Photoelectric Press Safety Device

RPX Series

User's Guide

We heartily express our gratitude for your making use of our company's product. Prior to using this device, please adhere to the following guidelines:

- Please read through and understand the instructions contained in this User's Guide before operation, inspection and maintenance of the device,
- When transferring the device to the next owner, please attach this User's Guide to it without fail.
- This device has been manufactured in accordance with Japan's regulations and standards.
- When using the device in a foreign country, it is necessary to observe the safety standards of the country.
- Please retain this User's Guide carefully for ready reference.

RIKEN OPTECH CORPORATION

INTRODUCTION

We heartily express our gratitude for your making use of our RPX series photoelectric safety device. The RPX series meets the construction code for press safety devices and is compliant with the certification requirements of the Ministry of Health, Labor and Welfare.

＜Sensor only＞

Certificate No. TA532 (RPX414X2,RPX425X2,RPX414X2FL1)

Certificate No. TA533 (RPX414X4,RPX425X4,RPX414X4FL1)

Certificate No. TA538 (RPX414X2FL2)

Certificate No. TA539 (RPX414X4FL2)

Certificate No. TA543 (RPX425X2FL1,RPX414X2FL3)

Certificate No. TA542 (RPX425X4FL1,RPX414X4FL3)

＜With control box＞

Certificate No. TA531 (RPX414,RPX425,RPX414FL1)

Certificate No.TA537 (RPX414FL2)

Certificate No. TA541 (RPX425FL1,RPX414FL3)

Certificate No. TA544 (RPX425,RPX414)　※Blanking Spec. (Special box used)

Regulations and Standards

1. The RPX is electro-sensitive protective equipment (ESPE) in accordance with European Union (EU) Machinery Directive Index Annex V, Item 2.
2. EC Declaration of Conformity

   RIKEN OPTECH declares that the RPX is in conformity with the requirements of the following EC Directives:

   Machinery Directive 2006/42/EC

   EMC Directive 2004/108/EC
3. The RPX is in conformity with the following standards

   ・Type 4 model

   (1) European standards

   EN61496-1 (Type 4 ESPE) . prEN61496-2 (Type 4 AOPD) ,

   EN61508-1 through-7 (SIL3) , EN ISO 13849-1:2008 (Category 4, PL e)

   (2) International standards

   IEC61496-1 (Type 4 ESPE) , IEC61496-2 (Type 4 AOPD) ,

   EN61508-1 through-7 (SIL3)

   (3) JIS standards

   JIS B9704-1 (Type 4 ESPE) . JIS B 9704-2 (Type 4 AOPD)

   (4) North American standards

   UL61496-1 (Type 4 ESPE) , UL61496-2 (Type 4 AOPD) , UL508, UL1998、

   CAN/CSA C22.2 No.14、CAN/CSA C22.2 No.0.8

   ・Type 2 model

   (1)European standards

   EN61496-1 (Type 2 ESPE) , prEN61496-2 (Type 2 AOPD) ,

   EN61508-1 through -7 (SIL1), EN ISO 13849-1:2008 (Category 2, PL c)

   (2) International standards

   IEC61496-1 (Type 2 ESPE) , IEC61496-2 (Type 2 AOPD) ,

   IEC61508-1 through -7 (SIL1)

   (3) JIS standards

   JIS B9704-1 (Type 2 ESPE) , JIS B 9704-2 (Type 2 AOPD)

(4) North American standards

UL61496-1 (Type 2 ESPE) , UL61496-2 (Type 2 AOPD) , UL508, UL1998、CAN/CSA C22.2 No.14, CAN/CSA C22.2 No.0.8

4. The RPX received the following approvals from the EU accredited body, TÜV SÜD Product Service GmbH:

・Type 4 model。

—EC Type-Examination in accordance with the EU Machinery Directive, Type 4 ESPE (EN61496-1),Type 4 AOPD (prEN61496-2)

—TÜV SÜD Product Service GmbH Type Approval, Type 4 ESPE (EN61496-1), Type 4 AOPD(prEN61496-2), SIL1, 2, 3 (EN61508-1 through -7), Category B, 1, 2, 3, 4 and PL a, b, c, d, e (ENISO13849-1:2008), Application: EN954-1 Category B, 1, 2, 3, 4

・Type 2 model

—EC Type-Examination in accordance with the EU Machinery Directive, Type 2 ESPE (EN61496-1),Type 2 AOPD (prEN61496-2)

—TÜV SÜD Product Service GmbH Type Approval, Type 2 ESPE (EN61496-1), Type 2 AOPD(prEN61496-2), SIL 1 (EN61508-1 through -7), Category B, 1, 2 and PL a, b, c (EN ISO13849-1:2008), Application: EN954-1 Category B, 1, 2

5. The RPX received the certificates of UL listing for US and Canadian safety standards from the Third Party Assessment Body UL.

・Type 4 model

—Both are: Type 4 ESPE (UL61496-1), Type 4 AOPD (UL61496-2)

・Type 2 model

—Both are: Type 2 ESPE (UL61496-1), Type 2 AOPD (UL61496-2)

6. The RPX is designed according to the standards listed below. To make sure that the final system complies with the following standards and regulations, you are asked to design and use it in accordance with all other related standards, laws, and regulations.
If you have any questions, consult with specialized organizations such as the body responsible for prescribing and/or enforcing machinery safety regulations in the location where the equipment is to be used.

- European Standards: EN415-4, EN692, EN693
- U.S. Occupational Safety and Health Standards: OSHA 29 CFR 1910.212
- U.S. Occupational Safety and Health Standards: OSHA 29 CFR 1910.217
- American National Standards: ANSI B11.1 to B11.19
- American National Standards: ANSI/RIA 15.06
- Canadian Standards Association CSA Z142, Z432, Z434
- SEMI Standards SEMI S2
- Ministry of Health, Labour and Welfare "Guidelines for Comprehensive Safety Standards of Machinery", Standard Bureau's Notification No. 501 dated June 1, 2001.

* For the name of the year of issue of the above-mentioned standards, please refer to Section "Citation Standards" (p.48).

Note: Those standards apply to the sensors only.

Before operating the safety device, it is important to read through this User's Guide and fully understand the items contained therein.
In order to ensure safe operation, be sure to read the User's Guide because things which you must not do, must do, must be adhered to and must be attended to are stated therein.
This manual describes functions, rated performance, wiring, for conservation.
In addition, the important items are described in detail as "Danger," "Warning" and "Caution." We request users to correctly understand the photoelectric safety device and abide by the items described in the User's Guide for the sake of safe operation.

An explanation of this User's Guide will be provided by our sales staff. However, if you have any questions, please refer to our office.

Safety Instructions

In order to ensure safe operation of the RPX, safety instructions are shown by the following symbols in this Use's Guide. These instructions specify important matters for safe operation. The symbols and their meanings are as follows:

WARNING	There is a possibility of death or serious injury resulting from improper use by ignoring this indication.

	Symbol that means "Must not do."

⚠ WARNING

Applicable machines

○This device cannot be used except for machines with quick-stopping mechanism or with restart prevention circuit.

Installation position of emitter/receiver

○ Ensure the safe distance conforming to the time delay specified on the certification plate.
When the machine does not stop before the operator reaches the dangerous part., there is a possibility of suffering serious injury.

○ Install the emitter/receiver so that part of the human body remains in the detection area.
Install the emitter/receiver so as to operate efficiently over the entire length of the protection height (stroke length + die height).

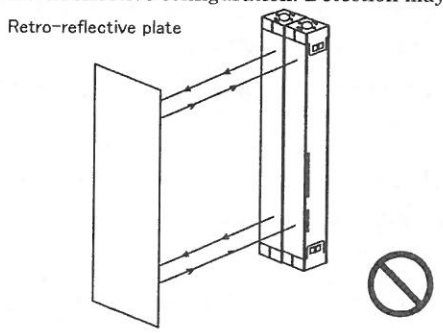
○ Install a protective structure around the machine so that the operator can reach the dangerous part only after passing through the detection area.

○ Never change the installation position.

○ Install the emitter/receiver so as not to be affected by wall reflection.
Detection becomes impossible, so there is a possibility of suffering serious injury.

○ In the case of using plural photoelectric safety devices, install them, using a light-insulating shield or the like to prevent mutual interference.

○ Do not use a reflective or retro-reflective configuration. Detection may become impossible.



Installation of auxiliary beams

○ When a clearance through which part of the human body enters exists between the beam centerline of the emitter/receiver and the front end of the bolster, install auxiliary beams at intervals of 75 mm or less in horizontal distance.

Never use the photoelectric safety device in the detached or nonfunctioning state.

○ Using it in such a state may result in death or serious injury.

Inspection before operation of the safety device

○ Check the photoelectric safety device by the attached test piece to see whether or not it operates properly.

⚠ WARNING
Do not use the safety device in a flammable or explosive environment.
Do not disassemble, repair or modify the main body.
Protection from flying workpieces cannot be provided. Other safety measures should be taken.
Securely tighten the fixing screws for the main body and cord connectors.
Periodical inspection of the safety device o Subject the safety device to the manufacturer's periodical inspection at least once a year.

Request

(1) Do not connect an AC power supply directly to the emitter/receiver.
(Please refer to Paragraph 4-4-2 "Wiring method" of this User's Guide.)

(2) Periodical inspection of the safety device
Subject the safety device to the manufacturer's periodical inspection at least once a year.

(3) When trouble occurs in the safety device or the press machine, immediately stop the press machine and make contact with the press foreman.

(4) Installation environment
Do not install the safety device in the following places:
- Place exposed to direct sunlight or strong ambient light.
- Place where temperature is high and dew may condense.
- Place where corrosive gas exists.

Instructions before Use

Please check to see that the following goods are contained in the box. All possible measures have been taken to ensure proper packaging. However, if anything is deficient, please contact our local business office nearest you.

(1) Emitter/receiver 1 set

(2) Sensor fittings

① Embedded type rear fittings --- 4 sets

② Side fittings --- 4 sets

③ Spacers --- 4 pcs.

④ Embedded hexagon socket head bolt (M5×14) ---16pcs.

(3) Test rod × 1 pc.

For Type RPX414-□□□□■... φ14mm 1 pc.

For Type RPX425-□□□□■... φ25mm 1 pc.

For Type RPX425-□□□□■FL1... φ45mm 1 pc.

For Type RPX414-□□□□■FL1... φ23mm 1 pc.

For Type RPX414-□□□□■FL2... φ32mm 1 pc.

For Type RPX414-□□□□■FL3... φ41mm 1 pc.

● Instruction manual (this User's Guide) 1 book

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Chapter 1 OVERVIEW

1-1 Features

Detection distance

RPX414-225X4～RPX414-1620X4 : 9m (aperture angle±2.5°)
RPX414-1683X4～RPX414-2061X4 : 7m (aperture angle±2.5°)

RPX425-240X4～RPX425-1620X4 : 9m (aperture angle±2.5°)
RPX425-1680X4～RPX425-2460X4 : 7m (aperture angle±2.5°)

RPX414-225X2～RPX414-2061X2 : 4m (aperture angle±5°)
RPX425-240X2～RPX425-2460X2 : 4m (aperture angle±5°)

RPX414-225X4FL1～RPX414-1620X4FL1 : 9m (aperture angle±2.5°)
RPX414-1683X4FL1～RPX414-2061X4FL1 : 7m (aperture angle±2.5°)
RPX414-225X2FL1～RPX414-2061X2FL1 : 4m (aperture angle±5°)

RPX414-225X4FL2～RPX414-1620X4FL2 : 9m (aperture angle±2.5°)
RPX414-1683X4FL2～RPX414-2061X4FL2 : 7m (aperture angle±2.5°)
RPX414-225X2FL2～RPX414-2061X2FL2 : 4m (aperture angle±5°)

RPX414-225X4FL3～RPX414-1620X4FL3 : 9m (aperture angle±2.5°)
RPX414-1638X4FL3～RPX414-2061X4FL3 : 7m (aperture angle±2.5°)
RPX414-225X2FL3～RPX414-2061X2FL3 : 4m (aperture angle±5°)

Continuous light interrupting width (minimum detectable object)

RPX414-□□□□■series : 14mm (standard type)
RPX425-□□□□■series : 25mm (standard type)
RPX414-□□□□■FL1 series : 23mm (floating 1 beam type)
RPX414-□□□□■FL2 series : 32mm (floating 2 beam type)
RPX414-□□□□■FL3 series : 41mm (floating 3 beam type)
RPX425-□□□□■FL1 series : 45mm (floating 1 beam type)

In calculating the safety distance, each series is different in "additional distance+ C)."

Additional distance (C)

RPX414-□□□□■series : 0 mm
RPX425-□□□□■series : 0 mm
RPX414-□□□□■FL1series : 0 mm
RPX414-□□□□■FL2series : 200 mm
RPX414-□□□□■FL3series : 300 mm
RPX425-□□□□■series : 300 mm

Detection widths are various, so necessary sizes for the device can be selected.

RPX414-□□□□■series : 225mm and 234mm～2061mm[per 63mm]
RPX425-□□□□■series : 240mm～2460mm[60mm]
RPX414-□□□□■FL1series : 207mm、216mm～2043mm[per 63mm]
RPX414-□□□□■FL2series : 189mm、198mm～2025mm[per 3mm]
RPX414-□□□□■FL3series : 171mm、180mm～2007mm[per 63mm]
RPX425-□□□□■FL1series : 200mm～2420mm[per 60mm]

Light quantity display monitor

The quantity of light received is displayed by 5 LEDs. Light beams are easy to align.

Error display

When an error occurs, the error state is displayed by 3 LEDs. The cause of the error is easy to investigate.

External diagnosis function (stop of light emission)

Forcibly stops light emission from the emitter. This function is beneficial for the inspection at the start of the safety system.

Connecting function

A maximum of 4 sets with up to 400 beams in total can be connected in series. Auxiliary beams are easy to install.

1-2 Function

- Self-diagnosis function at power-up

  At power-up, self-diagnosis is performed for about 2 seconds. When no trouble is found, the sensor immediately starts to operate normally.

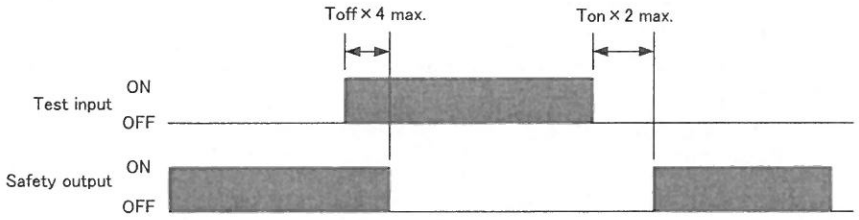
- Cyclic self-diagnosis function

  Self-diagnosis relating to safety is repeated within the response time. If electronic components fail, the sensor gets into the lockout state.

- External test function (test input)

  The function to diagnose with optional timing. With a voltage of 9-24V applied to the test input wire (black or green), light emission stops and the control output turns off.

  (The application time needs to be more than 4 times as longer as "T off.")

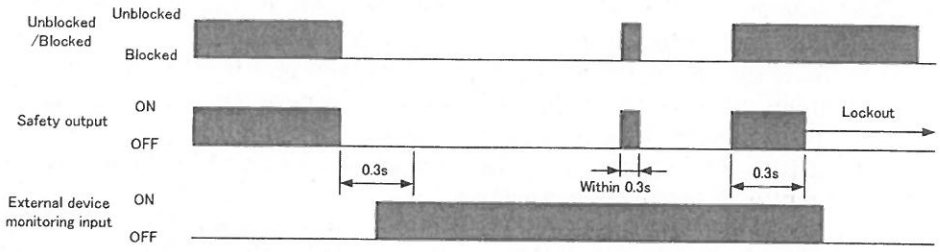


Ton: Response time of OSSD OFF → ON
Toff: Response time of OSSD ON → OFF

● External relay monitor function

The receiver confirms that the load relays for control output are operating properly.

Connect the contacts B of two load relays in series. If the contacts B show a delay time within 300 ms when the control output switches from ON to OFF, the sensor judges that there is no trouble and continues operating normally.

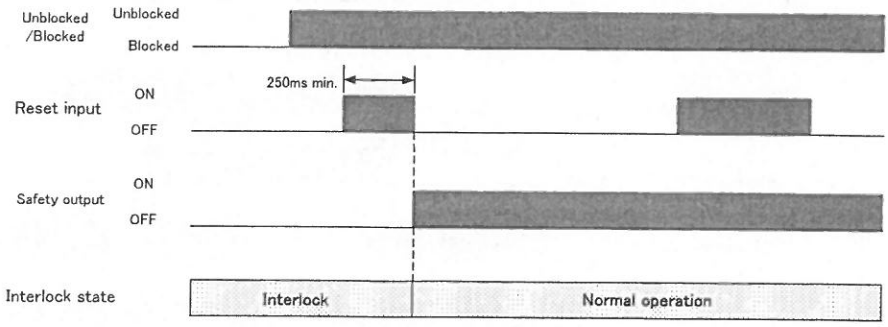


● Manual reset function

After power-up and when light is interrupted, the sensor gets into the interlock state.

In that state, the sensor keeps the control output off. Thus the control output does not turn on even when the sensor gets into the receive state.

With no light-shielding object in the detection area, apply a voltage of 9-24V to the reset input wire for 250 ms or more. After that, open the wire or decrease the voltage to 0-1.5V. The interlock state is canceled and the control output turns on.



● Muting function (not provided for the FL type)

(Only the autoreset mode is available.)

⚠WARNING

Do not use the muting function while the press slide is lowering. Using it in that state is dangerous because the press does not stop even when light is interrupted.

○ Start conditions

The sensor gets into the muting state when the following two conditions are met:

1. The control output is on with the RPX in the ON state.
2. After turning on the muting input 1 (connecting to 9-24V), turn on the muting input 2 (connect to 9-24V) within the muting input time limits of T1min～T1max (0.03～3 seconds).

   Up to 0.15 seconds after the conditions of Item 2 above are formed, the muting function becomes active.

   In cases where the conditions of Item 1 are met, but the time conditions of Item 2 are not met, a muting error results and the muting error indicating lamp on the receiver side goes on.

   In the muting error state, however, the safety function of the RPX operates and the sensor continues operating normally.

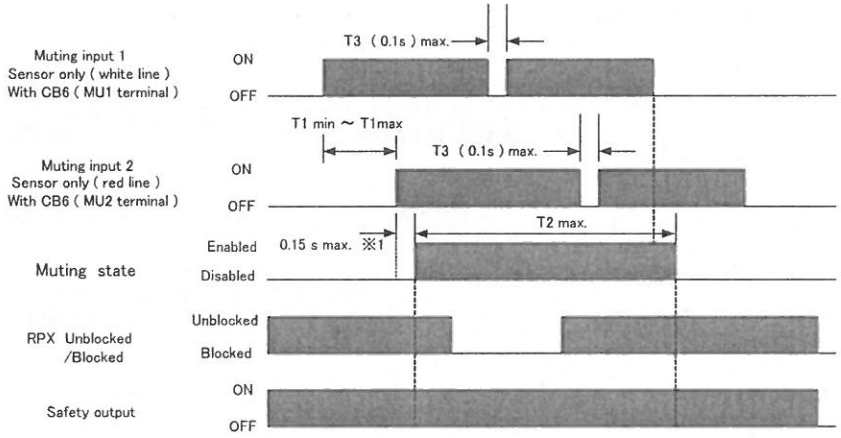
   The muting error is canceled under either of the following conditions:

   - Muting is started by the correct muting procedure (performed in the order of the start conditions 1 and 2),
   - The power supply is turned on again with the muting inputs 1 and 2 off.

○End conditions

The muting state is canceled when either of the following conditions is met:

- The muting input 1 or 2 turns off when T3 (0.1 seconds or more) is exceeded.
- The muting duration exceeds the muting time limit of T2 (60 seconds).

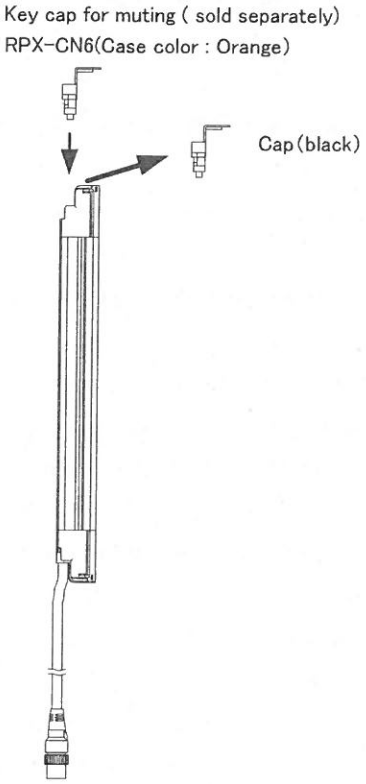


*1: These are the time values when the sensor is used as a single body. When plural sensors are connected, the following time values apply.

Single : 0.15 s	2 Connected : 0.26 s	3 Connected : 0.29 s	4 Connected : 0.32 s

● How to extend to the muting system:

1. Remove the cap of the emitter or receiver.
2. In place of the removed cap, attach the key cap for muting.



● Lockout reset

When the cause that has led to lockout is eliminated, lockout can be cancelled by either of the following methods:

- Powering up again
- Reset input

At the time of manual reset, apply a voltage of 9-24V to the reset input wire for 100 ms or more and then open the wire or apply a voltage of 0-1.5V to it again (emitter: yellow wire).

At the time of autoreset, open the reset input wire or apply a voltage of 0-1.5V to it for 100 ms or more and then apply a voltage of 9-24V to it (emitter: yellow wire).

* As for interlock wiring error and blinking error (error-A, -B, -C), lockout cannot be cancelled by reset input, in some cases

1-3 Type Names

Names of emitter/receiver

(1) (2) (3) (4)

RPX4○○−□■−□■−□■−□■△

(1) (2) (3) (4)

RPX4○○−□■ FL◆−□■ FL◆−□■ FL◆−□■ FL◆

○○denotes the sensor series name.

□denotes the protection height.

■denotes the aperture angle type X2 or X4.

(1) denotes the main beam.

(2) denotes the first series-connected sensors.

(3) denotes the second series-connected sensors.

(4) denotes the third series-connected sensors.

When (2)-(4) are not used, make no entry therein.

(Four sets are connectable in series. Up to 400 beams in total are available.)

△denotes whether or not the muting function for the emitter/receiver is provided. It is not provided for the standard type,

When the muting function is provided, enter "M."

FL denotes the sensor of the floating specification.

The muting function is not provided.

◆ denotes the number of floating beams.

Chapter 2 RATINGS/PERFORMANCE

2-1 List of Ratings

Item Type		RPX414-□□□X4 RPX414-□□□X2	RPX425-□□□X4 RPX425-□□□X2
Number of beams		26,27～234 (protection height 225～2097 mm at 63 mm intervals)	13～125 (protection height 240～2480 mm at 60 mm intervals)
Beam pitch		9 mm	20 mm
Continuous light interrupting width		14 mm	25 mm
Detection distance		X4 type: 0.2～9 m (protection height 1620mm or less) 0.2～7 m (protection height 1640 mm or more) X2 type: 0.2～4 m	
Response time		ON→OFF : 10 ms～27.5 ms or less、OFF→ON : 40 ms～110 ms or less	
Supply voltage (Vs)		Power supply to emitter/receiver DC24V±20% (ripple p-p10%or less)	
Consumption current	Emitter	～50 beams:76 mA :51～100 beams:106 mA or less:101～150 beams:130 mA or less 151～200 beams:153 mA or less:201～234 beams:165 mA or less	
	Receiver	～50 beams:68 mA :51～100 beams:90 mA or less:101～150beams:111 mA or less 151～200 beams:128 mA or less:201～234 beams:142 mA or less	
Light source		Infrared LED (wavelength 870 nm)	
Control output (OSSD)		PNP transistor output ×2、load current 300 mA or less、residual voltage 2V or less (excluding effect of cord extension)、allowable capacitive load 2.2 μF、leak current 1 mA or less	
Inversion output (non-safety output)		PNP transister×1、load current 300 mA or less、residual voltage 2V or less (excluding effect of cord extension) , leak current 1 mA or less	
Input voltage		Test input, interlock select input, reset input and muting input ON voltage : 9～24V (Vs) (sink current 3 m A or less) OFF voltage : 0～1.5V or open External relay monitor input : ON voltage : 9～24V (Vs) (sink current 5m A or less) OFF voltage : 0～1.5V or open	
Effective aperture angle		X4 type: ±2.5° or less /X2 type: ±5° or less when detection distance is 3 m or more	
Indicating lamp	Emitter	Light receive level indicating lamp (greenLED×2、orange LED×3):: Goes on according to light intensity. Error mode indicating lamp (red LED×3) : Blinks to indicate fault. Power indicating lamp (green LED×1): Goes on in energized state. Interlock indicating lamp (orange LED×1): Goes on in interlock state and blinks at lockout. External relay monitor indicating lamp (muting input 1 indicating lamp)、 Test indicating lamp (muting input 2 indicating lamp) (green LED×2) : Goes on or blinks according to function.	
	Receiver	Light receive level indicating lamp (green LED×2、orange LED×3): Goes on according to light intensity. Error mode indicating lamp (red LED×3): Blinks to indicate fault. OFF output indicating lamp (red LED×1): Goes on when control output is off and blinks at lockout ON output indicating lamp (red LED×1): Goes on when control output is on. Muting error indicating lamp, blanking/test indicating lamp (green LED×2) : Goes on or blinks according to function.	
Ambient temperature		during operation:-10～55℃ (not to freeze) : during storage : -30～70℃	
Ambient humidity		during operation: 35～85%RH (not to freeze) : during storage : 35～95%RH	
Ambient light intensity		Incandescent light: light intensity on light receiving surface 3,000 lx or less/ sunlight : light intensity on light receiving surface 10,000 lx or less	
Insulation resistance		20MΩ or more (with DC500V megger)	
Withstand voltage		AC1000V 50/60Hz for 1 minute	
Protective structure		Emitter/receiver : IP65	
Vibration resistance		Malfunction : 10～55Hz、double amplitude 0.7 mm、20 sweeps in each of X, Y and Z directions	
Impact resistance		Malfunction : 100m/s^2、{10G}、1000 cycles in each of X, Y and Z directions	
Applicable standards		Refer to the pages on regulations and standards.	

Item Type		RPX414-□□□■FL1	RPX414-□□□■FL2	RPX414-□□□■FL3	RPX425-□□□■FL1
Number of beams		26,27～234 (protection height 207,216～2079 mm at 63 mm intervals)	26,27～234 (protection height 189,198～2061 mm at 63 mm intervals)	26,27～234 (protection height 171,180～2043 mm at 63 mm intervals)	13～125 (protection height 200～2440 mm at 60 mm intervals)
Beam pitch		9 mm	9 mm	9 mm	20 mm
Continuous light interrupting width		23 mm	32 mm	41 mm	45 mm
Detection distance		0.2～9 m (X4 type) (protection height 1620 mm or less) 0.2～7 m (X4 type) (protection height 1640 mm or more) 0.2～4 m (X2 type)			
Response time		ON→OFF : 10 ms～27.5 ms or less、OFF→ON : 40 ms～110 ms or less			
Supply voltage (Vs)		Power supply to emitter/receiver DC24V±20% (ripple p-p10% or less)			
Consumption current	Emitter	～50 beams:76 mA :51～100 beams:106 mA or less:101～150 beams:130 mA or less 151～200 beams:153 mA or less:201～234 beams:165 mA or less			
	Receiver	～50 beams: 68mA :51～100 beams:90 mA or less:101～150 beams:111 mA or less 151～200 beams:128 mA or less:201～234 beams:142 mA or less			
Light source		Infrared LED (wavelength 870 nm)			
Control output (OSSD)		PNP transistor output ×2、load current 300 mA or less、residual voltage 2V or less (excluding effect of cord extension)、allowable capacitive load 2.2 μF、leak current 1mA or less			
Inversion output (non-safety output)		PNP transister×1、load current 300 mA or less、residual voltage 2V or less (excluding effect of cord extension)、leak current 1mA or less			
Input voltage		Test input、interlock select input, reset input and muting input, ON voltage : 9～24V (Vs) (sink current 3m A or less) OFF voltage : 0～1.5V or open Eternal relay monitor input : ON voltage : 9～24V (Vs) (sink current5m A or less) OFF voltage : 0～1.5V or open			
Effective aperture angle		X4 type ±2.5° or less /X2 ﾀｲﾌﾟ : ±5° or less when detection distance is 3m or more			
Indicating lamp	Emitter	Light receive level indicating lamp (greenLED×2、orange LED×3): Goes on according to light intensity. Error mode indicating lamp (red LED×3): Blinks to indicate fault. Power indicating lamp (green LED×1): Goes on in energized state. Interlock indicating light (orange LED×1): Goes on in interlock state and blinks at lockout. External relay monitor indicating lamp (muting input 1 indicating lamp)、 Blanking/test indicating lamp (muting input 2 indicating lamp)) (green LED×2) : Goes on or blinks according to function.			
	Receiver	Light receive level indicating lamp (green LED×2、orange LED×3): Goes on according to light intensity. Error mode indicating lamp (red LED×3): Blinks to indicate fault. OFF output indicating lamp (red LED×1): Goes on when control output is off and blinks at lockout. ON output indicating lamp (green LED×1): Goes on when control output is on. Muting error indicating lamp, blanking/test indicating lamp (green LED×2) : Goes on or blinks according to function.			
Ambient temperature		during operation:-10～55℃ (not to freeze) : during storage : -30～70℃			
Ambient humidity		during operation: 35～85%RH (not to freeze) : during storage : 35～95%RH			
Ambient light intensity		Incandescent lamp: light intensity on light receiving surface 3,000 lx or less/ sunlight : light intensity on light receiving surface 10,000 lx or less			
Insulation resistance		20 MΩ or more (with DC500V megger)			
Withstand voltage		AC1000V 50/60Hz for 1 minute			
Protective structure		Emitter/receiver : IP65			
Vibration resistance		Malfunction : 10～55Hz、double amplitude 0.7 ㎜、20 sweeps in each of X, Y and Z directions direction			
Impact resistance		Malfunction : 100m/s²、{10G}、1000 cycles in each of X, Y and Z directions			

2-2 Response Time and Consumption Current of Emitter/Receiver

	Type name Numeral in □	Protection height (mm)	Number of beams	Response time (ON→OFF) (ms)	Response time (OFF→ON) (ms)	Consumption current (mA) Type name in ( )
RPX414 −□X4 RPX414 −□X2	225～234	225～234	26～27	11.0	44	144
	297～360	297～360	34～41	12.0	48	144
	423～486	423～486	48～55	13.0	52	(～423) 144
	549	549	62	14.0	56	(～549) 196
	612～675	612～675	69～76	15.0	60	196
	738～990	738～990	83～111	17.5	70	(～864) 196 (～990) 241
	1053～1242	1053～1242	118～139	20.0	80	241
	1305～1557	1305～1557	146～174	22.5	90	(～1305) 241 (～1557) 281
	1620～1809	1620～1809	181～202	25.0	100	(～1746) 281 (～1809) 307
	1872～2061	1872～2061	209～230	27.5	110	307
RPX425 −□X4 RPX425 −□X2	240～300	240～300	13～16	10.0	40	144
	360～480	360～480	19～25	11.0	44	144
	600～720	600～720	31～37	12.0	48	144
	840～1080	840～1080	43～55	13.0	52	(～960) 144 (～1080) 196
	1200～1320	1200～1320	61～67	14.0	56	196
	1440～1560	1440～1560	73～79	15.0	60	196
	1680～2160	1680～2160	85～109	17.5	70	(～1920) 196 (～2160) 241
	2280～2460	2280～2460	115～124	20.0	80	241
RPX414- □X4FL1 RPX414- □X2FL1	225～234	207～216	26～27	11.0	44	144
	297～360	279～342	34～41	12.0	48	144
	423～486	405～468	48～55	13.0	52	(～423) 144
	549	531	62	14.0	56	(～549) 196
	612～675	594～657	69～76	15.0	60	196
	738～990	720～972	83～111	17.5	70	(～864) 196 (～990) 241
	1053～1242	1035～1224	118～139	20.0	80	241
	1305～1557	1287～1539	146～174	22.5	90	(～1305) 241 (～1557) 281
	1620～1809	1602～1791	181～202	25.0	100	(～1746) 281 (～1809) 307
	1872～2061	1854～2043	209～230	27.5	110	307

	Type name Numeral in □	Protection height (mm)	Number of beams	Response time (ON→OFF) (ms)	Response time (OFF→ON) (ms)	Consumption current (mA)
RPX414-□X4FL2 RPX414-□X2FL2	225～234	189～198	26～27	11.0	44	144
	297～360	261～324	34～41	12.0	48	144
	423～486	387～450	48～55	13.0	52	(～423) 144 (～549) 196
	549	513	62	14.0	56	
	612～675	576～639	69～76	15.0	60	196
	738～990	702～954	83～111	17.5	70	(～864) 196 (～990) 241
	1053～1242	1017～1206	118～139	20.0	80	241
	1305～1557	1269～1521	146～174	22.5	90	(～1305) 241 (～1557) 281
	1620～1809	1584～1773	181～202	25.0	100	(～1746) 281 (～1809) 307
	1872～2061	1836～2025	209～230	27.5	110	307
RPX414-□X4FL3 RPX414-□X2FL3	225～234	171～180	26～27	11.0	44	144
	297～360	243～306	34～41	12.0	48	144
	423～486	369～432	48～55	13.0	52	(～423) 144 (～549) 196
	549	495	62	14.0	56	
	612～675	558～621	69～76	15.0	60	196
	738～990	684～936	83～111	17.5	70	(～864) 196 (～990) 241
	1053～1242	999～1188	118～139	20.0	80	241
	1305～1557	1251～1503	146～174	22.5	90	(～1305) 241 (～1557) 281
	1620～1809	1566～1755	181～202	25.0	100	(～1746) 281 (～1809) 307
	1872～2061	1818～2007	209～230	27.5	110	307
RPX425-□X4FL1 RPX425-□X2FL1	240～300	200～260	13～16	10.0	40	144
	360～480	320～440	19～25	11.0	44	144
	600～720	560～680	31～37	12.0	48	144
	840～1080	800～1040	43～55	13.0	52	(～960) 144 (～1080) 196
	1200～1320	1160～1280	61～67	14.0	56	196
	1440～1560	1400～1520	73～79	15.0	60	196
	1680～2160	1640～2120	85～109	17.5	70	(～1920) 196 (～2160) 241
	2280～2460	2240～2420	115～124	20.0	80	241

Response time of series connected sets

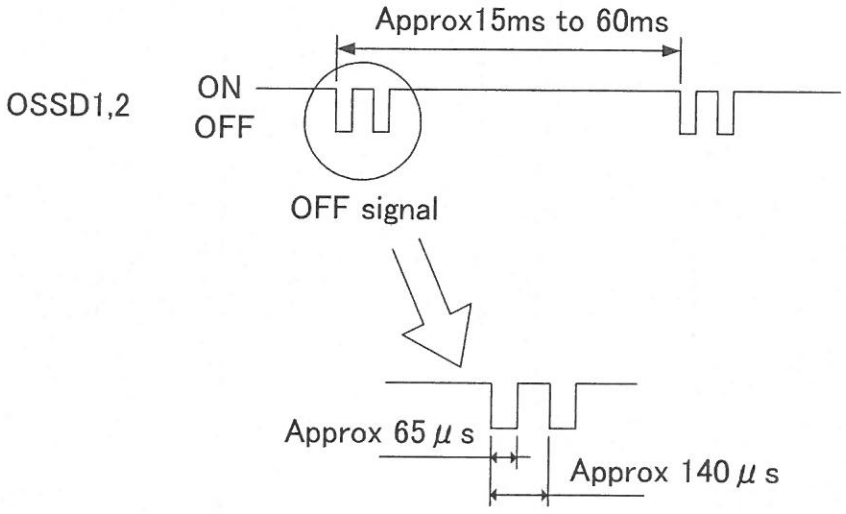
2 sets connected in series : (sum of response times of individual sensors) −1) ms

3 sets connected in series : (sum of response times of individual sensors) −5) ms

4 sets connected in series : (sum of response times of individual sensors) −8) ms

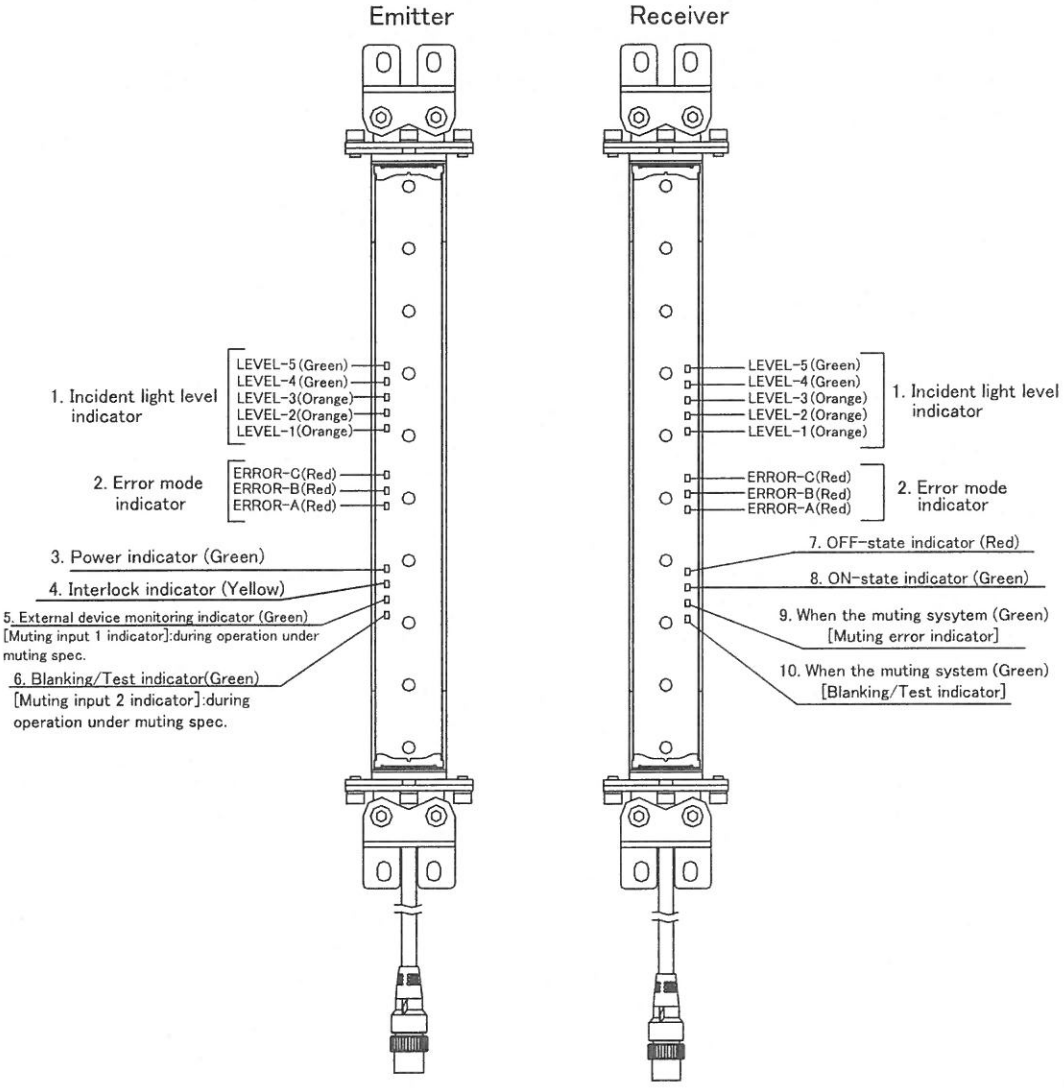
2-3 Waveform of Sensor Control Output

When the sensor is in the ON state, the control output is cyclically turned off as shown below for the purpose of diagnosing the output circuit. The output circuit is diagnosed as being normal when the OFF signal is fed back. When the OFF pulse is not included in the output signal, the receiver judges the output circuit or wiring as being faulty and gets into the lockout state.



Chapter 3 NAMES AND FUNCTIONS OF COMPONENTS

3-1 Emitter/Receiver Type : RPX4○○−□□□□■



No	Internal indicating lamp		ON / Blink	Description
1	Light receive level indicating lamp 1～3 (orange) 4～5 (green)	LEVEL-1～5	ON	Indicates light receiving state of RPX in states of 1～5.
2	Error mode indicating lamp (red)	ERROR-A～C	ON / Blink	Goes on/blinks when RPX gets into lockout state and indicates cause of error according to states of A～C.
3	Power indicating lamp (green))	POWER	ON	Goes when power is turned on.
4	Interlock indicating lamp (yellow)	INTLK	ON / Blink	Goes on when RPX is in interlock state and blinks at lockout.
5	External relay monitor indicating lamp (green)	EDM	ON	Goes on when an input is given to external relay monitor input.
	[Muting input 2 indicating lamp]		ON	Goes on when an input is given to muting input 2 during operation under muting spec. Blinks in muting state.
6	Blanking/test indicating light (green)	BLANKING /TEST	ON	Goes on when blanking function is activated. (Special control box for blanking is used.) Goes on at emitter side during standard operation and at receiver side during operation under muting spec.
			Blink	Blinks in external test state. Goes on at emitter side in standard operation and at receiver side at time of getting into muting state.
	[Muting input 1 1indicating lamp]		ON	Goes on when an input is given to muting input 1 during operation under muting spec. Blinks in muting state.
7	OFF output indicating light (red)	OFF	ON	Goes on when control output is off.
			Blink	Blinks in lockout state.
8	ON output indicating light (green)	OFF	ON	Goes on when control output is on.
9	Muting error indicating light (green)	MUTING ERROR	ON	Goes on in muting error state during operation under muting spec...
10	Blanking/test indicating lamp (green) during operation under muting spec.	BLANKING /TEST	ON	Goes on when blanking function is activated by using blanking box during operation under muting spec.
			Blink	Blinks in external test state during operation under muting spec.

Chapter 4 WIRING AND INSTALLATION

4-1 Installation Conditions

4-1-1 Detection area and approach route

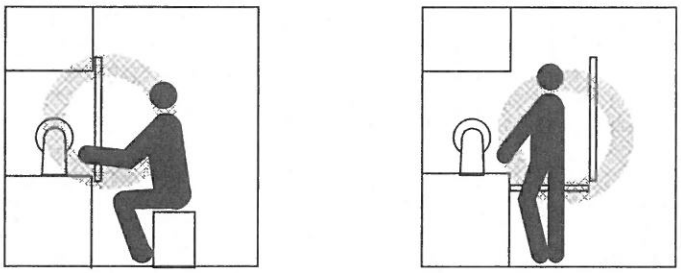
⚠ WARNING
The device is not applicable to machines that are incapable of quick stopping by electric control.
Install a protective structure around the machine so that the operator cannot reach the dangerous part of the machine unless he passes through the detection area. Install the device so that part of the human body always remains in the detection area when operating in the dangerous part of the machine. The human body becomes undetectable, so there is a possibility of suffering serious injury.

Machines to which the RPX can be installed are those which are capable of quick stopping by electric control. Confirm that the machine itself is designed so as not to interfere with the safety function such as stopping.

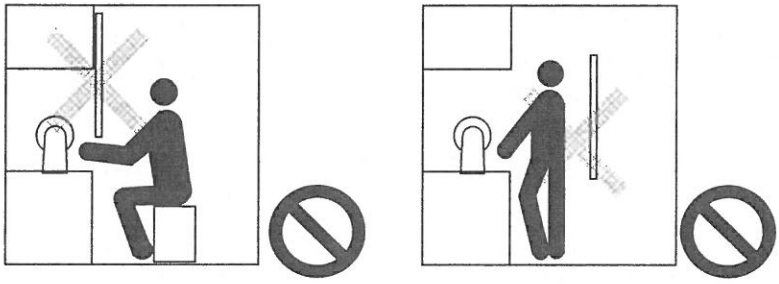
The detection area of the RPX emitter/receiver includes the entire range connecting the detection width of the emitter with that of the receiver. Provide such a protective structure which prevents the operator from reaching the dangerous part of the machine unless he passes through the detection area.

Install the device so that the operator working in the dangerous part of the machine is always kept detectable by the RPX emitter/receiver. In cases where the space between the machine and the RPX emitter/receiver is so wide that the operator may enter the space and becomes undetectable, make it possible for part of the operator to always remain in the detection area of the RPX emitter/receiver by using auxiliary beams.

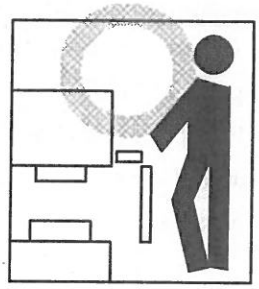
Correct installation



Incorrect installation



In the case of small-sized presses, etc., when a clearance is formed through which the operator's arms, etc. can get inside, prevent this possibility by using auxiliary beams, etc.



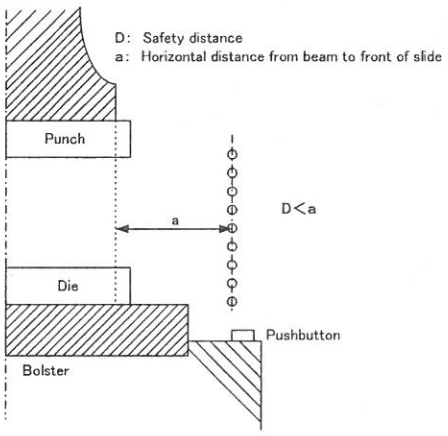
4-1-2 Safety distance

⚠ WARNING

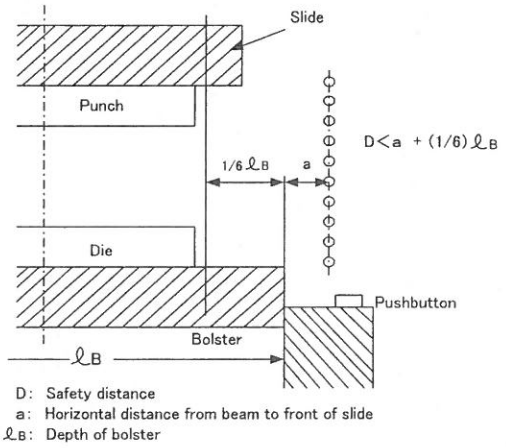
Provide a safety distance (D) between the RPX emitter/receiver and the dangerous part. When the machine does not stop before the operator reaches its dangerous part, there is a possibility of suffering serious injury.

The safety distance is the minimum distance by which the RPX emitter/receiver must be separated from the dangerous part to stop the dangerous part before the human body or object reaches there. When the human body vertically enters the detection area of the emitter/receiver, the safety distance is calculated based on the following concept:

C-type press



Straight side type press



Safety distance D=1.6(Tl+Ts)+C

D : Safety distance (unit: mm)

Tl : Duration from when the hand interrupts a light beam until the quick stop mechanism starts operating (unit: ms)

Ts : Duration from when the quick stop mechanism starts operating until the slide stops (unit: ms)

C : Additional distance entered in the lower column of Table 1 according to the continuous light interrupting width in the upper column.

Table 1

Detection capability (mm)	30 or less	Over 30 to 35	Over 35 to 45	Over 45 to 50
Additional distance (mm)	0	200	300	400

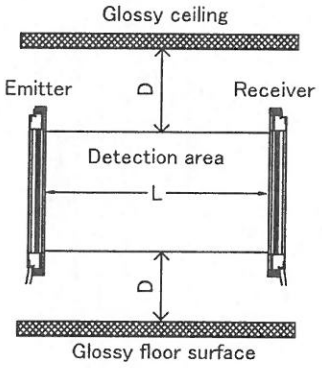
(fig.1)

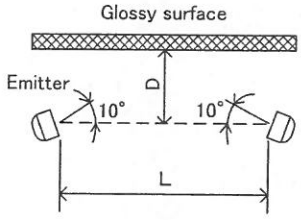
4-1-3 Distance from glossy surface

⚠ WARNING

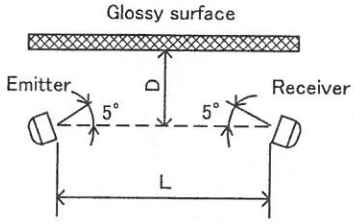
Install the device so as not to be affected by the reflection from glossy surfaces. The human body becomes undetectable, so there is a possibility of suffering serious injury.

Separate the device from the glossy surfaces (highly reflective surfaces) of the metallic wall, floor, ceiling, work, etc, by more than the distance D shown below:





RPX4□□□□X2 type



RPX4□□□□X4 type

Sensor type	Distance between emitter and receiver (detection distance L)	Allowable installation distance D
RPX414-□X2 RPX414-□X2FL1	0.2 ～ 3m	0.26m
RPX414-□X2FL2 RPX414-□X2FL3 RPX425-□X2 RPX425-□X2FL1	3 ～ 5m	L/2×tan10°= L×0.089 (m)
	3 ～ 5m	L/2×tan5°= L×0.044 (m)
RPX414-□X4 RPX414-□X4FL1	0.2 ～ 3m	0.13m
RPX414-□X4FL2 RPX414-□X4FL3 RPX425-□X4 RPX425-□X4FL1	3 ～ 5m	L/2×tan5°= L×0.044 (m)

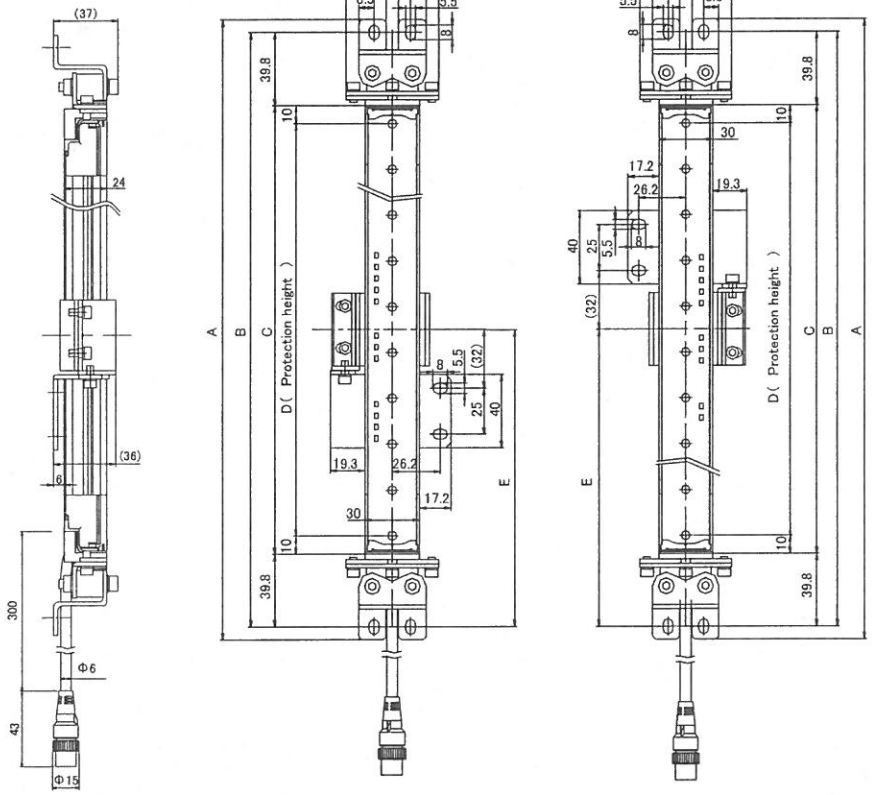
Note 1; Though the aperture angle of the RPX4-□X2 emitter/receiver is ±5° (when L>3m) as specified in IEC61496−2, install the sensor apart from the glossy surfaces, taking the directivity angle as ±10° with consideration to misalignment of light beams, etc. at the time of installation.

Though the aperture angle of the RPX4-□X4 is ±2.5° (when L>3m) , install the sensor apart from the glossy surfaces, taking the directivity angle as ±5° with consideration to misalignment of light beams, etc. at the time of installation.

4-2 Outline Dimensional Drawing

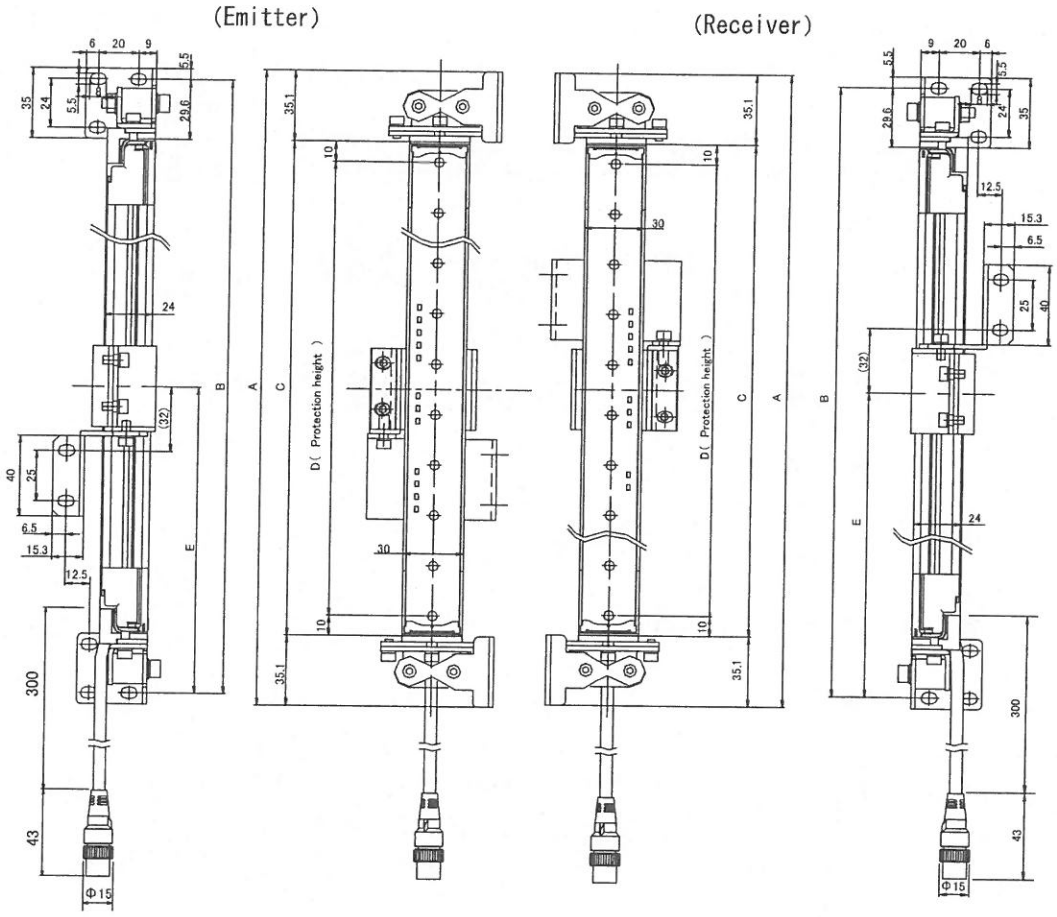
4-2-1 Emitter/receiver

① Backside mounting



Type	D (Numeral after "−" in type)	A	B	C	Q'ty of inter-mediate fittings	E
RPX414-225～549 RPX425-240～480	225～549 240～480	C+93.6	C+79.6	D+20	0	−
RPX414-612～1053 RPX425-600～1080	612～1053 600～1080				1	B/2
RPX414-1116～1638 RPX425-1200～1560	1116～1620 1200～1560				2	B/3
RPX414-1683～2061 RPX425-1680～2460	1683～2061 1680～2460				3	B/4

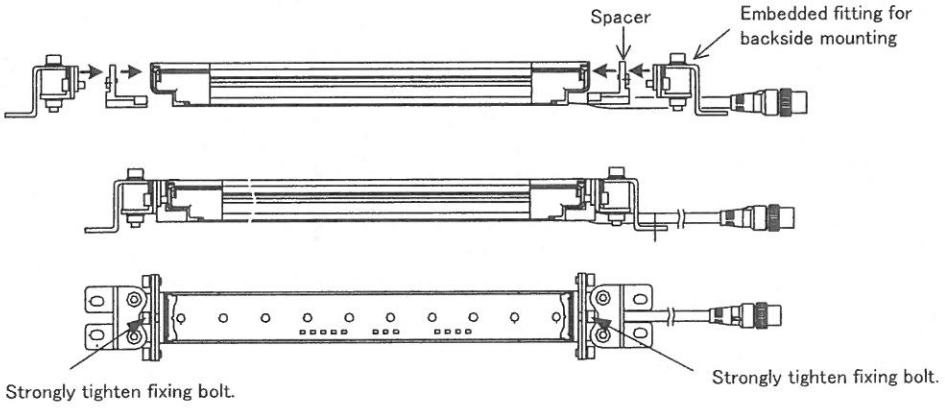
② Side mounting



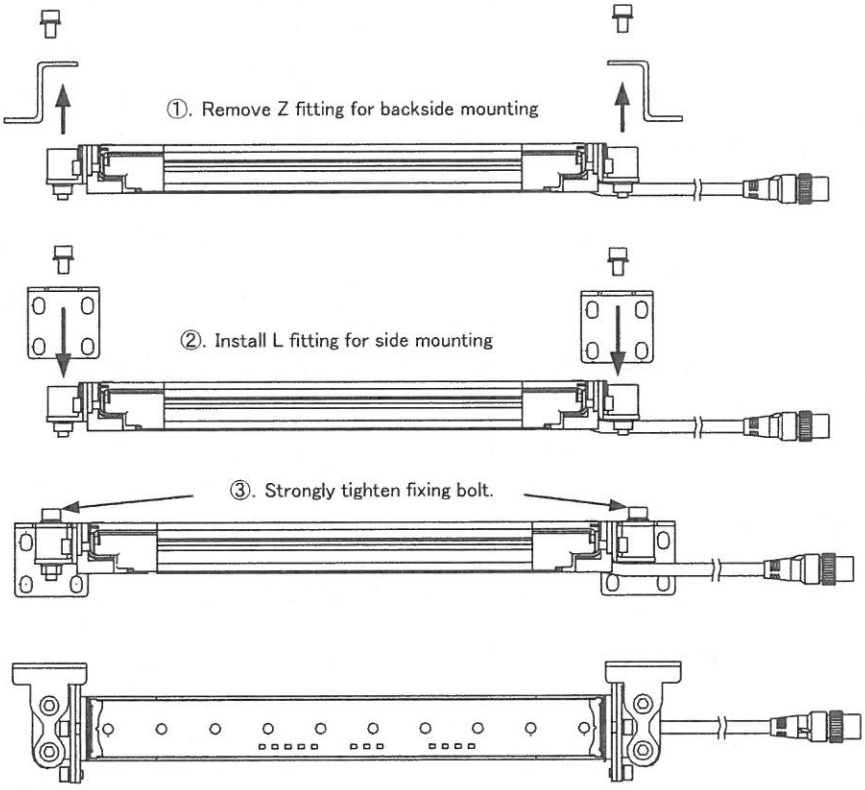
Type	D (Numeral after "—" in type name)	A	B	C	Q'ty of inter-mediate fittings	E
RPX414-225～549 RPX425-240～480	225～549 240～480	C+70.2	C+59.2	D+20	0	—
RPX414-612～1053 RPX425-580～1080	612～1053 580～1080				1	B/2
RPX414-1116～1620 RPX425-1200～1560	1116～1620 1200～1560				2	B/3
RPX414-1683～2061 RPX425-1680～2460	1683～2061 1680～2460				3	B/4

4-2-2 How to attach fittings

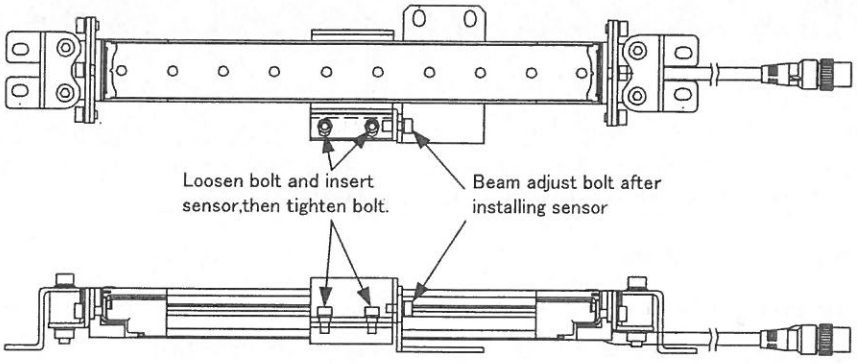
① Fittings for rear mounting



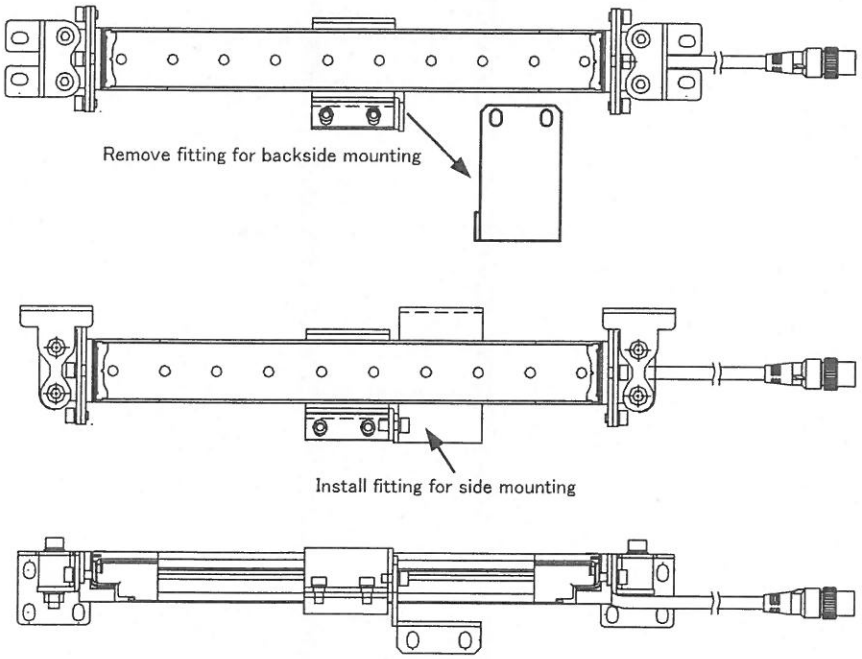
② Fittings for side mounting



③ Intermediate fittings for rear mounting



④ Intermediate fittings for side mounting



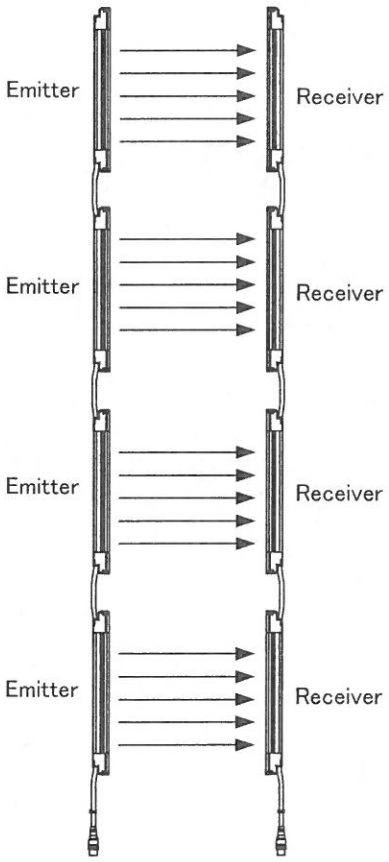
4-3 How to Prevent Mutual Interference

⚠ WARNING
Use the same set type for the emitter and receiver standing opposite each other. Using an incorrect combination results in producing an area in which detection cannot be done.
Do not use the sensors in reflective configuration. Detection may become impossible.
When using plural sets of RPX sensors, install them by making connections or using the light-insulating shield so that mutual interference does not occur,

1) Connecting in series

When plural sets are used, mutual interference can be prevented by connecting them in series. Four sets with up to 400 beams are connectable.

With series-connected RPX sets, light is emitted by time-division control, so mutual interference does not occur, which ensures safety.



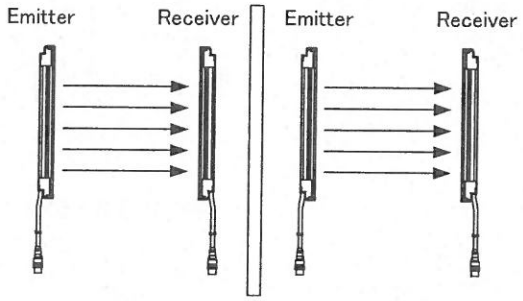
2) Not connecting in series

Even when the sensor sets are not connected, mutual interference can be prevented for up to 3 sets by the light interference prevention algorism.

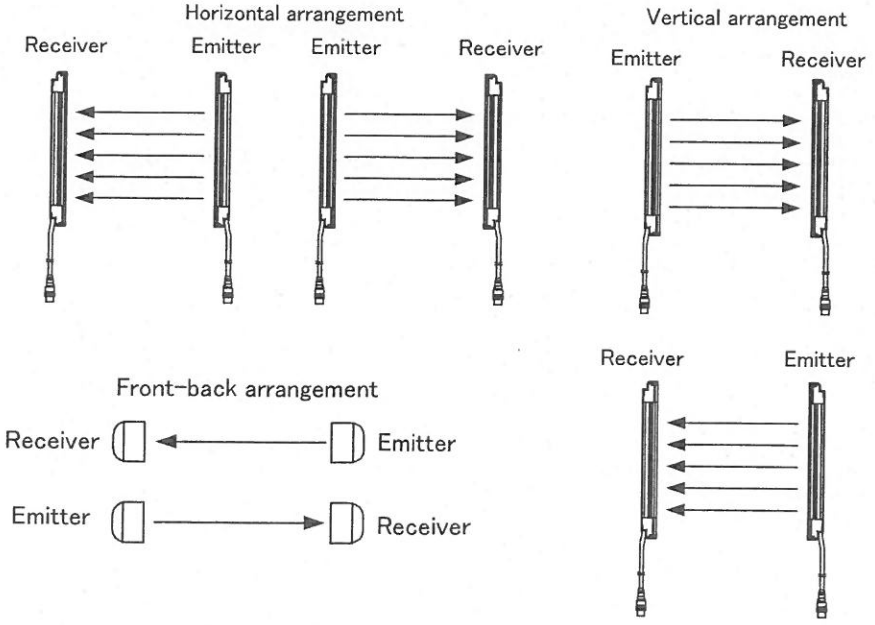
When installing 4 or more sets of RPX sensors without making connections, arrange them so that mutual interference does not occur. In this case, if the installation distance between 2 sets is short, mutual interference may occur due to reflection on the RPX surfaces. If mutual interference occurs, the RPX sensors get into the lockout state,

It is beneficial to take measures by combining the following 4 items:

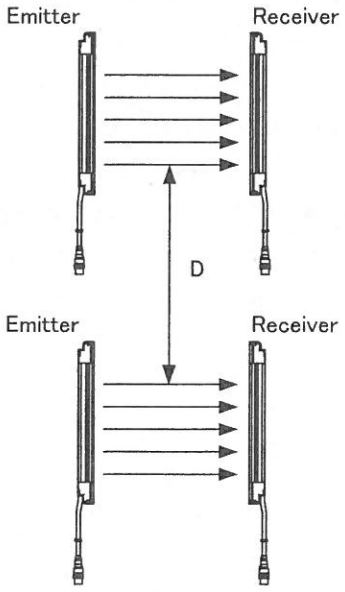
1. Install a light interrupting shield between 2 sets.

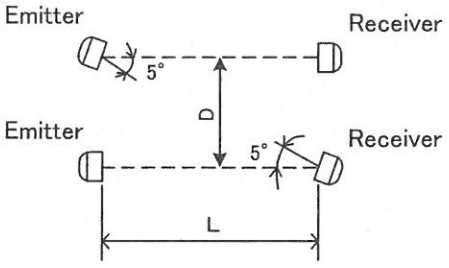


2. Make 2 sets different in emission direction (staggered arrangement).

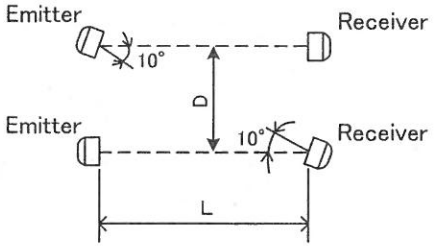


3. Install 2 sets by spacing them by a distance preventing interference.





RPX4□□□□X4 type



RPX4□□□□X2 type

Sensor type	Distance between emitter and receiver (detection distance L)	Allowable installation distance D
RPX414-□X2 RPX414-□X2FL1 RPX414-□X2BFL1 RPX425-□X2	0.2 ~ 3m	0.52m
	3 ~ 5m	L×tan10°= L×0.177 (m)
RPX414-□X4 RPX414-□X4FL1 RPX414-□X4BFL1 RPX425-□X4	0.2 ~ 3m	0.26m
	3 ~ 5m	L×tan5°= L×0.088 (m)

4-4 Wirung

⚠ WARNING
Be sure to use the stop output for both lines and form the safety system. If the safety system is formed for one line only, there is a possibility of suffering serious injury when the output circuit fails.
Do not make the output wire of the emitter/receiver short to +24V. The output always stays on. This is dangerous,
Do not connect each wire of the emitter/receiver to a DC power exceeding DC24V+20%. Do not connect to the AC power, either. There may be a risk of electric shock.
Terminate any unused signal wires of the emitter/receiver so as not to touch other things.

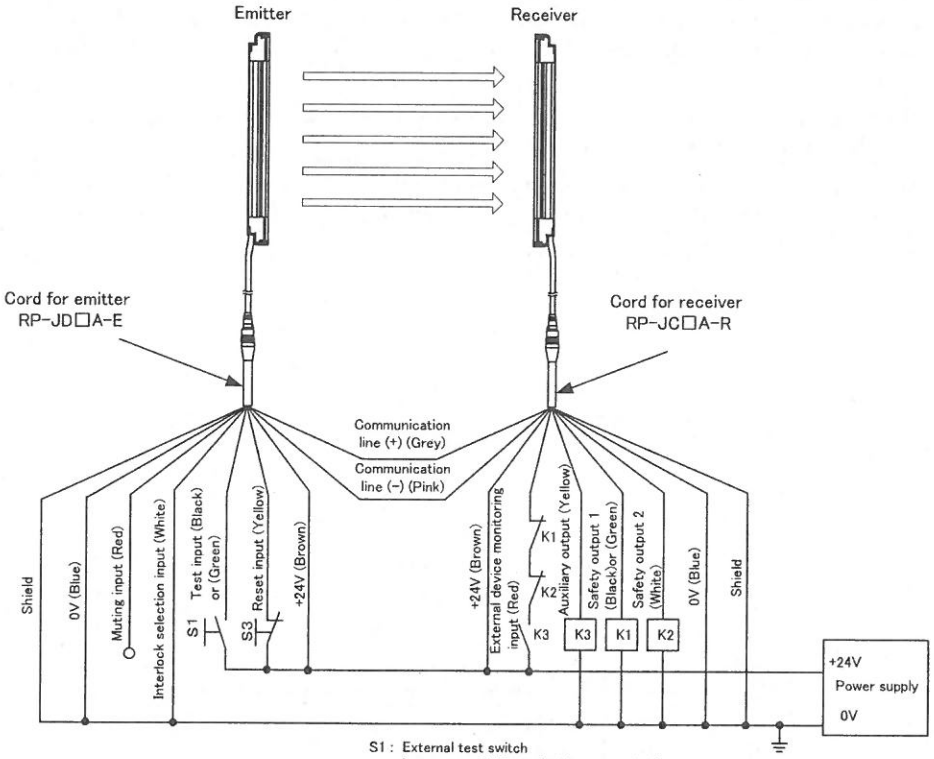
4-4-1 Wiring of emitter/receiver

	Wire color	Function name
Emitter	Shield	０Ｖ
	Grey	Communication wire ＲＳ４８５(Ａ)
	Pink	Communication wire ＲＳ４８５(Ｂ)
	Brown	Power ＤＣ２４Ｖ
	Yellow	For autoreset or muting specification, connect to (+24V). For manual reset, input interlock reset signal.
	Blue	Power ０Ｖ
	Black or green	Test (external diagnosis) input （２４Ｖ） .
	White	Interlock mode select wire (used for OFF holding operation of output when light is interrupted) . Muting input 1 for muting specification.
	Red	Muting input 2 for muting specification. Open for normal specification

	Wire color	Function name
Receiver	Shield	０Ｖ
	Grey	Communication wire ＲＳ４８５(Ａ)
	Pink	Communication wire ＲＳ４８５(Ｂ)
	Brown	Power ＤＣ２４Ｖ
	Blue	Power ０Ｖ
	Black or green	PNP transistor output that is on when light is received
	White	PNP transistor output that is on when light is received
	Red	Relay monitor (welding check) input
	Yellow	PNP transistor output that is on when light is interrupted

4-4-2 Wiring method

- Autoreset mode,wiring when external relay monitor function is used

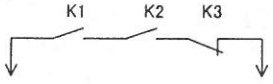


S1 : External test switch
(connect to 0V if a switch is not required)

S3 : Lockout reset switch
(connect to 24V if a switch is not required)

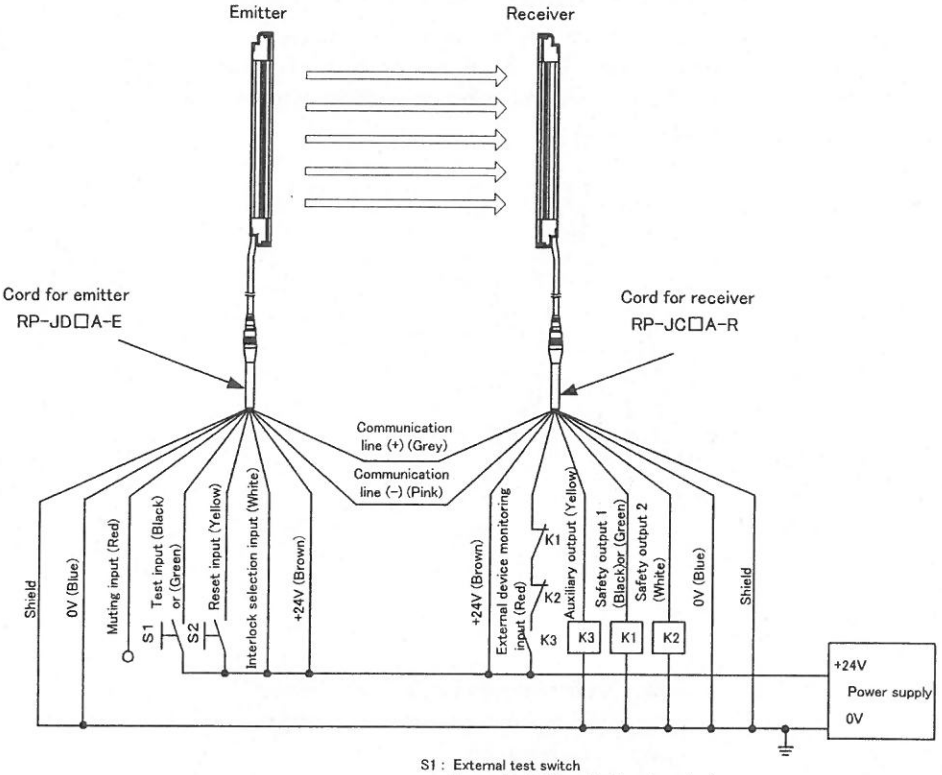
K1,K2 : Safety relay with forcibly-guided contact or magnetic contactor to control dangerous part of machine

K3 : Inversion output (non-safety) of control output used as auxiliary output to connect contacts a of K1 and K2 and contact b of K3 in series so that better safety can be ensured.



Stop output

- Manual reset mode,wiring when external relay monitor function is used

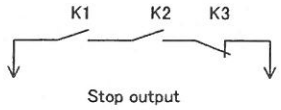


S1 : External test switch
(connect to 0V if a switch is not required)

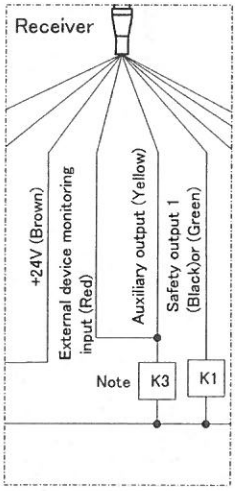
S2 : Interlock / lockout reset switch

K1,K2 : Safety relay with forcibly-guided contact or magnetic contactor to control dangerous part of machine

K3 : Inversion output (non-safety) of control output used as auxiliary output to connect contacts a of K1 and K2 and contact b of K3 in series so that better safety can be ensured.

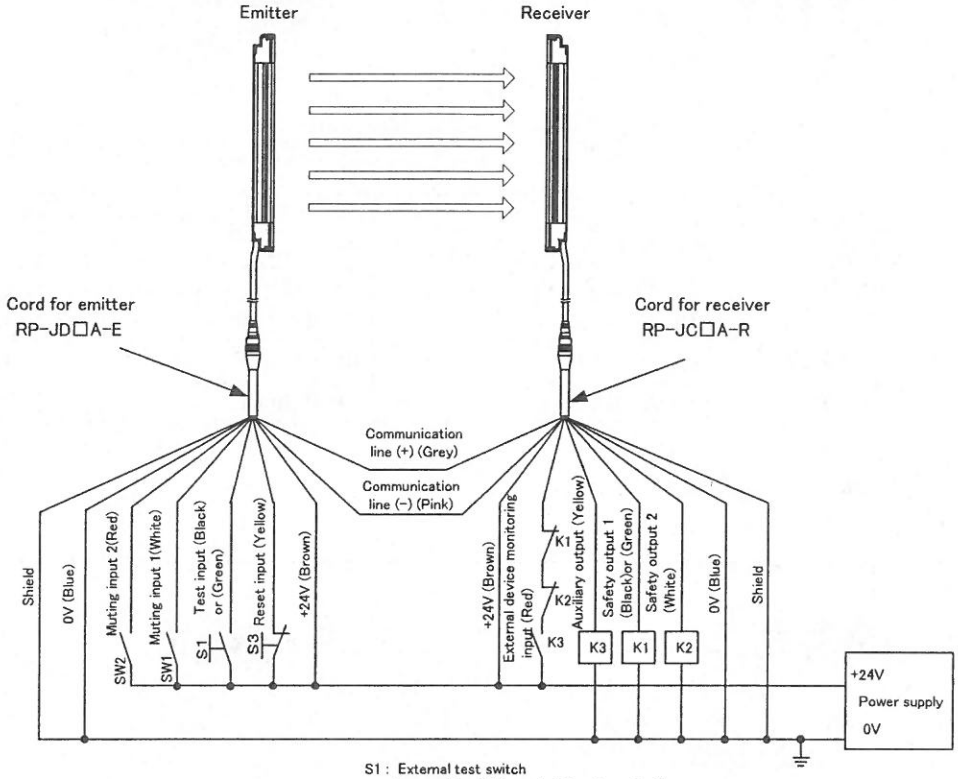


- When does not use external device monitoring function
  - When external device monitor function is unnecessary, it is made inactive by connecting auxiliary output(inversion output)and external device monitor input.



Note : When K3 is unnecessary,auxiliary output only needs to be connected to external device monitor input.

- Muting function , wiring when external device monitor function is used
  (Active for autoreset mode only)



S1 : External test switch
(connect to 0V if a switch is not required)

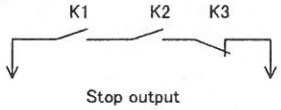
S3 : Lockout reset switch
(connect to 24V if a switch is not required)

SW1 : Muting switch1

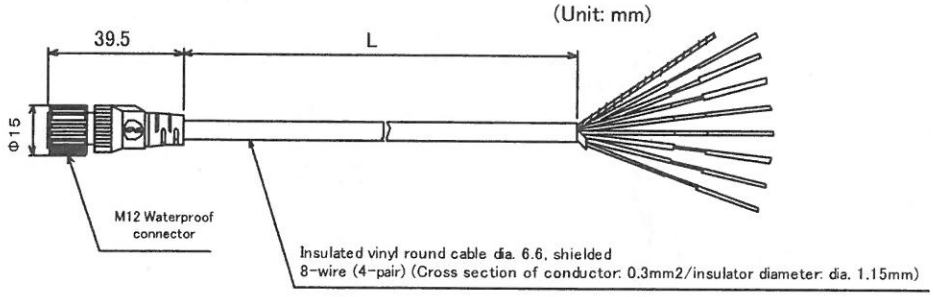
SW2 : Muting switch2

K1,K2 : Safety relay with forcibly-guided contact or magnetic contactor to control dangerous part of machine

K3 : Inversion output (non-safety) of control output used as auxiliary output to connect contacts a of K1 and K2 and contact b of K3 in series so that better safety can be ensured.

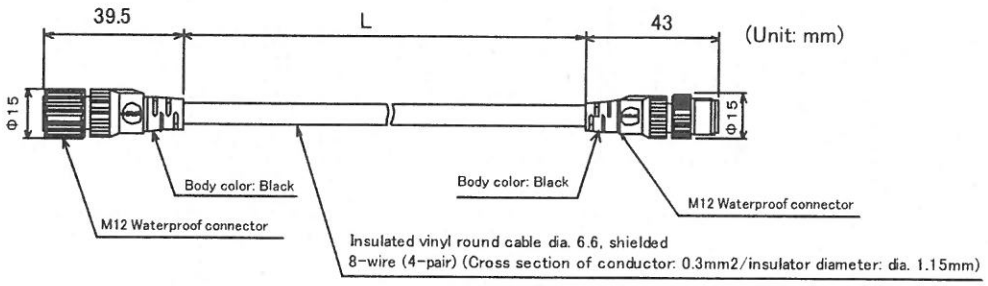


4-4-3 Unilateral connector cord (sold separately)



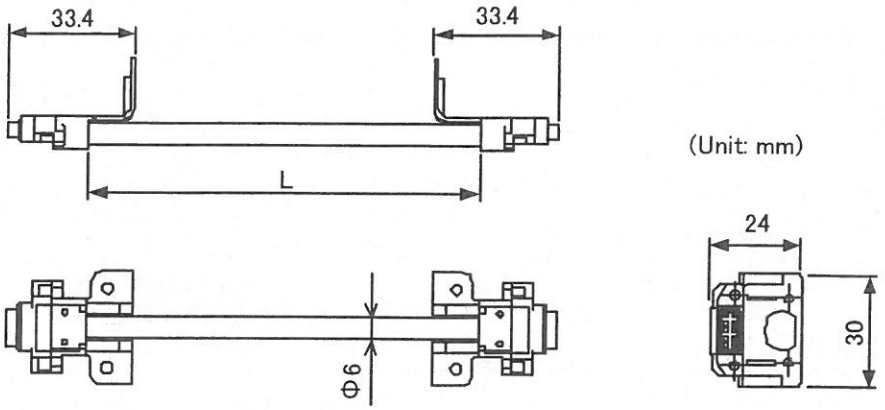
Set type	For emitter		For receiver		L
RP-JD3A	RP-JD3A-E	Grey cord	RP-JD3A-R	Black cord	3000
RP-JD7A	RP-JD7A-E		RP-JD7A-R		7000
RP-JD10A	RP-JD10A-E		RP-JD10A-R		10000
RP-JD15A	RP-JD15A-E		RP-JD15A-R		15000
RP-JD20A	RP-JD20A-E		RP-JD20A-R		20000

4-4-4 Extension cord (sold separately)



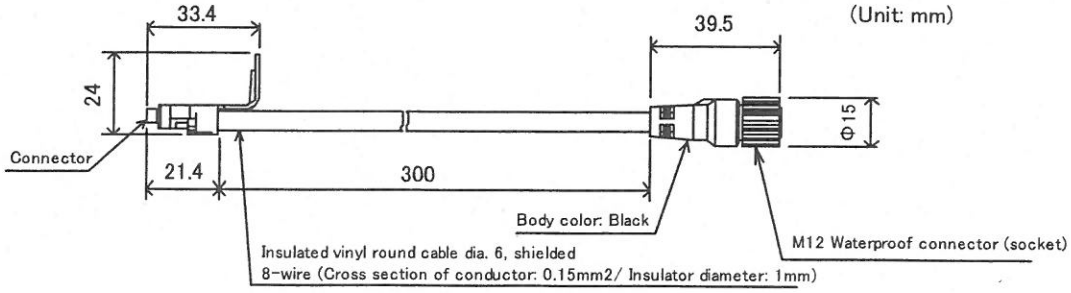
Set type	For emitter		For receiver		L
RP-JDR5B	RP-JDR5B-E	Grey cord	RP-JDR5B-R	Black cord	500
RP-JD1B	RP-JD1B-E		RP-JD1B-R		1000
RP-JD3B	RP-JD3B-E		RP-JD3B-R		3000
RP-JD5B	RP-JD5B-E		RP-JD5B-R		5000
RP-JD7B	RP-JD7B-E		RP-JD7B-R		7000
RP-JD10B	RP-JD10B-E		RP-JD10B-R		10000
RP-JD15B	RP-JD15B-E		RP-JD15B-R		15000
RP-JD20B	RP-JD20B-E		RP-JD20B-R		20000

4-4-5 Series connection cord for adhesion (sold separately)



Set type	For emitter		For receiver		L
RPX-JJR06L	RPX-JJR06L-E	Grey cord	RPX-JJR06L-R	Black cord	65
RPX-JJR15L	RPX-JJR15L -E		RPX-JJR15L -R		150

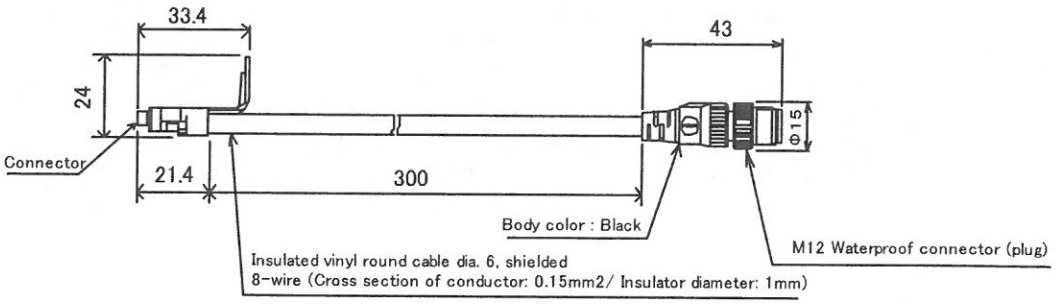
4-4-6 Series connection cord for extension (sold separately)



Set type	For emitter		For receiver	
RPX-JJR3W	RPX-JJR3W-E	Grey cord	RPX-JJR3W-R	Black cord

4-4-7 Connection Cable (RPX-JJR3K, sold separately)

The connection cable is a standard included product. Purchase a replacement when damaged or lost.



Set type	For emitter		For receiver	
RPX-JJR3K	RPX-JJR3K-E	Grey cord	RPX-JJR3K-R	Black cord

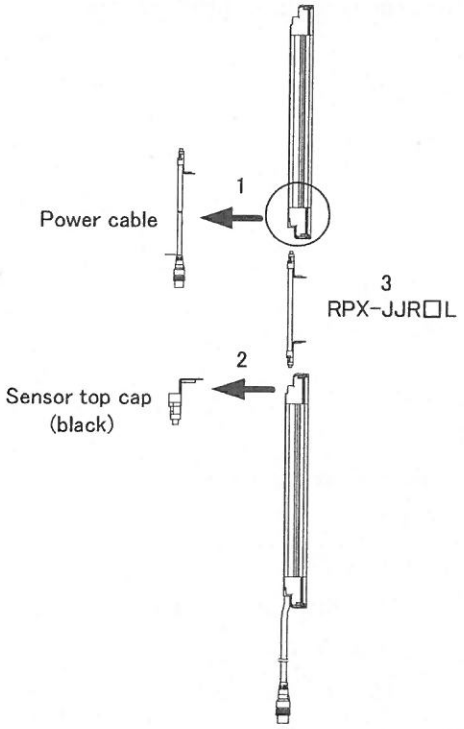
4-5 Connection Method

4-5-1 Series connection cord for adhesion RPX-JJR□L (sold separately)

1. Remove the power cord of the secondary side RPX.
2. Remove the top cap of the primary side RPX.
3. Connect the sensors by series connection cord for adhesion RPX-JJR□L.

At that time, be careful not to install the RPX upside down.

Connect 1～3 to both the emitter and the receiver.

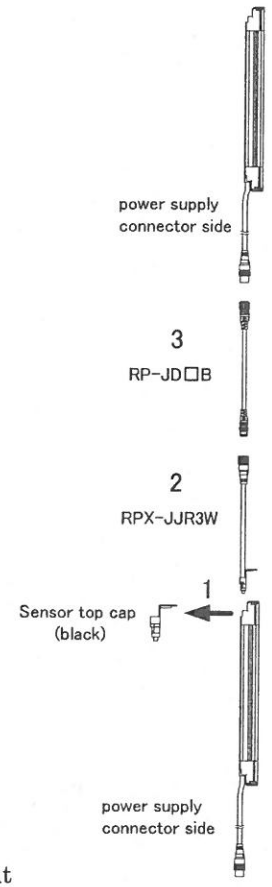


Note 1): Removing and installing the cap and series connection cord may result in displacing the rubber packing around the connector. When the rubber packing is displaced, push it down into the connector as far as it goes and then make it adhere to the RPX.

Note 2): When installing the cord and cap, securely tighten the screws (M2, four each) (recommendable torque 0.15 N・m). Dropping off or degradation of the protective function may result.

4-5-2 Series connection cord for extension RPX-JJR3WL (sold separately)

1. Remove the top cap of the primary side RPX.
2. Connect the sensors by the series connection cord for extension Type RPX-JJR3W.
3. When changing the connection distance between RPX sensors, connect a bilateral connector cord Type RP-JD□B (sold separately) .
   At that time, be careful not to install the RPX upside down.
   Connect 1～3 to both the emitter and the receiver.



• Length of power cord

The length of the power cord must not exceed:

- Single (1 set)---- max.100m
- 2 connections (2 sets) --- max.60m
  15 m btw connections
- 3 connections (3 sets) ---max.45m
  15 m btw connections
- 4 connections (4 sets)--- max. 30m
  15 m btw connections

* Cable specification when extending the cord without using a special cable. Use a cord (twisted pair cord) that has a better performance than the following and do not use it in the same piping as that for high voltage cable and power cable.

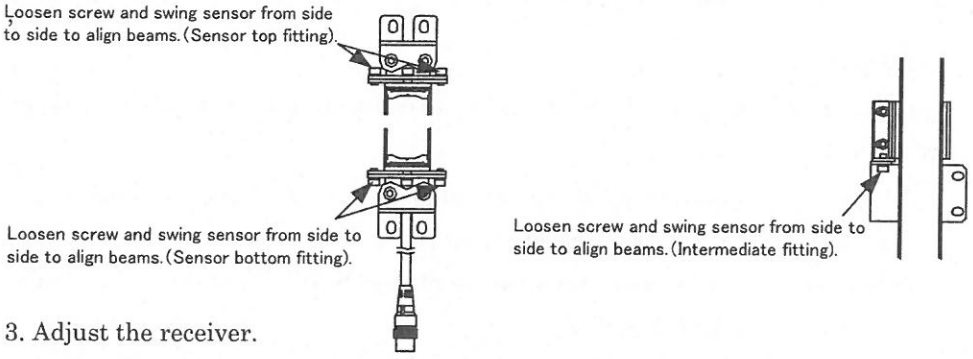
- 8-core (0.3 mm² ×4 pairs、conductor resistance 0.058 Ω/m) with braided shield
- Communication wires (+) <special cable color : grey> and (-) <special cable color : pink>, and 24V wire <special cable color : brown> and 0V wire <special cable color : blue>, are used as a twisted pair respectively.

4-6 Adjusting Method

[Procedure]

1. Confirm the following;
   - The optical surfaces of the emitter and receiver are not dirty.
   - There is no light-shielding object in the detection area of the emitter/receiver.
2. Adjust the beams of the emitter.

   Adjust the torsion angle of the emitter while looking at the light receive level indicating lamp and align the emitter to the center of the angle at which the ON output indicating lamp (ON: green) goes on.



3. Adjust the receiver.

   Adjust the torsion angle of the receiver while looking at the light receive level indicating lamp and align the receiver to the center of the angle at which the ON output indicating lamp (ON: green) goes on

4. Confirm that the 5 light receive level indicating lamps are all lit.
5. After completing this adjustment, use care not to cause the state of beam adjustment of the emitter/receiver to vary and tighten all fittings set screws and fixing screws. The values of tightening torque for attached screws are shown below:

Fittings	Nominal designation and length of screw (mm)	Tightening torque
Fittings (upper and lower)	M5×14	2.3 N·m
Fittings (intermediate)	M5×14	2.3 N·m

6. In cases where angle adjustment of the receiver is complete, but all light receive level indicating lamps do not go on, check whether or not the mounting surfaces of the emitter and receiver are parallel and whether or not the mounting heights of the emitter and receiver are correct.

⚠ WARNING
Be sure to use the RPX after the following inspection has been normally completed. There is a possibility of injury and death.
Do not disassemble, repair and modify the main body. There is a risk of losing the primary safety function.

[Request]

Record and retain the inspection results in order to ensure safety.

Perform inspection only after fully understanding the RPX and machine.

In cases where the installer, design engineer and user are different, give a sufficient guidance about maintenance to the user.

Daily inspection

Confirm the following inspection items before operation and at the time of change in work shifts:

1.□There is no approach route to the dangerous part of the machine with the exception of the detection area of the RPX.

2.□When working in the dangerous part of the machine, part of the body remains in the detection area of the RPX.

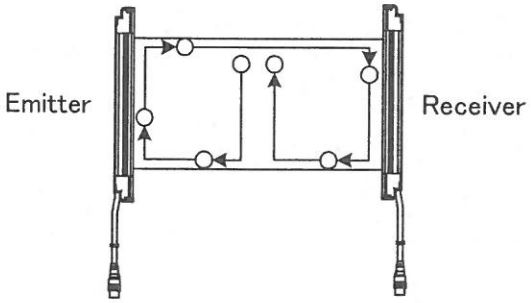
3.□The measured value of the safety distance is greater than the calculated value.

4.□The optical surfaces of the emitter and receiver are not dirty and damaged.

5.□The detectable object for inspection is not deformed.

6.□Turn on the power supply to the RPX with nothing existing in the detection area. The power indicating lamp and ON output indicating lamp go on within 2 seconds after power up.

7.□When the test piece is made to move in the detection area as shown below, the test rod can be detected. That is, when the test rod enters the detection area, all of the 5 light receive level indicating lamps go off and the OFF output indicating lamp goes on.



Bring the machine into the operating state and confirm the stop of the dangerous part as follows:

8. The dangerous part is in the operating state with nothing existing in the detection area.
9. When the test piece is made to enter the detection area at three places "right before emitter," "right before receiver" and "middle between emitter and receiver," the dangerous part stops at once (use the correct test piece).
10. The dangerous part continues stopping as far as the detectable body for inspection exists in the detection area.
11. Turn off the power supply to the RPX with nothing existing in the detection area and the dangerous part stops.

Semi-annual inspection

Confirm the following inspection items every six months and when the machine settings are altered:

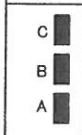
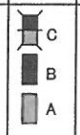
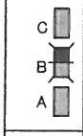
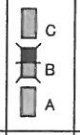
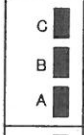
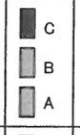
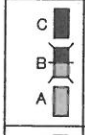
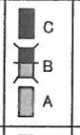
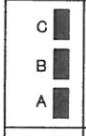
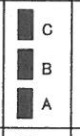
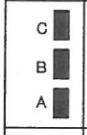
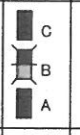
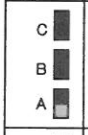
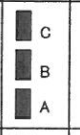
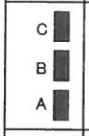
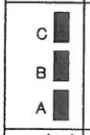
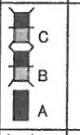
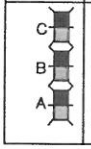
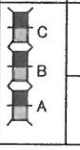
1. The machine itself is designed not to interfere with the safety function such as stopping.
2. Modifications and connection changes that adversely affect the control system of the machine have not been made.
3. The output of the RPX and the machine are correctly wired.
4. The actual response time of the machine as a whole is less than the calculated value.
5. The switching frequency of the relay is sufficiently low with respect to the lifetime switching frequency.
6. The tightening screws of fittings are not loose.
7. There is no ambient light.

Chapter 6 BEFORE TROUBLE SEEMS TO EXIST

6-1 Lockout State

When the emitter/receiver gets into the lockout state, the error mode indicating lamps blink to indicate errors.

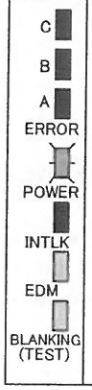
Take measures according to the table below:

Emitter	Receiver	Error code	Cause	Solution
		Mutual interference error	Entry of ambient light	Interrupt ambient light
		Power capacity error	①. Supply voltage deviating from ratings. ②. Voltage change due to insufficient. current capacity of power supply. ③. Momentary turn-off or stop due to sharing of power supply with other device.	①. Connect to DC24V±20% supply voltage. ②. Replace with power supply greater in current capacity. ③. Stop sharing and use as special power supply.
		Blanking monitoring error. (Note:When special box for blanking is used)	Light entering fixed blanking beam.	Correct position of device etc to prevent light entering fixed blanking beam. (Set device again.)
		Communication error	①. The communication line or other wiring is broken or short-circuited. ②. Connector of power cord or seriesconnected cord detached. ③. Communication error due to noise ④. Faulty internal circuit	①. Check whether or not wiring and cord are faulty. ②. Check noise environment around communication wire.
		Lockout of other sensor than the primary receiver (error mode indicator will not turn on)	A sensor other than the primary receiver is in lockout when seriesconnected.	Replace sensor.
		External device monitoring error	①. Relay is welded. ②. The relay and external device monitoring input line are not properly wired. ③. The relay response time exceeds the allowable delay time. ④. Wire broken or shorted.	①. Replace the relay. ②. Check the wiring for the relay. ③. Replace the relay with one that has an appropriate response time.
		Interlock wiring error	①. The reset input line and interlock selection input line are not properly wired. ②. The interlock selection input line is broken or short-circuited.	①. Check that wiring has been made for auto reset or manual reset. ②. Check wiring of interlock selection input line.
		Safety output error (1)	①. Safety output lines are shortcircuited to each other at power on. ②. Safety output line and 24V, 0V, or device or the connection. other input/output line are shortcircuited at power on. ③. Failure of safety output circuit.	①. Wire the output lines properly. ②. Replace the receiver. ③. Check if series connection cables are connected properly
		Safety output error (2)	①. Safety output lines are shortcircuited to each other after power on. ②. Safety output line and 24V, 0V, or device or the connection. other input/output line are shortcircuited after power on.	①. Wire the output lines properly. ②. Check if series connection cables are connected properly
		Effect of noise.	Effect of noise is excessive.	Check noise environment around emitter/receiver.
		Failure of RPX's internal circuit.	RPX's internal circuit is damaged.	Replace the RPX.

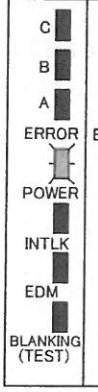
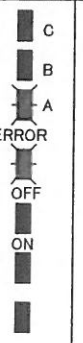
6-2 Troubles Except in Lockout State

The measures to deal with trouble when the emitter/receiver does not operate though the lockout indicating lamp and error mode indicating lamp do not blink are shown below:

The state in which the light receive level indicating lamp does not go on and only the power indicating lamp and OFF output indicating lamp are on when light is allowed to enter:

Emitter	Receiver	Cause	Action
		①. Beam is misaligned. ②.Test input is being applied. ③. Detection surface of an emitter or a receiver is dirty.	①. Adjust the beam so that it should receive light. ②. Check if the test indicator is blinking. If it is blinking, set the test input OFF or open. ③. Clean the surface.

The state in which the light receive level indicating lamp does not go on and only the power indicating lamp, OFF output indicating lamp and receiver side error code A are on when light is allowed to enter:

Emitter	Receiver	Cause	Action
		①. Communication line is broken between an emitter and a receiver. ②. Effect of noise on the communication line is too much. ③. Power connector is detached.	①. Perform the proper wiring. ②. Check the noise level in the environment around the communication line. ③. Plug the power connector tightly to ensure connection.

CITATION STANDARDS

International standards

- IEC61496-1:2008 "Safety of machinery: Electro-sensitive protective equipment, Part 1 General requirements and tests"
- IEC61496-2:2006 "Safety of machinery: Electro-sensitive protective equipment, Part 2 Requirements for facilities using active electro-sensitive protective equipment"
- IEC61508-1～3 : 2010 "Functional safety of electric/electronic/programmable electronic control systems"
- IEC62061 : 2005 "Safety of machinery: Safety: Safety-related electric/electronic/ programmable electronic control systems"
- ISO13849-1 : 2006 "Safety of machinery: Safety-related components of control systems, Part1 General principle for design"
- ISO13855 : 2010 "Safety of machinery: Positioning of protective equipment corresponding to approach speed of parts of human body"

European standards

- EN61496-1 : 2004+A 1 : 2008 "Safety of machinery: Electro-sensitive protective equipment, Part 1 General requirements and tests"
- CLC/TS61496-2 : 2006 "Safety of machinery: Electro-sensitive protective equipment, Part 2 Requirements for facilities using active electro-sensitive protective equipment"
- EN61508-1～3 : 2010 "Functional safety of electric/electronic/programmable electronic related systems"
- EN415-4 : 1997 "Palletizers and depalletizers"
- EN692 : 2005+A1 : 2009 "Machine presses"
- EN693 : 2001+A1 : 2009 "Hydraulic presses"
- EN ISO13855 : 2010 "Safety of machinery: Positioning of protective equipment corresponding to approach of parts of human body"
- EN1037 : 1995+A1 : 2008 "Safety of machinery: Prevention of unexpected startup"
- EN61000-6-4:2007 "Electromagnetic compatibility(EMC), Part 6-4: General standard-Emission standard for industrial environment"
- EN62061 : 2005 "Safety of machinery: Safety-related electric/electronic/programmable electronic control systems"
- EN ISO13849-1 : 2008 "Safety of machinery: Safety-related components of control systems. Part 1 General principle for design"

US Occupational Safety and Health regulations

- OSHA 29 CFR 1910.212 "General requirements"
- OSHA 29 CFR 1910.217 "Machine presses"

US standards

- ANSI B11.1 : 2009 "Machine presses"
- ANSI B11.2 : 1995 (R2005) "Hydraulic presses"
- ANSI B11.3 : 2002 (R2007) "Power press brakes"
- ANSI B11.4 : 2003 (R2008) "Shears"
- ANSI B11.5 : 1988 (R2008) "Iron workers"

- ANSI B11.6 : 2001 (R2007) "Lathes"
- ANSI B11.7 : 1995 (R2005) "Cold headers and cold forming"
- ANSI B11.8 : 2001 (R2007) "Drilling, milling and boring machines"
- ANSI B11.9 : 1975 (R2005) "Grinding machines"
- ANSI B11.10 : 2003 (R2009) "Metal sawing machines"」
- ANSI B11.11 : 2001 (R2007) "Gear cutters"
- ANSI B11.12 : 2005 "Roll forming machines and roll bending machines"
- ANSI B11.13 : 1992 (R2007) " Single and multiple-spindle automatic bar and chucking machines"
- ANSI B11.15 : 2001 "Pipe, tube and shape bending machines"
- ANSI B11.16 : 2003 (R2009) " Powder metal compacting presses"
- ANSI B11.17 : 2004 (R2009) " Horizontal hydraulic extrusion presses"
- ANSI B11.18 : 2006 " Machinery and machine systems for processing of coiled strip sheet, and plate"
- ANSI B11.19 : 2003 (R2009) " Design, construction, care and operation of the safeguarding when referred to by other B11 machine tools"
- ANSI /RIA 15.06 : 1999 (R2009) "Safety requirements related to industrial robots and robot systems"
- UL1998 : 1998 "Safety-related software"
- UL508 : 1999 "Industrial control equipment"
- UL61496-1 : 2002 "Electro-sensitive protective equipment, Part 1 General rules"
- UL61496-2 : 2002 "Electro-sensitive protective equipment, Part 2 Photoelectric devices"
-

Canadian standards

- CAN/CSA C22.2 No.14 "Industrial control equipment"
- CAN/CSA C.22.2 No.0.8 "Electronic technology-integrated safety functions"
- CSA Z142 "Power press operation: Requirements for health, safety and protection"
- CSA Z432 "Safety protection of machinery"
- CSA Z434 "General safety requirements for industrial robots and robot systems"

SEMI standards

- SEMI S2-0706 "Environmental, health and safety guidelines for semiconductor manufacturing equipment"

JIS standards

- JIS B 9704-1 : 2006 "Safety of machinery: Electro-sensitive protective equipment, Part 1 General requirements and tests"
- JIS B 9704-2 : 2008 "Safety of machinery: Electro-sensitive protective equipment, Part 2 Requirements for facilities using active electro-sensitive protective equipment"

- When considering using the device in the conditions or environment not specified in this User's Guide or for nuclear control, railways, aircrafts, vehicles, combustion devices, medical equipment, amusement machines and safety equipment and for applications which are expected to greatly affect human life and property and for which safety is especially required, please be sure to operate the device, leaving some leeway with respect to the ratings and performance, and take measures to ensure safety such as fail-safe operation. In addition, please check up necessary matters with the Specification etc., consulting with our business staff.

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