Photoelectric Press Safety Device

RPZ 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 RPZ type photoelectric safety device. The RPZ type 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. TA535 (RPZ425X2)
Certificate No. TA536 (RPZ425X4)

<With control box>
Certificate No. TA534 (RPZ425X2 or RPZ425X4 and control box)

Regulations and Standards

1. The RPZ 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 RPZ is in conformity with the requirements of the following EC Directives:

   Machinery Directive 2006/42/EC

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

・Type 4 model

(1)European standards

EN 61496-1 (Type 4 ESPE), CLC/TS 61496-2 (Type 4 AOPD), EN 61508-1 through -3 (SIL3),EN 61000-6-4, EN ISO 13849-1:2008 (Category 4, PL e)

(2)International standards

IEC 61496-1 (Type 4 ESPE), IEC 61496-2 (Type 4 AOPD), IEC 61508-1 through -3 (SIL3),ISO 13849-1: 2006 (Category 4, PL e)

(3)JIS standards

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

(4)North American Standards:

UL 61496-1 (Type 4 ESPE), UL 61496-2 (Type 4 AOPD), UL 508, UL 1998, CAN/CSA C22.2 No.14,CAN/CSA C22.2 No.0.8

・Type 2 model

(1)European standards

EN 61496-1(Type2 ESPE),CLC/TS 61496-2 (Type 2 AOPD), EN 61508-1 through -3 (SIL1),EN 61000-6-4, EN ISO 13849-1:2008 (Category 2, PL c)

(2)International standards

IEC 61496-1 (Type 2 ESPE), IEC 61496-2 (Type 2 AOPD), IEC 61508-1 through -3 (SIL1),ISO 13849-1: 2006 (Category 2, PL c)

(3)JIS standards

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

(4)North American Standards:

UL 61496-1 (Type 2 ESPE), UL 61496-2 (Type 2 AOPD), UL 508, UL 1998, CAN/CSA C22.2 No.14,
CAN/CSA C22.2 No.0.8

4. The RPZ received the approvals of EC Type-Examination in accordance with the EU Machinery Directive, Type 4 ESPE and Type 4 AOPD from the EU accredited body, TÜV SÜD Product Service GmbH.
5. The RPZ received the certificates of UL listing for US and Canadian safety standards, Type 4 ESPE and Type 4 AOPD from the Third Party Assessment Body UL.
6. The RPZ 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
   - Japan Ministry of Health, Labour and Welfare "Guidelines for Comprehensive Safety Standards of Machinery", Standard Bureau's Notification No. 0731001 dated July 31, 2007.

* For the name of the year of issue of the above-mentioned standards, please refer to Section "Citation Standards" (p.42).

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 RPZ, 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

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

Installation position of emitter/receiver

o 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.

o 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).

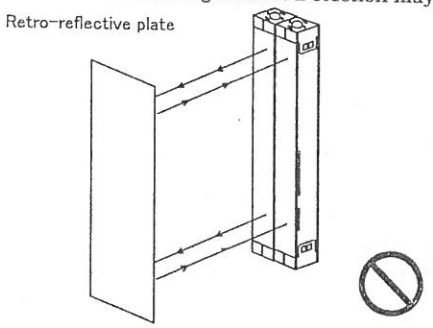
o Install a protective structure around the machine so that the operator can reach the dangerous part only after passing through the detection area.

o Never change the installation position.

o 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.

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

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



Installation of auxiliary beams

o 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.

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

Inspection before operation of the safety device

o 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 "Wiring" 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 Type RPZ425−□□□□■ 1set

(2) Sensor fittings

① Embedded fittings for emitter 2 sets, for receiver 2 sets・・・4 sets

② Embedded hexagon socket head bolt (M5×14) ・・・8 pcs.

(3) Test rod × 1 pc.

For Type RPZ425−□□□□■... φ25mm 1 pc.

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

Table of contents

Chapter 1 OVERVIEW

1-1 Features

Detection distance

RPZ425-140X4～RPZ425-2020X4 : 7m (aperture angle ±2.5°)

RPZ425-140X2～RPZ425-2020X2 : 4m (aperture angle ±5°)

Continuous light interrupting width (minimum detectable object)

RPZ425-□□□□■ series : 25mm

Additional distance(C)

RPZ425-□□□□■ series : C=0 mm

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

RPZ425-□□□□■ series : 140mm～180mm [per 40mm]

: 260mm～2020mm [per 80mm]

Light quantity display monitor (STB)

The green LED goes on when the quantity of light received exceeds 170% of the threshold value.

Internal error display

Blinks when an internal error occurs.

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 3 sets with up to 192 beams in total can be connected in series. Auxiliary beams are easy to install.

Top light entrance indicating lamp

Goes on when light enters the uppermost beam.

Bottom light entrance indicating lamp

Goes on when light enters the lowermost beam.

This makes it easy to align beams.

1-2 Function

❹ 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.

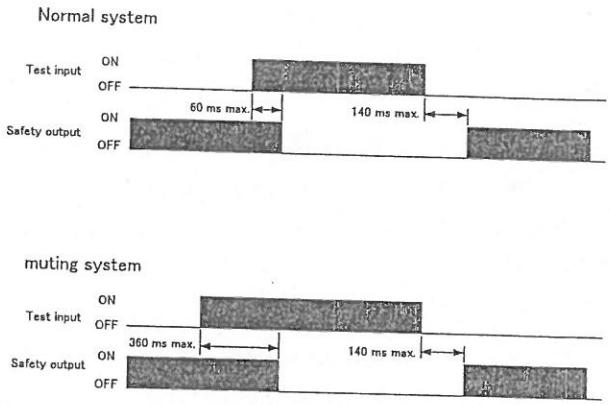
❺ Cyclic self-diagnosis function

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

❻ External test function (test input)

The function to stop light emission forcibly on a signal from the outside. It also serves to check whether or not the safety system stops properly (control output turns off) when light is interrupted.

With a voltage of (Vs -3V)～Vs applied to the test input wire (black or green), light emission stops and the control output turns off. Vs is the sensor supply voltage in the operating environment.



- External relay monitor function

  The external relay monitor function cannot be used when the muting System is on.

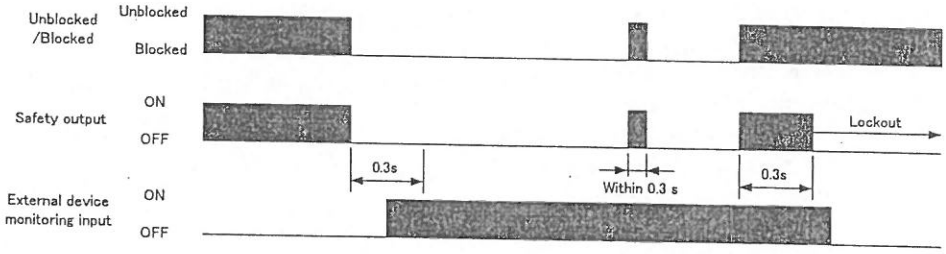
  Monitor that a volrage of (Vs-3V)～Vs is applied to the external relay monitor input wire of the sensor receiver through the contact B of the external ralay when the control output switches from ON to OFF.

  Vs is the sensor supply voltage in the operating environment.

  In case of trouble , the sensor gets into the lockout state. However , a delay of the relay up to 300ms is judged normal.

  When the external relay monitor is not used ,connect the auxiliary output wire to the external monitor input wire.

The RPZ type sensor reads the value of relay monitor at least 0.5 seconds after the power supply turns on. When the control output switches again within the allowable delay time after its switchover, the sensor does not get into the lockout state even if the value of the external relay monitor input remains unchanged.



● Manual reset function

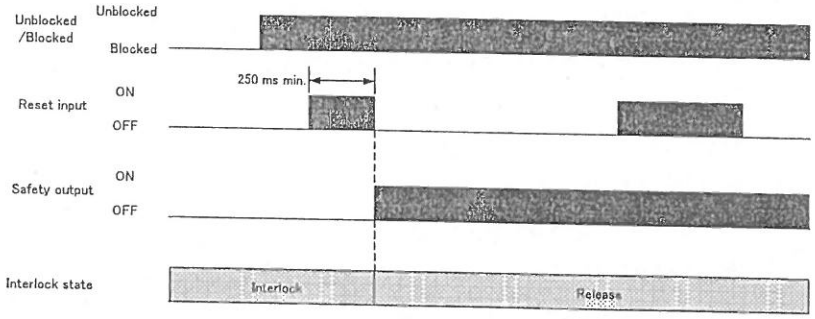
After power-up and when light is interrupted, the sensor gets into the interlock state.

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, switch the reset input from OFF to ON.

With no light-shielding object in the detection area, apply a voltage of (Vs～3V)～Vs to the reset input wire for 250 ms or more. After that, open the wire or change the voltage to (0～1/2 Vs)V. The interlock state is canceled and the control output turns on.

Vs is the sensor supply voltage in the operating environment.



● Muting function

⚠ 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 RPZ in the ON state.
2. After turning on the muting input 1 (connecting to (Vs-3V)～24V, turn on the muting input 2 (connect to (Vs-3V)～24V within the muting input time limits of T1min～T1max (0.1～3 seconds).

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

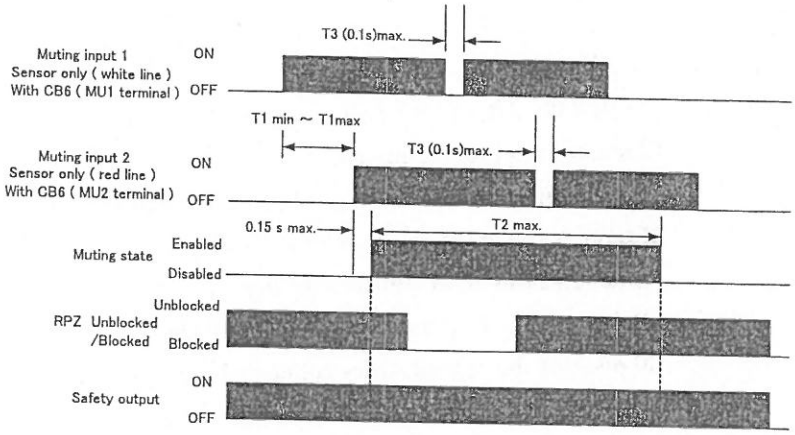
   In cases where the conditions of Item 1 are met, but the time conditions of Item 2 are not met, a muting error results and the muting error indicating lamp on the receiver side goes on.

   In the muting error state, however, the safety function of the RPZ 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.

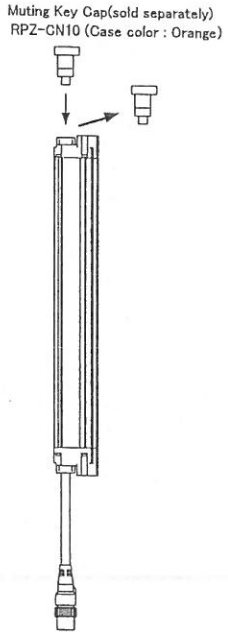
○ End conditions

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).



● 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.



1-3 Type Names

Names of emitter/receiver

RPZ425—□■ △

□ denotes the protection height.

■ denotes the aperture angle type X2 or X4.

△ Enter "M" when the muting function is provided.

Set configuration

(1) (2) (3)

RPZ425—□■-□■-□■ △

The RPZ425 denotes the series name of the sensor。

□denotes the protection height.

(when the numeral is 4-digit, enter all 4 digits).

■denotes the aperture angle type X2 or X4.

(1) denotes the main emitter/receiver.

(2) denotes the first series-connected sensors.

(3) denotes the second series-connected sensors.

When these are not used, make no entry therein.

(Three sets are connectable in series. Up to 192 beams in total are available).

Chapter 2 RATINGS/PERFORMANCE

2-1 List of Ratings

Item Type		RPZ425-□□□X4	RPZ425-□□□X2
Number of beams		8 (protection height 140 mm) 10-102 (protection height 180-2020 mm, at 80 mm intervals)	
Beam pitch		20 mm	
Continuous light interrupting width		25 mm	
Detection distance		0.2-7 m	0.2-4 m
Response time		ON→OFF : 15 ms or less、OFF→ON : 70 mm or less (when light enters in stable condition)	
Supply voltage (Vs)		Power supply to emitter/receiver DC24V±20% (ripple p-p10%or less)	
Consumption power		For consumption power of emitter/receiver, refer to attached table.	
Light source		Infrared LED (wavelength 870nm)	
Control output (OSSD)		PNP transistor output ×2、load current 200 mA or less、residual voltage 2V or less (excluding effect of cord extension)、leak current 1 mA or less, inductive load 2,2H or less (*1), allowable capacitive load 1 μF *2	
Inversion output (non-safety output)		PNPtransister×1、load current 100 mA or less、residual voltage 2V or less (excluding effect of cord extension)、leak current 1 mA or less,	
Input voltage		ON voltage : (Vs～3V)～Vs (Vs is voltage value in operating environment) OFF voltage : 0～1/2 Vs or open	
Effective aperture angle		±2.5° or less when detection distance is 3 m or more	±5° or less when detection distance is 3 m or more
Indicating lamp	Emitter	Top/bottom light receive level indicating lamp (blue LED×2) Stability indicating lamp (green LED×1) ON/OFF output indicating lamp (green LED×1. Red LED x 1). Lockout indicating lamp (red LED×1): Power indicating lamp (green LED x 1) Test indicating lamp (green LED x 1) Muting error indicating lamp (green LED x 1) Muting input 1/2 indicating lamp (green LED x 2)	
	Receiver	Top/bottom light receive level indicating lamp (blue LED×2) Stability indicating lamp (green LED×1) : ON/OFF output indicating lamp (green LED×1. Red LED x 1). Lockout indicating lamp (red LED×1): Communication indicating lamp(green LED x 1) Configuration indicating lamp(green LED x 1) Internal error indicating lamp (red LED x 1) Interlock indicating lamp (yellow LED x 1) External relay monitor indicating lamp (green LED x 1)	
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, control box IP54	
Vibration resistance		Malfunction : 10～55Hz、double amplitude 0.7 ㎜、20 sweeps in each of X, Y and Z directions	
Impact resistance		Malfunction : 100 m/s²、{10G}、1000 cycles in each of X, Y and Z directions	
Applicable standards		Refer to the pages on regulations and standards.	

*1: The value of inductive load is the maximum value when the control output frequently repeats .turning on and off. When the control output is being used at 4Hz or less, the value of available inductive load becomes high.

*2: The value to be taken into account when connecting elements such as additional condenser which include capacitive load.

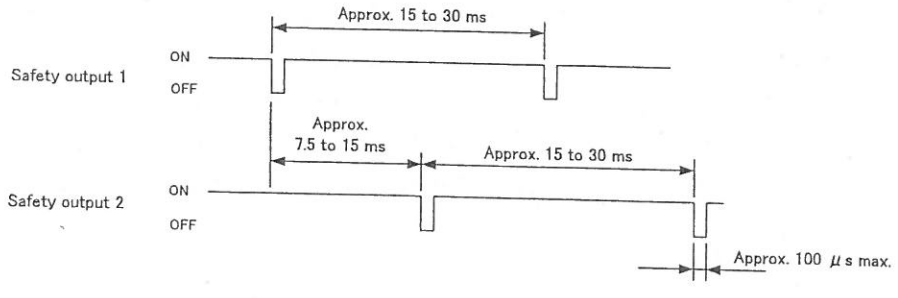
2-2 Response Time and Consumption Current of Emitter/Receiver

	Detection width (mm)	Number of beams	Response time (ON→OFF) (ms)	Response time (OFF→ON) (ms)	Consumption current (mA)
RPZ425−□□□□■	140	8	15 or less	70 or less	82
	180	10			85
	260	14			89
	340	18			93
	420	22			97
	580	30			105
	660	34			110
	740	38			114
	900	46			123
	1060	54			123
	1220	62			131
	1380	70			138
	1540	78			145
	1700	86			154
	1860	94			161
	2020	102			168

* The sum of response times also becomes 15 ms or less in the case of series connection.

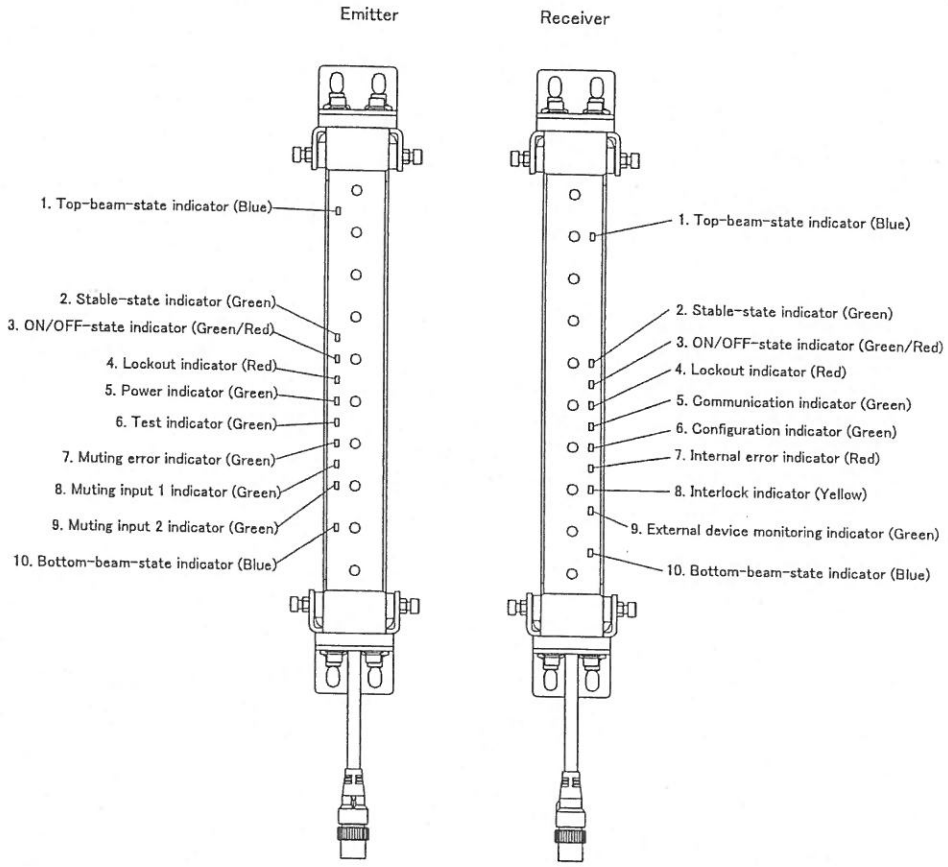
2-3 Waveform of Sensor Control Output

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 Name and content of indicator

3-1 Emitter/Receiver Type R P Z 4 2 5 − □□□□■



<Emitter>

No	Internal indicating lamp		ON	Blink
1	Top light entry indicating lamp	TOP	Goes on when light enters uppermost beam.	Blinks when cap error or connection error occurs during muting.
2	Stability indicating lamp	STB	Goes on when quantity of light received exceeds 170% of threshold value of ON output.	Blinks when control output turns off due to effect of ambient light or vibration.
3	ON/OFF output indicating lamp	ON OFF	Green: Goes on when control output turns on. Red: Goes on when control output turns off.	Red: Blinks at lockout of control output.
4	Lockout indicating lamp	LOCKOUT	Goes on at lockout on receiver side.	Blinks at lockout on emitter side
5	Power indicating lamp	POWER	Goes on when power supply to emitter is on.	Blinks when at lockout by supply voltage or noise.
6	Test indicating lamp	TEST	—	Blinks in external test state.
7	Muting error indicating lamp	MUTING ERROR	—	Blinks in muting error state.
8	Muting input 1 indicating lamp	MUTE1	Goes on in interlock state.	—
9	Muting input 2 indicating lamp	MUTE2	Goes on when input exists in external monitor input.	—
10	Bottom light entry indicating lamp	BTM	Goes on when light enters lowermost beam.	Blinks during muting.

<Receiver>

No	Internal indicating lamp		ON	Blink
1	Top light entry indicating lamp	TOP	Goes on when light enters uppermost beam.	Blinks when cap error or connection error occurs during muting.
2	Stability indicating lamp	STB	Goes on when quantity of light received exceeds 170% of threshold value of ON output.	Blinks when control output turns off due to effect of ambient light or vibration.
3	ON/OFF output indicating lamp	ON OFF	Green: Goes on when control output turns on. Red: Goes on when control output turns off.	Red: Blinks at lockout of control output.
4	Lockout indicating lamp	LOCKOUT	Goes on at lockout on receiver side.	Blinks at lockout on emitter side.
5	Communication indicating lamp	COM	Goes on when communication between emitter and receive is established.	Blinks at lockout by supply voltage or noise.
6	Configuration indicating lamp	CFG	—	Blinks in external test state.
7	Internal error indicating lamp	INTERNAL	—	Blinks at lockout by internal fault.
8	Interlock indicating lamp	INT-LK	Goes on when muting input 1 is on during operation of muting system	Blinks at lockout by faulty wiring.
9	External relay monitor indicating lamp	EDM	Goes on when muting input 2 is on during operation of muting system	Blinks lockout by internal relay monitor error.
10	Bottom light entry indicating lamp	BTM	Goes on when light enters lowermost beam.	Blinks during muting.

Chapter 4 WIRING AND INSTALLATION

4-1 Installation Conditions

4-1-1 Detection area and approach route

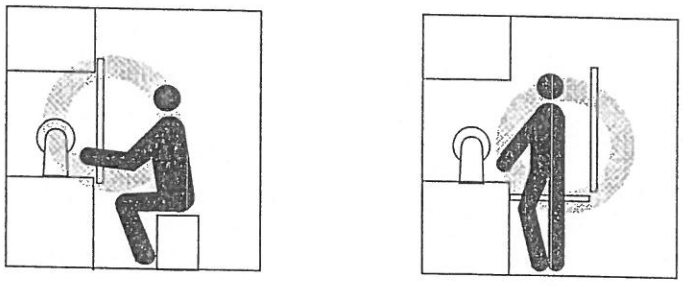
⚠WARNING
The device is not applicable to machines that are incapable of quick stopping by electric control.
Install a protective structure around the machine so that the operator cannot reach the dangerous part of the machine unless he passes through the detection area. Install the device so that part 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 RPZ 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.

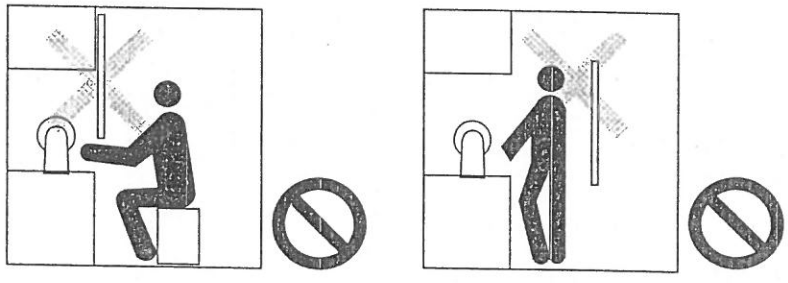
The detection area of the RPZ emitter/receiver includes the entire range connecting the detection width of the emitter with that of the receiver. Provide such a protective structure which prevents the operator from reaching the dangerous part of the machine unless he passes through the detection area.

Install the device so that the operator working in the dangerous part of the machine is always kept detectable by the RPZ emitter/receiver. In cases where the space between the machine and the RPZ 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 RPZ emitter/receiver by using auxiliary beams.

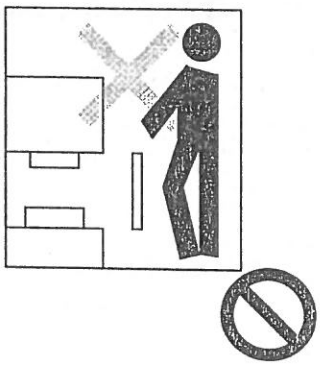
Correct installation

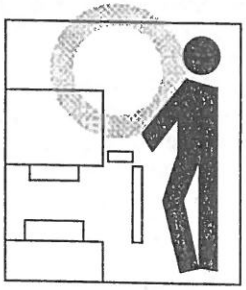


Incorrect installation



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.



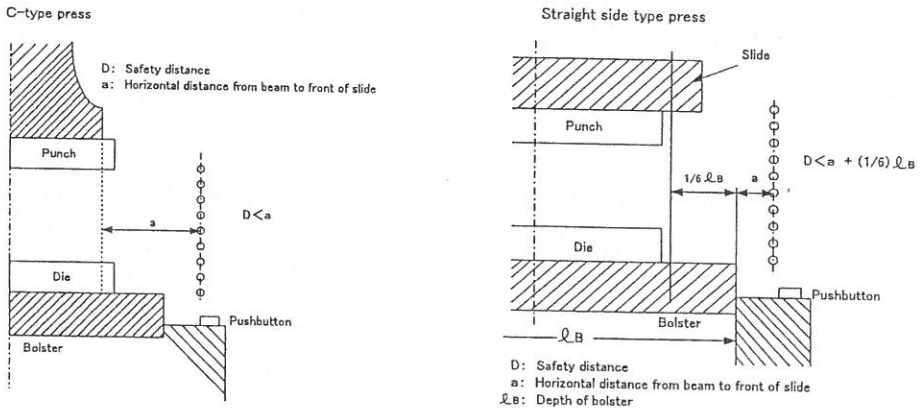


4-1-2 Safety distance

⚠ WARNING

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

The safety distance is the minimum distance by which the RPZ 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:



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

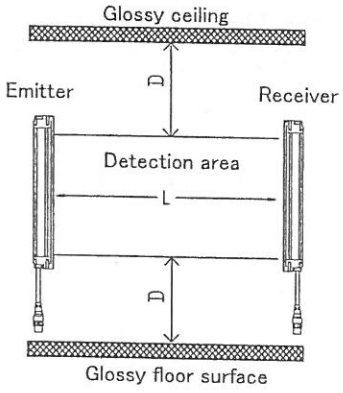
(fig.1)

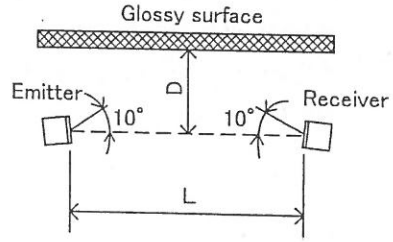
4-1-3 Distance from glossy surface

⚠ WARNING

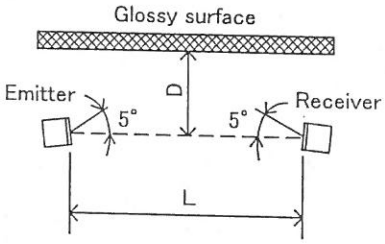
Install the device so as not to be affected by the reflection from glossy surfaces. The operator becomes undetectable, so there is a possibility of suffering serious injury.

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:





RPZ425□X2 type



RPZ425□X4 type

Sensor type	Distance between emitter and receiver (detection distance L)	Allowable installation distance D
RPZ425-□X2	0.2 ~ 3m	0.26m
	over 3 m	L/2×tan10°= L×0.089 (m)
RPZ425-□X4	0.2 ~ 3m	0.13m
	over 3m	L/2×tan5°= L×0.044 (m)

Note 1; Though the aperture angle of the RPZ425-□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 RPZ425-□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.

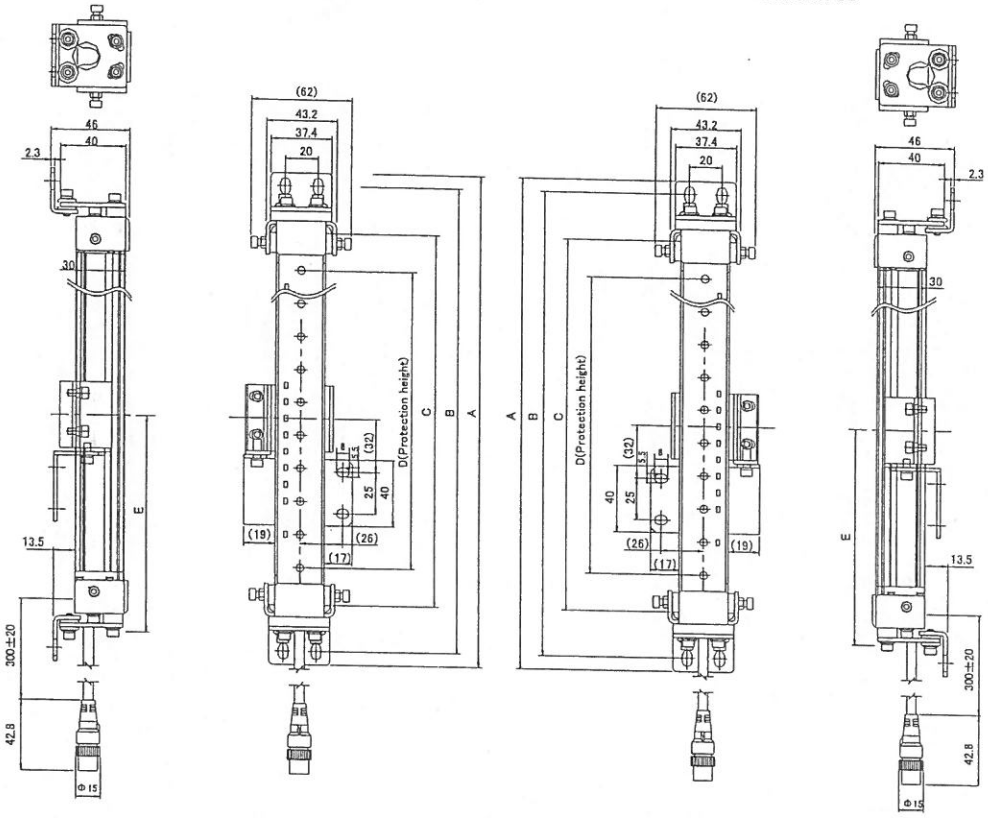
4-2 Outline Dimensional Drawing

4-2-1 Emitter/receiver

① Rear mounting

Emitter

Receiver

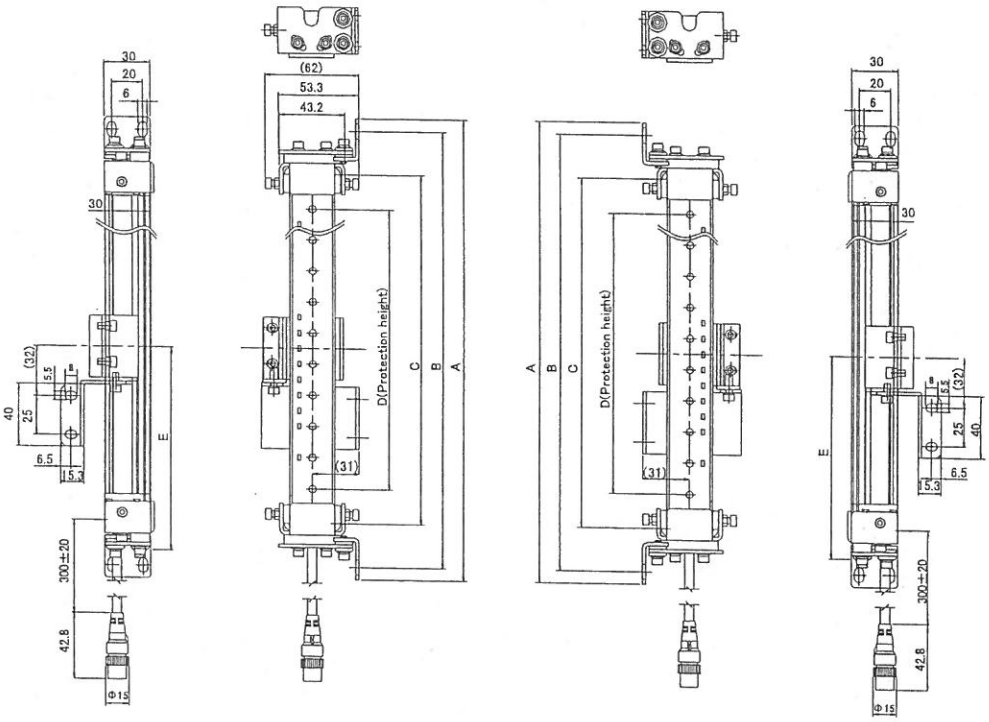


Type	D (Numeral after "—" in type)	A	B	C	Q'ty of inter-mediate fittings	E
RPZ425-140～1060	140～1060	C+73	C+57	D+45	0	—
RPZ425-1220	1220				1	C/2
RPZ425-1380～2020	1380～2020				2	C/3

② Side mounting

Emitter

Receiver



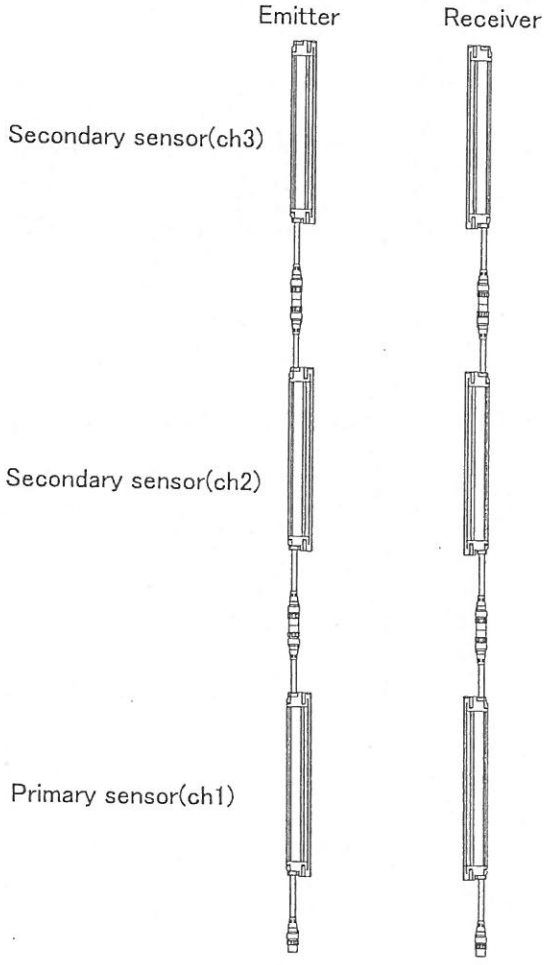
Type	D (Numeral after "—" in type)	A	B	C	Q'ty of inter-mediate fittings	E
RPZ425-140 ~ 1060	140~1060	C+73	C+57	D+45	0	—
RPZ425-1220	1220				1	C/2
RPZ425-1380 ~ 2020	1380~2020				2	C/3

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 2 emitters/receivers, use auxiliary beams. When using the CB6-W, install them using the light–interrupting 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. Three sets with up to 192 beams are connectable.



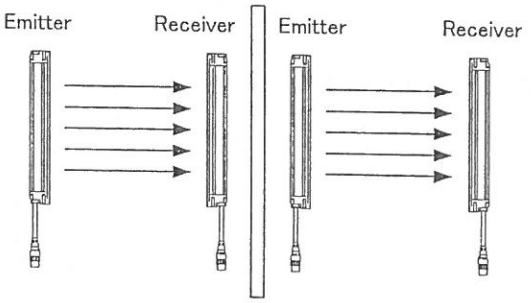
2) Not connecting in series

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

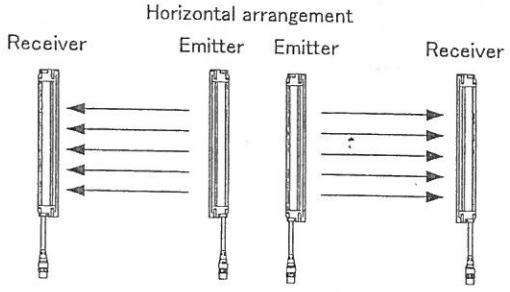
When installing 4 or more sets of RPZ sensors without making connections, arrange them so that mutual interference does not occur. In this case, if the installation distance between 2 sets is short, mutual interference may occur due to reflection on the RPZ surfaces. If mutual interference occurs, the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

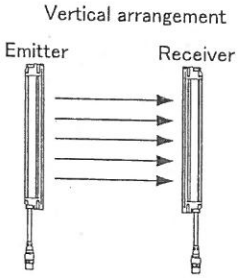
It is beneficial to take measures by combining the following 4 items:

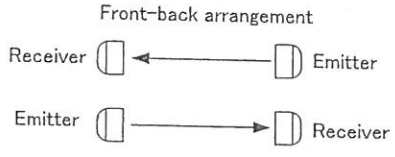
1. Install a light interrupting shield between 2 sets.

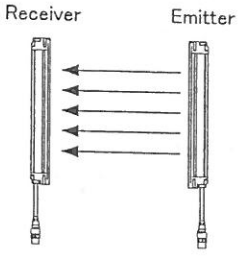


2. Make 2 sets different in emission direction (staggered arrangement).

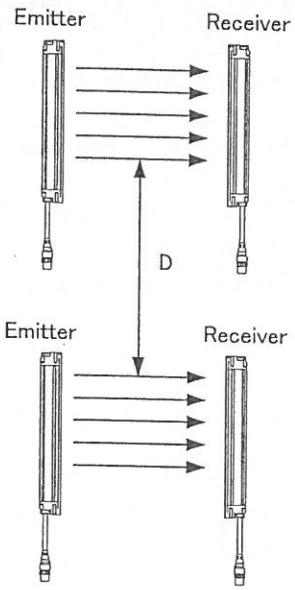


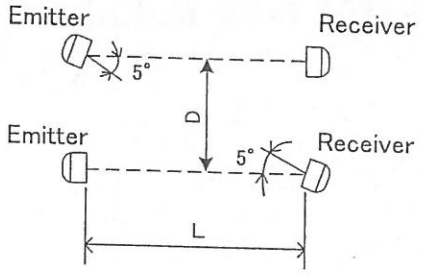




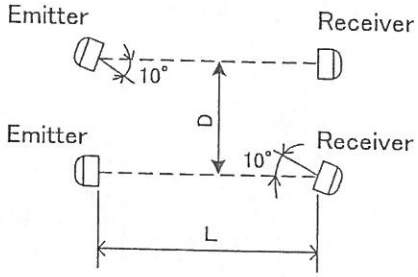


3. Install 2 sets by spacing them by a distance preventing interference.





RPZ425□X4 type



RPZ425□X2 type

Sensor type	Distance between emitter and receiver (detection distance L)	Allowable installation distance D
RPZ425-□X2	0.2 ～ 3 m	0.52 m
	over 3 m	L×tan10°= L×0.177 (m)
RPZ425-□X4	0.2 ～ 3 m	0.26 m
	over 3 m	L×tan5°= L×0.088 (m)

4-4 Wiring

⚠ 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.

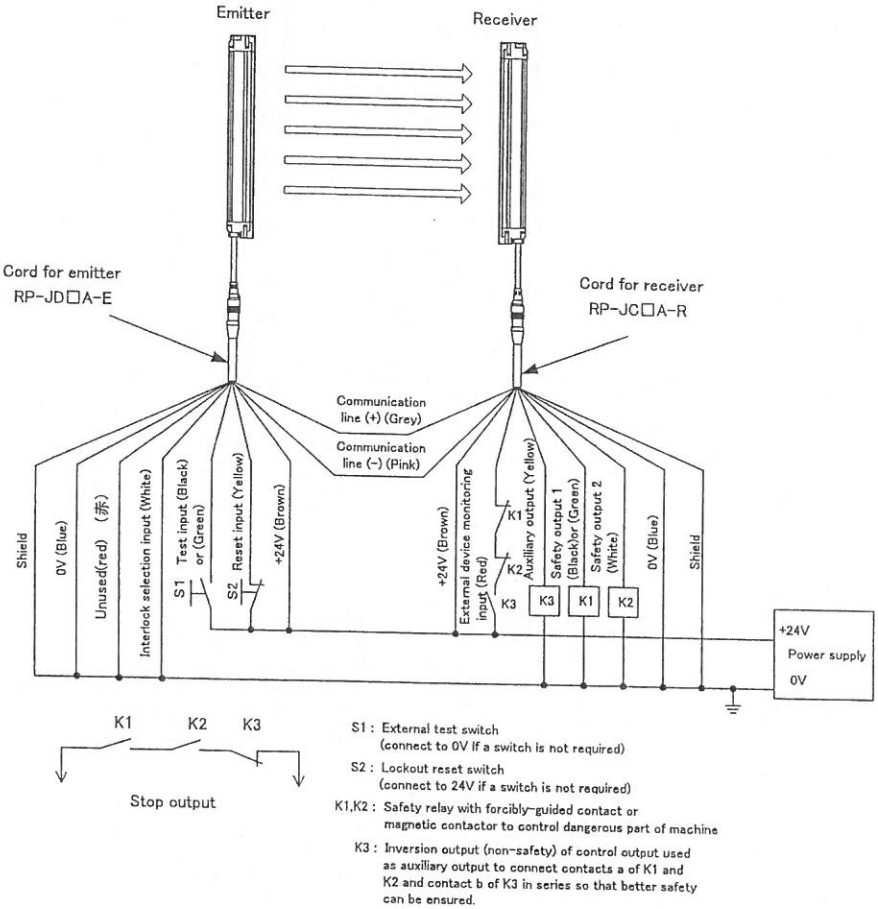
4-4-1 Wiring of emitter/receive

	Wire color	Function name
Emitter	Shield	0 V
	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 0 V
	Black or green	Feeds 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 or 0 V for normal specification

	Wire color	Function name
Receiver	Shield	0 V
	Grey	Communication wire RS485(A)
	Pink	Communication wire RS485(B)
	Brown	Power DC24V
	Blue	Power 0 V
	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 of sensors

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



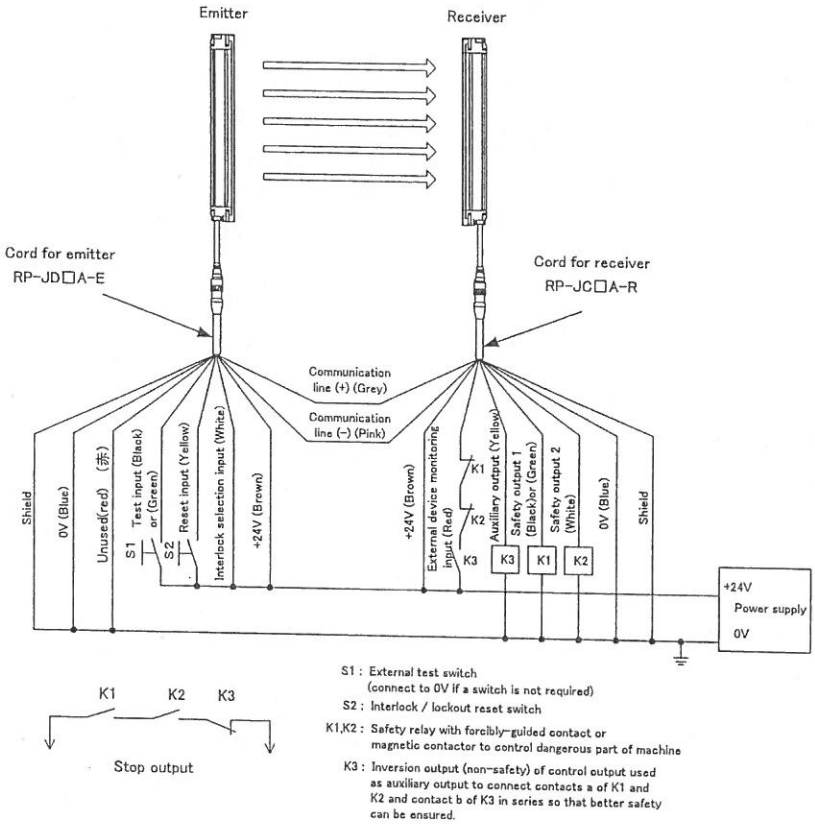
S1 : External test switch
(connect to 0V if a switch is not required)

S2 : 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

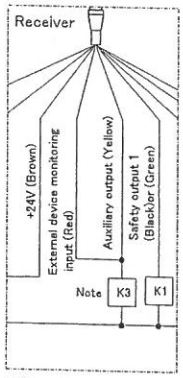
K3 : Inversion output (non-safety) of control output used as auxiliary output to connect contacts a of K1 and K2 and contact b of K3 in series so that better safety can be ensured.

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



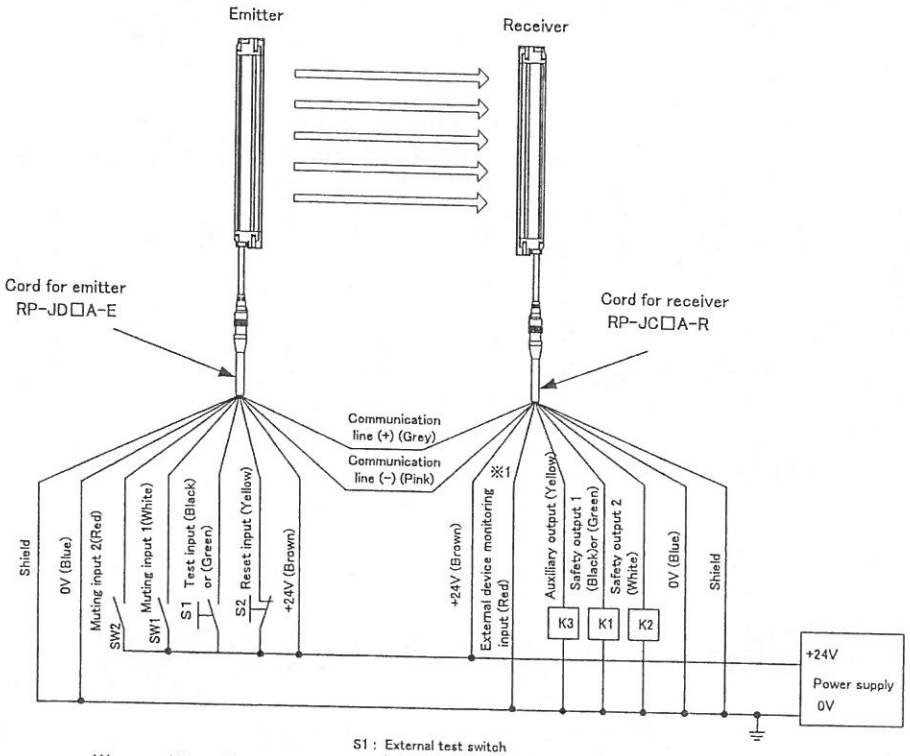
• When does not use external device monitoring function

- 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

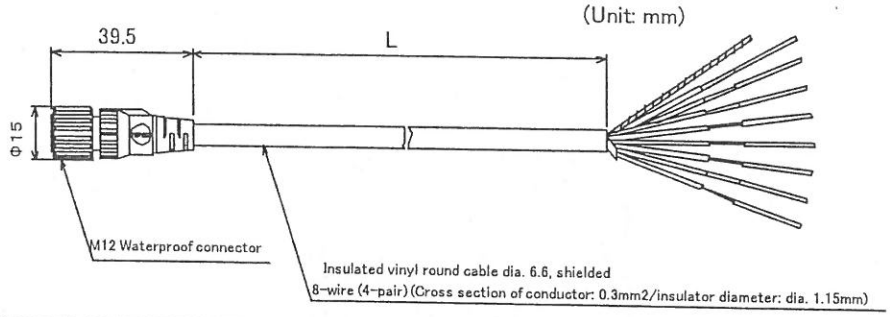


S1 : External test switch
(connect to 0V if a switch is not required)
S2 : Lockout reset switch
(connect to 24V if a switch is not required)
SW1 : Muting switch1
SW2 : Muting switch2
K1,K2 : Safety relay with forcibly-guided contact or magnetic contactor to control dangerous part of machine
K3 : Inversion 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.

※1 : Under muting system, connect to 0 V as the external device monitoring cannot be used.

4-4-3 Unilateral connector cord (RP-JD□A ,sold separately))

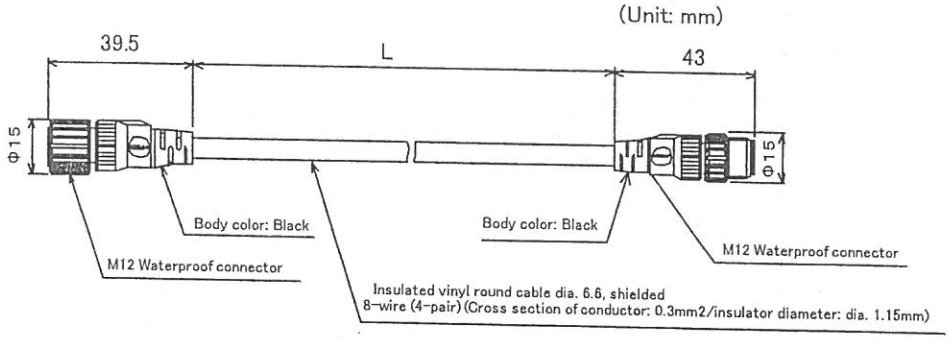
(Unit: mm)



Set type	For emitter		For receiver		L
RP-JD3A	RP-JD3A-E	Gray cable	RP-JD3A-R	Black cable	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 (RP-JD□B ,sold separately)

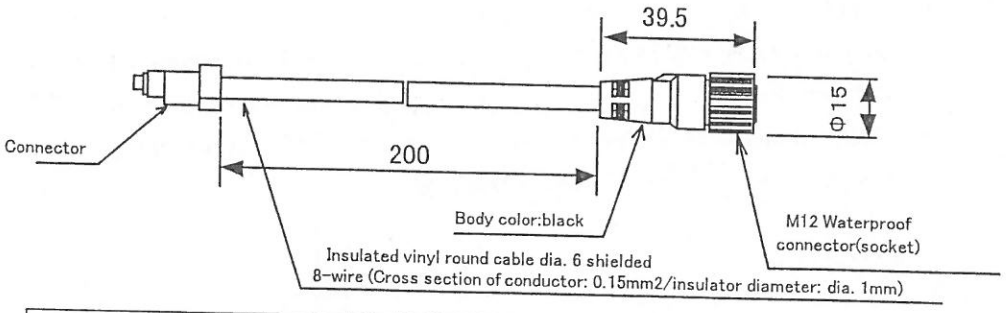
(Unit: mm)



Set type	For emitter		For receiver		L
RP-JDR5B	RP-JDR5B-E	Gray cable	RP-JDR5B-R	Black cable	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 (RPZ-JBR2W ,sold separately)

(Unit: mm)

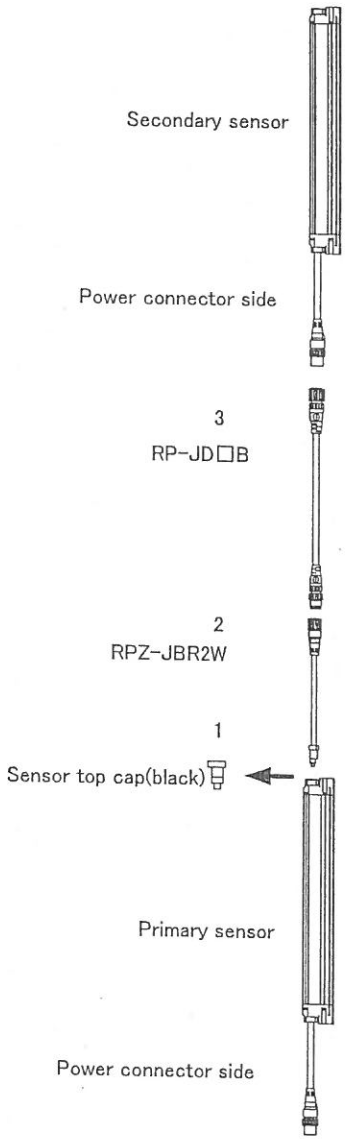


Set type	For emitter		For receiver	
RPZ-JBR2W	RPZ-JBR2W-E	Gray cable	RPZ-JBR2W-R	Black cable

4-5 Connection Method

4-5-1 Connecting in series

1. Remove the top cap of the primary side RPZ.
   Loosen the screw (M3+screw) of the cap so as to be able to remove the cap.
2. Connect the sensors by series connection cord for adhesion Type RPZ-JBR2W.
3. When changing the connecting distance between RPZs, connect a bilateral connector cord RP-JD□B (sold separately).



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 install to the RPZ.

Note 2): When installing the cord and cap, securely tighten the screws (M3+screw, two each) (recommendable torque 0.54 N・m). Dropping off or degradation of the protective function may result.

• Length of power cord

The length of the power cord must not exceed:

・Single (1 set)---- max.30 m

・2 connections (2 sets) --- max.30 m 7 m between connections

・3 connections (3 sets) --- max.30 m 7 m between 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 mm^2 ×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]

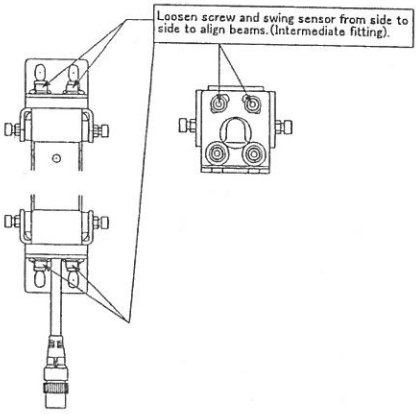
1. Confirm the following:

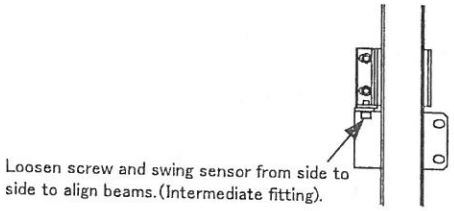
●The optical surfaces of the emitter and receiver are not dirty.

●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 top beam state and bottom beam state indicating lamp and stable state 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 emitter while looking at the light top beam state and bottom beam state indicating lamp and stable state indicating lamp and align the emitter to the center of the angle at which the ON output indicating lamp (ON: green) goes on.

4. Please make sure that the stable state indicating lamp is 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 RPZ 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 RPZ 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 RPZ.

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

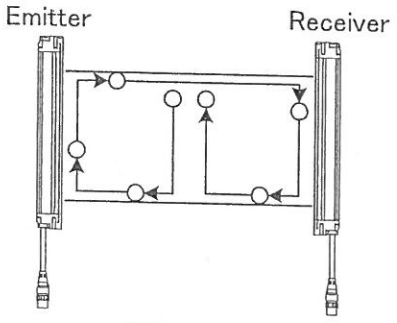
3.□The measured value of the safety distance is greater than the calculated value.

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 RPZ 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 RPZ 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 RPZ 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 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:

<Indicator status at lockout>

Combination of Indicators and Error Description  ON Blink OFF

LOCKOUT	POWER	TOP	Cap error
		STB	Ambient light error
		ON OFF	Safety output error
		INT -LK	Input wiring error
		EDM	External device monitoring
		COM	Communication error
		INTERNAL	Internal error
		CFG	Configuration error of emitter-receiver combination
	POWER	ON OFF	Safety output error due to power supply voltage or noise
		COM	Communication error due to power supply voltage or noise
		INTERNAL	Internal error due to power supply voltage or noise

<Indicator status at warning>

The combination of indicators when an error occurs and description of warnings

LOCKOUT	POWER	STB	Malfunction due to ambient light or vibration
		MUTING ERROR	Muting error

The sensor continues to operate when a warning occurs.

Error	Possible cause and remedy
Cap error	There is a possibility that cap has come off. Install cap correctly.
Communication error	There is a possibility that communication wire or other wires are shorted or broken. Check whether or not wires and cords are faulty.
	There is a possibility that power cord connector has come off. Check whether or not power cord connector has come off.
	When wires other than special cords are extended, there is a possibility that cords having equivalent or better performance are not used. Use cords having performance equivalent to or better than special cords. Connect shield to OV wire. Refer to 4-4 "Wiring."
Control output error	There is a possibility that control output wires are shorted to each other or to other signal wires. Connect control output wires correctly. Refer to 4-4 "Wiring."
Input wiring error	There is a possibility that combination of interlock select input wire and reset input wire is incorrect. When cap for muting is installed, there is a possibility that reset input wire is incorrectly connected. Perform wiring in correct combination. Refer to 4-4 "Wiring."
External relay monitor error	There is a possibility that emitter and receiver when connected to connector-connected type controller are connected in reverse. Check connecting position of connector.
	When auxiliary output wire is shorted in place of relay, there is a possibility that auxiliary output wire is broken or shorted. Check whether or not external relay monitor input wire and auxiliary output wire are faulty.
	There is a possibility that relay is welded. Replace relay.
	There is a possibility that relay and external relay monitor input wire are incorrectly wired. Check relay and wiring. Refer to 4-4 "Wiring.".
	There is a possibility that response time of relay exceeds allowable delay time (0.3 seconds). Replace with relay having proper response time. Refer to 4-4 "Wiring."
Internal error	There is a possibility of failure of internal circuit. Replace light curtain.
Configuration error in combination of emitter and receiver	There is a possibility that emitter and receiver are of different types. Check that emitter and receiver are of same type. There is a possibility that series-connected cord is shorted, broken or detached. Check that series-connected cord is properly connected. Replace series-connected cord if damaged.
Ambient light error	There is a possibility that light from other power switch or RPZ installed in other place is entering receiver. Take remedial measures, referring to 4-3 "How to Prevent Mutual Interference."
Control output error by supply voltage or noise	There is a possibility that supply voltage has temporarily dropped (to about DC12V) during operation. Check whether or not temporary drop of supply voltage has been caused by effect of inductive load, etc. When special power supply is not used, investigate consumption current of other equipment connected to see that capacity is sufficient.
	There is a possibility that device is affected by excessive noise. When noise is emitted by other equipment that shares supply voltage, use special power supply for safety components without sharing power supply. When supply voltage line is laid in parallel with power line, it tends to pick up noise easily. Install special power supply source in vicinity of light curtain or install supply voltage line apart from power line. When power source exists in vicinity of supply voltage source and is grounded to same grounding point, supply voltage source tends to be easily affected by mode noise. Use a different or special grounding point.
	There is a possibility that supply voltage deviates from ratings. Connect to supply voltage of DC24V±20%.

Error	Possible cause and remedy
	There is a possibility that voltage variation is caused by insufficient current capacity of power source. Replace with power source with high current capacity.
	There is a possibility of momentary turning off or momentary stop due to sharing of power supply with other device. Cancel sharing of power supply with other device and use a special power supply for electro-sensitive protective function.
Communication error by supply voltage or noise	There is a possibility of faulty communication due to noise. Check noise environment around communication wire.
	There is a possibility that supply voltage has temporarily dropped (to about DC12V) during operation. Check whether or not temporary drop of supply voltage has been caused by effect of inductive load, etc. When special power supply is not used, investigate consumption current of other equipment connected to see that capacity is sufficient.
Internal error by supply voltage or noise	There is a possibility of failure of internal circuit by supply voltage or noise. Check noise environment around communication wire. Check that supply voltage is DC24V±20% and replace sensor.
Malfunction by ambient light or vibration	There is a possibility of momentary misalignment of beams by vibration or malfunction by ambient light. Check installation condition. Take remedial measures, referring to 4-3 "How to Prevent Mutual Interference."
Muting error	There is a possibility that muting input has been applied in incorrect order. Causes of muting error can be known from lighting patterns of indicating lamp. For lighting patterns of indicating lamp, refer to attached table "Indicating Lamps in Case of Muting Error."

< Muting Error Indication >

Internal indicator Muting error indicator	Cause and measures
 Blimking: one	Power supply may have been turned ON with muting input 1 or 2 being ON. Check the condition of the muting signal and light curtain.
	Muting input 2 may have been turned ON before muting input 1 was turned ON. Check the condition of the muting signal.
	Muting input 1 and 2 may have been turned ON at the same time. ・Check the arrangement of the muting signal. ・Check if the wiring of muting input 1 and 2 is short-circuited.
	Check the condition of the light curtains.
 Blinking: Twice	Muting input 2 may have been turned ON within T1min (= 0.1 sec) after muting input 1 was turned ON.
	It may have taken T1max (= 3 sec) or longer for muting input 2 to be turned ON after muting input 1 was turned ON.
	The light curtain may have been blocked after muting input 1 was turned ON but before muting input 2 was turned ON.
 Blinking: Three times	The light curtain may have been blocked within 0.15 sec after muting input 1 and 2 were normally turned ON.

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"

MEMO

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- 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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