Photoelectric switches with built-in amplifier PH1C

■ Features

- Highly compact with dimensions of 10.8 x 31 x 20mm
- Energy-saving design
- Covers a wide range of detection with distances of 10m (transmission type), 3 or 4m (retroreflective type), or 1m (diffuse reflection type)
- Retroreflective type equipped with mirror surface rejection function
- High-speed response time of 1ms
- Light-ON/Dark-ON selectable with operation mode switch
- Equipped with various protective functions
- High degree of protection of IP67 (IEC) enables use even in environments where exposure to water is possible.
- Improved alignment (±2.5˚) of optical and mechanical axes simplifies adjustment (transmission type, retroreflective type)
- Environment-friendly lead-free solder used
- Meets CE Mark requirements.

XX03-014A,15A

Transmission type
PH1CT

XX03-013A

Retroreflective type
PH1CR
Diffuse reflection type
PH1CD

XX03-007A

Reflector
PH1X

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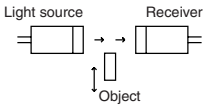
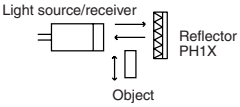
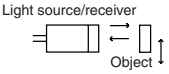
■ Types

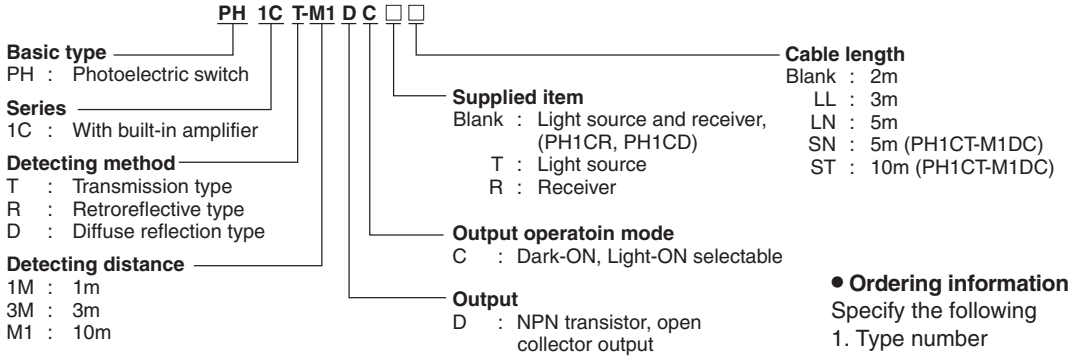
Detecting method	Detecting distance	Light emitting element	Output	Output operation mode	Type	Supplied item	Cable length
Transmission type 	10m	Red LED	NPN transistor, open collector output	Dark-ON / Light-ON selectable	**PH1CT-M1DC** **PH1CT-M1DCSN** **PH1CT-M1DCST**	Light source and receiver	2m 5m 10m
					PH1CT-M1DCR **PH1CT-M1DCRLN**	Receiver	2m 5m
					PH1CT-M1DCT **PH1CT-M1DCTLN**	Light source	2m 5m
Retroreflective type (with mirror surface rejection) 	0.1 to 3m (using PH1X-R1) 0.1 to 4m (using PH1X-R1S)	Red LED			**PH1CR-3MDC** **PH1CR-3MDCLN**	Light source/ receiver	2m 5m
Diffuse reflection type 	1m	Infrared LED			**PH1CD-1MDC** **PH1CD-1MDCLL**	Light source/ receiver	2m 3m

■ Ratings and specifications

Detection method		Transmission type	Retroreflective type (with mirror surface rejection)	Diffuse reflection type
Type		**PH1CT-M1DC**	**PH1CR-3MDC**	**PH1CD-1MDC**
Light emitting element		Red LED		Infrared LED
Supply voltage		12 to 24V DC ±10% (ripple ±10% or less)		
Current consumption		Light source: 15mA, Receiver: 20mA	30mA max.	
Detecting distance		10m	0.1 to 3m (using PH1X-R1) 0.1 to 4m (using PH1X-R1S)	1m (white mat paper 30 x 30cm)
Detectable target		Opaque 12mm dia. min.	Opaque 75mm dia. min.	Transparent or opaque
Directional angle		Light source and receiver: 3 to 15° each	Light source/receiver: 2 to 10°, Reflector: 30°	–
Differential		–		Max. 20% of detecting distance
Detecting output		NPN transistor, open collector output Load current: 100mA max. (26.4V DC) Residual voltage: 1V DC max. at load current less than 10mA 2V DC max. at load current of 10 to 100mA		
Output operation mode		Dark-ON / Light-ON selectable		
Response time		1ms max. (operation/reset)		
Indicator	Operation indicator	Orange LED (Light source: power supply indicator)	Orange LED	Orange LED
	Stability level indicator	Green LED (Receiver)	Green LED	Green LED
Connection		Attached cable (2m, 0.2mm²)		
Sensitivity adjustment		Dial		
Ambient operating illumination		Incandescent lamp: 3000 lx max. (at receiving surface) Sunlight: 10000 lx max. (at receiving surface)		
Ambient temperature		Operating: –25 to +55˚C (no icing), storage: –40 to +70˚C		
Ambient humidity		Operating: 35 to 85%RH (no condensation), storage: 35 to 95%RH		
Degree of protection		IP67 (IEC)		
Protective function		Reverse polarity (input), short-circuit and reverse polarity (output)	Reverse polarity (input), short-circuit, reverse polarity (output) and mutual interference	
Insulation resistance		20MΩ (500V DC megger)		
Dielectric strength		1,000V AC for 1min		
Vibration		10 to 55Hz, 1.5mm double amplitude or 300m/s² (2 hours for each X, Y, Z direction)		
Shock		500m/s² (3 times for each X, Y, Z direction)		
Material	Casing	Polybutylene terephthalate resin (PBT)		
	Lens	Polyarylate resin (PAR)	Methacrylic resin (PMMA)	Polyarylate resin (PAR)
Mass		Approx. 120g	Approx. 65g	Approx. 65g
Accessory (option)		Mounting bracket (PH1X-P1, PH1X-P2)		

Note : Reflectors PH1X-R1 and R1S (for retroreflective type PH1CR use) are sold separately.

■ Type number nomenclature

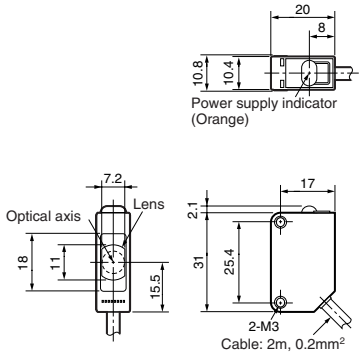


● **Ordering information**
Specify the following
1. Type number

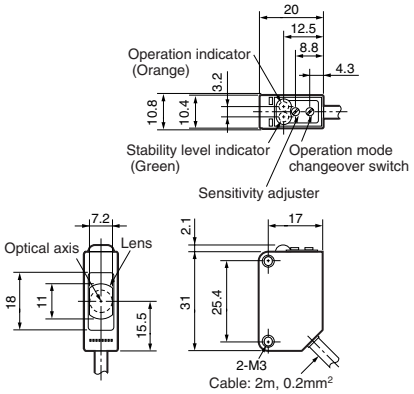
■ Dimensions, mm

● PH1CT-M1DC

Light source

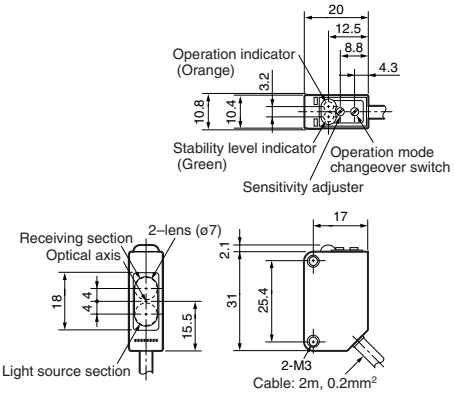


Receiver



● PH1CR-3MDC, PH1CD-1MDC

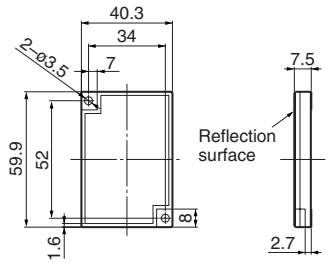
Light source/receiver



■ Dimensions, mm (sold separately)

● Reflector

PH1X-R1, PH1X-R1S

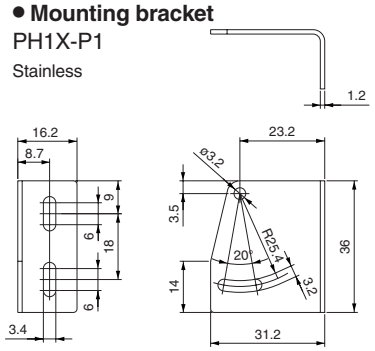


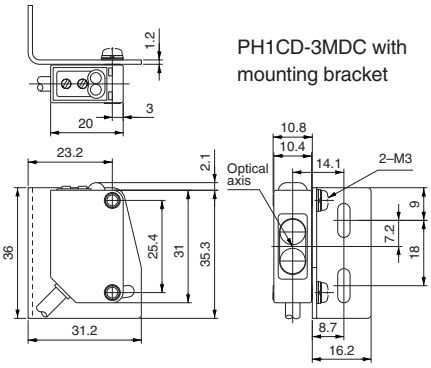
Reflection surface: Methacrylic resin (PMMA)
Reverse side: Acrylonitrile butadiene styrene resin (ABS)

● Mounting bracket

PH1X-P1

Stainless

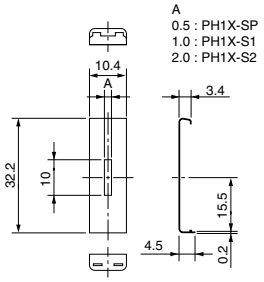




● Slit

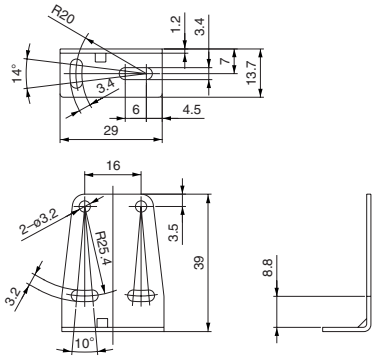
PH1X-SP, PH1X-S1, PH1X-S2

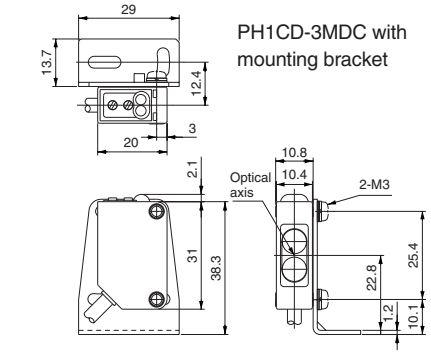
Stainless



PH1X-P2

Stainless





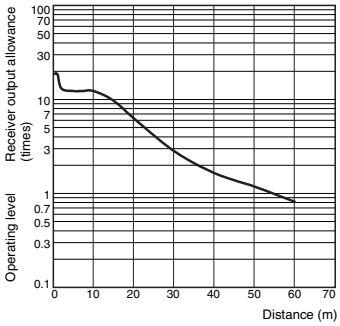
● Detection characteristics using PH1X slit

Photoelective switch	PH1CT-M1DC		
Slit width (mm)	0.5×10	1×10	2×10
Detecting distance (m)	0.7	1.5	3.5
Minimum detectable target (mm dia.)	0.2	0.5	0.8

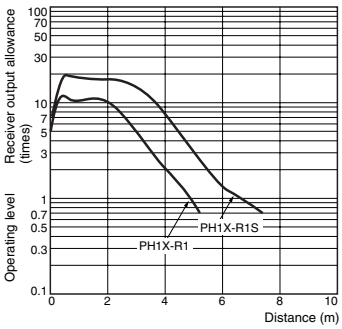
■ Characteristic curve, typical

● Receiver output-Distance

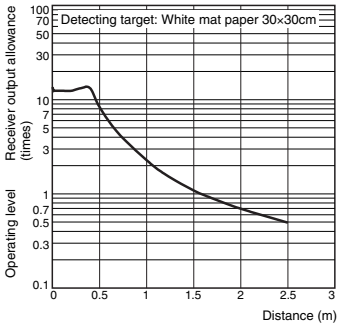
PH1CT-M1DC



PH1CR-3MDC + Reflector

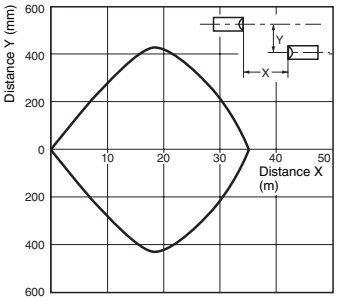


PH1CD-1MDC

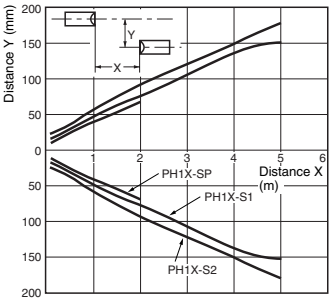


● Setting range of light source and receiver head

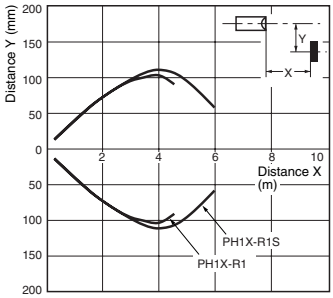
PH1CT-M1DC



PH1CT-M1DC + Slit

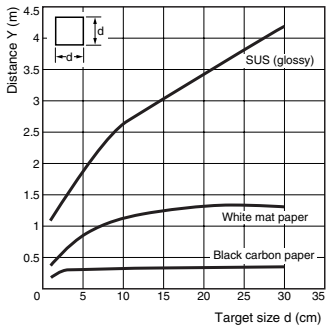


PH1CR-3MDC + Reflector



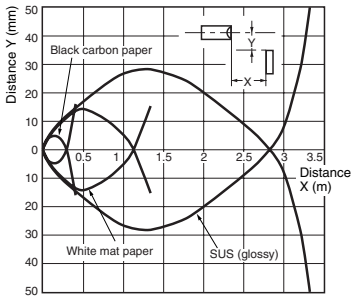
● Size of detecting target - Distance

PH1CD-1MDC



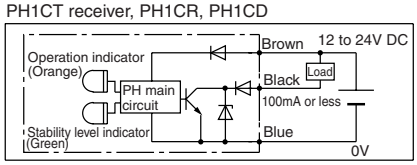
● Operating range

PH1CD-1MDC

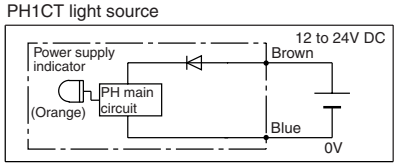


■ Wiring diagrams

PH1CT receiver, PH1CR, PH1CD

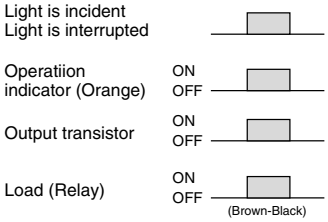


PH1CT light source

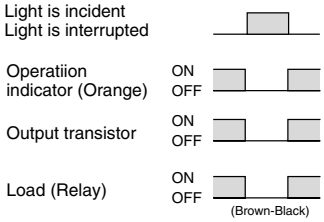


■ Timing diagrams

● "Light-ON" mode (switch: L side)



● "Dark-ON" mode (switch: D side)



■ Indicator

● Operation indicator (Ope)

Lights when the switch is activated (output transistor ON) irrespective of Light-ON, Dark-ON.

● Stability level indicator (Stab)

Lights when the incident light or shaded light is good enough for stable level.

Status of incident light		Indicator	**Stab** (green)	**Ope** (orange)	Allowance
Light-ON	Dark-ON				
Stable incident	Stable shade		ON	ON	Operation level ×1.11
Unstable incident	Unstable shade		OFF	ON	Operation level
Unstable shade	Unstable incident		OFF	OFF	Operation level ×0.86
Stable shade	Stable incident		ON	OFF	

■ Optical axis adjustment

● Transmission type

Swinging the light source and receiver up and down and right and left when no objects exist, set and fix the light source and receiver to the center within the range where the operation indicator (orange) is lit or is turned off (Dark-ON). At the same time make sure that the stability level indicator (green) is lit.

● Retroreflective type

Swinging the unit and reflector up and down and right and left when no objects exist, set and fix the unit and reflector to the center within the range where the operation indicator (orange) is lit or is turned off (Dark-ON). At the same time make sure that the stability level indicator (green) is lit.

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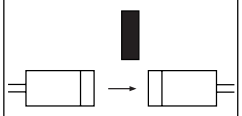
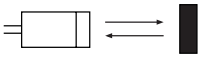
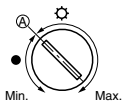
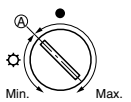
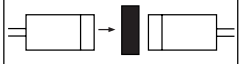
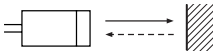
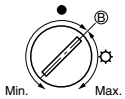
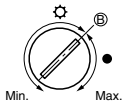
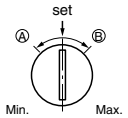
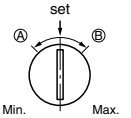
■ Sensitivity adjustment

- When carrying a normal detection, set the sensitivity adjuster at the maximum sensitivity value by turning it fully clockwise.
- Sensitivity adjustment is necessary for the following cases.
  - Transmission type: To detect translucent or minute objects
  - Reflection type: To detect objects with inadequate contrast
- Carry out the sensitivity adjustment as follows. (When excessive power is added to the sensitivity adjuster, it might be damaged.)

Step	State of detected object		Operation indicator and sensitivity adjuster		Step
	Transmission type	Reflection type	Light-ON	Dark-ON	
1		Detected object 			By turning the sensitivity adjuster, obtain point A and B at that the status of the operation indicator changes. Unless the status changed, two points at finishing turning the sensitivity adjuster will be point A or B.
2		Background object 			
3	—	—			An intermediate position between point A and B will be the optimum position.

Note: ☼ lit, ● not lit