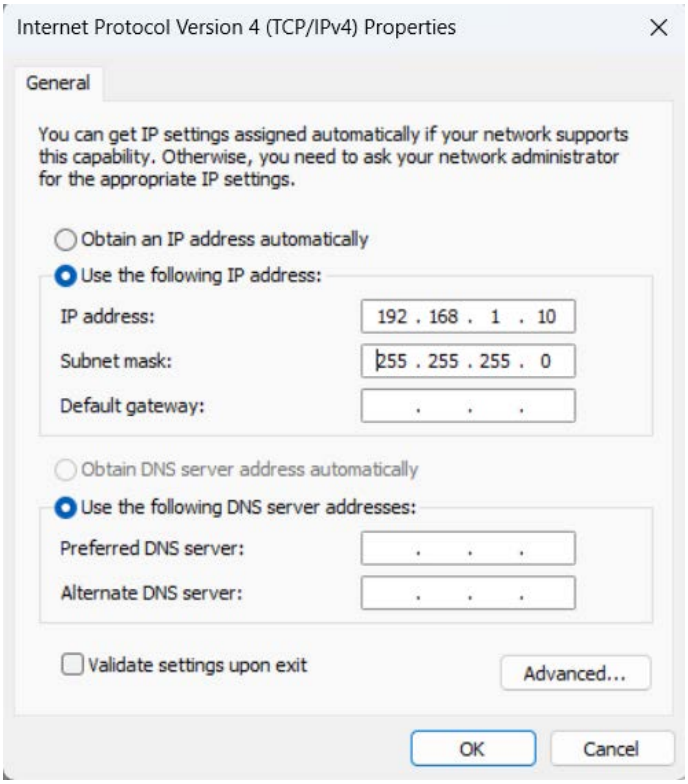


Figure 7 - Computer IP Setting: Step 3

NOTE

When network addresses (IP LiDAR, IP Host, Net Mask, etc.) are changed, a power cycle of the LGS-N25 should always be performed. This way when the device reboots, it uses the new values.

LEDs

There are 2 LED indicators.

Figure 8 - LGS-N25 LEDs

LED	MEANING
	Power On. Red and Green lights are always ON.
	Start. Device self checking, Red and Green LED flash.
	Normal operation. Red OFF, Green ON.
	Fault. Red ON, Green LED flash.

CHAPTER 5
DATA PACKET FORMAT

The LGS-N25 enables laser point cloud data transmission. Please refer to the following for the analysis of LiDAR point cloud data.

The transmission of information between the LGS-N25 and the PC follows the UDP standard network protocol. The data is in Little-endian format, with the low byte first and the high byte second.

OVERVIEW

Total length of data packet is 772 bytes, including 48 bytes for the header file, 720 bytes for the laser return data and 4 bytes for the CRC32.

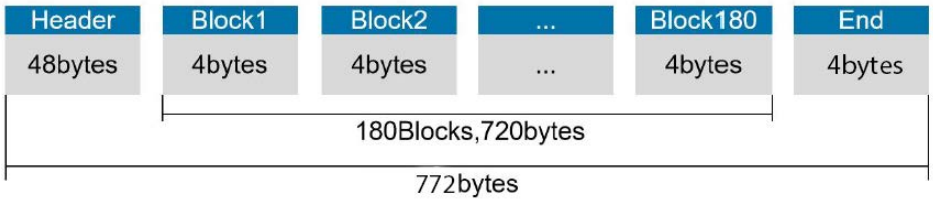


Figure 1 - Format of point cloud information packet

The total length of a data frame is 772 bytes, including:

- Frame header: 48 bytes
- Data block: 180 x 4 = 720 bytes
- CRC32: 4 bytes

DEFINITION OF HEADER

Total length of data packet is 772 bytes, among which 48 bytes represent the header, 720 bytes represent the data returned by laser and 4 bytes represent the CRC32.

OFFSET	LENGTH	DESCRIPTION	REMARK
0	2	Identifiers. Fixed as 0xFEAC	
2	2	Protocol Version: 0x0301	Protocol Version: 0x0301
4	4	Packet size, including header + data+CRC32	Packet size, including header + data+CRC32 Total bytes
8	2	Head size	The number of bytes in the packet header of this packet
10	1	Distance ratio	Used to calculate the distance. Distance = Distance count x Distance scale. For current proximity products, this scale value is 1, unit mm
11	1	Data type of data area	0x01:range (uint16) + intensity (uint16)
12	2	Scan count, starting from 0 and restarting from 0 when the limit is reached	Scan count from power-on, 0, 1, 2.....65535, 0, 1.....
14	2	Packet counting, starting from 0 and restarting from 0 when the upper limit is reached	Count of packets sent from power-up, 0, 1, 2.....65535, 0, 1.....
16	4	Timestamp, NTP64 format, fractional part	The decimal part of the NTP64 format timestamp, which can be synchronized with the time-stamp server. Unsynchronized indicates the time from the start of the main program; synchronized indicates the time from 1900-01-01 00:00:00
20	4	Timestamp, NTP64 format, integer part	The integer part of the NTP64 format timestamp, which can be synchronized with the time-stamp server. Unsynchronized indicates the time from the start of the main program; synchronized indicates the time from 1900-01-01 00:00:00
24	2	Bit[14:0]: Rotational Speed, Unit: 0.01Hz; Bit 15: Rotation direction (0: Clockwise, 1: Counterclockwise)	LiDAR real-time rotational speed. The highest bit indicates the direction of rotation: 0 represents clockwise, 1 represents counterclockwise; the value of the lower 15 bits indicates the rotational speed, the unit RPM (revolutions per minute) and Hz relationship: RPM = Hz × 60

OFFSET	LENGTH	DESCRIPTION	REMARK
26	2	Points included in 360 ° for calculating horizontal angular resolution	Indicates the number of angles in the range of 360 degrees, which is used to calculate the angular resolution. For example: 1600 means the angular resolution is 360/1600=0.225°
28	2	Input	Input IO state, Bit[3:0] corresponds to Input3~0
30	2	Output	Output IO status, Bit[3:0] corresponds to Output3~0
32	4	System Status	0 indicates normal operation, and each Bit indicates a state. Bit31:Not ready, Bit0:Motor fault, Bit1:Voltage, Bit2:Temperature, Bit3:Measurement system
36	2	Scan start point serial number, starting from 0	Scan the starting point serial number, convert the angle: serial number × the above calculation of the angular resolution, such as the angular resolution calculated after getting 0.25, serial number value of 400 × 0.25 = 100 °
38	2	Scan end point serial number, starting from 0	Scan the last point serial number, convert the angle: serial number × the angular resolution calculated above, such as the angular resolution calculated after getting 0.25, serial number value of 1000 × 0.25 = 250 °
40	2	The starting point serial number of this package start from 0.0 represents 0°	This package starting point serial number, conversion angle: serial number × the above calculation of the angular resolution, such as the angular resolution calculation to get 0.25 after the serial number value of 400 × 0.25 = 100 °
42	2	Number of measurement points in this package N	The number of points contained in this packet.
44	4	Reserved	

DEFINITION OF BLOCK

The length of data block is 720 bytes and contains:

- 2 bytes related to distance
- 2 bytes related to the signal strength for the 180 points acquired in each packet.

OFFSET	LENGTH	DESCRIPTION	REMARK
0	2	Distance reading 0, unsigned integer which is, "the value of the reading × the distance ratio of the package head" to get the measurement distance (unit: mm)	The distance reading, together with the distance ratio, calculates the measured distance. Measured distance = distance reading × distance ratio in the package head. Example: reading 100, proportion 1, the measured distance is 100 × 1 = 100 mm
2	2	Signal strength reading 0, unsigned integer	
4	2	Distance reading1, unsigned integer which is, "the value of the reading × the distance ratio of the package head" to get the measurement distance (unit: mm)	The distance reading, together with the distance ratio, calculates the measured distance. Measured distance = distance reading × distance ratio in the package head. Example: reading 100, proportion 1, the measured distance is 100 × 1 = 100 mm
6	2	Signal strength reading 1, unsigned integer	

DATA CONVERSION

Angle calculation

The calculation of the LGS-N25 angle is shown in the following example.

1. The 27th/28th byte of the header file converts the points contained in 360° to calculate the horizontal angular resolution. For example: 1440 means the angle resolution is 360/1440=0.25°.

2. Conversion angle: serial number × the angle resolution calculated above, for example, the serial number value is 400 × 0.25 = 100 °.

Distance calculation

The distance calculation for LGS-N25 is shown in the following example.

1. Obtain distance value: 0x11 & 0x12
2. Byte High-Low Swap: 0x12 & 0x11
3. Combine to unsigned hexadecimal number: 0x1211
4. Convert to decimal numbers: 4625
5. Multiply the distance ratio: Assume a distance ratio of 1mm
6. Result: 4625 mm

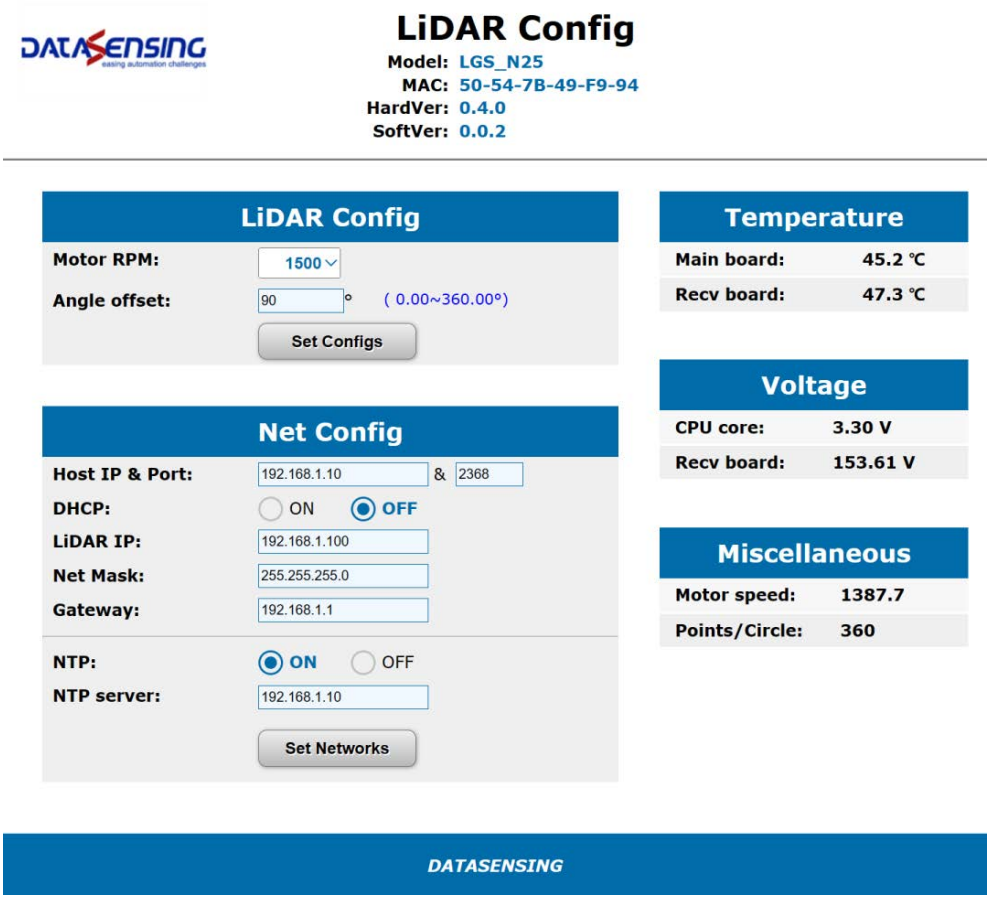
Calculation of signal strength

The signal strength of LGS-N25 is calculated as shown in the following example.

1. Obtain signal strength values: 0x11 & 0x12
2. Byte High-Low Swap: 0x12 & 0x11
3. Combined into unsigned hexadecimal numbers. 0x1211
4. Convert to decimal numbers: 4625
5. Result: 4625

CHAPTER 6
PARAMETER CONFIGURATION

Type the device's IP on a web browser to enter in the LiDAR configuration windows (see figure below):



CONFIGURATION THROUGH LGS VIEW PC SOFTWARE

NOTE

If you upgrade or downgrade the LGS View app, first uninstall the current version through the Windows Control Panel (Control Panel\Programs\Programs and Features).

The **LGS View** software interface is shown below.

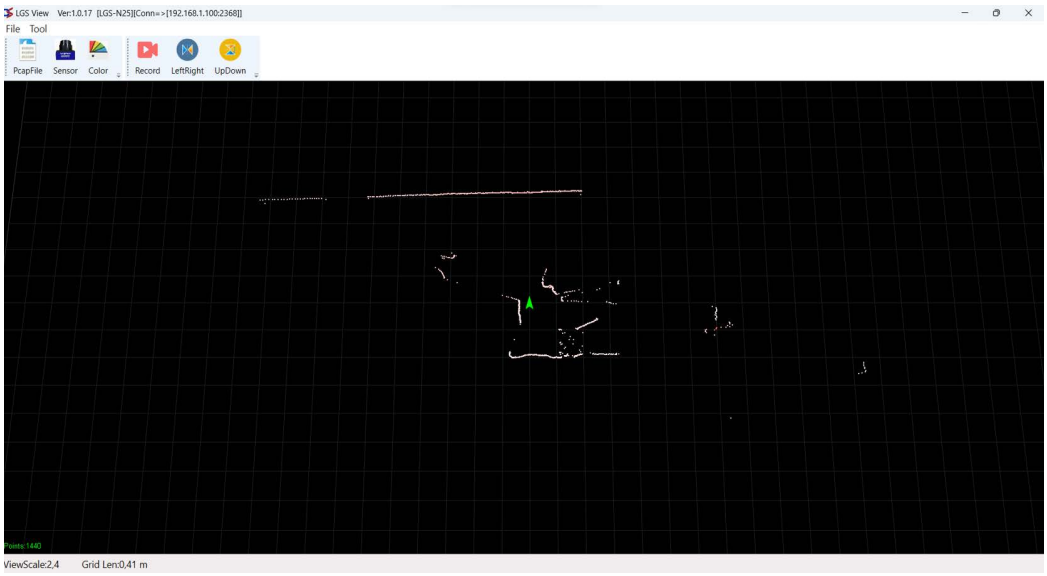


Figure 1 - Sample of PC software interface

NOTE

The PC software interface may change due to product update.

NOTE

If Windows Firewall is active on the configuration PC, a pop-up window will appear. Follow the procedure described in "LGS View: Windows Firewall" on page 18**.**

Operating environment

The required environment for the software to run is as follows:

- OS: Windows 10 and above
- .NET Framework: 4.5.2
- Pcap: wpcap runtime

Network environment

The default factory static IP for LiDAR is as follows:

- LiDAR IP: 192.168.1.100
- Net mask: 255.255.255.0

The following static IP must be configured on the PC:

- Host IP: 192.168.1.10
- Net mask: 255.255.255.0

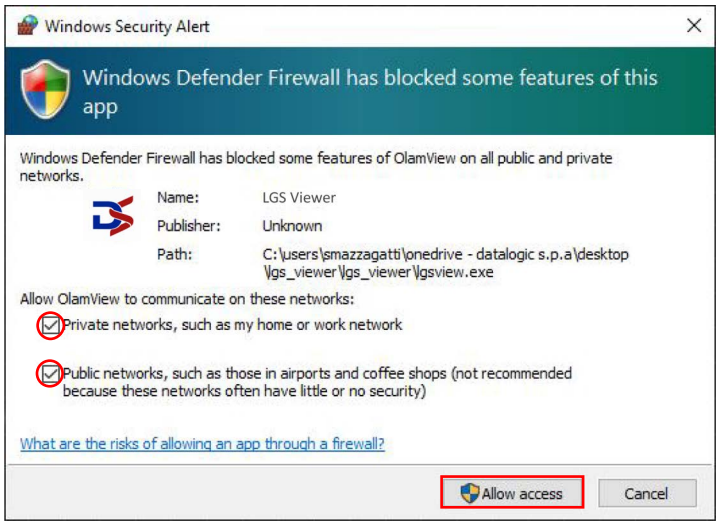
LGS View: Windows Firewall

If **Windows Firewall** is active on the configuration PC, a pop-up window will appear.

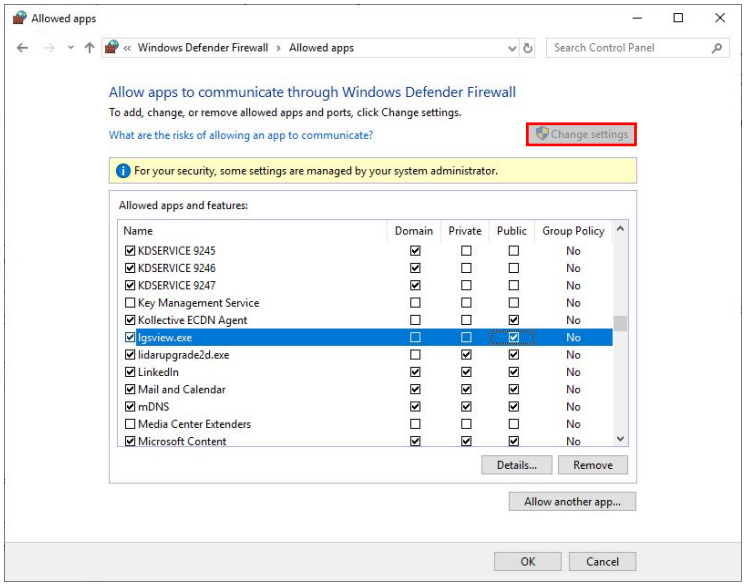
NOTE

If no firewall window appears, but an “Unable to connect” message is still shown, it may be due to the antivirus firewall installed on you PC.

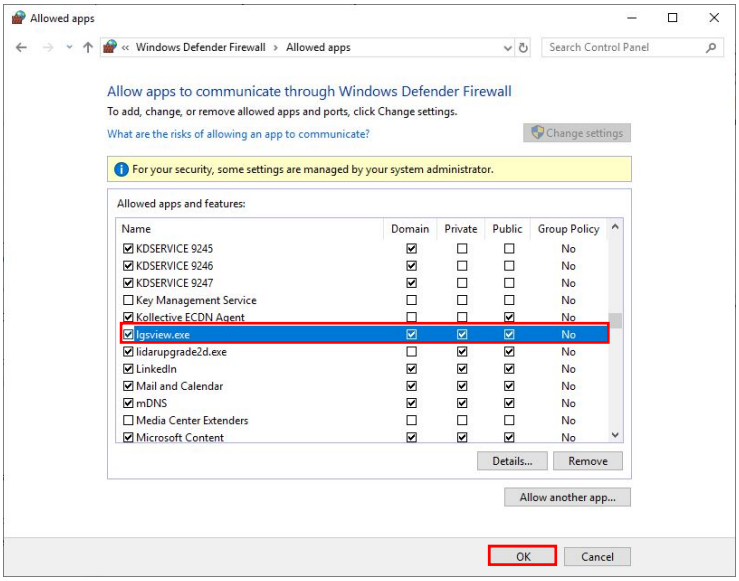
Do not close the pop-up window before allowing access to both private and public networks of the PC to communicate and exchange data with the device through the Ethernet port.



If you close the pop-up window before confirming the Firewall authorization, go to Control Panel > System and Security > Windows Defender Firewall > Allowed apps, and click on “Change settings”.



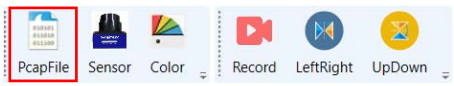
Scroll down the list and check the boxes on the lgsview.exe row as shown in the figure below, then click *OK*. The Firewall is now disabled on LGS View.



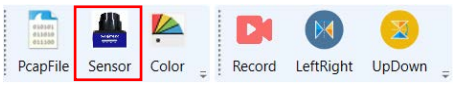
Using LGS View

Menu icons

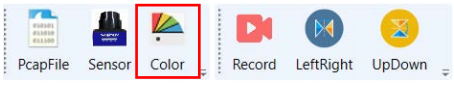
The menu icons have the following functions:



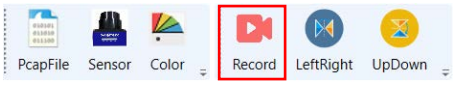
Capture file: read a previously saved .pcap file containing a scanner measure data. Alternatively, go to *File > Open > Capture File*.



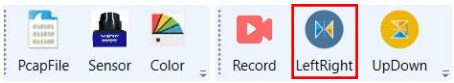
Select Sensor: select and connect a scanner to read its measure data in real time. Alternatively, go to *File > Open > Select Sensor*.



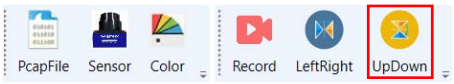
Color Coding: change the color coding representing the intensity value for each point being displayed. The software will provide scheme level graphics in the Color directory that loads the root at initialization. The graphic size is 256*23;*.bmp (24 bit).



Record: record a sequence of measure data and save it on a .pcap file.



LeftRight: Change the display of the target from the LiDAR. After the button is pressed, the target displayed to the right of the GUI will be displayed to the left.



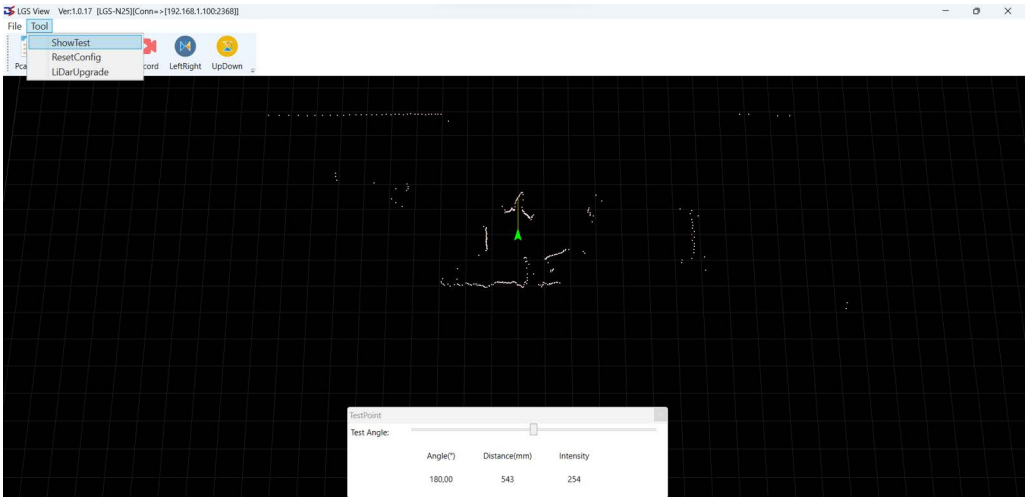
UpDown: Change the display of the target from the LiDAR. After the button is pressed, the target displayed at the bottom of the GUI will be displayed at the top.

To zoom in and out, use the mouse wheel (or two fingers in the case of a touchpad).

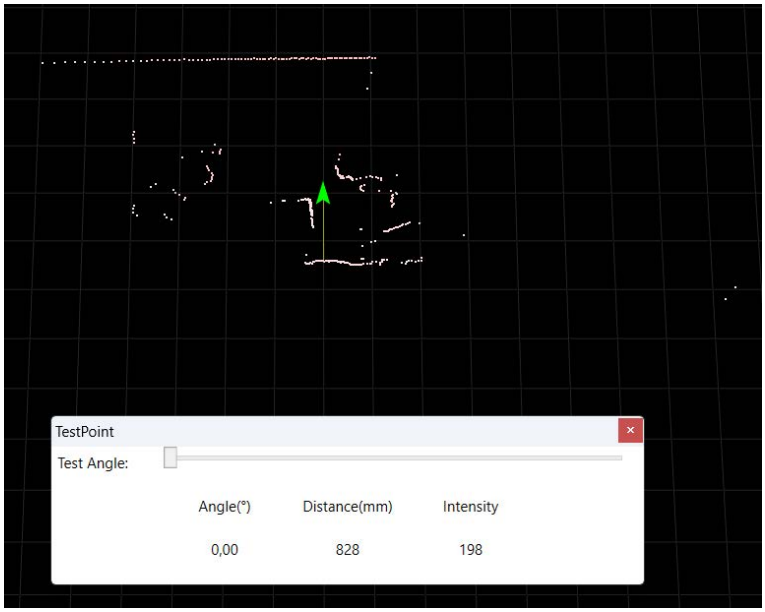
To center/decenter the measurement images, hold down the right mouse button and move the cursor.

Basic measurement

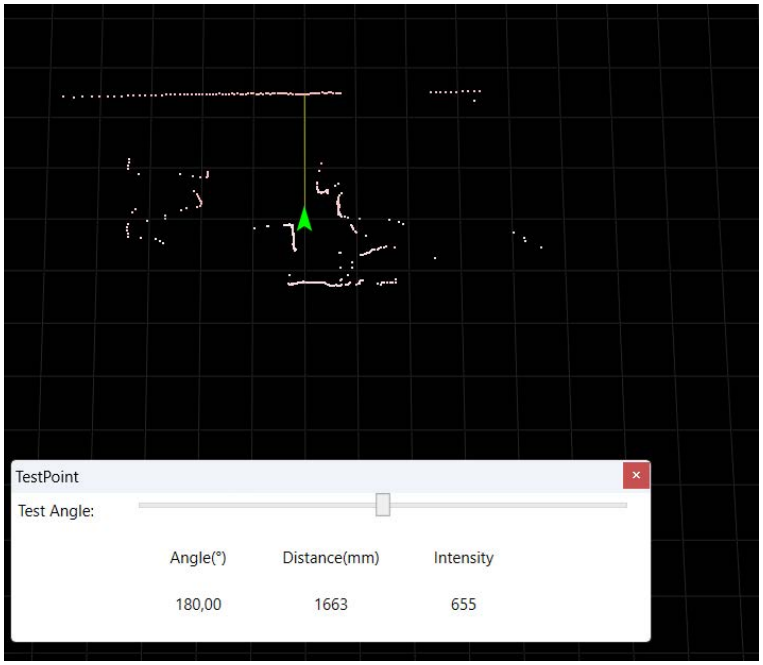
Go to *Tool* > *ShowTest*. The purpose of LGS View is to monitor in real time the cloud of points generated by LGS-N25 inside a system of coordinates. The *ShowTest* function can be used to measure the angle (°), distance (mm) and intensity of each point.



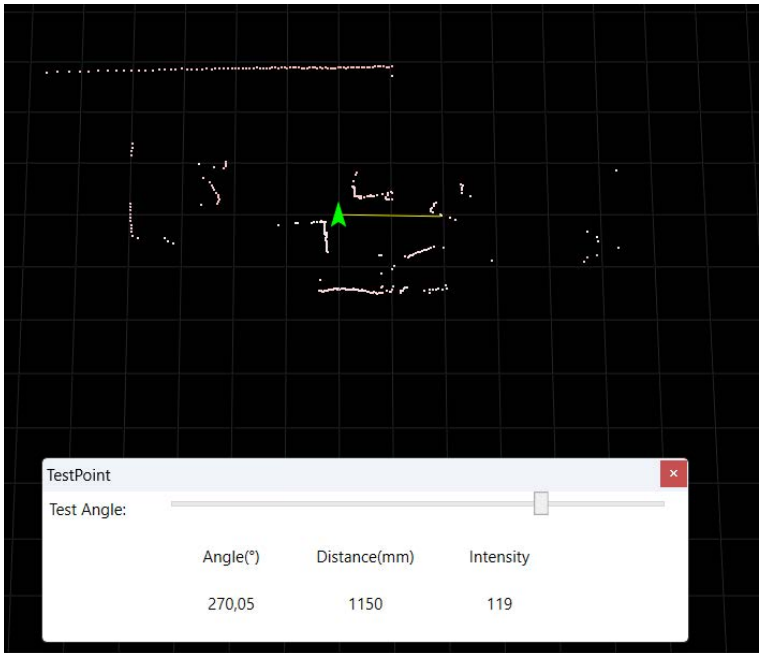
Angles start from 0° in the point behind the LiDAR and go on clockwise up to 360°:



Angle 0° == 360°

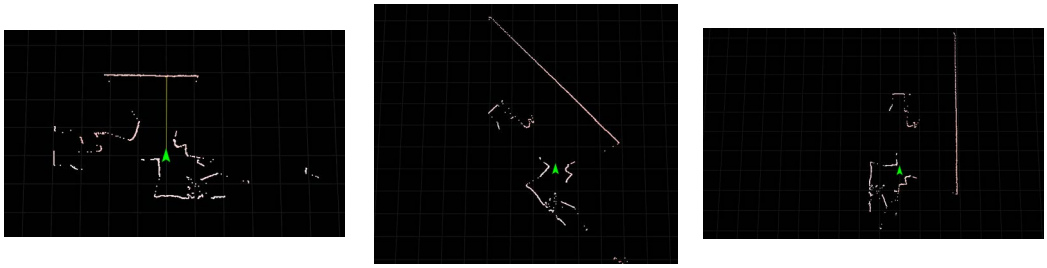


Angle 0° == 180°



Angle 0° == 270°

To set an offset angle, go to the configuration page (see "Configuration through LGS View PC software" on page 16). The offset angle is added to the actual angle of each point, causing a clockwise rotation of a cloud of points:



Offset = 0° Offset = 45° Offset = 90°

Reset the LiDAR

The ResetConfig software program can be used to restore the following settings to factory configuration:

- IP: 192.168.1.100
- Host: 192.168.1.100:2368

From the LGS View software program go to *Tool > ResetConfig* or launch the ResetConfig software program. The following window is displayed. Click on the *Reset(S)* button to restore settings to factory configuration.

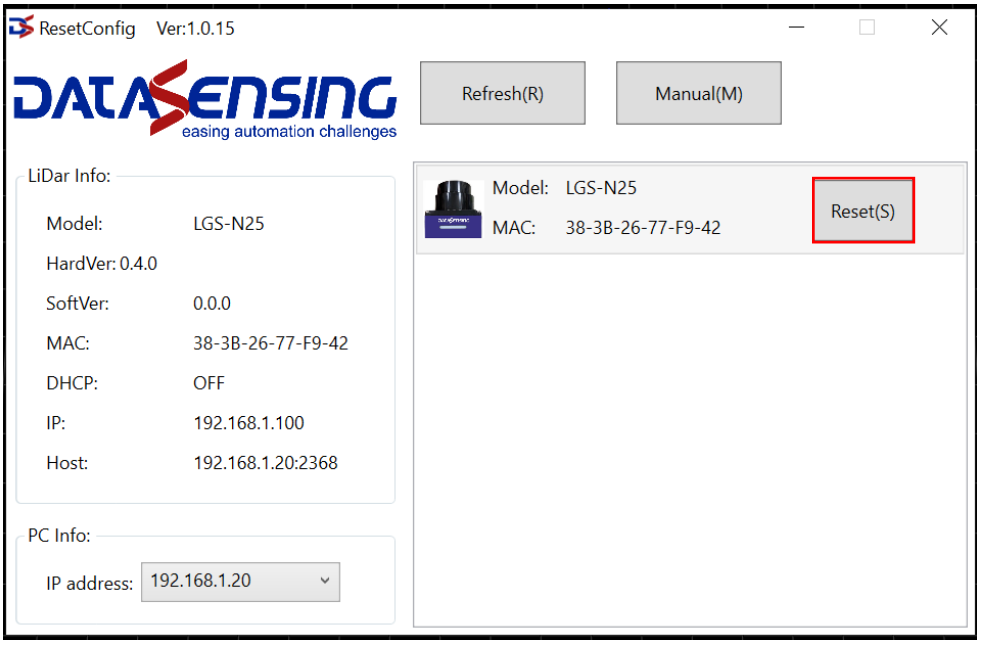
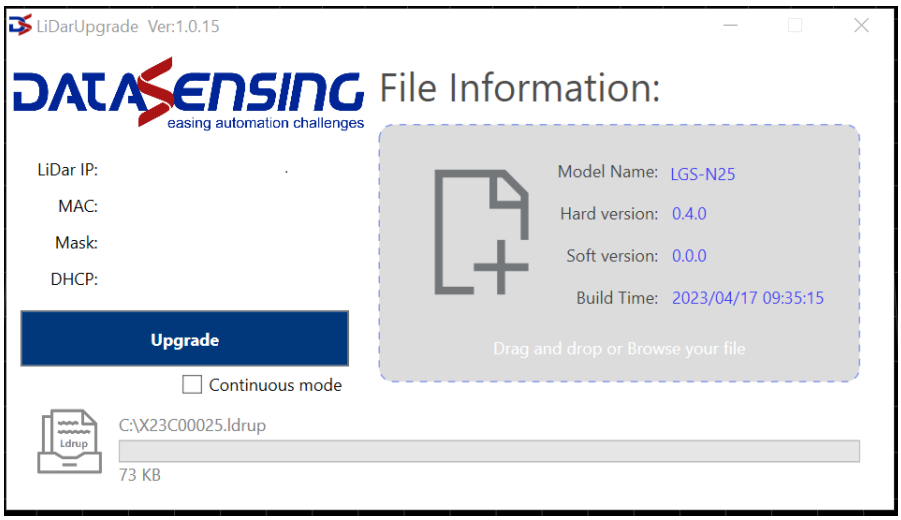


Figure 2 - ResetConfig software program

Firmware upgrade

Going to *Tool* > *LidarUpgrade* opens the firmware upgrade module:

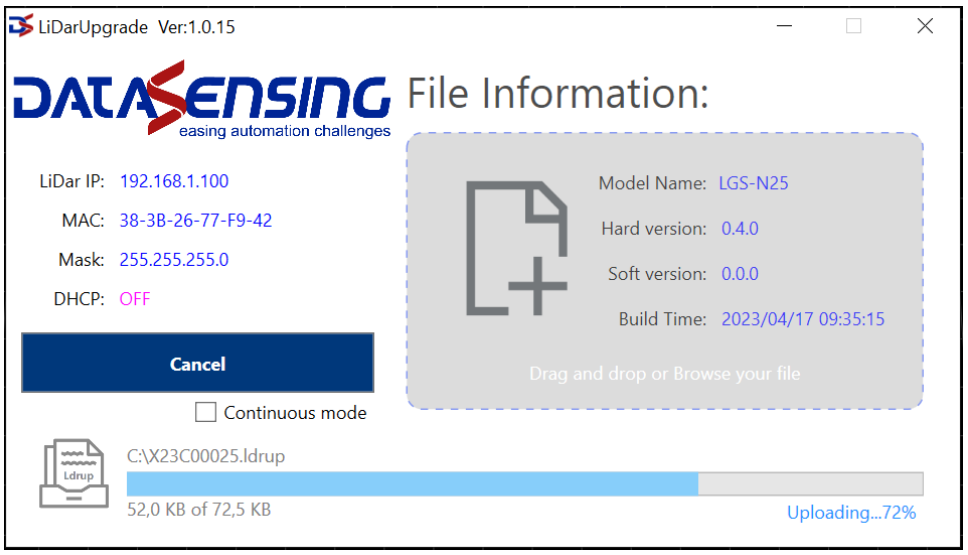


To upgrade the firmware, follow the procedure below:

1. Click on the gray box to the right and select the .ldrup firmware file (or drag it to the specified area).

NOTE **Check the "Continuous mode" box to automatically upgrade the firmware on each device that will be consecutively connected to the computer.**

2. Click on the *Upgrade* button.



3. Power cycle the device while keeping LGS View connected. The progress bar will fill up.

4. Open the LiDAR configuration web page and check that the firmware has been upgraded.

CHAPTER 7
TECHNICAL PARAMETERS

GENERAL SPECIFICATIONS	
Wavelength	905 ± 20 nm
Laser class	Class 1
Channel	1
Scanning angle	360°
Scanning rate	10,15, 25 Hz
Ambient light limit	>80000 LUX @ sunlight
Light spot divergence angle	4(H); 0.3(V) mrad
Horizontal plane	<= 0,8°

INTERFACE	
Interface type	IEEE 802.3u 100Mbps Ethernet
Protocol	UDP TCP/IP

ELECTRICAL SPECIFICATIONS	
Operation voltage	9 to 30 VDC
Power consumption (25°C)	< 5W @15Hz
Power connector	4pin, M12x1 Connector Standard
Communication Interface	4pin, M12x1 socket D-coded

MEASUREMENT PARAMETERS	
Absolute accuracy	<± 30 (0.4~25m)
Repeat accuracy	<= 20 (0.4~25m)
Angle resolution	0.25° @ 10 Hz / 0.5° @ 15 Hz / 1° @ 25 Hz
Working distance (based on reflectivity)	0.1~5m @ 3,5% 0.1~10m @ 10% 0.1~25m @ 80% 0.1~25m @ High Reflection

MEASUREMENT PARAMETERS	
Resolution of output distance	1 mm
Point cloud density	14.4K@10Hz, 10.8K@15Hz, 9K@25Hz
Signal intensity	0-20000

AMBIENT CONDITIONS	
Operating temperature	-10 to +60 °C
Storage temperature	-20 to +70 °C
Relative humidity	< 95% (No Condensation)

MECHANICAL SPECIFICATIONS	
Housing width	65 mm
Housing length	65 mm
Housing height	70 mm
Degree of protection	IP67
Material	Body and cap: aluminum Window: polycarbonate Panel and LED cover: polycarbonate and ABS
Mass	< 500 g

COMPLIANCE AND CERTIFICATIONS	
Vibration	IEC 60068-2-6:2007
Shock	IEC 60068-2-27:2008
EMC	IEC 61000-6-2:2016-08 / IEC 61000-6-3:2006-07
Laser safety	IEC 60825-1
ROHS	✓
Safety requirements	UL61010-1

INDICATORS	
LED indicator	RGB*2 Color
Operation indicator	Green LED: Power ON
Function indicator	Red LED: LiDAR fault

SOFTWARE	
Basic software	Datasensing LGS View OS required: Windows 10 and above

CHAPTER 8
CABLES AND ACCESSORIES

CABLES

	MODEL	1ST END	2ND END	LENGTH	CODE
POWER CABLE	CS-A1-02-U-03	4 pin female	free wires	3 m	95ASE1120
	CS-A1-02-U-05			5 m	95ASE1130
	CS-A1-02-U-10			10 m	95ASE1140
	CS-A1-02-U-15			15 m	95ASE1150
	CS-A1-02-U-25			25 m	95ASE1160
ETHERNET TO HOST CABLES	CAB-ETH-M01 M12-IP67 ETHERNET CAB. (1M)	4 pin male	RJ45	1 m	93A051346
	CAB-ETH-M03 M12-IP67 ETHERNET CAB. (3M)			3 m	93A051347
	CAB-ETH-M05 M12-IP67 ETHERNET CAB. (5M)			5 m	93A051348
	CAB-ETH-M10 M12-IP67 ETHERNET CAB. (10M)			10 m	93A051391

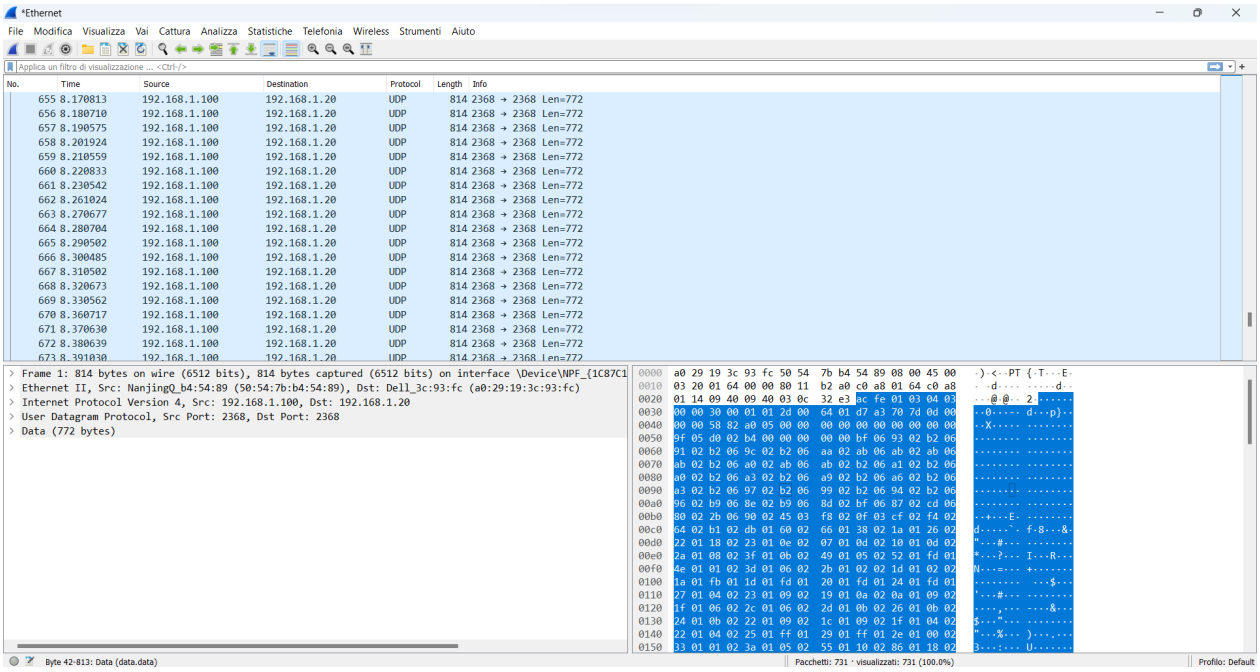
ACCESSORIES

MAINTENANCE ACCESSORIES		
DESCRIPTION	MODEL	ORDER NO.
Liquid cleaner in spray bottle (1 lt)	SLS-CLEANER	95ASE2990
Cleaning cloth (22 cm x 22 cm), 100 pcs	SLS-CLOTH	95ASE3000

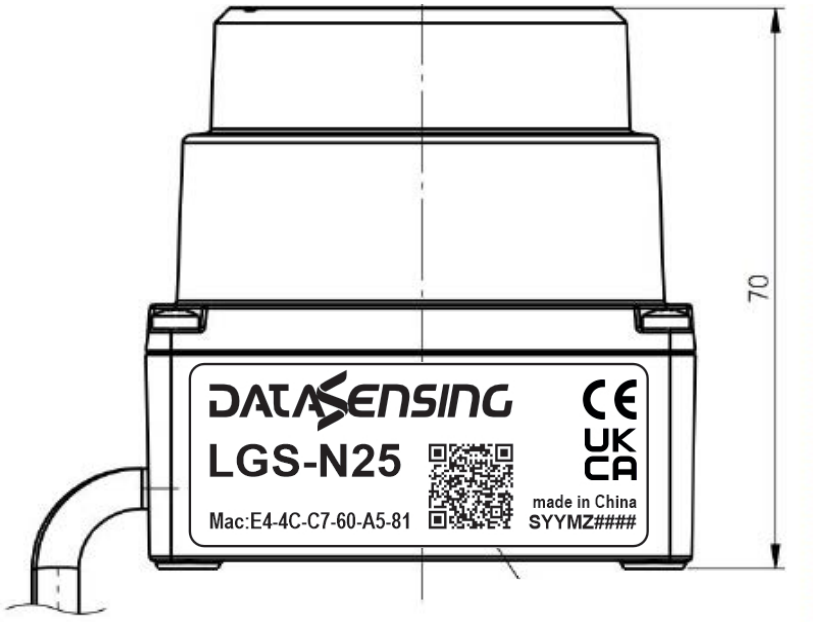
CHAPTER 9
TROUBLESHOOTING

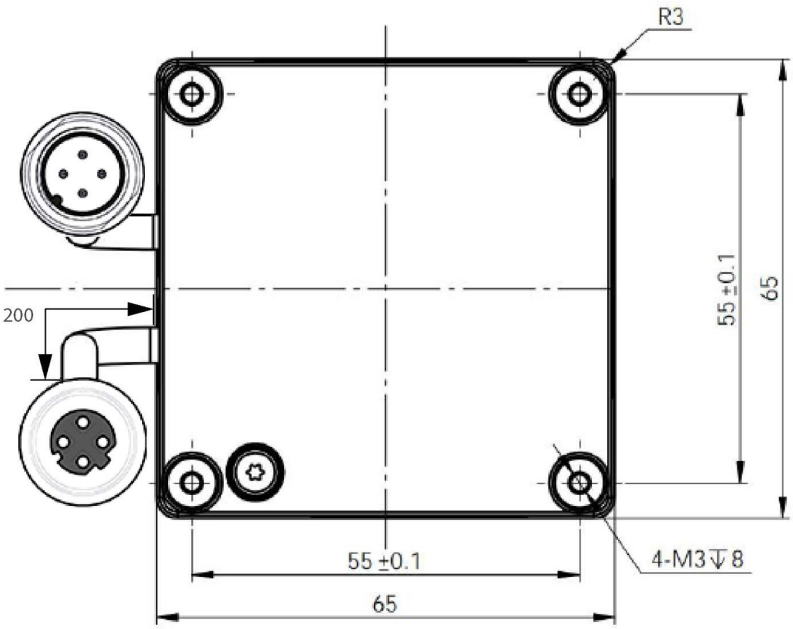
PROBLEM	SOLUTION
LiDAR fails to scan	• Check power connection • Check whether voltage meets 9 to 30 VDC If failure persists, contact Datasensing Technical Support.
LiDAR scan produces no data	• Check net connection • Check the IP setting of the data receiver • Try to use a third-party data capture tool to check whether data can be obtained normally • Check if only one LiDAR software is started • Verify that the firewall on the receiving end of the data is turned off, or that there is no other security software or process blocking data transmission. If failure persists, contact Datasensing Technical Support.

APPENDIX A
DATA PACKET



APPENDIX B
MECHANICAL DIMENSIONS





APPENDIX C
RECOMMENDATIONS FOR MECHANICAL INSTALLATION

1. Protect the product respect to high shock and vibration source.
2. Do not expose it to any direct sunlight (windows, skylights) or any other heat source in order to keep the temperature as the standard profile
3. It is recommended that the installation base used to fix the LiDAR be as flat as possible without any unevenness.
4. The positioning posts on the installation base should strictly follow the depth of the positioning posts at the bottom of the LiDAR. The height of the positioning posts should not be higher than 4mm. The material of the mounting base is recommended to be aluminum alloy or similar metallic material.
5. When installing the LiDAR, if there are contact mounting surfaces above and below the LiDAR, please ensure that the distance between the mounting surfaces is greater than the height of the LiDAR to avoid damaging to his parts.
6. When installing and wiring the LiDAR, do not pull excessively the wires and keep it a bit loose.
7. In order to avoid any impact on measurement accuracy due to mutual interference between LiDARs, we recommend installation as shown below

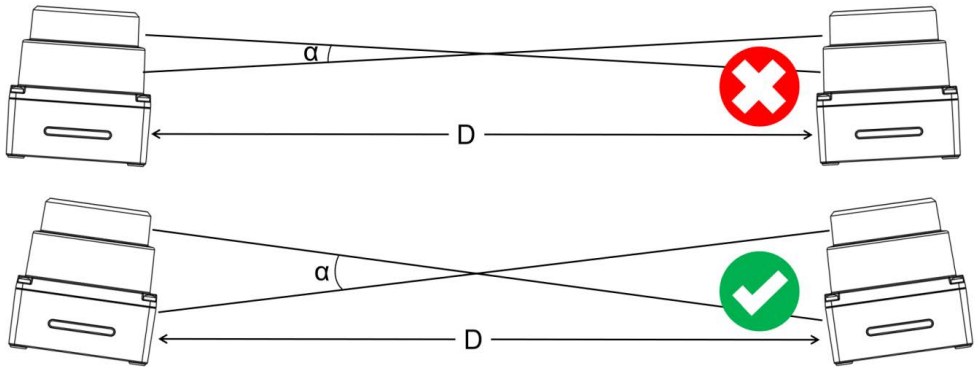


Figure 1 Multiple liDARs on the same plane to prevent optical path crosstalk

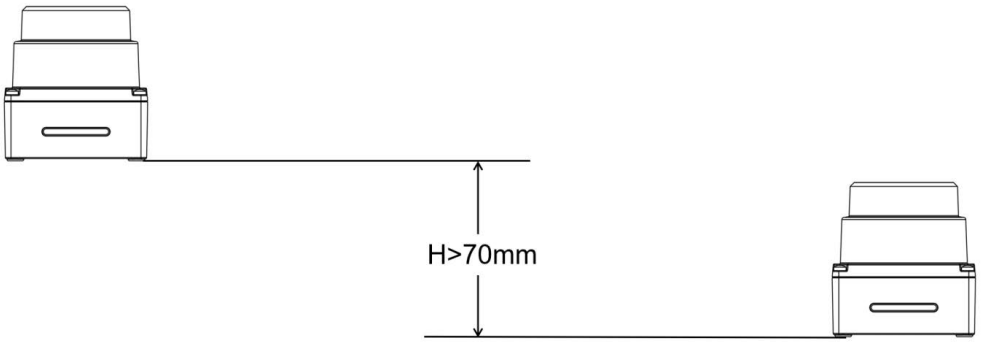


Figure 2 Multiple liDARs forward placement

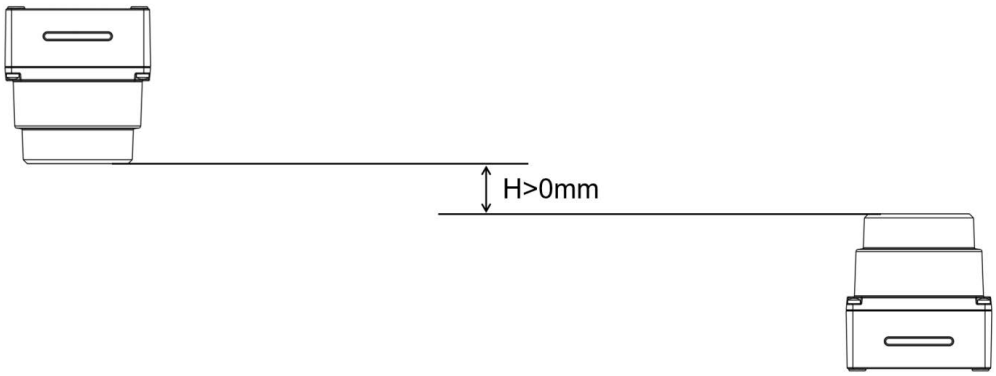


Figure 3 Multiple liDARs window covers placed opposite each other

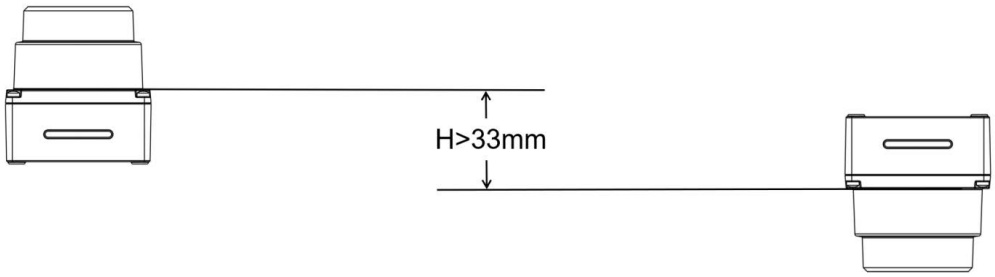


Figure 4 Multiple liDARs bottoms placed opposite each other

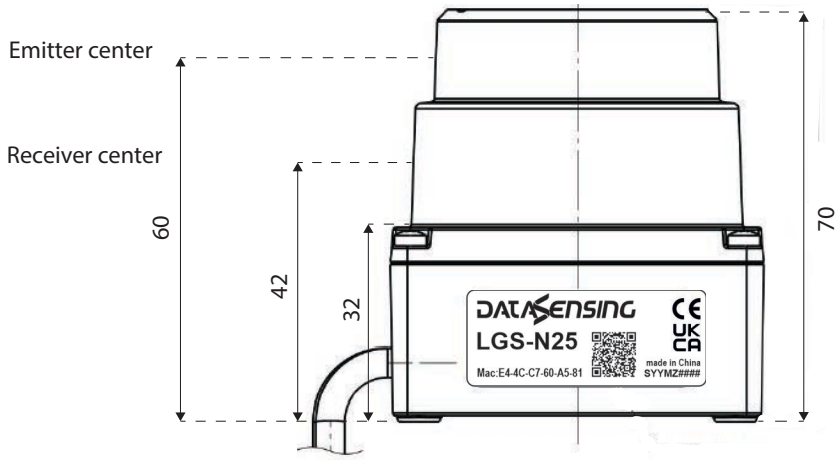


Figure 5 LGS-N25 light output position and receiving position

APPENDIX D
CLEANING OF SENSORS

In order to accurately sense the surrounding environment, LGS-N25 needs to be kept clean, especially the ring-shaped optical window.

Precautions

Please read the contents of this Appendix D carefully and completely before cleaning LGS-N25 liDAR otherwise improper operation may damage the equipment.

Required materials

1. Clean fiber cloth - ref. maintenance accessory “SLS-CLOTH” 95ASE3000
2. Spray filled with clean water
3. Anti-static alcohol free solution - ref. maintenance accessory “SLS-CLEANER” 95ASE2990
4. Clean gloves

Cleaning method

If there is only some dust adhered to the surface of the radar, you can directly use the clean fiber cloth 95ASE3000 with a small amount of anti-static alcohol free solution 95ASE2990 to gently wipe the surface of the window LiDAR, and then wipe it dry with a dry and clean fiber cloth.

If the surface of liDAR's optical window is stained with lumps of foreign matter such as mud, clean water should first be sprayed on the surface of the dirty parts to remove the mud and other foreign matter.

CAUTION

Do not wipe off the mud directly with a fiber cloth, as this may scratch the surface irreparably).

If the first operation result not effective, secondly, spray warm water, with eventually mild soap, on the dirty area.

The lubricating effect of soapy water can accelerate the removal of foreign matter.

Gently try to wipe the surface of the liDAR with the fiber cloth again, but be careful not to scratch the window surface.

Finally, clean the soap residue on the liDAR surface with clean water (if there is still residue on the surface clean it again with anti-static alcohol free solution), and wipe it dry with a dry microfiber cloth

NOTES

Datasensing S.r.l.
Strada S. Caterina 235 | 41122 Modena | Italy
Tel. +39 059 420411 | Fax +39 059 253973

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