KEYENCE

96M17795

96M17795-1

Self-contained CMOS Laser Sensor LR-ZH□B Series Instruction Manual

Read this manual before using the product in order to achieve maximum performance.
Keep this manual in a safe place after reading it so that it can be used at any time.

The following symbols alert you to important messages.
Be sure to read these messages carefully.

DANGER	**Indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
WARNING	**Indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
NOTICE	**Indicates a situation which, if not avoided, could result in product damage as well as property damage.**

1. Introduction

1-1 Safety Information for LR-ZH Series

DANGER	• **Do not use this product for the purpose to protect a human body or a part of human body.** • **This product is not intended for use as explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.**
WARNING	**This product is a sensor of direct current power supply type. Do not apply alternating current. Doing so may cause rupture or burnout.**
NOTICE	• **Do not wire this product along with power lines or high-tension lines. Doing so may lead to product malfunctions or damage due to noise.** • **Do not use this product outdoors or in a place where extraneous light can enter the light-receiving element directly.** • **Use with an over current protection device which is rated 30 V or more and not more than 1 A.**

1-2 Safety Precautions on Laser Product

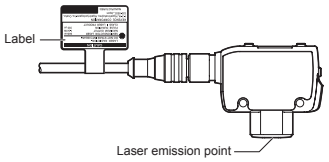
This product employs a semiconductor laser for its light source.

Item	Description
Wavelength /Output /Pulse width	660 nm/1.0 mW/330 μs
FDA(CDRH) Part1040.10	Class Ⅱ laser product
IEC 60825-1 (JIS C 6802)	Class 2 laser product

Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.

WARNING	• **Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.** • **Do not disassemble, remodel or repair this product. Laser emission from this product is not automatically stopped when it is disassembled.** • **Precautions on Class 2 Laser Product** **- Do not stare into the direct or specularly reflected beam.** **- Do not direct the beam at other people or into areas where other people unconnected with the laser work might be present.** **- Be careful of the path of the laser beam. If there is a possibility that the operator may be exposed to the specular reflections, block the beam by installing a protective enclosure.** **- Install the products so that the path of the laser beam is not as the same height as that of human eye.**

■ **Location of label and laser emission point**



● **FDA warning/certification/identification label (included with the product, English)**

Regardless of the country or region the product is used, affix the FDA warning/certification/identification label included in the package of this product as shown on the illustration. (Affix this label in a location that is not splashed with oils or chemicals.)

● **Laser warning/explanation labels (included with the product in each language)**

When using this product outside of U.S., use the suitable warning/explanation label included in the package of this product according to the countries and/or regions where this product is used. In this case, it can be affixed on the FDA warning label, which has already been affixed to this product.

1-3 Precautions on Regulations and Standards

■ **UL Certification**

This product is an UL/c-UL Listed product.
- UL File No. E301717
- Category NRKH, NRKH7

Be sure to consider the following specifications when using this product as a UL/c-UL Listed Product.
- Use a power supply with Class 2 output defined in NFPA70 (NEC: National Electrical Code).
- Power supply, External input and Control output circuits shall be connected to a single Class 2 source only.
- Install the product at the ambient temperature 45°C or below when using with following optional cable. (OP-75721, OP-85502, OP-75722, OP-87274)

■ **CE and UKCA Marking**

Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable EU Directive(s) and UK regulations, based on the following specifications. Be sure to consider the following specifications when using this product in the Member States of European Union and in the United Kingdom.

● **EMC Directive (CE) and Electromagnetic Compatibility Regulations (UKCA)**

Applicable standard: (BS)EN60947-5-2, Class A

Remarks: These specifications do not give any guarantee that the end product with this product incorporated complies with the essential requirements of EMC Directive and Electromagnetic Compatibility Regulations. The manufacturer of the end-product is solely responsible for the compliance on the end-product itself according to EMC Directive and Electromagnetic Compatibility Regulations.

■ **FCC Regulations**

This product complies with the following regulations specified by the FCC.
- Applicable regulation FCC Part 15 Subpart B ClassA
- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interface, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1-4 Specifications

Type		Distance setting
Appearance		M18 Threaded Mount
Model		LR-ZH490CB*1
Detectable distance		25 to 490 mm (465 to 0)*2
Standard detection deviation		25 to 170 mm : 9 mm 170 to 290mm : 25mm 290 to 390mm : 40mm 390 to 490mm : 50mm
Display resolution		1 to 5 (1 to 5 mm)
Spot diameter		Approx. ϕ3 mm
Response time		1.5 ms/10 ms/50 ms selectable
Light source	Type	Red laser (660 nm)
	Laser class	Class 2 laser product (IEC60825-1) Class Ⅱ Laser product (FDA(CDRH) Part1040.10)
Function	Indicator	3-digit 7-segment display (white), output indicator (yellow), DATUM indicator (orange), 1 spot indicator (green)
	Timer	OFF/ON delay/OFF delay/One-shot
Specifications	Power voltage	10 to 30 VDC, including 10% ripple (P-P), Class 2 or LPS
	Power consumption	450 mW or less (18 mA or less at 24 V, 34 mA or less at 12 V)
	Control output	NPN open collector/PNP open collector selectable, Applied voltage 30 VDC or less, Control current 100 mA or less, Residual voltage 1.2 V or less at 10 mA or less, 2 V or less at 10 to 100 mA
	Protection circuit	Protection against reverse power connection, output overcurrent, output surge, reverse output connection
	Output operation	Light-ON/Dark-ON selectable
	External input	Short-circuit current NPN: 1 mA or less/ PNP: 2 mA or less For input time, refer to the time chart. (Instruction manual page 5)
Environmental resistance	Enclosure rating	IP68(IEC60529)/IP69K(DIN40050-9)/ 4X, 6P, 13(NEMA250)
	Ambient light*3	Incandescent lamp: 10,000 lx or less Sunlight: 20,000 lx or less at 240 mm Incandescent lamp: 2,000 lx or less Sunlight: 4,000 lx or less at 490 mm
	Ambient temperature	−10 to +50°C (no freezing)
	Storage temperature	−25 to +75°C (no freezing)
	Ambient humidity	35 to 85%RH (no condensation)
	Shock resistance	1,000 m/s² in X, Y, Z axis directions respectively 6 times
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm in the X, Y, Z axis directions respectively, 2 hours
	Insulating resistance	20 MΩ or more (500 VDC)
	Withstand voltage	1,000 VAC 50/60 Hz 1 min
Material		Case: SUS316L, Display: PES, Lens cover: PMMA with scratch-resistant coating, Packing/Connector ring: FKM Nut: SUS316L, Toothed washer: SUS304
Weight		Approx. 75 g

*1 IO-Link specification v.1.1/COM2 (38.4 kbps) is supported. (Only when PNP output is selected.)
You can download a setup file from the KEYENCE website (www.keyence.com).
If you are using the product in an environment in which you cannot download files over the Internet, contact your nearest KEYENCE office.
*2 Display reading used as a guide for the detecting distance. When the setting value is tuned, the readout shifts. When the value exceeds "-99", "-FF" is displayed.
*3 When the response time is 10 ms

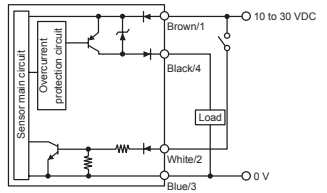
1-5 Package contents

- Sensor
  A connector cap is supplied with connector sensors.
- FDA warning/certification/identification label
- Laser warning/explanation labels
- Instruction Manual
- Nut
- Toothed washer

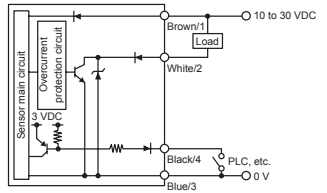
2. Installation and Wiring

2-1 I/O Circuit Diagram

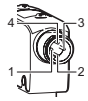
● **When PNP output is selected**



● **When NPN output is selected**



2-2 Wiring

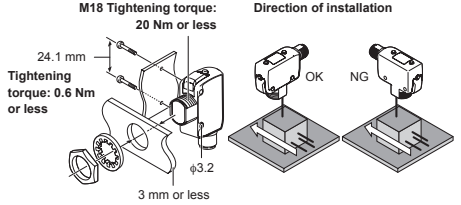


1 : 10 to 30 V
2 : OUT (NPN)/IN (PNP)
3 : 0 V
4 : OUT (PNP)/IN (NPN)

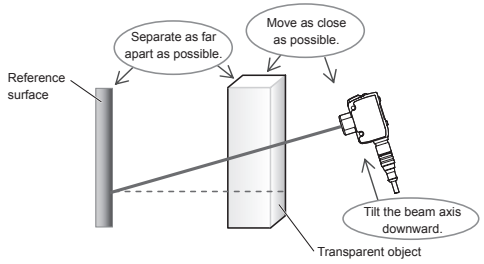
M12 Connector tightening torque: 0.8 Nm

* Tighten the connector by a hand, and then retighten it by using tools and so on. Insufficient tightening will degrade water-resistant performance.

2-3 Installation



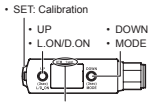
■ **If detection is unstable**
- When detecting transparent targets, move the sensor as close as possible to the workpiece, and move the workpiece as far away as possible from the background for increased stability.
- Tilt the optical axis of the sensor as much as possible in reference to the background surface. (10° or more)



- For thin objects or transparent objects, use of "Universal Change Detection" is recommended.(See "■ Universal Change Detection" (page 3))
- If the sensor is affected by ambient light, install a light blocking plate, or change the installation location.

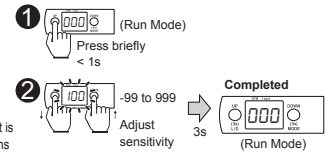
3. Settings

3-1 Part names and functions



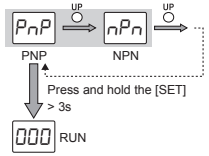
DTM : This lights up when datum calibration is performed.
1 spot : This turns off when no light is returned, multiple reflections occur, or if detection is not stable after initiating "Universal Change Detection".

● Manual adjustment



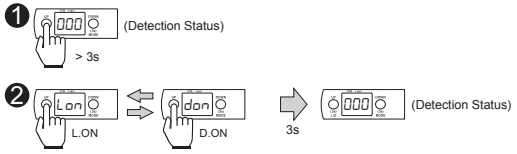
3-2 Initial Settings (PNP/NPN Selection)

When the power is turned on for the first time after purchase, or initialization is performed, the initial setting (PNP/NPN selection) is required as shown below.

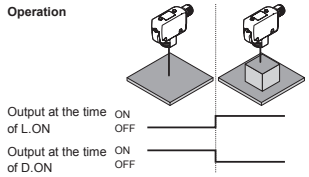


* After the initial setup is complete, "PNP/NPN selection" setting cannot be changed. To change this setting, initialize the sensor. "■ Initialization (return sensor to factory default settings)" (page 4)

3-3 Output configuration (L.ON ↔ D.ON)

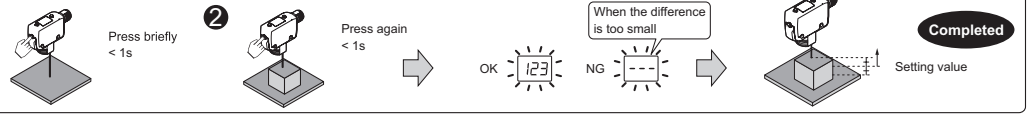


Operation

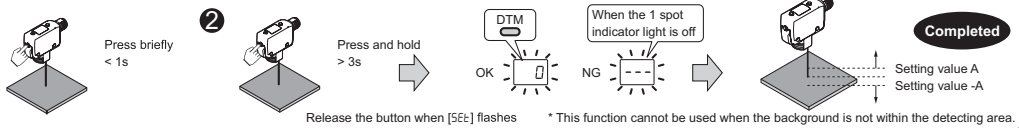


3-4 Sensitivity adjustment

When differentiating two distinct state (i.e. part present vs. absent)(2-point calibration)



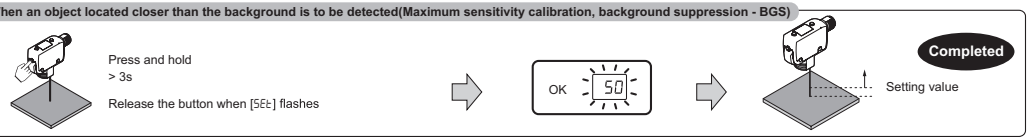
Do-it-all detection for opaque targets(Datum calibration)



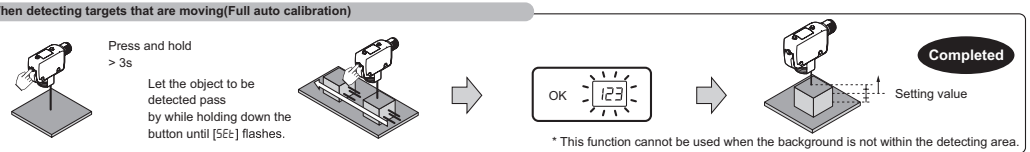
Release the button when [SEt] flashes

* This function cannot be used when the background is not within the detecting area.

When an object located closer than the background is to be detected(Maximum sensitivity calibration, background suppression - BGS)

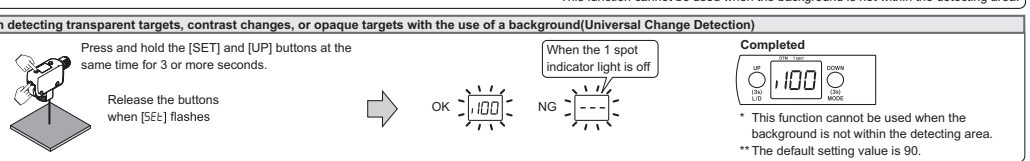


When detecting targets that are moving(Full auto calibration)



* This function cannot be used when the background is not within the detecting area.

When detecting transparent targets, contrast changes, or opaque targets with the use of a background(Universal Change Detection)



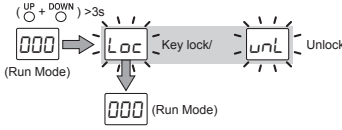
* This function cannot be used when the background is not within the detecting area.
** The default setting value is 90.

■ **Universal Change Detection**

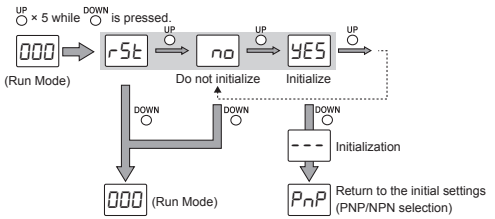
"Universal Change Detection" works by storing the light receiving pattern (distance and returned light intensity) associated with a set background or reference surface. From here, the sensor is able to detect any variations from the calibrated light receiving pattern (position changes and/or intensity changes). To ensure the sensor properly detects changes in position or returned light intensity, the "DSC function" is turned ON to ignore gradual changes in the background due to buildup or vibration.
The "DSC function" can be turned OFF, or the correction time can be changed. (For details, see 4-3 "DSC function" (page 5))
When using "Universal Change Detection", the display represents the degree of conformity with the calibrated light receiving pattern of the background. The display value when fixed on the set background is "100". This value decreases as the degree of conformity with the background decreases. (When detection appears to be unstable, refer to "■ If detection is unstable" (page 2))

3-5 Useful functions

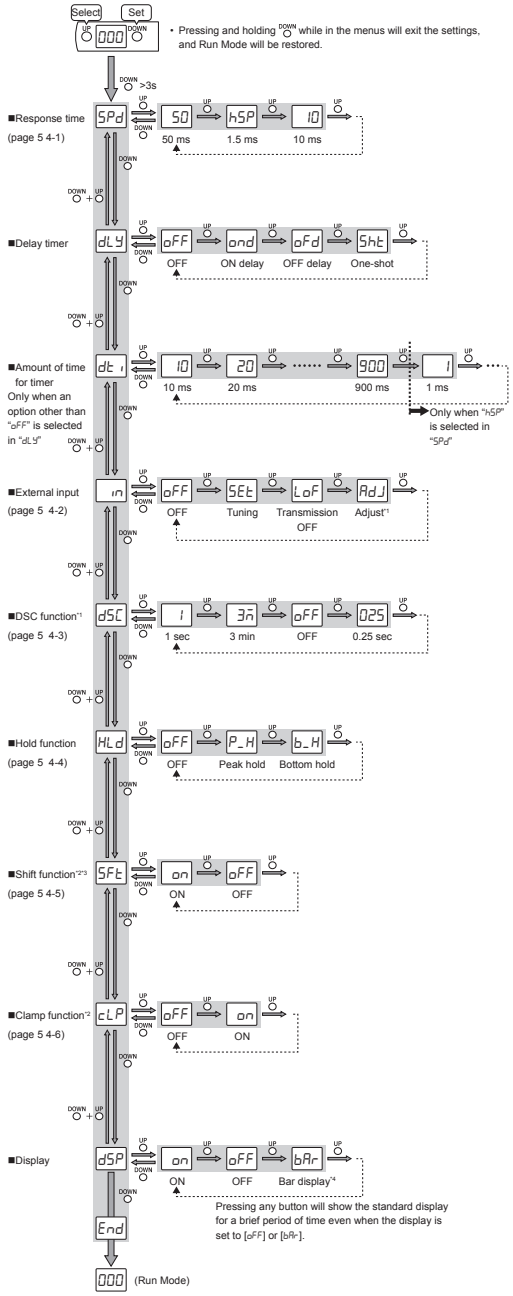
■ **Key lock**



■ **Initialization (return sensor to factory default settings)**



4. Advanced Settings



*1 Enabled only when "Universal Change Detection" is performed.
*2 Disabled when "Universal Change Detection" is performed.
*3 Utilized when "Datum calibration" is performed, regardless of setting.
*4 Cannot be set when "Universal Change Detection" is performed.

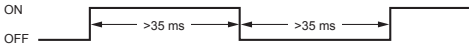
4-1 Response time (SPd)

The longer the response time, the more reliable and stable the detection.
When detection is unstable due to the workpieces moving at a high speed, set the response time to a smaller value.

4-2 External input (in)

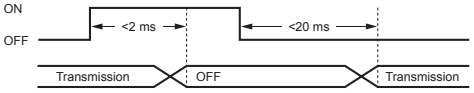
Turning the external input wire ON will enable one of the following functions to be performed.

- **Tuning (SEt)**
  This performs the same function as the [SET] button.

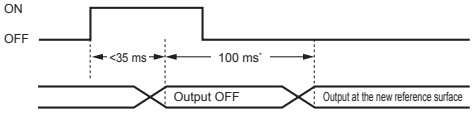


* "Universal Change Detection" cannot be performed.

- **Transmission OFF (LoF)**
  This turns off the laser diode.



- **Adjust (RdJ)**
  Enabled only when "Universal Change Detection" is performed.
  When enabled, this function will recalibrate the background. There is no limit to the number of times this feature can be used. The setting is reset when power is cycled.



* 250 ms when the response time is 50 ms

4-3 DSC function (dSC)

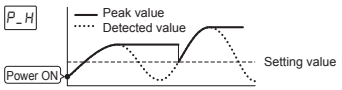
Enabled only when "Universal Change Detection" is performed. The DSC function works by compensating for gradual changes in the received light pattern of the background, caused by vibration or buildup, and maintains the display value at "0.100". This allows the sensor to only sense instantaneous changes in position or returned light intensity when a target is present. The correction time can be changed in the settings.

- 0.25 seconds (025): Correct approx. every 0.25 seconds.
- 1 second (1): (Default): Corrects approx. every second.
- 3 minutes (3m): Corrects approx. every 3 minutes.
- OFF (oFF): Sets the DSC function to OFF.

(Note)
When the speed of an object is very slow, the correction function may be affected by the object, and detection may not be correctly performed.
In this case, slow down the correction time, or set this function to OFF.

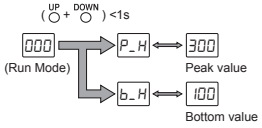
4-4 Hold function (HLd)

Display values can be held. The hold value is updated each time the detected value exceeds the setting value.



●Setting procedure

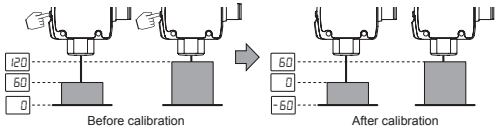
1. Set the hold function (page 4).
2. Switch the display screen.



4-5 Shift function (SFt)

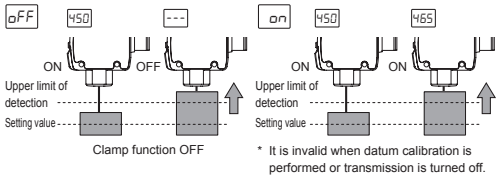
Can be used for calibrations other than "Universal Change Detection".
Turning the shift function ON will shift the display when calibrating. In Datum calibration, the display value is shifted regardless of this function setting.

(Example of a 2-point calibration)



4-6 Clamp function (cLP)

Can be used for calibrations other than "Universal Change Detection".
Turning the clamp function ON will maintain the previous display value and output status when light is not received by the unit.



* It is invalid when datum calibration is performed or transmission is turned off.

5. Troubleshooting

5-1 Notes when using "Universal Change Detection"

- If the [1spot] indicator is off after calibration, detection is unstable. The possible causes are shown below. Check the installation condition, and perform calibration again.
  - The distance between the sensor and the background has changed by 5% or more from the calibrated distance.
  - An insufficient amount of light has been reflected from the background.
- If the response time is changed after calibration, perform calibration again.

5-2 Error display

Display	Description	Checks and Remedies	Control Output
ErC	Current of 100 mA or more flows through the control output	• Check power resistance. • Check the control output cable for contact with other cables.	OFF
ErS	System error	Contact the nearest sales office.	OFF
ErL	Laser diode failure		FAR
ErE	Error in the EEPROM that stores sensor settings*		Normal
ooo	Excessive reflected light	Adjust the installation angle of the sensor.	Inconsistent
---	Insufficient reflected light	• Verify that the detecting distance is within specifications. • Adjust the installation angle of the sensor.	FAR
-FF	The detected object is too far from the display range	• Move the target closer. • Turn OFF the shift function.	Normal
0 to 100	The "Universal Change Detection" mode is being utilized.	Use as is.	Normal
Loc	The key lock function is enabled	Release the key lock function by pressing UP and DOWN at the same time (> 3s).	Normal
P_H	The peak value is displayed	Press UP and DOWN at the same time to switch screens.	Normal
b_H	The bottom value is displayed	Press UP and DOWN at the same time to switch screens.	Normal
No display or indicators	The sensor is not turned on	• Check the power voltage and power capacity. • Check the sensor power cable.	Inconsistent

* The settings can be rewritten up to 1 million times.

5-3 Default Settings/Values List

Item	Default
Response time	50 ms
Delay timer	OFF
Amount of time for timer	10 ms
External input	OFF
DSC function	1 sec

Item	Default
Hold function	OFF
Shift function	ON
Clamp function	OFF
Display	ON
Setting value	LR-ZH490*: 100 During "Universal Change Detection": 90
Output operation	L.ON

5-4 WARRANTIES AND DISCLAIMERS

(1) KEYENCE warrants the Products to be free of defects in materials and workmanship for a period of one (1) year from the date of shipment. If any models or samples were shown to Buyer, such models or samples were used merely to illustrate the general type and quality of the Products and not to represent that the Products would necessarily conform to said models or samples. Any Products found to be defective must be shipped to KEYENCE with all shipping costs paid by Buyer or offered to KEYENCE for inspection and examination. Upon examination by KEYENCE, KEYENCE, at its sole option, will refund the purchase price of, or repair or replace at no charge any Products found to be defective. This warranty does not apply to any defects resulting from any action of Buyer, including but not limited to improper installation, improper interfacing, improper repair, unauthorized modification, misapplication and mishandling, such as exposure to excessive current, heat, coldness, moisture, vibration or outdoors air. Components which wear are not warranted.

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17795GB 2034-1 96M17795 Printed in Japan