Date : 2020.12.1

Scanning laser range sensor

UST-05LX
Instruction Manual

△2×3	FDA standards updated	5, 11	2024.12.20	Matsunaka	RS-02322
△1×1	Durability of surrounding intensity was improved	5	2020.12.1	H.Ota	RS-01575
Symbol	Amended Reason	Pages	Date	Corrector	Amendment No

Approved by	Checked by	Drawn by	Designed by	Title	UST-05LX Instruction Manual	
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Safety precautions

Markings and symbols are used in this document to alert the user about safety-related issues. Follow the instructions of these special markings and symbols to ensure safety during the operation.

Mark	Meaning
Danger	Procedures that could lead to dangerous situation, critical injury or death if not carried out properly
Note	Points that should be considered for the proper operation

1. Safety precautions Danger

Make sure to read the following safety precautions for the correct use and operation of the UST.

(1) General precautions

- Operate the UST within the specifications described in this instruction manual. Perform necessary maintenance to prevent deterioration of UST's detection capability.
- Do not modify or disassemble the UST to ensure its housing rating (IP65) is maintained. Such modifications will void the warranty.
- The UST is not a safety device. Do not use this sensor for the purpose of protecting humans.
- The detection capability of the UST will decrease if dust covers the optical window. Regular cleaning of the optical window is necessary while working under dusty environment.
- The UST should be disposed as industrial waste or in accordance with the local disposal directives.

(2) Operating environment

- Make sure that the UST's operating environment is within the stated specification (temperature, humidity, vibration, ambient light, etc.)
- Do not use or mount the UST near devices that could generate strong electromagnetic waves as it could affect the operation of the sensor.
- Do not use or mount the UST in dusty, smoky, or misty environments, or where corrosive substances are present. Working under such environments may decrease the detection capacity of the sensor.
- This product is for indoor use only.

(3) Installation of UST

- Install the UST on a firm surface or structure to avoid displacement.
- Install the UST where there is no influence of a shock or vibration.
- Shock and vibration should not loosen the mounting. Detection result will be different if the sensor is displaced due to such condition.
- The UST should be mounted with a provision of sufficient space for maintenance.
- Do not add any protective materials such as glass, transparent cover, etc in the front of the optical window. This may lead to loss of detection capability of the UST.
- Avoid direct sunlight as it may cause sensor malfunction.

(4) Wiring

- Switch off all the power supplies during wiring.
- When a converter is used for supplying the power, make sure it fulfills the following requirements.
  a) A rated output voltage within the range of DC 10V to 30V (above 1A)
  b) The power supply complies with the requirements of electrical compatibility regulations (EMC) of the respective country, states and district.
- All the input/output signal cables should be installed away from machines, power lines and high-voltage cables.

(5) Inspection and maintenance

- Stop the machine and system if faults are detected during these tests.
- Clean the optical window when it gets contaminated. If the optical window is damaged it should be replaced by a new one.

2. General

The sensor uses a laser source (wave length 905nm) to scan 270° field with the angular step of 0.25°.

The coordinates are calculated with the step angle and the distance data. By the communication protocol it is possible to obtain distance data output of each angle.

Number of steps: 1081

Scan angle: 270°

Step angle: 0.25°

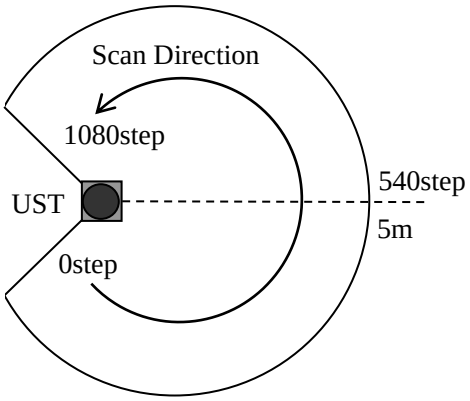

Fig.1 Detection Area

3. Important Notes

- This sensor is not a safety device/tool.
- This sensor is not use for human detection.
- Hokuyo products are not developed and manufactured for the use in weapons, equipment or related technologies intended for destroying human lives or creating mass destruction. If such possibilities or usages are revealed, the sales of Hokuyo products to those customers might be halted by the laws of Japan such as Foreign Exchange Law, Foreign Trade Law or Export Trade control order. In additional, we will export Hokuyo products for the purpose of maintaining the global peace and security in accordance with the above laws of Japan.

4. Specification

Product name	Scanning laser range finder
Model	UST-05LX
Supply voltage	DC 12V/DC 24V (Operation range 10 to 30V, ripple within ±10%)
Supply current	150mA or less (when using DC 24V) During start up about 450mA is necessary
Light source	Laser semiconductor (905nm) FDA Laser safety class 1(IEC60825-1:2014) △2
Detection range and object	Guaranteed detection range : 0.06m to 5m (white Kent sheet) : 0.06m to 2m (diffuse reflectance 10%) *Maximum detection range: 15m
Accuracy	±40mm *1
Repeated accuracy	σ< 30mm *1
Scan angle	270°
Scan speed	25msec (motor speed 2400rpm)
Angular resolution	0.25°
Start up time	Within 10sec (Start up time differs if malfunctions is detected during startup)
Inputs	IP reset input, photo coupler Input (current 4mA at ON)
Outputs	Synchronization output photo coupler. open collector output Max DC 30V 50mA
Interface	Ethernet 100BASE-TX
LED display	Blue LED : ON during normal operation, blink during the start up and malfunction state.
Ambient temperature, humidity	-10°C to +50°C below 85%RH (without dew, frost)
Surrounding intensity	Less than 80,000 lx △1 Note : Avoid direct sunlight or other illumination sources as it may cause sensor malfunction
Storage temperature, humidity	-30°C to +70°C below 85%RH (without dew, frost)
Vibration resistance	10 to 55Hz double amplitude of 1.5mm for 2hrs in each X,Y, and Z direction 55 to 200Hz 98m/s^2 sweep of 2min for 1 hr in each X,Y, and Z direction
Vibration resistance (During start up)	55 to 150Hz 19.6m/s^2 Back and bottom attachment sweep of 2min for 0.5hr in each X,Y, and Z direction
Shock resistance	196m/s^2 (20G) X,Y, and Z direction each10 times
Insulation resistance	10MΩ DC 500V Megger
Protective structure	IP65
Weight	130g (without cable)
Operation life	5 years under normal temperature (motor life)
Material	Optical window: Polycarbonate, Body: Aluminum
Dimensions (W×D×H)	50×50×70(mm) (Sensor only)

*1Under the factory standard testing condition using white Kent sheet.

5. External Dimensions

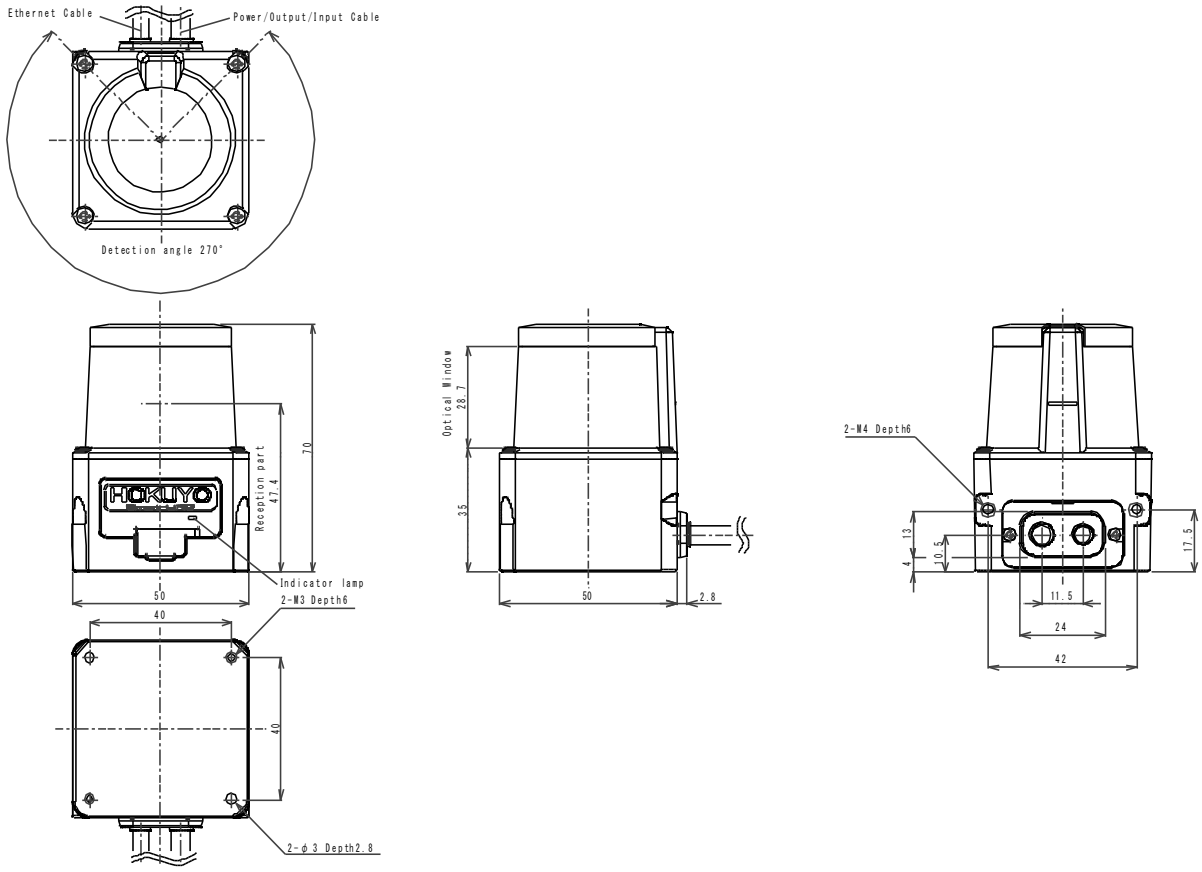

Fig.2 External Dimensions

6. Indicator lamp (LED)

Blue display: ON during normal operation

Blink during start up, IP reset and malfunction state.

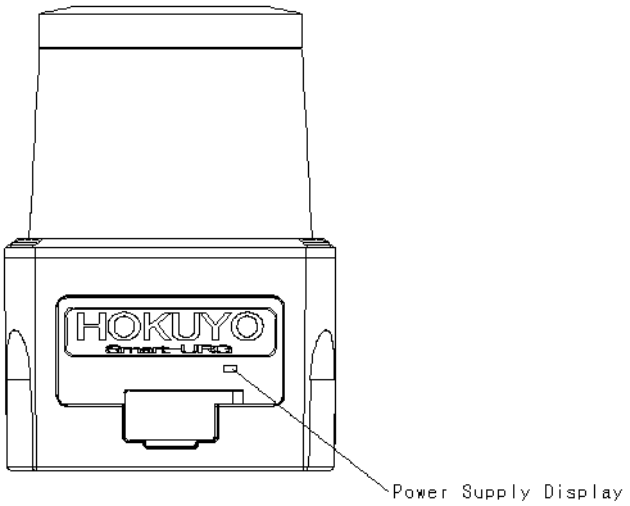

Fig.3 Indicator lamp

7. Installation

This chapter describes cautions during sensor installation.

(1) Method of installation

- The laser spot of the UST is as shown in figure 4 the spread of laser spot differs on the front and side. Mount the sensor at height 200mm above the floor. When mounting below 200mm, incline 1°in upward direction.

*The size value is for reference only.

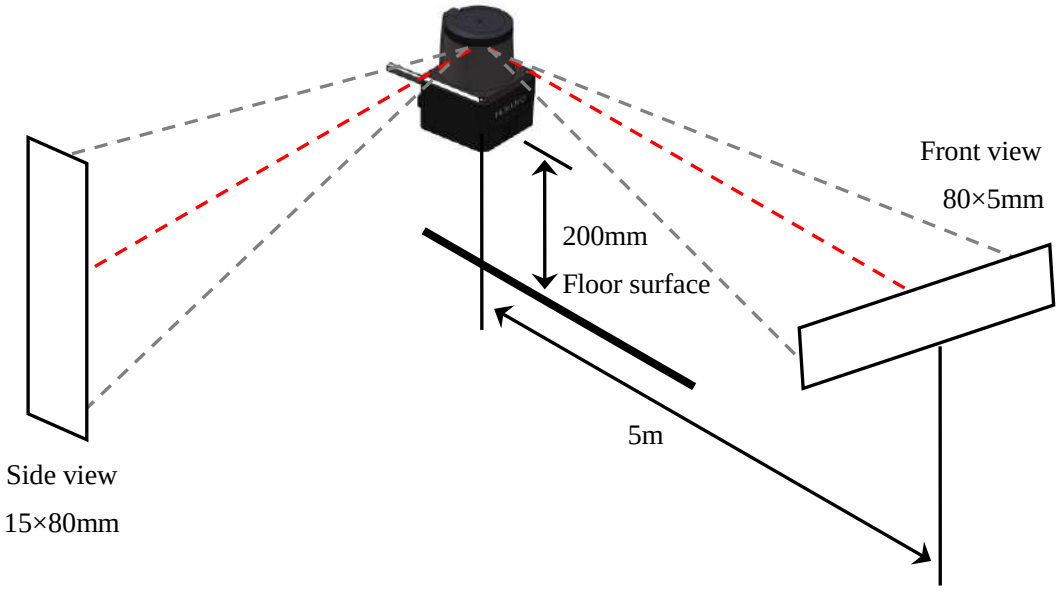

Fig.4 Size of laser spot

- The UST can be fixed to a surface using either the back mounting plate or the bottom mounting plate, each plate provided with two screw holes

  In the case of using the back mounting plate: 2 M4 screw holes are available (screw depth 6mm).
  In the case of using the bottom mounting plate: 2 M3 screw holes are available (screw depth 6mm)

- Mounting plate is used as frame ground (FG). Mount the sensor on a stable structure.

(2) Optical-axis adjustment

- Angular tolerance with respect to structure axis is ±0.3° in horizontal plane and ±1° vertical plane. Use adjustment mechanism for precisely adjusting the detection plane.

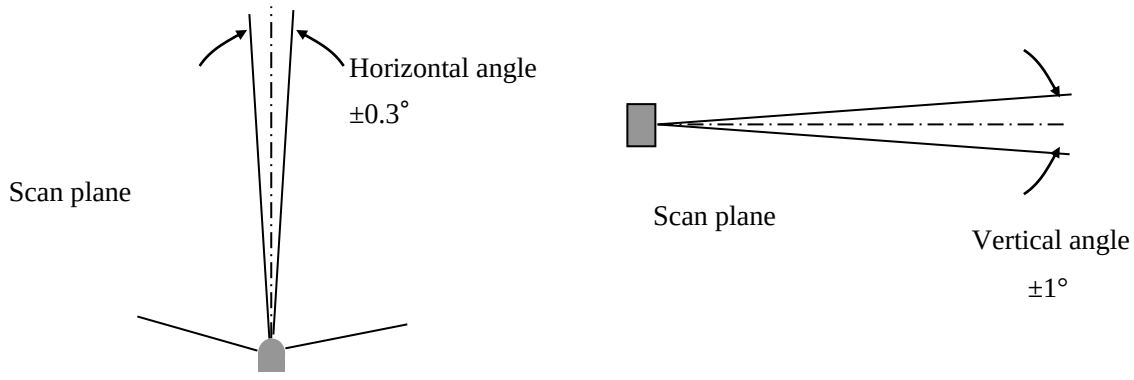

Fig.5 Angular tolerance with respect to structure axis

(3) Mutual interference

- Mutual interference could occur when multiple identical sensors are mounted at the same detection plane. The sensor could not identify the origin of the received laser pulses. It might be the cause of measurement error for the one or two steps. Performing data filtering could overcome this problem.

(4) Heat dissipation

- Heat is generated as the internal circuit of the sensor runs at very high speed. The generated heat is concentrated at the bottom of the sensor. Mount heat sink or any appropriate component to release the generated heat. (An Aluminum plate (200mm×200mm×2mm) is recommended as the heat sink.)

8. Wire color and function

Table 1 and Table 2 show the color of each lead wire, signal name, function, etc.

Table 1: Power supply, I/O cable (1000mm)

Color	Signal	Function	Description	AWG
Red	COM Input +	Input	COM Input +	28
Gray	COM Output -	Input	COM Output -	28
Light blue	Input	Input	IP reset input	28
Orange	Output	Output	Synchronous output	28
Brown	+VIN	Power	Power Supply**:** DC 12V /DC 24V	28
Blue	-VIN	Power	Power Supply **:** 0V	28

*Input/Output direction is defined from the sensor point of view (sensor as reference).

*Attachment connector SHR-06V-S(JST Mfg. Company) is for test purpose only.

Table 2: Ethernet cable (Cat6 300mm)

Color	Signal
Blue	TX+
White	TX-
Orange	RX+
Yellow	RX-

9. Synchronization output

- 1 pulse is approximately 1ms.Output signal synchronization timing chart is shown below

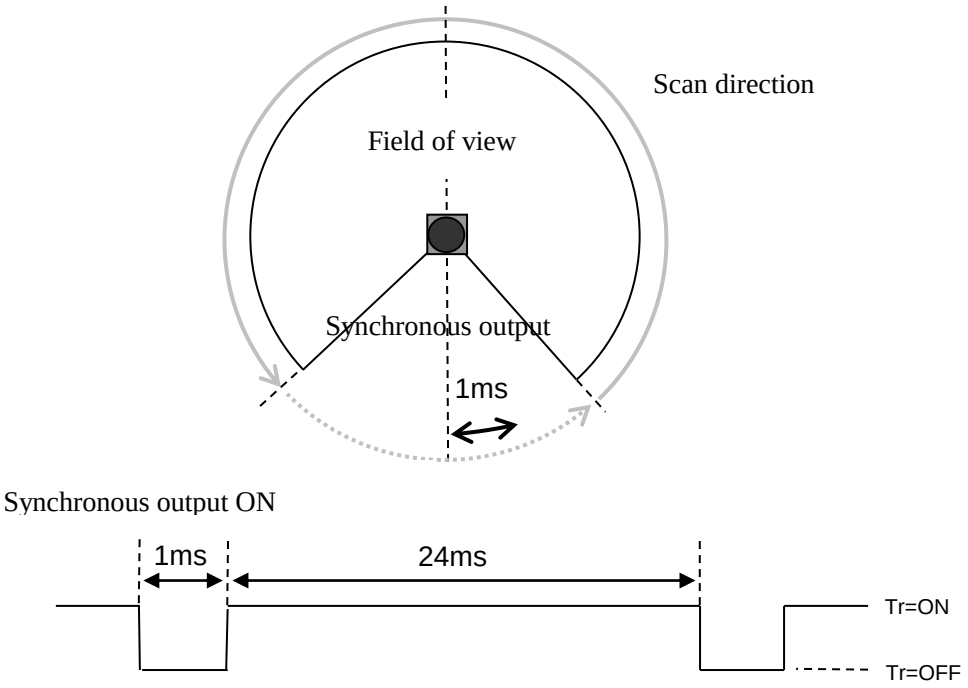

Fig.6 Synchronous output signal

10. Communication

- Communication protocol
  The communication protocol is partly base on SCIP2.2.
  For the details on the communication protocol, refer to the Communication specification (C-42-04076).
- Detail on measurement value
  The details of output value x for each measurement steps.

Table 3: About distance value

Distance value (x)mm	Meaning
x < 21	Output numerical No. “4” as Measurement error.
21 ≦ x ≦ 15000	Measured distance value [mm].
x > 15000	Output numerical No. “65533” as object does not exit or the object has low reflectivity.

11. Input/Output circuit

- Input circuit

  Photo coupler input circuit (anode COM, Input ON current 4mA)

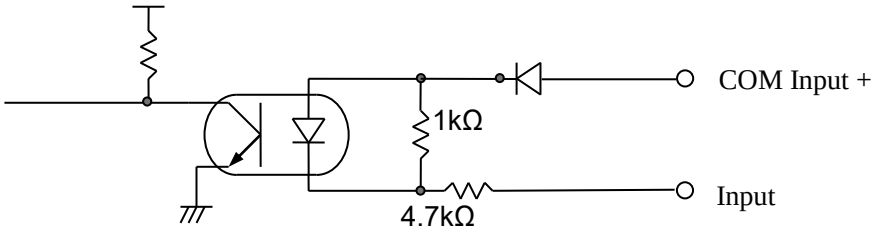

Fig.7 Input circuit

- Output circuit

  NPN open collector output circuit (maximum DC 30V, 50mA)

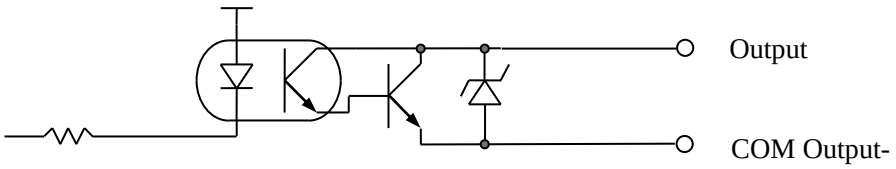

Fig.8 Output circuit

12. Ethernet Setting

- About Initial value

  Initial value of IP: 192.168.0.10

  Port No. : 10940

- About IP initialization

  To reset IP address to the factory default value, please provide power to input circuit (seeSection 11) and connect IP RESET LINE to COM- for more than 2 sec.

  After IP RESET LINE is disconnected from COM- or opened, the sensor LED blinks and the sensor start to reboot.

13. Troubleshooting

Table 4: Troubleshooting list

Situation	Possible reason	Solution suggestion
UST is not operating	Power supply is OFF /Over voltage/Under voltage	Make sure power supply is ON. Voltage is within the specification.
	Cable is damaged	Power supply cable is in good condition
LED is blinking	UST is damaged	Replace with a new UST, if it is damaged.

14. Applicable directives and standards

Table 5 shows the conformant EU directives and EN standards.

Table 5: Directives and Standards

Directives/Standard	Details
Directives	EMC Directives RoHS Directives
EMC Directives	(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

●About the laser safety

The UST laser safety standard is class 1.

Wave length・・・・・・・・・・・905nm(Infrared laser)

Average laser power・・・・・3.19mW or less

Standard・・・・・・・・・・・・・ IEC60825-1(2014) △2

Accession number・・・・・・・1420210-000

About Laser Safety Standard Class 1: under normal operation conditions (operations which can be foreseen rationally) it is guaranteed as safety class laser. Additional measures are not necessary to maintain laser safety.

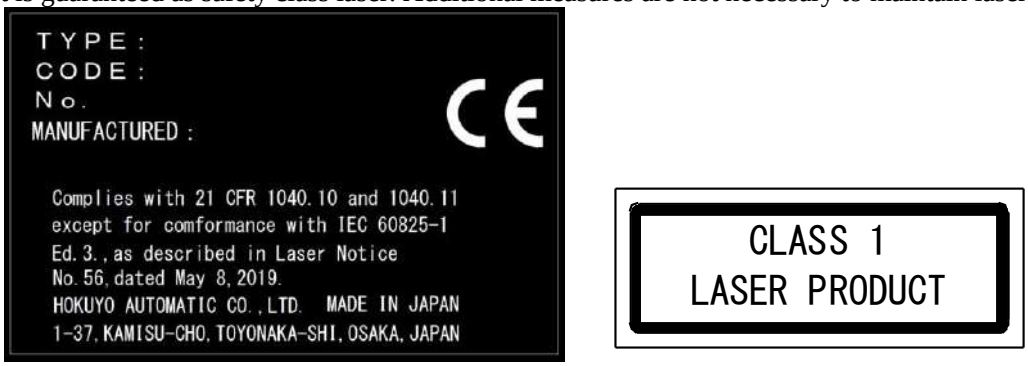

Fig.9 Certified labels △2