

YUJIN LiDAR

User Manual YRL Series

YRL2-05 | YRL2-10 | YRL2-20 | YRL3-05 | YRL3-10 | YRL3-20



ROS

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How to Use

This manual provides important information for using the YUJIN LiDAR. Please read it before using this product to operate it correctly. The operating instructions are intended to be used by qualified specialists.

Manual Symbols

In this manual, symbols are used to mark safety information.

Please refer to the following for safe use.

Warning

Indicates handling requirements that if not maintained might lead to fatality or serious injuries.

Caution

Indicates handling requirements that if not maintained might lead to minor injuries or material damages.

Notice

Indicates handling requirements that if not maintained might lead to problems using the product or property damage.

Important

Indicates important information and tips regarding the use of the product.

Important

All information materials can be found at the following website:

<http://www.yujinrobot.com>

Important Safety Instructions

Safe and accurate use of the product can help prevent danger or damages.

Follow the methods described in the instructions below.

Installation Safety Guide



- The product should only be used for the purpose indicated in the system introduction and may not be used as a weapon or for military purposes.
- This product is not a safety sensor. Do not use this product in a place where human injury, loss of life, or property damage may occur.
- Use within the specified voltage and power, otherwise fire or damage may occur to the product.
- Do not apply heat or pressure as it may cause fire or damage to the product.
- Do not disassemble this unit as it may cause fire or damage to the product.
- Do not use in areas where flammable, explosive, or corrosive gases are present or where there may be potential damage.

Operation Safety Guide



- Do not disassemble during operation as it may cause fire or damage to the product.
- Do not look at the product for a long time at close range during operation as it may cause damage to your eyes.
- The product may become hot if operated for a long time. Do not touch to avoid burns.



- Interference or contact between different laser light sources may cause abnormal operation of the sensor.
- Do not step on the unit or place heavy objects on it as it may cause abnormal operation of the sensor.
- Do not use in dusty or humid places or in direct sunlight.
- Fasten the product firmly in places where there is a lot of vibration.
- Do not drop objects on the product or shock it.

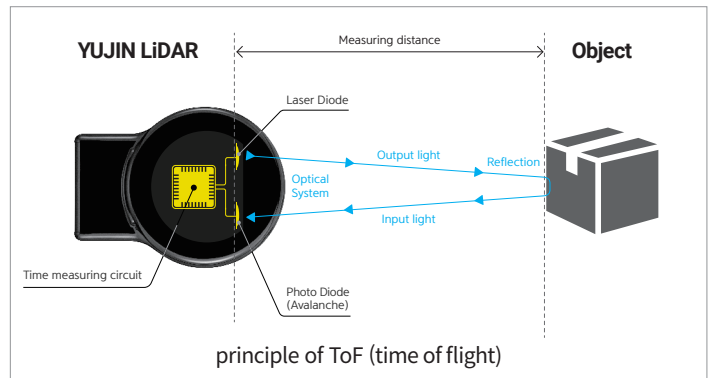
| | |
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1. About the Product

1.1. Product Description

The YUJIN LiDAR YRL Series is a laser sensor that scans horizontally and vertically to detect objects. The sensor uses a single laser (wavelength: 905 nm), and a mirror moves through the motor and detects the entire scan area.

Distance measurement uses the time of flight (ToF) method. The ToF method calculates the distance to an object by measuring the time it takes for a LiDAR laser pulse to be reflected from the surface of the object back to the source.



Measurement results are provided as distances, angles, and coordinate values for each point cloud. The YRL Series can only be operated indoors and cannot be used as a safety device. The YRL3 Series is a 3D scanning sensor that simultaneously scans horizontally and vertically. The YRL2 Series is a 2D scanning sensor, which is a laser sensor that performs horizontal scanning at one vertical angle.

⚠ Please do not look directly at the laser and do not disassemble it during the operation.

YRL Series – Models Classification

| | Model | Type | Measurement Range | Environment |
|-------------|---------|----------|-------------------|-------------|
| YUJIN LiDAR | YRL2-05 | 2D LiDAR | 5m | Indoor |
| | YRL2-10 | | 10m | |
| | YRL2-20 | | 20m | |
| | YRL3-05 | 3D LiDAR | 5m | |
| | YRL3-10 | | 10m | |
| | YRL3-20 | | 20m | |

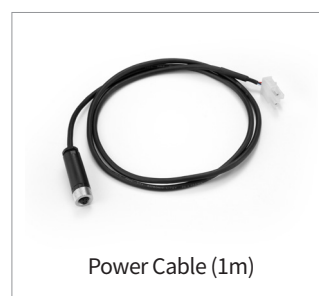
1.2. Product Components

The product is packaged in individual boxes. Please check the components upon arrival.

🔊 Please contact your dealer or Yujin Robot about any problem or inconvenience.



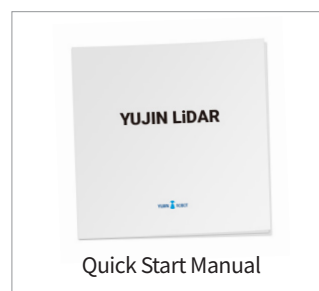
YUJIN LiDAR



Power Cable (1m)



Ethernet Cable (1m)



Quick Start Manual

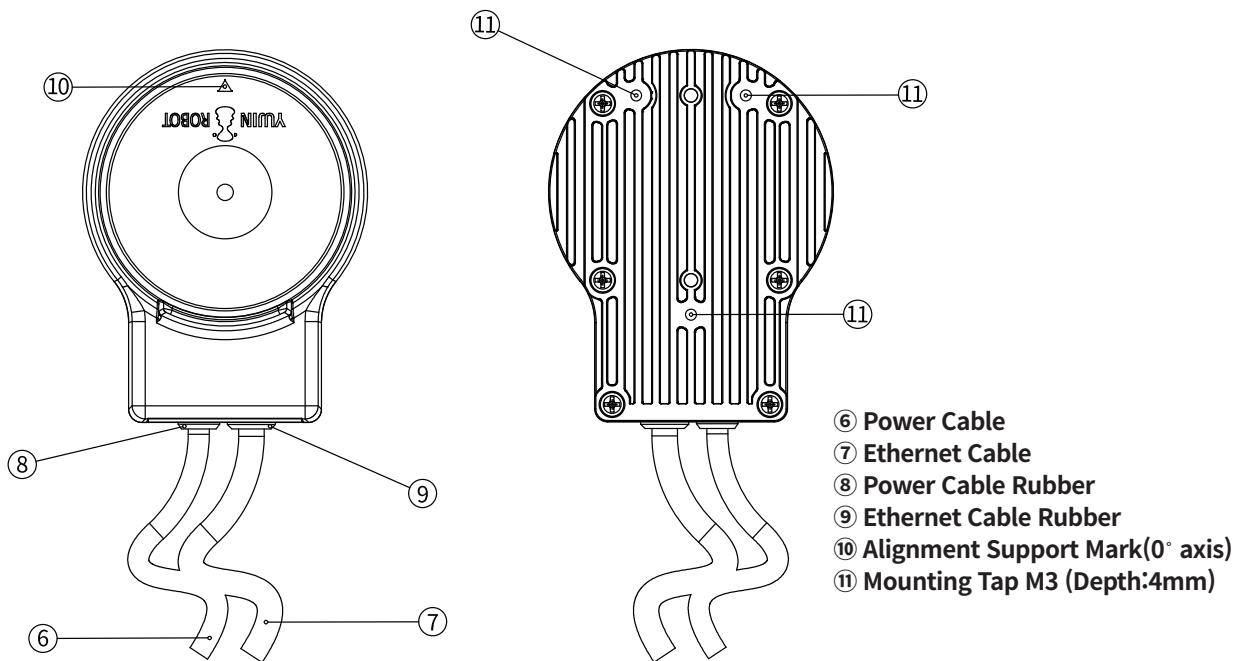
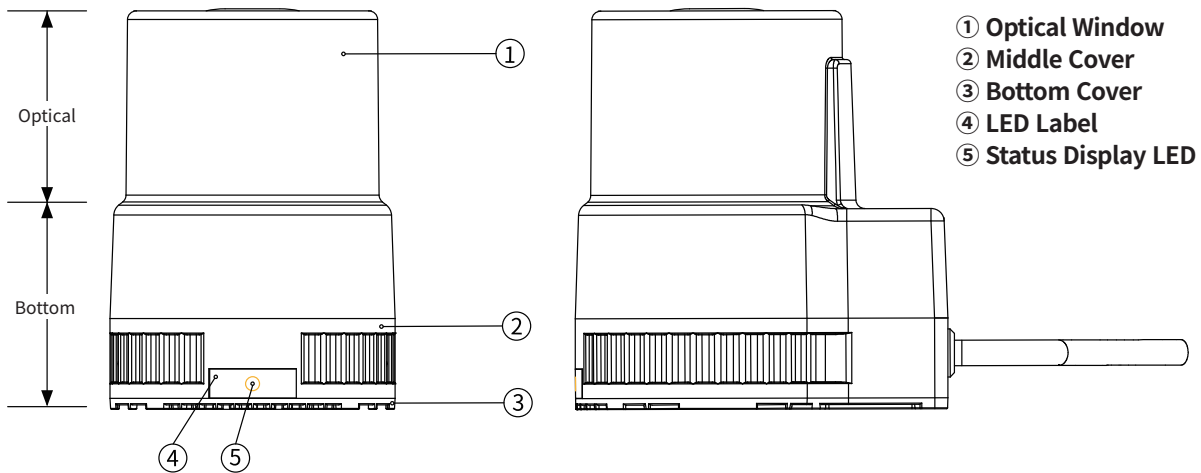
🔊 The default network settings are shown as below. You can change the settings in the YUJIN LiDAR Viewer.

- IP address : 192.168.1.250
- Port number : 1234

1. About the Product

1.3. Product Diagram

The product is divided into optical and bottom. Please refer to the part names below for details.



1.4. Features

The YRL Series is developed on the basis of Yujin Robot's core technology. It holds a patent for the scanning type of driving method with extended application availability.

- Time of Flight (ToF) Single Channel LiDAR
- Compact Size and Lower Cost
- ROS (Robot Operating System) Compatible
- Quick and Scalable Software Support
- Wider Field of View

2. Key Functions

2.1. Specifications

Basic Specification

| Environment Condition | Indoor | | | | | |
|--|--|--|--|--|--|--|
| Model Name | YRL2-05 | YRL2-10 | YRL2-20 | YRL3-05 | YRL3-10 | YRL3-20 |
| Measurement Range (Kodak R-27 Gray Cards White 90%) | 0.1~5m 2m at 10% remission 5m at 90% remission | 0.1~10m 4m at 10% remission 10m at 90% remission | 0.1~20m 8m at 10% remission 20m at 90% remission | 0.1~5m 2m at 10% remission 5m at 90% remission | 0.1~10m 4m at 10% remission 10m at 90% remission | 0.1~20m 8m at 10% remission 20m at 90% remission |
| Horizontal Angle | 270 ° | | | | | |
| Vertical Angle | - | | | 90° (+/- 45°) | | |
| Light Source | Laser Diode | | | | | |
| Laser Class | Class 1, eye safety (IEC 60825-1:2014) | | | | | |
| Laser Wavelength | 905 nm | | | | | |
| Horizontal Scan Frequency | 20 Hz | | | | | |
| Vertical Scan Frequency | - | | | 0.57Hz (1scan 1.76sec. If vertical 90°) | | |
| Range Resolution | <10mm | | | | | |
| Horizontal Angular Resolution | 0.55 ° | | | | | |
| Vertical Angular Resolution | - | | | 0.35 ° (Max 257 step) | | |

Performance

| Sampling Rate | 130,000 | | | | |
|------------------|------------|--|--|-----------------|--|
| Data Packet Rate | 13,000 | | | | |
| Data Format | UDP packet | | | | |
| Response Time | >50ms | | | >50ms per layer | |
| Accuracy | ± 50 mm | Within 15m : ± 50 mm 15m or more : ± 100 mm | | ± 50 mm | Within 15m : ± 50 mm 15m or more : ± 100 mm |

2. Key Functions

Interface

| | | |
|-------------------------|--|--|
| Communication Interface | 100Mbps Ethernet | |
| Optical Indicators | 1 x LED (Green : Available, Red: Error) | |
| Protocol | UDP packet | |
| Configuration Software | YUJIN LiDAR Viewer | |
| Output Data | Horizontal Angle, Range, Intensity, Cartesian coordinates (x,y) | Horizontal Angle, Vertical Angle, Range, Intensity, Cartesian coordinates (x,y,z) |

Mechanics/Electronics

| | | |
|-----------------------|--|----|
| Electrical Connection | 1 x M8 for Power, 1 x M12 for Data | |
| Supply Voltage | DC 12V | |
| Power Consumption | 5W | 6W |
| Materials | Top window cover(PC), Bottom cover(AL) | |
| Enclosure Rating(IP) | IP67 | |
| Weight | 400g | |
| Dimension W x D x H | 65mm x 85mm x 91.40mm | |

Ambient data

| | | |
|--|--|--|
| Electromagnetic Compatibility (EMC) | KN 61000-6-3, KN 61000-6-1 EN61000-6-1:2007, EN61000-6-3:2007/A1:2011 EN61000-4-2:2009, EN61000-4-3:2006 +A1:2008 +A2:2010 EN61000-4-4:2012, EN61000-4-6:2014, EN61000-4-8:2010 | |
| Vibration Resistance | EN60068-2-6:2007 (10 to 55Hz, double amplitude 1.5mm each 2 hrs in X, Y and Z directions) | |
| Impact Resistance | EN 60068-2-27:2008 : 908m/s ² (100G) X, Y and Z directions each 3 times | |
| Temperature Resistance | -10 ° ~ 50 ° | |
| Operating Humidity | 95 % | |
| Storage Temperature | -20 ° ~ 70 °C | |
| Storage Humidity | 0 ~ 85% RH | |
| Ambient light immunity | LED light : 100,000 Lux | |
| Certificate | KC, CE, RoHS | |

2. Key Functions

2.2. Performance

1) Output Data

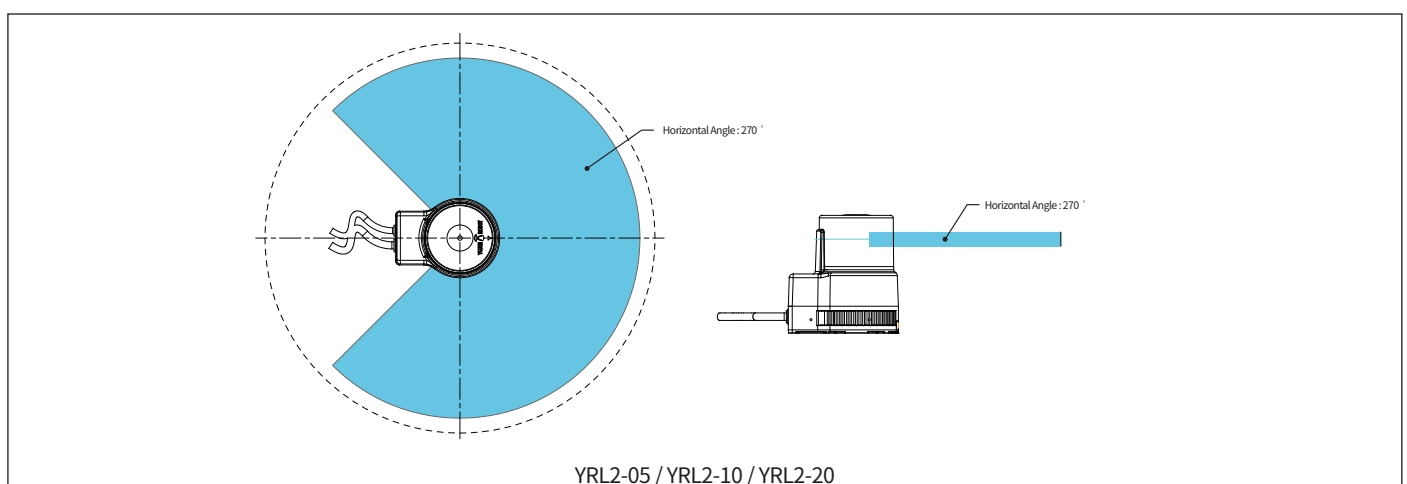
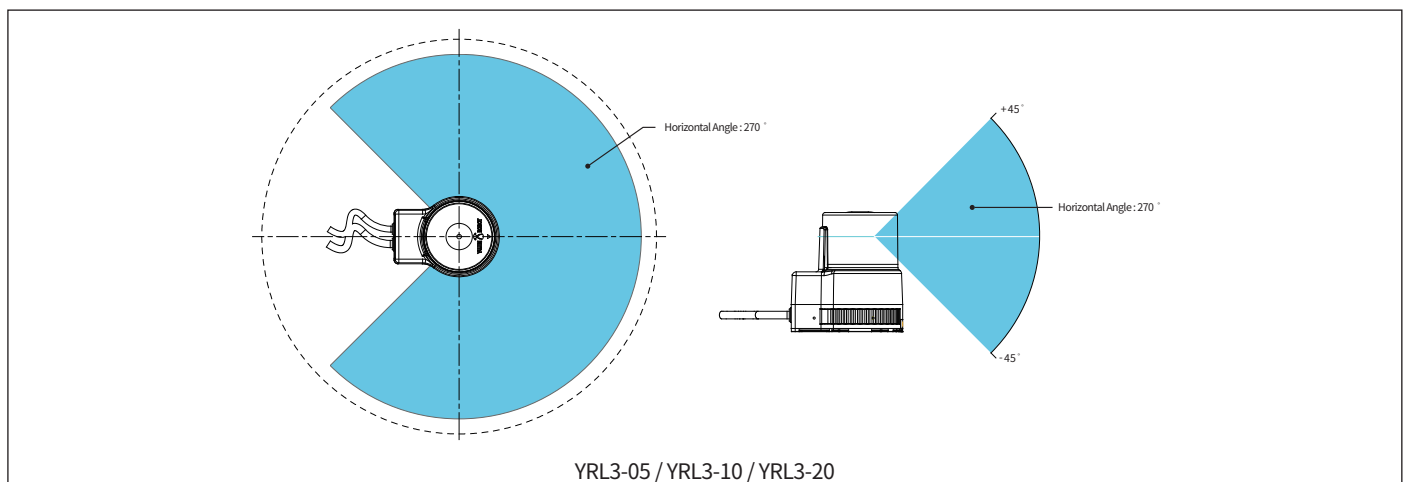
The YRL Series can collect 13,000 point cloud per second, and each point cloud contains the following information.

| | |
|---------------------|---|
| 1) Horizontal Angle | Measured horizontal angle (-135° ~ +135°) |
| 2) Vertical Angle | Measured vertical angle (-45° ~ +45°, max 90°), 3D LiDAR only |
| 3) Range | Measured send/received time of the laser in the sensor |
| 4) Intensity | Measured reflectance data in sensor |
| 5) Coordinate Value | Measured sample coordinate value X, Y (3D LiDAR = X, Y, Z) |

🔊 For more detail, please check the driver interface in chapter 4.

2) Scanning Angle

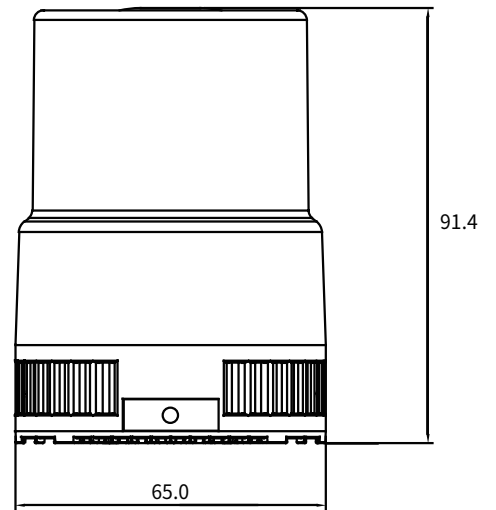
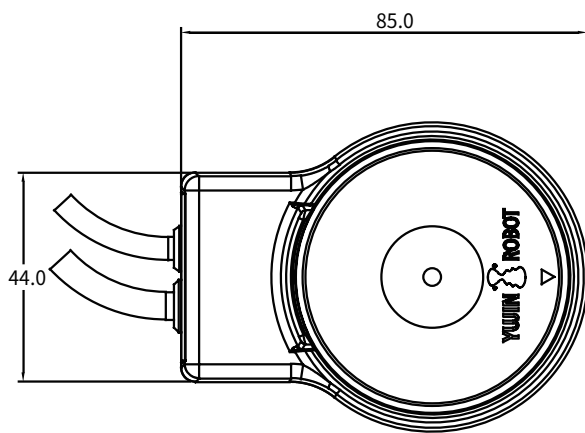
YRL offers the following scan ranges for horizontal and vertical areas. Please use the product according to your environment.



✓ You can modify the vertical angles of YRL3 series by Yuiin LiDAR Viewer.

2. Key Functions

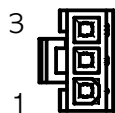
2.3. Dimensions



2. Key Functions

2.4. Pin Assignment

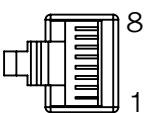
Power Input Connector



MOLEX : 39-01-4030

| Pin Number | Function | Remark |
|------------|----------|-------------|
| 1 | +12V | Red & White |
| 3 | GND | Black |

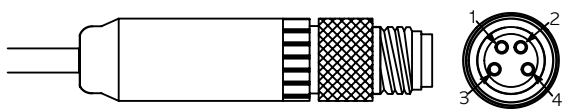
Ethernet RJ45 Connector



RJ45

| Pin Number | Function |
|------------|----------|
| 1 | TX+ |
| 2 | TX- |
| 3 | RX+ |
| 6 | RX- |

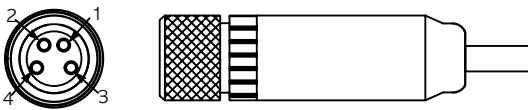
IP PWR Connector



L102-M8-H0401(Male)

| Pin Number | Function |
|------------|----------|
| 1 | +12V |
| 2 | +12V |
| 3 | GND |
| 4 | GND |

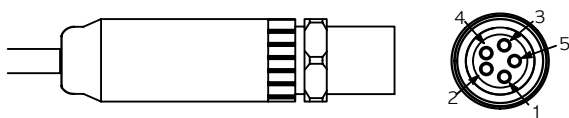
IP PWR EXTENSION Connector



L102-M8-T0402-01(Female)

| Pin Number | Function |
|------------|----------|
| 1 | +12V |
| 2 | +12V |
| 3 | GND |
| 4 | GND |

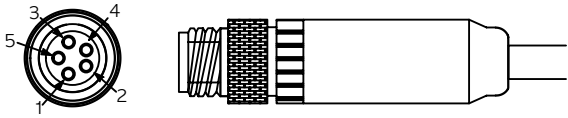
IP Ethernet Connector



L102-M12-R05A01(Female)

| Pin Number | Function |
|------------|----------|
| 1 | TX+ |
| 2 | TX- |
| 3 | RX+ |
| 4 | RX- |
| 5 | GND |

IP Ethernet EXTENSION Connector



L102-M12-R05A02(Male)

| Pin Number | Function |
|------------|----------|
| 1 | TX+ |
| 2 | TX- |
| 3 | RX+ |
| 4 | RX- |
| 5 | GND |

3. Use of the Product

3.1. Installing the YUJIN LiDAR Viewer

Install the YUJIN LiDAR referring to the recommended specifications below:

3.1.1. Recommended Specifications

| | | |
|----------------------------|------------|--|
| Recommended Specifications | System | more than 1GHz, 64bit processor |
| | OS | Windows 10 64 bit, Ubuntu 18.04 64 bit |
| | Memory | 1 GB |
| | Storage | 450 MB |
| | Resolution | 1024 x 768 |

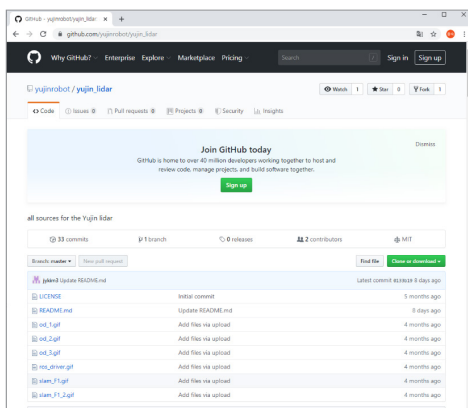
🔊 The LiDAR may not be installed properly if it fails to meet the recommended specification.

3.1.2. Installing the Viewer

The viewer can be installed after downloading the product according to the OS of the computer where you want to install the viewer. The product can be downloaded from GitHub.

🔊 The GitHub download address is given below:

https://github.com/yujinrobot/yujin_lidar



- 1) Download the viewer from GitHub that matches your computer OS.
- 2) Proceed with installing the LiDAR after the required product is downloaded.
- 3) Run the program as an administrator.

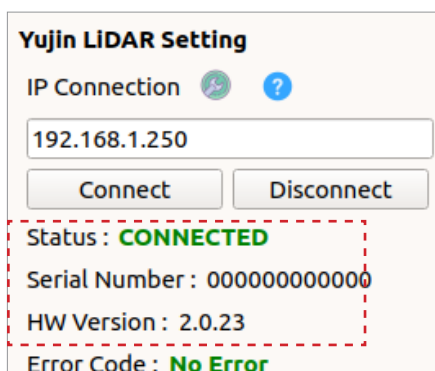
✓ Run the program where the related software is installed after the qt5 is installed.

Install) `sudo apt-get install qt5-default`
Run) `sudo -H ./Yujin_Lidar_Viewer.sh`

3.2. Connection and Use

3.2.1. Connecting the product

- 1) Connect the power of the YRL.
- 2) Connect the communication cable (Ethernet cable) of YRL to the computer.
- 3) Set the IP address of the computer network to 192.168.1.12. (The basic setting of the LiDAR IP is 192.168.1.250)
- 4) Run the YUJIN LiDAR Viewer.
- 5) Connect LiDAR through the connection button of the YUJIN LiDAR Viewer.
- 6) Click Calibration file creation under the Utility tab. (File creation is required only for the initial connection of the corresponding LiDAR.)
- 7) Click "Import a Calibration File" under Utility tab, and refer to the calibration file created in step 6.



🔊 If the connection is made normally, the status value changes to "Connected" and you can verify the serial number and hardware version.

🔊 Calibration file is a unique data file for each LiDAR product to measure distances, so it is essential to import a calibration file at first.

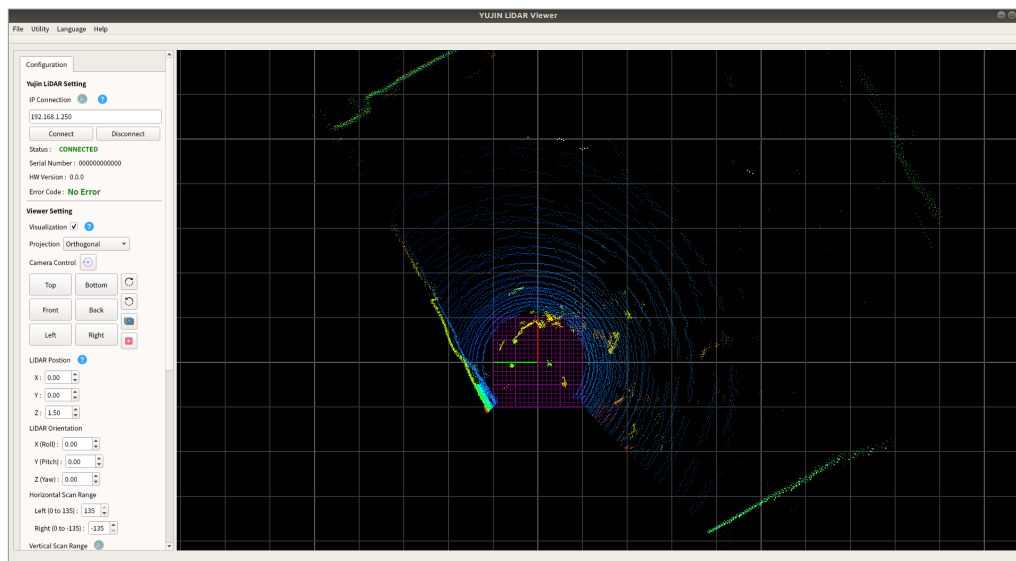
✓ If the connection is not made, please check the LiDAR power, data (Ethernet) cable, LiDAR IP address and computer IP address.

⚠ Each LiDAR product has its own unique calibration file. The name of the calibration file will be lk+serial number(12 digits).bin

3. Use of the Product

3.2.2. Using the program

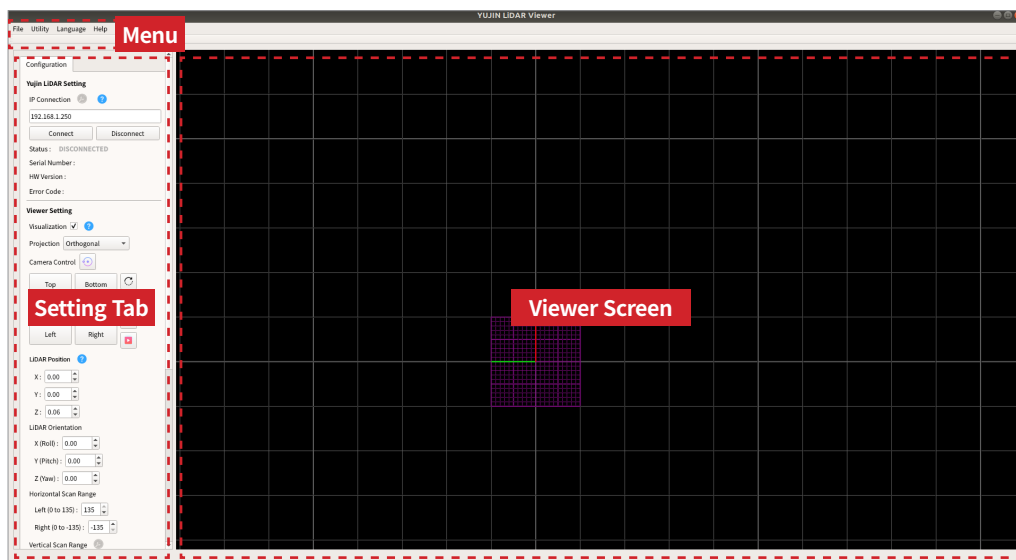
YUJIN LiDAR data appear on the viewer automatically when the connection is made successfully. You can also get a visualized data you want by changing configuration values of the viewer.



3.3. Name and Functions of the YUJIN LiDAR Viewer

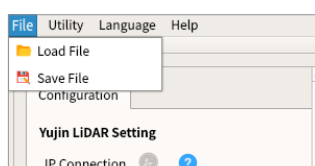
Once the YUJIN LiDAR is connected to the viewer, you can see the point cloud data on the screen in real time. Various settings are available for users to see the visualized data you want.

3.3.1. Name of the Viewer



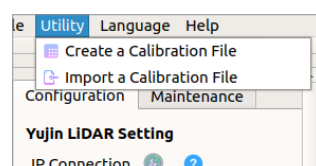
3.3.2. Functions of the Viewer

1) Menu



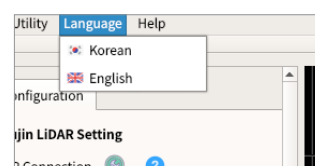
File

You can store what you are using in a file or open a stored file.



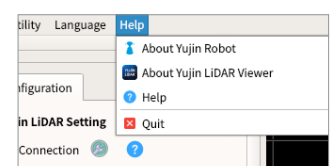
Utility

Through creating and importing a calibration file, the initial setting for a YRL series LiDAR can be done.



Language

You can select either Korean or English.



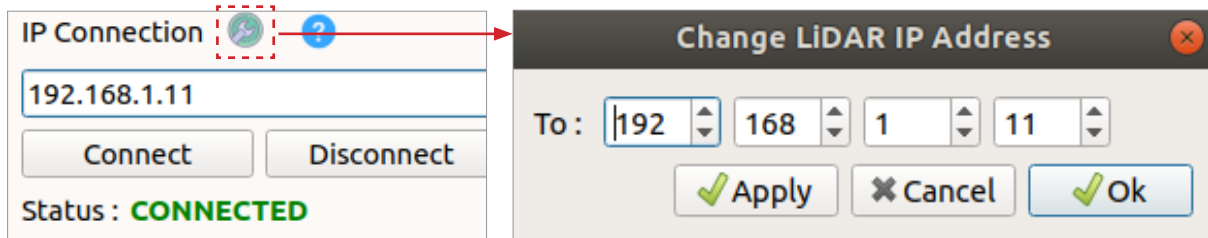
Help

You can verify information on the product and YUJIN.

3. Use of the Product

2) Setting Tab

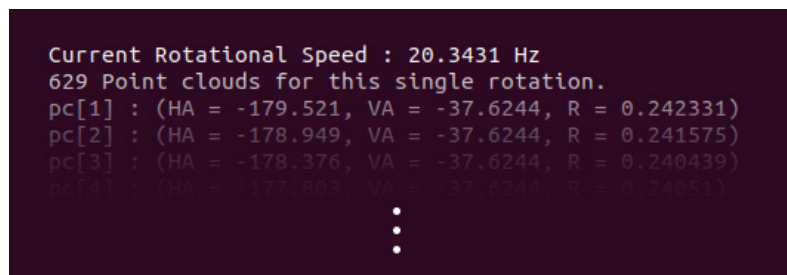
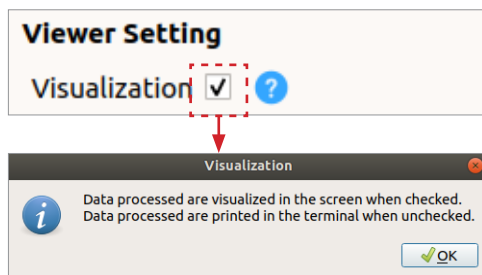
2-1) YUJIN LiDAR Setting



- YUJIN LiDAR IP : You can change the IP value.
- You can either connect or disconnect the program and product with the connection and disconnect button.
- You can verify status information about the product connected (status, serial number and hardware version).
- You can change the IP address of your LiDAR by clicking the setting icon.

2-2) Setting Viewer

2-2-1) Visualization : Data processed are visualized in the screen.

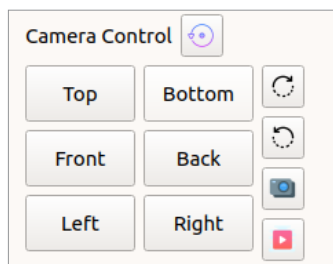


🔊 Data processed are printed in the terminal when unchecked.

2-2-2) Projecting conversion : A 3D space is projected into 2D screen.

- Orthogonal projection : A 3D environment is expressed in 2D without a perspective feeling.
- Perspective projection : A 3D environment is expressed in 2D with a perspective feeling.

2-2-3) Camera adjustment : You can adjust the location and direction of a camera, which is the object watching the point cloud in the 3D coordinate.



| Button | Description |
|--------|--|
| | Rotates, drawing a circle around the Z axis of (0,0,0). |
| | Top view seeing the LiDAR from above at (0, 0, 10). |
| | Bottom view seeing the LiDAR from below at (0, 0, -10). |
| | Front view seeing the LiDAR from the front at (10, 0, 0). |
| | Back view seeing the LiDAR from the back at (-10, 0, 0). |
| | Left view seeing the LiDAR from the left at (0, 10, 0). |
| | Right view seeing the LiDAR from the right at (0, -10, 0). |
| | Rotates 90o clockwise in the corresponding view. |
| | Rotates 90o anti-clockwise in the corresponding view. |
| | Stores the point cloud currently visualized in a file. |
| | Visualize the point cloud stored. Scanning resumes in real time with another click. |

🔊 Some functions are supported by mouse click and scrolling.

3. Use of the Product

2-2-4) Position and direction of LiDAR : The position and direction of LiDAR can be set on a screen.
Input the actual sensor height in the Z value of the LiDAR Position to see the actual view.

🔊 If the LiDAR is on the bottom, the sensor height is 0.06 m.

LiDAR Position ?
X :
Y :
Z :
LiDAR Orientation
X (Roll) :
Y (Pitch) :
Z (Yaw) :

| Function | Default value | Minimum value | Maximum value | Description |
|----------------|---------------|---------------|---------------|--|
| X | 0.00 | -99.00 | 99.00 | Coordinate X of the LiDAR position |
| Y | 0.00 | -99.00 | 99.00 | Coordinate Y of the LiDAR position |
| Z | 0.06 | -99.00 | 99.00 | Coordinate Z of the LiDAR position |
| Roll (Degree) | 0.00 | -360.00 | 360.00 | Rotating volume in a clockwise direction for the X axis of LiDAR |
| Pitch (Degree) | 0.00 | -360.00 | 360.00 | Rotating volume in a clockwise direction for the Y axis of LiDAR |
| Yaw (Degree) | 0.00 | -360.00 | 360.00 | Rotating volume in a clockwise direction for the Z axis of LiDAR |

2-2-5) Scanning range by LiDAR

The horizontal scan range can be controlled in the viewer and the point cloud data on the screen can be fabricated.

Horizontal Scan Range
Left (0 to 135) :
Right (0 to -135) :

| Function | Minimum value | Maximum value | Description |
|-------------------------------|---------------|---------------|-----------------------------|
| Horizontal scan range (left) | 0 | 135 | Horizontal left scan range |
| Horizontal scan range (right) | -135 | 0 | Horizontal right scan range |

The Vertical scan range can be controlled in the viewer and the point cloud data on the screen can be fabricated.

Vertical Scan Range
Upper (0 to 45) :
Lower (0 to -45) :

| Function | Minimum value | Maximum value | Description |
|------------------------------|---------------|---------------|----------------------------|
| Vertical scan range (top) | 0 | 45 | Vertical top scan range |
| Vertical scan range (bottom) | -45 | 0 | Vertical bottom scan range |

- ✓ Actual vertical scan range of the LiDAR can change by clicking the setting icon
It must include the range between -10° and +10° when change the vertical scanning range.

Vertical Scan Range
Upper (0 to 45) :
Lower (0 to -45) :

Change Actual Vertical Scan Range
Lower (-45 ~ -10) : Upper (+10 ~ +45) :

2-2-6) Environment color

The environment color of the viewer screen changes (change the background, ground and grid color).

Environment Color
Background :
Ground :
Grid :

| Environment | Supporting Color |
|-------------|--------------------------|
| Background | Black, white |
| Ground | Black, gray, white |
| Grid | Black, gray, white, none |

3. Use of the Product

2-3) Setting the Point Cloud

2-3-1) Data setting

Point Cloud Setting

Data Setting

Color

Vertical Data Range :

0.00

to

3.00

?

Cloud Size :

1.40

?

Noise Filter :

0.01

?

Stack :

100

?

| Function | Default value | Min. value | Max. value | Description |
|---------------------|---------------|------------|------------|--|
| Vertical data range | 3.00 | -99.00 | 99.00 | Vertical data range to be visualized. |
| Cloud size | 1.40 | 0.00 | 10.00 | Size of the point cloud. |
| Noise filter | 0.01 | 0.00 | 10.00 | Scattered noise is filtered. |
| Stack | 50 | 0 | 1500 | The data scanned are tied, while the LiDAR turns around. |

Changes in the surrounding situation can be easily recognized if the stack is low but seeing the overall picture is difficult. On the other hand, if the stack is high, the overall picture can be seen because the data remain longer on the screen, but changes in the surrounding situation cannot be recognized easily.

2-3-2) Point cloud colors

Point Cloud Setting

Data Setting

Color

Intensity Mode ☒

Axis Mode ☐

Standard Axis :

Z-axis

Color Variation Range :

0.00

to

3.00

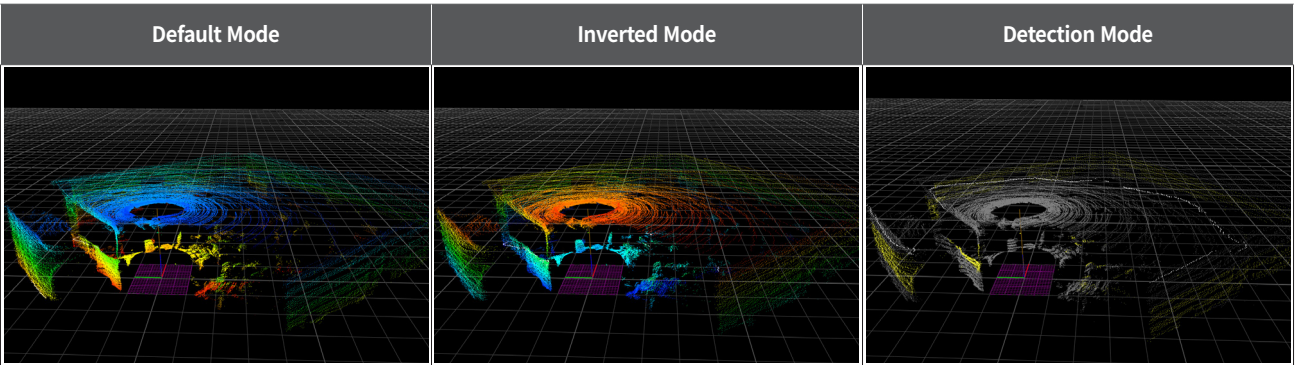
Inverted Mode ☐

Detection Mode ☐

The basic colors of the point cloud are divided into Intensity mode, in which the color is expressed according to the strength of the laser reflected, and Axis mode, according to the basic axis and color range. The colors consist of red, orange, yellow, yellowish green, green, skyblue and blue.

The relevant function is for the users to easily recognize the surrounding situation of the LiDAR with the range of changing colors and vertical data. Please select and set the color you want by changing the set value.

- Inverted mode : Convert the color changing pattern.
- Detection : The data within the range of color change can be visualized in yellow, while the data out of range are black.



4. Driver Interface (API)

Scan data can be fabricated and collected by the API provided after the YUJIN LiDAR driver is installed.

The driver and sample can be downloaded from the website of YUJIN or GitHub (github.com/yujinrobot/yujin_lidar).

4.1. Parameter

It describes the variable values used by the API.

🔊 The mark before each number is the function given only to the 3D LiDAR

| No. | Parameter Name | Default | Explanation |
|-----|--------------------|---------------|--|
| 1 | ip_address | 192.168.1.250 | Input IP address to the driver. Sensor IP address should be set. |
| 2 | cal_file_path | lk.bin | Calibration file address currently referenced. |
| 3 | sensor_height | 0.06 | Height of the product from the ground in meters. When the product is on a floor, sensor height is 0.06 m. |
| * 4 | max_range | 10^5 | Maximum range of data in meters that driver allows. |
| * 5 | upper_data_limit | 3.0 | Upper limit of data in z-axis in meters, having sensor_height as a standard. |
| * 6 | lower_data_limit | 0.0 | Lower limit of data in z-axis in meters, having sensor_height as a standard. |
| * 7 | max_vertical_ang | 135 | Upper vertical limit of data in degrees that is visualised. This value should be from 0 to 135. |
| 8 | min_vertical_ang | -135 | Lower vertical limit of data in degrees that is visualised. This value should be from -135 to 0. |
| 9 | max_horizontal_ang | 90 | Right horizontal limit of data in degrees that is visualised. This value should be from 0 to 90. |
| 10 | min_horizontal_ang | -90 | Left horizontal limit of data in degrees that is visualised. This value should be from -90 to 0. |
| 11 | filter_level | 0.01 | Level of filter that removes data that seem to be non-object. |
| 12 | error_code | 0 | Current LiDAR status & error code |
| 13 | model_no | N/A | Model number of the product |

4. Driver Interface (API)

4.2. Parameter Input/Output Functions

It can bring forth the variable value of a driver through the API or change the value.

🔊 The mark before each number is the function given only to the 3D LiDAR

| No. | Parameter Name | Unit | Explanation |
|------|--|--------|--|
| 1 | void getInputIpAddress(std::string &ip_address) | N/A | Returns input ip_address in driver |
| | void setInputIpAddress(std::string ip_address) | | Updates input ip_address in driver |
| 2 | void setCalibrationFilePath(std::string cal_file_path) | N/A | Updates Calibration file address |
| * 3 | void getSensorHeight(float &sensor_height) | m | Returns sensor_height in driver |
| | void setSensorHeight(float sensor_height) | | Updates sensor_height in driver |
| 4 | void getMaxRange(double &max_range) | m | Returns max_range in driver |
| | void setMaxRange(double max_range) | | Updates max_range in driver |
| * 5 | void getUpperDataLimit(float &upper_data_limit) | m | Returns upper_data_limit in driver |
| | void setUpperDataLimit(float upper_data_limit) | | Updates upper_data_limit in driver |
| * 6 | void getLowerDataLimit(float &lower_data_limit) | m | Returns lower_data_limit in driver |
| | void setLowerDataLimit(float lower_data_limit) | | Updates lower_data_limit in driver |
| * 7 | void getMaxVerticalAngle(double &max_vertical_ang) | degree | Returns max_vertical_ang in driver |
| | void setMaxVerticalAngle(double max_vertical_ang) | | Updates max_vertical_ang in driver |
| * 8 | void getMinVerticalAngle(double &min_vertical_ang) | degree | Returns min_vertical_ang in driver |
| | void setMinVerticalAngle(double min_vertical_ang) | | Updates min_vertical_ang in driver |
| 9 | void getMaxHorizontalAngle(double &max_horizontal_ang) | degree | Returns max_horizontal_ang in driver |
| | void setMaxHorizontalAngle(double max_horizontal_ang) | | Updates max_horizontal_ang in driver |
| 10 | void getMinHorizontalAngle(double &min_horizontal_ang) | degree | Returns min_horizontal_ang in driver |
| | void setMinHorizontalAngle(double min_horizontal_ang) | | Updates min_horizontal_ang in driver |
| * 11 | void getCurrentFilterLevel(float &filter_level) | N/A | Returns filter_level in driver |
| | void setCurrentFilterLevel(float filter_level) | | Updates filter_level in driver |
| 12 | void getErrorCode(std::string &error_code) | N/A | Returns LiDAR error code that is renewed every 30 seconds. |

4. Driver Interface (API)

4.3. Data Output Functions

It can verify the status and data of YUJIN LiDAR through the API.

🔊 The mark before each number is the function given only to the 2D LiDAR

| No. | Parameter Name | Unit | Explanation |
|-----|--|--------------|---|
| 1 | <code>void getConnectionState(bool &connection_state)</code> | N/A | Check connection status. (False, True) |
| 2 | <code>void getRPS(double &rotation_per_sec)</code> | N/A | Returns rotational speed of LiDAR. |
| * 3 | <code>void getCartesianOutputs(std::vector<float> &output_x, std::vector<float> &output_y, std::vector<float> &output_z)</code> | m | Returns output data in 3D cartesian coordinate system, that are processed by parameters from 2 to 10 in parameter table. |
| * 4 | <code>void getSphericalOutputs(std::vector<float> &range, std::vector<float> &horizontal_ang, std::vector<float> &vertical_ang)</code> | m, radian | Returns output data in 3D spherical coordinate system, that are processed by only filter_level. No parameter except filter_level affects returned output data from this function. |
| * 5 | <code>void getSphericalOutputsWithIntensity(std::vector<float> &intensity, std::vector<float> &range, std::vector<float> &horizontal_ang, std::vector<float> &vertical_ang)</code> | m, radian | Does the same thing as getSphericalOutputs, but also returns data that are inversely proportional to intensities of reflected laser. |

🔊 When YRL2 series use, data is outputted with output_z = 0.2, vertical_angle = 0.

4.4. LiDAR Input/Output Functions

It can verify the firmware value of YUJIN LiDAR and update the value through the API.

🔊 It can be used after successfully generating the communication socket of the driver.

🔊 The mark before each number is the function given only to the 3D LiDAR

| No. | Parameter Name | Unit | Explanation |
|-----|--|--------|---|
| 1 | <code>void fwGetYrlIpAddress(int &ip_a, int &ip_b, int &ip_c, int &ip_d);</code> | N/A | Returns ip address of the product. |
| | <code>void fwSetYrlIpAddress(int ip_a, int ip_b, int ip_c, int ip_d)</code> | | Updates ip address of the product. |
| * 2 | <code>void fwGetYrlVerticalAngles(int &lower_angle, int &upper_angle);</code> | degree | Returns lower vertical limit of mirror movement in degree. |
| | <code>void fwSetYrlVerticalAngles(int lower_angle, int upper_angle);</code> | | Updates lower vertical limit of mirror movement in degree. Allowed range is from 0 to 35. |
| 3 | <code>void fwGetModelNo(unsigned int& model_no);</code> | N/A | returns it's model number |

🔊 When you change its' vertical range using fwSetYrlVerticalAngles, you should reboot the product in order to get updated vertical angle values using fwGetYrlVerticalAngles

4. Driver Interface (API)

4.5. Error Code Table

🔊 The mark before each number is the function given only to the 2D LiDAR

| No. | Error Code | Error Name | LED | Solution | Description |
|-----|------------|--------------------------------|------------|---|---|
| 1 | A | Power Error | Red | Customer service inquiry. | Power Error |
| 2 | B | Horizontal rotation error | Red | Customer service inquiry. | Mirror horizontal rotation error |
| * 3 | C | Vertical movement error | Red | Customer service inquiry. | Mirror vertical movement error |
| 4 | D | Temperature measurement error | Red | Customer service inquiry. | Temperature measurement error |
| 5 | E | Sensor data transmission error | Red | Customer service inquiry. | Sensor data transmission error |
| 6 | F | Temperature range error | Red, Green | Adjust ambient temperature to LiDAR's normal operating temperature(-10~50C) | Ambient temperature range exceeded |
| 7 | G | Communication data error | - | Parameter format check | Data communication error occurs when changing parameters (automatic release after 1 minute) |
| 8 | H | Parameter data error | - | Parameter data check | The parameter specification range is exceeded when changing parameters (automatic release after 1 minute) |
| 9 | I | Command / Code error | - | - | Unspecified command / code input when changing parameters (automatic release after 2 minutes) |
| 10 | O | No Error | - | - | No Error |

To improve quality, the product's design and specifications may change without prior notice.



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