

**YVT Series**

# 3D LiDAR Area Mapping, Spatial Recognition & Navigation

## YVT - 35LX-F0

Compact 3D LiDAR sensor used for area mapping, spatial recognition and navigation on autonomous mobile robots and industrial vehicles. Using a high-density interlace mode, it can detect indoor and outdoor environments nearly gap-free regardless of whether objects are moving or not. With the ability for this sensor to see real-time data in a 3D environment from any perspective, a high-resolution point cloud can be produced.



**CE**  
RoHS

# COMPACT, LIGHTWEIGHT 3D LIDAR SENSOR

## 1. Introduction

### Operation Principle

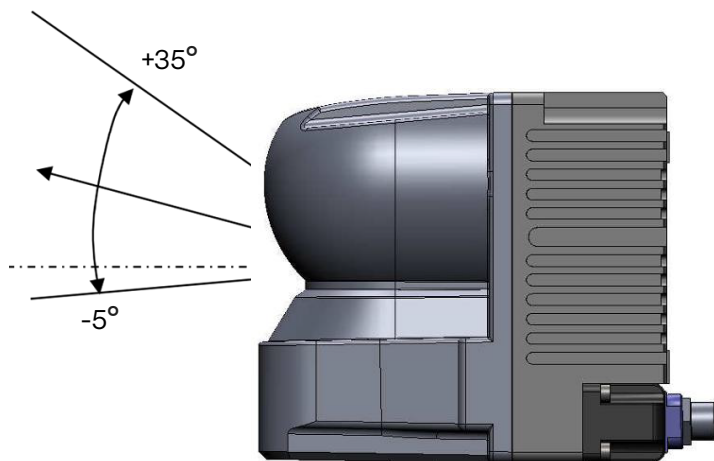
- This sensor uses a laser beam ( $\lambda=905\text{nm}$ ) to scan a semispherical field. User can obtain the distance and its corresponding angle data. The distance of an object is measured by using the Time of Flight (TOF) principle. User can convert the measurement data into 3D coordinates by using transform calculation.
- This product is class 1 laser product.

## 2. Structure (Scanning image of laser beam)

### (1) Structure diagram

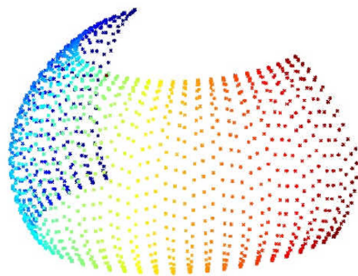
Vertical Scanning Range  $40^\circ$

$+15^\circ$   
(Center of vertical scanning)

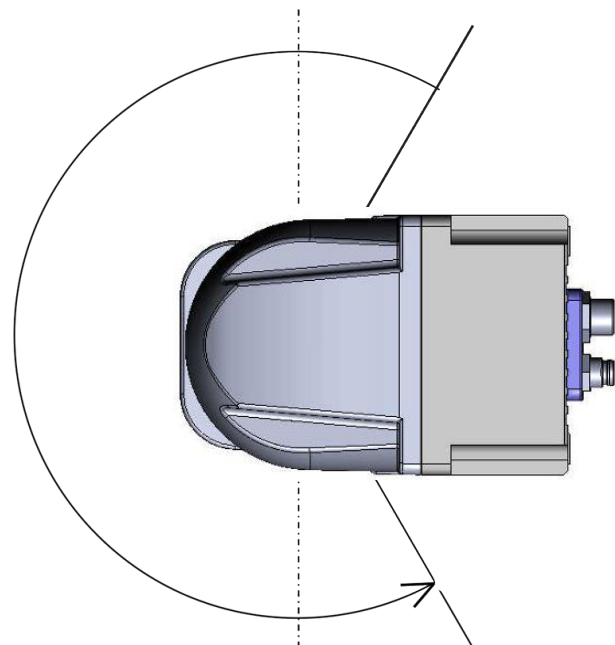
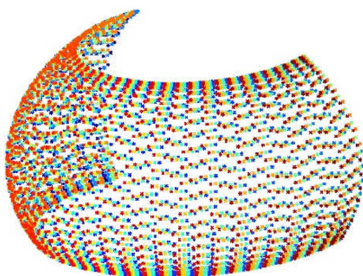


Horizontal scanning range  $210^\circ$

**Scanning Image**  
Non-Interlace

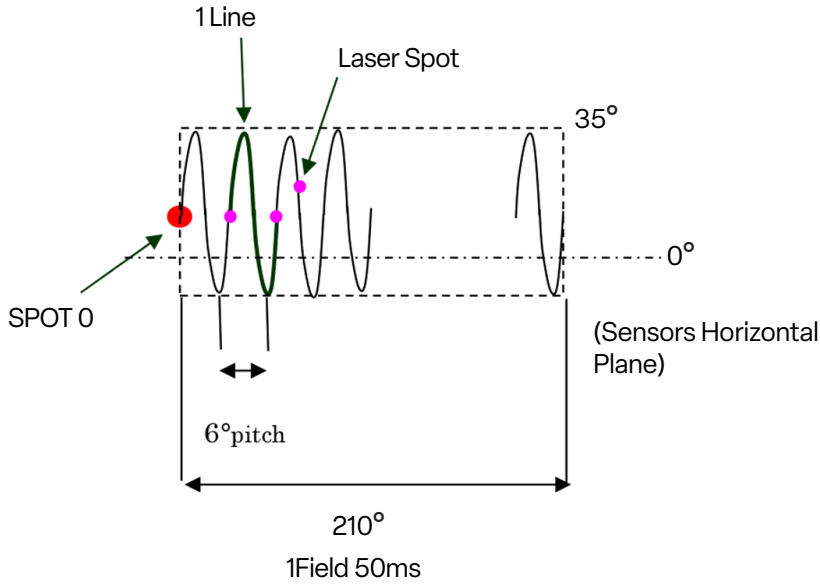


4 Interlace



Direction of horizontal scanning

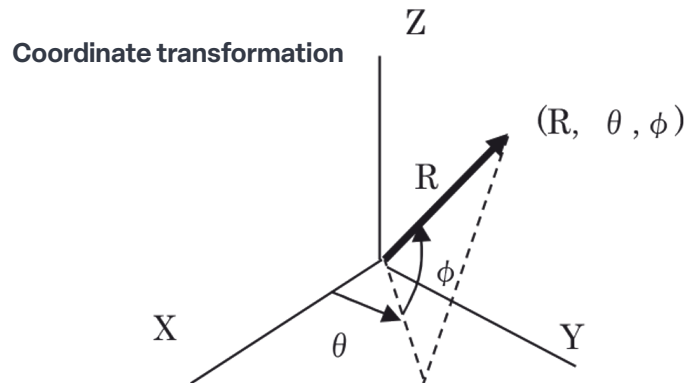
## (2) Explanation of laser beam



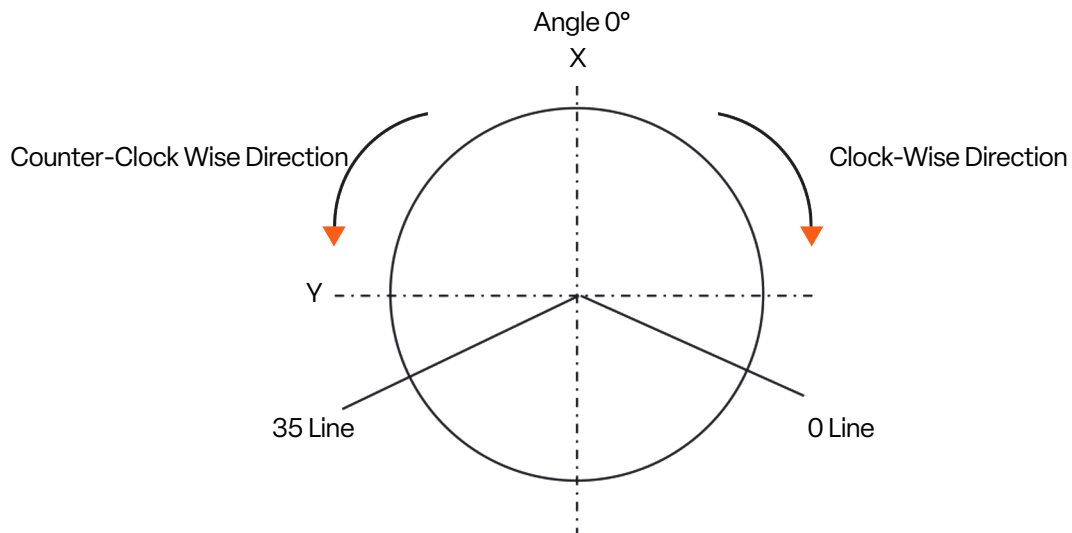
1Frame	Max 200Field
1Field	36Line
1Line	74spot (Total 90spot - OFF 16spot)
Laser off spot 17,19,20,21,23,24,25,27, 63,65,66,67,69,70,71,73	

**Caution:** First Spot (SPOT NO.0) of the line is at vertical 15°

## (3) The relation between field, line and spot (During non-interlace)



θ: Rotating direction of the motor while performing horizontal scan





### 3. Product Specs

Product Name	3D LIDAR
Model	YVT-35LX-F0
Light source	Laser diode Wave length=905nm Laser Safety Class 1 (IEC60825-1:2007 and IEC60825-1:2014)
Supply voltage	DC12V / 24V (Operating Voltage Range 10~30V) (When using 12V : Startup 1.5A / Normal 0.8A)
Horizontal scan angle	210° or more pitch 6° Accuracy±0.125°
Vertical scan angle	40° (-5° to 35°) Accuracy±2°
Data spots (Resolution)	2590 spots or more (No interlace, 20fps) 518000 spots or more (Interlace HD mode, 0.1fps)
Interlace	Horizontal: Max 20 times HD Mode: Horizontal 20 times × vertical 10 times
Detection range at center of vertical scan (upward 15°)	Horizontal scan -45°<θ<45°0.3-35m (white paper) 0.3-11m (black paper reflectance 10%) -75°<θ≤-45°, 45°≤θ<75°0.3-20m (white paper) 0.3-6m (black paper reflectance 10%) θ≤-75°, 75°≤θ 0.3-10m (white paper) 0.3-3m (black paper reflectance 10%)  * The number above is at 15° upward of vertical scan. * Detection range at 35° upward / -5° downward of vertical scan will decrease upto 70%.
Detection accuracy (at temperature 25°C)	Center White paper below 15m : ±50mm White paper 15m- : ±100mm
Repeated accuracy (at temperature 25°C)	Center White paper below 15m : σ< 20mm White paper 15m- : σ< 35mm
No. of detection echoes	UP to 4 echoes
Horizontal scan speed	20Hz
Vertical scan speed	1200Hz
Input / Output	PPS Input : photo-coupler input (Active high at 2mA or more) Synchronous Output : photo coupler open collector output (30VDC 50mA MAX)
Interface	Ethernet (TCP/IP) 100BASE-TX (Auto-negotiation)
Protective structure	IP67 (Power supply is off) Cannot be used underwater
Weight	Approx. 650g
Size	70mm×105mm×95mm (W×D×H)
Ambient temperature, humidity	-10 to 50°C below 85% (Without dew/frost)
Vibration	10 to 57.5Hz double amplitude 1.5mmp-p 57.5Hz to 150Hz 98m / s <sup>2</sup> (10 G) for 2hrs in each X,Y and Z direction Sweep rate: 1 octave/min (3.9sec / sweep) (Both in operating and non-operating state)
Noise level	In front direction 53db (at distance 1m) Frequency 1200Hz
Surrounding intensity	100,000lx (Avoid direct sunlight)
Gyro	Acceleration and angular velocity (InvenSense MPU-6500) #1
Communication protocol	VSSP 2.1
EMC	(EMI)EN61326-1:2013 EN55011:2009+A1:2010 (EMS)EN61326-1:2013 EN61000-4-2:2009 EN61000-4-3:2006+A1:2008+A2:2010 EN61000-4-4:2012 EN61000-4-6:2009 EN61000-4-8:2010

**#1 For details, refer to Gyro's catalog.**

**Caution:** Sensor's warm up duration is about 60 sec after power ON. During the warm up state, measurement data cannot be obtained. Also, it requires about 2 to 3 min for stable vertical scan.

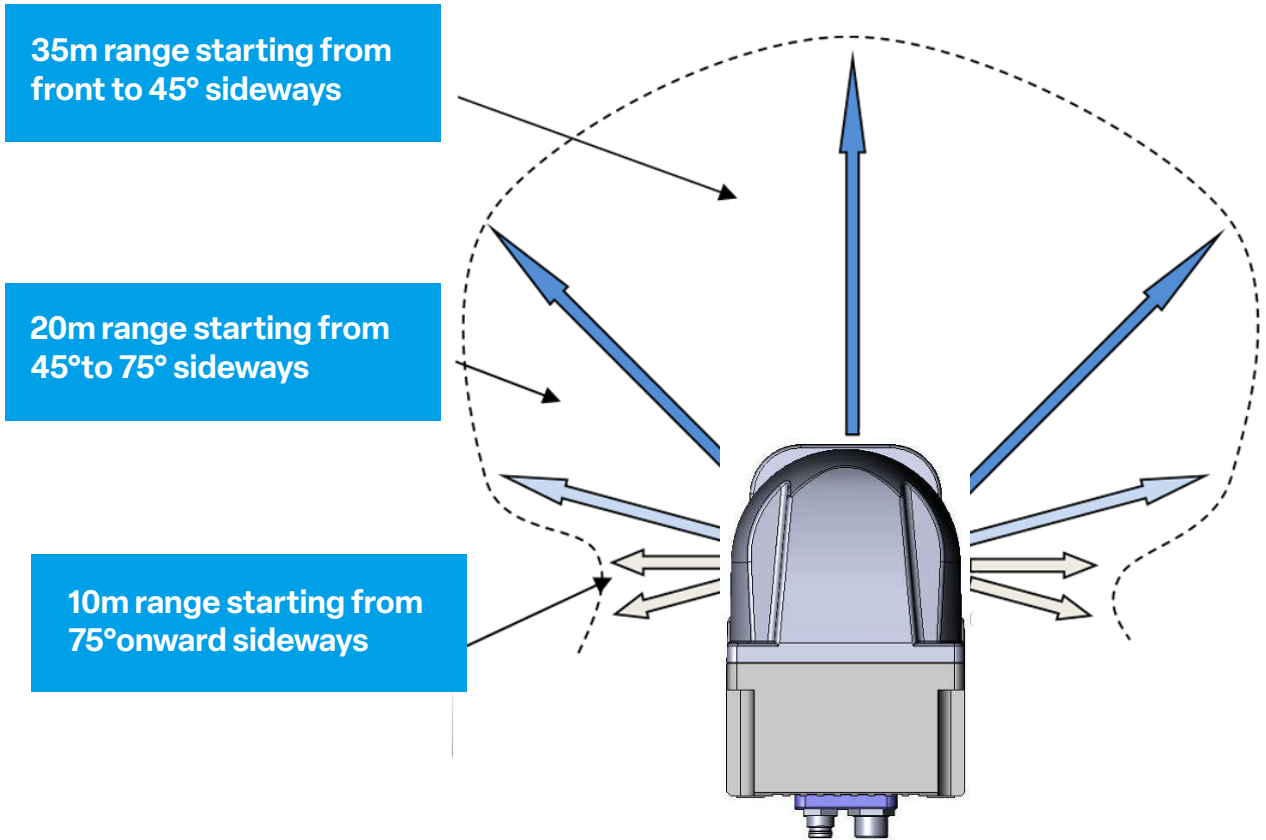
**Caution:** Product inspection is performed only in the front direction. Detection distance and accuracy may differ depending on the direction of measurement. Also, the accuracy described above is for an ambient temperature of 25 ° C.

**Caution:** Near range data may contain noise at the first echo of upper direction spots.

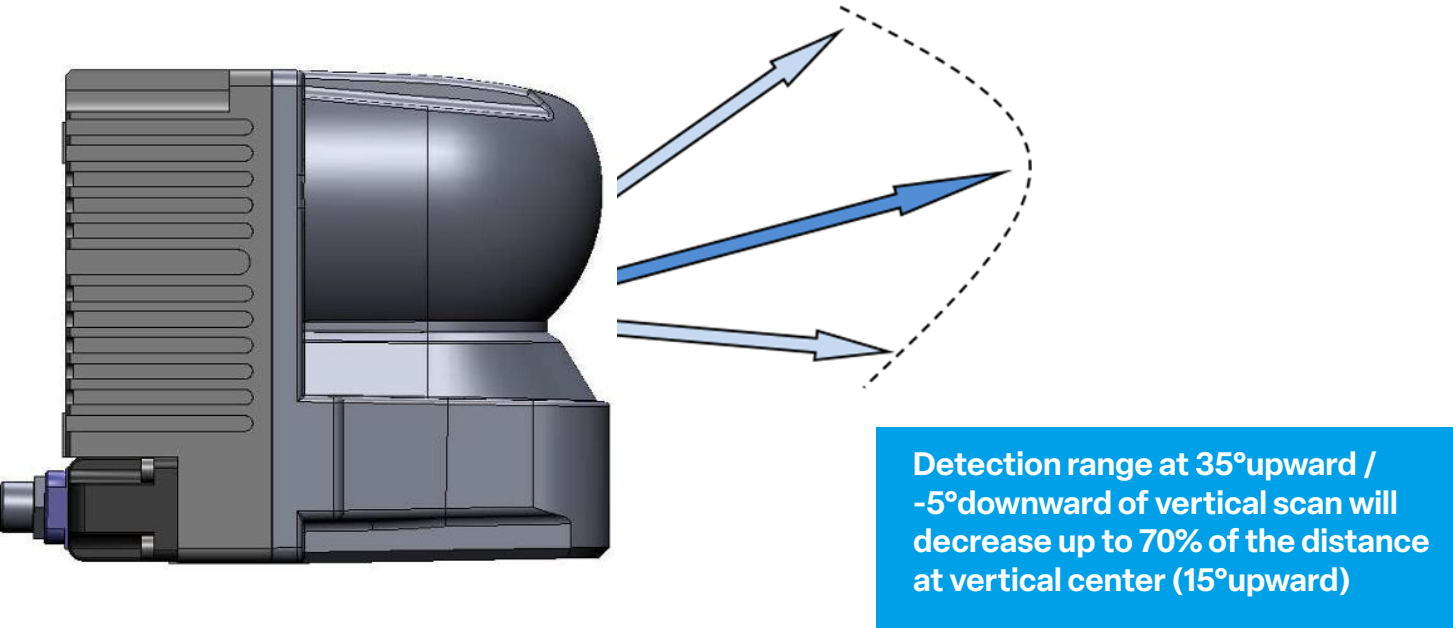
**Caution:** Objects with very low reflectivity may not be detected at close range even though it is detected at further distances.

# Image of Detection Distance Range

## Horizontal Scanning



## Vertical Scanning



## 4. Gyro Data

The example of data obtained from InvenSense MPU-6500 is as below

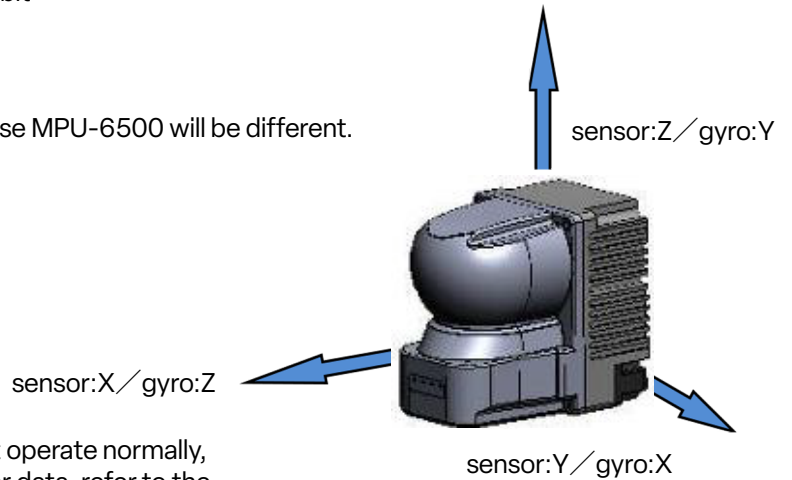
### FS setting

Angular\_vel : Each velocity 500deg/s full scale 16bit

Accel\_ : Acceleration ±4G full scale 16bit

**Caution:** XYZ coordinate of sensor and InvenSense MPU-6500 will be different.  
Mutual relation of coordinates is as below.

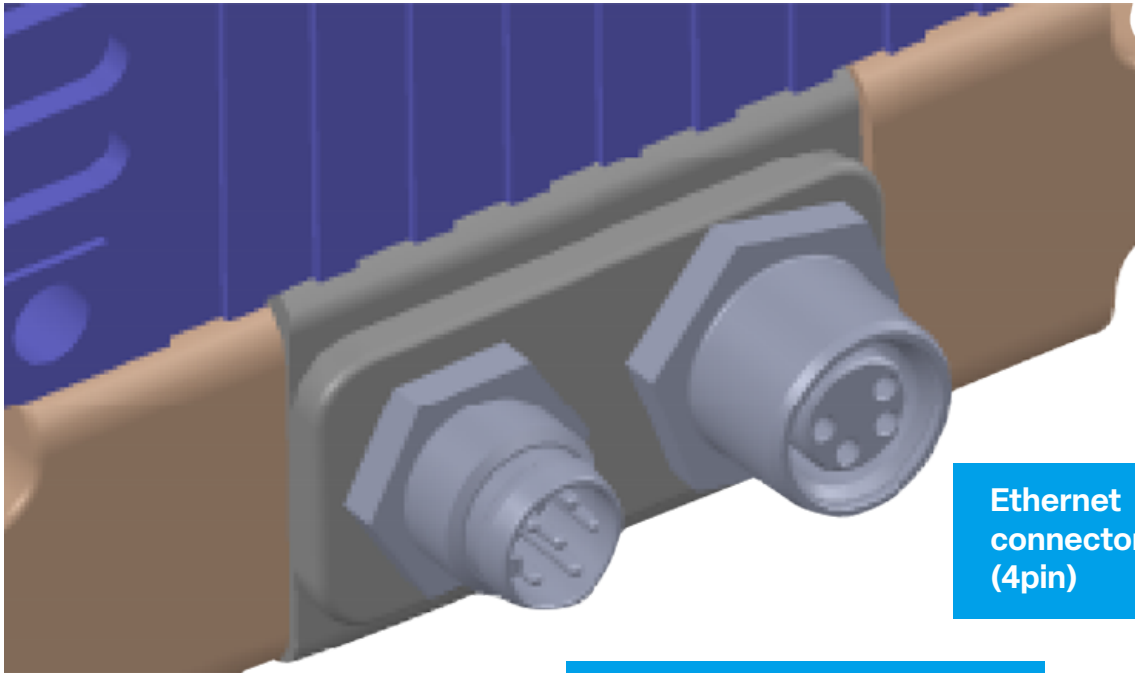
Sensor	Angular_vel/Accel_
X	Z
Y	X
Z	Y



**Caution:** The function of magnet\_X/Y/Z does not operate normally, therefore it cannot be used for the details on other data, refer to the catalog of InvenSense MPU-6500

Angular_vel_X	-67		
Angular_vel_Y	216		
Angular_vel_Z	-261		
Accel_X	-128		
Accel_Y	8368		
Accel_Z	-2492		
Magnet_X			
Magnet_Y			
Magnet_Z			
Temperature	11216		

## 5. Connection & Indicator LED

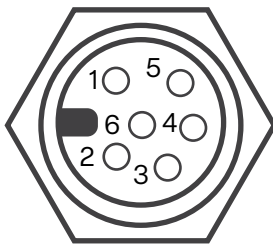


**Ethernet connector (4pin)**

**Power Supply · Input/Output Signal Connector (6pin)**

### 5-1. Connector Pin

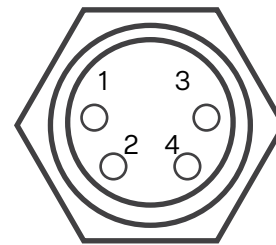
#### 5-1-1 Power supply Input/Output connector



**M8 Waterproof Connector**

PIN No	Function
1	+VIN (DC12 / 24V)
2	PPS COM
3	-VIN (0V)
4	-COM
5	SYNC OUT
6	PPS IN

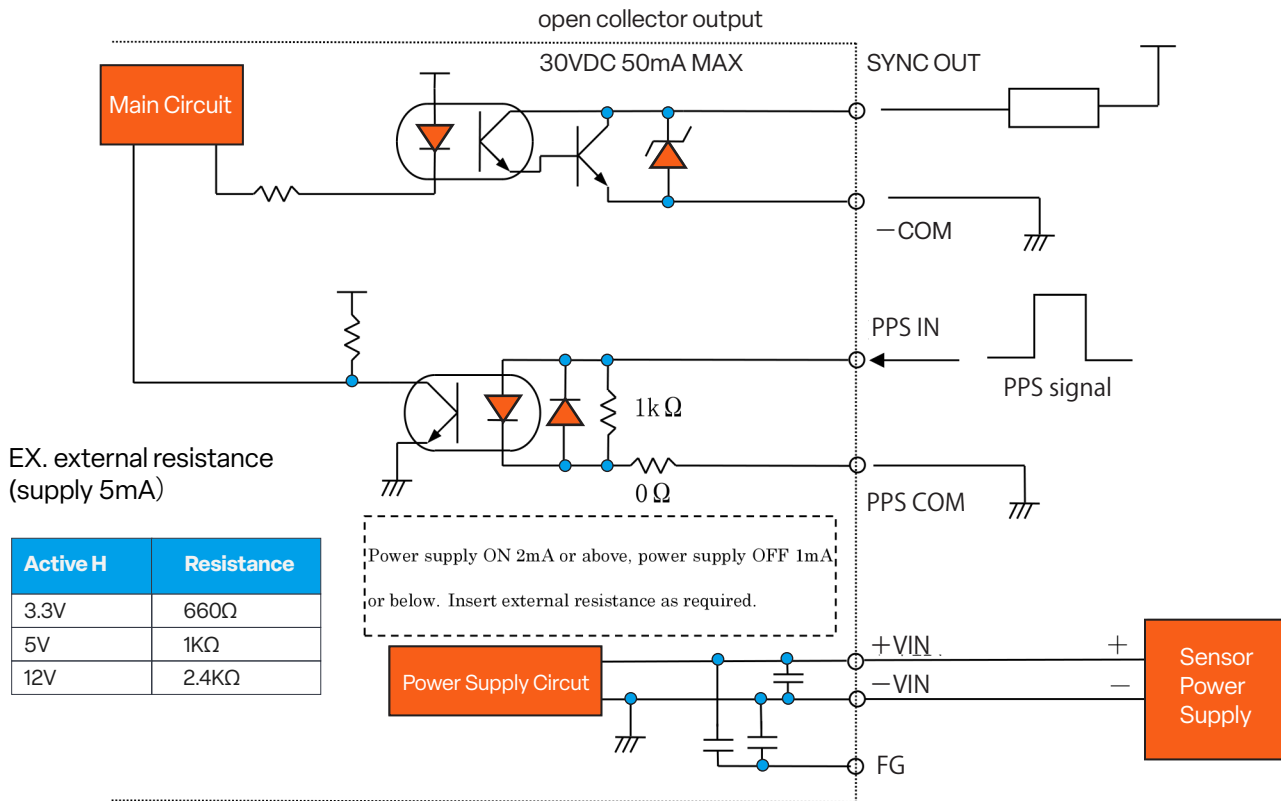
#### 5-1-2. Ethernet connector



**M8 Waterproof Connector**

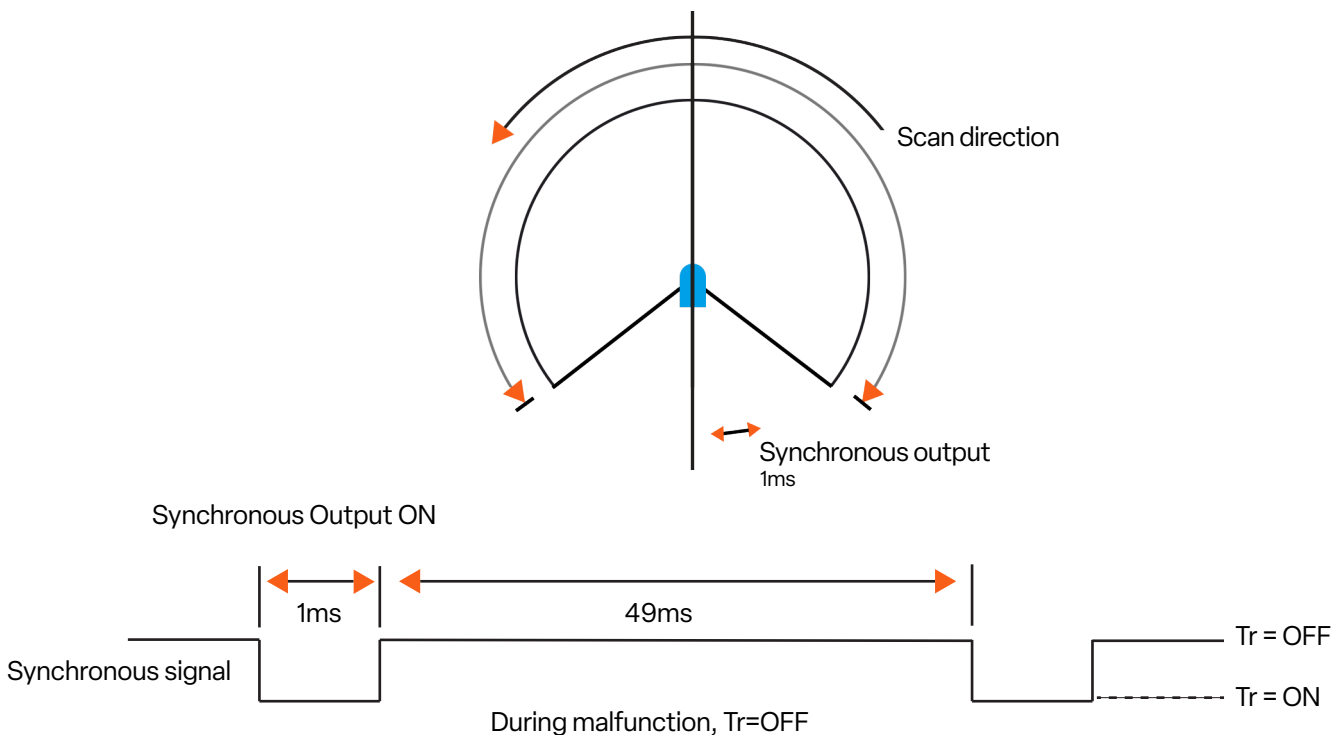
PIN No	Function
1	TX+
2	RD+
3	RD-
4	TX-

### 5-1-3. Input/Output Circuit Diagram



### 5-1-4 Synchronous output

Sensor outputs a 1ms pulse in every scan which is synchronous with the scanning. The timing of the synchronous output signal is shown in the figure below.





## 5-2 Connection cable specifications (Sold separately)

### 5-2-1 Power supply cable

Model No.: YVT-C003 (3m) / C005 (5m)

Pin No.	Function	Wire color
1	+VIN (DC12 / 24V)	Brown
2	PPS COM	White
3	-VIN (0V)	Blue
4	-COM	Black
5	SYNC OUT	Gray
6	PPS IN	Pink

### 5-2-2 Ethernet cable

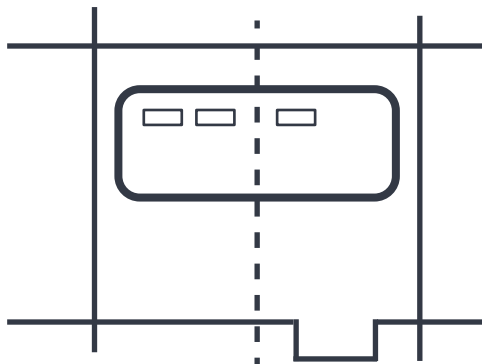
Model No.: YVT-ENET003 (3m) / ENET005 (5m)

M8 Waterproof connector		
Pin No.	Function	Wire color
1	TX+	Yellow
2	RD+	White
3	RD-	Blue
4	TX-	Orange

RJ45		
Pin No.	Function	Wire Color
1	TX+	Yellow
2	TX-	Orange
3	RD+	White
4	NC	—
5	NC	—
6	RD-	Blue
7	NC	—
8	NC	—

For more details on the communication protocol, refer to the communication specification.

### 5.3 Indicator LED



Power supply	Green
Malfunction	Red
Communication	Orange

## 6. Ethernet setting

### 6.1 Initial value

Initial value of IP : 192.168.0.10

Port number : 10940

## 7. Cautions

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The sensor generates heat due to high processing rate. The generated heat is concentrated at the back side of the sensor. Please mount heatsinks or any appropriate component to release the generated heat. An aluminum plate (200 x 200 x 2) is recommended as the heatsinks.

## 8. Disclaimer

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This sensor is not certified for 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 light is 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.



ISO14001 Certified  
JQA-EM3873



ISO9001 Certified  
JQA-1742

- Read instruction manual carefully before use.
- Products published in this brochure are intended to be used under specific conditions.
- For product related questions or technical issues, please contact our offices.



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