

# Convergent reflection sensing ensures stable detection

## Stable detection by convergent reflective mode

Stable detection characteristics are obtained since it is convergent reflective type and senses a limited area.



LASER MARKERS

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

PLC

PM2





# Cable type is also available

Cumbersome soldering is not required. It saves space and improves reliability.



## Hardly affected by background

Even a specular background does not affect the sensing performance if the sensor is located 30 mm 1.181 in away from it.



<sup>(</sup>However, the specular background should be a plane surface, directly facing the sensor. A spherical or curved background may be detected.

# Dark object detectable

Since the sensor is very sensitive, it can detect even a dark object of low reflectivity.



# Minute object detectable

A  $\emptyset 0.05 \text{ mm } \emptyset 0.002 \text{ in}$ copper wire can be detected at a distance of 5 mm 0.197 in under the optimum condition.



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FIBER SENSORS

LASER SENSORS

PHOTO-ELECTRIC SENSORS

AREA SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR OPTIONS

# APPLICATIONS

## Sensing capacitors in a tray





# ORDER GUIDE

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PM2-LH10B         PM2-LF10         Dark-Of           PM2-LF10         PM2-LF10         Light-Of           PM2-LL10B         PM2-LL10         Dark-Of           PM2-LL10         PM2-LL10         Dark-Of           PM2-LL10B         PM2-LL10         Dark-Of           PM2-LL10B         PM2-LL10         Dark-Of           PM2-LL10B         PM2-LL10         Dark-Of           PM2-LL10B         PM2-LL10-C1         Dark-Of           PM2-LL10-C1         PM2-LL10-C1         Dark-Of           PM2-LL10-C1         PM2-LL10-C1         Dark-Of           PM2-LL10-C1         PM2-LL10-C1         Dark-Of	or type ensing Top sensing	<b>A</b>		PM2-LH10	NPN open-collector transistor	Light-ON	
PM2-LF10         Light-Of           Diggs troug         Diggs trou         Diggs trou			2.5 to 8 mm	PM2-LH10B		Dark-ON	
OPEO       Image: State of the				PM2-LF10		Light-ON	
Image: Section of the section of th	Connect Front s	and a second		PM2-LF10B		Dark-ON	
00 00 00 00 00 00 00 00 00 00 00 00 00	L type (Top sensing)			PM2-LL10		Light-ON	
Building       0.098 to 0.315 in (Convergent point: 5 mm 0.197 in)       PM2-LH10-C1       NPN open-collector transistor       Light-Of         PM2-LH10B-C1       PM2-LH10B-C1       Dark-Of       Dark-Of         PM2-LF10-C1       PM2-LF10-C1       Light-Of         PM2-LF10B-C1       PM2-LF10B-C1       Dark-Of         PM2-LF10B-C1       PM2-LF10B-C1       Dark-Of         Dark-Of       PM2-LF10B-C1       Light-Of         PM2-LF10B-C1       PM2-LF10B-C1       Light-Of				PM2-LL10B		Dark-ON	
Build of the set	nsing L		0.098 to 0.315 in (Convergent point: 5 mm 0.197 in)	PM2-LH10-C1		Light-ON	
Drug     PM2-LF10-C1     Light-Of       PM2-LF10B-C1     Dark-Of       Dark-Of     Light-Of       Dark-Of     Light-Of	Top se			PM2-LH10B-C1	-	Dark-ON	
PM2-LF10B-C1 Dark-ON Dark-ON Dark-ON Light-ON	Liype (Top sensing) Front sensing			PM2-LF10-C1	-	Light-ON	
PM2-LL10-C1				PM2-LF10B-C1		Dark-ON	
					PM2-LL10-C1		Light-ON
PM2-LL10B-C1 Dark-Of					PM2-LL10B-C1		Dark-ON

# **OPTIONS**

Designation	Model No.	Description	
Connector	CN-13	Dedicated connector	
Connector	CN-13-C1	0.2 mm <sup>2</sup> 3-core cabtyre cable, 1 m 3.281 ft long	
attached cable	CN-13-C3	0.2 mm <sup>2</sup> 3-core cabtyre cable, 3 m 9.843 ft long	



## **Connector attached cable**



FIBER SENSORS

LASE SENSOR

# SPECIFICATIONS

SENSORS		Туре	Connector type			Cable type				
PHOTO- ELECTRIC			Top sensing	Front sensing	L type (Top sensing)	Top sensing	Front sensing	L type (Top sensing)		
MICRO		- v	Light-ON	PM2-LH10	PM2-LF10	PM2-LL10	PM2-LH10-C1	PM2-LF10-C1	PM2-LL10-C1	
ELECTRIC SENSORS	Item	n / Mode	Dark-ON	PM2-LH10B	PM2-LF10B	PM2-LL10B	PM2-LH10B-C1	PM2-LF10B-C1	PM2-LL10B-C1	
AREA	Sensing range			2.5 to 8 mm 0.098 to 0.315 in (Conv. point: 5 mm 0.197 in) with white non-glossy paper (15 × 15 mm 0.591 × 0.591 in) (Note 2						
JIGHT	Min. sensing object			Ø0.05 mm Ø0.002 in copper wire (Setting distance: 5 mm 0.197 in)						
CURTAINS / SAFETY	Hysteresis			20 % or less of operation distance with white non-glossy paper (15 × 15 mm 0.591 × 0.591 in)						
COMPONENTS PRESSURE /	Repeatability (perpendicular to sensing axis)			0.08 mm 0.003 in or less (Note 3)						
FLOW SENSORS	Supply voltage			5 to 24 V DC ±10 % Ripple P-P 5 % or less						
INDUCTIVE	Current consumption			Average: 25 mA or less, Peak: 80 mA or less						
SENSORS			NPN open-collector transistor							
PARTICULAR	Output		<ul> <li>Maximum sink current: 100 mA</li> <li>Applied voltage: 30 V DC or less (between output and 0 V)</li> </ul>							
SENSURS	Outp	Output		Residual voltage: 1 V or less (at 100 mA sink current)						
SENSOR			U.4 V or less (at 16 mA sink current)							
SIMPLE		Utilization	category	DC-12 or DC-13						
UNITS	Overcurrent protection		Incorporated							
WIRE-SAVING	Response time		0.8 ms or less							
	Operation indicator			Red LED (lights up when the output is ON)						
MEASURE- MENT SENSORS	RE- NT DRS CT CT CT CT CT CT CT CT CT CT		legree	3 (Industrial environment)						
STATIC			45 to 25 % PL Storage: 45 to 25 % PL							
PREVENTION DEVICES			45 to 65 % KT, Stoldye. 45 to 65 % KT							
LASER	En C									
MARKERS	Vibration resistance 10 to 55 Hz frequency 15 mm 0.059 in amplitude in X. Y and Z directions for two hours e			each						
PLC	Shock resistance		500 m/s <sup>2</sup> acceleration (50 G approx.) in X. Y and Z directions for three times each							
HUMAN	Emitting element		Infrared LED (Peak emission wavelength: 880 nm 0.035 mil, modulated)							
MACHINE INTERFACES	Material		Enclosure: Polycarbonate, Terminal part: Copper alloy (Ag plated)			) Enclosure: Polycarbonate, Fixed cable part: PBT				
ENERGY CONSUMPTION	Cable					0.2 mm <sup>2</sup> 3-core cabtyre cable, 1 m 3.281 ft long (Note 4)				
FA COMPONENTS FA COMPONENTS	Wiring length		$ \left( \begin{array}{c} \mbox{Total length up to 2 m 6.562 ft is possible with 0.3 mm^2, or more, cable.} \\ (\mbox{ If the cable is extended for 2 m 6.562 ft, or more, a capacitor} \\ \mbox{of 10 } \mu \mbox{F must be connected between +V and 0 V terminals.} \end{array} \right) $							
VISION SYSTEMS UV CURING SYSTEMS	Weight		Net weight: 4.5 g Gross weight: 85 (10	approx. g approx. ) piece package)	Net weight: 4 g approx. Gross weight: 80 g approx. (10 piece package)	Net w Gross	eight: 25 g approx weight: 330 g appro: (10 piece pa	x ckage)		
		43.340						1 <u>1</u> 00 00		

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.

2) The sensing range may extend up to 12.5 mm 0.492 in with white non-glossy paper due to product variation.

3) The repeatability is specified for white non-glossy paper (15 × 15 mm 0.591 × 0.591 in) at a setting distance of 5 mm 0.197 in.

4) Cable cannot be extended.

Selection Guide U-shaped Convergent Reflective

PM2

# I/O CIRCUIT AND WIRING DIAGRAMS

#### I/O circuit diagram



Note: Make sure to connect terminals correctly as the sensor does not incorporate a reverse polarity protection circuit.

Symbols ... ZD: Surge absorption zener diode Tr: NPN output transistor

#### Wiring diagram



Distance to convergent p

2 0.079

Vertical (up and down) direction

Ó

-Center

Operating point { (mm in)

0.

Down

10

8 1.31

6

236 5

4

2 0.079

0

20

15

10

0.079

White

N5

Up ৰ

Setting distance L (mm in)-

# SENSING CHARACTERISTICS (TYPICAL)

#### Sensing fields

· Horizontal (left and right) direction The sensors can be mounted 10 side by side However, if the sensor is slanted, there may be 8 1.315 Ē White interference Setting distance L (mm Verify first whether there is any 6 interference prior to use. point 197 4 157 Horizontal direction Distance to N5 convergent 2 0 2 0.079 2 0.079 0.0 Left -Cente Right Operating point { (mm in)



#### Correlation between lightness and sensing range



The sensing region (typical) is represented by oblique lines in the left figure. However, the sensitivity should be set with enough margin because of slight variation in products.

Lightness shown on the left may differ slightly from the actual object condition.

# PRECAUTIONS FOR PROPER USE

#### All models



- · Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which
- meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

#### Mounting

· When fixing the sensor with screws, use M3 screws and the tightening torgue should be 0.49 N·m or less. Further, use small, round type plain washers (ø6 mm ø0.236 in).



#### Others

- · Do not use during the initial transient time (50 ms) after the power supply is switched on.
- Take care that the product does not come in direct contact with oil, grease, or organic solvents, such as, thinner, etc.

#### Sensing range L (mm in) the product. Further, if there is a point 0 it affects the sensing, stainless steel copper plate plate Mirror Non-glossy aluminum plate board non-glossy paper (N5) to convergent White non-glossy paper White ceramic circuit board Glass epoxy printed circuit bo (Green masked surface) non-glossy iron Glossy Distance 3lack-painted, Gray ı

LASER SENSORS PHOTO-ELECTRIC The sensors can be mounted side by side However, if the sensor is slanted, there may be interference Verify first whether there is any interference prior to use. AREA SENSORS LIGHT CURTAINS / Vertical direction SAFETY COMPONENTS 15 × 15 mm 0.591 × 0.591 in Non-glossy paper PRESSURE FLOW SENSORS INDUCTIVE PROXIMIT' SENSORS PARTICULAR USE SENSORS SENSOR OPTIONS SIMPLE WIRE-SAVING UNITS Correlation between material (15 × 15 mm 0.591 × 0.591 in) and sensing range The bars in the graph WIRE-SAVING SYSTEMS indicate the sensing range (typical) for the respective MEASURE-MENT SENSORS material. However, there is a slight variation in the STATIC FLFCTRICITY sensing range depending on DEVICES LASER MARKERS reflective object (conveyer, etc.) in the background of PLC the sensing object, since HUMAN separate it by more than MACHINE twice the sensing range ENERGY shown in the left graph. VISUALIZATION COMPONENTS FA COMPONENTS MACHINE VISION SYSTEMS

Refer to p.1458~ for general precautions.



UV CURING SYSTEMS

Selectior Guide

U-shaped

PM2

- · Make sure to connect terminals correctly as the sensor does not incorporate a reverse polarity protection circuit.
- · If the sensor is being used in a noisy environment, examine the extent of noise. Further, if equipment, such as motor, solenoid or electromagnetic valve, which generates a large surge, is present near the sensor, connect a surge absorber to the equipment.

#### Setting

Wiring

· The optimum setting distance (distance to convergent point) is 5 mm 0.197 in.

The sensor is not affected even by a specular background if it is located 30 mm 1.181 in, or more, away from the sensor.



However, the specular background should be a plane surface, directly facing the sensor. A spherical or curved background may be detected.



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LASER SENSORS

PHOTO-ELECTRIC SENSORS

AREA SENSORS

> LIGHT CURTAINS /

COMPONENTS

PRESSURE / FLOW SENSORS

INDUCTIVE PROXIMITY SENSORS

PARTICULAR USE SENSORS

SENSOR

SIMPLE WIRE-SAVING UNITS

WIRE-SAVING SYSTEMS

MEASURE-MENT SENSORS

STATIC ELECTRICITY PREVENTION

LASER MARKERS

HUMAN MACHINE INTERFACES

ENERGY CONSUMPTION VISUALIZATION

COMPONENTS FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

DEVICES

PLC

# FIBER PRECAUTIONS FOR PROPER USE

Refer to p.1458~ for general precautions.

# Connector type

# Cautions in plugging or unplugging a connector Do not plug or unplug a connector more than 10 times. Be sure not to give stress more than 5 N to a terminal of both a connector and a sensor. If you do not follow the above cautions, it will cause a poor contact.

#### Procedures of plugging or unplugging a connector

①Insert a connector straight into a sensor until the connector lug is locked by the sensor hook.



When unplugging, give as much stress as a connector lug can be relieved from a hook. Then unplug it.

Caution: Be sure to hold a connector when plugging or unplugging it. Do not hold a terminal or a cable when plugging or unplugging the connector. Otherwise, it will cause a poor contact.



# DIMENSIONS (Unit: mm in)

PM2-LH10 PM2-LH10B



## Soldering (Both connector CN-13 and sensor)

 If soldering is done directly on the terminals, strictly adhere to the conditions given below.

Soldering temperature	260 °C 500 °F or less
Soldering time	10 sec. or less
Soldering position	Refer to the below figure







## Wiring

• The cable length must be 2 m 6.562 ft, or less, with 0.3 mm<sup>2</sup>, or more, cable. If the cable is extended for more than 2 m 6.562 ft, connect a capacitor of 10  $\mu$ F approx. between +V and 0 V terminals.



The CAD data in the dimensions can be downloaded from our website.



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3.2 0.126 The CAD data in the dimensions can be downloaded from our website.

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FIBER SENSORS

# DIMENSIONS (Unit: mm in)







PM2-LF10B-C1



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PM2-LF10-C1

Sensor