Autonics



W 7.2 mm Photoelectric Sensors

BTS Series

PRODUCT MANUAL

Be sure to follow the instructions and precautions in the instruction manual, other manuals, and the Autonics website.
The specifications, dimensions, and other information in this document are subject to change without notice for product improvement.
Certain models may be discontinued without notice.

Safety Precautions

- 'Safety Precautions' are provided to ensure safe and proper use of the product and to prevent accidents or hazards. Please make sure to follow them carefully.
- ⚠ symbol indicates a caution, warning of potential hazards under certain conditions.

⚠ Warning Failure to follow instructions may result in serious injury or death.

01. Fail-safe device must be installed when using the product in applications that may cause serious injuries or property loss. (E.g. nuclear control systems, medical equipment, ships, vehicles, railroads, aircraft, combustion devices, safety devices, security systems, disaster prevention devices, etc.)
Failure to do so may result in personal injury, property loss or fire.

02. Do not use or store the product in environments containing flammable, explosive, or corrosive gases, or in places exposed to high humidity, direct sunlight, radiant heat, vibration, shock, or salt.
Failure to do so may result in explosion or fire.

03. Do not disassemble, repair, or modify the product without authorization.
Failure to do so may result in fire.

04. Do not connect, repair, or inspect the product while connected to a power source.
Failure to do so may result in fire.

05. Check the connection diagram before wiring.
Failure to do so may result in fire.

⚠ Caution Failure to follow instructions may result in injury or product damage.

01. Use the product within its rated specifications and performance limits.
Failure to do so may result in fire or product damage.

02. Use a dry cloth to clean the product. Do not use water or organic solvents.
Failure to do so may result in fire.

Cautions During Use

- Make sure to follow the instructions in 'Cautions During Use'. Failure to do so may result in unexpected accidents.
- When connecting inductive loads such as DC relays or solenoid valves use a diode, varistor, or similar component to suppress surges.
- Wait at least 0.3 seconds after applying power before using the product. When using separate power supplies for sensor and load, apply power to the sensor first.
- Power input should be supplied from an isolated and limited voltage/current source, or from a Class 2 or SELV power supply.
- To prevent surges and inductive noise, separate the wiring from high-voltage and power lines, and keep wiring lengths as short as possible.
- When supplying power with an SMPS, ground the F.G. terminal and connect a noise suppression capacitor between the 0 V and F.G. terminals.
- When using the product with noise-generating devices (e.g. switching regulators, inverters, servo motors, etc.), make sure to ground the F.G. terminal of the unit.
- This product may be used in the following environmental conditions.
  - Indoors (UL Type 1 Enclosure)
  - Altitude: up to 2,000 m
  - Pollution Degree 3
  - Installation Category II

Product Components

- Product, instruction manual
- [Through-beam] Brackets × 2, Sub-brackets × 2, M2 bolt × 4
- [Polarized retroreflective] Reflector (MS-6), Bracket, Sub-bracket, M2 bolt × 2
- [Diffuse / BGS reflective] Bracket, Sub-bracket, M2 bolt × 2

Ordering Information

For reference only. The actual product does not support all combinations.
To check all supported models, please refer to the Autonics website.

BTS ❶ - ❷ ❸ ❹ ❺ ❻ - ❼ - ❽ - ❾

❶ Sensing distance
Number: Sensing distance (unit: mm)
Number+M: Sensing distance (unit: m)

❷ Sensing type
T: Through-beam
P: Polarized retroreflective
D: Diffuse reflective
G: BGS reflective

❸ Power supply
D: 10 - 30 VDC

❹ Output
T: Solid-state (transistor)

❺ Operation mode
L: Light ON
D: Dark ON

❻ Through-beam Emitter / Receiver 01)
No mark: Reflective type
1: Emitter
2: Receiver

❼ Connection type
No mark: Cable type
W: Cable connector type

❽ Control output
No mark: NPN open collector output
P: PNP open collector output

❾ Cable specification
No mark: General type
F: Flexible type

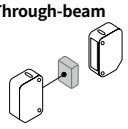
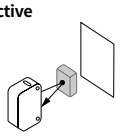
01) This model name is for through-beam photoelectric sensor management only and is not required when placing an order.

Sold Separately

- Reflector: MS Series
- Reflector tape: MST Series
- Connector cable: C□D(H)408-□, C□D(H)4-□EB
- Bracket: BK-BTS-□
- Sub-bracket: BK-BTS-SUB-□
- Slit for through-beam type:
  (round-shaped) ST-BTS-R0.5/1
  (rectangular-shaped) ST-BTS-S0.5

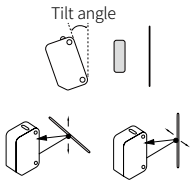
Cautions During Installation

- Be sure to install the product according to the operating environment, location, and specified ratings. Consider the following conditions.
  - Installation environment and background (reflected light)
  - Sensing distance and sensing target
  - Movement direction of sensing target
  - Sensor characteristic curves
- Check the mutual interference prevention values in the 'Specifications.' Installing multiple photoelectric sensors in close proximity may cause malfunctions due to mutual interference.
- Impact from hard objects, or excessive or repeated bending of the cable, may compromise the product's water-resistance.
- Test the sensor before use. Verify that the indicator operates correctly according to the presence or absence of the sensing target.

Through-beam	Retroreflective	Reflective
		
Emitter - Receiver: Install facing each other	Sensor - Reflector: Install facing each other, at least 10 mm apart (parallel with the sensing surface of the unit) Adjust the reflector up, down, left, and right and fix it at the center point of where the stability indicator operates.	Sensor - Sensing target: Install facing each other (parallel with the sensing surface of the unit) BGS reflective type: Recommended to move the sensing target horizontally or back and forth

Diffuse / BGS Reflective Type

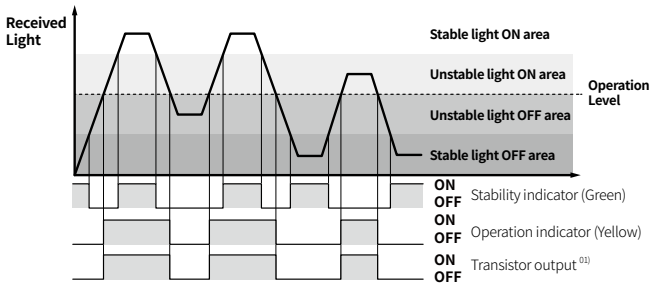
- When detecting glossy or mirror-like objects, install the sensor at an angle of 5 to 10°, and make sure that background objects do not affect detection.
- When detecting minimum sensing targets (copper wire or opaque objects), set the movement direction of the sensing target relative to the sensor. For stable detection, install the sensor or position the sensing target at an angle of 5 to 10°.



Operation Timing Chart and Indicators

■ Light ON Mode

- In Dark ON mode, the waveforms are reversed.



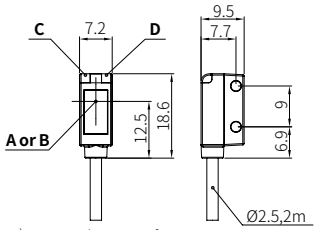
01) If the internal circuit is damaged or an overcurrent occurs, the control output will turn OFF, and the stability indicator will flash at 0.3 second intervals.

Dimensions

- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)
- Cable type shown as reference.
  Refer to the 'Specifications' section for details on the cable, wire, and connectors.

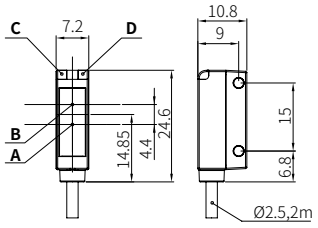
A	Emitter optical axis	C	Operation indicator (yellow)
B	Receiver optical axis	D	Stability indicator (green)

■ Through-Beam type 01)

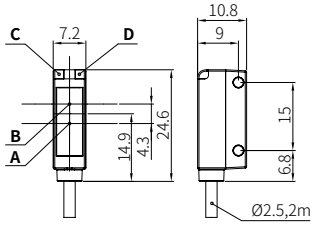


01) Receiver shown as reference.
The indicators are located only on the receiver.

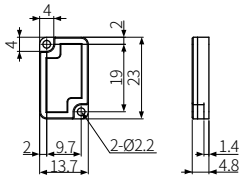
■ Diffuse, BGS Reflective Type



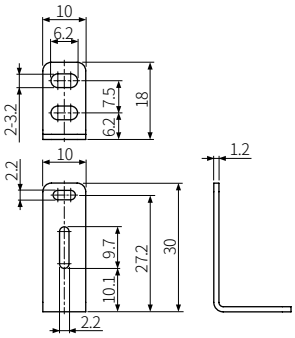
■ Polarized Retroreflective Type



■ Reflector (MS-6)

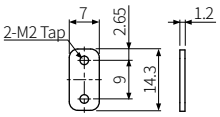


■ Bracket (BK-BTS-A)

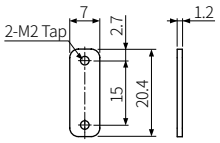


■ Sub-Bracket

- For through-beam type (BK-BTS-SUB-T)

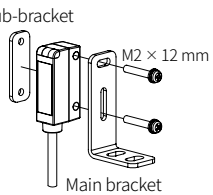


- For reflective type (BK-BTS-SUB-R)



Mounting to the Bracket

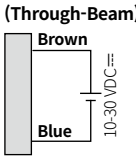
01. Align the mounting holes on the sensor with the included main bracket and sub-bracket.
02. Mount the sensor between the main and sub brackets using the included M2 bolts to prevent the sensors from optical axis distortion. (tightening torque: ≤ 0.3 N·m)



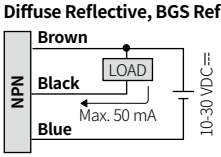
Connections

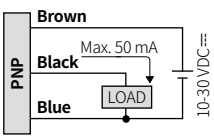
■ Cable Type

Emitter (Through-Beam)



Receiver (Through-Beam), Polarized Retroreflective, Diffuse Reflective, BGS Reflective

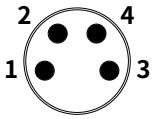




- The white wire of reflective type model is not used.

■ Cable Connector Type

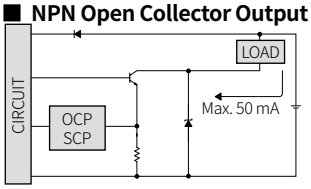
- For LOAD connection, refer to the cable type connection diagram.
- Tighten the connector completely so that the screw threads are not visible (tightening torque: ≤ 0.2 N·m)
- If subject to vibration, use PTFE tape to secure the connector and prevent it from loosening.
- Pins ② and ④ are not used (N.C.) on the through-beam type emitter.
- Pin ② is not used on the through-beam type receiver and reflective type models.



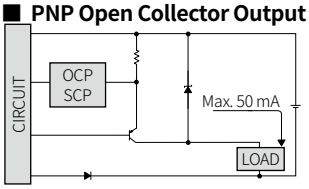
Pin	Color	Function
①	Brown	+V
②	White	N.C
③	Blue	0 V
④	Black	OUT

Circuit Diagram

■ NPN Open Collector Output



■ PNP Open Collector Output



- OCP (over-current protection), SCP (short-circuit protection)
- If the control output terminal is short-circuited or a current exceeding the rated current is supplied, normal control signals will not be output due to the protection circuit.

Specifications

Model	BTS□-TDT□-□-□			BTS□-PDT□-□-□
Sensing type	Through-beam			Polarized retroreflective
Sensing distance	500 mm	1 m	3 m	200 mm 01)
Sensing target	Opaque materials			Opaque materials
Min. sensing target	≥ Ø 2 mm 02)	≥ Ø 2 mm 02)	≥ Ø 3 mm 02)	≥ Ø 2 mm 03)
Response time	≤ 0.5 ms			≤ 0.5 ms
Light source type	Red LED			Red LED
Light source wavelength	650 nm			650 nm
Mutual interference prevention	-			≤ 4 units
Operation mode	Light ON, Dark ON models			
Indicator	Operation indicator (yellow), stability indicator (green)			
Certifications	CE UKCA cULus			CE UKCA cULus
Unit weight (with packaging)	≈ 40 g (≈ 65 g)			≈ 25 g (≈ 45 g)

01) Reflector (MS-6)
02) Rated sensing distance in 'Specifications'
03) Sensing distance 100 mm

Model	BTS□-DDT□-□-□	BTS□-GDT□-□-□		
Sensing type	Diffuse reflective	BGS reflective		
Sensing distance	200 mm 01)	1 to 15 mm 02)	1 to 30 mm 02)	3 to 50 mm 02)
Sensing target	Opaque materials, translucent materials			
Min. sensing target	≥ Ø 2 mm 03)	≥ Ø 0.1 mm 04)		
Hysteresis (% of sensing distance)	≤ 10%	≤ 5%	≤ 5%	≤ 10%
Black/white error	-	≤ 10% of sensing distance		
Response time	≤ 0.5 ms	≤ 0.7 ms		
Light source type	Red LED	Red LED		
Light source wavelength	650 nm	650 nm		
Mutual interference prevention	≤ 4 units	≤ 4 units		
Operation mode	Light ON, Dark ON models			
Indicator	Operation indicator (yellow), stability indicator (green)			
Certifications	CE UKCA cULus	CE UKCA cULus		
Unit weight (with packaging)	≈ 25 g (≈ 45 g)	≈ 25 g (≈ 45 g)		

01) Non-glossy white paper 100 × 100 mm
02) Non-glossy white paper 50 × 50 mm
03) Sensing distance 100 mm
04) Sensing distance 10 mm

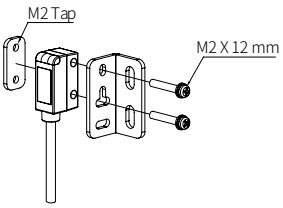
Power supply	10 - 30 VDC⎓ (ripple P-P: ≤ 10%)
Current consumption	Varies by sensing type
Through-beam type	Emitter: ≤ 10 mA, receiver: ≤ 20 mA
Reflective type	≤ 20 mA
Control output	NPN open collector output, PNP open collector output models
Load voltage	≤ 30 VDC⎓
Load current	≤ 50 mA
Residual voltage	NPN: ≤ 2 VDC⎓, PNP: ≤ 2 VDC⎓
Protection circuit	Reverse power protection circuit, output short overcurrent protection circuit, reverse output protection circuit
Insulation resistance	≥ 20 MΩ (500 VDC⎓ megger)
Noise immunity	Square-wave noise generated by noise simulator (pulse width: 1 μs) ±240 VDC⎓
Dielectric strength	Between charging part and case: 1,000 VAC~ 50/60 Hz for 1 min
Vibration resistance	1.5 mm double amplitude or 300 m/s² at frequency of 10 to 2,000 Hz in each X, Y, Z direction for 0.5 hours
Shock resistance	1000 m/s² (≈ 100 G) in each X, Y, Z direction for 3 times
Ambient illuminance (Receiver)	Sunlight: ≤ 10,000 lx, incandescent lamp: ≤ 5,000 lx
Ambient temperature	-25 to 55 °C, Storage: -30 to 70 °C (rated at no freezing or condensation)
Ambient humidity	35 to 85%RH, Storage: 35 to 85%RH (rated at no freezing or condensation)
Protection rating	IP67 (IEC standard)
Connection	Cable type, cable connector type models
Cable specifications	Ø 2.5 mm, emitter: 2-wire, receiver: 3-wire, reflective type: 4-wire
Cable length	Cable type: 2 m / Cable connector type: 300 mm
Wire specifications	AWG 28 (0.08 mm, 19 PCS)
Insulator diameter	Standard type: Ø 0.68 mm (2-wire, 3-wire, 4-wire) Flexible type: Ø 0.86 mm (2-wire), Ø 0.8 mm (3-wire), Ø 0.74 mm (4-wire)
Connector specification	M8 4-pin plug type
Material	Case: PC / sensing part: PMMA / bracket, bolt: stainless steel 304

Sold Separately: Bracket (BK-BTS-B)

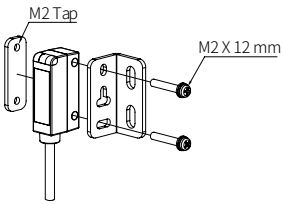
■ Mounting to the Bracket

01. Align the mounting holes on the sensor with the included main bracket and sub-bracket.
02. Mount the sensor between the main and sub brackets using the included M2 bolts to prevent the sensors from optical axis distortion. (tightening torque: ≤ 0.3 N·m)

• Through-beam

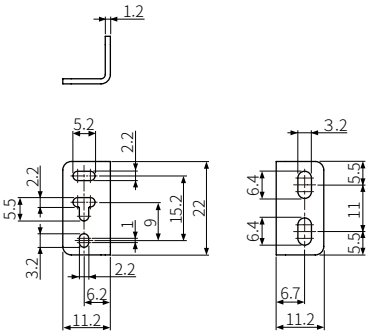


• Reflective



■ Dimensions

- Material: SUS304
- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)

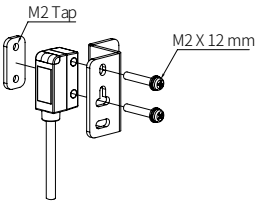


Sold Separately: Bracket (BK-BTS-C)

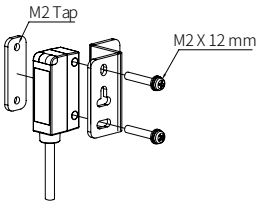
■ Mounting to the Bracket

01. Align the mounting holes on the sensor with the included main bracket and sub-bracket.
02. Mount the sensor between the main and sub brackets using the included M2 bolts to prevent the sensors from optical axis distortion. (tightening torque: ≤ 0.3 N·m)

• Through-beam

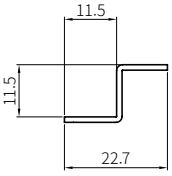


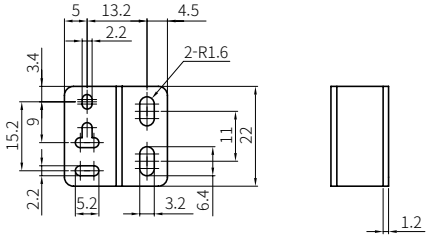
• Reflective



■ Dimensions

- Material: SUS304
- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)

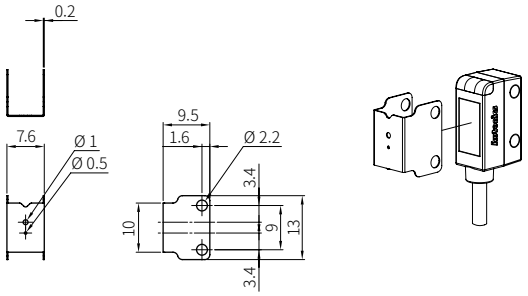




Sold Separately: Slit for Through-beam Type

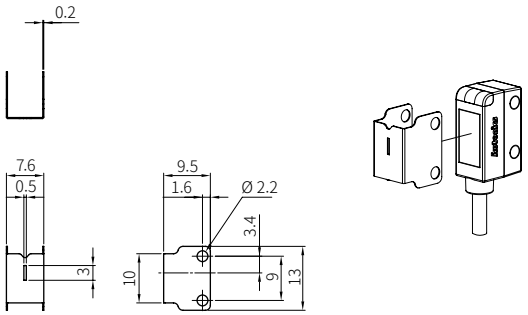
- Material: SUS301
- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)

■ Round-Shaped Slit: ST-BTS-R0.5/1



Slit size	Apply	Sensing distance			Min. sensing target		
		BTS500	BTS1M	BTS3M	BTS500	BTS1M	BTS3M
Ø 0.5 mm	Emitter	140 mm	190 mm	840 mm	Ø 2 mm		Ø 3 mm
	Emitter/ Receiver	30 mm	50 mm	150 mm	Ø 0.5 mm		
Ø 1 mm	Emitter	300 mm	400 mm	1400 mm	Ø 2 mm		Ø 3 mm
	Emitter/ Receiver	100 mm	160 mm	480 mm	Ø1 mm		

■ Rectangular-Shaped Slit: ST-BTS-S0.5



Slit size	Apply	Sensing distance			Min. sensing target		
		BTS500	BTS1M	BTS3M	BTS500	BTS1M	BTS3M
0.5×3 mm	Emitter	310 mm	420 mm	1540 mm	Ø 2 mm		Ø 3 mm
	Emitter/ Receiver	140 mm	210 mm	910 mm	0.5 × 3 mm		

Sold Separately: M8 Connector Cable

- For more information, refer to the M8/M12 Connector Cable product manual.

Appearance	Power	Connector 1	Connector 2	Length	Feature	Model
	DC	M8 (Socket-Female) 4-pin	4-wire	2 m	PVC	CID408-2
				5 m		CID408-5
	DC	M8 (Socket-Female) 4-pin	4-wire	2 m	Oil resistant PVC	CIDH408-2
				5 m		CIDH408-5
	DC	M8 (Socket-Female) 4-pin, L type	4-wire	2 m	PVC	CLD408-2
				5 m		CLD408-5
	DC	M8 (Socket-Female) 4-pin, L type	4-wire	2 m	Oil resistant PVC	CLDH408-2
				5 m		CLDH408-5

Appearance	Power	Connector 1	Connector 2	Length	Feature	Model
	DC	M8 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin	2 m	PVC, black	C1D4-2EB
				5 m		C1D4-5EB
	DC	M8 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin, L type	2 m	PVC, black	C2D4-2EB
				5 m		C2D4-5EB
	DC	M8 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin, L type	2 m	PVC, black	C3D4-2EB
				5 m		C3D4-5EB
	DC	M8 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin	2 m	PVC, black	C4D4-2EB
				5 m		C4D4-5EB

Appearance	Power	Connector 1	Connector 2	Length	Feature	Model
	DC	M8 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin	2 m	Oil resistant PVC, dark gray	C1DH4-2EB
				5 m		C1DH4-5EB
	DC	M8 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin, L type	2 m	Oil resistant PVC, dark gray	C2DH4-2EB
				5 m		C2DH4-5EB
	DC	M8 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin, L type	2 m	Oil resistant PVC, dark gray	C3DH4-2EB
				5 m		C3DH4-5EB
	DC	M8 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin	2 m	Oil resistant PVC, dark gray	C4DH4-2EB
				5 m		C4DH4-5EB

Sold Separately: Reflector (MS Series)

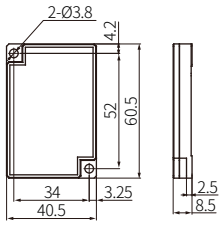
Appearance	Size (W × H)	Reflectance	Sensing type	Model
	40.5 × 60.5 mm	Typical reflectance	Retroreflective	MS-2
		Typical reflectance	Polarized retroreflective	MS-2A
		High reflectance	Polarized retroreflective	MS-2S
	81.5 × 60.5 mm	Typical reflectance	Retroreflective	MS-3
		High reflectance	Polarized retroreflective	MS-3S
	29.3 × 38 mm	Typical reflectance	Retroreflective	MS-4
	15.4 × 24 mm	Typical reflectance	Retroreflective	MS-5
	13.7 × 23 mm	Typical reflectance	Retroreflective	MS-6

- Material: PMMA / ABS (front part / rear part)
- Installation: Bolt mounting

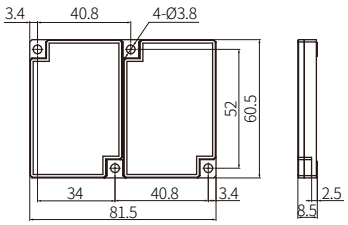
■ Dimensions

(Unit: mm)

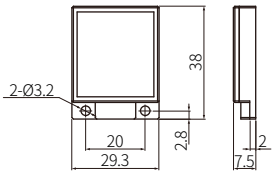
MS-2□



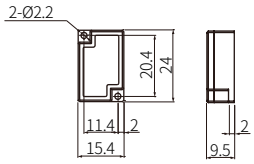
MS-3□



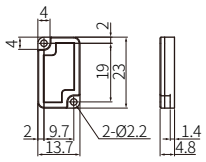
MS-4



MS-5



MS-6



■ Cautions During Installation

- Select a reflector size appropriate for the sensor's operating environment and installation space.
- Generally, a larger reflector provides a longer detection distance.
- Using a high-reflectance reflector increases the detection distance.
- Reflectance may vary depending on the sensor's operating conditions.

Sold Separately: Reflector Tape (MST Series)

Appearance	Size (W × H)	Packaged unit	Sensing type	Model
	50 × 50 mm	10	• Retroreflective • Polarized retroreflective	MST-50-10
	100 × 100 mm	5	• Retroreflective • Polarized retroreflective	MST-100-5
	200 × 200 mm	2	• Retroreflective • Polarized retroreflective	MST-200-2

- Material: PMMA / PC / Acrylic (surface film / prism layer / adhesive layer)
- Ambient temperature: -35 to 65 °C (temperature for adhesion: 10 to 30 °C)
- Installation: Tape cutting (installation distance: ≥ 20 mm)

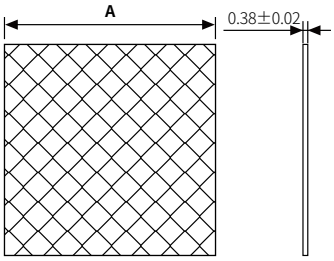
■ Effective Reflectance of MST Series

Series	Sensing type	MST-50-10	MST-100-5	MST-200-2
BTS	Retroreflective	130%	140%	150%
BM		70%	110%	170%
BMS		90%	120%	190%
BEN		90%	130%	140%
BX		90%	100%	110%
BJ/BJR/BJX	Polarized retroreflective	40%	60%	80%
BH		60%	80%	140%
BEN		70%	90%	120%
BX		30%	40%	60%
BRQ		40%	80%	90%
BRQP-B (short body)		40%	50%	80%
BRQPS (side sensing)		25%	30%	35%

- The values are relative measurements based on our standard mirrors set to 100%.
- The reflectance may decrease depending on the installation angle (angle of incidence) between the sensor optical axis and the mirror surface.

■ Dimensions

(Unit: mm)



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

■ Cautions During Installation

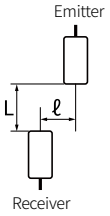
- Select a reflector tape size appropriate for the sensor's operating environment and installation space.
- Generally, a larger reflector tape provides a longer sensing distance.
- Check the reflectance of the reflector tape before use.
- Reflectance may vary depending on the sensor's operating conditions.
- Clean the surface where the reflector tape will be applied with a dry cloth before attachment.
- Avoid creasing or damaging the surface of the reflector tape.
- Clean regularly to maintain optimal performance.
  Use only neutral detergents, and avoid other chemical solvents.

Product Characteristics

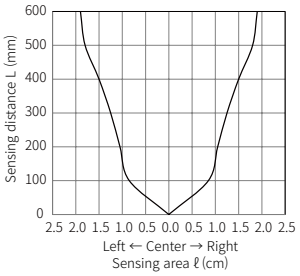
This data is based on internal testing and for reference only. Performance may vary by installation and usage environment. Product testing prior to use is recommended.

Through-Beam Type (TYPICAL)

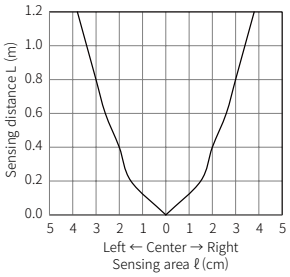
■ Detection Area



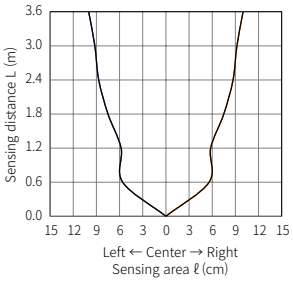
• BTS500-T



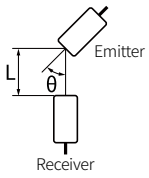
• BTS1M-T



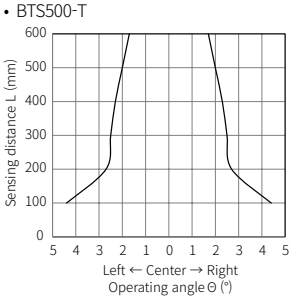
• BTS3M-T



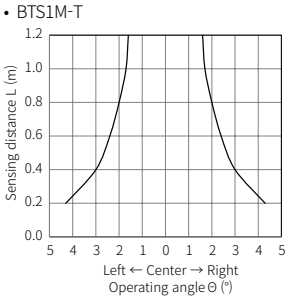
■ Emitter Angle



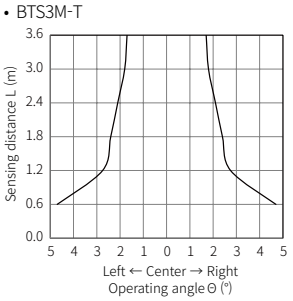
• BTS500-T



• BTS1M-T

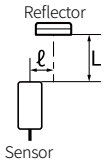


• BTS3M-T

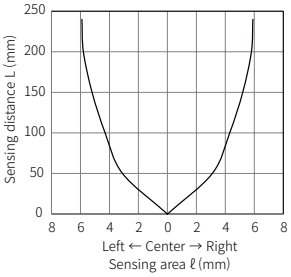


Polarized Retroreflective Type (TYPICAL)

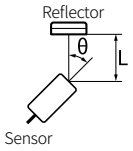
■ Detection Area



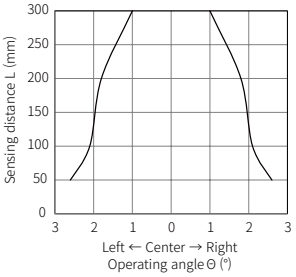
• BTS200-P



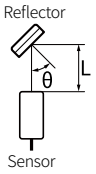
■ Sensor Angle



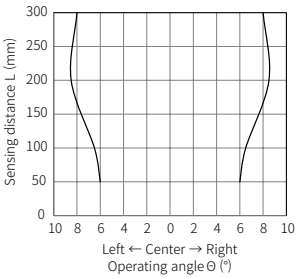
• BTS200-P



■ Reflector Angle

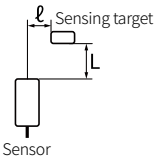


• BTS200-P

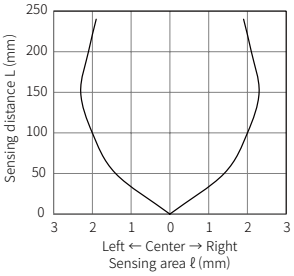


Diffuse Reflective Type (TYPICAL)

■ Detection Area

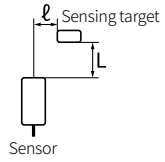


• BTS200-D

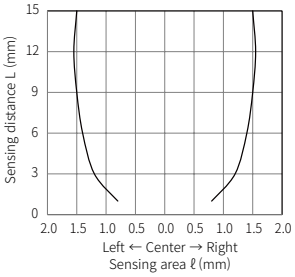


BGS Reflective Type (TYPICAL)

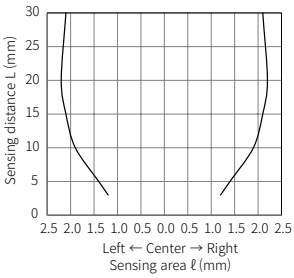
■ Detection Area



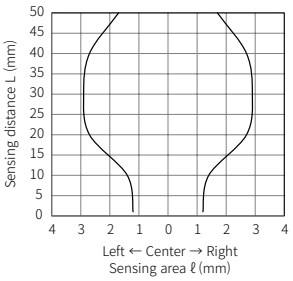
• BTS15-G



• BTS30-G

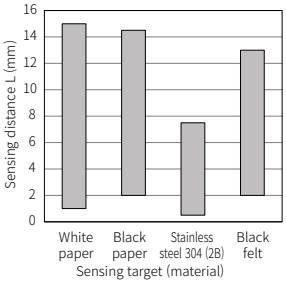


• BTS50-G

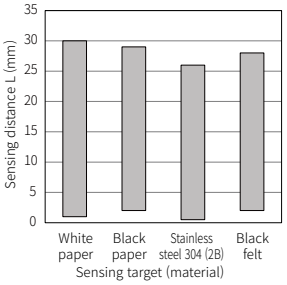


■ Detection Distance by Material

• BTS15-G



• BTS30-G



• BTS50-G

