Date: 2021.03.12

# Scanning Laser Range Finder
# Smart-URG Pro
# UST-30LC
# Specification

CE

RoHS

| Symbol | Amended Reason | Pages | Date | Amended by | Ref.No |
|---|---|---|---|---|---|
| ⚠×2 | Added the startup temperature conditions | P5 | 2023.07.12 | T.Kasahara | RS-02050 |
| ⚠×1 | Comment   added | P6 | 2021.11.05 | Y.Kamioka | RS-01738 |

| Approved by | Checked by | Drawn by | Designed by | Title | UST-30LC Specification | |
|---|---|---|---|---|---|---|
| M.Hino | A.Yamamoto | T.Kasahara | A.Yamamoto | Drawing No. | C-42-04468 | 1/13 |

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## 1. General

UST-30LC is a sensor which scans a 270° field using a laser beam ($\lambda$= 905 nm), then calculates coordinates by measuring the distance to an object and its corresponding step angle (LX mode) and detects obstacles within the setting area (LA mode). Only LX mode supports the multi echo data output. In LA mode, selected single echo output data is available. The desired mode (LX or LA) can be selected in the configuration application.

### 1-2. Area configuration

The 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 an Ethernet cable. See section 7 for details on types of area configuration.
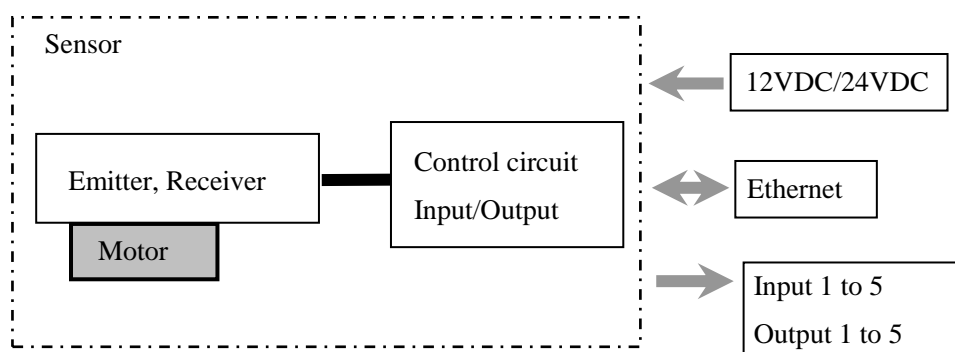
### 1-3. Area switching

The sensor has 5 external inputs for switching the area. Provide the correct signal states on these inputs (see Table 1) to switch the area. There are modes 1 and 2 in LA mode. Use mode 2 when using the motor synchronization function. However, the number of areas that can be set decrease.
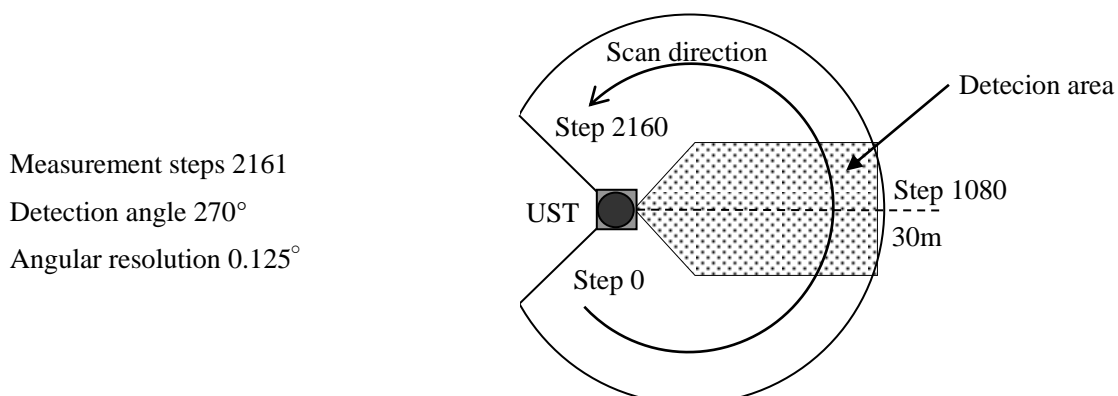
### 1-4. Malfunction output

The sensor has a self-diagnostic function. It switches the malfunction output to an OFF state when errors are detected in the internal components.

## 2. Structure

### 2-1.Strucure diagram



### 2-2. Laser scanning image

Measurement steps 2161
Detection angle 270°
Angular resolution 0.125°



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|---|---|---|---|---|

### 3. Important notes

(1) This sensor is not a safety device/tool.

(2) This sensor cannot be used for human body detection as per the machinery directives.

(3) Hokuyo products are not developed and manufactured for the use in weapons, equipments 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) Sensor emits laser for measurement. Sensor's operation may become unstable under the influence of strong interference light or when emitted lights are not reflected back from the object.

(5) 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 operates the sensor.

(7) Before using the sensor, please read carefully and understand this specification.

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**4. Specifications**

| | |
|---|---|
| Product name | Scanning Laser Range Finder |
| Model | UST-30LC |
| Supply voltage | 12VDC/24VDC  (operation range 10 to 30V ripple within 10%） |
| Supply current(*1) | 150mA or less (when using DC24V)<br>(during start up 450mA is necessary.) |
| Supply power | Less than 3.6 W(steady state) |
| Light source | Laser semiconductor (905nm) |
| Laser Safety | Class1 (IEC60825-1:2014) |
| Detection range and object | 0.05m to 30m(*2)   (white kent sheet)<br>0.05m to 12m(*2)    (diffuse reflectance 10%)<br>Max. detection distance : 60m<br>Min. detection size ：90mm(10m)、180mm(20m)、260mm(30m) |
| Accuracy | ±40mm   (*2) |
| Repeated accuracy | σ< 20mm   (*2) |
| Scan angle | 270° |
| Scan speed(*3) | 25msec (motor speed 2400rpm) |
| Angular resolution | 0.125° |
| Start up time | Within 10 sec (start up time differs if malfunction is detected during start up) |
| Outputs | Photo-coupler, open collector output Max DC 30V 50mA<br>Output 1**:** Output 1 OFF during object detection<br>Output 2**:** Output 2 OFF during object detection<br>Output 3**:** Output 3 OFF during object detection<br>Malfunction output**:** ON during normal operation, OFF during malfunction<br>Synchronous output **:** Synchronization signal during Master/Slave operation.<br>Note**:** Output 1 to 3 are switched OFF during malfunction state |
| Inputs | Photo-coupler, common cathode, power supply is 4mA when input is ON<br>Input 1 to 5**:** Area switching inputs (refer Table1) |
| Output response time (*4) | OFF | 66msec to 3241msec |
| | ON | 66msec to 3241msec |
| Interface | Ethernet 100BASE-TX |
| LED display | LX mode<br>Power supply LED display (blue): Blinks during start up and malfunction state.<br>LA mode<br>Blue LED**:** ON during normal operation, blink during the start up, configuration and malfunction state<br>Orange LED 1**:** Output 1 ON during object detection<br>Orange LED 2**:** Output 2 ON during object detection<br>Orange LED 3**:** Output 3 ON during object detection |
| Synchronization function (*5) | Synchronization Master/Slave operation mode (can set by using Area Designer)<br>Synchronization slave mode(0°  )<br>Synchronization slave mode(90°  )<br>Synchronization slave mode(180°  )<br>Synchronization slave mode(270°  ) |

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|---|---|---|---|---|

## 4. Specifications

| | |
|---|---|
| Surrounding intensity | Less than 100,000lx<br>Note : Avoid direct sunlight or other illumination sources as it may cause sensor malfunction |
| Ambient temperature and humidity | -30°C to +50°C (*7) , below 85%RH (without dew, frost) ⚠2 |
| Storage temperature and 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<br>55 to 200Hz 98m / s$^2$ sweep of 2min for 1hr in each X,Y and Z direction |
| Shock resistance | 196m/s$^2$ (20G) X,Y and Z direction each 10 times |
| Insulation resistance | 10MΩ |
| EMC standards | （EMI）<br>EN61326-1：2013<br>EN55011：2009 + A1：2010<br>（EMS）<br>EN61326-1：2013<br>EN61000-4-2：2009<br>EN61000-4-3：2006 + A1：2008 + A2：2010<br>EN61000-4-4：2012<br>EN61000-4-6：2014<br>EN61000-4-8：2010 |
| RoHS | (EU)2015/863 |
| Protective Structure | IP67(*6) |
| Weight | 130g (excluding cable) |
| Material | Front case: Polycarbonate, Rear case: Aluminum |
| Dimensions(W×D×H) | 50×50×70mm (sensor only） |

(*1) Please use a power supply with enough current capacity.

(*2) Under the factory standard testing conditions using white kent sheet.

In the low temperature environment of -11℃ or below, the detection distance will be as below.

white kent sheet：0.05m to 25m, diffuse reflectance 10%：0.05m to 8m

(*3) In the case of using other command than MD,MS and ME. There is possibility of delay in response speed,

due to surrounding environment.

(*4) Initial setting is 66msec. ON/OFF delay function switching is possible by Area Designer. Response time can be

further delayed by a maximum of 1scan during the area switching.

(*5) Initial setting is synchronization master. When using synchronization operation, refer to section 9 for details

about synchronization wiring. Synchronization slave setting is possible using Area Designer.

(*6) The protective structure of Ethernet and Power connector is not IP67.

(*7) The startup temperature is -10°C to +50°C. ⚠2

Table 1: Input states and corresponding area number

| [Input 1] | [Input 2] | [Input 3] | [Input 4] | [Input 5] | Area Number[*2] |
|---|---|---|---|---|---|
| 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 |

※OFF: Low level, ON: High level ⚠

*1：Laser is switched off when all inputs (1 to 5) are ON.
*2：When using the synchronization function in LA mode 2, the maximum area number will be 15.

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|---|---|---|---|---|

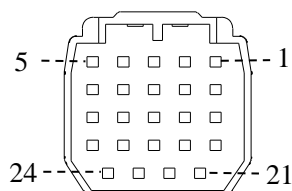## 5. Connection

### 5-1. Power source, I/O cable

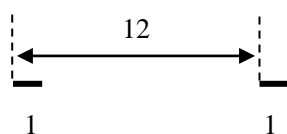connector : DF62B-24EP-2.2C(00) Hirose
Cable length: 1000mm
Keep the output wires open or connect to output "Com Output +" if not in use.
Keep the input wires open or connect to output "Com Input -" if not in use.
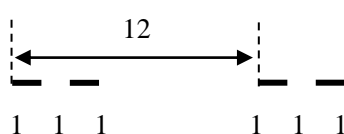The input and output directions are based on this product.
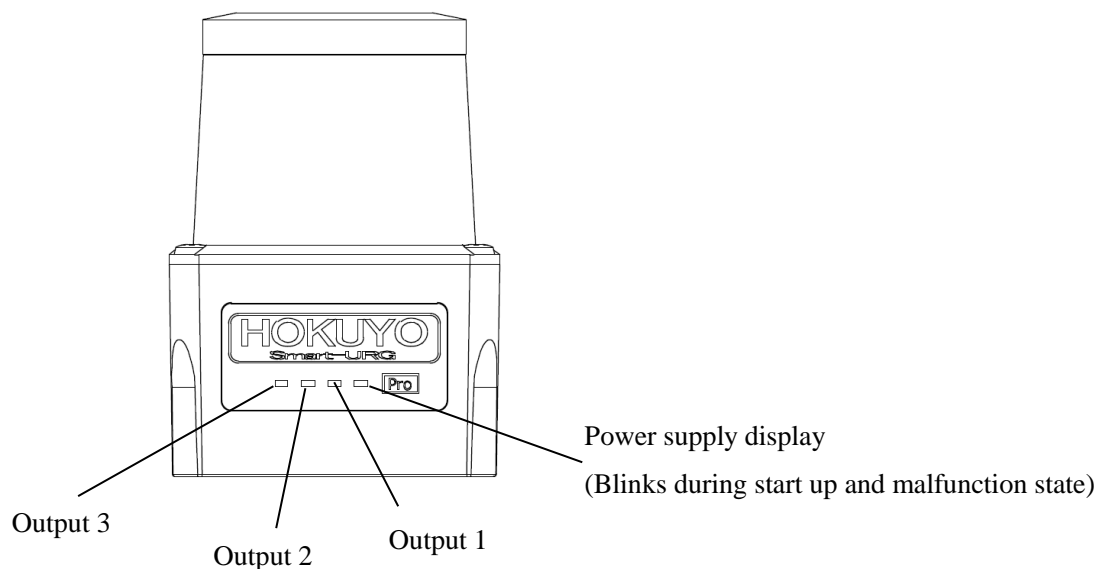
Short point 1 :                    [mm]

```
        12
  |<--------->|
   ▬         ▬
   1         1
```

Short point 2 :

```
        12
  |<--------->|
  ▬  ▬  ▬     ▬  ▬  ▬
  1  1  1     1  1  1
```

| Number | 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) | Malfunction output |
| 7 | Yellow(Red short point 1) | Synchronous output |
| 8 | Yellow(Black short point 1) | COM Input - |
| 9 | Pink(Red short point 1) | COM Output + |
| 10 | Pink(Black short point 1) | Input 1 |
| 11 | Orange(Red short point 2) | Input 2 |
| 12 | Orange(Black short point 2) | Input 3 |
| 13 | Gray(Red short point 2) | Input 4 |
| 14 | Gray(Black short point 2) | Input 5/ Synchronous input |
| 15 | NC | NC |
| 16 | NC | NC |
| 17 | NC | NC |
| 18 | NC | NC |
| 19 | NC | NC |
| 20 | NC | NC |
| 21 | NC | NC |
| 22 | NC | NC |
| 23 | NC | NC |
| 24 | NC | NC |

### 5-2. Ethernet cable

Cable length: 300mm

| Color | Signal |
|---|---|
| White(Orange) | TX+ |
| Orange | TX- |
| White(Green) | RX+ |
| Green | RX- |

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|---|---|---|---|---|

## 6. LED display

Power supply display

(Blinks during start up and malfunction state)

Output 3

Output 2

Output 1

## 7. Area configuration

### 7-1 Normal configuration

In the normal configuration, the area for Output 1 is configured first and the shape of it can be configured freely.
Areas for Output 2 and Output 3 are dependent on the set area of Output 1 and therefore they are configured inside it. The shapes of Output 2 and Output 3 areas can be straight, fan shape or ratio (Figure 1).
Figure 2 and Table 2 show the relationship between the detected object position and the output states.
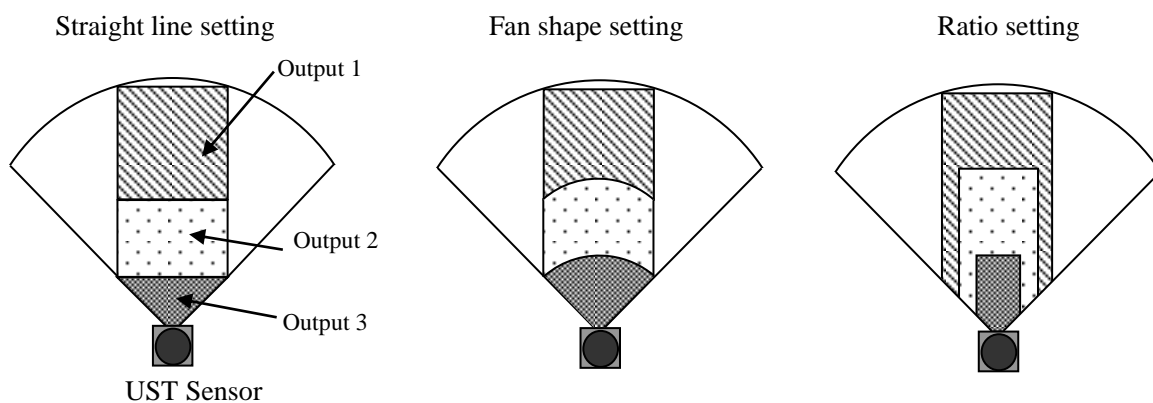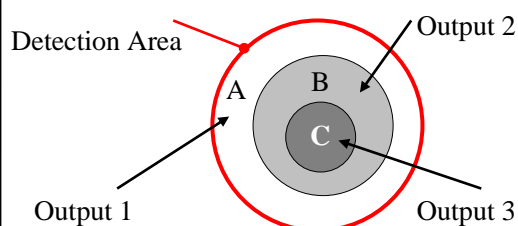
Straight line setting

Fan shape setting

Ratio setting

Output 1

Output 2

Output 3

UST Sensor

Figure 1: Normal area configuration

Detection Area

Output 2

A    B

C

Output 1

Output 3

| Object position | Output 1 | Output 2 | Output 3 |
|:---:|:---:|:---:|:---:|
| A | OFF | ON | ON |
| B | OFF | OFF | ON |
| C | OFF | OFF | OFF |

Figure 2: Output areas

Table 2: Relationship between object position and output states

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|---|---|---|---|---|

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## 7-2. Independent configuration

In the independent configuration, areas for Output 1, Output 2 and Output 3 can be configured freely. The field covered by each output can be completely separate from the other output areas or there can be an overlapping region between the output areas Figure 3 (a) and (b).

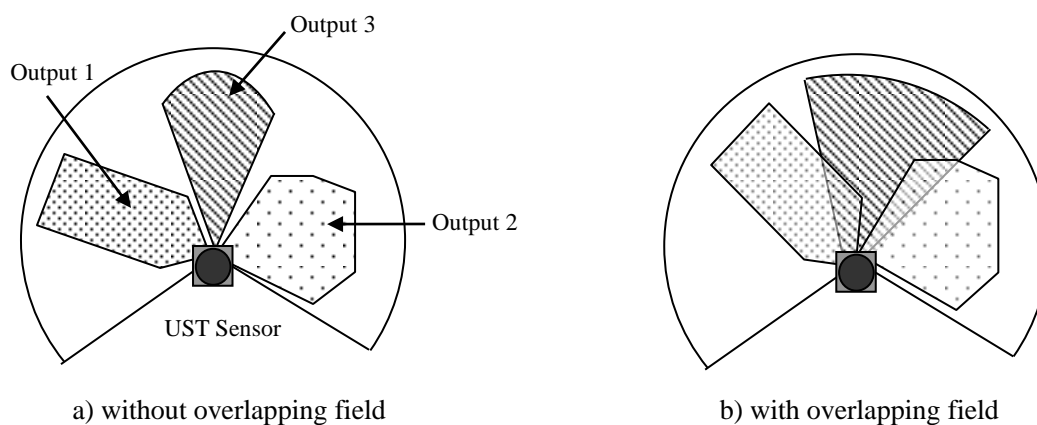Figure 4 and Table 3 show the relationship between the object position and the output states.
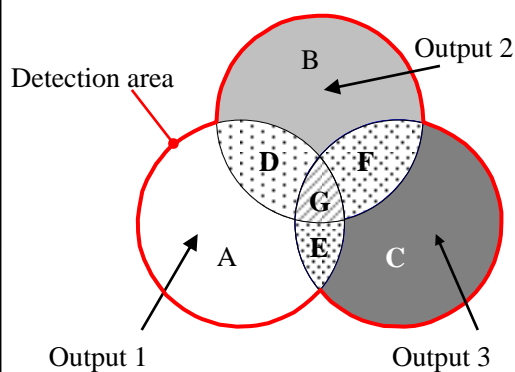


a) without overlapping field          b) with overlapping field

Figure 3: Independent area configuration



Figure 4: Output areas

| Object position | Output 1 | Output 2 | Output 3 |
|-----------------|----------|----------|----------|
| 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: Relationship between object position and output area

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|-------|------------------------|------------|------------|------|

## 8. Input/Output circuit connection example

1k Ω
10k Ω
COM Output +
+
I/O power supply
−
Resistor
Output 1,2,3,
Malfunction output
1k Ω
10k Ω

Main circuit

COM Input -

4.7k Ω
1k Ω
Input 1,2,3,4,5
or PNP circuit

4.7k Ω
1k Ω

Power circuit
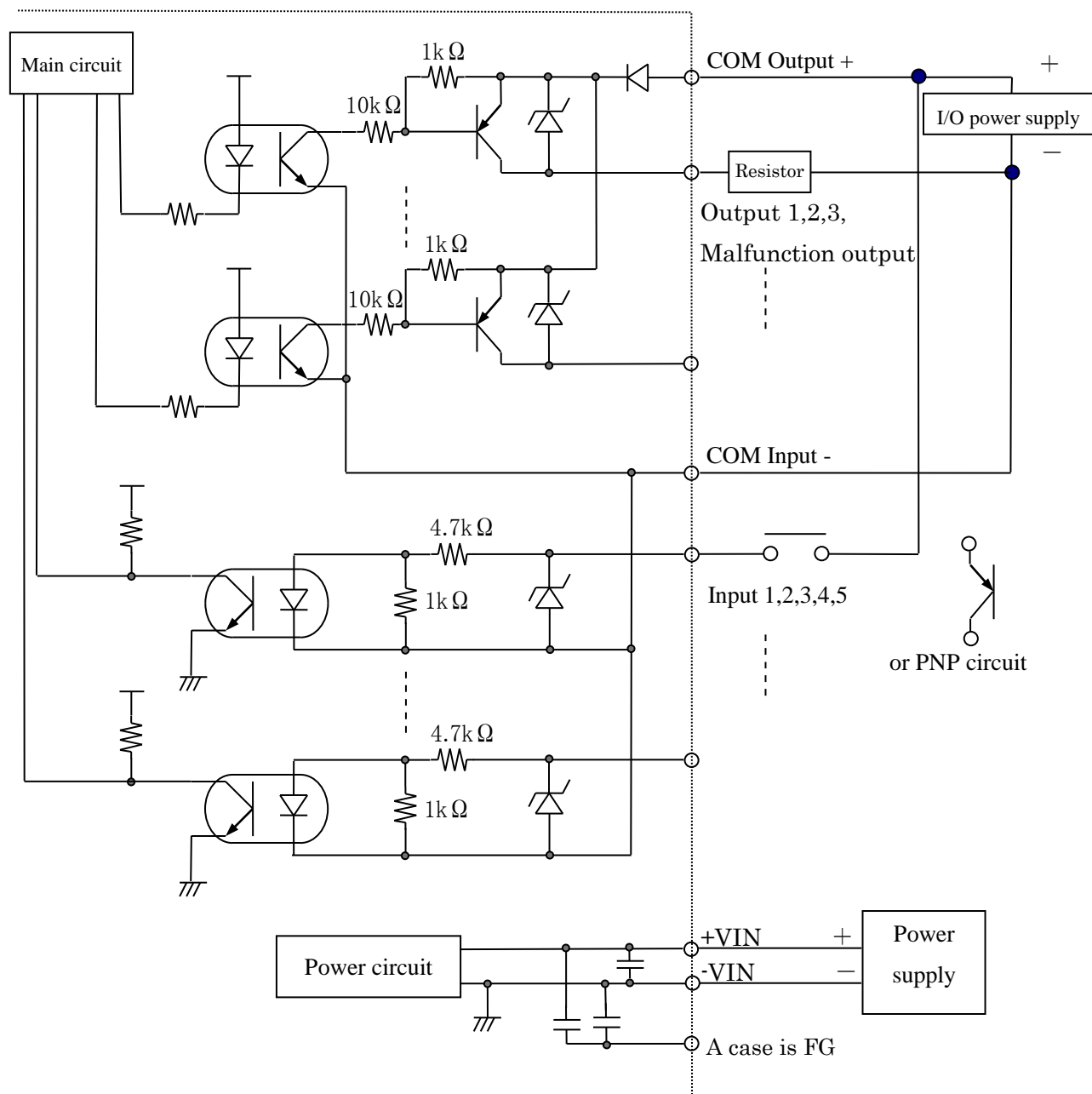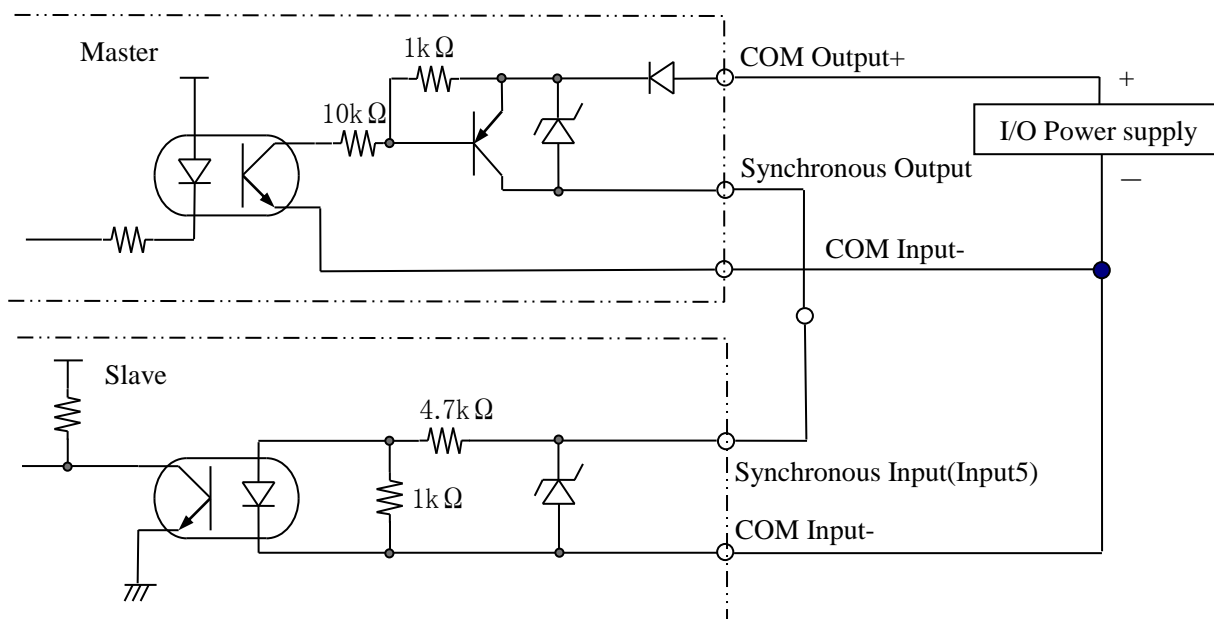+VIN +
Power
-VIN −
supply
A case is FG

Figure 5: Connection example of inputs, outputs and power supply

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|---|---|---|---|---|

**9. The example of Synchronous wiring**



Master
1k Ω
10k Ω
COM Output+
I/O Power supply
+
Synchronous Output
COM Input-
−

Slave
4.7k Ω
1k Ω
Synchronous Input(Input5)
COM Input-

Note: This function is available in LA mode 2.

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|-------|------------------------|-------------|------------|-------|

## 10. Measurement Data

| Distance Value (x) | Meaning |
|---|---|
| x < 10 | Output numerical number "65534" as Measurement error |
| $10 \leqq x \leqq 60000$ | Valid distance [mm] |
| x > 60000 | Output numerical number "65533" <br> as Measurement error (object does not exists or object has low reflectivity) |

## 11. Control signal

### 11-1. Synchronous output

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



*Tr is ON during malfunction
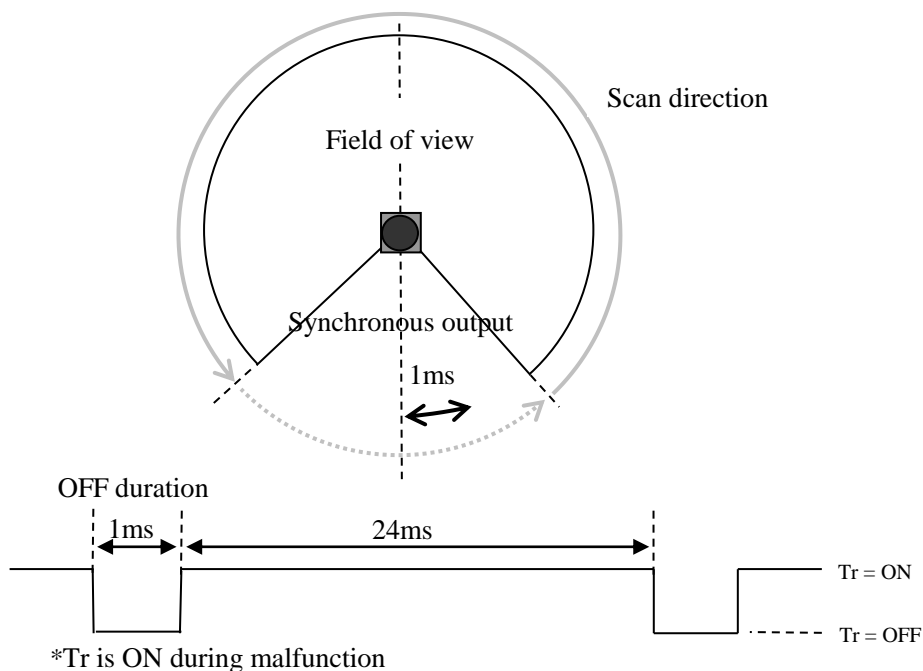
## 12. Multi-echo function

   This sensor provides a maximum of three echo (1st, 2nd, last) for each step (one direction). It also provides distance value and level value for each step. (For LX mode only)

   Multiple echo are generated when the laser beam is split by reflection on surface of transparent objects, reflection on object's edge and reflection from small particles such as rain, mist, dust and fog. Thus, distance and level value obtained from the multiple reflections in the same direction is called multi echo. However, if the distance between two object is too close or the object has low reflectance, the sensor may not detect it as multi echo.

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|---|---|---|---|---|

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### 13. Ethernet Setting

1. The setting value is as below.

IP Initial value    :192.168.0.10

Port number        :10940

2. About changing IP address

It is possible to change and reset the IP address using a specialized application (IP Discovery).

For details on installation and operation of IP Discovery, Please refer to IP discovery manual. (C-41-02603)

### 14. Cautions for operation

This sensor uses high speed processing components that generate heat during operation.

The heat is concentrated at the bottom of the unit. When mounting, please attach the bottom of the unit to a good heat sink. A 200mm x 200mm x 2mm aluminum plate is recommended as a heat sink.

If multiple sensors are installed side by side, a sensor might mistake the laser pulses of other units as its own and the detection error occurs. When it happens, usually the error lasts for one or two steps of measurement.    Please use software filters to handle this type of error.

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