Digital Mark Sensor Amplifier Built-in

LX-100 SERIES

Related Information
- General terms and conditions............. F-7
- Glossary of terms....................... P.1455~
- Sensor selection guide ....P.885~
- General precautions .... P.1458~

CE Conforming to EMC Directive

UL Recognition

panasonic.net/id/pidsx/global

PNP — PNP output type available

TIMER — Timer

Automatic sensitivity setting

Introduction of the 3 LED mark sensor

Can detect any mark!

Coaxial reflective optics and a sharp 1 × 5 mm 0.039 × 0.197 in spot enable high precision sensing. Stable detection of marks is possible.

3 LED Newly developed

R•G•B light emitting elements all in one
To detect any marking, this unit is equipped with red, green and blue LED light emitting elements all in one.

High precision coaxial reflective optical system
Panasonic Industrial Devices SUNX's unique coaxial reflective optics technology ensures very accurate sensing. The unit is made with a scratchproof glass lens.

Total reflection mirror
Half mirror
Glass lens

▲ Image schematic
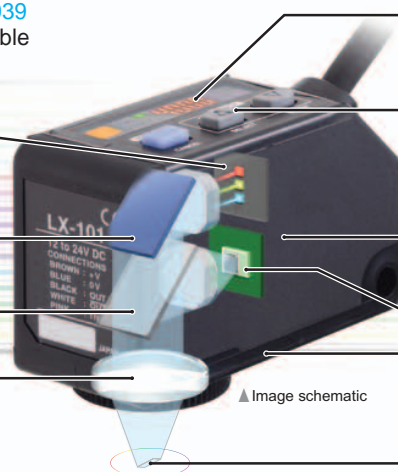
4-digit digital display
The 4-digit digital display enables numerical sensing control and minute settings.

Operation panel
3 large buttons that click into position making operation easy.

Highest in the industry

12-bit A/D converter
A resolution of 1/4,000 is realized to enable high precision mark sensing.

Receiving element

Protection IP67
Washing the machines and production line with water will not affect the sensor thanks to its waterproof construction.

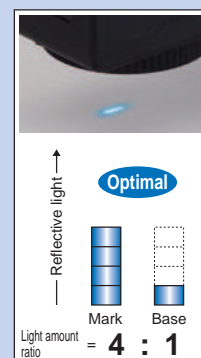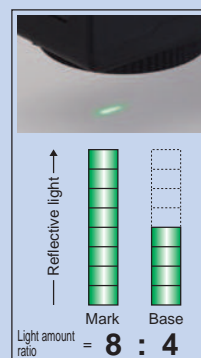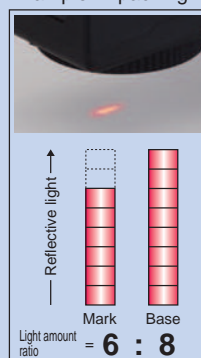Spot size 1 × 5 mm 0.039 × 0.197 in approx.

Automatic optimal LED selection function

The 3 colors of the R•G•B LEDs are optimally selected according to the color combination. With the **LX-100**'s Mark mode, the built-in "Automatic optimal LED selection function" automatically selects the LED for the largest contrast (S / N ratio) between the mark and base (non-mark area) to ensure optimal sensing. For more stable detection, the sensor makes selection according to the contrast and not according to the reflected light variation between the mark and base (non-mark area).

The example on the right deals with reflected light on packing film.
Great figures are indicated for the blue LED's light amount ratio and, for even more stable sensing, the blue LED effectuates this mark sensing.

Example: A packing film

Reflective light ↑ | Light amount ratio | Mark | Base | = 6 : 8

Reflective light ↑ | Light amount ratio | Mark | Base | = 8 : 4

Reflective light ↑ | Optimal | Light amount ratio | Mark | Base | = 4 : 1

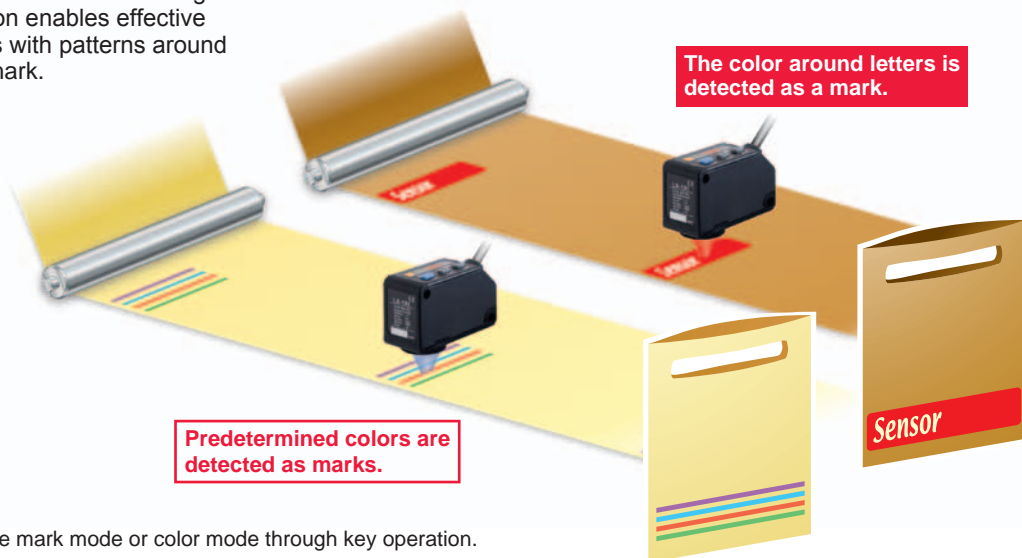## Two detection modes can be selected from to suit the application

Mark mode `Ultra high-speed response`

This sensing mode automatically selects a single color from the 3 R•G•B LEDs to achieve an ultra quick 45 µs response time. The automatic optimal LED selection function automatically selects the LED that is most suitable for the sensing. This function is perfect for ultra quick sensing.

Automatic selection of the optimal LED

RED

GREEN

BLUE
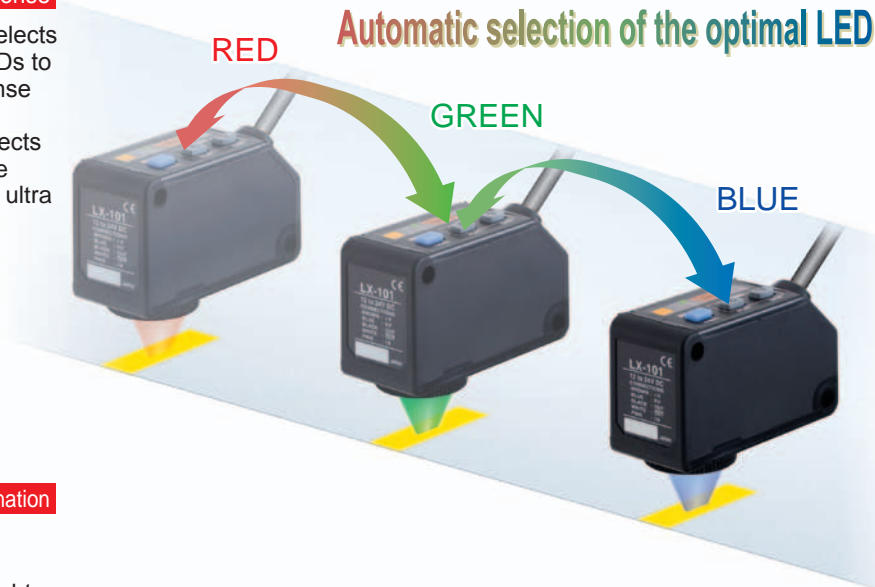
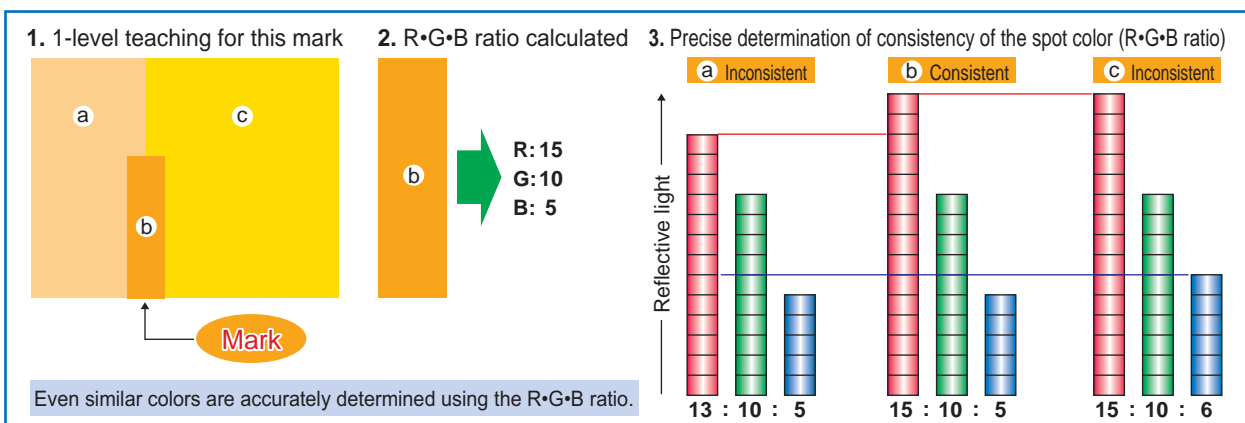### Color mode `High precision discrimination`

All 3 R•G•B LEDs light up and high precision mark color discrimination occurs using the R•G•B reflective light ratio. This function enables effective detection of films with patterns around the area of the mark.

The color around letters is detected as a mark.

Predetermined colors are detected as marks.

Sensor

* You can select the mark mode or color mode through key operation.

High precision mark color discrimination

The color mode on the **LX-100** series utilizes all 3 R•G•B LEDs to determine the R•G•B ratio of the mark color. The built-in 12-bit A/D converter enables high precision 1/4,000-resolution judgments. The figure below is a graphic description of this process.

1. 1-level teaching for this mark

a

c

b

Mark

Even similar colors are accurately determined using the R•G•B ratio.

2. R•G•B ratio calculated

b

R : 15
G : 10
B : 5

3. Precise determination of consistency of the spot color (R•G•B ratio)

a Inconsistent   b Consistent   c Inconsistent

Reflective light

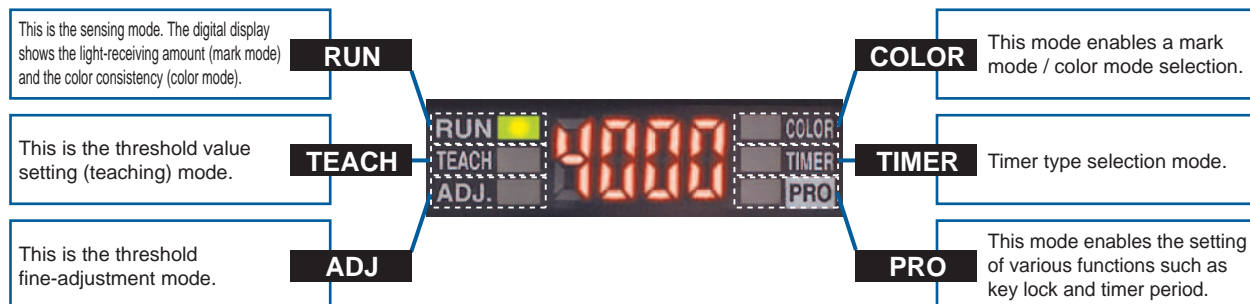13 : 10 : 5   15 : 10 : 5   15 : 10 : 6

Its digital display makes settings easy! Numerical control of the settings is possible

The 4-digit digital display enables easy verification of received light from marks and base (non-mark area). Also, the threshold value can be controlled numerically enabling setting indication easily. Displaying the direct code enables settings verification. This function is handy for remote maintenance.

MODE indicator

Operation indicator

MODE key
(PRO mode: CANCEL key)

ON key
(PRO mode: SELECT key)

4-digit digital display
(Light-receiving amount and setting values are displayed.)

MODE indicator

OFF key
(PRO mode: ENTER key)

Even beginners can quickly master MODE NAVI operation

The sensor's basic operations are represented by 6 indicators (MODE NAVI). The user can check what mode the sensor is presently in with a quick glance making operation simple.

This is the sensing mode. The digital display shows the light-receiving amount (mark mode) and the color consistency (color mode). **RUN**

This is the threshold value setting (teaching) mode. **TEACH**

This is the threshold fine-adjustment mode. **ADJ**

COLOR This mode enables a mark mode / color mode selection.

TIMER Timer type selection mode.

PRO This mode enables the setting of various functions such as key lock and timer period.

Sensing status digitally controllable

The sensing status, displayed numerically, can be verified at a glance. Also, the sensor settings for each type of packing film can be digitally indicated.

• **Example of sensor setting indication**

■ Selected LED: Red LED
■ Threshold value: 600

■ Selected LED: Green LED
■ Threshold value: 1850

■ Selected LED: Blue LED
■ Threshold value: 1600
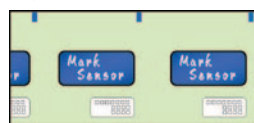
Direct codes enable settings verification at a glance

The settings for the **LX-100** series sensors are displayed using a 4-digit direct code. Direct codes enable easy setting verification and maintenance by phone.

What is the direct code?

The direct code is 0004. At present, the sensor is operating with a mark at 2300 and base at 860.
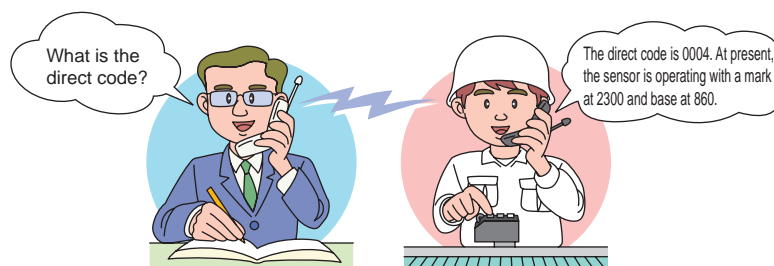
Direct code table (D-Code)

The sensor setting modes can be verified by a 4-digit code (D-Code). The table below shows a list of all available codes.

• When in RUN mode, press the MODE key for at least 2 sec. to display the direct code. (Remove your finger from the MODE key and the direct code will disappear.)

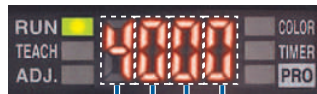| 1st digit				2nd digit				3rd digit			4th digit	
Display	Sensing mode (light source color)	Operation mode (Note 1)	Sensing (Note 2)	Display	Display mode	ECO mode (Note 4)	Turn mode (Note 5)	Display	Key lock	Timer mode	Display	Timer period
0	Mark mode (green)	L-ON	FINE	0	Standard	OFF	OFF	0	Full lock (All operations disabled)	non	0	1 ms
1			COARSE	1			ON	1		OFF-delay	1	2 ms
2		D-ON	FINE	2		ON	OFF	2		ON-delay	2	5 ms
3			COARSE	3			ON	3	RUN teaching (Teaching only enabled)	non	3	10 ms
4	Mark mode (blue)	L-ON	FINE	4	Percent display (Note 3)	OFF	OFF	4		OFF-delay	4	20 ms
5			COARSE	5			ON	5		ON-delay	5	50 ms
6		D-ON	FINE	6		ON	OFF	6	RUN adjust (Threshold value adjustment only enabled)	non	6	100 ms
7			COARSE	7			ON	7		OFF-delay	7	200 ms
8	Mark mode (red)	L-ON	FINE	8				8		ON-delay	8	500 ms
9			COARSE	9				9			9	
A		D-ON	FINE	A				A			A	
b			COARSE	b				b			b	
c	Color mode	Consistent-ON	FINE	c				c			c	
d			COARSE	d				d			d	
E		Inconsistent-ON	FINE	E				E			E	
F			COARSE	F				F			F	

Notes: 1) In Mark mode, L-ON / D-ON is automatically set in the sensor. For example, with 2-level teaching, press the ON key at the targeted mark and press the OFF key at the base (non-mark area). When doing so, the operator does not have to consider L-ON / D-ON.
2) Sensing accuracy can be set to either FINE (standard) or COARSE.
3) The percent display is only enabled in mark mode.
4) ECO mode is a function that reduces power consumption by turning off the digital display in the event that no button operations are made for a predetermined time (approx. 10 sec. or more) in RUN mode. Press any button to turn the digital display on again.
5) The turn mode is a function that reverses the digital display making it easily to be viewed in the event that the sensor installation renders the display up-side-down.
* Default setting: D-code = "0004".

Super simple teaching

Press the ON button at the targeted mark.

Here is an example of the most basic setting method "2-level teaching".

Mode selection	Press MODE key and select TEACH mode.

Teaching	❶ Align the spot on the mark and press the ON key. ❷ Align the spot onto the base (non-mark area) and press the OFF key. * The ❶ ❷ order can be reversed.

Display showing complete settings

Sensing	Teaching complete. The optimal LED is automatically selected and the sensor automatically returns to RUN mode.

Other teaching methods

• Full-auto teaching: In Mark mode, teaching is effective without stopping the sensing object.
• 1-level teaching: In Color mode, the color detected is aligned by the spot and teaching is effective.

External teaching possible

Teaching is possible through external input using an operation panel or touch panel even on hard-to-reach color mark sensors located inside an equipment. Also, models can be interchanged easily.

Mark mode
2-level teaching and full-auto teaching possible

Color mode
1-level teaching possible

Compact design for significant space savings

High precision sensing and multiple functions are all packed in a compact W57 × D24 × H38 mm W2.244 × D0.945 × H1.496 in body.
Cable and plug-in connector types are available depending on the equipment used. These sensors can be easily introduced to existing facilities.

38 mm
1.496 in
24 mm
0.945 in
57 mm
2.244 in

Key lock function

The key lock function enables input operation control that prevents mistaken changes in the sensor settings. Other detailed settings include "RUN adjust", allowing threshold value adjustment only, and "RUN teaching", allowing teaching operation only.
If the sensor is set to "RUN adjust" or "RUN teaching", adjustment and teaching are possible having the sensor remained in RUN mode.
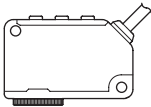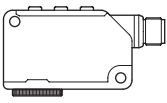
■ ORDER GUIDE

Sensors | Mating cable is not supplied with the plug-in connector type. Please order it separately.

Type	Appearance	Model No.	Output	Sensing range
Cable type		**LX-101**	NPN open-collector transistor	10 ±3 mm 0.394 ±0.118 in
Cable type		**LX-101-P**	PNP open-collector transistor	10 ±3 mm 0.394 ±0.118 in
Plug-in connector type		**LX-101-Z**	NPN open-collector transistor	
Plug-in connector type		**LX-101-P-Z**	PNP open-collector transistor	

Mating cables for plug-in connector type sensor | Mating cable is not supplied with the plug-in connector type sensor. Please order it separately.

Type	Model No.	Description
Straight	**CN-24B-C2**	Length: 2 m 6.562 ft	
Straight	**CN-24B-C5**	Length: 5 m 16.404 ft	0.34 mm² 4-core cabtyre cable, with connector on one end Cable outer diameter: ø5 mm ø0.197 in
Elbow	**CN-24BL-C2**	Length: 2 m 6.562 ft
Elbow	**CN-24BL-C5**	Length: 5 m 16.404 ft

Mating cables for plug-in connector type sensor

• **CN-24B-C2** • **CN-24BL-C2**
• **CN-24B-C5** • **CN-24BL-C5**

ø14 mm ø0.551 in
43.5 mm 1.713 in
ø5 mm ø0.197 in

ø5 mm ø0.197 in
ø14 mm ø0.551 in
31 mm 1.220 in
29 mm 1.142 in
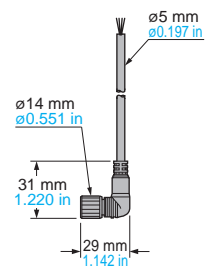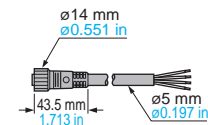
■ OPTIONS

Type	Model No.	Description
Sensor mounting bracket	**MS-LX-1**	Mounting bracket made for **LX-100** series applicable for various kinds of installations
Sensor mounting bracket	**MS-LX-2**	

Sensor mounting bracket

• **MS-LX-1**
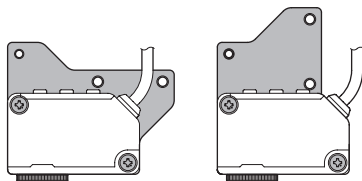
Two M4 (length 28 mm 1.102 in) screws with washers are attached.

• **MS-LX-2**
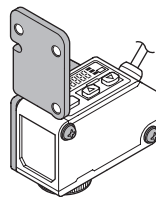
Two M4 (length 30 mm 1.181 in) screws with washers are attached.

■ SPECIFICATIONS

		Type	Cable type	Plug-in connector type
Item	Model No.	NPN output	**LX-101**	**LX-101-Z**
		PNP output	**LX-101-P**	**LX-101-P-Z**
Sensing range			10 ±3 mm 0.394 ±0.118 in	
Spot size			1 × 5 mm 0.039 × 0.197 in (at 10 mm 0.394 in setting distance)	
Supply voltage			12 to 24 V DC ±10 % Ripple P-P 10 % or less	
Current consumption			Normal mode: 750 mW or less (Current consumption 30 mA or less at 24 V supply voltage) ECO mode: 600 mW or less (Current consumption 25 mA or less at 24 V supply voltage)	
Output 1 (OUT)			<NPN output type> NPN open-collector transistor • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less (at 50 mA sink current) <PNP output type> PNP open-collector transistor • Maximum source current: 50 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1.5 V or less (at 50 mA source current)	<NPN output type> NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less (at 100 mA sink current) <PNP output type> PNP open-collector transistor • Maximum source current: 100 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1.5 V or less (at 100 mA source current)
	Short-circuit protection		Incorporated	
	Output operation		Mark mode: Light-ON / Dark-ON (Auto-setting on teaching), Color mode: Consistent-ON / Inconsistent-ON (Setting on teaching)	
Output 2 (OUT)			<NPN output type> NPN open-collector transistor • Maximum sink current: 50 mA • Applied voltage: 30 V DC or less (between output and 0 V) • Residual voltage: 1.5 V or less (at 50 mA sink current) <PNP output type> PNP open-collector transistor • Maximum source current: 50 mA • Applied voltage: 30 V DC or less (between output and +V) • Residual voltage: 1.5 V or less (at 50 mA source current)	——
	Short-circuit protection		Incorporated	——
	Output operation		Inverted operation of the output 1	——
Response time			Mark mode: 45 μs or less, Color mode: 150 μs or less	

Teaching input			<NPN output type>
			NPN non-contact input
			• Signal condition: High… +5 V to +V, or open
			  Low… 0 to +2 V
			  (source current: 0.5 mA or less)
			• Input impedance: 10 kΩ approx.
				<PNP output type>
				PNP non-contact input
				• Signal condition: High… +4 V to +V
				  (sink current: 3 mA or less)
				  Low… 0 to +0.6 V, or open
				• Input impedance: 10 kΩ approx.

Digital display			4-digit red LED display	
Sensitivity setting			Mark mode: 2-level teaching / Full-auto teaching, Color mode: 1-level teaching	
Fine sensitivity adjustment function			Incorporated	
Timer function			Incorporated with variable ON-delay / OFF-delay timer, switchable either effective or ineffective (Timer period: 1 to 500 ms, 9 levels variable)	
Environmental resistance	Protection		IP67 (IEC)	
	Ambient temperature		−10 to +55 °C +14 to +131 °F (No dew condensation or icing allowed), Storage: −20 to +70 °C −4 to +158 °F	
	Ambient humidity		35 to 85 % RH, Storage: 35 to 85 % RH	
	Ambient illuminance		Incandescent light: 3,000 ℓx at the light-receiving face	
	Voltage withstandability		1,000 V AC for one min. between all supply terminals connected together and enclosure	
	Vibration resistance		10 to 500 Hz frequency, 3.0 mm 0.118 in amplitude (max. 20 G) in X, Y and Z directions for two hours each	
	Shock resistance		500 m/s² acceleration (50 G approx.) in X, Y and Z directions for three times each	
Emitting element			Combined Red / Green / Blue LEDs (Peak emission wavelength: 640 nm 0.025 mil / 525 nm 0.021 mil / 470 nm 0.019 mil)	
Material			Enclosure: PBT, Display cover: Polycarbonate, Operation buttons: Silicone rubber, Lens: Glass, Lens holder: Aluminum	
Cable			0.34 mm² 5-core cabtyre cable, 2 m 6.562 ft long	(Note 2)
Cable extension			Extension up to total 100 m 328.084 ft is possible with 0.3 mm², or more, cable.	
Weight			Net weight: 120 g approx., Gross weight: 180 g approx.	Net weight: 55 g approx., Gross weight: 120 g approx.
Accessory			M4 (length 30 mm 1.181 in) screw with washers: 2 pcs.	

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.
　　　 2) Mating cable is not supplied with the plug-in connector type. Please order it separately.

I/O CIRCUIT AND WIRING DIAGRAMS

LX-101(-Z) — NPN output type

I/O circuit diagram

Notes: 1) The current of the plug-in connector type **LX-101-Z** is 100 mA max.
2) The output 2 is not incorporated to the plug-in connector type **LX-101-Z**.

*1

Non-voltage contact or NPN transistor

or

• Teaching input
High: 5 V to +V, or open
Low: 0 to +2 V (source current: 0.5 mA or less)
Teaching is carried out at the Low.

Symbols … D_1, D_2 : Reverse supply polarity protection diode
ZD_1, ZD_2: Surge absorption zener diode
Tr_1, Tr_2 : NPN output transistor

LX-101-P(-Z) — PNP output type

I/O circuit diagram

Notes: 1) The current of the plug-in connector type **LX-101-P-Z** is 100 mA max.
2) The output 2 is not incorporated to the plug-in connector type **LX-101-P-Z**.

*1

Non-voltage contact or PNP transistor

or

• Teaching input
High: +4 V to +V (sink current: 3 mA or less)
Low: 0 to +0.6 V, or open
Teaching is carried out at the High.

Symbols … D_1, D_2 : Reverse supply polarity protection diode
ZD_1, ZD_2: Surge absorption zener diode
Tr_1, Tr_2 : PNP output transistor

Connector pin layout of plug-in connector type

Connector pin No.	Description
①	+V
②	Teaching input
③	0 V
④	Output

SPOT SIZE CHARACTERISTICS (TYPICAL)

(Unit: mm in)

Setting distance L (Note 1)	Spot size (Note 2)	
	Width (W)	Length (D)
7 0.276	2.0 0.079	5.5 0.217
8 0.315	1.7 0.067	5.5 0.217
9 0.354	1.2 0.047	5.3 0.209
10 0.394	1.0 0.039	5.0 0.197
11 0.433	1.3 0.051	5.0 0.197
12 0.472	1.5 0.059	5.0 0.197
13 0.512	2.0 0.079	5.0 0.197

Notes: 1) Setting distance "L" represents the distance from the lens surface to the sensing object.
2) Examples only meant for use as a guideline.

■ PRECAUTIONS FOR PROPER USE

⚠ • 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

• Care must be taken regarding the sensor mounting direction with respect to the object's direction of movement.
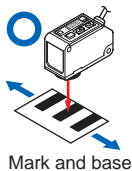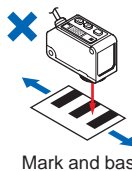

Mark and base   Mark and base

Do not make the sensor detect an object in this direction because it may cause unstable operation.

• The tightening torque should be 0.8 N·m or less.

Sensing glossy object

• Objects with a glossy surface have a large amount of specular reflection particles that may destabilize sensing. In such a case, by slightly tilting the sensor's beam axis, this specular reflection can be reduced rendering sensing more stable.

• If the surface of the sensing object has a shine, mount the sensor inclining approx. 10 to 15 degrees against the sensing object.
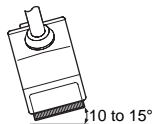
10 to 15°

Wiring

• Make sure to carry out wiring in the power supply off condition.
• Take care that wrong wiring will damage the sensor.
• Verify that the supply voltage variation is within the rating.
• Take care that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the sensor may get burnt or damaged.
• In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
• If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
• Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
• Take care that short-circuit of the load or wrong wiring may burn or damage the sensor.
• Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
• Extension up to total 100 m is possible with 0.3 mm^2, or more, cable. However, in order to reduce noise, make the wiring as short as possible.

Others

• Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
• Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency light device or sunlight etc., as it may affect the sensing performance.
• Do not touch the lens of the sensor by hand directly. If the lens becomes dirty, wipe it off with a soft cloth gently.
• When the inside lens is steamed up, unscrew the lens to get rid of the condensation.
• These sensors are only for indoor use.
• Do not use this sensor in places having excessive vapor, dust, etc., or where it may come in direct contact with water, or corrosive gas.
• Take care that the product does not come in contact with water, oil, grease, or organic solvents, such as, thinner, etc.
• Make sure that stress by forcible bend or pulling with 76 N, or more, force is not applied to the sensor cable joint.
• This sensor cannot be used in an environment containing inflammable or explosive gases.
• Never disassemble or modify the sensor.

■ LIST OF PROMODE SETTING ITEMS

• Before performing teaching or each detail setting, perform the setting of either mark mode or color mode with mark / color mode setting of NAVI mode.

NAVImode

RUN — Run

At mark mode setting:
Indicates the absolute value of emitting amount. It is possible to indicate the relative value (percent value) against threshold value.
At color mode setting:
Indicates color matching degree with relative value.

MODE / CANCEL — Press
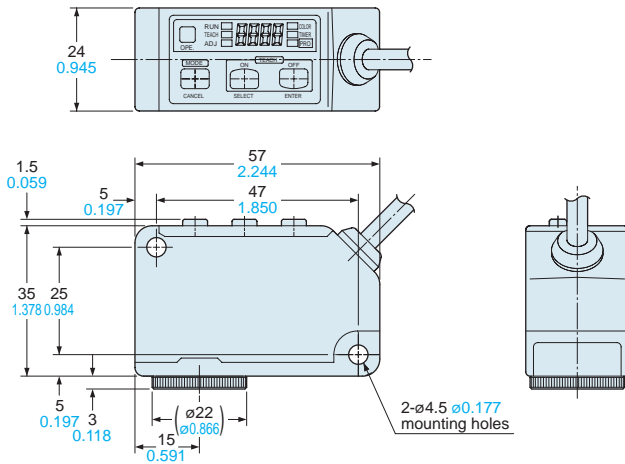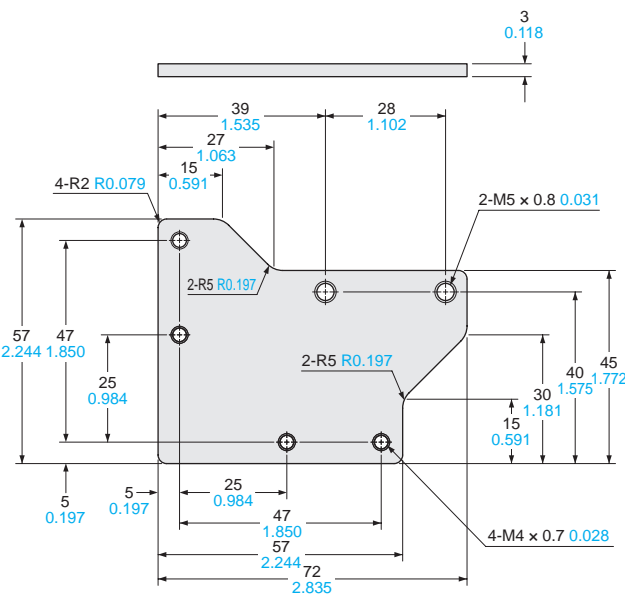
TEACH — Teaching

At mark mode setting:
Sets the threshold value by '2-level teaching' or 'full-auto teaching'.
At color mode setting:
Sets the threshold value by '1-level teaching'.

ADJ — Adjust

At mark mode setting:
Allows fine adjustment of the threshold value.
At color mode setting:
Allows adjustment of sensing tolerance value.

COLOR — Mark / Color mode setting

Sets mark mode or color mode.

TIMER — Timer operation setting

Configures operation of the timer.

PRO — PRO

Allows various detailed settings to be configured.

Press OFF / ENTER

PROmode

• For selecting a setting item, press 'ON key'. For confirming each selected setting item, press 'OFF / ENTER key'. After confirming setting, the digital display flashes. For canceling setting, press 'MODE key'.

SEnS — Sensing setting
Sets the sensing level (hysteresis.)

Press OFF / ENTER → **FinE** Sensing level: Fine
Press OFF / SELECT → **COAS** Sensing level: Coarse

dELY — Timer setting
Sets timer setting period by 9-steps.

t-20 (20ms) → **t-50** (50ms) → **t100** (100ms) → **t200** (200ms) → **t500** (500ms)
t-10 (10ms) ← **t- 5** (5ms) ← **t- 2** (2ms) ← **t- 1** (1ms)

Loc — Key lock setting
Selects key lock function.

FuLL Set full key lock.
tEch Set key lock except for RUN teaching mode. (RUN teaching)
AdJ Set key lock except for RUN adjust mode.(RUN adjust)

diSP — Display setting
Selects display method of digital desplay.

Std
Mark mode setting: Displays incident light intesity
Color mode setting: Displays color coincidence

---P
Mark mode setting: Displays relative value (percentage)
Color mode setting: Displays color coincidence

Eco — Eco setting
Sets ON / OFF of eco mode.

oFF Eco setting: OFF ↔ **on** Eco setting: ON

turn — Display inverting mode setting
Changes display direction of digital display.

oFF Not invert the display. ↔ **on** Invert the display.

rSEt — Reset setting
Resets to factory setting.

no Not reset the settings. ↔ **YES** Reset the settings.

MODE / CANCEL — Press

MODE / CANCEL — Press

DIMENSIONS (Unit: mm in)

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

LX-101   LX-101-P · Sensor

LX-101-Z   LX-101-P-Z · Sensor

MS-LX-1 · Sensor mounting bracket (Optional)

Material: Stainless steel (SUS)

Two M4 (length 28 mm 1.102 in) screws with washers are attached.

MS-LX-2 · Sensor mounting bracket (Optional)

Material: Stainless steel (SUS)

Two M4 (length 30 mm 1.181 in) screws with washers are attached.