Digital Mark Sensor Amplifier Built-in
LX-100 SERIES

Related Information
■ General terms and conditions..... P.1
■ Sensor selection guide ..... P.11~ / P.727~
■ Glossary of terms..... P.983~
■ General precautions ..... P.986~

SUNX website http://www.sunx.com

CE Conforming to EMC Directive

c UL us Recognition

PNP output type available

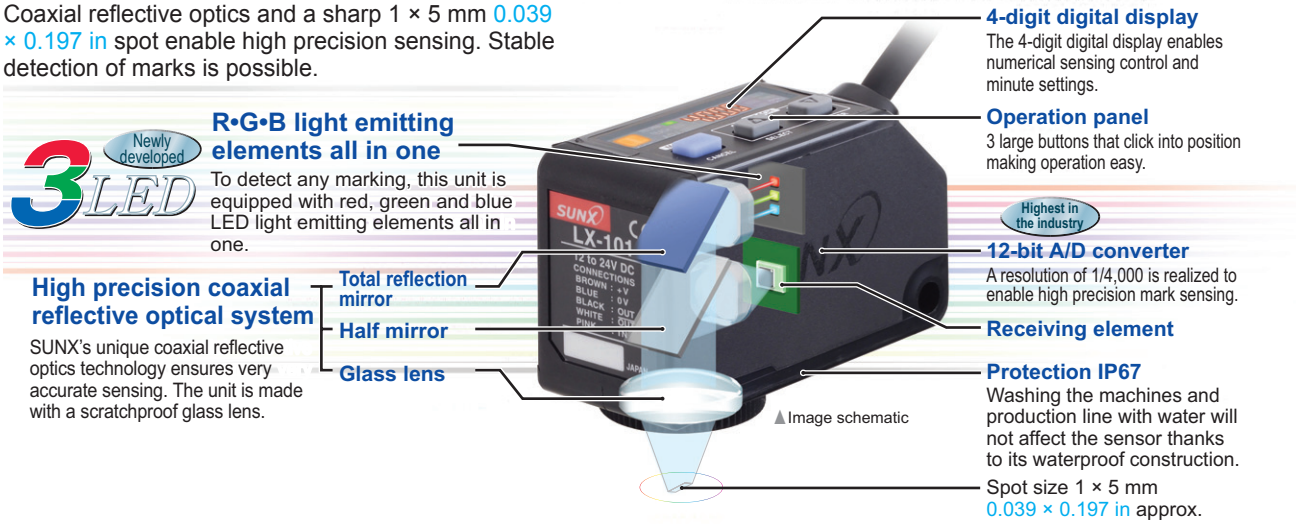
Timer

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.

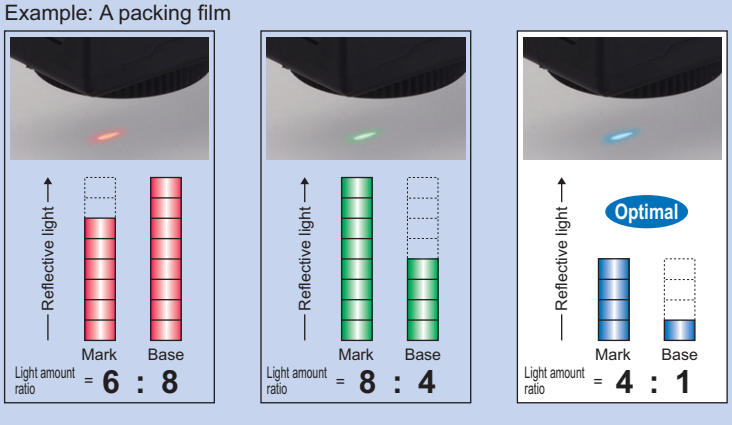


Automatic optimal LED selection function

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



FIBER SENSORS
LASER SENSORS
PHOTOELECTRIC SENSORS
MICRO PHOTOELECTRIC SENSORS
AREA SENSORS
SAFETY COMPONENTS
PRESSURE SENSORS
INDUCTIVE PROXIMITY SENSORS
PARTICULAR USE SENSORS
SENSOR OPTIONS
WIRE-SAVING SYSTEMS
MEASUREMENT SENSORS
STATIC CONTROL DEVICES
LASER MARKERS
Selection Guide
Wafer Detection
M-DW1
HD-T1
Liquid Leak Detection
EX-F70 / EX-F60
Liquid Level Detection
EX-F1
Color Mark Detection
LX-100
FZ-10
Small / Slim Object Detection
NA1-11
Metal-sheet Double-feed Detection
GD
Other Products

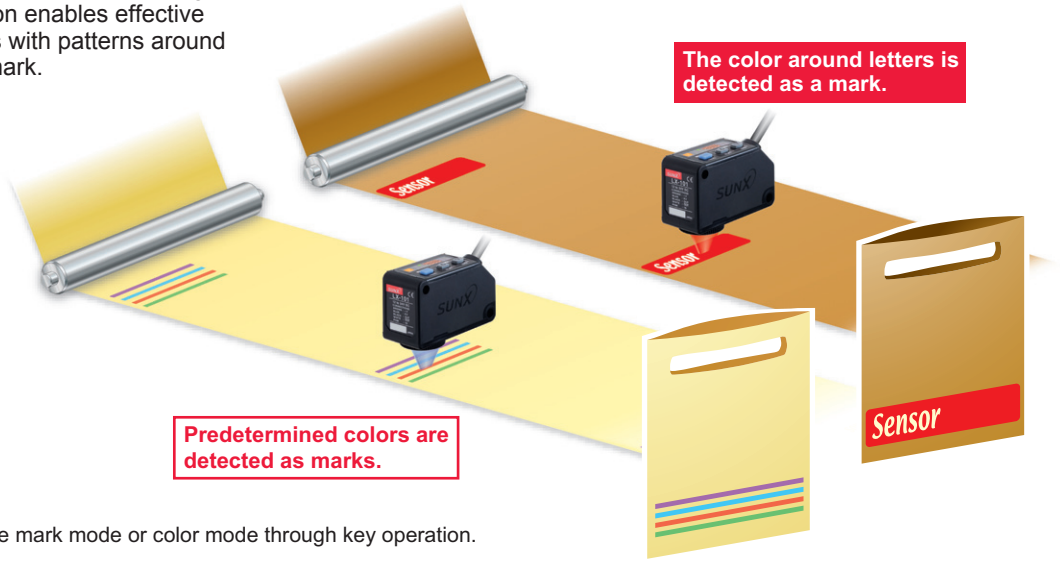
Two detection modes can be selected from to suit the application

Mark mode Ultra high-speed response

This sensing mode automatically selects a single color from the 3 R•G•B LEDs to realize 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.

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.

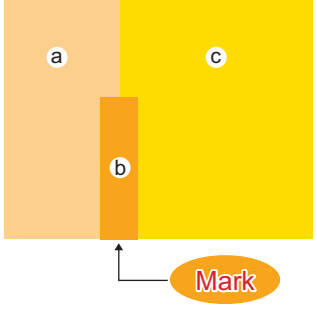


* You can select the mark mode or color mode through key operation.

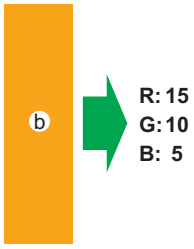
High precision mark color discrimination

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.

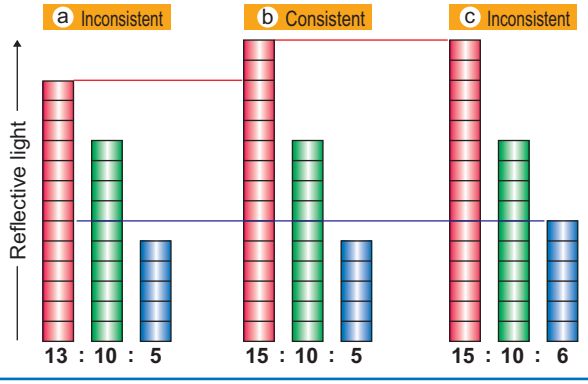
1. 1-level teaching for this mark



2. R•G•B ratio calculated



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



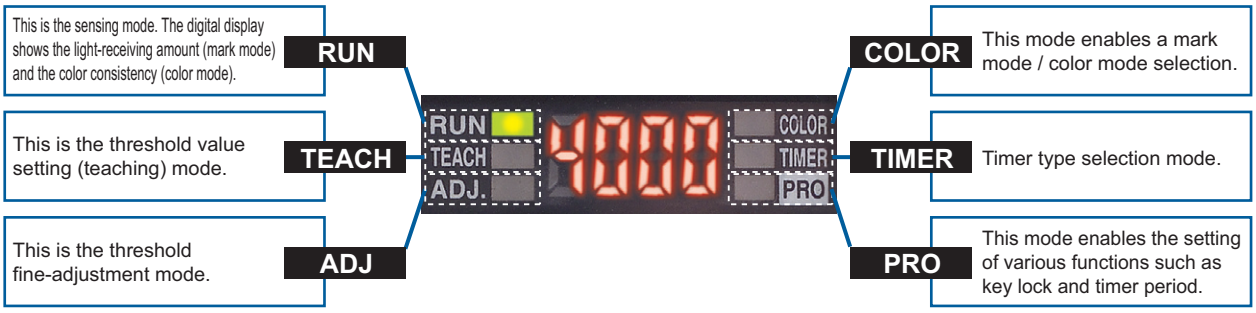
Even similar colors are accurately determined using the R•G•B ratio.

Its digital display makes for easy settings! Numerical control of the settings 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.

Even beginners can quickly master MODE NAVI operation

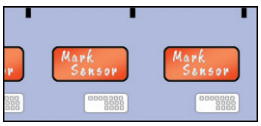
The sensor's basic operations are represented by 6 indicators (MODE NAVI). The user can check what mode the sensor is presently in with a quick glance rendering operation simple.



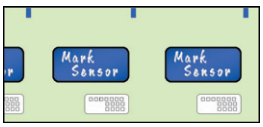
Sensing status digitally controllable

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

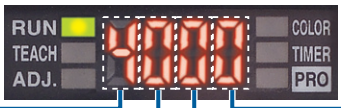
■ Selected LED: Blue LED
■ Threshold value: 1600

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 settings verification and maintenance by phone.

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			
Display	Sensing mode (light source color)	Operation mode (Note 1)	Sensing (Note 2)
0	Mark mode (green)	L-ON	FINE
1			COARSE
2		D-ON	FINE
3			COARSE
4	Mark mode (blue)	L-ON	FINE
5			COARSE
6		D-ON	FINE
7			COARSE
8	Mark mode (red)	L-ON	FINE
9			COARSE
A		D-ON	FINE
b			COARSE
C	Color mode	Consistent-ON	FINE
d			COARSE
E		Inconsistent-ON	FINE
F			COARSE

2nd digit			
Display	Display mode	ECO mode (Note 4)	Turn mode (Note 5)
0	Standard	OFF	OFF
1			ON
2		ON	OFF
3			ON
4	Percent display (Note 3)	OFF	OFF
5			ON
6		ON	OFF
7			ON
8	———		
9			
A			
b			
C			
d			
E			
F			

3rd digit		
Display	Key lock	Timer mode
0	Full lock (All operations disabled)	non
1		OFF-delay
2		ON-delay
3	RUN teaching (Teaching only enabled)	non
4		OFF-delay
5		ON-delay
6	RUN adjust (Threshold value adjustment only enabled)	non
7		OFF-delay
8		ON-delay
9	———	
A		
b		
C		
d		
E		
F		

4th digit	
Display	Timer period
0	1 ms
1	2 ms
2	5 ms
3	10 ms
4	20 ms
5	50 ms
6	100 ms
7	200 ms
8	500 ms
9	———
A	———
b	———
C	———
d	———
E	———
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 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 viewed in the event 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.

We provided an example of the most basic setting method "2-level teaching".

Mode selection Press MODE key and select TEACH mode.

Teaching
1. Align the spot on the mark and press the ON key.
2. Align the spot onto the base (non-mark area) and press the OFF key.

* The 1 2 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 effectuated without stopping the sensing object.
- 1-level teaching: In Color mode, the color detected is aligned by the spot and teaching is effectuated.

External teaching possible

Teaching is possible by external input using the operation panel or touch panel even for color mark sensors whose position within the equipment is out of reach. Models can be easily interchanged.

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 provided all 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 already existing facilities.

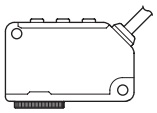
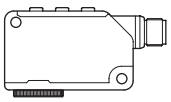
Key lock function

The key lock function enables input operation control that prevents mistaken changes in the sensor settings. Also possible are minute settings such as "RUN adjust", allowing threshold value adjustment only, and "RUN teaching", allowing teaching operation only.
If setting the sensor to "RUN adjust" or "RUN teaching", adjustments and teaching is possible with the sensor left 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
		LX-101-P	PNP open-collector transistor	
Plug-in connector type		**LX-101-Z**	NPN open-collector transistor	
		LX-101-P-Z	PNP open-collector transistor	

Mating cables for plug-in connector type sensor

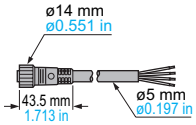
Mating cable is not supplied with the plug-in connector type sensor. Please order it separately.

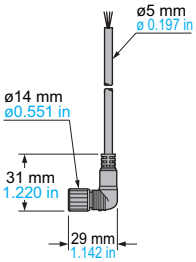
Type	Model No.	Description
Straight	**CN-24B-C2**	Length: 2 m 6.562 ft
	CN-24B-C5	Length: 5 m 16.404 ft
Elbow	**CN-24BL-C2**	Length: 2 m 6.562 ft
	CN-24BL-C5	Length: 5 m 16.404 ft

0.34 mm² 4-core cabtyre cable, with connector on one end
Cable outer diameter: ø5 mm ø0.197 in

Mating cables for plug-in connector type sensor

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



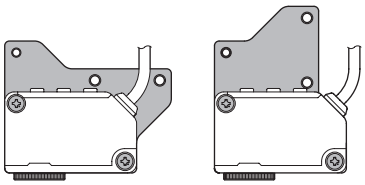


OPTIONS

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

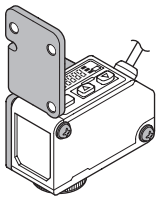
Sensor mounting bracket

- **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

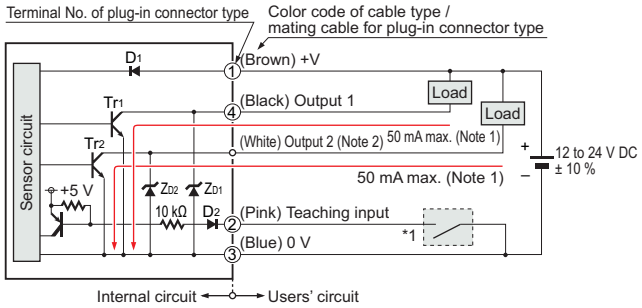
Item \ Type		Cable type	Plug-in connector type
Model No.	NPN output	LX-101	LX-101-Z
	PNP output	LX-101-P	LX-101-P-Z
Sensing range		10 ± 3 mm 0.394 ± 0.118 in	
Spot size		1 × 5 mm 0.039 × 0.197 in (at 10 mm 0.394 in setting distance)	
Supply voltage		12 to 24 V DC ± 10 % Ripple P-P 10 % or less	
Current 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 ($\overline{OUT}$)		<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) (Refer to p.984 for details of standards.)	
	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

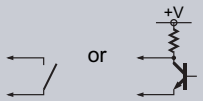
I/O circuit diagram



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

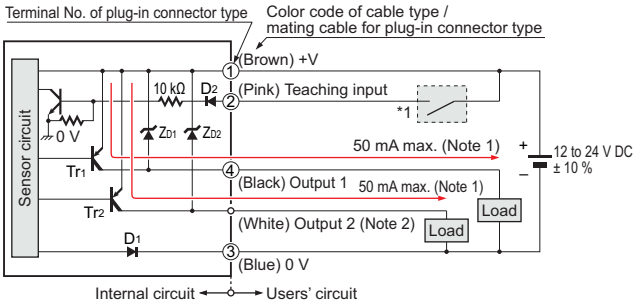


- Teaching input
  High: 5 V to +V, or open
  Low: 0 to +2 V(source current: 0.5 mA or less)
  Teaching is carried out at the Low.

Symbols … D_1, D_2 : Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : NPN output transistor

LX-101-P(-Z) PNP output type

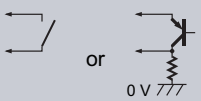
I/O circuit diagram



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

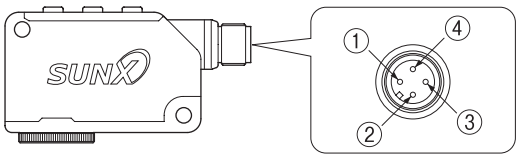
Non-voltage contact or PNP transistor



- 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.

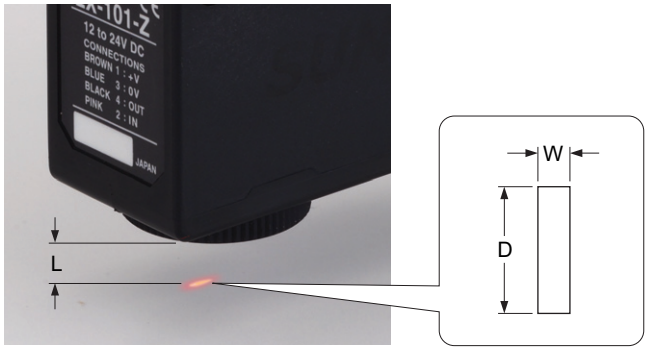
Symbols … D_1, D_2 : Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
Tr_1, Tr_2 : PNP output transistor

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.

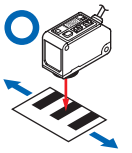
PRECAUTIONS FOR PROPER USE

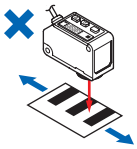
Refer to p.986~ for general precautions.

- 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

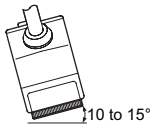

Mark and base

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.



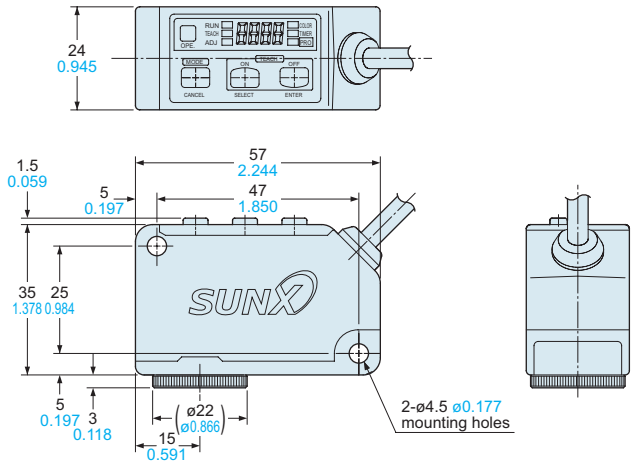
Others

- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.

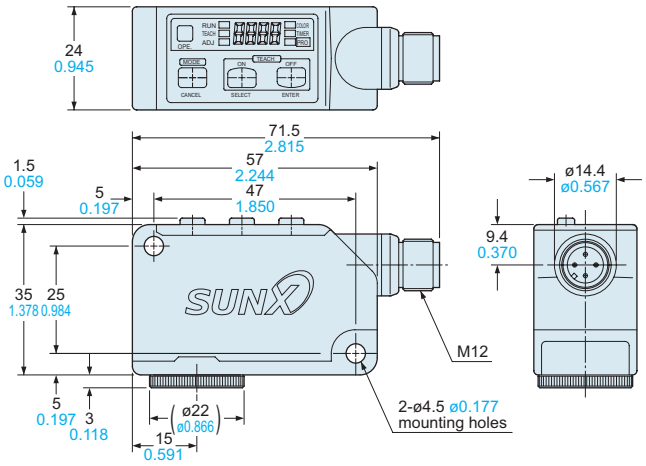
DIMENSIONS (Unit: mm in)

The CAD data in the dimensions can be downloaded from the SUNX website: http://www.sunx.com

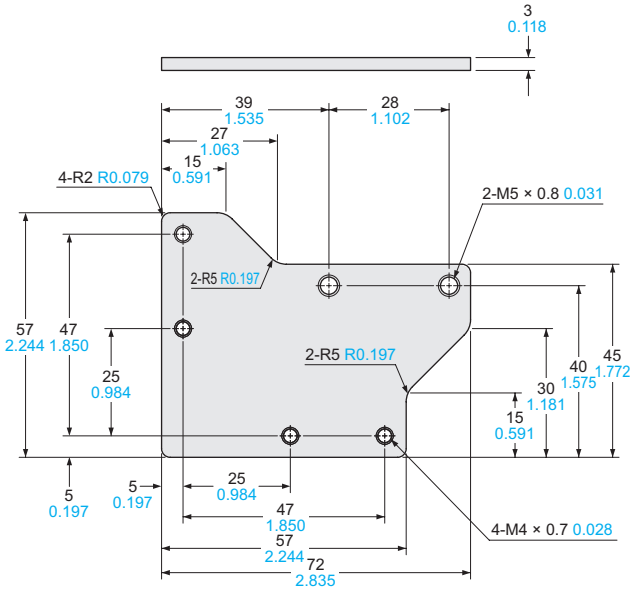
LX-101 LX-101-P Sensor



LX-101-Z LX-101-P-Z Sensor



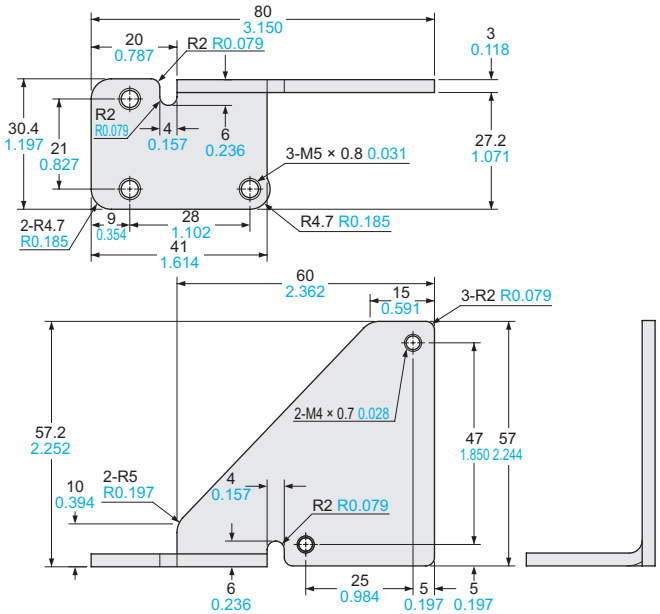
MS-LX-1 Sensor mounting bracket (Optional)



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.