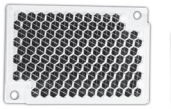
Compact, Amplifier Built-In Type with Universal Voltage

▣ Features

- Small and power supply built-in type
- Easy installation with LED indicators on product
- Light ON/Dark ON operation mode switch
- Status and output LED indication
- Built-in IC photo diode for disturbing light and electrical noise

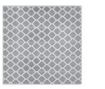
Please read "Safety Considerations" in the instruction manual before using.

CE (DC power)



(MS-2)

(MS-4)



(MST-□)

※MS-4, MST-□ is sold separately.

▣ Specifications

• Free power, Relay contact output type

Model		BEN10M-TFR	BEN5M-MFR	BEN3M-PFR	BEN300-DFR
Sensing type		Through-beam	Retroreflective (standard type)	Retroreflective (built-in polarizing filter)	Diffuse reflective
Sensing distance		10m	5m※1	3m※1	300mm※2
Sensing target		Opaque materials of min. Ø16mm	Opaque materials of min. Ø60mm		Translucent, opaque materials
Hysteresis		—			Max. 20% at rated setting distance
Response time		Max. 20ms			
Power supply		24-240VAC⏦ ±10% 50/60Hz, 24-240VDC⎓ ±10% (ripple P-P: max. 10%)			
Current consumption		Max. 4VA			
Light source		Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment		—	Sensitivity adjuster		
Operation mode		Light ON/Dark ON operation mode switch			
Control output		Relay contact output (relay contact capacity: 30VDC⎓ 3A of resistive load, 250VAC⏦ 3A resistive load, relay contact composition: 1c)			
Relay life cycle		Mechanically: min. 50,000,000 operation, electrically: min. 100,000 operation			
Light receiving element		Photo IC			
Indicator		Operation indicator: red LED, stability indicator: green LED (the red lamp on emitter of transmitted beam type is for power indication)			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Insulation type		Double or strong insulation (mark: ⧈ , dielectric voltage between the measured input and the power: 1kV)			
Noise immunity		±1,000V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1000VAC 50/60Hz for 1 minute			
Vibration	Mechanical	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
	Malfunction	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 minutes			
Shock	Mechanical	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)			
	Ambient temperature	-20 to 65℃, storage: -25 to 70℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP50 (IEC standard)			
Material		Case, case cover: heat resistant acrylonitrile butadiene styrene, sensing part: polycarbonate (with polarizing filter: polymethyl methacrylate), bracket: steel plate cold commercial, bolt: steel chromium molybdenum, nut: steel chromium molybdenum			
Cable		Ø5mm, 5-wire, 2m (emitter of through-beam type: Ø5mm, 2-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)			
Accessory	Individual	—	Reflector (MS-2)		—
	Common	Adjustment screwdriver, mounting bracket, M4 bolt: 4, M4 nut: 4	Adjustment screwdriver, mounting bracket, M4 bolt: 2, M4 nut: 2		
Unit weight		Approx. 354g	Approx. 208g		Approx. 195g

※1: The sensing distance is specified with using the MS-2 reflector and the same as the MS-4 reflector. Sensing distance is the setting range of the reflector. The sensor can detect under 0.1m.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "▣Reflectivity by Reflective Tape Model" table before using the tapes.
※2: Non-glossy white paper 200×200mm.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

● DC power, Solid state output type

Model		BEN10M-TDT	BEN5M-MDT	BEN3M-PDT	BEN300-DDT
Sensing type		Through-beam	Retroreflective	Retroreflective (with polarizing filter)	Diffuse reflective
Sensing distance		10m	5m※1	3m※1	300mm※2
Sensing target		Opaque materials of Min. Ø16mm	Opaque materials of min. Ø60mm		Translucent, opaque materials
Hysteresis		—			Max. 20% at rated setting distance
Response time		Max. 1ms			
Power supply		12-24VDC⎓±10% (ripple P-P: max. 10%)			
Current consumption		Max. 50mA			
Light source		Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment		—	Sensitivity adjuster		
Operation mode		Light ON/Dark ON operation mode switch			
Control output		NPN open collector / PNP open collector simultaneous output ●Load voltage: max. 30VDC⎓ ●Load current: max. 200mA ●Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC			
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit			
Light receiving element		Photo IC			
Indicator		Operation indicator: red, stability indicator: green (the red lamp on Emitter of transmitted beam type is for power indication)			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1000VAC 50/60Hz for 1 minute			
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. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)			
	Ambient temperature	-20 to 65℃, storage: -25 to 70℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP50 (IEC standard)			
Material		case, case cover: heat resistant acrylonitrile butadiene styrene, sensing part: polycarbonate (with polarizing filter: polymethyl methacrylate), bracket: steel plate cold commercial, bolt: steel chromium molybdenum, nut: steel chromium molybdenum			
Cable		Ø5mm, 4-wire, 2m (emitter of through-beam type: Ø5mm, 2-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator diameter: Ø1.25mm)			
Accessory	Individual	—	Reflector (MS-2)		—
	Common	Adjustment screwdriver, mounting bracket, M4 bolt: 4, M4 nut: 4	Adjustment screwdriver, mounting bracket, M4 bolt: 2, M4 nut: 4		
Approval		CE			
Unit weight		Approx. 342g	Approx. 200g		Approx. 187g

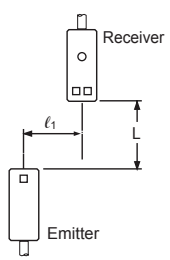
※1: The sensing distance is specified with using the MS-2 reflector and the same as the MS-4 reflector. Sensing distance is the setting range of the reflector. The sensor can detect under 0.1m.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "▣Reflectivity by Reflective Tape Model" table before using the tapes.
※2: Non-glossy white paper 100×100mm.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

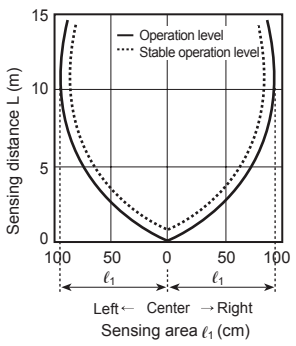
▣ Feature data

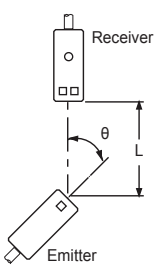
◎ Through-beam type

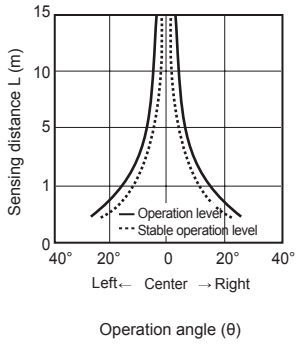
● BEN10M-TFR ● BEN10M-TDT

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data







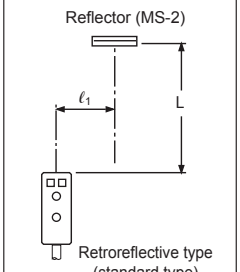
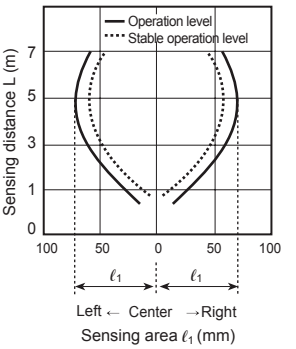


▣ Feature Data

◎ Retroreflective type (standard type)

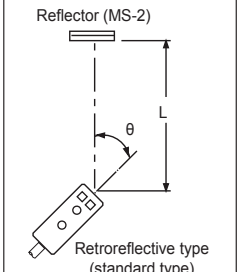
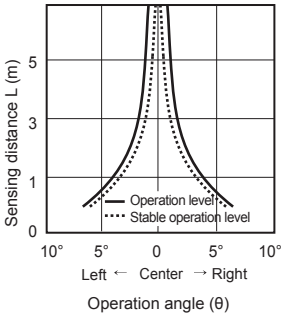
● BEN5M-MFR ● BEN5M-MDT

Parallel shifting characteristic

Measuring method	Data
	

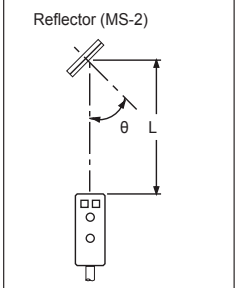
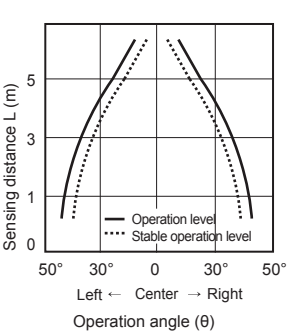
● BEN5M-MFR ● BEN5M-MDT

Sensor angle characteristic

Measuring method	Data
	

● BEN5M-MFR ● BEN5M-MDT

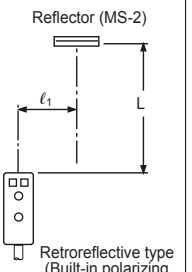
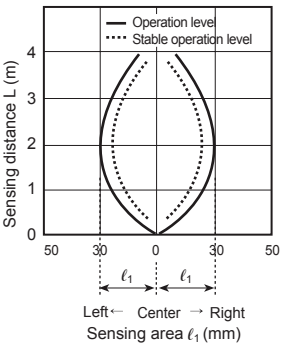
Reflector angle characteristic

Measuring method	Data
	

◎ Retroreflective type (built-in polarizing filter)

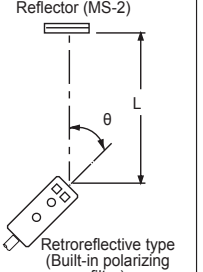
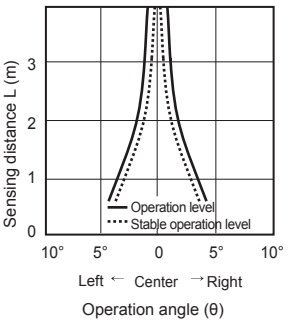
● BEN3M-PFR ● BEN3M-PDT

Parallel shifting characteristic

Measuring method	Data
	

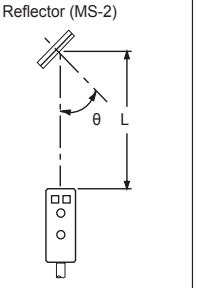
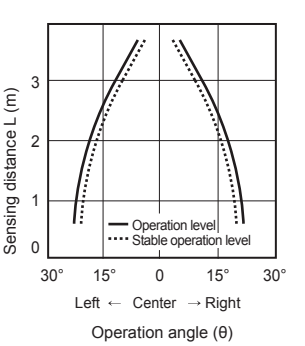
● BEN3M-PFR ● BEN3M-PDT

Sensor angle characteristic

Measuring method	Data
	

● BEN3M-PFR ● BEN3M-PDT

Reflector angle characteristic

Measuring method	Data
	

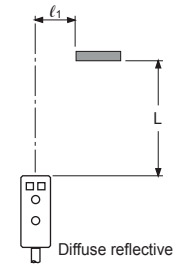
◎ Diffuse reflective type

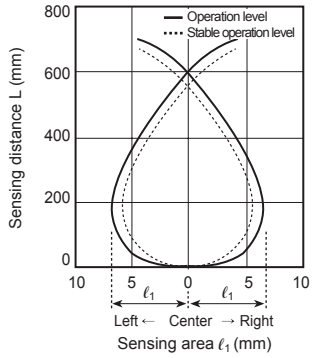
● BEN300-DFR ● BEN300-DDT

Sensing area characteristic

Measuring method	Data

Standard sensing target:
Non-glossy white paper
100×100mm





▣ Operation Mode

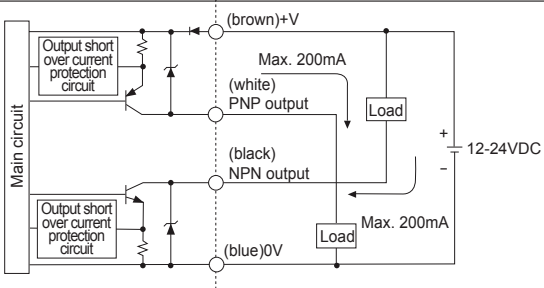
Operation mode	Light ON
Receiver operation	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF
Transistor output	ON / OFF

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

▣ Control Output Diagram

● DC voltage (NPN/PNP synchronous output)

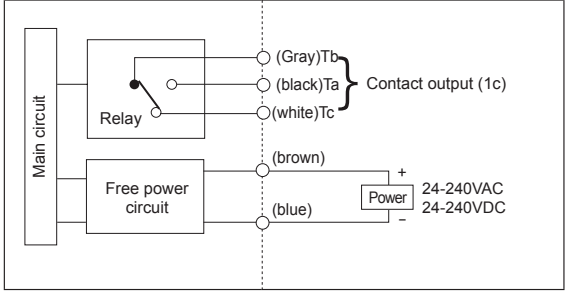
Photoelectric sensor circuit | Connection



※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.

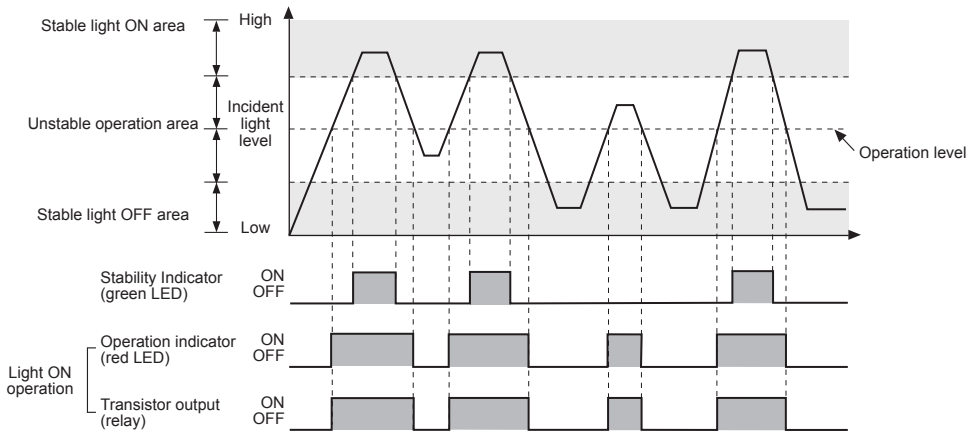
● Free power (Relay contact output)

Photoelectric sensor circuit | Connection



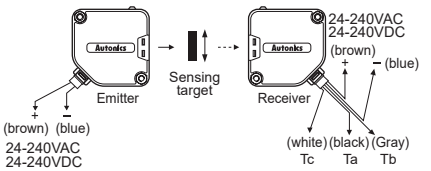
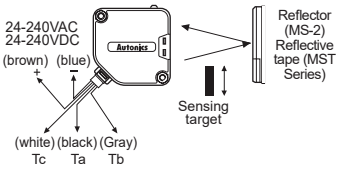
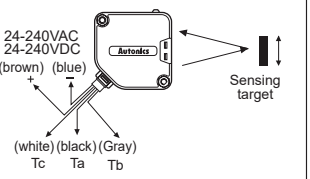
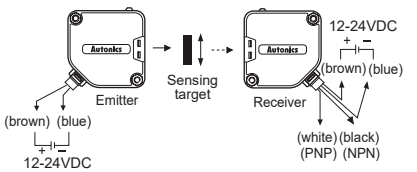
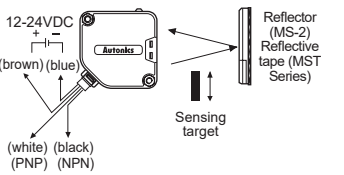
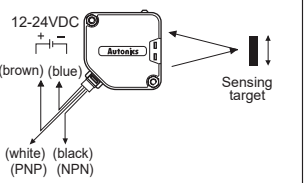
※The product is not equipped with the output short over current protection circuit. If short-circuit the control output terminal or supply current over the rated specification, it may result in product damage.

▣ Operation Timing Diagram



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

▣ Connections

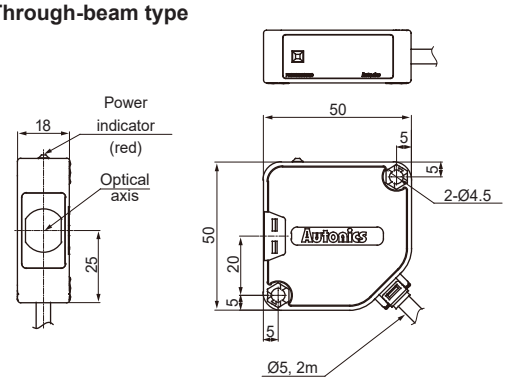
Through-beam	Retroreflective	Diffuse reflective
● BEN10M-TFR1 ● BEN10M-TFR2	**● BEN5M-MFR (standard type) ● BEN3M-PFR (built-in polarizing filter)**	**● BEN300-DFR**
		
● BEN10M-TDT1 ● BEN10M-TDT2	**● BEN5M-MDT (standard type) ● BEN3M-PDT (built-in polarizing filter)**	**● BEN300-DDT**
		

※ Unused line must be insulated.

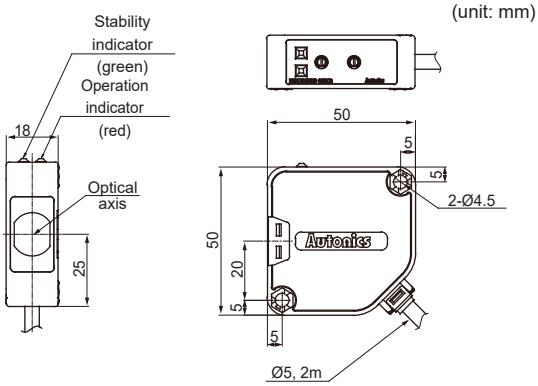
▣ Dimensions

(unit: mm)

●Through-beam type

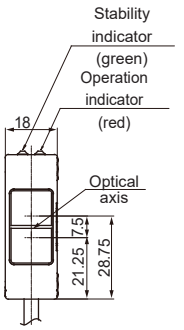


<Emitter>

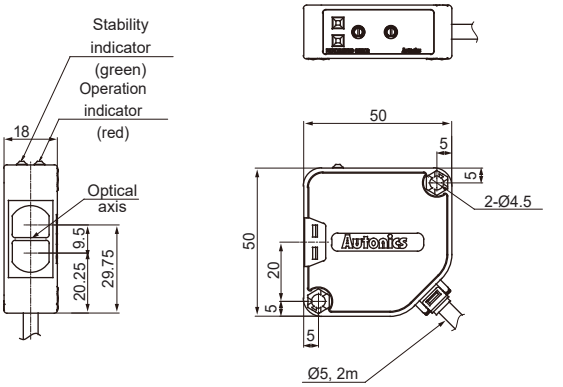


<Receiver>

●Retroreflective type

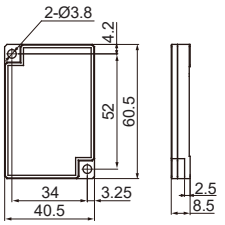


●Diffuse reflective type

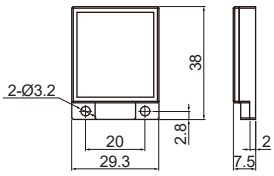


● Reflector

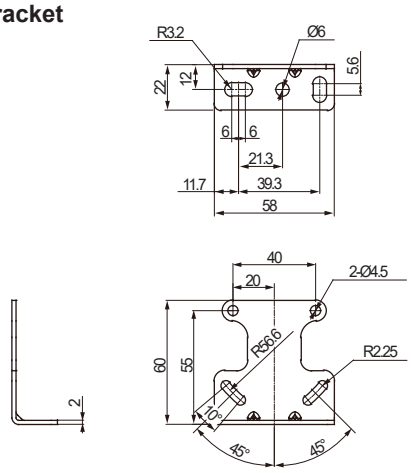
· MS-2



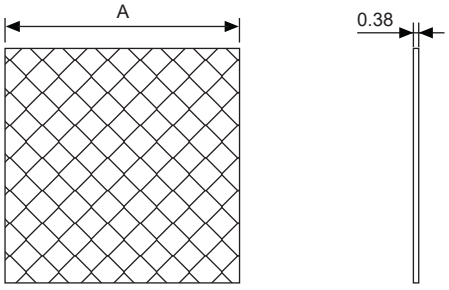
· MS-4 (sold separately)



● Bracket



● Reflective tape (sold separately)



(unit: mm)

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

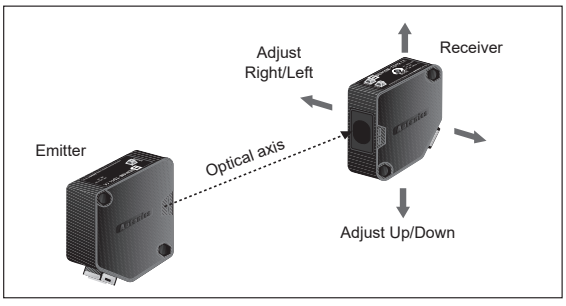
▣ Mounting and sensitivity adjustment

When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 1.2N·m.

◎ Through-beam type

1. Supply the power to the photoelectric sensor, after setting the emitter and the receiver facing each other.
2. Set the receiver in center of position in the middle of the stability range of indicator by adjusting the receiver or the emitter right and left, up and down.
3. After the adjustment, check the stability of operation by putting the object at the optical axis.

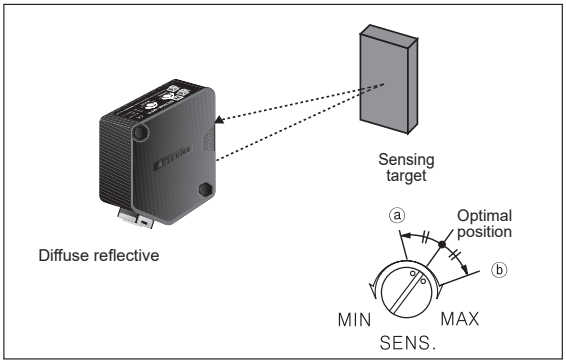
※If the sensing target is translucent body or smaller than Ø16mm, it can be missed by sensor because light penetrate it.



◎ Diffuse reflective type

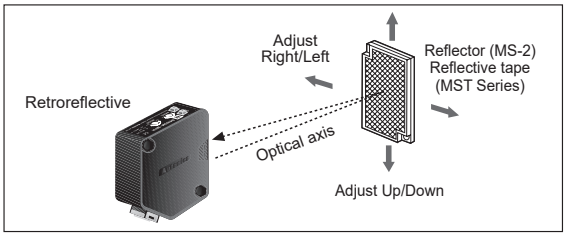
1. The sensitivity should be adjusted depending on a sensing target or mounting place.
2. Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster.
3. Take the target out of the sensing area, then turn the sensitivity adjuster until position ⓑ where the operation indicator turns ON. If the indicator dose not turn ON, max. position is ⓑ.
4. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

※The sensing distance indicated on specification chart is for 100×100mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.



◎ Retroreflective type

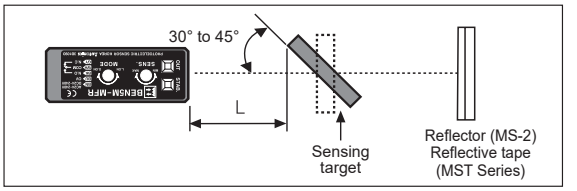
1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector or reflective tape face to face.
2. Set the photoelectric sensor in the position which indicator turns on, by adjusting the reflector or the sensor right and left, up and down.
3. Fix both units tightly after checking that the unit detects the target.



※If using more than 2 photoelectric sensors in parallel, the space among them should be more than 30cm.

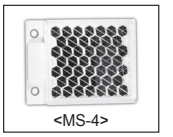
※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and the photoelectric sensor or the surface of the target should be installed at angle of 30° to 45° against optical axis. (When a sensing target with high reflectance near by, photoelectric sensing with the polarizing filter should be used.)

※Sensitivity adjustment: Refer to the diffuse reflective type's.



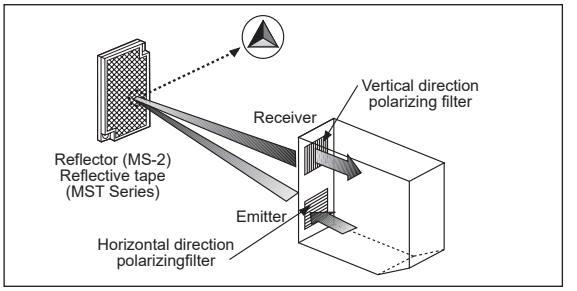
※If the mounting place is too narrow, please use MS-4 instead of MS-2.

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



◎ Retroreflective type with polarizing filter

The light passed through the polarizing filter of the emitter reaches to the MS-2 reflector or reflective tape converting as horizontal direction. It reaches to the receiver element of polarizing filter converting as vertical by the MS-2 reflector or reflective tape. Therefore, this type can also detect reflective mirror.



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

▣ Reflectivity by Reflective Tape Model

	Standard	Built-in polarizing filter
MST-50-10 (50×50mm)	90%	70%
MST-100-5 (100×100mm)	130%	90%
MST-200-2 (200×200mm)	140%	120%

※This reflectivity is based on the reflector (MS-2).

※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.