3D TOF Sensor Module
B5L

TOF Sensor Module ideal for 3D distance measurement
High ambient light immunity and flexible assembly

OMRON
Introducing the assembly type TOF Sensor, a product that brings together all of OMRON’s technologies.

A TOF (Time of Flight) sensor uses the flight time of light to measure distances to objects. As well as being able to turn captured images into 3D images, it can also measure at a speed of 20 frames per second, allowing it to track the movement of objects three-dimensionally.

Emitted waves

Received (reflected) waves

Interfering light

Ambient light immunity equivalent to 100,000/uni00A0lx!

Its powerful ambient light immunity ensures stable detection performance free from saturation even in bright places.

- **High precision**
- **Long life**

Achieves high output accuracy for compensated signals. ±2% (2/uni00A0m)

Note: Functionality and performance may decrease under certain operating conditions. Refer to User’s Manual (manual number: E596) for details.

*1. According to OMRON’s evaluation method (reliability acceleration test at the ambient temperature of 20°C and the humidity of 65%RH)
*2. However, product specifications are not guaranteed.

- **Long life equivalent to 5 years under continuous driving.**
  - According to OMRON’s research in March, 2020
  - *1

- **Long life thanks to OMRON’s unique circuit design and heat emission design.**

- **Ideal for applications that require the use of multiple devices such as robots at the same time.**

What is a TOF Sensor?

A TOF (Time of Flight) sensor uses the flight time of light to measure distances to objects. As well as being able to turn captured images into 3D images, it can also measure at a speed of 20 frames per second, allowing it to track the movement of objects three-dimensionally.

Time of Flight Sensor

Real-time 3D sensing of distance to humans or objects. TOF method-based distance image sensor module.
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**Interfering light immunity**

Ambient light immunity equivalent to 100,000 lx!
Its powerful ambient light immunity ensures stable detection performance free from saturation even in bright places.

**High precision**

±2% (2 m)
Achieves high output accuracy for compensated signals.

**Long life**

Long life equivalent to 5 years under continuous driving.
According to OMRON's research in March, 2020.
Long life thanks to OMRON's unique circuit design and heat emission design.

**Interference prevention**

With interference prevention function (up to 17 units)
According to OMRON's research in March, 2020.
Ideal for applications that require the use of multiple devices such as robots at the same time.

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Differences from a conventional camera sensor

The use of extensive distance information enables the sensor to identify its peripheral environment.

Watch a demonstration video here

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**2D image**

*Far*

**3D image**

*Near*
Three Features of OMRON’s 3D TOF Sensor Module

Ambient light immunity

Capable of delivering stable detection performance even in direct sunlight.

- Lens design that corresponds to the wavelength of the emitter LEDs
- Arrangement of emitters and receivers minimizing the effect of suspended particles of dust
- Optical simulation technology

Bringing together the best

Optical design technology
- Lens design that corresponds to the wavelength of the emitter LEDs
- Arrangement of emitters and receivers minimizing the effect of suspended particles of dust
- Optical simulation technology

Circuit design
- High-current LED driver
- High-speed transmission technology
The 3D TOF sensor module incorporates a wide range of OMRON's proprietary technologies in a single product.

**High precision**
Outputs compensated signals to minimize control processing on the end user's actual machine.

**Long life**
Long life is ensured thanks to OMRON's proprietary circuit design, heat emission design and the adoption of LEDs for the emission elements.

**Features**
- Lens design that corresponds to the wavelength of the emitter LEDs
- Arrangement of emitters and receivers minimizing the effect of suspended particles of dust
- Optical simulation technology
- High-current LED driver circuit
- High-speed transmission circuit technology
- Calculation processing
- Compensation processing
- 3D conversion processing
- Image filtering
Example applications

Ideal for applications that require extensive distance information. The inclusion of interference prevention function allows the use of multiple devices at once.

<table>
<thead>
<tr>
<th>AMR/ Service robots</th>
<th>Logistics and conveyance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop detection/ Environment recognition</td>
<td>Volume and shape measurement</td>
</tr>
<tr>
<td>Periphery recognition/ Human recognition</td>
<td>Empty space detection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monitoring and observation</th>
<th>Automatic doors/elevators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral understanding and observation of patients under long-term care</td>
<td>Counting people and tracking traffic flows</td>
</tr>
</tbody>
</table>

Note: The example applications shown are for reference only. Systems must be constructed separately. Be sure to check the actual operating conditions before use.
Example applications

Ideal for applications that require extensive distance information. The inclusion of interference prevention function allows the use of multiple devices at once.

- Drop detection/
- Environment recognition
- Behavioral understanding and observation of patients under long-term care
- Volume and shape measurement
- Counting people and tracking traffic flows
- Periphery recognition/
- Human recognition
- Empty space detection

Note: The example applications shown are for reference only. Systems must be constructed separately. Be sure to check the actual operating conditions before use.

<table>
<thead>
<tr>
<th>Type</th>
<th>Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection principle</td>
<td>Detection range (white paper)</td>
</tr>
<tr>
<td>TOF</td>
<td>0.5 m to 4 m</td>
</tr>
</tbody>
</table>

### Ratings/Specifications

#### Ratings

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light source</td>
<td>LED, NIR 940 nm</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>VDC24±10%</td>
</tr>
</tbody>
</table>
| Power consumption (current consumption) | Average during measuring: 0.3 A *1  
Maximum: 3 A (Reference) *1 |
| Ambient temperature | Operation: 0 to +50°C *2  
Storage: -20 to +60°C *2 |
| Ambient humidity | Operation/storage: 35 to 85%RH or less *3 |
| Tightening torque of mounting hole | 0.91 to 1.37 N·m |
| Vibration (durability) | 10 to 150 Hz, 50 m/s², complex amplitude of 0.7 mm or less  
Scanning 3 times each in X, Y, Z directions for 8 min |
| Impact (durability) | 300 m/s²  
3 times each in X, Y, Z directions |
| Appearance | Approx. 103×64.3×43.1 mm  
Approx. 108.6×64.3×43.1 mm (including the Connector) |
| Protective structure | IEC60529 IP10 |
| Weight | Approx. 305 g |
| Materials | Frame: die-cast aluminum  
Cover: polycarbonate (PC)  
Filter: acrylic resin (PMMA)  
Heat sink: aluminum |

*1. Standard mode/exposure time setting=850 (default)  
*2. With no condensation or icing  
*3. With no condensation

#### Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement distance</td>
<td>0.5 to 4 m</td>
</tr>
<tr>
<td>Detection resolution</td>
<td>Approx. 0.3°</td>
</tr>
<tr>
<td>Horizontal detection range (angle of view)</td>
<td>87° or above</td>
</tr>
<tr>
<td>Vertical detection range (angle of view)</td>
<td>67° or above</td>
</tr>
</tbody>
</table>
| Distance accuracy | ±2% (+4 cm) or less *4*5  
at 2 m central part 10x10 pixels |
| Repeating accuracy | 1% (2 cm) or less *4*5  
at 2 m central part 10x10 pixels |
| Frame rate | Approx. 10 fps *4 |
| Starting time | 30 seconds or less *6 |
| Warm-up time | Approx. 30 minutes *7 |

*4. Distance accuracy and repeating accuracy are obtained under the following conditions:  
* Based on OMRON’s measurement environment  
* Ambient temperature: 25°C  
* Standard mode/LED light projecting frequency ID=8 (default)  
*5. Target object: reflectance 70% (white paper)  
* Distance accuracy: Average of 100 measurements (10,000 pieces of data in total) at the central part (10x10 pixels) 2 m away from this product  
* Repeating accuracy: Standard deviation of 100 measurements (10,000 pieces of data in total) at the central part (10x10 pixels) 2 m away from this product  
* Standard mode/exposure time setting=850 (default)  
*6. Time from power ON until communication is possible  
*7. Time from power ON until performance is stable

#### Communication specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Receive commands from the host and return execution results.</td>
</tr>
<tr>
<td>Interface</td>
<td>USB2.0 CDC class</td>
</tr>
<tr>
<td>Communication protocol</td>
<td>Unique specifications. Refer to User’s Manual (manual number: E596-E1) for details.</td>
</tr>
</tbody>
</table>

#### Operation mode

<table>
<thead>
<tr>
<th>Operation mode</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard mode</td>
<td>Turn on the HDR function *8, and calculate the distance from two measurements.</td>
</tr>
<tr>
<td>High-speed mode</td>
<td>Turn off the HDR function *8, and calculate the distance from one measurement.</td>
</tr>
</tbody>
</table>

*8. HDR function: A function that changes the shutter speed and performs the measurement multiple times.
**Product information**

**B5L 3D TOF Sensor Module**
- **Datasheet**
- **User’s Manual**

**Photomicrosensors Selection Guide**
- **Catalog No. Y211-E1**

**Light Convergent Reflective Sensor**
- **Catalog No. E589-E1**

**Sensors Selector Guide**
- **Catalog No. Y232-E1**

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