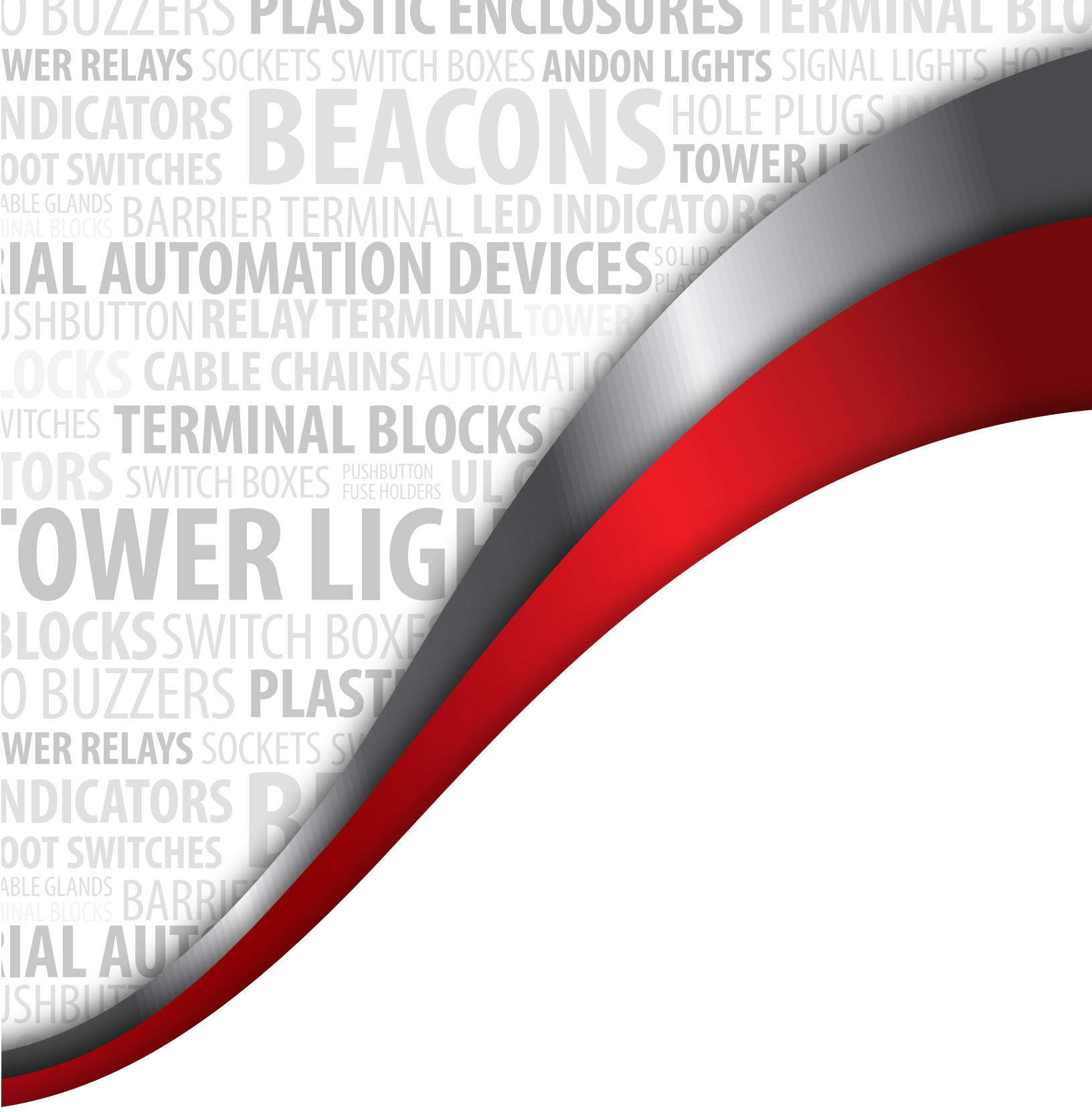


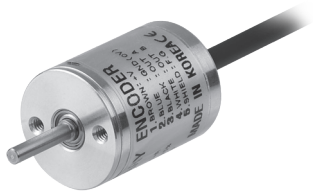
AmeriMation

SENSORS

Shaft Type Ø15mm Incremental Rotary Encoder

▣ Features

- **Ultra-compact (Ø15mm) and ultra-lightweight (14g)**
- Easy installation in tight or limited spaces
- Low moment of inertia
- Power supply: 5VDC ±5%



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

▣ Ordering Information

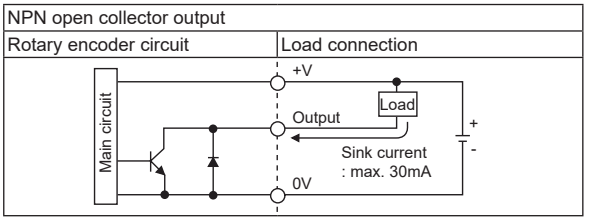
Item		Shaft Type Ø15mm Incremental Rotary Encoder
Model		E15S2-36-2-N-5-R
Resolution (PPR)※1		36
Electrical specification	Output phase	A, B phase
	Phase difference of output	Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	NPN open collector output - Load current: max. 30mA, Residual voltage: max. 0.4VDC⎓
	Response time (rise/fall)	Max. 1μs (cable length: 1m, I sink=20mA)
	Max. response frequency	10kHz
	Power supply	5VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption	Max. 50mA (disconnection of the load)
	Insulation resistance	Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength	500VAC 50/60Hz for 1 min (between all terminals and case)
	Connection	Axial cable type
Mechanical specification	Starting torque	Max. 10gf·cm (9.8×10^{-4}N·m)
	Moment of inertia	Max. 0.5g·cm² (5×10^{-8}kg·m²)
	Shaft loading	Radial: 200gf, Thrust: 200gf
	Max. allowable revolution※2	3,000rpm
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		Approx. max. 50G
Environment	Ambient temperature	-10 to 70℃, storage: -20 to 80℃
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure		IP50 (IEC standard)
Cable		Ø3mm, 4-wire, 500mm, Flexible PVC insulation shielded cable (AWG30, core diameter: 0.102mm, number of cores: 7, insulator diameter: Ø0.71mm)
Accessory		Ø2mm coupling
Weight※3		Approx. 37g (approx. 14g)

※1: Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

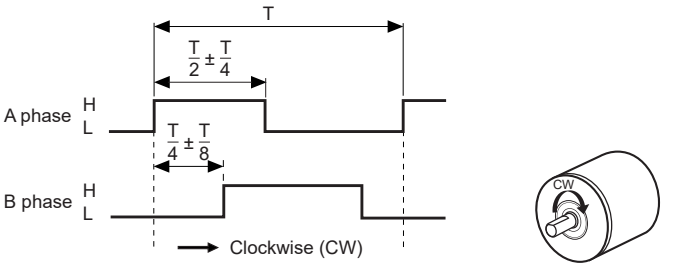
$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60\ \text{sec}]$$

※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

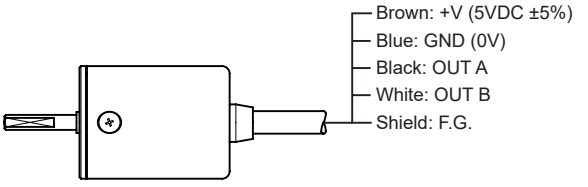
■ Control Output Diagram



■ Output Waveform



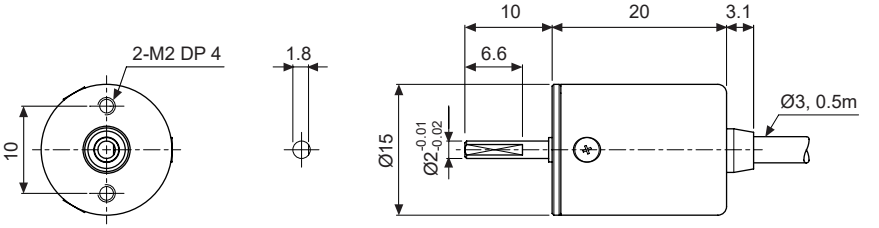
■ Connections



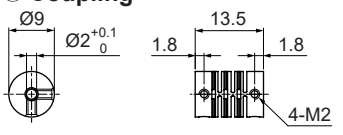
※Unused wires must be insulated.
※The metal case and shield cable should be grounded (F.G.).
※Do not apply tensile strength over 15N to the cable.

■ Dimensions

(unit: mm)



◎ Coupling



- Parallel misalignment: max. 0.15mm
- Angular misalignment: max. 2°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you insta ll this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

Shaft Type Ø18mm Incremental Rotary Encoder [NPN open collector/Voltage/No Amp. output]

▣ Features

- **Ultra-compact (Ø18mm) and ultra-lightweight (12g/10g)**
- Easy installation in tight or limited spaces
- Low moment of inertia
- Power supply: 5VDC ±5%

[Axial cable type]

[Radial cable type]

▣ Applications

- Suitable for office machine such as ATMs, bill counting machines, copy machines

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

※Except for No Amp. output type.

▣ Ordering Information

E18S | 2.5 | – | 200 | – | 1 | – | N | – | 5 | – | R

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø18mm, shaft type	2: Ø2mm 2.5: Ø2.5mm	100, 200, 300, 400	1: A	N: NPN open collector output V: Voltage output	5: 5VDC ±5%	R: Axial cable type S: Radial cable type
Ø18mm, shaft type	2: Ø2mm 2.5: Ø2.5mm	200, 300	1: A	A: No Amp.	5: 5VDC ±5%	R: Axial cable type S: Radial cable type

Shaft Type Ø18mm Incremental Rotary Encoder [NPN open collector/Voltage output]

▣ Specifications

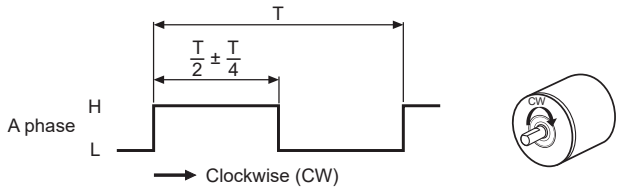
Item			Ø18mm shaft type of Incremental Rotary Encoder
Resolution (PPR)※1			100, 200, 300, 400
Electrical specification	Output phase		A phase
	Control output	NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
	Response time (rise/fall)	NPN open collector output	Max. 1μs (cable length: 1m, I sink = 20mA)
		Voltage output	
	Max. response frequency		25kHz
	Power supply		5VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		500VAC 50/60Hz for 1 min (between all terminals and case)
	Connection		Axial cable type, radial cable type
Mechanical specification	Starting torque		Max. 10gf·cm (9.8×10^{-4} N·m)
	Moment of inertia		Max. 0.5g·cm² (5×10^{-8} kg·m²)
	Shaft loading		Radial: max. 200gf, Thrust: max. 200gf
	Max. allowable revolution※2		6,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment		Ambient temperature	-10 to 70℃, storage: -20 to 80℃
		Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø1.28mm, 3-wire, 150mm, Flat ribbon cable (AWG26, core diameter: 0.16mm, number of cores: 7, insulator diameter: Ø1.28mm)
Accessory			Ø2mm coupling (supplied only for Ø2mm shaft diameter model)
Approval			CE c UL us
Weight※3			Ø2mm Shaft diameter model: approx. 35.4g (approx. 12g) Ø2.5mm Shaft diameter model: approx. 34.2g (approx. 12g)

※1: Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)}= \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

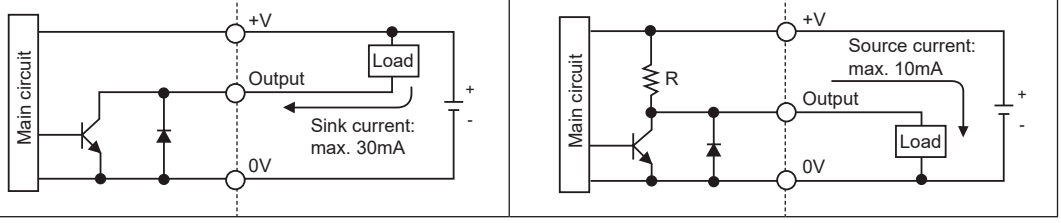
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Output Waveform

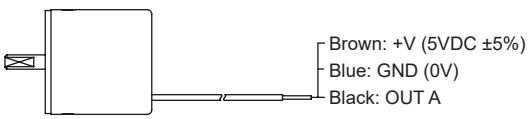


▣ Control Output Diagram

NPN open collector output		Voltage output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



▣ Connections

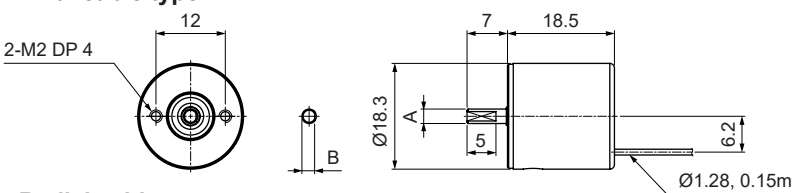


※Do not apply tensile strength over 10N to the cable.

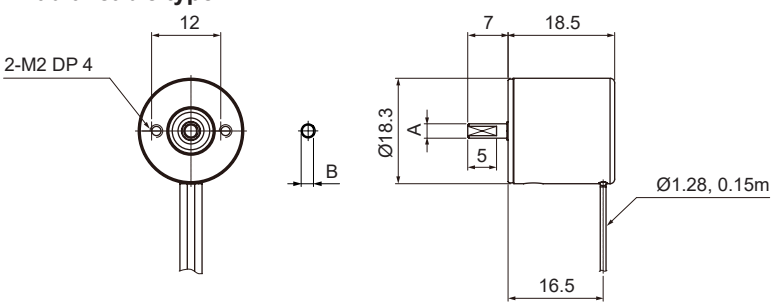
▣ Dimensions

(unit: mm)

• Axial cable type

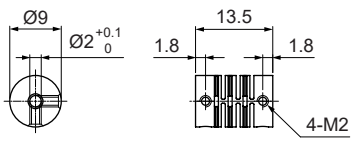


• Radial cable type



Model	A	B
E18S2	$Ø2.0^{-0.004}_{-0.02}$	1.7
E18S2.5	$Ø2.5^{-0.004}_{-0.02}$	2.2

◎ Coupling



- Parallel misalignment: max. 0.15mm
- Angular misalignment: max. 2°
- End-play: max. 0.2mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to ERB series section.

Shaft Type Ø18mm Incremental Rotary Encoder [No Amp. output]

▣ Specifications

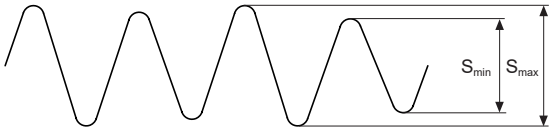
Item			Ø18mm shaft type of Incremental Rotary Encoder
Resolution (PPR)※1			200, 300
Electrical specification	Output phase		A phase
	Output waveform		Quasi-sinusoidal (No Amp.)
	Output signal amplitude		Min. 150mV_{P-P}
	Output amplitude variation		Max. 40%
	Max. response frequency		10kHz
	Power supply		5VDC⎓ ±5% (ripple P-P: max. 5%)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		500VAC 50/60Hz for 1 min (between all terminals and case)
	Connection		Axial cable type, radial cable type
Optical elements specifications	LED	Current flow	I_F: max. 50mA
		Reverse voltage	V_R: max. 5VDC⎓
		Current consumption	P_D: max. 95mW
	Photo transistor	Collector-Emitter voltage	V_{CEO}: max. 30VDC⎓
		Emitter-Collector voltage	V_{ECO}: max. 5VDC⎓
		Collector current	I_C: max. 20mA
		Collector Current consumption	P_C: max. 75mW
Mechanical specification	Starting torque		Max. 10gf·cm (9.8×10^{-4}N·m)
	Moment of inertia		Max. 0.5g·cm² (5×10^{-8}kg·m²)
	Shaft loading		Radial: max. 200gf, Thrust: max. 200gf
	Max. allowable revolution※2		3,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each of X, Y, Z directions for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -20 to 80℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø1mm, 4-wire, 150mm, Flat ribbon cable (AWG26, core diameter: 0.16mm, number of cores: 7, insulator diameter: Ø0.98mm)
Accessory			Ø2mm coupling (only for the Ø2mm shaft diameter model)
Weight※3			Approx. 33.5g (approx. 10g)

※1: Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$\text{[Max. response revolution (rpm)]} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}$$

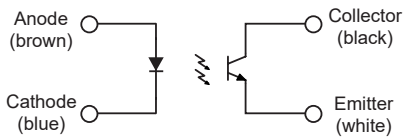
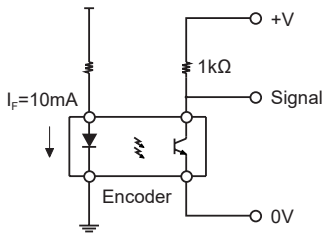
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Output Waveform

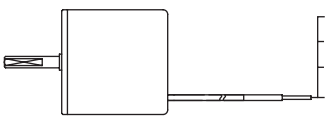


※Output signal amplitude: $S_{min} \geq 150mV_{P-P}$
Output amplitude variation: $(S_{max}/S_{min}-1)\times 100 \leq 40\%$

▣ Control Output Diagram

Internal circuit	Measurement circuit
	

▣ Connections

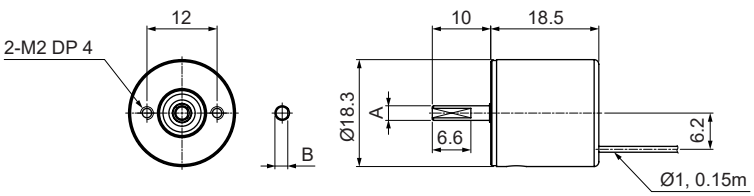


※Do not apply tensile strength over 10N to the cable.

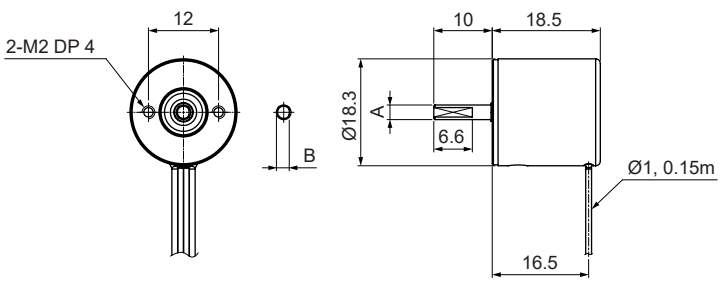
▣ Dimensions

(unit: mm)

● **Axial cable type**

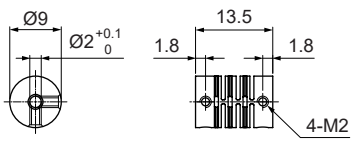


● **Radial cable type**



Model	A	B
E18S2	$Ø2.0^{-0.01}_{-0.02}$	$1.8^{0}_{-0.1}$
E18S2.5	$Ø2.5^{-0.01}_{-0.02}$	$2.3^{0}_{-0.1}$

◎ Coupling



- Parallel misalignment: max. 0.15mm
- Angular misalignment: max. 2°
- End-play: max. 0.2mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

Shaft Type/Blind Hollow Shaft Type Ø20mm Incremental Rotary Encoder

■ Features

- **Ø20mm of miniature rotary encoder**
- Easy installation at narrow space
- Low moment of inertia
- Power supply: 5VDC, 12VDC ±5%
- Various output types

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

E20S Series

E20HB Series

■ Ordering Information

E20[S] — 2 — 360 — 3 — N — 12 — R

Series	Shaft diameter		Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø20mm S: shaft type	External	2: Ø2mm	100, 200, 320, 360	3: A, B, Z 6: A, Ā, B, B̄, Z, Z̄	N: NPN open collector output V: Voltage output L: Line driver output (※)	5: 5VDC ±5% 12: 12VDC ±5%	R: Axial cable type S: Radial cable type
Ø20mm HB: blind hollow shaft type	Inner	2: Ø2mm 2.5: Ø2.5mm 3: Ø3mm					

※The power of Line driver is only for 5VDC.

■ Specifications

Item			Shaft Type/Blind Hollow Shaft Type Ø20mm Incremental Rotary Encoder
Resolution (PPR)※1			100, 200, 320, 360
Electrical specification	Output phase		A, B, Z phase (line driver output A, Ā, B, B̄, Z, Z̄ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, output voltage: min. 2.5VDC⎓
	Response time (rise/fall)	NPN open collector output	Max. 1μs (cable length: 1m, I sink = 20mA)
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 1m, I sink = 20mA)
	Max. response frequency		100kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 60mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		500VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial cable type, radial cable type
Mechanical specification	Starting torque		Max. 5gf·cm (5×10^{-4} N·m)
	Moment of inertia		Max. 0.5g·cm² (5×10^{-8} kg·m²)
	Shaft loading		Radial: 200gf, Thrust: 200gf
	Max. allowable revolution※2		6,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment		Ambient temperature	-10 to 70℃, storage: -20 to 80℃
		Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø3mm, 5-wire (line driver output: 8-wire), 1m, Shield cable
Accessory			Ø2mm Coupling (shaft type), Bracket (blind hollow shaft type)
Approval			CE (except line driver output)
Unit weight			Approx. 35g

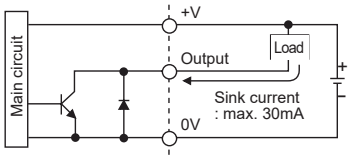
※1: Not indicated resolutions are customizable.

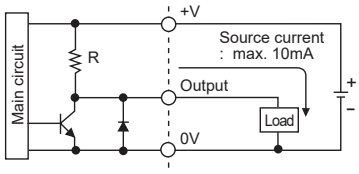
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

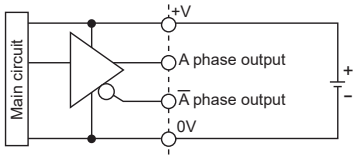
$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※Environment resistance is rated at no freezing or condensation.

■ Control Output Diagram

NPN open collector output	
Rotary encoder circuit	Load connection
	

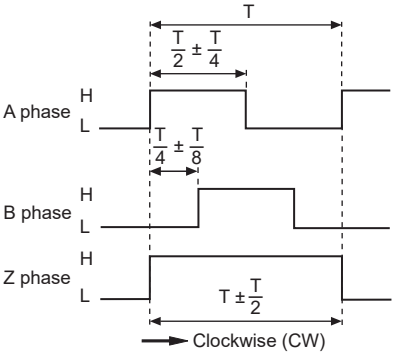
Voltage output	
Rotary encoder circuit	Load connection
	

Line driver output	
Rotary encoder circuit	Load connection
	

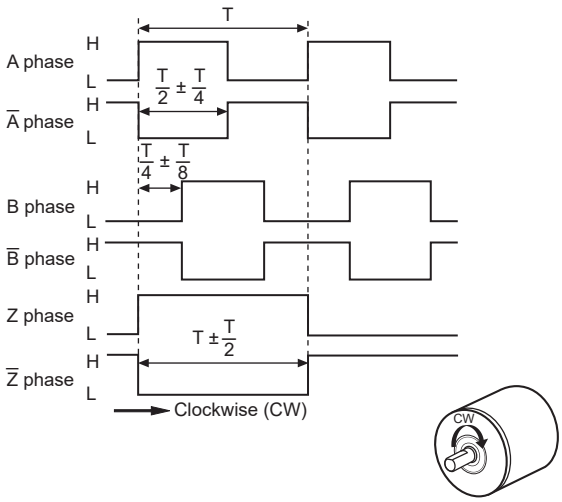
※The output circuit of A, B, Z phase are same. (line driver output is A, Ā, B, B̄, Z, Z̄)

■ Output Waveform

◎ NPN open collector output / Voltage output

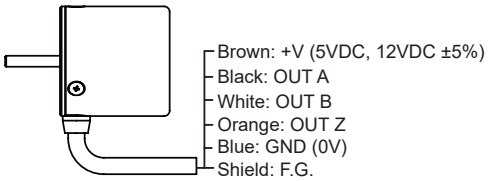


◎ Line driver output

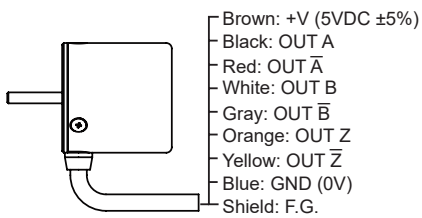


■ Connections

◎ NPN open collector output / Voltage output



◎ Line driver output

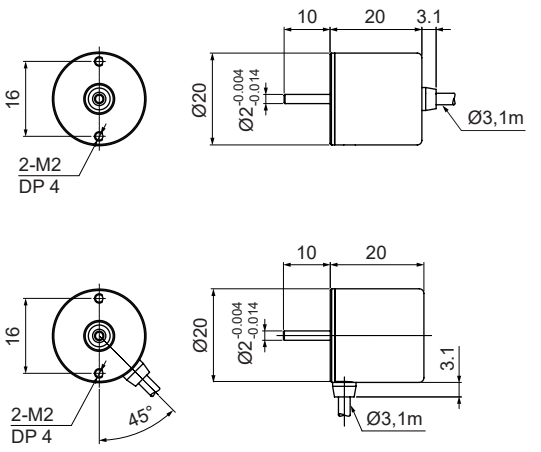


※Do not apply tensile strength over 15N to the cable.

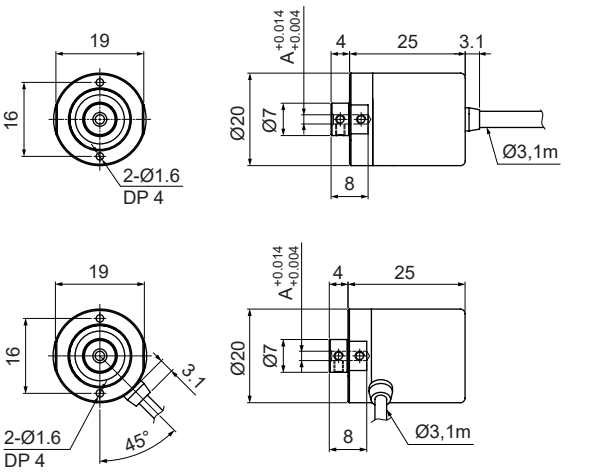
▣ Dimensions

(unit: mm)

◎ Shaft type

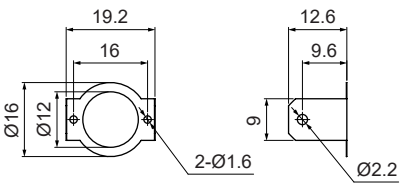


◎ Blind hollow shaft type

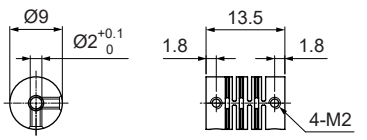


Model	E20HB2	E20HB2.5	E20HB3
A	Ø2	Ø2.5	Ø3

◎ Bracket (E20HB)



◎ Coupling (E20S)



- Parallel misalignment: max. 0.15mm
- Angular misalignment: max. 2°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to ERB series section.

Shaft Type Ø30mm Incremental Rotary Encoder

■ Features

- Ø30mm of miniature shaft type rotary encoder
- Easy installation at narrow space
- Low moment of inertia
- Power supply: 5VDC, 12-24VDC ±5%
- Various output types

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

■ Ordering Information

E30S	4	—	3000	—	3	—	N	—	24	—	

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø30mm, shaft type	Ø4mm	100, 200, 360, 500, 1000, 1024, 3000	3: A, B, Z 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output (※)	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark : axial cable type C: axial cable connector type

※The power of Line driver is only for 5VDC.

■ Specifications

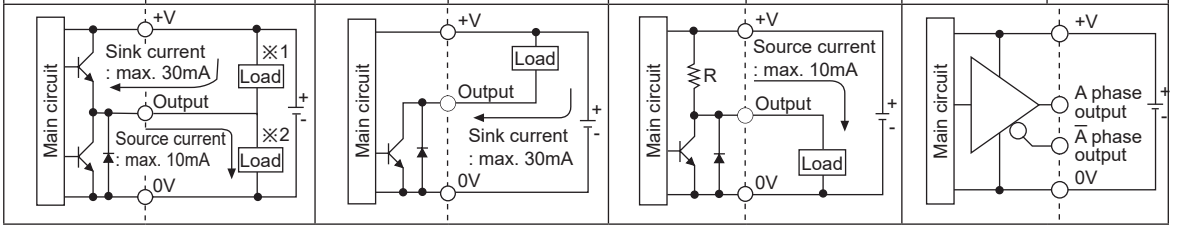
Item			Shaft type Ø30mm Incremental Rotary Encoder
Resolution (PPR)※1			100, 200, 360, 500, 1000, 1024, 3000
Electrical specification	Output phase		A, B, Z phase (line driver: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, Output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, output voltage: min. 2.5VDC⎓
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	Max. 1μs (5VDC: output resistance 820Ω), Max. 2μs (12-24VDC: output resistance 4.7kΩ) (cable length: 2m, I sink = 20mA)
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial cable type, axial cable connector type
Mechanical specification	Starting torque		Max. 20gf·cm (0.002N·m)
	Moment of inertia		Max. 20g·cm^2 (2×10^{-6} kg·m^2)
	Shaft loading		Radial: max. 2kgf, Thrust: max. 1kgf
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment		Ambient temperature	-10 to 70℃, storage: -25 to 85℃
		Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Ø4mm coupling
Approval			CE (except line driver output)
Unit weight			Approx. 80g

※1: Not indicated resolutions are customizable.
※Environment resistance is rated at no freezing or condensation.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

▣ Control Output Diagram

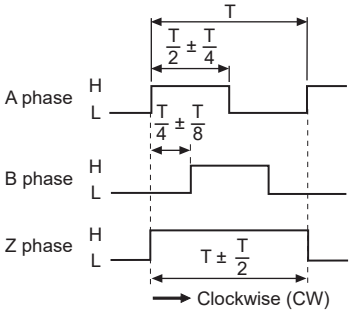
Totem pole output		NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



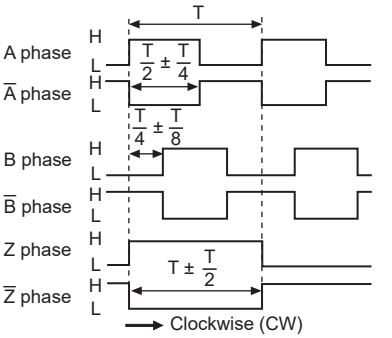
- The output circuit of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)
- Totem pole output type can be used for NPN open collector output type (※1) or Voltage output type (※2).

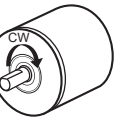
▣ Output Waveform

◎ Totem pole output / NPN open collector output / Voltage output



◎ Line driver output



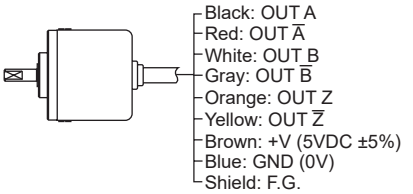


▣ Connections

◎ Axial cable type

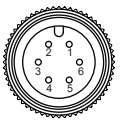
- **Totem pole output / NPN open collector output / Voltage output**

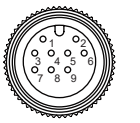
- **Line driver output**



◎ Axial cable connector type

- **Totem pole output / NPN open collector output / Voltage output**
- **Line driver output**





Totem pole output / NPN open collector output / Voltage output			Line driver output		
Pin No.	Function	Cable color	Pin No.	Function	Cable color
①	OUT A	Black	①	OUT A	Black
②	OUT B	White	②	OUT Ā	Red
③	OUT Z	Orange	③	+V	Brown
④	+V	Brown	④	GND	Blue
⑤	GND	Blue	⑤	OUT B	White
⑥	F.G.	Shield	⑥	OUT B̄	Gray
—			⑦	OUT Z	Orange
			⑧	OUT Z̄	Yellow
			⑨	F.G.	Shield

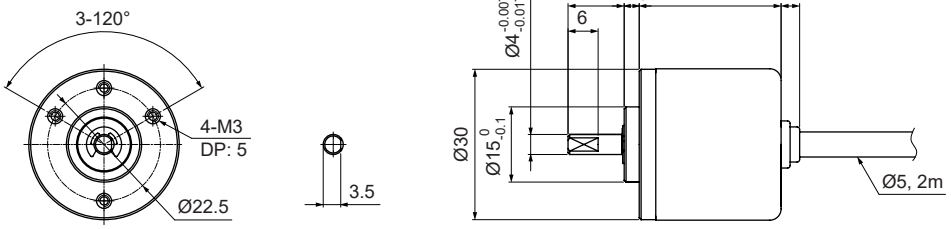
※F.G. (field ground): It should be grounded separately.

※Unused wires must be insulated.
※The metal case and shield wire of encoder should be grounded (F.G.).
※Do not apply tensile strength over 30N to the cable.

▣ Dimensions

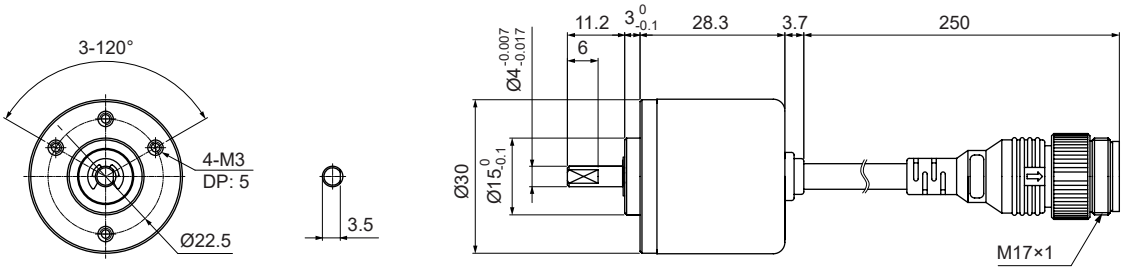
(unit: mm)

◎ Axial cable type



Cable for axial cable type
Ø5, 5-wire (line driver output: 8-wire), 2m, Shield cable

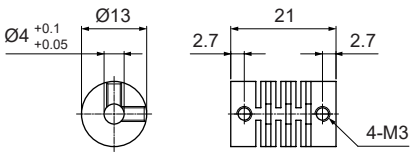
◎ Axial cable connector type



Cable for axial cable connector type
Ø5, 5-wire (line driver output: 8-wire), 250mm, Shield cable

※Connector cable is sold separately and refer to the 'Connectors, Connector Cables, Sensor Distribution Boxes, Sockets' section.

◎ Coupling (E30S)



- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

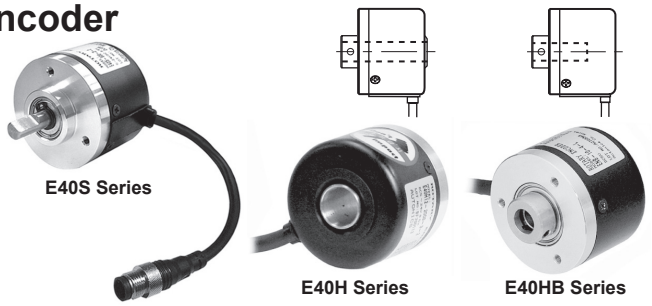
※It must not use larger shaft loading than specification.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø40mm Incremental Rotary Encoder

■ Features

- Easy installation at narrow space
- Low moment of inertia
- Power supply: 5VDC, 12-24VDC ±5%
- Various output types

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



■ Ordering Information

E40 H	8	— 5000	— 3	— N	— 24	—

Series	Shaft diameter		Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø40mm S: shaft type	External	6: Ø6mm 8: Ø8mm	Refer to resolution	2: A, B 3: A, B, Z 4: A, $\overline{A}$, B, $\overline{B}$ 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5 : 5VDC ±5% 24: 12-24VDC ±5%	No mark : Radial cable type C: Radial cable connector type
Ø40mm H: hollow shaft type, HB: blind hollow shaft type	Inner	6: Ø6mm 8: Ø8mm 10: Ø10mm 12: Ø12mm					

■ Specifications

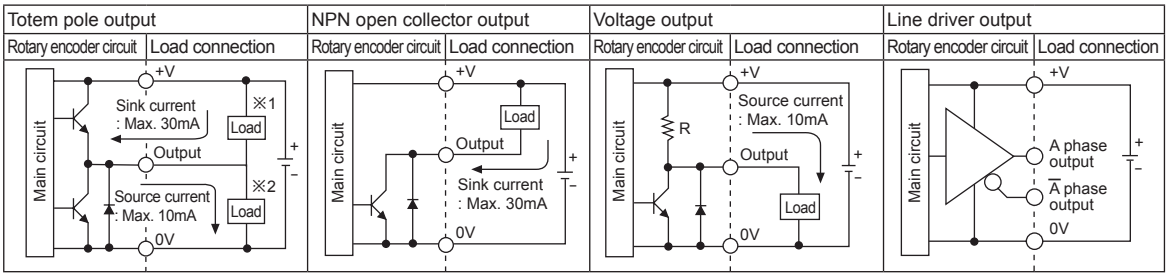
Item			Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø40mm Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2 ,*5, 10, *12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 5000
Electrical specification	Output phase		A, B, Z phase (line driver A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, output voltage (power voltage 5VDC⎓): min. 2.5VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial cable type, Radial cable connector type
Mechanical specification	Starting torque		• S type: max. 40gf·cm (0.004N·m) • H/HB type: max. 50gf·cm (0.005N·m)
	Moment of inertia		Max. 40g·cm^2 (4×10^{-6} kg·m^2)
	Shaft loading		Radial: max. 2kgf, Thrust: max. 1kgf
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			• S type: Ø6mm coupling, Ø8mm coupling • H/HB type: bracket
Approval			CE (except line driver output)
Unit weight			Approx. 120g

※1: '*' pulse is only for A, B phase (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase). Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※Environment resistance is rated at no freezing or condensation.

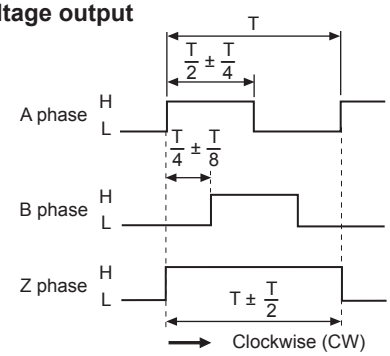
▣ Control Output Diagram



- Totem pole output type can be used for NPN open collector output type (※1) or Voltage output type (※2).
- All output circuits of A, B, Z phase are same. (line driver output is A, Ā, B, B̄, Z, Z̄)

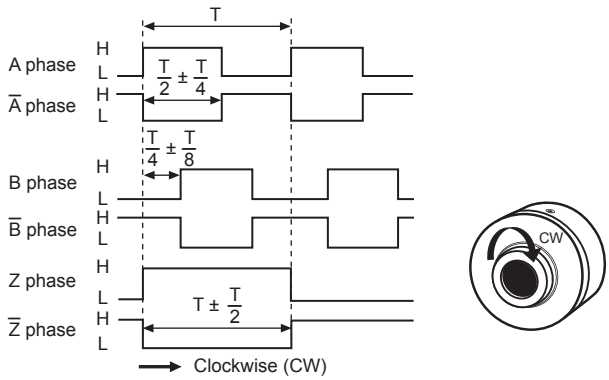
▣ Output Waveform

● Totem pole output / NPN open collector output / Voltage output



※Z reverse phase output is optional.

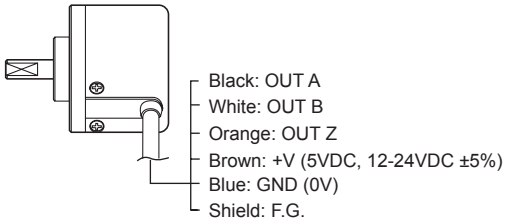
● Line driver output



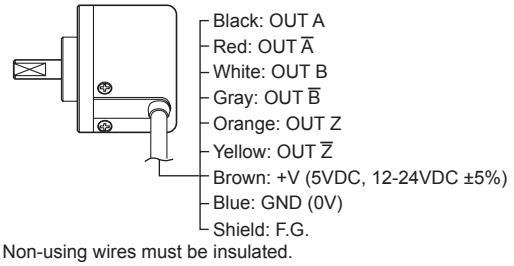
▣ Connections

◎ Radial cable type

● Totem pole output / NPN open collector output / Voltage output



● Line driver output



※Non-using wires must be insulated.
※The shield cable and metal case of encoder must be grounded (F.G.).
※Do not apply tensile strength over 30N to the cable.

◎ Radial cable connector type

● Totem pole output / NPN open collector output / Voltage output

Pin No	Cable color	Function
①	Black	OUT A
②	White	OUT B
③	Orange	OUT Z
④	Brown	+V
⑤	Blue	GND
⑥		F.G.

• Line driver output

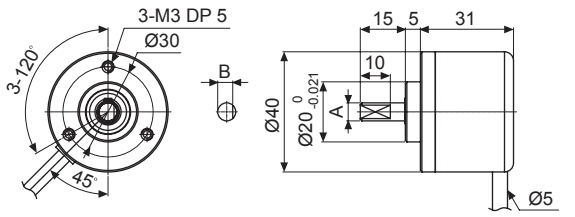
Pin No	Cable color	Function
①	Black	OUT A
②	Red	OUT Ā
③	Brown	+V
④	Blue	GND
⑤	White	OUT B
⑥	Gray	OUT B̄
⑦	Orange	OUT Z
⑧	Yellow	OUT Z̄
⑨	Shield	F.G.

※F.G. (field ground): It should be grounded separately.

▣ Dimensions

(unit: mm)

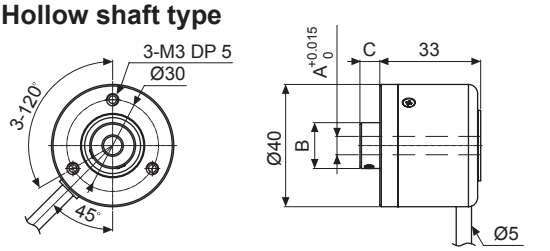
◎ Shaft type



A	Ø6	-0.004 -0.016	Ø8	-0.005 -0.02
B	5		7	

Cable for radial cable type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable
Cable for radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

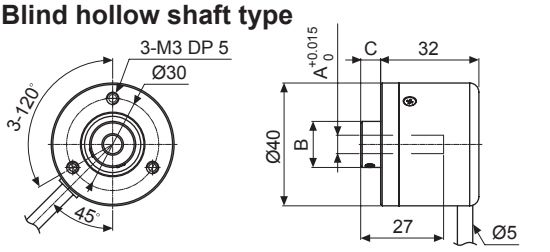
◎ Hollow shaft type



A	Ø6	Ø8	Ø10	Ø12
B	Ø15		Ø17	
C	6.5		6.3	

Cable for radial cable type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable
Cable for radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

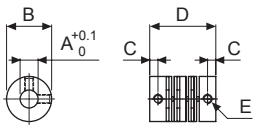
◎ Blind hollow shaft type



A	Ø6	Ø8	Ø10	Ø12
B	Ø15		Ø17	
C	6.5		6.3	

Cable for radial cable type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable
Cable for radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

◎ Coupling (shaft type)

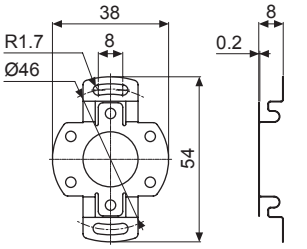


- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

	A	B	C	D	E
E40S6 Ø6mm coupling	Ø6	Ø15	2.8	22	4-M3
E40S8 Ø8mm coupling	Ø8	Ø19	3.4	25	4-M4

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15 N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to page G-98.
※For flexible coupling (ERB series) information, refer to page G-91.

◎ Bracket (Hollow shaft, blind hollow shaft type)



Shaft Type Ø50mm Incremental Rotary Encoder

■ Features

- Suitable for measuring angle, position, revolution, speed, acceleration and distance
- Power supply: 5VDC, 12-24VDC ±5%

■ Applications

- Various tooling machinery, packing machine and general industrial machinery, etc.

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

■ Ordering Information (former name: ENB)

E50S — 8 — 8000 — 3 — N — 24 — ☐

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø50mm, shaft type	Ø8mm	Refer to resolution	2: A, B 3: A, B, Z 4: A, $\overline{A}$, B, $\overline{B}$ 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark: Axial cable type C: Axial cable connector type CR: Axial connector type CS: Radial connector type

■ Specifications

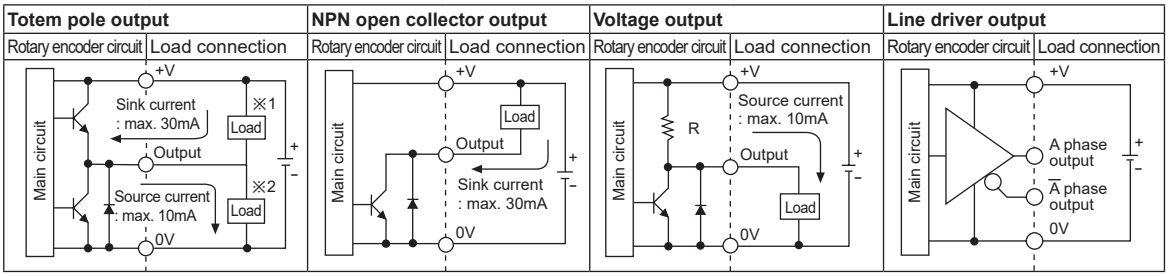
Item			Shaft Type Ø50mm Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2 ,*5, 10, 12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 125, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 4000, 5000, 6000, 8000
Electrical specification	Output phase		A, B, Z phase (line driver: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, Output voltage (power voltage 5VDC⎓): min.2.5VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial cable type, Axial cable connector type, Axial/Radial connector type
Mechanical specification	Starting torque		Max. 70gf·cm (0.007N·m)※2, max. 800gf·cm (0.078N·m)※3
	Moment of inertia		Max. 80g·cm^2 (8×10^{-6} kg·m^2)※2, max. 400g·cm^2 (4×10^{-5} kg·m^2)※3
	Shaft loading		Radial: max. 10kgf, Thrust: max. 2.5kgf
	Max. allowable revolution※4		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			Axial cable type, Axial cable connector type: IP50 (IEC standard)※5, Axial/Radial connector type: IP65 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG 24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Ø8mm coupling, bracket
Approval			CE (except for line driver output)
Weight※6			Approx. 363g (approx. 275g), Axial/Radial connector type: approx. 268g (approx. 180g)

※1: '*' pulse is only for A, B phase (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase). Not indicated resolutions are customizable.
※2: This value is for Axial cable type, Axial cable connector type (protection structure: IP50).
※3: This value is for Axial cable type, Axial cable connector type (protection structure: IP64), Axial/Radial connector type (protection structure: IP65).
※4: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

【Max. response resolution (rpm) = $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec 】

※5: In case of axial cable type, axial cable connector type, they are available to order the option protection structure IP64.
※6: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

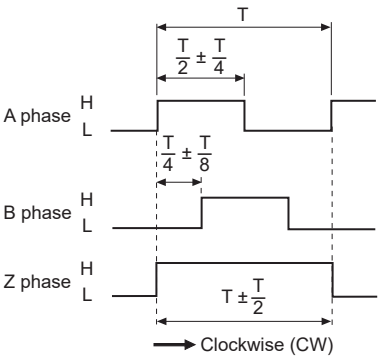
▣ Control Output Diagram



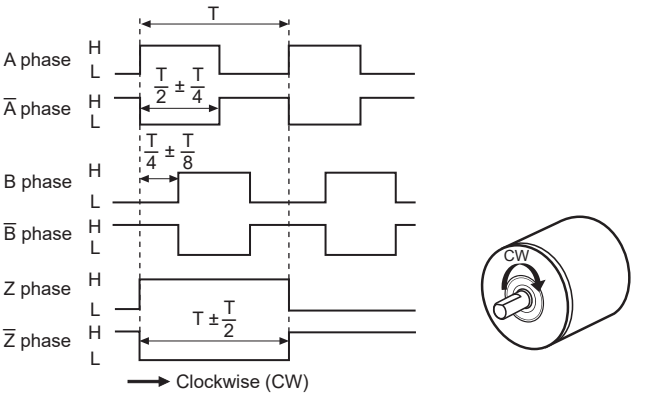
- All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)
- Totem pole output type can be used for NPN open collector type(※1) or voltage output type(※2).

▣ Output Waveforms

● Totem pole output / NPN open collector output / Voltage output



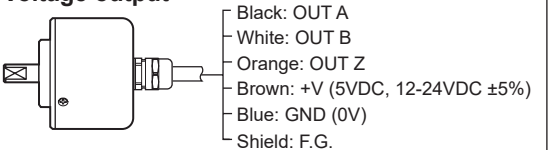
● Line driver output



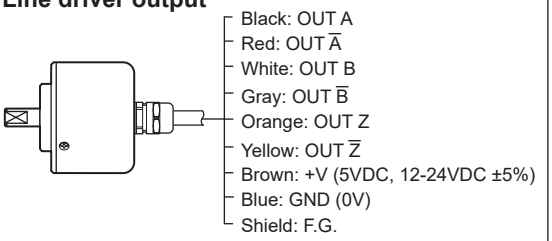
▣ Connections

◎ Axial cable type

● Totem pole output / NPN open collector output / Voltage output



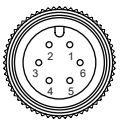
● Line driver output



※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).
※Do not apply tensile strength over 30N to the cable.

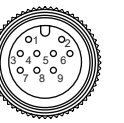
◎ Axial cable connector type / Axial/Radial connector type

• Totem pole output NPN open collector output Voltage output



Pin No.	Cable color	Function
1	Black	OUT A
2	White	OUT B
3	Orange	OUT Z
4	Brown	+V
5	Blue	GND
6	Shield	F.G.

• Line driver output



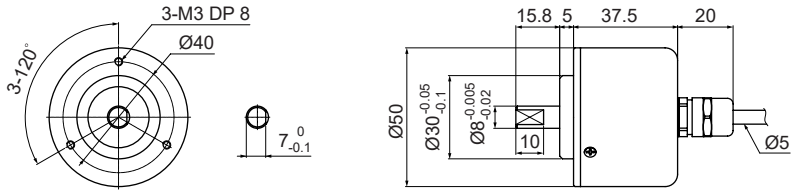
Pin No.	Cable color	Function
1	Black	OUT A
2	Red	OUT Ā
3	Brown	+V
4	Blue	GND
5	White	OUT B
6	Gray	OUT B̄
7	Orange	OUT Z
8	Yellow	OUT Z̄
9	Shield	F.G.

※F.G. (field ground): It should be grounded separately.

▣ Dimensions

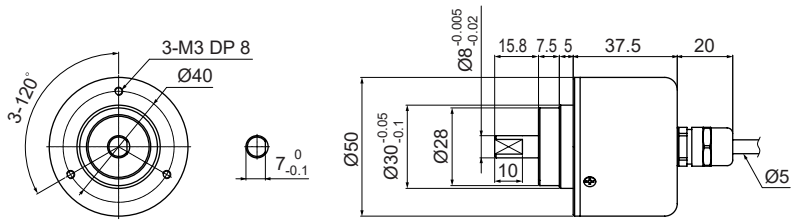
(unit: mm)

◎ Axial cable type, Axial cable connector type (IP50)



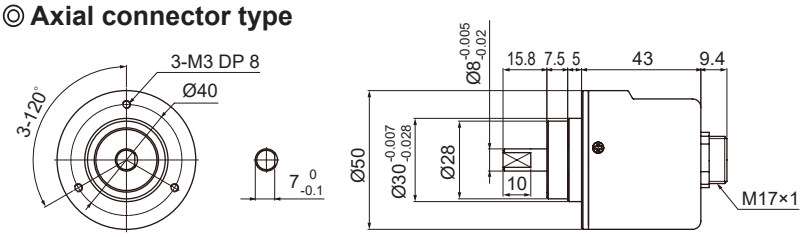
Cable for Axial cable type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable
Cable for Axial cable connector type (M17×1)
Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

◎ Axial cable type, Axial cable connector type (IP64) (option)

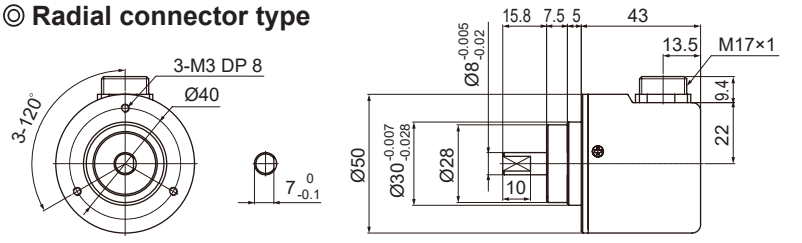


Cable for Axial cable type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable
Cable for Axial cable connector type (M17×1)
Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

◎ Axial connector type

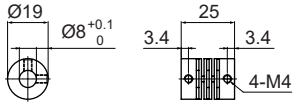


◎ Radial connector type



※Connector cable is sold separately and refer to the 'Connectors, Connector Cables, Sensor Distribution Boxes, Sockets' section.

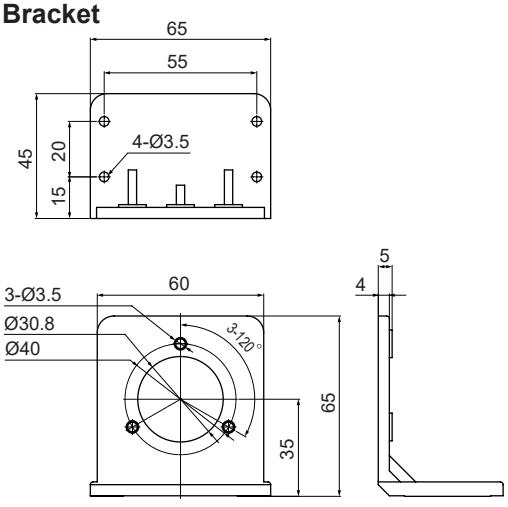
◎ Coupling



- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

◎ Bracket



Ø58mm Incremental Rotary Encoder

▣ Features

[Totem pole, NPN open collector, Voltage, Line driver output type]

- Ø58mm flange type
- Suitable for measuring angle, position, revolution, speed, acceleration and distance
- Power supply: 5VDC, 12-24VDC ±5%

[Analog sine wave OP Amp output type]

- Taper shaft
- Analog sine wave OP Amp output
- Power supply: 5VDC ±5%

⚠ **Please read "Safety Considerations" in operation manual before using.**

CE

▣ Ordering Information

E58SC	10	–	8000	–	3	–	N	–	24	–	

Series (Ø58mm)	Shaft diameter			Pulses/ revolution	Output phase	Control output	Power supply	Cable※1
SC: Shaft Clamping	External	10	Ø10mm	Refer to resolution	2: A, B 3: A, B, Z 4: A, $\overline{A}$, B, $\overline{B}$ 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark : Axial/Radial cable type C: Axial/Radial cable connector type CR: Axial connector type CS: Radial connector type
SS: Shaft Synchro		6	Ø6mm					
H: Hollow shaft	Inner	12	Ø12mm					
HB: Blind hollow shaft								
S: Shaft	External	Ø9.25mm		2048	10: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, C, $\overline{C}$, D, $\overline{D}$	A: Analog sine wave OP Amp output	5: 5VDC ±5%	R: Axial cable type S: Radial cable type

※1: Please refer to 'connection' in the specifications for the detailed information about cable.

Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø58mm Incremental Rotary Encoder

■ Specifications

Item			Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø58mm Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2, *5, 10, *12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 125, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 5000, 6000, 8000
Electrical specification	Output phase		A, B, Z phase (line driver output: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$(T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, output voltage (power voltage 5VDC⎓): min. 2.5VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
	Response time (rise, fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 min (between all terminals and case)
	Connection		• SC/SS/HB type: axial cable type, axial cable connector type, axial/radial connector type • H type: radial cable type, radial cable connector type
Mechanical specification	Starting torque		• SC/SS type: max. 40gf·cm (0.004N·m) • H/HB type: max. 90gf·cm (0.009N·m)
	Moment of inertia		• SC/SS type: max. 15g·cm^2 (1.5×10^{-6} kg·m^2) • H/HB type: max. 20g·cm^2 (2×10^{-6} kg·m^2)
	Shaft loading		• SC/SS type-Radial: max. 10kgf, Thrust: max. 2.5kgf • H/HB type-Radial: max. 2kgf, Thrust: max. 1kgf
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Coupling (SC type: Ø10mm, SS type: Ø6mm), Bracket
Approval			CE (except for line driver output)
Weight※3	Cable type, Cable connector type		• SC type: approx. 420g (approx. 310g) • SS type: approx. 395g (approx. 285g) • H/HB type: approx. 380g (approx. 270g)
	Connector type		• SC type: approx. 340g (approx. 230g) • SS type: approx. 315g (approx. 205g) • HB type: approx. 310g (approx. 200g)

※1: '*' pulse is only for A, B phase. (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase) [In case of hollow shaft type, 6000, 8000 PPR excluded] Not indicated resolutions are customizable.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

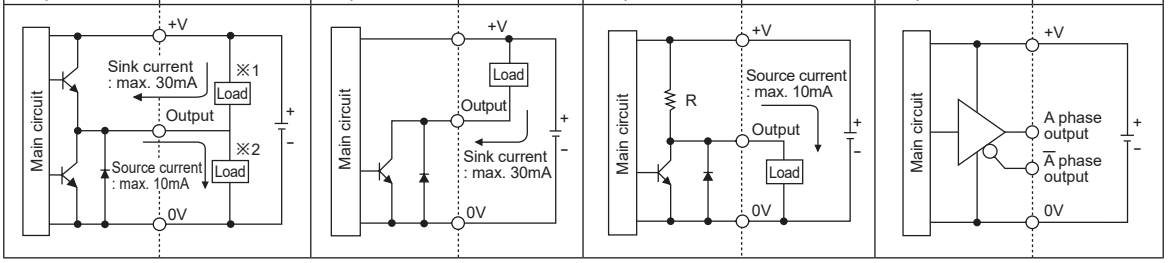
[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※3: The weight includes packaging. The weight in parenthesis is for unit only.

※Environment resistance is rated at no freezing or condensation.

▣ Control Output Diagram

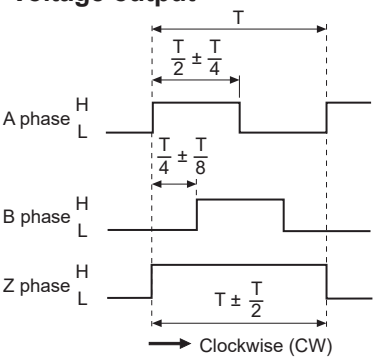
Totem pole output		NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



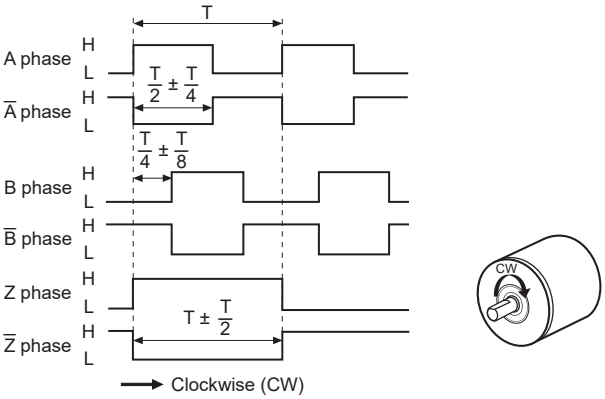
- All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

▣ Output Waveforms

◎ Totem pole output / NPN open collector output / Voltage output



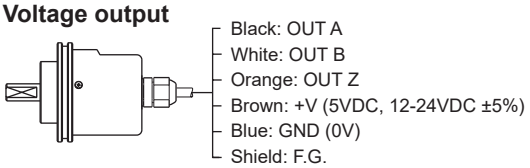
◎ Line driver output



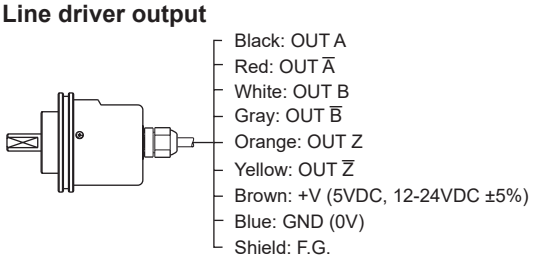
▣ Connections

◎ Axial/Radial cable type

- **Totem pole output / NPN open collector output / Voltage output**



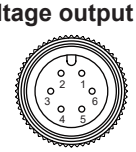
- **Line driver output**



※Unused wires must be insulated.
※The metal cable and shield cable of encoder should be grounded (F.G.)
※Do not apply tensile strength over 30N to the cable.

◎ Axial/Radial cable connector type / Axial/Radial connector type

- **Totem pole output / NPN open collector output / Voltage output**



Pin No.	Function	Cable color
1	OUT A	Black
2	OUT B	White
3	OUT Z	Orange
4	+V	Brown
5	GND	Blue
6	F.G.	Shield

- **Line driver output**

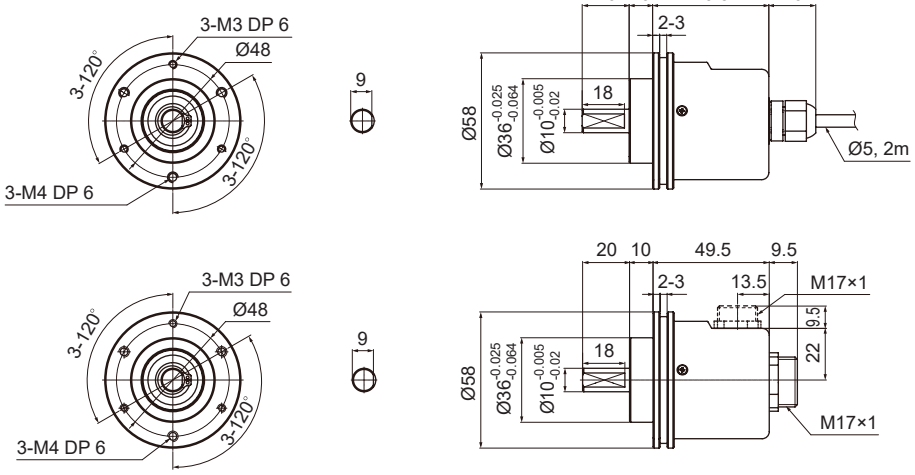
Pin No.	Function	Cable color
1	OUT A	Black
2	OUT Ā	Red
3	+V	Brown
4	GND	Blue
5	OUT B	White
6	OUT B̄	Gray
7	OUT Z	Orange
8	OUT Z̄	Yellow
9	F.G.	Shield

※F.G. (field ground): It should be grounded separately.

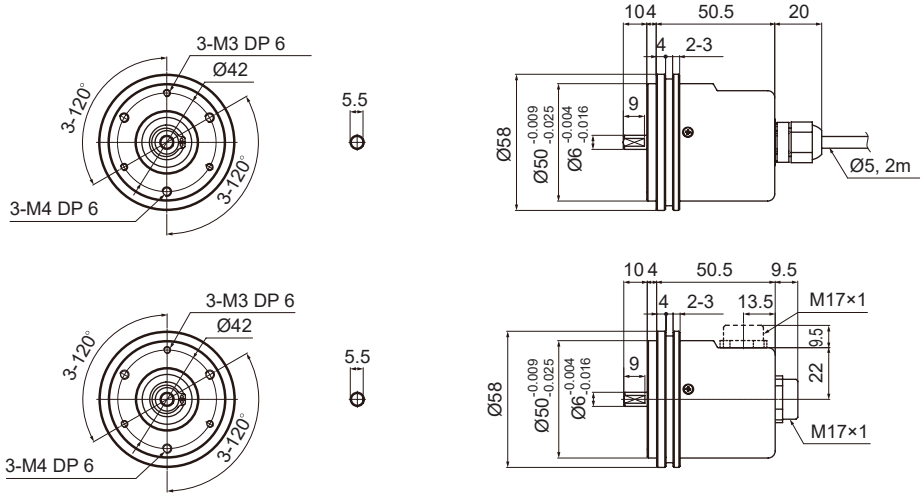
▣ Dimensions

(unit: mm)

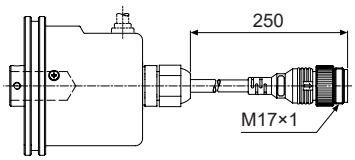
◎ Shaft clamping type (SC)



◎ Shaft synchro type (SS)



● Axial / Radial cable connector type



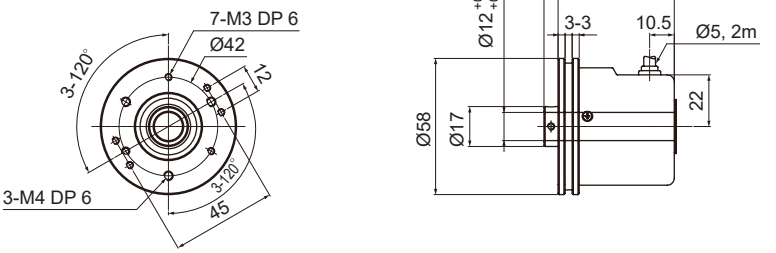
Cable for Axial/Radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), 250mm, Shield cable

※Connector cable is sold separately and refer to page H-10 for specifications.

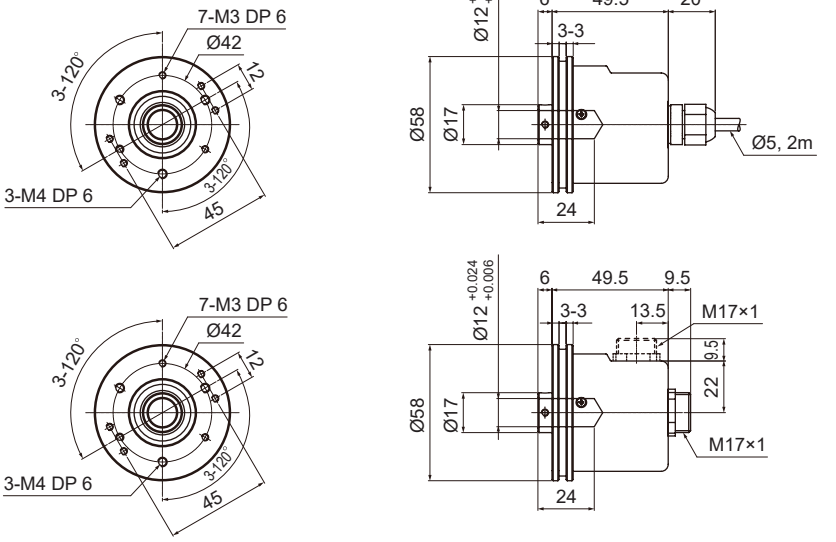
▣ Dimensions

(unit: mm)

◎ Hollow shaft type (H)

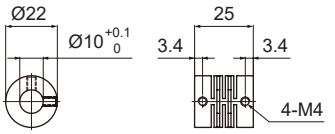


◎ Blind hollow shaft type (HB)

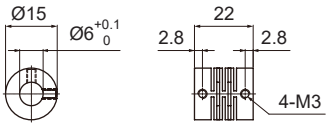


◎ Coupling

• E58SC10



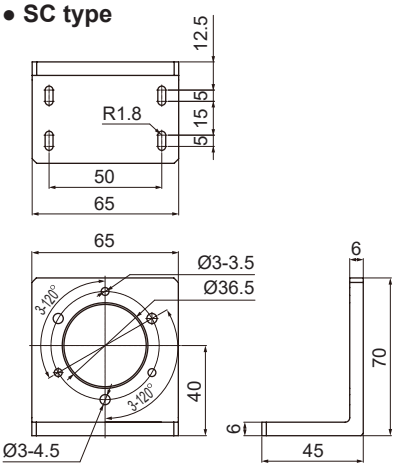
• E58SS6



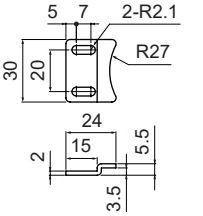
- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

◎ Bracket

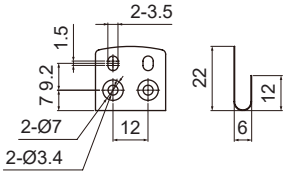
• SC type



• SS type



• H/HB type



※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15 N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to page G-98.
※For flexible coupling (ERB series) information, refer to page G-91.

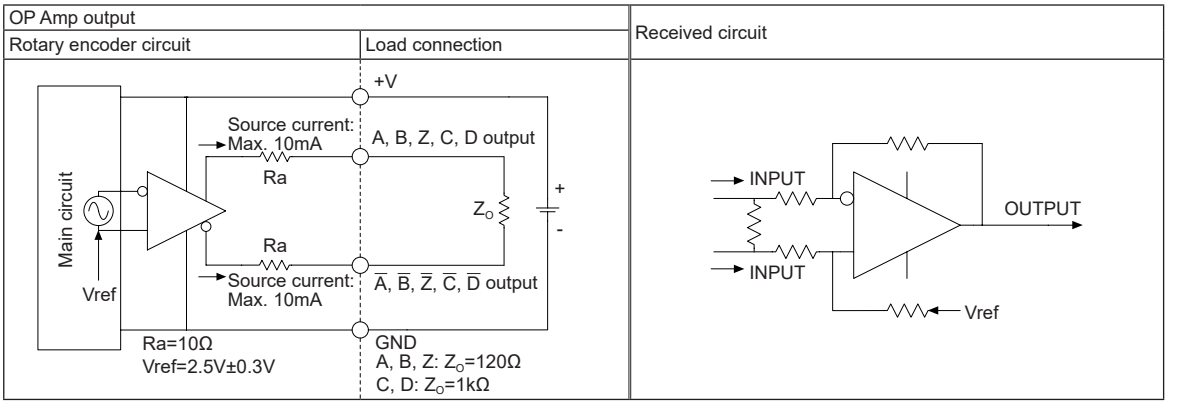
Shaft Type Ø58mm Sine Wave Incremental Rotary Encoder

■ Specifications

Item			Shaft Type Ø58mm Sine Wave Incremental Rotary Encodez	
Model			E58S9.25-2048-10-A-5-R	E58S9.25-2048-10-A-5-S
Revolution (PPR)			2,048	
Output phase			A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, C, $\overline{C}$, D, $\overline{D}$ phase	
Phase difference of output			Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1cycle of A phase) Phase difference between C and D: 90°	
Electrical specification	Control output	Output type	OP Amp output	
		Output current	Max. 10mA	
		Output voltage	V_{P-P} ⎓: 0.5V±0.1V	
		DC offset	V_{DC}: 2.5V±0.3V	
	Max. response frequency		200kHz	
	Power supply		5VDC⎓ ±5% (ripple P-P: max. 5%)	
	Current consumption		Max. 120mA (disconnection of the load)	
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)	
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)	
	Connection		Axial cable type	Radial cable type
Mechanical specification	Starting torque		Max. 100gf·cm (0.0098N·m)	
	Moment of inertia		Max. 15g·cm^2 (1.5×10^{-6} kg·m^2)	
	Shaft loading		Radial: 10kgf, Thrust: 2.5kgf	
	Max. allowable revolution		6,000rpm	
Shaft			Taper shaft Ø9.25mm, Taper 1:10	
Vibration			1.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours	
Shock			Approx. max. 100G	
Environment		Ambient temp.	-20 to 100℃, storage: -25 to 100℃	
		Ambient humi.	35 to 85%RH, storage: 35 to 90%RH	
Protection structure			IP50 (IEC standard)	
Cable			Ø6mm, 17-wire, 9m※1, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 17, insulator out diameter: Ø0.8mm)	
Accessory			M5×0.8 (50L), M5×0.8 (47L) wrench bolt	
Approval			CE	
Weight※2			Approx. 1.02kg (approx. 930g)	

※1: Option is 7m, 15m.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

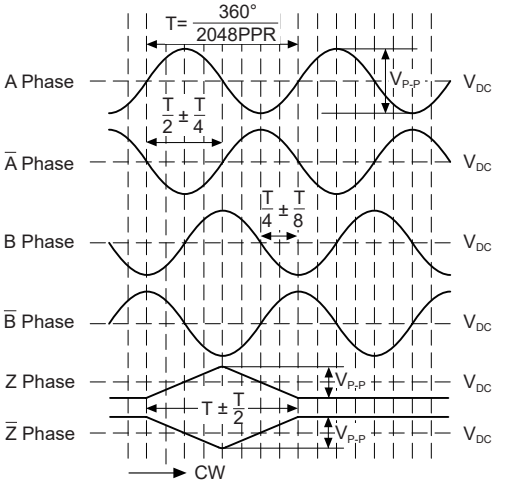
▣ Control Output Diagram



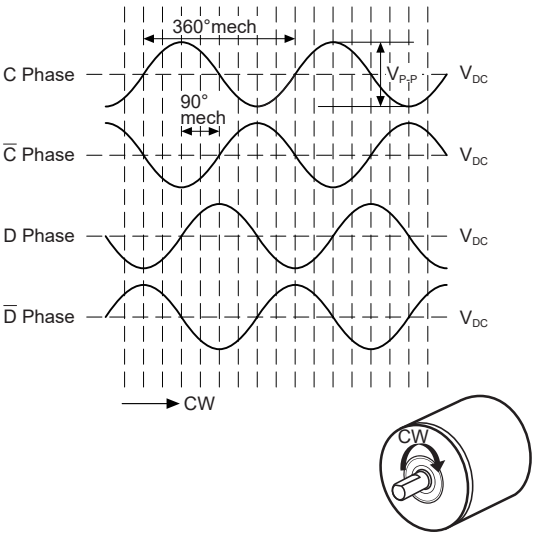
● All output circuits of A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, C, $\overline{C}$, D, $\overline{D}$ phase are the same.

▣ Output Waveforms

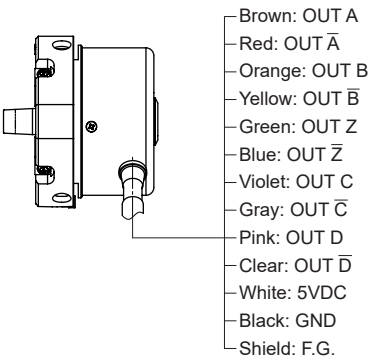
◎ A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase



◎ C, $\overline{C}$, D, $\overline{D}$ phase



▣ Connections

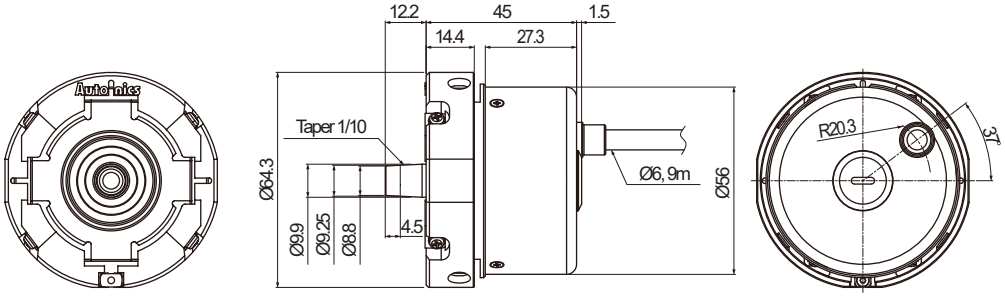


※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).
※The output circuit has the dedicated IC and be sure not to short-circuit when wiring the output cables.

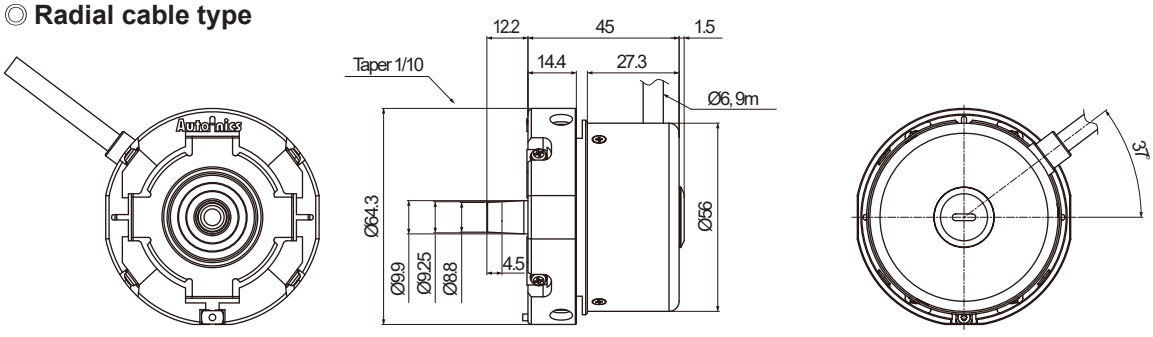
▣ Dimensions

(unit: mm)

◎ Axial cable type

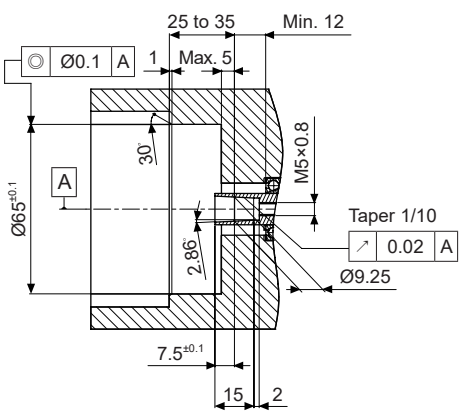


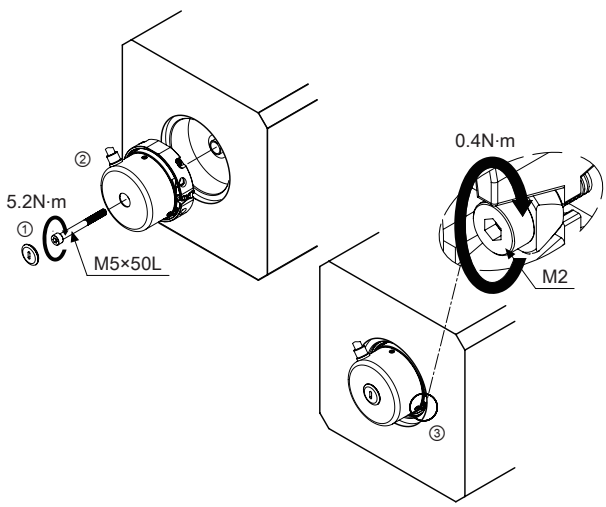
◎ Radial cable type



▣ Installation

(unit: mm)



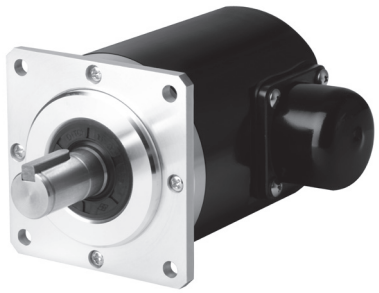


① Insert the M5×50L wrench bolt at rear of the E58S .
② Install the E58S on the device.
③ Adjust bracket size with M2 wrench.

Shaft Type Ø68mm Incremental Rotary Encoder

■ Features

- Ø68mm, shaft diameter: Ø15mm
- High speed response frequency: 180kHz
- Radial connector type
- Suitable for tooling machinery
- Protection structure IP65 (IEC standard) (tentative water-proof/oil)
- High shaft loading capabilities (allowable load weight is 10kgf)



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

■ Ordering Information

E68S	15	– 1024	– 6	– L	– 5
Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply
Ø68mm, shaft type	Ø15mm	500, 600, 1024	6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	L: Line driver output	5VDC ±5%

※Connector standard: MS3102A20-29P

■ Specifications

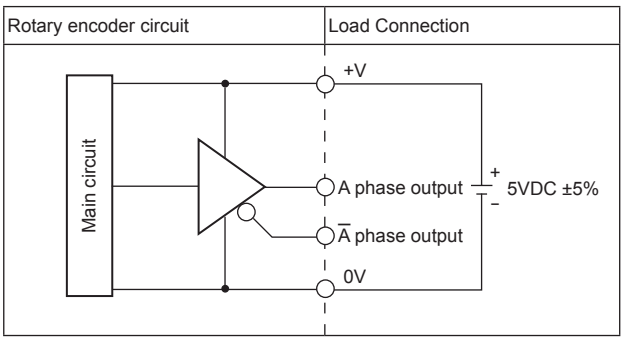
Item		Shaft Type Ø68mm Incremental Rotary Encoder
Resolution (PPR)※1		500, 600, 1024
Electrical specification	Output phase	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase
	Phase difference of output	Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, output voltage: min. 2.5VDC⎓
	Response time (rise/fall)	Max. 0.5μs (cable: 1m, I sink = 20mA)
	Power supply	5VDC⎓ ± 5% (ripple P-P: max. 5%)
	Max. response frequency	180kHz
	Current consumption	Max. 50mA (disconnection of the load)
	Insulation resistance	Over 100MΩ (at 500VDC megger) (between all terminals and case)
	Dielectric strength	750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection	Radial connector type (MS3102A20-29P)
Mechanical specification	Starting torque	Max. 1.5kgf·cm (0.15N·m)
	Shaft loading	Radial: max. 20kgf, Thrust: max. 10kgf
	Max. allowable revolution※2	6,500rpm
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		Approx. max. 50G
Environment	Ambient temperature	-10 to 70℃, storage: -25 to 85℃
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure		IP65 (IEC standard)
Unit weight		Approx. 550g

※1: Not indicated resolutions are available customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

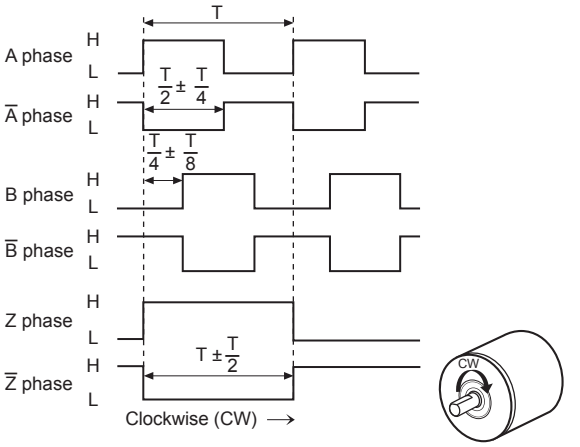
※Environment resistance is rated at no freezing or condensation.

▣ Control Output Diagram

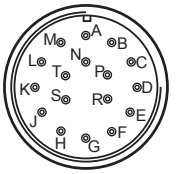


※All output circuits of A, Ā, B, B̄, Z, Z̄ phase are same.

▣ Output Waveform



▣ Connections

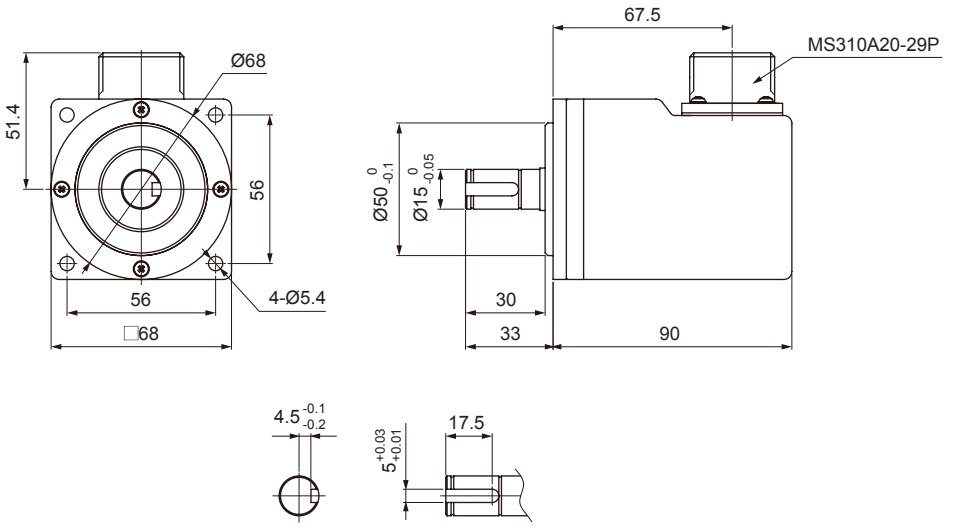


Pin No.	Connection
A	A phase
B	Z phase
C	B phase
D, F, G, J, L, S	N·C
E, H	5VDC
K, M	0V
N	Ā phase
P	Z̄ phase
R	B̄ phase
T	Shield (F.G.)

※N·C: Not Connected.
※E and H terminals, K and M terminals are connected internally.

▣ Dimensions

(unit: mm)

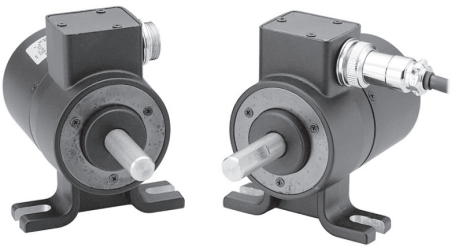


Side-Mounting Shaft Type Incremental Rotary Encoder

■ Features

- Strong die cast structure against external impact
- Convenient structure for direct mounting on the frame
- Connector type
- Power supply: 5VDC, 12-24VDC ±5%

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



■ Ordering Information

ENA — **5000** — **3** — **N** — **24**

Series	Pulses/revolution	Output phase	Control output	Power supply
Side-mounting shaft type (external diameter of shaft: Ø10mm)	Refer to resolution	2: A, B 3: A, B, Z	T: Totem pole output N: NPN open collector output V: Voltage output	5 : 5VDC ±5% 24: 12-24VDC ±5%

■ Specifications

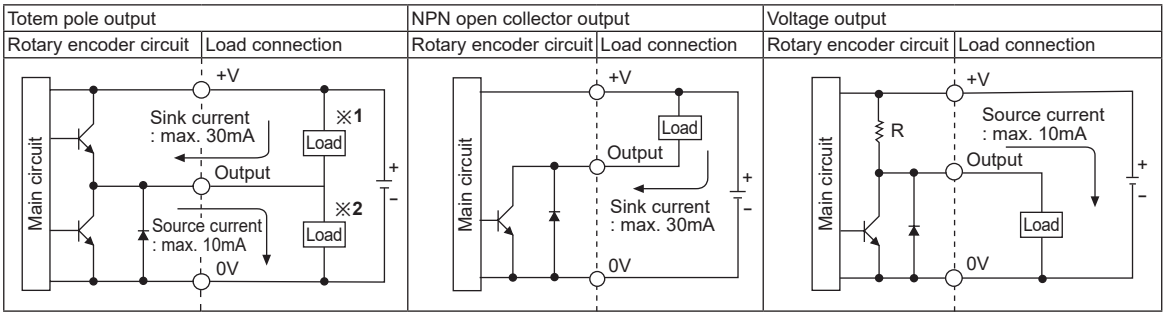
Item			Side-mounting Shaft Type Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2, *5, 10, 12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200,1500, 1800, 2000, 2048, 2500. 3000, 3600, 5000
Electrical specification	Output phase		•ENA-□-2-□-□: A, B phase •ENA-□-3-□-□: A, B, Z phase
	Phase difference of output		Phase difference between A and B: $\frac{T}{4}\pm\frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
	Max. response frequency		300kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial connector type
Mechanical specification	Starting torque		Max. 70gf·cm (0.007N·m)
	Moment of inertia		Max. 80g·cm² (8×10^{-6} kg·m²)
	Shaft loading		Radial: max. 10kgf, Thrust: max. 2.5kgf
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment		Ambient temperature	-10 to 70℃, storage: -25 to 85℃
		Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable	ENA-□-2-□-□		Ø5mm, 4-wire, 2m, Shield cable (AWG 24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
	ENA-□-3-□-□		Ø5mm, 5-wire, 2m, Shield cable (AWG 24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Ø10mm coupling, Connector cable
Approval			CE
Unit weight			Approx. 345g

※1: '*' pulse is only for A, B phase. Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

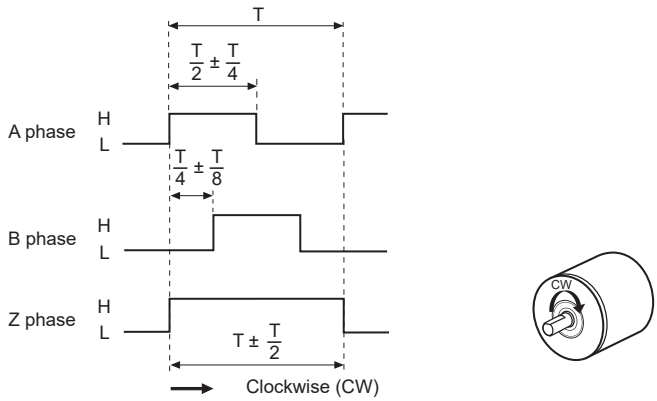
※Environment resistance is rated at no freezing or condensation.

■ Control Output Diagram



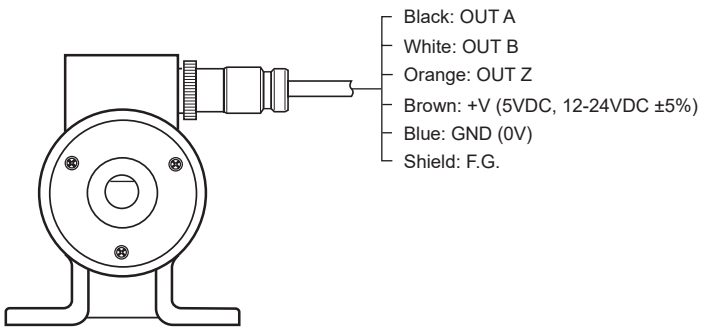
- The output circuits of A, B, Z phase are same.
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

■ Output Waveform



※In case of ENA-□-3-□-□ model, Z phase is output.

■ Connections



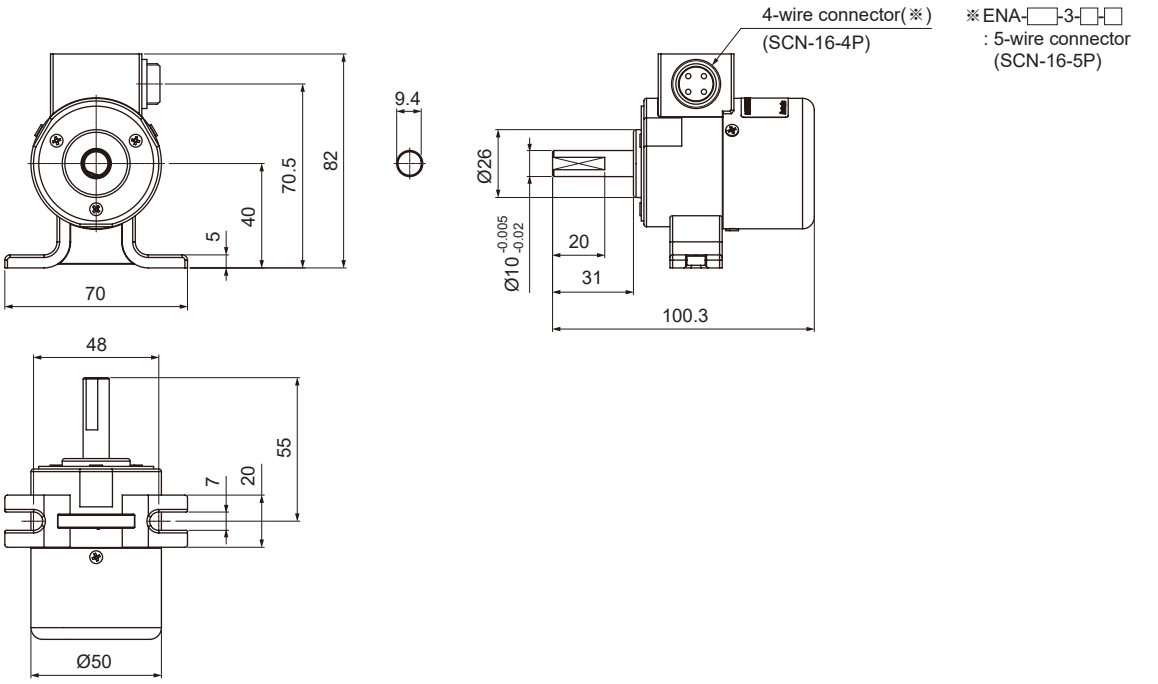
Pin No	Cable color	Function
①	Black	OUT A
②	White	OUT B
③	Brown	+V
④	Blue	GND

①	Black	OUT A
②	White	OUT B
③	Orange	OUT Z
④	Brown	+V
⑤	Blue	GND

※In case of ENA-□-3-□-□ model, Z phase is output.
※Unused wires must be insulated.
※The metal case and shield cable of encoder must be grounded (F.G.).
※Do not apply tensile strength over 30N to the cable.

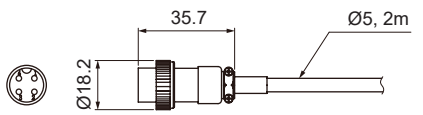
▣ Dimensions

(unit: mm)

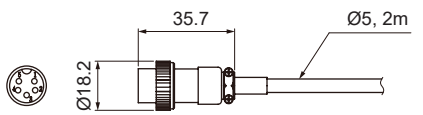


◎ Connector cable

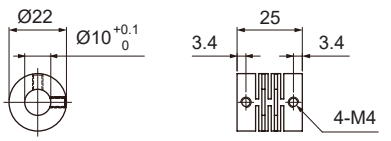
- ENA-□-2-□ (2m, 4-wire)



- ENA-□-3-□ (2m, 5-wire)



◎ Coupling



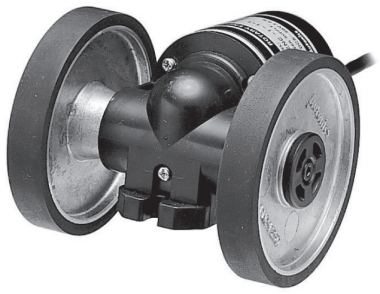
- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description .
※For flexible coupling (ERB series) information, refer to the ERB series section.

Wheel Type Incremental Rotary Encoder

■ Features

- Suitable for measuring the length or speed of target moving successively by wheel type
- The output waveform according to measuring distance is proportional to the unit of International Measurement type (meter or inch)
- Power supply: 5VDC, 12-24VDC ±5%



■ Applications

- Various packing machine, sheet manufacturing, textile machinery, and general industrial machinery etc.

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

CE

■ Ordering Information

ENC – 1 – 1 — N — 24 —

Series	Output phase	Min. measuring unit	Control output	Power supply	Cable
Wheel type	1: A, B	1: 1mm 4: 0.01yd 2: 1cm 5: 0.1yd 3: 1m 6: 1yd	T: Totem pole output N: NPN open collector output V: Voltage output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark: Axial cable type C: Axial cable connector type

■ Specifications

Item			Wheel Type Incremental Rotary Encoder
Min. measuring unit			1mm/pulse, 1cm/pulse, 1m/pulse, 0.01yd/pulse, 0.1yd/pulse, 1yd/pulse
Electrical specification	Output phase		A, B phase
	Phase difference of output		Phase difference between A and B : $\frac{T}{4} \pm \frac{T}{8}$ (T=1cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
	Max. response frequency		180kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial cable type, Axial cable connector type
Mechanical specification		Starting torque	Depend on coefficient of friction
		Max. allowable revolution※1	5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment		Ambient temperature	-10 to 70℃ (at non-freezing status), storage: -25 to 85℃
		Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Cable		Axial cable type	Ø5mm, 4-wire, 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
		Axial cable connector type	Ø5mm, 5-wire, 250mm, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Protection structure			IP50 (IEC standard)
Approval			CE
Unit weight			Approx. 494g

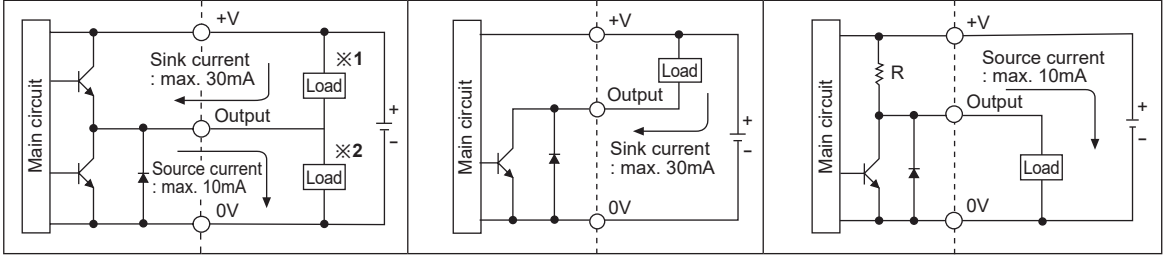
※1: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※Environment resistance is rated at no freezing or condensation.

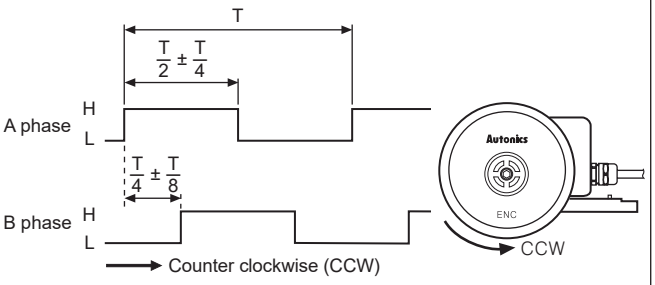
▣ Control Output Diagram

Totem pole output		NPN open collector output		Voltage output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



- The output circuits of A, B phase are same.
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

▣ Output Waveform



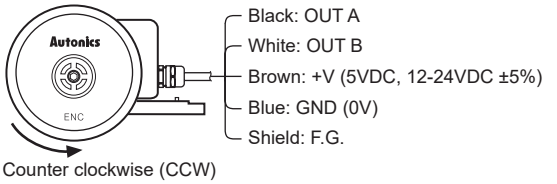
▣ Resolution

Wheel circumference	No※1	No. of encoder pulse	Gear ratio	Min. measuring unit
250mm	1	250-pulse	1:1	1mm/pulse
	2	100-pulse	4:1	1cm/pulse
	3	1-pulse	4:1	1m/pulse
228.6mm (0.25/yd)	4	100-pulse	4:1	0.01yd/pulse
	5	10-pulse	4:1	0.1yd/pulse
	6	1-pulse	4:1	1yd/pulse

※1: This table is for the numbers which represents 'min. measuring unit' in model name.

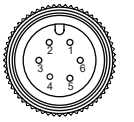
▣ Connections

◎ Axial cable type



※Unused wires must be insulated.
※The metal case and shield wire of encoder must be grounded (F.G.)
※Do not apply tensile strength over 30N to the cable.

◎ Axial cable connector type

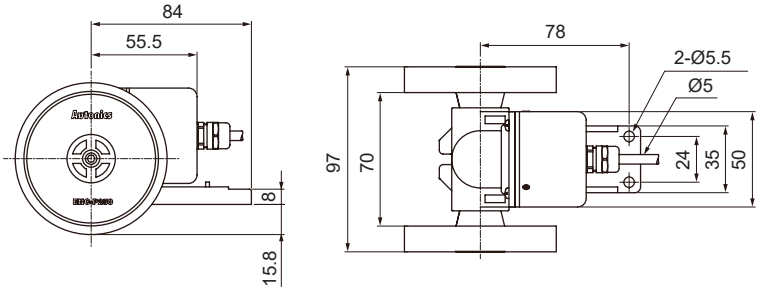


Pin No	Cable color	Function
①	Black	OUT A
②	White	OUT B
③	Orange	N·C
④	Brown	+V
⑤	Blue	GND
⑥	Shield	F.G.

※F.G. (field ground)
: It must be grounded separately.

▣ Dimensions

(unit: mm)



Cable for axial cable type
Ø5mm, 4-wire, Length: 2m, Shield cable
Cable for axial cable connector type
Ø5mm, 5-wire, Length: 250mm, Shield cable

※The wheel circumference(Ø) is changed according to model, please refer to resolution chart.
※Connector cable is sold separately and refer to the 'Connectors, Connector Cables, Sensor Distribution Boxes, Sockets' section.

Shaft Type/Blind Hollow Shaft Type Ø20mm Incremental Rotary Encoder

■ Features

- **Ø20mm of miniature rotary encoder**
- Easy installation at narrow space
- Low moment of inertia
- Power supply: 5VDC, 12VDC ±5%
- Various output types

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

E20S Series

E20HB Series

■ Ordering Information

E20S | **2** | – | **360** | – | **3** | – | **N** | – | **12** | – | **R**

Series	Shaft diameter		Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø20mm S: shaft type	External	2: Ø2mm	100, 200, 320, 360	3: A, B, Z 6: A, Ā, B, B̄, Z, Z̄	N: NPN open collector output V: Voltage output L: Line driver output (※)	5: 5VDC ±5% 12: 12VDC ±5%	R: Axial cable type S: Radial cable type
Ø20mm HB: blind hollow shaft type	Inner	2: Ø2mm 2.5: Ø2.5mm 3: Ø3mm					

※The power of Line driver is only for 5VDC.

■ Specifications

Item			Shaft Type/Blind Hollow Shaft Type Ø20mm Incremental Rotary Encoder
Resolution (PPR)※1			100, 200, 320, 360
Electrical specification	Output phase		A, B, Z phase (line driver output A, Ā, B, B̄, Z, Z̄ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, output voltage: min. 2.5VDC⎓
	Response time (rise/fall)	NPN open collector output	Max. 1μs (cable length: 1m, I sink = 20mA)
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 1m, I sink = 20mA)
	Max. response frequency		100kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 60mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		500VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Axial cable type, radial cable type
Mechanical specification	Starting torque		Max. 5gf·cm (5×10^{-4} N·m)
	Moment of inertia		Max. 0.5g·cm² (5×10^{-8} kg·m²)
	Shaft loading		Radial: 200gf, Thrust: 200gf
	Max. allowable revolution※2		6,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment		Ambient temperature	-10 to 70℃, storage: -20 to 80℃
		Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø3mm, 5-wire (line driver output: 8-wire), 1m, Shield cable
Accessory			Ø2mm Coupling (shaft type), Bracket (blind hollow shaft type)
Approval			CE (except line driver output)
Unit weight			Approx. 35g

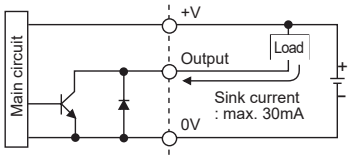
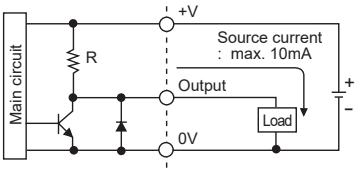
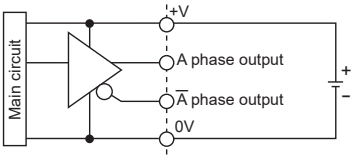
※1: Not indicated resolutions are customizable.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※Environment resistance is rated at no freezing or condensation.

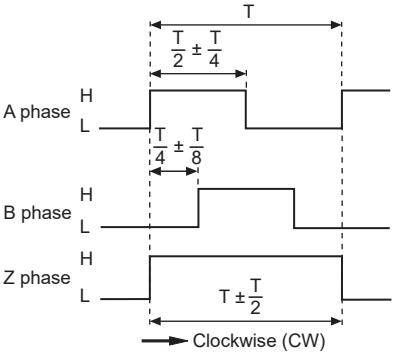
▣ Control Output Diagram

NPN open collector output		Voltage output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection
			
Line driver output			
Rotary encoder circuit	Load connection		
		—	

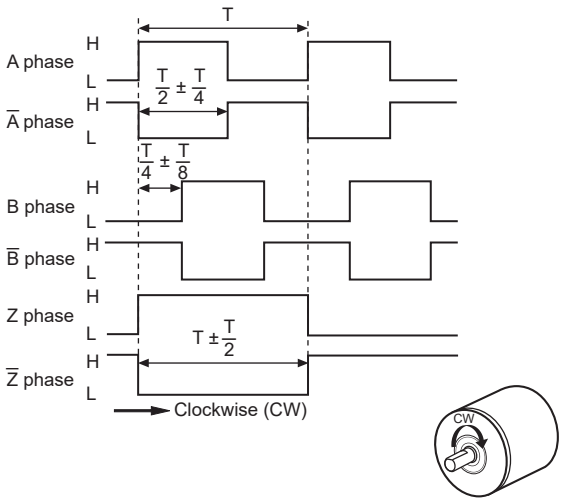
※The output circuit of A, B, Z phase are same. (line driver output is A, Ā, B, B̄, Z, Z̄)

▣ Output Waveform

◎ NPN open collector output / Voltage output

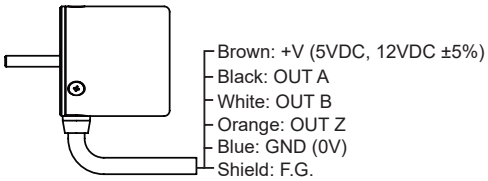


◎ Line driver output

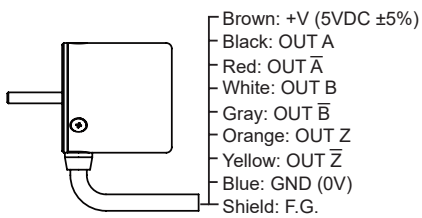


▣ Connections

◎ NPN open collector output / Voltage output



◎ Line driver output

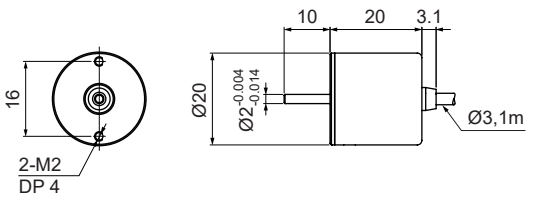


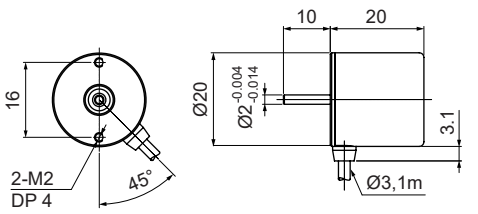
※Do not apply tensile strength over 15N to the cable.

▣ Dimensions

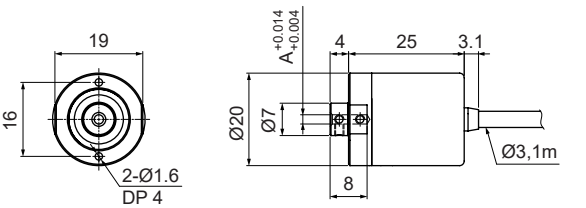
(unit: mm)

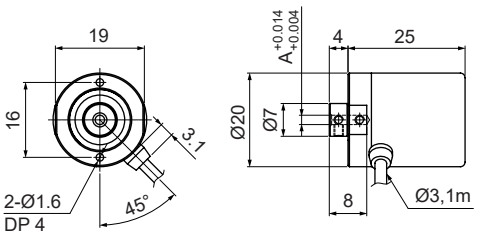
◎ Shaft type





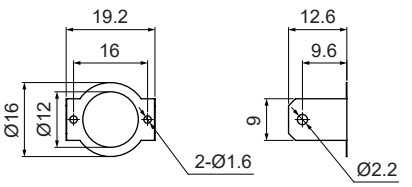
◎ Blind hollow shaft type



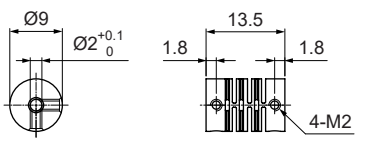


Model	E20HB2	E20HB2.5	E20HB3
A	Ø2	Ø2.5	Ø3

◎ Bracket (E20HB)



◎ Coupling (E20S)



- Parallel misalignment: max. 0.15mm
- Angular misalignment: max. 2°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger,
it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary"
section of Technical Description.
※For flexible coupling (ERB series) information, refer to ERB series section.

Ø58mm Incremental Rotary Encoder

▣ Features

[Totem pole, NPN open collector, Voltage, Line driver output type]

- Ø58mm flange type
- Suitable for measuring angle, position, revolution, speed, acceleration and distance
- Power supply: 5VDC, 12-24VDC ±5%

[Analog sine wave OP Amp output type]

- Taper shaft
- Analog sine wave OP Amp output
- Power supply: 5VDC ±5%

⚠ **Please read "Safety Considerations" in operation manual before using.**

CE

▣ Ordering Information

E58SC	10	–	8000	–	3	–	N	–	24	–	

Series (Ø58mm)	Shaft diameter			Pulses/ revolution	Output phase	Control output	Power supply	Cable※1
SC: Shaft Clamping	External	10	Ø10mm	Refer to resolution	2: A, B 3: A, B, Z 4: A, $\overline{A}$, B, $\overline{B}$ 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark : Axial/Radial cable type C: Axial/Radial cable connector type CR: Axial connector type CS: Radial connector type
SS: Shaft Synchro		6	Ø6mm					
H: Hollow shaft	Inner	12	Ø12mm					
HB: Blind hollow shaft								
S: Shaft	External	Ø9.25mm		2048	10: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, C, $\overline{C}$, D, $\overline{D}$	A: Analog sine wave OP Amp output	5: 5VDC ±5%	R: Axial cable type S: Radial cable type

※1: Please refer to 'connection' in the specifications for the detailed information about cable.

Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø58mm Incremental Rotary Encoder

■ Specifications

Item			Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø58mm Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2, *5, 10, *12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 125, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 5000, 6000, 8000
Electrical specification	Output phase		A, B, Z phase (line driver output: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$(T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, output voltage (power voltage 5VDC⎓): min. 2.5VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
	Response time (rise, fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 min (between all terminals and case)
	Connection		• SC/SS/HB type: axial cable type, axial cable connector type, axial/radial connector type • H type: radial cable type, radial cable connector type
Mechanical specification	Starting torque		• SC/SS type: max. 40gf·cm (0.004N·m) • H/HB type: max. 90gf·cm (0.009N·m)
	Moment of inertia		• SC/SS type: max. 15g·cm^2 (1.5×10^{-6} kg·m^2) • H/HB type: max. 20g·cm^2 (2×10^{-6} kg·m^2)
	Shaft loading		• SC/SS type-Radial: max. 10kgf, Thrust: max. 2.5kgf • H/HB type-Radial: max. 2kgf, Thrust: max. 1kgf
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Coupling (SC type: Ø10mm, SS type: Ø6mm), Bracket
Approval			CE (except for line driver output)
Weight※3	Cable type, Cable connector type		• SC type: approx. 420g (approx. 310g) • SS type: approx. 395g (approx. 285g) • H/HB type: approx. 380g (approx. 270g)
	Connector type		• SC type: approx. 340g (approx. 230g) • SS type: approx. 315g (approx. 205g) • HB type: approx. 310g (approx. 200g)

※1: '*' pulse is only for A, B phase. (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase) [In case of hollow shaft type, 6000, 8000 PPR excluded] Not indicated resolutions are customizable.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

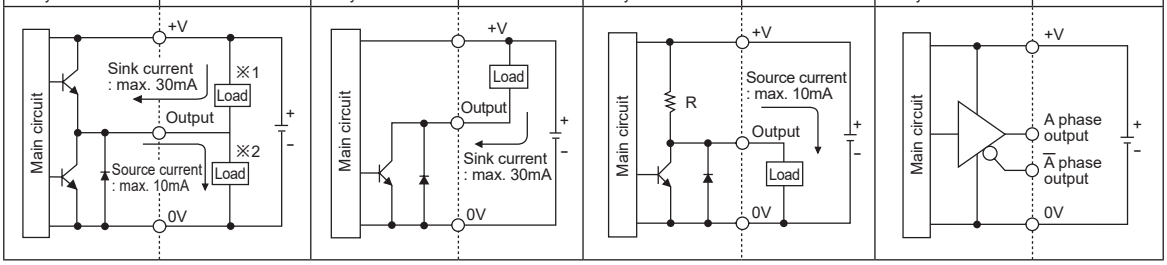
[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※3: The weight includes packaging. The weight in parenthesis is for unit only.

※Environment resistance is rated at no freezing or condensation.

▣ Control Output Diagram

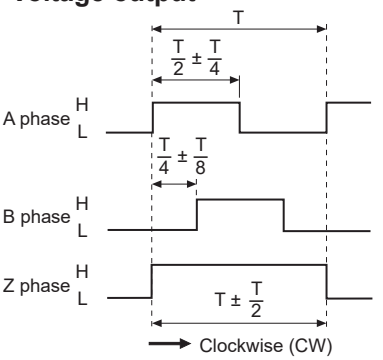
Totem pole output		NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



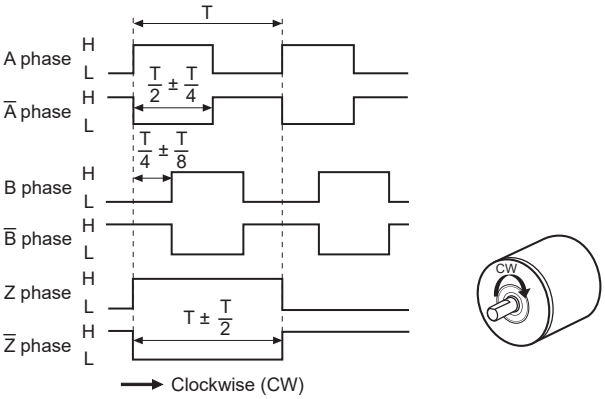
- All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

▣ Output Waveforms

◎ Totem pole output / NPN open collector output / Voltage output



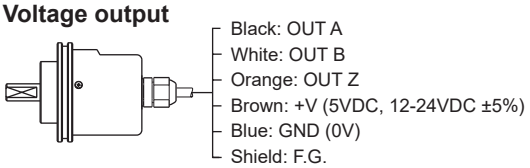
◎ Line driver output



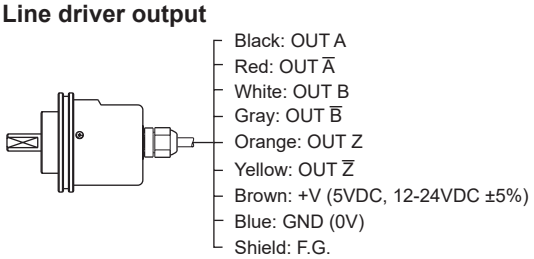
▣ Connections

◎ Axial/Radial cable type

- **Totem pole output / NPN open collector output / Voltage output**



- **Line driver output**



※Unused wires must be insulated.
※The metal cable and shield cable of encoder should be grounded (F.G.)
※Do not apply tensile strength over 30N to the cable.

◎ Axial/Radial cable connector type / Axial/Radial connector type

- **Totem pole output / NPN open collector output / Voltage output**

Pin No.	Function	Cable color
1	OUT A	Black
2	OUT B	White
3	OUT Z	Orange
4	+V	Brown
5	GND	Blue
6	F.G.	Shield

- **Line driver output**

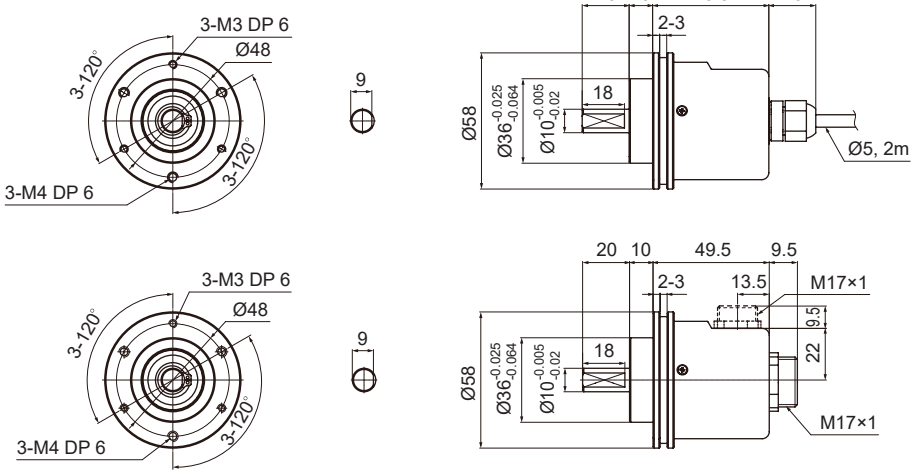
Pin No.	Function	Cable color
1	OUT A	Black
2	OUT $\overline{A}$	Red
3	+V	Brown
4	GND	Blue
5	OUT B	White
6	OUT $\overline{B}$	Gray
7	OUT Z	Orange
8	OUT $\overline{Z}$	Yellow
9	F.G.	Shield

※F.G. (field ground): It should be grounded separately.

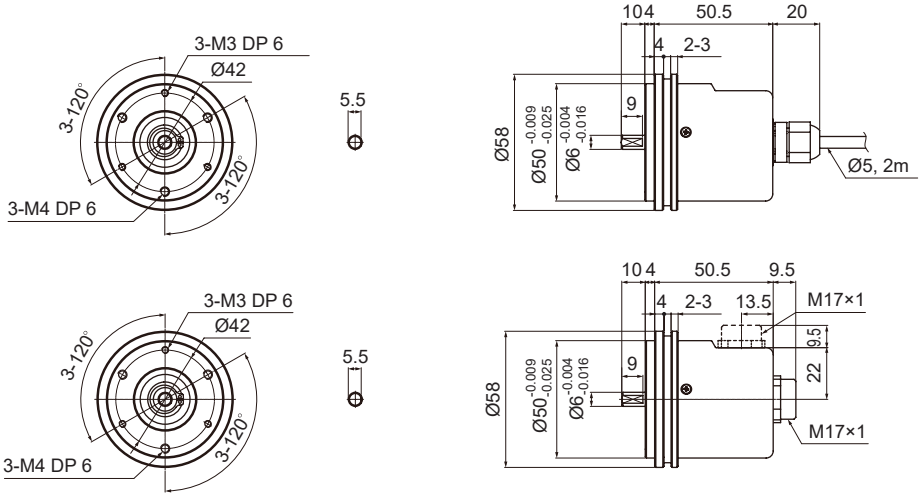
▣ Dimensions

(unit: mm)

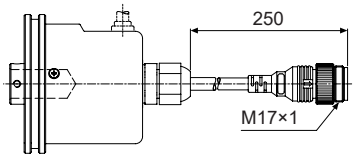
◎ Shaft clamping type (SC)



◎ Shaft synchro type (SS)



● Axial / Radial cable connector type



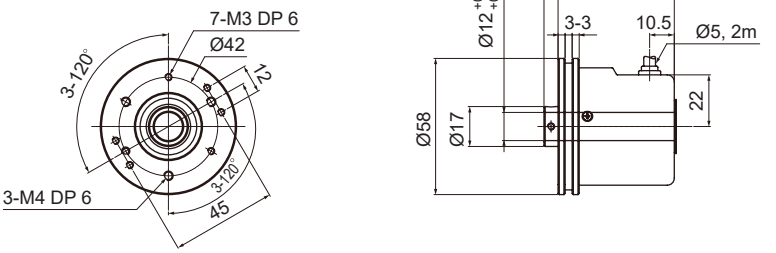
Cable for Axial/Radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), 250mm, Shield cable

※Connector cable is sold separately and refer to page H-10 for specifications.

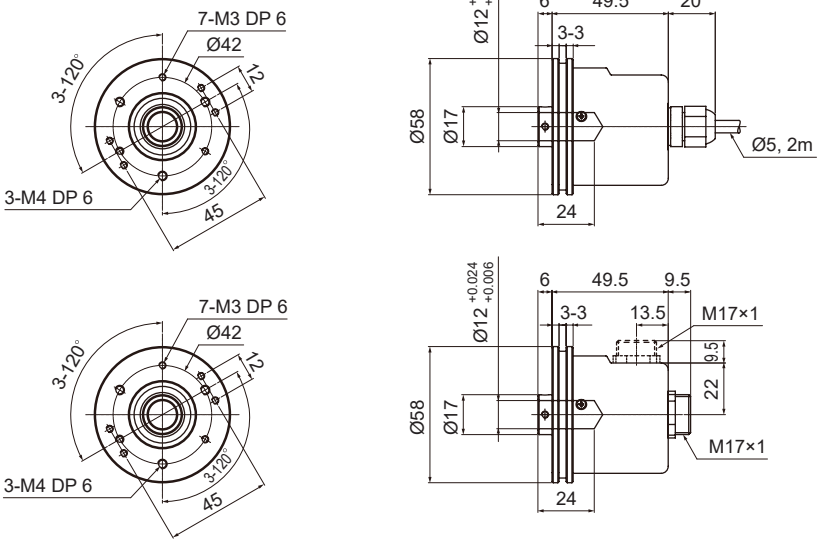
▣ Dimensions

(unit: mm)

◎ Hollow shaft type (H)

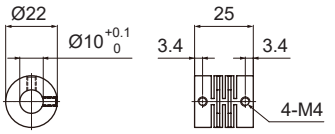


◎ Blind hollow shaft type (HB)

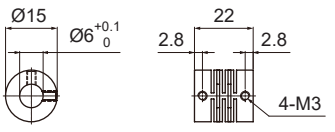


◎ Coupling

• E58SC10



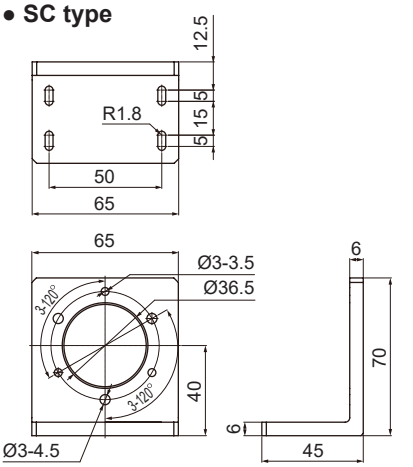
• E58SS6



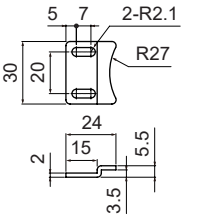
- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

◎ Bracket

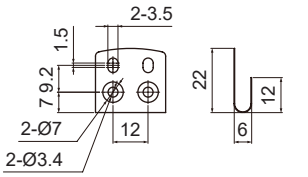
• SC type



• SS type



• H/HB type



※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15 N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to page G-98.
※For flexible coupling (ERB series) information, refer to page G-91.

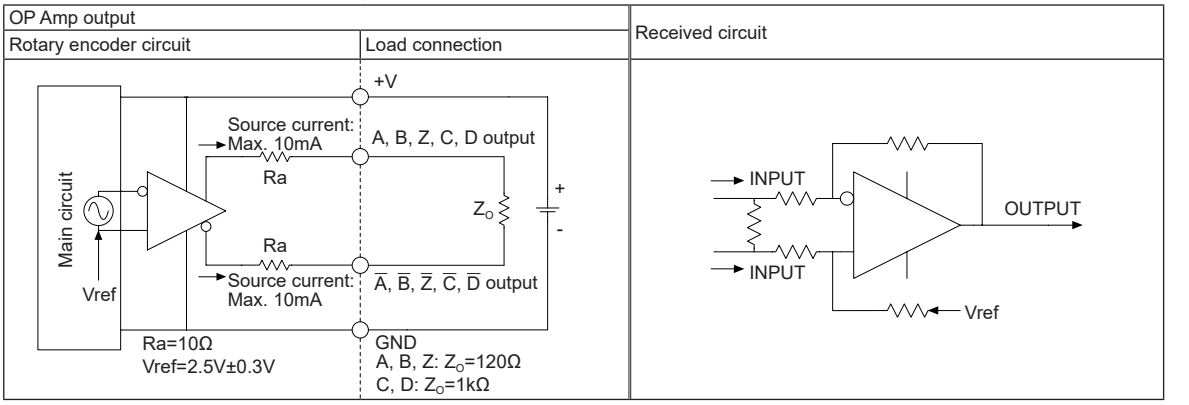
Shaft Type Ø58mm Sine Wave Incremental Rotary Encoder

▣ Specifications

Item			Shaft Type Ø58mm Sine Wave Incremental Rotary Encodez	
Model			E58S9.25-2048-10-A-5-R	E58S9.25-2048-10-A-5-S
Revolution (PPR)			2,048	
Output phase			A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, C, $\overline{C}$, D, $\overline{D}$ phase	
Phase difference of output			Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1cycle of A phase) Phase difference between C and D: 90°	
Electrical specification	Control output	Output type	OP Amp output	
		Output current	Max. 10mA	
		Output voltage	V_{P-P} ⎓: 0.5V±0.1V	
		DC offset	V_{DC}: 2.5V±0.3V	
	Max. response frequency		200kHz	
	Power supply		5VDC⎓ ±5% (ripple P-P: max. 5%)	
	Current consumption		Max. 120mA (disconnection of the load)	
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)	
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)	
	Connection		Axial cable type	Radial cable type
Mechanical specification	Starting torque		Max. 100gf·cm (0.0098N·m)	
	Moment of inertia		Max. 15g·cm^2 (1.5×10^{-6} kg·m^2)	
	Shaft loading		Radial: 10kgf, Thrust: 2.5kgf	
	Max. allowable revolution		6,000rpm	
Shaft			Taper shaft Ø9.25mm, Taper 1:10	
Vibration			1.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours	
Shock			Approx. max. 100G	
Environment		Ambient temp.	-20 to 100℃, storage: -25 to 100℃	
		Ambient humi.	35 to 85%RH, storage: 35 to 90%RH	
Protection structure			IP50 (IEC standard)	
Cable			Ø6mm, 17-wire, 9m※1, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 17, insulator out diameter: Ø0.8mm)	
Accessory			M5×0.8 (50L), M5×0.8 (47L) wrench bolt	
Approval			CE	
Weight※2			Approx. 1.02kg (approx. 930g)	

※1: Option is 7m, 15m.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

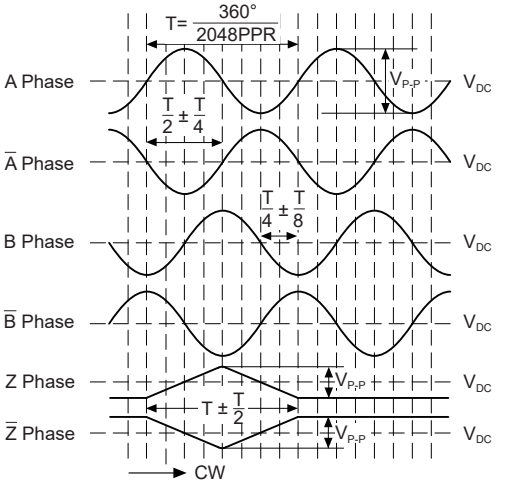
▣ Control Output Diagram



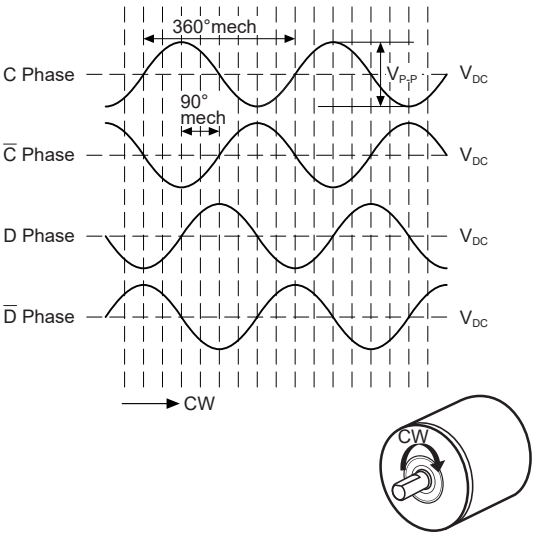
● All output circuits of A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, C, $\overline{C}$, D, $\overline{D}$ phase are the same.

▣ Output Waveforms

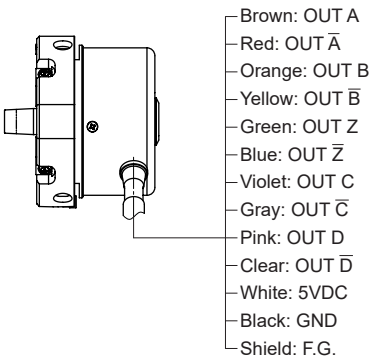
◎ A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase



◎ C, $\overline{C}$, D, $\overline{D}$ phase



▣ Connections

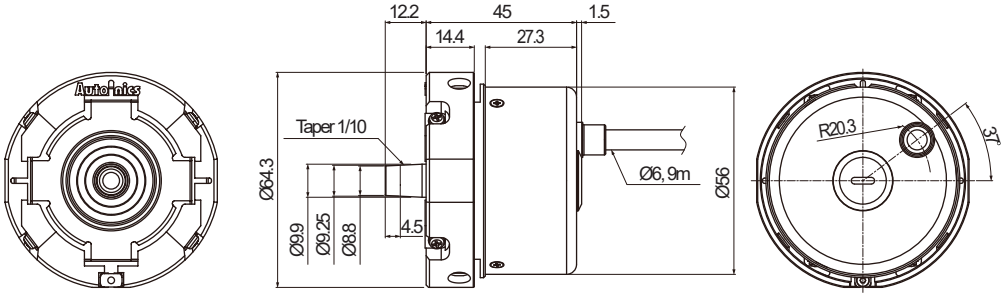


※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).
※The output circuit has the dedicated IC and be sure not to short-circuit when wiring the output cables.

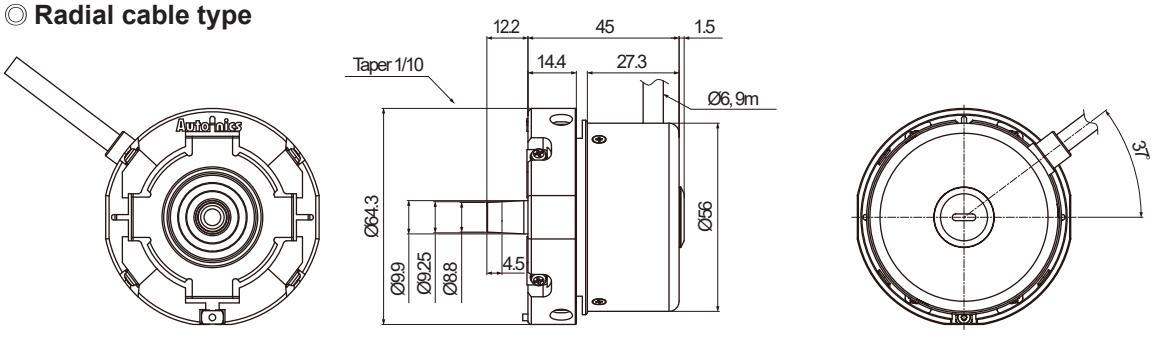
▣ Dimensions

(unit: mm)

◎ Axial cable type

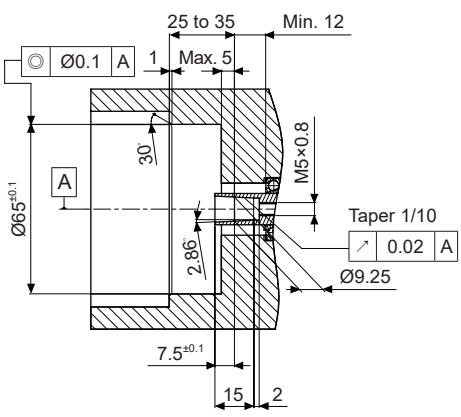


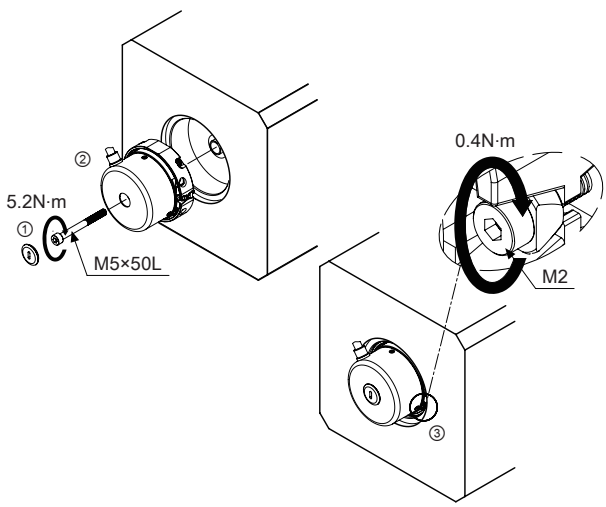
◎ Radial cable type



▣ Installation

(unit: mm)





① Insert the M5×50L wrench bolt at rear of the E58S .
② Install the E58S on the device.
③ Adjust bracket size with M2 wrench.

Hollow Shaft Type Ø60mm Incremental Rotary Encoder

▣ Features

[Totem pole, NPN open collector, Voltage, Line driver output type]

- Ø60mm, Inner diameter of shaft Ø20mm
- Suitable for measuring angle, position, revolution, speed, acceleration and distance
- Power supply: 5VDC, 12-24VDC ±5%
- Various output types

[Analog sine wave OP Amp output type]

- Ø60mm, Inner diameter of shaft Ø20mm
- Power supply: 5VDC ±5%
- Analog sine wave OP Amp output

⚠ **Please read "Safety Considerations" in operation manual before using.**

CE

▣ Ordering Information

E60H	20	- 8192	- 3	- N	- 24	-

Series	Shaft inner diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø60mm, hollow shaft type	Ø20mm	100, 1024, 5000, 8192	3: A, B, Z 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark: Radial cable type C: Radial cable connector type
Ø60mm, hollow shaft type	Ø20mm	2048	10: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, C, $\overline{C}$, D, $\overline{D}$	A: Analog sine wave OP Amp output	5: 5VDC ±5%	R: Axial cable type S: Radial cable type

Hollow Shaft Type Ø60mm Incremental Rotary Encoder

■ Specifications

Item			Hollow Shaft Type Ø60mm Incremental Rotary Encoder
Resolution (PPR)※1			100, 1024, 5000, 8192
Electrical specification	Output phase		A, B, Z phase (line driver output: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$(T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, output voltage (power voltage 5VDC⎓): min. (power voltage-2.0) VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, Output voltage (power voltage 5VDC⎓): min. 2.5VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial cable type, Radial cable connector type
Mechanical specification		Starting torque	Max. 150gf·cm (0.0147 N·m)
		Moment of inertia	Max. 110g·cm² (11×10^{-6} kg·m²)
		Shaft loading	Radial: max. 5kgf, Thrust: max. 2.5kgf
		Max. allowable revolution※2	6,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 100G
Environment		Ambient temperature	-10 to 70℃, storage: -25 to 85℃
		Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Bracket: 2
Approval			CE (except line driver output)
Weight※3			Approx. 397g (approx. 300g)

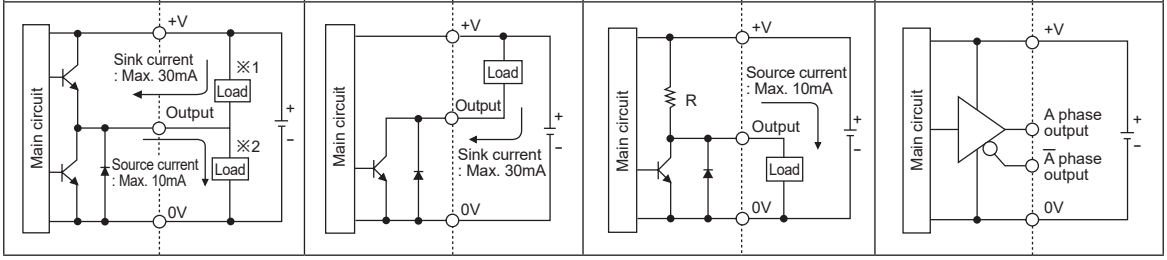
※1: Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Control Output Diagram

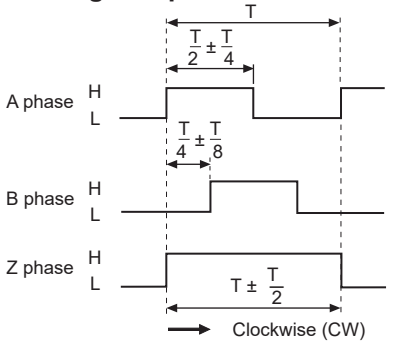
Totem pole output		NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection



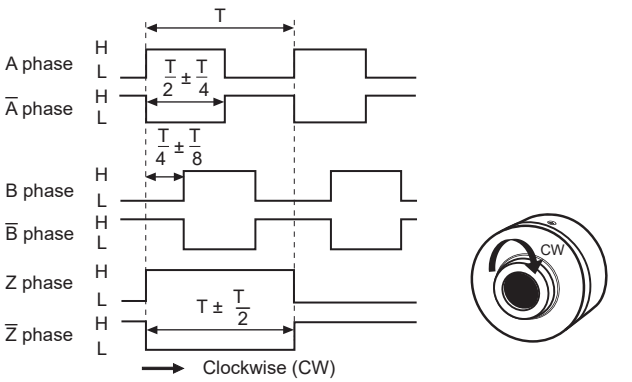
- All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

■ Output Waveforms

◎ Totem pole output / NPN open collector output / Voltage output



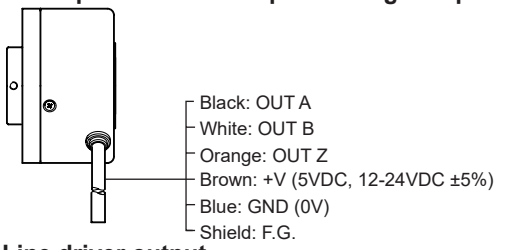
◎ Line driver output



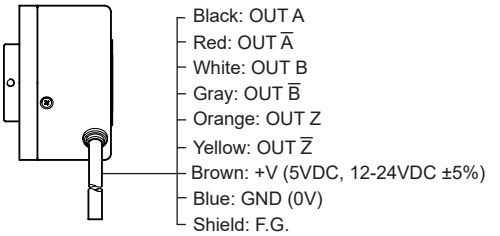
■ Connections

◎ Radial cable type

- **Totem pole output / NPN open collector output / Voltage output**



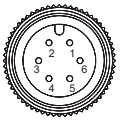
- **Line driver output**



※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).
※Do not apply tensile strength over 30N to the cable.

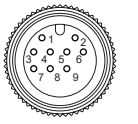
◎ Radial cable connector type

- **Totem pole output / NPN open collector output / Voltage output**



Pin No.	Function	Cable color
1	OUT A	Black
2	OUT B	White
3	OUT Z	Orange
4	+V	Brown
5	GND	Blue
6	F.G.	Shield

- **Line driver output**

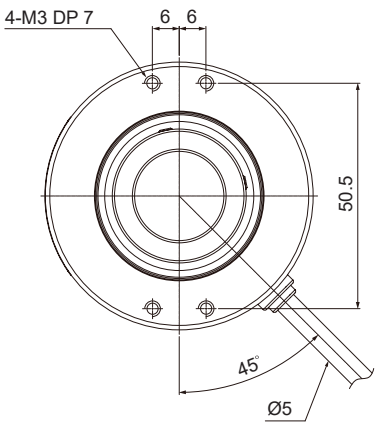


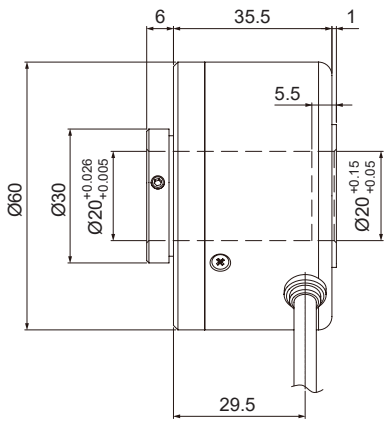
Pin No.	Function	Cable color
1	OUT A	Black
2	OUT Ā	Red
3	+V	Brown
4	GND	Blue
5	OUT B	White
6	OUT B̄	Gray
7	OUT Z	Orange
8	OUT Z̄	Yellow
9	F.G.	Shield

※F.G. (field ground): It should be grounded separately.

▣ Dimensions

(unit: mm)

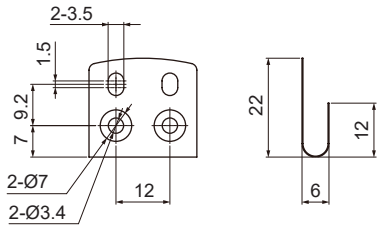




Cable for Radial cable type	Cable for radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable	Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

※Connector cable is sold separately and refer to page H-10 for specifications.

◎ Bracket



※Fix the unit by a wrench under 0.15 N·m of torque.

Hollow Shaft Type Ø60mm Sine Wave Incremental Rotary Encoder

▣ Specifications

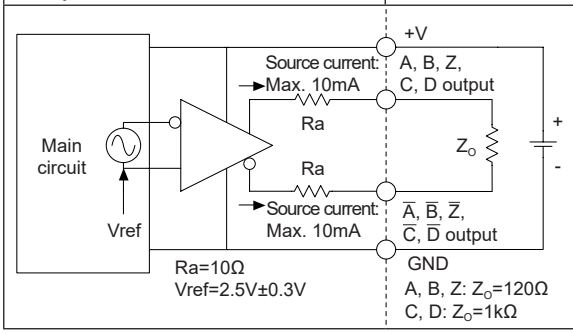
Item			Hollow Shaft Type Ø60mm Sine Wave Incremental Rotary Encoder	
Model			E60H20-2048-10-A-5-R	E60H20-2048-10-A-5-S
Resolution (PPR)			2,048	
Output phase			A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, C, $\overline{C}$, D, $\overline{D}$ phase	
Phase difference of output			Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1cycle of A phase) Phase difference between C and D: 90°	
Electrical specification	Control output	Output type	OP Amp output	
		Output current	Max. 10mA	
		Output voltage	$V_{p\text{-}p}$⎓: 0.5V±0.1V	
		DC OFFSET	V_{DC}: 2.5V±0.3V	
	Max. response frequency		200kHz	
	Power supply		5VDC⎓ ±5% (ripple P-P: Max. 5%)	
	Current consumption		Max. 120mA (disconnection of the load)	
	Insulation resistance		Over 100MΩ (at 500VDC between all terminals and case)	
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)	
	Connection		Axial cable type	Radial cable type
Mechanical specification	Starting torque		Max. 200gf·cm (0.02N·m)	
	Moment of inertia		Max. 110g·cm^2 (11×10^{-6} kg·m^2)	
	Shaft loading		Radial: 5kgf, Thrust: 2.5kgf	
	Max. allowable revolution		6000rpm	
Vibration			1.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours	
Shock			Approx. max. 100G	
Environment		Ambient temp.	-20 to 100℃, storage: -25 to 100℃	
		Ambient humi.	35 to 85%RH, storage: 35 to 90%RH	
Protection structure			IP40 (IEC standard)	
Cable			Ø6mm, 17-wire, 9m※1, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 17, insulator out diameter: Ø0.8mm)	
Accessory			Bracket: 2	
Approval			CE	
Weight※2			Approx. 750g (approx. 720g)	

※1: Option is 7m, 15m.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

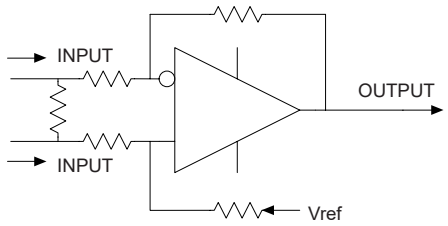
■ Control Output Diagram

OP Amp output

Rotary encoder circuit | Load connection



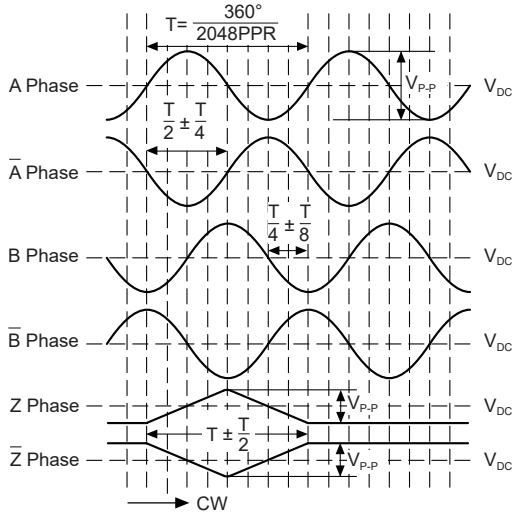
Received circuit



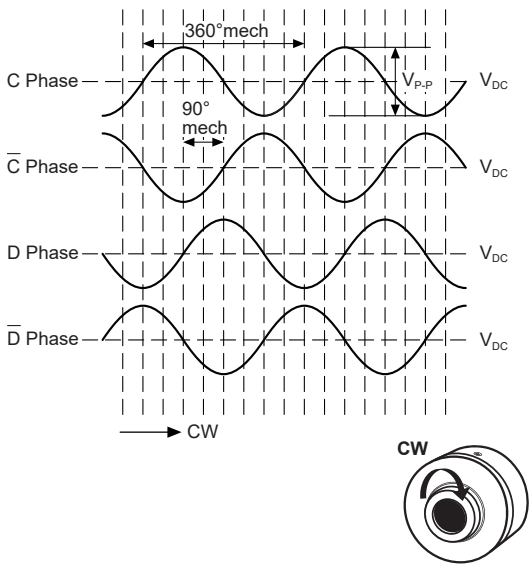
※All output circuits of A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, C, $\overline{C}$, D, $\overline{D}$ phase are the same.

■ Output Waveforms

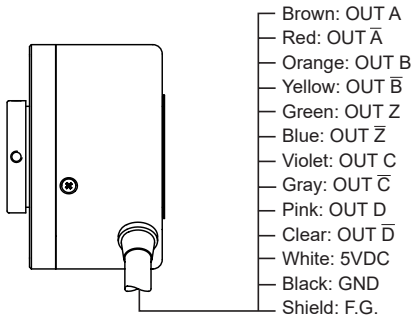
◎ A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase



◎ C, $\overline{C}$, D, $\overline{D}$ phase



■ Connections

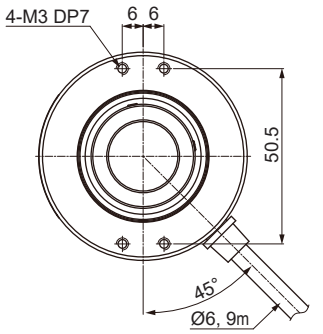


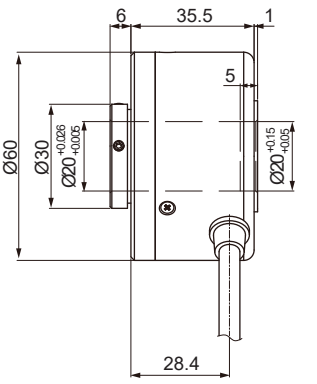
※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).
※The output circuit has the dedicated IC and be sure not to short-circuit when wiring the output cables.

▣ Dimensions

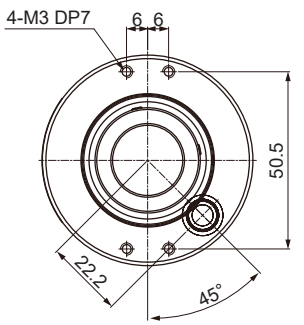
(unit: mm)

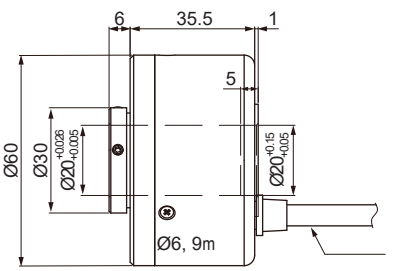
◎ Axial cable type



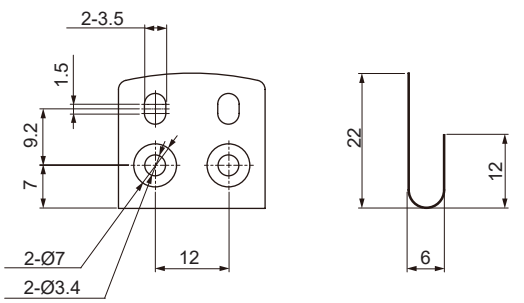


◎ Radial cable type





● Bracket



※Fix the unit by a wrench under 0.15 N·m of torque.

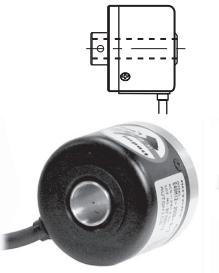
Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø40mm Incremental Rotary Encoder

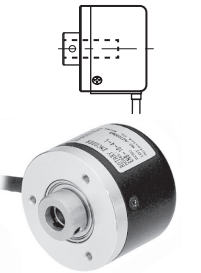
■ Features

- Easy installation at narrow space
- Low moment of inertia
- Power supply: 5VDC, 12-24VDC ±5%
- Various output types

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


E40S Series


E40H Series


E40HB Series

■ Ordering Information

E40 H	8	—	5000	—	3	—	N	—	24	—	

Series	Shaft diameter		Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø40mm S: shaft type	External	6: Ø6mm 8: Ø8mm	Refer to resolution	2: A, B 3: A, B, Z 4: A, $\overline{A}$, B, $\overline{B}$ 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5 : 5VDC ±5% 24: 12-24VDC ±5%	No mark : Radial cable type C: Radial cable connector type
Ø40mm H: hollow shaft type, HB: blind hollow shaft type	Inner	6: Ø6mm 8: Ø8mm 10: Ø10mm 12: Ø12mm					

■ Specifications

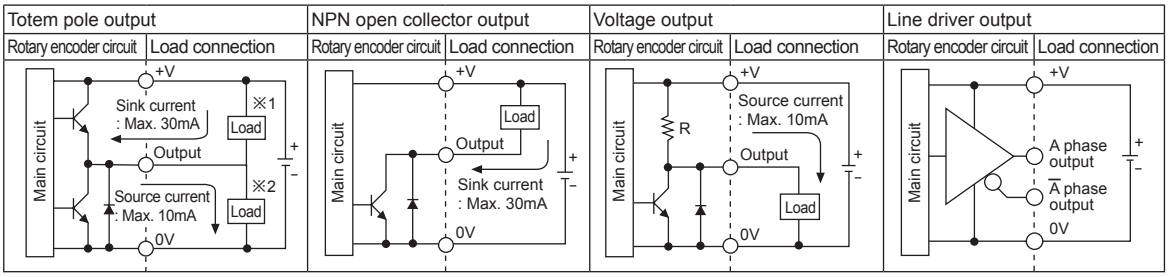
Item			Shaft Type/Hollow Shaft Type/Blind Hollow Shaft Type Ø40mm Incremental Rotary Encoder
Resolution (PPR)※1			*1, *2 ,*5, 10, *12, 15, 20, 23, 25, 30, 35, 40, 45, 50, 60, 75, 100, 120, 150, 192, 200, 240, 250, 256, 300, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 5000
Electrical specification	Output phase		A, B, Z phase (line driver A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, output voltage (power voltage 5VDC⎓): min. 2.5VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial cable type, Radial cable connector type
Mechanical specification	Starting torque		• S type: max. 40gf·cm (0.004N·m) • H/HB type: max. 50gf·cm (0.005N·m)
	Moment of inertia		Max. 40g·cm^2 (4×10^{-6} kg·m^2)
	Shaft loading		Radial: max. 2kgf, Thrust: max. 1kgf
	Max. allowable revolution※2		5,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			• S type: Ø6mm coupling, Ø8mm coupling • H/HB type: bracket
Approval			CE (except line driver output)
Unit weight			Approx. 120g

※1: '*' pulse is only for A, B phase (line driver output is for A, $\overline{A}$, B, $\overline{B}$ phase). Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※Environment resistance is rated at no freezing or condensation.

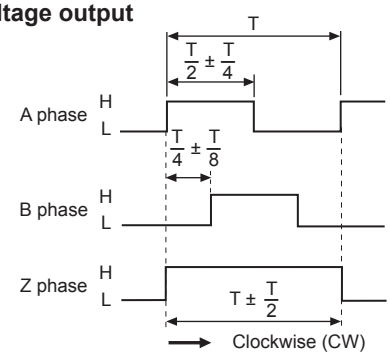
▣ Control Output Diagram



- Totem pole output type can be used for NPN open collector output type (※1) or Voltage output type (※2).
- All output circuits of A, B, Z phase are same. (line driver output is A, Ā, B, B̄, Z, Z̄)

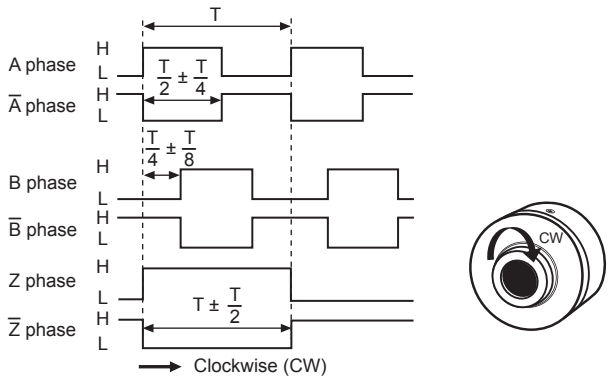
▣ Output Waveform

● Totem pole output / NPN open collector output / Voltage output



※Z reverse phase output is optional.

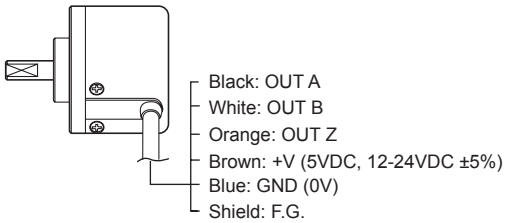
● Line driver output



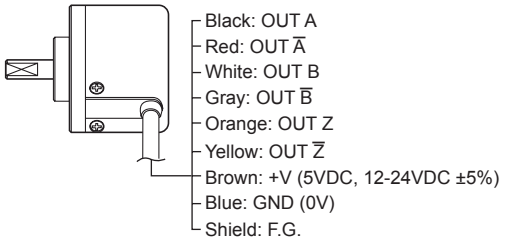
▣ Connections

◎ Radial cable type

● Totem pole output / NPN open collector output / Voltage output



● Line driver output



※Non-using wires must be insulated.
※The shield cable and metal case of encoder must be grounded (F.G.).
※Do not apply tensile strength over 30N to the cable.

◎ Radial cable connector type

● Totem pole output / NPN open collector output / Voltage output

Pin No	Cable color	Function
①	Black	OUT A
②	White	OUT B
③	Orange	OUT Z
④	Brown	+V
⑤	Blue	GND
⑥		F.G.

• Line driver output

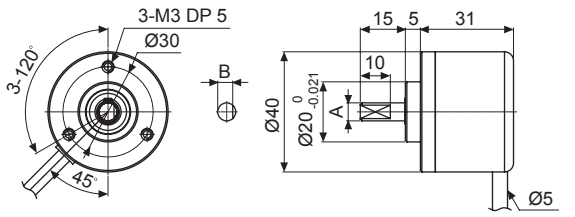
Pin No	Cable color	Function
①	Black	OUT A
②	Red	OUT Ā
③	Brown	+V
④	Blue	GND
⑤	White	OUT B
⑥	Gray	OUT B̄
⑦	Orange	OUT Z
⑧	Yellow	OUT Z̄
⑨	Shield	F.G.

※F.G. (field ground): It should be grounded separately.

▣ Dimensions

(unit: mm)

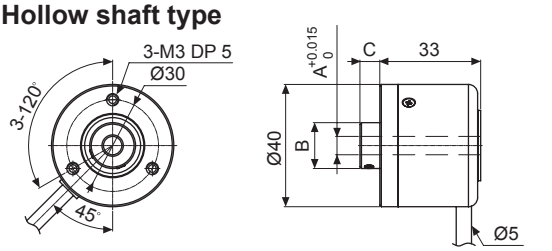
◎ Shaft type



A	Ø6	-0.004 -0.016	Ø8	-0.005 -0.02
B	5		7	

Cable for radial cable type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable
Cable for radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

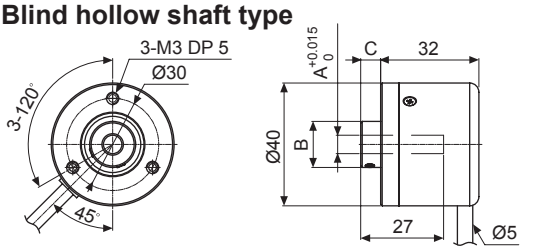
◎ Hollow shaft type



A	Ø6	Ø8	Ø10	Ø12
B	Ø15		Ø17	
C	6.5		6.3	

Cable for radial cable type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable
Cable for radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

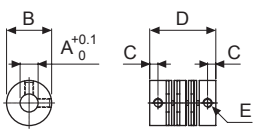
◎ Blind hollow shaft type



A	Ø6	Ø8	Ø10	Ø12
B	Ø15		Ø17	
C	6.5		6.3	

Cable for radial cable type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable
Cable for radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

◎ Coupling (shaft type)

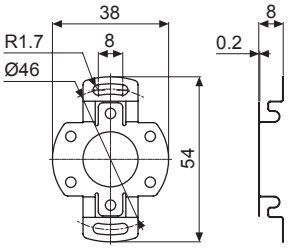


- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

	A	B	C	D	E
E40S6 Ø6mm coupling	Ø6	Ø15	2.8	22	4-M3
E40S8 Ø8mm coupling	Ø8	Ø19	3.4	25	4-M4

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15 N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to page G-98.
※For flexible coupling (ERB series) information, refer to page G-91.

◎ Bracket (Hollow shaft, blind hollow shaft type)



Hollow Shaft Type Ø80mm Incremental Rotary Encoder

■ Features

- Ø80mm, Inner diameter of shaft Ø30mm, Ø32mm
- No coupling needed with direct installation at motor or rotation shaft of machine
- Power supply: 5VDC, 12-24VDC ±5%
- Various output types

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

CE

■ Ordering Information

E80H **30** – **3200** – **3** – **N** – **24** – ☐

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply	Cable
Ø80mm, hollow shaft type	30: Ø30mm 32: Ø32mm	60, 100, 360, 500, 512, 1024, 3200	3: A, B, Z 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%	No mark: Radial cable type C: Radial cable connector type

■ Specifications

Item			Hollow Shaft Type Ø80mm Incremental Rotary Encoder
Resolution (PPR)※1			60, 100, 360, 500, 512, 1024, 3200
Electrical specification	Output phase		A, B, Z phase (line driver output A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, Output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC ⎓ • [High] - Load current: max. -20mA, Output voltage (power voltage 5VDC⎓): min. 2.5VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
	Response time (rise, fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		200kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial cable type, Radial cable connector type
Mechanical specification	Starting torque		Max. 200gf·cm (0.0196N·m)
	Moment of inertia		Max. 800g·cm² (8×10^{-5} kg·m²)
	Shaft loading		Radial: max. 5kgf, Thrust: max. 2.5kgf
	Max. allowable revolution※2		3,600rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment		Ambient temperature	-10 to 70℃, storage: -25 to 85℃
		Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Spring bracket
Approval			CE (except for line driver output)
Unit weight			Approx. 560g

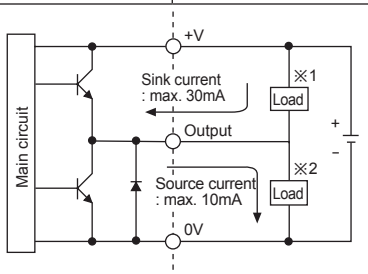
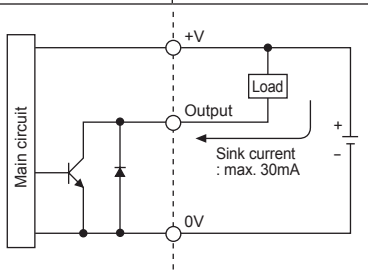
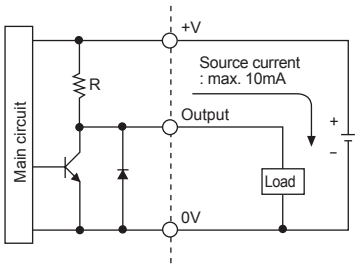
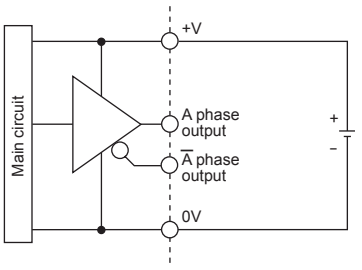
※1: Not indicated resolutions are customizable.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※Environment resistance is rated at no freezing or condensation.

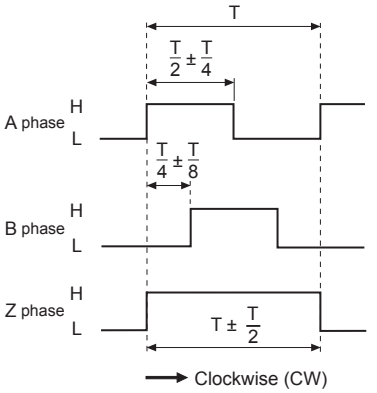
▣ Control Output Diagram

Totem pole output		NPN open collector output	
Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection
			
Voltage output		**Line driver output**	
Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection
			

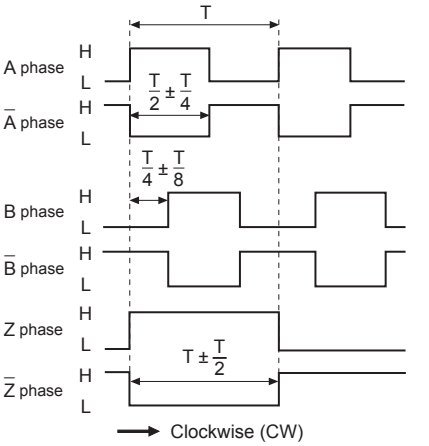
- All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)
- Totem pole output type can be used for NPN open collector type (※1) or voltage output type (※2).

▣ Output Waveforms

◎ Totem pole output / NPN open collector output / Voltage output



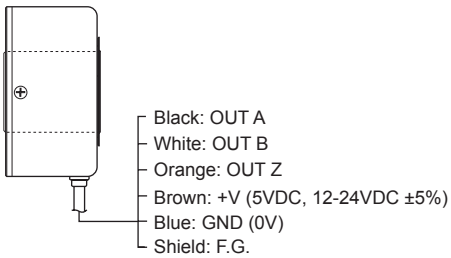
◎ Line driver output



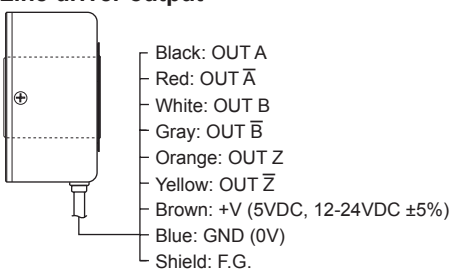
▣ Connections

◎ Radial cable type

● Totem pole output / NPN open collector output / Voltage output



● Line driver output



◎ Radial cable connector type

● Totem pole output / NPN open collector output / Voltage output

Pin No.	Function	Cable color
1	OUT A	Black
2	OUT B	White
3	OUT Z	Orange
4	+V	Brown
5	GND	Blue
6	F.G.	Shield

● Line driver output

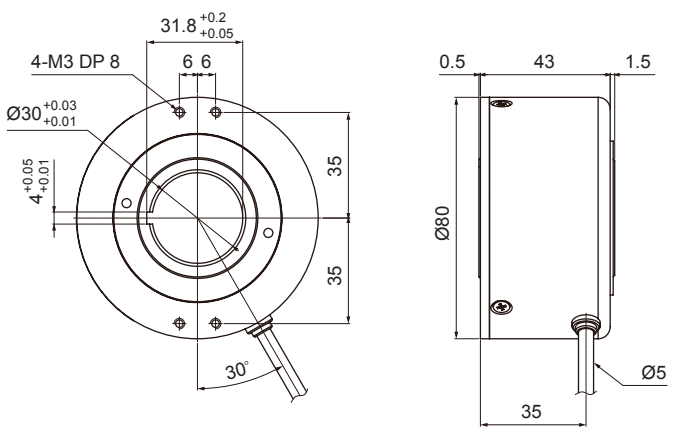
Pin No.	Function	Cable color
1	OUT A	Black
2	OUT $\overline{A}$	Red
3	+V	Brown
4	GND	Blue
5	OUT B	White
6	OUT $\overline{B}$	Gray
7	OUT Z	Orange
8	OUT $\overline{Z}$	Yellow
9	F.G.	Shield

※F.G. (field ground): It should be grounded separately.

※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).
※Do not apply tensile strength over 30N to the cable.

▣ Dimensions

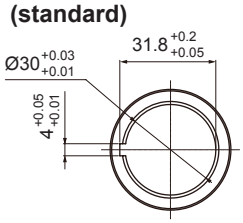
(unit: mm)



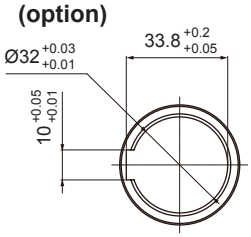
Cable for radial cable type	Cable for radial cable connector type
Ø5mm, 5-wire (line driver output: 8-wire), Length: 2m, Shield cable	Ø5mm, 5-wire (line driver output: 8-wire), Length: 250mm, Shield cable

※Connector cable is sold separately and refer to page H-10 for specifications.

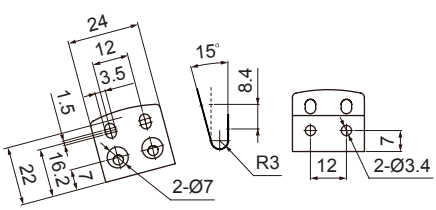
● Shaft inner diameter (standard)



● Shaft inner diameter (option)



◎ Bracket



Hollow Shaft Type Ø88mm Incremental Rotary Encoder

■ Features

- Ø88mm, Inner diameter of shaft Ø30mm
- No coupling needed with direct installation at elevator winding machine
- Power supply: 5VDC, 15VDC ±5%
- Control output: Complemental output, Line driver output

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

CE

■ Ordering Information

E88H	30	– 1024	– 2	–	– 15

Series	Shaft inner diameter	Pulses/revolution	Output phase	Control output	Power supply
Ø88mm, hollow shaft type	Ø30mm	1024	2: A, B 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	No mark: Complemental output L: Line driver output	15: 15VDC ±5% 5: 5VDC ±5%

■ Specifications

Item		Hollow Shaft Type Ø88mm Incremental Rotary Encoder	
Model		**E88H30-1024-2-15**	**E88H30-1024-6-L-5**
Revolution (PPR)		1,024	
Electrical specification	Output phase	A, B phase	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase
	Phase difference of output	Output between A and B phase: $\frac{T}{4} \pm \frac{T}{10}$ (T=1cycle of A phase)	
	Control output	• [L]-Load current: max. 15mA, Residual voltage: max. 2.0VDC⎓ • [H]-Load current: max. 15mA, Output voltage: min. 10VDC⎓	• [L]-Load current: max. 20mA, Residual voltage: max. 0.5VDC⎓ • [H]-Load current: max. -20mA, Output voltage: min. 2.5VDC⎓
	Response time (rise, fall)	Max. 1μs (cable length: 8m, load resistance: 1kΩ)	Max. 0.5μs (cable length: 8m, I sink=20mA)
	Max. response frequency	150kHz	
	Power supply	15VDC⎓ ±5% (ripple P-P: max. 5%)	5VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption	Max. 60mA (disconnection of the load)	Max. 50mA (disconnection of the load)
	Insulation resistance	Over 100MΩ (at 500VDC megger)	
	Dielectric strength	750VAC 50/60Hz for 1 min (between all terminals and case)	
	Connection	Radial cable type	
Mechanical specification	Starting torque	Max. 600gf·cm (0.06N·m)	
	Moment of inertia	Max. 800g·cm^2 (8×10^{-5} kg·m^2)	
	Shaft loading	Radial: max. 5kgf, thrust: max. 2.5kgf	
	Max. allowable revolution※1	3,600rpm	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		Approx. max. 100G	
Environment	Ambient temp.	-10 to 70℃, storage: -25 to 85℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 90%RH	
Protection structure		IP50 (IEC standard)	
Cable		Ø6mm, 6-wire, 8m, shield cable (AWG24, core diameter: 0.16mm, number of cores: 11, insulator out diameter: Ø1mm)	Ø6mm, 8-wire, 8m, shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory		Spring bracket: 2	
Approval		CE (except line driver output model)	
Weight※2		Approx. 1.49kg (approx. 1.45kg)	

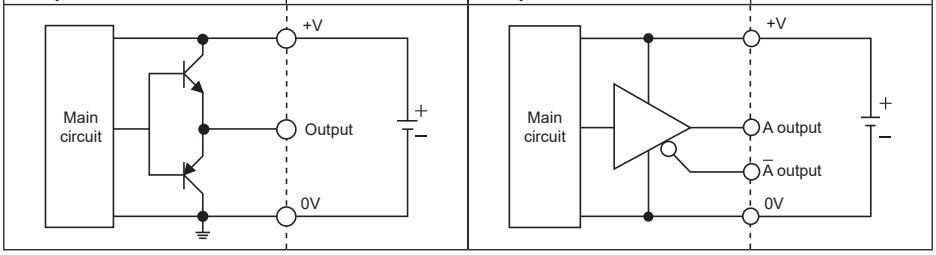
※1: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)}= \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60\ \text{sec}]$$

※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Control Output Diagram

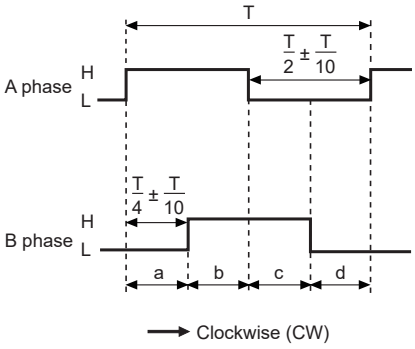
Complemental output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



※All output circuits of A, Ā, B, B̄, Z, Z̄ phase are the same.

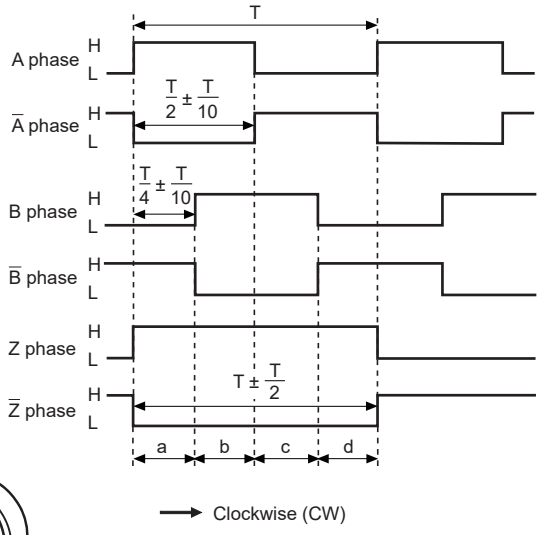
■ Output Waveforms

◎ Complemental output



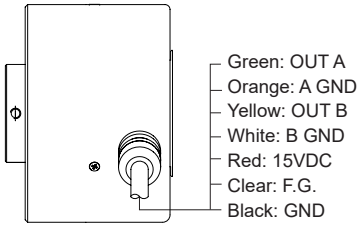
Note	Standard error
a+b+c+d	T (1 cycle of A, B phase)
a+b, c+d	$\frac{T}{2} \pm \frac{T}{10}$
a, b, c, d	$\frac{T}{4} \pm \frac{T}{10}$

◎ Line driver output

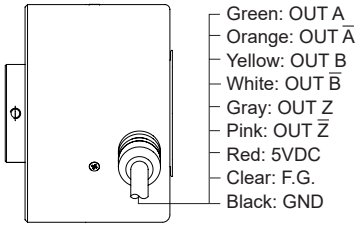


■ Connections

◎ Complemental output



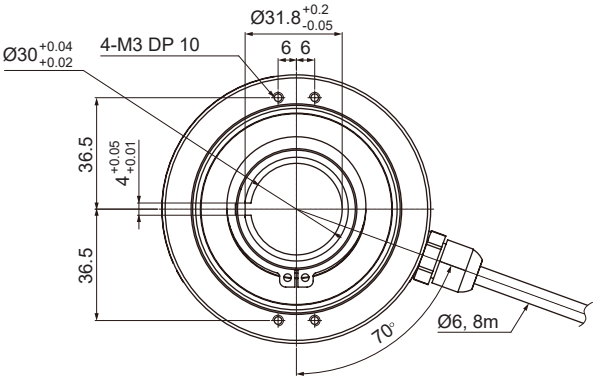
◎ Line driver output

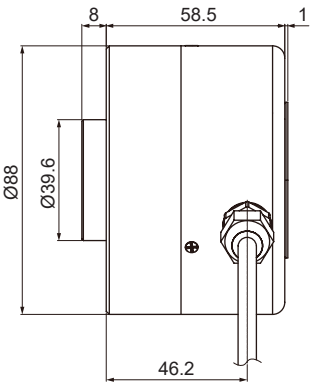


※Unused wires must be insulated.
※The metal case and shield cable of encoder should be grounded (F.G.).
※The output circuit has the dedicated IC and be sure not to short-circuit when wiring the output cables.
※Do not apply tensile strength over 30N to the cable.

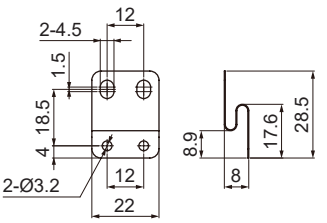
▣ Dimensions

(unit: mm)





◎ Bracket



※Fix the unit by a wrench under 0.15N·m of torque.

Hollow Shaft Type Ø100mm Incremental Rotary Encoder

■ Features

- Great environmental resistance
- High stability of output
- Exclusive for Elevator

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

CE

■ Ordering Information

E100H — **35** — **10000** — **6** — **L** — **5**

Series	Shaft diameter	Pulses/revolution	Output phase	Control output	Power supply
Ø100mm, hollow shaft type	Ø35mm	512, 1024, 10000	3: A, B, Z 6: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$	T: Totem pole output N: NPN open collector output V: Voltage output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%

■ Specifications

Item			Hollow Shaft Type Ø100mm Incremental Rotary Encoder
Resolution (PPR)※1			512, 1024, 10000
Electrical specification	Output phase		A, B, Z phase (line driver output A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4}\pm\frac{T}{8}$ (T=1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA, output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
		NPN open collector output	Load current: max. 30mA, residual voltage: max. 0.4VDC⎓
		Voltage output	Load current: max. 10mA, residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, output voltage (power voltage 5VDC⎓): min. 2.5VDC⎓, output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0)VDC⎓
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 2m, I sink = 20mA)
		NPN open collector output	
		Voltage output	
		Line driver output	Max. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency		300kHz
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 80mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Radial connector type
Mechanical specification	Starting torque		Max. 300gf·cm (0.03N·m)
	Moment of inertia		Max. 800g·cm^2 (8×10^{-5} kg·m^2)
	Shaft loading		Radial: max. 5kgf, Thrust: max. 2.5kgf
	Max. allowable revolution※2		3,600rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø5mm, 5-wire (line driver output: Ø6mm, 8-wire), 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory			Bracket: 2
Approval			CE (except for line driver output)
Weight※3			Approx. 1400g (approx. 1130g)

※1: Not indicated resolutions are customizable.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

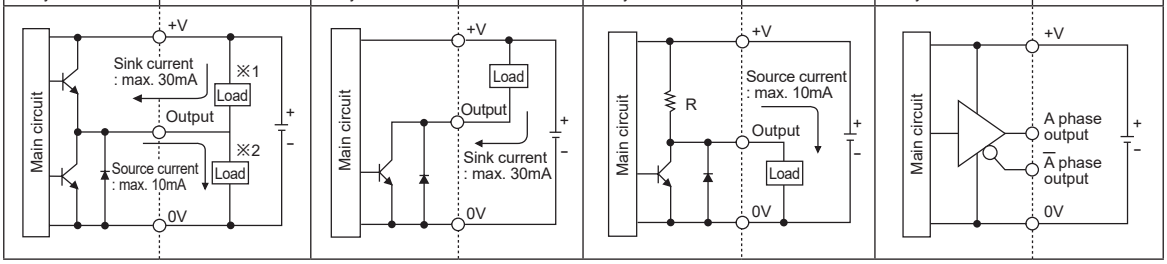
[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※3: The weight includes packaging. The weight in parenthesis is for unit only.

※Environment resistance is rated at no freezing or condensation.

▣ Control Output Diagram

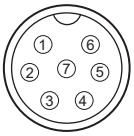
Totem pole output		NPN open collector output		Voltage output		Line driver output	
Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection	Rotary encoder circuit	Load Connection



- Totem pole output type can be used for NPN open collector output type (※1) or Voltage output type (※2).
- All output circuits of A, B, Z phase are same. (line driver output is A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)

▣ Connections

◎ Totem pole output / NPN open collector output / Voltage output



SCN-16-7P

Pin No.	Function	Cable color
①	+V	Brown
②	GND	Blue
③	OUT A	Black
④	OUT B	White
⑤	OUT Z	Orange
⑥	F.G.	Shield
⑦	N·C	N.C

◎ Line driver output

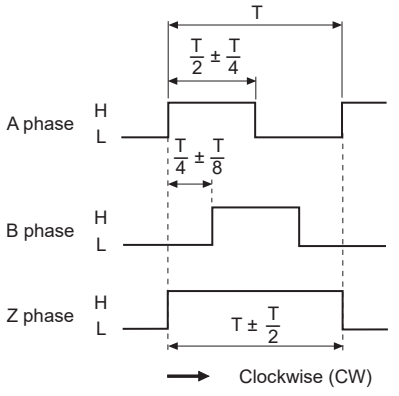
SCN-20-10P

Pin No.	Function	Cable color
①	+V	Brown
②	GND	Blue
③	OUT A	Black
④	OUT $\overline{A}$	Red
⑤	F.G.	Shield
⑥	OUT B	White
⑦	OUT $\overline{B}$	Gray
⑧	OUT Z	Orange
⑨	OUT $\overline{Z}$	Yellow
⑩	N·C	N·C

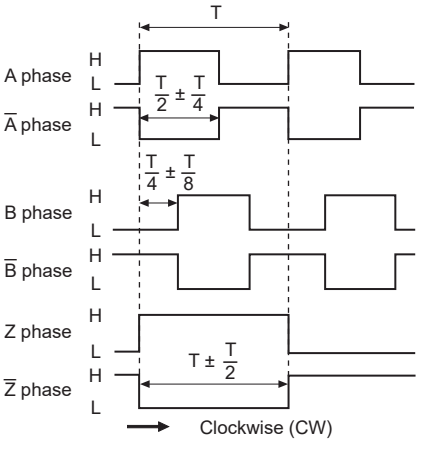
※N·C (not connected)
※Unused wires must be insulated.
※The metal case and shield cable should be grounded (F.G.).
※Do not apply tensile strength over 30N to the cable.

▣ Output Waveform

◎ Totem pole output / NPN open collector output / Voltage output

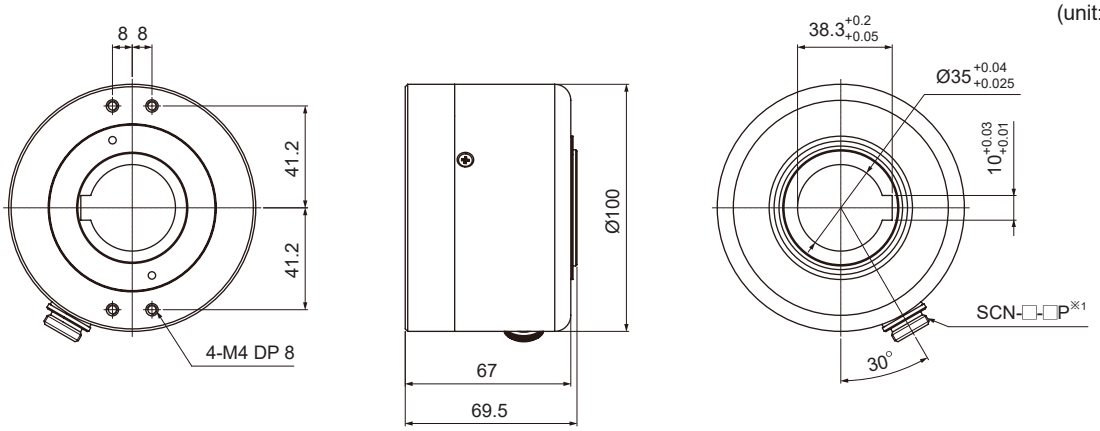


◎ Line driver output



▣ Dimensions

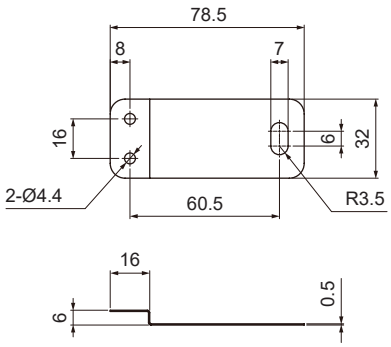
(unit: mm)



※1

Control output	Connector
Totem pole output	SCN-16-7P
NPN open collector output	
Voltage output	
Line driver output	SCN-20-10P

◎ Bracket



※Fix the unit or a coupling by a wrench under 0.15N·m of torque.

Manual Handle Type Incremental Rotary Encoder

■ Features

- Suitable for manual pulse input type such as numerically controlled or milling machinery
- Terminal connection type
- Power supply: 5VDC ±5%, 12-24VDC ±5%

■ Applications

- Industrial tooling machinery

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

CE

■ Ordering Information

ENH – 100 – 1 – T – 24

Series	Pulses/revolution	Clickstopper position	Control output	Power supply
Handle type	25, 100	1: Normal "H" 2: Normal "L"	T: Totem pole output V: Voltage output L: Line driver output (※)	5: 5VDC ±5% 24: 12-24VDC ±5%

※The power of Line driver is only for 5VDC.

■ Specifications

Item			Manual Handle Type Incremental Rotary Encoder
Resolution (PPR)※1			25,100
Electrical specification	Output phase		A, B phase (line driver output A, $\overline{A}$, B, $\overline{B}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T= 1 cycle of A phase)
	Control output	Totem pole output	• [Low] - Load current: max. 30mA, Residual voltage: max. 0.4VDC⎓ • [High] - Load current: max. 10mA Output voltage (power voltage 5VDC⎓): min. (power voltage-2.0)VDC⎓, Output voltage (power voltage 12-24VDC⎓): min. (power voltage-3.0) VDC⎓
		Voltage output	Load current: max. 10mA, Residual voltage: max. 0.4VDC⎓
		Line driver output	• [Low] - Load current: max. 20mA, Residual voltage: max. 0.5VDC⎓ • [High] - Load current: max. -20mA, Output voltage: min. 2.5VDC⎓
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 1m, I sink = 20mA)
		Voltage output	
		Line driver output	Max. 0.2μs (cable length: 1m, I sink = 20mA)
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max.5%) • 12-24VDC⎓ ±5% (ripple P-P: max.5%)
	Current consumption		Max. 40mA (disconnection of the load), Line driver output: max. 50mA (disconnection of the load)
	Max. response frequency		10kHz
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		Terminal block type
Mechanical specification	Starting torque		Max. 1kgf·cm (0.098N·m)
	Shaft loading		Radial: max. 2kgf, Thrust: max. 1kgf
	Max. allowable revolution※2		Max. 200rpm (normal), 600rpm (peak)
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90℃
Protection structure			IP50 (IEC standard)
Approval			CE (except for line driver output)
Weight※3			Approx. 330g (approx. 260g)

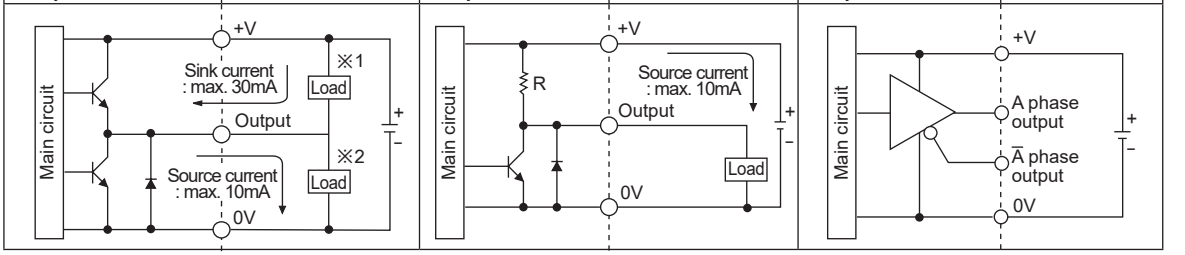
※1: Not indicated resolutions are customizable.
※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Control Output Diagram

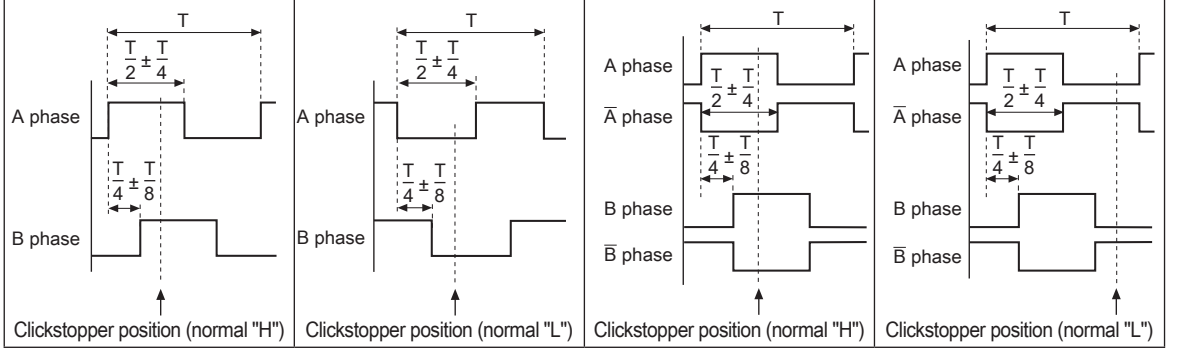
Totem pole output		Voltage output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



- The output circuits for A, B phase (line driver output is A, Ā, B, B̄ phase) are same.
- Totem pole output can be used for NPN open collector type (※1) or voltage output type (※2).

▣ Output Waveform

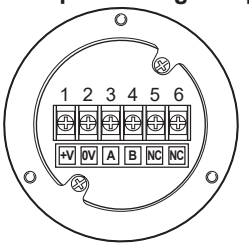
ENH- ☐ -1-T-5, 24 ENH- ☐ -1-V-5, 24	ENH- ☐ -2-T-5, 24 ENH- ☐ -2-V-5, 24	ENH- ☐ -1-L-5	ENH- ☐ -2-L-5



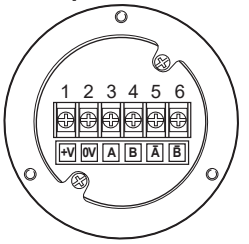
※Clickstopper position Normal "H" or Normal "L": It shows the waveform when the handle is stopped.

▣ Connections

●Totem pole output / Voltage output



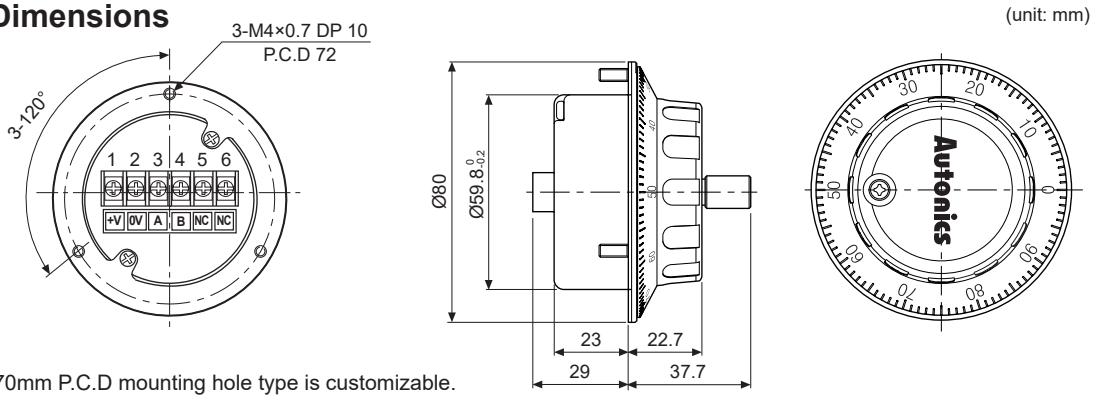
●Line driver output



※Do not use terminal No. 5, 6.

▣ Dimensions

(unit: mm)



※Ø70mm P.C.D mounting hole type is customizable.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.

Portable, Handle Type Incremental Rotary Encoder

▣ Features

- Suitable for manual pulse input type such as numerically controlled or milling machinery
- Emergency stop switch, enable switch is available
- 6-axis, 4-rate select switches

▣ Application

- Industrial tooling machinery

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

▣ Ordering Information

ENHP — 100 — 1 — L — 5

Series	Pulses/revolution	Clickstopper position	Control output	Power supply
Portable handle type	100	1: Normal "H" 2: Normal "L"	T: Totem pole output L: Line driver output	5: 5VDC ±5% 24: 12-24VDC ±5%

※Line driver power is only 5VDC.

▣ Specifications

Item			Portable, Handle Type Incremental Rotary Encoder
Resolution (PPR)※1			100
Electrical specification	Output phase		A, B phase (line driver output A, $\overline{A}$, B, $\overline{B}$ phase)
	Phase difference of output		Phase difference between A and B: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)
	Rotary switch output		BCD Code output • Axis select switch (OFF, X, Y, Z, A, B) • Rate select switch (R1, R2, R3, R4)
	Control output	Totem pole output	• [Low] - Load current: Max. 30mA, Residual voltage: Max. 0.4VDC • [High] - Load current: Max. 10mA, Output voltage (power voltage 5VDC): Min. (power voltage-2.0)VDC Output voltage (power voltage 12-24VDC): Min. (power voltage-3.0)VDC
		Line driver output	• [Low] - Load current: Max. 20mA, Residual voltage: Max. 0.5VDC • [High] - Load current: Max. -20mA, Output voltage: Min. 2.5VDC
	Response time (rise/fall)	Totem pole output	Max. 1μs (cable length: 1m, I sink = 20mA)
		Line driver output	Max. 0.5μs (cable length: 1m, I sink = 20mA)
	Power supply		• 5VDC ±5% (ripple P-P: max. 5%) • 12-24VDC ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 40mA (disconnection of the load), Line driver output: Max. 50mA (disconnection of the load)
	Max. response frequency		10kHz
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
	Connection		25Pin D-SUB of connector type
Mechanical specification		Starting torque	Max. 1kgf·cm (0.098N·m)
		Shaft loading	Radial: 2kgf, Thrust: 1kgf
		Max. allowable revolution ※2	Max. 200rpm (normal), 600rpm (peak)
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment		Ambient temperature	-10 to 70℃, storage: -25 to 85℃
		Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure※3			IP67 (IEC standard) for Box
Cable			Ø5mm, 18-wire, 8m, Spring code cable (AWG28, core diameter: 0.08mm, number of cores: 18, insulator out diameter: Ø0.7mm)
Unit weight			Approx. 730g

※1: Not indicated resolutions are customizable.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

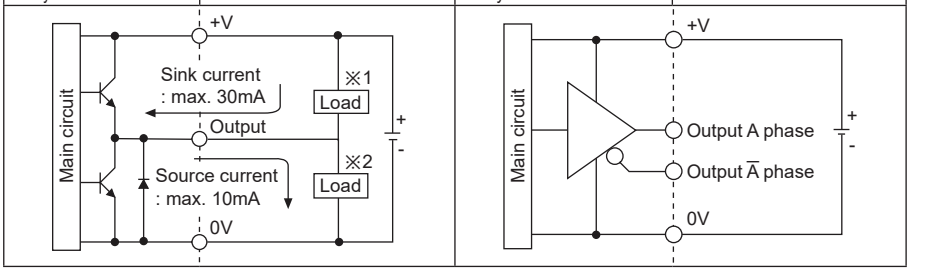
[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

※3: It is protection for the rear case and the wiring part.

※Environment resistance is rated at no freezing or condensation.

▣ Control Output Diagram

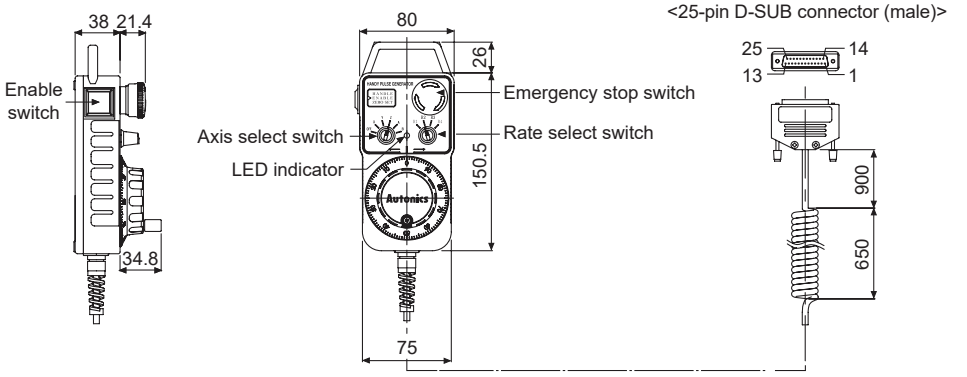
Totem pole output		Line driver output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection



※The output circuits of A, B phase (line driver output A, Ā, B, B̄ phase) are same.
※Totem pole output type can be used for NPN open collector output type **(※1)** or voltage output type **(※2)**.

▣ Dimensions

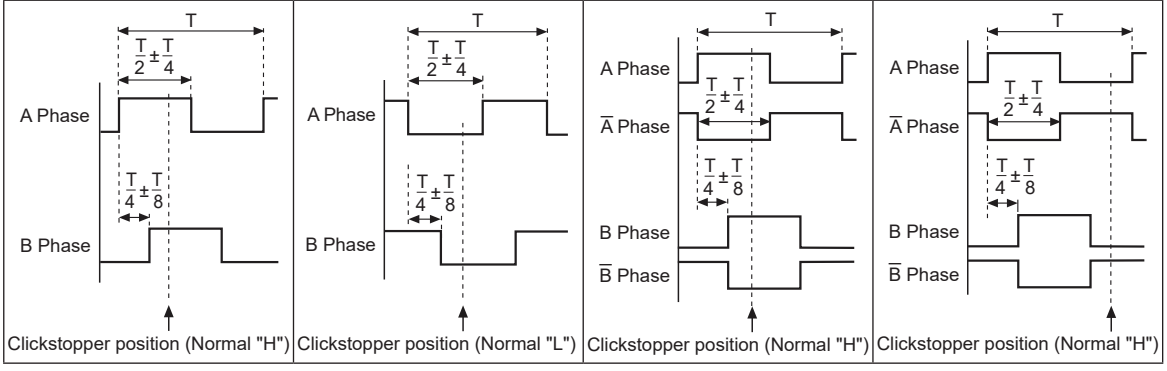
(unit: mm)



※Fix the unit or a coupling by a wrench under 0.15N·m of torque.

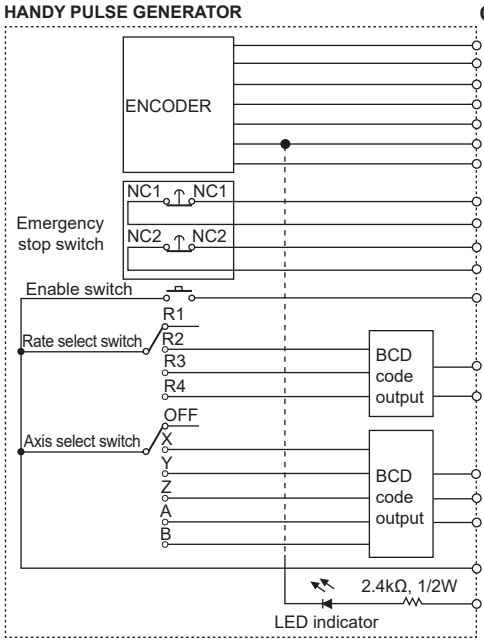
▣ Output Waveform

ENHP-100-1-T-□	ENHP-100-2-T-□	ENHP-100-1-L-5	ENHP-100-2-L-5



※Clickstopper position Normal "H" or Normal "L": It shows the waveform when the handles is stopped.
※Encoder revolution direction: It is clockwise (CW) from the dial.

▣ Connections



COLOR	SIGNAL	24P CONNECTOR (PIN NO.)
SHIELD	F.G.	
YELLOW	OUT A	1
LT.VIOLET	OUT $\overline{A}$ ※1	2
WHITE	OUT B	3
CLEAR	OUT $\overline{B}$ ※2	4
BLACK	0V	5
RED	+V	6
GREEN	E-STOP1	8
LT.GREEN	E-STOP1	9
PINK	E-STOP2	22
GRASS GREEN	E-STOP2	24
VIOLET	ENABLE	10
BROWN	FEED RATE	11
LT.BROWN	SELECT	12
ORANGE	AXIS SELECT	13
LT.BLUE		14
BLUE		15
LT.YELLOW	BCD COMMON	16
GRAY	LED (+)	18

● AXIS SELECT

Axis	BCD code output		
	Pin No.15	Pin No.14	Pin No.13
OFF	0	0	0
X axis	0	0	1
Y axis	0	1	0
Z axis	0	1	1
A axis	1	0	0
B axis	1	0	1

● RATE SELECT

Rate	BCD code output	
	Pin No.12	Pin No.11
R1	0	0
R2	0	1
R3	1	0
R4	1	1

※1: Totem pole output does not have $\overline{A}$, $\overline{B}$ output signal.
※COMMON terminal (pin no. 16) of Axis select switch and Rate select switch are common.

Shaft Type Ø50mm Single-turn Absolute Rotary Encoder

■ Features

- Compact size of external diameter: Ø50mm
- Various output code: BCD, Binary, Gray code
- Various and high resolution (720, 1024-division)
- Protection structure IP64 (dust-proof, oil-proof)

■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

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

CE

■ Ordering Information

EP50S | **8** | – | **1024** | – | **1** | **R** | – | **P** | – | **24**

Series	Shaft diameter	Pulses/revolution	Output code	Revolution direction	Control output	Power supply
Ø50mm shaft type	Ø8mm	Refer to resolution	1: BCD code 2: Binary code 3: Gray code	F: Output increases by CW rotation direction at the shaft R: Output increases by CCW rotation direction at the shaft	P: PNP open collector output N: NPN open collector output	5 : 5VDC±5% 24: 12-24VDC ±5%

■ Specifications

Item			Shaft Type Ø50mm Single-turn Absolute Rotary Encoder
Model	PNP open collector output		EP50S8-□-□□-P-□
	NPN open collector output		EP50S8-□-□□-N-□
Resolution			6, 8, 10, 12, 16, 20, 24, 32, 40, 45, 48, 64, 90, 128, 180, 256, 360, 512, 720, 1024-division
Electrical specification	Control output	PNP open collector output	Output voltage: min. (power supply-1.5)VDC⎓, load current: max. 32mA
		NPN open collector output	Load current: max. 32mA, residual voltage: max. 1VDC⎓
	Response time (rise, fall)		Ton=800nsec, Toff=max. 800nsec (cable: 2m, I sink = 32mA)
	Max. response frequency		35kHz
	Power supply		• 5VDC⎓±5% (ripple P-P: max. 5%) • 12-24VDC⎓±5% (ripple P-P: max. 5%)
	Current consumption		Max. 100mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 min (between all terminals and case)
	Connection		Axial cable type (cable gland)
Mechanical specification	Starting torque		Max. 70gf·cm (0.0069N·m)
	Moment of inertia		Max. 40g·cm² (4×10⁻⁶kg·m²)
	Shaft loading		Radial: max. 10kgf, Thrust: max. 2.5kgf
	Max. allowable revolution※1		3,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 50G
Environment	Ambient temp.		-10 to 70℃, storage: -25 to 85℃
	Ambient humi.		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP64 (IEC standard)
Cable			Ø7mm, 15-wire, 2m, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 40, insulator diameter: Ø0.8mm)
Accessory			Bracket, Coupling
Approval			CE
Weight※2			Approx. 482g (approx. 398g)

※1: In case of Parallel type model, Make sure that Max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60\ \text{sec}]$$

※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Specifications

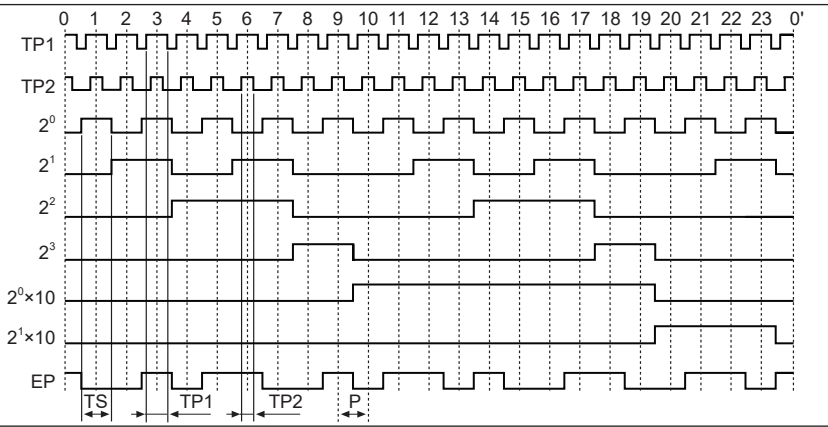
Item		Shaft Type Ø50mm Single-turn Absolute Rotary Encoder			
Model	PNP open collector output	EP50S8-□□-□□-P-□			
	NPN open collector output	EP50S8-□□-□□-N-□			
Output code		Division	BCD code	Binary code	Gray code
Output phase / Output angle※1		1024	TS: 0.3515° ±15'(13bit)	TS: 0.3515° ±15'(10bit)	TS: 0.703° ±15'(10bit)
		720	TS: 0.5° ±25'(11bit)	TS: 0.5° ±25'(10bit)	TS: 1° ±25'(10bit)
		512	TS: 0.703° ±15'(11bit)	TS: 0.703° ±15'(9bit)	TS: 1.406° ±15'(9bit)
		360	TS: 1° ±25'(10bit)	TS: 1° ±25'(9bit)	TS: 2° ±25'(9bit)
		256	TS: 1.406° ±15'(10bit)	TS: 1.406° ±15'(8bit)	TS: 2.8125° ±15'(8bit)
		180	TS: 2° ±25'(9bit)	TS: 2° ±25'(8bit)	TS: 4° ±25'(8bit)
		128	TS: 2.8125° ±15'(9bit)	TS: 2.8125° ±15'(7bit)	TS: 5.625° ±15'(7bit)
		90	TS: 4° ±25'(8bit)	TS: 4° ±25'(7bit)	TS: 8° ±25'(7bit)
		64	TS: 5.625° ±15'(7bit)	TS: 5.625° ±15'(6bit)	TS: 11.25° ±15'(6bit)
		48	TS: 7.5° ±25'(7bit)	TS: 7.5° ±25'(6bit)	TS: 15° ±25'(6bit)
		45	TS: 8° ±25'(7bit)	TS: 8° ±25'(6bit)	TS: 16° ±25'(6bit)
		40	TP1: 5° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 9° ±60'(6bit) EP: 9° ±60'(1bit)	TP1: 5° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 9° ±60'(6bit) EP: 9° ±60'(1bit)	TP1: 5° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 18° ±60'(6bit) EP: 9° ±60'(1bit)
		32	TP1: 7° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 11.25° ±60'(6bit) EP: 11.25° ±60'(1bit)	TP1: 7° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 11.25° ±60'(5bit) EP: 11.25° ±60'(1bit)	TP1: 7° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 22.5° ±60'(5bit) EP: 11.25° ±60'(1bit)
		24	TP1: 8° ±60'(1bit) TP2: 3° ±60'(1bit) TS: 15° ±60'(6bit) EP: 15° ±60'(1bit)	TP1: 8° ±60'(1bit) TP2: 3° ±60'(1bit) TS: 15° ±60'(5bit) EP: 15° ±60'(1bit)	TP1: 8° ±60'(1bit) TP2: 3° ±60'(1bit) TS: 30° ±60'(5bit) EP: 15° ±60'(1bit)
		20	TP1: 12° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 18° ±60'(5bit) EP: 18° ±60'(1bit)	TP1: 12° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 18° ±60'(5bit) EP: 18° ±60'(1bit)	TP1: 12° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 36° ±60'(5bit) EP: 18° ±60'(1bit)
		16	TP1: 15° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 22.5° ±60'(5bit) EP: 22.5° ±60'(1bit)	TP1: 15° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 22.5° ±60'(4bit) EP: 22.5° ±60'(1bit)	TP1: 15° ±60'(1bit) TP2: 2° ±60'(1bit) TS: 45° ±60'(4bit) EP: 22.5° ±60'(1bit)
		12	TP1: 15° ±60'(1bit) TP2: 3° ±60'(1bit) TS: 30° ±60'(5bit) EP: 30° ±60'(1bit)	TP1: 15° ±60'(1bit) TP2: 3° ±60'(1bit) TS: 30° ±60'(4bit) EP: 30° ±60'(1bit)	TP1: 15° ±60'(1bit) TP2: 3° ±60'(1bit) TS: 60° ±60'(4bit) EP: 30° ±60'(1bit)
		10	TP1: 30° ±60'(1bit) TP2: 12° ±60'(1bit) TS: 36° ±60'(4bit) EP: 36° ±60'(1bit)	TP1: 30° ±60'(1bit) TP2: 12° ±60'(1bit) TS: 36° ±60'(4bit) EP: 36° ±60'(1bit)	TP1: 30° ±60'(1bit) TP2: 12° ±60'(1bit) TS: 72° ±60'(4bit) EP: 36° ±60'(1bit)
		8	TP1: 39° ±60'(1bit) TP2: 15° ±60'(1bit) TS: 45° ±60'(3bit) EP: 45° ±60'(1bit)	TP1: 39° ±60'(1bit) TP2: 15° ±60'(1bit) TS: 45° ±60'(3bit) EP: 45° ±60'(1bit)	TP1: 39° ±60'(1bit) TP2: 15° ±60'(1bit) TS: 90° ±60'(3bit) EP: 45° ±60'(1bit)
		6	TP1: 53° ±60'(1bit) TP2: 15° ±60'(1bit) TS: 60° ±60'(3bit) EP: 60° ±60'(1bit)	TP1: 53° ±60'(1bit) TP2: 15° ±60'(1bit) TS: 60° ±60'(3bit) EP: 60° ±60'(1bit)	TP1: 53° ±60'(1bit) TP2: 15° ±60'(1bit) TS: 120° ±60'(3bit) EP: 60° ±60'(1bit)

※1: TS=Signal Pulse, TP=Timing Pulse, EP=Even Parity

▣ Output Waveform

◎ 24-division (BCD code output)

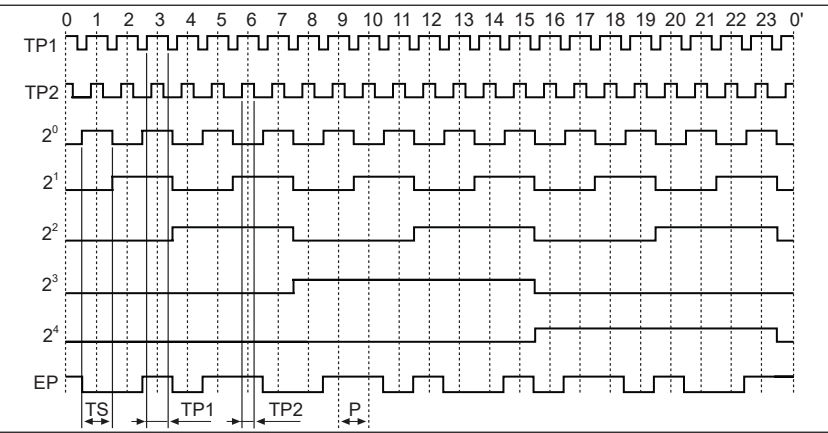
Model	EP50S8-24-1 ☐ - ☐ - ☐



※TP1=8°±60', TP2=3°±60', TS=15°±60', P=15°±60'
※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

◎ 24-division (Binary code output)

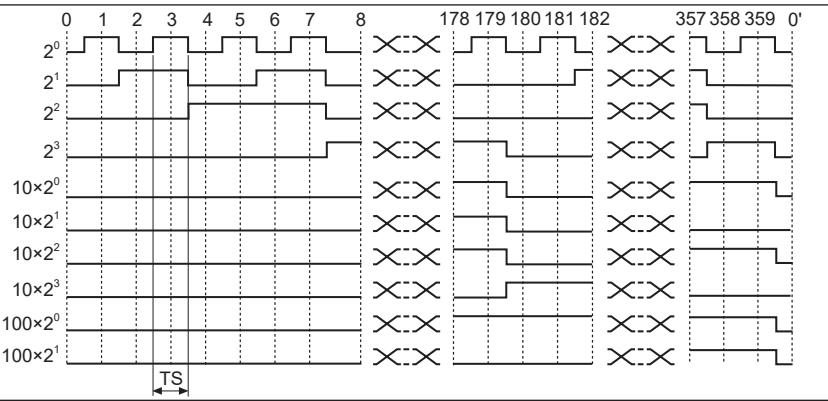
Model	EP50S8-24-2 ☐ - ☐ - ☐



※TP1=8°±60', TP2=3°±60', TS=15°±60', P=15°±60'
※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

● 360-division (BCD code output)

Model	EP50S8-360-1☐-P-☐

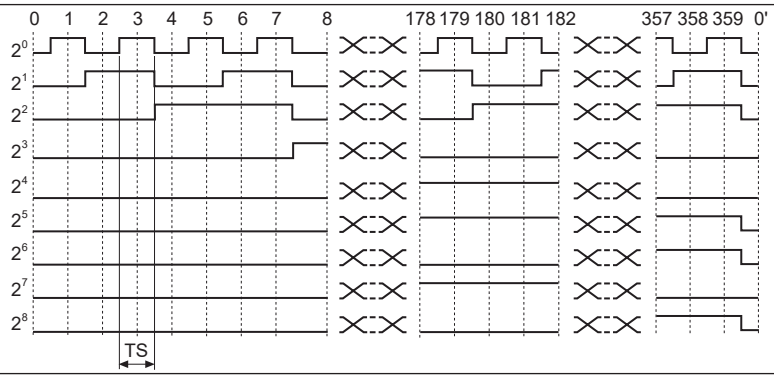


※TS=1°±25'
※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

▣ Output Waveform

◎ 360-division (Binary code output)

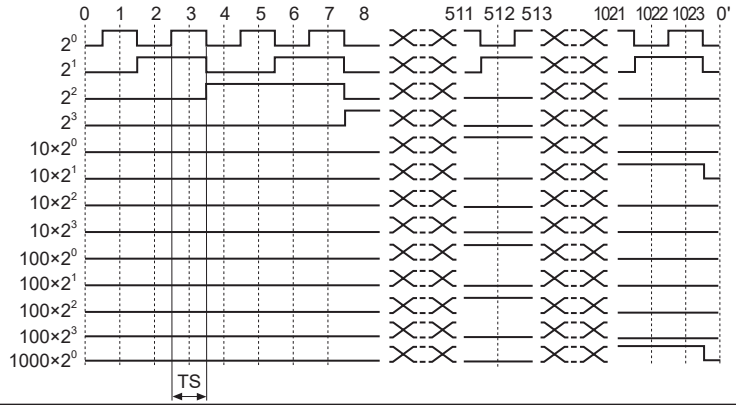
Model	EP50S8-360-2□-P-□



※TS=1°±25'
※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

◎ 1024-division (BCD code output)

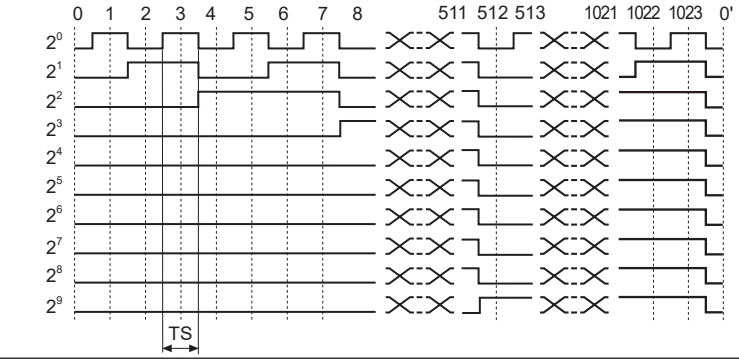
Model	EP50S8-1024-1□-□-□



※TS=0.3515°±15'
※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

◎ 1024-division (Binary code output)

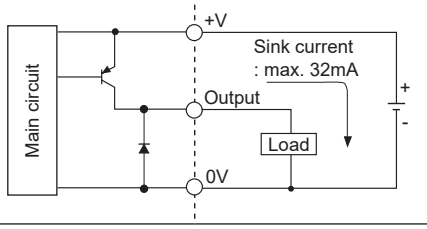
Model	EP50S8-1024-2□-P-□



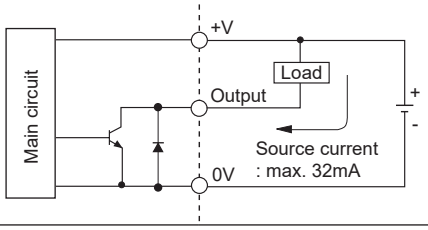
※TS=0.3515°±15'
※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

■ Control Output Circuit

PNP open collector output	
Rotary encoder circuit	Load connection



NPN open collector output	
Rotary encoder circuit	Load connection



※Each bit of output has the same circuit.
※Please be aware of the fact that overload and short circuit may cause circuit break.

■ Connections

◎ BCD code

Color \ Resolution		6	8	10	12	16	20	24	32	40	45	48	64	90	128	180	256	360	512	720	1024
Power	White	+V																			
	Black	0V																			
Output wire	Brown	2^0																			
	Red	2^1																			
	Orange	2^2																			
	Yellow	N·C		2^3																	
	Blue	N·C				$2^0\times10$															
	Purple	N·C						$2^1\times10$													
	Gray	N·C								$2^2\times10$											
	White/Brown	TP1									N·C		$2^3\times10$								
	White/Red	TP2									N·C			$2^0\times100$							
	White/Orange	EP									N·C				$2^1\times100$						
	White/Yellow	N·C																	$2^2\times100$		
	White/Blue	N·C																		$2^3\times100$	
	White/Purple	N·C																			$2^0\times1000$
	Shield wire	Signal shield cable (F.G.)																			

※Unused wires must be insulated.
※Encoder metal case and shield cable must be grounded (F.G.).
※N·C (not connected)
※Please use caution to avoid short circuit when connecting output cables because I/O circuit uses the dedicated driver IC.
※Do not apply tensile strength over 30N to the cable.

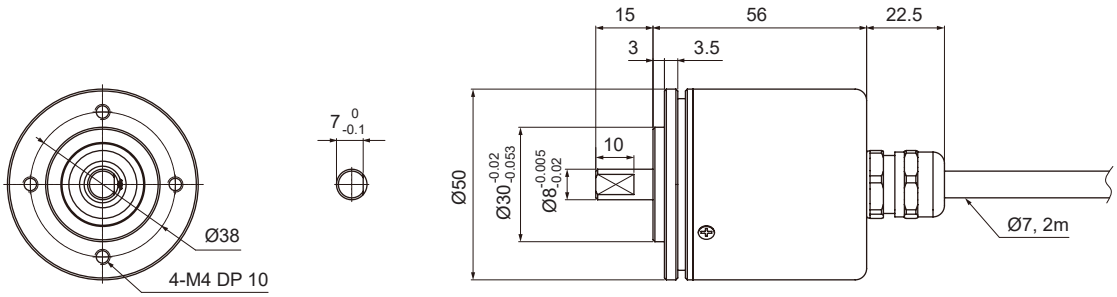
◎ Binary code/Gray code

Color \ Resolution		6	8	10	12	16	20	24	32	40	45	48	64	90	128	180	256	360	512	720	1024
Power	White	+V																			
	Black	0V																			
Output wire	Brown	2^0																			
	Red	2^1																			
	Orange	2^2																			
	Yellow	N·C		2^3																	
	Blue	N·C				2^4															
	Purple	N·C						2^5													
	Gray	N·C								2^6											
	White/Brown	TP1									N·C		2^7								
	White/Red	TP2									N·C			2^8							
	White/Orange	EP									N·C				2^9						
	Shield wire	Signal shield cable (F.G.)																			

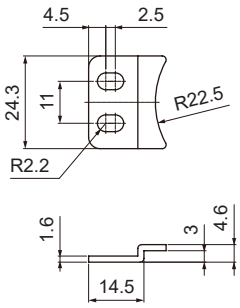
※Unused wires must be insulated.
※Encoder metal case and shield cable must be grounded (F.G.).
※N·C (not connected)
※Please use caution to avoid short circuit when connecting output cables because I/O circuit uses the dedicated driver IC.
※Do not apply tensile strength over 30N to the cable.

▣ Dimensions

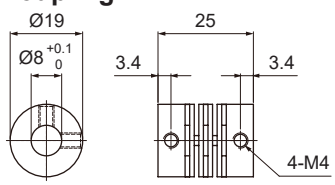
(unit: mm)



◎ Bracket



◎ Coupling



- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

Shaft Type Ø50mm Plastic case, Single-turn Absolute Rotary Encoder

■ Features

- Light as plastic structure
- Power supply: 5VDC, 12-24VDC ±5%
- Shift gray code output

■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

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

■ Ordering Information

EP50S **6** **P** – **360** – **3** **F** – **N** – **24**

Series	Shaft diameter	Outer material	Steps/revolution	Output code	Revolution direction	Control output	Power supply
Ø50mm shaft type	6: Ø6mm 8: Ø8mm	Plastic	180, 360	3: Shift gray code	F: Output value increases at CW direction R: Output value increase at CCW direction	N: NPN open collector output	5: 5VDC ±5% 24: 12-24VDC ±5%

■ Specifications

Item		Shaft Type Ø50mm Single-turn Absolute Rotary Encoder
Resolution		180, 360-division
Electrical specification	Output code	Gray code (shift gray code)
	Output phase / Output angle	TS: Signal Pulse (9-bit), TS: 2°±25'
	Control output	NPN open collector output - Load current: Max. 15mA, Residual voltage: Max. 1VDC
	Response time (rise/fall)	Ton=Max. 1μs, Toff=Max. 1μs (cable length: 2m, I sink = 15mA)
	Max. response frequency	20kHz
	Power supply	• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption	Max. 80mA (disconnection of the load)
	Connection	Axial cable type (cable gland)
Mechanical specification	Starting torque	Max. 40gf·cm (0.004N·m)
	Moment of inertia	Max. 50g·cm² (5×10⁻⁶kg·m²)
	Shaft loading	Radial: 2kgf, Thrust: 1kgf
	Max. allowable revolution※1	3,000rpm
Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		Approx. max. 50G
Environment	Ambient temperature	-10 to 55℃, storage: -25 to 85℃
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH
Protection structure		IP50 (IEC standard)
Cable		Ø6mm, 12-wire, 2m, Shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)
Accessory		Fixing bracket, Coupling
Weight※2		Approx. 308g (approx. 280g)

※1: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

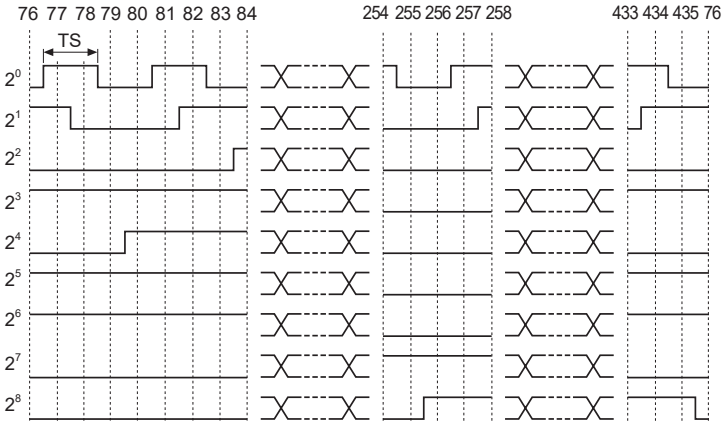
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

Plastic case, Absolute Ø50mm Single-turn Shaft Type

■ Output Waveform

◎ 360-division

Model	EP50S□P-360-3F-N

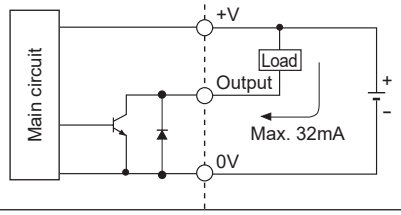


※TS=2°±25'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

■ Control Output Diagram

NPN open collector output

Rotary encoder circuit	Load connection



※Be sure that if overload or short-circuit to output terminal, output circuit is damaged.

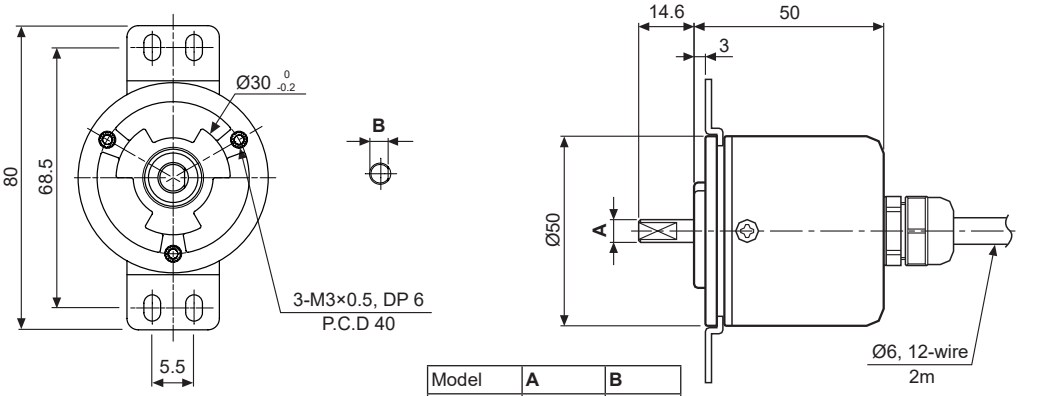
■ Connections

Color \ Resolution		360-division
Power	White	+V (5VDC, 12-24VDC)
	Black	0V (GND)
Output wire	Brown	2^0
	Red	2^1
	Orange	2^2
	Yellow	2^3
	Blue	2^4
	Purple	2^5
	Gray	2^6
	White/Brown	2^7
	White/Red	2^8
	White/Orange	N·C
	Shield wire	F.G.

※Do not apply tensile strength over 30N to the cable.

▣ Dimensions

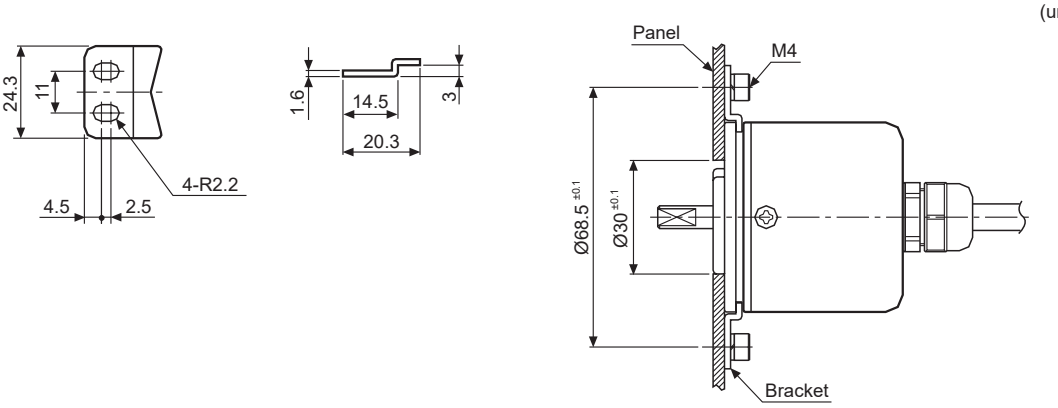
(unit: mm)



Model	A	B
E50S6P	Ø6 -0.013 -0.007	5
E50S8P	Ø8 -0.015 -0.01	7

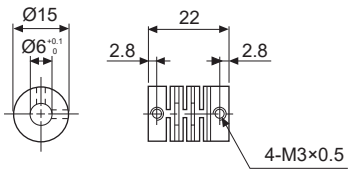
◎ Bracket

(unit: mm)

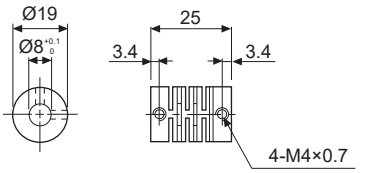


◎ Coupling

● Ø6mm coupling



● Ø8mm coupling



- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

Shaft Type/Blind Hollow Shaft Type Ø58mm Single-turn Absolute Rotary Encoder

■ Features

- Ø58mm flange type
- Applicable to various mounting environments
- Various output code: BCD, Binary, Gray code (customizable)
- Various and high resolution (720, 1024-division)

■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

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

CE

■ Ordering Information

EP58SC **10** – **1024** – **1** **R** – **P** – **24**

Series Ø58mm	Shaft diameter			Pulses/ revolution	Output code	Rotating direction	Control output	Power supply
SC: Shaft clamping	External	10	Ø10mm	Refer to resolution	1: BCD code 2: Binary code 3: Gray code	F: Output value increases at CW direction R: Output value increases at CCW direction	P: PNP open collector output N: NPN open collector output	5: 5VDC ±5% 24: 12-24VDC ±5%
SS: Shaft synchro		6	Ø6mm					
HB: Blind hollow shaft	Inner	8	Ø8mm					

■ Specifications

Type			Shaft Type/Blind Hollow Shaft Type Ø58mm Single-turn Absolute Rotary Encoder							
Resolution			720, 360, 180, 90, 45-division				1024, 512, 256, 128, 64-division			
Electrical specification	Output code		Division	BCD code	Binary code	Gray code	Division	BCD code	Binary code	Gray code
	Output phase/ Output angle※1		720	TS: 0.5°±25' (11-bit)	TS: 0.5°±25' (10-bit)	TS: 1°±25' (10-bit)	1024	TS: 0.3515°±15' (13-bit)	TS: 0.3515°±15' (10-bit)	TS: 0.703°±15' (10-bit)
			360	TS: 1°±25' (10-bit)	TS: 1°±25' (9-bit)	TS: 2°±25' (9-bit)	512	TS: 0.703°±15' (11-bit)	TS: 0.703°±15' (9-bit)	TS: 1.406°±15' (9-bit)
			180	TS: 2°±25' (9-bit)	TS: 2°±25' (8-bit)	TS: 4°±25' (8-bit)	256	TS: 1.406°±15' (10-bit)	TS: 1.406°±15' (8-bit)	TS: 2.8125°±15' (8-bit)
			90	TS: 4°±25' (8-bit)	TS: 4°±25' (7-bit)	TS: 8°±25' (7-bit)	128	TS: 2.8125°±15' (9-bit)	TS: 2.8125°±15' (7-bit)	TS: 5.625°±15' (7-bit)
			45	TS: 8°±25' (7-bit)	TS: 8°±25' (6-bit)	TS: 16°±25' (6-bit)	64	TS: 5.625°±15' (7-bit)	TS: 5.625°±15' (6-bit)	TS: 11.25°±15' (6-bit)
	Control output	PNP open collector output	Output voltage: min. (power supply-1.5)VDC⎓, load current: max. 32mA							
		NPN open collector output	Load current: max. 32mA, residual voltage: max. 1VDC⎓							
	Response time (rise/fall)		Ton=800ns, Toff=Max. 800ns (cable: 2m, I sink = 32mA)							
	Max. response frequency		35kHz							
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)							
	Current consumption		Max. 100mA (disconnection of the load)							
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)							
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)							
	Connection		Axial cable type (cable gland)							
Mechanical specification	Starting torque		• SC/SS type: max. 40gf·cm (0.004N·m) • HB type: max. 90gf·cm (0.009N·m)							
	Moment of inertia		• SC/SS type: max. 15g·cm² (1.5×10⁻⁶kg·m²) • HB type: max. 20g·cm² (2.0×10⁻⁶kg·m²)							
	Shaft loading		• SC/SS type: radial: max. 10kgf, thrust: max. 2.5kgf • HB type: radial: max. 2kgf, thrust: max. 1kgf							
	Max. allowable revolution※2		3,000rpm							
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock			Approx. max. 50G							
Environment	Ambient temp.		-10 to 70℃, storage: -25 to 85℃							
	Ambient humi.		35 to 85%RH, storage: 35 to 90%RH							
Protection structure			IP50 (IEC standard)							
Cable			Ø7mm, 15-wire, 2m, Shield cable							
Accessories			Ø10mm (SC type)/Ø6mm (SS type) coupling, Fixing bracket							
Approval			CE							
Weight※3			• SC type: approx. 545g (approx. 435g) • SS type: approx. 525g (approx. 415g) • HB type: approx. 520g (approx. 410g)							

※1: TS=Signal Pulse ※Environment resistance is rated at no freezing or condensation.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

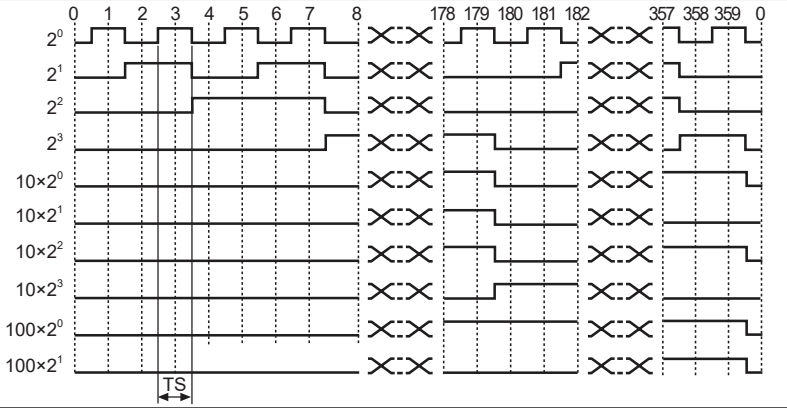
$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※3: The weight includes packaging. The weight in parenthesis is for unit only.

▣ Output Waveform

◎ 360-division (BCD code output)

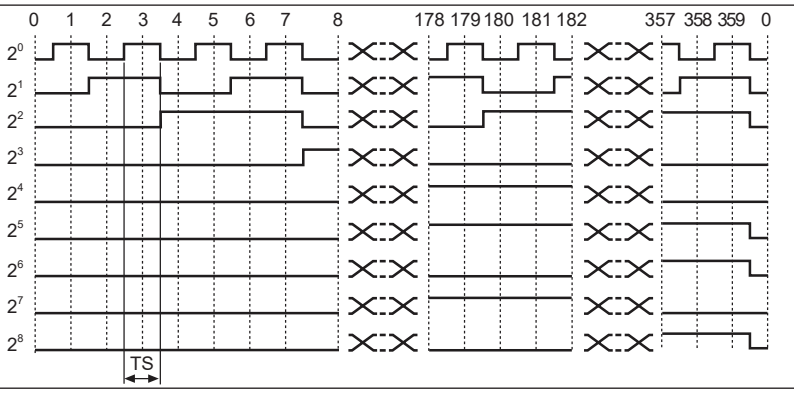
Model	EP58□□-360-1□-P-□



※TS=1°±25'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

◎ 360-division (Binary code output)

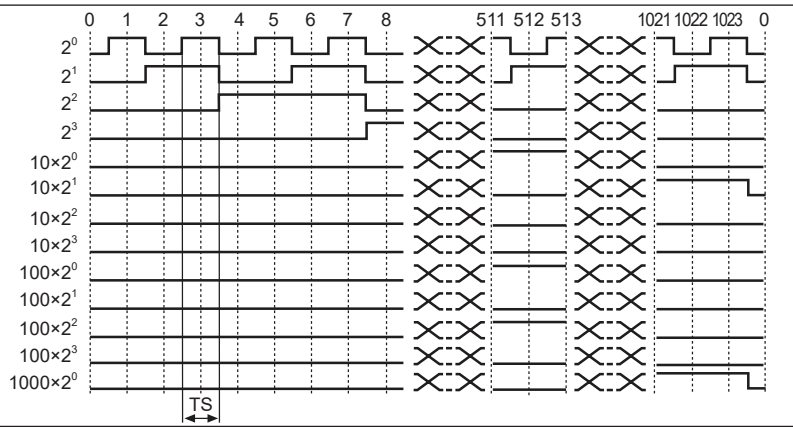
Model	EP58□□-360-2□-P-□



※TS=1°±25'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

◎ 1024-division (BCD code output)

Model	EP58□□-1024-1□-P-□

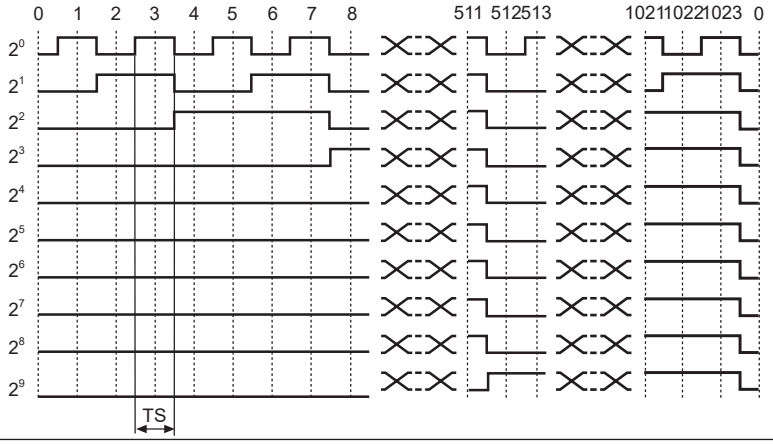


※TS=0.3515°±15'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

■ Output Waveform

◎ 1024-division (Binary code output)

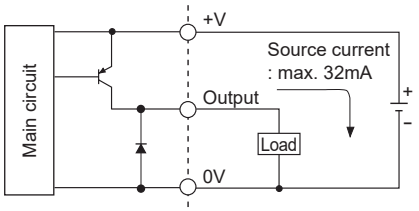
Model	EP58□□-1024-2□-P-□

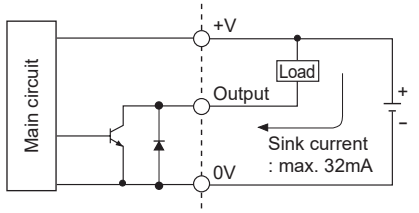


※TS=0.3515°±15'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to the above waveform.)

■ Control Output Diagram

PNP open collector output		NPN open collector output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection





※In case of overload or short on output terminal, it may cause output circuit break.

■ Connections

◎ BCD code

Color \ Resolution		45-division	64-division	90-division	128-division	180-division	256-division	360-division	512-division	720-division	1024-division
Power	White	+V									
	Black	GND (0V)									
Output wire	Brown	2^0									
	Red	2^1									
	Orange	2^2									
	Yellow	2^3									
	Blue	2^0×10									
	Purple	2^1×10									
	Gray	2^2×10									
	White/Brown	N·C	2^3×10								
	White/Red	N·C		2^0×100							
	White/Orange	N·C			2^1×100						
	White/Yellow	N·C						2^2×100			
	White/Blue	N·C									2^3×100
	White/Purple	N·C									2^0×1000
	Shield wire	F.G.									

◎ Binary code / Gray code

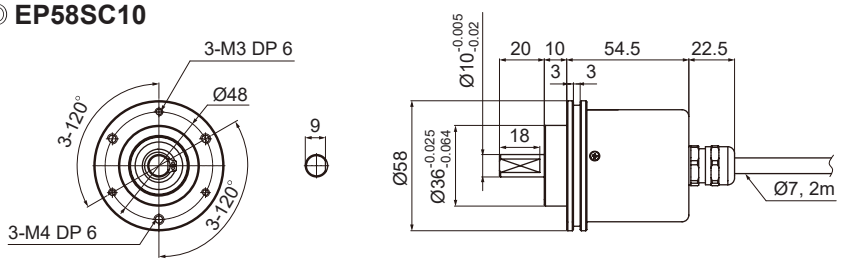
Color \ Resolution		45-division	64-division	90-division	128-division	180-division	256-division	360-division	512-division	720-division	1024-division
Power	White	+V									
	Black	GND (0V)									
Output wire	Brown	2^0									
	Red	2^1									
	Orange	2^2									
	Yellow	2^3									
	Blue	2^4									
	Purple	2^5									
	Gray	N·C	2^6								
	White/Brown	N·C		2^7							
	White/Red	N·C			2^8						
	White/Orange	N·C				2^9					
	White/Yellow	N·C									
	White/Blue	N·C									
	White/Purple	N·C									
	Shield wire	F.G.									

※Unused wires must be insulated.
※Encoder metal case and shield wire must be grounded (F.G.).
※N·C (not connected)
※Output cable must not be short-circuited, because Driver IC is used in output circuit.
※Do not apply tensile strength over 30N to the cable.

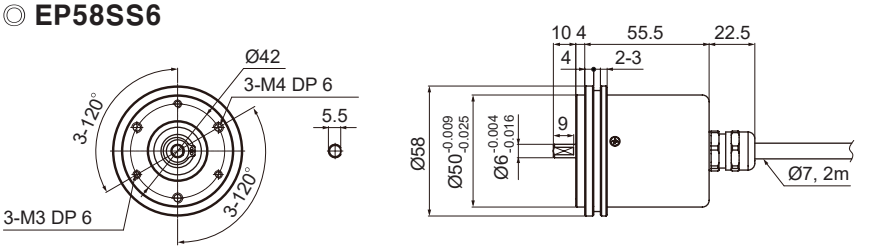
▣ Dimensions

(unit: mm)

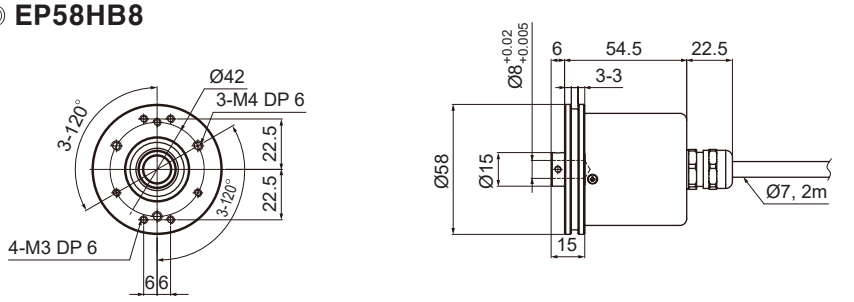
◎ EP58SC10



◎ EP58SS6

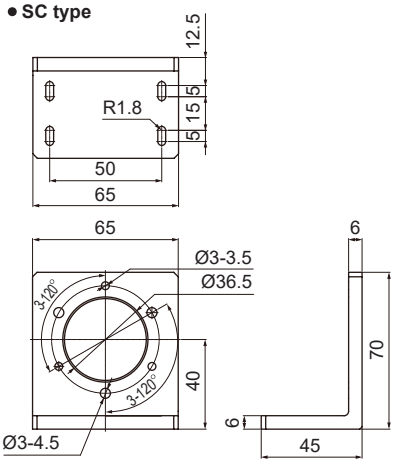


◎ EP58HB8

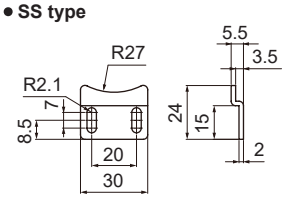


◎ Bracket

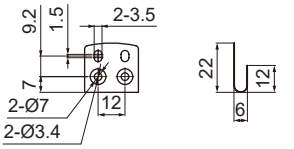
● SC type



● SS type

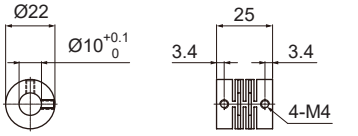


● HB type

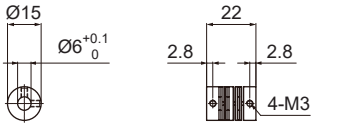


◎ Coupling

● EP58SC10



● EP58SS6



- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

Shaft Type Ø60mm Single-turn Absolute Rotary Encoder

▣ Features

- Allows to measure absolute variable angle with BCD code
- Strong against external impact
- Memorizing the absolute position when power is cut off

▣ Applications

Precision numerical control machine for industrial plant

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

▣ Ordering Information

ENP	–	1	1	1	R	–	360	–	P

Series	Output code	Output	Power supply	Revolution direction	Pulses/revolution	Control output
Ø60mm shaft type (shaft diameter : Ø10mm)	BCD code	0: Negative logic 1: Positive logic	0: 5VDC ±5% 1: 12-24VDC ±5%	F: Output value increase at CW direction R: Output value increase at CCW direction	006: 6-divison 016:16-divison 008: 8-divison 024: 24-divison 012: 12-divison 360: 360-divison	P: PNP open collector output N: NPN open collector output

▣ Specifications

Item			Shaft Type Ø60mm Single-turn Absolute Rotary Encoder					
Model	PNP open collector output		**ENP-111□-006-P**	**ENP-111□-008-P**	**ENP-111□-012-P**	**ENP-111□-016-P**	**ENP-111□-024-P**	**ENP-11□□-360-P**
	NPN open collector output		**ENP-101□-006-N**	**ENP-101□-008-N**	**ENP-101□-012-N**	**ENP-101□-016-N**	**ENP-101□-024-N**	**ENP-10□□-360-N**
Resolution※1			6-division	8-division	12-division	16-division	24-division	360-division
Electrical specification	Output phase		TP (timing pulse) : 2-bit TS (signal pulse) : 4-bit (BCD, EP)	TP (timing pulse) : 2-bit TS (signal pulse) : 5-bit (BCD, EP)	TP (timing pulse) : 2-bit TS (signal pulse) : 6-bit (BCD, EP)	TP (timing pulse) : 2-bit TS (signal pulse) : 6-bit (BCD, EP)	TP (timing pulse) : 2-bit TS (signal pulse) : 7-bit (BCD, EP)	TS (signal pulse) : 10-bit (BCD)
	Output of phase differences		TP1: 53° ±30' TP2: 15° ±30' P: 60° ±30' TS: 56° ±30'	TP1: 39° ±30' TP2: 15° ±30' P: 45° ±30' TS: 42° ±30'	TP1: 3° ±30' TP2: 15° ±30' P: 30° ±30' TS: 26° ±30'	TP1: 2° ±30' TP2: 11.25° ±30' P: 22.5° ±30' TS: 19.5° ±30'	TP1: 8° ±30' TP2: 3° ±30' P: 15° ±30' TS: 11° ±30'	TS: 1° ±30'
	Control output	PNP open collector output	Output voltage: min. (power supply-1.5V)VDC⎓, Load current: max. 32mA					
		NPN open collector output	Load current: max. 32mA, residual voltage: max. 1VDC⎓					
	Response time (rise/fall)	PNP open collector output	Ton=800ns, Toff=max. 800ns (cable length: 1m, I sink=32mA)					
		NPN open collector output	Ton=800ns, Toff=max. 800ns (cable length: 1m, I sink=32mA)					
	Max. response frequency		20kHz					
	Power supply		• 5VDC⎓ ±5% (ripple P-P: max. 5%) • 12-24VDC⎓ ±5% (ripple P-P: max. 5%)					
	Current consumption		Max. 100mA (disconnection of the load)					
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)					
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)					
	Connection		Axial cable type					
Mechanical specification	Starting toque		Max. 500gf·cm (0.05N·m)					
	Moment of inertia		Max. 300g·cm^2 (3×10^{-5}kg·m^2)					
	Shaft loading		Radial: max. 10kgf, Thrust: max. 2.5kgf					
	Mechanical revolution※2		3,600rpm					
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock			Approx. max. 75G					
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃					
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH					
Protection structure			IP50 (IEC standard)					
Cable			Ø8mm, 12-wire, 1m, double shield cable (AWG24, core diameter: 0.08mm, number of cores: 40, insulator diameter: Ø1mm)					
Accessory			Mounting bracket, coupling					
Weight※3			Approx. 478g (approx. 400g)					

※1: Not indicated resolutions are customizable.

※2: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

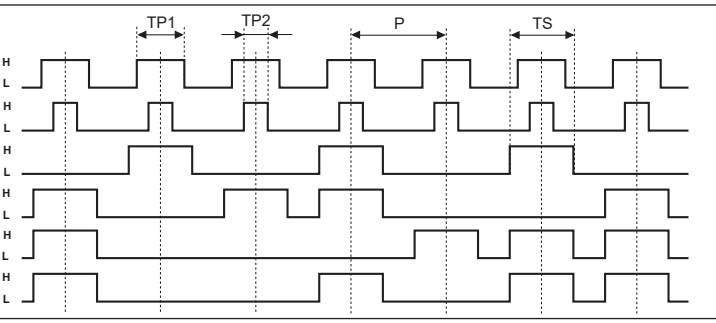
$$[\text{Max. response revolution (rpm)} = \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※3: The weight includes packaging. The weight in parenthesis is for unit only.

※Environment resistance is rated at no freezing or condensation.

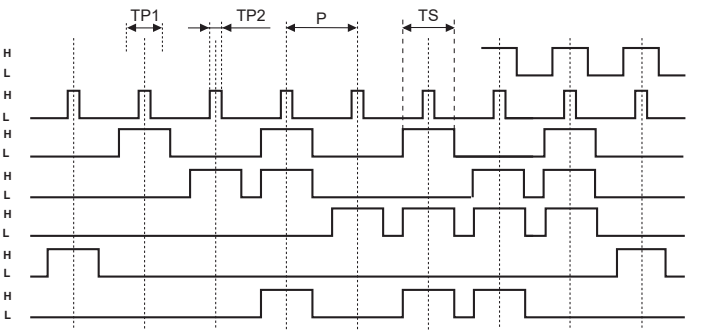
▣ Output Waveform

◎ 6-division

Model		ENP-111□-006-P						
Shaft revolution angle (°)		0°	60°	120°	180°	240°	300°	360°
Output value		6	1	2	3	4	5	6
Wire color	Wire function							
Black	TP1							
Gray	TP2							
Brown	BCD (2^0)							
Red	BCD (2^1)							
Orange	BCD (2^2)							
White	EP (PARITY)							

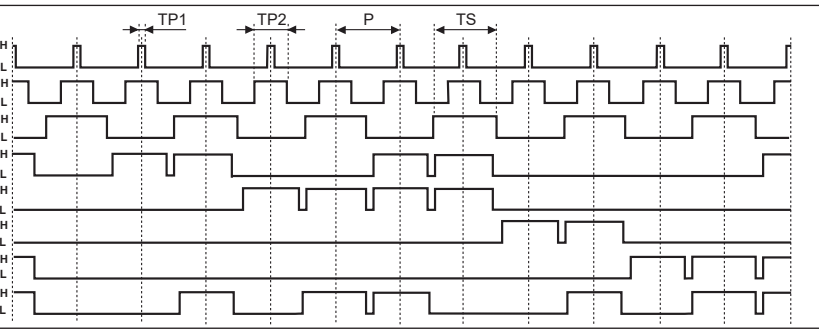
※TP1=53°±30', TP2=15°±30' ※P > TS (56°) > TP1 ※P=60°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

◎ 8-division

Model		ENP-111□-008-P								
Shaft revolution angle (°)		0°	45°	90°	135°	180°	225°	270°	315°	360°
Output value		8	1	2	3	4	5	6	7	8
Wire color	Wire function									
Black	TP1									
Gray	TP2									
Brown	BCD (2^0)									
Red	BCD (2^1)									
Orange	BCD (2^2)									
Yellow	BCD (2^3)									
White	EP (PARITY)									

※TP1=39°±30', TP2=15°±30' ※P > TS (42°) > TP1 ※P=45°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

◎ 12-division

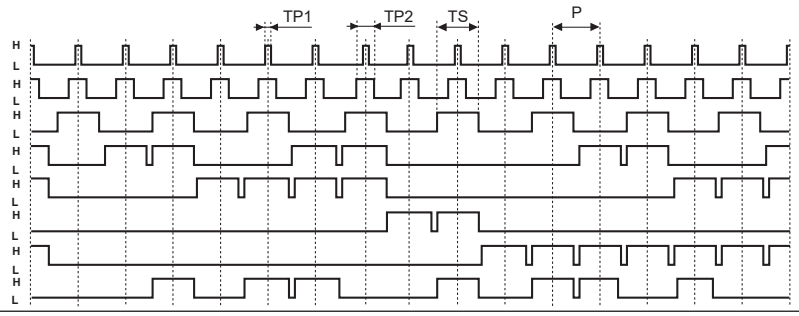
Model		ENP-111□-012-P												
Shaft revolution angle (°)		0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
Output value		12	1	2	3	4	5	6	7	8	9	10	11	12
Wire color	Wire function													
Black	TP1													
Gray	TP2													
Brown	BCD (2^0)													
Red	BCD (2^1)													
Orange	BCD (2^2)													
Yellow	BCD (2^3)													
Green	BCD (2×10^0)													
White	EP (PARITY)													

※TP1=3°±30', TP2=15°±30' ※P > TS (26°) > TP1 ※P=30°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)
※The option model for TS (signal pulse) signal with 5-bit (BCD, EP) is available.

▣ Output Waveform

◎ 16-division

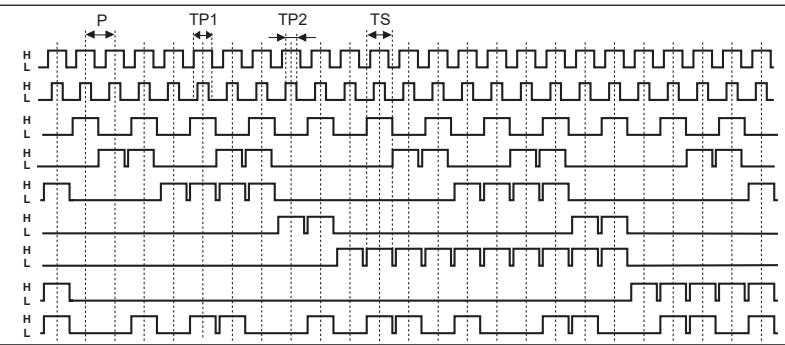
Model		ENP-111□-016-P
Shaft revolution angle (°)		0° 22.5° 45° 67.5° 90° 112.5° 135° 157.5° 180° 202.5° 225° 247.5° 270° 292.5° 315° 337.5° 360°
Output value		16 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Wire color	Wire function	
Black	TP1	
Gray	TP2	
Brown	BCD (2^0)	
Red	BCD (2^1)	
Orange	BCD (2^2)	
Yellow	BCD (2^3)	
Green	BCD (2×10^0)	
White	EP (PARITY)	



※TP1=2°±30', TP2=11.25°±30' ※P > TS (19.5°) > TP1 ※P=22.5°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)
※The option model for TS (signal pulse) signal with 5-bit (BCD, EP) is available.

◎ 24-division

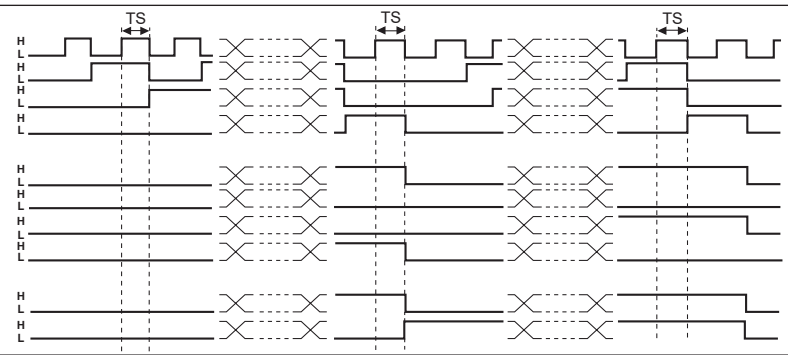
Model		ENP-111□-024-P
Shaft revolution angle (°)		0° 15° 30° 45° 60° 75° 90° 105° 120° 135° 150° 165° 180° 195° 210° 225° 240° 255° 270° 285° 300° 315° 330° 345° 360°
Output value		24 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Wire color	Wire function	
Black	TP1	
Gray	TP2	
Brown	BCD (2^0)	
Red	BCD (2^1)	
Orange	BCD (2^2)	
Yellow	BCD (2^3)	
Green	BCD ($2^0\times10$)	
Blue	BCD ($2^1\times10$)	
White	EP (PARITY)	



※TP1=8°±30', TP2=3°±30' ※P > TS (11°) > TP1 ※P=15°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

◎ 360-division

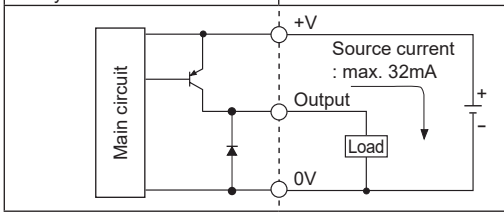
Model		ENP-11□□-360-P
Shaft revolution angle (°)		0° 1° 2° 3° 4° 5° ····· 198° 199° 200° 201° 202° ····· 356° 357° 358° 359° 360°
Output value		0 1 2 3 4 5 ····· 198 199 200 201 200 ····· 356 357 358 359 0
Wire color	Wire function	
Black	BCD (2^0)	
Brown	BCD (2^1)	
Red	BCD (2^2)	
Orange	BCD (2^3)	
Yellow	BCD ($2^0\times10$)	
Green	BCD ($2^1\times10$)	
Blue	BCD ($2^2\times10$)	
Violeet	BCD ($2^3\times10$)	
Gray	BCD ($2^0\times100$)	
White	BCD ($2^1\times100$)	

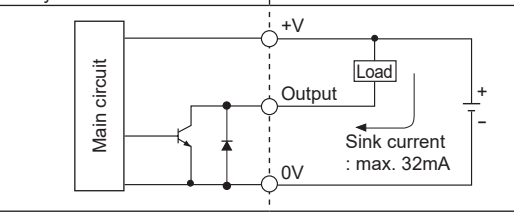


※TS=1°±30'
※Above waveform is based on the positive logic. (the output waveform of negative logic is opposite to above waveform.)

■ Control Output Diagram

PNP open collector output		NPN open collector output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection





※Output circuit of each output signal is same.

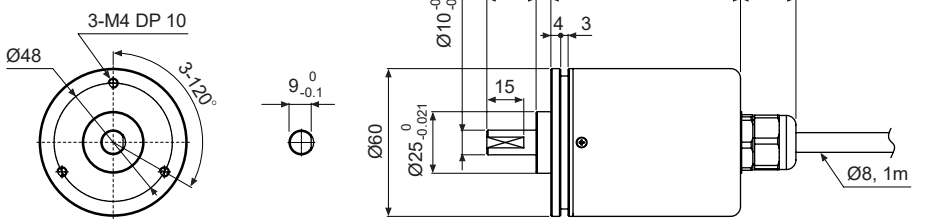
■ Connections

Wire color \ Resolution		6-division	8-division	12-division	16-division	24-division	360-division
Power wire	White※1	+V					
	Black※1	GND (0V)					
	Shield	F.G.					
Output wire	Black	TP1 ※2					2^0
	Brown	2^0	2^0	2^0	2^0	2^0	2^1
	Red	2^1	2^1	2^1	2^1	2^1	2^2
	Orange	2^2	2^2	2^2	2^2	2^2	2^3
	Yellow	N·C	2^3	2^3	2^3	2^3	2^0×10
	Green	N·C	N·C	2^0×10	2^0×10	2^0×10	2^1×10
	Blue	N·C	N·C	N·C	N·C	2^1×10	2^2×10
	Purple	N·C					2^3×10
	Gray	TP2 ※2					2^0×100
	White	EP (PARITY) ※3					2^1×100
	Shield	F.G.					

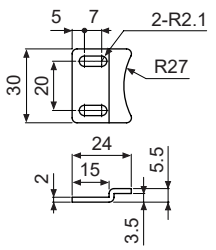
※1: Insulator external diameter is Ø1.5mm.
※2: TP1/TP2: Because low resolution model has long output signal period, this signal for enable is easy to determine signal recognition point about output.
※3: EP: Parity signal. It outputs odd parity.
※Unused wire must be insulated.
※Encoder case and shield wire must be grounded.
※N·C (not connected)
※Output cable must not be short-circuited, because Driver IC is used in output circuit.
※Do not apply tensile strength over 30N to the cable.

■ Dimensions

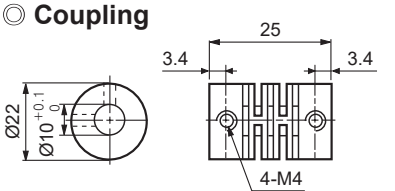
(unit: mm)



◎ Bracket



◎ Coupling



- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

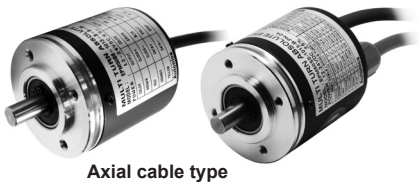
※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

Shaft Type Ø50mm Multi-turn Absolute Rotary Encoder

■ Features

- **Total 23-bit resolution (8388608-division) of 10-bit single-turn (1024-division) and 13-bit multi-turn (8192-revolution)**
- Compact size of Ø50mm
- Parallel data/SSI data transmission type
- Easy zero adjustment using single-turn/multi-turn data separated reset function
- Memorizing revolution data up to ±90° after blackout without memory back up function
- Possible CW/CCW direction setting with direction function
- Maximizing users convenience with clear, over flow alarm (OVF) function
- Protection structure IP64 (IEC standard) (dust-proof, oil-proof)
- Provides Latch function (parallel output model only)

Radial cable type



Axial cable type

■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

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

■ Ordering Information

EPM50S	8	–	10	13	–	B	–	PN	–	24	–	

Series	Shaft diameter	Single-turn	Multi-turn	Output code	Control output	Power supply	Cable
Ø50mm Shaft type	Ø8mm	10-bit (1024 -division)	13-bit (8192 -revolution)	Binary code	PN: Parallel NPN open collector output S: SSI Line driver output	12-24VDC±5%	No mark: Axial cable type S: Radial cable type

■ Specifications

Type			Shaft Type Ø50mm Multi-turn Absolute Rotary Encoder	
Model			EPM50S8-1013-B-S-24-□	EPM50S8-1013-B-PN-24-□
Resolution		Single-turn	1024-division (10-bit)	
		Multi-turn	8192-revolution (13-bit)	
Rotation limit when power off※1			±90°	
Electrical specification	Output	Output code	24-bit, Binary code	Binary code
		Control output	SSI (Synchronous Serial Interface) Line driver [Low] - Sink current: max. 20mA, Residual voltage: max. 0.5VDC⎓ [High] - Sink current: max. -20mA, Output voltage: min. 2.5VDC⎓	Parallel NPN open collector output Sink current: max. 32mA, Residual voltage: max. 1VDC⎓
		Output signal	Single-turn data, multi-turn count, over flow alarm (OVF)※2	
		Output logic	—	Negative logic output
		Response time (rise, fall)	—	Max. 1μs (cable: 2m, I sink = 32mA)
	Input	Input signal	Single-turn data reset ※3, Multi-turn count reset ※4, Direction, Clear	
			—	Latch
		Input level	0-1VDC⎓	
		Input logic	Low Active, Open or High for common use	
		Input time	Single-turn data reset※3, Multi-turn count reset※4, Direction, Clear: approx. over 100ms	
			—	Latch: approx. over 500μs
		SSI clock input – Input level	5VDC⎓ ±5%	—
		SSI clock input – Input frequency	100kHz to 1MHz	
	Max. response frequency		—	50kHz
	Power supply		12-24VDC⎓ ±5% (ripple P-P: max. 5%)	
	Current consumption		Max. 150mA (disconnection of the load)	Max. 100mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)	
	Dielectric strength		750VAC 50/60Hz for 1 min (between all terminals and case)	
	Connection		Axial/Radial cable type (cable gland)	

※1: It calibrates the multi-turn counts by comparing single-turn data before/after power off without counting multi-turn counts when power is off. It shall be used on the condition that no overrated revolution occurred since proper multi-turn data may not be available if any revolutions occurred over ±90° from the position when power is off.
※2: OVF alarm is ON when multi-turn count is out of counting range (0 to 8191 revolutions).
※3: Single-turn data will be reset as 「0」 when single-turn data reset is input.
※4: Multi-turn count will be reset as 「0 revolution」 when multi-turn count reset is input.

■ Specifications

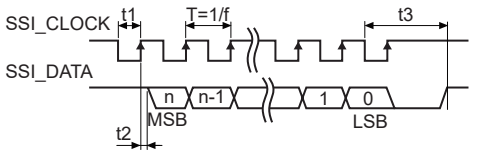
Type		Shaft Type Ø50mm Multi-turn Absolute Rotary Encoder	
Model		**EPM50S8-1013-B-S-24-□**	**EPM50S8-1013-B-PN-24-□**
Mechanical specification	Starting torque	Max. 70gf·cm (0.0069N·m)	
	Moment of inertia	Max. 40g·cm² (4×10^{-6}kg·m²)	
	Shaft loading	Radial: max. 10kgf, Thrust: max. 2.5kgf	
	Max. allowable revolution※5	3,000rpm	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		Approx. max. 50G	
Environment	Ambient temp.	-10 to 70℃, storage: -25 to 85℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 90%RH	
Protection structure		Axial cable type: IP64 (IEC standard), Radial cable type: IP50 (IEC standard)	
Cable		Ø6mm, 10-wire, 2m, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 19, insulation out diameter: Ø0.8mm)	Ø6mm, 17-wire×2, 2m, Shield cable (AWG28, core diameter: 0.08mm, number of cores: 17, insulation out diameter: Ø0.8mm)
Accessory		Bracket, coupling	
Approval		CE	
Weight※6		Approx. 409g (approx. 324g)	Approx. 560g (approx. 475g)

※5: In case of Parallel type model, Make sure that Max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

[Max. response revolution (rpm)= $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec]

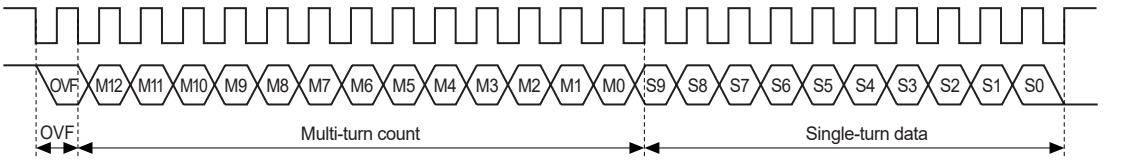
※6: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

■ Synchronous Serial Interface (SSI) Output Timing Diagram



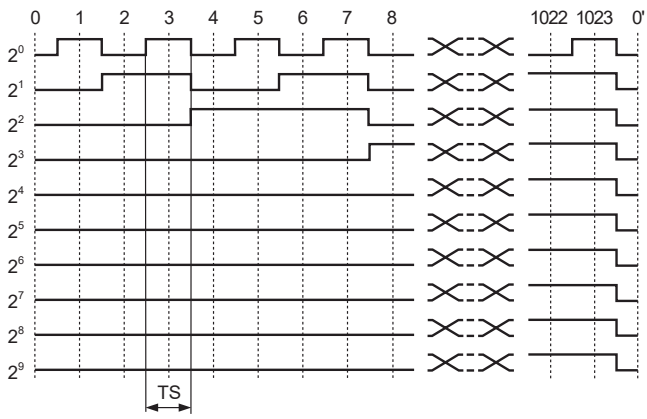
Clock Frequency f	100kHz to 1MHz
T	T: 1 to 10µs
	0.5µs < t1 < 5µs
Time lag t2	t2 < 0.3µs
Monoflop Time t3	15µs < t3 < 30µs

■ Synchronous Serial Interface (SSI) Data Output



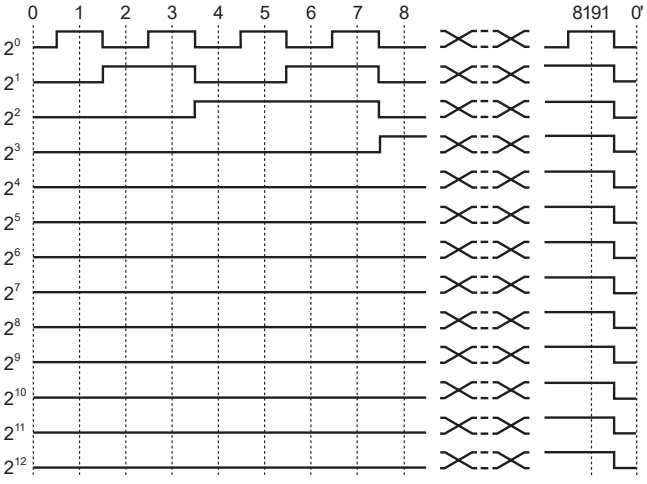
Clock input bit	Data output name	Data output bit	Clock input bit	Data output name	Data output bit
1	Over flow alarm bit	0-bit	15	Single-turn data	9-bit (MSB)
2	Multi-turn count	12-bit (MSB)	16		8-bit
3		11-bit	17		7-bit
4		10-bit	18		6-bit
5		9-bit	19		5-bit
6		8-bit	20		4-bit
7		7-bit	21		3-bit
8		6-bit	22		2-bit
9		5-bit	23		1-bit
10		4-bit	24		0-bit (LSB)
11		3-bit			
12		2-bit			
13		1-bit			
14		0-bit (LSB)			

■ Parallel Interface 1024-Division Single-turn Data Output Waveform



※TS=0.3515625°±15'
※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

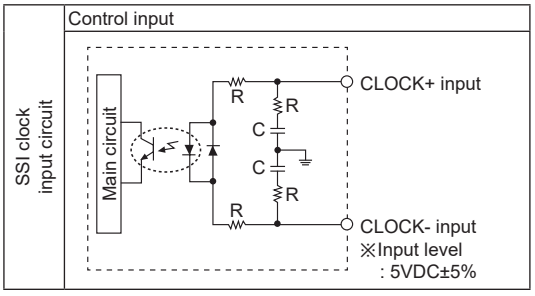
■ Parallel Interface 8192-Revolution Multi-turn Count Data Output Waveform

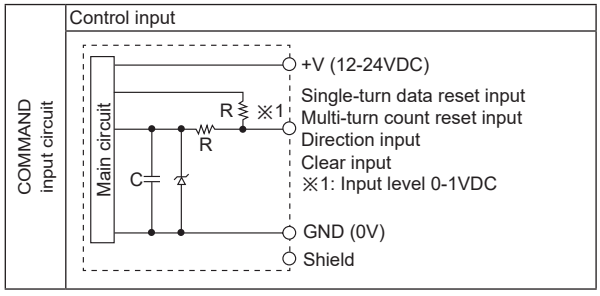


※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

■ Control Output I/O Circuit

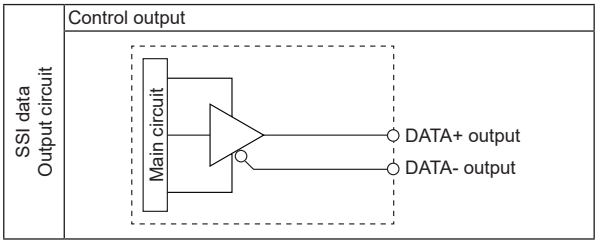
• SSI input



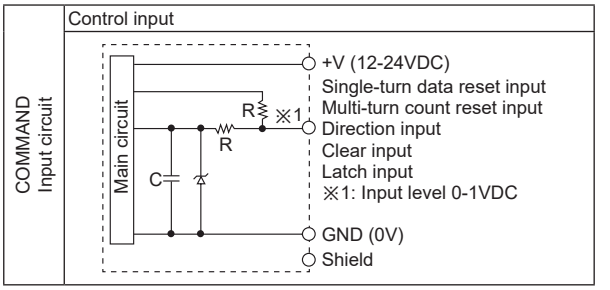


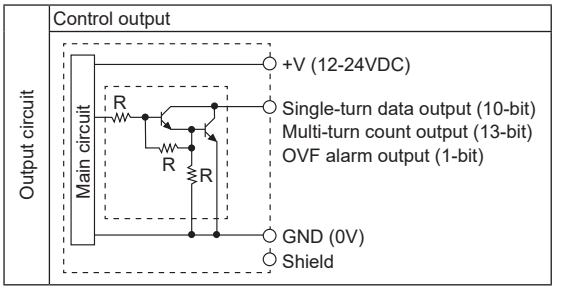
▣ Control Output I/O Circuit

◎ SSI output



◎ Parallel input/output





※Each bit of output has the same circuit.
※Please be aware of the fact that overload and short circuit may cause circuit break.

▣ Connections

◎ SSI Line driver output type

Cable					
Cable color	Description		Cable color	Description	
Brown	SSI	CLOCK+	Gray	COMMAND	Single-turn data reset
Red		CLOCK-	Blue		Multi-turn count reset
Orange		DATA+	Green		Direction
Yellow		DATA-	Purple		Clear
White	+V (12-24VDC)		Shield	Signal shield cable (F.G.)	
Black	GND (0V)		—		

◎ Parallel NPN open collector output type

Multi-turn count cable (sheath color: black)		
Cable color	Description	
Brown	Multi-turn count	2^0
Red		2^1
Orange		2^2
Yellow		2^3
Green		2^4
Blue		2^5
Purple		2^6
Gray		2^7
Pink		2^8
Clear		2^9
Light brown		2^{10}
Light yellow		2^{11}
Light green		2^{12}
Light blue	OVF	
Light purple	Multi-turn count reset	
White	+V (12-24VDC)	
Black	GND (0V)	
Shield	Signal shield cable (F.G.)	

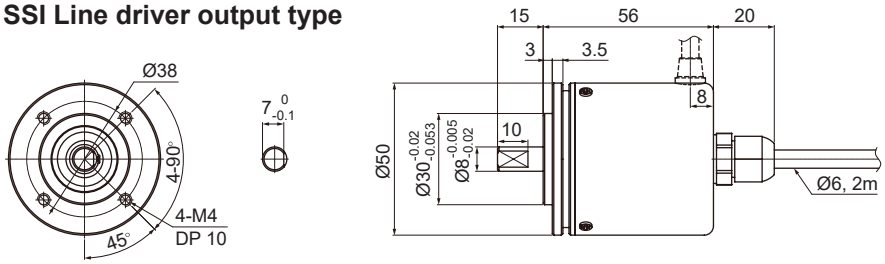
Single-turn data cable (sheath color: gray)		
Cable color	Description	
Brown	Single-turn data	2^0
Red		2^1
Orange		2^2
Yellow		2^3
Green		2^4
Blue		2^5
Purple		2^6
Gray		2^7
Pink		2^8
Clear		2^9
Light brown	N.C.	
Light yellow	Direction	
Light green	Latch	
Light blue	Clear	
Light purple	Single-turn data reset	
White	+V (12-24VDC)	
Black	GND (0V)	
Shield	Signal shield cable (F.G.)	

※Unused wires must be insulated.
※Do the wiring properly.
※Encoder metal case and shield cable must be grounded (F.G.).
※Please use caution to avoid short circuit when connecting output cables because I/O circuit uses the dedicated driver IC.
※As for Parallel output, it is recommended to connect +V and GND of both multi-turn count cable and single-turn data cable.
※Do not apply tensile strength over 30N to the cable.

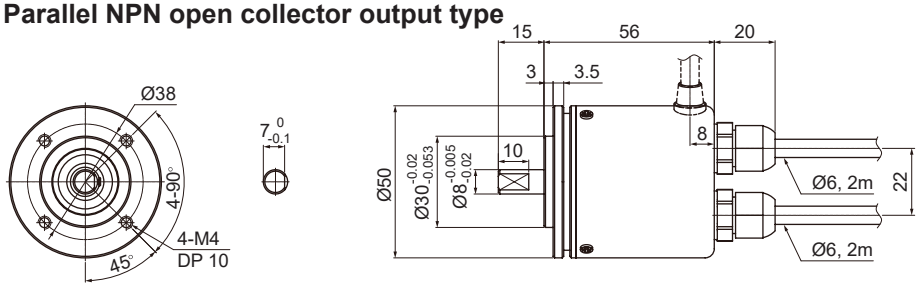
▣ Dimensions

(unit: mm)

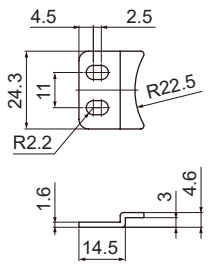
◎ SSI Line driver output type



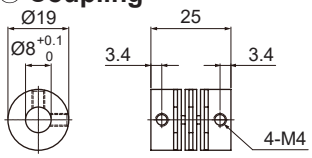
◎ Parallel NPN open collector output type



◎ Bracket



◎ Coupling



- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

▣ Functions

◎ Single-turn data reset

Single-turn data will be reset as 「0」 when single-turn data reset cable is inputted 0 to 1V (over 100ms). In case of not using single-turn data reset cable, connect the line to OPEN or + V.

◎ Multi-turn count reset

Multi-turn data will be reset as 「0 revolution」 when multi-turn count reset cable is inputted 0 to 1V (over 100ms). In case of not using multi-turn count reset cable, connect the line to OPEN or + V.
OVF alarm will be reset with multi-turn count reset input.

◎ Direction

Connect the direction cable to OPEN or +V and turn on the power. Output will increase when rotation direction is CW from shaft axis. In case of connecting 0 to 1 V (over 100ms), output will increase when rotation direction is CCW. If direction setting is reset, single-turn data, multi-turn count and OVF will be reset together since direction setting is initial setting which is set with Power ON.

◎ Clear

Single-turn data will be reset as 「0」 and multi-count will be also reset as 「0 revolution」 when clear cable is inputted 0 to 1V (over 100ms). In case of not using clear cable, connect the cable to OPEN or + V. OVF alarm will be reset with clear input.

◎ Latch (parallel output model only)

When the latch cable is inputted 0 to 1V (over 500μs), outputs for single-turn data, multi-turn count and OVF at latch point will be remained. When latch cable is connected to OPEN or +V, output will be returned to operating mode output.

◎ Over flow alarm (OVF)

It is an alarm function when multi-turn count is out of rotation ranges (0 to 8191 revolutions).
Over flow alarm is also reset with multi-turn count value when multi-turn count reset signal is inputted.

Shaft type Ø50mm Magnetic Single-turn Absolute Rotary Encoder

■ Features

- **Higher resistant to vibration and impact by magnetic elements than optical encoder**
- Various output code: BCD, Binary, Gray code
- Various and high resolution (32, 40, 45, 48, 64, 90, 128, 180, 256, 360, 512, 720, 1024-division)
- Power supply: 5VDC ±5%, 12-24VDC ±5%
- Protection structure IP50 (IEC standard)

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

CE

■ Ordering Information

MGA50S	8	—	1024	—	1	R	—	N	—	5

Series	Shaft diameter	Pulses/revolution	Output code	Revolution direction	Control output	Power supply
Ø50mm shaft type	Ø8mm	Refer to resolution	1: BCD code 2: Binary code 3: Gray code	F: Output value increase at CW direction R: Output value increase at CCW direction	N: NPN open collector output	5: 5VDC ±5% 24: 12-24VDC ±5%

■ Specifications

Type			Shaft Type Ø50mm Magnetic Single-turn Absolute Rotary Encoder			
Model			MGA50S8-□-□□-N-□			
Resolution※1			32, 40, 45, 48, 64, 90, 128, 180, 256, 360, 512, 720, 1024-division			
Electrical specification	Output	Hysteresis	±0.1°			
		Positioning error※2	±1-bit (LSB: Least Significant Bit)			
		Output code	Division	BCD code	Binary code	Gray code
		Output phase/ Output angle※3	1024	TS: 0.3515°±15' (13-bit)	TS: 0.3515°±15' (10-bit)	TS: 0.703°±15' (10-bit)
			720	TS: 0.5°±25' (11-bit)	TS: 0.5°±25' (10-bit)	TS: 1°±25' (10-bit)
			512	TS: 0.703°±25' (11-bit)	TS: 0.703°±25' (9-bit)	TS: 1.406°±25' (9-bit)
			360	TS: 1°±25' (10-bit)	TS: 1°±25' (9-bit)	TS: 2°±25' (9-bit)
			256	TS: 1.406°±25' (10-bit)	TS: 1.406°±25' (8-bit)	TS: 2.8125°±25' (8-bit)
			180	TS: 2°±25' (9-bit)	TS: 2°±25' (8-bit)	TS: 4°±25' (8-bit)
			128	TS: 2.8125°±25' (9-bit)	TS: 2.8125°±25' (7-bit)	TS: 5.625°±25' (7-bit)
			90	TS: 4°±25' (8-bit)	TS: 4°±25' (7-bit)	TS: 8°±25' (7-bit)
			64	TP1: 4.5°±60' (1-bit) TP2: 1.125°±60' (1-bit) TS: 5.625°±60' (7-bit) EP: 5.625°±60' (1-bit)	TP1: 4.5°±60' (1-bit) TP2: 1.125°±60' (1-bit) TS: 5.625°±60' (6-bit) EP: 5.625°±60' (1-bit)	TP1: 4.5°±60' (1-bit) TP2: 1.125°±60' (1-bit) TS: 11.25°±60' (6-bit) EP: 5.625°±60' (1-bit)
			48	TP1: 6°±60' (1-bit) TP2: 1.5°±60' (1-bit) TS: 7.5°±60' (7-bit) EP: 7.5°±60' (1-bit)	TP1: 6°±60' (1-bit) TP2: 1.5°±60' (1-bit) TS: 7.5°±60' (6-bit) EP: 7.5°±60' (1-bit)	TP1: 6°±60' (1-bit) TP2: 15°±60' (1-bit) TS: 1.5°±60' (6-bit) EP: 7.5°±60' (1-bit)
			45	TP1: 6.4°±60' (1-bit) TP2: 1.6°±60' (1-bit) TS: 8°±60' (7-bit) EP: 8°±60' (1-bit)	TP1: 6.4°±60' (1-bit) TP2: 1.6°±60' (1-bit) TS: 8°±60' (6-bit) EP: 8°±60' (1-bit)	TP1: 6.4°±60' (1-bit) TP2: 1.6°±60' (1-bit) TS: 16°±60' (6-bit) EP: 8°±60' (1-bit)
			40	TP1: 7.2°±60' (1-bit) TP2: 1.8°±60' (1-bit) TS: 9°±60' (6-bit) EP: 9°±60' (1-bit)	TP1: 7.2°±60' (1-bit) TP2: 1.8°±60' (1-bit) TS: 9°±60' (6-bit) EP: 9°±60' (1-bit)	TP1: 7.2°±60' (1-bit) TP2: 1.8°±60' (1-bit) TS: 18°±60' (6-bit) EP: 9°±60' (1-bit)
			32	TP1: 9°±60' (1-bit) TP2: 2.25°±60' (1-bit) TS: 11.25°±60' (6-bit) EP: 11.25°±60' (1-bit)	TP1: 9°±60' (1-bit) TP2: 2.25°±60' (1-bit) TS: 11.25°±60' (5-bit) EP: 11.25°±60' (1-bit)	TP1: 9°±60' (1-bit) TP2: 2.25°±60' (1-bit) TS: 22.5°±60' (5-bit) EP: 11.25°±60' (1-bit)

※1: Not indicated resolutions are customizable.
※2: When turning ON/OFF the unit, there may be ±1-bit (LSB) error at present position by hysteresis.
※3: TP1, TP2 other output angles are available as option.

■ Specifications

Type			**Shaft Type Ø50mm Magnetic Single-turn Absolute Rotary Encoder**
Model			MGA50S8-□-□□-N-□
Electrical specification	Output	Output type	NPN open collector output
		Output capacity	Load current max. 32mA, residual voltage max. 1VDC⎓
		Output logic	Negative logic output
		Response time (rise/fall)	Max. 1㎲ (cable length: 2m, I sink=32mA)
	Max. response frequency		30kHz
	Power supply		5VDC⎓ ±5% (ripple P-P: max. 5%), 12-24VDC⎓ ±5% (ripple P-P: max. 5%)
	Current consumption		Max. 60mA (disconnection of load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)
	Dielectric strength		750VAC 50/60Hz for 1 min (between all terminals and case)
	Connection		Axial cable type (cable gland)
Mechanical specification	Starting torque		Max. 70gf·cm (0.007N·m)
	Moment of inertia		Max. 80g·cm^2 (8×10^{-6}kg·m^2)
	Shaft loading		Radial: max. 10kgf, Thrust: max. 2.5kgf
	Max. allowable revolution※4		3,000rpm
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock			Approx. max. 75G
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH
Protection structure			IP50 (IEC standard)
Cable			Ø6mm, 17-wire, 2m, Shield cable (AWG 28, core diameter: 0.08mm, number of cores: 17, insulator diameter: Ø0.8mm)
Accessory			Bracket, Coupling
Approval			CE
Weight※5			Approx. 400g (approx. 270g)

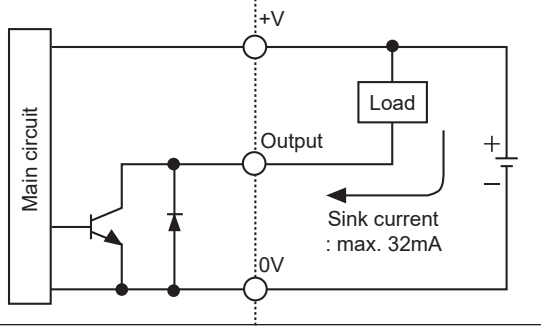
※4: Make sure that max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

【Max. response revolution (rpm)=$\frac{\text{Max. response frequency}}{\text{Resolution}}$× 60 sec】

※5: The weight includes packaging. The weight in parenthesis is for unit only.

※Environment resistance is rated at no freezing or condensation.

■ Control Output Circuit

Output type	NPN open collector output	
Type	Rotary encoder	Load connection
Output circuit		

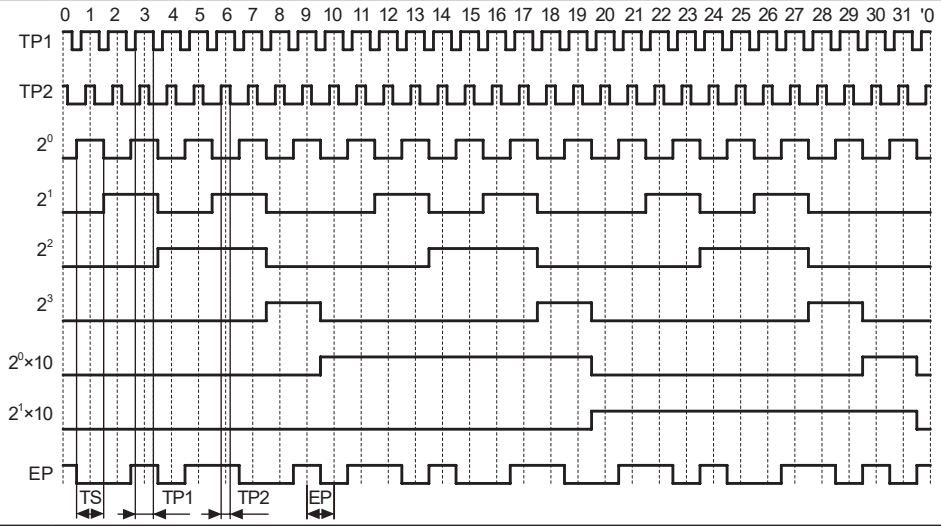
※The output of each bit is same circuit.

※Be sure that when applying excessive load or being short, the circuit may be damaged.

▣ Output Waveform

◎ 32-division (BCD code output)

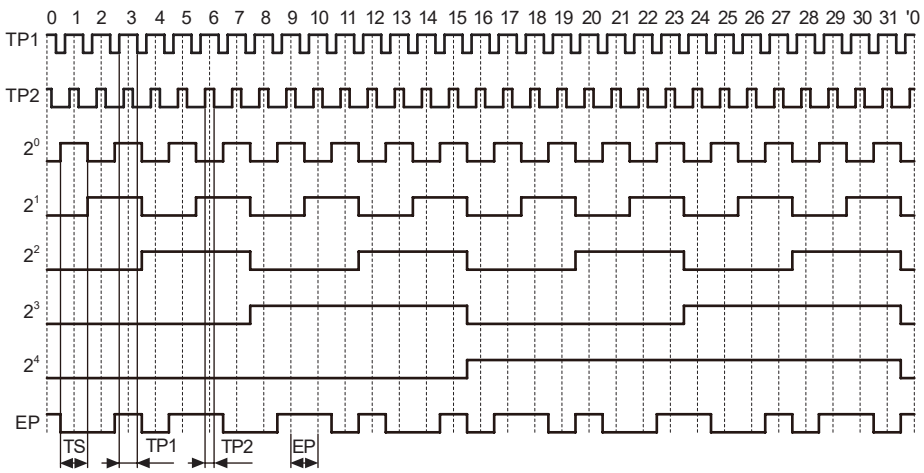
Model	MGA50S8-32-1□-N-□



※TP1=9°±60', TP2=2.25°±60', TS=11.25°±60', EP=11.25°±60'
※The above waveform is based on the positive logic. (the output waveform of negative logic is opposed.)

◎ 32-division (Binary code output)

Model	MGA50S8-32-2□-N-□

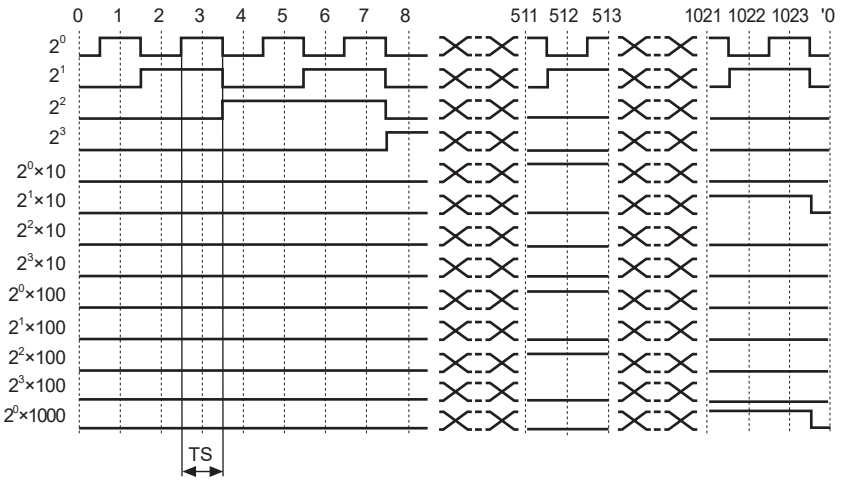


※TP1=9°±60', TP2=2.25°±60', TS=11.25°±60', EP=11.25°±60'
※The above waveform is based on the positive logic. (the output waveform of negative logic is opposed.)

▣ Output Waveform

◎ 1024-division (BCD code output)

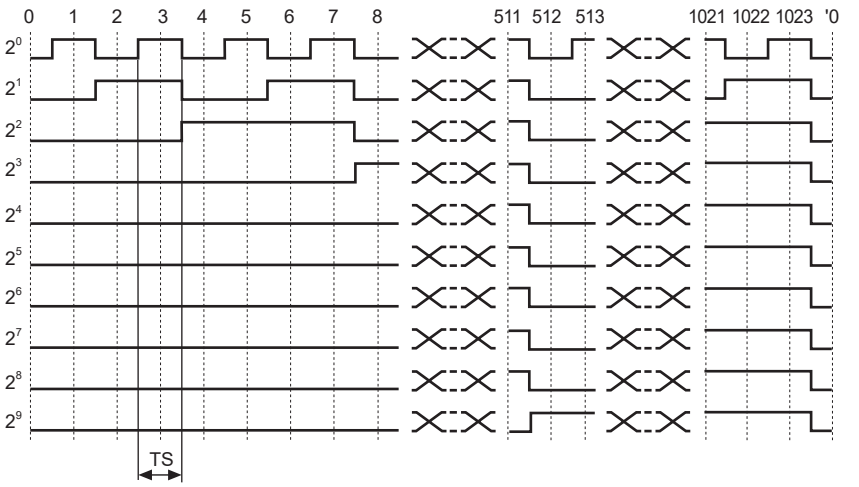
Model	MGA50S8-1024-1□-N-□



※TS=0.3515°±15'
※The above waveform is based on the positive logic. (the output waveform of negative logic is opposed.)

◎ 1024-division (Binary code output)

Model	MGA50S8-1024-2□-N-□



※TS=0.3515°±15'
※The above waveform is based on the positive logic. (the output waveform of negative logic is opposed.)

■ Connection

◎ BCD code

Color \ Resolution		32 -division	40 -division	45 -division	48 -division	64 -division	90 -division	128 -division	180 -division	256 -division	360 -division	512 -division	720 -division	1024 -division
Power	White	+V												
	Black	0V												
Output cable	Brown	2^0												
	Red	2^1												
	Orange	2^2												
	Yellow	2^3												
	Green	2^0×10												
	Blue	2^1×10												
	Purple	N·C		2^2×10										
	Gray	TP1					2^3×10							
	Pink	TP2					N·C	2^0×100						
	Transparent	EP					N·C			2^1×100				
	Light Brown	N·C										2^2×100		
	Light Yellow	N·C												2^3×100
	Light Green	N·C												2^0×1000
	Light Blue	N·C												
	Light Purple	N·C												
	Shield cable	Signal shield cable (F.G.)												

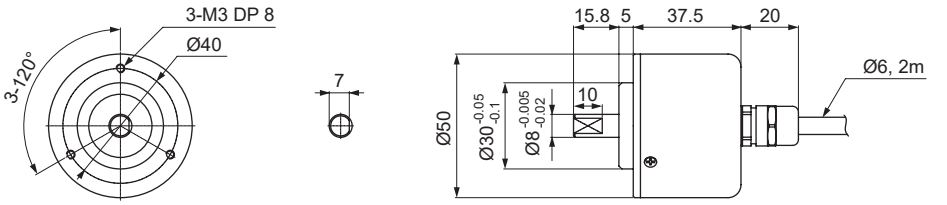
◎ Binary Code/Gray code

Color \ Resolution		32 -division	40 -division	45 -division	48 -division	64 -division	90 -division	128 -division	180 -division	256 -division	360 -division	512 -division	720 -division	1024 -division
Power	White	+V												
	Black	0V												
Output cable	Brown	2^0												
	Red	2^1												
	Orange	2^2												
	Yellow	2^3												
	Green	2^4												
	Blue	N·C	2^5											
	Purple	N·C					2^6							
	Gray	TP1					N·C	2^7						
	Pink	TP2					N·C			2^8				
	Transparent	EP					N·C						2^9	
	Light Brown	N·C												
	Light Yellow	N·C												
	Light Green	N·C												
	Light Blue	N·C												
	Light Purple	N·C												
	Shield cable	Signal shield cable (F.G.)												

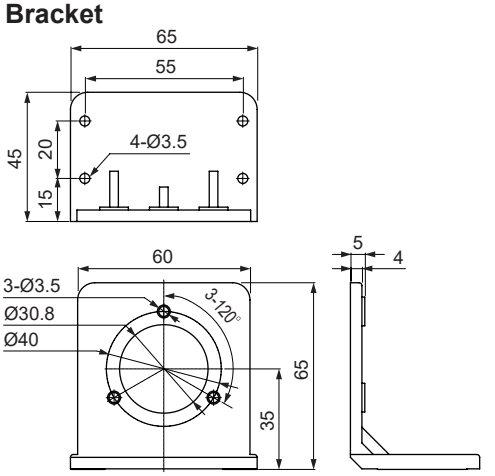
※Non-using wires must be insulated.
※Encoder case and shield cable must be grounded.
※N·C (not connected)
※Please make sure not to short when wiring output cables because the dedicated driver IC is used at output circuit.
※Do not apply tensile strength over 30N to the cable.

■ Dimensions

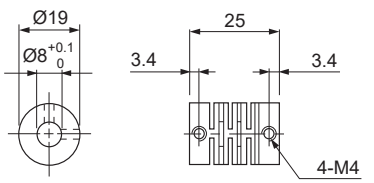
(unit: mm)



◎ Bracket



◎ Coupling



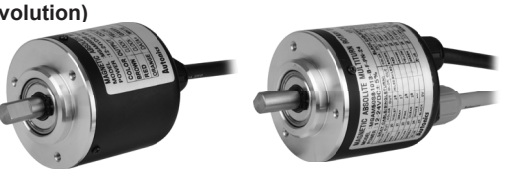
- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft. Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15 N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

Shaft Type Ø50mm Magnetic Multi-turn Absolute Rotary Encoder

■ Features

- **Higher resistant to vibration and impact by magnetic elements than optical encoder**
- **Total 23-bit resolution (8,388,608-division) of 10-bit single-turn (1,024-division) and 13-bit multi-turn (8,192-revolution)**
- Compact size of Ø50mm
- Parallel data/SSI data transmission type
- Maximizing users convenience with over flow alarm (OVF) function
- Power supply: 12-24VDC ±5%
- Protection structure IP50 (IEC standard)



■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

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

■ Ordering Information

MGAM50S	8	– 10	13	– B	– F	– PN	– 24

Series	Shaft diameter	Single-turn	Multi-turn	Output code	Rotation direction	Control output	Power supply
Ø50mm Shaft type	Ø8mm	10-bit (1024 -division)	13-bit (8192 -revolution)	Binary Code	F: Output increases by CW rotation direction at the shaft R: Output increases by CCW rotation direction at the shaft	PN: Parallel NPN open collector output S: SSI Line driver output	12-24VDC±5%

■ Specifications

Type			Shaft Type Ø50mm Magnetic Multi-turn Absolute Rotary Encoder	
Model			**MGAM50S8-1013-B-F-S-24**	**MGAM50S8-1013-B-F-PN-24**
Resolution		Single-turn	1024-division (10-bit)	
		Multi-turn	8192-revolution (13-bit)	
Rotation limit when power off ※1			±90°	
Electrical specification	Output	Hysteresis	±0.1°	
		Positioning error※2	±1-bit (LSB: Least Significant Bit)	
		Output code	24-bit, Binary code	Binary code
		Control output	SSI (Synchronous Serial Interface) Line driver output [Low] - Sink current: max. 20mA, Residual voltage: max. 0.5VDC⎓ [High] - Sink current: max. -20mA, Output voltage: min. 2.5VDC⎓	Parallel NPN open collector output Sink current: max. 20mA, Residual voltage: max. 1VDC⎓
		Output signal	Single-turn data, multi-turn count, over flow alarm (OVF)※3	
		Output logic	—	Negative logic output
		Response time (rise, fall)	—	Max. 1μs (cable: 2m, I sink = 20mA)
	Multi-turn count reset input※4	Input level	0-1VDC⎓	
		Input logic	Low Active, Open for common use	
		Input time	Over 100ms	
	SSI clock input	Input level	5VDC⎓ ±5%	—
		Input frequency	100kHz to 1MHz	
	Max. response frequency		—	30kHz
	Power supply		12-24VDC⎓ ±5% (ripple P-P: max. 5%)	
	Current consumption		Max. 150mA (disconnection of the load)	Max. 100mA (disconnection of the load)
	Insulation resistance		Over 100MΩ (at 500VDC megger between all terminals and case)	
	Dielectric strength		750VAC 50/60Hz for 1 minute (between all terminals and case)	
	Connection		Axial cable type (cable gland)	

※1: It calibrates the multi-turn counts by comparing single-turn data before/after power off without counting multi-turn counts when power is off. It shall be used on the condition that no overrated revolution occurred since proper multi-turn counts may not be available if any revolutions occurred over ±90°from the position when power is off.
※2: When turning ON/OFF the unit, there may be ±1-bit (LSB) error at present position by hysteresis.
※3: OVF alarm is ON when multi-turn count is out of counting range (0 to 8191 revolutions).
※4: Multi-turn count shall be initialized as 「0 revolution」 when multi-turn count reset is input.

■ Specifications

Type		Shaft Type Ø50mm Magnetic Multi-turn Absolute Rotary Encoder	
Model		**MGAM50S8-1013-B-F-S-24**	**MGAM50S8-1013-B-F-PN-24**
Mechanical specification	Starting torque	Max. 70gf·cm (0.0069N·m)	
	Moment of inertia	Max. 80g·cm^2 (8×10^{-6}kg·m^2)	
	Shaft loading	Radial: max. 10kgf, Thrust: max. 2.5kgf	
	Max. allowable revolution※5	3,000rpm	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		Approx. max. 50G	
Environment	Ambient temp.	-10 to 70℃, storage: -25 to 85℃	
	Ambient humid.	35 to 85%RH, storage: 35 to 90%RH	
Protection structure		IP50 (IEC standard)	
Cable		Ø6mm, 10-wire, 2m, Shield cable (AWG 28, core diameter: 0.08mm, number of cores: 19, insulator out diameter: Ø0.8mm)	Ø6mm, 17-wire×2, 2m, Shield cable (AWG 28, core diameter: 0.08mm, number of cores: 17, insulator out diameter: Ø0.8mm)
Accessories		Bracket, coupling	
Approval		CE	
Weight※6		Approx. 391g (approx. 261g)	Approx. 523g (approx. 393g)

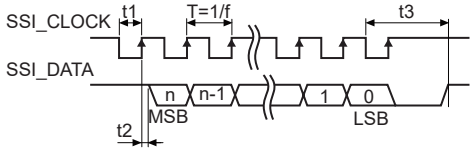
※5: In case of Parallel type model, Make sure that Max. response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

【Max. response revolution (rpm) = $\frac{\text{Max. response frequency}}{\text{Resolution}}$ × 60 sec】

※6: The weight includes packaging. The weight in parenthesis is for unit only.

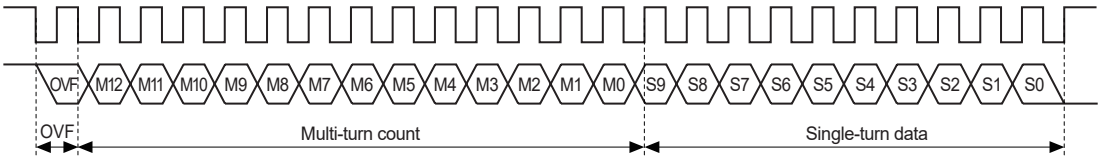
※Environment resistance is rated at no freezing or condensation.

■ Synchronous Serial Interface (SSI) Output Timing Diagram



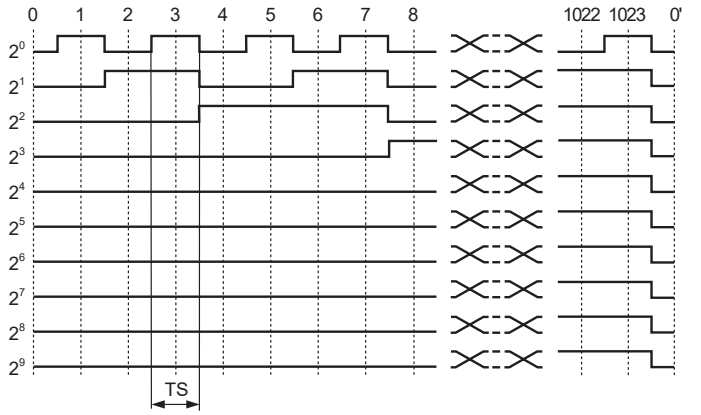
Clock Frequency f	100kHz to 1MHz
T	T: 1 to 10μs
	0.5μs < t1 < 5μs
Time lag t2	t2 < 0.3μs
Monoflop Time t3	15μs < t3 < 30μs

■ Synchronous Serial Interface (SSI) Data Output



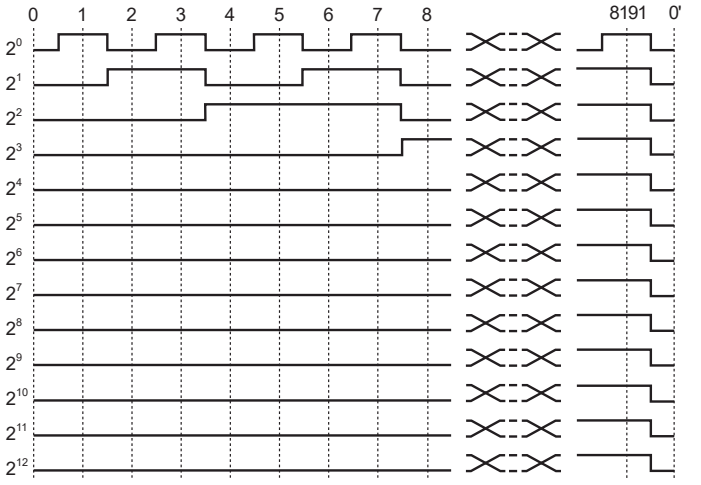
Clock input bit	Data output name	Data output bit	Clock input bit	Data output name	Data output bit
1	Over flow alarm bit	0-bit	15	Single-turn data	9-bit (MSB)
2	Multi-turn count	12-bit (MSB)	16		8-bit
3		11-bit	17		7-bit
4		10-bit	18		6-bit
5		9-bit	19		5-bit
6		8-bit	20		4-bit
7		7-bit	21		3-bit
8		6-bit	22		2-bit
9		5-bit	23		1-bit
10		4-bit	24		0-bit (LSB)
11		3-bit			
12		2-bit			
13		1-bit			
14		0-bit (LSB)			

▣ Parallel Interface 1024-division Single-turn Data Output Waveform



※TS=0.3515625°±15'
※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

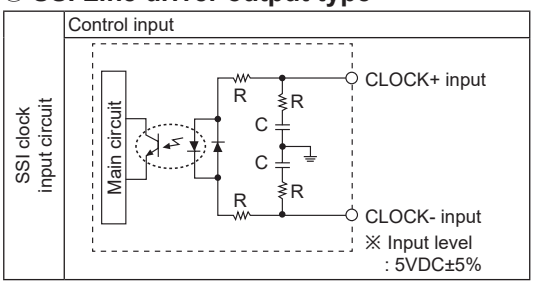
▣ Parallel Interface 8192-revolution Multi-turn Count Data Output Waveform

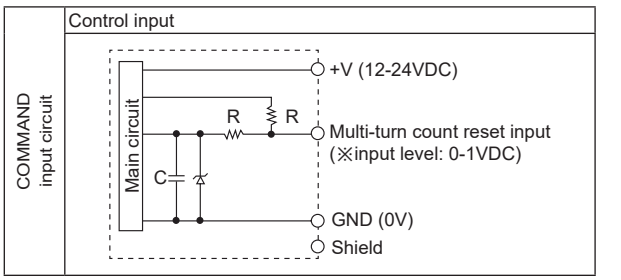


※The above waveform is based on the positive logic. (The output waveform of negative logic is opposed.)

▣ Control Output I/O Circuit

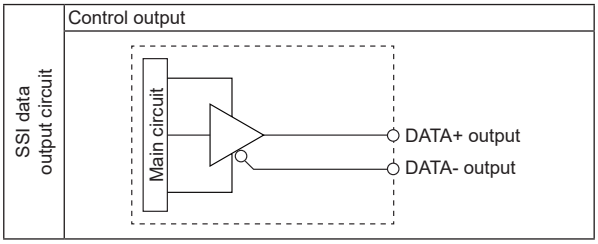
◎ SSI Line driver output type



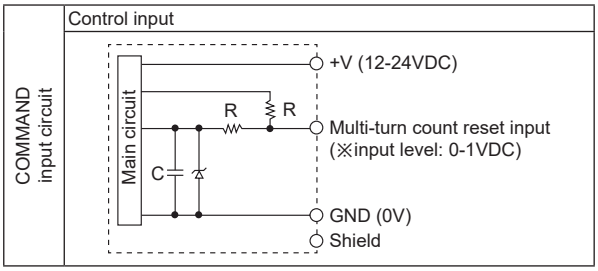


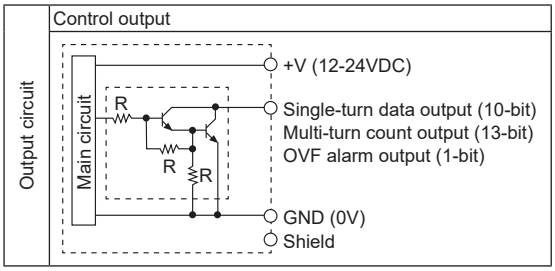
▣ Control Output I/O Circuit

◎ SSI Line driver output type



◎ Parallel NPN open collector output type





※Each bit of output has the same circuit.
※Please be aware of the fact that overload and short circuit may cause circuit break.

▣ Connections

◎ SSI Line driver output type

Cable					
Cable color	Description		Cable color	Description	
Brown	SSI	CLOCK+	Green	COMMAND	Multi-turn count reset
Red		CLOCK-	Blue		N·C
Orange		DATA+	Purple		N·C
Yellow		DATA-	Gray		N·C
White	+V (12-24VDC)		Shield	Signal shield cable (F.G.)	
Black	GND (0V)		—		

◎ Parallel NPN open collector output type

Multi-turn count cable (sheath color: black)		
Cable color	Description	
Brown	Multi-turn count	2^0
Red		2^1
Orange		2^2
Yellow		2^3
Green		2^4
Blue		2^5
Purple		2^6
Gray		2^7
Pink		2^8
Clear		2^9
Light brown		2^{10}
Light yellow		2^{11}
Light green		2^{12}
Light blue	OVF	
Light purple	Multi-turn count reset	
White	N.C.	
Black	N.C.	
Shield	Signal shield cable (F.G.)	

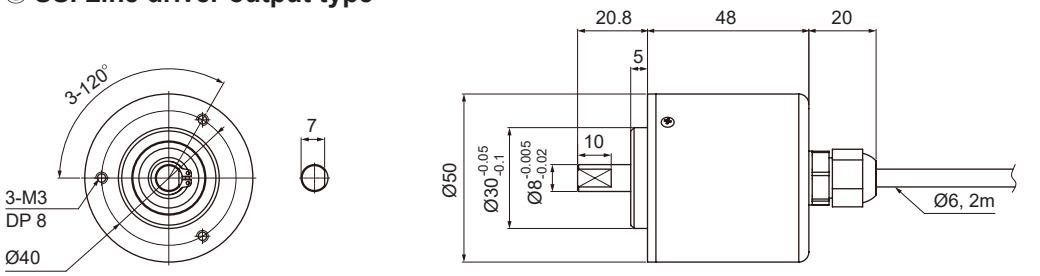
Single-turn data cable (sheath color: gray)		
Cable color	Description	
Brown	Single-turn data	2^0
Red		2^1
Orange		2^2
Yellow		2^3
Green		2^4
Blue		2^5
Purple		2^6
Gray		2^7
Pink		2^8
Clear		2^9
Light brown	N.C.	
Light yellow	N.C.	
Light green	N.C.	
Light blue	N.C.	
Light purple	N.C.	
White	+V (12-24VDC)	
Black	GND (0V)	
Shield	Signal shield cable (F.G.)	

※Unused wires must be insulated.
※Do the wiring properly.
※Encoder metal case and shield cable must be grounded (F.G.).
※Please use caution to avoid short circuit when connecting output cables because I/O circuit uses the dedicated driver IC.
※Do not apply tensile strength over 30N to the cable.

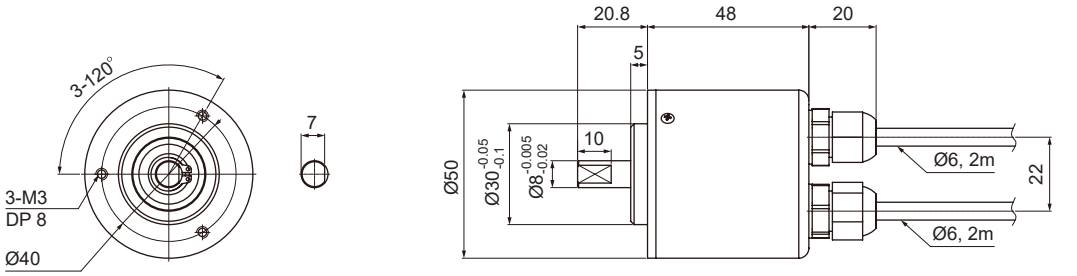
▣ Dimensions

(unit: mm)

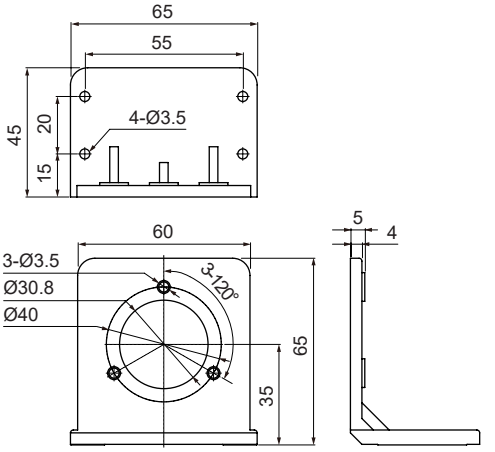
◎ SSI Line driver output type



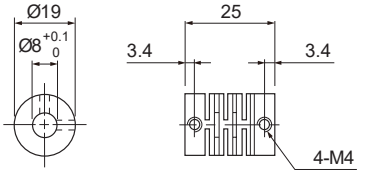
◎ Parallel NPN open collector output type



◎ Bracket



◎ Coupling



- Parallel misalignment: max. 0.25mm
- Angular misalignment: max. 5°
- End-play: max. 0.5mm

※Do not load overweight on the shaft.
※Do not put strong impact when insert a coupling into shaft.
Failure to follow this instruction may result in product damage.
※Fix the unit or a coupling by a wrench under 0.15N·m of torque.
※When you install this unit, if eccentricity and deflection angle are larger, it may shorten the life cycle of this unit.
※For parallel misalignment, angular misalignment, end-play terms, refer to the "Glossary" section of Technical Description.
※For flexible coupling (ERB series) information, refer to the ERB series section.

▣ Functions

◎ Multi-turn count reset

Multi-turn data will be reset as 「0 revolution」 when multi-turn count reset cable (light purple) is inputted 0 to 1V (over 100ms).

◎ Over flow alarm (OVF)

It is an alarm function when multi-turn count is out of rotation ranges (0 to 8191 revolutions).
Over flow alarm is also reset with multi-turn count value when multi-turn count reset signal is inputted.

Absolute Wire-Type Linear Scale Encoder

■ Features

- Max. measuring range 512mm
- Min. resolution: 0.1mm
- Various output codes: Binary, Gray code

■ Applications

Manufacturing facility for FPD and semi-conductor, machine tool, robot, medical devices

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

CE

■ Ordering Information

EWLS – **50** – **512** – **B** – **PN** – **24**

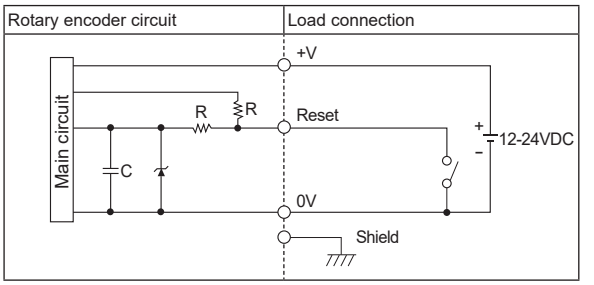
Series	Body size	Measuring range	Output code	Control output	Power supply
Absolute Wire-type Linear Scale	50mm×50mm	512mm	B: Binary Code G: Gray Code	Parallel NPN open collector output	12-24VDC ±5%

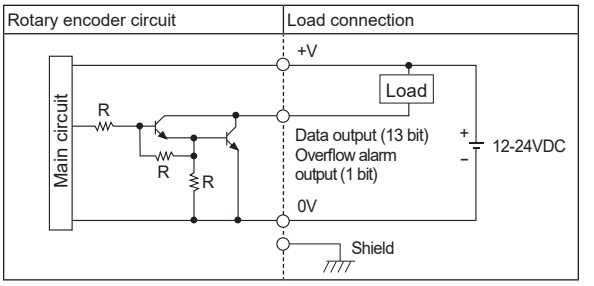
■ Specifications

Item			Absolute Wire-type Linear Scale	
Model			**EWLS50-512-B-PN-24**	**EWLS50-512-G-PN-24**
Measuring range			512mm	
Max. output pulse/mm			5,120-division/512mm	
Min. resolution※1			0.1mm	
Accuracy			±0.1/100mm	
Response speed			Max. 500mm/sec.	
Wire movement limit when power is off ※2			Max.±20mm	
Electrical specification	Output	Output code	Binary	Gray
		Output signal	Data, Overflow alarm	
		Control output	Parallel NPN open collector output	
		Output capacity	Load current: Max. 32mA, Residual voltage: Max. 1VDC⎓	
		Logic	Negative logic output	
		Response time	Max. 1μs (Cable length: 2m, I sink=32mA)	
	Input	Input signal	Reset	
		Input level	High: 5-24VDC⎓, Low: 0-1.2VDC⎓	
		Input logic	Low Active, OPEN or HIGH for common use	
		Input time	Min. 100ms	
	Max. Response frequency		50kHz	
	Power supply		12-24VDC⎓ ± 5% (Ripple P-P: Max. 5%)	
	Current consumption		Max. 150mA (disconnection of the load)	
	Insulation resistance		Min. 100MΩ (500VDC megger)	
	Dielectric strength		750VAC 50/60Hz for 1minute	
	Connection		Cable type (Cable Gland)	
Wire tensile force			0.5N to 4N (50gf to 400gf)	
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min.) in each X, Y, Z direction for 2 hours	
Shock			Approx. Max. 50G	
Environment	Ambient temperature		-10 to 70℃, storage: -25 to 85℃	
	Ambient humidity		35 to 85%RH, storage: 35 to 90%RH	
Cable			Ø6mm, 17-wire, Length: 2m, Shield cable (AWG28, Core diameter: 0.08mm, Number of cores: 19, Insulator out diameter: Ø0.8mm)	
Material			Cap: SPCD, Body: A2024, Wire: SUS303	
Accessories			Hexagon wrench screw (M4×8)	
Approval			CE	
Unit weight			Approx. 450g	

※1: Not indicated resolutions are customizable.
※2: The unit will not process data when the power is OFF. It calibrates the data by comparing values of before and after power OFF status. It should be used in the condition that wire movement is limit, because you cannot get the correct data when you utilize wiring function over ±20mm at the position when power is OFF.
※Environment resistance is rated at no freezing or condensation.

▣ Control I/O Circuit





※Output of each bit is the same circuit.
※Overload or short may cause circuit break.

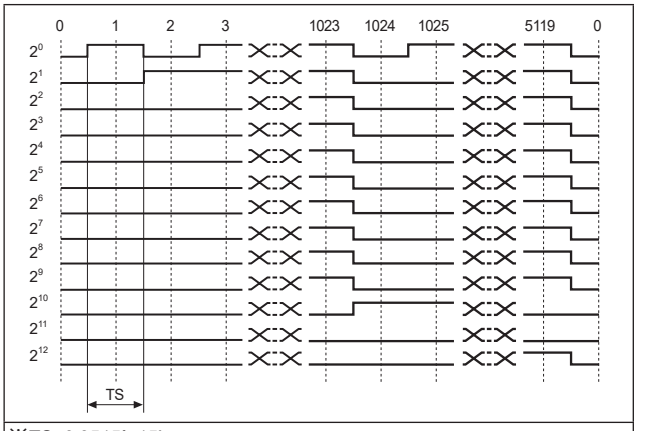
▣ Connections

Cable color	Description	
Brown	Data signal output	2^0
Red		2^1
Orange		2^2
Yellow		2^3
Green		2^4
Blue		2^5
Purple		2^6
Gray		2^7
Pink		2^8
Clear		2^9
Light brown		2^{10}
Light yellow		2^{11}
Light green		2^{12}
Light blue	Overflow alarm signal output	
Light Purple	Reset signal input	
White	+V (12-24VDC)	
Black	GND (0V)	
Shield wire	Signal shield cable (F.G.)	

※Do not apply tensile strength over 10N to the cable.

▣ Output Waveform

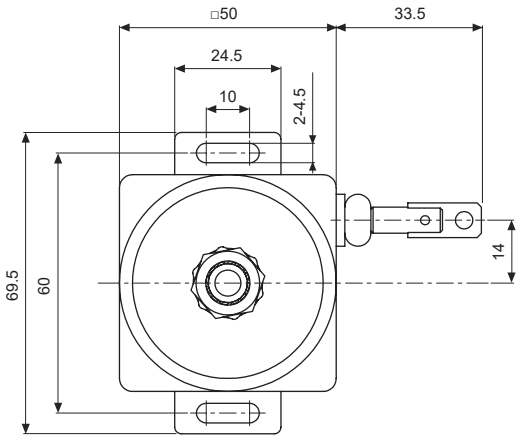
● Binary Code output

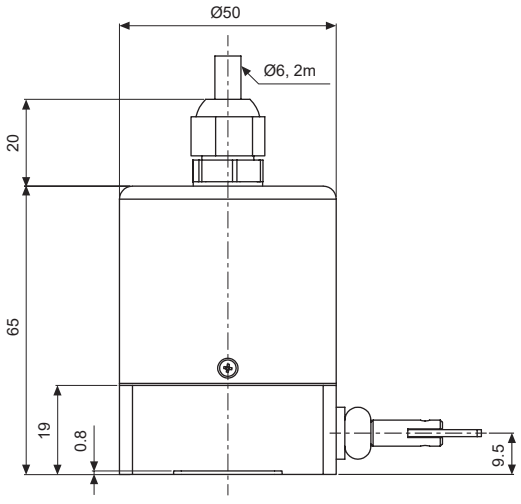


※TS=0.3515˚±15'
※Above waveform is based on the positive logic.
(The output waveform of negative logic is opposite to above waveform.)

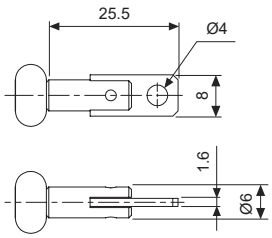
▣ Dimensions

(unit: mm)





● **Hook**



Flexible coupling

■ Features

- Zero (0) Backlash
- High torsional stiffness by high strength aluminum alloy AL 7075-T6
- High corrosion resistance with alumite treated surface
- Two connection types (clamp type, set screw type)

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

■ Applications

- Stepper motor, Servo motor, Precision motor, high-precision encoder, dynamometer driver, high speed/precision position control system

■ Ordering Information

ERB | **A** | **-** | **19** | **C** | **-** | **d_1/d_2**

Bore diameters	Number/Number	Bore diameters
Connection type	S	Set screw
	C	Clamp
External diameter	Number	External diameter (mm)
Type	A	Double beam (normal type)
Item	ERB	Radial beam type coupling

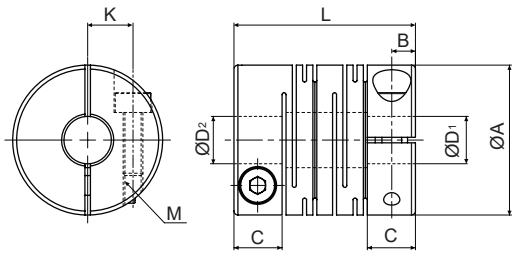
■ Specifications

Model		ERB-A-19C-☐	ERB-A-19S-☐	ERB-A-26C-☐	ERB-A-26S-☐
Connection type		Clamp	Set screw	Clamp	Set screw
Max. revolutions		8000rpm	20000rpm	6000rpm	15000 rpm
Max. torque		1.2N·m (12.17kgf·cm)		3.0N·m (30.42kgf·cm)	
Rated torque		0.6N·m (6.08kgf·cm)		1.5N·m (15.21kgf·cm)	
Mounting bolt (mounting torque)		M2.5 (1N·m)	M3 (0.7N·m)	M3 (0.7N·m)	M4 (1.7N·m)
Torsional stiffness		140N·m/rad		240N·m/rad	
Moment of inertia		6.4×10^{-7}kg·m^2		3.4×10^{-6}kg·m^2	
Max. allowable misalign-ment	Angular misalignment	2.5°			
	Parallel misalignment	0.15mm		0.2mm	
	End-play	±0.3mm		±0.4mm	
Standard bore diameter (tolerance h7)		Ø4, Ø5, Ø6mm		Ø6, Ø8mm	
Min. allowable bore diameter		Ø4mm		Ø5mm	
Max. allowable bore diameter		Ø8mm		Ø12mm	
Material		Aluminum (AL 7075-T6), Alumite surface			
Weight		Approx. 14.9g (approx. 14.4g)		Approx. 37.3g (approx. 36.7g)	

▣ Dimensions

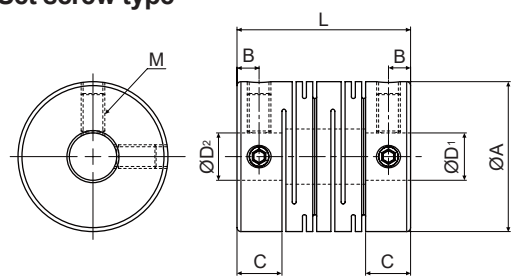
(unit: mm)

◎ Clamp type



Model	ØA	L	$ØD_1$	$ØD_2$	M	C	B	K
ERB-A-19C-04/04	19	23	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	M2.5	6.1	3	5.75
ERB-A-19C-04/05				$5^{+0.018}_{0}$				
ERB-A-19C-04/06				$6^{+0.018}_{0}$				
ERB-A-19C-05/05			$5^{+0.018}_{0}$	$5^{+0.018}_{0}$				
ERB-A-19C-05/06				$6^{+0.018}_{0}$				
ERB-A-19C-06/06			$6^{+0.018}_{0}$					
ERB-A-26C-06/06	26	31.4	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	M3	7.4	3.7	8.55
ERB-A-26C-06/08				$8^{+0.018}_{0}$				
ERB-A-26C-08/08			$8^{+0.018}_{0}$					

◎ Set screw type



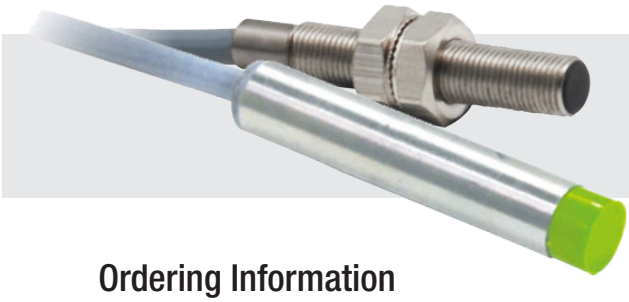
Model	ØA	L	$ØD_1$	$ØD_2$	M	C	B
ERB-A-19S-04/04	19	22	$4^{+0.018}_{0}$	$4^{+0.018}_{0}$	M3	5.7	2.8
ERB-A-19S-04/05				$5^{+0.018}_{0}$			
ERB-A-19S-04/06				$6^{+0.018}_{0}$			
ERB-A-19S-05/05			$5^{+0.018}_{0}$	$5^{+0.018}_{0}$			
ERB-A-19S-05/06				$6^{+0.018}_{0}$			
ERB-A-19S-06/06			$6^{+0.018}_{0}$				
ERB-A-26S-06/06	26	30	$6^{+0.018}_{0}$	$6^{+0.018}_{0}$	M4	6.8	3.4
ERB-A-26S-06/08				$8^{+0.018}_{0}$			
ERB-A-26S-08/08			$8^{+0.018}_{0}$				

▣ Proper Usage

The flexible coupling is available in the places where vibration or misalignment occurs. It must be used within the rated allowable misalignment range.
When using the flexible coupling over the rated misalignment range, it may cause vibration or shorten the life cycle.
When there are more than two misalignments, each allowable value is 50%.
It is recommended to use the flexible coupling below 1/3 of the allowable misalignment value to extend the life of the coupling and the applied equipment.

◎ Caution for using

- Couplings are for transferring rotation angle and power between shafts. Before using this, make sure to check the purpose and appropriacy.
- This product uses high strength aluminum alloy and has spring power as Radial beam type. However, if the coupling is dropped, hit or applied excessive power, it may be damaged or transformed.
- If the coupling is applied over the rated misalignment, or the tolerance of the shaft is over the allowable value, it may cause plastic deformation, damage of the product or shorten the life cycle.
- When it occurs abnormal sound during operating the equipment with this coupling, stop the operation and remove the cause such as misalignment, unscrewing, or rotation hazard.
- If this coupling is applied to the equipment which has big fluctuation of load, shaft may be loose by unscrewing. Tighten the screw securely and prevent from unscrewing.
- This product is for transferring rotation power. If there is a risk of human contact, attach the caution label or install a safety cover in a prominent position.
- Rated torque is available to transfer the power continuously. Check the rated capacity before using this product.
- Max. torque is available to transfer the power in a moment. Check the rated capacity before using this product.



KPR Series

Cylindrical Inductive Proximity Sensors

- Wear-resistant full stainless housing (M3, M5)
- Built-in protection circuits
- High intensity LED operation indicator
- Long life cycle and high reliability

Ordering Information

KPR A1 11 (3)

① ② ③

		Size	Sensing Distance	Detecting Face	Output Available	Body Type
① Size/ Detecting Face	**A1**	M3	1mm	Flush	3-wire	Non-threaded body
	B2	M5	1mm	Flush	3-wire	Threaded body
	CH3	M6.5	1.5mm	Flush	2-wire	Non-threaded body
	EH3		2mm	Non-Flush	2-wire	Non-threaded body
	E3	M8	2mm	Flush	3-wire, 2-wire	Threaded body
	F3		3mm	Non-Flush	3-wire, 2-wire	Threaded body

		Type	Output	Power Supply
② Output/ Power Supply	**11**	DC 3-wire	NPN NO	10 ~ 30VDC
	21		NPN NC	
	31		PNP NO	
	41		PNP NC	
	51	DC 2-wire	NO	
	61		NC	

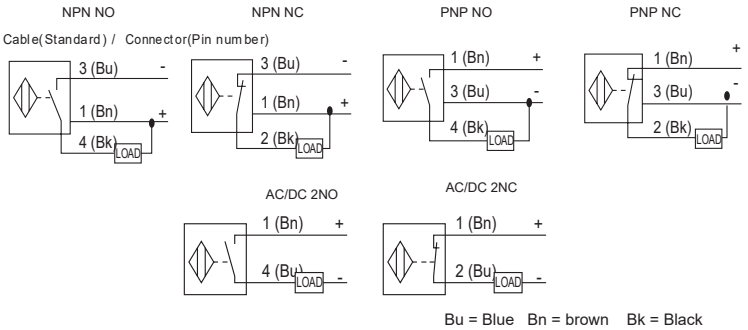
③ Cable Type	**no mark**	2m cable	for size M3, M5, M6.5 only
	2	M8 Connector	for size M5, M8 only
	3	M12 Connector	for size M8 only

Specifications

Detected Objects	Iron, Aluminum, Copper, Stainless Steel, Brass (Reduced sensing distances for non-iron metals)
Hysteresis	Max.15% of sensing distance
Operation Indicator	LED
Protection Circuit	load short circuit protection, Surge protection circuit, Reverse polarity protection circuit
Ambient/Storage Temperature	-25°C ~ 70°C (with no icing)
Ambient/Storage Humidity	35% ~ 95% (with no icing)
Affection by Temperature	-25°C ~ 70°C Max. ±10% for sensing distance at ambient temperature 23°C
Affection by Voltage	Max. ±1% for sensing distance at rated voltage ±15%
Insulation Resistance	Over 50MΩ (at 500VDC megger)
Vibration	1.5mm amplitude at frequency of 10Hz ~ 55Hz in each of X, Y, Z direction for 2 hours
Shock	1000m/s2 (approx. 50G) in each of X, Y, Z direction for 10 times
Meterial	Stainless Steel(M3, M5 only) / Nickel copper plated
IP rate	IP67

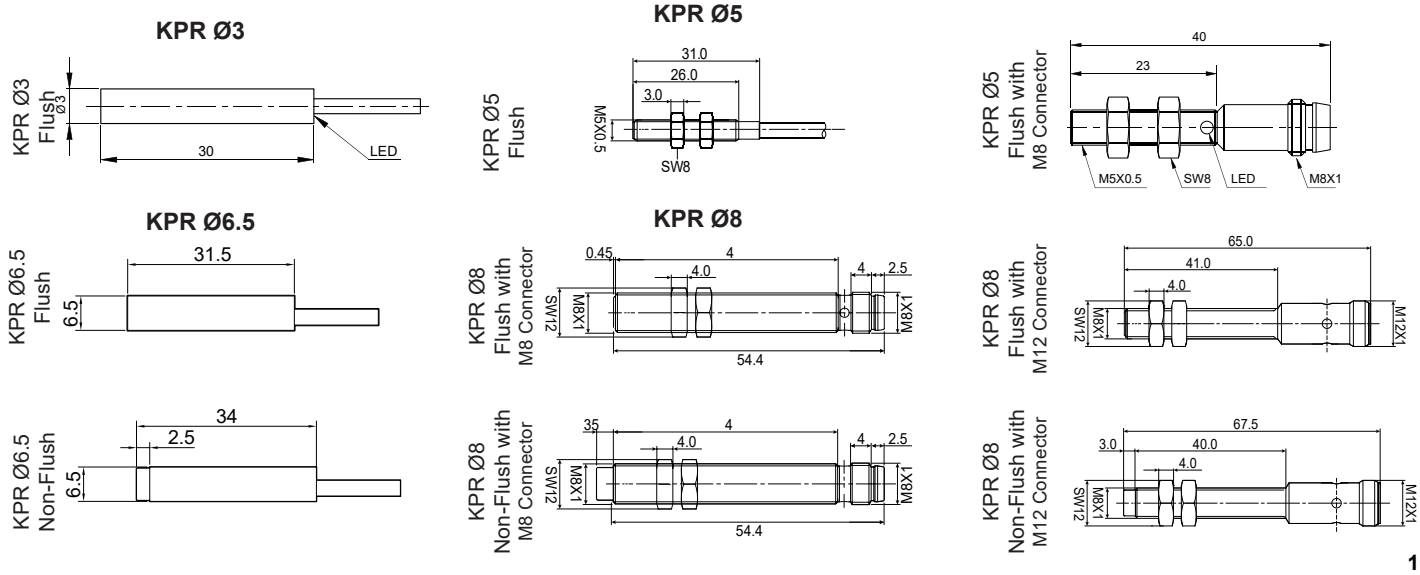
			DC 3/4-wire	DC 2-wire
Power Supply			10 ~ 30VDC	
Current Consumption			Max. 10mA	Max. 0.8mA
Voltage Drop			Residual Voltage : Max. 2V Load Current: Max. 200mA	Residual Voltage : Max 4V Load Current : 3mA ~ 100mA
Dielectric Strength			1,000VAC, 50/60Hz for 1 min	
Mex. Response Frequency	**M3**	Flush	2500Hz	-
	M5	Flush	2500Hz	-
	M6.5	Flush/ Non-Flush	-	2500Hz
	M8	Flush	2000Hz	800Hz
		Non-Flush	1500Hz	500Hz

Wiring Diagram

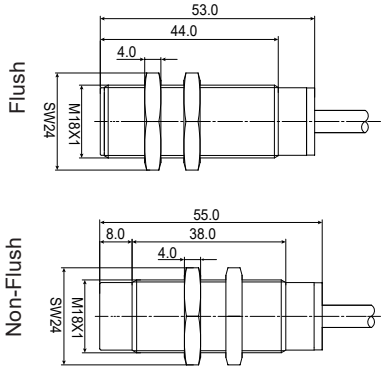


Bu = Blue Bn = brown Bk = Black

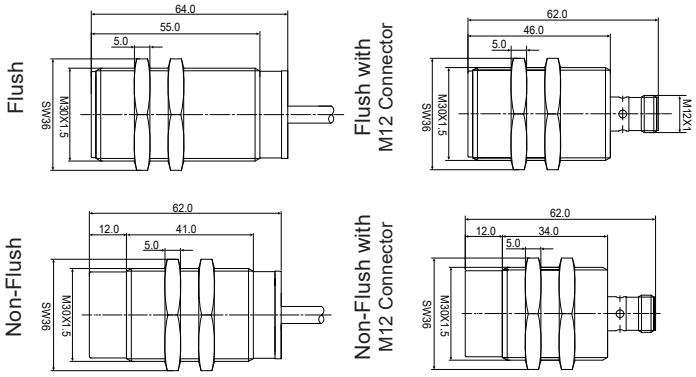
Dimensions (Unit: mm)



KPRM Ø18



KPRM Ø30



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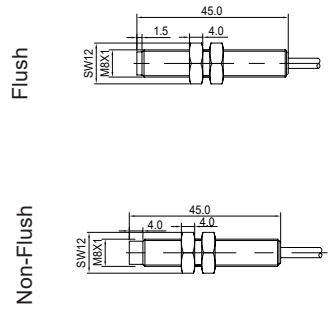

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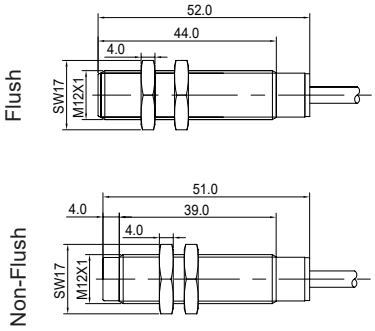

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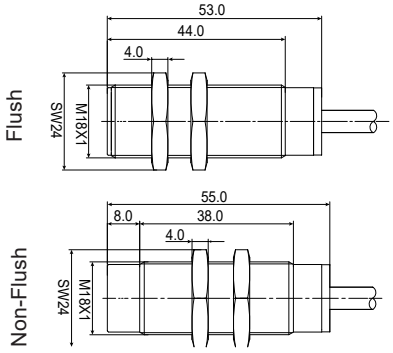

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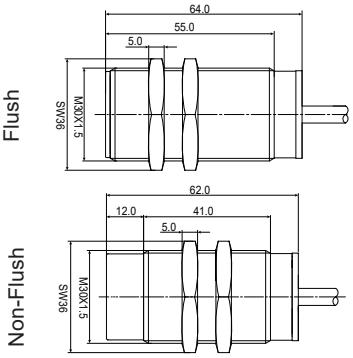
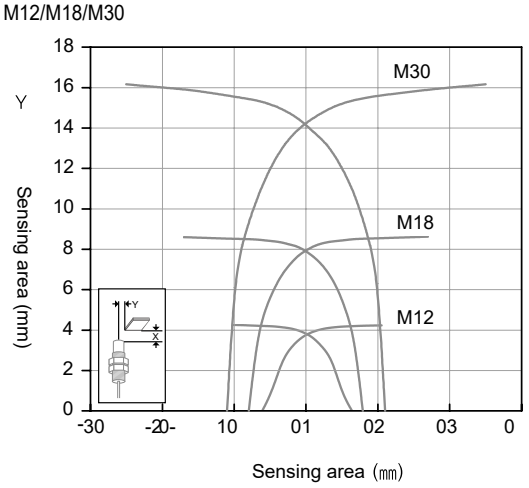
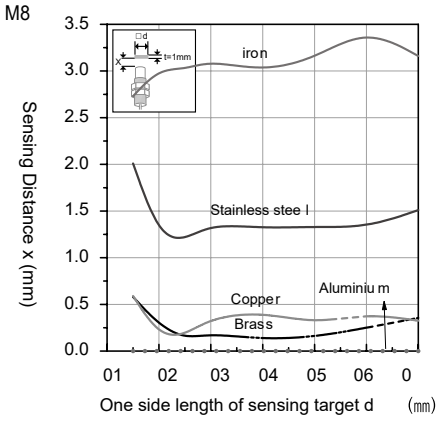
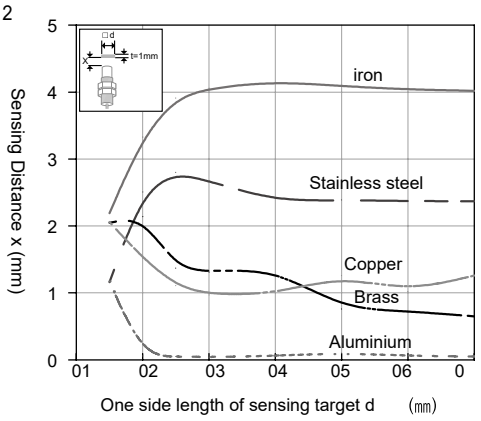


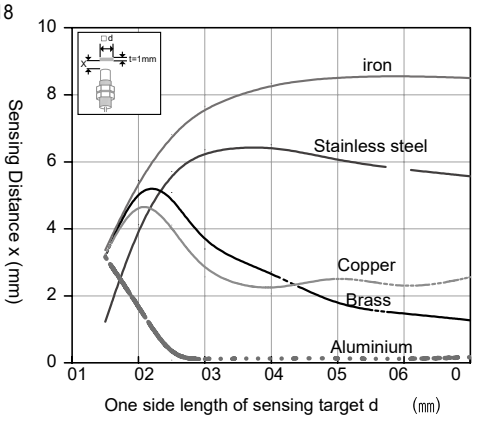
Sensing Distance Feature Data by Parallel(Left/Right) Movement

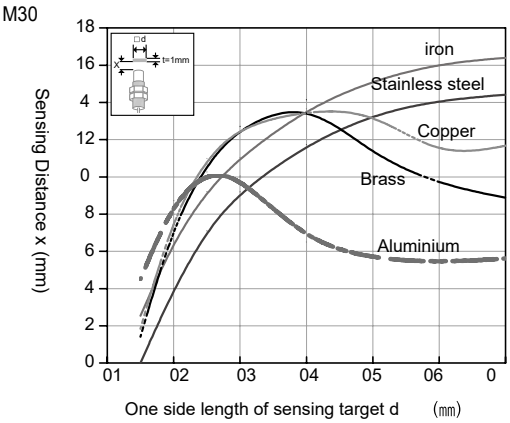


Sensing Distance Feature Data by Target Material and Size









Cylindrical Type Proximity Sensor

▣ Features

- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit
- Built-in output short over current protection circuit (DC type)
- Long life cycle and high reliability, and simple operation
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches

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

▣ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	PRT08-1.5DO PRT08-1.5DC PRT08-1.5DO-V	PRT08-2DO PRT08-2DC	PRT12-2□O PRT12-2□C	PRT12-4□O PRT12-4□C	PRT18-5□O PRT18-5□C	PRT18-8□O PRT18-8□C	PRT30-10□O PRT30-10□C PRT30-10DO-V	PRT30-15□O PRT30-15□C
Diameter of sensing side	8mm		12mm		18mm		30mm	
Sensing distance	1.5mm	2mm	2mm	4mm	5mm	8mm	10mm	15mm
Installation	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis	Max. 10% of sensing distance							
Standard sensing target	8×8×1mm (iron)		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.05mm	0 to 1.4mm	0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operating voltage)	12-24VDC⎓ (10-30VDC⎓)							
Leakage current	Max. 0.6mA							
Response frequency※1	1.5kHz	1kHz	1.5kHz	500Hz		350Hz	400Hz	200Hz
Residual voltage※2	Max. 3.5V (non-polarity type is max. 5V)							
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃ (for PRT08 Series: ±20% max.)							
Control output	2 to 100mA							
Insulation resistance	Over 50MΩ (at 500VDC megger)							
Dielectric strength	1,500VAC 50/60Hz for 1 min							
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Indicator	Operation indicator: Red LED							
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃							
Environment: Ambient humidity	35 to 95% RH, storage: 35 to 95% RH							
Protection circuit	Surge protection circuit		Surge protection circuit, output short over current protection circuit					
Protection structure	IP67 (IEC standard)							
Cable	Ø3.5mm, 2-wire, 2m (AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulator diameter: Ø1mm)		Ø4mm, 2-wire, 2m		Ø5mm, 2-wire, 2m			
			AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm					
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)							
Approval	CE							
Weight※3	Approx. 64g (approx. 52g)		Approx.84g (approx. 72g)		Approx.122g (approx. 110g)		Approx.207g (approx. 170g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected device because residual voltage is 5V.
※3: The weight includes packaging. The weight in parenthesis in for unit only.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

● DC 3-wire type

Model	PR08-1.5DN PR08-1.5DP PR08-1.5DN2 PR08-1.5DP2 PRL08-1.5DN PRL08-1.5DP PRL08-1.5DN2 PRL08-1.5DP2	PR08-2DN PR08-2DP PR08-2DN2 PR08-2DP2 PRL08-2DN PRL08-2DP PRL08-2DN2 PRL08-2DP2	PR12-2DN PR12-2DP PR12-2DN2 PR12-2DP2 PRS12-2DN PRS12-2DP PRS12-2DN2 PRS12-2DP2	PR12-4DN PR12-4DP PR12-4DN2 PR12-4DP2 PRS12-4DN PRS12-4DP PRS12-4DN2 PRS12-4DP2 PRL12-4DN PRL12-4DP	PR18-5DN PR18-5DP PR18-5DN2 PR18-5DP2 PR18-5DN-V PRL18-5DN PRL18-5DP PRL18-5DN2 PRL18-5DP2	PR18-8DN PR18-8DP PR18-8DN2 PR18-8DP2 PRL18-8DN PRL18-8DP PRL18-8DN2 PRL18-8DP2	PR30-10DN PR30-10DP PR30-10DN2 PR30-10DP2 PRL30-10DN PRL30-10DP PRL30-10DN2 PRL30-10DP2	PR30-15DN PR30-15DP PR30-15DN2 PR30-15DP2 PRL30-15DN PRL30-15DP PRL30-15DN2 PRL30-15DP2
Diameter of sensing side	8mm		12mm		18mm		30mm	
Sensing distance	1.5mm	2mm	2mm	4mm	5mm	8mm	10mm	15mm
Installation	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis	Max. 10% of sensing distance							
Standard sensing target	8×8×1mm (iron)		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.05mm	0 to 1.4mm	0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)	12-24VDC⎓ (10-30VDC⎓)							
Current consumption	Max. 10mA							
Response frequency※1	1.5kHz	1kHz	1.5kHz	500Hz		350Hz	400Hz	200Hz
Residual voltage	Max. 2.0V		Max. 1.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃, PR08 Series: max. ±20%							
Control output	Max. 200mA							
Insulation resistance	Over 50MΩ (at 500VDC megger)							
Dielectric strength	1,500VAC 50/60Hz for 1 min							
Vibration	1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Indicator	Operation indicator: Red LED							
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃							
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH							
Protection circuit	Surge protection circuit, Reverse polarity protection circuit, output short over current protection circuit							
Protection structure	IP67 (IEC standard)							
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)							
Cable	Ø3.5mm, 3-wire, 2m (AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulator diameter: Ø1mm)		Ø4mm, 3-wire, 2m		Ø5mm, 3-wire, 2m			
			AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm					
Approval	CE							
Weight※2	PR: Approx. 64g (approx. 52g) PRL: Approx. 66g (approx. 54g)		PR: Approx. 84g (approx. 72g) PRS: Approx. 82g (approx. 70g) PRL: Approx. 88g (approx. 76g)		PR: Approx. 122g (approx. 110g) PRL: Approx. 142g (approx. 130g)		PR: Approx. 207g (approx. 170g) PRL: Approx. 247g (approx. 210g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

● AC 2-wire type

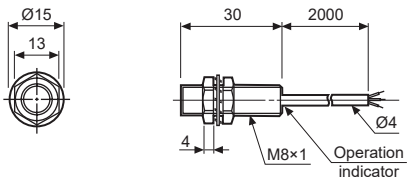
Model		PR12-2AO PR12-2AC	PR12-4AO PR12-4AC	PR18-5AO PR18-5AC PRL18-5AO PRL18-5AC	PR18-8AO PR18-8AC PRL18-8AO PRL18-8AC	PR30-10AO PR30-10AC PRL30-10AO PRL30-10AC	PR30-15AO PR30-15AC PRL30-15AO PRL30-15AC
Diameter of sensing side		12mm		18mm		30mm	
Sensing distance		2mm	4mm	5mm	8mm	10mm	15mm
Installation		Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)		100-240VAC∼ (85-264VAC∼)					
Leakage current		Max. 2.5mA					
Response frequency※1		20Hz					
Residual voltage		Max. 10V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		5 to 150mA		5 to 200mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		2,500VAC 50/60Hz for 1 min					
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Indicator		Operation indicator: Red LED					
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit					
Protection structure		IP67 (IEC standard)					
Cable		Ø4mm, 2-wire, 2m		Ø5mm, 2-wire, 2m			
		AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm					
Insulation type		Double insulation or reinforced insulation (Mark: ⊡, dielectric strength between the measuring input part and the power part: 1kV)					
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC)					
Approval		CE					
Weight※2		Approx. 84g (approx. 66g)		PR: Approx. 130g (approx. 118g) PRL: Approx. 142g (approx. 130g)		PR: Approx. 207g (approx. 170g) PRL: Approx. 245g (approx. 208g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

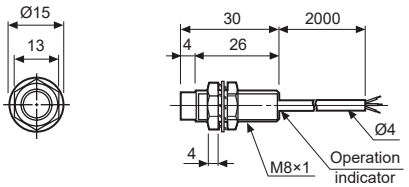
▣ Dimensions

(unit: mm)

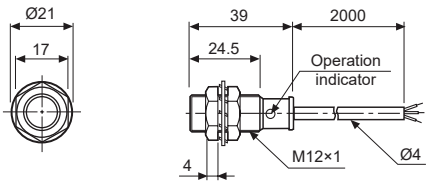
● PR(T)08-1.5D□



● PR(T)08-2D□



● PRS12-2D□



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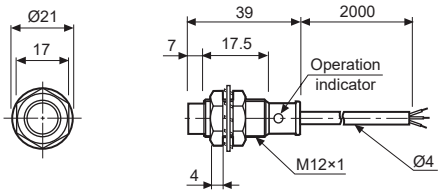
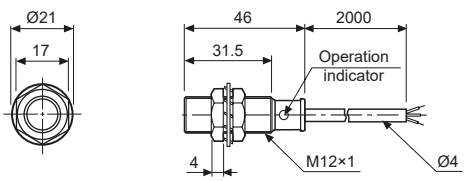
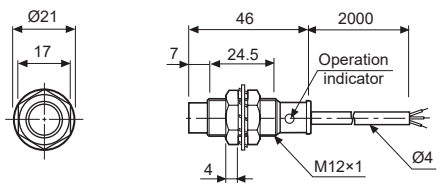


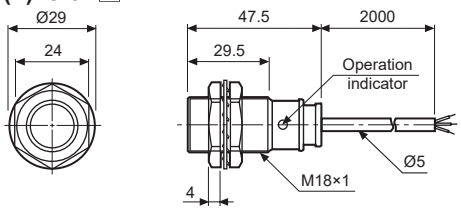
● PR(T)12-2D□



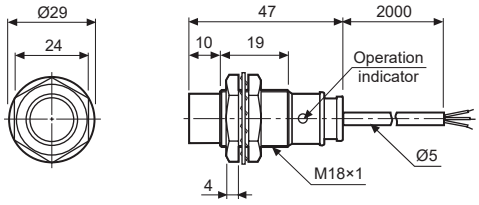
● PR(T)12-4D□



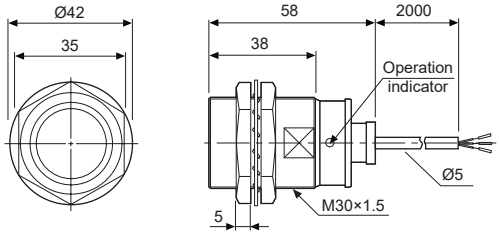
● PR(T)18-5D□



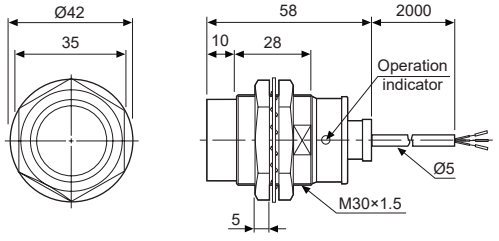
● PR(T)18-8D□



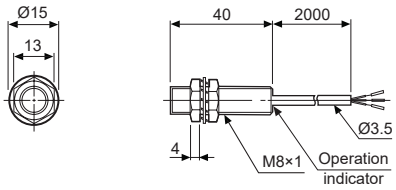
● PR(T)30-10D□



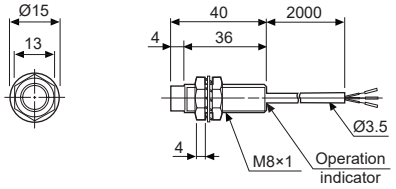
● PR(T)30-15D□



● PRL08-1.5D□



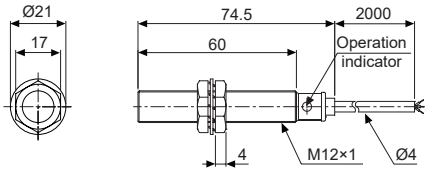
● PRL08-2D□



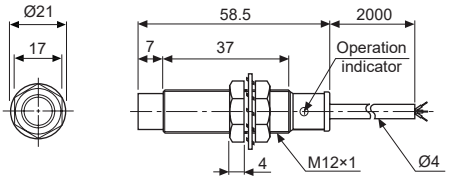
▣ Dimensions

(unit: mm)

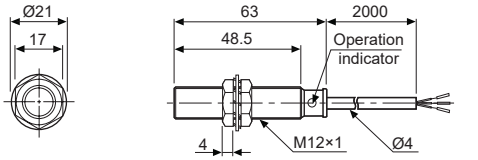
● **PRL12-2D□**



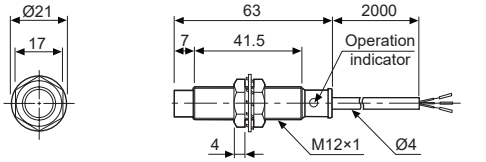
● **PRL12-4D□**



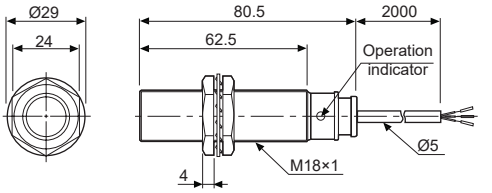
● **PR12-2A□**



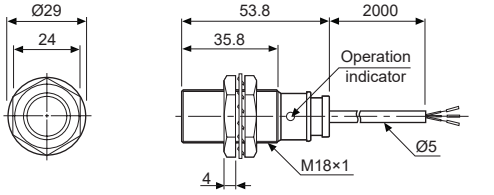
● **PR12-4A□**



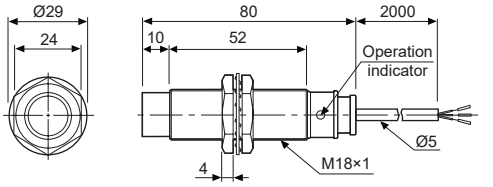
● **PRL18-5D□** ● **PRL18-5A□**



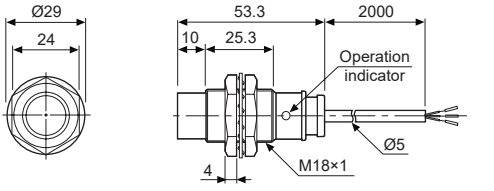
● **PR18-5A□**



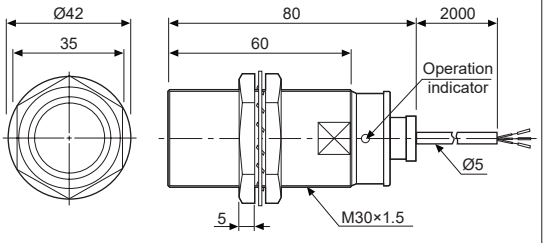
● **PRL18-8D□** ● **PRL18-8A□**



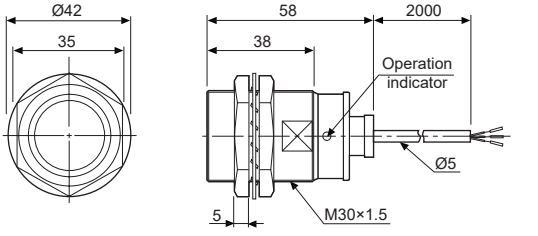
● **PR18-8A□**



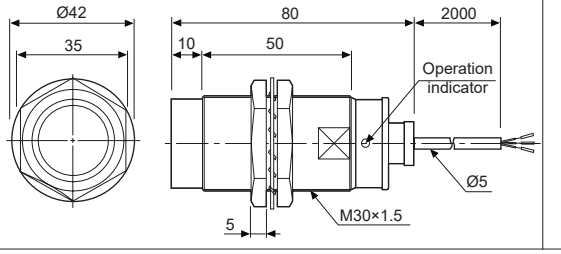
● **PRL30-10D□** ● **PRL30-10A□**



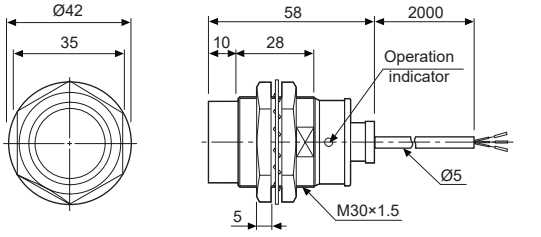
● **PR30-10A□**



● **PRL30-15D□** ● **PRL30-15A□**

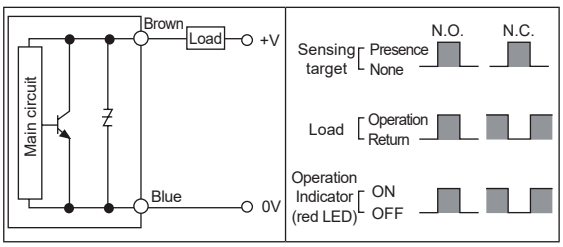


● **PR30-15A□**



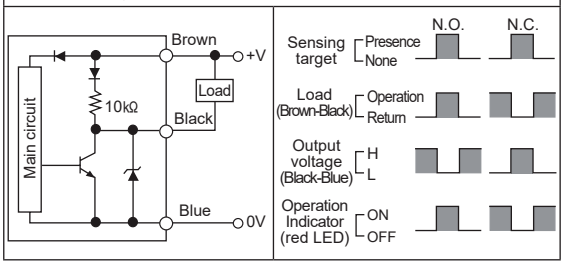
▣ Control Output Diagram and Load Operation

◎ DC 2-wire type

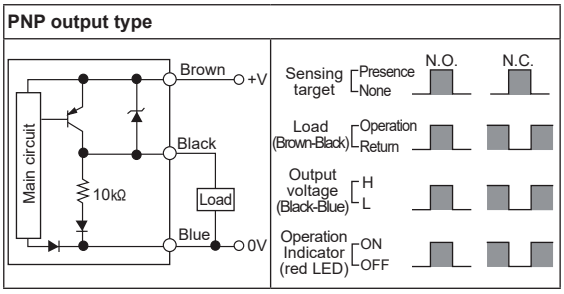


◎ DC 3-wire type

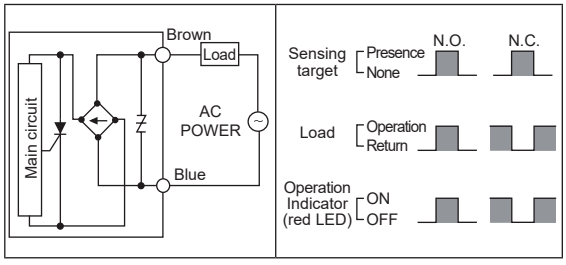
NPN output type



PNP output type

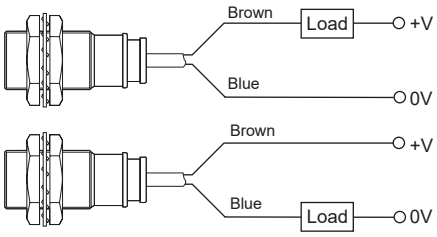


◎ AC 2-wire type



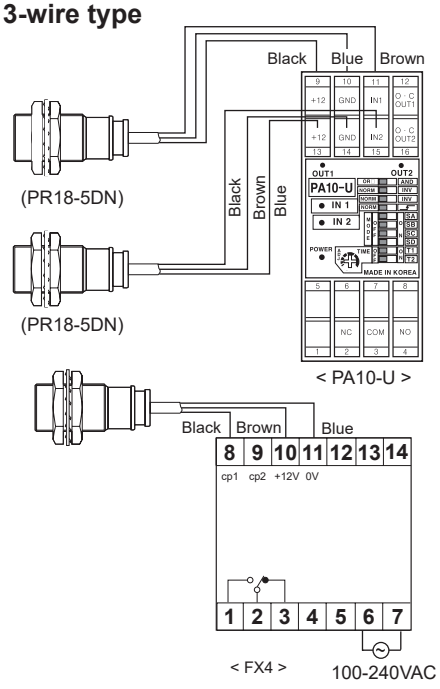
▣ Connections

◎ DC 2-wire type

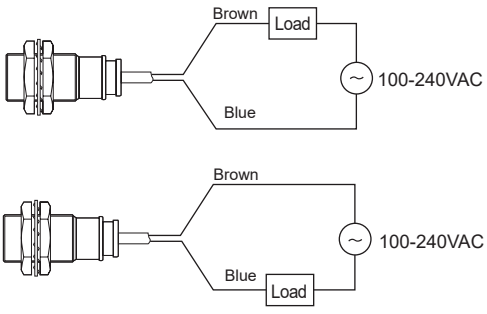


※The load can be connected to either wire.

◎ DC 3-wire type

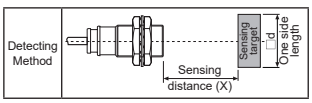


◎ AC 2-wire type

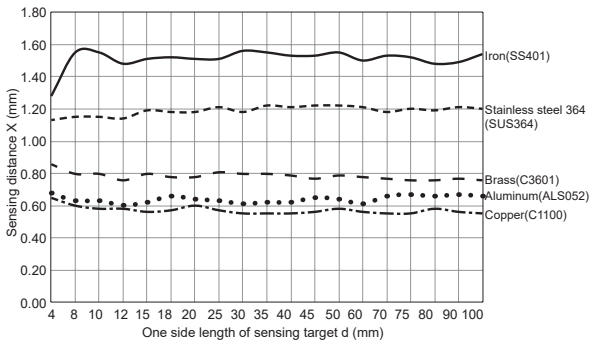


※The load can be connected to either wire.

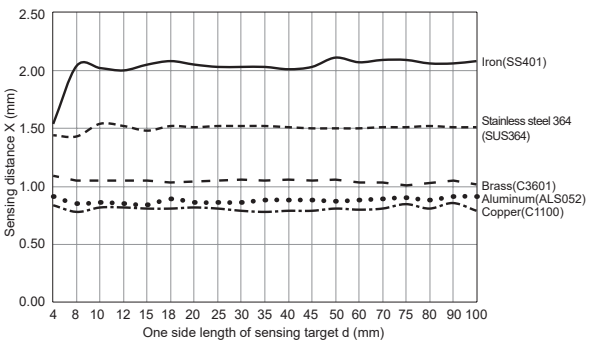
▣ Sensing Distance Feature Data by Target Material and Size



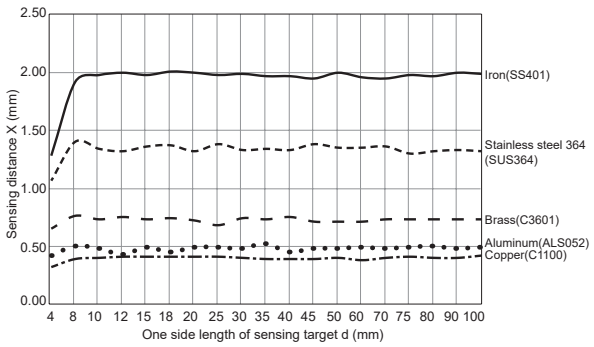
● PRT08-1.5D□



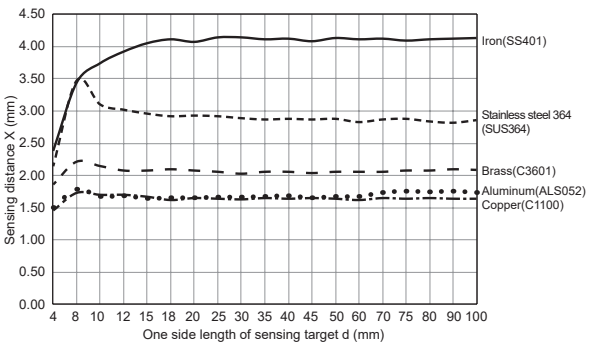
● PRT08-2D□



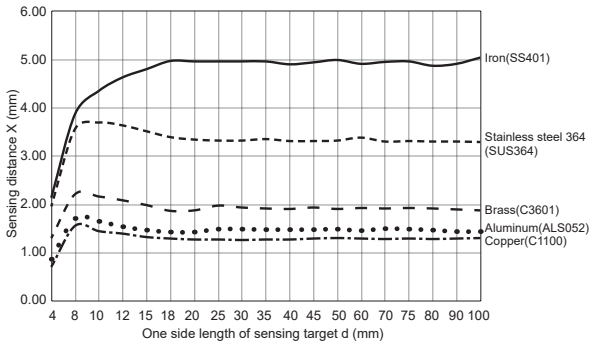
● PRT12-2D□, PR12-2A□



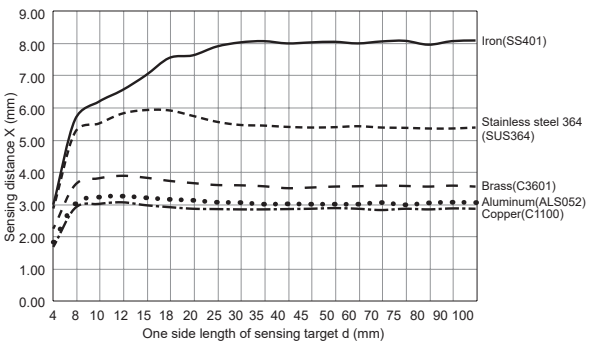
● PRT12-4D□, PR12-4A□



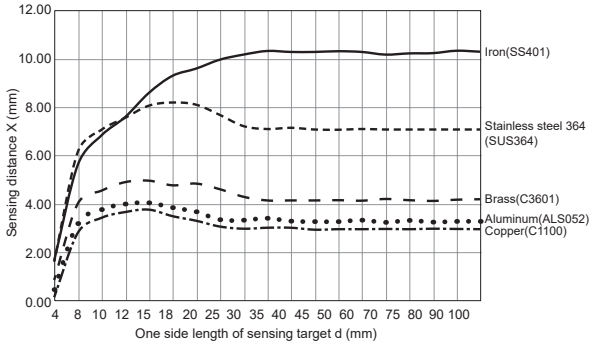
● PRT18-5D□, PR(L)18-5A□



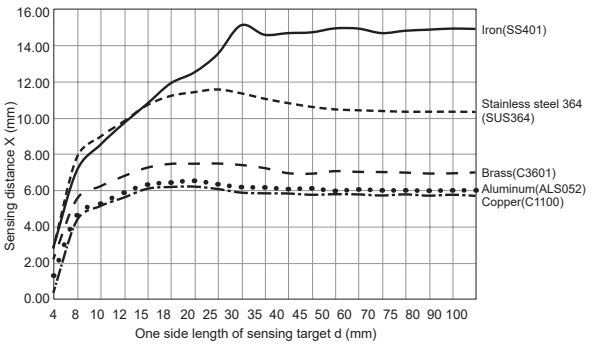
● PRT18-8D□, PR(L)18-8A□



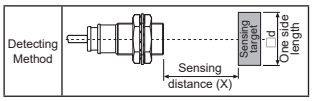
● PRT30-10D□, PR(L)30-10A□



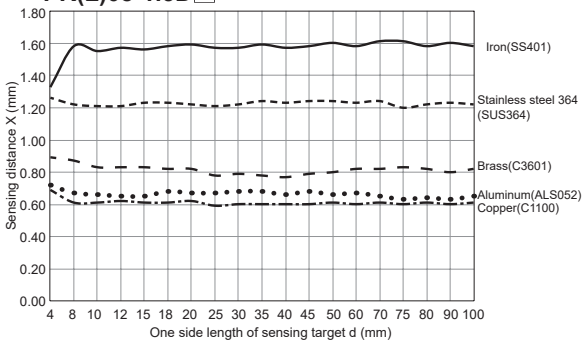
● PRT30-15D□, PR(L)30-15A□



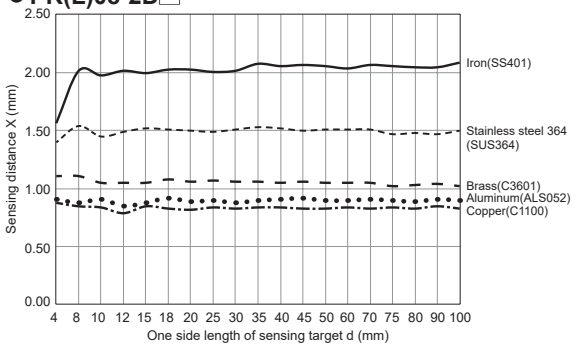
▣ Sensing Distance Feature Data by Target Material and Size



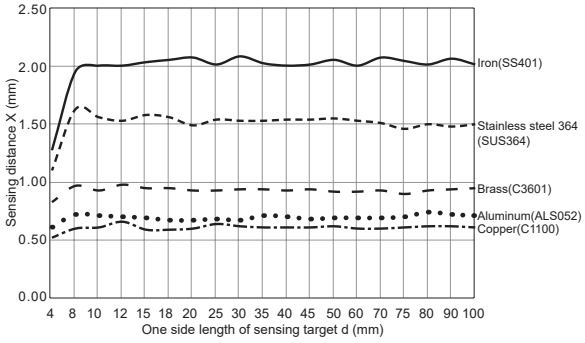
● PR(L)08-1.5D□



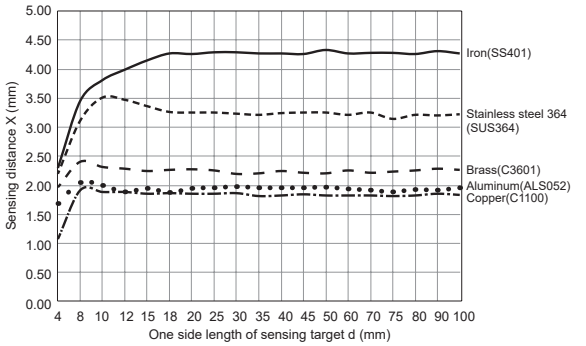
● PR(L)08-2D□



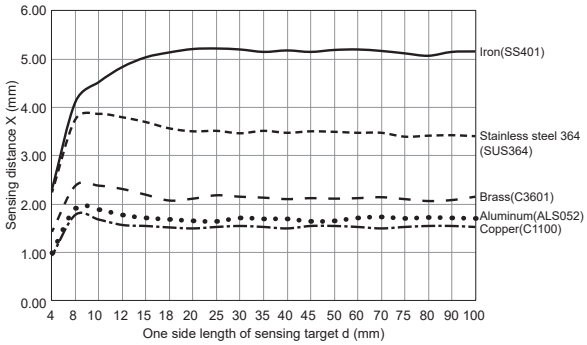
● PR(S/L)12-2D□



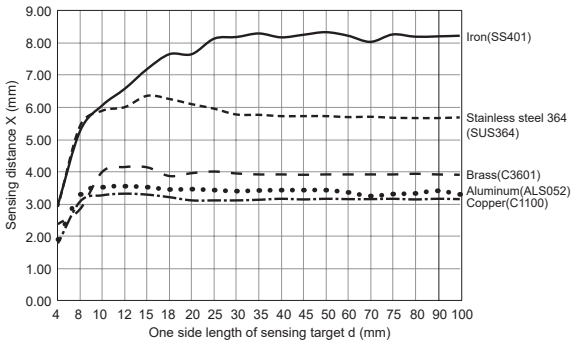
● PR(S/L)12-4D□



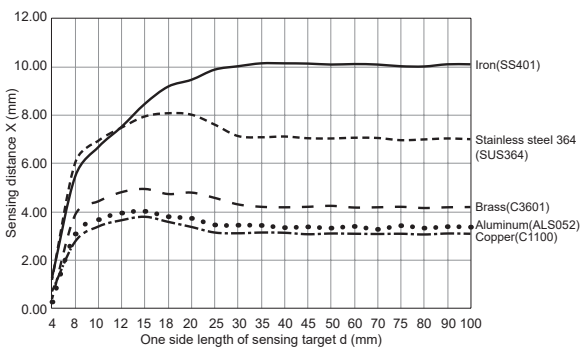
● PR(L)18-5D□



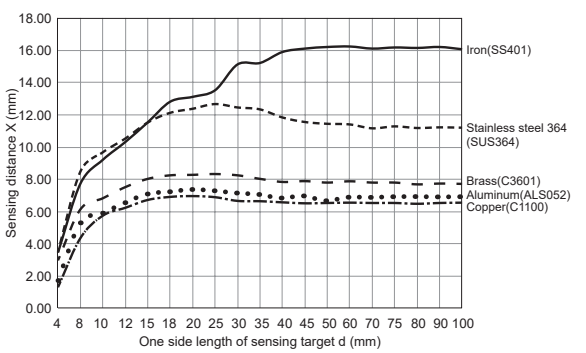
● PR(L)18-8D□



● PR(L)30-10D□

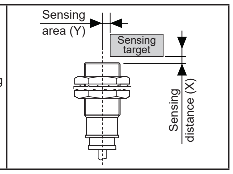


● PR(L)30-15D□

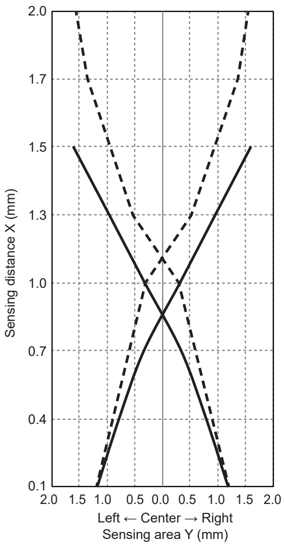


■ Sensing Distance Feature Data by Parallel (Left/Right) Movement

Detecting Method

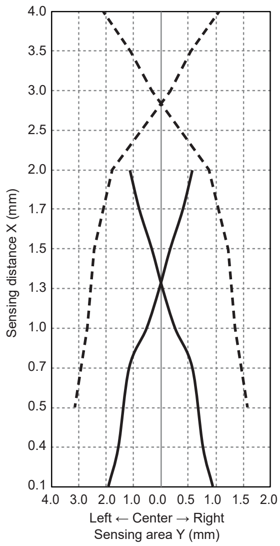


● PRT08-1.5D□/2D□



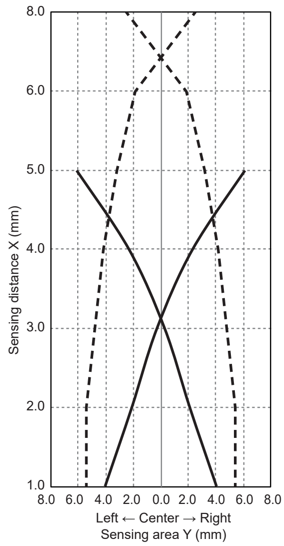
———	PRT08-1.5D□
- - - - -	PRT08-2D□

● PRT12-2D□/4D□ , PR12-2A□/4A□



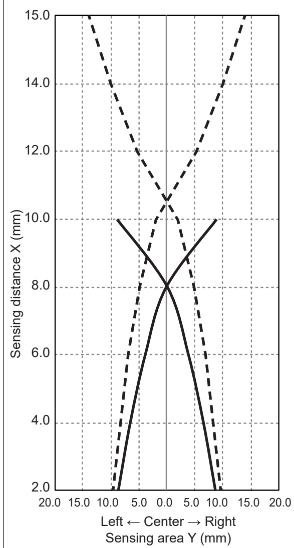
———	PRT12-2D□, PR12-2A□
- - - - -	PRT12-4D□, PR12-4A□

● PRT18-5D□/8D□, PR(L)18-5A□/8A□



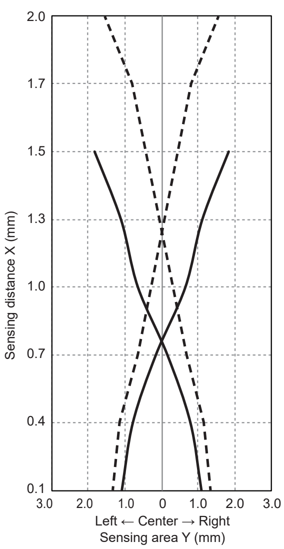
———	PRT18-5D□, PR(L)18-5A□
- - - - -	PRT18-8D□, PR(L)18-8A□

● PRT30-10D□/15D□ , PR(L)30-10A□/15A□



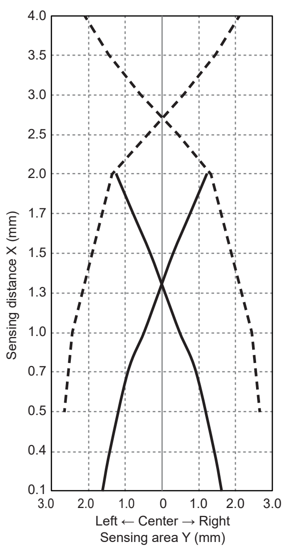
———	PRT30-10D□, PR(L)30-10A□
- - - - -	PRT30-15D□, PR(L)30-15A□

● PR(L)08-1.5D□/2D□



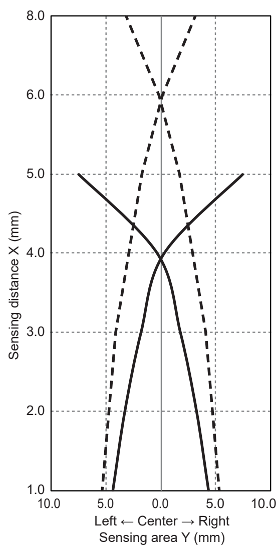
———	PR(L)08-1.5D□
- - - - -	PR(L)08-2D□

● PR(S/L)12-2D□/4D□



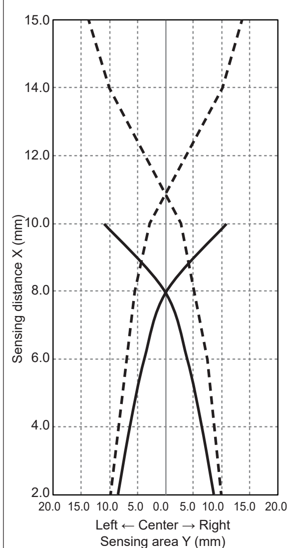
———	PR(S/L)12-2D□
- - - - -	PR(S/L)12-4D□

● PR(L)18-5D□/8D□



———	PR(L)18-5D□
- - - - -	PR(L)18-8D□

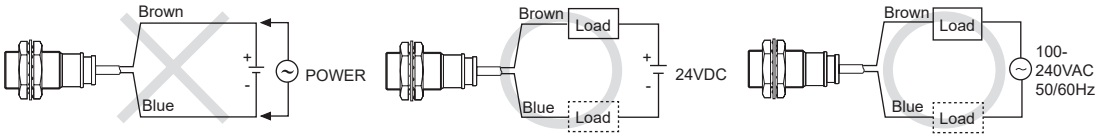
● PR(L)30-10D□/15D□



———	PR(L)30-10D□
- - - - -	PR(L)30-15D□

▣ Proper Usage

◎ Load connections

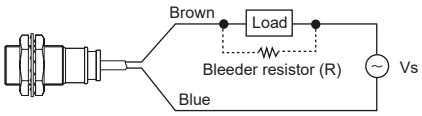


< DC 2-wire type & AC 2-wire type > < DC 2-wire type > < AC 2-wire type >

When using DC or AC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

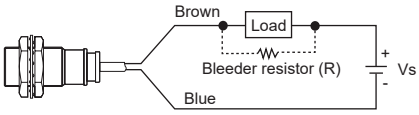
◎ In case of the load current is small

● AC 2-wire type



110VAC: Min. 20kΩ 3W
220VAC: Min. 39kΩ 10W

● DC 2-wire type



It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I: Action current of load, R: Bleeder resistance, P: Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

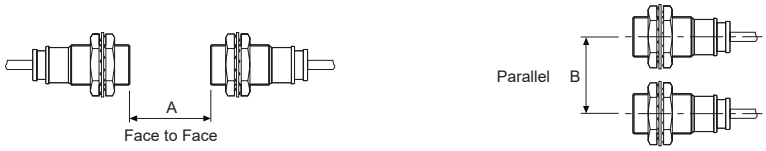
※W value of Bleeder resistor should be bigger for proper heat dissipation.

$$R \le \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

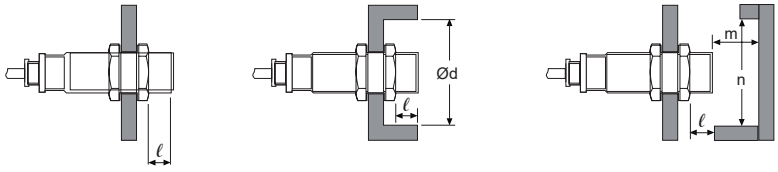
[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P : Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.



When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Item \ Model	PRT08-1.5D□ PR(L)08-1.5D□	PRT08-2D□ PR(L)08-2D□	PRT12-2D□ PR(S/L)12-2D□ PR12-2A□	PRT12-4D□ PR(S/L)12-4D□ PR12-4A□	PRT18-5D□ PR(L)18-5D□ PR(L)18-5A□	PRT18-8D□ PR(L)18-8D□ PR(L)18-8A□	PRT30-10D□ PR(L)30-10D□ PR(L)30-10A□	PRT30-15D□ PR(L)30-15D□ PR(L)30-15A□
A	9	12	12	24	30	48	60	90
B	16	24	24	36	36	54	60	90
ℓ	0	8	0	11	0	14	0	15
Ød	8	24	12	36	18	54	30	90
m	4.5	6	6	12	15	24	30	45
n	12	24	18	36	27	54	45	90

Cylindrical Cable Connector Type Proximity Sensor

▣ Features

- Shorten the time of maintenance with the body
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit
- Built-in output short over current protection circuit
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches

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

CE

▣ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	PRWT08-1.5DO PRWT08-1.5DC PRWT08-1.5DO-I PRWT08-1.5DC-I PRWT08-1.5DO-V PRWT08-1.5DC-V PRWT08-1.5DO-IV PRWT08-1.5DC-IV	PRWT08-2DO PRWT08-2DC PRWT08-2DO-I PRWT08-2DC-I PRWT08-2DO-V PRWT08-2DC-V PRWT08-2DO-IV PRWT08-2DC-IV	PRWT12-2□O PRWT12-2□C PRWT12-2□O-I PRWT12-2□C-I	PRWT12-4□O PRWT12-4□C PRWT12-4□O-I PRWT12-4□C-I	PRWT18-5□O PRWT18-5□C PRWT18-5□O-I PRWT18-5□C-I	PRWT18-8□O PRWT18-8□C PRWT18-8□O-I PRWT18-8□C-I	PRWT30-10□O PRWT30-10□C PRWT30-10□O-I PRWT30-10□C-I PRWT30-10DO-V PRWT30-10DC-IV	PRWT30-15□O PRWT30-15□C PRWT30-15□O-I PRWT30-15□C-I PRWT30-15□O-V PRWT30-15□C-IV
Diameter of sensing side	8mm		12mm		18mm		30mm	
Sensing distance	1.5mm	2mm		4mm	5mm	8mm	10mm	15mm
Installation	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis	Max. 10% of sensing distance							
Standard sensing target	8×8×1mm (iron)		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.05mm	0 to 1.4mm		0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)	12-24VDC⎓ (10-30VDC⎓)							
Leakage current	Max. 0.6mA							
Response frequency※1	1.5kHz	1kHz	1.5kHz	500Hz		350Hz	400Hz	200Hz
Residual voltage※2	Max. 3.5V (non-polarity type is max. 5V)							
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃ (for PRWT08 Series: ±20% max.)							
Control output	2 to 100mA							
Insulation resistance	Over 50MΩ (at 500VDC megger)							
Dielectric strength	1,500VAC 50/60Hz for 1 min							
Vibration	1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock	500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times							
Indicator	Operation indicator: Red LED							
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃							
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH							
Protection circuit	Surge protection circuit		Surge protection circuit, output short over current protection circuit					
Protection structure	IP67 (IEC standard)							
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)							
Cable	Ø4mm, 2-wire, 300mm, M12 connector				Ø5mm, 2-wire, 300mm, M12 connector			
	(AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)							
Approval	CE							
Weight※3	Approx. 44g (approx. 32g)		Approx. 54g (approx. 42g)		Approx.70g (approx. 58g)		Approx. 134g (approx. 122g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected device because residual voltage is 5V.
※3: The weight includes packaging. The weight in parenthesis in for unit only.
※Please fasten the vibration part with PTFE type.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

● DC 3-wire type

Model	PRW08-1.5DN PRW08-1.5DP PRW08-1.5DN2 PRW08-1.5DP2 PRW08-1.5DN-V PRW08-1.5DP-V PRW08-1.5DN2-V PRW08-1.5DN2-V PRWL08-1.5DN PRWL08-1.5DP PRWL08-1.5DN2 PRWL08-1.5DP2	PRW08-2DN PRW08-2DP PRW08-2DN2 PRW08-2DP2 PRW08-2DN-V PRW08-2DP-V PRW08-2DN2-V PRW08-2DP2-V PRWL08-2DN PRWL08-2DP PRWL08-2DN2 PRWL08-2DP2	PRW12-2DN PRW12-2DP PRW12-2DN2 PRW12-2DP2	PRW12-4DN PRW12-4DP PRW12-4DN2 PRW12-4DP2	PRW18-5DN PRW18-5DP PRW18-5DN2 PRW18-5DP2 PRWL18-5DN PRWL18-5DP PRWL18-5DN2 PRWL18-5DP2	PRW18-8DN PRW18-8DP PRW18-8DN2 PRW18-8DP2 PRWL18-8DN PRWL18-8DP PRWL18-8DN2 PRWL18-8DP2	PRW30-10DN PRW30-10DP PRW30-10DN2 PRW30-10DP2 PRW30-10DN-V PRW30-10DP-V PRW30-10DN2-V PRW30-10DP2-V PRWL30-10DN PRWL30-10DP PRWL30-10DN2 PRWL30-10DP2	PRW30-15DN PRW30-15DP PRW30-15DN2 PRW30-15DP2 PRW30-15DN-V PRW30-15DP-V PRW30-15DN2-V PRW30-15DP2-V PRWL30-15DN PRWL30-15DP PRWL30-15DN2 PRWL30-15DP2
Diameter of sensing side	8mm		12mm		18mm		30mm	
Sensing distance	1.5mm	2mm		4mm	5mm	8mm	10mm	15mm
Installation	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis	Max. 10% of sensing distance							
Standard sensing target	8×8×1mm (iron)		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.05mm	0 to 1.4mm		0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)	12-24VDC⎓ (10-30VDC⎓)							
Current consumption	Max. 10mA							
Response frequency※1	1.5kHz	1kHz	1.5kHz	500Hz		350Hz	400Hz	200Hz
Residual voltage	Max. 2V		Max. 1.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃ (for PRW(L)08 series: ±20% max.)							
Control output	200mA							
Insulation resistance	Over 50MΩ (at 500VDC megger)							
Dielectric strength	1,500VAC 50/60Hz for 1 min							
Vibration	1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Indicator	Operation indicator: Red LED							
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃							
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH							
Protection circuit	Surge protection circuit, Reverse polarity protection circuit, output short over current protection circuit							
Protection structure	IP67 (IEC standard)							
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)							
Cable	Ø4mm, 3-wire, 300mm, M12 connector				Ø5mm, 3-wire, 300mm, M12 connector			
	(AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)							
Approval	CE							
Weight※2	PRW: Approx. 44g (approx. 32g) PRWL: Approx. 46g (approx. 34g)		Approx. 54g (approx. 42g)		PRW: Approx. 70g (approx. 58g) PRWL: Approx. 90g (approx. 78g)		PRW: Approx. 134g (approx. 122g) PRWL: Approx. 195g (approx. 158g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

● AC 2-wire type

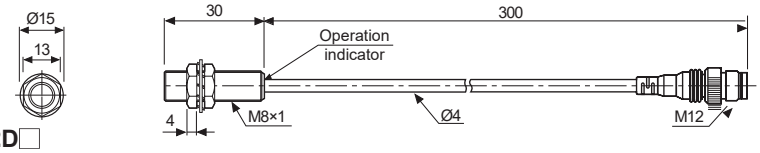
Model	PRW12-2AO PRW12-2AC	PRW12-4AO PRW12-4AC	PRW18-5AO PRW18-5AC PRWL18-5AO PRWL18-5AC	PRW18-8AO PRW18-8AC PRWL18-8AO PRWL18-8AC	PRW30-10AO PRW30-10AC PRWL30-10AO PRWL30-10AC	PRW30-15AO PRW30-15AC PRWL30-15AO PRWL30-15AC
Diameter of sensing side	12mm		18mm		30mm	
Sensing distance	2mm	4mm	5mm	8mm	10mm	15mm
Installation	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operation voltage)	100-240VAC～ (85-264VAC～)					
Leakage current	Max. 2.5mA					
Response frequency※1	20Hz					
Residual voltage	Max. 10V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	5 to 150mA		5 to 200mA			
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	2,500VAC 50/60Hz for 1 min					
Vibration	1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Indicator	Operation indicator: Red LED					
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit	Surge protection circuit					
Protection structure	IP67 (IEC standard)					
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant Acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC)					
Cable	Ø4mm, 2-wire, 300mm, M12 connector		Ø5mm, 2-wire, 300mm, M12 connector			
	AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm					
Approval	CE					
Weight※2	Approx. 54g (approx. 42g)		PRW: Approx. 78g (approx. 66g) PRWL: Approx. 90g (approx. 78g)		PRW: Approx. 134g (approx. 122g) PRWL: Approx. 195g (approx. 158g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

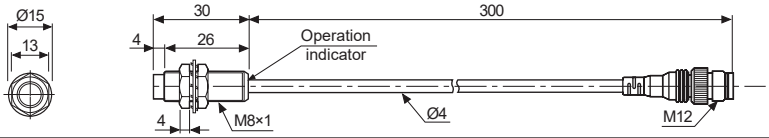
▣ Dimensions

(unit: mm)

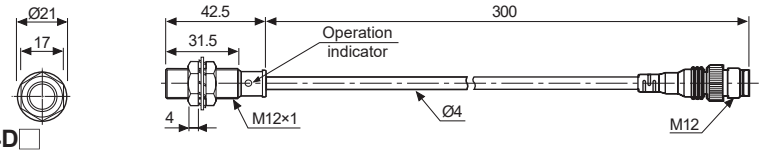
● **PRWT08-1.5D□(-I)** ● **PRW08-1.5D□**



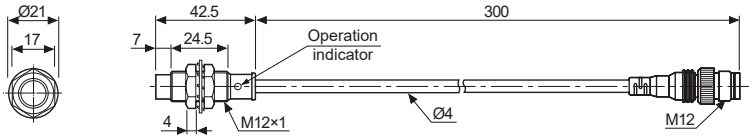
● **PRWT08-2D□(-I)** ● **PRW08-2D□**



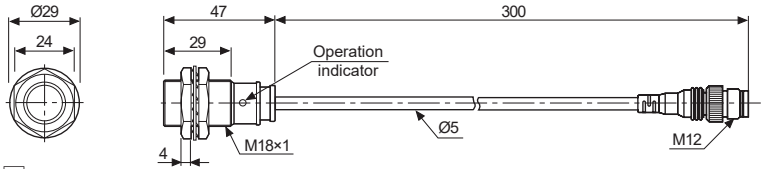
● **PRWT12-2D□(-I)** ● **PRW12-2D□**



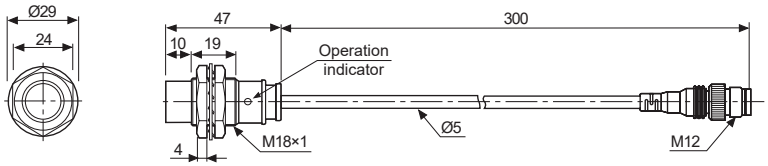
● **PRWT12-4D□(-I)** ● **PRW12-4D□**



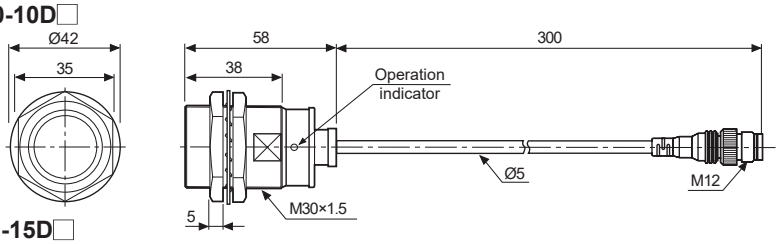
● **PRWT18-5D□(-I)** ● **PRW18-5D□**



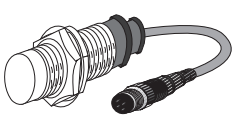
● **PRWT18-8D□(-I)** ● **PRW18-8D□**

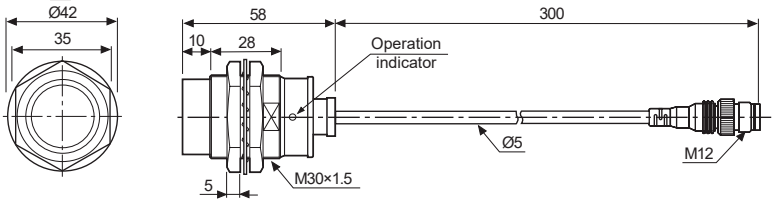


● **PRWT30-10D□(-I)** ● **PRW30-10D□**

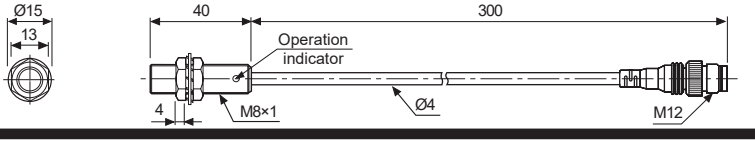


● **PRWT30-15D□(-I)** ● **PRW30-15D□**





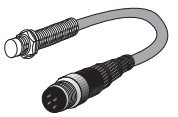
● **PRWL08-1.5D□**

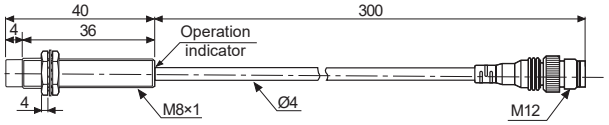


▣ Dimensions

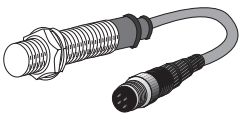
(unit: mm)

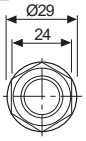
● **PRWL08-2D□**

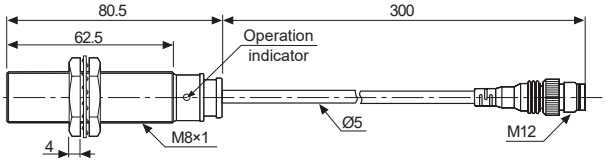




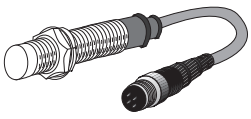
● **PRWL18-5D□** ● **PRWL18-5A□**

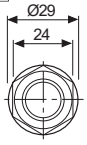


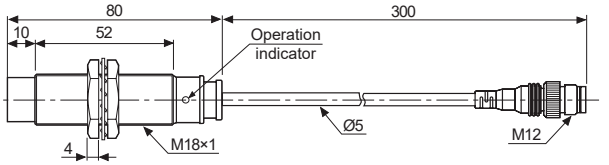




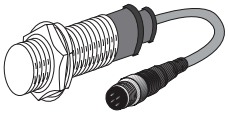
● **PRWL18-8D□** ● **PRWL18-8A□**

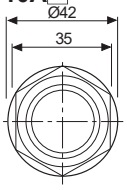


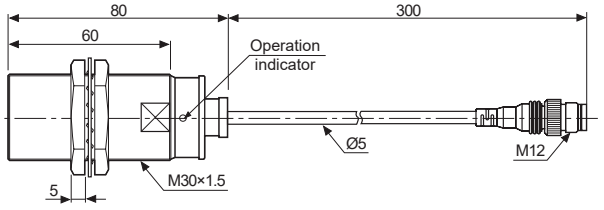




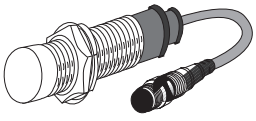
● **PRWL30-10D□** ● **PRWL30-10A□**

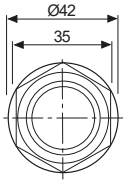


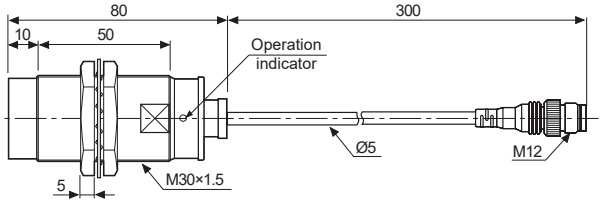




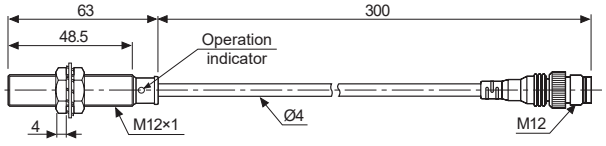
● **PRWL30-15D□** ● **PRWL30-15A□**



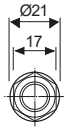


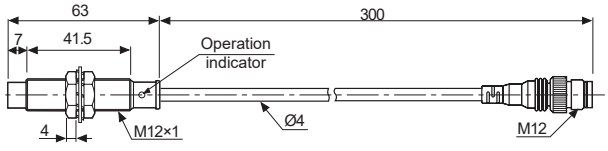


● **PRW12-2A□**

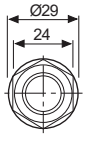


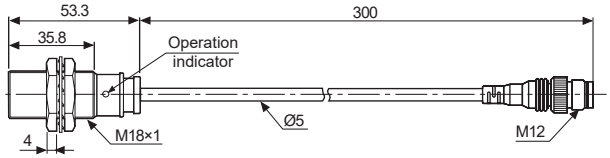
● **PRW12-4A□**



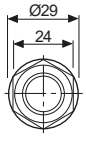


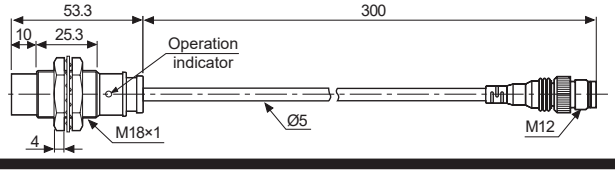
● **PRW18-5A□**





● **PRW18-8A□**

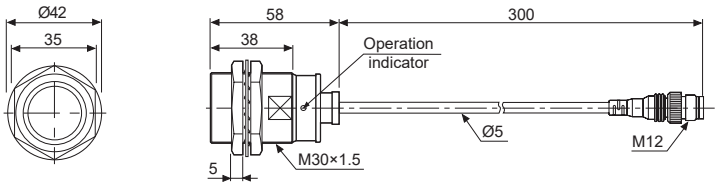




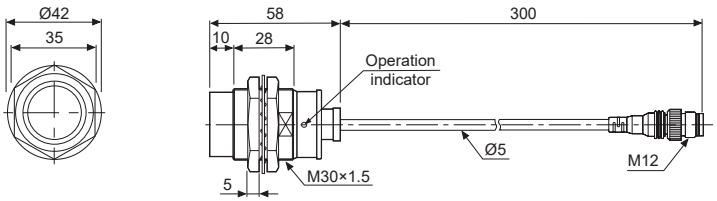
▣ Dimensions

(unit:mm)

● **PRW30-10A□**

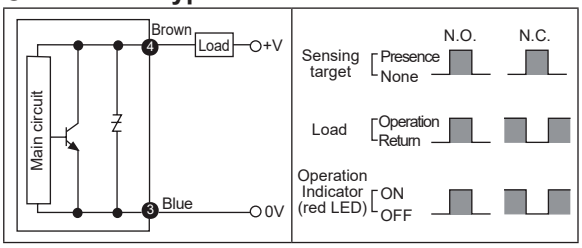


● **PRW30-15A□**



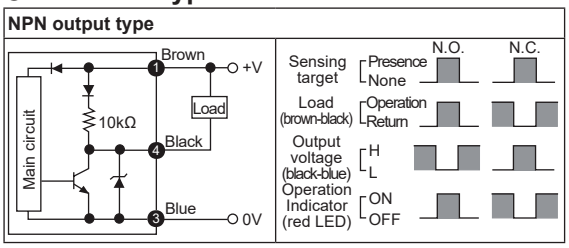
▣ Control Output Diagram and Load Operation

◎ DC 2-wire type

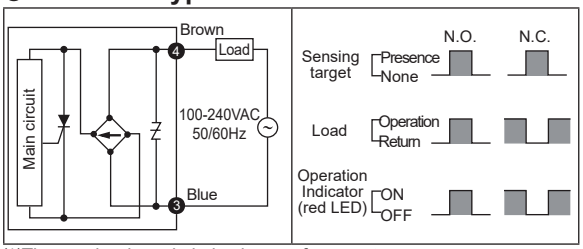


◎ DC 3-wire type

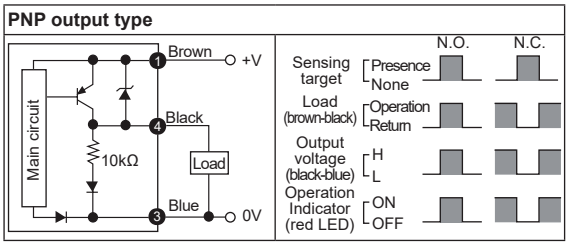
NPN output type



◎ AC 2-wire type



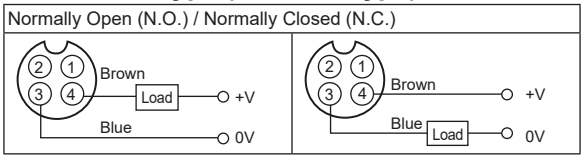
PNP output type



※The number in a circle is pin no. of connector.

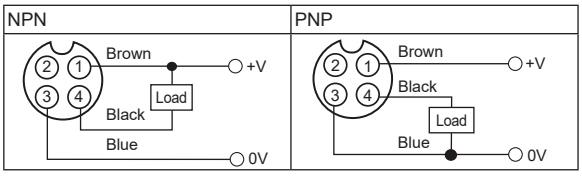
▣ Wiring Diagram

◎ DC 2-wire type (standard type)



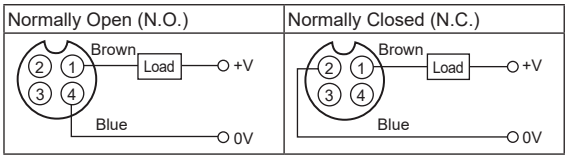
※Pin ①, ② are not used terminals.
※When using DC 3-wire type of connector cable, black (12-24VDC) and blue (0V) cables can be used.

◎ DC 3-wire type



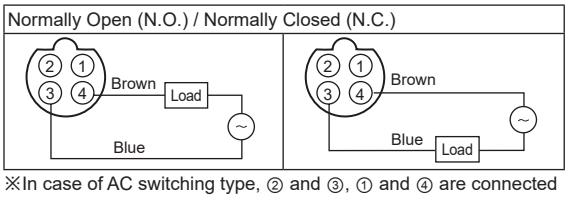
※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)
※Please fasten the vibration part with PTFE tape.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

◎ DC 2-wire type (IEC standard type)



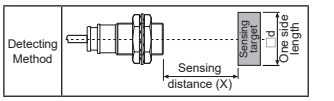
※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The type, pin arrangement of connector based upon IEC standard is being developed.
※Please put "I" behind of standard type for purchasing IEC standard product. E.g.)PRWT12-4DO-I
※Please put "I" behind of model name for selecting proximity sensor by IEC standard. E.g.)CID2-2-I, CLD2-2-I

◎ AC 2-wire type

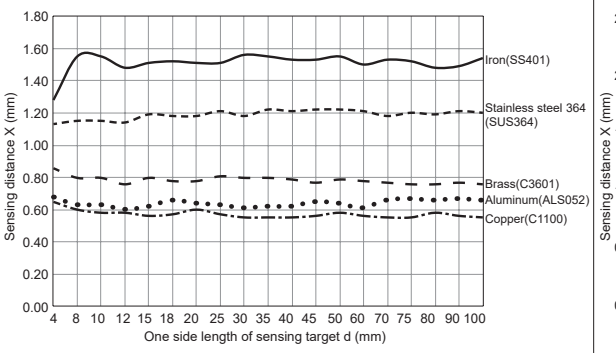


※In case of AC switching type, ② and ③, ① and ④ are connected to each other inside.

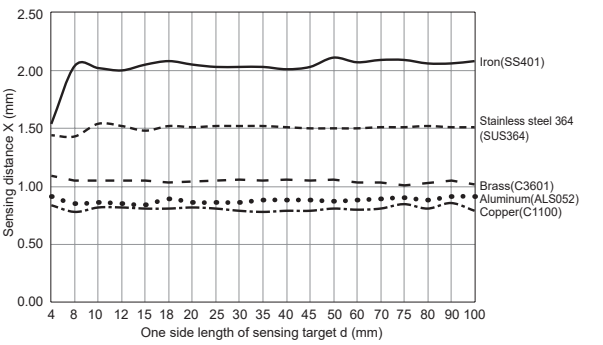
▣ Sensing Distance Feature Data by Target Material and Size



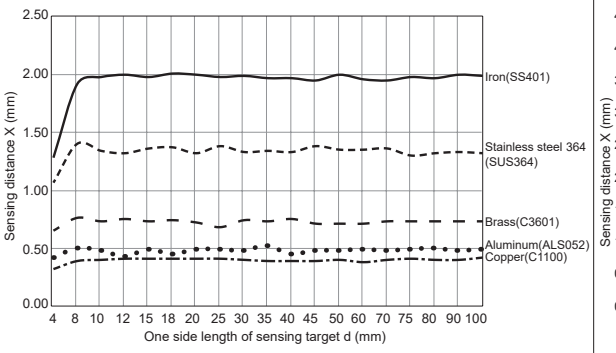
● PRWT08-1.5D□



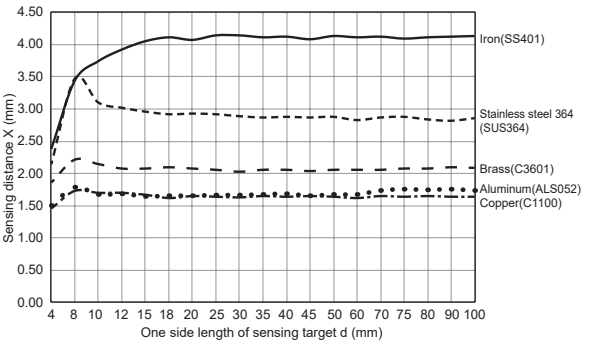
● PRWT08-2D□



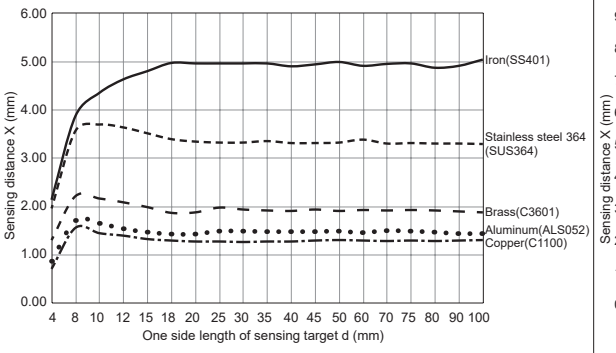
● PRWT12-2D□, PRW12-2A□



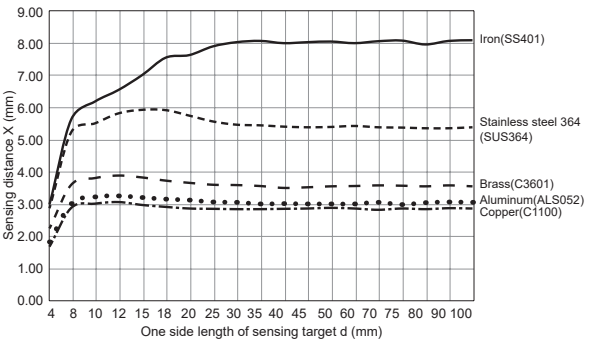
● PRWT12-4D□, PRW12-4A□



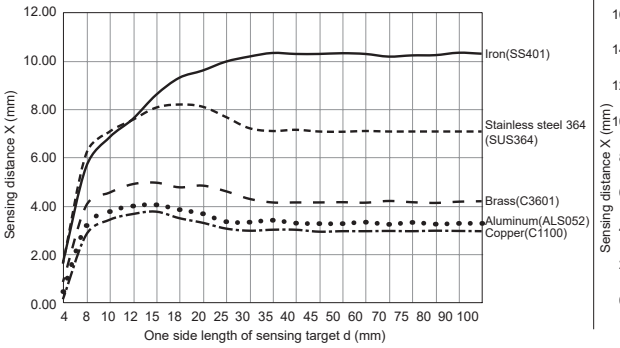
● PRWT18-5D□, PRW(L)18-5A□



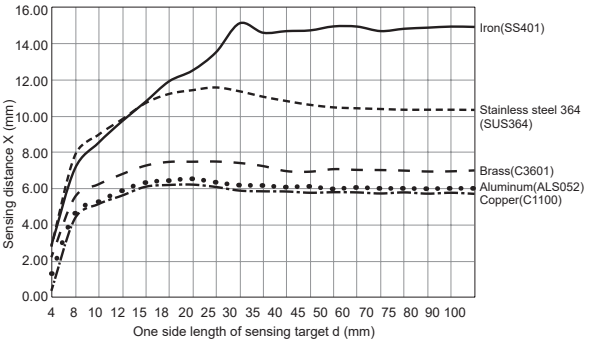
● PRWT18-8D□, PRW(L)18-8A□



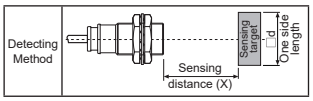
● PRWT30-10D□, PRW(L)30-10A□



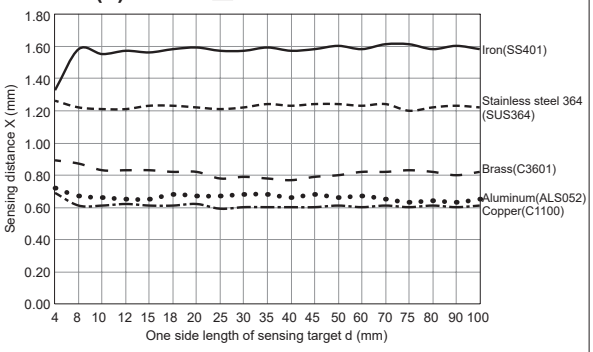
● PRWT30-15D□, PRW(L)30-15A□



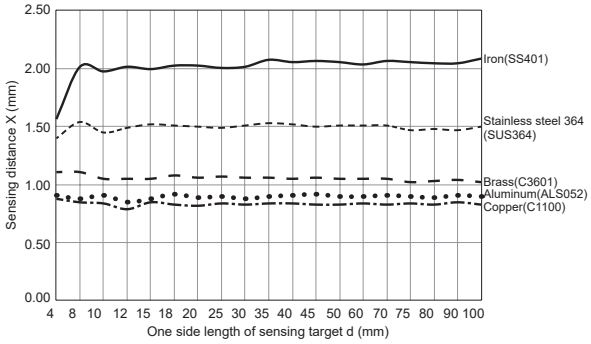
▣ Sensing Distance Feature Data by Target Material and Size



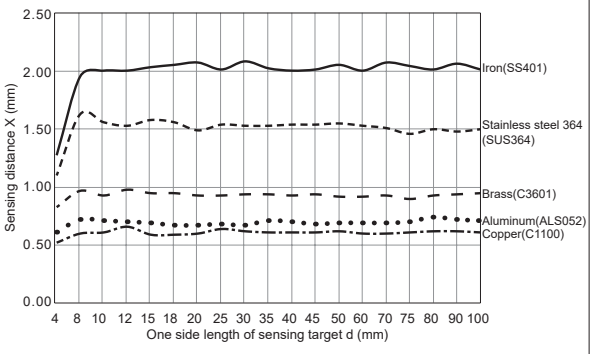
● PRW(L)08-1.5D□



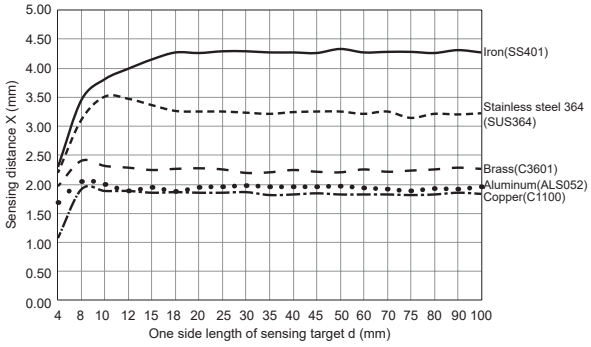
● PRW(L)08-2D□



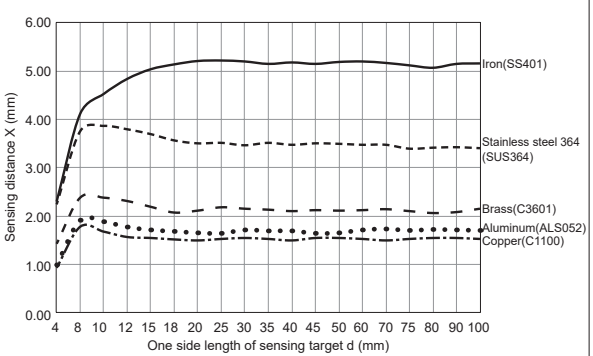
● PRW12-2D□



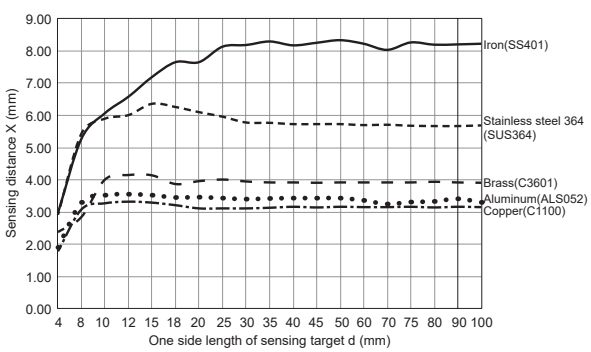
● PRW12-4D□



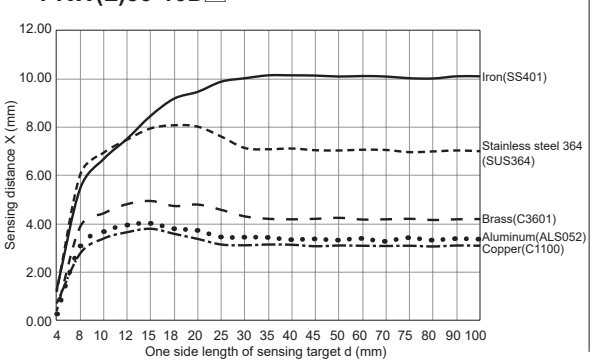
● PRW(L)18-5D□



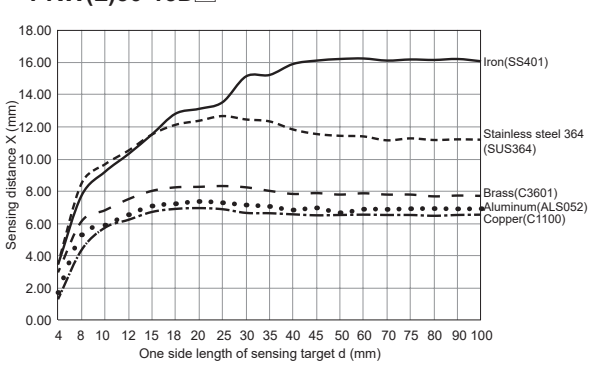
● PRW(L)18-8D□



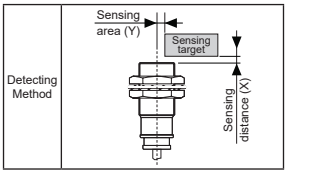
● PRW(L)30-10D□



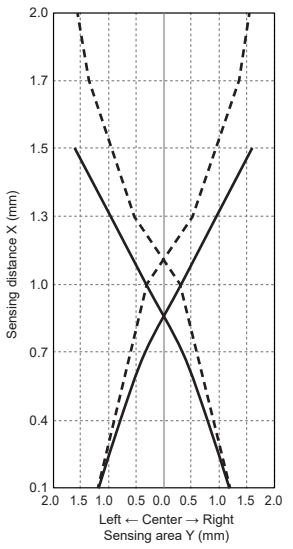
● PRW(L)30-15D□



▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement

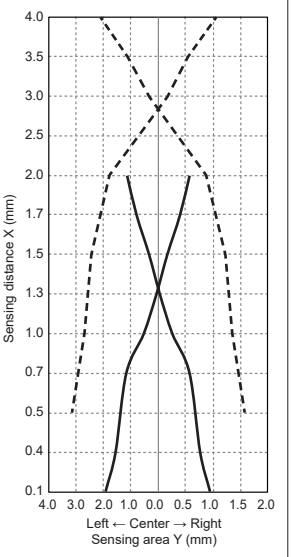


● PRWT08-1.5D□/2D□



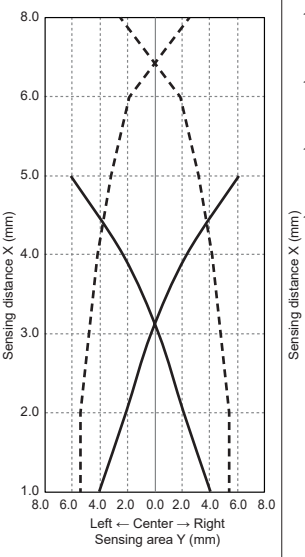
———	PRWT08-1.5D□
- - - - -	PRWT08-2D□

● PRWT12-2D□/4D□ , PRW12-2A□/4A□



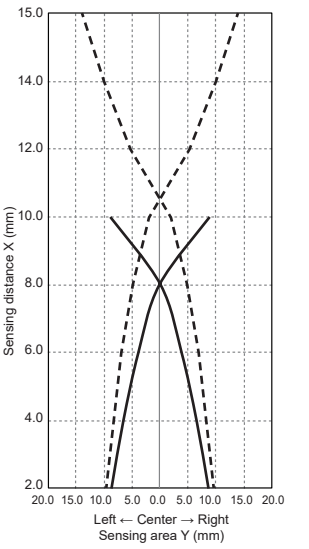
———	PRWT12-2D□, PRW12-2A□
- - - - -	PRWT12-4D□, PRW12-4A□

● PRWT18-5D□/8D□, PRW(L)18-5A□/8A□



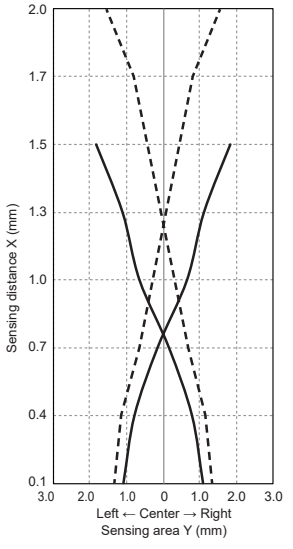
———	PRWT18-5D□, PRW(L)18-5A□
- - - - -	PRWT18-8D□, PRW(L)18-8A□

● PRWT30-10D□/15D□ , PRW(L)30-10A□/15A□



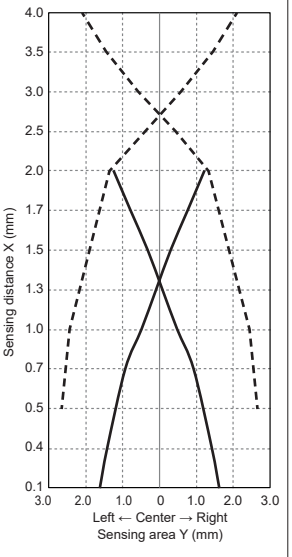
———	PRWT30-10D□, PRW(L)30-10A□
- - - - -	PRWT30-15D□, PRW(L)30-15A□

● PRW(L)08-1.5D□/2D□



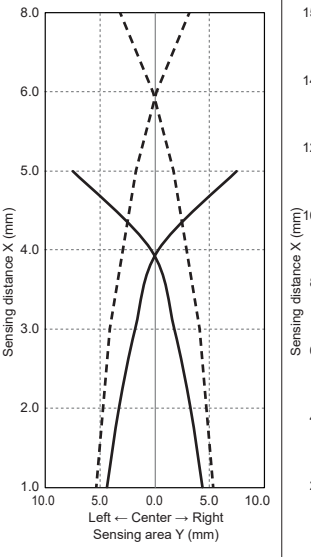
———	PRW(L)08-1.5D□
- - - - -	PRW(L)08-2D□

● PRW12-2D□/4D□



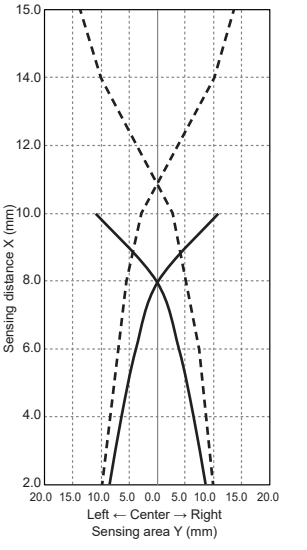
———	PRW12-2D□
- - - - -	PRW12-4D□

● PRW(L)18-5D□/8D□



———	PRW(L)18-5D□
- - - - -	PRW(L)18-8D□

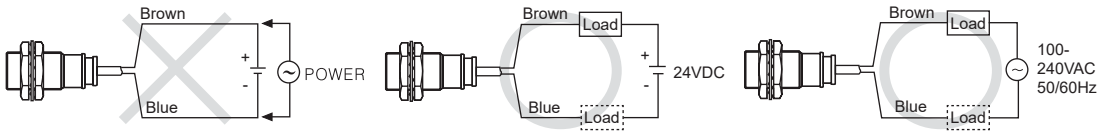
● PRW(L)30-10D□/15D□



———	PRW(L)30-10D□
- - - - -	PRW(L)30-15D□

▣ Proper Usage

◎ Load connections

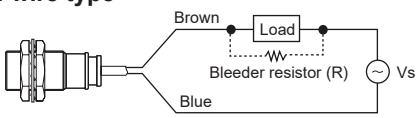


<DC 2-wire type & AC 2-wire type > < DC 2-wire type > < AC 2-wire type >

When using DC or AC 2-wire type proximity sensor, the load must be connected otherwise internal components may be damaged. The load can be connected to either wire.

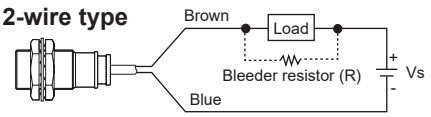
◎ In case of the load current is small

● AC 2-wire type



110VAC: Over 20kΩ 3W
220VAC: Over 39kΩ 10W

● DC 2-wire type



It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \leq \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I: Action current of load, R: Bleeder resistance, P: Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

※W value of Bleeder resistor should be bigger for proper heat dissipation.

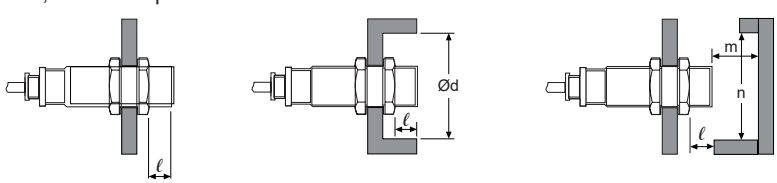
$$R \leq \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor
Ioff: Return current of load, P: Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.

When sensors are mounted on metallic panel, it must be prevented sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Item \ Model	PRW(L)08-1.5D□ PRWT08-1.5D□	PRW(L)08-2D□ PRWT08-2D□	PRWT12-2D□ PRW12-2A□	PRWT12-4D□ PRW12-4A□	PRWT18-5D□ PRW(L)18-5D□ PRW(L)18-5A□	PRWT18-8D□ PRW(L)18-8D□ PRW(L)18-8A□	PRWT30-10D□ PRW(L)30-10D□ PRW(L)30-10A□	PRWT30-15D□ PRW(L)30-15D□ PRW(L)30-15A□
A	9	12	12	24	30	48	60	90
B	16	24	24	36	36	54	60	90
ℓ	0	8	0	11	0	14	0	15
Ød	8	24	12	36	18	54	30	90
m	4.5	6	6	12	15	24	30	45
n	12	24	18	36	27	54	45	90

Cylindrical Connector Type Proximity Sensor

▣ Features

- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit
- Built-in output short over current protection circuit (DC type)
- IP67 protection structure (IEC standard) for connector part
- Replaceable for micro switches and limit switches

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

CE

▣ Specifications

• DC 2-wire type

Model	PRCMT12-2DO PRCMT12-2DC PRCMT12-2DO-I PRCMT12-2DC-I	PRCMT12-4DO PRCMT12-4DC PRCMT12-4DO-I PRCMT12-4DC-I	PRCMT18-5DO PRCMT18-5DC PRCMT18-5DO-I PRCMT18-5DC-I	PRCMT18-8DO PRCMT18-8DC PRCMT18-8DO-I PRCMT18-8DC-I	PRCMT30-10DO PRCMT30-10DC PRCMT30-10DO-I PRCMT30-10DC-I	PRCMT30-15DO PRCMT30-15DC PRCMT30-15DO-I PRCMT30-15DC-I
Diameter of sensing side	12mm		18mm		30mm	
Sensing distance	2mm	4mm	5mm	8mm	10mm	15mm
Installation	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Setting distance	0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operating voltage)	12-24VDC⎓ (10-30VDC⎓)					
Leakage current	Max. 0.6mA					
Response frequency※1	1.5kHz	500Hz	350Hz	400Hz	200Hz	
Residual voltage	Max. 3.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	2 to 100mA					
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	1,500VAC 50/60Hz for 1 min					
Vibration	1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z directions for 2 hours					
Shock	500m/s² (approx. 50G) in each X, Y, Z directions for 3 times					
Indicator	Operation indicator: Red LED					
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit	Surge protection circuit, output short over current protection circuit					
Protection structure	IP67 (IEC standard)					
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate					
Approval	CE					
Weight※2	Approx. 38g (approx. 26g)		Approx. 60g (approx. 48g)		Approx. 154g (approx. 142g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※There is IEC standard connector cable.
For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

• DC 3-wire type

Model	PRCM12-2DN PRCM12-2DP PRCM12-2DN2 PRCM12-2DP2	PRCM12-4DN PRCM12-4DP PRCM12-4DN2 PRCM12-4DP2	PRCM18-5DN PRCM18-5DP PRCM18-5DN2 PRCM18-5DP2 PRCML18-5DN PRCML18-5DP PRCML18-5DN2 PRCML18-5DP2	PRCM18-8DN PRCM18-8DP PRCM18-8DN2 PRCM18-8DP2 PRCML18-8DN PRCML18-8DP PRCML18-8DN2 PRCML18-8DP2	PRCM30-10DN PRCM30-10DP PRCM30-10DN2 PRCM30-10DP2 PRCML30-10DN PRCML30-10DP PRCML30-10DN2 PRCML30-10DP2	PRCM30-15DN PRCM30-15DP PRCM30-15DN2 PRCM30-15DP2 PRCML30-15DN PRCML30-15DP PRCML30-15DN2 PRCML30-15DP2
Diameter of sensing side	12mm		18mm		30mm	
Sensing distance	2mm	4mm	5mm	8mm	10mm	15mm
Installation	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Sensing distance	0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operating voltage)	12-24VDC⎓ (10-30VDC⎓)					
Current consumption	Max. 10mA					
Response frequency※1	1.5kHz	500Hz	500Hz	350Hz	400Hz	200Hz
Residual voltage	Max. 1.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20°C					
Control output	Max. 200mA					
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	1,500VAC 50/60Hz for 1 min					
Vibration	1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z directions for 2 hours					
Shock	500m/s² (approx. 50G) in each X, Y, Z directions for 3 times					
Indicator	Operation indicator: Red LED					
Environment: Ambient temperature	-25 to 70°C, storage: -30 to 80°C					
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit	Surge protection circuit, reverse polarity protection circuit, output short over current protection circuit					
Protection structure	IP67 (IEC standard)					
Material	Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate					
Approval	CE					
Weight※2	Approx. 38g (approx. 26g)		PRCM: Approx. 61g (approx. 49g) PRCML: Approx. 85g (approx. 73g)		PRCM: Approx. 146g (approx. 134g) PRCML: Approx. 181g (approx. 169g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesisa in for unit only.
※Environment resistance is rated at no freezing or condensation.

• AC 2-wire type

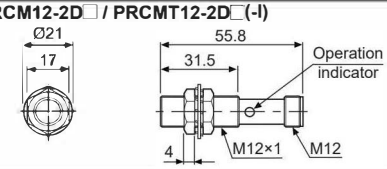
Model		PRCM12-2AO PRCM12-2AC	PRCM12-4AO PRCM12-4AC	PRCM18-5AO PRCM18-5AC PRCML18-5AO PRCML18-5AC	PRCM18-8AO PRCM18-8AC PRCML18-8AO PRCML18-8AC	PRCM30-10AO PRCM30-10AC PRCML30-10AO PRCML30-10AC	PRCM30-15AO PRCM30-15AC PRCML30-15AO PRCML30-15AC
Diameter of sensing side		12mm		18mm		30mm	
Sensing distance		2mm	4mm	5mm	8mm	10mm	15mm
Installation		Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)		18×18×1mm (iron)	25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)
Sensing distance		0 to 1.4mm	0 to 2.8mm	0 to 3.5mm	0 to 5.6mm	0 to 7mm	0 to 10.5mm
Power supply (operating voltage)		100-240VAC~ (85-264VAC~)					
Leakage current		Max. 2.5mA					
Response frequency※1		20Hz					
Residual voltage		Max. 10V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		5 to 150mA		5 to 200mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		2,500VAC 50/60Hz for 1 min					
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z directions for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z directions for 3 times					
Indicator		Operation indicator: Red LED					
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit					
Protection structure		IP67 (IEC standard)					
Insulation type		Double insulation or reinforced insulation (Mark: ⊡, dielectric strength between the measuring input part and the power part: 1kV)					
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate					
Approval		CE					
Weight※2		Approx. 42g (approx. 30g)		PRCM: Approx. 66g (approx. 54g) PRCML: Approx. 78g (approx. 66g)		PRCM: Approx. 154g (approx. 142g) PRCML: Approx. 194g (approx. 182g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

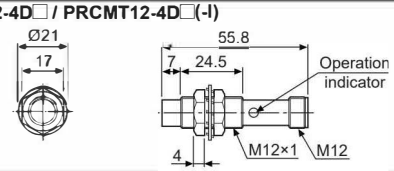
▣ Dimensions

(unit: mm)

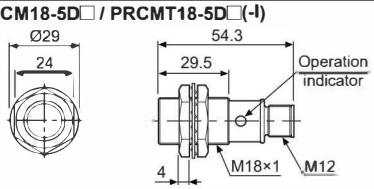
● **PRCM12-2D□ / PRCMT12-2D□(-I)**



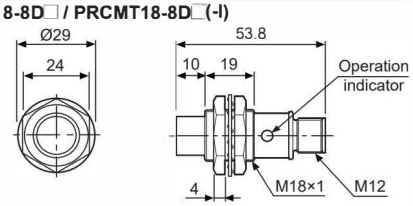
● **PRCM12-4D□ / PRCMT12-4D□(-I)**



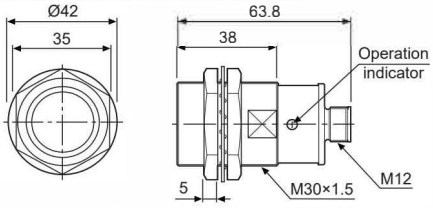
● **PRCM18-5D□ / PRCMT18-5D□(-I)**



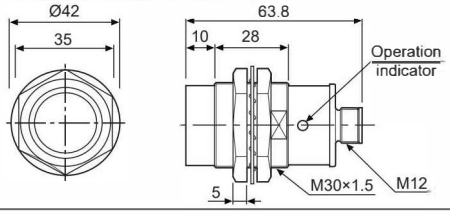
● **PRCM18-8D□ / PRCMT18-8D□(-I)**



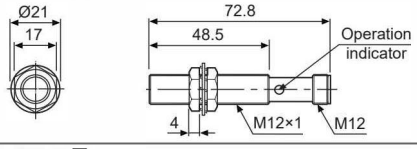
● **PRCM30-10D□ / PRCMT30-10D□(-I)**



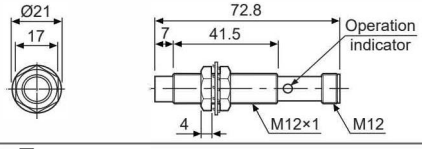
● **PRCM30-15D□ / PRCMT30-15D□(-I)**



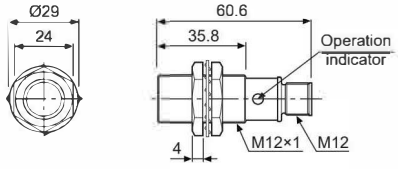
● **PRCM12-2A□**



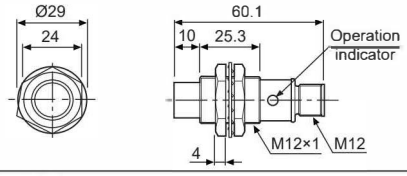
● **PRCM12-4A□**



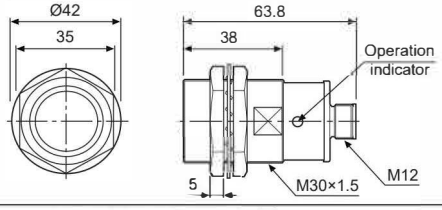
● **PRCM18-5A□**



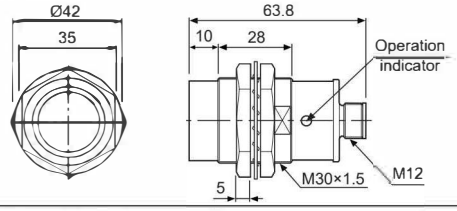
● **PRCM18-8A□**



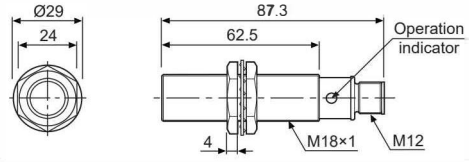
● **PRCM30-10A□**



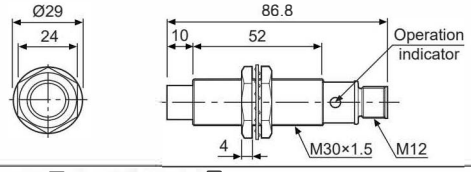
● **PRCM30-15A□**



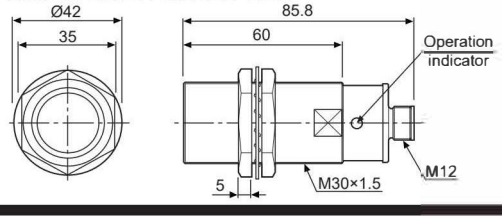
● **PRCML18-5D□ / PRCML18-5A□**



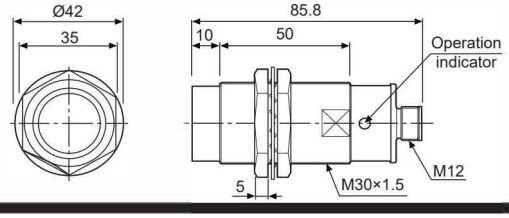
● **PRCML18-8D□ / PRCML18-8A□**



● **PRCML30-10D□ / PRCML30-10A□**

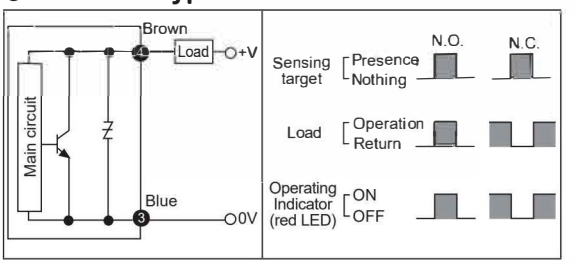


● **PRCML30-15D□ / PRCML30-15A□**



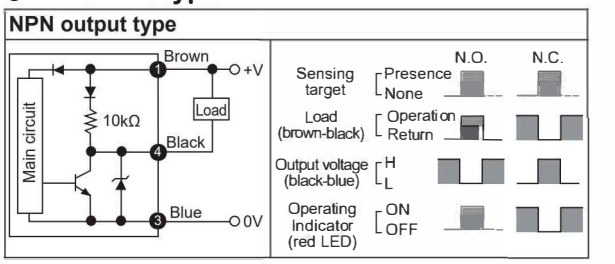
■ Control Output Diagram and Load Operation

◎ DC 2-wire type

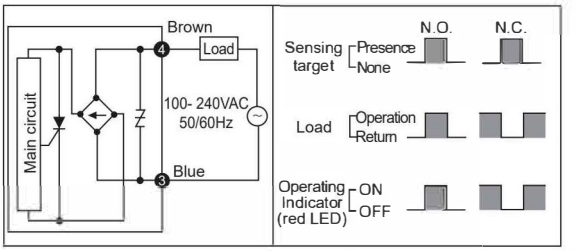


◎ DC 3-wire type

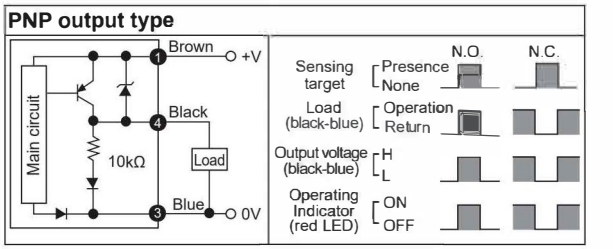
NPN output type



◎ AC 2-wire type



PNP output type

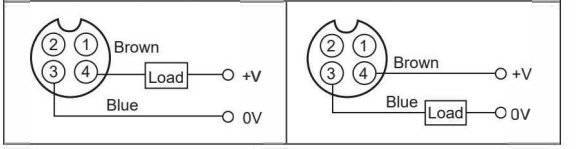


※The number in a circle is pin no. of connector.

■ Wiring Diagram

◎ DC 2-wire type (standard type)

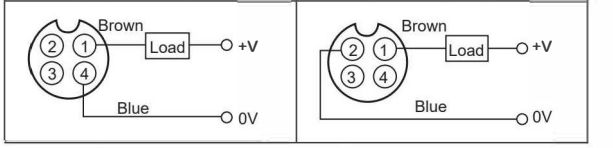
Normally Open (N.O.) / Normally Closed (N.C.)



※Pin ①, ② are not used terminals.
※For DC 3-wire type connector cable, it is available to use with black wire (12-24V DC) and blue wire (0V).

◎ DC 2-wire type (IEC standard type)

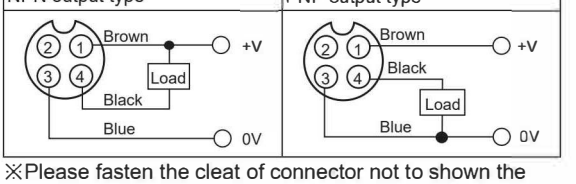
Normally Open (N.O.)	Normally Closed (N.C.)



※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The pin arrangement of connector applying IEC standard is being developed.
※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product.
E.g.) PRCMT12-4DO-I
※The connector cable for IEC standard is being developed. Please attach "I' at the end of the name of standard type.
E.g.) CID2-2-I, CLD2-5-I

◎ DC 3-wire type

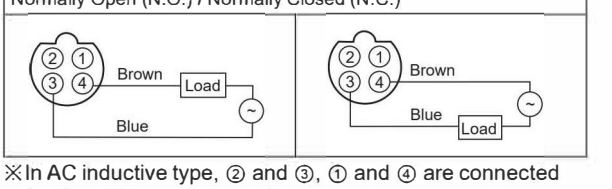
NPN output type	PNP output type



※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)

◎ AC 2-wire type

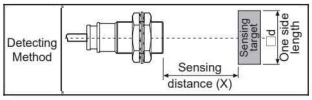
Normally Open (N.O.) / Normally Closed (N.C.)



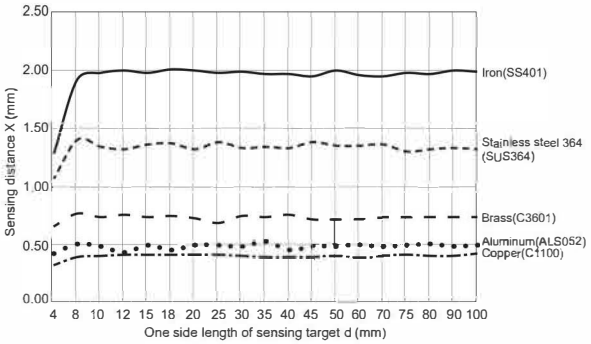
※In AC inductive type, ② and ③, ① and ④ are connected inside of the connector cable.

※Please fasten the vibration part with PTFE tape.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

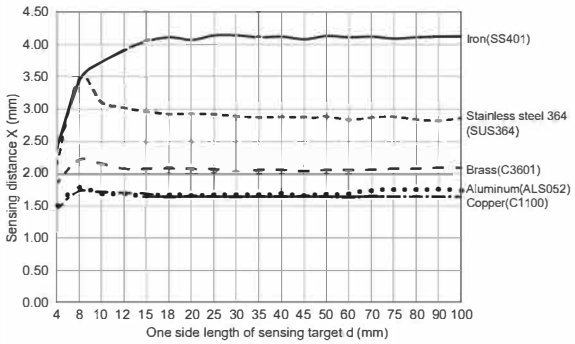
▣ Sensing Distance Feature Data by Target Material and Size



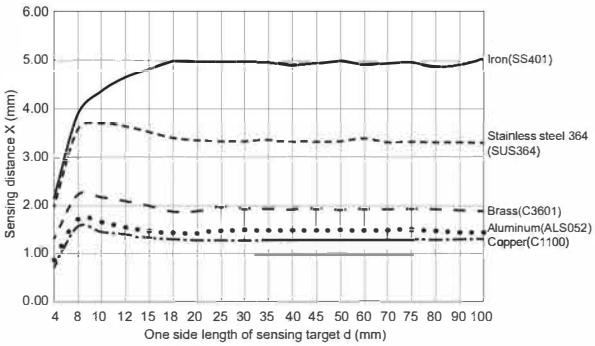
● PRCMT12-2D□, PRCM12-2A□



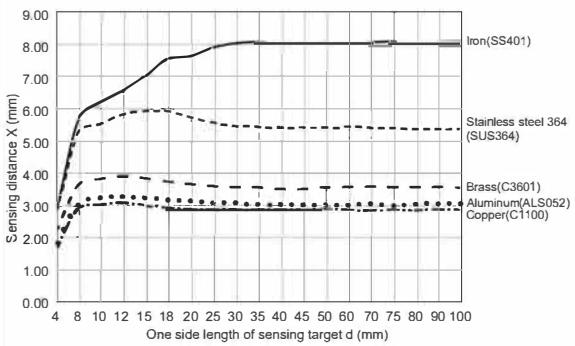
● PRCMT12-4D□, PRCM12-4A□



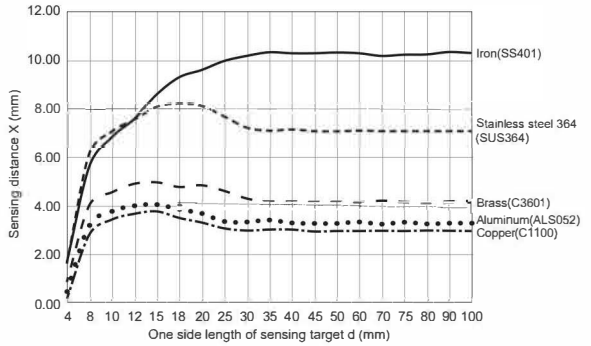
● PRCMT18-5D□, PRCM(L)18-5A□



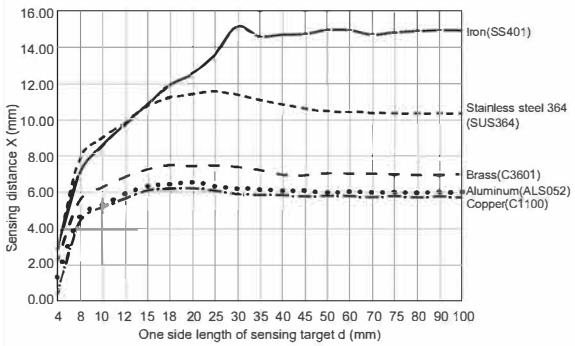
● PRCMT18-8D□, PRCM(L)18-8A□



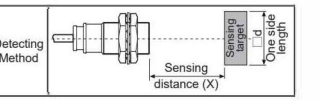
● PRCMT30-10D□, PRCM(L)30-10A□



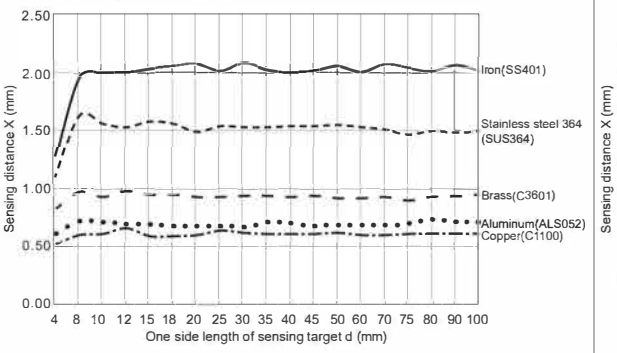
● PRCMT30-15D□, PRCM(L)30-15A□



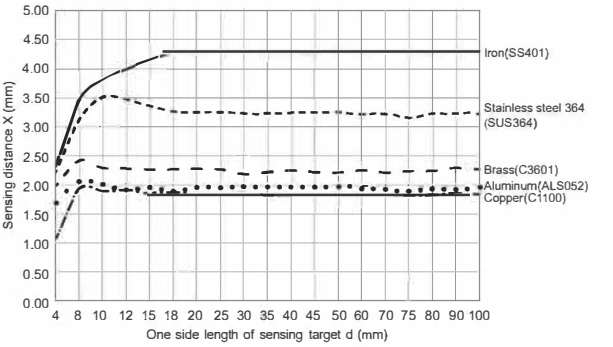
▣ Sensing Distance Feature Data by Target Material and Size



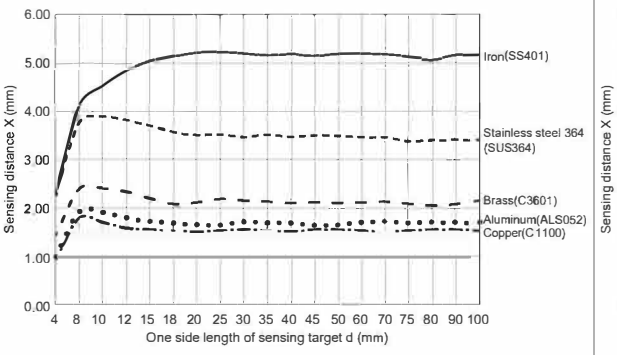
● PRCM(L)12-2D□



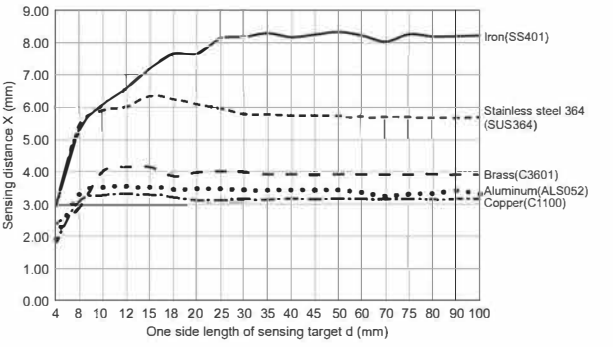
● PRCM12-4D□



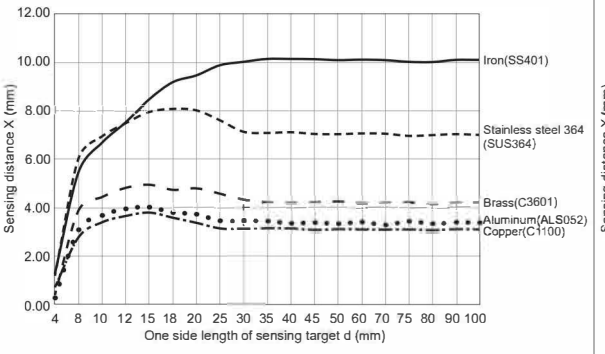
● PRCM(L)18-5D□



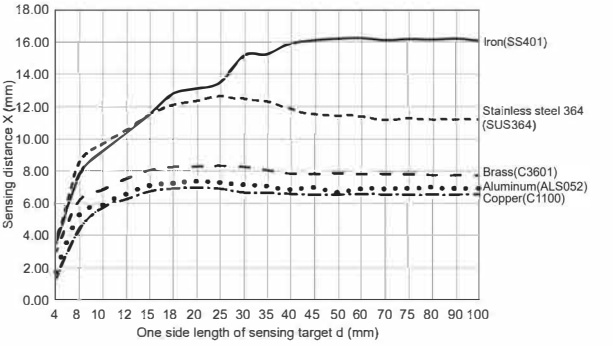
● PRCM(L)18-8D□



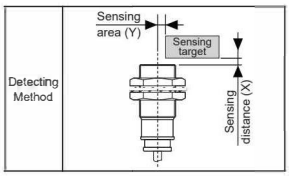
● PRCM(L)30-10D□



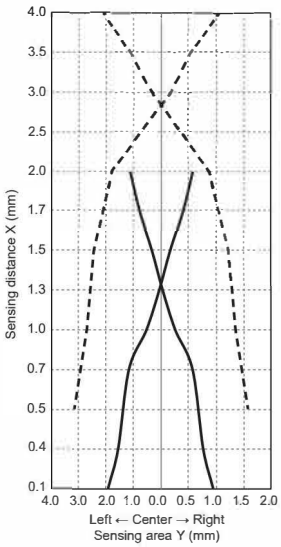
● PRCM(L)30-15D□



▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement

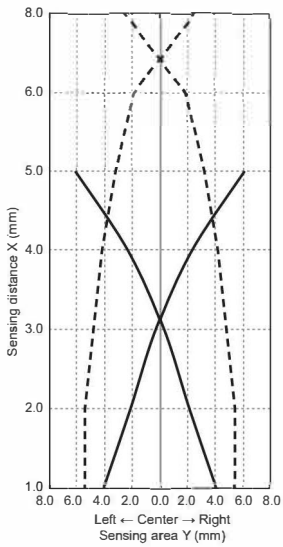


● PRCMT12-2D□/4D□ , PRCM12-2A□/4A□



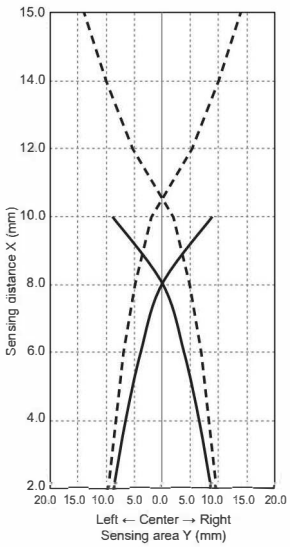
———	PRCMT12-2D□, PRCM12-2A□
- - - - -	PRCMT12-4D□, PRCM12-4A□

● PRCMT18-5D□/8D□, PRCM(L)18-5A□/8A□



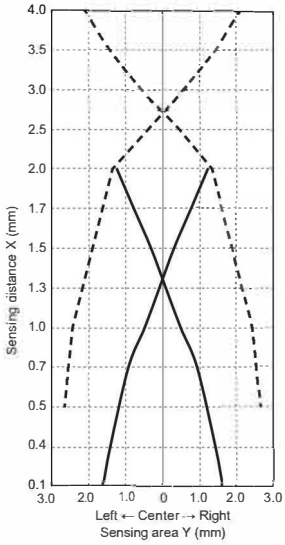
———	PRCMT18-5D□, PRCM(L)18-5A□
- - - - -	PRCMT18-8D□, PRCM(L)18-8A□

● PRCMT30-10D□/15D□ , PRCM(L)30-10A□/15A□



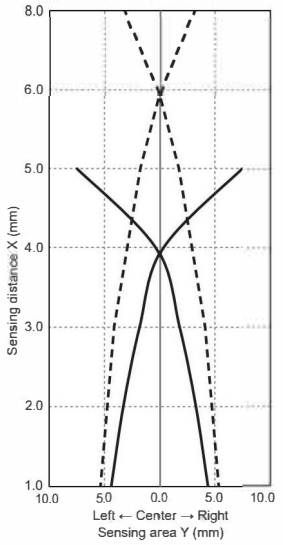
———	PRCMT30-10D□, PRCM(L)30-10A□
- - - - -	PRCMT30-15D□, PRCM(L)30-15A□

● PRCM(L)12-2D□ PRCM12-4D□



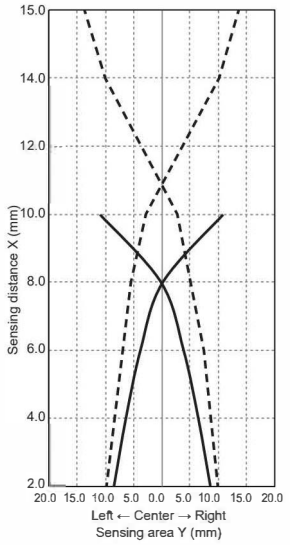
———	PRCM(L)12-2D□
- - - - -	PRCM12-4D□

● PRCM(L)18-5D□/8D□



———	PRCM(L)18-5D□
- - - - -	PRCM(L)18-8D□

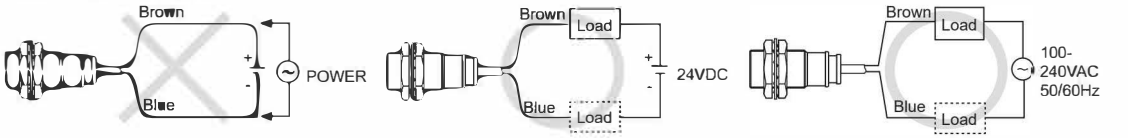
● PRCM(L)30-10D□/15D□



———	PRCM(L)30-10D□
- - - - -	PRCM(L)30-15D□

▣ Proper Usage

◎ Load connections

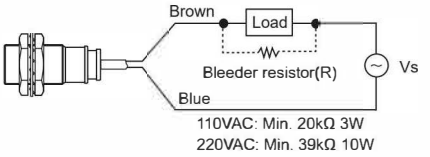


< DC 2-wire type & AC 2-wire type > < DC 2-wire type > < AC 2-wire type >

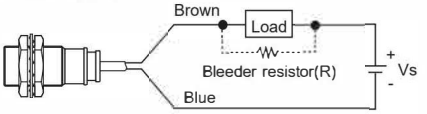
When using DC or AC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ Load connections

• AC 2-wire type



• DC 2-wire type



It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I: Action current of load, R: Bleeder resistance, P: Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

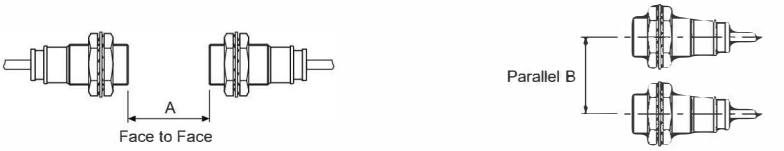
※W value of Bleeder resistor should be bigger for proper heat dissipation.

$$R \le \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

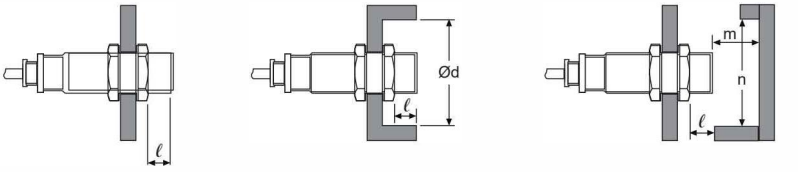
[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P: Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.



When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



(unit: mm)

Item \ Model	PRCMT12-2D□ PRCM12-2D□ PRCM12-2A□	PRCMT12-4D□ PRCM12-4D□ PRCM12-4A□	PRCMT18-5D□ PRCM(L)18-5D□ PRCM(L)18-5A□	PRCMT18-8D□ PRCM(L)18-8D□ PRCM(L)18-8A□	PRCMT30-10D□ PRCM(L)30-10D□ PRCM(L)30-10A□	PRCMT30-15D□ PRCM(L)30-15D□ PRCM(L)30-15A□
A	12	24	30	48	60	90
B	24	36	36	54	60	90
ℓ	0	11	0	14	0	15
Ød	12	36	18	54	30	90
m	6	12	15	24	30	45
n	18	36	27	54	45	90

Cylindrical, Long Sensing Distance, Cable Type Proximity Sensor

▣ Features

- Long sensing distance
  (1.5 to 2 times longer sensing distance guaranteed compared to existing models)
- Improved the noise immunity with dedicated IC
- Built-in surge protection, reverse polarity protection, output short over current protection circuit
- Long life cycle and high reliability, and simple operation
- Red LED operation indicator
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches
- Strain relief cables
  : improved flexural strength of cable connecting component (except for PRDT08-□DO-□)

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

CE

▣ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	PRDT08-2DO PRDT08-2DC PRDT08-2DO-V PRDT08-2DC-V	PRDT08-4DO PRDT08-4DC PRDT08-4DO-V PRDT08-4DC-V	PRDT12-4 D O PRDT12-4 D C PRDT12-4DO-V PRDT12-4DC-V PRDLT12-4DO PRDLT12-4DC PRDLT12-4DO-V PRDLT12-4DC-V	PRDT12-8 D O PRDT12-8 D C PRDT12-8DO-V PRDT12-8DC-V PRDLT12-8DO PRDLT12-8DC PRDLT12-8DO-V PRDLT12-8DC-V	PRDT18-7 D O PRDT18-7 D C PRDT18-7 D O-V PRDT18-7 D C-V PRDLT18-7 D O PRDLT18-7 D C PRDLT18-7 D O-V PRDLT18-7 D C-V	PRDT18-14 D O PRDT18-14 D C PRDT18-14 D O-V PRDT18-14 D C-V PRDLT18-14 D O PRDLT18-14 D C PRDLT18-14 D O-V PRDLT18-14 D C-V	PRDT30-15 D O PRDT30-15DC PRDT30-15 D O-V PRDT30-15DC-V PRDLT30-15DO PRDLT30-15DC PRDLT30-15DO-V PRDLT30-15DC-V	PRDT30-25 D O PRDT30-25 D C PRDT30-25 D O-V PRDT30-25 D C-V PRDLT30-25DO PRDLT30-25DC PRDLT30-25DO-V PRDLT30-25DC-V
Diameter of sensing side	8mm		12mm		18mm		30mm	
Sensing distance	2mm	4mm	4mm	8mm	7mm	14mm	15mm	25mm
Installation	Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)
Hysteresis	Max. 15% of sensing distance		Max. 10% of sensing distance					
Standard sensing target	8×8×1mm (iron)	12×12×1mm (iron)	12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance	0 to 1.4mm	0 to 2.8mm	0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)	12-24VDC⎓ (10-30VDC⎓)							
Leakage current	Max. 0.8mA		Max. 0.6mA					
Response frequency※1	1kHz	800Hz	450Hz	400Hz	250Hz	200Hz	100Hz	
Residual voltage※2	Max. 3.5V (non-polarity type is max. 5V)							
Affection by Temp.	Max. ±15% for sensing distance at ambient temperature 20℃		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	2 to 100mA							

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected divice because residual voltage is 5V.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model									
	PRDT08-2DO PRDT08-2DC PRDT08-2DO-V PRDT08-2DC-V	PRDT08-4DO PRDT08-4DC PRDT08-4DO-V PRDT08-4DC-V	PRDT12-4 D O PRDT12-4 D C PRDT12-4DO-V PRDT12-4DC-V PRDLT12-4DO PRDLT12-4DC PRDLT12-4DO-V PRDLT12-4DC-V	PRDT12-8 D O PRDT12-8 D C PRDT12-8DO-V PRDT12-8DC-V PRDLT12-8DO PRDLT12-8DC PRDLT12-8DO-V PRDLT12-8DC-V	PRDT18-7 D O PRDT18-7 D C PRDT18-7 D O-V PRDT18-7 D C-V PRDLT18-7 D O PRDLT18-7 D C PRDLT18-7 D O-V PRDLT18-7 D C-V	PRDT18-14 D O PRDT18-14 D C PRDT18-14 D O-V PRDT18-14 D C-V PRDLT18-14 D O PRDLT18-14 D C PRDLT18-14 D O-V PRDLT18-14 D C-V	PRDT30-15 D O PRDT30-15DC PRDT30-15 D O-V PRDT30-15DC-V PRDLT30-15DO PRDLT30-15DC PRDLT30-15DO-V PRDLT30-15DC-V	PRDT30-25 D O PRDT30-25 D C PRDT30-25 D O-V PRDT30-25 D C-V PRDLT30-25DO PRDLT30-25DC PRDLT30-25DO-V PRDLT30-25DC-V
Insulation resistance	Over 50MΩ (at 500VDC megger)								
Dielectric strength	1,500VAC 50/60Hz for 1 min								
Vibration	1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours								
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times								
Indicator	Operation indicator: Red LED								
Environment – Ambient temp.	-25 to 70℃, storage: -30 to 80℃								
Environment – Ambient humi.	35 to 95% RH, storage: 35 to 95% RH								
Protection circuit	Surge protection circuit, reverse polarity protection circuit, output short over current protection circuit								
Material	Case/Nut: Nickel plated brass (case of PRDT08: SUS303), Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC), oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)								
Cable※3	Ø3.5mm, 2-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator diameter: Ø1.0mm)		Ø4mm, 2-wire, 2m (AWG22, core diameter: 0.08mm, Number of cores: 60, insulator diameter: Ø1.25mm)		Ø5mm, 2-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)				
Approval	CE								
Protection structure	IP67 (IEC standard)								
Weight※4 – PRDT	Approx. 58g(approx. 50g)		Approx. 74g (approx. 62g)	Approx. 72g (approx. 60g)	Approx. 115g (approx. 97g)	Approx. 110g (approx. 92g)	Approx. 175g (approx. 138g)	Approx. 180g (approx. 143g)	
Weight※4 – PRDLT	—		Approx. 94g (approx. 82g)	Approx. 92g (approx. 80g)	Approx. 145g (approx. 127g)	Approx. 140g (approx. 122g)	Approx. 215g (approx. 178g)	Approx. 220g (approx. 183g)	

※3: Do not pull the Ø3.5mm cable with a tensile strength of 25N, the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over.
It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: The weight includes packaging. The weight in parenthesis in for unit only.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

● DC 3-wire type

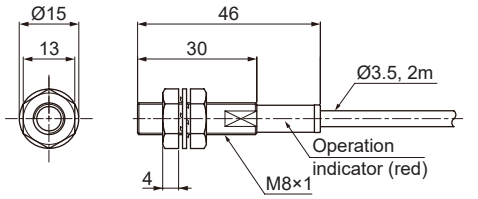
Model		PRD12-4DN PRD12-4DP PRD12-4DN2 PRD12-4DP2 PRDL12-4DN PRDL12-4DP PRDL12-4DN2 PRDL12-4DP2	PRD12-8DN PRD12-8DP PRD12-8DN2 PRD12-8DP2 PRDL12-8DN PRDL12-8DP PRDL12-8DN2 PRDL12-8DP2	PRD18-7DN PRD18-7DP PRD18-7DN2 PRD18-7DP2 PRD18-7DN-V PRD18-7DP-V PRDL18-7DN PRDL18-7DP PRDL18-7DN2 PRDL18-7DP2 PRDL18-7DN-V	PRD18-14DN PRD18-14DP PRD18-14DN2 PRD18-14DP2 PRD18-14DN-V PRD18-14DP-V PRDL18-14DN PRDL18-14DP PRDL18-14DN2 PRDL18-14DP2 PRDL18-14DP-V	PRD30-15DN PRD30-15DP PRD30-15DN2 PRD30-15DP2 PRD30-15DN-V PRD30-15DP-V PRD30-15DN2-V PRD30-15DP2-V PRDL30-15DN PRDL30-15DP PRDL30-15DN2 PRDL30-15DP2 PRDL30-15DN-V	PRD30-25DN PRD30-25DP PRD30-25DN2 PRD30-25DP2 PRD30-25DN-V PRD30-25DP-V PRD30-25DN2-V PRD30-25DP2-V PRDL30-25DN PRDL30-25DP PRDL30-25DN2 PRDL30-25DP2 PRDL30-25DN-V
Diameter of sensing side		12mm		18mm		30mm	
Sensing distance		4mm	8mm	7mm	14mm	15mm	25mm
Installation		Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance		0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)					
Leakage current		Max. 10mA					
Response frequency※1		500Hz	400Hz	300Hz	200Hz	100HZ	100Hz
Residual voltage		Max. 1.5V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		200mA					
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		1,500VAC 50/60Hz for 1 min					
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Indicator		Operation indicator: Red LED					
Environment	Ambient temp.	-25 to 70℃, storage: -30 to 80℃					
		35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit, Reverse polarity protection circuit, output short over current protection circuit					
Protection structure		IP67 (IEC standard)					
Material		Case/Nut: Nickel plated Brass, Washer: Nickel plated Iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant Polyvinyl chloride (PVC)					
Cable※2		Ø4mm, 3-wire, 2m		Ø5mm, 3-wire, 2m			
		AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm					
Approval		CE					
Unit weight	PRD	Approx. 74g	Approx. 72g	Approx. 115g	Approx. 110g	Approx. 175g	Approx. 180g
	PRDL	Approx. 94g	Approx. 92g	Approx. 145g	Approx. 140g	Approx. 215g	Approx. 220g

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

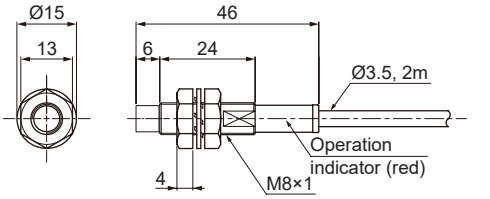
▣ Dimensions

(unit: mm)

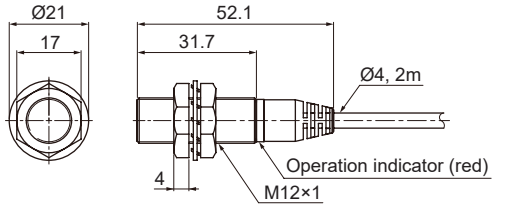
● **PRDT08-2D□**



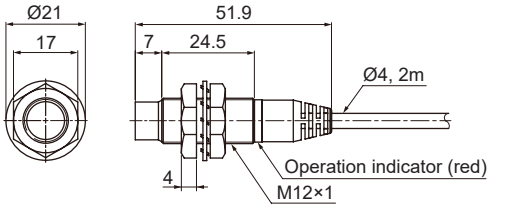
● **PRDT08-4D□**



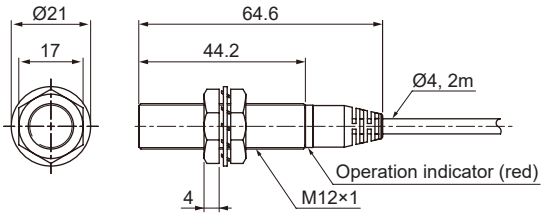
● **PRD(T)12-4D□**



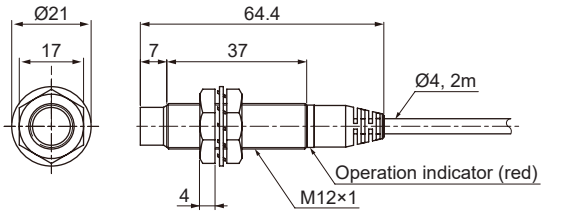
● **PRD(T)12-8D□**



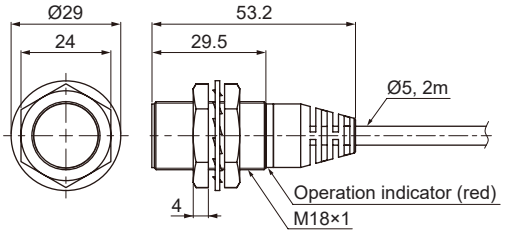
● **PRDL(T)12-4D□**



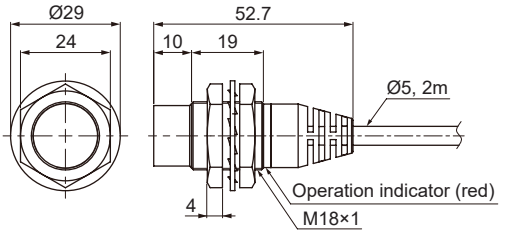
● **PRDL(T)12-8D□**



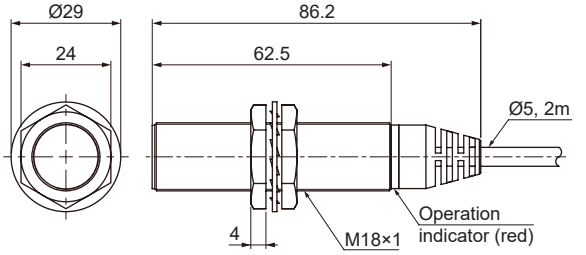
● **PRD(T)18-7D□**



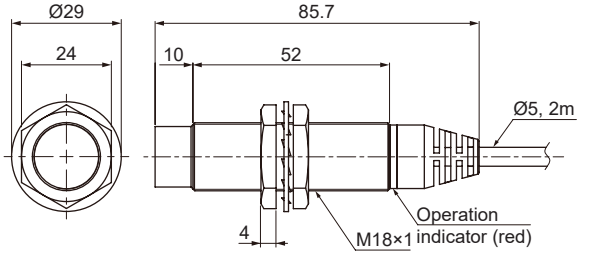
● **PRD(T)18-14D□**



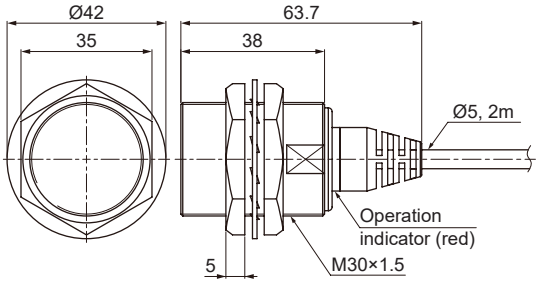
● **PRDL(T)18-7D□**



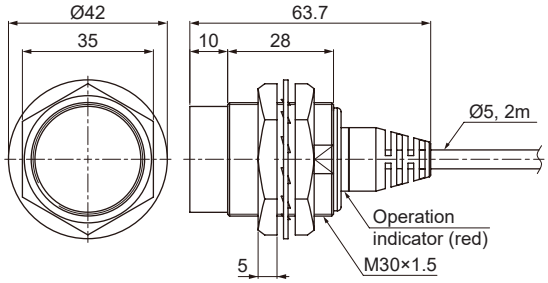
● **PRDL(T)18-14D□**



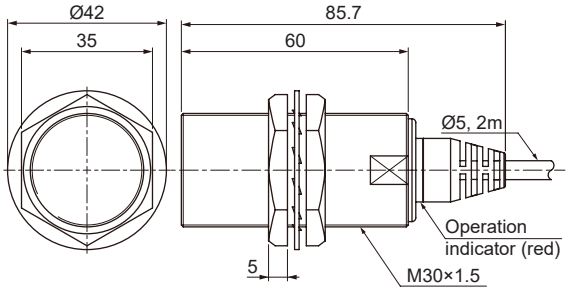
● **PRD(T)30-15D□**



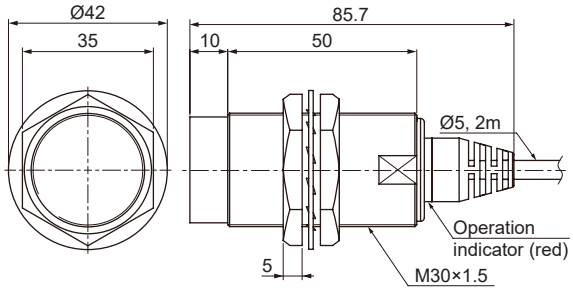
● **PRD(T)30-25D□**



● **PRDL(T)30-15D□**

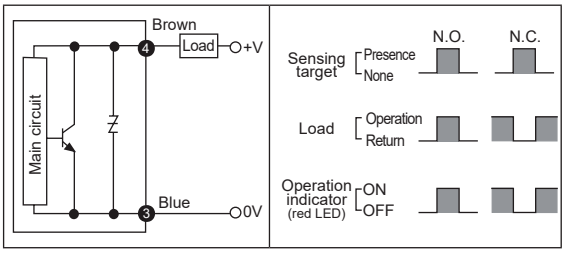


● **PRDL(T)30-25D□**



▣ Control Output Diagram and Load Operation

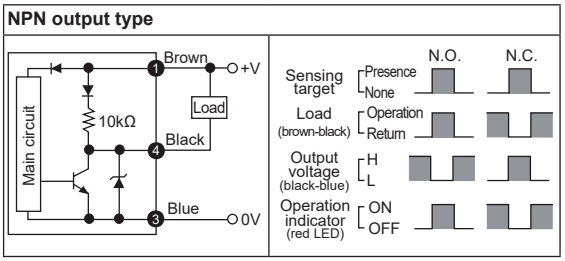
◎ DC 2-wire type



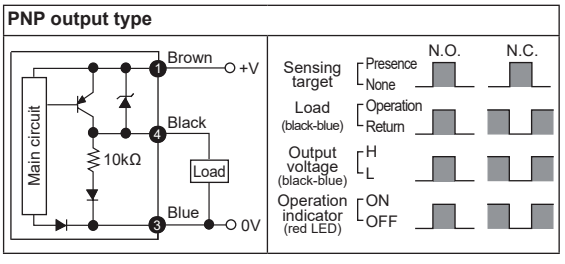
※The number in a circle is pin no. of connector.

◎ DC 3-wire type

NPN output type

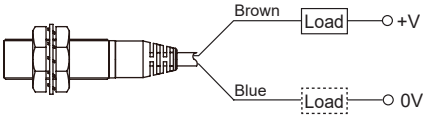


PNP output type



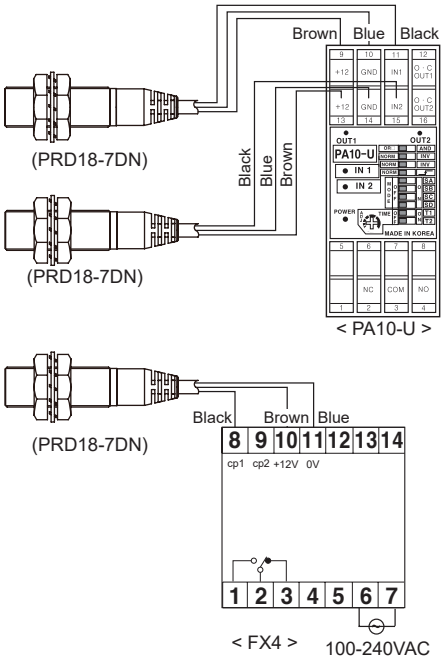
▣ Connections

◎ DC 2-wire type

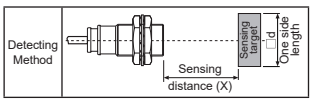


※The load can be connected to either wire.

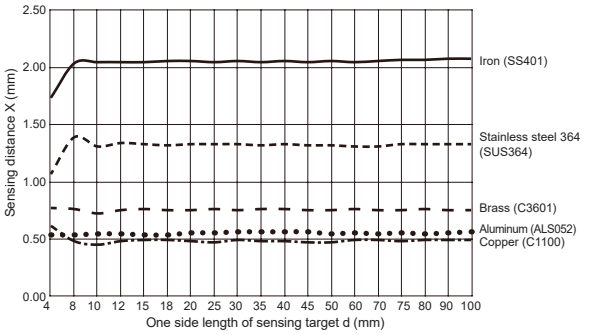
◎ DC 3-wire type



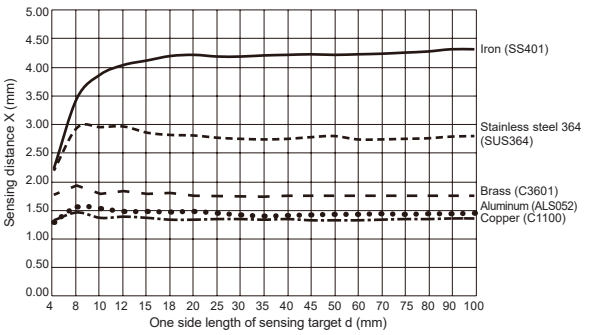
▣ Sensing Distance Feature Data by Target Material and Size



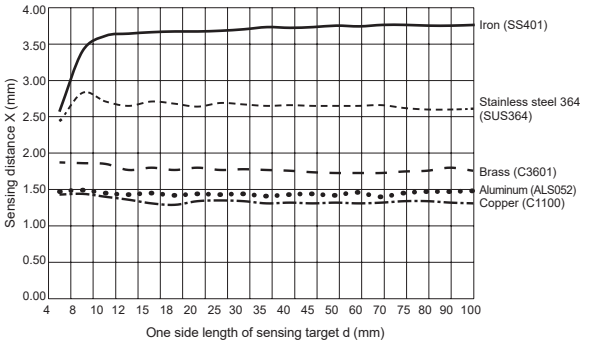
● PRDT08-2D□



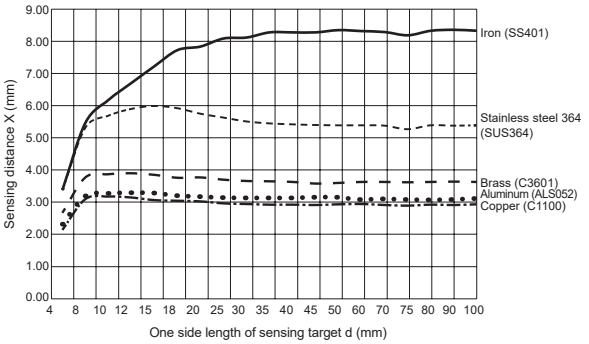
● PRDT08-4D□



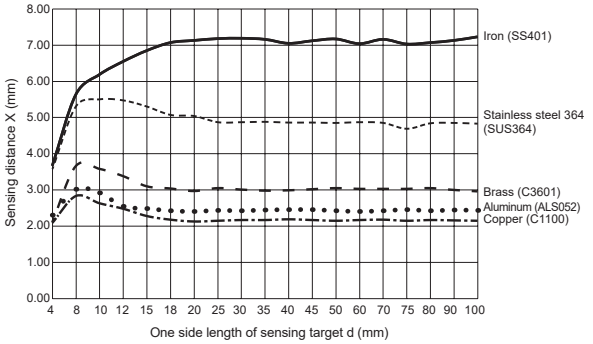
● PRD(L)T12-4D□



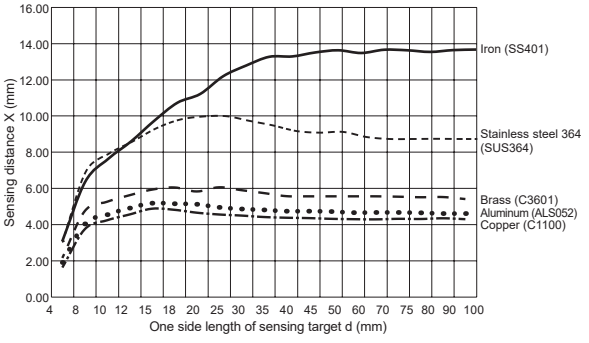
● PRD(L)T12-8D□



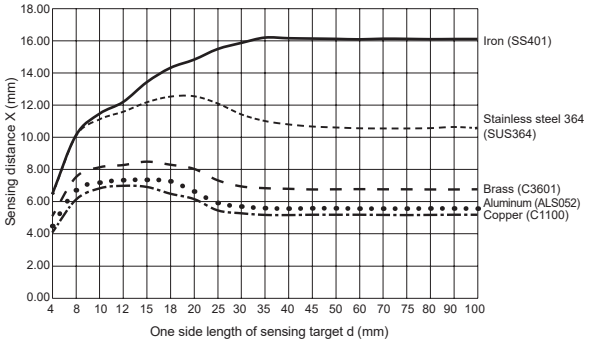
● PRD(L)T18-7D□



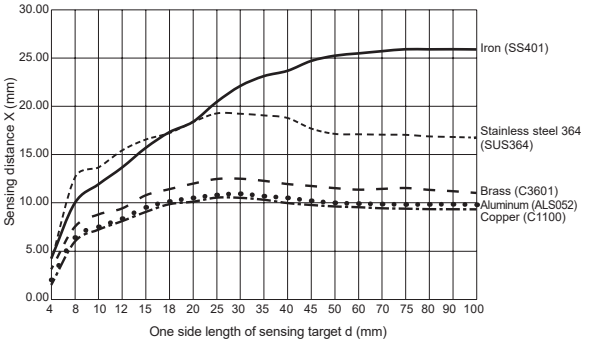
● PRD(L)T18-14D□



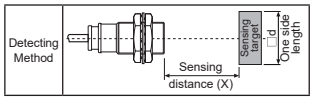
● PRD(L)T30-15D□



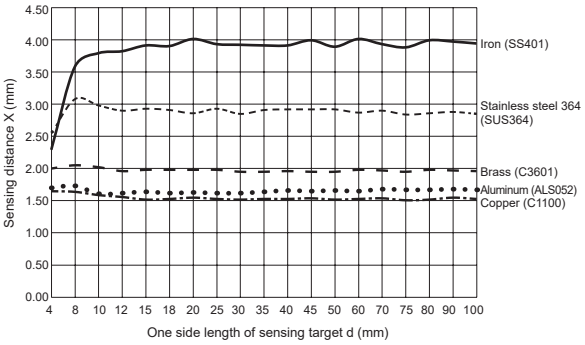
● PRD(L)T30-25D□



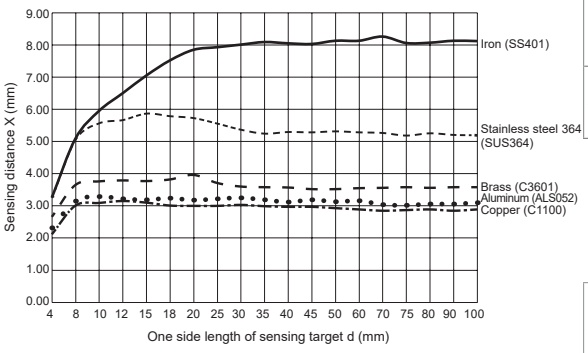
■ Sensing Distance Feature Data by Target Material and Size



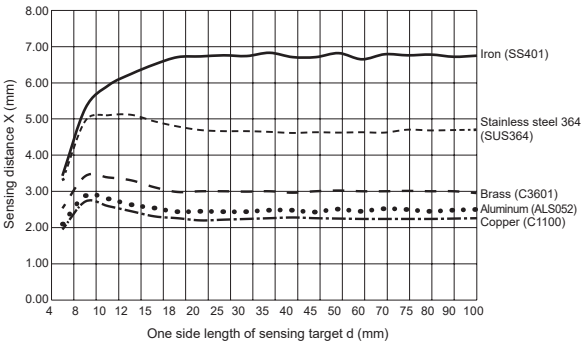
● PRD(L)12-4D□



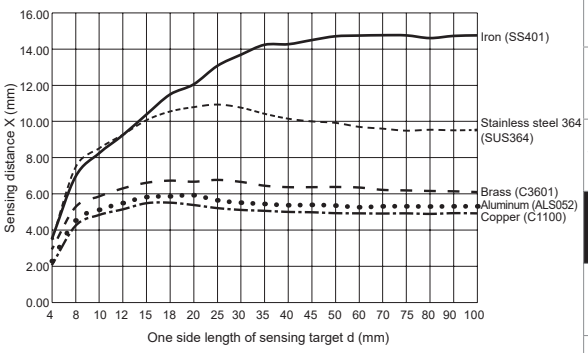
● PRD(L)12-8D□



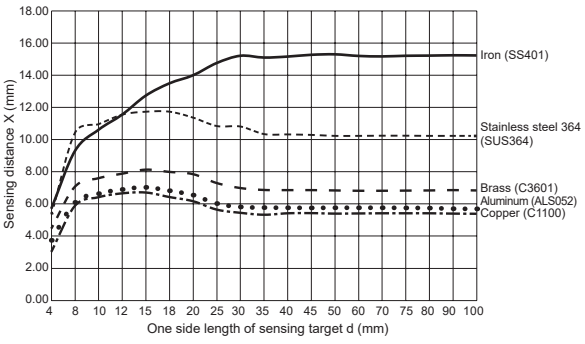
● PRD(L)18-7D□



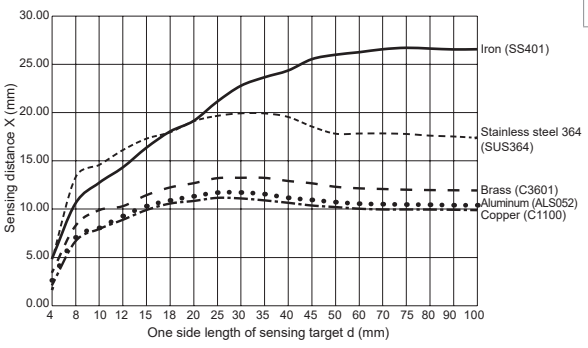
● PRD(L)18-14D□



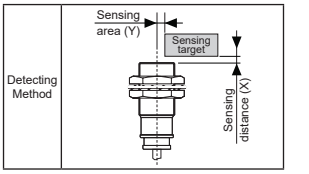
● PRD(L)30-15D□



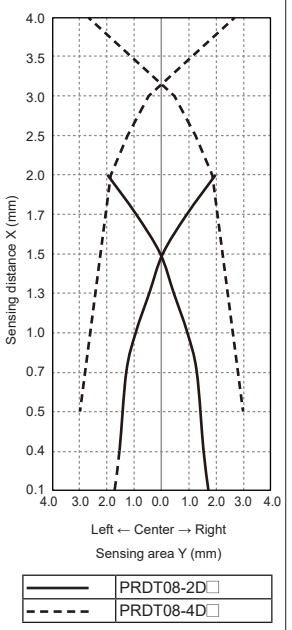
● PRD(L)30-25D□



▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement

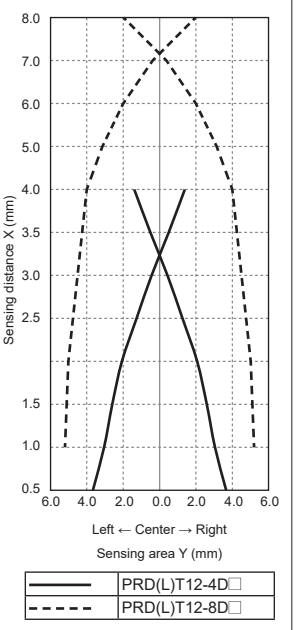


● PRDT08-2D□/4D□



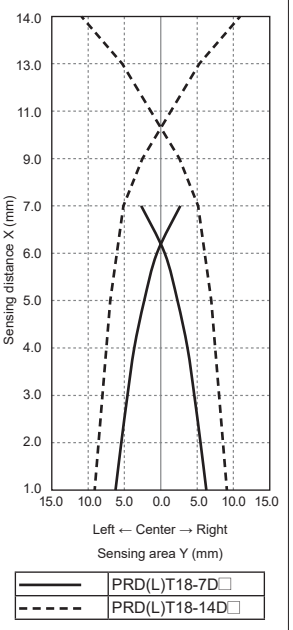
———	PRDT08-2D□
- - - - -	PRDT08-4D□

● PRD(L)T12-4D□/8D□



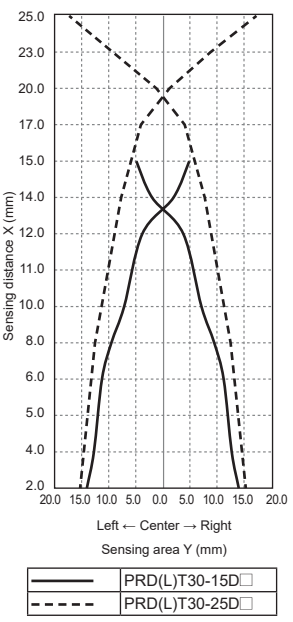
———	PRD(L)T12-4D□
- - - - -	PRD(L)T12-8D□

● PRD(L)T18-7D□/14D□



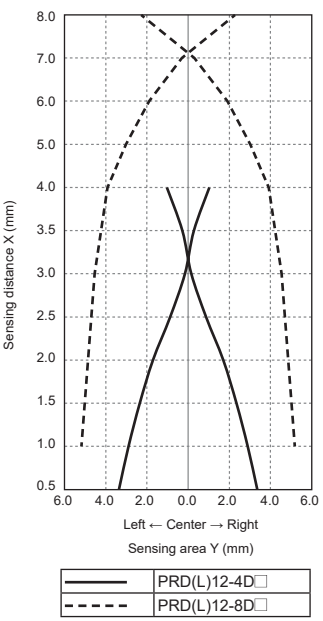
———	PRD(L)T18-7D□
- - - - -	PRD(L)T18-14D□

● PRD(L)T30-15D□/25D□



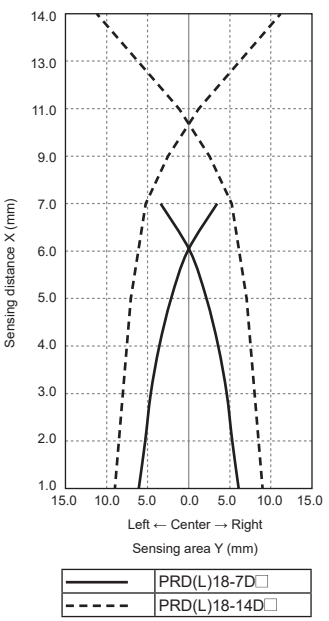
———	PRD(L)T30-15D□
- - - - -	PRD(L)T30-25D□

● PRD(L)12-4D□/8D□



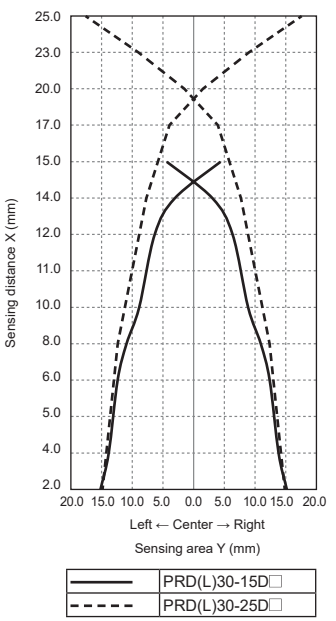
———	PRD(L)12-4D□
- - - - -	PRD(L)12-8D□

● PRD(L)18-7D□/14D□



———	PRD(L)18-7D□
- - - - -	PRD(L)18-14D□

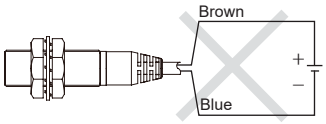
● PRD(L)30-15D□/25D□



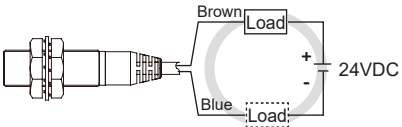
———	PRD(L)30-15D□
- - - - -	PRD(L)30-25D□

▣ Proper Usage

◎ Load connections



< DC 2-wire type >

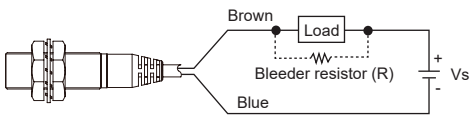


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

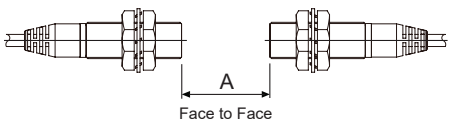
※W value of Bleeder resistor should be bigger for proper heat dissipation.

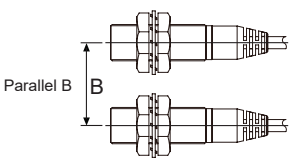
$$R \leq \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor, Ioff: Return current of load, P: Number of Bleeder resistance watt]

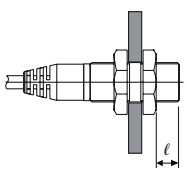
◎ Mutual-interference & Influence by surrounding metals

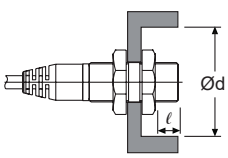
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

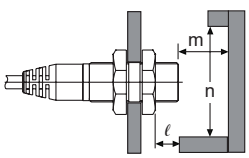




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



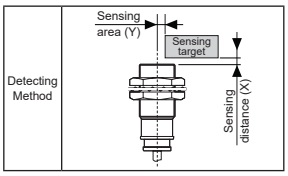




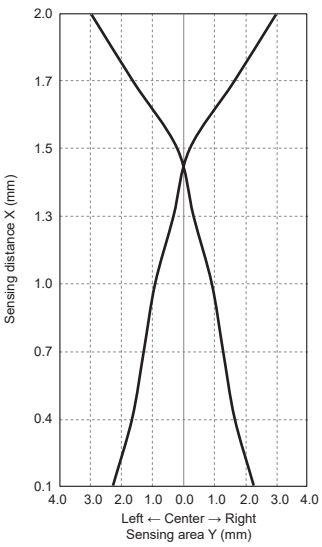
(unit: mm)

Item \ Model	PRDT08-2D□	PRDT08-4D□	PRD(L)T12-4D□ PRD(L)12-4D□	PRD(L)T12-8D□ PRD(L)12-8D□	PRD(L)T18-7D□ PRD(L)18-7D□	PRD(L)T18-14D□ PRD(L)18-14D□	PRD(L)T30-15D□ PRD(L)30-15D□	PRD(L)T30-25D□ PRD(L)30-25D□
A	20	80	25	120	50	200	110	350
B	15	60	25	100	35	110	90	
ℓ	0	12	2.5	15	3.5	14	6	20
Ød	8	24	18	40	27	70	45	120
m	6	8	12	20	24	40	45	90
n	12	24	18	40	27	70	45	120

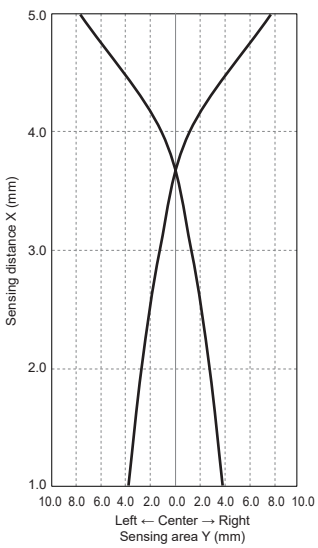
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



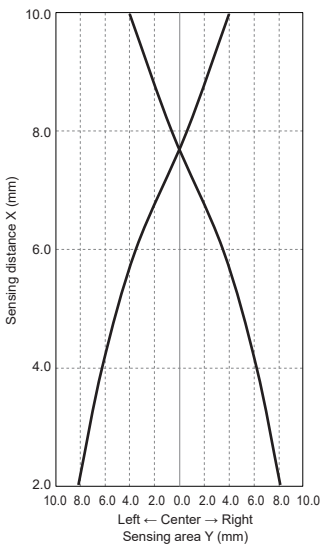
● PRAWT12-2D□



● PRAWT18-5D□



● PRAWT30-10D□



Cylindrical, Long Sensing Distance, Cable Connector Type Proximity Sensor

▣ Features

- Long sensing distance
  (1.5 to 2 times longer sensing distance guaranteed compared to existing models)
- Improved the noise immunity with dedicated IC
- Built-in surge protection, reverse polarity protection, output short over current protection circuit
- Long life cycle and high reliability, and simple operation
- Red LED operation indicator
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches
- Strain relief cables
  : improved flexural strength of cable connecting component (except for PRDWT08-□DO-□)

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

▣ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model	PRDWT08-2DO PRDWT08-2DC PRDWT08-2DO-I PRDWT08-2DC-I PRDWT08-2DO-V PRDWT08-2DC-V PRDWT08-2DO-IV PRDWT08-2DC-IV	PRDWT08-4DO PRDWT08-4DC PRDWT08-4DO-I PRDWT08-4DC-I PRDWT08-4DO-V PRDWT08-4DC-V PRDWT08-4DO-IV PRDWT08-4DC-IV	PRDWT12-4□O PRDWT12-4□C PRDWT12-4□O-I PRDWT12-4□C-I PRDWT12-4□O-IV PRDWT12-4□C-IV PRDWT12-4DO-V PRDWT12-4DC-V	PRDWT12-8□O PRDWT12-8□C PRDWT12-8□O-I PRDWT12-8□C-I PRDWT12-8□O-IV PRDWT12-8□C-IV PRDWT12-8DO-V PRDWT12-8DC-V	PRDWT18-7□O PRDWT18-7□C PRDWT18-7□O-I PRDWT18-7□C-I PRDWT18-7□O-IV PRDWT18-7□C-IV PRDWT18-7DO-V PRDWT18-7DC-V PRDWLT18-7DO-IV	PRDWT18-14□O PRDWT18-14□C PRDWT18-14□O-I PRDWT18-14□C-I PRDWT18-14□O-IV PRDWT18-14□C-IV PRDWT18-14DO-V PRDWT18-14DC-V	PRDWT30-15□O PRDWT30-15□C PRDWT30-15□O-I PRDWT30-15DC-I PRDWT30-15□O-IV PRDWT30-15DC-IV PRDWT30-15DO-V PRDWT30-15DC-V	PRDWT30-25DO PRDWT30-25DC PRDWT30-25DO-I PRDWT30-25DC-I PRDWT30-25DO-IV PRDWT30-25DC-IV PRDWT30-25DO-V PRDWT30-25DC-V
Diameter of sensing side	8mm		12mm		18mm		30mm	
Sensing distance	2mm	4mm	4mm	8mm	7mm	14mm	15mm	25mm
Installation	Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)
Hysteresis	Max. 15% of sensing distance		Max. 10% of sensing distance					
Standard sensing target	8×8×1mm (iron)	12×12×1mm (iron)	12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance	0 to 1.4mm	0 to 2.8mm	0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)	12-24VDC⎓ (10-30VDC⎓)							
Leakage current	Max. 0.8mA		Max. 0.6mA					
Response frequency※1	1kHz	800Hz	450Hz	400Hz	250Hz	200Hz	100Hz	
Residual voltage※2	Max. 3.5V (non-polarity type is max. 5V)							
Affection by Temp.	Max. ±15% for sensing distance at ambient temperature 20℃		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	2 to 100mA							

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected device because residual voltage is 5V.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

Model		PRDWT08-2DO PRDWT08-2DC PRDWT08-2DO-I PRDWT08-2DC-I PRDWT08-2DO-V PRDWT08-2DC-V PRDWT08-2DO-IV PRDWT08-2DC-IV	PRDWT08-4DO PRDWT08-4DC PRDWT08-4DO-I PRDWT08-4DC-I PRDWT08-4DO-V PRDWT08-4DC-V PRDWT08-4DO-IV PRDWT08-4DC-IV	PRDWT12-4 D O PRDWT12-4 D C PRDWT12-4 D O-I PRDWT12-4 D C-I PRDWT12-4 D O-IV PRDWT12-4 D C-IV PRDWT12-4DO-V PRDWT12-4DC-V	PRDWT12-8 D O PRDWT12-8 D C PRDWT12-8 D O-I PRDWT12-8 D C-I PRDWT12-8 D O-IV PRDWT12-8 D C-IV PRDWT12-8DO-V PRDWT12-8DC-V	PRDWT18-7 D O PRDWT18-7 D C PRDWT18-7 D O-I PRDWT18-7 D C-I PRDWT18-7 D O-IV PRDWT18-7 D C-IV PRDWT18-7DO-V PRDWT18-7DC-V PRDWLT18-7DO-IV	PRDWT18-14 D O PRDWT18-14 D C PRDWT18-14 D O-I PRDWT18-14 D C-I PRDWT18-14 D O-IV PRDWT18-14 D C-IV PRDWT18-14DO-V PRDWT18-14DC-V	PRDWT30-15 D O PRDWT30-15 D C PRDWT30-15 D O-I PRDWT30-15DC-I PRDWT30-15 D O-IV PRDWT30-15DC-IV PRDWT30-15DO-V PRDWT30-15DC-V	PRDWT30-25DO PRDWT30-25DC PRDWT30-25DO-I PRDWT30-25DC-I PRDWT30-25DO-IV PRDWT30-25DC-IV PRDWT30-25DO-V PRDWT30-25DC-V
Insulation resistance		Over 50MΩ (at 500VDC megger)							
Dielectric strength		1,500VAC 50/60Hz for 1 min							
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Indicator		Operation indicator: Red LED							
Environment	Ambient temp.	-25 to 70℃, storage: -30 to 80℃							
	Ambient humi.	35 to 95% RH, storage: 35 to 95% RH							
Protection circuit		Surge protection circuit, reverse polarity protection circuit, output short over current protection circuit							
Material		Case/Nut: Nickel plated brass (case of PRDT08: SUS303), Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)							
Cable※3		Ø3.5mm, 2-wire, 300mm, M12 connector (AWG24, core diameter: 0.08mm, number of cores: 40, insulator diameter: Ø1.0mm)		Ø4mm, 2-wire, 300mm, M12 connector (AWG22, core diameter: 0.08mm, number of cores: 60, insulator diameter: Ø1.25mm)		Ø5mm, 2-wire, 300mm, M12 connector (AWG22, core diameter: 0.08mm, number of cores: 60, insulator diameter: Ø1.25mm)			
Approval		CE							
Protection structure		IP67 (IEC standard)							
Weight※4	PRDWT	Approx. 28g (approx. 20g)	Approx. 44g (approx. 32g)	Approx. 42g (approx. 30g)	Approx. 80g (approx. 62g)	Approx. 75g (approx. 57g)	Approx. 140g (approx. 130g)	Approx. 145g (approx. 108g)	
	PRDWLT	—	—	—	Approx. 110g (approx. 92g)	—	—	—	

※3: Do not pull the Ø3.5mm cable with a tensile strength of 25N, the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over.
It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: The weight includes packaging. The weight in parenthesis in for unit only.
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

● DC 3-wire type

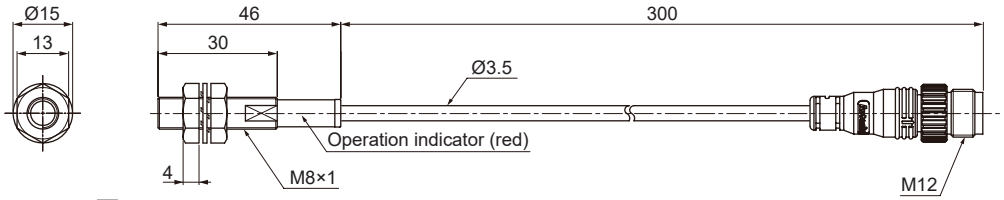
Model		PRDW12-4DN PRDW12-4DP PRDW12-4DN2 PRDW12-4DP2 PRDW12-4DN-V PRDW12-4DP-V PRDW12-4DN2-V PRDW12-4DP2-V PRDWL12-4DN PRDWL12-4DP PRDWL12-4DN2 PRDWL12-4DP2	PRDW12-8DN PRDW12-8DP PRDW12-8DN2 PRDW12-8DP2 PRDW12-8DN-V PRDW12-8DP-V PRDW12-8DN2-V PRDW12-8DP2-V PRDWL12-8DN PRDWL12-8DP PRDWL12-8DN2 PRDWL12-8DP2	PRDW18-7DN PRDW18-7DP PRDW18-7DN2 PRDW18-7DP2 PRDW18-7DN-V PRDW18-7DP-V PRDW18-7DN2-V PRDW18-7DP2-V PRDWL18-7DN PRDWL18-7DP PRDWL18-7DN2 PRDWL18-7DP2	PRDW18-14DN PRDW18-14DP PRDW18-14DN2 PRDW18-14DP2 PRDW18-14DN-V PRDW18-14DP-V PRDW18-14DN2-V PRDW18-14DP2-V PRDWL18-14DN PRDWL18-14DP PRDWL18-14DN2 PRDWL18-14DP2	PRDW30-15DN PRDW30-15DP PRDW30-15DN2 PRDW30-15DP2 PRDW30-15DN-V PRDW30-15DP-V PRDW30-15DN2-V PRDW30-15DP2-V PRDWL30-15DN PRDWL30-15DP PRDWL30-15DN2 PRDWL30-15DP2	PRDW30-25DN PRDW30-25DP PRDW30-25DN2 PRDW30-25DP2 PRDW30-25DN-V PRDW30-25DP-V PRDW30-25DN2-V PRDW30-25DP2-V PRDWL30-25DN PRDWL30-25DP PRDWL30-25DN2 PRDWL30-25DP2
Diameter of sensing side		12mm		18mm		30mm	
Sensing distance		4mm	8mm	7mm	14mm	15mm	25mm
Installation		Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)	Shield (flush)	Non-Shield (non-flush)
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance		0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)					
Leakage current		Max. 10mA					
Response frequency※1		500Hz	400Hz	300Hz	200Hz	100HZ	100Hz
Residual voltage		Max. 1.5V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		200mA					
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		1,500VAC 50/60Hz for 1 min					
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Indicator		Operation indicator: Red LED					
Environment	Ambient temp.	-25 to 70℃, storage: -30 to 80℃					
	Ambient humi.	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit, reverse polarity protection circuit, output short over current protection circuit					
Protection structure		IP67 (IEC standard)					
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)					
Cable※2		Ø4mm, 2-wire, 300mm, M12 connector		Ø5mm, 3-wire, 300mm, M12 connector			
		AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm					
Approval		CE					
Unit weight	PRDW	Approx. 44g	Approx. 42g	Approx. 80g	Approx. 75g	Approx. 140g	Approx. 145g
	PRDWL	Approx. 64g	Approx. 62g	Approx. 110g	Approx. 105g	Approx. 180g	Approx. 185g

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※The last 'V' of model name is for the model with oil-resistance reinforced cable.
※Environment resistance is rated at no freezing or condensation.

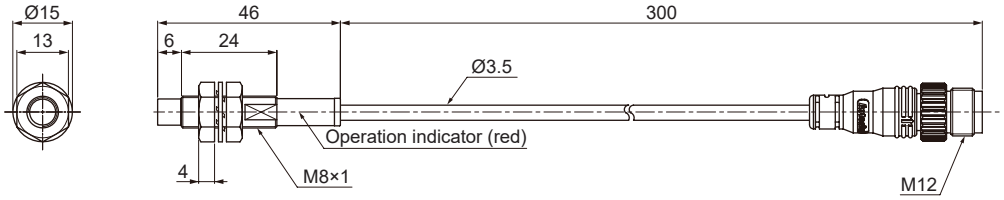
▣ Dimensions

(unit: mm)

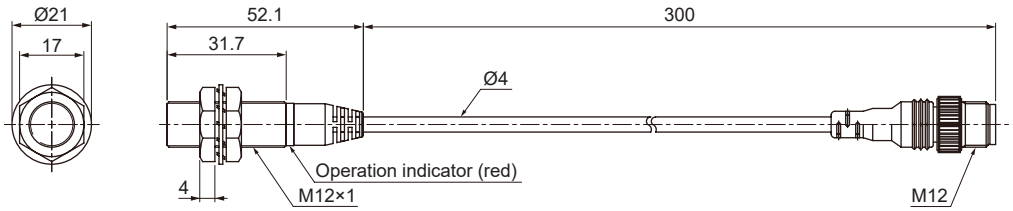
● **PRDWT08-2D□**



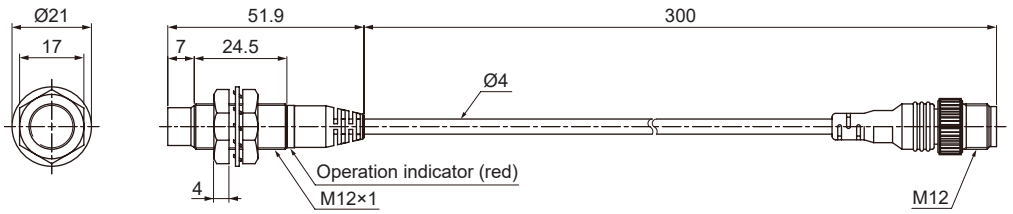
● **PRDWT08-4D□**



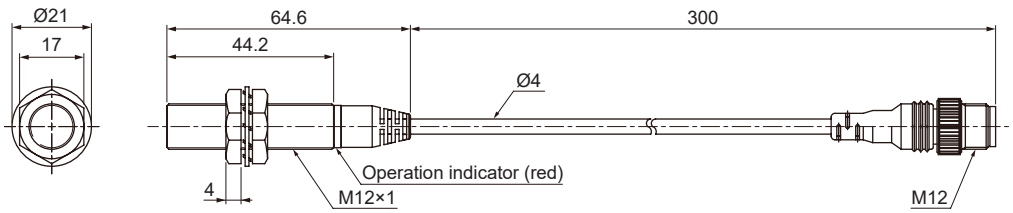
● **PRDW(T)12-4D□**



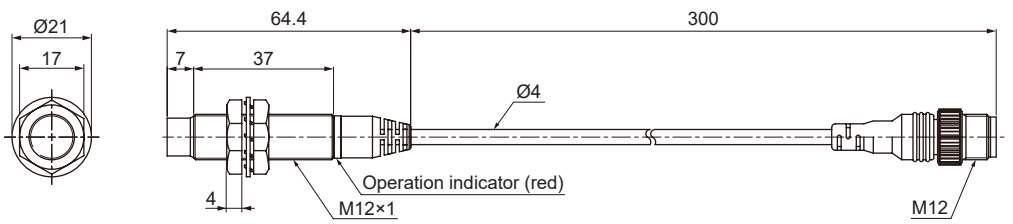
● **PRDW(T)12-8D□**



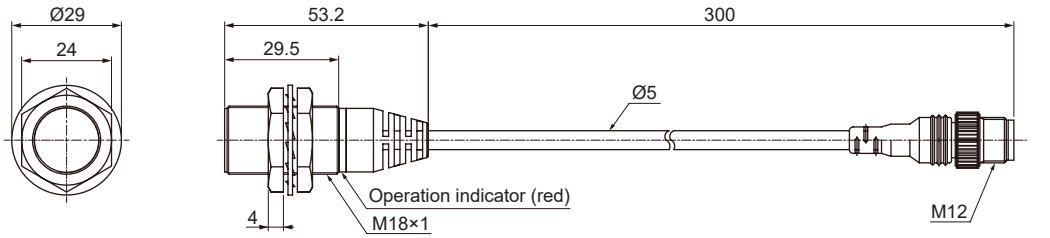
● **PRDWL12-4D□**



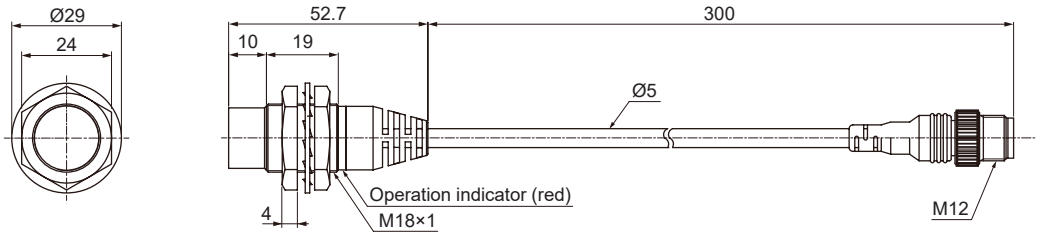
● **PRDWL12-8D□**



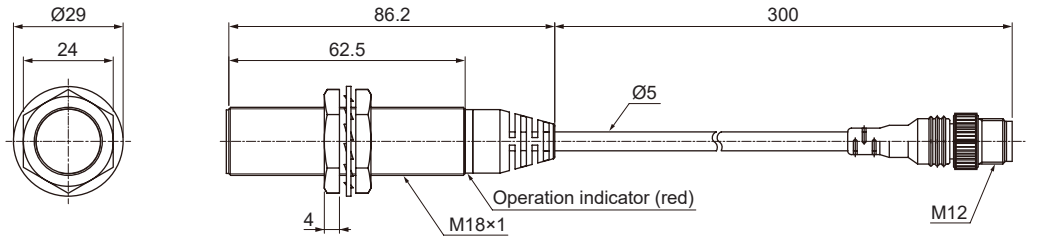
● **PRDW(T)18-7D□**



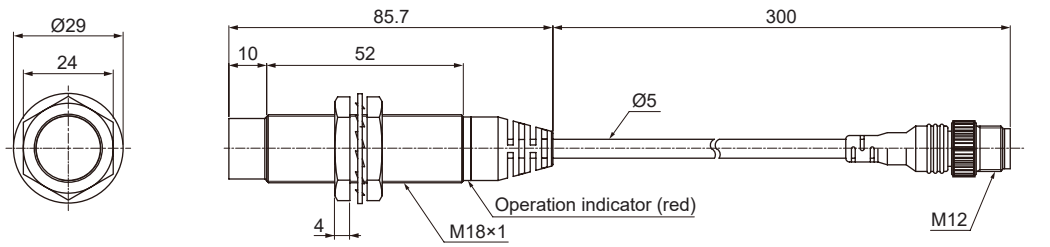
● **PRDW(T)18-14D□**



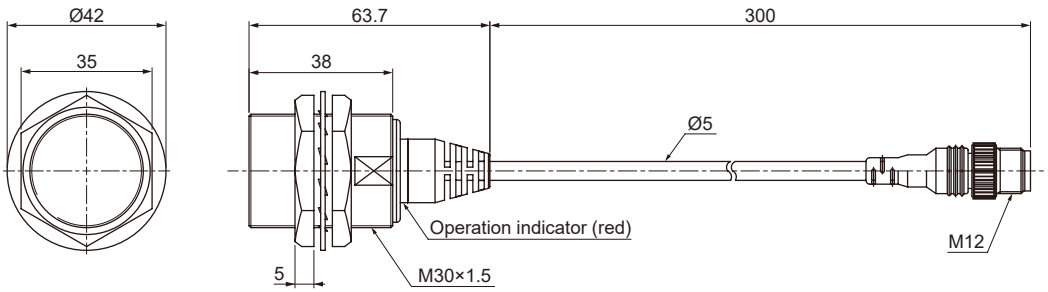
● **PRDWL(T)18-7D□**



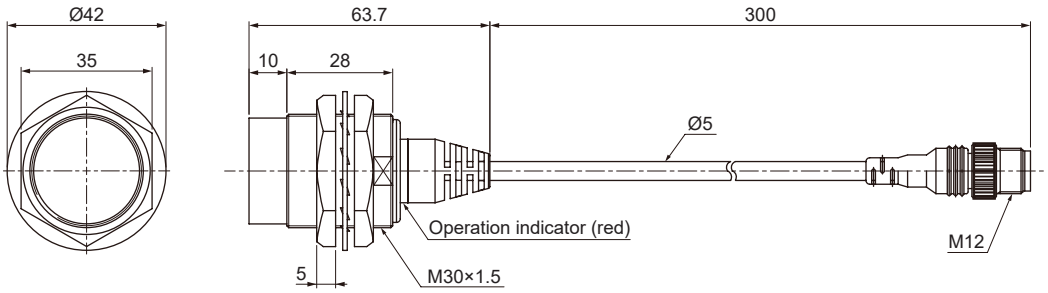
● **PRDWL18-14D□**



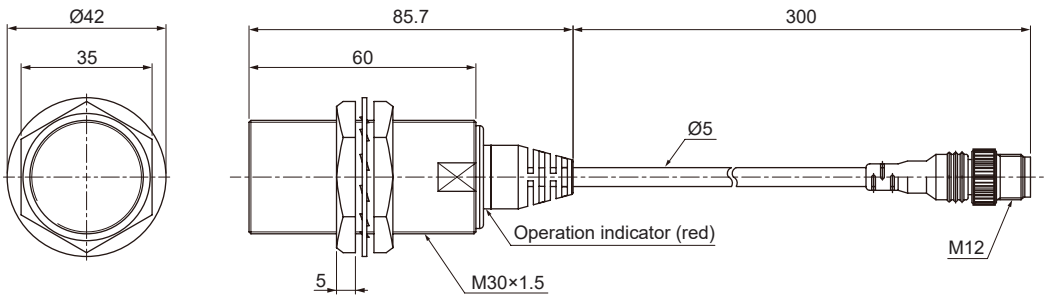
● **PRDW(T)30-15D□**



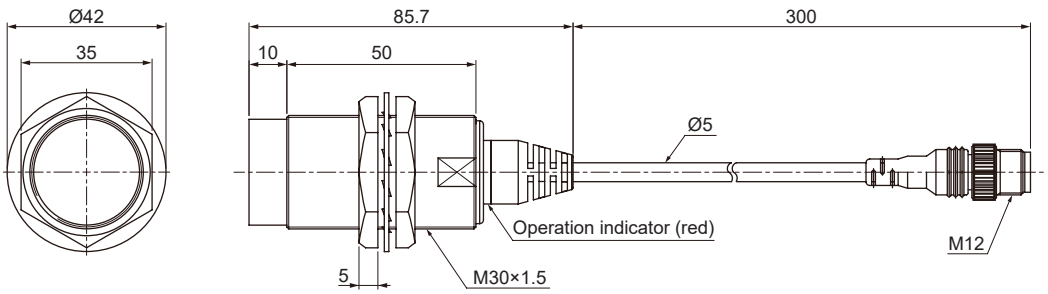
● **PRDW(T)30-25D□**



● **PRDWL30-15D□**

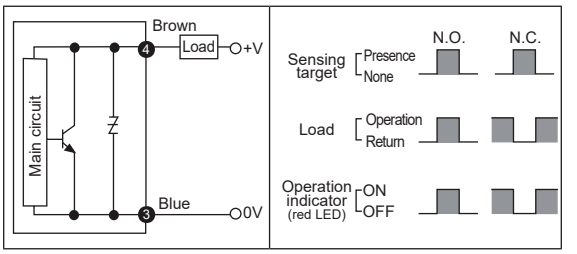


● **PRDWL30-25D□**



▣ Control Output Diagram and Load Operation

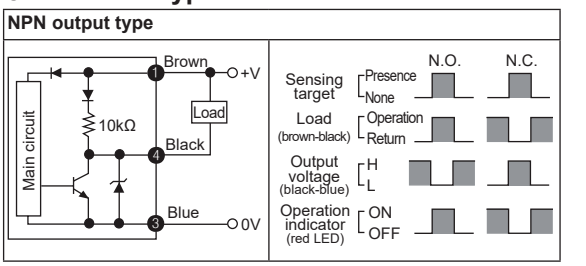
◎ DC 2-wire type



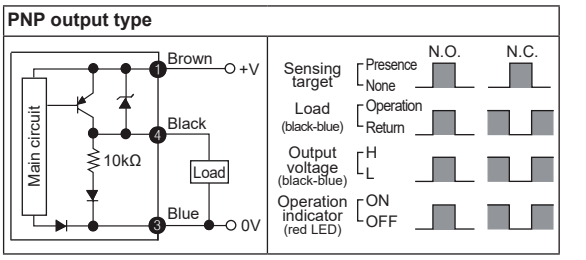
※The number in a circle is pin no. of connector.

◎ DC 3-wire type

NPN output type



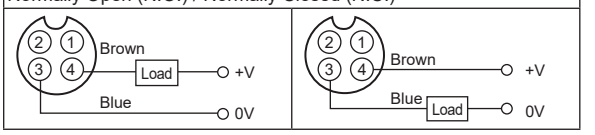
PNP output type



▣ Wiring Diagram

◎ DC 2-wire type (standard type)

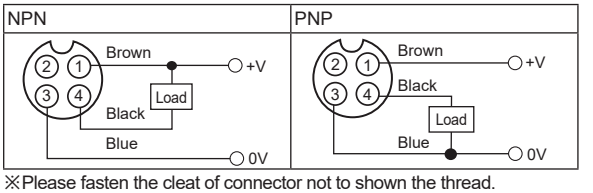
Normally Open (N.O.) / Normally Closed (N.C.)



※Pin ①, ② are not used terminals.
※When using DC 3-wire type of connector cable, black (12-24VDC) and blue (0V) cables can be used.

◎ DC 3-wire type

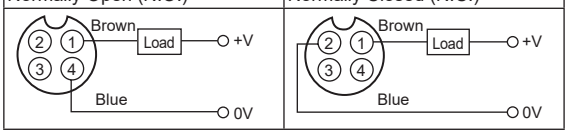
NPN | PNP



※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)
※Please fasten the vibration part with PEFT tape.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

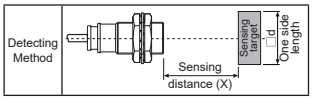
◎ DC 2-wire type (IEC standard type)

Normally Open (N.O.) | Normally Closed (N.C.)

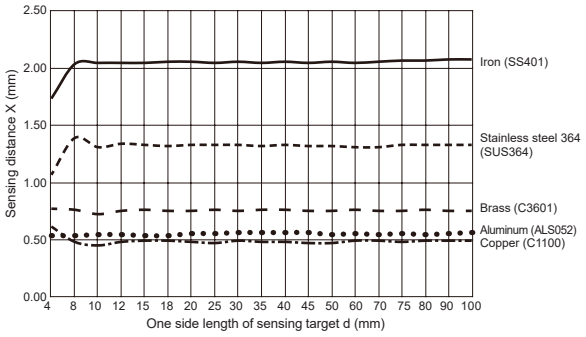


※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The type, pin arrangement of connector based upon IEC standard is being developed.
※Please put "I" behind of standard type for purchasing IEC standard product. E.g.) PRDWT12-4DO-I
※Please put "I" behind of model name for selecting proximity sensor by IEC standard. E.g.) CID2-2-I, CLD2-2-I

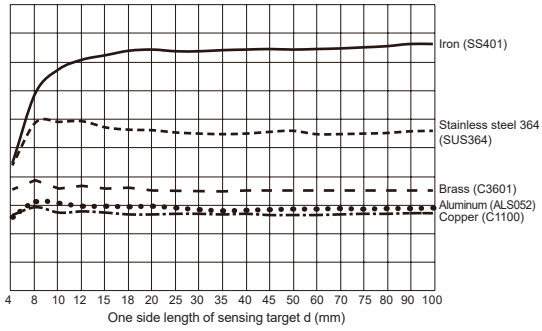
▣ Sensing Distance Feature Data by Target Material and Size



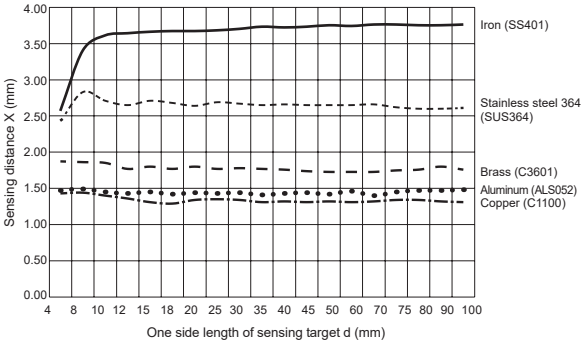
● PRDWT08-2D□



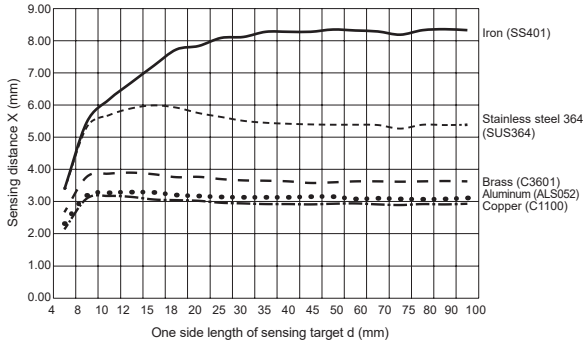
● PRDWT08-4D□



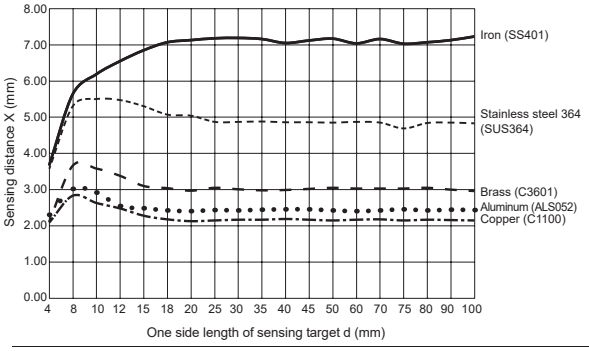
● PRDWT12-4D□



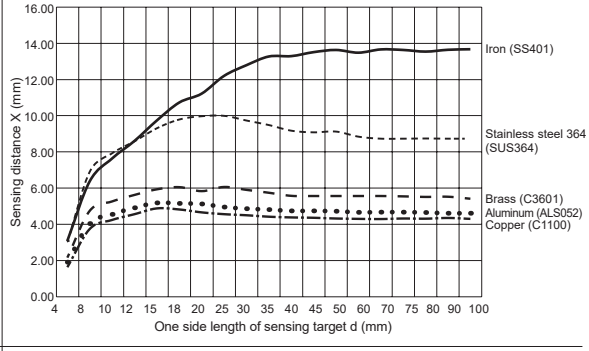
● PRDWT12-8D□



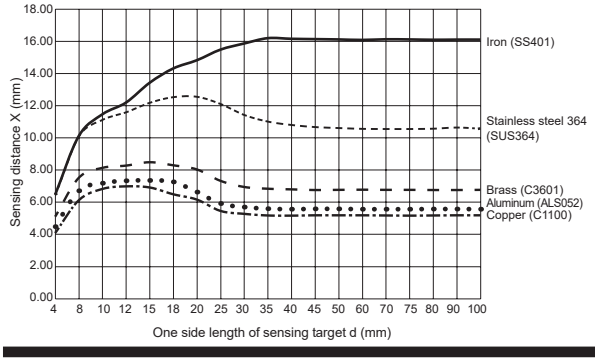
● PRDW(L)T18-7D□



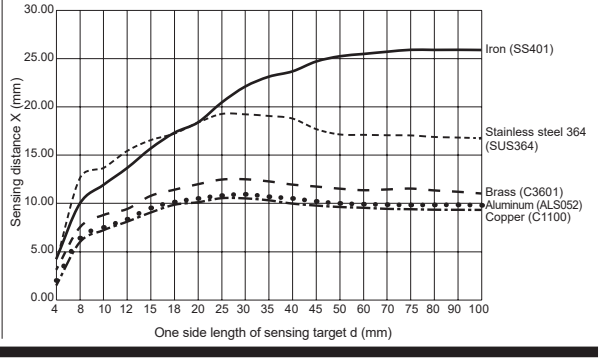
● PRDWT18-14D□



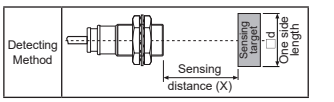
● PRDWT30-15D□



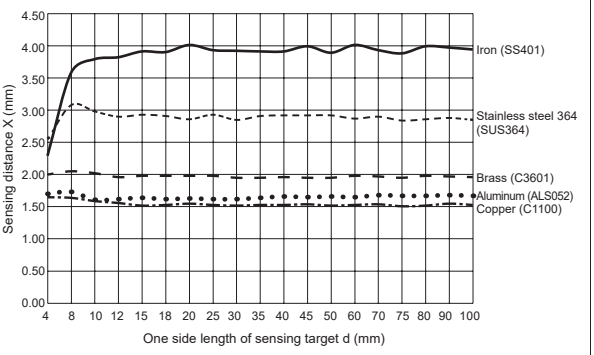
● PRDWT30-25D□



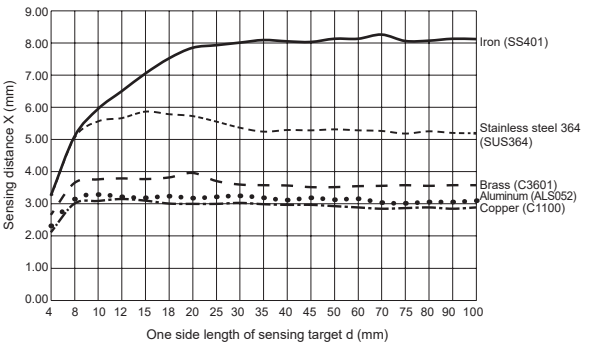
▣ Sensing Distance Feature Data by Target Material and Size



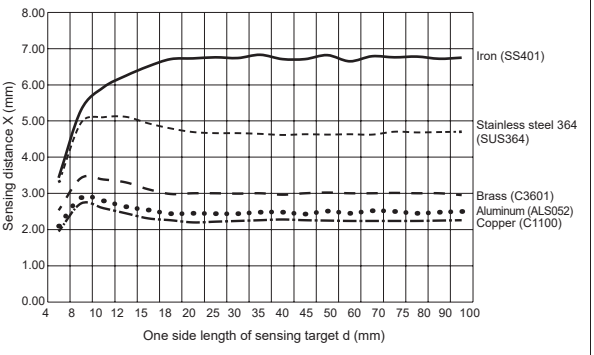
● PRDW(L)12-4D□



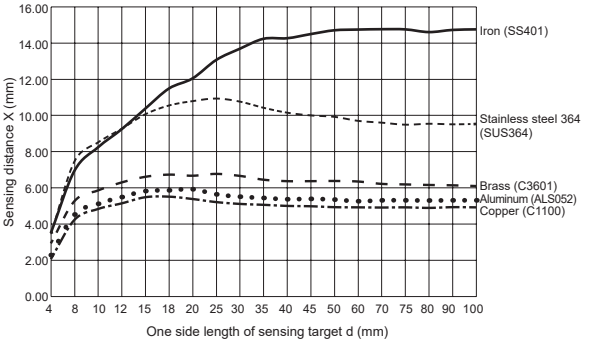
● PRDW(L)12-8D□



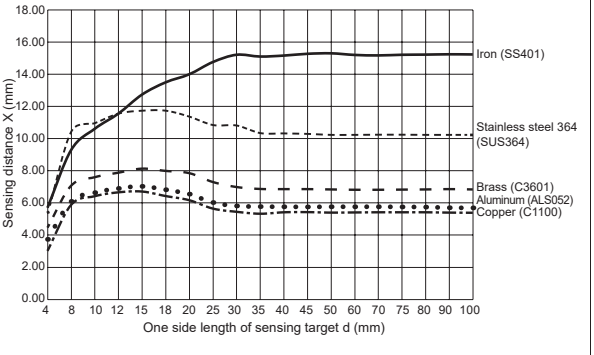
● PRDW(L)18-7D□



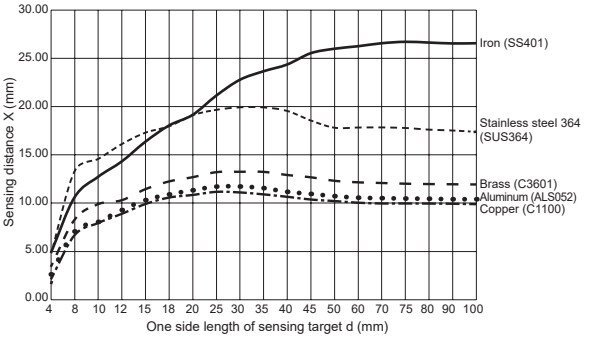
● PRDW(L)18-14D□



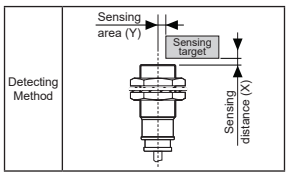
● PRDW(L)30-15D□



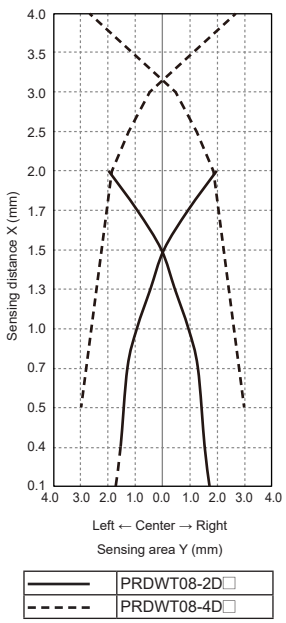
● PRDW(L)30-25D□



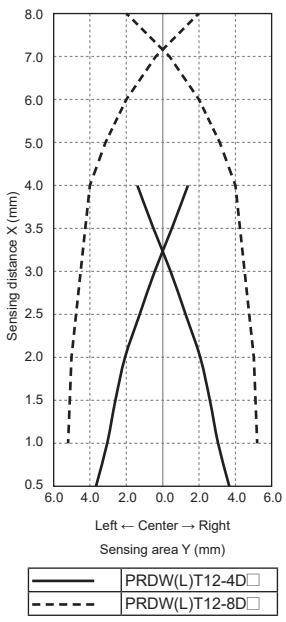
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



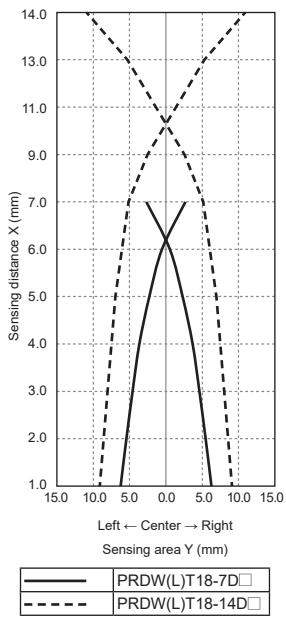
● PRDWT08-2D□/4D□



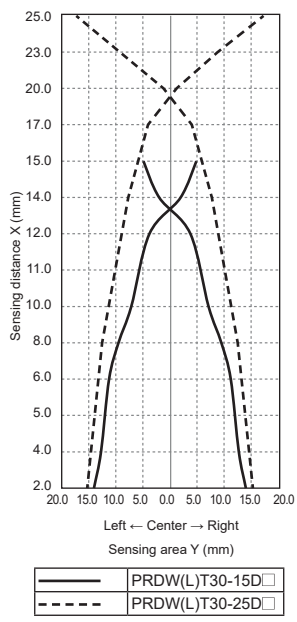
● PRDWT12-4D□/8D□



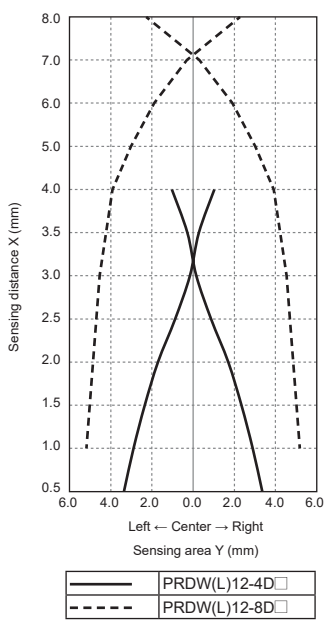
● PRDW(L)T18-7D□ PRDWT18-14D□



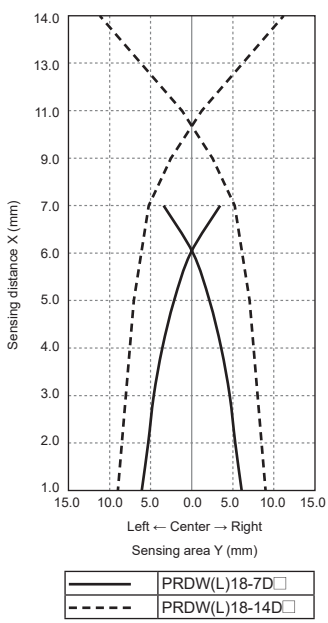
● PRDWT30-15D□/25D□



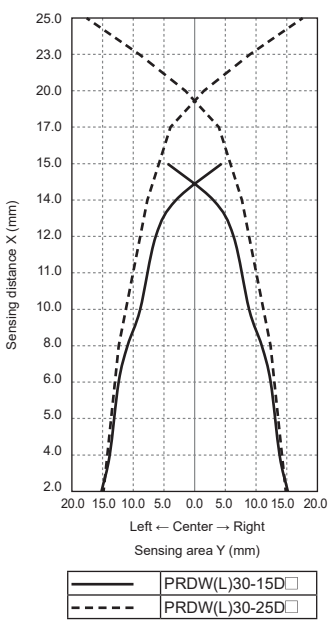
● PRDW(L)12-4D□/8D□



● PRDW(L)18-7D□/14D□

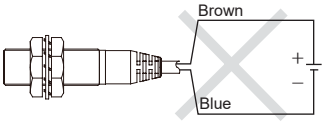


● PRDW(L)30-15D□/25D□

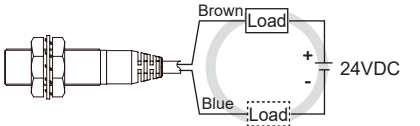


▣ Proper Usage

◎ Load connections



< DC 2-wire type >

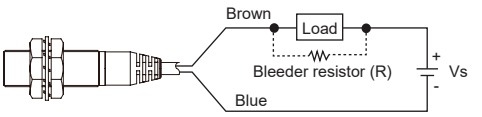


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● **DC 2-wire type**



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

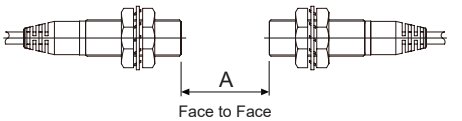
※W value of Bleeder resistor should be bigger for proper heat dissipation.

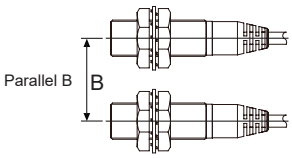
$$R \leq \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P: Number of Bleeder resistance watt]

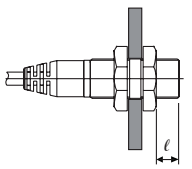
◎ Mutual-interference & Influence by surrounding metals

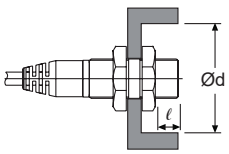
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

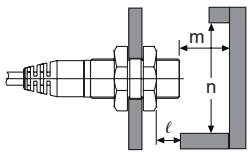




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRDWT08-2D□	PRDWT08-4D□	PRDWT12-4D□ PRDW(L)12-4D□	PRDWT12-8D□ PRDW(L)12-8D□	PRDW(L)T18-7D□ PRDW(L)18-7D□	PRDWT18-14D□ PRDW(L)18-14D□	PRDWT30-15D□ PRDW(L)30-15D□	PRDWT30-25D□ PRDW(L)30-25D□
A	20	80	25	120	50	200	110	350
B	15	60	25	100	35	110	90	300
ℓ	0	12	2.5	15	3.5	14	6	20
Ød	8	24	18	40	27	70	45	120
m	6	8	12	20	24	40	45	90
n	12	24	18	40	27	70	45	120

Cylindrical Long Sensing Distance, Connector Type Proximity Sensor

▣ Features

- **Long sensing distance (1.5 to 2 times longer sensing distance guaranteed compared to existing models)**
- Shorten the time of maintenance
- Easy to check operation from various angles with 4-side LED (DC 2-wire)
- Red LED operation indicator (DC 3-wire)
- Improved the noise immunity with dedicated IC
- Built-in surge protection, reverse polarity protection, output short over current protection circuit
- IP67 protection structure (IEC standard)

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

▣ Specifications

● DC 2-wire type

Model		PRDCMT12-4DO PRDCMT12-4DC PRDCMT12-4DO-I PRDCMT12-4DC-I	PRDCMT12-8DO PRDCMT12-8DC PRDCMT12-8DO-I PRDCMT12-8DC-I	PRDCMT18-7DO PRDCMT18-7DC PRDCMT18-7DO-I PRDCMT18-7DC-I PRDCMLT18-7DO PRDCMLT18-7DC PRDCMLT18-7DO-I PRDCMLT18-7DC-I	PRDCMT18-14DO PRDCMT18-14DC PRDCMT18-14DO-I PRDCMT18-14DC-I PRDCMLT18-14DO PRDCMLT18-14DC PRDCMLT18-14DO-I PRDCMLT18-14DC-I	PRDCMT30-15DO PRDCMT30-15DC PRDCMT30-15DO-I PRDCMT30-15DC-I PRDCMLT30-15DO PRDCMLT30-15DC PRDCMLT30-15DO-I PRDCMLT30-15DC-I	PRDCMT30-25DO PRDCMT30-25DC PRDCMT30-25DO-I PRDCMT30-25DC-I PRDCMLT30-25DO PRDCMLT30-25DC PRDCMLT30-25DO-I PRDCMLT30-25DC-I
Diameter of the sensing side		12mm		18mm		30mm	
Sensing distance		4mm	8mm	7mm	14mm	15mm	25mm
Installation		Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance		0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)					
Leakage current		Max. 0.6mA					
Response frequency※1		450Hz	400Hz	250Hz	200Hz	100Hz	100Hz
Residual voltage		Max. 3.5V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		2 to 100mA					
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		1,500VAC 50/60Hz for 1 min					
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Indicator		Operation indicator: Red LED (4 sides)					
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit, power reverse polarity protection circuit, output short over current protection circuit					
Material		Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Heat-resistant acrylonitrile butadiene styrene					
Approval		CE					
Protection structure		IP67 (IEC standard)					
Weight※2		Approx. 28g (approx. 18g)		PRDCMT: Approx. 60g(approx. 42g) PRDCMLT: Approx. 78g(approx. 60g)		PRDCMT: Approx. 150g(approx. 110g) PRDCMLT: Approx. 190g(approx. 150g)	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

● DC 3-wire type

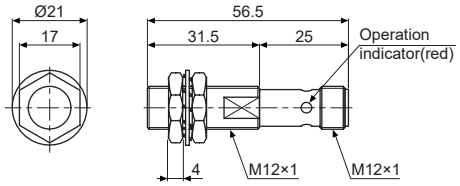
Model	PRDCM12-4DN PRDCM12-4DP PRDCM12-4DN2 PRDCM12-4DP2 PRDCML12-4DN PRDCML12-4DP PRDCML12-4DN2 PRDCML12-4DP2	PRDCM12-8DN PRDCM12-8DP PRDCM12-8DN2 PRDCM12-8DP2 PRDCML12-8DN PRDCML12-8DP PRDCML12-8DN2 PRDCML12-8DP2	PRDCM18-7DN PRDCM18-7DP PRDCM18-7DN2 PRDCM18-7DP2 PRDCML18-7DN PRDCML18-7DP PRDCML18-7DN2 PRDCML18-7DP2	PRDCM18-14DN PRDCM18-14DP PRDCM18-14DN2 PRDCM18-14DP2 PRDCML18-14DN PRDCML18-14DP PRDCML18-14DN2 PRDCML18-14DP2	PRDCM30-15DN PRDCM30-15DP PRDCM30-15DN2 PRDCM30-15DP2 PRDCML30-15DN PRDCML30-15DP PRDCML30-15DN2 PRDCML30-15DP2	PRDCM30-25DN PRDCM30-25DP PRDCM30-25DN2 PRDCM30-25DP2 PRDCML30-25DN PRDCML30-25DP PRDCML30-25DN2 PRDCML30-25DP2
Diameter of the sensing side	12mm		18mm		30mm	
Sensing distance	4mm	8mm	7mm	14mm	15mm	25mm
Installation	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)	Shield (flush)	Non-shield (non-flush)
Hysteresis	Max. 10% of sensing distance					
Standard sensing target	12×12×1mm (iron)	25×25×1mm (iron)	20×20×1mm (iron)	40×40×1mm (iron)	45×45×1mm (iron)	75×75×1mm (iron)
Setting distance	0 to 2.8mm	0 to 5.6mm	0 to 4.9mm	0 to 9.8mm	0 to 10.5mm	0 to 17.5mm
Power supply (operating voltage)	12-24VDC⎓ (10-30VDC⎓)					
Current consumption	Max. 10mA					
Response frequency※1	500Hz	400Hz	300Hz	200Hz	100Hz	100Hz
Residual voltage	Max. 1.5V					
Affection by Temp.	Max. ±10% for sensing distance at ambient temperature 20℃					
Control output	Max. 200mA					
Insulation resistance	Over 50MΩ (at 500VDC megger)					
Dielectric strength	1,500VAC 50/60Hz for 1 min					
Vibration	1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Indicator	Operation indicator: Red LED					
Environment: Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
Environment: Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit	Surge protection circuit, power reverse polarity protection circuit, output short over current protection circuit					
Protection structure	IP67 (IEC standard)					
Material	Case/Nut: nickel plated brass, washer: nickel plated iron, Sensing surface: heat-resistant acrylonitrile butadiene styrene					
Approval	CE					
Unit Weight	PRDCM: Approx. 26g PRDCML: Approx. 34g		PRDCM: Approx. 48g PRDCML: Approx. 66g		PRDCM: Approx. 142g PRDCML: Approx. 182g	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※Environment resistance is rated at no freezing or condensation.

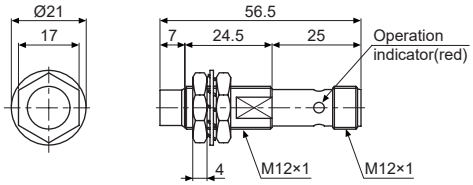
▣ Dimensions

(unit: mm)

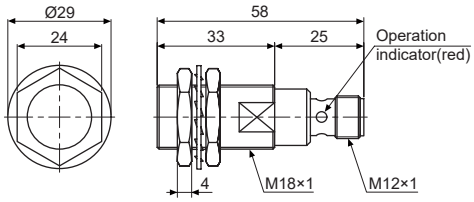
● PRDCMT12-4D□-□



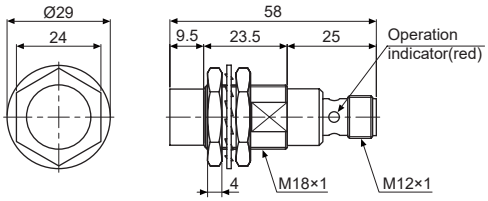
● PRDCMT12-8D□-□



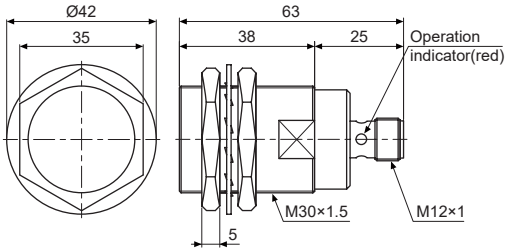
● PRDCMT18-7D□-□



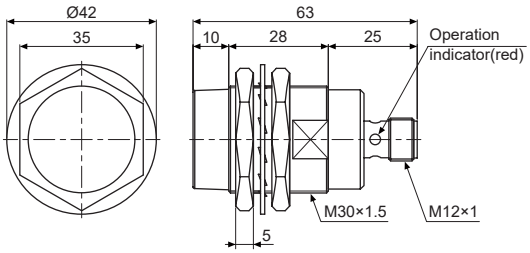
● PRDCMT18-14D□-□



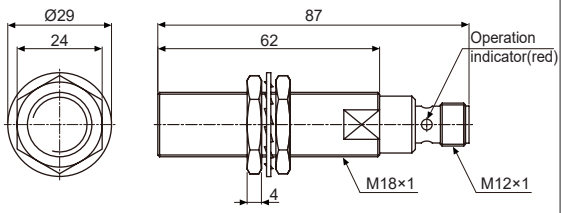
● PRDCMT30-15D□-□



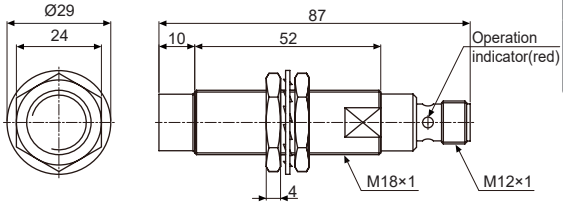
● PRDCMT30-25D□-□



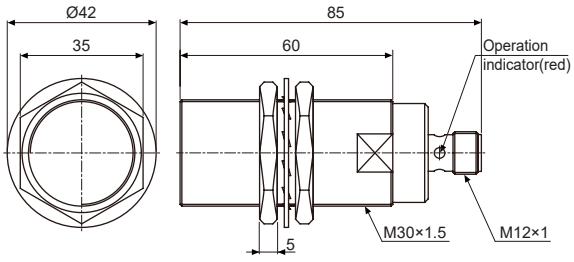
● PRDCMLT18-7D□-□



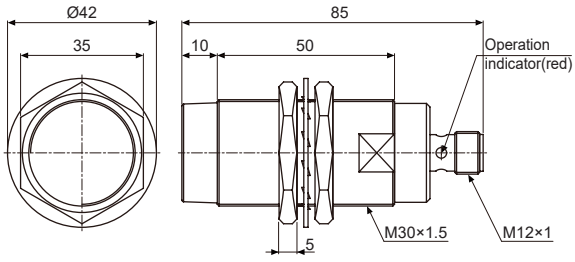
● PRDCMLT18-14D□-□



● PRDCMLT30-15D□-□



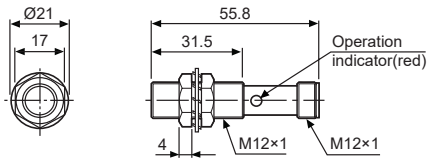
● PRDCMLT30-25D□-□



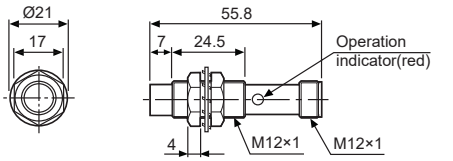
▣ Dimensions

(unit: mm)

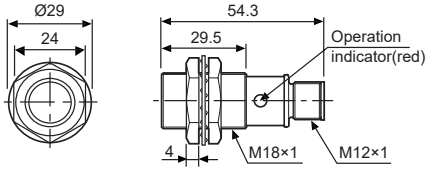
● PRDCM12-4D□



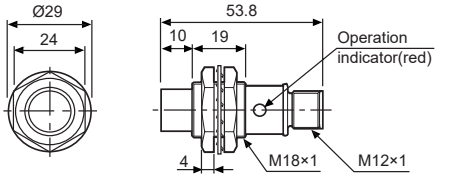
● PRDCM12-8D□



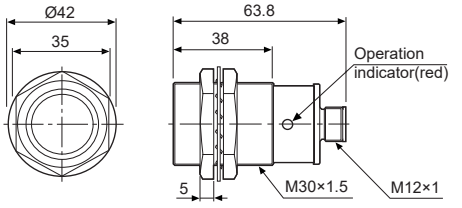
● PRDCM18-7D□



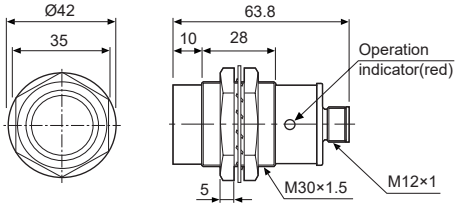
● PRDCM18-14D□



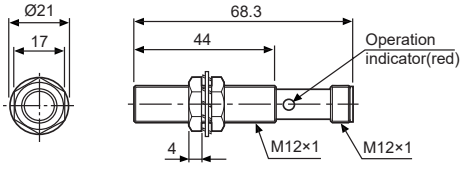
● PRDCM30-15D□



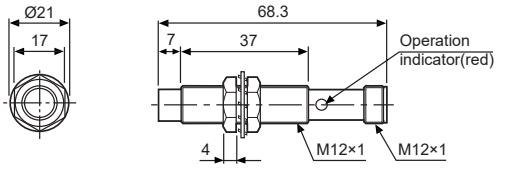
● PRDCM30-25D□



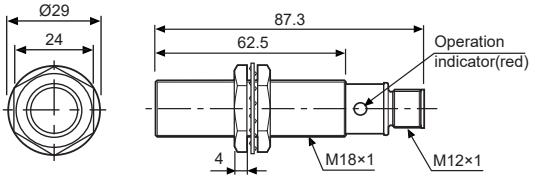
● PRDCML12-4D□



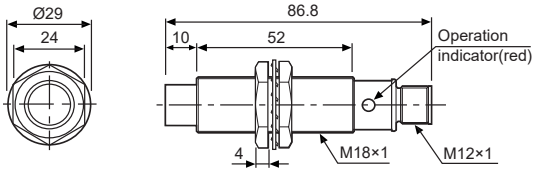
● PRDCML12-8D□



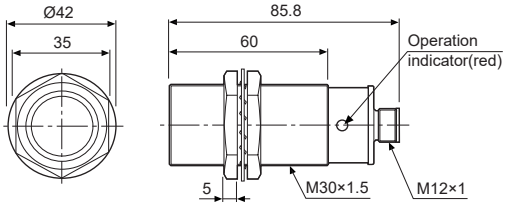
● PRDCML18-7D□



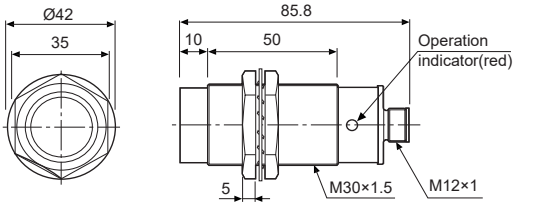
● PRDCML18-14D□



● PRDCML30-15D□

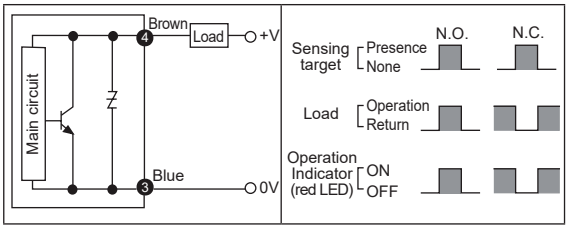


● PRDCML30-25D□



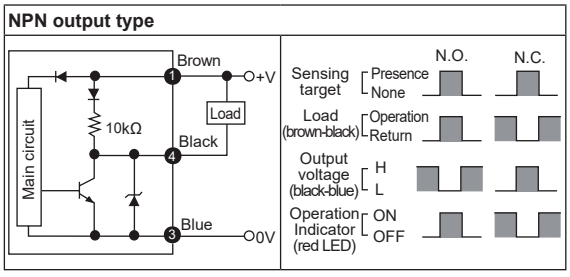
▣ Control Output Diagram and Load Operation

◎ DC 2-wire type

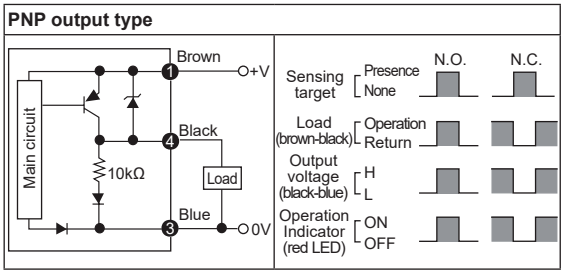


◎ DC 3-wire type

NPN output type



PNP output type

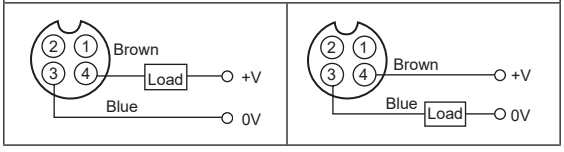


※The number in a circle is pin no. of connector.

▣ Wiring Diagram

◎ DC 2-wire type (standard type)

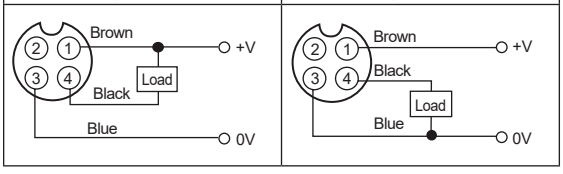
Normally Open (N.O.) / Normally Closed (N.C.)



※Pin ①, ② are not used terminals.
※For DC 3-wire type connector cable, it is available to use with black wire (12-24V DC) and blue wire (0V).

◎ DC 3-wire type

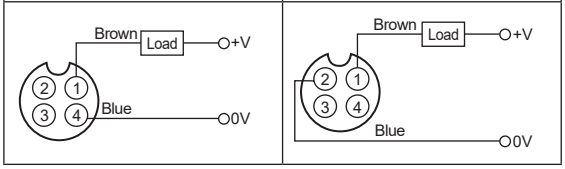
NPN output type	PNP output type



※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)

◎ DC 2-wire type (IEC standard type)

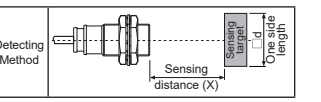
Normally Open (N.O.)	Normally Closed (N.C.)



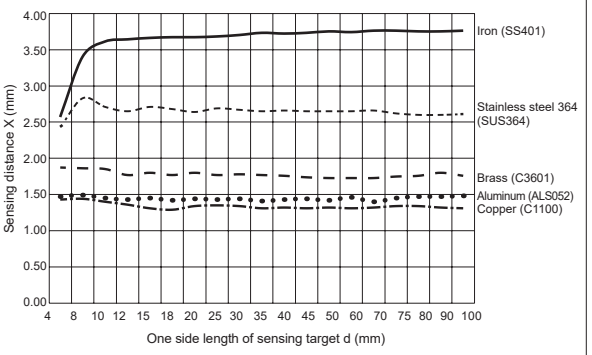
※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The pin arrangement of connector applying IEC standard is being developed.
※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product.
E.g.)PRDCMT12-4DO-I
※The connector cable for IEC standard is being developed. Please attach "I' at the end of the name of standard type.
E.g.)CID2-2-I, CLD2-5-I

※Please fasten the vibration part with PEFE tape.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

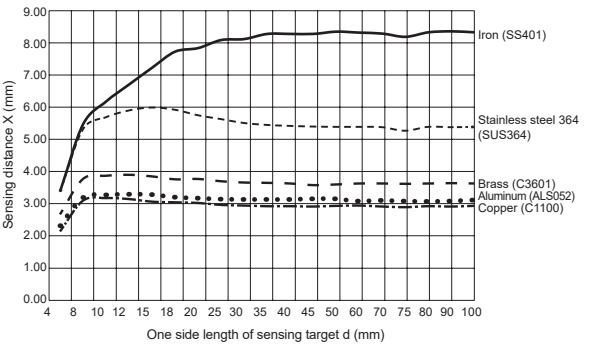
▣ Sensing Distance Feature Data by Target Material and Size



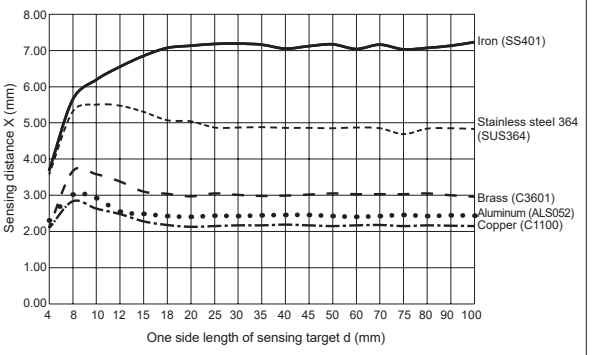
● PRDCMT12-4D□-□



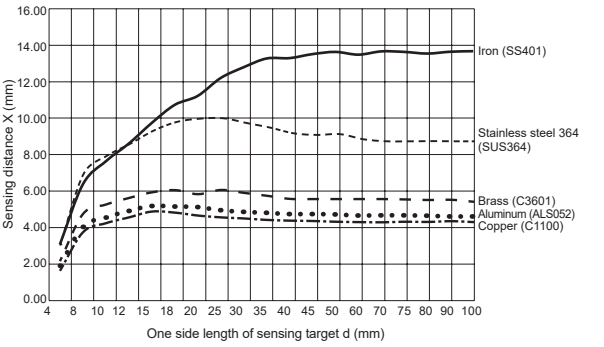
● PRDCMT12-8D□-□



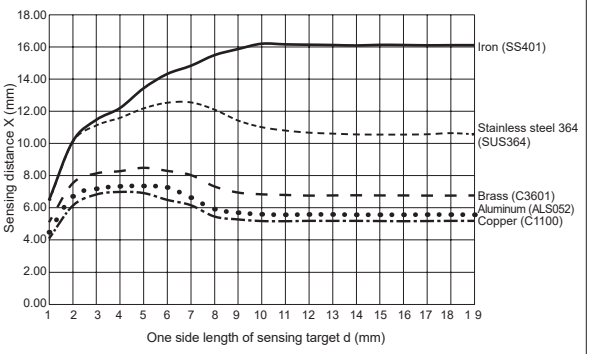
● PRDCM(L)T18-7D□-□



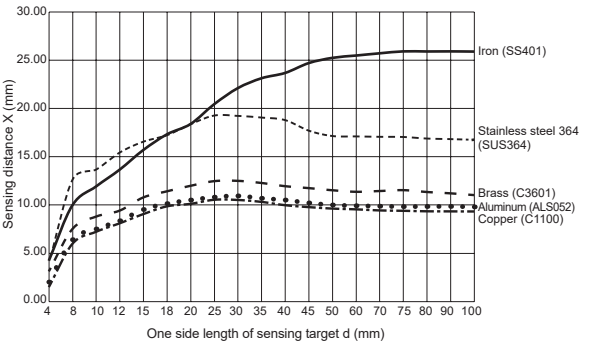
● PRDCM(L)T18-14D□-□



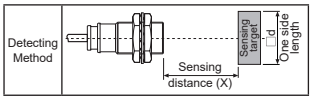
● PRDCM(L)T30-15D□-□



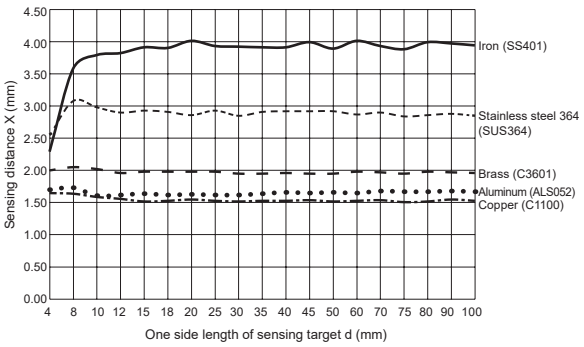
● PRDCM(L)T30-25D□-□



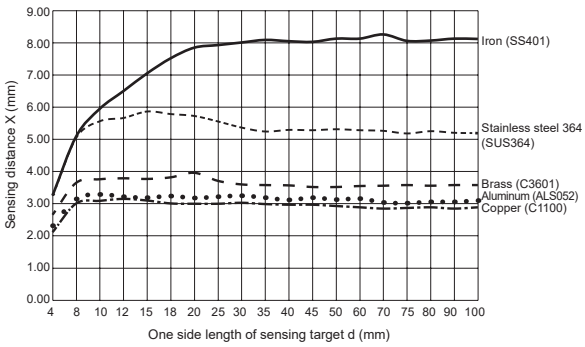
▣ Sensing Distance Feature Data by Target Material and Size



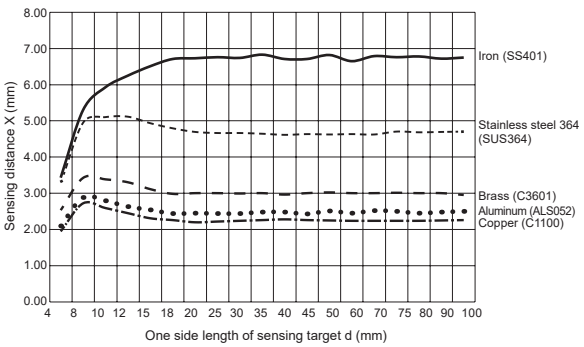
● PRDCM(L)12-4D□



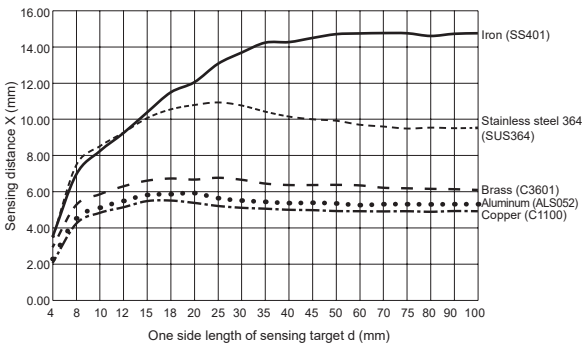
● PRDCM(L)12-8D□



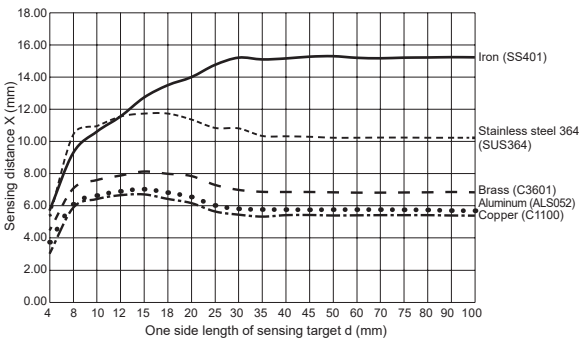
● PRDCM(L)18-7D□



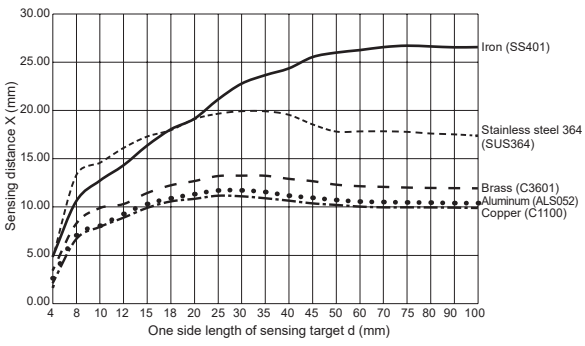
● PRDCM(L)18-14D□



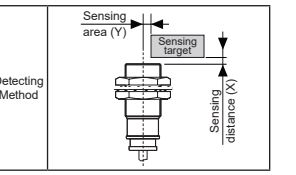
● PRDCM(L)30-15D□



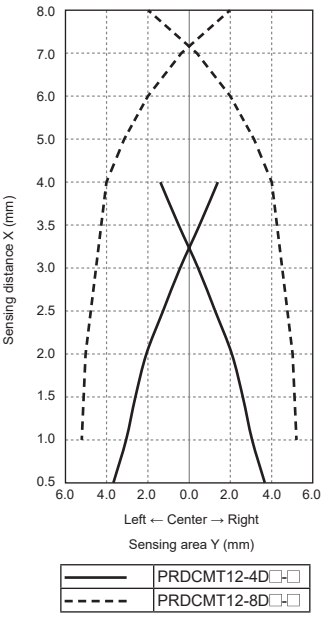
● PRDCM(L)30-25D□



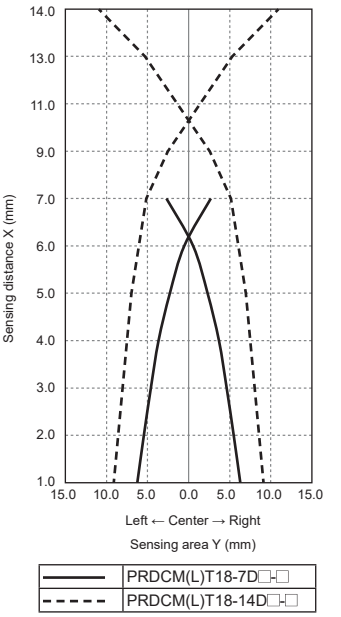
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



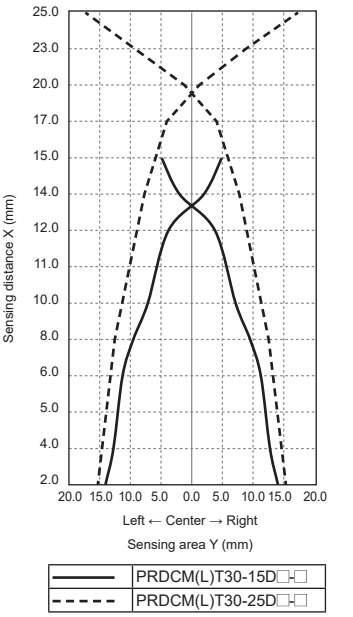
● PRDCMT12-4D□-□/ PRDCMT12-8D□-□



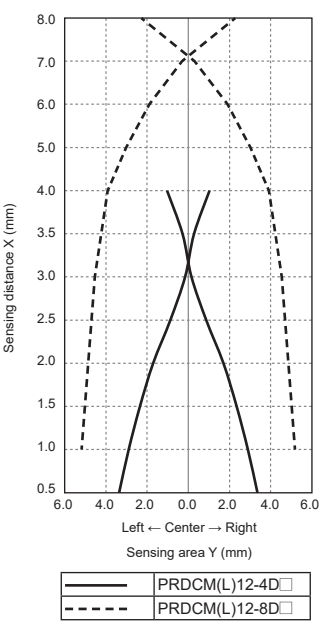
● PRDCM(L)T18-7D□-□/ PRDCM(L)T18-14D□-□



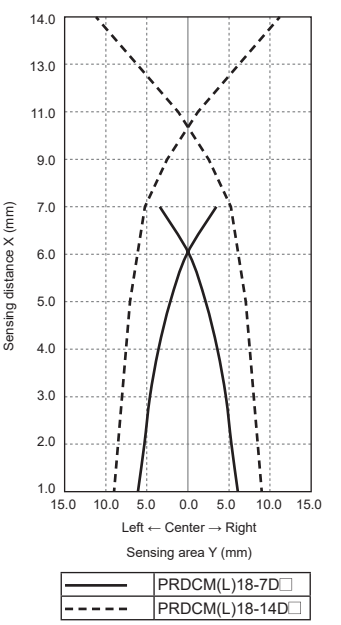
● PRDCM(L)T30-15D□-□/ PRDCM(L)T30-25D□-□



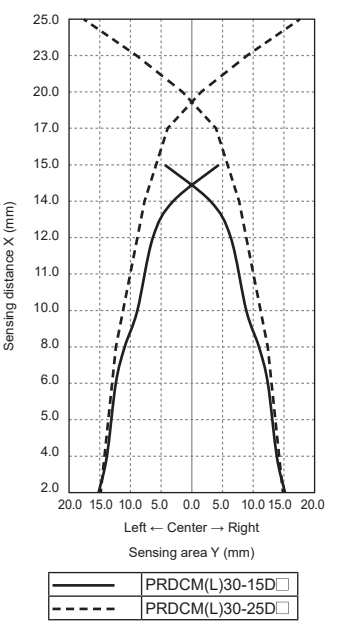
● PRDCM(L)12-4D□/8D□



● PRDCM(L)18-7D□/14D□

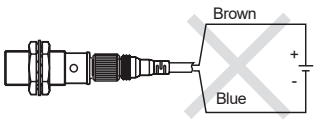


● PRDCM(L)30-15D□/25D□

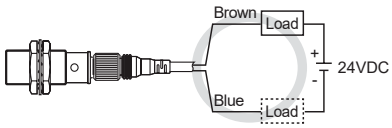


▣ Proper Usage

◎ Load connections



< DC 2-wire type >

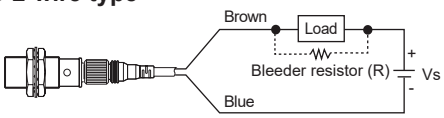


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



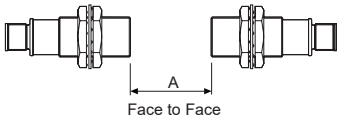
$$R \leq \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

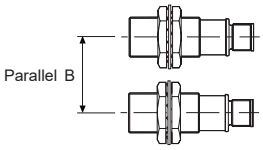
[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P: Number of Bleeder resistance watt]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

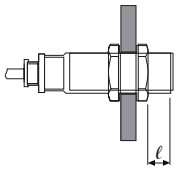
◎ Mutual-interference & Influence by surrounding metals

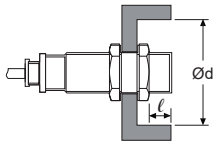
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.

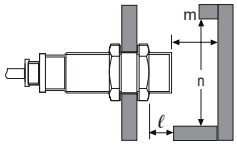




When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Model / Item	PRDCMT12-4D□-□ PRDCM(L)12-4D□	PRDCMT12-8D□-□ PRDCM(L)12-8D□	PRDCM(L)T18-7D□-□ PRDCM(L)18-7D□	PRDCM(L)T18-14D□-□ PRDCM(L)18-14D□	PRDCM(L)T30-15D□-□ PRDCM(L)30-15D□	PRDCM(L)T30-25D□-□ PRDCM(L)30-25D□
A	24	48	42	84	90	150
B	24	36	36	54	60	90
ℓ	0	11	0	14	0	15
Ød	12	36	18	54	30	90
m	12	24	21	42	45	75
n	18	36	27	54	45	90

▣ Specifications

● DC 3-wire type

Model		PRA12-2DN PRA12-2DP PRA12-2DN2 PRA12-2DP2	PRA18-5DN PRA18-5DP PRA18-5DN2 PRA18-5DP2	PRA30-10DN PRA30-10DP PRA30-10DN2 PRA30-10DP2
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		2mm	5mm	10mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance		0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		
Current consumption		Max. 10mA		
Response frequency※1		1.5kHz	500Hz	400Hz
Residual voltage		Max. 1.5V		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		Max. 200mA		
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 min		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (appox. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit, reverse polarity protection circuit, output short over current protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 3-wire, 2m	Ø5mm, 3-wire, 2m	
		AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material		Case/Nut: PTFE coated brass, Washer: PTFE coated iron, Sensing surface: PTFE, Standard cable (black): Polyvinyl chloride (PVC)		
Approval		CE		
Weight※2		Approx. 84g (approx. 72g)	Approx. 122g (appox. 110g)	Approx. 207g (approx. 170g)

● AC 2-wire type

Model		PRA12-2AO PRA12-2AC	PRA18-5AO PRA18-5AC	PRA30-10AO PRA30-10AC
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		2mm	5mm	10mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance		0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		100-240VAC～ (85-264VAC～)		
Leakage current		Max. 2.5mA		
Response frequency※1		20Hz		
Residual voltage		Max. 10V		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		5 to 150mA	5 to 200mA	
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		2,500VAC 50/60Hz for 1 min		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 2-wire, 2m	Ø5mm, 2-wire, 2m	
		AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material		Case/Nut: PTFE coated brass, Washer: PTFE coated iron, Sensing surface: PTFE, Standard cable (black): Polyvinyl chloride (PVC)		
Insulation type		Double insulation or reinforced insulation (Mark: ⧈, Dielectric strength between the measuring input part and the power part: 1.5kVAC)		
Approval		CE		
Weight※2		Approx. 78g (approx. 66g)	Approx. 118g (approx. 106g)	Approx. 207g (approx. 170g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

Cylindrial, Spatter-Resistance, Cable Type Proximity Sensor

▣ Features

- Prevent malfunction due to welding spatter with PTFE coating
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit
- Built-in output short over current protection circuit (DC type)
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

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

CE

▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PTFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

▣ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

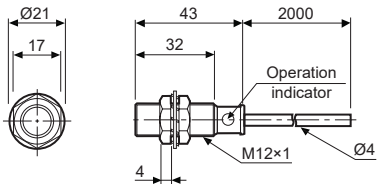
Model		PRAT12-2□O PRAT12-2□C PRAT12-2DO-V PRAT12-2DC-V	PRAT18-5□O PRAT18-5□C PRAT18-5DO-V PRAT18-5DC-V	PRAT30-10□O PRAT30-10□C PRAT30-10DO-V PRAT30-10DC-V
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		2mm	5mm	10mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance		0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		
Leakage current		Max. 0.6mA		
Response frequency※1		1.5kHz	500Hz	400Hz
Residual voltage※2		Max. 3.5V (non-polarity type is max. 5V)		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		2 to 100mA		
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 min (between all terminals and case)		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z directions for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit, output short over current protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 2-wire, 2m	Ø5mm, 2-wire, 2m	
		AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material		Case/Nut: PTFE coated brass, Washer: PTFE coated iron, Sensing surface: PTFE, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)		
Approval		CE		
Weight※3		Approx. 84g (approx. 72g)	Approx. 122g (approx. 110g)	Approx. 207g (approx. 170g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected device because residual voltage is 5V.
※3: The weight includes packaging. The weight in parenthesis in for unit only.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※Environment resistance is rated at no freezing or condensation.

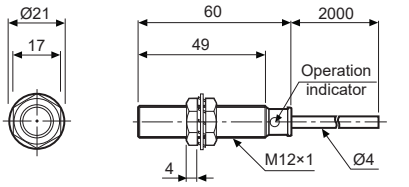
▣ Dimensions

(unit: mm)

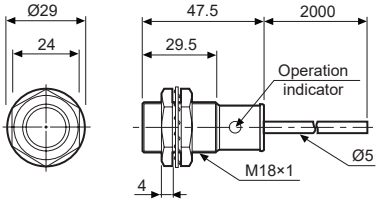
● **PRA12-2D□ / PRAT12-2D□**



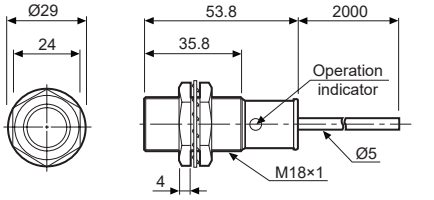
● **PRA12-2A□**



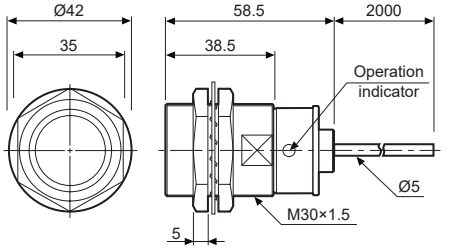
● **PRA18-5D□ / PRAT18-5D□**



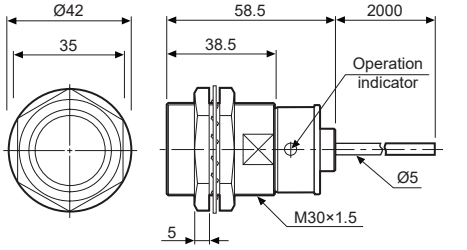
● **PRA18-5A□**



● **PRA30-10D□ / PRAT30-10D□**

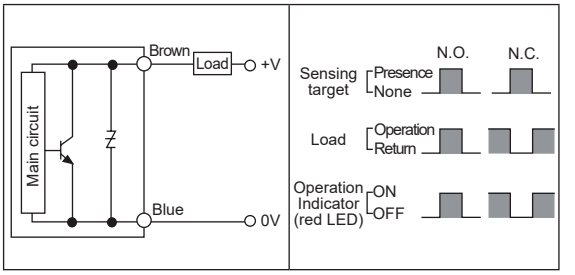


● **PRA 30-10A□**

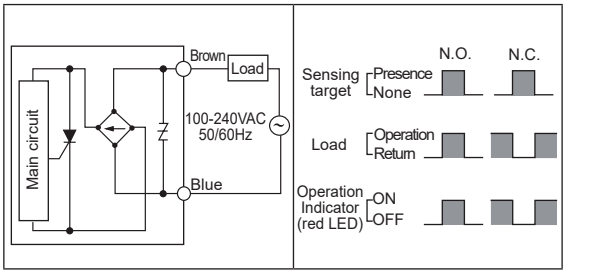


▣ Control Output Diagram and Load Operation

◎ DC 2-wire type

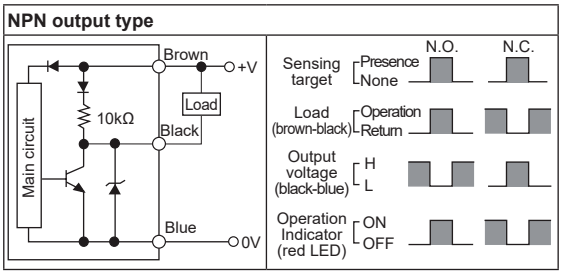


◎ AC 2-wire type

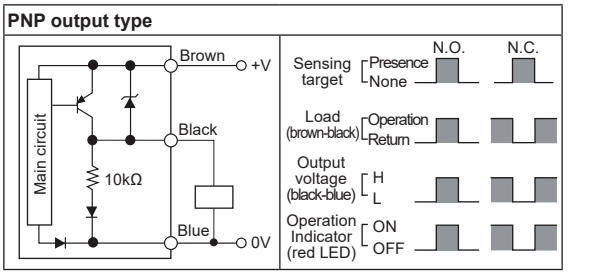


◎ DC 3-wire type

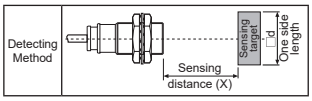
NPN output type



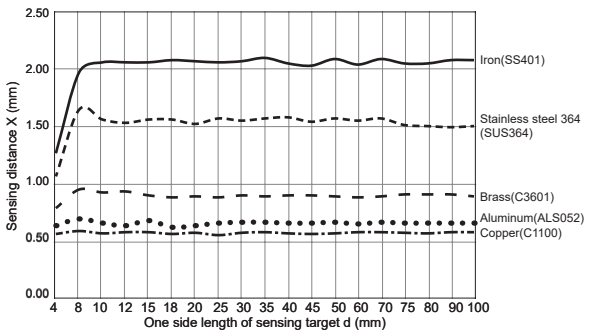
PNP output type



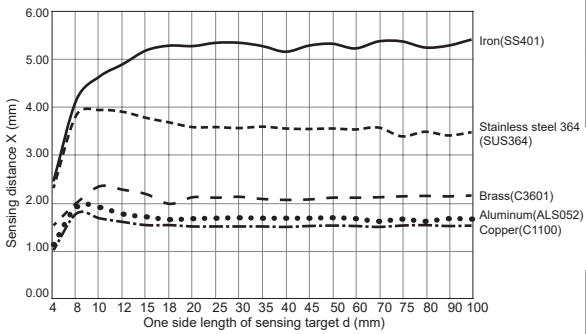
▣ Sensing Distance Feature Data by Target Material and Size



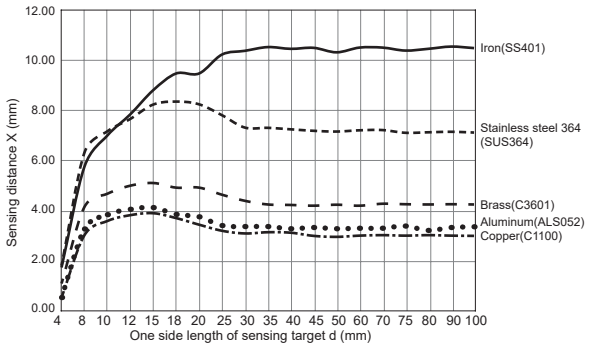
● PRAT12-2D□, PRA12-2A□



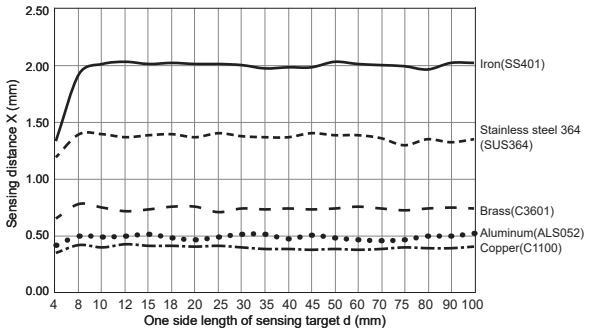
● PRAT18-5D□, PRA18-5A□



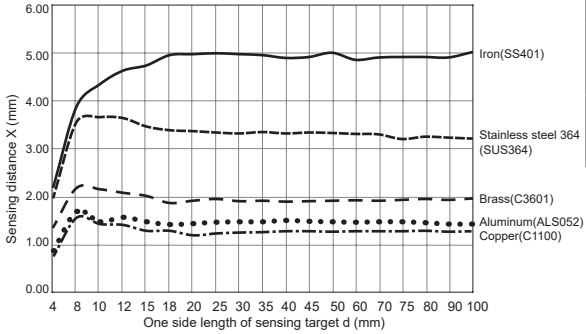
● PRAT30-10D□, PRA30-10A□



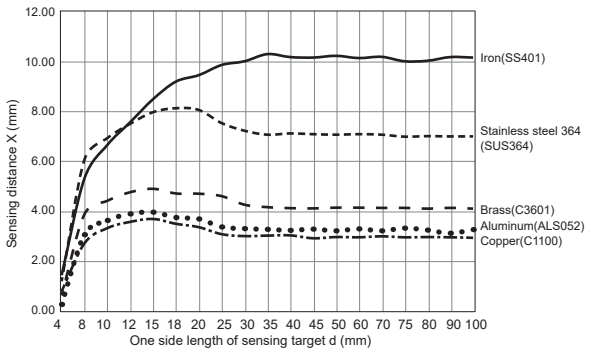
● PRA12-2D□



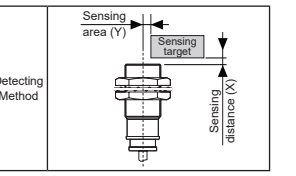
● PRA18-5D□



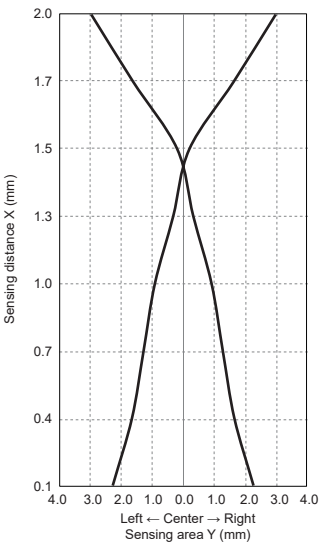
● PRA30-10D□



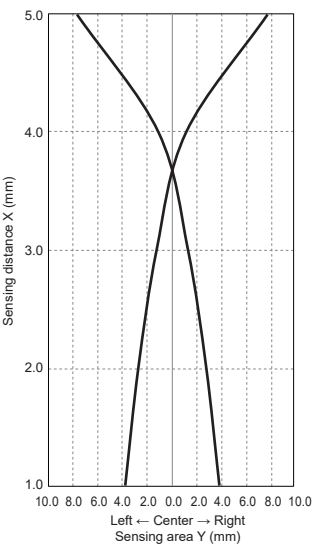
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



● PRAT12-2D□, PRA12-2A□



● PRAT18-5D□, PRA18-5A□



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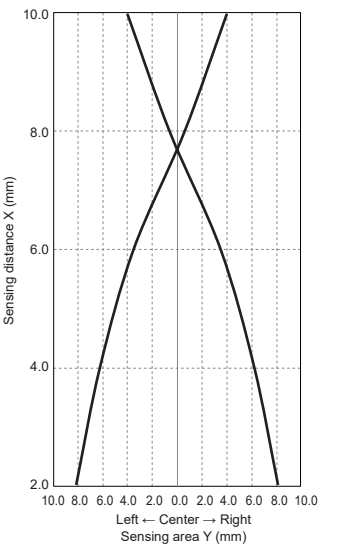
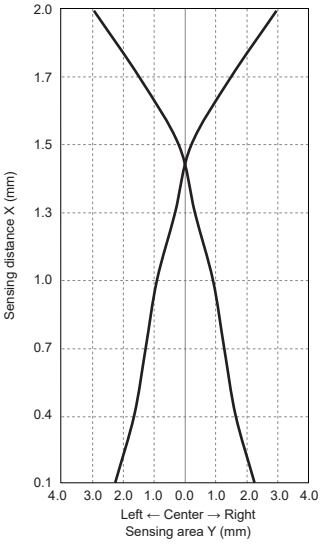
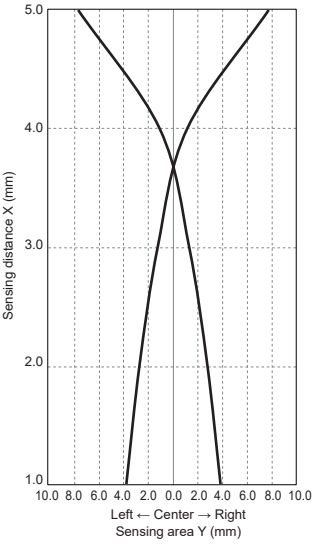


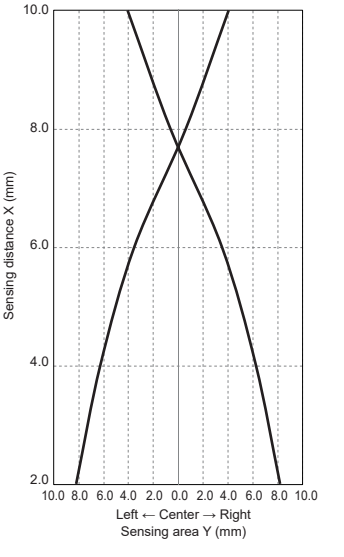
● PRA12-2D□



● PRA18-5D□

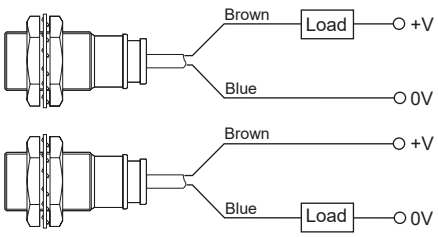


● PRA30-10D□



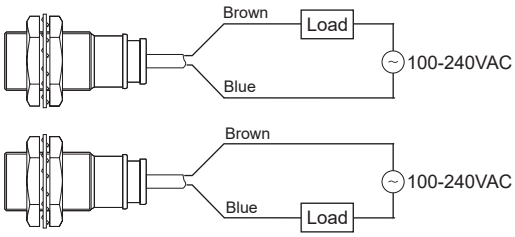
▣ Connections

◎ DC 2-wire type



※The load can be connected to either wire.

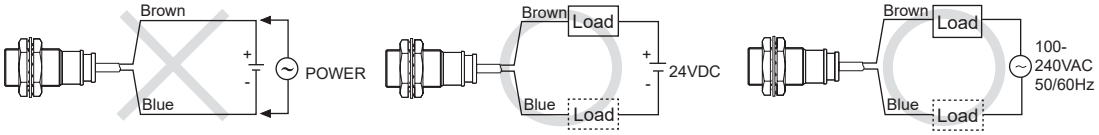
◎ AC 2-wire type



※No need to consider polarity for non-polarity type of power supply.

▣ Proper Usage

◎ Load connections

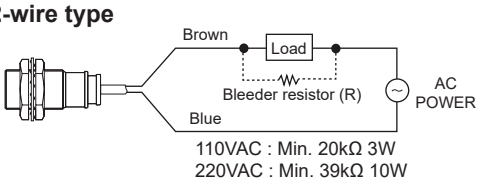


<DC 2-wire type & AC 2-wire type> <DC 2-wire type> <AC 2-wire type>

When using DC or AC 2-wire type proximity sensor, the load must be connected otherwise internal components may be damaged. The load can be connected to either wire.

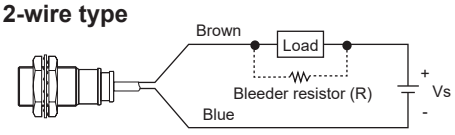
◎ In case of the load current is small

● AC 2-wire type



110VAC : Min. 20kΩ 3W
220VAC : Min. 39kΩ 10W

● DC 2-wire type



If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I: Action current of load, R: Bleeder resistance, P: Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

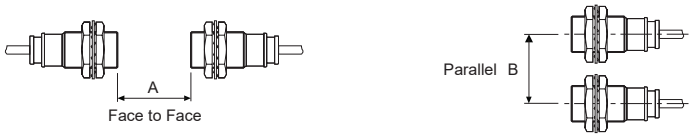
※W value of Bleeder resistor should be bigger for proper heat.

$$R \le \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

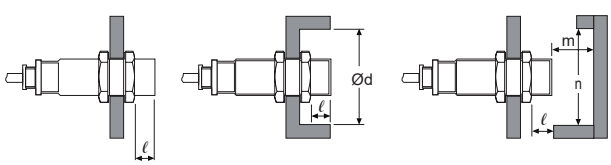
[Vs: Power supply, Io: Min. action current of proximity sensor
Ioff: Return current of load, P: Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of th may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.



When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates. (unit: mm)



Item \ Model	PRAT12-2D□ PRA12-2D□ PRA12-2A□	PRAT18-5D□ PRA18-5D□ PRA18-5A□	PRAT30-10D□ PRA30-10D□ PRA30-10A□
A	12	30	60
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	6	15	30
n	18	27	45

Cylindrial, Spatter-Resistance, Cable Connector Type

▣ Features

- Prevent malfunction due to welding spatter with PTFE coating
- Improved the noise immunity with dedicated IC
- Built-in surge protection circuit
- Built-in output short over current protection circuit
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

Please read "Safety Considerations" in operation manual before using.

▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PTFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

▣ Specifications

● DC 2-wire type

※When the □ model name is X, it is non-polarity model.

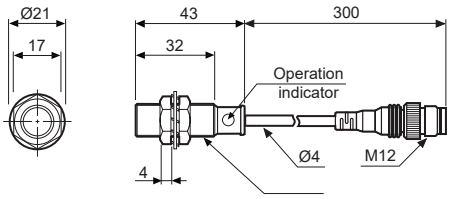
Model		PRAWT12-2□C PRAWT12-2□O PRAWT12-2□C-I PRAWT12-2□O-I	PRAWT18-5□O PRAWT18-5□C PRAWT18-5□O-I PRAWT18-5□C-I	PRAWT30-10□O PRAWT30-10□C PRAWT30-10□O-I PRAWT30-10□C-I
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		2mm	5mm	10mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance		0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		
Leakage current		Max. 0.6mA		
Response frequency※1		1.5kHz	500Hz	400Hz
Residual voltage※2		Max. 3.5V (non-polarity type is max. 5V)		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		2 to 100mA		
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 min (between all terminals and case)		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit, output short over current protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 2-wire, 300mm, M12 connector	Ø5mm, 2-wire, 300mm, M12 connector	
		AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material		Case/Nut: PTFE coated brass, Washer: PTFE coated iron, Sensing surface: PTFE, Standard cable (black): Polyvinyl chloride (PVC)		
Approval		CE		
Weight※3		Approx. 54g (approx. 42g)	Approx. 70g (approx. 58g)	Approx. 134g (approx. 122g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: Before using non-polarity type, check the condition of connected divice because residual voltage is 5V.
※3: The weight includes packaging. The weight in parenthesis in for unit only.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets
※The '□' of model name is for power type. 'D' is 12-24VDC, 'X' is non-polarity 12-24VDC.
※Environment resistance is rated at no freezing or condensation.

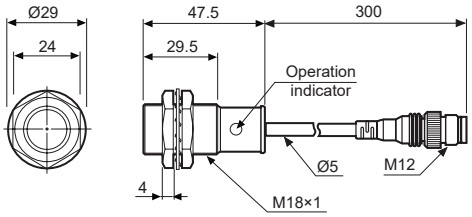
▣ Dimensions

(unit: mm)

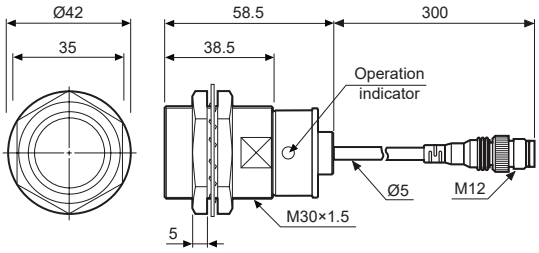
● **PRAWT12-2D□**



● **PRAWT18-5D□**

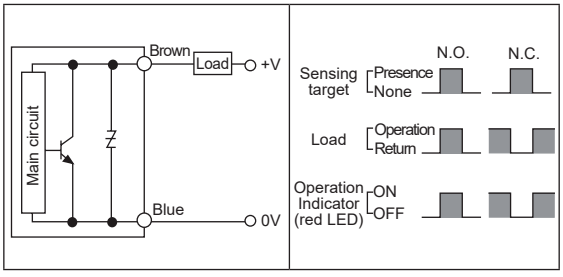


● **PRAWT30-10D□**



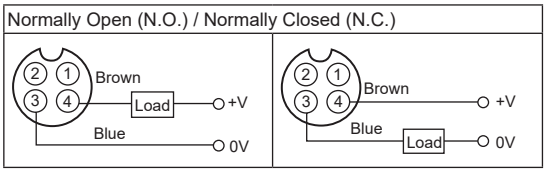
▣ Control Output Diagram and Load Operation

◎ DC 2-wire type



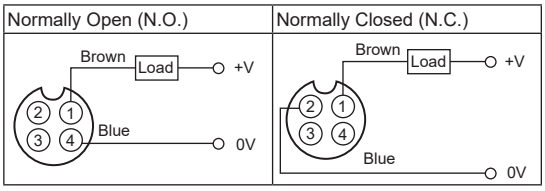
▣ Wiring Diagram

◎ DC 2-wire type (standard type)



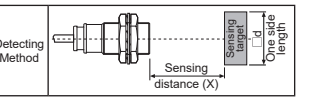
※①, ② are not used terminals.

◎ DC 2-wire type (IEC standard type)

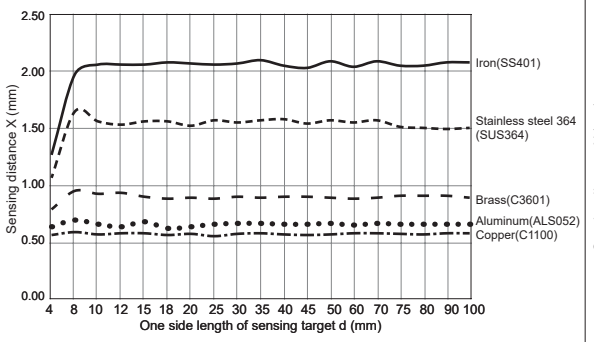


※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The pin arrangement of connector applying IEC standard is being developed.
※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product.
E.g.) PRAWT12-2DO-I
※The connector cable for IEC standard is being developed.
Please attach "I' at the end of the name of standard type.
E.g.) CID2-2-I, CLD2-5-I

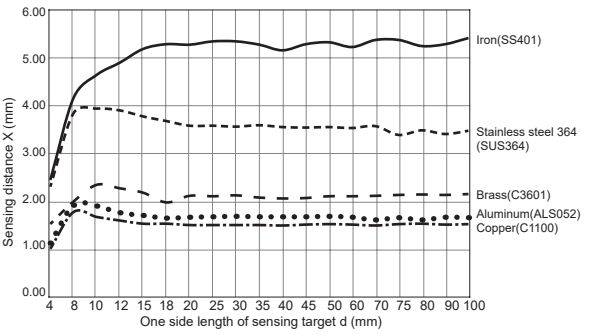
▣ Sensing Distance Feature Data by Target Material and Size



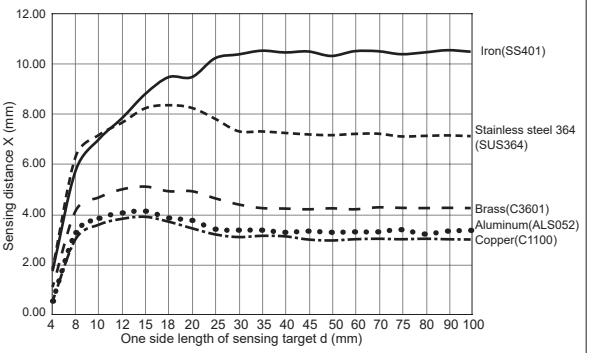
● PRAWT12-2D□



● PRAWT18-5D□

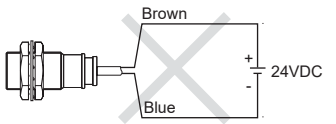


● PRAWT30-10D□

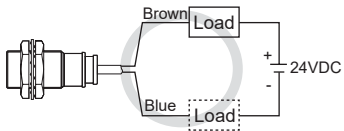


▣ Proper Usage

◎ Load connections



<DC 2-wire type>

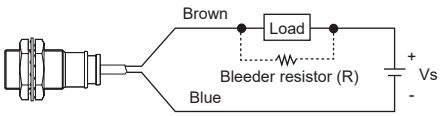


<DC 2-wire type>

When using DC 2-wire type proximity sensor, the load must be connected otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I: Action current of load, R: Bleeder resistance, P: Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

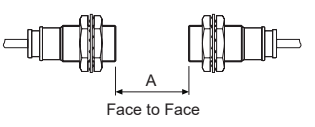
※W value of Bleeder resistor should be bigger for proper heat.

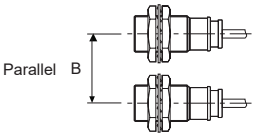
$$R \le \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor
Ioff: Return current of load, P: Number of Bleeder resistance watt]

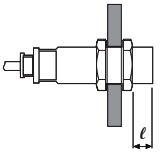
◎ Mutual-interference & Influence by surrounding metals

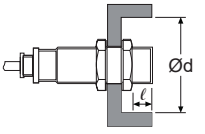
When several proximity sensors are mounted close to one another a malfunction of th may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.

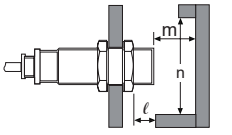




When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRAWT12-2D□	PRAWT18-5D□	PRAWT30-10D□
A	12	30	60
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	6	15	30
n	18	27	45

Cylindrical Spatter-Resistance Connector Type Proximity Sensor

▣ Features

- Prevent malfunction due to welding spatter with PEFE coating
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit, output short over current protection circuit
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

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

CE

▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PEFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

▣ Specifications

• DC 2-wire type

Model		PRACMT12-2DO PRACMT12-2DC PRACMT12-2DO-I PRACMT12-2DC-I	PRACMT18-5DO PRACMT18-5DC PRACMT18-5DO-I PRACMT18-5DC-I	PRACMT30-10DO PRACMT30-10DC PRACMT30-10DO-I PRACMT30-10DC-I
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		2mm	5mm	10mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance		0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		
Leakage current		Max. 0.6mA		
Response frequency※1		1.5kHz	500Hz	400Hz
Residual voltage		Max. 3.5V		
Affection by Temp.		Max ±10% for sensing distance at ambient temperature 20℃		
Control output		2 to 100mA		
Insulation resistance		Over 500MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 min		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z directions for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95% RH, storage: 35 to 95% RH		
Protection circuit		Surge protection circuit, output short over current protection circuit		
Protection structure		IP67 (IEC standards)		
Material		Case/Nut: PEFE coated brass, Washer: PEFE coated iron, Sensing surface: PEFE		
Approval		CE		
Weight※2		Approx. 38g (approx. 26g)	Approx. 61g (approx. 49g)	Approx. 146g (approx. 134g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

● DC 3-wire type

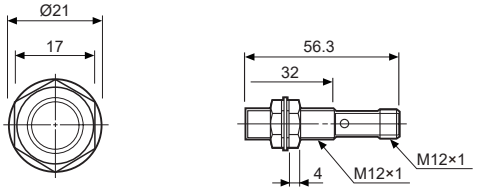
Model		PRACM12-2DN PRACM12-2DP PRACM12-2DN2 PRACM12-2DP2	PRACM18-5DN PRACM18-5DP PRACM18-5DN2 PRACM18-5DP2	PRACM30-10DN PRACM30-10DP PRACM30-10DN2 PRACM30-10DP2
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		2mm	5mm	10mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	18×18×1mm (iron)	30×30×1mm (iron)
Setting distance		0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		
Current consumption		Max. 10mA		
Response frequency※1		1.5kHz	500Hz	400Hz
Residual voltage		Max. 1.5V		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		Max. 200mA		
Insulation resistance		Over 500MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 min		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (appox. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit, reverse polarity protection circuit, output short over current protection circuit		
Protection structure		IP67 (IEC standard)		
Material		Case/Nut: PEFE coated brass, Washer: PEFE coated iron, Sensing surface: PEFE		
Approval		CE		
Weight※2		Approx. 38g (approx. 26g)	Approx. 61g (approx. 49g)	Approx. 146g (approx. 134g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

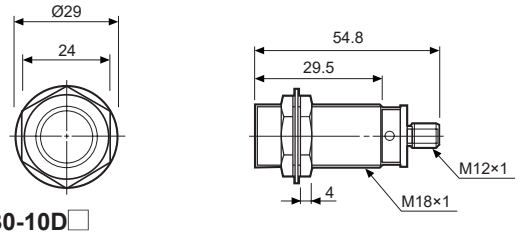
▣ Dimensions

(unit: mm)

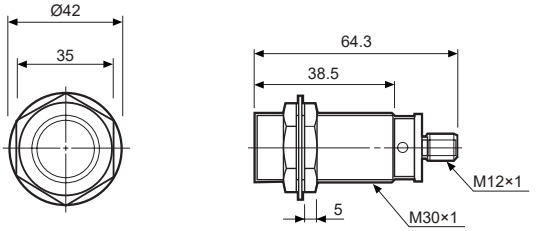
● PRACM(T)12-2D□



● PRACM(T)18-5D□

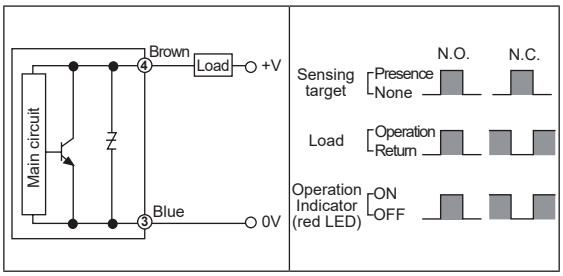


● PRACM(T)30-10D□



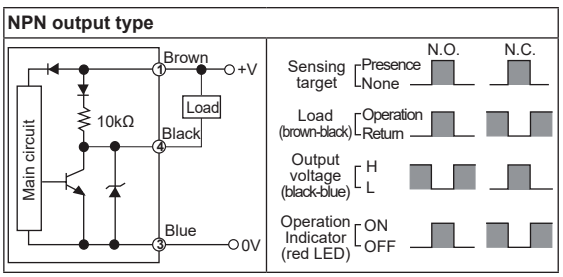
▣ Control Output Diagram and Load Operation

◎ DC 2-wire type

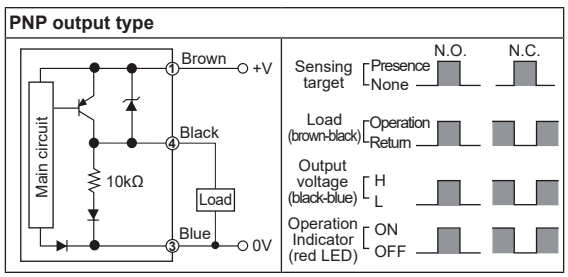


◎ DC 3-wire type

NPN output type



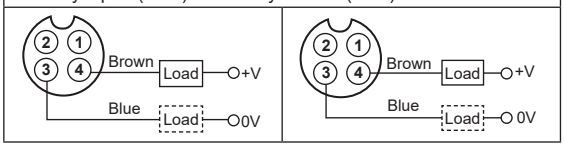
PNP output type



▣ Wiring Diagram

◎ DC 2-wire type (standard type)

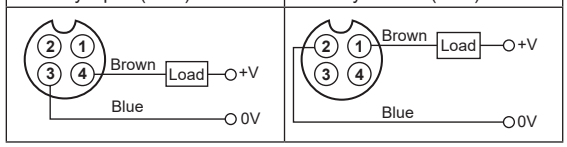
Normally Open (N.O.) / Normally Closed (N.C.)



※Pin ①, ② are not used terminals.
※For DC 3-wire type connector cable, it is available to use with use black wire (12-24VDC) and blue wire (0V).

◎ DC 2-wire type (IEC standard type)

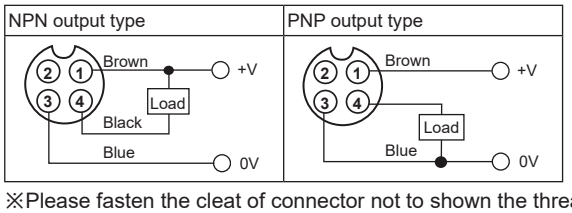
Normally Open (N.O.)	Normally Closed (N.C.)



※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The pin arrangement of connector applying IEC standard is being developed.
※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product.
E.g.) PRACMT12-5DO-I
※The connector cable for IEC standard is being developed. Please attach "I" at the end of the name of standard type.
E.g.) CID2-2-I, CLD2-5-I

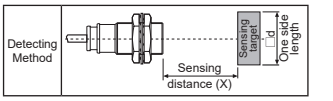
◎ DC 3-wire type

NPN output type	PNP output type

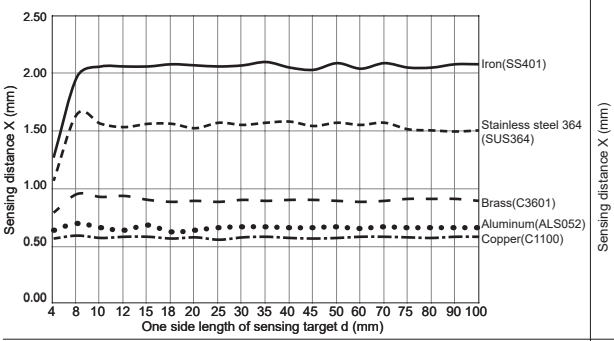


※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)
※Please fasten the vibration part with PEFE tape.
※For more information about cable and specification,
refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

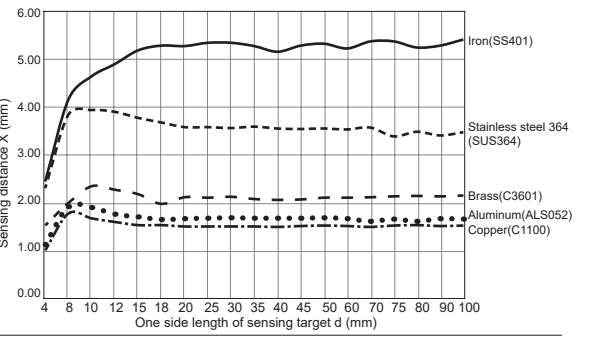
▣ Sensing Distance Feature Data by Target Material and Size



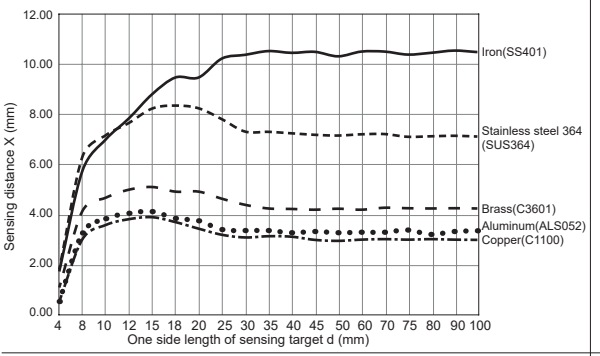
● PRACMT12-2D□



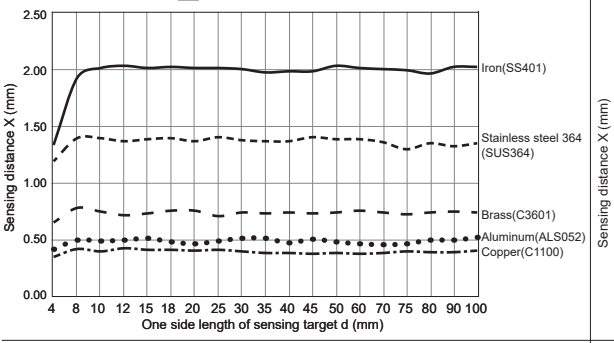
● PRACMT18-5D□



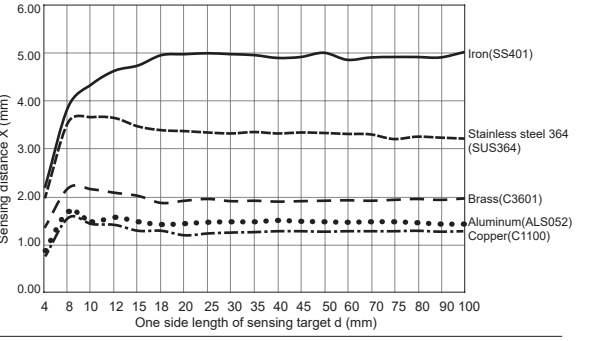
● PRACMT30-10D□



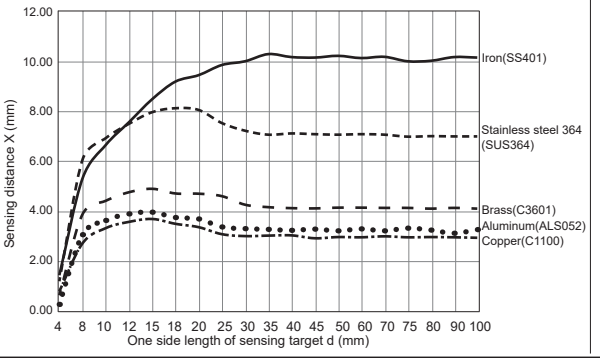
● D□



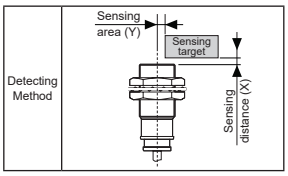
● PRACM18-5D□



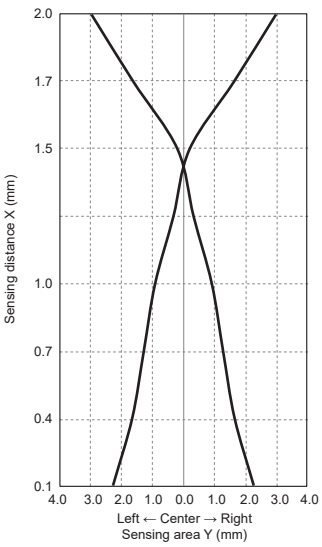
● PRACM30-10D□



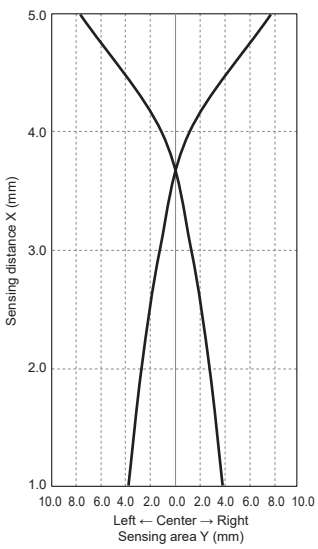
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



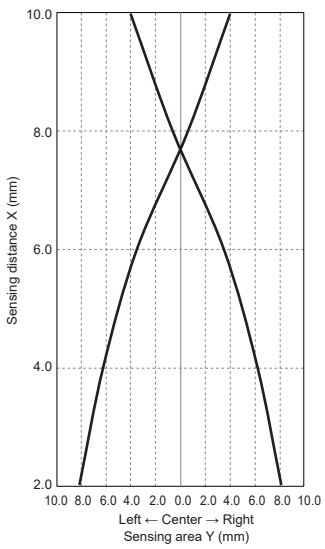
● PRACMT12-2D□



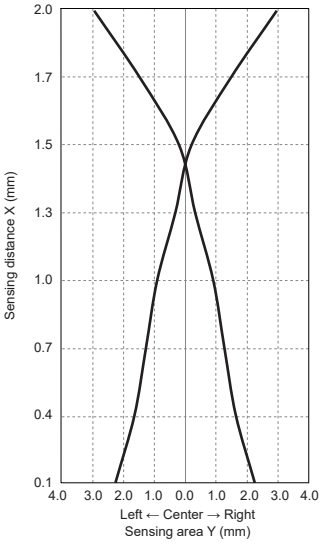
● PRACMT18-5D□



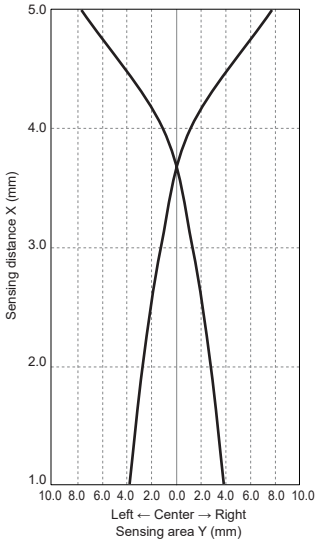
● PRACMT30-10D□



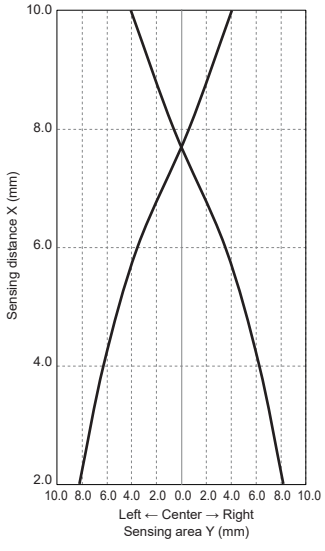
● PRACM12-2D□



● PRACM18-5D□

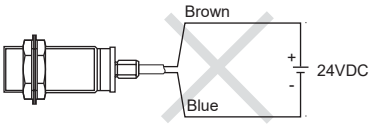


● PRACM30-10D□

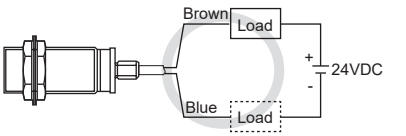


▣ Proper Usage

◎ Load connections



< DC 2-wire type >

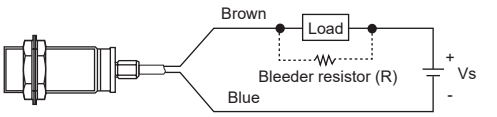


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I: Action current of load, R: Bleeder resistance, P: Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

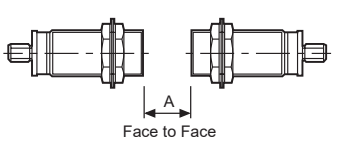
※W value of Bleeder resistor should be bigger for proper heat.

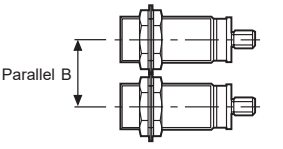
$$R \le \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor
Ioff: Return current of load, P: Number of Bleeder resistance watt]

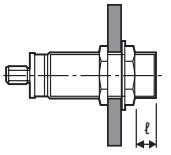
◎ Mutual-interference & Influence by surrounding metals

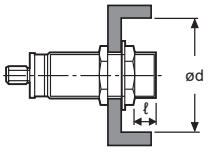
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

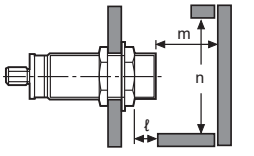




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







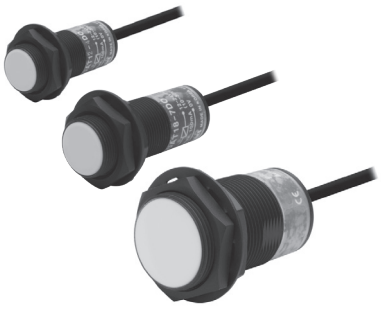
(unit: mm)

Item \ Model	PRACMT12-2D□ PRACM12-2D□	PRACMT18-5D□ PRACM18-5D□	PRACMT30-10D□ PRACM30-10D□
A	12	30	60
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	6	15	30
n	18	27	45

Cylindrical, Long Sensing Distance, Spatter-Resistance, Cable Type

▣ Features

- Long sensing distance
  (1.5 to 2 times longer sensing distance guaranteed compared to existing models)
- Prevent malfunction due to welding spatter with PEFE coating
- Improved the noise immunity with dedicated IC
- Built-in surge protection, output short over current protection circuit
- Red LED operation indication
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches



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

CE

▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PEFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

▣ Specifications

● DC 2-wire type

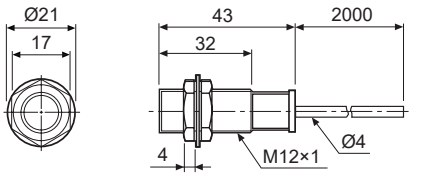
Model		**PRDAT12-4DO PRDAT12-4DC PRDAT12-4DO-V PRDAT12-4DC-V**	**PRDAT18-7DO PRDAT18-7DC PRDAT18-7DO-V PRDAT18-7DC-V**	**PRDAT30-15DO PRDAT30-15DC PRDAT30-15DO-V PRDAT30-15DC-V**
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		4mm	7mm	15mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	20×20×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 2.8mm	0 to 4.9mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		
Leakage current		Max. 0.6mA		
Response frequency※1		450Hz	250Hz	100Hz
Residual voltage		Max. 3.5V		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		2 to 100mA		
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 min		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit, output short over current protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 2-wire, 2m, M12 connector	Ø5mm, 2-wire, 2m, M12 connector	
		AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material		Case/Nut: PEFE coated brass, Washer: PEFE coated iron, Sensing surface: PEFE, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)		
Approval		CE		
Weight※2		Approx. 84g (approx. 72g)	Approx. 134g (approx. 122g)	Approx. 221g (approx. 184g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

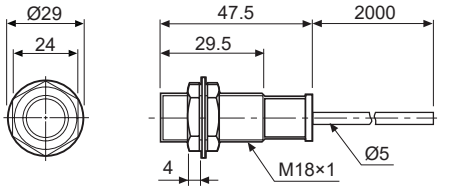
▣ Dimensions

(unit: mm)

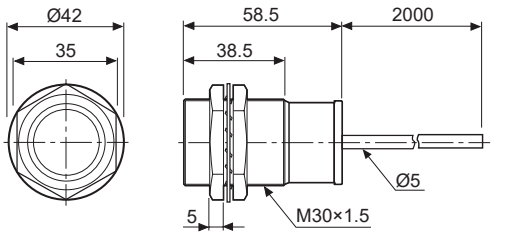
● **PRDAT12-4D□**



● **PRDAT18-7D□**

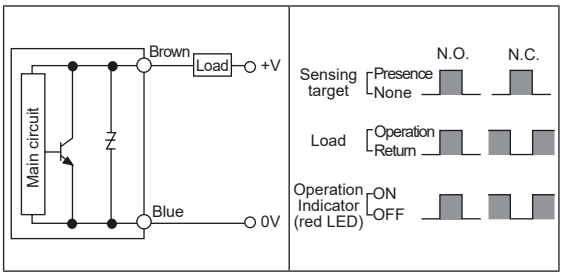


● **PRDAT30-15D□**



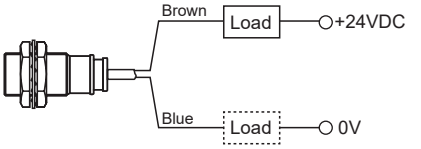
▣ Control Output Diagram and Load Operation

◎ DC 2-wire type



▣ Connections

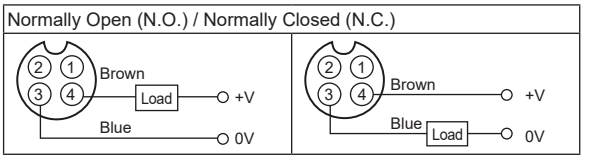
◎ DC 2-wire type



※For using DC 2-wire type, connect load before suppling the power and using this unit, or inner element may be damaged.
※The load can be connected to either wire.

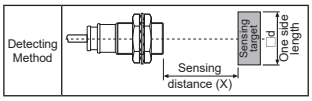
▣ Wiring Diagram

◎ DC 2-wire type (standard type)

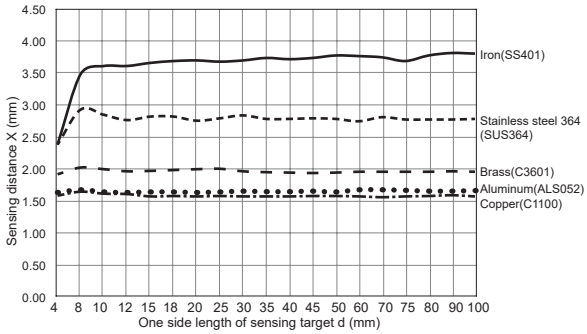


※Pin ①, ② are not used terminals.
※When using DC 3-wire type of connector cable, black (12-24VDC) and blue (0V) cables can be used.

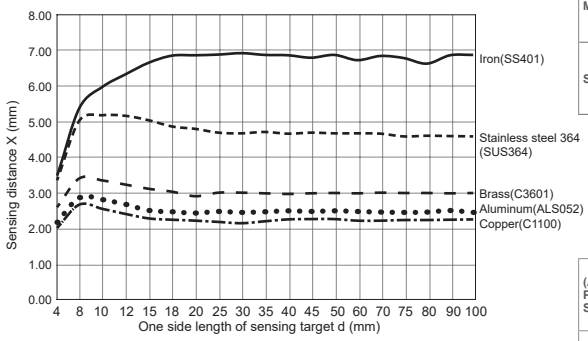
▣ Sensing Distance Feature Data by Target Material and Size



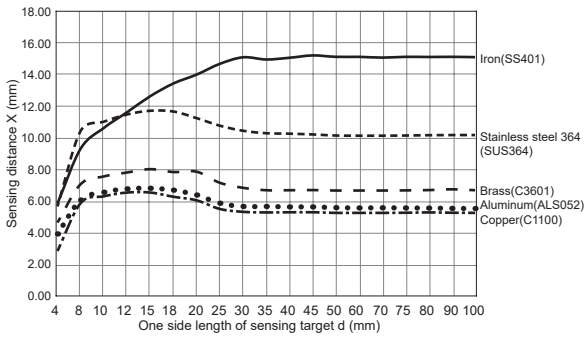
● PRDAT12-4D□



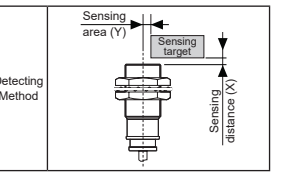
● PRDAT18-7D□



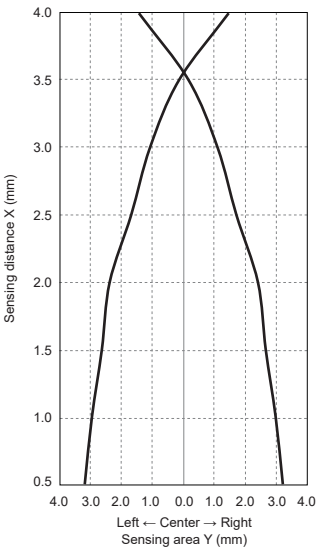
● PRDAT30-15D□



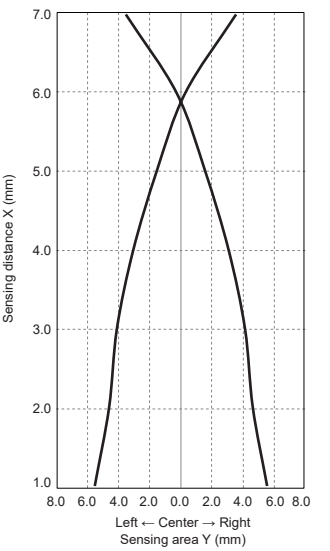
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



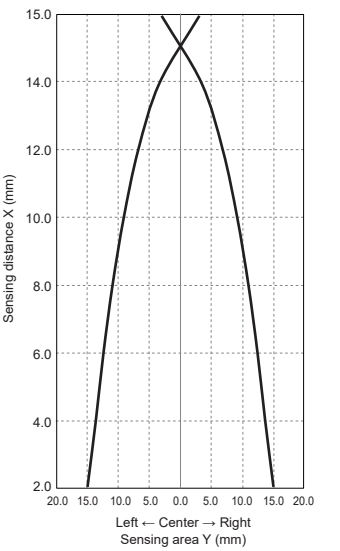
● PRDAT12-4D□



● PRDAT18-7D□

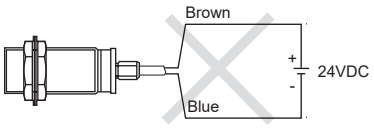


● PRDAT30-15D□

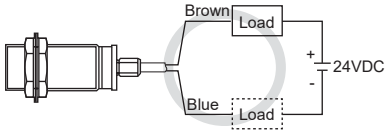


▣ Proper Usage

◎ Load connections



< DC 2-wire type >

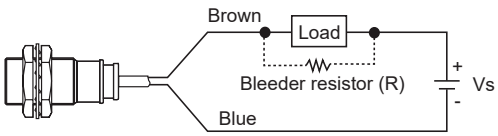


< DC 2-wire type >

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \leq \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

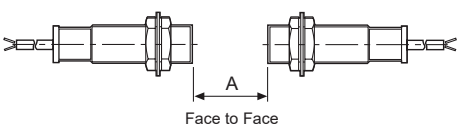
[I: Action current of load, R: Bleeder resistance, P: Permissible power]

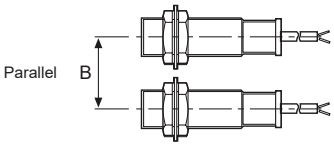
$$R \leq \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply,
Ioff: Return current of load,
Io: Min. action current of proximity sensor,
P: Number of Bleeder resistance watt]

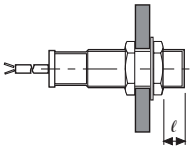
◎ Mutual-interference & Influence by surrounding metals

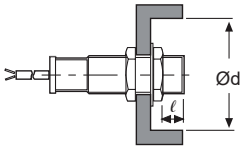
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

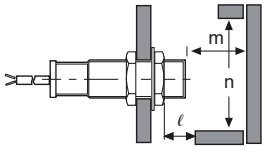




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRDAT12-4D□	PRDAT18-7D□	PRDAT30-15D□
A	24	42	90
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	12	21	45
n	18	27	45

Cylindrical, Long Sensing Distance, Spatter-Resistance, Cable Connector type, Proximity Sensor

▣ Features

- Long sensing distance
  (1.5 to 2 times longer sensing distance guaranteed compared to existing models)
- Prevent malfunction due to welding spatter with PEFE coating
- Improved the noise immunity with dedicated IC
- Built-in surge protection, output short over current protection circuit
- Red LED operation indication
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

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

CE

▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PEFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

▣ Specifications

● DC 2-wire type

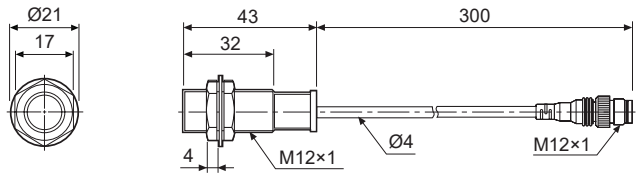
Model		**PRDAWT12-4DO PRDAWT12-4DC PRDAWT12-4DO-I PRDAWT12-4DC-I**	**PRDAWT18-7DO PRDAWT18-7DC PRDAWT18-7DO-I PRDAWT18-7DC-I PRDAWT18-7DO-IV PRDAWT18-7DC-IV**	**PRDAWT30-15DO PRDAWT30-15DC PRDAWT30-15DO-I PRDAWT30-15DC-I PRDAWT30-15DO-IV**
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		4mm	7mm	15mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	20×20×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 2.8mm	0 to 4.9mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		
Leakage current		Max. 0.6mA		
Response frequency※1		450Hz	250Hz	100Hz
Residual voltage		Max. 3.5V		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		2 to 100mA		
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 minute		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit, output short over current protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 2-wire, 300mm, M12 connector	Ø5mm, 2-wire, 300mm, M12 connector	
		AWG22, Core diameter: 0.8mm, Number of cores: 60, Insulator diameter: Ø1.25mm		
Material		Case/Nut: PEFE coated brass, Washer: PEFE coated iron, Sensing surface: PEFE, Standard cable (black): Polyvinyl chloride (PVC), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)		
Approval		CE		
Weight※2		Approx. 54g (approx. 42g)	Approx. 77g (approx. 65g)	Approx. 155g (approx. 143g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

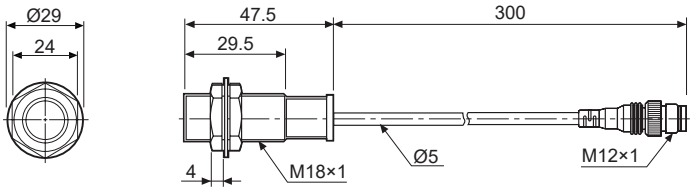
▣ Dimensions

(unit: mm)

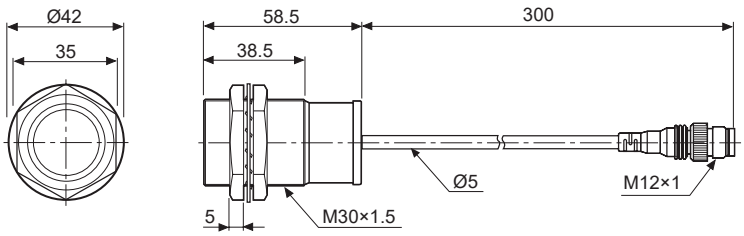
• **PRDAWT12-4D□**



• **PRDAWT18-7D□**

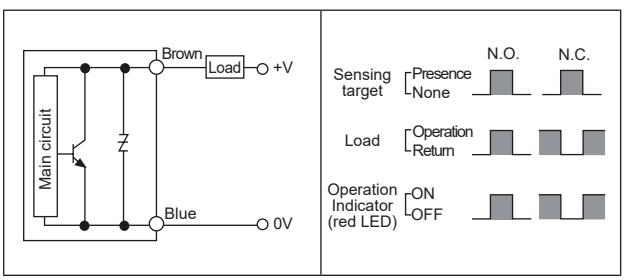


• **PRDAWT30-15D□**

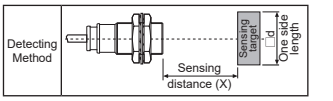


▣ Control Output Diagram and Load Operation

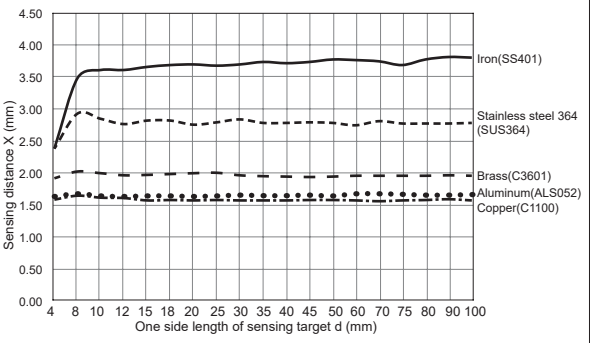
◎ DC 2-wire type



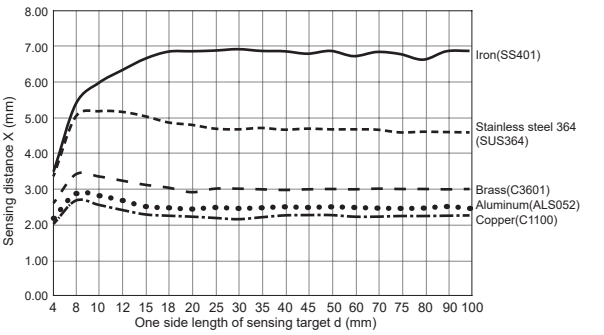
▣ Sensing Distance Feature Data by Target Material and Size



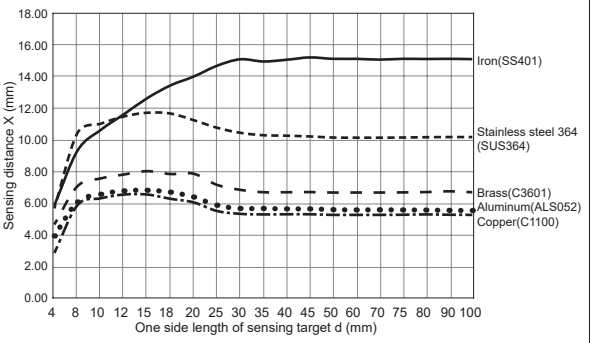
● PRDAWT12-4D□



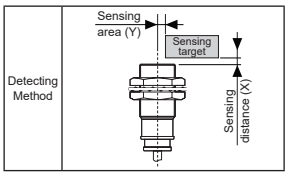
● PRDAWT18-7D□



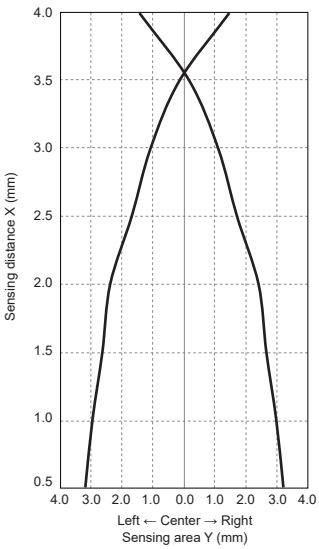
● PRDAWT30-15D□



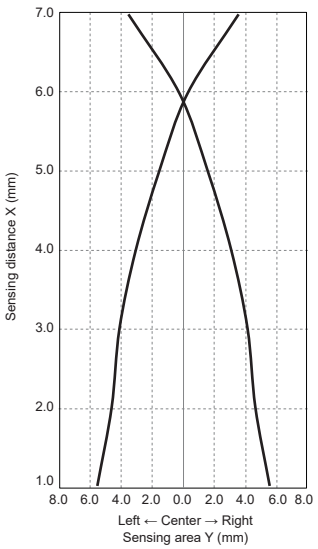
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



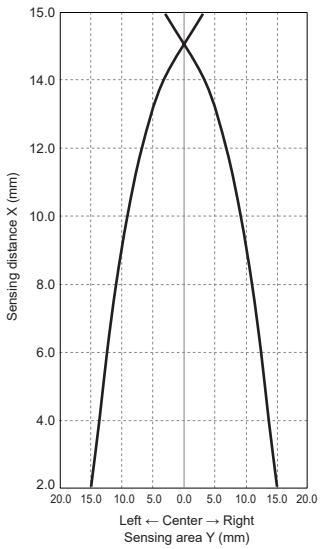
● PRDAWT12-4D□



● PRDAWT18-7D□

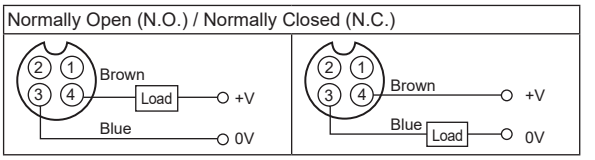


● PRDAWT30-15D□



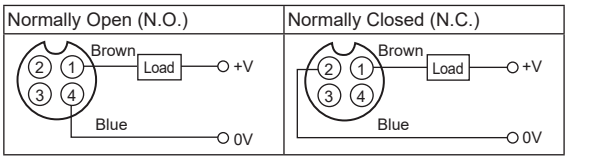
▣ Wiring Diagram

◎ DC 2-wire type (standard type)



※Pin ①, ② are not used terminals.
※When using DC 3-wire type of connector cable, black (12-24VDC) and blue (0V) cables can be used.

◎ DC 2-wire type (IEC standard type)

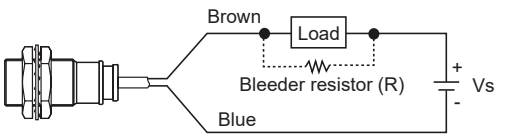


※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The type, pin arrangement of connector based upon IEC standard is being developed.
※Please put "I" behind of standard type for purchasing IEC standard product. E.g.) PRDAWT18-7DO-I
※Please put "I" behind of model name for selecting proximity sensor by IEC standard. E.g.) CID2-2-I, CLD2-2-I

▣ Proper Usage

◎ In case of the load current is small

● DC 2-wire type



Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

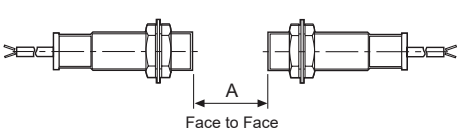
[I: Action current of load, R: Bleeder resistance, P: Permissible power]

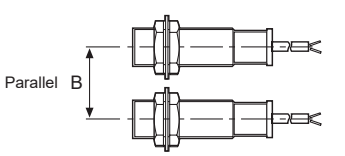
$$R \le \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply,
Ioff: Return current of load,
Io: Min. action current of proximity sensor,
P: Number of Bleeder resistance watt]

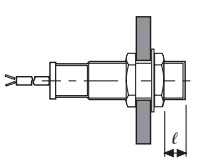
◎ Mutual-interference & Influence by surrounding metals

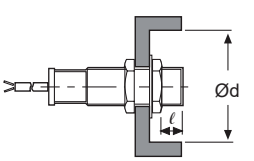
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

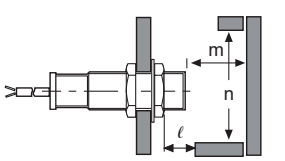




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRDAWT12-4D□	PRDAWT18-7D□	PRDAWT30-15D□
A	24	42	90
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	12	21	45
n	18	27	45

Long Distance Cylindrical Spatter-Resistance Connector Type Proximity Sensor

▣ Features

- Prevent malfunction due to welding spatter with PEFE coating
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit (DC 3-wire type)
- Built-in surge protection circuit, output short over current protection circuit
- IP67 protection structure (IEC standard)
- Replaceable for spatter-resistance type limit switches

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

CE

▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PEFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

▣ Specifications

● DC 2-wire type

Model		PRDACMT12-4DO PRDACMT12-4DC PRDACMT12-4DO-I PRDACMT12-4DC-I	PRDACMT18-7DO PRDACMT18-7DC PRDACMT18-7DO-I PRDACMT18-7DC-I	PRDACMT30-15DO PRDACMT30-15DC PRDACMT30-15DO-I PRDACMT30-15DC-I
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		4mm	7mm	15mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	20×20×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 2.8mm	0 to 4.9mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		
Leakage current		Max. 0.6mA		
Response frequency※1		450Hz	250Hz	100Hz
Residual voltage		Max. 3.5V		
Affection by Temp.		Max ±10% for sensing distance at ambient temperature 20℃		
Control output		2 to 100mA		
Insulation resistance		Over 500MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 min		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95% RH, storage: 35 to 95% RH		
Protection circuit		Surge protection circuit, output short over current protection circuit		
Protection structure		IP67 (IEC standard)		
Material		Case/Nut: PEFE coated brass, Washer: PEFE coated iron, Sensing surface: PEFE		
Approval		CE		
Weight※2		Approx. 38g (approx. 26g)	Approx. 61g (approx. 49g)	Approx. 146g (approx. 134g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

● DC 3-wire type

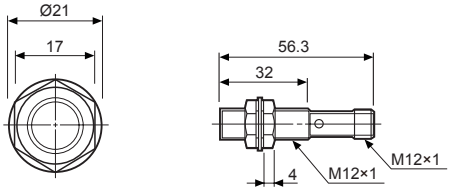
Model		PRDACM12-4DN PRDACM12-4DP PRDACM12-4DN2 PRDACM12-4DP2	PRDACM18-7DN PRDACM18-7DP PRDACM18-7DN2 PRDACM18-7DP2	PRDACM30-15DN PRDACM30-15DP PRDACM30-15DN2 PRDACM30-15DP2
Diameter of the sensing side		12mm	18mm	30mm
Sensing distance		4mm	7mm	15mm
Installation		Shield (flush)		
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)	20×20×1mm (iron)	45×45×1mm (iron)
Setting distance		0 to 2.8mm	0 to 4.9mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		
Leakage current		Max. 10mA		
Response frequency※1		500Hz	300Hz	100Hz
Residual voltage		Max. 1.5V		
Affection by Temp.		Max ±10% for sensing distance at ambient temperature 20℃		
Control output		Max. 200mA		
Insulation resistance		Over 500MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 min		
Vibration		1mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃ , storage: -30 to 80℃		
	Ambient humidity	35 to 95% RH, storage: 35 to 95% RH		
Protection circuit		Surge protection circuit, reverse polarity protection circuit, output short over current protection circuit		
Protection structure		IP67 (IEC standard)		
Material		Case/Nut: PEFE coated brass, Washer: PEFE coated iron, Sensing surface: PEFE		
Approval		CE		
Weight※2		Approx. 38g (approx. 26g)	Approx. 61g (approx. 49g)	Approx. 146g (approx. 134g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

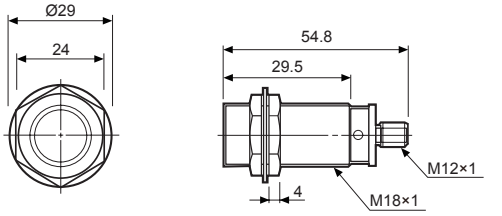
▣ Dimensions

(unit: mm)

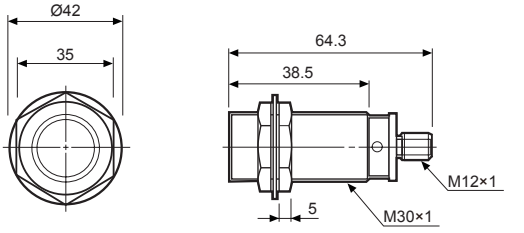
● PRDACM(T)12-4D□



● PRDACM(T)18-7D□

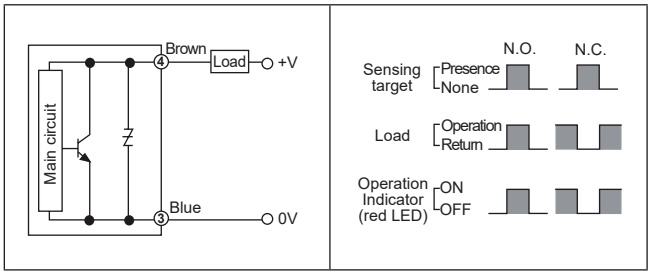


● PRDACM(T)30-15D□

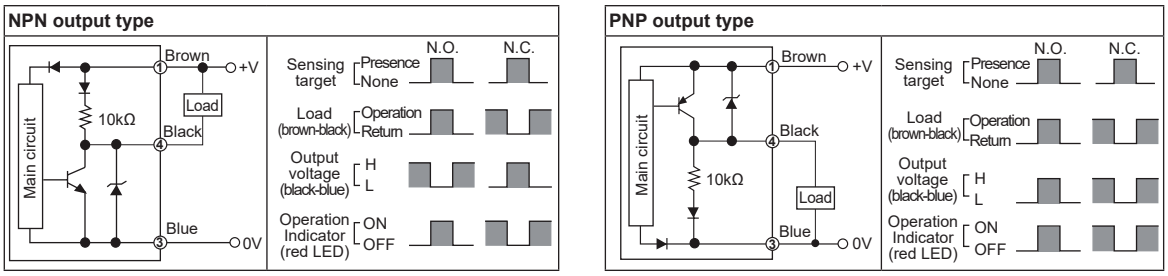


▣ Control Output Diagram and Load Operation

◎ DC 2-wire type

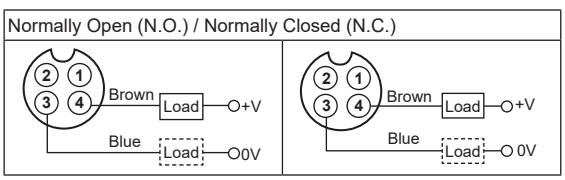


◎ DC 3-wire type



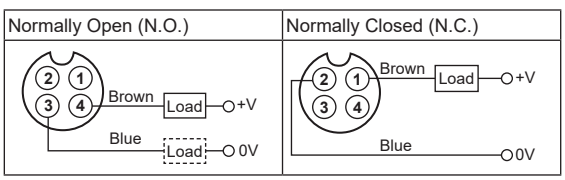
▣ Wiring Diagram

◎ DC 2-wire type (standard type)



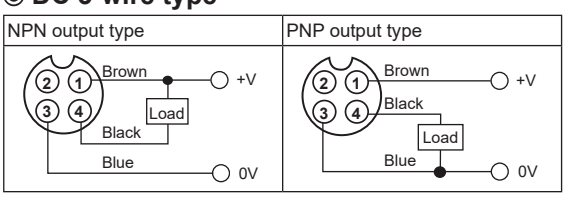
※Pin ①, ② are not used terminals.
※For DC 3-wire type connector cable, it is available to use with use black wire (12-24VDC) and blue wire (0V).

◎ DC 2-wire type (IEC standard type)



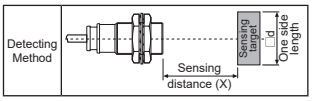
※②,③ of N.O. type and ③,④ of N.C. type are not used terminals.
※The pin arrangement of connector applying IEC standard is being developed.
※Please attach "I" at the end of the name of standard type for purchasing the IEC standard product.
E.g.) PRDACMT12-4DO-I
※The connector cable for IEC standard is being developed. Please attach "I" at the end of the name of standard type.
E.g.) CID2-2-I, CLD2-5-I

◎ DC 3-wire type

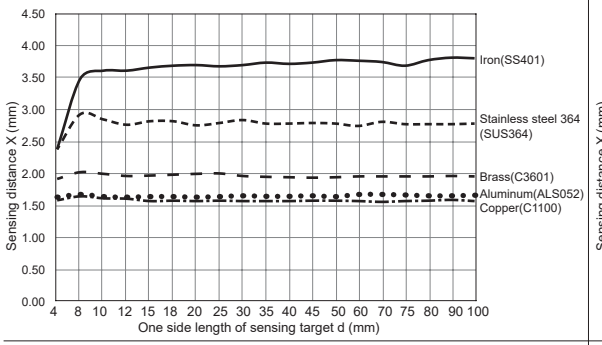


※Please fasten the cleat of connector not to shown the thread. (0.39 to 0.49N·m)
※Please fasten the vibration part with PEFE tape.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

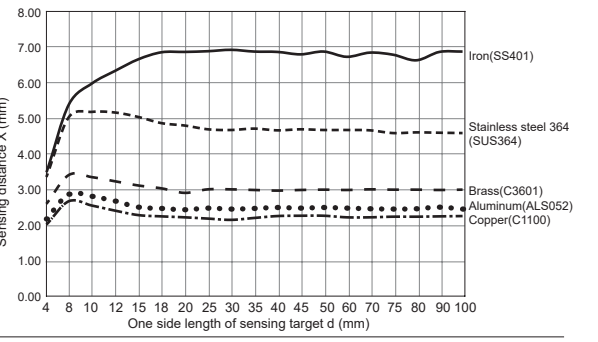
▣ Sensing Distance Feature Data by Target Material and Size



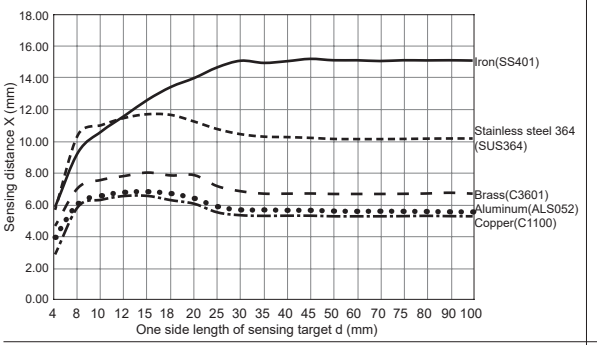
● PRDACMT12-4D□



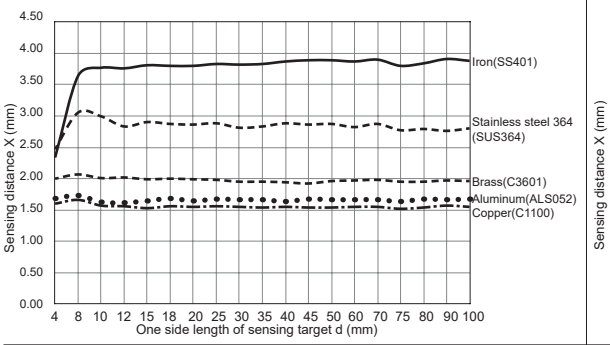
● PRDACMT18-7D□



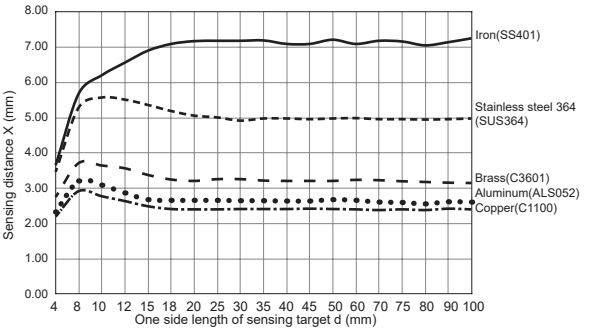
● PRDACMT30-15D□



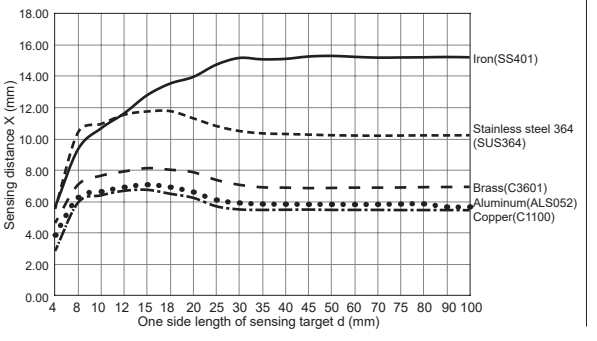
● PRDACM12-4D□



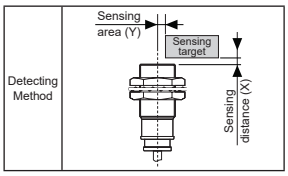
● PRDACM18-7D□



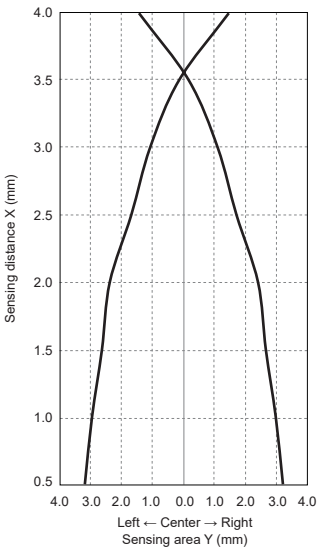
● PRDACM30-15D□



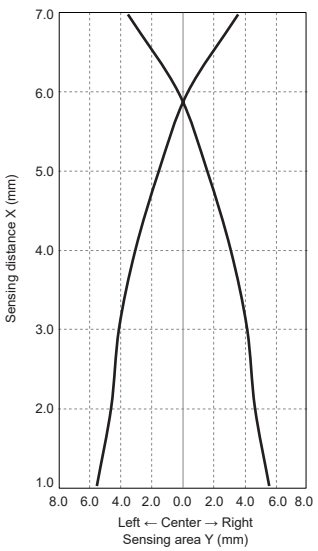
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



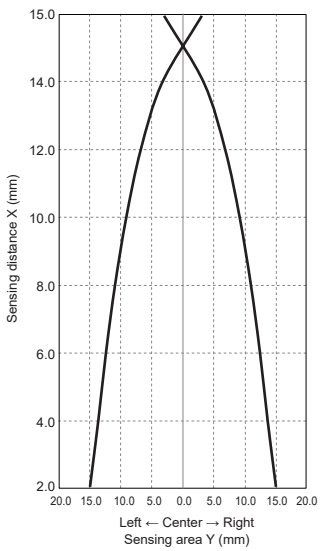
● PRDACMT12-4D□



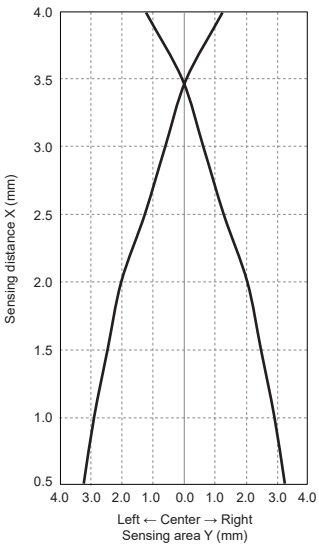
● PRDACMT18-7D□



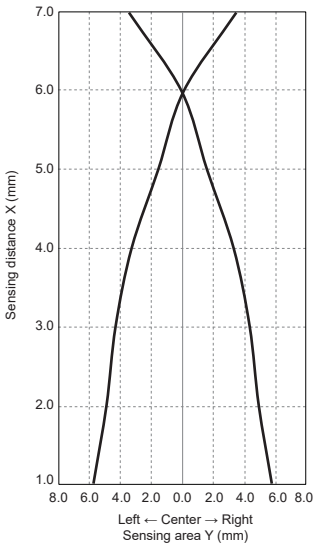
● PRDACMT30-15D□



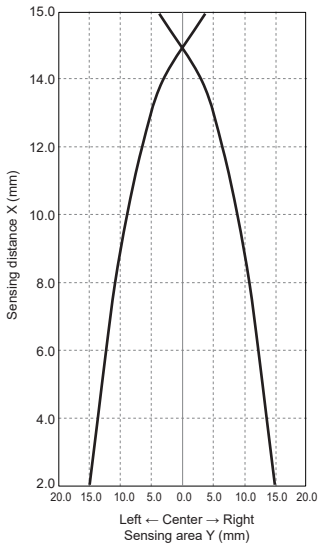
● PRDACM12-4D□



● PRDACM18-7D□

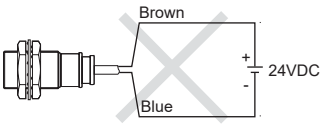


● PRDACM30-15D□

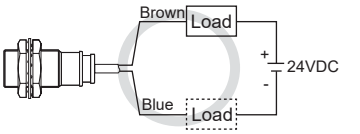


▣ Proper Usage

◎ Load connections



<DC 2-wire type>

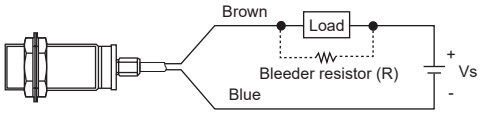


<DC 2-wire type>

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I: Action current of load, R: Bleeder resistance, P: Permissible power]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.

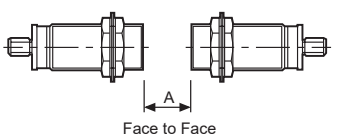
※W value of Bleeder resistor should be bigger for proper heat.

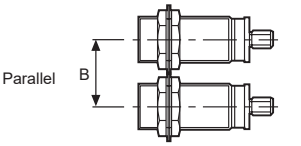
$$R \le \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor
Ioff: Return current of load, P: Number of Bleeder resistance watt]

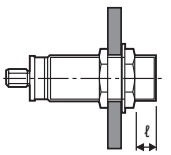
◎ Mutual-interference & Influence by surrounding metals

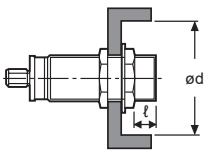
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

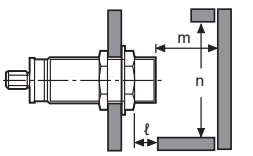




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.





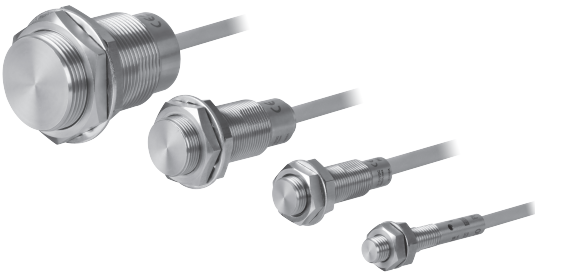


(unit: mm)

Item \ Model	PRDACMT12-4D□ PRDACM12-4D□	PRDACMT18-7D□ PRDACM18-7D□	PRDACMT30-15D□ PRDACM30-15D□
A	24	42	90
B	24	36	60
ℓ	0	0	0
Ød	12	18	30
m	12	21	45
n	18	27	45

Full Metal, Cylindrical, Cable Type Proximity Sensor

▣ Features



- High impact and wear resistance to friction with the work or metallic brush (sensing face/housing material: stainless steel)
- Reduced possibility of malfunction by aluminum scraps
- Excellent noise immunity with specialized sensor IC
- Built-in surge protection circuit and output short over current protection circuit
- Excellent visibility with a 360° ring type of indicator (red LED) (except for PRFT08 model)
- Equipped with the oil resistant cable
- Protection structure: IP67 (IEC standard)

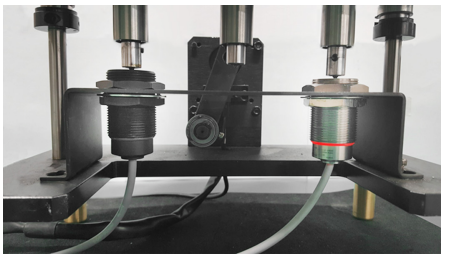
⚠ **Please read "Safety Considerations" in the instruction manual before using.**

CE

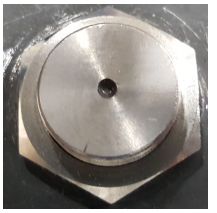
▣ Durability Test

High resistance to the impact of removing Welding sludge attached to the sensing face

◎ Continuous hitting test

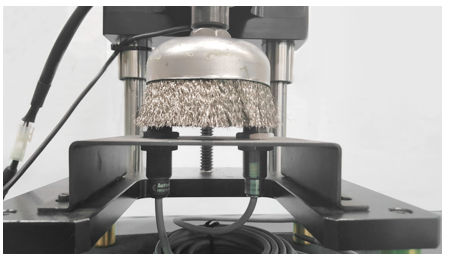


Test conditions
Hitting object: 1.3kg of weight
Hitting speed: 48 times per 1 min
The number of hitting times: 300 thousand times
Test model: PRF18



<Test result>

◎ Metallic brush test

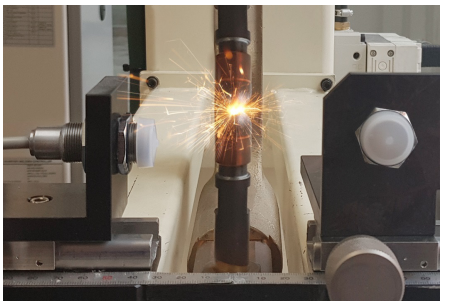


Test conditions
Testing object: stainless cup brush
Rotation speed: 80RPM
Testing time: 3 hours
Test model: PRF18

<Test result>

▣ Electromagnetic Resistance Test

Large current from welding generates magnetic field which can affect the proximity sensor to malfunction due to noise.
This product, however, can be used near strong noise without malfunctioning, thanks to excellent electromagnetic resistance.
This test is conducted in the environment of welding.



Test conditions
Welding current: 13,000A
Installation direction: front and side
Test model: PRFT Series

Diameter of sensing side	Minimum sensing distance between weld and sensor	
Installation direction	Front	Side
8mm	60mm	70mm
12mm	30mm	60mm
18mm	10mm	50mm
30mm	120mm	120mm

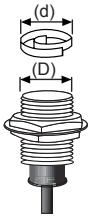
※Minimum sensing distance can be different by welding environment.

※When using PRF Series in the environment of welding, use the spatter-resistant protection cover.
The protection cover is sold separately. Refer to the 'Proper Usage' in (F) Proximity Sensors for usage of the protection cover.

▣ Effect of Aluminum Scraps

When aluminum scraps are attached or stacked at sensing side, the proximity sensor does not detect and sensing signal is OFF. However, the below cases may occur to sensing signal. In this case, remove the scraps.

(1) When the size of aluminum scraps (d) is bigger than 2/3 of the sensing side size (D)



Model \ Size	D (mm)
PRFT08	6
PRFT12	10
PRFT18	16
PRFT30	28

(2) When aluminum scraps are attached on the sensing side by external pressure

▣ Specifications

● DC 2-wire type

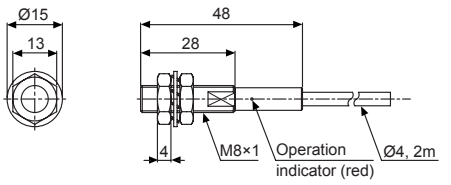
Model		PRFT08-1.5DO-V	PRFT12-2DO-V	PRFT18-5DO-V	PRFT30-10DO-V
Diameter of sensing side		8mm	12mm	18mm	30mm
Sensing distance※1		1.5mm	2mm	5mm	10mm
Installation		Shield (flush)			
Hysteresis		Max. 15% of sensing distance			
Standard sensing target		8×8×1mm (iron)	12×12×1mm (iron)	30×30×1mm (iron)	54×54×1mm (iron)
Setting distance		0 to 1.05mm	0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)			
Leakage current		Max. 0.8mA			
Response frequency※2		200Hz	100Hz	80Hz	50Hz
Residual voltage		Max. 3.5V			
Affection by Temp.		Max. ±20% for sensing distance at ambient temperature 20℃			
Control output		Max. 3 to 100mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 10 times	1,000m/s^2 (approx. 100G) in each X, Y, Z direction for 10 times		
Indicator		Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -25 to 70℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit, output short over current protection circuit			
Protection		IP67 (IEC standard)			
Cable※3		Ø4mm, 2-wire, 2m※4	Ø5mm, 2-wire, 2m※4		
		AWG22, core diameter: 0.08mm, no. of cores: 60, insulator diameter: Ø1.25mm			
Material		Case/Nut: Stainless steel 303 (SUS303), Washer: Stainless steel 304 (SUS304), Sensing side: Stainless steel 303 (SUS303, thickness is 0.8mm, in case of PRFT08 is 0.4mm), Oil resistant cable (gray): Oil resistant Polyvinyl chloride (PVC)			
Approval		CE			
Weight※5		Approx. 80g (approx. 55g)	Approx. 110g (approx. 83g)	Approx. 132g (approx. 97g)	Approx. 225g (approx. 170g)

※1: Use accessories (nut, washer) made of SUS. Or, sensing distance cannot be guaranteed.
※2: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※3: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: Option is 5m.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

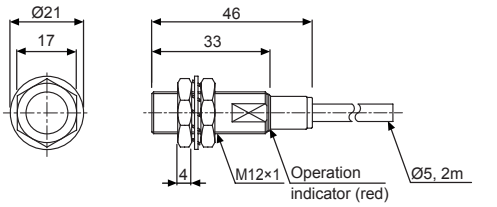
▣ Dimensions

(unit: mm)

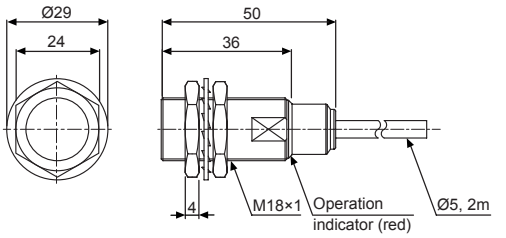
● **PRFT08-1.5DO-V**



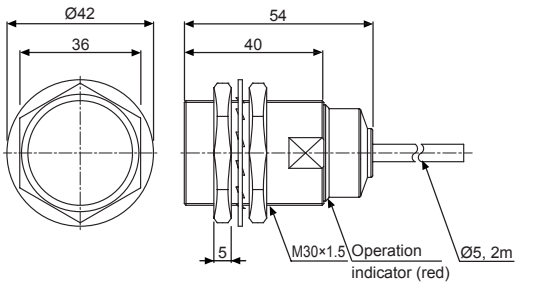
● **PRFT12-2DO-V**



● **PRFT18-5DO-V**

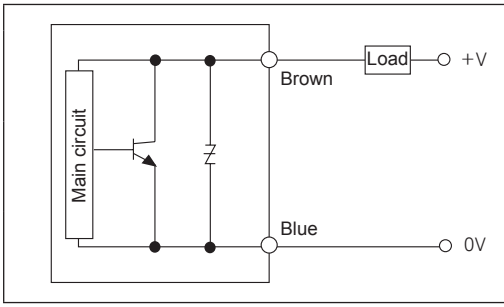


● **PRFT30-10DO-V**



▣ Control Output Diagram & Load Operating

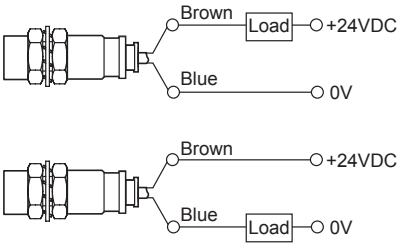
● **DC 2-wire type**



Normally Open (N.O.)	
Sensing target	Presence / Nothing
Load	Operation / Return
Opreration Indicator (red LED)	ON / OFF

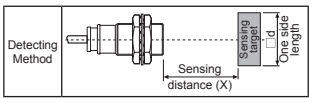
▣ Connections

● **DC 2-wire type**

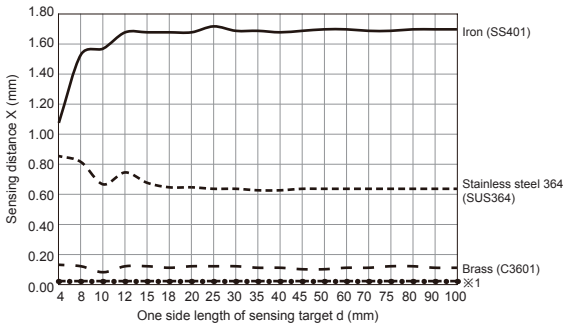


※Load can be wired to any direction.

▣ Sensing Distance Feature Data by Target Material and Size

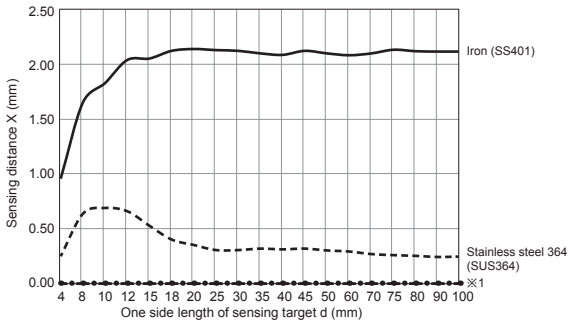


● PRFT08-1.5DO-V



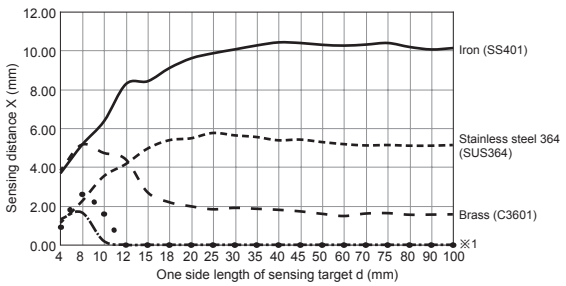
※1: Aluminum(ALS052), Copper(C1100)

● PRFT12-2DO-V



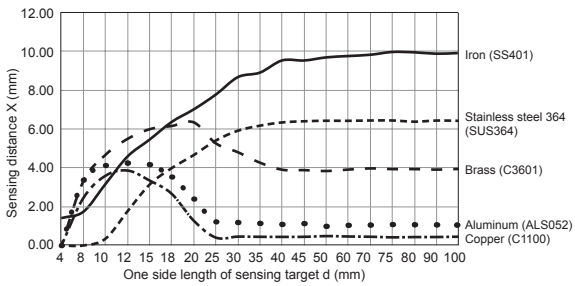
※1: Brass(C3601), Aluminum(ALS052), Copper(C1100)

● PRFT18-5DO-V

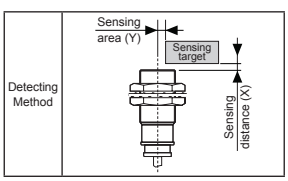


※1: Aluminum(ALS052), Copper(C1100)

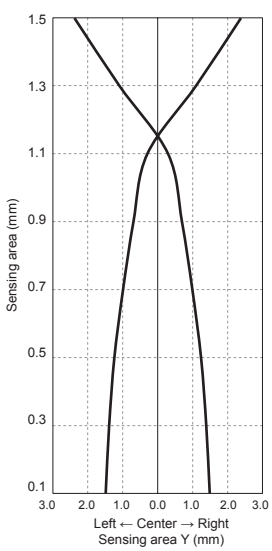
● PRFT30-10DO-V



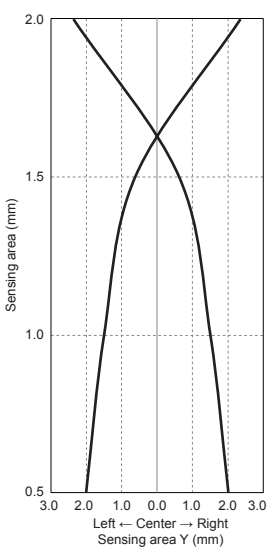
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



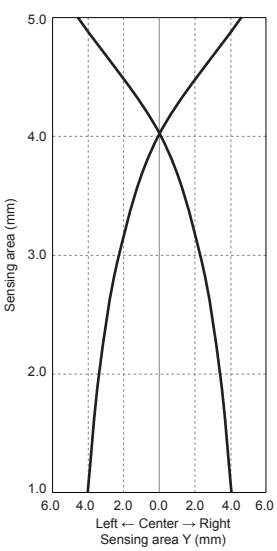
● PRFT08-1.5DO-V



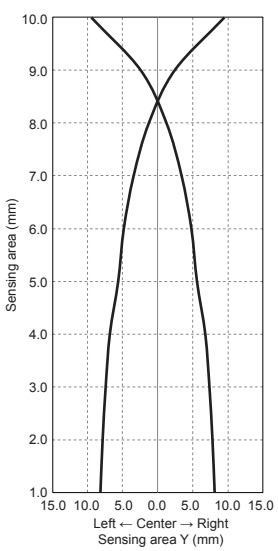
● PRFT12-2DO-V



● PRFT18-5DO-V

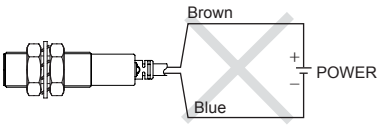


● PRFT30-10DO-V

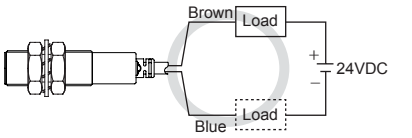


▣ Proper Usage

◎ Load connections



<DC 2-wire type>

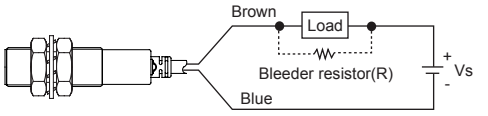


<DC 2-wire type>

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



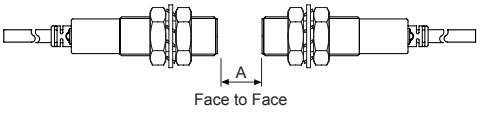
$$R \leq \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

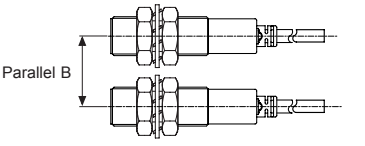
[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P: Number of Bleeder resistance watt]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

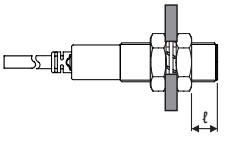
◎ Mutual-interference & Influence by surrounding metals

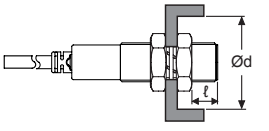
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

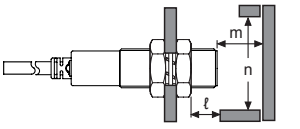




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRFT08-1.5DO-V	PRFT12-2DO-V	PRFT18-5DO-V	PRFT30-10DO-V
A	35	40	65	110
B	30	35	60	100
ℓ	0	0	0	0
Ød	8	12	18	30
m	4.5	8	20	40
n	30	40	60	100

KPRM Series

All Metal Inductive Proximity Sensors

- Wear-resistant full stainless housing
- Equipped with the oil resistant cable
- High intensity LED operation indicator
- Long life cycle and high reliability

Ordering Information

KPRM	T	B3	61	(3)
	①	②	③	④

① Series	no mark	All Metal Proximity Sensors		
	T	All Metal PTFE Coated Proximity Sensors		
② Size/ Detecting Face		Size	Sensing Distance	Detecting Face
	B3*	M8 (2-wire)	1mm	Flush
	E3*		2mm	Non-Flush
	E3**	M8 (3-wire)	2mm	Flush
	F3**		3mm	Non-Flush
	E4	M12	2mm	Flush
	G4		4mm	Non-Flush
	H5	M18	5mm	Flush
	K5		8mm	Non-Flush
	L6	M30	10mm	Flush
	P6		15mm	Non-Flush
③ Output/ Power Supply		Type	Output	Power Supply
	11	DC 3-wire	NPN NO	10 ~ 30VDC
	21		NPN NC	
	31		PNP NO	
	41		PNP NC	
	51	DC 2-wire	NO	
	61		NC	
④ Cable Type	no mark	2m PUR cable		
	3***	M12 Connector		

* DC 2-wire only
** DC-3-wire only
*** Not available for KPRM M8 type or KPRMT Series

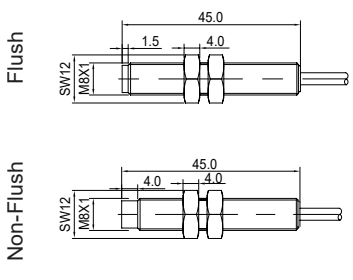
Specifications

Detected Objects	Iron, Aluminum, Copper, Stainless steel, brass (Reduced sensing distances for non-iron metals)
Hysteresis	Max.15% of sensing distance
Operation Indicator	LED
Protection Circuit	load short circuit protection, Surge protection circuit, Reverse polarity protection circuit
Ambient/Storage Temperature	-30°C ~ 85°C (with no icing)
Ambient/Storage Humidity	35% ~ 95% (with no icing)
Affection by Temperature	-25°C ~ 70°C Max. ±10% for sensing distance at ambient temperature 23°C
Affection by Voltage	Max. ±1% for sensing distance at rated voltage ±15%
Insulation Resistance	Over 50MΩ (at 500VDC megger)
Vibration	1.5mm amplitude at frequency of 10Hz ~ 55Hz in each of X, Y, Z direction for 2 hours
Shock	1000m/s² (approx. 50G) in each of X, Y, Z direction for 10 times
Meterial	Stainless Steel
IP rate	IP68

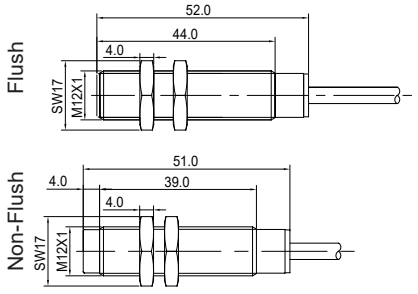
	DC 3-wire	DC 2-wire
Power Supply	10 ~ 30VDC	
Current Consumption	Max. 10mA	Max. 0.8mA
Voltage Drop	Residual Voltage : Max. 2V Load Current: Max. 200mA	Residual Voltage : Max 4V Load Current : 3mA ~ 100mA
Dielectric Strength	1,000VAC, 50/60Hz for 1 min	
Mex. Response Frequency	300Hz (KPRM Ø30 : 150Hz)	

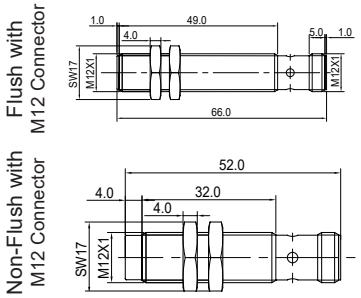
Dimensions (Unit: mm)

KPRM Ø8



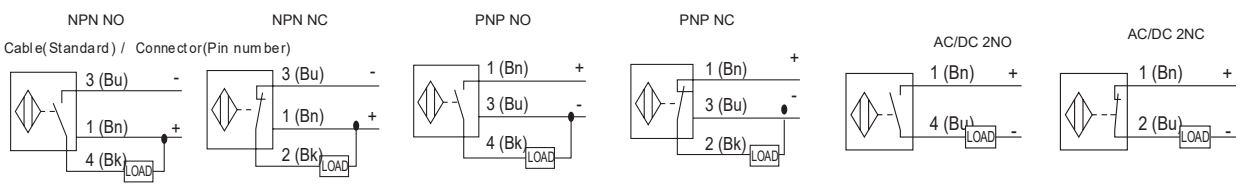
KPRM Ø12





Wiring Diagram

Bu = Blue Bn = brown Bk = Black



Full Metal, Cylindrical, Cable Connector Type Proximity Sensor

■ Features

- High impact and wear resistance to friction with the work or metallic brush (sensing face/housing material: stainless steel)
- Reduced possibility of malfunction by aluminum scraps
- Excellent noise immunity with specialized sensor IC
- Built-in surge protection circuit and output short over current protection circuit
- Excellent visibility with a 360° ring type of indicator (red LED) (except for PRFWT08 model)
- Equipped with the oil resistant cable
- Protection structure: IP67 (IEC standard)

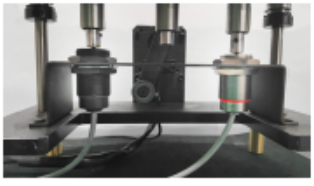
⚠ Please read "Safety Considerations" in the instruction manual before using.

CE

■ Durability Test

High resistance to the impact of removing Welding sludge attached to the sensing face

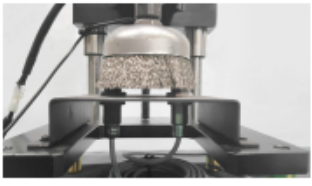
◎ Continuous hitting test



Test conditions
Hitting object: 1.3kg of weight
Hitting speed: 48 times per 1 min
The number of hitting times: 300 thousand times
Test model: PRFW18

<Test result>

◎ Metallic brush test



Test conditions
Testing object: stainless cup brush
Rotation speed: 80RPM
Testing time: 3 hours
Test model: PRFW18

<Test result>

■ Electromagnetic Resistance Test

Large current from welding generates magnetic field which can affect the proximity sensor to malfunction due to noise.
This product, however, can be used near strong noise without malfunctioning, thanks to excellent electromagnetic resistance.
This test is conducted in the environment of welding.

Test conditions
Welding current: 13,000A
Installation direction: front and side
Test model: PRFW Series

Diameter of sensing side	Minimum sensing distance between weld and sensor	
Installation direction	Front	Side
8mm	60mm	70mm
12mm	30mm	60mm
18mm	10mm	50mm
30mm	120mm	120mm

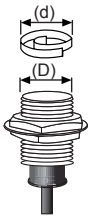
※ Minimum sensing distance can be different by welding environment.

※ When using PRFW Series in the environment of welding, use the spatter-resistant protection cover.
The protection cover is sold separately. Refer to the 'Proper Usage' in (F) Proximity Sensors for usage of the protection cover.

▣ Effect of Aluminum Scraps

When aluminum scraps are attached or stacked at sensing side, the proximity sensor does not detect and sensing signal is OFF. However, the below cases may occur to sensing signal. In this case, remove the scraps.

(1) When the size of aluminum scraps (d) is bigger than 2/3 of the sensing side size (D)



Model \ Size	D (mm)
PRFWT08	6
PRFWT12	10
PRFWT18	16
PRFWT30	28

(2) When aluminum scraps are attached on the sensing side by external pressure

▣ Specifications

● DC 2-wire type

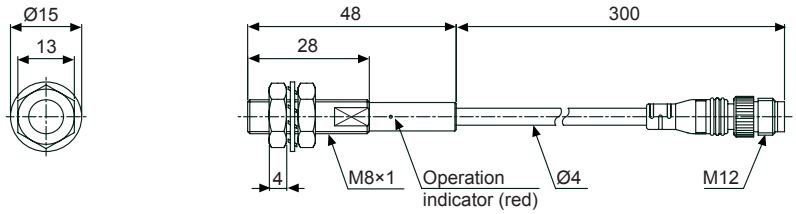
Model		PRFWT08-1.5DO-IV	PRFWT12-2DO-IV	PRFWT18-5DO-IV	PRFWT30-10DO-IV
Diameter of sensing side		8mm	12mm	18mm	30mm
Sensing distance※1		1.5mm	2mm	5mm	10mm
Installation		Shield (flush)			
Hysteresis		Max. 15% of sensing distance			
Standard sensing target		8×8×1mm (iron)	12×12×1mm (iron)	30×30×1mm (iron)	54×54×1mm (iron)
Setting distance		0 to 1.05mm	0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)			
Leakage current		Max. 0.8mA			
Response frequency※2		200Hz	100Hz	80Hz	50Hz
Residual voltage		Max. 3.5V			
Affection by Temp.		Max. ±20% for sensing distance at ambient temperature 20℃			
Control output		Max. 3 to 100mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 10 times	1,000m/s² (approx. 100G) in each X, Y, Z direction for 10 times		
Indicator		Operation indicator: Red LED			
Environ-ment	Ambient temperature	-25 to 70℃, storage: -25 to 70℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit, output short over current protection circuit			
Protection		IP67 (IEC standard)			
Cable※3		Ø4mm, 2-wire, 300mm, M12 connector	Ø5mm, 2-wire, 300mm, M12 connector		
		AWG22, core diameter: 0.08mm, no. of cores: 60, insulator diameter: Ø1.25mm			
Material		Case/Nut: Stainless steel 303 (SUS303), Washer: Stainless steel 304 (SUS304), Sensing side: Stainless steel 303 (SUS303, thickness is 0.8mm, in case of PRFWT08 is 0.4mm), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)			
Approval		CE			
Weight※4		Approx. 80g (approx. 55g)	Approx. 110g (approx. 83g)	Approx. 132g (approx. 97g)	Approx. 225g (approx. 170g)

※1: Use accessories (nut, washer) made of SUS. Or, sensing distance cannot be guaranteed.
※2: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※3: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

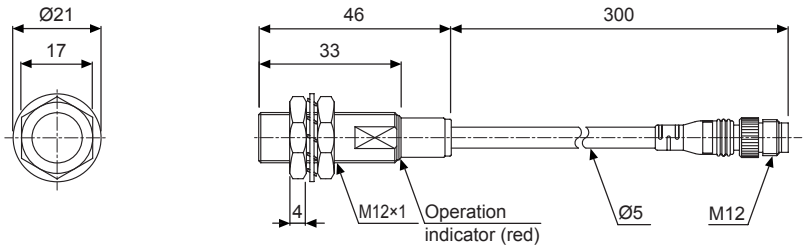
▣ Dimensions

(unit: mm)

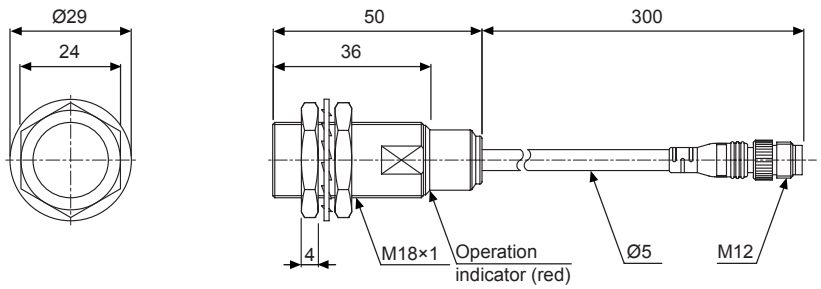
● PRFWT08-1.5DO-IV



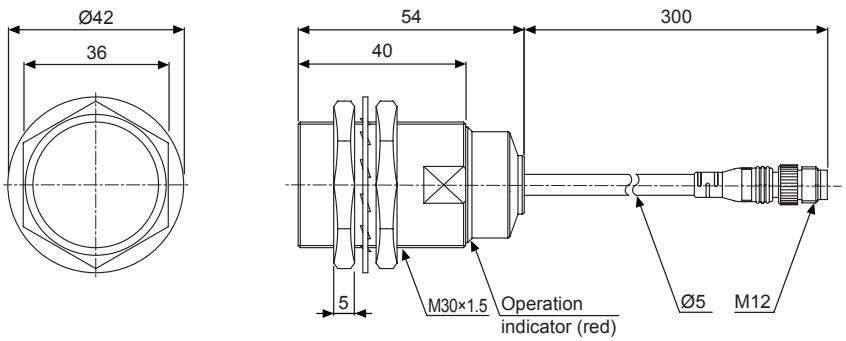
● PRFWT12-2DO-IV



● PRFWT18-5DO-IV

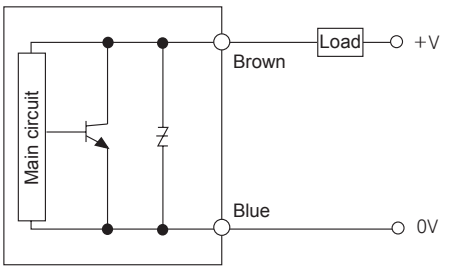


● PRFWT30-10DO-IV



▣ Control Output Diagram & Load Operating

● DC 2-wire type

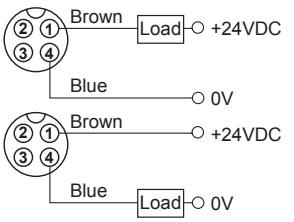


Normally Open (N.O.)	
Sensing target	Presence / Nothing
Load	Operation / Return
Operation Indicator (red LED)	ON / OFF

▣ Connections

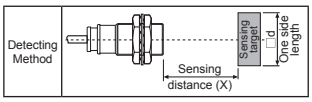
● DC 2-wire type (IEC standard)

Normally Open (N.O.)

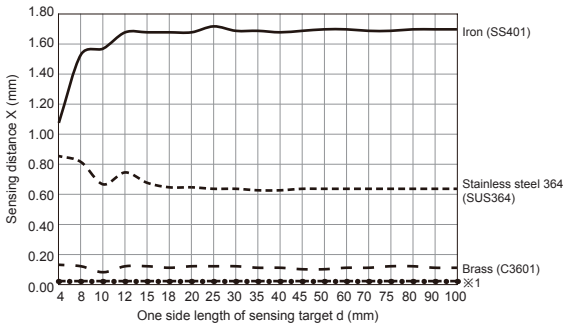


※②, ③ are N·C (Not Connected) terminals.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

▣ Sensing Distance Feature Data by Target Material and Size

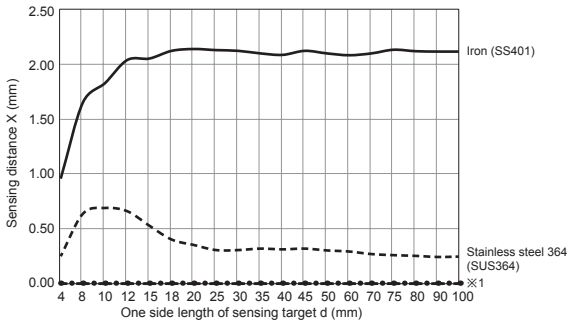


● PRFWT8-1.5DO-IV



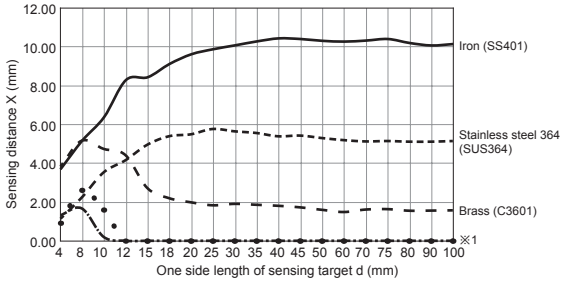
※1: Aluminum(ALS052), Copper(C1100)

● PRFWT12-2DO-IV



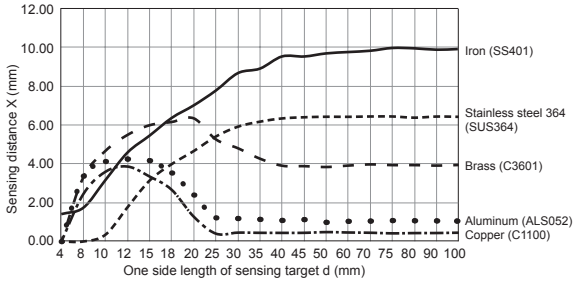
※1: Brass(C3601), Aluminum(ALS052), Copper(C1100)

● PRFWT18-5DO-IV

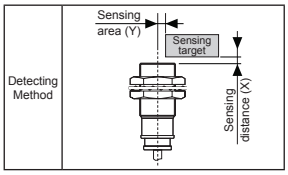


※1: Aluminum(ALS052), Copper(C1100)

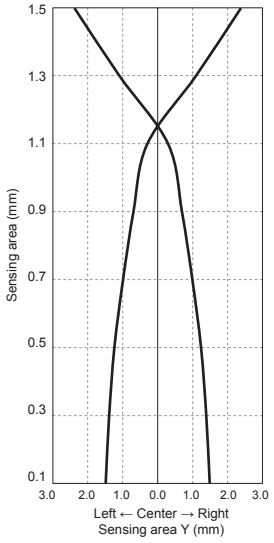
● PRFWT30-10DO-IV



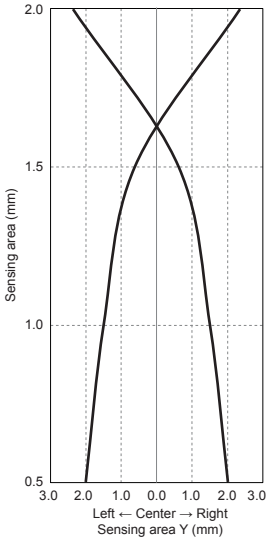
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



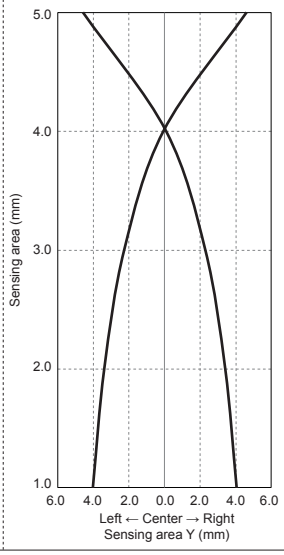
● PRFWT80-1.5DO-IV



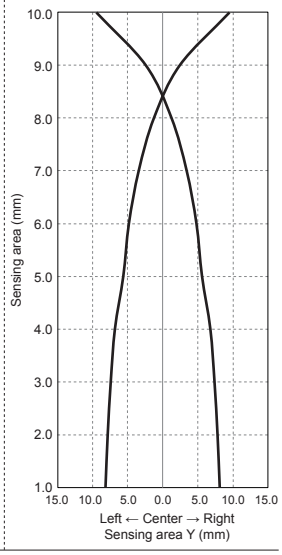
● PRFWT12-2DO-IV



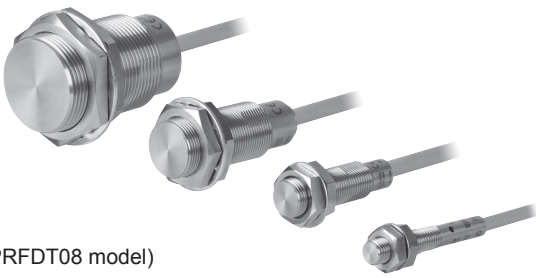
● PRFWT18-5DO-IV



● PRFWT30-10DO-IV



Full Metal, Cylindrical, Long Sensing Distance, Cable Type Proximity Sensor



▣ Features

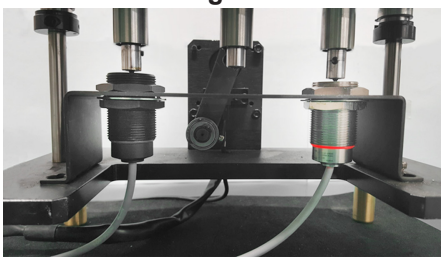
- Long sensing distance
- High impact and wear resistance to friction with the work or metallic brush (sensing face/housing material: stainless steel)
- Reduced possibility of malfunction by aluminum scraps
- Excellent noise immunity with specialized sensor IC
- Built-in surge protection circuit and output short over current protection circuit
- Stability indicator (green LED) and operation indicator (red LED) : excellent visibility with the 360˚ ring type indicator (except for PRFDT08 model)
- Equipped with the oil resistant cable
- Protection structure: IP67 (IEC standard)

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

▣ Durability Test

High resistance to the impact of removing Welding sludge attached to the sensing face

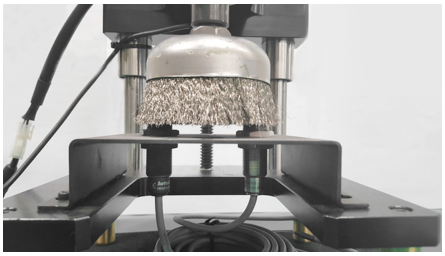
◎ Continuous hitting test



Test conditions
Hitting object: 1.3kg of weight
Hitting speed: 48 times per 1 min
The number of hitting times: 300 thousand times
Test model: PRFD18

<Test result>

◎ Metallic brush test

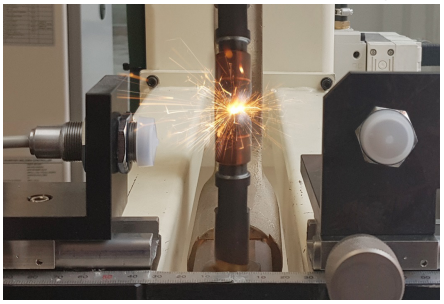


Test conditions
Testing object: stainless cup brush
Rotation speed: 80RPM
Testing time: 3 hours
Test model: PRFD18

<Test result>

▣ Electromagnetic Resistance Test

Large current from welding generates magnetic field which can affect the proximity sensor to malfunction due to noise.
This product, however, can be used near strong noise without malfunctioning, thanks to excellent electromagnetic resistance.
This test is conducted in the environment of welding.



Test conditions
Welding current: 13,000A
Installation direction: front and side
Test model: PRFD Series

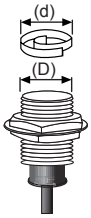
Diameter of sensing side	Minimum sensing distance between weld and sensor	
Installation direction	Front	Side
8mm	80mm	80mm
12mm	No effect from noise	50mm
18mm	30mm	50mm
30mm	120mm	110mm

※Minimum sensing distance can be different by welding environment.
※When using PRFD Series in the environment of welding, use the spatter-resistant protection cover.
The protection cover is sold separately. Refer to the 'Proper Usage' in (F) Proximity Sensors for usage of the protection cover.

■ Effect of Aluminum Scraps

When aluminum scraps are attached or stacked at sensing side, the proximity sensor does not detect and sensing signal is OFF. However, the below cases may occur to sensing signal. In this case, remove the scraps.

(1) When the size of aluminum scraps (d) is bigger than 2/3 of the sensing side size (D)



Model \ Size	D (mm)
PRFDT08	6
PRFDT12	10
PRFDT18	16
PRFDT30	28

(2) When aluminum scraps are attached on the sensing side by external pressure

■ Specifications

● DC 2-wire type

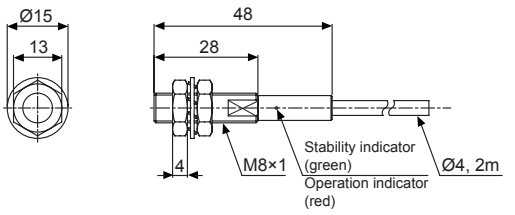
Model		PRFDT08-2DO-V	PRFDT12-3DO-V	PRFDT18-7DO-V	PRFDT30-12DO-V
Diameter of sensing side		8mm	12mm	18mm	30mm
Sensing distance※1		2mm	3mm	7mm	12mm
Installation		Shield (flush)			
Hysteresis		Max. 15% of sensing distance			
Standard sensing target		12×12×1mm (iron)	12×12×1mm (iron)	30×30×1mm (iron)	54×54×1mm (iron)
Setting distance		0 to 1.4mm	0 to 2.1mm	0 to 4.9mm	0 to 8.4mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)			
Leakage current		Max. 0.8mA			
Response frequency※2		150Hz	80Hz	80Hz	50Hz
Residual voltage		Max. 3.5VDC⎓			
Affection by Temp.		Max. ±20% for sensing distance at ambient temperature 20℃			
Control output		Max. 3 to 100mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 10 times	1,000m/s^2 (approx. 100G) in each X, Y, Z direction for 10 times		
Indicator		Stability indicator: green LED, Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -25 to 70℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit, output short over current protection circuit			
Protection		IP67 (IEC standard)			
Cable※3		Ø4mm, 2-wire, 2m※4	Ø5mm, 2-wire, 2m※4		
		AWG22, core diameter: 0.08mm, no. of cores: 60, insulator diameter: Ø1.25mm			
Material		Case/Nut: Stainless steel 303(SUS 303), Washer: Stainless steel 304(SUS 304), Sensing side: Stainless steel 303 (SUS 303, thickness of PRFDT08: 0.2mm, PRFDT12/18: 0.4mm, PRFDT30: 0.5mm), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)			
Approval		CE			
Weight※5		Approx. 80g (approx. 55g)	Approx. 110g (approx. 83g)	Approx. 132g (approx. 97g)	Approx. 225g (approx. 170g)

※1: Use accessories (nut, washer) made of SUS. Or, sensing distance cannot be guaranteed.
※2: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※3: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: Option is 5m.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

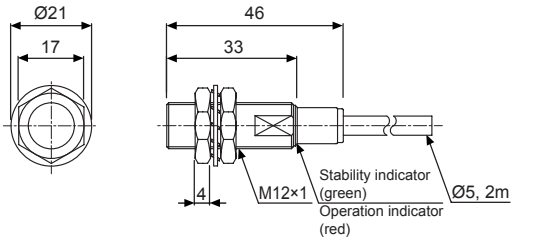
▣ Dimensions

(unit: mm)

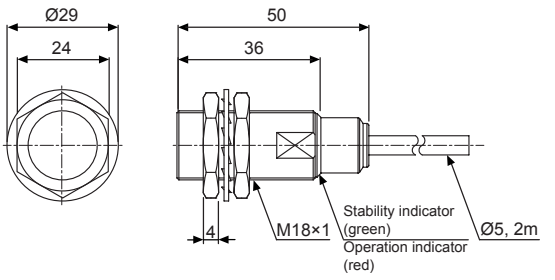
● **PRFDT08-2DO-V**



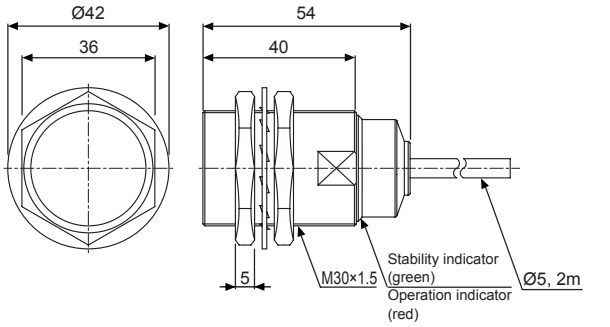
● **PRFDT12-3DO-V**



● **PRFDT18-7DO-V**

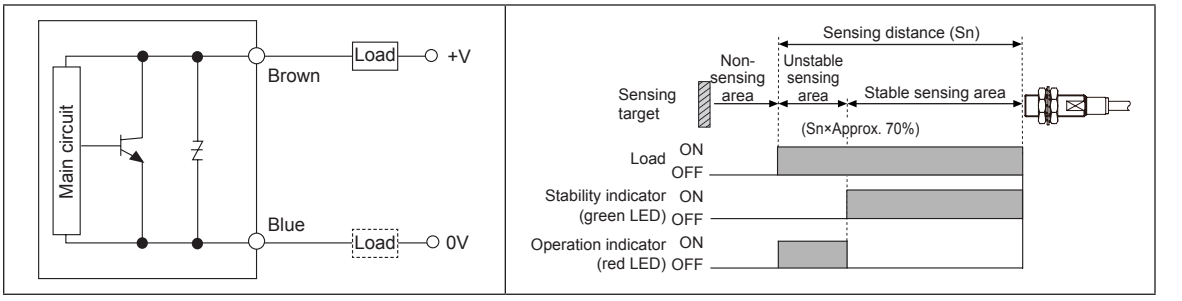


● **PRFDT30-12DO-V**



▣ Control Output Diagram & Load Operating

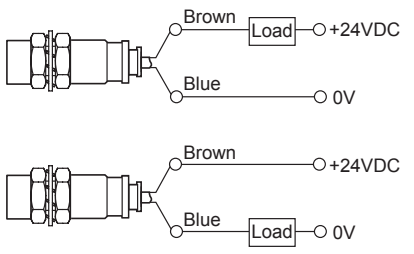
● **DC 2-wire type**



※When the sensing target is placed over approx. 70% of sensing distance (Sn), the operation indicator (red LED) turns ON.
When the target is placed within approx. 70% of sensing distance (Sn), the stability indicator (green LED) turns ON.
Use the sensor at the position where the stability indicator turns ON.

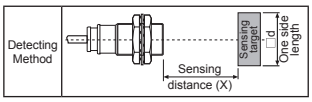
▣ Connections

● **DC 2-wire type**

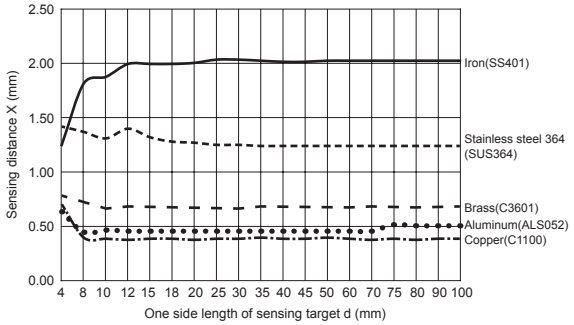


※Load can be wired to any direction.

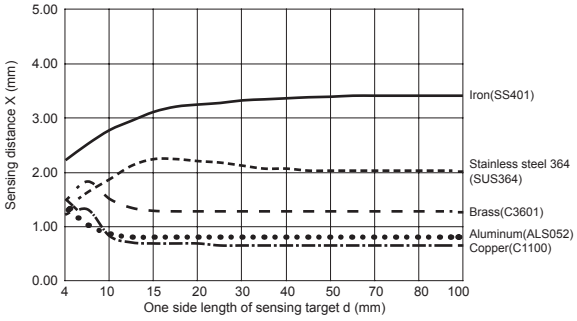
▣ Sensing Distance Feature Data by Target Material and Size



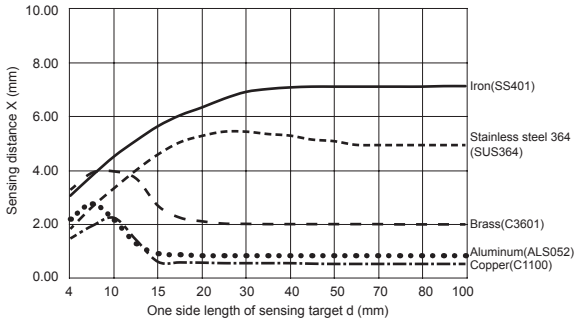
● PRFDT08-2DO-V



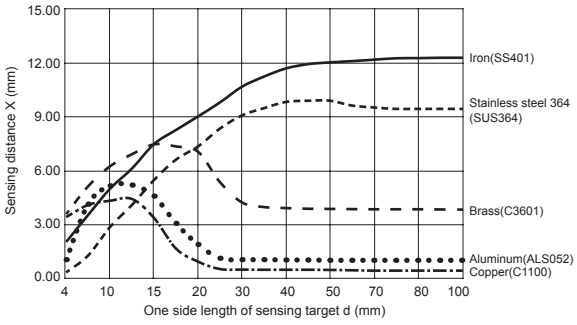
● PRFDT12-3DO-V



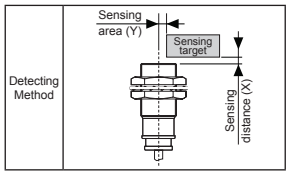
● PRFDT18-7DO-V



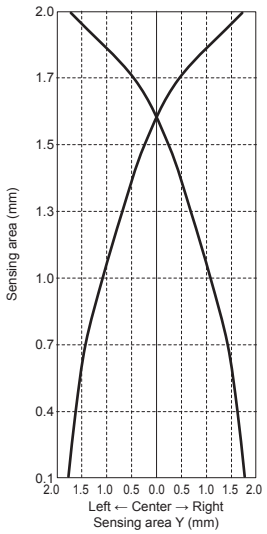
● PRFDT30-12DO-V



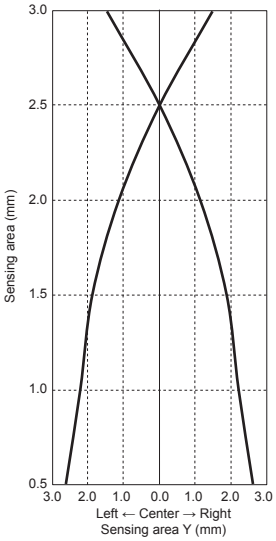
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



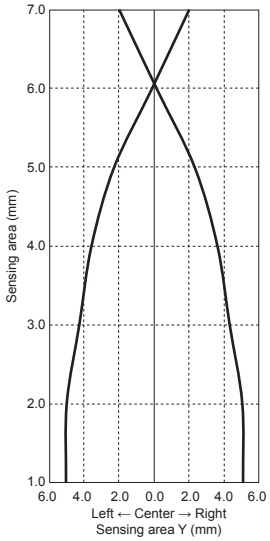
● PRFDT08-2DO-V



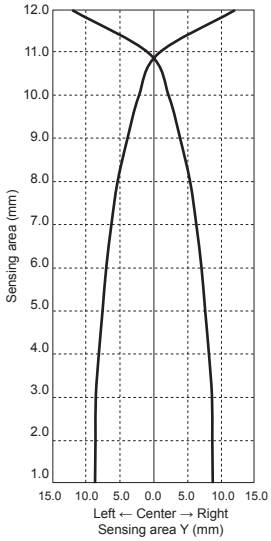
● PRFDT12-3DO-V



● PRFDT18-7DO-V

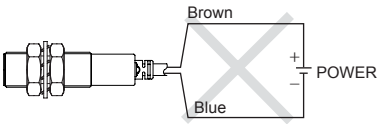


● PRFDT30-12DO-V

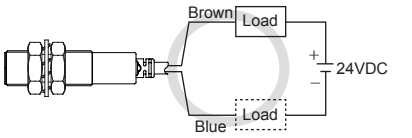


▣ Proper Usage

◎ Load connections



<DC 2-wire type>

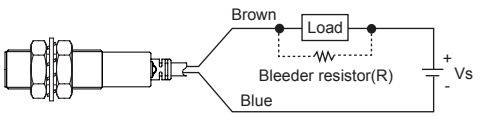


<DC 2-wire type>

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



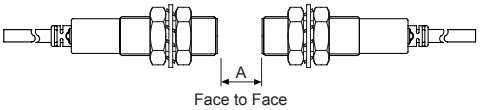
$$R \leq \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

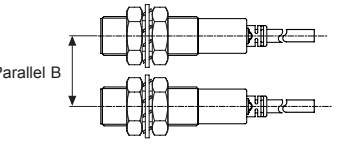
[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P: Number of Bleeder resistance watt]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

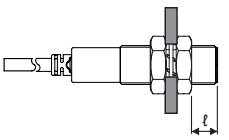
◎ Mutual-interference & Influence by surrounding metals

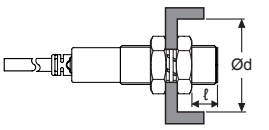
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.
Do NOT connect the sensors more than three in parallel.

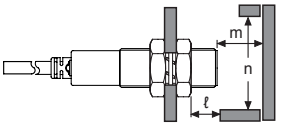




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRFDT08-2DO-V	PRFDT12-3DO-V	PRFDT18-7DO-V	PRFDT30-12DO-V
A	35	40	65	110
B	35	35	60	100
ℓ	0	0	0	0
Ød	8	12	18	30
m	8	12	28	48
n	30	40	60	100

Full Metal, Cylindrical, Long Sensing Distance, Cable Connector Type Proximity Sensor

▣ Features

- Long sensing distance
- High impact and wear resistance to friction with the work or metallic brush (sensing face/housing material: stainless steel)
- Reduced possibility of malfunction by aluminum scraps
- Excellent noise immunity with specialized sensor IC
- Built-in surge protection circuit and output short over current protection circuit
- Stability indicator (green LED) and operation indicator (red LED) : excellent visibility with the 360˚ ring type indicator (except for PRFDWT08 model)
- Equipped with the oil resistant cable
- Protection structure: IP67 (IEC standard)

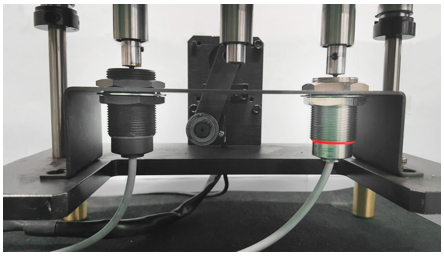
Please read "Safety Considerations" in the instruction manual before using.

CE

▣ Durability Test

High resistance to the impact of removing Welding sludge attached to the sensing face

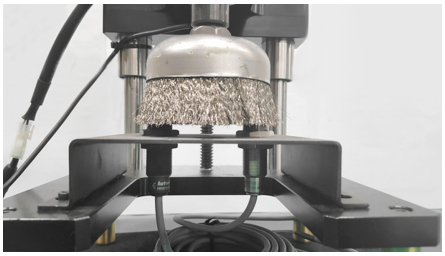
◎ Continuous hitting test



Test conditions
Hitting object: 1.3kg of weight
Hitting speed: 48 times per 1 min
The number of hitting times: 300 thousand times
Test model: PRFDW18

<Test result>

◎ Metallic brush test

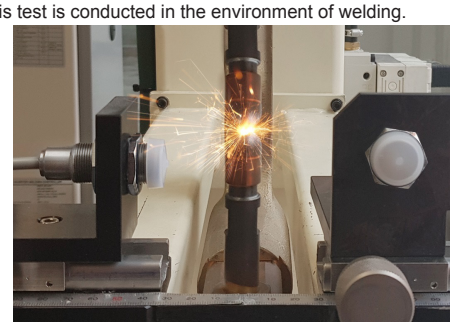


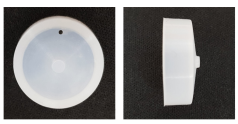
Test conditions
Testing object: stainless cup brush
Rotation speed: 80RPM
Testing time: 3 hours
Test model: PRFDW18

<Test result>

▣ Electromagnetic Resistance Test

Large current from welding generates magnetic field which can affect the proximity sensor to malfunction due to noise.
This product, however, can be used near strong noise without malfunctioning, thanks to excellent electromagnetic resistance.
This test is conducted in the environment of welding.





Test conditions
Welding current: 13,000A
Installation direction: front and side
Test model: PRFDW Series

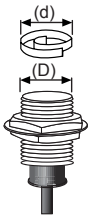
Diameter of sensing side	Minimum sensing distance between weld and sensor	
Installation direction	Front	Side
8mm	80mm	80mm
12mm	No effect from noise	50mm
18mm	30mm	50mm
30mm	120mm	110mm

※Minimum sensing distance can be different by welding environment.
※When using PRFDW Series in the environment of welding, use the spatter-resistant protection cover.
The protection cover is sold separately. Refer to the 'Proper Usage' in (F) Proximity Sensors for usage of the protection cover.

▣ Effect of Aluminum Scraps

When aluminum scraps are attached or stacked at sensing side, the proximity sensor does not detect and sensing signal is OFF. However, the below cases may occur to sensing signal. In this case, remove the scraps.

(1) When the size of aluminum scraps (d) is bigger than 2/3 of the sensing side size (D)



Model \ Size	D (mm)
PRFDWT08	6
PRFDWT12	10
PRFDWT18	16
PRFDWT30	28

(2) When aluminum scraps are attached on the sensing side by external pressure

▣ Specifications

● DC 2-wire type

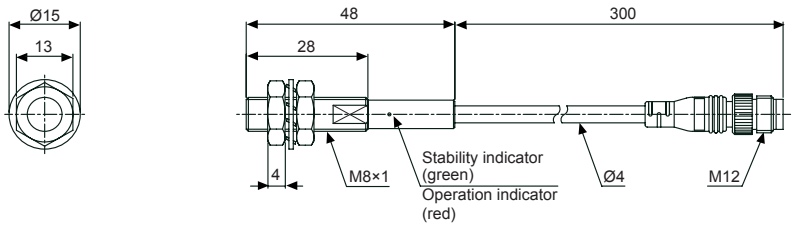
Model		PRFDWT08-2DO-IV	PRFDWT12-3DO-IV	PRFDWT18-7DO-IV	PRFDWT30-12DO-IV
Diameter of sensing side		8mm	12mm	18mm	30mm
Sensing distance※1		2mm	3mm	7mm	12mm
Installation		Shield (flush)			
Hysteresis		Max. 15% of sensing distance			
Standard sensing target		12×12×1mm (iron)	12×12×1mm (iron)	30×30×1mm (iron)	54×54×1mm (iron)
Setting distance		0 to 1.4mm	0 to 2.1mm	0 to 4.9mm	0 to 8.4mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)			
Leakage current		Max. 0.8mA			
Response frequency※2		150Hz	80Hz	80Hz	50Hz
Residual voltage		Max. 3.5V			
Affection by Temp.		Max. ±20% for sensing distance at ambient temperature 20℃			
Control output		Max. 3 to 100mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 10 times	1,000m/s^2 (approx. 100G) in each X, Y, Z direction for 10 times		
Indicator		Stability indicator: Green LED, Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -25 to 70℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit, output short over current protection circuit			
Protection		IP67 (IEC standard)			
Cable※3		Ø4mm, 2-wire, 300mm, M12 connector	Ø5mm, 2-wire, 300mm, M12 connector		
		AWG22, core diameter: 0.08mm, no. of cores: 60, insulator diameter: Ø1.25mm			
Material		Case/Nut: Stainless steel 303 (SUS 303), Washer: Stainless steel 304 (SUS 304), Sensing side: Stainless steel 303 (SUS 303, thickness of PRFDWT08: 0.2mm, PRFDWT12/18: 0.4mm, PRFDWT30: 0.5mm), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)			
Approval		CE			
Weight※4		Approx. 80g (approx. 55g)	Approx. 110g (approx. 83g)	Approx. 132g (approx. 97g)	Approx. 225g (approx. 170g)

※1: Use accessories (nut, washer) made of SUS. Or, sensing distance cannot be guaranteed.
※2: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※3: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

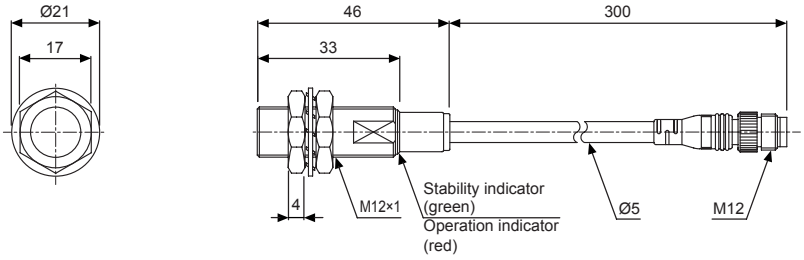
▣ Dimensions

(unit: mm)

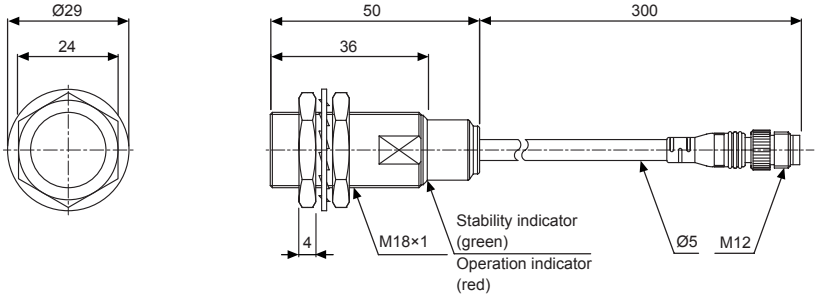
● PRFDWT08-2DO-IV



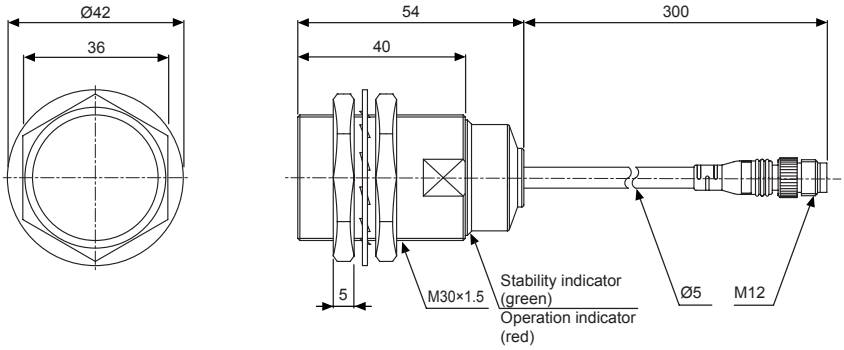
● PRFDWT12-3DO-IV



● PRFDWT18-7DO-IV

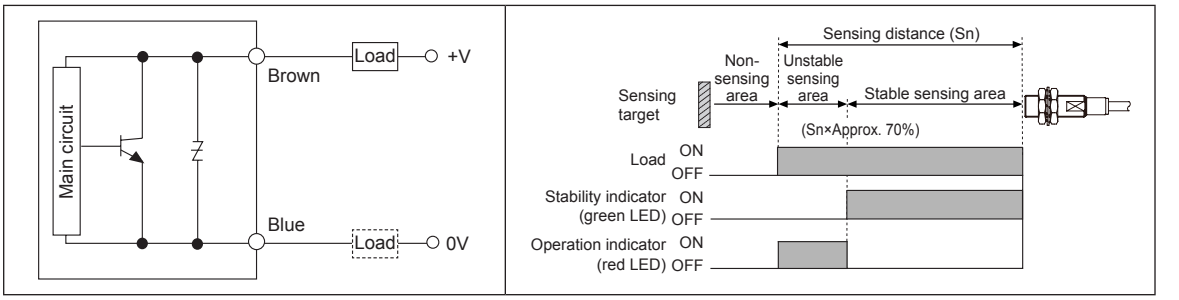


● PRFDWT30-12DO-IV



▣ Control Output Diagram & Load Operating

● DC 2-wire type

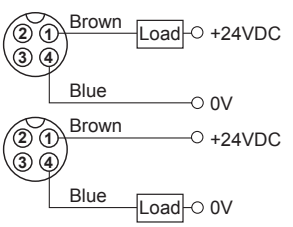


※When the sensing target is placed over approx. 70% of sensing distance (Sn), the operation indicator (red LED) turns ON.
When the target is placed within approx. 70% of sensing distance (Sn), the stability indicator (green LED) turns ON.
Use the sensor at the position where the stability indicator turns ON.

▣ Connections

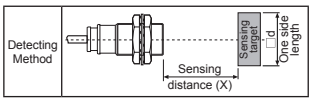
● DC 2-wire type (IEC standard)

Normally Open (N.O.)

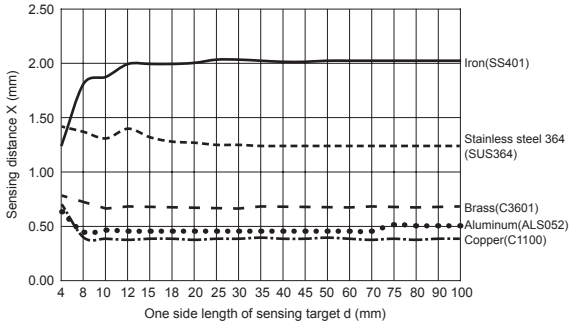


※②, ③ are N·C (Not Connected) terminals.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

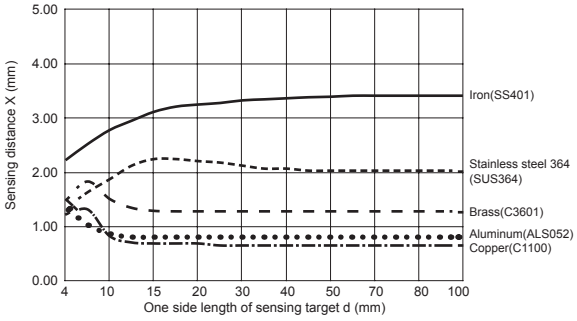
▣ Sensing Distance Feature Data by Target Material and Size



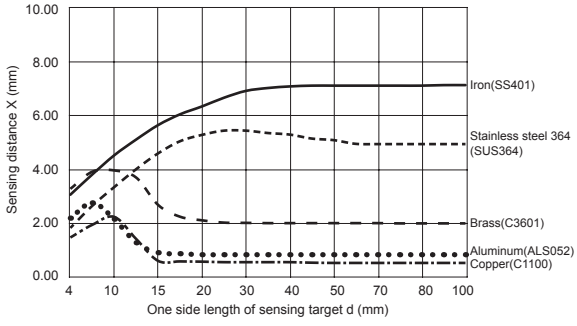
● PRFDWT08-2DO-IV



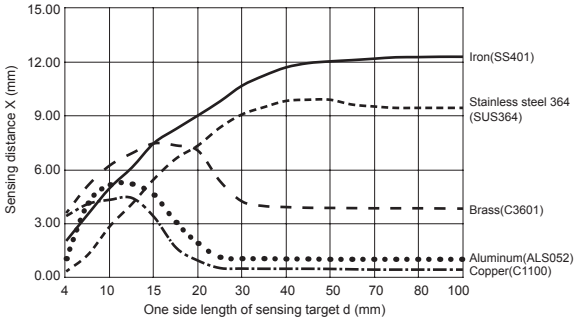
● PRFDWT12-3DO-IV



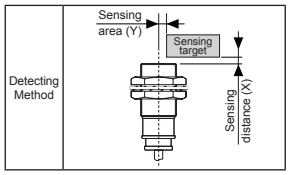
● PRFDWT18-7DO-IV



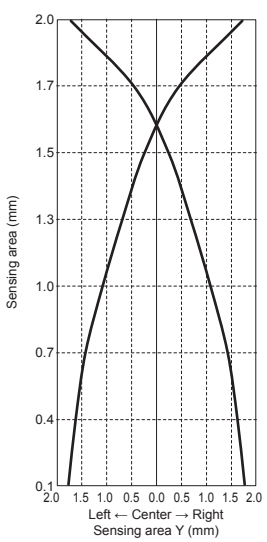
● PRFDWT30-12DO-IV



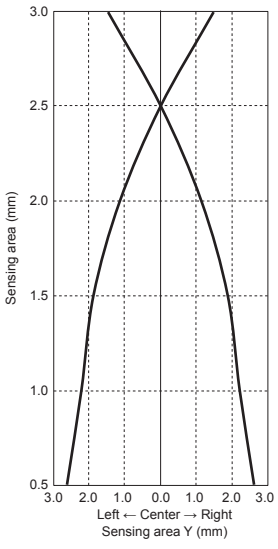
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



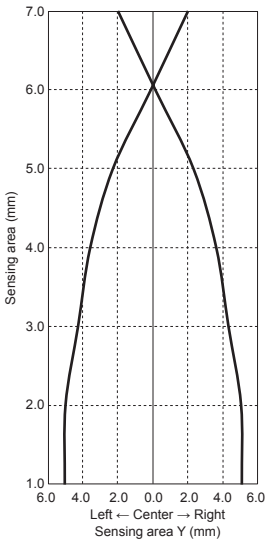
● PRFDWT08-2DO-IV



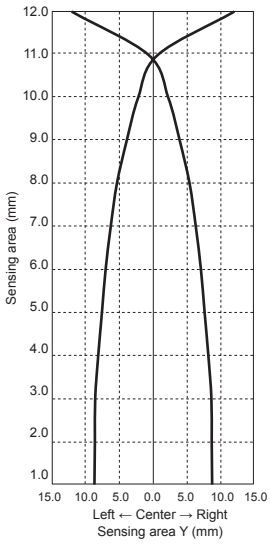
● PRFDWT12-3DO-IV



● PRFDWT18-7DO-IV

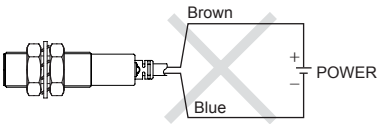


● PRFDWT30-12DO-IV

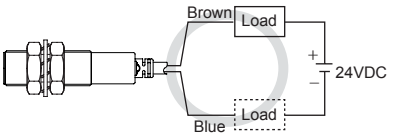


▣ Proper Usage

◎ Load connections



<DC 2-wire type>

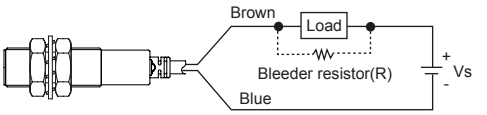


<DC 2-wire type>

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



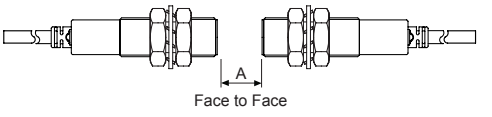
$$R \leq \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

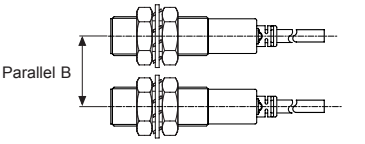
[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P: Number of Bleeder resistance watt]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

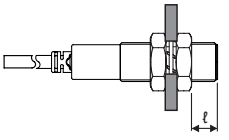
◎ Mutual-interference & Influence by surrounding metals

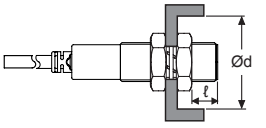
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.
Do NOT connect the sensors more than three in parallel.

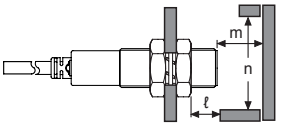




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRFDWT08-2DO-IV	PRFDWT12-3DO-IV	PRFDWT18-7DO-IV	PRFDWT30-12DO-IV
A	35	40	65	110
B	35	35	60	100
ℓ	0	0	0	0
Ød	8	12	18	30
m	8	12	28	48
n	30	40	60	100

Full Metal, Cylindrical, Spatter-Resistance, Cable Type, Proximity Sensor

▣ Features

- High impact and wear resistance to friction with the work or metallic brush (sensing face/housing material: stainless steel)
- Reduced possibility of malfunction by aluminum scraps
- Prevent malfunction due to spatter with PTFE coating
- Excellent noise immunity with specialized sensor IC
- Built-in surge protection circuit and output short over current protection circuit
- Excellent visibility with a 360° ring type of indicator (red LED) (except for PRFAT08 model)
- Equipped with the oil resistant cable
- Protection structure: IP67 (IEC standard)

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

CE

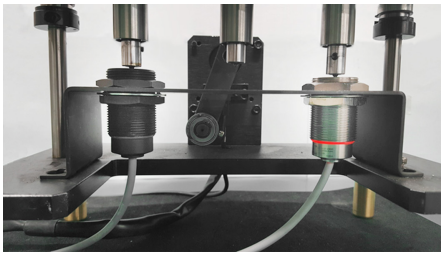
▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PTFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

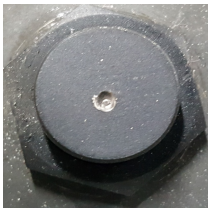
▣ Durability Test

Highly resistant to the impact of removing welding sludge attached to the sensing face

◎ Continuous hitting test

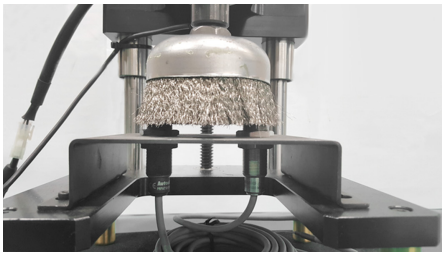


Test conditions
Hitting object: 1.3kg of weight
Hitting speed: 48 times per 1 min
The number of hitting times: 300 thousand times
Test model: PRFA18



<Test result>

◎ Metallic brush test

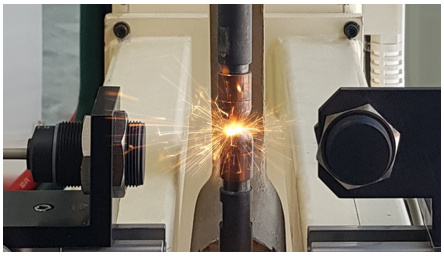


Test conditions
Testing object: stainless cup brush
Rotation speed: 80RPM
Testing time: 3 hours
Test model: PRFA18

<Test result>

▣ Electromagnetic Resistance Test

Large current from welding generates magnetic field which can affect the proximity sensor to malfunction due to noise.
This product, however, can be used near strong noise without malfunctioning, thanks to excellent electromagnetic resistance.
This test is conducted in the environment of welding.



Test conditions
Welding current: 13,000A
Installation direction: front and side
Test model: PRFA Series

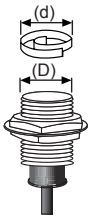
Diameter of sensing side	Minimum sensing distance between weld and sensor	
Installation direction	Front	Side
8mm	60mm	70mm
12mm	30mm	60mm
18mm	10mm	50mm
30mm	120mm	120mm

※Minimum sensing distance can be different by welding environment.

▣ Effect of Aluminum Scraps

When aluminum scraps are attached or stacked at sensing side, the proximity sensor does not detect and sensing signal is OFF. However, the below cases may occur to sensing signal. In this case, remove the scraps.

(1) When the size of aluminum scraps (d) is bigger than 2/3 of the sensing side size (D)



Model \ Size	D (mm)
PRFAT08	6
PRFAT12	10
PRFAT18	16
PRFAT30	28

(2) When aluminum scraps are attached on the sensing side by external pressure

▣ Specifications

● DC 2-wire type

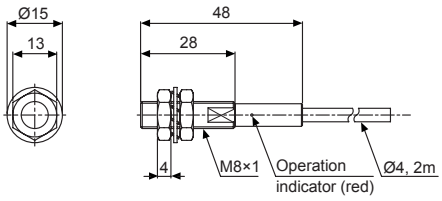
Model		PRFAT08-1.5DO-V	PRFAT12-2DO-V	PRFAT18-5DO-V	PRFAT30-10DO-V
Diameter of sensing side		8mm	12mm	18mm	30mm
Sensing distance※1		1.5mm	2mm	5mm	10mm
Installation		Shield (flush)			
Hysteresis		Max. 15% of sensing distance			
Standard sensing target		8×8×1mm (iron)	12×12×1mm (iron)	30×30×1mm (iron)	54×54×1mm (iron)
Setting distance		0 to 1.05mm	0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)			
Leakage current		Max. 0.8mA			
Response frequency※2		200Hz	100Hz	80Hz	50Hz
Residual voltage		Max. 3.5V			
Affection by Temp.		Max. ±20% for sensing distance at ambient temperature 20℃			
Control output		Max. 3 to 100mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 10 times	1,000m/s^2 (approx. 100G) in each X, Y, Z direction for 10 times		
Indicator		Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -25 to 70℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit, output short over current protection circuit			
Protection		IP67 (IEC standard)			
Cable※3		Ø4mm, 2-wire, 2m※4	Ø5mm, 2-wire, 2m※4		
		AWG22, core diameter: 0.08mm, no. of cores: 60, insulator diameter: Ø1.25mm			
Material		Case/Nut: Stainless steel 303 (SUS303, PTFE coated), Washer: Stainless steel 304 (SUS304), Sensing side: Stainless steel 303 (SUS303 , PTFE coated, thickness is 0.8mm, in case of PRFAT08 is 0.4mm), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)			
Approval		CE			
Weight※5		Approx. 80g (approx. 55g)	Approx. 110g (approx. 83g)	Approx. 132g (approx. 97g)	Approx. 225g (approx. 170g)

※1: Use accessories (nut, washer) made of SUS. Or, sensing distance cannot be guaranteed.
※2: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※3: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: Option is 5m.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

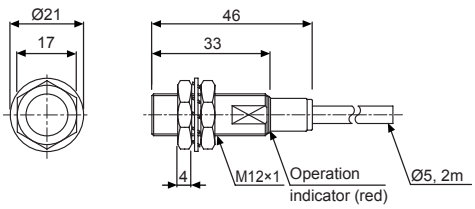
▣ Dimensions

(unit: mm)

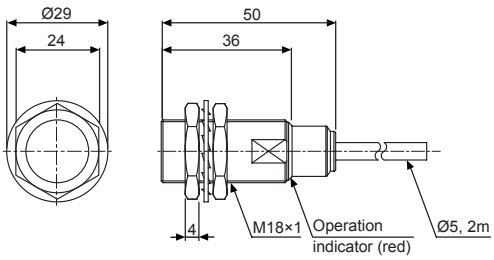
● **PRFAT08-1.5DO-V**



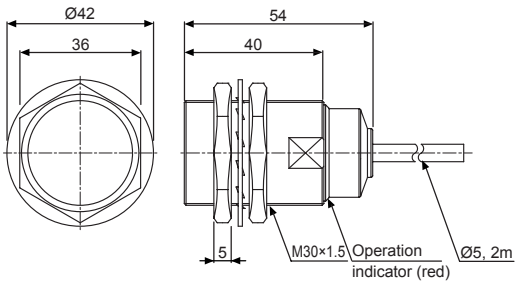
● **PRFAT12-2DO-V**



● **PRFAT18-5DO-V**

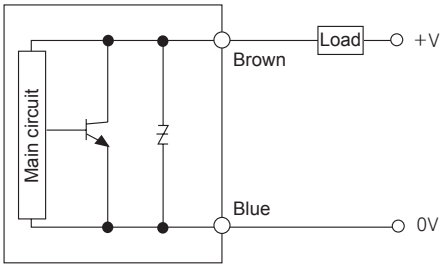


● **PRFAT30-10DO-V**



▣ Control Output Diagram & Load Operating

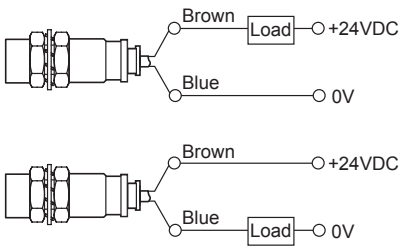
● **DC 2-wire type**



	Normally Open (N.O.)
Sensing target	Presence / Nothing
Load	Operation / Return
Opreration Indicator (red LED)	ON / OFF

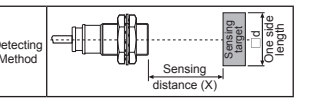
▣ Connections

● **DC 2-wire type**

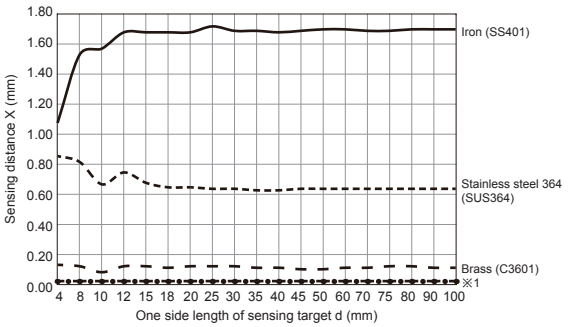


※Load can be wired to any direction.

▣ Sensing Distance Feature Data by Target Material and Size

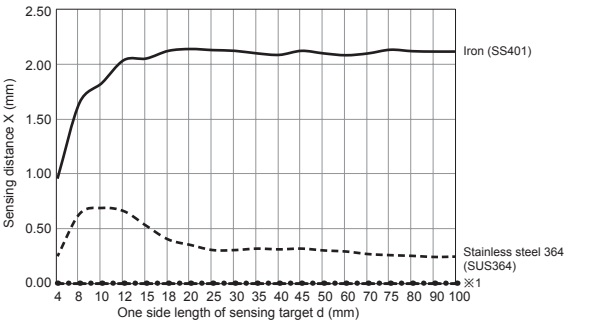


● PRFAT08-1.5DO-V



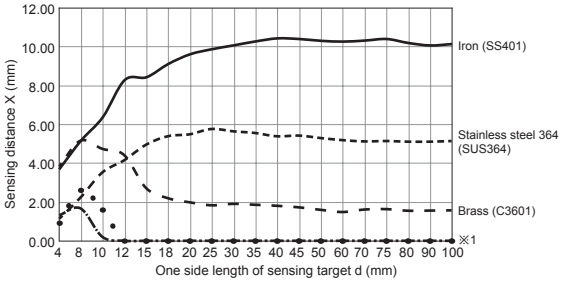
※1: Aluminum(ALS052), Copper(C1100)

● PRFAT12-2DO-V



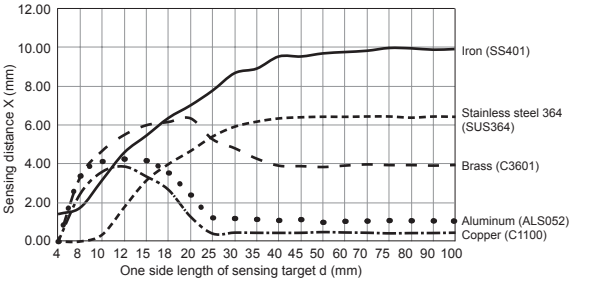
※1: Brass(C3601), Aluminum(ALS052), Copper(C1100)

● PRFAT18-5DO-V

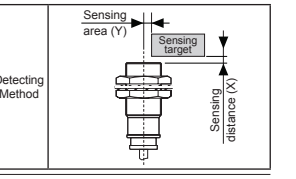


※1: Aluminum(ALS052), Copper(C1100)

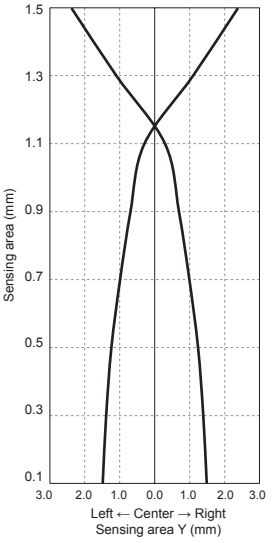
● PRFAT30-10DO-V



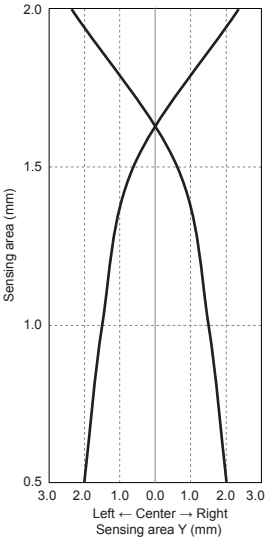
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



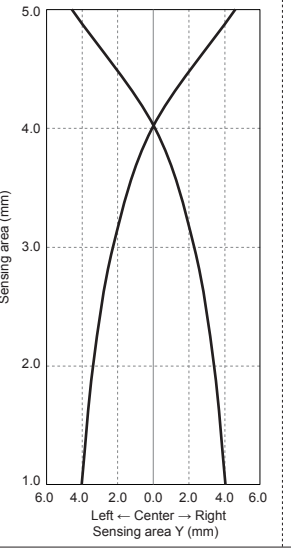
● PRFAT08-1.5DO-V



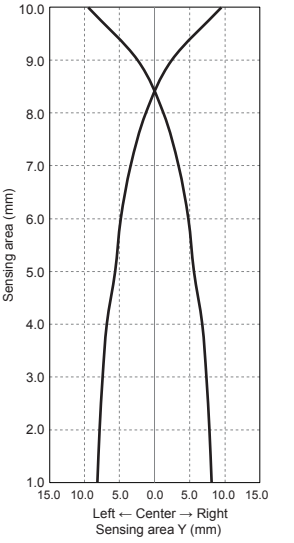
● PRFAT12-2DO-V



● PRFAT18-5DO-V

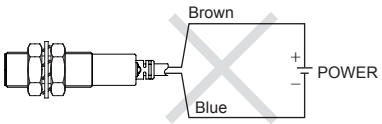


● PRFAT30-10DO-V

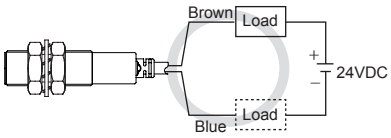


▣ Proper Usage

◎ Load connections



<DC 2-wire type>

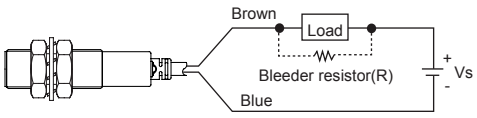


<DC 2-wire type>

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



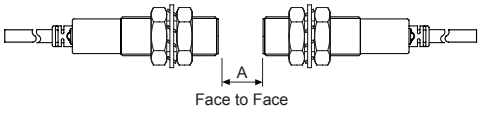
$$R \leq \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

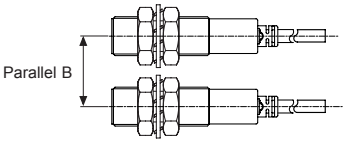
[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P: Number of Bleeder resistance watt]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

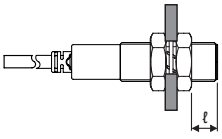
◎ Mutual-interference & Influence by surrounding metals

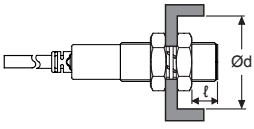
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

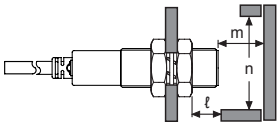




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRFAT08-1.5DO-V	PRFAT12-2DO-V	PRFAT18-5DO-V	PRFAT30-10DO-V
A	35	40	65	110
B	30	35	60	100
ℓ	0	0	0	0
Ød	8	12	18	30
m	4.5	8	20	40
n	30	40	60	100

Full Metal, Cylindrical, Spatter-Resistance, Cable Connector Type

▣ Features

- High impact and wear resistance to friction with the work or metallic brush (sensing face/housing material: stainless steel)
- Reduced possibility of malfunction by aluminum scraps
- Prevent malfunction due to spatter with PTFE coating
- Excellent noise immunity with specialized sensor IC
- Built-in surge protection circuit and output short over current protection circuit
- Excellent visibility with a 360° ring type of indicator (red LED) (except for PRFAWT08 model)
- Equipped with the oil resistant cable
- Protection structure: IP67 (IEC standard)

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

CE

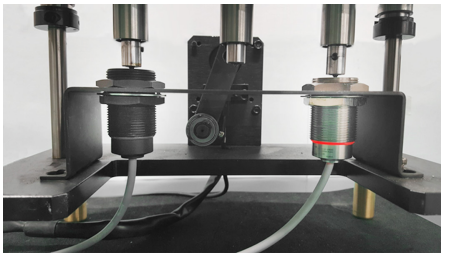
▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PTFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

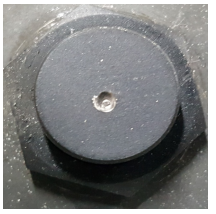
▣ Durability Test

Highly resistant to the impact of removing welding sludge attached to the sensing face

◎ Continuous hitting test

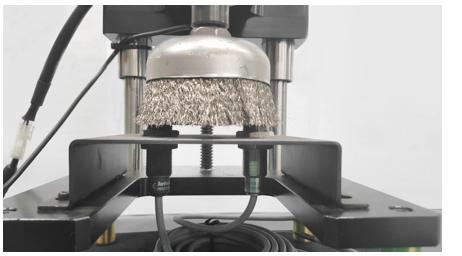


Test conditions
Hitting object: 1.3kg of weight
Hitting speed: 48 times per 1 min
The number of hitting times: 300 thousand times
Test model: PRFAW18



<Test result>

◎ Metallic brush test

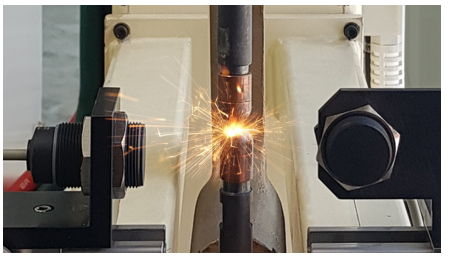


Test conditions
Testing object: stainless cup brush
Rotation speed: 80RPM
Testing time: 3 hours
Test model: PRFAW18

<Test result>

▣ Electromagnetic Resistance Test

Large current from welding generates magnetic field which can affect the proximity sensor to malfunction due to noise.
This product, however, can be used near strong noise without malfunctioning, thanks to excellent electromagnetic resistance.
This test is conducted in the environment of welding.



Test conditions
Welding current: 13,000A
Installation direction: front and side
Test model: PRFAW Series

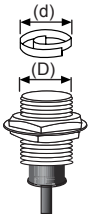
Diameter of sensing side	Minimum sensing distance between weld and sensor	
Installation direction	Front	Side
8mm	60mm	70mm
12mm	30mm	60mm
18mm	10mm	50mm
30mm	120mm	120mm

※Minimum sensing distance can be different by welding environment.

▣ Effect of Aluminum Scraps

When aluminum scraps are attached or stacked at sensing side, the proximity sensor does not detect and sensing signal is OFF. However, the below cases may occur to sensing signal. In this case, remove the scraps.

(1) When the size of aluminum scraps (d) is bigger than 2/3 of the sensing side size (D)



Model \ Size	D (mm)
PRFAWT08	6
PRFAWT12	10
PRFAWT18	16
PRFAWT30	28

(2) When aluminum scraps are attached on the sensing side by external pressure

▣ Specifications

● DC 2-wire type

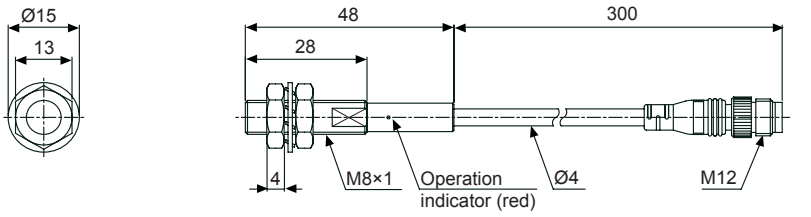
Model		PRFAWT08-1.5DO-IV	PRFAWT12-2DO-IV	PRFAWT18-5DO-IV	PRFAWT30-10DO-IV
Diameter of sensing side		8mm	12mm	18mm	30mm
Sensing distance※1		1.5mm	2mm	5mm	10mm
Installation		Shield (flush)			
Hysteresis		Max. 15% of sensing distance			
Standard sensing target		8×8×1mm (iron)	12×12×1mm (iron)	30×30×1mm (iron)	54×54×1mm (iron)
Setting distance		0 to 1.05mm	0 to 1.4mm	0 to 3.5mm	0 to 7mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)			
Leakage current		Max. 0.8mA			
Response frequency※2		200Hz	100Hz	80Hz	50Hz
Residual voltage		Max. 3.5V			
Affection by Temp.		Max. ±20% for sensing distance at ambient temperature 20℃			
Control output		Max. 3 to 100mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 10 times	1,000m/s^2 (approx. 100G) in each X, Y, Z direction for 10 times		
Indicator		Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -25 to 70℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit, output short over current protection circuit			
Protection		IP67 (IEC standard)			
Cable※3		Ø4mm, 2-wire, 300mm, M12 connector	Ø5mm, 2-wire, 300mm, M12 connector		
		AWG22, core diameter: 0.08mm, no. of cores: 60, insulator diameter: Ø1.25mm			
Material		Case/Nut: Stainless steel 303 (SUS303, PTFE coated), Washer: Stainless steel 304 (SUS304), Sensing side: Stainless steel 303 (SUS303 , PTFE coated, thickness is 0.8mm, in case of PRFAWT08 is 0.4mm), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)			
Approval		CE			
Weight※4		Approx. 80g (approx. 55g)	Approx. 110g (approx. 83g)	Approx. 132g (approx. 97g)	Approx. 225g (approx. 170g)

※1: Use accessories (nut, washer) made of SUS. Or, sensing distance cannot be guaranteed.
※2: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※3: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

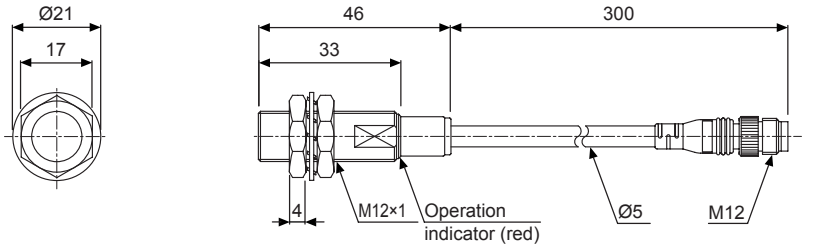
▣ Dimensions

(unit: mm)

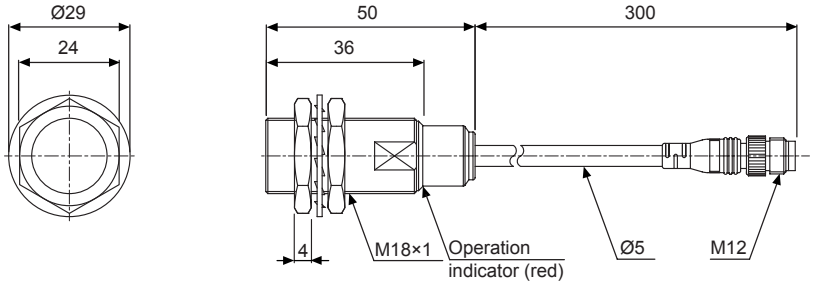
● **PRFAWT08-1.5DO-IV**



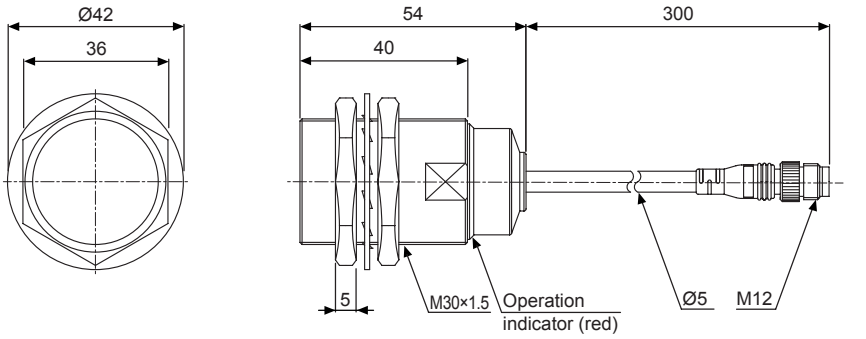
● **PRFAWT12-2DO-IV**



● **PRFAWT18-5DO-IV**

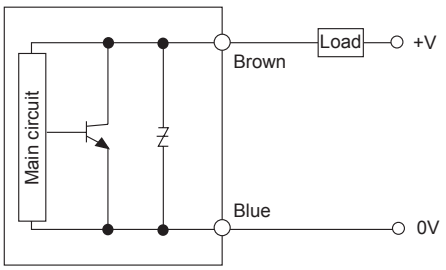


● **PRFAWT30-10DO-IV**



▣ Control Output Diagram & Load Operating

● DC 2-wire type

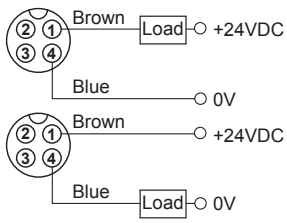


Normally Open (N.O.)	
Sensing target	Presence / Nothing
Load	Operation / Return
Operation Indicator (red LED)	ON / OFF

▣ Connections

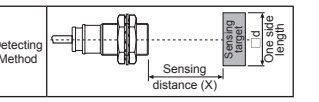
● DC 2-wire type (IEC standard)

Normally Open (N.O.)

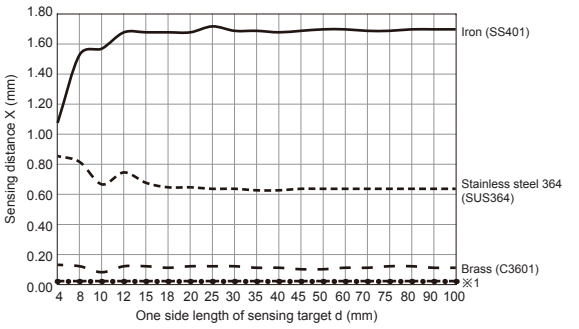


※②, ③ are N·C (Not Connected) terminals.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

▣ Sensing Distance Feature Data by Target Material and Size

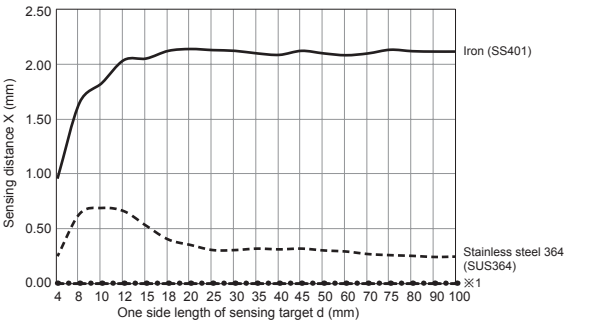


● PRFAWT08-1.5DO-IV



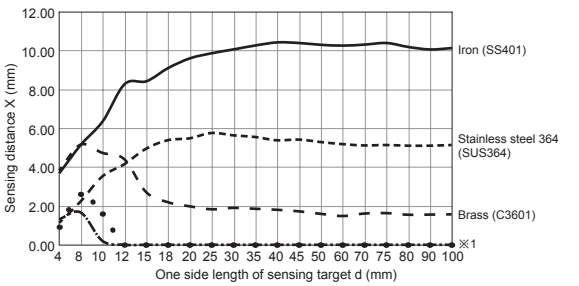
※1: Aluminum(ALS052), Copper(C1100)

● PRFAWT12-2DO-IV



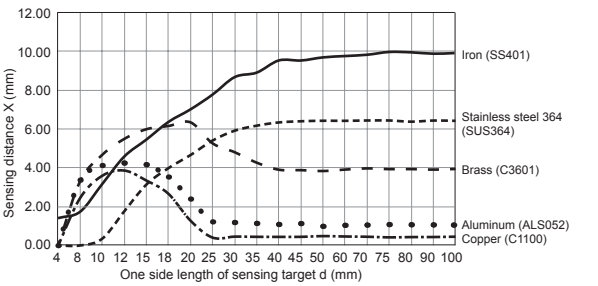
※1: Brass(C3601), Aluminum(ALS052), Copper(C1100)

● PRFAWT18-5DO-IV

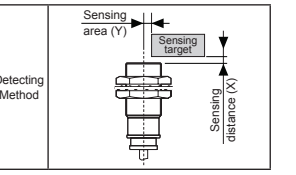


※1: Aluminum(ALS052), Copper(C1100)

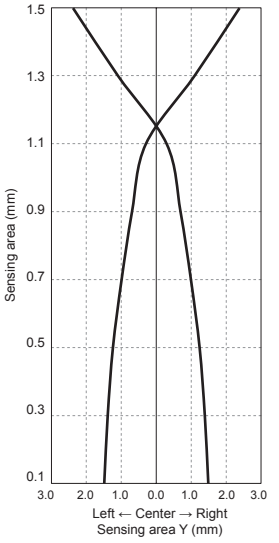
● PRFAWT30-10DO-IV



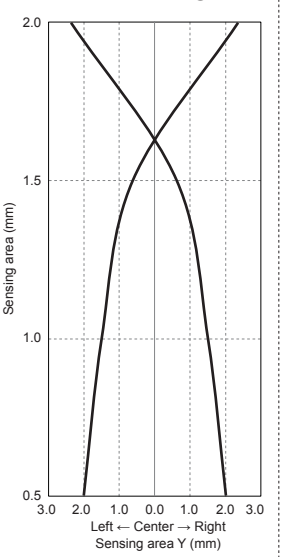
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



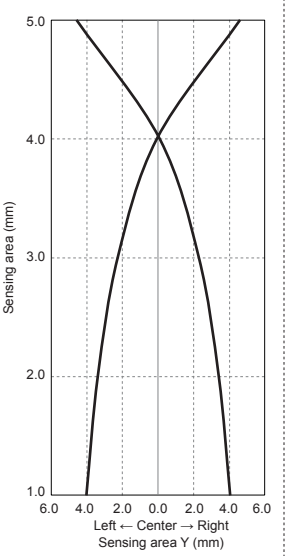
● PRFAWT08-1.5DO-IV



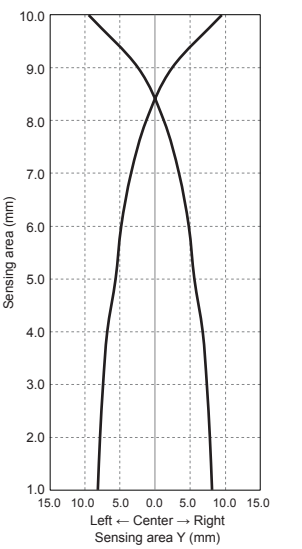
● PRFAWT12-2DO-IV



● PRFAWT18-5DO-IV

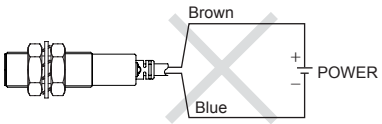


● PRFAWT30-10DO-IV

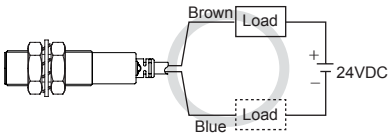


▣ Proper Usage

◎ Load connections



<DC 2-wire type>



<DC 2-wire type>

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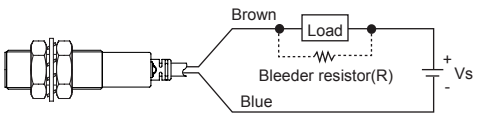
The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



$$R \le \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P: Number of Bleeder resistance watt]

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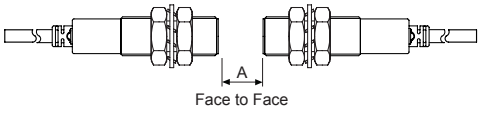
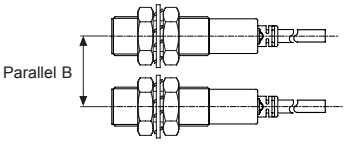
※W value of Bleeder resistor should be bigger for proper heat dissipation.

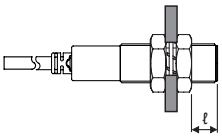
◎ Mutual-interference & Influence by surrounding metals

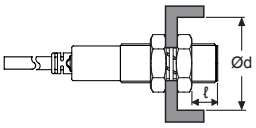
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.

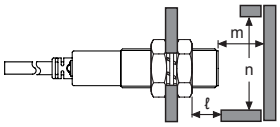




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.





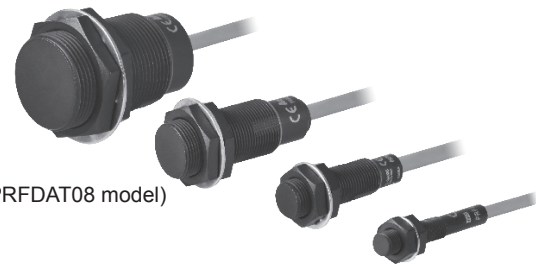


(unit: mm)

Item \ Model	PRFAWT08-1.5DO-IV	PRFAWT12-2DO-IV	PRFAWT18-5DO-IV	PRFAWT30-10DO-IV
A	35	40	65	110
B	30	35	60	100
ℓ	0	0	0	0
Ød	8	12	18	30
m	4.5	8	20	40
n	30	40	60	100

Full Metal, Cylindrical, Long Sensing Distance, Spatter-Resistance, Cable Type, Proximity Sensor

▣ Features



- Long sensing distance
- High impact and wear resistance to friction with the work or metallic brush (sensing face/housing material: stainless steel)
- Reduced possibility of malfunction by aluminum scraps
- Prevent malfunction due to spatter with PTFE coating
- Excellent noise immunity with specialized sensor IC
- Built-in surge protection circuit and output short over current protection circuit
- Stability indicator (green LED) and operation indicator (red LED) : excellent visibility with the 360˚ ring type indicator (except for PRFDAT08 model)
- Equipped with the oil resistant cable
- Protection structure: IP67 (IEC standard)

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

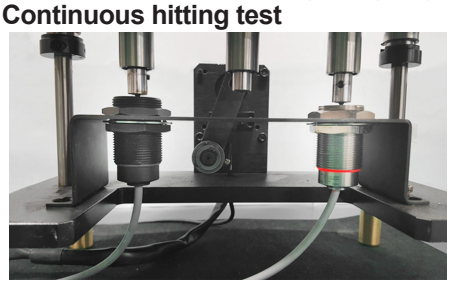
▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PTFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

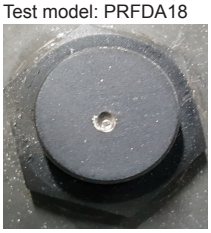
▣ Durability Test

Highly resistant to the impact of removing welding sludge attached to the sensing face

◎ Continuous hitting test



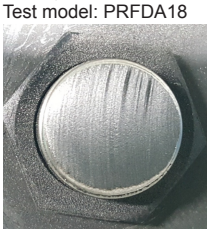
Test conditions
Hitting object: 1.3kg of weight
Hitting speed: 48 times per 1 min
The number of hitting times: 300 thousand times
Test model: PRFDA18



<Test result>

◎ Metallic brush test

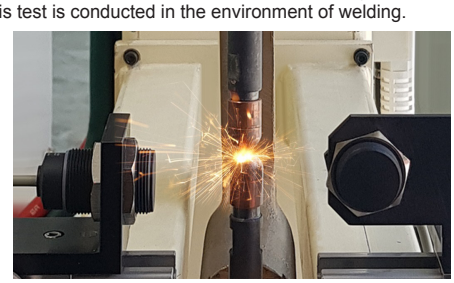
Test conditions
Testing object: stainless cup brush
Rotation speed: 80RPM
Testing time: 3 hours
Test model: PRFDA18



<Test result>

▣ Electromagnetic Resistance Test

Large current from welding generates magnetic field which can affect the proximity sensor to malfunction due to noise.
This product, however, can be used near strong noise without malfunctioning, thanks to excellent electromagnetic resistance.
This test is conducted in the environment of welding.



Test conditions
Welding current: 13,000A
Installation direction: front and side
Test model: PRFDA Series

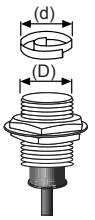
Diameter of sensing side	Minimum sensing distance between weld and sensor	
Installation direction	Front	Side
8mm	80mm	80mm
12mm	No effect from noise	50mm
18mm	30mm	50mm
30mm	120mm	110mm

※Minimum sensing distance can be different by welding environment.

▣ Effect of Aluminum Scraps

When aluminum scraps are attached or stacked at sensing side, the proximity sensor does not detect and sensing signal is OFF. However, the below cases may occur to sensing signal. In this case, remove the scraps.

(1) When the size of aluminum scraps (d) is bigger than 2/3 of the sensing side size (D)



Model \ Size	D (mm)
PRFDAT08	6
PRFDAT12	10
PRFDAT18	16
PRFDAT30	28

(2) When aluminum scraps are attached on the sensing side by external pressure

▣ Specifications

● DC 2-wire type

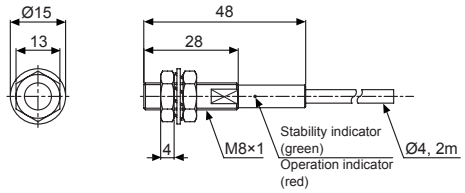
Model		PRFDAT08-2DO-V	PRFDAT12-3DO-V	PRFDAT18-7DO-V	PRFDAT30-12DO-V
Diameter of sensing side		8mm	12mm	18mm	30mm
Sensing distance※1		2mm	3mm	7mm	12mm
Installation		Shield (flush)			
Hysteresis		Max. 15% of sensing distance			
Standard sensing target		12×12×1mm (iron)	12×12×1mm (iron)	30×30×1mm (iron)	54×54×1mm (iron)
Setting distance		0 to 1.4mm	0 to 2.1mm	0 to 4.9mm	0 to 8.4mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)			
Leakage current		Max. 0.8mA			
Response frequency※2		150Hz	80Hz	80Hz	50Hz
Residual voltage		Max. 3.5V			
Affection by Temp.		Max. ±20% for sensing distance at ambient temperature 20℃			
Control output		Max. 3 to 100mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 10 times	1,000m/s^2 (approx. 100G) in each X, Y, Z direction for 10 times		
Indicator		Stability indicator: Green LED, Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -25 to 70℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit, output short over current protection circuit			
Protection		IP67 (IEC standard)			
Cable※3		Ø4mm, 2-wire, 2m※4	Ø5mm, 2-wire, 2m※4		
		AWG22, core diameter: 0.08mm, no. of cores: 60, insulator diameter: Ø1.25mm			
Material		Case/Nut: Stainless steel 303 (SUS 303, PTFE coated), Washer: Stainless steel 304 (SUS 304), Sensing side: stainless steel 303 (SUS 303, PTFE coated, thickness of PRFDAT08: 0.2mm, PRFDAT12/18: 0.4mm, PRFDAT30: 0.5mm), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)			
Approval		CE			
Weight※5		Approx. 80g (approx. 55g)	Approx. 110g (approx. 83g)	Approx. 132g (approx. 97g)	Approx. 225g (approx. 170g)

※1: Use accessories (nut, washer) made of SUS. Or, sensing distance cannot be guaranteed.
※2: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※3: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: Option is 5m.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

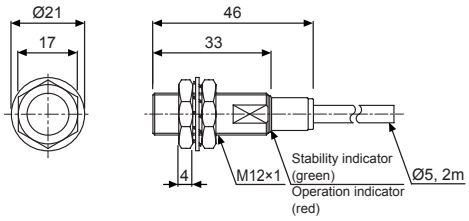
▣ Dimensions

(unit: mm)

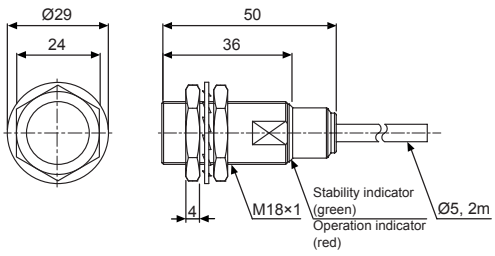
● PRFDAT08-2DO-V



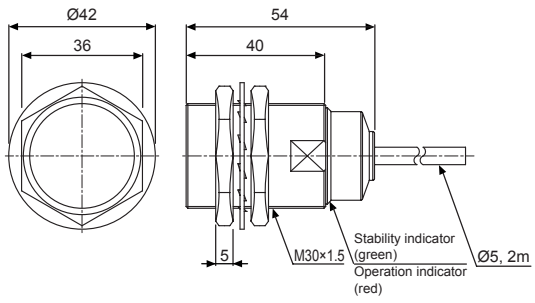
● PRFDAT12-3DO-V



● PRFDAT18-7DO-V

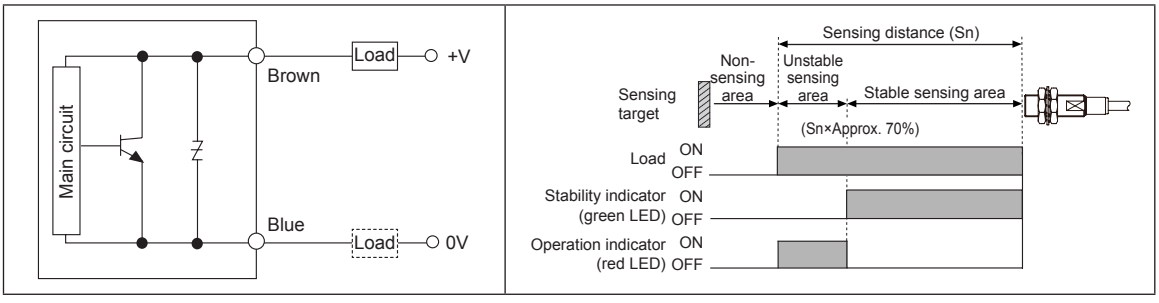


● PRFDAT30-12DO-V



▣ Control Output Diagram & Load Operating

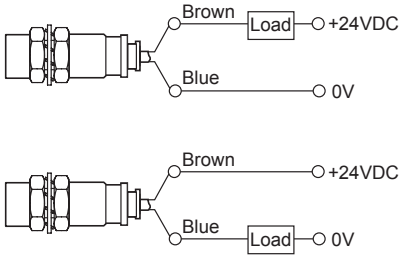
● DC 2-wire type



※When the sensing target is placed over approx. 70% of sensing distance (Sn), the operation indicator (red LED) turns ON.
When the target is placed within approx. 70% of sensing distance (Sn), the stability indicator (green LED) turns ON.
Use the sensor at the position where the stability indicator turns ON.

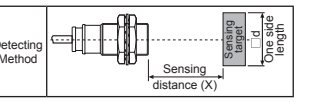
▣ Connections

● DC 2-wire type

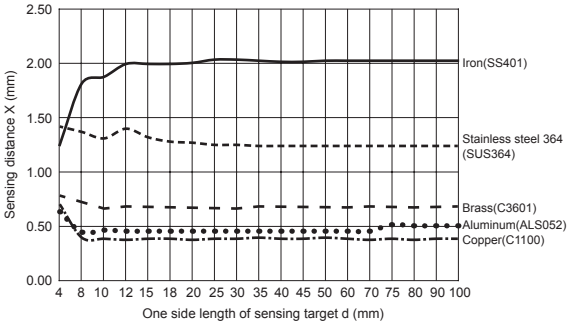


※Load can be wired to any direction.

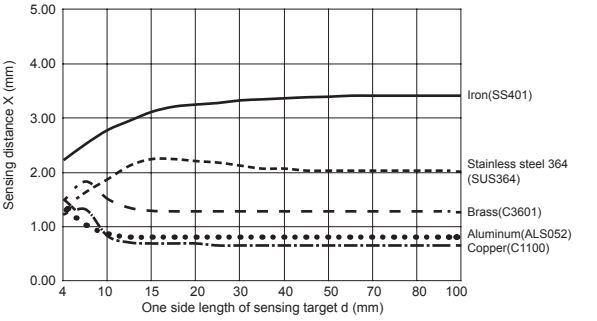
▣ Sensing Distance Feature Data by Target Material and Size



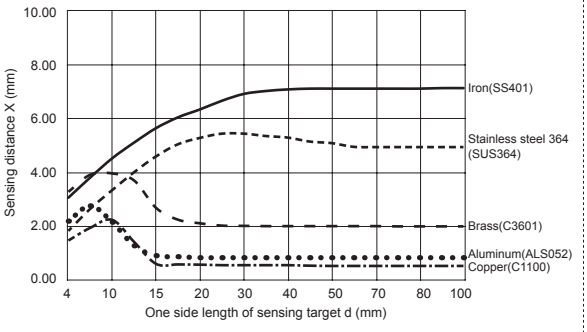
● PRFDAT08-2DO-V



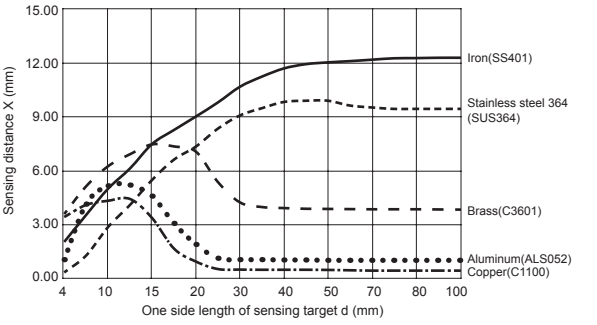
● PRFDAT12-3DO-V



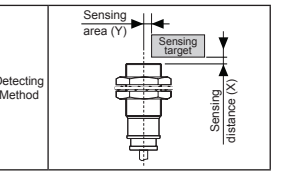
● PRFDAT18-7DO-V



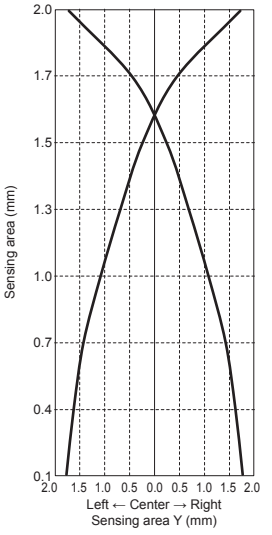
● PRFDAT30-12DO-V



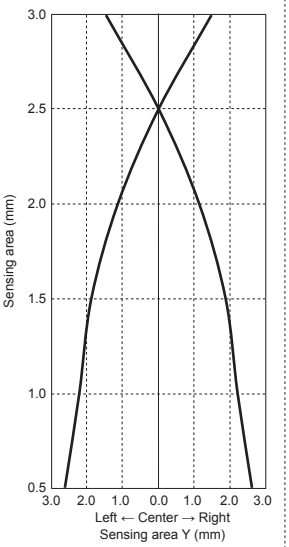
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



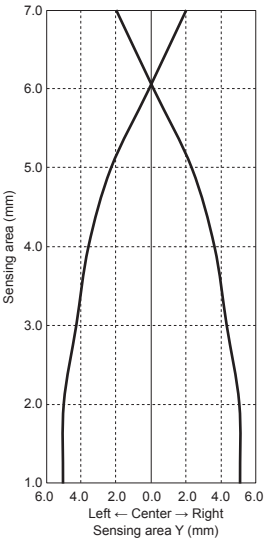
● PRFDAT08-2DO-V



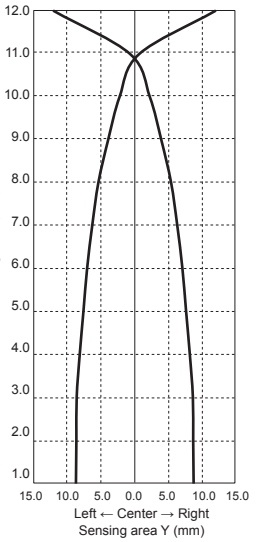
● PRFDAT12-3DO-V



● PRFDAT18-7DO-V

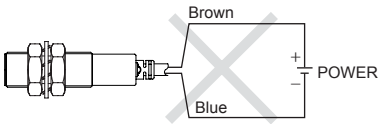


● PRFDAT30-12DO-V

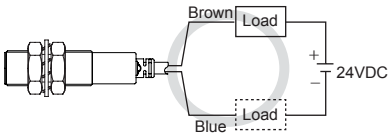


▣ Proper Usage

◎ Load connections



<DC 2-wire type>

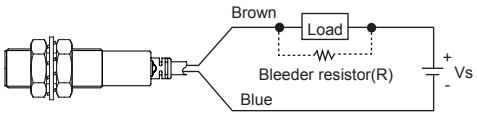


<DC 2-wire type>

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged. The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



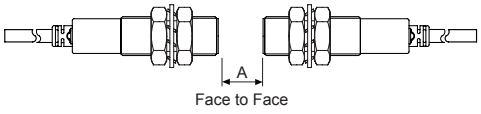
$$R \leq \frac{Vs}{Io\text{-}Ioff}\ (k\Omega) \qquad P > \frac{Vs^2}{R}\ (W)$$

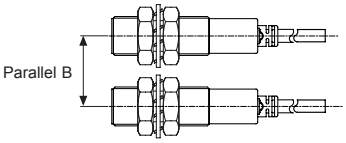
[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P: Number of Bleeder resistance watt]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

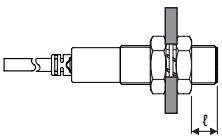
◎ Mutual-interference & Influence by surrounding metals

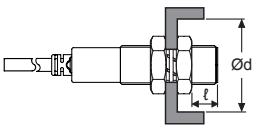
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.
Do NOT connect the sensors more than three in parallel.

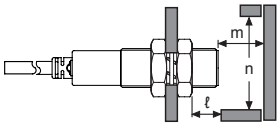




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRFDAT08-2DO-V	PRFDAT12-3DO-V	PRFDAT18-7DO-V	PRFDAT30-12DO-V
A	35	40	65	110
B	35	35	60	100
ℓ	0	0	0	0
Ød	8	12	18	30
m	8	12	28	48
n	30	40	60	100

Full Metal, Cylindrical, Long Sensing Distance, Spatter-Resistance, Cable Connector Type

▣ Features

- Long sensing distance
- High impact and wear resistance to friction with the work or metallic brush (sensing face/housing material: stainless steel)
- Reduced possibility of malfunction by aluminum scraps
- Prevent malfunction due to spatter with PTFE coating
- Excellent noise immunity with specialized sensor IC
- Built-in surge protection circuit and output short over current protection circuit
- Stability indicator (green LED) and operation indicator (red LED) : excellent visibility with the 360˚ ring type indicator (except for PRFDAWT08 model)
- Equipped with the oil resistant cable
- Protection structure: IP67 (IEC standard)

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

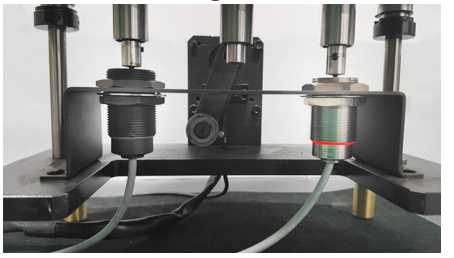
▣ The Characteristic of Spatter-Resistance Type

The hot arc from arc welding machine is adhesive even with metals or plastics.
Therefore, normal proximity sensor might have malfunction even though there are no sensing object if the arcs are put on the sensing surface. The arcs are not adhered on the sensing part of the spatter-resistance type proximity sensor as the part is coated with PTFE against thermal resistance.
Also, the protection cover sold optionally has the same function.

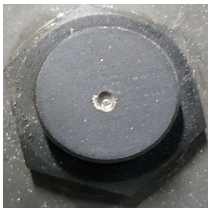
▣ Durability Test

Highly resistant to the impact of removing welding sludge attached to the sensing face

◎ Continuous hitting test

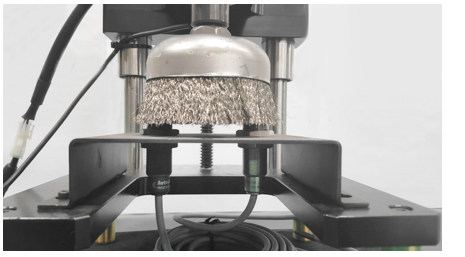


Test conditions
Hitting object: 1.3kg of weight
Hitting speed: 48 times per 1 min
The number of hitting times: 300 thousand times
Test model: PRFDAW18

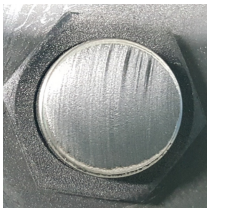


<Test result>

◎ Metallic brush test



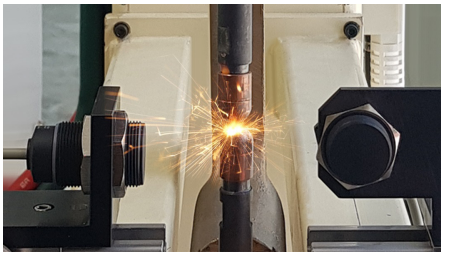
Test conditions
Testing object: stainless cup brush
Rotation speed: 80RPM
Testing time: 3 hours
Test model: PRFDAW18



<Test result>

▣ Electromagnetic Resistance Test

Large current from welding generates magnetic field which can affect the proximity sensor to malfunction due to noise.
This product, however, can be used near strong noise without malfunctioning, thanks to excellent electromagnetic resistance.
This test is conducted in the environment of welding.



Test conditions
Welding current: 13,000A
Installation direction: front and side
Test model: PRFDAW Series

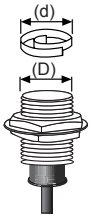
Diameter of sensing side	Minimum sensing distance between weld and sensor	
Installation direction	Front	Side
8mm	80mm	80mm
12mm	No effect from noise	50mm
18mm	30mm	50mm
30mm	120mm	110mm

※Minimum sensing distance can be different by welding environment.

▣ Effect of Aluminum Scraps

When aluminum scraps are attached or stacked at sensing side, the proximity sensor does not detect and sensing signal is OFF.
However, the below cases may occur to sensing signal. In this case, remove the scraps.

(1) When the size of aluminum scraps (d) is bigger than 2/3 of the sensing side size (D)



Model \ Size	D (mm)
PRFDAWT08	6
PRFDAWT12	10
PRFDAWT18	16
PRFDAWT30	28

(2) When aluminum scraps are attached on the sensing side by external pressure

▣ Specifications

● DC 2-wire type

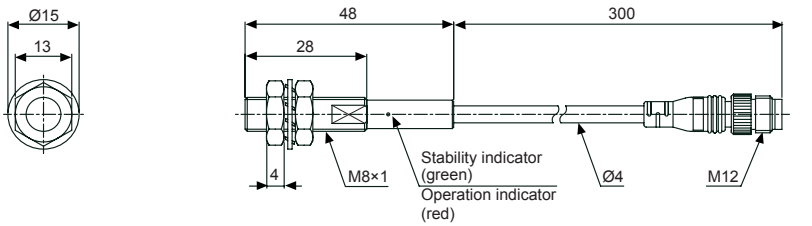
Model		PRFDAWT08-2DO-IV	PRFDAWT12-3DO-IV	PRFDAWT18-7DO-IV	PRFDAWT30-12DO-IV
Diameter of sensing side		8mm	12mm	18mm	30mm
Sensing distance※1		2mm	3mm	7mm	12mm
Installation		Shield (flush)			
Hysteresis		Max. 15% of sensing distance			
Standard sensing target		12×12×1mm (iron)	12×12×1mm (iron)	30×30×1mm (iron)	54×54×1mm (iron)
Setting distance		0 to 1.4mm	0 to 2.1mm	0 to 4.9mm	0 to 8.4mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)			
Leakage current		Max. 0.8mA			
Response frequency※2		150Hz	80Hz	80Hz	50Hz
Residual voltage		Max. 3.5V			
Affection by Temp.		Max. ±20% for sensing distance at ambient temperature 20℃			
Control output		Max. 3 to 100mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 10 times	1,000m/s^2 (approx. 100G) in each X, Y, Z direction for 10 times		
Indicator		Stability indicator: Green LED, Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -25 to 70℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit, output short over current protection circuit			
Protection		IP67 (IEC standard)			
Cable※3		Ø4mm, 2-wire, 300mm, M12 connector	Ø5mm, 2-wire, 300mm, M12 connector		
		AWG22, core diameter: 0.08mm, no. of cores: 60, insulator diameter: Ø1.25mm			
Material		Case/Nut: Stainless steel 303 (SUS 303, PTFE coated), Washer: Stainless steel 304 (SUS 304), Sensing side: Stainless steel 303 (SUS 303, PTFE coated, thickness of PRFDAWT08: 0.2mm, PRFDAWT12/18: 0.4mm, RFDAWT30: 0.5mm), Oil resistant cable (gray): Oil resistant polyvinyl chloride (PVC)			
Approval		CE			
Weight※4		Approx. 80g (approx. 55g)	Approx. 110g (approx. 83g)	Approx. 132g (approx. 97g)	Approx. 225g (approx. 170g)

※1: Use accessories (nut, washer) made of SUS. Or, sensing distance cannot be guaranteed.
※2: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※3: Do not pull the Ø4mm cable with a tensile strength of 30N or over and the Ø5mm cable with a tensile strength of 50N or over. It may result in fire due to the broken wire. When extending wire, use AWG22 cable or over within 200m.
※4: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

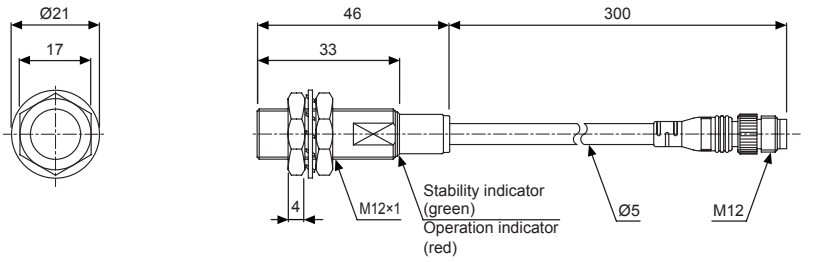
▣ Dimensions

(unit: mm)

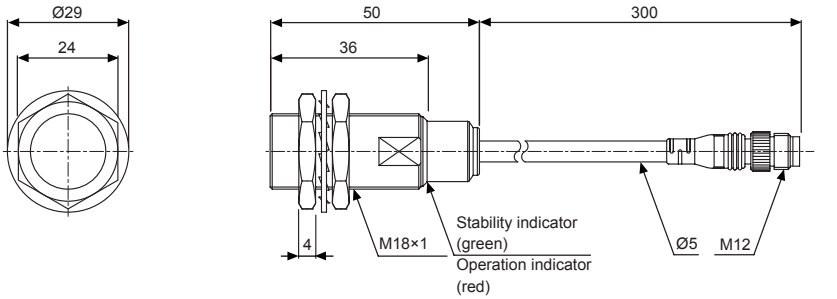
● PRFDAWT8-2DO-IV



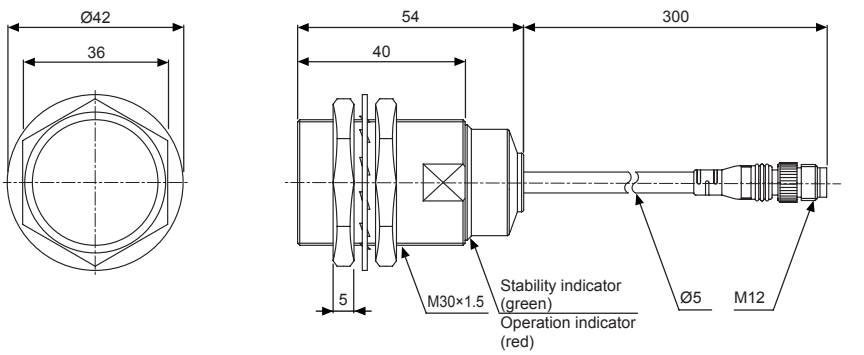
● PRFDAWT12-3DO-IV



● PRFDAWT18-7DO-IV

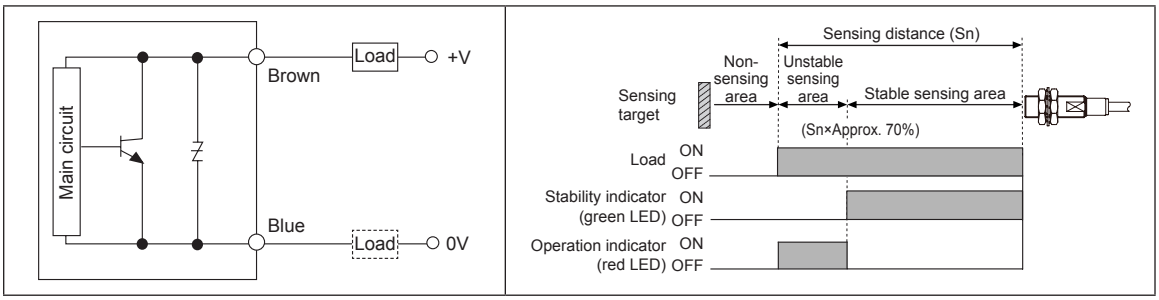


● PRFDAWT30-12DO-IV



▣ Control Output Diagram & Load Operating

● DC 2-wire type

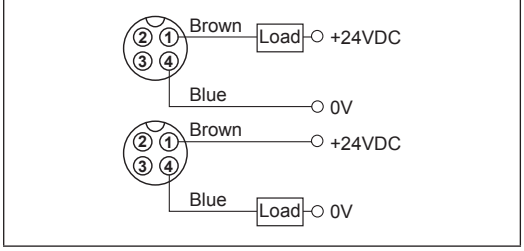


※When the sensing target is placed over approx. 70% of sensing distance (Sn), the operation indicator (red LED) turns ON.
When the target is placed within approx. 70% of sensing distance (Sn), the stability indicator (green LED) turns ON.
Use the sensor at the position where the stability indicator turns ON.

▣ Connections

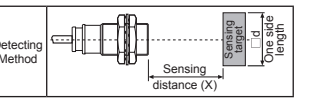
● DC 2-wire type (IEC standard)

Normally Open (N.O.)

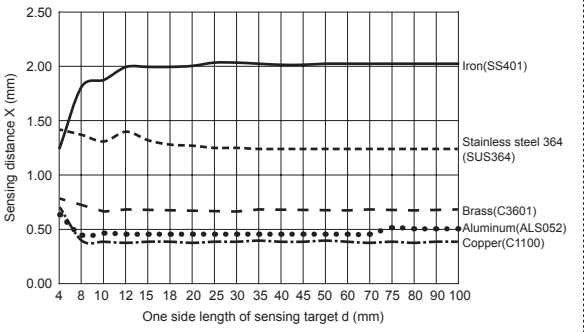


※②, ③ are N·C (Not Connected) terminals.
※For more information about cable and specification, refer to the (I) Connectors/Cable Connectors/Sensor Distribution Boxes/Sockets

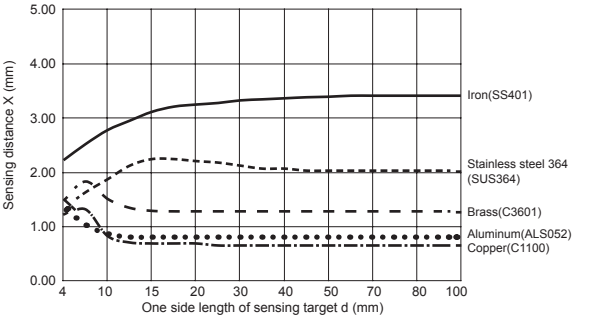
▣ Sensing Distance Feature Data by Target Material and Size



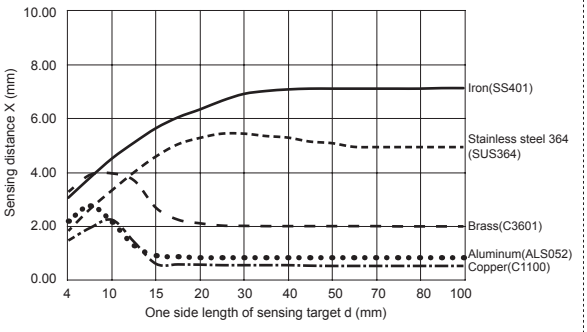
● PRFDAWT08-2DO-IV



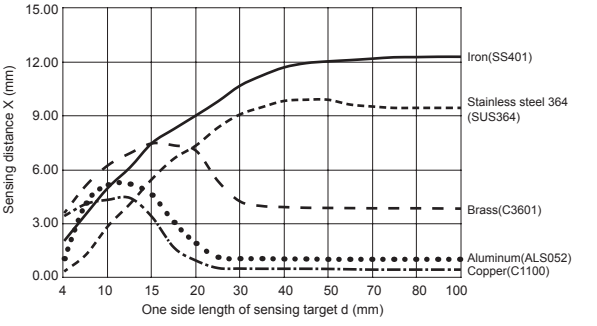
● PRFDAWT12-3DO-IV



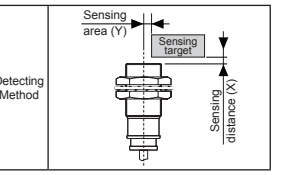
● PRFDAWT18-7DO-IV



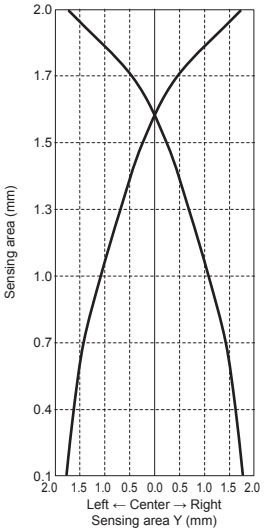
● PRFDAWT30-12DO-IV



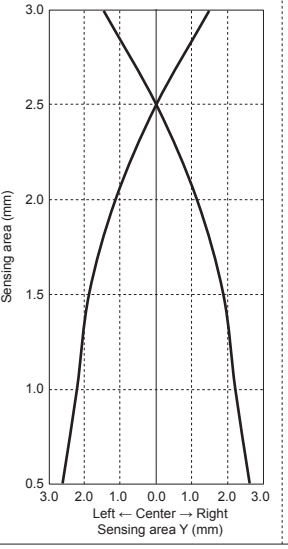
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



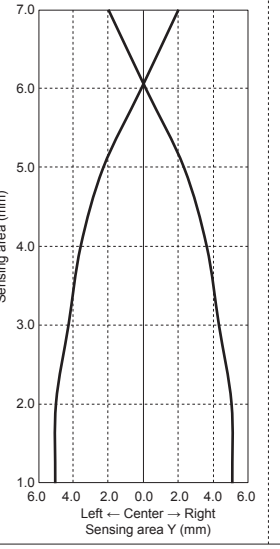
● PRFDAWT08-2DO-IV



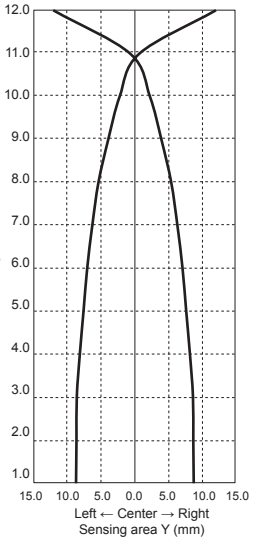
● PRFDAWT12-3DO-IV



● PRFDAWT18-7DO-IV

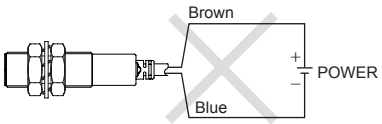


● PRFDAWT30-12DO-IV

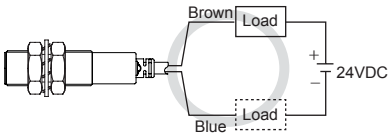


▣ Proper Usage

◎ Load connections



<DC 2-wire type>

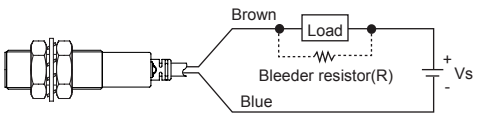


<DC 2-wire type>

When using DC 2-wire type proximity sensor, the load must be connected, otherwise internal components may be damaged.
The load can be connected to either wire.

◎ In case of the load current is small

● DC 2-wire type



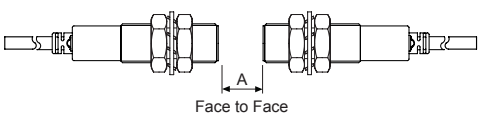
$R \leq \frac{Vs}{Io\text{-}Ioff}$ (kΩ) $P > \frac{Vs^2}{R}$ (W)

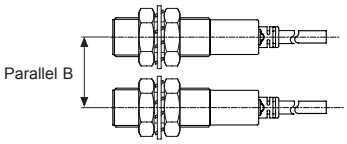
[Vs: Power supply, Io: Min. action current of proximity sensor,
Ioff: Return current of load, P : Number of Bleeder resistance watt]

Please make the current on proximity sensor smaller than the return current of load by connecting a bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

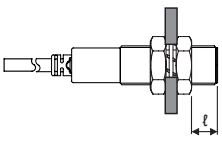
◎ Mutual-interference & Influence by surrounding metals

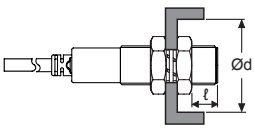
When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below chart indicates.
Do NOT connect the sensors more than three in parallel.

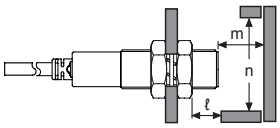




When sensors are mounted on metallic panel, it is required to protect the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.







(unit: mm)

Item \ Model	PRFDAWT08-2DO-IV	PRFDAWT12-3DO-IV	PRFDAWT18-7DO-IV	PRFDAWT30-12DO-IV
A	35	40	65	110
B	35	35	60	100
ℓ	0	0	0	0
Ød	8	12	18	30
m	8	12	28	48
n	30	40	60	100

Rectangular, Standard Type Proximity Sensor

▣ Features

- Excellent noise immunity with specialized sensor IC
- Long life cycle, reliable performance, economical, and easy-to-install
- Operation indicator (red LED)
- Built-in surge protection circuit
- Built-in output short over current protection circuit (DC types)
- Built-in reverse polarity protection circuit (DC 3-wire types)
- IP67 protection structure (IEC standard)

[PSN17]

- Alternate frequency models allow adjacent installation of multiple sensors without interference (PSN17-□-F)

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

▣ Specifications

※The existing PST17 is upgraded its function and design and changed as PSNT17.
※The case color of Normal Close type is changed from orange to gray.

• DC 2-wire type

Model		PSNT17-5DO PSNT17-5DC	PSNT17-5DOU PSNT17-5DCU
Sensing side		Front side	Upper side
Sensing distance		5mm	
Hysteresis		Max. 10% of sensing distance	
Standard sensing target		18×18×1mm (iron)	
Setting distance		0 to 3.5mm	
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)	
Leakage current		Max. 0.6mA	
Response frequency※1		700Hz	
Residual voltage		Max. 3.5V	
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃	
Control output		2 to 100mA	
Insulation resistance		Over 50MΩ (at 500VDC megger)	
Dielectric strength		1,500VAC 50/60Hz for 1 min	
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Indicator		Operation indicator: Red LED	
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃	
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH	
Protection circuit		Surge protection circuit, output short over current protection circuit	
Protection structure		IP67 (IEC standard)	
Cable		Ø4mm, 2-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)	
Approval		CE	
Unit weight		Approx. 71g	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※Environment resistance is rated at no freezing or condensation.

▣ Specifications

● DC 3-wire type

● PS Series

※The existing PST17 is upgraded its function and design and changed as PSN17.
※The case color of PNP output type is changed from orange to gray.

Environment		PS12-4DN PS12-4DP PS12-4DN2	PS12-4DNU PS12-4DPU PS12-4DN2U	PS50-30DN PS50-30DP PS50-30DN2 PS50-30DP2
Sensing side		Front side	Upper side	Front side
Sensing distance		4mm		30mm
Hysteresis		Max. 10% of sensing distance		
Standard sensing target		12×12×1mm (iron)		90×90×1mm (iron)
Setting distance		0 to 2.8mm		0 to 21mm
Power supply (operation voltage)		12-24VDC⎓ (10-30VDC⎓)		
Current consumption		Max. 10mA		
Response frequency※1		500Hz		50Hz
Residual voltage		Max. 1.5V		
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃		
Control output		Max. 200mA		
Insulation resistance		Over 50MΩ (at 500VDC megger)		
Dielectric strength		1,500VAC 50/60Hz for 1 min		
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Indicator		Operation indicator: Red LED		
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃		
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH		
Protection circuit		Surge protection circuit, output short over current protection circuit, reverse polarity protection circuit		
Protection structure		IP67 (IEC standard)		
Cable		Ø4mm, 3-wire, 2m		Ø5mm, 3-wire, 2m
		AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm		
Material		Case: Heat-resistant acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC)		Case: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC)
Approval		CE		
Weight※2		Approx. 77g (approx. 62g)		Approx. 256g (approx. 220g)

● PSN Series (frame size 17mm)

※The case color of Normally Closed type is changed from orange to gray.

Model		PSN17-5DN PSN17-5DP PSN17-5DN2 PSN17-5DP2 PSN17-5DN-F	PSN17-5DNU PSN17-5DPU PSN17-5DN2U PSN17-5DP2U	PSN17-8DN PSN17-8DP PSN17-8DN2 PSN17-8DP2	PSN17-8DNU PSN17-8DPU PSN17-8DN2U PSN17-8DP2U	PSN17-8DN-F PSN17-8DP-F PSN17-8DN2-F	PSN17-8DNU-F PSN17-8DPU-F PSN17-8DN2U-F
Sensing side		Front side	Upper side	Front side	Upper side	Front side	Upper side
Sensing distance		5mm		8mm			
Hysteresis		Max. 10% of sensing distance					
Standard sensing target		18×18×1mm (iron)		25×25×1mm (iron)			
Setting distance		0 to 3.5mm		0 to 5mm			
Power supply (operation voltage)		12-24VDC⎓ (10-30VDC⎓)					
Current consumption		Max. 10mA					
Response frequency※1		700Hz		200Hz			
Residual voltage		Max. 1.5V					
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃					
Control output		Max. 200mA					
Insulation resistance		Over 50MΩ (at 500VDC megger)					
Dielectric strength		1,500VAC 50/60Hz for 1 min					
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in X, Y, Z direction for 3 times					
Indicator		Operation indicator: Red LED					
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃					
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH					
Protection circuit		Surge protection circuit, output short over current protection circuit, reverse polarity protection circuit					
Protection structure		IP67 (IEC standard)					
Cable		Ø4mm, 3-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)					
Material		Case: Heat-resistant acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC)					
Approval		CE					
Weight※2		Approx. 71g		Approx. 70g			

▣ Specifications

● PSN Series (frame size 25/30/40mm)

※The case color of Normally Closed type is changed from orange to gray.

Model		PSN25-5DN PSN25-5DP PSN25-5DN2 PSN25-5DP2	PSN30-10DN PSN30-10DP PSN30-10DN2 PSN30-10DP2	PSN30-15DN PSN30-15DP PSN30-15DN2 PSN30-15DP2	PSN40-20DN PSN40-20DP PSN40-20DN2 PSN40-20DP2
Sensing side		Front side			
Sensing distance		5mm	10mm	15mm	20mm
Hysteresis		Max. 10% of sensing distance			
Standard sensing target		25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)	60×60×1mm (iron)
Setting distance		0 to 3.5mm	0 to 7mm	0 to 10.5mm	0 to 14mm
Power supply (operation voltage)		12-24VDC⎓ (10-30VDC⎓)			
Current consumption		Max. 10mA			
Response frequency※1		300Hz	250Hz	200Hz	100Hz
Residual voltage		Max. 1.5V			
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃			
Control output		Max. 200mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,500VAC 50/60Hz for 1 min			
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in X, Y, Z direction for 3 times			
Indicator		Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit, output short over current protection circuit, reverse polarity protection circuit			
Protection structure		IP67 (IEC standard)			
Cable		Ø4mm, 3-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)			
Material		Case: Heat-resistant acrylonitrile butadiene styrene, Standard cable (black): Polyvinyl chloride (PVC)			
Approval		CE			
Weight※2		Approx. 70g	Approx. 111g		Approx. 185g

● AC 2-wire type

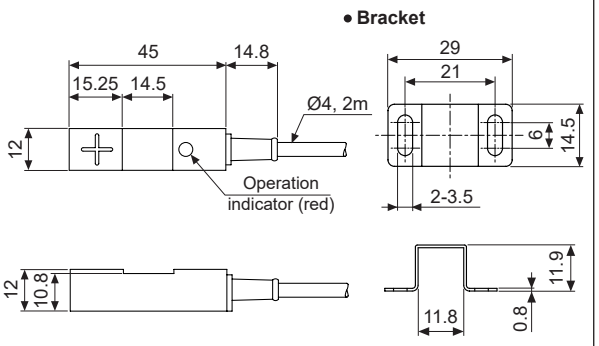
Model		PSN25-5AO PSN25-5AC	PSN30-10AO PSN30-10AC	PSN30-15AO PSN30-15AC	PSN40-20AO PSN40-20AC
Sensing side		Front side			
Sensing distance		5mm	10mm	15mm	20mm
Hysteresis		Max. 10% of sensing distance			
Standard sensing target		25×25×1mm (iron)	30×30×1mm (iron)	45×45×1mm (iron)	60×60×1mm (iron)
Setting distance		0 to 3.5mm	0 to 7mm	0 to 10.5mm	0 to 14mm
Power supply (operating voltage)		100-240VAC～ (85-264VAC～)			
Leakage current		Max. 2.5mA			
Response frequency※1		20Hz			
Residual voltage		Max. 10V			
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃			
Control output		5 to 200mA			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,500VAC 50/60Hz for 1 min			
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in X, Y, Z direction for 3 times			
Indicator		Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Surge protection circuit			
Protection structure		IP67 (IEC standard)			
Cable		Ø4mm, 2-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)			
Approval		CE			
Unit weight		Approx. 65g	Approx. 106g		Approx. 152g

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※Environment resistance is rated at no freezing or condensation.

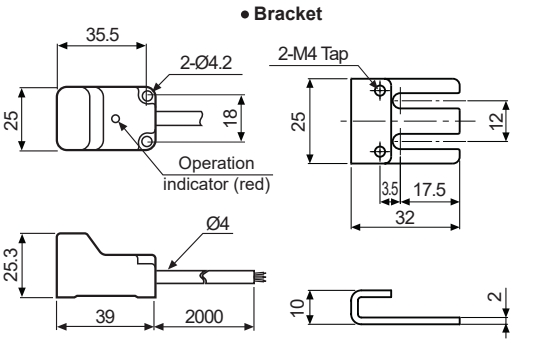
▣ Dimensions

(unit: mm)

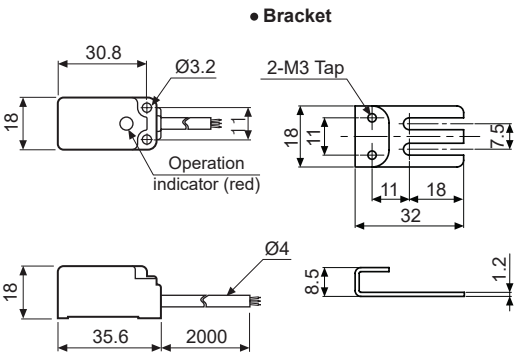
● PS12



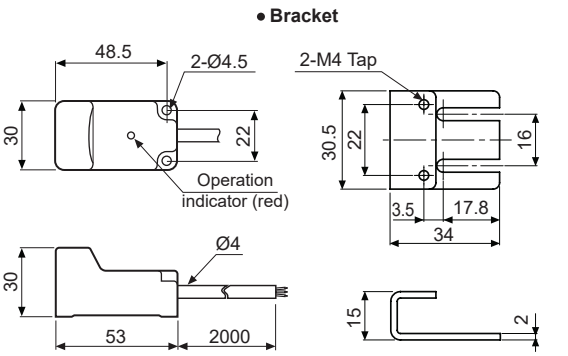
● PSN25



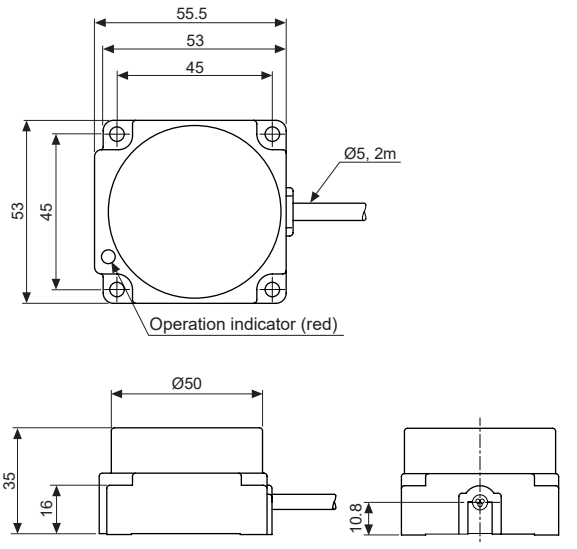
● PSN17 / PSNT17(former: PS17/ PST17)



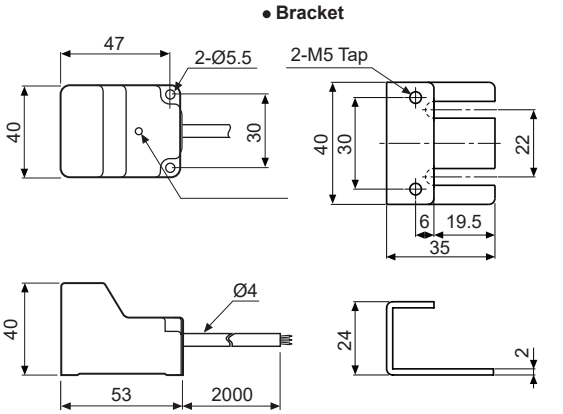
● PSN30



● PS50



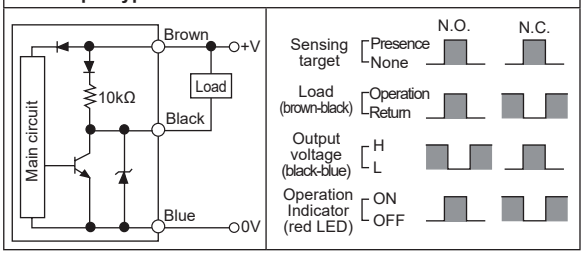
● PSN40



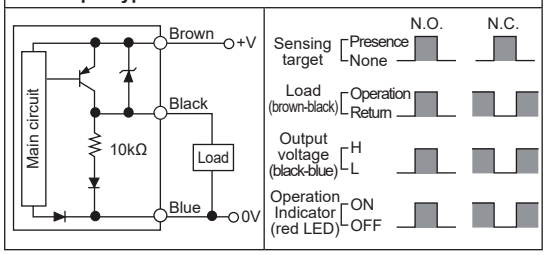
▣ Control Output Diagram and Load Operation

◎ DC 3-wire type

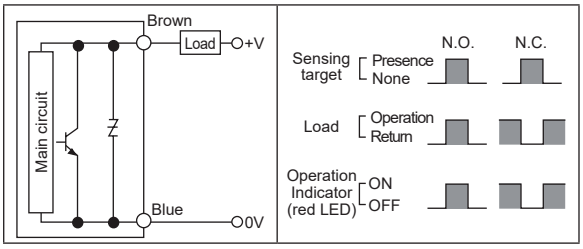
NPN output type



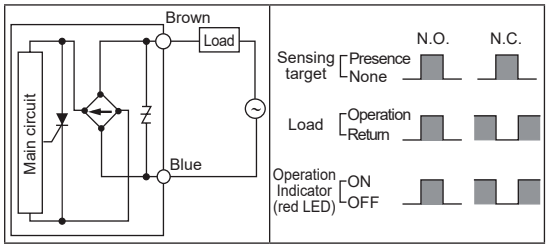
PNP output type



◎ DC 2-wire type

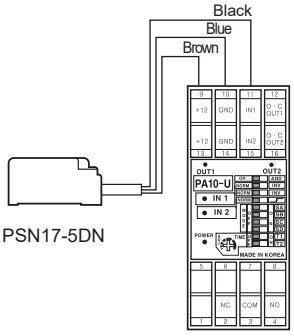


◎ AC 2-wire type

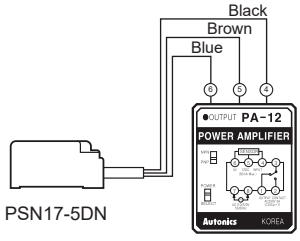


▣ Connections

◎ DC 3-wire type



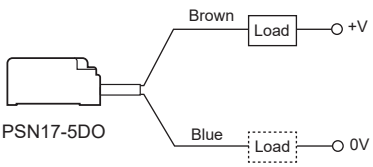
< PA10-U >



< PA-12 >

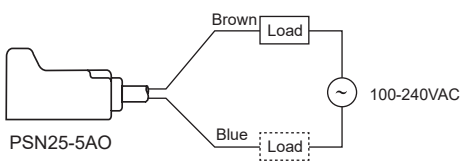
※There is NPN/PNP selection switch in PA-12.

◎ DC 2-wire type



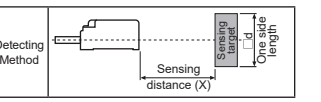
※The load can be connected to either wire.

◎ AC 2-wire type

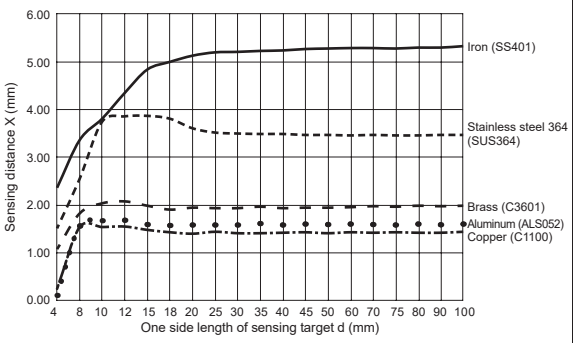


※The load can be connected to either wire.

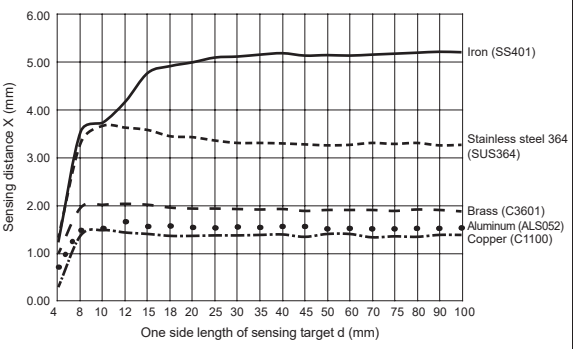
▣ Sensing Distance Feature Data by Target Material and Size



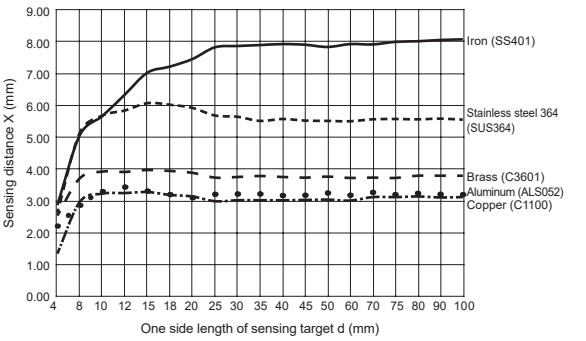
● PSNT17-5D□



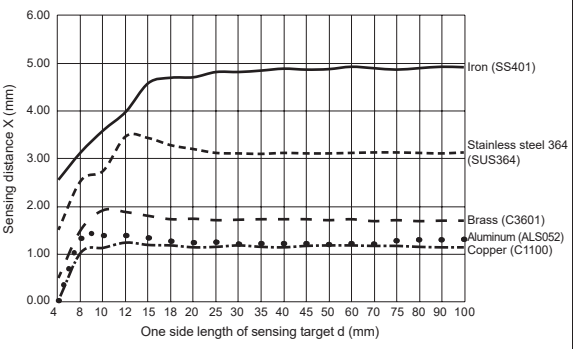
● PSN17-5D□



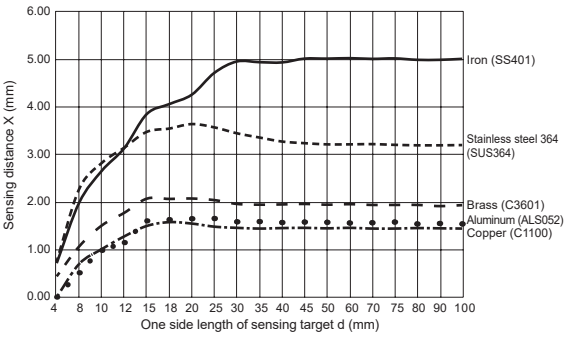
● PSN17-8D□



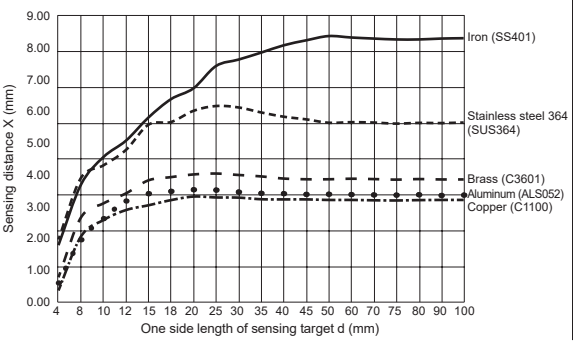
● PSN25-5□



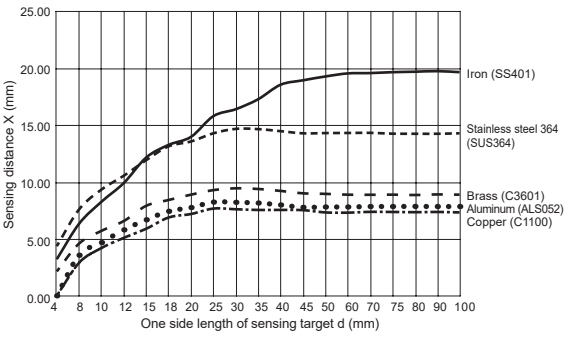
● PSN30-10□



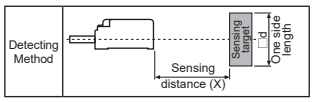
● PSN30-15□



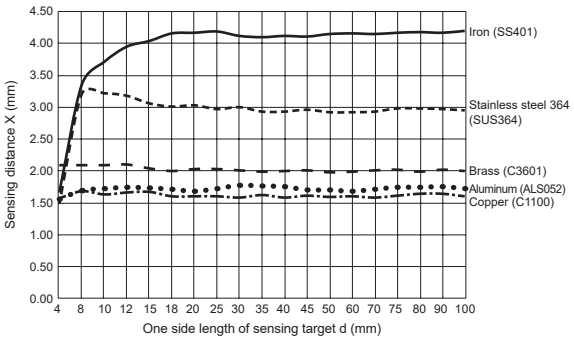
● PSN40-20□



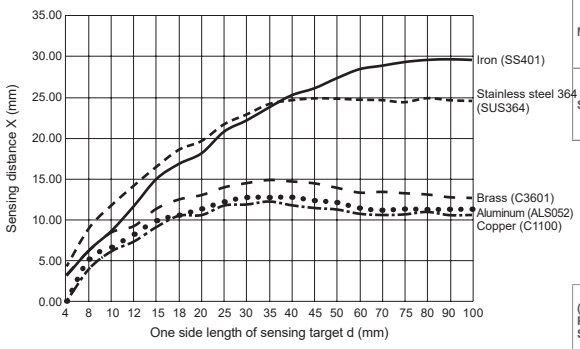
■ Sensing Distance Feature Data by Target Material and Size



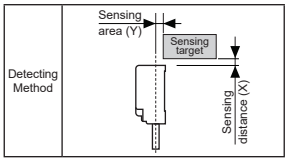
● PS12-4D□



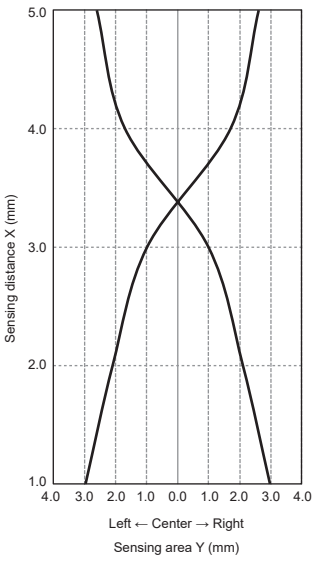
● PS50-30D□



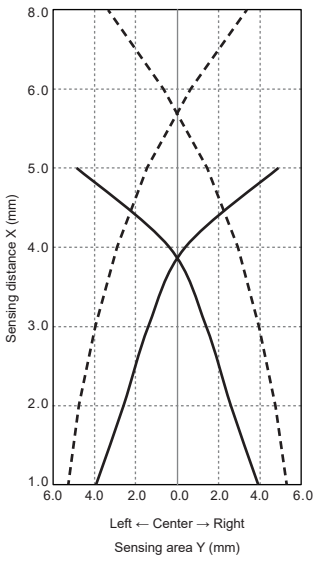
■ Sensing Distance Feature Data by Parallel (Left/Right) Movement



● PSNT17-5D□

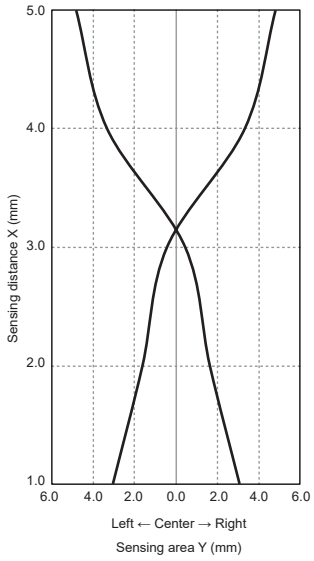


● PSN17-5D□/8D□

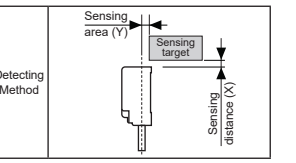


———	PSN17-5D□
- - - -	PSN17-8D□

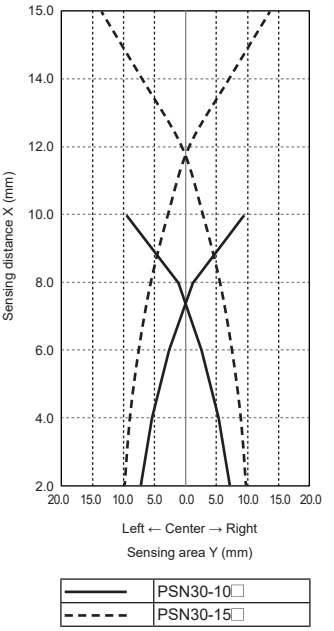
● PSN25-5□



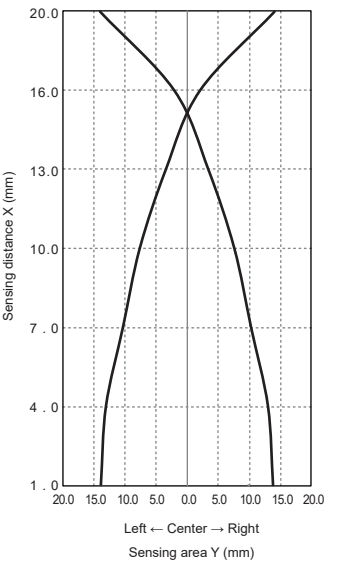
▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement



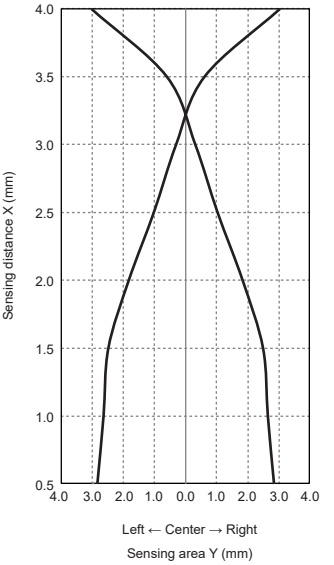
● PSN30-10□/15□



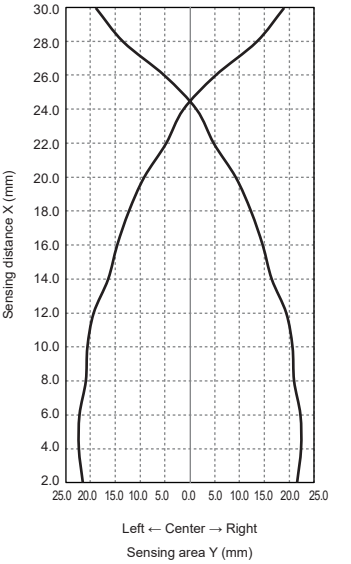
● PSN40-20□



● PS12-4D□

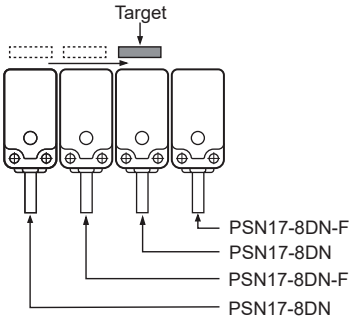


● PS50-30D□



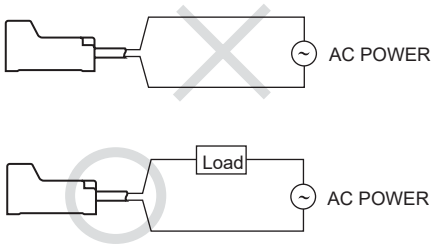
▣ Proper Usage

◎ Differential frequency



When installing several proximity sensor closely, it may cause malfunction due to mutual interference. Therefore, please use differential frequency for the application
※Differential frequency type is only for 17 square.

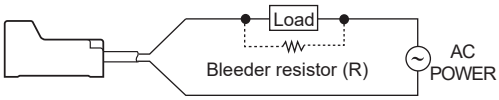
◎ Connection of the power supply



When using DC 2-wire and AC 2-wire type, a load must be connected before applying power; otherwise, components can be damaged.

◎ In case of the load current is small

● AC 2-wire type



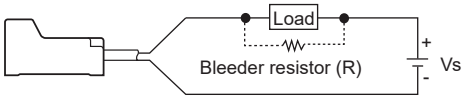
110VAC: Min. 20kΩ 3W
220VAC: Min. 39kΩ 10W

It may cause return failure of load by residual voltage.
If the load current is under 5mA, please make sure the residual voltage is less than the return voltage of the load by connecting a bleeder resistor in parallel with the load as shown in the diagram.

$$R \le \frac{Vs}{I}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[I: Action current of load, R: Bleeder resistance, P: Permissible power]

● DC 2-wire type



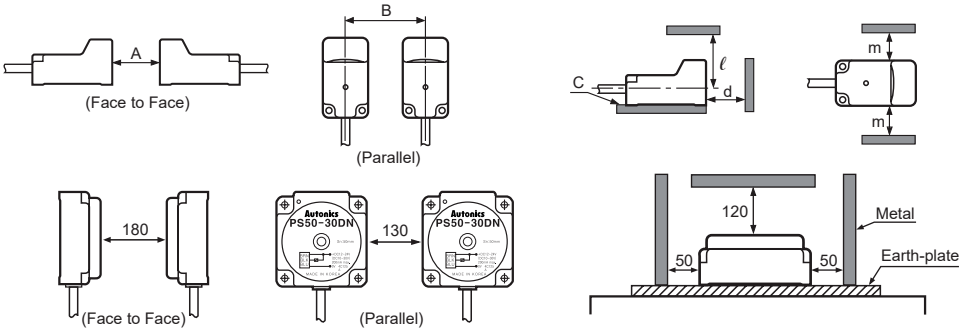
Please make the current on proximity sensor smaller than the return current of load by connecting a Bleeder resistor in parallel.
※W value of Bleeder resistor should be bigger for proper heat dissipation.

$$R \le \frac{Vs}{Io\text{-}Ioff}(k\Omega) \qquad P > \frac{Vs^2}{R}(W)$$

[Vs: Power supply, Io: Min. action current of proximity sensor
Ioff: Return current of load, P: Number of Bleeder resistance watt]

◎ Mutual-interference & Influence by surrounding metals

When several proximity sensors are mounted close to one another a malfunction of the may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.



(unit: mm)

Item \ Model	PS12	PSN17 / PSNT17		PSN25	PSN30		PSN40
	4mm	5mm	8mm	5mm	10mm	15mm	20mm
A	24	30	48	30	60	90	120
B	24	36	40	40	50	65	70
C	5	5	5	5	5	5	5
d	12	15	24	15	30	45	60
ℓ	18	24	33	25	30	45	45
m	12	18	20	20	25	35	35

Rectangular, Flat Type Proximity Sensor

▣ Features

- Easy to mount in narrow space by flat structure (height: 10mm)
- Improved the noise immunity with dedicated IC (DC type)
- Built-in reverse polarity protection circuit, output short over current protection circuit (DC type)
- Built-in surge protection circuit
- Red LED operation indicator
- IP67 protection structure (IEC standard)
- Replaceable for micro switches and limit switches

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

CE

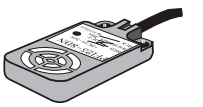
▣ Type

◎ DC 3-wire type

Appearance	Model
	**PFI25-8DN**
	PFI25-8DP
	PFI25-8DN2 ※
	PFI25-8DP2 ※

※ mark can be customized.

◎ AC 2-wire type

Appearance	Model
	**PFI25-8AO**
	PFI25-8AC

▣ Specification

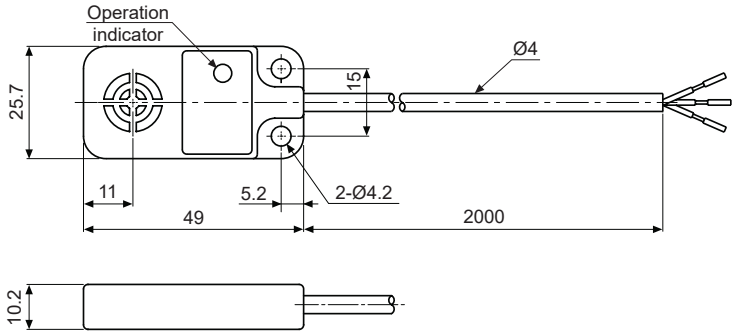
Model		**PFI25-8DN** **PFI25-8DN2** **PFI25-8DP** **PFI25-8DP2**	**PFI25-8AO** **PFI25-8AC**
Sensing side		Upper side	
Sensing distance		8mm	
Hysteresis		Max. 10% of sensing distance	
Standard sensing target		25×25×1mm (iron)	
Setting distance		0 to 5.6mm	
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)	100-240VAC～ (85-264VAC～)
Current consumption/ Leakage current		Max. 10mA	Max. 2.5mA
Response frequency※1		200Hz	20Hz
Residual voltage		Max. 1.5V	Max. 10V
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃	
Control output		Max. 200mA	5 to 150mA
Insulation resistance		Over 50MΩ (at 500VDC megger)	
Dielectric strength		1,500VAC 50/60Hz for 1 min	2,500VAC 50/60Hz for 1 min
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Indicator		Operation indicator: Red LED	
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃	
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH	
Protection circuit		Surge protection circuit, reverse polarity protection circuit, output short over current protection circuit	Surge protection circuit
Cable		Ø4mm, 3-wire, 2m	Ø4mm, 2-wire, 2m
		AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25	
Material		Case: Poly Phenylene Sulfide, Standard cable (black): Polyvinyl chloride (PVC)	
Protection structure		IP67 (IEC standard)	
Approval		CE	
Unit weight		Approx. 70g	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.

※Environment resistance is rated at no freezing or condensation.

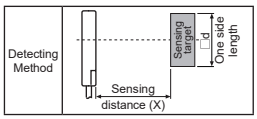
▣ Dimensions

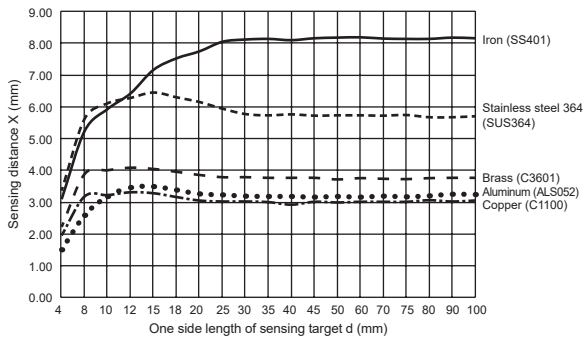
(unit: mm)



▣ Sensing Distance Feature Data by Target Material and Size

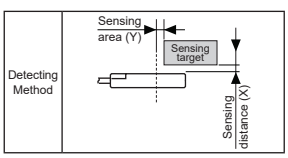
● **PFI25-8□**

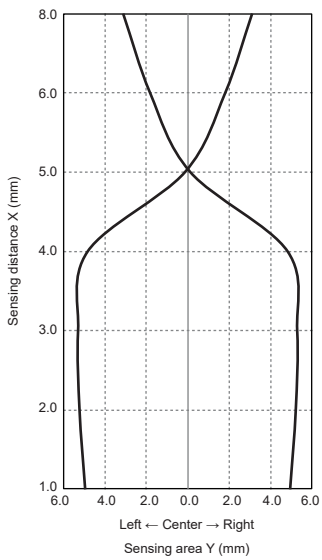




▣ Sensing Distance Feature Data by Parallel (Left/Right) Movement

● **PFI25-8□**

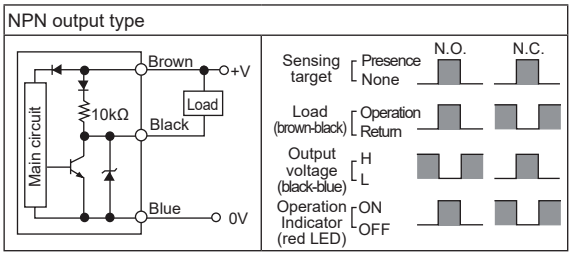




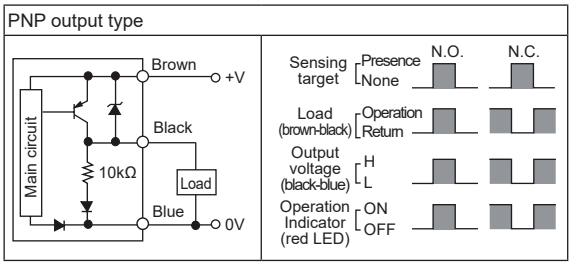
▣ Control Output Diagram and Load Operation

◎ DC 3-wire type

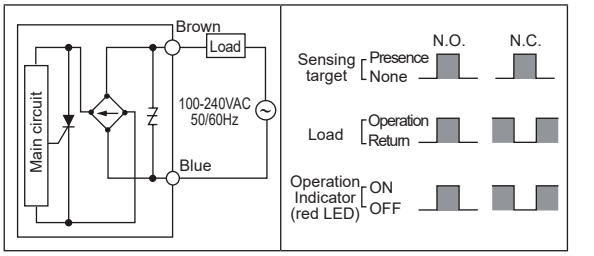
NPN output type



PNP output type



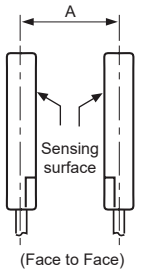
◎ AC 2-wire type



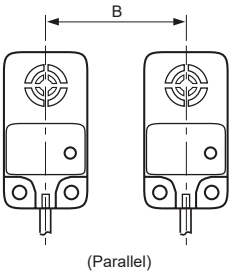
▣ Proper Usage

◎ Mutual-interference

When several proximity sensors are mounted close to one another a malfunction of the sensor may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.



(Face to Face)



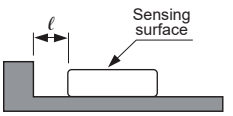
(Parallel)

(unit: mm)

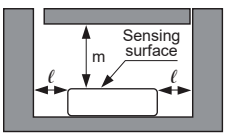
A	100
B	80

◎ Influence by surrounding metals

When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.



When the height between the proximity sensor and surrounding metals is same.



When the height between the proximity sensor and surrounding metals is different.

(unit: mm)

ℓ	5
m	15

Rectangular, Long Sensing Distance Type Proximity Sensor

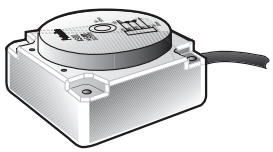
▣ Features

- Sensing up to as 50mm
- Improved the noise immunity with dedicated IC
- Built-in reverse polarity protection circuit, surge protection circuit, output short over current protection circuit
- Wide range of power supply: 12-48VDC (voltage range: 10-65VDC)
- Simultaneous output of Normally Open+Normally Closed
- Built-in power indicator and operation indicator
- IP67 protection structure (IEC standard)

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

▣ Type

◎ DC 4-wire long distance type

Appearance	Model
	**AS80-50DN3**
	AS80-50DP3

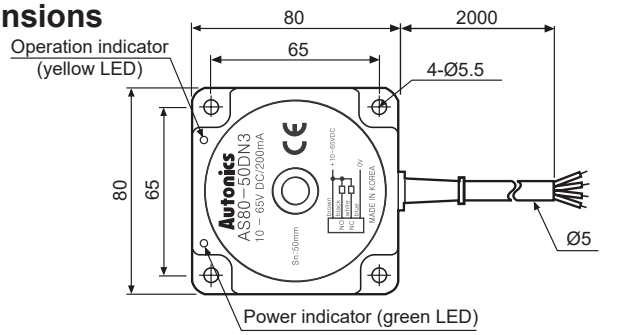
▣ Specification

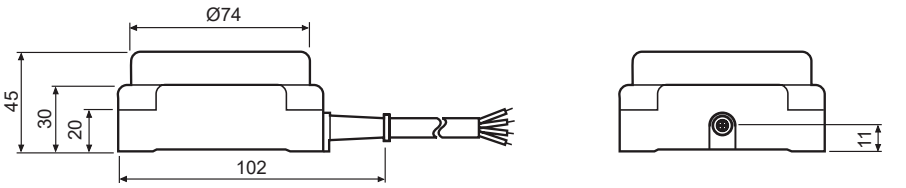
Model		**AS80-50DN3**	**AS80-50DP3**
Sensing side		Upper side	
Sensing type		NPN Normally Open + Normally Closed	PNP Normally Open + Normally Closed
Sensing distance		50mm	
Hysteresis		Max. 15% of sensing distance	
Standard sensing target		150×150×1mm (iron)	
Setting distance		0 to 35mm	
Power supply (operating voltage)		12-48VDC⎓ (10-65VDC⎓)	
Current consumption		Max. 20mA	
Response frequency※1		30Hz	
Residual voltage		Max. 2V	
Affection by Temp.		Max. ±10% for sensing distance at ambient temperature 20℃	
Control output		Max. 200mA	
Insulation resistance		Over 50MΩ (at 500VDC megger)	
Dielectric strength		1,500VAC 50/60Hz for 1 min	
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (appox. 50G) in X, Y, Z direction for 3 times	
Indicator		Power indicator: Green LED, Operation indicator: Yellow LED	
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃	
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH	
Protection circuit		Surge protection circuit, reverse polarity protection circuit, output short over current protection circuit	
Cable		Ø5mm, 4-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator diameter: Ø1.25mm)	
Approval		CE	
Protection structure		IP67 (IEC standard)	
Unit weight		Approx. 470g	

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※Environment resistance is rated at no freezing or condensation.

■ Dimensions

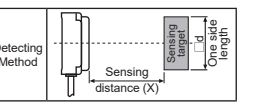
(unit: mm)

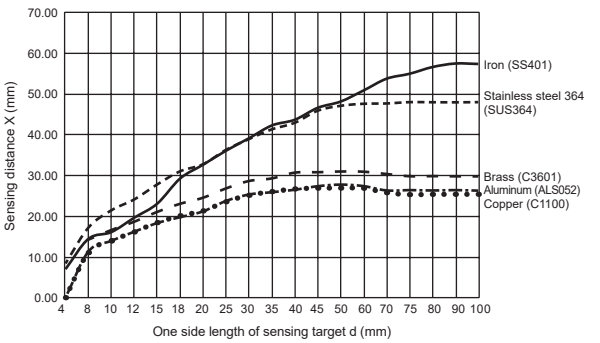




■ Sensing Distance Feature Data by Target Material and Size

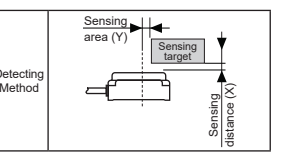
● **AS80-50D□**

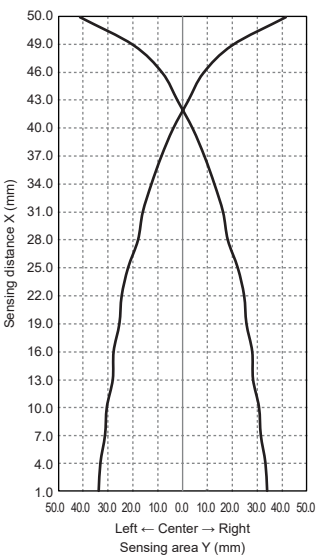




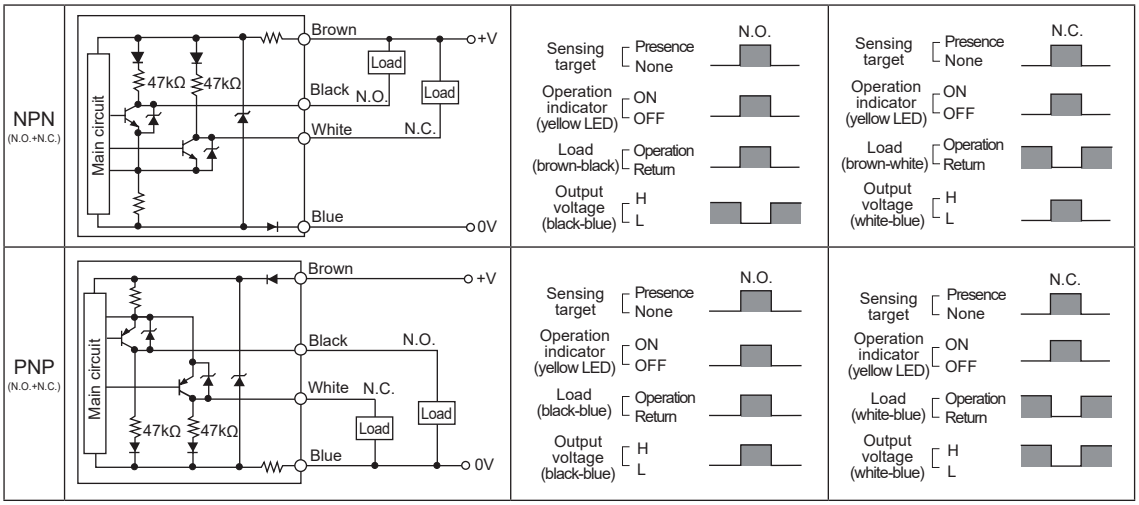
■ Sensing Distance Feature Data by Parallel (Left/Right) Movement

● **AS80-50D□**





▣ Control Output Diagram and Load Operation



▣ Proper Usage

◎ Mutual-interference

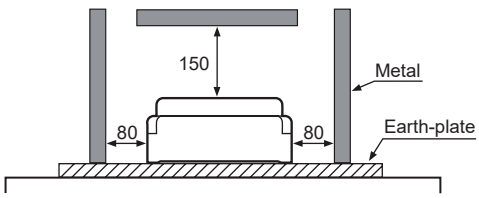
When several proximity sensors are mounted close to one another a malfunction of the sensor may be caused due to mutual interference. Therefore, be sure to provide a minimum distance between the two sensors as below chart indicates.

(unit: mm)

◎ Influence by surrounding metals

When sensors are mounted on metallic panel, you must prevent the sensors from being affected by any metallic object except target. Therefore, be sure to provide a minimum distance as below chart indicates.

(unit: mm)



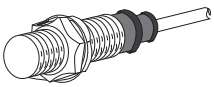
Tranmission coupler

■ Features

- Loop powered type
  The signal is transmitted by magnetic coupling of coils.
- Superior with environmental resistance
  Non-malfunction for oil or dust on transmission part
- Applications
  Drilling, Machine table, Robot arm, Conveyor belt and Various revolution axis.

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

■ Type

Appearances		Model
M18		**PET18-5**

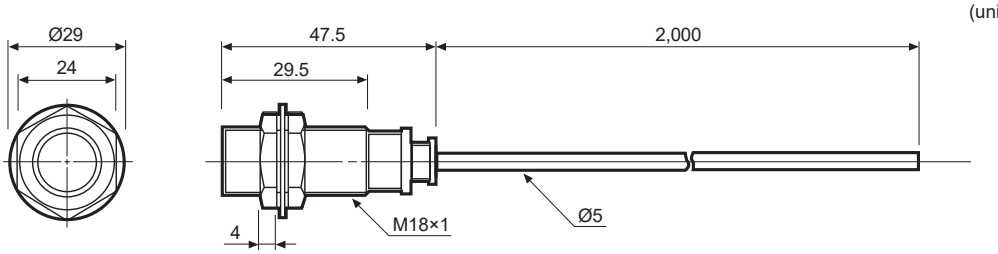
■ Specifications

Model		**PET18-5**						
Transmitting distance		5mm						
Set transmitting distance		1 to 4.5mm						
Response time		Max. 1ms						
Insulation resistance		Over 50MΩ (at 500VDC megger)						
Dielectric strength		1,500VAC 50/60Hz for 1 min						
Vibration		1mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours						
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times						
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃						
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH						
Protection structure		IP67 (IEC standard)						
Cable		Ø5mm, 2-wire, 2m (AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)						
Material		Case and nut: Nickel-plated brass, Washer: Nickel-plated steel, Sensing part: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC)						
Weight※1		Approx. 133g (approx. 121g)						
Application of proximity sensor		PR18-5DN PR18-5DP PR18-5DN2 PR18-5DP2	PRW18-5DN PRW18-5DP PRW18-5DN2 PRW18-5DP2	PRCM18-5DN PRCM18-5DP PRCM18-5DN2 PRCM18-5DP2	PRWL18-5DN PRWL18-5DP PRWL18-5DN2 PRWL18-5DP2	PRL18-5DN PRL18-5DP PRL18-5DN2 PRL18-5DP2	PRCML18-5DN PRCML18-5DP PRCML18-5DN2 PRCML18-5DP2	PRT18-5DO PRT18-5DC PRCMT18-5DO PRCMT18-5DC

※1: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

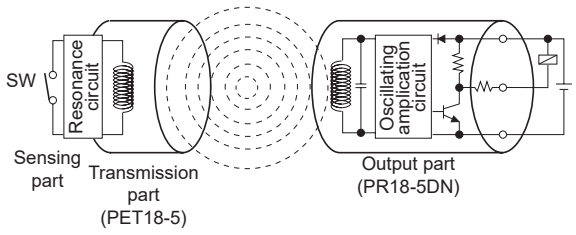
■ Dimensions

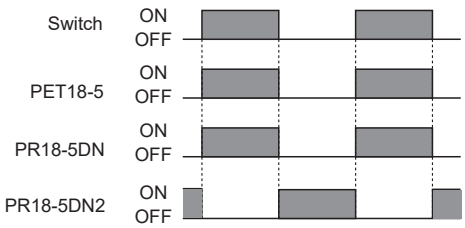
(unit: mm)



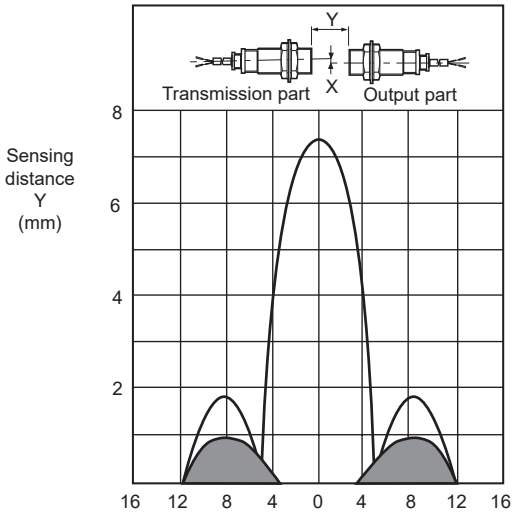
▣ Operation Mechanism

It transmits ON/OFF signal with a magnetic coupling of coils. The coil of transmission part and proximity sensor is coupled electronically, the induced current is generated at closed-loop of transmission part influenced by a magnetic field from proximity sensor coil when the switch of sensing part is ON.



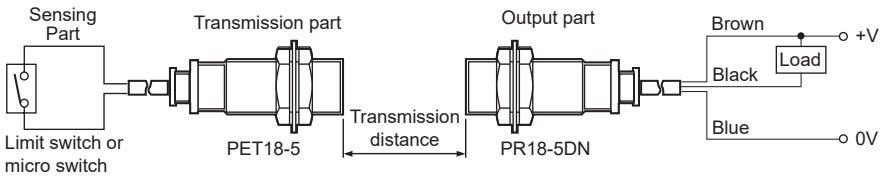


▣ Feature Data



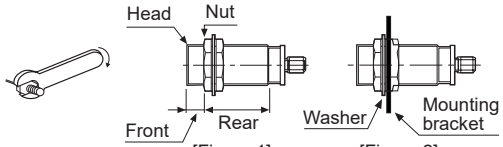
Please note the proximity sensor detects the surrounding cover of the sensing side of transmission coupler even the connection switch is OFF in sensing part of ▩ part.

▣ Connections



▣ Proper Usage

1. This equipment shall not be used outdoors or beyond specified temperature range.
2. Do not apply over tensile strength of cord. (Ø5: Max. 50N)
3. Do not use the same conduit with cord of this unit and electric power line or power line.
4. Do not put overload to tighten nut, please use the supplied washer for tightening.



[Figure 1] [Figure 2]

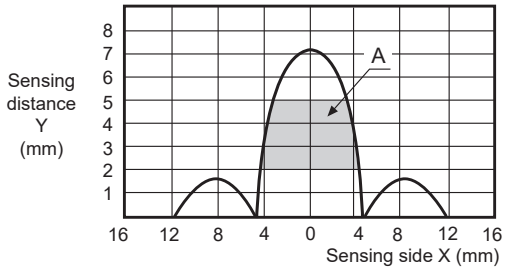
[Table 1]

Model \ Strength		Front		Rear
		Size	Torque	Torque
PET18-5	Flush	—	150kgf·cm (14.7N·m)	

Note1) Allowable tightening torque of a nut may be different by the distance from the head. For allowable tightening torque and the range of front and rear parts, refer to [Table 1] and above[Figure 1] respectively. The rear part includes a nut on the head side(as the [Figure 1]). Please apply a tightening torque of the front part when the nut on the front is located in the front part.

Note2) The allowable tightening torque denotes a torque value when using a provided washer as above [Figure 2].

5. Please shorten the wiring to avoid noise.
6. Please use the cable written on the specification of the product. If the other cable or a crooked cable is used, the waterproof cannot be maintained.
7. 0.3mm^2 or larger cable can be extended up to 5m.
8. When the transceiver is attached to the proximity sensor or close to the wires, it may cause a malfunction.
9. The contact switch in the sensing part should not have leakage current when it is OFF.
10. The contact resistance is under 300mΩ, open resistance is more than 10MΩ to satisfy the specification of contact switch. (limit switch or micro switch)
11. The inductive proximity sensor used in output part may cause a malfunction, if metal particles attach to sensing area.
12. It is able to transmit signal through the plastic or mirror.
13. Please set sensing distance within part A of the below operation range for mounting at the rotator.



Cylindrical, Capacitive type proximity sensor

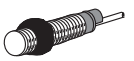
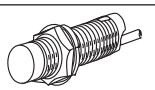
■ Features

- Sensing of iron, metal, plastic, water, stone, wood etc.
- Long life cycle and high reliability
- DC type: Built-in surge protection circuit,
  reverse polarity protection circuit
  AC type: Built-in surge protection circuit
- Easy to adjust of the sensing distance with sensitivity adjuster
- Red LED operation indicator
- Easy to control of level and position

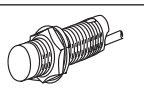
Please read "Safety Considerations" in the instruction manual before using.

■ Type

◎ DC 3-wire type

Appearances		Model
M18		**CR18-8DN**
		CR18-8DP
		CR18-8DN2 ※
M30		**CR30-15DN**
		CR30-15DP
		CR30-15DM2 ※

◎ AC 2-wire type

Appearances		Model
M18		**CR18-8AO**
		CR18-8AC
M30		**CR30-15AO**
		CR30-15AC

※ mark can be customized.

■ Specifications

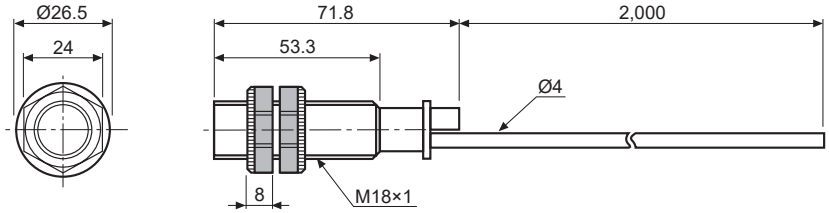
Model		**CR18-8DN CR18-8DP CR18-8DN2**	**CR30-15DN CR30-15DP CR30-15DN2**	**CR18-8AO CR18-8AC**	**CR30-15AO CR30-15AC**
Diameter of the sensing side		18mm	30mm	18mm	30mm
Sensing distance		8mm	15mm	8mm	15mm
Installation		Non-shield (non-flush)			
Hysteresis		Max. 20% of sensing distance			
Standard sensing target		50×50×1mm (iron)			
Setting distance		0 to 5.6mm	0 to 10.5mm	0 to 5.6mm	0 to 10.5mm
Power supply (operating voltage)		12-24VDC⎓ (10-30VDC⎓)		100-240VAC～ 50/60Hz (85-264VAC～)	
Current consumption		Max. 15mA		—	
Leakage current		—		Max. 2.2mA	
Response frequency※1		50Hz		20Hz	
Residual voltage		Max. 1.5V		Max. 20V	
Affection by Temp.		Max. ±20% for sensing distance at ambient temperature 20℃			
Control output		Max. 200mA		5 to 200mA	
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,500VAC 50/60Hz for 1 min			
Vibration		1mm amplitude at frequency of 10 to 55Hz (for 1 min) in each of X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each of X, Y, Z direction for 3 times			
Indicator		Operation indicator: Red LED			
Environment	Ambient temperature	-25 to 70℃, storage: -30 to 80℃			
	Ambient humidity	35 to 95%RH, storage: 35 to 95%RH			
Protection circuit		Reverse polarity protection circuit, Serge protection circuit		Serge protection circuit	
Protection structure		IP66 (IEC standard)	IP65 (IEC standard)	IP66 (IEC standard)	IP65 (IEC standard)
Cable		Ø4mm, 3-wire, 2m	Ø5mm, 3-wire, 2m	Ø4mm, 2-wire, 2m	Ø5mm, 2-wire, 2m
		AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm			
Material		CR18 - Case/Nut: PA6, Standard cable (black): Polyvinyl chloride (PVC) CR30 - Case/Nut: Nickel plated brass, Washer: Nickel plated iron, Sensing surface: Polybutylene terephthalate, Standard cable (black): Polyvinyl chloride (PVC)			
Weight※2		Approx. 88g (approx. 76g)	Approx. 243g (approx. 206g)	Approx. 82g (approx. 70g)	Approx. 237g (approx. 200g)

※1: The response frequency is the average value. The standard sensing target is used and the width is set as 2 times of the standard sensing target, 1/2 of the sensing distance for the distance.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

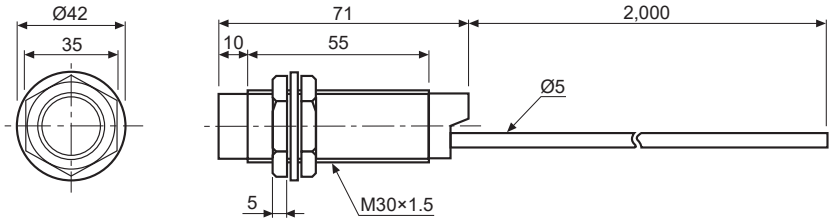
▣ Dimensions

(unit: mm)

● **CR18-8□□**



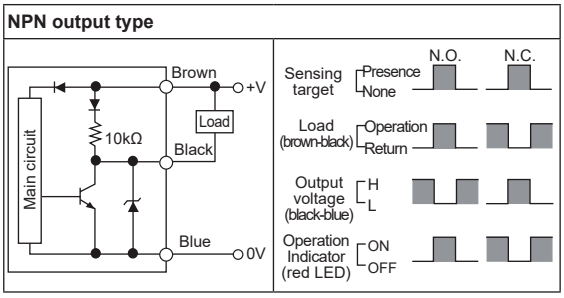
● **CR30-15□□**



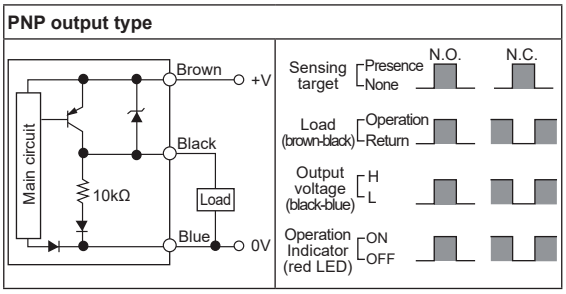
▣ Control Output Diagram and Load Operation

◎ DC 3-wire type

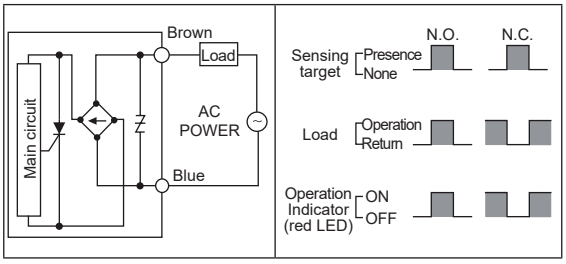
NPN output type



PNP output type

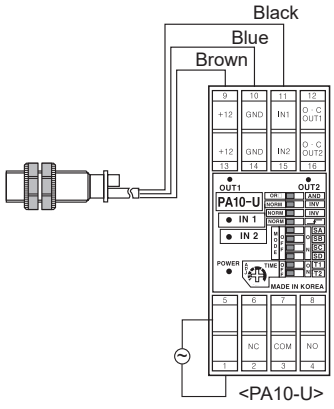


◎ AC 2-wire type

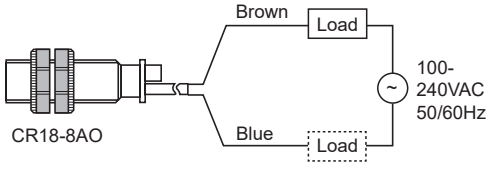


▣ Connections

◎ DC 3-wire type



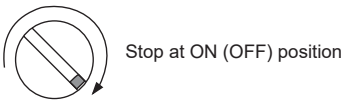
◎ AC 2-wire type



▣ Sensitivity Adjustment

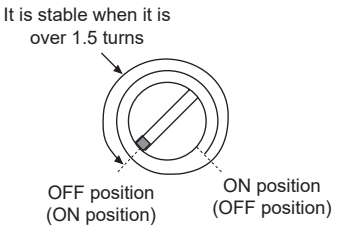
Please turn potention VR to set sensitivity as below procedure.

1. Without a sensing object, turn the potention VR to the right and stop at the proximity sensor is ON (OFF).

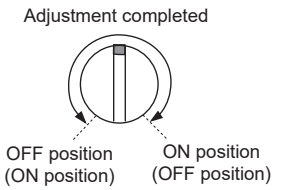


2. Put the object in right sensing position, turn the potention VR to the left and stop at the proximity sensor is OFF (ON).

3. If the difference of the number of potention VR rotation between the ON (OFF) point and the OFF (ON) point is more than 1.5 turns, the sensing operation will be stable.



4. If it is set in sensitivity adjustment position of potention VR at center between **1** and **2**, sensitivity setting will be completed.



※When there is distance fluctuation between proximity sensor and the target, please adjust **2** at the farthest distance from this unit.
※Turning potention VR toward clockwise, it will be max., or turning toward counter clockwise, it will be min. The number of adjustment should be 15±3 revolution and if it is turned to the right or left excessively, it will not stop, but it idles without breakdown.
※( ) is for Normally closed type.

▣ Grounding

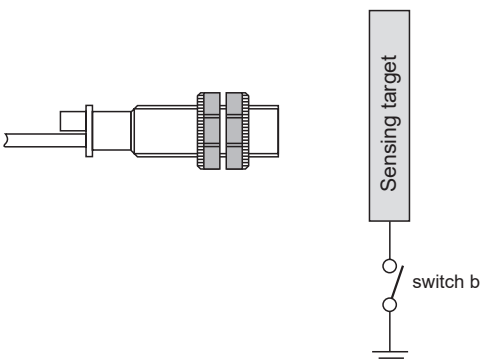
The sensing distance will be changed by grounding status of capacitive proximity sensor and the target[50×50×1mm(Iron)]. Please check the material when installing the sensor and selecting the target.

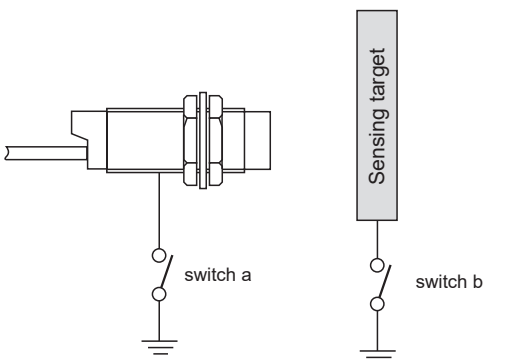
● CR18 type

Ground condition (switch b)	ON	OFF
Operating distance (mm)	8	4

● CR30 type

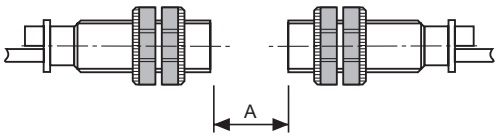
Ground condition	Switch a	ON	OFF	ON	OFF
	Switch b	ON	ON	OFF	OFF
Operating distance (mm)		15	18	6	6





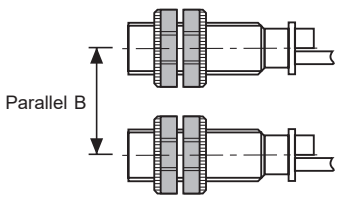
▣ Mutual-Interference & Influence by Surrounding Metals

When several proximity sensors are mounted closely, malfunction of sensor may be caused due to mutual interference. Therefore, be sure to keep a minimum distance between the two sensors as below charts.

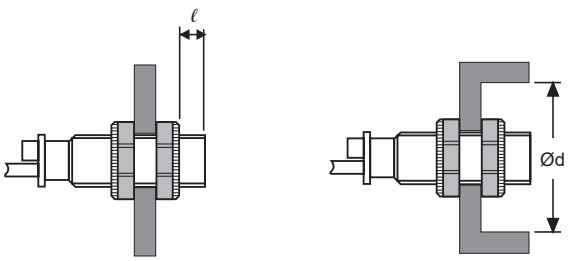


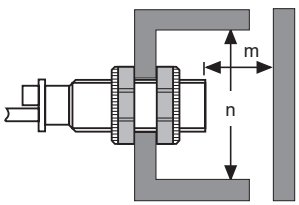
(unit: mm)

Item \ Model	CR18	CR30
A	48	90
B	54	90



When sensors are mounted on metallic panel, you must prevent the sensors from malfunction by any metallic object. Therefore, be sure to keep a minimum distance as below charts.





(unit: mm)

Item \ Model	CR18	CR30
ℓ	20	10
Ød	54	90
m	24	45
n	54	90

▣ Materials

◎ Materials of sensing targets
Sensing distance may be different by electrical characteristic of sensing target (conductivity, non dielectric constant) and status of water absorption, size etc.

◎ Effect by high frequency electrical field
It may cause malfunction by machinery which generate high frequency of electrical field such as a washing machine etc.

◎ Surrounding environment
There is water or oil on surface of sensing part, it may cause malfunction.
If the bottle for sensing of level is coated by oil etc., it may cause malfunction.
Especially, 15mm type has high sensitivity for induced objects, please be careful of waterdrops.

◎ Organic solvents
Do not let the oil or oil liquid is flowed into the sensor because the case is made by plastic.

KCR/S Series

Capacitive Proximity Sensor

- Sensing of metal, plastic, liquid, wood etc.
- Easy to adjust sensing distance
- Various Sizes (M12, M18, M30)
- Long life cycle and high reliability

Ordering Information

KCR **K5** **21** **3**

① ② ③

		Size	Sensing Distance	Detecting Face
① Size/ Detecting Face	**E4**	M12	2mm	Flush
	G4		4mm	Non-Flush
	H5	M18	5mm	Flush
	K5		8mm	Non-Flush
	L6	M30	10mm	Flush
	P6		15mm	Non-Flush

		Type	Output	Power Supply
② Output/ Power Supply	**11**	DC 3-wire	NPN NO	10 ~ 30VDC
	21		NPN NC	
	31		PNP NO	
	41		PNP NC	
	55*	AC 2-wire	NO	20 ~ 240VAC
	65*		NC	

③ Cable Type	**no mark**	2m cable
	3	M12 Connector

* For M18(H5, K5) only

KCS Series

Model	Output	Wiring	Type/ Power	Sensing Distance	Body
KCS LG11	NPN NO	2m cable	DC 3-wire, 10~30 VDC	10mm	Rectangular Plastic body Non-flush
KCS LG21	NPN NC				
KCS LG31	PNP NO				
KCS LG41	PNP NC				

Specifications

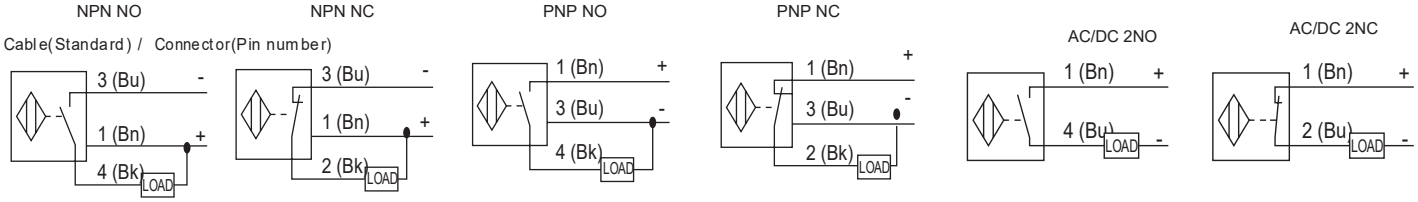
Detected Objects	Metal, Plastic, Liquid, Granular Materials etc.
Hysteresis	Max. 4% ~ 20% of sensing distance
Operation Indicator	LED
Protection Circuit	Surge protection circuit, Reverse polarity protection circuit
Ambient Temperature	-25°C to 70°C
Ambient Humidity	35% ~ 95%
Affection by Temperature	Max. ±10% for sensing distance at ambient temperature 23°C
Affection by Voltage	Max. ±1% for sensing distance at rated voltage ±15%
Insulation Resistance	Over 50MΩ (at 500VDC megger)
Vibration	1.5mm amplitude at frequency of 10Hz ~ 55Hz in each of X, Y, Z direction for 2 hours
Shock	500m/S2 (approx. 50G) in each of X, Y, Z direction for 10 times
Meterial	KCR: Nickel copper plate KCS: Plastic
IP rate	IP67

	KCR DC 3-wire	KCR AC 2-wire	KCS DC 3-wire
Power Supply	10 ~ 30VDC	20 ~ 240VAC	10 ~ 30VDC
Current Consumption	Max. 15mA	-	Max. 10mA
Leakage Current	-	Max. 2.2mA	-
Voltage Drop	Residual Voltage: Max. 2V Load Current: Max. 200mA	Load Current : 5 ~ 300mA	Residual Voltage: Max. 1.5V Load Current : Max. 200mA
Dielectric Strength	1,000VAC, 50/60Hz for 1 min	4,000VAC, 50/60Hz for 1 min	1,000VAC, 50/60Hz for 1 min
Mex. Response Frequency	50Hz	15Hz	30Hz

Wiring Diagram

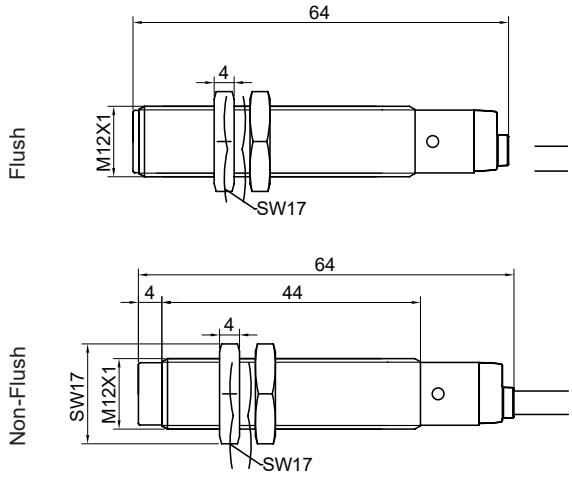
Bu = Blue Bn = brown Bk = Black

Cable(Standard) / Connector(Pin number)

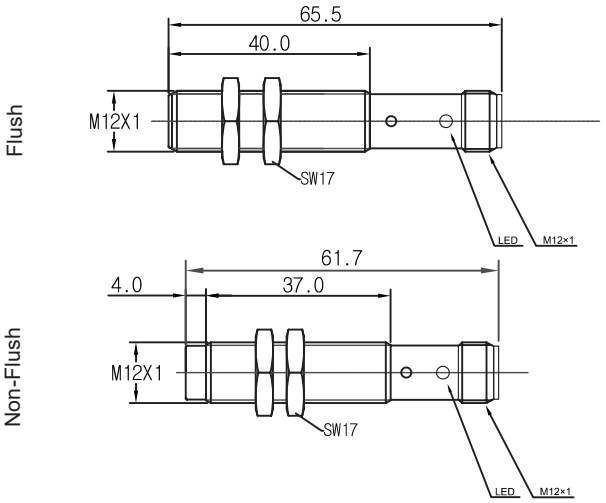


Dimensions (Unit: mm)

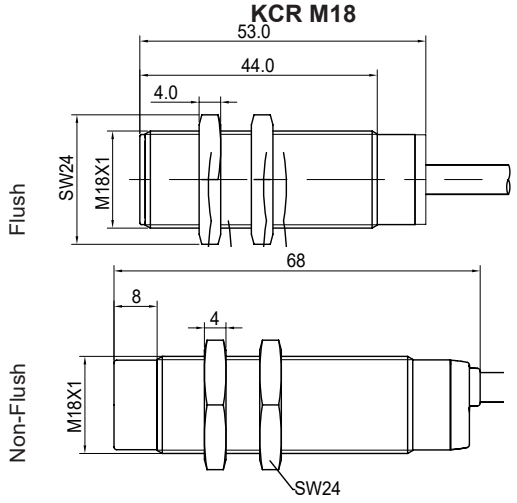
KCR M12



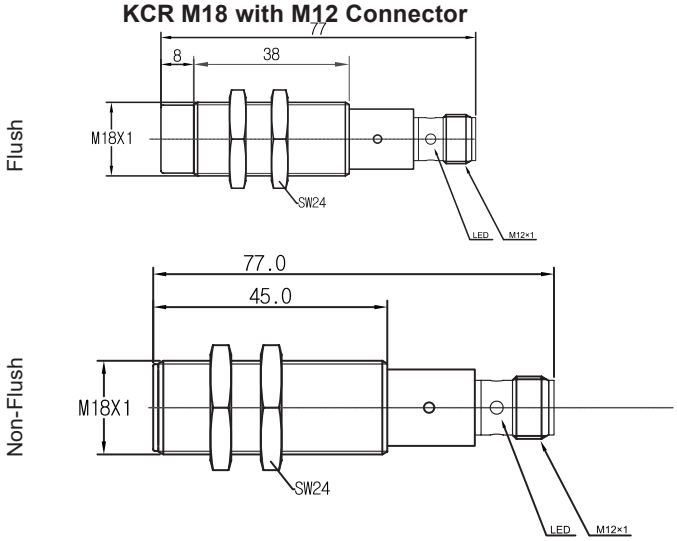
KCR M12 with M12 Connector



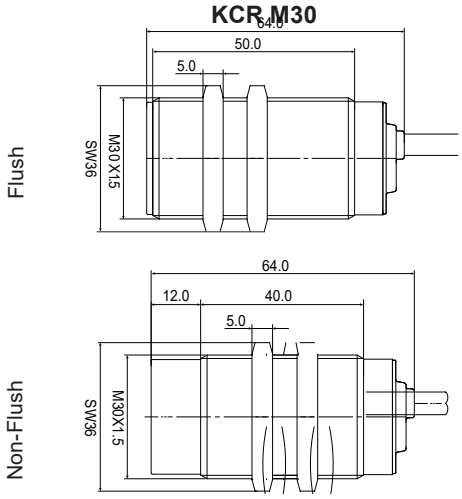
KCR M18



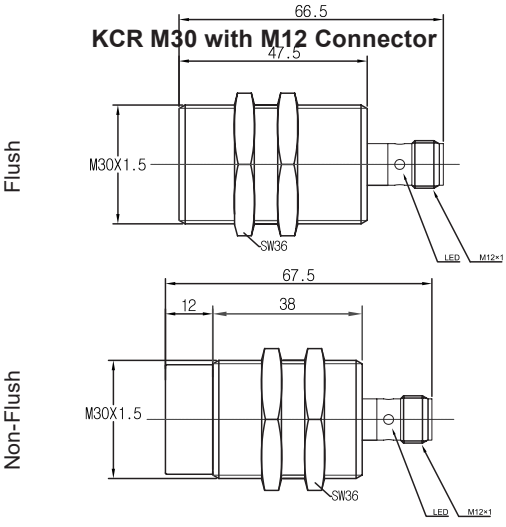
KCR M18 with M12 Connector



KCR M30



KCR M30 with M12 Connector



KCS-LG

Color Mark Sensor

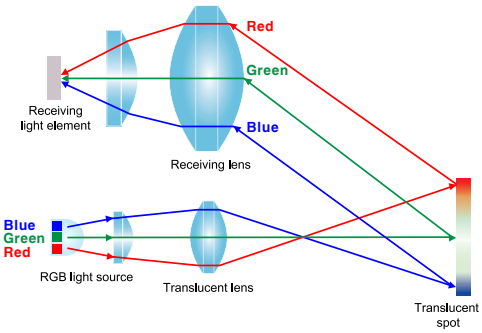
Feature

- Outstanding color matching accuracy
  - RGB light emitting diodes and 12-bit resolution
  - 2 detection modes (color only / color + intensity)
  - 3-step sensitivity adjustment for each mode (fine, normal, rough)
- External light interference reduction minimizes errors and allows stable detection
- Check reference color with teaching indicator
- Operation indicator (red LED), stability indicator (green LED), timer indicator (orange LED)
- Configure operation functions with external input from wiring
- W1.24 × L6.7 mm spot size for detection of tiny targets and color marks
- IP67 protection structure (IEC standard)

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

Overview

General photoelectric sensor detects present or absent of target by light.
Color mark sensor detects colors of surfaces by RGB (red, green, and blue) light source.
Saving the desired color at the inner memory, color mark sensor emits RGB LED light source to the target sequentially.
Color mark sensor calculates ratio of the three colors, RGB, for the optimized sensing via the inner light collection lens.
Using off-axis optical system for minimized optical loss, and cylindrical lens, BC Series compares setting color and sensing color with full-color determination.



Applications

Packaging, stickers industry: Label status, Mark color check, etc.
Electronic components, semiconductor industry: Defective unit check, Connector color check, etc.

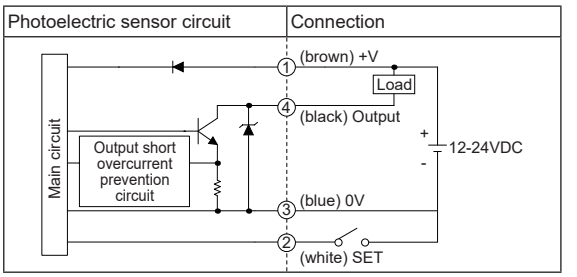
Specifications

Model		BC15-LDT-C	BC15-LDT-C-P
Sensing method		Convergent reflective type	
Sensing distance		15mm ±2mm	
Sensing target		Opaque, translucent	
Hysteresis		Max. 20% of sensing distance (may vary by sensing mode or sensitivity)	
Spot size		1.24×6.7mm (rectangular)	
Response time		500μs	
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 30mA	
Light source		Full Color LED (red, green, blue)	
Sensing mode		C (color only) mode, C+I (color + intensity) mode	
Output mode		Color match output, color mismatch output	
Output timer		40ms OFF delay timer function	
Control output		NPN or PNP open collector output • Load voltage: max. 30VDC⎓ • Load current: max. 100mA • Residual voltage - NPN: max. 1VDC⎓ , PNP: max. 2.5VDC	
Protection circuit		Reverse polarity protection, output short overcurrent protection	
Indicator		Operation indicator: red LED, stability indicator: green LED, teaching indicator: full Color LED	
Connection method		Connector type	
External input		External SET cable input	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±240V of square wave noise (pulse width: 1μs) from the noise simulator	
Dielectric strength		1,000VAC at 50/60Hz for 1min	
Vibration		1.5mm amplitude at 10 to 55Hz frequency in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Incandescent lamp: max. 3,000lx (receiver illumination)	
	Ambient temp.	-10 to 55℃, storage: -25 to 75℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP67 (IEC standard)	
Material		Case: polycarbonate, sensing part: acrylic, bracket: stainless steel 304, bolt: carbon steel	
Accessories		Fixing bracket, M3 bolts: 2, adjustment screwdriver: 1	
Approval		CE	
Weight※1		Approx. 80g (approx. 14g)	

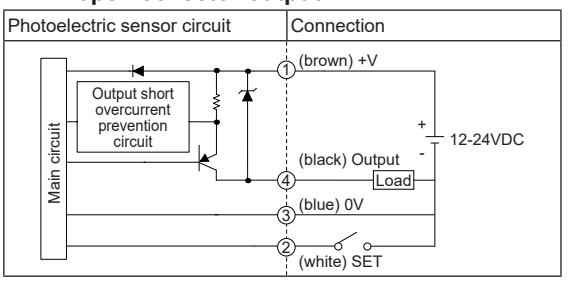
※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature and humidity of environment resistance is rated at non-freezing or condensation.

■ Control Output Diagram

• NPN open collector output

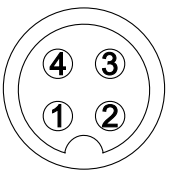


• PNP open collector output



※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

■ Connections for Connector Part



M12 Connector Pin

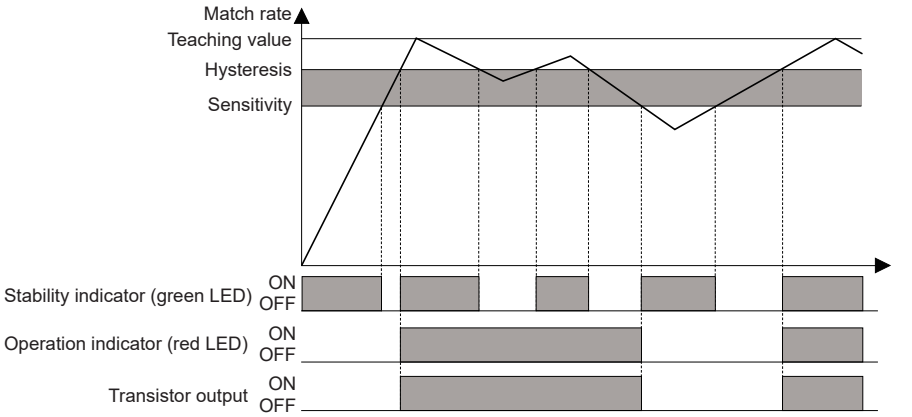
Pin number	Cable color	Name
1	Brown	+V
2	White	SET
3	Blue	GND (0V)
4	Black	OUT

• Connector cable (sold separately)

※Connector cable model
: CIDH4-□
(connector length □: 2, 3, 5, 7m)

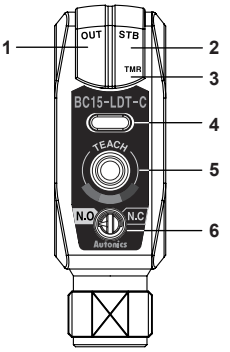
※Please use Autonics M12 connectors.
For more information, please refer to the connector cable section.

■ Operation Mode



※The waveforms of “Operation indicator” and “Transistor output” are for color match mode operation.
They are opposite operation for color mismatch mode operation.

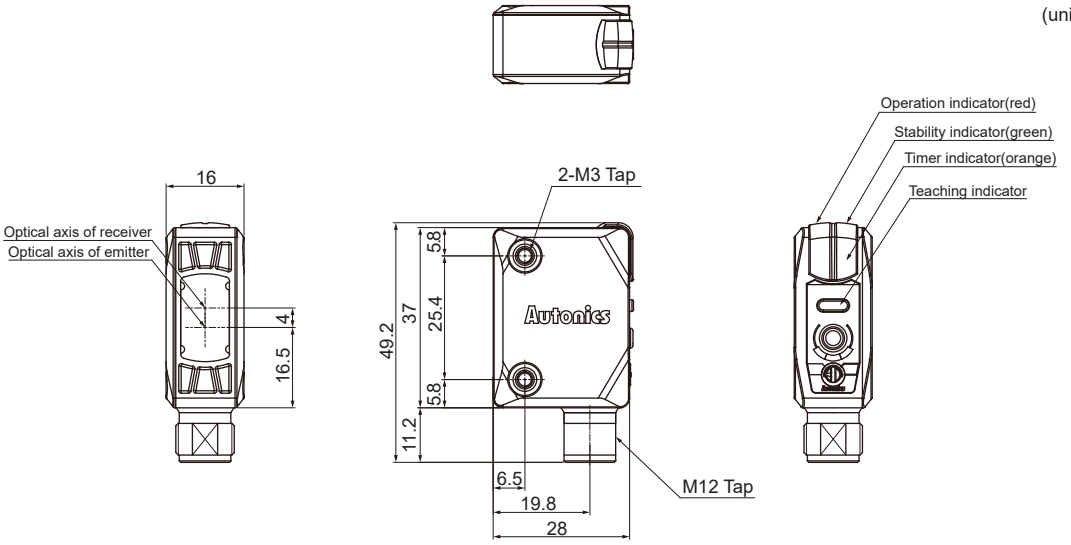
■ Unit Description



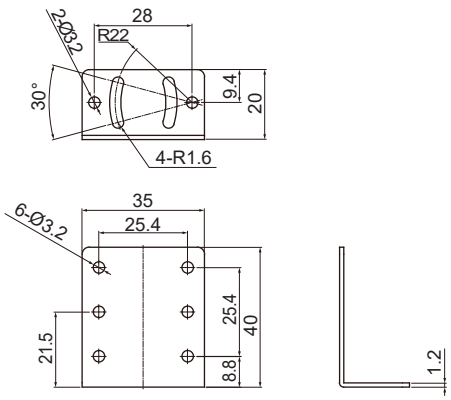
1. Operation indicator (OUT): ON (red) indicates operation.
2. Stability indicator (STB): ON (green) indicates stable status.
3. Timer indicator (TMR): ON (orange) when timer is set.
4. Teaching indicator:
   Displays the reference color after successfully "teaching" the color.
   ※The teaching color and the color displayed on the teaching indicator may differ depending on environment conditions (ambient light, reflection angle, material, etc.) .
5. SET key: Used for function settings.
6. Color match/mismatch switch
   - N.O.: Output ON when target color matches reference color.
   - N.C.: Output ON when target color does not match reference color.

▣ Dimensions

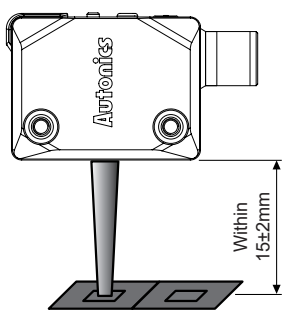
(unit: mm)



• **Fixing Bracket**



▣ Installation and Sensitivity Adjustment



①Installation
: Place the color mark sensor and the target object facing each other then affix the unit. The installation distance should be within ±2mm of 15mm .
②Press the SET key to enter teaching standby status. Place the desired color at the sensing position (spot) and hold the SET key for 3 seconds to set the reference color. When it is complete, the teaching indicator will display the set color
③Hold the SET key for 3 seconds change sensing mode and sensitivity settings.
④Hold the SET key for 5 seconds to set the timer. The timer is a 40ms OFF delay timer.

※In case of teaching error, the output indicator and teaching indicator will flash depending on the intensity of received light.
※When detecting metal or glossy objects tilt install the sensor at about 10 to 20 degree angle.
※When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
※When installing the product, tighten the screw with a tightening torque of 0.8N·m.

▣ Functions

◎ **Color teaching**
Set the reference color with the teaching function. Press the SET key in RUN mode to enter teaching standby status. Place the desired color at the sensing position (spot) and hold the SET key for over 3 seconds.
When teaching is complete, the teaching color indicator will turn ON.
When there is an error, the operation indicator will flash (red).

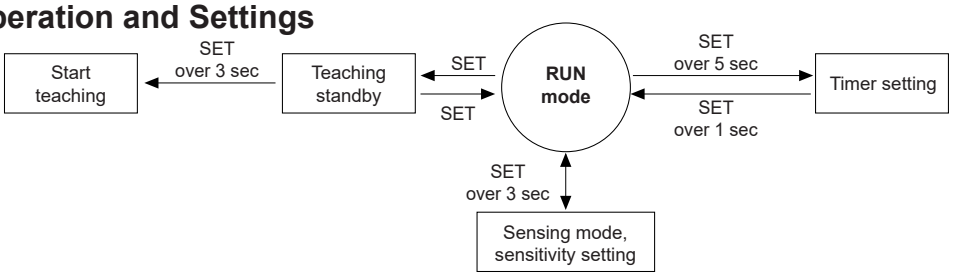
◎ **Display teaching**
The set reference color can be displayed on the teaching indicator.
With the ability to check the set reference color there is no need to re-set the teaching color every time.
It may difficult to check the similar colors when installing multiple sensors.
Teaching indicator color is available only for reference.
※The teaching color and the color displayed on the teaching indicator may differ depending on environment conditions (ambient light, reflection angle, material, etc.)

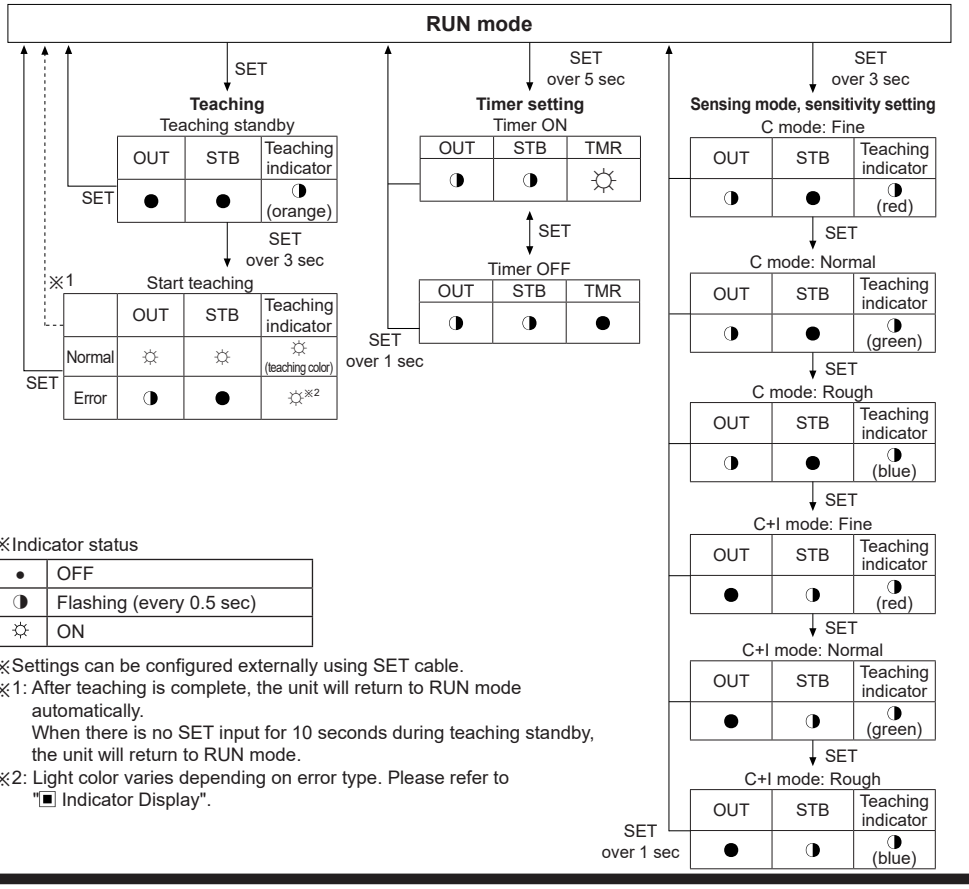
◎ **Sensing mode, sensitivity setting (color tolerance)**
Two sensing modes; C (color only) mode discriminates by color rate and C+I (color +intensity) mode discriminates by color rate and contrast.
Set the sensing sensitivity (fine, normal, rough) at each sensing mode.

◎ **Color match/mismatch mode**
- Color match mode (N.O.) : Output ON when target color matches reference color.
  Turn the color match/mismatch switch towards N.O.
- Color mismatch mode (N.C.) : Output ON when target color does not match reference color.
  Turn the color match/mismatch switch towards N.C.

◎ **OFF delay timer**
Timer (40ms OFF delay) functions helps prevent output malfunction from target objects moving too rapidly. The timer indicator turns ON (orange) when the timer function is set.

▣ Operation and Settings





※Indicator status

●	OFF
◑	Flashing (every 0.5 sec)
☼	ON

※Settings can be configured externally using SET cable.
※1: After teaching is complete, the unit will return to RUN mode automatically.
When there is no SET input for 10 seconds during teaching standby, the unit will return to RUN mode.
※2: Light color varies depending on error type. Please refer to "▣ Indicator Display".

■ Feature Data

◎ BC Series Standard Sensing Color

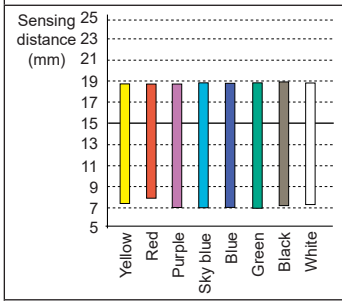
Color code \ Reference color		Yellow	Red	Purple	Sky blue	Blue	Green	Black	White
PANTONE Color code	Uncoated	Yellow U	Red032U	Purple U	306U	Blue072U	Green U	405U	—
	Coated	Yellow C	Red032C	Purple C	306C	Blue072C	Green C	405C	—

◎ Color sensing distance by mode

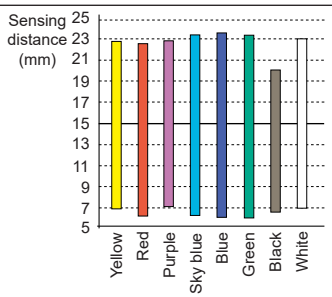
Uncoated

C (color only) mode

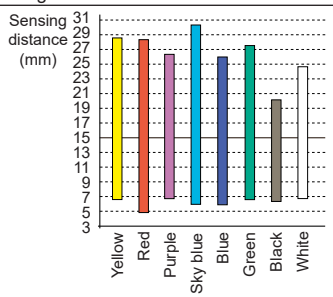
Fine



Normal

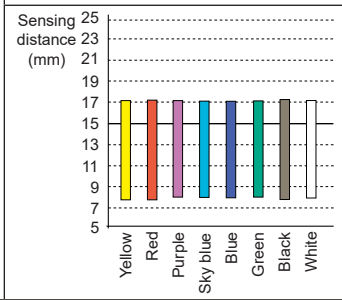


Rough

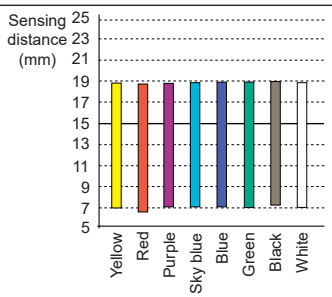


C+I (color + intensity) mode

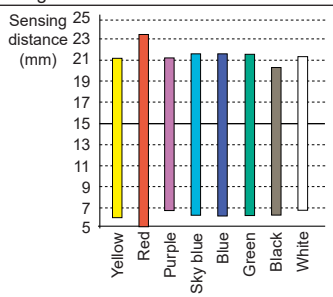
Fine



Normal



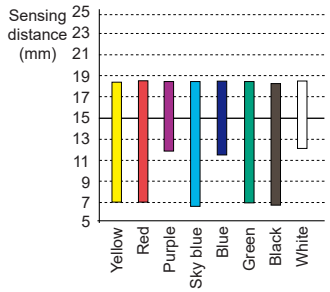
Rough



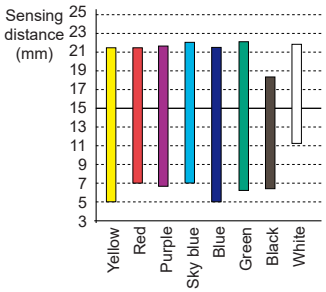
Coated

C (color only) mode

Fine



Normal



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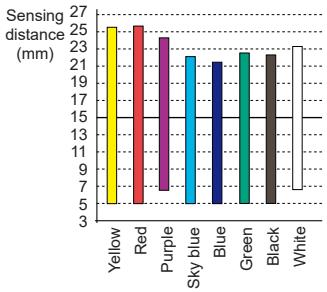
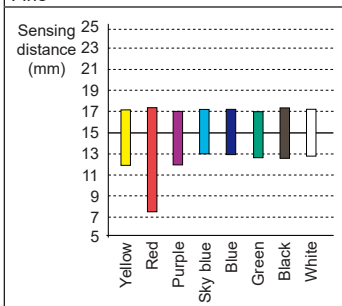
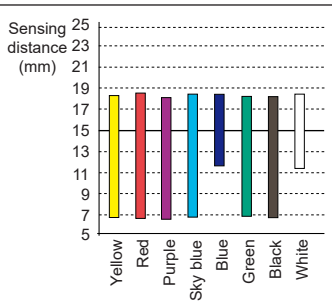


C+I (color + intensity) mode

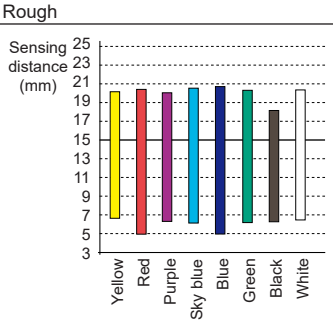
Fine



Normal



Rough

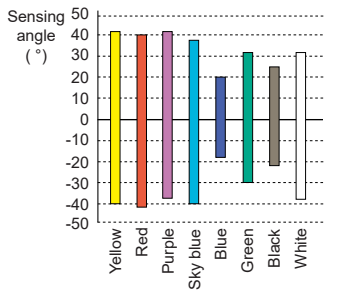


◎ **Color sensing angle by mode**

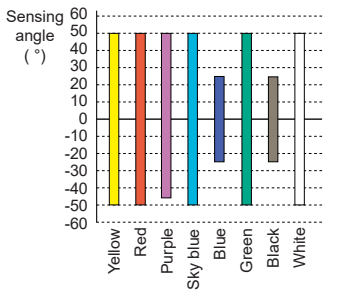
Uncoated

C (color only) mode

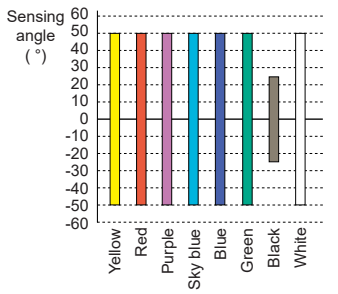
Fine



Normal

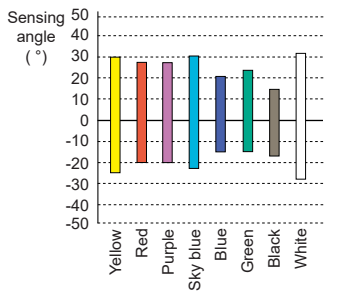


Rough

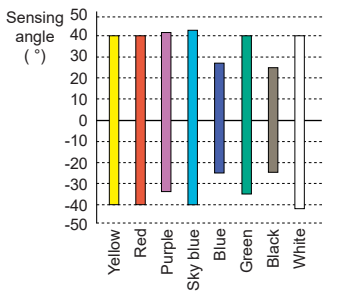


C+I (color + intensity) mode

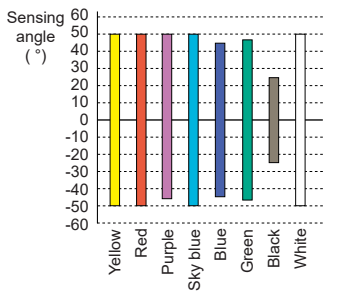
Fine



Normal



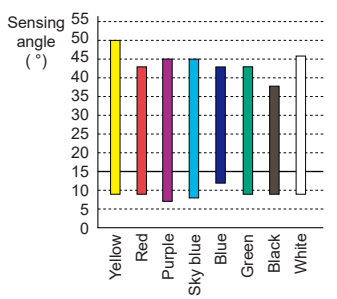
Rough



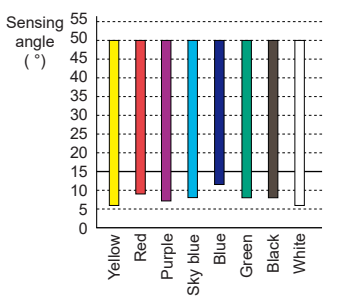
Coated

C (color only) mode

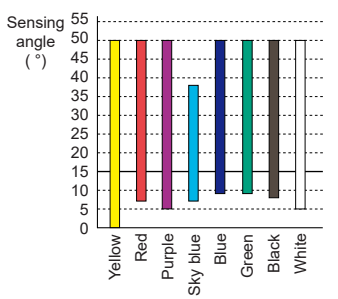
Fine



Normal

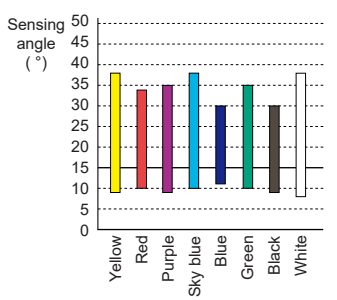


Rough

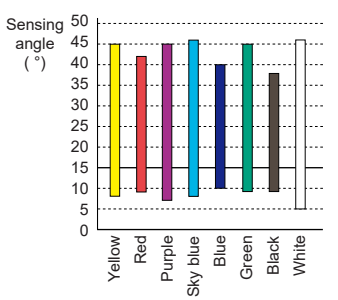


C+I (color + intensity) mode

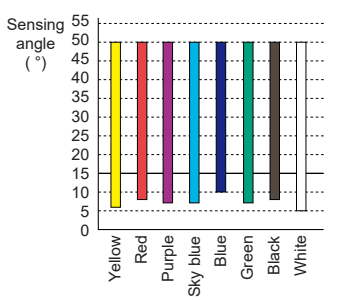
Fine



Normal



Rough



■ Indicator Display

Status			Operation indicator (red LED)	Stability indicator (green LED)	Teaching indicator (full color LED)	Timer indicator (orange LED)	
						Timer ON	Timer OFF
Normal operation	Stable match		☼	☼	☼ (teaching color)	☼	●
	Unstable match		☼	●			
	Unstable mismatch		●	●			
	Stable mismatch		●	☼			
Sensitivity setting (C mode)	Fine		◑	●	◑ (red)		
	Normal				◑ (green)		
	Rough				◑ (blue)		
Sensitivity setting (C+I mode)	Fine		●	◑	◑ (red)		
	Normal				◑ (green)		
	Rough				◑ (blue)		
Teaching setting	Teaching standby		●	●	◑ (orange)		
	Normal teaching		☼	☼	☼ (teaching color)		
	Teaching error	Excess light intensity	◑	●	☼ (green)		
		Insufficient light intensity	◑	●	☼ (red)		
		Fluctuating light intensity	◑	●	☼ (blue)		
Timer setting	ON		◑	◑	☼ (teaching color)	☼	
	OFF		◑	◑	☼ (teaching color)	●	
Overcurrent input			ⓟ	ⓐ	●	●	

※Indicator status

☼	ON	●	OFF
◑	Flashing (every 0.5 sec)	ⓟⓐ	Flashing alternately (every 0.5 sec)

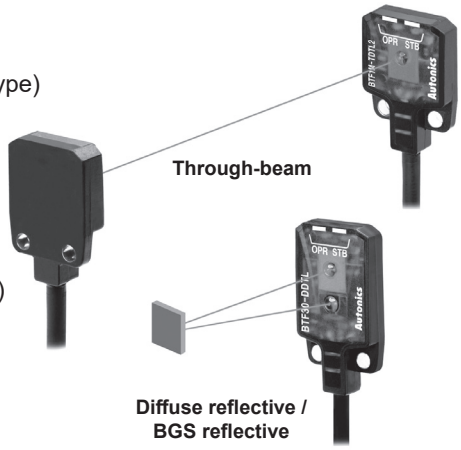
■ Troubleshooting

Problem	Cause	Troubleshooting
Will not operate	Power supply	Supply power within rated specifications
	Connection error	Check the cable connections.
Will not operate occasionally	Excess light intensity alarm during teaching, output chattering	Install the sensor at a 10 to 20 degree angle. (when sensing metal or glossy objects)
	Converter external light interference	Install a visor on the sensor or install the unit away from the external light source.
	Contamination of sensor cover	Remove the substance using a soft brush and reset the sensitivity.
	Connector error	Check connector assembly.
Other error	—	Check the display status of the indicators.

Ultra-slim and Amplifier Built-in Type

▣ Features

- Ultra-thin size of only 3.7mm
  - W13 × H19 × L3.7mm (through-beam type)
  - W13 × H24 × L3.7mm (diffuse reflective type, BGS reflective type)
- Detection methods and minimum target size
  - Through-beam type (BTF1M): Ø2mm
  - Diffuse reflective type (BTF30): Ø0.2mm (at distance 10mm)
  - BGS reflective type (BTF15): Ø0.2mm (at distance 10mm)
- Detecting distance may vary by environmental factors
- Maximum detection distance: 1m (through-beam type)
- Stability indicator (green LED) and operation indicator (red LED)
- Stainless steel 304 mounting brackets
- IP67 protection structure (IEC standard)



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

CE

▣ Specifications

Model							
	NPN open collector output	**BTF1M-TDTL**	**BTF1M-TDTD**	**BTF30-DDTL**	**BTF30-DDTD**	**BTF15-BDTL**	**BTF15-BDTD**
	PNP open collector output	**BTF1M-TDTL-P**	**BTF1M-TDTD-P**	**BTF30-DDTL-P**	**BTF30-DDTD-P**	**BTF15-BDTL-P**	**BTF15-BDTD-P**
Sensing type		Through-beam		Diffuse reflective		BGS reflective	
Sensing distance		1m		5 to 30mm※1		1 to 15mm※1	
Sensing target		Opaque material over Ø2mm		Translucent, opaque materials			
Min. sensing target		Opaque material of Ø2mm		Ø0.2mm (sensing distance 10mm)		Ø0.2mm non-illuminated objects (sensing distance 10mm)	
Hysteresis		—		Max. 20% at sensing distance		Max. 5% at sensing distance	
Reflectivity characteristics (black/white error)		—		—		Max. 15% of maximum sensing distance	
Response time		Max. 1ms					
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)					
Current consumption		Max. 20mA (this is for each emitter and receiver of throught-beam type.)					
Light source		Red LED (650nm)					
Operation mode		Light ON	Dark ON	Light ON	Dark ON	Light ON	Dark ON
Control output		NPN or PNP open collector output • Load voltage: max. 26.4VDC⎓ • Load current: max. 50mA • Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2VDC					
Protection circuit		Power reverse polarity protection circuit, output short over current protection circuit					
Indicator		Operation indicator: red LED, stability indicator: green LED					
Connection		Cable type					
Insulation resistance		Over 20MΩ (at 500VDC megger)					
Noise immunity		±240V the square wave noise (pulse width:1μs) 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 X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Environment	Ambient illumination	Sunlight: max. 10,000lx, incandescent lamp: max. 3,000lx (receiver illumination)					
	Ambient temperature	-25 to 55℃, storage: -40 to 70℃					
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH					
Protection		IP67 (IEC standards)					
Material		Case: polybutylene terephthalate, sensing part: polymethyl methacrylate, bracket: SUS304 (steel use stainless 304), bolt: carbon steel, sleeve: SUS304 (steel use stainless 304)					
Cable		Ø2.5mm, 3P, 2m (emitter of through-beam type: Ø2.5mm, 2P, 2m) (AWG 28, core diameter: 0.08mm, number of core: 19, insulator out diameter: Ø0.9mm)					
Accessory		Fixing bracket, M2 bolt: 4		Fixing bracket, M2 bolt: 2			
Approval		CE					
Weight※2		Approx. 70g (approx. 40g)		Approx. 40g (approx. 25g)			

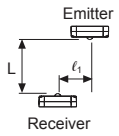
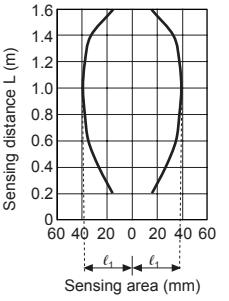
※1: Non-glossy white paper 50×50mm.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.

▣ Feature Data

◎ Through-beam type

● BTF1M-TDTL / BTF1M-TDTL-P

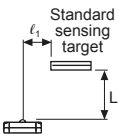
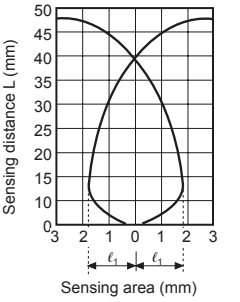
Sensing area characteristic

Measuring method	Data
	

◎ Diffuse reflective type

● BTF30-DDTL / BTF30-DDTL-P

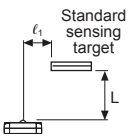
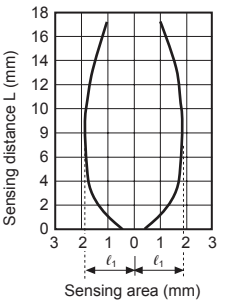
Sensing area characteristic

Measuring method	Data
	

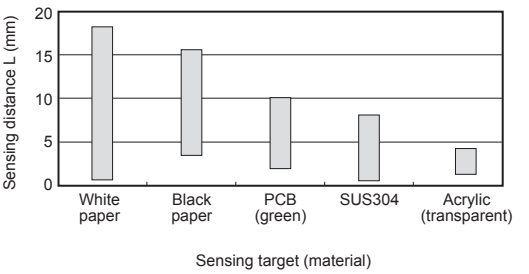
◎ BGS reflective type

● BTF15-BDTL / BTF15-BDTL-P

Sensing area characteristic

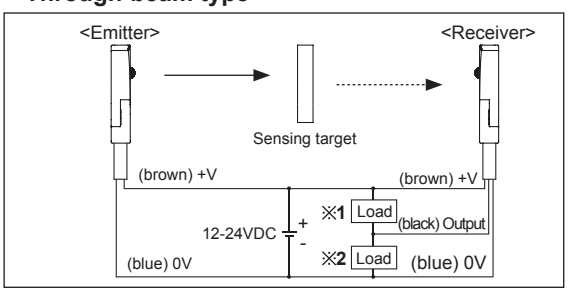
Measuring method	Data
	

Sensing distance by material

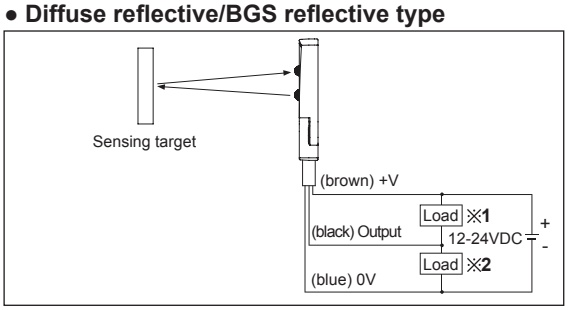


▣ Connections

● Through-beam type



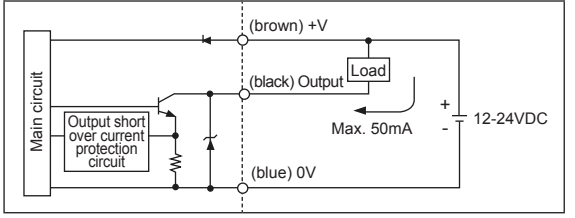
● Diffuse reflective/BGS reflective type



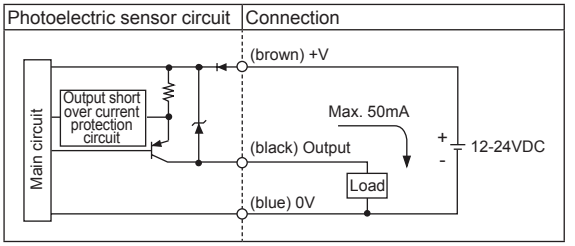
※1: Load connection for NPN output
※2: Load connection for PNP output

▣ Control Output Circuit Diagram

● NPN open collector output

Photoelectric sensor circuit	Connection
	

● PNP open collector output

Photoelectric sensor circuit	Connection
	

※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

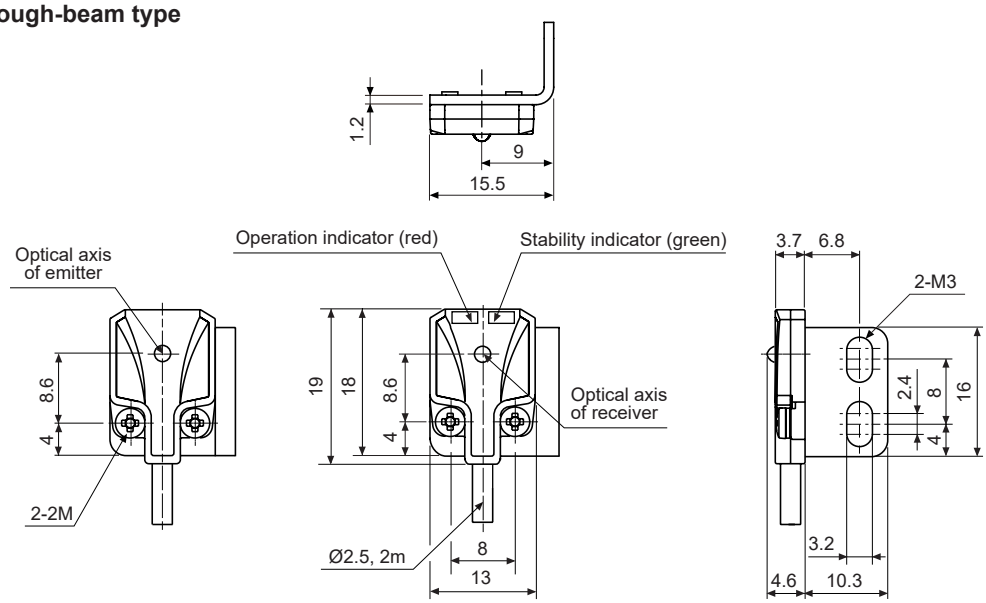
▣ Operation Mode

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

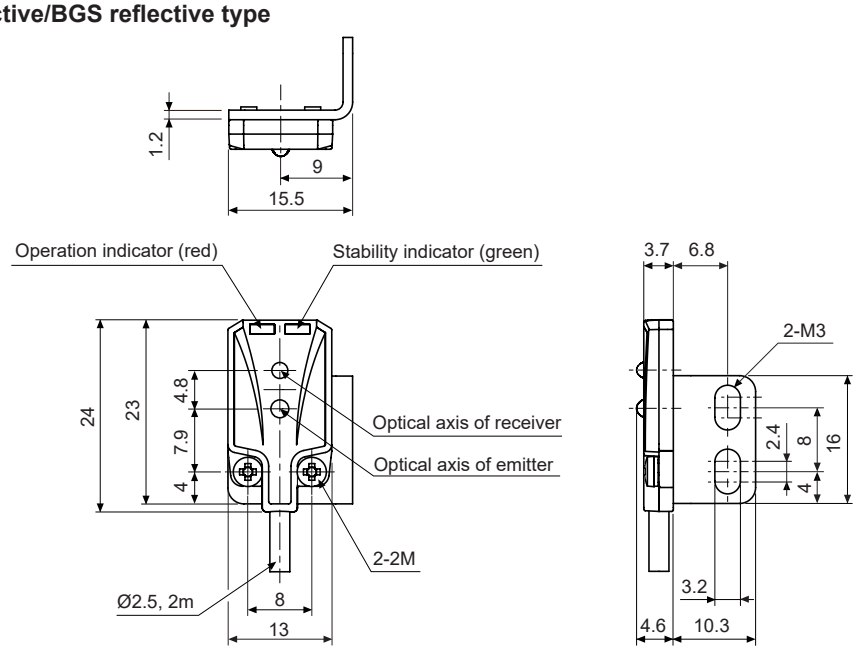
▣ Dimensions

(unit: mm)

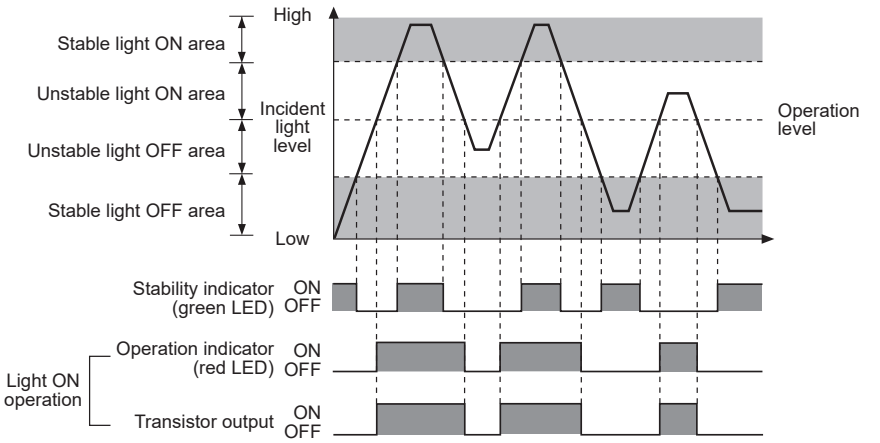
● **Through-beam type**



● **Diffuse reflective/BGS reflective type**



▣ Operation Timing Diagram



※The waveform of 'Operation indicator' and 'Transistor output' are for Light ON operation.
The waveform are reversed for Dark ON operation.

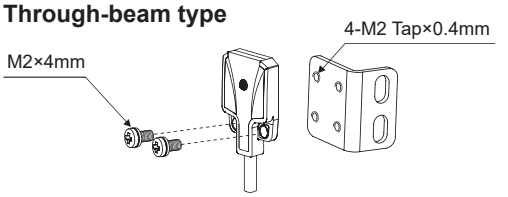
▣ Installation and Adjustment

◎ For mounting

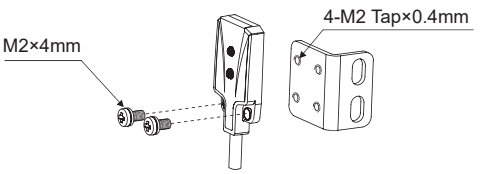
When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference. When installing the product, tighten the screw with a tightening torque of 0.3N·m.

※Do not impact on the unit with hard objects and do not bend the cable part too much. It may cause damage to waterproof function.

● Through-beam type

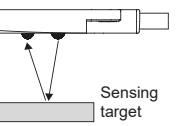


● Diffuse reflective/BGS reflective type

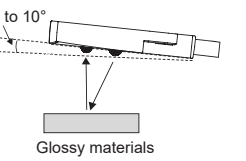


※ Notice for BGS reflective type

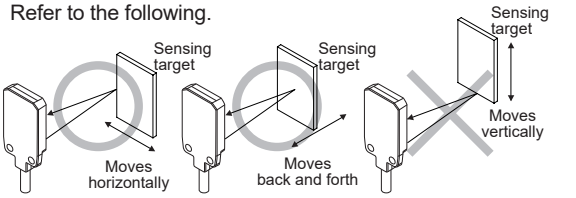
1) Make sure that the sensing side of this sensor is parallel with the surface of each sensing object.



2) If the sensing object has glossary surface or high reflection, the sensor tilts from 5 to 10˚as shown in the figure.
Make sure whether the sensor is influenced by any background objects.



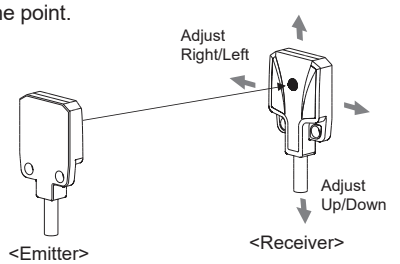
3) Make sure to install the sensor in the proper direction with considering moving direction of sensing objects.
Refer to the following.



◎ Optical axis adjustment

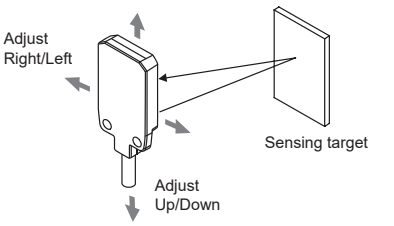
● Through-beam type

Set the emitter and the receiver facing each other and adjust these up·down, right·left after checking the point of operating the stability indicator. Fix the emitter and the receiver at the center of the point.



● Diffuse reflective/BGS reflective type

After placing a sensing target, fix it in the middle of position where the stability indicator operates when adjusting the sensor to up·down, right·left. Make sure that the sensing side of the sensor is parallel with the surface of each sensing target.



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 "Safety Considerations" in the instruction manual before using.

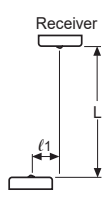
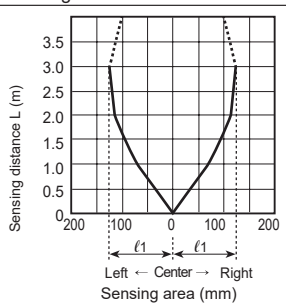
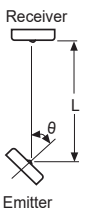
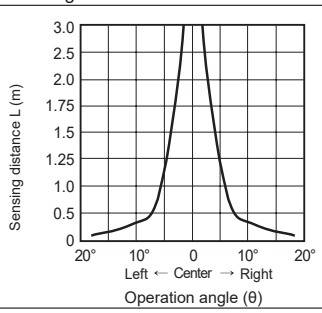
CE

■ Specifications

Model	NPN open collector output	**BPS3M-TDT**	**BPS3M-TDTL**
	PNP open collector output	**BPS3M-TDT-P**	**BPS3M-TDTL-P**
Sensing type		Through-beam	
Sensing target		Opaque materials of min. Ø5mm	
Operation mode		Dark ON	Light ON
Sensing distance		3m	
Response time		Max. 1ms	
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 20mA	
Light source		Infrared LED (850nm)	
Control output		NPN or PNP open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 100mA ●Residual voltage - NPN: max. 1VDC⎓, PNP: Max. 2.5VDC	
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit	
Indicator		Emitter - power indicator: red LED, receiver - operation indicator: red LED	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator	
Dielectric strength		1,000VAC 50/60Hz for 1 minute	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)	
	Ambient temperature	-25 to 65℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 90%RH	
Protection structure		IP67 (IEC standard)	
Material		Case: polycarbonate, bolt: steel chromium molybdenum, nut: steel chromium molybdenum	
Cable		Ø3mm, 3-wire, 2m (emitter of through-beam type: Ø3mm, 2-wire, 2m) (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)	
Accessory		M3 bolt: 4, M3 nut: 4	
Approval		CE	
Unit weight		Approx. 66g	

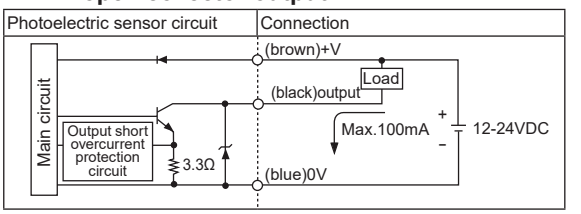
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

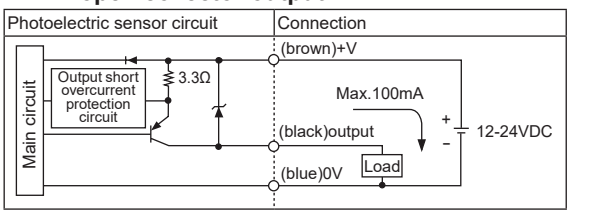
Measuring method	Parallel shifting characteristic	Measuring method	Sensor angle characteristic
			

▣ Control Output Diagram

● NPN open collector output



● PNP open collector output



※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Operation Mode

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

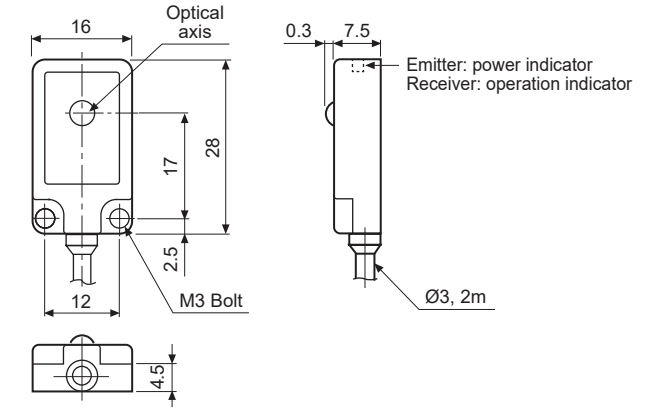
※Dark ON mode is standard and Light ON (Received Light: ON) mode is customizable.

▣ Connections

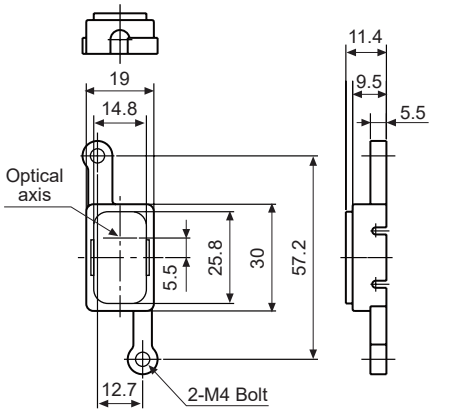
NPN open collector output	PNP open collector output
● BPS3M-TDT1 (brown)+V (blue)0V 12-24VDC (emitter)	**● BPS3M-TDT1** (brown)+V (blue)0V 12-24VDC (emitter)
● BPS3M-TDT2 / BPS3M-TDTL2 (brown)+V (black)Output Load (blue)0V 12-24VDC (receiver)	**● BPS3M-TDT2-P / BPS3M-TDTL2-P** (brown)+V (black)Output (blue)0V Load 12-24VDC (receiver)

▣ Dimensions

(unit: mm)



●Cover (sold separately)



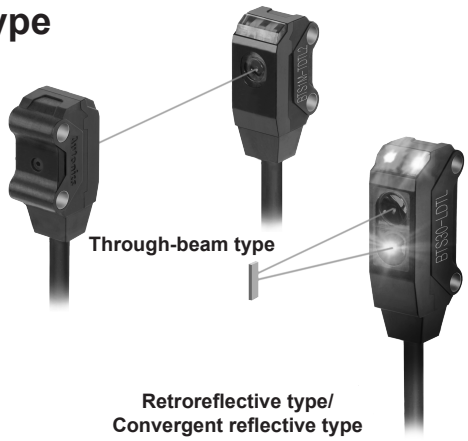
Ultra-compact and Amplifier Built-in Type

▣ Features

- Ultra-slim width of only 7.2mm
  - W7.2×H18.6×L9.5mm (through-beam type)
  - W7.2×H24.6×L10.8mm
    (retroreflective type, convergent reflective type)
- Detection methods and minimum target size
  - Through-beam type (BTS1M): Ø2mm
  - Retroreflective type (BTS200): Ø2mm (at distance 100mm)
  - Convergent reflective type (BTS15/BTS30):
    Ø0.15mm (at distance 10mm)

  ※Detecting distance may vary by environmental factors
- Maximum detection distance: 1m (through-beam type)
- Stability indicator (red LED) and operation indicator (green LED)
- Stainless steel 304 mounting brackets
- IP67 protection structure (IEC standard)

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



Through-beam type

Retroreflective type/
Convergent reflective type

▣ Specifications

Model									
	NPN open collector output	BTS1M-TDTL	BTS1M-TDTD	BTS200-MDTL	BTS200-MDTD	BTS30-LDTL	BTS30-LDTD	BTS15-LDTL	BTS15-LDTD
	PNP open collector output	BTS1M-TDTL-P	BTS1M-TDTD-P	BTS200-MDTL-P	BTS200-MDTD-P	BTS30-LDTL-P	BTS30-LDTD-P	BTS15-LDTL-P	BTS15-LDTD-P
Sensing type		Through-beam type		Retroreflective type		Convergent reflective type			
Sensing distance		1m		10 to 200mm※1		5 to 30mm※2		5 to 15mm※2	
Sensing target		Opaque material of max. Ø2mm		Opaque material of max. Ø27mm		Opaque material, Translucent materials			
Min. sensing target		Opaque material of Ø2mm		Opaque material of Ø2mm※3 (sensing distance 100mm)		Ø0.15mm (sensing distance 10mm)			
Hysteresis distance		—		—		Max. 15% of maximum sensing distance			
Response time		Max. 1ms							
Power supply		12-24VDC⎓±10% (ripple P-P: max. 10%)							
Current consumption		Max. 20mA (in case of through-beam type, this value is for each emitter and receiver)							
Light source		Red LED (650nm)							
Operation mode		Light ON	Dark ON	Light ON	Dark ON	Light ON	Dark ON	Light ON	Dark ON
Control output		NPN or PNP open collector output ·Load voltage: max. 26.4VDC⎓ ·Load current: max. 50mA ·Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2VDC							
Protection circuit		Power reverse polarity protection circuit, output short over current protection circuit							
Indicator		Operation indicator: red LED, stability indicator: green LED							
Connection		Cable type							
Insulation resistance		Over 20MΩ (at 500VDC megger)							
Noise immunity		±240V the square wave noise (pulse width: 1㎲) by the noise simulator							
Dielectric strength		1,000VAC 50/60Hz for 1 min							
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Environment	Ambient illumination	Sunlight: max. 10,000lx, incandescent lamp: max. 3,000lx (receiver illumination)							
	Ambient temperature	-20 to 55℃, storage: -30 to 70℃							
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH							
Protection structure		IP67 (IEC standard)							
Material		Case: polybutylene terephthalate, sensing part: polymethyl methacrylate, bracket: stainless steel 304, Bolt: carbon steel wire for cold heading (SWCH10A)							
Cable		Ø2.5mm, 3-wire, 2m (emitter of through-beam type: Ø2.5mm, 2-wire, 2m) (AWG 28, core wire diameter: 0.08mm, number of cores: 19, insulator out diameter: Ø0.9mm)							
Accessory		Bracket A: 2, sub-bracket for through-beam type: 2, M2 bolt: 4		Reflector (MS-6),bracket A, Sub-bracket for reflective type, M2 bolt: 2		Bracket A, sub-bracket for reflective type, M2 bolt: 2			
Approval		CE							
Weight※4		Approx. 65g (approx. 40g)		Approx. 45g (approx. 25g)					

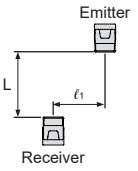
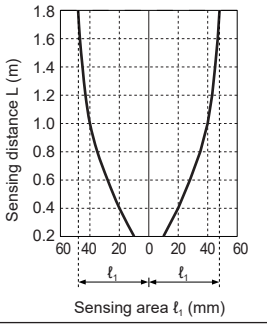
※1: The sensing distance is specified with using the MS-6 reflector.
When using reflective tapes, the Reflectivity vary by the size of the tape.
Please refer to the '▣ Reflectivity by Reflective Tape Model' table before using the tape.
※2: Non-glossy white paper 50×50mm.
※3: It will vary by the installation environment and sensing conditions.
Please refer to the '◎ Conditions of min. sensing target and installations (retroreflective type)'.
※4: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.

▣ Feature Data

◎ Through-beam type

● BTS1M-TDTL / BTS1M-TDTL-P

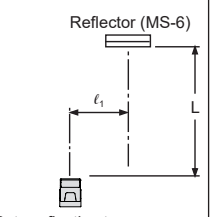
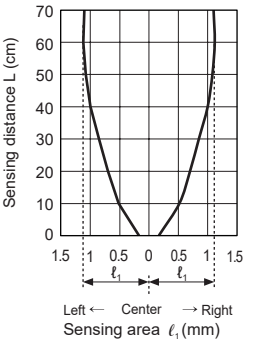
Parallel shifting characteristic

Measuring method	Data
	

◎ Retroreflective type

● BTS200-MDTD / BTS200-MDTD-P

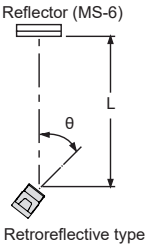
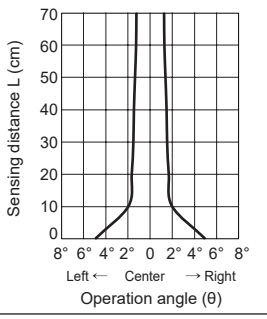
Parallel shifting characteristic

Measuring method	Data
	

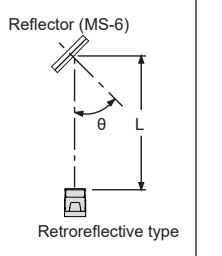
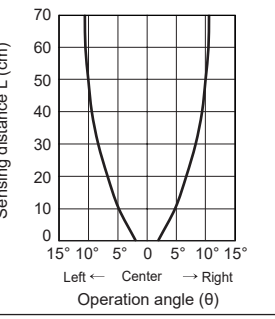
◎ Retroreflective type

● BTS200-MDTD / BTS200-MDTD-P

Sensor angle characteristic

Measuring method	Data
	

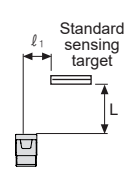
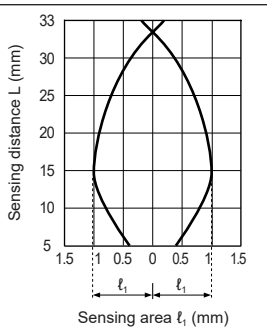
Reflector angle characteristic

Measuring method	Data
	

◎ Convergent reflective type

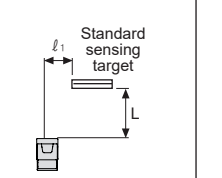
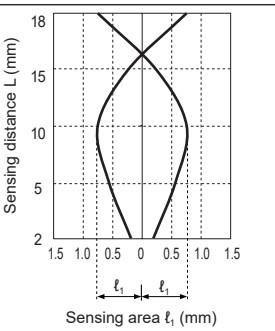
● BTS30-LDTL / BTS30-LDTL-P

Sensing area characteristic

Measuring method	Data
	

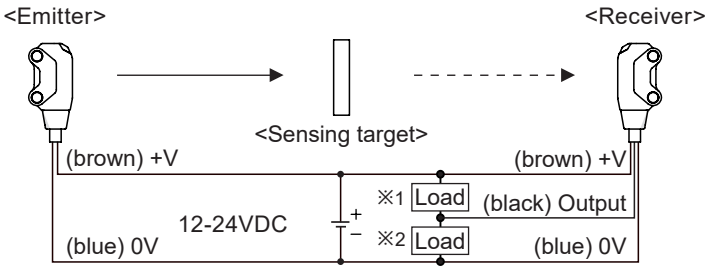
● BTS15-LDTL / BTS15-LDTL-P

Sensing area characteristic

Measuring method	Data
	

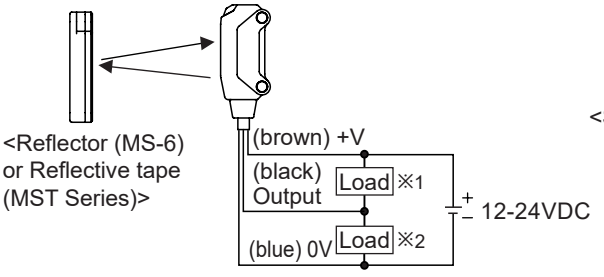
▣ Connections

● Through-beam type

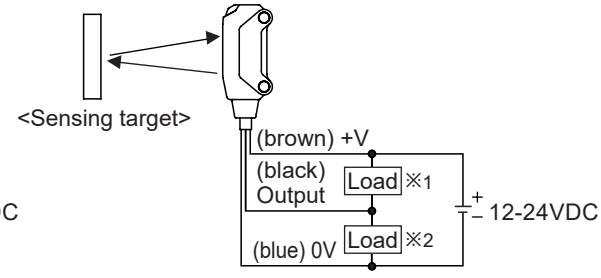


※1: Load connection for NPN output
※2: Load connection for PNP output

● Retroreflective type

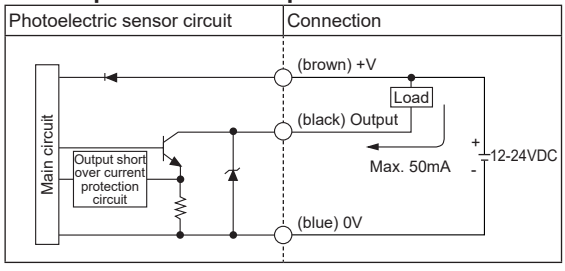


● Convergent reflective type

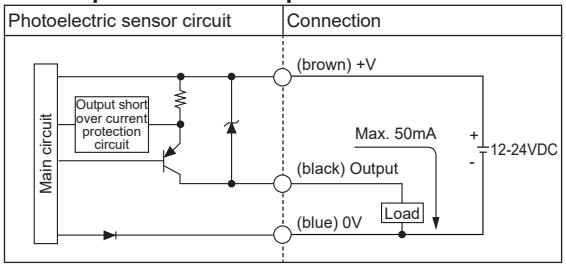


▣ Control Output Circuit Diagram

● NPN open collector output



● PNP open collector output

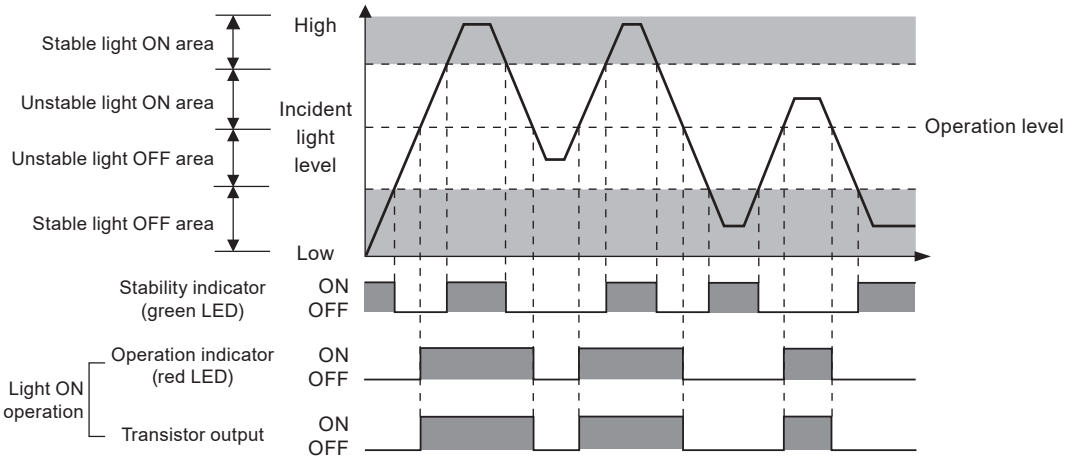


※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Operation Mode

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

▣ Operating Timing Diagram

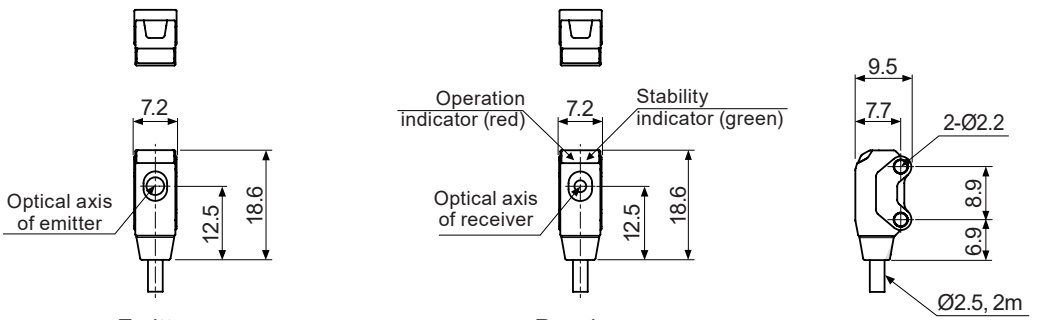


※The waveforms of “Operation indicator” and “Transistor output” are for Light ON operation.
They are reversed for for Dark ON operation.

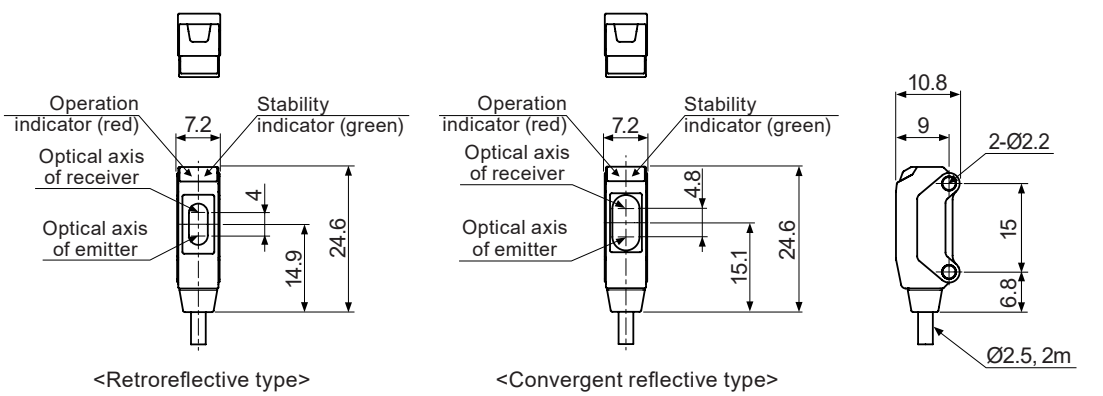
▣ Dimensions

(unit: mm)

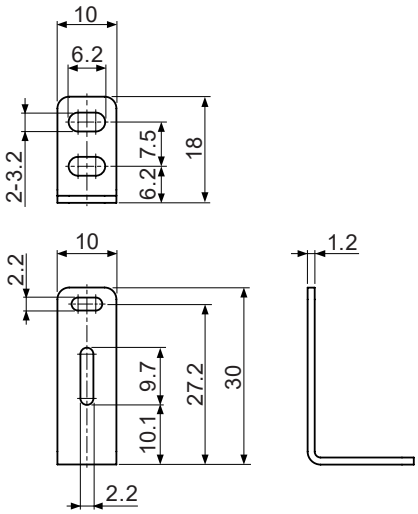
● **Through-beam type**



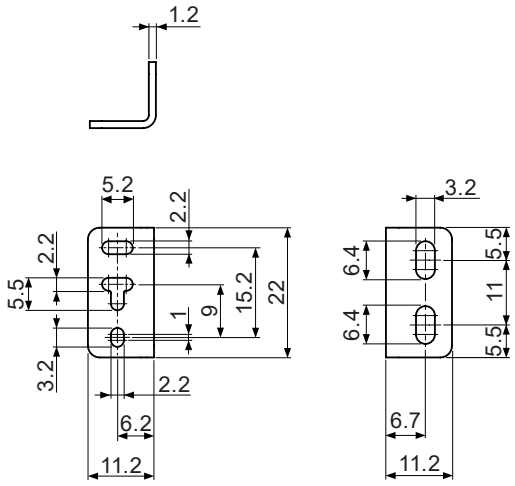
● **Retroreflective/Convergent reflective type**



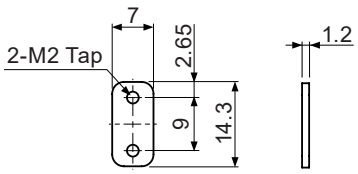
● **Bracket A**



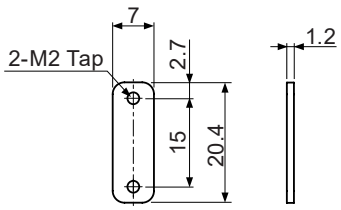
● **Bracket B (sold separately)**



● **Sub-bracket for through-beam type**

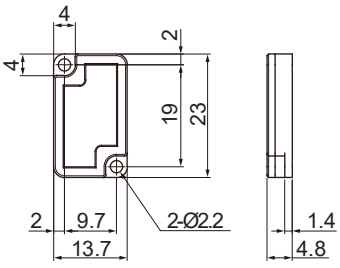


● **Sub-bracket for reflective type**

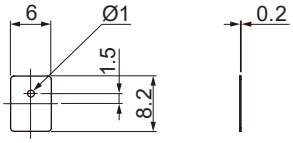


※The sub-bracket for each sensing type is included bracket A (B).

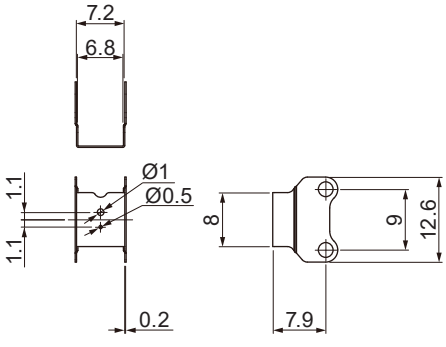
● **Reflector (MS-6)**



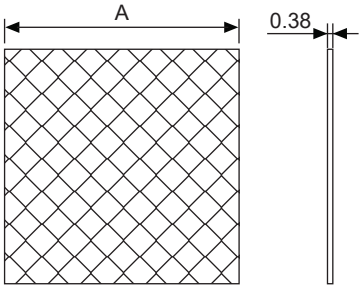
● **Slit (BTS1M-ST, sold separately)**



● **Slit (BTS1M-ST-T, sold separately)**



● **Reflective tape (sold separately)**



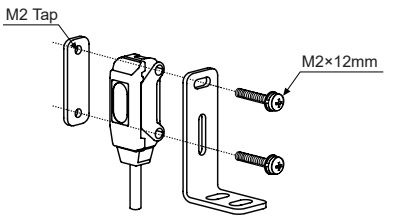
(unit: mm)

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

▣ Mounting and Sensitivity Adjustment

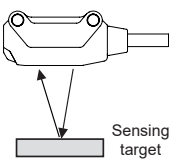
◎ Installation

When installing the product, tighten the screw with a tightening torque of 0.3N·m.
When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
※Exercise caution. Do not apply excessive impact to the unit or bend the cable section. The inside unit may be wet.

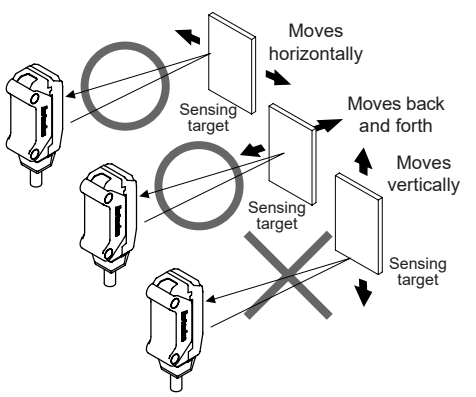


※Cautions during installation of convergent reflective type

1)Make sure that the sensing side of this sensor is parallel to the surface of each object.



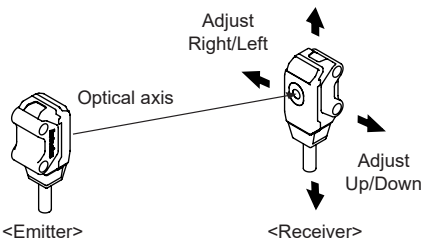
2)Make sure to install the sensor after carefully considering the moving direction of the sensing objects. Refer to the illustration below:



◎ Optical axis adjustment

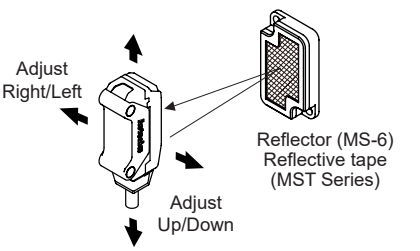
● Through-beam type

Set the emitter and the receiver facing each other. Adjust the emitter or the receiver up, down, left, right and fix the unit at the center point of where the stability indicator is operating.



● Retroreflective type

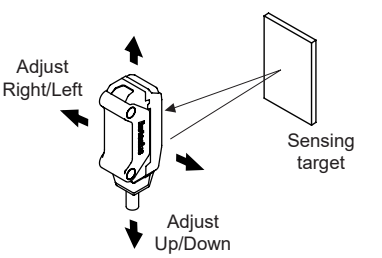
Place the sensor and the reflector (MS-6) or reflective tape facing each other. Adjust the reflector up, down, left, right and fix the reflector at the center position where the stability indicator is operating.
Make sure that the sensing side of the sensor is parallel to the surface of the reflector.



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

● Convergent reflective type

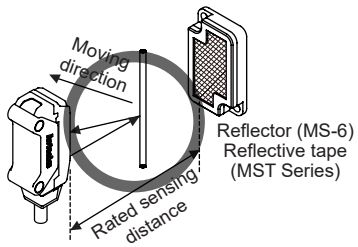
Place the sensing target, then adjust the sensor up, down, left, right and fix the sensor at the center position where the stability indicator is operating.
Make sure that the sensing side of the sensor is parallel to the surface of each object.



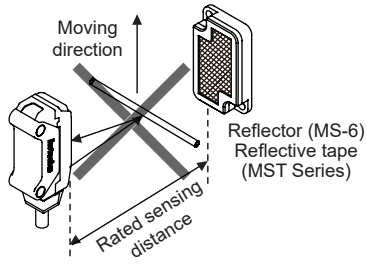
◎ Conditions of min. sensing target and installations (retroreflective type)

When installing the retroreflective photoelectric sensor, be sure to check the moving direction of sensing targets. Please refer to the [Figure 1, 2].
As the [Figure 3], please consist the center between the sensor and the reflector (MS-6) or reflective tape, and check the stable Light ON operations (operation (red) / stability (green) indicators turn ON). Min. sensing target is detected 100mm away from the sensor (example).

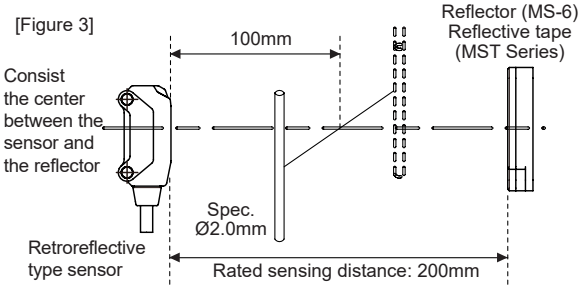
[Figure 1]



[Figure 2]



[Figure 3]



※The size of minimum sensing target will vary by the installation environment of the reflector (MS-6) and the sensing position and material of the sensing target.

▣ Reflectivity by Reflective Tape Model

MST-50-10 (50×50mm)	95%
MST-100-5 (100×100mm)	100%
MST-200-2 (200×200mm)	100%

※This reflectivity is based on the reflector (MS-6).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

▣ Accessory (sold separately)

• BTS1M-ST

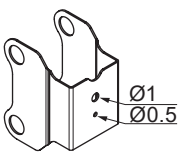
Ø1

※This slit is for BTS1M-TDT□-□ only.
Attach only to the emitter to use.
※4 pieces are packed and sold separately.
※This slit is sticker for attachment, please remove the dirt on lens of photoelectric sensor before using it. After attaching the slit, remove the front protection film.

※Min. sensing target and max. sensing distance by Ø of the slit when attach the slit at an emitter.

Slit Ø	Min. sensing target	Max. sensing distance
Ø1	Opaque materials of min. Ø1.6	500mm

• BTS1M-ST-T

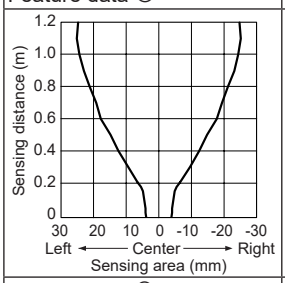


※This slit is for BTS1M-TDT□-□ only.
※This slit can be used in Ø1 or Ø0.5 by its installation direction.
※2 pieces are packed and sold separately.
※This slit is made of SUS. After covering the product with the slit, fix them with the bolts and sub-bracket.

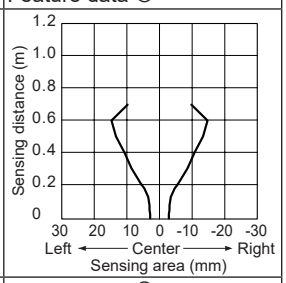
※Min. sensing target and max. sensing distance by Ø of the slit

Slit Ø	Applied condition		Min. sensing target	Max. sensing distance	Feature data number
	Emitter	Receiver			
Ø1	Applied	—	Opaque materials of min. Ø1.6	500mm	①
	—	Applied			
	Applied	Applied	Opaque materials of min. Ø1.2	300mm	②
Ø0.5	Applied	—	Opaque materials of min. Ø1.2	300mm	③
	—	Applied			
	Applied	Applied	Opaque materials of min. Ø0.8	100mm	④

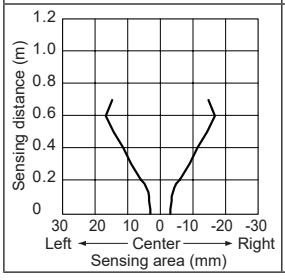
Feature data ①



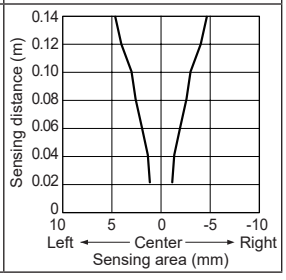
Feature data ②



Feature data ③



Feature data ④



Compact and Long Sensing Distance Type

▣ Features

■ Long distance sensing type

- High performance lens with long sensing distance
  - Through-beam type: 15m
  - Diffuse reflective type: 1m
  - Polarized retroreflective type: 3m (MS-2A)
- M.S.R. (Mirror Surface Rejection) function (polarized retroreflective type) for detecting mirrors or highly reflective targets
- Compact size: W10.6 × H32 × L20mm
- Light ON/Dark ON operation mode switch
- Sensitivity adjuster
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit
- Mutual interference prevention function (except through-beam type)
- Excellent noise immunity and minimal influence from ambient light
- IP65 protection structure (IEC standard) / IP67 for BJ-C connector types

(MS-2A) (MST-□)

Connector type
※The model name with '-C' is connector type.
※MST-□ is sold separately.

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

▣ Specifications

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 type	Diffuse reflective		
Sensing distance		15m	10m	7m	3m※1	1m※2	300mm※3	100mm※3
Sensing target		Opaque material of min. Ø12mm		Opaque material of min. Ø8mm	Opaque material of min. Ø75mm	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		Sensitivity adjuster						
Operation mode		Light ON/Dark ON operation mode switch						
Control output		NPN or PNP open collector output ●Load voltage: max. 26.4VDC⎓ ●Load current: max. 100mA ●Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC						
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit, mutual interference prevention function (except through-beam type)						
Indicator		Operation indicator: red LED, stable indicator: green LED (emitter's power indicator: green)						
Insulation resistance		Over 20MΩ (at 500VDC megger)						
Noise immunity		±240V the square wave noise (pulse width:1μs) by the noise simulator						
Dielectric strength		1000VAC 50/60Hz for 1minute						
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours						
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times						
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)						
	Ambient temperature	-25 to 55℃, storage: -40 to 70℃						
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH						
Protection structure		BJ: IP65 (IEC standard), BJ-C: IP67 (IEC standard)						
Material		Case: polycarbonate+acrylonitrile butadiene styrene, LED cap: polycarbonate, sensing part: polymethyl methacrylate, bracket: SUS304 (steel use stainless 304), bolt, nut: steel chromium molybdenum, sleeve: brass, ni-plate						
Cable※4		BJ: Ø3.5mm, 3-wire, 2m (emitter of through-beam type: Ø3.5mm, 2-wire, 2m) (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)						
Accessory	Common	Fixing bracket※5, M3 bolt: 4, M3 nut: 4, adjustment screwdriver			Fixing bracket※5, M3 bolt: 2, M3 nut: 2, adjustment screwdriver			
	Individual	—			Reflector (MS-2A)	—		
Approval		CE						
Weight※6		BJ: approx. 115g (approx. 90g) BJ-C: approx. 45g (approx. 20g)			BJ: approx. 85g (approx. 60g) BJ-C: approx. 55g (approx. 30g)	BJ: approx. 70g (approx. 45g) BJ-C: approx. 35g (approx. 10g)		

※1: The sensing distance is specified with the MS-2A reflector. The distance between the sensor and the reflector should be set over 0.1m.
The sensing distance is extended from 0.1 to 4m or 0.1 to 5m when using optional reflector MS-2S or MS-3S.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "▣ Reflectivity By Reflective Tape Model" table before using the tapes.
※2: Non-glossy white paper 300×300mm. ※3: Non-glossy white paper 100×100mm.
※4: M8 connector cable is sold separately. (cable - AWG22, Core diameter: 0.08mm, Number of cores: 60, Insulator out diameter: Ø1.25mm)
※5: Cable type includes bracket A and connector type includes bracket B. ※6: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

Transparent Glass Sensing/BGS Reflective/Micro Spot Type

▣ Features

■ BGS reflective type

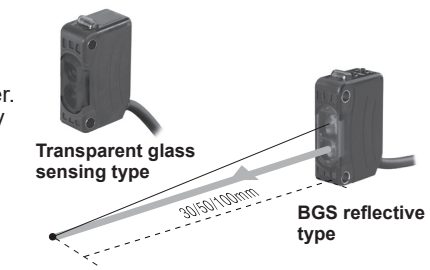
- BGS (background suppression) minimizes detection errors from background objects and the color or material of target objects. Also the detecting distance can be configured with the sensitivity adjuster.
- Visible light source allows users to identify the sensing area, and the tiny spot size minimizes influence from surrounding objects

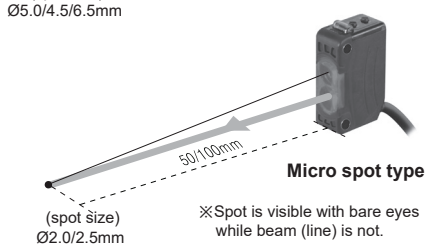
■ Transparent glass sensing type / Micro spot type

- Stable detection of transparent targets (LCD, PDP, glass etc.) (transparent glass sensing types)
- Check sensing area with visible micro spot (micro spot types)
- Detect tiny objects (minimum target size: Ø0.2mm copper wire)

■ Commonness

- Compact size: W10.6 × H32 × L20mm
- Light ON/Dark ON operation mode switch (except BJG30-DDT)
- Sensitivity adjuster (except BJG3-DDT)
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit
- Mutual interference prevention function (except BGS reflective type)
- Excellent noise immunity and minimal influence from ambient light
- IP65 protection structure (IEC standard)





※Spot is visible with bare eyes while beam (line) is not.

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

CE

▣ Specifications

Type		Transparent glass sensing type		BGS reflective type※1		Micro spot type	
Model	NPN open collector output	BJG30-DDT		BJ30-BDT	BJ50-BDT	BJN50-NDT	BJN100-NDT
	PNP open collector output	—		BJ30-BDT-P	BJ50-BDT-P	BJN50-NDT-P	BJN100-NDT-P
Sensing type		Diffuse reflective		BGS reflective		Narrow beam reflective	
Sensing distance		30mm※2	15mm※3	10 to 30mm※4	10 to 50mm※4	30 to 70mm	70 to 130mm
Sensing target		Transparent glass, opaque materials, translucent		Translucent, opaque materials		Translucent, opaque materials	
Min. diameter of transmitting spot		—		Approx. Ø5.0mm	Approx. Ø4.5mm	Approx. Ø2.0mm	Approx. Ø2.5mm
Min. sensing target		—				Approx. min. Ø0.2mm (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		Infrared LED (850nm)		Red LED (660nm)		Red LED (650nm)	
Sensitivity adjustment		—		Sensitivity adjuster			
Operation mode		Light ON fixed		Light ON/Dark ON operation mode switch			
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. 1VDC⎓, PNP: min. 2.5VDC			
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit, mutual interference prevention function (except BGS reflective type)					
Indicator		Operation indicator: red LED, stability indicator: green LED					
Insulation resistance		Over 20MΩ (at 500VDC megger)					
Noise immunity		±240V the square wave noise (pulse width:1μs) by the noise simulator					
Dielectric strength		1,000VAC 50/60Hz for 1 min					
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times					
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)					
	Ambient temperature	-25 to 55℃, storage: -40 to 70℃					
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH					
Protection structure		IP65 (IEC standard)					
Material		Case: polycarbonate+acrylonitrile butadiene styrene, LED cap: polycarbonate, sensing part: polymethyl methacrylate, bracket: SUS304 (steel use stainless 304), bolt, nut: steel chromium molybdenum, sleeve: brass, ni-plate					
Cable		Ø3.5mm, 3-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)					
Accessory		Fixing bracket, M3 bolt: 2, M3 nut: 2		Fixing bracket, M3 bolt: 2, M3 nut: 2, adjustment screwdriver			
Approval		CE					
Unit weight		Approx. 45g		Approx. 50g		Approx. 45g	

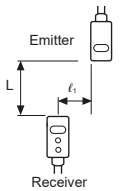
※1: In case of BGS sensing type, black/white difference is max. 10% of sensing distance and sensitivity adjustment range is -10% of max. sensing distance (based on non-glossy white paper).
※2: Non-glossy white paper 100×100mm.
※3: Transparent glass 50×50mm, t=3.0mm.
※4: Non-glossy white paper 50×50mm.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

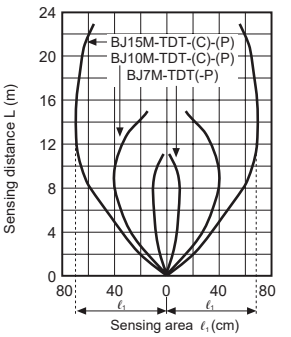
▣ Feature Data

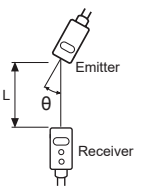
◎ Through-beam type

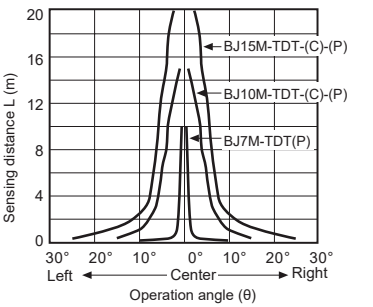
● BJ15M-TDT- (C)- (P) / BJ10M-TDT- (C)- (P) / BJ7M-TDT- (P)

Parallel shifting characterisitic		Angle characteristic	
Measuring method	Data	Measuring method	Data





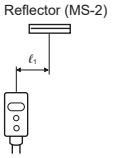


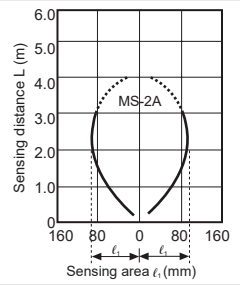


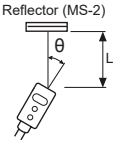
◎ Retroreflective type

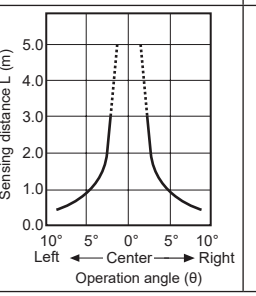
● BJ3M-PDT- (C)- (P)

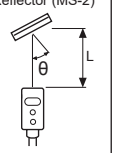
Parallel shifting characterisitic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data

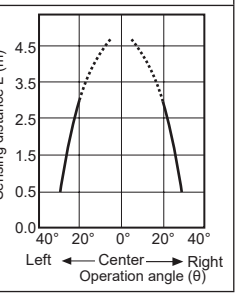








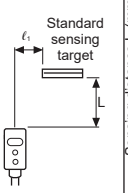


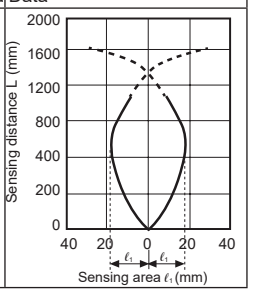


◎ Diffuse/Narrow beam reflective type

● BJ1M-DDT- (C)- (P)

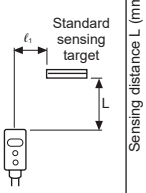
Sensing area characteristic	
Measuring method	Data

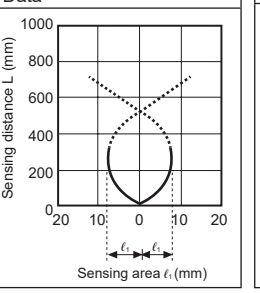




● BJ300-DDT- (C)- (P)

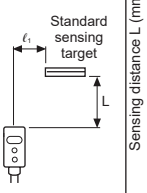
Sensing area characteristic	
Measuring method	Data

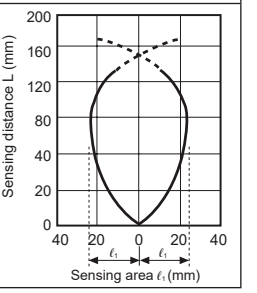




● BJ100-DDT- (C)- (P)

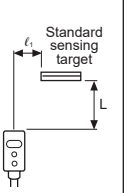
Sensing area characteristic	
Measuring method	Data

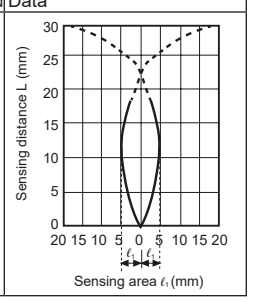




● BJG30-DDT

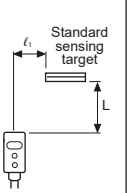
Sensing area characteristic	
Measuring method	Data

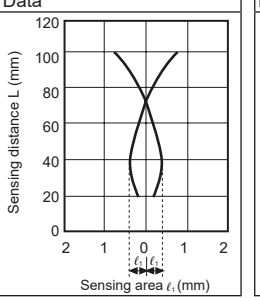




● BJN50-NDT- (P)

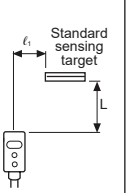
Sensing area characteristic	
Measuring method	Data

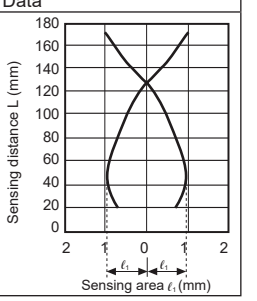




● BJN100-NDT- (P)

Sensing area characteristic	
Measuring method	Data





Long Sensing Distance/BGS Reflective/Micro Spot Type

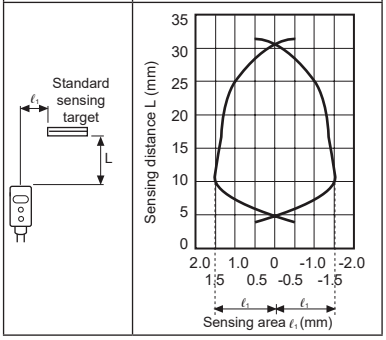
▣ Feature Data

◎ BGS reflective type

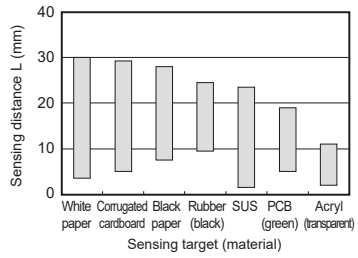
● **BJ30-BDT / BJ30-BDT-P**

Sensing area characteristic

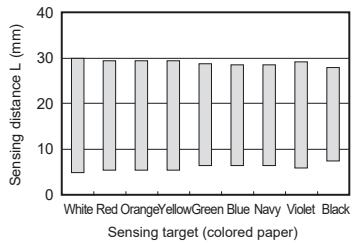
Measuring method | Data



Sensing distance by material



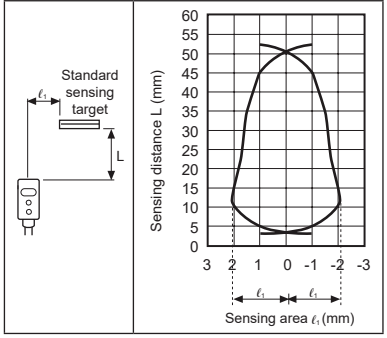
Sensing distance by color



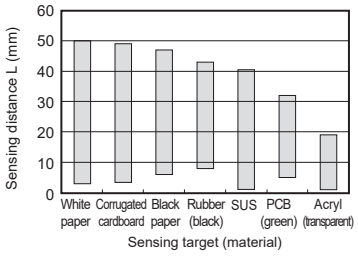
● **BJ50-BDT / BJ50-BDT-P**

Sensing area characteristic

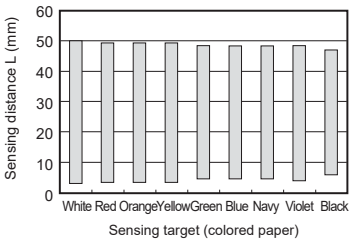
Measuring method | Data



Sensing distance by material

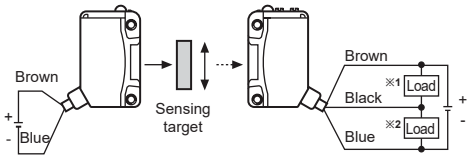


Sensing distance by color

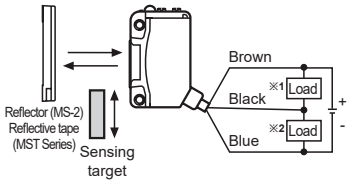


▣ Connections

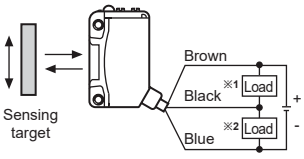
● **Through-beam type**



● **Retroreflective type**

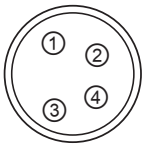


● **Diffuse/Narrow beam/ BGS reflective type**



※1: Load connection for NPN output
※2: Load connection for PNP output

▣ Connections for Connector Part



M8 Connector pin

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

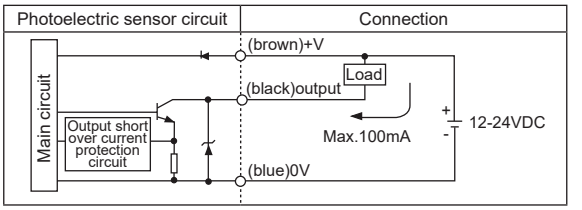
※Connector pin ② is N·C (not connected) terminal.

● **Connector cable (sold separately)**

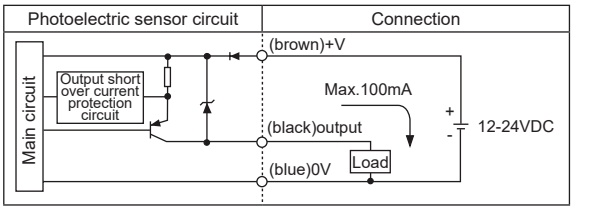
※Connector cable model
: CID408- □ , CLD408- □
※Please refer to the connector cable section.

▣ Control Output Diagram

● NPN open collector output



● PNP open collector output



※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

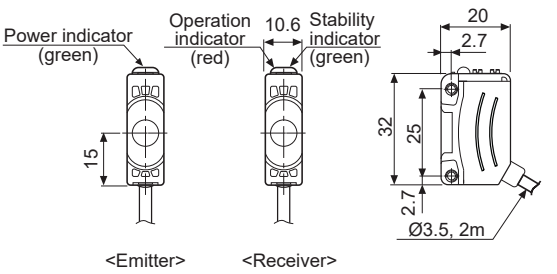
▣ Operation Mode

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

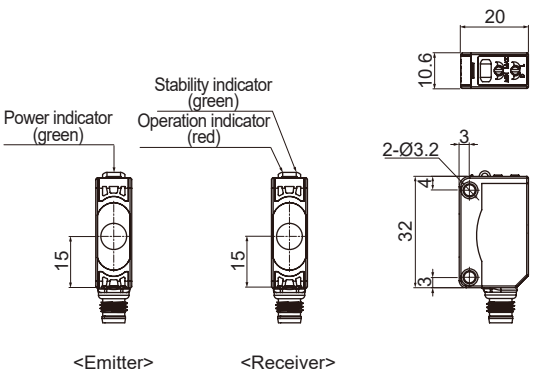
▣ Dimensions

(unit: mm)

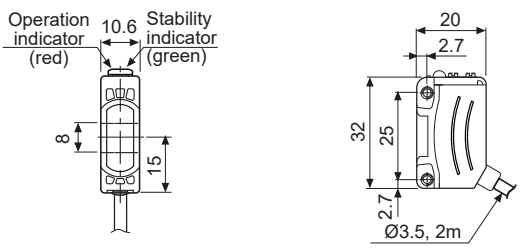
●Through-beam type



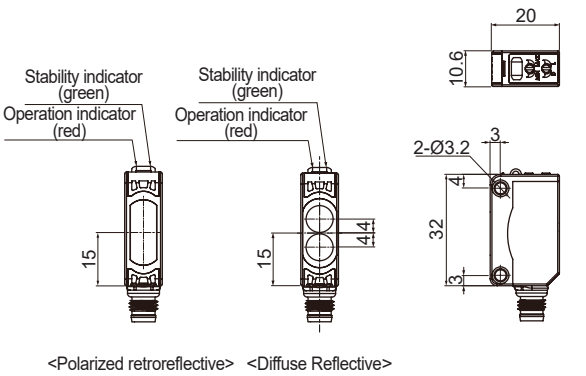
●Through-beam type (connector type)



● Retroreflective type

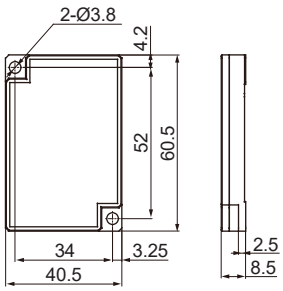


● Retroreflective type (connector type)

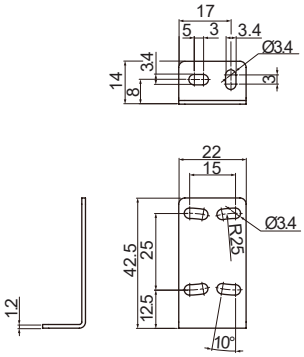


Long Sensing Distance/BGS Reflective/Micro Spot Type

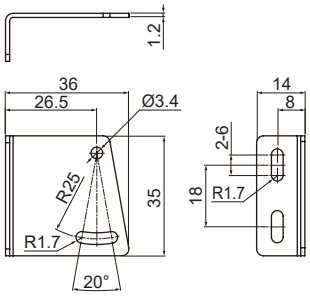
● **Reflector(MS-2A)**



● **Bracket A**

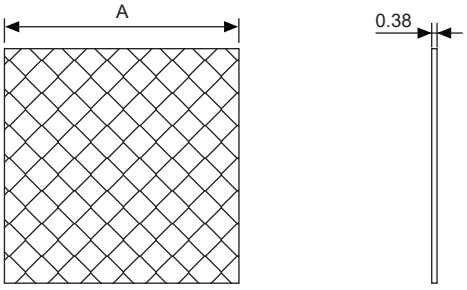


● **Bracket B**



※Cable type provides the bracket A and connector type provides the bracket B.
The other bracket is also avilable as sold separately.

● **Reflective tape (sold separately)**

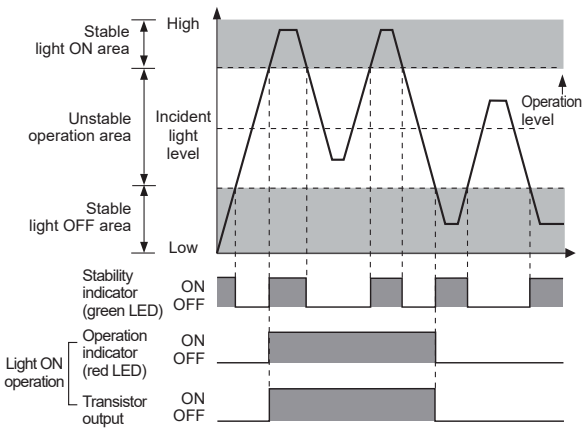


(unit: mm)

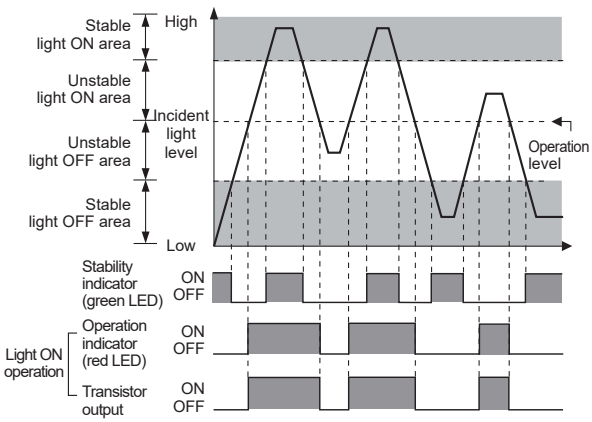
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

▣ Operation Timing Diagram

● **Through-beam type**



● **Retroreflective/Diffuse/Narrow beam/ BGS reflective type**

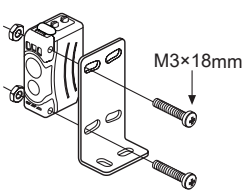


※The waveforms of “Operation indicator” and “Transistor output” are for Light ON operation.
They are opposite operation for Dark ON operation.

▣ Mounting and Adjustment

◎ For mounting

When using the reflective type photoelectric sensors closely over three units, it may result in malfunction due to mutual interference.
When using the through-beam type photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 0.5N·m.



◎ Switching of operation mode

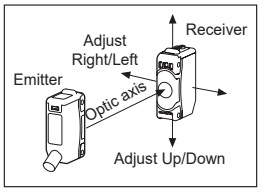
Light ON operation		Turn the operation mode switch to the end of right (L direction), it is set as Light ON.
Dark ON operation		Turn the operation mode switch to the end of left (D direction), it is set as Dark ON.

※For through-beam type, the operation mode switch is built-in the receiver.

◎ Optical axis adjustment

●Through-beam type

1. Place the emitter and the receiver facing each other and supply the power.
2. After adjusting the position of the emitter and the receiver and checking their stable indicating range, mount them in the middle of the range.

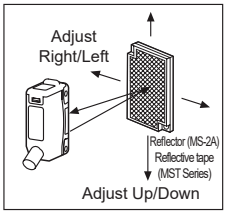


3. After mounting this unit, check the operation of the sensor and lighting of the stability indicator in both status. (none or sensing target status)

※When the sensing target is translucent or small (under sensing target of ' ▣ **Specifications**'), it may not be detected by the sensor because the light can penetrate it.

● Retroreflective type

1.Place the sensor and the reflector (or reflective tape) facing each other and supply the power.
2.After adjusting the position of the sensor and reflector (or reflective tape) and checking their stable indicating range, mount them in the middle of the range. (none or sensing target status)

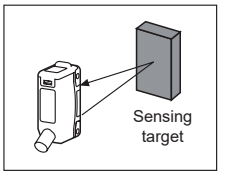


3.After mounting this unit, check the operation of the sensor and in both status. (none or sensing target status)

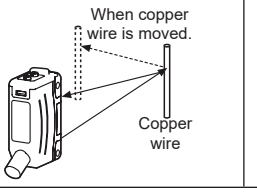
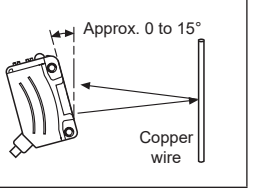
※Please use reflective tape (MST Series) for where a reflector is not installed.

● Diffuse/Narrow beam/BGS reflective type

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

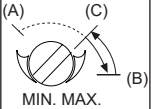
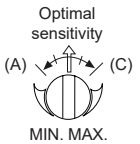


● Object (copper wire) detection <Micro spot type>

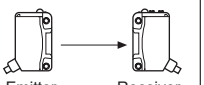
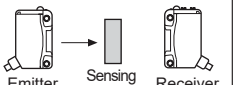
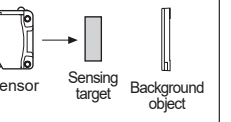
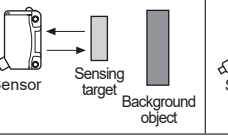
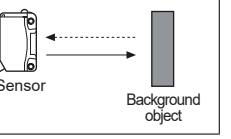
[Figure 1]	[Figure 2]
	

※Mount the 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

Order	Position	Description
1		Turn the sensitivity adjuster to the right of min. and check position (A) where the operation indicator is turned ON in "Light ON status".
2		Turn the sensitivity adjuster more to the right of position (A), check position (B) where the operation indicator is turned ON. And turn the sensitivity adjuster to the left, check position (C) where the operation indicator is turned OFF in "Light OFF status". ※If the operation indicator is not turned ON although the sensitivity adjuster is turned to the max. position, the max. position is (C).
3		Set the sensitivity adjuster at the center of (A) and (C). To set the optimum sensitivity, check the operation and lighting of stability indicator with sensing target or without it. If the stability indicator is not turned ON, 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		
Retro-reflective type		
Diffuse/ Narrow beam/ BGS reflective		

※Set the sensitivity to operate in stable light ON area and the reliability for the environment (temperature, voltage, dust etc) is increased. In unstable light ON area, be sure to check the variation of environment.

※Do not apply excessive force on the sensitivity adjuster or operation mode switch, they may be broken.

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

▣ Reflectivity by Reflective Tape Model

MST-50-10(50×50mm)	40%
MST-100-5(100×100mm)	60%
MST-200-2(200×200mm)	100%

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

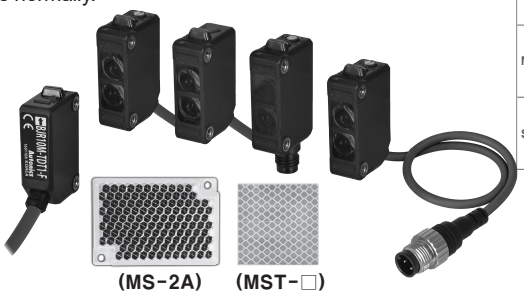
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.

※For using reflective tape, installation distance should be min. 20mm.

Compact Oil Resistant/Oil Proof Type Photoelectric Sensor

▣ Features

- Stronger in the environment with full of cutting fluid or lubricating oil (optimized for automobile and machine tool industry)
  BJR (oil resistant type): Special coating prevents penetration of oil into the product.
  BJR-F (oil proof type): Even if oil penetrates into the product, it operates normally.
- Long sensing distance with lens of high performance
  - Through-beam type: 15m, Diffuse reflective type: 1m,
    Polarized retroreflective type: 3m (MS-2S)
- M.S.R. (Mirror Surface Rejection) function (retroreflective type)
- Compact size: W20 × H32 × L11mm
- Light ON/Dark ON operation mode switch
- Sensitivity adjuster
- Built-in reverse polarity protection circuit and
  output short overcurrent protection circuit
- Mutual interference prevention function (except through-beam type)
- Excellent noise immunity and minimal influence from ambient light
- IP67 protection structure (IEC standard)
  BJR (oil resistant type): IP67G oil resistance protection structure (JEM standard)
  BJR-F (oil proof type): IP67F oil proof protection structure (JEM standard)



(MS-2A) (MST-□)

※The model name with '-C' is connector type, and with '-W' is cable connector type.
※MST-□ is sold separately.

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

▣ Specifications

◎ BJR (oil resistant type)

Model					
	NPN open collector output	**BJR15M-TDT-□**	**BJR3M-PDT-□**	**BJR1M-DDT-□**	**BJR100-DDT-□**
	PNP open collector output	**BJR15M-TDT-□-P**	**BJR3M-PDT-□-P**	**BJR1M-DDT-□-P**	**BJR100-DDT-□-P**
Sensing type		Through-beam type	Retroreflective type (built-in polarizing filter)	Diffuse reflective type	
Sensing distance		15m	3m※1	1m※2	100mm※3
Sensing target		Opaque material over Ø12mm	Opaque material over Ø75mm	Translucent, opaque materials	
Hysteresis		—		Max. 20% at sensing distance	
Response time		Max. 1ms			
Power supply		10-30VDC⎓ ±10% (ripple P-P: max. 10%)			
Current consumption		Emitter/Receiver: max. 20mA	Max. 30mA		
Light source		Infrared LED (850nm)	Red LED (660nm)	Red LED (660nm)	Infrared LED (850nm)
Sensitivity adjustment		Sensitivity adjuster			
Operation mode		Light ON / Dark ON selectable by switch			
Control output		NPN or PNP open collector output • Load voltage: Max. 30VDC⎓ • Load current: Max. 100mA • Residual voltage - NPN: Max. 1VDC⎓, PNP: Max. 2VDC			
Protection circuit		Power reverse polarity protection circuit, output short over current protection circuit	Power reverse polarity protection circuit, output short over current protection circuit, interference prevention function		
Indicator		Operation indicator: yellow LED, stability indicator: green LED (emitter's power indicator: red LED)			
Connection		Cable type, cable connector type			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1,000VAC 50/60Hz for 1 minute			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
Environment	Ambient illu.	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)			
	Ambient temp.	-25 to 60℃, storage: -40 to 70℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP67 (IEC standard), IP67G※4 (JEM standard)			
Material		Case: acrylonitrile-butadiene-styrene, LED Cap: polyamide 12, lens cover: polymethyl methacrylate			
Cable	Cable type	Ø4mm, 3-wire, 2m (emitter of through-beam type: Ø4mm, 2-wire, 2m) (AWG26, core diameter: 0.52mm, number of cores: 20, insulator out diameter: Ø1mm)			
	Cable connector type※6, ※7	Ø4mm, 3-wire, 300mm (emitter of through-beam type: Ø4mm, 2-wire, 300mm), M12 connector (AWG26, core diameter: 0.52mm, number of cores: 20, insulator out diameter: Ø1mm)			
Accessory	Common	Mounting bracket, M3 bolt: 4, adjustment screwdriver	Mounting bracket, M3 bolt: 2, adjustment screwdriver		
	Individual	—	Reflector (MS-2S)	—	
Approval		CE			
Weight※9	Cable type	Approx. 145g (approx. 95g)	Approx. 115g (approx. 50g)	Approx. 100g (approx. 50g)	
	Cable connector type	Approx. 105g (approx. 55g)	Approx. 95g (approx. 30g)	Approx. 80g (approx. 30g)	

◎ BJR-F (oil proof type)

Model						
NPN open collector output		BJR15M-TDT-□-F	BJR10M-TDT-□-F	BJR3M-PDT-□-F	BJR1M-DDT-□-F	BJR100-DDT-□-F
PNP open collector output		BJR15M-TDT-□-P-F	BJR10M-TDT-□-P-F	BJR3M-PDT-□-P-F	BJR1M-DDT-□-P-F	BJR100-DDT-□-P-F
Sensing type		Through-beam type		Retroreflective type (built-in polarizing filter)	Diffuse reflective type	
Sensing distance		15m	10m	3m※1	1m※2	100mm※3
Sensing target		Opaque material over Ø12mm		Opaque material over Ø75mm	Translucent, opaque materials	
Hysteresis		—			Max. 20% at sensing distance	
Response time		Max. 1ms				
Power supply		10-30VDC⎓ ±10% (ripple P-P: max. 10%)				
Current consumption		Emitter/Receiver: max. 20mA		Max. 30mA		
Light source		Infrared LED (850nm)	Red LED (660nm)	Red LED (660nm)	Infrared LED (850nm)	
Sensitivity adjustment		Sensitivity adjuster				
Operation mode		Light ON / Dark ON selectable by switch				
Control output		NPN or PNP open collector output • Load voltage: Max. 30VDC⎓ • Load current: Max. 100mA • Residual voltage - NPN: Max. 1VDC⎓, PNP: Max. 2VDC				
Protection circuit		Power reverse polarity protection circuit, output short over current protection circuit		Power reverse polarity protection circuit, output short over current protection circuit, interference prevention function		
Indicator		Operation indicator: yellow LED, stability indicator: green LED (emitter's power indicator: red LED)				
Connection		Cable type, Connector type, Cable connector type				
Insulation resistance		Over 20MΩ (at 500VDC megger)				
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator				
Dielectric strength		1,000VAC 50/60Hz for 1 minute				
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours				
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times				
Environment	Ambient illu.	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)				
	Ambient temp.	-25 to 60℃, storage: -40 to 70℃				
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH				
Protection structure		IP67 (IEC standard), IP67F※4 (JEM standard)				
Material		Case: acrylonitrile-butadiene-styrene, LED Cap: polyamide 12, lens cover: polymethyl methacrylate				
Cable	Cable type	Ø4mm, 3-wire, 2m (emitter of through-beam type: Ø4mm, 2-wire, 2m) (AWG26, core diameter: 0.52mm, number of cores: 20, insulator out diameter: Ø1mm)				
	Connector type※5	M8 connector				
	Cable connector type※6	Ø4mm, 3-wire, 300mm (emitter of through-beam type: Ø4mm, 2-wire, 300mm), M12 connector (AWG26, core diameter: 0.52mm, number of cores: 20, insulator out diameter: Ø1mm)				
Accessory	Common	Mounting bracket※8, M3 bolt: 4, adjustment screwdriver		Mounting bracket※8, M3 bolt: 2, adjustment screwdriver		
	Individual	—		Reflector (MS-2S)	—	
Approval		CE				
Weight※9	Cable type	Approx. 145g (approx. 95g)		Approx. 115g (approx. 50g)	Approx. 100g (approx. 50g)	
	Connector type	Approx. 65g (approx. 12g)		Approx. 75g (approx. 6g)	Approx. 60g (approx. 6g)	
	Cable connector type	Approx. 105g (approx. 55g)		Approx. 95g (approx. 30g)	Approx. 80g (approx. 30g)	

※1: The sensing distance is specified with using the MS-2S reflector. The distance between the sensor and the reflector should be set over 0.1m. When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the catalog or website.
※2: Non-glossy white paper 300×300mm.
※3: Non-glossy white paper 100×100mm.
※4: Alphabet represents protection structure for oil resistance/oil proof which is defined according to the JEM.
G: Oil (drop or dust) from any direction never penetrate into the product.
F: The product is not affected by oil (drop or dust) from any direction.
※5: M8 connector cable is sold separately. (AWG26, core diameter: 0.1mm, number of cores: 20, insulator out diameter: Ø1mm)
※6: M12 connector cable is sold separately. (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.65mm)
※7: Although some of the cable connector type products can have color difference in the connector part due to the coating, it does not affect operation and performance.
※8: Cable type and cable connector type includes bracket A and connector type includes bracket B.
※9: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.

▣ Oil Resistance/Oil Proof Test

For IP67G, IP67F protection structure, we conducted reliability test on the oil in the following table, and got a result of pass.
When reviewing the oil to be used, refer to the following table.

Oil type	JIS standard	Oil name	Kinetic viscosity (mm^2/s, 40℃)	PH
Lubricating oil	—	Velocite Oil No.3	2	—
Water-insoluble cutting fluid	2-5	Tectyl Cut 527	27	—
Water-soluble cutting fluid	—	Tectyl Cool 263C	—	9.5 (10% Solution)

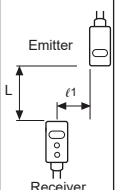
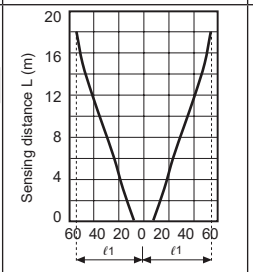
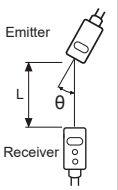
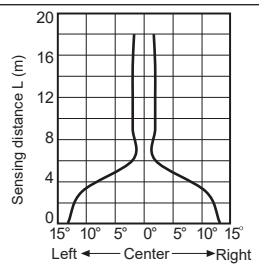
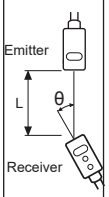
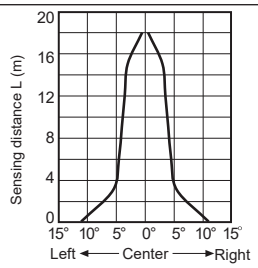
• Result of dropping test for 240 hours with the above oil
- BJR (oil resistant type): Special coating prevents penetration of oil into the product. It obtains IP67G (JEM standard) protection structure of enhanced oil resistance.
- BJR-F (oil proof type): Even if oil penetrates into the product, it operates normally. It obtains IP67F (JEM standard) protection structure of enhanced oil proof.

▣ Feature Data

◎ BJR (oil resistant type)

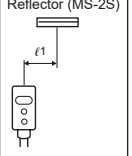
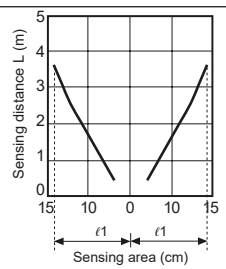
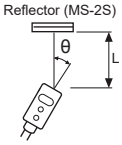
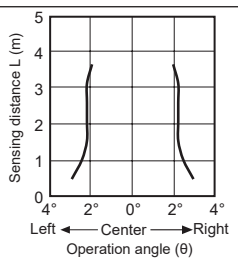
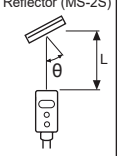
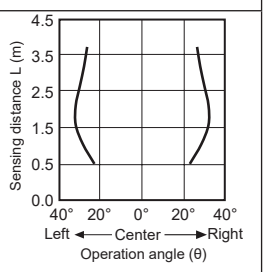
• Through-beam type

- BJR15M-TDT-(C)-(P)

Parallel shifting characterisitic		Emitter angle characteristic		Receiver angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
					

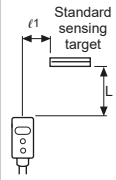
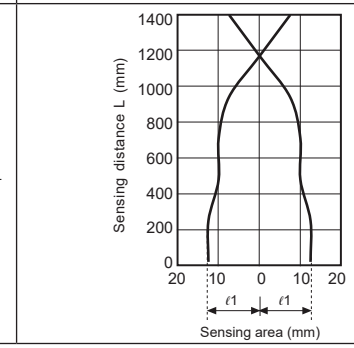
• Retroreflective type

- BJ3M-PDT-(C)-(P)

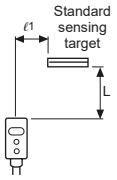
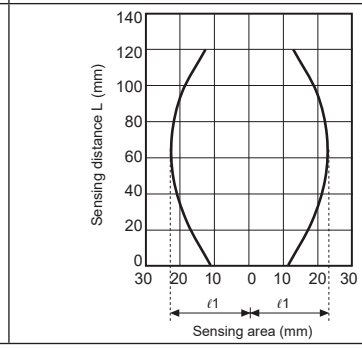
Parallel shifting characterisitic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
					

• Diffuse reflective type

- BJR1M-DDT-(C)-(P)

Sensing area characteristic	
Measuring method	Data
	

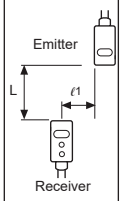
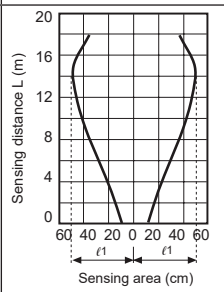
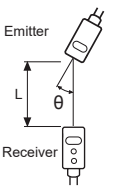
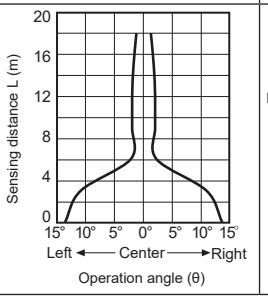
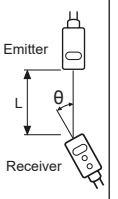
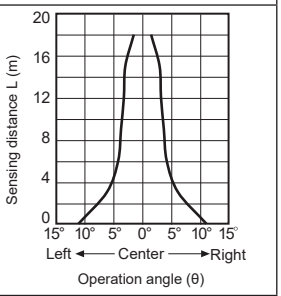
- BJR100-DDT-(C)-(P)

Sensing area characteristic	
Measuring method	Data
	

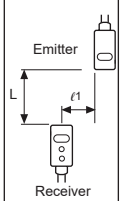
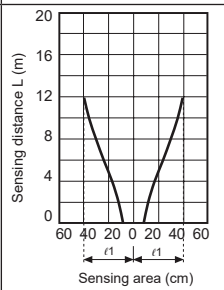
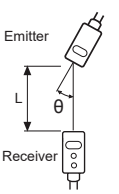
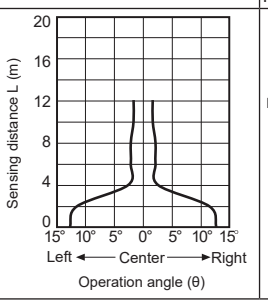
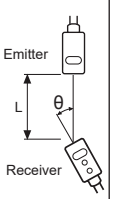
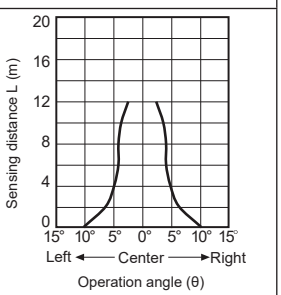
◎ BJR-F (oil proof type)

• Through-beam type

- BJR15M-TDT-(C)-(P)-F

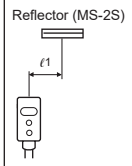
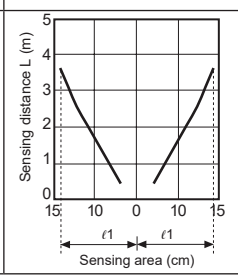
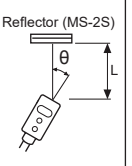
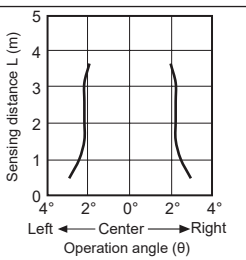
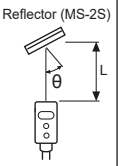
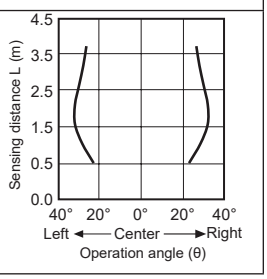
Parallel shifting characterisitic		Emitter angle characteristic		Receiver angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
					

- BJR10M-TDT-(C)-(P)-F

Parallel shifting characterisitic		Emitter angle characteristic		Receiver angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
					

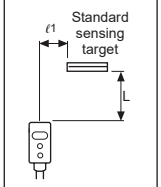
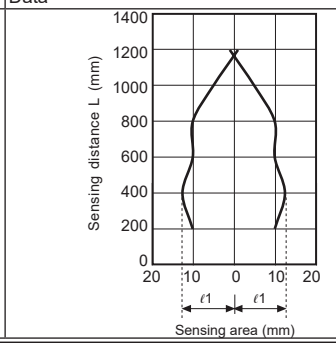
• Retroreflective type

- BJ3M-PDT-(C)-(P)-F

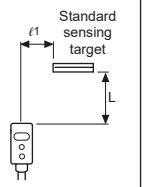
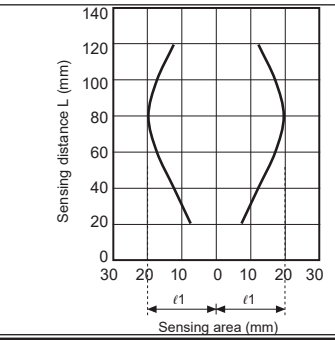
Parallel shifting characterisitic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
					

• Diffuse reflective type

- BJR1M-DDT-(C)-(P)-F

Sensing area characteristic	
Measuring method	Data
	

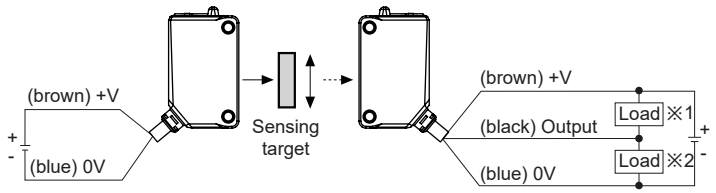
- BJR100-DDT-(C)-(P)-F

Sensing area characteristic	
Measuring method	Data
	

▣ Connections

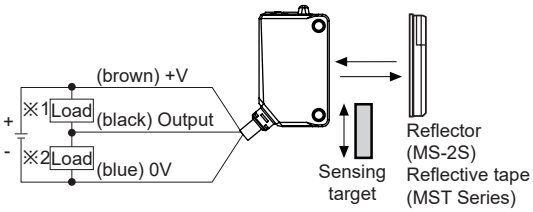
◎ Cable type

● Through-beam type

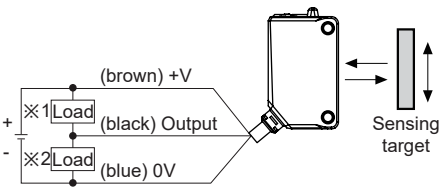


※1: Load connection for NPN output
※2: Load connection for PNP output

● Retroreflective type

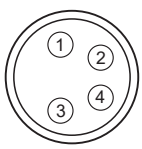


● Diffuse reflective type



◎ Connections for connector part

● Connector type (BJR-F)

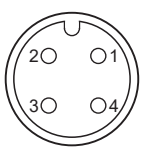


[M8 connector pin]

Connections for cable connector part			
Connector pin No.	Cable colors	Functions	Etc.
①	Brown	Power Source (+V)	Connector cable (sold separately) • CIDH408-□ • CLDH408-□
②	White	N·C	
③	Blue	Power Source (0V)	
④	Black	Output	

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

● Cable connector type

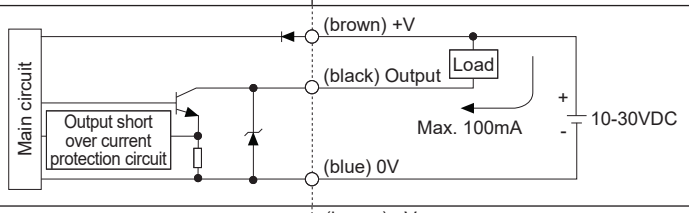
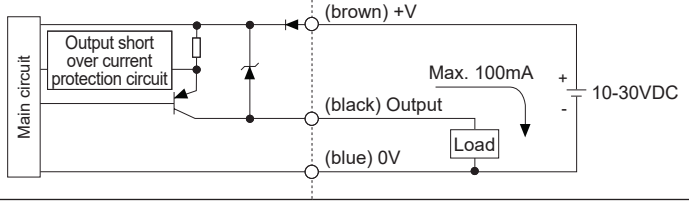


[M12 connector pin]

Connections for cable connector part			
Connector pin No.	Cable colors	Functions	Etc.
①	Brown	Power Source (+V)	Connector cable (sold separately) • CIDH4-□ • CLDH4-□
②	White	N·C	
③	Blue	Power Source (0V)	
④	Black	Output	

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

▣ Control Output Diagram

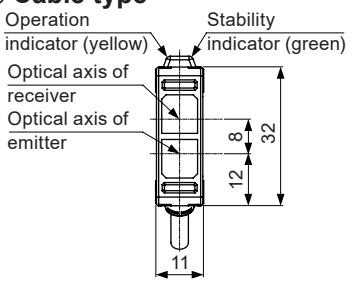
Item	Photoelectric sensor circuit	Connection
NPN open collector output		
PNP open collector output		

※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

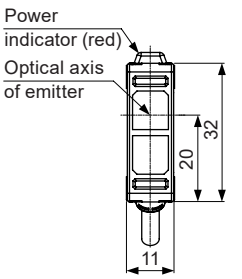
▣ Dimensions

(unit: mm)

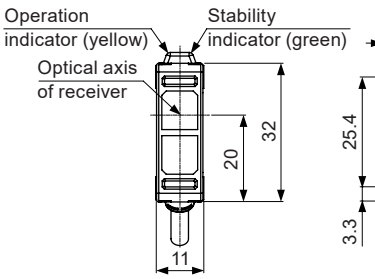
◎ Cable type



[Retroreflective/Diffuse type]

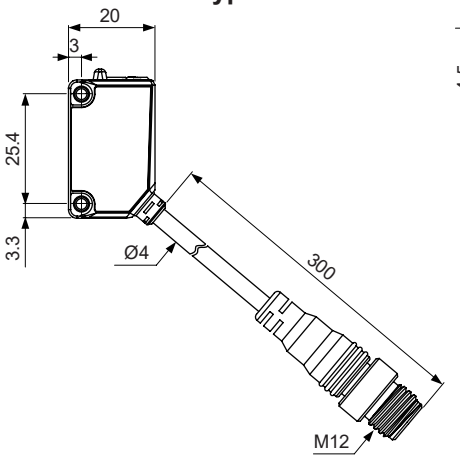


[Through-beam type (emitter)]

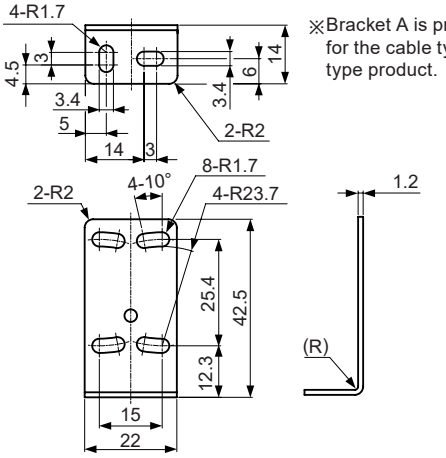


[Through-beam type (receiver)]

◎ Cable connector type

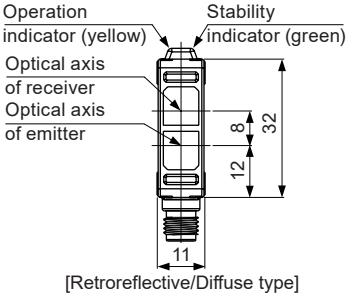


● Bracket A

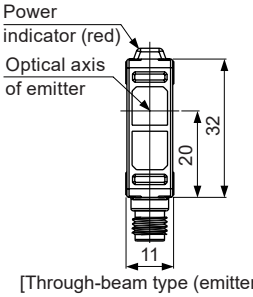


※Bracket A is provided as an accessory for the cable type and cable connector type product.

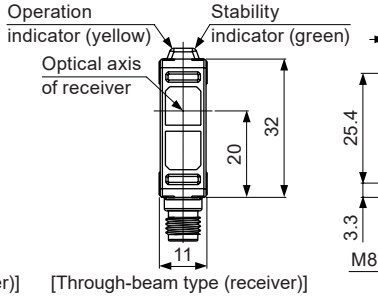
◎ Connector type (BJR-F)



[Retroreflective/Diffuse type]

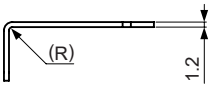


[Through-beam type (emitter)]

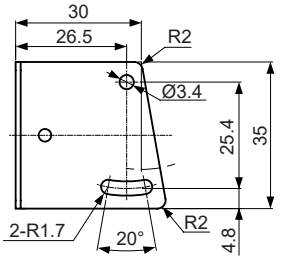


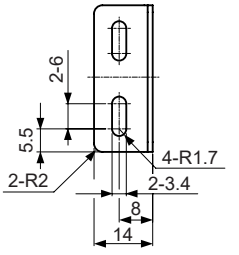
[Through-beam type (receiver)]

● Bracket B (BK-BJP-B)

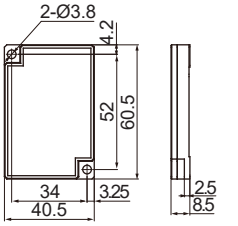


※Bracket B is provided as an accessory for the connector type product.
※It can be purchased separately.

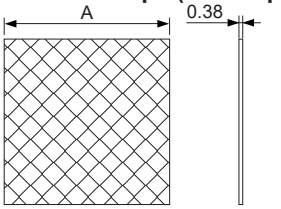




● Reflector (MS-2S)



● Reflective tape (sold separately)



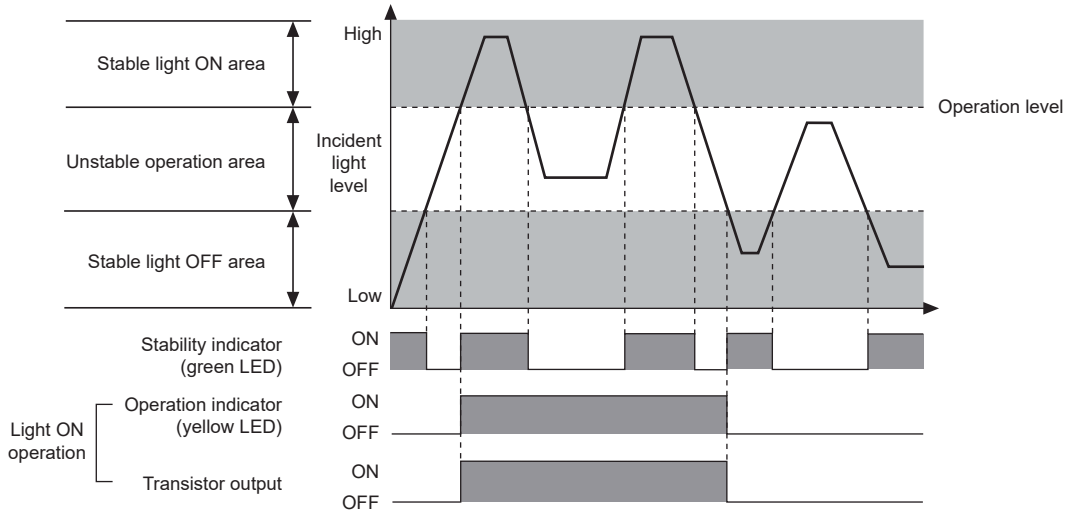
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

▣ Operation Mode

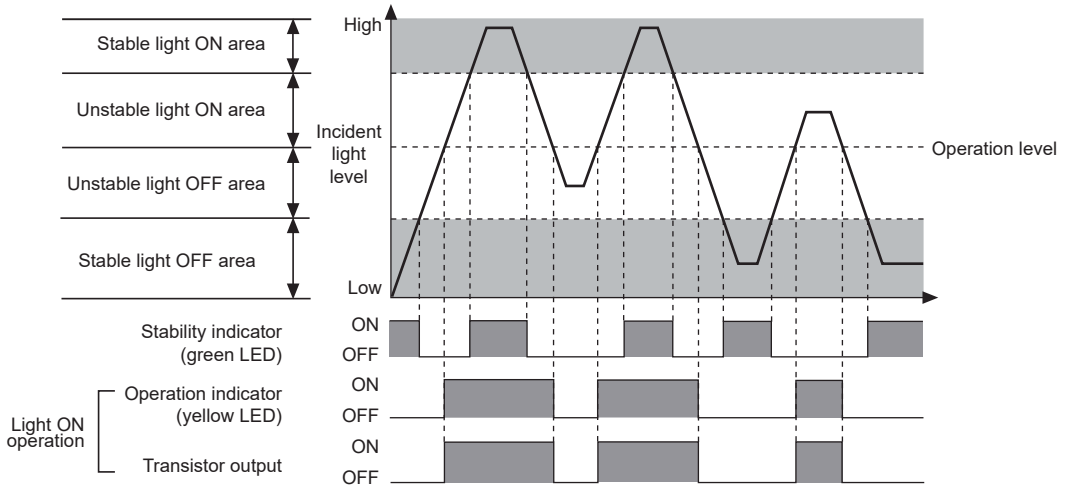
Operation mode	Light ON	Dark ON
Receiver operation	Received light Interrupted light	Received light Interrupted light
Operation indicator (red LED)	ON OFF	ON OFF
Transistor output (NPN/PNP)	ON OFF	ON OFF

▣ Operation Timing Diagram

◎ Through-beam type



◎ Retroreflective type/Diffuse reflective type

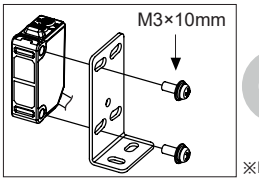


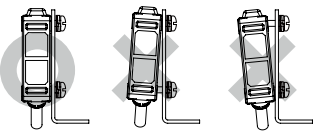
※The waveforms of 'Operation indicator' and 'Transistor output' are for Light ON operation. The waveforms are reversed for Dark ON operation.

▣ Installation and Adjustment

◎ For mounting

When using the reflective type photoelectric sensors closely over three units, it may result in malfunction due to mutual interference.
When using the through-beam type photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 0.5 N·m.





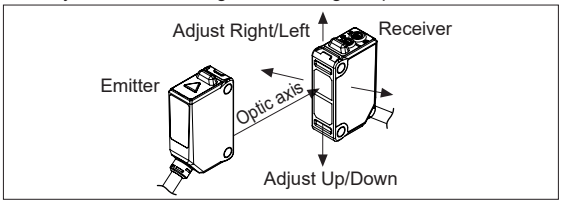
※Install the sensor horizontally with the bracket.

◎ Optical axis adjustment

● Through-beam type

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

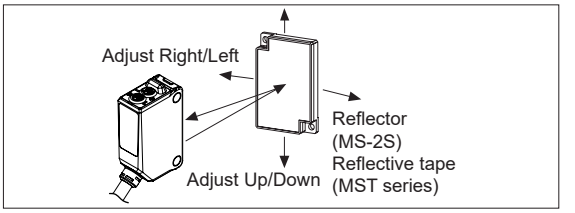
※If the sensing target is translucent body or smaller than Ø15mm, it may not sense the target because light is passed.



● Retroreflective type

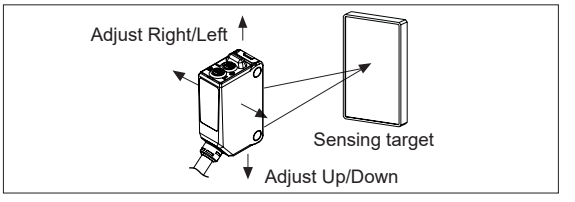
1. Place the sensor and the reflector (or reflective tape) facing each other and supply the power.
2. After adjusting the position of the sensor and reflector (or reflective tape) and checking their stable indicating range, mount them in the middle of the range. (none or sensing target status)
3. After mounting this unit, check the operation of the sensor and in both status. (none or sensing target status)

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

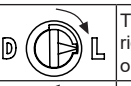
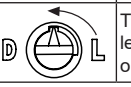


● Diffuse reflective type

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

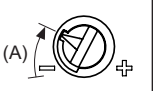
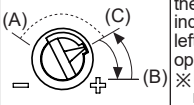
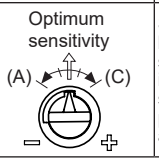


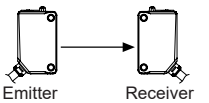
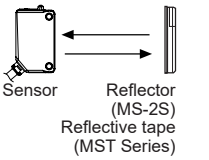
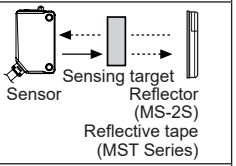
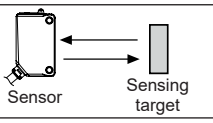
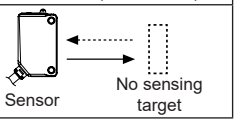
◎ Operation mode switching

Light ON		Turn the switch all the way to the right (towards L) to select Light ON operation.
Dark ON		Turn the switch all the way to the left (towards D) to select Dark ON operation.

※For through-beam type, the switch is built-in the receiver.

◎ Sensitivity adjustment

Order	Sensitivity setting	Descriptions
1		From Light ON status, turn the sensitivity setting adjuster slowly to the right from MIN sensitivity and check the position where operation indicator turns on (A).
2		From Dark ON status, turn the sensitivity setting adjuster further right and check the position where the operation indicator turns on (B). Turn the adjuster left and check the position where the operation indicator turns off (C). ※If the operation indicator does not turn on at MAX sensitivity, the maximum sensitivity setting is set at position (C).
3		Set the adjuster at the center position between (A) and (C) for optimal sensitivity. Also, check if the stability indicator turns off with or without the sensing target. If it does not turn off, please review the operation mode again, as sensitivity may be unstable.

	Light ON	Dark ON
Through-beam type		
Retro-reflective type		
Diffuse reflective type		

※Please set the sensitivity setting adjuster is executed in stable Light ON area and the reliability of environment (temperature, supply, dust etc.) is increased after the mounting it in a stable area.
※When adjusting sensitivity or switching operation modes, please use the Autonics adjustment screwdriver (included accessory). Using a screwdriver with a bigger diameter than the adjuster buttons may cause errors when making adjustments.
※ It may cause breakdown when the sensitivity setting adjuster or the operation mode selection switch is turned by force.

▣ Reflectivity by Reflective Tape Model

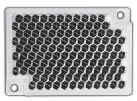
MST-50-10(50×50mm)	35%
MST-100-5(100×100mm)	45%
MST-200-2(200×200mm)	55%

※This reflectivity is based on the reflector (MS-2S).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

Long Distance Sensing Compact Type Photoelectric Sensor

■ Features

- Long sensing distance with high quality lens
  : Through-beam type 30m, Diffuse reflective type 1m, Polarized retroreflective type 3m (MS-2A)
- M.S.R. (Mirror Surface Rejection) function (polarized retroreflective type)
- Compact size: W20×H32×L11mm
- IP65 protection structure (IEC standard)
- Light ON/Dark ON operation mode switch
- Sensitivity adjuster
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit
- Mutual interference prevention function (except through-beam type)
- Excellent noise immunity and minimal influence from ambient light



(MS-2A)

(MST-□)

※The model name with '-C' is connector type.
※MST-□ is sold separately.

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

■ Specifications

Model	NPN open collector output	BJX30M-TDT BJX30M-TDT-C	BJX15M-TDT BJX15M-TDT-C	BJX10M-TDT BJX10M-TDT-C	BJX3M-PDT BJX3M-PDT-C	BJX1M-DDT BJX1M-DDT-C	BJX300-DDT BJX300-DDT-C	BJX100-DDT BJX100-DDT-C
	PNP open collector output	BJX30M-TDT-P BJX30M-TDT-C-P	BJX15M-TDT-P BJX15M-TDT-C-P	BJX10M-TDT-P BJX10M-TDT-C-P	BJX3M-PDT-P BJX3M-PDT-C-P	BJX1M-DDT-P BJX1M-DDT-C-P	BJX300-DDT-P BJX300-DDT-C-P	BJX100-DDT-P BJX100-DDT-C-P
Sensing type		Through-beam type			Retroreflective type (built-in polarizing filter)	Diffuse reflective type		
Sensing distance		30m	15m	10m	3m※1	1m※2	300mm※3	100mm※3
Sensing target		Opaque material over Ø15mm			Opaque material over Ø75mm	Opaque, translucent materials		
Hysteresis		—				Max. 20% at sensing distance		
Response time		Max. 1ms						
Power supply		10-30VDC⎓ ±10% (ripple P-P: max. 10%)						
Power consumption		Emitter / Receiver: max. 20mA			Max. 30mA			
Light source		Red LED (660nm)	Infrared LED (850nm)	Red LED (660nm)	Red LED (660nm)	Red LED (660nm)	Red LED (660nm)	Infrared LED (850nm)
Sensitivity adjustment		Sensitivity adjuster						
Operation mode		Light ON / Dark ON selectable by switch						
Control output		NPN or PNP open collector output • Load voltage: max. 30VDC⎓ • Load current: max. 100mA • Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2VDC						
Protection circuit		Power reverse polarity protection circuit, output short over current protection circuit			Power reverse polarity protection circuit, output short over current protection circuit, interference prevention function			
Indicator		Operation indicator: yellow LED, stability indicator: green LED (emitter's power indicator: red LED)						
Insulation resistance		Over 20MΩ (500VDC megger)						
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator						
Dielectric strength		1,000VAC 50/60Hz for 1 minute						
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours						
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times						
Environment	Ambient illu.	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)						
	Ambient temp.※4	-25 to 60℃, storage: -40 to 70℃						
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH						
Protection structure		IP65 (IEC standard)						
Material		Case: polycarbonate, LED CAP: polycarbonate, sensing part: polymethyl methacrylate acrylic,						
Cable※5		Ø4mm, 3-wire, 2m (emitter of through-beam type: Ø4mm, 2-wire, 2m) (AWG26, core diameter: 0.52mm, number of cores: 20, insulator out diameter: Ø1mm)						
Accessory	Common	Mounting bracket※6, M3 bolt: 4, adjustment screwdriver			Mounting bracket※6, M3 bolt: 2, adjustment screwdriver			
	Individual	—			Reflector (MS-2A)	—		
Approval		CE cULus						
Weight※7	Cable type	Approx. 145g (approx. 95g)			Approx. 115g (approx. 50g)	Approx. 100g (approx. 50g)		
	Connector type	Approx. 65g (approx. 12g)			Approx. 75g (approx. 6g)	Approx. 60g (approx. 6g)		

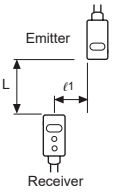
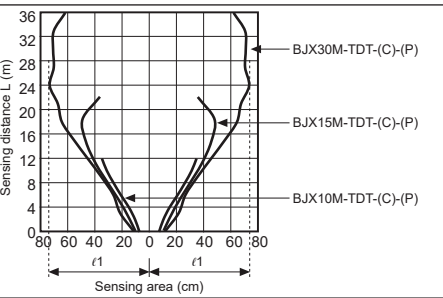
※1: The sensing distance is specified with using the MS-2A reflector. The distance between the sensor and the reflector should be set over 0.1m.
When using reflective tapes, the reflectivity will vary by size of the tape. Please refer to the catalog or website.
※2: Non-glossy white paper 300×300mm. ※3: Non-glossy white paper 100×100mm.
※4: UL approved surrounding air temperature 40℃
※5: M8 connector cable is sold separately.(AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)
※6: Cable type includes bracket A and connector type includes bracket B.
※7: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.

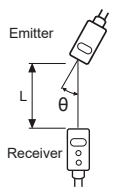
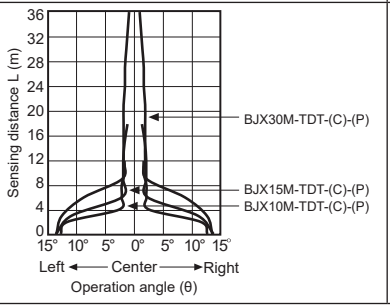
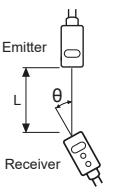
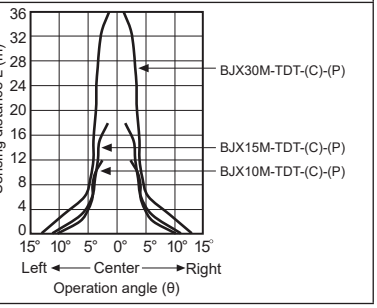
▣ Feature Data

◎ Through-beam type

• BJX30M-TDT-(C)-(P) / BJX15M-TDT-(C)-(P) / BJX10M-TDT-(P)

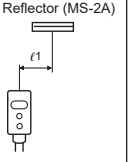
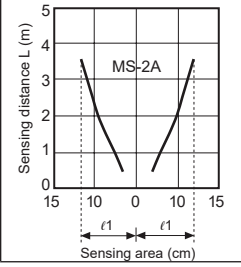
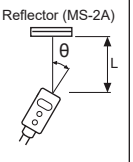
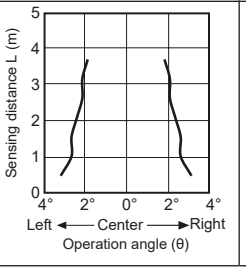
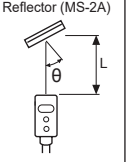
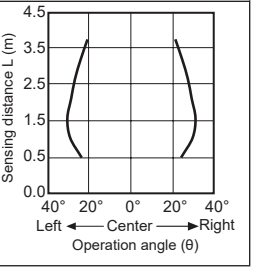
Parallel shifting characterisitic

Measuring method	Data
	

Emitter angle characteristic		Receiver angle characteristic	
Measuring method	Data	Measuring method	Data
			

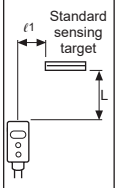
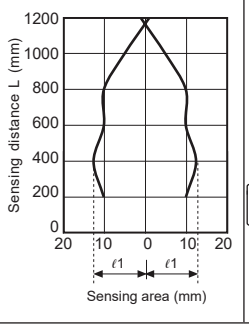
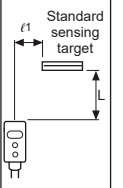
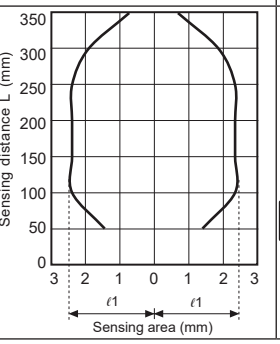
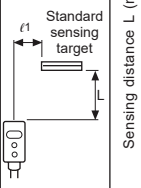
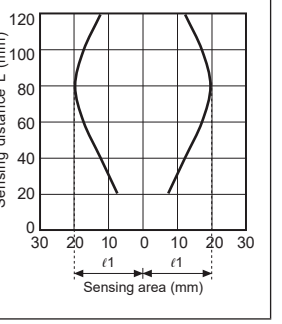
◎ Retroreflective type

• BJX3M-PDT-(C)-(P)

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

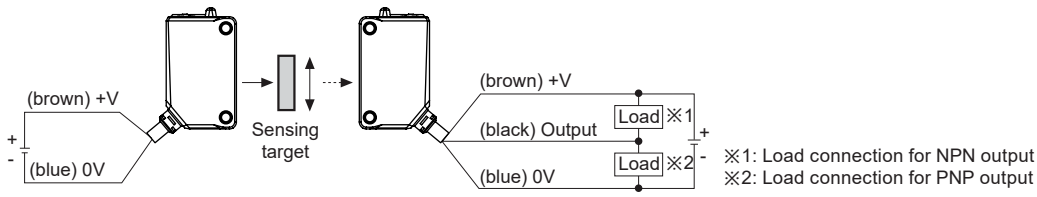
◎ Diffuse reflective type

• BJX1M-DDT-(C)-(P) **• BJX400-DDT-(C)-(P)** **• BJX100-DDT-(C)-(P)**

Sensing area characteristic		Sensing area characteristic		Sensing area characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
					

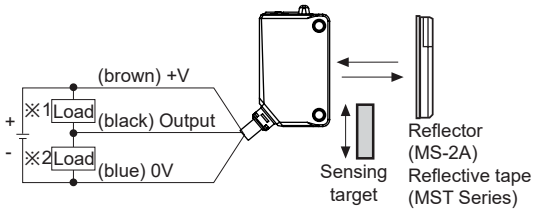
▣ Connections

● Through-beam type

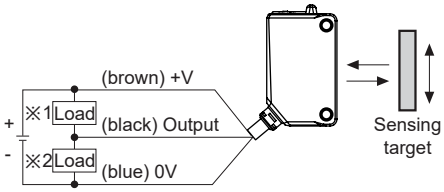


※1: Load connection for NPN output
※2: Load connection for PNP output

● Retroreflective type

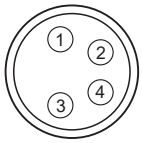


● Diffuse reflective type



◎ Connections for connector part

● Connector type

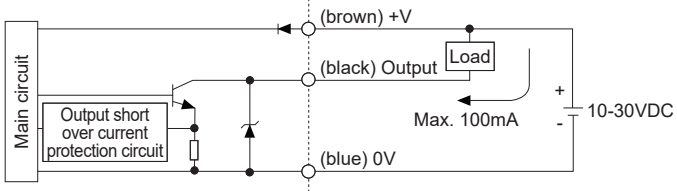
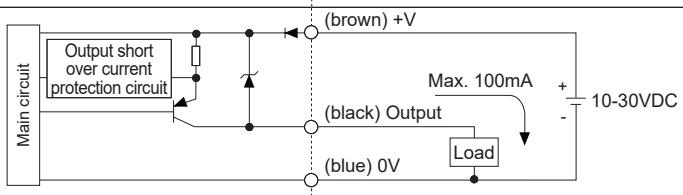


[M8 connector pin]

Connections for cable connector part			
Connector pin No.	Cable colors	Functions	Etc.
①	Brown	Power Source (+V)	Connector cable (sold separately) • CIDH408-□ • CLDH408-□
②	White	N·C	
③	Blue	Power Source (0V)	
④	Black	Output	

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

▣ Control Output Diagram

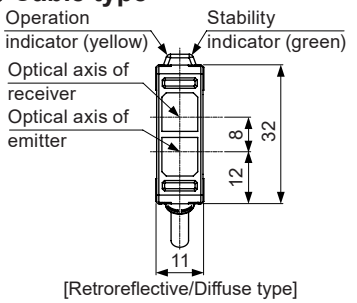
Item	Photoelectric sensor circuit	Connection
NPN open collector output		
PNP open collector output		

※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

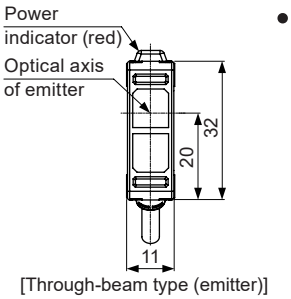
▣ Dimensions

(unit: mm)

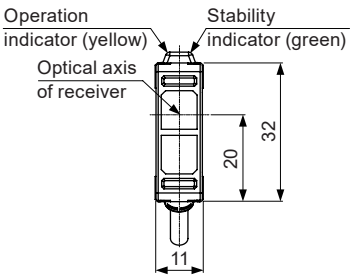
◎ Cable type



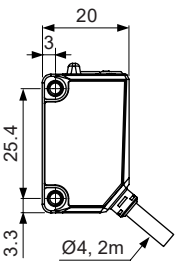
[Retroreflective/Diffuse type]



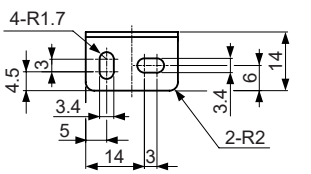
[Through-beam type (emitter)]

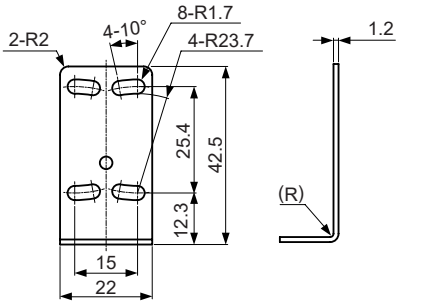


[Through-beam type (receiver)]

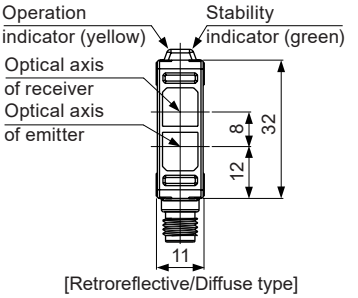


● Bracket A

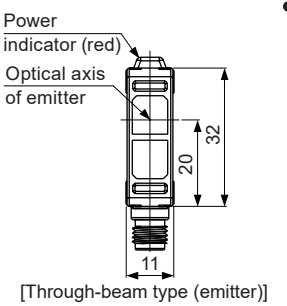




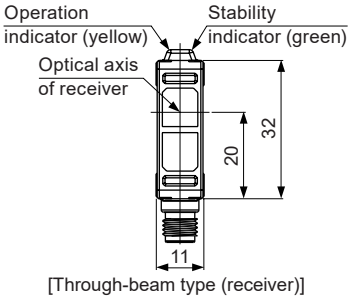
◎ Connector type



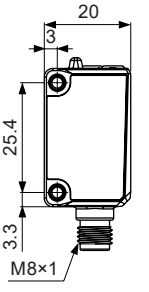
[Retroreflective/Diffuse type]



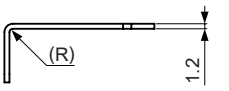
[Through-beam type (emitter)]

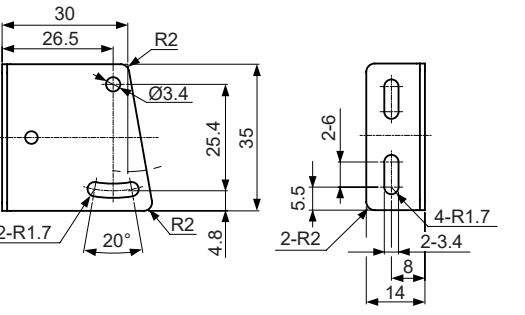


[Through-beam type (receiver)]

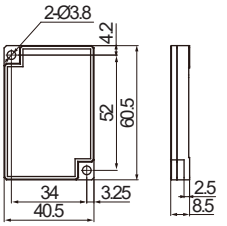


● Bracket B

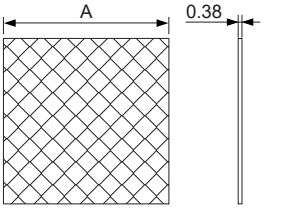




● Reflector (MS-2A)



● Reflective tape (sold separately)



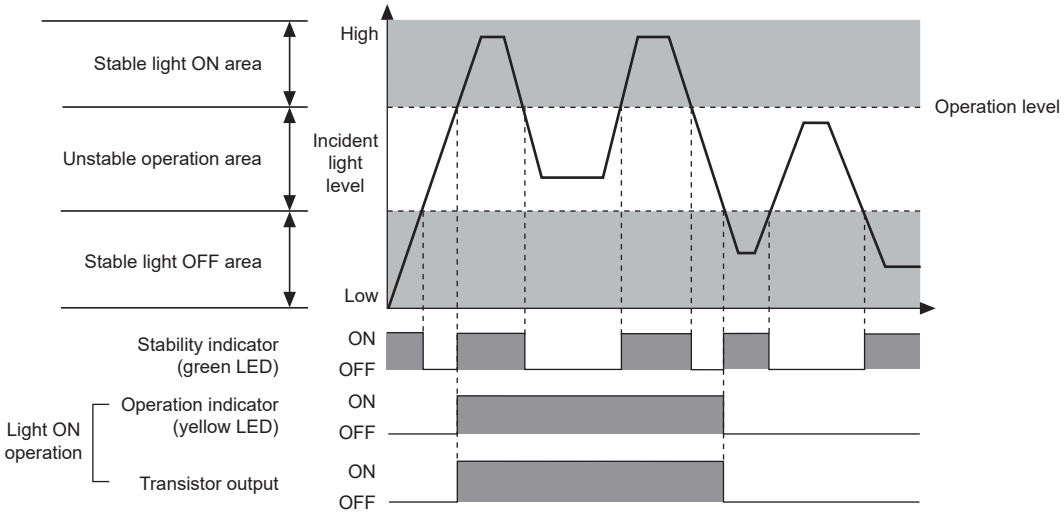
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

▣ Operation Mode

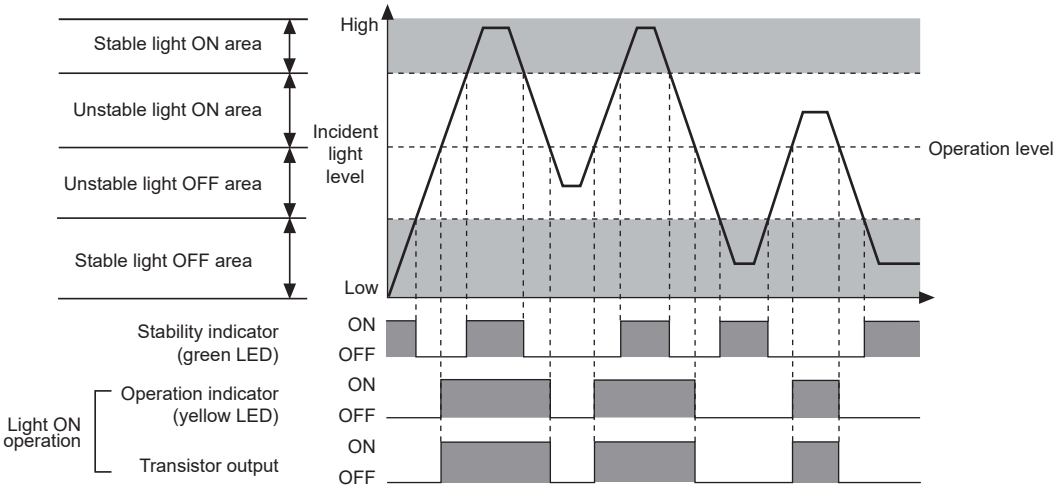
Operation mode	Light ON	Dark ON
Receiver operation	Received light Interrupted light	Received light Interrupted light
Operation indicator (red LED)	ON OFF	ON OFF
Transistor output (NPN/PNP)	ON OFF	ON OFF

▣ Operation Timing Diagram

◎ Through-beam type



◎ Retroreflective type/Diffuse reflective type

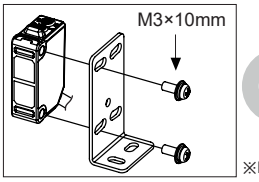


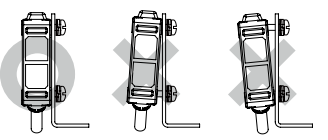
※The waveforms of 'Operation indicator' and 'Transistor output' are for Light ON operation. The waveforms are reversed for Dark ON operation.

▣ Installation and Adjustment

◎ For mounting

When using the reflective type photoelectric sensors closely over three units, it may result in malfunction due to mutual interference.
When using the through-beam type photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 0.5 N·m.





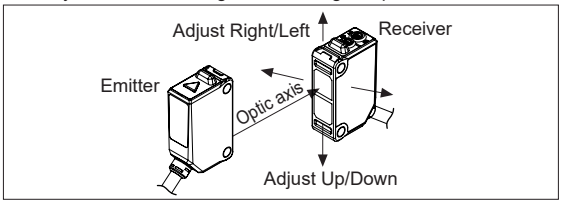
※Install the sensor horizontally with the bracket.

◎ Optical axis adjustment

● Through-beam type

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

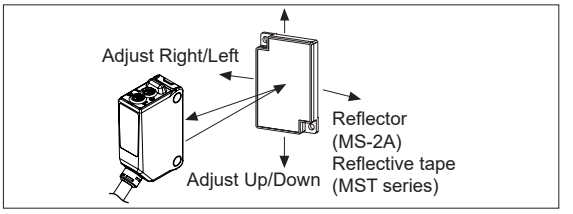
※If the sensing target is translucent body or smaller than Ø15mm, it may not sense the target because light is passed.



● Retroreflective type

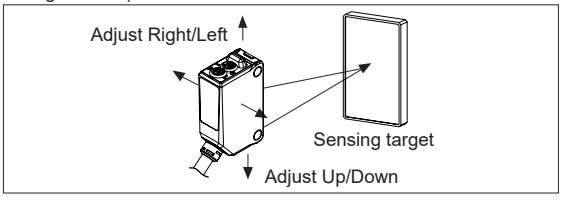
1. Place the sensor and the reflector (or reflective tape) facing each other and supply the power.
2. After adjusting the position of the sensor and reflector (or reflective tape) and checking their stable indicating range, mount them in the middle of the range. (none or sensing target status)
3. After mounting this unit, check the operation of the sensor and in both status. (none or sensing target status)

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

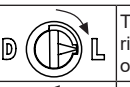
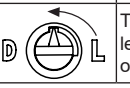


● Diffuse reflective type

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

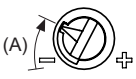
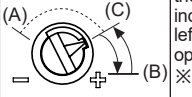
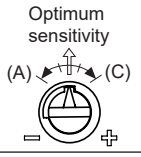


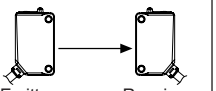
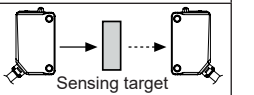
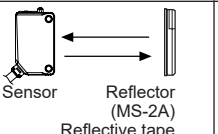
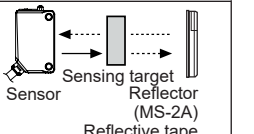
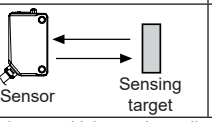
◎ Operation mode switching

Light ON		Turn the switch all the way to the right (towards L) to select Light ON operation.
Dark ON		Turn the switch all the way to the left (towards D) to select Dark ON operation.

※For through-beam type, the switch is built-in the receiver.

◎ Sensitivity adjustment

Order	Sensitivity setting	Descriptions
1		From Light ON status, turn the sensitivity setting adjuster slowly to the right from MIN sensitivity and check the position where operation indicator turns on (A).
2		From Dark ON status, turn the sensitivity setting adjuster further right and check the position where the operation indicator turns on (B). Turn the adjuster left and check the position where the operation indicator turns off (C). ※If the operation indicator does not turn on at MAX sensitivity, the maximum sensitivity setting is set at position (C).
3		Set the adjuster at the center position between (A) and (C) for optimal sensitivity. Also, check if the stability indicator turns off with or without the sensing target. If it does not turn off, please review the operation mode again, as sensitivity may be unstable.

	Light ON	Dark ON
Through-beam type		
Retro-reflective type		
Diffuse reflective type		

※Please set the sensitivity setting adjuster is executed in stable Light ON area and the reliability of environment (temperature, supply, dust etc.) is increased after the mounting it in a stable area.
※When adjusting sensitivity or switching operation modes, please use the Autonics adjustment screwdriver (included accessory). Using a screwdriver with a bigger diameter than the adjuster buttons may cause errors when making adjustments.
※ It may cause breakdown when the sensitivity setting adjuster or the operation mode selection switch is turned by force.

▣ Reflectivity by Reflective Tape Model

MST-50-10(50×50mm)	35%
MST-100-5(100×100mm)	45%
MST-200-2(200×200mm)	55%

※This reflectivity is based on the reflector (MS-2A).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

Photoelectric Sensor for PCB detection

▣ Features

- 30mm×3mm of rectangular light beam (at 30mm distance) provides accurate detection of PCBs regardless of holes, incomplete fabrication, protrusions, or intrusions on the boards.
- Background suppression (BGS) sensing method allows stable detection regardless of the color, texture or surface of the background object.
- Sensing distance: 10 to 100mm (adjustable distance: 20 to 100mm)
- Light ON / Dark ON operation mode switch
- Power reverse polarity protection circuit, output short over current protection circuit
- IP65 protection structure (IEC standard)

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

CE

▣ Model

Model	Application	Sensing distance	Sensing type	Power supply	Output type	Control output
BJP100-BDT	For PCB detection	100mm	BGS reflective type	12-24VDC	Transistor output	NPN open collector output
BJP100-BDT-P						PNP open collector output

▣ Specifications

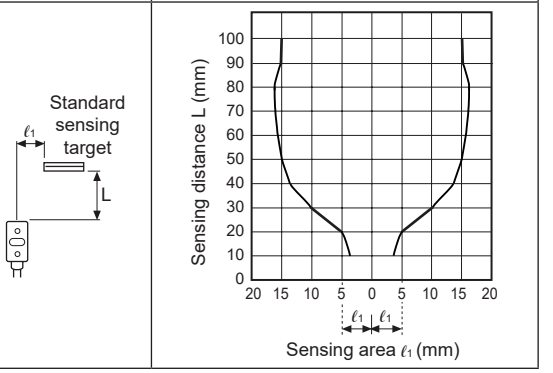
Model	NPN open collector output	**BJP100-BDT**
	PNP open collector output	**BJP100-BDT-P**
Sensing type		BGS reflective
Sensing distance※1		10 to 100mm (at setting distance: 100mm)
Available setting distance※1		20 to 100mm
Hysteresis※1		Max. 10% of setting distance
Sensing target		Opaque
Response time		Max. 1.5ms
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)
Current consumption		Max. 30mA
Light source		Red LED (660nm)
Distance setting		Distance setting adjuster
Operation mode		Light ON/Dark ON selectable by switch
Control output		NPN or PNP open collector output • Load voltage: max. 26.4VDC⎓ • Load current: max. 100mA • Residual voltage - NPN: max.1VDC⎓, PNP: max. 2VDC
Protection circuit		Power reverse polarity protection circuit, output short over current protection circuit
Indicator		Operation indicator: red LED, stability indicator: green LED
Connection		Cable type
Insulation resistance		Over 20MΩ (at 500VDC megger)
Noise immunity		±240V of square wave noise (pulse width: 1μs) by the noise simulator
Dielectric strength		1,000VAC at 50/60Hz for 1min
Vibration		1.5mm amplitude at 10 to 55Hz frequency in each X, Y, Z direction for 2 hours
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times
Environment	Ambient illumination	Sunlight: max. 10,000lx, Incandescent lamp: max. 3,000lx (receiver illumination)
	Ambient temperature	-20 to 55℃, storage: -40 to 70℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Protection structure		IP65 (IEC standard)
Material		Case: polycarbonate+acrylonitrile butadiene styrene, LED indicator: polycarbonate, sensing part: polymethyl methacrylate
Cable		Ø3.5mm, 3-wire, 2m (AWG 24, core wire diameter: 0.08mm, no. of core wires: 40, insulator diameter: Ø1mm)
Accessories		Adjustment screwdriver, bracket A, M3 bolts: 2, M3 nuts: 2
Approval		CE
Weight※2		Approx. 105g (approx. 50g)

※1: Non-glossy white paper 100×100mm.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Beam spot size is approx. 30×3mm (width×height, at distance: 30mm).
※The temperature and humidity of environment resistance is rated at non-freezing or condensation.

▣ Feature Data

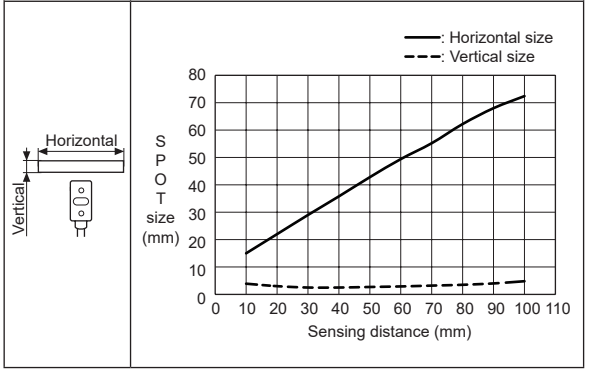
◎ Sensing area characteristic

Measuring method	Data
Standard sensing target, ℓ_1, L	Sensing distance L (mm) vs Sensing area ℓ_1 (mm)



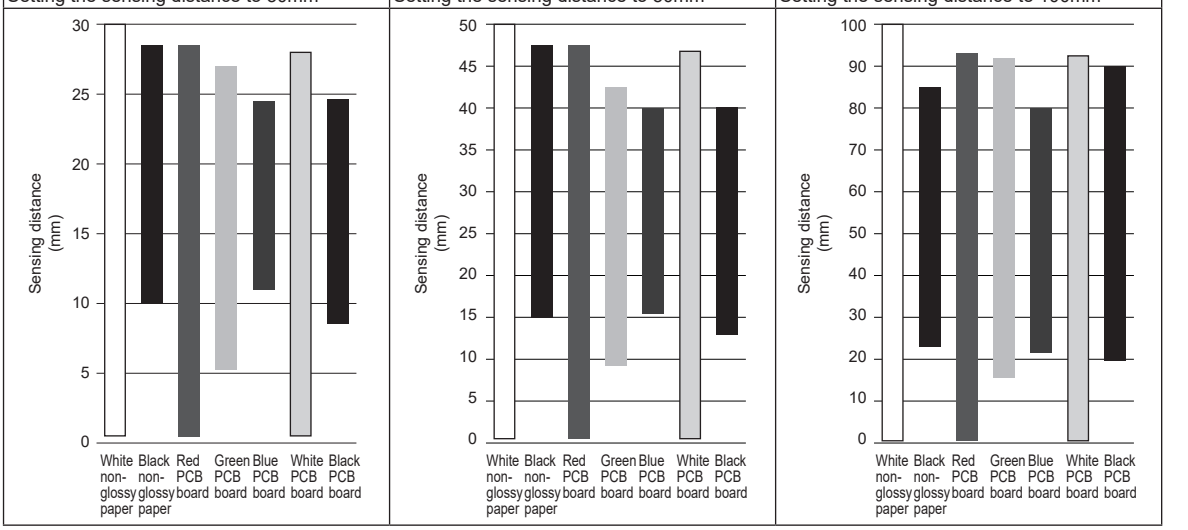
◎ Emitter SPOT size characteristic by sensing distance

Measuring method	Data
Horizontal, Vertical	SPOT size (mm) vs Sensing distance (mm)



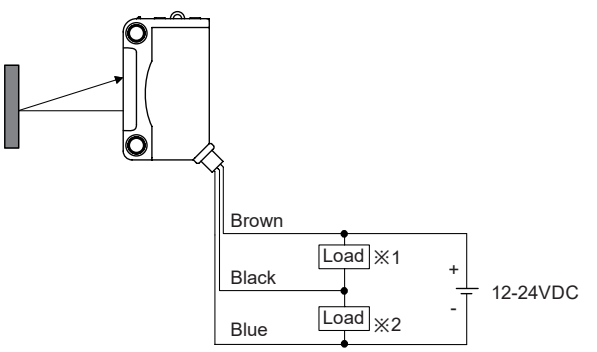
◎ Optical characteristic by sensing target material

Setting the sensing distance to 30mm	Setting the sensing distance to 50mm	Setting the sensing distance to 100mm



※ Above graphs are rated for each sensing target at the status that the sensing target is the white non-glossy paper and the sensing distance is set to 30mm, 50mm, 100mm.
※ Standard status of PCB board is with glossy surface.

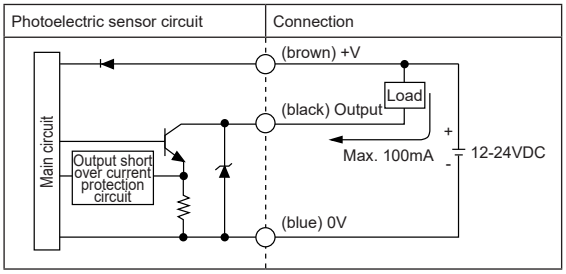
▣ Connections



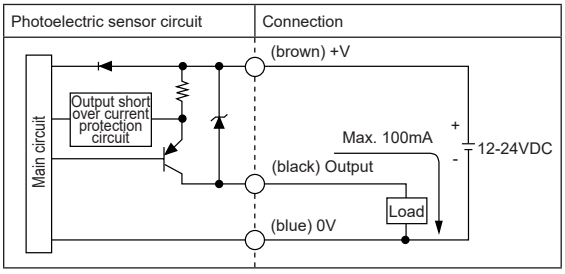
※1: Load connection of NPN open collector output
※2: Load connection of PNP open collector output

▣ Control Output Circuit Diagram

• NPN open collector output



• PNP open collector output



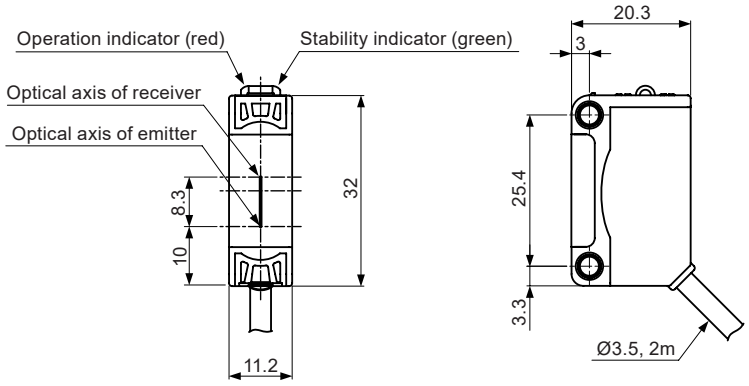
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Operation Mode

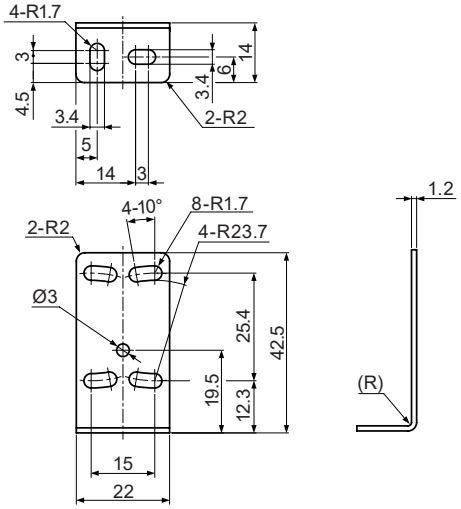
Operation mode	Light ON	Dark ON
Receiver operation	Received light / Interrupted light	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF	ON / OFF
Transistor output	ON / OFF	ON / OFF

▣ Dimensions

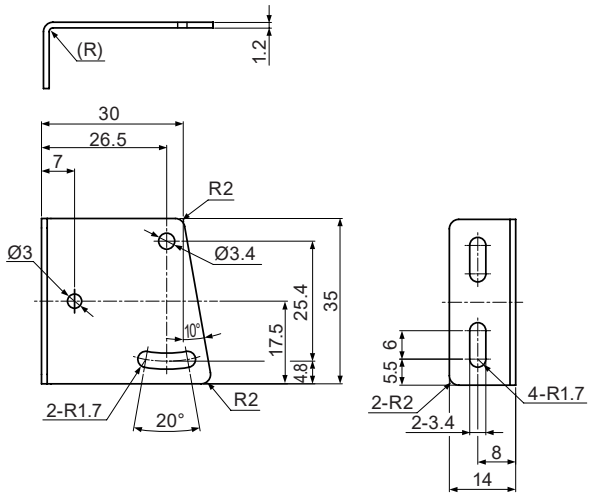
(unit: mm)



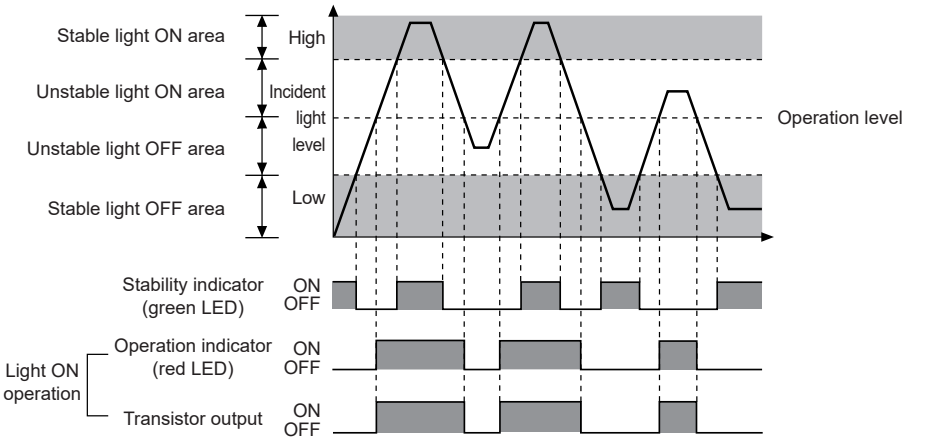
•Bracket A



•Bracket B (BK-BJP-B, sold separately)



▣ Operation Timing Diagram

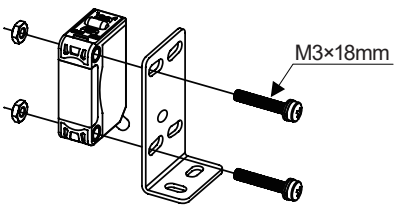


※The waveforms of 'Operation indicator' and 'Transistor output' are for Light ON operation.
The waveforms are reversed for Dark ON operation.

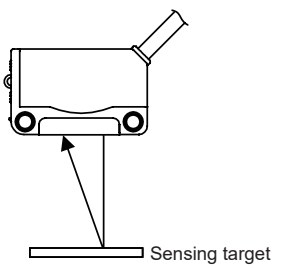
▣ Installation and Adjustment

◎ For mounting

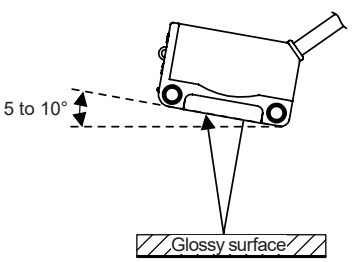
When using photoelectric sensors closely over three units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 0.5N·m.



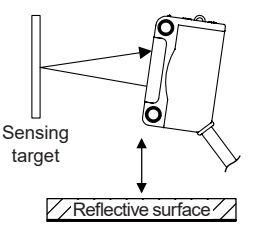
- The sensing side of the unit and the surface of the target object should be parallel when installed.



- If the sensing target has a glossy surface, mount the sensor at a 5 to 10° angle as shown in the figure. Check to see that there is no influence from background objects.

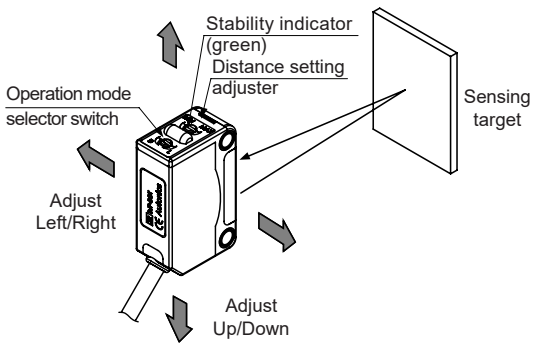


- If there is a reflective surface beneath the sensor, the reflected light may reflect off the surface of the reflective object. Make sure that the sensor is tilted upwards as shown in the figure, or install the sensor distant to the reflective surface.



◎ Optical axis adjustment

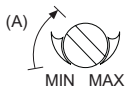
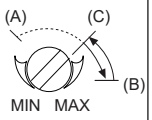
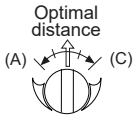
● Place the sensing target. Move the sensor slightly in each direction and check the operation of the stability indicator. Fix the sensor at the center point.

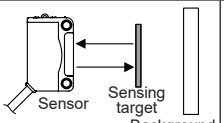
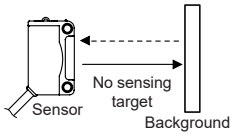


◎ Operation mode switching

Light ON		Turn the operation mode selection switch all the way to the right (towards L) to select Light ON operation.
Dark ON		Turn the operation mode selection switch all the way to the left (towards D) to select Dark ON operation.

◎ Distance setting

Order	Distance setting	Description
1		From Light ON status, turn the distance setting adjuster slowly to the right from MIN distance and check the position where operation indicator turns on (A).
2		From Dark ON status, turn the distance setting adjuster further right and check the position where the operation indicator turns on (B). Turn the adjuster left and check the position where the operation indicator turns off (C). ※If the operation indicator does not turn on at MAX distance, the maximum setting distance is set at position (C).
3		Set the adjuster at the center position between (A) and (C) for optimal sensitivity. Also, check if the stability indicator turns off with or without the sensing target. If it does not turn off, please review the operation mode again, as sensitivity may be unstable.

	Light ON status	Dark ON status
BGS reflective type		

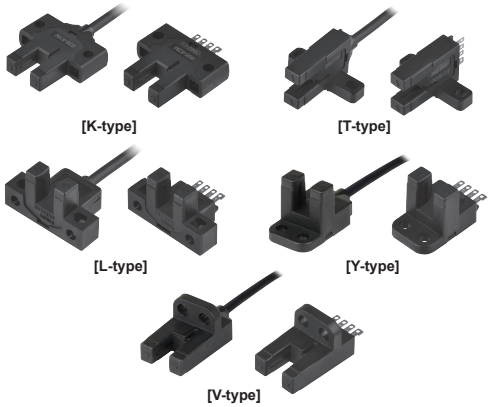
※Set the distance setting within stable Light ON range for increased environmental (temperature, voltage, dust etc.) resistance after installation.

※Do not use excessive force when turning the operation selector or distance setting adjuster. It may cause product damage.

Photomicro Sensor

■ Features

- Ultra compact, Built-in amplifier, NPN/PNP open collector output
- Various selection by installation position (appearance: K, T, L, Y, V type)
- Light ON / Dark ON selectable by control terminal/cable
- 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 "Safety Considerations" in the instruction manual before using.**

CE

■ Ordering Information

BS 5 – K 2 M – P

Control output	No mark	NPN open collector output		
	P	PNP open collector output		
Size	M	Middle		
Connection type	1	Cable type		
	2	Connector type		
Appearance	K	K-Type	Y	Y-Type
	T	T-Type	V	V-Type
	L	L-Type		
Sensing distance	5	Unit: mm (fixed)		
Item	BS	Photo electronic sensor		

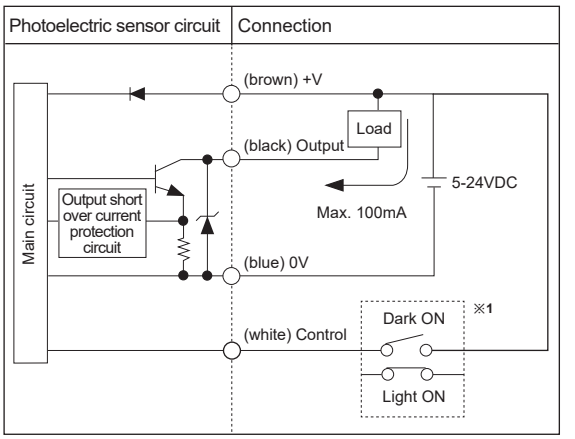
■ Specifications

Model		BS5-K1M	BS5-T1M	BS5-L1M	BS5-Y1M	BS5-V1M	BS5-K2M	BS5-T2M	BS5-L2M	BS5-Y2M	BS5-V2M
	NPN open collector output										
	PNP open collector output	BS5-K1M-P	BS5-T1M-P	BS5-L1M-P	BS5-Y1M-P	BS5-V1M-P	BS5-K2M-P	BS5-T2M-P	BS5-L2M-P	BS5-Y2M-P	BS5-V2M-P
Sensing type		Through-beam (not modulated)									
Sensing distance		5mm fixed									
Sensing target		Ø0.8×2mm opaque materials									
Hysteresis		0.05mm									
Response time		Light ON: max. 20μs, dark ON: max. 100μs									
Response frequency※1		2kHz									
Power supply		5-24VDC⎓ ±10% (ripple P-P: max. 10%)									
Current consumption		Max. 30mA (at 26.4VDC)									
Light source		Infrared LED (940nm)									
Operation mode		Light ON / Dark ON selectable by control cable					Light ON / Dark ON selectable by control terminal				
Control output		NPN or PNP open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 100mA ●Residual voltage: max. 1.2VDC⎓									
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit									
Indicator		Operation Indicator: red LED									
Connection		Cable type					Connector type				
Insulation resistance		Over 20MΩ (at 250VDC megger)									
Noise immunity		±240V the square wave noise (pulse width:1μs) 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 X, Y, Z direction for 2 hours									
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times									
Environment	Ambient illumination	Fluorescent lamp: max. 1000lx (receiver illumination)									
	Ambient temperature	-20 to 55℃, storage: -25 to 85℃									
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH									
Protection structure		IP50 (IEC standard)									
Material		Polybutylene terephthalate									
Cable		Ø3mm, 4-wire, 1m (AWG28, core diameter: 0.08mm, number of cores: 19, insulator out diameter: Ø0.88mm)					—				
Approval		CE									
Weight※2		Approx. 50g (approx. 30g)									

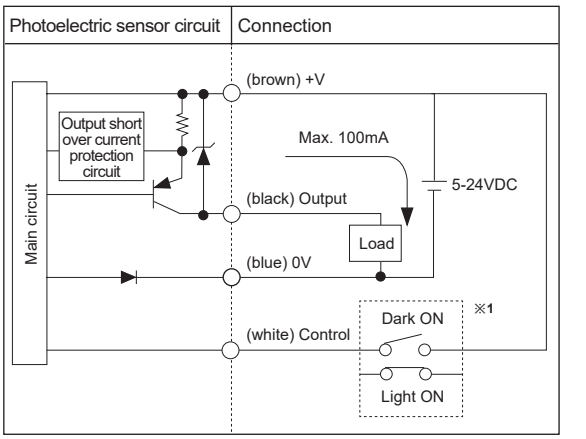
※1: The value from revolving the circle panel which duty ratio is 1:1. ※2: The weight includes packaging. The weight in parenthesis in for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Control Output Diagram

● NPN open collector output



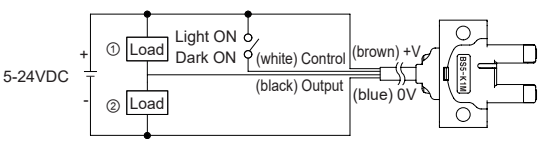
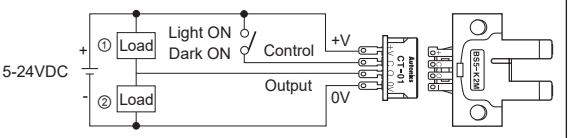
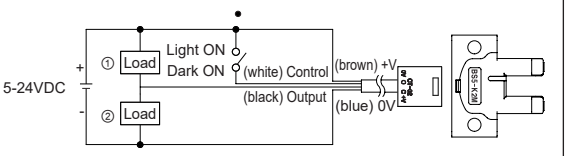
● PNP open collector output



※1: Operation mode selection: Connect (white) Control (terminal) into terminal (brown) +V to operate Light ON mode. Dark ON mode is available with disconnection status.

※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Connections

Cable Type	Connector Type
	  ※Connect the unit using the connector (CT-01, sold separately), the connector cable (CT-02, sold separately). If it is soldered on terminal pin directly without the connector, the connector cable. It may cause product damage.
①Load connection for NPN output ②Load connection for PNP output	

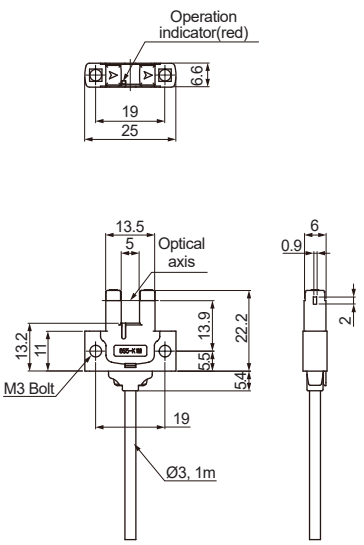
▣ Operation Mode

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

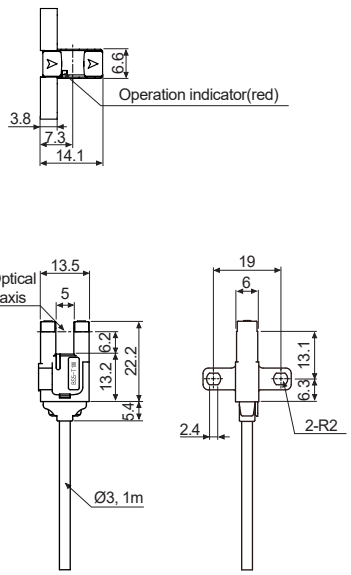
▣ Dimensions

(unit: mm)

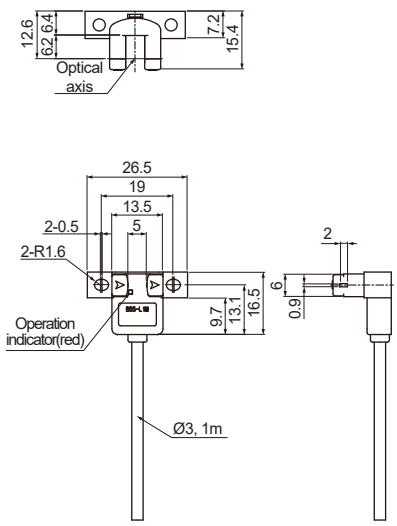
• BS5-K1M / BS5-K1M-P



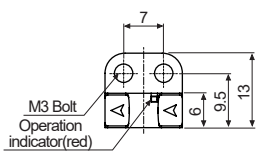
• BS5-T1M / BS5-T1M-P

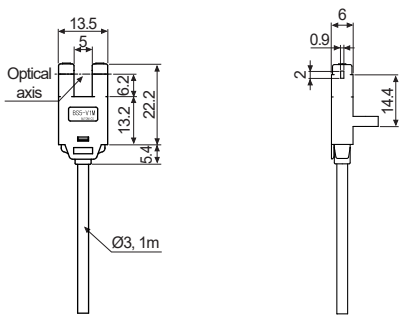


• BS5-L1M / BS5-L1M-P

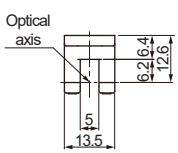


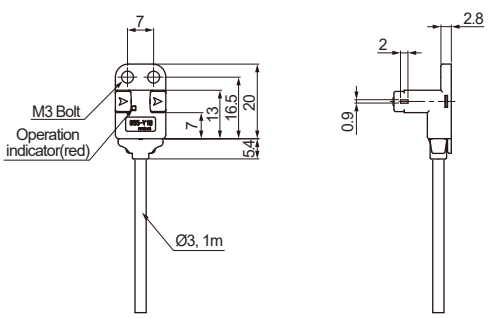
• BS5-V1M / BS5-V1M-P





• BS5-Y1M / BS5-Y1M-P



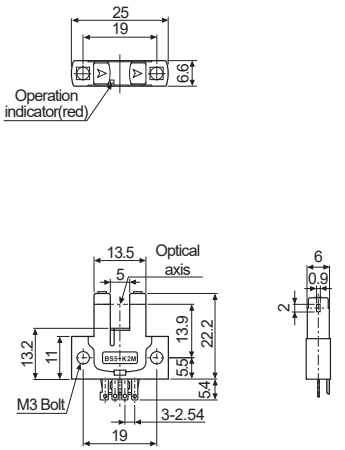


※When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
※When installing the product, tighten the screw with a tightening torque of 0.49N·m.

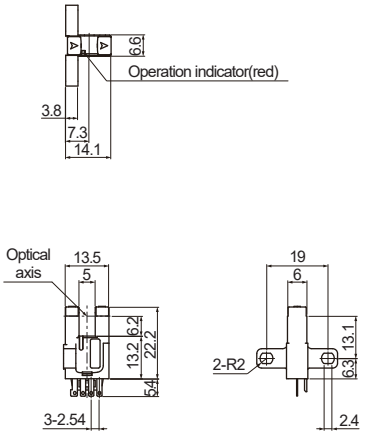
▣ Dimensions

(unit: mm)

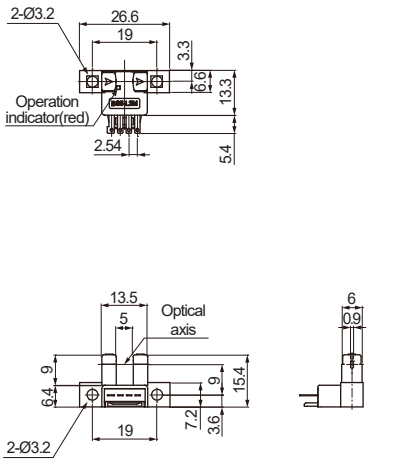
● BS5-K2M / BS5-K2M-P



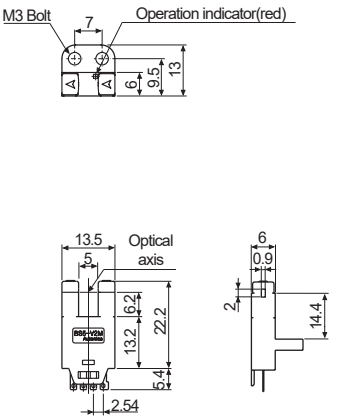
● BS5-T2M / BS5-T2M-P



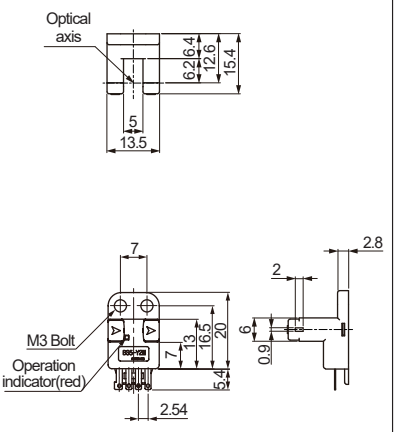
● BS5-L2M / BS5-L2M-P



● BS5-V2M / BS5-V2M-P

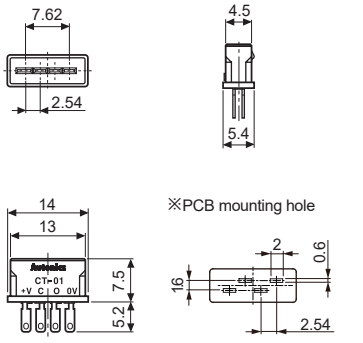


● BS5-Y2M / BS5-Y2M-P

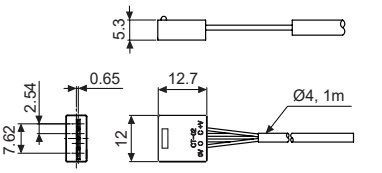


● Connector type (sold separately)

● Connector (CT-01)



● Connector (CT-02)



※Cable: Ø4mm, 4-wire, 1m
(AWG22, Core wire diameter: 0.08mm, No. of core wire: 60, Insulator out diameter: Ø1.2mm)
※Cable length is available to option.

Push Button Type Photomicro Sensors

■ Features

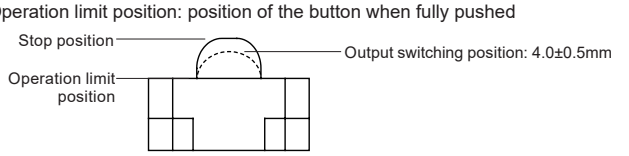
- Button operation enables accurate detection regardless of material, color, or reflectance of target object
- Optimized for transport detection of semiconductor wafer enclosures (FOUP, FOSB, etc.)
- Optical detection of button operation guarantees mechanical life cycle of 5 million operations
- Total of 4 red LED indicators (side:2, top:2) for higher visibility of operation status
- Increased product durability with steel mounting brackets
- Emitter OFF function and check stable operation functions
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit

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

■ Specifications

Model	NPN open collector output	**BS5-P1ML**	**BS5-P1MD**
	PNP open collector output	**BS5-P1ML-P**	**BS5-P1MD-P**
Operation method※1		Push button type	
Button operation※2	Stop position	5.0±0.4mm	
	Output switching position	4.0±0.5mm	
	Operation limit position	Below 0mm	
Operation load※3		Max. 3N (max. 0.3kgf)	
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 35mA	
Light source		Infrared LED (940nm)	
Operation mode		Light ON (output OFF when button is pushed)	Dark ON (output ON when button is pushed)
Control output		NPN or PNP open collector output ·Load voltage: max. 26.4VDC⎓ ·Load current: max. 50mA ·Residual voltage: max. 1VDC⎓	
External input※4	NPN output	Emitter OFF: short at 0V or max. 0.25VDC⎓ (outflow current max. 30mA) Emitter ON: open (leakage current max. 0.4mA)	
	PNP output	Emitter OFF: short at +V or min. -0.25VDC⎓ of +V (absorption current max. 30mA) Emitter ON: open (leakage current max. 0.4mA)	
	Response	Under 1ms	
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit	
Indicator		Operation indicator: red LED	
Insulation resistance		Over 20MΩ (at 250VDC megger)	
Noise immunity		±240V of square wave noise (pulse width:1 μs) from the noise simulator	
Dielectric strength		1,000VAC at 50/60Hz for 1min	
Vibration		1.5mm amplitude at 10 to 55Hz frequency in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Mechanical life cycle		Min. 5,000,000 operations (1 operation = stop position - operation limit position - stop position)	
Environment	Ambient illuminance	Fluorescent lamp: max. 1,000lx (receiver illuminance)	
	Ambient temperature	-20 to 55℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP40 (IEC standard)	
Material		Case: polycarbonate + glass fiber, button: polyoxymethylene, sleeve: SUS304 (steel use stainless 304)	
Cable		Ø3mm, 4-wire, 1m (AWG 28, core diameter: 0.08mm, no. of core wires: 19, insulator diameter: Ø0.88mm)	
Approval		CE	
Weight※5		Approx. 50g (approx. 30g)	

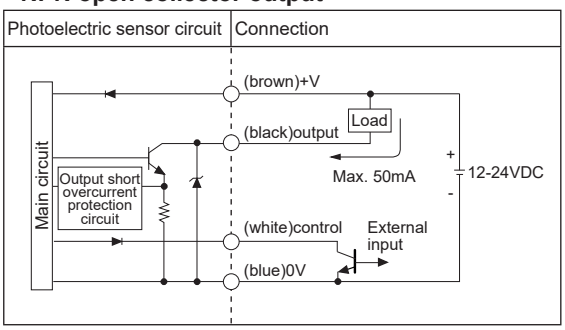
※1: Detection occurs when the button is pushed and the light source is blocked.
※2: Stop position: position of the button without any applied pressure
Output switching position: position where the output switches ON/OFF
Operation limit position: position of the button when fully pushed



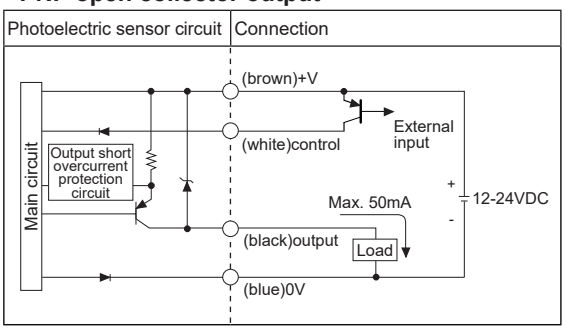
※3: Pressure required to push the button from stop position to output switching position
※4: External input when using emitter OFF function or check stable operation functions.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature and humidity of environment resistance are rated at non-freezing or condensation.

▣ Control Output Diagram

• NPN open collector output



• PNP open collector output



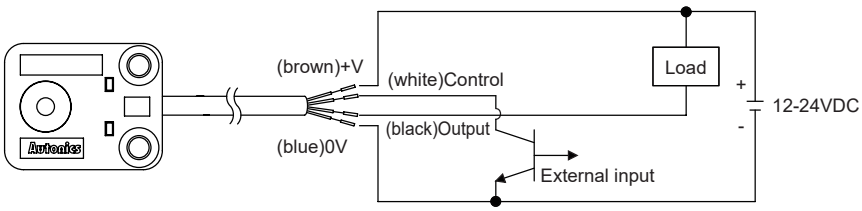
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Operation Mode

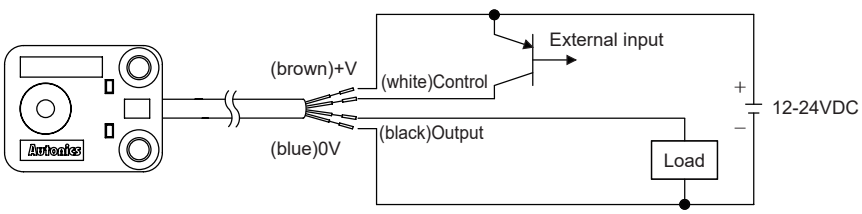
Operation mode	Light ON(output OFF when button is pushed)	Dark ON(output ON when button is pushed)
Button position	Pushed / Raised	Pushed / Raised
Receiver operaion	Received light / Interrupted light	Received light / Interrupted light
Operation indicator (redLED)	ON / OFF	ON / OFF
Transistor output	ON / OFF	ON / OFF

▣ Connections

• NPN open collector output

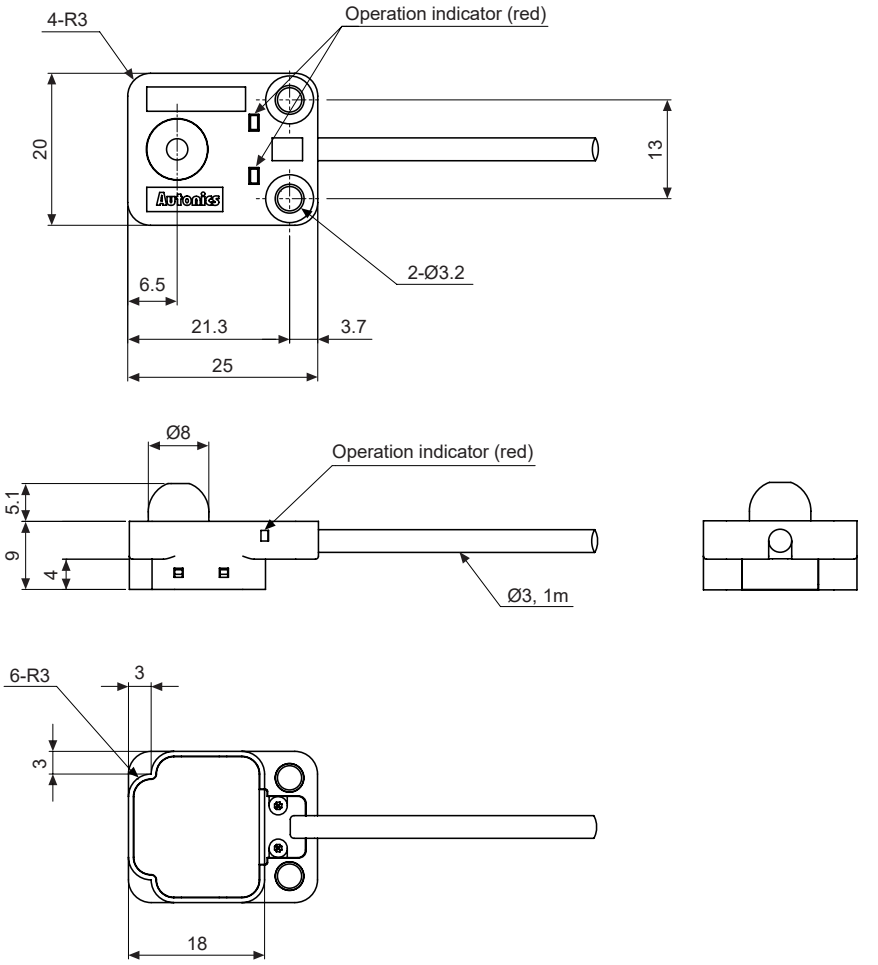


• PNP open collector output



▣ Dimensions

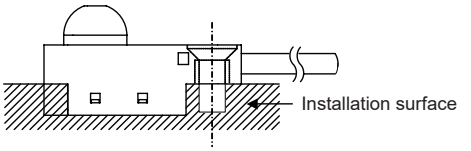
(unit: mm)



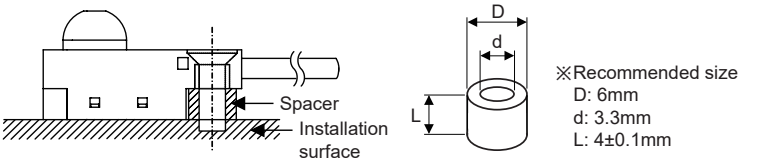
▣ Installation

When installing the product, tighten the screw with a tightening torque of 0.59N·m.
Do not pull the cable with a tensile strength of 30N or over. It may result in fire due to the broken wire.

1) Installation on non-flush surface
Install the sensor after fitting the sensor in the opening as shown in the figure below.



2) Installation on flush surface
Insert a spacer between the installation surface and the mounting surface of the sensor as shown in the figure below.

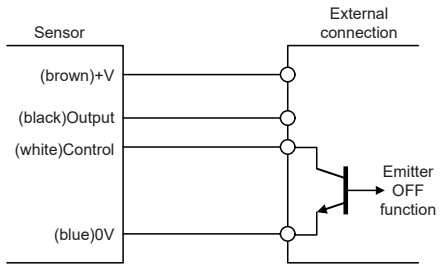
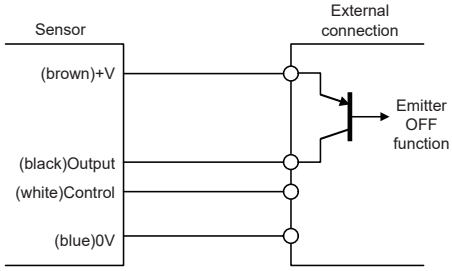


※Recommended size
D: 6mm
d: 3.3mm
L: 4±0.1mm

▣ Functions

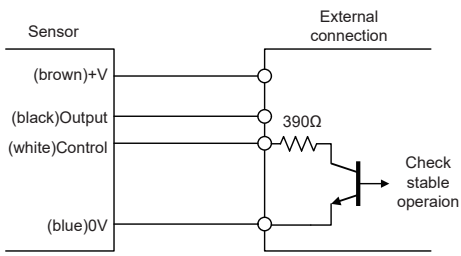
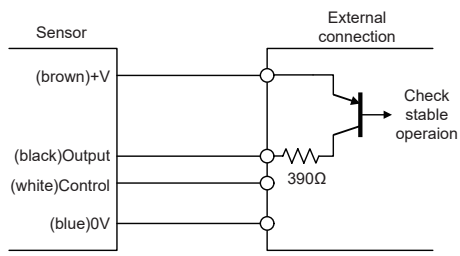
● Emitter OFF function

The emitter LED can be turned ON/OFF without pushing the button, to test for stable operation of the receiver.

NPN open collector output	PNP open collector output
	

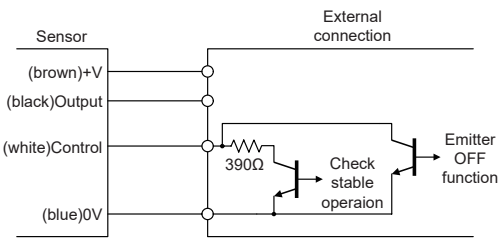
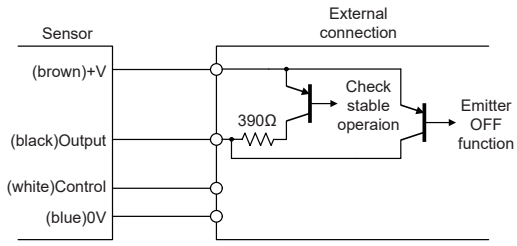
● Check stable operation function

Reduces the LED intensity by approximately 20% while button is not pushed, and check that the receiver is still receiving light (same transistor ON status as at 100%) This ensures that sensor will not malfunction due to changing light intensity.

NPN open collector output	PNP open collector output
	

● Simultaneous use of emitter OFF and check stable operation function

Follow the circuit diagram below:

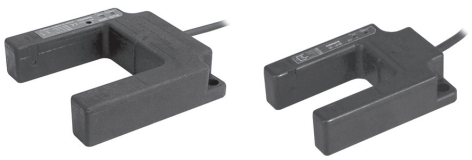
NPN open collector output	PNP open collector output
	

※When using the emitter OFF function and check stable operation function simultaneously, the transistor used should be able to open and close 50mA/10V and resistance should be over 1/8W. Failure may cause product damage.
※When emitter OFF function and stable operation check function is not used, insulate the control (white) wire. Otherwise, it may result in product damage.

Reinforced Plastic Case U-shaped Type

▣ Features

- Improved noise resistance to disturbance light
- Max. 1ms high speed response type
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit
- Light ON / Dark ON Selectable by control wire
- Protection structure IP66 (IEC standard)
  : BUP-30, BUP-50



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

CE

▣ Specifications

Model	NPN open collector output	BUP-30	BUP-30S	BUP-50	BUP-50S
	PNP open collector output	BUP-30-P	BUP-30S-P	BUP-50-P	BUP-50S-P
Sensing type		Through-beam			
Sensing target		Opaque materials of min. Ø4mm	Opaque materials of min. Ø1.5mm	Opaque materials of min. Ø4mm	Opaque materials of min. Ø1.5mm
Operation mode		Selectable Light ON or Dark ON by control wire			
Sensing distance		30mm		50mm	
Response speed		Max. 1ms			
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)			
Current consumption		Max. 30mA			
Light source		Infrared LED (940nm)			
Sensitivity adjustment		Fixed	Sensitivity adjuster	Fixed	Sensitivity adjuster
Control output		NPN or PNP open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 200mA ●Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC			
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit			
Indication		Power indicator: green LED, operation indicator: red LED			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1,000VAC 50/60Hz for 1 minute			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiving illumination)			
	Ambient temperature	-25 to 65℃[BUP-30S (-P) & BUP-50S (-P): -10 to 60℃], storage: -25 to 70℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP66 (IEC standard)	IP50 (IEC standard)	IP66 (IEC standard)	IP50 (IEC standard)
Material		Case: acrylonitrile butadiene styrene, cap: polycarbonate			
Cable		Ø4mm, 4-wire, 2m (AWG22, core diameter: 0.08mm, number of cores: 60, insulation out diameter: Ø1.25mm)			
Accessory		—	Adjuster driver	—	Adjuster driver
Approval		CE			
Unit weight		Approx. 90g		Approx. 140g	

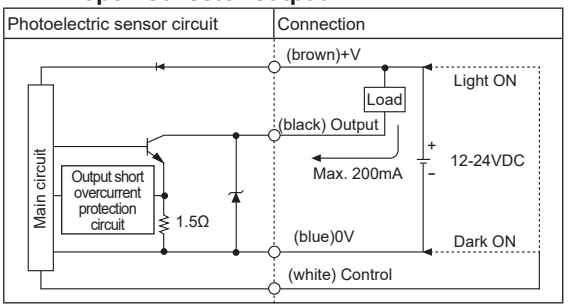
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Operation Mode

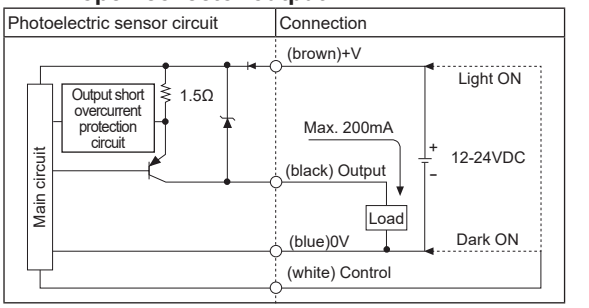
Operation mode	Light ON	Dark ON
Receiver operation	Received light Interrupted light	Received light Interrupted light
Operation indicator (red LED)	ON OFF	ON OFF
Transistor output	ON OFF	ON OFF

■ Control Output Diagram

● NPN open collector output



● PNP open collector output

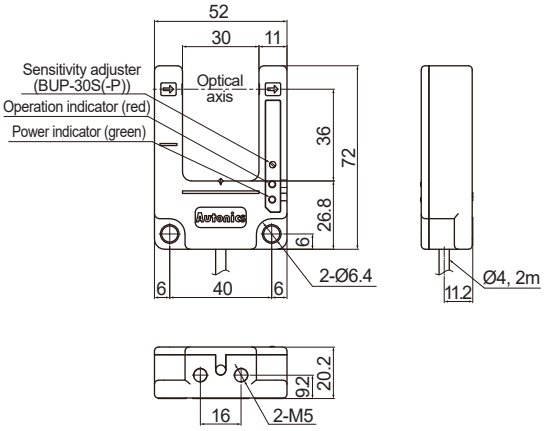


※Select Light ON / Dark ON by control wire. - Light ON: Connect control wire to +V / Dark ON: Connect control wire to 0V
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

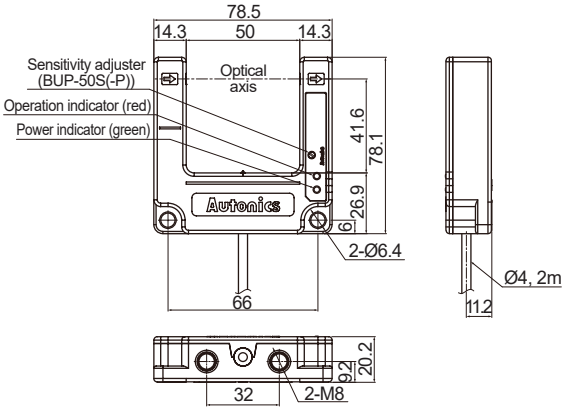
■ Dimensions

(unit: mm)

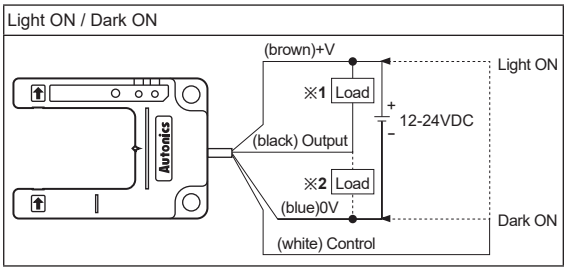
● BUP-30, BUP-30-P, BUP-30S, BUP-30S-P



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



■ Connections



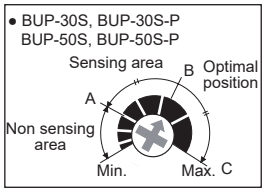
※1: Load connection for NPN open collector output
※2: Load connection for PNP open collector output

■ Mounting and Sensitivity Adjustment

Check the position where the photoelectric sensor will be used and the connection then supply the power and set sensitivity as below.

※BUP-30□-□: When installing the product, tighten the screw with a tightening torque of 1.96N·m.
BUP-50□-□: When installing the product, tighten the screw with a tightening torque of 4.9N·m.

● Sensitivity adjustment



When placing a target within sensing range of sensor, turn the sensitivity adjuster from the minimum position and check the position 'A' where the operation indicator is turned on (dark on) or turned off (light on). Turn the sensitivity adjuster to 'B' in the middle between 'A' and 'C' which is the maximum sensitivity position. this will be the optimal sensitivity position. (the operation indicator can be operated at the lowest sensitivity position.)

4-CH U-shaped Type

■ Features

- Highly reliable 4 channel detection
- High-speed response time under 1 ms
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit
- IP65 protection structure (IEC standard)

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

■ Specifications

Model		BUM4-40D-W-4M	BUM4-40D-W-2M/A	BUM4-40D-W-3M/A	BUM4-40D-W-4M/A	BUM4-40D-W-2M/B	BUM4-40D-W-3M/B	BUM4-40D-W-4M/B
Sensing type		Through-beam						
Sensing distance		40mm						
Sensing target		Opaque materials of min. Ø4.0mm						
Sensing CH		4 channels						
Hysteresis		Max. 1ms						
Power supply		18-35VDC⎓ ±10% (ripple P-P: max. 10%)						
Current consumption		Max. 50mA						
Light source		Infrared LED (940nm)						
Operation mode		Dark ON						
Control output		NPN open collector output (individual 4 outputs) • Load voltage: max. 35VDC⎓, • Load current: max. 100mA, • Residual voltage: max. 4VDC⎓						
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit						
Indicator		Output indicator: red LED, power indicator: green LED						
Insulation resistance		Over 20MΩ (at 500VDC megger)						
Noise immunity		±240V the square wave noise (pulse width 1μs) by noise simulator						
Dielectric strength		1000VAC 50/60Hz for 1 min						
Vibration		1.5mm amplitude at frequency of 10to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours						
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times						
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)						
	Ambient temperature	-25 to 65℃, storage: -25 to 70℃						
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH						
Protection		IP65 (IEC standards)						
Material		Case, cover: ABS						
Cable		Ø6.0mm, 8-wire (AWG 22, core diameter: Ø1.2mm, number of cores: 60)						
Cable length		4m	2m	3m	4m	2m	3m	4m
Bracket		—	H01/H04 (G01)			H03/H04 (G02)		
Accessory		M12 bolt: 4, M12 nut: 4, M5 bolt: 2						
Approval		CE						
Weight※1		Approx. 510g (approx. 500g)	Approx. 1.5kg (approx. 500g)					

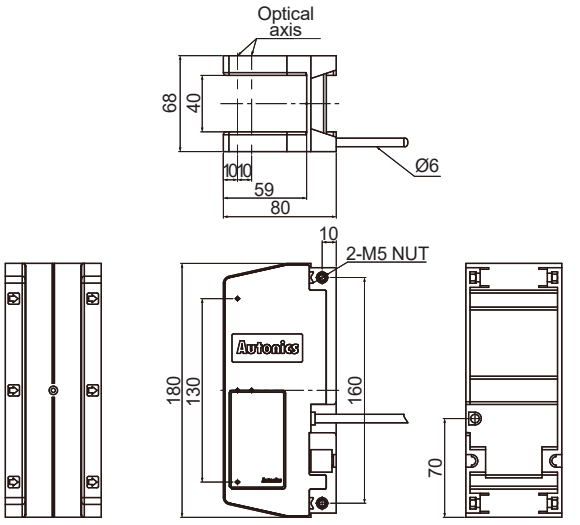
※1: The weight is with packaging and the weight in parenthesis is only unit weight.
※The temperature or humidity mentioned in Environment indicates a non-freezing or condensation environment.

■ Operation Mode

Operaiton mode	Dark ON
Receiver operation	Received light Interrupt light
Operation indicator (LED)	ON OFF
Transistor output	ON OFF

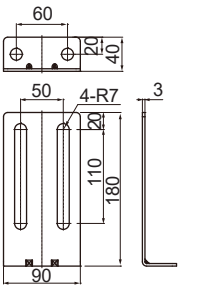
▣ Dimensions

(unit: mm)

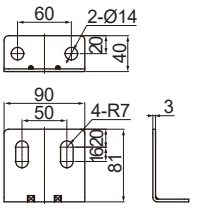


◎Bracket

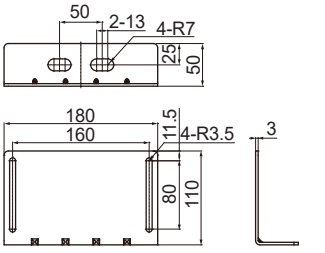
● H01



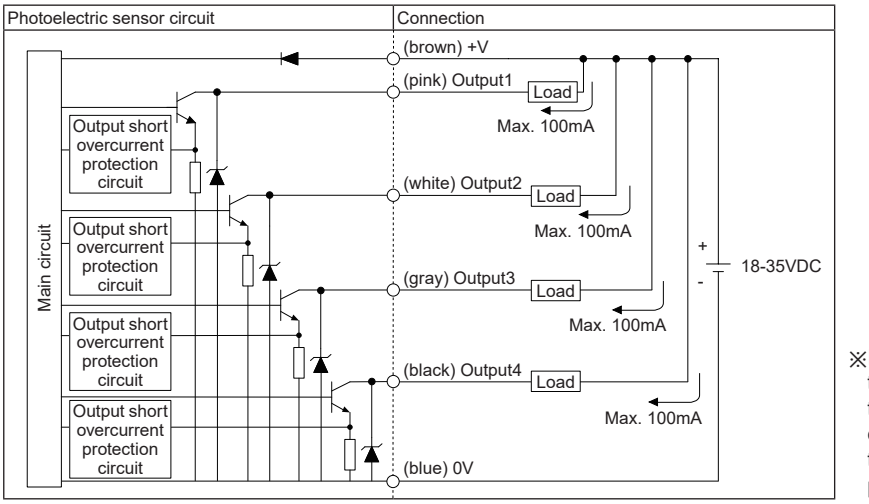
● H03



● H04

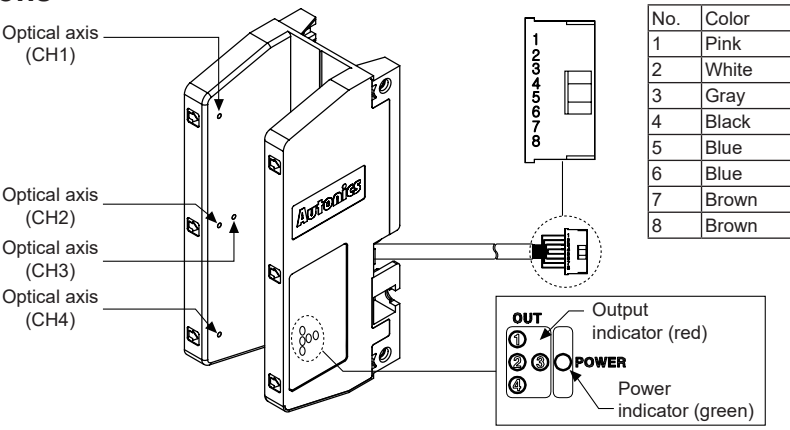


▣ Control Output Diagram



※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Connections



No.	Color	Name
1	Pink	OUT1
2	White	OUT2
3	Gray	OUT3
4	Black	OUT4
5	Blue	0V
6	Blue	
7	Brown	+V
8	Brown	

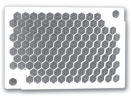
Cylindrical (Ø18mm) Type

▣ Features

- Realizes long sensing distance (20m) (through-beam type)
- Superior noise resistance with digital signal processing
- High-speed response time under 1ms
- Power reverse polarity protection circuit, output short over current protection circuit
- Suitable for sensing in narrow space (narrow beam type)
- External sensitivity adjustment (except through-beam type)
- Light ON, Dark ON switchable by control wire (except through-beam type)
- Excellent environment-resistance performance with glass lens(BR4M)
- Protection structure IP66 (IEC standard)

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

Cable type



(MS-2)

Connector Type

(MST-□)

※The model name with '-C' is connector type.
※MST-□ is sold separately.

▣ Specifications

model	NPN open collector output	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 output	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
Case		Plastic	Metal	Plastic	Metal	Plastic	Metal	Plastic	Metal	Metal			
Sensing type		Diffuse reflective type				Narrow beam reflective type		Retroreflective type		Through-beam type			
Sensing distance		100mm※1		400mm※2		200mm※2		3m※3		4m	20m	4m	20m
Sensing target		Opaque, translucent materials						Opaque materials of min. Ø60mm		Opaque materials of min. Ø15mm			
Hysteresis		Max. 20% at rated sensing 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		Sensitivity adjuster								Fixed			
Operation mode		Selectable Light ON or Dark ON 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. 1VDC⎓, PNP: max. 2.5VDC											
Protection circuit		Power reverse polarity protection circuit, output short over current protection circuit											
Indicator		Operation indicator: red LED, power indicator: red LED (only for emitter of through-beam type)											
Connection		Cable type, connector type											
Insulation resistance		Over 20MΩ (at 500VDC megger)											
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator											
Dielectric strength		1000VAC 50/60Hz for 1 minute											
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours											
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times											
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)											
	Ambient temperature	-10 to 60℃, storage: -25 to 75℃											
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH											
Protection structure		IP66 (IEC standard) (BR20M Series: IP67)											
Material		●Case - BRP: polyamide (black) BR: brass, ni-plate ●Sensing part - polycarbonate lens						●Case - BRP: polyamide (black) BR: brass, ni-plate ●Sensing part - acrylic lens		●Case - brass, ni-plate ●Sensing part - BR4M: glass lens BR20M: polycarbonate lens			
Cable	Cable type	Ø5mm, 4-wire, 2m (emitter of through-beam type: Ø5mm, 2-wire, 2m / receiver: Ø5mm, 3-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)											
	Connector type	M12 connector											
Accessory	Individual	Adjustment screwdriver						Adjustment screwdriver, Reflector (MS-2)		—			
	Common	● BR: M18 fixing nut: 2, washer: 1 ● BRP: M18 fixing nut: 2								● BR: M18 fixing nut: 4, washer: 2 ● BRP: M18 fixing nut: 4			
Approval		CE											
Weight※4		●BRP: approx. 140g (approx. 100g) ●BR: approx. 160g (approx. 120g) ●BRP-C: approx. 70g (approx. 30g) ●BR-C: approx. 90g (approx. 50g)								●BR: approx. 340g (approx. 300g) ●BR-C: approx. 150g (approx.110g)			

※1: Non-glossy white paper 50×50mm. ※2: Non-glossy white paper 100×100mm.
※3: The sensing distance is specified with using the MS-2 reflector. The distance between the sensor and the reflector should be set over 0.1m. When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the catalog or website.
※4: The weight includes packaging. The weight in parenthesis is for unit only.
※Tightening torque for connector is 0.39 to 0.49N·m.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.

▣ Feature Data

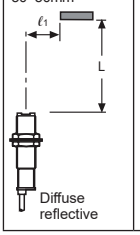
◎ Diffuse reflective type / Narrow beam reflective type

●BR100-DDT-□(-P)/BRP100-DDT-□(-P)

Sensing area characteristic

Measuring method

Standard sensing target:Non-glossy white paper 50×50mm



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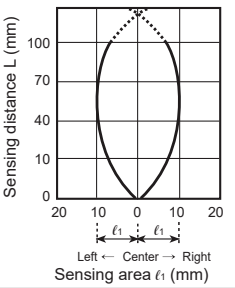
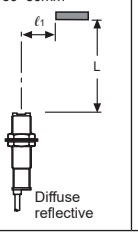


●BR400-DDT-□(-P)/BRP400-DDT-□(-P)

Sensing area characteristic

Measuring method

Standard sensing target:Non-glossy white paper 50×50mm



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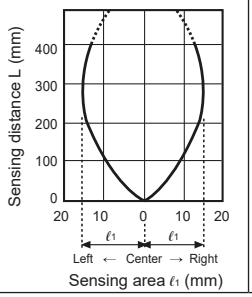
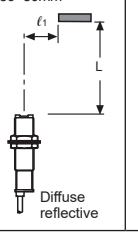


●BR200-DDTN-□(-P)/BRP200-DDTN-□(-P)

Sensing area characteristic

Measuring method

Standard sensing target:Non-glossy white paper 50×50mm



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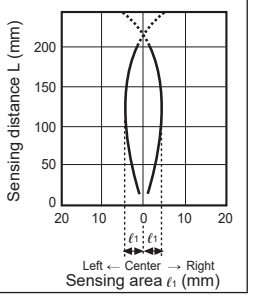


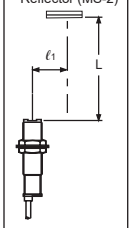
◎ Retroreflective type

● BR3M-MDT-□(-P) / BRP3M-MDT-□(-P)

Parallel shifting characteristic

Measuring method

Reflector (MS-2)



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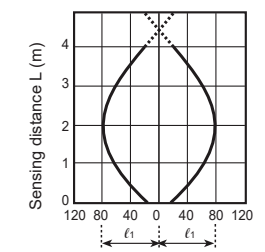
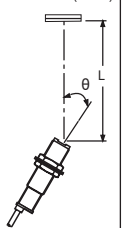


Parallel shifting characteristic

Measuring method

Reflector (MS-2)



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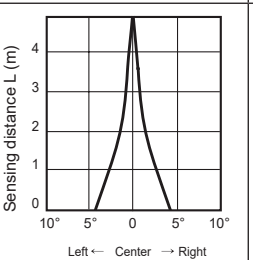
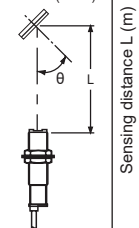


Parallel shifting characteristic

Measuring method

Reflector (MS-2)



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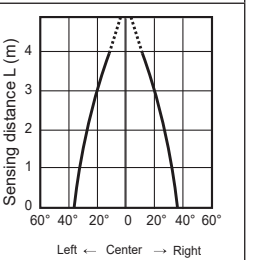
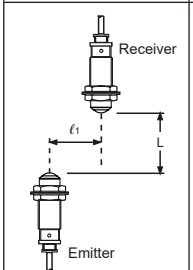


◎ Through-beam type

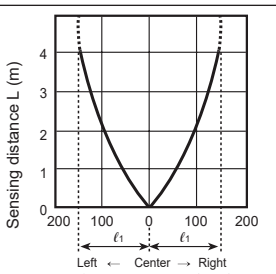
● BR4M-TDT□-□ / BR4M-TDT□-□-P

Parallel shifting characteristic

Measuring method

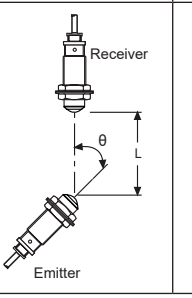


Data



Angle characteristic

Measuring method



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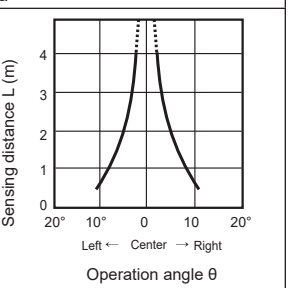
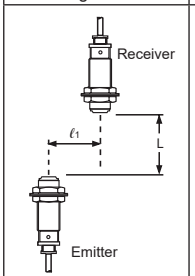


● BR20M-TDT□-□ / BR20M-TDT□-□-P

Parallel shifting characteristic

Measuring method



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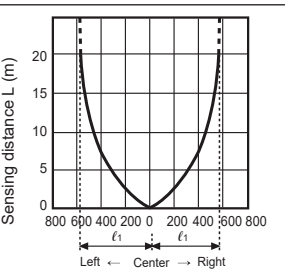
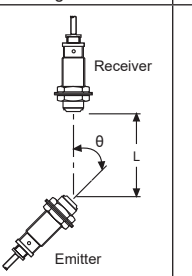


Angle characteristic

Measuring method



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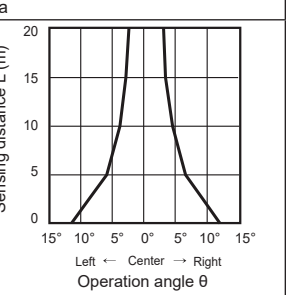
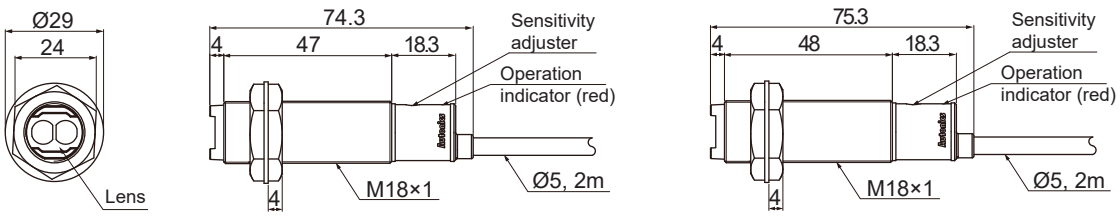


▣ Dimensions

(unit: mm)

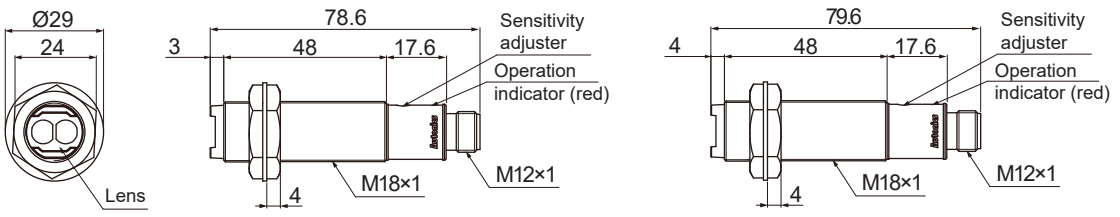
◎ Diffuse reflective/Narrow beam reflective/Retroreflective type

- **BR100-DDT(-P)** • **BR200-DDTN(-P)**
- **BR400-DDT(-P)**



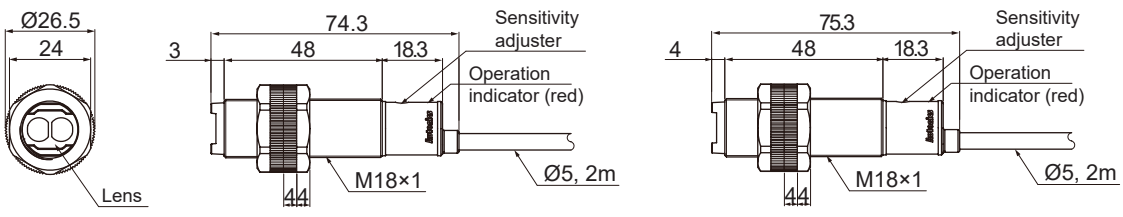
- **BR3M-MDT(-P)**

- **BR100-DDT-C(-P)** • **BR200-DDTN-C(-P)**
- **BR400-DDT-C(-P)**



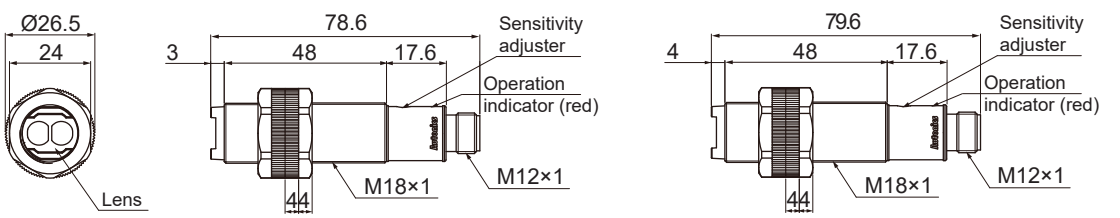
- **BR3M-MDT-C(-P)**

- **BRP100-DDT(-P)** • **BRP200-DDTN(-P)**
- **BRP400-DDT(-P)**



- **BRP3M-MDT(-P)**

- **BRP100-DDT-C(-P)** • **BRP200-DDTN-C(-P)**
- **BRP400-DDT-C(-P)**



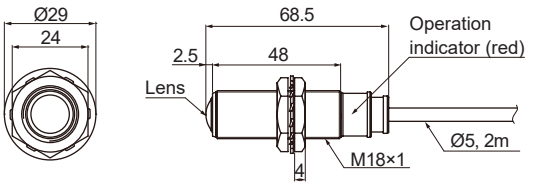
- **BRP3M-MDT-C(-P)**

◎ Through-beam type

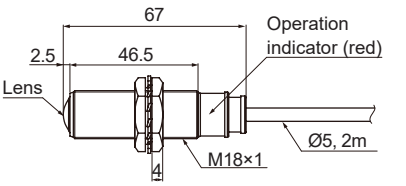
(unit: mm)

• BR4M-TDTD(-P) / BR4M-TDTL(-P)

<Emitter>

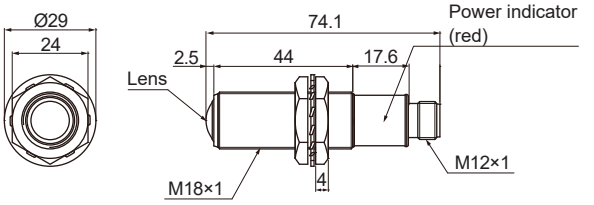


<Receiver>

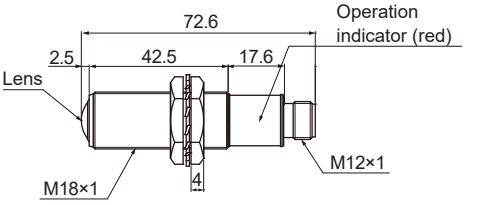


• BR4M-TDTD-C(-P) / BR4M-TDTL-C(-P)

<Emitter>

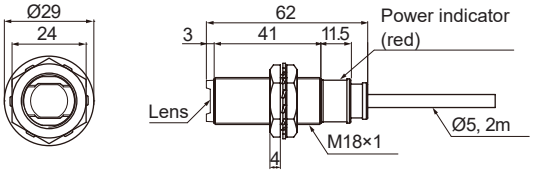


<Receiver>

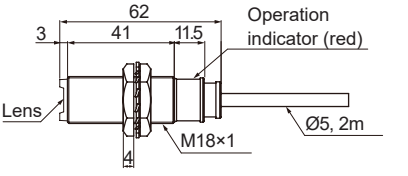


• BR20M-TDTD(-P) / BR20M-TDTL(-P)

<Emitter>

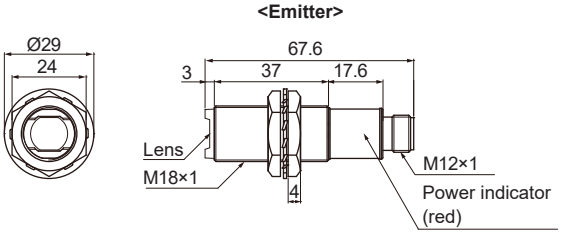


<Receiver>

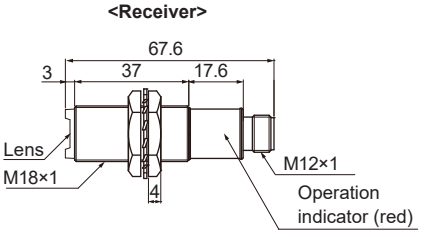


• BR20M-TDTD-C(-P) / BR20M-TDTL-C(-P)

<Emitter>

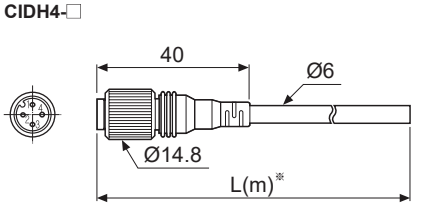


<Receiver>

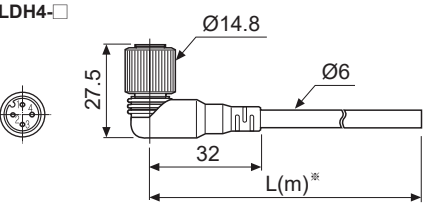


• Connection cable (sold separately)

· CIDH4-□

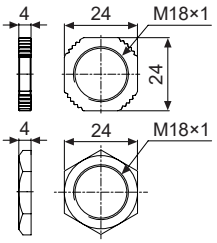


· CLDH4-□



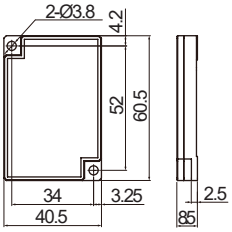
※Specifi cation of connector cable: Ø6mm, 4-wire, 2m/3m/5m/7m
(AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.65mm)

● **M18 fixing nut**

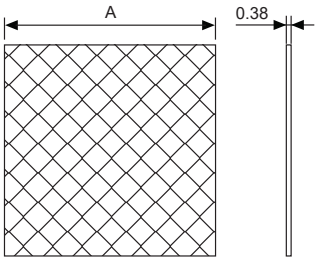


● **Reflector**

· **MS-2**



● **Reflective tape (sold separately)**



(unit: mm)

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

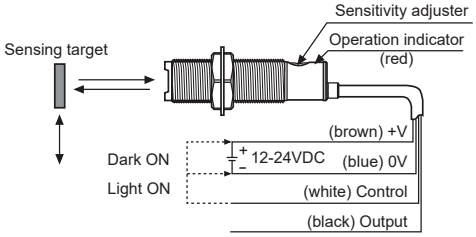
▣ Operation Mode

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

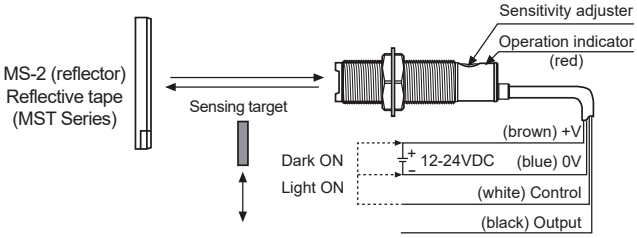
※The transistor output will be held OFF for 0.5 sec after supplied power in order to prevent malfunction of this photoelectric sensor (except through-beam type).

▣ Connections

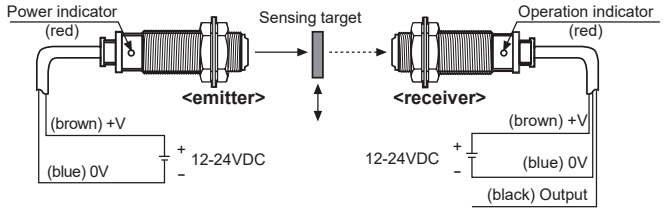
● **Diffuse reflective type / Narrow beam reflective type**



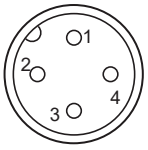
● **Retroreflective type**



● **Through-beam type**



▣ Connections for Connector Part



M12 Connector pin

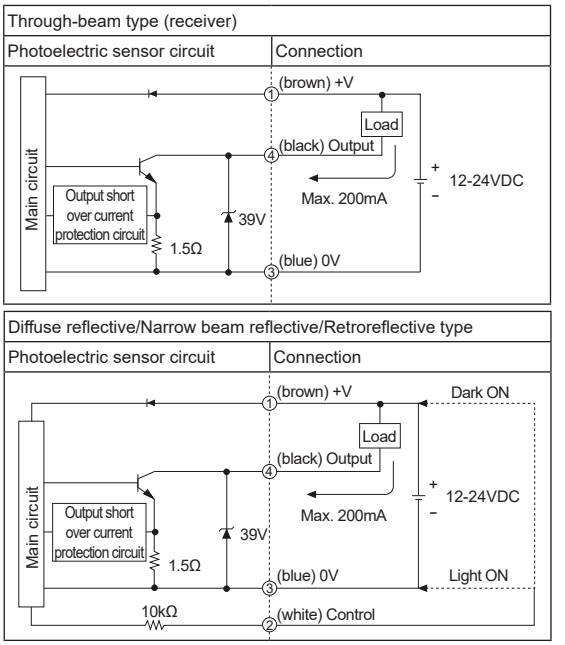
Pin No.	Cable color	Application		
		Diffuse/ Narrow beam reflective/ Retroreflective type	Through-beam type	
			Emitter	Receiver
1	Brown	24VDC	24VDC	24VDC
2	White	CONTROL	N·C	GND
3	Blue	GND	GND	GND
4	Black	OUTPUT	N·C	OUTPUT

● Connector cable (sold separately)

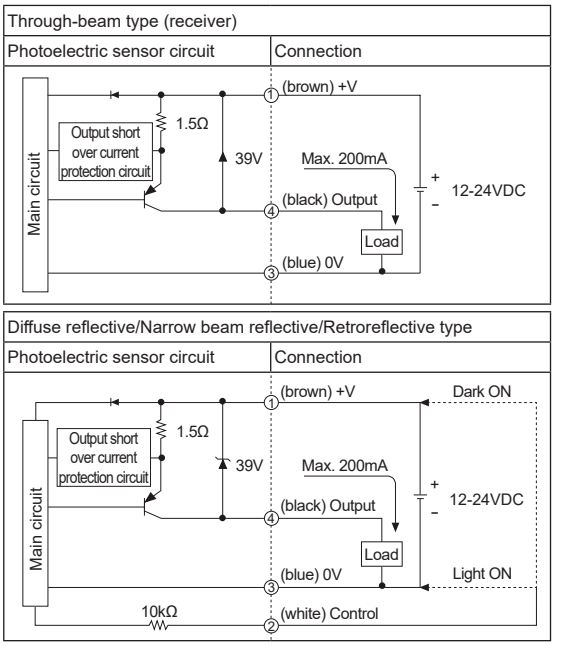
※Please refer to the connector cable section.

▣ Control Output Diagram

● NPN open collector output



● PNP open collector output



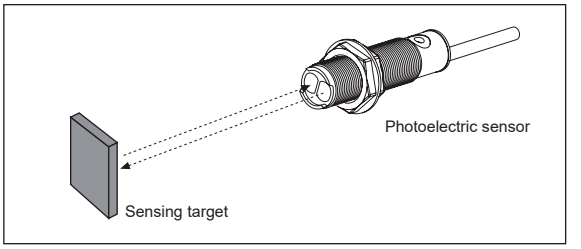
※Before using this unit, select Light ON/Dark ON with control wire. (light on: connect control wire 0V / dark on: connect control wire with +V)
※Control wire is only for Diffuse reflective/Narrow beam reflective/Retroreflective type.
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Installation and Sensitivity Adjustment

Install the sensor to the desired place and check the connections. Supply the power to the sensor and adjust the optical axis and the sensitivity as following.
When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 0.39N·m for BRP and to 14.7N·m for BR.

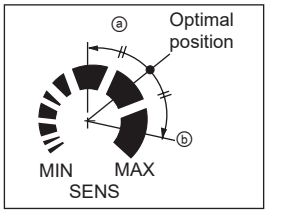
◎ Diffuse reflective/Narrow beam reflective type

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 sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster.
3. Take the target out of the sensing area, then turn the sensitivity adjuster until position ⓑ where the operation indicator turns ON. If the indicator dose not turn ON, max. position is ⓑ.
4. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

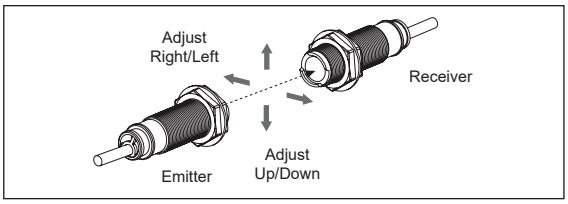
※Be sure that it can be different by size, surface and gloss of target.



◎ Through-beam type

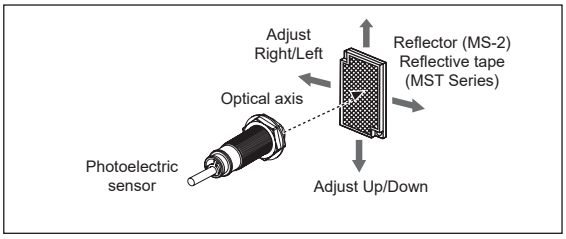
1. Supply the power to the photoelectric sensor, after setting the emitter and the receiver facing each other.
2. Set the receiver in center of position in the middle of the operation range of indicator by adjusting the receiver or the emitter right and left, up and down.
3. After the adjustment, check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

※If the sensing target is translucent body or smaller than Ø15, it can be missed by sensor cause light penetrate it.



◎ Retroreflective type

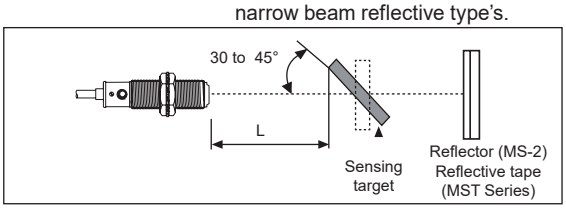
1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector (MS-2) or reflective tape face to face.
2. Set the photoelectric sensor in the position which indicator turns on, as adjusting the reflector or the sensor right and left, up and down.
3. Fix both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



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

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

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



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

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


<MS-4>

▣ Reflectivity by Reflective Tape Model

MST-50-10 (50×50mm)	80%
MST-100-5 (100×100mm)	120%
MST-200-2 (200×200mm)	140%

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

※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.

※For using reflective tape, installation distance should be min. 20mm.

Cylindrical Type Photoelectric Sensor

▣ Features

[Common]
- Excellent noise immunity and minimal influence from ambient light
- Power/Output reverse polarity protection circuit, output short over current protection circuit
- Mutual interference prevention function (except through-beam type)
- Sensitivity adjuster
- Light ON, Dark ON switchable by control wire

[BRQT, BRQM, BRQP Series (front sensing type)]
- Various materials: Plastic, Metal (Ni-plated Brass), Stainless steel 316L
- Long sensing distance: 30m (through-beam type)
- Body size - BRQT, BRQM: Standard
  BRQP: Standard, Short body
- Protection structure - BRQT: IP67 (IEC standard), IP69K (DIN standard)
  BRQM, BRQP: IP67 (IEC standard)

[BRQPS Series (side sensing type)]
- Protection structure: IP67 (IEC standard)

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

[BRQT, BRQM, BRQP Series (front sensing type)]

BRQT-A
SUS316L Standard

BRQM-A
Ni-plate Brass Standard

BRQP-A
Plastic Standard

BRQP-B
Plastic Short-body

Reflector (MS-2A)

Reflective tape (MST series)

[BRQPS Series (side sensing type)]

Reflector (MS-2S)

Reflective tape (MST series)

※The model name with '-C' is connector type.
※Reflective tape (MST series) is sold separately.

▣ Ordering Information

BRQ T □ 5 M – T D T □ A – C – P

		Front sensing type	Side sensing type
Control output	No mark	NPN open collector output	
	P	PNP open collector output	
Connection	No mark	Cable type	
	C	Connector type	
Appearance	A	Standard	Standard
	B	Short body※1	—
Emitter/Receiver	1	Emitter	
	2	Receiver	
Output	T	Transistor output	
Power supply	D	DC power	
Sensing type	T	Through-beam type	
	P	Retroreflective type (built-in polarizing filter)	
	D	Diffuse reflective type	
Sensing distance unit	No mark	mm	
	M	m	
Sensing distance	Number	Sensing distance	
Form of sensing	No mark	Front sensing type	—
	S	—	Side sensing type
Case material	T	Stainless steel 316L	—
	M	Brass, Ni-plate	—
	P	Plastic	Plastic
Item	BRQ	Cylindrical type photoelectric sensor	

※1: This is only for BRQP Series.
※⋯ This information is intended for product management of through-beam type. (no need to refer when selecting model)

Cylindrical Type Photoelectric Sensor (front sensing type)

▣ Specifications

Model	NPN open collector output	**BRQ□5M-TDT□-□**	**BRQ□20M-TDT□-□**	**BRQ□30M-TDT□-□**	**BRQ□3M-PDT□-□**	**BRQ□100-DDT□-□**	**BRQ□400-DDT□-□**	**BRQ□1M-DDT□-□**
	PNP open collector output	**BRQ□5M-TDT□-□-P**	**BRQ□20M-TDT□-□-P**	**BRQ□30M-TDT□-□-P**	**BRQ□3M-PDT□-□-P**	**BRQ□100-DDT□-□-P**	**BRQ□400-DDT□-□-P**	**BRQ□1M-DDT□-□-P**
Sensing type		Through-beam type			Retroreflective type (built-in polarizing filter)	Diffuse reflective type		
Sensing distance		5m	20m	30m	3m※1	100mm※2	400mm※2	1m※3
Sensing target		Opaque materials of min. Ø7mm			Opaque materials of min. Ø75mm	Opaque, translucent materials		
Hysteresis		—				Max. 20% at rated sensing distance		
Response time		Max. 1ms						
Power supply		10-30VDC⎓ ±10% (ripple P-P: max.10%)						
Current consumption		Emitter/Receiver: max. 20mA			Max. 30mA			
Light source		Red LED (660nm)				Infrared LED (850nm)	Red LED (660nm)	
Sensitivity adjustment		Sensitivity adjuster						
Operation mode		Selectable Light ON or Dark ON by control wire (white)						
Control output		NPN or PNP open collector output · Load voltage: max. 30VDC⎓ · Load current: max. 100mA · Residual voltage: max. 2VDC⎓						
Protection circuit		Power/Output reverse polarity protection circuit, output short over current protection circuit, interference prevention function (except through-beam type)						
Indicator		Operation indicator: yellow LED, stability indicator: green LED (emitter power indicator of through-beam type: red LED)						
Connection		Cable type, connector type						
Insulation resistance		Over 20MΩ (at 500VDC megger)						
Noise immunity		±240V the square wave noise (pulse width:1μs) 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 X, Y, Z direction for 2 hours						
Shock		500m/s² (approx. 50G) in X, Y, Z direction for 3 times						
Environment	Ambient illu.	Sunlight: max. 11,000lx, Incandescent lamp: max. 3,000lx (receiver illumination)						
	Ambient temp.	-25 to 60℃, storage: -30 to 70℃						
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH						
Protection structure		· BRQT Series: IP67 (IEC standard), IP69K (DIN standard) · BRQM, BRQP Series: IP67 (IEC standard)						
Material		· Case: BRQT Series - stainless steel 316L / BRQM Series - brass, Ni-plate / BRQP Series - polycarbonate · Lens, Lens cover: polymethyl methacrylate acrylic						
Cable※4	Cable type	Ø4mm, 4-wire, 2m (emitter of through-beam type: Ø4mm, 2-wire, 2m) (AWG26, core diameter: 0.52mm, number of cores: 20, insulator out diameter: Ø1mm)						
Accessory	Individual	—			Reflector (MS-2A)	—		
	Common	M18 fixing nut: 4, adjustment screwdriver			M18 fixing nut: 2, adjustment screwdriver			
Approval		CE c UL us						
Weight※5	Cable type	BRQT-A/BRQM-A: approx. 220g (approx. 140g) BRQP-A: approx. 160g (approx. 110g) BRQP-B: approx. 150g (approx. 100g)			BRQT-A/BRQM-A: approx. 150g (approx. 70g) BRQP-A: approx. 120g (approx. 60g) BRQP-B: approx. 120g (approx. 50g)			
	Connector type	BRQT-A/BRQM-A: approx. 160g (approx. 50g) BRQP-A: approx. 110g (approx. 25g) BRQP-B: approx. 100g (approx. 20g)			BRQT-A/BRQM-A: approx. 140g (approx. 30g) BRQP-A: approx. 110g (approx. 15g) BRQP-B: approx. 100g (approx. 10g)			

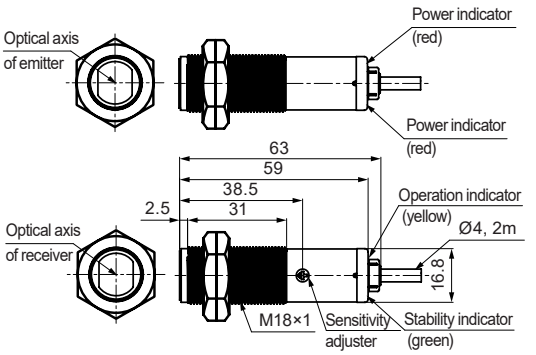
※1: The sensing distance is specified with using the MS-2A reflector. The distance between the sensor and the reflector should be set over 0.1m. When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the '▣ Reflectivity by Reflective Tape Model' table before using the tape.
※2: Non-glossy white paper 100×100mm.
※3: Non-glossy white paper 300×300mm.
※4: M12 connector cable is sold separately.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.

▣ Dimensions

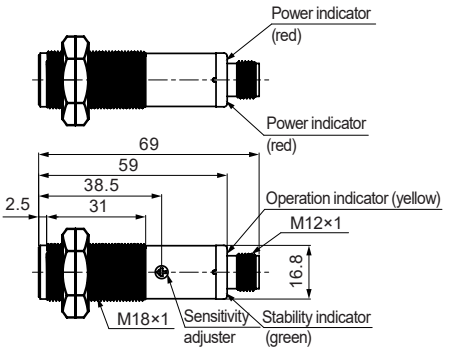
(unit: mm)

◎ Through-beam type

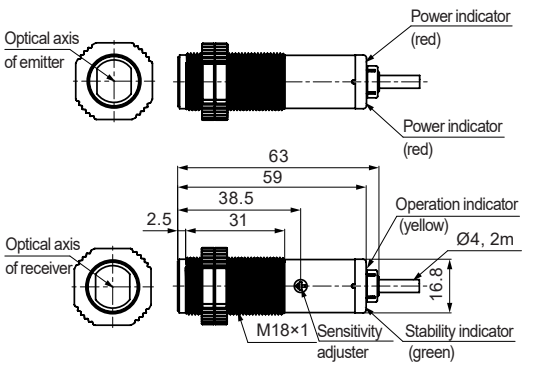
- **BRQT□-TDTA(-P)**
- **BRQM□-TDTA(-P)**



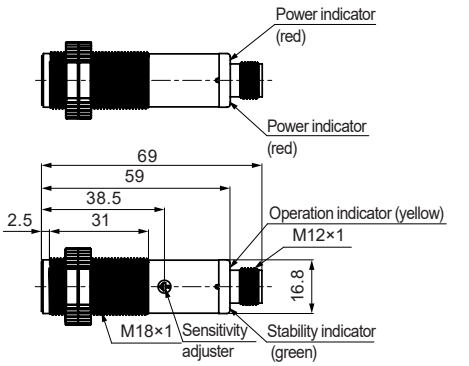
- **BRQT□-TDTA-C(-P)**
- **BRQM□-TDTA-C(-P)**



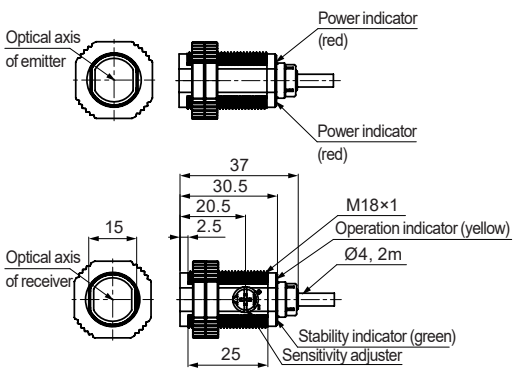
- **BRQP□-TDTA(-P)**



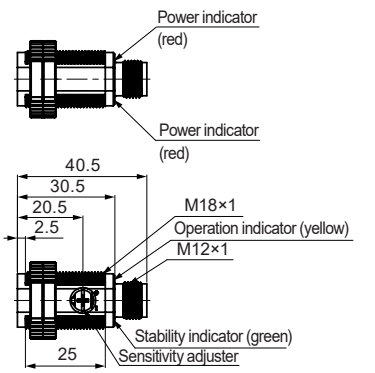
- **BRQP□-TDTA-C(-P)**



- **BRQP□-TDTB(-P)**



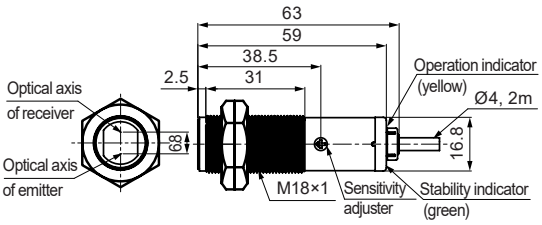
- **BRQP□-TDTB-C(-P)**



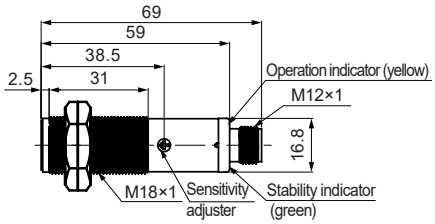
◎ Retroreflective/Diffuse reflective type

(unit: mm)

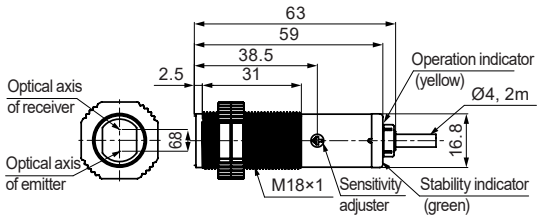
- **BRQT3M-PDTA(-P)/BRQM3M-PDTA(-P)**
- **BRQT□-DDTA(-P)/BRQM□-DDTA(-P)**



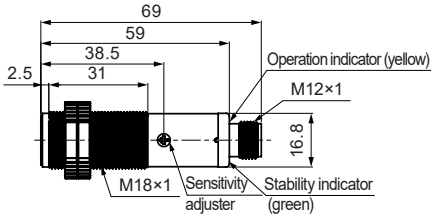
- **BRQT3M-PDTA-C(-P)/BRQM3M-PDTA-C(-P)**
- **BRQT□-DDTA-C(-P)/BRQM□-DDTA-C(-P)**



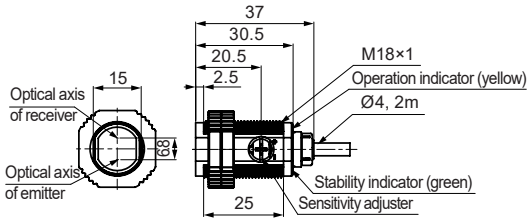
- **BRQP3M-PDTA(-P)**
- **BRQP□-DDTA(-P)**



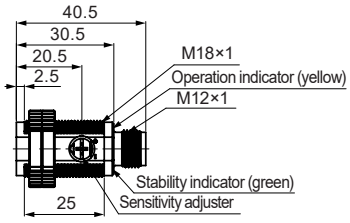
- **BRQP3M-PDTA-C(-P)**
- **BRQP□-DDTA-C(-P)**



- **BRQP3M-PDTB(-P)**
- **BRQP□-DDTB(-P)**

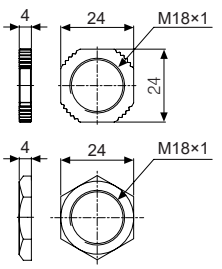


- **BRQP3M-PDTB-C(-P)**
- **BRQP□-DDTB-C(-P)**



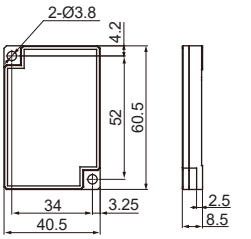
(unit: mm)

● M18 fixing nut



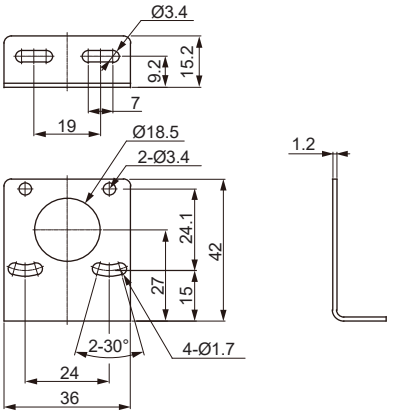
● Reflector

· MS-2A

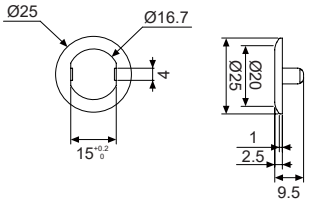


◎ Sold separately

● Bracket(BK-BR-A)

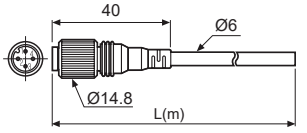


● Fixing cap
(BK-BR-B, only for BRQP□-□□□B-□)

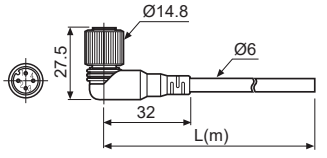


● Connection cable

· CIDH4-□

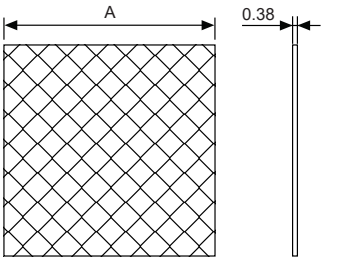


· CLDH4-□



※Specification of connector cable: Ø6mm, 4-wire, 2m/3m/5m/7m (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.65mm)

● Reflective tape



(unit: mm)

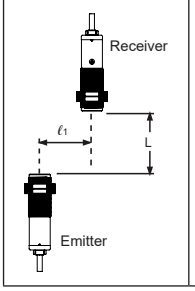
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

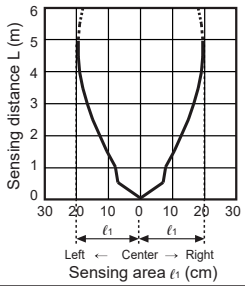
▣ Feature Data

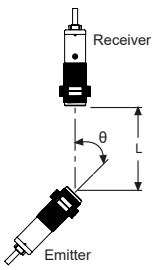
◎ Through-beam type

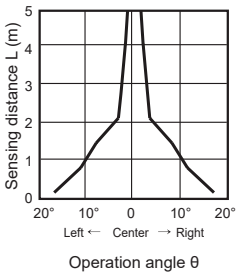
●BRQ□5M-TDT□-□(-P)

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data



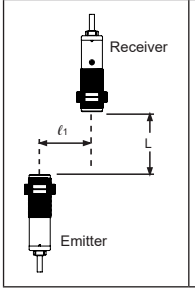


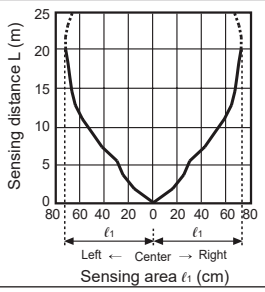


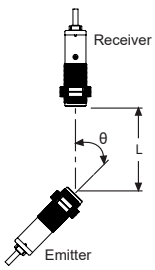


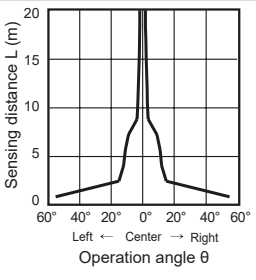
●BRQ□20M-TDT□-□(-P)

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data



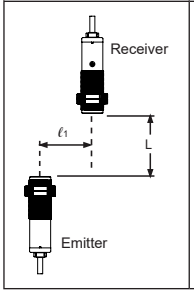


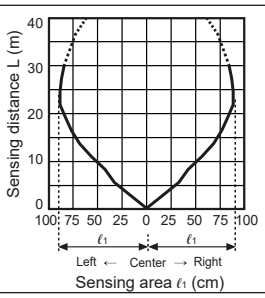


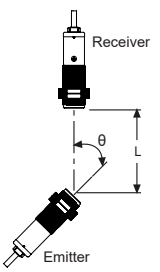


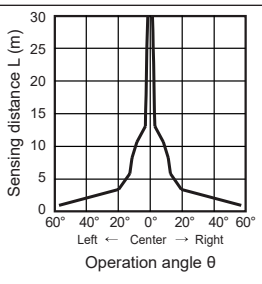
●BRQ□30M-TDT□-□(-P)

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data





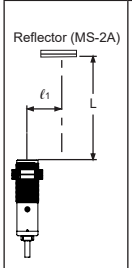


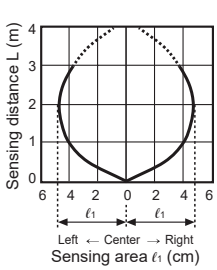


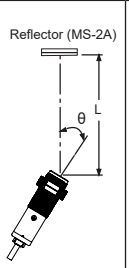
◎ Retroreflective type

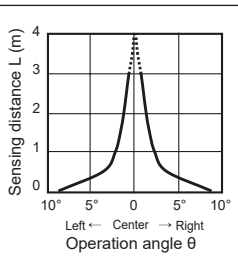
●BRQ□3M-PDT□-□-P

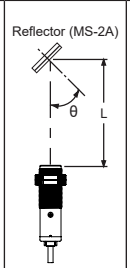
Parallel shifting characteristic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data

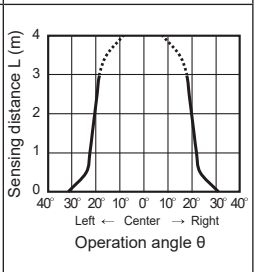








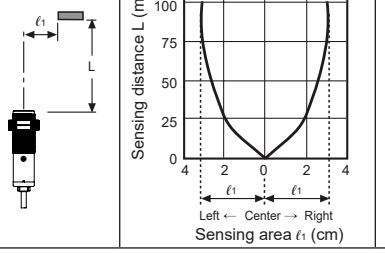




◎ Diffuse reflective type

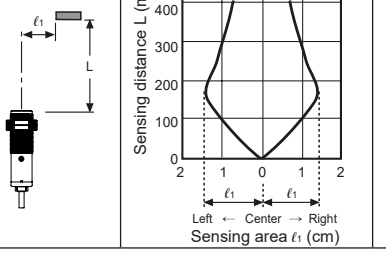
●BRQ□100-DDT□-□(-P)

Sensing area characteristic	
Measuring method	Data



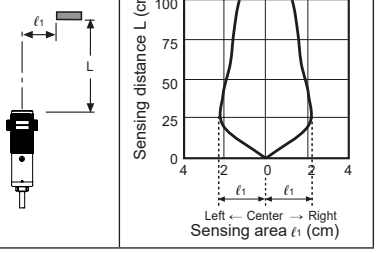
●BRQ□400-DDT-□(-P)

Sensing area characteristic	
Measuring method	Data



●BRQ□1M-DDT□-□(-P)

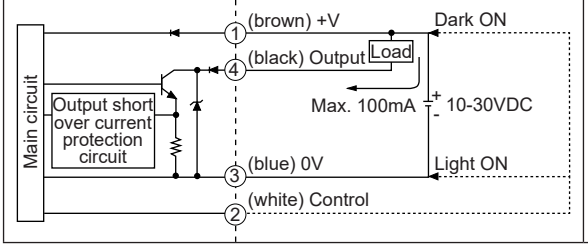
Sensing area characteristic	
Measuring method	Data



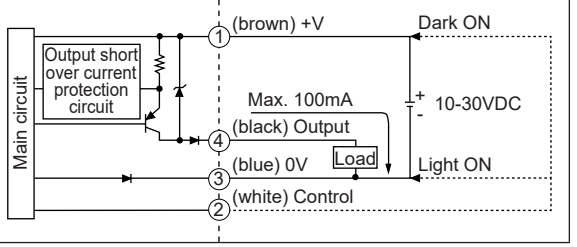
■ Control Output Circuit Diagram

● Through-beam/Retroreflective/Diffuse reflective type

NPN open collector output	
Photoelectric sensor circuit	Connection

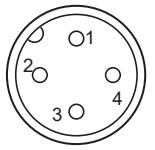


PNP open collector output	
Photoelectric sensor circuit	Connection



※Before using this unit, select Light ON/Dark ON with control cable.
(Light ON: connect control cable with 0V/Dark ON: connect control cable with +V)
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

■ Connections for Connector Part



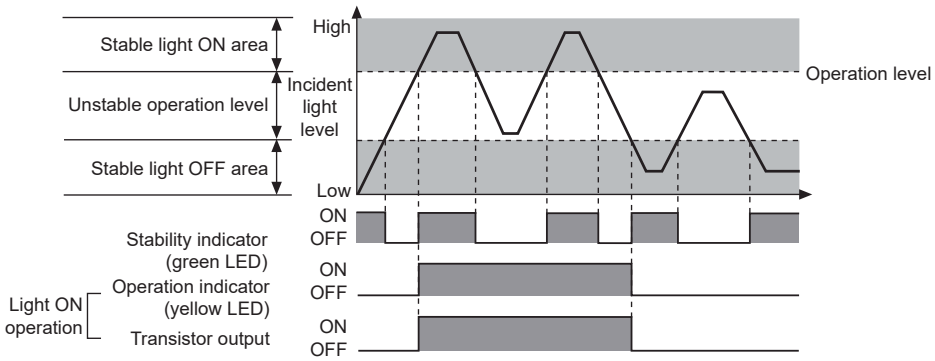
M12 Connector pin

Pin No.	Cable color	Application		
		Diffuse/ Retroreflective type	Through-beam type	
			Emitter	Receiver
1	Brown	30VDC	30VDC	30VDC
2	White	CONTROL	N.C	CONTROL
3	Blue	GND	GND	GND
4	Black	OUTPUT	N.C	OUTPUT

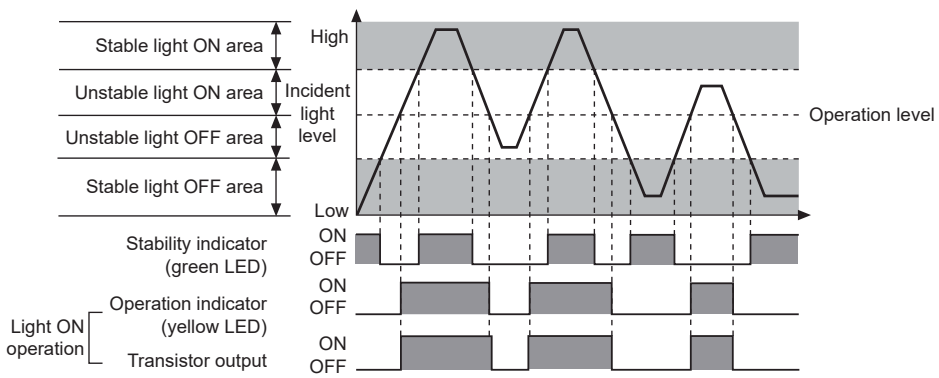
● Connector cable (sold separately)
※Please refer to the connector cable part.

▣ Operation Timing Diagram

◎ Through-beam type



◎ Retroreflective/Diffuse reflective type

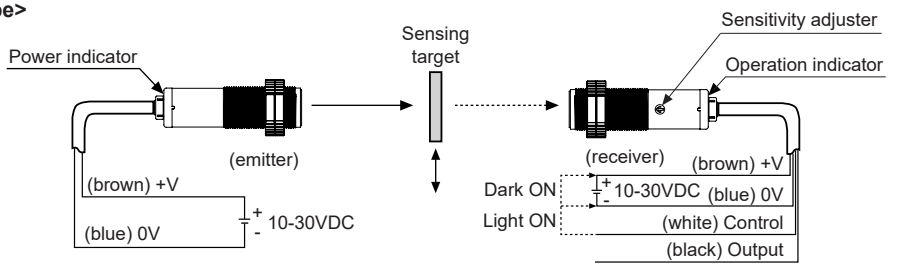


※The waveforms of 'Operation indicator' and 'Transistor output' are for Light ON operation.
They are opposite operation for Dark ON operation.

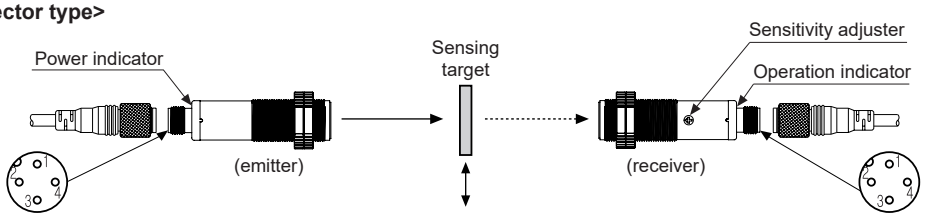
▣ Connections

• Through-beam type

<Cable type>

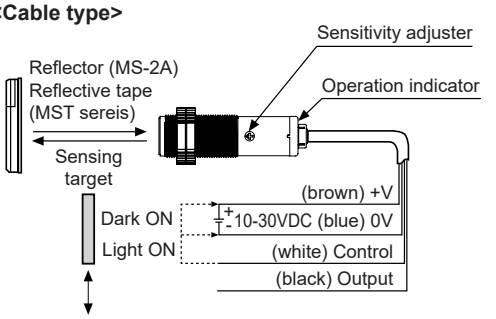


<Connector type>

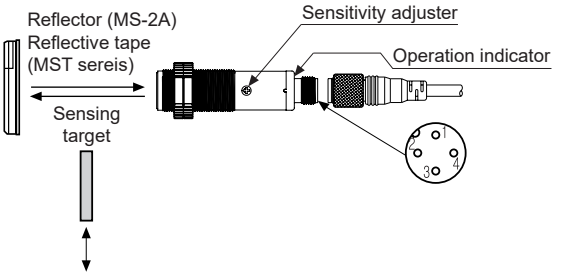


• Retroreflective type

<Cable type>

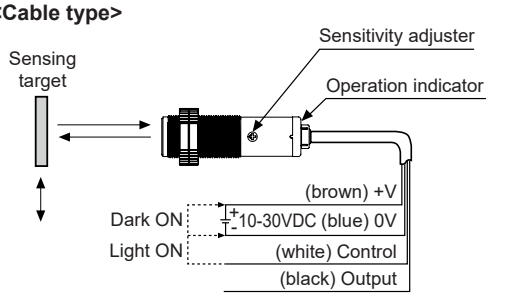


<Connector type>

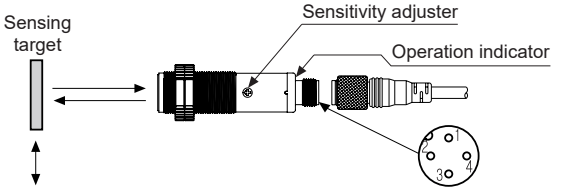


• Diffuse reflective type

<Cable type>



<Connector type>



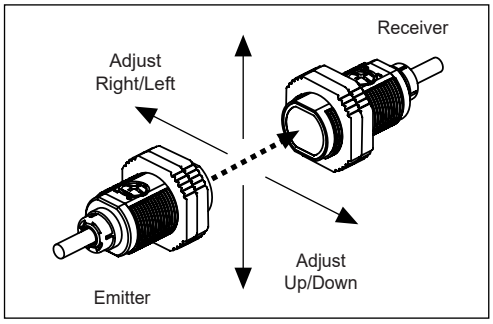
▣ Installation and Adjustment

Install the sensor to the desired place and check the connections. Supply the power to the sensor and adjust the optical axis and the sensitivity as following.
When using the reflective type photoelectric sensors closely over three units, it may result in malfunction due to mutual interference.
When using the through-beam type photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 14.7N·m for BRQT/BRQM and 0.39N·m for BRQP.

◎ Through-beam type

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

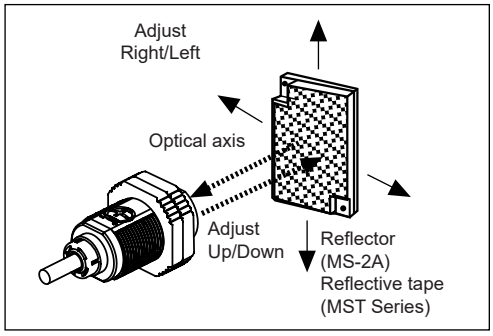
※If the sensing target is translucent body or smaller than Ø7mm, it can be missed by sensor cause light penetrate it.



◎ Retroreflective type

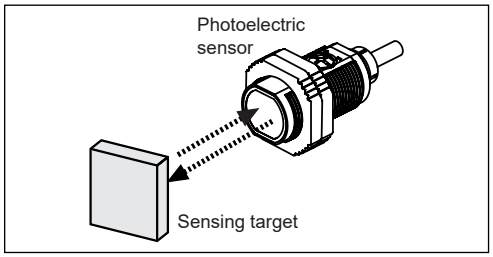
1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector (MS-2A) or reflective tape in face to face.
2. Set the photoelectric sensor in the position which indicator turns on, as adjusting the reflector or the sensor right and left, up and down.
3. Fix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

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



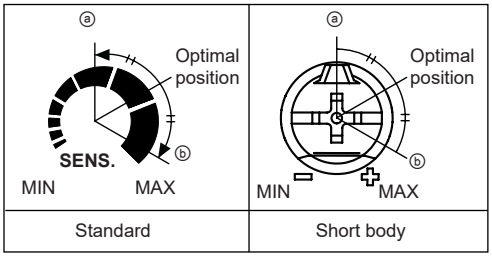
◎ Diffuse reflective type

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



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

※Be aware of the fact that sensing distance can be different by size, surface and gloss of the target.



▣ Reflectivity by Reflective Tape Model

Model	Standard	Short body
MST-50-10 (50×50mm)	40%	40%
MST-100-5 (100×100mm)	50%	80%
MST-200-2 (200×200mm)	80%	85%

※This reflectivity is based on the reflector (MS-2A).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

Cylindrical Type Photoelectric Sensor (side sensing type)

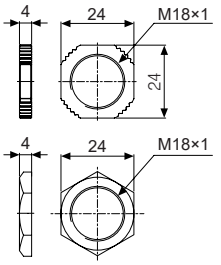
▣ Specifications

Model	NPN open collector output	**BRQPS10M-TDTA(-C)**	**BRQPS20M-TDTA(-C)**	**BRQPS3M-PDTA(-C)**	**BRQPS100-DDTA(-C)**	**BRQPS400-DDTA(-C)**	**BRQPS700-DDTA(-C)**
	PNP open collector output	**BRQPS10M-TDTA(-C)-P**	**BRQPS20M-TDTA(-C)-P**	**BRQPS3M-PDTA(-C)-P**	**BRQPS100-DDTA(-C)-P**	**BRQPS400-DDTA(-C)-P**	**BRQPS700-DDTA(-C)-P**
Sensing type		Through-beam type		Retroreflective type (built-in polarizing filter)	Diffuse reflective type		
Sensing distance		10m	20m	3m※1	100mm※2	400mm※2	700mm※3
Sensing target		Opaque materials of min. Ø7mm		Opaque materials of min. Ø75mm	Opaque, translucent materials		
Hysteresis		—			Max. 20% of maximum sensing distance		
Response time		Max. 1ms					
Power supply		10-30VDC⎓ ±10% (ripple P-P: max. 10%)					
Current consumption		Emitter/Receiver: max. 20mA		Max. 30mA			
Light source		Red LED (660nm)					
Sensitivity adjustment		Sensitivity adjuster					
Operation mode		Selectable Light ON or Dark ON by control wire (white)					
Control output		NPN or PNP open collector output • Load voltage: max. 30VDC⎓ • Load current: max. 100mA • Residual voltage: max. 2VDC⎓					
Protection circuit		Power/Output reverse polarity protection circuit, output short over current protection circuit, interference prevention function (except through-beam type)					
Indicator		Operation indicator: yellow LED, stability indicator: green LED (emitter power indicator of through-beam type: red LED)					
Connection		Cable type, connector type					
Insulation resistance		Over 20MΩ (at 500VDC megger)					
Noise immunity		±240V the squre wave noise (pulse width: 1μs) 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 X, Y, Z direction for 2 hours					
Shock		500m/s² (approx. 50G) in X, Y, Z directions for 3 times					
Environment	Ambient illu.	Sunlight: max.11,000lx, incandescent lamp: 3,000lx (receiver illumination)					
	Ambient temp.	-25 to 60℃, storage: -30 to 70℃					
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH					
Protection structure		IP67 (IEC standard)					
Material		Case: polycarbonate, lens, lens cover: polymethyl methacrylate acrylic					
Cable※4		Ø4mm, 4-wire, 2m (emitter of through-beam type: Ø4mm, 2-wire, 2m) (AWG26, core diameter: 0.52mm, number of cores: 20, insulator out diameter: Ø1mm)					
Accessory	Individual	—		Reflector (MS-2S)	—		
	Common	M18 fixing nut: 4, adjustment screwdriver		M18 fixing nut: 2, adjustment screwdriver			
Approval		CE c UL us					
Weight※5	Cable type	Approx. 170g (approx. 120g)		Approx. 130g (approx. 70g)			
	Connector type	Approx. 120g (approx. 35g)		Approx. 120g (approx. 25g)			

※1: The sensing distance is specified with the MS-2S reflector. The distance between the sensor and the reflector should be set over 0.1m. When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the '▣ Reflectivity by Reflective Tape Model' table before using the tape.
※2: Non-glossy white paper 100×100mm.
※3: Non-glossy white paper 200×200mm.
※4: M12 connector cable is sold separately.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature and humidity mentioned in Environment indicates a non freezing or condensation.

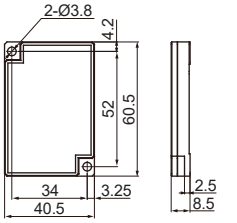
(unit: mm)

● **M18 fixing nut**



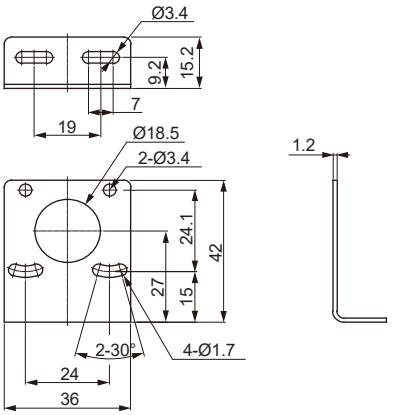
● **Reflector**

· **MS-2S**

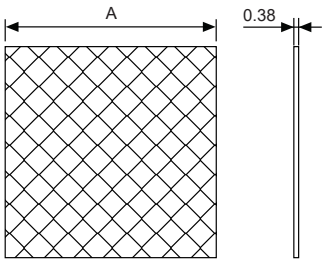


◎ Sold separately

● **Bracket(BK-BR-A)**



● **Reflective tape**

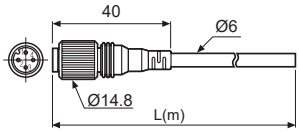


(unit: mm)

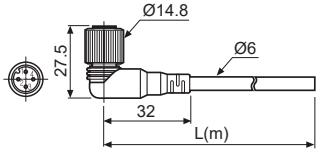
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

● **Connection cable**

· **CIDH4-□**



· **CLDH4-□**

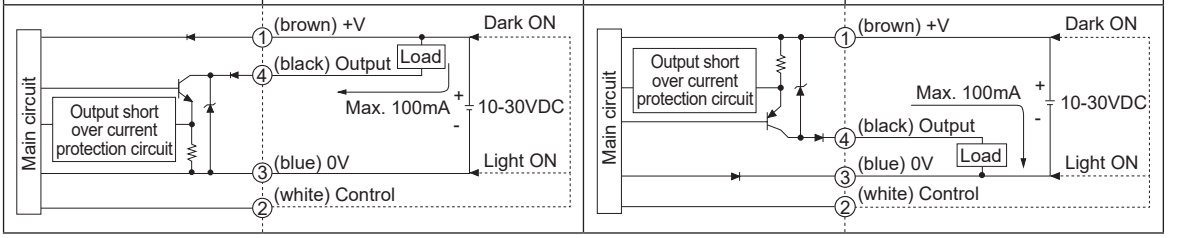


※Specification of connector cable: Ø6mm, 4-wire, 2m/3m/5m/7m
(AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.65mm)

■ Control Output Circuit Diagram

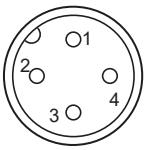
• Through-beam/Retroreflective/Diffuse reflective type

NPN open collector output		PNP open collector output	
Photoelectric sensor circuit	Connection	Photoelectric sensor circuit	Connection



※Before using this unit, select Light ON/Dark ON with control wire. (Light ON: connect control wire to 0V/Dark ON: connect control wire to +V)
※If short-circuit the control output terminal or supply current over the rated specifi cation, normal control signal is not output due to the output short over current protection circuit

■ Connections for Connector Part



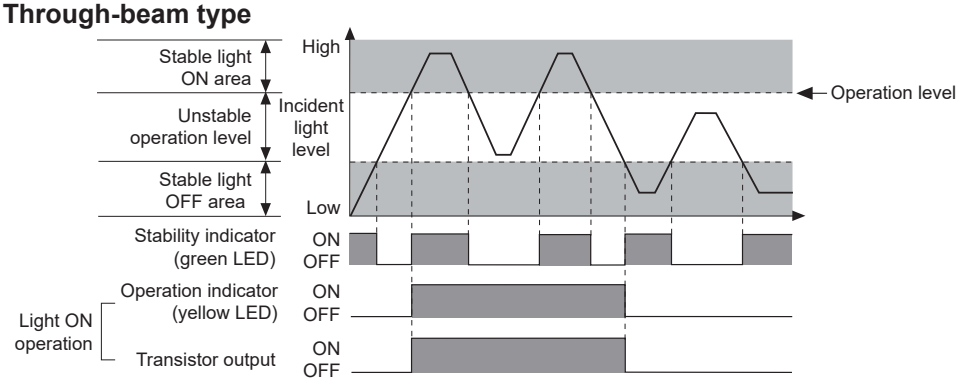
M12 Connector pin

Pin No.	Cable color	Application		
		Diffuse/ Retroreflective type	Through-beam type	
			Emitter	Receiver
1	Brown	30VDC	30VDC	30VDC
2	White	CONTROL	N.C	CONTROL
3	Blue	GND	GND	GND
4	Black	OUTPUT	N.C	OUTPUT

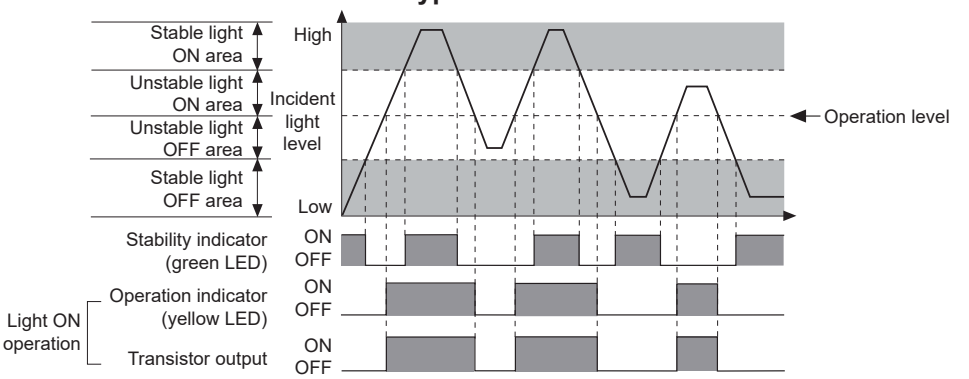
• Connector cable (sold separately)
※Please refer to the connector cable part.

■ Operation Timing Diagram

◎ Through-beam type



◎ Retroreflective/Diffuse reflective type



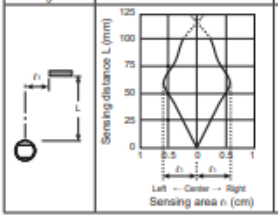
※The waveforms of 'Operation indicator' and 'Transistor output' are for Light ON operation.
The waveforms are reversed in Dark On operation.

▣ Feature Data

◎ Diffuse reflective type

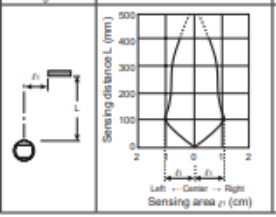
• BRQPS100-DDTA-□(-P)

Sensing area characteristic	
Measuring method	Data



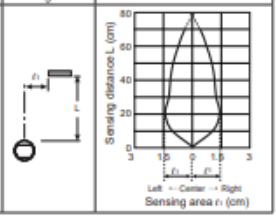
• BRQPS400-DDTA-□(-P)

Sensing area characteristic	
Measuring method	Data



• BRQPS700-DDTA-□(-P)

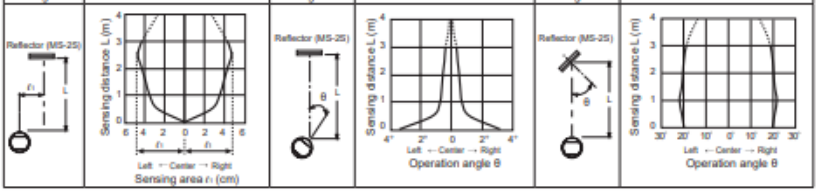
Sensing area characteristic	
Measuring method	Data



◎ Retroreflective type

• BRQPS3M-PDTA-□(-P)

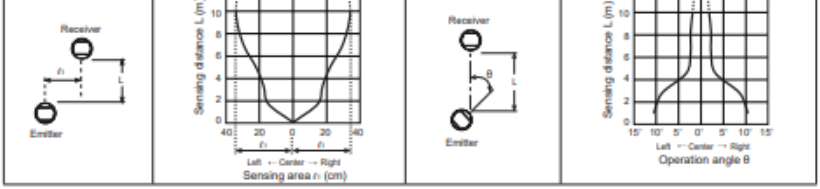
Parallel shifting characteristic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data



◎ Through-beam type

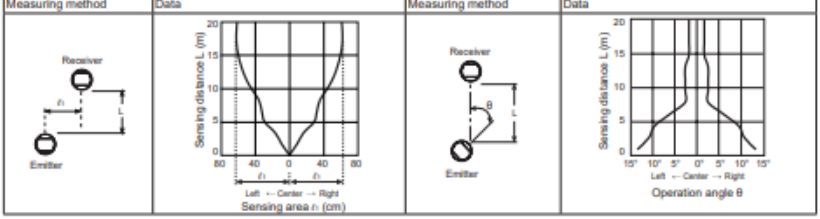
• BRQPS10M-TDTA-□(-P)

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data



• BRQPS20M-TDTA-□(-P)

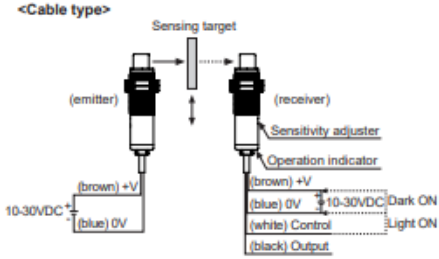
Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data



▣ Connections

- **Through-beam type**

<Cable type>



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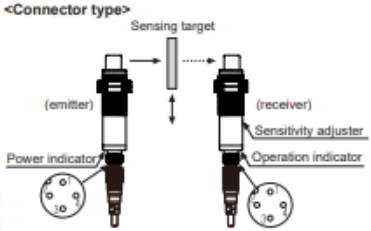
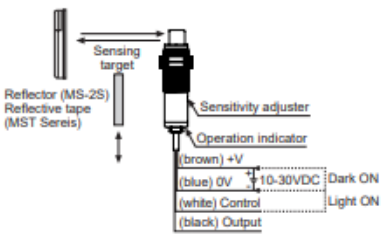


- **Retroreflective type**

<Cable type>



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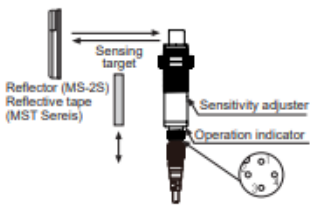
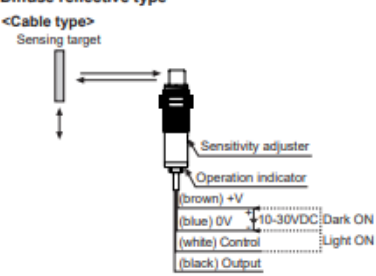
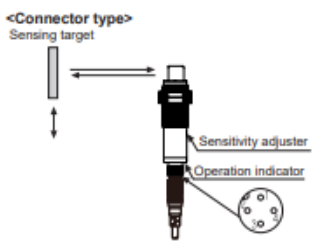


- **Diffuse reflective type**

<Cable type>



<Connector type>



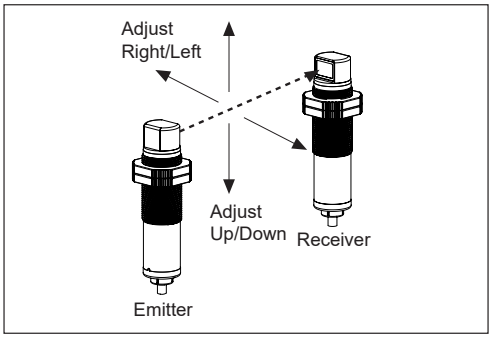
▣ Installation and Adjustment

Install the sensor to the desired place and check the connections.
Supply the power to the sensor and adjust the optical axis and the sensitivity as following.
When using the reflective type photoelectric sensors closely over three units, it may result in malfunction due to mutual interference.
When using the through-beam type photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the fixing nuts with a tightening torque of 0.39N·m.

◎ Through-beam type

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

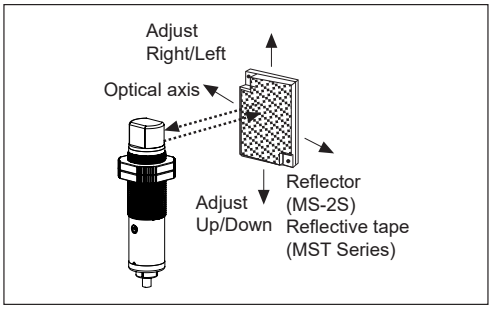
※If the sensing target is translucent body or smaller than Ø7mm, it can be missed by sensor cause light penetrate it.



◎ Retroreflective type

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

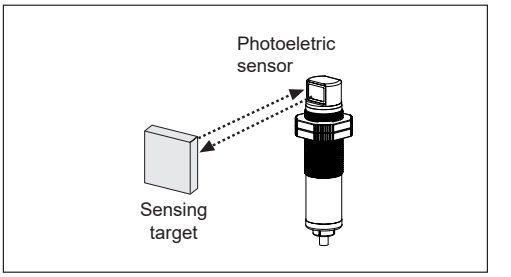
※Sensitivity adjustment
: Refer to the diffuse reflective type's.

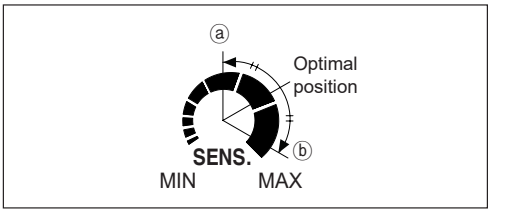


◎ Diffuse reflective type

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

※Be aware of the fact that sensing distance can be different by size, surface and gloss of the target.





▣ Reflectivity by Reflective Tape Model

MST-50-10 (50×50mm)	25%
MST-100-5 (100×100mm)	30%
MST-200-2 (200×200mm)	35%

※This reflectivity is based on the reflector (MS-2S).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

Small, Diffuse Reflective Type with Long Sensing Distance

▣ Features

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

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

CE

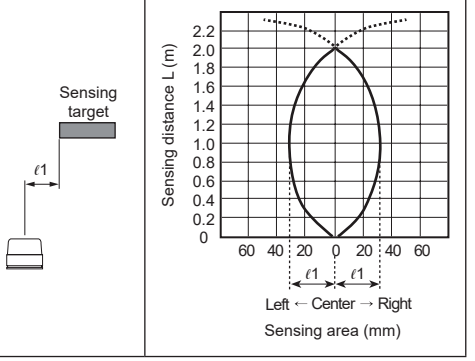
▣ Specifications

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		Sensitivity adjuster	
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. 1VDC⎓, PNP: min. 2.5VDC	
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit	
Indicator		●Operation indicator: red LED ●Stability indicator: orange LED (light on), green LED (dark on)	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator	
Dielectric strength		1000VAC 50/60Hz for 1 minute	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiving illumination)	
	Ambient temperature	-25 to 55℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP64 (IEC standard)	
Material		Case: acrylonitrile butadiene styrene, sensing part: polycarbonate, indicator: polycarbonate, adjuster: IXEF	
Cable		Ø3mm, 3-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)	
Accessory		Adjuster driver	
Approval		CE	
Unit weight		Approx. 50g	

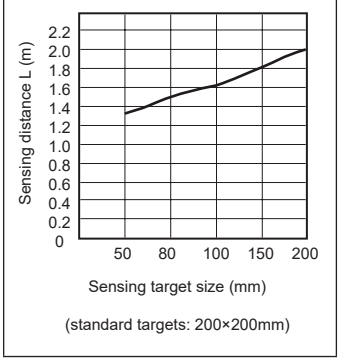
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

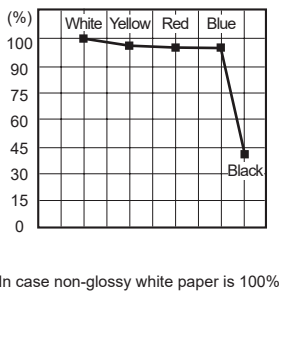
Sensing area characteristic



Sensing distance against the target size

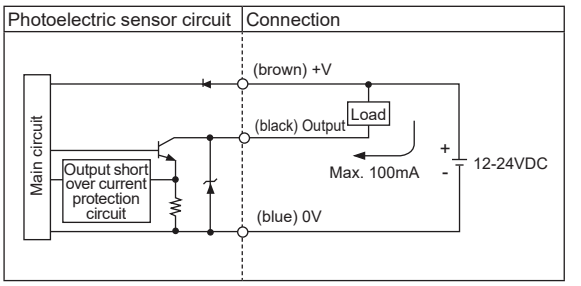


Sensing distance against the target color

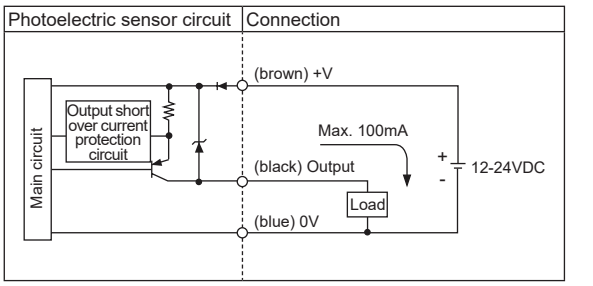


■ Control Output Diagram

● NPN open collector output

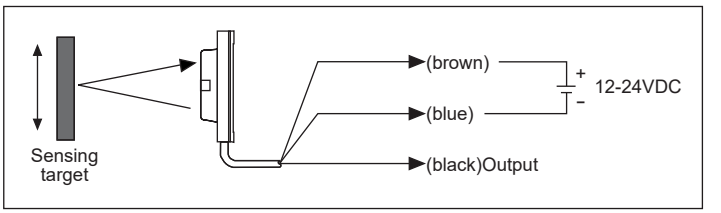


● PNP open collector output



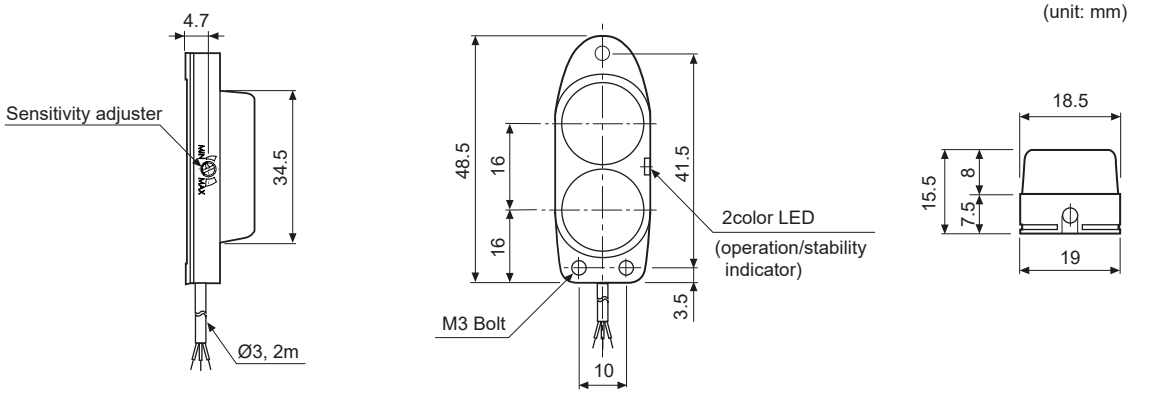
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

■ Connections



■ Dimensions

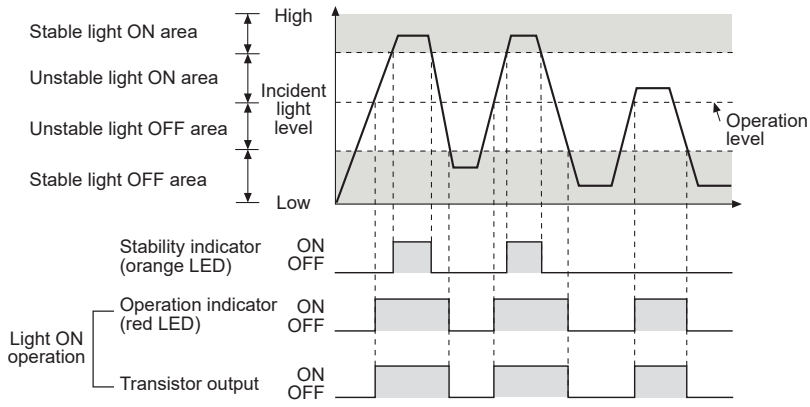
(unit: mm)



▣ Operation Mode

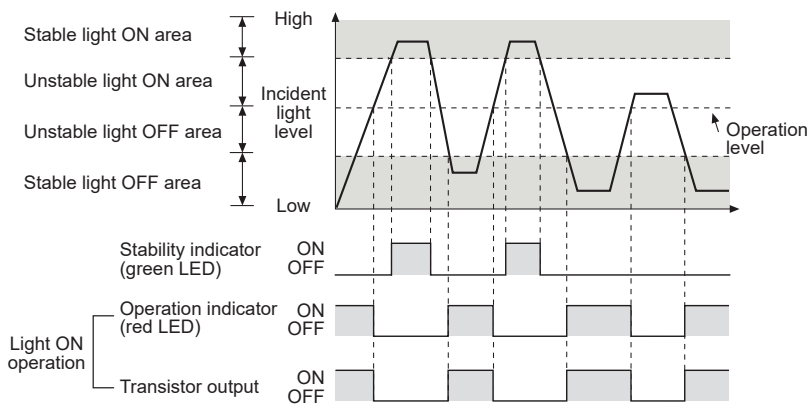
If the control output terminal is short-circuit or over current than the rated current flows the unit, the sensor does not operate normally by protection circuit.

● Light ON



(control output according to amount of receiving light)

● Dark ON

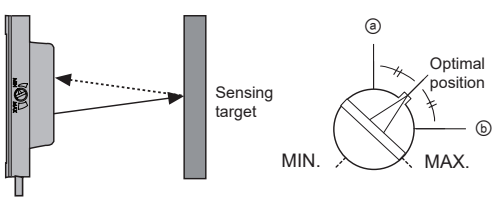


(control output according to amount of receiving light)

▣ Mounting and Sensitivity Adjustment

Install the sensor to the desired place and check the connections.
Supply the power to the sensor and adjust the optical axis and the sensitivity as follow ;
When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 0.5N·m.

● Optical axis adjustment



Mount this unit at the center where the stability indicator turns ON with moving the unit toward right or left, up or down.

● Adjustment

1. When sensing the object, set the sensitivity adjuster 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 sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster
4. Take the target out of the sensing area, then turn the sensitivity adjuster until position ⓑ where the operation indicator turns ON. If the indicator dose not turn ON, max. position is ⓑ.
5. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

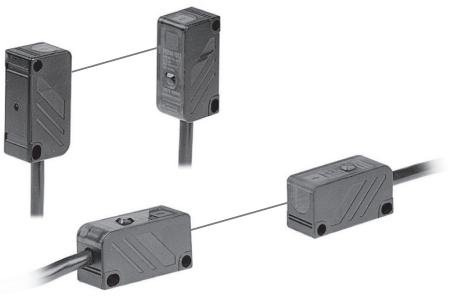
※The sensing distance indicated on specification chart is for 200×200mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.

Small Emitter/Receiver Synchronizing Type

▣ Features

- Small size: W12×H30×L16mm
- Minimize malfunction by extraneous light by synchronizing emitter and receiver
- Built-in reverse polarity protection circuit, output short overcurrent protection circuit
- Fast response speed: Max. 1ms

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



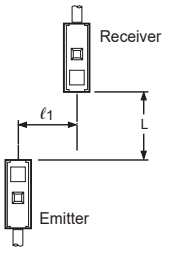
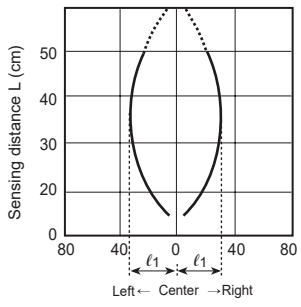
▣ Specifications

Model		Standard type	Side sensing type
		BY500-TDT	**BYS500-TDT**
Sensing type		Through-beam	
Sensing distance		500mm	
Sensing target		Opaque materials of min. Ø5mm	
Response time		Max. 1ms	
Power supply		12-24VDC⎓ ±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. 1VDC⎓	
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit	
Indicator		Operation indicator: red LED	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator	
Dielectric strength		1,000VAC 50/60Hz for 1 minute	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiving illumination)	
	Ambient temperature	-10 to 60℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP50 (IEC standard)	
Material		Case: acrylonitrile butadiene styrene, sensing part: acrylic, bracket: steel plate cold commercial, bolt: steel chromium molybdenum, nut: steel chromium molybdenum	
Cable		Ø4mm, 4-wire, 2m (emitter of through-beam type: Ø4mm, 3-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)	
Accessories		Fixing bracket, M3 bolt: 4, M3 nut: 4	
Unit weight		Approx. 150g	

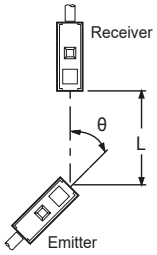
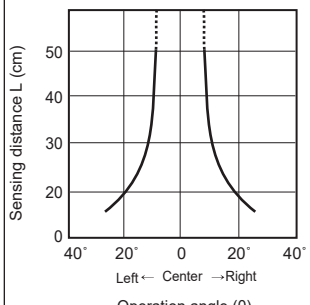
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Feature Data

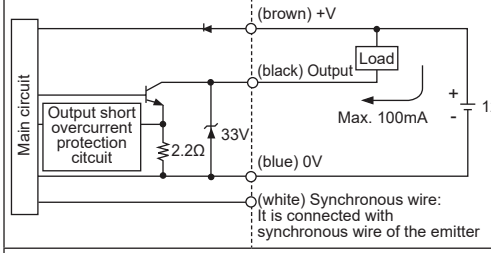
Parallel shifting characteristic

Measuring method	Data
	

Angle characteristic

Measuring method	Data
	

■ Control Output Diagram

Photoelectric sensor circuit	Connection
	

※Applicable models: BY500-TDT2, BYS500-TDT2 (receiver)

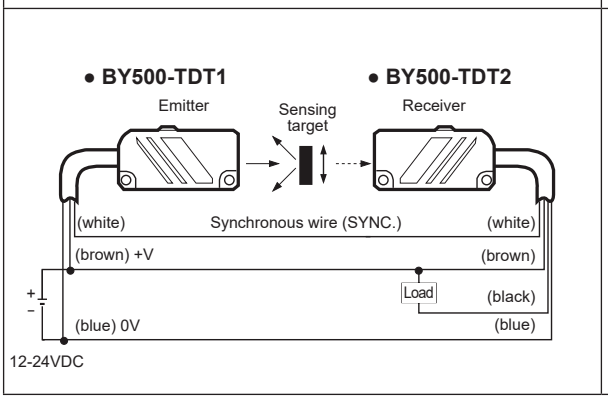
■ Operation Mode

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

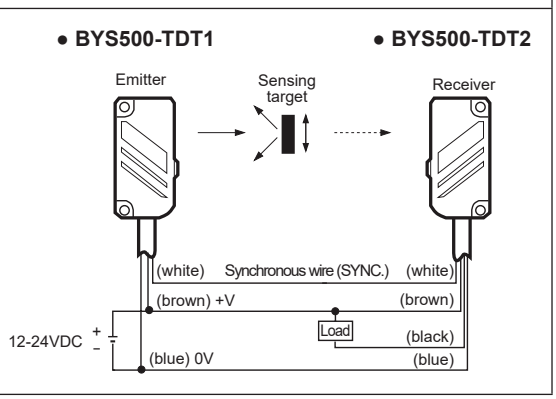
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.
※Please supply the power to the brown and the blue wires of the emitter and Synchronous wire (white) of the receiver must be connected with that of the emitter.

■ Connections

Standard type (dark on)



Side Sensing type (dark on)

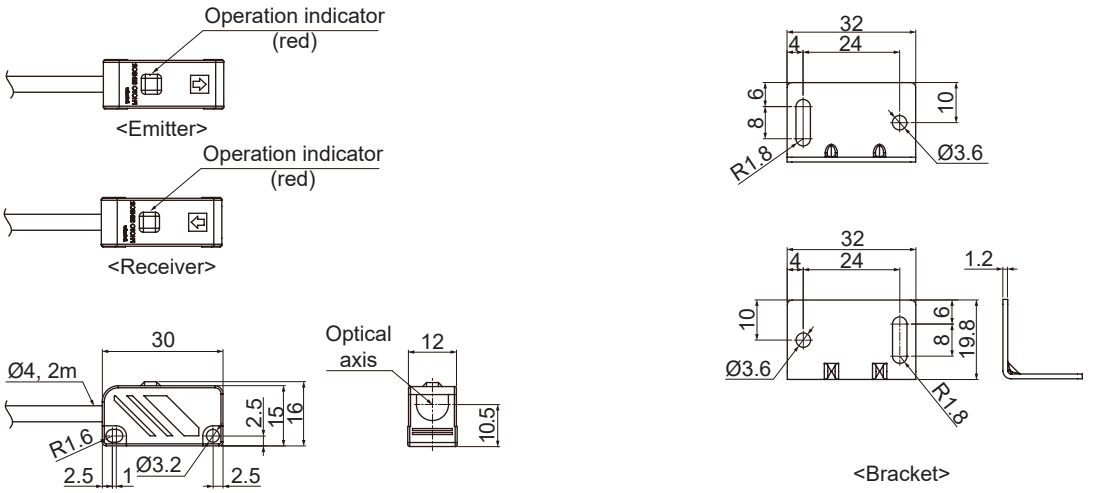


※The power of the emitter and the receiver must be supplied from the same power line.
※Synchronous wire (white) of the receiver must be connected with that of the emitter, or it may cause malfunction.

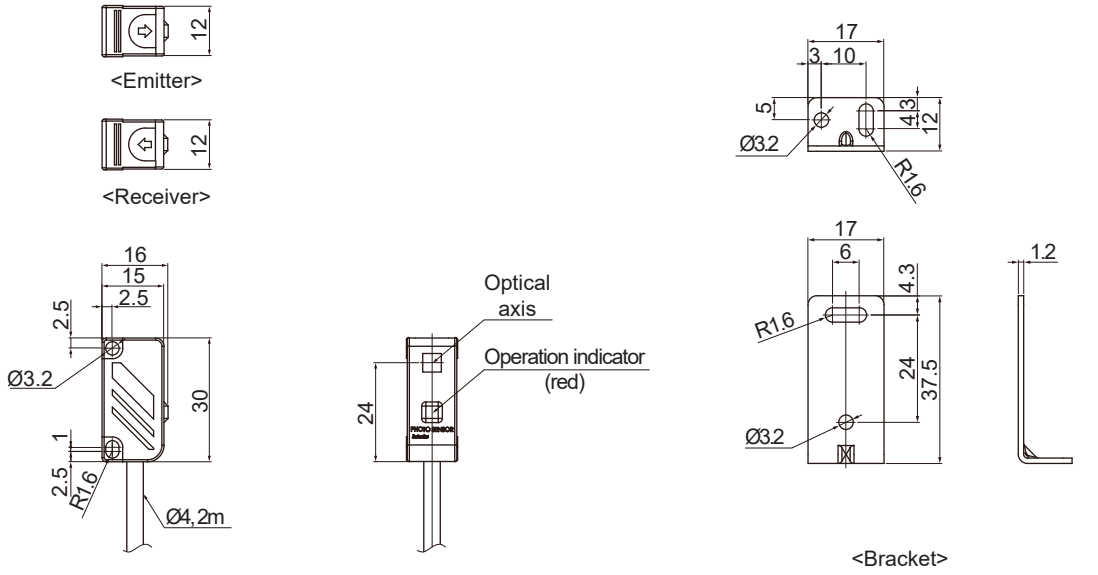
▣ Dimensions

(unit: mm)

● **BY500-TDT**



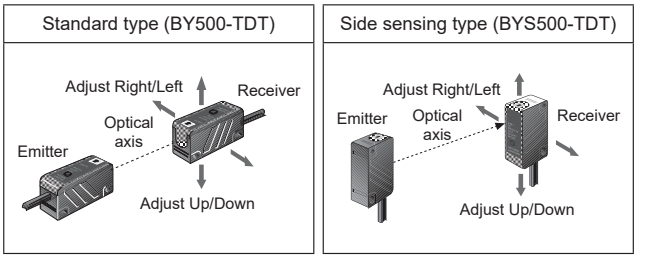
● **BYS500-TDT**



▣ Mounting and Sensitivity Adjustment

1. Supply the power to the sensor, after installing the emitter and the receiver facing each other.
2. Set the receiver in the middle of position where the operation 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 detects the target.

※If a sensing target is translucent body or smaller than Ø5mm, it might not be detected because the because light penetrate it.



※ When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.

※ When installing the product, tighten the screw with a tightening torque of 0.3N·m.

Small Diffuse Reflective and Convergent Reflective Type

▣ Features

- Easy installation by compact size
- Superior detection not affected by color of target (convergent 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 2 sec variable)
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit

BYD30 (50)-DDT-U

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

CE

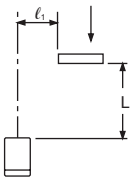
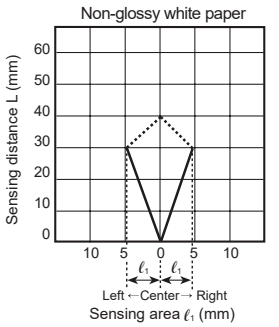
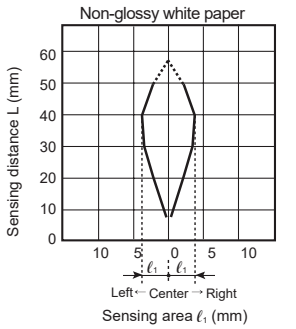
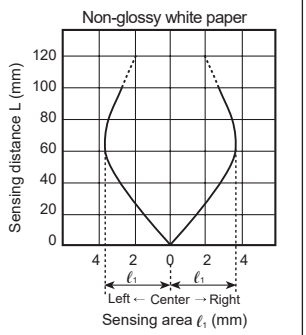
▣ Specifications

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	Convergent reflective		Diffuse reflective	Through-beam	
Sensing distance	10 to 30mm※3	10 to 50mm※3	100mm※3	3m	
Sensing target	Translucent, opaque materials			Opaque materials of Min. Ø6mm	
Hysteresis	Max. 10% at sensing distance		Max. 25% 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⎓±10% (ripple P-P: max. 10%)				
Current consumption	Max. 35mA			Max. 30mA	
Light source	Infrared LED				
Sensitivity adjustment	Fixed		Sensitivity adjuster	Fixed	
Operation mode	Light ON 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 or PNP open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 100mA ●Residual voltage - NPN: Max.1VDC⎓, PNP: Max. 2.5VDC	
Protection circuit	Reverse polarity protection circuit, output short overcurrent protection circuit				
Timer function	Built-in timer (off delay) Delay Time: max. 0.1 to 2 sec (timer adjuster)		—		
Indication	Operation indicator: red LED				
Insulation resistance	Over 20MΩ (at 500VDC megger)				
Noise immunity	±240V the square wave noise (pulse width: 1μs) by the noise simulator				
Dielectric strength	1,000VAC 50/60Hz for 1minute				
Vibration	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours				
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times				
Environment: Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)				
Environment: Ambient temperature	-20 to 65℃, storage: -25 to 70℃				
Environment: Ambient humidity	35 to 85%RH, storage: 35 to 85%RH				
Protection structure	Standard type: IP64 (IEC standards)/ ※1,※2: IP50 (IEC standards)		IP50 (IEC standard)	IP64 (IEC standard)	
Material	Case: acrylonitrile butadiene styrene, sensing part: acrylic, bracket: steel plate cold commercial, bolt: steel chromium molybdenum, nut: steel chromium molybdenum, sleeve: brass, Ni-plate				
Cable	Ø3.5mm, 3-wire, 2m (emitter of through-beam type: Ø3.5mm, 2-wire, 2m) (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)				
Accessory	Adjustment screwdriver, fixing bracket A, M3 bolt: 2, M3 nut: 2			Fixing bracket A, M3 bolt: 2, M3 nut: 2	
Approval	CE				
Weight※4	Approx. 75g (approx. 38g)			Approx. 105g (approx. 80g)	

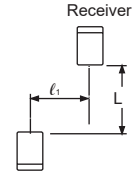
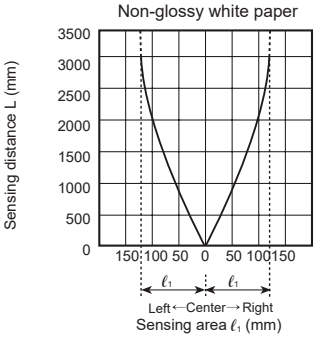
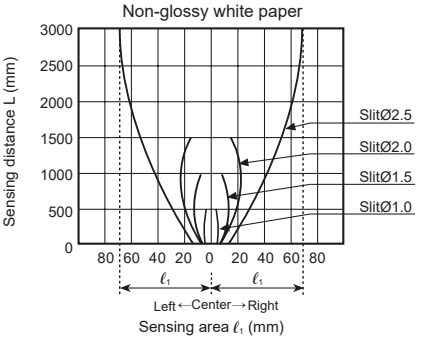
※1: Operation indicator is on the top.
※2: OFF delay timer is built-in. (delay time: max. 0.1 to 2sec)
※3: Non-glossy white paper 50×50mm.
※4: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Feature Data

◎ Sensing distance (convergent/diffuse reflective type)

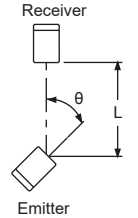
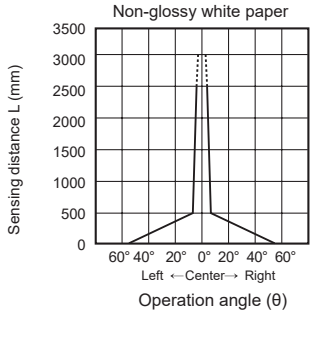
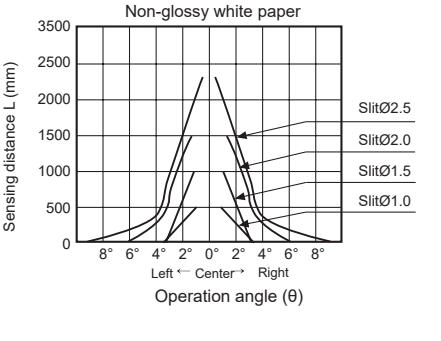
Measuring method	BYD30-DDT(-U) / BYD30-DDT-T	BYD50-DDT(-U) / BYD50-DDT-T	BYD100-DDT
Standard sensing target: Non-glossy white paper 50×50mm 			

◎ Parallel shifting (through-beam type)

Measuring method	BYD3M-TDT	BYD3M-TDT (SLIT)
		

※Above characteristic is from 400mm sensing distance to install transmitted beam type slit (Ø1, Ø1.5, Ø2, Ø2.5).

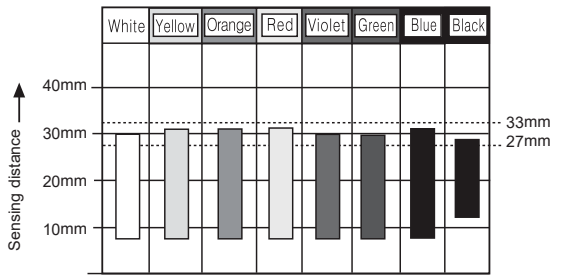
◎ Sensor angle (through-beam type)

Measuring method	BYD3M-TDT	BYD3M-TDT (SLIT)
		

※Above characteristic is from 400mm sensing distance to install transmitted beam type slit (Ø1, Ø1.5, Ø2, Ø2.5).

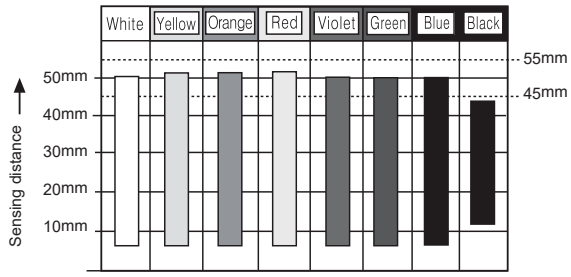
▣ Sensing Distance by Color (Convergent Reflective Type)

BYD30-DDT (-U), BYD30-DDT-T



※Size of sensing target:
Non-glossy paper 50×50mm

BYD50-DDT (-U), BYD50-DDT-T



※Size of sensing target:
Non-glossy paper 50×50mm

1)This model is photoelectric sensor with stable convergent detection type, therefore it is not affected by color or material within the range of sensing distance as specified in chart.
2)It is able to detect target stably because of small effect from background.

▣ Operation Mode

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

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

● BYD30-DDT-T, BYD50-DDT-T

Operation mode	Light ON
Receiver operation	Received light / Interrupted light — Ta
Operation indicator (red LED)	ON / OFF — t, T, t, T
Transistor output	ON / OFF

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

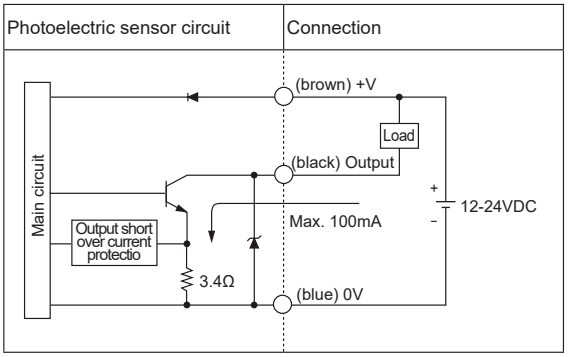
● BYD3M-TDT, BYD3M-TDT-P

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

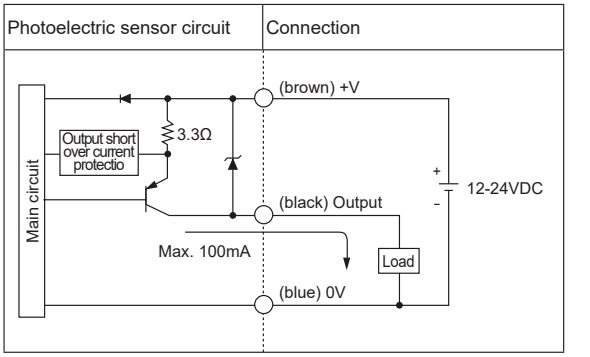
※To prevent malfunction, output of units keeps the state of OFF for 0.5sec after power ON.
※Light ON mode is customizable.

▣ Control Output Diagram

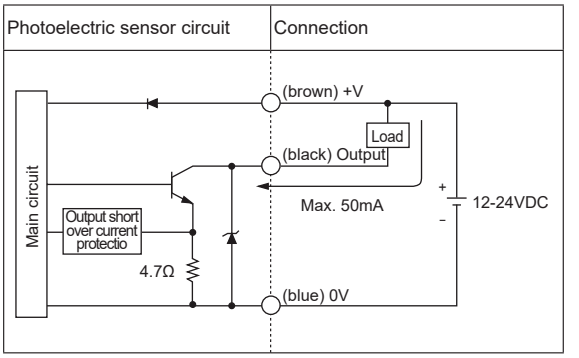
● **BYD3M-TDT2**



● **BYD3M-TDT2-P**



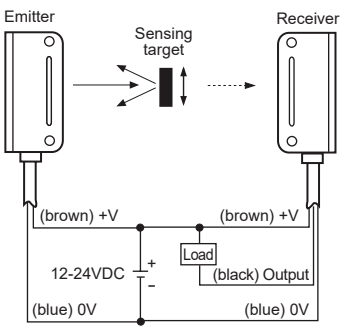
● **BYD30-DDT (-U), BYD50-DDT (-U)**
● **BYD30-DDT-T, BYD50-DDT-Tb**
● **BYD100-DDT**



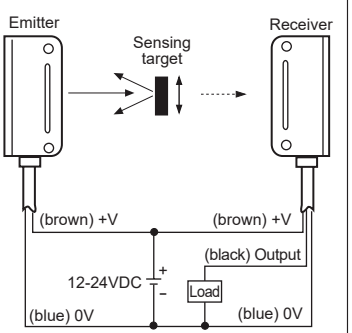
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Connections

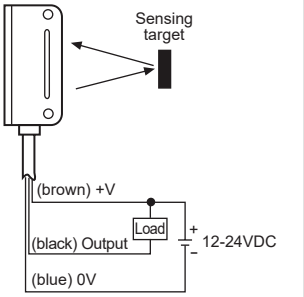
BYD3M-TDT



BYD3M-TDT-P



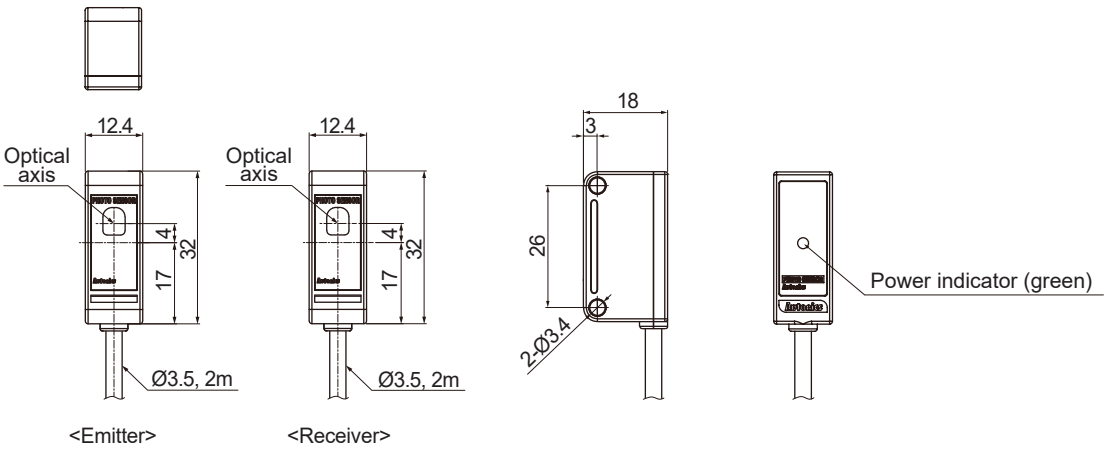
BYD30-DDT (-U), BYD50-DDT (-U), BYD30-DDT-T, BYD50-DDT-T, BYD100-DDT



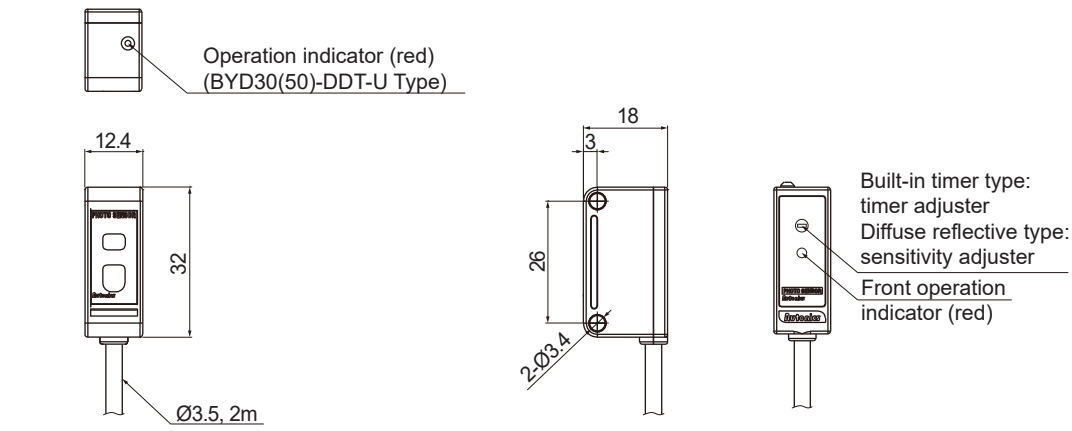
▣ Dimensions

(unit: mm)

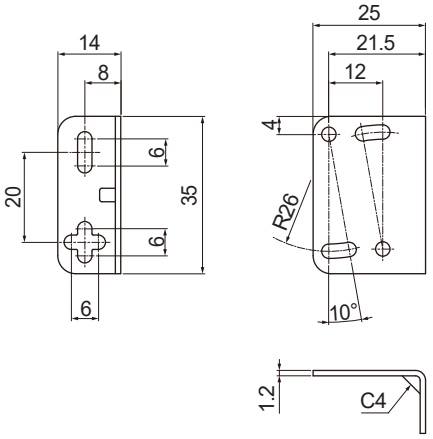
● Through-beam type



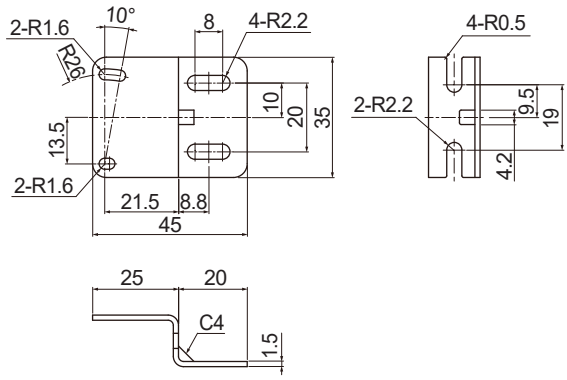
● Convergent/Diffuse reflective type



● Bracket A



● Bracket B (sold separately)

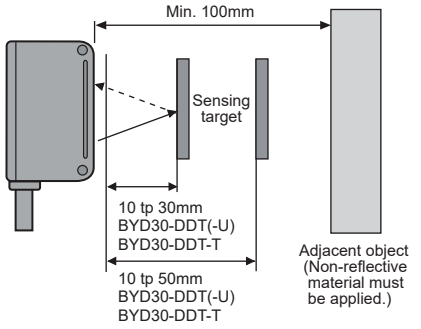


▣ Mounting and Sensitivity Adjustment

※When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
※When installing the product, tighten the screw with a tightening torque of 0.5N·m.

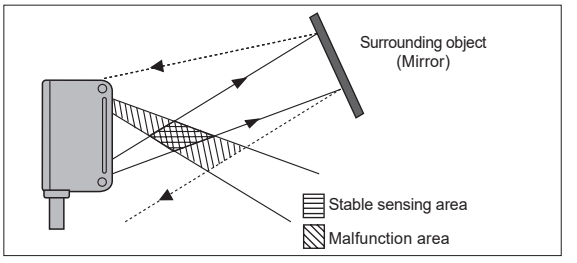
◎ Convergent reflective type

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

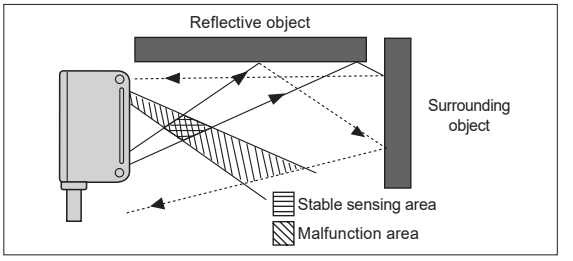


2. Install a target at sensing position and adjust the sensor to right and left or up and down to be at the right angle against the optical axis and fix it at stable operating position.
   Keep the distance BYD30-DDT, (-T), (-U): 10 to 30mm
   BYD50-DDT, (-T), (-U): 10 to 50mm between the photo-electric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

※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.



※It may cause malfunction, when surrounding object is mirror and emitter axis and mirror surface meet at right angles.

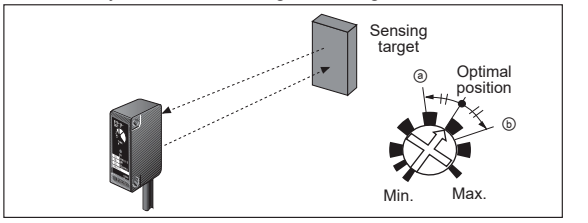


※It may cause malfunction due to reflected light when reflective material is placed near the optical axis.

◎ Diffuse reflective type

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

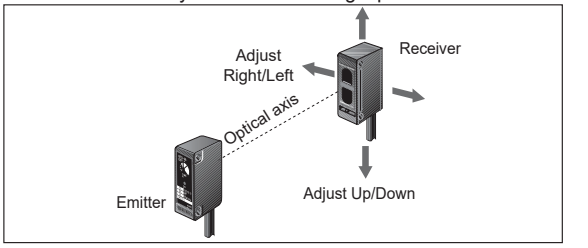
※The sensing distance indicated on specification chart is for 50×50mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.



◎ Through-beam type

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

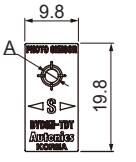
※If the sensing target is translucent body or smaller than Ø6mm, it can be missed by sensor because light penetrate it.



▣ Accessory (sold separately)

● Slit (Model name: BYD3M-ST)

(unit: mm)



● Min. sensing target and Max. sensing distance by slit Ø

- Attach the slit on receiver and emitter together.

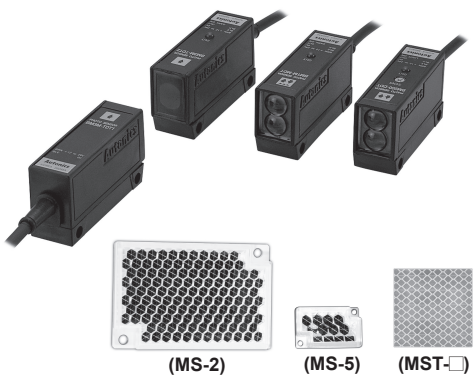
A	Min. sensing target	Min. sensing distance
Ø1.0	Opaque materials of Min. Ø0.8	500mm
Ø1.5	Opaque materials of Min. Ø1.5	700mm
Ø2.0	Opaque materials of Min. Ø2.0	1200mm
Ø2.5	Opaque materials of Min. Ø2.5	2300mm

※This slit is for BYD3M-TDT (-P) only.
※Total 8 pieces, 2 pieces of each Ø, are packed.
※This slit is sticker for attachment, please remove the dirt on lens of the photoelectric sensor before using it.

Small and Light, Common Type

▣ 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.
- Built-in reverse polarity protection circuit.



(MS-2)

(MS-5)

(MST-□)

※MS-5, MST-□ is sold separately.

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

CE

▣ Specifications

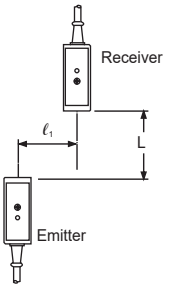
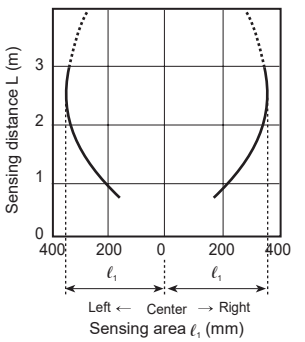
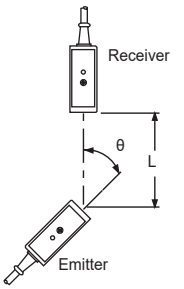
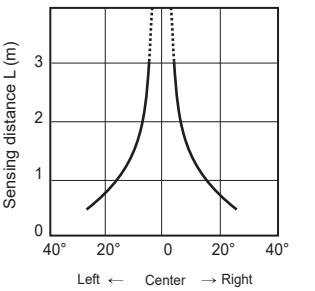
Model		BM3M-TDT	BM1M-MDT	BM200-DDT
Sensing type		Through-beam	Retroreflective	Diffuse reflective
Sensing distance		3m	1m※1	200mm※2
Sensing target		Opaque materials of Min. Ø8mm	Opaque materials of Min. Ø60mm	Transparent, translucent, opaque materials
Hysteresis		—		Max. 10% at rated setting distance
Response time		Max. 3ms		
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)		
Current consumption		Max. 45mA	Max. 40mA	
Light source		Infrared LED (940nm)		
Sensitivity adjustment		Fixed		Sensitivity adjuster
Operation mode		Dark ON		Light ON (Dark ON: option)
Control output		NPN open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 100mA ●Residual voltage: max. 1VDC⎓		
Protection circuit		Reverse polarity protection circuit		
Indication		Operation indicator: red LED		
Connection		Cable type		
Insulation resistance		Over 20MΩ (at 500VDC megger)		
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator		
Dielectric strength		1,000VAC 50/60Hz for 1 minute		
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Environment	Ambient illumination	Sunlight: max. 11,000lx incandescent lamp: max. 3,000lx (receiver illumination)		
	Ambient temperature	-10 to 60℃, storage: -25 to 70℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Material		Case: acrylonitrile butadiene styrene, sensing part: polycarbonate, bracket: steel plate cold commercial, bolt: steel chromium molybdenum, nut: steel chromium molybdenum	Case: acrylonitrile butadiene styrene, sensing part: acrylic, bracket: steel plate cold commercial, bolt: steel chromium molybdenum, nut: steel chromium molybdenum	
Cable		Ø4mm, 3-wire, 2m (emitter of through-beam type: Ø4mm, 2-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)		
Accessories	Individual	—	Reflector (MS-2)	Adjuster driver
	Common	Fixing bracket, 4M bolt: 4, 4M nut: 4	Fixing bracket, 4M bolt: 2, 4M nut: 2	
Approval		CE		
Weight※3		Approx. 240g (approx. 170g)	Approx. 188g (approx. 105g)	Approx. 156g (approx. 88g)

※1: The sensing distance is specified with using the MS-2 reflector, and it is the same when using MS-5 (sold separately).
The distance between the sensor and the reflector should be set over 0.1m. When using reflective tapes, the reflectivity will vary by size of the tape. Please refer to the "▣Reflectivity by Reflective Tape Model" table before using the tapes.
※2: Non-glossy white paper 200×200mm.
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.

▣ Feature Data

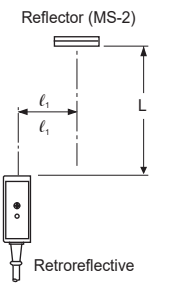
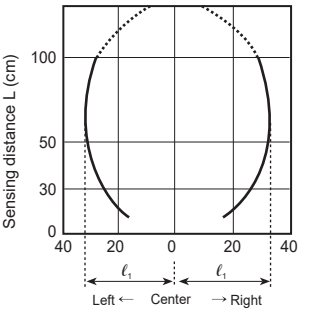
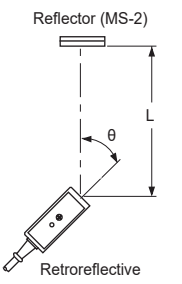
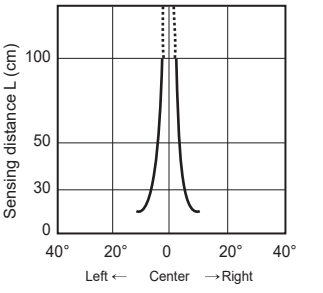
◎ Through-beam type

● BM3M-TDT

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

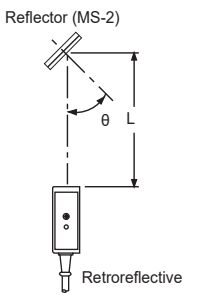
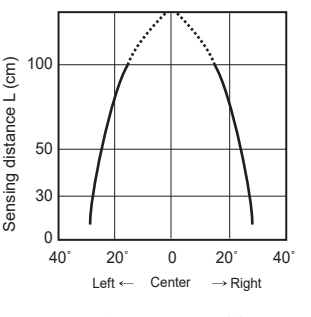
◎ Retroreflective type

● BM1M-MDT

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

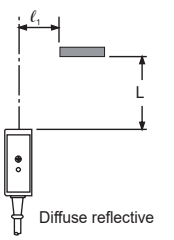
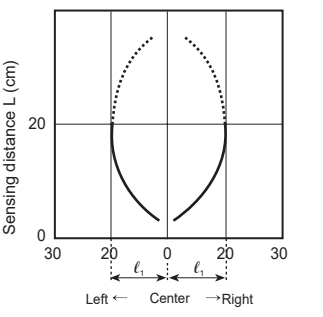
◎ Retroreflective type

● BM1M-MDT

Reflector angle characteristic	
Measuring method	Data
	

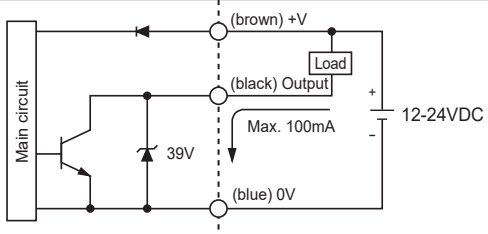
◎ Diffuse reflective type

● BM200-DDT

Sensing area characteristic	
Measuring method	Data
Standard sensing target: Non-glossy white paper 200×200mm 	

▣ Control Output Circuit Diagram

Photoelectric sensor circuit	Connection



Through-beam: **BM3M-TDT2** Diffuse reflective: **BM200-DDT**
Retroreflective: **BM1M-MDT**

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

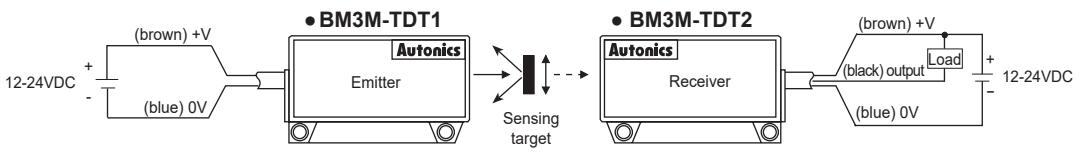
▣ Operation Mode

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

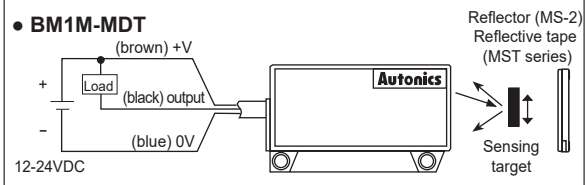
Operation mode	Dark ON
Receiver operation	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF
Transistor output	ON / OFF

▣ Connections

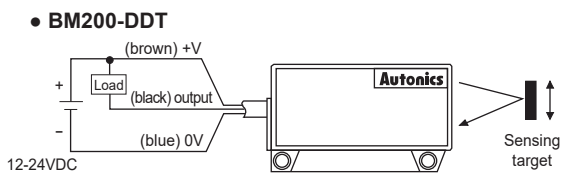
Through-beam (Dark ON)



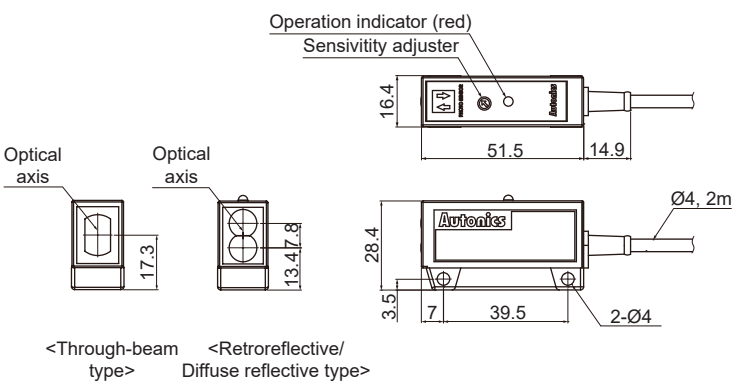
Retroreflective (Dark ON)



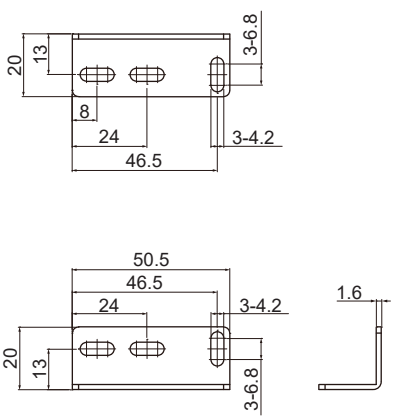
Diffuse reflective (Light ON)



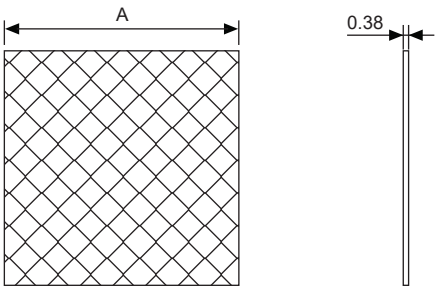
▣ Dimensions



● Bracket (unit: mm)



● **Reflective tape (MST Series, sold separately)**

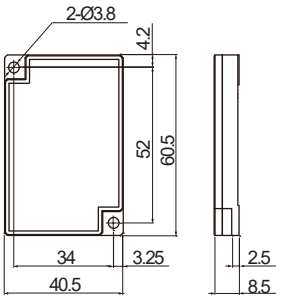


(unit: mm)

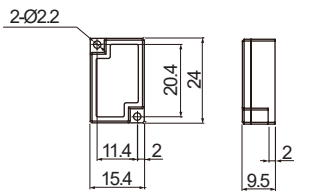
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

● **Reflector**

· **MS-2**



· **MS-5 (sold separately)**



▣ Installation and Adjustment

◎ For installation

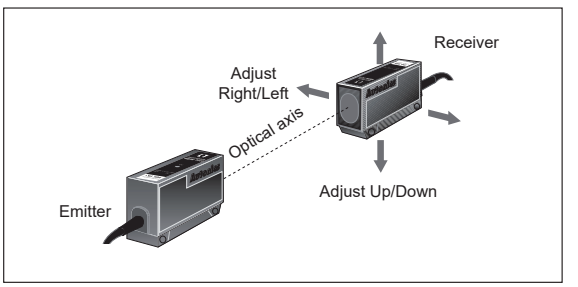
When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 0.8 N·m.
Do not impact on the unit with the hard object or bend the cable with excessive power. Otherwise, It may result in damage to the waterproof function.

◎ For optical axis adjustment

● **Through-beam type**

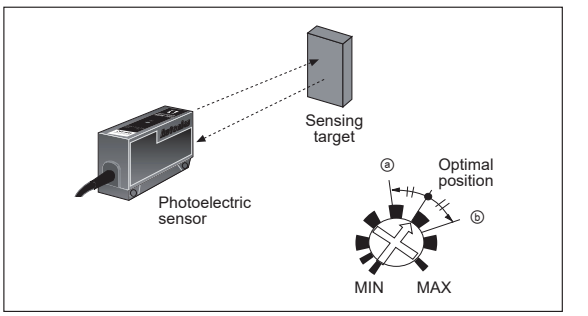
1. Supply the power to the photoelectric sensor, after setting the emitter and the receiver facing each other.
2. Set the receiver in center of position in the middle of the operation range of indicator by adjusting the receiver or the emitter right and left, up and down.
3. After the adjustment, check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

※If the sensing target is translucent body or smaller than Ø8mm, it can be missed by sensor because light penetrate it.



● **Diffuse reflective type**

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

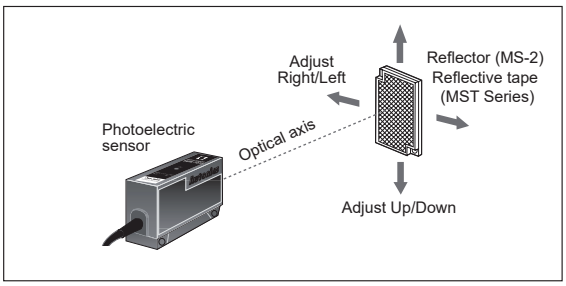


※The sensing distance indicated on specification chart is for 200×200mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.

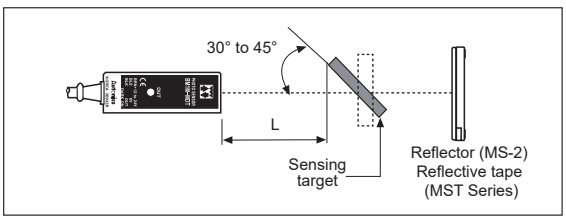
● **Retroreflective type**

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

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



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



※If the mounting place is too narrow, please use MS-5 instead of MS-2.

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


<MS-5>

▣ Reflectivity by Reflective Tape Model

MST-50-10 (50×50mm)	70%
MST-100-5 (100×100mm)	110%
MST-200-2 (200×200mm)	170%

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

※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.

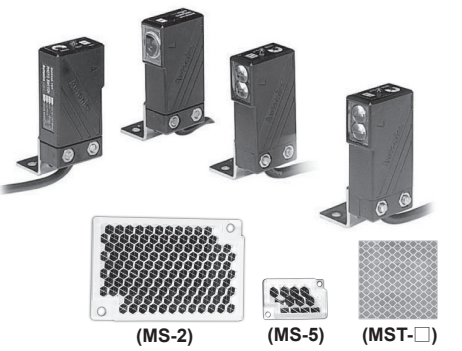
※For using reflective tape, installation distance should be min. 20mm.

High Speed Response Type with Built-in Output Protection Circuit

▣ Features

- Reverse power polarity and overcurrent
- Response time: Max. 1ms
- Light ON/Dark ON mode selectable by control wire
- Sensitivity adjuster (except for through-beam type)

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



(MS-2) (MS-5) (MST-□)

※MS-5, MST-□ is sold separately.

▣ Specifications

Model	NPN open collector output	**BMS5M-TDT**	**BMS2M-MDT**	**BMS300-DDT**
	PNP open collector output	**BMS5M-TDT-P**	**BMS2M-MDT-P**	**BMS300-DDT-P**
Sensing type		Through-beam	Retroreflective	Diffuse reflective
Sensing distance		5m	2m※1	300mm※2
Sensing target		Opaque materials of Min. Ø10mm	Opaque materials of Min. Ø60mm	Translucent, Opaque materials
Hysteresis		—		Max. 20% at rated setting distance
Response time		Max. 1ms		
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)		
Current consumption		Max. 50mA	Max. 45mA	
Light source		Infrared LED (940nm)		
Sensitivity adjustment		—		Sensitivity adjuster
Operation mode		Selectable Light ON or Dark ON by control wire		
Control output		NPN or PNP open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 200mA ●Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC		
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit		
Indicator		Operation indicator: red LED, power indicator: red LED (BMS5M-TDT1)		
Insulation resistance		Over 20MΩ (at 500VDC megger)		
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator		
Dielectric strength		1000VAC 50/60Hz for 1minute		
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times		
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)		
	Ambient temperature	-10 to 60℃, storage: -25 to 70℃		
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH		
Material		Case: acrylonitrile butadiene styrene, sensing part: polycarbonate, bracket: steel plate cold commercial, bolt: steel chromium molybdenum, nut: steel chromium molybdenum	Case: acrylonitrile butadiene styrene, sensing part: acryl, bracket: steel plate cold commercial, bolt: steel chromium molybdenum, nut: steel chromium molybdenum	
Cable		Ø5mm, 4-wire, 2m (emitter of through-beam type: Ø5mm, 2-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)		
Accessories	Individual	—	Reflector (MS-2)	—
	Common	Fixing bracket, M4 bolt: 4, M4 nut: 4	Fixing bracket, M4 bolt: 4, M4 nut: 4, adjustment screwdriver	
Approval		CE		
Unit weight		Approx. 180g	Approx. 110g	Approx. 100g

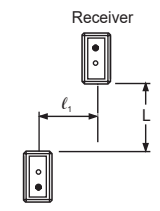
※1: It is sensing distance between sensor and reflector MS-2 and it is the same when MS-5 is used. It is detectable under 0.1m.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "▣Reflectivity by Reflective Tape Model" table before using the tapes.
※2: Non-glossy white paper 100×100mm.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

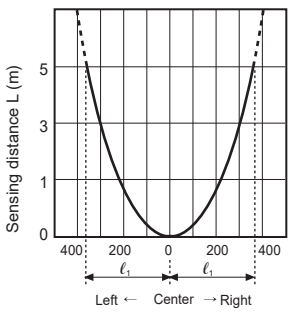
▣ Feature Data

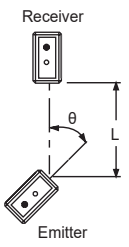
◎ Through-beam type

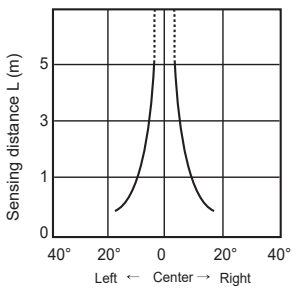
● BMS5M-TDT ● BMS5M-TDT-P

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data





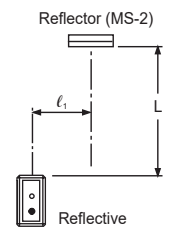


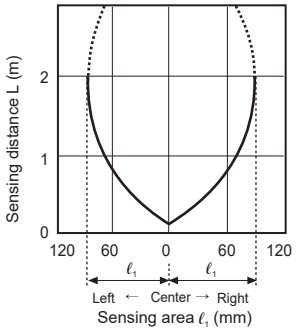


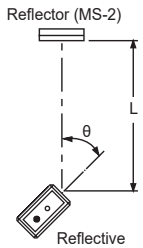
◎ Retroreflective type

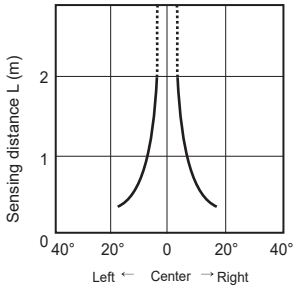
● BMS2M-MDT ● BMS2M-MDT-P

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





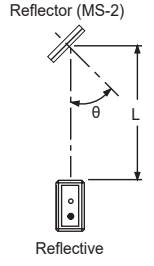


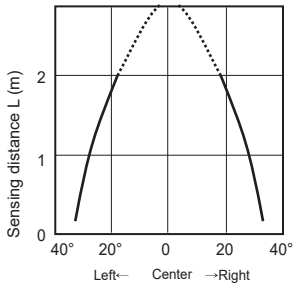


◎ Retroreflective type

● BMS2M-MDT ● BMS2M-MDT-P

Reflector angle characteristic	
Measuring method	Data

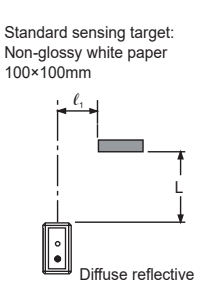


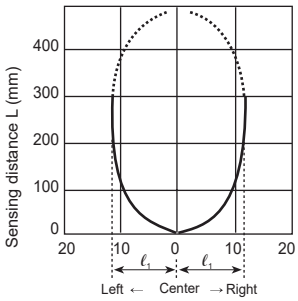


◎ Diffuse reflective type

● BMS300-DDT ● BMS300-DDT-P

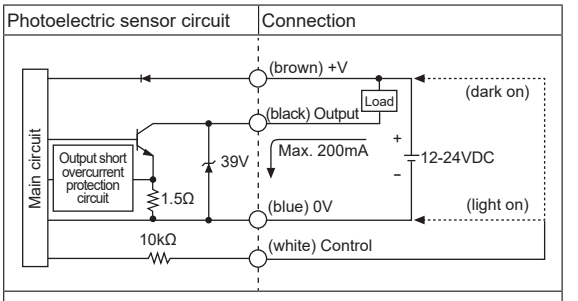
Sensing area characteristic	
Measuring method	Data





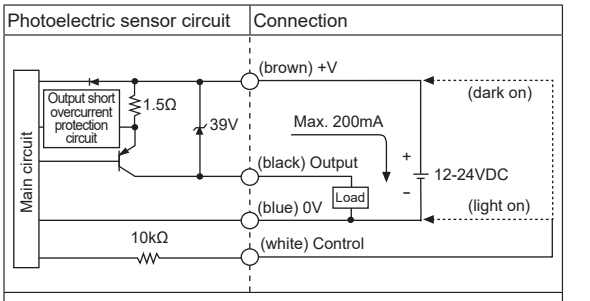
▣ Control Output Diagram

● NPN open collector output



Through-beam: **BMS5M-TDT2**, Retroreflective: **BMS2M-MDT**
Diffuse reflective: **BMS300-DDT**

● PNP open collector output



Through-beam: **BMS5M-TDT2-P**, Retroreflective: **BMS2M-MDT-P**
Diffuse reflective: **BMS300-DDT-P**

※Select Light ON / Dark ON by control wire. - Light ON: Connect control wire to 0V / Dark ON: Connect control wire to +V
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

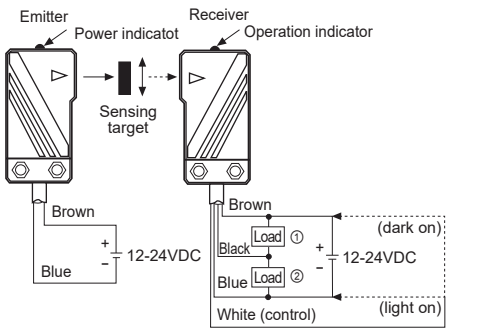
▣ Operation Mode

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

※To prevent malfunction, this sensor maintains control output OFF for 0.5 sec after supplying the power.

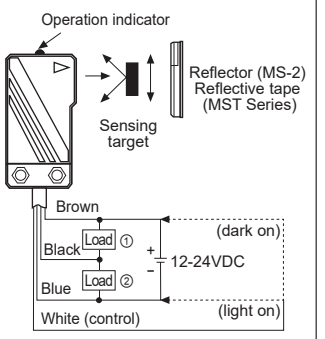
▣ Connections

BMS5M-TDT, BMS5M-TDT-P



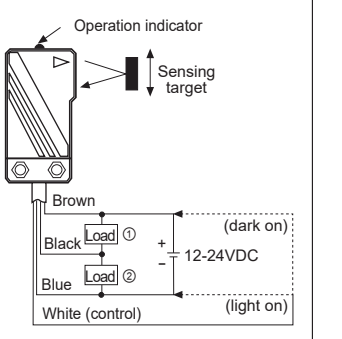
①Load connection for NPN output
②Load connection for PNP output

BMS2M-MDT, BMS2M-MDT-P



①Load connection for NPN output
②Load connection for PNP output

BMS300-DDT, BMS300-DDT-P



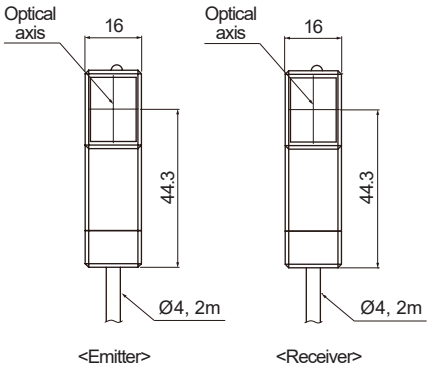
①Load connection for NPN output
②Load connection for PNP output

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

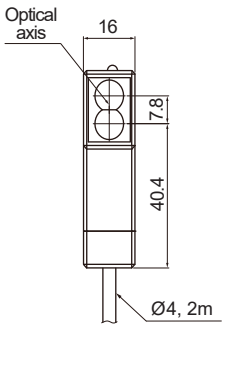
▣ Dimensions

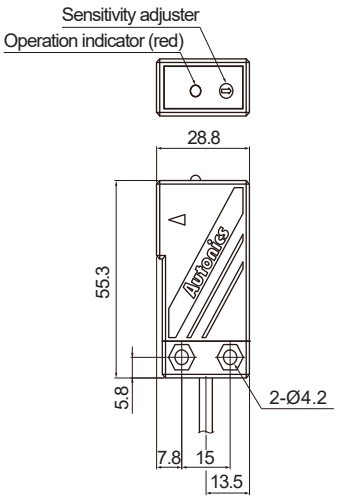
(unit: mm)

• Through-beam type



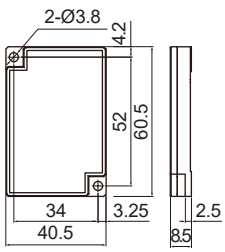
• Retroreflective/Diffuse reflective type



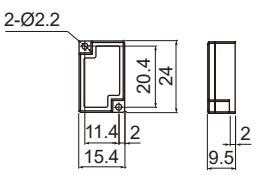


• Reflector

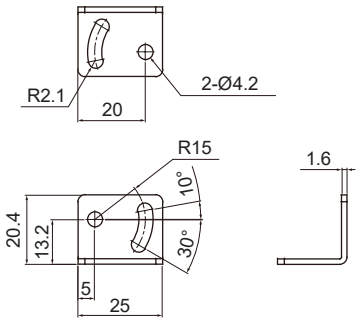
· MS-2



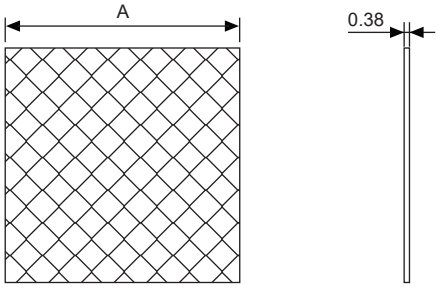
· MS-5(sold separately)



• Bracket



• Reflective tape (MST Series, sold separately)



(unit: mm)

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

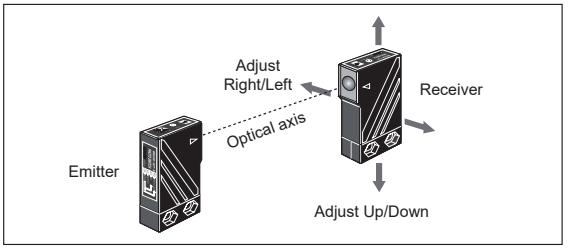
▣ Mounting and Sensitivity Adjustment

Install the sensor to the desired place and check the connections.
Supply the power to the sensor and adjust the optical axis and the sensitivity as follow:
When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 0.8N·m.

◎ Optical axis adjustment

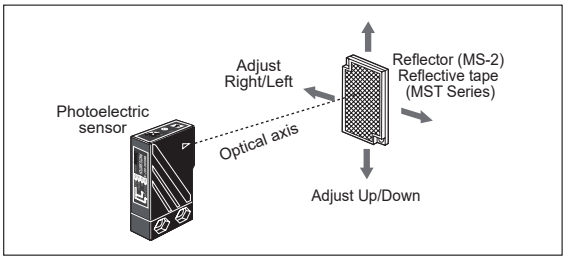
● Through-beam type

Set the photoelectric sensor in the middle of the operation range of the operation indicator by adjusting the receiver or emitter right and left, up and down.



● Retroreflective type

Mount the photoelectric sensor and the reflector or reflective tape facing each other then fix them in the middle of operation range of the operation indicator by adjusting the reflector (or reflective tape) right and left, up and down.



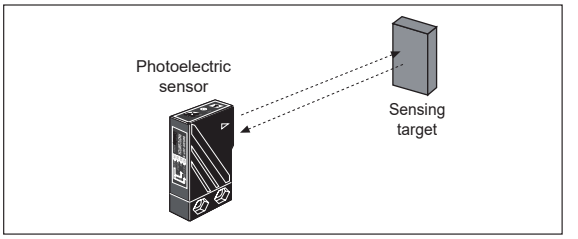
※If the mounting place is too narrow, please use MS-5 instead of MS-2.

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


<MS-5>

● Diffuse reflective type

Mount the photoelectric sensor and the target then fix them in the middle of operation range of the operation indicator by adjusting the photoelectric sensor right and left, up and down.

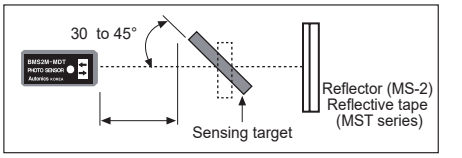


◎ Sensitivity adjustment

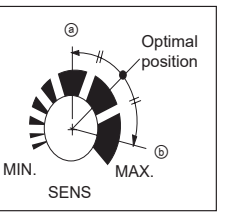
● Retroreflective type

Fix the sensitivity adjuster at max. position and then check if the sensor operates normally to pass the target within sensing area of the sensor.
If the sensor does not work normally by noise or external light, turn the sensitivity adjuster slowly up to the position.

※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 the photoelectric sensor. Therefore enough space between the target should be used and the photoelectric sensor or the surface of the target should be mounted at angle of 30° to 45° against optical axis.



● Diffuse reflective type



Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster up to position ⓐ which the operation indicator turn ON from min.
Take the target out of the sensing area, then turn the sensitivity adjuster until position where the indicator turns ON. If position ⓑ is not checked, the max. position is ⓑ. Set the sensitivity adjuster in the middle of two switching position ⓐ, ⓑ.

※Please be aware not to make the unstable operation of sensor by background and mounting side.

▣ Reflectivity by Reflective Tape Model

MST-50-10 (50×50mm)	90%
MST-100-5 (100×100mm)	120%
MST-200-2 (200×200mm)	190%

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

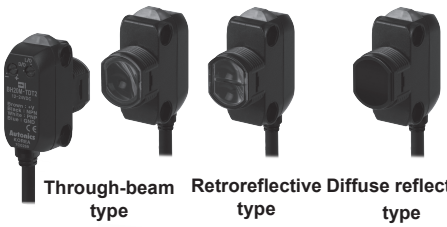
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.

※For using reflective tape, installation distance should be min. 20mm.

Front/Side Installation Type

▣ Features

- Easy front (M18 nut) and side (M3 bolt/nut) installation
- NPN open collector / PNP open collector simultaneous output
- Sensing distance: Through-beam type 20m / Retroreflective type 4m / Diffuse reflective type 1m, 300mm
- Small size: W14×H34.5×L28mm
- M.S.R. (Mirror Surface Rejection) function prevents malfunction from reflective objects such as metals or mirrors (retroreflective type)
- Sensitivity adjuster
- Light ON/Dark ON selectable by switch
- Operation indicator (red LED) and stability indicator (green LED)
- Power reverse polarity protection circuit, Output short over current protection circuit
- Interference prevention function (except through-beam type)
- IP67 protection structure (IEC standard)



Through-beam type | Retroreflective type | Diffuse reflective type

Reflector (MS-2A)

Reflective tape (MST Series)

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

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▣ Specifications

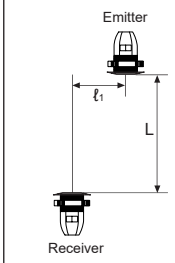
Model		BH20M-TDT	BH4M-PDT	BH1M-DDT	BH300-DDT
Sensing type		Through-beam	Retroreflective (built-in polarized filter)	Diffuse reflective	
Sensing distance		20m	4m※1	1m※2	300mm※3
Sensing target		Opaque material over Ø20mm	Opaque material over Ø75mm	—	
Hysteresis		—		Max. 20% at sensing distance	
Response time		Max. 1ms			
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)			
Current consumption		Emitter/Receiver : max. 20mA	Max. 30mA	Max. 35mA	Max. 30mA
Light source		Red LED (660nm)	Red LED (660nm)	Infrared LED (850nm)	Red LED (660nm)
Sensitivity adjustment		Sensitivity adjuster			
Operation mode		Light ON / Dark ON selectable by switch			
Control output		NPN / PNP open collector simultaneous 2 output · Load voltage: max. 26.4VDC⎓ · Load current: max. 100mA · Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC			
Protection circuit		Interference prevention function (except through-beam type), power reverse polarity protection circuit, output short over current protection circuit			
Indicator		Operation indicator: red LED Stability indicator: green LED (emitter of through-beam type's power indicator: green)			
Connection		Cable type			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 minute			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in X, Y, Z direction for 3 times			
Environment	Ambient illu.	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)			
	Ambient temp.※4	-25 to 55℃, storage: -40 to 70℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP67 (IEC standard)			
Material		Case: polycarbonates, LED indicator: polycarbonates, sensing part: polymethyl methacrylate acrylic			
Cable		Ø4mm, 4-wire, 2.1m (emitter of through-beam type: Ø4mm, 2-wire, 2.1m) (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1.03mm)			
Accessory	Common	Adjustment screwdriver, fixing bracket, M18 fixing nut, fixing cap, M3 bolt, M3 nut			
	Individual	—	Reflector (MS-2A)	—	
Approval		CE cULus LISTED			
Weight※5		Approx. 190g (approx. 120g)	Approx. 140g (approx. 60g)	Approx. 130g (approx. 60g)	

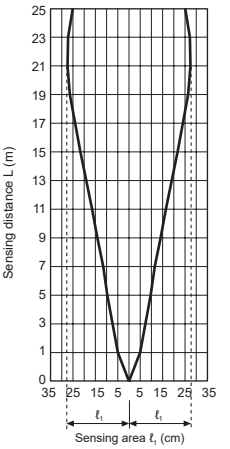
※1: The sensing distance is specified with using the MS-2A reflector. The distance between the sensor and the reflector should be set over 0.1m. When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the '▣ Reflectivity By Reflective Tape Model' table before using the tape.
※2: Non-glossy white paper 300×300mm.
※3: Non-glossy white paper 100×100mm.
※4: UL approved surrounding air temperature 40℃
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.

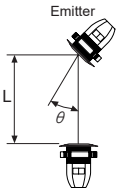
▣ Feature Data

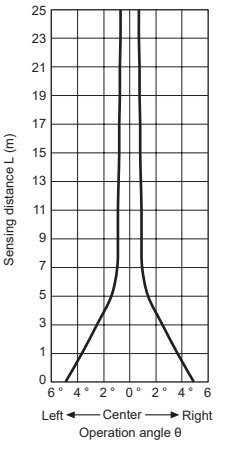
◎ Through-beam type: BH20M-TDT

Parallel shifting characterisitic		Angle characteristic	
Measuring method	Data	Measuring method	Data



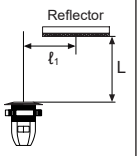


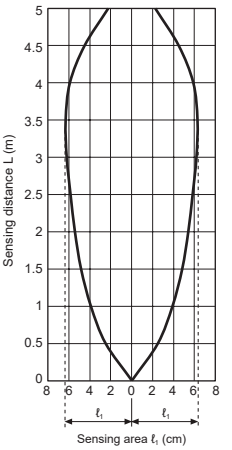


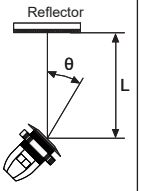


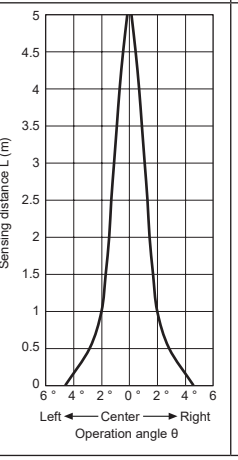
◎ Retroreflective type: BH4M-PDT

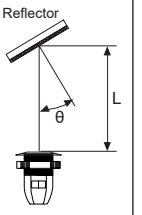
Parallel shifting characterisitic		Sensor angle characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data

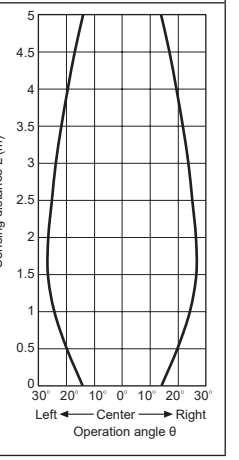








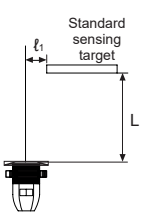


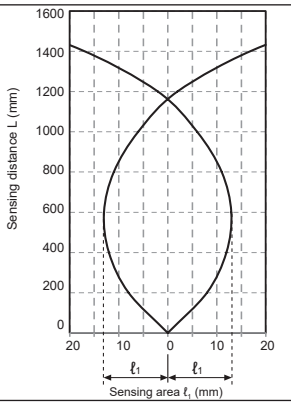


◎ Diffuse reflective type

• BH1M-DDT

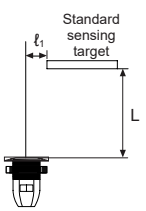
Sensing area characteristic	
Measuring method	Data

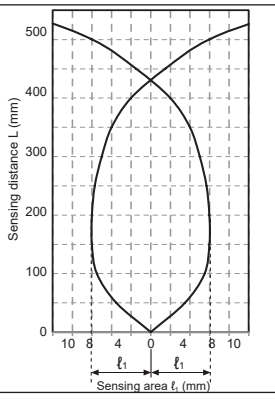




• BH300-DDT

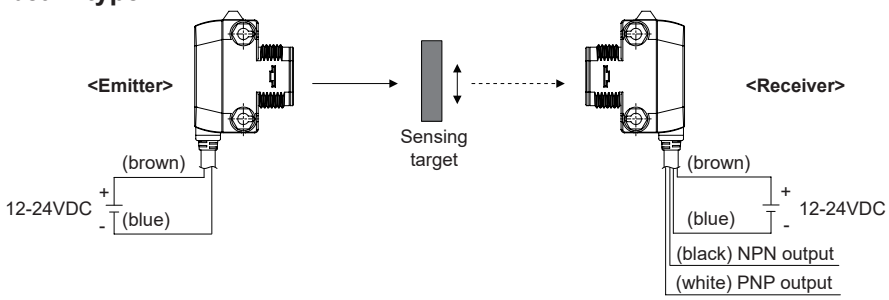
Sensing area characteristic	
Measuring method	Data



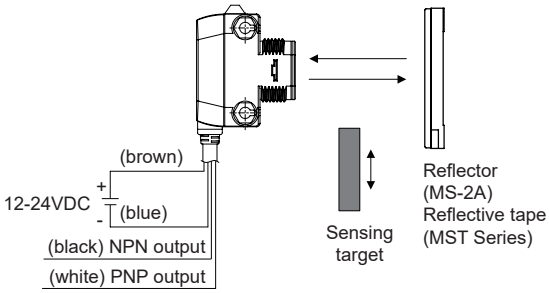


▣ Connections

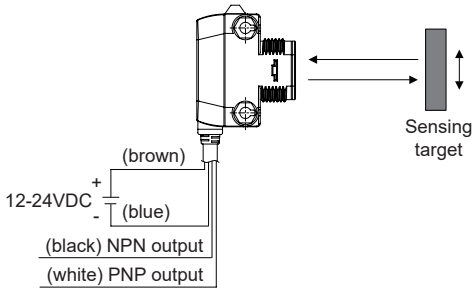
◎ Through-beam type



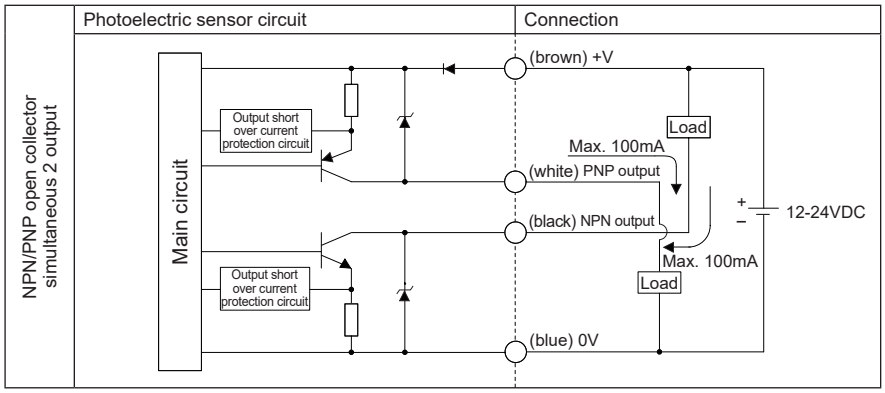
◎ Retroreflective type



◎ Diffuse reflective type



▣ Control Output Diagram



※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Operation Mode

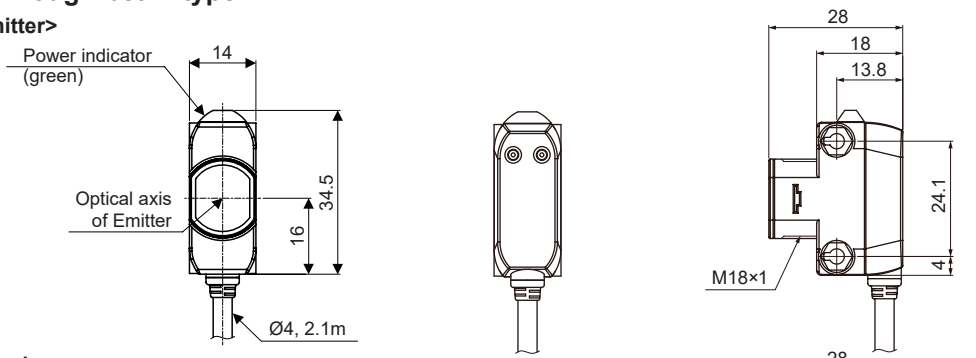
Operation mode	Light ON	Dark ON
Receiver operation	Received light Interrupted light	Received light Interrupted light
Operation indicator (red LED)	ON OFF	ON OFF
Transistor output (NPN/PNP)	ON OFF	ON OFF

▣ Dimensions

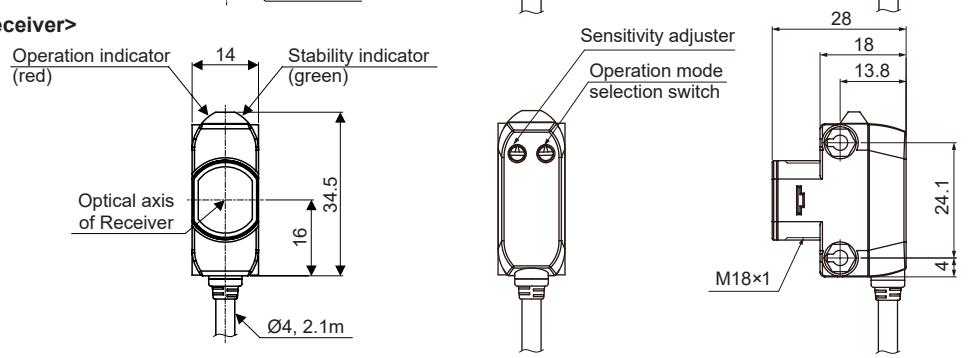
(unit: mm)

◎ Through-beam type

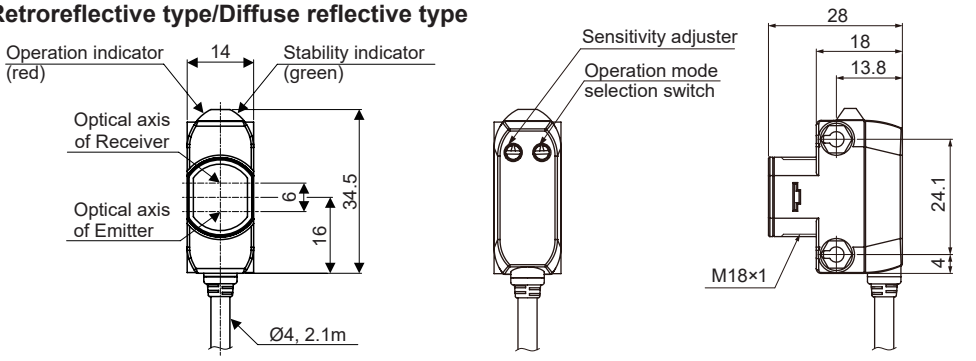
<Emitter>



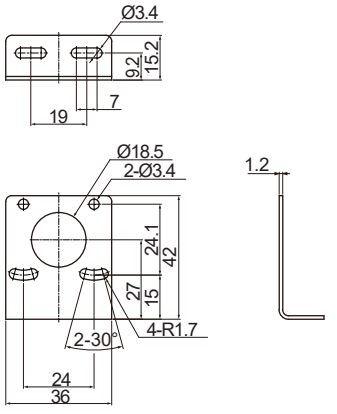
<Receiver>



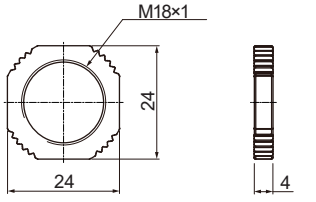
◎ Retroreflective type/Diffuse reflective type



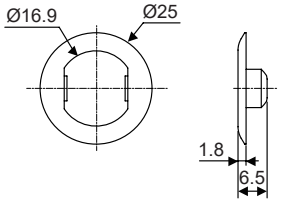
● Bracket



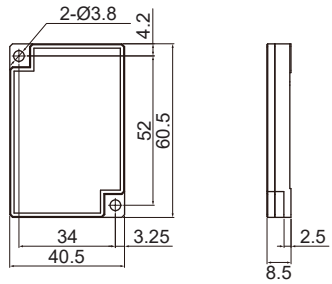
● M18 fixing nut



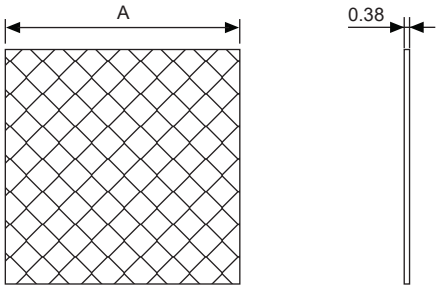
● Fixing cap



● **Reflector (MS-2A)**



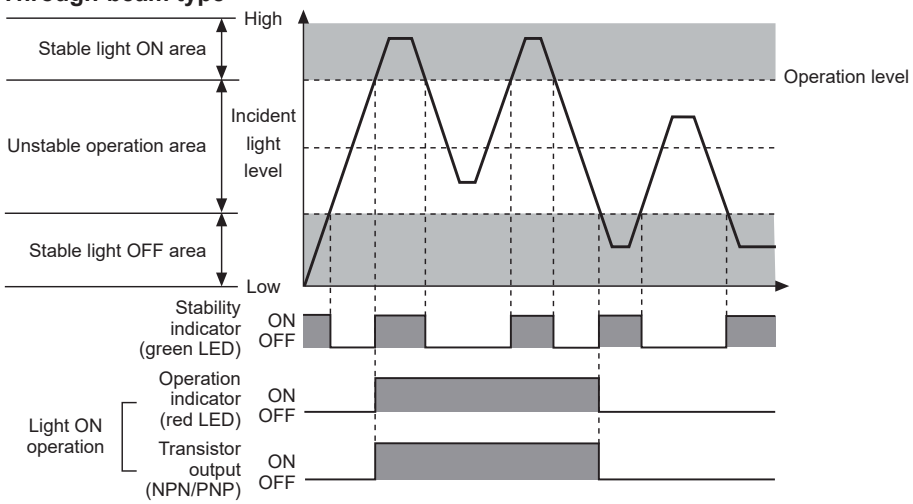
● **Reflective tape (sold separately)**



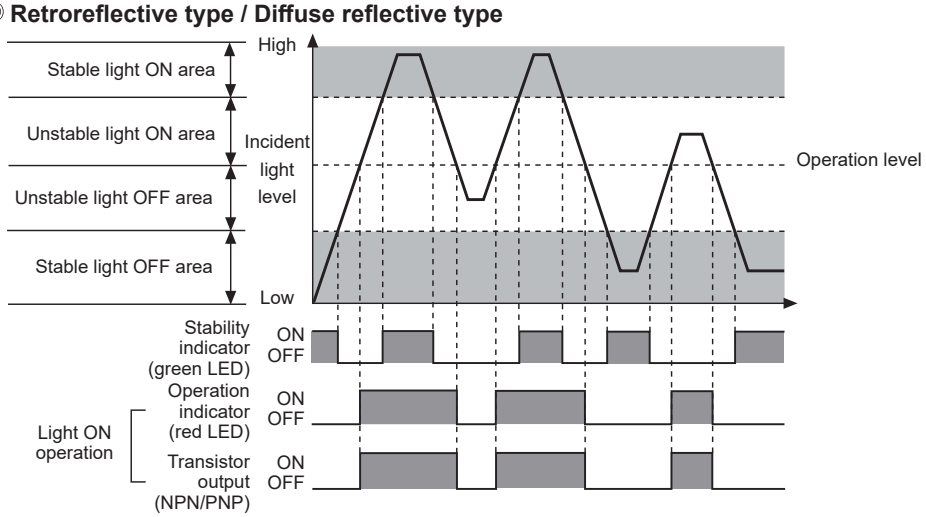
Model	A
MST-50-10	□50
MST-100-5	□100
MST-200-2	□200

▣ Operation Timing Diagram

◎ **Through-beam type**



◎ **Retroreflective type / Diffuse reflective type**



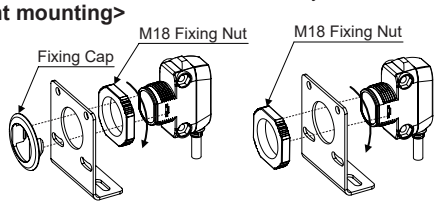
※The waveforms of "Operation indicator" and "Transistor output" are for Light ON, the waveforms are reversed for Dark ON.

▣ Installation and Sensitivity Adjustment

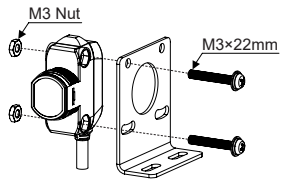
◎ For mounting

Please use M18 fixing nut or M3 bolt and nut to mount the sensor, and make sure that the tightening torque is under 0.5N·m.
When using the reflective type photoelectric sensors closely over three units, it may result in malfunction due to mutual interference.
When using the through-beam type photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
※Exercise caution. Do not apply excessive impact to the unit or bend the cable section. The inside unit may be wet.

<Front mounting>



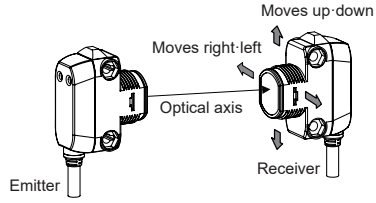
<Side mounting>



◎ Optical axis adjustment

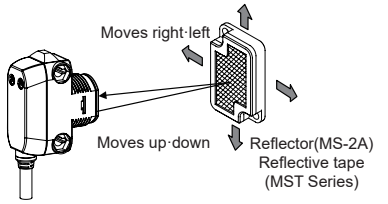
●Through-beam type

Set the emitter and the receiver facing each other and adjust these up·down, right·left after to check the point operating the stability indicator. Fix the emitter and the receiver at the center of the point.



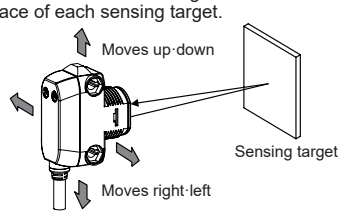
●Retroreflective type

Set the photoelectric sensor and the reflector(MS-2A) or reflective tape facing each other and adjust the reflector up·down, right·left after to check the point operating the stability indicator.
Make sure that the sensing side of the sensor is parallel with the reflector.

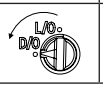


●Diffuse reflective type

After place a sensing target, fix it in the middle of position where the stability indicator operates adjusting the sensor to up·down, right·left. Make sure that the sensing side of the sensor is parallel with the surface of each sensing target.

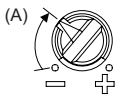
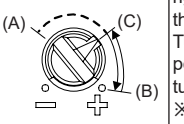
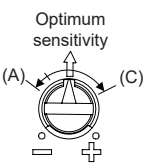


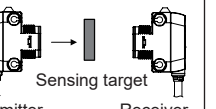
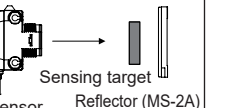
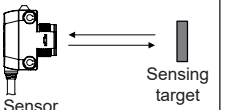
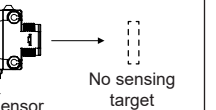
◎ Operation mode switching

Light ON		Turn the operation mode selection switch to L/O direction (the end of right).
Dark ON		Turn the operation mode selection switch to D/O direction (the end of left).

※For through-beam type, the selection switch is built-in the receiver.

◎ Sensitivity adjustment

Order	Sensitivity setting	Descriptions
1		From Light ON status, turn the sensitivity setting adjuster slowly to the right from min. sensitivity (-) and check the position where operation indicator turns on (A).
2		From Dark ON status, turn the sensitivity setting adjuster further right and check the position where the operation indicator turns on (B). Turn the adjuster left and check the position where the operation indicator turns off (C). ※If the operation indicator does not turn on at max. sensitivity (+), the maximum sensitivity setting is set at position (C).
3		Set the adjuster at the center position between (A) and (C) for optimal sensitivity. Also, check if the stability indicator turns off with or without the sensing target. If it does not turn off, please review the operation mode again, as sensitivity may be unstable.

	Light ON	Dark ON
Through-beam type		
Retro-reflective type		
Diffuse reflective type		

※Please set the sensitivity setting adjuster is executed in stable Light ON area and the reliability of environment (temperature, supply, dust etc.) is increased after the mounting it in a stable area.
※It may cause breakdown when the sensitivity setting adjuster or the operation mode selection switch is turned by force.

▣ Reflectivity by Reflective Tape Model

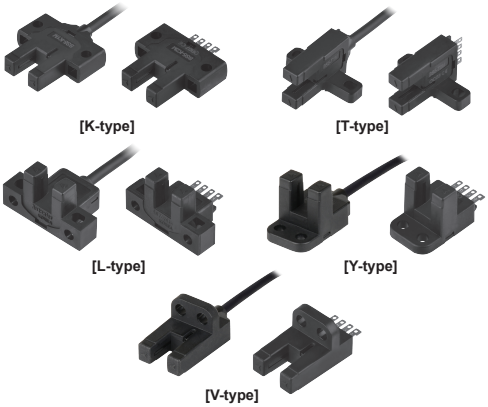
MST-50-10 (50×50mm)	60%
MST-100-5 (100×100mm)	80%
MST-200-2 (200×200mm)	140%

※This reflectivity is based on the reflector (MS-2A).
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.
※For using reflective tape, installation distance should be min. 20mm.

Photomicro Sensor

■ Features

- Ultra compact, Built-in amplifier, NPN/PNP open collector output
- Various selection by installation position (appearance: K, T, L, Y, V type)
- Light ON / Dark ON selectable by control terminal/cable
- 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 "Safety Considerations" in the instruction manual before using.**

CE

■ Ordering Information

BS 5 – K 2 M – P

Control output	No mark	NPN open collector output		
	P	PNP open collector output		
Size	M	Middle		
Connection type	1	Cable type		
	2	Connector type		
Appearance	K	K-Type	Y	Y-Type
	T	T-Type	V	V-Type
	L	L-Type		
Sensing distance	5	Unit: mm (fixed)		
Item	BS	Photo electronic sensor		

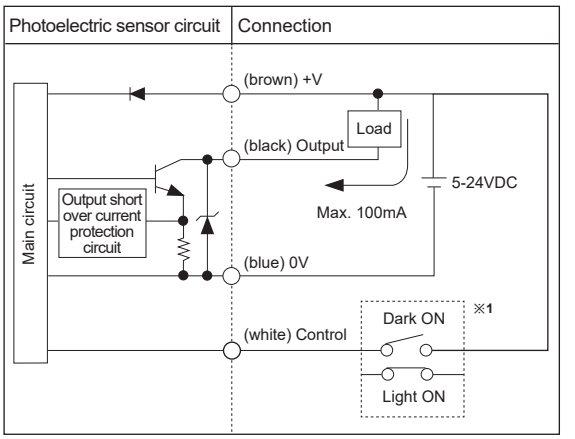
■ Specifications

Model		BS5-K1M	BS5-T1M	BS5-L1M	BS5-Y1M	BS5-V1M	BS5-K2M	BS5-T2M	BS5-L2M	BS5-Y2M	BS5-V2M
	NPN open collector output										
	PNP open collector output	BS5-K1M-P	BS5-T1M-P	BS5-L1M-P	BS5-Y1M-P	BS5-V1M-P	BS5-K2M-P	BS5-T2M-P	BS5-L2M-P	BS5-Y2M-P	BS5-V2M-P
Sensing type		Through-beam (not modulated)									
Sensing distance		5mm fixed									
Sensing target		Ø0.8×2mm opaque materials									
Hysteresis		0.05mm									
Response time		Light ON: max. 20μs, dark ON: max. 100μs									
Response frequency※1		2kHz									
Power supply		5-24VDC⎓ ±10% (ripple P-P: max. 10%)									
Current consumption		Max. 30mA (at 26.4VDC)									
Light source		Infrared LED (940nm)									
Operation mode		Light ON / Dark ON selectable by control cable					Light ON / Dark ON selectable by control terminal				
Control output		NPN or PNP open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 100mA ●Residual voltage: max. 1.2VDC⎓									
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit									
Indicator		Operation Indicator: red LED									
Connection		Cable type					Connector type				
Insulation resistance		Over 20MΩ (at 250VDC megger)									
Noise immunity		±240V the square wave noise (pulse width:1μs) 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 X, Y, Z direction for 2 hours									
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times									
Environment	Ambient illumination	Fluorescent lamp: max. 1000lx (receiver illumination)									
	Ambient temperature	-20 to 55℃, storage: -25 to 85℃									
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH									
Protection structure		IP50 (IEC standard)									
Material		Polybutylene terephthalate									
Cable		Ø3mm, 4-wire, 1m (AWG28, core diameter: 0.08mm, number of cores: 19, insulator out diameter: Ø0.88mm)					—				
Approval		CE									
Weight※2		Approx. 50g (approx. 30g)									

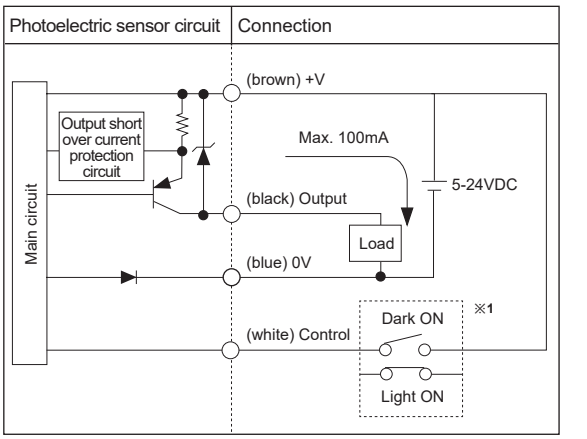
※1: The value from revolving the circle panel which duty ratio is 1:1. ※2: The weight includes packaging. The weight in parenthesis in for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Control Output Diagram

● **NPN open collector output**



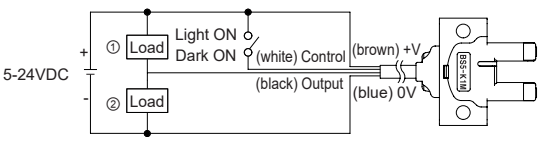
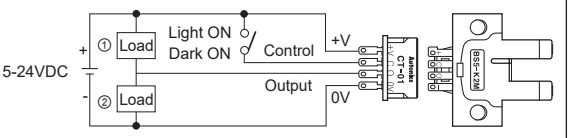
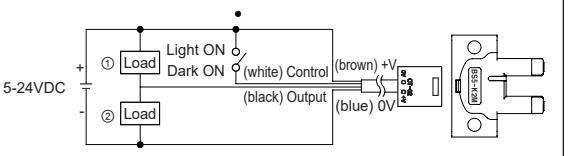
● **PNP open collector output**



※1: Operation mode selection: Connect (white) Control (terminal) into terminal (brown) +V to operate Light ON mode. Dark ON mode is available with disconnection status.

※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Connections

Cable Type	Connector Type
	  ※Connect the unit using the connector (CT-01, sold separately), the connector cable (CT-02, sold separately). If it is soldered on terminal pin directly without the connector, the connector cable. It may cause product damage.
①Load connection for NPN output ②Load connection for PNP output	

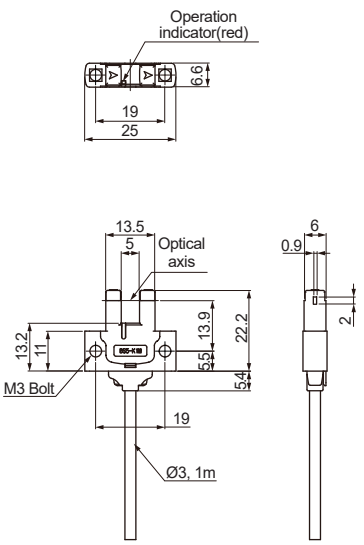
▣ Operation Mode

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

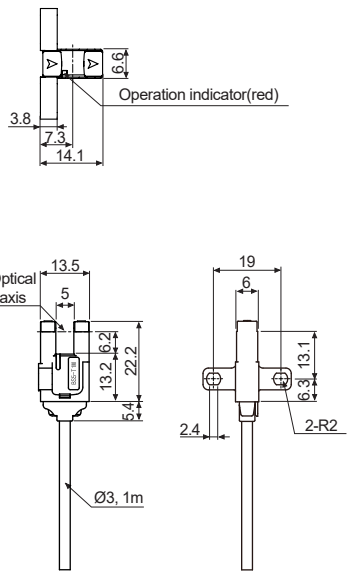
▣ Dimensions

(unit: mm)

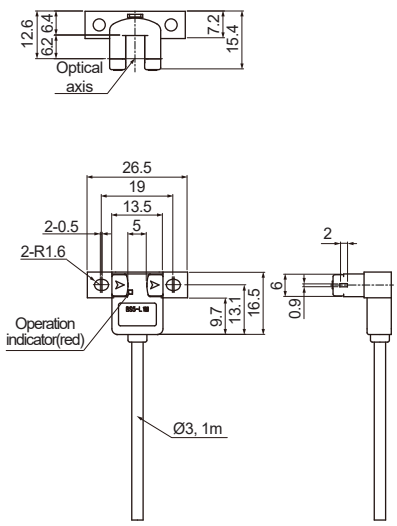
• BS5-K1M / BS5-K1M-P



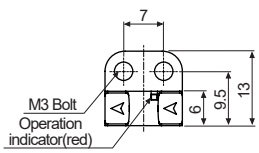
• BS5-T1M / BS5-T1M-P

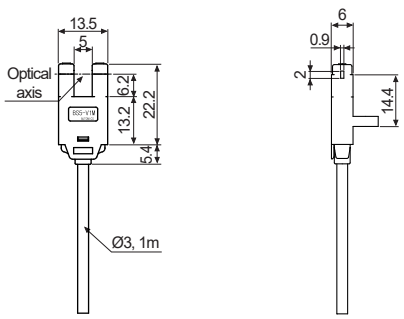


• BS5-L1M / BS5-L1M-P

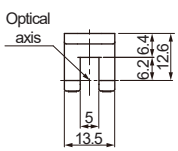


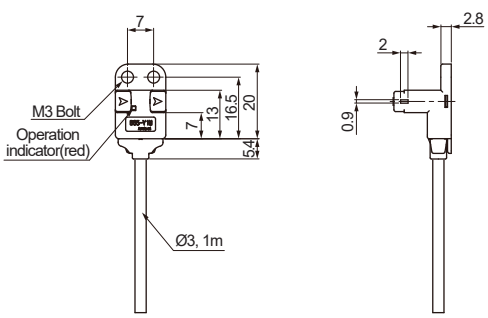
• BS5-V1M / BS5-V1M-P





• BS5-Y1M / BS5-Y1M-P



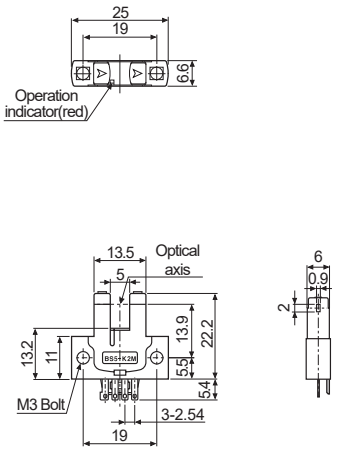


※When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
※When installing the product, tighten the screw with a tightening torque of 0.49N·m.

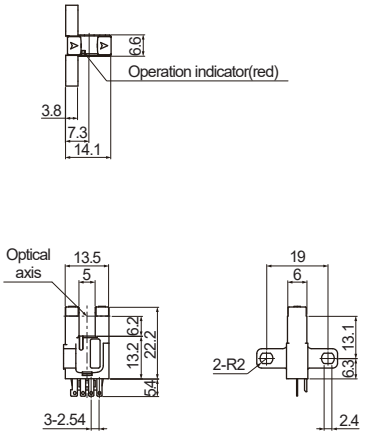
▣ Dimensions

(unit: mm)

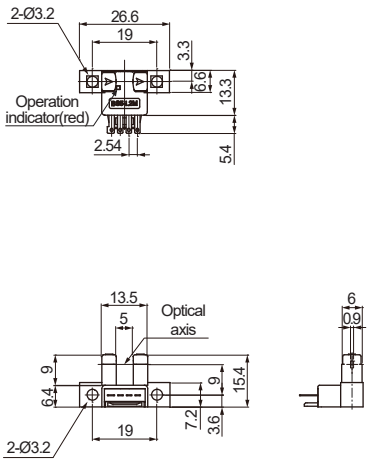
● BS5-K2M / BS5-K2M-P



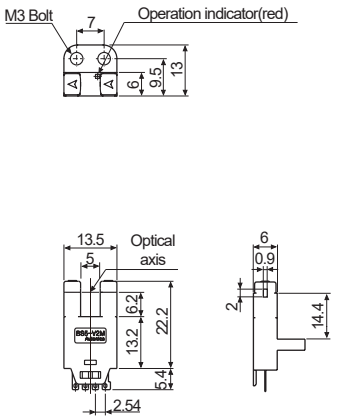
● BS5-T2M / BS5-T2M-P



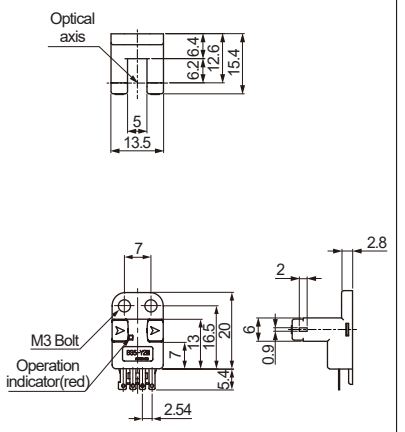
● BS5-L2M / BS5-L2M-P



● BS5-V2M / BS5-V2M-P

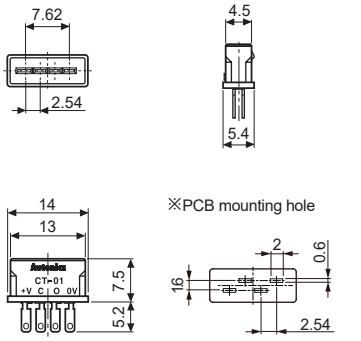


● BS5-Y2M / BS5-Y2M-P

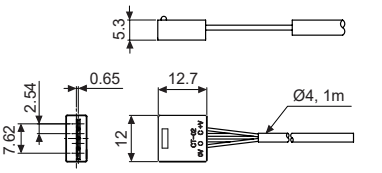


● Connector type (sold separately)

● Connector (CT-01)



● Connector (CT-02)



※Cable: Ø4mm, 4-wire, 1m
(AWG22, Core wire diameter: 0.08mm, No. of core wire: 60, Insulator out diameter: Ø1.2mm)
※Cable length is available to option.

Push Button Type Photomicro Sensors

■ Features

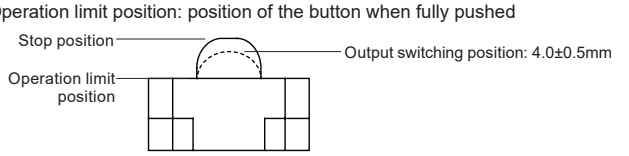
- Button operation enables accurate detection regardless of material, color, or reflectance of target object
- Optimized for transport detection of semiconductor wafer enclosures (FOUP, FOSB, etc.)
- Optical detection of button operation guarantees mechanical life cycle of 5 million operations
- Total of 4 red LED indicators (side:2, top:2) for higher visibility of operation status
- Increased product durability with steel mounting brackets
- Emitter OFF function and check stable operation functions
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit

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

■ Specifications

Model	NPN open collector output	**BS5-P1ML**	**BS5-P1MD**
	PNP open collector output	**BS5-P1ML-P**	**BS5-P1MD-P**
Operation method※1		Push button type	
Button operation※2	Stop position	5.0±0.4mm	
	Output switching position	4.0±0.5mm	
	Operation limit position	Below 0mm	
Operation load※3		Max. 3N (max. 0.3kgf)	
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 35mA	
Light source		Infrared LED (940nm)	
Operation mode		Light ON (output OFF when button is pushed)	Dark ON (output ON when button is pushed)
Control output		NPN or PNP open collector output ·Load voltage: max. 26.4VDC⎓ ·Load current: max. 50mA ·Residual voltage: max. 1VDC⎓	
External input※4	NPN output	Emitter OFF: short at 0V or max. 0.25VDC⎓ (outflow current max. 30mA) Emitter ON: open (leakage current max. 0.4mA)	
	PNP output	Emitter OFF: short at +V or min. -0.25VDC⎓ of +V (absorption current max. 30mA) Emitter ON: open (leakage current max. 0.4mA)	
	Response	Under 1ms	
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit	
Indicator		Operation indicator: red LED	
Insulation resistance		Over 20MΩ (at 250VDC megger)	
Noise immunity		±240V of square wave noise (pulse width:1 μs) from the noise simulator	
Dielectric strength		1,000VAC at 50/60Hz for 1min	
Vibration		1.5mm amplitude at 10 to 55Hz frequency in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Mechanical life cycle		Min. 5,000,000 operations (1 operation = stop position - operation limit position - stop position)	
Environment	Ambient illuminance	Fluorescent lamp: max. 1,000lx (receiver illuminance)	
	Ambient temperature	-20 to 55℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP40 (IEC standard)	
Material		Case: polycarbonate + glass fiber, button: polyoxymethylene, sleeve: SUS304 (steel use stainless 304)	
Cable		Ø3mm, 4-wire, 1m (AWG 28, core diameter: 0.08mm, no. of core wires: 19, insulator diameter: Ø0.88mm)	
Approval		CE	
Weight※5		Approx. 50g (approx. 30g)	

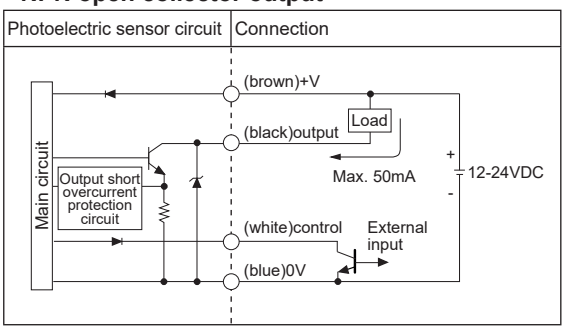
※1: Detection occurs when the button is pushed and the light source is blocked.
※2: Stop position: position of the button without any applied pressure
Output switching position: position where the output switches ON/OFF
Operation limit position: position of the button when fully pushed



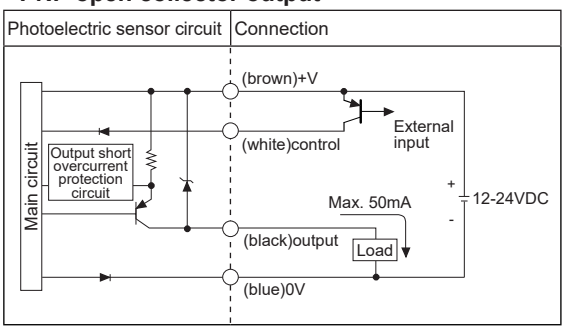
※3: Pressure required to push the button from stop position to output switching position
※4: External input when using emitter OFF function or check stable operation functions.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature and humidity of environment resistance are rated at non-freezing or condensation.

▣ Control Output Diagram

• NPN open collector output



• PNP open collector output



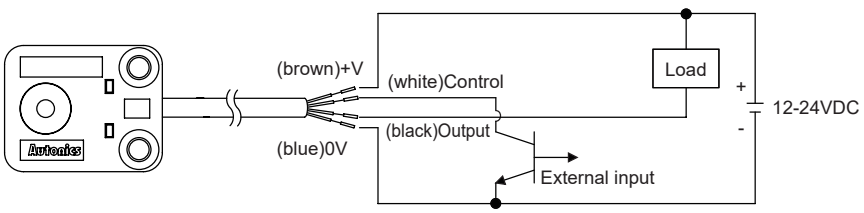
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Operation Mode

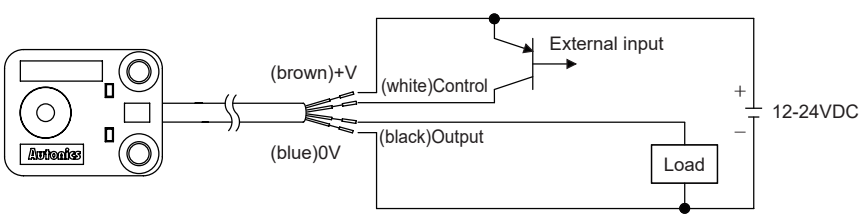
Operation mode	Light ON(output OFF when button is pushed)	Dark ON(output ON when button is pushed)
Button position	Pushed / Raised	Pushed / Raised
Receiver operaion	Received light / Interrupted light	Received light / Interrupted light
Operation indicator (redLED)	ON / OFF	ON / OFF
Transistor output	ON / OFF	ON / OFF

▣ Connections

• NPN open collector output

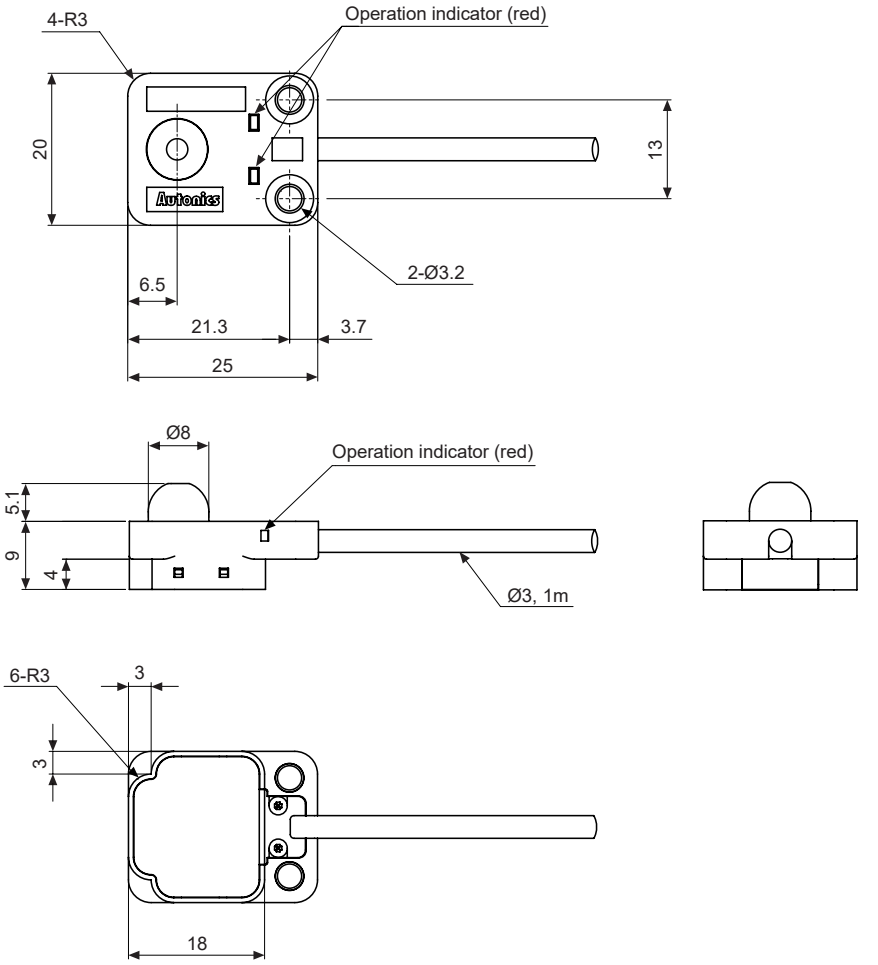


• PNP open collector output



▣ Dimensions

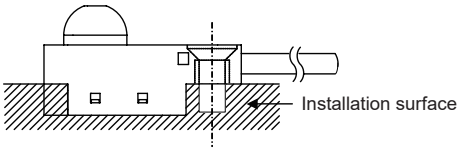
(unit: mm)



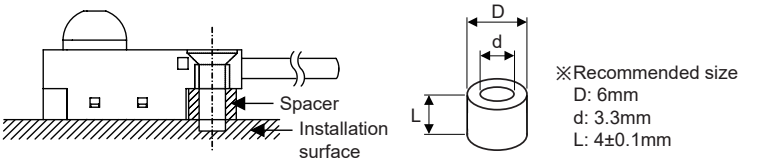
▣ Installation

When installing the product, tighten the screw with a tightening torque of 0.59N·m.
Do not pull the cable with a tensile strength of 30N or over. It may result in fire due to the broken wire.

1) Installation on non-flush surface
Install the sensor after fitting the sensor in the opening as shown in the figure below.



2) Installation on flush surface
Insert a spacer between the installation surface and the mounting surface of the sensor as shown in the figure below.

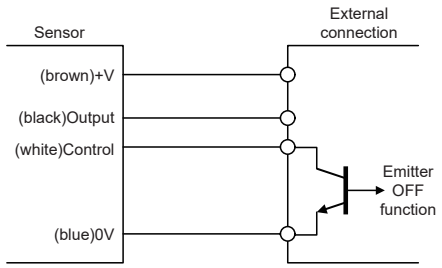
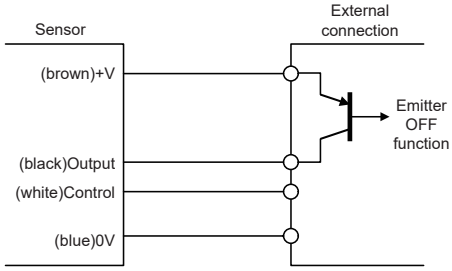


※Recommended size
D: 6mm
d: 3.3mm
L: 4±0.1mm

▣ Functions

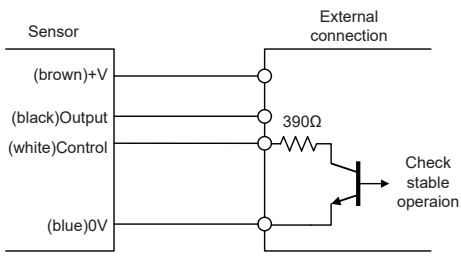
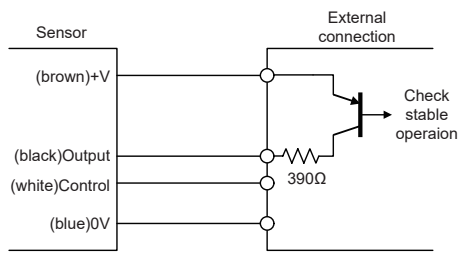
● Emitter OFF function

The emitter LED can be turned ON/OFF without pushing the button, to test for stable operation of the receiver.

NPN open collector output	PNP open collector output
	

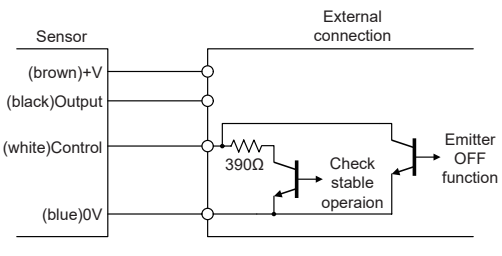
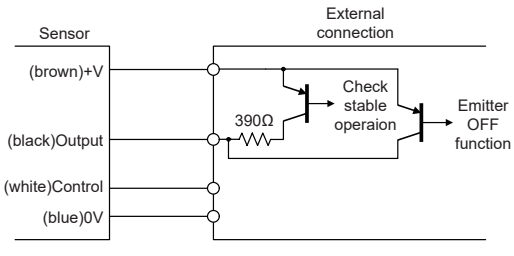
● Check stable operation function

Reduces the LED intensity by approximately 20% while button is not pushed, and check that the receiver is still receiving light (same transistor ON status as at 100%) This ensures that sensor will not malfunction due to changing light intensity.

NPN open collector output	PNP open collector output
	

● Simultaneous use of emitter OFF and check stable operation function

Follow the circuit diagram below:

NPN open collector output	PNP open collector output
	

※When using the emitter OFF function and check stable operation function simultaneously, the transistor used should be able to open and close 50mA/10V and resistance should be over 1/8W. Failure may cause product damage.
※When emitter OFF function and stable operation check function is not used, insulate the control (white) wire. Otherwise, it may result in product damage.

Compact, Amplifier Built-In Type with Universal Voltage

▣ Features

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

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

CE (DC power)

(MS-2) (MS-4) (MST-□)

※MS-4, MST-□ is sold separately.

▣ Specifications

● Free power, Relay contact output type

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

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

● DC power, Solid state output type

Model		BEN10M-TDT	BEN5M-MDT	BEN3M-PDT	BEN300-DDT
Sensing type		Through-beam	Retroreflective	Retroreflective (with polarizing filter)	Diffuse reflective
Sensing distance		10m	5m※1	3m※1	300mm※2
Sensing target		Opaque materials of Min. Ø16mm	Opaque materials of min. Ø60mm		Translucent, opaque materials
Hysteresis		—			Max. 20% at rated setting distance
Response time		Max. 1ms			
Power supply		12-24VDC⎓±10% (ripple P-P: max. 10%)			
Current consumption		Max. 50mA			
Light source		Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment		—	Sensitivity adjuster		
Operation mode		Light ON/Dark ON operation mode switch			
Control output		NPN open collector / PNP open collector simultaneous output ●Load voltage: max. 30VDC⎓ ●Load current: max. 200mA ●Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC			
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit			
Light receiving element		Photo IC			
Indicator		Operation indicator: red, stability indicator: green (the red lamp on Emitter of transmitted beam type is for power indication)			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1000VAC 50/60Hz for 1 minute			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)			
	Ambient temperature	-20 to 65°C, storage: -25 to 70°C			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP50 (IEC standard)			
Material		case, case cover: heat resistant acrylonitrile butadiene styrene, sensing part: polycarbonate (with polarizing filter: polymethyl methacrylate), bracket: steel plate cold commercial, bolt: steel chromium molybdenum, nut: steel chromium molybdenum			
Cable		Ø5mm, 4-wire, 2m (emitter of through-beam type: Ø5mm, 2-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator diameter: Ø1.25mm)			
Accessory	Individual	—	Reflector (MS-2)		—
	Common	Adjustment screwdriver, mounting bracket, M4 bolt: 4, M4 nut: 4	Adjustment screwdriver, mounting bracket, M4 bolt: 2, M4 nut: 4		
Approval		CE			
Unit weight		Approx. 342g	Approx. 200g		Approx. 187g

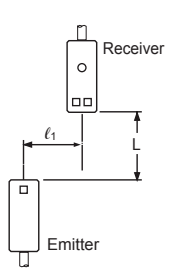
※1: The sensing distance is specified with using the MS-2 reflector and the same as the MS-4 reflector. Sensing distance is the setting range of the reflector. The sensor can detect under 0.1m.
When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "▣Reflectivity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

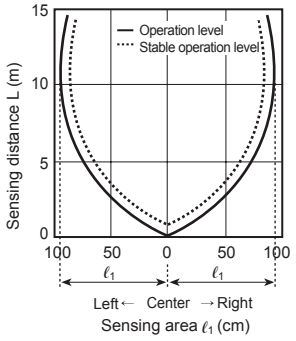
▣ Feature data

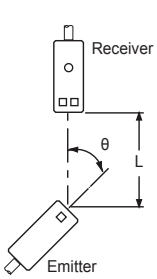
◎ Through-beam type

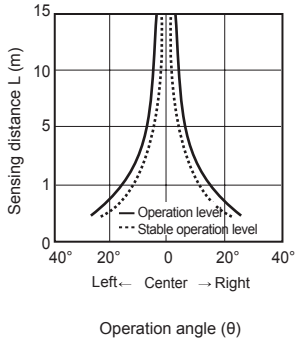
● BEN10M-TFR ● BEN10M-TDT

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data







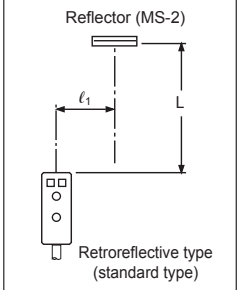
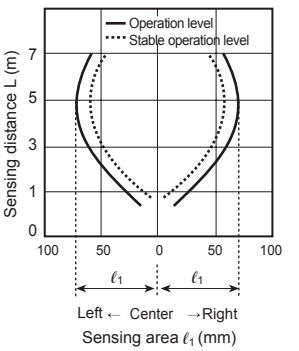


▣ Feature Data

◎ Retroreflective type (standard type)

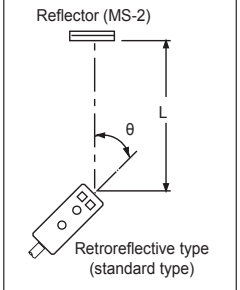
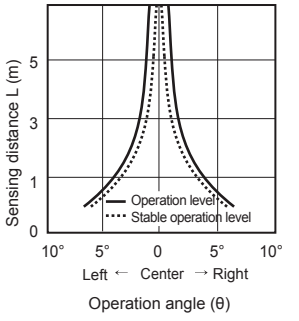
● BEN5M-MFR ● BEN5M-MDT

Parallel shifting characteristic

Measuring method	Data
	

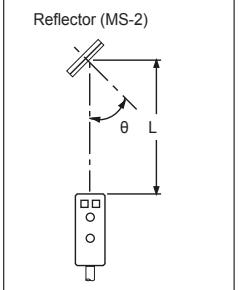
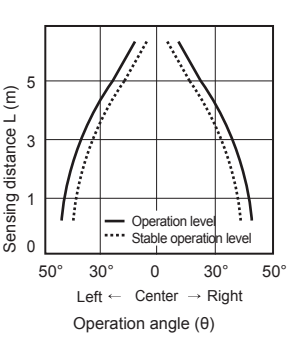
● BEN5M-MFR ● BEN5M-MDT

Sensor angle characteristic

Measuring method	Data
	

● BEN5M-MFR ● BEN5M-MDT

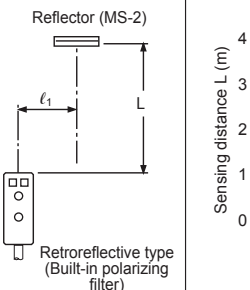
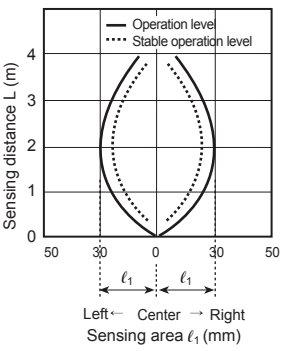
Reflector angle characteristic

Measuring method	Data
	

◎ Retroreflective type (built-in polarizing filter)

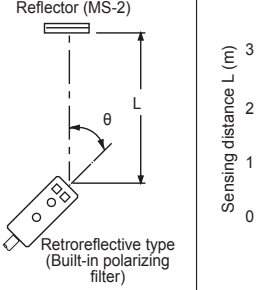
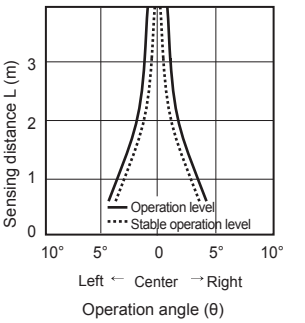
● BEN3M-PFR ● BEN3M-PDT

Parallel shifting characteristic

Measuring method	Data
	

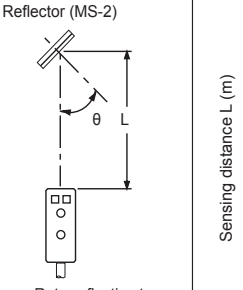
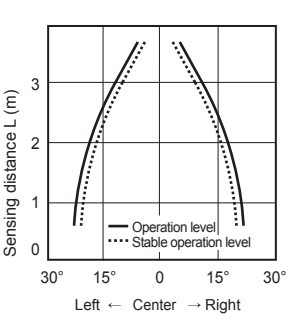
● BEN3M-PFR ● BEN3M-PDT

Sensor angle characteristic

Measuring method	Data
	

● BEN3M-PFR ● BEN3M-PDT

Reflector angle characteristic

Measuring method	Data
	

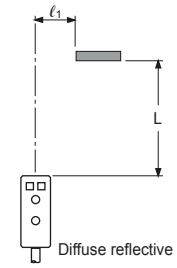
◎ Diffuse reflective type

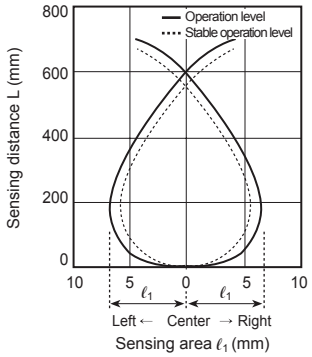
● BEN300-DFR ● BEN300-DDT

Sensing area characteristic

Measuring method	Data

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





▣ Operation Mode

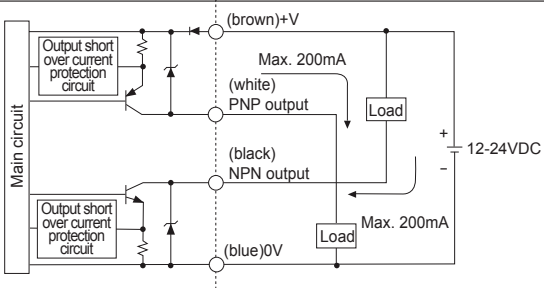
Operation mode	Light ON
Receiver operation	Received light / Interrupted light
Operation indicator (red LED)	ON / OFF
Transistor output	ON / OFF

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

▣ Control Output Diagram

● DC voltage (NPN/PNP synchronous output)

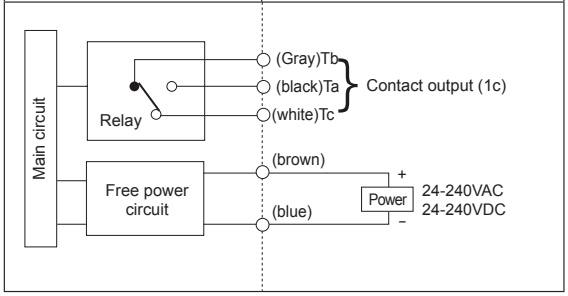
Photoelectric sensor circuit | Connection



※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

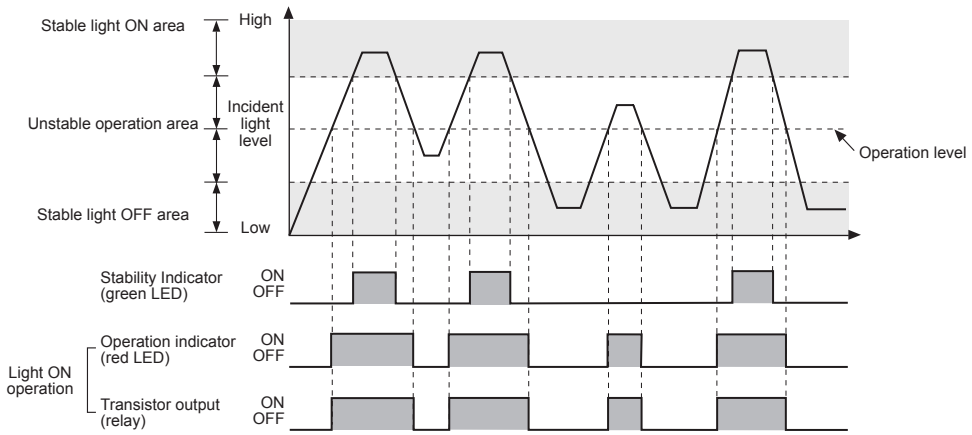
● Free power (Relay contact output)

Photoelectric sensor circuit | Connection



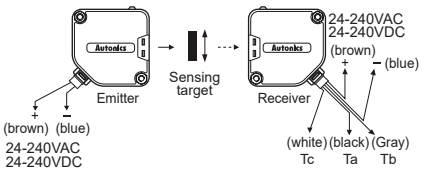
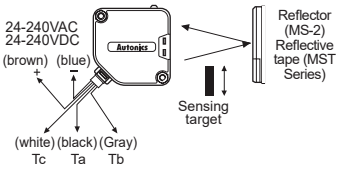
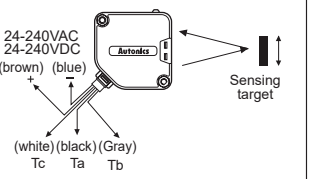
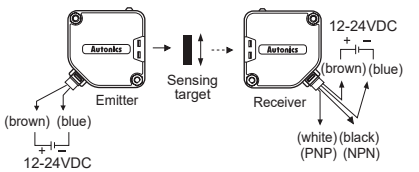
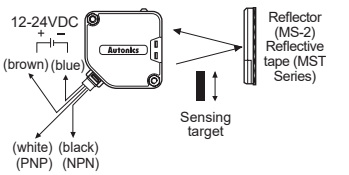
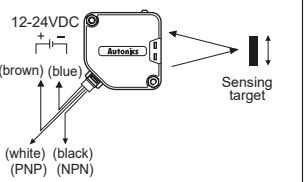
※The product is not equipped with the output short over current protection circuit. If short-circuit the control output terminal or supply current over the rated specification, it may result in product damage.

▣ Operation Timing Diagram



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

▣ Connections

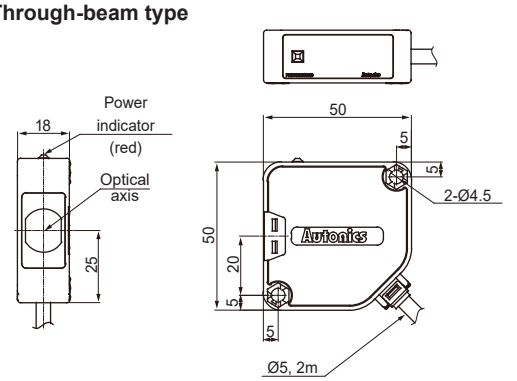
Through-beam	Retroreflective	Diffuse reflective
● BEN10M-TFR1 ● BEN10M-TFR2	**● BEN5M-MFR (standard type) ● BEN3M-PFR (built-in polarizing filter)**	**● BEN300-DFR**
		
● BEN10M-TDT1 ● BEN10M-TDT2	**● BEN5M-MDT (standard type) ● BEN3M-PDT (built-in polarizing filter)**	**● BEN300-DDT**
		

※ Unused line must be insulated.

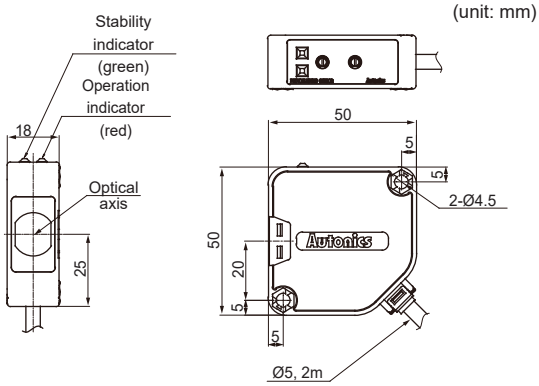
▣ Dimensions

(unit: mm)

●Through-beam type

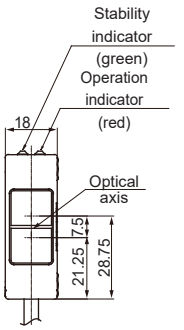


<Emitter>

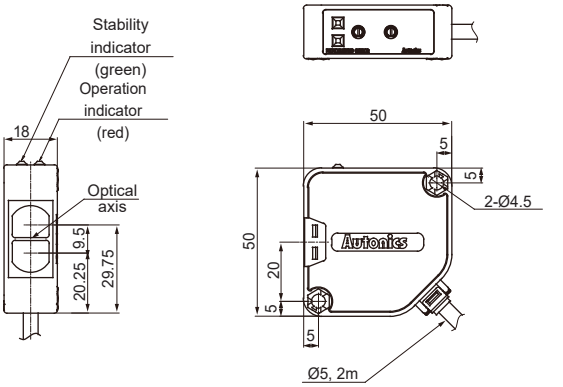


<Receiver>

●Retroreflective type

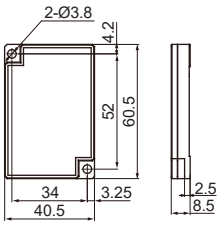


●Diffuse reflective type

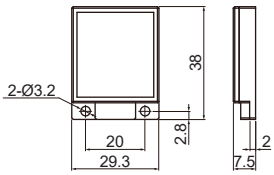


● Reflector

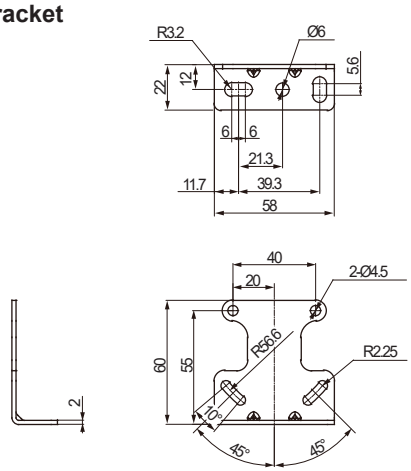
· MS-2



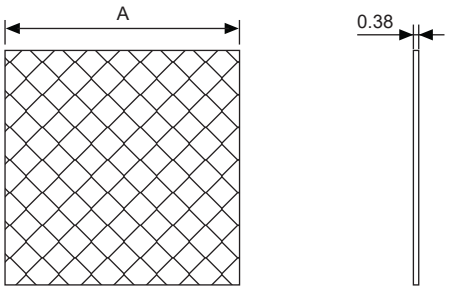
· MS-4 (sold separately)



● Bracket



● Reflective tape (sold separately)



(unit: mm)

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

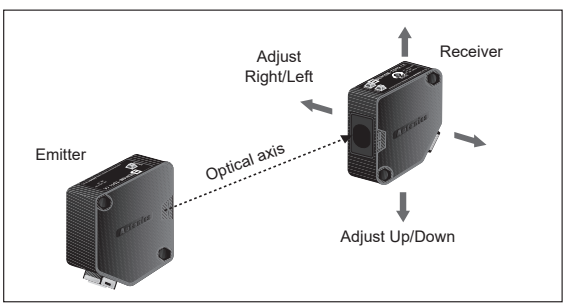
▣ Mounting and sensitivity adjustment

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

◎ Through-beam type

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

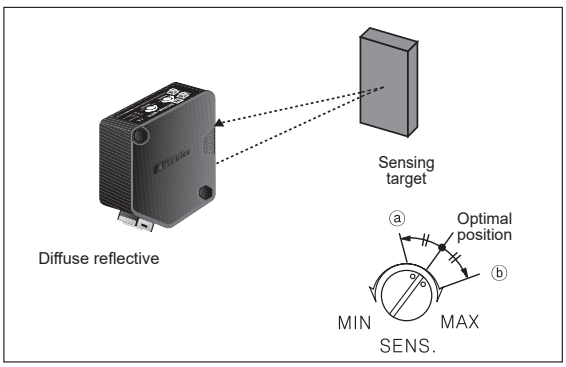
※If the sensing target is translucent body or smaller than Ø16mm, it can be missed by sensor because light penetrate it.



◎ Diffuse reflective type

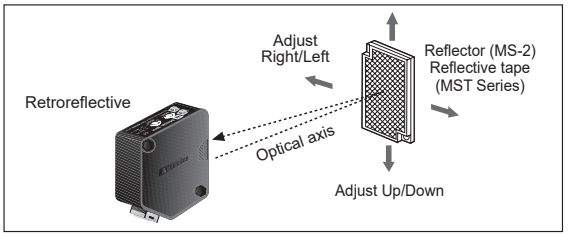
1. The sensitivity should be adjusted depending on a sensing target or mounting place.
2. Set the target at a position to be detected by the beam, then turn the sensitivity adjuster until position ⓐ where the operation indicator turns ON from min. position of the sensitivity adjuster.
3. Take the target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

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



◎ Retroreflective type

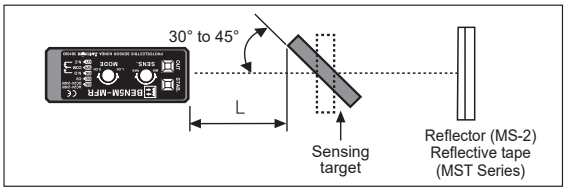
1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector or reflective tape face to face.
2. Set the photoelectric sensor in the position which indicator turns on, by adjusting the reflector or the sensor right and left, up and down.
3. Fix both units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



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

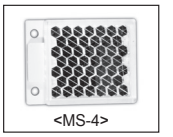
※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and the photoelectric sensor or the surface of the target should be installed at angle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

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



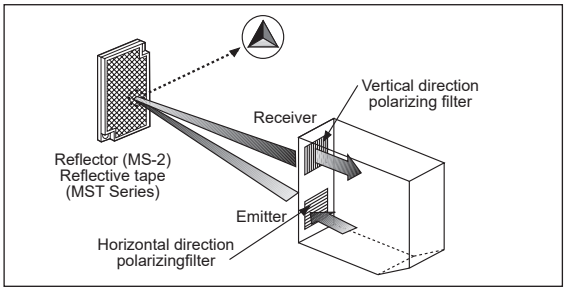
※If the mounting place is too narrow, please use MS-4 instead of MS-2.

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



◎ Retroreflective type with polarizing filter

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



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

▣ Reflectivity by Reflective Tape Model

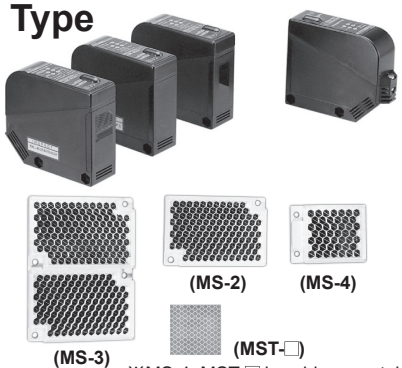
	Standard	Built-in polarizing filter
MST-50-10 (50×50mm)	90%	70%
MST-100-5 (100×100mm)	130%	90%
MST-200-2 (200×200mm)	140%	120%

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

※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.

※For using reflective tape, installation distance should be min. 20mm.

Terminal Type and Long Sensing Distance Type



※MS-4, MST-□ is sold separately.

▣ Features

- Sensitivity adjuster
- Timer function: ON Delay, OFF Delay, One-shot Delay
- NPN/PNP open collector output (DC power type)
- Self-diagnosis function (green LED turns on in stable level)
- Wide power supply range: Universal 24-240VDC/24-240VAC
- Protection structure IP66 (IEC standard)

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

CE

▣ Specifications

◎ Free power type, Relay contact output 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 (built-in polarizing filter)	Diffuse reflective
Sensing distance		15m	0.1 to 5m (reflector MS-2)※1	0.1 to 2m (reflector MS-2), 0.1 to 3m (reflector MS-3)※1	700mm※2
Sensing target		Opaque materials of Min. Ø15mm	Opaque materials of Min. Ø60mm		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%)			
Power consumption		Max. 3VA			
Light source		Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment		Sensitivity adjuster			
Operation mode		Light ON/Dark ON operation mode switch			
Control output		Relay contact output (contact capacity: 30VDC⎓ 3A, 250VAC⎓ 3A at resistive load, contact composition: 1c)※3			
Relay life cycle		Mechanically: min. 50,000,000, electrically: min. 100,000			
Self-diagnosis output		Self-diagnosis indicator (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 5 sec (timer adjuster)]			
Indicator		Operation indicator: yellow LED, self-diagnosis indicator: green LED			
Connection		Terminal connection			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Insulation type		Double or strong insulation (mark: ⊡, dielectric voltage between the measured input and the power: 1.5kV)			
Noise immunity		±1,000V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1500VAC 50/60Hz for 1 minute			
Vibration	Mechanical	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
	Malfunction	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 minutes			
Shock	Mechanical	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Environment	Ambient illu.	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)			
	Ambient temp.	-20 to 55℃, storage: -25 to 70℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP66 (IEC standard)			
Material		Case, lens cover: polycarbonate, sensing part: acrylic, bracket, bolt, nut: steel chromium molybdenum			
Accessory	Individual	—	Reflector (MS-2)	Reflector (MS-3)	—
	Common	Adjustment screwdriver, mounting bracket, Z bolt: 2, washer: 2, Ø6 waterproof rubber: 2, Ø10 waterproof rubber: 2	Adjustment screwdriver, mounting bracket, Z bolt: 1, washer: 1, Ø6 waterproof rubber :1, Ø10 waterproof rubber: 1		
Approval		CE			
Unit weight		TFR: approx. 225g TFR-T: approx. 226g	MFR: approx. 130g MFR-T: approx. 131g	PFR: approx. 148g PFR-T: approx. 149g	DFR: approx. 115g DFR-T: approx. 116g

※1: The sensing distance of the retroreflective type sensor is possible setting range between reflector and sensor. A target object can be sensed in 0.1m distance. When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "▣Reflectivity by Reflective Tape Model" table before using the tapes.

※2: Non-glossy white paper 200×200mm.

※3: Relay contact output of 1a type is option.

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Specifications

◎ DC power type, Solid state output 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 (built-in polarizing filter)	Diffuse reflective
Sensing distance		15m	0.1 to 5m (reflector MS-2)※1	0.1 to 2m (reflector MS-2), 0.1 to 3m (reflector MS-3)※1	700mm※2
Sensing target		Opaque materials of Min. Ø15mm	Opaque materials of Min. Ø60mm		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. 50mA			
Light source		Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment		Sensitivity adjuster			
Operation mode		Light ON/Dark ON operation mode switch			
Control output		NPN or PNP open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 200mA ●Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC			
Self-diagnosis output		NPN open collector output (green LED turns on at stable operation and output (transistor output) turns on) ●Load voltage: max. 30VDC⎓ ●Load current: max. 50mA ●Residual voltage - max. 1VDC⎓(50mA), max. 0.4VDC(16mA)			
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit			
Timer function		Selectable ON delay, OFF delay, one shot delay by slide switch [delay time: 0.1 to 5 sec (timer adjuster)]			
Indicator		Operation indicator: yellow LED, Self-diagnosis indicator: green LED			
Connection		Terminal connection			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength		1500VAC 50/60Hz for 1 minute			
Vibration	Mechanical	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
	Malfunction	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 10 minutes			
Shock	Mechanical	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
	Malfunction	100m/s² (approx. 10G) in each X, Y, Z direction for 3 times			
Environment	Ambient illu.	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)			
	Ambient temp.	-20 to 55℃, storage: -25 to 70℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP66 (IEC standard)			
Material		Case, lens cover: polycarbonate, sensing part: acrylic, bracket, bolt, nut: steel chromium molybdenum			
Accessory	Individual	—	Reflector (MS-2)	Reflector (MS-3)	—
	Common	Adjustment screwdriver, mounting bracket, Z bolt: 2, washer: 2, Ø6 waterproof rubber: 2, Ø10 waterproof rubber: 2	Adjustment screwdriver, mounting bracket, Z bolt: 1, washer: 1, Ø6 waterproof rubber :1, Ø10 waterproof rubber: 1		
Approval		CE			
Unit weight		TDT: approx. 211g TDT-T: approx. 212g	MDT: approx. 123g MDT-T: approx. 124g	PDT: approx. 141g PDT-T: approx. 142g	DDT: approx. 116g DDT-T: approx. 117g

※1: The sensing distance of the retroreflective type sensor is possible setting range between reflector and sensor. A target object can be sensed in 0.1m distance. When using reflective tapes, the reflectivity will vary by the size of the tape. Please refer to the "▣Reflectivity by Reflective Tape Model" table before using the tapes.

※2: Non-glossy white paper 200×200mm.

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Feature Data

◎ Through-beam type

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

Parallel shifting characteristic		Angle Characteristic	
Measuring method	Data	Measuring method	Data
Receiver, Emitter, L, ℓ_1	Sensing distance L (m): 15, 12, 9, 6, 3, 0; 200 150 100 50 0 50 100 150 200; ℓ_1 ℓ_1; Left ← Center → Right; Sensing area ℓ_1 (cm)	Receiver, θ, L, Emitter	Sensing distance L (m): 15, 12, 9, 6, 3, 0; 80° 60° 40° 20° 0 20° 40° 60° 80°; Left ← Center → Right; Operation angle (θ)

◎ Diffuse reflective type

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

Sensing area	
Measuring method	Data
Standard sensing target: non-glossy white paper 200×200mm, ℓ_1, L, Diffuse reflective	Sensing distance L (mm): 900, 700, 500, 300, 100, 0; 40 30 20 10 0 10 20 30 40; ℓ_1 ℓ_1; Left ← Center → Right; Sensing area ℓ_1 (mm)

◎ Retroreflective type

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

Parallel shifting characteristic		Angle Characteristic		Reflector angle characteristic	
Measuring method	Data	Measuring method	Data	Measuring method	Data
Reflector (MS-2), ℓ_1, L, Retroreflective type (standard type)	Sensing distance L (m): 5, 4, 3, 2, 1, 0; 150 100 50 0 50 100 150; ℓ_1 ℓ_1; Left ← Center → Right; Sensing area ℓ_1 (mm)	Reflector (MS-2), θ, L, Retroreflective type (standard type)	Sensing distance L (m): 5, 4, 3, 2, 1, 0; 4° 3° 2° 1° 0 1° 2° 3° 4°; Left ← Center → Right; Operation angle (θ)	Reflector (MS-2), θ, L, Retroreflective type (standard type)	Sensing distance L (m): 5, 4, 3, 2, 1, 0; 60° 40° 20° 0 20° 40° 60°; Left ← Center → Right; Operation angle (θ)

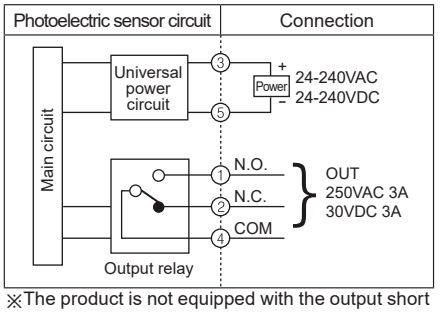
◎ Retroreflective type (Built-in polarizing filter)

- **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
Reflector (MS-3), ℓ_1, L, Retroreflective type (built-in polarizing filter)	Sensing distance L (m): 3, 2, 1, 0; 90 60 30 0 30 60 90; ℓ_1 ℓ_1; Left ← Center → Right; Sensing area ℓ_1 (mm)	Reflector (MS-3), θ, L, Retroreflective type (built-in polarizing filter)	Sensing distance L (m): 3, 2, 1, 0; 6° 4° 2° 0 2° 4° 6°; Left ← Center → Right; Operation angle (θ)	Reflector (MS-3), θ, L, Retroreflective type (built-in polarizing filter)	Sensing distance L (m): 3, 2, 1, 0; 40° 30° 20° 10° 0 10° 20° 30° 40°; Left ← Center → Right; Operation angle (θ)

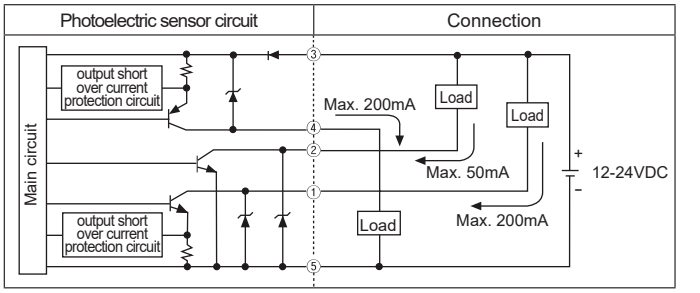
▣ Control Output Diagram

◎ Free power type (Relay contact output)



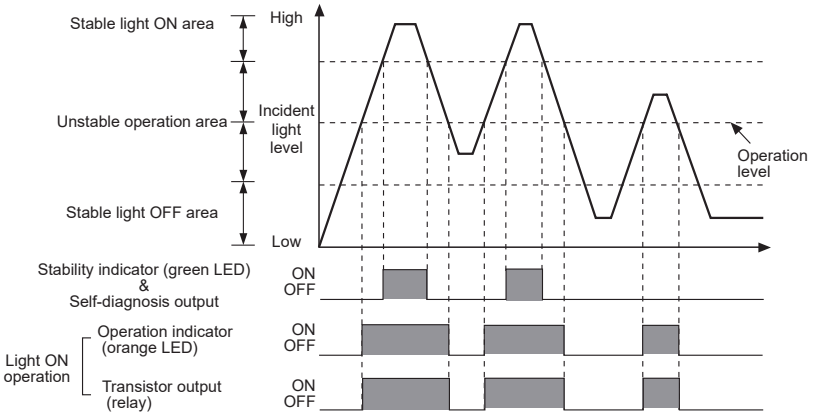
※The product is not equipped with the output short over current protection circuit. If short-circuit the control output terminal or supply current over the rated specification, it may result in product damage.

◎ DC power type (NPN/PNP open collector simultaneous output)



※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Operation Timing Diagram



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

▣ Timer Mode

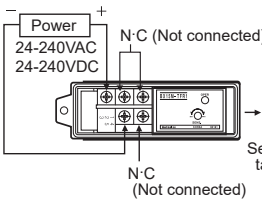
Timer mode	Switch position		Operation mode \ Status of light	Received light / Interrupted light
	S1	S2		
Normal	ON	ON	Light ON	ON / OFF
			Dark ON	ON / OFF
One-shot Delay	ON	OFF	Light ON	ON / OFF
			Dark ON	ON / OFF
ON Delay	OFF	ON	Light ON	ON / OFF
			Dark ON	ON / OFF
OFF Delay	OFF	OFF	Light ON	ON / OFF
			Dark ON	ON / OFF

※T: Time can be set by the timer adjuster.
※Conversion to other timer modes is applied after a former mode is finished.

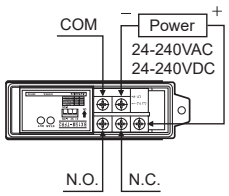
▣ Connections

◎ Through-beam type

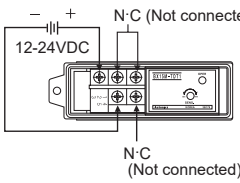
● BX15M-TFR1



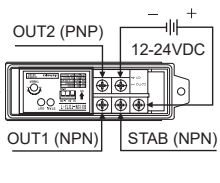
● BX15M-TFR2
BX15M-TFR2-T



● BX15M-TDT1

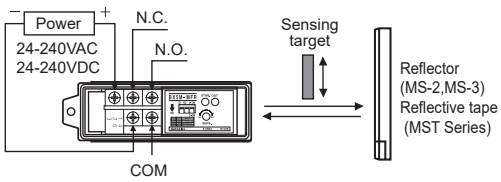


● BX15M-TDT2
BX15M-TDT2-T

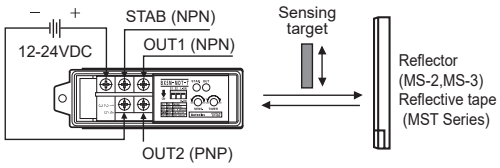


◎ Retroreflective type / Retroreflective type with polarizing filter

● BX5M-MFR, BX5M-MFR-T (standard type)
● BX3M-PFR, BX3M-PFR-T (built-in polarizing filter)

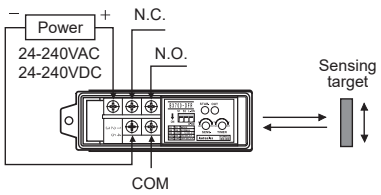


● BX5M-MDT, BX5M-MDT-T (standard type)
● BX3M-PDT, BX3M-PDT-T (built-in polarizing filter)

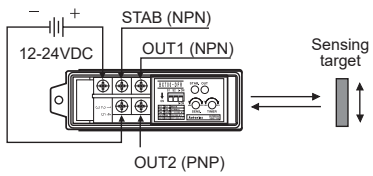


◎ Diffuse reflective type

● BX700-DFR, BX700-DFR-T

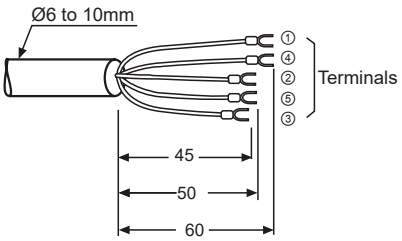


● BX700-DDT, BX700-DDT-T

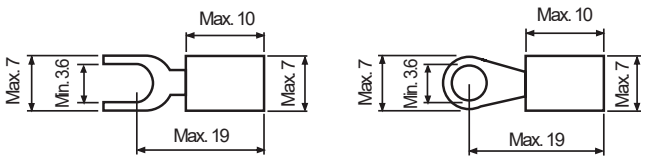


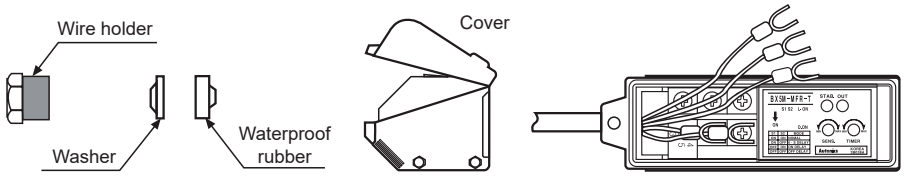
◎ Cable

(unit: mm)



●Terminal size

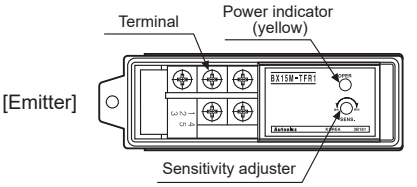


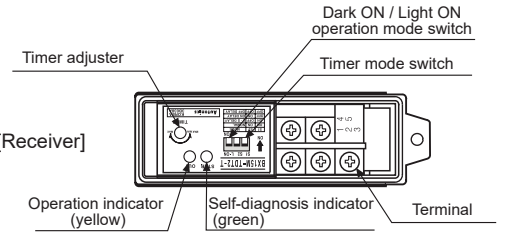


※To connect the wires on the terminal, following as above figures.
※Select the round wire with the size of Ø6 to 10mm for the waterproof and tighten the cable holder by torque of 1.0 to 1.5N·m.
※When wiring, tighten the terminal screw with a tightening torque of 0.8N·m.

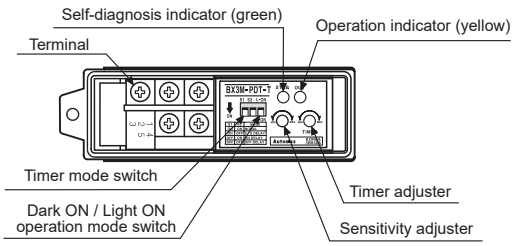
▣ Front Panel Identification

◎ Through-beam type

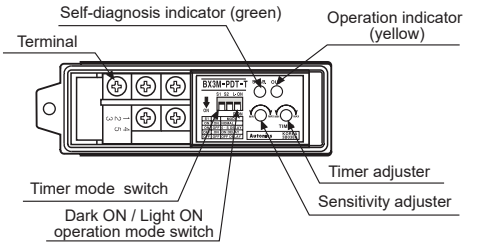




◎ Retroreflective type (Standard type, Built-in polarizing filter)



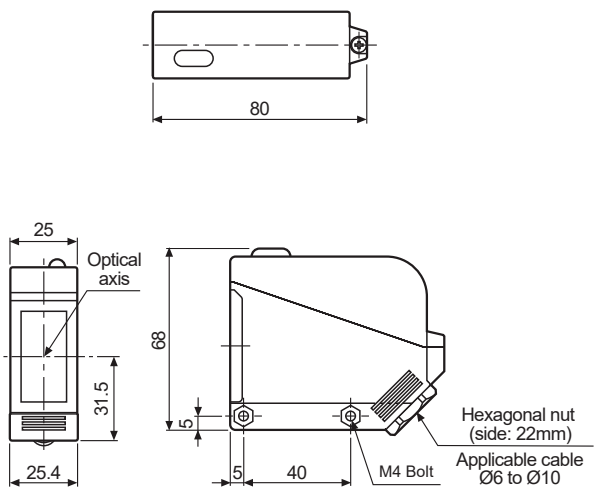
◎ Diffuse reflective type



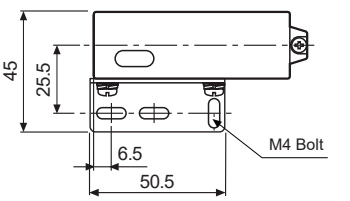
※There are no timer mode switch and the timer adjuster in no timer function type.

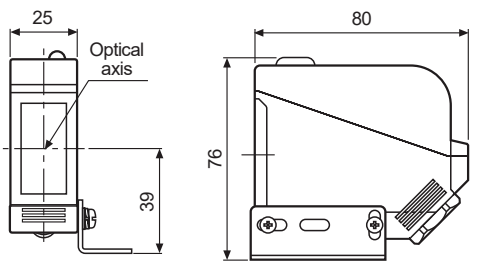
▣ Dimensions

(unit: mm)



● **Connect the bracket**

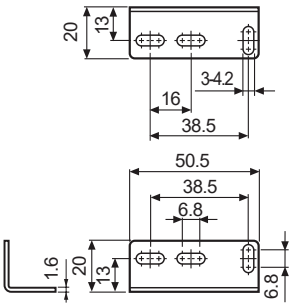




▣ Dimensions

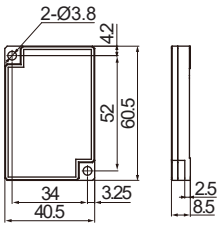
(unit: mm)

● **Bracket**

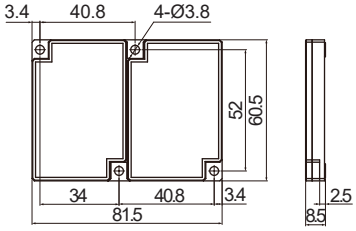


● **Reflector**

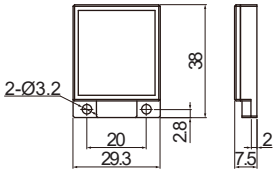
· **MS-2**



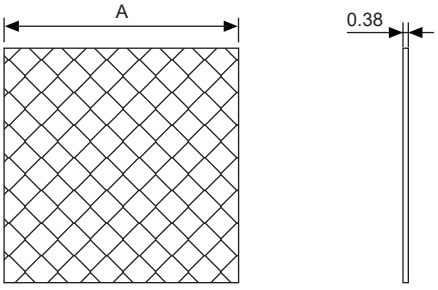
· **MS-3**



· **MS-4 (sold separately)**



● **Reflective tape (sold separately)**



(unit: mm)

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

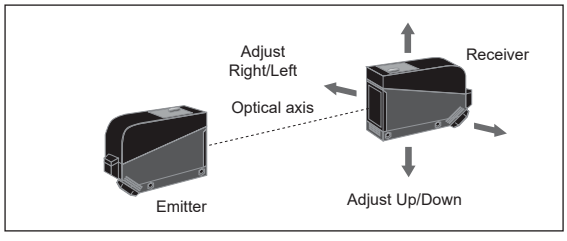
▣ Mounting and Sensitivity Adjustment

Use the product with the protective cover in the place.
Failure to follow this instruction may result in electric shock.
When extending wire, use AWG20 cable or over within 100m.
When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the wire holder with a tightening torque of 1.0 to 1.5N·m.
When installing the cover, tighten the screw with a tightening torque of 0.3 to 0.5 N·m.

◎ Through-beam type

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

※If the sensing target is translucent body or smaller than Ø15mm, it can be missed by sensor because light penetrate it.
※Sensitivity adjustment: Refer to the diffuse reflective type's.

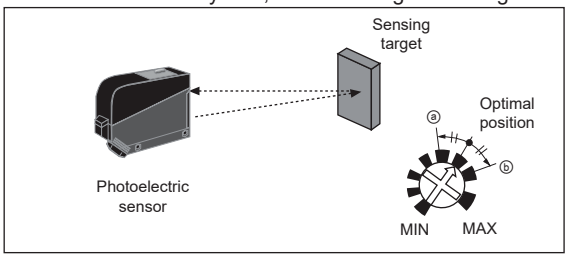


◎ Diffuse reflective type

1. The sensitivity should be adjusted depending on a sensing target or mounting place.
2. Set the sensing target at a position to be sensed by the beam, then turn the sensitivity adjuster from the min. position of the sensitivity adjuster to the position ⓐ where the operation indicator (yellow LED) turns ON. (The self-diagnosis indicator (green LED) is in OFF status.)
3. The operation indicator turns OFF, when the sensing target is removed from the position ⓐ. Without the sensing target, turn the sensitivity adjuster from the position ⓐ to position ⓑ where the operation indicator (yellow LED) turns ON. (If the operation indicator does not turn ON, max. position of the sensitivity adjuster is ⓑ.)
4. Set the sensitivity adjuster at the center of two switching position ⓐ, ⓑ.

※Above sensitivity adjustment is for Light ON mode. If it is for Dark ON mode, operation indicator (yellow LED) operates opposite.

※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.



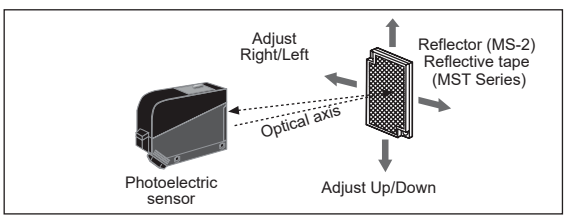
◎ Retroreflective type

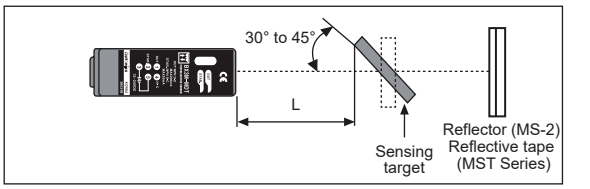
1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector or reflective tape face to face.
2. Set the photoelectric sensor in the position which indicator turns on, by adjusting the reflector (or reflective tape) or the sensor right and left, up and down.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

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

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

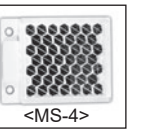
※Sensitivity adjustment: Refer to the diffuse reflective type's.





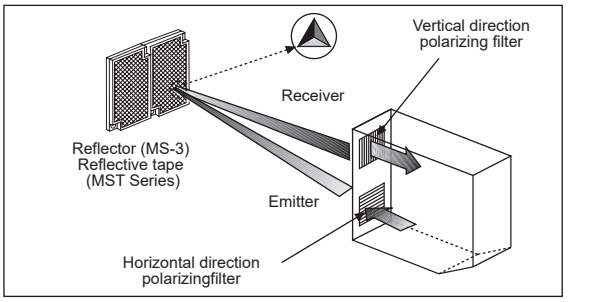
※If the mounting place is too narrow, please use MS-4 instead of MS-2.

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



◎ Retroreflective type (Built-in polarizing filter)

The light passed through the polarizing filter of the emitter reaches to the MS-3 reflector or reflective tape converting as horizontal direction. It reaches to the receiver element of polarizing filter converting as vertical by the MS-3 reflector or reflective tape. Therefore, this type can also detect reflective mirror.



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

▣ Reflectivity by Reflective Tape Model

Model	Standard	Built-in polarizing filter
MST-50-10 (50×50mm)	90%	30%
MST-100-5 (100×100mm)	100%	40%
MST-200-2 (200×200mm)	110%	60%

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

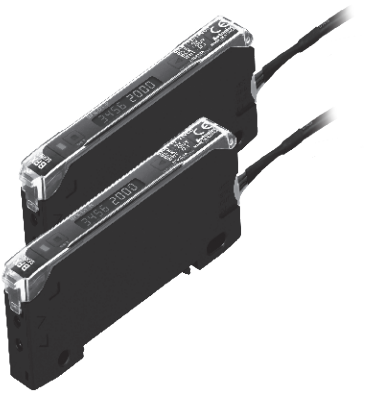
※Reflectivity may vary depending on usage environment and installation conditions.
The sensing distance and minimum sensing target size increase as the size of the tape increases.
Please check the reflectivity before using reflective tapes.

※For using reflective tape, installation distance should be min. 20mm.

LCD Display, Digital Fiber Optic Amplifier

▣ Features

- Dual-display for light incident level and setting value (BF5 -D)
- Enables to detect the minute object with 1/10,000 high resolution
- Enables to detect with high-speed moving object (response speed 50μs)
- 5 response speeds
  : ultra fast mode (50μs), high speed mode (150μs), standard mode (500μs), long distance mode (4ms), ultra long distance mode (10ms)
- Anti-saturation setting function prevents malfunction by saturated light
- External input
  : emitter OFF, remote sensitivity setting, peak reset, output ON/OFF/Keep, energy saving OFF
- Multiple sensitivity setting modes available
  : auto tuning (fine-adjusting sensitivity), teaching sensitivity setting (button or external input-auto-tuning, 1-point, 2-point, positioning)



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

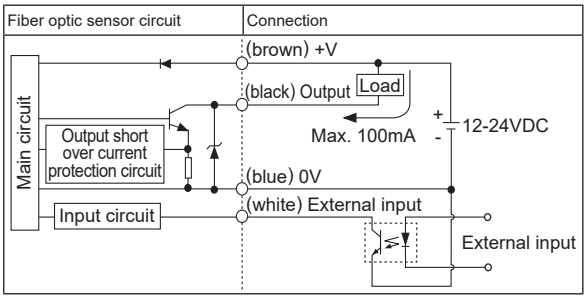
▣ Specifications

Model	NPN open collector output	PNP open collector output
	BFX-D1-N	**BFX-D1-P**
Light source	Red LED (660nm, modulated)	
Power supply	12-24VDC⎓ ±10%	
Current consumption	Max. 50mA	
Operation mode	Light ON/Dark ON Selectable	
Control output	NPN or PNP open collector output • Load voltage: max. 24VDC⎓ • Load current: max. 100mA • Residual voltage - NPN: max. 1VDC⎓, PNP: max. 3VDC	
Protection circuit	Reverse power polarity protection, output short over current protection circuit, surge protection	
Response time	Ultra Fast: 50μs, fast: 150μs, standard: 500μs, long: 4ms, ultra Long: 10ms	
Display method	7 Segment (PV: red, SV: green) LCD Display, control output indicator (red) LED method	
Display function	Incident light level/SV display [4,000/10,000 resolution], standard / percentage display, high/low peak value display, normal/reversed display	
Sensitivity setting	• Manual sensitivity setting • Teaching sensitivity setting (sensitivity setting by button or external input) : auto-tuning, 1-point, 2-point, positioning	
Timer function	OFF, OFF Delay, ON Delay, One-shot (time setting: 1 to 5000ms)	
External input function	Remote sensitivity setting, peak value reset, emitter OFF, control output setting (Keep/ON/OFF), energy saving OFF (operates applying over 2ms of external input signal)	
Insulation resistance	Over 20MΩ (at 500VDC megger)	
Dielectric strength	1,000VAC 50/60Hz for 1min	
Vibration	1.5 mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock	500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Environment: Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (received illumination)	
Environment: Ambient temperature	-10 to 50℃, storage: -20 to 70℃	
Environment: Ambient humidity	35 to 85%RH, storage: 35 to 85% RH	
Protection	IP40 (IEC standard)	
Material	Case: polyketon, cover: polycarbonates	
Fiber optic cable tightening torque	Min. 2kgf	
Accessories	Connector type wire (Ø4mm, 4-wire, 2m / AWG22, core diameter: 0.08mm, number of cores: 60, insulator diameter: Ø1.25mm)	
Approval	CE	
Weight※1	Approx. 115g (approx. 16g)	

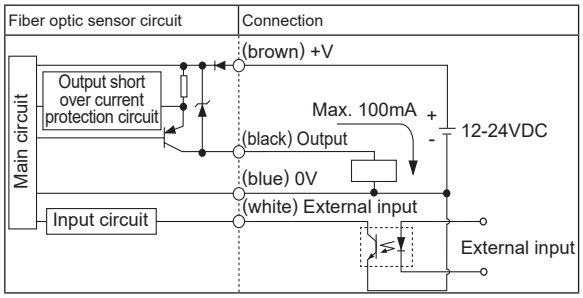
※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Control Output Circuit Diagram and Connections

• NPN open collector output



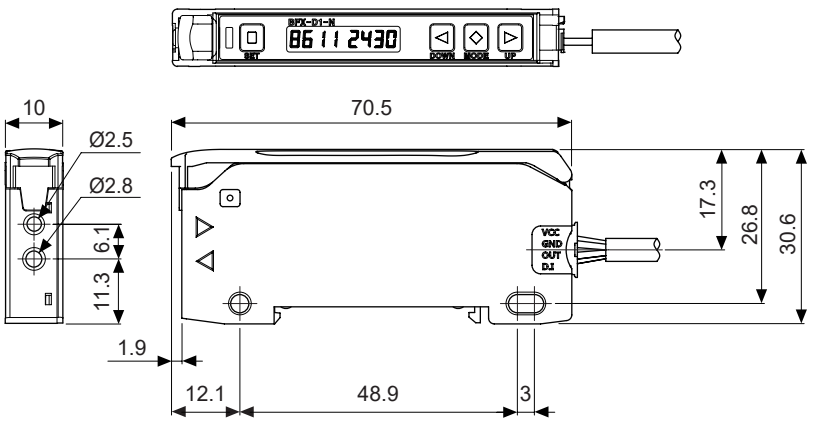
• PNP open collector output



※When using external input function, use photocoupler, external controller, etc. Otherwise, it may result in product damage.

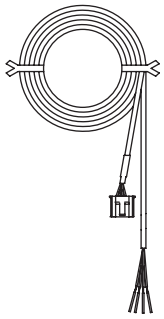
▣ Dimensions

(unit: mm)



• Accessories

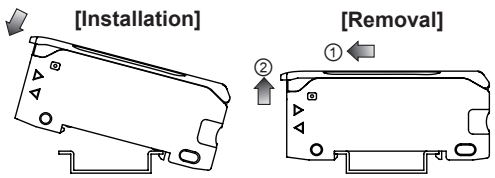
• Connector type wire (length: 2m)



▣ Installations

◎ Amplifier unit mounting

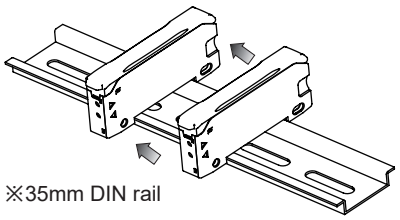
- Installation: Hang up the backside holder on the DIN rail and press the unit toward the DIN rail.
- Removal: Slide the back part of the unit as the ① figure and lift up the unit as the ② figure.



◎ Installing with several units

- After mounting the amplifier unit on DIN rail, attach additional amplifier units adjacently as shown in the arrow.
- This unit does not have mutual interference prevention function. Be sure not to have mutual interference.

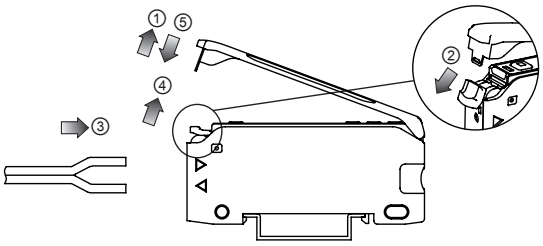
※Do not supply the power while connecting / disconnecting amplifier units.



※35mm DIN rail

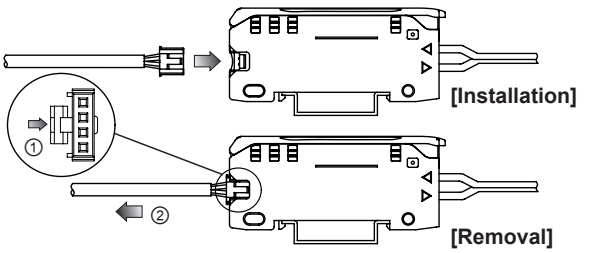
◎ Connector cable attachment and detachment

- Lift up the protective cover to the ① direction and completely lower the lock lever to the direction of to the ② direction to release the lock setting.
- Insert the cable to the ③ direction and adhere between the cable and the inside of the amplifier unit. (Insert depth: receiver part approx. 8mm / emitter part approx. 7mm)
- Place up the lock lever to lock the lock setting to the ④ direction and close the protective cover to the ⑤ direction.

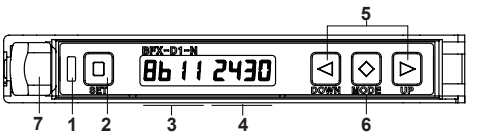


◎ Insert/Remove connector

- Insert the connector into the amplifier unit until it clicks into the right position.
- Remove the connector by pressing the end part at ① direction and pull it to ② direction.

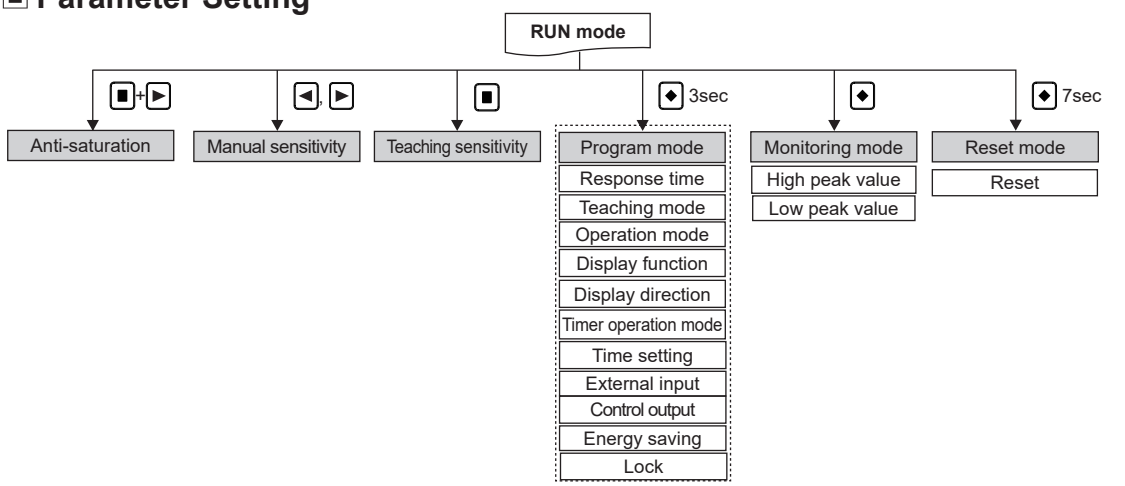


▣ Unit Descriptions



1. **Control output indicator:** Used to indicate control output provided by comparing SV and actual incident light level.
2. ▣ **(SET) key:** Used to execute each operation and to set sensing sensitivity.
3. **Measured value (PV) display part**
   - RUN mode: It displays present value (PV) of input incident light.
   - Setting mode: It displays the parameter.
4. **Set value (SV) display part**
   - RUN mode: It displays the setting value (SV).
   - Setting mode: It displays the setting value of the parameter.
5. ◄, ► **key:** Used to enter SV setting mode, move up/down digit, set sensitivity manually.
6. ◆ **(MODE) key:** Used to enter program mode, RUN mode, move parameters, or save the setting value.
7. **Lock lever:** Used to connect fiber optic cable.

▣ Parameter Setting



▣ Sensitivity Setting

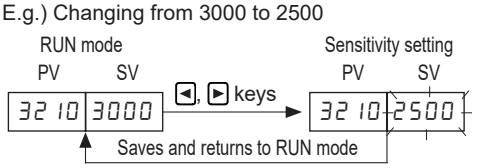
※**You can set sensitivity by manual or teaching (sensitivity setting by button or external input). Execute the proper sensitivity settings for your application.**

◎ Manual sensitivity setting (fine-adjusting sensitivity)

- This setting is to set the sensitivity manually.
- Used to fine-adjust sensitivity after the teaching sensitivity setting.
- Incident light level is still displayed on the Measured value (PV) display part during setting.

① Press the ◄, ► keys to set the value in RUN mode.
② Press the ◆ (MODE) key to save the setting. If there is no key input for 3 sec after completing setting, last set value flashes twice (every 0.5 sec) and automatically saved it and returned to RUN mode.

E.g.) Changing from 3000 to 2500



◆(MODE) key or
after 3 sec, the value flashes twice (every 0.5 sec)

◎ Teaching sensitivity setting (sensitivity setting by button or external input)

- Sensitivity setting by button (▣ (SET) key) : Press the ▣ (SET) key once in RUN mode and teaching automatically starts. When teaching completes, it returns to RUN mode automatically.
- Sensitivity setting by external input: Set the sensitivity by external input signal wire not by using the ▣ (SET). This is available only when external input [d-in] is set as [SEt]. (Refer to " ▣ Control output circuit diagram and Connections".)
- During teaching, the Measured value (PV) display part displays the set teaching mode parameter and the setting value (SV) display part displays progressing status.
- Before sensitivity setting, set the proper teaching mode (auto-tuning, one-point , two-point, positioning teaching mode) .

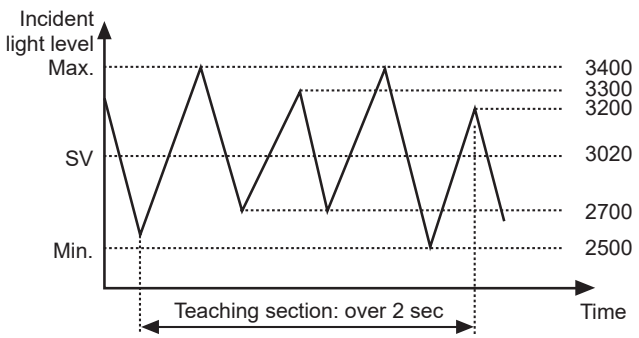
※Refer to the below for the each teaching sensitivity setting.

1) Auto-tuning teach mode

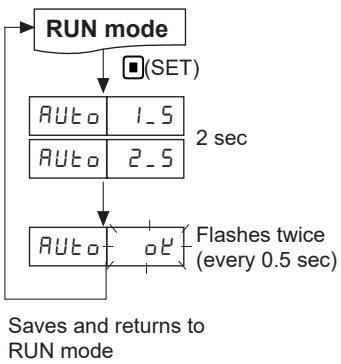
※Suitable when incident level of sensing object is not stable or when sensing fast moving objects.
※Auto-tune automatically sets the sensitivity using the average value of the max./min. incident light level within a certain time period.

$$\text{Set value} = \frac{\text{P (Max)} + \text{P (Min)}}{2}$$

- Set Teaching mode [SEnS] to auto-tuning [AUto].



※Press the ▣ (SET) key once, and teaching starts automatically.

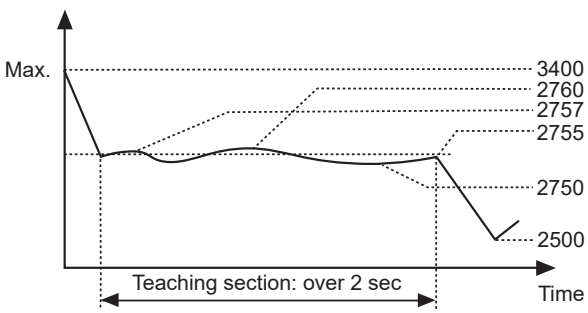


Saves and returns to RUN mode

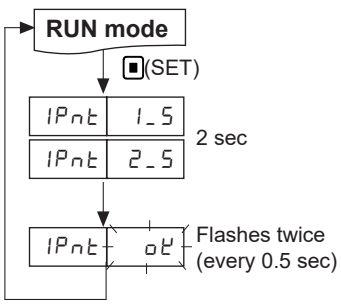
2) One-point teach mode

※One of teaching modes that sets the maximum sensitivity by teaching one sensitivity setting point when setting the SV with no sensing object (reflective) or when setting the SV with incident light level 0 (through-beam) / Suitable for the applications required little effect of dust or background.

- Set Teaching mode [SEnS] to 1-point [1Pnt].



※Press the ▣ (SET) key once, and teaching starts automatically.

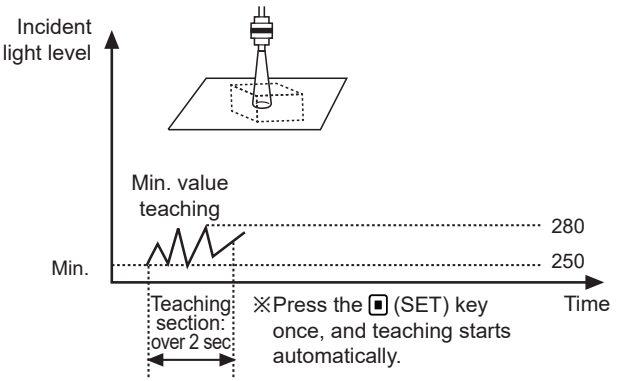


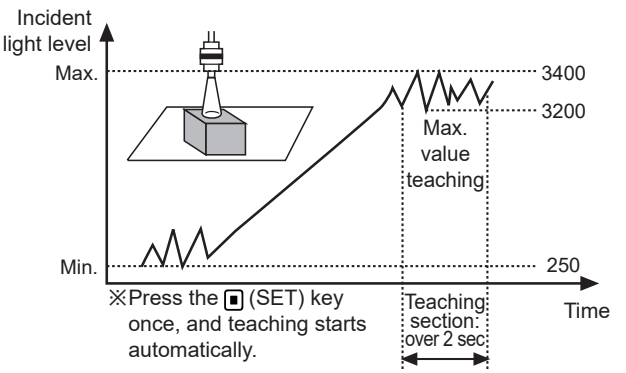
Saves and returns to RUN mode

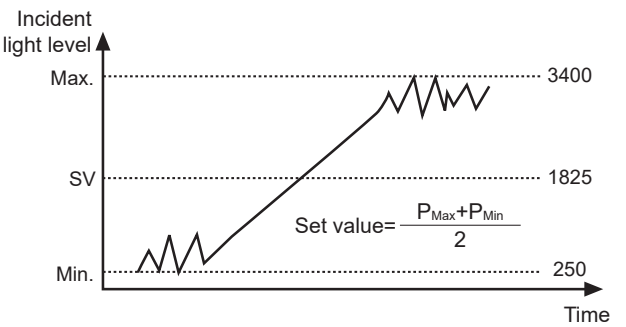
3) Two-point teach mode

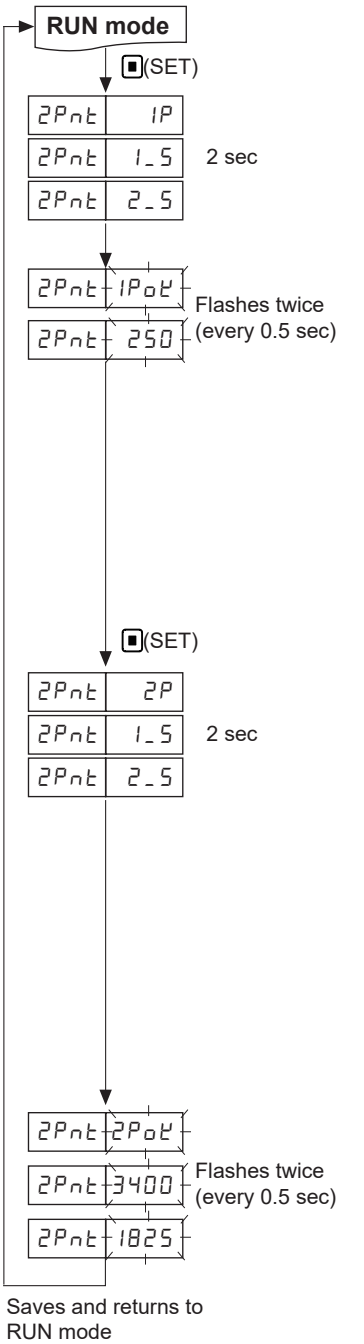
※Suitable when incident light level is stable or when sensing object is slow or at stopped position.
※One of teaching modes that sets the sensitivity using the average value of two incident light levels obtained from two point teaching - one point with a sensing object and the other point without a sensing object.

● Set Teaching mode [5En5] to 2-point [2Pnt].





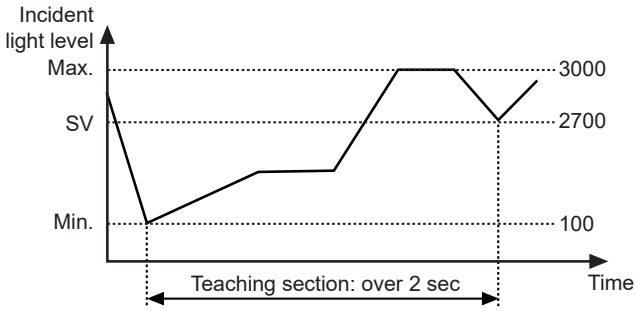




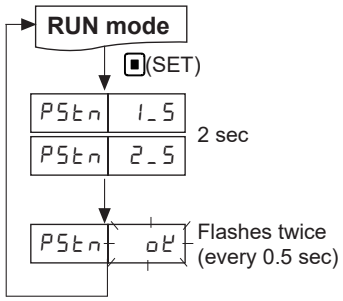
4) Positioning teach mode

※One of teaching modes that sets the sensitivity to 90% of max. incident light level when sensing an object with a hole on the surface (Through-beam) or sensing a moving object having curve (Reflective).

- Set teaching mode [SEnS] to positioning [PStn].



※Press the ■ (SET) key once, and teaching starts automatically.



※Set value (SV) range for sensing distance.

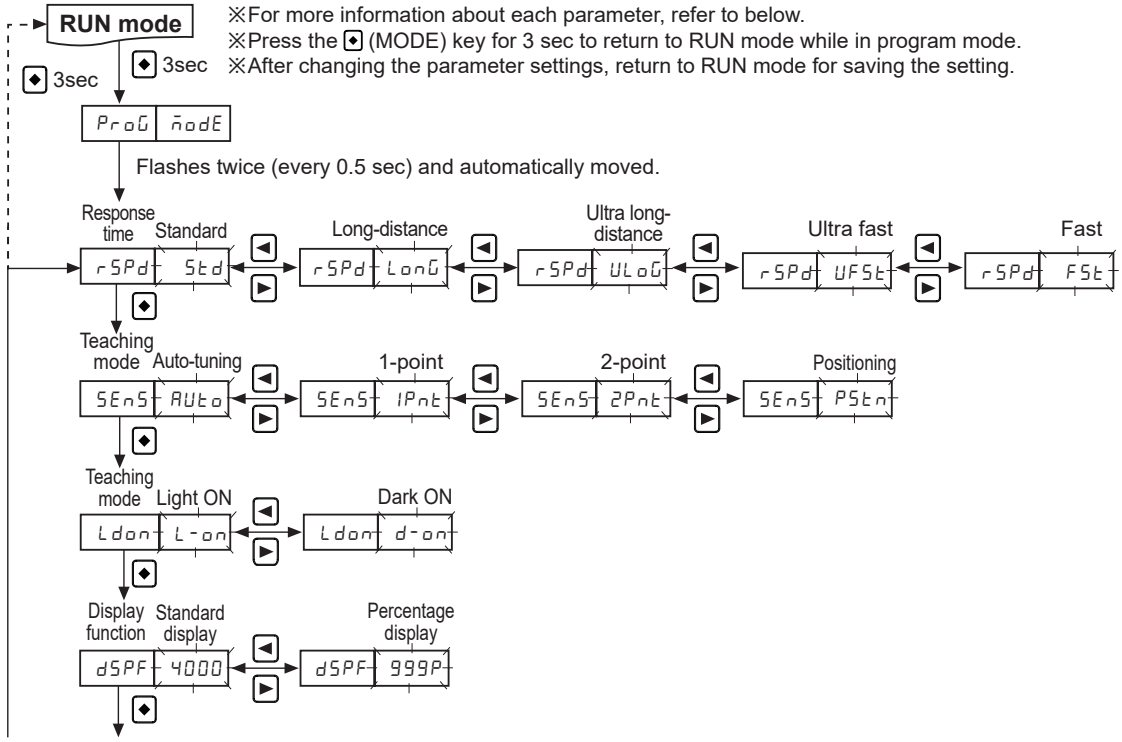
Response Time	Teaching when incident light level is 0	Teaching when incident light level is saturated
UFSt / FSt / Std	Set to 10-digit.	Set to 3980-digit.
LoG / ULoG	Set to 5-digit.	Set to 9980-digit.

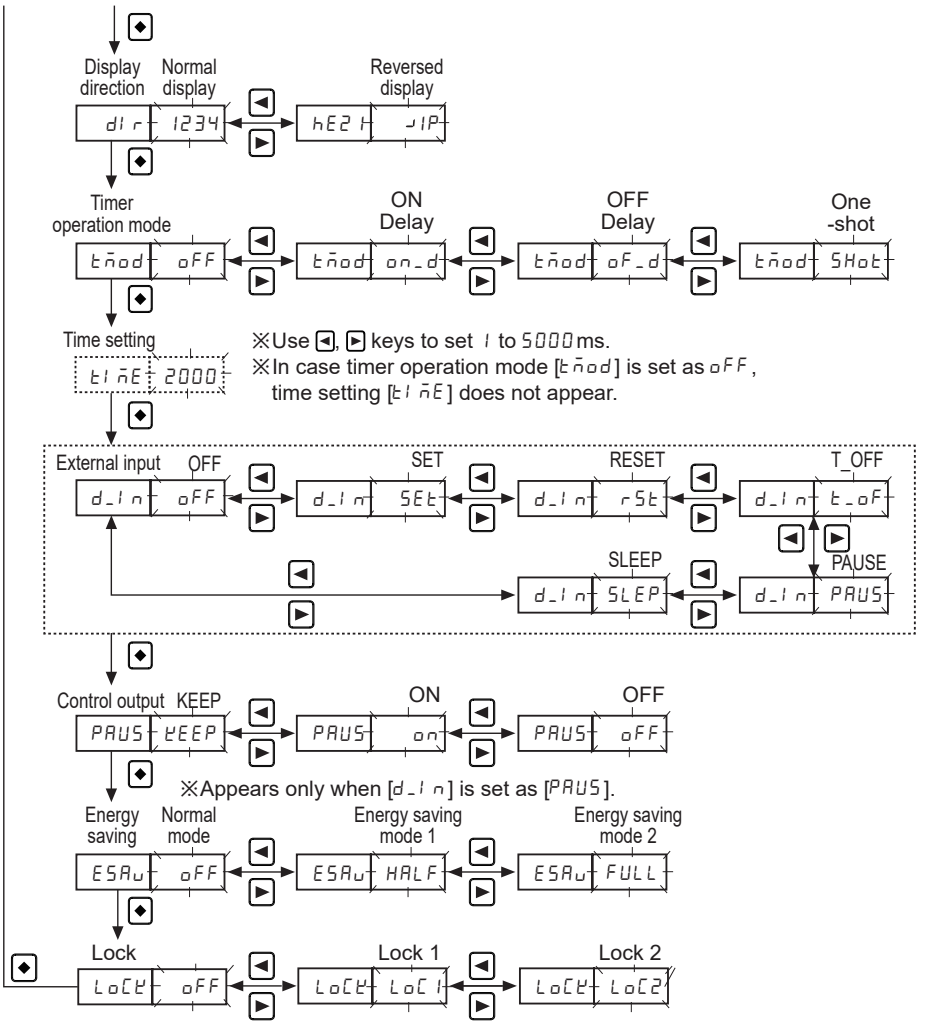
■ Error Display

Error code	Cause	Troubleshooting
Err	In case overcurrent inflow occurs into the output circuit.	Remove the overcurrent due to the overload.

■ Program Mode

◎ When entering into program mode, the parameter turns ON at the Measured value (PV) display part and the setting value flashes every 0.5 sec at the setting value (SV) display part. Use the ◀, ▶ keys to set each setting value.
◎ Press the ◆ (MODE) key one time after setting each parameter to save the setting and enter into next mode.
◎ If the lock is set, unlock the key before setting parameters.





▣ Program Mode Function

◎ Response time [rSPd]

This function is to set the response time of control output.

- Ultra fast [UFSt]: 50μs
- Fast [FSt]: 150μs
- Standard [Std]: 500μs
- Long distance [LonG]: 4ms
- Ultra long distance [ULoG]: 10ms

◎ Operation mode[Ldon]

This function is to set Light ON - control output is ON when incident light level is higher than setting value and Dark ON - control output is ON when incident light level is lower than setting value.

◎ Display [dSPF]

This function is to select display mode for incident light level on the PV display part.
: standard display (4000) / Percentage display (999P)

- Display range of standard display: 0 to 4000 (0 to 9999, in case of long distance mode)
- Display range of percentage display: 0P to 999P (decimal point is not displayed)

◎ Display direction [dIr]

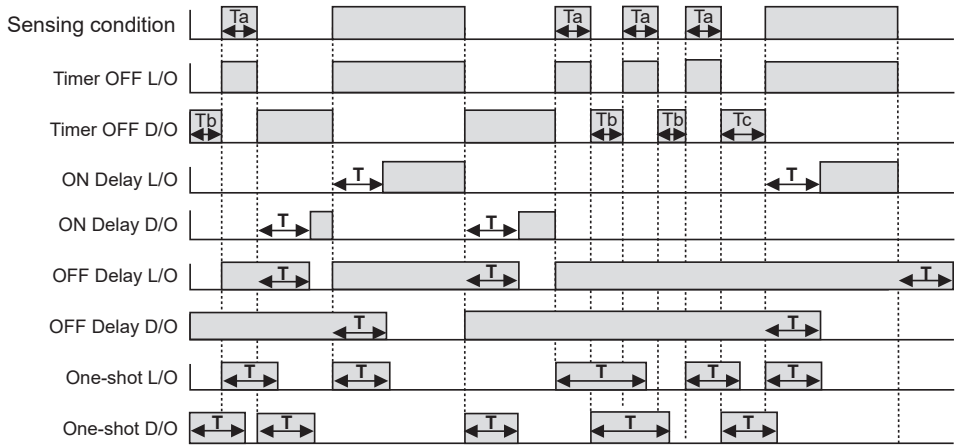
This function is to reverse the display direction to suit the unit installation location.
: Normal display / Reversed display selectable.
※Reversed display is upside-down (180˚) display of normal display.

◎ Timer [Timer operation mode: tMod, Time setting: tIME]

This function is for when the response speed of external device is too slow or control output time is short by small target sensing.

- Timer OFF [OFF]: Do not use timer function.
- ON Delay [On-d]: Control output time from OFF to ON is delayed during the setting time.
- OFF Delay [oF-d]: Control output time from ON to OFF is delayed during the setting time.
- One-shot [SHot]: Control output turns ON or OFF within the setting time.
- Time setting [tIME]: 1 to 5000ms
- Timing chart

[T: setting time]



※Setting time: T>Ta , T>Tb , T>Tc>Tb

◎ External input [d-In]

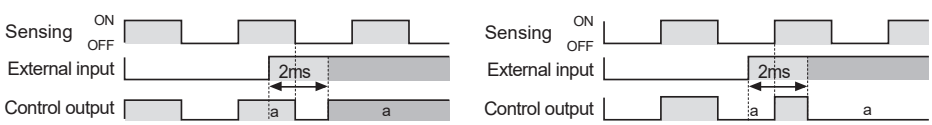
If button operation is difficult, external input is available to execute the dedicated operation.

- OFF [OFF]: Do not use external input function.
- SET [SEt]: External input is used for sensitivity setting, depending on the teaching mode [SEnS].
- RESET [rSt]: External input is used for initializing high peak/low peak.
- T_OFF [t-oF]: During external input, emitter turns OFF.
- PAUSE [PAUS]: External input is used for setting control output mode between Keep/ON/OFF.
- SLEEP [SLEP]: External input is used for turning OFF the energy saving [ESAu] mode.

◎ Control output setting [PAUS]

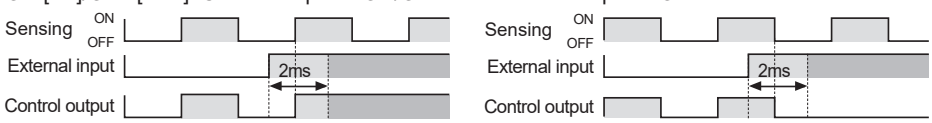
External input is used for setting control output mode between Keep [KEEP]/ON [On]/OFF [OFF]. Only when inputting over the response time (2ms), it is regarded as external input and control output is changed as setting.
(This function is activated only when external input [d-In] is set to [PAUS].)

- Keep [KEEP]: Control output status at the inputting moment of external input (a) is maintained while external input is ON.



<External input: Keep (a=ON) > <External input: Keep (a=OFF) >

- ON [On]/OFF [OFF]: Control output is ON/OFF while external input is ON.



<External input: ON> <External input: OFF>

◎ Energy saving [ESAu]

This function is to save unit's power consumption by reducing power supplying to display parts in case of no setting input within 60 sec.

Type	Control output indicator	Measured value (PV) display part	Set value (SV) display part
Normal mode [OFF]	☼	☼	☼
Energy saving mode 1 [HALF]	☼	☼	●
Energy saving mode 2 [FULL]	☼	●	●

☼: ON
●: OFF

◎ Lock [LoCK]

Two types of key lock setting available in order to prevent SV changes due to careless.

Parameter	oFF	LoC1	LoC2
Sensitivity setting	●	◐	◐
Program mode	●	◐	○
Parameter reset	●	○	○
Anti-saturation	●	○	○
External input	●	○	○

●: available to check/set
◐: available to check/ unavailable to set
○: unavailable to check/set

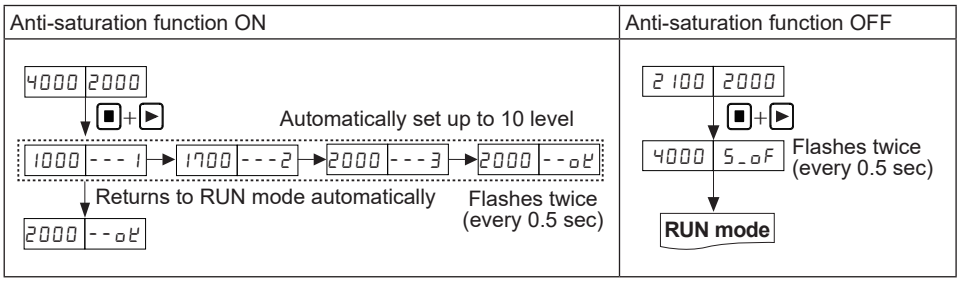
● In case of LoC2, it is required to set to lock first to enter into parameter mode.

◎ Anti-saturation

- When the sensing target comes too close and it is saturation status, this function corrects the optimize status.
- Press the ■ (SET) + ▶ keys one time and anti-saturation function operates automatically. There are max. 10 levels.
- Press the ■ (SET) + ▶ keys one time again and anti-saturation function is cleared.
- During anti-saturation, the setting value (SV) display part displays current level.
- When response time mode is ultra fast[UFSt], fast[FSt], standard[Std], and incident light is over than 2000, the setting is complete. When the mode is long distance[LonG], ultra long distance[ULoG], and incident light is over than 5000, the setting is complete. After completing the setting, it returns to RUN mode automatically.

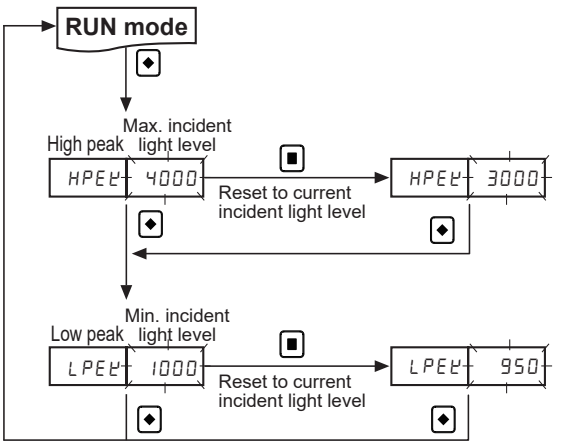
※This function does not execute when present incident is lower than the determined value.
(UFSt, FSt, Std: 2000, LonG, ULoG: 5000)

※When anti-saturation function is set, control output operation may be changed.



▣ Monitoring Mode

This function is to monitor high/low peak value of incident light level. The monitored high/low peak value can be reset.



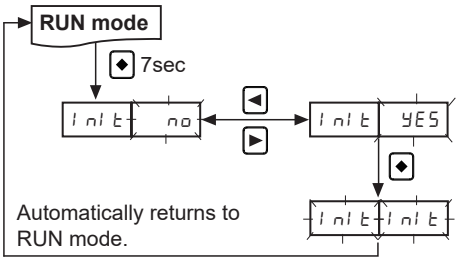
① Press the ◆ (MODE) key for a sec to monitor max/min incident light level.
② Press the ■ (SET) key to initialize max/min value to current incident light level during monitoring.
③ Press the ◆ (MODE) key to return to RUN mode.

※When lock is set as LoC2 and max./min. value is checked, it is not reset.

▣ Parameter Reset

- This function is to initialize all parameters in memory to default value in case the possibility of mis-setting or mis-operation.
- Set lock function [LoCK] to oFF to execute parameter initialization.
- High peak value [HPEK] and low peak value [LPEK] is not initialized.

◎ Parameter reset flow



① Press the ◆ (MODE) key for 7 sec in RUN mode. [Init] turns ON on the Measured value (PV) display part and no flashes every 0.5 sec on the setting value (SV) display part.
② Press the ◆ (MODE) key once again to return to RUN mode not to execute the initialization.
③ Select YES using ◀, ▶ keys and press the ◆ (MODE) key. Init flashes twice on both the Measured value (PV) and Set value (SV) display parts.
④ When parameter initialization is completed, it is automatically returned to RUN mode.

◎ Factory default

Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
rSPd	Std	SEnS	AUto	Ldon	L-on	dSPF	4000	dIr	1234
tmod	oFF	d-In	oFF	ESAu	oFF	LoCK	oFF	—	—
SV: 2000									

Dual Digital Display Type Fiber Optic Amplifiers

■ Features

- Dual-display for light incident level and setting value (BF5□-D)
- Enables to detect the minute object with 1/10,000 high resolution
- Enables to detect with high-speed moving object (response speed 50μs)
- 5 response speeds
  : Ultra fast mode (50μs), High speed mode (150μs), Standard mode (500μs), Long distance mode (4ms), Ultra long distance mode (10ms)
- Anti-saturation setting function prevents malfunction by saturated light
- Easy sensitivity setting
- Long lasting amplifier regardless of element's life degradation or temperature change
- Multiple sensitivity setting modes available
  : auto tuning, 1 point (maximum sensitivity), 2 point, positioning teaching
- Up to 8 units enable to connect with mutual interference prevention function using side connectors
- Auto channel setting function for multiple installations
- Adopts red, green, blue light sources for various environment
- Slim design (W10×H30×L70mm)

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

CE

■ Ordering Information

BF 5 R - D 1 - N

Control output	N	NPN open collector output
	P	PNP open collector output
Standard	1	Standard type
Display type	D	Dual display type
	S	Single display type
Light source	R	Red LED
	G	Green LED
	B	Blue LED
Series	5	Series
Item	BF	Fiber Sensor

■ Specifications

Display type		Dual Display type			Single Display type
Model	NPN open collector output	**BF5R-D1-N**	**BF5G-D1-N**	**BF5B-D1-N**	**BF5R-S1-N**
	PNP open collector output	**BF5R-D1-P**	**BF5G-D1-P**	**BF5B-D1-P**	**BF5R-S1-P**
Light source		Red LED (660nm)	Green LED (530nm)	Blue LED (470nm)	Red LED (660nm)
Power supply		12-24VDC⎓±10%			
Current consumption		Max. 50mA			
Operation mode		Light ON / Dark ON Selectable			
Control output		NPN or PNP open collector ●Load voltage: max. 24VDC⎓ ●Load current: max. 100mA ●Residual voltage - NPN: max. 1V, PNP: max. 3V			
Protection circuit		Power reverse polarity protection circuit, output short over current protection circuit, surge protection circuit			
Response time		Ultra Fast: 50μs, ultra long: 10ms (only for dual display type), fast: 150μs, STD: 500μs, long: 4ms			
Display method		●Incident light level: red, 4-digit, 7-segment ●SV: green, 4-digit, 7-segment ●Control output indicator: red LED			●Incident light level / SV: red, 4-digit, 7-segment ●Control output indicator: red LED
Display function		Incident light level / SV [4,000/10,000 resolution], percentage, High/Low peak value, Normal / Reversed (only for dual display type)			
Sensitivity setting		Manual sensitivity, teaching sensitivity (auto tuning, 1 point, 2 point teaching, positioning teaching)			Manual sensitivity, teaching sensitivity (auto tuning)
Mutual interference prevention		Max. 8 unit sets (automatically set regardless of response time)			
Initializing		Initializing as factory mode			—
Energy saving		Normal / Energy saving 1 / Energy saving 2			—
Timer		OFF, OFF Delay, ON Delay, One-shot			OFF, 10ms OFF Delay timer, 40ms OFF Delay timer

▣ Specifications

Display type		Dual Display type			Single Display type
Model	NPN open collector output	**BF5R-D1-N**	**BF5G-D1-N**	**BF5B-D1-N**	**BF5R-S1-N**
	PNP open collector output	**BF5R-D1-P**	**BF5G-D1-P**	**BF5B-D1-P**	**BF5R-S1-P**
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Incandescent lamp: max. 3000lx sunlight: max. 11000lx (received illumination)			
	Ambient temperature	-10 to 50℃, storage: -20 to 70℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP40 (IEC standards)			
Material		Case: polybutylene terephthalate, cover: polycarbonate			
Fiber cable Tightening torque		Min. 2kgf			
Accessory		Connector type wire (Ø4mm, 3-wire, 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm), Side connector			
Approval		CE			
Weight※1		Approx. 138g (approx. 20g)			

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Feature Data

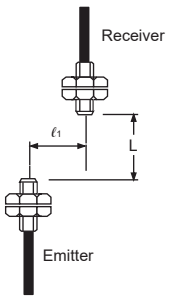
◎ Ultra fast [UFSt] mode

• Through-beam type

- Measurement: BF5□ + FT-420-10

Parallel shifting characteristic

Measuring method



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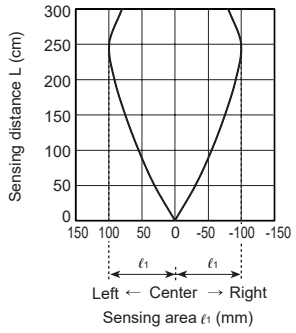
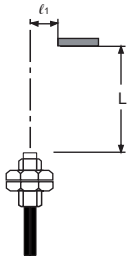


• Diffuse reflective type

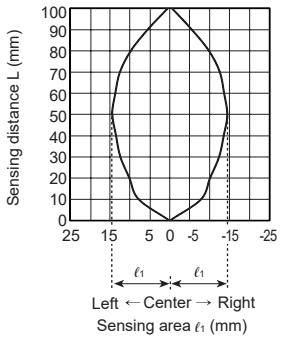
- Measurement: BF5□ + FD-620-10

Sensing area characteristic

Measuring method



Data



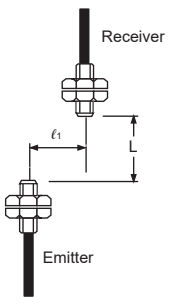
◎ Fast [FSt] mode

• Through-beam type

- Measurement: BF5□ + FT-420-10

Parallel shifting characteristic

Measuring method



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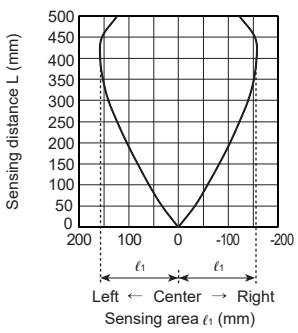
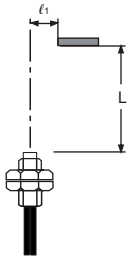


• Diffuse reflective type

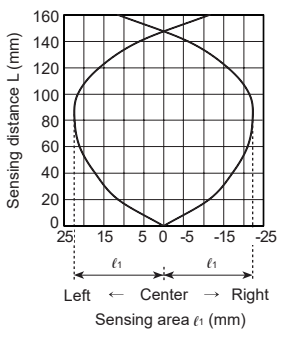
- Measurement: BF5□ + FD-620-10

Sensing area characteristic

Measuring method



Data



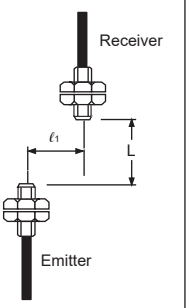
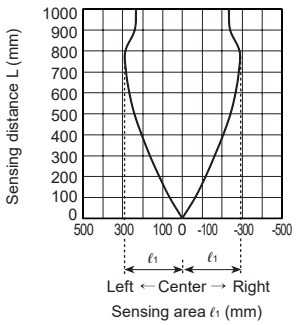
▣ Feature Data

◎ Standard [Std] mode

• Through-beam type

- Measurement: BF5□ + FT-420-10

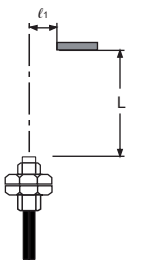
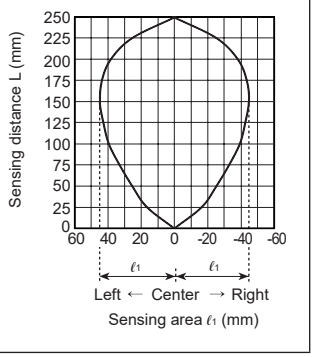
Parallel shifting characteristic

Measuring method	Data
	

• Diffuse reflective type

- Measurement: BF5□ + FD-620-10

Sensing area characteristic

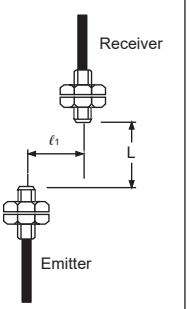
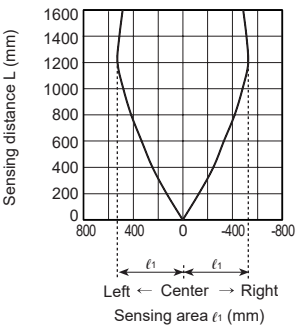
Measuring method	Data
	

◎ Long [Long] mode

• Through-beam type

- Measurement: BF5□ + FT-420-10

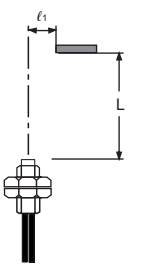
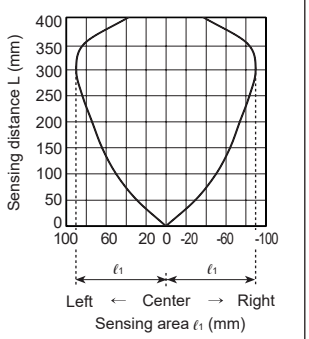
Parallel shifting characteristic

Measuring method	Data
	

• Diffuse reflective type

- Measurement: BF5□ + FD-620-10

Sensing area characteristic

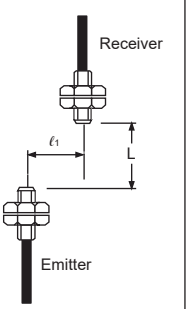
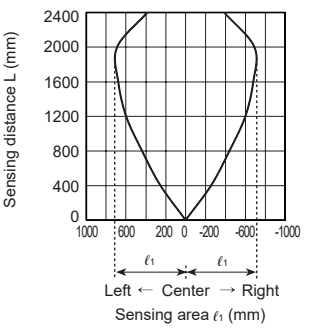
Measuring method	Data
	

◎ Ultra long [ULong] mode

• Through-beam type

- Measurement: BF5□ + FT-420-10

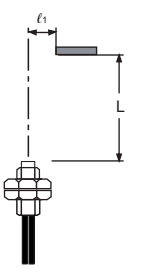
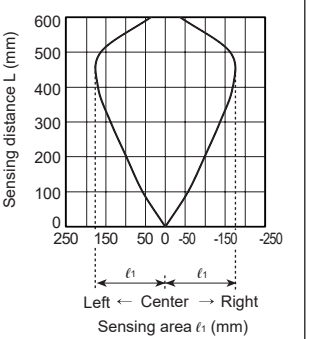
Parallel shifting characteristic

Measuring method	Data
	

• Diffuse reflective type

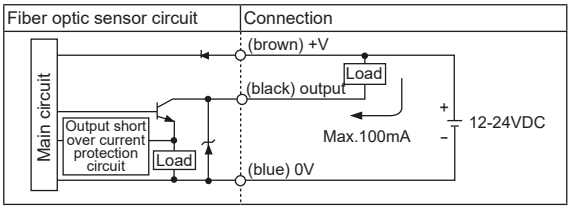
- Measurement: BF5□ + FD-620-10

Sensing area characteristic

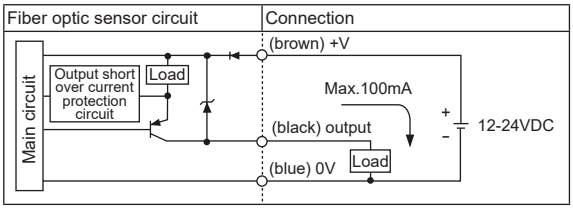
Measuring method	Data
	

▣ Control Output Diagram

● NPN open collector output



● PNP open collector output

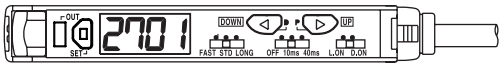


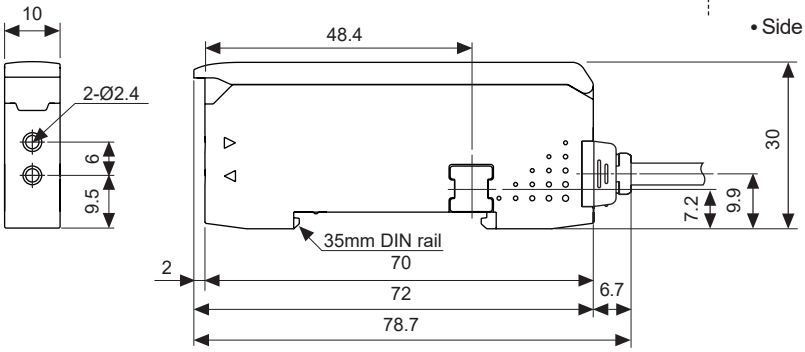
▣ Dimensions

(unit: mm)

● BF5□-D1-□

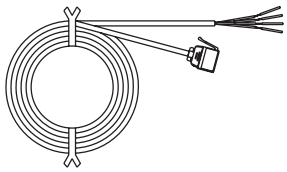
● BF5R-S1-□





● Accessories

• Connector type wire (length: 2m)



• Side connector

▣ Installations

◎ Amplifier unit mounting

- Installation: Hang up the backside holder on the DIN rail and press the unit toward the DIN rail.
- Removal: Slide the back part of the unit as the figure ① and lift up the unit as the figure ②.

◎ Amplifier unit connection

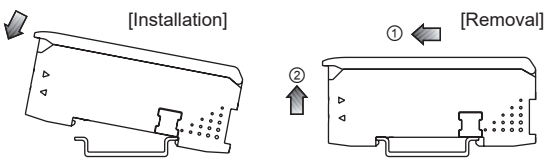
- Remove the side cover at the connecting side as the figure ① and connect the side connector as the figure ②.

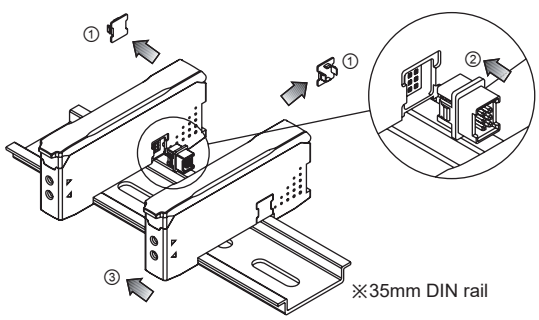
※Be sure that if you connect a side connector with excessive force, it may cause extruded pins.

- After mounting the unit on the DIN rail, push gently both units to fasten each other as the figure ③.

※Make sure that connections between the unit case and connectors are correct. Improper connection may cause malfunction of channel setting and mutual interference prevention functions.

※Do not supply the power while connecting / disconnecting amplifier units.



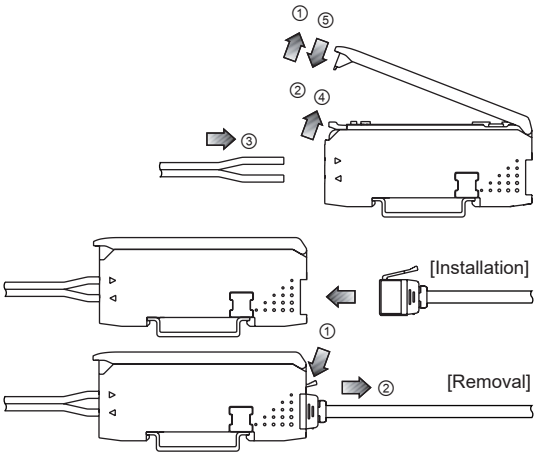


◎ Fiber cable connection

- Lift up the protective cover ① and push down the lock lever to the direction of ② to release the lock setting.
- Insert the cable to the direction of ③ with slightly moving up and down 15˚, and gently press into the unit until the cable is completely inserted (inserted length: around 13mm).
- Lift up the lock lever to lock the lock setting ④ and close the protective cover to ⑤.

◎ Wire connector connection

- Insert the connector into the amplifier unit until it clicks into right position.
- When removing the connector, pull out the connector to the ① direction by pressing the lever downside to the ② direction.

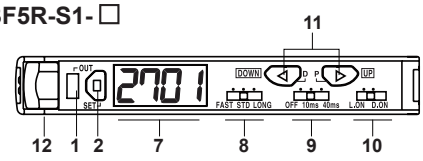


▣ Unit Descriptions

● **BF5☐-D1-☐**

1. Control output indicator (red)
: Used to indicate control output provided by comparing SV and actual incident light level
2. Sensitivity setting key
: Used to execute each operation and to set sensing sensitivity
3. PV display part (4-digit, red, 7-segment)
: Used to indicate incident light level and parameters
4. SV display part (4-digit, green, 7-segment)
: Used to indicate SV and setting data
5. Up/down key
● Used to up/down setting values
● Used to Fine-adjusting sensitivity
6. MODE key
● Used to enter into program mode / data Bank mode
● Used to move each parameter

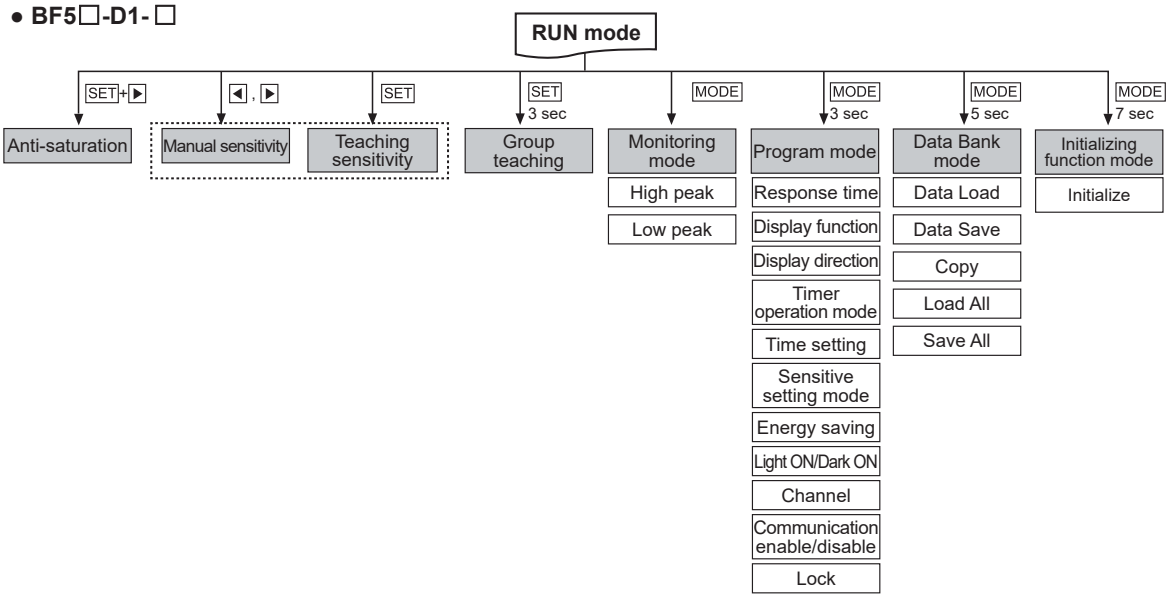
● **BF5R-S1-☐**



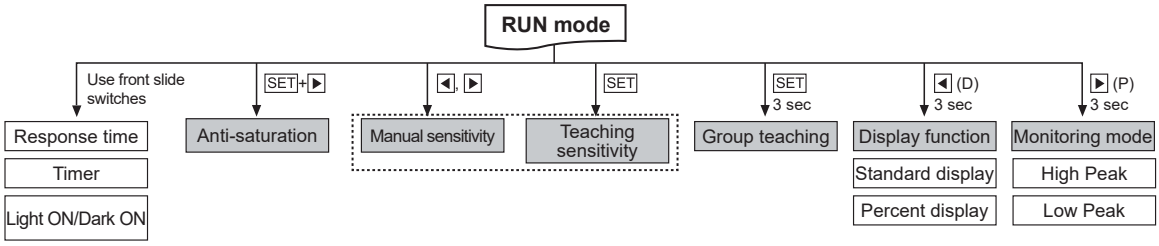
7. PV/SV display part (4-digit, red, 7-segment)
: Used to indicate incident light level / SV and parameters
8. Response time setting switch: FAST, STD, LONG
9. Timer setting switch
: Used to select OFF Delay time (OFF, 10ms, 40ms)
10. Operation mode setting switch
: Used to select Light ON / Dark ON
11. Up/Down key
● Used to up/down setting values
● Used to enter into each mode
● Used to Fine-adjusting sensitivity
12. Lock lever

▣ Parameter Setting

● **BF5☐-D1-☐**



● **BF5R-S1-☐**



Dual display type

▣ Sensitivity Setting

※There are two methods available for sensitivity setting - manual/teaching sensitivity setting.
Select the method most suitable for your application.

◎ Manual sensitivity setting (Fine-adjusting sensitivity)

- The setting is to set the sensitivity manually.
- Used to fine-adjusting sensitivity after the teaching sensitivity setting.
- Incident light level is still displayed on the PV display part during setting.

① Press the ◀ and ▶ keys to set the value.
② There is no additional key for completing the setting. After completing setting and no key input for 3 sec, let set value flashing twice (every 0.5 sec) and automatically it saved and returned to RUN mode.

◎ Teaching sensitivity setting (Auto-tuning, One-point, Two-point, Positioning)

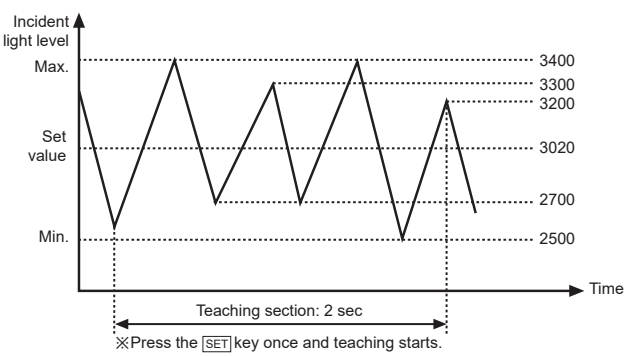
- How to enter into sensitivity setting mode in RUN mode
  Press the SET key once and teaching starts automatically.
  When teaching is completed, this unit returns to RUN mode automatically.
- The PV display part displays the set teaching mode parameter and the SV display part displays the progressing status while teaching is in the process.
  ※If there is no key operation for 60 sec after entering into teaching mode, it automatically returns to RUN mode.

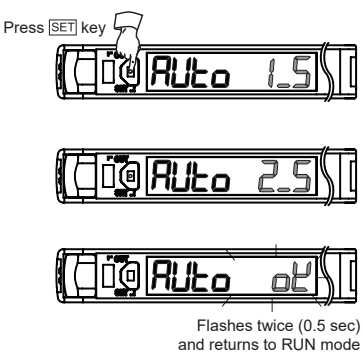
1) Auto-tuning

※Suitable when unstable incident light level of sensing object or when sensing fast moving objects.
※Auto-tune automatically sets the sensitivity by using the average value of the incident light level within a certain period.

$$\text{Set\_value} = \frac{\text{P1+P2+} \cdots \text{+Pn-1+Pn}}{\text{n}}$$

- Set Teaching mode parameter[SEnS] to AUto.

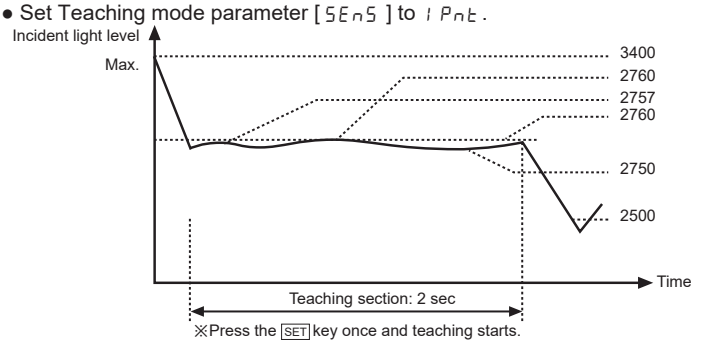


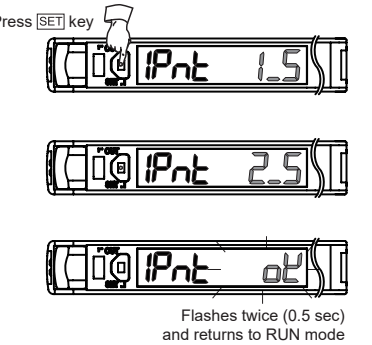


2) One-point teaching mode

※One of teaching modes that sets the maximum sensitivity by teaching one sensitivity setting point when setting the SV with no sensing object (Reflective) or when setting the SV with incident light level 0 (Through-beam) / Suitable for the applications no effect of dust or background.

● Set Teaching mode parameter [SEnS] to 1Pnt.





※SV range for sensing distance.

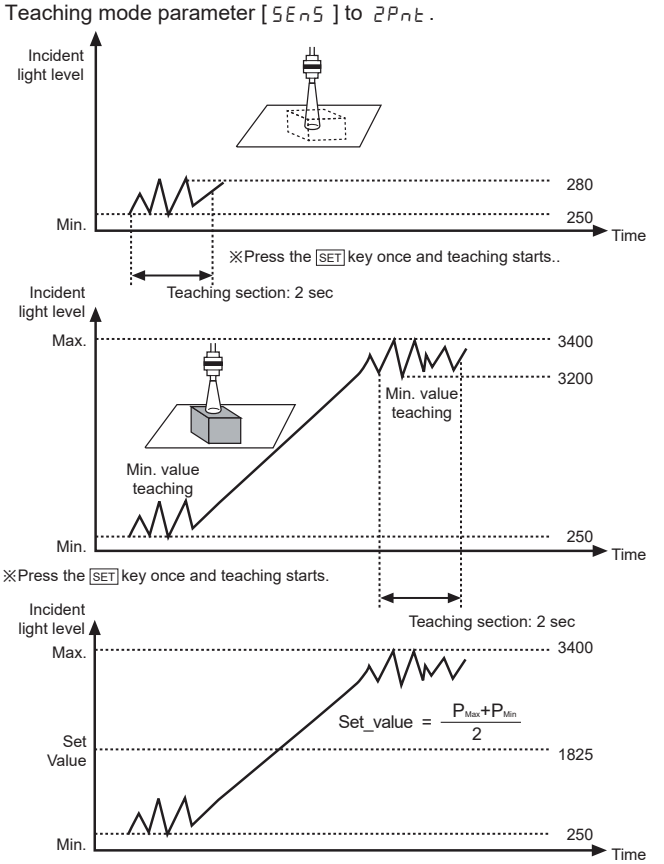
Response Time	Teaching when incident light level is 0	Teaching when incident light level is saturated
UFSt	In case incident light level is 0, set to 10-digit.	In case incident light level is saturated, set to 3980-digit.
FSt		
Std		
LoG	In case incident light level is 0, set to 5-digit.	In case incident light level is saturated,set to 9980-digit.
ULoG		

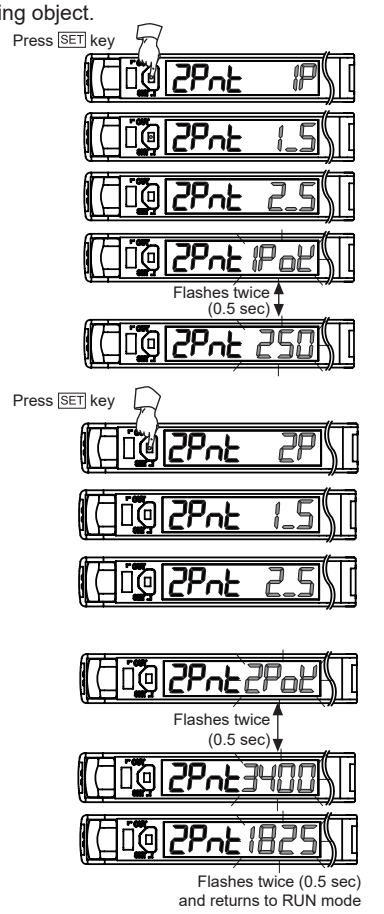
3) Two-point teaching mode

※Suitable when incident light level is stable or when sensing object is slow or at stopped position.

※One of teaching modes that sets the sensitivity by using average value of two incident light levels obtained from two point teaching - one point with a sensing object and another point without a sensing object.

● Set Teaching mode parameter [SEnS] to 2Pnt.



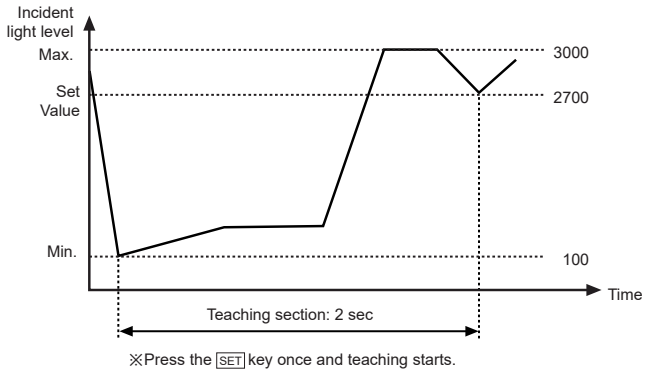


※Make sure that two point teaching must be done within 60 sec after one point teaching. If not, teaching mode is cancelled and it returns to RUN mode.

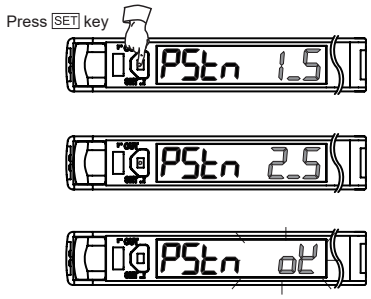
4) Positioning teaching mode

※One of teaching modes that sets the sensitivity by 90% of max. incident light level when sensing an object with a hole on the surface (Through-beam) or sensing a moving object with curve (Reflective).

● Set Teaching mode parameter [SEnS] to PStn.



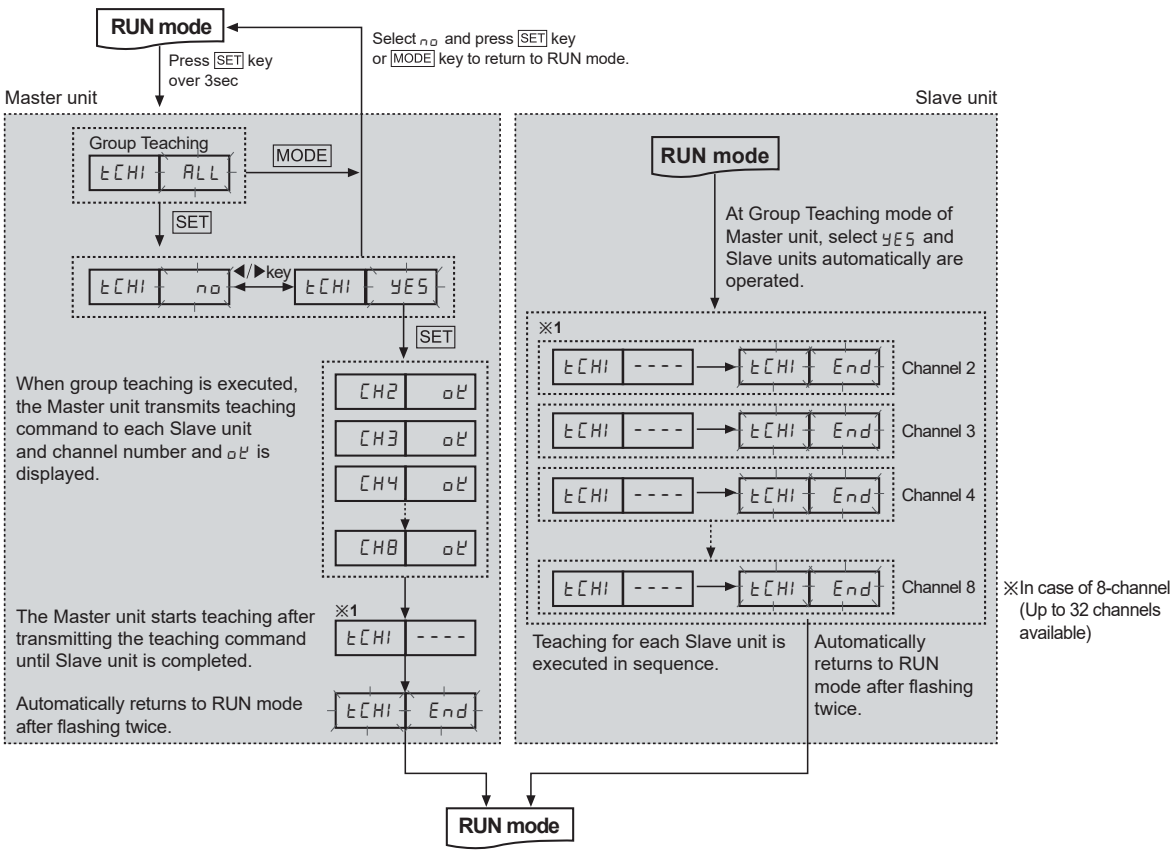
※Press the SET key once and teaching starts.



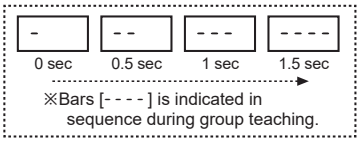
Flashes twice (0.5 sec) and returns to RUN mode

▣ Group Teaching mode

A function to set the sensitivity of Slave amplifier units according to the command of Master amplifier unit (a certain amplifier unit) in a successive and collective way.

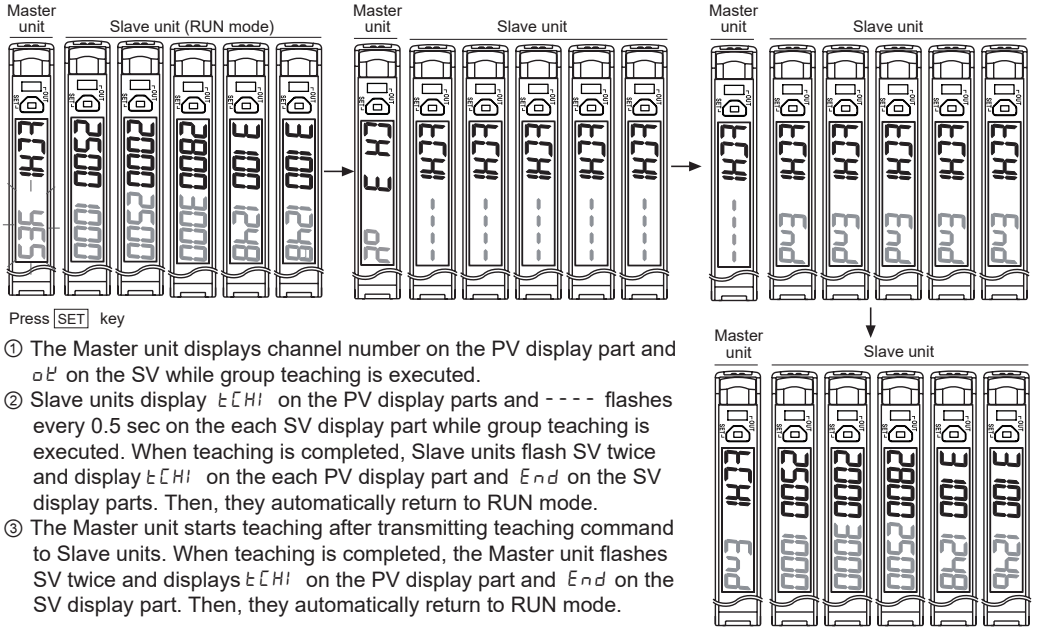


※**1:** Display part status while teaching is in the process



※Bars [- - - -] is indicated in sequence during group teaching.

● **Master / Slave unit display during group teaching mode**

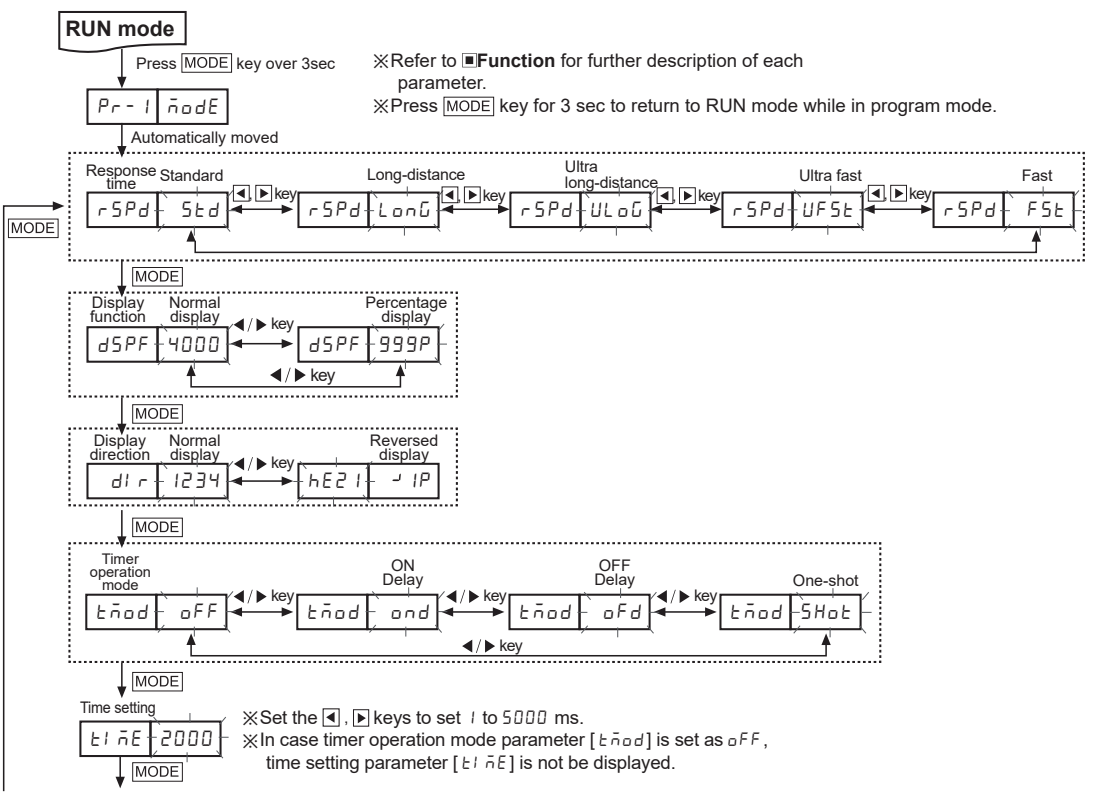


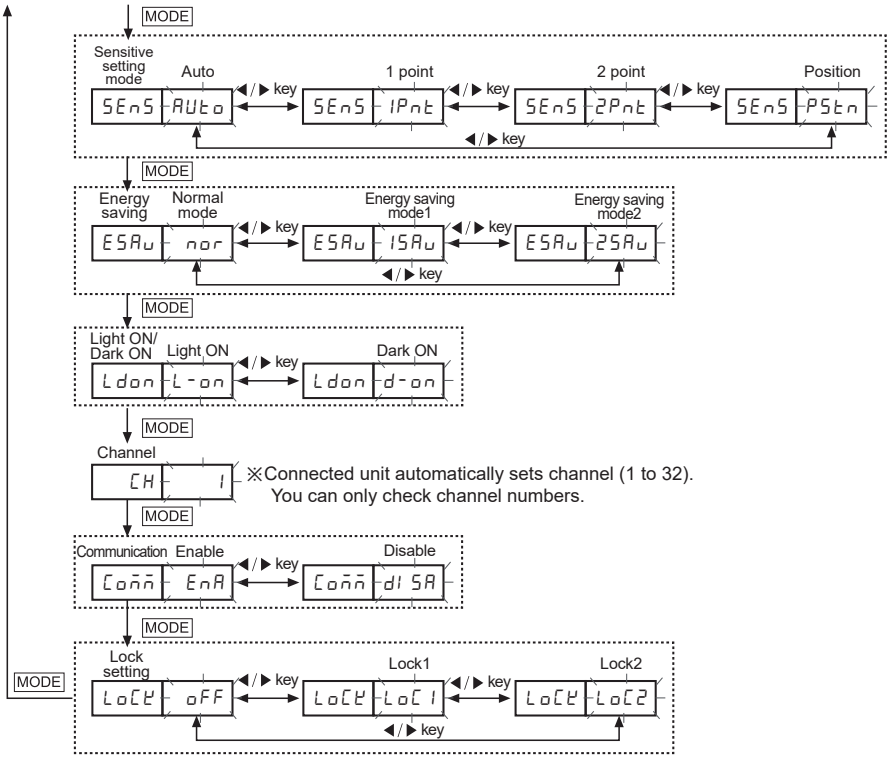
① The Master unit displays channel number on the PV display part and oU on the SV while group teaching is executed.
② Slave units display tCHI on the PV display parts and - - - - flashes every 0.5 sec on the each SV display part while group teaching is executed. When teaching is completed, Slave units flash SV twice and display tCHI on the each PV display part and End on the SV display parts. Then, they automatically return to RUN mode.
③ The Master unit starts teaching after transmitting teaching command to Slave units. When teaching is completed, the Master unit flashes SV twice and displays tCHI on the PV display part and End on the SV display part. Then, they automatically return to RUN mode.

▣ Program Mode Setting

- When entering into program mode, parameters lights ON on the PV display part and setting values flashes every 0.5 sec on SV display part. Use the ◀ , ▶ keys to set each setting value.
- Press the MODE key one time after setting each parameter to save each setting and enter into next mode.
- If the key lock is set, unlock the key lock before setting parameters.

◎ Program mode flow





■ Function

◎ Response time setting [rSPd]

A function to set the response time of control output - 4 response modes selectable.

- Ultra fast [UFSt] mode: 50μs
- Fast [FSt] mode: 150μs
- Standard [Std] mode: 500μs
- Long-distance [LonG] mode: 4ms
- Ultra long-distance [ULoG] mode: 10ms

◎ Display [dSPF]

A function to select incident light level display mode on PV display window: Standard display [4000] / Percentage display [999P]

- Display range of standard mode: 0 to 4000 (0 to 9999, in case of long distance mode)
- Display range of percentage mode: 0P to 999P (Decimal point is not displayed)

◎ Display direction [dIr]

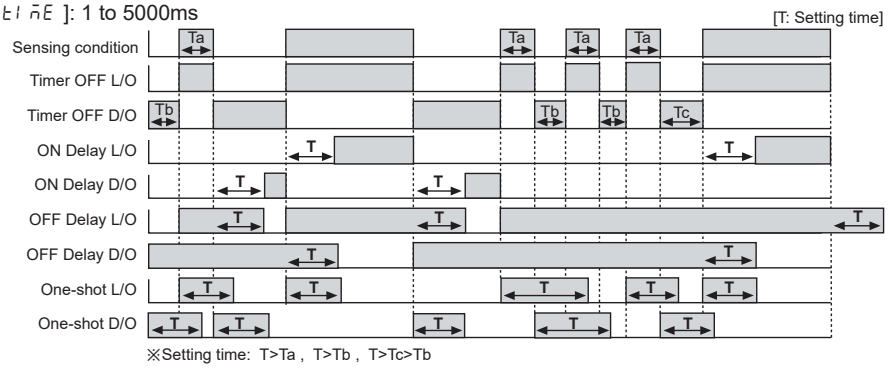
A function to reverse the display direction to suit the unit in the location for installation: Normal display / Reversed display selectable.

※Reversed display is upside-down (180°) display of normal display.

◎ Timer [Timer operation mode: tmod, Time: tIME]

Used when external device's response time is too late or when control output time is too short due to small sensing object - 3 modes are available.

- Timer Off [oFF]: Not using timer function.
- On Delay [ond]: Delays control output ON time from OFF for a certain period of setting time.
- Off Delay [oFd]: Delays control output OFF time from ON for a certain period of setting time.
- One-shot [SHot]: Turns control output ON or OFF within a certain period of setting time.
- Setting time [tIME]: 1 to 5000ms
- **Time chart**



※Setting time: T>Ta , T>Tb , T>Tc>Tb

◎ Energy saving [ESAu]

A function to save unit's power consumption by reducing power supply to display parts in case of no setting input within 60 sec.

● Selectable from 2 power saving modes
- Normal mode [nor]: Main output indicator (OUT), PV/SV display part ON
- Energy saving mode 1 [1SAu]: Main output indicator (OUT) and PV display part ON
- Energy saving mode 2 [2SAu]: Main output indicator (OUT) ON

◎ Operation mode [Ldon]

A function to set Light ON - control output is ON when incident light level is higher than setting value Dark ON - control output is ON when incident light level is lower than setting value.

◎ Communication enable / disable setting [Conn]

A function to set communication write [enable (EnA) / disable (dI SA)] for Slave amplifier units while certain instructions (Load/Save/Copy) or Group teaching is in progress by the Master amplifier unit.

◎ Lock [LoCK]

Two types of key lock setting are available in order to prevent SV changes by careless.

	oFF	Loc 1	Loc2
Sensitivity setting	●	◐	◐
Data Bank mode	●	○	○
Program mode	●	◐	○
Parameter initialization	●	○	○

※●: Check / Setting both available
◐: Check available
○: Check / Setting both unavailable

● In case of [Loc2]mode, it is not available to use the lock function first to enter into parameter mode.

▣ Data Bank Setting

A function to save settings for group amplifier units in each data Bank by using Master unit's command or by adjusting one amplifier unit's setting and to load required data Bank without resetting for each unit's parameters and setting values.

● LOAD [LoAd]: Loads preset data bank (bAnK0, 1, 2) and applies it to the amplifier unit.
Detailed Bank parameters can be read and changed.
● SAVE [SAuE]: Saves one amplifier unit settings in one of data bank (bAnK0, 1, 2).
● COPY [CoPY]: Copies the currently loaded Bank by Master's instructions to the other amplifier units (1:1) or the whole amplifier units (1: M).
● LOAD ALL [LdAL]: Selects one data bank by Master's instructions and loads it to entire group units.
● SAVE ALL [SuAL]: Selects one data bank by Master's instructions and saves it in entire group units.

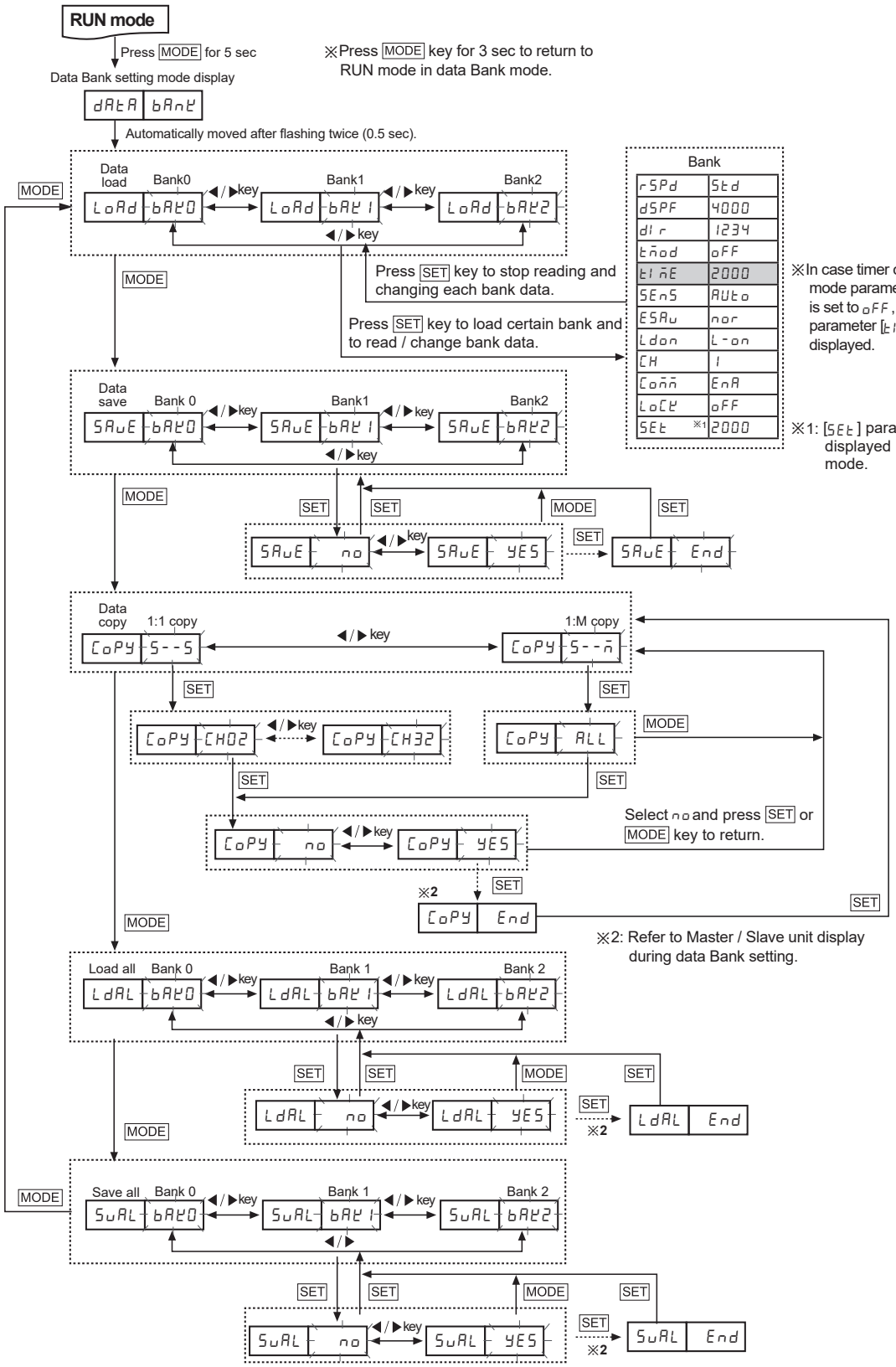
※For BF5□-D1-□, three data banks are available ([bAnK0], [bAnK 1] and [bAnK2]) so that three different sensing object information can be saved. Each Bank can be read and changed. It allows users to detect three different sensing objects with one amplifier unit without resetting each parameter.

※Data bank function can be executed only if all amplifier units are in RUN mode.

※Copy/Load All/Save All functions are applicable only if multiple amplifier units are connected.

※If lock function is set (Loc 1/Loc2) on amplifier units or if the Slave unit is set to communication disable[dI SA], Load and Save command for the unit is not executed.

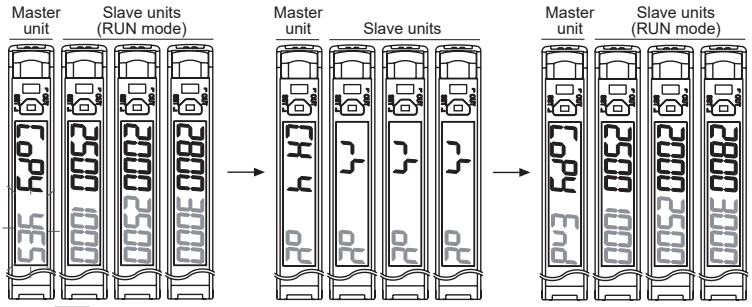
◎ Data Bank mode flow



Bank	
rSPd	Std
dSPF	4000
dIr	1234
tMod	oFF
tIME	2000
SEnS	AUto
ESAu	nor
Ldon	L-on
CH	1
CoMM	EnA
LoCK	oFF
SEt ※1	2000

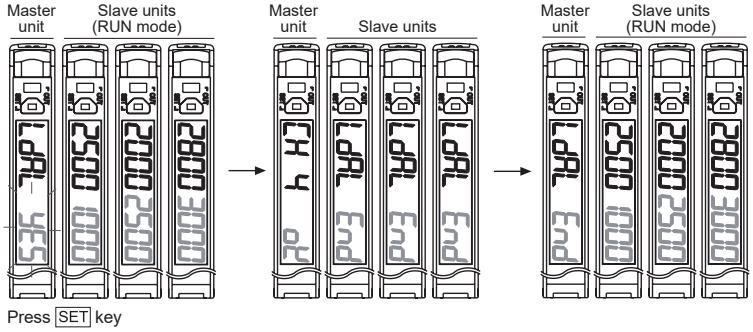
◎ Master / Slave unit display during data Bank setting

● Copy All



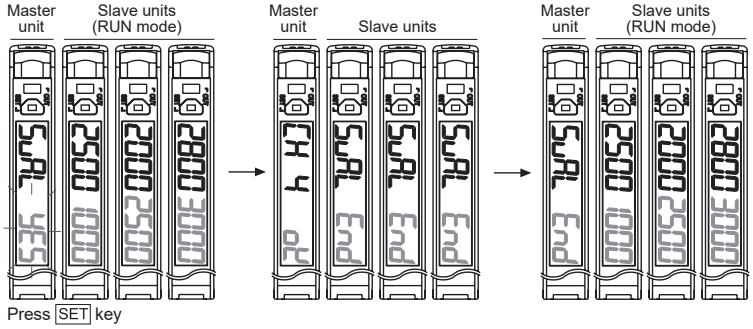
① While Copy All is executed, the Master unit displays the channel number on the PV display part and oU on the SV display part.
② While Copy All is executed, the Slave units display rN on the PV display part and oU on the SV display part and they return to RUN mode.
③ When Copy All is completed, the Master unit displays CoPY on the PV display part and End on the SV display part. Press the SET key to return to Data Copy mode.
※In case of 1:1 Copy, it progresses likewise.

● Load All



① While Load All is executed, the Master unit displays the channel number on the PV display part and oU on the SV display part.
② While Load All is executed, the Slave units display LdAL on the PV display part and End on the SV display part and they return to RUN mode.
③ When Load All is completed, the Master unit displays LdAL on the PV display part and End on the SV display part. Press the SET key to return to Load All mode.

● Save All



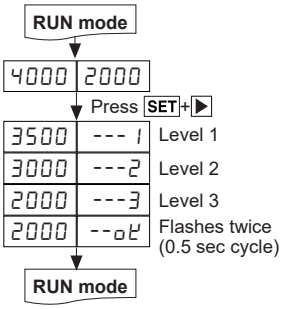
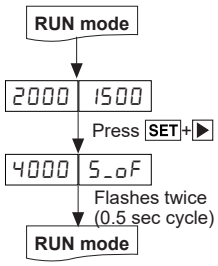
① While Save All is executed, the Master unit displays the channel number on the PV display part and oU on the SV display part.
② While Save All is executed, the Slave units display SuAL on the PV display part and End on the SV display part and they return to RUN mode.
③ When Save All is completed, the Master unit displays SuAL on the PV display part and End on the SV display part. Press the SET key to return to Save All mode.

※If communication write enable / disable parameter [Comm] for the Slave unit is set to disable dI SA while Save All, Load All or Copy is executed, the master unit displays channel number on the PV display part and dI SA on the SV display part.

▣ Anti-Saturation Setting Function

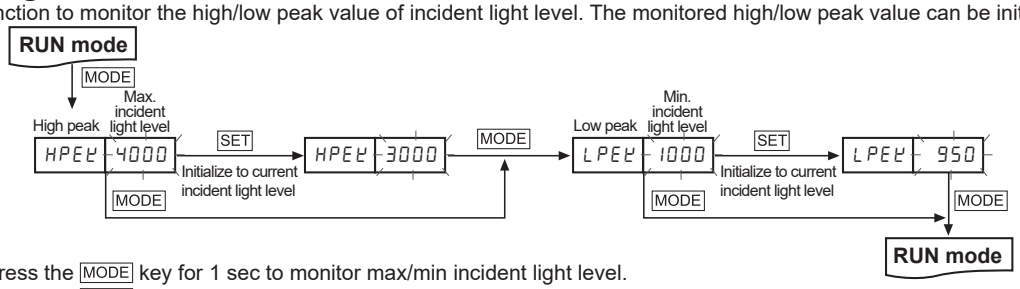
- When the sensing target comes too close and it is saturation status, this function changed to the optimize status.
- Press the SET+▶ keys one time and anti-saturation function is operated automatically. There are max. 10 levels.
- Press the SET+▶ keys one time again and anti-saturation function is cleared.
- During anti-saturation, the SV display part displays current level.
- When response mode is ultra fast [UFSt], fast [FSt] or standard [Std] and incident light level is lower than 2200, this function is cleared and this unit returns RUN mode automatically. When response mode is long distance [LonG], ultra long distance [ULoG] and incident light level is lower than 5500, this function is cleared and this unit returns RUN mode automatically.

※This function is not operated when incident light level is lower by each mode (UFSt, FSt, Std: 2200, ULoG, LonG: 5500).
※If saturation status is too high and it does not reach the target value, it stops at level 10 and this unit returns RUN mode.
※When anti-saturation function is set, control output operation may be changed.

Anti-saturation function ON	Anti-saturation function OFF
	

▣ High Peak, Low Peak Function

A function to monitor the high/low peak value of incident light level. The monitored high/low peak value can be initialized.

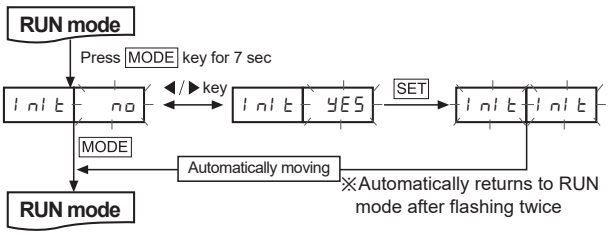


① Press the MODE key for 1 sec to monitor max/min incident light level.
② Press the MODE key to initialize max/min value to current incident light level during monitoring.
③ Press the MODE key to return to RUN mode.

▣ Initializing Function

A function to initialize all parameters about default value in case of mis-setting or mis-operation.
※Set lock function [LoCU] to oFF to execute Initializing Function.
※High peak value[HPEU] and low peak value[LPEU] shall not be initialized.

◎ Parameter initialize flow



① Press the MODE key for 7 sec in RUN mode. Init parameter turns ON on PV display part and no flashes every 0.5sec on SV display part.
② Press the MODE key once again to return to RUN mode without executing initializing Function.
③ Select YES using the ◀, ▶ keys and press the SET key. Init flashes twice on both PV and SV display parts.
④ When parameter initialization is completed, it automatically returns to RUN mode.

◎ Parameter value for initialization (factory default)

Parameter	Factory default	Parameter	Factory default	Parameter	Factory default
rSPd	Std	tmod	oFF	Ldon	L-on
dSPF	4000	SEnS	AUto	Comm	EnA
dir	1234	ESAu	nor	LoCU	oFF
SV: 2000, Bank 0 to 2: Initialized					

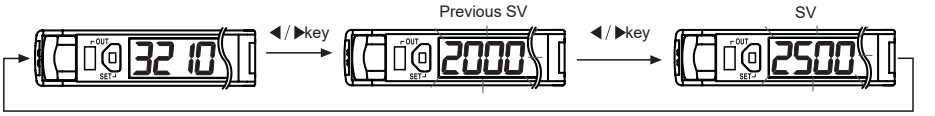
Single display type

▣ Sensitivity Setting

※**There are two methods available for sensitivity setting - manual or teaching mode. Select the most suitable method for your application.**

◎ Manual sensitivity setting (Fine-adjusting sensitivity)

- The setting is to set the sensitivity manually.
- Used to fine-adjust sensitivity after the teaching sensitivity setting.
- Incident light level is still displayed on the PV/SV display part during SV setting.

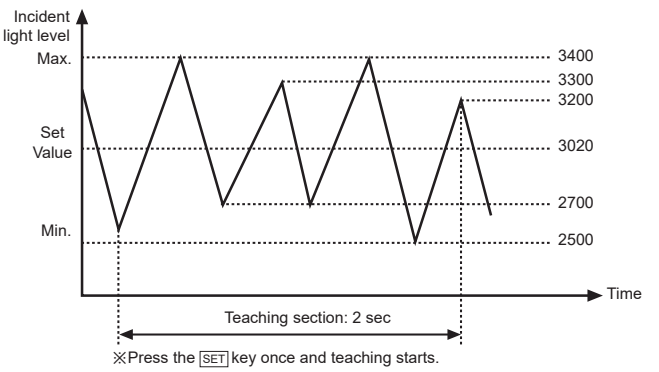


① Press the ◀ or ▶ key once in RUN mode, then previous SV flashes twice (every 0.5 sec).
② Press the ◀ and ▶ keys to set the value.
③ There is no additional key for completing the setting. If there is no key input for 3 sec after completing setting, newly set value flashes twice (every 0.5 sec) and automatically is saved and it returns to RUN mode.

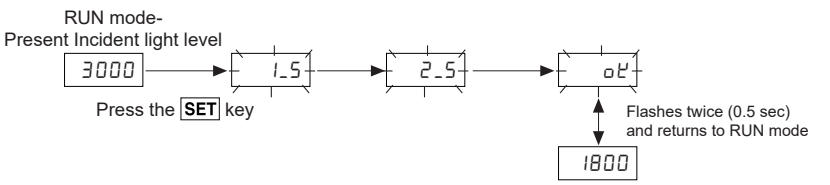
◎ Teaching sensitivity setting (Auto tuning)

- For BF5R-S1-□ model, teaching sensitivity setting mode is fixed to auto-tuning.

※This mode is easy for the sensitivity when incident light level of sensing object is not stable or moves fast.
※One of teaching modes that sets the sensitivity by using average value of the maximum and minimum incident light level within a certain period.



$$Set\_value = \frac{P1+P2+\cdots+Pn-1+Pn}{n}$$



① In RUN mode, press the SET key once with the desired sensing target.
② When pressing the SET key once, and teaching starts and is progressed automatically for 2 sec.
③ After completing teaching, oU is flashes twice for 0.5 sec and it returns to RUN mode.

▣ Function

◎ Response time setting

Use front slide switch to set response time.

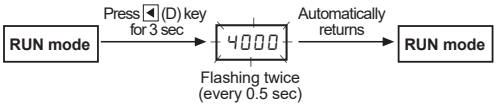
- Fast (FAST) mode: 150μs
- Standard (STD) mode: 500μs
- Long distance (LONG) mode: 4ms

◎ Display function (Factory mode: standard display)

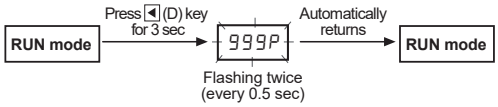
A function to select incident light level display on display part.

- Display range of standard mode: 0 to 4000 (0 to 9999, in case of long distance mode)
- Display range of percentage mode: 0P to 999P (Decimal point is not displayed)

<When changing to standard display mode>



<When changing to percentage display mode>

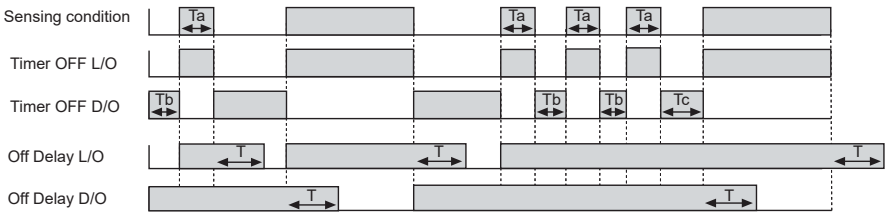


◎ Timer function

※For the BF5R-S1-☐ model (single display type), only OFF Delay mode is available. Select the setting time (OFF/10ms/40ms) using the front slide switch.

- **Time chart**

[T = 10ms or 40ms]



※Setting time: T>Ta , T>Tb , T>Tc>Tb

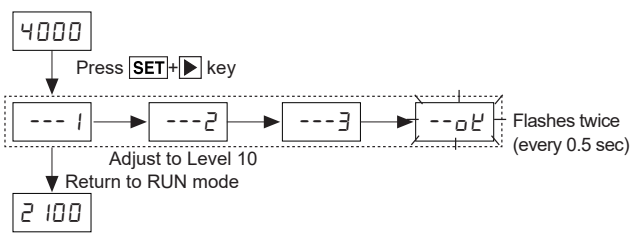
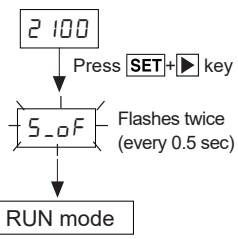
◎ Light ON / Dark ON switching function

A function to set Light ON - control output is ON when incident light level is higher than setting value and Dark ON - control output is ON when incident light level is lower than setting value.
BF5R-S1-☐ (Single display type) model uses the front slide switch to set each mode.

▣ Anti-Saturation Setting Function

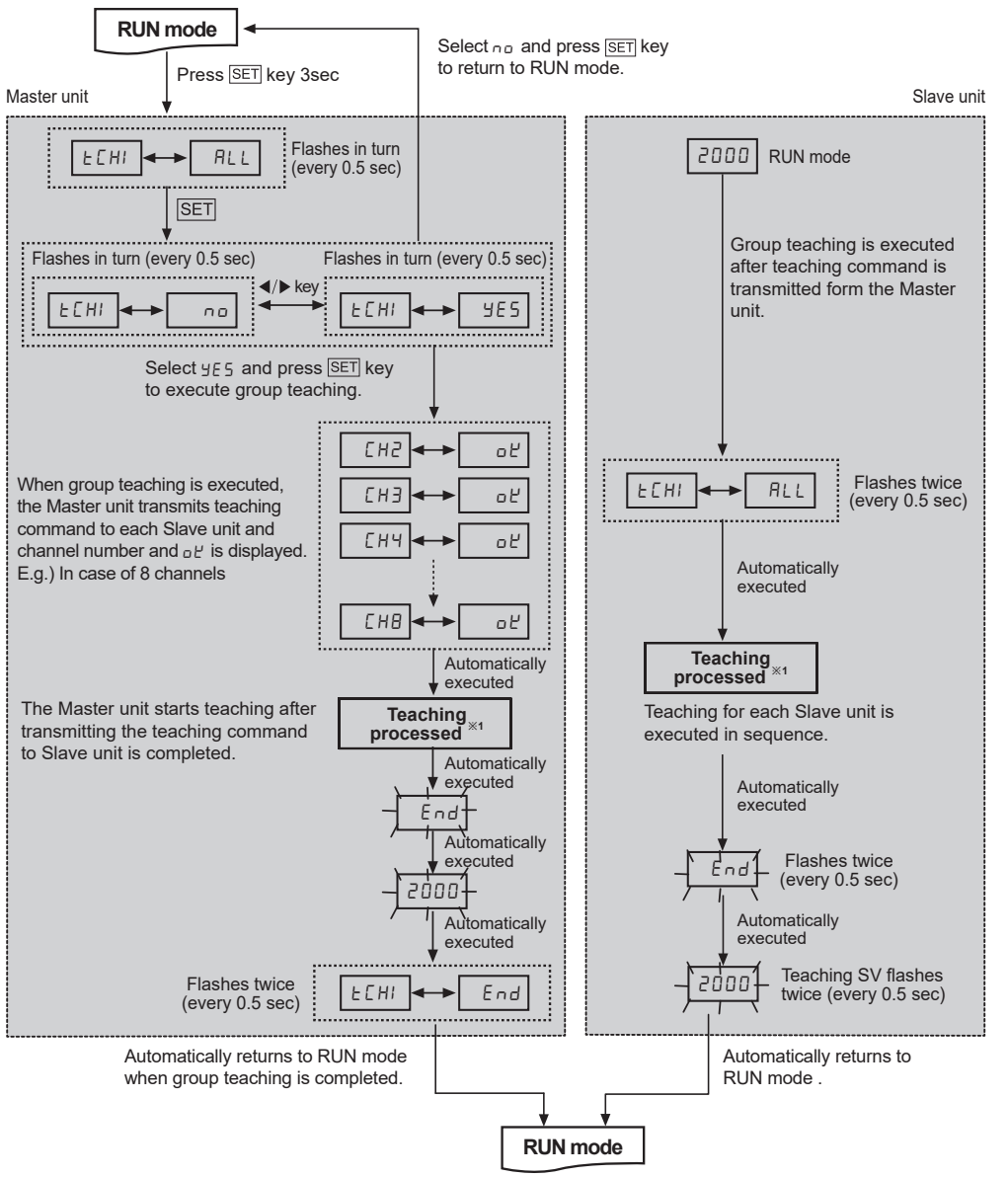
- When the sensing target comes too close and it is saturation status, this function changed to the optimize status.
- Press the SET+▶ keys one time and anti-saturation function is operated automatically. There are max. 10 levels.
- Press the SET+▶ keys one time again and anti-saturation function is cleared.
- During anti-saturation, the PV/SV display part displays current level.
- When response mode is fast [**FST**] or standard [**STD**] and incident light level is lower than 2200, this function is cleared and this unit returns RUN mode automatically. When response mode is long distance [**LONG**] and incident light level is lower than 5500, this function is cleared and this unit returns RUN mode automatically.

※This function is not operated when incident light is lower by each mode (**FST**, **STD**: 2200, **LONG**: 5500).
※If saturation status is too high and it does not reach the target value, it stops at level 10 and this unit returns RUN mode.
※When anti-saturation function is set, control output operation may be changed.

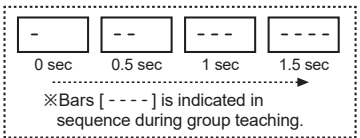
Anti-saturation function ON	Anti-saturation function OFF
	

▣ Group Teaching

A function to set the sensitivity of Slave amplifier units according to the command of Master amplifier unit (a certain amplifier unit) in a successive and collective way.

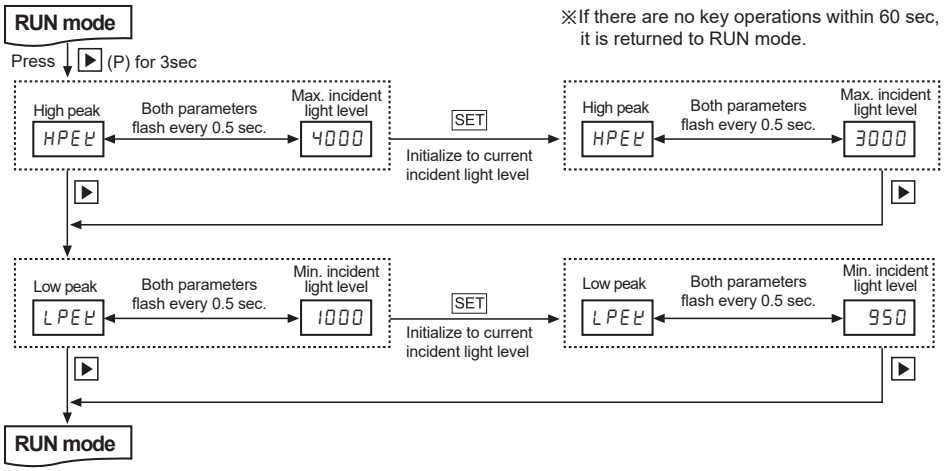


※1: Display part status while teaching is in the process



▣ High Peak, Low Peak Function

A function to monitor the high/low peak value of incident light level. The monitored high/low peak value can be initialized.



Common features

▣ Function

◎ Amplifier units connection using side connector

In case multiple amplifier units are connected, the power for one unit will be supplied to all connected units.

◎ Auto channel setting

- The channel for each amplifier unit - connected by side connector - is automatically set in a certain direction (→) as soon as power is supplied. Channel number is increasing one by one.
- Auto set channel can be checked in channel parameter in program mode.
- In case of BF5R-S1-☐, auto set channel can be checked only when initial power is supplied. (Not available afterwards).
- Channel range: 1 to 32 (applied the same to all models)

※**Note that auto set channel cannot be changed and the channel number of each amplifier unit is not saved in case of power OFF.**

▣ Mutual Interference Prevention

A function to set different light receiving time for each amplifier unit in case of installing the fiber cable adjacently in order to prevent mutual interference occurring. (Set automatically when power is turned ON.)
※Mutual interference function is allowed up to maximum 8 amplifier units regardless of the unit model and response time.

▣ Error Code

Error code	Cause	Troubleshooting
ErrL	In case incident light level is below the min range when teaching.	Increase the incident light level above min range.
Err	In case overcurrent inflow occurs into output circuit.	Remove overcurrent through overload.
Erb	• In case Slave is failed to execute Master's instructions due to unstable communication line connection during Group Copy / Load / Save / Teaching. • In case other communication errors occur	• Check amplifier unit's connection again. • Check circuit and hardware around side connector.

High Reliability of Fiber Optic Amplifier for Convenient Mounting

▣ Features

- High speed response: max. 0.5ms
- Auto sensitivity setting (button setting)/external input sensitivity setting type
- External synchronization input, mutual interference protection, self-diagnosis
- Reverse power polarity protection and output short overcurrent protection circuit
- Timer function: selectable none / 40ms OFF delay timer (fixed) (standard type, remote sensitivity setting type only)
- Automatically selectable Light ON / Dark ON
- Precise detection of small target and easy to install in the complicated place

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

▣ Ordering Information

BF 4 R P - E

Feature	No mark	Standard type
	E	External synchronization input type
	R	External input sensitivity setting type
Control output	No mark	NPN open collector output
	P	PNP open collector output
Light source	R	Red LED
	G	Green LED
Series	4	Series
Item	BF	Fiber Sensor

▣ Specifications

Model		Standard type				External synchronization input type		External input sensitivity setting type	
		BF4RP	**BF4GP**	**BF4R**	**BF4G**	**BF4R-E**	**BF4G-E**	**BF4R-R**	**BF4G-R**
Light source		Red LED (660nm)	Green LED (525nm)	Red LED (660nm)	Green LED (525nm)	Red LED (660nm)	Green LED (525nm)	Red LED (660nm)	Green LED (525nm)
Power supply		12-24VDC⎓ ±10% (ripple P-P: max.10%)							
Current consumption		Max. 45mA							
Operation mode		Light ON/Dark ON switching							
Control output		NPN or PNP open collector output ● Load voltage: max. 30VDC⎓ ● Load current: max. 100mA ● Residual voltage - NPN: max. 1V (load current: 100mA), max. 0.4V (load current: 16mA) / PNP: max. 2.5V							
Protection circuit		Reverse power polarity protection circuit, output short overcurrent protection circuit							
Response time		Max. 0.5ms (frequency 1), max. 0.7ms (frequency 2)							
Sensitivity setting		Sensitivity setting button (ON/OFF)							
Indicator		Control output indicator (OUT): red LED, Stability indicator (STAB): green LED (turns ON at stable light ON/OFF level)							
Mutual interference prevention		Built-in differential frequency mode (frequency 1 (normal mode): max. 0.5ms, frequency 2: max. 0.7ms)							
Self-diagnosis output		ON state under unstable sensing (when the target stays for 300ms in unstable level), ON state when control output is short-circuited							
		● Load voltage: max. 30VDC⎓ ● Load current: max. 50mA ● Residual voltage - NPN: max. 1V (load current: 50mA), max. 0.4V (load current: 16mA) / PNP: max. 2.5V							
Input of stop transmission function		—				Built-in		—	
External synchronization function		—				Built-in (gate/trigger)		—	
Remote sensitivity setting function		—				—		Built-in	
Timer function		OFF delay (40ms)				—		OFF delay (40ms)	
Insulation resistance		Over 20MΩ (at 500VDC megger)							
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulator							
Dielectric strength		1,000VAC 50/60Hz for 1 minute							
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours							
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times							
Environment	Ambient illumination	Sunlight: max. 11000lx, Incandescent lamp: max. 3000lx (received illumination)							
	Ambient temperature	-10 to 50℃, storage: -20 to 70℃							
	Ambient humidity	35 to 85% RH, storage:35 to 85% RH							
Material		Case: heat-resistance acrylonitrile butadiene styrene, cover: polycarbonate							
Cable		Ø4mm, 4-wire, 2m (AWG22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)				Ø4mm, 6-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)			
Accessory		Mounting bracket, bolts, nuts							
Approval		CE							
Weight※1		Approx. 120g (approx. 65g)							

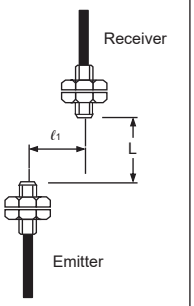
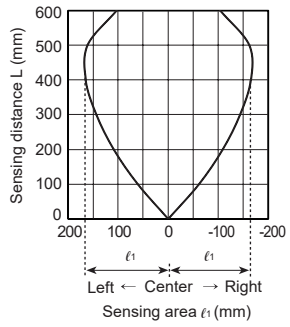
※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Feature Data

◎ Through-beam type

● Measurement: BF4□(-□)+ FT-420-10

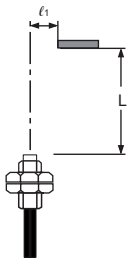
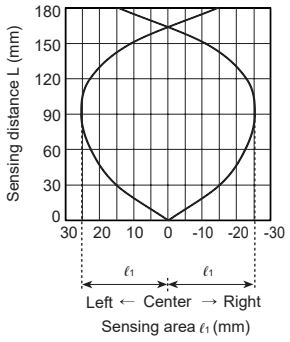
Parallel shifting characteristic

Measuring method	Data
	

◎ Diffuse reflective type

● Measurement: BF4□(-□) + FD-620-10

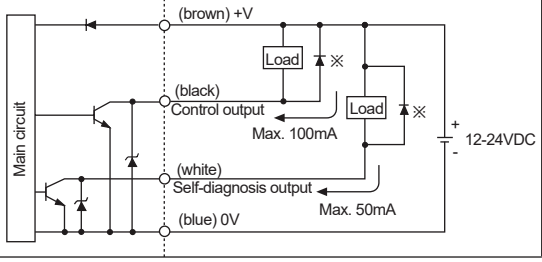
Sensing area characteristic

Measuring method	Data
	

▣ Control Output Diagram

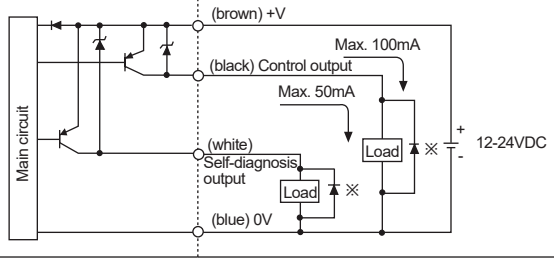
BF4R / BF4G

Fiber optic sensor circuit | Connection



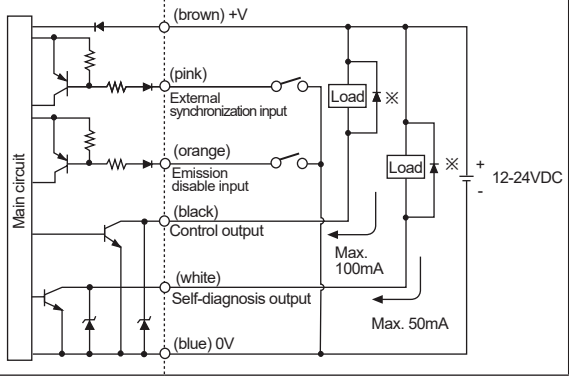
BF4RP / BF4GP

Fiber optic sensor circuit | Connection



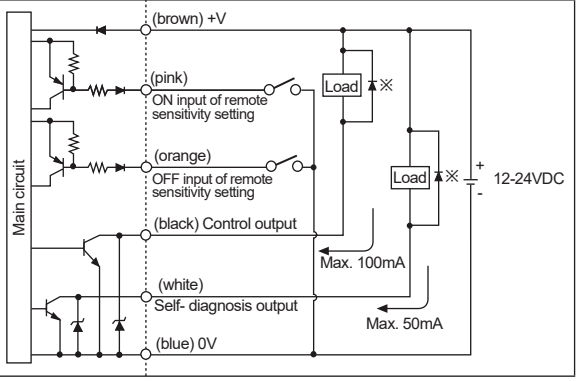
BF4R-E / BF4G-E

Fiber optic sensor circuit | Connection



BF4R-R / BF4G-R

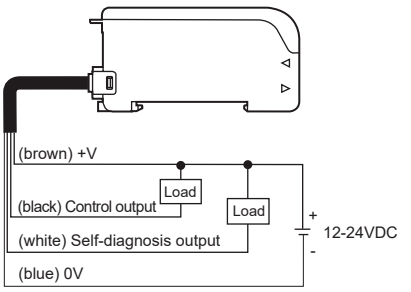
Fiber optic sensor circuit | Connection



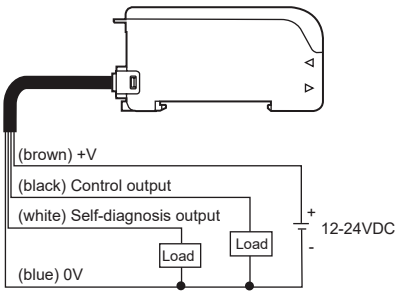
※Connect Diode at external terminal for inductive load.

▣ Connections

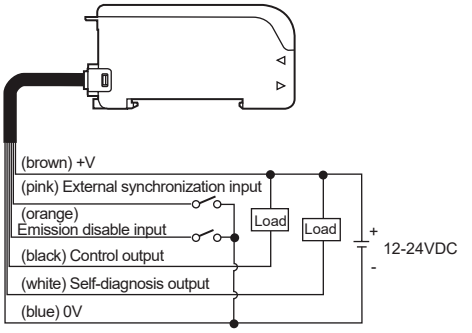
● **BF4R / BF4G**



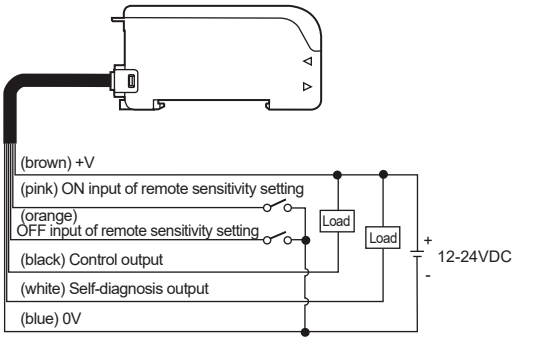
● **BF4RP / BF4GP**



● **BF4R-E / BF4G-E**

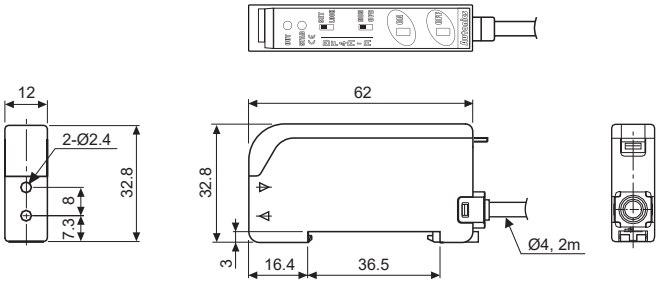


● **BF4R-R / BF4G-R**

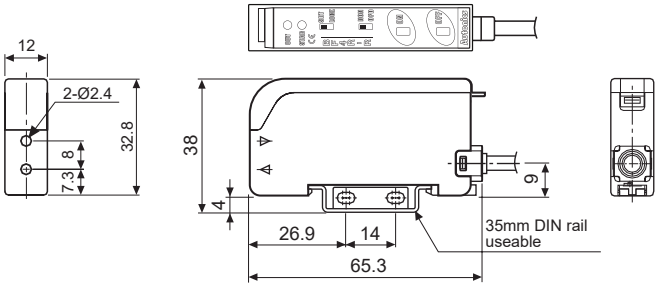


▣ Dimensions

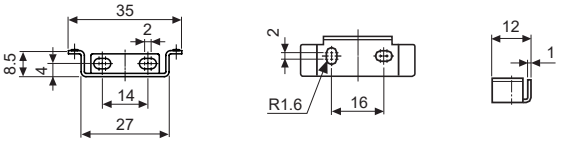
(unit: mm)



● **Connect the bracket**



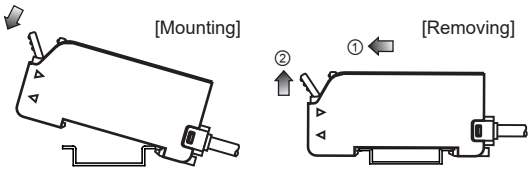
● **Bracket**



▣ Installations

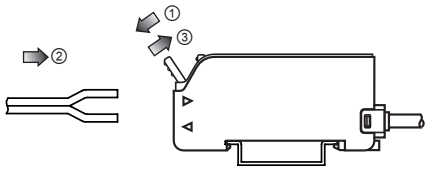
◎ Mounting amplifier unit

- Hook the front part of the amplifier on DIN rail. Press the rear part of the amplifier on DIN rail.
- Push the back of amplifier toward ① and lift the hole for fiber toward ② up then simply take it out without tools.



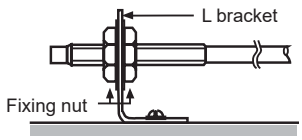
◎ Installation of fiber optic cable

- Lift up the protective cover to the ① direction to release the lock setting.
- Insert the cable to the ② direction and adhere between the cable and the inside of the amplifier unit. (insert depth: approx. 10mm)
- Place up the lock lever to ③ direction to lock the lock setting and close the protective cover.

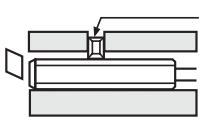


◎ Connection of fiber optic cable & amplifier

● In case of using L bracket



● In case of using screw

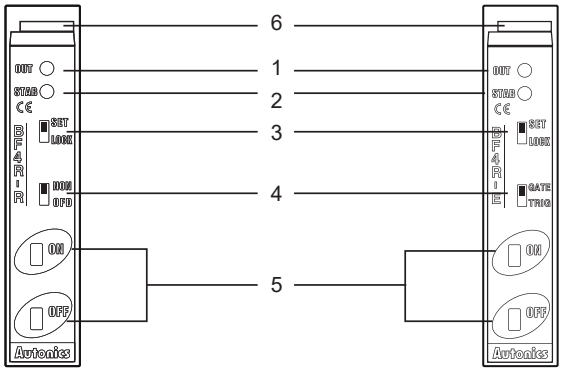


※Notice: If setting bolt is tightened with over specified tightening torque, hood of fiber optic cable may be damaged.

▣ Unit Description

● Standard type (BF4R/BF4RP/BF4G/BF4GP)
External input sensitivity setting type (BF4□-R)

● External synchronization input type (BF4□-E)



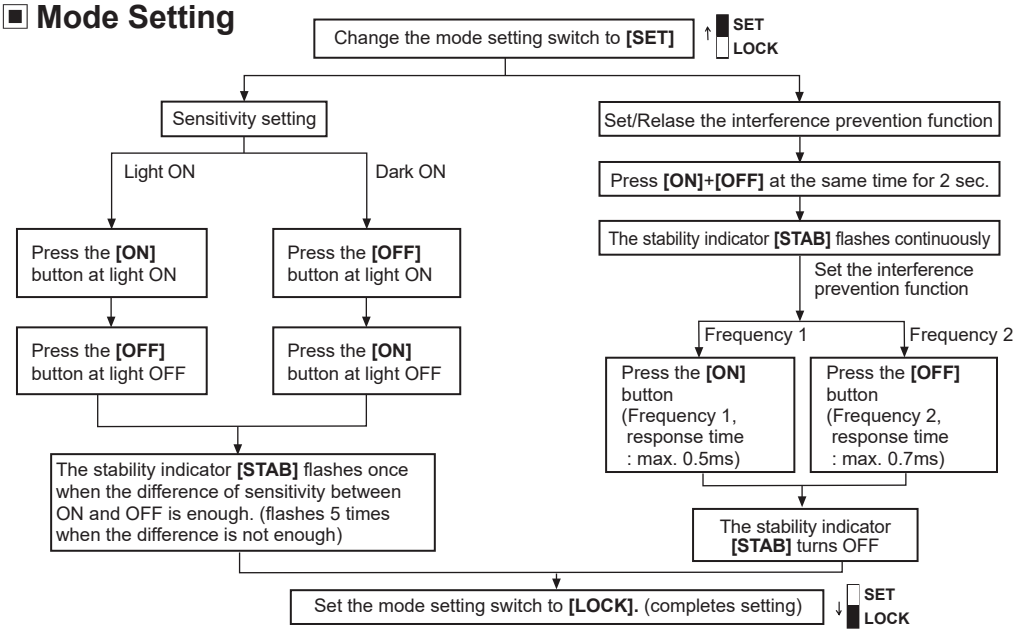
1. Control output indicator (red): Turns ON or OFF by control output status.
2. Stability indicator (green): Turns ON at stable light ON/OFF level.
3. Mode setting switch - SET: Set the switch to [**SET**] to use set the function.
- LOCK: Set the switch to [**LOCK**] not to set the function.

4. Timer setting switch (standard type, external input sensitivity setting type)
- NON: Set the switch to [**NON**] not to use timer function.
- OFD: Set the switch to [**OFD**] to use OFF Delay timer function.

External synchronization setting switch (external synchronization input type)
- GATE: Set the switch to [**GATE**] to use external synchronization as gate synchronization.
- TRIG: Set the switch to [**TRIG**] to use external synchronization as trigger synchronization.

5. Sensitivity setting button: Used for sensitivity setting
6. Lock lever: Used for connecting fiber optic cable.

▣ Mode Setting



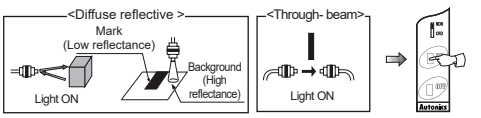
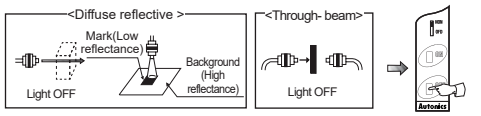
▣ Sensitivity Adjustment

Before sensitivity setting, install the fiber optic cable.
After completing the setting, do not move or bend the fiber optic cable. If not, it may cause incorrect detection.

◎ Adjustment by the sensitivity setting button (common)

● Light ON

The control output turns on at Light ON status and turns off at Light OFF status.

Order	Setting method
①	Mount the fiber optic cable within sensing distance.
②	Change the mode setting switch to [**SET**]. 
③	Diffuse reflective: Press the **[ON]** button with a sensing target. Through-beam: Press the **[ON]** button without a sensing target. 
④	The stability indicator [STAB] (green) flashes at ON state. (check the target position) 
⑤	Diffuse reflective: Press the **[OFF]** button without a sensing target. Through-beam: Press the **[OFF]** button with a sensing target. 
⑥	•When there is enough sensitivity difference between ON state and OFF state, the stability indicator **[STAB]** flashes one time only at stable sensing level. •When there is not enough sensitivity difference between ON state and OFF state, the stability indicator **[STAB]** flashes five times at unstable sensing level. ※The sensitivity can be set at unstable sensing area.
⑦	Change the mode selection switch to [**LOCK**] to fix the set sensitivity. Even though the sensitivity setting button is touched, setting sensitivity shall not be changed. 

※When the power is OFF, the set sensitivity is saved.

● Dark ON

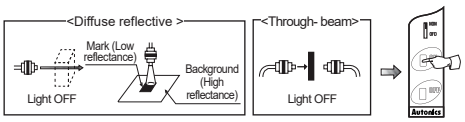
The control output turns off at Light ON status and turns on at Light OFF status.

<How to set sensitivity>

The setting order are same as Light ON mode except ③ & ⑤. The ③ & ⑤ order is opposite from Light ON.

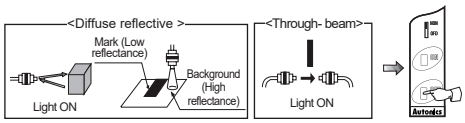
- ③ state

Diffuse reflective: Press the [**ON**] button without a sensing target.
Through-beam: Press the [**ON**] button with a sensing target.



- ⑤ state

Diffuse reflective: Press the [**OFF**] button with a sensing target.
Through-beam: Press the [**OFF**] button without a sensing target.



◎ Setting as max. sensitivity (common)

① Set the mode setting switch to [**SET**].
② If there is no sensing target,
- **Light ON**: Press the [**ON → OFF**] button
- **Dark ON**: Press the [**OFF → ON**] button

③ Set the mode selection switch to [**LOCK**] mode.

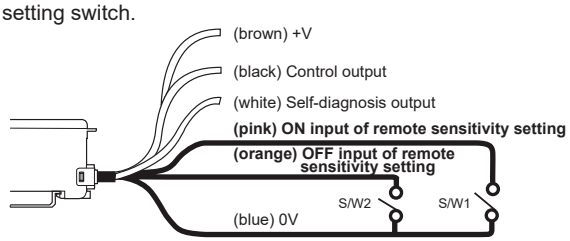
※**External sensitivity setting**
- **Light ON** (From above ③)
  External sensitivity setting **ON** input (High→Low→High)
  External sensitivity setting **OFF** input (High→Low→High)
- **Dark ON Mode** (From above ③)
  External sensitivity setting **OFF** input (High→Low→High)
  External sensitivity setting **ON** input (High→Low→High)

< Application >

- To extend sensing distance (diffuse reflective type):
  If fiber optic sensor is used in place where there are targets with high reflectivity and low reflectivity, it is able to get stable detection by adjusting max. sensitivity.
- Used at bad environment (through-beam type):
  If fiber optic sensor is used in place where there is lots of dust or moisture, it might cause malfunction.
  It can perform the stable detection by using max. sensitivity.

◎ External input sensitivity setting type [BF4□-R]

External input sensitivity setting type, BF4□-R can adjust the sensitivity with input signal lines without the mode setting switch.



● Light ON

- ON input of remote sensitivity setting (SW1):
  Turns ON the SW1 and then turn OFF instead of ③ state of adjustment by the sensitivity setting button.
- OFF input of remote sensitivity setting (SW2):
  Turns on the SW2 and then turn OFF instead of ⑤ state of adjustment by the sensitivity setting button.

● Dark ON

- OFF input of remote sensitivity setting (SW2):
  Turns on the SW2 and then turn OFF instead of ③ state of adjustment by the sensitivity setting button.
- ON input of remote sensitivity setting (SW1):
  Turns on the SW1 and then turn OFF instead of ⑤ state of adjustment by the sensitivity setting button.

<External sensitivity setting input signal condition>

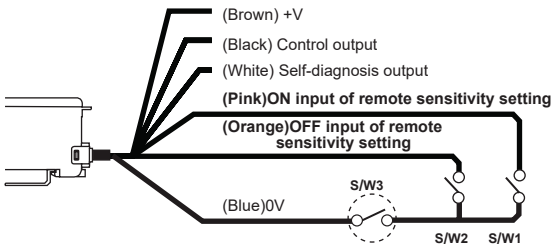
State	Signal condition
High	4.5-30VDC or Open
Low	0-1VDC

※Input impedance:10kΩ

◎ Prohibition of inputting External sensitivity setting [BF4□-R]

Even though mode switch is at Lock position, it is able to input external sensitivity setting when Switch 1 and Switch 2 are ON. Therefore please install Switch 3 in order to prevent from malfunction as below.

※SW3 - OFF: Disable to set external sensitivity
※SW3 - ON: Enable to set external sensitivity



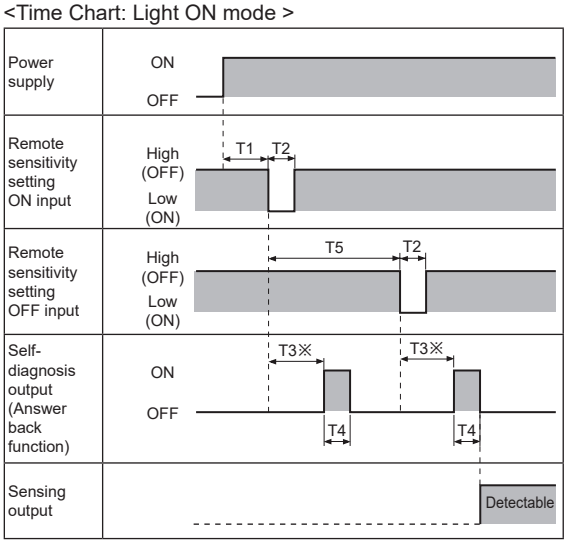
Switch for prohibiting sensitivity setting

◎ Self-diagnosis output (answer back) function [BF4□-R]

When ON or OFF input of remote sensitivity setting is applied, after 300ms, self-diagnosis output turns on for 40ms and then the sensor keeps normal sensing state. (Note: Time chart)

※Self-diagnosis output does not turn on if there is no difference of sensitivity between ON input and OFF input and stable sensing is not executed, but stable sensing operates after 340ms.

<Time Chart: Light ON mode >



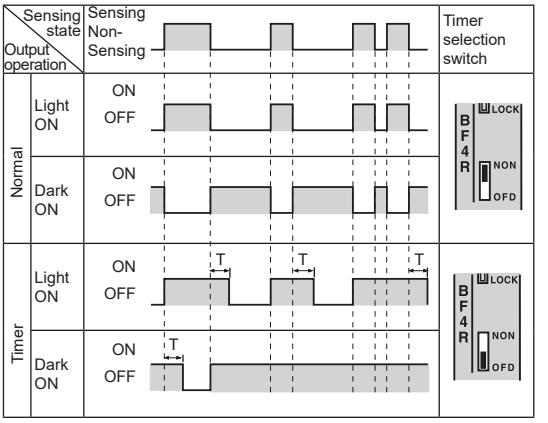
※During period T3 (approx. 300ms), do not change the received light value by moving the object, etc.

- T1≥1,000ms : after power turns ON, it can be set after 1sec.
- T2≥5ms : ON/OFF input time of remote sensitivity setting must be min. 5ms
- T3≒300ms : when ON/OFF input of remote sensitivity setting is applied, self-diagnosis output turns ON after 300ms)
- T4≒40ms : ON time of self-diagnosis output
- T5≥500ms : when ON input of remote sensitivity setting is applied, apply OFF input of remote sensitivity setting after 500ms

▣ Timer (OFF Delay) Function [BF4R/BF4G/BF4RP/BF4GP/BF4□-R]

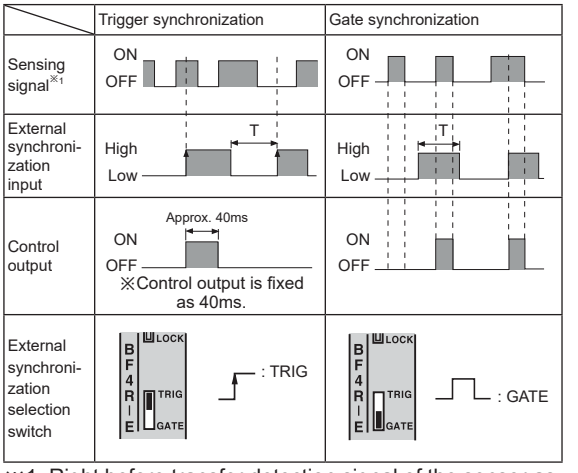
Standard type and External input sensitivity setting type both contain the built-in OFF Delay timer, approx. 40ms. The timer works when the timer selection switch is set to **[OFD]**.
The output turns off after remaining for additional 40ms at OFF position of the sensing output. It is useful when the response time of the connected device is slow or when the sensing signal from a tiny object is too short.

<Time Chart> T≒40ms



▣ External Synchronization Input Function [BF4R□-E]

By using external synchronization function, the time for making sensing can be specified by external synchronization. (trigger synchronization and gate synchronization)



※1: Right before transfer detection signal of the sensor as control output.

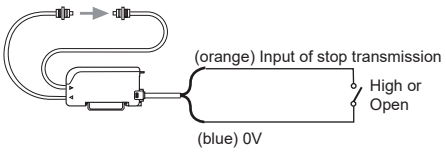
※T≥0.5ms (using interference prevention function: T≥0.7ms)

<Input signal condition for External synchronization>

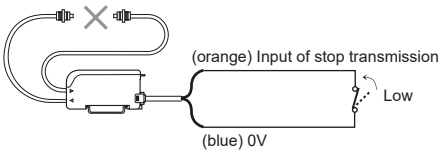
State	Signal condition
High	4.5-30VDC or Open
Low	0-1VDC

▣ Stop Transmission Function [BF4□-E]-Operation Test

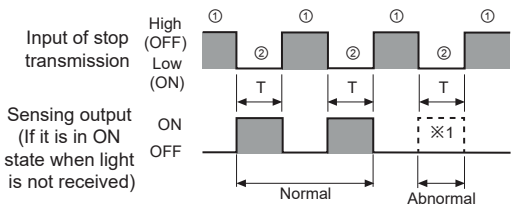
This function is available under light ON state only and it is for checking normal state of the sensor.



[If input of stop transmission is at High or Open state, light is transmitted.]



[If input of stop transmission is at Low, light is transmitted.]



※①: Transmission area, ②: Stop transmission area

※1: If transmission is stopped, control output must turn on, but if control output does not turn on, it seems that sensor has some problems.

※T≥0.5ms
(when using interference prevention function T≥0.7ms)

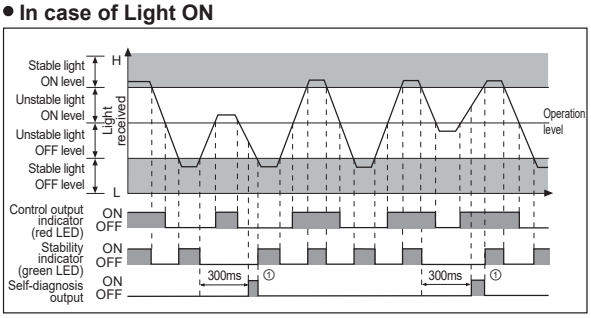
<Input signal condition for Stop transmission>

State	Signal condition
High	4.5-30VDC or Open
Low	0-1VDC

▣ Self-Diagnosis Function (common)

When fiber hood is contaminated by dust, transmitted light is lowered by element ability loss or received light is lowered by missing of optical axis, the self-diagnosis output will turn on.

● In case of Light ON



● When detecting state remains over 300ms at unstable light ON/OFF level, the self diagnosis output turns ON. In case of stable light ON/OFF level, the self diagnosis output turns OFF. (① position)

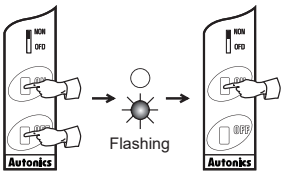
▣ Mutual Interference Prevention Function (common)

Two fiber optic cables can be mounted very closely by setting different transmission frequencies.

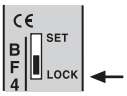
● Interference prevention function (operation of differential frequency mode)

First sensor- Frequency 1 (response time: max. 0.5ms)

① Set the mode setting switch to [**SET**].
② Press the [**ON**] + [**OFF**] buttons for 2 sec at the same time.
③ The Stability indicator [**STAB**] flashes continuously.
④ **Press the [ON] button.**
⑤ The Stability indicator [**STAB**] turns off.

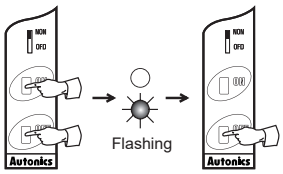


⑥ Set the mode setting switch to [**LOCK**].

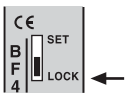


Second sensor- Frequency 2 (response time: max. 0.7ms)

① Set the mode setting switch to [**SET**].
② Press the [**ON**] + [**OFF**] buttons for 2 sec at the same time.
③ The Stability indicator [**STAB**] flashes continuously.
④ **Press the [OFF] button.**
⑤ The Stability indicator [**STAB**] turns off.



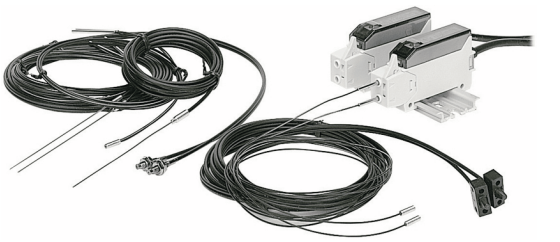
⑥ Set the mode setting switch to [**LOCK**].



High Accuracy Fiber Optic Amplifier with Twin Adjuster

▣ Features

- Convenient DIN rail mounting type
- Response time: max. 1ms
- Enables to adjust sensitivity with high accuracy by dual adjuster
- Selectable Light ON/Dark ON operation mode by control wire
- Reverse power polarity protection and output short overcurrent protection circuit
- Enables to use for explosion proof (fiber part)
- Adjustable length with free cut type fiber optic cable



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

▣ Ordering Information

BF 3 RX - P

Control output	No mark	NPN open collector output
	P	PNP open collector output
Light source	RX	Red LED
Series	3	Series
Item	BF	Fiber Sensor

▣ Specifications

Model		BF3RX	BF3RX-P
Response time		Max. 1ms	
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)	
Current consumption		Max. 40mA	
Light source		Red LED (660nm)	
Sensitivity adjustment		Sensitivity adjuster (dual adjustment: coarse adjustment, fine adjustment)	
Operation mode		Selectable Light ON or Dark ON by control cable	
Control output		NPN or PNP open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 200mA, ●Residual voltage - NPN: max. 1V, PNP: max. 2.5V	
Protection circuit		Reverse power polarity protection circuit, output short overcurrent protection circuit	
Indication		Operation indicator: red LED	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±240V the square wave noise (pulse width: 1μs)by the noise simulator	
Dielectric strength		1,000VAC 50/60Hz for 1minute	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)	
	Ambient temperature	-10 to 50℃, storage: -25 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Material		Case: acrylonitrile butadiene styrene, cover: polycarbonate	
Cable		Ø5mm, 4-wire, 2m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)	
Accessory		Adjustment screwdriver, bracket, bolts, nuts	
Unit weight		Approx. 90g	

※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

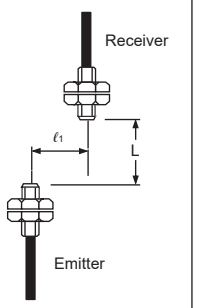
▣ Feature Data

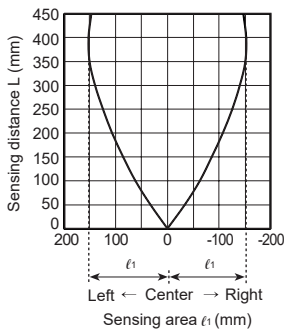
◎ Through-beam type

● Measurement: BF3RX + FT-420-10

Parallel shifting characteristic

Measuring method	Data



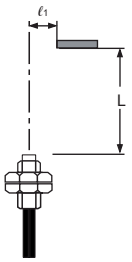


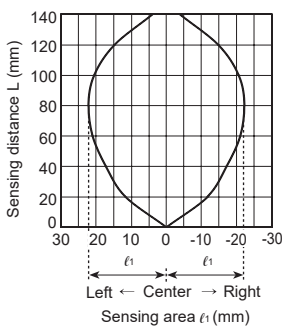
◎ Diffuse reflective type

● Measurement: BF3RX + FD-620-10

Sensing area characteristic

Measuring method	Data



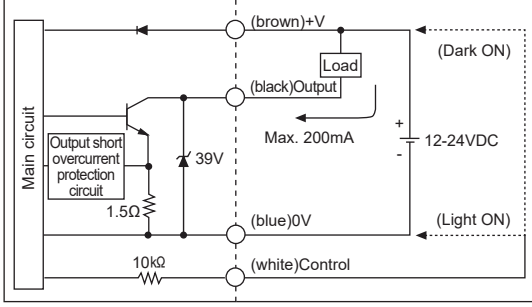


▣ Control Output Diagram

● BF3RX

NPN open collector output

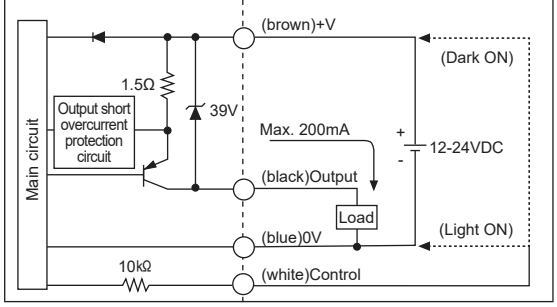
Fiber optic sensor circuit	Connection



● BF3RX-P

PNP open collector output

Fiber optic sensor circuit	Connection



※When selecting Dark ON or Light ON, please use control wire (White)
- Light ON: Connect control wire to 0V
- Dark ON: Connect control wire to +V

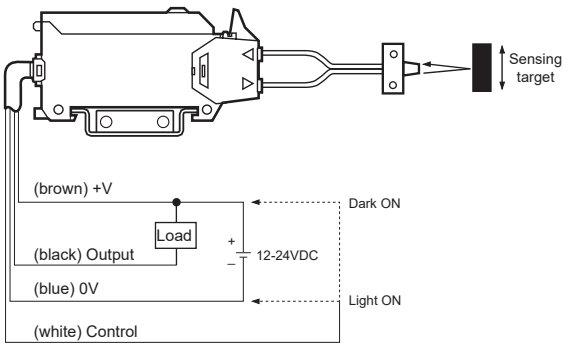
▣ Operation Mode

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

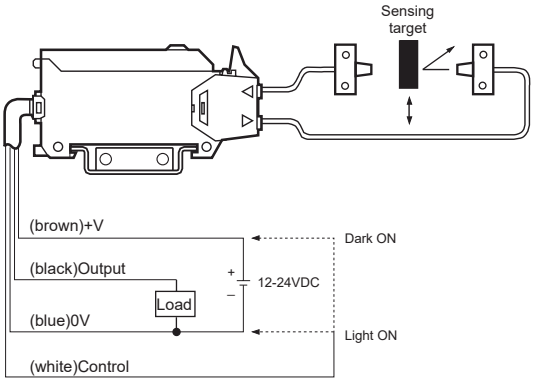
Operation mode	Dark ON	
Receiver operation	Received light Interrupted light	
Operation indicator (red LED)	ON OFF	
Transistor output	ON OFF	

▣ Connections

● BF3RX



● BF3RX-P

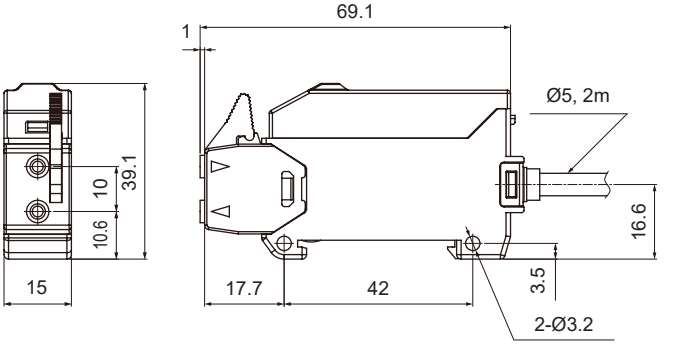


※Enables to use diffuse reflective type or through-beam type according to the fiber optic cable.
※Adapter marked fiber optic cable should be used with adapter ( ).
※GT-420-13H2 cannot be used because the length inserted into amp is too short.

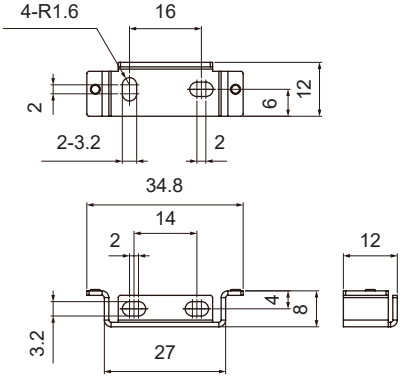
▣ Dimensions

(unit: mm)

◎ Amplifier



◎ Bracket

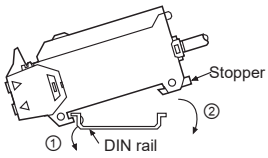


▣ Installations

◎ Mounting amplifier unit

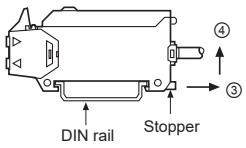
● When mounting the amplifier

①Hook the front part of the amplifier on DIN rail (or bracket).
②Press the rear part of the amplifier on DIN rail (or bracket).



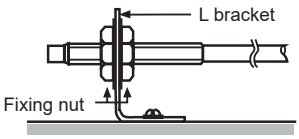
● When releasing the amplifier

Push the back of amplifier toward ③ and lift the hole for fiber toward ④ up then simply take it out without tools.

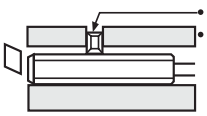


◎ Installation of fiber optic cable

● In case of using L bracket

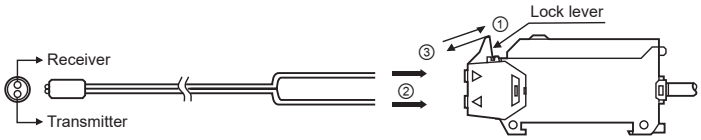


● In case of using screw



※Notice: If setting bolt is tightened with over specified tightening torque, hood of fiber optic cable may be damaged.

◎ Connection of fiber optic cable & amplifier



① Open the lock lever to " ↓ " direction.
② Insert the fiber optic cable in the amplifier slowly. (depth: approx. 21mm)
③ Close the lock lever to " ↑ " direction.

▣ Sensitivity Adjustment

◎ Adjustment by the sensitivity setting button (common)

● Adjust as the optimum sensitivity according to the order as below.
● Please observe below chart because operation lamp will be changed by sensing method.

Order	Sensing type		Adjustment	Adjuster	
	Reflective	Through-beam		COARSE	FINE
1	Initial setting		The adjuster (coarse) should be fixed at min and fixed at center (▼) for Fine adjustment.	Min.	(-) (+)
2	Light ON	Light ON	Fix the adjuster (coarse) to ON position by turning clockwise slowly when light is being received.	ON Min.	(-) (+)
3	Light ON	Light ON	Turn the adjuster (fine) until it is OFF toward (-), and turn until it is ON toward (+) again, then confirm that this will be A position.	The adjuster is not required to set afterward.	ON A OFF (-) (+)
4	Dark ON	Dark ON	And then turn the adjuster (fine) until it is ON toward (+), and turning until it is OFF toward (-) again when light is not received. Then confirm that this position will be B position. (When it will not be ON, max. position will be B.)		OFF B ON (-) (+)
5	—	—	Fix it at the middle of A and B position. This will be the best position to set.		A B (-) (+)
6	Light ON	Light ON	If you cannot adjust as above method, set the adjuster (fine) at max. position toward (+), then execute again.	Min.	(-) (+) Max.

Digital Fiber Optic Amplifier (BF5) Communication Converter

▣ Features

- Sets all Functional performance and parameters from external devices (PL, PLC)
- Supports various communications
  : RS485 communication, Serial Communication, SW input
- Connected up to 32 amplifier units (BF5 series)
- Slim design with depth 10mm (W10×H30×L70mm)

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

▣ User Manual

- Visit our website (www.autonics.com) to download user manual and communication manual.
- User manual describes for specifications and function, and communication manual describes for RS485 communication (Modbus RTU protocol) and parameter address map data.

▣ Comprehensive Device Management Program (DAQMaster)

- DAQMaster is comprehensive device management program to set parameter and manage monitoring data.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >

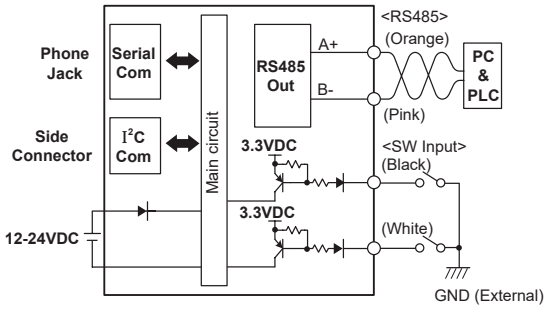
▣ Specifications

Model		NPN Solid-state input	PNP Solid-state input
		BFC-N	BFC-P
Power supply※1		12-24VDC⎓ ±10%	
Current consumption		Max. 40mA	
SW input (SW1, SW2)		LOW: 0-1V, HIGH: 5-24V	
		SW1/SW2 - HH: Standby, HL: BANK0, LH: BANK1, LL: BANK2	SW1/SW2 - LL: Standby, LH: BANK0, HL: BANK1, HH: BANK2
Communication function		RS485 communication, serial communication, SW input	
Communication speed		1200, 2400, 4800, 9600, 19200, 38400bps	
Indication		● Parameter: Red 4-digit 7-segment ● Set value: Green 4-digit 7-segment ● Indicator: TX indicator (red), RX indicator (green)	
Function		● Real-time monitoring (incident light level, on/off state) ● Executes every BF5 feature and sets parameter by external device (PC, PLC)	
Environment	Ambient temperature	-10 to 50℃, storage: -20 to 60℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Vibration		1.5 mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times	
Protection structure		IP40 (IEC standard)	
Material		Case: Polybutylene terephthalate, Cover: Polycarbonate	
Accessory		Connector type wire (Ø4mm, 3-wire, 2m) (AWG 22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm), Side connector	
Approval		CE	
Unit weight		Approx. 15g	

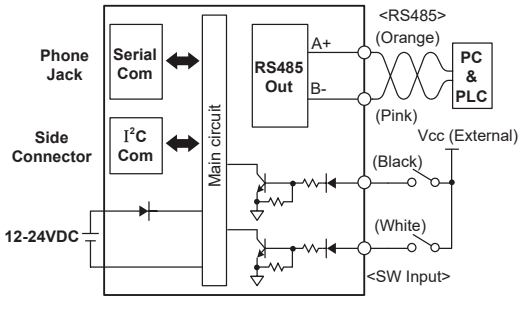
※1: Power is supplied from the voltage of the amplifier unit connected by a side connector.
※Environment resistance is rated at no freezing or condensation.

▣ Control Output Diagram and Terminal Connections

BFC-N

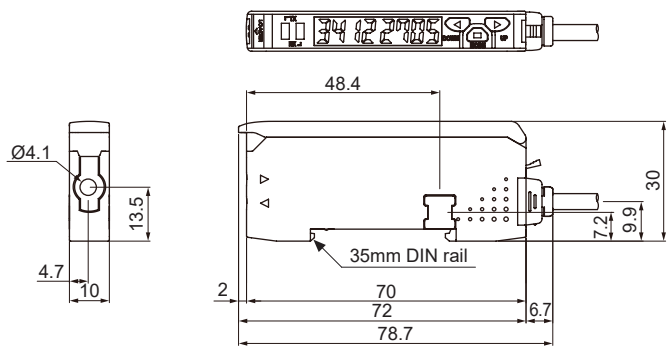


BFC-P



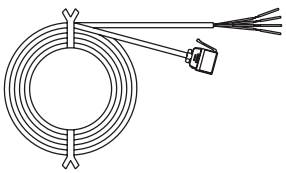
▣ Dimensions

(unit: mm)



• Accessories

• Connector type wire (length: 2m)

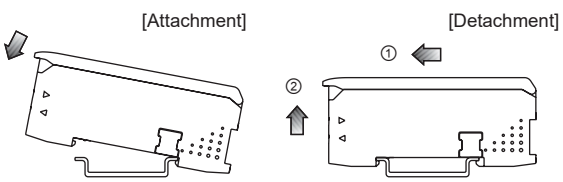


• Side connector

▣ Installations

◎ DIN rail installations

- Attachment: Hang up the backside holder on the DIN rail and press the unit toward the DIN rail.
- Detachment: Slide the back part of the unit as the ① figure and lift up the unit as the ② figure.



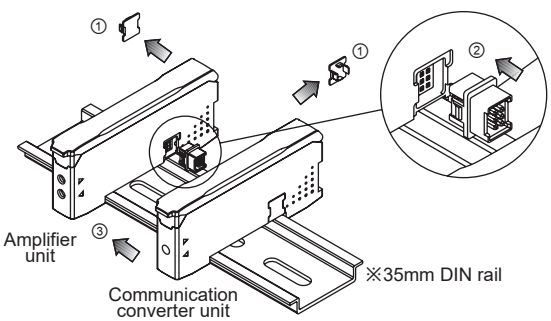
◎ Communication converter unit (BFC series) and Amplifier unit (BF5 series) Connection

- Remove the side cover at the side of communication converter unit where amplifier unit will be connected.
- Attach the side connector to the socket on the side of the communication converter.

※Be sure that if you connect a side connector with excessive force, it may cause extruded pins.

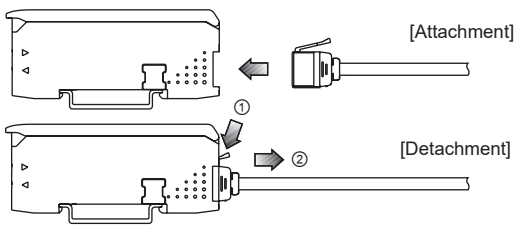
- After attaching the communication converter unit and the amplifier unit to the DIN rail, push gently to make both units fastened into each other.

※Improper connection may cause malfunction.
※Do not supply the power while connecting or disconnecting.



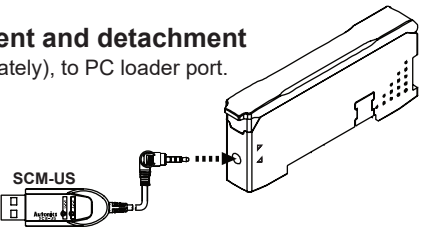
◎ Connector cable attachment and detachment

- Attachment: Insert the connector cable into the installed communication converter unit on DIN rail until it clicks.
- Detachment: Pull out the connector cable by pressing the connector cable lever downside.



◎ USB to Serial converter (SCM-US) attachment and detachment

● Connect the USB to Serial converter, SCM-US (sold separately), to PC loader port.



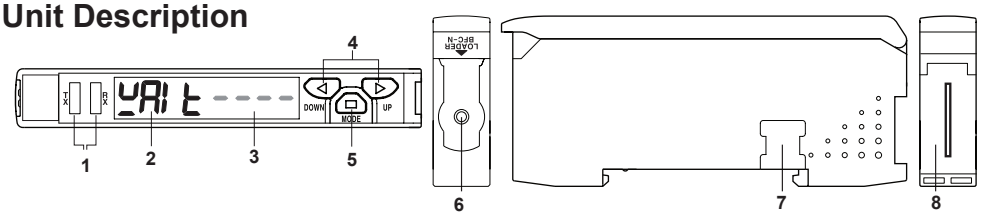
▣ Communication Converter (sold separately)

● SCM-WF48
(Wi-Fi to RS485·USB wireless communication converter)

● SCM-US48I
(USB to RS485 converter)

● SCM-38I
(RS232C to RS485 converter)

▣ Unit Description

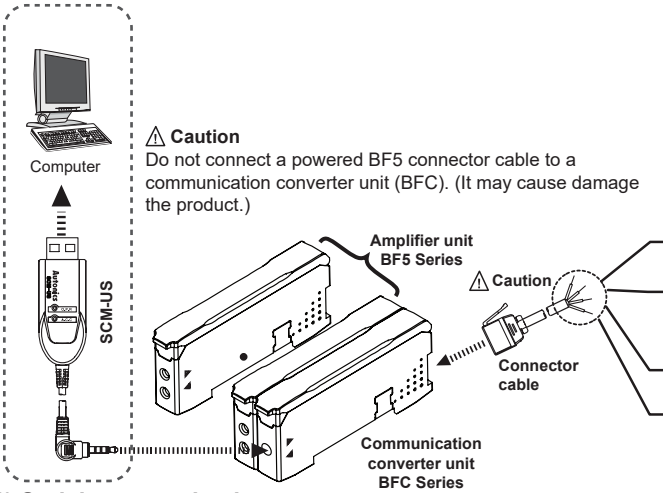


1. TX (Send)-Red LED, RX (Receive)-Green LED: Turns on when communicating and inputting SW.
2. Parameter indication (4-digit red 7seg.): Indicates parameter and processes of communication instruction/execution.
3. Set value indication (4-digit green 7seg.): Indicates set value and process of communication instruction/execution.
4. UP, DOWN key: To modify set value
5. MODE key: To shift or select parameter when entering parameter setting mode.
6. PC loader port: In case of PC communication, use USB to Serial converter (SCM-US, sold separately).
7. Side cover: To connect an amplifier unit, use a side connector (accessory). Remove a side cover to connect an amplifier unit.
8. Connector cable port: Terminal for attaching a connector cable (accessory) is used for RS485 communication or SW input.

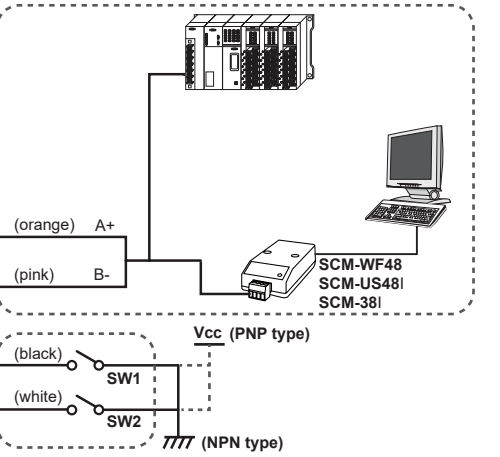
▣ Communication Mode

This communication converter unit supports 2 communication modes and SW input mode.
You can use only 1 mode of 3 modes.

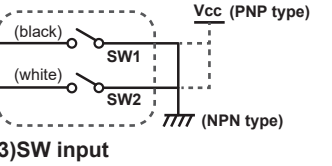
1) Serial communication



2) RS485 communication



3)SW input



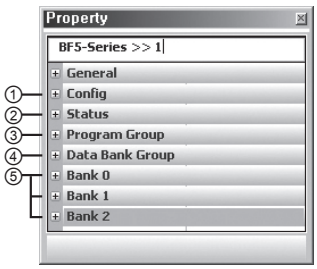
1) Serial communication

① Connect the USB to Serial converter (SCM-US, sold separately) to the PC loader port for communicating with PC.
② It is very easy to manage parameters and monitor data of connected amplifier units (BF5 series) by using the integrated management program DAQMaster (free).

2) RS485 communication

- PLC connection: ① Connect directly to a PLC by using RS485 communication cable of the communication converter unit.
  ② Amplifier units (BF5 series) can be controlled through PLC.
- PC connection: ① Connect PC by using Communication converter (SCM-WF48, SCM-US48I, SCM-38I sold separately).
  ② It is very easy to manage parameters and monitor data of connected amplifier units (BF5 series) by using the comprehensive device management program DAQMaster (free).

※Following is a screen of DAQMaster properties window of a computer connected communication converter unit.



① Config
Indicates the number of amplifier units connected to the communication converter unit (BFC).

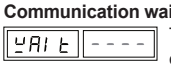
② Status
Indicates the information of the selected amplifier unit (dual, single) by channel, connected to communication converter unit (BFC).

③ Program group
Set values of the amplifier unit can be changed. When set values of the amplifier unit are changed, TX (red) and RX (green) LEDs on communication converter unit will flash indicating application of set values to the amplifier unit.

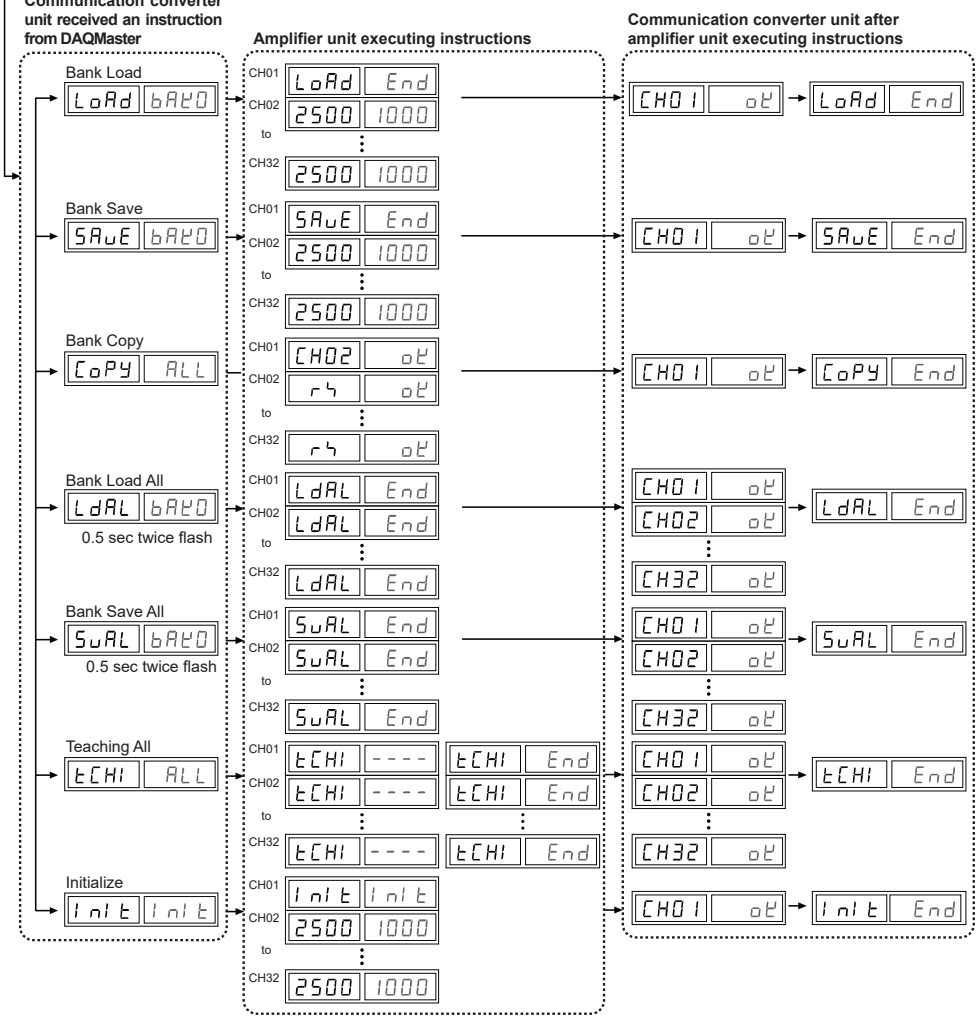
④ Data Bank Group
Data bank and group teaching features of amplifier unit can be set. Amplifier unit can be initialized as well.

※Indications appear on communication converter and amplifier units depending on applied instruction as below.

Communication waiting state



This indicates the waiting state for instructions while preserving master unit (PC,PLC) and communication converter unit in real time data transfer (incident light level of the amplifier unit).



⑤ **Data Bank:** Set value of data bank (Bank 0, Bank 1, Bank 2) can be saved.

3) SW input

SW input is a feature which allows amplifier unit connected with the communication converter unit to load all banks.
Applying signals to SW1 (Black) and SW2 (White) of the connector cables connected to the communication converter unit allows change of banks as shown in chart 1. (SW input signal duration should be longer than 3 seconds.)

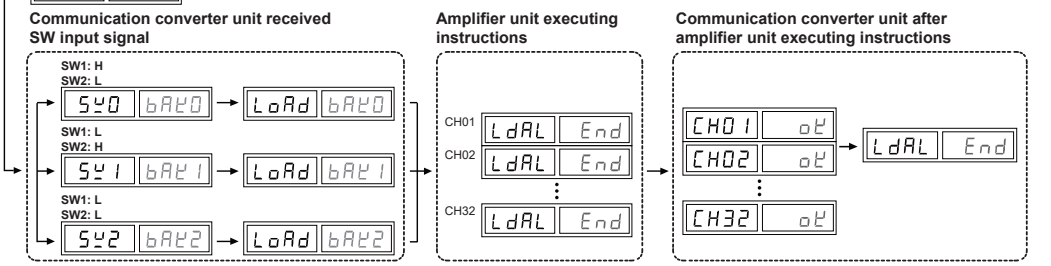
[Chart 1] Bank selection table based on SW input

	Bank	NPN		PNP	
		SW1	SW2	SW1	SW2
1	Standby signal (Using set Bank)	H	H	L	L
2	Bank 0	H	L	L	H
3	Bank 1	L	H	H	L
4	Bank 2	L	L	H	H

※Indications appear on communication converter and amplifier units depending on applied instruction as below.

SW input standby state

At the standby state as shown above display indicates the current bank in use.

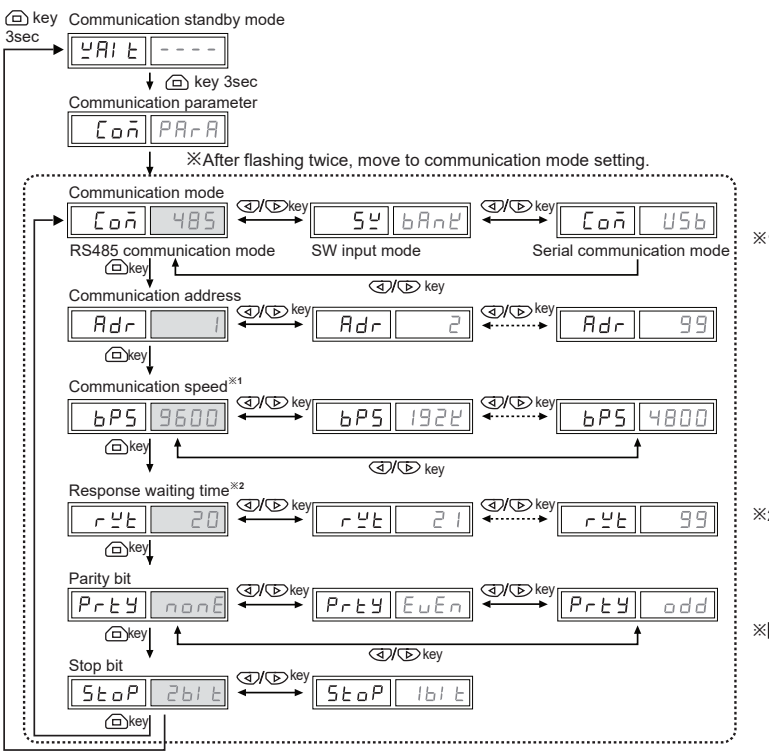


< Communication specification >

Standard	EIA RS485	Standard	EIA RS485
Maximum connections	31 (address setting: 01 to 99)	Response wating time	20 to 99ms
Communication method	2-wire half duplex	Start bit	1-bit (fixed)
Synchronization method	Asynchronous	Stop bit	1-bit, 2-bit
Effective communication distance	Max. 800m	Parity bit	None, Even, Odd
Communication speed	1200, 2400, 4800, 9600, 19200, 38400bps	Data bit	8-bit (fixed)
		Protocol	Modbus RTU

※It is not allowed to set overlapping communication address at the same communication line.
※Please use a proper twist pair for RS485 communication.

▣ Parameter Setting



※1:

Communication speed display	
Speed	Display
1200	1200
2400	2400
4800	4800
9600	9600
19200	192U
38400	384U

※2: Communication response waiting time ranges is 20 to 99ms (Depending on the number of amplifier units connected, response time may increase up to 350ms.)

※ ▭: Factory default

▣ Error Code

Error code	Cause	Troubleshooting
ErA	Reading/Writing errors occur while processing data in EEPROM of amplifier unit.	Check the circuitry around EEPROM inside the product.
Erb	● Slave fails to execute Master's group instructions such as Copy/Load/Save/Teaching sent through communication line due to unstable communication line. ● Other communication problems.	● Check the connection status between communication unit and amplifier units. ● Check the circuitry around the side connector and hardware condition.

Solution methods for communication problems

1) Communication errors during Serial or RS485 connections
- Check if the communication mode selected in communication converter unit suits in installation environment.
- Check and equalize the address of communication converter unit and address set in DAQMaster.
- Check and equalize the communication port of communication converter unit and the communication port number set in DAQMaster.

2) Communication errors during SW signal input
- Check if the communication mode set in communication converter unit is SW input mode (SW Bank).
- Check if the connections are made thoroughly depending on NPN or PNP input type.

Clarification of fiber optic cable model by type

▣ Features

■ Six cable head types available

- Area Detection Type
  -Area detection sensors with wide detection atea
  -Detection of vibrating or falling objects
  -11mm beam width and 750mm maximum detection distance
- Perpendicular Type
  -Easy installation with a single nut
- Flat Type
  -Compact flat heads for installation in tight spaces
  -Various sensing directions
  (top view, flat view, L-type view, top+side view)
  -Integrated bracket types with simple installation
- Cylindrical Type (thread end, cylindrical end)
  : standard cylindrical fiber optic sensors for bracket mounting
- Injection molded plastic type

■ Various Fiber cable types

- Standard type: standard fider optic cables with efficient signal transmission
- FIxible type: Ideal to install in the environments of curves, minimized light intensity changing from bending of the cable, and proper for the tidy installation
- Break-resistant type: withstand frequent dending without breaking
- Coaxial type: excellent signal transmission at close proximity
- Heat-resistant type: withstand extreme temperature conditions form -40℃ to 250℃

▣ Ordering Information

F	T	□	-	4	20	-	10	□	S

Option

S	Small hood

Cable type

No mark	Standard type (-40 to 70℃)
H	Heat-resistance (-40 to 105℃)
H1	Heat-resistance (-40 to 150℃)
H2	Heat-resistance (-40 to 250℃)
R	Flexible type (R1, R2)
B	Break-resistant type (R5)

Fiber diameter

05	Ø0.5mm
06	Ø0.6mm
10	Ø1.0mm
13	Ø1.3mm
14	Ø1.4mm
15	Ø1.5mm
20	Ø2.0mm
F	Ø0.5mm, Ø0.25mm×4 (coaxial type)
F1	Ø0.5mm, Ø0.25mm×9 (coaxial type)
F2	Ø1.0mm, Ø0.265mm×16 (coaxial type)

Cable length

05	0.5m
10	1m
20	2m
10M	10m

Hood diameter (nut)

15	Ø1.5mm
2	Ø2mm (M2)
3	Ø3mm (M3)
4	Ø4mm (M4)
6	Ø6mm (M6)

Head form

No mark	Standard type (bolt type)
W11	Area type (sensing height 11mm)
P	Plastic injection molding type
S	SUS type (SUS length 90mm)
S1	SUS type (SUS length 35mm)
S2	SUS type (SUS length 45mm)
C	Cylinder type
CS	Cylinder+SUS type (SUS length 15mm)
H	Fire cable protection tube
LU	L type/Top view (height 12.2mm)
LU1	L type/Top view (height 17.2mm)
LU2	L type/Top view (height 22.2mm)
F	Flat type/Flat view
FN	Flat type/Side view
FU	Flat type/Top view (up)
FB	Flat type/Side view+Top view (bending)
R	Right-angle

Sensing type

T	Through-beam type
D	Diffuse reflective type
L	Convergent reflective type

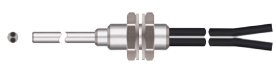
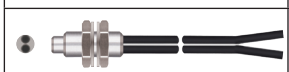
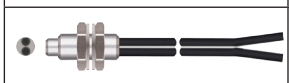
Fiber material

F	Plastic Fiber cable
G	Glass Fiber cable

※It might cause wrong model selection not existing in the above ordering information.

▣ Diffuse Reflective Type

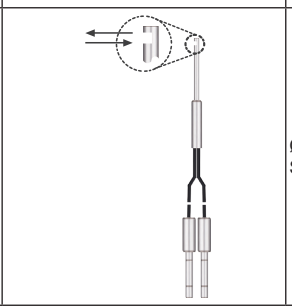
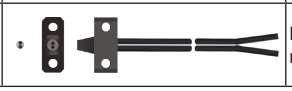
(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Bolt type	Standard type		M3	40※2	Ø0.03	R15	1m (Free cut)	-40 to 70℃	**FD-310-05**
			M3	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FD-320-05**
			M4	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FD-420-05**
			M3 (SUS type, 90mm)	40※2	Ø0.03	R15 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FDS-320-05**
			M3 (SUS type, 45mm)						**FDS2-320-05**
			M4 (SUS type, 90mm)						**FDS-420-05**
			M4 (SUS type, 45mm)						**FDS2-420-05**
			M6	120※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FD-620-10**
			M6 (SUS type, 90mm)	120※2	Ø0.03	R30 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FDS-620-10**
			M6 (SUS type, 45mm)						**FDS2-620-10**
	Heat-resistant type		M6	120※2	Ø0.03	R30	2m (Free cut)	-40 to 105℃	**FD-620-10H**
			M6	160※2	Ø0.03	R50	2m (Free cut)	-40 to 150℃	**FD-620-15H1**
			M4 (Glass type)	100※2	Ø0.03	R50	2m	-40 to 250℃	**GD-420-20H2**
			M6 (Glass type)						**GD-620-20H2**
	Flexible type※4		M3	35※1	Ø0.0125	R1	2m (Free cut)	-40 to 60℃	**FD-320-05R**
			M4						**FD-420-05R**
			M6	130※1	Ø0.04	R1	2m (Free cut)	-40 to 60℃	**FD-620-10R**
	Break-resistant type※4		M3	35※2	Ø0.0125	R5	2m (Free cut)	-40 to 60℃	**FD-320-06B**
			M4						**FD-420-06B**
			M6	100※2	Ø0.0125	R5	2m (Free cut)	-40 to 60℃	**FD-620-13B**

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.
• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]
※Glass type is for BF5, BF4 Series.

▣ Diffuse Reflective Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Bolt type	Coaxial type		M3	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FD-320-F**
			M3	60※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FD-320-F1**
			M6	120※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FD-620-F2**
Cylinder type	Standard type		Ø3mm	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FDC-320-05**
			Ø3mm (SUS type, 15mm)	40※2	Ø0.03	R15 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FDCS-320-05**
	Break-resistant type※4		Ø3mm	35※2	Ø0.0125	R5	2m (Free cut)	-40 to 60℃	**FDC-320-06B**
	Standard type		Ø3mm Side view	30※1	Ø0.0125	R15	2m	-40 to 60℃	**FDCSN-320-05**
	Coaxial type		Ø3mm	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FDC-320-F**
Flat type	Flexible type		Top view	35※1	Ø0.0125	R1	1m (Free cut)	-40 to 60℃	**FDFU-210-05R**
			Side view	30※1	Ø0.0125	R1	1m (Free cut)	-40 to 60℃	**FDFN-210-05R**
			Flat view	30※1	Ø0.0125	R1	1m (Free cut)	-40 to 60℃	**FDF-210-05R**
Right angle	Flexible type		M6	120※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FDR-610-10R**
Plastic	Standard type		Plastic injection molding type	120※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FDP-320-10**

▣ Convergent Reflective Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Flat type	Standard type		Convergent reflective type	8※1	Ø0.0125	R25	2m	-40 to 60℃	**FLF-320-10**

※1: The sensing distance is a standard for BF5 Series.

※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED. It is applied to 40% of sensing distance for BF3RX.

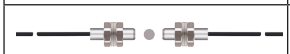
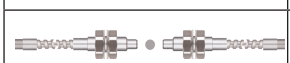
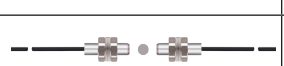
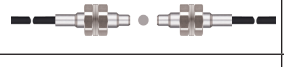
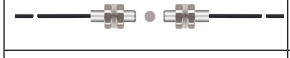
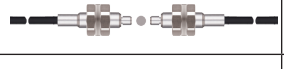
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.

※4: • **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.

※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable. [(FC-3) should be used for cutting fiber cable.]

▣ Through-Beam Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Bolt type	Standard type		M3	150※2	Ø0.5	R15	1m (Free cut)	-40 to 70℃	**FT-310-05**
			M3	150※2	Ø0.5	R15	2m (Free cut)	-40 to 70℃	**FT-320-05**
			M3 (SUS type, 90mm)	150※2	Ø0.5	R15 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FTS-320-05**
			M3 (SUS type, 45mm)						**FTS1-320-05**
			M3 (SUS type, 45mm)						**FTS2-320-05**
			M4	500※2	Ø1	R30	2m (Free cut)	-40 to 70℃	**FT-420-10**
			M4 (SUS type, 90mm)	500※2	Ø1	R30 (SUS part 10)	2m (Free cut)	-40 to 70℃	**FTS-420-10**
			M4 (SUS type, 45mm)	500※2	Ø1	R30 (SUS part 10R)	2m (Free cut)	-40 to 70℃	**FTS2-420-10**
	Heat-resistant type		M4	300※2	Ø1	R30	2m (Free cut)	-40 to 105℃	**FT-420-10H**
			M4	500※2	Ø1	R50	2m (Free cut)	-40 to 150℃	**FT-420-15H1**
			M4 (Glass type)	400※2	Ø1	R25	2m	-40 to 250℃	**GT-420-13H2**
	Flexible type※4		M3	110※1	Ø0.3	R1	2m (Free cut)	-40 to 60℃	**FT-320-05R**
			M4	500※1	Ø0.5	R1	2m (Free cut)	-40 to 60℃	**FT-420-10R**
	Break-resistant type※4		M3	110※1	Ø0.3	R5	2m (Free cut)	-40 to 60℃	**FT-320-06B**
			M4	400※1	Ø0.6	R5	2m (Free cut)	-40 to 60℃	**FT-420-13B**
Cylinder type	Standard type		Ø1.5mm	150※2	Ø0.5	R15	2m (Free cut)	-40 to 70℃	**FTC-1520-05**
			Ø2mm	150※2	Ø0.5	R15	2m (Free cut)	-40 to 70℃	**FTC-220-05**
			Ø2mm (SUS type, 15mm)	150※2	Ø0.5	R15 (SUS part10R)	2m (Free cut)	-40 to 70℃	**FTCS-220-05**
			Ø3mm	150※2	Ø1	R30	2m (Free cut)	-40 to 70℃	**FTC-320-10**

※1: The sensing distance is a standard for BF5 Series.

※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.

※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.

※4: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.

• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.

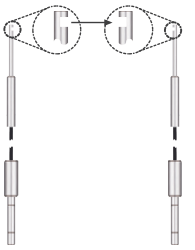
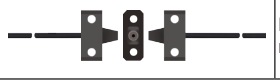
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]

※FT-420-13 was discontinued. FT-420-13B is replacement.

※Glass type is for BF5R, BF4R Series.

▣ Through-Beam Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Cylinder type	Flexible type※4		Ø3mm	110※1	Ø0.3	R1	2m (Free cut)	-40 to 60℃	**FTC-220-05R**
	Break-resistant type※4		Ø3mm	110※2	Ø0.3	R5	2m (Free cut)	-40 to 60℃	**FTC-1520-06B**
	Standard type		Ø2.47mm Side view	120※1	Ø0.0125	R15	2m	-40 to 60℃	**FTCSN-2520-05**
Flat type	Flexible type		Top view	110※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTFU-210-05R**
			Side view	110※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTFN-210-05R**
			Flat view	100※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTF-210-05R**
			Side view+ Top view (Bending)	110※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTFB-210-05R**
			L type Top view height 12.2mm	500※1	Ø0.06	R1	1m (Free cut)	-40 to 60℃	**FTLU-310-10R**
			L type Top view height 17.2mm						**FTLU1-310-10R**
			L type Top view height 22.2mm						**FTLU2-310-10R**
Right angle	Flexible type		M4	460※1	Ø0.5	R1	1m (Free cut)	-40 to 60℃	**FTR-410-10R**
Area type	Flexible type		Ø1mm	750※5	Ø0.07	R2	1m (Free cut)	-40 to 60℃	**FTW11-210-10R**
Plastic	Standard type		Plastic injection molding type	500※2	Ø1	R30	2m (Free cut)	-40 to 70℃	**FTP-320-10**

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.
• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※5: The sensing distance is a standard for BF5 Series, and it is varied by operation mode.
(Ultra fast mode: 450mm / Fast mode: 750mm / Standard mode: 1400mm / Long distance mode, Ultra long distance mode: 1800mm)
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]

▣ Dimensions

Model	Diffuse reflective type	Model	Diffuse reflective type
FDFU-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303	**FDC-320-06B**	M3-D0.6
FDFN-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303	**FD-420-06B**	M4-D0.6
FDF-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303	**FD-620-13B**	M6-D1.3
FD-310-05	M3-D0.5	**FDC-320-05**	Ø3-D0.5
FD-320-05(R)	M3-D0.5	**FDCS-320-05**	Ø3-D0.5 / Stainless steel Ø1.5×15mm
FD-420-05(R)	M4-D0.5	**FDC-320-F**	Co-axial Ø3 / Ø0.5, Ø0.25×4
FD-620-10(R)	M6-D1.0	**FDS-320-05**	M3-D0.5 / Stainless steel Ø1.5×90mm

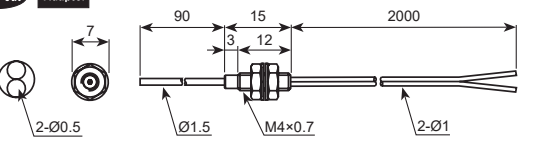
▣ Dimensions

Model	Diffuse reflective type
FD-320-06B	M3-D0.6

Free cut Adapter

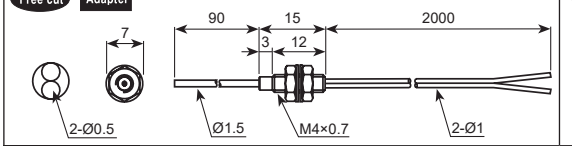
Model	Diffuse reflective type
FDS2-320-05	M3-D0.5 / Stainless steel Ø1.5×45mm

Free cut Adapter



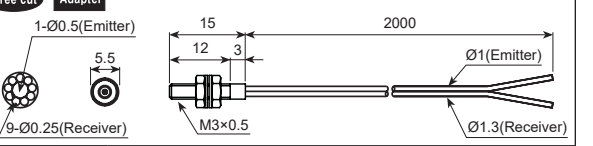
Model	Diffuse reflective type
FDS-420-05	M4-D0.5 / Stainless steel Ø1.5×90mm

Free cut Adapter



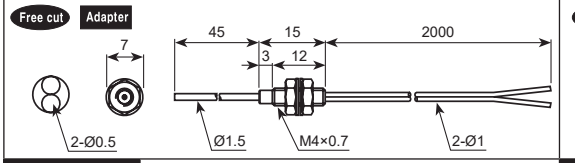
Model	Diffuse reflective type
FD-320-F1	Co-axial M3 / Ø0.5, Ø0.25×9

Free cut Adapter



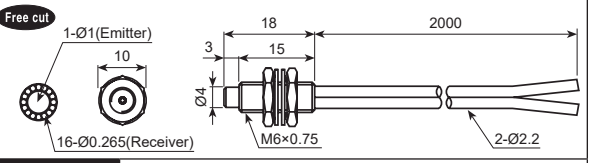
Model	Diffuse reflective type
FDS2-420-05	M4-D0.5 / SUS Ø1.5×45mm

Free cut Adapter



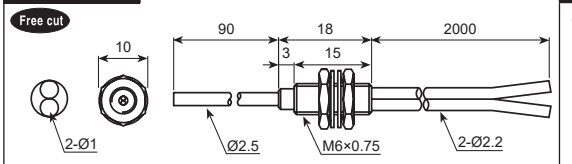
Model	Diffuse reflective type
FD-620-F2	Co-axial M6 / Ø1.0, Ø0.265×16

Free cut



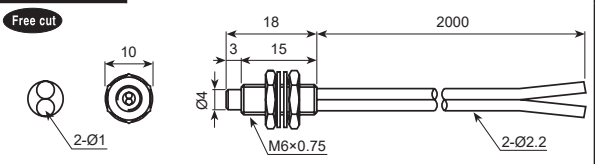
Model	Diffuse reflective type
FDS-620-10	M6-D1.0 / SUS Ø2.5×90mm

Free cut



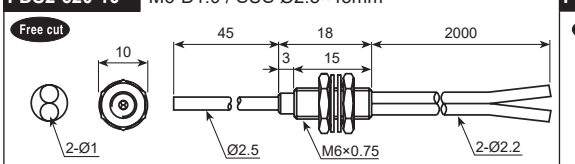
Model	Diffuse reflective type
FD-620-10H	M6-D1.0 / Heat-resistant 105℃

Free cut



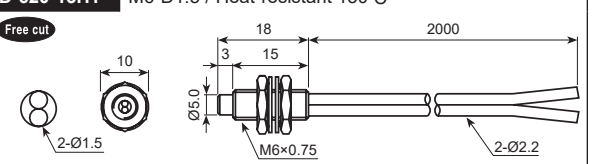
Model	Diffuse reflective type
FDS2-620-10	M6-D1.0 / SUS Ø2.5×45mm

Free cut



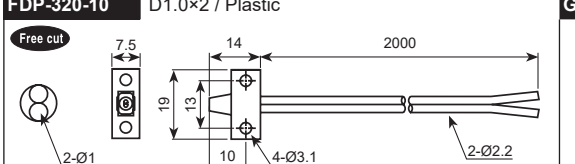
Model	Diffuse reflective type
FD-620-15H1	M6-D1.5 / Heat-resistant 150℃

Free cut

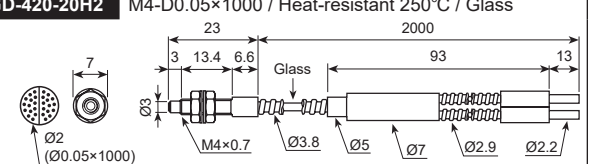


Model	Diffuse reflective type
FDP-320-10	D1.0×2 / Plastic

Free cut

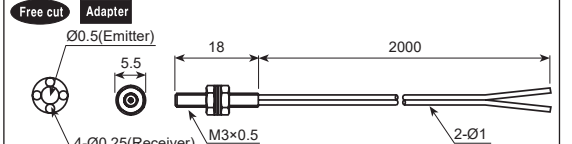


Model	Diffuse reflective type
GD-420-20H2	M4-D0.05×1000 / Heat-resistant 250℃ / Glass

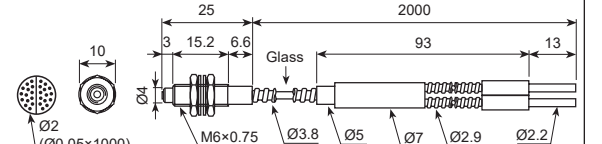


Model	Diffuse reflective type
FD-320-F	Co-axial M3 / Ø0.5, Ø0.25×4

Free cut Adapter

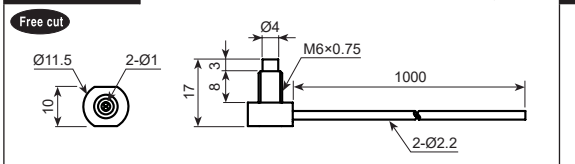


Model	Diffuse reflective type
GD-620-20H2	M6-D0.05×1000 / Heat-resistant 250℃

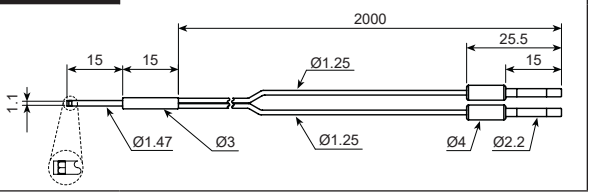


Model	Diffuse reflective type
FDR-610-10R	M6-D1.0 / ※Hood material: Stainless steel type 303

Free cut

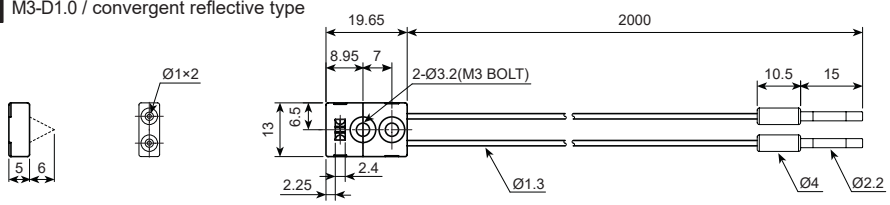


Model	Diffuse reflective type
FDCSN-320-05	Ø3 / Stainless steel Ø1.47×20 / Side view

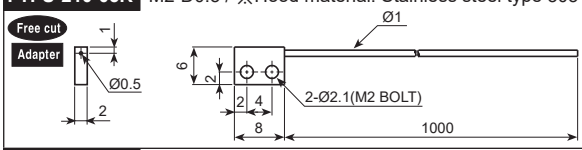


▣ Dimensions

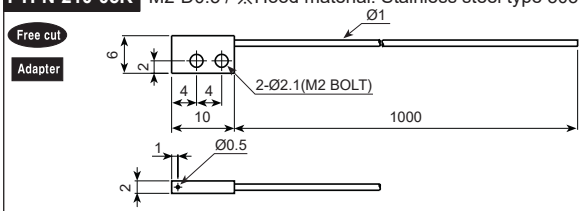
Model	Convergent reflective type
FLF-320-10	M3-D1.0 / convergent reflective type



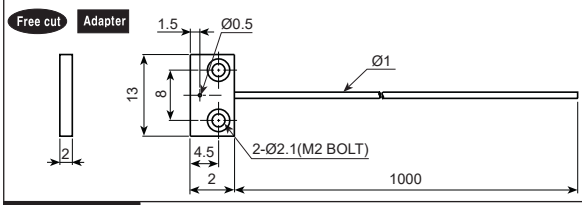
Model	Through-beam type
FTFU-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303



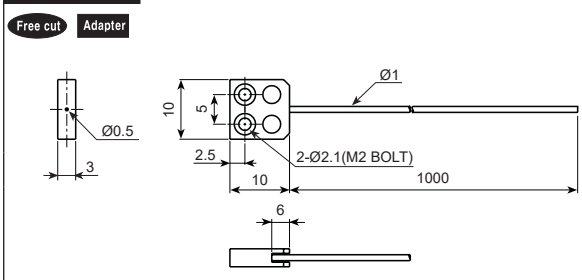
Model	Through-beam type
FTFN-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303



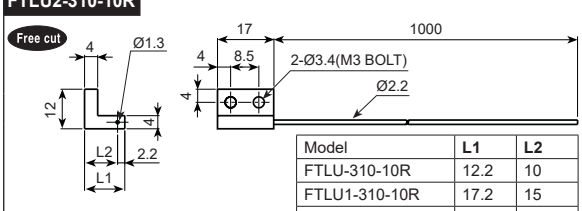
Model	Through-beam type
FTF-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303



Model	Through-beam type
FTFB-210-05R	M2-D0.5 / ※Hood material: Aluminum

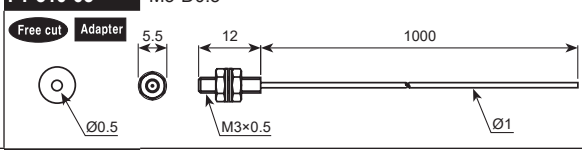


Model	Through-beam type
FTLU-310-10R FTLU1-310-10R FTLU2-310-10R	M2-D0.5 / ※Hood material: Aluminum

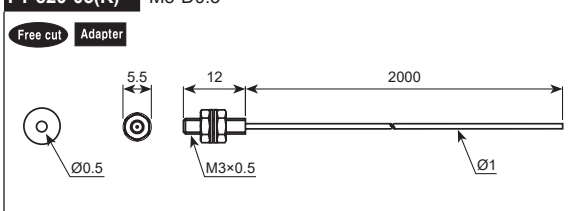


Model	L1	L2
FTLU-310-10R	12.2	10
FTLU1-310-10R	17.2	15
FTLU2-310-10R	22.2	20

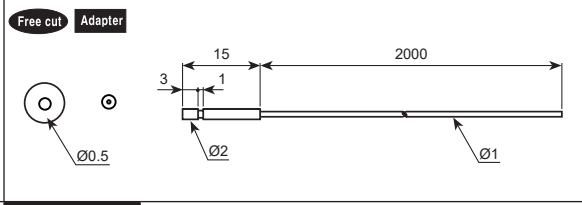
Model	Through-beam type
FT-310-05	M3-D0.5



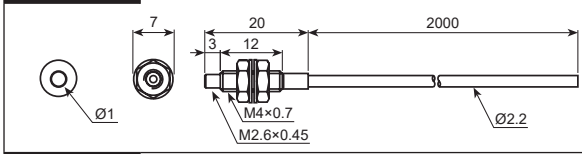
Model	Through-beam type
FT-320-05(R)	M3-D0.5



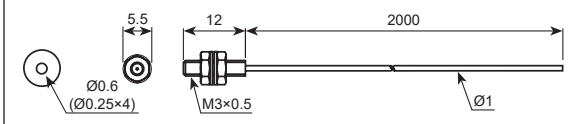
Model	Through-beam type
FTC-220-05(R)	Ø2-D0.5



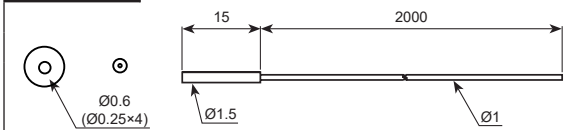
Model	Through-beam type
FT-420-10R	M4-D1.0



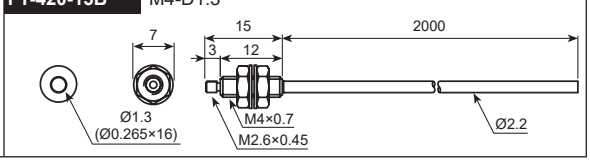
Model	Through-beam type
FT-320-06B	M3-D0.6



Model	Through-beam type
FTC-1520-06B	Ø1.5-D0.6

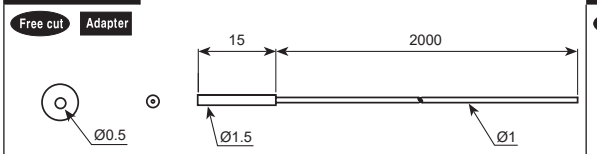


Model	Through-beam type
FT-420-13B	M4-D1.3

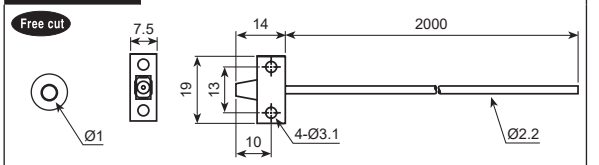


▣ Dimensions

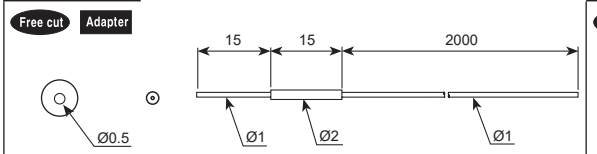
Model	Through-beam type
FTC-1520-05	Ø1.5-D0.5



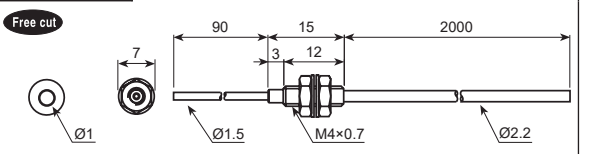
Model	Through-beam type
FTP-320-10	D1.0 / Plastic



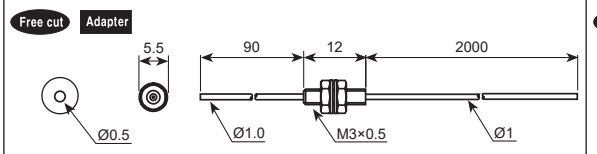
Model	Through-beam type
FTCS-220-05	Ø2-D0.5 / SUS Ø1.0×15mm



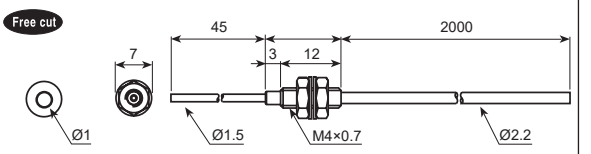
Model	Through-beam type
FTS-420-10	M4-D1.0 / Stainless steel Ø1.5×90m



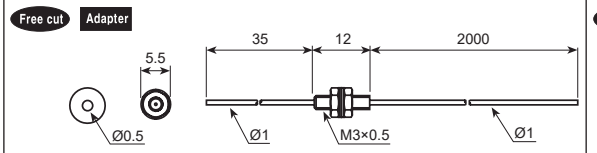
Model	Through-beam type
FTS-320-05	M3-D0.5 / SUS Ø1.0×90mm



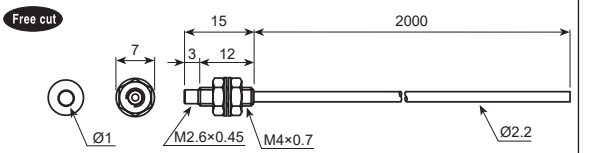
Model	Through-beam type
FTS2-420-10	M4-D1.0 / Stainless steel Ø1.5×45m



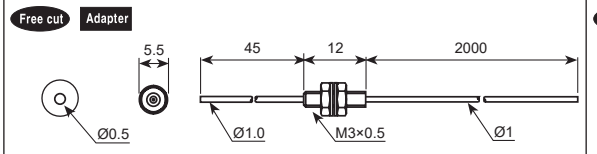
Model	Through-beam type
FTS1-320-05	M3-D0.5 / SUS Ø1.0×35mm



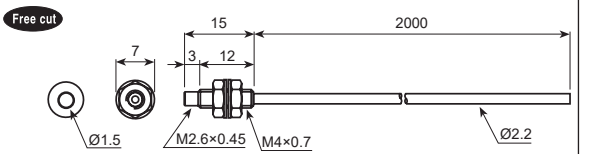
Model	Through-beam type
FT-420-10H	M4-D1.0 / Heat-resistant 105℃



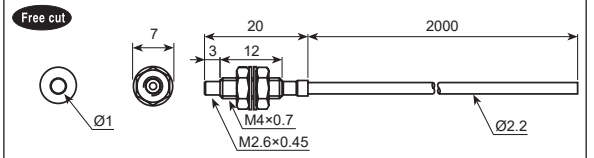
Model	Through-beam type
FTS2-320-05	M3-D0.5 / SUS Ø1.0×45mm



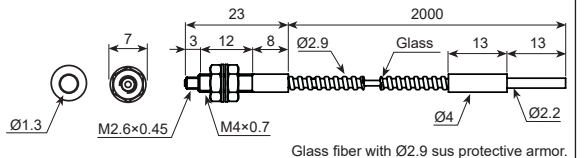
Model	Through-beam type
FT-420-15H1	M4-D1.5 / Heat-resistant 150℃



Model	Through-beam type
FT-420-10	M4-D1.0

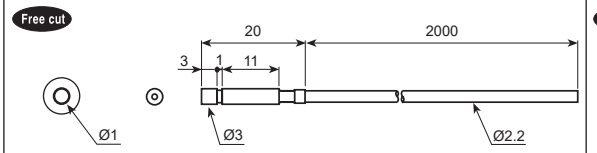


Model	Through-beam type
GT-420-13H2	M4-D1.3 / Heat-resistant Max. 250℃ / Glass

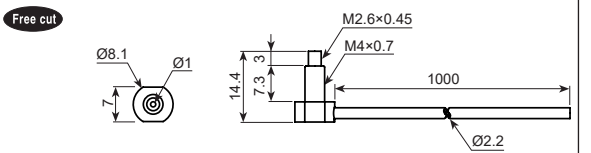


Glass fiber with Ø2.9 sus protective armor.

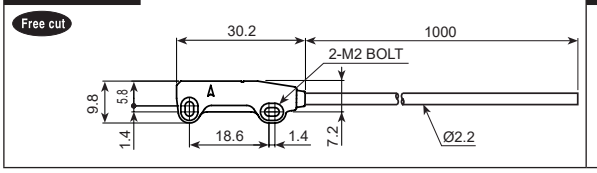
Model	Through-beam type
FTC-320-10	Ø3-D1.0



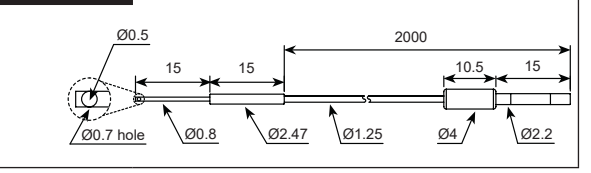
Model	Through-beam type
FTR-410-10R	M4-D1.0 ※Hood material: Stainless steel type 303



Model	Through-beam type
FTW11-210-10R	M2-D1.0



Model	Through-beam type
FTCSN-2520-05	Ø2.47-D0.5 / Stainless steel Ø0.8×15mm / Side view



▣ Lens Unit For Long Distance Detection (sold separately)

◎ Model : FTL-M26


<Lens unit>


<Mounting at cable>

◎ Mounting of lens

Mount the lens unit on the 3mm projecting point of the front hood.

◎ Ambient temperature range of lens unit

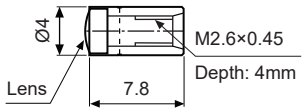
It should be used within -40 to 100℃. (not over 100℃.)

◎ Applicable fiber optic cable and max. mounting distance

- **FT-420-10 : 2500mm**
- **FT-420-10H : 1500mm**

◎ Dimensions

(unit: mm)

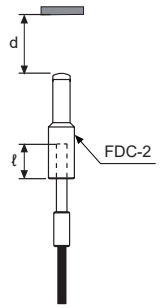
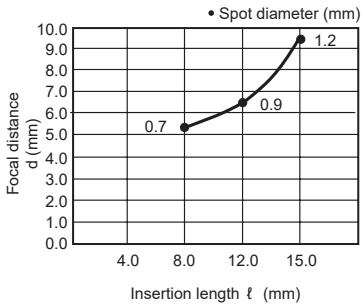


▣ Micro Spot Fiber Optic Cable And Lens Unit (sold separately)

◎ Model

- Fiber optic cable: **FDC-320-F**
- Micro spot lens: **FDC-2**

◎ Feature data

Measuring method	Beam spot characteristic
	

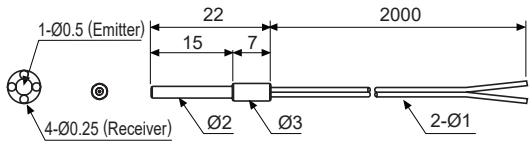
◎ Ambient temperature range of lens unit

It should be used within -40 to 100℃. (not over 100℃.)

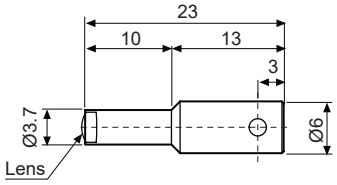
◎ Dimensions

(unit: mm)

- **FDC-320-F**



- **FDC-2**

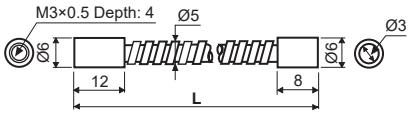
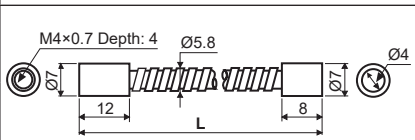
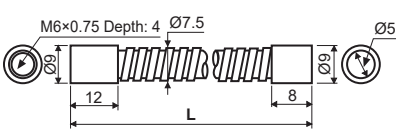


▣ Protection Tube For Fiber Optic Cable (sold separately)

◎ Application

: Protect cable from impact or cutting

(unit: mm)

Model	Appearance and Dimension	L
FTH-305		500
FTH-310		1000
FTH-405		500
FTH-410		1000
FDH-605		500
FDH-610		1000

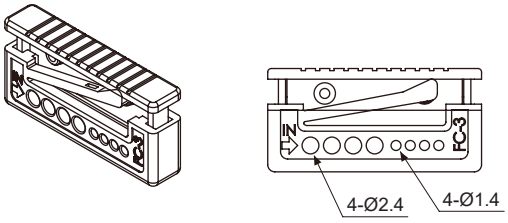
※Additional 8mm is for tube coupling.

▣ Accessory

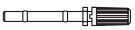
◎ Fiber cutter

Applications: Cutting fiber optic cable, free cut type

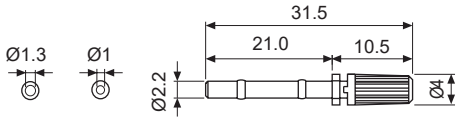
- **FC-3**



◎ Adapter

Adapter: Adapter marked fiber optic cable should be used with adapter 

(unit: mm)



※The inside diameter Ø1 (standard and black)
※The inside diameter Ø1.3(Only applied to the receiver of FD-320-F1 and dark gray.)

Clarification of fiber optic cable model by type

▣ Features

■ Six cable head types available

- Area Detection Type
  -Area detection sensors with wide detection atea
  -Detection of vibrating or falling objects
  -11mm beam width and 750mm maximum detection distance
- Perpendicular Type
  -Easy installation with a single nut
- Flat Type
  -Compact flat heads for installation in tight spaces
  -Various sensing directions
  (top view, flat view, L-type view, top+side view)
  -Integrated bracket types with simple installation
- Cylindrical Type (thread end, cylindrical end)
  : standard cylindrical fiber optic sensors for bracket mounting
- Injection molded plastic type

■ Various Fiber cable types

- Standard type: standard fider optic cables with efficient signal transmission
- FIxible type: Ideal to install in the environments of curves, minimized light intensity changing from bending of the cable, and proper for the tidy installation
- Break-resistant type: withstand frequent dending without breaking
- Coaxial type: excellent signal transmission at close proximity
- Heat-resistant type: withstand extreme temperature conditions form -40℃ to 250℃

▣ Ordering Information

F	T	□	-	4	20	-	10	□	S

Option

S	Small hood

Cable type

No mark	Standard type (-40 to 70℃)
H	Heat-resistance (-40 to 105℃)
H1	Heat-resistance (-40 to 150℃)
H2	Heat-resistance (-40 to 250℃)
R	Flexible type (R1, R2)
B	Break-resistant type (R5)

Fiber diameter

05	Ø0.5mm
06	Ø0.6mm
10	Ø1.0mm
13	Ø1.3mm
14	Ø1.4mm
15	Ø1.5mm
20	Ø2.0mm
F	Ø0.5mm, Ø0.25mm×4 (coaxial type)
F1	Ø0.5mm, Ø0.25mm×9 (coaxial type)
F2	Ø1.0mm, Ø0.265mm×16 (coaxial type)

Cable length

05	0.5m
10	1m
20	2m
10M	10m

Hood diameter (nut)

15	Ø1.5mm
2	Ø2mm (M2)
3	Ø3mm (M3)
4	Ø4mm (M4)
6	Ø6mm (M6)

Head form

No mark	Standard type (bolt type)
W11	Area type (sensing height 11mm)
P	Plastic injection molding type
S	SUS type (SUS length 90mm)
S1	SUS type (SUS length 35mm)
S2	SUS type (SUS length 45mm)
C	Cylinder type
CS	Cylinder+SUS type (SUS length 15mm)
H	Fire cable protection tube
LU	L type/Top view (height 12.2mm)
LU1	L type/Top view (height 17.2mm)
LU2	L type/Top view (height 22.2mm)
F	Flat type/Flat view
FN	Flat type/Side view
FU	Flat type/Top view (up)
FB	Flat type/Side view+Top view (bending)
R	Right-angle

Sensing type

T	Through-beam type
D	Diffuse reflective type
L	Convergent reflective type

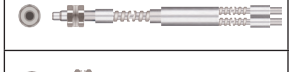
Fiber material

F	Plastic Fiber cable
G	Glass Fiber cable

※It might cause wrong model selection not existing in the above ordering information.

▣ Diffuse Reflective Type

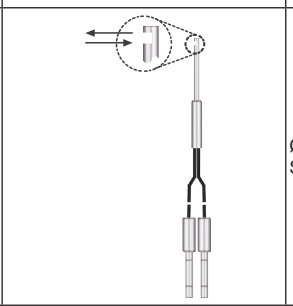
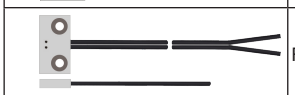
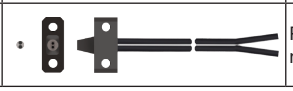
(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Bolt type	Standard type		M3	40※2	Ø0.03	R15	1m (Free cut)	-40 to 70℃	**FD-310-05**
			M3	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FD-320-05**
			M4	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FD-420-05**
			M3 (SUS type, 90mm)	40※2	Ø0.03	R15 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FDS-320-05**
			M3 (SUS type, 45mm)						**FDS2-320-05**
			M4 (SUS type, 90mm)						**FDS-420-05**
			M4 (SUS type, 45mm)						**FDS2-420-05**
			M6	120※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FD-620-10**
			M6 (SUS type, 90mm)	120※2	Ø0.03	R30 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FDS-620-10**
			M6 (SUS type, 45mm)						**FDS2-620-10**
	Heat-resistant type		M6	120※2	Ø0.03	R30	2m (Free cut)	-40 to 105℃	**FD-620-10H**
			M6	160※2	Ø0.03	R50	2m (Free cut)	-40 to 150℃	**FD-620-15H1**
			M4 (Glass type)	100※2	Ø0.03	R50	2m	-40 to 250℃	**GD-420-20H2**
			M6 (Glass type)						**GD-620-20H2**
	Flexible type※4		M3	35※1	Ø0.0125	R1	2m (Free cut)	-40 to 60℃	**FD-320-05R**
			M4						**FD-420-05R**
			M6	130※1	Ø0.04	R1	2m (Free cut)	-40 to 60℃	**FD-620-10R**
	Break-resistant type※4		M3	35※2	Ø0.0125	R5	2m (Free cut)	-40 to 60℃	**FD-320-06B**
			M4						**FD-420-06B**
			M6	100※2	Ø0.0125	R5	2m (Free cut)	-40 to 60℃	**FD-620-13B**

※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED. It is applied to 40% of sensing distance for BF3RX.
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.
• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable. [(FC-3) should be used for cutting fiber cable.]
※Glass type is for BF5, BF4 Series.

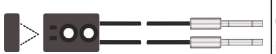
▣ Diffuse Reflective Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Bolt type	Coaxial type		M3	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FD-320-F**
			M3	60※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FD-320-F1**
			M6	120※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FD-620-F2**
Cylinder type	Standard type		Ø3mm	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FDC-320-05**
			Ø3mm (SUS type, 15mm)	40※2	Ø0.03	R15 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FDCS-320-05**
	Break-resistant type※4		Ø3mm	35※2	Ø0.0125	R5	2m (Free cut)	-40 to 60℃	**FDC-320-06B**
	Standard type		Ø3mm Side view	30※1	Ø0.0125	R15	2m	-40 to 60℃	**FDCSN-320-05**
	Coaxial type		Ø3mm	40※2	Ø0.03	R15	2m (Free cut)	-40 to 70℃	**FDC-320-F**
Flat type	Flexible type		Top view	35※1	Ø0.0125	R1	1m (Free cut)	-40 to 60℃	**FDFU-210-05R**
			Side view	30※1	Ø0.0125	R1	1m (Free cut)	-40 to 60℃	**FDFN-210-05R**
			Flat view	30※1	Ø0.0125	R1	1m (Free cut)	-40 to 60℃	**FDF-210-05R**
Right angle	Flexible type		M6	120※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FDR-610-10R**
Plastic	Standard type		Plastic injection molding type	120※2	Ø0.03	R30	2m (Free cut)	-40 to 70℃	**FDP-320-10**

▣ Convergent Reflective Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Flat type	Standard type		Convergent reflective type	8※1	Ø0.0125	R25	2m	-40 to 60℃	**FLF-320-10**

※1: The sensing distance is a standard for BF5 Series.

※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED. It is applied to 40% of sensing distance for BF3RX.

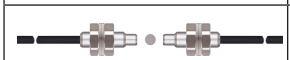
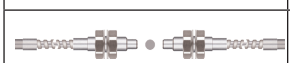
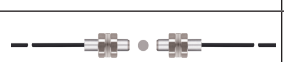
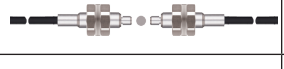
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.

※4: • **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.

※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable. [(FC-3) should be used for cutting fiber cable.]

▣ Through-Beam Type

(based on Non-glossy white paper)

Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Bolt type	Standard type		M3	150※2	Ø0.5	R15	1m (Free cut)	-40 to 70℃	**FT-310-05**
			M3	150※2	Ø0.5	R15	2m (Free cut)	-40 to 70℃	**FT-320-05**
			M3 (SUS type, 90mm)	150※2	Ø0.5	R15 (SUS part R10)	2m (Free cut)	-40 to 70℃	**FTS-320-05**
			M3 (SUS type, 45mm)						**FTS1-320-05**
			M3 (SUS type, 45mm)						**FTS2-320-05**
			M4	500※2	Ø1	R30	2m (Free cut)	-40 to 70℃	**FT-420-10**
			M4 (SUS type, 90mm)	500※2	Ø1	R30 (SUS part 10)	2m (Free cut)	-40 to 70℃	**FTS-420-10**
			M4 (SUS type, 45mm)	500※2	Ø1	R30 (SUS part 10R)	2m (Free cut)	-40 to 70℃	**FTS2-420-10**
	Heat-resistant type		M4	300※2	Ø1	R30	2m (Free cut)	-40 to 105℃	**FT-420-10H**
			M4	500※2	Ø1	R50	2m (Free cut)	-40 to 150℃	**FT-420-15H1**
			M4 (Glass type)	400※2	Ø1	R25	2m	-40 to 250℃	**GT-420-13H2**
	Flexible type※4		M3	110※1	Ø0.3	R1	2m (Free cut)	-40 to 60℃	**FT-320-05R**
			M4	500※1	Ø0.5	R1	2m (Free cut)	-40 to 60℃	**FT-420-10R**
	Break-resistant type※4		M3	110※1	Ø0.3	R5	2m (Free cut)	-40 to 60℃	**FT-320-06B**
			M4	400※1	Ø0.6	R5	2m (Free cut)	-40 to 60℃	**FT-420-13B**
Cylinder type	Standard type		Ø1.5mm	150※2	Ø0.5	R15	2m (Free cut)	-40 to 70℃	**FTC-1520-05**
			Ø2mm	150※2	Ø0.5	R15	2m (Free cut)	-40 to 70℃	**FTC-220-05**
			Ø2mm (SUS type, 15mm)	150※2	Ø0.5	R15 (SUS part10R)	2m (Free cut)	-40 to 70℃	**FTCS-220-05**
			Ø3mm	150※2	Ø1	R30	2m (Free cut)	-40 to 70℃	**FTC-320-10**

※1: The sensing distance is a standard for BF5 Series.

※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.

※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.

※4: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.

• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.

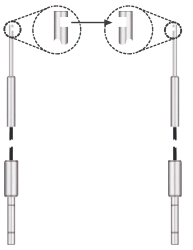
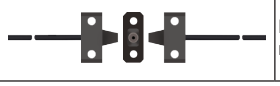
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]

※FT-420-13 was discontinued. FT-420-13B is replacement.

※Glass type is for BF5R, BF4R Series.

▣ Through-Beam Type

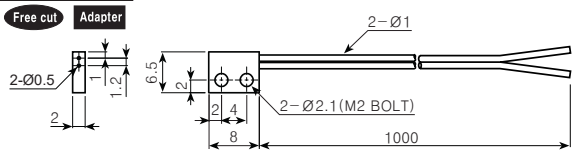
(based on Non-glossy white paper)

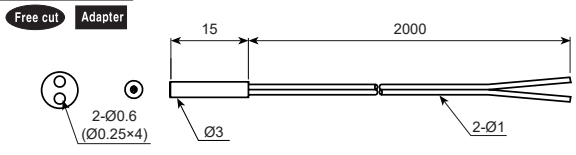
Type		Appearance	Feature	Sensing distance (mm)	Min. Sensing Target※3	Allowable Bend Radius	Cable length (L)	Ambient Temperature	Model
Cylinder type	Flexible type※4		Ø3mm	110※1	Ø0.3	R1	2m (Free cut)	-40 to 60℃	**FTC-220-05R**
	Break-resistant type※4		Ø3mm	110※2	Ø0.3	R5	2m (Free cut)	-40 to 60℃	**FTC-1520-06B**
	Standard type		Ø2.47mm Side view	120※1	Ø0.0125	R15	2m	-40 to 60℃	**FTCSN-2520-05**
Flat type	Flexible type		Top view	110※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTFU-210-05R**
			Side view	110※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTFN-210-05R**
			Flat view	100※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTF-210-05R**
			Side view+ Top view (Bending)	110※1	Ø0.04	R1	1m (Free cut)	-40 to 60℃	**FTFB-210-05R**
			L type Top view height 12.2mm	500※1	Ø0.06	R1	1m (Free cut)	-40 to 60℃	**FTLU-310-10R**
			L type Top view height 17.2mm						**FTLU1-310-10R**
			L type Top view height 22.2mm						**FTLU2-310-10R**
Right angle	Flexible type		M4	460※1	Ø0.5	R1	1m (Free cut)	-40 to 60℃	**FTR-410-10R**
Area type	Flexible type		Ø1mm	750※5	Ø0.07	R2	1m (Free cut)	-40 to 60℃	**FTW11-210-10R**
Plastic	Standard type		Plastic injection molding type	500※2	Ø1	R30	2m (Free cut)	-40 to 70℃	**FTP-320-10**

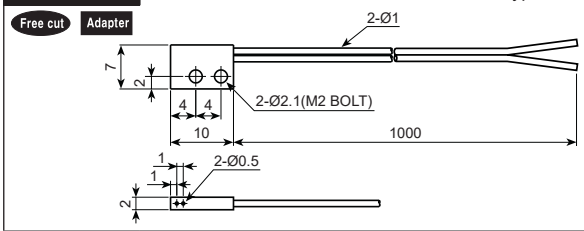
※1: The sensing distance is a standard for BF5 Series.
※2: The sensing distance is a standard for red LED of BF4 Series and 10% of red LED is applied when it is green LED.
It is applied to 40% of sensing distance for BF3RX.
※3: Min. sensing target is a value measured opaque material in accurate output status and the sensing distance is different with the rated sensing distance ※2.
※4: • **Flexible optical fiber (Multi core):** A large number of ultra-fine cores are all surrounded by cladding. Easy to install it in the many places as the change of the intensity of radiation by bending is small.
• **Break-resistant optical fiber:** The fiber units contain a large number of independent fine fibers, by ensuring a high degree of flexibility. It can be used for moving parts (robot hand) and it is not easily broken.
※5: The sensing distance is a standard for BF5 Series, and it is varied by operation mode.
(Ultra fast mode: 450mm / Fast mode: 750mm / Standard mode: 1400mm / Long distance mode, Ultra long distance mode: 1800mm)
※Free cut type's sensing distance can be shortened about max. 20% than the normal according to condition of the cable.
[(FC-3) should be used for cutting fiber cable.]

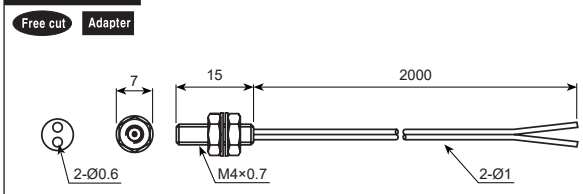
▣ Dimensions

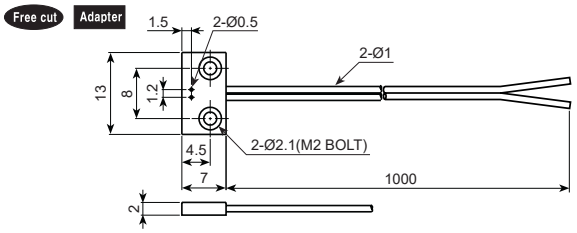
Model	Diffuse reflective type	Model	Diffuse reflective type
FDFU-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303	**FDC-320-06B**	M3-D0.6
FDFN-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303	**FD-420-06B**	M4-D0.6
FDF-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303	**FD-620-13B**	M6-D1.3
FD-310-05	M3-D0.5	**FDC-320-05**	Ø3-D0.5
FD-320-05(R)	M3-D0.5	**FDCS-320-05**	Ø3-D0.5 / Stainless steel Ø1.5×15mm
FD-420-05(R)	M4-D0.5	**FDC-320-F**	Co-axial Ø3 / Ø0.5, Ø0.25×4
FD-620-10(R)	M6-D1.0	**FDS-320-05**	M3-D0.5 / Stainless steel Ø1.5×90mm

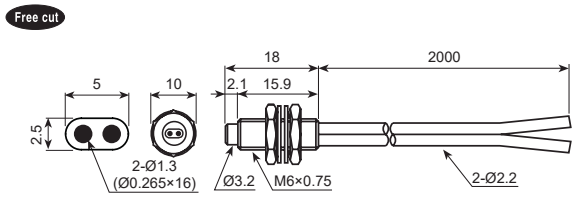


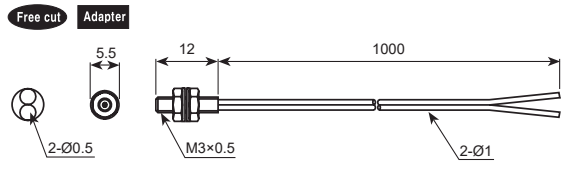


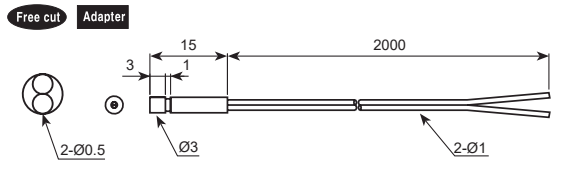


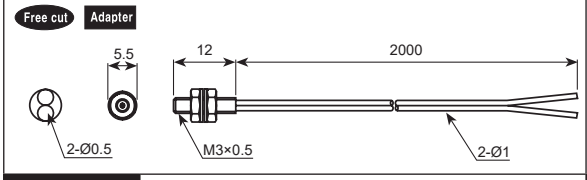


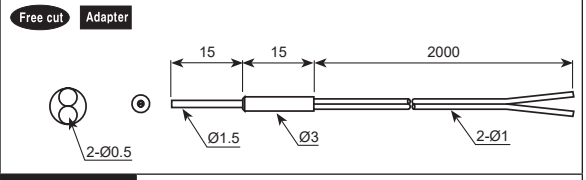


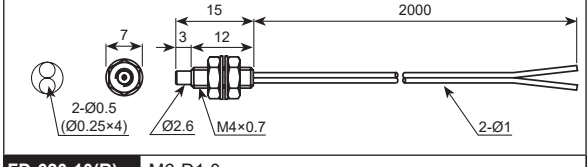


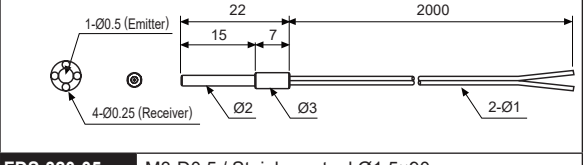


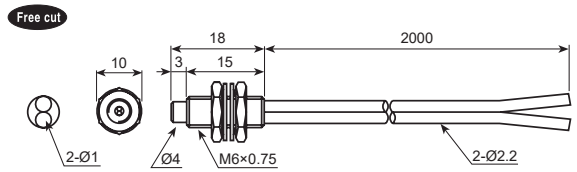


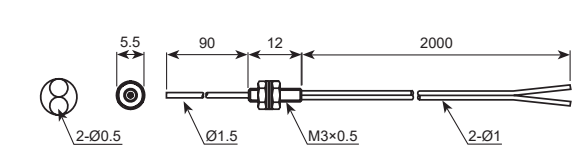








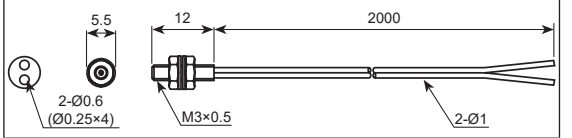




▣ Dimensions

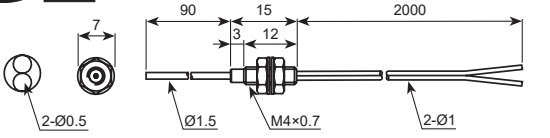
Model	Diffuse reflective type
FD-320-06B	M3-D0.6

Free cut Adapter



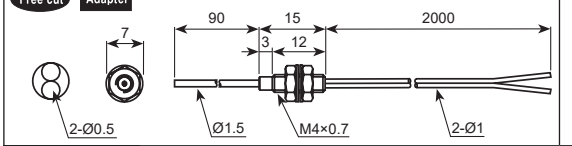
Model	Diffuse reflective type
FDS2-320-05	M3-D0.5 / Stainless steel Ø1.5×45mm

Free cut Adapter



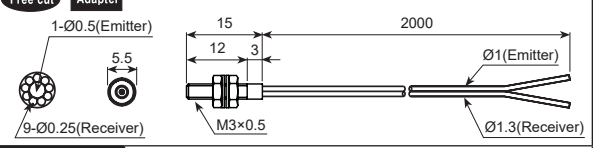
Model	Diffuse reflective type
FDS-420-05	M4-D0.5 / Stainless steel Ø1.5×90mm

Free cut Adapter



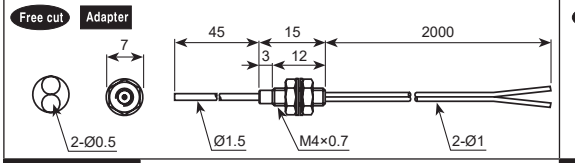
Model	Diffuse reflective type
FD-320-F1	Co-axial M3 / Ø0.5, Ø0.25×9

Free cut Adapter



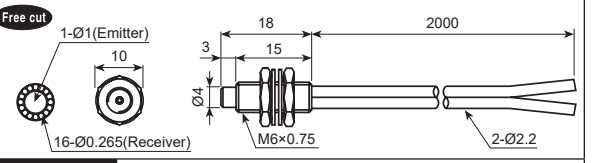
Model	Diffuse reflective type
FDS2-420-05	M4-D0.5 / SUS Ø1.5×45mm

Free cut Adapter



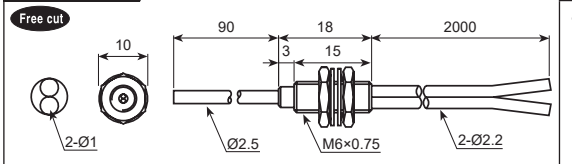
Model	Diffuse reflective type
FD-620-F2	Co-axial M6 / Ø1.0, Ø0.265×16

Free cut



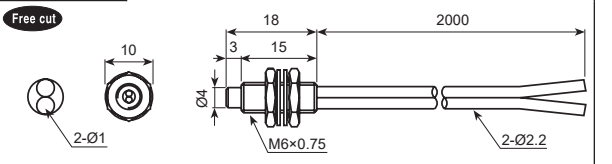
Model	Diffuse reflective type
FDS-620-10	M6-D1.0 / SUS Ø2.5×90mm

Free cut



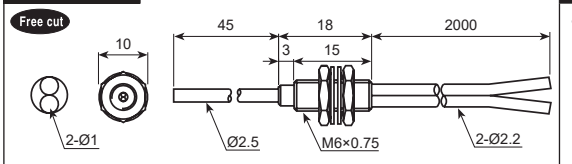
Model	Diffuse reflective type
FD-620-10H	M6-D1.0 / Heat-resistant 105℃

Free cut



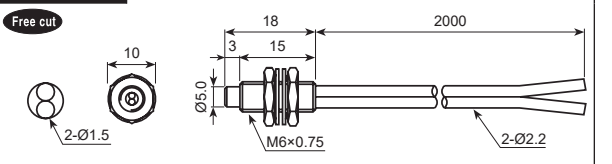
Model	Diffuse reflective type
FDS2-620-10	M6-D1.0 / SUS Ø2.5×45mm

Free cut



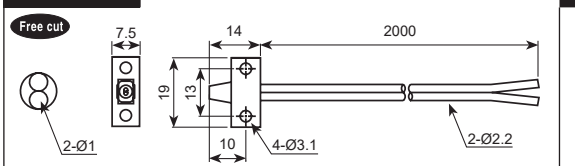
Model	Diffuse reflective type
FD-620-15H1	M6-D1.5 / Heat-resistant 150℃

Free cut

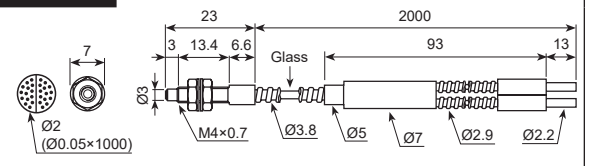


Model	Diffuse reflective type
FDP-320-10	D1.0×2 / Plastic

Free cut

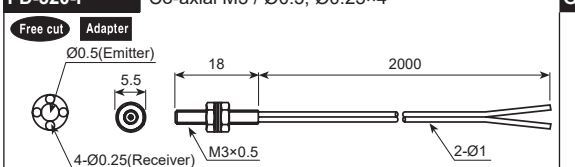


Model	Diffuse reflective type
GD-420-20H2	M4-D0.05×1000 / Heat-resistant 250℃ / Glass

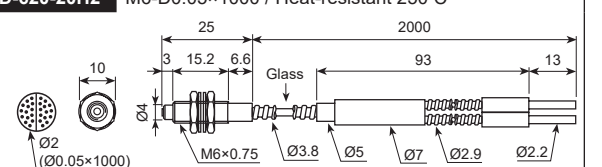


Model	Diffuse reflective type
FD-320-F	Co-axial M3 / Ø0.5, Ø0.25×4

Free cut Adapter

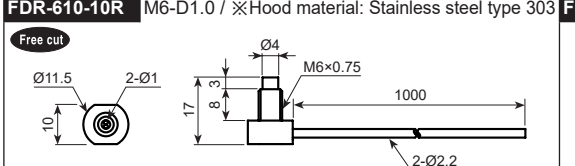


Model	Diffuse reflective type
GD-620-20H2	M6-D0.05×1000 / Heat-resistant 250℃

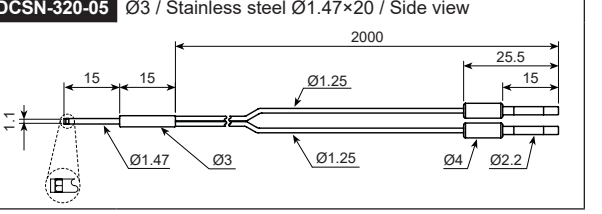


Model	Diffuse reflective type
FDR-610-10R	M6-D1.0 / ※Hood material: Stainless steel type 303

Free cut

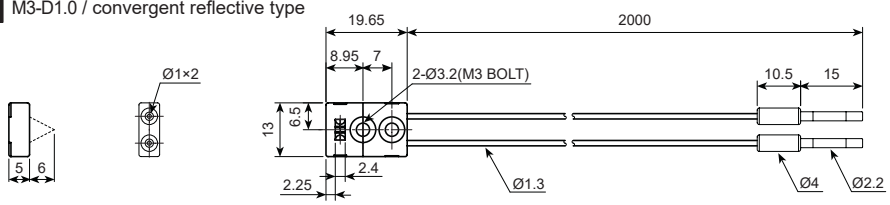


Model	Diffuse reflective type
FDCSN-320-05	Ø3 / Stainless steel Ø1.47×20 / Side view

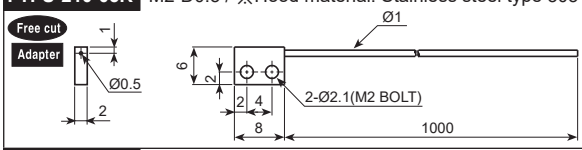


▣ Dimensions

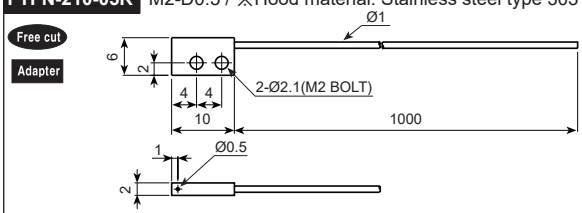
Model	Convergent reflective type
FLF-320-10	M3-D1.0 / convergent reflective type



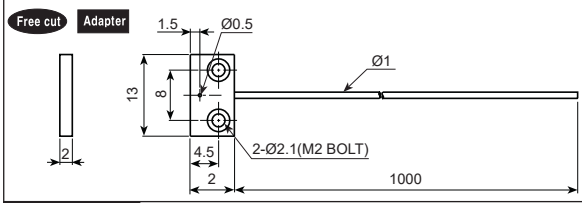
Model	Through-beam type
FTFU-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303



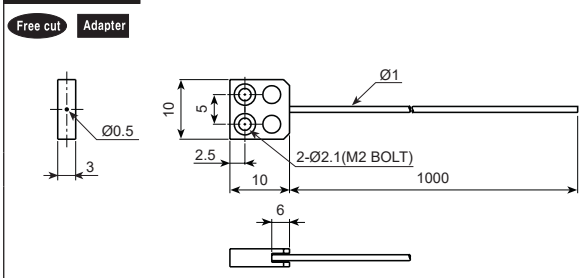
Model	Through-beam type
FTFN-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303



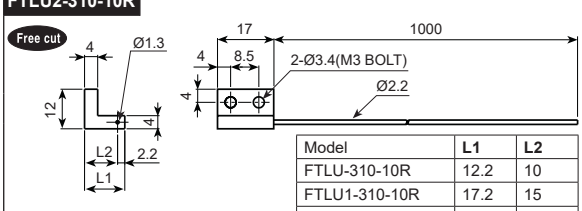
Model	Through-beam type
FTF-210-05R	M2-D0.5 / ※Hood material: Stainless steel type 303



Model	Through-beam type
FTFB-210-05R	M2-D0.5 / ※Hood material: Aluminum

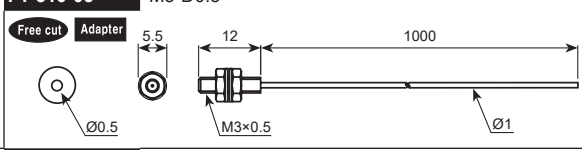


Model	Through-beam type
FTLU-310-10R FTLU1-310-10R FTLU2-310-10R	M2-D0.5 / ※Hood material: Aluminum

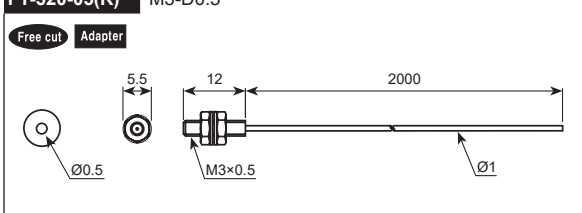


Model	L1	L2
FTLU-310-10R	12.2	10
FTLU1-310-10R	17.2	15
FTLU2-310-10R	22.2	20

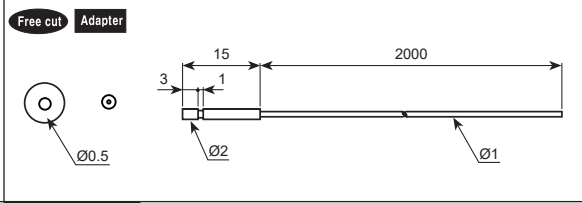
Model	Through-beam type
FT-310-05	M3-D0.5



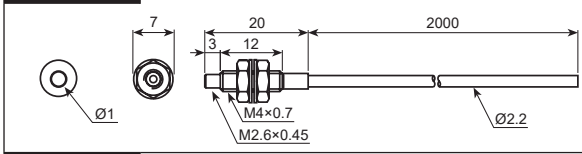
Model	Through-beam type
FT-320-05(R)	M3-D0.5



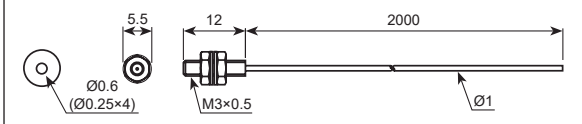
Model	Through-beam type
FTC-220-05(R)	Ø2-D0.5



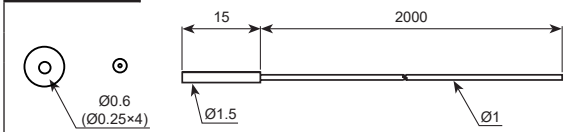
Model	Through-beam type
FT-420-10R	M4-D1.0



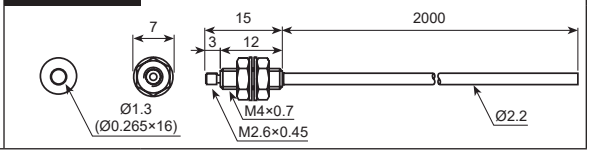
Model	Through-beam type
FT-320-06B	M3-D0.6



Model	Through-beam type
FTC-1520-06B	Ø1.5-D0.6

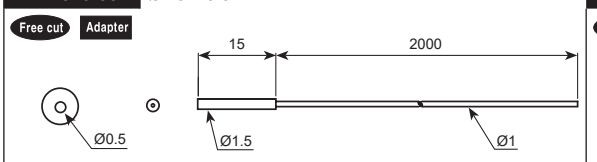


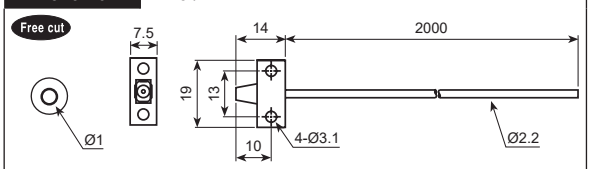
Model	Through-beam type
FT-420-13B	M4-D1.3

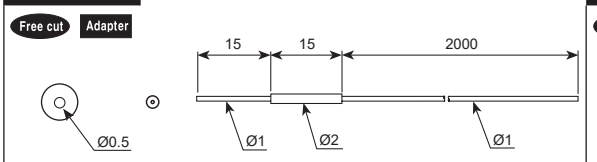


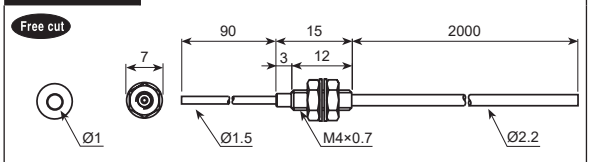
▣ Dimensions

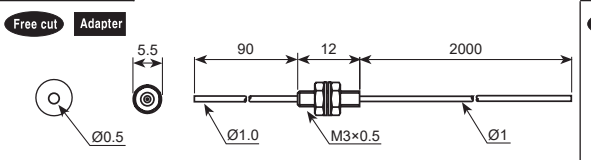
Model	Through-beam type	Model	Through-beam type
FTC-1520-05	Ø1.5-D0.5	FTP-320-10	D1.0 / Plastic
FTCS-220-05	Ø2-D0.5 / SUS Ø1.0×15mm	FTS-420-10	M4-D1.0 / Stainless steel Ø1.5×90m
FTS-320-05	M3-D0.5 / SUS Ø1.0×90mm	FTS2-420-10	M4-D1.0 / Stainless steel Ø1.5×45m
FTS1-320-05	M3-D0.5 / SUS Ø1.0×35mm	FT-420-10H	M4-D1.0 / Heat-resistant 105℃
FTS2-320-05	M3-D0.5 / SUS Ø1.0×45mm	FT-420-15H1	M4-D1.5 / Heat-resistant 150℃
FT-420-10	M4-D1.0	GT-420-13H2	M4-D1.3 / Heat-resistant Max. 250℃ / Glass
FTC-320-10	Ø3-D1.0	FTR-410-10R	M4-D1.0 ※Hood material: Stainless steel type 303
FTW11-210-10R	M2-D1.0	FTCSN-2520-05	Ø2.47-D0.5 / Stainless steel Ø0.8×15mm / Side view

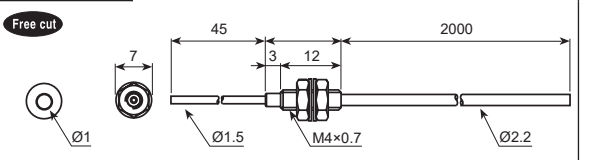


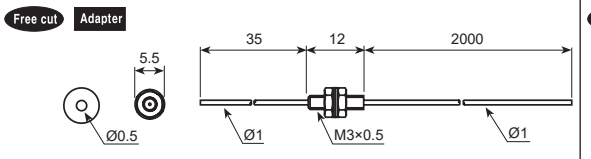


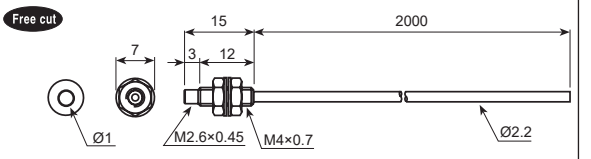


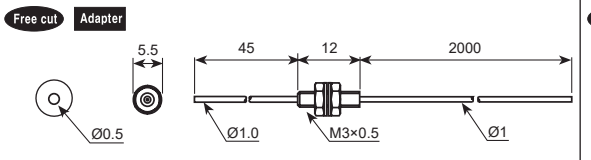


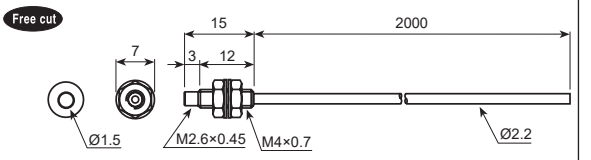


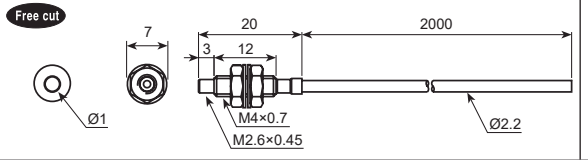


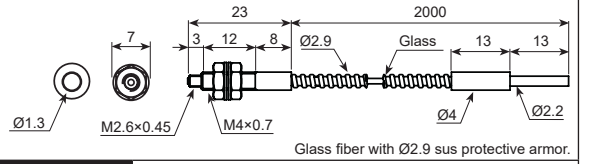


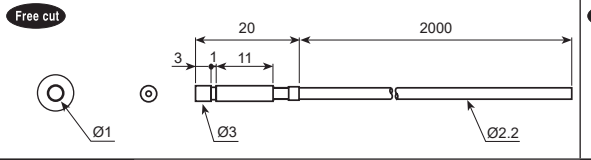


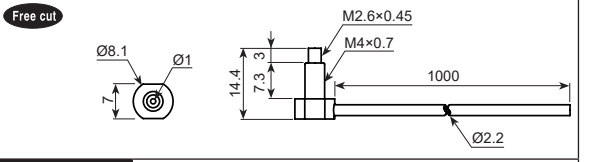


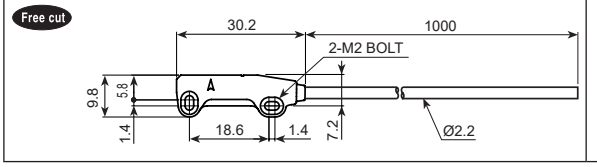


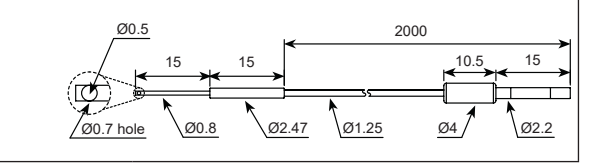












▣ Lens Unit For Long Distance Detection (sold separately)

◎ Model : FTL-M26


<Lens unit>


<Mounting at cable>

◎ Mounting of lens

Mount the lens unit on the 3mm projecting point of the front hood.

◎ Ambient temperature range of lens unit

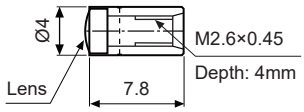
It should be used within -40 to 100℃. (not over 100℃.)

◎ Applicable fiber optic cable and max. mounting distance

- **FT-420-10 : 2500mm**
- **FT-420-10H : 1500mm**

◎ Dimensions

(unit: mm)

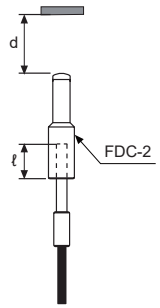
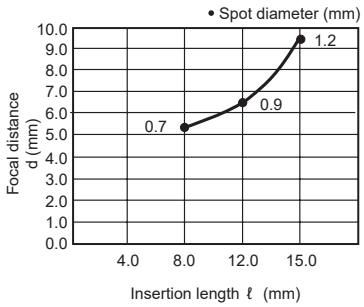


▣ Micro Spot Fiber Optic Cable And Lens Unit (sold separately)

◎ Model

- Fiber optic cable: **FDC-320-F**
- Micro spot lens: **FDC-2**

◎ Feature data

Measuring method	Beam spot characteristic
	

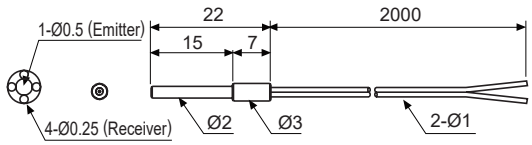
◎ Ambient temperature range of lens unit

It should be used within -40 to 100℃. (not over 100℃.)

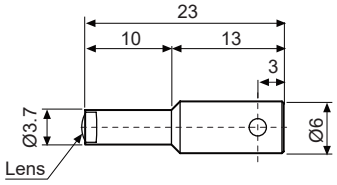
◎ Dimensions

(unit: mm)

- **FDC-320-F**



- **FDC-2**

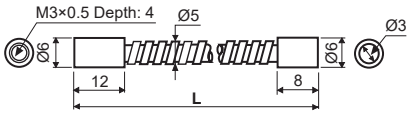
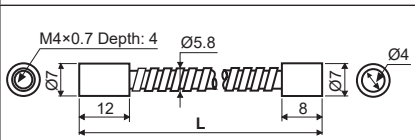
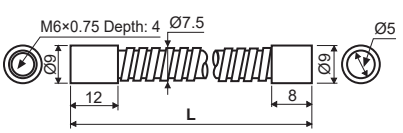


▣ Protection Tube For Fiber Optic Cable (sold separately)

◎ Application

: Protect cable from impact or cutting

(unit: mm)

Model	Appearance and Dimension	L
FTH-305		500
FTH-310		1000
FTH-405		500
FTH-410		1000
FDH-605		500
FDH-610		1000

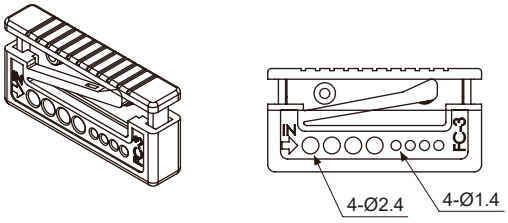
※Additional 8mm is for tube coupling.

▣ Accessory

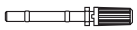
◎ Fiber cutter

Applications: Cutting fiber optic cable, free cut type

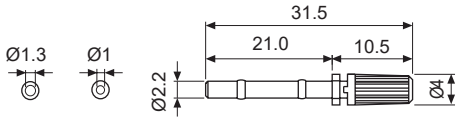
- **FC-3**



◎ Adapter

Adapter: Adapter marked fiber optic cable should be used with adapter 

(unit: mm)



※The inside diameter Ø1 (standard and black)
※The inside diameter Ø1.3(Only applied to the receiver of FD-320-F1 and dark gray.)

Liquid Level Sensor for Mounting Pipe (Through-Beam)

▣ Features

- Detects liquid in a transparent/semitransparent pipe diameter Ø6 to 13mm, thickness 1mm
- Compact size: W23×H14×L13mm
- Selectable Light ON/Dark ON operation mode by operation mode switching button
- Easy to check operation status by operation mode indicator [green LED (Light ON: on, Dark ON: off)], operation indicator [red LED]
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit
- IP64 of protection structure (IEC standards)

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

▣ Model

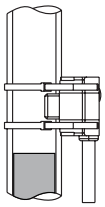
Model	Pipe diameter	Sensing type	Power supply	Control output
BL13-TDT	Ø6 to 13mm	Through-beam	12-24VDC ±10%	NPN open collector output
BL13-TDT-P				PNP open collector output

▣ Specifications

Model	NPN open collector output	**BL13-TDT**
	PNP open collector output	**BL13-TDT-P**
Sensing type		Through-beam
Applicable pipe		●Using binding band: Ø6 to 13mm ●Using protection bracket: Ø12.7mm (1/2 inch) transparent pipes in 1mm thicknes s (FEP (fluoroplastic) or with equivalent transparency)
Standard sensing target		Liquid in a pipe※1
Response time		Max. 2ms
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)
Current consumption		Max. 30mA
Light source		Infrared LED (950nm)
Operation mode		Light ON/Dark ON operation mode switch button
Control output		NPN or PNP open collector output ●Load voltage: max. 30VDC⎓ ●Load current: max. 100mA ●Residual voltage: max. 1VDC⎓
Protection circuit		Reverse polarity protection circuit, output short overcurrent protection circuit
Indicator		Operation indicator: red LED, operation mode indicator: green LED
Insulation resistance		Over 20MΩ (at 500VDC megger)
Noise immunity		±240V the square wave noise (pulse width: 1㎲) by the noise simulator
Dielectric strength		1,000VAC 50/60Hz for 1 minute (between all terminals and case)
Vibration		1.5mm amplitude or 300m/s^2 at frequency of 10 to 55Hz in each of X, Y, Z direction for 2 hours
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times
Envi-ron-ment	Ambient illumination	Sunlight/incandescent lamp: max. 3,000lx for each (receiver illumination)
	Ambient temperature	10 to 55℃, storage: -25 to 65℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Protection structure		IP64 (IEC standard)
Material		Case: polycarbonate
Cable		Ø2.5, 3-wire, 1m (AWG28, core diameter: 0.08mm, number of cores: 19, insulator diameter: Ø0.9)
Accessory		Binding band: 2, anti-slip tube: 2
Approval		CE
Weight※2		Approx. 50g (approx. 13g)

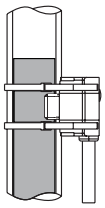
※1: This may not detect the liquid with low transparent, with high viscosity, or with floating matters.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

▣ Operation Mode

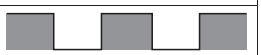


Absent liquid (light on)

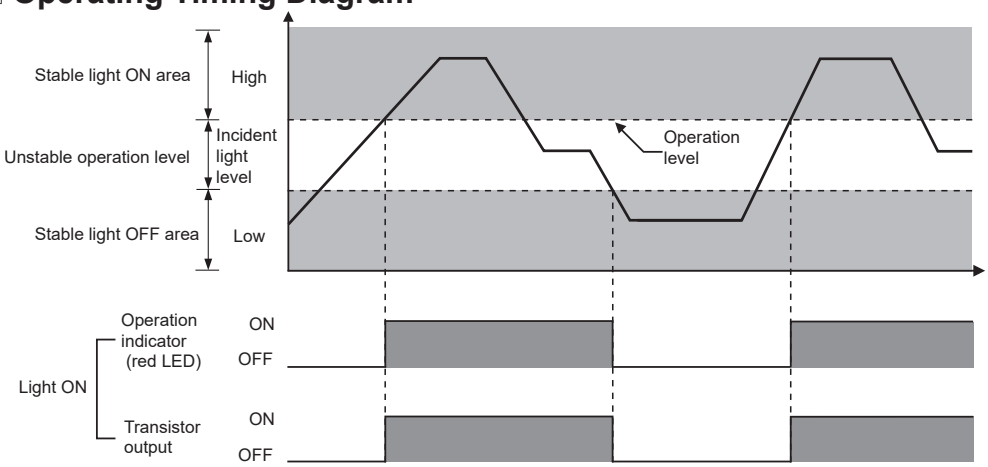
Operation mode	Light ON
Receiver operation	Received light / Interrupted light 
Operation indicator (red LED)	ON / OFF 
Transistor output	ON / OFF 



Present liquid (dark on)

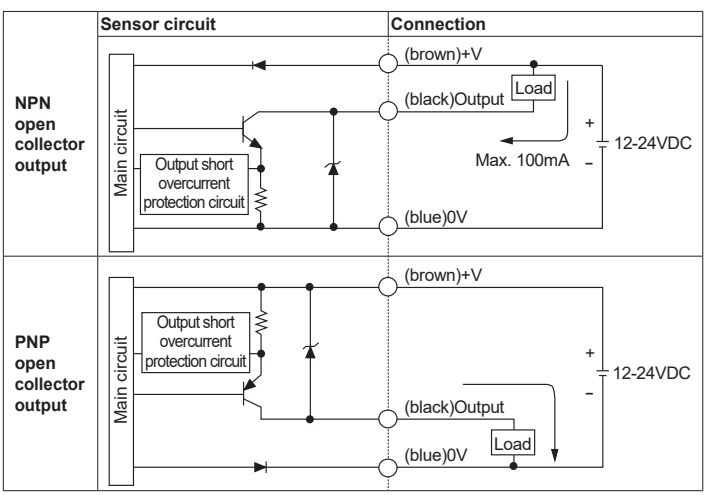
Operation mode	Dark ON
Receiver operation	Received light / Interrupted light 
Operation indicator (red LED)	ON / OFF 
Transistor output	ON / OFF 

▣ Operating Timing Diagram



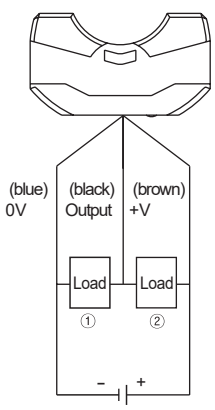
※The waveforms of 'Operation indicator' and 'Transistor output' are for Light ON, it is operated as reverse in Dark ON.

▣ Control Output Circuit Diagram



※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

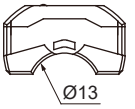
▣ Connection

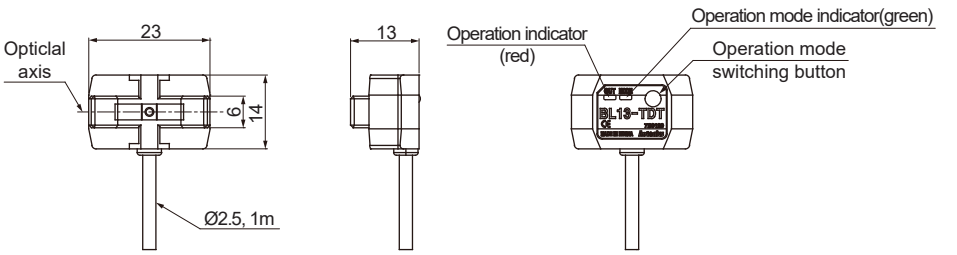


①Load connection for PNP output
②Load connection for NPN output

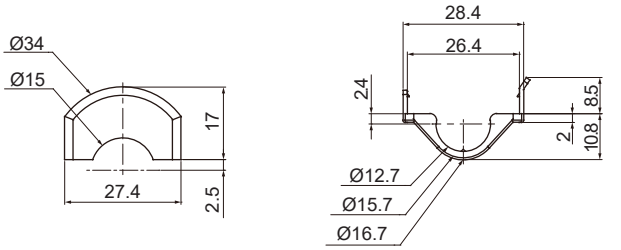
▣ Dimensions

(unit: mm)





◎ **Protection bracket (BK-BL13-P(sold separately))**

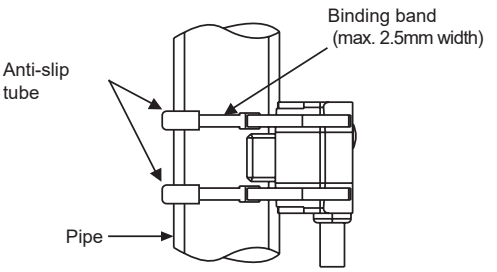


※For using the protection bracket, only Ø12.7mm (1/2 inch) pipes are available.

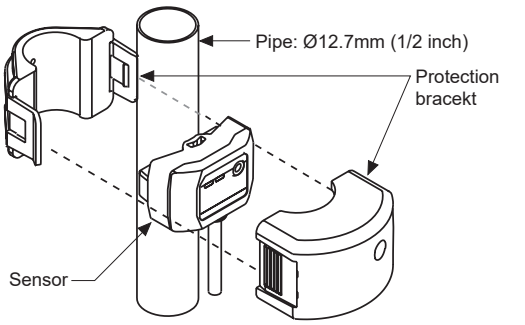
▣ Installation

If installing this unit at opaque pipes, it is impossible to detect accurately. Install this unit at the rated pipes.
Using binding band: Ø6 to 13mm, Using protection bracket: Ø12.7mm (1/2 inch)

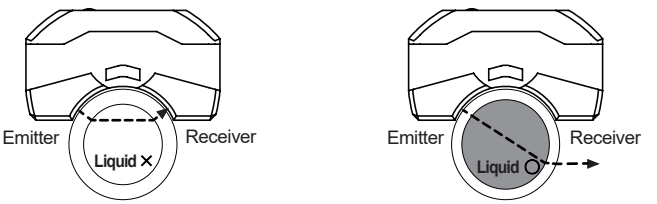
- If installing this unit at an opaque pipe, it is impossible to detect accurately. Install this unit at the rated pipe.
- Fix a pipe and this sensor tightly with binding bands and anti-slip tubes as the below figure and cut the spare part of binding bands with scissors or a knife.
- When connecting binding bands, be careful not to transform a pipe.



◎ Protection bracket (sold separately)
Choose a location on the pipe and attach the sensor and the protection bracket.

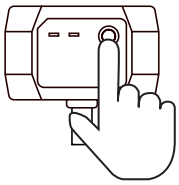


※Principle of operation
It detects whether there is liquid or not in a pipe by refractive index of light.



▣ Functions

● Operation mode switching

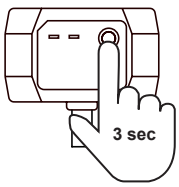


Light ON ⟷ Press operation mode switching button once ⟷ Dark ON

Operation mode indicator (green LED) ON

Operation mode indicator (green LED) OFF

● Operation mode lock setting



Lock operation mode ⟷ Press operation mode switching button for over 3 sec (until operation mode indicator flashes) ⟷ Unlock operation mode

※If you press the operation mode switching button (less than 3 sec) in lock operation status and the operation mode indicator (green LED) flashes 3 times.

Compact, Dual LCD Display Digital Pressure Sensor

▣ Features

- Pressure measurement of any gas, liquid or oil [Fluid type]
  (※except substances which may corrode stainless steel 316L)
- Simultaneous display of present value (PV) and set value (SV)
  ※Selectable SV, pressure unit, or none display for SV display part
- Selectable NPN, PNP open collector output by parameter setting
- 3 colors for PV display part (run mode: red or green / setting mode: orange)
- 12-segment LCD display for easier value reading
- Measurement range: -100.0 to 100.0kPa, -100 to 1,000kPa
  (pneumatic type: compound pressure, fluid type: sealed gauge pressure)
- Analog output: voltage (1-5VDC), current (DC4-20mA)
- Parameter copy function
- Option input/output: auto shift, remote zero, hold (only for PSQ-□C□□U-□)
- Forced output control mode for device testing and maintenance
- Min. display unit: 0.1kPa, 1kPa (variable by model)
- One-touch connector type for easy wiring and maintenance
- Password setting for SV

Pneumatic type

Fluid type

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

▣ Ordering Information

PS Q – □ C 01 C □ – Rc1/8

	Applied fluid / Pressure port	Pneumatic type	Fluid type
Pressure port	**Rc1/8**	●	●
	R1/8	●	●
	NPT1/8	●	—
	R1/4	—	●
	NPT1/4	—	●
	9/16-18UNF	—	●
Option Input/Output	**No mark**	NPN or PNP open collector output	
	U	NPN or PNP open collector output + analog output or external input type	
Cable	**No mark**	Cable type	
	C	Connector type	
Pressure range	**01**	100kPa	
	1	1,000kPa	
Applicable fluid	**C**	Compound pressure	
Applicable fluid	**No mark**	Pneumatic type (air, non-corrosive gas)	
	B	Fluid type (gas, liquid, oil)	
Appearance	**Q**	Regular square type (30×30mm), dual display	
Item	**PS**	Pressure Sensor	

▣ Pressure Conversion Chart

from \ to	Pa	kPa	MPa	kgf/cm²	mmHg	mmH_2O	psi	bar	inHg
1Pa	1	0.001	0.000001	0.000010197	0.007501	0.101972	0.000145038	0.00001	0.0002953
1kPa	1000.000	1	0.001	0.010197	7.500617	101.971626	0.145038	0.01	0.2953
1MPa	1000000	1000	1	10.197162	7500.61683	101971.626	145.038243	10	295.299875
1kgf/cm²	98066.5	98.0665	0.098067	1	735.55924	10000.0005	14.223393	0.980665	28.959025
1mmHg	133.322368	0.133322	0.000133	0.001359	1	13.595099	0.019337	0.001333	0.039370
$1mmH_2O$	9.80665	0.009807	—	0.000099	0.073556	1	0.00142	0.000098	0.002896
1psi	6894.733	6.89473	0.006895	0.070307	51.714752	703.016716	1	0.068947	2.036014
1bar	100000.0	100.0000	0.100000	1.019716	750.062	10197.1626	14.503824	1	29.529988
1inHg	3386.388	3.386388	0.003386	0.034532	25.40022	345.315507	0.491156	0.033864	1

E.g.) For calculating 760mmHg to kPa : According to above chart, 1mmHg is 0.133322kPa,
therefore 760mmHg will be 760×0.133322kPa=101.32472kPa.

■ Pressure and Max. Pressure Display Range

Type	MPa	kPa	kgf/cm²	bar	psi	mmHg	inHg	mmH_2O
Compound pressure	—	**-100.0 to 100.0** (-101.3 to 110.0)	**-1.020 to 1.020** (-1.033 to 1.122)	**-1.000 to 1.000** (-1.013 to 1.100)	**-14.50 to 14.50** (-14.70 to 15.95)	**-750 to 750** (-760.0 to 825.1)	**-29.5 to 29.5** (-29.91 to 32.48)	**-102.0 to 102.0** (-103.3 to112.2)
	—	**-100 to 1000** (-101 to 1100)	**-1.020 to 10.20** (-1.030 to 11.22)	**-1.000 to 10.00** (-1.01 to 11.00)	**-14.50 to 145.0** (-14.65 to 159.5)	**-750 to 7500** (-757.6 to 8251)	**-29.5 to 295** (-29.83 to 324.8)	**-102.0 to 1020** (-103.0 to 1122)

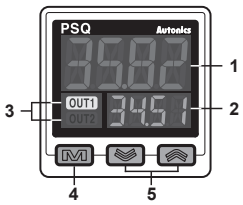
※( ) is Max. pressure display range. ※For using mmH_2O unit, multiply display value by 100.

■ Specifications

Pressure type		Gauge pressure (In case of fluid type, standard pressure are sealed gauge pressure※1)			
Type		NPN or PNP open collector output type		NPN or PNP open collector output+ analog output or external input type	
Model		**PSQ-** □**C01**□ **-** □	**PSQ-** □**C1**□ **-** □	**PSQ-** □**C01**□ **U-** □	**PSQ-** □**C1**□ **U-** □
Rated pressure range		-100.0 to 100.0kPa	-100 to 1,000kPa	-100.0 to 100.0kPa	-100 to 1,000kPa
Display&Setting pressure range		-101.3 to 110.0kPa	-101 to 1,100kPa	-101.3 to 110.0kPa	-101 to 1,100kPa
Min. display unit		0.1kPa	1kPa	0.1kPa	1kPa
Max. pressure range	Pneumatic type	2 times of rated pressure	1.5 times of rated pressure	2 times of rated pressure	1.5 times of rated pressure
	Fluid type	3 times of rated pressure			
Applied fluid		• **Pneumatic type:** air, non-corrosive gas • **Fluid type:** air, non-corrosive gas and fluid that do not corrode stainless steel 316L			
Power supply		12-24VDC⎓ (ripple P-P: max. 10%)			
Allowable voltage range		90 to 110% of rated voltage			
Current consumption		Max. 50mA		Max. 50mA (analog output: max. 70mA)	
Control output		NPN or PNP open collector output · Load voltage: max. 30VDC⎓ · Load current: max. 100mA · Residual voltage: max. 2VDC⎓			
	Hysteresis※2	Min. display interval			
	Repeat error	±0.2% F.S. ± min. display interval			
	Response time	Select one; 2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1,000ms, 5,000ms			
	Protection circuit	Output short over current protection circuit			
Analog output※3	Voltage output	—		· Output voltage: 1-5VDC⎓ ±2.5% F.S. · Linear: max. ±1% F.S. · Resolution: 1/2,000 · Output impedance: approx. 240Ω · Response time: 50ms	
	Current output	—		· Output current: DC4-20mA ±2.5% F.S. · Linear: max. ±1% F.S. · Resolution: 1/2,000 · Output impedance: approx. 100kΩ · Response time: 50ms	
External input※3 (Auto shift/ Remote zero/Hold)		—		· ON voltage: max. 0.4VDC⎓ · OFF voltage: 5-Vin or open · Resolution: 1/2,000 · Output impedance: approx. 100kΩ	
Display digits		Present value (PV) display part, setting value (SV) display part: 4-digit			
Display method		12-segment LCD method			
Min. display interval	MPa	0.001	0.001	0.001	0.001
	kPa	0.1	1	0.1	1
	kgf/cm^2	0.001	0.01	0.001	0.01
	bar	0.001	0.01	0.001	0.01
	psi	0.02	0.2	0.02	0.2
	mmHg	1	—	1	—
	inHg	0.1	—	0.1	—
	mmH_2O	0.1	—	0.1	—
Display accuracy		0 to 50℃: max. ±0.5% F.S., -10 to 0℃: max. ±1% F.S.			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1min			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 2 hours			
Environment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃			
	Ambient humi.	30 to 80%RH, storage: 30 to 80%RH			
Cable (fluid type)		Ø4mm, 5-wire, 3m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)			
Protection structure		• **Pneumatic type:** IP40 (IEC standard) • **Fluid type:** IP65 (IEC standard)			
Material		• **Pneumatic type -** Front case: polycarbonate, rear case: polycarbonate, pressure port: brass-nickel plated • **Fluid type -** Front case: polycarbonate, rear case: polyamide 6, pressure port: stainless steel 316L			
Approval		CE, cULus			
Weight※4		• **Pneumatic type:** approx. 165g (approx. 80g) • **Fluid type:** approx. 210g (approx. 125g)			

※1: The unit is sealed structure. It is based on atmospheric pressure 101.3kPa.
※2: In hysteresis output mode, it is variable.
※3: Select one between analog output (voltage or current) and external input.
※4: The weight includes packaging. The weight in parenthesis is for unit only.
※For using mmH_2O unit, multiply display value by 100.
※Environment resistance is rated at no freezing or condensation.

▣ Unit Description

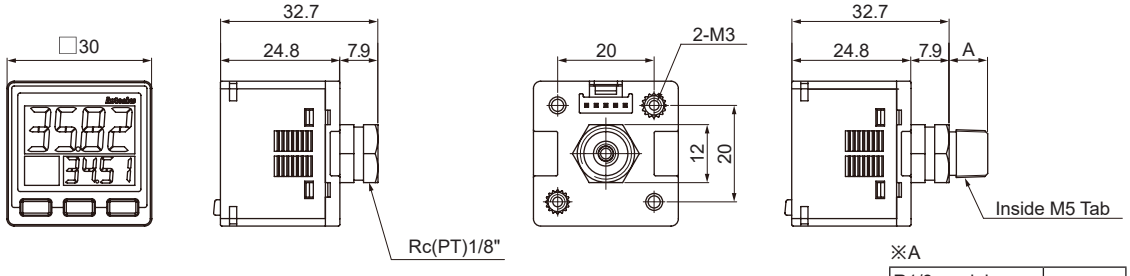


1. Present value (PV) display part (green, red, orange by setting/status)
RUN mode: Displays PV.
Setting mode: Displays parameter.
2. Setting value (SV) display part (green)
RUN mode: Displays setting value, unit, etc.
Setting mode: Displays SV.
3. Output indicator (OUT1, OUT2) (orange): Turns ON while the control output turns ON.
4. M key
RUN mode: Press the M key for over 2 sec to enter parameter 1 group.
Press the M key for over 4 sec to enter parameter 2 group.
Setting mode: Press the M key to select the setting items.
Press the M key for over 2 sec to return RUN mode.
5. ▽, △ key
RUN mode: Press the ▽, △ key to set preset value of output operation mode.
Press the M+▽ keys to set key lock/unlock.
Press the ▽+△ keys to adjust zero point.
Press the M+△ keys to set peak hold.
Preset value setting mode: Press the ▽, △ key to increase/decrease setting value.
Setting mode: Changes the parameter.

▣ Dimensions

(unit: mm)

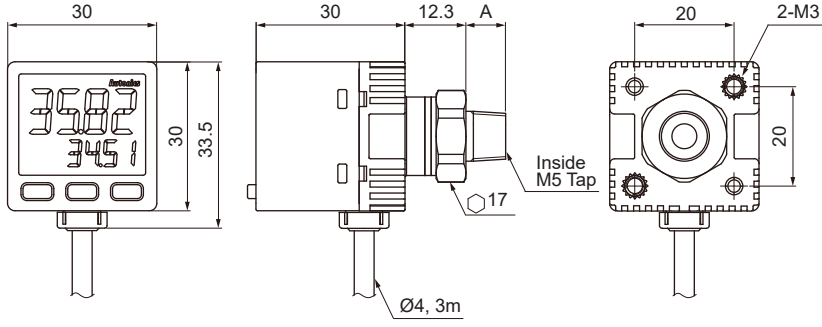
◎ Pneumatic type



※A

R1/8 model	8mm
NPT1/8 model	

◎ Fluid type

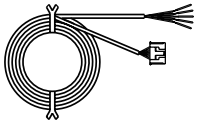


※A

R1/8 model (standard)	8mm
Rc1/8 model	0mm
R1/4 model	11.5mm
NPT1/4 model	
9/16-18UNF model (metal gasket sealing method)	15.4mm

◎ Accessory

● **Connector cable (PSO-C01, Pneumatic/Fluid type)**



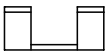
※Ø4mm, 5-wire, 2m
(AWG24, core diameter: 0.08mm,
number of cores: 40,
insulator diameter: Ø1mm)

▣ Dimensions

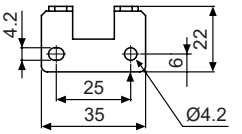
◎ Accessory

(unit: mm)

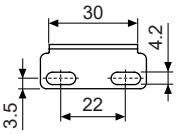
● **Bracket A (Pneumatic type)**

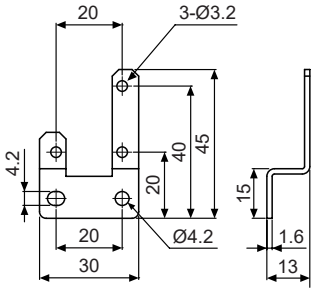


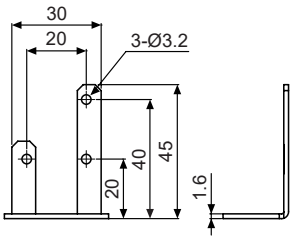
● **Bracket B (Pneumatic type)**

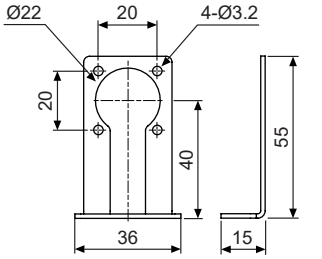


● **Bracket C (Fluid type)**





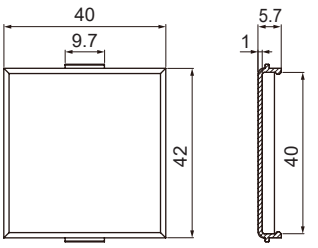




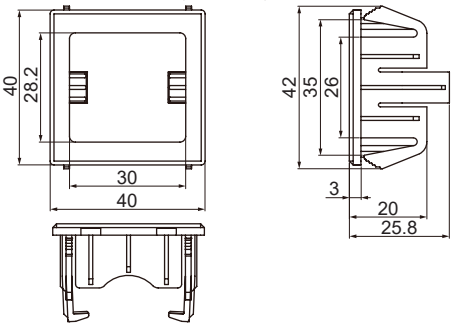
◎ Sold separately

● **Integrated installation set (Pneumatic/Fluid type)**

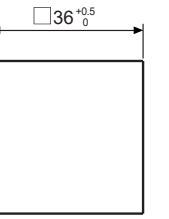
· Front cover (PSO-P01)



· Panel bracket (PSO-B02)



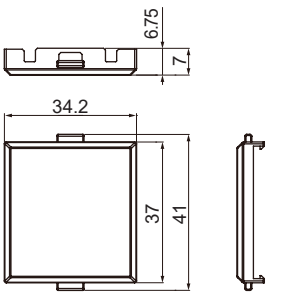
· Panel cut-out



(panel thickness 0.8 to 3.5mm)

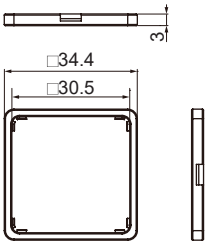
● **Separate installation set (Pneumatic type)**

· Front cover (PSO-P02)

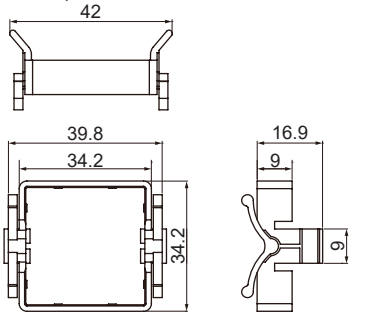


· Front/Rear pael bracket set (PSO-B04)

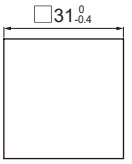
<Front panel bracket>



<Rear panel bracket>

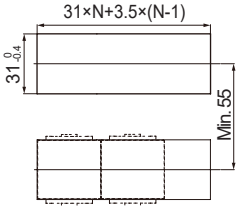


· Panel cut-out



(panel thickness: 0.5 to 7mm)

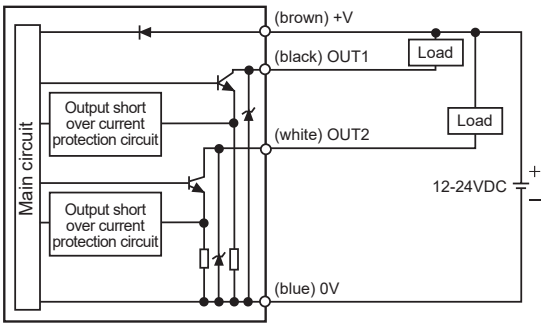
<When 'N' units are installed in series>



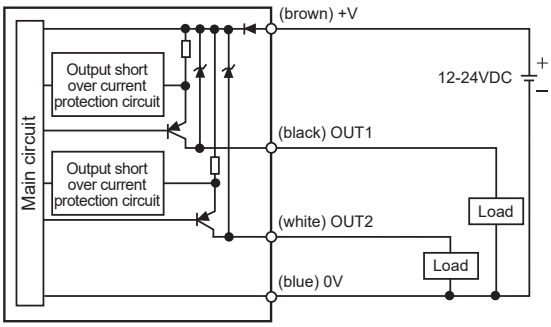
● **M5 gender (PSO-Z01, Pneumatic type)**

■ Input/Output Circuit and Connections

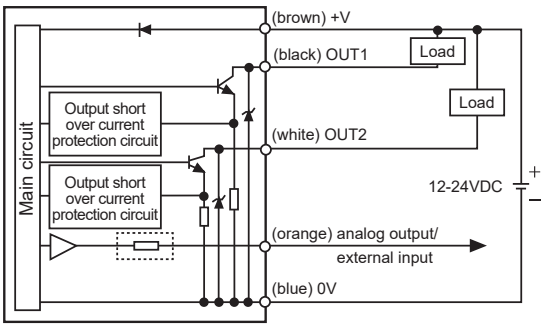
◎ NPN open collector output type



◎ PNP open collector output type

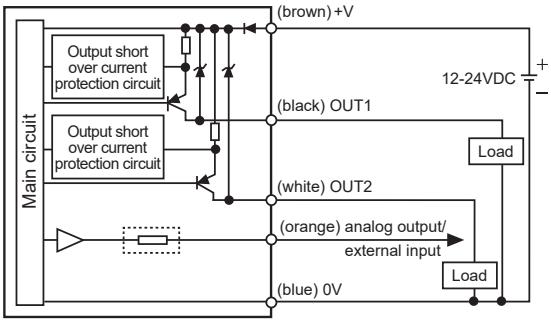


◎ NPN open collector output+ analog output or external input type



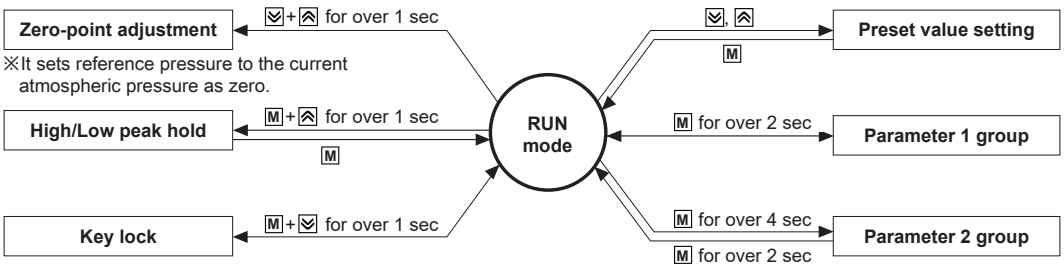
※ ⋯⋯ : output impedance

◎ PNP open collector output+ analog output or external input type

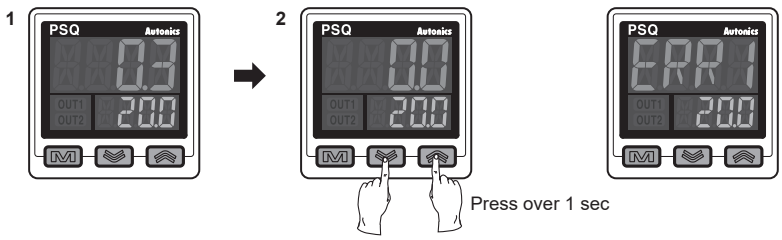


※ ⋯⋯ : output impedance

■ Setting for Each Mode



■ Zero-point Adjustment



※If executing zero-point adjustment when external pressure over ±5% of rated pressure is applied, ERR1 flashes five times during pressing the keys. Remove external pressure and execute zero point again.

1. To set zero atmospheric pressure forcibly, press the ▼+▲ keys over 1 sec in RUN mode with the opened pressure port.
2. Zero point adjustment is completed, the PV display part displays 0.0.

※Please execute zero-point adjustment regularly.

▣ Parameter Setting

※After entering parameter 1/2 group, if there is no additional key input for 60 sec, it maintains previous setting value and it returns to RUN mode.
※Press the ▼, ▲ key to set the setting value.
※After entering parameter 1/2 group, press the M key for over 2 sec to return to RUN mode.
※When pressing the M key once returning RUN mode from parameter 1 group, 2 group within 2 sec, it enters the previous parameter group.
※Some parameters are activated/deactivated according to the setting of other parameters. Refer to the description of each parameter.

◎ Parameter Group

Parameter 1 group

Parameter name		Setting range		Description	Factory default
oUt1	OUT1 operation mode	EASY HYS.M WIN AUto F.oUt	Easy Hysteresis Window comparison Auto sensitivity setting Forced output control	Select OUT1 operation mode. ※When setting OUT1 operation mode as auto sensitivity setting mode [AUto] or forced output control mode [F.oUt], OUT2 operation mode is set automatically same as the setting value of OUT1 operation mode.	EASY
oUt2	OUT2 operation mode	oFF EASY HYS.M WIN	OFF Easy Hysteresis Window comparison	Select OUT2 operation mode.	oFF
I/o※1	Analog output/ External input	A-V A-C SHFt ZERo HoLd	Analog voltage output Analog current output Auto shift Remote zero Hold	Select analog output/external input operation mode. Auto shift: When reference pressure of the pressure sensor changes, It corrects present pressure to reference pressure and by moving detection level as much as fluctuation level. Remote zero: It is the same function as auto shift but remote zero makes the measured pressure as 0 forcibly. Hold: The function to hold present value (PV) and control output while signal is input. ※When OUT1 operation mode is set as [F.oUt] or applied pressure is higher/lower than the display pressure range, auto shift [SHFt], remote zero [ZERo] functions are not available.	A-V
SHot※1	Auto shift applied terminal	oUt1 oUt2 ALL	OUT1 OUT2 OUT1 & OUT2	Select auto shift applied terminal. ※Appears when Analog output/External input is [SHFt].	oUt1
ZE.ot※1	Remote zero applied terminal	oUt1 oUt2 ALL	OUT1 OUT2 OUT1 & OUT2	Select remote zero applied terminal. ※Appears when analog output/external input is [ZERo].	oUt1
No.NC	Output type				No

	OUT1	OUT2	
No	Normally Open	OFF	※Appears when OUT2 operation mode is [oFF].
NC	Normally Closed	OFF	
1o2o	Normally Open	Normally Open	※Appears when OUT1 operation mode is [AUto], or OUT2 operation mode is [HYS.M], [WIN].
1o2C	Normally Closed	Normally Open	
1C2o	Normally Closed	Normally Open	
1C2C	Normally Closed	Normally Closed	

SPd	Response time	2.5, 5, 10, 25, 50, 100, 250, 500, 1000, 5000	It can prevent control output from chattering by changing response time. ※If the response time is getting longer, the detection will be more stable but present value (PV) might be different from the real pressure value.	2.5
CLoR	PV display color	R-oN G-oN REd GREN	Normal: Green / Output: Red Normal: Red / Output: Green Fixed red Fixed green	Select the present value (PV) display and the color linked output.	R-oN
dISP	Color linked output	oUt1 oUt2 ALL	OUT1 OUT2 OUT1 & OUT2	Select the color linked output. ※Appears when OUT2 operation mode is not [oFF] and PV display color is set as [R-oN] and [G-oN].	oUt1
UNIt	Display unit	KPA MPA KGF bAR PSI MMHG INHG H2o	kPa MPa kgf/cm^2 bar psi mmHg inHg mmH$_2$O	Select the display unit. ※For using mmH$_2$O unit, multiply display value by 100.	KPA

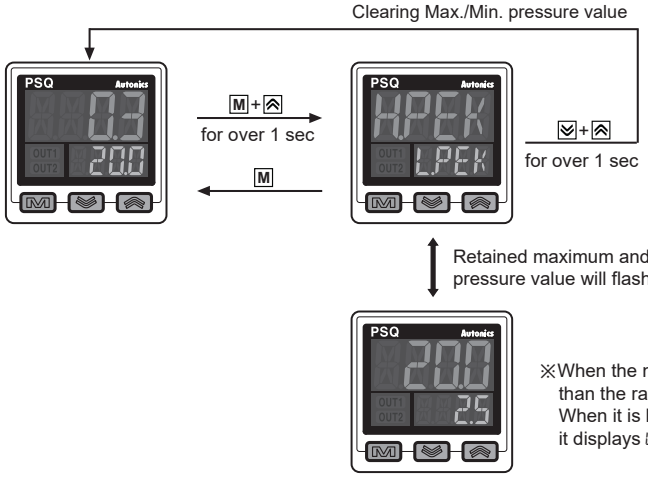
※1: Appears only in NPN or PNP open collector output + analog output or external input model.

■ Parameter Setting

Parameter 2 group					
Parameter name		**Setting range**		**Description**	**Factory default**
SUb	SV display part	Std UNIt oFF	Standard Unit OFF	Select the display type at the SV display part in RUN mode. Standard [Std]: Display setting value (SV) always. Unit [UNIt]: Display pressure unit normally. When pressing ▽, △ key, display setting value (SV) for 5 sec. None [oFF]: It does not display any value normally. When pressing ▽, △ key, display setting value (SV) for 5 sec. ※If select unit [UNIt] or None [oFF], changing setting value (SV) is available when setting value is displayed.	Std
CoPY	Parameter copy	oFF oN oN-L	OFF ON ON with key lock	This function is for copying parameter settings of Master to Slave 1:1. ※For the details, refer to '■ Functions - ◎ Paprameter Copy'.	oFF
INIt	Parameter reset	oFF oN	OFF Reset parameter setting	Reset the parameter settings.	oFF
PWd	Password	0000 to 9999	——	Set the 4-digit password. [0000]: Disable password [0001]: Only checking parameters	0000
SoUt	Control output switching	NPN PNP	NPN PNP	Select type of control output.	NPN
HYS	Hysteresis for easy mode	1 to 11111111	Bar type (Min: 1ea , Max: 8ea)	Set the hysteresis for easy mode. Rated pressure range / Hysteresis per 1 Bar -100.0 to 100.0kPa / 0.1kPa -100.0 to 1,000kPa / 1kPa ※Appears when OUT1 or OUT2 operation mode is easy mode. ※Although the display unit is changed, standard unit of hysteresis for easy mode is not changed.	111

■ High/Low Peak Hold

This function is to diagnose malfunction of the system caused by parasitic pressure through memorizing input the max./min. pressure occurred from the system.

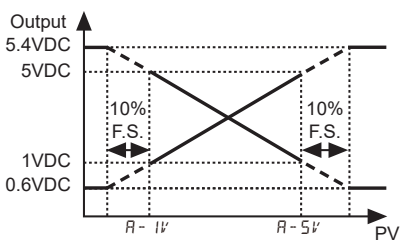


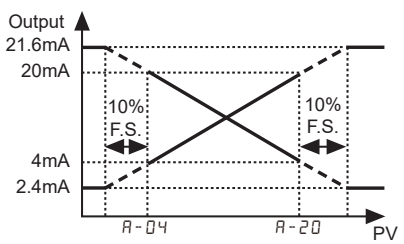
※Clearing Max./Min. pressure value.
1. Press the M+△ key for over 1 sec in RUN mode and set the peak hold.
2. High peak is displayed on present value (PV) display, and low peak is displayed on setting value (SV) display.
3. Press the ▽+△ key for over 1 sec, initialize high/low peak value.

※When the memorized Max. pressure is higher than the rated pressure, it displays HHHH. When it is lower than the rated pressure, it displays LLLL.

■ Analog Output Scale Adjustment

• only for NPN or PNP open collector output+analog output or external input type model





▣ Preset Setting

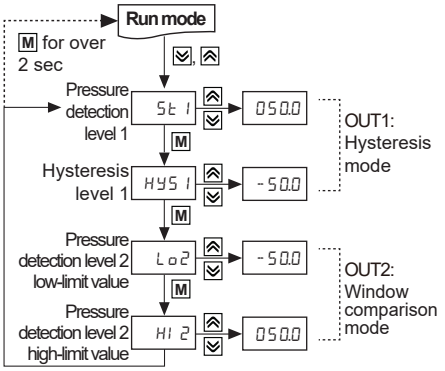
◎ Setting guide

· To enter the preset setting mode, press the ⋙, ⋘ key in RUN mode.
· Press the ⋙, ⋘ key to change preset value, the M key to move to the next mode.
· If there is no additional key or the M key input for over 2 sec during setting, the value is automatically set and it returns to RUN mode. (except forced output control mode)

●NPN or PNP open collector output(OUT1/2)

1. Select OUT1/2 operation mode [oUt 1/2] to use in parameter 1 group.
   (OUT1/2 operation mode: easy, hysteresis, window comparison, auto sensitivity setting, forced output control)
2. Enter the preset setting mode from RUN mode.
   (set items are displayed in the order of OUT1 - OUT2)
3. Set the value for each item.

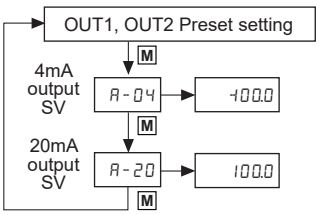
· Setting example
OUT1: Hysteresis mode
OUT2: Window comparison mode



●Analog output/External input

1. Select analog output/extenal input mode [I /o] to use in parameter 1 group.
   (Analog output/extenal input: analog voltage output, analog current output, auto Shift, remote zero, hold)
2. Enter the preset setting mode from RUN mode.
   (analog output/external input items are displayed after OUT1 - OUT2)
3. Set the value for each item.

· Setting example
Analog current output scale



●Note

· Setting items and setting value are displayed at the setting value (SV) display part alternatively.
· Operation mode (easy, hysteresis, window comparison, auto sensitivity setting) that can be set separately per each output (OUT1/OUT2) display parameter name with identification number.([St]: [St 1]/[St2])
· When changing pressure unit or analog output/extenal input, the preset value is initialized corresponding to changed item.
· When changing operation mode, the preset value is reset for the changed mode.

●Preset setting by output operation mode

Output operation mode		Preset		Setting range	Factory default	
					-100.0 to 100.0kPa	-100 to 1,000kPa
EASY	Easy	P	Pressure detection level	Min. display pressure < [P] ≤ Max. display pressure	050.0	0500
HYS.M	Hysteresis	St	Pressure detection level	Min. display pressure < [St] ≤ Max. display pressure	050.0	0500
		HYS	Hysteresis level	Min. display pressure ≤ [HYS] < [St]	-50.0	0000
WIN	Window comparison	Lo	Pressure detection level low-limit	Min. display pressure ≤ [Lo] ≤ Max. display pressure - (3 × min. display unit)	-50.0	0000
		HI	Pressure detection level high-limit	[Lo] + (3 × min. display unit) ≤ [HI] ≤ Max. display pressure	050.0	0500
AUto	Auto sensitivity setting	St 1	Pressure detection level 1	Min. display pressure ≤ [St 1] ≤ Max. display pressure - 1% of rated pressure	-50.0	0000
		St2	Pressure detection level 2	[St 1] + 1% of rated pressure ≤ [St2] ≤ Max. display pressure	050.0	0500
		SEt	Pressure detection level	$SEt=\frac{(St\ 1+St2)}{2}$, [St 1] ≤ [SEt] ≤ [St2] Pressure detection level [SEt] can be selectable by pressing the ⋙, ⋘ key.	000.0	0250
F.oUt	Forced output control	—	—	—	—	—
A-V	Analog voltage output	A- 1V	1V output SV	0% F.S. ≤ [A- 1V] ≤ 100% F.S.	400.0	0000
		A-5V	5V output SV	[A- 1V] + 10% F.S. ≤ [A-5V] ≤ 100% F.S. or 0% F.S.≤ [A-5V] ≤ [A- 1V] - 10% F.S.	100.0	1000
A-C	Analog current output	A-04	4mA output SV	0% F.S. ≤ [A-04] ≤ 100% F.S.	400.0	0000
		A-20	20mA output SV	[A-04] + 10% F.S. ≤ [A-20] ≤ 100% F.S. or 0% F.S. ≤ [A-20] ≤ [A-04] - 10% F.S.	100.0	1000

▣ Preset Setting

●Preset setting by external input mode

External input mode		Preset		Setting range	Factory default
SHFt	Auto shift	SHIN	Auto shift correction value※	Min. preset setting value < [SHIN] < Max. preset setting value	000.0
ZERo	Remote zero	ZEIN	Remote zero correction value※	Min. preset setting value < [ZEIN] < Max. preset setting value	000.0
HoLd	Hold	—	—	—	—

※Apply 0VDC to orange cable over 1ms to operate auto shift or remote zero mode.
※Press the ▼+▲ for over 1 sec to delete set auto shift correction.

◎ Supported operation mode list

NPN or PNP open collector output			
OUT1		OUT2	
EASY	Easy	oFF	OFF
		EASY	Easy
		HYS.M	Hysteresis
		WIN	Window comparison
HYS.M	Hysteresis	oFF	OFF
		EASY	Easy
		HYS.M	Hysteresis
		WIN	Window comparison
WIN	Window comparison	oFF	OFF
		EASY	Easy
		HYS.M	Hysteresis
		WIN	Window comparison
AUTo	Auto sensitivity setting		
F.oUt	Forced output control		

Analog output※	
A-V	Analog voltage output
A-C	Analog current output

External input※	
SHFt	Auto shift
ZERo	Remote zero
HoLd	Hold

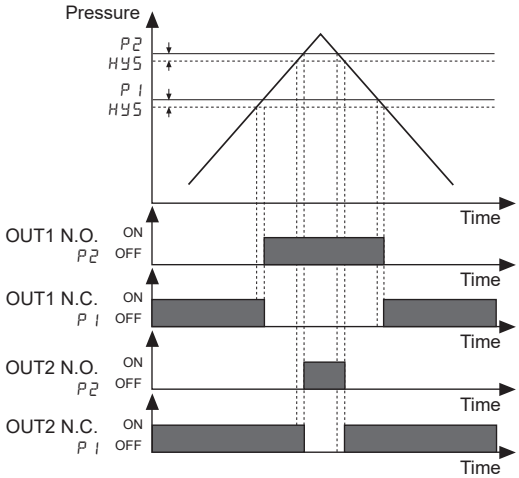
※Analog output (voltage or current) and external input (auto shift/remote zero/hold) are not available at the same time.

▣ Output Operation Mode

※PSQ Series has 5 output operation mode. Use the proper operation mode in accordance with the desired application of detection.

◎ Easy mode [EASY]

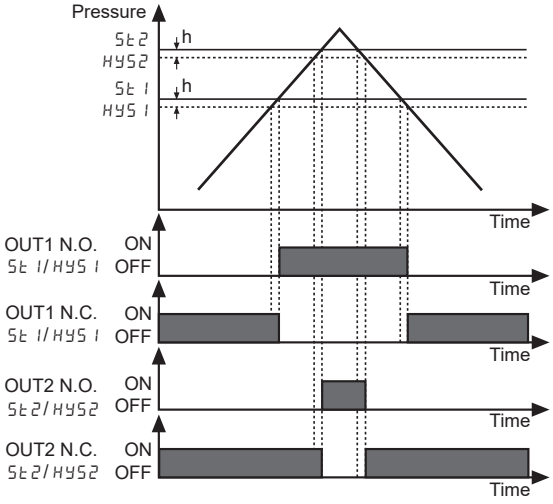
- Set the hysteresis of pressure detection automatically.
- Set the pressure detection level [P1, P2].



※It is possible to set the hysteresis value in hysteresis for easy mode of parameter 2 group.

◎ Hysteresis mode [HYS.M]

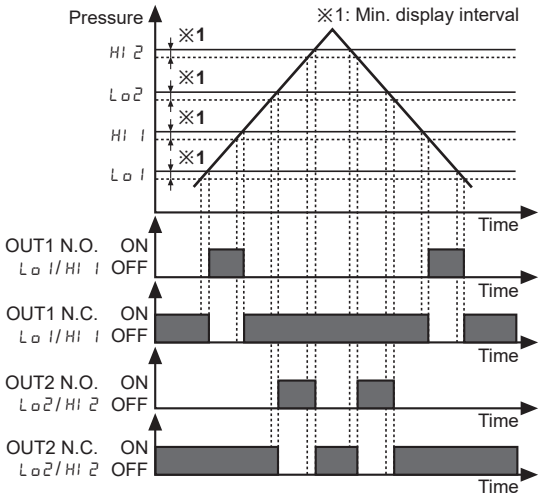
- Set the hysteresis of pressure detection.
- Set the pressure detection level [St1, St2] and hysteresis [HYS1, HYS2].



▣ Output Operation Mode

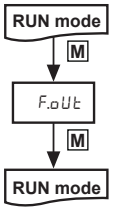
◎ Window comparison output mode [WIN]

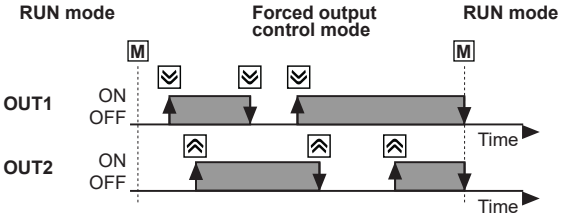
- It detects pressure at the desired range.
- Set high-limit value of pressure detection level [HI 1, HI 2], and low-limit value of pressure detection level [Lo 1, Lo2].
- Hysteresis is fixed as Min. display interval.



◎ Forced output control mode [F.oUt]

- Regardless of setting value, it maintains comparison output OFF and displays present pressure.
- Set OUT1 operation mode [oUt 1] of parameter 1 group as [F.oUt] and return to RUN mode. The PV display part displays the measured pressure and the SV display part displays [F.oUt].
- During forced output control mode, press the ⩛ or ⩓ key to turn ON/OFF OUT1, 2 manually.

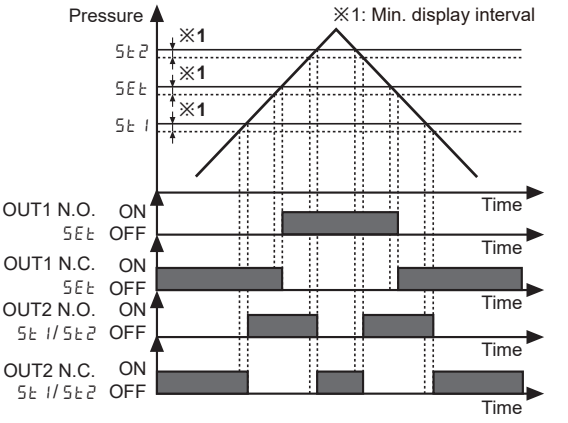




◎ Auto sensitivity setting mode [AUto]

- It sets the proper detection sensitivity automatically.
- It sets by the two pressure points [St 1, St2].
- Hysteresis is fixed as Min. display interval.
- The pressure detection level [SEt] is shown in the below formula.

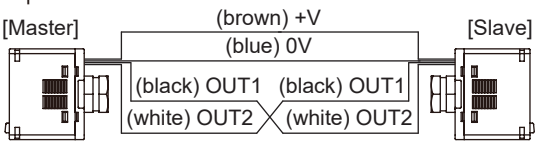
$$SEt = \frac{(St\,1 + St2)}{2}$$

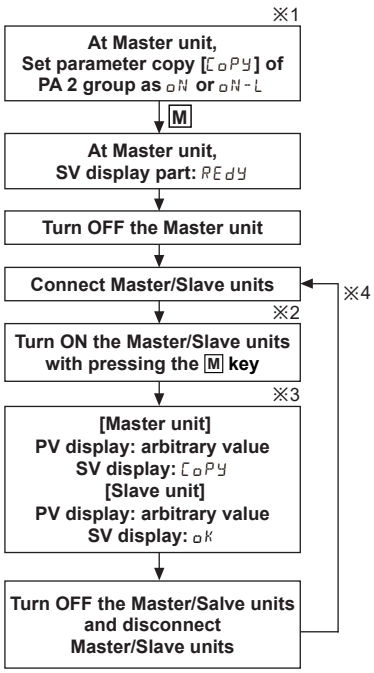


▣ Functions

◎ Parameter copy

※This function is for copying parameter settings of Master to Slave 1:1. Master and Slave should be the same specification model.





※1: oN: Copies SVs.,
oN-L : Copies SVs and locks front keys of Slave unit.

※2: When connecting Master unit and Slave unit incorrectly, the PV display of Master unit displays ERR4.
Turn OFF the Master unit power and turn ON it.
It displays REdY at SV display part.

※3: The PV display part of Master displays as orange color. The PV display part of Slave displays as green color. When completing copy, the PV display part of Master and Slave displays the same arbitrary value.

※4: Connect other Slave units to copy parameters.

◎ Analog output scale adjustment

※only for NPN or PNP open collector output+ analog output or external input type

Set output voltage, output current to the current display value at 1-5VDC voltage output [A-V], DC4-20mA [A-C] current output.

- Set pressure value for 1VDC output [A-1V] and pressure value for 5VDC output [A-5V].
  [A-1V] setting range: 0% F.S.≤ [A-1V]≤100% F.S.
  [A-5V] setting range: 0% F.S.≤ [A-5V]≤ [A-1V]-10% F.S. or [A-1V]+10% F.S.≤ [A-5V]≤100% F.S.
- Set pressure value for 4mA output [A-04] and pressure value for 20mA output [A-20].
  [A-04] setting range: 0% F.S.≤ [A-04]≤100% F.S.
  [A-20] setting range: 0% F.S.≤ [A-20]≤ [A-04]-10% F.S. or [A-04]+10% F.S.≤ [A-20]≤100% F.S.

◎ Auto Shift/Remote Zero/Hold input

※Only for NPN or PNP open collector output+ analog output or external input type

● Auto Shift [SHFt], Remote Zero [ZERo]

When reference pressure of the pressure sensor changes, apply auto shift or remote zero digital input. It corrects present pressure to reference pressure and by moving detection level as much as fluctuation level. In case of remote zero, it is the same function as auto shift but remote zero makes the measured pressure as 0 forcibly. When changing analog output and external input setting, auto shift correction value [SHJN], remote zero correction value [ZEJN] are also reset as 0.

- Setting correction value
  : Press the ▽, △ key to set SV manually or apply 0VDC to orange cable over 1ms.
  When selecting analog output/external input [I/o] of parameter 1 group as [SHFt] or [ZERo], press the M key to select control output at [SHot], [ZEot] to be with correction value.
- Deleting correction value
  : Press the ▽+△ keys for over 1 sec to delete set auto shift correction.

● Hold [HoLd]

The function to hold PV and control output while signal is input.

◎ Output mode change

● OUT1 operation mode

There are 4 kinds of control output mode in order to realize the various pressure detection.

- Hysteresis mode [HYS.M]
  : When needed to change hysteresis for detecting pressure.
- Window comparison output mode [WIN]
  : When needed to detect pressure in certain area.
- Automatic sensitivity setting mode [AUto]
  : When needed to set detection sensitivity automatically at proper position.
- Forced output control mode [F.oUt]
  : When needed to display pressure with remaining comparison output OFF regardless of setting value.

● OUT2 operation mode

Select control output mode between two types or oFF.
In case of OUT1 operation mode, select automatic sensitivity setting mode [AUto] or forced output control mode [F.oUt]. OUT2 operation mode setting is inactive.

- Hysteresis mode [HYS.M]
  : When needed to change hysteresis for detecting pressure.
- Window comparison output mode [WIN]
  : When needed to detect pressure in certain area.
- OFF [oFF]

◎ Output type change

Output type for OUT1 and OUT2 can be able to set Normally Open or Normally Closed.
※Note that Normally Open and Normally Closed provide opposite output.

SV	OUT1 output	OUT2 output
no	Normally Open	OFF
nC	Normally Closed	OFF
1o2o	Normally Open	Normally Open
1o2C	Normally Open	Normally Closed
1C2o	Normally Closed	Normally Open
1C2C	Normally Closed	Normally Closed

◎ Response time (chattering prevention)

It can prevent control output from chattering by changing response time.
There are 10 types of response time; 2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1,000ms, 5,000ms.
If the response time is getting longer, the detection will be more stable by increasing the number of digital filter.

◎ PV display color and color linked output

You can select PV display color to the linked output status.
There are 4 types as below.
Select color linked output among [oUt 1], [oUt2], or [ALL].

SV	PV display color
R-oN	Green in normal status. When the set color linked output turns ON, it displays red.
G-oN	Red in normal status. When the set color linked output turns ON, it displays green.
REd	Red is fixed.
GREN	Green is fixed.

◎ Pressure unit change

PSQ series has 8 kinds of pressure unit.
Please select the proper unit for application.
• kPa, MPa, kgf/cm^2, bar, psi, mmHg, inHg, mmH_2O
※When using mmH_2O unit, multiply display value by 100.

◎ SV display part

Select the display type at the SV display part in RUN mode.
There are 3 types; displaying SV [Std], displaying unit [UNIt], none [oFF]

◎ RESET

This function is to reset all parameters as factory default except control output SV to prevent wrong settings or difficult operation.

◎ Password

This function is to limit parameter settings, to check the parameter or to change the parameter settings only for entering the set password.
• 0000: Password function OFF
• 0001: Only checking parameters
• Setting range: 0002 to 9999

◎ Control output change

Select between NPN open collector output or PNP open collector output.

◎ Key lock

The key lock function prevents key operations so that conditions set in each mode.
- Press the M+▽ key over 1 sec in RUN mode to lock keys. The PV display part displays [LoCK], and the SV display part displays [oN] for 1 sec and it returns in RUN mode.
- Press the M+▽ key over 1 sec in RUN mode to unlock keys. The PV display part displays [LoCK], and the SV display part displays [oFF] for 1 sec and it returns in RUN mode.

◎ Zero-point adjustment

The zero-point adjustment function forcibly sets the pressure value to "zero" when the pressure port is opened to atmospheric pressure. When the zero adjustment is applied, analog output [Voltage or Current] is changed by this function.
To set zero atmospheric pressure forcibly,
press the ▽+△ keys over 1 sec in RUN mode with the opened pressure port.

◎ High/Low Peak Hold

This function is to diagnose malfunction of the system caused by parasitic pressure through memorizing input the max./min. pressure occurred from the system.
Press the M+△△ key more than 1 sec in RUN mode and set the Peak Hold.

◎ Error and troubleshooting

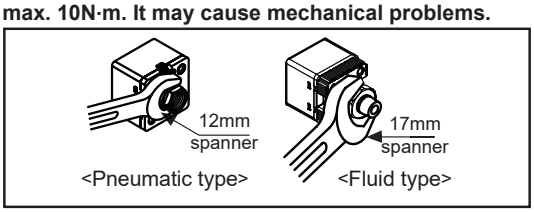
Display	Cause	Troubleshooting
ERR1	When adjusting zero point while external pressure is input.	Try again after removing external pressure.
ERR2	When over current is applied on control output	Remove the over current conditions by adjusting load resistance.
ERR3	When the range of Auto sensitivity setting mode ST1, ST2 is set incorrectly.	Check the setting range and set St 1, St2.
ERR4	When connection between master and slave is wrong during copying parameters.	Check the cables between sensors and the connection of the same models.
ERR5	When entering invalid password.	Enter valid password.
HHHH	When applied pressure exceeds the high-limit of display pressure range.	Apply pressure within the display pressure range.
LLLL	When applied pressure exceeds the low-limit of display pressure range.	
-HH-	When the correction value of auto shift, remote zero exceeds the high-limit of the setting range.	Set the correction value of auto shift, remove zero within the setting range.
-LL-	When the correction value of auto shift, remote zero exceeds the low-limit of the setting range.	
-HL-	When [HH], [LL] occur both.	

▣ Installation

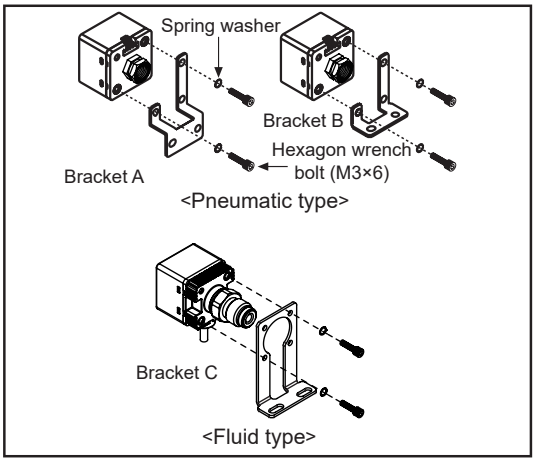
1. Pressure port is divided as standard and option specification. Therefore, make sure use commercially available one touch fitting.
   - Pneumatic type: Rc1/8, R1/8, NPT1/8
   - Fluid type: Rc1/8, R1/8, R1/4, NPT1/4, 9/16-18UNF
2. Use a spanner (pneumatic type: 12mm, fluid type: 17mm) at the metal part of the unit in order not to overload on the body when connecting one touch fitting.
3. Two different brackets are provided for pneumatic type and one different brackets are provided for fluid type. Select proper one with considering your application environments.
4. At first, please unscrew hexagon wrench bolt and assemble the bracket on this unit by fixing hexagon the wrench bolt.
   In this case, tightening torque of hexagon wrench should be max. 3N·m. It may cause mechanical problems.

⚠ Caution

The tightening torque of one touch fitting should be max. 10N·m. It may cause mechanical problems.



<Pneumatic type> <Fluid type>

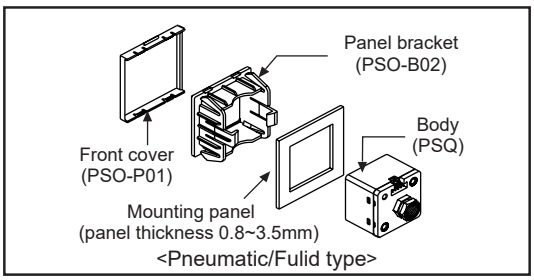


<Pneumatic type>

<Fluid type>

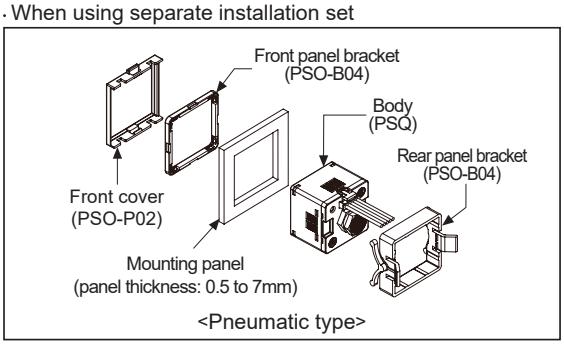
5. PSQ Series has panel bracket (PSO-B02), front cover (PSO-P01) are sold separately. When mounting the unit on panel, please follow the below figure.

· When using integrated installation set



<Pneumatic/Fulid type>

· When using separate installation set



<Pneumatic type>

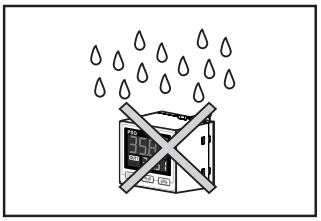
6. Do not pull the cable with a tensile strength of 30N or over.

▣ Proper Usage

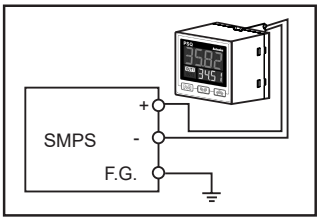
⚠ Caution

PSQ Series is for sensing of non corrosive gas.
Do not use this product at corrosive gas or flammable gas, etc.

- 12-24VDC model, power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Do not insert any sharp or pointed object into pressure port. Failure to follow these instructions may result in malfunction and damage to the sensor.
- Be sure that this unit must avoid direct touch with water, oil, thinner, etc.



- Do not use the product in preparation time (within 3 sec). for operating after power-on.
- When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.



- Avoid wiring with power line or high voltage line. It may cause malfunction by noise.
- When moving this unit from cold place to warm place, please remove the humidity on the cover.
- Do not press the setting button with sharp or pointed object.
- Do not apply a tensile strength in excess of 30N to the cables or connector.
- This unit may be used in the following environment.
  ① Indoors
  ② Altitude max. 2,000m
  ③ Pollution degree 3
  ④ Installation category II

Compact, Dual LCD Display Digital Pressure Sensor

▣ Features

- Pressure measurement of any gas, liquid or oil [Fluid type]
  (※except substances which may corrode stainless steel 316L)
- Simultaneous display of present value (PV) and set value (SV)
  ※Selectable SV, pressure unit, or none display for SV display part
- Selectable NPN, PNP open collector output by parameter setting
- 3 colors for PV display part (run mode: red or green / setting mode: orange)
- 12-segment LCD display for easier value reading
- Measurement range: -100.0 to 100.0kPa, -100 to 1,000kPa
  (pneumatic type: compound pressure, fluid type: sealed gauge pressure)
- Analog output: voltage (1-5VDC), current (DC4-20mA)
- Parameter copy function
- Option input/output: auto shift, remote zero, hold (only for PSQ-□C□□U-□)
- Forced output control mode for device testing and maintenance
- Min. display unit: 0.1kPa, 1kPa (variable by model)
- One-touch connector type for easy wiring and maintenance
- Password setting for SV

Pneumatic type

Fluid type

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

▣ Ordering Information

PS Q – □ C 01 C □ – Rc1/8

	Applied fluid / Pressure port	Pneumatic type	Fluid type
Pressure port	**Rc1/8**	●	●
	R1/8	●	●
	NPT1/8	●	—
	R1/4	—	●
	NPT1/4	—	●
	9/16-18UNF	—	●
Option Input/Output	**No mark**	NPN or PNP open collector output	
	U	NPN or PNP open collector output + analog output or external input type	
Cable	**No mark**	Cable type	
	C	Connector type	
Pressure range	**01**	100kPa	
	1	1,000kPa	
Applicable fluid	**C**	Compound pressure	
Applicable fluid	**No mark**	Pneumatic type (air, non-corrosive gas)	
	B	Fluid type (gas, liquid, oil)	
Appearance	**Q**	Regular square type (30×30mm), dual display	
Item	**PS**	Pressure Sensor	

▣ Pressure Conversion Chart

from \ to	Pa	kPa	MPa	kgf/cm²	mmHg	mmH_2O	psi	bar	inHg
1Pa	1	0.001	0.000001	0.000010197	0.007501	0.101972	0.000145038	0.00001	0.0002953
1kPa	1000.000	1	0.001	0.010197	7.500617	101.971626	0.145038	0.01	0.2953
1MPa	1000000	1000	1	10.197162	7500.61683	101971.626	145.038243	10	295.299875
1kgf/cm²	98066.5	98.0665	0.098067	1	735.55924	10000.0005	14.223393	0.980665	28.959025
1mmHg	133.322368	0.133322	0.000133	0.001359	1	13.595099	0.019337	0.001333	0.039370
1mmH_2O	9.80665	0.009807	—	0.000099	0.073556	1	0.00142	0.000098	0.002896
1psi	6894.733	6.89473	0.006895	0.070307	51.714752	703.016716	1	0.068947	2.036014
1bar	100000.0	100.0000	0.100000	1.019716	750.062	10197.1626	14.503824	1	29.529988
1inHg	3386.388	3.386388	0.003386	0.034532	25.40022	345.315507	0.491156	0.033864	1

E.g.) For calculating 760mmHg to kPa : According to above chart, 1mmHg is 0.133322kPa,
therefore 760mmHg will be 760×0.133322kPa=101.32472kPa.

■ Pressure and Max. Pressure Display Range

Type	MPa	kPa	kgf/cm²	bar	psi	mmHg	inHg	mmH_2O
Compound pressure	—	**-100.0 to 100.0** (-101.3 to 110.0)	**-1.020 to 1.020** (-1.033 to 1.122)	**-1.000 to 1.000** (-1.013 to 1.100)	**-14.50 to 14.50** (-14.70 to 15.95)	**-750 to 750** (-760.0 to 825.1)	**-29.5 to 29.5** (-29.91 to 32.48)	**-102.0 to 102.0** (-103.3 to112.2)
	—	**-100 to 1000** (-101 to 1100)	**-1.020 to 10.20** (-1.030 to 11.22)	**-1.000 to 10.00** (-1.01 to 11.00)	**-14.50 to 145.0** (-14.65 to 159.5)	**-750 to 7500** (-757.6 to 8251)	**-29.5 to 295** (-29.83 to 324.8)	**-102.0 to 1020** (-103.0 to 1122)

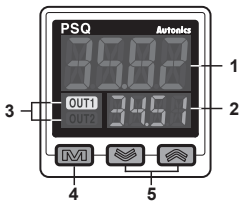
※( ) is Max. pressure display range. ※For using mmH_2O unit, multiply display value by 100.

■ Specifications

Pressure type		Gauge pressure (In case of fluid type, standard pressure are sealed gauge pressure※1)			
Type		NPN or PNP open collector output type		NPN or PNP open collector output+ analog output or external input type	
Model		**PSQ-** □**C01**□ **-** □	**PSQ-** □**C1**□ **-** □	**PSQ-** □**C01**□ **U-** □	**PSQ-** □**C1**□ **U-** □
Rated pressure range		-100.0 to 100.0kPa	-100 to 1,000kPa	-100.0 to 100.0kPa	-100 to 1,000kPa
Display&Setting pressure range		-101.3 to 110.0kPa	-101 to 1,100kPa	-101.3 to 110.0kPa	-101 to 1,100kPa
Min. display unit		0.1kPa	1kPa	0.1kPa	1kPa
Max. pressure range	Pneumatic type	2 times of rated pressure	1.5 times of rated pressure	2 times of rated pressure	1.5 times of rated pressure
	Fluid type	3 times of rated pressure			
Applied fluid		• **Pneumatic type:** air, non-corrosive gas • **Fluid type:** air, non-corrosive gas and fluid that do not corrode stainless steel 316L			
Power supply		12-24VDC⎓ (ripple P-P: max. 10%)			
Allowable voltage range		90 to 110% of rated voltage			
Current consumption		Max. 50mA		Max. 50mA (analog output: max. 70mA)	
Control output		NPN or PNP open collector output · Load voltage: max. 30VDC⎓ · Load current: max. 100mA · Residual voltage: max. 2VDC⎓			
	Hysteresis※2	Min. display interval			
	Repeat error	±0.2% F.S. ± min. display interval			
	Response time	Select one; 2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1,000ms, 5,000ms			
	Protection circuit	Output short over current protection circuit			
Analog output※3	Voltage output	—		· Output voltage: 1-5VDC⎓ ±2.5% F.S. · Linear: max. ±1% F.S. · Resolution: 1/2,000 · Output impedance: approx. 240Ω · Response time: 50ms	
	Current output	—		· Output current: DC4-20mA ±2.5% F.S. · Linear: max. ±1% F.S. · Resolution: 1/2,000 · Output impedance: approx. 100kΩ · Response time: 50ms	
External input※3 (Auto shift/ Remote zero/Hold)		—		· ON voltage: max. 0.4VDC⎓ · OFF voltage: 5-Vin or open · Resolution: 1/2,000 · Output impedance: approx. 100kΩ	
Display digits		Present value (PV) display part, setting value (SV) display part: 4-digit			
Display method		12-segment LCD method			
Min. display interval	MPa	0.001	0.001	0.001	0.001
	kPa	0.1	1	0.1	1
	kgf/cm^2	0.001	0.01	0.001	0.01
	bar	0.001	0.01	0.001	0.01
	psi	0.02	0.2	0.02	0.2
	mmHg	1	—	1	—
	inHg	0.1	—	0.1	—
	mmH_2O	0.1	—	0.1	—
Display accuracy		0 to 50℃: max. ±0.5% F.S., -10 to 0℃: max. ±1% F.S.			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1min			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1min) in each X, Y, Z direction for 2 hours			
Environment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃			
	Ambient humi.	30 to 80%RH, storage: 30 to 80%RH			
Cable (fluid type)		Ø4mm, 5-wire, 3m (AWG24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)			
Protection structure		• **Pneumatic type:** IP40 (IEC standard) • **Fluid type:** IP65 (IEC standard)			
Material		• **Pneumatic type -** Front case: polycarbonate, rear case: polycarbonate, pressure port: brass-nickel plated • **Fluid type -** Front case: polycarbonate, rear case: polyamide 6, pressure port: stainless steel 316L			
Approval		CE, cULus			
Weight※4		• **Pneumatic type:** approx. 165g (approx. 80g) • **Fluid type:** approx. 210g (approx. 125g)			

※1: The unit is sealed structure. It is based on atmospheric pressure 101.3kPa.
※2: In hysteresis output mode, it is variable.
※3: Select one between analog output (voltage or current) and external input.
※4: The weight includes packaging. The weight in parenthesis is for unit only.
※For using mmH_2O unit, multiply display value by 100.
※Environment resistance is rated at no freezing or condensation.

▣ Unit Description

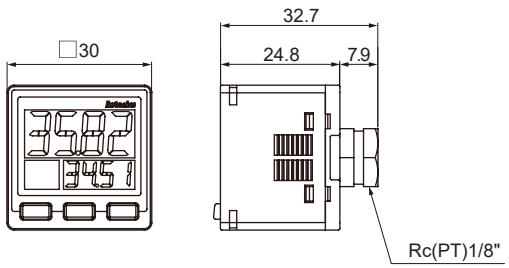


1. Present value (PV) display part (green, red, orange by setting/status)
RUN mode: Displays PV.
Setting mode: Displays parameter.
2. Setting value (SV) display part (green)
RUN mode: Displays setting value, unit, etc.
Setting mode: Displays SV.
3. Output indicator (OUT1, OUT2) (orange): Turns ON while the control output turns ON.
4. M key
RUN mode: Press the M key for over 2 sec to enter parameter 1 group.
Press the M key for over 4 sec to enter parameter 2 group.
Setting mode: Press the M key to select the setting items.
Press the M key for over 2 sec to return RUN mode.
5. ▽, △ key
RUN mode: Press the ▽, △ key to set preset value of output operation mode.
Press the M+▽ keys to set key lock/unlock.
Press the ▽+△ keys to adjust zero point.
Press the M+△ keys to set peak hold.
Preset value setting mode: Press the ▽, △ key to increase/decrease setting value.
Setting mode: Changes the parameter.

▣ Dimensions

(unit: mm)

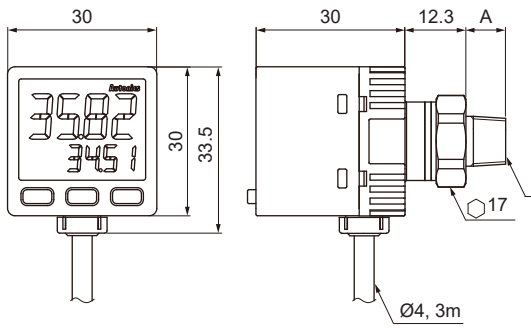
◎ Pneumatic type



※A

R1/8 model	8mm
NPT1/8 model	

◎ Fluid type

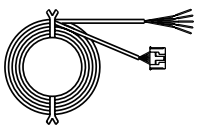


※A

R1/8 model (standard)	8mm
Rc1/8 model	0mm
R1/4 model	11.5mm
NPT1/4 model	
9/16-18UNF model (metal gasket sealing method)	15.4mm

◎ Accessory

● **Connector cable (PSO-C01, Pneumatic/Fluid type)**



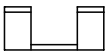
※Ø4mm, 5-wire, 2m
(AWG24, core diameter: 0.08mm,
number of cores: 40,
insulator diameter: Ø1mm)

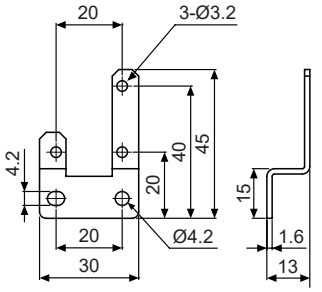
▣ Dimensions

◎ Accessory

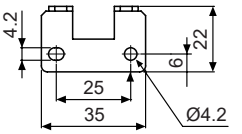
(unit: mm)

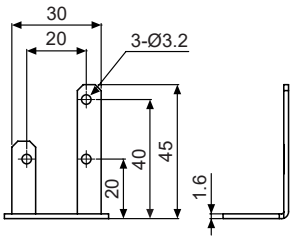
● **Bracket A (Pneumatic type)**



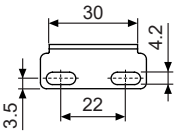


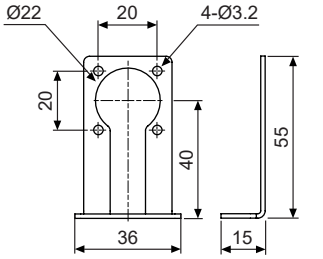
● **Bracket B (Pneumatic type)**





● **Bracket C (Fluid type)**

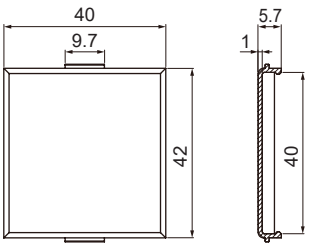




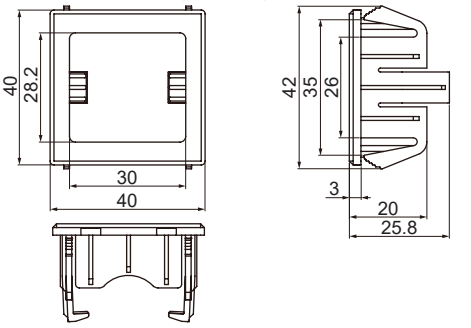
◎ Sold separately

● **Integrated installation set (Pneumatic/Fluid type)**

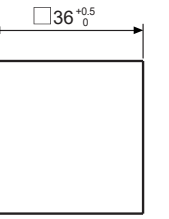
· Front cover (PSO-P01)



· Panel bracket (PSO-B02)



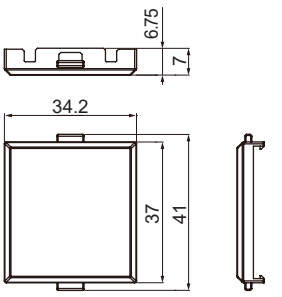
· Panel cut-out



(panel thickness 0.8 to 3.5mm)

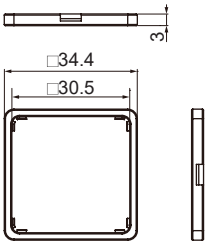
● **Separate installation set (Pneumatic type)**

· Front cover (PSO-P02)

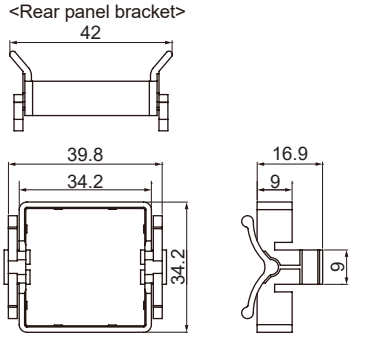


· Front/Rear pael bracket set (PSO-B04)

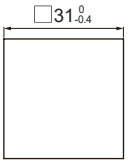
<Front panel bracket>



<Rear panel bracket>

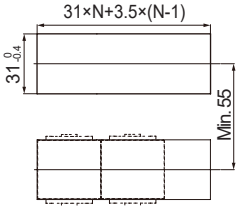


· Panel cut-out



(panel thickness: 0.5 to 7mm)

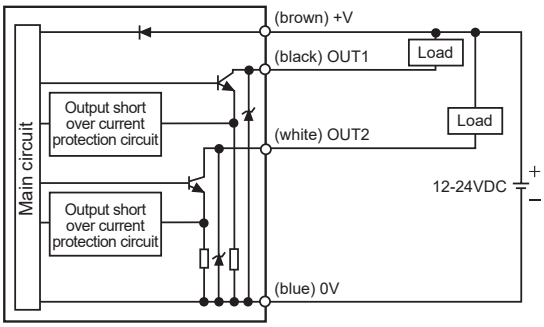
<When 'N' units are installed in series>



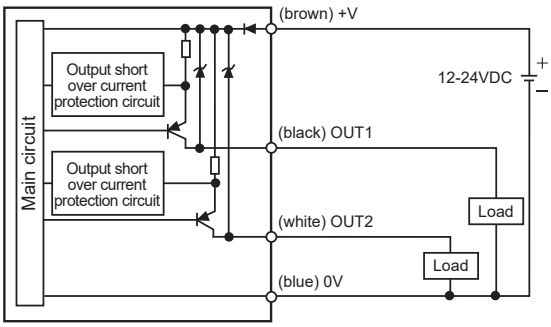
● **M5 gender (PSO-Z01, Pneumatic type)**

■ Input/Output Circuit and Connections

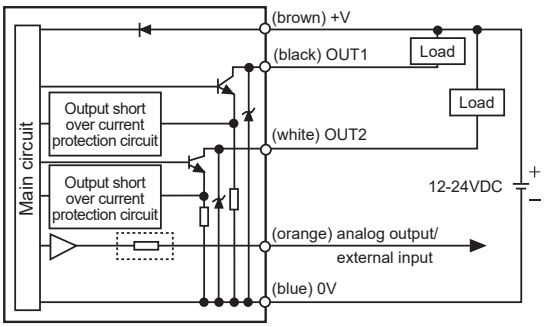
◎ NPN open collector output type



◎ PNP open collector output type

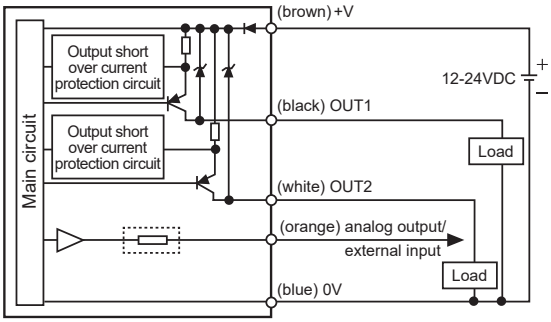


◎ NPN open collector output+ analog output or external input type



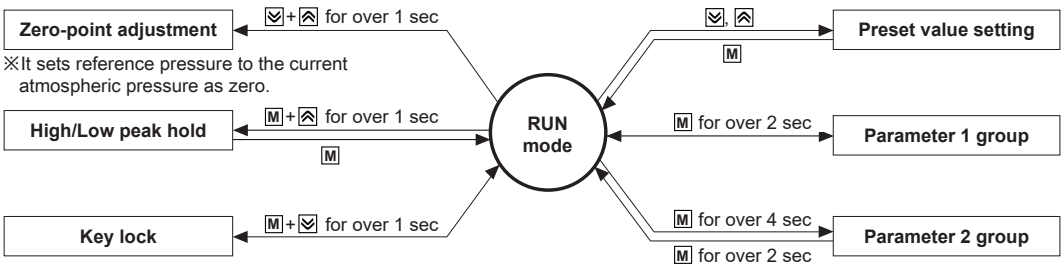
※ ⋯⋯ : output impedance

◎ PNP open collector output+ analog output or external input type

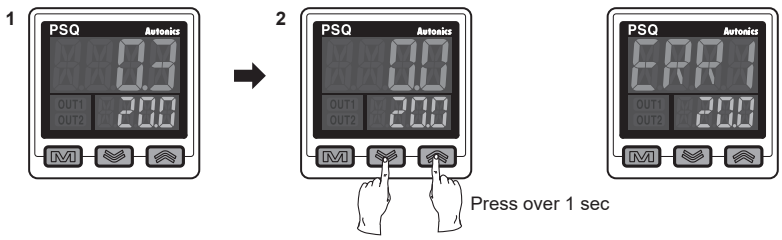


※ ⋯⋯ : output impedance

■ Setting for Each Mode



■ Zero-point Adjustment



※If executing zero-point adjustment when external pressure over ±5% of rated pressure is applied, ERR1 flashes five times during pressing the keys. Remove external pressure and execute zero point again.

1. To set zero atmospheric pressure forcibly, press the ▼+▲ keys over 1 sec in RUN mode with the opened pressure port.
2. Zero point adjustment is completed, the PV display part displays 0.0.

※Please execute zero-point adjustment regularly.

▣ Parameter Setting

※After entering parameter 1/2 group, if there is no additional key input for 60 sec, it maintains previous setting value and it returns to RUN mode.
※Press the [▼], [▲] key to set the setting value.
※After entering parameter 1/2 group, press the [M] key for over 2 sec to return to RUN mode.
※When pressing the [M] key once returning RUN mode from parameter 1 group, 2 group within 2 sec, it enters the previous parameter group.
※Some parameters are activated/deactivated according to the setting of other parameters. Refer to the description of each parameter.

◎ Parameter Group

Parameter 1 group

Parameter name		Setting range		Description	Factory default
oUt1	OUT1 operation mode	EASY HYS.M WIN AUto F.oUt	Easy Hysteresis Window comparison Auto sensitivity setting Forced output control	Select OUT1 operation mode. ※When setting OUT1 operation mode as auto sensitivity setting mode [AUto] or forced output control mode [F.oUt], OUT2 operation mode is set automatically same as the setting value of OUT1 operation mode.	EASY
oUt2	OUT2 operation mode	oFF EASY HYS.M WIN	OFF Easy Hysteresis Window comparison	Select OUT2 operation mode.	oFF
I/o※1	Analog output/ External input	A-V A-C SHFt ZERo HoLd	Analog voltage output Analog current output Auto shift Remote zero Hold	Select analog output/external input operation mode. Auto shift: When reference pressure of the pressure sensor changes, It corrects present pressure to reference pressure and by moving detection level as much as fluctuation level. Remote zero: It is the same function as auto shift but remote zero makes the measured pressure as 0 forcibly. Hold: The function to hold present value (PV) and control output while signal is input. ※When OUT1 operation mode is set as [F.oUt] or applied pressure is higher/lower than the display pressure range, auto shift [SHFt], remote zero [ZERo] functions are not available.	A-V
SHot※1	Auto shift applied terminal	oUt1 oUt2 ALL	OUT1 OUT2 OUT1 & OUT2	Select auto shift applied terminal. ※Appears when Analog output/External input is [SHFt].	oUt1
ZE.ot※1	Remote zero applied terminal	oUt1 oUt2 ALL	OUT1 OUT2 OUT1 & OUT2	Select remote zero applied terminal. ※Appears when analog output/external input is [ZERo].	oUt1
No.NC	Output type				No

	OUT1	OUT2	
No	Normally Open	OFF	※Appears when OUT2 operation mode is [oFF].
NC	Normally Closed	OFF	
1o2o	Normally Open	Normally Open	※Appears when OUT1 operation mode is [AUto], or OUT2 operation mode is [HYS.M], [WIN].
1o2C	Normally Closed	Normally Open	
1C2o	Normally Closed	Normally Open	
1C2C	Normally Closed	Normally Closed	

SPd	Response time	2.5, 5, 10, 25, 50, 100, 250, 500, 1000, 5000	It can prevent control output from chattering by changing response time. ※If the response time is getting longer, the detection will be more stable but present value (PV) might be different from the real pressure value.	2.5
CLoR	PV display color	R-oN: Normal: Green / Output: Red G-oN: Normal: Red / Output: Green REd: Fixed red GREN: Fixed green	Select the present value (PV) display and the color linked output.	R-oN
diSP	Color linked output	oUt1: OUT1 oUt2: OUT2 ALL: OUT1 & OUT2	Select the color linked output. ※Appears when OUT2 operation mode is not [oFF] and PV display color is set as [R-oN] and [G-oN].	oUt1
UNIt	Display unit	KPA: kPa MPA: MPa KGF: kgf/cm^2 bAR: bar PSI: psi MMHG: mmHg INHG: inHg H2o: mmH$_2$O	Select the display unit. ※For using mmH$_2$O unit, multiply display value by 100.	KPA

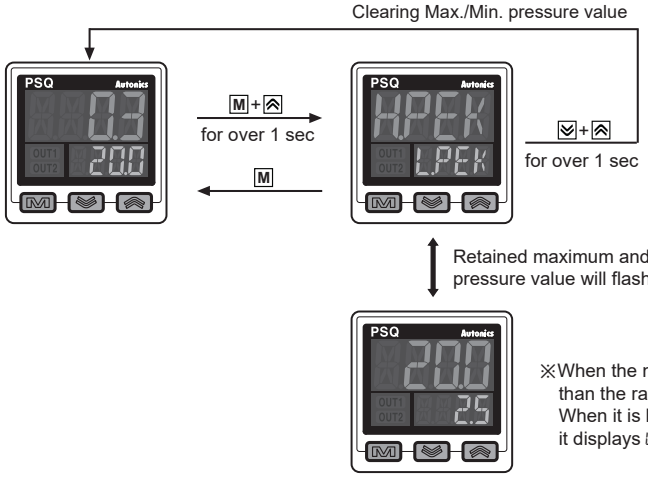
※1: Appears only in NPN or PNP open collector output + analog output or external input model.

▣ Parameter Setting

Parameter 2 group					
Parameter name		**Setting range**		**Description**	**Factory default**
SUb	SV display part	Std UNIt oFF	Standard Unit OFF	Select the display type at the SV display part in RUN mode. Standard [Std]: Display setting value (SV) always. Unit [UNIt]: Display pressure unit normally. When pressing ▽, △ key, display setting value (SV) for 5 sec. None [oFF]: It does not display any value normally. When pressing ▽, △ key, display setting value (SV) for 5 sec. ※If select unit [UNIt] or None [oFF], changing setting value (SV) is available when setting value is displayed.	Std
CoPY	Parameter copy	oFF oN oN-L	OFF ON ON with key lock	This function is for copying parameter settings of Master to Slave 1:1. ※For the details, refer to '▣ Functions - ◎ Paprameter Copy'.	oFF
INIt	Parameter reset	oFF oN	OFF Reset parameter setting	Reset the parameter settings.	oFF
PWd	Password	0000 to 9999	——	Set the 4-digit password. [0000]: Disable password [0001]: Only checking parameters	0000
SoUt	Control output switching	NPN PNP	NPN PNP	Select type of control output.	NPN
HYS	Hysteresis for easy mode	1 to 1111111	Bar type (Min: 1ea , Max: 8ea)	Set the hysteresis for easy mode. Rated pressure range / Hysteresis per 1 Bar -100.0 to 100.0kPa / 0.1kPa -100.0 to 1,000kPa / 1kPa ※Appears when OUT1 or OUT2 operation mode is easy mode. ※Although the display unit is changed, standard unit of hysteresis for easy mode is not changed.	111

▣ High/Low Peak Hold

This function is to diagnose malfunction of the system caused by parasitic pressure through memorizing input the max./min. pressure occurred from the system.

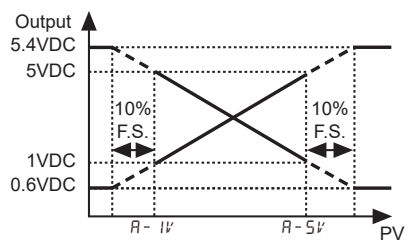


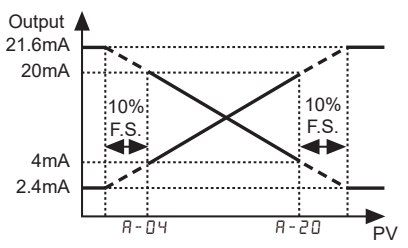
※Clearing Max./Min. pressure value.
1. Press the M+△ key for over 1 sec in RUN mode and set the peak hold.
2. High peak is displayed on present value (PV) display, and low peak is displayed on setting value (SV) display.
3. Press the ▽+△ key for over 1 sec, initialize high/low peak value.

※When the memorized Max. pressure is higher than the rated pressure, it displays HHHH.
When it is lower than the rated pressure, it displays LLLL.

▣ Analog Output Scale Adjustment

• only for NPN or PNP open collector output+analog output or external input type model





▣ Preset Setting

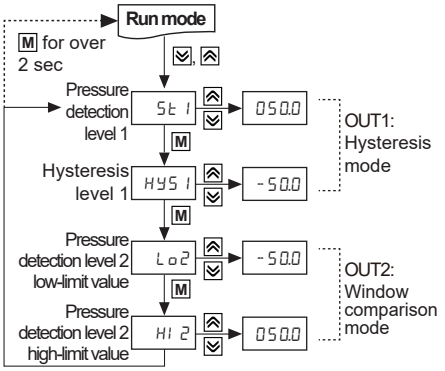
◎ Setting guide

- To enter the preset setting mode, press the [SV], [AV] key in RUN mode.
- Press the [SV], [AV] key to change preset value, the [M] key to move to the next mode.
- If there is no additional key or the [M] key input for over 2 sec during setting, the value is automatically set and it returns to RUN mode. (except forced output control mode)

●NPN or PNP open collector output(OUT1/2)

1. Select OUT1/2 operation mode [oUt 1/2] to use in parameter 1 group.
   (OUT1/2 operation mode: easy, hysteresis, window comparison, auto sensitivity setting, forced output control)
2. Enter the preset setting mode from RUN mode.
   (set items are displayed in the order of OUT1 - OUT2)
3. Set the value for each item.

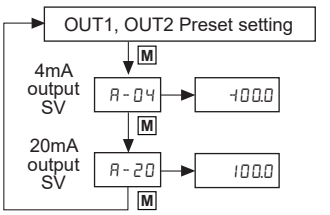
- Setting example
  OUT1: Hysteresis mode
  OUT2: Window comparison mode



●Analog output/External input

1. Select analog output/extenal input mode [I /o] to use in parameter 1 group.
   (Analog output/extenal input: analog voltage output, analog current output, auto Shift, remote zero, hold)
2. Enter the preset setting mode from RUN mode.
   (analog output/external input items are displayed after OUT1 - OUT2)
3. Set the value for each item.

- Setting example
  Analog current output scale



●Note

- Setting items and setting value are displayed at the setting value (SV) display part alternatively.
- Operation mode (easy, hysteresis, window comparison, auto sensitivity setting) that can be set separately per each output (OUT1/OUT2) display parameter name with identification number.([St]: [St 1]/[St2])
- When changing pressure unit or analog output/extenal input, the preset value is initialized corresponding to changed item.
- When changing operation mode, the preset value is reset for the changed mode.

●Preset setting by output operation mode

Output operation mode		Preset		Setting range	Factory default	
					-100.0 to 100.0kPa	-100 to 1,000kPa
EASY	Easy	P	Pressure detection level	Min. display pressure < [P] ≤ Max. display pressure	050.0	0500
HYS.M	Hysteresis	St	Pressure detection level	Min. display pressure < [St] ≤ Max. display pressure	050.0	0500
		HYS	Hysteresis level	Min. display pressure ≤ [HYS] < [St]	-50.0	0000
WIN	Window comparison	Lo	Pressure detection level low-limit	Min. display pressure ≤ [Lo] ≤ Max. display pressure - (3 × min. display unit)	-50.0	0000
		Hi	Pressure detection level high-limit	[Lo] + (3 × min. display unit) ≤ [Hi] ≤ Max. display pressure	050.0	0500
AUto	Auto sensitivity setting	St 1	Pressure detection level 1	Min. display pressure ≤ [St 1] ≤ Max. display pressure - 1% of rated pressure	-50.0	0000
		St2	Pressure detection level 2	[St 1] + 1% of rated pressure ≤ [St2] ≤ Max. display pressure	050.0	0500
		SEt	Pressure detection level	$SEt=\frac{(St\ 1+St2)}{2}$, [St 1] ≤ [SEt] ≤ [St2] Pressure detection level [SEt] can be selectable by pressing the [SV], [AV] key.	000.0	0250
F.oUt	Forced output control	—	—	—	—	—
A-V	Analog voltage output	A- 1V	1V output SV	0% F.S. ≤ [A- 1V] ≤ 100% F.S.	400.0	0000
		A-5V	5V output SV	[A- 1V] + 10% F.S. ≤ [A-5V] ≤ 100% F.S. or 0% F.S.≤ [A-5V] ≤ [A- 1V] - 10% F.S.	100.0	1000
A-C	Analog current output	A-04	4mA output SV	0% F.S. ≤ [A-04] ≤ 100% F.S.	400.0	0000
		A-20	20mA output SV	[A-04] + 10% F.S. ≤ [A-20] ≤ 100% F.S. or 0% F.S. ≤ [A-20] ≤ [A-04] - 10% F.S.	100.0	1000

▣ Preset Setting

●Preset setting by external input mode

External input mode		Preset		Setting range	Factory default
SHFt	Auto shift	SHIN	Auto shift correction value※	Min. preset setting value < [SHIN] < Max. preset setting value	000.0
ZERo	Remote zero	ZEIN	Remote zero correction value※	Min. preset setting value < [ZEIN] < Max. preset setting value	000.0
HoLd	Hold	—	—	—	—

※Apply 0VDC to orange cable over 1ms to operate auto shift or remote zero mode.
※Press the ▼+▲ for over 1 sec to delete set auto shift correction.

◎ Supported operation mode list

NPN or PNP open collector output			
OUT1		OUT2	
EASY	Easy	oFF	OFF
		EASY	Easy
		HYS.M	Hysteresis
		WIN	Window comparison
HYS.M	Hysteresis	oFF	OFF
		EASY	Easy
		HYS.M	Hysteresis
		WIN	Window comparison
WIN	Window comparison	oFF	OFF
		EASY	Easy
		HYS.M	Hysteresis
		WIN	Window comparison
AUTo	Auto sensitivity setting		
F.oUt	Forced output control		

Analog output※	
A-V	Analog voltage output
A-C	Analog current output

External input※	
SHFt	Auto shift
ZERo	Remote zero
HoLd	Hold

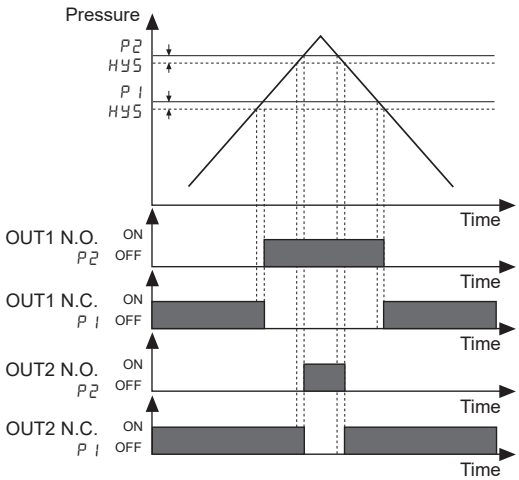
※Analog output (voltage or current) and external input (auto shift/remote zero/hold) are not available at the same time.

▣ Output Operation Mode

※PSQ Series has 5 output operation mode. Use the proper operation mode in accordance with the desired application of detection.

◎ Easy mode [EASY]

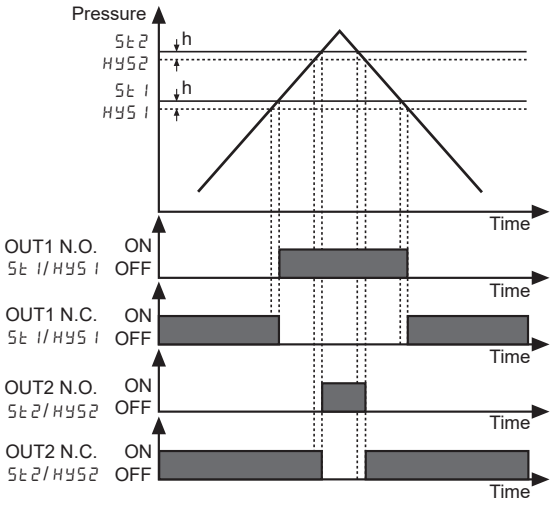
- Set the hysteresis of pressure detection automatically.
- Set the pressure detection level [P1, P2].



※It is possible to set the hysteresis value in hysteresis for easy mode of parameter 2 group.

◎ Hysteresis mode [HYS.M]

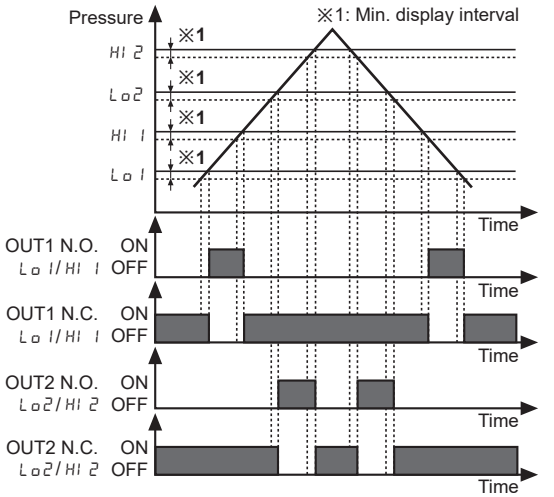
- Set the hysteresis of pressure detection.
- Set the pressure detection level [St1, St2] and hysteresis [HYS1, HYS2].



▣ Output Operation Mode

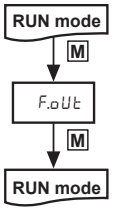
◎ Window comparison output mode [WIN]

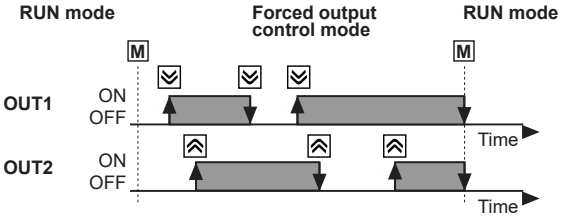
- It detects pressure at the desired range.
- Set high-limit value of pressure detection level [HI 1, HI 2], and low-limit value of pressure detection level [Lo 1, Lo2].
- Hysteresis is fixed as Min. display interval.



◎ Forced output control mode [F.oUt]

- Regardless of setting value, it maintains comparison output OFF and displays present pressure.
- Set OUT1 operation mode [oUt 1] of parameter 1 group as [F.oUt] and return to RUN mode. The PV display part displays the measured pressure and the SV display part displays [F.oUt].
- During forced output control mode, press the ▼ or ▲ key to turn ON/OFF OUT1, 2 manually.

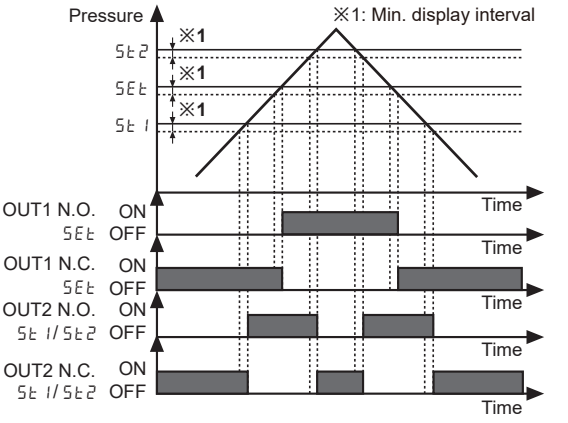




◎ Auto sensitivity setting mode [AUto]

- It sets the proper detection sensitivity automatically.
- It sets by the two pressure points [St 1, St2].
- Hysteresis is fixed as Min. display interval.
- The pressure detection level [SEt] is shown in the below formula.

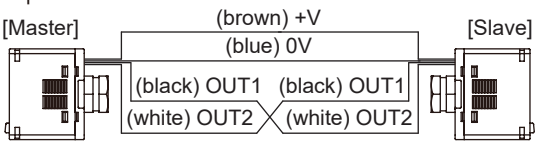
$$SEt = \frac{(St\,1 + St2)}{2}$$

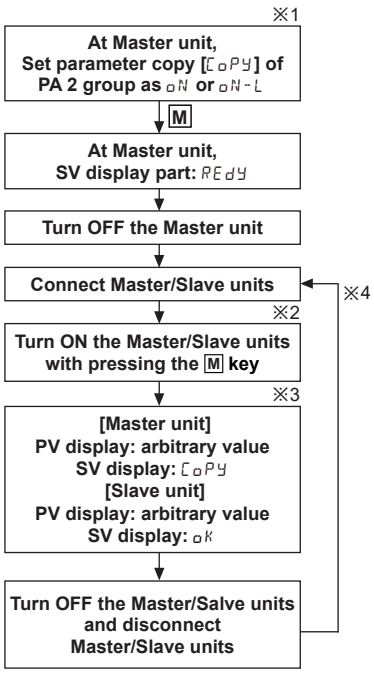


▣ Functions

◎ Parameter copy

※This function is for copying parameter settings of Master to Slave 1:1. Master and Slave should be the same specification model.





※1: oN: Copies SVs.,
oN-L : Copies SVs and locks front keys of Slave unit.

※2: When connecting Master unit and Slave unit incorrectly, the PV display of Master unit displays ERR4.
Turn OFF the Master unit power and turn ON it.
It displays REdY at SV display part.

※3: The PV display part of Master displays as orange color. The PV display part of Slave displays as green color. When completing copy, the PV display part of Master and Slave displays the same arbitrary value.

※4: Connect other Slave units to copy parameters.

◎ Analog output scale adjustment

※only for NPN or PNP open collector output+ analog output or external input type

Set output voltage, output current to the current display value at 1-5VDC voltage output [A-V], DC4-20mA [A-C] current output.

- Set pressure value for 1VDC output [A-1V] and pressure value for 5VDC output [A-5V].
  [A-1V] setting range: 0% F.S.≤ [A-1V]≤100% F.S.
  [A-5V] setting range: 0% F.S.≤ [A-5V]≤ [A-1V]-10% F.S. or [A-1V]+10% F.S.≤ [A-5V]≤100% F.S.
- Set pressure value for 4mA output [A-04] and pressure value for 20mA output [A-20].
  [A-04] setting range: 0% F.S.≤ [A-04]≤100% F.S.
  [A-20] setting range: 0% F.S.≤ [A-20]≤ [A-04]-10% F.S. or [A-04]+10% F.S.≤ [A-20]≤100% F.S.

◎ Auto Shift/Remote Zero/Hold input

※Only for NPN or PNP open collector output+ analog output or external input type

● Auto Shift [SHFt], Remote Zero [ZERo]

When reference pressure of the pressure sensor changes, apply auto shift or remote zero digital input. It corrects present pressure to reference pressure and by moving detection level as much as fluctuation level. In case of remote zero, it is the same function as auto shift but remote zero makes the measured pressure as 0 forcibly. When changing analog output and external input setting, auto shift correction value [SHIN], remote zero correction value [ZEIN] are also reset as 0.

- Setting correction value
  : Press the ▼, ▲ key to set SV manually or apply 0VDC to orange cable over 1ms.
  When selecting analog output/external input [I/o] of parameter 1 group as [SHFt] or [ZERo], press the M key to select control output at [SHot], [ZEot] to be with correction value.
- Deleting correction value
  : Press the ▼+▲ keys for over 1 sec to delete set auto shift correction.

● Hold [HoLd]

The function to hold PV and control output while signal is input.

◎ Output mode change

● OUT1 operation mode

There are 4 kinds of control output mode in order to realize the various pressure detection.

- Hysteresis mode [HYS.M]
  : When needed to change hysteresis for detecting pressure.
- Window comparison output mode [WIN]
  : When needed to detect pressure in certain area.
- Automatic sensitivity setting mode [AUto]
  : When needed to set detection sensitivity automatically at proper position.
- Forced output control mode [F.oUt]
  : When needed to display pressure with remaining comparison output OFF regardless of setting value.

● OUT2 operation mode

Select control output mode between two types or oFF.
In case of OUT1 operation mode, select automatic sensitivity setting mode [AUto] or forced output control mode [F.oUt]. OUT2 operation mode setting is inactive.

- Hysteresis mode [HYS.M]
  : When needed to change hysteresis for detecting pressure.
- Window comparison output mode [WIN]
  : When needed to detect pressure in certain area.
- OFF [oFF]

◎ Output type change

Output type for OUT1 and OUT2 can be able to set Normally Open or Normally Closed.
※Note that Normally Open and Normally Closed provide opposite output.

SV	OUT1 output	OUT2 output
no	Normally Open	OFF
nC	Normally Closed	OFF
1o2o	Normally Open	Normally Open
1o2C	Normally Open	Normally Closed
1C2o	Normally Closed	Normally Open
1C2C	Normally Closed	Normally Closed

◎ Response time (chattering prevention)

It can prevent control output from chattering by changing response time.
There are 10 types of response time; 2.5ms, 5ms, 10ms, 25ms, 50ms, 100ms, 250ms, 500ms, 1,000ms, 5,000ms.
If the response time is getting longer, the detection will be more stable by increasing the number of digital filter.

◎ PV display color and color linked output

You can select PV display color to the linked output status. There are 4 types as below.
Select color linked output among [oUt 1], [oUt2], or [ALL].

SV	PV display color
R-oN	Green in normal status. When the set color linked output turns ON, it displays red.
G-oN	Red in normal status. When the set color linked output turns ON, it displays green.
REd	Red is fixed.
GREN	Green is fixed.

◎ Pressure unit change

PSQ series has 8 kinds of pressure unit.
Please select the proper unit for application.
• kPa, MPa, kgf/cm^2, bar, psi, mmHg, inHg, mmH_2O
※When using mmH_2O unit, multiply display value by 100.

◎ SV display part

Select the display type at the SV display part in RUN mode.
There are 3 types; displaying SV [Std], displaying unit [UNIt], none [oFF]

◎ RESET

This function is to reset all parameters as factory default except control output SV to prevent wrong settings or difficult operation.

◎ Password

This function is to limit parameter settings, to check the parameter or to change the parameter settings only for entering the set password.
• 0000: Password function OFF
• 0001: Only checking parameters
• Setting range: 0002 to 9999

◎ Control output change

Select between NPN open collector output or PNP open collector output.

◎ Key lock

The key lock function prevents key operations so that conditions set in each mode.
- Press the M+▽ key over 1 sec in RUN mode to lock keys. The PV display part displays [LoCK], and the SV display part displays [oN] for 1 sec and it returns in RUN mode.
- Press the M+▽ key over 1 sec in RUN mode to unlock keys. The PV display part displays [LoCK], and the SV display part displays [oFF] for 1 sec and it returns in RUN mode.

◎ Zero-point adjustment

The zero-point adjustment function forcibly sets the pressure value to "zero" when the pressure port is opened to atmospheric pressure. When the zero adjustment is applied, analog output [Voltage or Current] is changed by this function.
To set zero atmospheric pressure forcibly,
press the ▽+△ keys over 1 sec in RUN mode with the opened pressure port.

◎ High/Low Peak Hold

This function is to diagnose malfunction of the system caused by parasitic pressure through memorizing input the max./min. pressure occurred from the system.
Press the M+△△ key more than 1 sec in RUN mode and set the Peak Hold.

◎ Error and troubleshooting

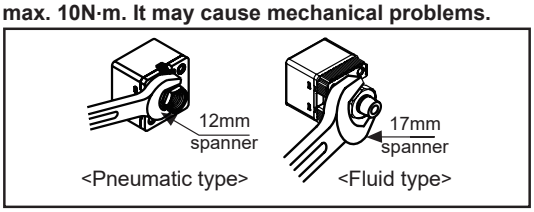
Display	Cause	Troubleshooting
ERR1	When adjusting zero point while external pressure is input.	Try again after removing external pressure.
ERR2	When over current is applied on control output	Remove the over current conditions by adjusting load resistance.
ERR3	When the range of Auto sensitivity setting mode ST1, ST2 is set incorrectly.	Check the setting range and set St 1, St2.
ERR4	When connection between master and slave is wrong during copying parameters.	Check the cables between sensors and the connection of the same models.
ERR5	When entering invalid password.	Enter valid password.
HHHH	When applied pressure exceeds the high-limit of display pressure range.	Apply pressure within the display pressure range.
LLLL	When applied pressure exceeds the low-limit of display pressure range.	
-HH-	When the correction value of auto shift, remote zero exceeds the high-limit of the setting range.	Set the correction value of auto shift, remove zero within the setting range.
-LL-	When the correction value of auto shift, remote zero exceeds the low-limit of the setting range.	
-HL-	When [HH], [LL] occur both.	

▣ Installation

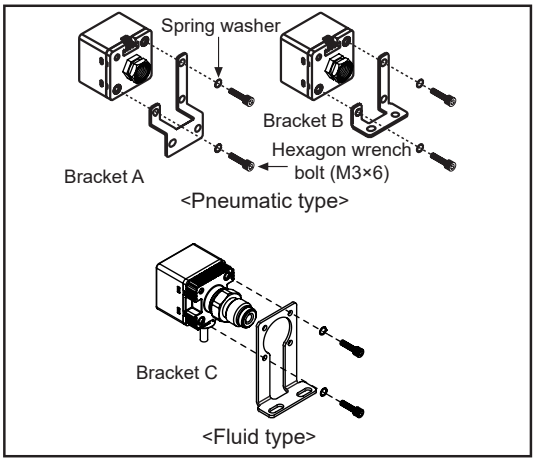
1. Pressure port is divided as standard and option specification. Therefore, make sure use commercially available one touch fitting.
   - Pneumatic type: Rc1/8, R1/8, NPT1/8
   - Fluid type: Rc1/8, R1/8, R1/4, NPT1/4, 9/16-18UNF
2. Use a spanner (pneumatic type: 12mm, fluid type: 17mm) at the metal part of the unit in order not to overload on the body when connecting one touch fitting.
3. Two different brackets are provided for pneumatic type and one different brackets are provided for fluid type. Select proper one with considering your application environments.
4. At first, please unscrew hexagon wrench bolt and assemble the bracket on this unit by fixing hexagon the wrench bolt.
   In this case, tightening torque of hexagon wrench should be max. 3N·m. It may cause mechanical problems.

⚠ Caution

The tightening torque of one touch fitting should be max. 10N·m. It may cause mechanical problems.



<Pneumatic type> <Fluid type>

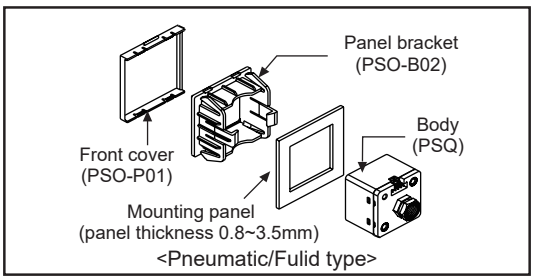


<Pneumatic type>

<Fluid type>

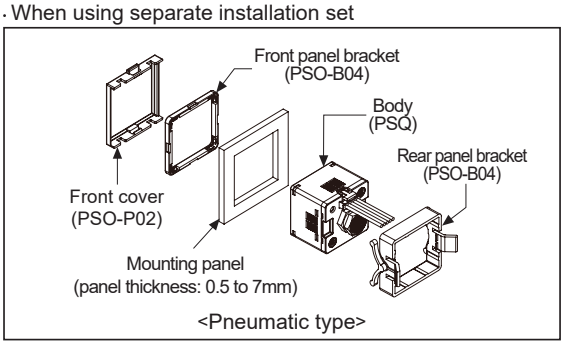
5. PSQ Series has panel bracket (PSO-B02), front cover (PSO-P01) are sold separately. When mounting the unit on panel, please follow the below figure.

· When using integrated installation set



<Pneumatic/Fulid type>

· When using separate installation set



<Pneumatic type>

6. Do not pull the cable with a tensile strength of 30N or over.

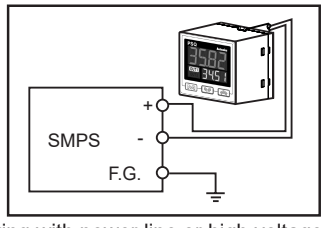
▣ Proper Usage

⚠ Caution

PSQ Series is for sensing of non corrosive gas.
Do not use this product at corrosive gas or flammable gas, etc.

- 12-24VDC model, power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Do not insert any sharp or pointed object into pressure port. Failure to follow these instructions may result in malfunction and damage to the sensor.
- Be sure that this unit must avoid direct touch with water, oil, thinner, etc.

- Do not use the product in preparation time (within 3 sec). for operating after power-on.
- When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.



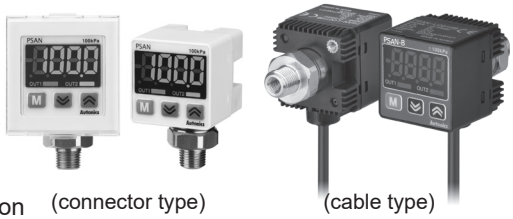
- Avoid wiring with power line or high voltage line. It may cause malfunction by noise.
- When moving this unit from cold place to warm place, please remove the humidity on the cover.
- Do not press the setting button with sharp or pointed object.
- Do not apply a tensile strength in excess of 30N to the cables or connector.
- This unit may be used in the following environment.
  ① Indoors
  ② Altitude max. 2,000m
  ③ Pollution degree 3
  ④ Installation category II

Compact, Digital Display Pressure Sensors

▣ Features

- Pressure measurement of any gas, liquid or oil
  (※except substances which may corrode stainless steel 316L)
- Auto shift function
  : with change in the original pressure, the external input adjusts the determined level to match the change in pressure
  (only available in models with auto shift/hold function)
- High display resolutions - negative pressure: 0.1kPa
  - standard pressure: 0.1kPa, 1kPa
  - compound pressure: 0.1kPa
- Hold function: hold current display value or control output
- Forced output control mode for device testing and maintenance
- One-touch connector type for easy wiring and maintenance
- Analog output: voltage (1-5VDC), current (DC4-20mA)
- Zero-point adjustment function,
  peak value monitoring function, chattering prevention function

Pneumatic type



(connector type) (cable type)

Fluid type

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

▣ Ordering Information

PS AN – ☐ V 01 C P V – Rc1/8

Pressure port※1	R1/8	Standard (fluid type), Option (pneumatic type)
	Rc1/8	Standard (pneumatic type)
	NPT1/8	Option
	7/16-20UNF	Option (fluid type)
	9/16-18UNF	Option (fluid type)
Option input/output	V	Voltage (1-5VDC) output
	A	Current (DC4-20mA) output
	H	Hold/Auto shift input
Control output	No mark	NPN open collector output
	P	PNP open collector output
Cable	C	Connector type
	No mark	Cable type
Pressure range	01	100kPa
	1	1,000kPa
Pressure type	No mark	Standard pressure
	V	Negative pressure
	C	Compound pressure
Applicable fluid	No mark	Pneumatic type (gas)/rear port type
	D	Pneumatic type (gas)/bottom port type
	L	Fluid type (gas, liquid, oil)/bottom port type
	B	Fluid type (gas, liquid, oil)/rear port type
Appearance	AN	Regular square New type (30×30mm)
Item	PS	Pressure Sensor

※1: In case of using M5 port, use PSO-Z01 (M5 Gender) together.

▣ Pressure and Max. Pressure Display Range

Type	MPa	kPa	kgf/cm²	bar	psi	mmHg	inHg	mmH₂O
Negative pressure	—	**0.0 to -101.3** (5.0 to -101.3)	**0.000 to -1.033** (0.051 to -1.033)	**0.000 to -1.013** (0.050 to -1.013)	**0.00 to -14.70** (0.74 to -14.70)	**0 to -760** (38.0 to -760.0)	**0.0 to -29.9** (1.50 to -29.90)	**0.0 to -103.3** (5.1 to -103.3)
Standard pressure	**0 to 0.100** (-0.005 to 0.110)	**0.0 to 100.0** (-5.0 to 110.0)	**0.000 to 1.020** (-0.051 to 1.122)	**0.000 to 1.000** (-0.050 to 1.100)	**0.00 to 14.50** (-0.72 to 15.96)	—	—	—
	0 to 1.000 (-0.050 to 1.100)	**0 to 1000** (-101.3 to 1100)	**0.00 to 10.20** (-0.51 to 11.22)	**0.00 to 10.00** (-0.50 to 11.00)	**0.0 to 145.0** (-7.2 to 159.6)	—	—	—
Compound pressure	—	**-101.3 to 100.0** (-101.3 to 110.0)	**-1.034 to 1.020** (-1.034 to 1.122)	**-1.013 to 1.000** (-1.013 to 1.100)	**-14.70 to 14.50** (-14.70 to 15.96)	**-760 to 750** (-760.0 to 824.0)	**-29.9 to 29.5** (-29.88 to 32.58)	**-103.4 to 102.0** (-103.4 to 112.2)

※ ( ) is max. pressure display range.
※For using a unit mmH_2O, multiply display value by 100.

▣ Pressure Conversion Chart

from \ to	Pa	kPa	MPa	kgf/cm²	mmHg	mmH₂O	psi	bar	inHg
1Pa	1	0.001	0.000001	0.000010197	0.007501	0.101972	0.000145038	0.00001	0.0002953
1kPa	1000	1	0.001	0.010197	7.500617	101.971626	0.145038	0.01	0.2953
1MPa	1000000	1000	1	10.197162	7500.61683	101971.626	145.038243	10	295.299875
1kgf/cm²	98066.5	98.0665	0.098067	1	735.55924	10000.0005	14.223393	0.980665	28.959025
1mmHg	133.322368	0.133322	0.000133	0.001359	1	13.595099	0.019337	0.001333	0.039370
1mmH₂O	9.80665	0.009807		0.000099	0.073556	1	0.00142	0.000098	0.002896
1psi	6894.733	6.89473	0.006895	0.070307	51.714752	703.0167161	1	0.068947	2.036014
1bar	100000	100	0.100000	1.019716	750.062	10197.1626	14.503824	1	29.529988
1inHg	3386.388	3.386388	0.003386	0.034532	25.40022	345.315507	0.491156	0.033864	1

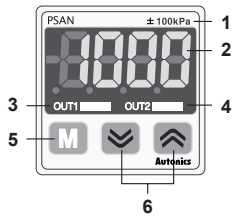
E.g.) For calculating 760mmHg to kPa
: According to above chart, 1mmHg is 0.133322kPa, therefore 760mmHg will be 760×0.133322kPa=101.32472kPa.

▣ Specifications

Pressure type			**Gauge pressure(In case of fluid type, negative pressure, compound pressure, 1,000kPa/standard pressure are sealed gauge pressure※5)**			
			Negative pressure	**Standard pressure**		**Compound pressure**
Model※1	Voltage output	Connector	**PSAN-(L/D)V01C(P)V-□**	**PSAN-(L/D)01C(P)V-□**	**PSAN-(L/D)1C(P)V-□**	**PSAN-(L/D)C01C(P)V-□**
		Cable	—	—	**PSAN-B1(P)V-□**	**PSAN-BC01(P)V-□**
	Current output	Connector	**PSAN-(L)V01C(P)A-□**	**PSAN-(L)01C(P)A-□**	**PSAN-(L)1C(P)A-□**	**PSAN-(L)C01C(P)A-□**
	Hold/Auto shift input	Connector	**PSAN-(L)V01C(P)H-□**	**PSAN-(L)01C(P)H-□**	**PSAN-(L)1C(P)H-□**	**PSAN-(L)C01C(P)H-□**
		Cable	—	—	**PSAN-B1(P)H-□**	**PSAN-BC01 (P)H-□**
Rated pressure range			0.0 to -101.3kPa	0.0 to 100.0kPa	0 to 1,000kPa	-101.3 to 100.0kPa
Display pressure range			5.0 to -101.3kPa	-5.0 to 110.0kPa	-101.3 to 1,100kPa	-101.3 to 110.0kPa
Min. display unit			0.1kPa	0.1kPa	1kPa	0.1kPa
Max. pressure range			2 times of rated pressure		1.5 times of rated pressure	2 times of rated pressure
Applied fluid			• **Pneumatic type** - Air, Non-corrosive gas • **Fluid type** - Air, Non-corrosive gas and fluid that do not corrode Stainless steel 316L			
Power supply			12V-24VDC⎓ ±10% (ripple P-P: Max. 10%)			
Current consumption			Max. 50mA (current output: max. 75mA)			
Control output			NPN or PNP open collector output • Load voltage: max. 30VDC⎓ • Load current: max. 100mA • Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2VDC			
	Hysteresis※2		Min. display interval			
	Repeat error		±0.2%F.S. ± Min. display interval			
	Response time		Selectable 2.5ms, 5ms, 100ms, 500ms, 1000ms			
	Protection circuit		Output short over current protection circuit			
Analog output※3		Voltage output	• Output voltage: 1-5VDC⎓ ±2% F.S. • Linear: Within ±1% F.S. • Output impedance: 1kΩ • Zero point: Max. 1VDC⎓ ±2% F.S. • Span: Max. 4VDC⎓ ±2% F.S. • Response time: 50ms • Resolution: Automatically changed to 1/1000 or 1/2000 by display unit			
		Current output	• Output current: DC4-20mA ±2% • Linear: Max. ±1% F.S. • Zero-point: Max. DC4mA ±2% F.S. • Span: Max. DC16mA ±2% F.S. • Response time: 70ms • Resolution: Automatically changed to 1/1000 or 1/2000 by display unit			
Display digit			4½-digit			
Display method			7-segment LED Display			
Min. display interval	MPa		—	0.001	0.001	—
	kPa		0.1	0.1	1	0.1
	kgf/cm²		0.001	0.001	0.01	0.001
	bar		0.001	0.001	0.01	0.001
	psi		0.01	0.01	0.1	0.02
	mmHg		0.4	—		0.8
	inHg		0.02			0.03
	mmH₂O		0.1			0.1
Display accuracy			0 to 50℃: max. ±0.5% F.S., -10 to 0℃: max. ±1% F.S.			
Insulation resistance			Over 50MΩ (at 500VDC megger)			
Dielectric strengtht			1000VAC 50/60Hz for 1 minute			
Vibration			1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Environment	Ambient temp.		-10 to 50℃, storage: -20 to 60℃			
	Ambient humi.		30 to 80%RH, storage: 30 to 80%RH			
Protection structure			Connector type: IP40 (IEC standard), Cable type: IP65 (IEC standard)			
Material			• **Pneumatic - Rear port type** - Front, Rear case: Polycarbonate, Pressure port: Nickel Plated Brass • **Pneumatic - Bottom port type** - Front case: Polycarbonate Rear case: Polybutylene Terephthalate + Glass Fiber 15%, Pressure port: Nickel Plated Brass • **Fluid type** - Front case: Polycarbonate, Rear case: Polyamide 6, Pressure port: Stainless steel 316L			
Cable			Ø4mm, 5-wire, 2m (connector type), 3m (cable type), AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulator out diameter: Ø1mm			
Approval			CE			
Weight※4			• **Pneumatic type - Rear port type**: Approx. 165g (approx. 80g) • **Pneumatic type - Bottom port type**: Approx. 170g (approx. 85g) • **Fluid type - Connector type**: Approx. 173g (approx. 88g) • **Fluid type - Cable type**: Approx. 167g (approx. 90g)			

※1: For ' (L)', ' (P)', '□' of model name, please refer to '▣ Ordering Information'.
※2: In hysteresis output mode, detection difference is variable.
※3: It is allowed to select one analog output type only.
※4: The weight includes packaging. The weight in parenthesis in for unit only.
※5: The unit is sealed structure. It is based on atmospheric pressure 101.3kPa.
※F.S.: Rated pressure.
※There may be ±1-digit error in hysteresis by pressure unit calculation error.
※Environment resistance is rated at no freezing or condensation.

▣ Unit Description



1. Range of rated pressure
: It is possible to change the pressure unit in Pressure sensor.
Please attach component label which is fit for specific indication unit.

2. 4-digit LED display (Red)
: Used to indicate measured pressure value, setting value and error message.

3. Output1 indicator (Red): Output1 is ON, LED will be ON.

4. Output2 indicator (Green): Output2 is ON, LED will be ON.

5. M key: Used to enter into Preset/Parameter setting mode and to save Setting mode.

6. ▼, ▲ key: Used to set parameter and preset, peak value check mode, function setting or output operation mode.

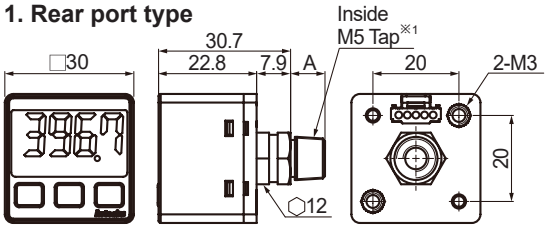
▼+▲ key : Used for zero point adjustment function by pressing ▼+▲ keys over 1 sec simultaneously in RUN mode.

▣ Dimensions

◎ Pneumatic type

(unit: mm)

1. Rear port type

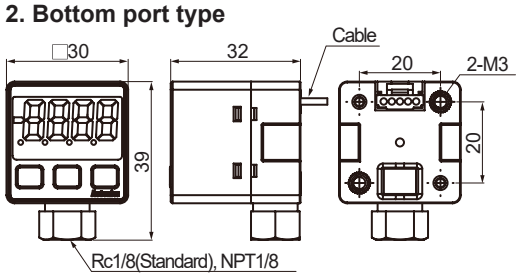


※1: Only for R1/8 and NPT1/8 models

※A

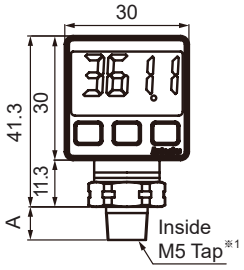
Rc1/8 model (standard)	0
NPT1/8 model	
R1/8 model	8

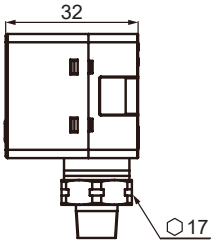
2. Bottom port type

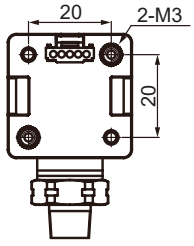


◎ Fluid type

1. Connector type





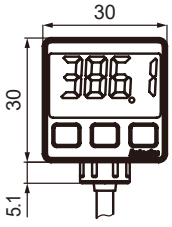


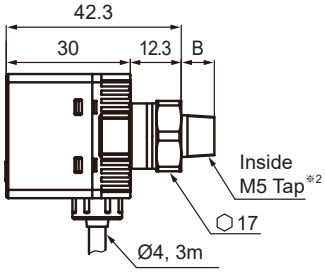
※A

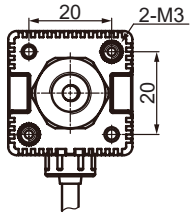
R1/8 model (standard)	8
NPT1/8 model	
7/16-20UNF model	11

※1: Only for R1/8 model, NPT1/8 model

2. Cable type







※B

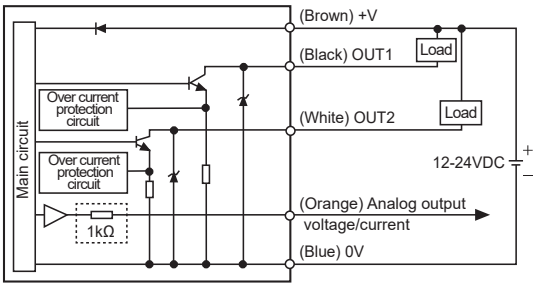
R1/8 model (standard)	8
9/16-18UNF model (metal gasket sealing method)	15.4

※2: Only for R1/8 model

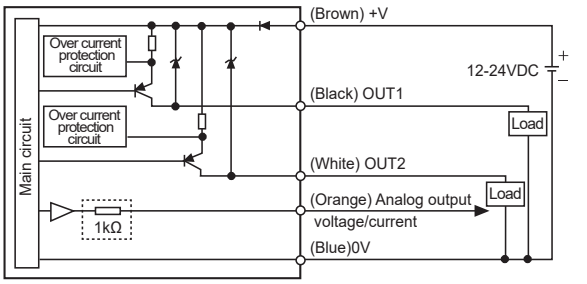
▣ Control Output Diagram

◎ Voltage (1-5VDC) output type (PSAN-□□□□□V-□)
Current (DC4-20mA) output type (PSAN-□□□□□A-□)

● NPN open collector output type



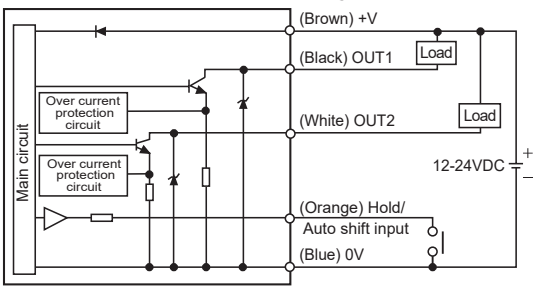
● PNP open collector output type



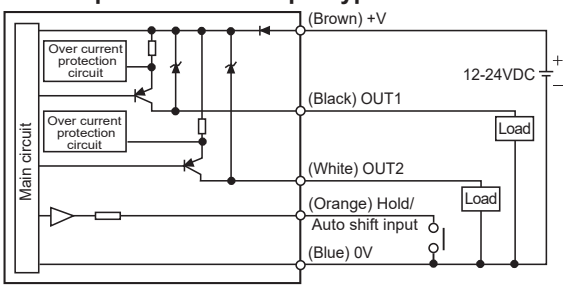
※In case of analog voltage output type models short-circuit protection is not embodied. (: For voltage output type only.)
Do not connect of power source or capacitive load directly.
※Be careful with input impedance of connecting devices when using analog voltage output type models.
※Be careful with voltage drop due to cable resistance when extending sensor cable.

◎ Hold/Auto shift input (PSAN-□□□□□H-□)

● NPN open collector output type



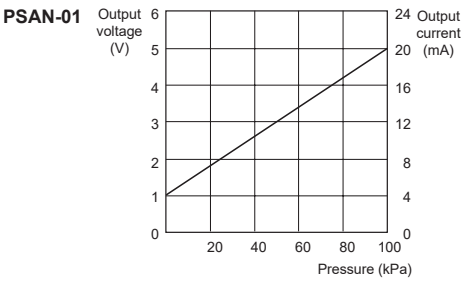
● PNP open collector output type



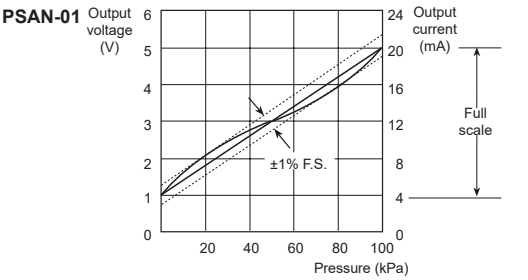
※If short-circuit the control output terminal or supply current over the rated specification, control signal is abnormal due to the current protection circuit

▣ Analog Output Characteristic

● Analog output voltage and current - Pressure characteristic



● Analog output voltage and current - Linear characteristic

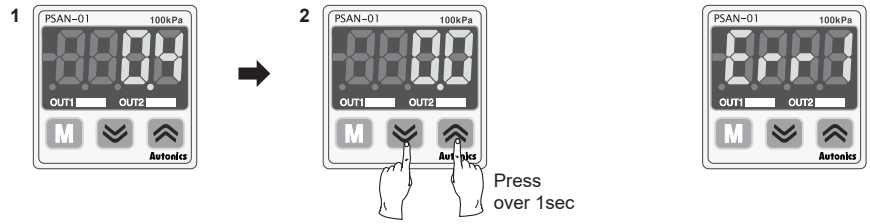


▣ Setting

RUN mode

Press M key over 3sec	Parameter setting	Pressure unit setting ▶ Output operation mode setting ▶ Output type setting ▶ Response time setting ▶ Analog output scale and Hold/Auto Shift input setting ▶ Key lock setting
M	Preset value setting	Detection level 1 setting (out1) ▶ Detection level 2 setting (out2)
	Forced output control mode setting	The forced output control mode is applied by pressing M key after selecting forced output control mode [F.oUt] in output operation mode [oUt.n] parameter. For more detailed information, refer to '● Forced output control mode' ' ▣ Output operation mode'
Press ▲ key over 3sec	Peak hold	High peak value check ▶ Low peak value check ▶ Auto shift input setting (In case of Hold/Auto shift input type model)
Press ▼+▲ keys over 1sec	Zero-point adjustment	Zero-point adjustment

▣ Zero Point Adjustment



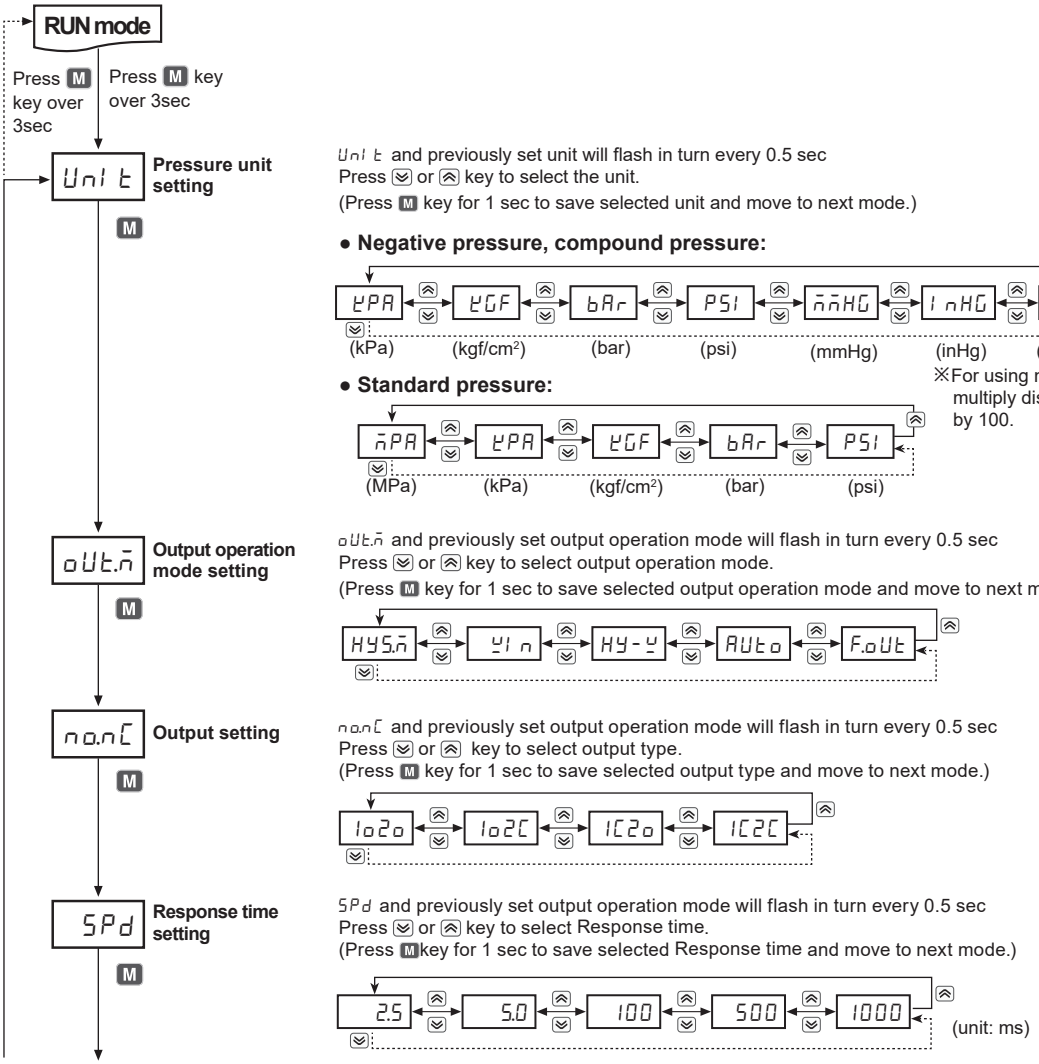
1. In state of atmospheric pressure during RUN mode, press ⩒ key and ⩓ key at the same time for over 1sec.
2. When the zero-point adjustment is complete, it will display 0.0 and return to RUN mode automatically.

※Please execute zero-point adjustment regularly.

※ Err 1 will flash while you execute zero point adjustment in the condition that external pressure exists.
Please execute zero-point adjustment again in state of atmospheric pressure without external pressure.

▣ Parameter Setting

1. It is able to set pressure unit, display resolution, output operation mode, output type, Response time, analog output scale, Hold/Auto shift and key lock setting in parameter setting mode.
2. If the key lock is set (lock1 or lock2), unlock the key lock before setting parameters. (Refer to Key Lock setting below.)



※ Refer to '◎ **Hold/Auto shift input setting**' in '■ **Functions**' for more details

Voltage (1-5VDC) output type (PSAN-□□□□□V-□)

※1 A-1u **1V scale setting** → M → ※2 A-5u **5V scale setting** → M

Current (DC4-20mA) output type (PSAN-□□□□□A-□)

※1 A-04 **4mA scale setting** → M → ※2 A-20 **20mA scale setting** → M

Hold/Auto shift input type (PSAN-□□□□□H-□)

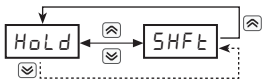
※3 d-in **Select external input function** → M → SH.ot **Select the control output for Auto shift function** → M

※1: A-1u (voltage output)/ A-04 (current output)and previously set pressure value will flash in turn every 0.5 sec
Press ▼ or ▲ key to set analog output scale value for 1V and 4mA.
Setting range: Min. rated pressure ≤ [A-1u, A-04] ≤ 90% of rated pressure
(Press M key for 1 sec to save selected pressure value as a scale value for 1V and 4mA and move to next mode.)

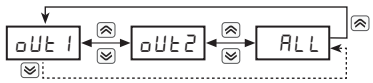
※2: A-5u (voltage output)/ A-20 (current output) and previously set pressure value will flash in turn every 0.5 sec
Press ▼, ▲ Key to set analog output scale value for 5V and 20mA.
Setting range:[A-1u, A-04]+10% of rated pressure ≤ [A-5u, A-20] ≤ Max. rated pressure
(Press M key for 1 sec to save selected pressure value as a scale value for 5V and 20mA and move to next mode.)

※3: d-in and previously set control function will flash in turn every 0.5 sec Press ▲, ▼ key to select external function.
(Press M key for 1 sec to save selected function and move to next mode.)

● **Select external input function**

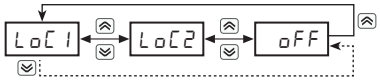


● **Select the control output for Auto shift function**



LoCK **Key Lock** → M

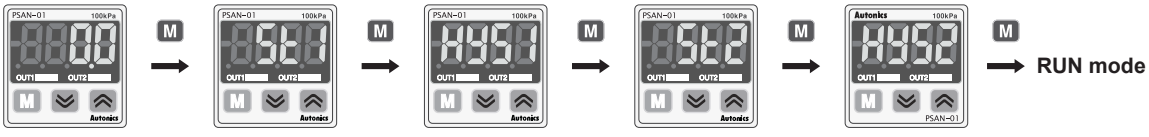
LoCK will flash in turn with previous setting parameter. Press ▼, ▲ key to select key lock setting.
(Press M key for 1 sec to save selected lock setting. Then, it will return to pressure unit setting mode.)



※When pressing M key for 3 sec in the middle of parameter setting, current setting value will be saved and it will return to RUN mode. If there is no additional key operation within 60 sec while setting, current set value is not valid and previous set value will remain.
※All settings are saved regardless of power failure. Make sure that this unit has a limited write life cycle (100,000 times).

■ Preset Setting

◎ Hysteresis mode [HYS.n]



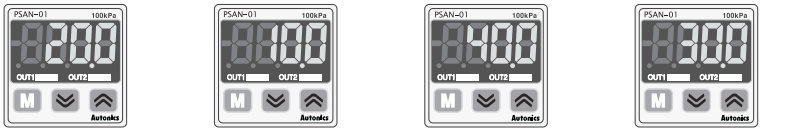
RUN mode

St1 and previously set value will flash in turn every 0.5 sec

HYS1 and previously set value will flash in turn every 0.5 sec

St2 and previously set value will flash in turn every 0.5 sec

HYS2 and previously set value will flash in turn every 0.5 sec



Press ▼ or ▲ Key to select St1 setting value.

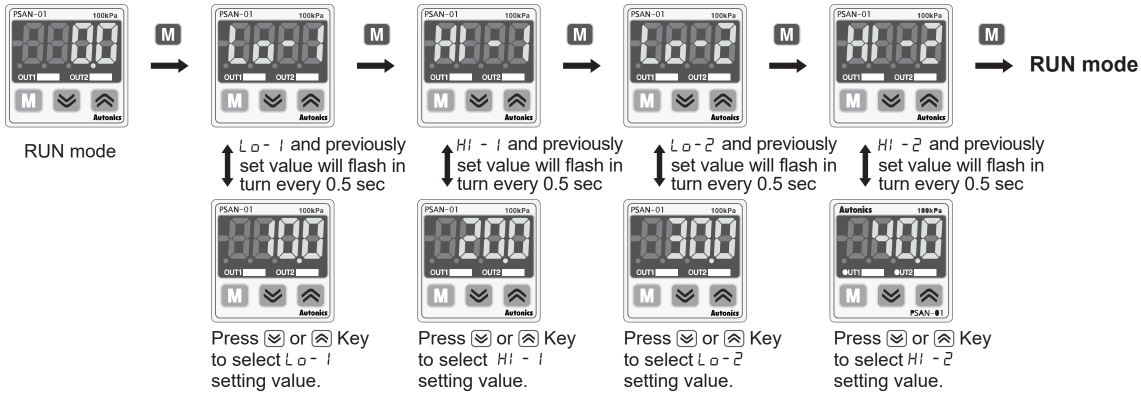
Press ▼ or ▲ key to select HYS1 setting value.

Press ▼ or ▲ key to select St2 setting value.

Press ▼ or ▲ key to select HYS2 setting value.

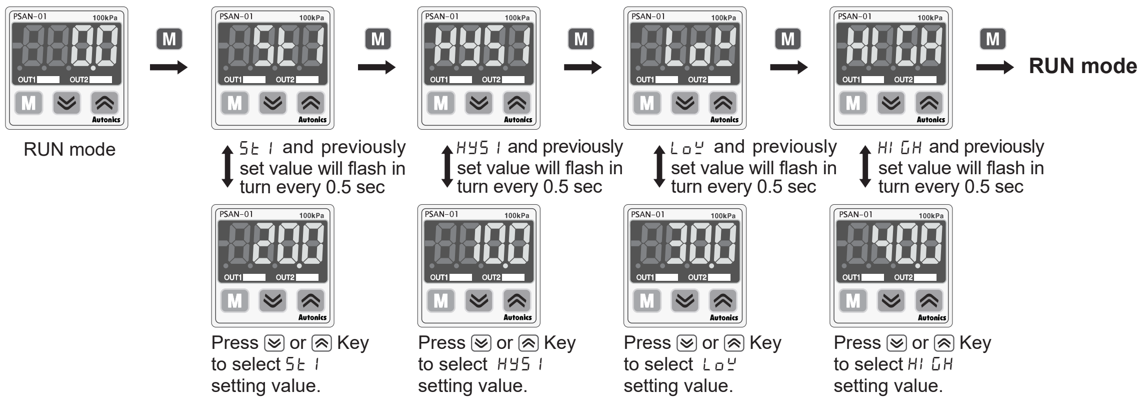
※St1 setting range : Min. display pressure < St1 ≤ Max. display pressure
※HYS1setting range : Min. display pressure ≤ HYS1 < St1
※St2 setting range : Min. display pressure < St2 ≤ Max. display pressure
※HYS2setting range : Min. display pressure ≤ HYS2 < St2

◎ Window comparison output mode [WIn]



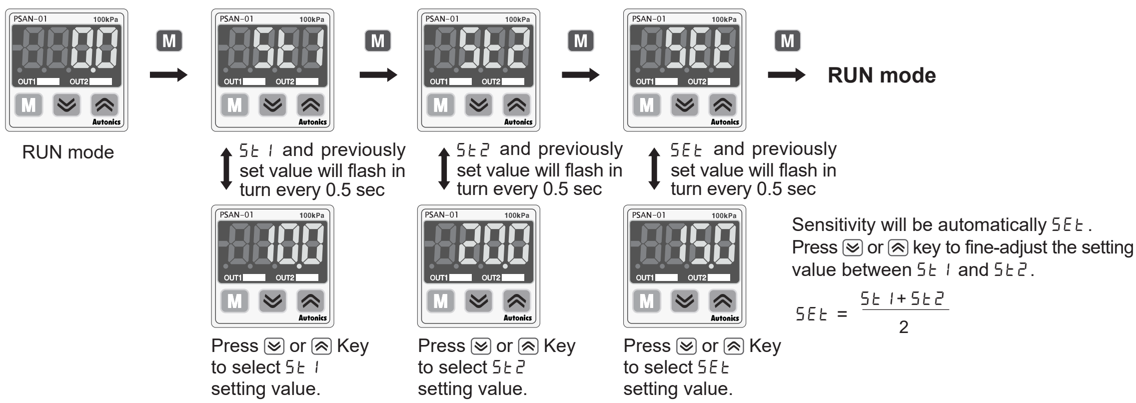
※Lo-1 setting range: Min. display pressure ≤ Lo-1 ≤ Max. display pressure- (3×min. display interval)
※HI-1 setting range: Lo-1+ (3×min. display interval) ≤ HI-1 ≤ Max. display pressure
※Lo-2 setting range: Min. display pressure ≤ Lo-2 ≤ Max. display pressure- (3×min. display interval)
※HI-2 setting range: Lo-2+ (3×min. display interval) ≤ HI-2 ≤ Max. display pressure
※The minimum display interval for hysteresis is fixed to 1.

◎ Hysteresis-Window comparison output mode [HY-W]



※St1 setting range : Min. display pressure < St1 ≤ Max. display pressure
※HYS1 setting range : Min. display pressure ≤ HYS1 < St1
※LoW setting range : Min. display pressure ≤ LoW ≤ Max. display pressure - (3×min. display interval)
※HIGH setting range : Low value + (3×min. display interval) ≤ HIGH ≤ Max. display pressure
※In case HYS1 and St1 have the same setting values, it will have the minimum display unit as a hysteresis.

◎ Automatic sensitivity setting mode [AUTo]



※St1 setting range : Min. display pressure < St1 ≤ Max. display pressure - 1% of rated pressure
※St2 setting range : St1 + 1% of rated pressure < St2 ≤ Max. display pressure
※If certain detection level difference is not ensured, or setting conditions are not met, Err3 message will flash three times and return to St2 setting mode. Check all setting conditions and set proper setting values.

◎ Forced output control mode [F.oUt]

If forced output control mode is selected, pressure value is displayed only.
(No output will be provided.)

Present pressure value and F.oUt will flash in turn every 0.5 sec

Control output 1 ON ⇄ Control output 1 OFF

Control output 2 ON ⇄ Control output 2 OFF

※When there is no additional key operation within 60 sec while setting, it returns to Run mode (Except for force output mode). Previously set values remain.

※In case of changing output operation mode, no preset values will be initialized. Instead, previous output operation settings will become the preset values.

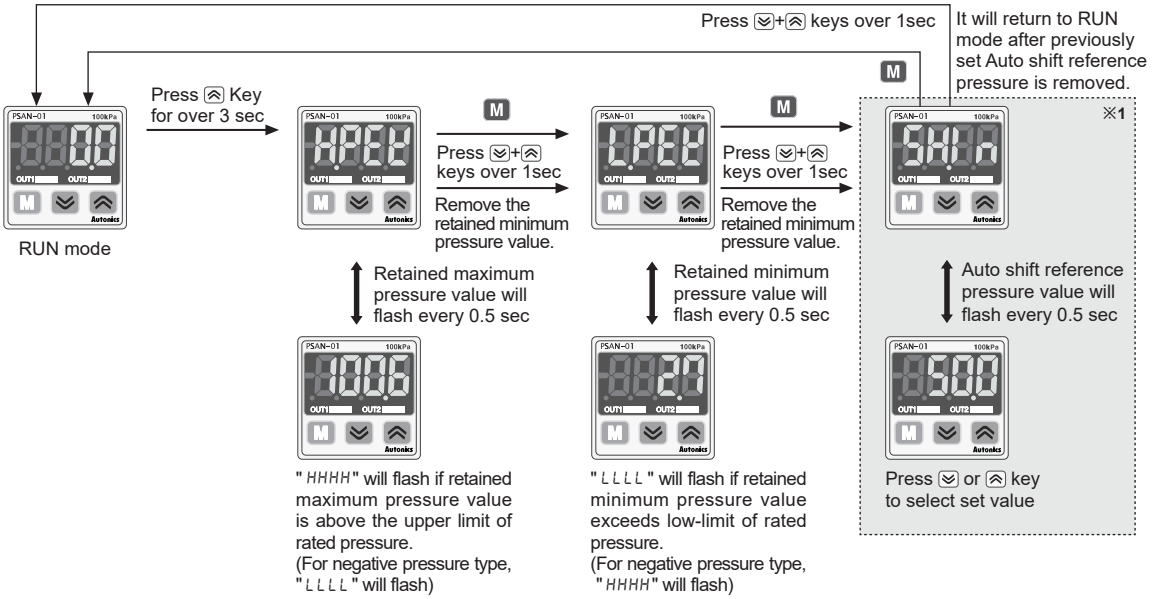
※When using the forced output function, Hold/Auto shift function is not available to use in Hold/Auto shift model.

※When changing pressure display unit, resolution, and Hold Auto shift input function, preset values will be initialized as shown on the next table. (When changing pressure display unit, preset value will be automatically switched to changed pressure unit.)

● Factory default (unit: kPa)

Output mode	Negative pressure 0.0 to -101.3	Standard pressure 0.0 to 100.0	Standard pressure 0 to 1,000	Compound pressure -101.3 to 100.0
HYS.n	SP 1:-50.0 HYS 1:0.0 SP2:-50.0 HYS2:0.0	SP 1:50.0 HYS 1:0.0 SP2:50.0 HYS2:0.0	SP 1:500 HYS 1:0 SP2:500 HYS2:0	SP 1:50.0 HYS 1:-50.0 SP2:50.0 HYS2:-50.0
in	Lo- 1:0.0 HI - 1:-50.0 Lo-2:0.0 HI -2:-50.0	Lo- 1:0.0 HI - 1:50.0 Lo-2:0.0 HI -2:50.0	Lo- 1:0 HI - 1:500 Lo-2:0 HI -2:500	Lo- 1:-50.0 HI - 1:50.0 Lo-2:-50.0 HI -2:50.0
HY-U	SP 1:-50.0 HYS 1:0.0 LoU:0.0 HI GH:-50.0	SP 1:50.0 HYS 1:0.0 LoU:0.0 HI GH:50.0	SP 1:500 HYS 1:0 LoU:500 HI GH:0	SP 1:50.0 HYS 1:-50.0 LoU:-50.0 HI GH:50.0
AUto	SP 1:0.0 SP2:-50.0 SEt:-25.0	SP 1:0.0 SP2:50.0 SEt:25.0	SP 1:0 SP2:500 SEt:250	SP 1:-50.0 SP2:50.0 SEt:0.0

■ High Peak/Low Peak Function and Auto Shift Reference Pressure Check/Change



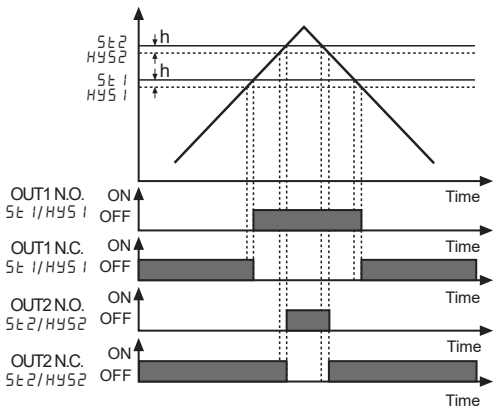
※1: Displayed only when d-in is set to SHFt (PSAN-□□□□□H-□ models only)

※If there is no Auto shift input, "0" will be displayed. (Refer to '◎ **High Peak / Low Peak Hold**' in '■ **Functions**' for more details.)

▣ Output Operation Mode

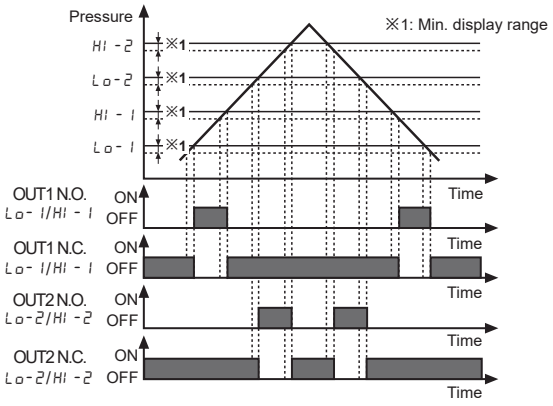
1. Hysteresis mode [HYS.n]

It is able to set certain value for pressure detection level [St 1, St2] and hysteresis [HYS 1, HYS2].



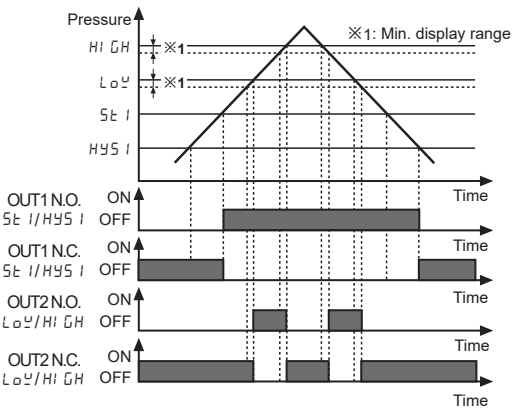
2. Window comparison output mode [Hi n]

① It is able to set the range for high [Hi - 1,Hi -2], low [Lo- 1, Lo-2] limit of pressure detection level when it is required to detect pressure at a certain range.
② Detection hysteresis is fixed to min. display range.



3. Hysteresis-window comparison output mode [HY-W]

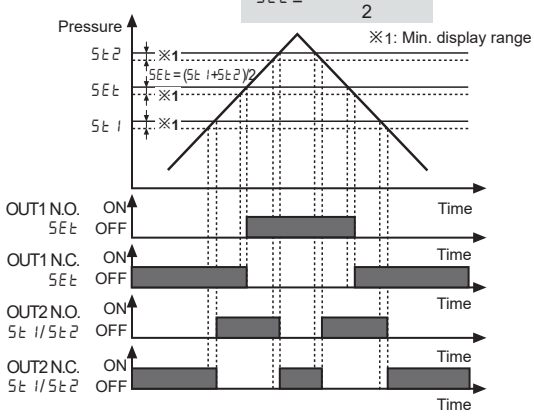
① It is available to set hysteresis mode and window comparison output mode when both hysteresis mode [St 1, St2] and window comparison output mode [LoW, Hi GH] are necessary.
② Detection hysteresis is fixed to min. display range.



4. Automatic sensitivity setting mode [AUTo]

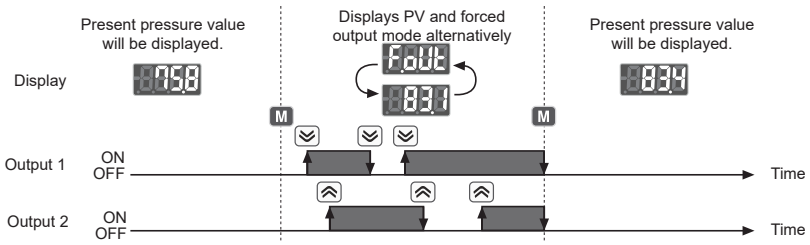
① This function is to set pressure detection level to the proper position automatically. It is set by applied pressure from two positions [St 1, St2].
② Detection hysteresis is fixed to min. display range.
③ The pressure detection level[SET] is shown in the following calculation.

$$SET = \frac{(St\ 1 + St2)}{2}$$



5. Forced output control mode [F.oUT]

① Used to display pressure with forcibly holding comparing output OFF regardless of setting value.
② In parameter setting, if output operation mode setting 'oUt.n' is changed to 'F.oUt', forced output control mode is operated.
③ Output 1, 2 can be ON/OFF manually by pressing ⋙, ⋘ key while the forced output control mode is applied.



▣ Functions

◎ Pressure unit change

PSAN-V01C (P) and PSAN-C01C (P) has 7 kinds of pressure unit, PSAN-01C (P) and PSAN-1C (P) has 5 kinds of pressure unit. Please select the proper unit for application.

• PSAN-V01C (P), PSAN-C01C (P)
: kPa, kgf/cm², bar, psi, mmHg, inHg, mmH_2O
• PSAN-01C (P), PSAN-1C (P) : MPa, kPa, kgf/cm², bar, psi
※When using mmH_2O unit, multiply display value by 100.

◎ Output mode change

There are 5 kinds of control output mode in order to realize the various pressure detection.

• Hysteresis mode [HYSn]
When needed to change hysteresis for detecting pressure.
• Window comparison output mode [Wn]
When needed to detect pressure in certain area.
• Hysteresis - Window comparison output mode [HY-W]
When both hysteresis mode and window comparison output mode are required.
• Automatic sensitivity setting mode [AUTo]
When needed to set detection sensitivity automatically at proper position.
• Forced output control mode [FoUt]
When needed to display pressure with remaining comparison output OFF regardless of setting value.

◎ Control output change

Type of control output for Out1 and Out2 can be able to set Normally Open or Normally Closed.
※Note that Normally Open and Normally Closed provide opposite output.

OUT1 output	OUT2 output	Parameter setting value
Normally Open	Normally Open	1o2o
Normally Open	Normally Closed	1o2C
Normally Closed	Normally Open	1C2o
Normally Closed	Normally Closed	1C2C

◎ Response time change (chattering prevention)

It can prevent chattering of control output by changing Response time. It is able to set 5 kinds of Response time (2.5ms, 5ms, 100ms, 500ms, 1000ms) and if the Response time is getting longer, the detection will be more stable by increasing the number.

◎ Analog output scale setting

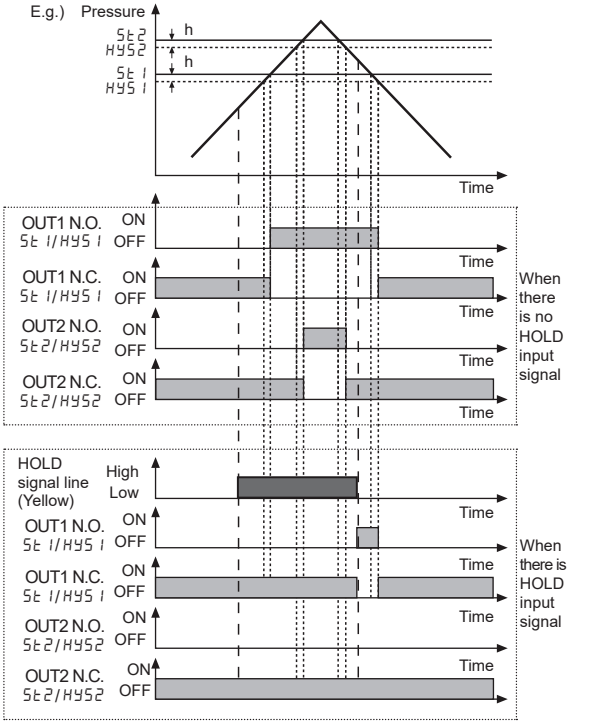
• Analog voltage output scale setting
The scale function for analog output voltage (1-5VDC) is not fixed to the rated pressure range. It can be changed for User's application. Analog output voltage range will be fixed to 1-5VDC within the pressure range from pressure point of 1VDC output [A-1u] to pressure point of 5VDC output [A-5u].

• Analog current output scale setting
The scale for analog output Current (DC4-20mA) is not fixed to the rated pressure range. It can be changed for User's application. Analog output voltage will be fixed to DC4-20mA within the rated pressure range from pressure point of 4mA output [A-04] to pressure point of 20mA output [A-20].

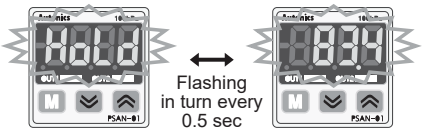
◎ Hold/Auto shift input setting

• Hold
A function to hold present pressure value and control output at the time of hold signal input.
※Present pressure value and Hold message will flash in turn every 0.5 sec while Hold function is set. Make sure that Hold function is not able to execute while forced output mode is executed.

▸ Control output timing chart
When Hold signal is applied in Hysteresis mode, refer to "▣ Control output diagram".



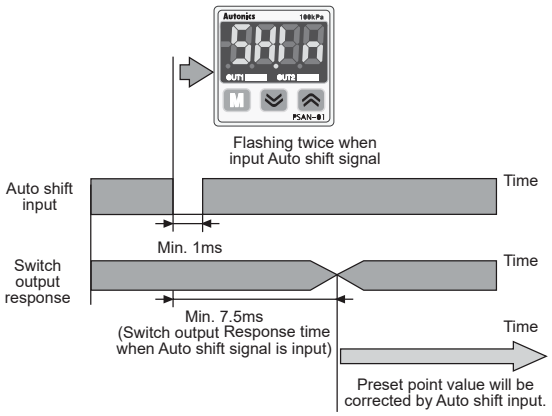
※[HoLd] and present pressure value will flash in turn every 0.5 sec while Hold signal is applied.



• Auto shift
A function to use the measured pressure at the moment of auto shift input as a reference pressure in order to correct the set point values of control output when initial pressure changes.
※Reference pressure is fixed to atmospheric pressure (0.0kPa) when Auto shift function is not used.
※SHIn (Auto shift compensation value) will be reset to 0 when changing control output or preset values.
※Auto shift function will not be executed if "HHHH" or "LLLL" error occurs or if forced output mode is set.
• SHot : Reference pressure change through setting.
• oUt1 : Changed reference will be applied to control output 1 only.
• oUt2 : Changed reference will be applied to control output 2 only.
• ALL : Changed reference will be applied to both control output 1 and control output 2.

▸ When Auto shift is used

When Auto shift input signal remains at low level more than 1ms, the measured pressure at this point will be saved as a reference value to make correct judgment regardless of pressure changes. Corrected preset pressure value will be applied after 7.5ms.
Measured reference pressure value will be saved in [SHI n].



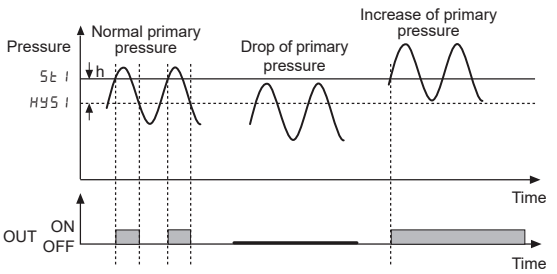
※When Auto shift function is used, the possible set pressure range will be wider than rated set pressure range.
※The possible set pressure range for Auto shift type models.

Pressure type	Set pressure range	Possible set pressure range for Auto shift type models
Vacuum pressure	-101.3kPa to 5.0kPa	-101.3kPa to 101.3kPa
Vacuum pressure	-5.0kPa to 110.0kPa	-110.0kPa to 110.0kPa
	-50.0kPa to 1100kPa	-1100kPa to 1100kPa
Compound pressure	-101.3kPa to 110.0kPa	-101.3kPa to 110.0kPa

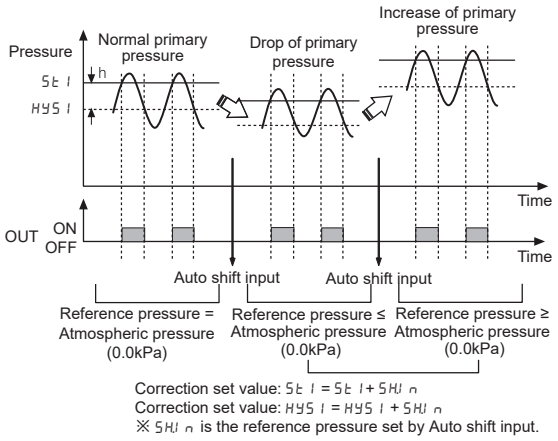
※If the set point value corrected by auto shift input exceeds set pressure range,an error message will flash three times and corrected value is not saved.
→[-HH-] displayed when the set point value corrected by Auto shift input is above the upper limit of set pressure range.
→ [-LL-] displayed when the set point value corrected by Auto shift input is below the lower limit of set pressure range.

▸ Example of Auto shift

< When Auto shift is not used >



< When Auto shift is used >



Correction set value: SET = SET + SHI n
Correction set value: HYS1 = HYS1 + SHI n
※ SHI n is the reference pressure set by Auto shift input.

◎ Key lock

The key lock function prevents key operations so that conditions set in each mode.
- LOC1: All keys are locked; therefore it is not available to change parameter settings, preset value, zero adjustment, High/Low peak check, and SHI n data initialization. (Lock setting change is available)
- LOC2: Partially locked status; therefore it is not available to change parameter settings only (Lock setting change is available). Other settings are still available.
- OFF: All of the setting is available, all keys are unlocked. to set detection sensitivity automatically at proper position.

◎ Zero-point adjustment

The key lock function prevents key operations so that conditions set in each mode.
The zero-point adjustment function forcibly sets the pressure value to "zero" when the pressure port is opened to atmospheric pressure. When the zero adjustment is applied, analog output [Voltage or Current] is changed by this function.
(Press ⩛ + ⩓ keys over 1 sec in RUN mode.)

◎ High peak / Low peak hold

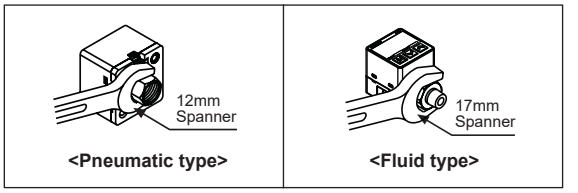
This function is to diagnosis malfunction of the system caused by parasitic pressure or to check through memorizing the max./min. pressure occurred from the system.

Error display	Description	Troubleshooting
Err1	When external pressure is input while adjusting zero point	Try again after removing external pressure
Err2	When overload is applied on control output	Remove overload
Err3	When setting condition is not met in Auto sensitivity setting mode	Check setting conditions and set proper setting values
LLLL	When applied pressure exceeds Low-limit of display pressure range	Apply pressure within display pressure range
HHHH	When applied pressure exceeds High-limit of display pressure range	
-HH- -LL- -Ho-	Auto shift correction error	Set the corrected setting value within setting pressure range.

▣ Installation

1. Pressure port is divided as standard and option specification. Therefore, be sure that to use commercially available one touch fitting.

2. Please connect it by using spanner (pneumatic type 12mm, fluid type 17mm) at the metal part in order not to overload on the body when connecting one touch fitting.

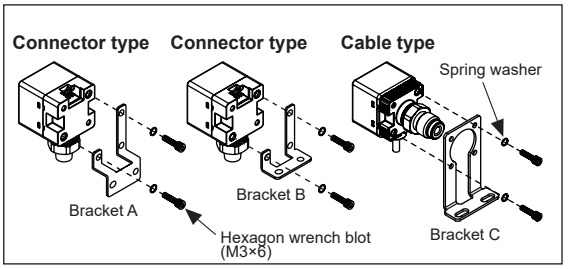


<Pneumatic type> <Fluid type>

⚠Caution

The tightening torque of one touch fitting should be max.10N·m. If not, it may cause mechanical problem.

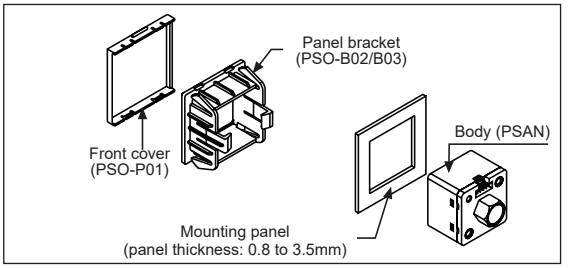
3. Two different brackets are provided for pneumatic type and three different brackets are provided for fluid type. Select proper one with considering your application environments.
4. At first, please unscrew hexagon wrench bolt and assemble the bracket on this unit by fixing hexagon the wrench bolt.



⚠Caution

In this case, tightening torque of hexagon wrench should be max. 3N·m. If not, it may cause mechanical problem.

5. Panel bracket (PSO-B02/B03) and front cover (PSO- P01) are sold separately. Please see the pictures for installation.



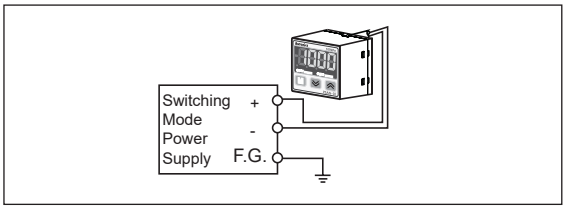
※Do not pull the cable with a tensile strength of 30N or over.

▣ Proper Usage

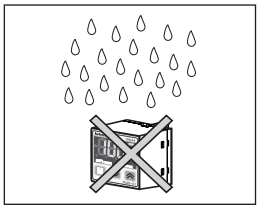
⚠Caution

PSAN Series is for sensing of non corrosive gas. Do not use this product at corrosive gas or flammable gas, etc.

- Please using this unit within the range of specification, if applying pressure is larger than specification, it may not be working properly due to damage.
- After supplying power, it takes 3 sec to work.
- When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.



- It may cause malfunction by noise, when wiring with power line or high voltage line.
- Do not insert any sharp or pointed object into pressure port. It may cause mechanical problem due to sensor damage.
- Do not use this unit with flammable gas, because this is not an explosion proof structure.
- Be sure that this unit should not be contacted directly with water, oil, thinner, etc.



- Wiring must be done with power off.

Compact, Digital Display Pressure Sensors

▣ Features

- High brightness red LED (LED height : 9.5mm)
- Min. display interval-Negative pressure: 0.1kPa
  -Standard pressure: 0.1kPa, 1kPa
  -Compound pressure: 0.2kPa
- Convertible pressure unit
  - Negative, Compound pressure : kPa, kgf/cm^2, bar, psi, mmHg, mmH$_2$O, inHg
  - Standard pressure : kPa, kgf/cm^2, bar, psi
- Various output modes : Hysteresis mode, Automatic sensitivity setting mode, Independent 2 output mode, Window comparative output mode
- Chattering prevention for output
  (selectable response time : 2.5ms, 5ms, 100ms, 500ms)
- One-touch connector type for easy wiring and maintenance
- Analog output: voltage (1-5VDC)
- Reverse power polarity and overcurrent protection circuit
- Zero-point adjustment function, peak value monitoring function, bottom hold display

PSA Series

PSB Series

PSB Series
Connector type

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

▣ Ordering Information

PS A – V 01 C P – Rc1/8

Pressure port	Rc1/8	Standard (PSA Series)
	NPT1/8	Option (PSA Series)
	M5	Standard (PSB Series)
Output type	No mark	NPN open collector output
	P	PNP open collector output
Cable※1	No mark	Cable type
	C	Connector type
Pressure range	01	100kPa
	1	1,000kPa
Pressure type	No mark	Standard pressure
	V	Negative pressure
	C	Compound pressure
Appearance	A	Regular square (30×30mm)
	B	Rectangular (cable type: 10.4×54.2mm) (connector type: 10×52mm)
Item	PS	Pressure Sensor

※1: It is only applied to PSB Series.

▣ Pressure and Max. Pressure Display Range

Type	kPa	kgf/cm^2	bar	psi	mmHg	inHg	mmH$_2$O
Negative pressure	**0.0 to -101.3** (5.0 to -101.3)	**0.000 to -1.033** (0.051 to -1.033)	**0.000 to -1.013** (0.05 to -1.013)	**0.00 to -14.70** (0.74 to -14.70)	**0 to -760** (38 to -760)	**0.0 to -29.9** (1.5 to -29.9)	**0.0 to -103.3** (5.2 to -103.3)
Standard pressure	**0.0 to 100.0** (-5.0 to 110.0)	**0.000 to 1.020** (-0.051 to 1.122)	**0.000 to 1.000** (-0.050 to 1.100)	**0.00 to 14.50** (-0.72 to 15.96)	—	—	—
	0 to 1000 (-50 to 1100)	**0.00 to 10.20** (-0.51 to 11.22)	**0.00 to 10.00** (-0.50 to 11.00)	**0.0 to 145.0** (-7.2 to 159.6)	—	—	—
Compound pressure	**-100.0 to 100.0** (-101.2 to 110.0)	**-1.020 to 1.020** (-1.034 to 1.122)	**-1.000 to 1.000** (-1.012 to 1.100)	**-14.50 to 14.50** (-14.70 to 15.96)	**-750 to 750** (-760 to 824)	**-29.5 to 29.5** (-29.8 to 32.6)	**-102.0 to 102.0** (-103.4 to 112.2)

※( ) is Max. pressure display range.
※For using a unit mmH$_2$O, multiply display value by 100.

▣ Pressure Conversion Chart

from \ to	Pa	kPa	MPa	kgf/cm^2	mmHg	mmH$_2$O	psi	bar	inHg
1Pa	1	0.001	0.000001	0.000010197	0.007501	0.101972	0.000145038	0.00001	0.0002953
1kPa	1000	1	0.001	0.010197	7.500617	101.971626	0.145038	0.01	0.2953
1MPa	1000000	1000	1	10.197162	7500.61683	101971.626	145.038243	10	295.299875
1kgf/cm^2	98066.5	98.0665	0.098067	1	735.55924	10000.0005	14.223393	0.980665	28.959025
1mmHg	133.322368	0.133322	0.000133	0.001359	1	13.595099	0.019337	0.001333	0.039370
1mmH$_2$O	9.80665	0.009807	—	0.000099	0.073556	1	0.00142	0.000098	0.002896
1psi	6894.733	6.89473	0.006895	0.070307	51.714752	703.016716	1	0.068947	2.036014
1bar	100000	100	0.100000	1.019716	750.062	10197.1626	14.503824	1	29.529988
1inHg	3386.388	3.386388	0.003386	0.034532	25.40022	345.315507	0.491156	0.033864	1

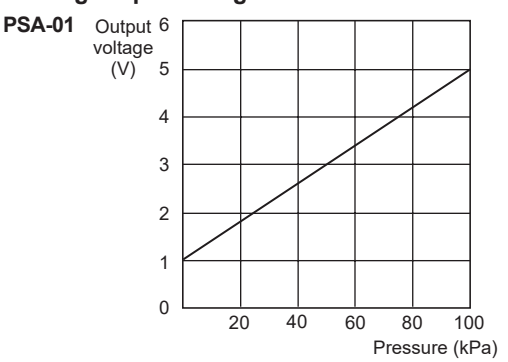
E.g.) For calculating 760mmHg as kPa : According to above chart, 1mmHg is 0.133322kPa, therefore 760mmHg will be 760×0.133322kPa=101.32472kPa.

▣ Specifications

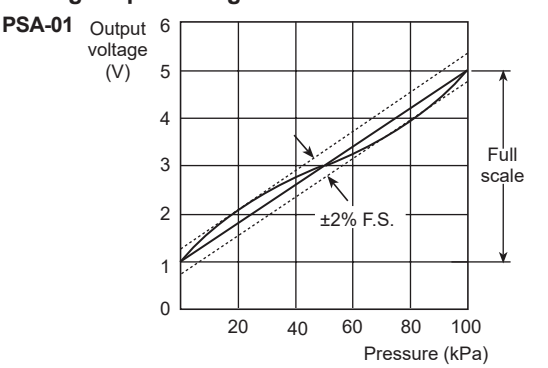
Pressure type		Gauge pressure			
		Negative pressure	Standard pressure		Compound pressure
Model※1	NPN open collector output	PSA-V01-☐ PSB-V01-☐ PSB-V01C-☐	PSA-01-☐ PSB-01-☐ PSB-01C-☐	PSA-1-☐ PSB-1-☐ PSB-1C-☐	PSA-C01-☐ PSB-C01-☐ PSB-C01C-☐
	PNP open collector output	PSA-V01P-☐ PSB-V01P-☐ PSB-V01CP-☐	PSA-01P-☐ PSB-01P-☐ PSB-01CP-☐	PSA-1P-☐ PSB-1P-☐ PSB-1CP-☐	PSA-C01P-☐ PSB-C01P-☐ PSB-C01CP-☐
Rated pressure range		0.0 to -101.3kPa	0.0 to 100.0kPa	0.0 to 1,000kPa	-100.0 to 100.0kPa
Display and set pressure range		5.0 to -101.3kPa	-5.0 to 110.0kPa	-50 to 1,100kPa	-101.2 to 110.0kPa
Max. pressure range		2 times of rated pressure		1.5 times of rated pressure	2 times of rated pressure
Applied fluid		Air, Non-corrosive gas			
Power supply		12-24VDC⎓ ±10% (ripple P-P : Max. 10%)			
Current consumption		Max. 50mA			
Control output		NPN or PNP open collector output • Load voltage: Max. 30VDC⎓ • Load current: Max. 100mA • Residual voltage - NPN: Max. 1VDC⎓, PNP: Max. 2VDC			
Hysteresis※2		1-digit fixed (2-digit for psi unit)			2-digit fixed
Repeat error		±0.2% F.S. ±1-digit			±0.2% F.S. ±2-digit
Response time		Selectable 2.5ms, 5ms, 100ms, 500ms			
Protection circuit		Output short over current protection circuit			
Analog output		• Output voltage: 1-5VDC⎓ ±2% F.S. • Zero-point: Within 1VDC⎓ ±2% F.S. • Span: Within 4VDC⎓ ±2% F.S. • Linear: Within ±2% F.S. • Resolution: Approx. 1/200 • Output impedance: 1kΩ			
Display digit		3½ -digit			
Display method		7-segment LED			
Min. display interval		1-digit (psi unit: 2-digit are fixed)			2-digit
Pressure unit		kPa, kgf/cm², bar, psi, mmHg, mmH_2O, inHg	kPa, kgf/cm², bar, psi		kPa, kgf/cm², bar, psi, mmHg, mmH_2O, inHg
Display accuracy		0 to 50℃: Max. ±1% F.S., -10 to 0℃ : Max. ±2% F.S.			
Environment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Material		• PSA - Front, Rear case: Polycarbonate (insert glass), Pressure port: die-cast (Zn) • PSB - Case, Pressure port, Cover: IX EF • PSB-C - Case, Pressure port, Cover: IXEF			
Protection structure		IP40 (IEC standard)			
Cable	Cable type	Ø4mm, 5-wire, 2m (AWG24, Core diameter: 0.08mm, Number of cores: 40, Insulation out diameter: Ø1mm)			
	Connector type	5-wire, 3m (AWG24, Insulation out diameter: Ø1mm)			
Approval		CE			
Weight※3		• **PSA:** Approx. 200g (approx. 120g) • **PSB:** Approx. 160g (approx. 70g) • **PSB-C:** Approx. 160g (approx. 70g)			

※1: '☐' is pressure port type. Please refer to the '▣ Ordering Information'.
※2: In hysteresis output mode, detection difference is variable.
※3: The weight includes packaging. The weight in parenthesis in for unit only.
※F.S.: Rated pressure.
※There may be ±1-digit error in hysteresis by pressure unit calculation error.
※The specification of pressure port is marked on the upper part of the case.
※Environment resistance is rated at no freezing or condensation.

● Analog output voltage-Pressure characteristic



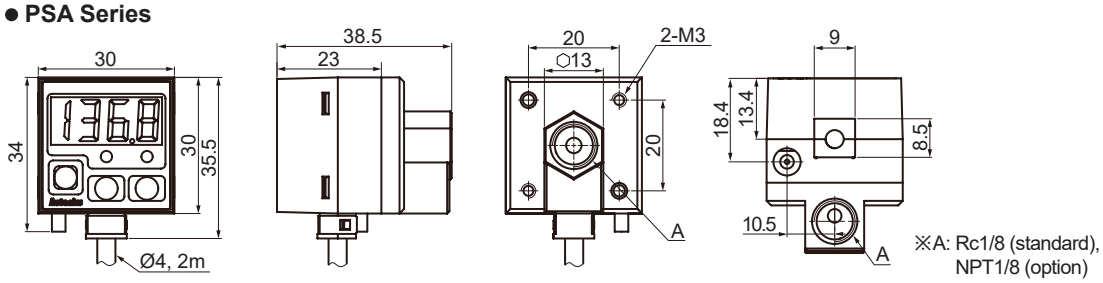
● Analog output voltage-Linear characteristic



▣ Dimensions

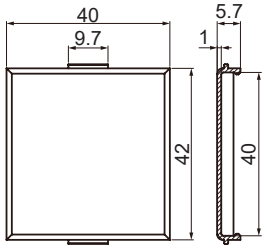
(unit: mm)

● **PSA Series**

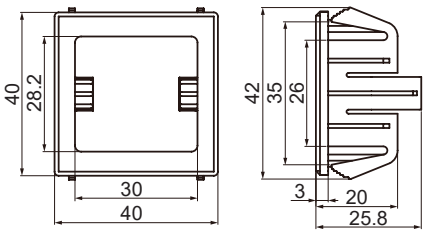


※A: Rc1/8 (standard), NPT1/8 (option)

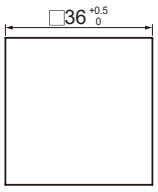
● **Sold separately (front cover (PSO-P01))**



● **Sold separately (panel bracket (PSO-01))**

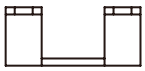


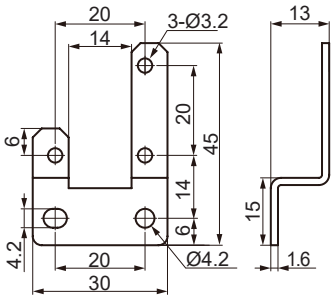
● **Panel cut-out**



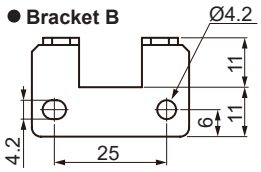
(panel thickness: 0.8 to 3.5mm)

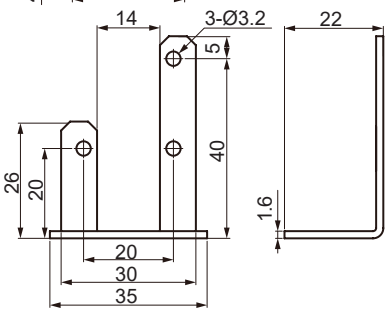
● **Bracket A**





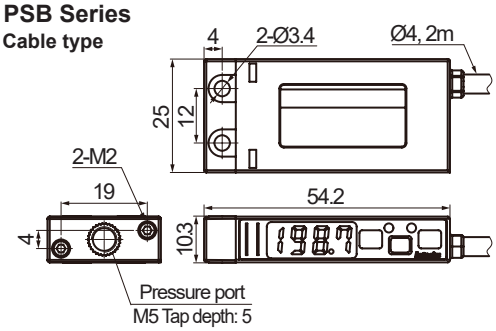
● **Bracket B**



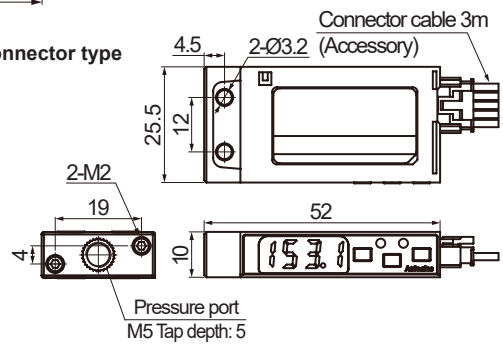


● **PSB Series**

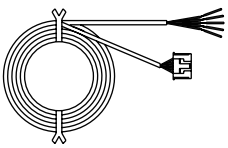
● **Cable type**



● **Connector type**



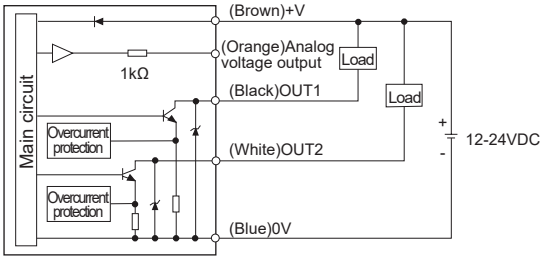
● **Sold separately (connector cable (PSO-C01))**



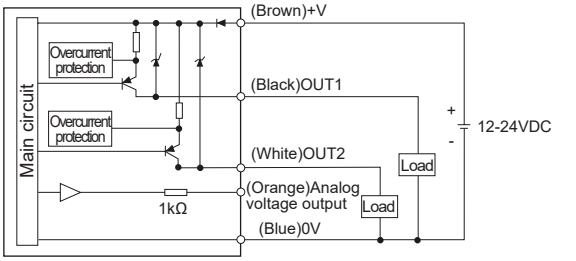
※Ø4mm, 5-wire, 2m
(AWG24, core diameter: 0.08mm, number of cores: 40, insulator diameter: Ø1mm)

▣ Control Output Diagram (PSA/PSB)

● NPN open collector output type



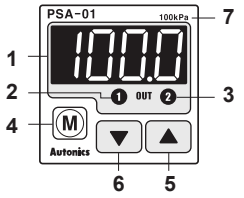
● PNP open collector output type



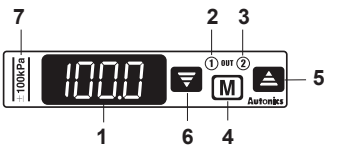
※There is no short-circuit protection in analog voltage output. Do not connect this output to power supply or capacitive load directly.
※Please observe input impedance of connected equipment when use analog voltage output.
And be sure to check voltage drop caused by resistance of extended wire.
※If short-circuit the control output terminal or supply current over the rated specification, control signal is abnormal due to the current protection circuit.

▣ Unit Description

(PSA Series)

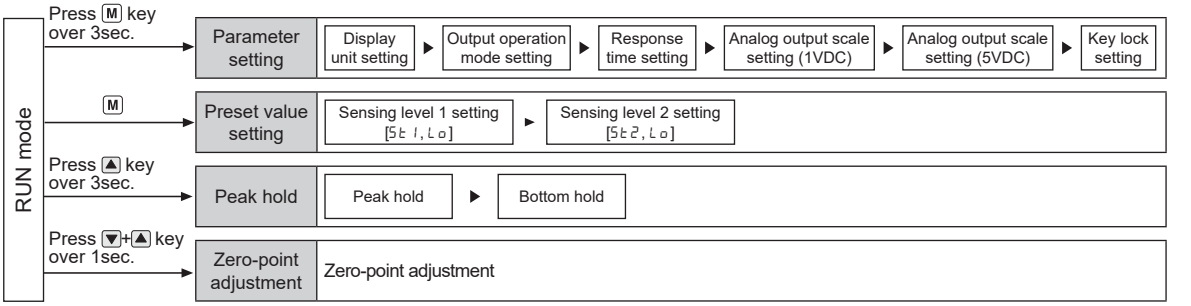


(PSB Series)



1. 3½digit LED display (red)
: Display sensing pressure, every setting value and display error.
2. 1 output indicator (red) : Output 1 is ON, LED will be ON.
3. 2 output indicator (PSA: red, PSB: green)
: Output 2 is ON,LED will be ON.
4. Mode key
: Parameter setting mode or preset setting mode, save setting value.
5. Up key
: Set the setting value to lower step in preset setting or pressure unit, output mode, response time, analog output scale, key lock, peak hold value, bottom hold value display in parameter setting.
6. Down key
: Set setting value to upper step in preset setting or pressure unit, output mode, response time, analog output scale, key lock, peak hold, bottom hold display in parameter setting.
7. Range of rated pressure
: It is possible to change the pressure unit in PSA Series. Please use different unit as label for your application.

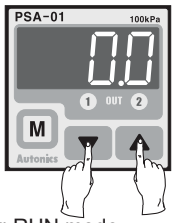
▣ Setting (PSA/PSB)

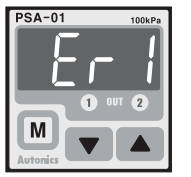


▣ Zero Point Adjustment (PSA/PSB)

1

2



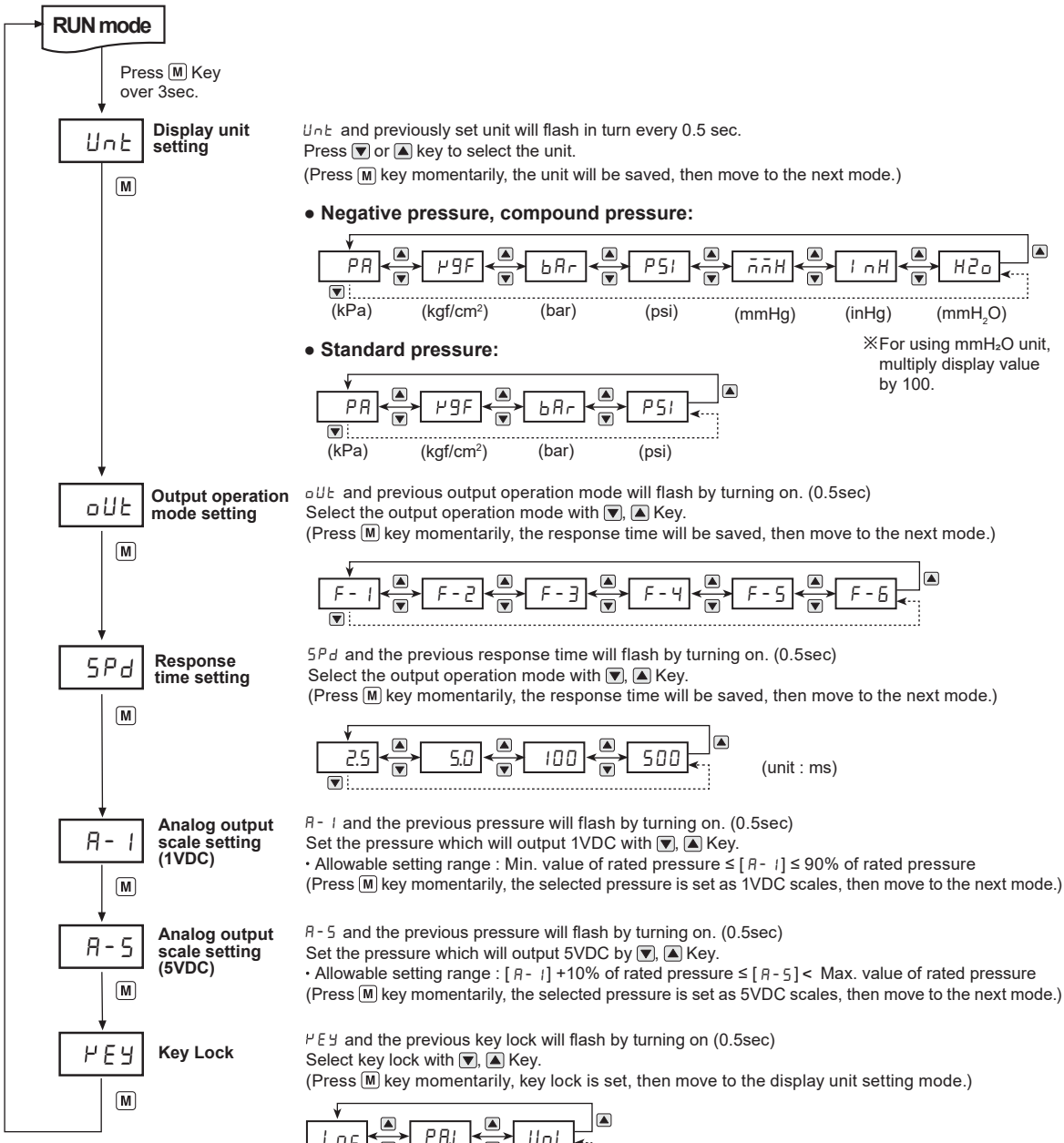


1. In state of atmospheric pressure during RUN mode, press ▼ key and ▲ key at the same time for over 1sec.
2. When the zero point adjustment is completed, it will display 0.0 and return to RUN mode automatically.

※Please execute zero point adjustment regularly.

※If executing zero point adjustment when external pressure has been applied, Er1 will be flashing. Please execute zero point again in state of atmospheric pressure.

▣ Parameter Setting (PSA/PSB)

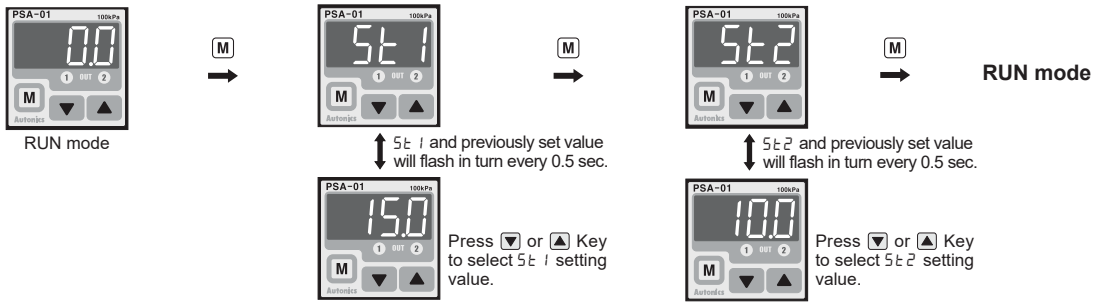


※Key lock functions
- Loc : Disable to change preset value and parameter value (Enable to change KEY mode only)
- PAL : Disable to change parameter setting/preset, zero point adjustment (Enable to check peak hold and bottom hold, and to change KEY mode)
- UnL : Enable to change preset value and parameter value (Lock off)

※When advance to parameter setting mode and preset setting mode, it displays "Setting item" and "Previous setting value" by 0.5 sec. turn. This display will stop by pressing ▼ or ▲ key (Display setting value), if any key is untouched for over 1 sec., it will display old value by 0.5sec. turn again.
※When M key is pressed for 3sec. during setting, it will return to RUN mode with memorizing on EEPROM. However, when there is any key is untouched for 60sec., it turns to RUN mode with keeping the previous setting value not current setting value.
※There is memory protection by EEPROM, but life cycle of EEPROM is 100,000 times.

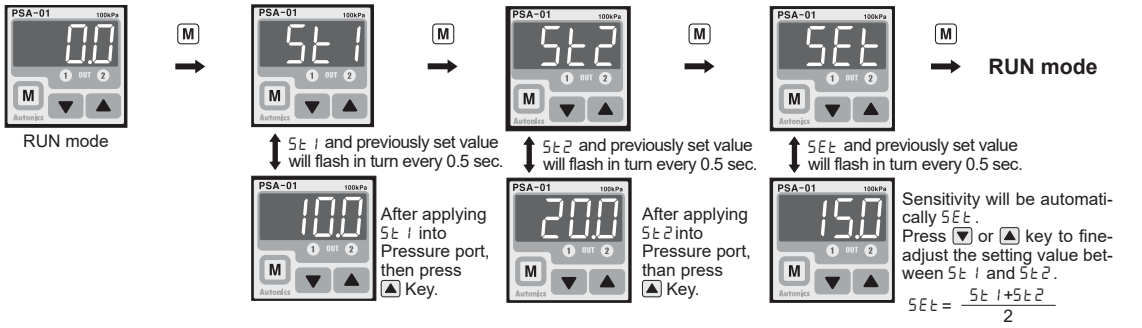
▣ Preset Value Setting (PSA/PSB)

◎ Hysteresis mode[F-1] and independent 2 output mode[F-3, F-4, F-5]



※SP1 setting range : Min. display pressure < SP1 ≤ Max. display pressure
※SP2 setting range : - Hysteresis mode: Min. display pressure ≤ SP2 < SP1
- 2 independent output mode: Min. display pressure < SP2 ≤ Max. display pressure

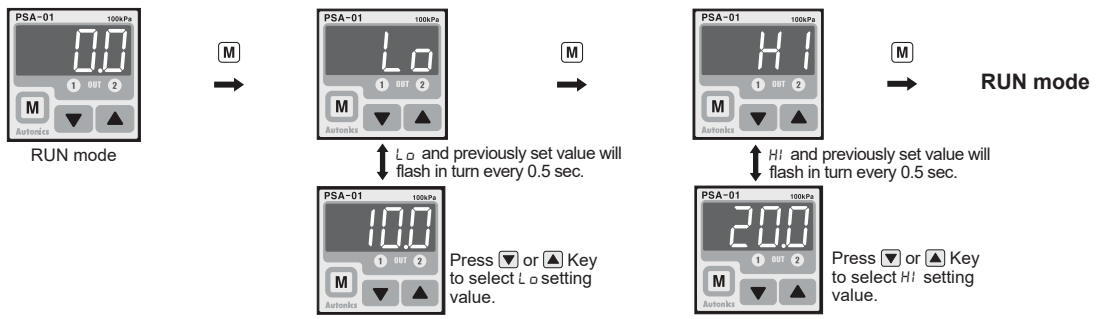
◎ Automatic sensitivity setting mode[F-2]



※SP1 setting range : Min. display pressure < SP1 ≤ Max. display pressure – 1% of rated pressure
※SP2 setting range : SP1 + 1% of rated pressure < SP2 ≤ Max. display pressure

Adjustable range of set value: Between SP1 and SP2.

◎ Window comparison output mode[F-6]



※Low value setting range : Min. display pressure ≤ Lo ≤ Max. display pressure
※High value setting range : Lo ≤ HI < Max. display pressure

- If no key is touched for 60sec., it will return to RUN mode. [Automatic sensitivity setting mode[F-2] is exception]
- When changing the display unit, preset value will be calculated according to the display unit.
- Whenever key touched one time, it is increased (decreased) as 1 digit (2 digits for psi unit and compound pressure) but it will be continuously increasing (decreasing) by pressing ▼, ▲ key constantly.

▣ Peak Hold and Bottom Hold Check

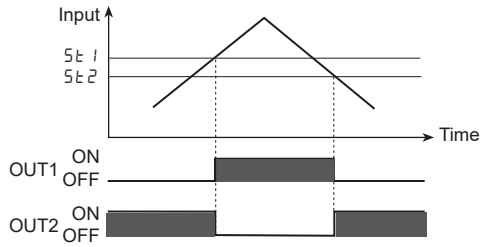
1. Press ▲ key for over 3sec. in RUN mode.
2. PE.H and memorized max. pressure (Negative pressure type is for max. negative pressure) will flash by turning on (0.5sec.) then display peak hold value.
3. bo.H and memorized min. pressure (Negative pressure type is for min. negative pressure) will flash by turning on (0.5sec.) then display bottom hold value.
4. If pressing ▲ key one time shortly, memorized peak hold and bottom hold value will be removed then return to RUN mode.

※When the peak hold and bottom hold value is over the max. display pressure value, it displays HHH, On the opposite, it displays LLL. Please remove peak hold and bottom hold value by using ▲ key.

▣ Output Operation Mode (PSA/PSB)

1. Hysteresis mode [F-1]

※It can be set for pressure sensing level[SP1] and sensing difference[SP2].
※SP1 setting range
: Min. display pressure < SP1 ≤ Max. display pressure
SP2 setting range
: Min. display pressure ≤ SP2 < SP1
• OUT 1: When applying pressure is larger than SP1, it wil be ON.
• OUT 2: When applying pressure is lower than SP2, it will be ON.

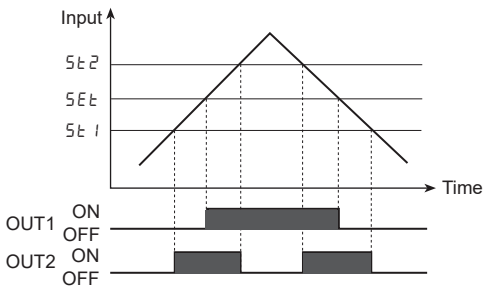


2. Automatic sensitivity setting mode [F-2]

※This function is to set pressure sensing level to the proper position automatically, it is set by received pressure from two positions [SP1, SP2].
※The sensing hysteresis fixed to 1 digit (2 digits for psi unit and compound type)
※The pressure sensing level [SEP] is shown in the following calculation.

$$SEP = \frac{(SP1 + SP2)}{2}$$

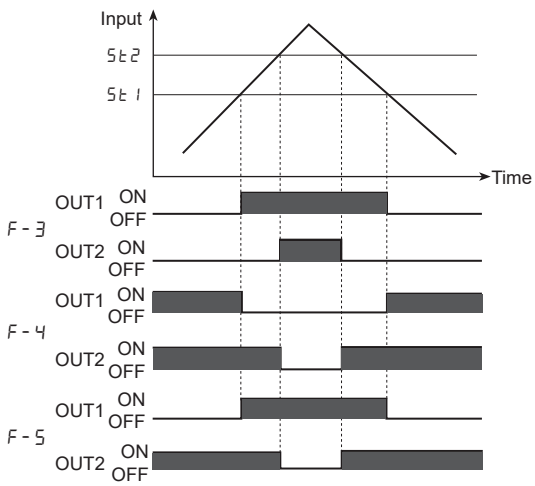
• OUT 1 : When applying pressure is larger than SEP value, it will be ON.
• OUT 2 : When applying pressure is between SP1 and SP2, it will be ON.



Note1) If it is not enough for difference of sensing level between SP1 and SP2, Er3 will be displayed. Please set again after applying enough pressure.
Note2) SP1 setting range: Min. display pressure ≤ SP1 ≤ Max. display pressure -1% of rated pressure
SP2 setting range: SP1 +1% of rated pressure ≤ SP2 ≤ Max. display pressure
Note3) If fine adjustment for sensing level is required, adjust sensing level by ▼, ▲ key.
(Adjustment range : Between SP1 and SP2)

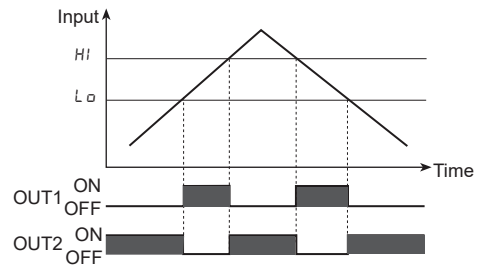
3. Independent 2 output mode [F-3, F-4, F-5]

※SP1 and SP2 can be set independently within display pressure range. One is for control, the other is for alarm or optional control.
※The sensing hysteresis fixed to 1 digit (2 digits for psi unit and compound type)
※SP1 setting range
: Min. display pressure ≤ SP1 ≤ Max. display pressure
SP2 setting range
: Min. display pressure ≤ SP2 ≤ Max. display pressure
● Independent 2 output mode [F-3]
• OUT 1 : It will be ON, when it is over SP1.
• OUT 2 : It will be ON, when it is over SP2.
● Independent 2 opposite mode [F-4]
• OUT 1 : It will be OFF when it is over SP1.
• OUT 2 : It will be OFF, when it is over SP2.
● Independent 2 cross mode [F-5]
• OUT 1 : It will be OFF when it is under SP1.
• OUT 2 : It will be ON, when it is under SP2.



4. Window comparison output mode [F-6]

※It is able to set High limit value [HI], Low limit value [Lo] of pressure sensing level in this mode.
※The sensing hysteresis fixed to 1 digit (psi unit and compound type 2 digits)
※Lo setting range
: Min. display pressure ≤ Lo < Max. display pressure
HI setting range : Lo ≤ HI < Max. display pressure
• OUT 1 : It will be ON between high limit value[HI] and low limit value[Lo]
• OUT 2 :It will be ON when it is over high limit value[HI] and low limit value[Lo].



▣ Functions (PSA/PSB)

◎ Pressure unit change

PS□-V01 (C) (P)/PS□-C01 (C) (P) has 7 kinds of pressure unit and PS□-01 (C) (P)/PS□-1 (C) (P) has 4 kinds of pressure unit.
Please select the proper unit for application.

- PS□-V01 (C) (P), PS□-C01 (C) (P) : kPa, kgf/cm², bar, psi, mmHg, inHg, mmH₂O
- PS□-01 (C) (P), PS□-1 (C) (P) : kPa, kgf/cm², bar, psi

※When using mmH₂O multiply the display value by 100.

◎ Output mode change

There are 6 kinds of control output modes in order to provide the various detection. Select a mode for your proper application.

• Hysteresis mode [F-1]
When variable hysteresis is required for pressure detection.

• Automatic sensitivity setting mode [F-2]
When it is required to set detecting sensitivity automatically at proper position.

• Independent 2 output mode [F-3, F-4, F-5]
When it is required to detect pressure from two position with one product.

• Window comparison output mode [F-6]
When is required to detect pressure in a certain range.

◎ Response time change (chattering prevention)

It can prevent chattering of control output by changing response time. It is able to set 4 kinds of response time (2.5, 5, 100, 500ms) and if the response is getting longer, the sensing will be more stable by increasing the number of digital filter.

◎ Analog output scale setting

It is not fixed the analog output (1-5VDC) scale as the rated pressure range but this is a function to change properly for user's application. When the position[A-1] for 1VDC output and the position [A-5] for 5VDC output are set, the pressure range of A-1 to A-5 is to 1-5VDC analog output.

◎ Key lock

This unit has 2 kinds of key lock function in order to prevent wrong operation.

- LoC : All keys are locked, it is impossible to change any parameter setting/preset, zero point adjustment, peak hold and bottom hold. (Enable to change KEY mode only).
- PAL : It is impossible to change parameter setting/preset, zero point adjustment. (Enable to check peak hold and bottom hold, and to change KEY mode).
- UnL : All keys are unlocked.

◎ Zero-point adjustment

This function is to set the display value of pressure at zero when port is opened to atmospheric pressure.

◎ Peak hold and bottom hold

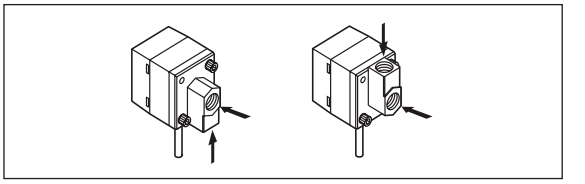
This function is diagnosis malfunction of the system caused by parasitic pressure or to check through memorizing the max./min. pressure that occurred in the system.

◎ Error display

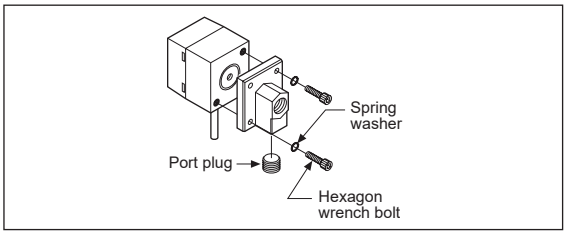
Error display	Description	Troubleshooting
Er1	When external pressure is input while adjusting zero point	Try again after removing external pressure
Er2	When overload is applied on control output	Remove overload
Er3	When the setting value is not matched with setting condition	Check setting conditions and set proper setting values
HHH	When applied pressure exceeds High-limit of display pressure range	Apply pressure within display pressure range
LLL	When applied pressure exceeds Low-limit of display pressure range	

▣ Installation (PSA Series)

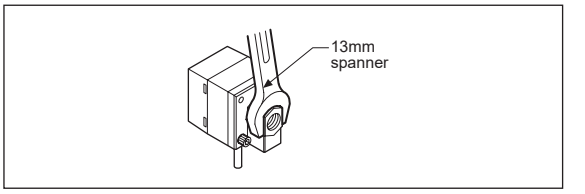
1. When installing pressure port, it is able to bring pressure from 3 directions by changing the mounting direction of the pressure port.
2. Basic spec of pressure port is Rc1/8 and option pressure port is NPT1/8. Use general one-touch fitting.



3. Please use seal tape at port plug in order to prevent pressure leak.
4. Please block another two pressure ports not used with port plug.



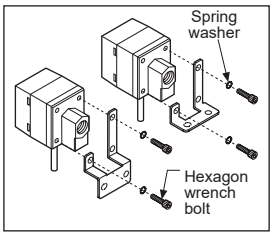
5. Please connect it by using spanner (13mm) at the metal part in order not to overload on the body when connecting one touch fitting.



⚠Caution

The tightening torque of one touch fitting should be max. 10N·m. If not, it may cause mechanical problem.

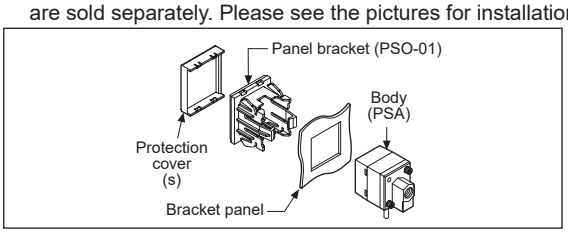
6. PSA Series has 2 kinds of brackets so it is able to install it in two different ways.
7. At first, please unscrew hexagon wrench bolt and assemble the bracket on this unit by fixing the hexagon wrench bolt.



⚠Caution

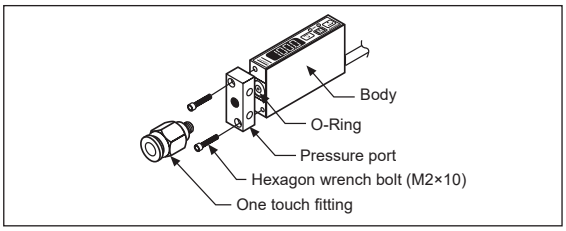
In this case, tightening torque of hexagon wrench should be max. 3N·m. If not, it may cause mechanical problem.

8. Bracket (PSO-01) and front protection cover (PSO-P01) are sold separately. Please see the pictures for installation.

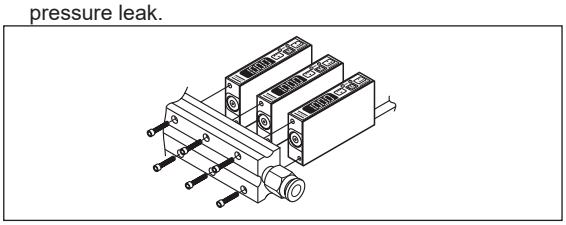


■ Installation (PSB Series)

1. Pressure port is M5. Use general one touch fitting.

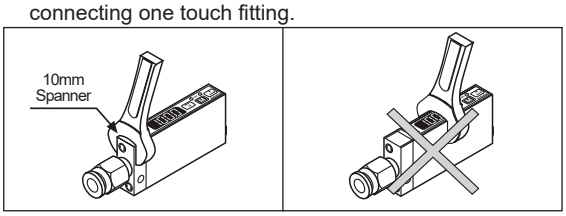


2. It is able to use it without the pressure port according to environment. In this case O-Ring between pressure port and its body should not be taken out in order to prevent pressure leak.



※Do not pull the cable with a tensile strength of 30N or over.

3. Please connect it by using spanner (10mm) at pressure port in order not to overload on the body when connecting one touch fitting.



⚠Caution

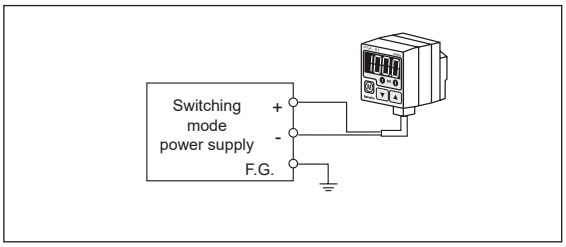
The tightening torque of one touch fitting and hexagon wrench should be Max. 5N·m and 2N·m. It may cause mechanical trouble. Please do not use spanner to install as it may cause mechanical trouble.

■ Proper Usage

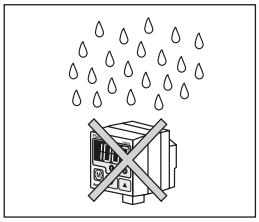
⚠Caution

PSA, PSB Series is for sensing of non corrosive gas. Do not use this product at corrosive gas or flammable gas, etc.

- Please using this unit within the range of specification, if applying pressure is larger than specification, it may not be working properly due to damage.
- After supplying power, it takes 3 sec. to work.
- When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.



- It may cause malfunction by noise, when wiring with power line or high voltage line.
- Do not insert any sharp or pointed object into pressure port. It may cause mechanical problem due to sensor damage.
- Do not use this unit with flammable gas, because this is not an explosion proof structure.
- Be sure that this unit should not be contacted directly with water, oil, thinner, etc.



- Wiring must be done with power off.

■ Accessory

● PSA/PSB

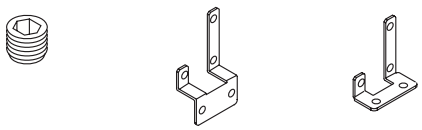
- Pressure unit label

±100kPa	±101.3kPa	100kPa	1MPa
±1.020kgf/cm²	-1.034kgf/cm²	1.020kgf/cm²	10.20kgf/cm²
±14.50psi	-14.70psi	14.50psi	145.0psi
±1.000bar	-1.013bar	1.000bar	10.00bar
±750mmhg	-760mmhg	×10	×10
±29.5inHg	-29.9inHg	×100	×100
±102.0mmH$_2$O	-103.4mmH$_2$O	×1000	×1000

DISPLAY UNIT LABEL

● Only for PSA Series

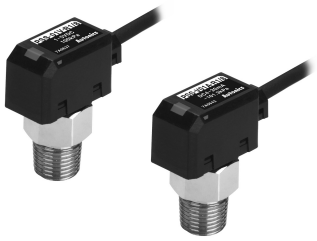
- Port plug
- Bracket A
- Bracket B



Compact, Non-indicating Pressure Sensors

▣ Features

- Rated pressure
  : negative pressure (-101.3 to 0.0kPa)
  standard pressure (0 to 100.0kPa, 0 to 1,000kPa)
  compound pressure (-101.3 to 100.0kPa)
- Compact design: W11.8×H29.3×L24.8mm (including pressure port)
- Analog output: Voltage (1-5VDC), current (DC4-20mA)
- Power supply: 12-24VDC ±10%



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

CE

▣ Ordering Information

PS S – V 01 V – R1/8

Pressure port	R1/8	Standard
Output	V	Voltage (1-5VDC) output
	A	Current (DC4-20mA) output
Pressure range	01	100kPa
	1	1,000kPa
Pressure type	No-mark	Standard pressure type
	V	Negative pressure type
	C	Compound pressure type
Size	S	Small (W11.8×H29.3×L24.8mm)
Item	PS	Pressure Sensor

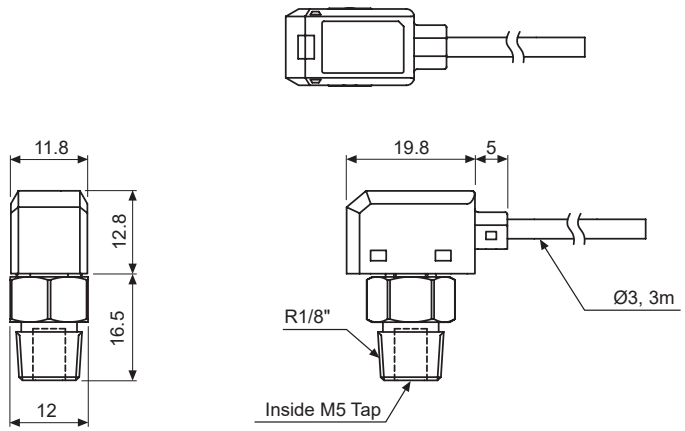
▣ Specifications

Pressure type		Gauge pressure			
		Negative pressure	Standard pressure		Compound pressure
Model	Voltage output	**PSS-V01V-R1/8**	**PSS-01V-R1/8**	**PSS-1V-R1/8**	**PSS-C01V-R1/8**
	Current output	**PSS-V01A-R1/8**	**PSS-01A-R1/8**	**PSS-1A-R1/8**	**PSS-C01A-R1/8**
Rated pressure range		0.0 to -101.3kPa	0.0 to 100.0kPa	0 to 1,000kPa	-101.3 to 100.0kPa
Analog output range		5.0 to -101.3kPa	-5.0 to 110.0kPa	-50 to 1,100kPa	-101.3 to 110.0kPa
Max. pressure range		2 times of rated pressure	2 times of rated pressure	1.5 times of rated pressure	2 times of rated pressure
Applied fluid		Air, non-corrosive gas			
Power supply		12-24VDC⎓ ±10% (ripple P-P: Max. 10%)			
Current consumption		Voltage output type: Max. 15mA, Current output type: —			
Effect by power supply		Max. ±0.3% F.S.			
Protection circuit		Reverse polarity protection circuit			
Analog output	Voltage output	•Output voltage: 1-5VDC⎓ ±2% F.S. •Linear: Max. ±1% F.S. •Output impedance: 1kΩ			
	Current output	•Output current: DC4-20mA ±2% F.S. •Linear: Max. ±1% F.S.			
Temp. characteristics of analog output		Max. ±2% F.S. of output voltage/current at 25℃ within temperature range 0 to 50℃			
Insulation resistance		Over 50MΩ (at 500VDC megger)			
Dielectric strength		2000VAC 50/60Hz for 1 minute			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours			
Environment	Ambient temp.	0 to 50℃, storage: -10 to 60℃			
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP40 (IEC standard)			
Material		Front, Rear case: Polycarbonate, Pressure port: Nickel plated brass			
Cable		Ø3, 4-wire, 3m (AWG28, Core diameter: 0.08mm, Number of cores: 19, Insulator out diameter: Ø0.88mm)			
Sold separately		Sensor connector wire mount plug (CNE-P04-□)※1			
Approval		CE			
Weight※2		Approx. 60g (approx. 26g)			

※1: For more information about sensor connector wire mount plug, refer to 'Connectors' and 'Sockets' chapters.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※F.S.: Rated pressure.
※Environment resistance is rated at no freezing or condensation.

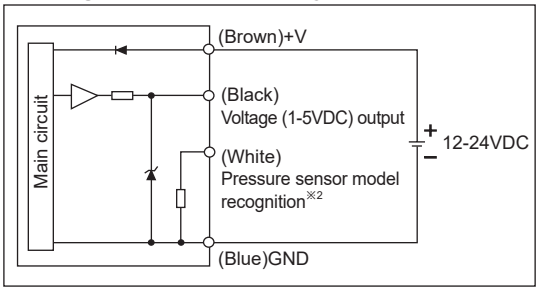
▣ Dimensions

(unit: mm)

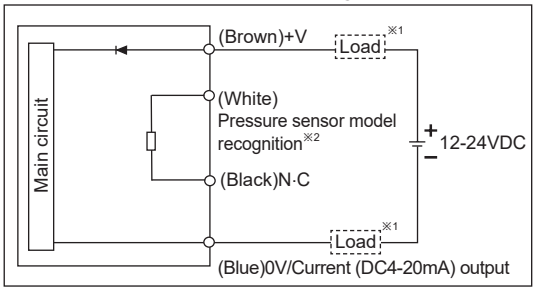


▣ Connections

● Voltage (1-5VDC) output type



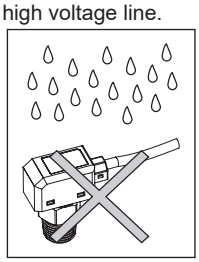
● Current (DC4-20mA) output type

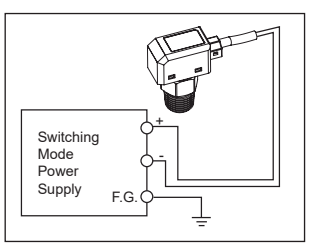


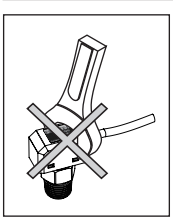
※1 : Load can be connected any directions.
※2 : Pressure sensor model is automatically recognized only by Autonics PSM Series, Multi-CH Pressure and Sensor indicator.
※Allowable load impedance: Max. 100Ω for 12VDC power, Max. 500Ω for 24VDC power
※The product is not equipped with the output short over current protection circuit. If short-circuit the control output terminal or supply current over the rated specification, it may result in product damage.

▣ Proper Usage

- Do not insert any sharp or pointed object into pressure port.
  Failure to follow this instruction may result in malfunction and damage the sensor.
- Be sure that this unit must avoid direct touch with water, oil, thinner etc.
- It is ready to operate 3 sec after it is turned ON. Be sure not to use the product within 3 sec.
- When using switching mode power supply, frame ground (F.G.) terminal of power supply should be grounded.
- To avoid inductive noise, keep the wiring away from power line, high voltage line.
  Failure to follow this instruction may result in malfunction.
- When moving this unit from warm place to cold place,
  please remove the humidity on the cover then use it.
- Do not use spanner to mounting this unit.
  Tightening torque for one touch fitting should be below 10N·m.
- Do not apply a tensile strength in excess of 30N to the cables or connector.
- This product may be used in the following environments.
  - Indoors
  - Altitude max. 2,000m
  - Pollution degree 3
  - Installation category II







Pressure Sensor Indicator

▣ Features

- Displays multi-CH (8CH/4CH) pressure sensor indicator and alarm output
- Input range: 1-5VDC, DC4-20mA (depending on model)
- Auto pressure sensor model identification function (only for PSS Series, pressure sensor)
- Selectable PV display part color by output operation (red/green)
- Easy check output by output indicator of each channel
- Supports RS485 (Modbus RTU) communication
- Freezer pressure control mode
- Easy wiring with sensor connector (CNE Series)
- Power supply: 12-24VDC ±10%

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

▣ Comprehensive Device Management Program (DAQMaster)

- DAQMaster is comprehensive device management program for convenient management of parameters and multiple device data monitoring.
- Visit our website (www.autonics.com) to download user manual and comprehensive device management program.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< DAQMaster screen >

▣ Ordering Information

PS M 4 – V □ D

Option	D	Digital input
	R	RS485 communication
Control output	No-mark	NPN open collector output
	P	PNP open collector output
Input	V	Voltage (1-5VDC) input
	A	Current (DC4-20mA) input
Number of channels	4	4-channel
	8	8-channel
Type	M	Multi Channel
Item	PS	Pressure Sensor

▣ Rated Pressure Range and Max. Display Pressure Range

Pressure type	Negative pressure		Standard pressure		Compound pressure	
	Decimal point	Range	Decimal point	Range	Decimal point	Range
MPa	—		0.001	**0.000 to 1.000** (-0.050 to 1.100)	—	
kPa	0.1	**0.0 to -101.3** (5.0 to -101.3)	0.1	**0.0 to 100.0** (-5.0 to 110.0)	0.1	**-101.3 to 100.0** (-101.3 to 110.0)
			1	**0 to 1000** (-101.3 to 1100)		
kgf/cm^2	0.001	**0.000 to -1.033** (0.051 to -1.033)	0.001	**0.000 to 1.020** (-0.051 to 1.122)	0.001	**-1.034 to 1.020** (-1.034 to 1.122)
			0.01	**0.00 to 10.20** (-0.51 to 11.22)		
bar	0.001	**0.000 to -1.013** (0.050 to -1.013)	0.001	**0.000 to 1.000** (-0.050 to 1.100)	0.001	**-1.013 to 1.000** (-1.013 to 1.100)
			0.01	**0.00 to 10.00** (-0.50 to 11.00)		
psi	0.01	**0.00 to -14.70** (0.74 to -14.70)	0.01	**0.00 to 14.50** (-0.72 to 15.96)	0.02	**-14.70 to 14.50** (-14.70 to 15.96)
			0.1	**0.0 to 145.0** (-7.2 to 159.6)		
mmHg	1	**0 to -760** (38.0 to -760.0)	—		1	**-760 to 750** (-760.0 to 824.0)
inHg	0.1	**0.0 to -29.9** (1.50 to -29.90)	—		0.1	**-29.9 to 29.5** (-29.88 to 32.58)
mmH$_2$O	0.1	**0.0 to -103.3** (5.1 to -103.3)	—		0.1	**-103.4 to 102.0** (-103.4 to 112.2)

※( ) is max. pressure display range.

※For using a unit mmH$_2$O, multiply display value by 100.

▣ Pressure Conversion Chart

from \ to	Pa	kPa	MPa	kgf/cm²	mmHg	mmH₂O	psi	bar	inHg
1Pa	1	0.001	0.000001	0.000010197	0.007501	0.101972	0.000145038	0.00001	0.0002953
1kPa	1000.000	1	0.001	0.010197	7.500617	101.971626	0.145038	0.01	0.2953
1MPa	1000000	1000	1	10.197162	7500.61683	101971.626	145.038243	10	295.299875
1kgf/cm²	98066.5	98.0665	0.098067	1	735.55924	10000.0005	14.223393	0.980665	28.959025
1mmHg	133.322368	0.133322	0.000133	0.001359	1	13.595099	0.019337	0.001333	0.039370
1mmH₂O	9.80665	0.009807	—	0.000099	0.073556	1	0.00142	0.000098	0.002896
1psi	6894.733	6.89473	0.006895	0.070307	51.714752	703.016716	1	0.068947	2.036014
1bar	100000.0	100.0000	0.100000	1.019716	750.062	10197.1626	14.503824	1	29.529988
1inHg	3386.388	3.386388	0.003386	0.034532	25.40022	345.315507	0.491156	0.033864	1

E.g.) For calculating 760mmHg to kPa
: According to above chart, 1mmHg is 0.133322kPa, therefore 760mmHg will be 760×0.133322kPa=101.32472kPa.

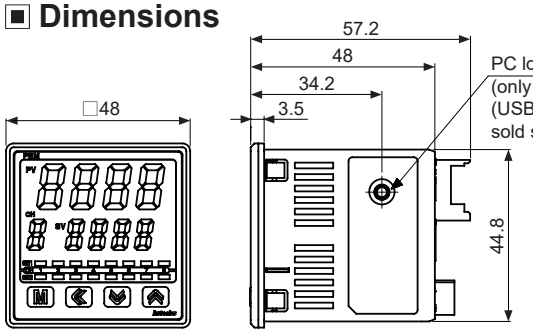
▣ Specifications

Model		PSM4-V□□	PSM4-A□□	PSM8-V□□	PSM8-A□□
Display pressure range		Depending on pressure type, pressure unit (refer to '▣ Rated Pressure Range and Max. Display Pressure Range')			
Power supply		12-24VDC⎓ (ripple P-P: max. 10%)			
Allowable voltage range		90 to 110% of rated voltage			
Power consumption		Max. 3W			
Current consumption※1		Max. 100mA (120mA for RS485 communication)			
Max. inputs		4		8	
Sensor input		1-5VDC⎓	DC4-20mA	1-5VDC⎓	DC4-20mA
Power supply for sensor※2		12-24VDC⎓, 40mA for each channel (max. current of 1-4CH: max. 100mA, max. current of 5-8CH: max. 100mA)			
Control output		NPN or PNP open collector output ● Load voltage: max. 30VDC⎓ ● Load current: max. 100mA ● Residual voltage-NPN: max. 1VDC⎓, PNP: max. 2VDC			
	Hysteresis	Min. display interval			
	Repeat error	±0.1% F.S. ±min. display interval			
	Response time	2.5ms, 100ms, 500ms, 1000ms		5ms, 100ms, 500ms, 1000ms	
	Protection circuits	Output short over current protection circuit, reverse polarity protection circuit			
Number of display digits		PV display part, SV display part: 4-digit, channel display part: 1-digit			
Display method	Display part	7-segment LED method ● PV display part: red or green※3 ● SV display part: green ● Channel display part: red			
	Output indicator	8 (OUT1, OUT2: 4 for each)		16 (OUT1, OUT2: 8 for each)	
Display accuracy		±0.1% ±2-digit (at 23 ±5℃)			
Control output and display temperature		0 to 50℃: ±0.2% F.S. ±2-digit (based on 25℃), -10 to 0℃: ±0.3% F.S. ±2-digit			
Digital input※4		Digital input (1 point) ● Contact input-[L]: max. 0.2V ● Non-contact input: ON- residual voltage max. 1.0V, OFF- leakage current max. 0.1mA			
Communication※5		RS485 communication (Modbus RTU method)			
Connections	Input	Sensor connector (for CNE-P04-□, sold separately) terminal			
	Output	Hirose connector 20-pin (HIF3BA-20D-2.54R, flat cable 20-wire, sold separately) terminal			
Insulation resistance		Over 100MΩ (at 500VDC megger)			
Dielectric strength		1,000VAC 50/60Hz for 1 min (between power terminal and case), 500VAC 50/60Hz for 1 min (between power terminal and RS485 terminal)※5			
Vibration		1.5mm amplitude at frequency of 10 to 50Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Environment	Ambient temp.	-10 to 50ºC, storage: -20 to 60ºC			
	Ambient humi.	30 to 85%RH, storage: 30 to 85%RH			
Protection structure		Front: IP65, the other part: IP30 (IEC standard)			
Accessory		Bracket			
Approval		CE			
Weight※6		Approx. 108g (approx. 65g)			

※1: Except current consumption of sensor part. When all output LED are ON, it is max. 120mA.
※2: Do not short +V and 0V of sensor connector. It may cause break inner circuit.
※3: It is able to select at PV display part color [CLor] in parameter 2 group.
※4: It is only for the digital input option model (PSM□-□□D).
※5: It is only for the RS485 communication option model (PSM□-□□R).
※6: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

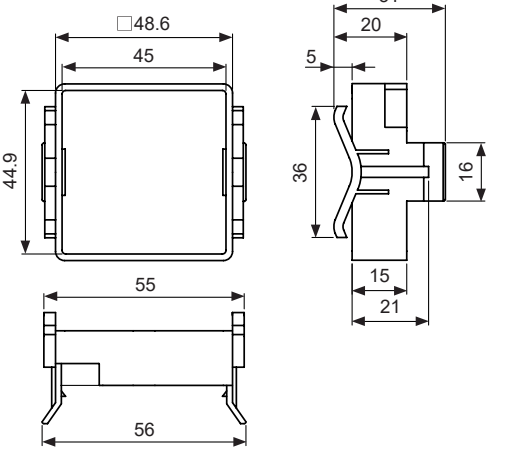
▣ Dimensions

(unit: mm)

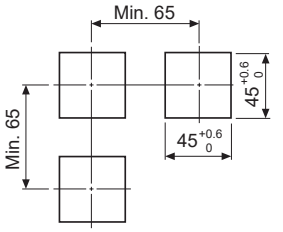


◎ Accessory

● **Bracket**



◎ Panel cut-out



▣ Sold Separately

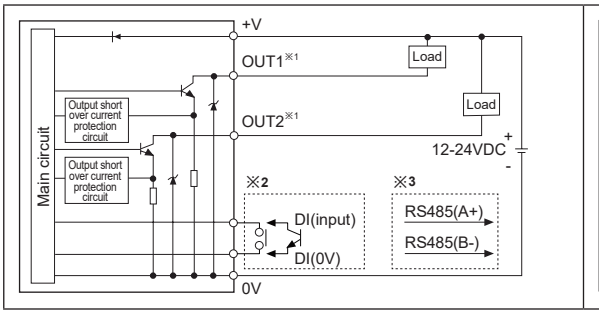
· Pressure sensor: PSS Series (8 types)
· Sensor connector plug: CNE-P04-□
· Communication converter: SCM-US (USB/Serial converter)
· Hirose connector: HIF3BA-20PA-2.54DS

[Standard Connector socket] Please contact to the manufacturer of the socket and cable.

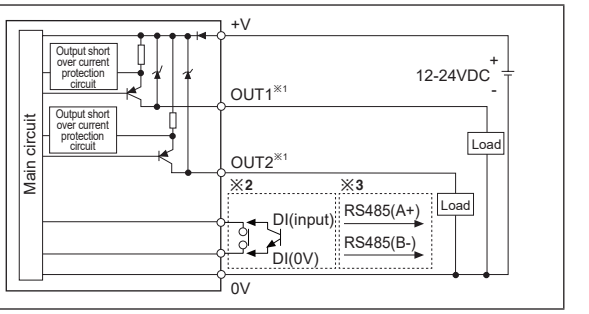
	Standard product	Manufacturer
Socket	HIF3BA-20D-2.54R	Hirose Electric
I/O Cable (sold separately)	CO20-HP□-L, CO20-HP□-R	Autonics

▣ Control Output Circuit

◎ NPN open collector output

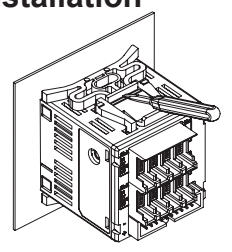


◎ PNP open collector output



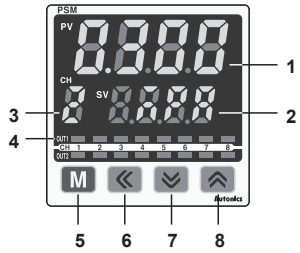
※1: PSM4: 4 of each OUT1/OUT2.
PSM8: 8 of each OUT1/OUT2.
※2: It is only for the digital input option model (PSM□-□□D).
※3: It is only for the RS485 communication option model (PSM□-□□R).
※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

▣ Installation



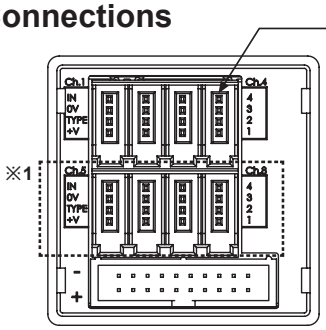
※Insert this unit into a panel, fasten bracket by pushing with tools as shown.

■ Unit Descriptions



1. **Present value (PV) display part (red or green)**
   RUN mode: Displays the measured value of the current channel.
   Setting mode: Displays the set parameter name.
2. **Setting value (SV) display part (green)**
   RUN mode: Displays the pressure unit of the current channel.
   Setting mode: Displays SV of the parameter.
3. **Channel display part (red)**
   RUN mode: Displays the channel.
   Setting mode: Displays the channel of the setting parameter.
4. **Output indicator (OUT1 (red), OUT2 (green))**
   Turns ON when the dedicated control output is ON.
   PSM4: OUT1/OUT2 of 4 channels
   PSM8: OUT1/OUT2 of 8 channels
5. **M Key**
   Sets preset value, enters parameter 1/2 group, moves between parameters or returns to RUN mode.
6. **« Key**
   RUN mode: Changes the currently displayed channel.
   Setting mode: Changes the setting channel or moves between digits.
7. **» Key**
   Setting mode: Changes SV from each parameter.
8. **^ Key**
   RUN mode: Enters peak value/auto shift correction value parameters.
   Setting mode: Changes SV from each parameter.

■ Connections



Sensor connector input
It is recommended to use Autoncis sensor connector CNE-P04-□ (sold separately).

PIN no.	Type	
	Voltage (1-5VDC) input	Current (DC4-20mA) input
4	INPUT	
3	0V	N·C
2	TYPE※2	
1	+V	

※1: Dot line parts are only for PSM8 Series.
※2: No.2 pin is for auto pressure sensor model identification.
Wire it only for using Autonics pressure sensor, PSS Series (sold separately).
Refer to the PSS series catalog.

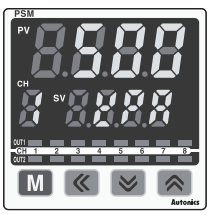
◎ Hirose connector (HIF3FB-20PA-2.54DSA) 20-pin

PIN no.	2	4	6	8	10	12	14	16	18	20
Type	0V	Ch4_OUT2	Ch4_OUT1	Ch3_ OUT2	Ch3_OUT1	Ch2_OUT2	Ch2_OUT1	Ch1_OUT2	Ch1_OUT1	DI(0V)/ RS485(B-)
PIN no.	1	3	5	7	9	11	13	15	17	19
Type	12-24VDC	Ch8_OUT2	Ch8_OUT1	Ch7_OUT2	Ch7_OUT1	Ch6_OUT2	Ch6_OUT1	Ch5_OUT2	Ch5_OUT1	DI(input)/ RS485(A+)
No. 19, 20 pins are sub I/O pins and support digital input function (DI) or RS485 communication by option.										

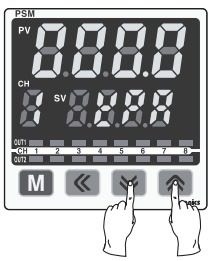
■ Zero-Point Adjustment

※Before using this unit, you must execute zero-point adjustment.

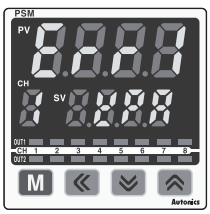
1.



2.



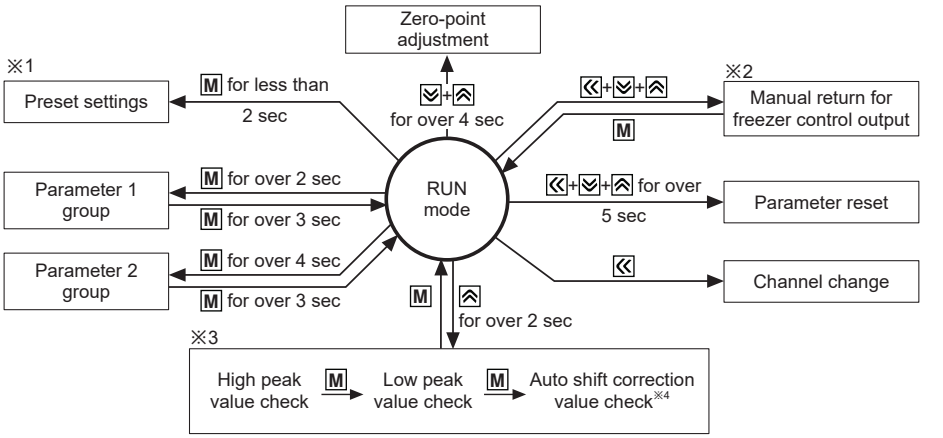
for over 4 sec



If there is external pressure and executing zero-point adjustment, [Err 1] flashes during pressing the keys. Remove the external pressure and re-execute zero-point adjustment at atmospheric pressure.

With opening pressure ports of pressure sensors, this function is to set zero-point for the current pressure display value forcibly.
Press the » + ^ keys for over 4 sec at the same time, the value of PV display part flashes twice as 0.0.0.0 and zero-adjustment is complete. You can set the applied channel range for this function at zero-point adjustment channel range [ZE.rS] in parameter 2 group.
※Zero-point adjustment allowable range: max. ±5% of rated pressure.
●[rS.CH]: Executes zero-point adjustment only for current channel.
●[rS.AL]: Executes zero-point adjustment for all channels.

▣ Settings



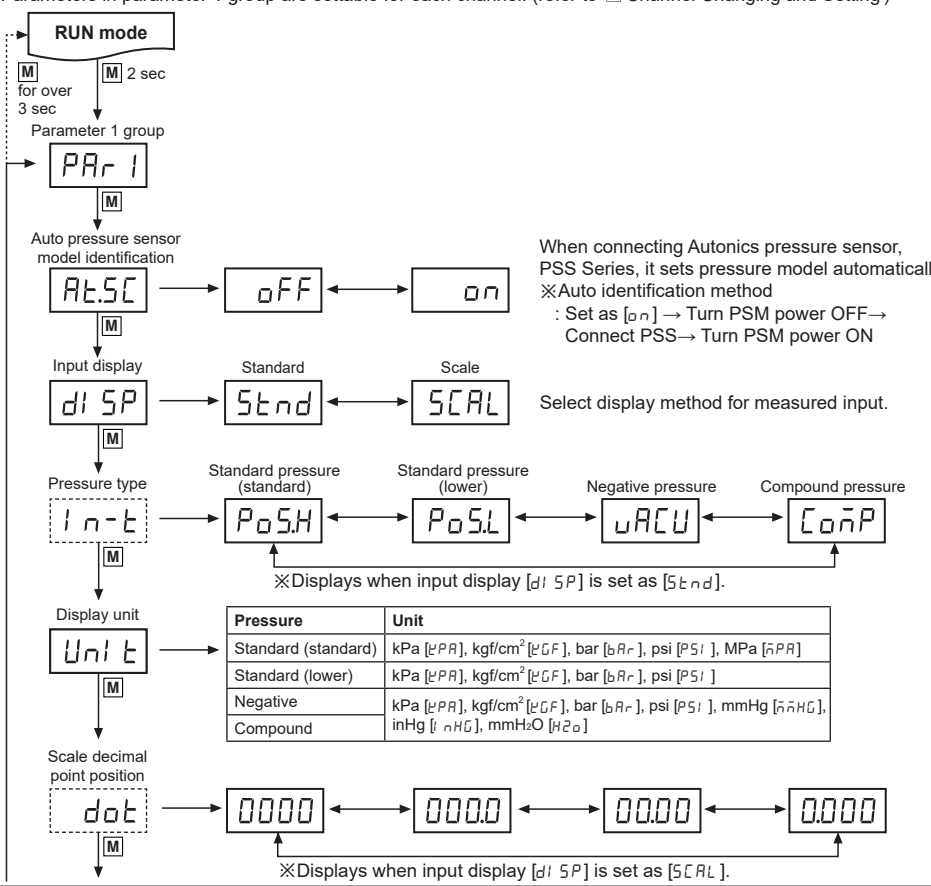
※1: When using forced output control mode, auto shift/hold input functions are not available. There is no preset setting function.
※2: It executes this function when more than one channel's output operation mode [oUt.M] is freezer pressure control [FrEE] and its control output 2 reset is manual [MAn].
※3: Press the ▽+△ keys for over 1 sec to reset high/low peak value or auto shift correction value.
※4: You can check it only when digital input function [d-In] set as Auto shift function [SHFt].

▣ Parameter Setting

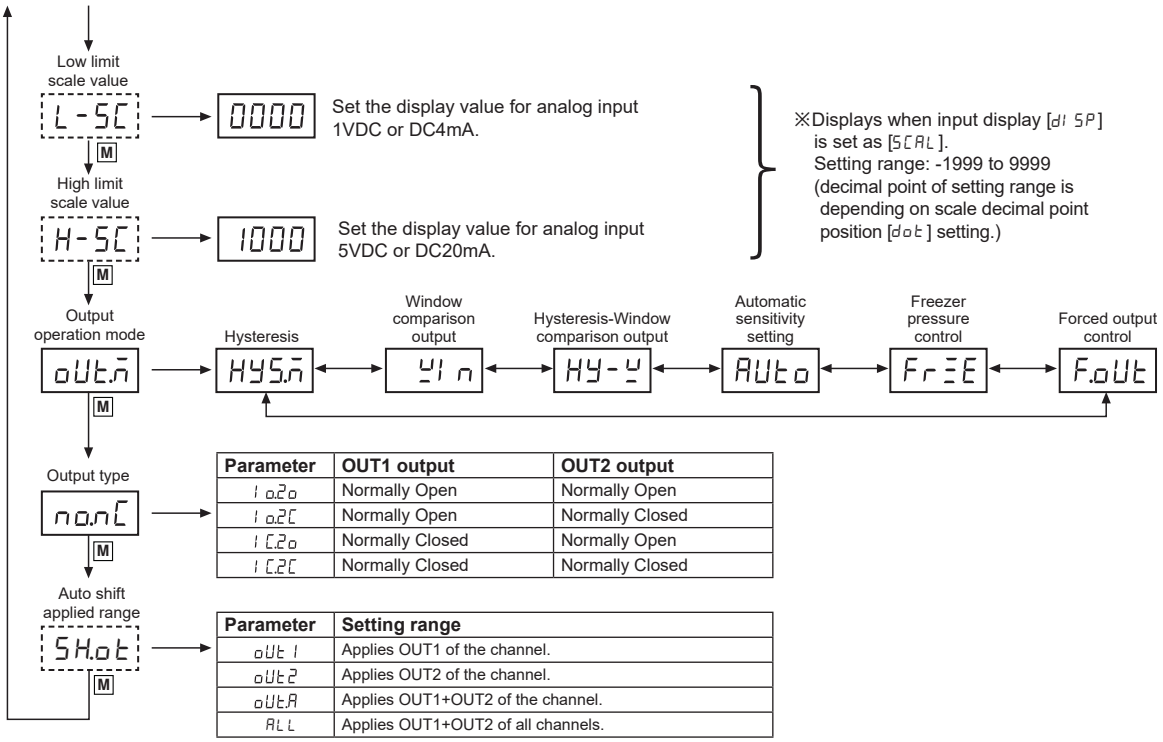
※After entering parameter 1/2 group, if there is no additional key input for 30 sec, it maintains previous setting value and it returns to RUN mode.
※Press the ▽, △ key to set the setting value.
※After entering parameter 1/2 group, press the M key for over 3 sec to at any parameters return to RUN mode.
※Dot line parameters may not be displayed by other parameter settings.

◎ Parameter 1 group

※Parameters in parameter 1 group are settable for each channel. (refer to '▣ Channel Changing and Setting')



Pressure	Unit
Standard (standard)	kPa [PA], kgf/cm² [kGF], bar [bAr], psi [PSI], MPa [MPA]
Standard (lower)	kPa [PA], kgf/cm² [kGF], bar [bAr], psi [PSI]
Negative	kPa [PA], kgf/cm² [kGF], bar [bAr], psi [PSI], mmHg [mmHG], inHg [InHG], mmH₂O [H2O]
Compound	



Output type

Parameter	OUT1 output	OUT2 output
1 o.2o	Normally Open	Normally Open
1 o.2C	Normally Open	Normally Closed
1 C.2o	Normally Closed	Normally Open
1 C.2C	Normally Closed	Normally Closed

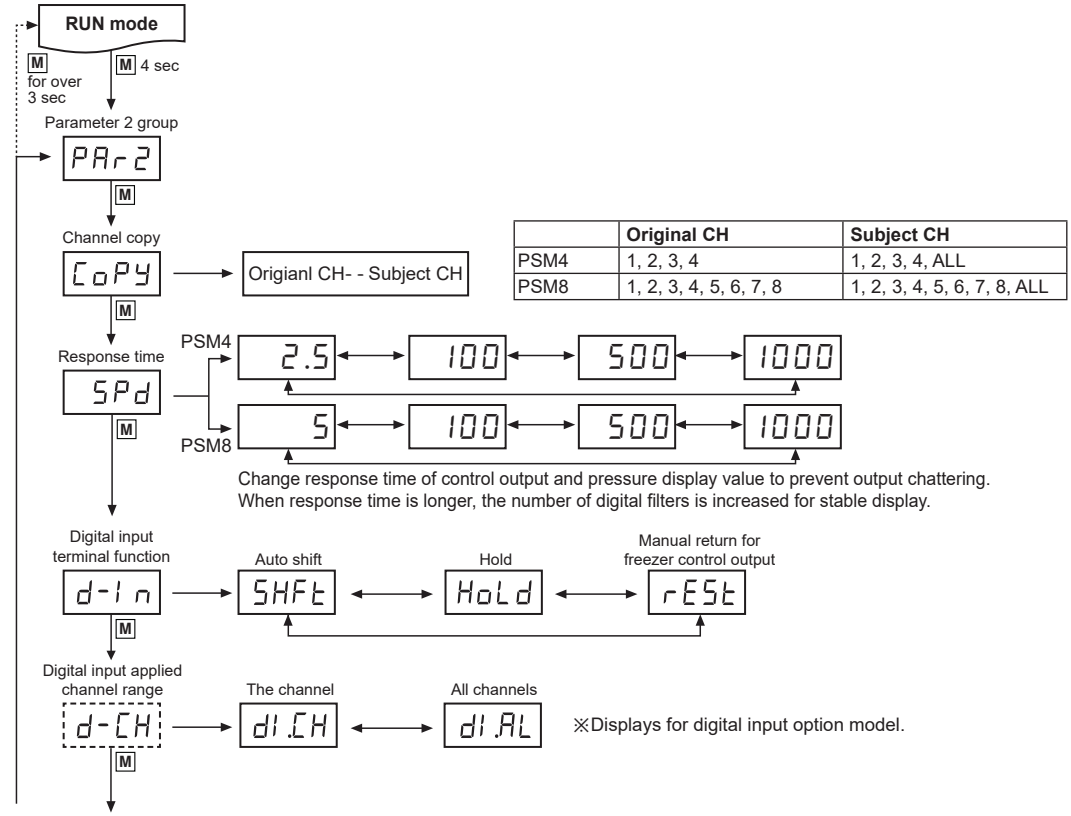
Auto shift applied range

Parameter	Setting range
oUt 1	Applies OUT1 of the channel.
oUt2	Applies OUT2 of the channel.
oUt.A	Applies OUT1+OUT2 of the channel.
ALL	Applies OUT1+OUT2 of all channels.

※Displays when digital input terminal [d-In] is set as [SHFt] in parameter 2 group.

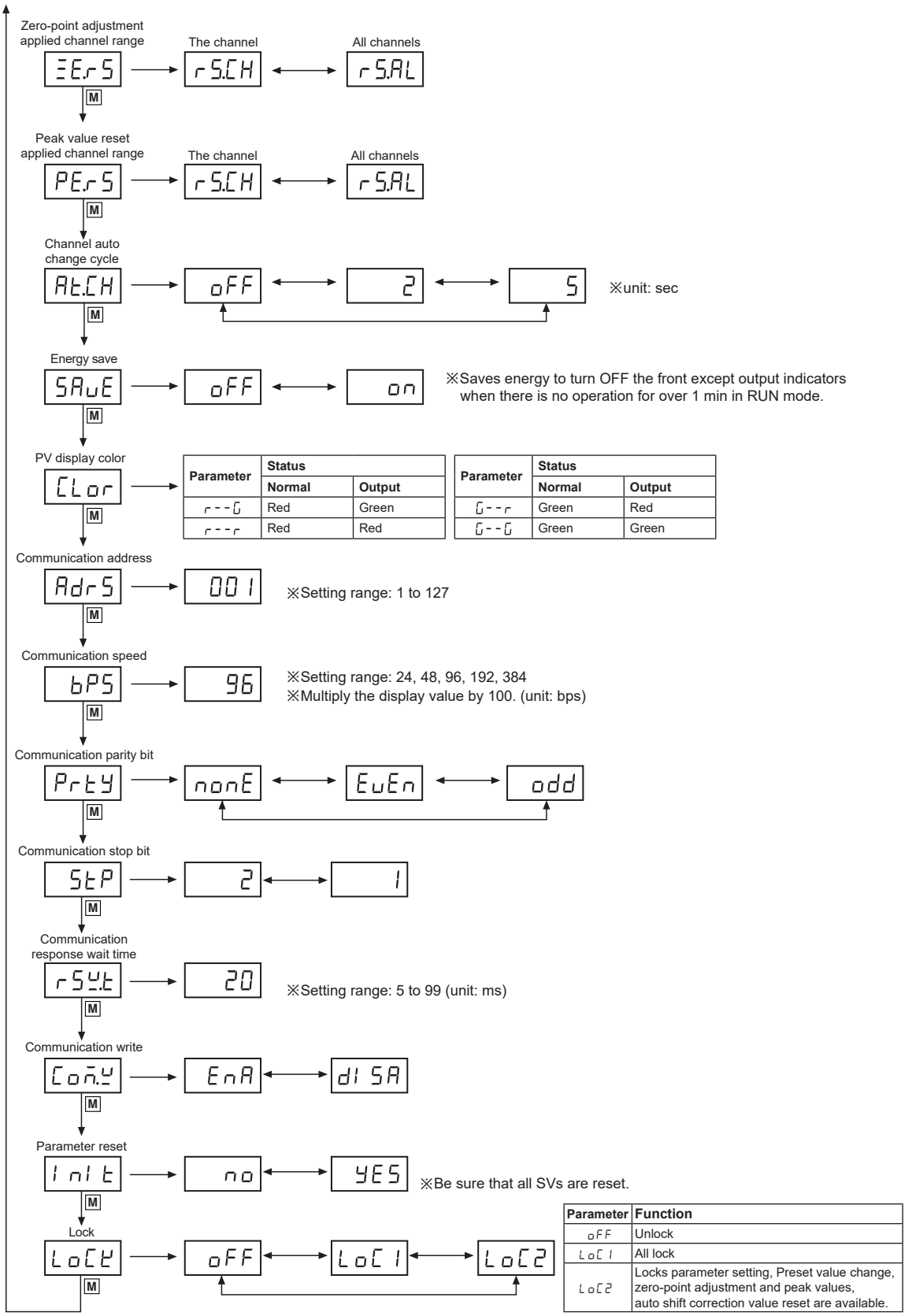
◎ Parameter 2 group

※Parameters in parameter 2 group are applied to all channels.



	Original CH	Subject CH
PSM4	1, 2, 3, 4	1, 2, 3, 4, ALL
PSM8	1, 2, 3, 4, 5, 6, 7, 8	1, 2, 3, 4, 5, 6, 7, 8, ALL

Change response time of control output and pressure display value to prevent output chattering.
When response time is longer, the number of digital filters is increased for stable display.

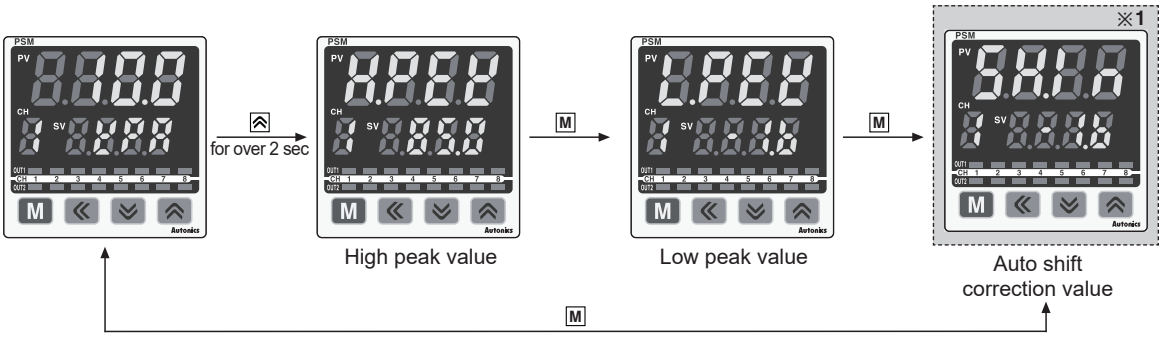


Parameter	Status	
	Normal	Output
r--G	Red	Green
r--r	Red	Red

Parameter	Status	
	Normal	Output
G--r	Green	Red
G--G	Green	Green

Parameter	Function
oFF	Unlock
Loc1	All lock
Loc2	Locks parameter setting, Preset value change, zero-point adjustment and peak values, auto shift correction value reset are available.

▣ High/Low Peak Value, Auto Shift Value Check



※1: It displays only when digital input terminal function [d-in] is [SHFt] in parameter 2 group.
※Press the ▼+▲ keys for over 1 sec, "- - - -" of the SV display part flashes twice and saved value is reset.
※This function is to diagnose malfunction of the system caused by parasitic pressure through memorizing the High/Low peak value occurred from the system.
※When digital input terminal function [d-in] is [SHFt] in parameter 2 group, you can check and correct auto shift correction value at [SHin].
※Press the ▲ key for over 2 sec to check high/low peak value, auto shift correction value of current channel in RUN mode. Press the ◀ key to change the channel.

▣ Auto Pressure Sensor Model Identification[At.SC]

When connecting Autonics pressure sensor, PSS Series, this unit recognizes pressure model [in-t] in parameter 1 group and pressure range automatically.
※Auto identification method
: Set auto pressure sensor model identification [At.SC] as [on] → Turn PSM power OFF → Connect PSS → PSM power ON
※This function is only for Autonics pressure sensor, PSS Series.
※Turn OFF the PSM power and connect PSS. Otherwise, it may cause malfunction.

▣ Channel Changing and Setting

※Manual channel changing: Set channel auto change cycle [At.CH] as [oFF] in parameter 2 group.
※Auto channel changing: Set channel auto change cycle [At.CH] as [2] or [5] in parameter 2 group.

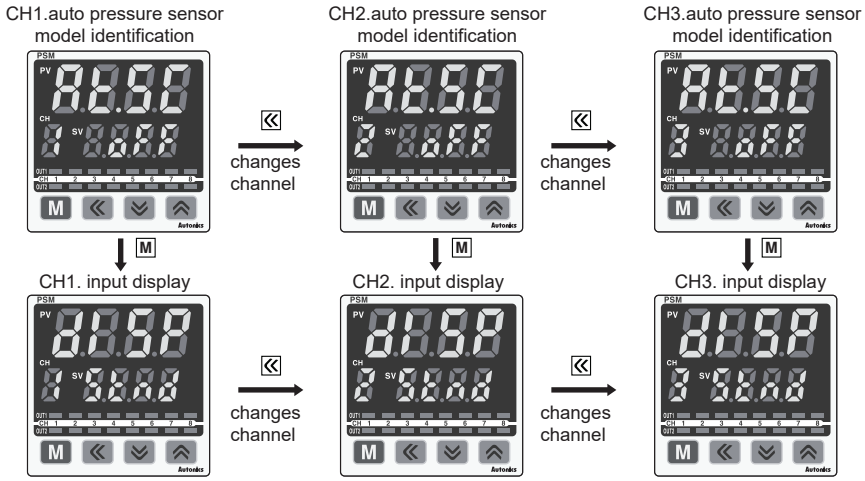
◎ Channel change

- Manual channel changing: Press the ◀ key in RUN mode. The SV display part changes channel and the PV display part displays the value of this channel.
- Auto channel changing: It displays only connected channels. It displays one of the connected channels and the next channel for the set time (2 or 5 sec) automatically.

※In auto channel changing, when pressing the ◀ key to change channel, it displays the value of this channel for 30 sec and it displays the next channel automatically.

◎ Channel setting

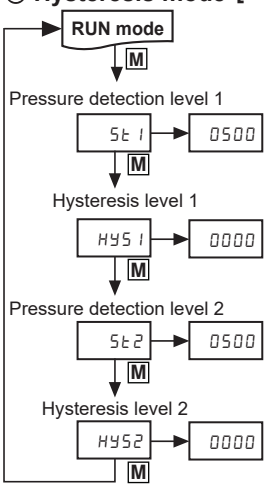
Parameter 1 group is available to set for each channel. Press the ◀ key once, channel is changed for the parameter.
E.g.)To set auto pressure sensor model identification [At.SC], and input display [di SP] at CH1, 2, 3 in parameter 1 group.



▣ Preset Setting

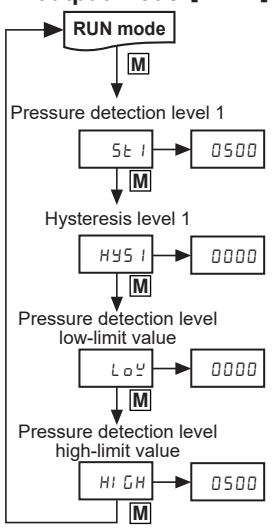
※The example is based on standard pressure, kPa.

◎ Hysteresis mode [HYS.ñ]



[Setting range]
- Min. display pressure<[St 1] ≤Max. display pressure
- Min. display pressure ≤[HYS 1]<[St 1]
- Min. display pressure<[St2] ≤Max. display pressure
- Min. display pressure ≤[HYS2]<[St2]

◎ Hysteresis-Window comparison output mode [HY-Y]

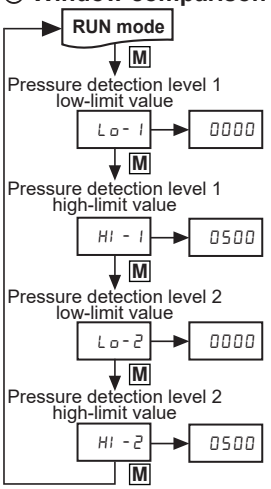


[Setting range]
- Min. display pressure <[St 1]≤Max. display pressure
- Min. display pressure ≤[HYS 1]<[St 1]
- Min. display pressure≤[LoY] ≤Max. display pressure -(3×min. display interval)
- Low value+(3×min. display interval)≤[HI GH] ≤Max. display pressure

◎ Forced output control mode [F.oUt]

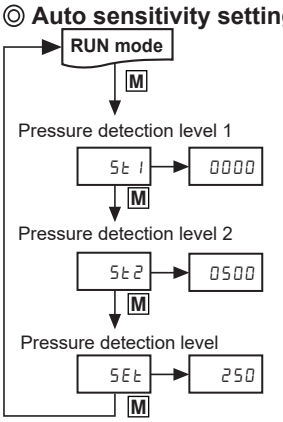
When using forced output control mode, hold/auto shift input functions are not available.

◎ Window comparison output mode [Yin]



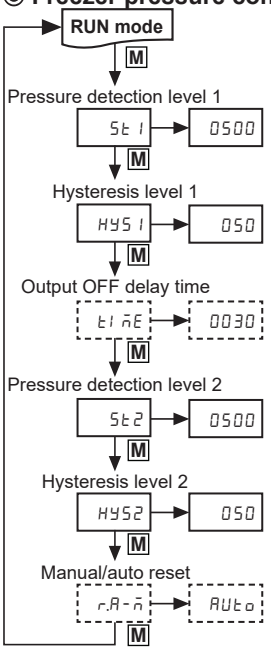
[Setting range]
- Min. display pressure≤[Lo- 1] ≤Max. display pressure -(3×min. display interval)
- Low value+(3×min. display interval)≤[HI - 1] ≤Max. display pressure
- Min. display pressure≤[Lo-2] ≤Max. display pressure -(3×min. display interval)
- Low value+(3×min. display interval)≤[HI -2] ≤Max. display pressure

◎ Auto sensitivity setting mode [AUto]



[Setting range]
- Min. display pressure≤[St 1] ≤Max. display pressure-1% of rated pressure
- [St 1]+1% of rated pressure ≤[St2]≤Max. display pressure
- Automatic setting : (St 1+St2)/2

◎ Freezer pressure control mode [FrEE]



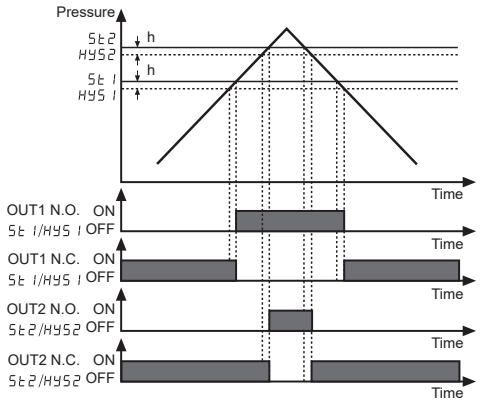
[Setting range]
- Min. display pressure<[St 1] ≤Max. display pressure
- 0<[HYS 1]<10% of display range (F.S.) (unit: digit)
- 0≤[tI ñE]≤3600 (unit: sec)
- Min. display pressure<[St2] ≤Max. display pressure
- 0<[HYS2]<10% of display range (F.S.) (unit: digit)
- [AUto]: Auto reset / [ñAn]: Manual reset

▣ Output Operation Mode

※PSM Series has 6 output operation modes.
Use the proper operation mode in accordance with the desired application of detection.

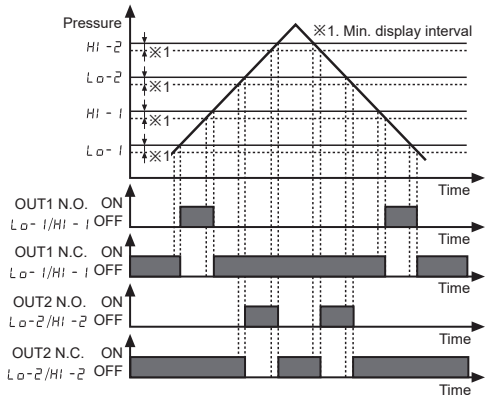
◎ Hysteresis mode [HYS.M]

- Set the hysteresis of pressure detection.
- Set the pressure detection level [St 1, St2] and hysteresis [HYS 1, HYS2].



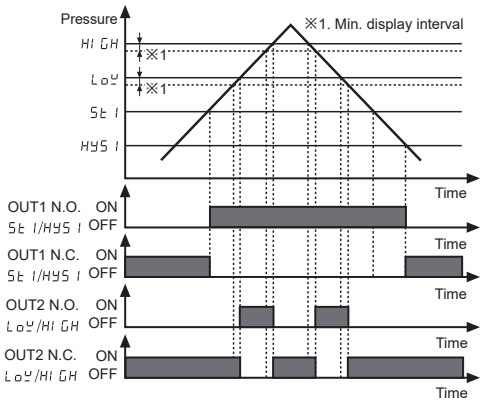
◎ Window comparison output mode [WIn]

- It detects pressure at the desired range.
- Set high-limit value of pressure detection level [HI - 1, HI - 2], and low-limit value of pressure detection level [Lo- 1, Lo- 2].
- Hysteresis is fixed as min. display interval.



◎ Hysteresis-Window comparison output mode [HY-W]

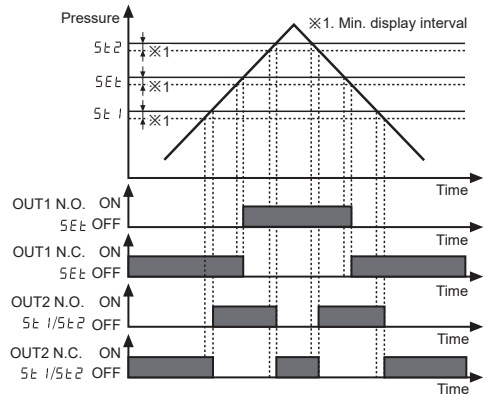
- It is available to set hysteresis mode [St 1, HYS 1] and window comparison output mode [LoW, HI GH].
- Hysteresis is fixed as min. display interval.



◎ Automatic sensitivity setting mode [AUto]

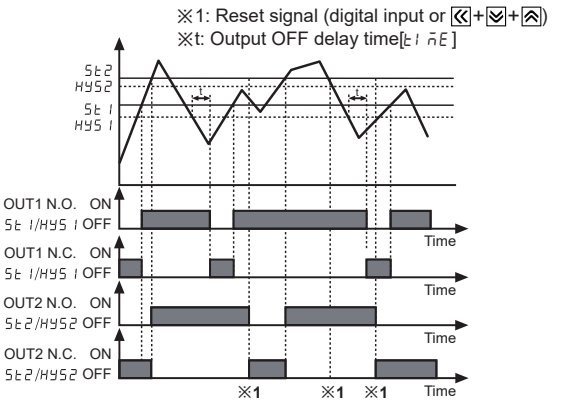
- It sets the proper detection sensitivity automatically.
- It sets by the two pressure points [St 1, St2].
- Hysteresis is fixed as min. display interval.
- The pressure detection level [SEt] is shown in the below formula.

$$SEt = \frac{(St\ 1 + St2)}{2}$$

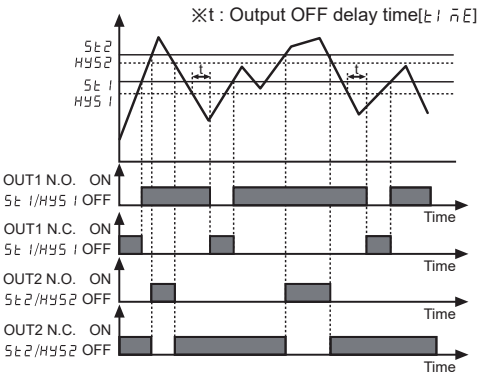


◎ Freezer pressure control mode [FrEE]

- This mode is proper for freezer system's pressure.
  OUT1 is utilized as main output control. Set the output OFF delay time to prevent frequent ON/OFF.
  OUT2 is utilized as alarm for error pressure.
- Set pressure detection level 1 [St 1] and hysteresis 1[HYS 1], output OFF delay time[t1 nE] for OUT1.
  During the output OFF delay time [t1 nE], it delays output after hysteresis 1[HYS 1], it turns OFF the output.
- Set pressure detection level 2 [St2], and hysteresis 2 [HYS2], manual/auto reset [r.A-n] for OUT2.
  - Manual reset [nAn]: Output maintains ON before applying the reset signal (digital input or ◁+▽+△) after hysteresis 2 [HYS2].
  - Auto reset [AUto]: Output turns OFF after hysteresis 2 [HYS2].
- OUT1 and OUT2 operate individually.



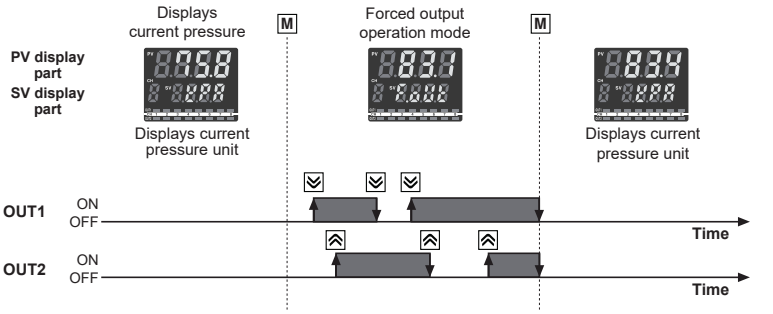
< Manual reset [nAn] >



< Auto reset [AUto] >

◎ Forced output control mode[F.oUt]

- Regardless of setting value, it maintains comparison output OFF and displays present pressure.
- RUN mode: Press the M key and it is forced output control mode [F.oUt].
- During forced output control mode, press the ▽ or △ key to turn ON/OFF OUT1, 2 manually.
- When pressing the ◁ key, output of current channel maintains that status and it moves to next channel.
  ※When using forced output control mode, auto shift/hold input functions are not available.



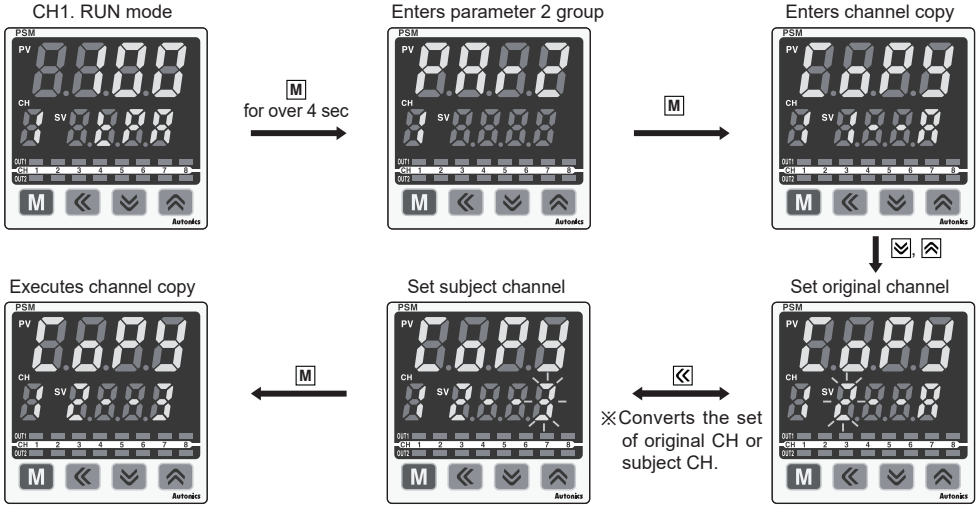
▣ Functions

◎ Channel copy

Parameter SV and preset values of the particular channel are able to copy to the desired channel or all channels.
Set [original CH- - subject CH] in PV display part at channel copy [CoPY] in parameter 2 group.
When executing channel copy, it copies preset values and parameter 1 group's SVs (except [SH.oF]).
Copied items are as below.

①Preset value
②Auto pressure sensor model identification [AF.SC]
③Input display [dI SP]
④Pressure type [I n-F]
⑤Display unit [Unit]
⑥Scale decimal point position [dot]
⑦Low limit scale value [L-SC]
⑧High limit scale value [H-SC]
⑨Output operation mode [oUT.M]
⑩Output type [no.nC]

※Auto shift correction value [SHI n] and zero-point adjustment [Zero] of the subject channel are reset.
E.g.)Copies parameter SV and preset values of CH2 to CH3. (original CH: 2, subject CH: 3)



◎ Pressure type [I n-F]

This unit is able to set measured pressure type by each channel.
This parameter is displayed only when input display [dI SP]is set as standard mode [Stnd].

- Setting range: Standard pressure (standard) [Pos.H], Standard pressure (lower) [Pos.L], Negative pressure [uACU], Compound pressure [CoMP]
- When using auto pressure sensor model identification [AF.SC], pressure type of each channel is set automatically.
- When changing pressure type, display unit [Unit], scale decimal point position [dot], high/low scale value [H-SC/L-SC], preset input value, and auto shift correction value [SHI n] are reset.

◎ Input display [dI SP]

Select display method for measured input.

- Standard mode [Stnd]: Displays input within the rated pressure display range by pressure type/unit.
- Scale mode [SCAL]: Displays input within the setting range (-1999 to 9999) of high/low limit scale value [L-SC/H-SC]. The resolution of PSM is 2000 and if setting range is over 2000, display value is automatically proportioned.

E.g.) When setting range -1999 to 2000 is over two times of the resolution of PSM, the display value is automatically proportioned.

※When changing input display, preset values are reset.

◎ Display scale function [H-SC/L-SC]

It displays low limit value (1VDC or DC4mA)/high limit value (5VDC or DC20mA) of transmitted analog input from pressure sensors as the set high/low limit value (setting range: -1999 to 9999).
High/Low limit scale value [L-SC/H-SC] parameters are displayed only when input display [dI SP] is set as scale mode [SCAL].

- Factory default of low limit scale value: 0000 / Factory default of high limit scale value: 1000

※High limit scale value should be set over low limit scale value ±(3×min. display unit).
(E.g.:When low limit scale is 50, set high limit scale value ≤ 47 or high limit scale≥ 53)

◎ Parameter reset [I nI t]

Hold the [◁]+[▽]+[△] key for over 5 sec in RUN mode, to enter re-set parameter menu [I nI t].
Select [YES] and all parameters are reset as factory default.

◎ Digital input terminal function

This unit executes the set function from digital input terminal [d-I n] in parameter 2 group or communication.
As the below, there are three functions to set digital input.

● **Auto shift function** [SHFt]

: When reset pressure of the pressure sensor is changed, supply auto shift digital input to correct the current pressure as reference pressure by the changed level.

- Press the [△] key for over 2 sec in RUN mode to check/correct auto-shift correction value [SHI n].
- When not using auto shift, reference pressure is atmospheric pressure (0.0kPa).

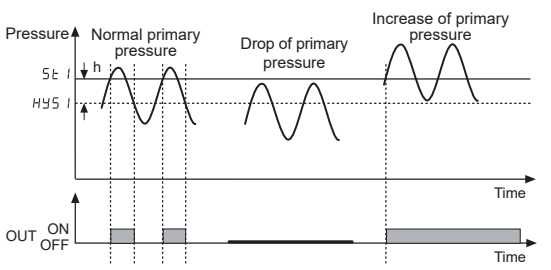
※When the channel is forced output control mode or the value is HHHH or LLLL, auto shift function does not operate.
※When auto shift digital input is supplied over 5 sec, reset pressures of OUT1, OUT2 for all channels are changed regardless of the applied setting range.
※When auto shift function is set, preset setting range is bigger than the rated pressure range as changed reset pressure.

<Preset range after auto shift correction>

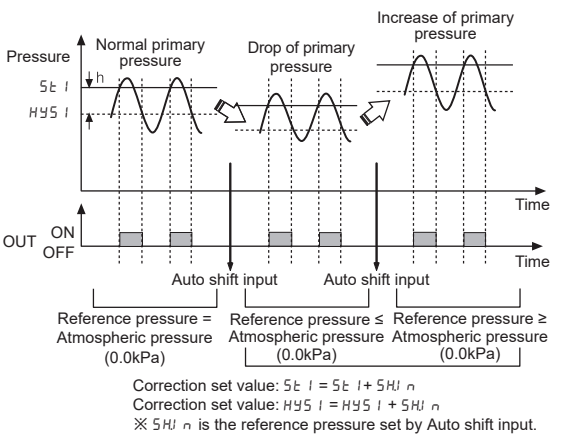
Pressure	Set pressure range (after correction)	Set pressure range (preset setting range)
Standard (standard)	-5.0 to 110.0kPa	-110.0 to 110.0kPa
Standard (lower)	-50.0 to 1,100kPa	-1,100 to 1,100kPa
Negative	-101.3 to 5.0kPa	-101.3 to 101.3kPa
Compound	-101.3 to 110.0kPa	-110.0 to 110.0kPa

▸ **Example of Auto shift function**

< When Auto shift is not used >



< When Auto Shift is used >



Correction set value: St I = St I + SHI n
Correction set value: HYS I = HYS I + SHI n
※ SHI n is the reference pressure set by Auto shift input.

● **Hold function** [HoLd]

: When hold digital input is supplied, it maintains the current display value and control output.
※When hold digital input is supplied over 5 sec, this function is applied for all channels regardless of the applied setting range.

● **Manual return for freezer control output function** [rESt]

: For freezer pressure control, when OUT2 is set as manual reset [mAn], it resets maintained OUT2 manually by supplying digital input of manual return for freezer control output.
Press the [◁]+[▽]+[△] keys in RUN mode, it enters [rESt] parameter to set the applied channel for manual return for control output before executing manual return for freezer control output.
Press the [M] key and it returns OUT2 manually.

- [HoLd]: Maintains the current output status.
- [ALL]: Returns all output status.
- Each channel: Displays only the CH which output is ON. Returns output of the select CH.

※For digital input option model (PSM□-□□D), it is available to set the applied channel range for digital input at digital input applied channel range [d-CH].

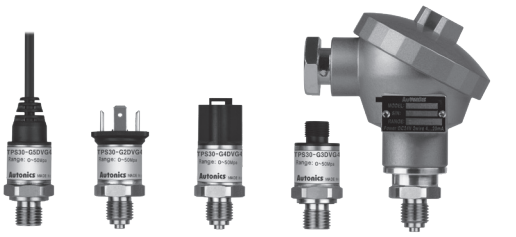
- [dI.CH]: Applies digital input for the channel.
- [dI.AL]: Applies digital input for all channels.

※By communications, the only one digital input function set at ADDRESS 400053(0034) is available.

Non-indicating Pressure Transmitters

▣ Features

- Robust build allows high or low pressure measurement in high and low temperature environments.
  : high pressure (0 to 60MPa), low pressure (0 to 2 MPa)
  : temperature range (-40 to 125℃) (may vary by model)
- For diverse applications including packaging machines, heavy machinery, factories, and shipbuilding.
- Pressure measurement of any gas, liquid, or oil.
- 316L stainless steel diaphragm for high corrosion resistance.
- Compact size allows easy installation in tight or limited spaces.
- 1ms high-speed response rate.
- Analog output: Voltage (1-5 VDC), Current (DC 4-20 mA)
- Built-in reverse polarity protection circuit.
- Various connector types
  : cable type, DIN43650-A connector type,
  DT04-3P connector type, M12 connector type, head type.
- Available thread sizes: G3/8, G1/4, R1/2
- Protection structure: IP67 (IEC standard)
  (except DIN43650-A connector type: IP65)

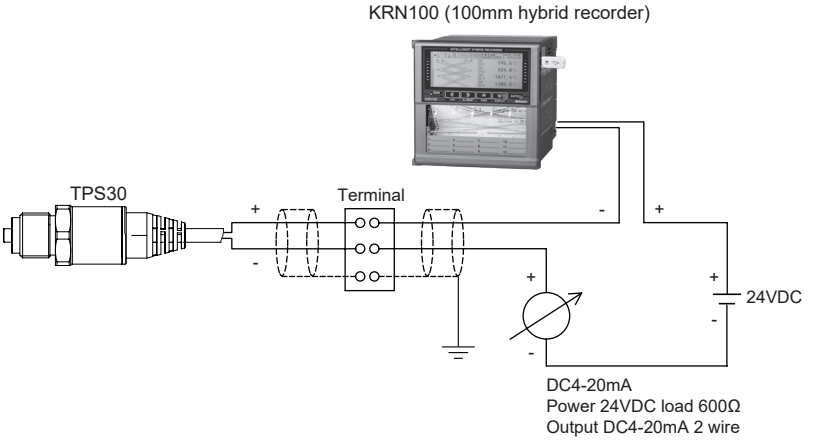


Cable type | DIN43650-A connector type | DT04-3P connector type | M12 connector type | Head type

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

CE

▣ Example of External Connections



■ Ordering Information

TPS30 – **G** **2** **9** **V** **G8** – **00** **(0 to 0.5MPa)**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

	Description		
①Item	TPS30	Non-indicating Pressure Transmitters	
②Measurement pressure	G	Gauge pressure, sealed gauge pressure※1	
	A	Absolute pressure	
③Cable	1	Head type	
	2	DIN43650-A connector type	
	3	M12 connector type	
	4	DT04-3P connector type	
	5	Cable type	
④Pressure range		Gauge pressure	Absolute pressure
	3	0 to 0.1MPa	0 to 0.1MPa
	4	0 to 0.2MPa	0 to 0.2MPa
	5	0 to 0.7MPa	0 to 0.7MPa
	6	0 to 1MPa	0 to 1MPa
	7	0 to 2MPa	0 to 2MPa
	8※2	0 to 3.5MPa	—
	9※2	0 to 5MPa	—
	A※2	0 to 10MPa	—
	B※2	0 to 20MPa	—
	C※2	0 to 40MPa	—
	D※2	0 to 50MPa	—
	E※2	0 to 60MPa	—
		Sealed gauge pressure※1	
	F	-0.1 to 0MPa	
	G	-0.1 to 0.1MPa	
	H	-0.1 to 0.7MPa	
	J	-0.1 to 1MPa	
	K	-0.1 to 2MPa	
	Z	Others	
⑤Output type	V	Voltage (1-5VDC) output	
	A	Current (DC4-20mA) output	
⑥Pressure port	G8	G3/8 (PF)(EN387)	
	G4	G1/4 (PF)(EN387)	
	R2	R1/2 (PT)(DIN3852)	
	N4	NPT1/4 (DIN3852)	
	ZZ※3	Others (option)	
⑦Option (connector cable)※4	00	Not used	
	2I	"I" type 2m	
	2L	"L" type 2m	
	5I	"I" type 5m	
	5L	"L" type 5m	
⑧User pressure range		User pressure range※5	

※1: The pressure is sealed gauge pressure. The unit is sealed structure. It is based on atmospheric pressure 101.3kPa (1.013bar).
※2: G1/4 is the standard pressure port. For the other pressure ranges, G3/8, R1/2 are standard pressure ports.
※3: The option ports are sold separately. In case of large amount ordering, contact the Autonics for manufacturing the requested pressure port.
※4: Only for M12 connector type.
※5: Write the desired pressure range and it is the default of user pressure range. (select "Z" at ④Pressure range)

■ Specifications

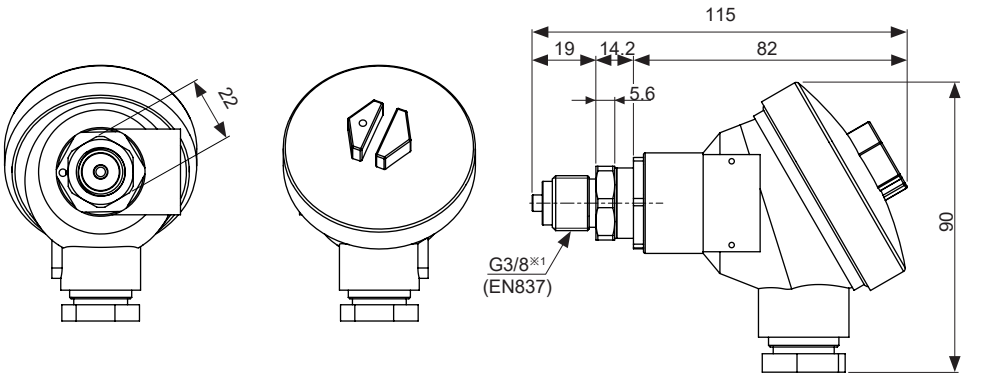
Series			TPS30															
Pressure type			Gauge pressure, absolute pressure					Sealed gauge pressure※1					Gauge pressure						
Rated pressure range (MPa)			0 to 0.1	0 to 0.2	0 to 0.7	0 to 1	0 to 2	-0.1 to 0	-0.1 to 0.1	-0.1 to 0.7	-0.1 to 1	-0.1 to 2	0 to 3.5	0 to 5	0 to 10	0 to 20	0 to 40	0 to 50	0 to 60
Expanded analog output range (MPa)			0 to 0.11	0 to 0.22	0 to 0.77	0 to 1.1	0 to 2.2	-0.1 to 0.01	-0.1 to 0.12	-0.1 to 0.78	-0.1 to 1.11	-0.1 to 2.21	0 to 3.85	0 to 5.5	0 to 11	0 to 22	0 to 44	0 to 55	0 to 66
Max. pressure range (MPa)			0.6	0.6	3	3	3	0.6	0.6	3	3	3	10	20	50	80	120	120	120
Burst pressure (MPa)			0.6	0.6	3	3	3	0.6	0.6	3	3	3	15	30	75	120	160	160	160
Measured materials			Liquid, gas, oil (inappropriate to corrosion environment for stainless steel 316L)																
Power supply			・Voltage output type: 8-36VDC⎓ (ripple P-P: max. 10%) ・Current output type: 11-36VDC⎓ (ripple P-P: max. 10%)																
Permissible voltage range			90 to 110% of rated voltage																
Current consumption			・Voltage output type: max. 20mA ・Current output type: max. 30mA																
Response time			Max. 1ms																
Protection circuit			Reverse polarity protection circuit																
Output type			・Voltage output type: 1-5VDC⎓ ・Current output type: DC4-20mA																
Compensation temperature			-10 to 80℃										0 to 80℃						
Accuracy			Max. ±0.5% F.S. (including linearity, hysteresis, reproducibility)																
Linearity			Max. ±0.2% F.S.																
Hysteresis			Max. ±0.2% F.S.																
Temp. Zero Shift			Max. ±0.1% F.S./10℃ (standard), max. ±0.25% F.S./10℃ (max.)																
Temp. Span Shift			Max. ±0.1% F.S./10℃ (standard), max. ±0.25% F.S./10℃ (max.)																
Temperature characteristics			-										-25 to 100℃: max. ±1.5% F.S. -40 to 125℃: max. ±2.5% F.S.						
Load resistance			Current output type: max. 700Ω (supplying 24VDC)																
Dielectric strength			500VAC 50/60Hz for 1 minute																
Insulation resistance			Over 100MΩ (at 500VDC megger)																
Environment	Ambient temp.	Voltage output	・Head type, DIN43650-A connector type, M12 connector type, DT04-3P connector type: -40 to 125℃, storage: -40 to 125℃ ・Cable type: -40 to 80℃, storage: -40 to 80℃																
		Current output	・Head type, DIN43650-A connector type, M12 connector type, DT04-3P connector type: -40 to 85℃, storage: -40 to 125℃ ・Cable type: -40 to 80℃, storage: -40 to 80℃																
	Ambient humidity		35 to 85%RH																
	Fluid temp.		-40 to 125℃																
Vibration			10g, 20 to 2,000Hz										20g, 20 to 2,000Hz						
Shock			100g/6ms										500g/1ms						
Tightening torque			Max. 10N·m																
Protection structure			・Head type, M12 connector type, DT04-3P connector type, cable type: IP67 (IEC standard) ・DIN43650-A connector type: IP65 (IEC standard)																
Material			Stainless steel 316L (head part of head type: aluminium diecasting), connector: polybutylene terephthalate G30, water-proof rubber: silicon																
Connection			・Voltage output type: +, -, Vout ・Current output type: +, -																
Approval			CE																
Weight※2			・Head type: approx. 330g (approx. 250g) ・DIN43650-A connector type, M12 connector type, DT04-3P connector type: approx. 130g (approx. 50g) ・Cable type: approx. 200g (approx. 120g)																

※1: The sensor is sealed structure. It is based on atmospheric pressure 101.3kPa (1.013bar).
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

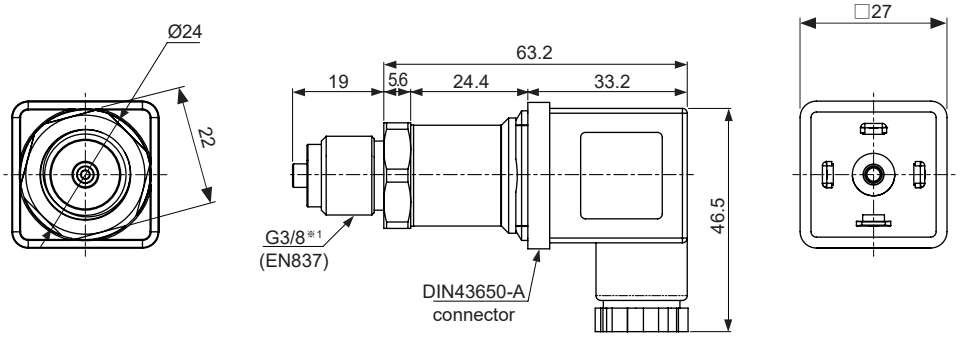
▣ Dimensions

(unit: mm)

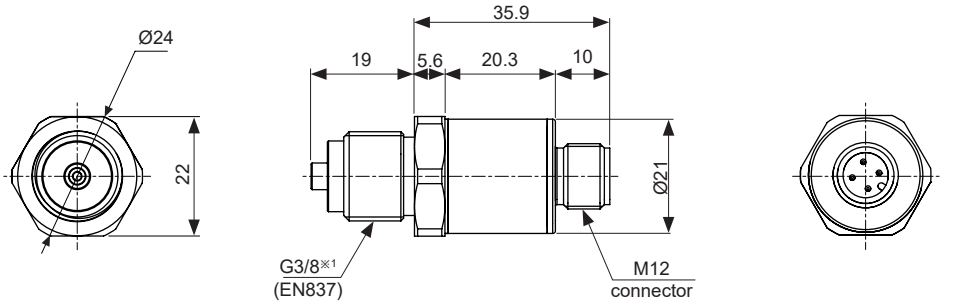
● **Head type**



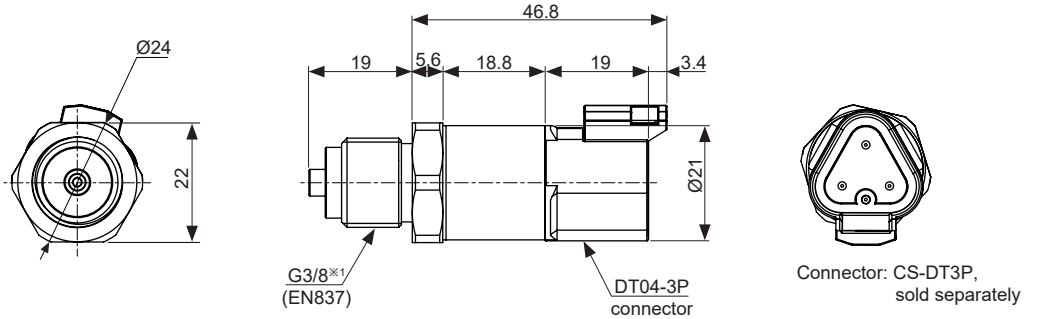
● **DIN43650-A connector type**



● **M12 connector type**



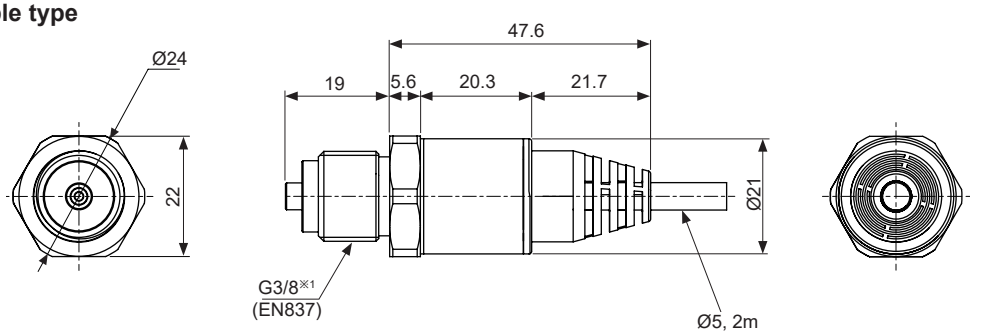
● **DT04-3P connector type**



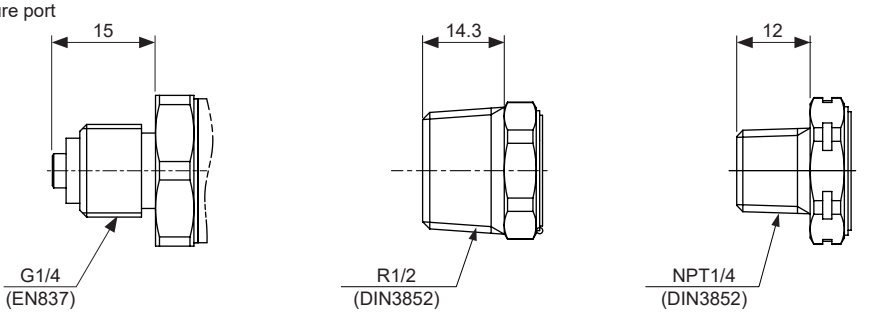
▣ Dimensions

(unit: mm)

● **Cable type**



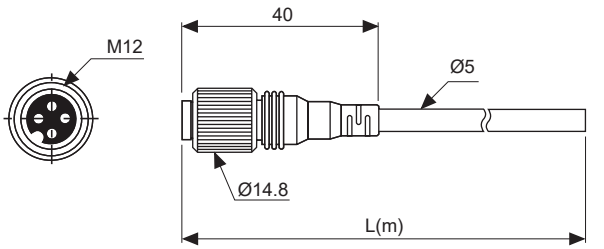
※1: Pressure port



▣ Connection Cable (Sold Separately)

(unit: mm)

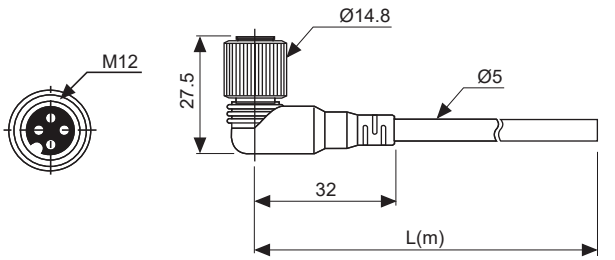
● **CID3-2/CID3-5**



Model	L(m)	Material
CID3-2	2	PVC
CID3-5	5	

※Only for M12 connector.

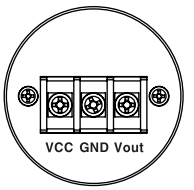
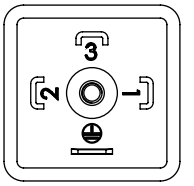
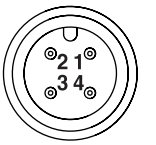
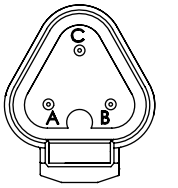
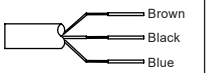
● **CLD3-2/CLD3-5**



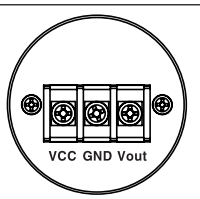
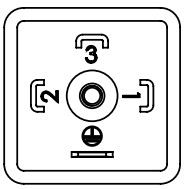
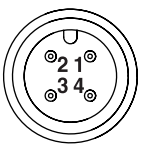
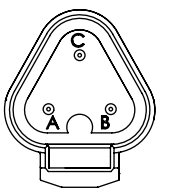
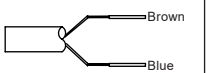
Model	L(m)	Material
CLD3-2	2	PVC
CLD3-5	5	

▣ Connectors

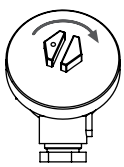
● Voltage output type

Pin type	Head type	DIN43650-A connector type	M12 connector type	DT04-3P connector type	Cable type
					
Func.	Pin				
+	+	1	1	A	Brown
-	-	⏚	3	C	Blue
Vout	Vout	2	4	B	Black
N·C	—	3	2	—	—

● Current output type

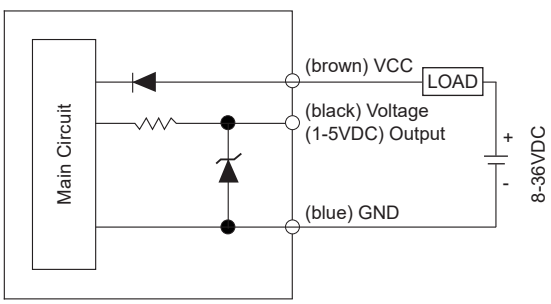
Pin type	Head type	DIN43650-A connector type	M12 connector type	DT04-3P connector type	Cable type
					
Func.	Pin				
+	+	1	1	A	Brown
-	-	⏚	3	C	Blue
N·C	Vout	2, 3	2, 4	B	—

※In case of head type, remove the top cover.



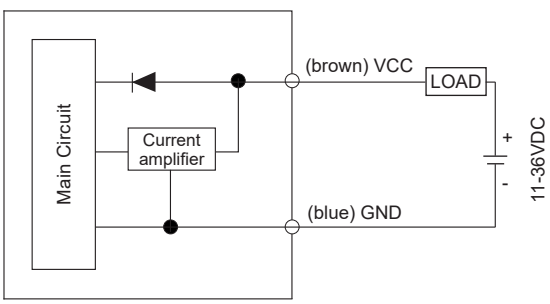
▣ Connections

● Voltage (1-5VDC) output type



※Cable color is only for cable type.

● Current (DC4-20mA) output type



▣ Troubleshooting

Error	Troubleshooting
No outputs	Check the power supply. Check the polarity (+, -) when wiring the cable. Check the connection part.
Abnormally fluctuating output	Check the power supply. Check the supplied pressure. Check the pressure line.
Out of zero point output value	Check the power supply. Check the load resistive value of current output type for a receiver is over 700Ω. (when supplying 24VDC) Check the measuring point and transmission distance. Check the line resistance is below 700Ω.

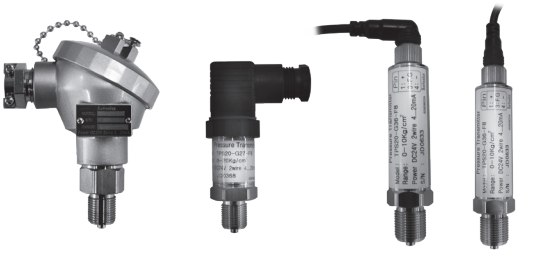
▣ Proper Usage

- Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
- 8-36VDC, 11-36VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- When installing the unit on pipe line, use the hexagon part of connections not to turn the unit with a pipe wrench. Do not use the unit with strong vibrations.
- Store the unit at the place without moisture, dust, and vibration.
- This product which does not have drive part at sensing part does not need to repair it. Even though inside of pressure pipe is normally clean, it needs to take maintenance once a year as below instructions.
  ① Check the broken status of outside.
  ② Check the pressure slot, cleanliness inside, and corrosion state.
  ③ Short each terminal and check the insulation resistance between the case and power.
- When removing a sensor for maintenance, follow the below instructions.
  ①Replace an O-ring which is used once.
  ②Be sure that diaphragm part is not damaged.
- Switch or circuit breaker for suppling or cutting off the power should be installed nearby users for convenient control.
- The unit cannot be repaired due to disassembled structure.
- The unit is fixed with bolt and nut at the both sides of case.
  Do not press excessive load (approx. 300kg/cm²), or it may cause damage to the unit.
- This unit may be used in the following environments.
  ① Indoor / Outdoor (in the environment condition rated in 'Specifications')
  ② Altitude max. 2,000 m
  ③ Pollution Degree 2
  ④ Installation Category II

Non-indicating Pressure Transmitters

▣ Features

- Excellent corrosion resistance with stainless steel housing
- High accuracy ±0.3% F.S.
- Various connection method
  - Head type, DIN connector type, connector cable type
- Various user friendly function
  - Built-in zero-point, span adjustment (head type)



[Head type] [DIN connector type] [Connector cable type]

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

▣ Ordering Information

TPS20 – G 1 5 F8 (0 to 5kgf/cm²)

① ② ③ ④ ⑤ ⑥

	Non-indicating Pressure Transmitters		
① Item	TPS20	Pressure Transmitter	
② Measurement presssure	G	Gauge pressure	
	A	Absolute pressure	
③ Cable	1	Head type	
	2	DIN connector type	
	3	Connector cable type	
④ Pressure range		Gauge pressure	Absolute pressure
	1	0 to 0.2kgf/cm²	—
	2	0 to 0.5kgf/cm²	—
	3	0 to 1kgf/cm²	0 to 1kgf/cm²
	4	0 to 2kgf/cm²	0 to 2kgf/cm²
	5	0 to 7kgf/cm²	0 to 7kgf/cm²
	6	0 to 10kgf/cm²	0 to 10kgf/cm²
	7	0 to 20kgf/cm²	0 to 20kgf/cm²
	8	0 to 35kgf/cm²	0 to 35kgf/cm²
	9	0 to 70kgf/cm²	—
	A	0 to 100kgf/cm²	—
	C	0 to 200kgf/cm²	—
	F	0 to 300kgf/cm²	—
	H	0 to 350kgf/cm²	—
	M	-760mmHg to 0kgf/cm²	—
	O	-760mmHg to 1kgf/cm²	—
	Q	-760mmHg to 7kgf/cm²	—
	V	-760mmHg to 10kgf/cm²	—
	X	-760mmHg to 20kgf/cm²	—
	Y	-760mmHg to 35kgf/cm²	—
	Z	Others	
⑤ Pressure port	P2	R1/2 (with adapter, PT)	
	P8	R3/8 (with adapter, PT)	
	F8	G3/8 (standard, PF)	
	ZZ	Others	
⑥ User pressure range		User pressure range※1	

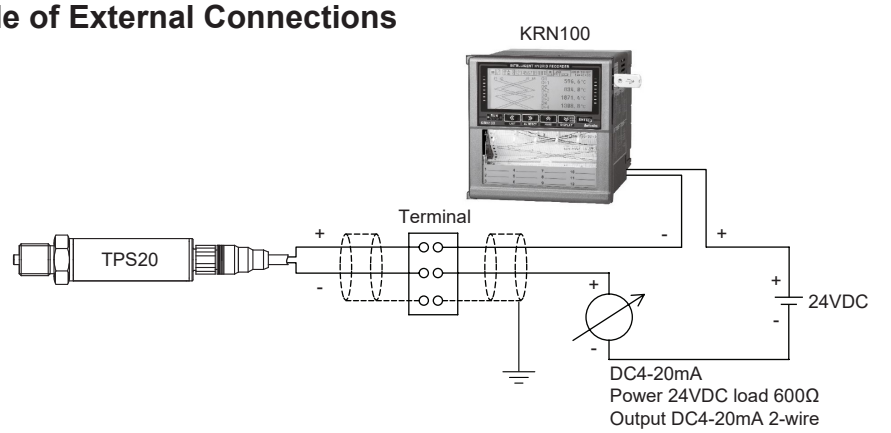
※ 1: Write the desired pressure range and it is the default of user pressure range. (select "Z" at ④Pressure range)
※ For ordering cable, order as CID3-2, CID3-5, CLD3-2, CLD3-5. (sold separately)

■ Specifications

Series		TPS20		
Pressure type		Gauge pressure	Absolute pressure	Compound pressure
Rated pressure range		0 to 0.2 to 350kgf/cm^2	0 to 1.0 to 35kgf/cm^2	-760mmHg to 0 to 35kgf/cm^2
Max. pressure range		300% of max. span		
Measured materials		Liquid, gas, oil (except corrosive environment of stainless steel type 316)		
Power supply		15-35VDC⎓		
Permissible voltage range		90 to 110% of rated voltage		
Current consumption		Max. 50mA		
Response time		Max. 100ms		
Protection circuit		Reverse polarity protection circuit		
Current output		DC4-20mA		
Linearity		±0.3% F.S. (-10 to 50℃), ±0.5%F.S. (50 to 70℃)		
Hysteresis		±0.3% F.S.		
Temp. Zero Shift		±0.03% F.S.		
Temp. Span Shift		±0.03% F.S. (at 25℃)		
Load resistance		Max. 600Ω		
Insulation resistance		Over 100MΩ (at 500VDC megger)		
Dielectric strength		500VAC 50/60Hz for 1 minute		
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours		
Shock		95m/s^2		
Tightening torque		Industrial plug over 5N		
Pressure port		G3/8t (standard), R3/8, R1/2		
Environment	Ambient temp.	-10 to 70℃, storage: -10 to 70℃		
	Ambient humi.	5 to 95% RH, storage: 5 to 95% RH		
Materials		Sealing, diaphragm, connection: stainless steel type 316, O-ring: fluoro rubber		
Connection		+, -		
Case structure		Drip-proof structure		
Approval		CE		
Weight※1		Approx. 350g (approx. 320g) (based on head type)		

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※F.S.(Full Scale): It is rated pressure range.
※Environment resistance is rated at no freezing or condensation.

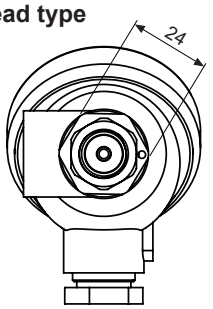
■ Example of External Connections

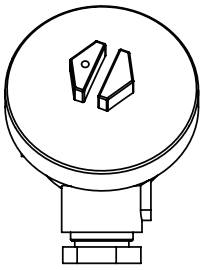


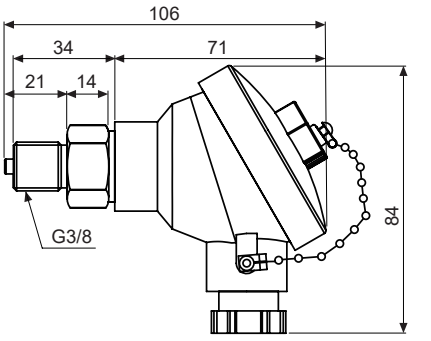
▣ Dimensions

(unit: mm)

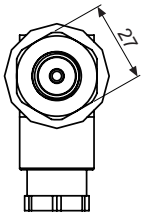
● **Head type**

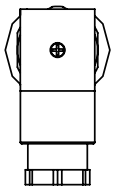


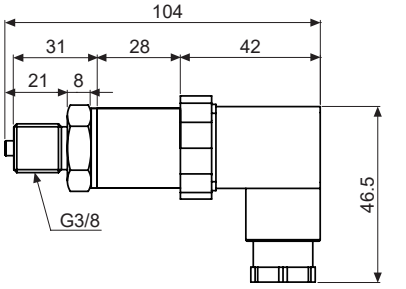




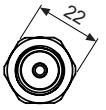
● **DIN connector type**

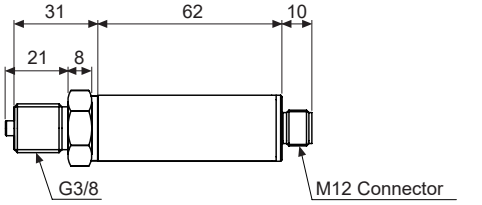






● **Connector cable type**



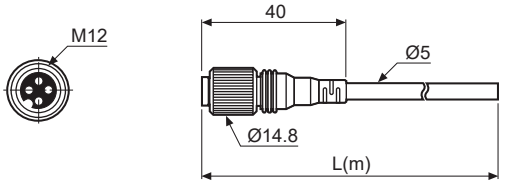


※The standard pressure port for above is G3/8.

▣ Connection Cable (Sold Separately)

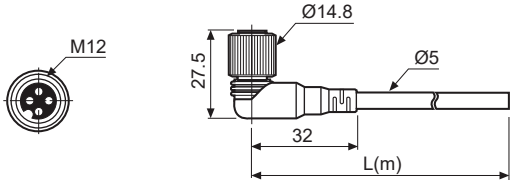
● **CID3-2 / CID3-5**

(unit: mm)



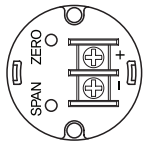
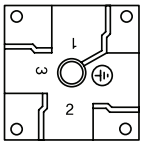
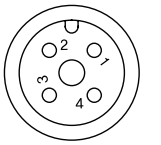
Model	L (m)	Meterial
CID3-2	2	PVC
CID3-5	5	

● **CLD3-2 / CLD3-5**



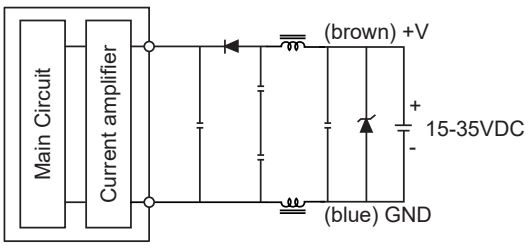
Model	L (m)	Meterial
CLD3-2	2	PVC
CLD3-5	5	

▣ Connectors

Head type		DIN connector type			Connector cable type		
	Pin		Pin	Func.		Pin	Func.
	+		1	+		1	+
	–		2	–		2	N·C
			3	N·C		3	F.G.
			⏚	F.G.		4	–

※In case of head type, remove the top cover.

▣ Connections



▣ Troubleshooting

Error	Troubleshooting
No outputs	Check the power supply. Check the polarity (+, -) when wiring cable. Check the connection part.
Abnormally fluctuating output	Check the power supply. Check the supplied pressure. Check the pressure line.
Out of zero point output value	Check the power supply. Check the load resistive value of current output type for a receiver is over 600Ω. Check the measuring point and transmission distance. Check the line resistance is below 600Ω.

▣ Proper Usage

- Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
- 15-35VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- When installing the unit on pipe line, use the hexagon part of connections not to turn the unit with a pipe wrench. Do not use the unit with strong vibrations.
- Store the unit at the place without moisture, dust, and vibration.
- This product which does not have drive part at sensing part does not need to repair it. Even though inside of pressure pipe is normally clean, it needs to take maintenance once a year as below instructions.
  ① Check the broken status of outside.
  ② Check the pressure slot, cleanliness inside, and corrosion state.
  ③ Short each terminal and check the insulation resistance between the case and power.
- When removing a sensor for maintenance, follow the below instructions.
  ①Replace an O-ring which is used once.
  ②Be sure that diaphragm part is not damaged.
- Switch or circuit breaker for suppling or cutting off the power should be installed nearby users for convenient control.
- The unit cannot be repaired due to disassembled structure.
- The unit is fixed with bolt and nut at the both sides of case.
  Do not press excessive load (approx. 300kg/cm²), or it may cause damage to the unit.
- This unit may be used in the following environments.
  ① Indoor / Outdoor (in the environment condition rated in 'Specifications')
  ② Altitude max. 2,000 m
  ③ Pollution Degree 2
  ④ Installation Category II

Display Type Pressure Transmitters

▣ Features

- HART protocol
- Display rotation in 330 ° range
- Better visibility with supporting backlight function
- Excellent corrosion resistance with stainless steel housing
- High accuracy ±0.2% F.S.
- Self-stable and filter device
- Explosion-proof specification: Ex D IIC T6
- Protection structure: IP67 (IEC standard)

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

HART® FIELD COMMUNICATIONS PROTOCOL

▣ Ordering Information

KT-302H	S	—	01	0	0	(-0.1 to 35MPa)
①	②		③	④	⑤	⑥

Item	Description		
①Item	KT-302H	Display Type Pressure Transmitters	
②Measurement pressure	S	Gauge pressure, sealed gauge pressure※1	
	A	Absolute pressure	
③Rated pressure range		Gauge pressure	Absolute pressure
	01	0 to 35kPa	0 to 35kPa
	02	0 to 0.1MPa	0 to 0.1MPa
	03	0 to 0.2MPa	0 to 0.2MPa
	04	0 to 0.7MPa	0 to 0.7MPa
	05	0 to 2MPa	0 to 2MPa
	06	0 to 3.5MPa	0 to 3.5MPa
	07	0 to 7MPa	—
	08	0 to 21MPa	
	09	0 to 35MPa	
		Sealed gauge pressure※1	
	14	-0.1 to 0MPa	
	15	-0.1 to 0.2MPa	
	16	-0.1 to 0.7MPa	
	17	-0.1 to 2MPa	
	18	-0.1 to 3.5MPa	
	Z	Others	
④Mounting bracket	0	Without bracket	
	1	With bracket	
⑤Pressure port	0	G3/8 (PF, standard)	
	1	Others	
⑥User pressure range※2		User pressure range	

※1: The pressure is sealed gauge pressure. The unit is sealed structure. It is based on atmospheric pressure 101.3kPa (1.013bar).
※2: Write the desired pressure range and it is the default of user pressure range. (select "Z" at ③Rated pressure range)

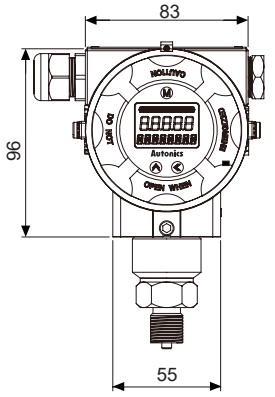
■ Specifications

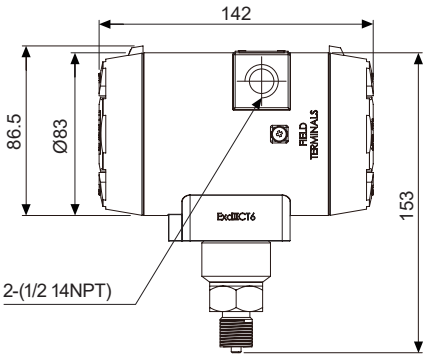
Series		KT-302H
Measured materials		Vapor, liquid, fluid (except corrosive environment of stainless steel 316)
Power supply		9-45VDC⎓
Display method		PV display part: 7-segment 5-digit, Parameter display part: 16-segment 8-digit, Bar LED: 52
Display range		-9999 to 99999
Output		DC4-20mA (2-wire) Low-limit 3.8mA, high-limit 22.8mA
Accuracy※1		±0.3% of F.S.
Setting method		Setting by front push keys and HART-protocol
Sampling cycle		200ms
Environment	Ambient temperature	-20 to 70 ℃, storage: -40 to 85 ℃
	Ambient humidity	0 to 85%RH, storage: 0 to 85%RH
Material		Body: aluminum (AlDc.8S), cover O-Ring: buna N, diaphragm: stainless steel 316, connections: stainless steel 316
Explosion class※2		Ex d IIC T6
Protection structure		IP67 (IEC standard)
Weight※3		Approx. 1.7kg (approx. 1.4kg)

※1: F.S.: Rated pressure range.
※2: This Explosion class is acquired and managed by Konics Co., Ltd.
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

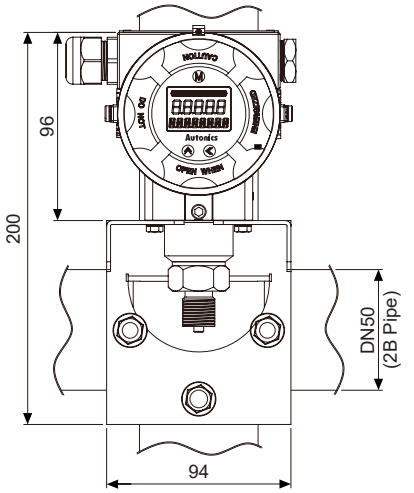
■ Dimensions

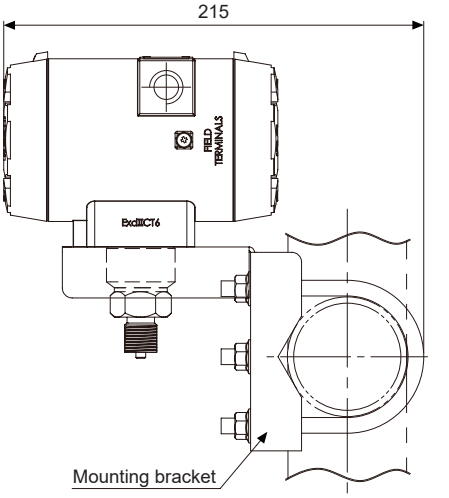
(unit: mm)



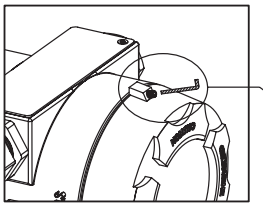


● **Mounting bracket**





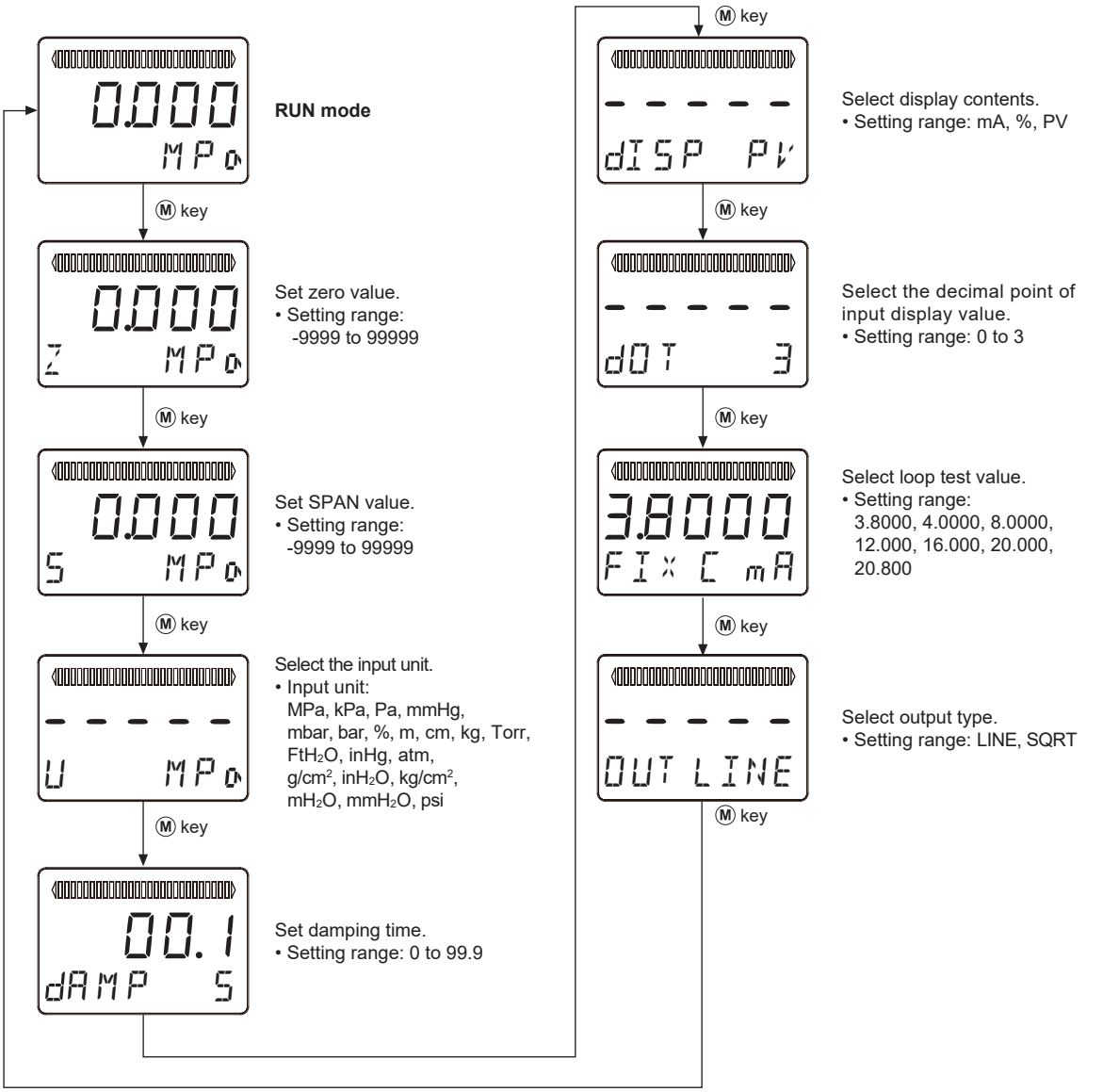
▣ Opening the Cover



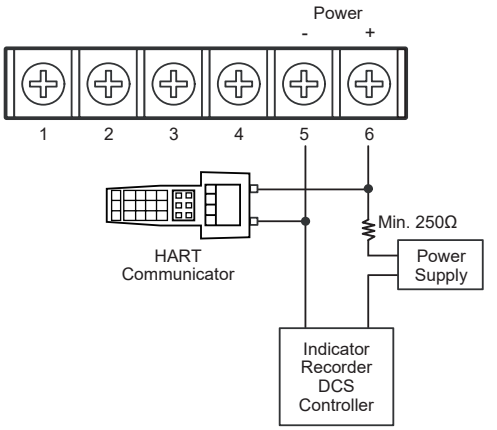
To open the cover, unscrew the M3×6L headless bolt using a 1.5 hexagon wrench and rotate the cover.

▣ Parameters

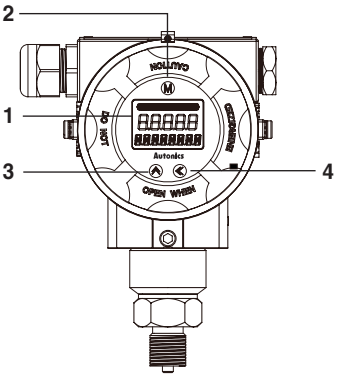
※**Do not press the ▲ and ◀ keys at the same time, or the product is reset and it does not operate.**
※◀: Moves digits / ▲: Changes set value
※Press the M key after checking/changing the set value and it saves and moves to the next parameter.
※Factory default depends on the pressure range of model.
※Below displays for parameters are different by models.



▣ Connections



▣ Unit Descriptions



1. Display part : Displays measured value and unit messages.
2. Ⓜ key: Enters set mode and saves the set values.
3. ⓐ key: Changes the set values of data.
4. ⓒ key: Changes the set position of data.

▣ Proper Usage

- Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
- 9-45VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- The connection of this unit should be separated from the power line and high voltage line in order to prevent inductive noise.
- Do not use this unit near the high frequency instruments
- Switch or circuit breaker for suppling or cutting off the power should be installed nearby users for convenient control.
- Use verified explosion-proof cable gland or sealing fitting.
  (explosion proof standard: over Ex d IIC T6, IP rating: over IP67 protection structure).
- Use dedicated external terminal for earth. For connecting earth, use a spring washer and earth cable which is over 4mm².
- This unit may be used in the following environments.
  ① Indoor / Outdoor (in the environment condition rated in 'Specifications')
  ② Altitude max. 2,000 m
  ③ Pollution Degree 2
  ④ Installation Category II

※The explosion-proof unit is certified and the same specifications which is reported to Korea Gas Safety Corporation. (This unit is manufactured following by the announcement 2013-54 of Ministry of Employment and Labor of Korea.)

Display Type Pressure Transmitters

▣ Features

- Minimized disturbance effect by improving noise resistance
- Excellent corrosion resistance with stainless steel housing
- High accuracy ±0.3% F.S.
- Various functions
  - User input range, display scale, output scale, digital filter, multi display selection, abnormal operation display, TUF (Two Unit Function), etc.
- Explosion-proof specification: Ex D IIC T6
- Protection structure: IP67 (IEC standard)
- Applications
  - Indoor heating, water supply and sewage, and incinerator and small and medium sized projects

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

CE

▣ Ordering Information

PTF30 — G 7 N N — F8 (-0.1 to 35MPa)

① ② ③ ④ ⑤ ⑥ ⑦

	Description		
①Item	PTF30	Display Type Pressure Transmitters	
②Measurement pressure	G	Gauge pressure, sealed gauge pressure※1	
	A	Absolute pressure	
③Rated pressure range		Gauge pressure	Absolute pressure
	1	0 to 35kPa	0 to 35kPa
	2	0 to 0.1MPa	0 to 0.1MPa
	3	0 to 0.2MPa	0 to 0.2MPa
	4	0 to 0.7MPa	0 to 0.7MPa
	5	0 to 2MPa	0 to 2MPa
	6	0 to 3.5MPa	0 to 3.5MPa
	7	0 to 7MPa	—
	8	0 to 21MPa	
	9	0 to 35MPa	
		Sealed gauge pressure※1	
	A	-35 to 0kPa	
	C	-0.1 to 0MPa	
	F	-0.1 to 0.2MPa	
	H	-0.1 to 0.7MPa	
	M	-0.1 to 2MPa	
	O	-0.1 to 3.5MPa	
	Z	Others	
④HART communication output	N	None	
⑤Mounting bracket	N	Without bracket	
	B	With bracket	
⑥Pressure port	F8	G3/8 (PF)	
⑦User pressure range		User pressure range※2	

※1: The pressure is sealed gauge pressure. The unit is sealed structure. It is based on atmospheric pressure 101.3kPa (1.013bar).
※2: Write the desired pressure range and it is the default of user pressure range.(select "Z" at ③Rated pressure range)

▣ Specifications

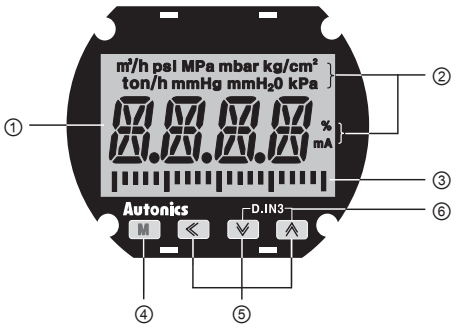
Series		PTF30
Measured materials		Vapor, liquid, fluid (except corrosive environment of stainless steel 316)
Power supply		15-35VDC⎓
Display method		12-segment 4-digit LCD Display
Character size		W6.24×H10.73mm (12-segment) / W1.45×H2.5mm (unit)
Output		DC4-20mA 2-wire Low-limit: 3.6mA (-2.5%), high-limit: 21.6mA (+10%)
Accuracy※1		±0.3% of F.S.
Temperature characteristics		At 20℃, ± (0.075% × URL + 0.15% × Span)
Setting method		Setting by front push keys
Sampling cycle		300ms
Dielectric resistance		1,000VAC for 1 min (between external terminal and case)
Vibration		0.75mm amplitude at frequency of 5 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Insulation resistance		Over 100MΩ (at 500VDC megger)
Noise immunity		Square shaped noise by noise simulator (pulse width 1μs) ±240V
Memory protection		Approx. 10 years (non-volatile semiconductor memory type)
Environment	Ambient temperature	-20 to 70℃, storage: -20 to 80℃
	Ambient humidity	0 to 85%RH
Material		Body: aluminum (AlDc.8S), cover O-Ring: buna N, diaphragm: stainless steel 316, connections: stainless steel 316
Explosion class※2		Ex d IIC T6
Protection structure		IP67 (IEC standard)
Approval		CE
Unit weight		Approx. 1.2kg

※1: F.S.: Rated pressure range.
※2: This Explosion class is acquired and managed by Konics Co., Ltd.
※Environment resistance is rated at no freezing or condensation.

▣ Pressure Conversion Chart

	gf/cm²	kgf/cm²	Pa	kPa	MPa	mbar	bar	mmH2O	psi	mmHg
1gf/cm²	1	0.001000	98.0665	0.0980665	0.000098	0.980665	0.000981	10.00000	0.014223	0.735559
1kgf/cm²	1000.000	1	98066.50	98.06650	0.098067	980.665	0.980665	10000.00	14.22334	735.5592
1Pa	0.010197	0.0000102	1	0.001000	0.000001	0.01	0.000010	0.101972	0.000145	0.007501
1kPa	10.19716	0.010197	1000.000	1	0.001000	10	0.010000	101.9716	0.145038	7.500617
1MPa	10197.16	10.19716	1000000	1000.000	1	10000	10.00000	101971.6	145.0378	7500.617
1mbar	1.019716	0.0010197	100.0000	0.100000	0.000100	1	0.001000	10.19716	0.014504	0.750062
1bar	1019.716	1.019716	100000.0	100.0000	0.100000	1000	1	10197.16	14.50377	750.0617
1mmH2O	0.100000	0.000100	9.80665	0.009807	0.0000098	0.0980665	0.000098	1	0.001422	0.073556
1psi	70.30699	0.070307	6894.757	6.894757	0.006895	68.94757	0.068948	703.0696	1	51.71493
1mmHg	1.359510	0.001360	133.3224	0.133322	0.0001333	1.333224	0.001333	13.59510	0.019337	1

■ Unit Descriptions



① Display part
: Displays detected pressure value, several setting value and errors.

② Unit display part: Displays the currently set input unit.

③ Output scale bar graph
: Displays output DC4-20mA as scale bar graph by 5% unit.

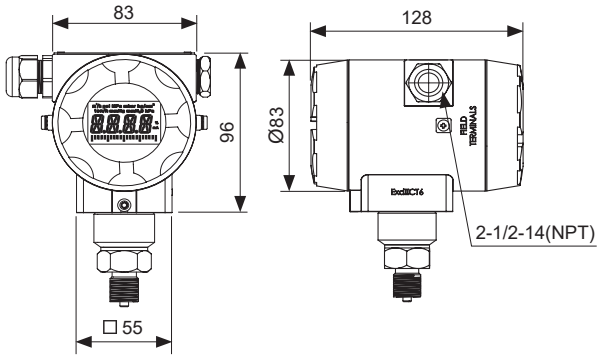
④ [M] key: Used to enter parameter mode, move parameters and save SV.

⑤ [≪], [∨], [∧] key: Used to enter parameter set mode, move digits.

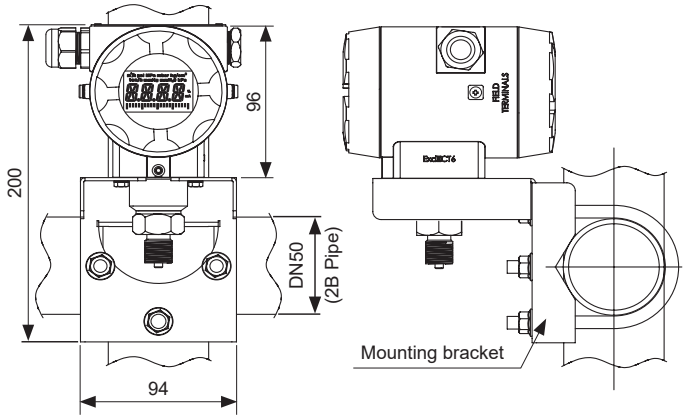
⑥ D.IN3: Press the [∨] and [∧] keys at the same time for 3 sec, the set function (display HOLD, zero-point adjustment) at dI -K in parameter.

■ Dimensions

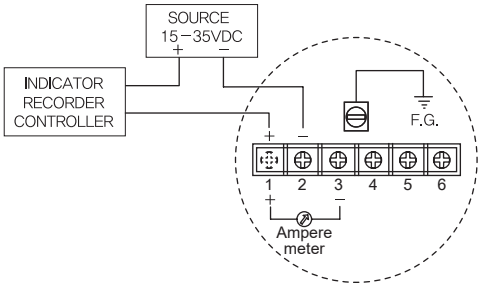
(unit: mm)



● **Mounting bracket**



■ Connections



※You can check DC4-20mA output by connecting an ampere meter. (impedance: max. 30Ω)

▣ Functions

■ Input unit [UNIT]

You can select input unit.
(bar, mbar, Pa, kPa, MPa, gf/cm^2, kgf/cm^2, mmH$_2$O, psi, mmHg, %, OFF)

■ User input range [L-RG, H-RG]

Even though each unit has the range, you can set user input range within the pressure range when input range is limited for actual usage.

■ Decimal point setting [dP]

This function is to change decimal point digit for input display value.

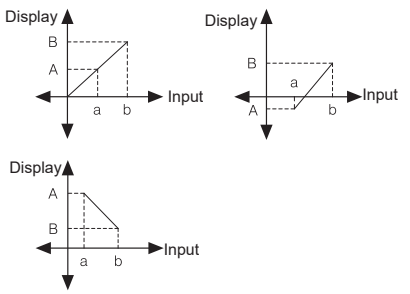
When input unit is set as % [%] or OFF [oFF], only the display position of decimal point is moved.

- Setting range: 0 / 0.0 / 0.00 / 0.000

※Setting range is different by the pressure range.

■ Display scale [L-SC, H-SC]

This function is to set (-1999 to 9999) for particular high/low limit value in order to display high/low limit value of measurement input. If measurement inputs are 'a' and 'b' and particular values are 'A' and 'B', it will display a=A, b=B as below graphs.

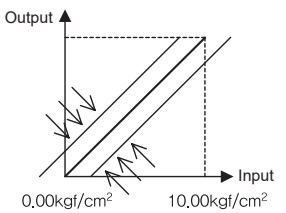


※This function is available only when input unit is % [%] or OFF [oFF].

■ Zero-point correction [ZERo]

It corrects the error of display value for 0% input.

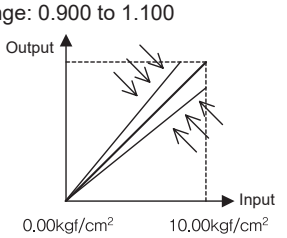
- Setting range: -999 to 999



■ Slope correction [SPAN]

It corrects the error of display value for 100% input.

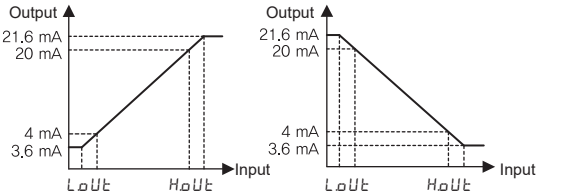
- Setting range: 0.900 to 1.100



■ Output scale [LoUt, HoUt]

For DC4-20mA current output, this function is set to display value for current output.

Set the display value for DC4mA [LoUt] and the display value for DC20mA [HoUt].



■ Digital filter [MAVF]

Digital filter is able to display stably and output the noise from input line and irregular signals. This unit applies moving average digital filter and display cycle is same.

- Setting range: 01 to 16

※When setting as 01, digital filter function does not run.

■ Digital input [dI-K]

By front keys operation (D.IN3: ▽ + △ for 3 sec), one of two functions executes as the below table.

Function		Operation
HoLd	Display Hold	Temporarily indicated value is stopped in order to confirm indicated value in unstable input.
Z-tM	Zero-point adjustment	It is same function as [ZERo]. When executing this function, you can check and change correction value at ZERo.

■ Multi-display selection [dSP1, dSP2]

Select one for display 1 and display 2 among PV, oUt, LPEK, HPEK. Set dSP1 and dSP2 differently and it displays two different values in turn for 2 sec. When selecting LPEK (HPEK), the left (or the right) of output scale bar graph flashes for 0.5 sec.

■ High/Low peak monitoring [LPEK, HPEK]

This function is to save high/low peak to check the invisible abnormal condition of system. Select this function display selection [dSP1, dSP2] parameter.

When the high/low peak is out of the temperature range, it displays HHHH or LLLL.

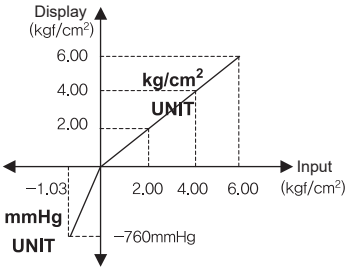
To initialize high/low peak, press the ▽ + △ keys at the same time for 3 sec at [HPEK] or [LPEK].

In this case, peak value is the present input value.

▣ Functions

■ Two unit function [tUF]

For compound pressure model, this function displays the input pressure which is below atmospheric pressure by mmHg unit. It displays the input pressure atmospheric pressure or over atmospheric pressure by the set pressure unit.



■ Lock [LoCK]

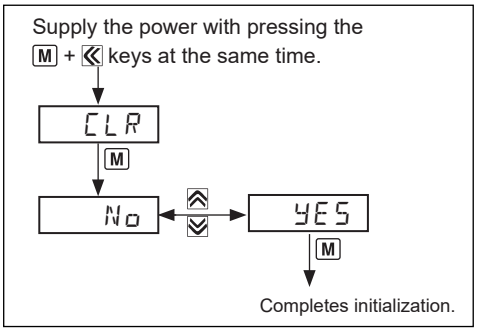
It limits to check parameter set value and to change it.

	oFF	LoC.1	LoC.2
Parameter	●	◐	○

●: Enable to check/set, ◐: Enable to check, disable to set,
○: Disable to check
In LoC.2, only the LoCK parameter displays.

■ Parameter initialization [INIt]

To initialize all parameter as factory default, supply the power to the product with pressing the M key and 1 key at the same time and it enters initialization parameter.



■ Error

Display	Descriptions	Troubleshooting
HHHH	Flashes when measured pressure is higher than the 'pressure range'.	Adjust measured pressure within the 'pressure range'.
LLLL	Flashes when measured pressure is lower than the 'pressure range'.	
ERR	Flashes when there is error to SV	Re-set it after checking the setting conditions

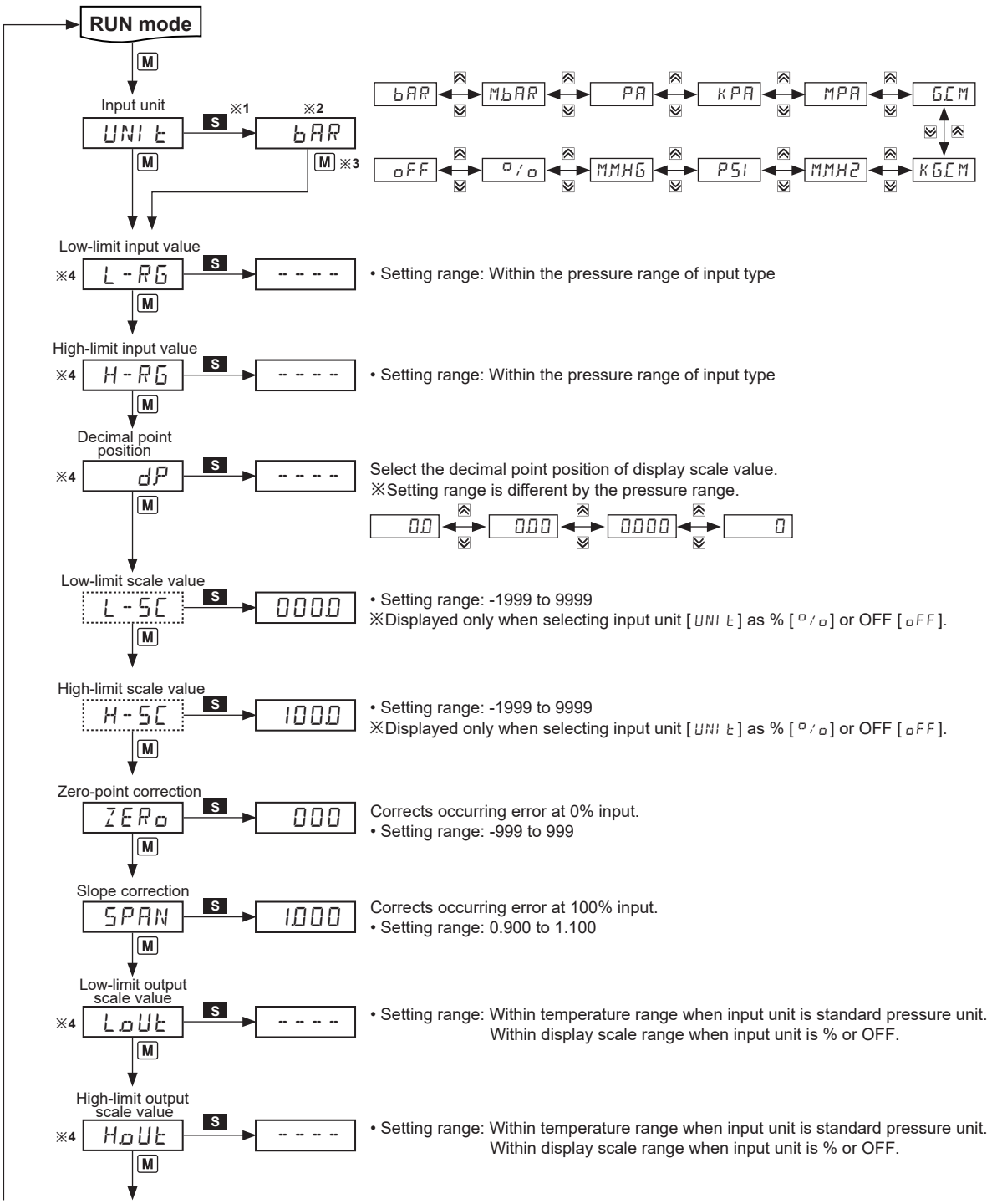
▣ Factory Default

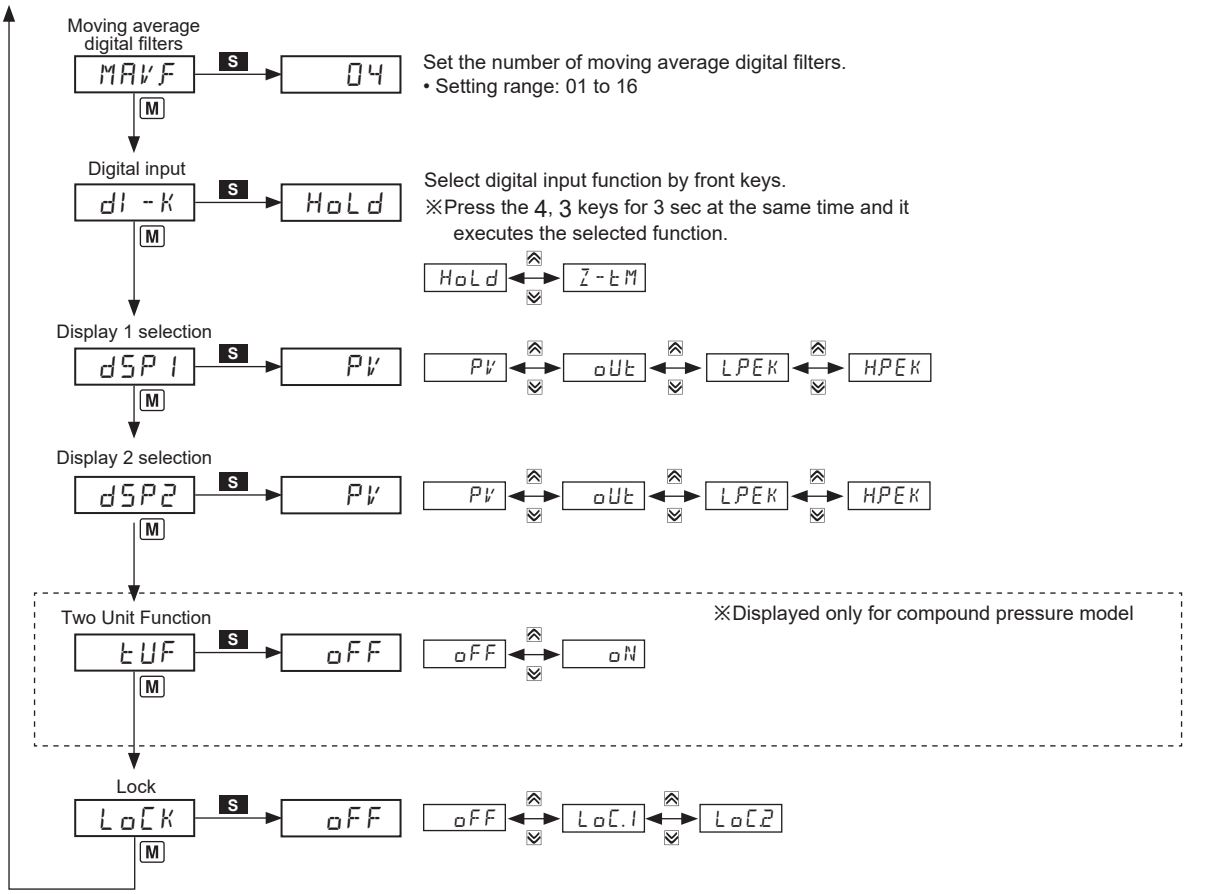
Parameter	Default	Parameter	Default	Parameter	Default	Parameter	Default
UNIt	bAR	L-SC	0000	LoUt	0000 ※1	dSP1	Pv
L-RG	0000 ※1	H-SC	1000	HoUt	0350 ※1	dSP2	Pv
H-RG	0350 ※1	ZERo	000	MAvF	04	tUF	oFF
dP	0350 ※1	SPAN	1000	dI-K	HoLd	LoCK	oFF

※1: Defaults are different by the pressure range by each model.

■ Parameters

※1. S: Press any key among the ≪, ∨, ∧.
※2. ≪: Moves digits / ∨, ∧: changes SV.
※3. Press the M key after checking/changing SV in each parameter.
The value flashes twice and is saved. It moves to next parameter.
※4. Defaults are different by the pressure range by each model.
※After entering setting group, press the M key for 3 sec or there is no additional key operation in 30 sec, it returns to RUN mode.
※[ ]: This parameter may or may not appear, depending on the other parameter set.





■ Proper Usage

- Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
- 15-35VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- The connection of this unit should be separated from the power line and high voltage line in order to prevent inductive noise.
- Do not use this unit near the high frequency instruments
- Switch or circuit breaker for suppling or cutting off the power should be installed nearby users for convenient control.
- Use verified explosion-proof cable gland or sealing fitting.
  (explosion proof standard: over Ex d IIC T6, IP rating: over IP67 protection structure).
- Use dedicated external terminal for earth. For connecting earth, use a spring washer and earth cable which is over 4mm².
- This unit may be used in the following environments.
  ① Indoor / Outdoor (in the environment condition rated in 'Specifications')
  ② Altitude max. 2,000 m
  ③ Pollution Degree 2
  ④ Installation Category II

※ **The explosion-proof unit is certified and the same specifications which is reported to Korea Gas Safety Corporation. (This unit is manufactured following by the announcement 2013-54 of Ministry of Employment and Labor of Korea.)**

Coil Pipe Syphons

▣ Features

- Prevent damage caused by high temperature direct affect on the pressure gauge
- Applications
  -pressure measurement of high temperature steam

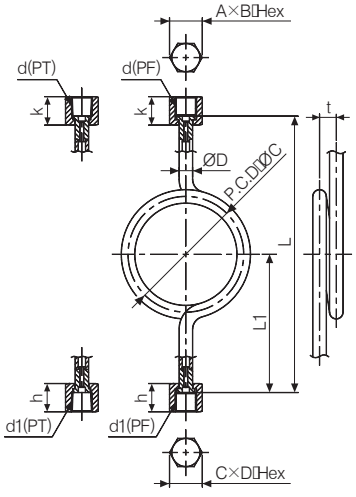
▣ Specifications

Series		SS-CS	
Material		Steel	Stainless Steel
	Connector (Joint-Outlet)	SS400(Ni-plating)	SUS316
	Connector (Joint-Intlet)	SS400(Ni-plating)	SUS316
	Pipe	STPG38(Ni-plating)	SUS316TP
	Nipple-Pipe	SS400(Ni-plating)	SUS316
Type		・Female x Female ・Female x Male ・Male x Male ・Female x Flange ・Male x Flange ・Flange x Flange	

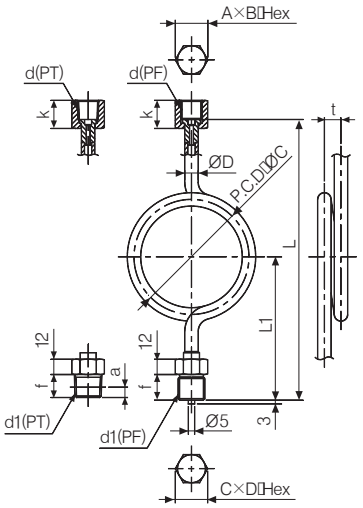
※Cooling effect : Depends on status of pipe like diameter, length, thickness, temperature, and etc.

▣ Dimensions

(unit:mm)

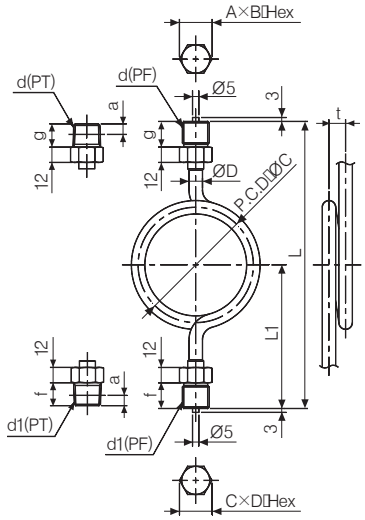


Model	Connector (d)	Connector (d1)	A×B Hex	C×D Hex	k	h	ØD	ØC	t	L1	L
SS-CS01 (F)×(F)	PF(PT)1/4	PF(PT)1/4	19×21.9	19×21.9	20	20	10.5	90	13	110	215
	PF(PT)1/4	PF(PT)3/8		22×25.4	20	22					
	PF(PT)1/4	PF(PT)1/2		27×31.1	20	24					
	PF(PT)3/8	PF(PT)1/4	22×25.4	19×21.9	22	20					
	PF(PT)3/8	PF(PT)3/8		22×25.4	22	22	10.5	90	13		
	PF(PT)3/8	PF(PT)1/2		27×31.1	22	24	17.3	115	20		
	PF(PT)1/2	PF(PT)1/4	27×31.1	19×21.9	24	20	10.5	90	13		
	PF(PT)1/2	PF(PT)3/8		22×25.4	24	22	10.5	90	13		
							17.3	115	20		
	PF(PT)1/2	PF(PT)1/2		27×31.1	24	24	10.5	90	13		
							17.3	115	20		
							21.7	120	25		

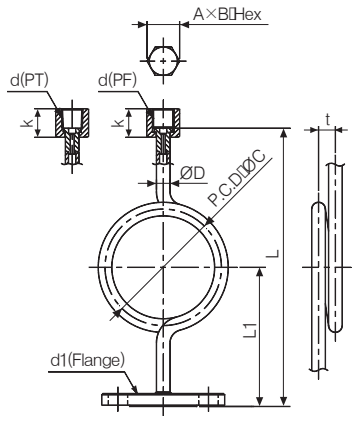


(unit:mm)

Model	Connector (d)	Connector (d1)	A×B Hex	C×D Hex	k	h	ØD	ØC	t	L1	L
SS-CS02 (F)×(M)	PF(PT)1/4	PF(PT)1/4	19×21.9	17×21.9	20	16	10.5	90	13	108	213
	PF(PT)1/4	PF(PT)3/8		19×21.9	20	18				110	215
	PF(PT)1/4	PF(PT)1/2		22×25.4	20	20				112	217
	PF(PT)3/8	PF(PT)1/4	22×25.4	22×25.4	22	16	10.5	90	13	108	213
	PF(PT)3/8	PF(PT)3/8			22	18				110	215
	PF(PT)3/8	PF(PT)1/2			22	20	17.3	115	20	112	217
	PF(PT)1/2	PF(PT)1/4	27×31.1	27×31.1	24	16	10.5	90	13	108	213
	PF(PT)1/2	PF(PT)3/8			20	18				110	215
							17.3	115	20		
	PF(PT)1/2	PF(PT)1/2			24	20				112	217
							21.7	120	25		

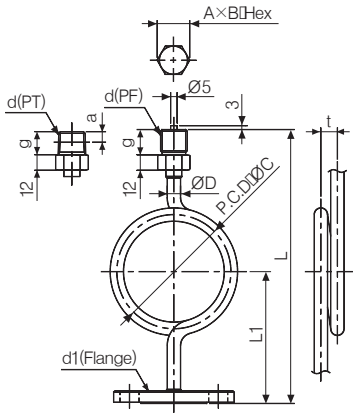


Model	Connector (d)	Connector (d1)	A×B Hex	C×D Hex	k	h	ØD	ØC	t	L1	L
SS-CS03 (M)×(M)	PF(PT)1/4	PF(PT)1/4	19×21.9	17×19.6	16	16	10.5	90	13	108	216
	PF(PT)1/4	PF(PT)3/8		19×21.9	18	18				110	220
	PF(PT)1/4	PF(PT)1/2		22×25.4	20	20				112	224
	PF(PT)3/8	PF(PT)1/4	22×25.4	22×25.4	16	16	10.5	90	13	108	216
	PF(PT)3/8	PF(PT)3/8			18	18				110	220
	PF(PT)3/8	PF(PT)1/2			20	20	17.3	115	20	112	224
	PF(PT)1/2	PF(PT)1/4	27×31.1	27×31.1	16	16	10.5	90	13	108	216
	PF(PT)1/2	PF(PT)3/8			18	18				110	220
							17.3	115	20		
	PF(PT)1/2	PF(PT)1/2			20	20				112	224
							21.7	120	25		

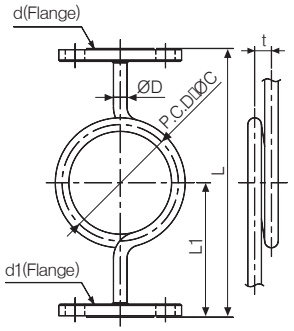


Model	Connector (d)	Connector (d1)	A×B Hex	k	ØD	ØC	t	L1	L
SS-CS04 (F)×Flange	PF(PT)1/4	JIS 10K	19×21.9	20	10.5	90	13	110	215
	PF(PT)1/4								
	PF(PT)1/4	JIS 20K							
	PF(PT)3/8		22×25.4	22	10.5	90	13		
	PF(PT)3/8				17.3	115	20		
	PF(PT)3/8	ANSI #150							
	PF(PT)1/2		27×31.1	24	10.5	90	13		
	PF(PT)1/2	ANSI #300			17.3	115	20		
	PF(PT)1/2				21.7	120	25		

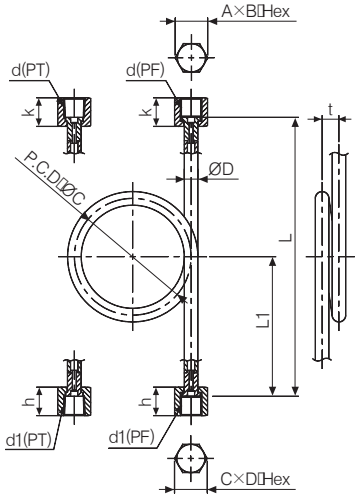
(unit:mm)



Model	Connector (d)	Connector (d1)	A×B Hex	k	ØD	ØC	t	L1	L
SS-CS05 (M)×Flange	PF(PT)1/4	JIS 10K	19×21.9	16	10.5	90	13	110	215
	PF(PT)1/4								
	PF(PT)1/4	JIS 20K							
	PF(PT)3/8		22×25.4	18	10.5	90	13		
	PF(PT)3/8				17.3	115	20		
	PF(PT)3/8	ANSI #150							
	PF(PT)1/2		27×31.1	20	10.5	90	13		
	PF(PT)1/2	ANSI #300			17.3	115	20		
	PF(PT)1/2				21.7	120	25		

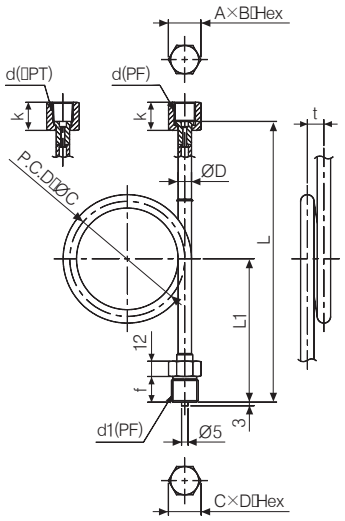


Model	Connector (d)	Connector (d1)	ØD	ØC	t	L1	L
SS-CS06 Flange×Flange	JIS 10K	JIS 10K	10.5	90	13	110	215
	JIS 20K	JIS 20K	17.3	115	20		
	ANSI #150	ANSI #150					
	ANSI #300	ANSI #300	21.7	120	25		

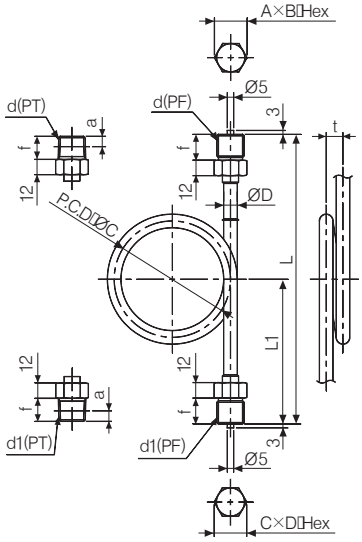


Model	Connector (d)	Connector (d1)	A×B Hex	C×D Hex	k	h	ØD	ØC	t	L1	L
SS-CS07 (F)×(F)	PF(PT)1/4	PF(PT)1/4	19×21.9	19×21.9	20	20	10.5	90	13	110	215
	PF(PT)1/4	PF(PT)3/8		22×25.4	20	22					
	PF(PT)1/4	PF(PT)1/2		27×31.1	20	24					
	PF(PT)3/8	PF(PT)1/4	22×25.4	19×21.9	22	20					
	PF(PT)3/8	PF(PT)3/8		22×25.4	22	22	10.5	90	13		
	PF(PT)3/8	PF(PT)1/2		27×31.1	22	24	17.3	115	20		
	PF(PT)1/2	PF(PT)1/4	27×31.1	19×21.9	24	20	10.5	90	13		
	PF(PT)1/2	PF(PT)3/8		22×25.4	24	22	10.5	90	13		
							17.3	115	20		
	PF(PT)1/2	PF(PT)1/2		27×31.1	24	24	10.5	90	13		
							17.3	115	20		
							21.7	120	25		

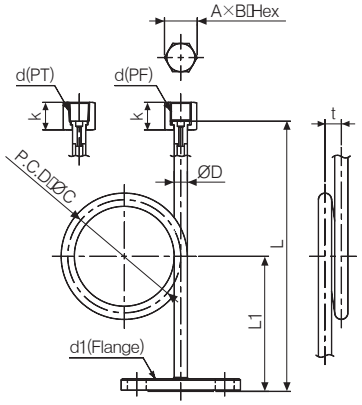
(unit:mm)



Model	Connector (d)	Connector (d1)	A×B Hex	C×D Hex	k	h	ØD	ØC	t	L1	L
SS-CS08 (F)×(M)	PF(PT)1/4	PF(PT)1/4	19×21.9	17×21.9	20	16	10.5	90	13	108	213
	PF(PT)1/4	PF(PT)3/8		19×21.9	20	18				110	215
	PF(PT)1/4	PF(PT)1/2		22×25.4	20	20				112	217
	PF(PT)3/8	PF(PT)1/4	22×25.4	22×25.4	22	16	10.5	90	13	108	213
	PF(PT)3/8	PF(PT)3/8			22	18				110	215
	PF(PT)3/8	PF(PT)1/2			22	20	17.3	115	20	112	217
	PF(PT)1/2	PF(PT)1/4	27×31.1	27×31.1	24	16	10.5	90	13	108	213
	PF(PT)1/2	PF(PT)3/8			24	18				110	215
							17.3	115	20		
	PF(PT)1/2	PF(PT)1/2			24	20				112	217
							21.7	120	25		

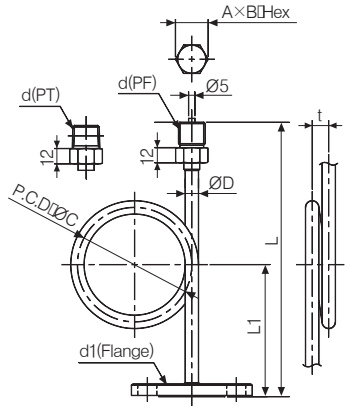


Model	Connector (d)	Connector (d1)	A×B Hex	C×D Hex	k	h	ØD	ØC	t	L1	L
SS-CS09 (M)×(M)	PF(PT)1/4	PF(PT)1/4	19×21.9	17×19.6	16	16	10.5	90	13	108	216
	PF(PT)1/4	PF(PT)3/8		19×21.9	18	18				110	220
	PF(PT)1/4	PF(PT)1/2		22×25.4	20	20				112	224
	PF(PT)3/8	PF(PT)1/4	22×25.4	22×25.4	16	16	10.5	90	13	108	216
	PF(PT)3/8	PF(PT)3/8			18	18				110	220
	PF(PT)3/8	PF(PT)1/2			20	20	17.3	115	20	112	224
	PF(PT)1/2	PF(PT)1/4	27×31.1	27×31.1	16	16	10.5	90	13	108	216
	PF(PT)1/2	PF(PT)3/8			18	18				110	220
							17.3	115	20		
	PF(PT)1/2	PF(PT)1/2			20	20				112	224
							21.7	120	25		

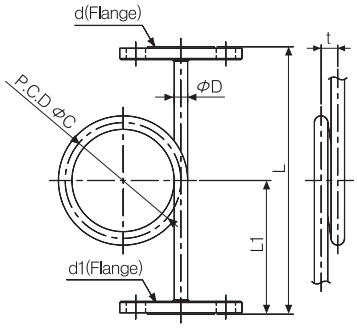


Model	Connector (d)	Connector (d1)	A×B Hex	k	ØD	ØC	t	L1	L
SS-CS10 (F)×Flange	PF(PT)1/4	JIS 10K	19×21.9	20	10.5	90	13	110	215
	PF(PT)1/4								
	PF(PT)1/4	JIS 20K							
	PF(PT)3/8		22×25.4	22	10.5	90	13		
	PF(PT)3/8								
	PF(PT)3/8	ANSI #150			17.3	115	20		
	PF(PT)1/2		27×31.1	24	10.5	90	13		
	PF(PT)1/2	ANSI #300			17.3	115	20		
	PF(PT)1/2				21.7	120	25		

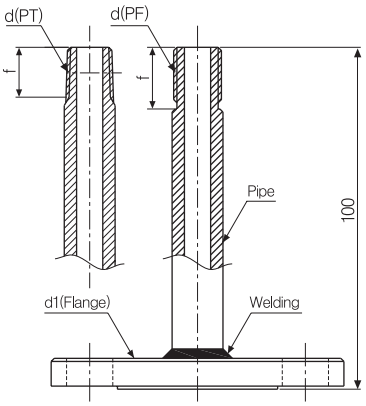
(unit:mm)



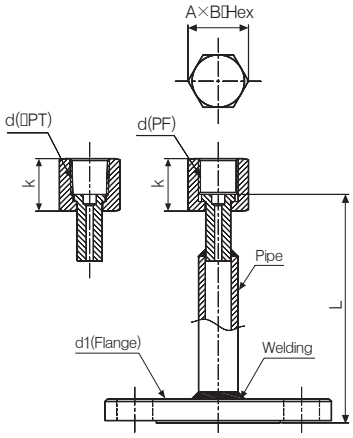
Model	Connector (d)	Connector (d1)	A×B Hex	k	ØD	ØC	t	L1	L
SS-CS11 (M)×Flange	PF(PT)1/4	JIS 10K	19×21.9	16	10.5	90	13	110	215
	PF(PT)1/4								
	PF(PT)1/4	JIS 20K							
	PF(PT)3/8		22×25.4	18	10.5	90	13		
	PF(PT)3/8	ANSI #150			17.3	115	20		
	PF(PT)3/8								
	PF(PT)1/2		27×31.1	20	10.5	90	13		
	PF(PT)1/2	ANSI #300			17.3	115	20		
	PF(PT)1/2				21.7	120	25		



Model	Connector (d)	Connector (d1)	ØD	Ø C	t	L1	L
SS-CS12 Flange×Flange	JIS 10K	JIS 10K	10.5	90	13	110	215
	JIS 20K	JIS 20K	17.3	115	20		
	ANSI #150	ANSI #150					
	ANSI #300	ANSI #300	21.7	120	25		



Model	Connector (d)	Connector (d1)	f
SS-IS01 (F)	PF3/8	JIS 10K	18
	PT3/8	JIS 20K	16
	PF1/2	ANSI #150	20
	PT1/2	ANSI #300	18



Model	Connector (d)	Connector (d1)	A×B Hex	k	L
SS-IS02 (M)	PF3/8	JIS 10K	22×25.4	22	98
	PT3/8	JIS 20K		22	96
	PF1/2	ANSI #150	27×31.1	24	100
	PT1/2	ANSI #300		24	98

MEMO

Snubbers

▣ Features

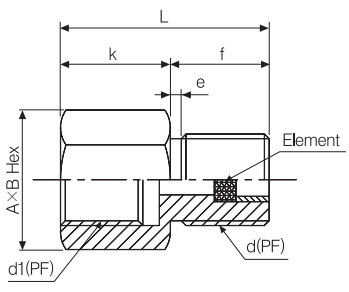
- Use as filter and buffer with ventilatable metal disk
- Suppress the effects of pulsating pressure
  - Less blockage than orifice mounting type
- Filters for tetrachloride, benzene, naphtha, etc.
- Applications
  - Filters for water, oil, etc.
  - Recycle industrial wastewater

▣ Specifications

Series		SS-SB	
Material		Brass	Stainless steel
	Body	YBSC	SUS316
	Stopper	BSBM	SUS316
	Packing(Gasket-Outlet)	CuB	SUS316
	Connector(Joint-Inlet)	SS400(Ni-plating)	SUS316
	Washer	SUS304	SUS304
	Packing(Gasket-Inlet)	Valqua 1500	Valqua 1500
	Ring	SUS304	SUS304
	Nut	SS400(Ni-plating)	SS400(Ni-plating)
Type		・PF(Male) x PF(Male) ・PF(Male) x PT(Female) ・PT(Female) x PF(Male) ・PT(Female) x PT(Female)	

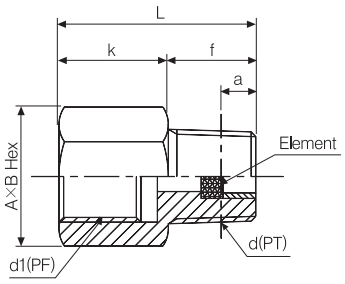
▣ Dimensions

(unit:mm)

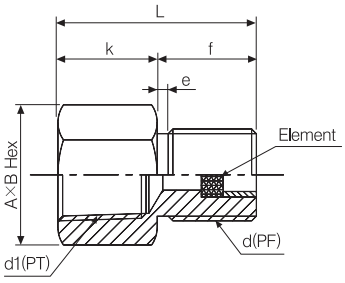


Model	Connector (d1)	Connector (d)	A×B Hex	k	f	L	e
SS-SB01 (PF)×(PF)	PF1/4	PF1/4	19×21.9	18	16	34	2
	PF1/4	PF3/8	19×21.9	18	18	36	2
	PF1/4	PF1/2	22×25.4	18	20	38	2
	PF3/8	PF1/4	22×25.4	20	16	36	2
	PF3/8	PF3/8	22×25.4	20	18	38	2
	PF3/8	PF1/2	22×25.4	20	20	40	2
	PF1/2	PF1/4	27×31.1	22	16	38	2
	PF1/2	PF3/8	27×31.1	22	18	40	2
	PF1/2	PF1/2	27×31.1	22	20	42	2

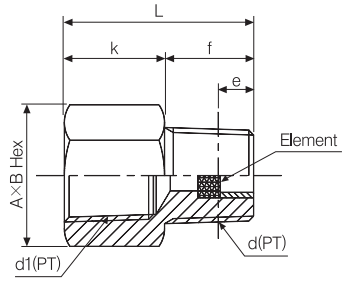
(unit:mm)



Model	Connector (d1)	Connector (d)	A×B Hex	k	f	L	a
SS-SB02 (PT)×(PF)	PF1/4	PT1/4	19×21.9	18	14	32	6.01
	PF1/4	PT3/8	19×21.9	18	16	34	6.35
	PF1/4	PT1/2	22×25.4	18	18	36	8.16
	PF3/8	PT1/4	22×25.4	20	14	34	6.01
	PF3/8	PT3/8	22×25.4	20	16	36	6.35
	PF3/8	PT1/2	22×25.4	20	18	36	8.16
	PF1/2	PT1/4	27×31.1	22	14	36	6.01
	PF1/2	PT3/8	27×31.1	22	16	38	6.35
	PF1/2	PT1/2	27×31.1	22	18	40	8.16



Model	Connector (d1)	Connector (d)	A×B Hex	k	f	L	e
SS-SB03 (PF)×(PT)	PT1/4	PF1/4	19×21.9	16	16	32	2
	PT1/4	PF3/8	19×21.9	16	16	34	2
	PT1/4	PF1/2	22×25.4	16	16	36	2
	PT3/8	PF1/4	22×25.4	18	18	34	2
	PT3/8	PF3/8	22×25.4	18	18	36	2
	PT3/8	PF1/2	22×25.4	18	18	38	2
	PT1/2	PF1/4	27×31.1	20	20	36	2
	PT1/2	PF3/8	27×31.1	20	20	38	2
	PT1/2	PF1/2	27×31.1	20	20	40	2



Model	Connector (d1)	Connector (d)	A×B Hex	k	f	L	e
SS-SB04 (PT)×(PF)	PT1/4	PT1/4	19×21.9	16	14	30	6.01
	PT1/4	PT3/8	19×21.9	16	16	32	6.35
	PT1/4	PT1/2	22×25.4	16	18	34	8.16
	PT3/8	PT1/4	22×25.4	18	14	32	6.01
	PT3/8	PT3/8	22×25.4	18	16	34	6.35
	PT3/8	PT1/2	22×25.4	18	18	36	8.16
	PT1/2	PT1/4	27×31.1	20	14	34	6.01
	PT1/2	PT3/8	27×31.1	20	16	36	6.35
	PT1/2	PT1/2	27×31.1	20	18	38	8.16

Adapters

▣ Features

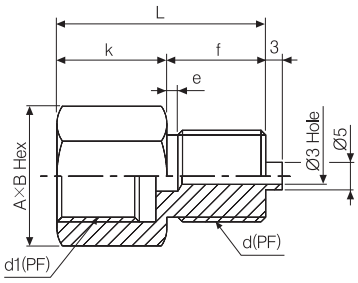
- Used to connect different types or diameters of screws or pipes
- Variable specifications for sizes and applications
- Applications
  - Connecting different types or diameters of screws or pipes
  - Mounting a pressure gauge on a panel
  - Connecting pressure pipes

▣ Specifications

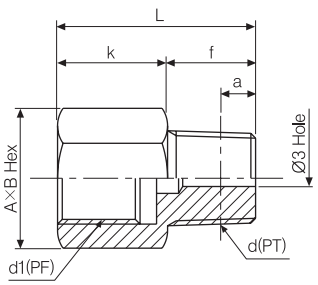
Series		SS-AD	
Material		Brass	Stainless steel
	Body	BSBM	SUS316
	Packing (Gasket-Outlet)	Teflon	Teflon
	Washer	BSBM	SUS316
Type		・PF(Male) x PF(Male) ・PF(Male) x PT(Female) ・PT(Female) x PF(Male) ・PT(Female) x PT(Female)	

▣ Dimensions

(unit:mm)

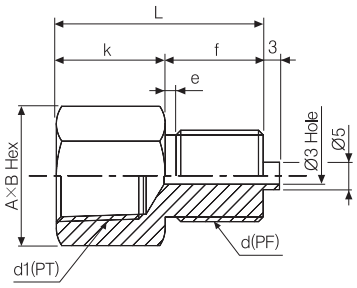


Model	Connector (d1)	Connector (d)	A×B Hex	k	f	L	e
SS-AD01 (PF)×(PF)	PF1/4	PF1/4	19×21.9	18	16	34	2
	PF1/4	PF3/8	19×21.9	18	18	36	2
	PF1/4	PF1/2	22×25.4	18	20	38	2
	PF3/8	PF1/4	22×25.4	20	16	36	2
	PF3/8	PF3/8	22×25.4	20	18	38	2
	PF3/8	PF1/2	22×25.4	20	20	40	2
	PF1/2	PF1/4	27×31.1	22	16	38	2
	PF1/2	PF3/8	27×31.1	22	18	40	2
	PF1/2	PF1/2	27×31.1	22	20	42	2

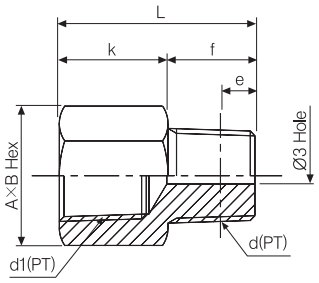


Model	Connector (d1)	Connector (d)	A×B Hex	k	f	L	a
SS-AD02 (PF)×(PT)	PF1/4	PT1/4	19×21.9	18	14	32	6.01
	PF1/4	PT3/8	19×21.9	18	16	34	6.35
	PF1/4	PT1/2	22×25.4	18	18	36	8.16
	PF3/8	PT1/4	22×25.4	20	14	34	6.01
	PF3/8	PT3/8	22×25.4	20	16	36	6.35
	PF3/8	PT1/2	22×25.4	20	18	36	8.16
	PF1/2	PT1/4	27×31.1	22	14	36	6.01
	PF1/2	PT3/8	27×31.1	22	16	38	6.35
	PF1/2	PT1/2	27×31.1	22	18	40	8.16

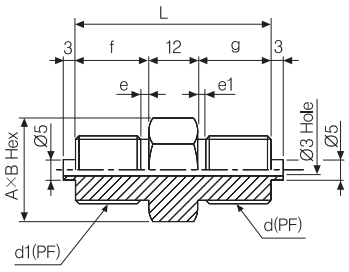
(unit:mm)



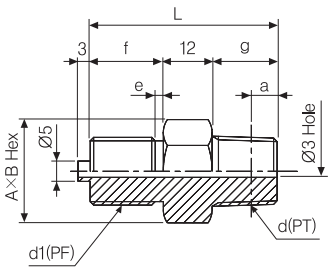
Model	Connector (d1)	Connector (d)	A×B Hex	k	f	L	e
SS-AD03 (PT)×(PF)	PT1/4	PF1/4	19×21.9	16	16	32	2
	PT1/4	PF3/8	19×21.9	16	18	34	2
	PT1/4	PF1/2	22×25.4	16	20	36	2
	PT3/8	PF1/4	22×25.4	18	16	34	2
	PT3/8	PF3/8	22×25.4	18	18	36	2
	PT3/8	PF1/2	22×25.4	18	20	38	2
	PT1/2	PF1/4	27×31.1	20	16	36	2
	PT1/2	PF3/8	27×31.1	20	18	38	2
	PT1/2	PF1/2	27×31.1	20	20	40	2



Model	Connector (d1)	Connector (d)	A×B Hex	k	f	L	e
SS-AD04 (PT)×(PT)	PT1/4	PT1/4	19×21.9	16	14	30	6.01
	PT1/4	PT3/8	19×21.9	16	16	32	6.35
	PT1/4	PT1/2	22×25.4	16	18	34	8.16
	PT3/8	PT1/4	22×25.4	18	14	32	6.01
	PT3/8	PT3/8	22×25.4	18	16	34	6.35
	PT3/8	PT1/2	22×25.4	18	18	36	8.16
	PT1/2	PT1/4	27×31.1	20	14	34	6.01
	PT1/2	PT3/8	27×31.1	20	16	36	6.35
	PT1/2	PT1/2	27×31.1	20	18	38	8.16

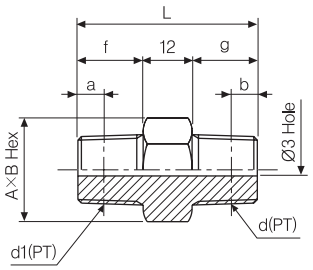


Model	Connector (d1)	Connector (d)	A×B Hex	f	g	L	e	e1
SS-AD05 (PF)×(PF)	PF1/4	PF1/4	19×21.9	16	16	44	2	2
	PF1/4	PF3/8	19×21.9	16	18	46	2	2
	PF1/4	PF1/2	22×25.4	16	20	48	2	2
	PF3/8	PF1/4	19×21.9	18	16	46	2	2
	PF3/8	PF3/8	19×21.9	18	18	48	2	2
	PF3/8	PF1/2	22×25.4	18	20	50	2	2
	PF1/2	PF1/4	22×25.4	20	16	48	2	2
	PF1/2	PF3/8	22×25.4	20	18	50	2	2
	PF1/2	PF1/2	22×25.4	20	20	52	2	2

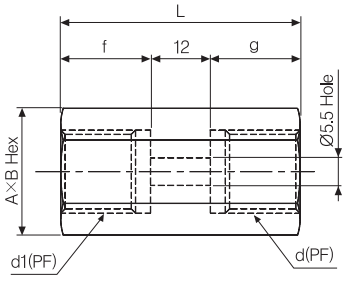


Model	Connector (d1)	Connector (d)	A×B Hex	f	g	L	e	a
SS-AD06 (PF)×(PT)	PF1/4	PT1/4	19×21.9	16	14	42	2	6.01
	PF1/4	PT3/8	19×21.9	16	16	44	2	6.35
	PF1/4	PT1/2	22×25.4	16	18	46	2	8.16
	PF3/8	PT1/4	19×21.9	18	14	44	2	6.01
	PF3/8	PT3/8	19×21.9	18	16	46	2	6.35
	PF3/8	PT1/2	22×25.4	18	18	48	2	8.16
	PF1/2	PT1/4	22×25.4	20	14	46	2	6.01
	PF1/2	PT3/8	22×25.4	20	16	48	2	6.35
	PF1/2	PT1/2	22×25.4	20	18	50	2	8.16

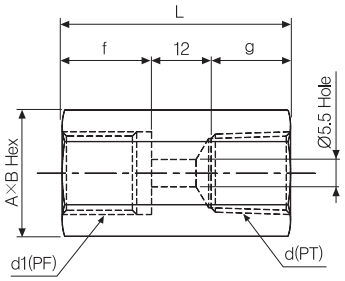
(unit:mm)



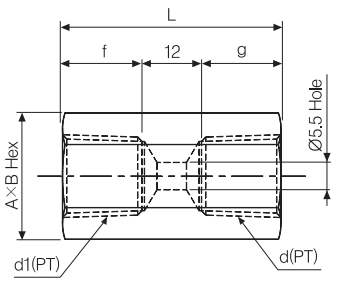
Model	Connector (d1)	Connector (d)	A×B Hex	f	g	L	a	b
SS-AD07 (PT)×(PT)	PT1/4	PT1/4	19×21.9	16	14	30	6.01	6.01
	PT1/4	PT3/8	19×21.9	16	16	32	6.35	6.35
	PT1/4	PT1/2	22×25.4	16	18	34	8.16	8.16
	PT3/8	PT1/4	19×21.9	18	14	32	6.01	6.01
	PT3/8	PT3/8	19×21.9	18	16	34	6.35	6.35
	PT3/8	PT1/2	22×25.4	18	18	36	8.16	8.16
	PT1/2	PT1/4	22×25.4	20	14	34	6.01	6.01
	PT1/2	PT3/8	22×25.4	20	16	36	6.35	6.35
	PT1/2	PT1/2	22×25.4	20	18	38	8.16	8.16



Model	Connector (d1)	Connector (d)	A×B Hex	f	g	L
SS-AD08 (PF)×(PF)	PF1/4	PF1/4	19×21.9	16	16	44
	PF1/4	PF3/8	22×25.4	16	18	46
	PF1/4	PF1/2	27×31.1	16	20	48
	PF3/8	PF1/4	22×25.4	18	16	46
	PF3/8	PF3/8	22×25.4	18	18	48
	PF3/8	PF1/2	27×31.1	18	20	50
	PF1/2	PF1/4	27×31.1	20	16	48
	PF1/2	PF3/8	27×31.1	20	18	50
	PF1/2	PF1/2	27×31.1	20	20	52



Model	Connector (d1)	Connector (d)	A×B Hex	f	g	L
SS-AD09 (PF)×(PT)	PF1/4	PT1/4	19×21.9	16	14	42
	PF1/4	PT3/8	22×25.4	16	16	44
	PF1/4	PT1/2	27×31.1	16	18	46
	PF3/8	PT1/4	22×25.4	18	14	44
	PF3/8	PT3/8	22×25.4	18	16	46
	PF3/8	PT1/2	27×31.1	18	18	48
	PF1/2	PT1/4	27×31.1	20	14	46
	PF1/2	PT3/8	27×31.1	20	16	48
	PF1/2	PT1/2	27×31.1	20	18	50



Model	Connector (d1)	Connector (d)	A×B Hex	f	g	L
SS-AD10 (PT)×(PT)	PF1/4	PT1/4	19×21.9	16	14	30
	PF1/4	PT3/8	22×25.4	16	16	32
	PF1/4	PT1/2	27×31.1	16	18	34
	PF3/8	PT1/4	22×25.4	18	14	32
	PF3/8	PT3/8	22×25.4	18	16	34
	PF3/8	PT1/2	27×31.1	18	18	36
	PF1/2	PT1/4	27×31.1	20	14	34
	PF1/2	PT3/8	27×31.1	20	16	36
	PF1/2	PT1/2	27×31.1	20	18	38

Auto Door Sensor

▣ Features

- Adjustable hold time switch (2, 7, 15 seconds)
- 4-step detection angle adjustment (7.5°, 14.5°, 21.5°, 28.5°)
- Adjustable detection area (left/right area elimination)
- Max. detection area: 2460 mm x 86 mm (height 2.7 m)
- Wide range power supply:
  24-240 VAC / 24-240 VDC (universal AC/DC type),
  12-24 VAC / 12-24 VDC (universal AC/DC type)
- Built-in microprocessor

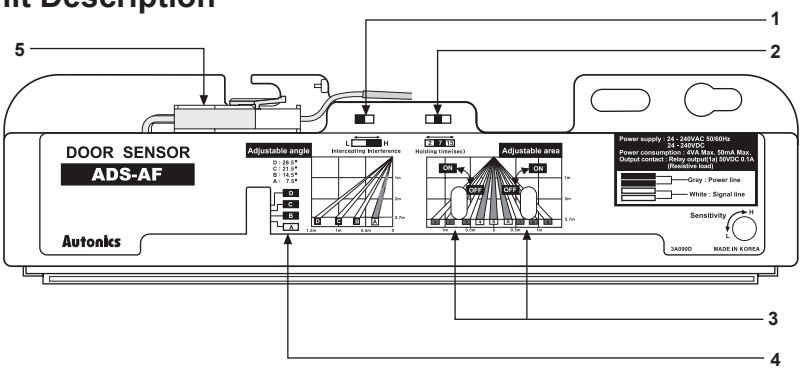
Please read "Caution for your safety" in operation manual before using.

▣ Specifications

Model		ADS-AF	ADS-AE
Cover color		Silver	
Power supply		24-240VAC～ ±10% 50/60Hz, 24-240VDC⎓ ±10% (ripple P-P: max. 10%)	12-24VAC～ ±10% 50/60Hz, 12-24VDC⎓ ±10% (ripple P-P: max. 10%)
Power consumption		Max. 4VA (at 240VAC～)	Max. 2VA (at 24VAC～)
Control output	Contact type	1a	
	Contact capacity※1	50VDC⎓ 0.1A (resistive load)	
Relay life cycle		Mechanical: Min. 20,000,000 times, Electrical: Min. 50,000 times	
Mounting height		2.0m to 2.7m (max. sensing distance: 3.0m)	
Sensing method		Infrared reflection method	
Sensing area		9 Point (refer to the below chart)	
Output holding time		Time delay approx. 0.5sec	
Stationary sensing time		Selectable 2sec, 7sec, 15sec (selectable by holding time setting switch)	
Interference prevention		H, L (selectable by interference prevention switch)	
Front sensing area		7.5°, 14.5°, 21.5°, 28.5°: 4 steps variable (adjusting by angle adjuster)	
Adjustable sensing area		(1, 2, 3 area), (7, 8, 9 area) Eliminate each by each : Adjusting with eliminating right/left sensing area lever	
Light source		Infrared emitting diode (modulated)	
Indicator		Operation indicator: Orange LED, Green LED, Red LED (refer to C-8 for the display status in operation)	
Connection method		Connector wire connection	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Noise immunity		±2,000V the square wave noise (pulse width:1μs) 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 X, Y, Z direction for 2 hours	
Shock		100m/s² (approx. 10G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Sunlight: Max. 3,000lx ,Incandescent lamp: Max. 3,000lx (receiver illumination)	
	Ambient temperature	-20℃ to 50℃, storage: -20 to 70℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Accessory		Cable: 2.5m, Mounting screw: 2, Mounting template	
Protection structure		IP50 (IEC standard)	
Material		Case: Acrylonitrile butadiene styrene, Lens: Acryl, Lens cover: Acryl	
Unit weight		Approx. 320g	

※**1: Do not use Load which is beyond the rated capacity of contact point of Relay.**
It can cause bad insulation, contact fusion, bad contact, relay breakdown, and fire etc.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

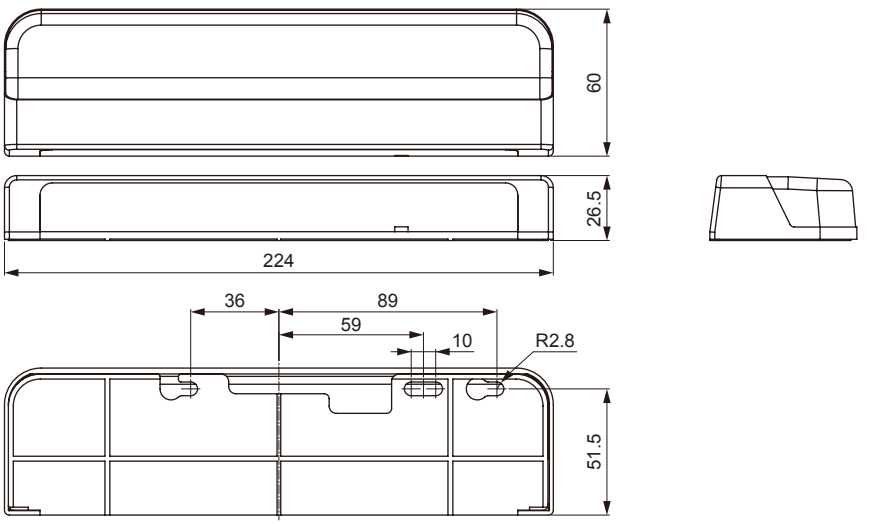
▣ Unit Description



1. Interference prevention switch
2. Holding time setting switch
3. Eliminating right/left sensing area lever
4. Angle adjuster
5. Body connector

▣ Dimensions

(unit: mm)



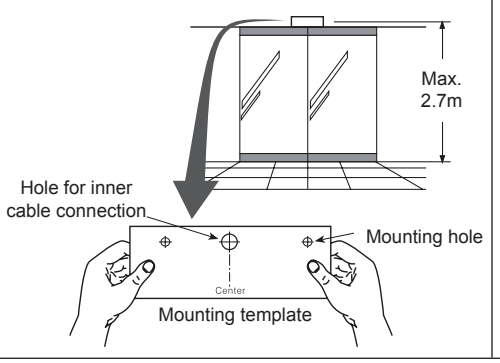
▣ Mounting Method

Installation order

1. Attach mounting template at mounting position

(mounting height: 2.0m to 2.7m)

- Drill Ø3.4mm hole based on mounting template.
- In case of wiring the cable on the wall to hide the cable, drill Ø9mm hole.
- Install the unit after removing the mounting template.



⚠ Caution

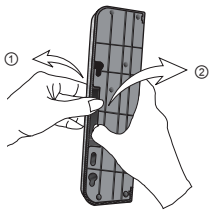
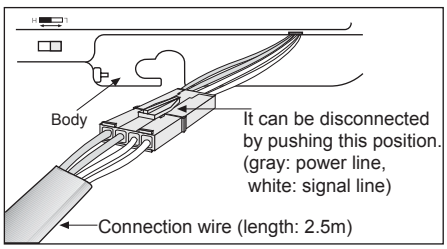
⚠ Warning **It may cause electric shock.**

- When this unit is used with cable outlet removed from cover, it must be installed indoors.
  (Electric shock or damage can occur if water flows through cable outlet.)

⚠ Caution **People can be jammed in the door.**

- If this unit is installed higher than 2.7m in height, it may not detect short children.
- If this unit is installed lower than 2.0m in height, it may not work properly.

▣ Installation

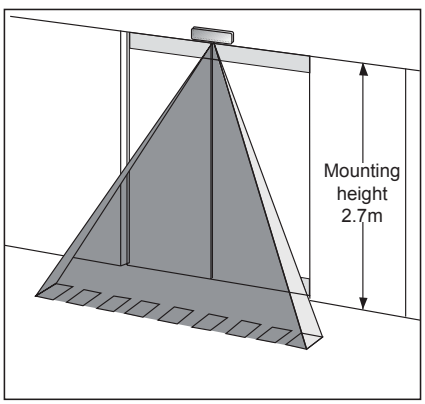
Installation order	⚠Caution
2. Please fix the unit with screws bolt after removing protection cover off. 	**⚠ Caution Mounting the unit** • Do not put excessive tightening torque on screw bolt when mounting this unit. It may result in mounting hole damage. **<How to remove protection cover>** • Pulling left thumb toward ①, key lock will be released and pull right thumb toward ②, protection cover and body will be detached.
3. Connect the code part of the extension cable to main control part. • Please install the connector in order to connect with the body.	
4. Connect the connector of the body and the connector of the extension cable. 	**⚠ Caution Connection of the connector** • Plug in the connector of the extension cable and the connector of the unit. The unit may not work normally by inferior contact.

▣ Adjustment

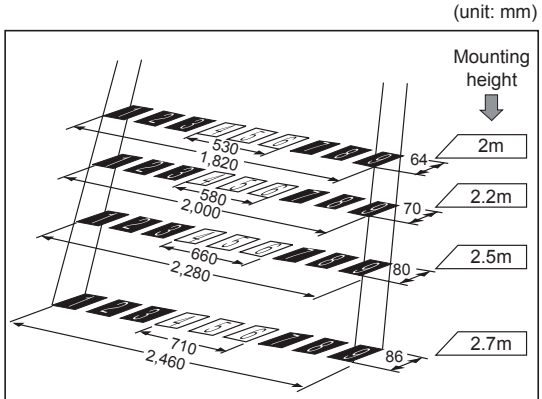
Please turn ON the power.

1. Check of the sensing area

This unit has characteristic of the sensing area as below chart and figure.

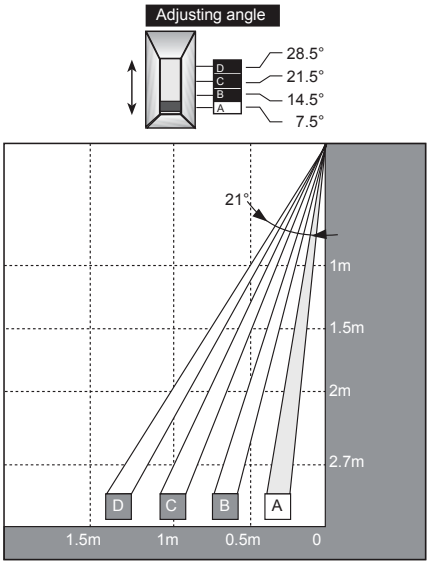


(unit: mm)



▣ Adjustment

2. Adjustable sensing area
Adjustable 7° in each step.
(sensing area angle step: 7.5° to 28.5°)



⚠ Caution People can be jammed in the door.

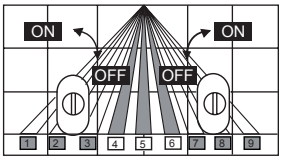
- The unit is not safety sensor. Install the fail-safe device before using the unit.

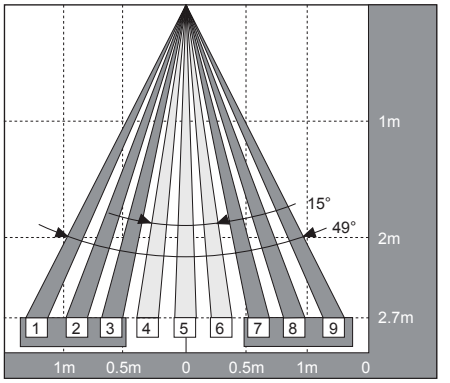
3. Adjustment of Left, Right sensing area width

Sensing area width 1, 2, 3 can be eliminated by left lever, 789 by right lever.

- Use the unit as removing non-sensing area by the lever adjusting width at narrow sensing area.

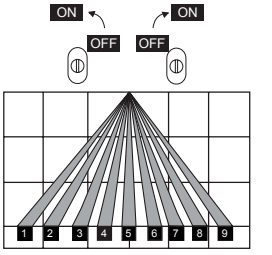
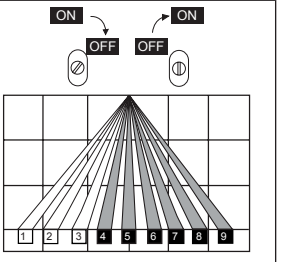
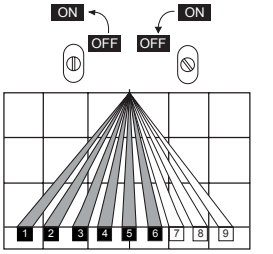
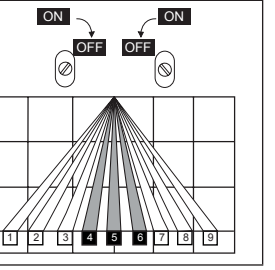
※Turn the adjuster till it stops it toward arrow direction by a (-)driver.





⚠ Caution Doors may malfunction.

- When eliminating the right/left sensing range, be sure to install the unit at place where a person approaches at the front of the door.
- In case of eliminating sensing area width: If a person approaches at the side of the door, they may not be detected and the door will not open.
- The sensing range for position of eliminating lever is as below.
- It can eliminate 1, 2, 3 by left lever and 7, 8, 9 by right lever at the once.

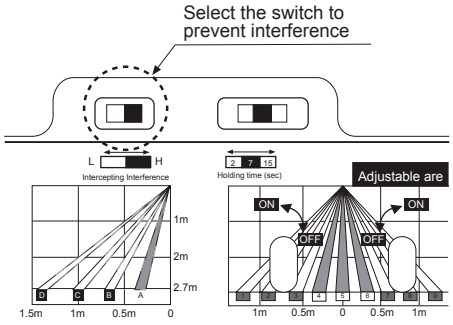
Right/Left full range sensing	Eliminating left sensing area
	
Eliminating right sensing area	**Eliminating right/left sensing area**
	

※It is not able to eliminate individual areas like elimination of area 1 or 7.

▣ Adjustment

4. How to set the switch for interference prevention

In case of using several door sensors adjacently, please set the interference prevention switches of the sensors differently.

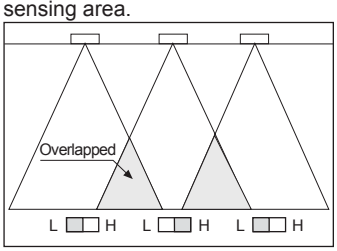


⚠ Caution Doors may malfunction.

When several door sensors are installed simultaneously without considering any interference prevention, it may cause malfunction by another door sensor even though there is no moving object.

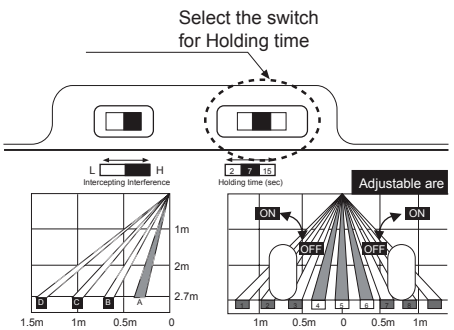
< Interference prevention >

If sensing area of the door sensors is overlapped, set each switch in difference or install the unit on non-overlapped sensing area.



5. Holding time switch setting

It is able to set the holding time by the holding time switch. (selectable 2sec, 7sec, 15sec)



⚠ Caution People can be jammed in the door.

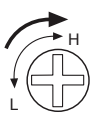
- The unit is not safety sensor. Install the fail-safe device before using the unit.
- The door will close after the time set by the holding time switch.

<Stationary sensing>

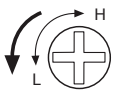
- When an object stays in the sensing area, output is kept in ON status during set holding time after output holding time.
- After set holding time, output turns OFF and the door closes.

6. Sensitivity Setting

- Even though people in the sensing area, if the sensor does not operate, turning the adjuster up to H. The sensitivity will be increased.



- Even though people in the sensing area, if the sensor operated, turning the adjuster up to L. The sensitivity will be decreased.

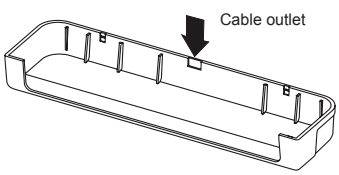


⚠ Caution Door can be opened and closed.

Please check the normal operation by turning the power ON/ OFF after finishing the sensitivity setting.
It may not operate normally after wrong sensitivity setting.

7. Unit cover and stripping

- Mount the cover on the unit.
- In case of using outlet to wire exposed cable, remove the cable outlet as below.



- Wrench and strip the protection cover putting a flathead screwdriver.

⚠ Warning It may cause electric shock.

- Use this unit with unit cover.
- Be sure that this unit does not come in direct touch with water. It may cause a damage to the equipment or cause electric shock.
- In case of without the cable outlet, the unit must be installed at inner position of door.
- Be sure that cable outlet does not come in direct touch with water. It may cause a damage to the equipment or cause electric shock.

▣ Adjustment

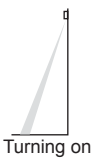
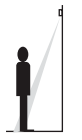
8. Sensing standby status

Right after turning on the power, the product is in the sensing standby status.

• After the sensing standby status is finished, sensing is stable.

9. Check of sensing operation

Check sensing operation as the below table.

Entry activation		 Turning on the power	 Turning on the power	 Enter the sensing area	 Holding sensing	 Out of sensing area
Operation indicator	Orange	LED ON	LED OFF	LED OFF	LED OFF	LED OFF
	Green	LED OFF	LED ON	LED OFF	LED ON	LED ON
	Red	LED OFF	LED OFF	LED ON	LED OFF	LED OFF
Output contact		OFF	OFF	ON	After holding time, OFF	After 0.5sec, OFF

10. Maintenance

- If the sensing lens is unclean, the unit may cause malfunction.
- In this case,please clean it with dry tissue and natural detergent.
- Do not use an organic materials such as benzene, etc. It may cause malfunction of sensing part.

⚠ Warning **It may cause electric shock.**

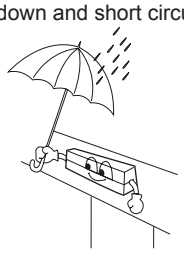
- Do not wash the unit with water.
- Do not repair or disassemble the unit.

▣ Troubleshooting

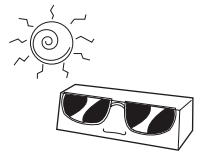
Malfunction	Cause	Troubleshooting
It does not work.	Power voltage	Check the power cable and adjust power voltage.
	Cable cut, disconnection	Check connector and wiring.
Sometimes it does not work.	The sensing lens are unclean	Clean the lens with dry tissue and natural detergent.
The door is opened even if people do not enter in sensing area.	There are moving objects.	Check surrounding environment for installation.
	By occurring sudden change of sensing area.	Check surrounding environment for installation.
	Sensing area is overlapped.	Install the unit to avoid overlap for sensing area. Set the switch intercepting interference.
	There is the equipment such as motor, neon lamp, generator, or high voltage line causing strong electric wave, noise.	Do not install the equipment causing strong electric wave, noise near the sensor.
	A drop of water is placed at the lens.	Remove a drop of water.

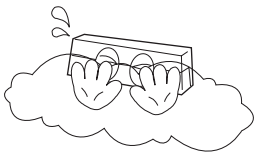
▣ Installation Environment

1. This product is not qualified for waterproof.
   Please install without being directly contacted with rain or snow, etc.
   It may cause breakdown and short circuit.



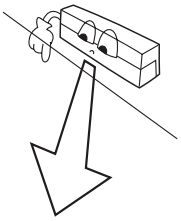
2. Do not install in the place where having reflecting light like sunshine directly reaches.
   It may does not operate normally.





4. If you place a movable object in the sensing area, it may cause malfunction by sensing the object because of natural phenomenon like wind, etc.

5. The sensing lens must be installed face to the door's threshold. If it faces the wall or roof, it may not operate normally.



▣ Caution for Using

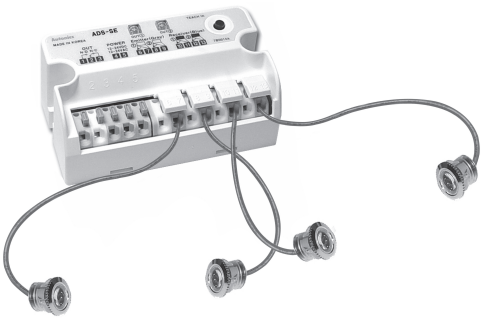
1. Follow instructions in 'Caution for Using'.
   Otherwise, It may cause unexpected accidents.
2. 12-24VDC, 12-24VAC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Use the product, 3 sec after supplying power.
   When using separate power supply for the sensor and load, supply power to sensor first.
4. When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
5. When connecting a DC relay or other inductive load, remove surge by using diodes or varistors.
6. Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
7. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 3
   ④Installation category II

Door Side Sensor

▣ Features

- Long sensing distance: 0 to 10m
- High ambient intensity of illumination: Max. 100,000lx of sunlight
- Easy to connect sensor head to controller
- Easy sensitivity setting (automatic sensitivity setting by one push method)
- Self-diagnosis function
- Compact Size (W77×L44×H30mm)

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



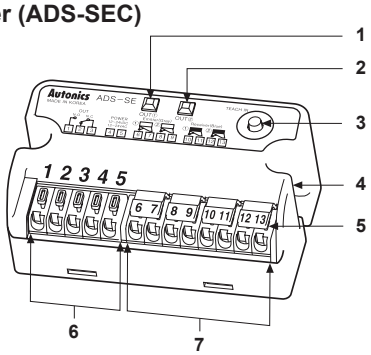
▣ Specifications

Model		ADS-SE
Sensing type		Through-beam type
Sensing distance		0 to 10m
Power supply		12-24VAC ±10% 50/60Hz / 12-24VDC ±10% (ripple P-P: max. 10%)
Power/Current consumption		AC: Max. 2VA / DC: Max. 50mA
Contact output	Contact composition	1c
	Contact capacity※1	50VDC 0.3A (resistive load)
	Relay life cycle	Mechanical- Min. 5,000,000 operations, Electrical- Min. 100,000 operations
Response time		Approx. 50ms (from light OFF)
Output holding time		Approx. 500ms (from light ON)
Available sensor set		2set
Indicator		Operation indicator: Red LED, Green LED(Refer to C-14 to 15 for the display status in operation)
Light source		Infrared LED (850nm modulated)
Environment	Ambient illumination	Sunlight: Max. 100,000lx (receiver illumination)
	Ambient temperature	-20 to 55℃, storage: -25 to 60℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Protection structure		IP30 (IEC standard)
Sensor cable length		10m
Sensor cable		Ø2.4mm, 1-wire, 5m (AWG26, core diameter: 0.16mm, number of cores: 7, insulator out diameter: Ø1.32mm)
Material		Sensor - Holder: Acrylonitrile butadiene styrene, Lens: Polymethyl methacrylate, Lens guide: Polycarbonate, Nut: Cu-Zn Controller - Housing: Acrylonitrile butadiene styrene, Cover: Acrylonitrile butadiene styrene, LED CAP: Polymethyl methacrylate, Bolt: Steel chromium molybdenum (brass, Ni-plate)
Accessory		Sensor: 1 set (ADS-SH), Fixing bolt for controller: 2 pieces
Unit weight		Approx. 300g

※**1: Do not use Load which is beyond the rated capacity of contact point of Relay.**
It can cause bad insulation, contact fusion, bad contact, relay breakdown, and fire etc.
※Please purchase 1 set of sensor separately when mounting 2 sets of sensor.
※The mounting bracket of sensor (ADS-SB12, ADS-SB10) is sold separately.
※It is enable to purchase a controller separately.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

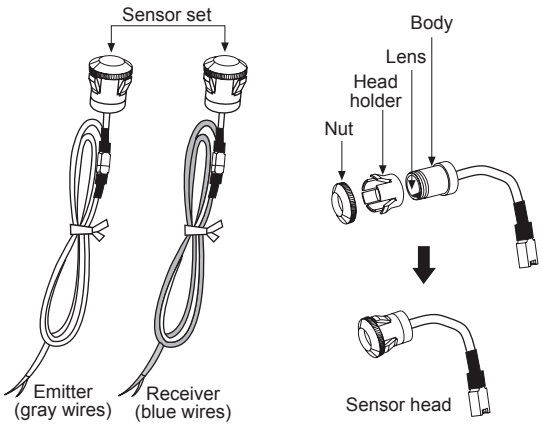
▣ Unit Description

● **Controller (ADS-SEC)**



1. Display LED (red)
2. Display LED (green)
3. Sensitivity setting button
4. Mounting hole
5. Wiring connection button
6. Terminal for power and output (1 to 5)
7. Terminal for emitter/receiver of sensor (6 to 13)

● **Sensor (ADS-SH)**

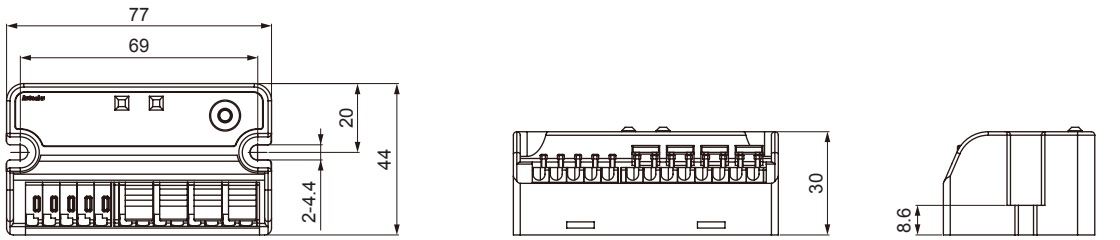


※It is able to use 2 sets of the sensor with this product.
If it is necessary, purchase a set more for using.

▣ Dimensions

(unit: mm)

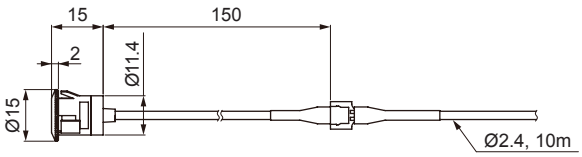
● **Controller (ADS-SEC)**



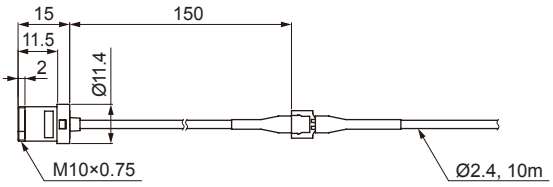
※It is able to purchase a controller (ADS-SEC) separately.

● **Sensors (ADS-SH)**

• **One push type**

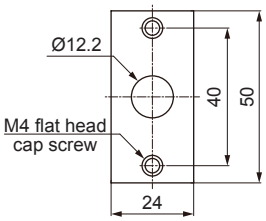


• **Screw type**

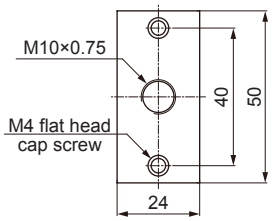


● **Mounting bracket (sold separately)**

• **One push type (ADS-SB12)**



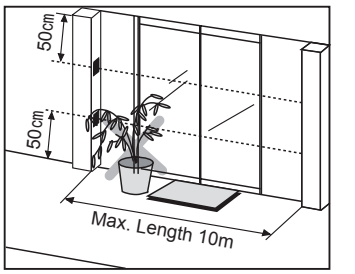
• **Screw type (ADS-SB12)**



▣ Installation

◎ Caution for sensor installation

1. Sensing distance is 10m.
   Install it in the rated distance.
2. Install the sensor with more than 50cm gap from the bottom and ceiling.
   It may cause malfunction by reflected beams from the surface of the bottom and ceiling.
3. Do not put obstacles between the emitter and the receiver.
   It may cause malfunction.
4. This product is for indoor. Avoid the place where exposed in direct sunlight or is in over rated intensity of illumination.



1. Make a hole on the side post of auto door as follows.

● When not using the mounting bracket

• Mounting hole of sensor head: Ø12.2$^{\pm0.1}$mm

• Panel thickness of sensor head: 1.5$^{\pm0.1}$mm

● When using the mounting bracket

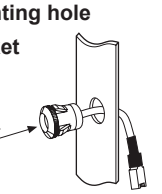
• Through hole of sensor head: Ø13 to Ø14mm

• Screw hole for fixing the bracket: M4 Tap or Ø3.5mm

2. Mount the sensor head in the mounting hole

● When not using the mounting bracket

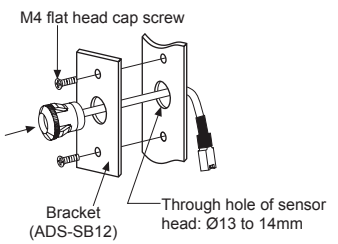
• One push method
Insert the sensor head into the mounting hole like the right picture.



● When using the mounting bracket

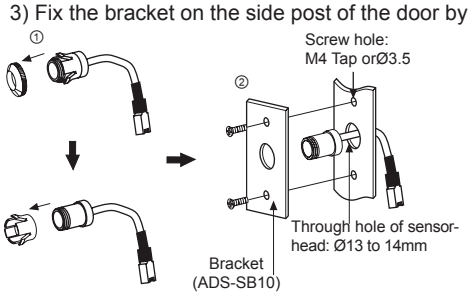
• One push method

1) Install the sensor head at the bracket first.
2) Fix the bracket by screws on the place for installing.



• **Screw method**

1) Remove nuts and the head holder from the sensor head.
2) Install the sensor head on the bracket.
3) Fix the bracket on the side post of the door by screws.



※The mounting bracket is sold separately.
If necessary, please purchase it for using.

⚠ Caution For mounting hole

• Check the mounting holes for the head of the emitter and the receiver are in parallel for the optical axes.
• Grind around the mounting holes drilled smoothly.
It may hurt a person by the sharp part and cause malfunction by sensor head inclined.

⚠ Caution When installing in One push method

• Check the nuts are fixed on the sensor body tightly.
• Install that there is no gap between the nuts and the side of the door (or bracket). It may cause malfunction because sensitivity setting is not available as the optical axes are not matched if sensor body is inclined.

⚠ Caution After installing the sensor head

• Check the damage such as scratches or pollutant on the lens of the sensor head.
It may cause malfunction in the condition of shading light or lack of sensitivity by dust.

⚠ Caution For maintenance and mending

• Keep the sensor head clean.
It may not operate normally.
Clean it by a piece of close with a neutral detergent.
Do not use organic solvent.
It may cause damage to lens of the head by organic solvent.
• Do not wash the head part of the sensor.
Sensor by water, it may cause product damage.

▣ Installation

◎ Controller installation

• Fix controller with the bolts (M4×20, 2pcs). Process the fixing hole of controller by M4 included in the package. Refer to dimension for installation.

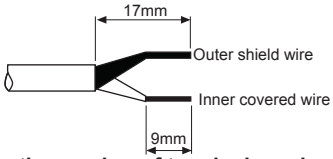
⚠ Warning When fixing controller

• Do not screw the bolts too tightly.
The fixing hole of controller may be broken.

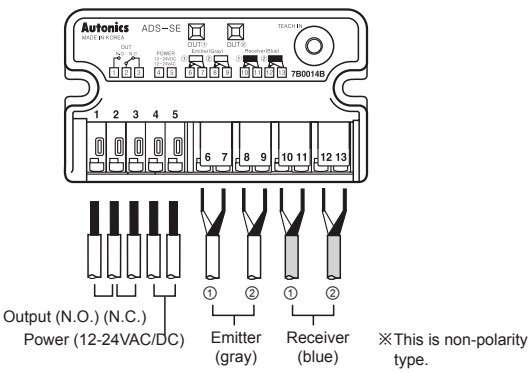
◎ Wiring connection

1. Follow as below when adjusting wiring length.

1) Cut off the wiring length as much as user needs.
2) Connect the wire to the terminal after taking off the wire covering. It is easy to connect if soldering the end of the wires.

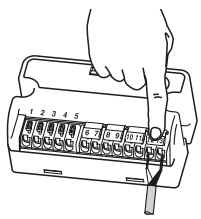


2. Match wires in the number of terminals and connect them.



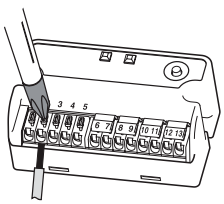
● Connection method for sensor

• Put outer shield and inner covered wires at once, pressing the insert button, then take off from the button.



● Connection method for power and output wires

• Put the wires pressing the terminal ends by a driver etc.



• Allowable diameter of power and output wires
- Single wire: Ø0.12 to 1.6mm² (AWG26 to 16)
- Stranded wire: Ø0.13 to 1.5mm² (AWG26 to 16)

⚠ Warning It may cause electric shock.

• Be sure of connecting wires in power off.

⚠ Caution It may cause damage to this product.

• Follow the left picture when cutting off the wires of sensor head. If the cover of wire is taken off too much, it may cause damage to this product as the end of both wires is shorted.

⚠ Caution Do not extend the wire of sensor head.

• Do not connect extended wire to the wire of sensor head. It may cause malfunction by noise.

⚠ Caution It may cause damage to this product.

• Do not connect two wires or more to a terminal.

⚠ Caution Wiring connection

• It does not operate normally if the wiring is connected conversely.

⚠ Caution It may cause damage to this product.

• Make sure of connecting power wire to the terminal 4, and 5. Otherwise, It may cause damage to this product.

▣ Proper Usage

◎ Sensitivity setting

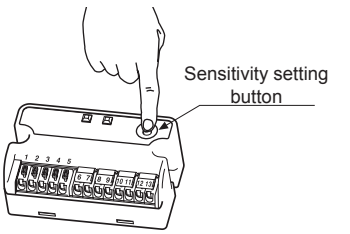
Set sensitivity after mount this product for a normal operation. It sets the optimum sensitivity automatically at the controller according to installed environment.

Order	LED display	Status
Press sensitivity setting button	Red/Green Flashed by turns	Ready
↓	↓	↓
After more than 1sec	Red/Green All LED OFF	The beginning of sensitivity setting
↓	↓	↓
Take off from button	Flashed at once ↓ Displaying operation status	The end of sensitivity setting
Check LED display after setting the sensitivity.		

※When sensitivity setting button is pressed less than 1sec sensitivity setting is cancelled, then it operates by previous setting.

⚠ Caution For mounting hole

- Check the wiring again with the connection diagram.
- When set the sensitivity, the transmitted beam must not be shaken and cut off.
- Do not put obstacles like a pot on the passage of the through beam.
- It may cause malfunction in above cases from lack of sensitivity or abnormal sensitivity setting.



◎ Sensitivity status and check after setting sensitivity

☼: light ON, ◐: flash, ●: light OFF

Connecting sensor	LED display		Status	
	Red	Green	After setting sensitivity	In operation
1set	☼	●	Sensitivity setting success	Received light
	◐	◐	Sensitivity setting failure	Emitter disconnection or sensor cable extention
	◐	●	—	Lack of sensitivity
	●	●	—	Interrupted light
2set	☼	☼	1, 2-channel sensitivity setting success	1, 2-channel received light
	☼	◐	1-channel sensitivity setting success, 2-channel sensitivity setting failure	2-channel lack of sensitivity
	☼	●	—	1-channel received light, 2-channel interrupted light
	◐	☼	1-channel sensitivity setting failure, 2-channel sensitivity setting success	1-channel lack of sensitivity
	●	☼	—	1-channel interrupted light, 2-channel received light
	◐	◐	1, 2-channel sensitivity setting failure	1, 2-channel lack of sensitivity or emitter disconnection
	●	●	—	1, 2-channel interrupted light

● After complete sensitivity setting for using one set of sensor, red LED is flashing, green LED is off and only red LED displays the operation status.

※After complete sensitivity setting in using two sets of sensors, red LED indicates the operation status of receiver set by receiver ① and green LED indicates the operation status of receiver set by receiver ②.

※Self-diagnosis function: If lack of sensitivity occurs by optical axes not matched and pollution by dust on the lens of emitter/receiver etc., the LED of normal operation channel flashes due to unstable operation.

● Check process for sensitivity setting failure

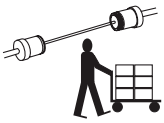
1. Check obstacles between the heads of emitter receiver.
2. Check pollutant on the lens of emitter receiver.
3. Check wires cut off and the connection with the connection diagram on the controller.
4. Check if the head of emitter/receiver is inclined or not.
5. Set sensitivity again after removing above problem.

※When sensitivity setting is failure even though above problem is solved, please contact us.

■ Operation Check

Please check the operation flow chart below.

☼: light ON, ●: light OFF

Operation					
Status		Power OFF	• Normal operation • No human or any material between sensors	Human or material is passing between sensors (When cutting off the transmitted beam)	After human or material is passed
LED display		●	☼ (red/green)	●	☼ (red/green)
Relay output	N.O.	OPEN	OPEN	CLOSE	OPEN
	N.C.	CLOSE	CLOSE	OPEN	CLOSE

■ Troubleshooting

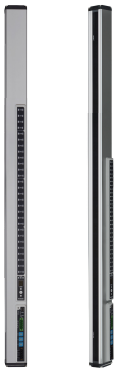
Malfunction	Cause	Troubleshooting
It does not work.	Power voltage	Check the power cable and adjust power voltage.
	Cable disconnection, incorrect connection	Please check wiring and terminal.
	Rated sensing distance	Use it in rated sensing distance.
Sometimes it does not work.	Pollution by pollutant on the lens of Emitter Receiver.	Remove the pollutant.
It is operated even if people does not enter in sensing area.	Rated sensing distance	Use it in rated sensing distance.
	There are obstacles between Emitter and Receiver.	Remove obstacles.
	There is equipment generating strong noise or ratio wave (Motor, Generator, High-tension wire).	Keep away from the equipment generating strong noise or ratio wave.

■ Cautions during Use

1. Follow instructions in 'Cautions during Use'.
   Otherwise, It may cause unexpected accidents.
2. 12-24VDC, 12-24VAC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Use the product, 1 sec after supplying power.
   When using separate power supply for the sensor and load, supply power to sensor first.
4. When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
5. When connecting a DC relay or other inductive load, remove surge by using diodes or varistors.
6. Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
7. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 3
   ④Installation category II

Diffuse Reflective Type Mapping Sensor

▣ Features



- Line-beam method minimizes bad condition of glass substrate detecting and non-detecting area (patent)
- Sensing distance: 95±10mm
- Models according to the orders
  : sensing channels (4 to 62CH), sensing target pitch (min. 20mm), sensing area (280 to 1775mm)
- Communication output models: CC-LINK(ver. 2.0), EtherCAT
- Easy installation with installation guide mode, background sensing mode
- Built-in channel interference error, 5-level sensing level setting, emitter/receiver damage alarm, etc.
- Easy to check status at front, side and long distance with the high-brightness indicators

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

(except EtherCAT model)

▣ Applications

Applications: Detecting display glass on the cassette, etc.

▣ Ordering Information

BWML **20** - **24** **CL** **L** - □ □ / ⬚

Custom order option	**No mark**	No option
	A	Mixed sensing pitch
	Number	Option
CH ordering orientation	**No mark**	Forward (bottom=1CH)
	R	Backward (top=1CH)
External device connection mode	**No mark**	Connector type
	T	Terminal type
Operation mode	**L**	Light ON
	D	Dark ON
Control output	**CL**	CC-LINK communication output
	EC	EtherCAT communication output
Sensing CH	**Number**	4 to 62CH
Sensing target pitch	**Number**	Min. 20mm
Item	**BWML**	Diffuse reflective type Mapping sensor

※⬚ This information is intended for product management of custom order option.
(no need to refer when selecting model)

▣ Specifications

● General specifications

Model		BWML□-□CL□-□□/□	BWML□-□EC□-□□/□
Control output		CC-LINK communication	EtherCAT communication
Sensing type		Diffuse reflective type	
Sensing distance		95mm ±10mm	
Sensing target		Transparent or opaque glass plate	
Sensing area		280 to 1775mm	
Sensing target pitch※1		20mm to ordered specification	
Sensing CH※1		4 to 62CH	
CH ordering orientation		Forward (bottom=1CH) / Backward (top=1CH) (parameter setting)	
Beam pattern		Line beam type	
Power supply		24VDC⎓ (ripple P-P: max. 10%)	
Protection circuit		Reverse polarity protection	
Current consumption		Max. 1.0A	
Operation mode		Light ON/Dark ON (parameter setting)	
Response time		Max. 120ms	
Noise immunity		The square wave noise by the noise simulator (voltage: 500V, period: 10ms, pulse width: 1us)	
Dielectric strength		· Between all power input terminals and F.G. terminal: 500VAC 50/60Hz for 1 min · Between communication input terminals and F.G. terminal: 1000VAC 50/60Hz for 1 min · Between power input terminals and communication input terminals: 1000VAC 50/60Hz for 1 min	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		210m/s^2 (approx. 21G) in each X, Y, Z direction for 3 times	
Environment	Allowable temp.	15 to 35℃, storage: -10 to 50℃	
	Allowable humi.	35 to 55%RH, storage: 35 to 85%RH	
Material		Case: aluminum, sensing part and indicator part: polymethyl methacrylate	
Accessory		Bracket A: 4, bracket B: 4, bolt: 8	
Protection structure		IP40 (IEC standard)	
Approval		CE, KC, CC-LINK	CE
Weight※2		Approx. 4.8kg (approx. 3.64kg) (based on BWML82-20ECL)	

※1: This product is order made.
In case that you want to make an older for the product under 8 channels, please contact us.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

● CC-LINK communication control output

Model	BWML□-□CL□−□□/□	
Version	CC-LINK Ver 1.1	CC-LINK Ver 2.0
Type of Station	Remote Device station	
Extended cyclic	—	1 time (single)
Number of occupied stations	1 station 32 points module, 2 station 64 points module	
Transmission speed	156kbps/625kbps/2.5Mbps/5Mbps/10Mbps	
Max. number of connection※1	42 units	
Number of I/O points	1 station: 32 points (I/O allocation) 2 station: 64 points (I/O allocation)	

※1: The number of connectable units = 16×A+54×B+88×C≤2304
- A: remote I/O station, max. 64 units
- B: remote device station, max. 42 units
- C: local, intelligent station, max. 26 units

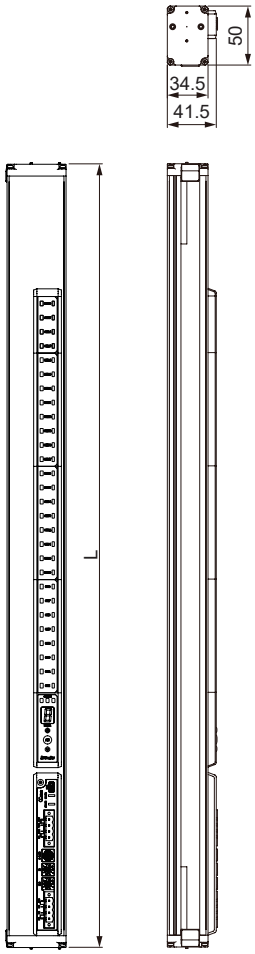
● EtertCAT communication control output

Model	BWML□-□EC□-□□/□
Comm. protocol	EtherCAT protocol
Physical layer	100BASE-TX (IEEE802.3u)
Comm. medium	Over CATEGORY 5/E (must be shield cable)
Connection method	Daisy chain
Transmission speed	100Mbps
Address range	0 to 65535 (16-bit)
Address setting	Software (EtherCAT Master)
Comm. range	Distance between nods: max. 100m

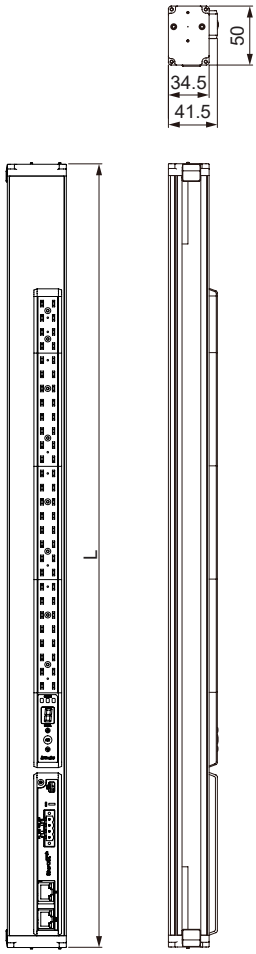
▣ Dimensions

(unit: mm)

◎ **CC-LINK**



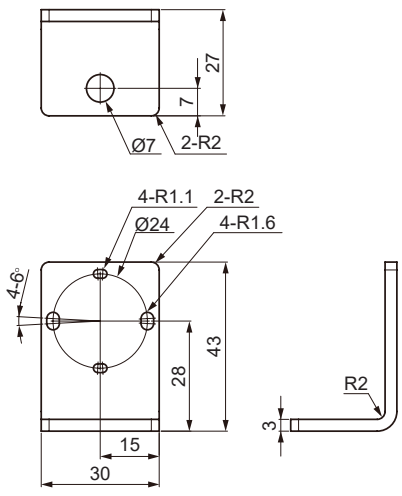
◎ **EtherCAT**



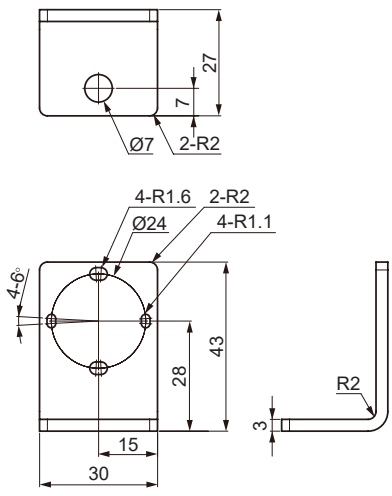
Length of the product (L)	Max. sensing area (mm)
384	280
434	310
484	335
564	460
614	490
664	515
744	640
794	670
844	695
924	820
974	850
1024	875
1104	1000
1154	1030
1204	1055
1284	1180
1334	1210
1384	1235
1464	1360
1514	1390
1564	1415
1644	1540
1694	1570
1744	1595
1824	1720
1874	1750
1924	1775

※Max. sensing area = 20+{sensing target pitch×(the total number of sensing target-1)}

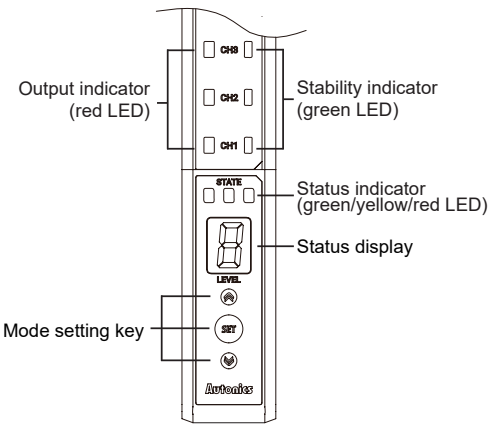
● **Bracket A**

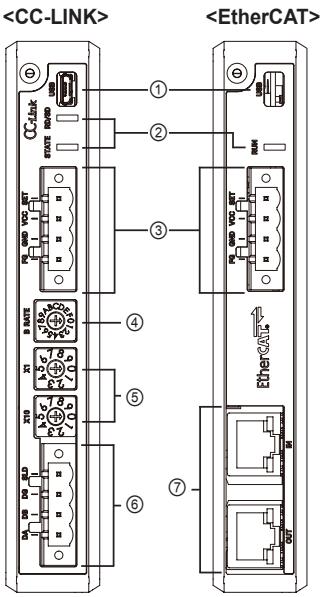


●**Bracket B**



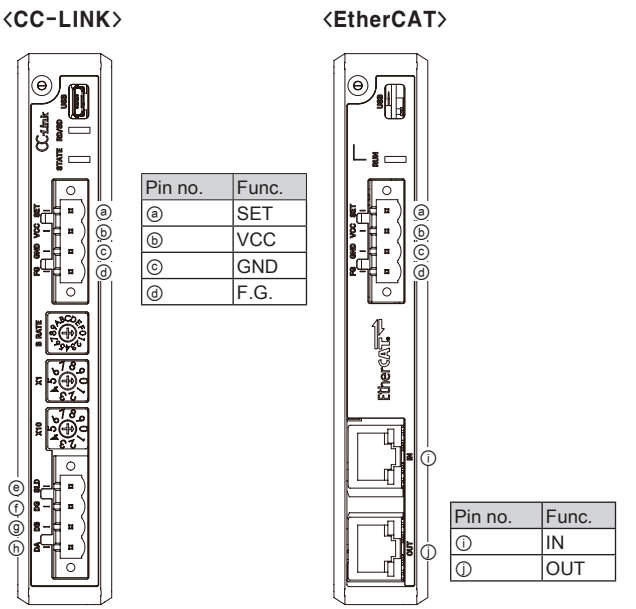
▣ Unit Descriptions





①USB port
: This port is only for firmware upgrade, channel setting, and A/S.
Do not use this port for the another purpose, or the product can malfunction.
②Comm. status indicator: It displays the communication status through LED.
③Power cable connector
④Comm. speed setting switch (B RATE): You can set CC-LINK communication speed.
⑤Comm. address setting switch: You can set CC-LINK address. (×10: 10^1, ×1: 10^0)
⑥CC-LINK comm. connector
⑦EtherCAT comm. input/output connector
: It is with the communication status indicator which turns on or flashes according to the communication status.

▣ Connections

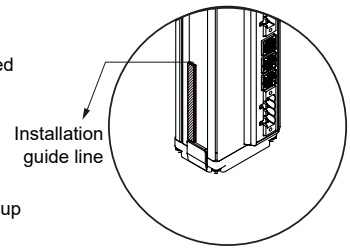


Pin no.	Func.
ⓐ	SET
ⓑ	VCC
ⓒ	GND
ⓓ	F.G.

Pin no.	Cable color	Func.
ⓔ	Yellow	DA
ⓕ	White	DB
ⓖ	Blue	DG
ⓗ	Yellow	SLD (shield)

Pin no.	Func.
ⓘ	IN
ⓙ	OUT

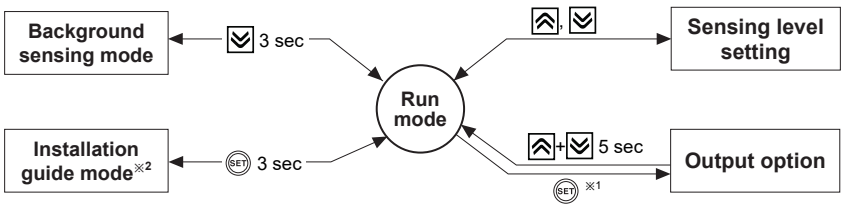
▣ Installation and Adjustment



①Install the product on the right side of the sensing target with the bracket.
②Adjust the height of the product to the place where the first glass of the full cassette is aligned with the installation guide line.
③Supply the power.
④Enter to the background sensing mode to detect background.
If any background object is detected, reinstall the product, changing the installation angle.
⑤Finish installation, when all channels are turned on after placing full cassette.
⑥If all channels are not turned on, enter to the installation guide mode and adjust the product up and down. Return to the run mode and finish installation, when all channels are turned on.

※If there is disturbing light (fluorescent light) near the product, install the product vertically away from the disturbing light (fluorescent light).
※Use the product only for sensing the glass over the 6.5 generation.
If the product is used for sensing the glass under the 6.5 generation, the product can malfunction.

▣ Mode Switching Method



※1: When the status display is ▯, press (SET) key to return to the run mode.
※2: Entering to the installation guide mode and pressing (SET) key starts teaching, and the product returns to the run mode after teaching completed.

▣ CC-LINK Baud Rate and Address Setting

- For CC-LINK setting, communication speed of PLC Master and BWML should be the same.
- Address is available from 1 to 64 and it should not be duplicated.
- When changing CC-LINK setting, turn OFF the power of this unit and re-supply the power.

Setting		Setting range
B RATE	Baud rate	0: 156kbps, 1: 625kbps, 2: 2.5Mbps 3: 5Mbps, 4: 10Mbps, 5 to F: not used
×10, ×1	Address of unit	0: Master, 01 to 64: settable address, 65 to 99: not used E.g.) To set 12 as address, set ×10 to 1 and ×1 to 2.

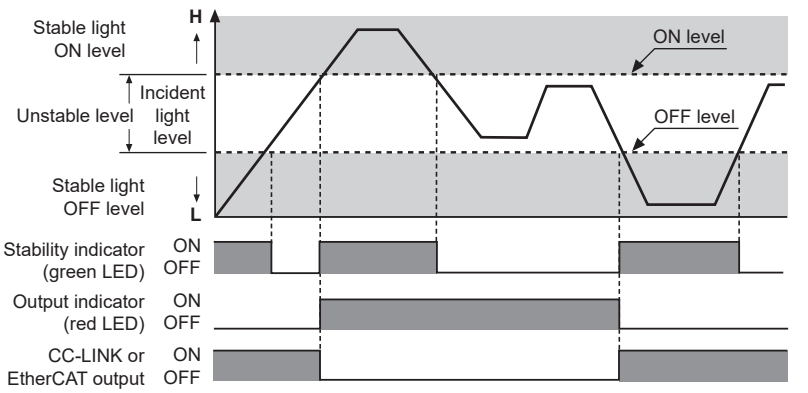
▣ EtherCAT I/O DATA Structure

※HIGH: ON, LOW: OFF for bit status.

1st Word	Description	2nd Word	Description
I/O0 [BIT0]	CH1 status	I/O0 [BIT0]	CH17 status
I/O1 [BIT1]	CH2 status	I/O1 [BIT1]	CH18 status
I/O2 [BIT2]	CH3 status	I/O2 [BIT2]	CH19 status
I/O3 [BIT3]	CH4 status	I/O3 [BIT3]	CH20 status
I/O4 [BIT4]	CH5 status	I/O4 [BIT4]	CH21 status
I/O5 [BIT5]	CH6 status	I/O5 [BIT5]	CH22 status
I/O6 [BIT6]	CH7 status	I/O6 [BIT6]	CH23 status
I/O7 [BIT7]	CH8 status	I/O7 [BIT7]	CH24 status
I/O8 [BIT8]	CH9 status	I/O8 [BIT8]	ERROR output BIT
I/O9 [BIT9]	CH10 status	I/O9 [BIT9]	ALARM output BIT
I/O10 [BIT10]	CH11 status	—	—
I/O11 [BIT11]	CH12 status		
I/O12 [BIT12]	CH13 status		
I/O13 [BIT13]	CH14 status		
I/O14 [BIT14]	CH15 status		
I/O15 [BIT15]	CH16 status		

※Since the above is based on the product of 24 CH, the number of I/O is changeable by product. EtherCAT I/O data structure consists of the number of CH+ERROR output BIT+ALARM output BIt.

▣ Operation Timing Diagram



※The waveforms of 'Operation indicator' and 'CC-LINK or EtherCAT output' are for Light ON.
The waveforms are reversed for Dark ON.

▣ Functions

◎ Background sensing mode

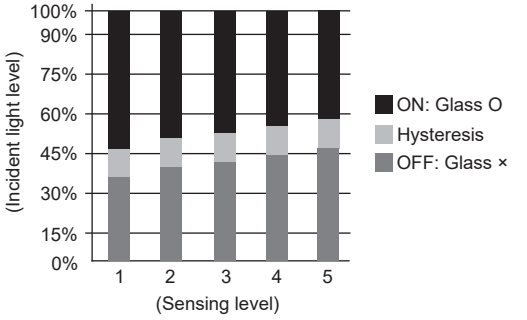
This function instructs adjusting angle to install the product by displaying presence of the background object in the status display when installing the product. Use this function when sensing is unstable due to the reflection from the background object or any obstacle.

◎ Installation guide mode

This function displays whether the sensing target is in the stable position of the guide line when installing the product through the output indicator. Entering installation guide mode and pressing (SET) key starts teaching.

◎ Sensing level setting

This function sets sensitivity by dividing receiving light into 5 levels for stable sensing. Use this function when some of the channels shows low sensing level due to the bent glass plate or diffused reflection. Factory default is level 5.



◎ Output option

After setting output option, press (SET) key to set additional option.

Output option (status display)	Description	Additional option	Output option (status display)	Description	Additional option
0	Returning to operation mode	—	4	Changing error output	A : A point b : B point
1	Status display orientation	F : Forward b : Backward	5	CC-LINK version	1 : Ver 1.1 2 : Ver 2.0
2	Channel ordering		6	CC-LINK station and points	1 : 1 station 32 points 2 : 2 station 64 points
3	Operation mode	L : Light ON d : Dark ON			

◎ Self-diagnosis

This function runs self-diagnose periodically in normal operation and displays the part in error at the status display when error occurs.
- Channel interference alarm: Outputs alarm when interference from another sensing target and external object in a channel area.
- Disturbing light sensing alarm
  : Outputs alarm when the receiver received external light besides light from the emitter.
  When the amount of disturbing light is under the affective level, the product operates normally in disturbing light operation mode.
- Emitter/Receiver damage alarm
  : Outputs alarm when emitter/receiver is damaged due to the long-term usage of emitter/receiver elements or strong impact to the product.

※For more information about operation indication display, refer to **"▣ Operation Indicator"**

▣ Operation Indicator

◎ CH indicator

(☼: light ON, ●: light OFF, ◑: flashing at 0.5 sec interval)

Item	Output indicator (red LED)	Stability indicator (green LED)
Stable light ON	☼	☼
Unstable light ON	☼	●
Unstable light OFF	●	●
Stable light OFF	●	☼

◎ Status indicator

(☼: light ON, ●: light OFF, ◑: flashing at 0.5 sec interval)

Item		Output indicator (red LED)	Stability indicator (green LED)	Status			Status display	Communication output
				Green	Yellow	Red		
Normal operation		—		☼	●	●	Sensing level	—
Background sensing mode	Sensed	ON (all CHs)	OFF (all CHs)	●	●	☼	b	Outputting ON at All CHs, outputting 'H' at N+1
	Not sensed	OFF (all CHs)	ON (all CHs)	☼	●	●		Outputting ON at All CHs
Installation guide mode	Optical axis coinciding CH	ON (LED of the CH)	ON (all CHs)	☼	●	●	n	Outputting ON at All CHs
	Optical axis not coinciding CH	OFF (LED of the CH)		●	◑	●		
	While teaching	OFF (all CHs)		☼	●	●	Flashing t twice	Outputting ON at All CHs
	Teaching passed	Displaying result and flashing all CHs twice		☼	●	●	Flashing t twice	—
	Teaching failed	Flashing alternately passed/failed CH twice		●	◑	●	Flashing E twice	Outputting ON at All CHs, outputting 'H' at N+1
Channel interference error		Flashing alternately relevant CH at 0.5 sec interval	ON (all CHs)	☼	◑	●	—	Outputting ON at All CHs, outputting 'H' at N+1
Disturbing light sensing alarm		Flashing alternately even and odd CH at 0.5 sec interval	ON (all CHs)	◑	☼	☼	—	Outputting alternately even and odd CH, outputting 'H' at N+2
Emitter/ receiver damage alarm※1	Emitter damage	ON (damaged CH)	ON (emitter)	●	◑	☼	b	Outputting 'H' at emitter/receiver damaged CH, outputting 'H' at N+1
	Receiver damage	ON (CH 7, 8)	ON (receiver)					
Comm. error	Product ↔ CH indicator	Flashing at 0.25 sec interval		◑	●	◑	E	Outputting ON at All CHs, outputting 'H' at N+1
	Product ↔ emitter/receiver	Flashing (malfunctioning CH)	ON (CH 1)	●	☼	☼	C	

※1: If emitter and receiver are damaged at the same time, output of receiver is prior to that of emitter, and lower number of channel indicator is turned on. The indicator of damaged channel is flashed at 0.25 second interval.
※N stands for all channel.

◎ Communication suatus indicator

● CC-LINK

Item		Communication status
STATE	RUN	ON (green LED)
RD/SD		OFF
STATE	Error	ON (red LED)
RD/SD		ON (red/green/yellow LED)

● EtherCAT

(☼: light ON, ●: light OFF, ◑: flashing at 0.5 sec interval)

Item		Communication status (green LED)
RUN	Initial status	●
	Pre operation status	Flashing at 200ms interval
	Safe operation status	Repeating 200ms ON and 1000ms OFF
	Operation status	☼
L/A IN, L/A OUT	No connection	●
	Operation status	Flashing at 50ms interval
	Disconnection in operation	☼

▣ Troubleshooting

Malfunction	Cause	Troubleshooting
Not operate	Power	Supply the rated power.
	Cable cut, disconnection	Check the wiring.
Not operate in sometimes	Sensor cover pollution by dirt	Remove dirt by soft brush or cloth and set sensitivity again.
	Connector connection failure	Check the connection area of connector.
Output is ON without a target	Initial sensitivity setting goes wrong	Remove the cause and set sensitivity again.
	There is a strong electric wave or noise generator.	Put away motor, electric generator, or high voltage line.

▣ Proper Usage

1. Follow instructions in 'Proper Usage'.
   Otherwise, it may cause unexpected accidents.
2. 24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Use the product, 1 sec after supplying power.
   When using separate power supply for the sensor and load, supply power to sensor first.
4. When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
5. When connecting a DC relay or other inductive load, remove surge by using diodes or varistors.
6. Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
7. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 2
   ④Installation category II

Through-beam Type Mapping Sensor

■ Features

- Double-scan method increases glass substrate detection stability
- Sensing distance: Glass generation+30%
- Models according to the orders (patent)
  : sensing channels (4 to 62CH), optical axes pitch (min. 25mm)
- Communication output models: CC-LINK(ver. 2.0), EtherCAT
- Easy installation with installation guide mode
- Built-in mutual interference prevention, self-diagnosis function
- Built-in optical axis misalignment alarm, sensing 9-level setting, emitter damage alarm

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

(except EtherCAT model)

■ Applications

Applications: Detecting display glass on the cassette, etc.

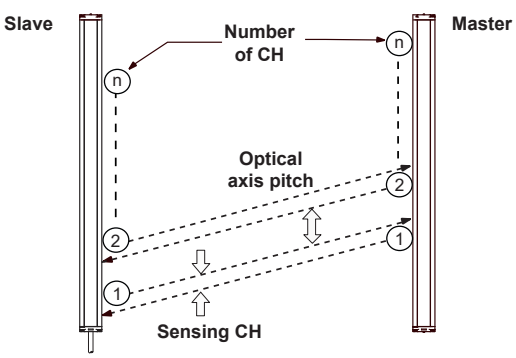
■ Ordering Information

BWM	82	–	24	CL	D	–			/	

Custom order option	**No mark**	No option
	A	Mixed sensing pitch
	Number	Option
CH ordering orientation	**No mark**	Forward (bottom=1CH)
	R	Backward (top=1CH)
External device connection mode	**No mark**	Connector type
	T	Terminal type
Operation mode	**L**	Light ON
	D	Dark ON
Control output	**CL**	CC-LINK communication output
	EC	EtherCAT communication output
Sensing CH※1	**Number**	4 to 62CH
Optical axis pitch※1	**Number**	25 to 200mm
Item	**BWM**	Through-beam type Mapping sensor

※ This information is intended for product management of custom order option.
(no need to refer when selecting model)

■ Number of CH, Optical Axis Pitch, Sensing CH



▣ Specification

● General specifications

Model		BWM□-□CL□-□□/□	BWM□-□EC□-□□/□
Control output		CC-LINK communication output	EtherCAT communication output
Sensing type		Through-beam type	
Sensing distance		Glass ±30%	
Sensing target		Transparent or opaque glass plate	
Optical axes pitch※1		25 to 200mm	
Sensing CH※1		4 to 62CH	
CH ordering orientation※1		Forward (bottom=1CH) / Backward (top=1CH)	
Beam pattern		Double scan type	
Power supply		24VDC⎓ (ripple P-P: max. 10%)	
Synchronization type		Synchronized by synchronous cable	
Protection circuit		Reverse polarity protection circuit	
Current consumption		Master: max. 200mA, slave: max. 150mA	
Operation mode※1		Light ON/Dark ON	
Response time		Max. 120ms	
Light source		Infrared LED (850nm modulated)	
Noise immunity		The square wave noise by the noise simulator (voltage: 500V, period: 10ms, pulse width: 1us)	
Dielectric strength		Between all power input terminals and F.G. terminal: 500VAC 50/60Hz for 1 min Between communication input terminals and F.G. terminal: 1000VAC 50/60Hz for 1 min Between power input terminals and communication input terminals: 1000VAC 50/60Hz for 1 min	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		210m/s^2 (approx. 21G) in each X, Y, Z direction for 3 times	
Environment	Allowable illum.	Max. 5,000lx of light bulb or semiconductor	
	Allowable temp.	15 to 35℃, storage: 15 to 35℃	
	Allowable humi.	35 to 85%RH, storage: 35 to 85%RH	
Material		Case: aluminum, sensing part and Indicator part: polymethyl methacrylate	
Connector	Connector type	4-pin, 6-pin connector (5.08mm pitch)	4-pin connector (5.08mm pitch)
	Terminal type	10-pin terminal	4-pin terminal
Cable		Ø5mm, 6-wire, 250mm, M17 connector	
Accessory		Bracket A: 4, bracket B: 4, bolt: 8	
Approval		CE, KC, CC-LINK	CE
Weight※2		Approx. 5.3kg (approx. 3.2kg) (based on BWM82-24CLD-T)	Approx 5.52kg (approx 3.42kg) (based on BWM28-50ECD-T)

※1: This product is order made.
In case that you want to make an older for the product under 8 channels, please contact us.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

● CC-LINK communication output

Model	BWM□-□CL□-□□/□	
Version	CC-LINK Ver 1.1	CC-LINK Ver 2.0
Type of station	Remote Device Station	
Extented cyclic	—	1 time (single)
Number of occupied stations	1 station 32-point module, 2 station 64-point module	
Transmission speed	156kbps/625kbps/2.5Mbps/ 5Mbps/10Mbps	
Max. number of connection※2	42-unit	
Number of I/O points	1 station: 32-point (I/O allocation), 2 station: 64-point (I/O allocation)	

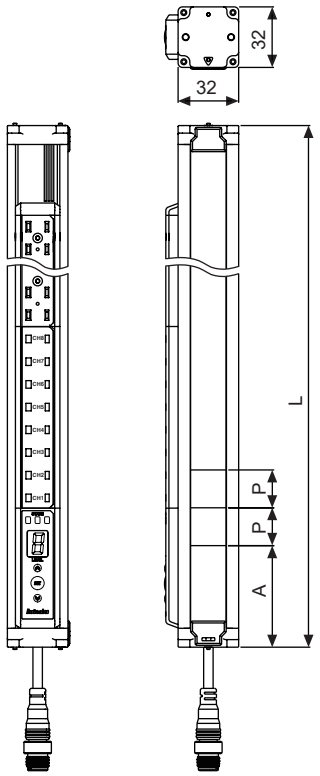
※1: The number of connectable units = 16×A+54×B+88×C≤2304
- A: remote I/O station, max. 64 units
- B: remote device station, max. 42 units
- C: local, intelligent station, max. 26 units

● EtherCAT communication output

Model	BWM□-□EC□-□□/□
Comm. protocol	EtherCAT protocol
Physical layer	100BASE-TX (IEEE 802.3u)
Comm. medium	Over CATEGORY 5/E (must be shield cable)
Connection method	Daisy chain
Transmission speed	100Mbps
Address range	0 to 65535 (16-bit)
Address setting	Software (EtherCAT Master)
Comm. range	Distance between nods: max. 100M

▣ Dimensions

<Slave>



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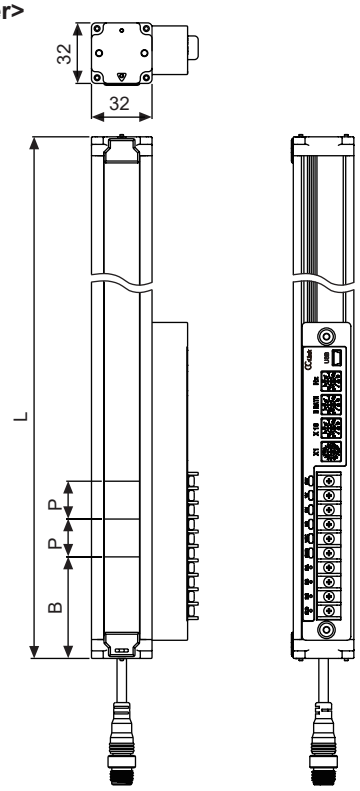
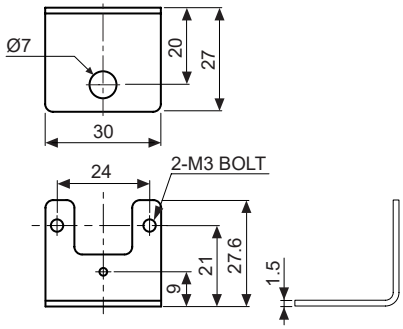
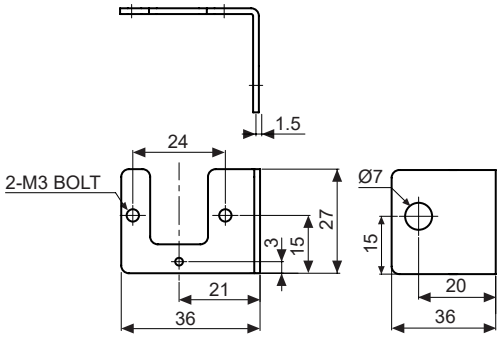


※Length of the product can be different by its ordered specification. Refer to the followings.
length of the product (L) = 105+{optical axis pitch (P)×(sensing CH-1)}
A: 45 to 65mm, B: 65 to 85mm

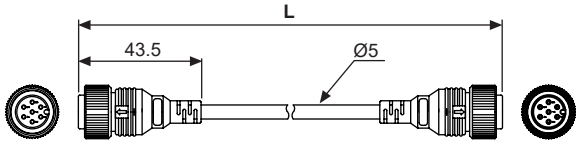
● **Bracket A**



● **Bracket B**



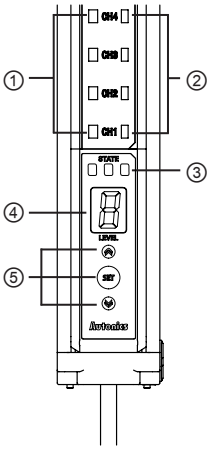
▣ Connection Cable (sold separately)



Model	L
C5D617-7P	7m
C5D617-10P	10m
C5D617-15P	15m

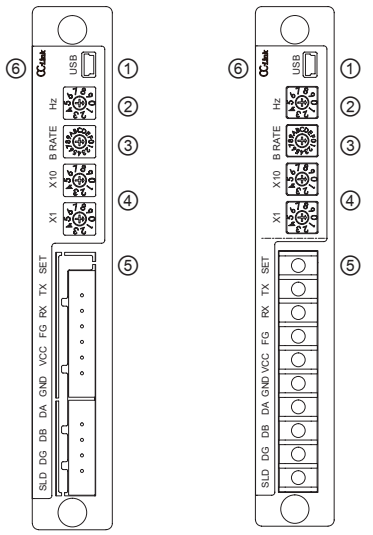
▣ Unit Description

◎ Slave



①Output indicator (red LED)
②Stability indicator (green LED)
③Status indicator (green/yellow/red LED)
④Status display
⑤Mode setting key

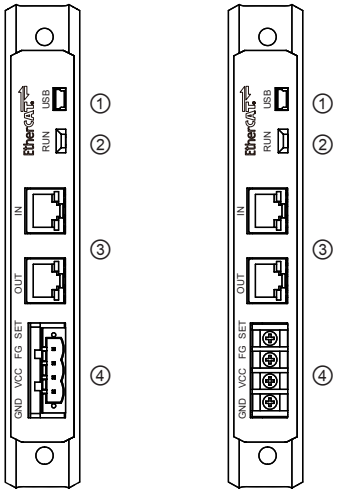
◎ CC-LINK Master



Connector type　　Terminal type

①USB port
: This port is only for firmware upgrade, run mode change, and A/S. Do not use this port for the another purpose, or the product can malfunction.
②Frequency setting switch (Hz)
: This switch is for setting mutual interference prevention function.
③Comm. speed setting switch (B RATE)
: You can set CC-LINK communication speed.
④Comm. address setting switch
: You can set CC-LINK address. (×10: 10^1, ×1: 10^0)
⑤Output part
- connector type: 4-pin/6-pin connector, terminal type: 10-pin terminal
⑥Comm. status indicator
: It displays the communication status through LED.

◎ EtherCAT Master

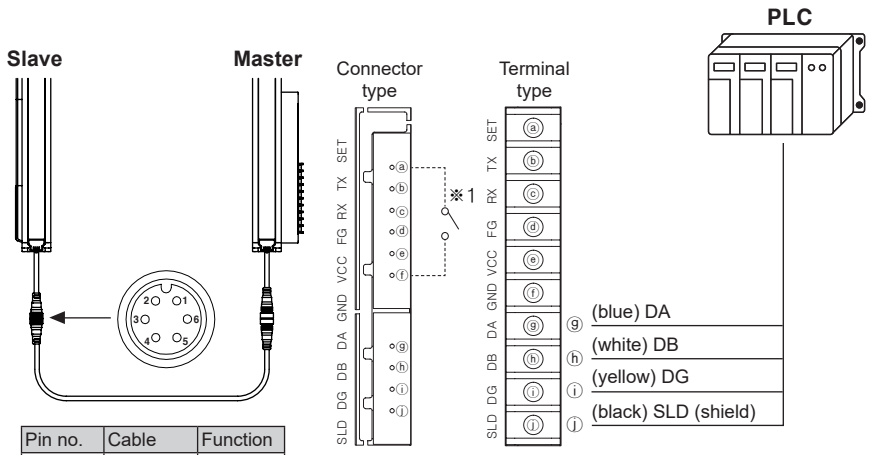


Connector type　　Terminal type

①USB port
: This port is only for firmware upgrade, run mode change, and A/S. Do not use this port for the another purpose, or the product can malfunction.
②Comm. status indicator
: It displays the communication status through LED.
③EtherCAT comm. input/output connector
: It is with the communication status indicator which turns on or flashes according to the communication status.
④Power and synchronous cable terminal

▣ Connections

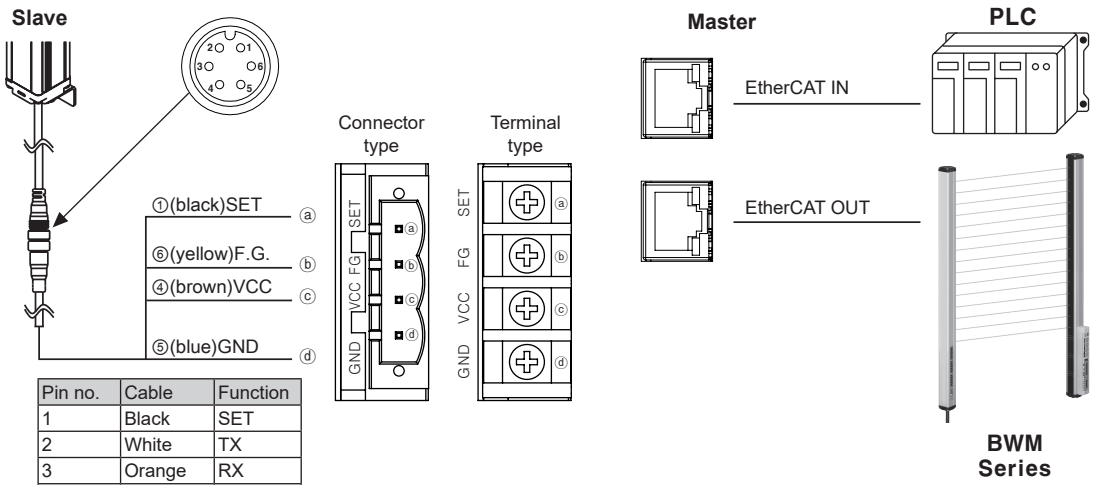
◎ CC-LINK communication output



Pin no.	Cable	Function
1	Black	SET
2	White	TX
3	Orange	RX
4	Brown	+V
5	Blue	-V
6	Yellow	F.G.

※1: Instead of (SET) key, you can use SET, GND terminal for teaching from external signal.

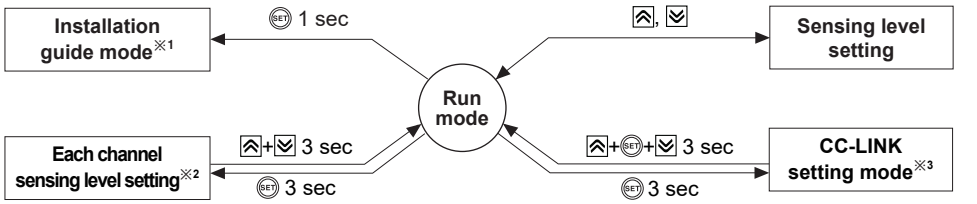
◎ EtherCAT communication output



Pin no.	Cable	Function
1	Black	SET
2	White	TX
3	Orange	RX
4	Brown	+V
5	Blue	-V
6	Yellow	F.G.

※1: Instead of (SET) key, you can use SET, GND terminal for teaching from external signal.

■ Mode Switching Method



※1: Entering to the installation guide mode and pressing SET key for 3 seconds starts teaching, and the product returns to the run mode after teaching completed.
※2: When the status display is d, select channel to change using ▲, ▼ key and press SET key.
When number of channel is flashing, set sensing level using ▲, ▼ key.
※3: Only for CC-LINK communication output model.

■ CC-LINK Baud Rate and Address Setting

- For CC-LINK setting, communication speed of PLC Master and BWM should be the same.
- Address is available from 1 to 64 and it should not be duplicated.
- When changing CC-LINK setting, turn OFF the power of this unit and re-supply it.
- Press ▲+SET+▼ key in the run mode and enter to the CC-LINK setting mode to set the version and the number of occupied station.
  The number of occupied station: status display 5, 1(station 1), 2(station 2)
  Version: status display C, 1(version 1.1), 2(version 2.0)

Setting		Setting range
B RATE	Baud rate	0: 156kbps, 1: 625kbps, 2: 2.5Mbps 3: 5Mbps, 4: 10Mbps, 5 to F: not used
×10, ×1	Address of unit	0: master, 1 to 64: settable address, 65 to 99: not used E.g.) To set 12 as address, set ×10 to 1 and ×1 to 2.

■ EtherCAT I/O DATA Structure

※HIGH: ON, LOW: OFF for bit status.

1st Word	Description	2nd Word	Description
I/O0 [BIT0]	CH1 status	I/O0 [BIT0]	CH17 status
I/O1 [BIT1]	CH2 status	I/O1 [BIT1]	CH18 status
I/O2 [BIT2]	CH3 status	I/O2 [BIT2]	CH19 status
I/O3 [BIT3]	CH4 status	I/O3 [BIT3]	CH20 status
I/O4 [BIT4]	CH5 status	I/O4 [BIT4]	CH21 status
I/O5 [BIT5]	CH6 status	I/O5 [BIT5]	CH22 status
I/O6 [BIT6]	CH7 status	I/O6 [BIT6]	CH23 status
I/O7 [BIT7]	CH8 status	I/O7 [BIT7]	CH24 status
I/O8 [BIT8]	CH9 status	I/O8 [BIT8]	ERROR output BIT
I/O9 [BIT9]	CH10 status	I/O9 [BIT9]	ALARM output BIT
I/O10 [BIT10]	CH11 status	—	—
I/O11 [BIT11]	CH12 status		
I/O12 [BIT12]	CH13 status		
I/O13 [BIT13]	CH14 status		
I/O14 [BIT14]	CH15 status		
I/O15 [BIT15]	CH16 status		

※Since the above is based on the product of 24 CH, the number of I/O is changeable by product.
EtherCAT I/O data structure consists of the number of CH+ERROR output BIT+ALARM output BIt.

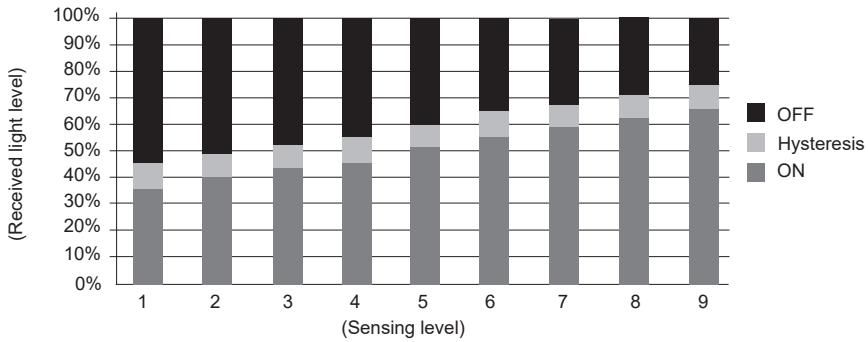
▣ Function

● Installation guide mode

This function displays whether the sensing target is in the stable position of the guide line when installing the product through the output indicator. Entering installation guide mode and pressing (SET) key starts teaching.
When teaching, this function detects channels with unstable received light level and adjust received light level of all channels to the same level.

● Sensing level setting

This function sets sensitivity by dividing received light into 9 levels for stable sensing. Use this function when some of the channels shows low sensing level due to the bent glass plate or
diffused reflection. Factory default is level 5.
※You can change sensing level of each channel separately in the each channel sensing level setting mode. When using the sensing level setting function after setting each channel sensing level using the each channel sensing level setting mode, sensing level settings of each channel are reset.



● Mutual interference prevention

When installing over 2 sensors closely, set the each frequency by the switch for frequency setting to prevent malfunction from mutual interference.

Mark	Freq.	Mark	Freq.
0	A	3	D
1	B	4 to 9	Not used
2	C		

● Optical axis misalignment alarm (low light intensity alarm)

Emitted light level can be reduced due to warped product or long-term usage.
When nothing is detected during operation, this function checks received light level and outputs alarm at 'OFF level+approx. 3%' of received light level. Emitted light level is returned to the normal level with teaching.

● Emitter damage alarm

Outputs alarm when emitter is damaged due to the long-term usage of emitter elements or strong impact to the product.

● Self-diagnosis function

Mapping sensor is able to self-diagnose periodically in normal operation. If error occurs, status indicator displays in which part error occurs.
· Malfunction of synchronous line: If there is malfunction of synchronous line, it displays error and outputs signal.

※For more information about operation indication display, refer to "▣ **Operation Indicator**"

▣ Operation Indicator

◎ [Slave] CH indicator

(☼: light ON, ●: light OFF, ◑: flashing at 0.5 sec interval)

Item	Output (red LED)	Stability (green LED)	Item	Output (red LED)	Stability (green LED)
Stable light ON	●	☼	Stable light OFF	☼	☼
Unstable light ON	●	●	Unstable light OFF	☼	●
Teaching error	◑	◑			

◎ [Slave] Status indicator

(☼: light ON, ●: light OFF, ◑: flashing at 0.5 sec interval)

Item		CH indicator※1	Status display	Status			CC-LINK, EtherCAT output
				green	yellow	red	
Normal operation		—	Sensing level	☼	●	●	—
Teaching error		Flashing (error channel)	—	●	◑	●	Outputting H at relevant CH, N+1
Malfunction of synchronous cable (communication error)		Flashing (all LED)	0 to 9 or C	◑	◑	◑	Outputting H at N+1, Outputting H or L at N+2
Emitter damage		Flashing at 0.25 sec interval (LED of the CH)	n	◑	●	◑	Outputting H at 1 to N+1
Installation guide mode	Coinciding all CHs optical axis	Flashing (all CHs)	n	☼	●	●	Outputting H at all CHs
	Optical axis coinciding CH	Flashing (LED of the CH)		●	◑	●	
	Optical axis not coinciding CH	OFF (LED of the CH)		●	◑	●	
Teaching	Coinciding all CHs optical axis	ON (all CHs)	t	☼	●	◑	
	Optical axis coinciding CH	ON (LED of the CH)		●	◑	◑	
	Optical axis not coinciding CH	OFF (LED of the CH)		●	◑	◑	
Optical axis misalignment alarm		—	—	◑	☼	◑	Outputting H at N+2
Individual optical axis controlling mode		Flashing (relevant CH)	0 to 9	●	☼	☼	—
CC-LINK setting change※2	No. of occupied station	Flashing (CH 1)	S	●	☼	☼	all CHs, Outputting N+1
	Version	Flashing (CH 2)	C	●	☼	☼	

※1: Except normal operation, stability indicator (green) stands for the master and output indicator (red) stands for the slave.
※2: Only for CC-LINK communication output model.
※N stands for all channel.

◎ [Master] Communication status indicator (CC-LINK)

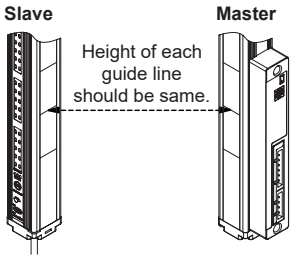
Item	Communication status
Connected status	Simultaneous ON (green, red LED)
Pre connection status	ON (green LED)
Error	ON (red LED)

◎ [Master] Communication status indicator (EtherCAT)

Item		Communication status (green LED)
RUN	Initial status	OFF
	Pre operation status	Flashing at 200ms interval
	Safe operation status	Repeating 200ms ON and 1000ms OFF
	Operation status	ON
L/A IN, L/A OUT	No connection	OFF
	Operation status	Flashing at 50ms interval
	Disconnection in operation	ON

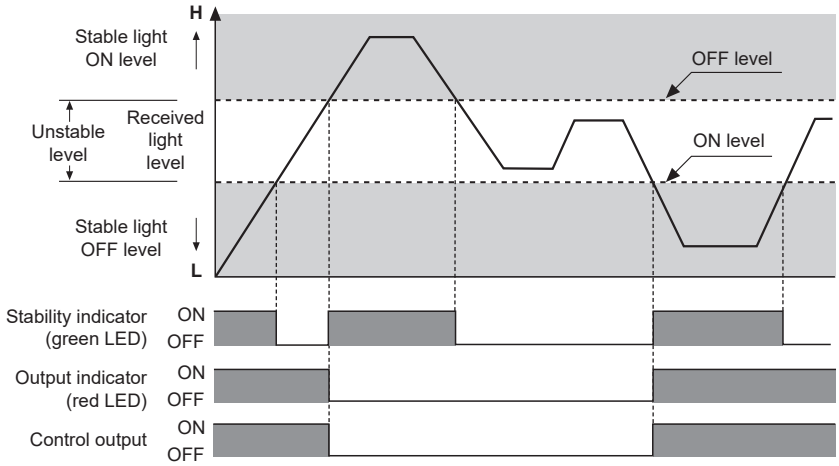
■ Installation and Adjustment

① Mount Master and Slave to face each other.
② Place a glass plate at the guide line and adjust sensor height.
③ Touch (SET) key of Slave once without a glass plate and it enters installation guide mode. (Shorting SET (gray) and GND (blue) has same function.)
④ Adjust Master and Slave up/down/right/left, and check the place where output/stability indicators flash (displaying coincidence of optical axes of all CHs) and status indicator lights ON. Fix them at this place by tightening screws (tightening torque: 0.39 to 0.49 N·m).
⑤ Pressing (SET) key for over 3 sec completes teaching and operates the device in RUN mode.



※If optical axis are not coincident, yellow LED of the status indicator flashes at 0.5 sec interval, and output indicator (red, slave) and stable indicator (green, master) flash at 0.5 sec interval. Please re-adjust the position of Master and Slave and execute teaching again.
※Avoid using the unit in the place where the sensor is exposed directly to the fluorescent light with high speed start or high frequency.

■ Operation Timing Diagram



※The waveforms of 'Operation indicator' and 'Control output' are for Dark ON. The waveforms are reversed for Light ON.

■ Troubleshooting

Malfunction	Cause	Troubleshooting
Not operate	Power	Supply the rated power.
	Cable cut, disconnection	Check the wiring.
Not operate in sometimes	Sensor cover pollution by dirt	Remove dirt by soft brush or cloth and set sensitivity again.
	Connector connection failure	Check the connection area of connector.
Output is ON without a target	Initial sensitivity setting goes wrong	Remove the cause and set sensitivity again.
	There is a strong electric wave or noise generator.	Put away motor, electric generator, or high voltage line.

■ Proper Usage

1. Follow instructions in 'Proper Usage'.
   Otherwise, it may cause unexpected accidents.
2. 24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Use the product, 1 sec after supplying power.
   When using separate power supply for the sensor and load, supply power to sensor first.
4. When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
5. When connecting a DC relay or other inductive load, remove surge by using diodes or varistors.
6. Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
7. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 2
   ④Installation category II

Cross-Beam Area Sensor

■ Features

Shaded parts (▬) are changed and added functions from previous BWC Series.

- Minimized blind zone with 3-point cross-beam netting method
- Long sensing distance: 1 to 7m
- 14 types of model
  : wide range of choice in the number of optical axis (4 to 20), pitch of optical axis (40, 80mm), and sensing width (120 to 1,040mm)
- Easy installation with installation mode
- Built-in interference protection, self-diagnosis function
- Self-diagnosis output
  : sensing front screen contamination and covering optical axis by itself, making easy to see the status from external equipment (patent)
- Conspicuous high luminance indicators at emitter/receiver for easy check of the status from side, front even long distance
- Suitable for KRS Korean Railway Srandard (BWC80-14HD meets KRS conditions.)
- Protection structure IP67 (IEC structure)

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

(only for BWC80-14HD model)

■ Applications

Various environment:
Utilized in various environment: obstacle detecting sensor for subway platform screen door (PSD), and etc.

■ Ordering Information

BWC **40** − **14** **H**

Operation mode	H	Light ON
	HD	Dark ON
Number of optical axes	Number	4 to 20
Optical axis pitch	40	40mm pitch
	80	80mm pitch
Item	BWC	Cross-beam area sensor

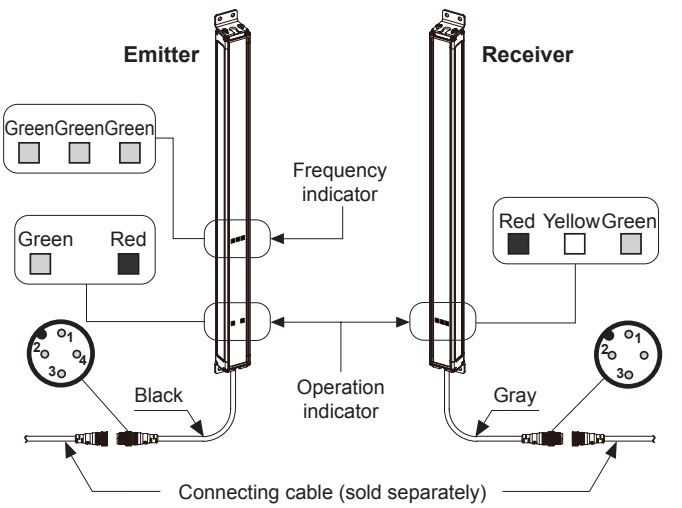
■ Specifications

Model	BWC40-□□H	BWC40-□□HD	BWC80-14H	BWC80-14HD
Sensing type	Through-beam type			
Sensing distance	1.0 to 7.0m			
Sensing target	Opaque material of min. Ø50mm		Opaque material of min. Ø90mm	
Optical axis pitch	40mm		80mm	
Number of optical axes	4/10/12/16/18/20		14	
Sensing height	120 to 760mm		1,040mm	
Beam pattern	3-point cross-beam netting type			
Response time	Max. 50ms			
Power supply	12-24VDC⎓ ±10% (ripple P-P: max. 10%)			
Current consumption	Max. 100mA			
Light source	Infrared LED (850nm modulated)			
Operation mode	Light ON	Dark ON	Light ON	Dark ON
Control output	NPN open collector output • Load voltage: max. 30VDC⎓ • Load current: max. 100mA (self-diagnosis output: max 50mA) • Residual voltage: max. 1VDC⎓			
Protection circuit	Reverse power polarity, output short over current protection circuit			
Insulation resistance	Over 20MΩ (at 500VDC megger)			
Synchronization type	Timing method by synchronous cable			
Self-diagnosis	Transmitted-received light monitoring, direct light monitoring, output circuit monitoring, self-diagnosis output (checking whether there is contamination on the front screen, or any obstacle on optical axis)			
Interference protection	Interference protection by frequency changing setting			
Noise immunity	±240V the square wave noise (pulse width: 1μs) by the noise simulation			
Dielectric strength	1,000VAC 50/60Hz for 1 min			
Vibration	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			

Model		BWC40-□□H	BWC40-□□HD	BWC80-14H	BWC80-14HD
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Ambient light: max. 100,000lx (received light side illumination)			
	Ambient temperature	-10 to 55℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP65 (IEC standard)			
Material		Case: Aluminum, sensing part and indicator: Acrylic			
Cable		Ø5mm, 4-wire, 300mm, M12 connector			
Accessory		Bracket A: 4, Bracket B: 4, Fixing bolt: 8			
Korean Railway Standards		—			KRS SG 0068
Approval		CE			CE, KC
Weight※1		Approx. 2.1kg (approx. 1.7kg) (based on BWC80-14H)			

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Structure



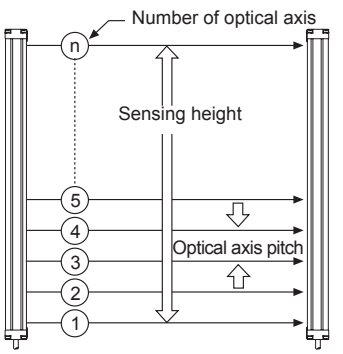
< Operation indicator>

LED color	Emitter	Receiver
Green	Power	Stable light ON
Yellow	—	Unstable area
Red	Installation mode	Stable light OFF

<Wiring connection>

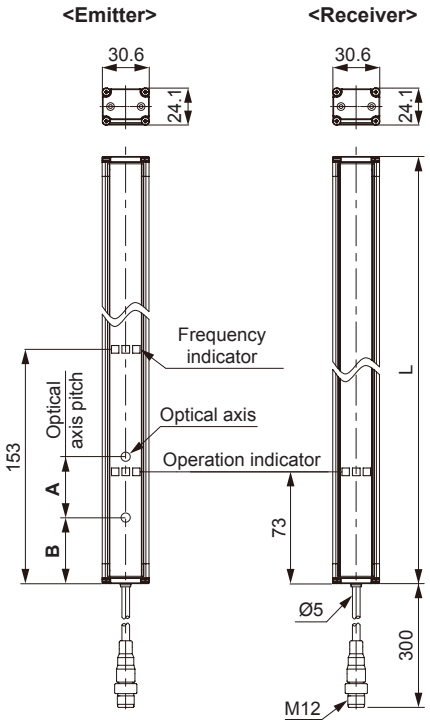
Pin No	Cable color	Emitter	Receiver
1	Brown	12-24VDC	12-24VDC
2	White	Sync	Sync
3	Blue	0V	0V
4	Black	Mode	OUT

■ Optical Axis Pitch/Number Of Optical Axis/Sensing Height



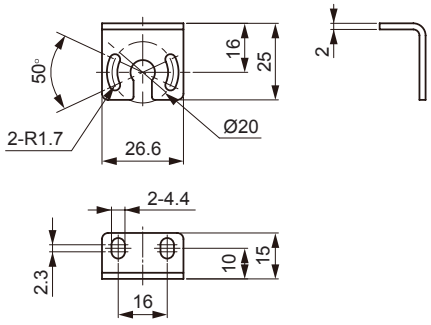
Model	Number of optical axis	Sensing height	Optical axis pitch
BWC40-04H/HD	4	120mm	40mm
BWC40-10H/HD	10	360mm	
BWC40-12H/HD	12	440mm	
BWC40-16H/HD	16	600mm	
BWC40-18H/HD	18	680mm	
BWC40-20H/HD	20	760mm	
BWC80-14H/HD	14	1,040mm	80mm

▣ Dimensions

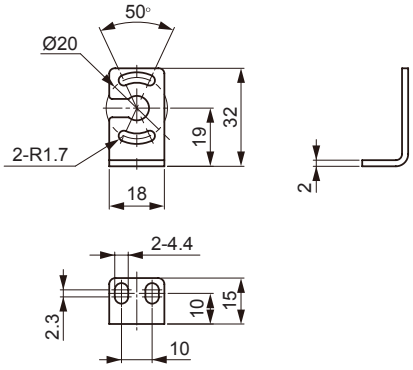


Model	L	A, B
BWC40-04H/HD	160	40
BWC40-10H/HD	400	
BWC40-12H/HD	480	
BWC40-16H/HD	640	
BWC40-18H/HD	720	
BWC40-20H/HD	800	
BWC80-14H/HD	1120	80

● **Bracket A**

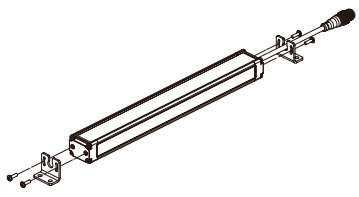


●**Bracket B**

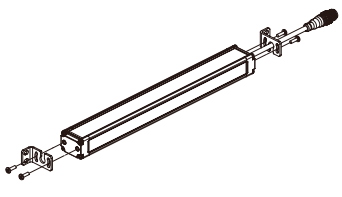


▣ Bracket Mounting

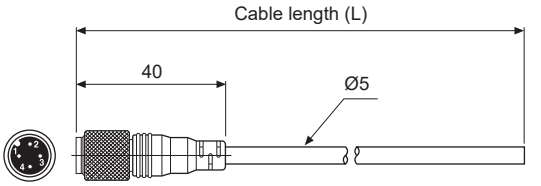
● **Mounting the bracket A**



● **Mounting the bracket B**



■ Connection Cable (sold separately)



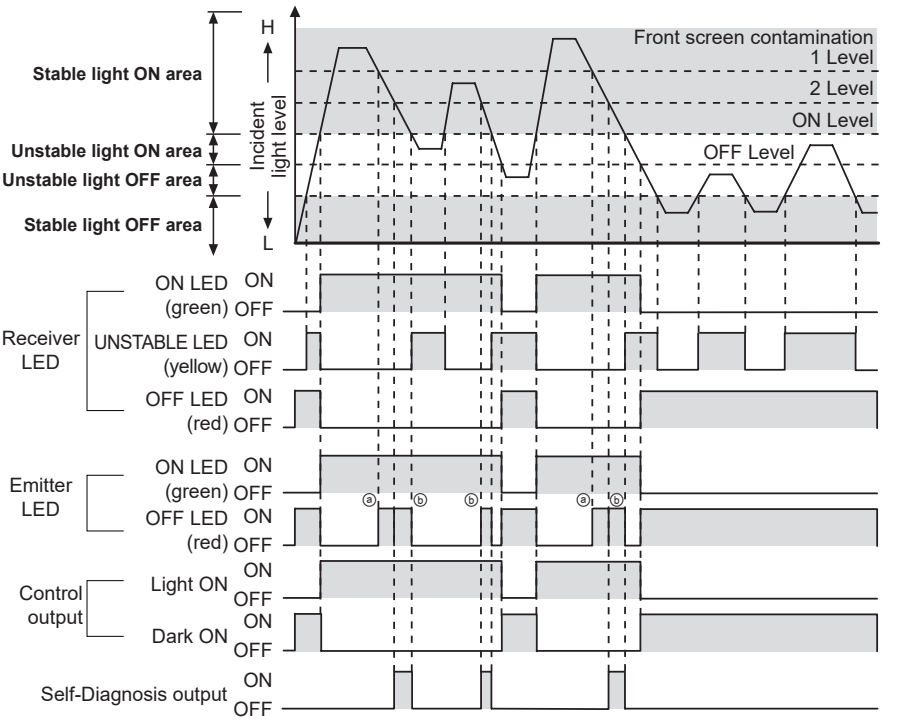
※Connection cable is sold separately as one set; each of emitter's and receiver's.

Type	Model	L	Cable color
Emitter	CID4-3T	3m	Black
	CID4-5T	5m	
	CID4-7T	7m	
	CID4-10T	10m	
	CID4-15T	15m	
Receiver	CID4-3R	3m	Gray
	CID4-5R	5m	
	CID4-7R	7m	
	CID4-10R	10m	
	CID4-15R	15m	

■ Operation Mode

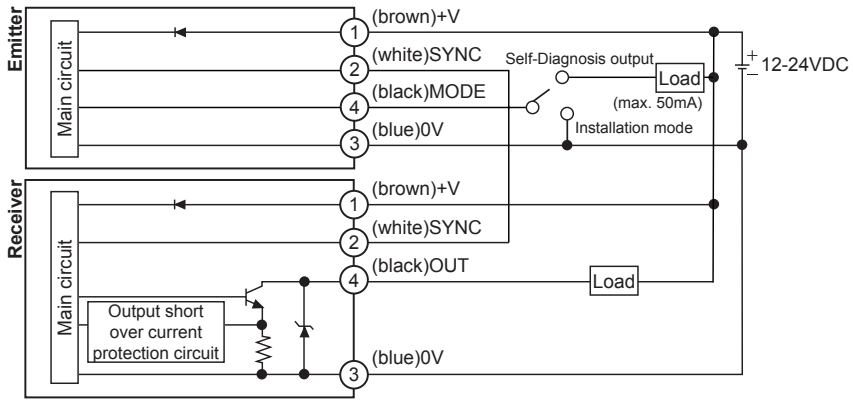
Operation mode	Light ON	Dark ON
Receiver	Received light Interrupted light	Received light Interrupted light
Operation indicator (green LED)	ON OFF	ON OFF
Transistor output	ON OFF	ON OFF

■ Operation Timing Diagram



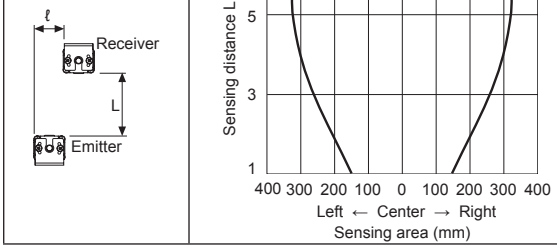
※ⓐ: [Self-diagnosis output] Front screen contamination level 1 / flashing at 1 sec interval
ⓑ: [Self-diagnosis output] Front screen contamination level 2, covering optical axis / flashing at 0.25 sec interval

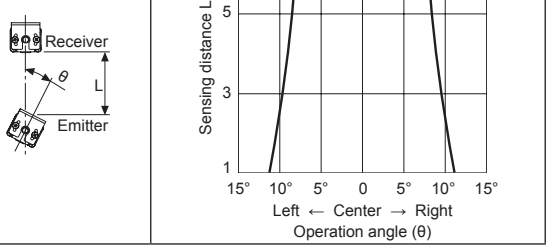
▣ Control Output Circuit



▣ Feature Data

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data





▣ Functions

◎ Interference protection

You can change transmitted light frequency to prevent interference from several units.
To change transmitted light frequency, input 0V for over 1 second to 4th terminal, (black) MODE, in installation mode.
Frequency type is displayed by frequency indicator.

☼: ON, ●: OFF

Transmitted light frequency	Frequency indicator		
	Green 1	Green 2	Green 3
Frequency A	☼	●	●
Frequency B	●	☼	●
Frequency C	●	●	☼
Frequency D	☼	●	☼
Frequency E	☼	☼	☼

◎ Installation mode

This function is for stable installation.
Inputting 0V to 4th terminal of emitter which is (black) MODE, supply power to the product to enter to the installation mode.

◎ Self-Diagnosis Output

This function outputs self-diagnosis signal, when front screen is contaminated with dust, optical axis is misaligned due to vibration, emitter is damaged due to the long-term usage, or light t is not received due to obstacle such as leaves and trash on the product. It operates in the operation mode, and you can check the status through an external device which is connected to 4th terminal of emitter, (black) MODE.

Item	Emitter operation indicator	Control output		Self-diagnosis output
		Light ON	Dark ON	
Front screen contamination level 1	Red, flashing at 1 sec interval	ON	OFF	OFF
Front screen contamination level 2, covering optical axis	Red, flashing at 0.25 sec interval	ON	OFF	ON

◎ Self-diagnosis

If there is checked malfunction during normal operation by regular self-diagnosis, control output turns OFF and operation indicator displays the state.

● Diagnosis item

① Break of light emitting element
② Break of emitter
③ Break of adjacent emitting element more than 2.
④ Break of receiver
⑤ Emitter failure
⑥ Receiver failure
⑦ Malfunction of synchronous cable

※For more information about operation indication display, refer to "▣ **Operation Indicator**"

▣ Operation Indicator

Item		Emitter		Receiver				
		Indicator		Indicator			Control output	
		Green	Red	Green	Yellow	Red	Light ON	Dark ON
Power supply		☼	●	—	—	—	—	—
Break of emitter		◑◑	◐◐	—	—	—	—	—
Break of light emitting element		◑	◐	◑	◑	◑	OFF	OFF
Break of adjacent emitting element more than 2.		◑	◑	◑	◑	◑	OFF	OFF
Installation mode	Normal installation	☼	◑	☼	●	◑	OFF	OFF
	Hysterisis section	●	◑	●	☼	◑		
	Abnormal installation	●	◑	●	●	◑		
Stable light ON		☼	●	☼	●	●	ON	OFF
Unstable light ON		☼	●	☼	☼	●	ON	OFF
Unstable light OFF		●	☼	●	☼	☼	OFF	ON
Stable light OFF		●	☼	●	●	☼	OFF	ON
Break of receiver		—	—	◑◑	●	◐◐	OFF	OFF
Control output over current		—	—	◑	◐	☼	OFF	OFF
Synchronous line malfunction		—	—	◑	●	◑	OFF	OFF
Emitter failure (time out)		—	—	◑	◑	◑	OFF	OFF
Receiver failure (time out)		◑	◑	—	—	—	OFF	OFF

Indicators	
☼	Lighting
●	Light out
◑	Flashing at 0.5 sec interval
◑◑ or ◑◑◑	Flashing simultaneously at 0.5 sec interval
◑◐	Cross-flashing at 0.5 sec interval
◑◑◑	Sequence-flashing at 0.5 sec interval

▣ Troubleshooting

Malfunction	Cause	Troubleshooting
Non-operation	Power supply	Supply the rated power.
	Cable incorrect connection, or isconnection	Check the wiring connection
	Out of rated sensing distance	Use it within rated sensing distance.
Non-operation in sometimes	Pollution by dirt of sensor cover	Remove dirt by soft brush or cloth.
	Connector connection failure	Check the assembled part of the connector
Control output is OFF even though there is not a target object.	Out of the rated sensing distance	Use it within the rated sensing distance.
	There is an obstacle to cut off the emitted light between emitter and receiver.	Remove the obstacle.
	There is strong electric wave or noise generator such as motor, electric generator, or high voltage line, etc.	Put away the strong electric wave or noise generator.
Operation indicator displays break of emitter	Break of emitter	Contact our company.
Operation indicator displays break of receiver	Break of receiver	
Operation indicator displays break of light emitting element	Break of light emitting element	
Operation indicator displays emitter/receiver failure	Emitter or Receiver failure	
	Bad wiring connection of synchronous cable in emitter and receiver	Check the wiring connection in emitter and receiver.
Check the wiring connection in emitter and receiver.	Control output line is shorted out.	Check the wiring connection.
	Over load	Check the rated load capacity.

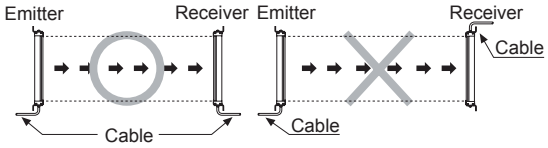
▣ Installation

For the first installation, enter installation mode.

① Entry method for installation mode: Supply the power with inputting 0V to terminal 4 (black) MODE of Emitter.
② After entering installation mode, install the unit at the position where green LED of receiver operation indicator turns ON.
③ After installation, re-supply the power to the unit.

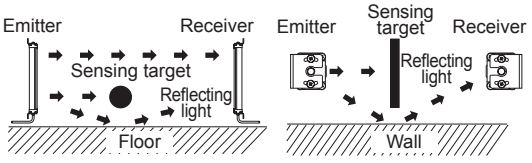
◎ For direction of installation

Emitter·Receiver should be installed in same up/down direction.



◎ For reflection from the surface of wall/flat

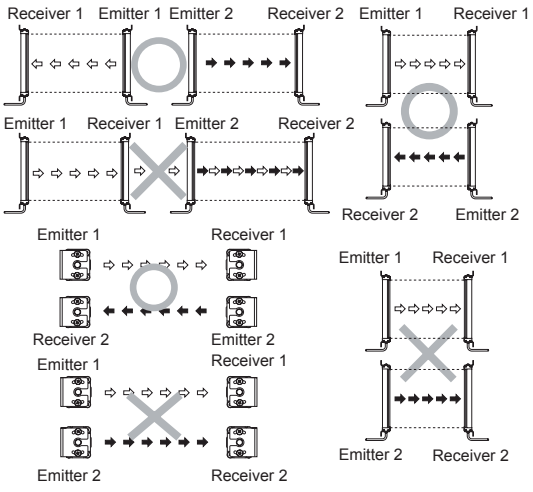
When installing it as below, the light reflected from the surface of wall and flat is not shaded. Please check whether it operates normally or not with a sensing target before using. (interval distance: min. 0.5m)



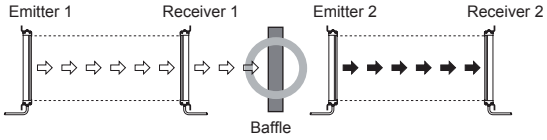
◎ For protection of interference

It may cause interference when installing more than 2 sets of the sensor. In order to avoid the interference of the sensor, please install as following figures and use interference protection function

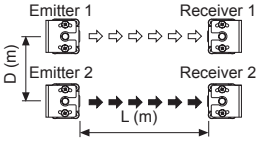
< Transmission direction should be opposite between 2 sets >



< Baffle should be installed between 2 sets>



<It should be installed out of the interference distance>



Sensing distance (L)	Installation allowable distance (D)
0.1 to 3m	Over 0.4m
Over 3m	L×tan8°=L×0.14

※It may be different by installation environment.
※Avoid using the unit in the place where the sensor is exposed directly to the fluorescent light with high speed start or high frequency.

▣ Proper Usage

1. Follow instructions in 'Proper Usage'.
   Otherwise, It may cause unexpected accidents.
2. 12-24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Use the product, 1 sec after supplying power.
   When using separate power supply for the sensor and load, supply power to sensor first.
4. When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
5. When connecting a DC relay or other inductive load, remove surge by using diodes or varistors.
6. Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
7. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 2
   ④Installation category II

Area Sensor

▣ Features

- Long sensing distance up to 7m
- 22 types of products
  (optical axis: 20/40mm, sensing height: 120 to 940mm)
- Minimizes unsensing area with 20mm optical axis pitch (BW20-□)
- Easy to recognize at side, front, and long-distance
  by high brightness LED of Emitter and Receiver
- Includes self-diagnosis function, mutual interference prevention
  function, external diagnosis function.
- Protection structure IP65 (IEC standard)

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

CE

▣ Ordering Information

BW **20** – **08** **P**

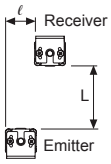
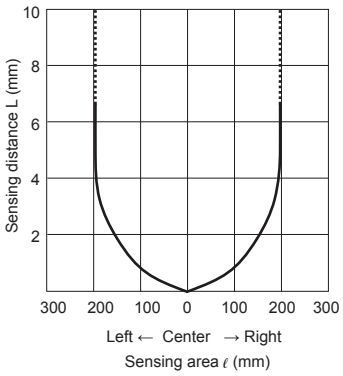
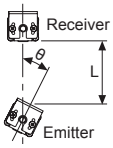
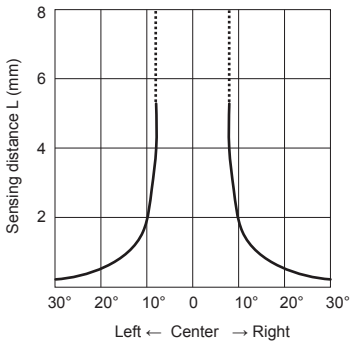
Control output	**No mark**	NPN open collector output
	P	PNP open collector output
Number of optical axis	**04 to 48**	4 to 48
Optical axis pitch	**20**	20mm
	40	40mm
Item	**BW**	Cross-beam area sensor

▣ Specifications

Model		**BW20-□(P)**	**BW40-□(P)**
Sensing method		Through-beam type	
Sensing distance		0.1 to 7m	
Min. sensing target		Opaque material of min. Ø30mm	Opaque material of min. Ø50mm
Optical axis pitch		20mm	40mm
Number of optical axis		8 to 48	4 to 24
Sensing height		140 to 940mm	120 to 920mm
Response time		Max. 10ms	
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. ±10%)	
Current consumption		Emitter: max. 120mA, Receiver: max. 120mA	
Operation mode		Light ON fixed	
Control output		NPN or PNP open collector output • Load voltage: max. 30VDC⎓ • Load current: max. 100mA • Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC	
Protection circuit		Reverse polarity protection circuit, output short over current protection circuit	
Light source		Infrared LED (850nm modulated)	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Synchronization type		Timing method by synchronous line	
Self-diagnosis		Emitter/Receiver monitoring, direct light monitoring, over current monitoring	
Interference protection		Interference protection by master/slave function	
Noise immunity		±240V the square wave noise (pulse width 1μs) by the noise simulator	
Dielectric strength		1,000VAC 50/60Hz for 1 min	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		500m/s^2 (approx. 50G) in each X, Y, Z direction for 3 times	
Environment	Ambient illumination	Ambient light: max. 100,000lx (receiver illumination)	
	Ambient temperature	-10 to 55℃, storage: -20 to 60℃	
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP65 (IEC standard)	
Material		• Case: aluminum, • Front cover, sensing part: acrylic	
Cable		Ø5mm, 4-wire, 300mm, M12 connector	
Accessory		Bracket A: 4, Bracket B: 4, Bolt : 8	
Approval		CE	
Weight※1		BW20-48: Approx. 2.1kg (approx. 1.4kg)	BW40-24: Approx. 2.1kg (approx. 1.4kg)

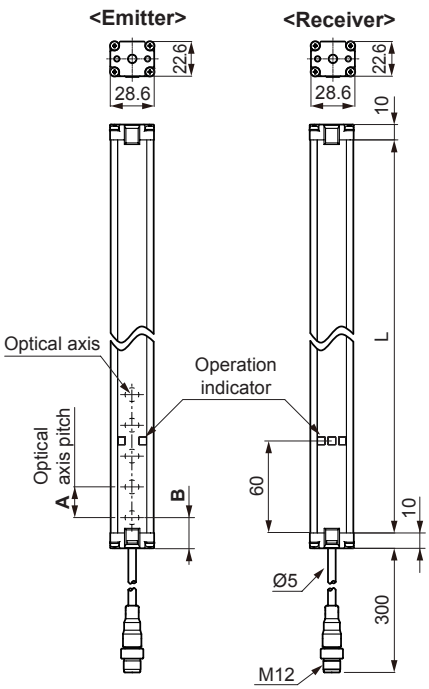
※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature and humidity of environment resistance is rated at non-freezing or condensation.

▣ Feature Data

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

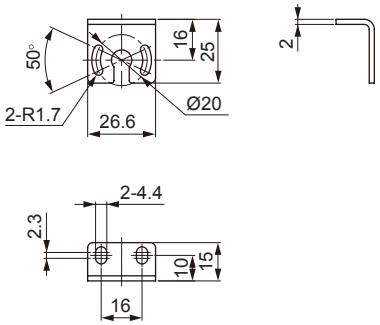
▣ Dimensions

(unit: mm)

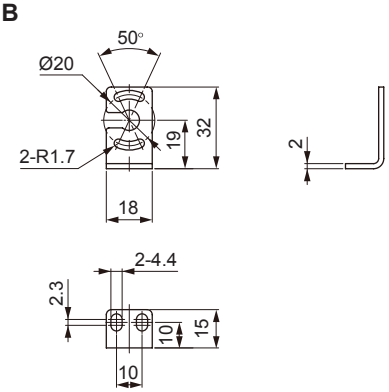


Model	L	A, B	Model	L	A, B
BW20-08(P)	160	20	BW40-04(P)	160	40
BW20-12(P)	240		BW40-06(P)	240	
BW20-16(P)	320		BW40-08(P)	320	
BW20-20(P)	400		BW40-10(P)	400	
BW20-24(P)	480		BW40-12(P)	480	
BW20-28(P)	560		BW40-14(P)	560	
BW20-32(P)	640		BW40-16(P)	640	
BW20-36(P)	720		BW40-18(P)	720	
BW20-40(P)	800		BW40-20(P)	800	
BW20-44(P)	880		BW40-22(P)	880	
BW20-48(P)	960		BW40-24(P)	960	

● **Bracket A**

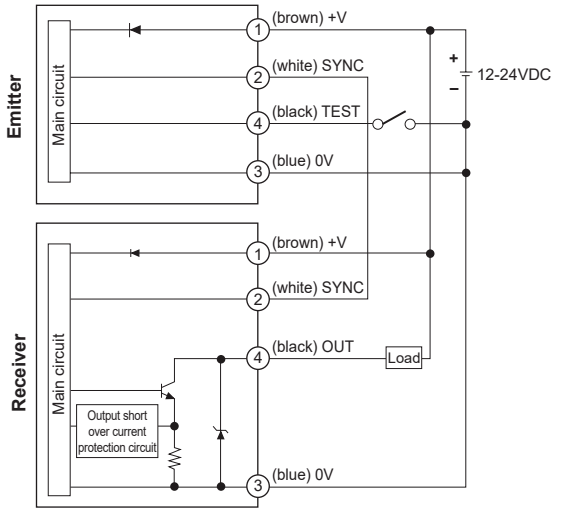


● **Bracket B**

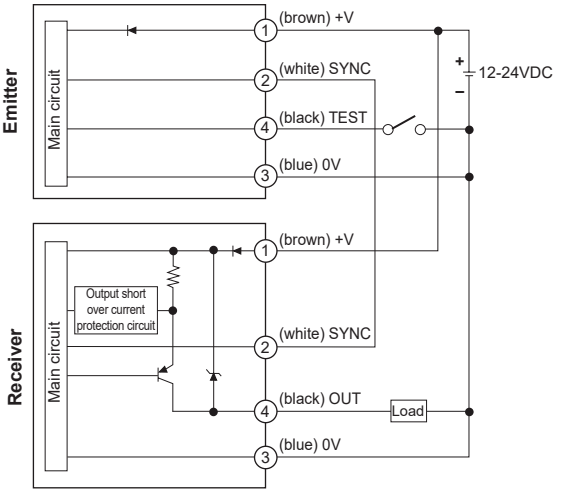


▣ Input·Output Circuit and Connections

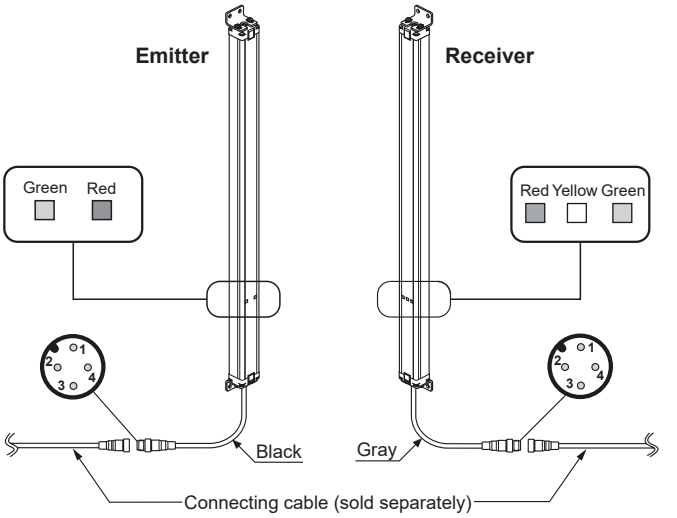
● NPN open collector output



● PNP open collector output



▣ Structure



<Operation indicator >

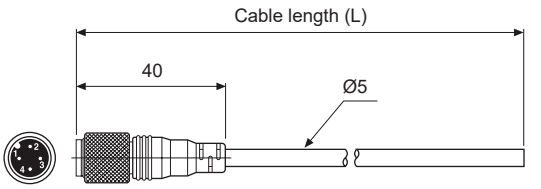
LED color	Emitter	Receiver
Green	POWER	Stable light ON
Yellow	—	Unstable
Red	TEST (M/S)	Stable light OFF

<Wiring Connection >

Pin No.	Cable color	Emitter	Receiver
1	Brown	12-24VDC	12-24VDC
2	White	SYNC	SYNC
3	Blue	0V	0V
4	Black	TEST (M/S)	OUT

▣ Connecting Cable (sold separately)

(unit: mm)

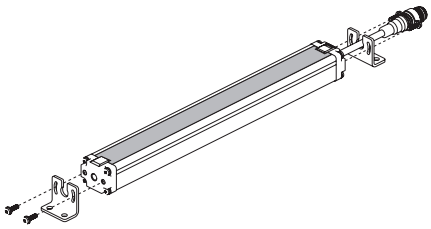


Type	Model	L	Cable color
Emitter	CID4-3T	3m	Black
	CID4-5T	5m	
	CID4-7T	7m	
	CID4-10T	10m	
	CID4-15T	15m	
Receiver	CID4-3R	3m	Gray
	CID4-5R	5m	
	CID4-7R	7m	
	CID4-10R	10m	
	CID4-15R	15m	

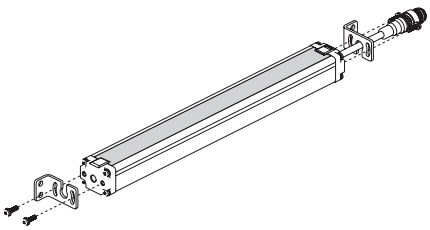
※Connecting cable is sold separately as one set; each of emitter's and receiver's.

▣ Bracket Mounting

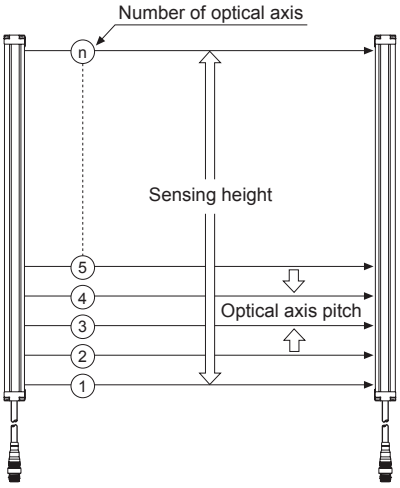
● **Mounting the bracket A**



● **Mounting the bracket B**



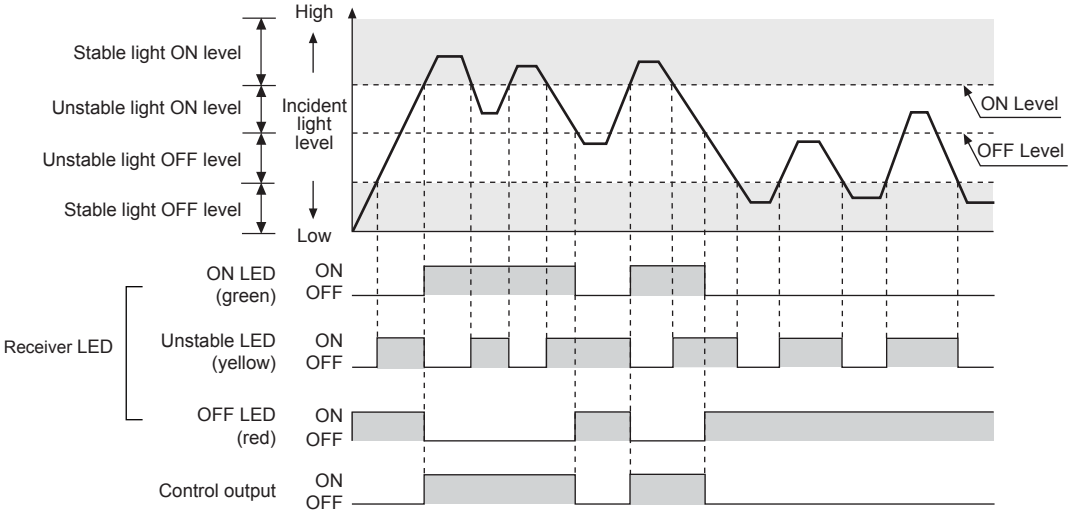
▣ Optical Axis Pitch/Number of Optical Axis/Sensing Height



Model	Number of optical axis	Sensing height	Optical axis pitch	Model	Number of optical axis	Sensing height	Optical axis pitch
BW20-08(P)	8	140mm	20mm	BW40-04(P)	4	120mm	40mm
BW20-12(P)	12	220mm		BW40-06(P)	6	200mm	
BW20-16(P)	16	300mm		BW40-08(P)	8	280mm	
BW20-20(P)	20	380mm		BW40-10(P)	10	360mm	
BW20-24(P)	24	460mm		BW40-12(P)	12	440mm	
BW20-28(P)	28	540mm		BW40-14(P)	14	520mm	
BW20-32(P)	32	620mm		BW40-16(P)	16	600mm	
BW20-36(P)	36	700mm		BW40-18(P)	18	680mm	
BW20-40(P)	40	780mm		BW40-20(P)	20	760mm	
BW20-44(P)	44	860mm		BW40-22(P)	22	840mm	
BW20-48(P)	48	940mm		BW40-24(P)	24	920mm	

▣ Operation Timing Diagram

● **Operation mode: Light ON fixed**

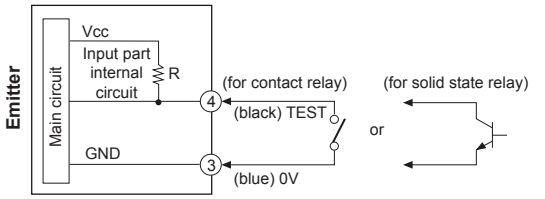


▣ Function

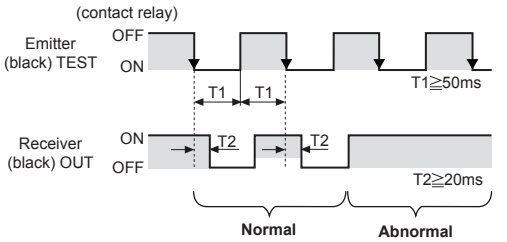
◎ Emitter OFF (external diagnosis)

When TEST input (black) of emitter is 0V, emitting stops and red LED of emitter flashes. By stopping the emitting while TEST input of emitter is 0V, it is noticeable whether sensor operates in order from the external system.
(If the emitting stops, sensor is in light OFF status and control output of receiver turns OFF.)

● Connections for TEST input



● Control output pulse by TEST input



◎ Self-diagnosis

The unit regularly executes self-diagnosis during operation. If error occurs, control output turns OFF and the operation indicator displays the status.

● Diagnosis items

- Emitter: ① Damage in light emitter
  ② Emitter failure (Time out)
  ③ Malfunction of MASTER/SLAVE line (operation in MASTER)
- Receiver: ① Damage in light receiver
  ② Control output over current
  ③ Malfunction, disconnection, or circuit break of synchronous line.

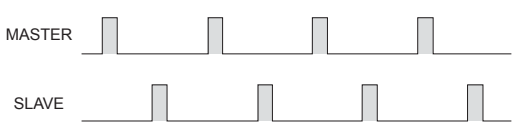
● Operation indicator displays each diagnosis items in different way. Refer to "▣ **Operation Indicator**".

◎ Interference protection

In case of using 2 sensors in parallel in order to extend sensing width, it may cause sensing error because as light interference.

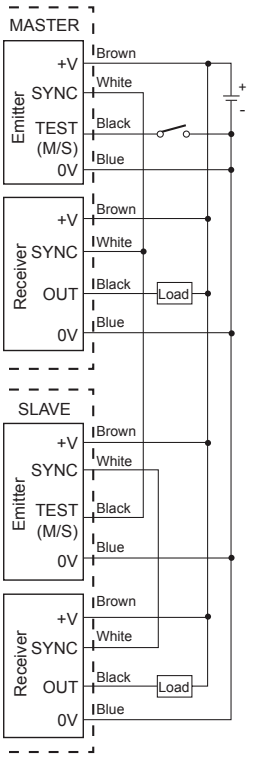
This function is operating a sensor as MASTER and another sensor as SLAVE to avoid these sensing errors by the light interference.

● Time chart for MASTER/SLAVE transmission pulse

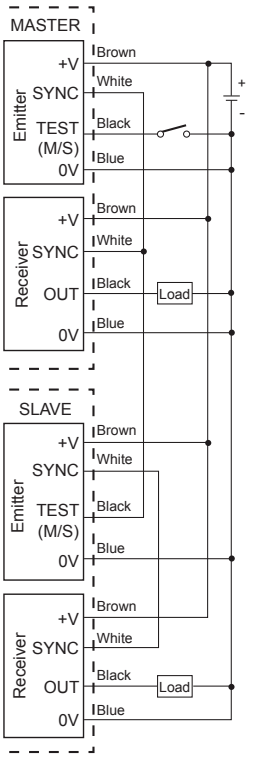


● MASTER/SLAVE connections

<NPN open collector output >



<PNP open collector output >

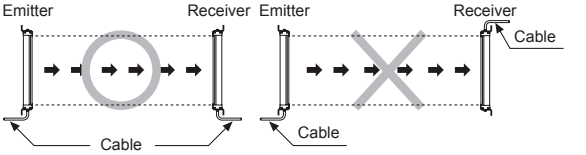


※Connect 'TEST (M/S)' of SLAVE emitter to 'SYNC' of MASTER.

▣ Installation

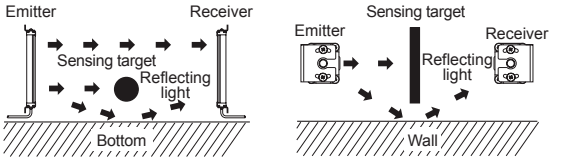
◎ For direction of installation

Emitter and receiver should be installed in same up/down direction.



◎ For reflection from the surface of wall and flat

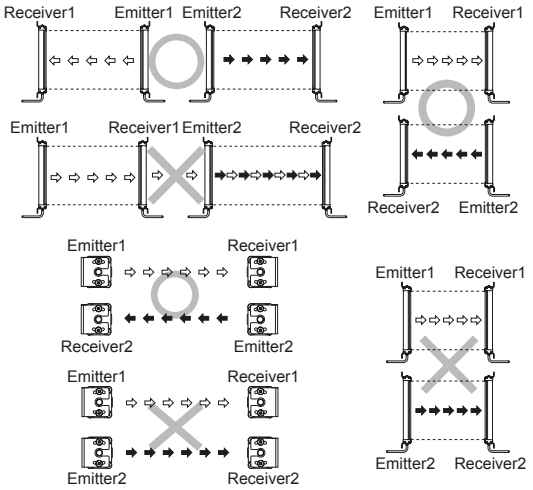
When installing it as below the light reflected from the surface of wall and flat will not be shaded. Please, check whether it operates normally or not with a sensing target before using. (Interval distance: min. 0.5m)



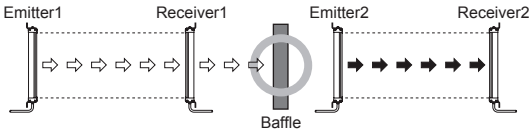
◎ For prevention of interference

It may cause interference when installing more than 2 sets of the sensor. In order to avoid the interference of the sensor, please install as following figures and use the interference protection function.

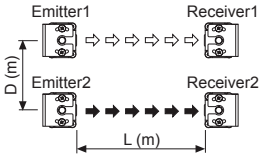
- **Transmission direction should be opposite between 2 sets**



- **Baffle should be installed between 2 sets**



- **It should be installed out of the interference distance**



Sensing distance (L)	Installation allowable distance (D)
0.1 to 3m	Min. 0.4m
Min. 3m	L×tan8°=min. L×0.14

※There can be a little different based on installation environment.
※Avoid using the unit in the place where the sensor is exposed directly to the fluorescent light with high speed start or high frequency.

■ Operation Indicator

Item		Emitter		Receiver			
		Indicator		Indicator			Control output Light ON
		Green	Red	Green	Yellow	Red	
Power ON		☼	●	–	–	–	–
MASTER operation		☼	●	–	–	–	–
SLAVE operation		☼	☼	–	–	–	–
Test input		☼	◑	–	–	–	–
Break of emitter		▶▶	◀◀	–	–	–	–
Break of light emitting element		▶	◀	▶	▶	▶	OFF
Install mode	Normal installation	●	◑	☼	●	◑	OFF
	Hysteresis installation	●	◑	●	☼	◑	OFF
	Abnormal installation	●	◑	●	●	◑	OFF
Stable light ON		–	–	☼	●	●	ON
Unstable light ON		–	–	☼	☼	●	ON
Unstable dark ON		–	–	●	☼	☼	OFF
Stable dark ON		–	–	●	●	☼	OFF
Break of receiver		–	–	▶▶	●	◀◀	OFF
Control output overcurrent		–	–	▶	◀	☼	OFF
Synchronous line noise		–	–	◑	●	◑	OFF
Emitter failure (time out)		–	–	◑	◑	◑	OFF

Display classification list	
☼	Light ON
●	Light OFF
◑	Flashing by 0.5 sec
◑ ◑ or ◑ ◑ ◑	Flashing simultaneously by 0.5 sec
▶ ◀	Cross-flashing by 0.5 sec
▶ ▶ ▶	Sequence-flashing twice by 0.5 sec
▶ ▶ ◀ ◀	Cross-flashing twice by 0.5 sec

■ Troubleshooting

Malfunction	Cause	Troubleshooting
Not operating	Power supply	Supply the rated power.
	Incorrect cable connection or disconnection	Check the wiring.
	Rated connection failure	Use it within rated sensing distance.
Not operating sometimes	Pollution by dirt of sensor cover	Remove dirt by soft brush or cloth.
	Connector connection failure	Check the assembled part of the connector.
Control output is OFF even though there is no target object.	Out of rated sensing distance	Use within the rated sensing distance.
	There is an obstacle to cut off the light emitted between emitter and receiver	Remove the obstacle.
	There is a strong electric wave or noise generated by motor, electric generator, high voltage line etc.	Put away the strong electric wave or noise generator.
LED displays for break of light emitting element	Break of light emitting element	Contact Autonics Corp.
LED displays for failure of emitter	Break of light emitting circuit	
LED displays for failure of receiver	Break of light emitting receiving element	
LED displays for synchronous line	Synchronous line incorrect connection or disconnection	Check the wiring.
	Break of synchronous circuit of emitter or receiver	Contact Autonics Corp.
LED displays for control output over current	Control output line is shorten	Check the wiring.
	Over load	Check the rated load capacity.
LED displays for emitter malfunction	Emitter malfunction	Treat after checking the emitter display LED.

▣ Proper Usage

1. Follow instructions in 'Proper Usage'.
   Otherwise, It may cause unexpected accidents.
2. 12-24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Use the product, 1 sec after supplying power.
   When using separate power supply for the sensor and load, supply power to sensor first.
4. When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
5. When connecting a DC relay or other inductive load, remove surge by using diodes or varistors.
6. Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
7. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 2
   ④Installation category II

Flat Area Sensor With Plastic Case

▣ Features

- **13mm slim body with fresnel lens**
- Adoption of plastic (PC/ABS) injection case
- Various functions; stop transmission, interference prevention, lightening/flashing JOB indicator, Light ON/Dark ON operation by switch
- Easy to recognize at side, front, and long-distance by high brightness LED of Emitter and Receiver
- Fast response time up to 7ms
- 4 models with various optical axis (8 to 20) and sensing height (140 to 380mm)
- Protection structure IP40 (IEC standard)

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

CE

▣ Specifications

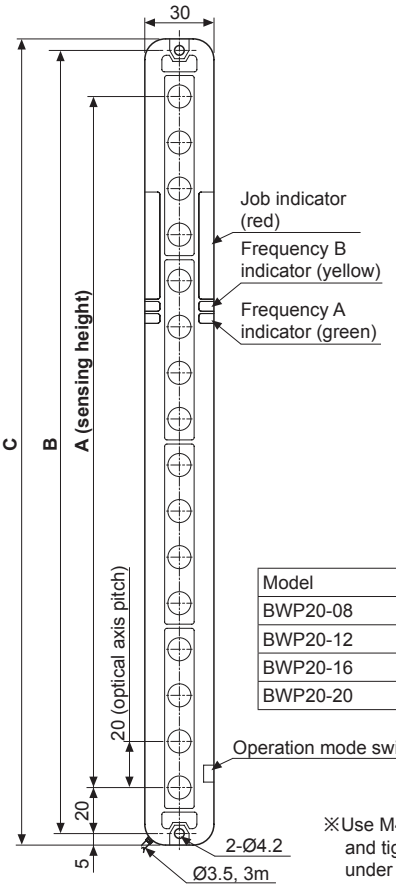
Model	NPN open collector output	BWP20-08	BWP20-12	BWP20-16	BWP20-20
	PNP open collector output	BWP20-08P	BWP20-12P	BWP20-16P	BWP20-20P
Sensing type		Through-beam			
Sensing distance		0.1 to 5m			
Sensing target		Opaque materials of min. Ø30mm			
Optical axis pitch		20mm			
Number of optical axis		8	12	16	20
Sensing height		140mm	220mm	300mm	380mm
Response time		Max. 6ms (frequency B selection is max. 7ms)			
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)			
Current consumption		Emitter: max. 80mA, receiver: max. 80mA			
Light source		Infrared LED (850nm modulated)			
Operation mode		Light ON/Dark ON by switch			
Control output		NPN or PNP open collector output • Load voltage: Max. 30VDC⎓ • Load current: Max. 150mA • Residual voltage - NPN: Max. 1VDC⎓, PNP: Max. 2.5VDC			
Protection circuit		Reverse power polarity, output short over current protection circuit			
Insulation resistance		Over 20MΩ (at 500VDC megger)			
Synchronization type		Synchronized by synchronous line			
Interference protection		Interference protection by transmission frequency selection			
Noise immunity		±240V the square wave noise (pulse width: 1μs) by the noise simulation			
Dielectric strength		1,000VAC 50/60Hz for 1 min			
Vibration		1.5mm amplitude or 300m/s^2 at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times			
Environment	Ambient illumination	Ambient light: max. 10,000lx (received light side illumination)			
	Ambient temperature	-10 to 55℃, storage: -20 to 60℃			
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH			
Protection structure		IP40 (IEC standard)			
Material		Case: Polycarbonate/Acrylonitrile butadiene styrene, Sensing part: Polymethyl methacrylate			
Cable		Ø3.5mm, 4-wire, 3m (AWG 24, core diameter: 0.08mm, number of cores: 40, insulator out diameter: Ø1mm)			
Approval		CE			
Weight※1		Approx. 480g (approx. 280g)	Approx. 520g (approx. 320g)	Approx. 620g (approx. 360g)	Approx. 680g (approx. 430g)

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation.

▣ Dimensions

(unit: mm)

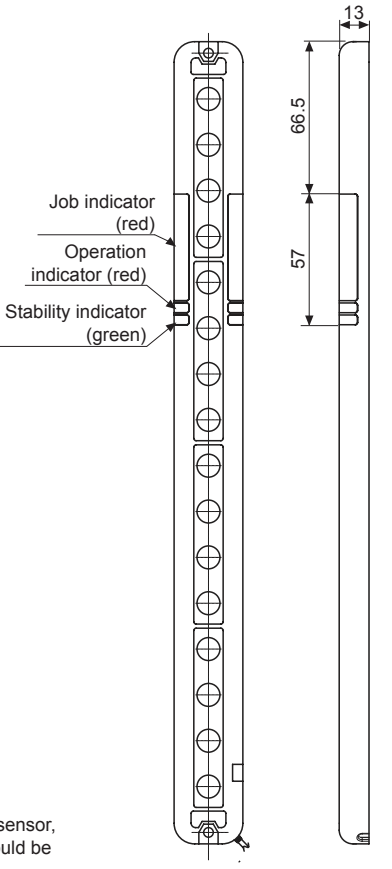
<Emitter>



Model	A	B	C
BWP20-08	140	180	190
BWP20-12	220	260	270
BWP20-16	300	340	350
BWP20-20	380	420	430

※Use M4 bolt for installing sensor, and tightening torque should be under 2N·m.

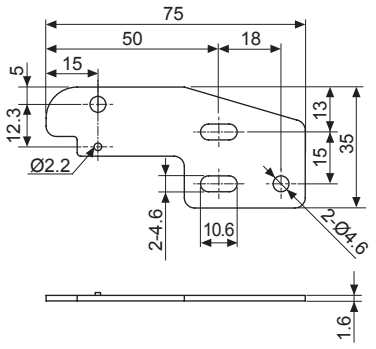
<Receiver>



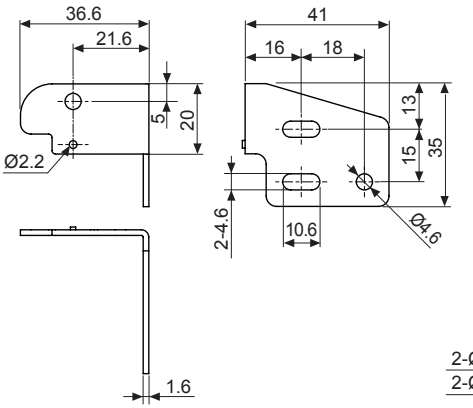
<Bracket>: sold separately

(unit: mm)

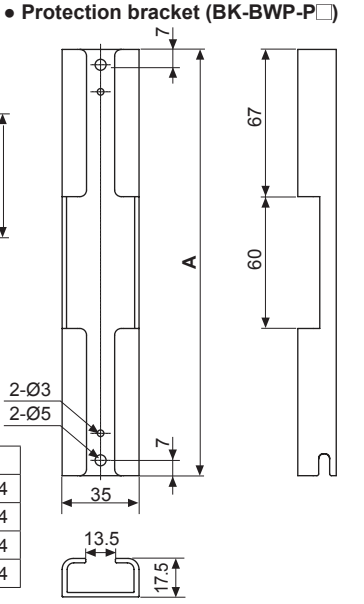
● Flat bracket (BK-BWP-ST)



● L-shaped bracket (BK-BWP-L)

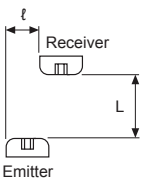
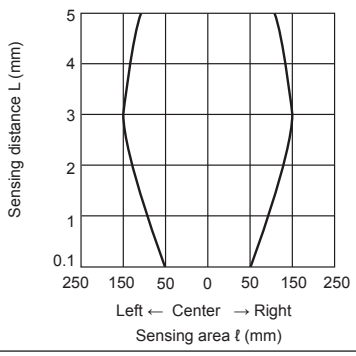
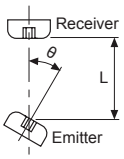
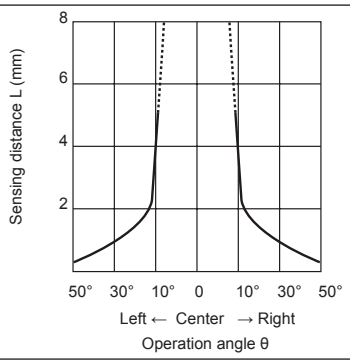


● Protection bracket (BK-BWP-P□)



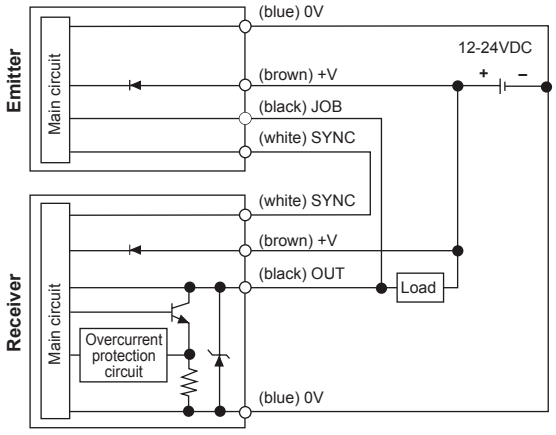
Model	A
BK-BWP-P08	194
BK-BWP-P12	274
BK-BWP-P16	354
BK-BWP-P20	434

■ Feature Data

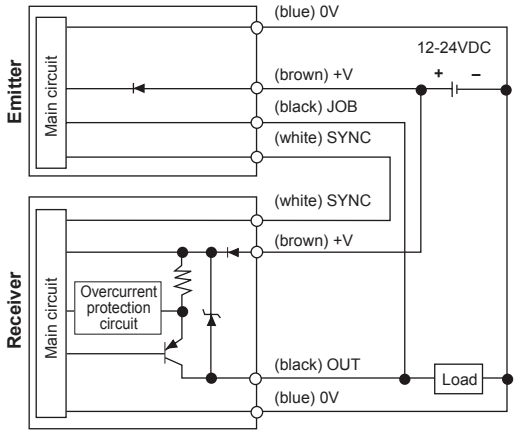
Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

■ Input/Output Circuit and Connection Diagram

● NPN open collector output

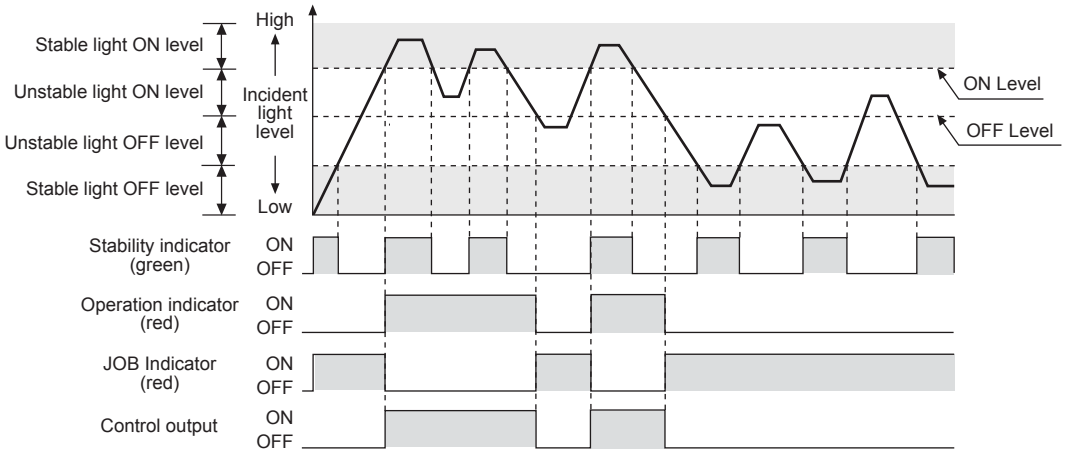


● PNP open collector output



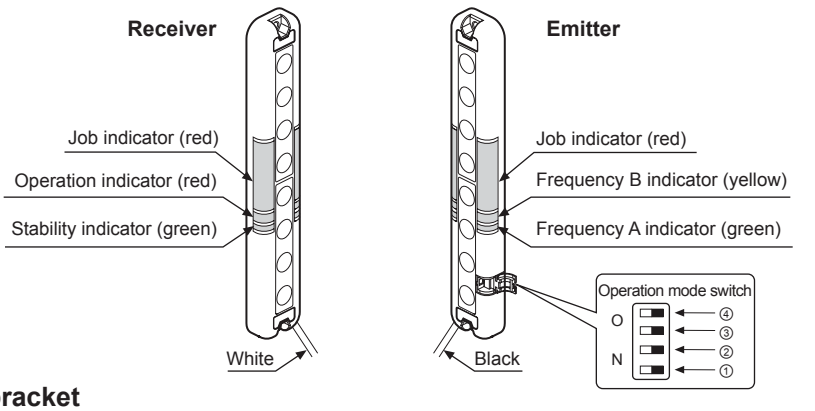
※If the receiver OUT (black) line and the emitter JOB (black) line are not connected each other, the JOB indicator of the emitter is not operated and maintain the light status.

■ Operation Timing Diagram



※The waveforms of operation indicator, job indicator, and control output are the state of operation for Light ON, but in case of Dark ON, it is opposite operation against Light ON mode.

▣ Structure



◎ Mounting of bracket

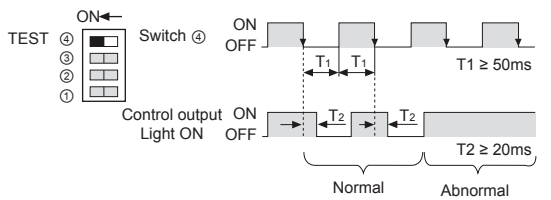
No	Function	Switch OFF	Switch ON
①	Transmission frequency selection	Frequency A	Frequency B
②	Light ON/Dark ON selection	Light ON operation	Dark ON operation
③	Steady/flashing light of Job indicator selection	Job indicator with Steady light	Job indicator with Flashing light
④	Job/TEST selection	Normal mode	TEST mode

▣ Functions

◎ TEST (stop transmission)

When selecting TEST mode, emit is stopped and green &yellow LED of emitter flashes. It is available to check whether sensor operates properly with stopping the transmission in TEST mode. It is changed to light OFF status when emit the transmission is stopped, control output is OFF in Light ON mode and ON in Dark ON mode.

- **Control output pulse for TEST input**



◎ Interference prevention

In case of using 2 of sensor in serial or parallel in order to extend sensing width, it may cause sensing error because of light interference.
This function is operating a sensor in transmission frequency A and another sensor in transmission frequency B to avoid these sensing errors by the light interference.

	Operation mode switch	Frequency A, B indicator
Sensor Ⓐ (transmission frequency A)	ON ④ ③ ② ① Frequency A	JOB INDI. Frequency A (green)
Sensor Ⓑ (transmission frequency B)	ON ④ ③ ② Frequency B ①	JOB INDI. Frequency B (yelloew)

◎ Light-ON / Dark-ON operation mode

The control output is ON when it is light ON in Light ON and the control output is ON when it is light OFF in Dark ON. It is available to select with user's preference.

	Operation mode switch	Control output operation
Light ON	ON ④ ③ ② ① Light ON	It is ON when \ it is light ON.
Dark ON	ON ④ ③ ② ① Dark ON	It is ON when it is light OFF.

◎ Lightening/Flashing JOB indicator

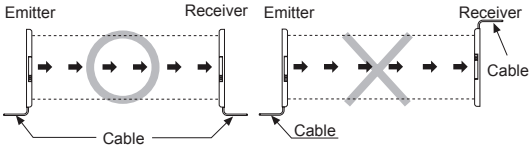
JOB indicator will be lighted and flashed to make out work sensing operation more easily.

Operation mode switch	JOB indicator operation
ON ④ ③ ② ① Lighting	Lighting indicator
ON Flashing ④ ③ ② ①	Flashing indicator

▣ Installation

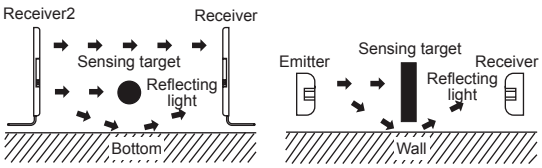
◎ For direction of installation

Emitter and receiver should be installed as same up/down position.



◎ For reflection from the surface of wall and flat

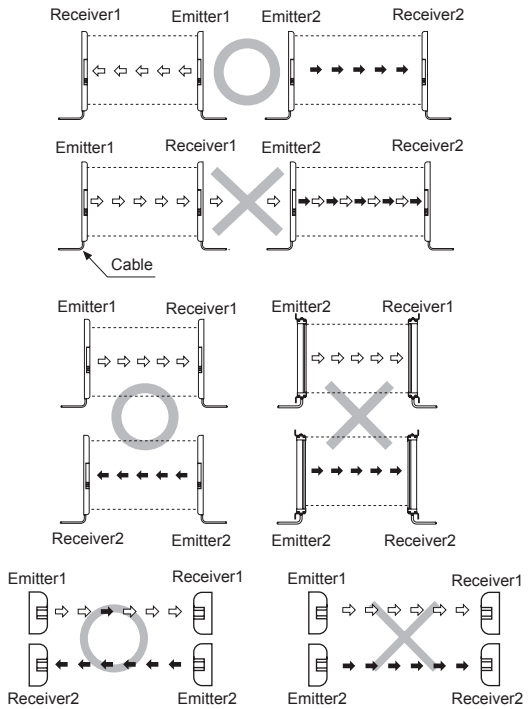
When installing it as below the light reflected from the surface of wall and flat will not be shaded. Please, check whether it operates normally or not with a sensing target before using. (interval distance: min. 0.3m)



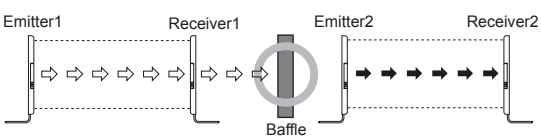
◎ For prevention of interference

It may cause interference when installing more than 2 sets of the sensor. In order to avoid the interference of the sensor, please install as following figures and use the interference protection function.

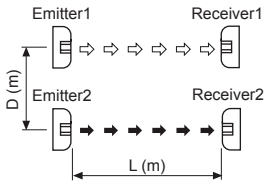
- **Transmission direction should be opposite between 2 sets**



- **Baffle should be installed between 2 sets.**



- **It should be installed out of the interference distance**



Sensing distance (L)	Installation allowable distance (D)
0.1 to 1m	Min. 0.2m
Min. 1m	Min. 0.3m

※It may be a little different based on installation environment.

※Avoid using the unit in the place where the sensor is exposed directly to the fluorescent light with high speed start or high frequency.

▣ Operation Indicator

Item	Emitter			Receiver			Control output
	Indicator			Indicator			
	Green	Yellow	JOB Indicator	Green	Red	JOB Indicator	
Power on	☼	●	—	—	—	—	—
FREQ. A operation	☼	●	—	—	—	—	—
FREQ. B operation	☼	☼	—	—	—	—	—
TEST	▶	◀	☼	☼	●	☼	OFF
Stable light ON	—	—	●	☼	☼	●	ON
Unstable light ON	—	—	●	●	☼	●	ON
Unstable light OFF	—	—	☼	●	●	☼	OFF
Stable light OFF	—	—	☼	☼	●	☼	OFF
Flashing function ON	—	—	◑	☼	●	◑	OFF
Synchronous line malfunction	—	—	☼	▶	◀	☼	OFF
Overcurrent	—	—	☼	◑	◑	☼	OFF

Display classification list	
☼	Light ON
●	Light OFF
◑	Flashing by 0.3 sec
◑ ◑	Flashing simultaneously by 0.3 sec
▶ ◀	Cross-Flashing by 0.3 sec

※The operation of 'Operation indicator (red)', 'Job indicator (red)', 'Control output' is for Light ON, in case of Dark ON, it is opposite operation against Light ON. (In case, malfunction of synchronous line and over current, control output is OFF regardless of the mode.)

▣ Troubleshooting

Malfunction	Cause	Troubleshooting
Non-operation	Power supply	Supply rated power.
	Cable incorrect connection or disconnection	Check the wiring.
	Rated connection failure	Use it within rated sensing distance.
Non-operation in sometimes	Pollution by dirt of sensor cover	Remove dirt by soft brush or cloth.
	Connector connection failure	Check the assembled part of the connector.
Control output is OFF even though there is not a target object.	Out of rated sensing distance	Use within rated sensing distance.
	There is an obstacle to cut off the light emitted between emitter and receiver	Remove the obstacle.
	There is a strong electric wave or noise generated by motor, electric generator, high voltage line etc.	Put away the strong electric wave or noise generator.
LED displays for synchronous line malfunction	Synchronous line incorrect connection or disconnection	Check the wiring.
	Break of synchronous circuit of emitter or receiver	Contact our company.
LED displays for over current	Control output line is shorten	Check the wiring.
	Over load	Check the rated load capacity.

▣ Proper Usage

1. Follow instructions in 'Proper Usage'.
   Otherwise, It may cause unexpected accidents.
2. 12-24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Use the product, 1 sec after supplying power.
   When using separate power supply for the sensor and load, supply power to sensor first.
4. When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
5. When connecting a DC relay or other inductive load, remove surge by using diodes or varistors.
6. Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
7. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 2
   ④Installation category II

Ultra-Flat (Length 10mm) Picking Sensor

▣ Features

- Plastic injection case
- Slim body (W30×H140×L9.9mm)
- Long/Short sensing distance mode
  (sensing distance selection function)
- Mutual interference prevention (frequency switching function)
- Selectable Light ON/Dark ON operation mode by switch
- Picking indicator includes
- Protection structure IP40 (IEC standard)

⚠ Please read "Safety Considerations" in operation manual before using.

CE

▣ Specifications

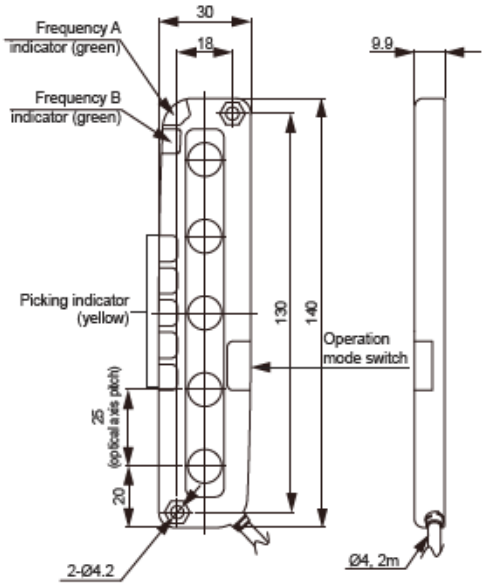
Model	NPN open collector output	**BWPK25-05**
	PNP open collector output	**BWPK25-05P**
Sensing type		Through-beam
Sensing distance	Long distance mode	0.1 to 3m
	Short distance mode	0.05 to 1m
Sensing target		Opaque materials of min. Ø35mm
Optical axis pitch		25mm
Number of optical axis		5
Sensing height		100mm
Response time		Max. 30ms
Power supply		12-24VDC⎓ ±10% (ripple P-P: max. 10%)
Current consumption		Emitter: max. 60mA, Receiver: max. 60mA
Light source		Infrared LED (850nm modulated)
Operation mode		Selectable Light ON/Dark ON by switch
Control output		NPN or PNP open collector output • Load voltage: max. 30VDC⎓ • Load current: max. 150mA • Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC
Protection circuit		Reverse power polarity, output short over current protection circuit
Insulation resistance		Over 20MΩ (at 500VDC megger)
Interference protection		Interference protection by transmission frequency selection
External picking input		Non-contact or contact input - NPN open collector output: Lighting (0-2V), Light out (5-30V or open) - PNP open collector output: Lighting (4-30V), Light out (0-3V or open)
Noise immunity		±240V the square wave noise (pulse width: 1㎲) by the noise simulation
Dielectric strength		1,000VAC 50/60Hz for 1minute
Vibration		1.5mm amplitude or 300m/s² at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		500m/s² (approx. 50G) in each X, Y, Z direction for 3 times
Environment	Ambient illumination	Ambient light: max. 10,000lx, Incandescent lamp: max. 3,000lx (received light side illumination)
	Ambient temperature	-10 to 55℃, storage: -20 to 60℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Protection structure		IP40 (IEC standard)
Material		Case: Polycarbonate/Acrylonitrile butadiene styrene, Sensing part: Polymethyl methacrylate
Cable		Ø4.0mm, 4-wire, 2m (emitter: Ø4.0mm, 3-wire, 2m) (AWG 22, core diameter: 0.08mm, number of cores: 60, insulator out diameter: Ø1.25mm)
Approval		CE
Weight※1		Approx. 220g (approx. 180g)

※1: The weight includes packaging. The weight in parenthesis is for unit only.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

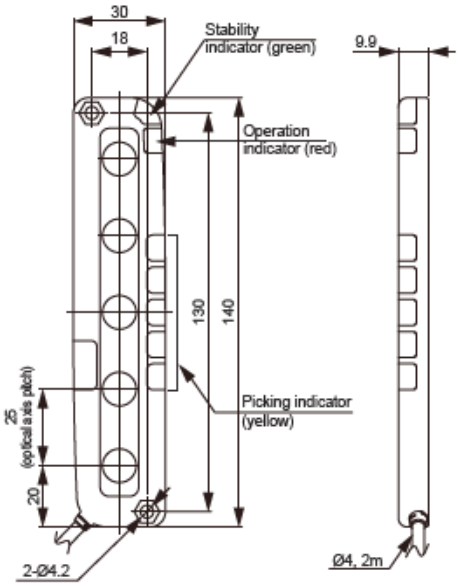
▣ Dimensions

(unit: mm)

<Emitter>

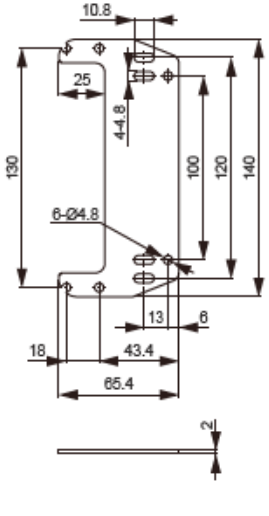


<Receiver>

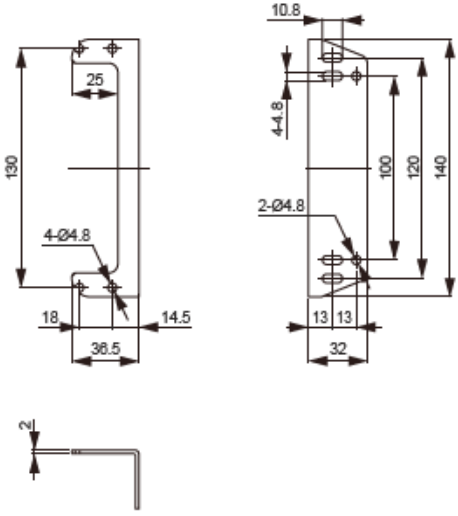


<Bracket>: sold separately

• Flat bracket (BK-BWPK-ST)

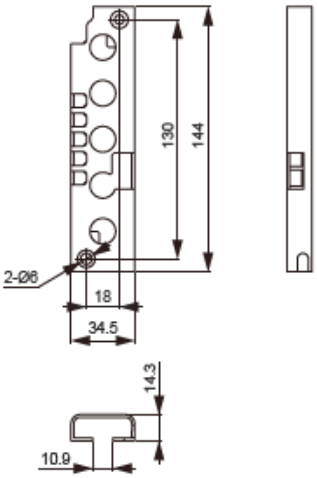


• L-shaped bracket (BK-BWPK-L)

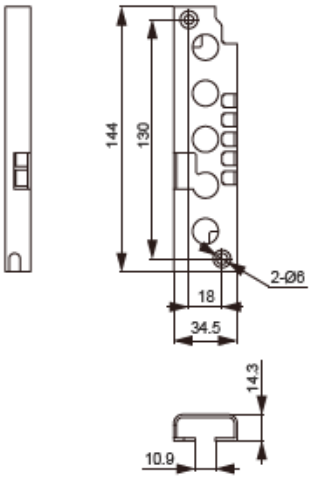


•Protection bracket
(BK-BWPK-P)

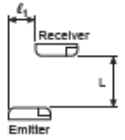
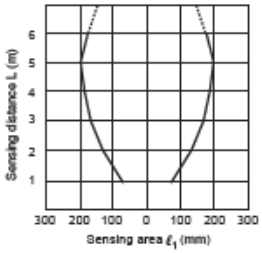
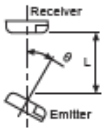
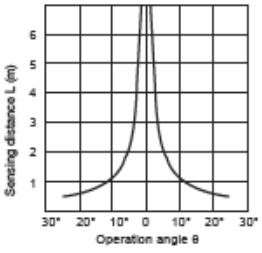
<Emitter>



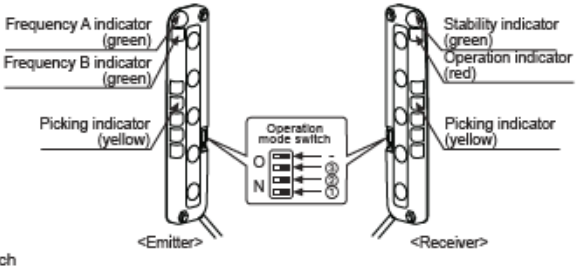
<Receiver>



▣ Feature Data

Parallel shifting characteristic		Angle characteristic	
Measuring method	Data	Measuring method	Data
			

▣ Structure

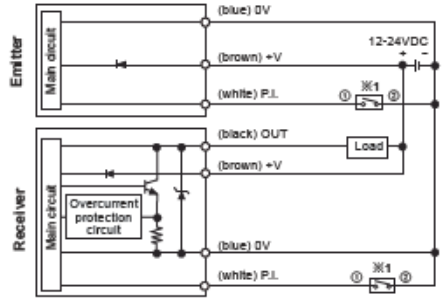


○ Operation mode switch

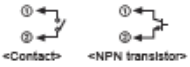
No	Function		Switch OFF	Switch ON
①	Selection of transmission frequency		Frequency A	Frequency B
②	Selection of operation indicator		Lighting indicator	Flashing indicator
③	Emitter	Selection of sensing distance mode	Long mode	Short mode
	Receiver	Selection of operation mode	Light ON	Dark ON

▣ Input/Output Circuit and Connection Diagram

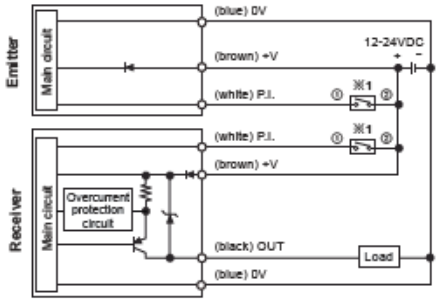
• NPN open collector output



※1: Picking input (P.I): Contact or transistor is ON, and picking indicator operates.



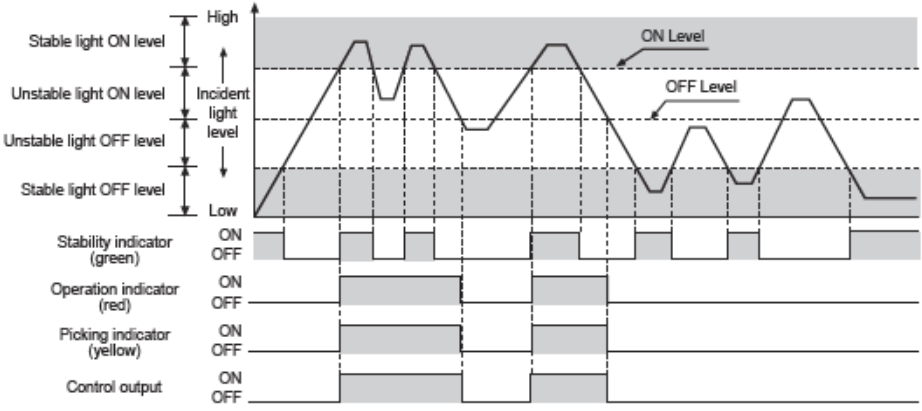
• PNP open collector output



※1: Picking input (P.I): Contact or transistor is ON, and picking indicator operates.

※Picking indicator: When external picking input (P.I) is short-circuited with OUT (Black), it is operated same as ON/OFF status of control output.

▣ Operation Timing Diagram



※The above diagram is the state of operation for Light ON, but in case of Dark ON, it is opposite operation against Light ON.
※Picking indicator is operated by connecting picking input line and output line. (If not connecting these, picking indicator is OFF regardless of operation mode.)

▣ Operation Indicator

Item	Emitter			Receiver			
	Indicator			Indicator			Control output
	Green	Green	Picking indicator (yellow)	Green	Red	Picking indicator (yellow)	
Power on	☼	●	–	–	–	–	–
FREQ. A operation	☼	●	–	–	–	–	–
FREQ. B operation	☼	☼	–	–	–	–	–
Stable light ON	–	–	☼	☼	☼	☼	ON
Flashing function ON	–	–	◑	☼	☼	◑	ON
Unstable light ON	–	–	☼	●	☼	☼	ON
Unstable light OFF	–	–	●	●	●	●	OFF
Stable light OFF	–	–	●	☼	●	●	OFF
Overcurrent	–	–	●	◑◑		●	OFF

Display classification list	
☼	Light ON
●	Light OFF
◑	Flashing by 0.3 sec
◑ ◑	Flashing simultaneously by 0.3 sec

※The operations of 'Operation indicator' and 'Picking indicator (red)' for stable light ON level, unstable light ON level, unstable light OFF level, and stable light OFF level are for Light ON. (In case of overcurrent, control output is OFF regardless of operation mode.)

▣ Function

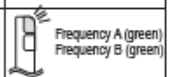
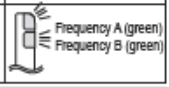
○ Switching of Long/Short mode (selectable sensing distance)

The rated sensing distance is 3m for Long mode, 1m for short mode. It minimizes interference setting as short mode when using more than 3 sets closely together.

	Operation mode switch (emitter)	Rated sensing distance
Long mode		3m
Short mode		1m

○ Interference protection

In case of using 2 pcs of sensor in serial or parallel in order to extend sensing width, it may cause sensing error because of light interference.
This function is operating a sensor in transmission frequency A and another sensor in transmission frequency B to avoid these sensing errors by the light interference.

	Operation mode switch (emitter+receiver)	Frequency A, B indicator (emitter)
Sensor Ⓐ (Transmission frequency A)		
Sensor Ⓑ (Transmission frequency B)		

○ Light ON/Dark ON mode

The control output is ON when it is light ON in Light ON and the control output is ON when it is light OFF in Dark ON. It is available to select with user's preference.

	Operation mode switch (receiver)	Control output operation
Light ON		It is ON when it is light ON.
Dark ON		It is ON when it is light OFF.

○ Switching of Lighting/Flashing of Picking indicator

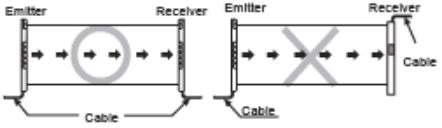
Picking indicator is lighting or flashing to make out work sensing operation more easily.

	Operation mode switch (emitter+receiver)	Picking indicator operation
Lighting		Lighting indicator
Flashing		Flashing indicator

▣ Installation

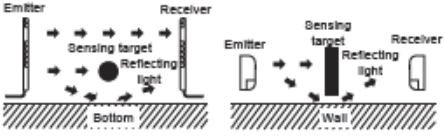
◎ For direction of installation

Emitter and receiver should be installed as same up/down position.



◎ For reflection from the surface of wall and flat

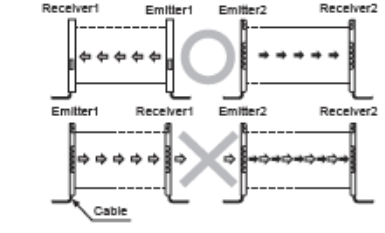
When installing it as below the light reflected from the surface of wall and flat will not be shaded. Please, check whether it operates normally or not with a sensing target before using. (interval distance: min. 0.3m)

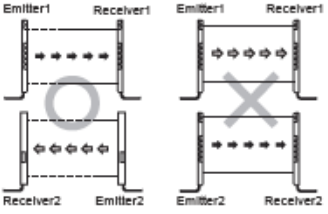


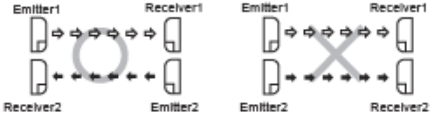
◎ For prevention of interference

It may cause interference when installing more than 2 sets of the sensor. In order to avoid the interference of the sensor, please install as following figures and use the interference protection function.

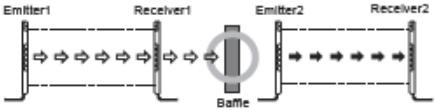
- **Transmission direction should be opposite between 2 sets**



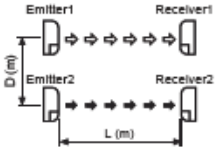




- **Baffle should be installed between 2 sets.**



- **It should be installed out of the interference distance**



Sensing distance (L)	Installation allowable distance (D)
0.1 to 1m	Min. 0.1m
Min. 1m	Min. 0.2m

※It may be a little different based on installation environment.

※Avoid using the unit in the place where the sensor is exposed directly to the fluorescent light with high speed start or high frequency.

▣ Troubleshooting

Malfunction	Cause	Troubleshooting
Non-operation	Power supply	Supply rated power.
	Cable incorrect connection or disconnection	Check the wiring.
	Rated connection failure	Use it within rated sensing distance.
Non-operation in sometimes	Pollution by dirt of sensor cover	Remove dirt by soft brush or cloth.
	Connector connection failure	Check the assembled part of the connector.
Control output is OFF even though there is not a target object.	Out of rated sensing distance	Use within rated sensing distance.
	There is an obstacle to cut off the light emitted between emitter and receiver	Remove the obstacle.
	There is a strong electric wave or noise generated by motor, electric generator, high voltage line etc.	Put away the strong electric wave or noise generator.
LED displays for over current	Control output line is shorten	Check the wiring.
	Over load	Check the rated load capacity.

Vision Sensor

Features

- Light integrated vision sensor
- Minimized image distortion with global shutter method
- Proprietary technology to block optical interference to improve optical performance (patent)
- Stronger in environment of vibration or impact with lens cover detachment prevention technology
- Various inspection function
  : Alignment, brightness, contrast, area, edge, shape comparison, length, angle, diameter, object counting, color identification, area of color, object of color counting
- Inspection test with simulator
- Flexible response to changing work environment by setting 32 work groups (64 inspection items for each work group)
- Saving data to FTP server
- Free vision sensor program (Vision Master)
  : Inspection simulator, managing parameter and work group, monitoring inspection result, inspection result FTP transmission, multilingual support, Etc.
- Protection structure IP67 (IEC standard)

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

Manual

For the detail information and instructions, please refer to user manual, and be sure to follow cautions written in the technical description (catalog, website).
Visit our website (**www.autonics.com**) to download manuals.

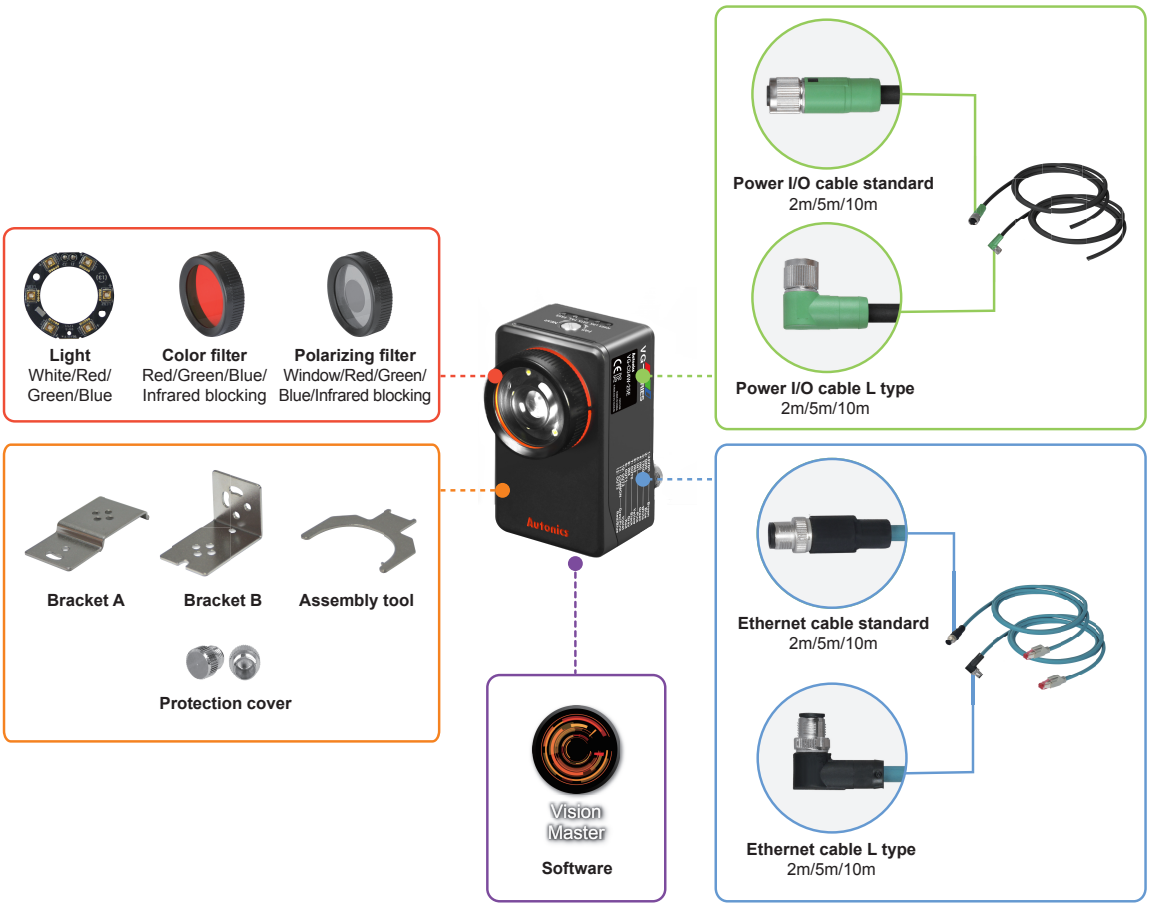
Ordering Information

V	G	–	M	04	W	–	8	E

Communication	**E**	Ethernet communication (TCP/IP)
Effective focal length	**8**	8mm
	16	16mm
	25	25mm
Light※1	**W**	White
	R	Red
	G	Green
	B	Blue
Resolution (pixel)	**04**	752×480
Image element	**M**	Mono CMOS
	C	Color CMOS
Type	**G**	General inspection
Item	**V**	Vision sensor

※1: Light can be purchased separately.

▣ Overall Configuration Diagram



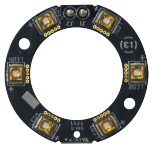
▣ Accessories

◎ Assembly tool
● ASST-VG

◎ Bracket A
● BK-VG-A

▣ Sold Separately

◎ Light
● LR-W-06-VG (white)
● LR-R-06-VG (red)
● LR-G-06-VG (green)
● LR-B-06-VG (blue)



◎ Bracket B
● BK-VG-B

◎ Panel PC
● APC-1011

◎ Protection cover
● P96-M12-1

※Protection cover protects the unused connector from foreign object.
When installing, hand tighten.

◎ Color filter
● FL-R-VG (red)
● FL-G-VG (green)
● FL-B-VG (blue)
● FL-IC-VG (infrared blocking)

◎ Polarizing filter
● FL-P-VG (window)
● FL-RP-VG (red)
● FL-GP-VG (green)
● FL-BP-VG (blue)
● FL-ICP-VG (infrared blocking)

◎ Power I/O cable
● Standard
CID-2-VG (2m)
CID-5-VG (5m)
CID-10-VG (10m)

● L type
CLD-2-VG (2m)
CLD-5-VG (5m)
CLD-10-VG (10m)

◎ Ethernet cable
● Standard
CIR-2-VG (2m)
CIR-5-VG (5m)
CIR-10-VG (10m)

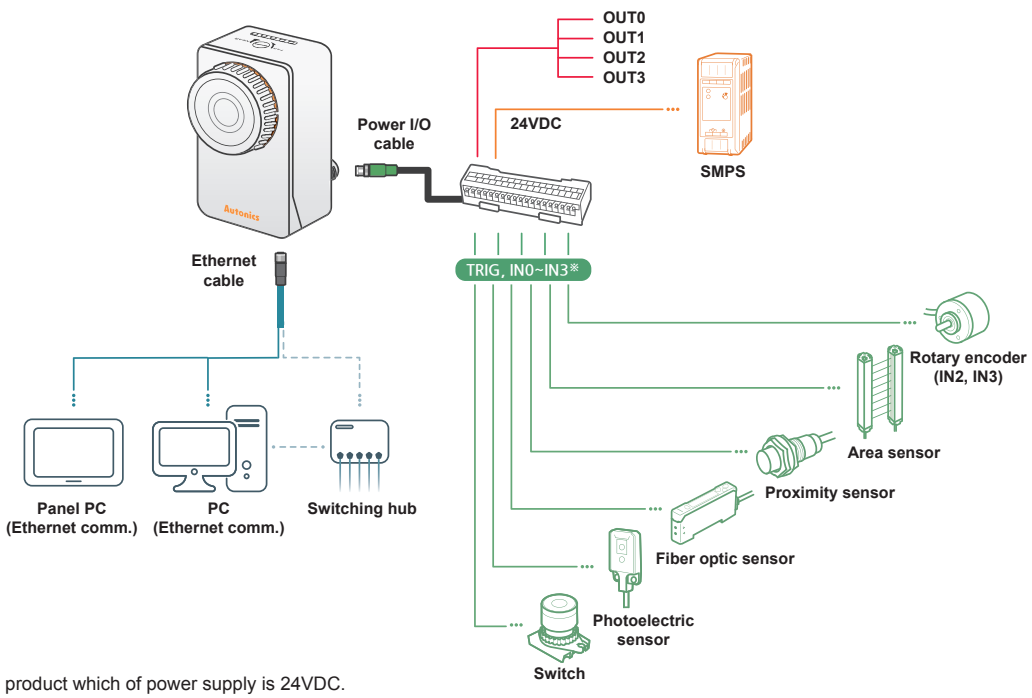
● L type
CLR-2-VG (2m)
CLR-5-VG (5m)
CLR-10-VG (10m)

▣ Specifications

Model		VG-M04□-8E	VG-M04□-16E	VG-M04□-25E	VG-C04□-8E	VG-C04□-16E	VG-C04□-25E
Effective focal length		8mm	16mm	25mm	8mm	16mm	25mm
Min. working distance		50mm	100mm	200mm	50mm	100mm	200mm
Power supply		24VDC⎓ (±10%)					
Current consumption		1A					
Inspection	Inspection item	Alignment, brightness, contrast, area, edge, shape comparison, length, angle, diameter, object counting			Alignment, brightness※2, contrast※2, area※2, edge, shape comparison※2, length, angle, diameter, object counting※2, color identification, area of color, object of color counting		
	Work group	32					
	Simultaneous inspection	64					
	Camera frame per second※1	Max. 60fps					
Image snap	Image filter	Preprocessing, external filter (color filter, polarizing filter)					
	Image element	1/3 inch mono CMOS			1/3 inch color CMOS		
	Resolution	752×480 pixel					
	Camera frame per second※1	Max. 60fps					
	Shutter	Global shutter					
	Exposure time	20 to 50,000μs					
Light	ON/OFF method	Pulse					
	Color	White, red, green, blue					
Trigger mode		External trigger, internal trigger, free-run trigger					
Input	Signal	Rated input 24VDC⎓ (±10%)					
	Type	External trigger (TRIG), work group change (IN0 to IN3), alarm cleared (IN0 to IN3), encoder (IN2, IN3)					
Output	Signal	NPN or PNP open collector output Max. 24VDC⎓ 50mA, residual voltage: max. 1.2VDC⎓					
	Type	Control output (OUT0 to OUT3) : inspection completion, inspection result, external light trigger, alarm, camera busy, changing work group completed					
	FTP transmission	Possible					
Communication		Ethernet (TCP/IP), 100BASE-TX/10BASE-T					
Protection circuit		Output short over current protection circuit					
Indicator		• Power indicator (POWER), Ethernet connection indicator (LINK), pass indicator (PASS): green LED • Data transmission indicator (DATA): orange LED • Failure indicator (FAIL): red LED					
Insulation resistance		Over 20MΩ (at 500VDC megger)					
Dielectric strength		500VAC 50/60Hz for 1 min					
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours					
Shock		300m/s^2 (approx. 30G) in each X, Y, Z direction for 3 times					
Environment	Ambient temp.	0 to 45℃, storage: -20 to 70℃					
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH					
Protection structure		IP67 (IEC standard)					
Material		Case: aluminum, lens cover/focus adjuster: polycarbonate, cable: polyurethane					
Accessories		Assembly tool, bracket A, mounting screw: 2					
Sold separately		Light, color filter, polarizing filter, power I/O cable, Ethernet cable, bracket B, protection cover, panel PC					
Approval		CE K					
Weight※3		Approx. 415g (approx. 273g)	Approx. 416g (approx. 274g)	Approx. 416g (approx. 274g)	Approx. 415g (approx. 273g)	Approx. 416g (approx. 274g)	Approx. 416g (approx. 274g)

※1: The number of camera frames per second can be different by image setting or inspection item.
※2: These inspection items convert a color image to a mono color image to inspect data.
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Connections

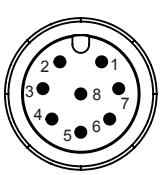


※Use the product which of power supply is 24VDC.
When selecting a product, please refer to Autonics selection guide.

◎ Power I/O cable (M12 12-pin connector)

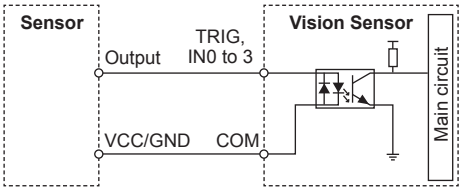
Pin arrangement	Pin No.	Cable color	Signal	Function		
	1	Brown	24VDC	24VDC		
	2	Blue	GND	GND		
	3	White	TRIG	Trigger input		
	4	Green	IN0	Work group change Bit 0	Work group change Clock	Alarm cleared
	5	Pink	IN1	Work group change Bit 1	Work group change Data	
	6	Yellow	IN2	Work group change Bit 2	Encoder - Up counter - Quadrature A	
	8	Gray	IN3	Work group change Bit 3	Encoder - Down counter - Quadrature B	
	11	Gray/Pink	COMMON	COMMON		
	7	Black	OUT0	Inspection completion, inspection result, external light trigger, alarm, camera busy, changing work group completed		
	9	Red	OUT1			
	10	Purple	OUT2			
	12	Red/Blue	OUT3			

◎ Ethernet cable (M12 8-pin/RJ45 connector)

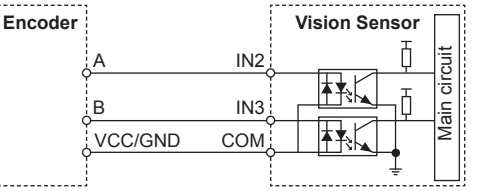
Pin arrangement	M12 8-pin		Cable color	RJ45	
	Pin No.	Signal		Pin No.	Signal
	6	RX+	White/Orange	1	TX+
	4	RX-	Orange	2	TX-
	5	TX+	White/Green	3	RX+
	8	TX-	Green	6	RX-
	1	—	White/Blue	5	—
	7	—	Blue	4	—
	2	—	White/Brown	7	—
	3	—	Brown	8	—

▣ Input Circuit Diagram

● **External trigger input (TRIG)**
Work group change input (IN0 to IN3)
Alarm cleared input (IN0 to IN3)

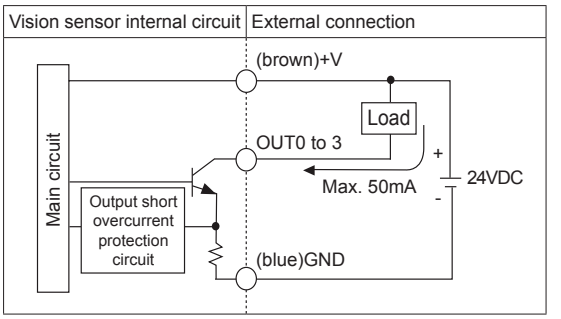


● **Encoder input (IN2, IN3)**

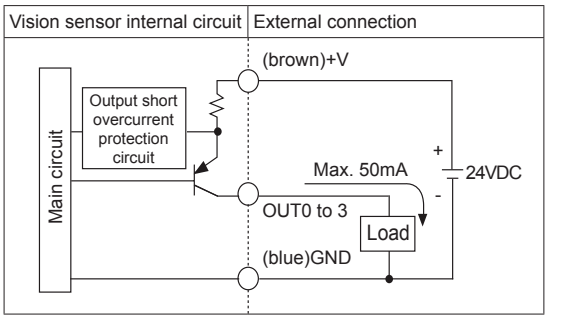


▣ Control Output Circuit Diagram

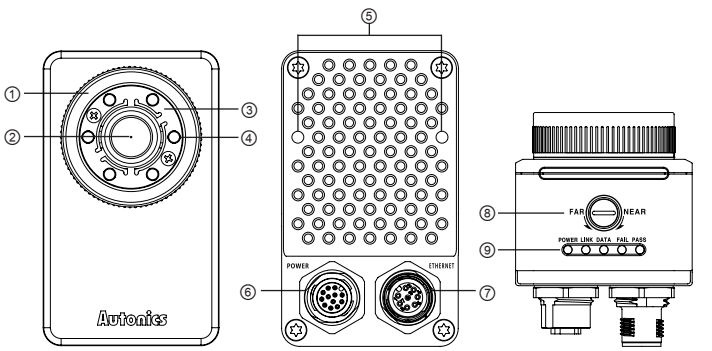
● **NPN open collector output**



● **PNP open collector output**



▣ Unit Description

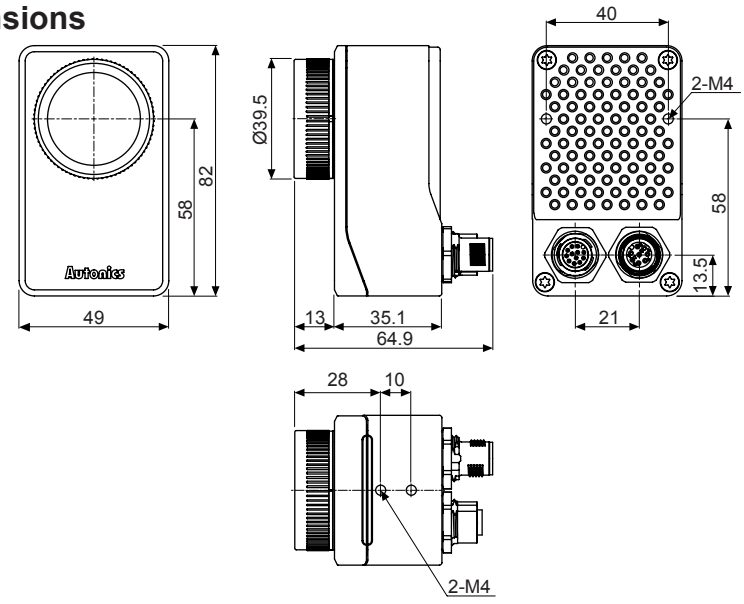


① Lens cover: Front cover of lens
※In case using a filter (color filter/polarizing filter), separate the lens cover with the assembly tool before insert the filter.
② Lens: There are 8mm, 16mm, 25mm models by effective focal length.
③ Light cover: Light cover fixes inner LED lights.
④ Light: Inner LED lights
※In order to change the light, separate lens cover and light cover.
⑤ Bracket mounting hole on back side: Install the vision master from the back side using bracket B.
⑥ Power I/O connector: Connect the power I/O cable.
⑦ Ethernet connector: Connect the Ethernet cable. It is for TCP/IP communication.
⑧ Focus adjuster: After fixing vision sensor, adjust focus by rotating the focus adjuster.
⑨ Indicators

Indicators		Color	Descriptions
POWER	Power indicator	Green LED	Turns ON when power is supplied.
LINK	Ethernet connection indicator	Green LED	Turns ON when vision sensor is connected with PC (Ethernet communication).
DATA	Data transmission indicator	Orange LED	Flashes when data is transmitted from vision sensor to PC.
FAIL	Failure indicator	Red LED	Flashes when detects failure during work group inspection.
PASS	Pass indicator	Green LED	Flashes when passed inspection during work group inspection.

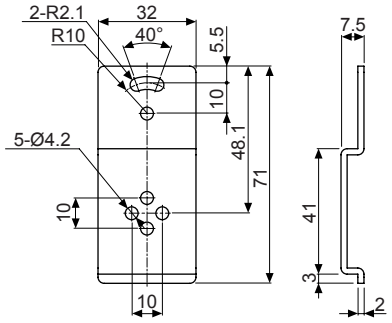
▣ Dimensions

(unit: mm)



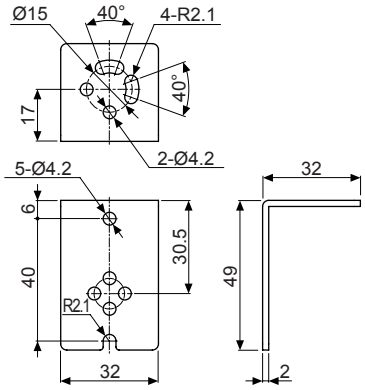
◎ Accessory

● **Bracket A (BK-VG-A)**



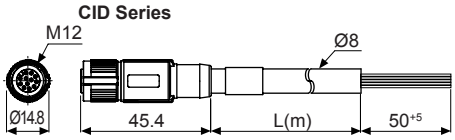
◎ Sold separately

● **Bracket B (BK-VG-B)**

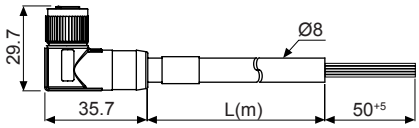


● **Power I/O cable (M12 12-pin connector)**

CID Series



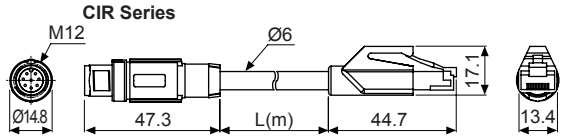
CLD Series



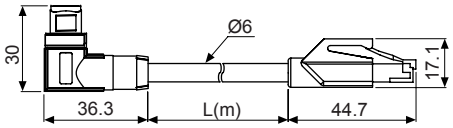
Type	Model	L
Standard	CID-2-VG	2m
	CID-5-VG	5m
	CID-10-VG	10m
L type	CLD-2-VG	2m
	CLD-5-VG	5m
	CLD-10-VG	10m

● **Ethernet cable (M12 8-pin/RJ45 connector)**

CIR Series



CLR Series



Type	Model	L
Standard	CIR-2-VG	2m
	CIR-5-VG	5m
	CIR-10-VG	10m
L type	CLR-2-VG	2m
	CLR-5-VG	5m
	CLR-10-VG	10m

▣ Installation

Installing vision sensor
- Checking working distance and FOV by effective focal length
- Bracket installation (fixing vision sensor)

→

Installing software
- Installing the vision sensor program, Vision Master, to PC

→

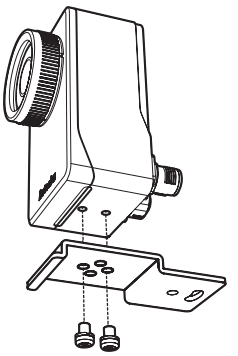
Connecting vision sensor and PC
- Setting network from Vision Master

→

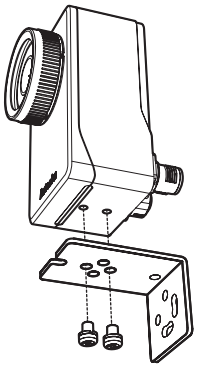
Adjusting vision sensor focus
- Running Vision Master and activating the 'Focusing Guide' function in the camera setting menu
- Adjusting focus with focus adjuster

◎ Bracket installation

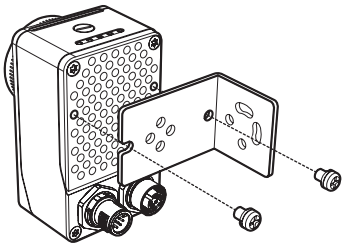
● **Install horizontally from the bottom - bracket A (accessory)**



● **Install vertically from the bottom - bracket B (sold separately)**

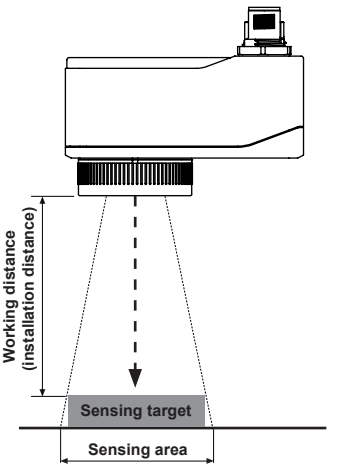


● **Install vertically from the back side − bracket B (sold separately)**



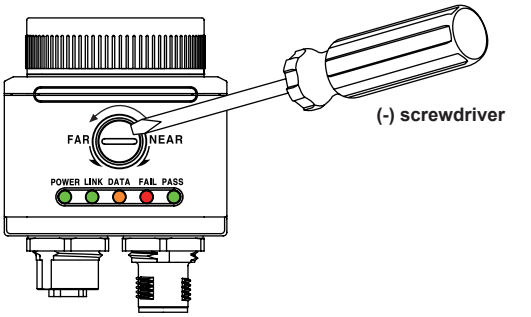
◎ Installation position

Place the sensing target at the center of the vision sensor lens.



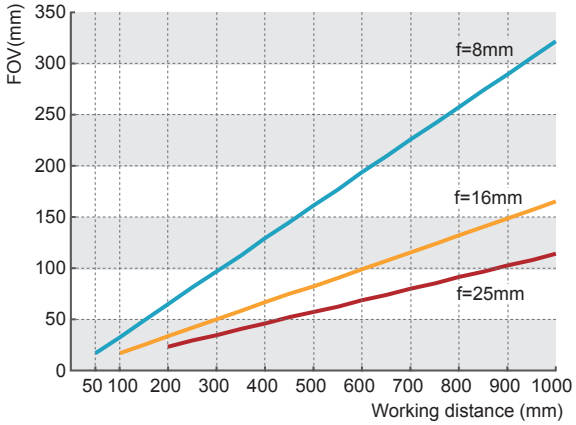
◎ Focus adjustment

After installing and running Vision Master, use the focusing guide function to adjust the focus.
Using (-) screwdriver, turn focus adjuster to right and left to adjust the focus.



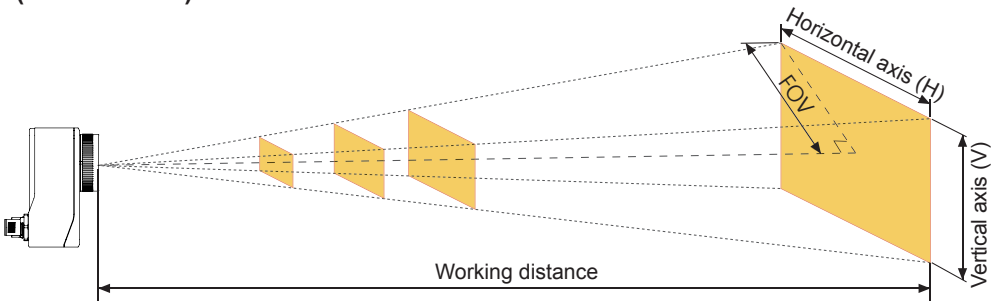
▣ Working Distance and FOV by Effective Focal Length

◎ Working distance



Effective focal length (f)	8mm	16mm	25mm
Min. working distance	50mm	100mm	200mm
Brightness	F2.0	F2.5	F2.5

◎ FOV (Field of view)



● Sensing range by effective focal length (unit: mm)

Effective focal length	Working distance	50	100	200	300	400	500	600	700	800	900	1,000
8mm	FOV	16	32	64	96	129	161	193	255	257	289	322
	Horizontal axis (H)	27	54	108	163	217	271	325	380	434	488	542
	Vertical axis (V)	17	35	69	104	138	173	208	242	277	311	346
16mm	FOV	—	16	33	49	66	82	99	155	132	148	165
	Horizontal axis (H)	—	28	56	83	111	139	167	195	222	250	278
	Vertical axis (V)	—	18	35	53	71	89	106	124	142	160	177
25mm	FOV	—	—	23	34	46	57	68	80	91	103	114
	Horizontal axis (H)	—	—	38	58	77	96	115	134	154	173	192
	Vertical axis (V)	—	—	25	37	49	61	74	86	98	110	123

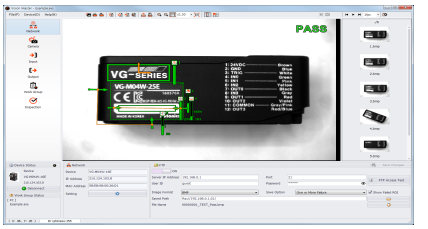
■ Vision Sensor Program [Vision Master]

Vision Master is the vision sensor program that allows setting of vision sensor parameters and management of monitoring data such as inspection status and status information.

<Computer specification for using software>

Item	Minimum specifications
System	32bit (×86) or 64bit (×64) processor over 1GHz
Operations	Microsoft Windows 7/8/10
Memory	1GB+
Hard disk	400MB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RJ45 Ethernet port

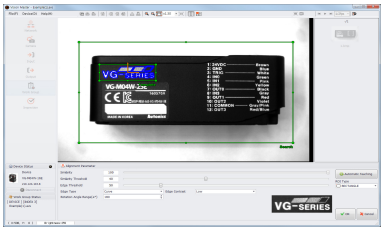
<Vision Master execution screen>



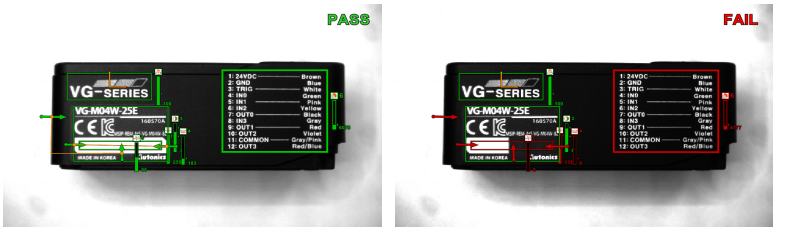
※Vision sensor is connected with Vision Master in Ethernet (TCP/IP) communication.
※For initial IP address of vision sensor, refer to the following table. Configure the network settings of vision sensor via Vision Master.

IP address	192.168.0.2
Subnet mask	255.255.255.0
Gateway	192.168.0.1

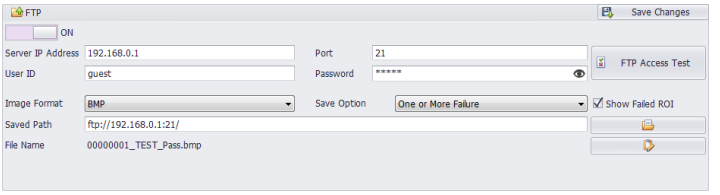
<Inspection setting screen>



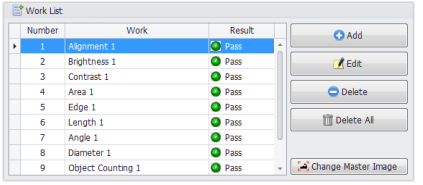
<Inspection executing screen>



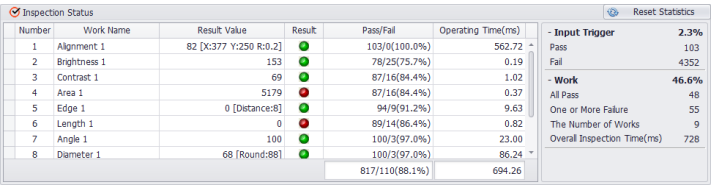
<FTP transmission setting screen>



<Registered inspections in work group>



<Inspection status monitoring screen>



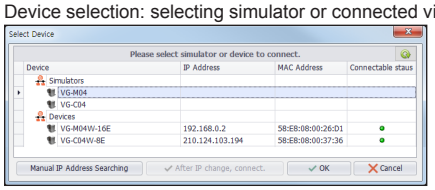
◎ Vision Master Work Flow

● Setting mode

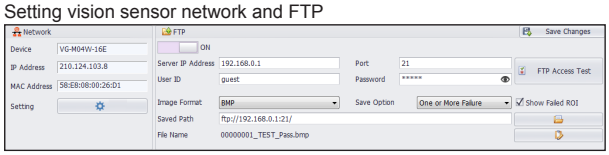
Setting mode

Network setting and device connection

① Device selection: selecting simulator or connected vision sensor

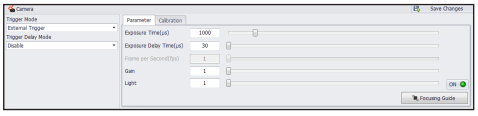


② Setting vision sensor network and FTP



Camera setting

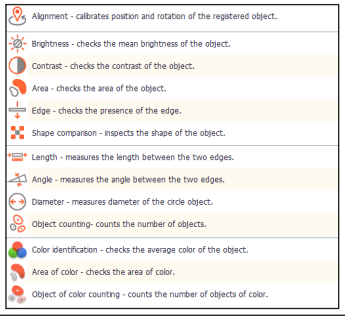
Input image shooting setting
- Trigger mode, camera exposure time, exposure delay time, frame per second, gain, light setting, calibration



Work group setting (max. 32)

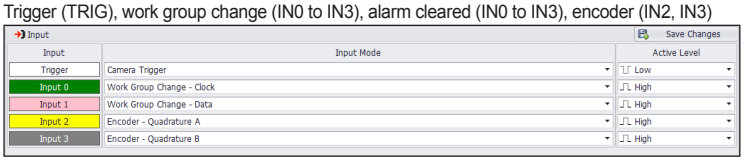
① Shooting inspection target or opening image file
② Selecting inspection item
- Alignment, brightness, contrast, area, edge, shape compraison, length, angel, diameter, object counting, color identification, area of color, object of color counting

③ ROI setting
④ Setting inspection parameter and registering inspection
⑤ Registering additional inspection (max. 64 for each work group)

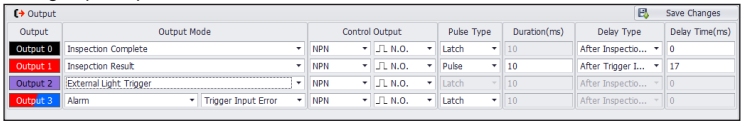


Input/Output setting

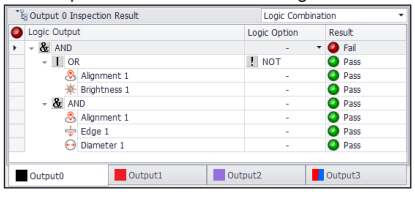
① Input setting
- Trigger (TRIG), work group change (IN0 to IN3), alarm cleared (IN0 to IN3), encoder (IN2, IN3)



② Output setting
- Inspection complete, inspection result, external light trigger, alarm, camera busy, changing work group completed



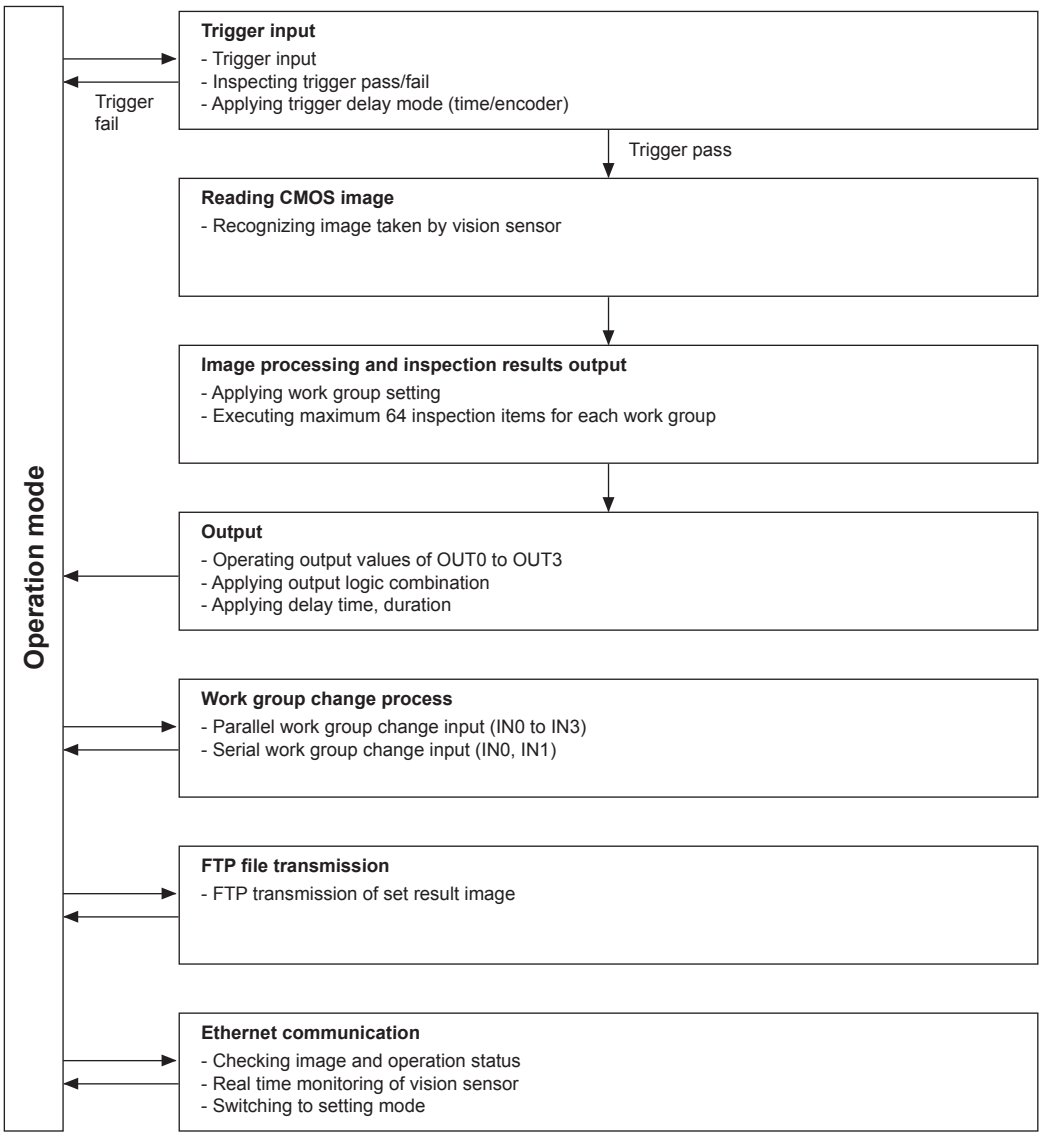
- Output logic combination: with logic combination operator, setting conditions for result output from inspection results which are registered in work group



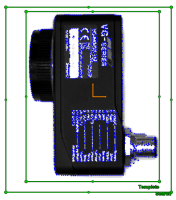
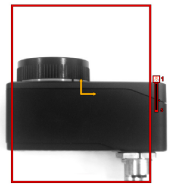
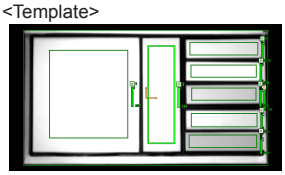
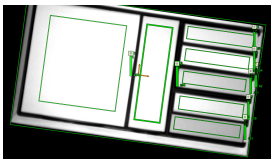
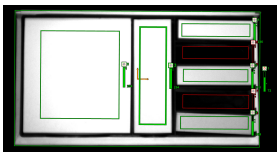
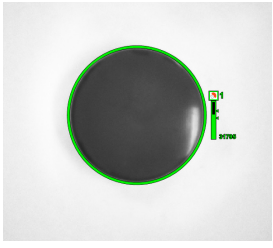
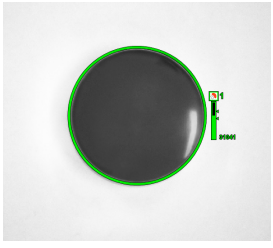
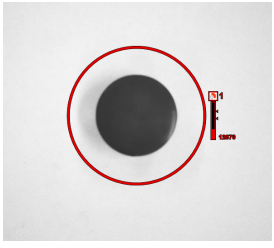
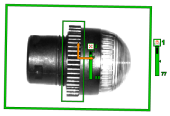
Inspection - operation mode

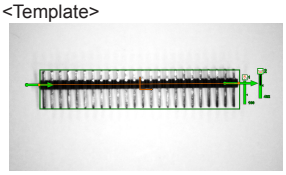
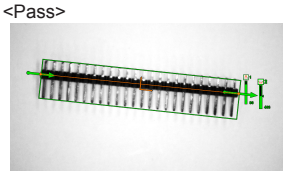
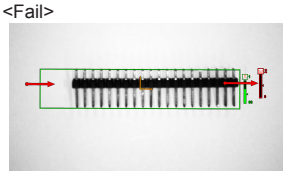
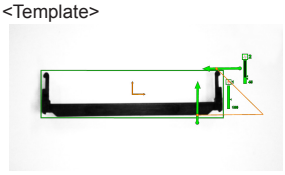
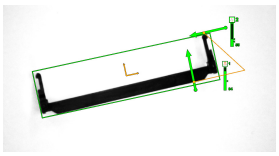
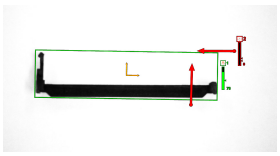
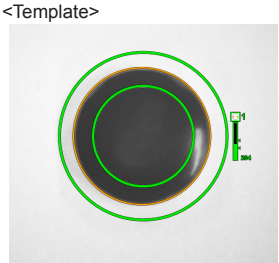
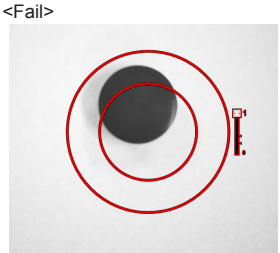
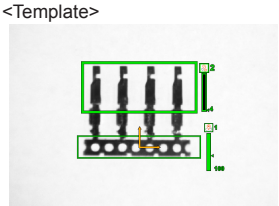
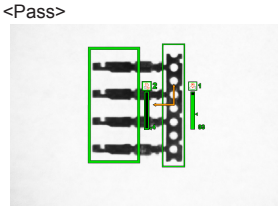
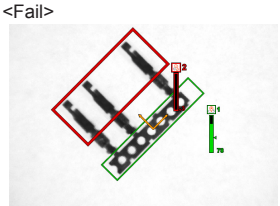
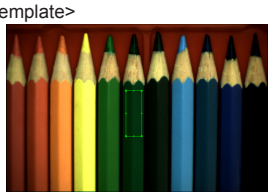
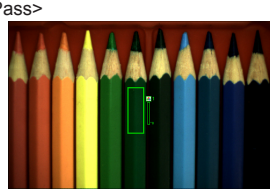
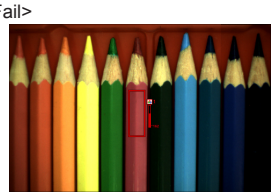
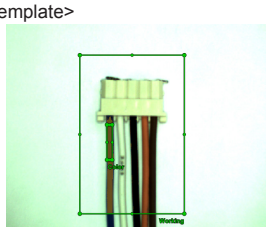
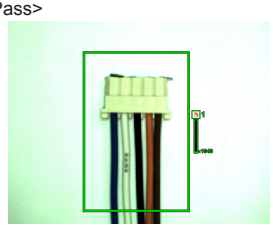
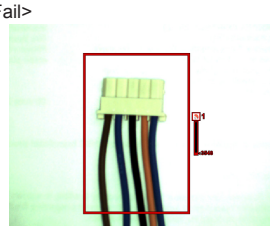
◎ Vision Master Work Flow

● **Operation mode**



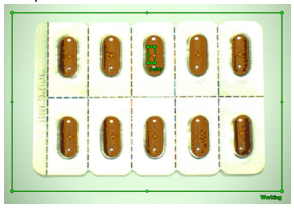
◎ Inspection function

Item	Description		
Alignment	Compares features of the registered image and input image to search for a similar pattern position, and inspects the input image with information of the searched pattern position and rotation angle.		
	<Template> 	<Pass> 	<Fail> 
Brightness	Inspects brightness of the ROI in the input image based on the mean brightness value of the ROI (Region of Interest) in the registered image.		
	<Template> 	<Pass> 	<Fail> 
Contrast	Inspects contrast of the ROI in the input image based on contrast of the ROI in the registered image.		
	<Template> 	<Pass> 	<Fail> 
Area	Inspects the ROI area of the input image based on the ROI area of the image registered by user.		
	<Template> 	<Pass> 	<Fail> 
Edge	Inspects the direction of the edge in the input image based on the edge registered by user in the same area.		
	<Template> 	<Pass> 	<Fail> 
Shape comparison	Compares shape of object in the ROI registered by user and that of the input image.		
	<Template> 	<Pass> 	<Fail> 

Item	Description		
Length	Inspects the input image based on the length between two edges registered by user.		
	<Template>	<Pass>	<Fail>
			
Angle	Inspects the input image based on the angle between two edges registered by user.		
	<Template>	<Pass>	<Fail>
			
Diameter	Inspects the input image based on the area between two circles registered by user.		
	<Template>	<Pass>	<Fail>
			
Object counting	Compares the number of objects in the ROI which is in the image registered by user and that in the input image.		
	<Template>	<Pass>	<Fail>
			
Color identification	Compares color of the ROI registered by user and that of the input image.		
	<Template>	<Pass>	<Fail>
			
Area of color	Compares the area of a certain color in the ROI registered by user and that in the input image.		
	<Template>	<Pass>	<Fail>
			

※These examples include position alignment. (except area, diameter, color identification, area of color, and object of color counting inspection)
※Color identification, area of color, and object of color counting are only for VG-C Series.

◎ Inspection function

Item	Description		
Object of color counting 	Compares the number of objects in a certain color which are in the ROI of registered image and that of the input image.		
	<Template> 	<Pass> 	<Fail> 

※These examples include position alignment. (except area, diameter, color identification, area of color, and object of color counting inspection)
※Color identification, area of color, and object of color counting are only for VG-C Series.

▣ Proper Usage

◎ Cautions during Use

- Follow instructions in Cautions during Use. Otherwise, it may cause unexpected accidents.
- 24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- In order to avoid malfunction from static electricity or noise, ground shield wire of the power I/O cable.
- Do not disconnect the power supply while setting operation or saving set information.
  It may cause data loss.
- Do not disconnect the power supply while updating firmware. It may cause product damage.
- Keep optical section of the sensor away from the contact with water, dust and oil.
  It may cause malfunction.
- When changing the light or filter, use the assembly tool and observe installation instruction.
- When the sensor is not used for a long time, separate the power cable to store.
- When connecting network, connection must be operated by technical expert.
- In the following case, disconnect the power supply immediately. It may cause fire or product damage.
  ① When water or foreign substance is detected in the product
  ② When the product is dropped or case is damaged
  ③ When smoke or smell is detected from the product
- Do not use the product in the place where strong magnetic field or electric noise is generated.
- This unit may be used in the following environments.
  ① Indoor (in the environment conditions in specifications)
  ② Altitude max. 2,000m
  ③ Pollution degree 2
  ④ Installation category II

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