YUJIN ROBOT

Document No : YRL_UM_EN_2101_V1.2

YUJIN LiDAR
User Manual YRL Series

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

ROS

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.

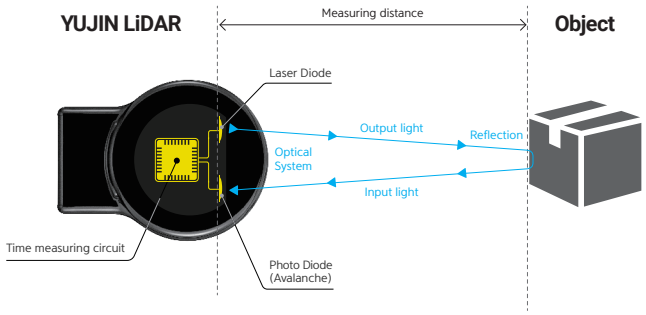
- Interference or contact between different laser light sources may cause abnormal operation of the sensor.
- Do not step on the unit or place heavy objects on it as it may cause abnormal operation of the sensor.
- Do not use in dusty or humid places or in direct sunlight.
- Fasten the product firmly in places where there is a lot of vibration.
- Do not drop objects on the product or shock it.
- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Contents

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.



principle of ToF (time of flight)

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

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

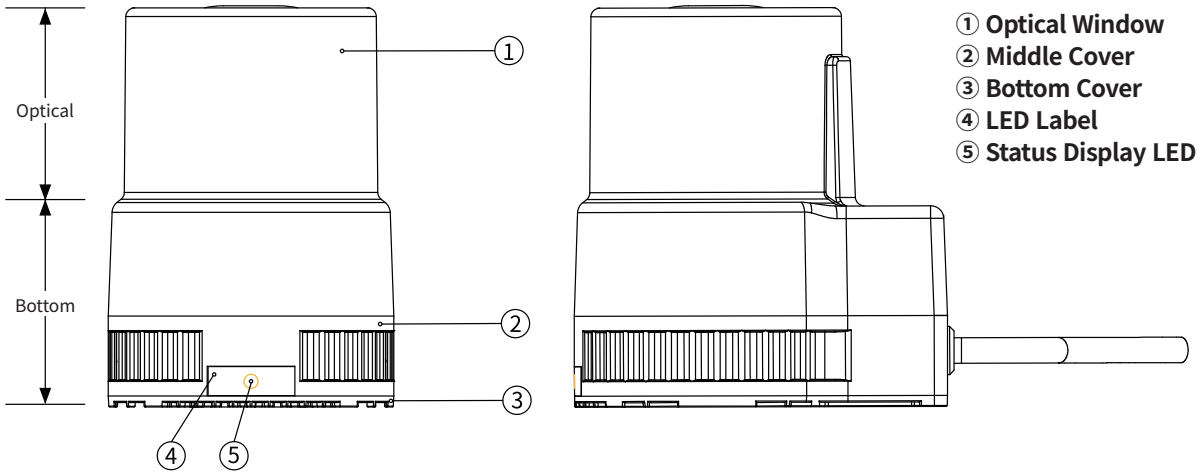
Quick Start Manual

🔊 **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

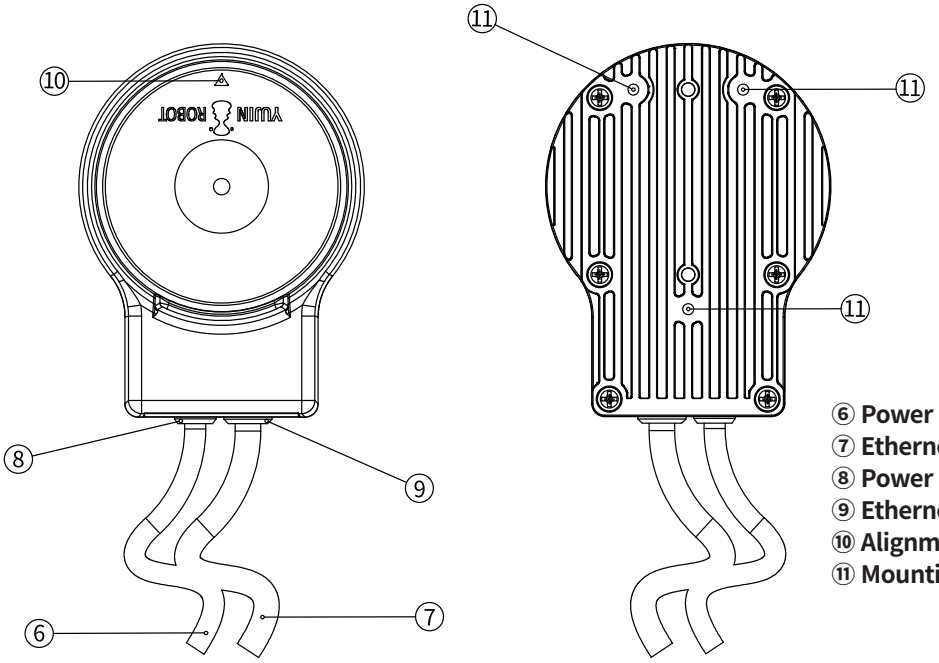
1. About the Product

1.3. Product Diagram

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



① Optical Window
② Middle Cover
③ Bottom Cover
④ LED Label
⑤ Status Display LED



⑥ Power Cable
⑦ Ethernet Cable
⑧ Power Cable Rubber
⑨ Ethernet Cable Rubber
⑩ Alignment Support Mark(0° axis)
⑪ Mounting Tap M3 (Depth:4mm)

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
- Class 1 laser product

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	9,750			
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/s2(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

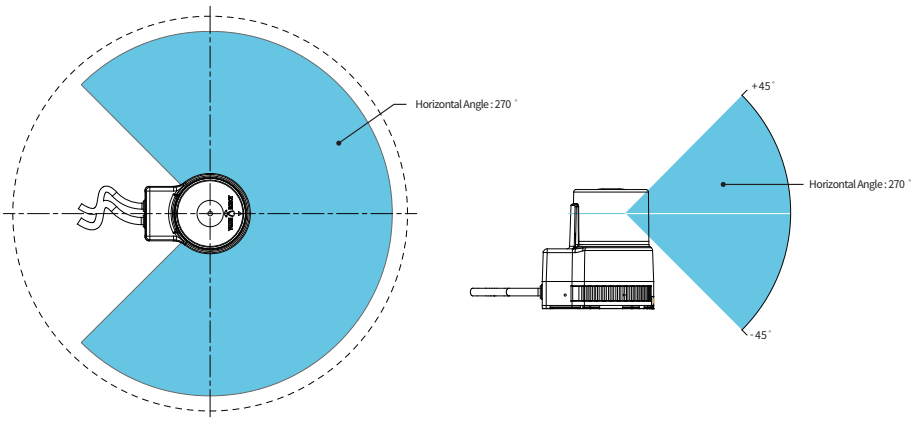
The YRL Series can collect 13,000 point cloud per second, and each point cloud contains the following information.

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)

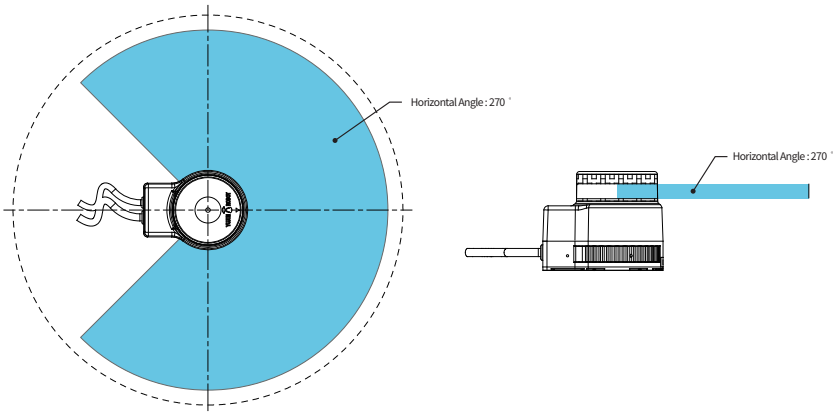
For more detail, please check the driver interface in chapter 4.

2) Scanning Angle

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



YRL3-05 / YRL3-10 / YRL3-20

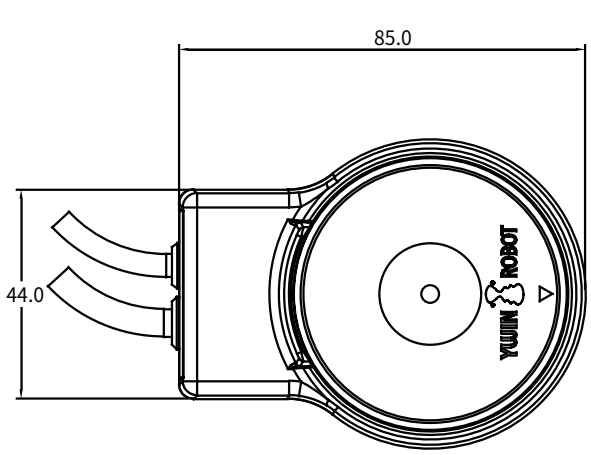


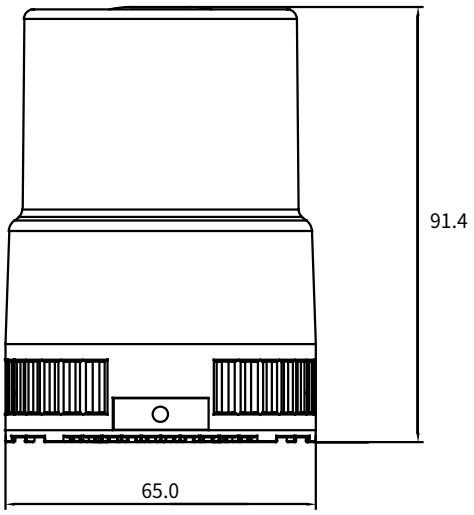
YRL2-05 / YRL2-10 / YRL2-20

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

2. Key Functions

2.3. Dimensions

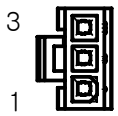




2. Key Functions

2.4. Pin Assignment

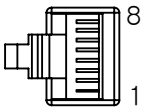
Power Input Connector



MOLEX : 39-01-4030

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

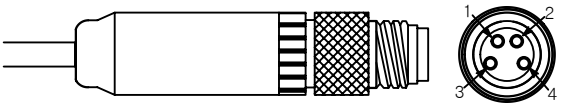
Ethernet RJ45 Connector



RJ45

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

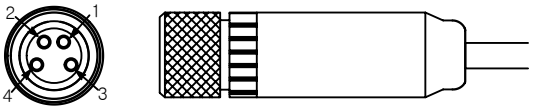
IP PWR Connector



L102-M8-H0401(Male)

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

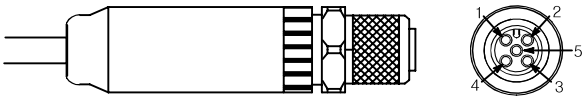
IP PWR EXTENSION Connector



L102-M8-T0402-01(Female)

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

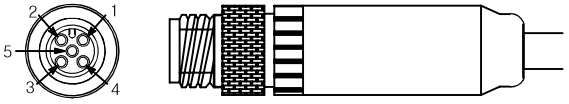
IP Ethernet Connector



L102-M12-R05A02(Female)

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

IP Ethernet EXTENSION Connector



L102-M12-R05A01(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

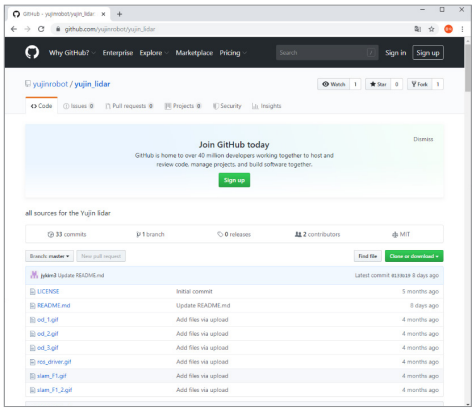
Recommended Specifications	System	more than 1GHz, 64bit processor
	OS	Windows 10 64 bit, Ubuntu 18.04 64 bit
	Memory	1 GB
	Storage	450 MB
	Resolution	1024 x 768

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.

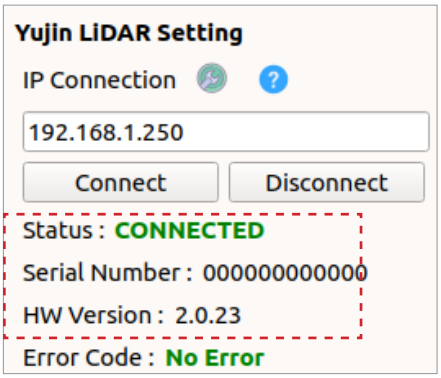
Run the program where the related software is installed after the qt5 is installed.

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.

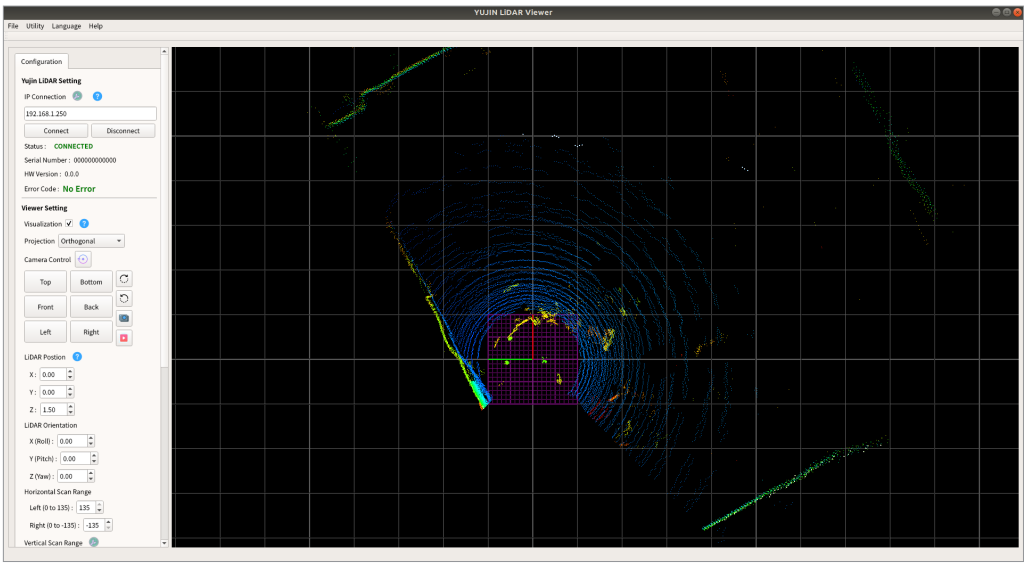
If the connection is not made, please check the LiDAR power, data (Ethernet) cable, LiDAR IP address and computer IP address.

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

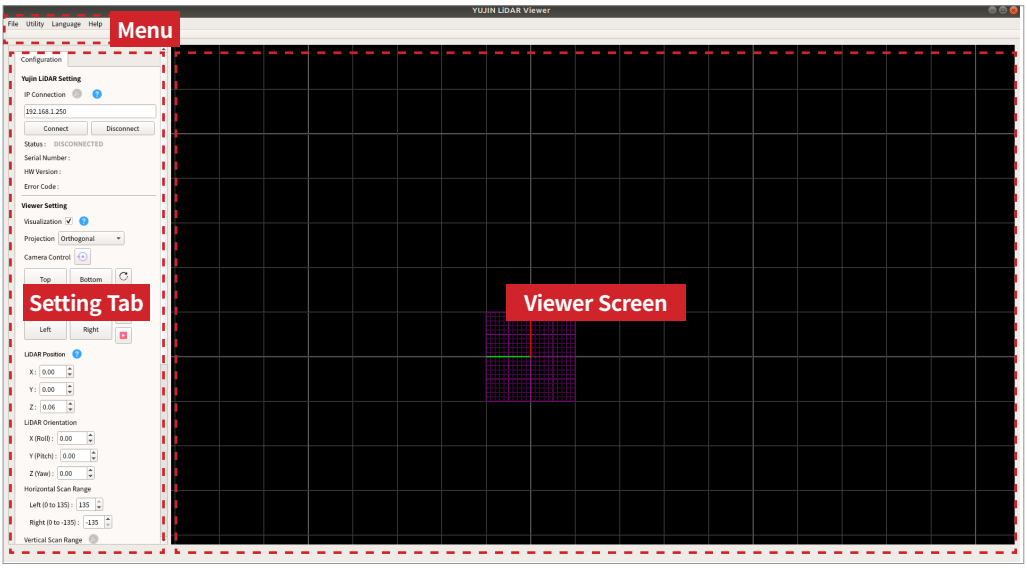
YUJIN LiDAR data appear on the viewer automatically when the connection is made successfully.
You can also get a visualized data you want by changing configuration values of the viewer.



3.3. Name and Functions of the YUJIN LiDAR Viewer

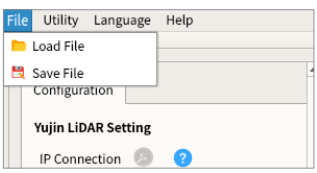
Once the YUJIN LiDAR is connected to the viewer, you can see the point cloud data on the screen in real time.
Various settings are availvable for users to see the visualized data you want.

3.3.1. Name of the Viewer

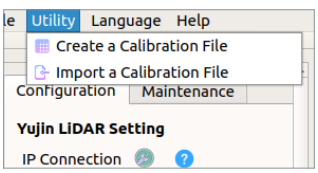


3.3.2. Functions of the Viewer

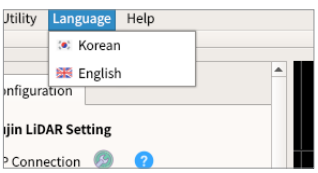
1) Menu



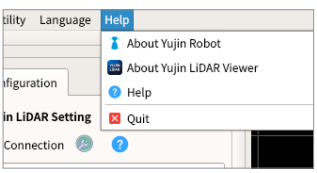
File
You can store what you are using in a file or open a stored file.



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.

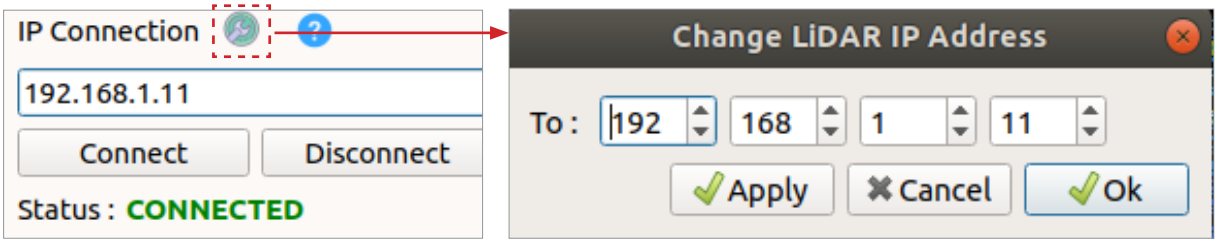


Help
You can verify information on the product and YUJIN.

3. Use of the Product

2) Setting Tab

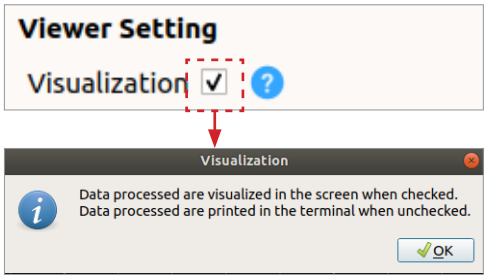
2-1) YUJIN LiDAR Setting

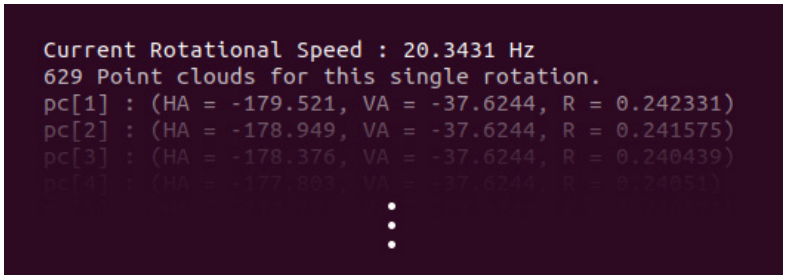


- YUJIN LiDAR IP : You can change the IP value.
- You can either connect or disconnect the program and product with the connection and disconnect button.
- You can verify status information about the product connected (status, serial number and hardware version).
- You can change the IP address of your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

2-2) Setting Viewer

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



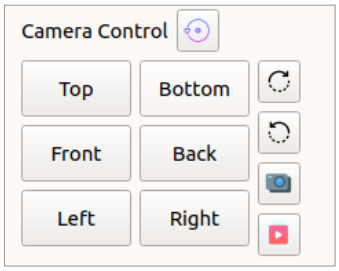


Data processed are printed in the terminal when unchecked.

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.

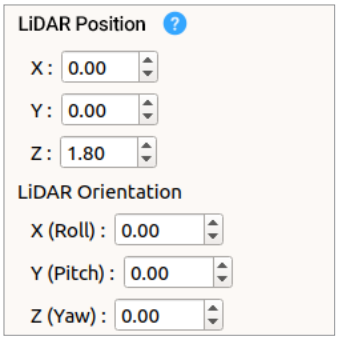


Button	Description
	Rotates, drawing a circle around the Z axis of (0,0,0).
Top	Top view seeing the LiDAR from above at (0, 0, 10).
Bottom	Bottom view seeing the LiDAR from below at (0, 0, -10).
Front	Front view seeing the LiDAR from the front at (10, 0, 0).
Back	Back view seeing the LiDAR from the back at (-10, 0, 0).
Left	Left view seeing the LiDAR from the left at (0, 10, 0).
Right	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.

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.

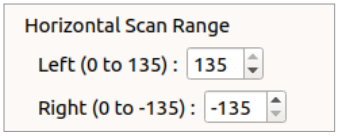
If the LiDAR is on the bottom, the sensor height is 0.06 m.



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

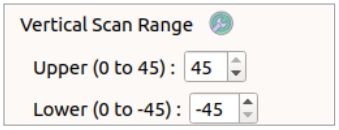
2-2-5) Scanning range by LiDAR

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



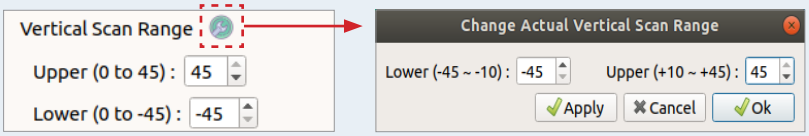
Function	Minimum value	Maximum value	Description
Horizontal scan range (left)	0	135	Horizontal left scan range
Horizontal scan range (right)	-135	0	Horizontal right scan range

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



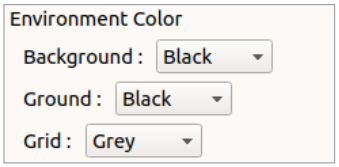
Function	Minimum value	Maximum value	Description
Vertical scan range (top)	0	45	Vertical top scan range
Vertical scan range (bottom)	-45	0	Vertical bottom scan range

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.



2-2-6) Environment color

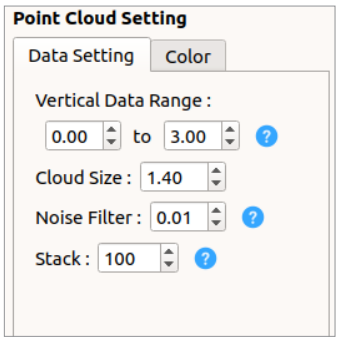
The environment color of the viewer screen changes (change the background, ground and grid color).



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

2-3) Setting the Point Cloud

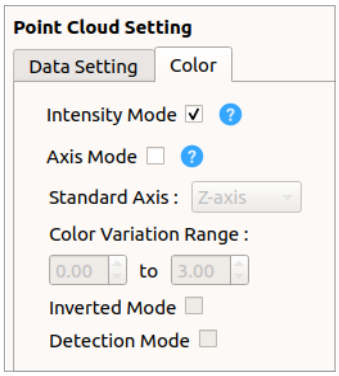
2-3-1) Data setting



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.

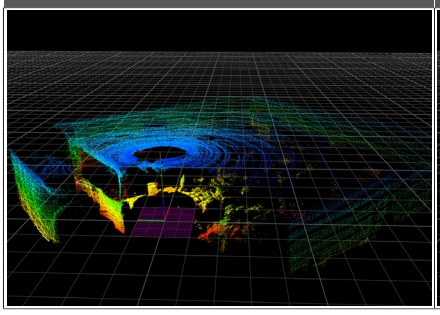
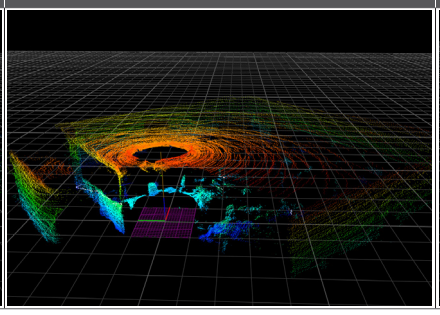
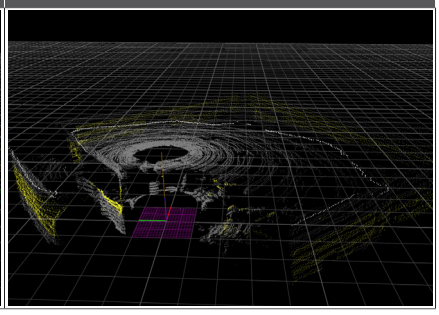
2-3-2) Point cloud colors



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.

Default Mode	Inverted Mode	Detection Mode
		

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	void getConnectionState(bool &connection_state)	N/A	Check connection status. (False, True)
2	void getRPS(double &rotation_per_sec)	N/A	Returns rotational speed of LiDAR.
*3	void getCartesianOutputs(std::vector <float> &output_x, std::vector <float> &output_y, std::vector <float> &output_z)	m	Returns output data in 3D cartesian coordinate system, that are processed by parameters from 2 to 10 in parameter table.
*4	void getSphericalOutputs(std::vector <float> &range, std::vector <float> &horizontal_ang, std::vector <float> &vertical_ang)	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	void getSphericalOutputsWithIntensity(std::vector <float> &intensity, std::vector <float> &range, std::vector <float> &horizontal_ang, std::vector <float> &vertical_ang)	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	void fwGetYrlIpAddress(int &ip_a, int &ip_b, int &ip_c, int &ip_d);	N/A	Returns ip address of the product.
	void fwSetYrlIpAddress(int ip_a, int ip_b, int ip_c, int ip_d)		Updates ip address of the product.
*2	void fwGetYrlVerticalAngles(int &lower_angle, int &upper_angle);	degree	Returns lower vertical limit of mirror movement in degree.
	void fwSetYrlVerticalAngles(int lower_angle, int upper_angle);		Updates lower vertical limit of mirror movement in degree. Allowed range is from 0 to 35.
3	void fwGetModelNo(unsigned int& model_no);	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 3D 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.

YUJIN ROBOT

YUJIN ROBOT Co., Ltd. | INNOVATION FOR A BETTER WORLD
Address : 33, Harmony-ro 187 beon-gil, Yeonsu-gu, Incheon, Republic of Korea
TEL : +82-32-550-2322
FAX : +82-32-550-2301
E-mail : lidar@yujinrobot.com
www.yujinrobot.com