

Scanning Laser Range Finder
Smart-URG eco
UST-05LN/UST-05LA
Specification (Draft)

Symbol	Amended Reason			Pages	Date	Corrector	Amendment No
Approved by	Checked by	Drawn by	Designed by	Title	UST-05LN / UST-05LA Specification (Draft)		
			Yamamoto				

1. General

1-1. Operation principle

UST-05LN/UST-05LA is a scanning laser range finder. The sensor emits pulsed laser beams around 270° field. When the emitted laser beams are reflected back from an object, its distance is measured by applying the Time-of-Flight (TOF) principle. The sensor has 541 measurement steps with 0.5° pitch.

User can preset up to 31 area patterns in the sensor. Each area has 3 outputs; Output1, Output2 and Output3 (see Fig. 1). When the sensor detects an object in the area, corresponding outputs are switched to OFF state.

User can obtain the measurement data from the sensor using SCIP communication protocol (UST-05LA only). For details, refer to SCIP communication protocol specification (document number C-42-3320B).

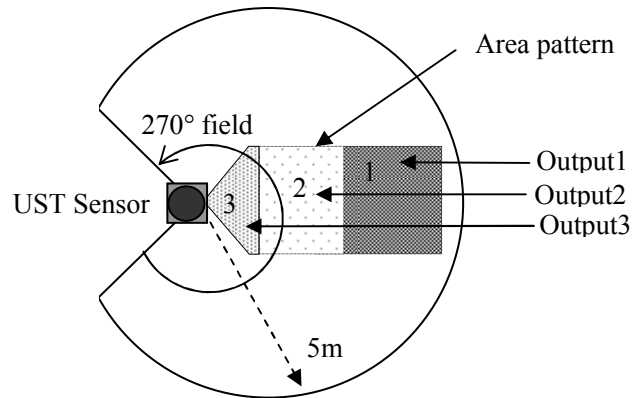


Fig. 1: Detection area and outputs in UST Sensor

1-2. Area configuration

User can configure areas in the sensor using application software provided by the manufacturer. Install the software in a supported operating system and connect the sensor using a USB cable. See section 6 for details on types of area configuration.

1-3. Area switching

Sensor has 5 external inputs for switching the area. Provide the correct signal states on these inputs (see Table 1) to switch the area.

1-4. Malfunction output

Sensor has self-diagnosis function. It switches the malfunction output to OFF state when errors are detected in the internal components.

1-5. Synchronous operation

Sensor has scanner synchronization function to avoid mutual interference between multiple sensors. To use this function connect Synchronous Output of one sensor (master) to the Synchronous Input of the other (slave). The slave sensor adjusts its scanner position with a preset time lag from the master. The time lag can be specified using the application software.

Title	UST-05LN / UST-05LA Specification (Draft)	Drawing No	C-42-03963	2/10
-------	--	------------	------------	------

1-6. Hysteresis of detection area

When objects are present on the boundary of an area, sensor may not detect them continuously. In such cases, the output signals oscillate frequently between the ON and the OFF states. Sensor has hysteresis function that temporarily increases the area size to prevent such oscillation. Ratio of increase can be specified using the application software.

1-7. Log function (For UST-05LA only)

Sensor logs the measurement data and the output states during the operation. The log data can be obtained for verification using the application software. Number of logs is limited due to the size of internal memory.

2. Structure

2-1. Structure Diagram

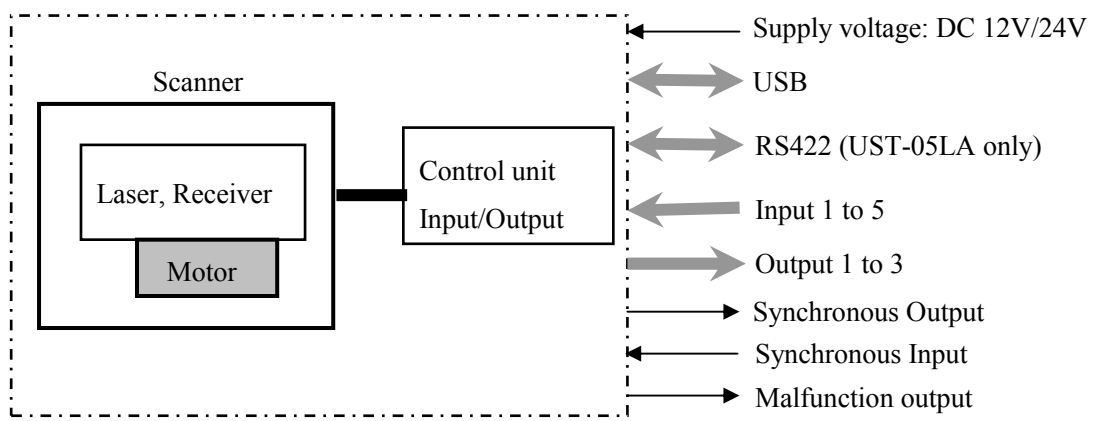


Fig. 2: Structure diagram

Title	UST-05LN / UST-05LA Specification (Draft)	Drawing No	C-42-03963	3/10
-------	--	------------	------------	------

3. Specification

Product name	Scanning Laser Range Finder
Model	UST-05LN / UST-05LA
Supply voltage	DC 12V/DC 24V (operation range 10 to 30V, ripple within 10%)
Supply current	150mA or less (during start up about 300mA is necessary.)
Light source	Laser semiconductor (905nm), Laser class 1
Detection range and object	60mm to 5000mm (white Kent sheet) 60mm to 2000mm (diffuse reflectance 10%)
Accuracy	60mm to 5000mm $\pm 40\text{mm}^{*1}$
Standard deviation	$\sigma < 30\text{mm}^{*1}$
Scan angle	270°
Scan speed	25ms (motor speed 2400rpm)
Angular resolution	0.5°
Start up time	Within 10s ^{*2}
Outputs	Photo-coupler/open collector output DC 30Vmax (50mA max) Output 1 to Output 3: Detection Output ^{*3} Output 4: Malfunction Output. Output 5: Synchronous Output
Output response time	50ms ^{*4}
Hysteresis	Hysteresis high (6.25% not less than 60mm) Hysteresis low (3.125% not less than 30mm) No Hysteresis
Interface	USB / RS422 ^{*5}
LED display	Blue LED: Power Supply LED ^{*6} Orange LED 1: Output 1 ^{*7} Orange LED 2: Output 2 ^{*7} Orange LED 3: Output 3 ^{*7}

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

*2: Start up time of the sensor varies if malfunction is detected during the start up.

*3: Output 1 to 3 are switched to OFF state during malfunction.

*4: Response time is delayed by max. 1 scan (25ms) during the area switching.

*5: For UST-05LA only.

*6: ON during normal operation and blinks during the start up and malfunction state.

*7: ON during the object detection.

Title	UST-05LN / UST-05LA Specification (Draft)	Drawing No	C-42-03963	4/10
-------	--	------------	------------	------

3. Specification (Continued)

Ambient temperature humidity	-10°C to +50°C, below 85%RH (without dew, frost)
Surrounding intensity	Less than 15,000lx ^{*1}
Storage temperature humidity	-30°C to +70°C, below 85%RH (without dew, frost)
Vibration resistance	Sinusoidal: Logarithmic sweep from 10 to 55Hz with displacement 1.5mm X, Y, Z, 3 directions for 2hrs. Random: Frequency from 55 to 200Hz with 98m/s ² sweep 2 min X,Y and Z directions, 1hr in each direction.
Shock resistance	196m/s ² (20G) X,Y and Z direction 10 times.
Insulation resistance	10MΩ, DC 500V
Protective structure	IP65
Weight	150g ^{*2}
Material	Front case: Polycarbonate, Rear case: ABS
Dimensions (W×D×H)	50×50×70mm ^{*2}
EMC standards	(EMI) EN61326-1:2006 EN55011:2007+A2:2007 (Group 1 Class A) (EMS) EN61326-1:2006 EN61000-4-2:1995 + A1:1998 + A2:2001 EN61000-4-3:2002 + A1:2002 EN61000-4-4:1995 + A1:2001 + A2:2001 EN61000-4-6:1996 + A1:2001 EN61000-4-8:1993 + A1:2001 (Laser) EN60825-1:1994+A11:1996+A2:2001
Inputs	Photo-coupler input with common anode. Current supply for inputs to switch ON is 4mA at each terminal ^{*3} . Input 1 to 5: Area switching inputs (refer Table1) Input 6: Synchronous input
Input response time	Sensor read the states of input signals once in every scan cycle. However it read the states of input signals at every 1msec when laser is switched off by the input signals

*1: Avoid the direct sunlight as it may cause sensor malfunction.

*2: Cable is not included

*3: Current supply is from the sensor. Inputs are ON when the supply current is over 4mA.

Title	UST-05LN / UST-05LA Specification (Draft)	Drawing No	C-42-03963	5/10
-------	--	------------	------------	------

Table1 : Input states and corresponding area number

[Input1]	[Input2]	[Input3]	[Input4]	[Input5]	Area Number
ON	ON	ON	ON	ON	Laser off* ¹
OFF	ON	ON	ON	ON	Area1
ON	OFF	ON	ON	ON	Area2
OFF	OFF	ON	ON	ON	Area3
ON	ON	OFF	ON	ON	Area4
OFF	ON	OFF	ON	ON	Area5
ON	OFF	OFF	ON	ON	Area6
OFF	OFF	OFF	ON	ON	Area7
ON	ON	ON	OFF	ON	Area8
OFF	ON	ON	OFF	ON	Area9
ON	OFF	ON	OFF	ON	Area10
OFF	OFF	ON	OFF	ON	Area11
ON	ON	OFF	OFF	ON	Area12
OFF	ON	OFF	OFF	ON	Area13
ON	OFF	OFF	OFF	ON	Area14
OFF	OFF	OFF	OFF	ON	Area15
ON	ON	ON	ON	OFF	Area16
OFF	ON	ON	ON	OFF	Area17
ON	OFF	ON	ON	OFF	Area18
OFF	OFF	ON	ON	OFF	Area19
ON	ON	OFF	ON	OFF	Area20
OFF	ON	OFF	ON	OFF	Area21
ON	OFF	OFF	ON	OFF	Area22
OFF	OFF	OFF	ON	OFF	Area23
ON	ON	ON	OFF	OFF	Area24
OFF	ON	ON	OFF	OFF	Area25
ON	OFF	ON	OFF	OFF	Area26
OFF	OFF	ON	OFF	OFF	Area27
ON	ON	OFF	OFF	OFF	Area28
OFF	ON	OFF	OFF	OFF	Area29
ON	OFF	OFF	OFF	OFF	Area30
OFF	OFF	OFF	OFF	OFF	Area31

*¹: Laser is switched off when all inputs (1 to 5) are ON.

Title	UST-05LN / UST-05LA Specification (Draft)	Drawing No	C-42-03963	6/10
-------	--	------------	------------	------

4. Connection

4-1. Power source, I/O Cable

Cable length: 500mm flying lead

Color	Signal
Brown	+VIN (DC12V/DC24V)
Blue	-VIN
Black	Output 1
White	Output 2
White (Blue)	Output 3
Orange	Malfunction Output
Fresh green	Synchronous Output
Gray	COM Output -
Red	COM Input +
Green	Input 1
Yellow	Input 2
Purple	Input 3
White (Black)	Input 4
White (Red)	Input 5
Light Blue	Synchronous Input
Pink	RS422_GND
Yellow (Red)	TXD+ (RS422: UST-05LA)
Yellow (Black)	TXD- (RS422: UST-05LA)
Yellow (Green)	RXD+ (RS422: UST-05LA)
Yellow (Blue)	RXD- (RS422: UST-05LA)

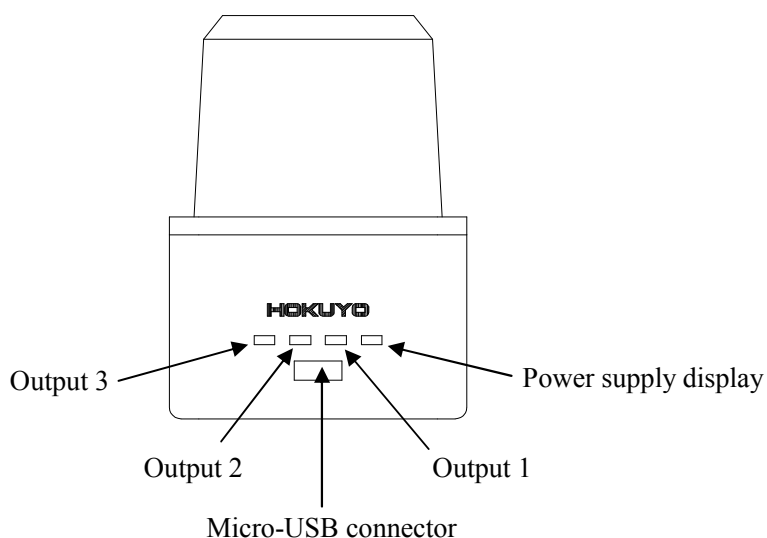
Note 1: Input/Output direction is mentioned from the sensor's side.

Note 2: Colors inside the bracket indicates dual color cable.

Note 3: Keep the inputs wires open or connect to input Com+ if not in use.

Note 4: Keep the output wires open or connect to output Com- if not in use.

5. LED display



Title	UST-05LN / UST-05LA Specification (Draft)	Drawing No	C-42-03963	7/10
-------	--	------------	------------	------

6. Area configuration

It is possible to configure two types of area in the sensor.

1. Normal configuration
2. Independent configuration

6-1 Normal configuration

In the normal configuration, area for Output1 is configured first. The shape of Output1 area can be configured freely. Areas for Output2 and Output3 are dependent on the Output1 area and therefore they are configured inside it. The shapes of Output2 and Output3 areas can be straight, fan shape or ratio (Fig. 3). Fig. 4 and Table 2 show the relation between the detected object position and the output states.

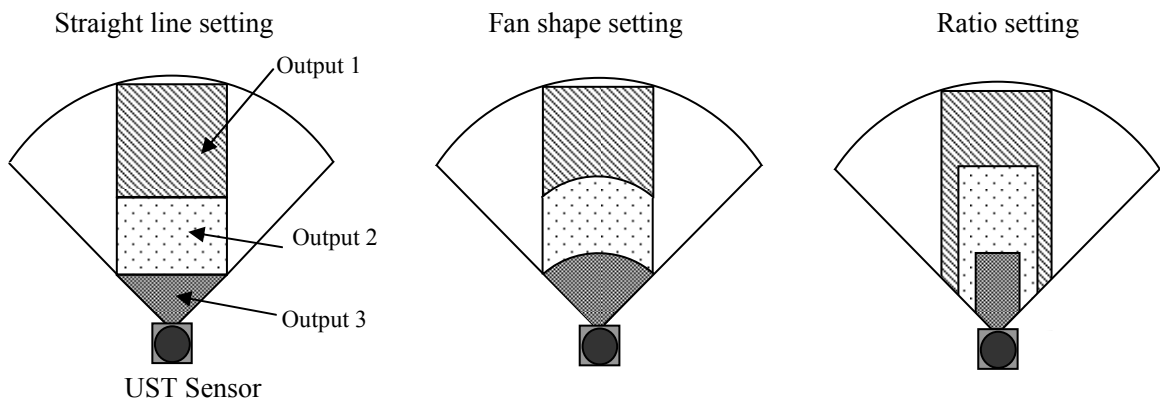


Fig. 3: Normal area configuration

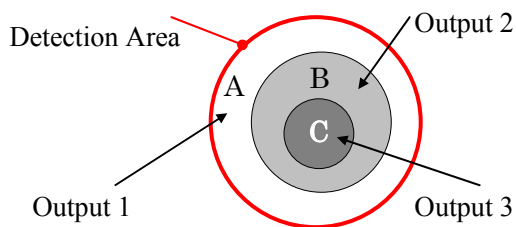


Fig. 4: Output areas

Object position	Output1	Output 2	Output3
A	OFF	ON	ON
B	OFF	OFF	ON
C	OFF	OFF	OFF

Table 2: Relation between object position and output states

Title	UST-05LN / UST-05LA Specification (Draft)	Drawing No	C-42-03963	8/10
-------	--	------------	------------	------

6-2. Independent configuration

In the independent configuration, areas for Output1, Output2 and Output3 can be configured freely. The field covered by each output can be completely separate from the other output areas or there can be overlapping region between the output areas (Fig. 5 (a) and (b)). Fig. 6 and Table 3 show the relation between the object position and the output states.

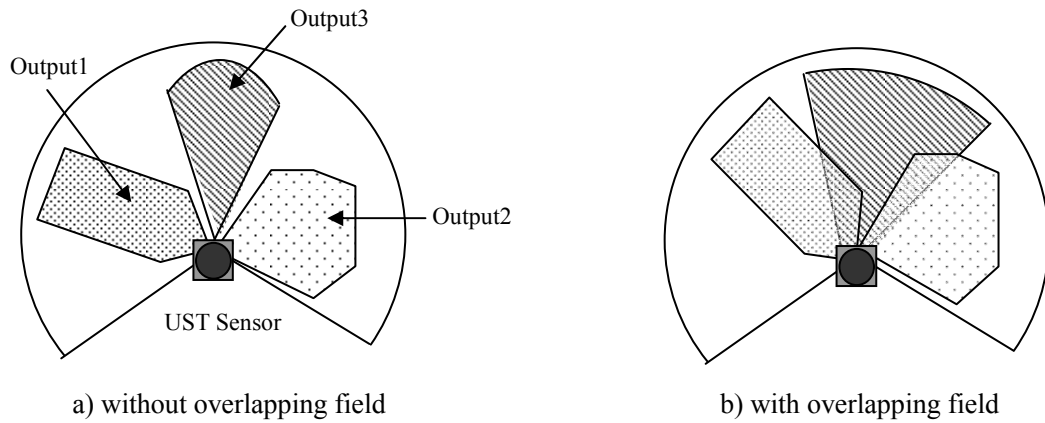


Fig. 5: Independent area configuration

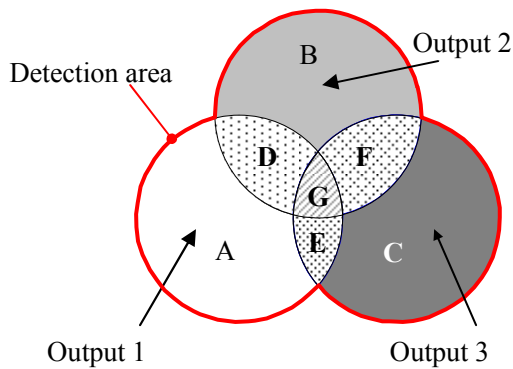


Fig. 6: Output areas

Object position	Output1	Output 2	Output3
A	OFF	ON	ON
B	ON	OFF	ON
C	ON	ON	OFF
D	OFF	OFF	ON
E	OFF	ON	OFF
F	ON	OFF	OFF
G	OFF	OFF	OFF

Table 3: Relation between object position and output area

Title	UST-05LN / UST-05LA Specification (Draft)	Drawing No	C-42-03963	9/10
-------	--	------------	------------	------

7. Input/Output circuit connection example

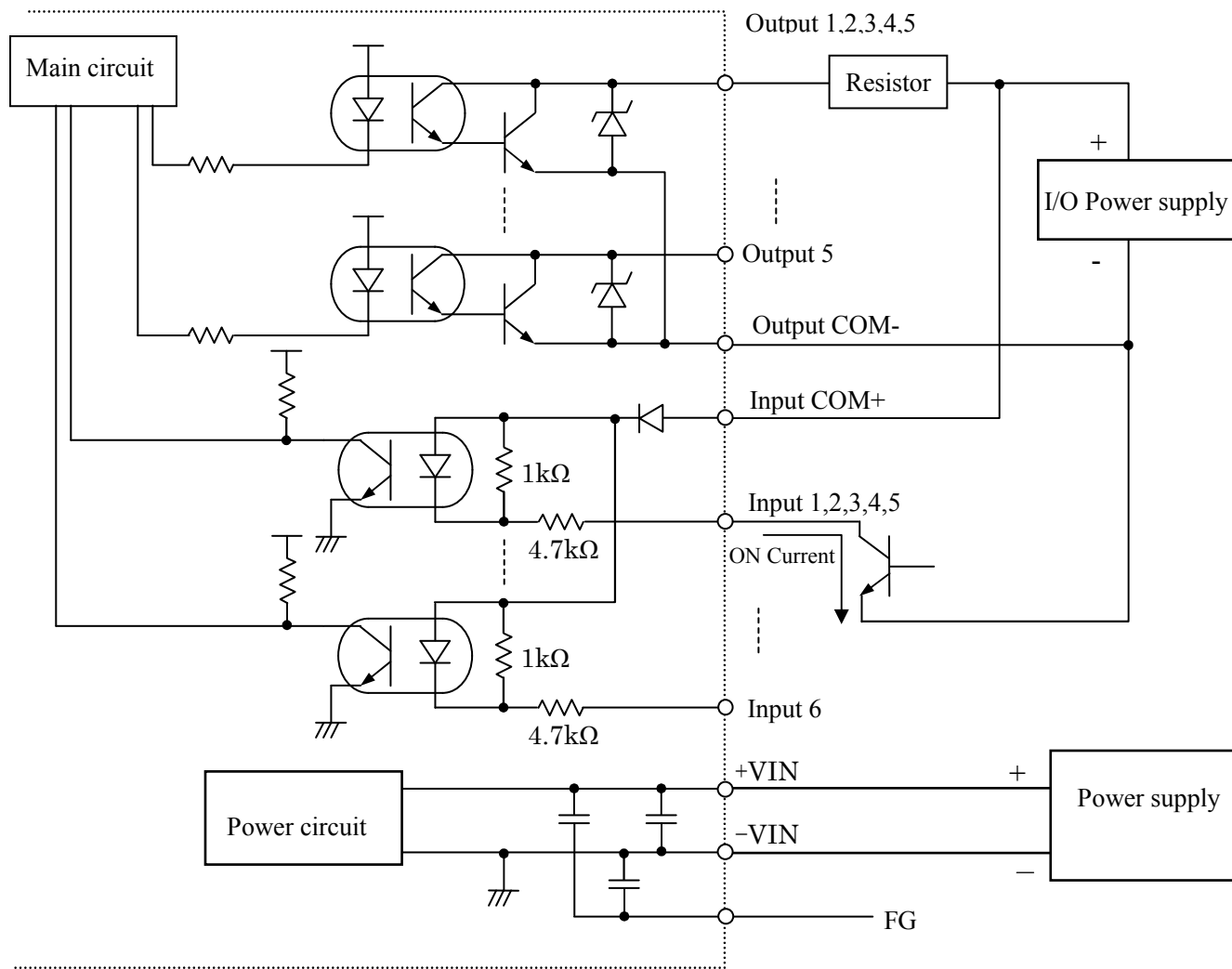


Fig. 7: Connection example of inputs, outputs and power supply.

Title	UST-05LN / UST-05LA Specification (Draft)	Drawing No	C-42-03963	10/10
-------	--	------------	------------	-------