**Ultra-compact and Amplifier Built-in Type**

**Features**
- Ultra-slim width of only 7.2mm
- W7.2×H24.6×L9.5mm (through-beam type)
- W7.2×H18.6×L10.8mm (retroreflective type, convergent reflective type)
- Detection methods and minimum target size
  - Through-beam type (BTS1M): Ø2mm
  - Retroreflective type (BTS200): Ø2mm (at distance 100mm)
  - Convergent reflective type (BTS15/BTS30):
    - Ø0.15mm (at distance 10mm)
- Detecting distance may vary by environmental factors
- Maximum detection distance: 1m (through-beam type)
- Stability indicator (red LED) and operation indicator (green LED)
- Stainless steel 304 mounting brackets
- IP67 protection structure (IEC standard)

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>NPN open collector output</th>
<th>PNP open collector output</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTS1M-TDTL</td>
<td>BTS1M-TDTL-P</td>
<td>BTS1M-TDTL-P</td>
</tr>
<tr>
<td>BTS15-LDTL</td>
<td>BTS15-LDTL-P</td>
<td>BTS15-LDTL-P</td>
</tr>
<tr>
<td>BTS200-MDTL</td>
<td>BTS200-MDTL-P</td>
<td>BTS200-MDTL-P</td>
</tr>
<tr>
<td>BTS200-MDTL</td>
<td>BTS200-MDTL-P</td>
<td>BTS200-MDTL-P</td>
</tr>
<tr>
<td>BTS30-LDTL</td>
<td>BTS30-LDTL-P</td>
<td>BTS30-LDTL-P</td>
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</tr>
</tbody>
</table>

| Sensing type | Through-beam type | Retroreflective type | Convergent reflective type |
| Sensing distance | 1m | 10 to 200mm | 5 to 30mm | 5 to 15mm |
| Sensing target | Ø2mm | Opaque material of max. Ø27mm | Opaque material of max. Ø27mm |
| Min. sensing target | Ø2mm | Opaque material of Ø22mm (sensing distance 100mm) | Ø22mm (sensing distance 100mm) |
| Hysteresis distance | — | — | — |

| Remarks |
|——|

- Maximum detection distance: 1m (through-beam type)
- Sensing distance: 10 to 200mm (retroreflective type)
- Sensing distance: 5 to 15mm (convergent reflective type)
- Hysteresis distance: max. 1ms (in case of through-beam type)
- Hysteresis distance: max. 1ms (in case of retroreflective type)
- Hysteresis distance: max. 1ms (in case of convergent reflective type)

**Environmental conditions**
- Ambience: Temp: 0°C to 55°C, RH: 35% to 85%
- Temperature or humidity mentioned in Environment indicates a non freezing or condensation.

**Power and Signal**
- Power supply: 12-24VDC ±10% (ripple P-P: max. 10%)
- Current consumption: Max. 20mA (in case of through-beam type, this value is for each emitter and receiver)
- Light source: Red LED (650nm)
- Dirt voltage: max. 26.4VDC
- Load current: max. 50mA
- Residual voltage - NPN: max. 1VDC, PNP: max. 2VDC

**Connection**
- Connection type: Cable type
- Cable: Over 20MΩ (at 500VDC megger)

**Noise immunity**
- ±240V for the square wave noise (pulse width: 1μs) by the noise simulator

**Dielectric strength**
- 1.000VAC 50/60Hz for 1 min

**Vibration**
- 1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours

**Shock**
- 500m/s² (approx. 50G) in each X, Y, Z direction for 3 times

**Noise immunity**
- ±240V for the square wave noise (pulse width: 1μs) by the noise simulator

| Ambient illumination | Sunlight: max. 10,000lx, incandescent lamp: max. 3,000lx (receiver illumination) |
| Ambient temperature | -20 to 55°C, storage: -30 to 70°C |
| Ambient humidity | 35 to 85%RH, storage: 35 to 85%RH |

**Protection structure**
- IP67 (IEC standard)

**Material**
- Case: polybutylene terephthalate, sensing part: polymethyl methacrylate, bracket: stainless steel 304, Bolt: carbon steel wire for cold heading (SWCH10A)

**Cable**
- Ø2.5mm, 3-wire, 2m (emitter of through-beam type: Ø2.5mm, 2-wire, 2m)
  - AWG 28, core wire diameter: 0.08mm, number of cores: 19, insulator outer diameter: Ø0.9mm

**Accessory**
- Bracket A: 2, sub-bracket for through-beam type, M2 bolt: 2
- Bracket A: 2, sub-bracket for reflective type, M2 bolt: 2

**Approval**
- Weight (±1mm)
  - BTS1M-TDTL: Approx. 65g (approx. 40g)
  - BTS15-LDTL: Approx. 45g (approx. 25g)

※1: The sensing distance is specified with using the MS-6 reflector.

When using reflective tapes, the Reflectivity vary by the size of the tape.

Please refer to the 'Reflectivity by Reflective Tape Model' table before using the tape.

※2: Non-glossy white paper 50×50mm.

※3: It will vary by the installation environment and sensing conditions.

Please refer to the 'Conditions of min. sensing target and installations (retroreflective type)'.

※4: The weight includes packaging. The weight in parenthesis is for unit only.

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.
### Feature Data

#### Through-beam type
- BTS1M-TDTL / BTS1M-TDTL-P

<table>
<thead>
<tr>
<th>Parallel shifting characteristic</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring method</td>
<td></td>
</tr>
</tbody>
</table>

#### Reflective type
- BTS200-MDTD / BTS200-MDTD-P

<table>
<thead>
<tr>
<th>Parallel shifting characteristic</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring method</td>
<td></td>
</tr>
</tbody>
</table>

### Retroreflective type
- BTS200-MDTD / BTS200-MDTD-P

<table>
<thead>
<tr>
<th>Sensor angle characteristic</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring method</td>
<td></td>
</tr>
</tbody>
</table>

#### Reflector angle characteristic
- Reflector (MS-6)

<table>
<thead>
<tr>
<th>Reflective type</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring method</td>
<td></td>
</tr>
</tbody>
</table>

### Convergent reflective type
- BTS30-LDTL / BTS30-LDTL-P

<table>
<thead>
<tr>
<th>Sensing area characteristic</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring method</td>
<td></td>
</tr>
</tbody>
</table>

#### Reflector angle characteristic
- Reflector (MS-6)

<table>
<thead>
<tr>
<th>Reflective type</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring method</td>
<td></td>
</tr>
</tbody>
</table>

### Sensing area characteristic
- BTS15-LDTL / BTS15-LDTL-P

<table>
<thead>
<tr>
<th>Sensing area characteristic</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring method</td>
<td></td>
</tr>
</tbody>
</table>
**Ultra-compact and Amplifier Built-in Type**

### Connections

- **Through-beam type**

  ![Before](https://via.placeholder.com/150)

  - **<Emitter>**
  - **<Sensing target>**
  - **<Receiver>**

  ![After](https://via.placeholder.com/150)

  ※1: Load connection for NPN output  
  ※2: Load connection for PNP output

- **Retroreflective type**

  ![Before](https://via.placeholder.com/150)

  - **<Reflector (MS-6) or Reflective tape (MST Series)>**

  ![After](https://via.placeholder.com/150)

- **Convergent reflective type**

  ![Before](https://via.placeholder.com/150)

  - **<Sensing target>**

### Control Output Circuit Diagram

- **NPN open collector output**

  ![Before](https://via.placeholder.com/150)

  - **Photoelectric sensor circuit**
  - **Connection**

  ![After](https://via.placeholder.com/150)

  ※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

- **PNP open collector output**

  ![Before](https://via.placeholder.com/150)

  - **Photoelectric sensor circuit**
  - **Connection**

### Operation Mode

<table>
<thead>
<tr>
<th>Operation mode</th>
<th>Light ON</th>
<th>Dark ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver operation</td>
<td>Received light</td>
<td>Received light</td>
</tr>
<tr>
<td></td>
<td>Interrupted light</td>
<td>Interrupted light</td>
</tr>
<tr>
<td>Operation indicator (red LED)</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Transistor output</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>
### BTS Series

#### Operating Timing Diagram

![Operating Timing Diagram](image)

※The waveforms of “Operation indicator” and “Transistor output” are for Light ON operation. They are reversed for Dark ON operation.

#### Dimensions

- **Through-beam type**

![Dimensions Through-beam type](image)

- **Retroreflective/Convergent reflective type**

![Dimensions Retroreflective/Convergent reflective type](image)
Ultra-compact and Amplifier Built-in Type

● Bracket A

● Bracket B (sold separately)

● Sub-bracket for through-beam type

● Sub-bracket for reflective type

※The sub-bracket for each sensing type is included bracket A (B).

● Reflector (MS-6)

● Slit (BTS1M-ST, sold separately)

● Slit (BTS1M-ST-T, sold separately)

● Reflective tape (sold separately)

<table>
<thead>
<tr>
<th>Model</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MST-50-10</td>
<td>50</td>
</tr>
<tr>
<td>MST-100-5</td>
<td>100</td>
</tr>
<tr>
<td>MST-200-2</td>
<td>200</td>
</tr>
</tbody>
</table>

(unit: mm)

Atonics
When installing the product, tighten the screw with a tightening torque of 0.3N·m. When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference. Exercise caution. Do not apply excessive impact to the unit or bend the cable section. The inside unit may be wet.

1) Make sure that the sensing side of this sensor is parallel to the surface of each object.

2) Make sure to install the sensor after carefully considering the moving direction of the sensing objects. Refer to the illustration below:

- **Cautions during installation of convergent reflective type**
- **Retroreflective type**
- **Convergent reflective type**

**Optical axis adjustment**

- **Through-beam type**
  Set the emitter and the receiver facing each other. Adjust the emitter or the receiver up, down, left, right and fix the unit at the center point of where the stability indicator is operating.

- **Retroreflective type**
  Place the sensor and the reflector (MS-6) or reflective tape facing each other. Adjust the reflector up, down, left, right and fix the reflector at the center position where the stability indicator is operating. Make sure that the sensing side of the sensor is parallel to the surface of the reflector.

- **Convergent reflective type**
  Place the sensing target, then adjust the sensor up, down, left, right and fix the sensor at the center position where the stability indicator is operating. Make sure that the sensing side of the sensor is parallel to the surface of each object.

※ Please use reflective tape (MST Series) for where a reflector is not installed.
Ultra-compact and Amplifier Built-in Type

**Conditions of min. sensing target and installations (retroreflective type)**

When installing the retroreflective photoelectric sensor, be sure to check the moving direction of sensing targets. Please refer to the [Figure 1, 2].

As the [Figure 3], please consist the center between the sensor and the reflector (MS-6) or reflective tape, and check the stable Light ON operations (operation (red) / stability (green) indicators turn ON). Min. sensing target is detected 100mm away from the sensor (example).

[Figure 1]

[Figure 2]

[Figure 3]

※The size of minimum sensing target will vary by the installation environment of the reflector (MS-6) and the sensing position and material of the sensing target.

**Reflectivity by Reflective Tape Model**

<table>
<thead>
<tr>
<th>Slit Ø</th>
<th>Applied condition</th>
<th>Min. sensing target</th>
<th>Max. sensing distance</th>
<th>Feature data number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø1</td>
<td>Applied</td>
<td>Opake materials of Ø1.6</td>
<td>500mm</td>
<td>①</td>
</tr>
<tr>
<td>Ø0.5</td>
<td>Applied</td>
<td>Opake materials of Ø1.2</td>
<td>300mm</td>
<td>③</td>
</tr>
<tr>
<td></td>
<td>Applied</td>
<td>Opake materials of Ø0.8</td>
<td>100mm</td>
<td>③</td>
</tr>
</tbody>
</table>

※This reflectivity is based on the reflector (MS-6).
※Reflectivity may vary depending on usage environment and installation conditions.

The sensing distance and minimum sensing target size increase as the size of the tape increases. Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.