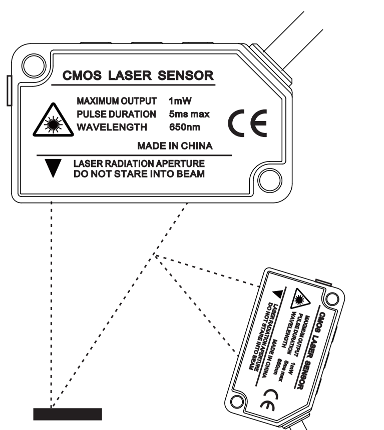
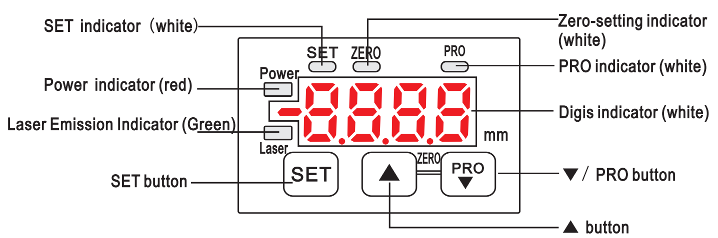
LC-S Series CMOS laser displacement sensor user manual

⚠ Warning

- Please read the instructions thoroughly and carefully in order to use the product correctly and reasonably.
- This product detects (judges, measures) the object. Do not use this product to ensure safety and prevent accidents that may affect people's lives and property.
- There is a certain danger in using the product incorrectly. When using the product, please do not look directly at the laser or observe the optical system through the lens.

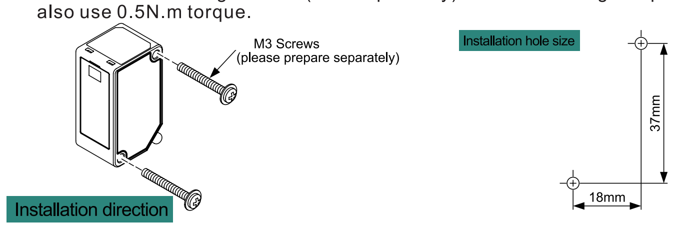


1 Name of each part



2 Installation

- When installing this product, please use M3 screw (please equip it separately). Use 0.5N.m torque.
- Use sensor mounting bracket (sold separately). When installing this product, also use 0.5N.m torque.

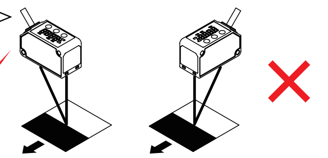


Installation direction

- Direction relative to the moving object

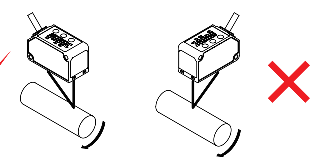
<In the case of material and colour difference.>

- When measuring, when the material and color of the moving object are extremely different, the measurement error can be controlled to a minimum by installing it in the direction shown in the following figure.



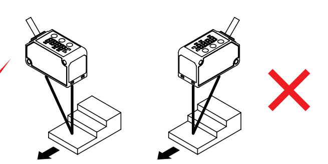
<Measuring rotating objects>

- When measuring a rotating object, please install it in the direction shown in the figure below, so as to restrain the influence of up-down vibration and position offset of the object.



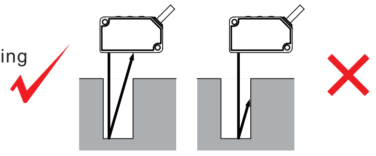
<In the case of step difference>

- In the case of moving measurement object with step difference, install it according to the method shown in the figure below, so as to restrain the influence of step difference edge.



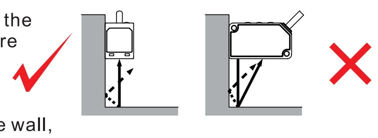
- Measurements in narrow locations and depressions

- When measuring in narrow places and small holes, when installing, please pay attention to avoid blocking the light path of the emitting part and the receiving part.



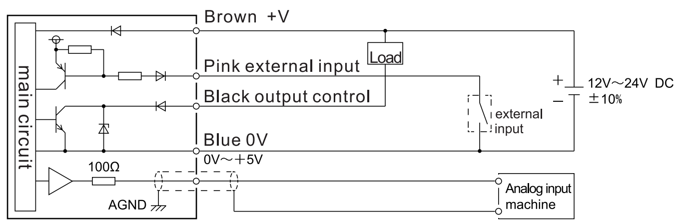
- When the sensor is mounted on the wall

- Installation should be according to the method shown in the following figure so as not to cause multiple light emitted from the wall to enter the light receiving part. In addition, in the case of high reflectivity of the wall, good results can be obtained if it is changed to dull black.

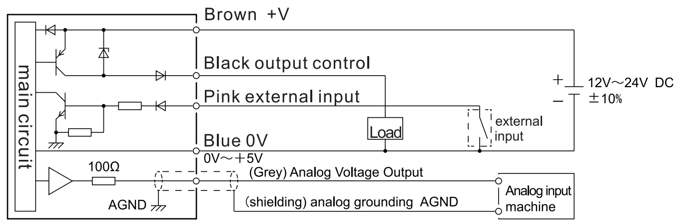


3 Input and Output Circuit Diagram

- NPN output



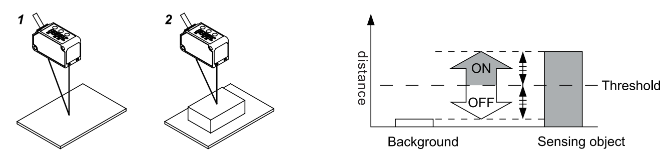
- PNP output

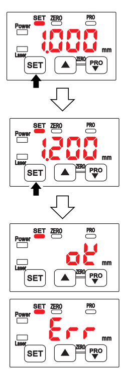


4 Teach

2 Point teaching

- Basic teaching methods





1. Press the SET key in the background absent condition.
2. Press the SET key in the sensing object absent condition.

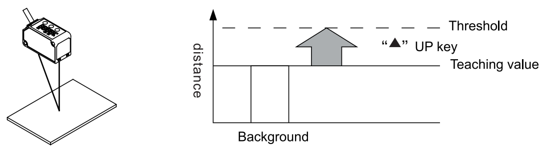
Stable sensing is possible

Stable sensing is not possible

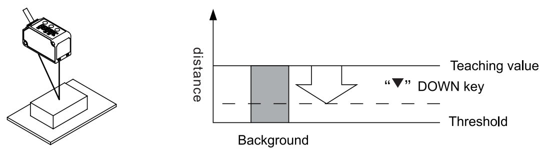
Limited teaching

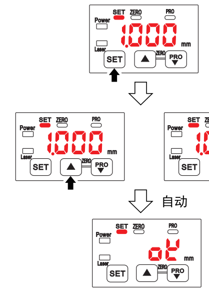
- This is teaching method in case small object or object in background are existing.

<When an object in background is used as reference>



<When a sensing object is used as reference>

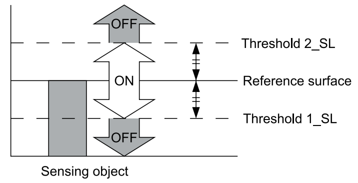


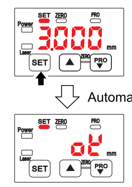


1. Press the SET key in the background absent condition or the sensing object absent condition.
2. When an object in the background is used as a reference, press the UP key to set the threshold on the sensor side. When a sensing object is used as a reference, press the DOWN key to set the threshold on the sensing object side.
3. The teaching is completed.

1-point teaching (Window comparator mode)

- This mode is used for setting the threshold range for the distance from the reference value of the sensing object, by performing 1-point teaching. This mode is used for sensing within the threshold range.
- When performing 1-point teaching (window comparator mode), preset "Window comparator mode 1" in the sensing output setting of the PRO mode. For the setting method, refer to " 9 PRO MODE SETTING."

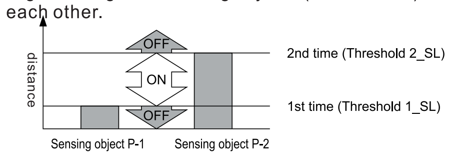


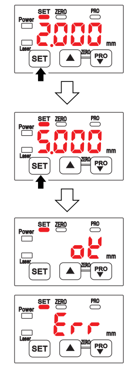


1. Press the TEACH key twice in the sensing object present condition. (1st time: TEACH mode, 2nd time: Teaching)
2. Teaching is completed.

2-point teaching (Window comparator mode)

- This is method to set the threshold range by conducting the 2-point teaching.
- When performing 2-point teaching (window comparator mode), preset "Window comparator mode 2" in the sensing output setting of the PRO mode. For the setting, refer to " 9 PRO MODE SETTING."
- When conducting teaching, use sensing objects (P-1 and P-2) whose distance are different from each other.





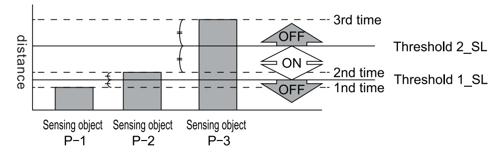
1. Press the SET key in the sensing object P-1 present condition. (1st time)
2. Press the TEACH key in the sensing object P-2 absent condition. (2nd time)

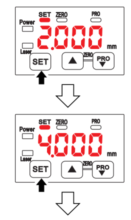
Stable sensing is possible

Stable sensing is not possible

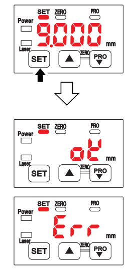
3-point teaching (Window comparator mode)

- This is the method to perform 3-point teaching (P-1, P-2, P-3) and to set the threshold range by setting threshold 1_SL in the mid-point between the 1st time and 2nd time, and threshold 2_SL in the mid-point between the 2nd time and 3rd time as shown in the following figure.
- When performing 3-point teaching (window comparator mode), preset "Window comparator mode 3" in the sensing output setting of the PRO mode. For the setting, refer to " 9 PRO MODE SETTING."
- When performing teaching, use sensing objects (P-1, P-2, P-3) with different distance.
- After teaching, P-1, P-2 and P-3 will be automatically rearranged from the smaller value.





1. Press the TEACH key in the sensing object P-1 present condition. (1st time)
2. Press the TEACH key in the sensing object P-2 absent condition. (2nd time)



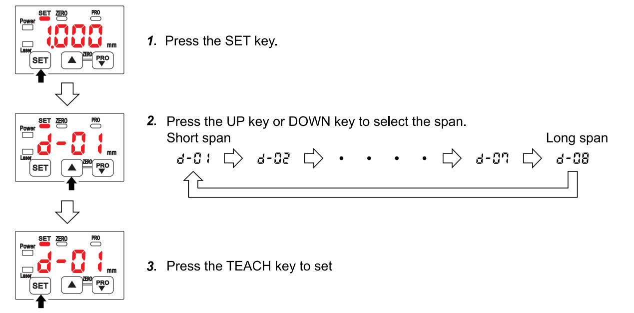
3. Press the SET key in the sensing object P-3 present condition. (3rd time)

Stable sensing is possible

Stable sensing is not possible

Span adjustment in rising differential mode or trailing differential mode

- This mode is used to cancel the gradual changes in the measured value, and to only detect sudden changes.
- When performing rising differential mode or trailing differential mode, preset "Rising differential mode" or "Trailing differential mode" in the sensing output setting of the PRO mode. For the setting method, refer to " 9 PRO MODE SETTING."
- The threshold can be set by using the threshold value fine adjustment function. For the threshold value fine adjustment function, refer to " 5 THRESHOLD VALUE FINE ADJUSTMENT FUNCTION."

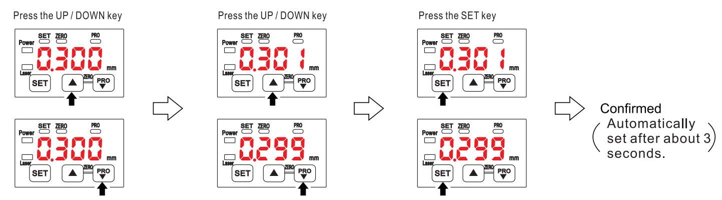


1. Press the SET key.
2. Press the UP key or DOWN key to select the span.
3. Press the TEACH key to set

5 Threshold value fine adjustment function

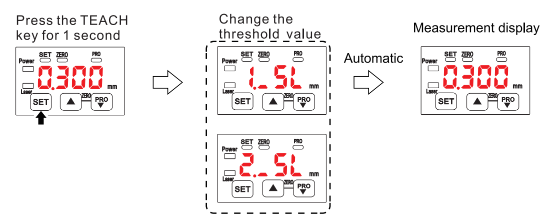
- Fine adjustment of the threshold can be performed in the measurement display.
- Fine adjustment of the threshold can be performed even after teaching.

<Normal sensing mode, rising differential mode or trailing differential mode>

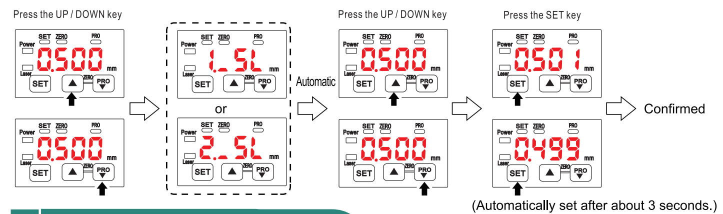


<Window comparator mode>

- When the sensing output is set to window comparator mode, the display of "1_SL" and "2_SL" can be changed by pressing the SET key for 1 second.



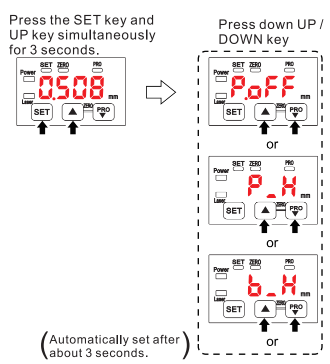
- When performing a fine adjustment of the threshold of "1_SL" or "2_SL", press the UP key or DOWN key. After "1_SL" or "2_SL" is displayed, the fine adjustment of the threshold can be performed.



(Automatically set after about 3 seconds.)

6 Peak / Bottom hold function

- The peak / bottom hold function, is for displaying the peak value and bottom value.
- When the zero set function is executed while the peak / bottom hold function is set to "Peak hold" or "Bottom hold", the held measured value will be reset.

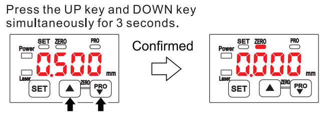


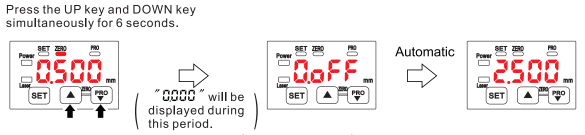
Digital Displa	Description	Function
PoFF	Hold function release	Releases the hold status, and outputs the current measured value
P_H	Peak hold	Holds maximum measured value
b_H	Bottom hold	Holds minimum measured value

7 Zero set function

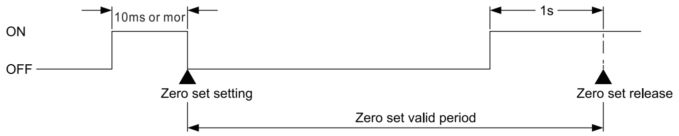
- The zero set function is the function to compulsorily set the measured value to "zero".
- The zero set indicator (yellow) will turn ON when the zero set is valid.
- When the zero set function is executed while the peak / bottom hold function is valid, the held measured value will be reset.
- When the display setting is set to Offset, the zero set function cannot be set.

<Zero set setting>





- The setting or releasing of the zero set from an external input operates as in the following figure.



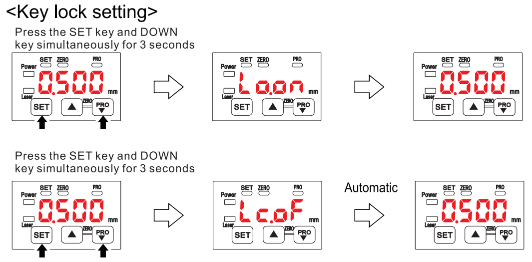
- When the power is turned ON again, zero set from external input can be released. At this time, the zero set will not be saved.
- Even when the zero set is set in the sensor, the zero set can be set or released from an external input. However, when the power is turned ON again, the zero set setting in the sensor will be displayed.

(※) When saved to the sensor through external input settings
Please use the external input settings set in 9 PRO mode to make the save valid.

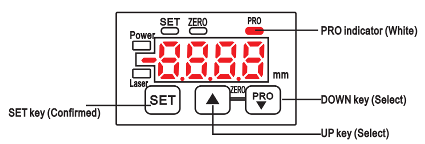
8 Key lock function

- The key lock function is to prevent acceptance of key operations, so that the conditions set in each setting mode are not changed accidentally.
- When key operation is performed after the key lock is set, "Loc" will be displayed on the digital display.

<Key lock setting>



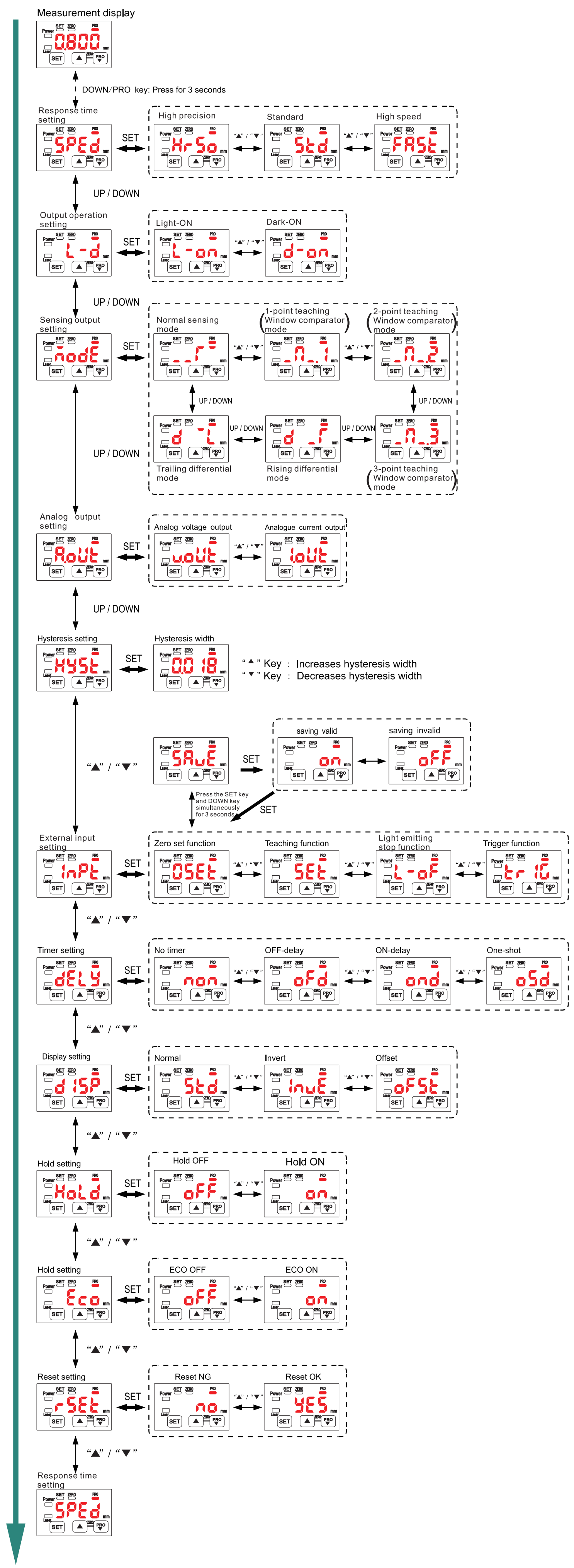
9 PRO Mode setting



- The PRO indicator (RED) will turn ON when the PRO mode is set.
- When the DOWN key is pressed for 3 seconds or more in the middle of the PRO MODE setting, the display returns to the measurement display.

Item	Default setting	Description
Response speed setting	Hr5o	Set the response time. "Hr5o": High precision 10ms, "Std": Standard 5ms, "FASt": High speed 1.5ms
Output operation setting	L-on	Select the control output operation mode. "L-on": Light-ON, "d-on": Dark-ON
Sensing output setting	__r¯	Set the sensing output. "__r¯": Normal sensing mode "_n_1": 1-point teaching (Window comparator mode) "_n_2": 2-point teaching (Window comparator mode) "_n_3": 3-point teaching (Window comparator mode) "d _r": Trailing differential mode "d ¯L": Trailing differential mode
Analog output setting	uoUt	Analog output setting "uoUt": Voltage analog output (0 to +5V) "loUt": Current analog output (4 to 20mA)
Hysteresis setting	<LC-S030> 00 10 <LC-S050> 0030 <LC-S100> 007 <LC-S200> 0.2 <LC-S400> 0.8	Set the hysteresis width. **LC-S030N**: 0. 001mm～5. 00mm **LC-S050N**: 0. 01mm～15. 00mm **LC-S100N**: 0. 02mm～35. 00mm **LC-S200N**: 0. 1mm ～80. 00mm **LC-S400N**: 0. 2mm～200. 0mm
External input setting	0SEt	Set the external input. "0SEt": Zero set function, "SEt": Teaching function "L-oF": Light emitting stop function, "tr iG": Trigger function
Timer setting	non	Set the timer operation. The timer time is fixed at 5ms. "non": No timer, "oFd": OFF-delay timer "ond": ON-delay timer, "o5d": One-shot timer
Display setting	Std	The display of the measured value can be changed. "Std": Normal, "InuE": Invert, "oFSt": Offset
Hold setting	oFF	Set the control output and the analogue output operation when a measurement error occurs (insufficient light intensity, saturation of light intensity, out of measurement range). "oFF": Hold OFF, "on": Hold ON
ECO Setting	oFF	The digital display can be set to go OFF when key operation is not performed for 30 seconds. Current consumption can be reduced. "oFF": ECO OFF, "on": ECO ON
Reset setting	no	Return to the default setting (factory setting). "no": Reset NG, "YES": Reset OK

Procedure



10 Error indication

- In case of errors, attempt the following measures.

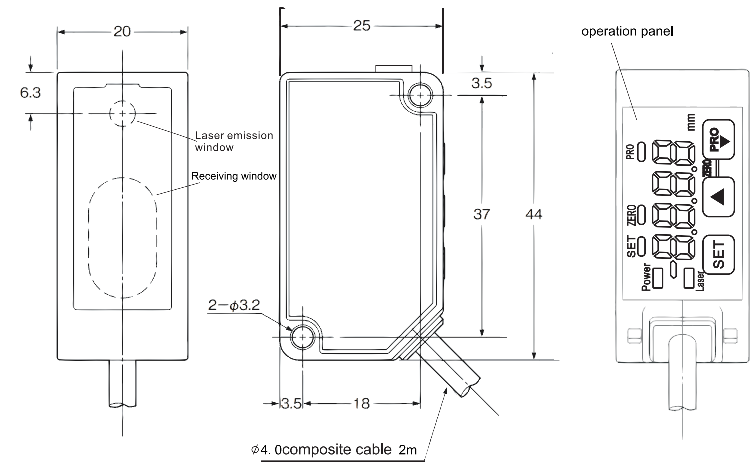
Error indication	Description	Remedy
< Hold OFF > ---- < Hold ON > Measured value blinks	Insufficient amount of reflected light. The sensing object is out of the sensing range.	Confirm that the sensing distance is within the specification range. Adjust the installation angle of the sensor.
E001	Flash memory is damaged or passed its life expectancy.	Please contact our office.
E011	Load of the sensing output is short-circuited causing an over-current to flow.	Turn OFF the power and check the load.
E021	The semiconductor laser is damaged or passed its life expectancy.	Please contact our office.
E031	• When zero set is set, the measurement is not performed normally. • Since the display setting is set to "Offset", the zero set function can not be used.	• Confirm that the sensing distance is within the specification range. • Set the display to any setting except "Offset."
E041	During teaching, the measurement is not performed normally.	Confirm that the sensing distance is within the specification range.

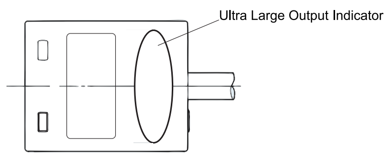
11 Specifications

Type		Dual output	Dual output	Dual output	Dual output	Dual output
Model	NPN	LC-S030MN	LC-S050MN	LC-S100MN	LC-S200MN	LC-S400MN
	PNP	LC-S030MP	LC-S050MP	LC-S100MP	LC-S200MP	LC-S400MP
Measure center distance		30mm	50mm	100mm	200mm	400mm
Measurement range		±5mm	±15mm	±35mm	±80mm	±200mm
Repeatability		10μm	50μm	100μm	200μm	400μm:（Measuring distance 200mm~400mm） 800μm:（Measuring distance 400mm~600mm）
Linearity		±0.2%F. S.	±0.2%F. S.	±0.2%F. S.	±0.3%F. S.	±0.3%F.S.:（Measuring distance 200mm~400mm） ±0.3%F.S.（Measuring distance 400mm~600mm）
Temperature characteristic		0. 03%F. S. /°C				
Light source		Red semiconductor laser Class 2 (JIS / IEC / GB) / Class II Max. output: 1mW, Emission peak wavelength: 655nm				
Beam diameter		about ø50μm	about ø100μm	about ø150μm	about ø300μm	about ø500μm
Supply voltage		12 to 24V DC ±10%, Ripple P-P 10% or less				
Power consumption		40mA or less (at 24V DC supply voltage), 60mA or less (at 12V DC supply voltage)				
Control output		<NPN output type> NPN open-collector transistor • Maximum sink current: 50mA • Applied voltage: 30V DC or less (Between control output to 0V) • Residual voltage: 1.5V or less (At 50mA sink current) • Leakage current: 0.1 mA or less			<PNP output type> PNP open-collector transistor • Maximum sink current: 50mA • Applied voltage: 30V DC or less (Between control output to 0V) • Residual voltage: 1.5V or less (At 50mA sink current) • Leakage current: 0.1 mA or less	
Output operation		Switchable either Light-ON or Dark-ON				
Short-circuit protection		Incorporated (Auto reset type)				
Analogue output	Voltage output Warning: (+ 5. 2V)	Output range: 0 to 5V Output impedance: 100Ω				
	Current output Warning: (0mA)	Output range: 4 to 20mA Load impedance: 300Ω or less				
Response time		Switchable between 1.5ms / 5ms / 10ms				
External input		NPN non-contact input, Valid: 0 to +1.2V DC Input impedance: Approx. 10kΩ				
Protection		IP67（IEC）				
Degree of pollution		2				
Ambient temperature		−10 to +45°C (No dew condensation or icing allowed), Storage: -20 to +60°C				
Ambient humidity		35 to 85% RH, Storage: 35 to 85% RH				
Ambient illuminance		Incandescent lamp: Acceptance surface illuminance 3,000lx or less				
Operating altitude		2,000m or less				
Cable		0. 15mm^2 5-core composite cable, 2m long				
Material		Enclosure: Aluminum die-cast, Front cover: Acrylic				
Weight		Approx. 35g (without cable), approx. 85g (including cable)				
Applicable standard		EMC Directive Compliance				

Note)
Supply voltage: 24V DC, ambient temperature: +20°C, response time: 10ms, and analogue output value of measurement center distance are used for unspecified measurement conditions. The subject is white paper.

12 Dimension drawing





13 Safety precautions

- Isolation of Sensor Cable from Power or High Voltage Cable
- Do not use the sensors outdoors
- 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.
- The overall length of the cable can be extended to 10m maximum with a cable size of 0.3mm² or more.
- The write lifetime of memory is about 100,000 times. "ON": When using memory to save effectively, pay attention to the write lifetime.
- Although it depends on the type, light from rapid start type or high frequency lighting type fluorescent lights, sunlight and etc. may affect the sensing, therefore make sure to prevent direct incident light.
- Keep water, oil, fingerprints and etc. which reflect light, or dust, particles or etc. which interrupts the light, away from the emitting / receiving surfaces of this product. If contaminants adhere to the surface, wipe off with a dust-free soft cloth, or lens cleaning paper.

14 Product Guarantee

1. Warranty period
One year warranty, the date from the product arrival the designated place of the buyer.

2. Warranty scope
(1) If there is an inhuman fault during the warranty period, we will repair the product free of charge.

But the following is not in the warranty:

- Failure caused by incorrect operation or incorrect use in accordance with the conditions specified in the manuals and user technical manuals.
- Failure is not caused by product defects, but by the purchaser's equipment or the software design of the purchaser.
- Failure caused by Purchaser's modification or repair.
- Failure caused by force majeure, is not in the warranty.

(2)The scope of warranty is limited to condition (1).

Our company do not bear any liability for the purchaser's equipment indirect losses (equipment damage, loss of opportunity, loss of profits, etc.) cause by our products.

3. To upgrade product performance, the contents of this manual may be amended without prior notice.