Date : 2024.10.28

3D LiDAR
YLM-10LX

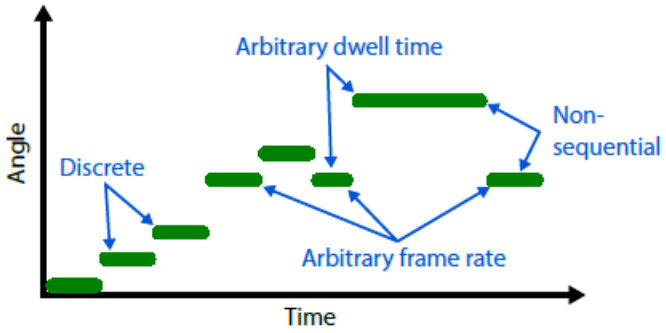
SPECIFICATIONS

Symbol	Amended Reason				Pages	Date	Corrector	Amendment No.
Approved by	Checked by	Drawn by	Designed by	Title	YLM-10LX Specifications		
HINO	HIGASHI	TAKEGAWA	TAKEGAWA	Drawing No.	C-42-04575		1/10

1. Overview

This sensor is a 3D LiDAR developed in collaboration with Lumotive, a U.S.-based company. Utilizing the polarization properties of liquid crystal, it achieves 3D environmental recognition through its unique beam steering technology, LCM (Light Control Metasurface), without using any mechanical moving parts. This technology enables the laser beam direction to be adjusted without the need for traditional mechanical components.

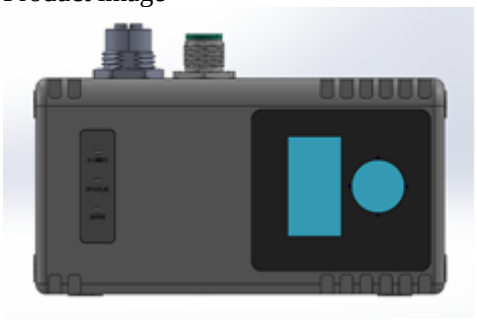
With LCM technology, the light emission can be scanned in discrete and non-continuous steps. Additionally, it allows for the configuration of arbitrary dwell times and frame rates.



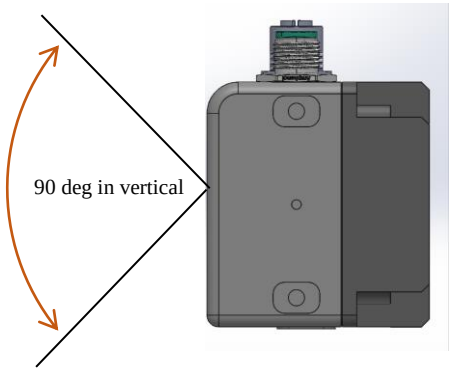
Scanning image with LCM technology

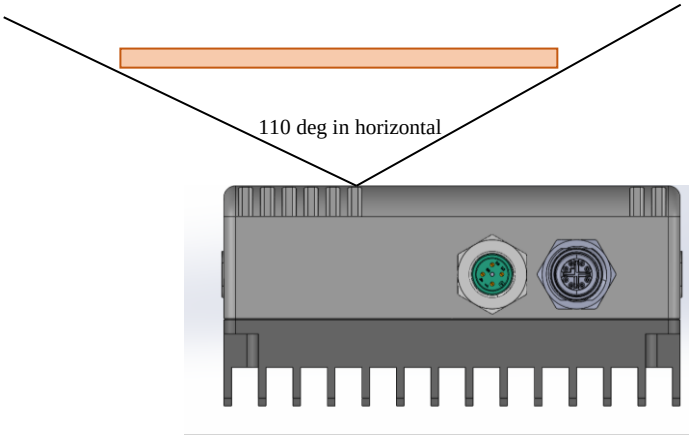
2. Composition

2.1 Product image



2.2 Scanning image





2.3 Method

This sensor is a non-coaxial LiDAR with separate optical paths for light emission and reception. The light emission is achieved using a VCSEL laser, which is expanded in the horizontal direction (110°) and vertically scanned by the LCM. Reflected light from the environment is received by a 2D ToF Image sensor to capture 3D point cloud data.

2.4 Basic component of LiDAR

Light projection	VCSEL Laser (λ= 905nm)
Beam-steering	LCM
Light-reception	ToF Image sensor

3. Disclaimer

- This sensor is not certified for the functional safety.
- This sensor cannot be used for human body detection as per the machinery directives.
- Sensor emits laser for measurement. Sensor's operation may become unstable under the influence of strong light interference or when emitted lights are not reflected back from the object.
- Sensor's operation may become unstable due to rain, snow and fog or due to dust pollution on the optical window.
- Rules and regulations related to safety should be strictly followed by the user when operating the sensor.
- When there is a risk that this sensor is intended for use in mass-destruction weapons, weapons and equipment aimed at killing human beings, and relevant technologies, or when uses for such purposes are clear, sales may be prohibited in accordance with the Foreign Exchange and Foreign Trade Act, and the Export Trade Control Order (Japanese law). Moreover, regarding export of products, the formalities according to laws/Export Trade Control Order are implemented in order to maintain international peace and safety.
- Caution – Use of controls or adjustments or performance of procedures other than those Specified here in may result in hazardous radiation exposure.
- Before using the sensor, make sure to read this specification thoroughly.

4. Specifications

Product name	3D LiDAR
Model No.	YLM-10LX
Supply voltage	15 to 30VDC
Current consumption	25W or less, 24VDC: 1A
Detection range (*a, *b, ※1)	0.3m~10m (for reflectance 10%) 1m~15m (for reflectance 90%)
Field of view (FOV)	110°(H) × 90°(V) The vertical FOV can be dynamically changed by software
Distance accuracy (*a, *b, ※2)	0.3m ~ 2.0m : < +/-80mm 2m~ : < +/-2.0%
Repeatability (*a, *b, ※2)	σ< 1.5%
Framerate (*a, *b)	2~60Hz (Framerate changes depending on vertical FOV and other parameters) Ex. QVGA, vertical FOV 90°(full frame) : 9.25Hz（default)
Discrete line scanning speed (*a, *b)	840 lines/sec
Number of point cloud data per sec	Approx. 500,000 points/sec (default: QVGA, vertical FOV 90°×9.25Hz)
Angular resolution (*a)	QVGA: 0.375° VGA: 0.188° (same in both horizontal and vertical direction)
Startup time (*b)	60sec
Interface	Ethernet (1000BASE-T)
Size	120(W) × 57.2(D) × 63.5(H) mm
Weight	650g
Light source	VCSEL Laser (λ= 905nm)
Ambient temperature	-20℃~+50℃, below 85%RH (without dew, frost)
Storage temperature	-20℃~+70℃, below 85%RH (without dew, frost)
Vibration resistance	10~55Hz Double amplitude 1.5mmp-p each 2hours 55~200Hz 98m/s^2(10G) Sweep 2min each 1hour in X, Y and Z directions
Shock resistance	196m/s^2 (20G) each 10 times in X, Y and Z directions
Protective structure	IP64
Laser safety class	Class 1 (compliant with IEC-60825-1)

*a : Lidar performance is defined through software using the Programmable Lidar API.
*b : Unless otherwise specified, the following conditions apply to all specifications:

- ✓ Measurement environment: Conducted in our testing setup;
- ✓ Ambient temperature: 25℃.
- ✓ Target reflectivity: 10%.
- ✓ Resolution: 320 × 240 (QVGA).
- ✓ On-axis (center of field of view).

※1 : Detection distance decreases with oblique angles due to reduced received light intensity, leading to lower accuracy.

※2 : Distance accuracy and repeatability are evaluated under the following conditions:

Distance Accuracy: The average of 100 measurements per pixel for a 5×5 pixel area at the center, further averaged across 25 locations.

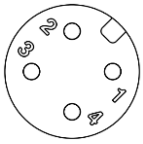
Repeatability: The standard deviation of 100 measurements per pixel for a 5×5 pixel area at the center, further averaged across 25 locations.

5. Connection

5.1 Connector-pin assignment

5.1.1 Power connector

Model No.: Amphenol M12A-04PMMS-SF8001 (M12, male, A-code)



PIN number	Function
1	+VIN +24VDC
2	Unused
3	-VIN 0VDC
4	Unused

5.1.2 Ethernet connector

Model No.: NorComp Inc. 859-X08-203R0R4 (M12, female, X-code)

PIN number	Function
1	TX_D1+
2	TX_D1-
3	RX_D2+
4	RX_D2-
5	BI_D4+
6	BI_D4-
7	BI_D3-
8	BI_D3+

5.2 Connection cable specification (sold separately)
5.2.1 Power cable with connector
Model No.: Phoenix Contact SAC-4P-3,0-PUR/M12FS SH 3m (1682854)
Sensor side: M12, female, A-code, straight connector / Power side: discrete wire

PIN number	Function	Wire color
1	+VIN	Brown
2	Unused	White
3	-VIN	Blue
4	Unused	Black

5.2.2 Ethernet connector
Model No.: Phoenix Contact NBC-M12MSX/2,0-94F/R4AC 2m (1407472)
Sensor side: M12, male, X-code, straight connector / Host side: RJ45

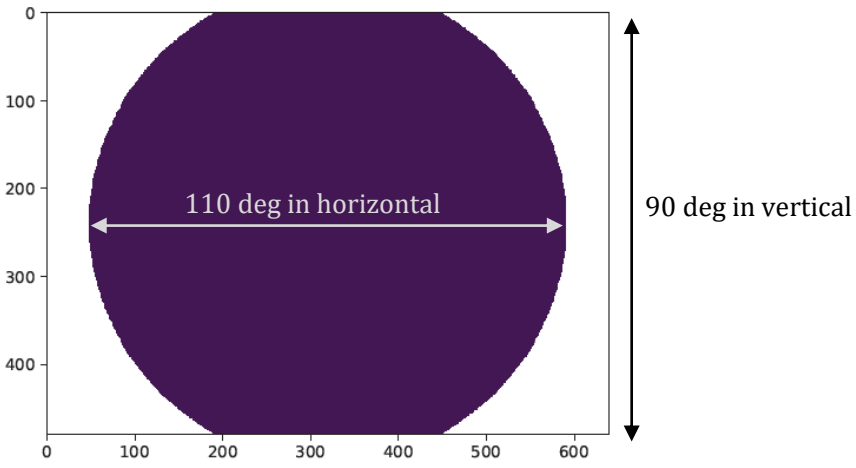
M12 connector			RJ45		
PIN number	Function	Wire color	Wire color	Function	PIN number
1	TX_D1+	White/Orange	White/Orange	TX_D1+	1
2	TX_D1-	Orange	Orange	TX_D1-	2
3	RX_D2+	White/Green	White/Green	RX_D2+	3
4	RX_D2-	Green	Blue	BI_D3+	4
5	BI_D4+	White/Brown	White/Blue	BI_D3-	5
6	BI_D4-	Brown	Green	RX_D2-	6
7	BI_D3-	White/Blue	White/Brown	BI_D4+	7
8	BI_D3+	Blue	Brown	BI_D4-	8

6. Web UI (User Interface)
The sensor is equipped with Web UI that allows basic operations such as setting FOV, starting and stopping scanning, etc., on the PC screen in a simplified manner. Please refer to the separately issued Web UI instruction manual for the operation method, settable items, etc.

Web UI screen sample

7. Resolution
The default resolution of this sensor is set to QVGA (320×240 pixels). This sensor can also be set to VGA (640×480 pixels) by changing with software. However, the higher the resolution, the lower the frame rate due to a trade-off with other specifications such as frame rate.

8. FOV



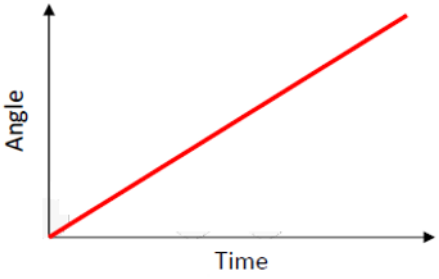
Effective FOV

9. Angle of FOV

This sensor allows up to 8 vertical field-of-view (FOV) configurations via the API, while the Web UI supports up to 3 configurations. The horizontal FOV is fixed at 110 degrees, but the vertical FOV can be adjusted through software to a maximum of 90 degrees. Similar to resolution, the FOV is subject to trade-offs with other specifications. Expanding the FOV results in a reduction of the frame rate.

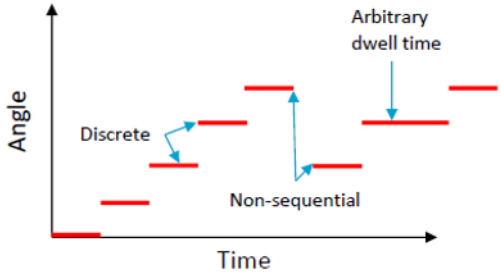
Unlike traditional mechanical scanning systems, where a fixed scanning range is traversed monotonously over time, digital scanning with Liquid Crystal Modulation (LCM) offers greater flexibility. With this technology, it is possible to perform random scanning within a user-defined range. This allows for more focused detection in specific areas, enabling the collection of highly adaptable and detailed data.

Mechanical scanning
(Motor, polygon, MEMS etc)



- Continuous (analog) steering
- Sequential angle order
- Fixed dwell time per pixel
- Requires calibration and feedback

Digital scanning
(LCM)



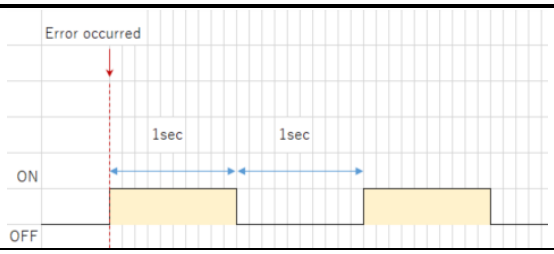
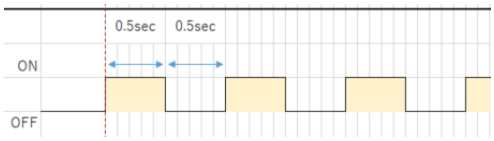
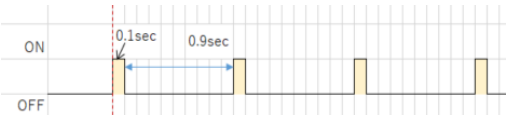
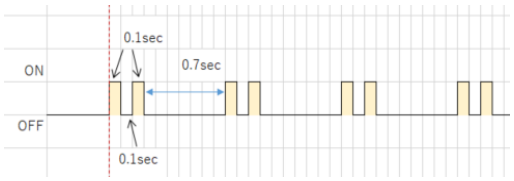
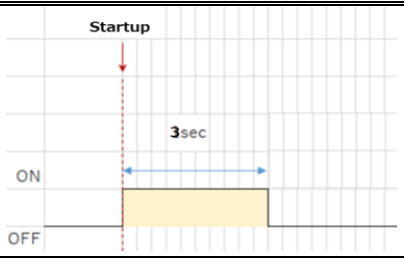
- Discrete (digital) steering
- Non-sequential, software-defined order
- Arbitrary, software-defined, dwell time per pixel
- No calibration and feedback

10. Indicator

10.1 Power : Green

Light-on : Power ON / Light-off : Power OFF

10.2 Status/Error (blinking) : Red

	Error	Emission Pattern
a	Laser Current Lit :1sec Unlit :1sec	
b	LCM Current Lit : 0.5sec Unlit : 0.5sec	
c	Ampl Current Lit : 0.1 sec Unlit : 0.9sec	
d	Power Supply Lit : 0.1sec×2 Unlit : 0.7sec	
e	Starting up Lit : 3sec	 (No abnormalities)

10.3 Data : Orange

Lit : Distance measurement active

Unlit : Distance measurement stopped

11. Ethernet setting

11.1 Default setting value is following.

IP Address: 192.168.0.10

Base port number: 10940 (10940~10947: assigned to each vertical FOV setting)

11.2 Changing the IP Address

You can change and reset the IP address using the dedicated application (IP Discovery). For details on installing and operating IP Discovery, please refer to the IP Discovery manual (C-41-02603).

12. Cautions

Due to the high-speed processing capabilities of this sensor, it generates a significant amount of heat. The heat dissipation is concentrated on the rear side of the housing, so when the sensor is used continuously in high-temperature environments, it is recommended to mount it on a frame with good heat dissipation properties.

13. Laser safety

The safety classification of this product is Class 1.

Class 1 in laser safety standards refers to lasers that are guaranteed to be safe under normal operating conditions (reasonably foreseeable operating conditions). Simply marking the product as a laser device eliminates the need for additional safety measures.

【Note】

- The built-in laser emits a high power output. Laser output is adjusted during the manufacturing and shipping process, and during operation, the output is controlled to remain within safe levels. Any control or adjustment procedures outside the specified guidelines may result in exposure to hazardous laser radiation. To avoid accidental exposure to laser radiation, do not disassemble or modify the product.
- While the product's laser safety class is 1 and does not pose a direct threat to human health, please avoid directly looking into the laser beam whenever possible.