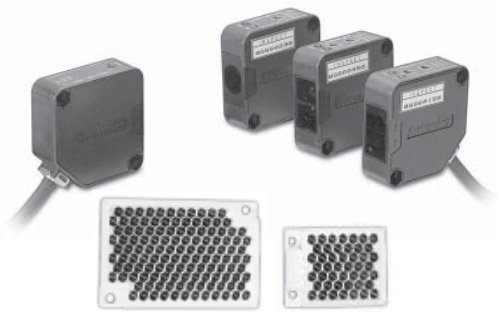
Compact, amplifier built-in type with Universal voltage

▣ Features

- Small and power supply built-in type
- Easy installation with LED indicators on product
- Enables to set the operation mode by switch (Light ON/Dark ON)
- Status and output LED indication
- Built-in IC photo diode for ambient light and electrical noise

⚠ Please read "Caution for your safety" in operation manual before using.

CE



(MS-2) (MS-4)

※ MS-4 is sold separately.

▣ Specifications

● Free power, Relay contact output type

Model		BEN10M-TFR	BEN5M-MFR	BEN3M-PFR	BEN300-DFR
Sensing type		Through-beam	Retroreflective	Retroreflective (with polarizing filter)	Diffuse reflective
Sensing distance		10m	0.1 to 5m ※1	0.1 to 3m ※1	300mm ※2
Sensing target		Opaque materials of Min. ø16mm	Opaque materials of Min. ø60mm		Translucent, Opaque materials
Hysteresis		—			Max. 20% at ratedsetting distance
Response time		Max. 20ms			
Response time		24-240VAC ±10% 50/60Hz, 24-240VDC ±10%(Ripple P-P : Max. 10%)			
Power consumption		Max. 4VA			
Light source		Infrared LED(850nm)		Red LED(660nm)	Infrared LED(940nm)
Sensitivity adjustment		—	Adjustment VR		
Operation mode		Selectable Light ON or Dark ON by VR			
Control output		Relay contact output ● Relay contact capacity: 30VDC 3A of resistive load, 250VAC 3A resistive load ● Relay contact composition: 1c			
Relay lifetime		Mechanically: Min. 50,000,000 operation, Electrically: Min. 100,000 operation			
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		Min. 20MΩ(at 500VDC megger)			
Insulation type		Double or strong insulation (Mark : ⊡ , Dielectric voltage between the measured input and the power: 1kV)			
Noise resistance		±1,000V the square wave noise(pulse width : 1μs) by the noise simulator			
Dielectric strength		1000VAC 50/60Hz for 1minute			
Vibration	Mechanical	1.5mm amplitude at frequency of 10 to 55Hz(for 1 min.) in each of X, Y, Z directions for 2 hours			
	Malfunction	1.5mm amplitude at frequency of 10 to 55Hz(for 1 min.) in each of X, Y, Z directions for 10 minutes			
Shock	Mechanical	500m/s²(50G) in each of X, Y, Z directions for 3 times			
	Malfunction	100m/s²(10G) in each of X, Y, Z directions 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		IP50(IEC standard)			
Material		● Case, Case cover: Heat resistant ABS ● Sensing part: PC(with polarizing filter: PMMA)			
Cable		ø5.0mm, 5-wire, Length: 2m(Emitter of through-beam type: ø5.0mm, 2-wire, Length: 2m) (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: ø1.25mm)			
Accessory	Individual	—	Reflector(MS-2)		—
	Common	VR adjustment driver, Mounting bracket, Bolts/nuts			
Unit weight		Approx. 354g	Approx. 208g		Approx. 195g

※1: The sensing distance is specified with using the MS-2 reflector and same as the MS-4 reflector. Sensing distance is setting range of the reflector. The sensor can detect under 0.1m.
※2: It is for Non-glossy white paper(100×100mm)
※ 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	0.1 to 5m ※1	0.1 to 3m ※1	300mm ※2
Sensing target		Opaque materials of Min. ø16mm	Opaque materials of Min. ø60mm		Translucent, Opaque materials
Hysteresis		—			Max. 20% at ratedsetting distance
Response time		Max. 1ms			
Response time		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		—	Adjustment VR		
Operation mode		Selectable Light ON or Dark ON by VR			
Control output		NPN open collector / PNP open collector simultaneous output ●Load voltage: Max. 30VDC ●Load current: Max. 200mA ●Residual voltage - NPN: Max. 1V, PNP: Max. 2.5V			
Protection circuit		Reverse polarity protection, Short-circuit protection			
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		Min. 20MΩ(at 500VDC megger)			
Noise resistance		±240V the square wave noise(pulse width: 1μs) by the noise simulator			
Dielectric strength		1000VAC 50/60Hz for 1minute			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz(for 1 min.) in each of X, Y, Z directions for 2 hours			
Shock		500m/s²(50G) in each of X, Y, Z directions 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		IP50(IEC standard)			
Material		● Case, Case cover: Heat resistant ABS ● Sensing part: PC(with polarizing filter: PMMA)			
Cable		ø5.0mm, 4-wire, Length: 2m(Emitter of through-beam type: ø5.0mm, 2-wire, Length: 2m) (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: ø1.25mm)			
Accessory	Individual	—	Reflector(MS-2)		—
	Common	VR adjustment driver, Mounting bracket, Bolts/nuts			
Approval		CE			
Unit weight		Approx. 342g	Approx. 200g		Approx. 187g

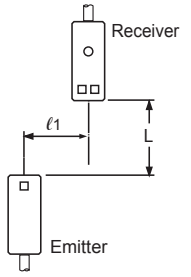
※1: The sensing distance is specified with using the MS-2 reflector and same as the MS-4 reflector. Sensing distance is setting range of the reflector. The sensor can detect under 0.1m.
※2: It is for Non-glossy white paper(100×100mm)
※ The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

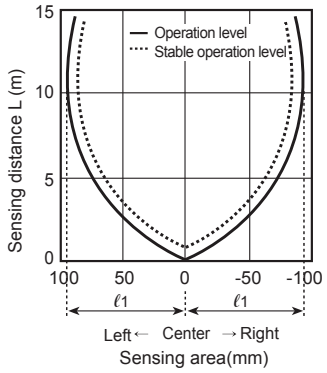
▣ Feature data

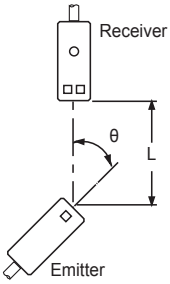
◎ Through-beam type

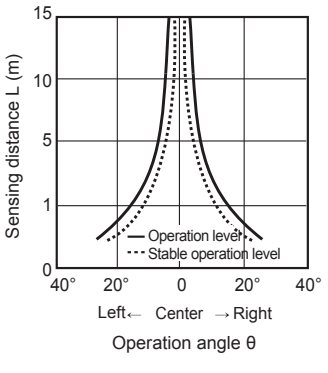
● BEN10M-TFR ● BEN10M-TDT

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data







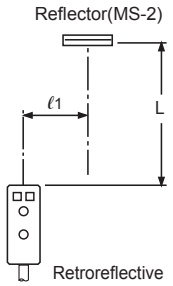
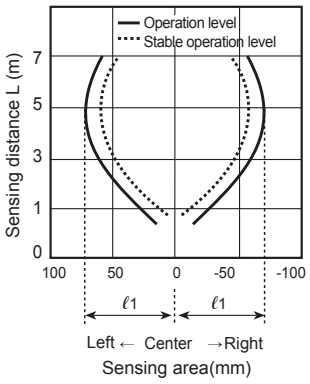


▣ Feature data

◎ Retroreflective type

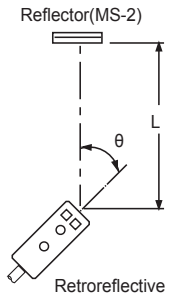
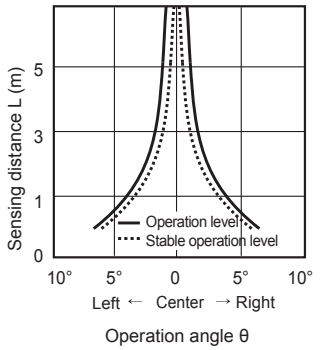
● BEN5M-MFR ● BEN5M-MDT

Parallel shifting characteristic

Measuring method	Data
	

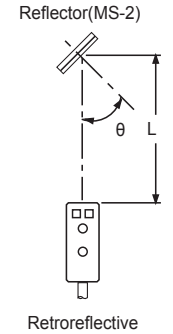
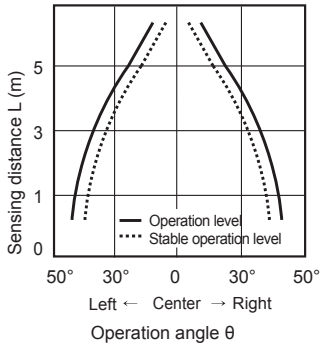
● BEN5M-MFR ● BEN5M-MDT

Sensor angle characteristic

Measuring method	Data
	

● BEN5M-MFR ● BEN5M-MDT

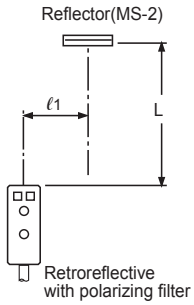
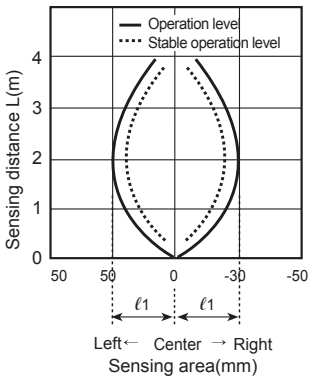
Reflector angle characteristic

Measuring method	Data
	

◎ Retroreflective type with polarizing filter

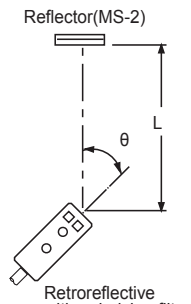
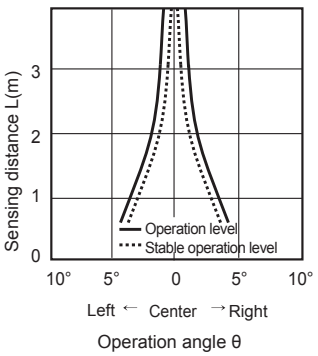
● BEN3M-PFR ● BEN3M-PDT

Parallel shifting characteristic

Measuring method	Data
	

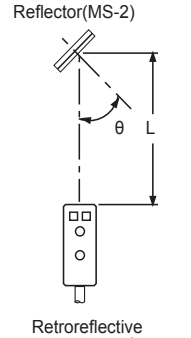
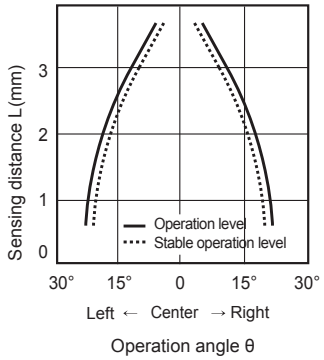
● BEN3M-PFR ● BEN3M-PDT

Sensor angle characteristic

Measuring method	Data
	

● BEN3M-PFR ● BEN3M-PDT

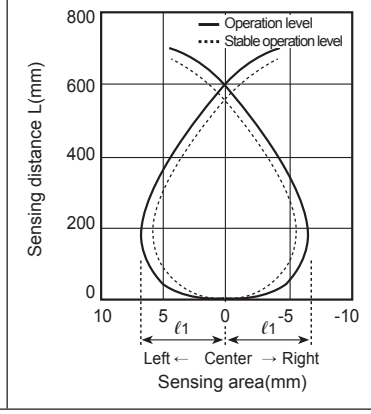
Reflector angle characteristic

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	

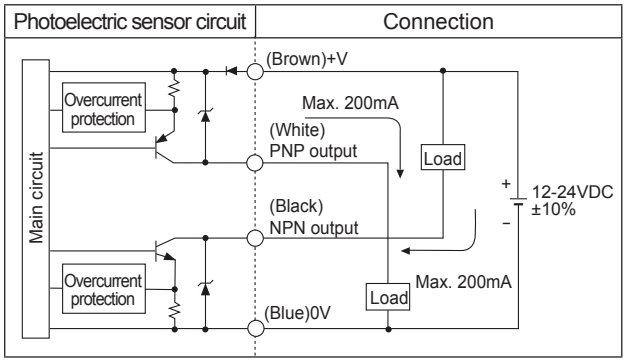
▣ Operation mode

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

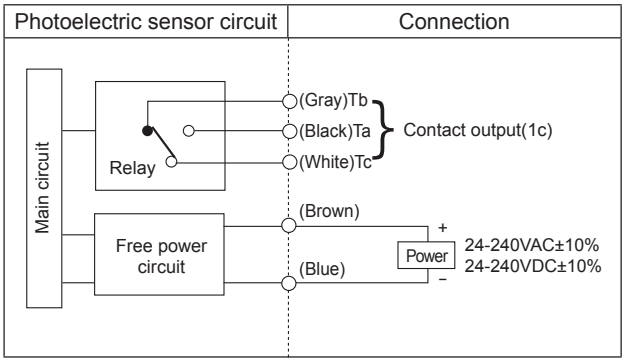
Operation mode	Dark ON
Receiver operation	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF
Transistor output	ON / OFF

▣ Control output diagram

● DC voltage(NPN/PNP synchronous output)

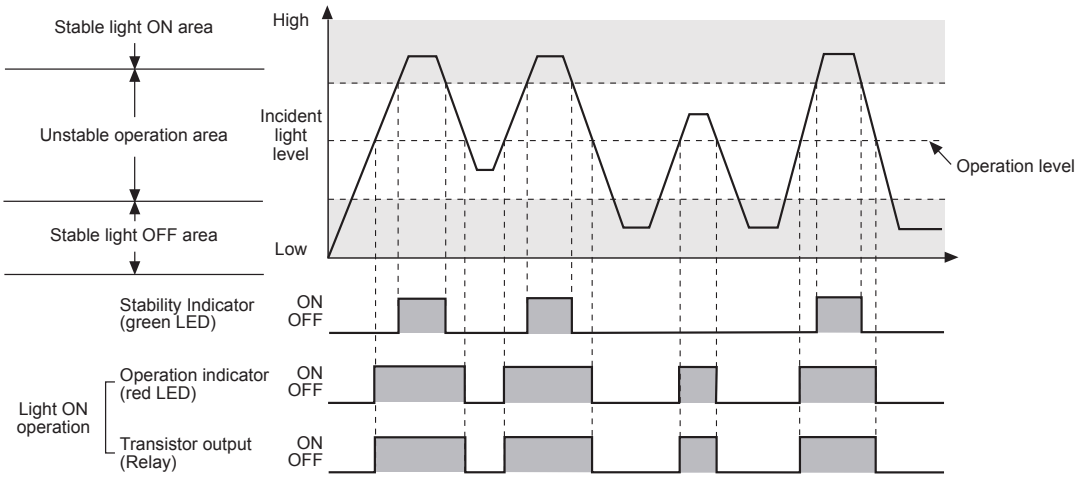


● Free power(Relay contact output)



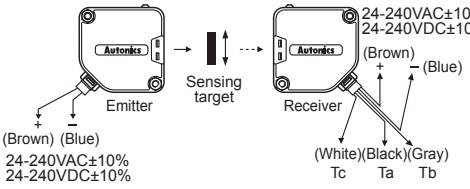
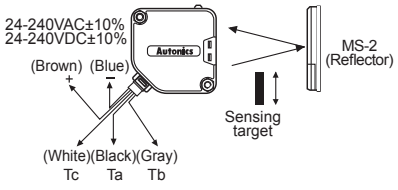
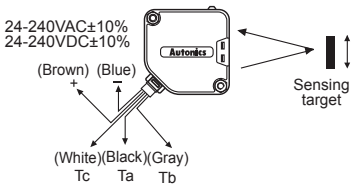
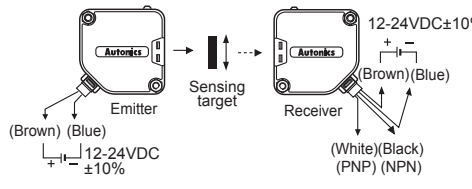
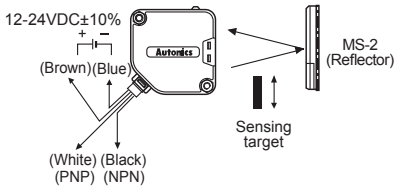
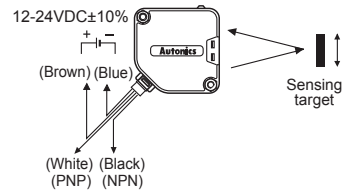
※ In case of product with the output protection device, if terminals of control output are short circuited or overcurrent condition exists, the control output turns OFF due to protection circuit.

▣ Operation timing diagram



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

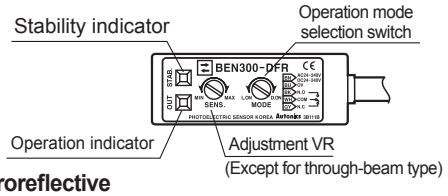
▣ Connections

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

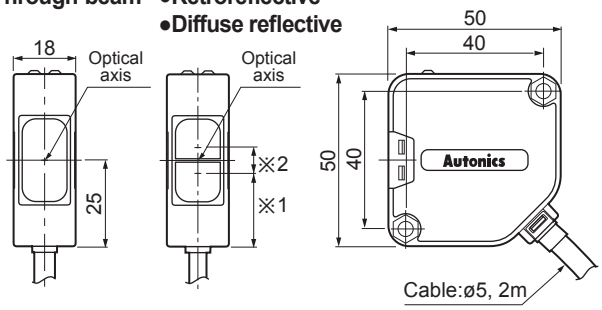
※ Unused line must be insulated.

▣ Dimensions

(unit: mm)

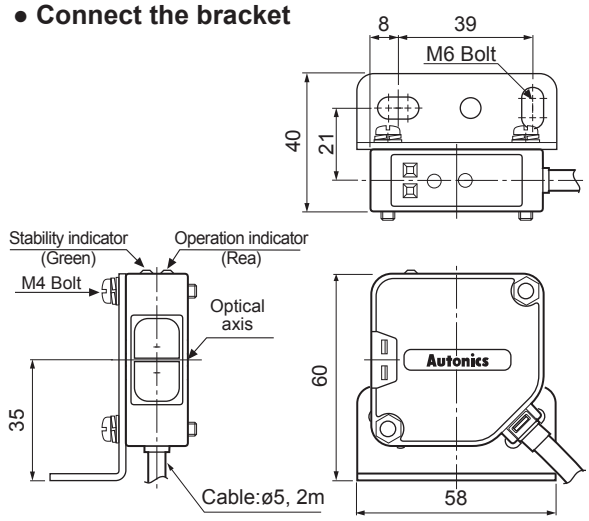


●Through-beam ●Retroreflective ●Diffuse reflective

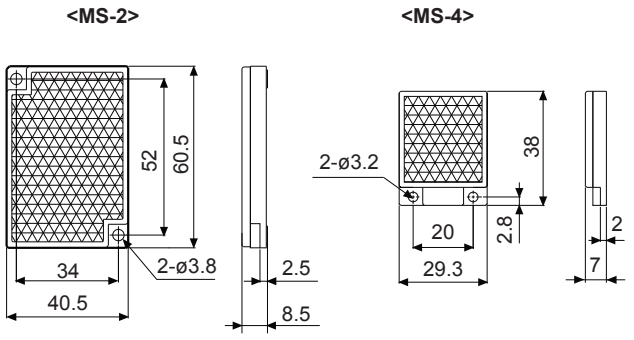


※1: Retroreflective: 21.25mm, Diffuse reflective: 20.25mm
※2: Retroreflective: 7.5mm, Diffuse reflective: 9.5mm

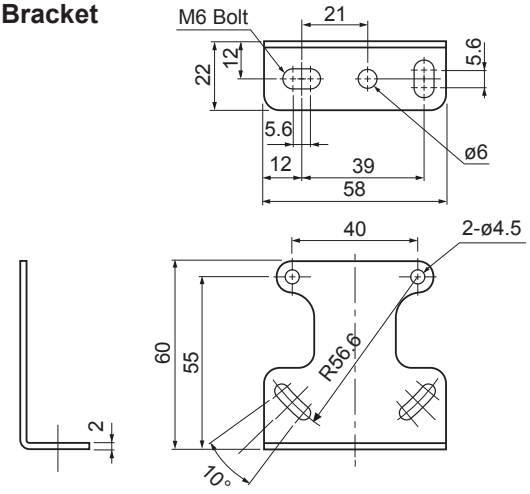
● Connect the bracket



● Reflector



● Bracket

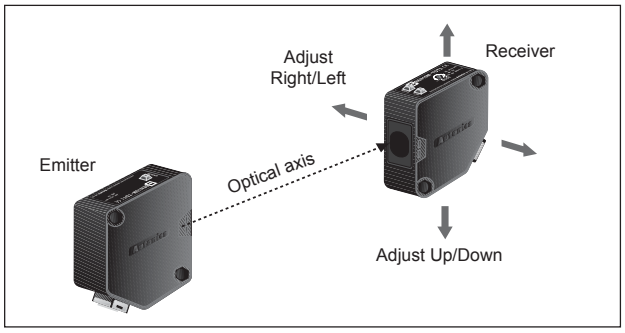


▣ Mounting and sensitivity adjustment

◎ 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 operation range of indicator adjusting the receiver or the emitter right and left, up and down.
3. After adjustment, check the stability of operation putting the object at the optical axis.

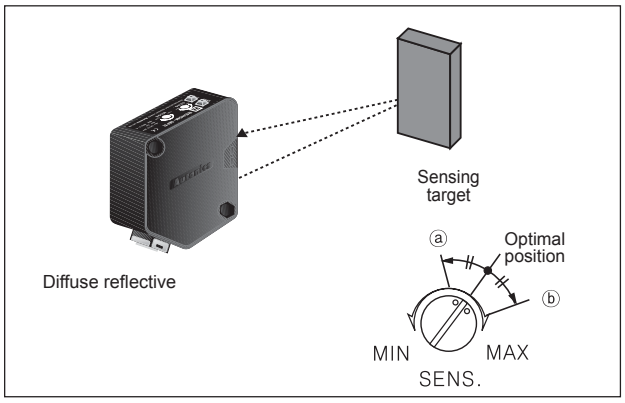
※ If the sensing target is translucent body or smaller than ø16mm, it can be missed by sensor cause light penetrate it.



◎ Diffuse reflective type

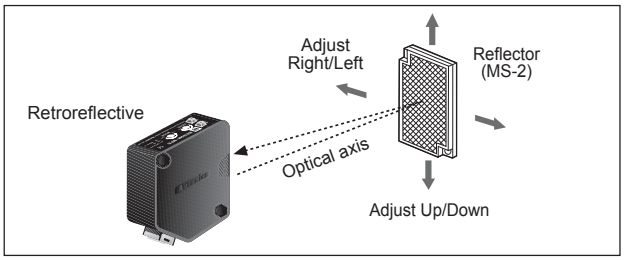
1. The sensitivity should be adjusted depending on a sensing target or mounting place.
2. Set the target at a position to be detected by the beam, then turn the adjustment VR until position ⓐ where the operation indicator turns ON from min. position of the adjustment VR.
3. Take the target out of the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

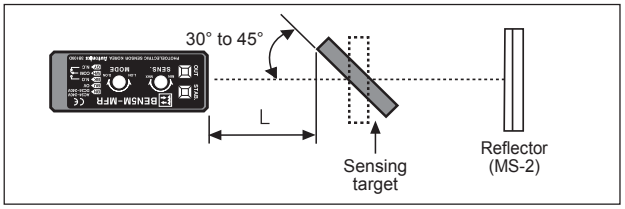
1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector(MS-2) in face to face.
2. Set the photoelectric sensor in the position which indicator turns on, as adjusting the reflector or the sensor right and left, up and down.
3. Fix both units tightly after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



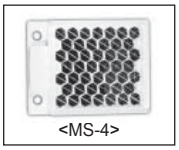
※If using more than 2 photoelectric sensors in parallel, the space between them should be more than 30cm.

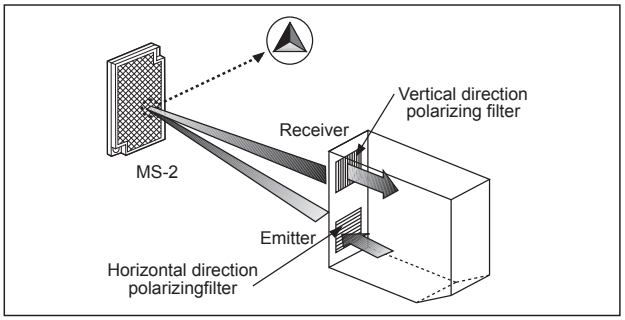
※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and the photoelectric sensor or the surface of the target should be installed at angle 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.



◎ Retroreflective type with polarizing filter

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