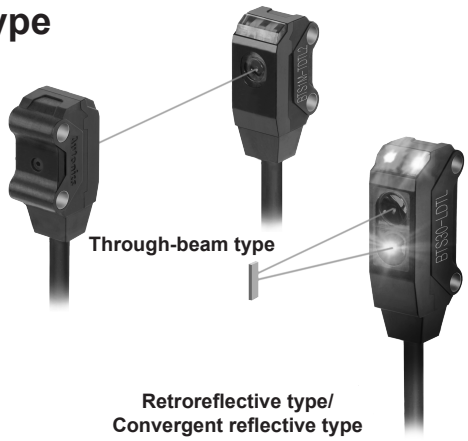
# Ultra-compact and Amplifier Built-in Type

## ▣ Features

- Ultra-slim width of only 7.2mm
  - W7.2×H18.6×L9.5mm (through-beam type)
  - W7.2×H24.6×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)

**Please read "Safety Considerations" in the instruction manual before using.**




## ▣ Specifications

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model | NPN open collector output | BTS1M-TDTL | BTS1M-TDTD | BTS200-MDTL | BTS200-MDTD | BTS30-LDTL | BTS30-LDTD | BTS15-LDTL | BTS15-LDTD |
| | PNP open collector output | BTS1M-TDTL-P | BTS1M-TDTD-P | BTS200-MDTL-P | BTS200-MDTD-P | BTS30-LDTL-P | BTS30-LDTD-P | BTS15-LDTL-P | BTS15-LDTD-P |
| Sensing type | | Through-beam type | | Retroreflective type | | Convergent reflective type | | | |
| Sensing distance | | 1m | | 10 to 200mm※1 | | 5 to 30mm※2 | | 5 to 15mm※2 | |
| Sensing target | | Opaque material of max. Ø2mm | | Opaque material of max. Ø27mm | | Opaque material, Translucent materials | | | |
| Min. sensing target | | Opaque material of Ø2mm | | Opaque material of Ø2mm※3 (sensing distance 100mm) | | Ø0.15mm (sensing distance 10mm) | | | |
| Hysteresis distance | | — | | — | | Max. 15% of maximum sensing distance | | | |
| Response time | | Max. 1ms | | | | | | | |
| 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) | | | | | | | |
| Operation mode | | Light ON | Dark ON | Light ON | Dark ON | Light ON | Dark ON | Light ON | Dark ON |
| Control output | | NPN or PNP open collector output<br>·Load voltage: max. 26.4VDC⎓ ·Load current: max. 50mA ·Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2VDC | | | | | | | |
| Protection circuit | | Power reverse polarity protec ion circuit, output short over current protec ion circuit | | | | | | | |
| Indicator | | Operation indicator: red LED, stability indicator: green LED | | | | | | | |
| Connection | | Cable type | | | | | | | |
| Insulation resistance | | Over 20MΩ (at 500VDC megger) | | | | | | | |
| Noise immunity | | ±240V the square wave noise (pulse width: 1㎲) 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 | | | | | | | |
| Environment | Ambient illumination | Sunlight: max. 10,000lx, incandescent lamp: max. 3,000lx (receiver illumination) | | | | | | | |
| | Ambient temperature | -20 to 55℃, storage: -30 to 70℃ | | | | | | | |
| | Ambient humidity | 35 to 85%RH, storage: 35 to 85%RH | | | | | | | |
| Protec ion 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 out diameter: Ø0.9mm) | | | | | | | |
| Accessory | | Bracket A: 2, sub-bracket for through-beam type: 2, M2 bolt: 4 | | Reflector (MS-6),bracket A, Sub-bracket for reflective type, M2 bolt: 2 | | Bracket A, sub-bracket for reflective type, M2 bolt: 2 | | | |
| Approval | | CE | | | | | | | |
| Weight※4 | | Approx. 65g (approx. 40g) | | Approx. 45g (approx. 25g) | | | | | |

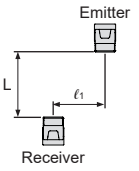
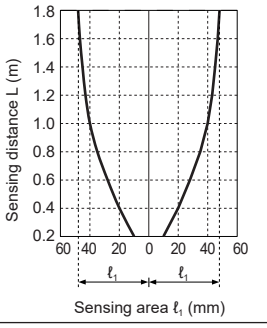
※1: The sensing distance is specified with using the MS-6 reflector.
When using reflective tapes, the Reflectivity vary by the size of the tape.
Please refer to the '▣ Reflectivity by Reflective Tape Model' table before using the tape.
※2: Non-glossy white paper 50×50mm.
※3: It will vary by the installation 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**

Parallel shifting characteristic

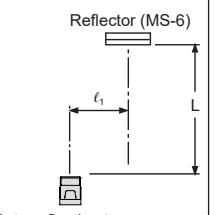
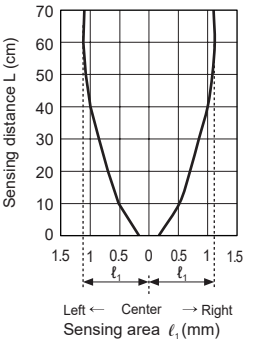
| Measuring method | Data |
|---|---|
|  |  |



### ◎ Retroreflective type

**• BTS200-MDTD / BTS200-MDTD-P**

Parallel shifting characteristic

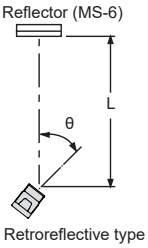
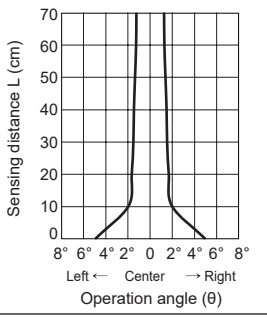
| Measuring method | Data |
|---|---|
|  |  |



### ◎ Retroreflective type

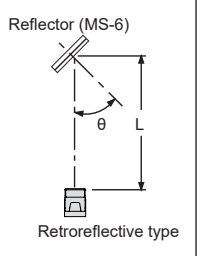
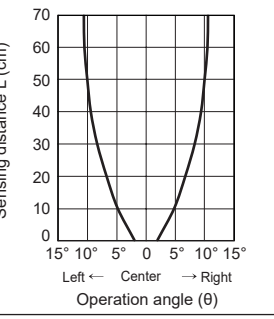
**• BTS200-MDTD / BTS200-MDTD-P**

Sensor angle characteristic

| Measuring method | Data |
|---|---|
|  |  |



Reflector angle characteristic

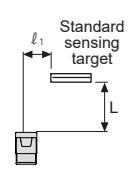
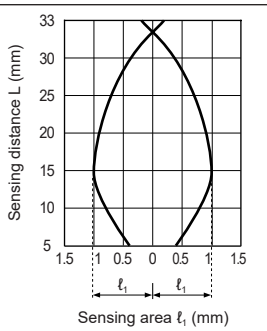
| Measuring method | Data |
|---|---|
|  |  |



### ◎ Convergent reflective type

**• BTS30-LDTL / BTS30-LDTL-P**

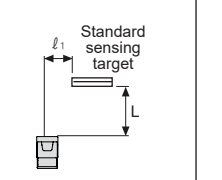
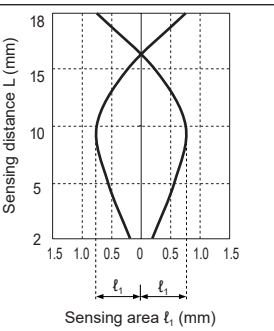
Sensing area characteristic

| Measuring method | Data |
|---|---|
|  |  |



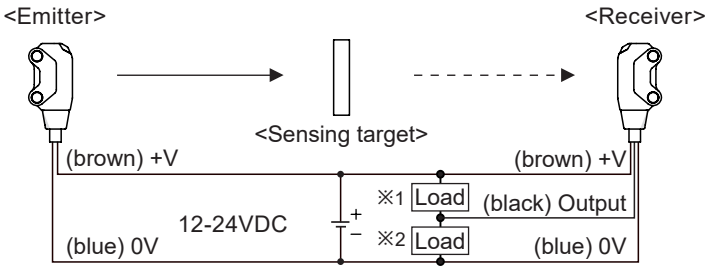
**• BTS15-LDTL / BTS15-LDTL-P**

Sensing area characteristic

| Measuring method | Data |
|---|---|
|  |  |

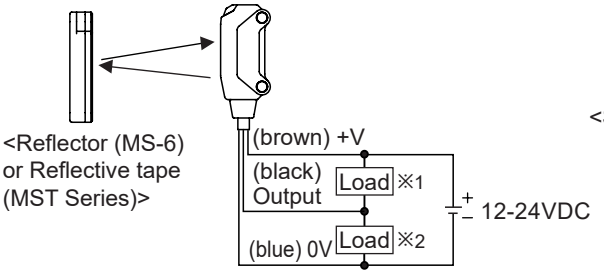
## ▣ Connections

**• Through-beam type**

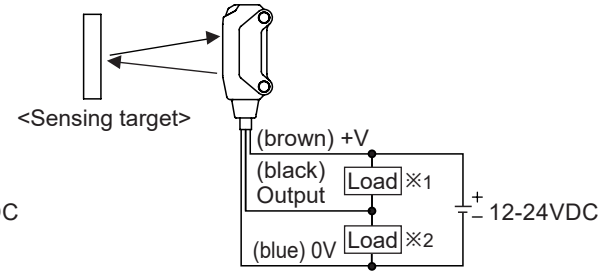



※1: Load connection for NPN output
※2: Load connection for PNP output

**• Retroreflective type**

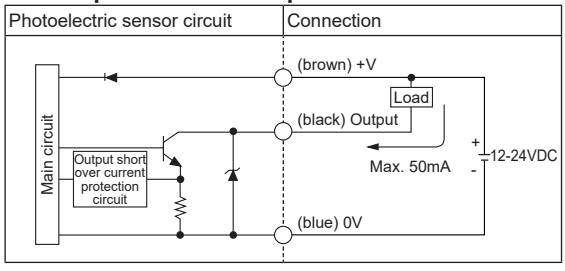



**• Convergent reflective type**

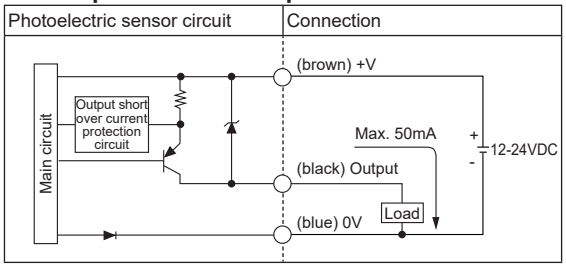



## ▣ Control Output Circuit Diagram

**• NPN open collector output**




**• PNP open collector output**

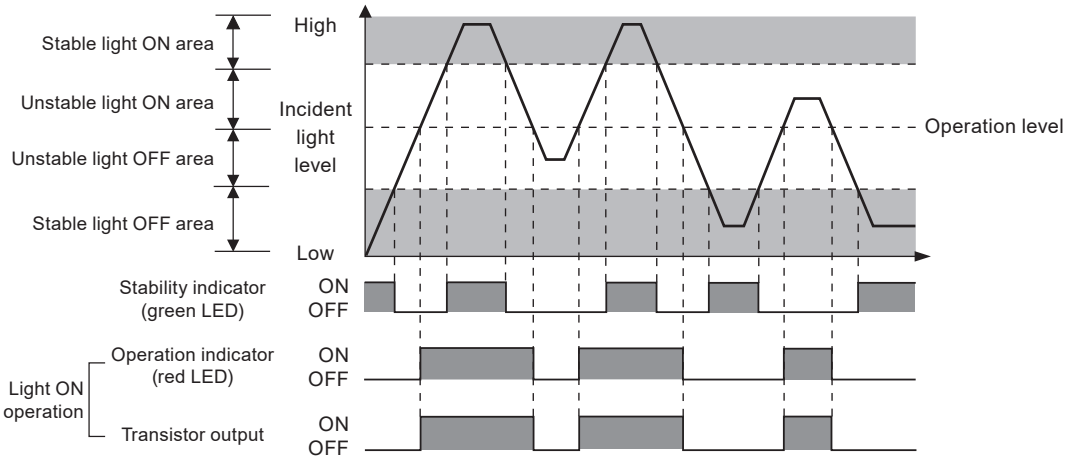



※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

## ▣ Operation Mode

| Operation mode | Light ON | Dark ON |
|---|---|---|
| Receiver operation | Received light / Interrupted light | Received light / Interrupted light |
| Operation indicator (red LED) | ON / OFF | ON / OFF |
| Transistor output | ON / OFF | ON / OFF |

## ▣ Operating Timing Diagram

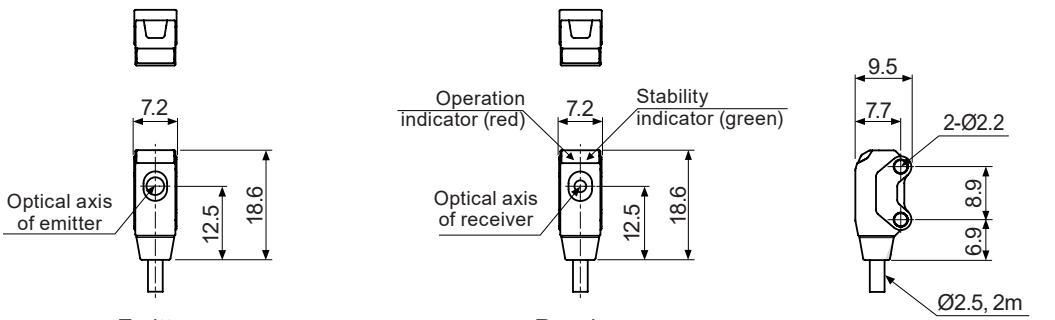



※The waveforms of “Operation indicator” and “Transistor output” are for Light ON operation.
They are reversed for for Dark ON operation.

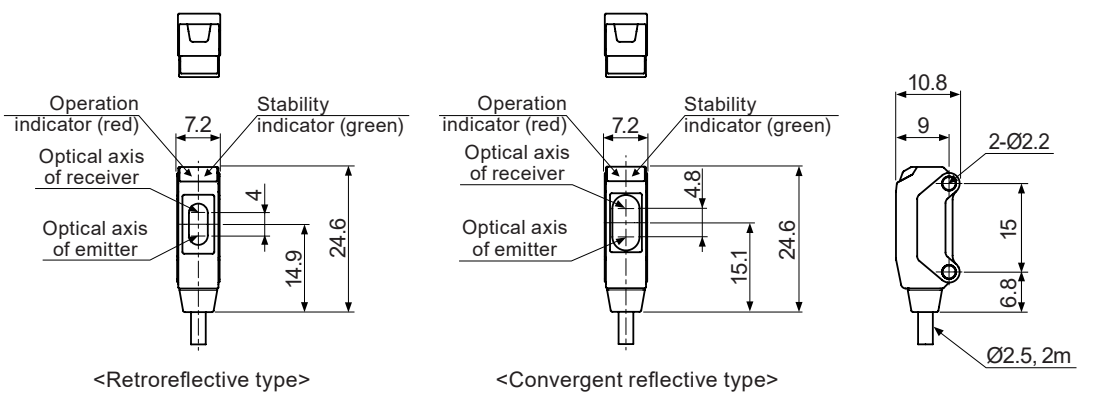
## ▣ Dimensions

(unit: mm)

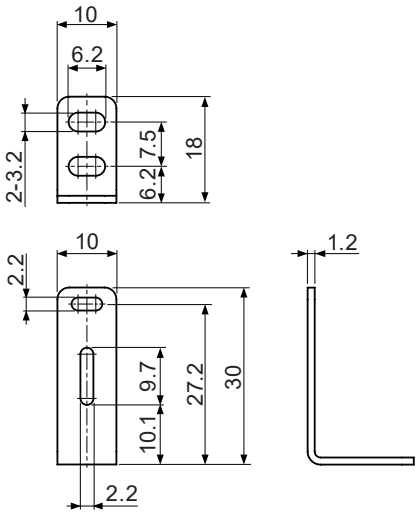
● **Through-beam type**



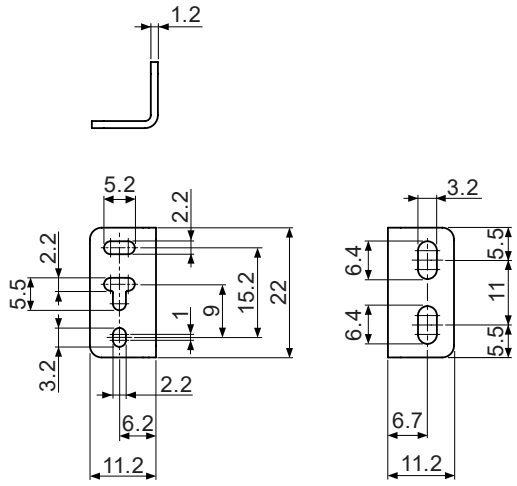

● **Retroreflective/Convergent reflective type**



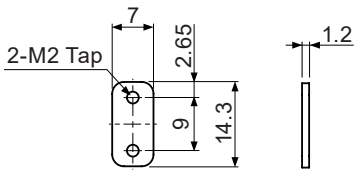
● **Bracket A**



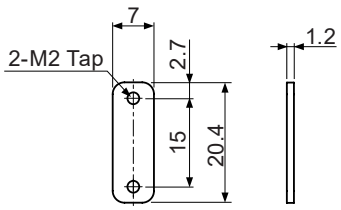

● **Bracket B (sold separately)**




● **Sub-bracket for through-beam type**

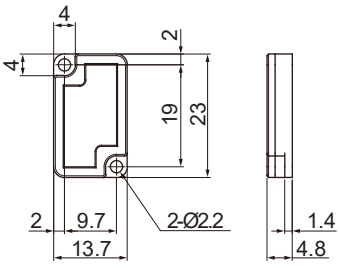



● **Sub-bracket for reflective type**

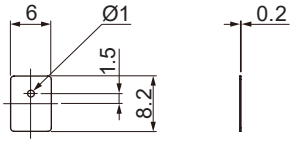



※The sub-bracket for each sensing type is included bracket A (B).

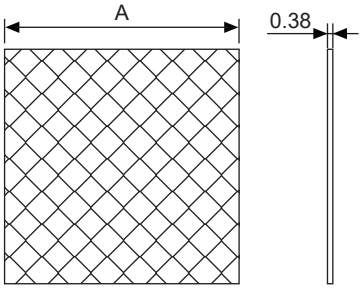
● **Reflector (MS-6)**




● **Slit (BTS1M-ST, sold separately)**



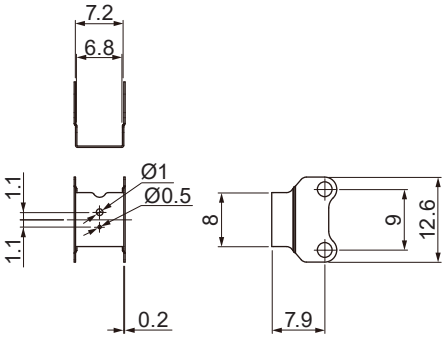

● **Reflective tape (sold separately)**




(unit: mm)

| Model | A |
|---|---|
| MST-50-10 | □50 |
| MST-100-5 | □100 |
| MST-200-2 | □200 |

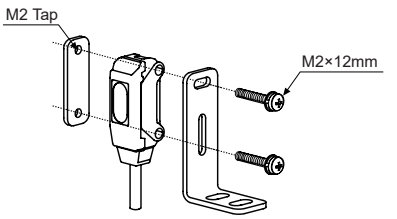
● **Slit (BTS1M-ST-T, sold separately)**



## ▣ Mounting and Sensitivity Adjustment

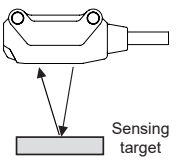
### ◎ Installation

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.

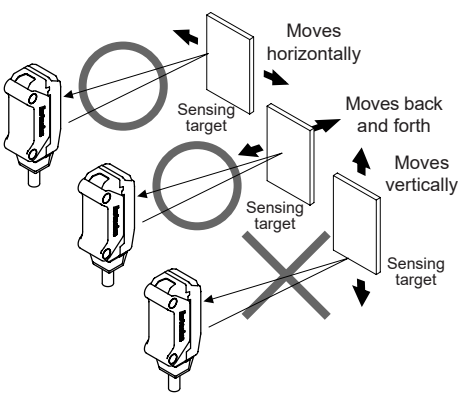



**※Cautions during installation of convergent reflective type**

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



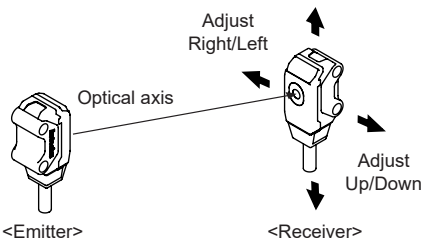

2)Make sure to install the sensor after carefully considering the moving direction of the sensing objects. Refer to the illustration below:




### ◎ Optical axis adjustment

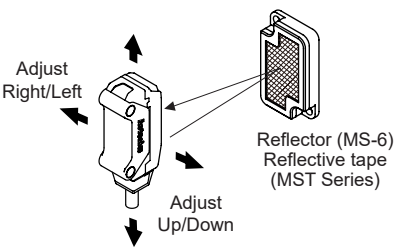
#### ● Through-beam type

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

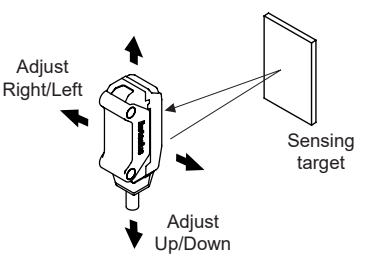
Place the sensor and the reflector (MS-6) or reflective tape facing each other. Adjust the reflector up, down, left, right and fix the reflector at the center position where the stability indicator is operating.
Make sure that the sensing side of the sensor is parallel to the surface of the reflector.




※Please use reflective tape (MST Series) for where a reflector is not installed.

#### ● Convergent reflective type

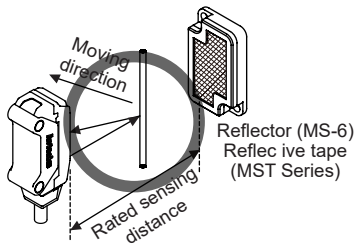
Place the sensing target, then adjust the sensor up, down, left, right and fix the sensor at the center position where the stability indicator is operating.
Make sure that the sensing side of the sensor is parallel to the surface of each object.



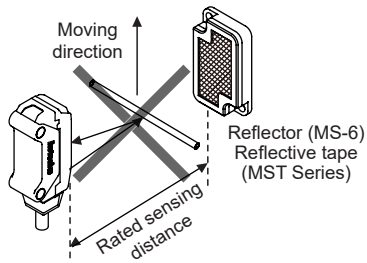
## ◎ Conditions of min. sensing target and installations (retroreflective type)

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).

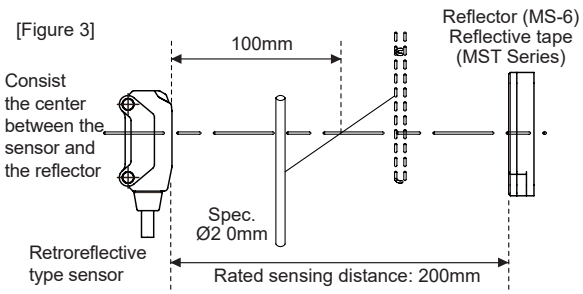
[Figure 1]




[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

| | |
|---|---|
| MST-50-10 (50×50mm) | 95% |
| MST-100-5 (100×100mm) | 100% |
| MST-200-2 (200×200mm) | 100% |

※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.

## ▣ Accessory (sold separately)

### • BTS1M-ST

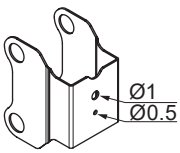
Ø1

※This slit is for BTS1M-TDT□-□ only.
Attach only to the emitter to use.
※4 pieces are packed and sold separately.
※This slit is sticker for attachment, please remove the dirt on lens of photoelectric sensor before using it. After attaching the slit, remove the front protection film.

※Min. sensing target and max. sensing distance by Ø of the slit when attach the slit at an emitter.

| Slit Ø | Min. sensing target | Max. sensing distance |
|---|---|---|
| Ø1 | Opaque materials of min. Ø1.6 | 500mm |

### • BTS1M-ST-T

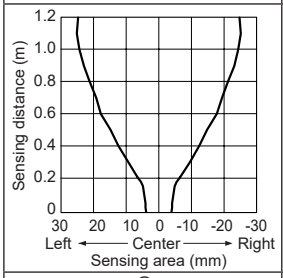



※This slit is for BTS1M-TDT□-□ only.
※This slit can be used in Ø1 or Ø0.5 by its installation direction.
※2 pieces are packed and sold separately.
※This slit is made of SUS. After covering the product with the slit, fix them with the bolts and sub-bracket.

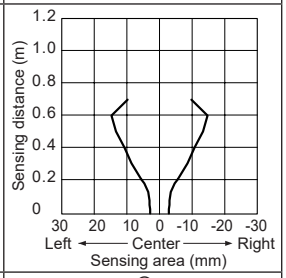
※Min. sensing target and max. sensing distance by Ø of the slit

| Slit Ø | Applied condition | | Min. sensing target | Max. sensing distance | Feature data number |
|---|---|---|---|---|---|
| | Emitter | Receiver | | | |
| Ø1 | Applied | — | Opaque materials of min. Ø1.6 | 500mm | ① |
| | — | Applied | | | |
| | Applied | Applied | Opaque materials of min. Ø1.2 | 300mm | ② |
| Ø0.5 | Applied | — | Opaque materials of min. Ø1.2 | 300mm | ③ |
| | — | Applied | | | |
| | Applied | Applied | Opaque materials of min. Ø0.8 | 100mm | ④ |

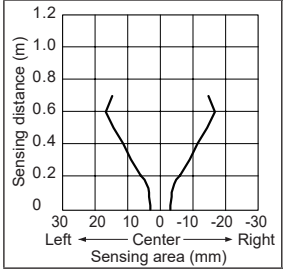
Feature data ①




Feature data ②




Feature data ③




Feature data ④