

(A) Photoelectric Sensor

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(A)
Photo
electric
sensor

(B)
Fiber
optic
sensor

(C)
Door/Area
sensor

(D)
Proximity
sensor

(E)
Pressure
sensor

(F)
Rotary
encoder

(G)
Connector/
Socket

(H)
Temp.
controller

(I)
SSR/
Power
controller

(J)
Counter

(K)
Timer

(L)
Panel
meter

(M)
Tacho/
Speed/
Pulse
meter

(N)
Display
unit

(O)
Sensor
controller

(P)
Switching
power
supply

(Q)
Stepping
motor &
Driver &
Controller

(R)
Graphic/
Logic
panel

(S)
Field
network
device

(T)
Production
stoppage
models &
replacement

Line-up

**Compact and long
sensing distance
BJ Series(Connector type)**



Line-up

**Cylindrical
BR Series(Connector type)**



Ordering Information







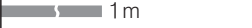





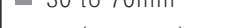






■ Ordering information(Photoelectric Sensor)

BEN	10	M	-	T	F	R			-			-	P
Item													
Sensing distance													
Sensing distance unit													
Sensing type													
Power Supply													
Control output													
Emitter/Receiver													
Reflective/Narrow beam type													
Timer													
Connection type													
NPN/PNP													
P													
Blank													
Outgoing cable type													
C													
Connector type													
T													
Blank													
Built-in Timer													
Blank													
Standard type													
Blank													
Reflective type(Diffuse type)													
N													
Narrow beam type(BR, BRP series only)													
1													
Emitter													
2													
Receiver													
R													
Contact output(Relay)													
T													
Solid-state output(Transistor)													
D													
DC power													
F													
Power supply built-in													
S													
Adjuster included(BUP series only)													
D													
Diffuse reflective type													
M													
Retroreflective type													
P													
Retroreflective with polarizing filter													
T													
Through-beam type													
Number													
Sensing distance(BUP series only)													
M													
Sensing distance unit : m													
Blank													
Sensing distance unit : mm													
Number													
Sensing distance													
BX													
BEN													
BA													
★ BPS													
★ BM/BMS													
★ BR/BRP													
★ BUP													
★ BY/BYS													
BYD													
Photoelectric sensor series													

★ 'S' represents lateral sensing type.




















'P' represents plastic case type.

Product Overview











Appearances	Sensing type	Sensing distance (Light source)	Model	Power supply	Response speed	Control output	Reference			
<div>BJ Series CE</div> <div></div> <div></div> <div>Connector type</div>	Through-beam type	 15m (Infrared LED)	BJ15M-TDT BJ15M-TDT-C BJ15M-TDT-P BJ15M-TDT-C-P	12–24VDC	Max. 1ms	NPN open collector output	A-6 to 12			
		 10m (Red LED)	BJ10M-TDT BJ10M-TDT-C BJ10M-TDT-P BJ10M-TDT-C-P			PNP open collector output				
		 7m (Red LED)	BJ7M-TDT BJ7M-TDT-P			NPN open collector output				
						PNP open collector output				
		Retro-reflective type	Polarizing filter built-in			BJ3M-PDT BJ3M-PDT-C BJ3M-PDT-P BJ3M-PDT-C-P		NPN open collector output		
			 0.1 to 3m (Red LED)					PNP open collector output		
	Diffuse reflective type	 1m (Infrared LED)	BJ1M-DDT BJ1M-DDT-C BJ1M-DDT-P BJ1M-DDT-C-P			NPN open collector output				
		 300mm (Red LED)	BJ300-DDT BJ300-DDT-C BJ300-DDT-P BJ300-DDT-C-P			PNP open collector output				
		 100mm (Infrared LED)	BJ100-DDT BJ100-DDT-C BJ100-DDT-P BJ100-DDT-C-P			NPN open collector output				
		 30mm (Infrared LED)	BJG30-DDT			PNP open collector output				
		NEW BGS reflective type (Limited distance reflective type) + (Narrow spot type)	 10 to 30mm (Red LED)			BJ30-BDT BJ30-BDT-P		Max. 1.5ms	NPN open collector output	
			 10 to 50mm (Red LED)			BJ50-BDT BJ50-BDT-P			PNP open collector output	
	 10 to 100mm (Red LED)		BJ100-BDT BJ100-BDT-P			NPN open collector output				
						PNP open collector output				
	Narrow beam reflective type (Micro spot type)	 30 to 70mm (Red LED)	BJN50-NDT BJN50-NDT-P			Max. 1ms		NPN open collector output		
		 70 to 130mm (Red LED)	BJN100-NDT BJN100-NDT-P					PNP open collector output		
								NPN open collector output		
								PNP open collector output		
	<div>BS5 Series CE</div> <div></div>	Through-beam type (Not modulated)	 5mm (Red LED)		BS5-L2M	5–24VDC		Received light : Max. 20 μ s Interrupted light : Max. 100 μ s	NPN open collector output	A-13 to 15
					BS5-K2M					
					BS5-T2M					
BS5-Y2M										
BS5-V2M										
<div>BA Series CE</div> <div></div> <div>Upgrade</div>	Diffuse reflective type	 2m (Infrared LED)	BA2M-DDT	12–24VDC	Max. 1ms	NPN open collector output	A-16 to 18			
			BA2M-DDTD			PNP open collector output				
			BA2M-DDT-P							
			BA2M-DDTD-P							

(A) Photo electric sensor
(B) Fiber optic sensor
(C) Door/Area sensor
(D) Proximity sensor
(E) Pressure sensor
(F) Rotary encoder
(G) Connector/Socket
(H) Temp. controller
(I) SSR/Power controller
(J) Counter
(K) Timer
(L) Panel meter
(M) Tacho/Speed/Pulse meter
(N) Display unit
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(P) Switching power supply
(Q) Stepping motor & Driver & Controller
(R) Graphic/Logic panel
(S) Field network device
(T) Production stoppage models & replacement

Product Overview




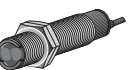

Appearances	Sensing type	Sensing distance (Light source)	Model	Power supply	Response speed	Control output	Reference	
BY Series Standard  Side sensing type 	Through-beam type	 500mm (Infrared LED)	BY500-TDT	12-24VDC	Max. 1ms	NPN open collector output	A-19 to 21	
			BYS500-TDT					
BYD Series CE  Operation indicator  BYD30-DDT-U BYD50-DDT-U	Through-beam type	 3m (Infrared LED)	BYD3M-TDT	12-24VDC	Max. 1ms	NPN open collector output	A-22 to 26	
			BYD3M-TDT-P			PNP open collector output		
	Limited distance reflective type	 30mm (Infrared LED)	BYD30-DDT		Max. 3ms	NPN open collector output		
			BYD30-DDT-U					
		 50mm (Infrared LED)	BYD30-DDT-T Timer built-in					
			BYD50-DDT					
			BYD50-DDT-U Timer built-in					
	Diffuse reflective type	 100mm (Infrared LED)	BYD100-DDT					
BPS Series CE 	Through-beam type	 3m (Infrared LED)	BPS3M-TDT	12-24VDC	Max. 1ms	NPN open collector output	A-27 to 28	
			BPS3M-TDTL			PNP open collector output		
			BPS3M-TDT-P					
			BPS3M-TDTL-P					
BM Series CE 	Through-beam type	 3m (Infrared LED)	BM3M-TDT	12-24VDC	Max. 3ms	NPN open collector output	A-29 to 32	
	Retro-reflective type	 0.1 to 1m (Infrared LED)	BM1M-MDT					
	Diffuse reflective type	 200mm (Infrared LED)	BM200-DDT					
BMS SERIES CE 	Through-beam type	 5m (Infrared LED)	BMS5M-TDT	12-24VDC	Max. 1ms	NPN open collector output	A-33 to 36	
			BMS5M-TDT-P			PNP open collector output		
	Retro-reflective type	 0.1 to 2m (Infrared LED)	BMS2M-MDT			NPN open collector output		
			BMS2M-MDT-P			PNP open collector output		
	Diffuse reflective type	 300mm (Infrared LED)	BMS300-DDT			NPN open collector output		
			BMS300-DDT-P			PNP open collector output		

Product Overview

Appearances	Sensing type	Sensing distance (Light source)	Model	Power supply	Response speed	Control output	Reference	
BEN Series CE (DC only) 	Through-beam type	 10m (Infrared LED)	BEN10M-TFR	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	A-37 to 42	
			BEN10M-TDT	12-24VDC	Max. 1ms	NPN/PNP open collector output		
	Retro-reflective type	Standard type  0.1 to 5m (Infrared LED)	BEN5M-MFR	24-240VAC/ 24-240VDC	Max. 20ms	Relay output		
			BEN5M-MDT	12-24VDC	Max. 1ms	NPN/PNP open collector output		
		Polarizing filter built-in  0.1 to 3m (Red LED)	BEN3M-PFR	24-240VAC/ 24-240VDC	Max. 20ms	Relay output		
			BEN3M-PDT	12-24VDC	Max. 1ms	NPN/PNP open collector output		
	Diffuse reflective type	 300mm (Infrared LED)	BEN300-DFR	24-240VAC/ 24-240VDC	Max. 20ms	Relay output		
			BEN300-DDT	12-24VDC	Max. 1ms	NPN/PNP open collector output		
BX Series CE 	Through-beam type	 15m (Infrared LED)	BX15M-TFR	24-240VAC/ 24-240VDC	Max. 20ms	Relay output	A-43 to 49	
			Timer built-in BX15M-TFR-T					
			BX15M-TDT	12-24VDC	Max. 1ms	NPN/PNP open collector output		
			Timer built-in BX15M-TDT-T					
	Retro-reflective type	Standard type  0.1 to 5m (Infrared LED)	BX5M-MFR	24-240VAC/ 24-240VDC	Max. 20ms	Relay output		
			Timer built-in BX5M-MFR-T					
			BX5M-MDT	12-24VDC	Max. 1ms	NPN/PNP open collector output		
			Timer built-in BX5M-MDT-T					
		Polarizing filter built-in  0.1 to 3m (Red LED)	BX3M-PFR	24-240VAC/ 24-240VDC	Max. 20ms	Relay output		
			Timer built-in BX3M-PFR-T					
			BX3M-PDT	12-24VDC	Max. 1ms	NPN/PNP open collector output		
			Timer built-in BX3M-PDT-T					
	Diffuse reflective type	 700mm (Infrared LED)	BX700-DFR	24-240VAC/ 24-240VDC	Max. 20ms	Relay output		
			Timer built-in BX700-DFR-T					
			BX700-DDT	12-24VDC	Max. 1ms	NPN/PNP open collector output		
			Timer built-in BX700-DDT-T					

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Product Overview

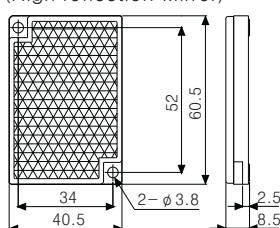
Appearances	Sensing type	Sensing distance (Light source)	Model	Power supply	Response speed	Control output	Reference
BR SERIES CE  BR4M (Metal case)  BR20M (Metal case)  BR (Metal case)  BRP (Plastic case)	Through-beam type	4m (Infrared LED)	BR4M-TDTL BR4M-TDTL-C BR4M-TDTD BR4M-TDTD-C	12-24VDC	Max. 3ms	NPN open collector output	A-50 to 55
			BR4M-TDTL-P BR4M-TDTL-C-P BR4M-TDTD-P BR4M-TDTD-C-P			PNP open collector output	
			BR20M-TDTL BR20M-TDTL-C BR20M-TDTD BR20M-TDTD-C			NPN open collector output	
			BR20M-TDTL-P BR20M-TDTL-C-P BR20M-TDTD-P BR20M-TDTD-C-P			PNP open collector output	
		20m (Infrared LED)	BR20M-TDTL BR20M-TDTL-C BR20M-TDTD BR20M-TDTD-C			NPN open collector output	
			BR20M-TDTL-P BR20M-TDTL-C-P BR20M-TDTD-P BR20M-TDTD-C-P			PNP open collector output	
			BR3M-MDT BR3M-MDT-C BR3M-MDT-P BR3M-MDT-C-P		Max. 1ms	NPN open collector output	
			BRP3M-MDT BRP3M-MDT-C BRP3M-MDT-P BRP3M-MDT-C-P			PNP open collector output	
	Retro-reflective type	0.1~3m (Infrared LED)	BR100-DDT BR100-DDT-C BR100-DDT-P BR100-DDT-C-P			NPN open collector output	
			BRP100-DDT BRP100-DDT-C BRP100-DDT-P BRP100-DDT-C-P			PNP open collector output	
			BR400-DDT BR400-DDT-C BR400-DDT-P BR400-DDT-C-P			NPN open collector output	
			BRP400-DDT BRP400-DDT-C BRP400-DDT-P BRP400-DDT-C-P			PNP open collector output	
		100mm (Infrared LED)	BR200-DDTN BR200-DDTN-C BR200-DDTN-P BR200-DDTN-C-P		Max. 1ms	NPN open collector output	
			BRP200-DDTN BRP200-DDTN-C BRP200-DDTN-P BRP200-DDTN-C-P			PNP open collector output	
			BR400-DDT BR400-DDT-C BR400-DDT-P BR400-DDT-C-P			NPN open collector output	
			BRP400-DDT BRP400-DDT-C BRP400-DDT-P BRP400-DDT-C-P			PNP open collector output	
	Diffuse reflective type	400mm (Infrared LED)	BR200-DDTN BR200-DDTN-C BR200-DDTN-P BR200-DDTN-C-P			NPN open collector output	
			BRP200-DDTN BRP200-DDTN-C BRP200-DDTN-P BRP200-DDTN-C-P			PNP open collector output	
			BR400-DDT BR400-DDT-C BR400-DDT-P BR400-DDT-C-P			NPN open collector output	
			BRP400-DDT BRP400-DDT-C BRP400-DDT-P BRP400-DDT-C-P			PNP open collector output	
	Narrow beam reflective type	200mm (Infrared LED)	BR200-DDTN BR200-DDTN-C BR200-DDTN-P BR200-DDTN-C-P			NPN open collector output	
			BRP200-DDTN BRP200-DDTN-C BRP200-DDTN-P BRP200-DDTN-C-P			PNP open collector output	
			BR400-DDT BR400-DDT-C BR400-DDT-P BR400-DDT-C-P			NPN open collector output	
			BRP400-DDT BRP400-DDT-C BRP400-DDT-P BRP400-DDT-C-P			PNP open collector output	
BUP SERIES CE 	Through-beam type	30mm	BUP-30 Adjuster built-in BUP-30S BUP-30-P Adjuster built-in BUP-30S-P	12-24VDC	Max. 1ms	NPN open collector output	A-56 to 57
			BUP-50 Adjuster built-in BUP-50S BUP-50-P Adjuster built-in BUP-50S-P			PNP open collector output	
			BUP-50 Adjuster built-in BUP-50S BUP-50-P Adjuster built-in BUP-50S-P			NPN open collector output	
			BUP-50 Adjuster built-in BUP-50S BUP-50-P Adjuster built-in BUP-50S-P			PNP open collector output	
		50mm	BUP-30 Adjuster built-in BUP-30S BUP-30-P Adjuster built-in BUP-30S-P			NPN open collector output	
			BUP-50 Adjuster built-in BUP-50S BUP-50-P Adjuster built-in BUP-50S-P			PNP open collector output	
			BUP-50 Adjuster built-in BUP-50S BUP-50-P Adjuster built-in BUP-50S-P			NPN open collector output	
			BUP-50 Adjuster built-in BUP-50S BUP-50-P Adjuster built-in BUP-50S-P			PNP open collector output	

○ Reflector

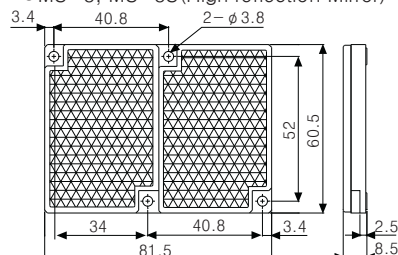
Retroreflective photo sensor is sold with a basic reflector. You can select other reflectors for the proper install environment.

- Select proper reflector size for the install space.
- Basically the bigger mirror size has the longer sensing distance.
- High reflective mirrors (MS-2S, MS-3S) tend to have longer sensing distance than a basic reflector's sensing distance.

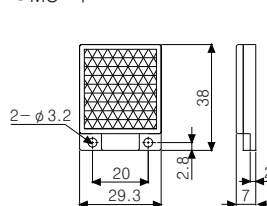
●MS-2, MS-2S
(High reflection Mirror)



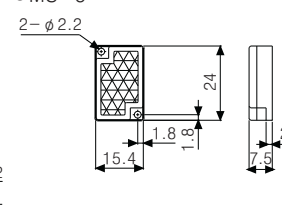
●MS-3, MS-3S (High reflection Mirror)



●MS-4



●MS-5



(Unit:mm)

Long sensing distance/BGS reflective/Micro spot type

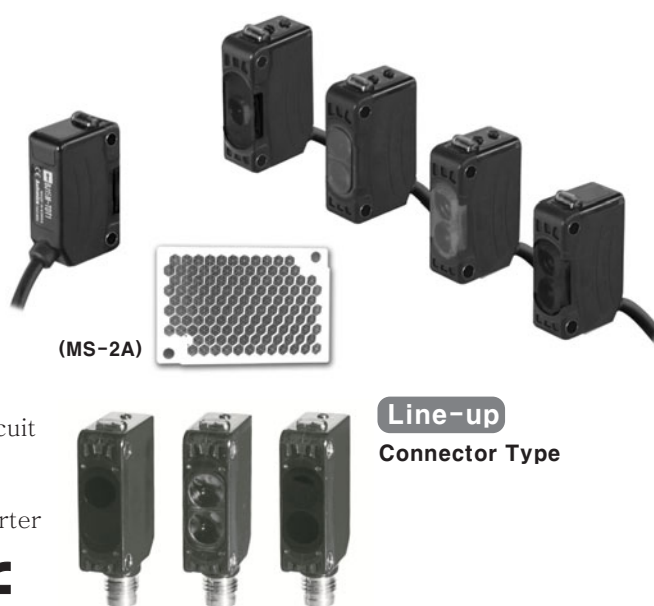
Compact and Long sensing distance

■ Features

■ Long distance sensing type

- Long sensing distance with high quality lens
- Detects up to 15m (Through-beam type)
- Long sensing distance : Diffuse reflective type 1m, Polarized retroreflective type 3m (MS-2A)
- M.S.R (Mirror Surface Rejection) function (Polarized retroreflective type)
- Compact size: W20×H32×L10.6mm
- Protection structure IP65/IP67 (IEC standard)
- Light ON/Dark ON selectable
- Sensitivity adjustment VR incorporated
- Reverse polarity, Output short-circuit protection circuit
- Auto mutual interference prevention function (Except through-beam type)
- Improved noise resistance and minimize effect of inverter disturbance light

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



Line-up
Connector Type

■ Specifications

*The model name with '-C' is connector type.

Type		Long distance sensing type							
Model	NPN Open collector output	BJ15M-TDT BJ15M-TDT-C	BJ10M-TDT BJ10M-TDT-C	BJ7M-TDT	BJ3M-PDT BJ3M-PDT-C	BJ1M-DDT BJ1M-DDT-C	BJ300-DDT BJ300-DDT-C	BJ100-DDT BJ100-DDT-C	
	PNP Open collector output	BJ15M-TDT-P BJ15M-TDT-C-P	BJ10M-TDT-P BJ10M-TDT-C-P	BJ7M-TDT-P	BJ3M-PDT-P BJ3M-PDT-C-P	BJ1M-DDT-P BJ1M-DDT-C-P	BJ300-DDT-P BJ300-DDT-C-P	BJ100-DDT-P BJ100-DDT-C-P	
Sensing type		Through-beam			Polarized retroreflective	Diffuse reflective			
Sensing distance		0 to15m	0 to 10m	0 to 7m	(★1) 0.1 to 3m (MS-2A)	1m (Non-glossy white paper 300×300mm)	300mm (Non-glossy white paper 100×100mm)	100mm (Non-glossy white paper 100×100mm)	
Sensing target		Opaque material over ϕ12mm		Opaque material over ϕ8mm	Opaque material over ϕ7.5mm	Translucent, Opaque materials			
Hysteresis		—————				Max. 20% at sensing distance			
Response time		Max. 1ms							
Power supply		12-24VDC ±10%(Ripple P-P : Max.10%)							
Current consumption		Emitter/Receiver : Max. 20mA			Max. 30mA				
Light source		Infrared LED (850nm)	Red LED (660nm)	Red LED (650nm)	Red LED (660nm)	Infrared LED (850nm)	Red LED (660nm)	Infrared LED (850nm)	
Sensitivity adjustment		Built-in VR							
Operation mode		Light ON/Dark ON mode selectable							
Control output		NPN or PNP open collector output • Load voltage : Max. 26.4VDC • Load current : Max. 100mA • Residual voltage⇒ NPN : Max. 1V, PNP : Min. (Power voltage -2.5V)							
Protection circuit		Reverse polarity protection, Output short-circuit protection			Reverse polarity protection, Interference prevention function, Output short-circuit protection				
Indicator		Operation : Red, Stable : Green (Emitter's power indicator : Green)							
Connection		BJ ⇨ Outgoing cable type, BJ-C ⇨ M8 Connector							
Insulation resistance		Max. 20MΩ (at 500VDC megger)							
Dielectric strength		1000VAC 50/60Hz for 1minute							
Vibration		1.5mm or 300mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours							
Shock		500m/s² X, Y, Z directions for 3 times							
Ambient illumination		Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx (Receiver illumination)							
Ambient temperature		Operation : -25 to 55℃, Storage : -40 to 70℃ (at non-freezing, at non-dew status)							
Ambient humidity		Operation & Storage : 35 to 85%RH (at non-dew status)							
Protection		BJ ⇨ IP65 (IEC standard), BJ-C ⇨ IP67 (IEC standard)							
Material		Case : PC+ABS, Lens : PMMA, LED Cap : PC							
Cable		(★2) BJ ⇨ ϕ3.5mm, 3P, Length : 2m (Emitter of through-beam type : ϕ3.5mm, 2P, Length : 2m) (24AWG, Core wire diameter: 0.08mm, No. of core wire: 40, Insulator diameter: 1mm)							
Accessory	Common	Mounting bracket, Bolt, Nut, VR adjustment driver							
	Individual	—————			Reflector (MS-2A)	—————			
Approval		CE							
Unit weight		BJ ⇨ Approx. 90g, BJ-C ⇨ Approx. 20g			BJ ⇨ Approx. 60g, BJ-C ⇨ Approx. 30g	BJ ⇨ Approx. 45g, BJ-C ⇨ Approx. 10g			

※ (*) The sensing distance is extended to 0.1~4m or 0.1~5m when using optional reflector MS-2S or MS-3S.

※ (*) M8 connector cable is sold separately.

(Cable \Rightarrow 22AWG, Core wire diameter: 0.08mm, No. of core wire: 60, Insulator diameter: 1.25mm)

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(S) Field network device

(T) Production stoppage models & replacement

Transparent glass sensing/BGS reflective/Micro spot type

■ Features

■ BGS reflective type

- No effects of background object with Background Suppress (B.G.S) feature
- High characteristic then limited distance reflective type's and available for the sensing distance setting with volume
- Narrow sensing width and visible spot type
- Stable sensing to minimize error range in color or glossy of sensing target

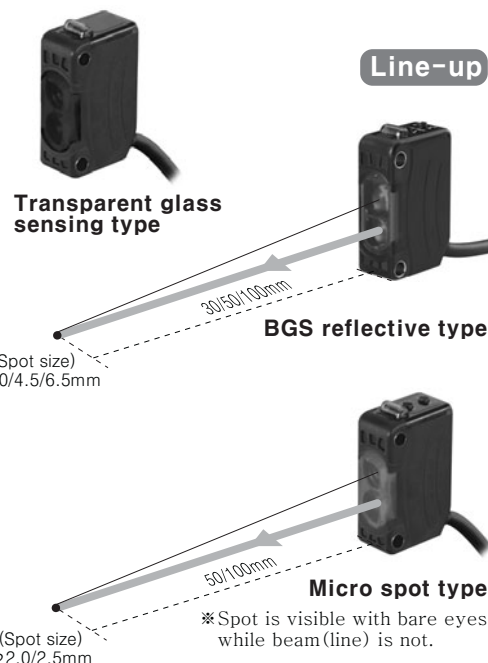
■ Transparent glass sensing type / Micro spot type

- Stable sensing for transparent object (LCD, PDP, glass etc) by BJG30-DDT
- Easy to check sensing location with visible micro spot
- Suitable for sensing small objects
(Min. sensing object: ϕ 0.2mm pure copper wire)

■ Commonness

- Compact size: W20×H32×L10.6mm
- Protection structure IP65 (IEC standard)
- Light ON/Dark ON selectable (Except BJG30-DDT)
- Sensitivity adjustment VR incorporated (Except BJG30-DDT)
- Reverse polarity, Output short-circuit protection circuit
- Auto mutual interference prevention function
- Improved noise resistance and minimize effect of inverter disturbance light

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



■ Specifications

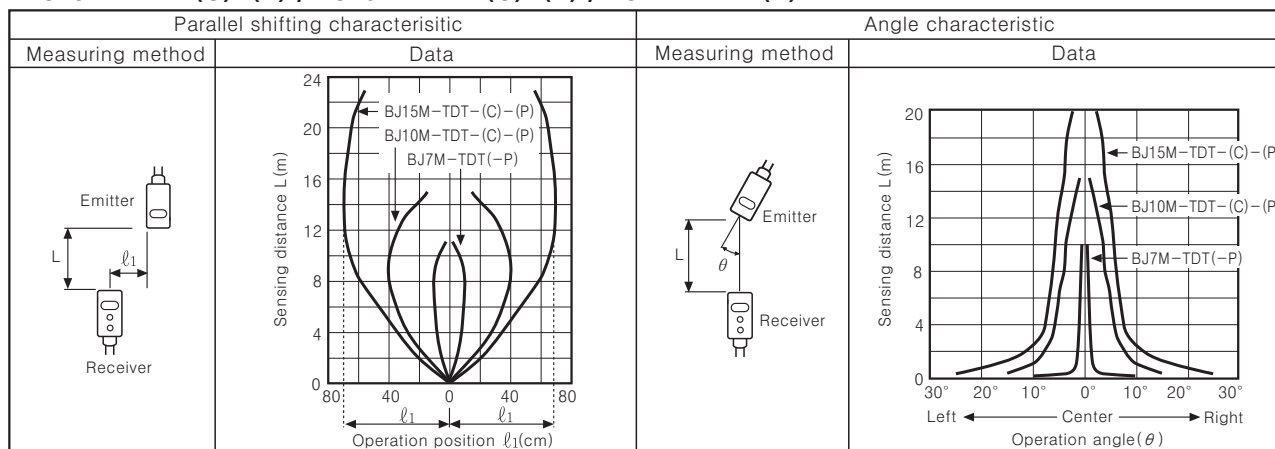
Type		Transparent glass sensing type		BGS reflective type			Micro spot type	
Model	NPN open collector output	BJG30-DDT		BJ30-BDT	BJ50-BDT	BJ100-BDT	BJN50-NDT	BJN100-NDT
	PNP open collector output	————		BJ30-BDT-P	BJ50-BDT-P	BJ100-BDT-P	BJN50-NDT-P	BJN100-NDT-P
Sensing type		Diffuse reflective		BGS reflective			Narrow beam reflective	
Sensing distance		0 to 30mm	0 to 15mm	10 to 30mm (Non-glossy white paper 50×50mm)	10 to 50mm (Non-glossy white paper 50×50mm)	10 to 100mm (Non-glossy white paper 100×100mm)	30 to 70mm	70 to 130mm
Sensing target		100×100mm Non-glossy white paper	Transparent glass 50×50mm (t=3.0mm)	Translucent, Opaque materials			Translucent, Opaque materials	
Min.diameter of transmitting SPOT		————		Approx. φ 5.0mm	Approx. φ 4.5mm	Approx. φ 6.5mm	Approx. φ 2.0mm	Approx. φ 2.5mm
Min.sensing target		————					Approx. min. φ 0.2mm(Copper wire)	
Hysteresis		Max. 20% at sensing distance		Max. 10% at sensing distance			Max. 25% at sensing distance	Max. 20% at sensing distance
Response time		Max. 1ms		Max. 1.5ms			Max. 1ms	
Power supply		12-24VDC ± 10% (Ripple P-P : Max.10%)						
Current consumption		Max. 30mA						
Light source/Wavelength		Infrared LED(850nm)		Red LED(660nm)			Red LED(650nm)	
Control output		NPN Open collector output • Load voltage : Max. 26.4VDC • Load current : Max. 100mA • Residual voltage : Max. 1V		NPN or PNP Open collector output • Load voltage : Max. 26.4VDC • Load current : Max. 100mA • Residual voltage : NPN : Max. 1V, PNP : Min. (Power voltage -2.5V)				
Sensitivity adjustment		————		Built-in VR				
Operation mode		Light ON mode fixed		Light ON / Dark ON mode selectable(Short rotator adjuster)				
Protection circuit		Reverse polarity protection, Output short-circuit protection, Interference prevention function						
Indicator		Operation indicator : Red, Stability indicator : Green						
Connection		Outgoing cable type						
Insulation resistance		Min. 20MΩ (at 500VDC megger)						
Dielectric strength		1,000VAC 50/60Hz for 1minute						
Vibration		1.5mm or 300m/s ² amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours						
Shock		500m/s ² X, Y, Z directions for 3 times						
Ambient illumination		Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx(Receiver illumination)						
Ambient temperature		Operation:-25 to 55℃, Storage:-40 to 70℃ (at non-freezing, non-dew status)						
Ambient humidity		Operation & Storage : 35 to 85%RH(at non-dew status)						
Protection		IP65 (IEC standard)						
Material		Case : PC+ABS, Lens : PMMA, LED CAP : PC						
Cable		φ 3.5mm, 3P, Length : 2m						
Accessory		Mounting bracket, Bolt		Mounting bracket, Bolt, Adjustment driver				
Approval		CE						
Unit weight		Approx. 45g		Approx. 50g			Approx. 45g	

Long sensing distance/BGS reflective/Micro spot type

■ Feature data

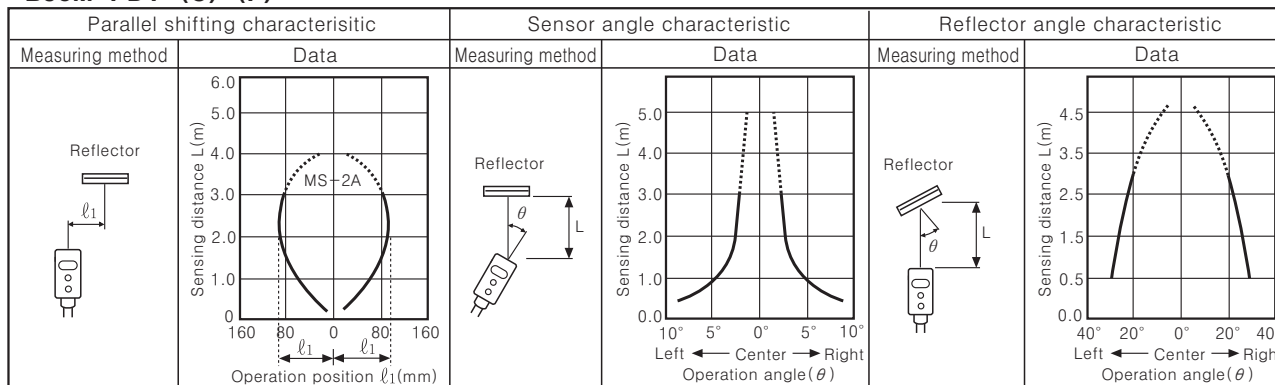
● Through-beam

● BJ15M-TDT-(C)-(P) / BJ10M-TDT-(C)-(P) / BJ7M-TDT-(P)



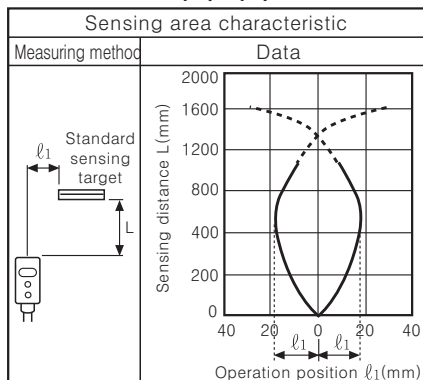
● Retroreflective type

● BJ3M-PDT-(C)-(P)

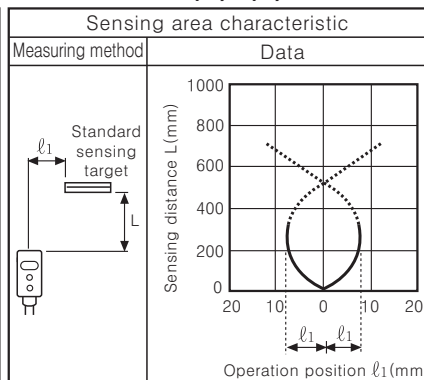


● Diffuse/Narrow beam reflective

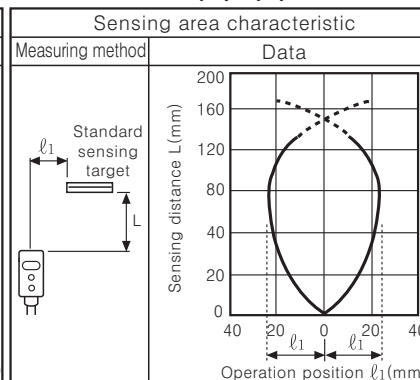
● BJ1M-DDT-(C)-(P)



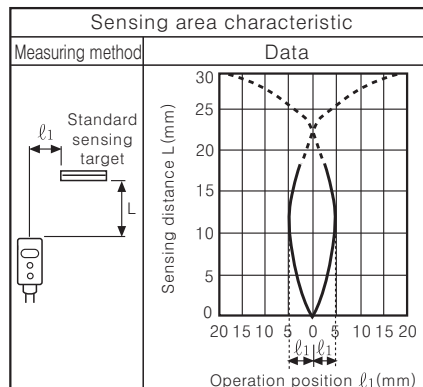
● BJ300-DDT-(C)-(P)



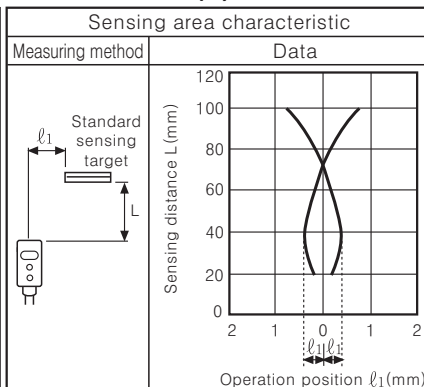
● BJ100-DDT-(C)-(P)



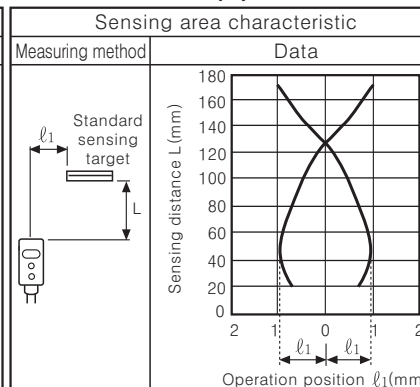
● BJG30-DDT



● BJN50-NDT-(P)



● BJN100-NDT-(P)



(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

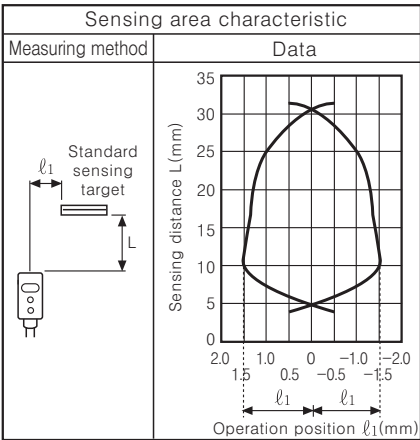
(T) Production stoppage models & replacement

BJ Series

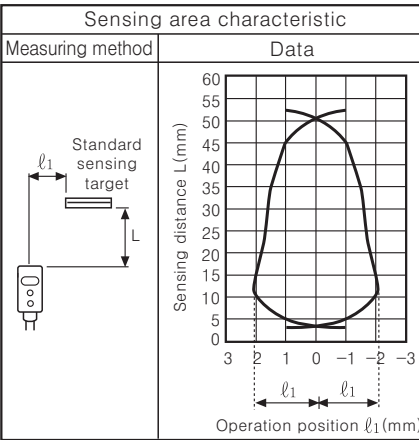
Feature data

BGS reflective

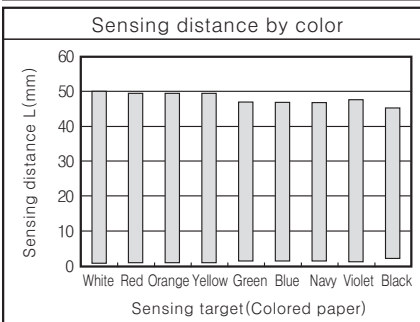
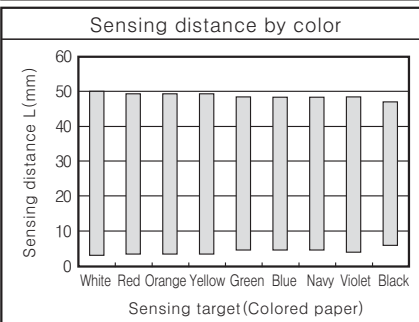
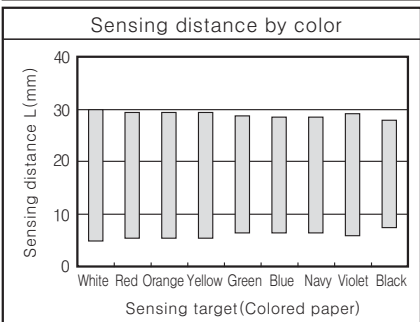
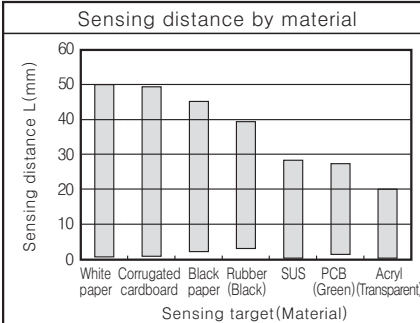
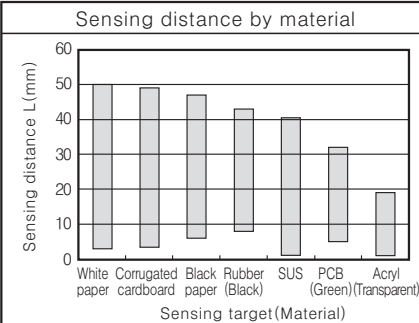
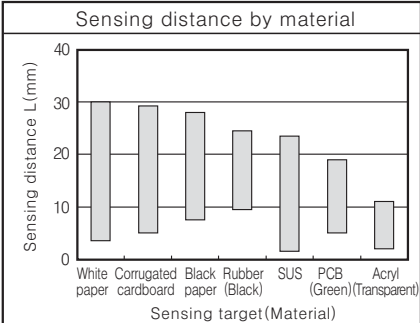
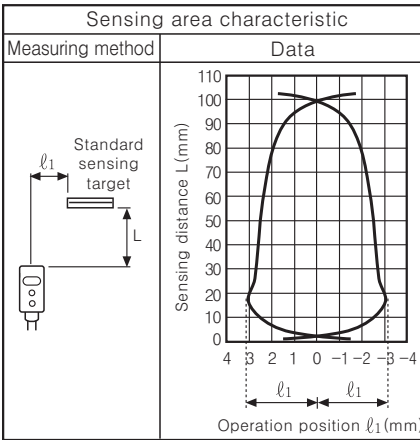
●BJ30-BDT / BJ30-BDT-P



●BJ50-BDT / BJ50-BDT-P

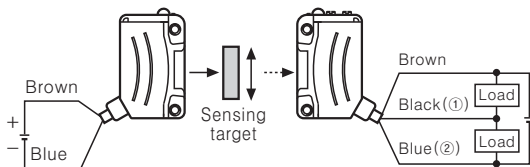


●BJ100-BDT / BJ100-BDT-P

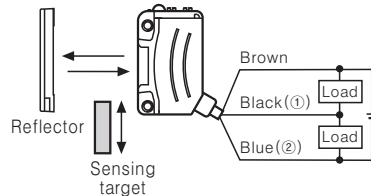


Connections

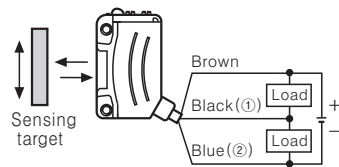
●Through-beam



●Retroreflective

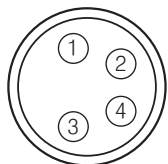


●Diffuse/Narrow beam/ BGS reflective



※ ① : The load connection of NPN open collector output, ② : The load connection of PNP open collector output

Connections



M8 Connector pin

Connector pin No.	Cable colors	Function
①	Brown	Power Source (+V)
②	White	—
③	Blue	Power Source (0V)
④	Black	Output

※ Connector pin ② is N.C (Not Connected) terminal.

●Connector cable (Sold separately)

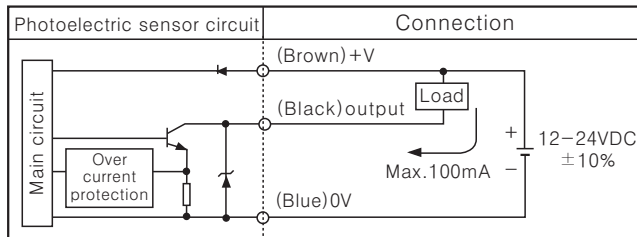
※ Connector cable model
: CID408-□, CLD408-□

※ Please refer to G-5 for connector cable.

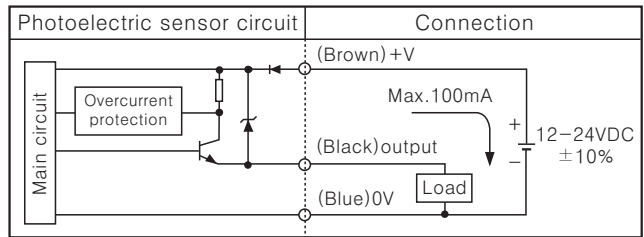
Long sensing distance/BGS reflective/Micro spot type

Control output diagram

●NPN output



●PNP output



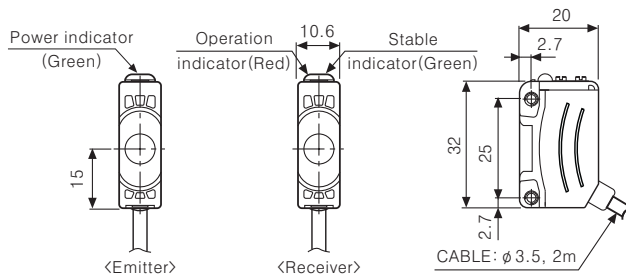
Operation mode

Light ON mode	Receiver operation	Operation indicator (Red LED)	TR output
	ON	ON	ON
	OFF	OFF	OFF
Dark ON mode	Receiver operation	Operation indicator (Red LED)	TR output
	ON	ON	ON
	OFF	OFF	OFF

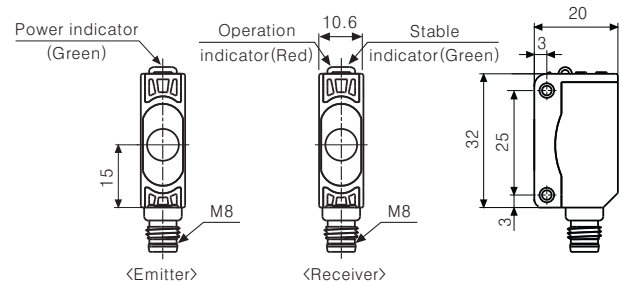
Dimensions

(Unit:mm)

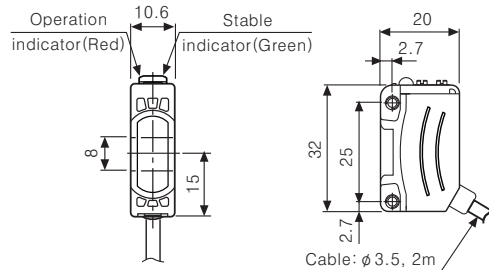
●Through-beam



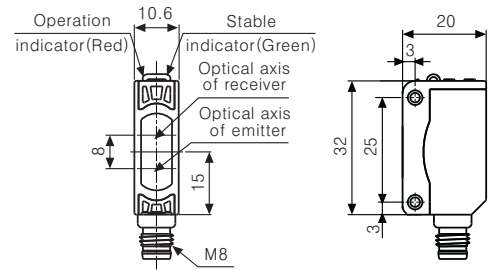
●Through-beam (Connector type)



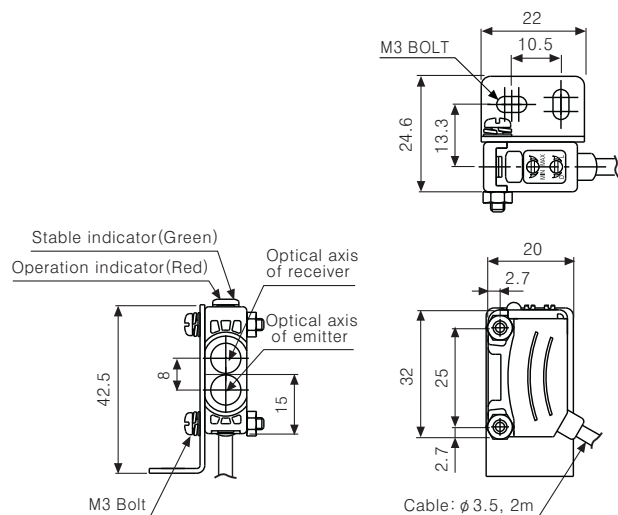
●Retroreflective



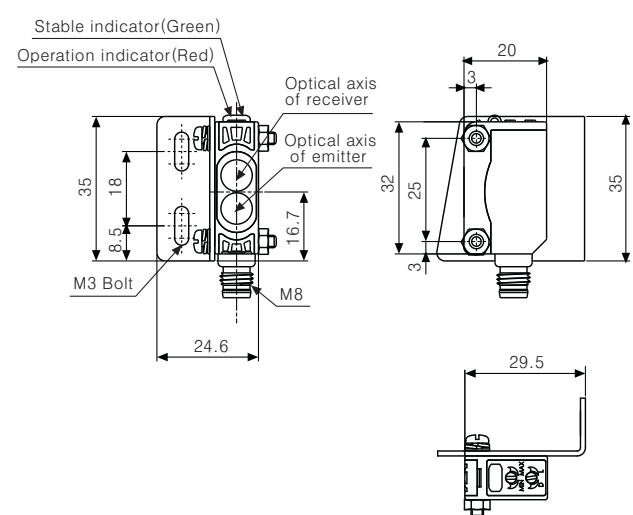
●Retroreflective (Connector type)



●Diffuse/Narrow beam/BGS reflective (Connect the bracket A)



●Diffuse reflective (Connector type) (Connect the bracket B)



(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

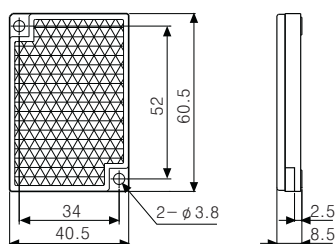
(T) Production stoppage models & replacement

BJ Series

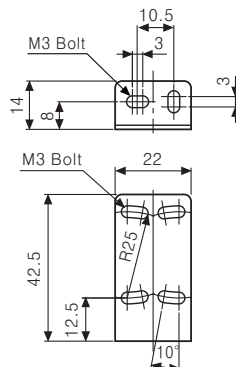
■ Dimensions

(Unit:mm)

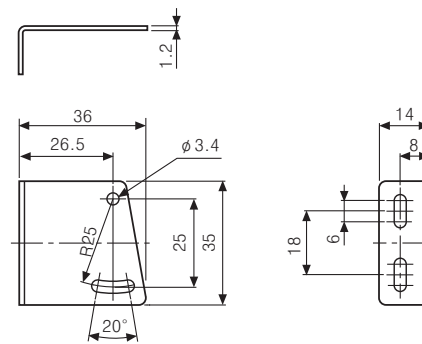
- Reflector
(Include: MS-2A,
Sold separately: MS-2S, MS-3S)



- Bracket A

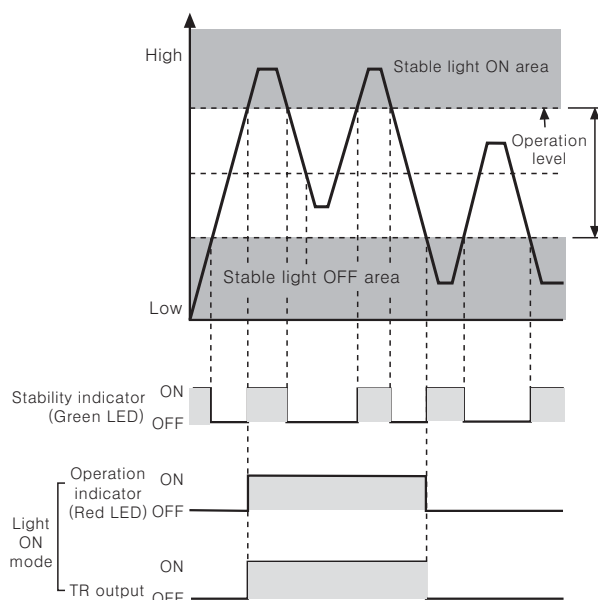


- Bracket B (Sold separately)

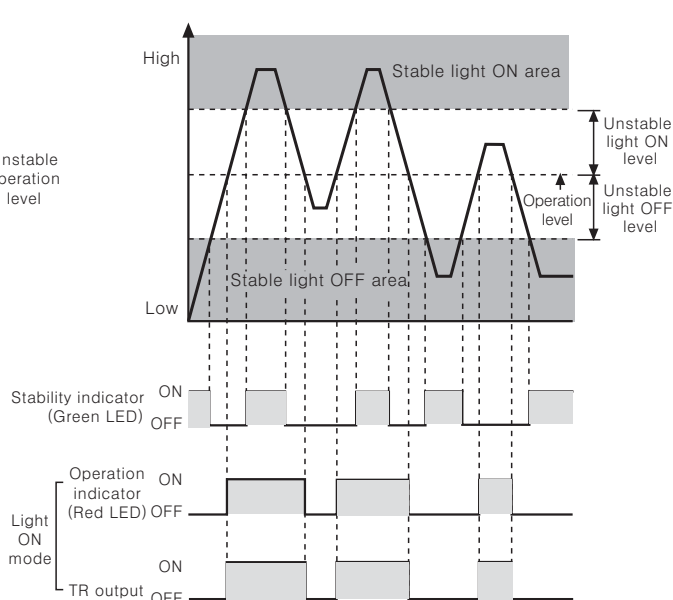


■ Operation timing diagram

◎ Through-beam



◎ Diffuse/Narrow beam/BGS reflective

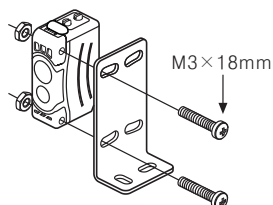


※ The waveform of "Operation indicator" and "TR output" is for Light ON mode, it is operated conversely for Dark ON mode.

■ Mounting and sensitivity adjustment

◎ For mounting

Please use M3 screw for mounting of sensor, set the tightening torque under 0.5kgf·cm.



◎ Switching of operation mode

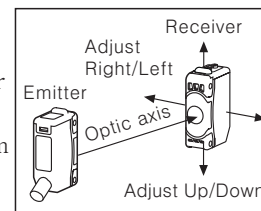
Light ON operation mode (Light ON)		Turn the operation switching adjuster to right (L direction), it is set as Light ON mode.
Dark ON operation mode (Dark ON)		Turn the operation switching adjuster to left (D direction), it is set as Light OFF mode.

※ The operation switching adjuster is installed in the receiver for transmitted beam type.

◎ Mounting

● Through-beam type

1. Place the emitter and receiver facing each other and apply the power.
2. After adjust the position of the emitter and receiver and check their stable indicating range, mount them in the middle of the range.
3. After mounting, check the operation of sensor and lighting of stable indicator in both status. (None or sensing target status)

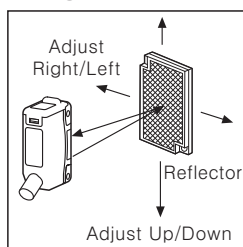


※ When the sensing target is translucent or small (under sensing target of **Specifications'**), it can be missed by the sensor because the light can penetrate it.

Long sensing distance/BGS reflective/Micro spot type

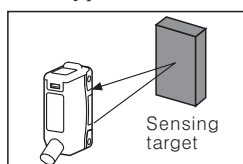
●Retroreflective type

1. Place the sensor and reflector facing each other and apply the power.
2. After adjust the position of the sensor and reflector and check their stable indicating range, mount them in the middle of the range.
3. After mounting, check the operation of sensor and lighting of stable indicating in both status. (None or sensing target status)

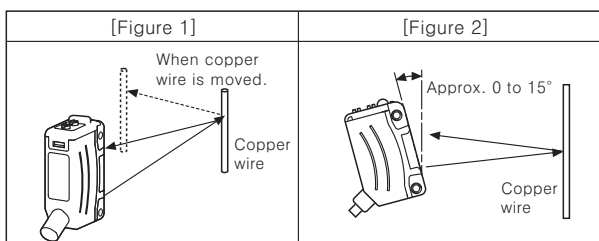


●Diffuse/Narrow beam/BGS reflective type

After place a sensing target, adjust the sensor to up or down, right or left. Then, fix the sensor in center of position where the indicator is operating.



●Object(Copper wire) detection <Micro spot type>



※Mount sensor slanted at an angle ranged 0 to 15° shown above as [Figure 2] for stable detection to detect as shown in [Figure 1].

■Sensitivity adjustment

◎Sensitivity adjustment

Order	Position	Description
1	(A) MIN MAX	Turn the sensitivity adjuster to the right of min. and check position(A) where the indicator is turned on in "Light ON status".
2	(A) (B) (C) MIN MAX	Turn the sensitivity adjuster more to the right of position(A), check position(B) where the indicator is turned on. And turn the adjuster to the left, check position(C) where the indicator is turned off in "Light OFF status". ※If the indicator is not lighted although the adjuster is turned to the max. position, the max. position is(C).
3	Optimal sensitivity (A) (C) MIN MAX	Set the adjuster at the center of (A) and (C). To set the optimum sensitivity, check the operation and lighting of stable indicator with sensing target or without it. If the indicator is not lighted, please check the sensing method again because sensitivity is unstable.

※No sensitivity adjustment function available for BJG30-DDT models

	"Light ON status"	"Light OFF status"
Through-beam type	Emitter → Receiver	Emitter → Sensing target → Receiver
Retro-reflective type	Sensor ↔ Reflector	Sensor → Sensing target → Reflector
Diffuse/Narrow beam/BGS reflective	Sensor → Sensing target → Background object	Sensor → Background object

※Set the sensitivity to operate in a stable light ON area, the reliability for the environment (Temperature, voltage, dust etc) will be increased.

※Do not apply an excessive force on adjuster, it can be broken.

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

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(K) Timer

(L) Panel meter

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(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

(T) Production stoppage models & replacement


BS5 Series

Micro photo sensor

■ Features


- Built-in amplifier, NPN open collector output
- Various selection by installation position
(Appearance: K, T, L, Y, V type)
- Light ON / Dark ON mode selectable
- High speed response frequency : 2kHz
- Wide range of power source: 5–24VDC
(Easy to connect with various IC, relay, programmable controller etc)
- Dust resistance structure
: Protecting by window of emitter/receiver
- Red LED status indication



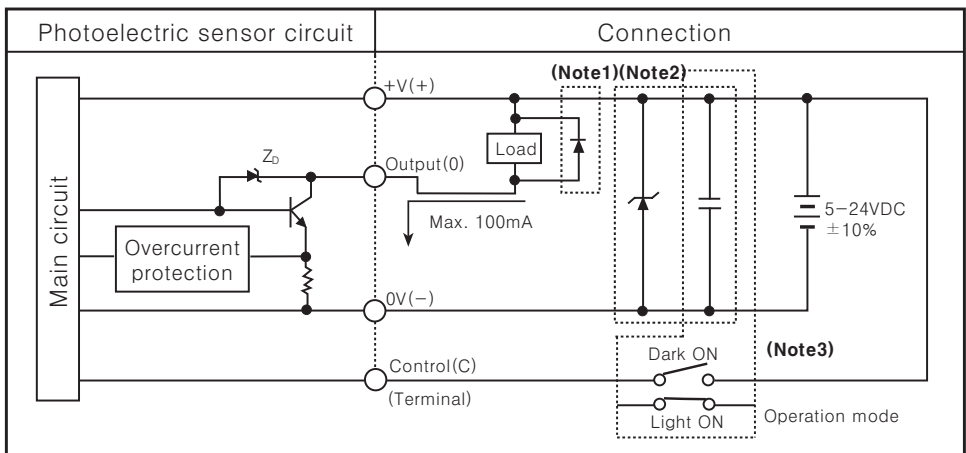
 Please read "Caution for your safety" in operation manual before using.



■ Specifications

Type	Micro photo sensor				
Model	BS5-K2M	BS5-T2M	BS5-L2M	BS5-Y2M	BS5-V2M
Sensing distance	5mm fixed				
Sensing type	Through-beam (Not modulated)				
Sensing target	Min. 0.8×1mm opaque materials				
Hysteresis	0.05mm				
Power supply	5–24VDC ±10% (Ripple P–P : Max. 10%)				
Current consumption	Max. 30mA (at 26.4VDC)				
Control output	NPN open collector output • Load voltage : Max. 30VDC • Load current : Max. 100mA • Residual voltage : Max. 1.2V				
Operation mode	Light ON / Dark ON mode selectable by control terminal				
Operation indicator	Red LED				
Response time	Received light : Max. 20μs, Interrupted light : Max. 100μs				
Response frequency	2kHz (Please see the measuring range of frequency response)				
Connection	Connector type				
Light emitting element	Infrared LED				
Light receiving element	Photo transistor				
Vibration	1.5mm or 300m/s ² amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours				
Shock	500m/s ² (50G) in X, Y, Z directions for 3 times				
Noise strength	±240V the square wave noise (pulse width: 1μs) by the noise simulator				
Dielectric strength	1,000VAC 50/60Hz for 1minute				
Insulation resistance	Min. 20MΩ (at 250VDC megger)				
Ambient illumination	Fluorescent lamp : Max. 1000lx (Receiver illumination)				
Ambient temperature	–20 to 55°C (at non-freezing status), Storage : –25 to 85°C				
Ambient humidity	Operation & Storage : 35 to 85%RH (at non-dew status)				
Protection	IP50 (IEC standard)				
Material	PBT				
Approval					
Unit weight	Approx. 30g				

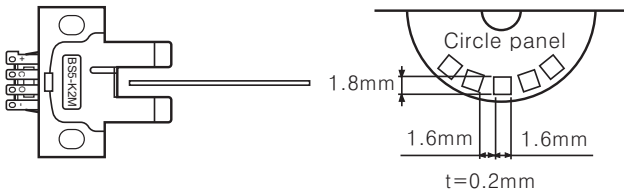
Control output diagram



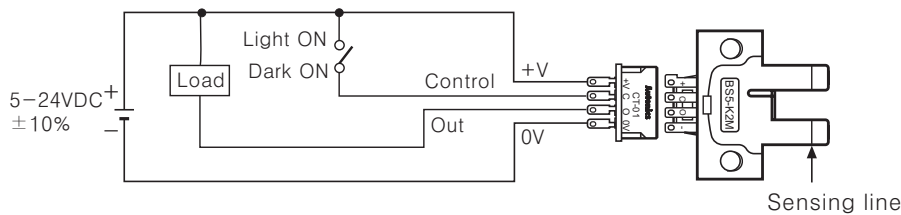
- ※ (Note1) There is Z_D (Zener Diode) absorbing the surge in output circuit, connect diode absorbing the surge at both terminals of load to protect the unit when connecting large inductive load.
- ※ (Note2) If there are surge in power line, connect Z_D (30 to 35V) or Condenser (0.1 to 1 μ F / 400 to 600V) to remove the surge.
- ※ (Note3) Operation mode selection : Connect Control(C) terminal into terminal +V(+) to operate Light ON mode. Dark ON mode is available with disconnection status. Please connect a condenser (Over 0.1 to 1 μ F / 50V) between terminal +V(+) and 0V for stable status in case of Light ON mode.

How to measure response frequency

Response frequency is the value getting from revolving the circle panel below.



Connections



- ※ Connect the unit using socket.
- If it is soldered on terminal pin, product damage may result.

Operation mode

Light ON mode	Receiver operation	ON	OFF	Dark ON mode	Receiver operation	ON	OFF
	Operation indicator (Red LED)	ON	OFF		Operation indicator (Red LED)	ON	OFF
	TR output	ON	OFF		TR output	ON	OFF

- ※ If the control output terminal is short-circuited or overcurrent condition exists, the control output will turn off due to protection circuit.

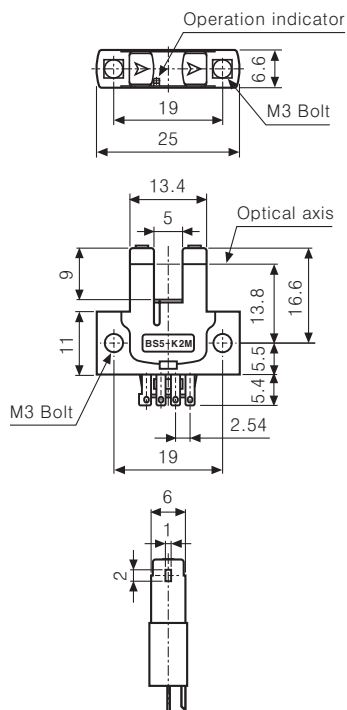
(A) Photo electric sensor
(B) Fiber optic sensor
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(D) Proximity sensor
(E) Pressure sensor
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(R) Graphic/Logic panel
(S) Field network device
(T) Production stoppage models & replacement

BS5 Series

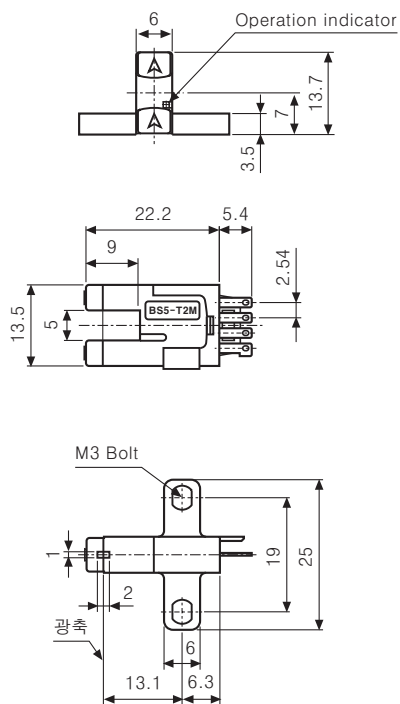
■ Dimensions

(Unit:mm)

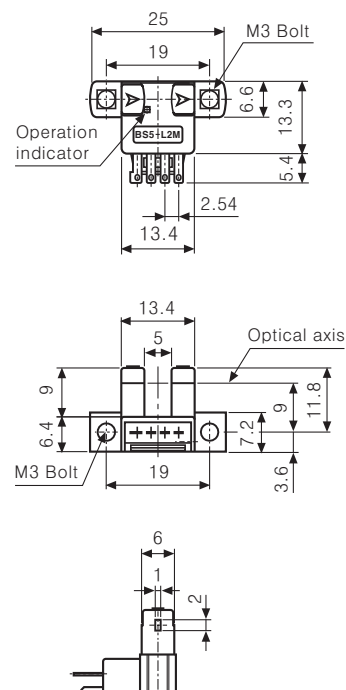
●BS5-K2M



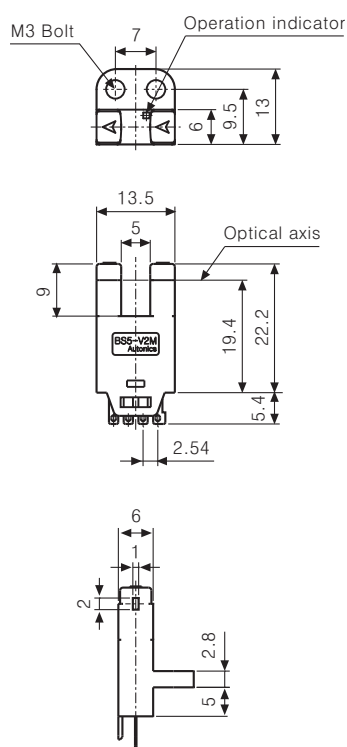
●BS5-T2M



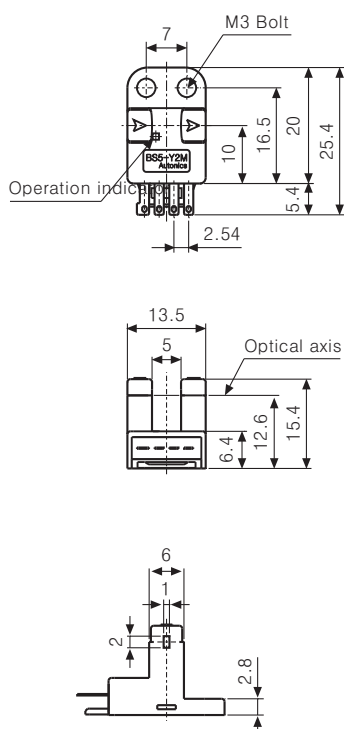
●BS5-L2M



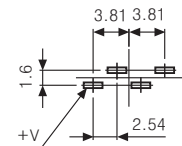
●BS5-V2M



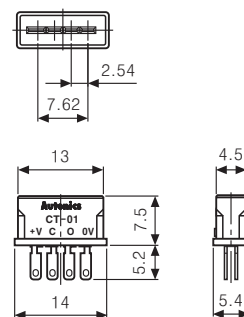
●BS5-Y2M



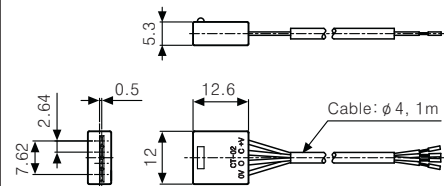
●PCB mounting hole



●Socket : CT-01(Sold separately)



●Socket : CT-02(Sold separately)



※Cable length is customizable.

Diffuse Reflective Type with Long Sensing Distance

Small, diffuse reflective type with long sensing distance

Upgrade

■ Features

- Realization of long sensing distance (2m) by special optical design.
- Protection structure IP64 (IEC standard) (Upgrade)
- Built-in stable light ON indicator.
- Includes sensitivity adjustment function.
- 2 color LED display.

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



■ Specifications

Model	NPN open collector	BA2M-DDT	BA2M-DDTD
	PNP open collector	BA2M-DDT-P	BA2M-DDTD-P
Sensing type	Diffuse reflective		
Sensing distance	2m (Non-glossy white paper 200×200mm)		
Sensing target	Translucent, Opaque materials		
Hysteresis	Max. 20% at sensing distance		
Response time	Approx. 1ms		
Power supply	12-24VDC ±10% (Ripple P-P : Max. 10%)		
Current consumption	Max. 15mA (Max. 30mA when the output is ON)		
Light source	Infrared LED (850nm)		
Sensitivity adjustment	Built-in VR		
Operation mode	Light ON		Dark ON
Control output	NPN or PNP open collector output • Load voltage : Max. 26.4VDC • Load current : Max. 100mA • Residual voltage : NPN : Max. 1V, PNP : Min. (Power voltage -2.5V)		
Protection circuit	Reverse polarity protection, Output short-circuit protection		
Receiver	Photo diode (Built-in IC)		
Indicator	• Operation : Red • Stability : Orange (Light ON), Green (Dark ON)		
Connection	Outgoing cable		
Insulation resistance	Min. 20MΩ (at 500VDC megger)		
Noise strength	±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 in each of X, Y, Z directions for 2 hours		
Shock	100m/s ² (10G) in X, Y, Z directions for 3 times		
Ambient illumination	Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx (Receiving illumination)		
Ambient temperature	Operation : -20 to 55℃, Storage : -25 to 70℃ (at non-freezing status)		
Ambient humidity	Operation, Storage : 35 to 85%RH (at non-dew status)		
Protection	IP64 (IEC standard)		
Material	Case : ABS, Lens : Acrylic		
Cable	3P, φ3mm, Length : 2m (AWG24, Core wire φ0.8mm annealed copper solid wire, 40 strands insulator, Outer diameter φ1mm)		
Accessory	Adjustment driver		
Approval	CE		
Unit weight	Approx. 50g		

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

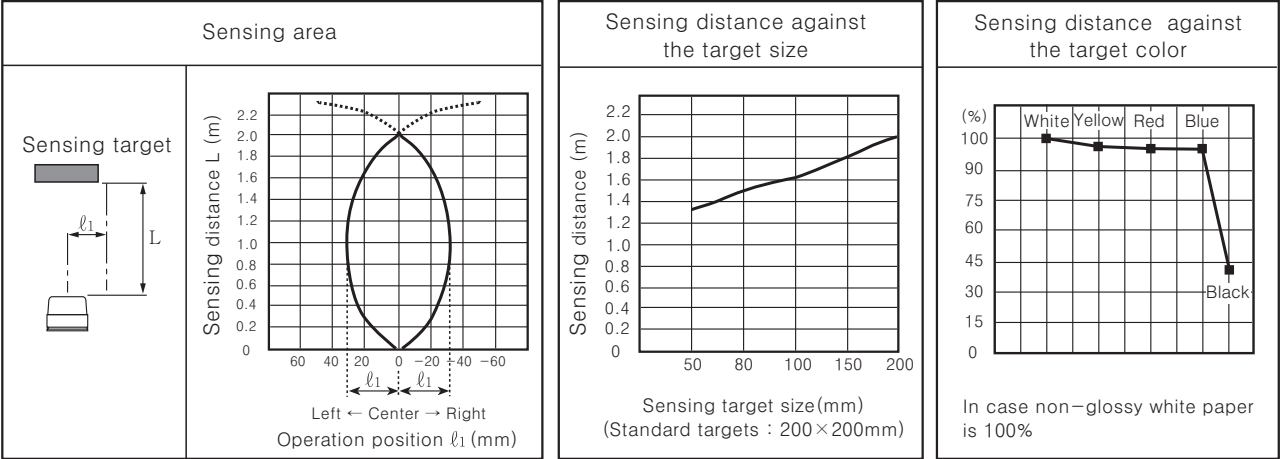
(R) Graphic/Logic panel

(S) Field network device

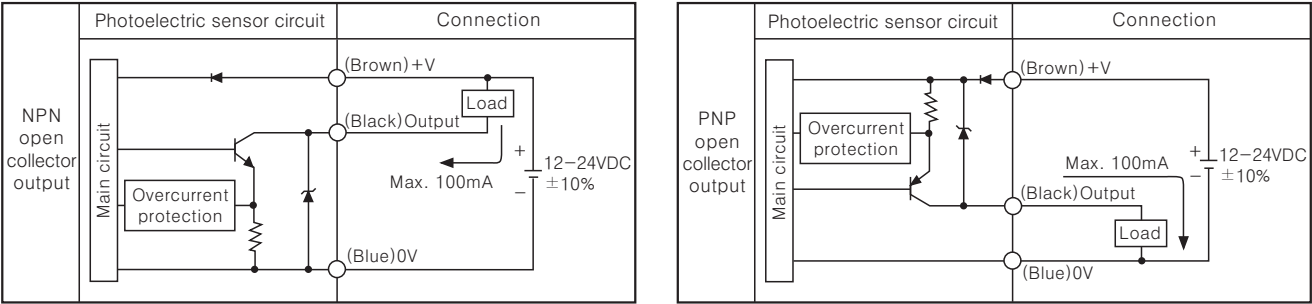
(T) Production stoppage models & replacement

BA Series

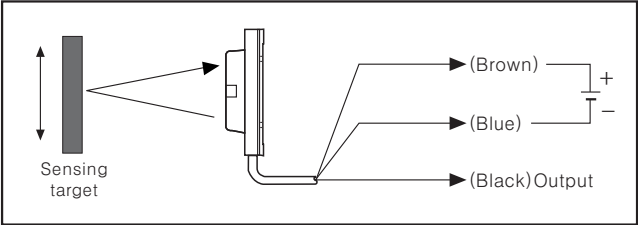
Feature data



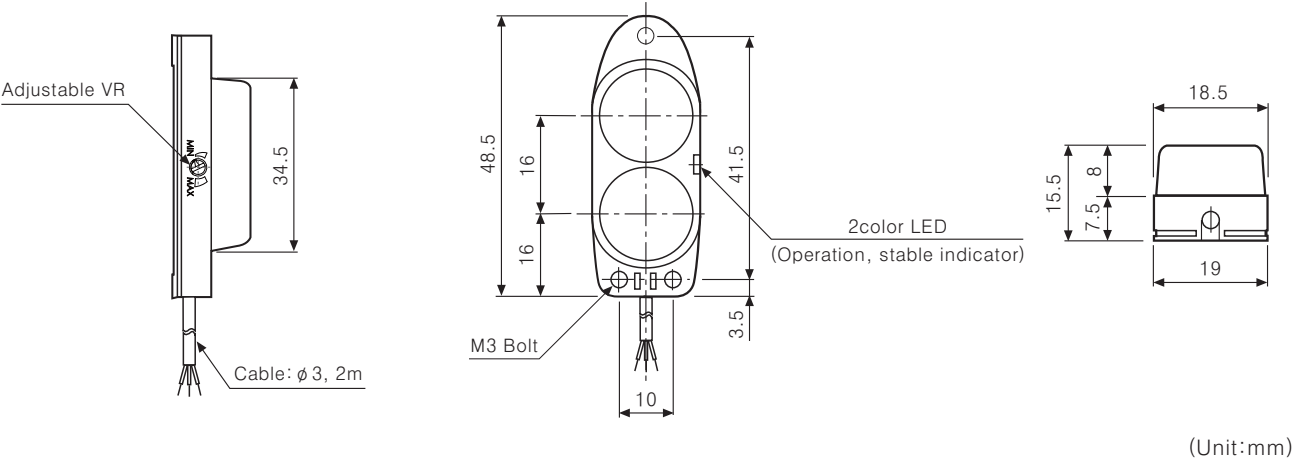
Control output diagram



Connections



Dimensions

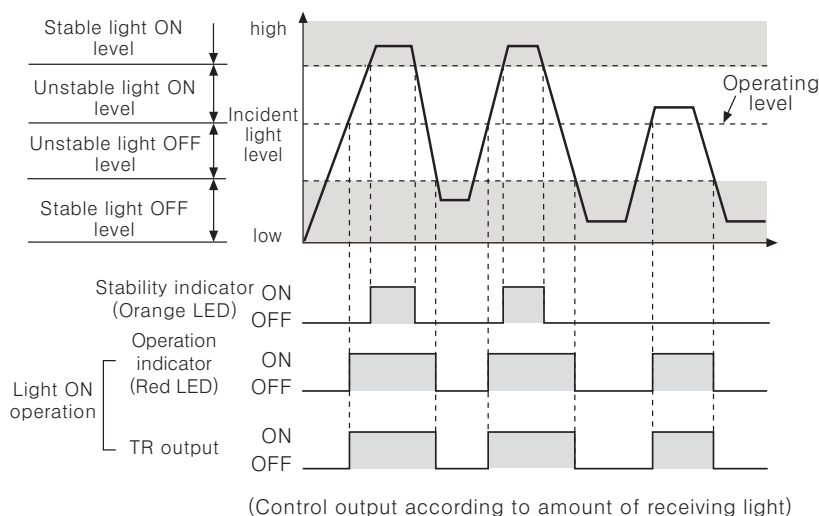


Diffuse Reflective Type with Long Sensing Distance

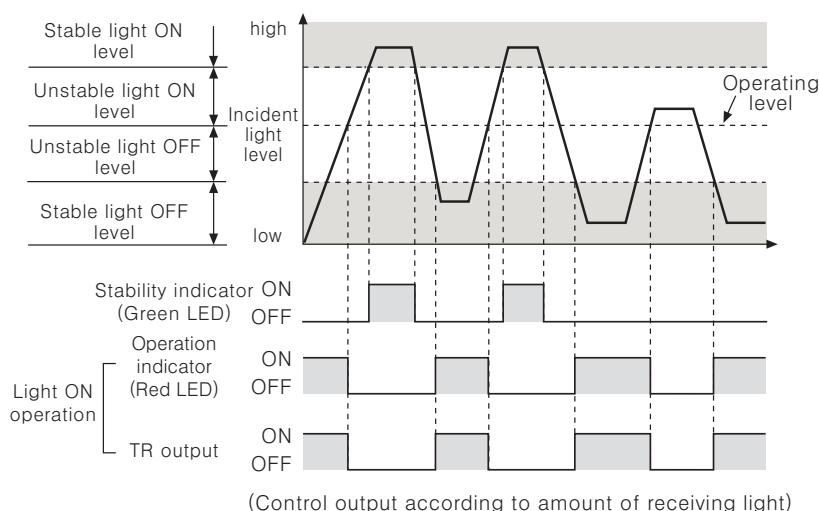
■ Operation mode

If the control output terminal is short-circuited or overcurrent condition exists, the control output will turn off due to protection circuit.

● Light ON mode



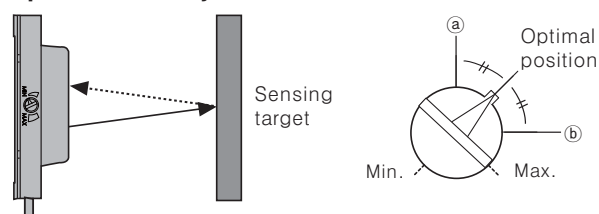
● Dark ON mode



■ Mounting and sensitivity adjustment

Please check wiring after setting the target and supply the power to this sensor.

● Optical axis adjustment



After place a sensing target, adjust the sensor to up or down, right or left. Then, fix the sensor in center of position where the indicator is operating.

● Adjustment

1. When sensing the object, set the sensitivity adjustment in stable Light ON area (orange: Light On, Green: Dark On) as shown '■ Operation mode'.
2. The sensitivity should be adjusted depending on a sensing target or mounting place.
3. Set the target at a position to be detected by the beam, then turn the adjuster until position ① where the indicator turns on from min. position of the adjuster.
4. Take the target out of the sensing area, then turn the adjuster until position ② where the indicator turns on. If the indicator dose not turn on, Max. position ②.
5. Set the adjuster at the center of two switching position ①, ②.

※ The sensing distance indicated on specification chart is for 200×200mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

(T) Production stoppage models & replacement

BY Series

Small emitter/receiver synchronizing type

■ Features

- Small size : W12×H16×D30mm
- Minimizing malfunction by extraneous light by synchronizing emitter and receiver.
- Reverse power polarity and overcurrent protection circuit
- Fast response speed : Max. 1ms



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

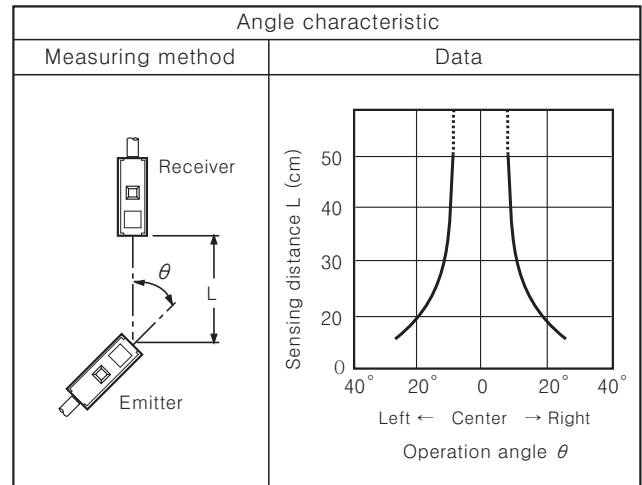
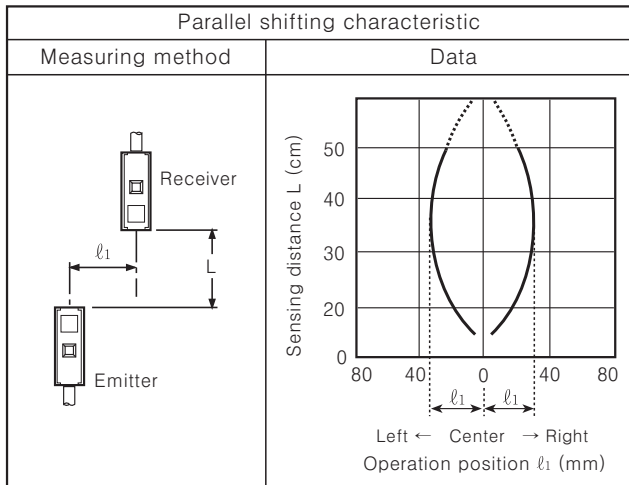
■ Specifications

Model	Standard type	Side sensing type
	BY500-TDT	BYS500-TDT
Sensing type	Through-beam	
Sensing distance	500mm	
Sensing target	Opaque materials of Min. ϕ 5mm	
Response time	Max. 1ms	
Power supply	12-24VDC \pm 10% (Ripple P-P : Max. 10%)	
Current consumption	Max. 30mA	
Light source	Infrared LED(940nm)	
Operation mode	Dark ON	
Control output	NPN open collector output • Load voltage : 30VDC • Load current : Max. 100mA • Residual voltage : Max. 1V	
Protection circuit	Reverse polarity protection, Output short-circuit protection	
Indicator	Operation indicator : Red LED	
Connection	Outgoing cable(2m)	
Insulation resistance	Min. 20M Ω (at 500VDC megger)	
Noise strength	\pm 240V the square wave noise (pulse width : 1 μ s) by the noise simulator	
Dielectric strength	1,000VAC 50/60Hz for 1minute	
Vibration	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours	
Shock	500m/s ² (50G) in X, Y, Z directions for 3 times	
Ambient illumination	Sunlight : Max. 11,000 lx, Incandescent lamp : Max. 3,000 lx	
Ambient temperature	-10 to 60℃ (at non-freezing status), Storage : -25 to 70℃	
Ambient humidity	35 to 85%RH, Storage : 35 to 85%RH	
Protection	IP50 (IEC standard)	
Material	Case : ABS, Lens : Acrylic	
Cable	4P, ϕ 4mm, Length : 2m	
Accessory	Mounting bracket, Bolts/Nuts	
Unit weight	Approx. 150g	

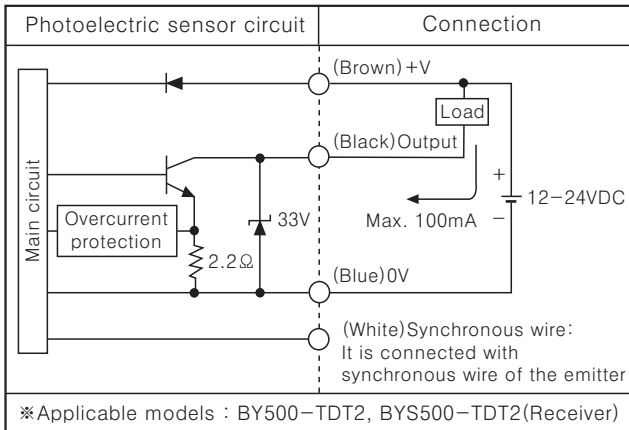
Small and Amplifier Built-in Type

Feature data

●BY500-TDT ●BYS500-TDT

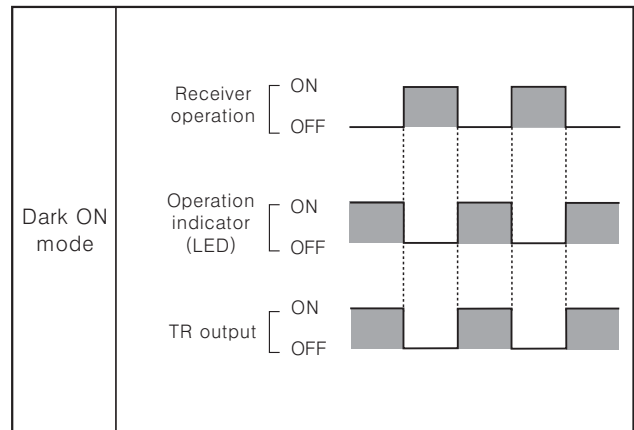


Control output diagram

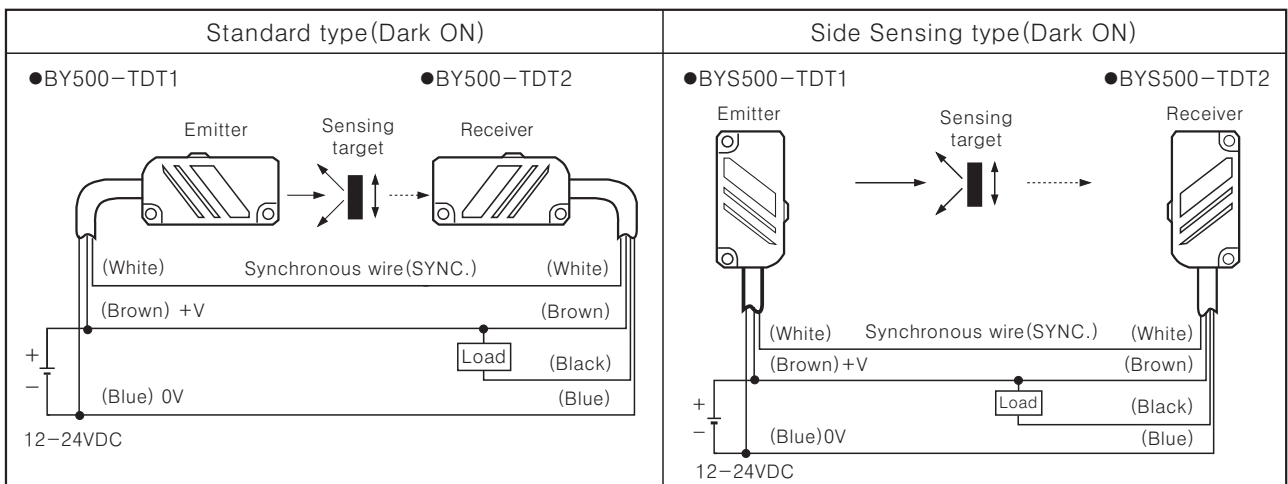


- ※If the control output terminal is short-circuited or overcurrent condition exists, the control output will turn off due to protection circuit.
- ※Please supply the power to Brown and Blue wire of emitter and Synchronous wire(White) of the receiver must be connected with that of the emitter.

Operation mode



Connections



- ※The power of the emitter and the receiver must be supplied from same power line.
- ※Synchronous wire(White) of the receiver must be connected with that of the emitter.

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

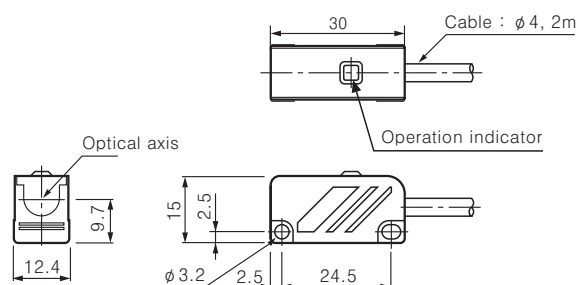
(T) Production stoppage models & replacement

BY Series

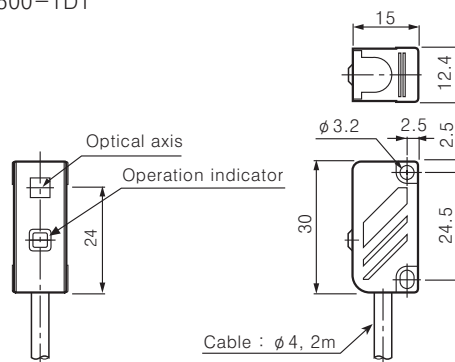
■ Dimensions

(Unit:mm)

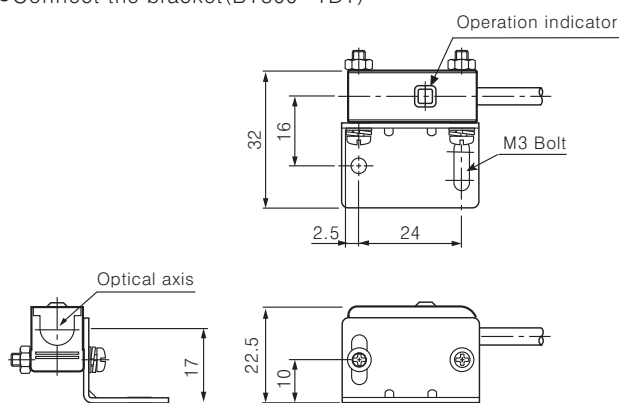
●BY500-TDT



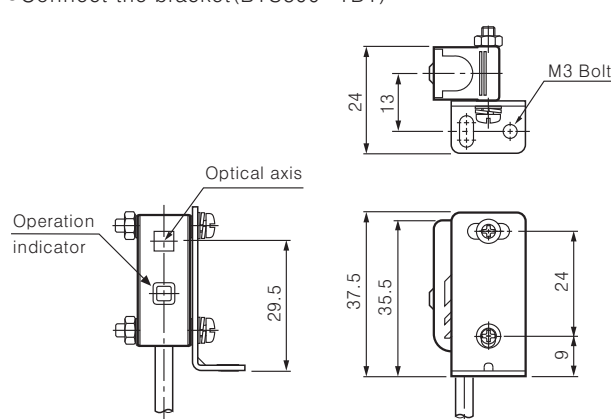
●BYS500-TDT



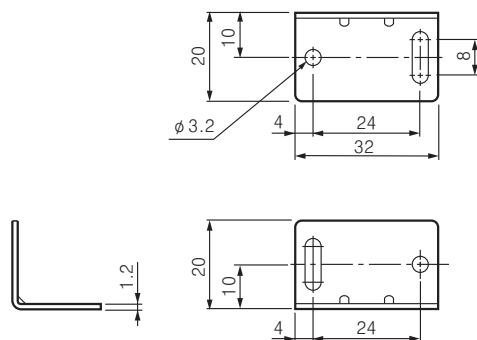
●Connect the bracket(BY500-TDT)



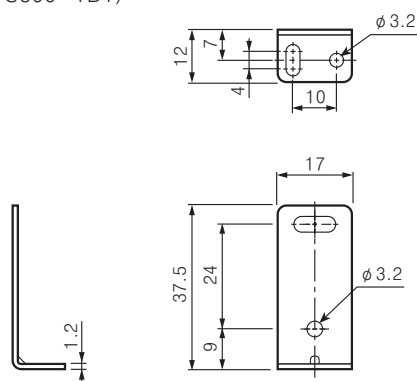
●Connect the bracket(BYS500-TDT)



●Bracket(BY500-TDT)



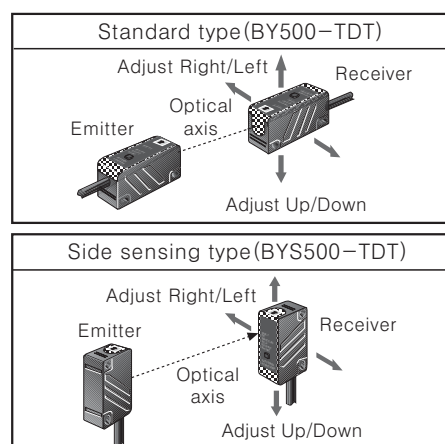
●Bracket(BYS500-TDT)



■ Mounting and sensitivity adjustment

1. Supply the power to the sensor, after install the emitter and the receiver facing each other.
2. Set the receiver in the middle of position where indicator turns on adjusting the receiver to the right and the left or up and down.
3. Fix both units tightly after checking that the unit sense the target.

※If the sensing target is translucent body or smaller than $\phi 5mm$, it might not be detected because the target allows too much light to pass.



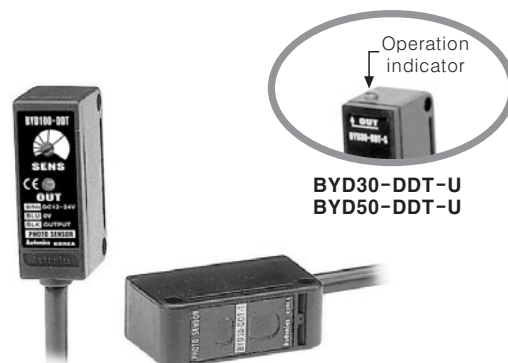
BYD Series Small and Amplifier Built-in Type

Small diffuse reflective and limited distance reflective type photoelectric sensor

■ Features

- Easy installation by compact size
- Superior detection not affected by color of target (Limited distance reflective type)
- Operation indicator is located on the top (BYD30-DDT-U, BYD50-DDT-U)
- Easy to adjust the response time via Timer function (OFF delay time : 0.1 to 2sec. variable)
- Built-in output short-circuit protection circuit / reverse polarity protection circuit

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



■ Specifications

Model	BYD30-DDT BYD30-DDT-U(★1) BYD30-DDT-T(★2)	BYD50-DDT BYD50-DDT-U(★1) BYD50-DDT-T(★2)	BYD100-DDT	BYD3M-TDT	BYD3M-TDT-P
Sensing type	Limited distance reflective		Diffuse reflective	Through-beam	
Sensing distance	(★3) 10 to 30mm	(★3) 10 to 50mm	(★3) 100mm	3m	
Sensing target	Translucent, Opaque materials			Opaque materials of Min. ϕ 6mm	
Hysteresis	Max. 10% at sensing distance		Max. 20% at sensing distance	————	
Response time	Operation:Max. 3ms, Return:Max. 100ms (When the timer adjuster is minimum)		Operation:Max. 3ms Return:Max. 100ms	Max. 1ms	
Power supply	12-24VDC \pm 10% (Ripple P-P : Max. 10%)				
Current consumption	Max. 35mA			Max. 30mA	
Light source	Infrared LED(modulated)				
Sensitivity adjustment	Fixed		Built-in VR	Fixed	
Operation mode	Light ON mode fixed			Dark ON(Light ON : Option)	
Control output	NPN open collector output Load voltage : Max. 30VDC, Load current : Max. 50mA, Residual voltage : Max. 1V			NPN open collector output Load voltage : Max. 30VDC, Load current : Max. 100mA, Residual voltage : Max. 1V	PNP open collector output Load current : Max. 100mA, Residual voltage : Min. (Power voltage -2.5V)
Protection circuit	Reverse polarity protection, Output short-circuit protection				
Timer function	Built-in OFF delay timer (Adjustable) <Delay time : Max. 0.1 to 2sec. >		————		
Indication	Operation indicator : Red LED				
Connection	Outgoing cable (2m)				
Insulation resistance	Min. 20M Ω (at 500VDC megger)				
Noise strength	\pm 240V the square wave noise(pulse width : 1 μ s) by the noise simulator				
Dielectric strength	1,000VAC 50/60Hz for 1minute				
Vibration	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours				
Shock	500m/s ² (50G) in X, Y, Z directions for 3 times				
Ambient illumination	Sunlight : Max. 11,000 lx, Incandescent lamp : Max. 3,000 lx				
Ambient temperature	-20 to 65℃ (at non-freezing status), Storage : -25 to 70℃				
Ambient humidity	35 to 85%RH, Storage : 35 to 85%RH				
Protection	IP64 (IEC standard) (Built-in timer type : IP50)		IP50 (IEC standard)	IP64 (IEC standard)	
Material	Case : ABS, Lens : Acrylic				
Cable	3P, ϕ 4mm, Length : 2m				
Accessory	Adjustment driver, Bracket A, Bolts, Nuts			Bracket A \times 2, Bolts, Nuts	
Approval					
Unit weight	Approx. 70g				

※ (★1) Operation indicator is on the top.

※ (★2) OFF delay timer is built-in. (Delay time : Max. 0.1 to 2sec.)

※ (★3) Sensing distance for Non-glossy white paper (50 \times 50mm).

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

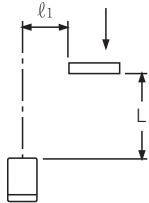
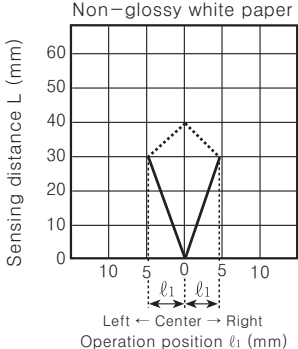
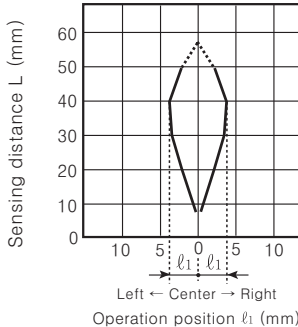
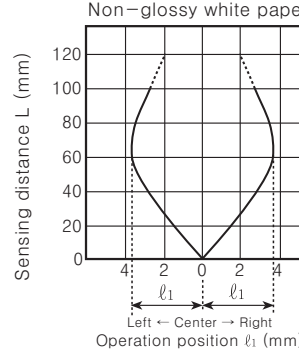
(R) Graphic/Logic panel

(S) Field network device

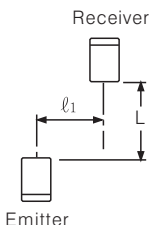
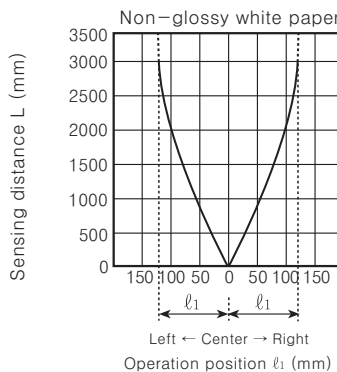
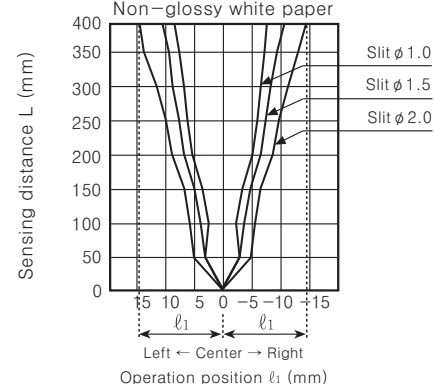
(T) Production stoppage models & replacement

Feature data

Sensing distance(Limited distance/Diffuse reflective)

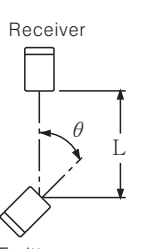
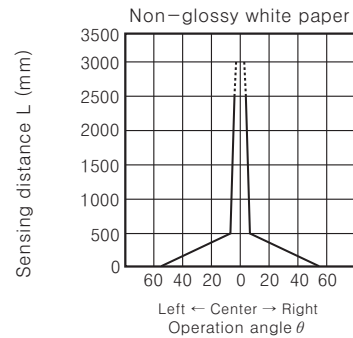
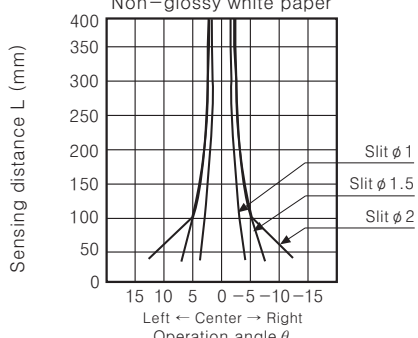
Measuring method	BYD30-DDT / BYD30-DDT-T	BYD50-DDT / BYD50-DDT-T	BYD100-DDT
Standard sensing target : Non-glossy white paper 50×50mm 	Non-glossy white paper 	Non-glossy white paper 	Non-glossy white paper 

Parallel shifting(Through-beam)

Measuring method	BYD3M-TDT	BYD3M-TDT(SLIT)
	Non-glossy white paper 	Non-glossy white paper 

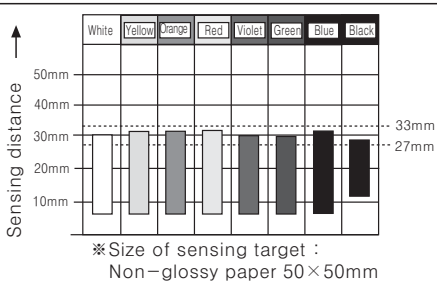
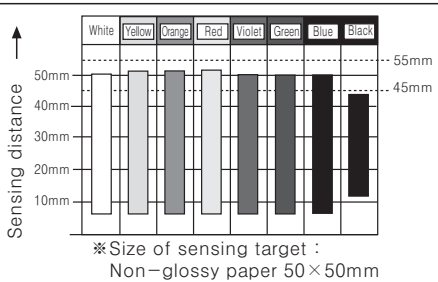
※Above characteristic is from 400mm sensing distance to install transmitted beam type slit (φ 1, φ 1.5, φ 2, φ 2.5).

Sensor angle(Through-beam)

Measuring method	BYD3M-TDT	BYD3M-TDT(SLIT)
	Non-glossy white paper 	Non-glossy white paper 

※Above characteristic is from 400mm sensing distance to install transmitted beam type slit (φ 1, φ 1.5, φ 2, φ 2.5).

Sensing distance by color(Limited distance reflective)

BYD30-DDT(-U), BYD30-DDT-T	BYD50-DDT(-U), BYD50-DDT-T	1) This model is stable limited distance detection photoelectric sensor, therefore it is not affected by color or material within range of sensing distance as specified in chart. 2) It is able to detect target stably because of small effect from background.
		

Small and Amplifier Built-in Type

■ Operation mode and timing diagram

●BYD30-DDT(-U), BYD50-DDT(-U), BYD100-DDT ●BYD30-DDT-T, BYD50-DDT-T

Operation mode	Light ON mode
Receiver operation	ON OFF
Operation indicator (LED)	ON OFF
TR output	ON OFF

Operation mode	Light ON mode
Receiver operation	ON OFF
Operation indicator (LED)	ON OFF
TR output	ON OFF

※T : Setting time by timer adjuster(0.1 to 2sec.)
 ※t : Max. 3ms(When the Timer adjuster is minimum)
 ※If (Ta) is shorter than (T), TR output will be ON.

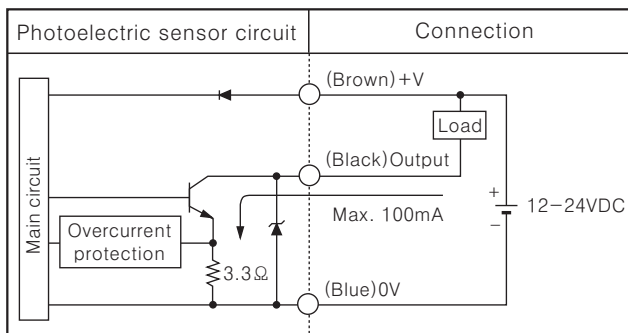
●BYD3M-TDT, BYD3M-TDT-P

Operation mode	Light ON mode	Dark ON mode
Receiver operation	ON OFF	ON OFF
Operation indicator (LED)	ON OFF	ON OFF
TR output	ON OFF	ON OFF

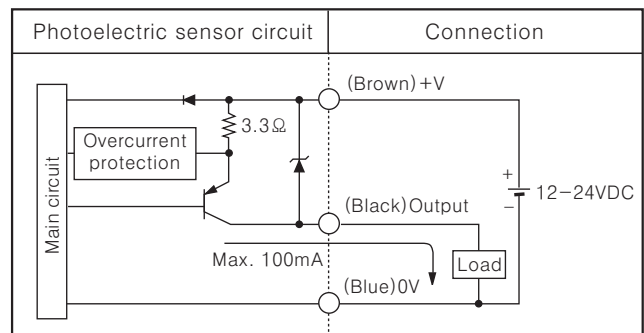
※To prevent incorrect operation, output of units keeps the state of OFF for 0.5sec. after power ON.
 ※If the control output terminal is short-circuited or overcurrent condition is existed, the control output will turn off due to protection circuit.
 ※Light ON mode is customizable.

■ Control output diagram

●BYD3M-TDT2



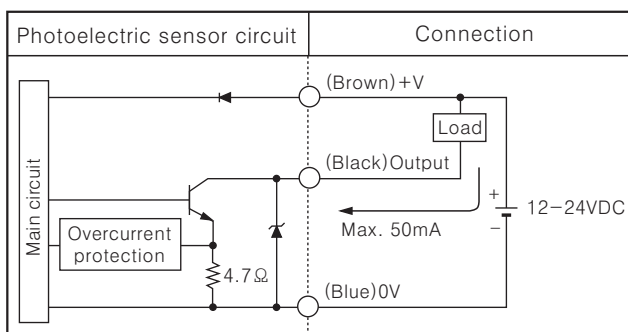
●BYD3M-TDT2-P



●BYD30-DDT(-U), BYD50-DDT(-U)

●BYD30-DDT-T, BYD50-DDT-T

●BYD100-DDT



(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

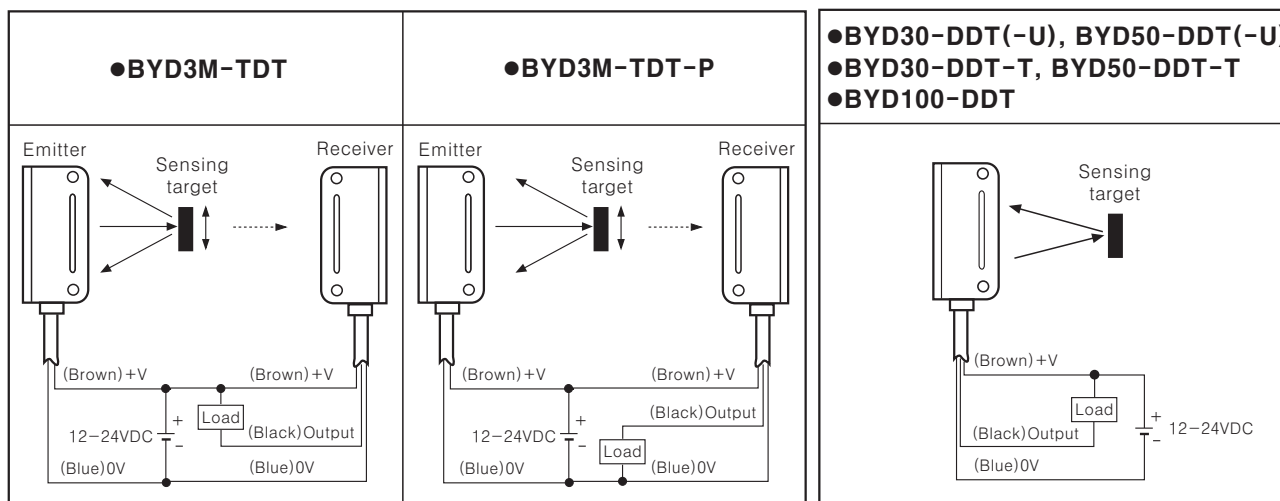
(R) Graphic/Logic panel

(S) Field network device

(T) Production stoppage models & replacement

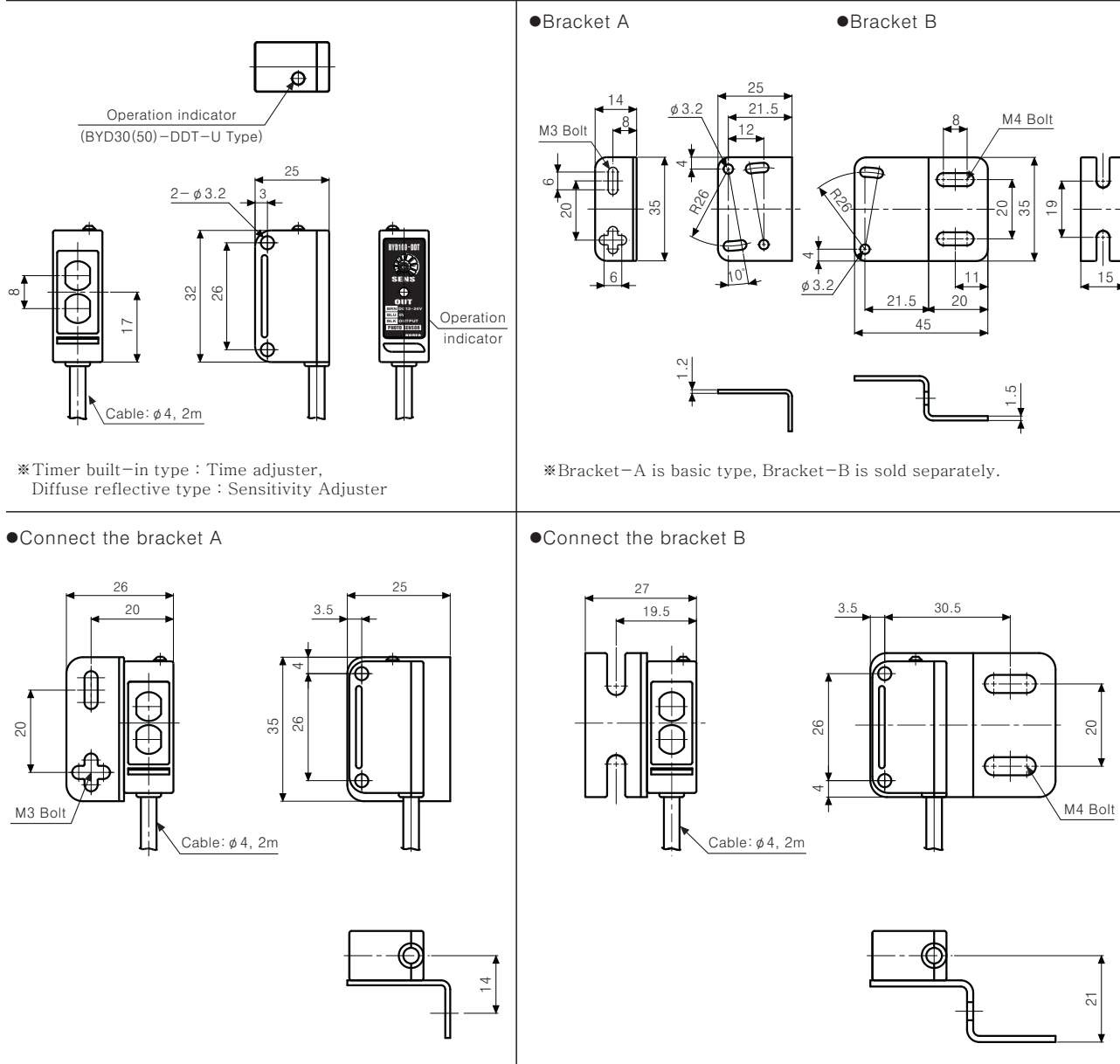
BYD Series

■ Connections



▣ Dimensions

(Unit:mm)

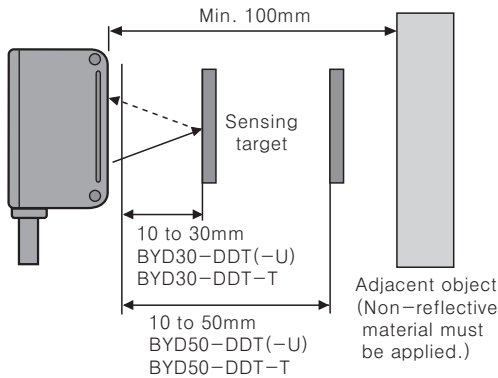


Small and Amplifier Built-in Type

■ Mounting and sensitivity adjustment

○ Limited distance reflective type

1. Supply the power to the sensor after install the sensor.

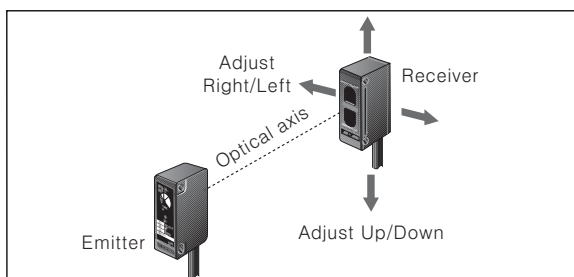


2. Install the target at sensing position and adjust the sensor to the right and the left or up and down to be at the right angle against optical axis and fix it at safe operating position.
Keep the distance
BYD30-DDT, (-T), (-U) : 10 to 30mm
BYD50-DDT, (-T), (-U) : 10 to 50mm
between photoelectric sensor and target.
3. Adjust the response time up to the optimum status in case of timer built-in type. Keep the distance min. 100mm between photoelectric sensor and object in background.
It may cause malfunction by reflection light from the other target.

※ The sensing distance indicated in the specification chart is that of non-glossy white paper in the target size 50×50mm. The sensing distance may be changed by the size of the target, reflectance of the target.

○ Through-beam type

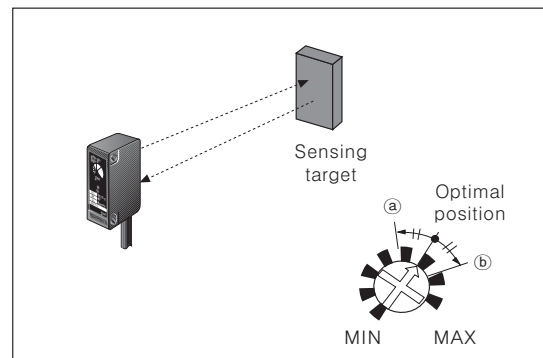
1. Supply the power to the photoelectric sensor, after set the emitter and the receiver facing each other.
 2. Set the receiver in the middle of the operation range of indicator adjusting the receiver and the emitter right and left, up and down.
 3. Adjust up and down direction as the same.
 4. After adjustment, check the stability of operation putting the object at the optical axis.
- ※ If the sensing target is translucent body or smaller than $\phi 6\text{mm}$, it can be missed by sensor because light penetrate it.



○ Diffuse reflective type

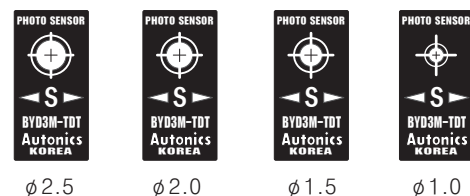
1. The sensitivity should be adjusted depending on a sensing target or mounting side.
2. Set the target at a position to be detected by the beam, then turn the adjuster until position ① in the operation range of indicator from min. position of the adjuster.
3. Take the target out of the sensing area,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

※ The sensing distance indicated on specification chart is for 50×50mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.



■ Accessory (Sold separately)

● Slit (Model name : BYD3M-Slit)



$\phi 2.5$ $\phi 2.0$ $\phi 1.5$ $\phi 1.0$

- Min. sensing target and Max. sensing distance by slit ϕ
— Attach the slit on receiver and emitter together.

SLIT ϕ	Min. sensing target	Max. sensing distance
$\phi 1.0$	Opaque materials of Min. $\phi 0.8$	500mm
$\phi 1.5$	Opaque materials of Min. $\phi 1.5$	700mm
$\phi 2.0$	Opaque materials of Min. $\phi 2.0$	1200mm

※ This slit is for BYD3M-TDT (-P) only.

※ 2 pieces of each different ϕ and total 8 pieces packed.

※ This slit is sticker for attachment, please remove the dirt on lens of photoelectric sensor before using it.

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device


(T) Production stoppage models & replacement

BPS Series

Slim photoelectric sensor for long sensing distance

■ Features

- Easy to mount by Flat type
- Realization of 3m sensing distance as small size
- Protection structure IP67 (IEC standard)

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

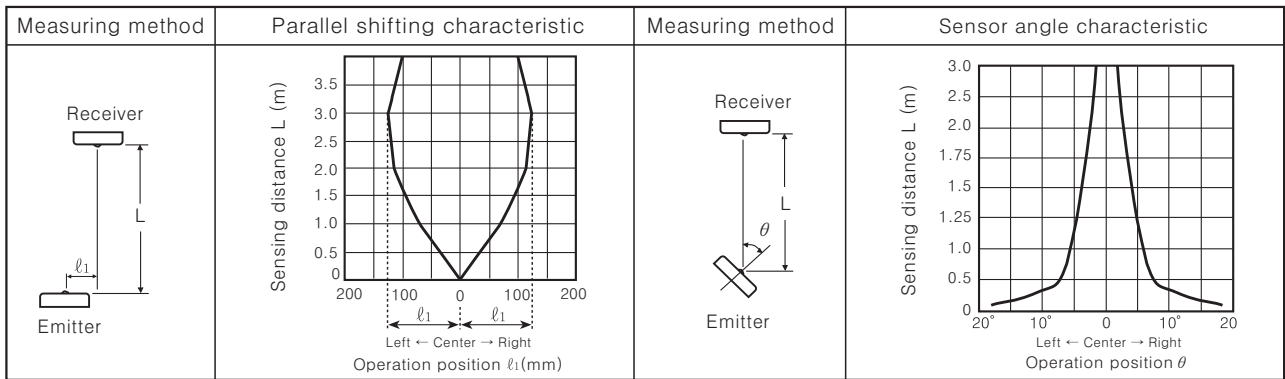


■ Specifications

Model	BPS3M-TDT	BPS3M-TDTL	BPS3M-TDT-P	BPS3M-TDTL-P
Sensing type	Through-beam			
Sensing target	Opaque materials of Min. ϕ 5mm			
Operation mode	Dark ON	Light ON	Dark ON	Light ON
Sensing distance	3m			
Response time	Max. 1ms			
Power supply	12-24VDC \pm 10% (Ripple P-P : Max. 10%)			
Current consumption	Max. 20mA			
Light source	Infrared LED(850nm)			
Control output	NPN open collector output ☞ Load voltage : Max. 30VDC, Load current : Max. 100mA, Residual voltage : Max. 1V		PNP open collector output ☞ Load current : Max. 100mA, Residual voltage : Min. (Power voltage -2.5V)	
Protection circuit	Reverse polarity protection, Output short-circuit protection			
Indicator	Emitter : Power indicator (Red LED), Receiver : Operation indicator (Red LED)			
Connection	Outgoing cable			
Insulation resistance	Min. 20M Ω (at 500VDC megger)			
Noise strength	\pm 240V the square wave noise (pulse width:1 μ s) by the noise simulator			
Dielectric strength	1,000VAC 50/60Hz for 1minute			
Vibration	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours			
Shock	500m/s ² (50G) in X, Y, Z directions for 3 times			
Ambient illumination	Sunlight : Max. 11,000lx , Incandescent lamp : Max. 3,000lx			
Ambient temperature	-25 to 65℃ (at non-freezing status), Storage : -25 to 70℃			
Ambient humidity	35 to 85%RH, Storage : 35 to 90%RH			
Protection	IP67 (IEC standard)			
Material	Case : PC			
Cable	• Emitter : ϕ 3mm, 2P • Receiver : ϕ 3mm, 3P • Length : 2m			
Approval	CE			
Unit weight	Approx. 66g			

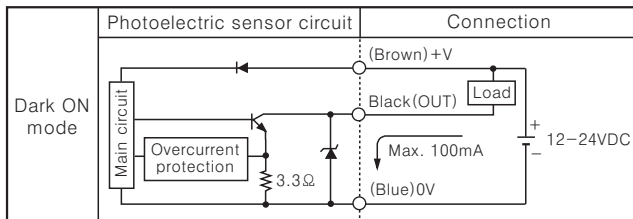
Slim and Amplifier Built-in Type

Feature data

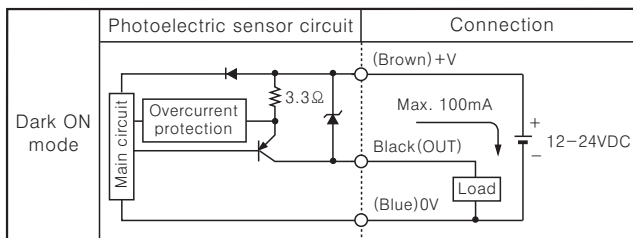


Control output diagram

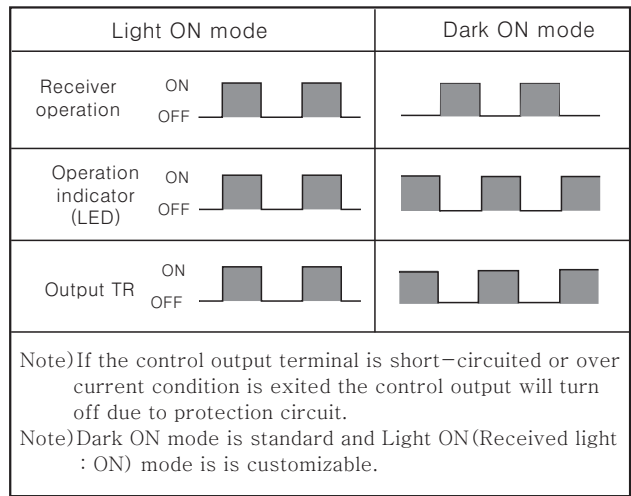
●NPN open collector output



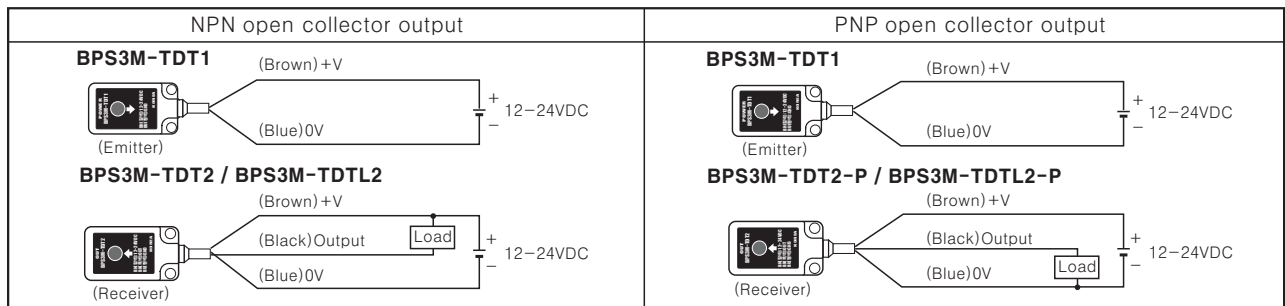
●PNP open collector output



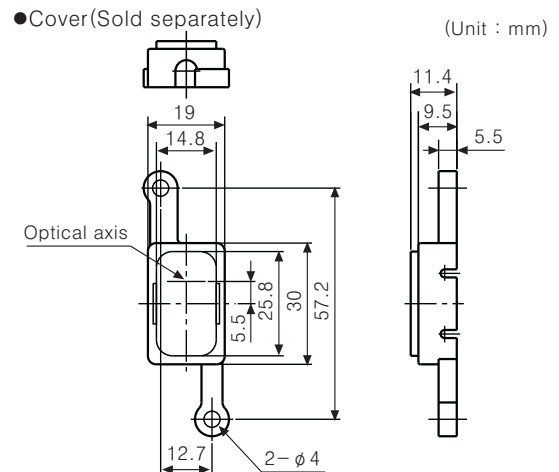
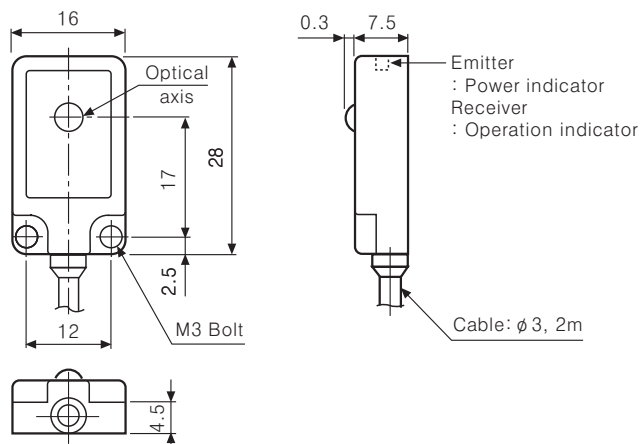
Operation mode



Connections



Dimensions




(A) Photo electric sensor
(B) Fiber optic sensor
(C) Door/Area sensor
(D) Proximity sensor
(E) Pressure sensor
(F) Rotary encoder
(G) Connector/Socket
(H) Temp. controller
(I) SSR/Power controller
(J) Counter
(K) Timer
(L) Panel meter
(M) Tacho/Speed/Pulse meter
(N) Display unit
(O) Sensor controller
(P) Switching power supply
(Q) Stepping motor & Driver & Controller
(R) Graphic/Logic panel
(S) Field network device
(T) Production stoppage models & replacement

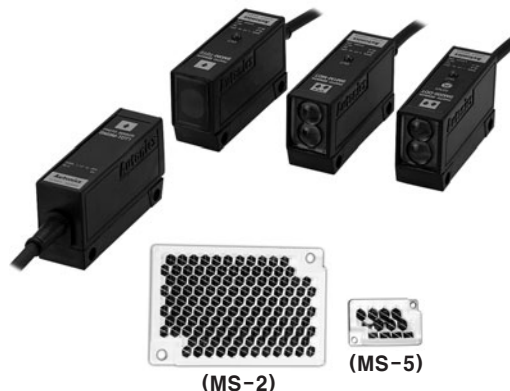
BM Series

Small and light, common type photoelectric sensor

■ Features

- Easy to mount at a narrow space with small size and light weight.
- Convenient to adjust the sensitivity by external sensitivity adjustment control.
(Diffuse reflective type only)
- Easy to mount by screw type in mounting hole.
- Reverse power polarity protection circuit.

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



※ MS-5 is sold separately.

■ Specifications

Model		BM3M-TDT	BM1M-MDT	BM200-DDT
Sensing type		Through-beam	Retroreflective	Diffuse reflective
Sensing distance		3m	(★1) 0.1 to 1m	(★2) 200mm
Sensing target		Opaque materials of Min. ϕ 8mm	Opaque materials of Min. ϕ 60mm	Translucent, Opaque materials
Hysteresis				Max. 10% at rated setting distance
Response time		Max. 3ms		
Power supply		12-24VDC \pm 10% (Ripple P-P : Max. 10%)		
Current consumption		Max. 45mA	Max. 40mA	
Light source		Infrared LED(940nm)		
Sensitivity adjustment		Fixed		Built-in VR
Operation mode		Dark ON		Light ON
Control output		NPN open collector output • Load voltage : Max. 30VDC • Load current : Max. 100mA • Residual voltage : Max. 1V		
Protection circuit		Reverse polarity protection		
Indication		Operation indicator : Red LED		
Connection		Outgoing cable		
Insulation resistance		Min. 20M Ω (at 500VDC megger)		
Noise strength		\pm 240V the square wave noise(pulse width : 1 μ s) by the noise simulator		
Dielectric strength		1,000VAC 50/60Hz for 1minute		
Vibration		1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours		
Shock		500m/s ² (50G) in X, Y, Z directions for 3 times		
Ambient illumination		Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx		
Ambient temperature		-10 to 60℃ (at non-freezing status), Storage : -25 to 70℃		
Ambient humidity		35 to 85%RH, Storage : 35 to 85%RH		
Material		Case : ABS, Lens : PMMA		
Cable		3P(2P for Transmitted beam type), ϕ 4mm, Length : 2m		
Accessories	Individual		Reflector(MS-2)	Adjustment driver
	Common	Fixing bracket, Bolts/nuts		
Approval		CE		
Unit weight		Approx. 170g	Approx. 105g	Approx. 88g

※ (★1) It is mounting distance between sensor and reflector MS-2 and it is same when MS-5 is used. It is detectable under 0.1m.

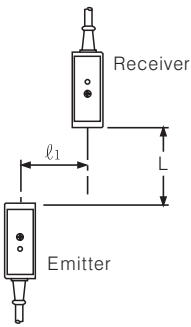
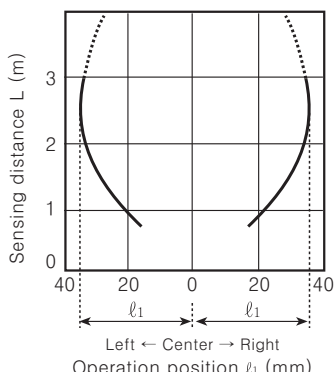
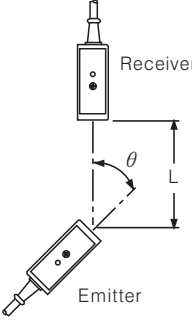
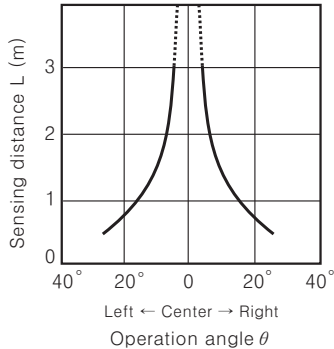
※ (★2) It is for Non-glossy white paper (100×100mm)

Amplifier Built-in Type for General Purpose

■ Feature data

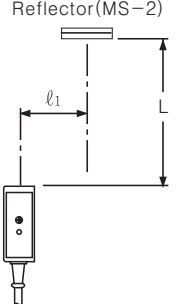
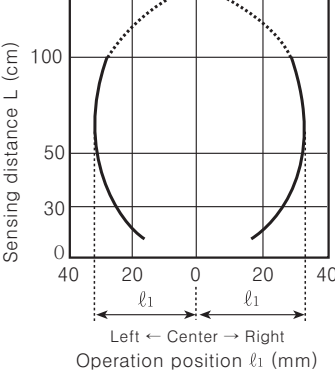
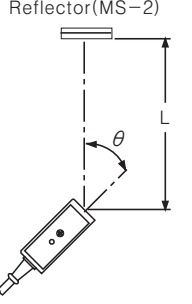
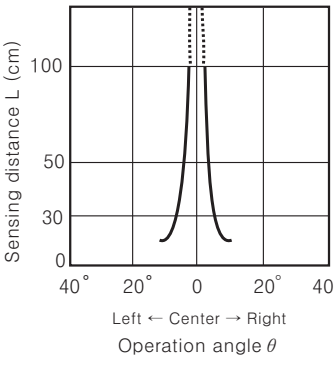
○ Through-beam

● BM3M-TDT

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

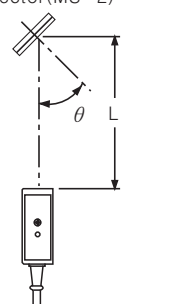
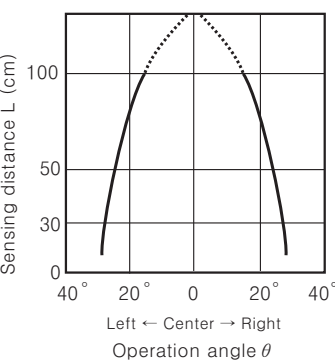
○ Retroreflective

● BM1M-MDT

Parallel shifting characteristic		Sensor angle characteristic	
Measuring method	Data	Measuring method	Data
			

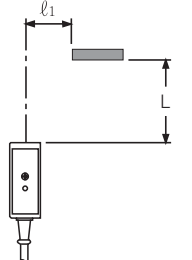
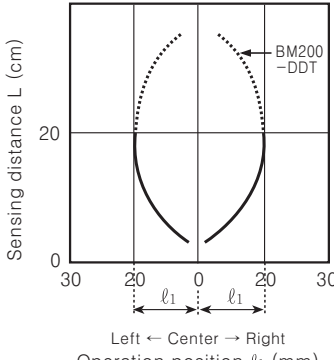
○ Retroreflective

● BM1M-MDT

Reflector angle characteristic	
Measuring method	Data
	

○ Diffuse reflective

● BM200-DDT

Sensing area characteristic	
Measuring method	Data
	

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

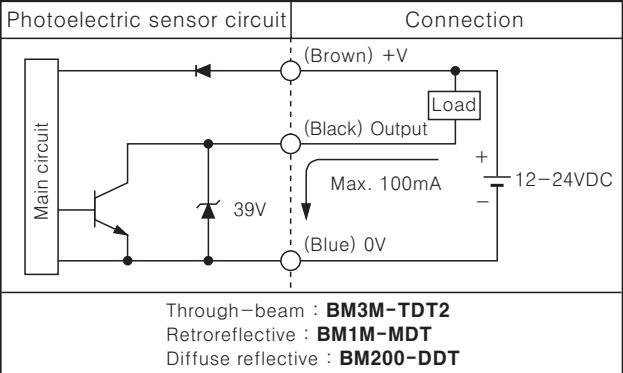
(R) Graphic/Logic panel

(S) Field network device

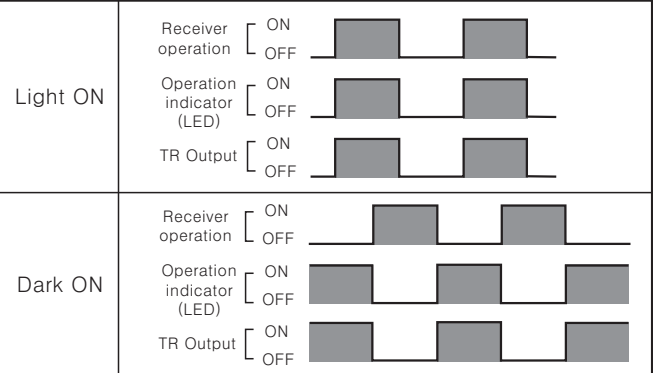
(T) Production stoppage models & replacement

BM Series

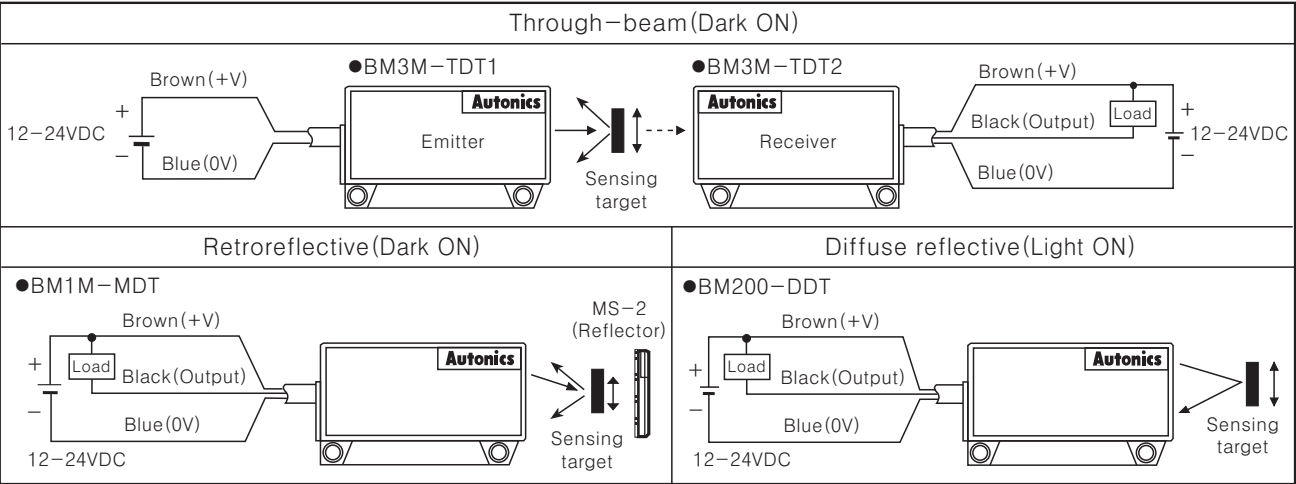
Control output diagram



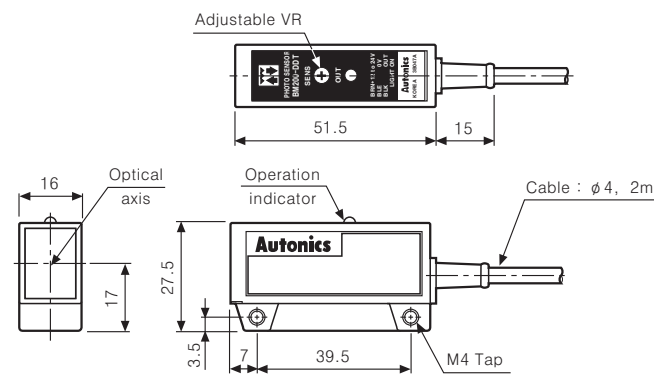
Operation mode



Connections

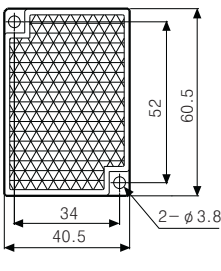


Dimensions

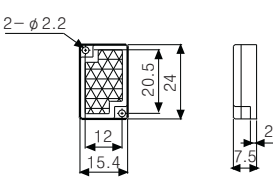


Reflector

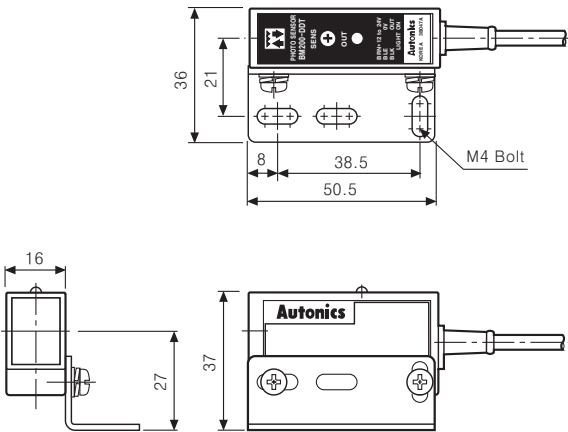
< MS-2 >



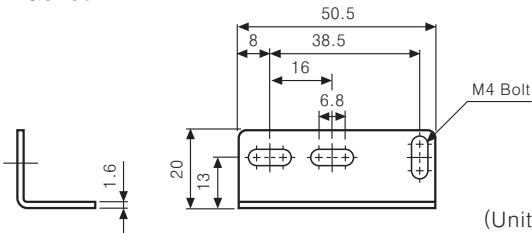
< MS-5 >



Connect the bracket



Bracket

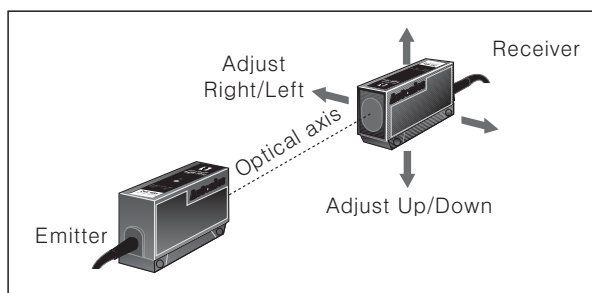


Amplifier Built-in Type for General Purpose

■ Mounting and sensitivity adjustment

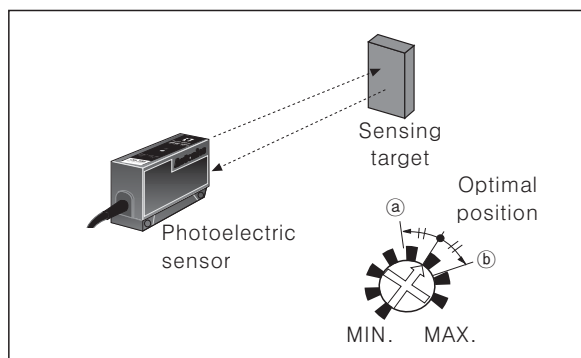
◎ Through-beam type

1. Supply the power to the photoelectric sensor, after set the emitter and the receiver facing each other.
 2. Set the receiver in the middle of the operation range of indicator adjusting the receiver or the emitter right and left, up and down.
 3. Adjust up and down direction as the same.
 4. After adjustment, check the stability of operation putting the object at the optical axis.
- ※ If the sensing target is translucent body or smaller than $\phi 8\text{mm}$, it can be missed by sensor because light penetrate it.



◎ Diffuse reflective type

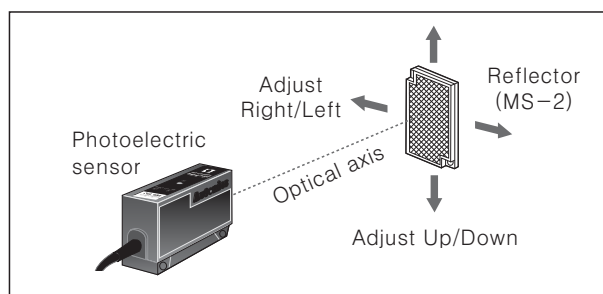
1. The sensitivity should be adjusted depending on a sensing target or mounting place.
2. Set the target at a position to be detected by the beam, then turn the adjuster until position ① where the indicator turns on from min. position of the adjuster.
3. Take the target out of the sensing area, then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



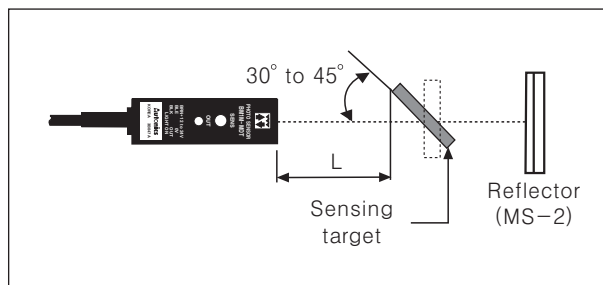
- ※ The sensing distance indicated on specification chart is for $200 \times 200\text{mm}$ of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.

◎ Retroreflective type

1. Supply the power to the photoelectric sensor, after set the emitter and the reflector (MS-2) facing to each other.
 2. Set the reflector or photoelectric sensor in the middle of the operation range of indicator adjusting the mirror or the sensor right and left, up and down.
 3. Adjust up and down direction as the same.
 4. After adjustment, check the stability of operation putting the object at the optical axis.
- ※ If use 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 enough space between the target should be used and photoelectric sensor or the surface of target should be installed at an angle of 30° to 45° against optical axis.



- ※ If the installing place is too small, please use MS-5 instead of MS-2 for same sensing distance.



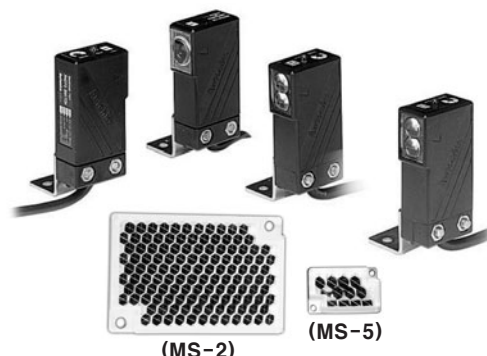
(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

BMS Series

High speed response type with built-in output protection circuit

■ Features

- Reverse power polarity and overcurrent
- High speed response : Max. 1ms
- Light ON/Dark ON mode selectable by control wire.
- Built-in the sensitivity adjuster.
(Except for through-beam type)



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



※ MS-5 is sold separately.

■ Specifications

Model		BMS5M-TDT	BMS2M-MDT	BMS300-DDT
		BMS5M-TDT-P	BMS2M-MDT-P	BMS300-DDT-P
Sensing type		Through-beam	Retroreflective	Diffuse reflective
Sensing distance		5m	(※1) 0.1 to 2m	(※2) 300mm
Sensing target		Opaque materials of Min. φ 10mm	Opaque materials of Min. φ 60mm	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	Max. 45mA	
Light source		Infrared LED(940nm)		
Sensitivity adjustment			Built-in VR	
Operation mode		Light ON, Dark ON selectable by control wire		
Control output		NPN or PNP open collector output • Load voltage : Max. 30VDC • Load current : Max. 200mA • Residual voltage: NPN : Max. 1V, PNP : Min. (Power voltage -2.5V)		
Protection circuit		Reverse power polarity, Output short-circuit(Overcurrent) protection circuit		
Indicator		Operation indicator : Red LED, Power indicator : Red LED(BMS5M-TDT1)		
Connection		Outgoing cable		
Insulation resistance		Min. 20MΩ (at 500VDC megger)		
Noise strength		±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 in each of X, Y, Z directions for 2 hours		
Shock		500m/s ² (50G) in X, Y, Z directions for 3 times		
Ambient illumination		Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx (Receiring illumination)		
Ambient temperature		-10 to 60℃ (at non-freezing stauts), Storage : -25 to 70℃		
Ambient humidity		35 to 85%RH, Storage : 35 to 85%RH		
Material		Case : ABS, Lens : Acrylic (Transmitted beam : PC)		
Cable		4P, φ 5mm, Length : 2m (Emitter of transmitted beam type: 2P, φ 5mm, length:2m)		
Accessories	Individual		Reflector (MS-2), Adjustment Driver	Adjustment Driver
	Common	Fixing bracket, Bolts, Nuts		
Approval		CE		
Unit weight		Approx. 180g	Approx. 110g	Approx. 100g

※ (*1) It is mounting distance between sensor and reflector MS-2 and it is same when MS-5 is used. It is detectable under 0.1m.

※ (*2) It is for Non-glossy white paper(100 \times 100mm)

Side Sensing Type with Built-in Amplifier

Feature data

○Through-beam

●BMS5M-TDT ●BMS5M-TDT-P

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data

○Retroreflective

●BMS2M-MDT ●BMS2M-MDT-P

Parallel shifting characteristic		Sensor angle characteristic	
Measuring method	Data	Measuring method	Data

○Retroreflective

●BMS2M-MDT
●BMS2M-MDT-P

Reflector angle characteristic	
Measuring method	Data

○Diffuse reflective

●BMS300-DDT
●BMS300-DDT-P

Sensing area characteristic	
Measuring method	Data
<p>Standard sensing target : Non-glossy white paper 100×100mm</p>	

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

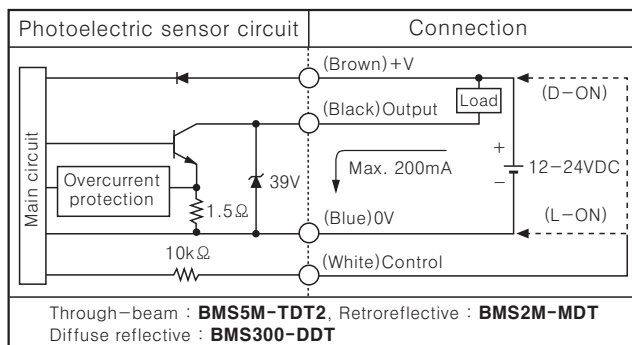
(S) Field network device

(T) Production stoppage models & replacement

BMS Series

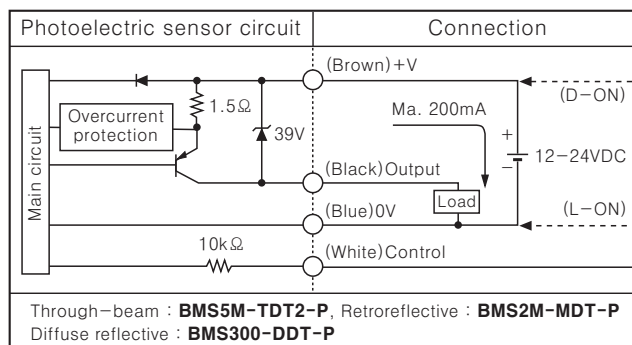
■ Control output diagram

- NPN open collector output

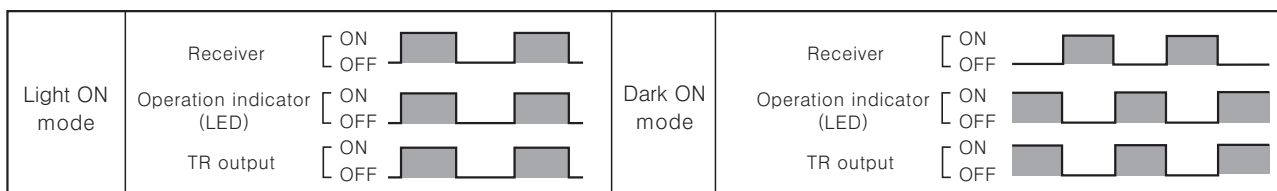


※Select Light ON / Dark ON by control wire. [Light ON : Connect control wire to 0V
Dark ON : Connect control wire to +V

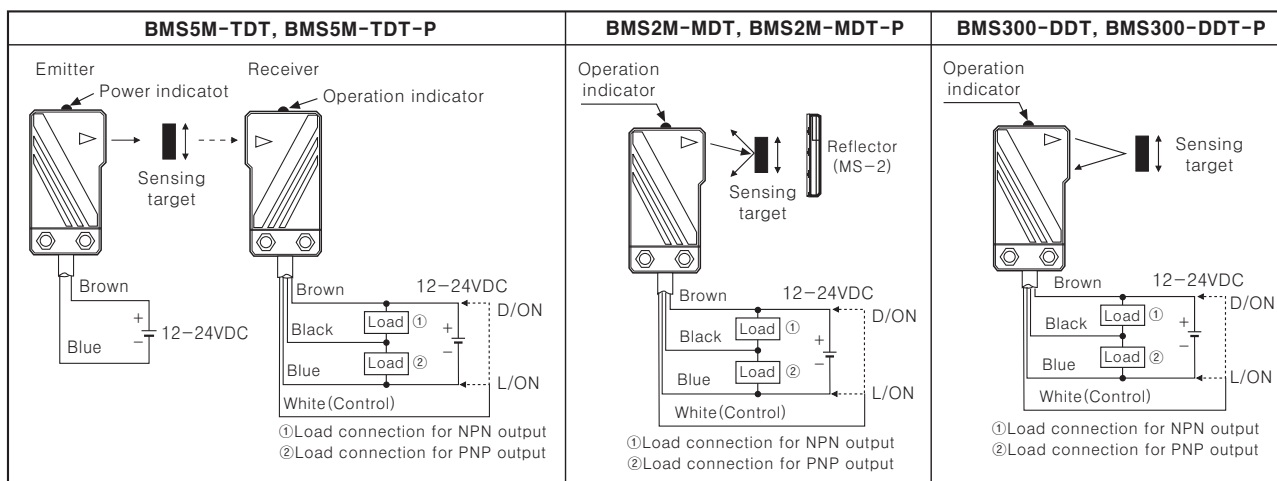
- PNP open collector output



■ Operation mode

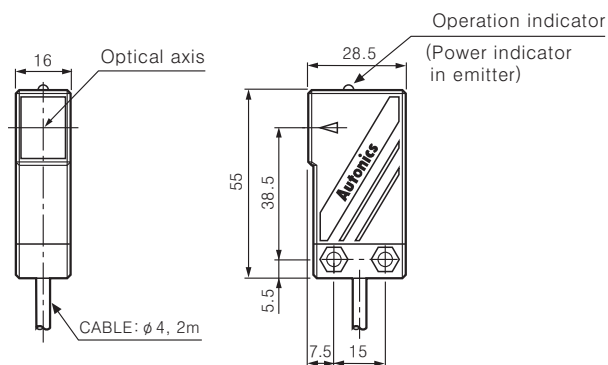


■ Connections

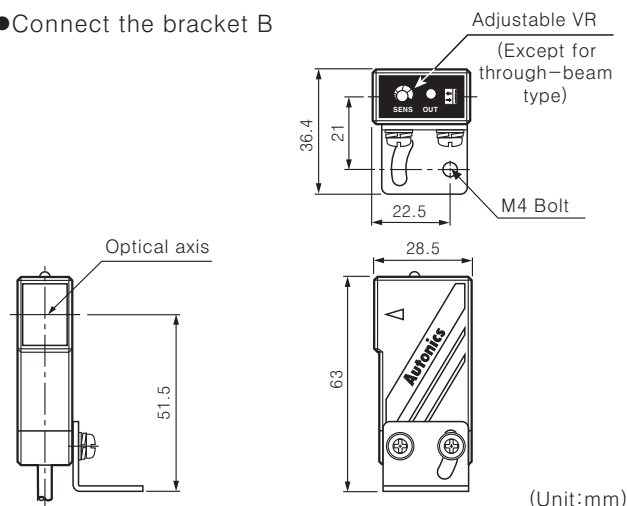


※Dark ON mode is on when control line is opened.

▣ Dimensions



- Connect the bracket B



(A) Photo electric sensor
(B) Fiber optic sensor
(C) Door/Area sensor
(D) Proximity sensor
(E) Pressure sensor
(F) Rotary encoder
(G) Connector/Socket
(H) Temp. controller
(I) SSR/Power controller
(J) Counter
(K) Timer
(L) Panel meter
(M) Tacho/Speed/Pulse meter
(N) Display unit
(O) Sensor controller
(P) Switching power supply
(Q) Stepping motor & Driver & Controller
(R) Graphic/Logic panel
(S) Field network device
(T) Production stoppage models & replacement

(Unit:mm)


A-36

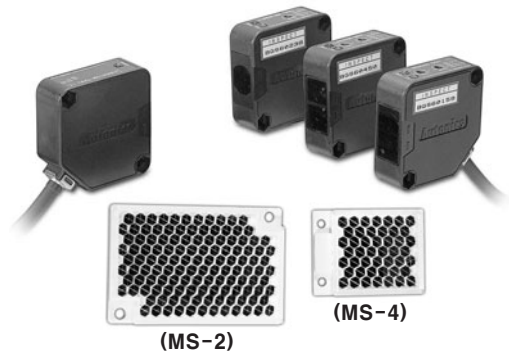
BEN Series

Compact, Power supply built-in type

■ Features

- Small and power supply built-in type.
- Easy installation with LED indicators on product.
- Able 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.



※ 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 (Standard type)	Retroreflective (with polarizing filter)	Diffuse reflective
Sensing distance		10m	(★1) 0.1 to 5m	(★1) 0.1 to 3m	(★2) 300mm
Sensing target		Opaque materials of Min. φ 16mm	Opaque materials of Min. φ 60mm		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%)			
Power consumption		Max. 4VA			
Light source		Infrared LED(850nm)		Red LED(660nm)	Infrared LED(940nm)
Sensitivity adjustment		—————	Built-in VR		
Operation mode		Light ON / Dark ON mode selectable			
Control output		Relay contact output (Contact capacity : 30VDC 3A resistive load, 250VAC 3A resistive load, Relay contact composition : 1c)			
Relay life cycle		Mechanically : Min. 50,000,000, Electrically : Min. 100,000			
Light receiving element		Built-in IC type photo diode			
Indicator		Operation indicator : Orange, Stable indicator : Green (The orange lamp on Emitter of transmitted beam type is for power indication)			
Connection		Outgoing cable			
Insulation resistance		Min. 20MΩ (at 500VDC megger)			
Noise strength		±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 in each of X, Y, Z directions for 2 hours			
	Malfunction	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 10 minutes			
Shock	Mechanical	500m/s ² (50G) in X, Y, Z directions for 3 times			
	Malfunction	100m/s ² (10G) in X, Y, Z directions for 3 times			
Ambient illumination		Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx			
Ambient temperature		-20 to 65℃ (at non-freezing status), Storage : -25 to 70℃			
Ambient humidity		35 to 85%RH, Storage : 35 to 85%RH			
Material		Case : ABS, Lens : Acrylic			
Protection		IP50(IEC standard)			
Cable		φ 6.0mm, 5P, Length : 2m			
Accessory	Individual	—————	Reflector(MS-2), Adjustment driver		Adjustment driver
	Common	Fixing bracket, Bolts, Nuts			
Unit weight		Approx. 354g	Approx. 208g		Approx. 195g

※ (★1) It is mounting distance between sensor and reflector MS-2 and it is same when MS-4 is used. It is detectable under 0.1m.

※ (★2) It is for Non-glossy white paper (100×100mm).

Power Supply Built-in Type

●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	(★1) 0.1 to 5m	(★1) 0.1 to 3m	(★2) 300mm
Sensing target		Opaque materials of Min. ϕ 16mm	Opaque materials of Min. ϕ 60mm		Translucent, Opaque materials
Hysteresis					Max. 20% at sensing distance
Response time		Max. 1ms			
Power supply		12-24VDC \pm 10% (Ripple P-P : Max. 10%)			
Power consumption		Max. 40mA			
Light source		Infrared LED(850nm)		Red LED(660nm)	Infrared LED(940nm)
Sensitivity adjustment			Built-in VR		
Operation mode		Light ON / Dark ON mode selectable			
Control output		NPN/PNP synchronous output • Load voltage : Max. 30VDC • Load current : Max. 200mA • Residual voltage ^③ NPN : Max. 1V, PNP : Min. (Power voltage -2.5V)			
Protection circuit		Reverse polarity protection, Short-circuit protection			
Light receiving element		Built-in IC type photo diode			
Indicator		Operation indicator : Orange, Stable indicator : Green (The orange lamp on Emitter of transmitted beam type is for power indicator)			
Connection		Outgoing cable			
Insulation resistance		Min. 20M Ω (at 500VDC megger)			
Noise strength		\pm 240V the square wave noise(pulse width : 1 μ s) by the noise simulator			
Dielectric strength		1000VAC 50/60Hz for 1minute			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours			
Shock		500m/s ² (50G) in X, Y, Z directions for 3 times			
Ambient illumination		Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx			
Ambient temperature		-20 to 65℃ (at non-freezing status), Storage : -25 to 70℃			
Ambient humidity		35 to 85%RH, Storage : 35 to 85%RH			
Protection		IP50(IEC standard)			
Material		Case : ABS, Lens : Acrylic			
Cable		ϕ 6.0mm, 4P, Length : 2m			
Accessory	Individual		Reflector(MS-2), Adjustment driver		Adjustment driver
	Common	Fixing bracket, Bolts, Nuts			
Approval		CE			
Unit weight		Approx. 342g	Approx. 200g		Approx. 187g

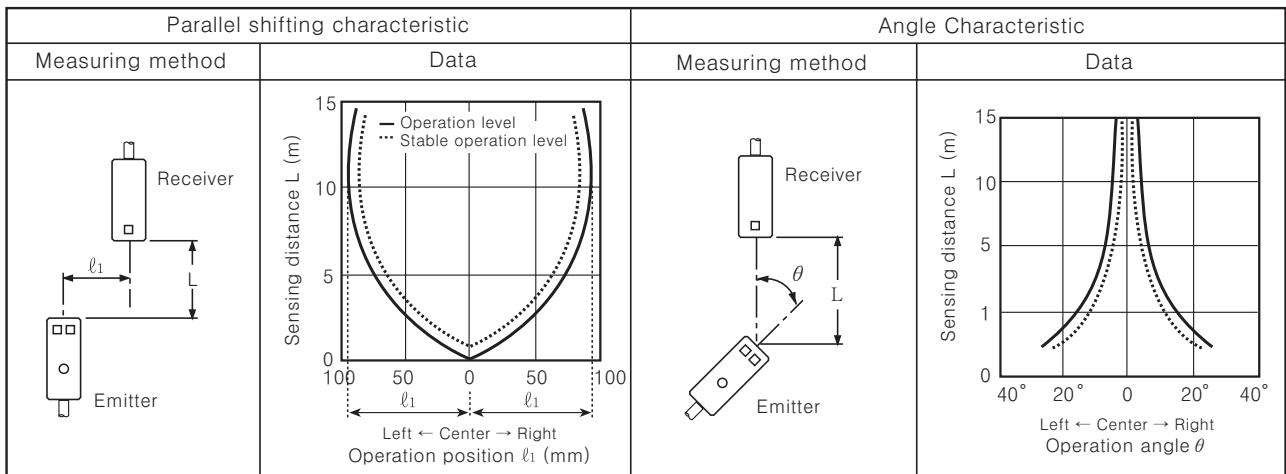
※(★1) It is mounting distance between sensor and reflector MS–2 and it is same when MS–4 is used. It is detectable under 0.1m.

※(★2) It is for Non-glossy white paper (100×100mm).

■Feature data

◎Through-beam

●BEN10M-TFR ●BEN10M-TDT



(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

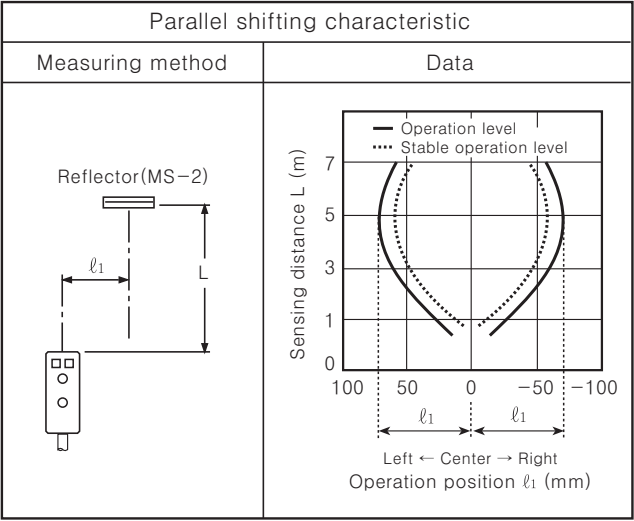
(T) Production stoppage models & replacement

BEN Series

Feature data

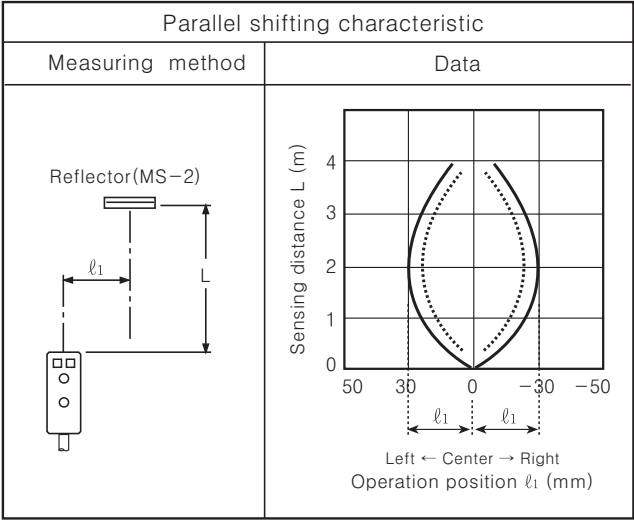
Retroreflective

●BEN5M-MFR ●BEN5M-MDT

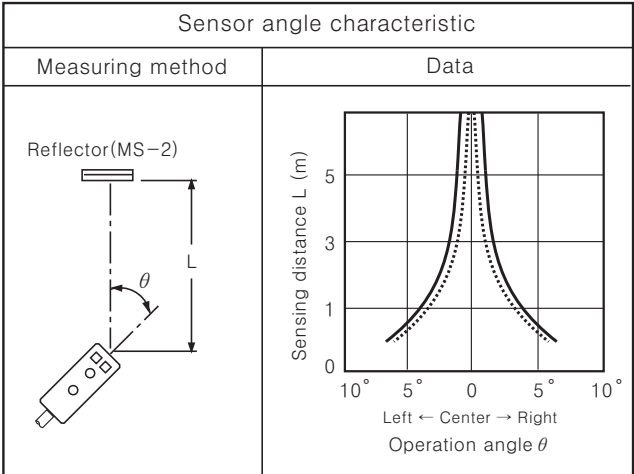


Retroreflective with polarizing filter

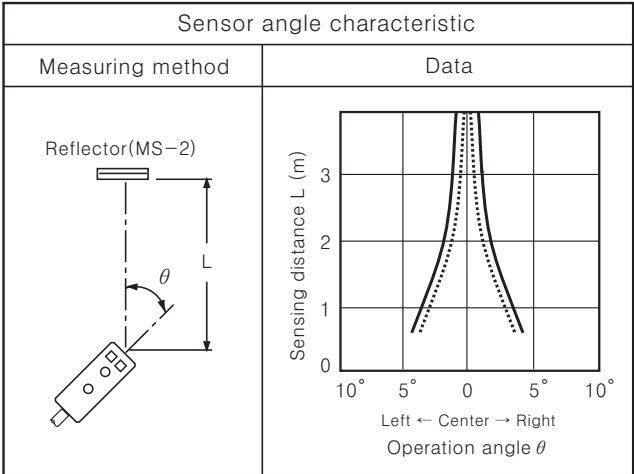
●BEN3M-PFR ●BEN3M-PDT



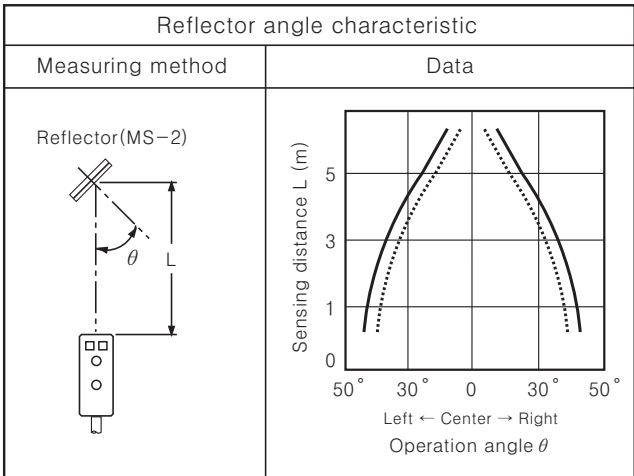
●BEN5M-MFR ●BEN5M-MDT



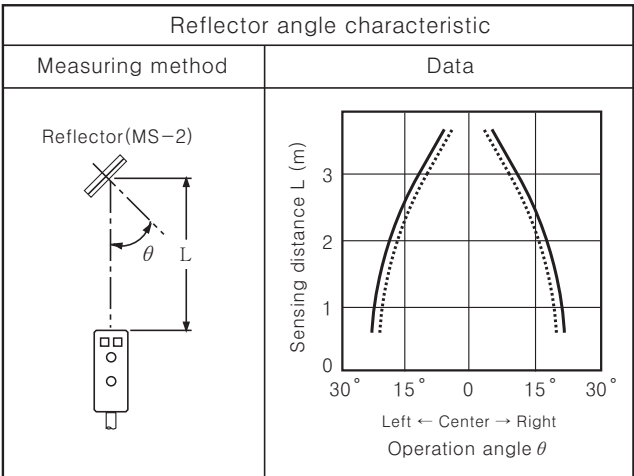
●BEN3M-PFR ●BEN3M-PDT



●BEN5M-MFR ●BEN5M-MDT



●BEN3M-PFR ●BEN3M-PDT

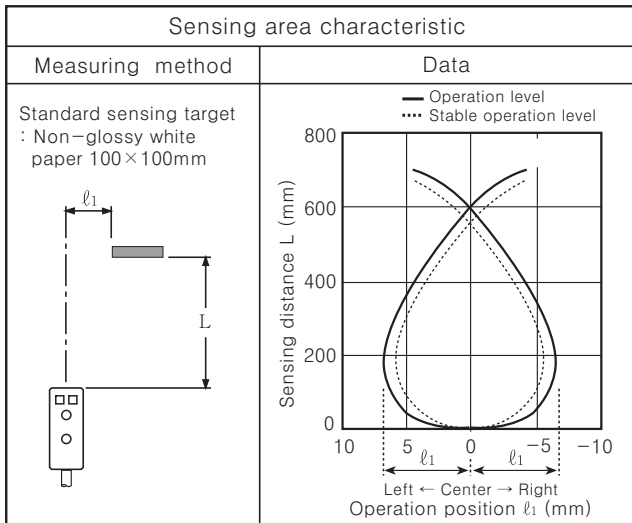


Power Supply Built-in Type

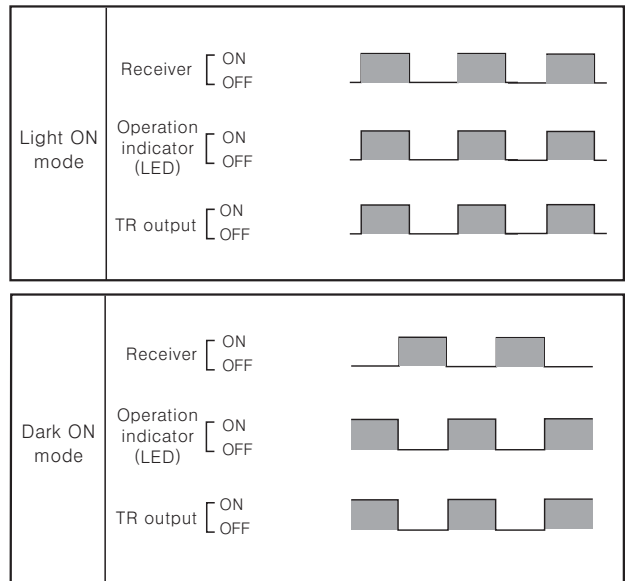
Feature data

Diffuse reflective

BEN300-DFR BEN300-DDT

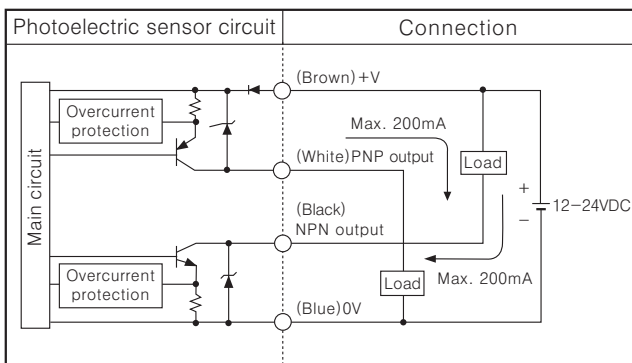


Operation mode

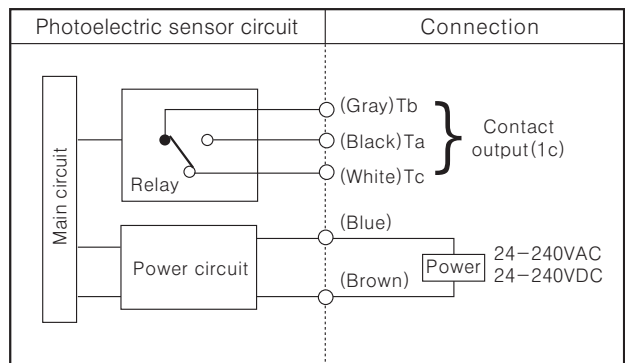


Control output diagram

DC voltage(NPN/PNP synchronous output)



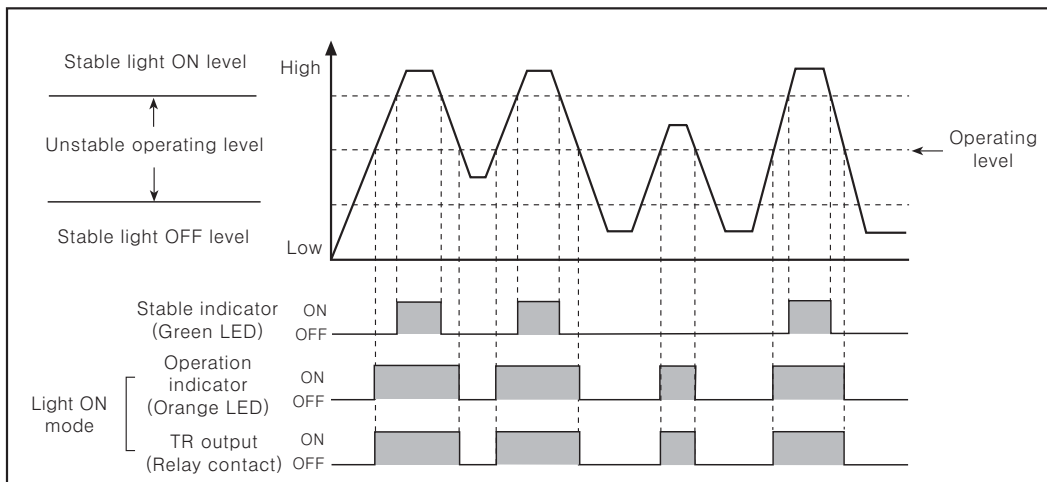
Free power(Relay contact output)



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

Operation timing diagram

Light ON mode



※The waveform of TR output and operation indicator are the state of operation for Light ON mode, but in case of Dark ON mode, it operates as reverse against Light ON mode.

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

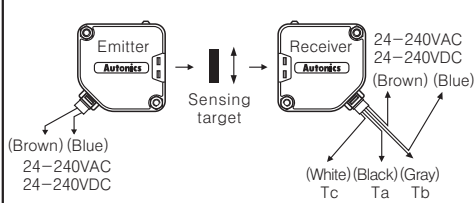
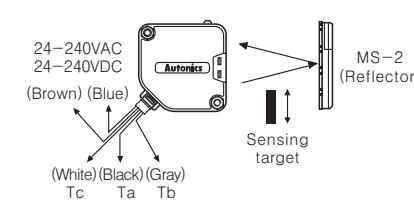
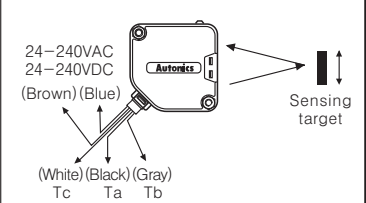
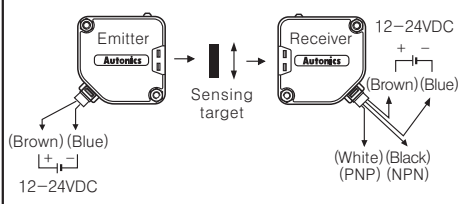
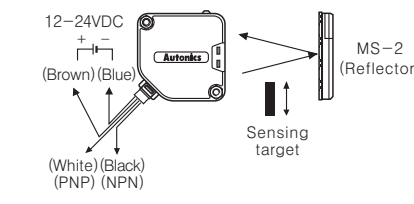
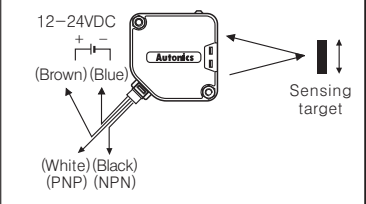
(R) Graphic/Logic panel

(S) Field network device

(T) Production stoppage models & replacement

BEN Series

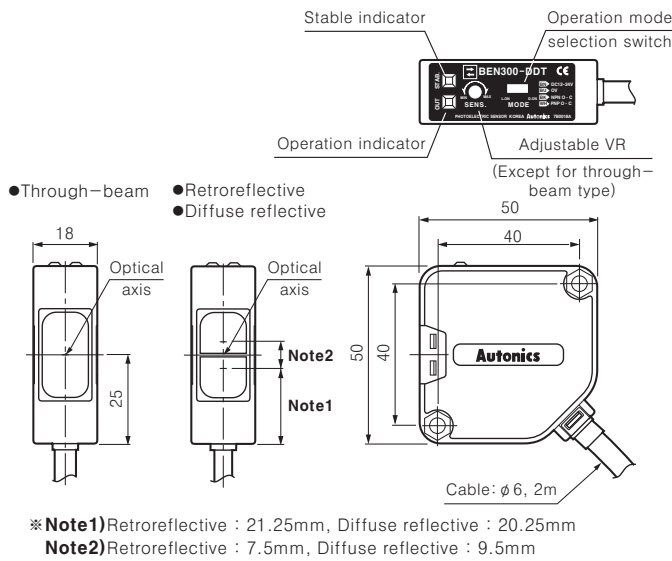
Connections

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 

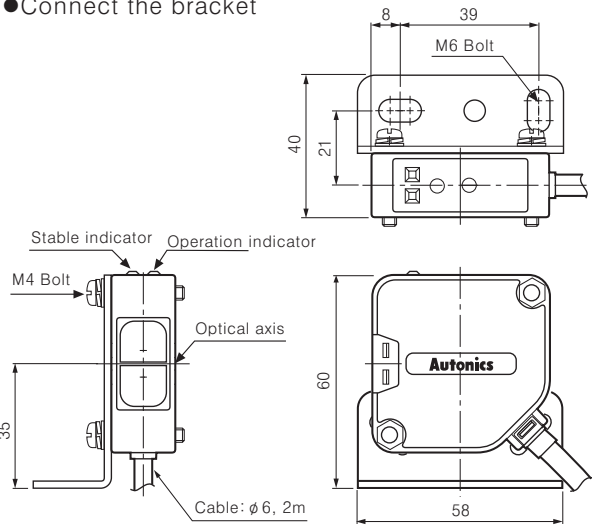
※ Unused line must be insulated.

Dimensions

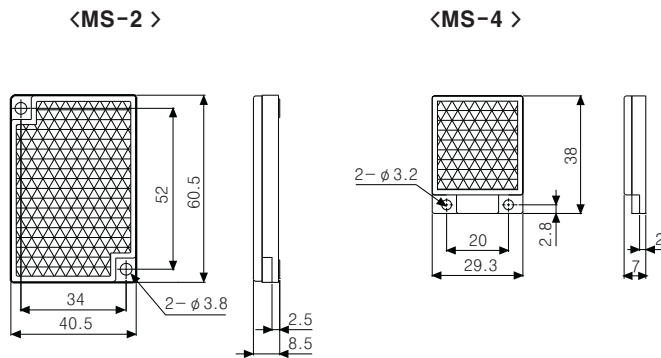
(Unit:mm)



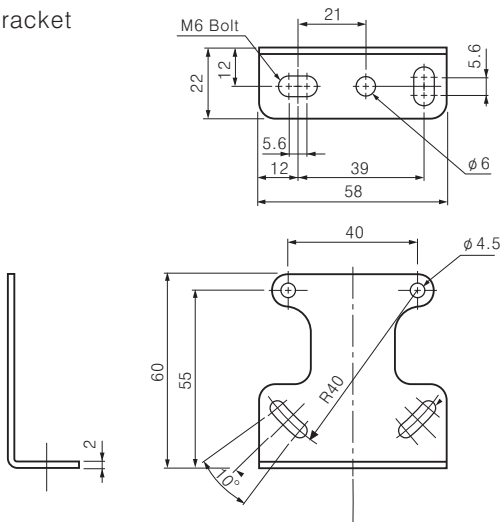
●Connect the bracket



●Reflector



●Bracket

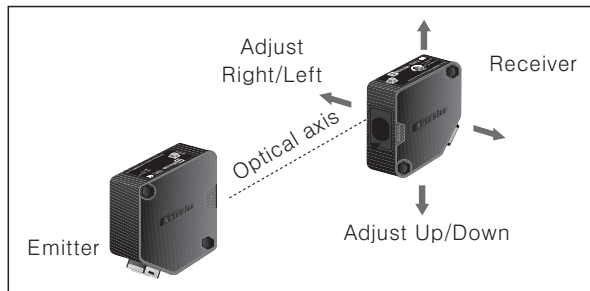


Power Supply Built-in Type

■ Mounting and sensitivity adjustment

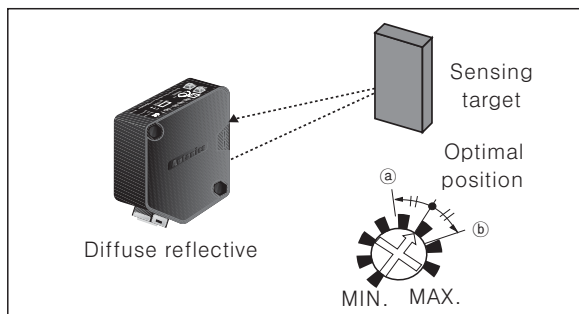
◎ Through-beam type

1. Supply the power to the photoelectric sensor, after set the emitter and the receiver facing each other.
 2. Set the receiver in the middle of the operation range of indicator adjusting the receiver or the emitter right and left, up and down.
 3. Adjust up and down direction as the same.
 4. After adjustment, check the stability of operation putting the object at the optical axis.
- ※If the sensing target is translucent body or smaller than $\phi 16\text{mm}$, it can be missed by sensor cause light passed.



◎ Diffuse reflective type

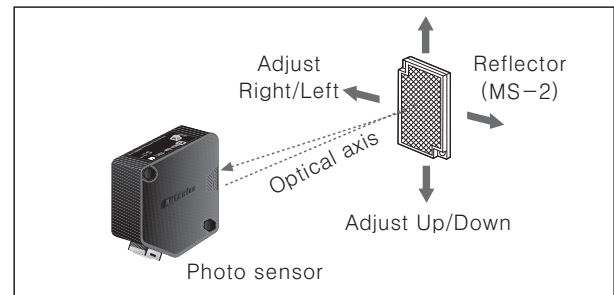
1. Adjust sensitivity regarding the effectiveness of behind object or mounting side.
 2. Set the target at a position to be detected by the beam, then turn the adjuster until position ① in the middle of the operation range of indicator from min. position of the adjuster.
 3. Take the target out of the sensing area, then turn the adjuster until position ② where the indicator turns on. If the indicator does not turn on, Max. position is position ②.
 4. Set the adjuster at the middle of two switching position ①, ②.
- ※The sensing distance indicated on specification chart is against $100 \times 100\text{mm}$ 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, after set the photoelectric sensor and the reflector (MS-2) facing each other.
2. Set the Photoelectric sensor in the middle of the position in the middle of the operation range of indicator adjusting the reflector or the sensor right and left, up and down.

3. Adjust up and down direction as the same.
4. After adjustment, check the stability of operation putting the object at the optical axis.

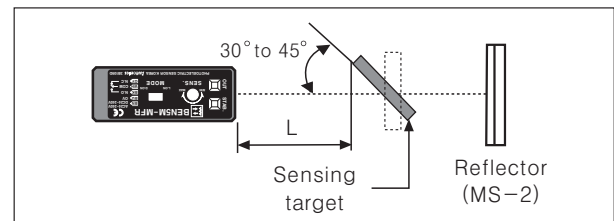


※If use more than 2 photoelectric sensors in parallel, the space between them should be more than 30cm.

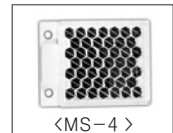
※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and photoelectric sensor or the surface of target should be installed at an angle of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

(When detecting target with high reflectance near by, photoelectric sensing with the polarizing filter should be used.)

※Sensitivity adjustment : Please see the diffuse reflective type.

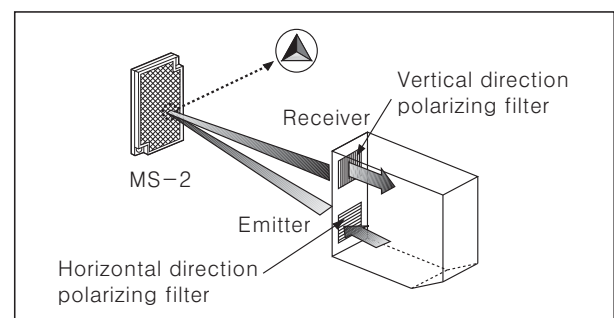


※If the mounting place is too small, please use MS-4 instead of MS-2 for same sensing distance.



◎ Retroreflective with polarizing filter

The light passed through the polarizing filter of emitter reaches to MS-2 converting as horizontal direction, it reaches to photodetector through the filter of receiver converting as vertical by MS-2 function. Even it can detect normal mirror.



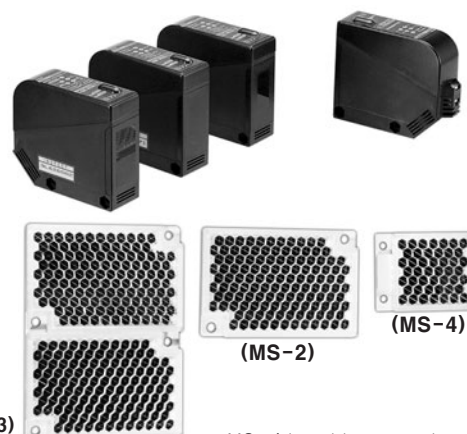
(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

BX Series

Terminal type and Long sensing distance type

■ Features

- Built-in sensitivity adjuster
- Timer : ON Delay, OFF Delay, One-shot Delay
- NPN/PNP open collector output (DC power type)
- Self-diagnosis function
(Green LED is lighted in stable level.)
- Reverse polarity, output short-circuit protection
- Power supply :
Universal 24-240VDC/24-240VAC
- Protection structure IP66 (IEC standard)



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




(MS-3)

※ MS-4 is sold separately.

■ Specifications

● Free power type

Model	Standard type	BX15M-TFR	BX5M-MFR	BX3M-PFR	BX700-DFR
	With Timer	BX15M-TFR-T	BX5M-MFR-T	BX3M-PFR-T	BX700-DFR-T
Sensing type		Through-beam	Retroreflective (Standard type)	Retroreflective (with polarizing filter)	Diffuse reflective
Sensing distance		15m	(★1) 0.1 to 5m(MS-2)	(★2) 0.1 to 3m(MS-3)	(★3) 700mm
Sensing target		Opaque materials of Min. ϕ15mm	Opaque materials of Min. ϕ60mm		Translucent, Opaque material
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. 3VA			
Light source		Infrared LED(850nm)		Red LED(660nm)	Infrared LED(940nm)
Sensitivity adjustment		Built-in VR			
Operation mode		Light ON / Dark ON mode selectable			
Control output		Relay contact output  Contact capacity : 30VDC 3A, 250VAC 3A at resistive load, Contact composition: 1c(SPDT)			
Relay life cycle		Mechanically : Min. 50,000,000, Electrically : Min. 100,000			
Self-diagnosis output		Green LED turns on at stable operation			
Timer function		Selectable ON Delay, OFF Delay, One Shot Delay by slide switch [Delay Time : 0.1 to 5sec.(Adjustable VR)]			
Indicator		Operation indicator : Yellow LED, Self-diagnosis indicator : Green LED			
Connection		Terminal connection			
Insulation resistance		Min. 20MΩ (at 500VDC megger)			
Insulation type		Double insulation			
Noise strength		±1,000V the square wave noise(pulse width : 1μs) by the noise simulator			
Dielectric strength		1500VAC 50/60Hz for 1minute			
Impulse dielectric strength		1kV(Generator : 1.2/50μs, Source impedance : 500Ω, Source energy : 0.5J)			
Vibration	Mechanical	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours			
	Malfuntion	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 10 minutes			
Shock	Mechanical	500m/s ² (50G) in X, Y, Z directions for 3 times			
	Malfuntion	100m/s ² (10G) in X, Y, Z directions for 3 times			
Ambient illumination		Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx			
Ambient temperature		-20 to 55℃ (at non-freezing status), Storage : -25 to 70℃			
Ambient humidity		35 to 85%RH, Storage : 35 to 85%RH			
Protection		IP66(IEC standard)			
Material		Case : ABS, Lens : Acrylic			
Accessory	Individual	—————	Reflector(MS-2)	Reflector(MS-3)	—————
	Common	Adjustment driver, Fixing bracket, Bolts, Nuts			
Approval		CE			
Unit weight		Approx. 226g	Approx. 131g	Approx. 149g	Approx. 116g

※ (★1) It is same when MS-4 is used and it is able to sense under 0.1m.

※ (★2) MS-2 is used, sensing distance will be 0.1 to 2m, it is able to sense under 0.1m.

※ (★3) It is for Non-glossy white paper (200 \times 200mm)

Long Sensing, Power Supply Built-in Type(Terminal Type)

■ Specifications

● DC power type

Model	Standard type	BX15M-TDT	BX5M-MDT	BX3M-PDT	BX700-DDT
	With Timer	BX15M-TDT-T	BX5M-MDT-T	BX3M-PDT-T	BX700-DDT-T
Sensing type		Through—beam	Retroreflective (Standard type)	Retroreflective (with polarizing filter)	Diffuse reflective
Sensing distance		15m	(★1) 0.1 to 5m(MS-2)	(★2) 0.1 to 3m(MS-3)	(★3) 700mm
Sensing target		Opaque materials of Min. ϕ 15mm	Opaque materials of Min. ϕ 60mm		Translucent, Opaque material
Hysteresis		—————			Max. 20% at rated setting distance
Response time		Max. 1ms			
Power supply		12-24VDC ±10% (Ripple P-P : Max. 10%)			
Current consumption		Max. 40mA	Max. 30mA		
Light source		Infrared LED(850nm)		Red LED(660nm)	Infrared LED(940nm)
Sensitivity adjustment		Built-in VR			
Operation mode		Light ON / Dark ON mode selectable			
Control output		NPN/PNP synchronous output • Load voltage : Max. 30VDC • Load current : Max. 200mA • Residual voltage: NPN : Max. 1V, PNP : Min. (Power voltage -2.5V)			
Self—diagnosis output		NPN open collector output (When photoelectric sensor operates stably, Green LED turns ON, and Output transistor turns ON.) ☞ Load voltage : Max. 30VDC, Load current : Max. 50mA, Residual voltage : Max. 1V at 50mA, Max. 0.4V at 16mA			
Protection circuit		Reverse polarity protection, Overload & short circuit protection			
Timer function		Selectable ON Delay, OFF Delay, One Shot Delay by slide switch [Delay Time : 0.1 to 5sec(VR adjustable)]			
Indicator		Operation indicator : Yellow LED, Self—diagnosis indicator : Green LED			
Connection		Terminal connection			
Insulation resistance		Min. 20MΩ (at 500VDC megger)			
Noise strength		±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 in each of X, Y, Z directions for 2 hours			
Shock		500m/s ² (50G) in X, Y, Z directions for 3 times			
Ambient illumination		Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx			
Ambient temperature		-20 to 55℃ (at non-freezing status), Storage : -25 to 70℃			
Ambient humidity		35 to 85%RH, Storage : 35 to 85%RH			
Protection		IP66 (IEC standard)			
Material		Case : ABS, Lens : Acryl			
Accessory	Individual	—————	Reflector(MS-2)	Reflector(MS-3)	—————
	Common	Adjustment driver, Fixing bracket, Bolts, Nuts			
Approval		CE			
Unit weight		Approx. 212g	Approx. 124g	Approx. 142g	Approx. 117g

※(★1) It is same when MS-4 is used and it is able to sense under 0.1m.

※(★2) MS-2 is used, sensing distance will be 0.1 to 2m, it is able to sense under 0.1m.

※(★3) It is for Non-glossy white paper(200×200mm).

(A)
Photo
electric
sensor

(B)
Fiber
optic
sensor

(C)
Door/Area
sensor

(D)
Proximity
sensor

(E)
Pressure
sensor

(F)
Rotary
encoder

(G)
Connector/
Socket

(H)
Temp.
controller

(I)
SSR/
Power
controller

(J)
Counter

(K)
Timer

(L)
Panel
meter

(M)
Tacho/
Speed/
Pulse
meter

(N)
Display
unit

(O)
Sensor
controller

(P)
Switching
power
supply

(Q)
Stepping
motor &
Driver &
Controller

(R)
Graphic/
Logic
panel

(S)
Field
network
device

(T)
Production
stoppage
models &
replacement

BX Series

Feature data

Through-beam

- BX15M-TFR / BX15M-TFR-T
- BX15M-TDT / BX15M-TDT-T

Parallel shifting characteristic		Angle Characteristic	
Measuring method	Data	Measuring method	Data

Diffuse reflective

- BX700-DFR / BX700-DFR-T
- BX700-DDT / BX700-DDT-T

Sensing area	
Measuring method	Data

Retroreflective

- BX5M-MFR / BX5M-MFR-T
- BX5M-MDT / BX5M-MDT-T

Parallel shifting characteristic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data

Retroreflective with polarizing filter

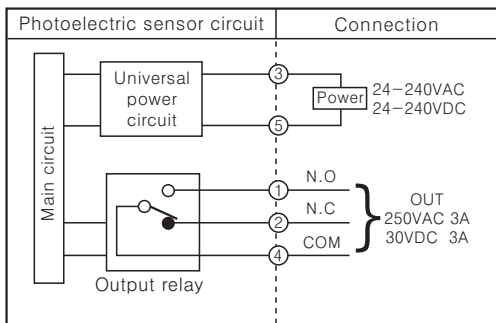
- BX3M-PFR / BX3M-PFR-T
- BX3M-PDT / BX3M-PDT-T

Parallel shifting characteristic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data

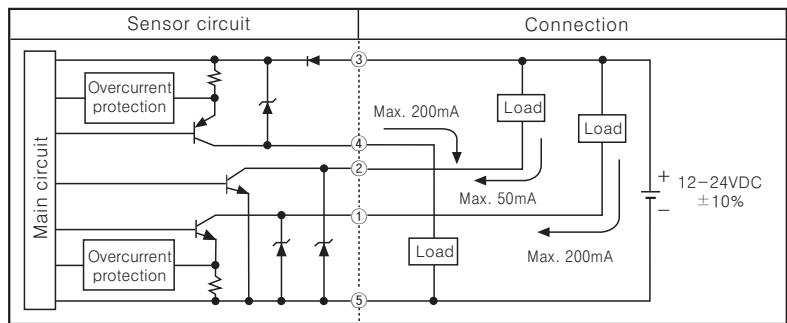
Long Sensing, Power Supply Built-in Type(Terminal Type)

■ Control output diagram

○ Free power



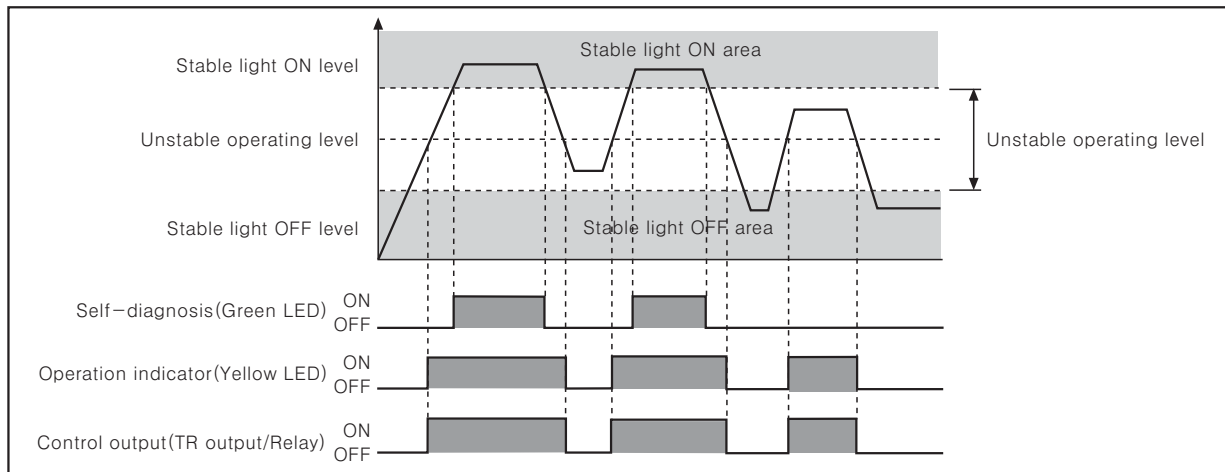
◎ DC voltage



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

■ Operation timing diagram

● Light ON mode



※Operation for Dark ON mode is opposed to above chart indication for Light ON mode.

※To prevent from the misoperation, output of units keeps the state of OFF for 0.5sec. after power ON.

■ Timer mode

Timer mode	Switch position		Status of light	Operation mode	OUT (Control output)	ON OFF	Timing diagram
	S1	S2					
Normal mode	ON	ON	Light ON	OUT (Control output)	ON	OFF	[Timing diagram for Normal mode Light ON]
			Dark ON	OUT (Control output)	ON	OFF	[Timing diagram for Normal mode Dark ON]
One shot delay mode	ON	OFF	Light ON	OUT (Control output)	ON	OFF	[Timing diagram for One shot delay mode Light ON]
			Dark ON	OUT (Control output)	ON	OFF	[Timing diagram for One shot delay mode Dark ON]
ON delay mode	OFF	ON	Light ON	OUT (Control output)	ON	OFF	[Timing diagram for ON delay mode Light ON]
			Dark ON	OUT (Control output)	ON	OFF	[Timing diagram for ON delay mode Dark ON]
OFF delay mode	OFF	OFF	Light ON	OUT (Control output)	ON	OFF	[Timing diagram for OFF delay mode Light ON]
			Dark ON	OUT (Control output)	ON	OFF	[Timing diagram for OFF delay mode Dark ON]

※T : Time set by timer adjuster.

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

(T) Production stoppage models & replacement

BX Series

■ Connections

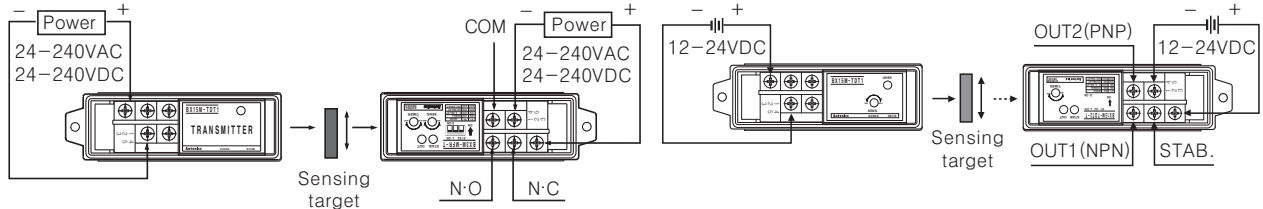
◎Through-beam

●BX15M-TFR1

●BX15M-TFR 2,
BX15M-TFR-T2

●BX15M-TDT1

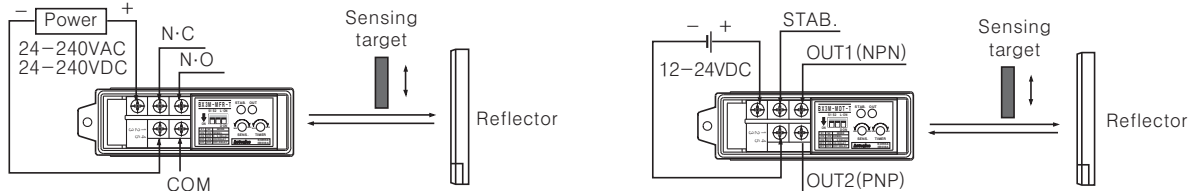
●BX15M-TDT2,
BX15M-TDT-T2



◎Retroreflective / Retroreflective with polarizing filter

●BX5M-MFR, BX5M-MFR-T
●BX3M-PFR, BX3M-PFR-T

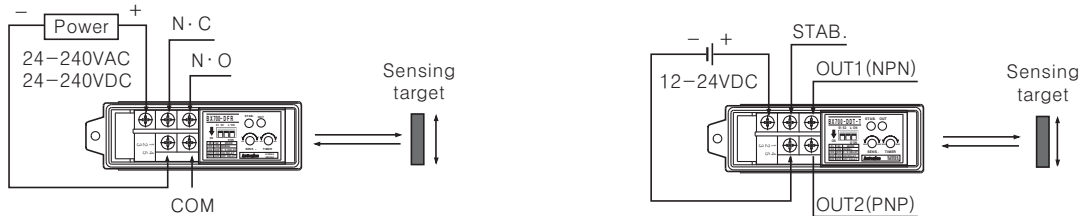
●BX5M-MDT, BX5M-MDT-T
●BX3M-PDT, BX3M-PDT-T



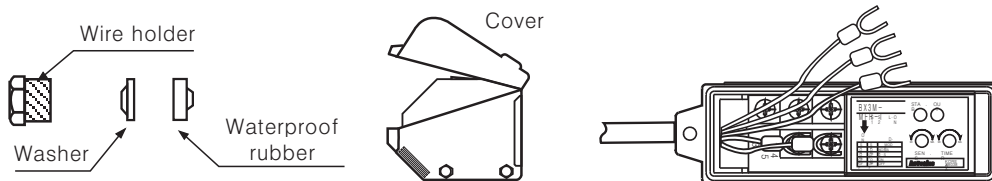
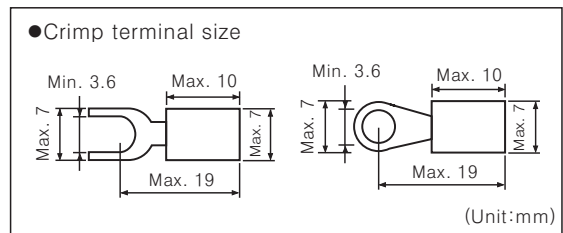
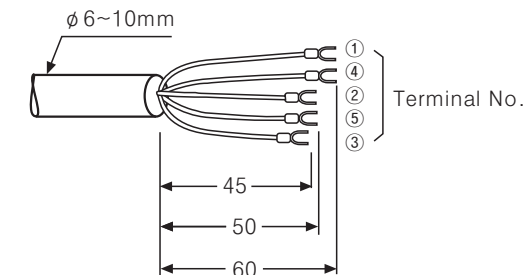
◎Diffuse reflective

●BX700-DFR, BX700-DFR-T

●BX700-DDT, BX700-DDT-T



◎Cable



※ On servicing wire, connect wire on terminal as above figure.

※ Select the round wire with the size of $\phi 6$ to 10mm for the waterproof and tighten the cable holder by torque of 1.0 to $1.5\text{N} \cdot \text{m}$.

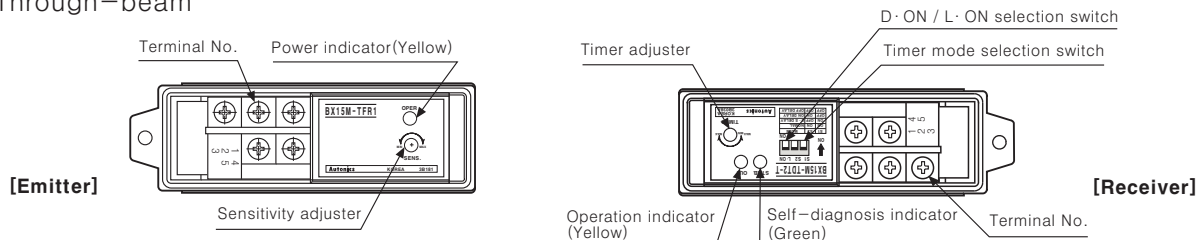
※ On servicing wire, tighten screw of terminals by torque of $0.8\text{N} \cdot \text{m}$.

※ On mounting the cover, tighten the cover nut by torque of 0.3 to $0.5\text{N} \cdot \text{m}$.

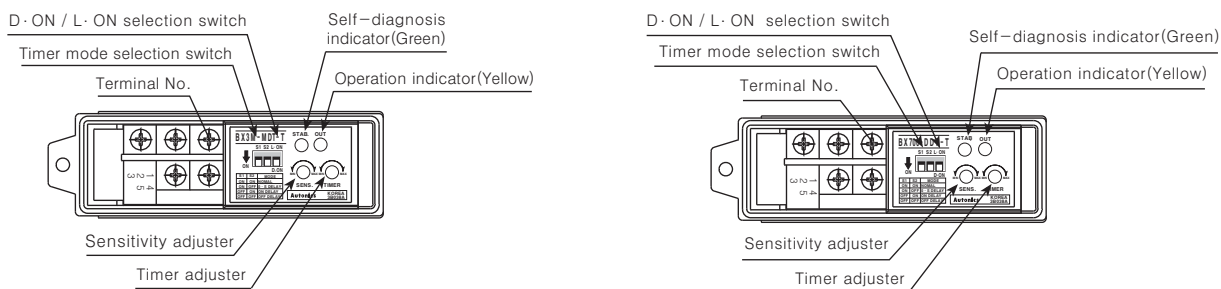
Long Sensing, Power Supply Built-in Type(Terminal Type)

■ Front panel identification

◎Through-beam



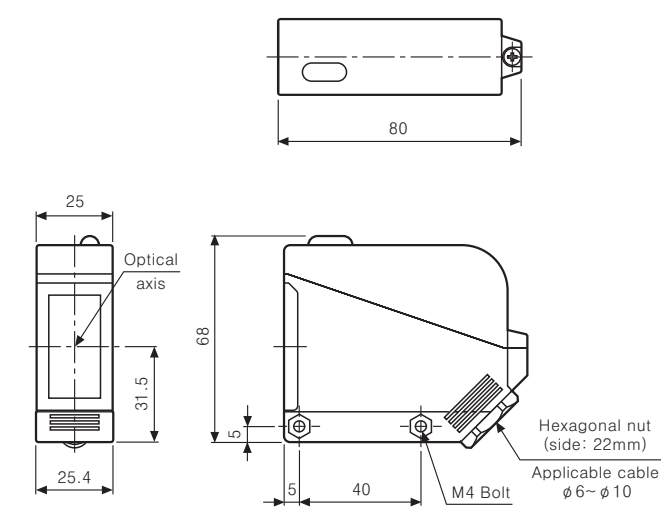
◎Retroreflective / Retroreflective with polarizing filter ◎Diffuse reflective



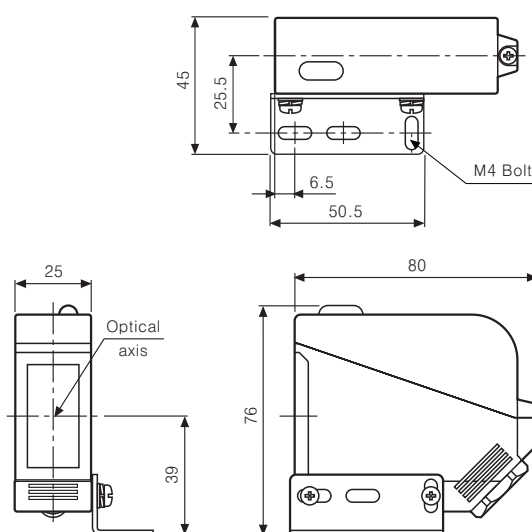
※There are no Timer mode selection switch and Timer adjuster in type without Timer function.

■ Dimensions

(Unit:mm)

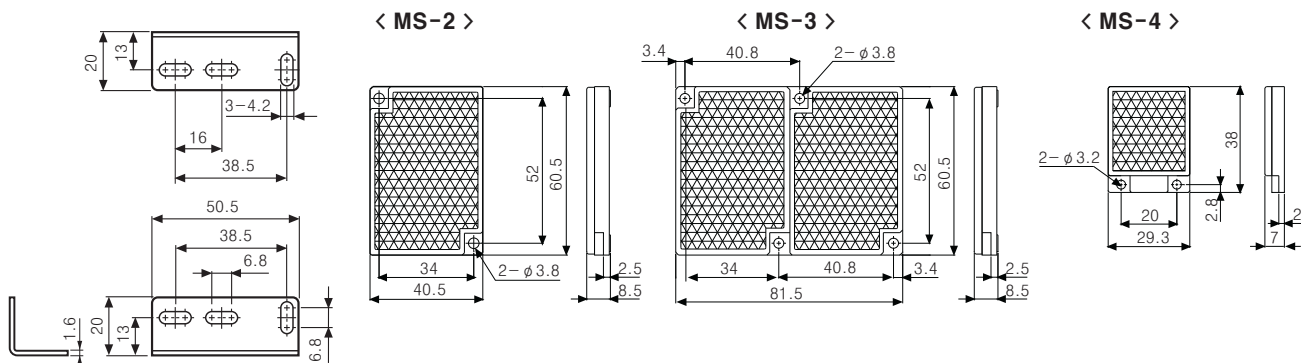


●Connect the bracket



●Bracket

●Reflector



(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

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(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

(T) Production stoppage models & replacement

BX Series

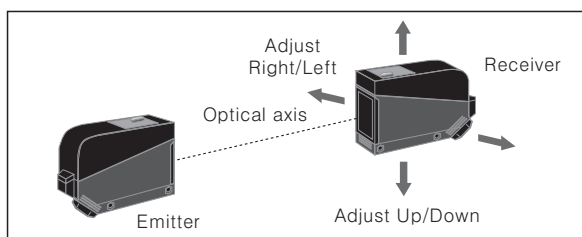
■ Mounting and sensitivity adjustment

◎ Through-beam type

1. Supply the power to the photoelectric sensor, after set 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. Adjust up and down direction as the same.
4. After adjustment, check the stability of operation putting the object at the optical axis.

※ If the sensing target is translucent body or smaller than $\phi 15\text{mm}$, it can be missed by sensor cause light penetrate it.

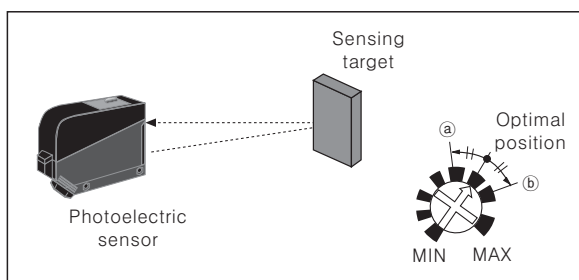
※ Sensitivity adjustment : Please see the diffuse reflective type.



◎ Diffuse reflective type

1. The sensitivity should be adjusted depending on a sensing target or mountin place.
2. Set the target at a position and turn sensitivity adjuster from minimum sensitivity position slowly, confirm position ㉑ in the middle of the operation range of indicator and self diagnosis indicator (Green LED) is OFF.
3. If turn adjuster higher slowly in state of removed target, the operation indicator (Yellow LED) will be OFF and self diagnosis indicator (Green LED) will be ON. Confirm this position as ㉒.
[When self diagnosis indicator (Green LED) and operation indicator (Yellow LED) are OFF, the Max. sensitivity position will be ㉒.]
4. Set the adjuster at the center of two switching position ㉑, ㉒.

※ Above sensitivity adjustment is when it is the state of Light ON mode. If it is the state of Dark ON mode, operation indicator (Yellow LED) will be opposite.

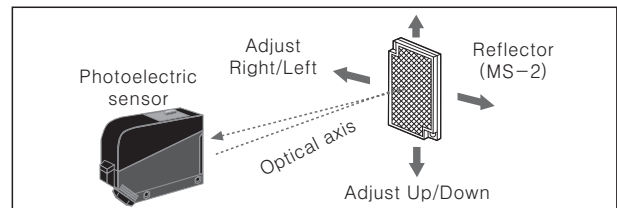


※ The sensing distance indicated on specification chart is against $200 \times 200\text{mm}$ of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.

◎ Retroreflective type

1. Supply the power to the photoelectric sensor, after set the photoelectric sensor and the reflector (MS-2) facing each other.
2. Set the photoelectric sensor in the middle of the operation range of indicator adjusting the reflector or the sensor right and left, up and down.
3. Adjust up and down direction as the same.
4. After adjustment, check the stability of operation putting the object at the optical axis.

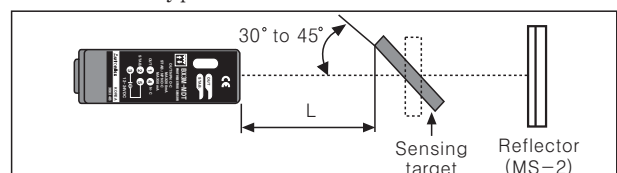
※ If use more than 2 photoelectric sensors in parallel, the space between them should be more than 30cm.



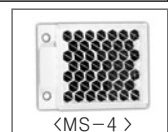
※ If use more than 2 photoelectric sensors in parallel, the space between them should be more than 30cm.

※ 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 photo sensor. Therefore put enough space between the target and photoelectric sensor or the surface of target should be installed at an angle of 30° to 45° against optical axis. (When detecting target with high reflectance near by, photoelectric sensor with the polarizing filter should be used.)

※ Sensitivity adjustment : Please refer to the diffuse reflective type.

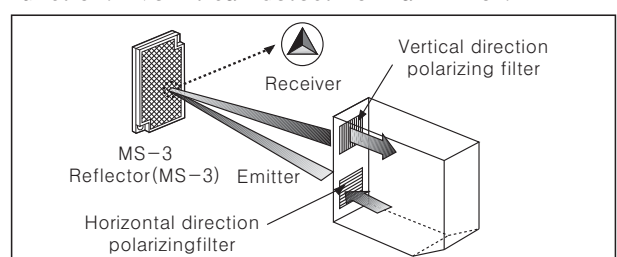


※ If the mounting place is too small, please use MS-4 instead of MS-2 for same sensing distance.



◎ Retroreflective with polarizing filter

The light passed through the polarizing filter of emitter reaches to MS-3 converting as horizontal direction, it reaches to photodetector through the filter of receiver converting as vertical by MS-3 function. Even it can detect normal mirror.



Upgraded cylindrical photoelectric sensor

■ Features

- Detects up to 20m (Through-beam type)
- Superior noise resistance with digital signal processing
- High-speed response time under 1ms
- Reverse power polarity and short-circuit (overcurrent) protection circuit
- Suitable for sensing in narrow space (Narrow beam type)
- External sensitivity adjustment (Diffuse reflective, Retroreflective type)
- Light ON, Dark ON switchable by control wire (Diffuse reflective, Retroreflective type)
- Excellent heat-resistance performance with glass lens (BR4M)
- Protection structure IP66 (IEC standard)

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



Line-up

(MS-2A)

Connector Type

■ Specifications

※ The model name with '-C' is connector type.

Model	NPN open collector	BRP100-DDT	BR100-DDT	BRP400-DDT	BR400-DDT	BRP200-DDTN	BR200-DDTN	BRP3M-MDT	BR3M-MDT	BR4M-TDTD BR20M-TDTD	BR4M-TDTL BR20M-TDTL
		BRP100-DDT-C	BR100-DDT-C	BRP400-DDT-C	BR400-DDT-C	BRP200-DDTN-C	BR200-DDTN-C	BRP3M-MDT-C	BR3M-MDT-C	BR4M-TDTD-C BR20M-TDTD-C	BR4M-TDTL-C BR20M-TDTL-C
	PNP open collector	BRP100-DDT-P	BR100-DDT-P	BRP400-DDT-P	BR400-DDT-P	BRP200-DDTN-P	BR200-DDTN-P	BRP3M-MDT-P	BR3M-MDT-P	BR4M-TDTD-P BR20M-TDTD-P	BR4M-TDTL-P BR20M-TDTL-P
		BRP100-DDT-C-P	BR100-DDT-C-P	BRP400-DDT-C-P	BR400-DDT-C-P	BRP200-DDTN-C-P	BR200-DDTN-C-P	BRP3M-MDT-C-P	BR3M-MDT-C-P	BR4M-TDTD-C-P BR20M-TDTD-C-P	BR4M-TDTL-C-P BR20M-TDTL-C-P
Sensing type		Diffuse reflective				Narrow beam reflective		Retroreflective		Through-beam	
Sensing distance		100mm(★1)		400mm(★2)		200mm(★2)		0.1 to 3m(★3)		4m / 20m	
Sensing target		Translucent, Opaque materials						Opaque materials of Min. ϕ 60mm		Opaque materials of Min. ϕ 15mm	
Hysteresis		Max. 20% at rated setting distance									
Response time		Max. 1ms									
Power supply		12-24VDC ±10%(Ripple P-P : Max. 10%)									
Current consumption		Max. 45mA									
Light source		Infrared LED(940nm)		Infrared LED(850nm)				Red LED(660nm)		Infrared LED(850nm)	
Sensitivity adjustment		Built-in VR								Fixed	
Operation mode		Light ON / Dark ON selectable by control wire(White)								Dark ON Light ON	
Control output		NPN or PNP open collector output • Load voltage : Max. 30VDC • Load current : Max. 200mA • Residual voltage ≦ NPN : Max. 1V, PNP : Min. (Power voltage -2.5V)									
Protection circuit		Short-circuit protection, Reverse polarity protection									
Indication		Power indicator(Emitter) : Red LED, Operation indicator(Receiver) : Red LED									
Connection		Outgoing cable									
Insulation resistance		Min. 20MΩ (at 500VDC megger)									
Noise strength		±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 in each of X, Y, Z directions for 2 hours									
Shock		500m/s ² (50G) in X, Y, Z directions for 3 times									
Ambient illumination		Sunlight : Max. 11,000lx, Incandescent lamp : Max. 3,000lx									
Storage temperature		-10 to 60℃ (at non-freezing status) Storage : -25 to 70℃									
Ambient humidity		35 to 85%RH, Storage : 35 to 85%RH									
Protection		IP66(IEC standard)									
Material		• BRP ≧ Case : PA(Nylon, Black), Lens : PC • BR ≧ Case : Brass, Ni-plate(BR-C : Ni-plate), Lens : PC						• Case ≧ BRP3M : PA(Nylon, Black) BR3M : Brass, Ni-plate(BR-C : Ni-plate) • Lens ≧ Acrylic		• Case ≧ Brass, Ni-plate(BR-C : Ni-plate) • Lens ≧ BR4M : Glass BR20M : PC	
Cable		• BR(P) ≧ 4P, Ø5mm, Length:2m(Emitter of through-beam type:2P, Ø5mm, Length:2mm / Receiver:3P, Ø5mm, Length:2mm) • BR(P)-C ≧ M12 • BR(P)-C Series : M12 socket type : ϕ5mm 4P, Length 3/5m, 22AWG, Core wire diameter : 0.08mm, No. of core wire : 60, Insulator diameter : ϕ1.2mm									
Accessory	Individual	Adjustment driver						Adjustment driver, Reflector(MS-2)		—	
	Common	BR : Fixing nuts, Washer / BRP : Fixing nuts									
Approval		CE									
Unit weight		• BRP Series : Approx. 100g, BR Series : Approx. 120g • BRP-C Series : Approx. 20g, BR-C Series : Approx. 35g								• BR Series:Approx. 300g • BR-C Series:Approx. 110g	

※ (★1) Non-glossy white paper 50 \times 50mm (★2) Non-glossy white paper 100 \times 100mm.

(★3) Detecting distance and detecting target for Retroreflective type is rated based on mirror (MS-2). Detecting distance indicates possible reflective mirror setting range. Sensing under 0.1m is also available.

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

(S) Field network device

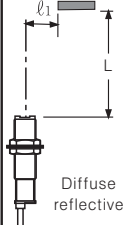
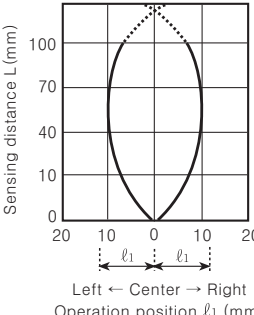
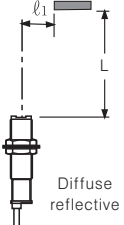
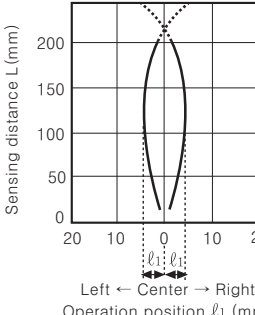
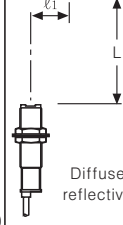
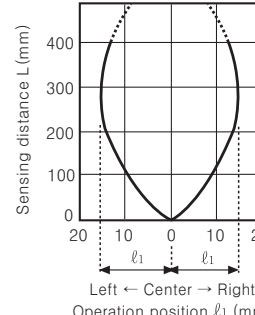
(T) Production stoppage models & replacement

BR Series

Feature data

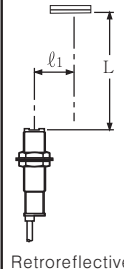
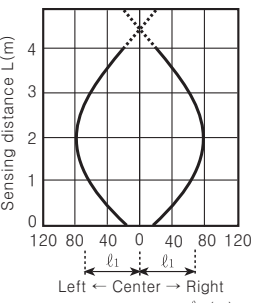
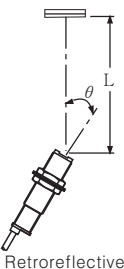
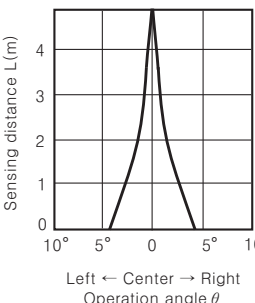
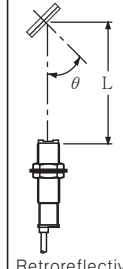
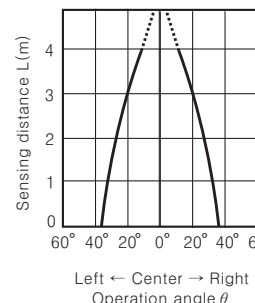
Diffuse reflective/Narrow beam reflective

●BR100-DDT-□(-P)/BRP100-DDT-□(-P) ●BR200-DDTN-□(-P)/BRP200-DDTN-□(-P) ●BR400-DDT-□(-P)/BRP400-DDT-□(-P)

Sensing area(Diffusion type)		Sensing area(Narrow beam type)		Sensing area(Diffusion type)	
Measuring method	Data	Measuring method	Data	Measuring method	Data
Standard sensing target: Non-glossy white paper 50×50mm 		Standard sensing target: Non-glossy white paper 50×50mm 		Standard sensing target: Non-glossy white paper 100×100mm 	

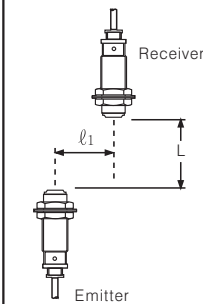
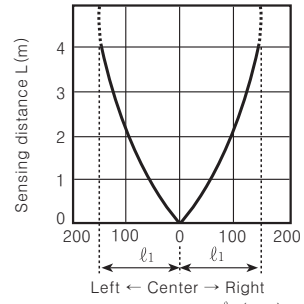
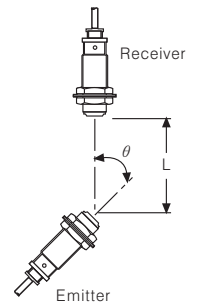
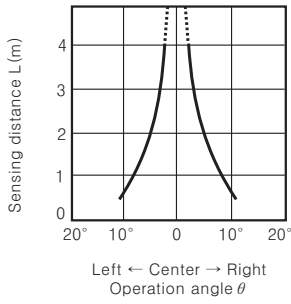
Retroreflective

●BR3M-MDT-□(-P) / BRP3M-MDT-□(-P)

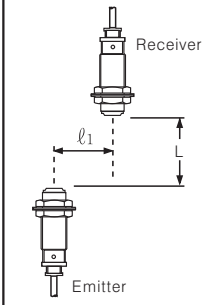
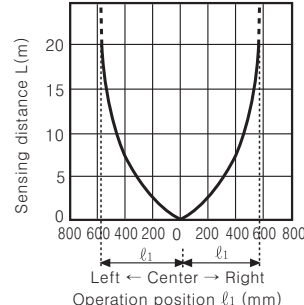
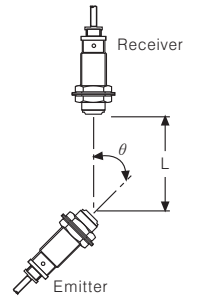
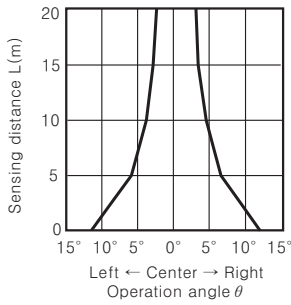
Parallel shifting characteristic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
Reflector(MS-2) 		Reflector(MS-2) 		Reflector(MS-2) 	

Through-beam

●BR4M-TDT□-□ / BR4M-TDT□-□-P

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

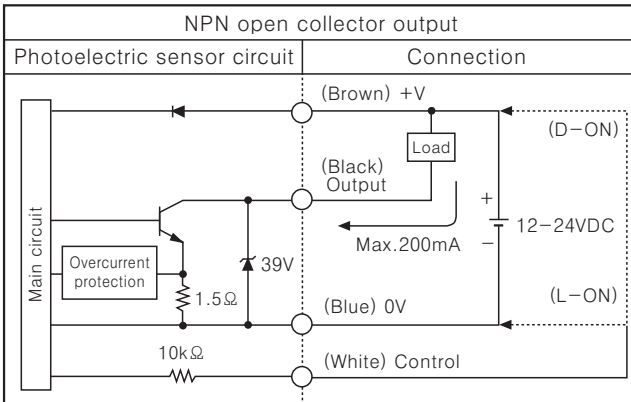
●BR20M-TDT□-□ / BR20M-TDT□-□-P

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

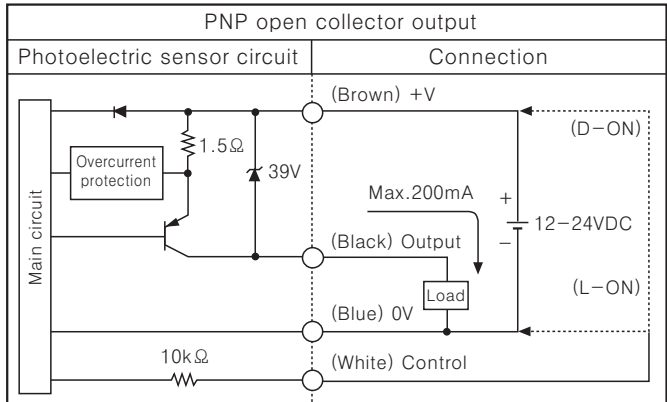
DC Cylindrical Housing Type

Control output diagram

- BR(P)100-DDT-□ / BR(P)200-DDTN-□ / BR(P)400-DDT-□
- BR(P)3M-MDT-□
- BR20M-TDTD2-□ / BR20M-TDTL2-□(Receiver)



- BR(P)100-DDT-□-P / BR(P)200-DDTN-□-P / BR(P)400-DDT-□-P
- BR(P)3M-MDT-□-P
- BR20M-TDTD2-□-P / BR20M-TDTL2-□-P(Receiver)

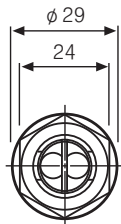


※Select Light ON / Dark ON by control wire.
 Light ON : Connect control wire to 0V
 Dark ON : Connect control wire to +V

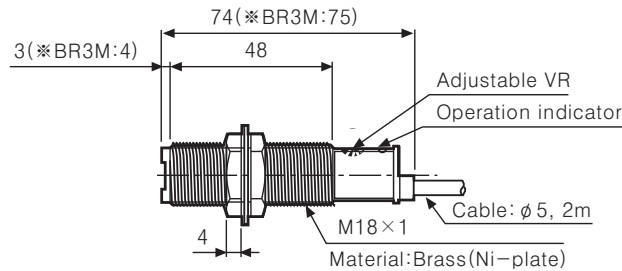
※Control wire is available only for diffuse reflective type and retroreflective type.

Dimensions

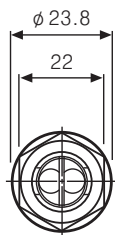
- BR100-DDT / BR100-DDT-P
- BR400-DDT / BR400-DDT-P



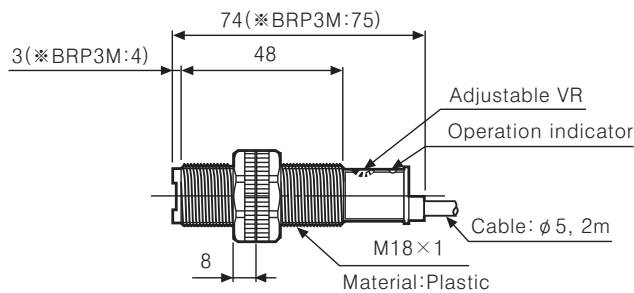
- BR200-DDTN / BR200-DDTN-P
- BR3M-MDT / BR3M-MDT-P (※)



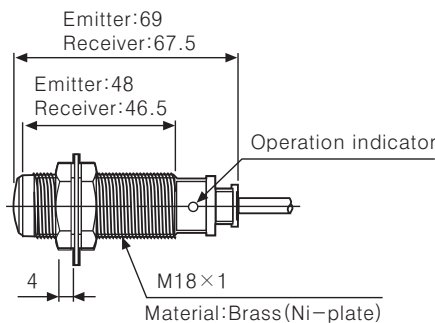
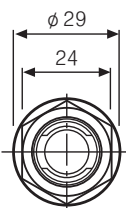
- BRP100-DDT / BRP100-DDT-P
- BRP400-DDT / BRP400-DDT-P



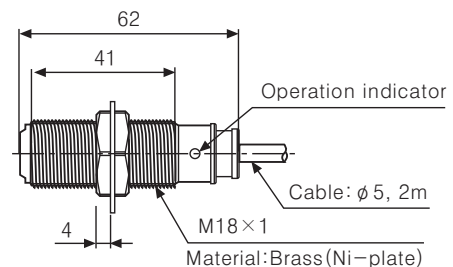
- BRP200-DDTN / BRP200-DDTN-P
- BRP3M-MDT / BRP3M-MDT-P (※)



- BR4M-TDTD / BR4M-TDTD-P / BR4M-TDTL / BR4M-TDTL-P
- BR20M-TDTD / BR20M-TDTD-P / BR20M-TDTL / BR20M-TDTL-P



< BR4M Series >



< BR20M Series >

(Unit:mm)

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

(R) Graphic/Logic panel

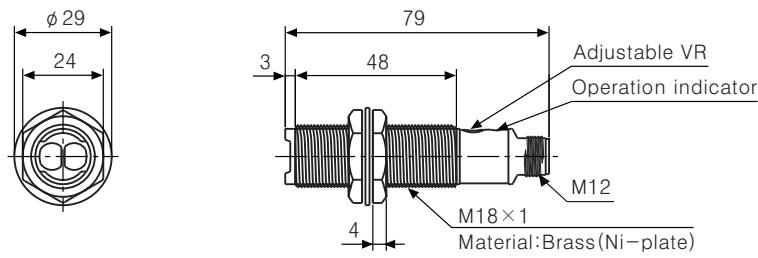
(S) Field network device

(T) Production stoppage models & replacement

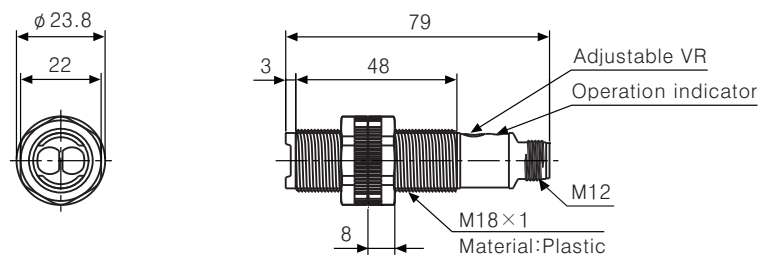
BR Series

■Dimensions

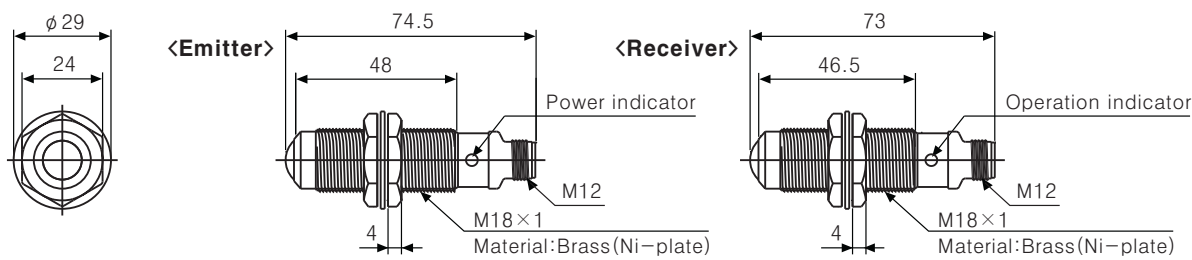
●BR100/200/400/3M-DDT(N)-C(-P)



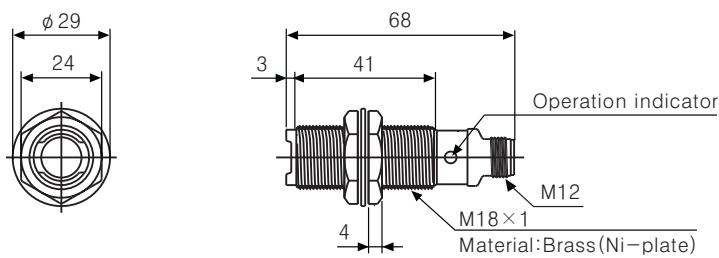
●BRP100/200/400/3M-DDT(N)-C(-P)



●BR4M-TDTD(L)-C(-P)



●BR20M-TDTD(L)-C(-P)



(Unit:mm)

■Operation mode

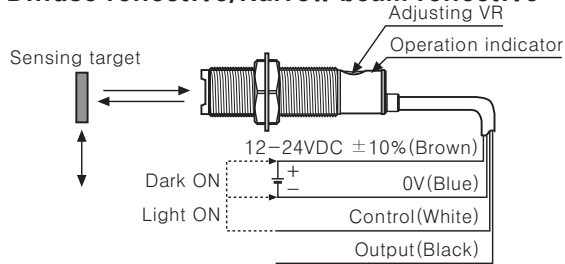
Light ON mode	Receiver	[ON OFF		Dark ON mode	Receiver	[ON OFF	
	Operation indicator (LED)	[ON OFF			Operation indicator (LED)	[ON OFF	
	TR output	[ON OFF			TR output	[ON OFF	

※ The control TR output will be held OFF for 0.5 sec. after supplied power in order to prevent malfunction of this photoelectric sensor (Diffuse reflective, retroreflective).
 ※ If the control output terminal is short-circuited or flow beyond rated current, the control signal will not be output normally due to protection circuit.

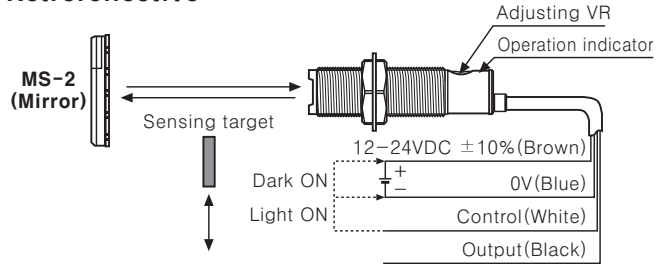
DC Cylindrical Housing Type

Connections

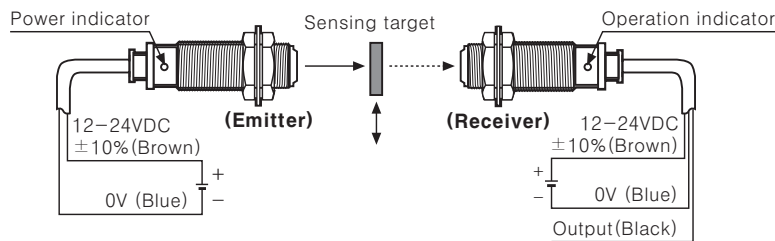
Diffuse reflective/Narrow beam reflective



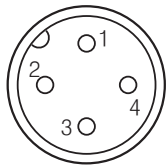
Retroreflective



Through-beam



Connections



M12 Connector pin

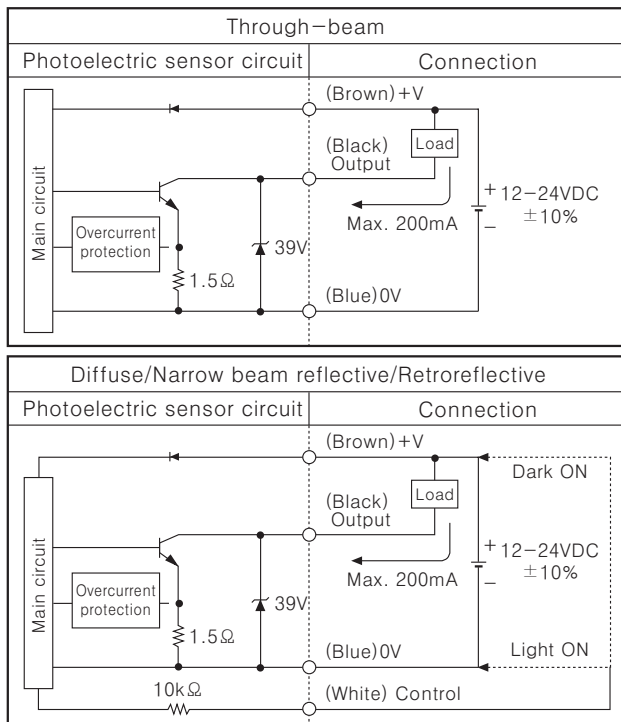
Connector pin No.	Cable colors	Application		
		Diffuse/Narrow beam reflective	Retroreflective	Through-beam
1	Brown	24VDC	24VDC	24VDC
2	White	CONTROL	N.C	GND
3	Blue	GND	GND	GND
4	Black	OUTPUT	N.C	OUTPUT

Connector cable (Sold separately)

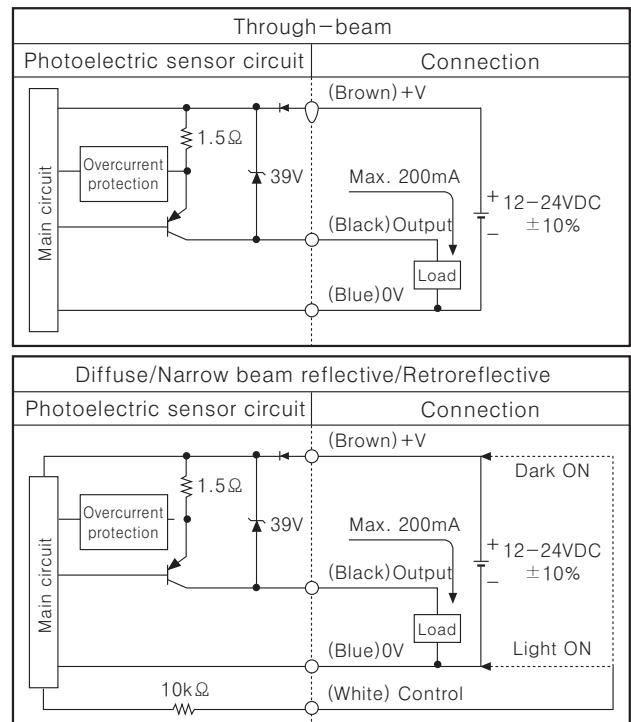
※Please refer to G-5 for connector cable.

Control output diagram

NPN open collector output



PNP open collector output

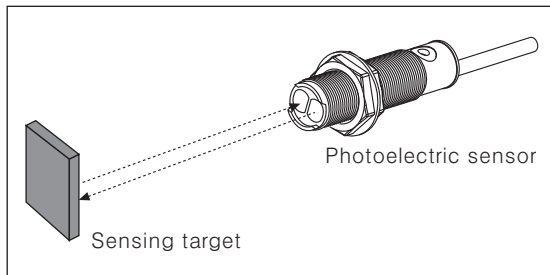


■ Mounting and sensitivity adjustment

Please supply the power to the sensor after mount the emitter and the receiver facing each other, and then adjust an optical axis and the sensitivity as follow;

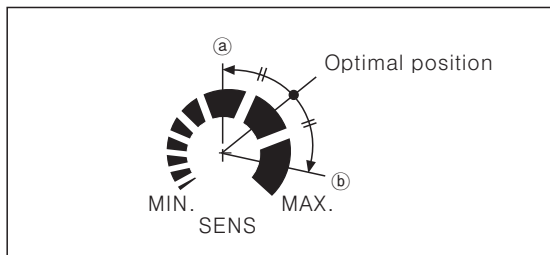
◎ Diffuse reflective/Narrow beam reflective type

1. The sensitivity should be adjusted depending on a sensing target or mounting place.



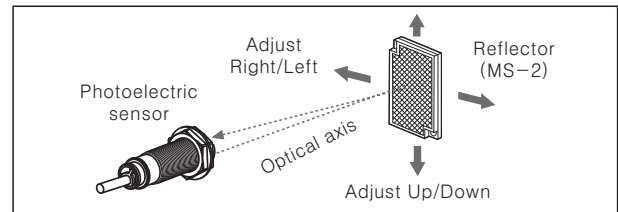
2. Set the target at a position to be detected by the beam, then turn the adjuster until position ① in the middle of the operation range of indicator from Min. position of the adjuster.
3. Take the target out of the sensing area, then turn the adjuster until position ② in the middle of the operation range of indicator. If the indicator does not turn on, max. position is position ②.
4. Set the adjuster in the middle of two switching position ①, ②.

※ The sensing distance indicated in the specification chart is that of non-glossy white paper in the target size 100×100mm or 50×50mm. Be sure that it can be different by size, surface and gloss of target.

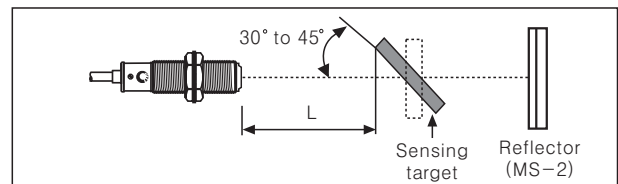


◎ Retroreflective type

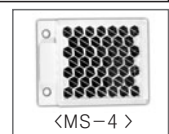
1. Supply the power to the photoelectric sensor, after set the photoelectric sensor and the reflector (MS-2) facing each other.
 2. Set the photoelectric sensor in the middle of the operation range of indicator adjusting the reflector or the sensor right and left, up and down.
 3. Adjust up and down direction as the same.
 4. After adjustment, check the stability of operation putting the object at the optical axis.
- ※ If use more than 2 photoelectric sensors in parallel, the space between them should be more than 30cm.



- ※ If use 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 photo sensor. Therefore put enough space between the target and photoelectric sensor or the surface of target should be installed at an angle of 30° to 45° against optical axis. (When detecting target with high reflectance near by, photoelectric sensor with the polarizing filter should be used.)
- ※ Sensitivity adjustment : Please refer to the diffuse reflective type.

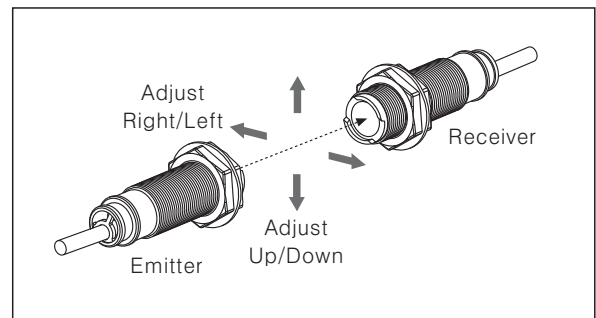


- ※ If the mounting place is too small, please use MS-4 instead of MS-2 for same sensing distance.



◎ Through-beam type

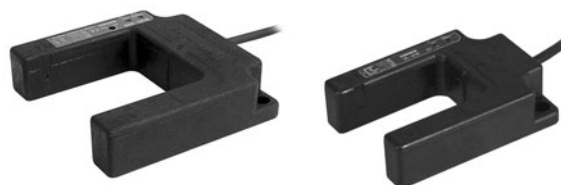
1. Supply the power to the photoelectric sensor, after mount the emitter and the receiver facing each other.
2. Set the receiver in center of position in the middle of the operation range of indicator adjusting the receiver and the emitter right and left, up and down.
3. Fix both units tightly after checking that the unit detect the target.



Reinforced plastic case U-Shaped type photoelectric sensor

■ Features

- Improved noise resistance to disturbance light
- High speed response type
- Reverse power polarity and short-circuit (Overcurrent) protection circuit
- Light ON / Dark ON Selectable by control wire
- Protection structure IP66 (IEC standard)
: BUP-30, BUP-50



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



■ Specifications

Model	NPN open collector	BUP-30	BUP-30S	BUP-50	BUP-50S
	PNP open collector	BUP-30-P	BUP-30S-P	BUP-50-P	BUP-50S-P
Sensing type	Through-beam				
Sensing target	Opaque materials of min. ϕ 4mm	Opaque materials of min. ϕ 1.5mm	Opaque materials of min. ϕ 4mm	Opaque materials of min. ϕ 1.5mm	
Operation mode	Light ON / Dark ON selectable by control wire (White)				
Sensing distance	30mm			50mm	
Response time	Max. 1ms				
Power supply	12-24VDC \pm 10% (Ripple P-P : Max. 10%)				
Current consumption	Max. 30mA				
Light source	Infrared LED (940nm)				
Sensitivity adjustment	Fixed	Built-in VR	Fixed	Built-in VR	
Control output	NPN or PNP open collector output • Load voltage : Max. 30VDC • Load current : Max. 200mA • Residual voltage φ NPN : Max. 1V, PNP : Min. (Power voltage -2.5V)				
Protection circuit	Reverse power polarity, Short-circuit protection				
Indication	Power indicator : Green LED, Operation indicator : Red LED				
Connection	Outgoing cable				
Insulation resistance	Min. 20M Ω (at 500VDC megger)				
Noise strength	\pm 240V the square wave noise (pulse width : 1 μ s) by the noise simulator				
Dielectric strength	1,000VAC 50/60Hz for 1 minute				
Vibration	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours				
Shock	1,000m/s ² (50G) in X, Y, Z directions for 3 times				
Ambient illumination	Sunlight : Max. 11,000lx Incandescent lamp : Max. 3,000lx				
Ambient temperature	Operation : -25 to 65℃ [BUP-30S(-P) & BUP-50S(-P) : -10 to 60℃], Storage : -25 to 70℃ (non-freezing condition)				
Ambient humidity	35 to 85%RH, Storage : 35 to 85%RH				
Protection	IP66 (IEC standard)	IP50 (IEC standard)	IP66 (IEC standard)	IP50 (IEC standard)	
Material	Case : PA				
Cable	4P, ϕ 4mm, Length : 2m				
Accessory	—————	Adjustment driver	—————	Adjustment driver	
Approval	CE				
Unit weight	Approx. 90g			Approx. 140g	

(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

(N) Display unit

(O) Sensor controller

(P) Switching power supply

(Q) Stepping motor & Driver & Controller

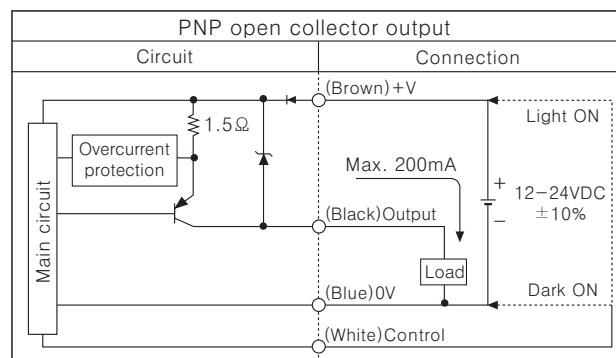
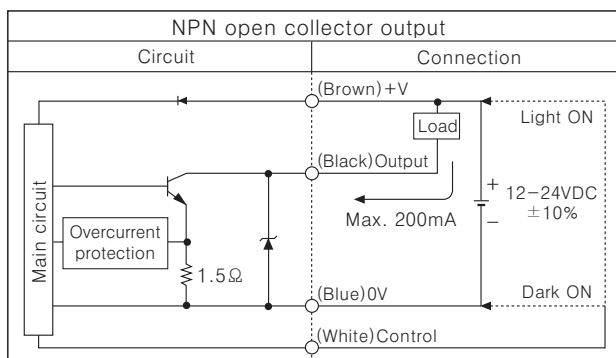
(R) Graphic/Logic panel

(S) Field network device

(T) Production stoppage models & replacement

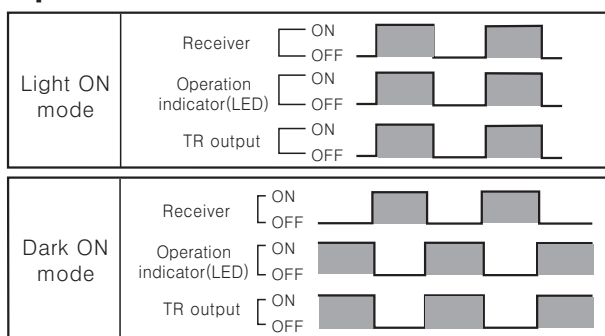
BUP Series

Control output diagram

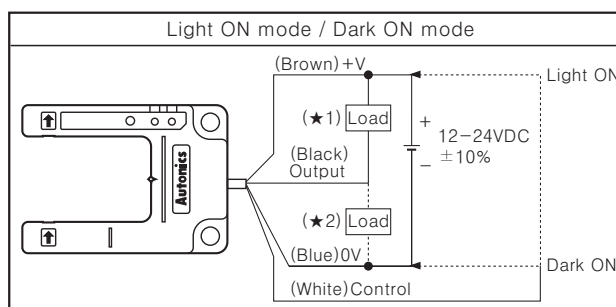


※Select Light ON / Dark ON by control wire.
 Light ON : Connect control wire to 0V
 Dark ON : Connect control wire to +V

Operation mode



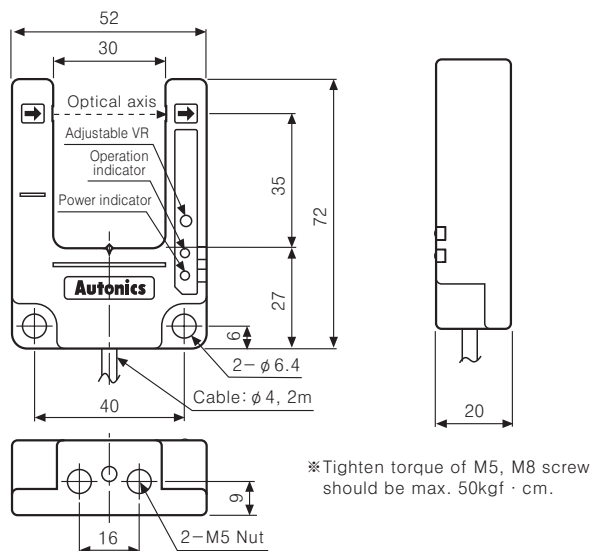
Connections



※(★1)–Load connection for NPN open collector output
 (★2)–Load connection for PNP open collector output

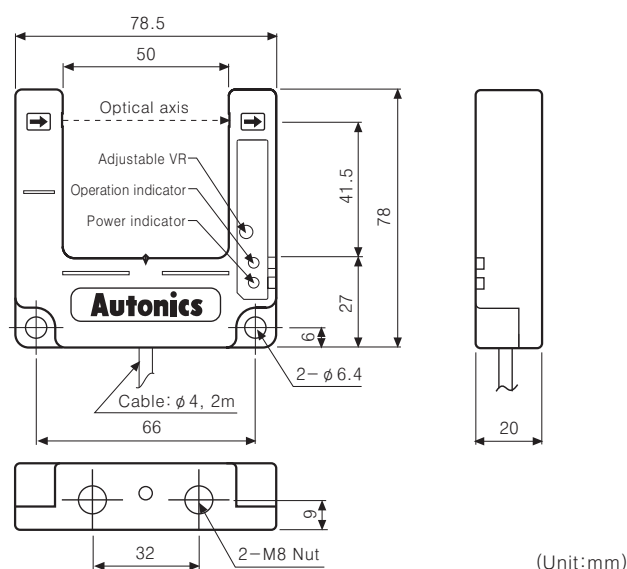
Dimensions

●BUP-30, BUP-30-P, BUP-30S, BUP-30S-P



※Tighten torque of M5, M8 screw should be max. 50kgf · cm.

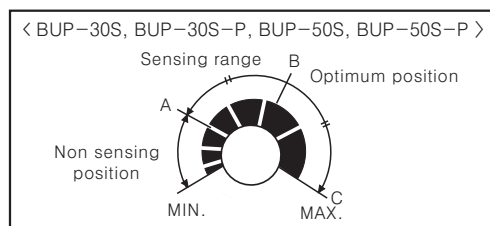
●BUP-50, BUP-50-P, BUP-50S, BUP-50S-P



(Unit:mm)

Mounting and sensitivity adjustment

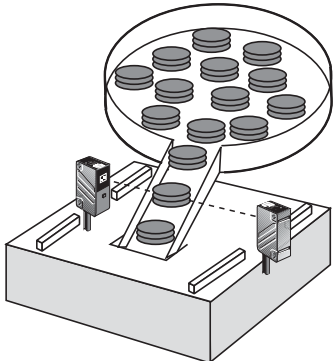
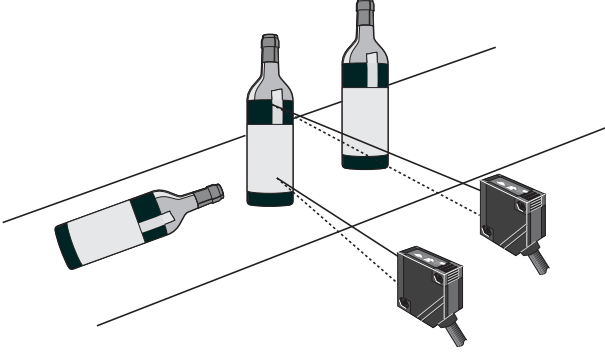
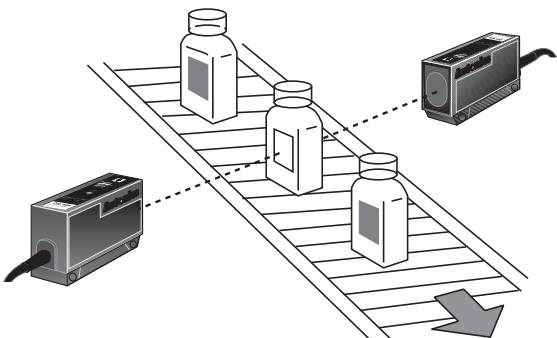
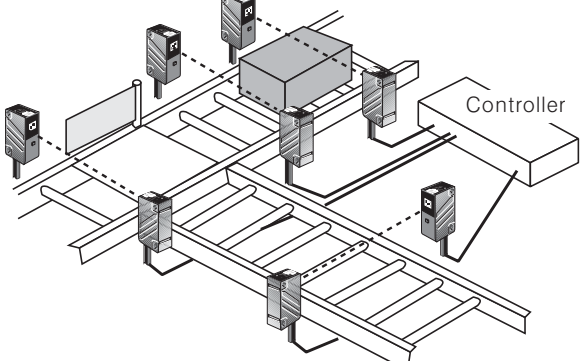
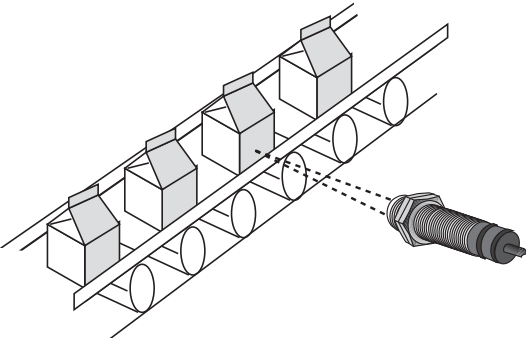
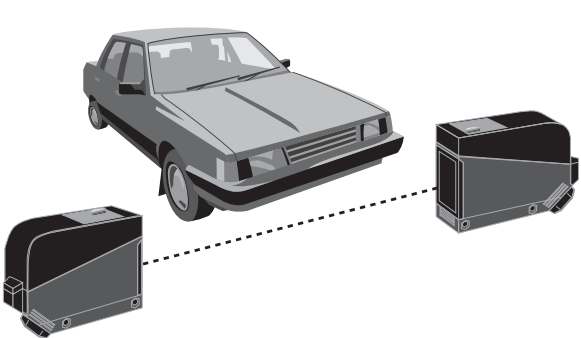
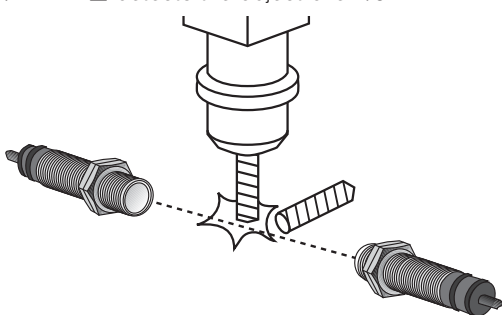
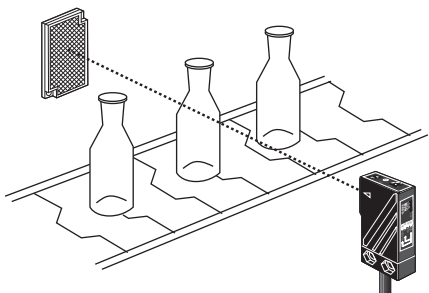
Please supply the power to the sensor after mount the emitter and the receiver facing each other, and then adjust an optical axis and the sensitivity as follow;



※Sensing target at a position to be detected by the beam, then turn the adjuster until position "A" in the middle of the operation range of indicator(Dark ON mode) or indicator is turned off(Light ON mode) (It is able to operate in min. sensitivity position.)

Place adjuster at "B", in the middle of two switching "A", "C".

■ Applications

<p>Sensing of passing objects in narrow place</p> 	<p>Sensing of fallen bottle</p> 
<p>Label sensing of transparent bottle</p> 	<p>Automatic conveyor line</p> 
<p>Sensing of milk pack</p> 	<p>Sensing of passing of the car</p> 
<p>Sensing of a broken drill blade</p> <p>※If the drill blade is thin, it cannot be detected because BR4M-TDT□ detects the object over 15mm.</p> 	<p>Sensing of present / absence of transparent bottle</p> <p>※Retroreflective type(Enable to adjust sensitivity)</p> 

(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
(J)	Counter
(K)	Timer
(L)	Panel meter
(M)	Tacho/Speed/Pulse meter
(N)	Display unit
(O)	Sensor controller
(P)	Switching power supply
(Q)	Stepping motor & Driver & Controller
(R)	Graphic/Logic panel
(S)	Field network device
(T)	Production stoppage models & replacement

Application

■ Applications

<p>Polarizing filter built in</p> <p>(Receiver) Vertical polarizing filter Vertical direction of vibration Horizontal direction of vibration Reflector MS-2 (MS-3) Vibration in horizont Horizontal direction of vibration Reflector MS-2 (MS-3) (Emitter) Horizontal Polarizing filter</p>	<p>Sensing of transparent vinyl</p> <p>*Application model BUP-30, BUP-50</p> <p>Transparent target < Installation method for transparent object ></p>
<p>Sensing position of moving target</p> <p>Crane U-shaped sensor</p>	<p>Sensing position of elevator</p> <p>Sensing target U-shaped sensor Elevator Entrance of elevator Sensing part Entrance of elevator</p>

Photoelectric sensor overview

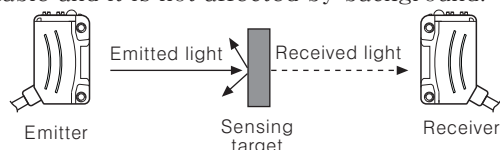
Sensors are differentiated depending on applied media. Light, one of the media, is also utilized for a sensor which is called a photoelectric sensor. It is a non-contact type which is applicable to sensing presence, passing, size, color and brightness of the target object.

Classification by sensing method

Photoelectric sensors can be classified into three categories depending on sensing type.

Through-beam photoelectric sensor

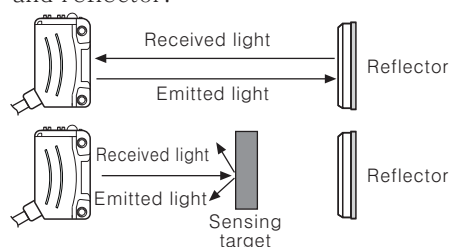
Through-beam type is to detect a target by using the difference of light intensity depending on presence of target with placing an emitter and a receiver face to face. Long sensing distance is available and it is not affected by background.



Retroreflective photoelectric sensor

Standard type

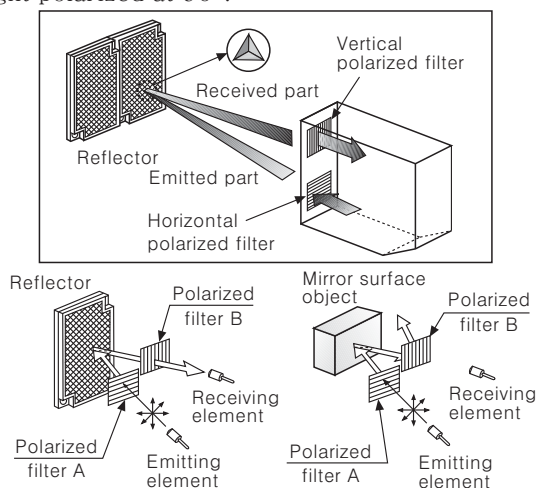
Retro reflective type uses a photoelectric sensor which is integrated with emitter and receiver, and a reflector with high light radiant in order to detect a target by comparing difference of light amount determined by the presence of target between the sensor and reflector.



Using highly reflective objects is limited but depends on install method, it could be available to use.

Polarized filter type

Like standard type of retroreflective photoelectric sensor, polarized filter type uses a photoelectric sensor which is integrated with emitter and receiver and a reflector. The emitted part and received part in the sensor have each polarized filter for receiving reflected light from the reflector which make the light polarized at 90°.

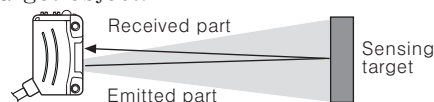


Diffuse reflective photoelectric sensor

Diffuse reflective is to detect a target by direct reflection off the target object. (Emitter / Receiver in one body)

Standard diffuse reflective type

Light source is diffused after passing the lens, detects a target by comparing difference of light amount which depends on size, color and brightness of the target object.



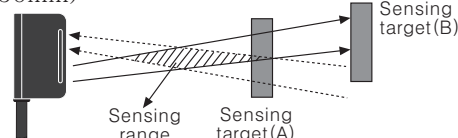
Narrow beam type

Narrowed beam spot size after passing the lens has little effect on background. It is suitable for sensing in narrow space or sensing small size of the target object.



Limited distance reflective type

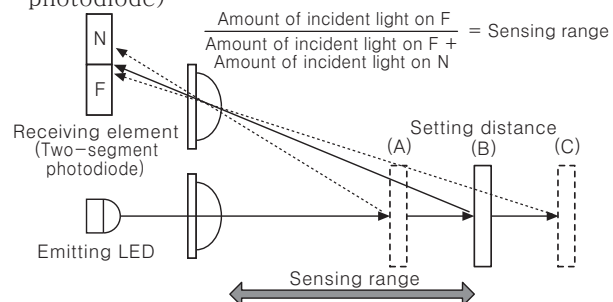
Limited distance reflective type sensed limited area (checked part) where optical source across. In the figure below, the sensing target at (A) can be detected while the target at (B) cannot. Due to limited area by optical source, there is little effect by background but it is not simple to modify sensing distance and sensing target in a specific area. (Within 50mm)



BGS (Background Suppression) type

It detects range of set distance which is applied the algorithm of triangulation principle which is for measuring the place where the reflected light forms an image on the receiving element or the optical system. Also it has little effect by size, color and surface condition of the sensing target and no effect on the background. Strong at temperature, power and voltage changes and available detect to sensing distance over 10mm.

※ Triangulation : Emitting light forms an image on the receiving light element after being reflected on the sensing target. In case sensing target is located at (B), same amount of reflected light will be received on both N and F part of receiving element. In case sensing target is located closer (A), larger amount of reflected light will be received on N part and less amount of light on F part. In case sensing target is located further (C), both N and F part will receive the reflected light vice versa. Therefore, sensing distance can be determined with calculating the amount of reflected light on both parts of receiving element (Two-segment photodiode)



(A)	Photo electric sensor
(B)	Fiber optic sensor
(C)	Door/Area sensor
(D)	Proximity sensor
(E)	Pressure sensor
(F)	Rotary encoder
(G)	Connector/Socket
(H)	Temp. controller
(I)	SSR/Power controller
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Technical Description

■ Glossary

◎LED : Light Emitting Diode

A semiconductor diode that emits light when an electric current passes through it. The color and brightness of LED is determined by the component, construction ratio, impurities of PN junction for improving single crystal which is made with gallium (Ga) to mixed crystal.

Infrared LED : Using P-N junction for GaAs

Red LED : Adding impurities Zn, O to GaP

Green LED : GaP/Green light emitting/ Yellow emitting is used due to low efficiency.

Yellow LED : Adding N to GaP / Higher emitting efficiency than Green emitting.

The most common emitting element for photoelectric sensor is IRED having high emitting efficiency and large outputs. Red or green LED is also frequently used according to applications.

◎Photo diode

A photo diode is a type of diode capable of converting light into either current or voltage when light reached to P layer. PN or PIN junction used. Si is generally used for semiconductor.

PIN photodiode is commonly used as receiving elements to catch optical signal with high response and frequency. Applicable to photoelectric sensor's receiving elements, PCM transmission for optical communication, and TV/ VTR remote controller's receiving parts.

◎Photo transistor

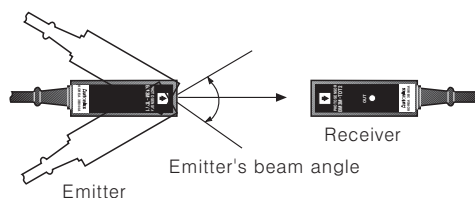
Compared to photo diodes, photo transistor has amplifying action by transistor. Control easily due to high receiving sensitivity for Base current. Thus it is available in a wide range of photoelectric sensors.

◎Sensing target

The sensing target serves as a reference for measuring basic performance.

◎Beam angle

Angle range for normal sensing by the sensors.



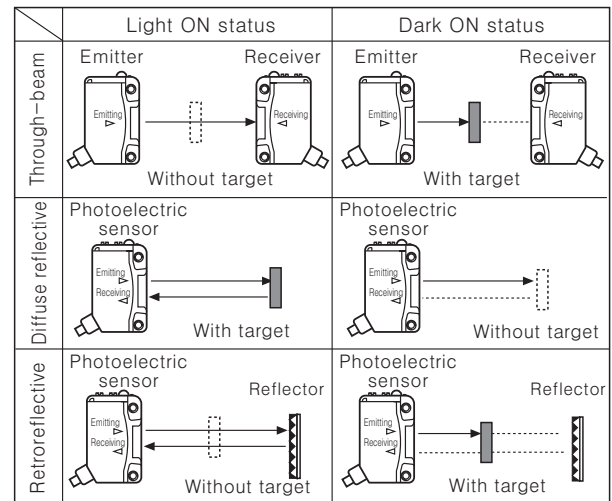
◎Operation mode

●Light ON

Output switching elements (TR or Relay) become ON when the receiver receives emitting light from the emitters.

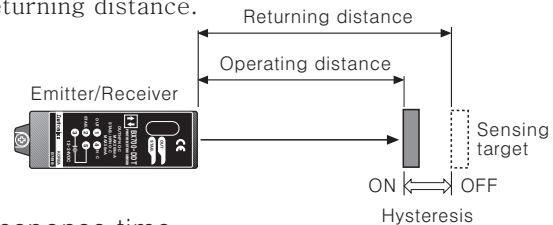
●Dark ON

Output switching elements (TR or Relay) become ON when the receiver receives ON lights from the emitters.



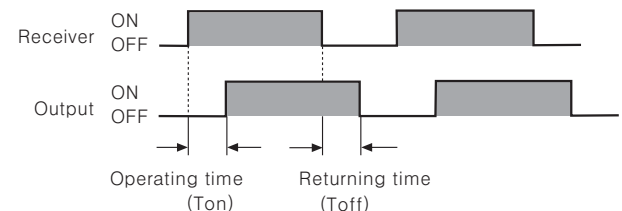
◎Hysteresis (Reflective type)

Distance difference between operating distance and returning distance.



◎Response time

The time lag between light received point and the point on which output operation becomes ON. (LIGHT ON mode) Generally, response time is represented as operation time (T_{on}). [Operating time (T_{on}) \approx Returning time (T_{off})]



■ Major features

◎Non-contact detection

Photoelectric sensor is a non-contact type which does not have any impact on the sensing target.

◎Wide range of sensing target

Applicable to a wide range of materials including transparent glass, metal, plastic, wood and liquid.

◎High speed response time

Using light as the medium, it is able to sensing high speed moving object.

◎Superior distinction performance

Using several characteristics of light, various kinds of sensors are developed. They are able to detect presence, passing, size, color, and brightness of the sensing target.

◎Easy to control application environment

Easy to control sensing range and environment of photoelectric sensor using lens such as half mirror, shield boards, slit.

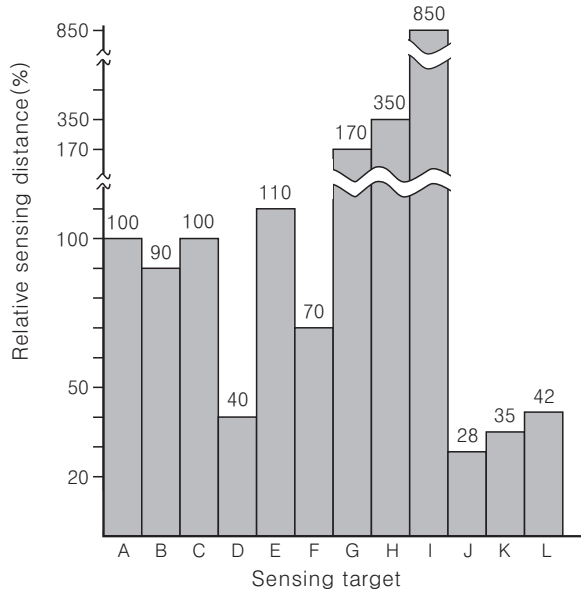
- ◎Low influence from magnetic field and vibration
Using light when photoelectric sensor detect the sensing target, it is less affected by magnetic and vibration.

◎Color identification

The rate at which an object reflects or absorbs light depends on both the wavelength of the emitted light and the color of the object. This property can be used to detect colors.

■About sensing object of retro reflective type sensors

◎Sensing distance according to color



- | | |
|---|-------------------------------|
| A : Non-glossy white paper (Standard) | F : Vinyl resin (Orange) |
| B : Corrugated card board with yellow color | G : Rubber board |
| C : Veneer board | H : Aluminum board |
| D : Non-glossy black paper (Brightness 3) | I : Reflective bar |
| E : Bakelite board with yellow color | J : Rusty steel bar $\phi 10$ |
| Acryl board (Black) | K : Black cloth (Towel) |
| Vinyl resin (Red) | L : Dark Blue cloth (Towel) |

※It shows ratio of sensing object each detection distance based on non-glossy white paper is 100%. Relative sensing distance depends on the model and sensing object size.

※Limited distance reflective type is not affected by color or material within range of sensing distance as specified in chart.

◎Sensing distance and range against the sensing target condition

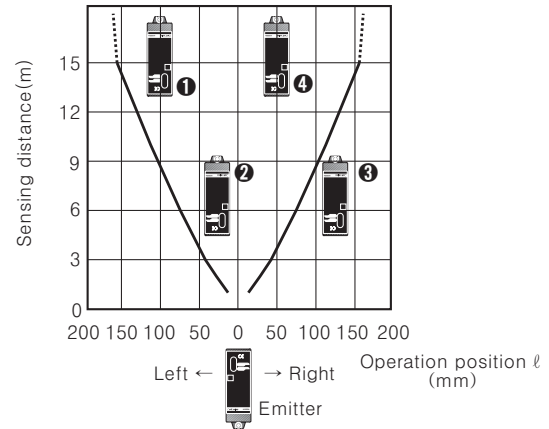
- ①As the reflectivity of the sensing target surface is high, the sensing distance will be long.
- ②As the size of the sensing target is big, the sensing distance is long.
- ③As the rate of reflection of the sensing target is low, the sensing area is narrow. However in the case of white non-glossy paper, it has lower reflectivity than glossy SUS or aluminum, but the property of sensing area is better by diffused reflection of the surface of the white paper.

■Feature data

Explains about feature data.

◎Example of parallel shifting characteristic (Through-beam type)

This characteristic for through-beam type, indicates about width of light for emitter.



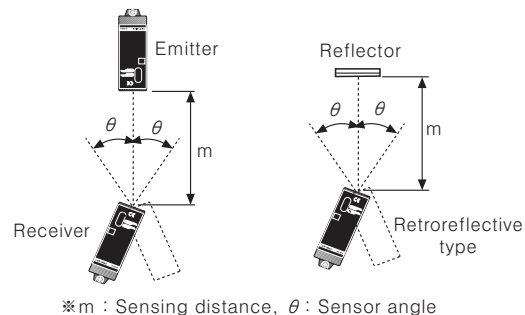
As shown in the figure, Receiver 1, 2, 4 operate normally but Receiver No. 3 is not normally working because it is out of the boundary. Refer to this data when placing multiple sensors in parallel, it is able to prevent mutual inference. In case installing the receiver at 9m point (as No. 2 in the figure), there must be 110mm interval between each unit in order to prevent mutual interference.

◎Sensing distance characteristic (Diffuse reflective type)

This is feature data of diffuse reflective type sensors same as the parallel shifting characteristic.

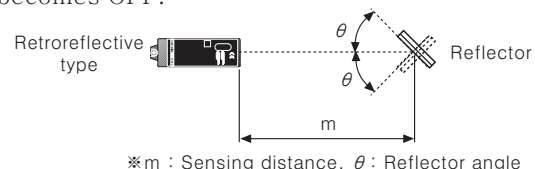
◎Angle sensor characteristic (Retroreflective type, Through-beam type)

After fixed emitter (or reflector), and sensor (receiver) moves an emitter towards the center axis from right or left, up or down until operation becomes OFF.



◎Reflector angle characteristic (Retroreflective type)

Move a reflector towards center axis from right or left, up or down with fixing the receiver until operation becomes OFF.



(A) Photo electric sensor

(B) Fiber optic sensor

(C) Door/Area sensor

(D) Proximity sensor

(E) Pressure sensor

(F) Rotary encoder

(G) Connector/Socket

(H) Temp. controller

(I) SSR/Power controller

(J) Counter

(K) Timer

(L) Panel meter

(M) Tacho/Speed/Pulse meter

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(T) Production stoppage models & replacement

Technical Description

■ Proper usage

◎ Precaution for proper installation

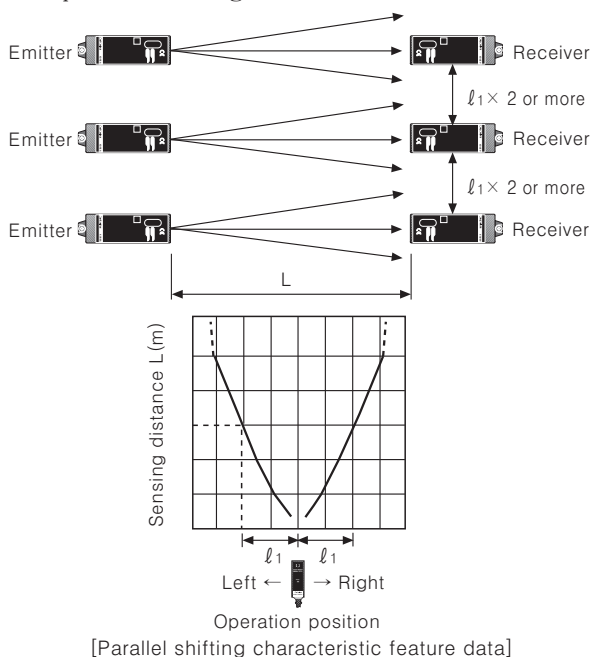
- Make sure enough sensing space (sensing stability) must be ensured when selecting and installing the sensor.
- Make sure that diameter of sensor lenses (\varnothing) is smaller than sensing target when selecting the sensors.
- If there are any possibilities for sensors to be damaged by sensing targets. For protecting photoelectric sensor use protection covers.
- In case the sensor is applied to high frequency machines, such as ultrasonic welding machine, etc, insulate the sensor and high frequency machines using insulating boards to prevent malfunction from induced current.
- Keep the cable as short as possible. In case of cable extension, make sure that thickness of the cable shall be over 0.3mm². Be careful of voltage drop.
- Photoelectric sensor is generally applied for machine, or equipment, it is easy to have the effect of vibration or shock. In order to prevent this effect, please follow countermeasures before using.
 - ① Do not make sensor's main body touch the sensing target directly.
 - ② Use sturdy material supports in order not to be affected by vibration or shock.
 - ③ Tighten fixed bracket's bolts and nuts.
- If photoelectric lens are dirty by dust, clean with a dried towel softly. Do not use organic solvent, such as thinners, etc.
- Avoid dust or any corrosion causing environments.

◎ Countermeasures for mutual interference

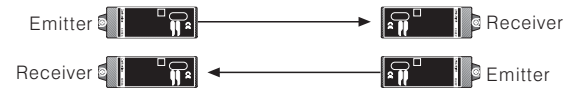
In the case of using photo sensor closely, user needs to make countermeasures because of interference which affects each other's operation.

● Through-beam type

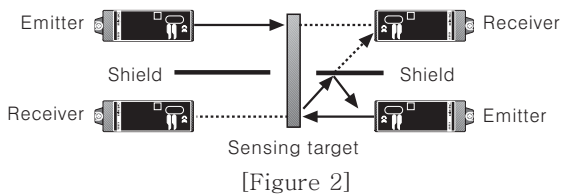
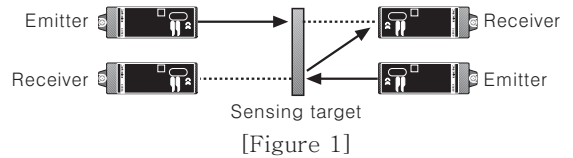
- 1) Increase the separation distance with referring to parallel shifting feature data.



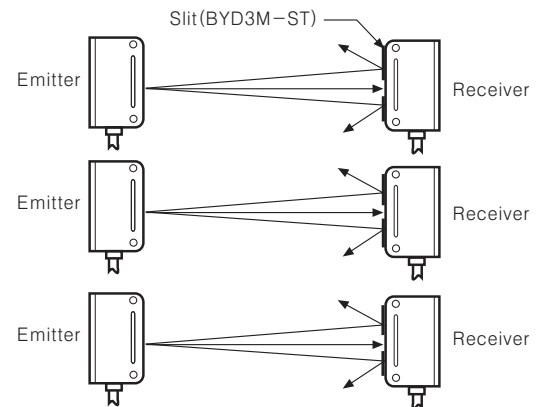
- 2) Place the emitter and the receiver alternately.



In this case, if the install distance of the photo sensor is close like [Figure 1], it can cause malfunction. User needs to install a shield like [Figure 2].



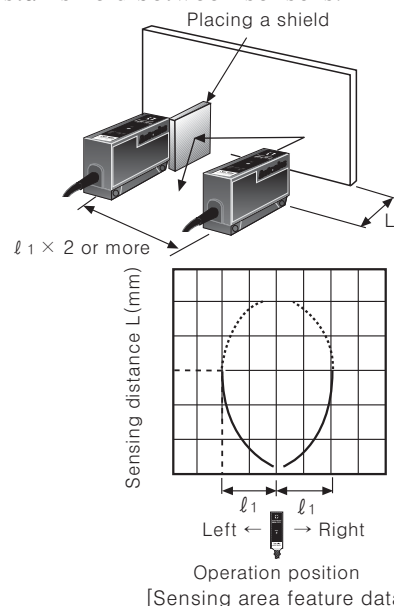
- 3) Narrow the light by using a slit on the receiver.



● Diffuse reflective type, limited distance reflective type

- 1) Check the install distance which has no interference at the sensing area characteristics of the sensor. Install the sensor with the 2 times longer operating position (ℓ_1) than sensing distance (L).

- 2) Install shield between sensors.

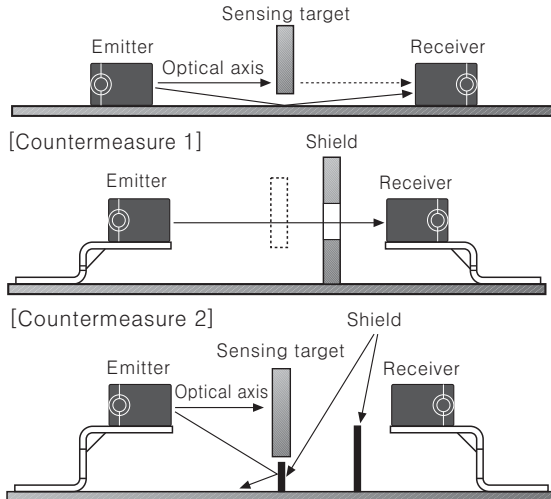


Technical Description

◎Influence of surroundings

●Through-beam type

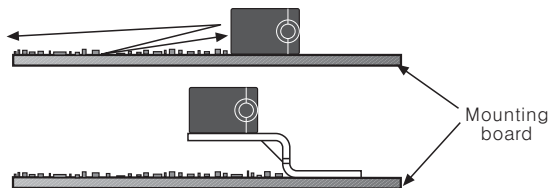
Emitted light is not completely interrupted by a sensing target because some amount of emitted light gets reflected from the mounting board and enters into the receiver.



●Diffuse reflective type

1. Effect of install surface

In case a diffuse reflective sensor is mounted on a rough mounting plate, the reflected light causes photoelectric sensor's malfunction. For prevent this, please mount the sensor with bracket.



2. Effect of the surrounding object

Even though the surrounding object such as wall is far apart from the sensing target, the object is able to affect the detection.

Countermeasure:

- ①Paint the background in black color to reduce reflected light.
- ②Increase the distance from the background.
- ③Select limited distance reflective type sensor.

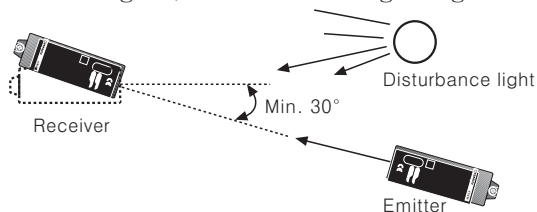
◎Influence of disturbance light

There are two types of photoelectric sensor which are modulated type and non-modulated type. Modulated type is not affected by normal disturbance light. But it can be affected by strong disturbance light or modulated disturbance light.

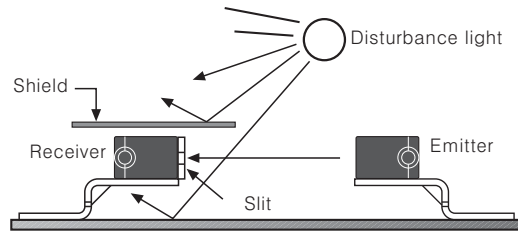
Strong disturbance light : Direct rays of sunlight

Modulated disturbance light : Arc welding spark, Inverter fluorescent.

1. Set the optical axis of the receiver more than 30° difference with the entering light direction of disturbance light. (Set exceed the range of light wide)



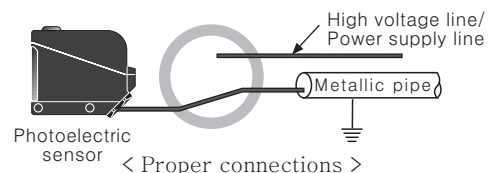
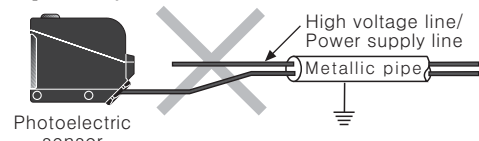
2. Attach the slit or protection cover on the receiver.



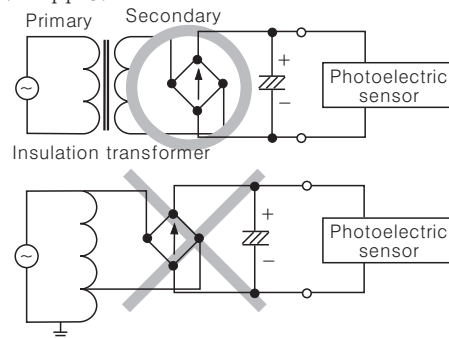
◎Operation power and grounding

- In case of commercial power, use power supply with low noise/ voltage variations. Avoid using the unit around the power generators or high voltage lines.

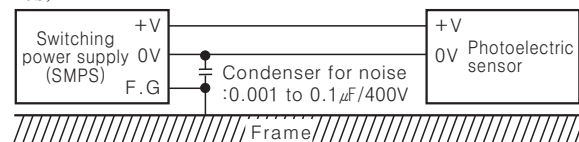
- Do not connect high voltage power source line and sensor's cable power line together. It may cause product damage or malfunction. Please wire lines separately.



- In case of DC power photoelectric sensors, use insulation transformer for rectified power supply with $\pm 10\%$ ripple.



- In case power is supplied from switching power supply, ensure that the frame ground (F.G.) terminal of the power supply is connected to an ground and connect a condenser for noise removal between 0V and F.G terminal. (Usually the condenser is equipped in switching power supply units)



In case of sensor's material is metal, ground the metal case to prevent electrostatic or product malfunction due to noise.

◎Precaution for power supply

- Please do not operate ON/OFF using power
- It is required at least 500ms for stable sensor operations after power supply is ON.

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(B)	Fiber optic sensor
(C)	Door/Area sensor
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