LGS-N50

USER MANUAL

LiDAR Guidance Scanner

DATALOGIC

Datalogic S.r.l.
Via S. Vitalino, 13
40012 Calderara di Reno (BO)
Italy
Tel. +39 051 3147011
Fax +39 051 3147205

Electronic versions of this document may be downloaded from the Datalogic website (www.datalogic.com). If you visit our website and would like to make comments or suggestions about this or other Datalogic publications, please let us know via the "Contact" page.

Disclaimer

Datalogic has taken reasonable measures to provide information in this manual that is complete and accurate, however, Datalogic shall not be liable for technical or editorial errors or omissions contained herein, nor for incidental or consequential damages resulting from the use of this material. Datalogic reserves the right to change any specification at any time without prior notice.

Trademarks

Datalogic and the Datalogic logo are registered trademarks of Datalogic S.p.A. in many countries, including the U.S.A. and the E.U.

LGS-N50 is a trademark of Datalogic S.p.A. and/or its affiliates. All other trademarks and brands are property of their respective owners.

Patents

See www.patents.datalogic.com for patent list.

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.

TECHNICAL SUPPORT

Support Through the Website

Datalogic provides several services as well as technical support through its website. Log on to (www.datalogic.com).

For quick access, from the home page click on the search icon, and type in the name of the product you're looking for. This allows you access to download Data Sheets, Manuals, Software & Utilities, and Drawings.

Hover over the Support & Service menu for access to Services and Technical Support.

Reseller Technical Support

An excellent source for technical assistance and information is an authorized Datalogic reseller. A reseller is acquainted with specific types of businesses, application software, and computer systems and can provide individualized assistance.

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

LGS-N50 is a 2D LiDAR sensor developed to meet the needs of Object Localization. The output of this product is point cloud data (Ethernet port).

A laser beam emitted from LGS-N50 internal laser diode is projected around LiDAR through a rotating mirror and then returns (the amount of returned laser energy depends on the reflectivity of objects). The LiDAR obtains the detected distance and angle information through calculation, as shown below.

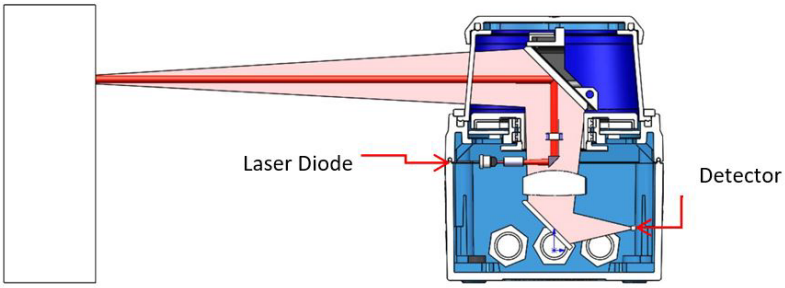


Figure 1 - LGS-N50 LiDAR working principle

Based on the TOF (Time of Flight) principle, the distance between objects and LiDAR is obtained according to the speed of light and time of flight of the laser. The calculation method is as follows:

$$D=c*T/2$$

Where:

D = distance

T = flying time

c = speed of light

CHAPTER 4
INSTALLATION AND USAGE

MECHANICAL CONNECTION

LGS-N50 LiDAR can be installed in two ways: back mounting and base mounting.

Back mounting

There are four M5 screw holes at the back of the main frame for installation (hole depth: 8mm).

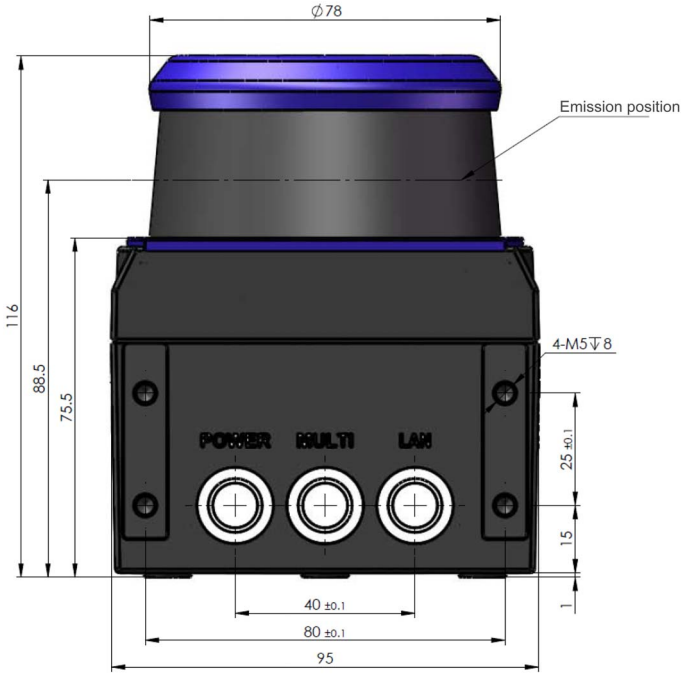


Figure 2 - LGS-N50 Back Mounting interface

Base mounting

There are three M5 screw holes at the base of the main frame for installation (hole depth: 8mm).

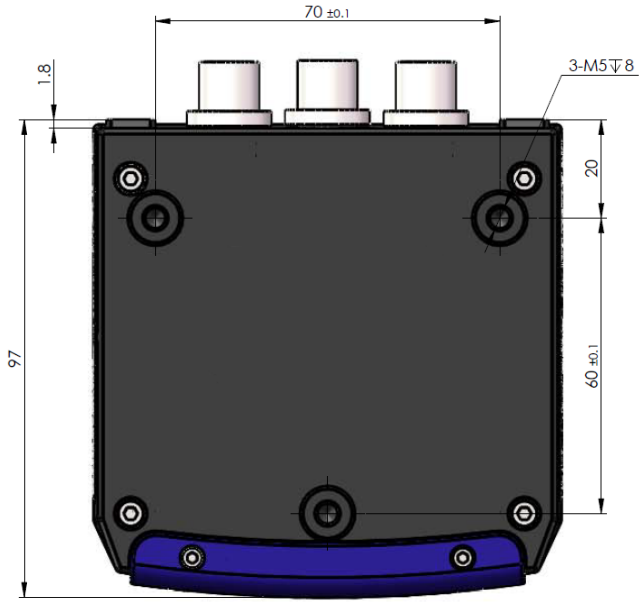


Figure 3 - LGS-N50 Base Mounting interface

ELECTRICAL CONNECTION

There are three connectors on the back of LGS-N50 for power supply, I/O and 4PIN Ethernet connection respectively as shown below:

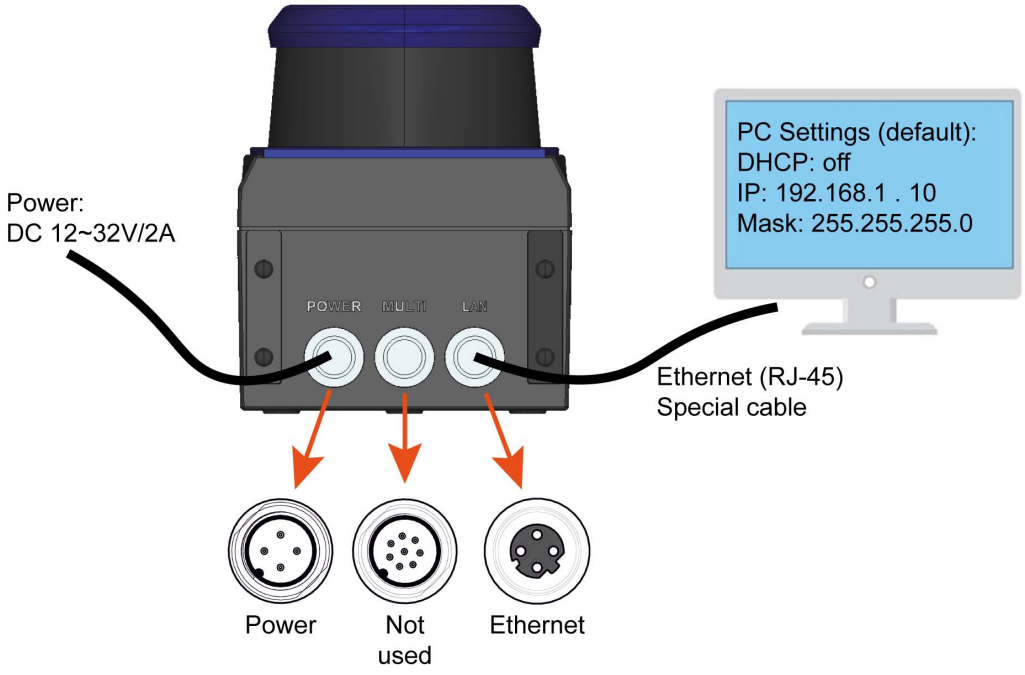


Figure 4 - LGS-N50 Connection

Power connector

Power supply interface adapts 12 to 32VDC. The pin definitions are as follows:

No.	DEFINITION	WIRING COLOR
1	+Vcc	Brown
2	Q2 (Out of temperature failure)	White
3	GND	Blue
4	Q1 (Generic failure)	Black

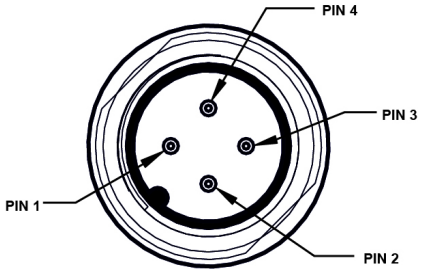


Figure 5 - Power connector

Ethernet connector

The pin definitions of Ethernet connector are as follows:

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

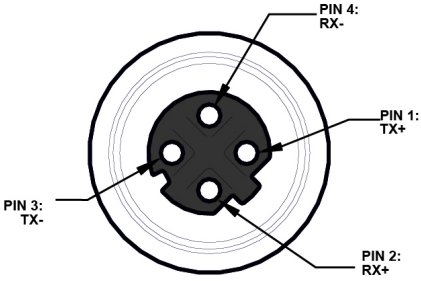


Figure 6 - Ethernet connector

COMMUNICATION

The LGS-N50 is connected to the computer through a standard Ethernet RJ-45 connector. The computer IP address must be set prior to establishing communication. Both the LiDAR and the computer IP addresses must be set within the same subnet without conflicting with each other. The point cloud packet receiving port number is 2368.

The IP address setup process is shown below:

- Computer IP: 192.168.1.10
- Computer subnet mask: 255.255.255.0

Factory default of LiDAR is as follows:

- LiDAR IP: 192.168.1.100
- LiDAR subnet mask: 255.255.255.0

The setting process in the computer is shown below:

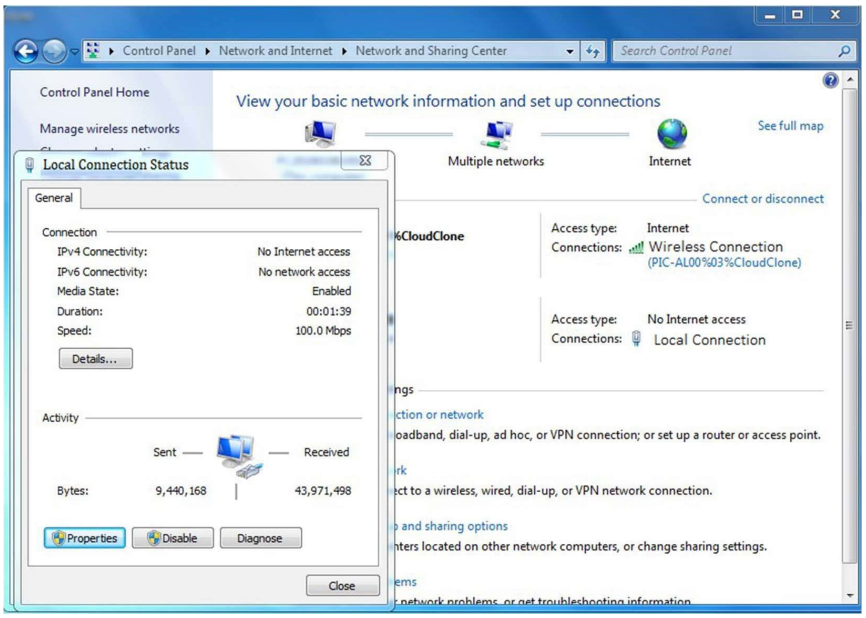


Figure 7 - Computer IP Setting: Step 1

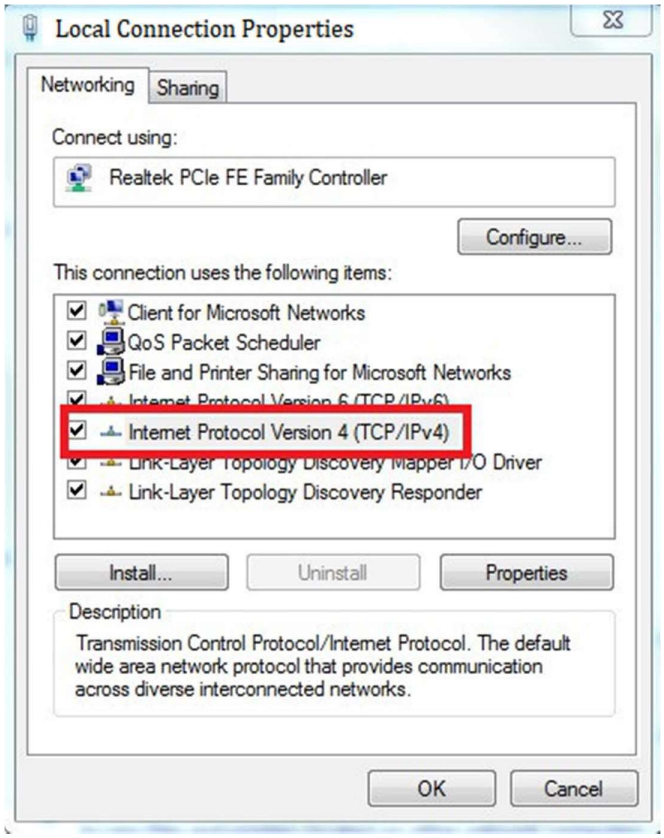


Figure 8 - Computer IP Setting: Step 2

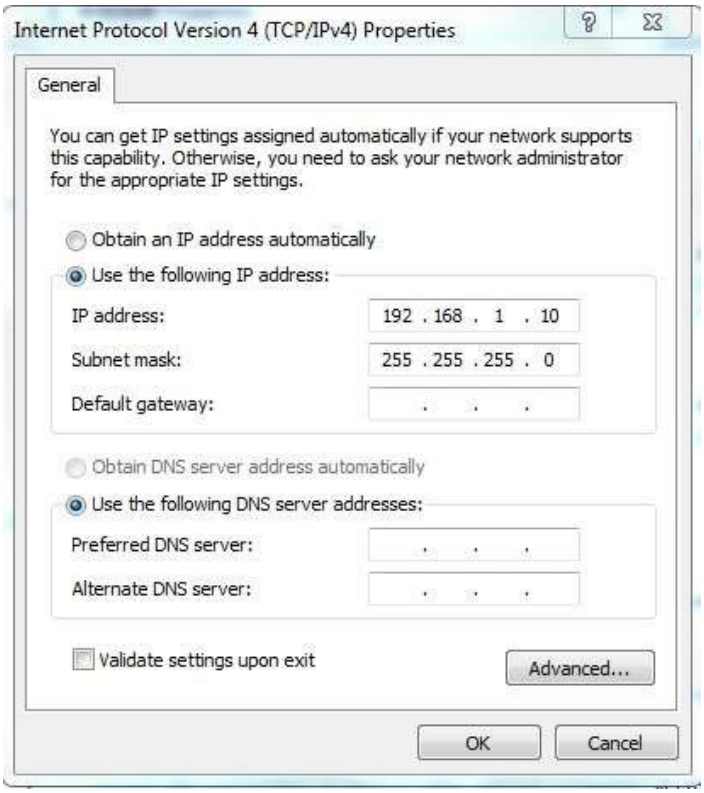


Figure 9 - Computer IP Setting: Step 3

LEDs

Figure 10 - LGS-N50 LEDs

LED	MEANING
PWR	Shows the status of powered devices (off = no power; on = powered)
Q1	Shows the status of “out of temperature range” (Tenvironment < Tmin or Tenvironment > Tmax). In such a case, Q1 blinks and the “ERR” LED lights up steadily.
Q2	Shows the status of “generic failure” (i.e. any failure other than Q1 such as motor block, voltage out of specifications, etc.). According to the internal diagnostic system, if some critical diagnostic test fails, Q2 blinks and the “ERR” LED lights up steadily.
ERR	Shows the status of device availability. If switched off, then the device is in normal operation. If it’s steadily on, then it shows an error condition (see Q1 and Q2). If it’s blinking, it indicates that the device is not ready to measure yet (i.e. at start-up).

CHAPTER 5
DATA PACKET FORMAT

Information transmission between LGS-N50 and computer follows UDP/IP standard network protocol. The data adapts Little-endian format with low byte at the front and high byte at the end.

OVERVIEW

Total length of data packet is 1240 bytes, among which the header has 40 bytes, data returned by laser has 1200 bytes.

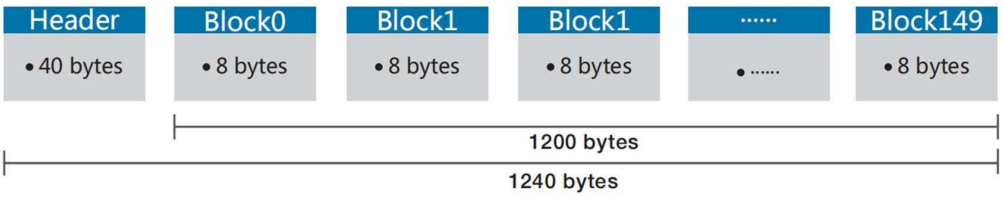


Figure 12 - Format of point cloud information packet

The total length of a data frame is 1240 byes, including:

- Frame header: 40 bytes
- Data block: 150 x 8 = 1200 bytes

DEFINITION OF HEADER

Total length of data packet is 1240 bytes, among which 40 bytes represent the header, and 1200 bytes represent the data returned by laser.

OFFSET	LENGTH	DESCRIPTION
0	4	ID, it is always 0xFEF0010F
4	2	Protocol version code, the current code is 0x0200
6	1	Distance scale, actual distance = readout data x distance scale (mm)
7	3	Brand name code. Use capital letters and digits. Us “\0” at the end for missing code
10	12	Commercial type code: end with “\0”
22	2	Internal type code
24	2	Hardware version
26	2	Software version
28	4	Time stamp (ms) indicating hour, minute, second, millisecond with 24 hour cycle
32	2	Bit[14:0] : Rotation rate Bit15 : Rotation direction (0: clockwise, 1: counterclockwise)
34	1	Safe zone status, same as the hardware INPUT/OUTPUT BIT[3:0] : Same as OUTPUT[3:0] BIT[7:4] : Same as INPUT[3:0]
35	1	Error status. A corresponding bit of “1” indicates an error. BIT0 : Motor fault BIT1 : Abnormal voltage BIT2 : Temperature fault
36	4	Reserved

DEFINITION OF BLOCK

The length of data block is 8 bytes as shown in the table below:

OFFSET	LENGTH	DESCRIPTION
0	2	Angle, unsigned integer. Range: 0 to 35999 Unit: 0.01°/LSB, range 0° to 359.99° Note: Data block is invalid if this value is greater than or equal to 0xFF00
2	2	Distance readout data, unsigned integer The distance is determined by “readout data x distance scale” (mm)
4	2	Signal strength, indicates the strength of the received signal, range 0 to 65535
6	2	Reserved

DATA CONVERSION

Angle calculation

To calculate the angle of LGS-N50, follow the example below:

1. Obtain angle value: 0xaa & 0x1d
2. Swap high bits and low bits: 0x1d & 0xaa
3. Combine into an unsigned hexadecimal number: 0x1daa
4. Convert to decimal: 7594
5. Multiply by minimum resolution: 0.01°
6. Result: 75.94°

Distance calculation

To calculate the distance of LGS-N50, follow the example below:

1. Obtain distance value: 0x11 & 0x12
2. Swap high bits and low bits: 0x12 & 0x11
3. Combine into an unsigned hexadecimal number: 0x1211
4. Convert to decimal: 4625
5. Multiply by minimum resolution: 1mm
6. Result: 4625mm

Calculation of signal strength

To calculate the signal strength of LGS-N50, follow the example below:

1. Obtain signal strength value: 0x11 & 0x12
2. Swap high bits and low bits: 0x12 & 0x11
3. Combine into an unsigned hexadecimal number: 0x1211
4. Convert to decimal: 4625
5. Result: 4625mm

CHAPTER 6
PARAMETER CONFIGURATION

WEB SERVER CONFIGURATION

LGS-N50 parameters are configured on the web server as follows:

- Open the web browser (recommended: Chrome, Firefox, Edge and other standards-compliant browsers). Enter the LiDAR IP address.
- The model and version are the product model and firmware version, shown on the upper end of the interface.
- The Temperature and Voltage on the right side of the interface are LiDAR's real-time parameters, which indicate the temperature and voltage information of specific modules inside. When the parameter font turns red, the LiDAR may not be working properly.
- The current LiDAR settings are automatically loaded when the page is refreshed.
- Select the required speed value by Motor RPM: 600/900/1200/1500, corresponding to the 10/15/20/25Hz LiDAR scanning frequency, then set the Offset Angle[1] from 0° to 359.97° (in 0.03° increments). Confirm by clicking Set Configs.
- Turn on/off DHCP: if ON, then LiDAR dynamically obtains the IP address from the DHCP server. If OFF, then LiDAR needs to set the static IP address.
- Change LiDAR IP: HostIP and LiDAR IP should be in the same network segment; click Set Network key to confirm, restart the LiDAR and the modification is completed.

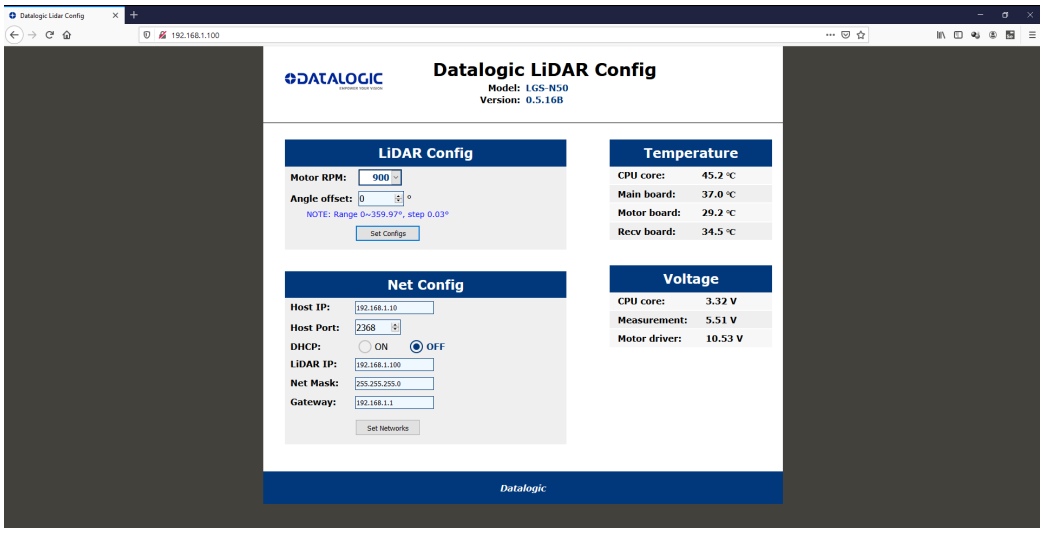


Figure 13 - Web Page parameter configuration

1. For more information on Offset Angles, see "Basic measurement" on page 17.

CONFIGURATION THROUGH LGS VIEWER PC SOFTWARE

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

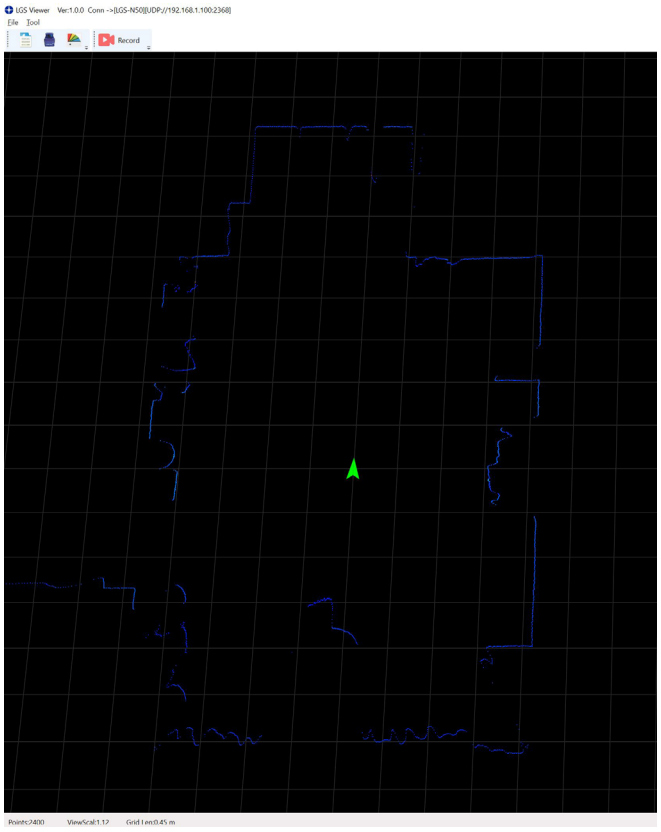


Figure 14 - Sample of PC software interface

NOTE

The web page setting interface and 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 Viewer: Windows Firewall" on page 15**.**

Operating environment

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

- OS: Windows 7 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 computer PC receiver sets the static IP as follows:

- Host IP: 192.168.1.10
- Net mask: 255.255.255.0

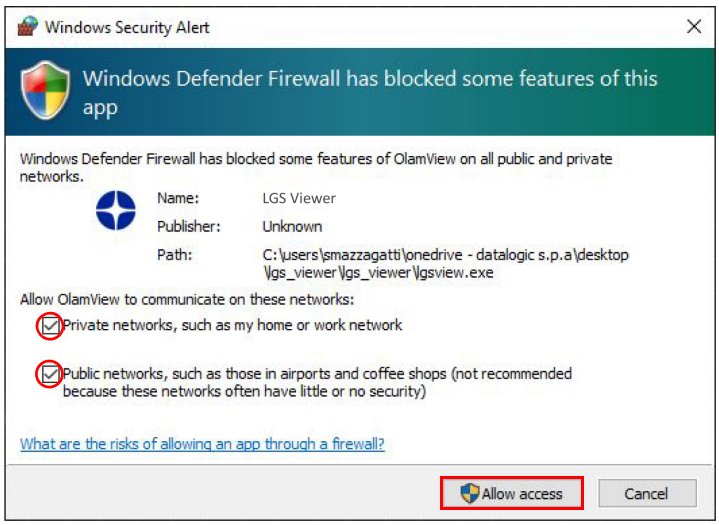
LGS Viewer: Windows Firewall

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

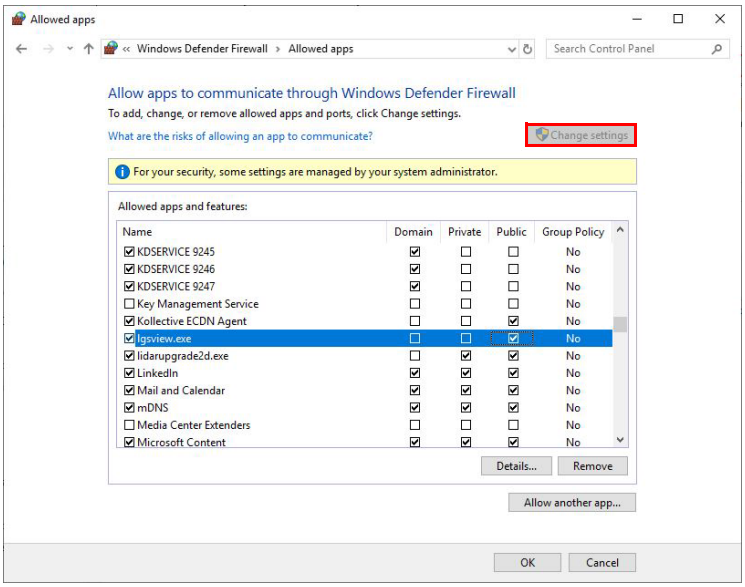
NOTE

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.

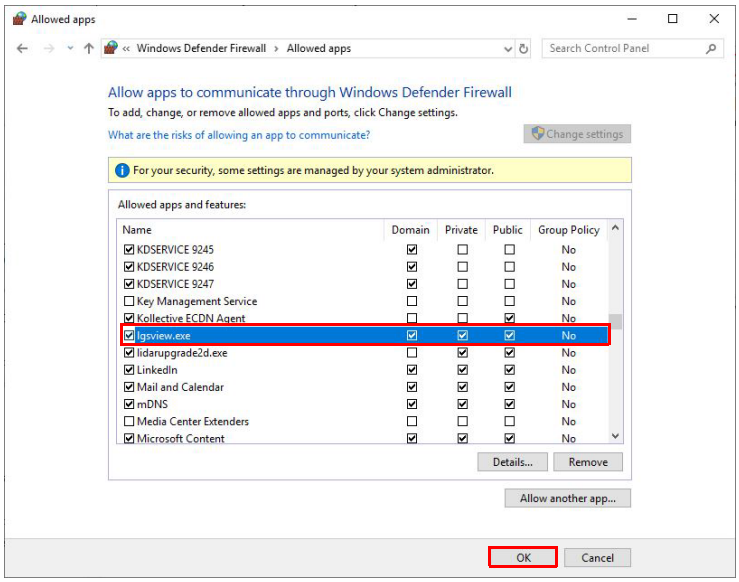
Do not close the pop-up window before allowing access to both private and public networks of the PC to communicate and exchange data with the device through the Ethernet port.



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”.



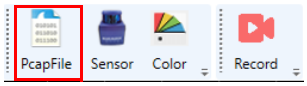
Scroll down the list and check the boxes on the lgsview.exe row as shown in the figure below, then click *OK*. The Firewall is now disabled on LGS Viewer.



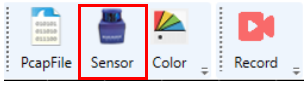
Using LGS Viewer

Menu icons

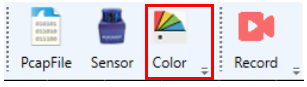
The menu icons have the following functions:



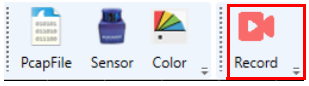
Capture file: read a previously saved .pcap file containing a scanner measure data. Alternatively, go to *File > Open > Capture File*.



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).



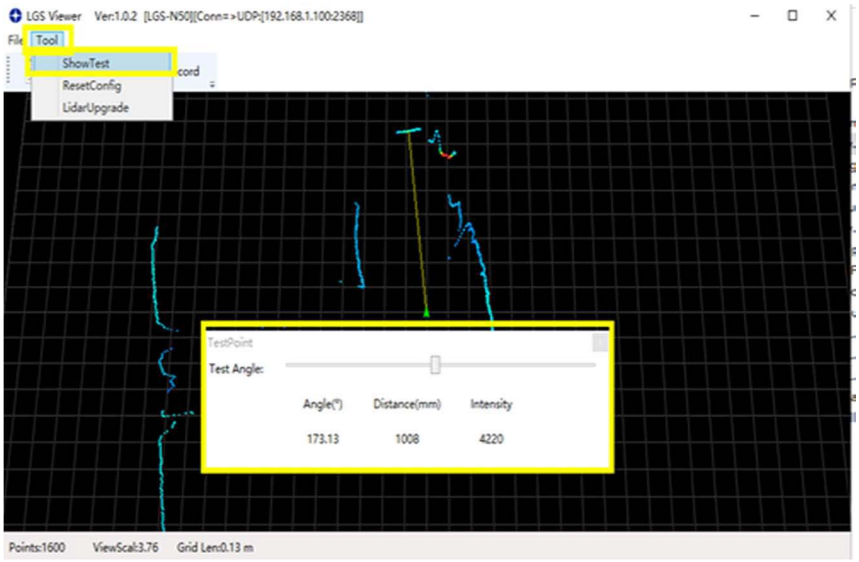
Record: record a sequence of measure data and save it on a .pcap file.

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

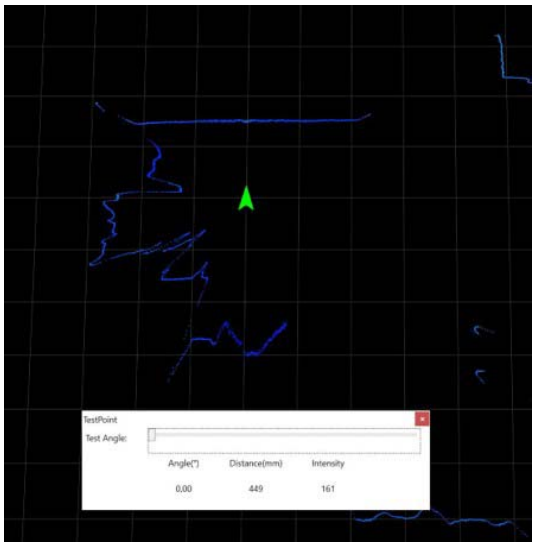
To center/decenter the measurement images, hold down the right mouse button and move the cursor.

Basic measurement

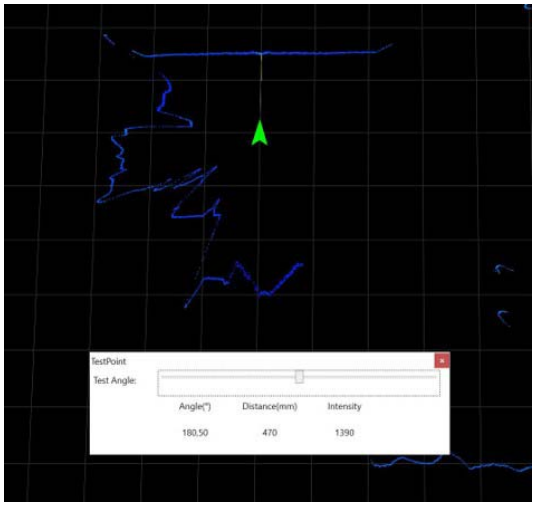
Go to *Tool* > *ShowTest*. The purpose of LGS Viewer is to monitor in real time the cloud of points generated by LGS-N50 inside a system of coordinates. The *ShowTest* function can be used to measure the angle (°), distance (mm) and intensity of each point..



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



Angle 0° == 360°

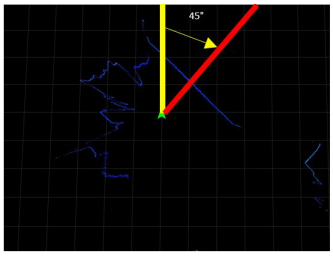


Angle 180°

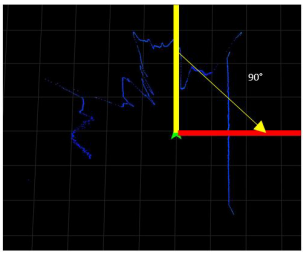
Angle 270°

To set an offset angle, go to the web configuration page (see "Web server configuration" on page 13). 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 Viewer 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.

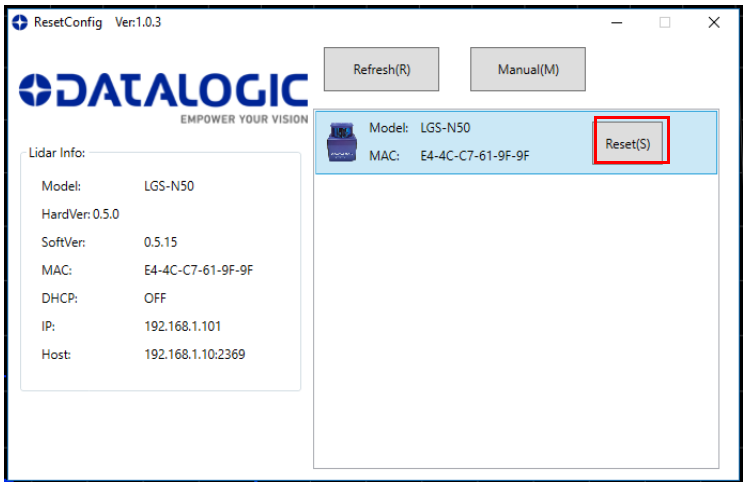
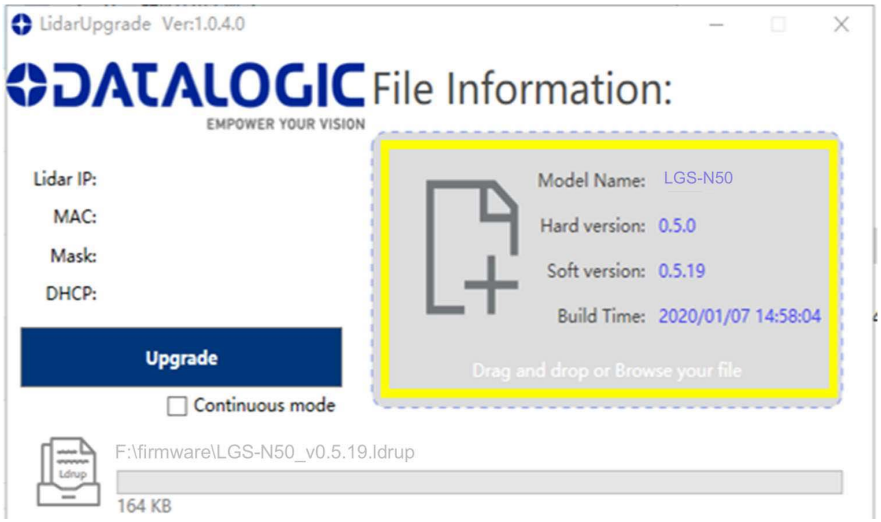


Figure 15 - ResetConfig software program

Firmware upgrade

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



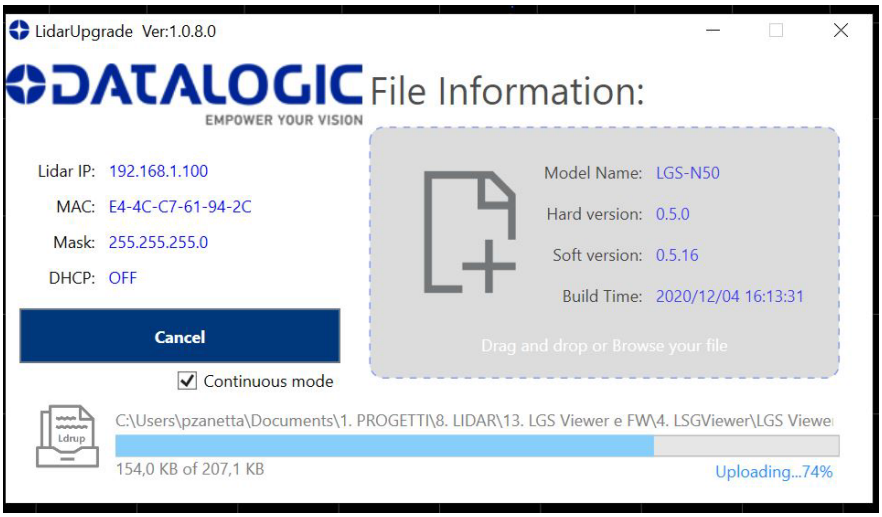
To upgrade the firmware, follow the procedure below:

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 Viewer 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 to 25 Hz
Measurement range	0.2 to 2 m @ 1.8% 0.2 to 15 m @ 10% 0.2 to 50 m @ 80%
Ambient light limit	>80000 LUX @ sunlight
Resolution	1 mm

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

ELECTRICAL SPECIFICATIONS	
Operation voltage	12 to 32 VDC
Power consumption (25°C)	7 W @ 15 Hz

MEASUREMENT ACCURACY	
Absolute accuracy	± 30 mm @ 90% WB
Repeat accuracy	< 20 mm @ 90% WB
Angle resolution	0.06° @ 10 Hz / 0.09° @ 15 Hz 0.12° @ 20 Hz / 0.15° @ 25 Hz

AMBIENT CONDITIONS	
Operating temperature	-20 to +50 °C
Storage temperature	-30 to +70 °C
Relative humidity	< 95 %

MECHANICAL SPECIFICATIONS	
Housing width	95 mm
Housing length	97 mm
Housing height	116 mm
Degree of protection	IP66
Connection	4pin, M12x1 Connector Standard (Supply) 8pin, M12x1 Connector A-coded Male (MultiPort) 4pin, M12x1 socket D-coded (LAN)
Material	Body and cap: aluminum Window: polycarbonate Panel and LED cover: polycarbonate and ABS
Mass	< 900 g

COMPLIANCE AND CERTIFICATIONS	
Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27
EMC	IEC 61000-6-2 / IEC 61000-6-3
Laser safety	IEC 60825-1
ROHS	✓
Safety requirements	UL61010-1

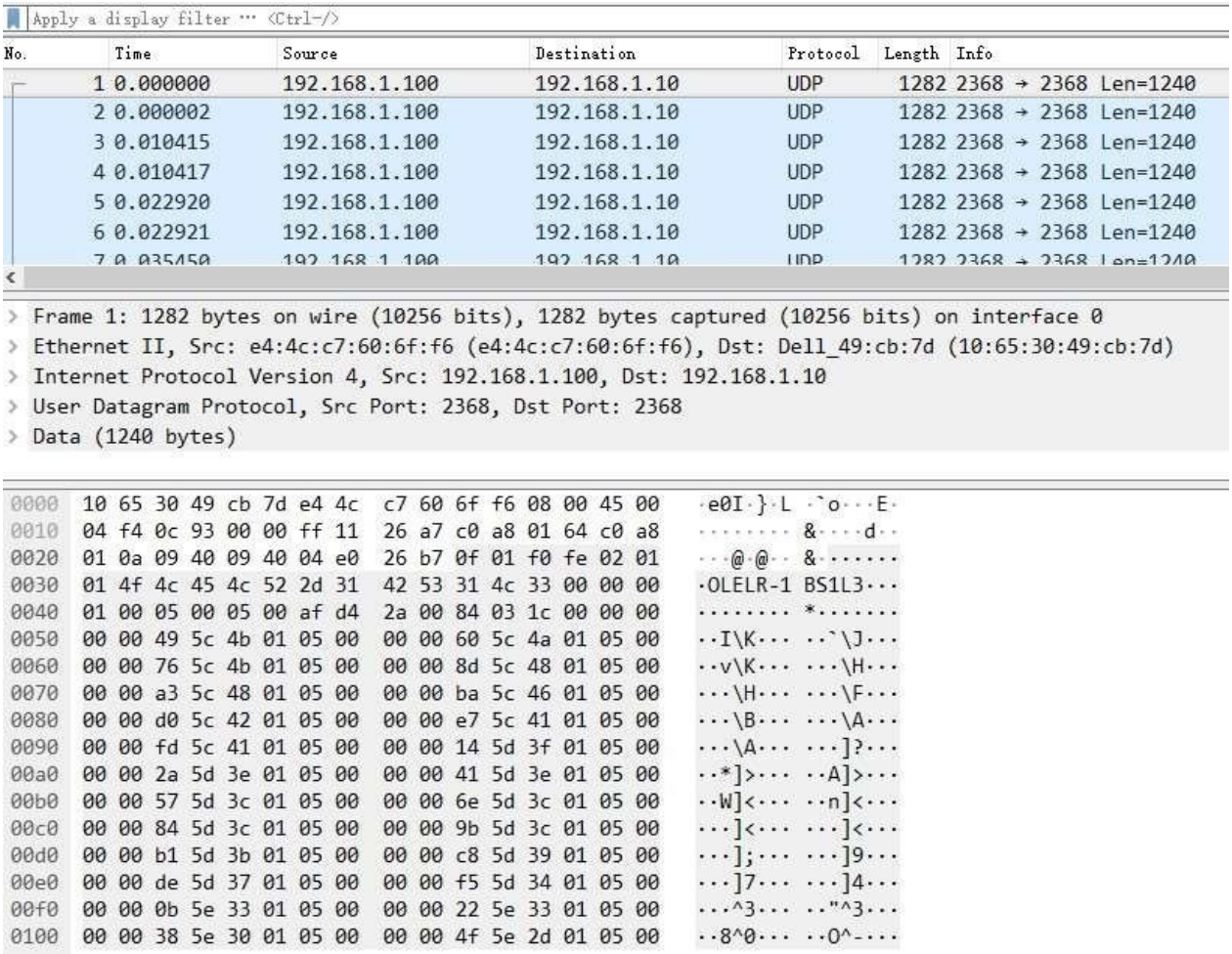
INDICATORS	
LED indicator	RGB*4 Color
Operation indicator	Green LED: Power ON
Function indicator	Red LED: LiDAR fault

SOFTWARE	
Basic software	Datalogic LGS Viewer

CHAPTER 8
TROUBLESHOOTING

PROBLEM	SOLUTION
LiDAR fails to scan	• Check power connection • Check whether voltage meets 12 to 32 VDC If failure persists, contact Datalogic 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 whether only one LiDAR software is started • Check whether the data receiver has any safety software or process that is blocking data transmission If failure persists, contact Datalogic Technical Support.

APPENDIX A
DATA PACKET



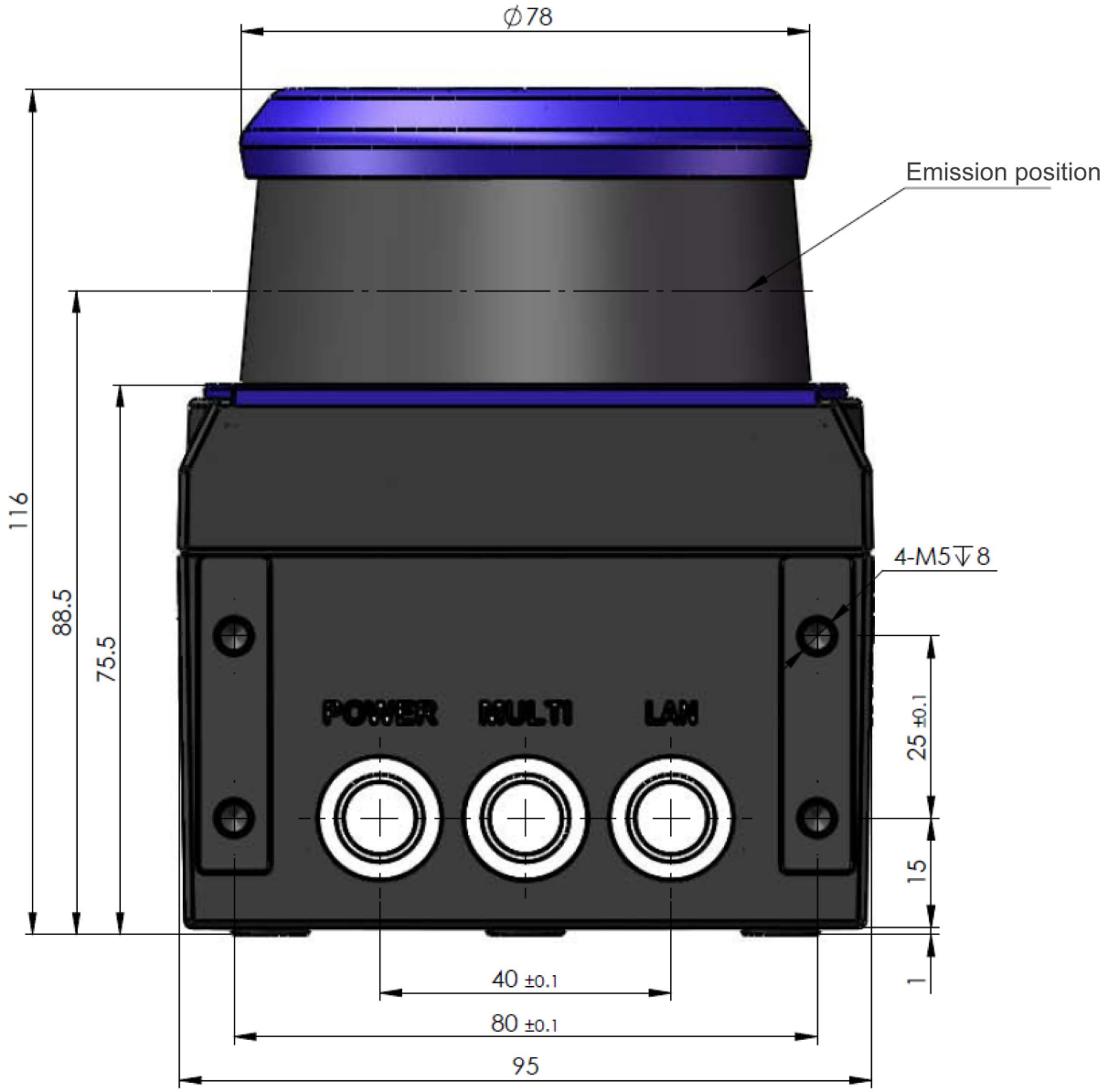
Apply a display filter ··· <Ctrl-/>

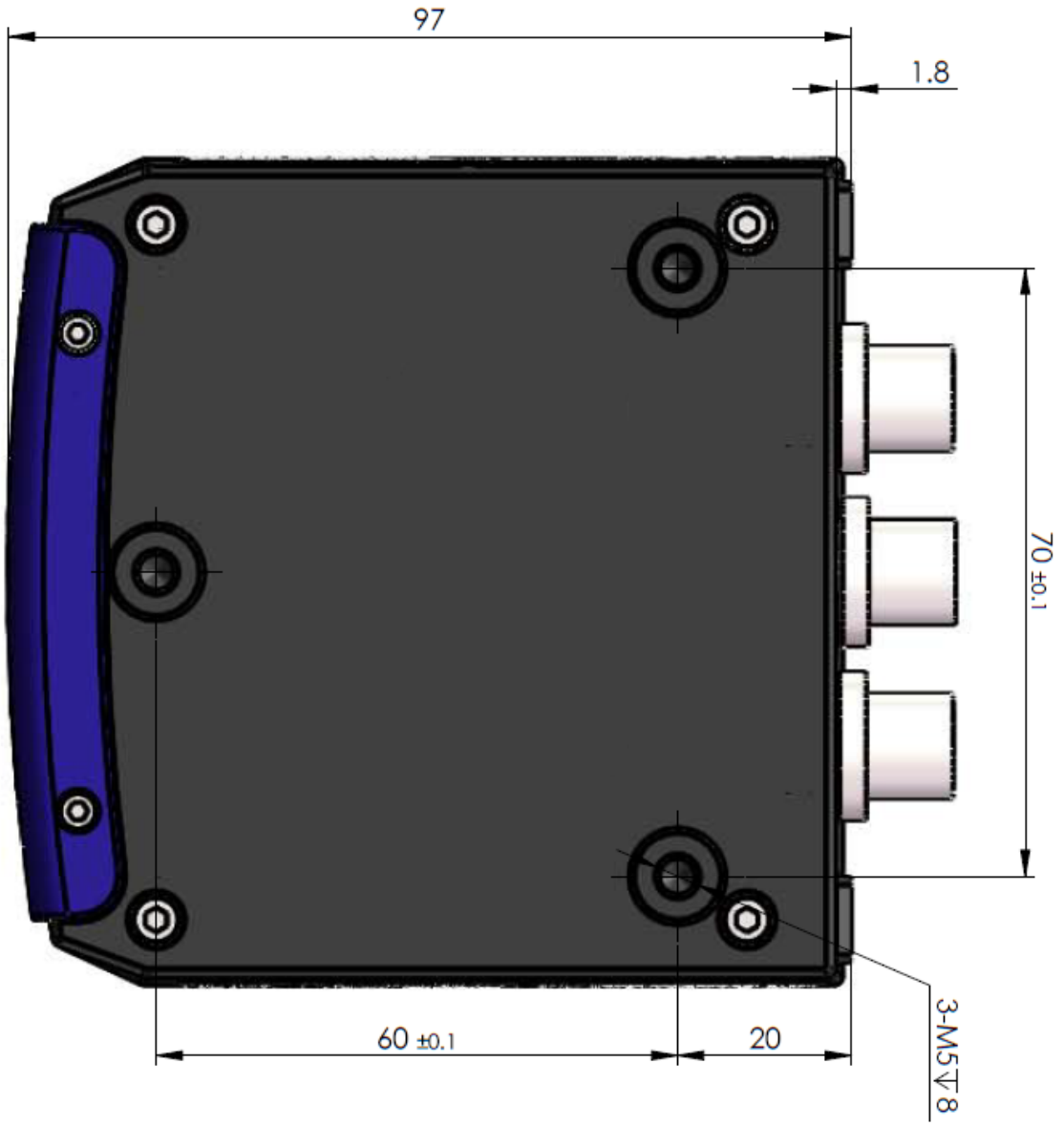
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.100	192.168.1.10	UDP	1282	2368 → 2368 Len=1240
2	0.000002	192.168.1.100	192.168.1.10	UDP	1282	2368 → 2368 Len=1240
3	0.010415	192.168.1.100	192.168.1.10	UDP	1282	2368 → 2368 Len=1240
4	0.010417	192.168.1.100	192.168.1.10	UDP	1282	2368 → 2368 Len=1240
5	0.022920	192.168.1.100	192.168.1.10	UDP	1282	2368 → 2368 Len=1240
6	0.022921	192.168.1.100	192.168.1.10	UDP	1282	2368 → 2368 Len=1240
7	0.035450	192.168.1.100	192.168.1.10	UDP	1282	2368 → 2368 Len=1240

> Frame 1: 1282 bytes on wire (10256 bits), 1282 bytes captured (10256 bits) on interface 0
> Ethernet II, Src: e4:4c:c7:60:6f:f6 (e4:4c:c7:60:6f:f6), Dst: Dell_49:cb:7d (10:65:30:49:cb:7d)
> Internet Protocol Version 4, Src: 192.168.1.100, Dst: 192.168.1.10
> User Datagram Protocol, Src Port: 2368, Dst Port: 2368
> Data (1240 bytes)

```
0000  10 65 30 49 cb 7d e4 4c  c7 60 6f f6 08 00 45 00   ·e0I·}·L ·`o···E·
0010  04 f4 0c 93 00 00 ff 11  26 a7 c0 a8 01 64 c0 a8   ········ &····d··
0020  01 0a 09 40 09 40 04 e0  26 b7 0f 01 f0 fe 02 01   ···@·@·· &·······
0030  01 4f 4c 45 4c 52 2d 31  42 53 31 4c 33 00 00 00   ·OLELR-1 BS1L3···
0040  01 00 05 00 05 00 af d4  2a 00 84 03 1c 00 00 00   ········ *·······
0050  00 00 49 5c 4b 01 05 00  00 00 60 5c 4a 01 05 00   ··I\K··· ··`\J···
0060  00 00 76 5c 4b 01 05 00  00 00 8d 5c 48 01 05 00   ··v\K··· ···\H···
0070  00 00 a3 5c 48 01 05 00  00 00 ba 5c 46 01 05 00   ···\H··· ···\F···
0080  00 00 d0 5c 42 01 05 00  00 00 e7 5c 41 01 05 00   ···\B··· ···\A···
0090  00 00 fd 5c 41 01 05 00  00 00 14 5d 3f 01 05 00   ···\A··· ···]?···
00a0  00 00 2a 5d 3e 01 05 00  00 00 41 5d 3e 01 05 00   ··*]>··· ··A]>···
00b0  00 00 57 5d 3c 01 05 00  00 00 6e 5d 3c 01 05 00   ··W]<··· ··n]<···
00c0  00 00 84 5d 3c 01 05 00  00 00 9b 5d 3c 01 05 00   ···]<··· ···]<···
00d0  00 00 b1 5d 3b 01 05 00  00 00 c8 5d 39 01 05 00   ···];··· ···]9···
00e0  00 00 de 5d 37 01 05 00  00 00 f5 5d 34 01 05 00   ···]7··· ···]4···
00f0  00 00 0b 5e 33 01 05 00  00 00 22 5e 33 01 05 00   ···^3··· ··"^3···
0100  00 00 38 5e 30 01 05 00  00 00 4f 5e 2d 01 05 00   ··8^0··· ··O^-···
```

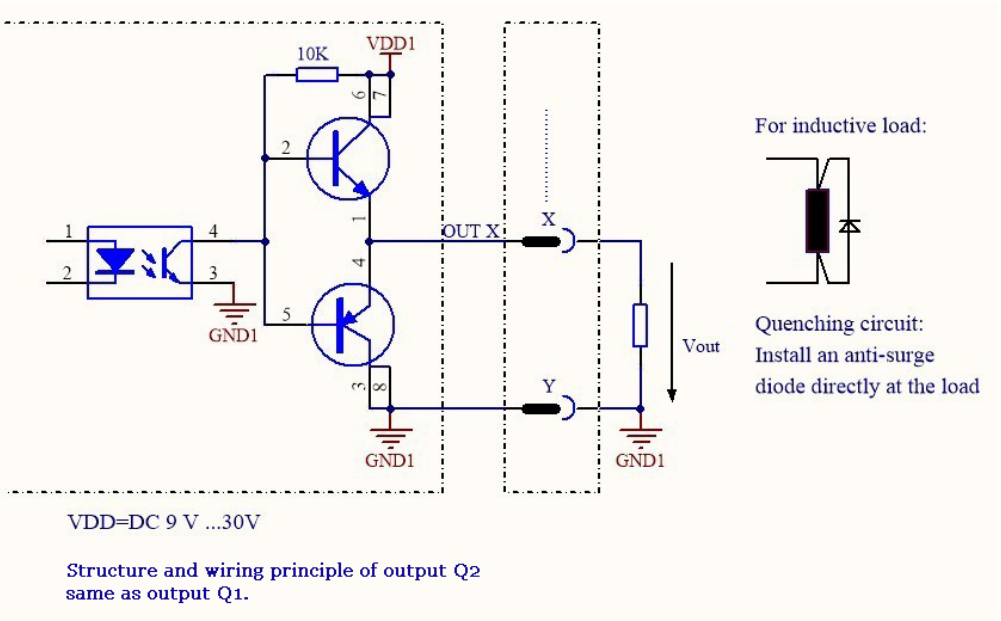
APPENDIX B
MECHANICAL DIMENSIONS




97
1.8
70 ±0.1
60 ±0.1
20
3-M5↧8

APPENDIX C
EXAMPLE OF ELECTRICAL CONNECTION

OUTPUT Q1:



DATALOGIC

www.datalogic.com

Datalogic S.r.l.
Via S. Vitalino, 13 | 40012 Calderara di Reno | Bologna - Italy
Tel. +39 051 3147011 | Fax +39 051 3147205

821007250 (Rev A) March 2021