

# Scanning Laser Range Finder

## Smart-URG eco

### UST-05LN

## Specification

CE  
RoHS

|                        |  |           |             |             |                        |           |              |
|------------------------|--|-----------|-------------|-------------|------------------------|-----------|--------------|
| $\triangle 6 \times 1$ | FDA standards updated                            |           |             | P4          | 2024.12.20             | Matsunaka | RS- 02322    |
| $\triangle 5 \times 1$ | Durability of surrounding intensity was improved |           |             | P5          | 2020.12.1              | Ota       | RS-01575     |
| $\triangle 4$          | Correction error (CE and RoHS mark added)        |           |             | P1          | 2017.4.14              | Kamioka   | RS-00903     |
| $\triangle 3 \times 1$ | Correction of errors                             |           |             | P7          | 2015.3.12              | Kasahara  | RS-00561     |
| $\triangle 2 \times 2$ | Correction of errors                             |           |             | P4, 11      | 2015.1.15              | Kasahara  | RS-00529     |
| Symbol                 | Amended Reason                                   |           |             | Pages       | Date                   | Corrector | Amendment No |
| Approved by            | Checked by                                       | Drawn by  | Designed by | Title       | UST-05LN Specification |           |              |
| Kamitani               | Iguchi   | Matsunaka | Yamamoto    |             |                        |           |              |
|                        |  |           |             | Drawing No. | C - 4 2 - 0 4 0 6 9    |           | 1/11         |



## 1. General

Make sure to read carefully and understand this document (C-41-02490) while using the product.

### 1-1. Operation principle

The UST-05LN is a scanning laser range finder. The sensor emits pulsed laser beams within a 270° field of view. 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 a 0.5° pitch.

The user can preset up to 31 area patterns in the sensor. Each area has 3 outputs; Output 1, Output 2 and Output 3 (see Figure 1). When the sensor detects an object in the area, corresponding outputs are switched to an OFF state.

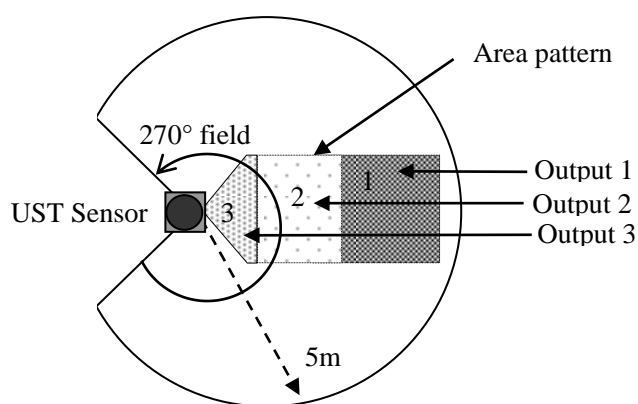


Figure. 1: Detection area and outputs in UST Sensor

### 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 a USB cable. See section 6 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.

### 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.

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1-5. Synchronous operation

The sensor has a scanner synchronization function to avoid mutual interference between multiple sensors. To use this function connect the 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.

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.

2. Structure

2-1. Structure Diagram

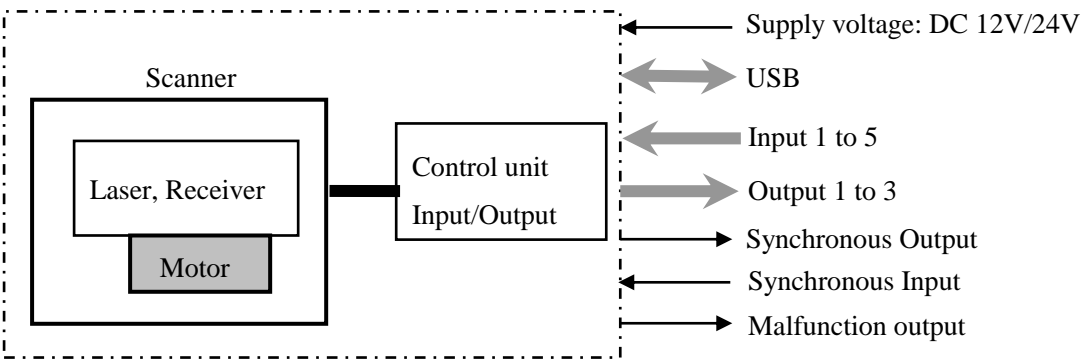


Figure. 2: Structure diagram

|       |                        |            |                     |      |
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### 3. Specification

|                            |  |                    |
|----------------------------|--|--------------------|
| Product name               | Scanning Laser Range Finder  |                    |
| Model                      | UST-05LN   |                    |
| Supply voltage             | DC 12V/DC 24V (operation range 10 to 30V, ripple within 10%)   |                    |
| Supply current             | 150mA (DC 24V) or less (during start up about 400mA is necessary.)   |                    |
| Light source               | Laser semiconductor (905nm), $\Delta$ 2014<br>Laser class 1(IEC60825-1:2007, Accession number:1420210-000)   |                    |
| Detection range and object | 60mm to 5000mm (white Kent sheet)<br>60mm to 2000mm (diffuse reflectance 10% )<br>Minimum detectable size 130mm (changes according to distance) *1   |                    |
| Accuracy                   | 60mm to 5000mm $\pm 40\text{mm}$ *2  |                    |
| Standard deviation         | $\sigma < 20\text{mm}$ *2  |                    |
| Scan angle                 | 270°   |                    |
| Scan speed                 | 25ms (motor speed 2400rpm)   |                    |
| Angular resolution         | 0.5°   |                    |
| 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>Synchronization output: Synchronization signal during Master/Slave operation.<br>Note: Output 1 to 3 are switched OFF during malfunction state |                    |
| Inputs                     | Photo-coupler, common anode, power supply is 4mA when input is ON<br>Input 1 to 5: Area switching inputs (refer Table1)<br>Synchronization input: Input synchronization signal during Slave operation.   |                    |
| Output response time *3    | OFF  | 66msec to 3241msec |
|                            | ON   | 66msec to 3241msec |
| Hysteresis $\Delta$        | Hysteresis high (6.25%)  |                    |
|                            | Hysteresis low (3.125%)  |                    |
|                            | No Hysteresis (Default)  |                    |
| Interface                  | USB  |                    |
| LED display                | 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   | Synchronization Master/Slave operation mode (can set by using Area Designer) *4<br>Synchronization slave mode (0°)<br>Synchronization slave mode (90°)<br>Synchronization slave mode (180°)<br>Synchronization slave mode (270°)   |                    |

\*1 In the case of installing the sensor parallel to the Emitter/Receiver surface. Minimum detectable size of the object can be set by Area Designer.

\*2 Under the factory standard testing condition using white Kent sheet.

\*3 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.

\*4 Initial setting is synchronization master. When using synchronization operation, refer to section 5.3 for details about synchronization wiring. Synchronization slave setting is possible using Area Designer.

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### 3. Specification (Continued)

|                              |  |
|------------------------------|--|
| Surrounding intensity        | Less than 80,000lx $\triangle$<br>Note : Avoid direct sunlight or other illumination sources as it may cause sensor malfunction  |
| Ambient temperature humidity | -10°C to +50°C, below 85%RH (without dew, frost)   |
| 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<br>55 to 200Hz 98m / s <sup>2</sup> sweep of 2min for 1hr in each X,Y and Z direction                                    |
| Shock resistance             | 196m/s <sup>2</sup> (20G) X,Y and Z direction 10 times.  |
| Insulation resistance        | 10MΩ, DC 500V  |
| Protective structure         | IP65   |
| 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>EN61000-4-6:2009<br>EN61000-4-8:2010 |
| Weight                       | 130g   |
| Material                     | Front case: Polycarbonate, Rear case: Aluminum   |
| Dimensions (W×D×H)           | 50×50×70mm   |

|       |                        |            |                     |      |
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Table 1: Input states and corresponding area number

| [Input 1] | [Input 2] | [Input 3] | [Input 4] | [Input 5] | Area Number             |
|-----------|-----------|-----------|-----------|-----------|-------------------------|
| ON        | ON        | ON        | ON        | ON        | Laser off <sup>*1</sup> |
| 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                  |

<sup>\*1</sup>: Laser is switched off when all inputs (1 to 5) are ON.

|       |                        |            |                     |      |
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## 4. Connection

### 4-1. Power source, I/O Cable

Cable length: 1000mm flying lead

| Color              | Signal             |
|--------------------|--------------------|
| Brown              | +VIN (DC12V/DC24V) |
| Blue               | -VIN               |
| Black              | Output 1           |
| White              | Output 2           |
| White (Blue)       | Output 3           |
| Orange             | Malfunction Output |
| Light 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               | Non Connect        |
| Yellow (Red)       | Non Connect        |
| Yellow (Black)     | Non Connect        |
| Light Blue (Red)   | Non Connect        |
| Light Blue (Black) | Non Connect        |

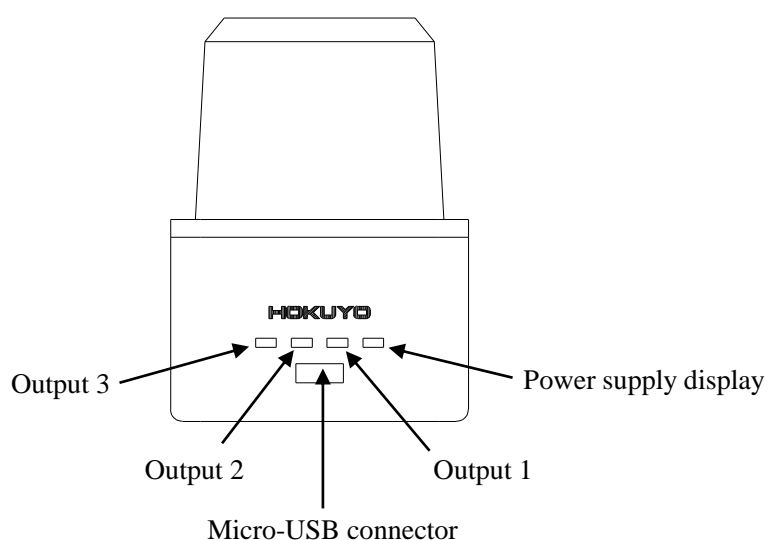
Note 1: Input/Output direction is mentioned from the sensor's side.

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

Note 3: Keep the input 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



|       |                        |            |                     |      |
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## 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, 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 3).

Figure 4 and Table 2 show the relationship between the detected object position and the output states.

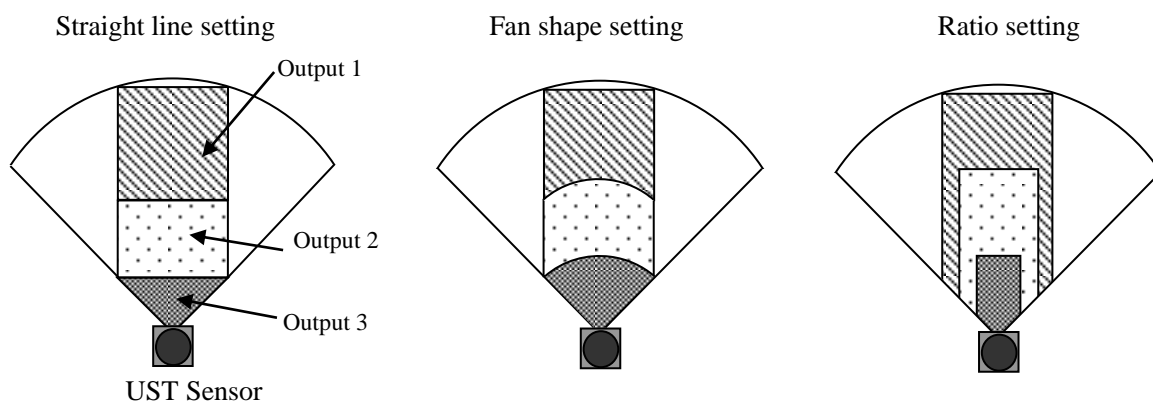


Figure 3: Normal area configuration

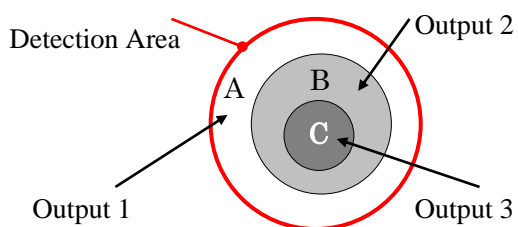


Figure 4: Output areas

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

Table 2: Relationship between object position and output states



## 6-2. 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 5 (a) and (b).

Figure 6 and Table 3 show the relationship between the object position and the output states.

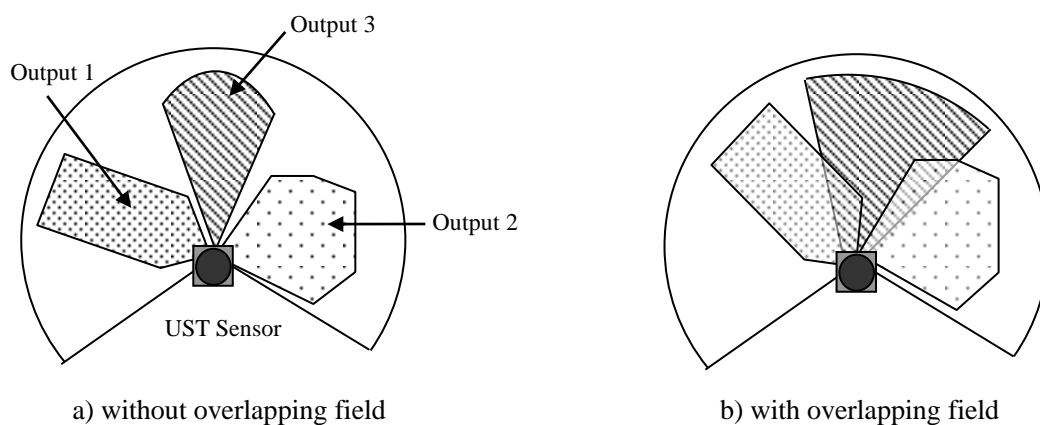


Figure 5: Independent area configuration

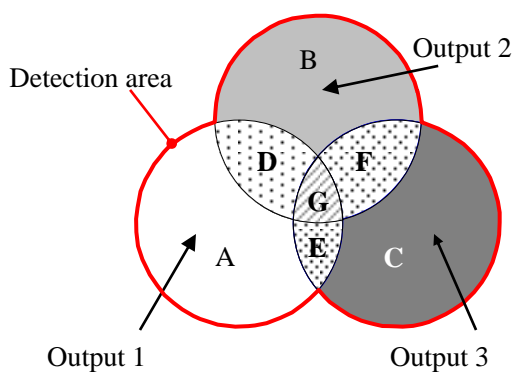


Figure 6: Output areas

| 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

## 7. Input/Output circuit connection example

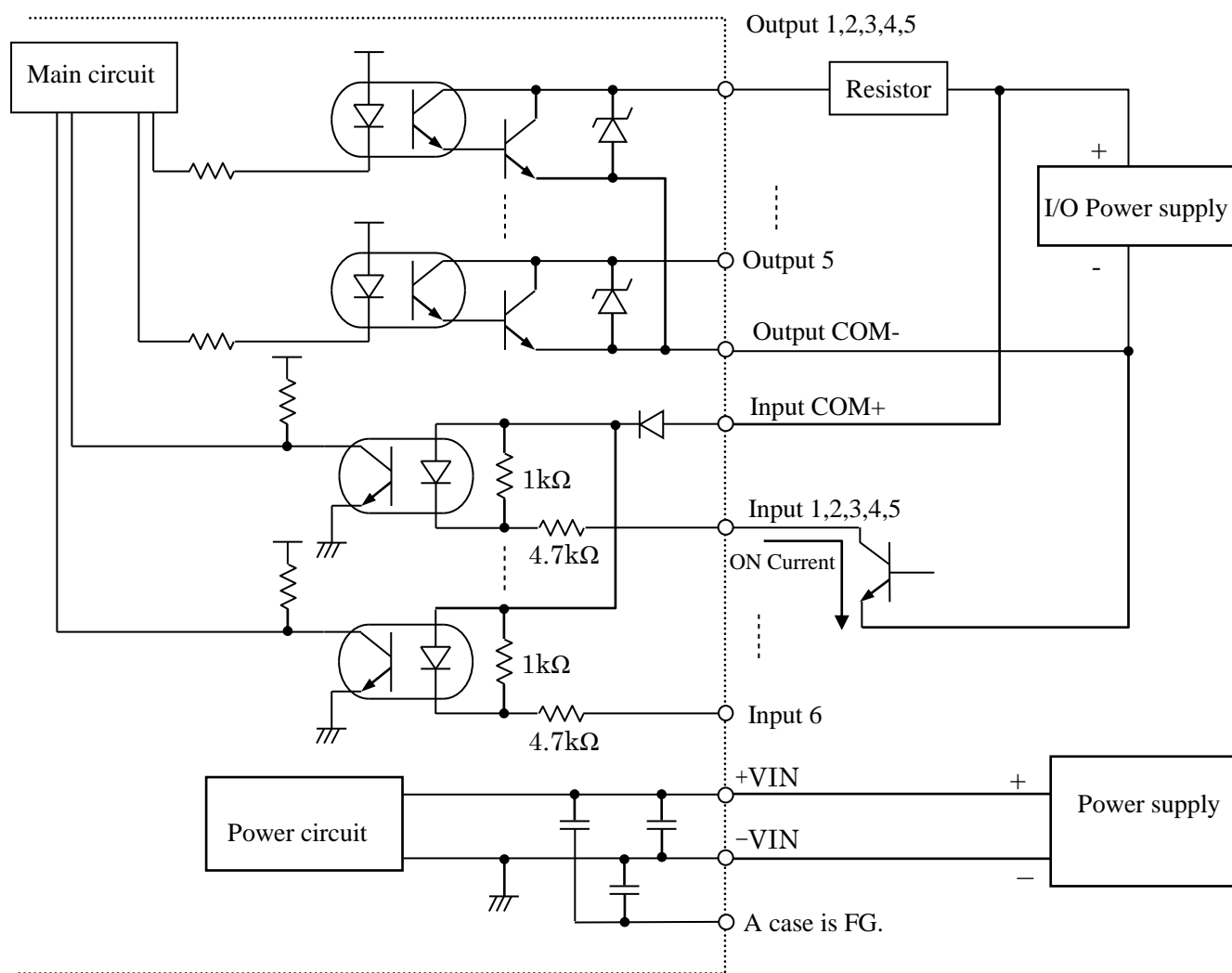


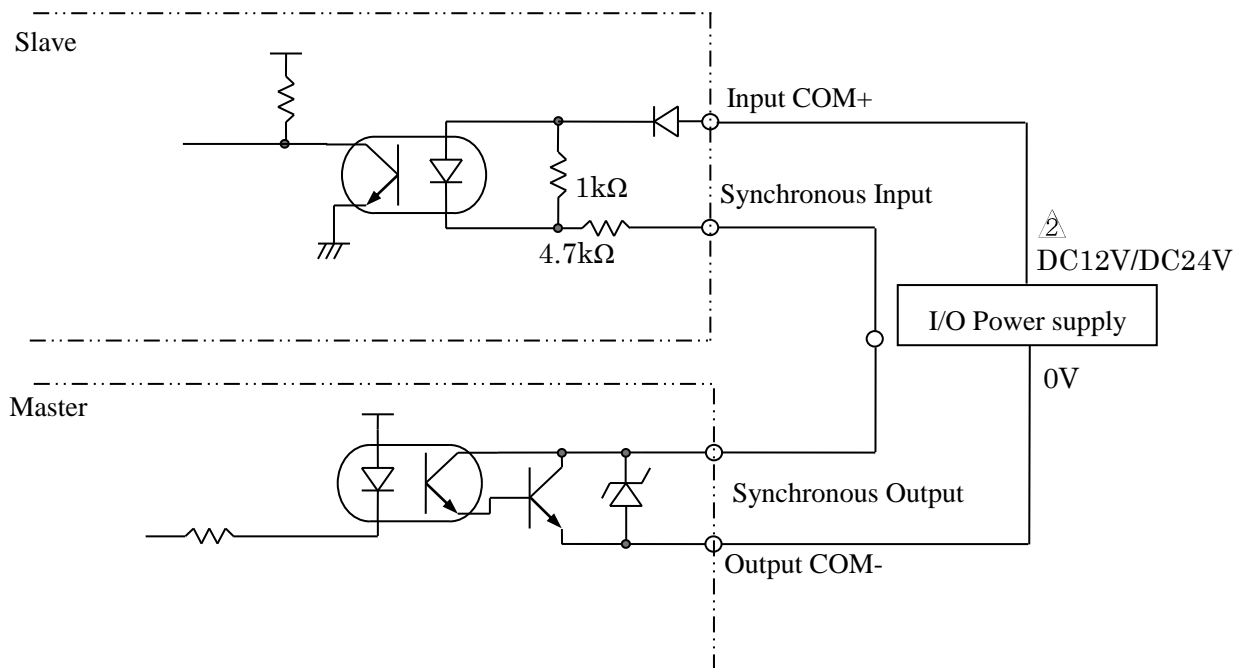
Figure 7: Connection example of inputs, outputs and power supply.

|       |                        |            |                     |       |
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## 8. The example of synchronous wiring

Synchronous Output (master) : Light green

Synchronous Input (slave) : Light Blue



|       |                        |            |                     |       |
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