Scanning Laser Range Finder Card-URG UCT-10LCM Specification

CE

RoHS

Symbol	Amended Reason	Pages	Date	Amended by	Amended No.

Approved by	Checked by	Drawn by	Designed by	Title	UCT-10LCM Specification	
M.Hino	A.Yamamoto	S.Nakamura	T.Kasahara	Drawing No.	C-42-04623	1／15

1. Overview

1-1. About our products

- This sensor scans a 100-degree field using a laser beam (λ=905nm), measuring the distance to the target and calculating its coordinates based on the step angle. It has two functions: one that outputs distance data per angle via communication (LX mode), and another that detects obstacles within a designated area (LA mode).
- It features three scan layers with different vertical angles and supports VSSP, enabling easy conversion to 3D coordinates.
- LX mode supports multi-echo data output, while LA mode allows for selected single-echo data output.
- With the dedicated application, it is possible to switch between multi-layer mode, which activates three emission layers, and single-layer mode, which activates only one selected layer.

1-2. Area Configuration

- The detection areas and modes can be configured via the dedicated application (AreaDesigner Prime) through Ethernet communication.
- In LA mode, up to two area patterns can be switched using external input.

1-3. Self-diagnostic Function

- The sensor features a self-diagnostic function that turns off the malfunction output when there is a laser emission abnormality or motor rotation abnormality.
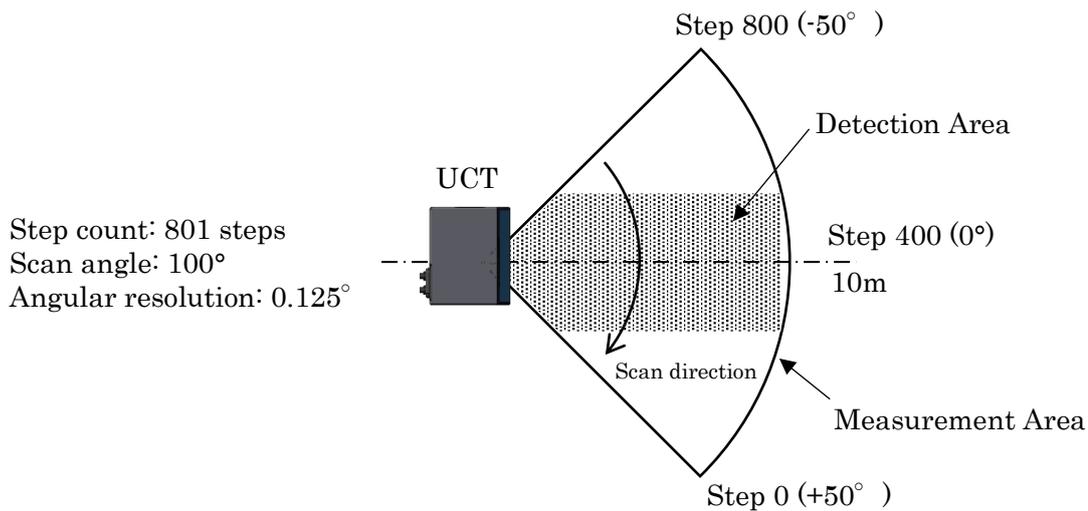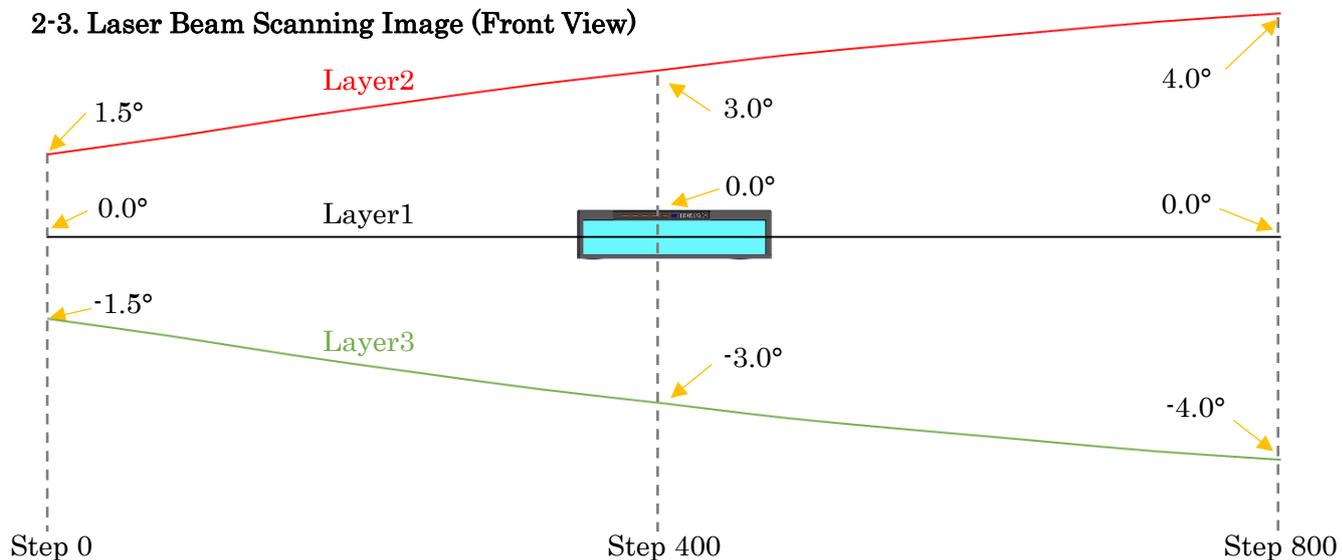
2. Structure

2-1. Block Diagram
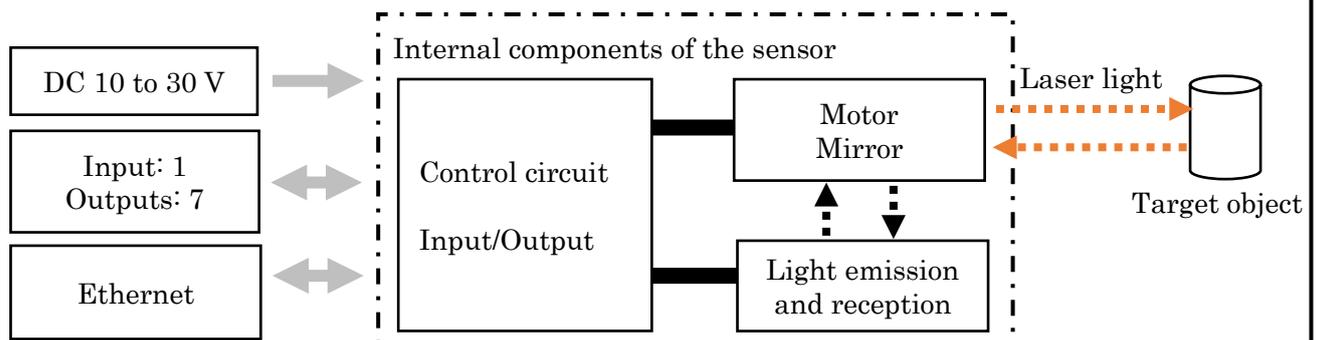
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2-2. Laser Beam Scanning Image (Top View)

Step 800 (-50°)

Detection Area

UCT

Step count: 801 steps
Scan angle: 100°
Angular resolution: 0.125°

Step 400 (0°)

10m

Scan direction

Measurement Area

Step 0 (+50°)

2-3. Laser Beam Scanning Image (Front View)

Layer2

4.0°

1.5°

3.0°

0.0°

Layer1

0.0°

0.0°

-1.5°

Layer3

-3.0°

-4.0°

Step 0

Step 400

Step 800

* Optical axis image in a concentric distance layout.

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3. Disclaimer

(1) This sensor is not a certified safety product.

(2) This sensor cannot be used as a human detection sensor under the Machinery Directive.

(3) Hokuyo products are not developed and manufactured for the use in weapons, equipment or related technologies intended for destroying human lives or causing 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 addition, Hokuyo products are for the purpose of maintaining the global peace and security in accordance with the above law of Japan.

(4) The sensor operates using laser light; therefore, it may become unstable if strong interference light interferes or if reflection from the target is insufficient.

(5) The sensor's operation may become unstable due to rain, snow and fog or due to dust pollution on the optical window.

(6) Rules and regulations related to safety should be followed strictly when machine users and system designers operate the sensor.

(7) Please read this specification document thoroughly before use.

4. Specifications

Model	UCT-10LCM
Supply voltage	DC12V/DC24V (operation range: 10 to 30V, ripple within 10%)
Power consumption	3W
Light source	Laser semiconductor (905nm)
Laser safety	Class1 (IEC60825-1:2014) Class 1 Laser Product
Accuracy [*1]	±40mm
Repeated accuracy [*1]	σ<20mm
Detection range and object [*1]	■Scan angle range: -45° to +45° 0.05m to 10m (reflectivity 90% white-kent sheet 600mm×2000mm) 0.05m to 4m (reflectivity 10% black paper 600mm×2000mm) ■Scan angle range: -50° to -45° and +45° to +50° 0.05m to 8m (reflectivity 90% white-kent sheet 600mm×2000mm) 0.05m to 3m (reflectivity 10% black paper 600mm×2000mm) Maximum measurement distance:30m Minimum detectable size:35mm(at 4m)、90mm(at 10m)
Scan angle	100°
Vertical angles	Layer1: 0°, Layer2: +3°, Layer3: -3° *Vertical angle in the front step
Scan speed	Multi-layer mode: 16.7ms (motor speed: 2400rpm / 3 layers) Single-layer mode: 50ms
Measurement resolution	1mm
Angular resolution	0.125°
Startup time	Within 10 seconds (may exceed under specific startup conditions)
Outputs	Total 7 outputs (NPN open collector output, DC 30V, 100mA MAX, residual voltage < 2V) Output 1: OFF in case of detection within region 1 Output 2: OFF in case of detection within region 2 Output 3: OFF in case of detection within region 3 Output 4: OFF in case of detection within region 4 Output 5: OFF in case of detection within region 5 Output 6: ON during normal operation, OFF during malfunction Output 7: Reference Output (ON during normal operation) Note: Outputs 1 to 5 and Output 7 are switched OFF during a malfunction state
Inputs	Total 1 input （photo-coupler input） Input 1: For switching the detection area
Output response time	Multi-layer mode: 37ms [*2] Single-layer mode: 70ms Note: Additional ON/OFF delay settings are possible (LAmode only).
Area switching time	Multi-layer mode: 24ms Single-layer mode: 57ms
Interface	Ethernet 100BASE-TX
LED display	Power Indicator (blue): Lights up during normal operation, blinks during startup, configuration, reference output operation, and malfunction states. Output Indicators 1 to 5 (orange): Light up when detection occurs in the area (off during LX mode). They light up with a pattern corresponding to the malfunction mode in the event of a malfunction.

*1: Under the factory standard testing conditions using white-kent sheet

*2: Slowest response time applies when continuous detection is possible in multi-layer mode. If continuous detection is not possible, the response time will be the same as in single-layer mode.

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Connection	Power and I/O: Connector(1m), Ethernet: RJ45(1m)
Ambient operating temperature	-10 to +50℃, below 85%RH (without dew, frost)
Storage temperature	-30 to +70℃, below 85%RH (without dew, frost)
Ambient light *3	Less than 100,000lx (indirect light)
Vibration resistance	10–55 Hz, double amplitude of 1.5 mm, 2 hours in each of X, Y, and Z directions 55–200 Hz, 98 m/s² (10 G), 2-minute sweep, 1 hour in each of X, Y, and Z directions
Shock resistance	196m/s² (20G) X,Y and Z direction each 10 times
Electromagnetic Compatibility (EMC)	EN55011:2016+A1:2017+A2:2021 EN IEC 61000-6-4:2019 EN IEC 61000-6-2:2019
Protective structure	IP65
Weight	100 g (excluding cable)
Material	Optical Window: Acrylic Bottom case: Aluminum Top cover: Polycarbonate
Dimensions (W×D×H)	80mm×65mm×20mm
IMU*4	3-axis acceleration and 3-axis angular (TDK InvenSense: IIM-42652) Relative position of the IMU with respect to the measurement origin: X: 17.1 mm, Y: 8.2 mm, Z: -8.3 mm
Communication Protocol*5	SCIP(TCP/UDP) VSSP(TCP)

*3: Detection is not guaranteed under direct sunlight or strong ambient light conditions.

Please ensure there is no direct sunlight entering the sensor.

*4: For details, refer to the data sheet.

*5: For details, refer to the respective communication specifications (C-42-04609, C-42-04610).

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5. Inputs and Outputs

5-1. Inputs and Selected Areas

The sensor has one input, and it allows configuration of up to two areas.

For each of the three layers within one area, up to five regions can be configured.

The output for each region is common across different layers.

*Example: When an object is detected in any of Layer 1: Region 1, Layer 2: Region 1, or Layer 3: Region 1, Output 1 is activated.

Input 1	Area Number	Layer	Region
ON	Area 0	Layer 1	Region 1
			Region 2
			Region 3
			Region 4
			Region 5
		Layer 2	Region 1
			Region 2
			Region 3
			Region 4
			Region 5
		Layer 3	Region 1
			Region 2
			Region 3
			Region 4
			Region 5
OFF	Area 1	Layer 1	Region 1
			Region 2
			Region 3
			Region 4
			Region 5
		Layer 2	Region 1
			Region 2
			Region 3
			Region 4
			Region 5
		Layer 3	Region 1
			Region 2
			Region 3
			Region 4
			Region 5

* OFF indicates H-level input or OPEN; ON indicates L-level input.

* If no regions are set within an area, it will be designated as a Laser-off area.

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5-2. Outputs

Detection outputs 1 to 5 correspond to regions 1 to 5. Below is an example of the detection outputs based on the position of detected objects:

Object position	Output 1	Output 2	Output 3	Output 4	Output 5
A	OFF	ON	ON	ON	ON
B	OFF	OFF	ON	ON	ON
C	OFF	OFF	OFF	ON	ON
D	ON	ON	ON	OFF	ON
E	OFF	OFF	ON	ON	OFF
F	ON	ON	OFF	ON	OFF

* When objects are detected, the outputs will turn OFF.
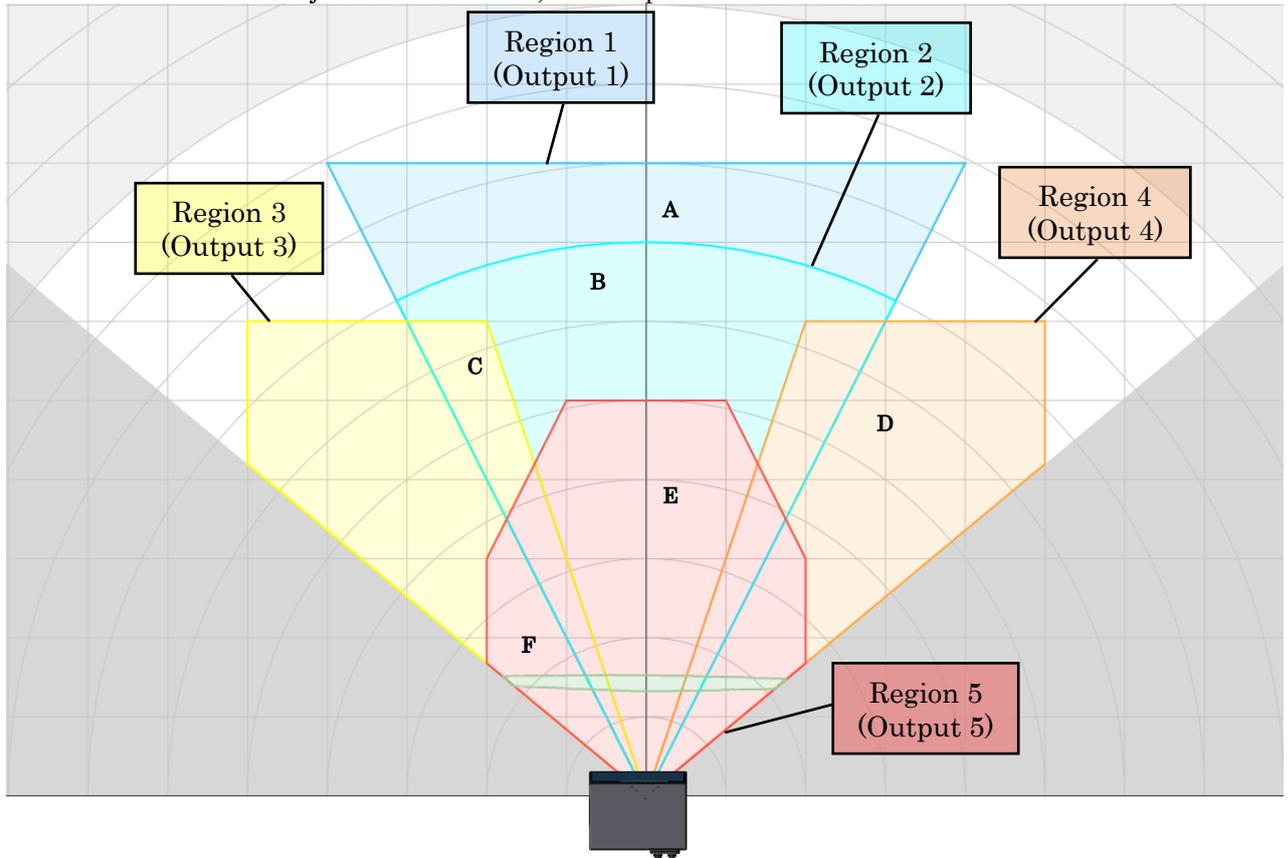
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6. Connection

6-1. Power Supply and I/O

Manufacturer: Hirose Electric Co., Ltd.

Model: DF62B-24EP-2.2C

Cable Length: 1000 mm

Pin No.	Wire color	Signal
1	Orange (Red short point 1)	+VIN (DC12V/DC24V)
2	Orange (Black short point 1)	-VIN
3	Gray (Red short point 1)	Output 1
4	Gray (Black short point 1)	Output 2
5	White (Red short point 1)	Output 3
6	White (Black short point 1)	Output 4
7	Yellow (Red short point 1)	Output 5
8	Yellow (Black short point 1)	NC
9	Pink (Red short point 1)	NC
10	Pink (Black short point 1)	Input1
11	Orange (Red short point 2)	NC
12	Orange (Black short point 2)	NC
13	Gray (Red short point 2)	NC
14	Gray (Black short point 2)	NC
15	White (Red short point 2)	Reference Output
16	White (Black short point 2)	Malfunction Output
17	Yellow (Red short point 2)	NC
18	Yellow (Black short point 2)	NC
19	Pink (Red short point 2)	NC
20	Pink (Black short point 2)	NC
21	NC	NC
22	NC	NC
23	NC	NC
24	NC	NC
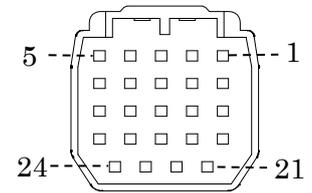
Short point 1: [mm]
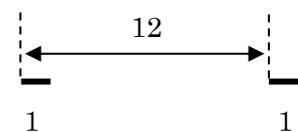
Short point 2:
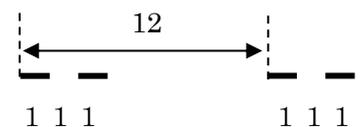
* The direction of inputs and outputs is indicated based on this product.

* Please leave unused input/output wires open.

6-2. Ethernet Cable

Cable Length: 1000 mm

Wire color	Signal
White (Orange)	TX+
Orange	TX-
White (Green)	RX+
Green	RX-

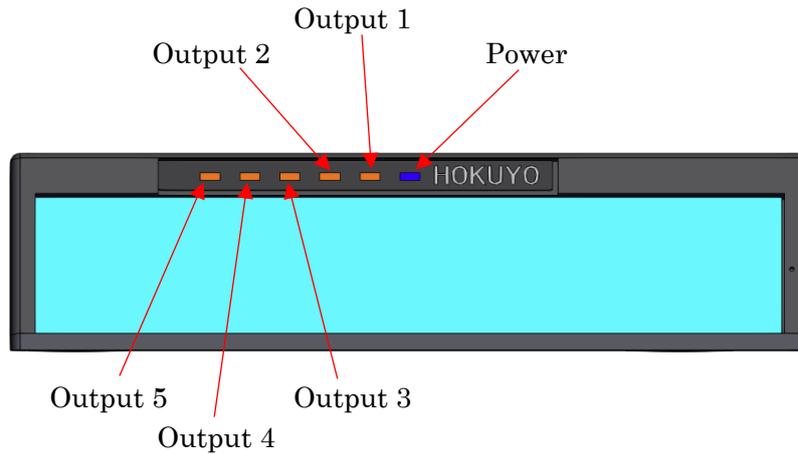| Title	UCT-10LCM Specification	Drawing No	C-42-04623	9／15

7. Indicator Lights

7-1. Position of Indicator Lights

7-2. Table of Indicator Lights and Output Signals

Sensor Status	Power indicator	Output indicator	Detection Output	Malfunction Output	Reference output
Startup	Blinks (2 times per second)	All turns ON	All turns OFF	ON	OFF
Operating	Normal : ON When reference output is detected: Blinks (0.5-second cycle / 50% duty cycle)	Detection: ON No detection: OFF	Detection: OFF No detection: ON	ON	Normal: ON Detection: OFF
Editing	Blinks (8 times per second)	All turns ON	All outputs OFF	ON	OFF
Malfunction	Blinks (1.5 times per second)	Lights up according to the malfunction mode	All outputs OFF	OFF	OFF

* In LX mode, the output indicator lights are off except during malfunction state.

* Immediately after power-on, the output state is indeterminate.

* The detection output and the reference output can be logically inverted using the application software.

7-3. Indicator Lights during Malfunction State

The output indicator lights illuminate according to the following patterns for each malfunction:

| Pattern	Malfunction state	Message
	Motor malfunction	motor speed is not stable within defined timeout
		cannot read motor encoder
		motor is not spinning within defined timeout
	Laser malfunction	laser is not responding
	Malfunction simulation	sensor error condition by fault simulation

8. Area Configuration

Area settings can be dependent settings, which rely on Region 1, or independent settings, in which regions can be configured individually

8-1. Dependent Setting

After configuring Region 1, Regions 2 to 5 will take shapes dependent on Region 1, forming within the interior of Region 1. Dependent shapes can be set as straight lines, fan shapes, or ratios, and these can be combined.

For settings that skip regions (e.g., Region 1 to Region 3), please create the regions using independent settings.

Straight line setting	Fan shape setting	Raito setting

Region 1
Region 2
Region 3
Region 4
Region 5

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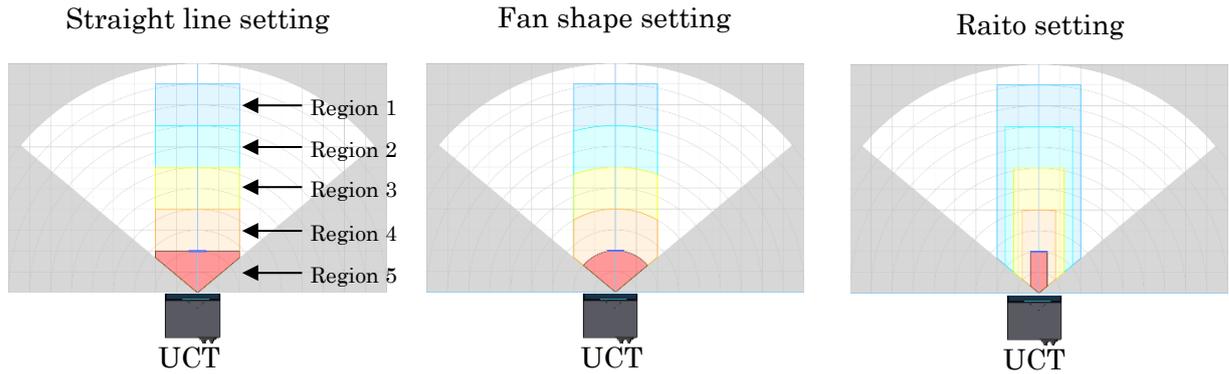
8-2. Independent Setting

Independent shapes can include polygons, arc, and rectangles, allowing for free configuration of each region. Additionally, independent shapes can be combined with dependent shapes as needed.
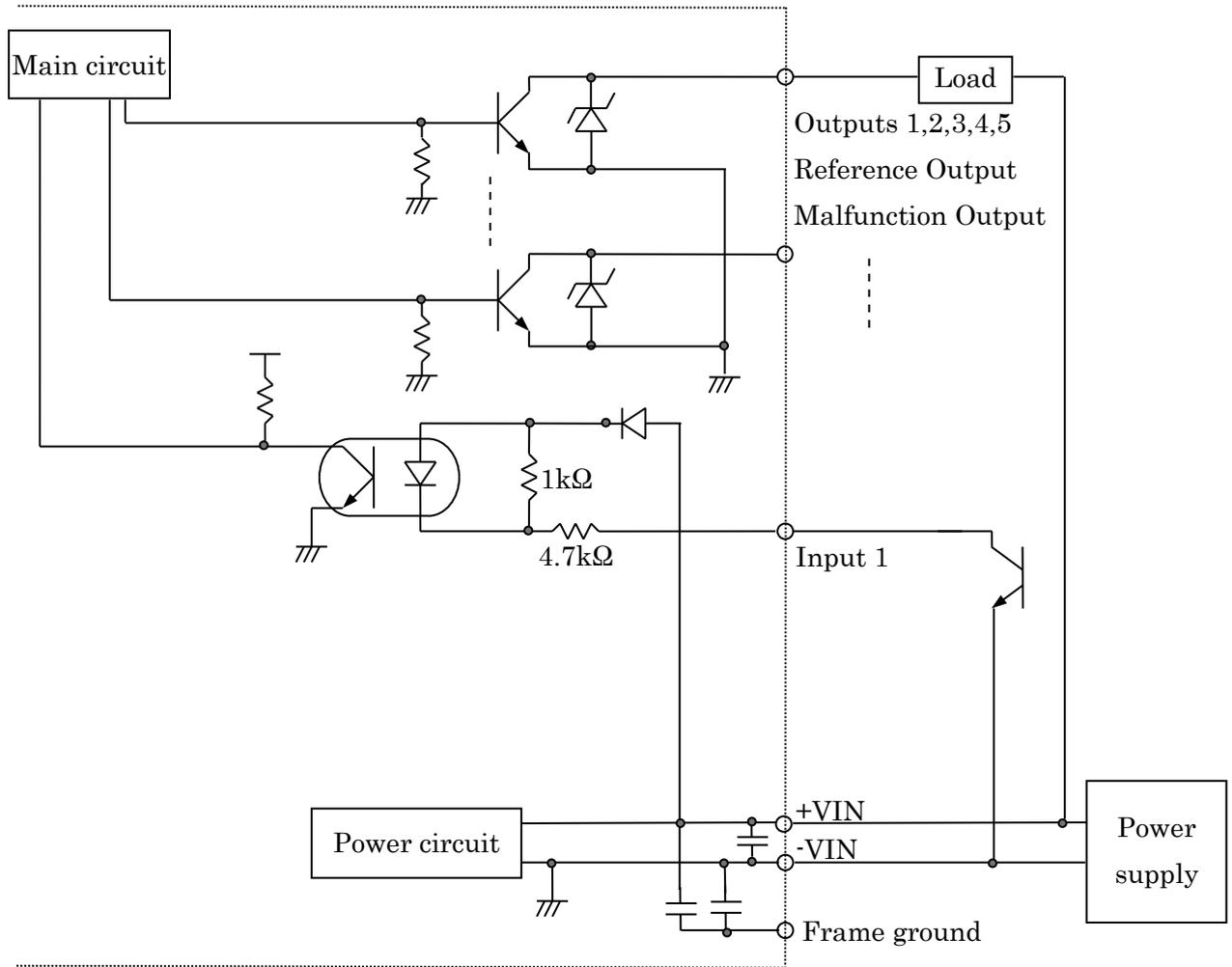
Polygon	Arc	Rectangle

UCT   UCT   UCT
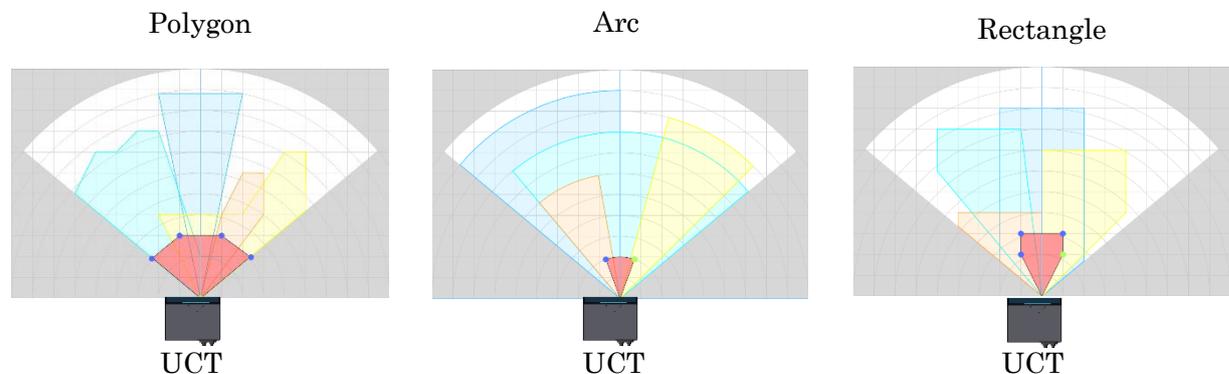
9. Input/output Circuit Connection Example

The mounting screw hole on the bottom of the case is designated as FG (frame ground).

Please ensure it is grounded to the housing.

10. Operation Method

10-1. Output Distance

In SCIP communication, the meaning of the measured distance value "x" for each step is as follows:

Output value x	Meaning
x < 10	Outputs 10 mm.
$10 \leqq x \leqq 30000$	Outputs the measured distance value in mm.
30000 < x	Outputs the value "65533." This value is also output when no object is detected or if the object cannot be measured.
x = 65531	Outputs this value when processed by the close range sensitivity filter.

10-2. Multi-Echo Function

This sensor can receive up to three reflected waves (1st, 2nd, last) for one step (one direction), allowing it to obtain distance and level values from each wave (LX mode only). When there are light-transmitting materials, rain, fog, dust, or edge of materials in front of the laser light, both the light reflected from these surfaces and the light reflected from the object beyond them will return to the sensor. This ability to obtain distance and level values from multiple reflected lights in the same direction is referred to as the multi-echo function.

However, if the distance between two objects is too close or the reflectivity is too low, it may not be possible to detect them as separate values.

10-3. Reference Function

The reference function switches the reference output terminal OFF when the measured distance deviates from the configured reference region. The allowable tolerance range can be configured. In addition to Area 0 and Area 1, one reference area can be configured.

Reference areas can be configured with regions on a per-layer basis.
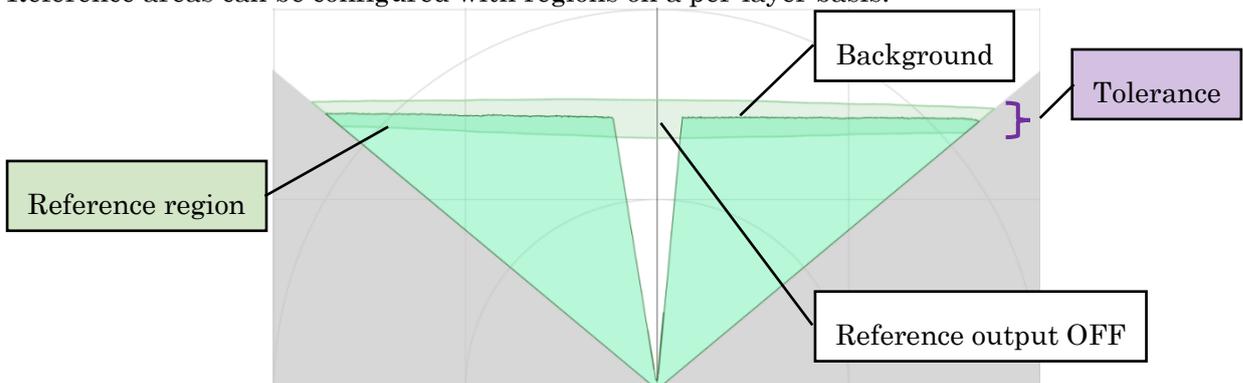
There are two methods for configuring reference regions: a manual method using a dedicated application, and an input-switching method in which an area input is assigned as the reference input.

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■Configuration and Output via Reference Input

Input 1	Area	Reference Output	Detection Output
OFF		Judged by the generated region	
ON		Judged by the generated region	Output according to the region of Area 1
ON(1s) → OFF	Area 1	Automatic generation performed Judged by the region after automatic generation	
OFF→ON		Judged by the generated region	

In the following cases, a reference region will not be generated for that step:

● When the measured distance is 10 meters or more

● When the measured distance fluctuates beyond the allowed tolerance

The measured distance is 10 meters or more

The measured distance fluctuates beyond the allowed tolerance
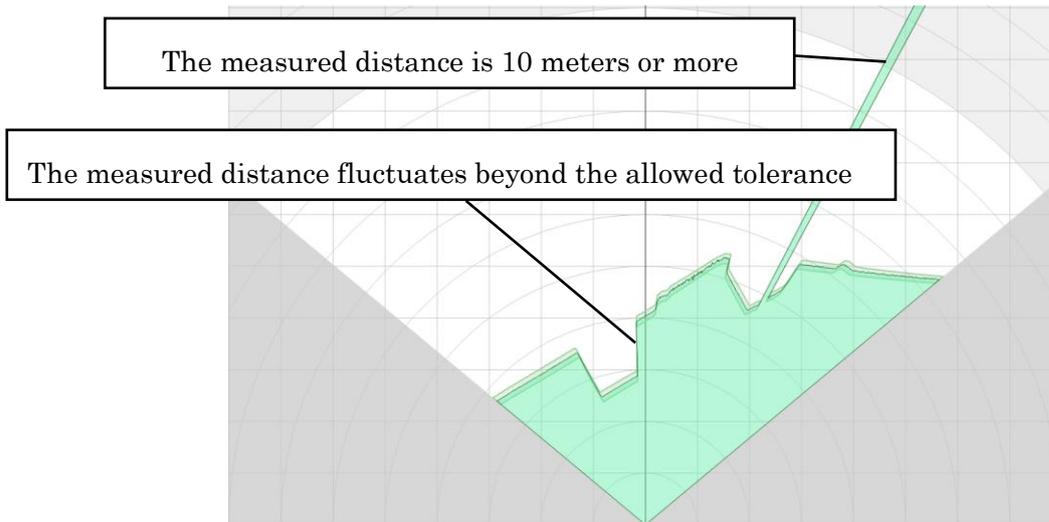
10-4. Ethernet Configuration

|	
Initial IP Address	192.168.0.10
Initial UDP Destination IP Address:	192.168.0.100
Port Number	10940

*IP address changes and initialization can be performed using the dedicated application "IP Discovery."

*The UDP destination IP address can be changed using "AreaDesigner Prime."

10-5. IMU

The Full-Scale settings and axis definitions of the IMU are as follows.

Accelerometer Full-Scale Range	±16g(2048LSB/g)
Gyroscope Full-Scale Range	±2000dps(16.4LSB/dps)
Output Data Rate	1KHz
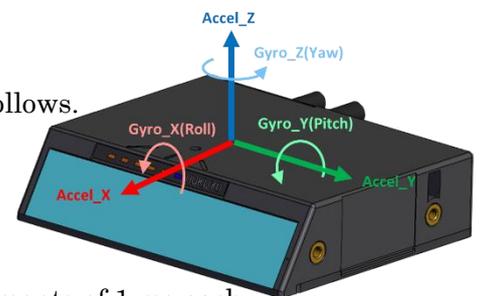
*Using VSSP, data is acquired every 20 ms in batches of 20 segments of 1 ms each.

*Functions for Magnet_X, Magnet_Y, and Magnet_Z are not supported.

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10-6. Handling Precautions

When multiple sensors are installed in close proximity, one sensor may misinterpret the laser pulses from another sensor as its own, potentially leading to detection errors. Such occurrences typically fall within a range of 1 to 2 steps. In these cases, please implement data filtering to mitigate the issue.

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