KEYENCE

96M12305

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Self-contained
CMOS Laser Sensor

LR-ZB250AN/ZB250AP



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.

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

Safety Information for LR-ZB Series

⚠ WARNING	• **This product is only intended to detect object(s). Do not use this product for the purpose to protect a human body or part of a human body.** • **This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.** • **This product uses DC power. The product may explode or burn if an AC voltage is applied.**

NOTICE	• **Do not wire the cable along with power lines or high-tension lines, as the sensor may malfunction or be damaged due to noise.** • **When using a commercially available switching regulator, ground the frame ground terminal and ground terminal.** • **Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.** • **Use with an over current protection device which is rated 30 V or more and not more than 1 A.**

Safety Precautions on Laser Product

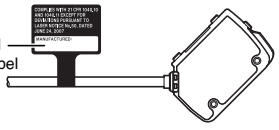
⚠ WARNING	• **This product employs a semiconductor laser for the light source.** • **Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.** **Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.** • **Laser emission from this product is not automatically stopped when it is disassembled. Do not disassemble this product.** • **Do not stare into the beam.**

Wavelength/Output	660 nm/145 µW
FDA(CDRH) Part1040.10 *	Class 1 laser product
IEC 60825-1	Class 1 laser product

* The laser classification for FDA (CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No.50.

■ Certification and Identification Label

- When using this product in the U.S. affix the Certification and Identification Label included in the package of this product as shown on the right.
  (Affix this label in a location that is not splashed with oils or chemicals.)



Consignes de sécurité relatives au Laser

⚠ AVERTISSEMENT	**L'utilisation des commandes ou réglages ou l'exécution des procédures autres que celles spécifiées dans les présentes exigences peuvent être la cause d'une exposition à un rayonnement dangereux.**

Precautions on Regulations and Standards

■ UL Certification

This product is an UL/C-UL Listed product.
- UL File No.: E301717, Category: NRKH/NRKH7, Enclosure Type 1 (UL50)

Be sure to consider the following specifications when using this product as a UL/CUL 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.

■ CE Marking

KEYENCE Corporation has confirmed that this product complies with the essential requirements of the applicable EC Directive, based on the following specifications.
Be sure to consider the following specifications when using this product in a member state of European Union.

- **EMC Directive (2004/108/EC)**
  - Applicable standard EMI: 60947-5-2, Class A, EMS: 60947-5-2

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

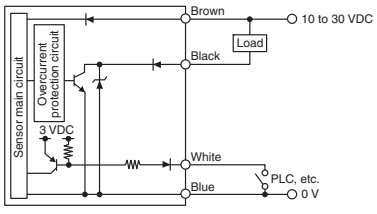
Specifications

Type		Distance setting
Appearance		Rectangular
Model	**NPN**	LR-ZB250AN
	PNP	LR-ZB250AP
Detectable distance		35 to 250 mm (215 to 0)*1
Standard detection deviation		35 to 180 mm : 9 mm 180 to 250 mm : 25 mm
Display resolution*2		1 to 3 (1 to 3 mm)
Spot diameter		2.4 X 1.2 mm at 250 mm
Response time		1.5 ms / 10 ms / 50 ms selectable
Connection		2 m cable
Light source	**Type**	Red laser (660 nm)
	Laser class	Class 1 laser product (IEC60825-1, FDA (CDRH) Part1040.10*3)
Function	**Indicator**	3-digit 7-segment display (red), 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 12V)
	Control output	LR-ZB250AN: NPN Open collector LR-ZB250AP: PNP Open collector 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 P3)
Environmental resistance	**Enclosure rating**	IP68 (IEC60529)/IP69K (DIN40050-9)/ 4X, 6P, 13 (NEMA250)
	Ambient light*4	Incandescent lamp: 2000 lx or less Sunlight: 4000 lx or less
	Ambient temperature	-10 to +50°C (No freezing)
	Storage temperature	-25 to +75°C
	Ambient humidity	35 to 85%RH (No condensation)
	Shock resistance	1000 m/s^2 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	1000 VAC 50/60 Hz 1 min
Material		Case: SUS316L, Display: PES, Lens cover: PMMA with scratch-resistant coating, Packing/Connector ring: FKM
Weight		Approx. 110 g (Including cable)

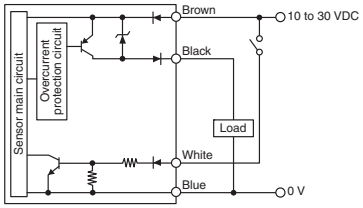
*1 Display reading used as a guide for the detecting distance. When the setting value is tuned, the readout shifts. When the value exceeds "-99", "-FF" is displayed.
*2 The display resolution is "1" in "I-DATUM mode".
*3 The laser classification for FDA (CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No.50.
*4 When the response time is 10 ms

I/O Circuit Diagram

LR-ZB250AN

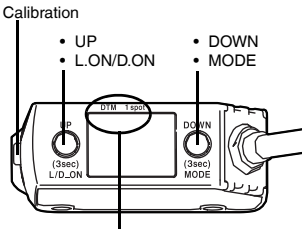


LR-ZB250AP



Basic Operation

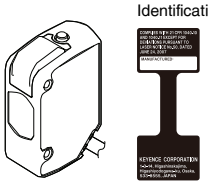
■ Part names and functions



DTM: This lights up when datum calibration is performed.
1 spot: This turns off when no light enters or multiple reflections occurs.

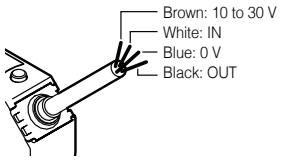
■ Package contents

- Sensor
- Certification and Identification Label



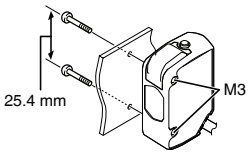
- Instruction Manual

■ Wiring

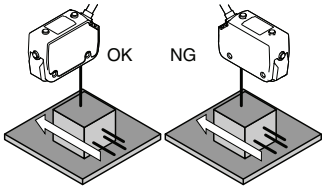


■ Installation

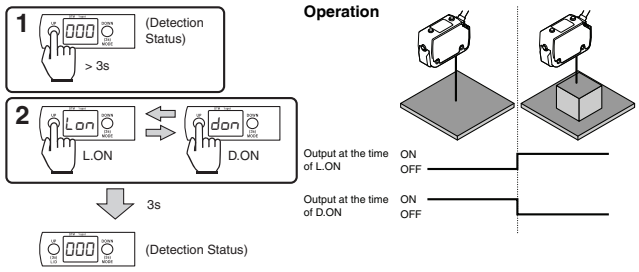
Tightening Torque: 0.6 Nm or less



Direction of installation

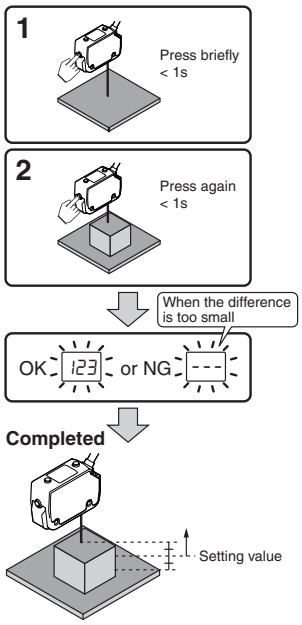


■ Output configuration (L.ON ↔ D.ON)

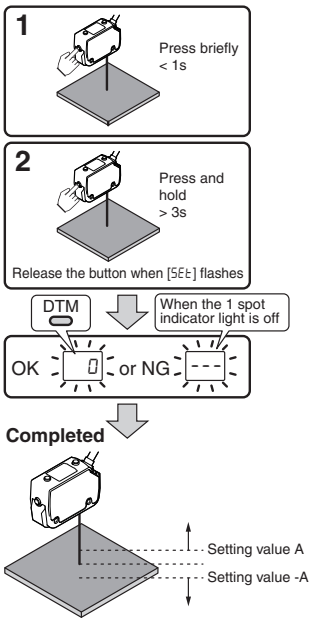


■ Sensitivity adjustment

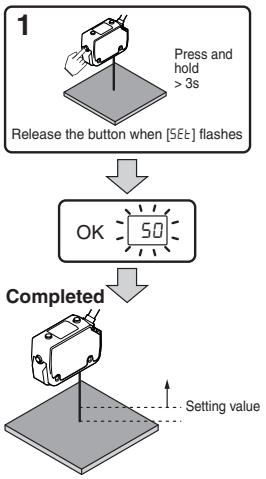
- **Basic setting (high accuracy) (2-point calibration, background suppression - BGS)**



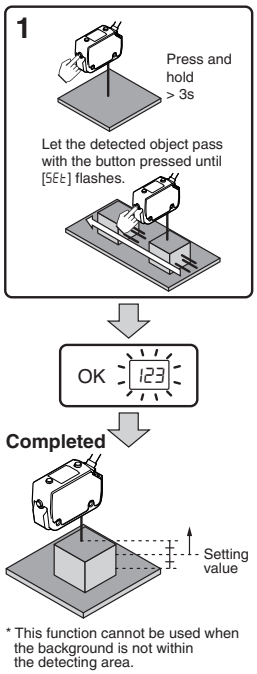
- **When an object other than the background is to be detected (Datum calibration, foreground suppression - FGS)**



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

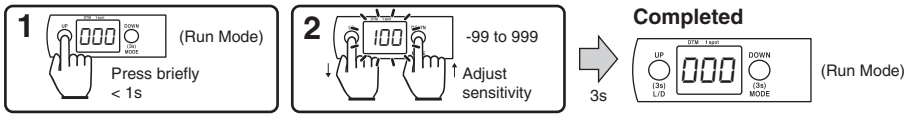


- **Moving target calibration (Full auto calibration, background suppression - BGS)**

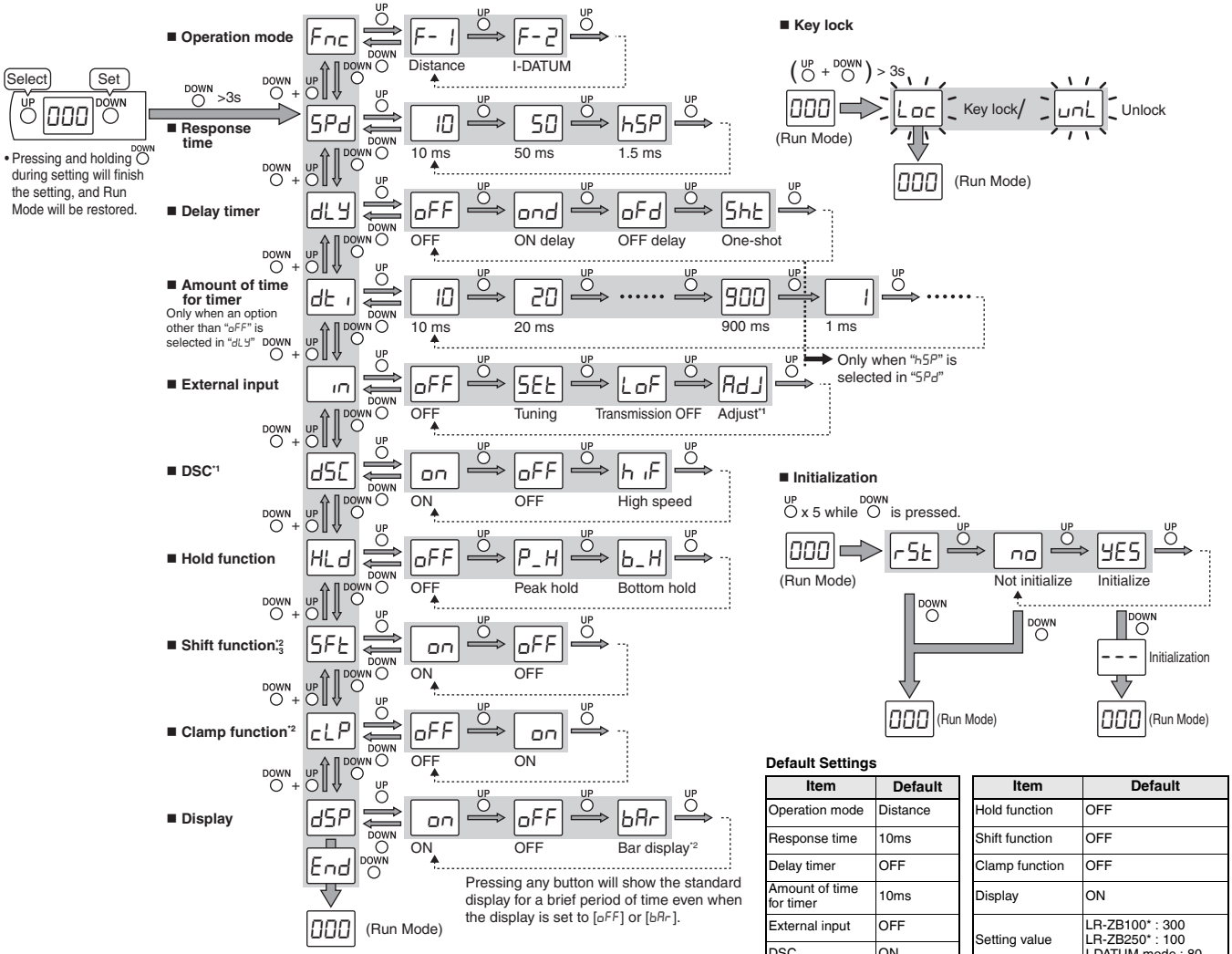


* This function cannot be used when the background is not within the detecting area.

- **Manual adjustment**



Advanced Settings



*1 This can be set only when the operation mode is set to "I-DATUM (F-2)".
*2 This can be set only when the operation mode is set t o "Distance (F-1)".
*3 This cannot be set when "Datum tuning" is being performed.

Default Settings

Item	Default
Operation mode	Distance
Response time	10ms
Delay timer	OFF
Amount of time for timer	10ms
External input	OFF
DSC	ON

Item	Default
Hold function	OFF
Shift function	OFF
Clamp function	OFF
Display	ON
Setting value	LR-ZB100* : 300 LR-ZB250* : 100 I-DATUM mode : 80
Output operation	L.ON

Various Functions

■ Operation mode (Fnc)

The "Distance (F-1)" mode detects distance.
"I-DATUM (F-2)" memorizes the "Light receiving pattern" and detects the amount of change from the reference surface. Even a subtle uneven part can be detected if the surface condition or color is different. Also, this mode is suitable for the detection of transparent objects.The display value is "100" for the background (reference surface) and the figure decreases when the target object is detected.

- **Setting procedure in I-DATUM mode (F-2)**
  1. Set the operation mode to "I-DATUM (F-2)".
  2. Set the reference surface.
     - **Standard tuning**
       1. Press the [SET button] briefly (<1s).
       2. Press and hold the [SET button] (>3s).

       [DTM indicator] will illuminate.
     - **High sensitivity tuning**
       1. Press and hold the [SET button] (>3s).

       [DTM indicator] will not illuminate.

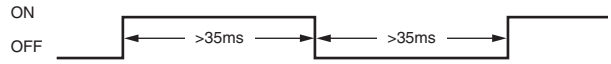
If no detection is achieved with the standard tuning, use the high sensitivity tuning.

When detecting transparent objects, refer to the "LR-ZB250AN/ZB250AP supplemental manual".
You can download the "LR-ZB250AN/ZB250AP supplemental manual" from the KEYENCE homepage.

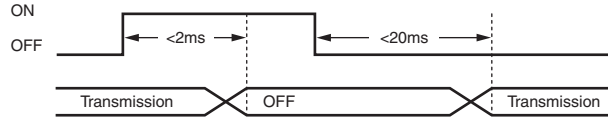
■ External input (in)

Turning the external input line (white line/(2) pin) ON will enable the following functions to be performed.

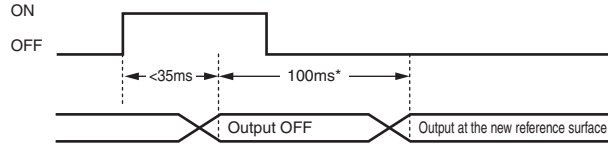
- **Tuning (SEt)**
  This performs the same function as the [SET] button.



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



- **Adjust (AdJ)**
  Sets the reference surface. There is no limit for the number of times of setting. The setting is reset by turning ON/OFF.



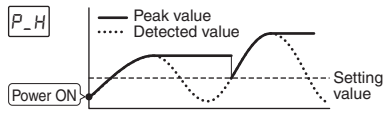
*250 ms when the response time is 50 ms

■ DSC function (dSC)

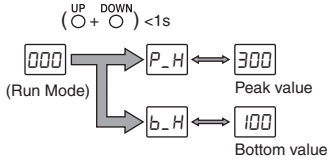
This can be set when the operation mode is set to "I-DATUM (F-2)". This mode automatically corrects the reference surface to "100" if changes due to temperature change or build-up occur. If the display value largely fluctuates on the reference surface, set the DSC function to [High speed (hiF)].

■ Hold function (HLd)

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

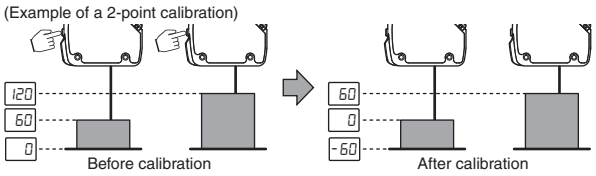


- **Setting procedure**
  1. Set the hold function (page 3).
  2. Switch the display screen.



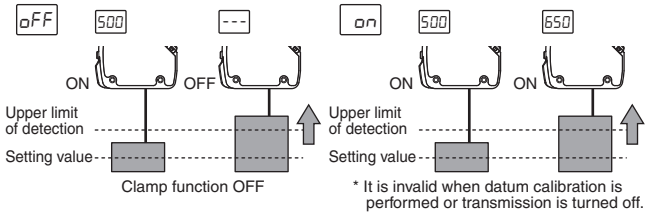
■ Shift function (SFt)

Turning the shift function ON will shift the display when tuning. In the Datum tuning/FGS, the display value is shifted regardless of this function.



■ Clamp function(cLP)

This can be used when the operation mode is set to "Distance (F- 1)". Turning the clamp function ON will keep the previous display value and output status when light cannot be received.



Troubleshooting

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
uuu	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 operation mode is "I-DATUM (F-2)".	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 when the operation mode is set to "Distance (F- 1)" and 10 thousand times in "I-DATUM mode (F-2)".

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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