

## Expandable Safety Light Curtains

# PJ-V Series

### Features

- Operation range up to 7 m 23.0'
- Optical axis pitch of 20 mm 0.79"
- Water-resistant IP-65 housing
- Highly cost effective expansion system
- Built-in LED indicators simplify alignment

### Detecting Distance

All models - 7 m (23.0')



### Description

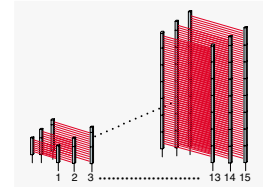
#### Flexible expansion system with an optical axis pitch of 20 mm 0.79"

The PJ-V Series features KEYENCE's unique optical axis expansion system (Safety Plus System). The optimal detection zone can be selected in 80-mm 3.15" increments. The number of optical axes can be increased or decreased as equipment or machinery changes.



#### Select from 15 steps, the widest range of detectable zones in the industry

The detection area ranges from 140 to 1260 mm 5.51" to 49.61". Three types of expansion units are available for designing the detection area to fit your application.

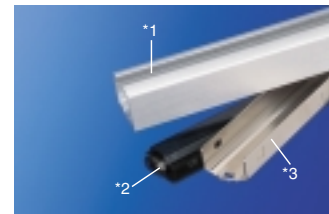


#### Long-operating range of up to 7 m 23.0'

The sufficient operating range provides reliable guarding for a wide variety of equipment or machinery ranging from a compact type to a large-scale type.

#### Slim and tough sensor head for use in harsh environments

Although the housing is very slim, the sensor head provides ultra-high rigidity. Metal is used for the outer housing, inner housing, and locking mechanism components to provide strength and allow the sensor head to endure vibration or impact.



- \*1: Strong, lightweight aluminum outer housing with 1.6 mm 0.06" thick walls
- \*2: Specially molded inner housing prevents foreign matter entry.
- \*3: Stereoscopically molded tough steel structural member

#### LED bar indicator simplifies optical alignment

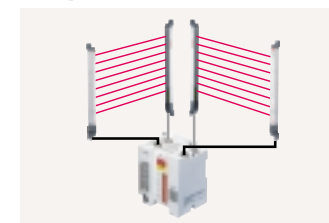
The number of lit LEDs on the bar varies depending on the number of clear optical axes. Anyone can easily perform optical alignment with no assistance. In addition, if a fault occurs, the indicators inform the operator of the fault status instantly.



- \* When all optical axes are stably clear, all LEDs are illuminated and the LED color changes from red to green.

#### Sub-controller enables two-head operation

The sub-controller enables two-sensor heads to be used without extra wiring. When a sub-controller is connected to the main controller, the mutual interference suppression function works automatically.

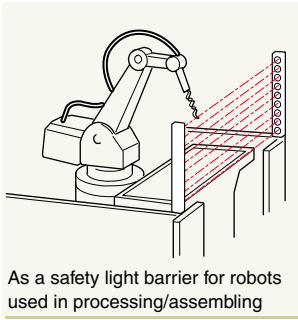


#### Space-saving safety controller

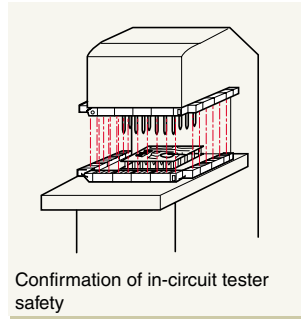
The controller features fault detection circuits plus three safety relays. The controller is highly compact for easy mounting to a DIN rail.

# Expandable Safety Light Curtains PJ-V

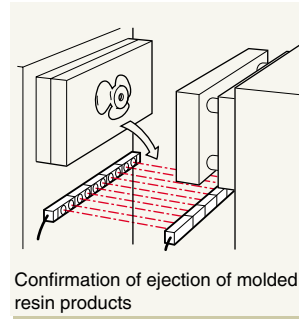
## Applications



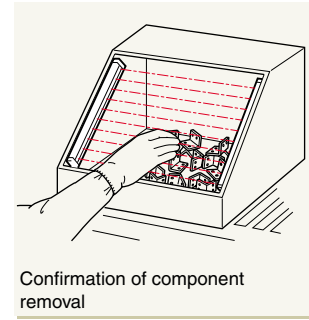
As a safety light barrier for robots used in processing/assembly



Confirmation of in-circuit tester safety



Confirmation of ejection of molded resin products



Confirmation of component removal

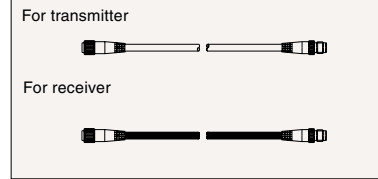
## Selection Chart

### Configuration

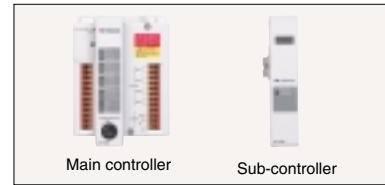
Sensor head



Connector cable



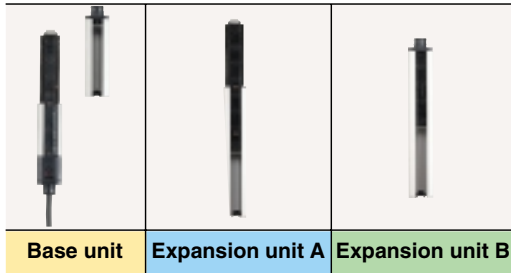
Controller



### Sensor head

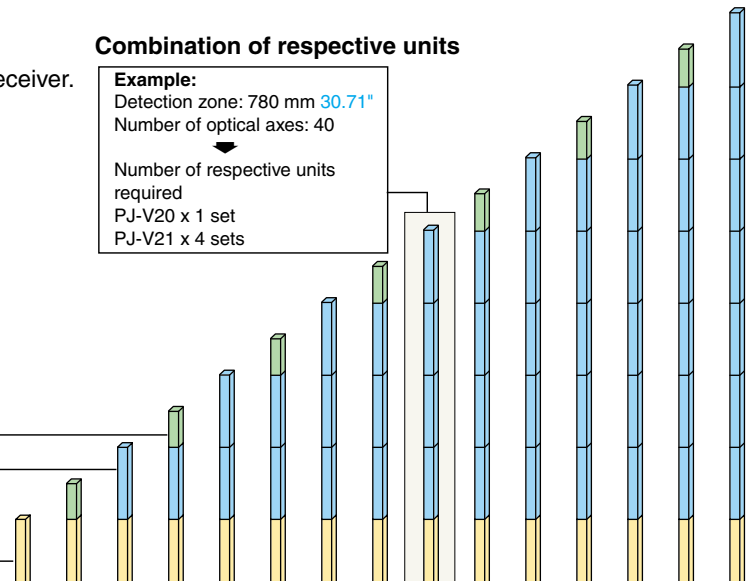
#### Expandable sensor head system

- Each unit consists of a paired transmitter and receiver.
- End caps are included with the base unit.
- Expansion unit B also serves as the end cap.



#### Combination of respective units

**Example:**  
 Detection zone: 780 mm 30.71"  
 Number of optical axes: 40  
 Number of respective units required  
 PJ-V20 x 1 set  
 PJ-V21 x 4 sets



Detection zone (mm)			140	220	300	380	460	540	620	700	780	860	940	1020	1100	1180	1260
			5.51"	8.66"	11.81"	14.96"	18.11"	21.26"	24.41"	27.56"	30.71"	33.86"	37.01"	40.16"	43.31"	46.46"	49.61"
Model	Unit type	Number of optical axes	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64
PJ-V20	Base unit	8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
PJ-V21	Expansion unit A	8	0	0	1	1	2	2	3	3	4	4	5	5	6	6	7
PJ-V22	Expansion unit B	4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0

### Controller

Model	Content	Application
PJ-V90	Main controller	When using a single sensor head
PJ-V91	Sub-controller	When using two sensor heads (PJ-V91 cannot be used independently.)

### Connector cable

Length	For transmitter	For receiver
	Model	Model
2 m 6.6'	PJ-VC2T	PJ-VC2R
5 m 16.4'	PJ-VC5T	PJ-VC5R
7 m 23.0'	PJ-VC7T	PJ-VC7R

\* The transmitter and receiver cable lengths can be extended separately. The transmitter and receiver cable lengths can each be extended up to 21 m 68.9' (excluding the length of the 50 cm 19.69' cable extruding from the base unit.)

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## Specifications

### Sensor head

Model	Base unit		Expansion unit A	Expansion unit B
	PJ-V20		PJ-V21	PJ-V22
Detection zone	140 to 1260 mm <b>5.51" to 49.61"</b>			
Number of optical axes	8 to 64 axes			
Optical axis pitch	20 mm <b>0.79"</b>			
Operating range	7 m <b>23.0'</b>			
Detection capability	Opaque materials (28 mm <b>1.10"</b> dia. min.)			
Light source	Infrared LED (880 nm)			
Operating form	LIGHT-ON			
Indicator	Bar of 8 two-color (red and green) LEDs both on transmitter and receiver			
Effective aperture angle <sup>1</sup>	±2.5°max. (when operating range is 3 m <b>9.8'</b> or more)			
Enclosure rating	IP-65			
Ambient light	Incandescent lamp: 5,000 lux max, Sunlight: 20,000 lux max			
Ambient temperature	-10 to +55°C			
Vibration	10 to 55 Hz, 0.7 mm <b>0.03"</b> double amplitude in X, Y and Z directions, 20 times respectively			
Shock immunity	100 m/s <sup>2</sup> <b>328.1'</b> [Approx. 10G], 16ms pulse in X, Y, and Z directions, 1000 times respectively			
Material	Housing: Aluminum, Lens cover: Polyarylate			
Weight	570 g (including end cap: 140 g)	320 g		290 g
Cable	Transmitter/Receiver	500 mm <b>19.69"</b> 4-core/5-core cable with connector (0.5 mm <sup>2</sup> , AWG20)		
	Extension	Transmitter and receiver cable lengths can each be extended up to 21 m <b>68.9'</b> (excluding 500-mm <b>19.69"</b> length of cable extruded from base unit).		

1. In accordance with IEC61496 (EN61496).

### Controller

Model	Main controller		Sub-controller
	PJ-V90		PJ-V91 <sup>1</sup>
Power supply	24 V DC ±10%		
Power consumption	20 W max. (including consumption by sensor head)		
Current consumption	PJ-V90+PJ-V20: 350 mA, PJ-V21: 25mA, PJ-V91+PJ-V20: 110 mA, PJ-V22: 15mA		
Output	FSD1, FSD2, SSD	4 A at 230 VAC, 2 A at 30 VDC (resistive load), 2 A at 230 VAC (COS $\phi$ = 0.3) 1 A at 30 VDC (COS $\phi$ = 0.3) (inductive load)	
	AUX	0.5 A at 125 VAC, 2 A at 30 VDC (resistive load), 0.25 A at 125 VAC (COS $\phi$ = 0.3) (inductive load), 1 A at 30 VDC (COS $\phi$ = 0.3) (inductive load)	
	Service life	Mechanical: 10 million operations or more, Electrical:100,000 operations or more	
Response time	FSD1, FSD2, SSD, AUX	15 ms max. (ON to OFF) (including sensor head response time)	
Signal input method	Non-voltage input		
Enclosure rating	IP-20 (Mount controller inside control panel with IP-54 or higher level enclosure rating.)		
Protection circuit	Power supply section: Reversed polarity protection, Surge absorber		
Ambient temperature	-10 to +55°C		
Vibration	10 to 55 Hz, 0.7 mm <b>0.03"</b> double amplitude in X, Y and Z directions, 20 times respectively		
Shock immunity	100 m/s <sup>2</sup> <b>328.1'</b> [Approx. 10G], 16ms pulse in X, Y, and Z directions, 1000 times respectively		
Material	Polycarbonate		
Weight	520 g	150 g	
Category	Category 4 ESPE according to EN954-1 (type 4 AOPD according to IEC61496)		

1. The PJ-V91 can not operate independently. It is a sub-controller that is connected to the PJ-V90.

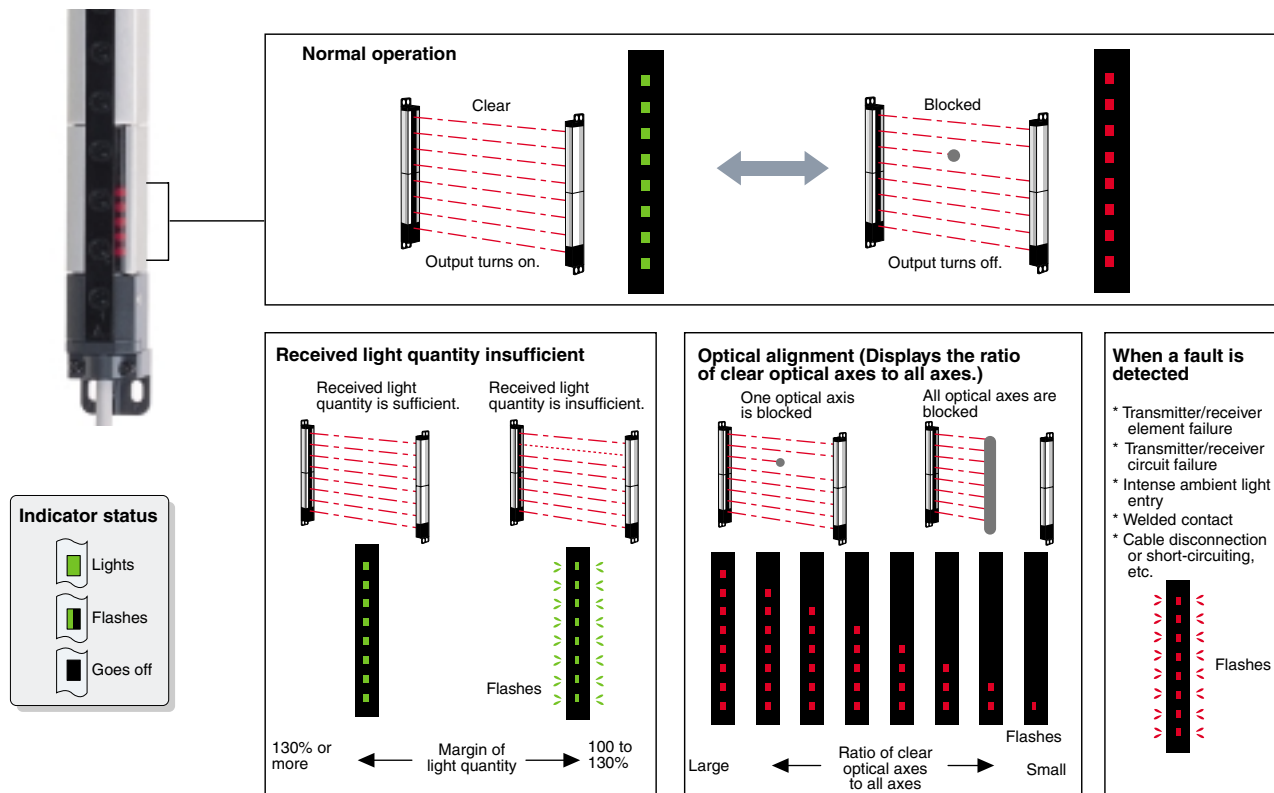
### Connector cable

Weight	PJ-VC2T: Approx. 150 g, PJ-VC5T: Approx. 340 g, PJ-VC7T: Approx. 460 g, PJ-VC2R: Approx. 160 g, PJ-VC5R: Approx. 360 g, PJ-VC7R: Approx. 490 g
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## Functions

### Bar LED Indicator

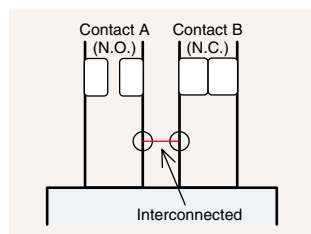
The transmitter and receiver are equipped with an indicator consisting of a bar of eight LEDs that inform the operator of the output status or fault occurrence.



### Safety relay

The PJ-V Series each uses three safety relays to ensure safety.

One "Normally open" contact and one "Normally close" contact are connected and move together. If one relay becomes immobilized by a welded contact, the welded contact can be detected based on the contact gap of the other relay. This ensures safety.



### LOCKOUT

According to the setting, the PJ-V Series can invoke LOCKOUT status when power is supplied, a failure in the part is detected, or an optical axis is blocked.

Lockout status is one of the sensor's non-hazardous statuses, in which all of the outputs are open and the machine is stopped.

### Fail-safe

A fail-safe system operates to ensure safety if a failure should occur in the system. If ambient light is received or the output circuit is damaged, for example, an ordinary photoelectric sensor cannot stop the machine even if a person accesses the hazardous area on the machine. Therefore, such a sensor cannot be regarded as fail-safe. The PJ-V Series performs a self-check using two independent circuits to detect a failure in the circuits, ambient light entry, or a welded relay contact. Therefore, they are high-level fail-safe sensors that reliably stop the machine in an emergency.

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## Self-diagnostic circuit

This circuit detects an internal failure in the PJ-V Series. The PJ-V Series performs a self-check using two independent self-diagnostic circuits. If a failure is detected, a stop signal is immediately sent to the machine connected to the circuits.

### Transmitter



Element failure



Circuit failure

### Receiver



Element failure



Circuit failure



Ambient light entry

### Controller



Welded contact



Drive circuit failure

### All



Cable disconnection or short-circuiting

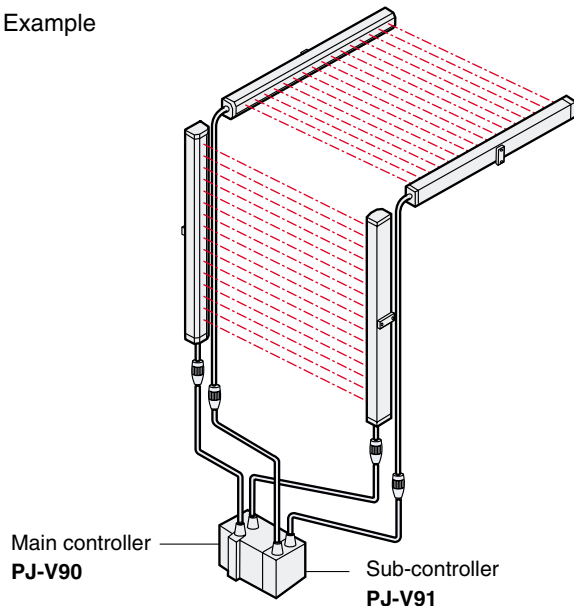


LSI failure

## Controller Extension

When two sensor heads are used in close proximity, using the sub-controller (PJ-V91) is convenient.

Example



### Advantages in using sub-controller

- **Mutual interference suppression function**

When the sub-controller is connected to the main controller, this function works automatically. There is no need for extra wiring, eliminating wiring error.

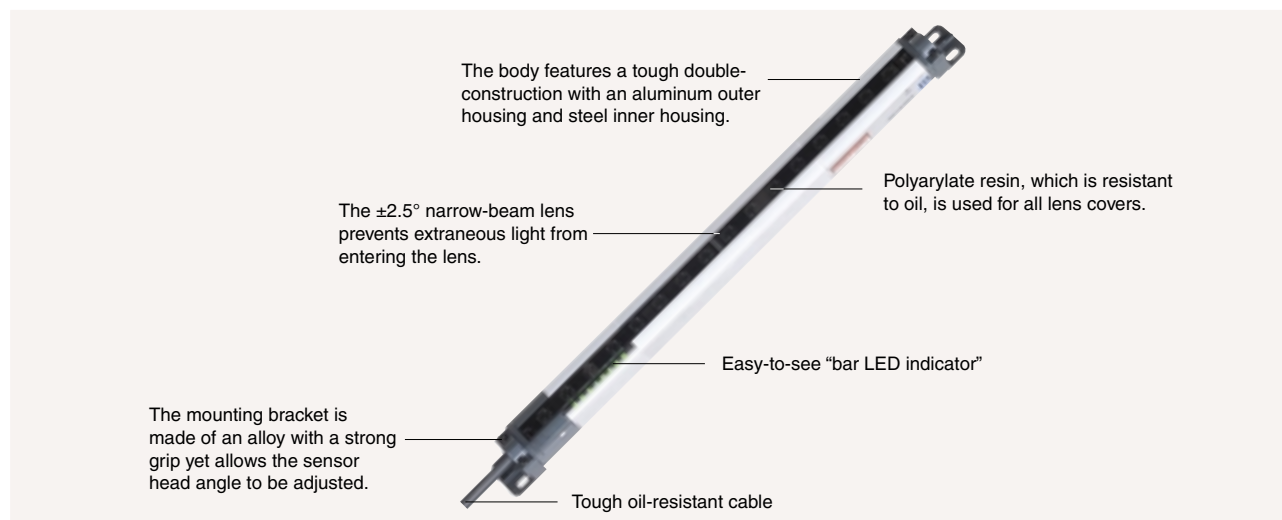
- **Wire-saving**

The sub-controller can be easily connected to the main controller using the connector. There is no need for wiring for power supply or output lines.

- **Low cost**

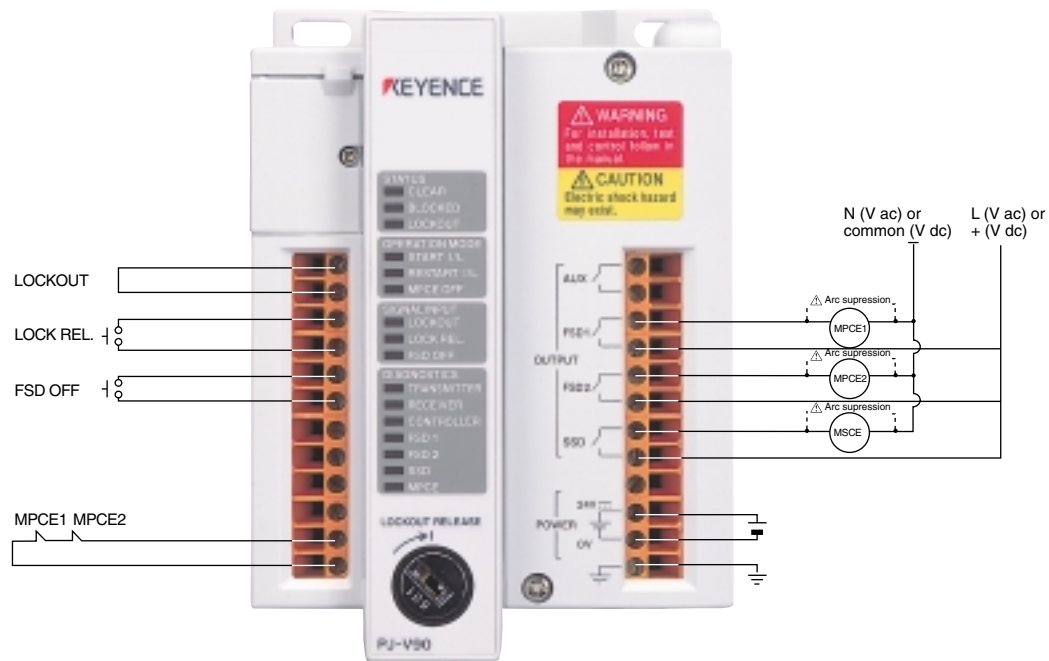
Using one main controller and sub-controller costs far less than using two main controllers.

## Appearance (sensor head)



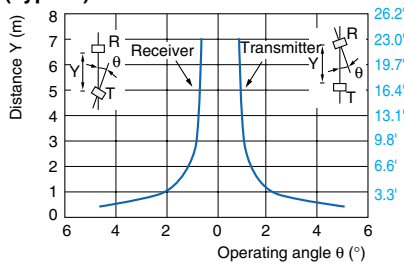
Expandable Safety Light Curtains **PJ-V**

Connections (controller)

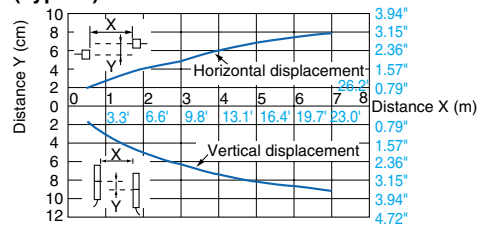


Characteristics

Angular displacement of optical axis (Typical)



Parallel displacement of optical axis (Typical)



Maintenance Accessories

All parts listed below are included with the PJ-V Series and are also available separately.



Test piece  
OP-31608



Release tool  
OP-31609



Mounting bracket  
OP-31784



Intermediate support  
OP-31785



End cap  
OP-31786

# PJ-V Expandable Safety Light Curtains

## Safety Standards

The PJ-V Series qualifies for the following international standards, and can be widely used overseas.

### Compliance with international standards:

Country/area	Standards	Qualifying organization	Marking
Europe	EN 61496-1, 2 EN 954-1 EN 60204-1	DEMKO	CE <sup>*2</sup>
U.S.A./Canada	IEC 61496-1, 2 UL491	UL	cUL <sup>us</sup> LISTED <sup>*3</sup>
	OSHA 1910.212 OSHA 1910.217 (C) ANSI B11.1 ~ B11.19 ANSI R15.06	*1	—

\*1 OSHA and ANSI do not qualify products for compliance. Therefore, conformity to these standards is decided by the machinery manufacturer.

\*2 The mark, when affixed to a product, shows that the product complies with requirements stipulated by EMC directives.

\*3 The mark, when affixed to a product, shows that the product is UL listed and displays the same effectiveness as when it is CSA listed.

### Risk level assessment

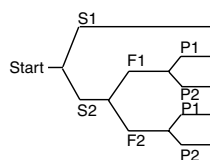
Risk level assessment for each machine stipulated by the EN standards (EC Machine Directive). According to the risk level, appropriate measures must be taken for each machine.

\* Since the PJ-V Series is categorized as category 4, it can be installed on any risk level machine.

### Risk level assessment flowchart

According to the flowchart below, the risk level for each machine is first determined. Then, the safety category applicable to each machine is found, and safety measures are taken by using a safety device or the like appropriate to the category.

Risk level	Safety category selection				
	B	1	2	3	4
I	▲	○	●	●	●
II	▲	○	○	●	●
III	×	▲	○	○	●
IV	×	▲	▲	○	●
V	×	▲	▲	▲	○



Symbol	Content of symbol	Rating	Content of rating
S	Injury level	S1	Slight injury (bruise, etc.)
		S2	Serious injury (limb amputation, death, etc.)
F	Exposure to risk	F1	Very little
		F2	Frequent or always
P	Risk avoidance	P1	Possible
		P2	Impossible

●: Safest measures against risk

○: Standard measures against risk

▲: Measures that require special means such as a protective device

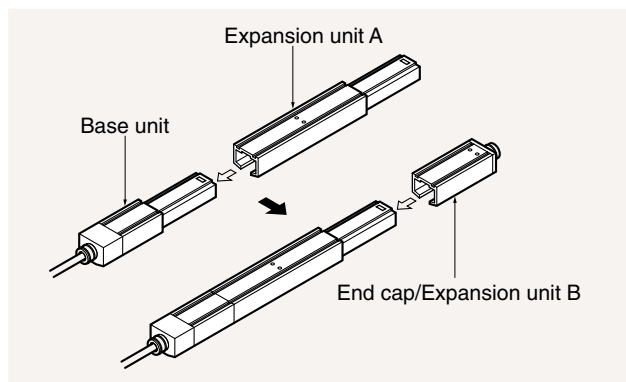
×: Improper measures

## Hints on Correct Use

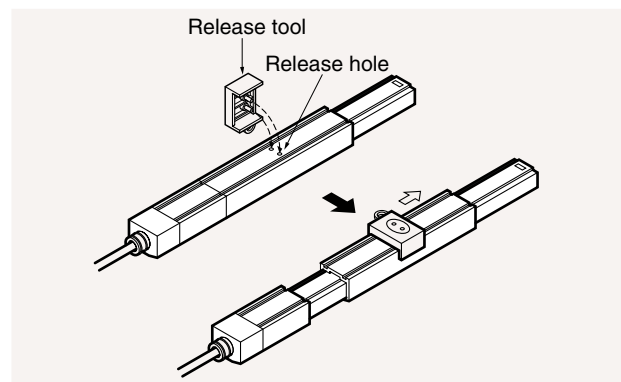
For details on usage, be sure to carefully read the Instruction Manual included with the PJ-V Series.

### Sensor head expansion

- Be sure to turn off the power supply before connecting the units.
- Note that if the end cap (top cover) or expansion unit B is not attached, the PJ-V Series does not operate.
- Pay attention not to confuse the transmitter with the receiver when connecting the units. Insert the unit until it is secure and check that it is not disconnected.



- Up to 64 optical axes can be used. Increasing the number of optical axes to more than the specified number will cause a failure.
- When increasing the number of optical axes to 36 or more, use the intermediate supports included with the base unit.
- The release tool has a hook through which a string can be passed.
- When disconnecting the unit, insert the release tool (included with each unit) into the release hole in the unit to be disconnected, and slide the unit with the tool inserted, as shown below.



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## Others

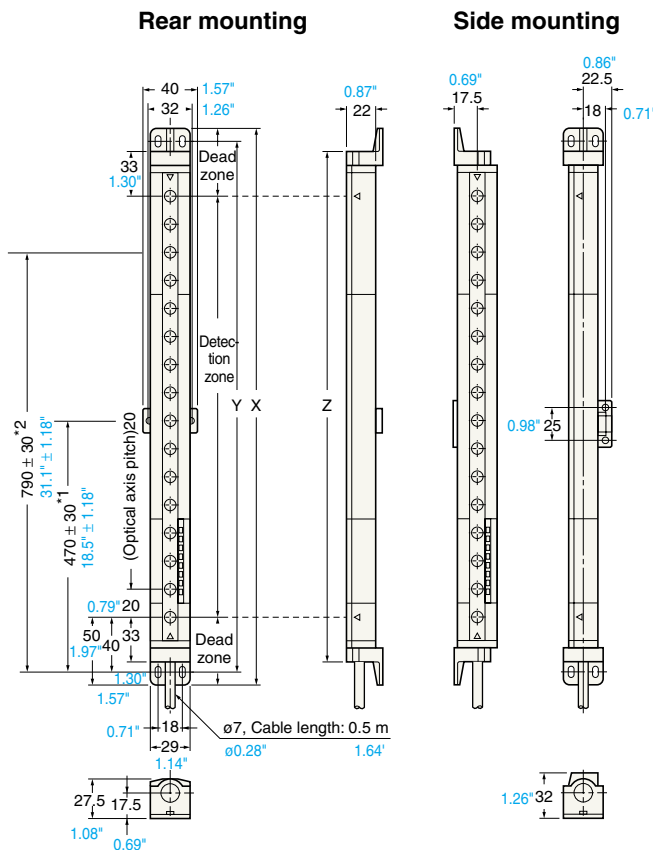
- Never disassemble the sensor head or controller.
- Do not install power supply lines or signal lines in the same conduit as or parallel to high voltage lines or power lines.
- Be sure to turn off the power supply before starting any wiring. Make all electrical connections in accordance with local electrical codes and laws.
- The LOCKOUT input terminals are initially short-circuited with a shorting bar. When using the LOCKOUT input, remove the shorting bar.
- The transmitter and receiver cable lengths can each be extended up to 21 m 68.90', excluding the length of the 50 cm 19.69" cable extruding from the base unit. Properly combine the 2 m 6.6', 5 m 16.4' and 7 m 23.0' special connector cables as required. The number of core wires for the transmitter cable is different from that for the receiver cable. Check the cable color so that the transmitter cable is not combined with the receiver cable.  
(Transmitter cable: Gray, Receiver cable: Black)
- The output relays incorporated into the controller can be easily renewed by replacing the relay board unit with a new one. Use the separately sold relay board unit (model: OP-31788). Also, be sure to turn off the power supply before replacing the relay board unit.

## Dimensions



### Sensor head PJ-V20/21/22

Unit: mm Inch



Number of optical axes	Detecting zone	X	Y	Z
8	140 5.51"	240 9.45"	220 8.66"	206 8.11"
12	220 8.66"	320 12.60"	300 11.81"	286 11.26"
16	300 11.81"	400 15.75"	380 14.96"	366 14.41"
20	380 14.96"	480 18.90"	460 18.11"	446 17.56"
24	460 18.11"	560 22.05"	540 21.26"	526 20.71"
28	540 21.26"	640 25.20"	620 24.41"	606 23.86"
32	620 24.41"	720 28.35"	700 27.56"	686 27.01"
○ 36	700 27.56"	800 31.50"	780 30.71"	766 30.16"
○ 40	780 30.71"	880 34.65"	860 33.86"	846 33.31"
○ 44	860 33.86"	960 37.80"	940 37.01"	926 36.46"
○ 48	940 37.01"	1040 40.94"	1020 40.16"	1006 39.61"
◎ 52	1020 40.16"	1120 44.09"	1100 43.31"	1086 42.76"
◎ 56	1100 43.31"	1200 47.24"	1180 46.46"	1166 45.91"
◎ 60	1180 46.46"	1280 50.39"	1260 49.61"	1246 49.06"
◎ 64	1260 49.61"	1360 53.54"	1340 52.80"	1326 52.20"

**Note:** When the number of optical axes is increased to the ○ marked number, set the unit to mounting position 1 on the intermediate support included with the expansion unit.

When the number of optical axes is increased to the ◎ marked number, set the unit to mounting positions 1 and 2, using two intermediate supports.

\*1. Mounting position for the intermediate support 1  
\*2. Mounting position for the intermediate support 2



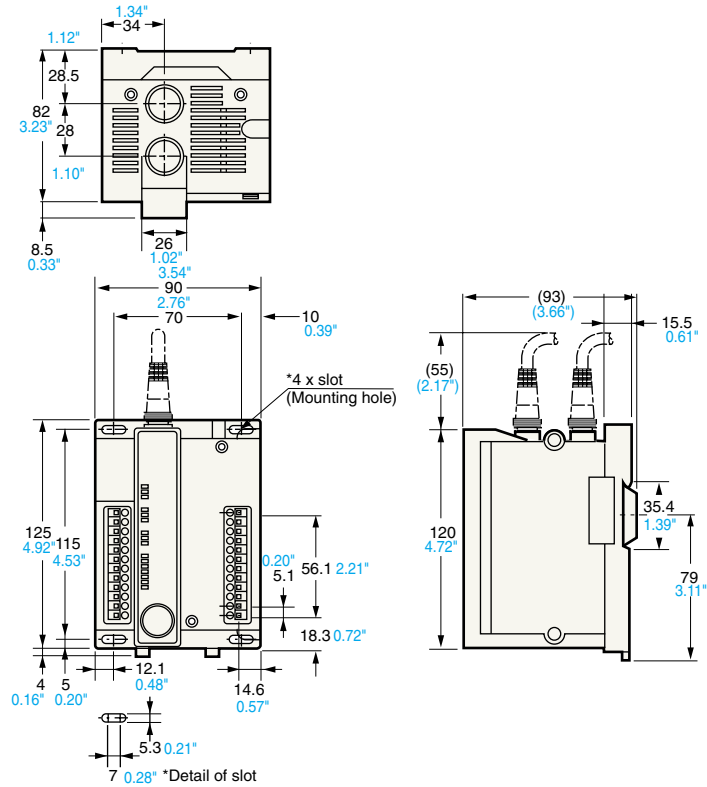
# PJ-V Expandable Safety Light Curtains

CAD

Unit: mm Inch

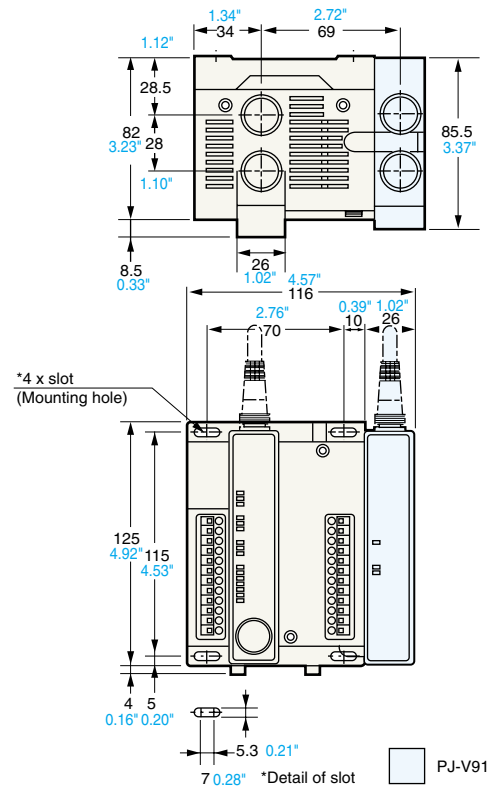
## Controller PJ-V90

(When using a single set of sensor heads)



## PJ-V90+PJ-V91

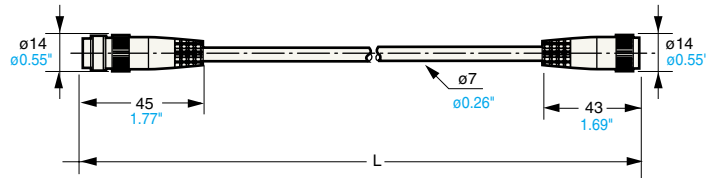
(When using two sets of sensor heads)



## Connector cable

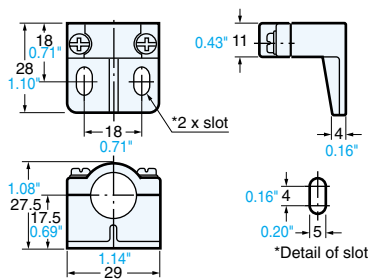
PJ-Vx CT

PJ-Vx CR



Cable length (L)	Transmitter cable	Receiver cable
2 m 6.6'	PJ-V2CT	PJ-V2CR
5 m 16.4'	PJ-V5CT	PJ-V5CR
7 m 23.0'	PJ-V7CT	PJ-V7CR

## Mounting bracket (standard)



## Intermediate support (standard)

Rear mounting

Side mounting

