KEYENCE

96M11353

Instruction Manual

Laser Displacement Sensors

LB-1000(W) Series

CONTENTS

SAFETY INFORMATION ON LB-1000 SERIES

This manual describes how to install the LB-1000 Series as well as its operating procedures and precautions. Read this manual carefully for your safety.

Symbols

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

⚠ WARNING Failure to follow instructions may lead to injury. (electric shock, burn, etc.)

⚠ CAUTION Failure to follow instructions may lead to product damage.

Note Provides additional information on proper operation.

General precautions

- At startup and during operation, be sure to monitor the functions and performance of the LB-1000 series.
- We recommend that you take substantial safety measures to avoid any damage in the event a problem occurs.
- Do not open or modify the LB-1000 series or use it in any way other than described in the specifications.
- When the LB-1000 series is used in combination with other instruments, functions and performance may be degraded, depending on operating conditions and the surrounding environment.
- 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 hazardous location and/or potentially explosive atmosphere.

SAFETY PRECAUTIONS ON LASER PRODUCT

1. Classification

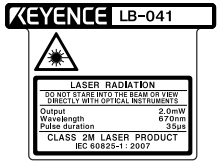
	LB-041/ LB-1001(W)	LB-081/ LB-1101(W)	LB-301/ LB-1201(W)
FDA (CDRH) 21CFR Part 1040.10	Class IIIa		IIIb
IEC/EN 60825-1	Class 2M	Class 3R	Class 3B

2. Labels

FDA (CDRH) Class IIIa [LB-041/1001(W) LB-081/1101(W)]

FDA (CDRH) Class IIIb [LB-301/1201(W)]

IEC Class 2M [LB-41]



IEC Class 3R [LB-81]

IEC Class 3B [LB-301]

3. Labels location

FDA Warning labels are attached to the sensor head as shown below. When using this product in the countries and/or regions other than U.S.A., use the IEC warning/explanatory label in the package of this product. In this case, it can be affixed on the FDA (CDRH) warning label, which has already been affixed to this product.

FDA (CDRH)

LB-041

LB-081

LB-301

4. Safety consideration

⚠ CAUTION

Use of controls or adjustments or the performance of procedures other than those specified herein may result in hazardous radiation exposure.

1) Class IIIb/3B laser products

⚠ WARNING

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

- **Do not directly look at or touch the laser beam and its reflection from a mirror-like surface.**
- **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. Make the laser path as short as possible and be sure to terminate the laser path with a diffusion reflector or diffusion absorber with proper reflectance and thermal characteristics so that the laser beam does not diffuse. (It is recommended that you install a protective enclosure.)**
- **Install the laser product carefully so that the laser beam is not unintentionally directed at mirror-like surfaces.**
- **Install the products so that the path of the laser beam is not as the same height as that of human eye.**
- **Wear protective eye goggles appropriate for the laser beam wavelength.**
- **Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.**
- **Clean the aperture regularly. In addition, stop the emission of the laser beam when cleaning.**
- **MPE (Maximum Permissible Exposure): 1.66mW/cm^2 (LB-301)**
- **NOHD (Nominal Ocular Hazard Distance): 17.2 m (LB-301) from the aperture.**

2) Class IIIa/3R laser products

⚠ WARNING

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

- **Do not directly look at or touch the laser beam and its reflection from a mirror-like surface.**
- **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. Make the laser path as short as possible and be sure to terminate the laser path with a diffusion reflector or diffusion absorber with proper reflectance and thermal characteristics so that the laser beam does not diffuse. (It is recommended that you install a protective enclosure.)**
- **Install the laser product carefully so that the laser beam is not unintentionally directed at mirror-like surfaces.**
- **Install the products so that the path of the laser beam is not as the same height as that of human eye.**
- **Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.**

3) Class 2M laser products

⚠ WARNING

Viewing the laser output with certain optical instruments designed for use at a distance (for example, telescopes and binoculars) may pose an eye hazard.

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

- **Do not stare into the 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 danger that the operator may be exposed to the laser beam reflected by specular or diffuse reflection, block the beam by installing an enclosure with the appropriate reflectance.
- **Install the products so that the path of the laser beam is not as the same height as that of human eye.**
- **Do not disassemble this product. Laser emission from this product is not automatically stopped when it is disassembled.**

5. Safety features provided with the LB-1000 series

The LB-1000 series is provided with the following safety features. Make sure these features function correctly before operating.

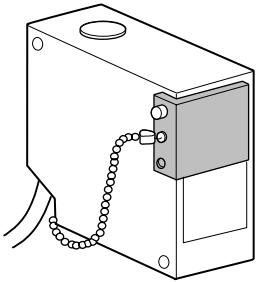
1. **Laser radiation emission warning**
   A visible LED informs you that the laser beam is being emitted, or is about to be emitted, at least 3 second after power is provided to the controller and the sensor head.
2. **Laser emission delay**
   Laser emission only starts after the LED has been ON for at least 3 seconds, thus decreasing the possibility of laser exposure.
3. **Laser emission stop input terminals**
   Terminals for controlling laser emission are provided on the controller. You can remotely control laser emission using these terminals.
4. **Key-operated switch**
   Set to the ON position to supply power. You can lock the power switch using the supplied key; the key can be removed only when the switch is set to the OFF position.
5. **Beam attenuator**
   A laser beam shield is supplied. This cover is to be attached to the laser-beam-emitting portion of the sensor head. If an operator must work in front of the sensor head and there is risk to the eyes from the laser beam, be sure to attach this cover.

SAFETY PRECAUTIONS ON LASER PRODUCT

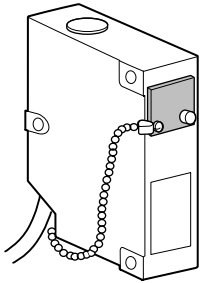
For use with shield:

Attach the shield to the front surface of the sensor head.

LB-041/LB-081



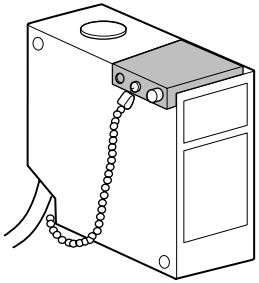
LB-301



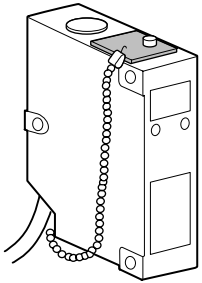
For use without shield:

Place the shield as shown below, and screw in place.

LB-041/LB-081



LB-301



PRECAUTIONS ON REGULATIONS AND STANDARDS

CE Marking

Applicable Models: LB-041/LB-1001W, LB-081/LB-1101W and LB-301/ LB-1201W

Keyence Corporation has confirmed that these products comply with the essential requirements of the applicable EC Directives, based on the following specifications. Be sure to consider the following specifications when using these products in the Member State of European Union.

■ EMC Directive (2004/108/EC)

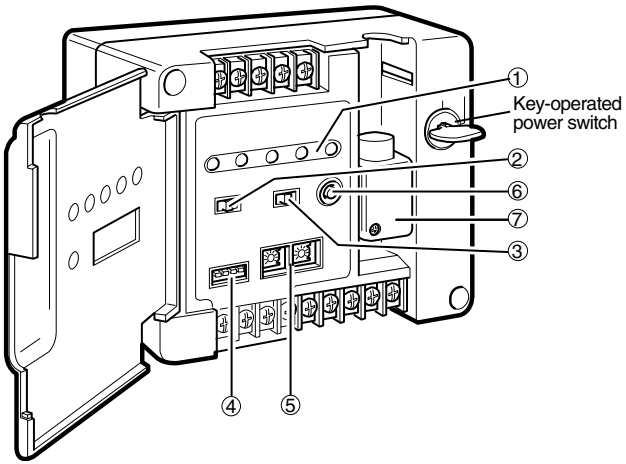
- Applicable Standard EMI: EN61326-1, Class A
  EMS: EN61326-1
- The length of the cable connected to the Sensor head or the Controller must be less than or equal to 30 m.

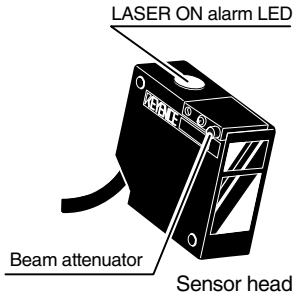
Remarks:

These specifications do not give any guarantee that the end-product with these products 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.

PART NAMES

Controller





① Indicators
TIM: Timing indicator
STB: Stability indicator (3-color indicator)
BRIGHT: Excessive light quantity indicator
DARK: Insufficient light quantity indicator
LASER ON: Laser radiation emission warning

② RESPONSE speed selector switch
Used to select response speed (0.4 ms, 10 ms, or 40 ms)

③ SENS (sensitivity) selector switch
Used to select WHITE, BLACK, or AUTO mode.

④ DIP switches (see p.11)
Used to switch to FUZZY logic control, alternating oscillation circuit, etc.

⑤ Output adjustment trimmers
SPAN: Span adjustment
For adjusting output voltage level relative to target displacement.
SHIFT: Zero point adjustment
For shifting output voltage reading to zero.

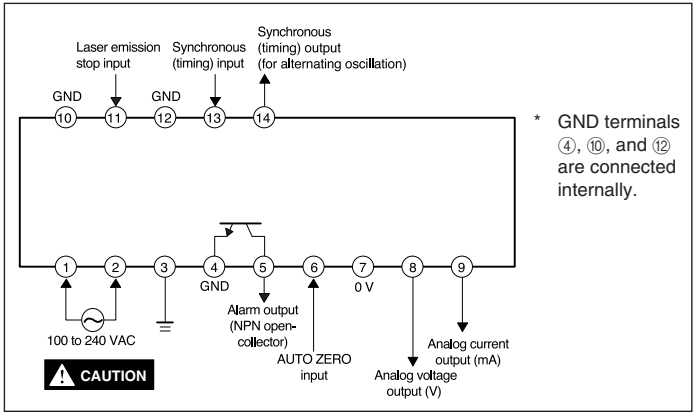
⑥ AUTO ZERO key
For resetting the analog output to 0 V (12 mA for current output).

⑦ Receptacle for sensor head cable

CONNECTIONS

LB-1001/1101/1201

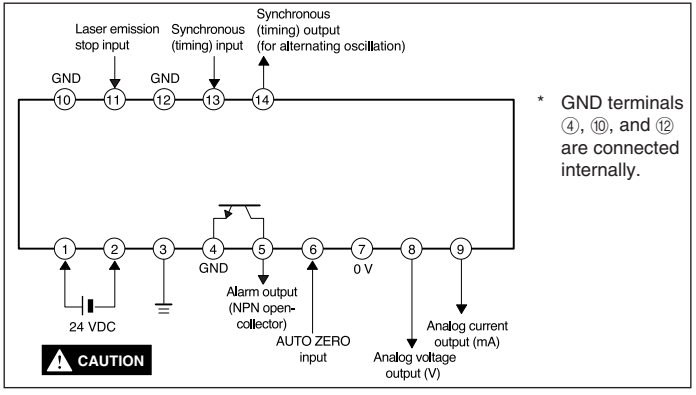
CAUTION Be sure to confirm the model number.



* GND terminals ④, ⑩, and ⑫ are connected internally.

LB-1001W/1101W/1201W

CAUTION Be sure to confirm the model number.



* GND terminals ④, ⑩, and ⑫ are connected internally.

■ Description of terminals

③ Earth ground terminal

⑤ Alarm output (NPN open-collector)
Outputs if light quantity is insufficient or excessive, or when no target is present in the operating range.

⑥ AUTO ZERO input
Connecting this terminal to a GND terminal (④, ⑩, or ⑫) resets the analog voltage output to 0 V (12 mA for current output).

⑨ Analog current output
Current of 4 to 20 mA relative to full measuring range is output.

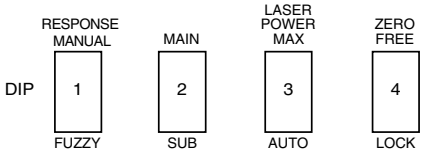
⑪ Laser emission stop input
Disconnecting this terminal from a GND terminal (④, ⑩, or ⑫) stops laser emission. Use this terminal in an emergency to stop laser emission. (Output will be retained at 12 V.)

⑬ Synchronous (timing) input
Connecting this terminal to a GND terminal (④, ⑩, or ⑫) permits timing input. Laser emission will stop, and the analog output value just prior to timing input will be retained. (DIP switch 2 of the controller must be set to MAIN.)

⑭ Synchronous (timing) output
When using 2 sensors (for thickness measurement, etc.), use this terminal to prevent mutual interference. It allows 2 sensors to alternately emit a laser beam at oscillation output of 30 Hz. (Set DIP switch 2 of one controller to MAIN, and the other to SUB.)

CONNECTIONS

■ Description of DIP switches



1 RESPONSE speed mode selector switch
To use the FUZZY logic control circuit, set the switch to FUZZY.

2 Interference suppression function selector switch
To have 2 sensors emit laser beams alternately, set the switch of one controller to MAIN and the other to SUB.

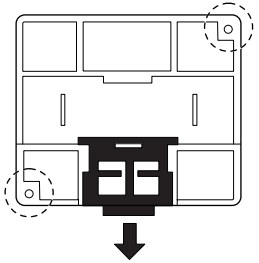
3 Laser power control selector switch
MAX: Laser emission power is set to maximum.
AUTO: Laser emission power is controlled according to changes in received light quantity. (Selecting AUTO mode prevents fluctuations in received light quantity caused by surface unevenness from affecting target measurement.

4 AUTO ZERO setting lock

INSTALLATION

Controller

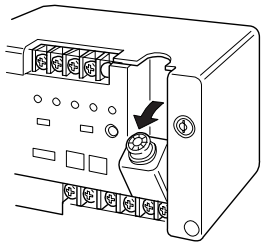
The controller can be mounted to a DIN rail. When mounting or removing the controller, pull the claw (bottom center) in the direction of the arrow. The controller can also be screw-mounted using the mounting holes provided.



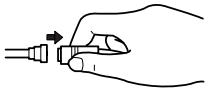
Sensor head

1. First, tilt the receptacle of the controller forward, as shown.
2. To attach the connector, gently press the plug into the receptacle, turn the plug left or right to locate the engaging position, then press until you hear a click.

(Also follow this procedure to connect an extension cable or sensor head cable to the receptacle.)

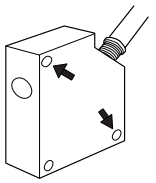


To remove the connector, hold the connecting sleeve as shown, and pull it out in the direction of the arrow.



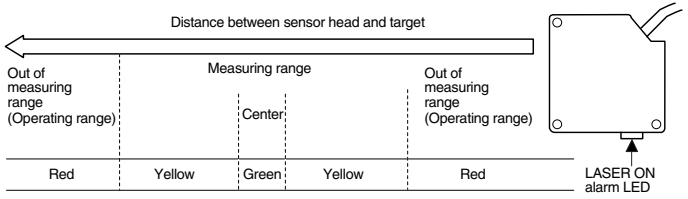
Mounting the sensor head

The sensor head has mounting holes, as shown in the figure on the right.
Secure the sensor head using M4 screws.
(LB-301 has three mounting holes.)



SETTING

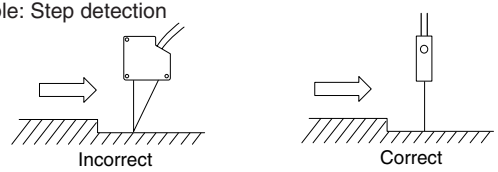
1. Adjust the distance between the sensor head and target and confirm the position with the LASER ON alarm LED. Set the sensor head so that the laser emitting surface is parallel to the measuring surface of the target, then secure it in place. (See figure below.)



When the LED lights green, the target is in the center area of the measuring range.
LB-041: approx. 40 mm
LB-081: approx. 80 mm
LB-301: approx. 300 mm

2. Adjust orientation of the sensor head (for a moving target).
Be sure to mount the sensor head as shown in the right-hand figure below to ensure stable measurement.

Example: Step detection

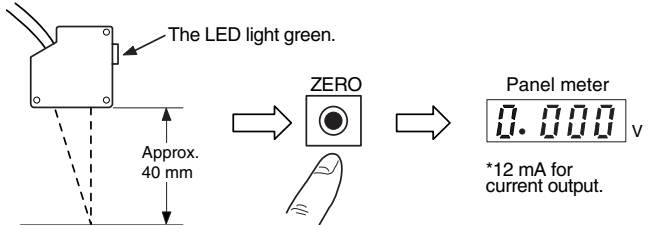


Example: Eccentricity measurement

AUTO ZERO/OUTPUT ADJUSTMENT

Press the AUTO ZERO key to reset the output voltage to zero at the mounting position.

Example: LB-041



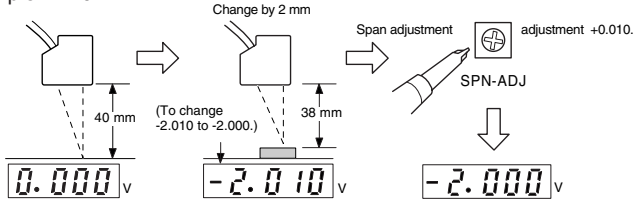
AUTO ZERO setting is possible from external terminals (connecting the ⑥ terminal to a GND terminal).

* The AUTO ZERO function can be used when the DIP switch No. 3 of the controller is set to FREE (top setting).

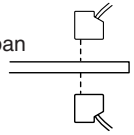
Output adjustment

If the output voltage value is not in proportion with the target displacement, adjust the output voltage using the SPAN adjustment trimmer.

Example: LB-041

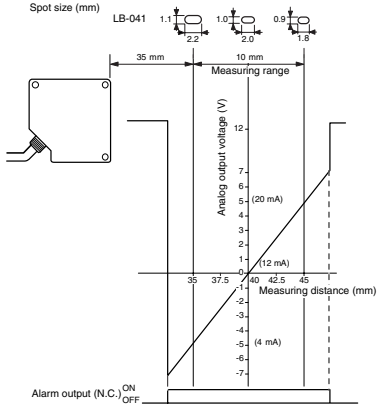


Note When a sensor is positioned on both sides of a target for measurement, be sure to adjust the span of each sensor separately.

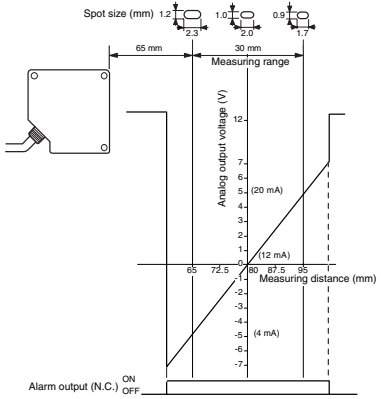


MEASURING RANGE VS. ANALOG OUTPUT

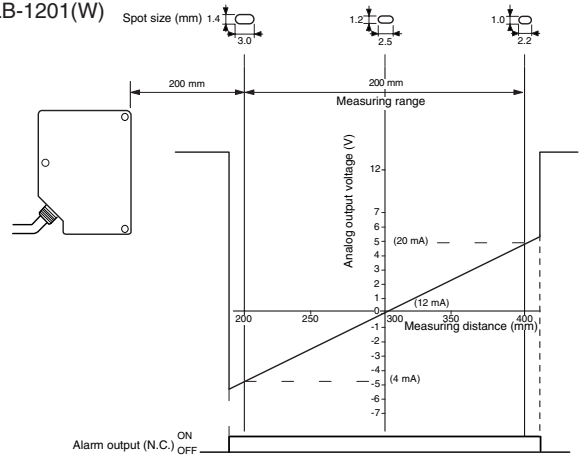
LB-041/LB-1001(W)



LB-081/LB-1101(W)



LB-301/LB-1201(W)

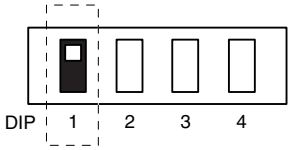


If the target is out of the measuring range:

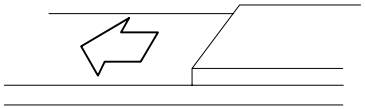
Less than 200 mm from the sensor: Analog output is retained at 12 V when the target is approximately 195 mm away from the sensor.
More than 400 mm from the sensor: Analog output is retained at 12 V when the target is approximately 405 mm away from the sensor.

SETTING DIP SWITCH 1 (FUZZY LOGIC CONTROL)

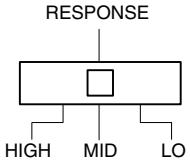
To use the FUZZY logic control circuit, set DIP switch 1 to FUZZY (bottom setting).
(The switch is factory-set to MANUAL)



The FUZZY logic control circuit is used to obtain both stability and high response speed when measuring a target traveling on a production line.



FUZZY mode is selected using the RESPONSE speed selector switch.



FUZZY mode settings

- RESPONSE speed selector switch MID
  Select for normal measurement. The optimal response speed is given according to absolute light quantity and changes in distance and light quantity received.

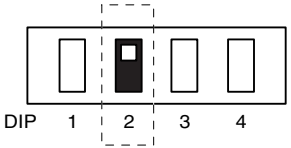
* The switch should normally be set to MID. Set to HIGH or LO only when you cannot perform accurate measurement with MID.

- RESPONSE speed selector switch HIGH
  Response speed is determined based mainly on changes in distance. Set to HIGH when positioning for stepped target detection, or detection of target recesses or projections.

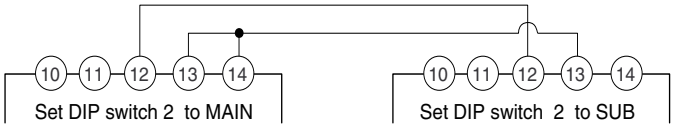
- RESPONSE speed selector switch LO
  Response speed is determined based mainly on changes in received light quantity. When detecting hairline finishes or targets of mottled material, setting the switch to LO will stabilize the output.

SETTING DIP SWITCH 2 (INTERFERENCE SUPPRESSION FUNCTION)

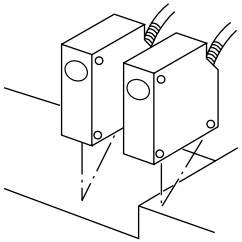
When using 2 sensor heads in close proximity, set the DIP switch of one controller to MAIN, and that of the other to SUB to suppress interference. (This can also be used for synchronized measurement.)



Wire as follows. (Upper terminals of controller)

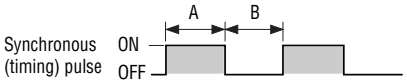


Example: Step measurement using 2 sensors.



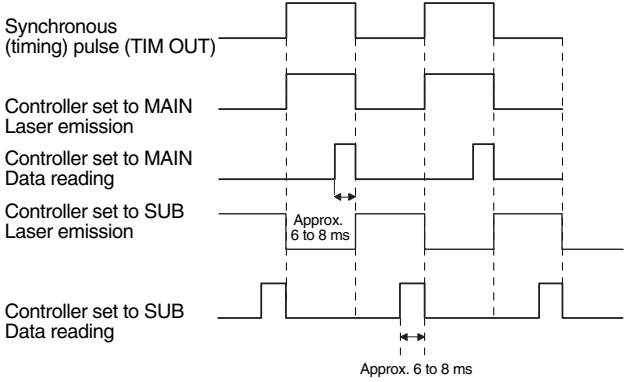
Alternating oscillation frequency and ON/OFF ratio (all models)

Frequency	ON/OFF ratio
30Hz	1 : 1



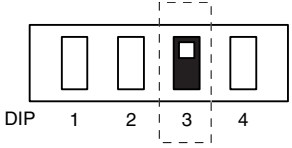
Note

- Controller set to MAIN: Monitor output is retained when the synchronous (timing) pulse is OFF.
  Controller set to SUB: Monitor output is retained when the synchronous (timing) pulse is ON.
- Controller set to MAIN: The laser beam is emitted at the rising edge of the synchronous (timing) pulse, but the signal is not read for 8 to 10 ms. Effective measurement occurs only during the last half of the synchronous (timing) pulse (6 to 8 ms).
  Controller set to SUB: The laser beam is emitted at the falling edge of the synchronous (timing) pulse, but the signal is not read for 8 to 10 ms. Effective measurement occurs only during the last half of the synchronous (timing) pulse (6 to 8 ms).



SETTING DIP SWITCH 3 (LASER POWER CONTROL)

Laser power control

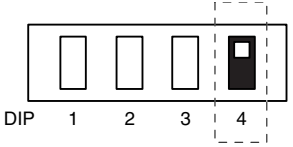


When the DIP switch is set to AUTO (bottom setting), emitted laser beam quantity is automatically controlled according to the reflectivity of the target. The switch is factory-set to MAX.

The AUTO mode is especially effective for measuring metal targets or targets of a mottled material.

SETTING DIP SWITCH 4 (AUTO ZERO)

AUTO ZERO setting lock



DIP switch 4 is factory-set to FREE. In this mode, AUTO ZERO can be performed by either using the key on the controller panel or short circuiting the terminals.

To prevent the output voltage from being mistakenly reset to zero, disable AUTO ZERO by setting the switch to LOCK (bottom setting).

Note:

- The SHIFT adjustment trimmer on the controller panel functions only when the switch is set to LOCK.
- When AUTO ZERO is used with the DIP switch set to FREE and then the switch is switched to LOCK, the AUTO ZERO setting becomes invalid and the AUTO ZERO function is disabled.

Caution:
After DIP switch 4 has been switched between FREE and LOCK, be sure to turn the power supply OFF once and then ON again.

TROUBLESHOOTING

If a problem occurs, first apply the remedy given in the troubleshooting guide below.
If this does not solve the problem, please contact your nearest distributor or Keyence office.

Problem	Cause	Remedy
Analog voltage does not change. (Measured value is not indicated.)	Sensor head is incorrectly mounted.	Secure sensor head in range where LASER ON alarm LED lights yellow or green.
	Connector of sensor head is not firmly inserted.	Fully insert connector to make proper contact.
	BRIGHT or DARK indicator is lit.	Adjust position and orientation of the sensor head to increase or decrease the light quantity received.
		Set DIP switch 3 to AUTO (bottom setting) to control laser power.
		Switch sensitivity selector switch.
Analog voltage output fluctuates.	Filter glass of sensor head is dirty	Clean using a soft cloth.
	Noise is affecting sensor operation.	Isolate power cable and connecting cable(s) of sensor from high-tension lines or power lines.
	There is vibration in feeder line.	Minimize vibration near measuring position.

Problem	Cause	Remedy
Resolution fluctuates greatly. Measurement is inaccurate.	Output voltage value is not in proportion with target displacement.	Calibrate output voltage using SPAN adjustment trimmer.
	RESPONSE speed selector switch is set to HIGH (0.4 ms).	If high response speed is not required, select lowest possible response speed.
	Target is moving.	Set DIP switch 1 to FUZZY and use FUZZY logic control.
	Extraneous light is affecting sensor operation.	Make sure that extraneous light does not fall on the light emitting/ receiving lenses of the sensor head.
When 2 sensors are used for thickness measurement, etc., analog output voltage fluctuates greatly.	SPAN adjustment has been performed for only one sensor.	Perform SPAN adjustment for each sensor separately.

HINTS ON CORRECT USE

Compatibility ⚠ CAUTION

The controller and sensor head of the LB-1000 series have been factory-calibrated in pairs. Therefore, in order to satisfy specifications, be sure to use a sensor head and controller having the same serial number.

Interference prevention ⚠ CAUTION

- Isolate the power cable and connecting cable(s) of the sensor from high-tension lines or power lines; otherwise the sensor may malfunction or the laser diode may deteriorate or be broken due to noise interference.
- The sensor head is case-grounded. If noise occurs at the mounting position of the sensor head, install insulation between the mounting position and sensor head.
- To prevent radiation noise interference, cover the sensor head with a metal casing. (Be sure that noise does not enter at the mounting position of the casing.)
- To prevent radiation noise and inductive noise interference, shield the cables with metal or use independent metal conduits.
- To avoid a malfunction due to excessive noise interference, be sure to correctly ground the earth ground terminal.

Operating environment ⚠ CAUTION

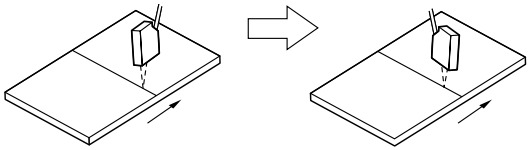
- Always keep the sensor head free from light-refracting substances such as water or oil.
- Make sure that extraneous light does not fall on the lenses of the sensor head.
- When extremely high measurement accuracy is required, install a cover over the sensor head to prevent light from entering.
- When no target is present, the effect of extraneous light on the sensor can be ignored by using timing input.

AUTO ZERO function lock (DIP switch 4)

- When DIP switch 4 is set to LOCK (bottom setting), the AUTO ZERO key on the front panel does not function. Note that when the switch is set to FREE, the AUTO ZERO function operates but the SHIFT adjustment trimmers cannot be used to adjust output.
- When AUTO ZERO is used with the DIP switch set to FREE and then the switch is switched to LOCK, the AUTO ZERO setting becomes invalid, and the AUTO ZERO function is disabled.
- After switching between FREE and LOCK, turn the power supply OFF once and then ON again to ensure that the monitor voltage will be normally output.

Sensor head orientation Note

When a target consists of differently colored portions or different materials separated by a border, measurement error may result depending on the orientation of the sensor head. To minimize measurement deviation, install the sensor head parallel to the border line as shown in the illustration below.



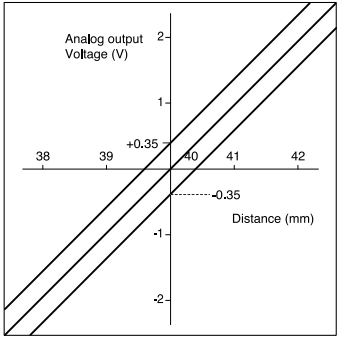
Operating illumination Note

Although the operating illumination is specified to 2,500 lux max., (LB-301: 4000 lux max.) if possible avoid using the sensor near lighting equipment that emits light in recurring pulses. If the sensor must be positioned near such equipment, minimize the effect by using a light shielding plate.

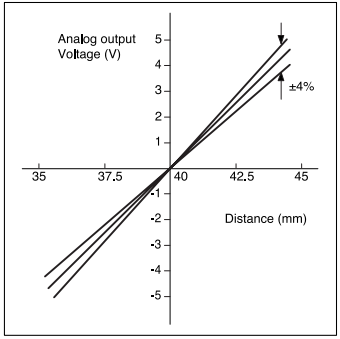
CHARACTERISTICS (TYPICAL)

■ LB-041/LB-1001(W): 40 mm ± 5 mm

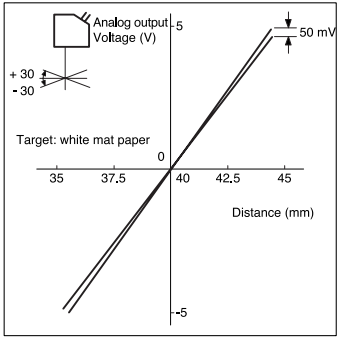
Shift-point adjustment range

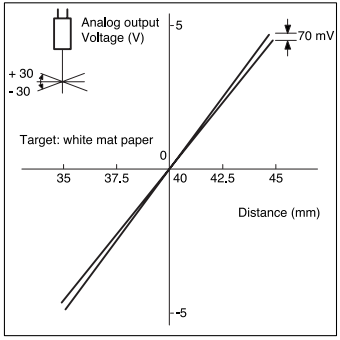


Span adjustment range



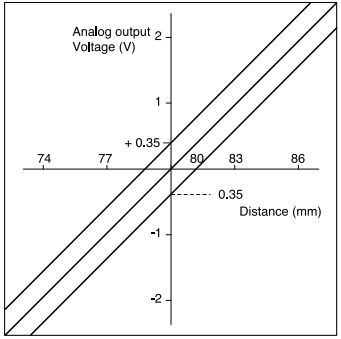
Changes in detection span when target is tilted



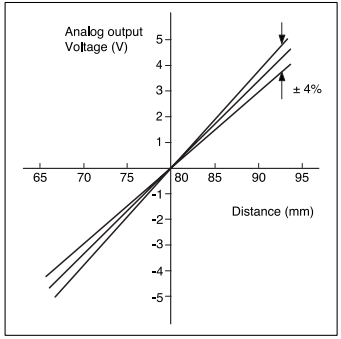


■ LB-081/LB-1101(W): 80 mm ± 15 mm

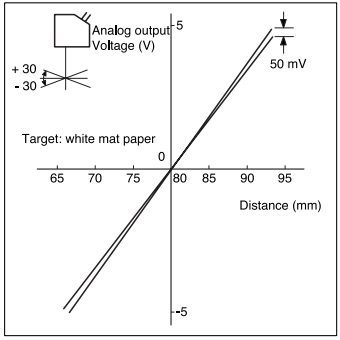
Shift-point adjustment range

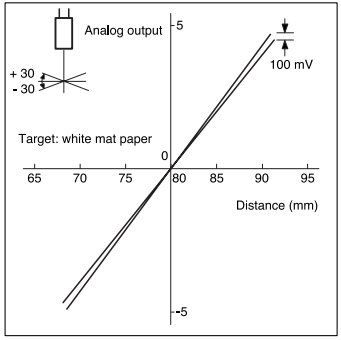


Span adjustment range



Changes in detection span when target is tilted



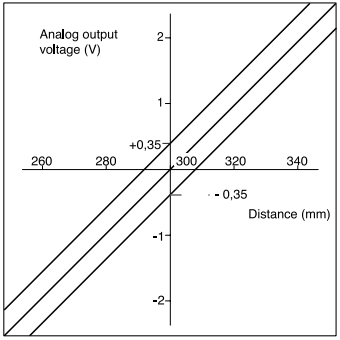


The shift-point adjustment range shows the range where the output voltage reading can be shifted to zero using the SHIFT adjustment trimmer (operates when DIP switch 4 is set to LOCK). The AUTO ZERO function (operates when DIP switch 4 is set to FREE), allows 0.V resetting at any position within the measuring range.

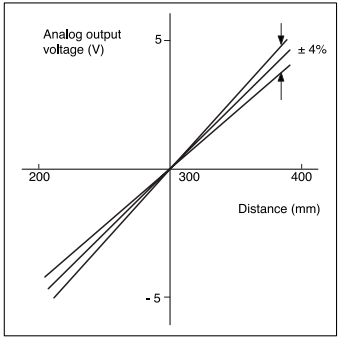
CHARACTERISTICS (TYPICAL)

■ LB-301/LB-1201(W): 300 mm ± 100 mm

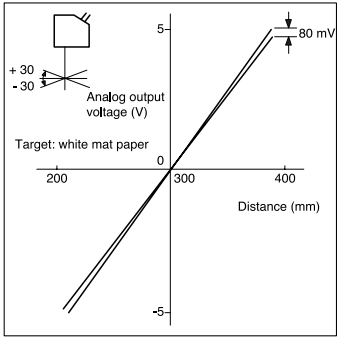
Shift-point adjustment range

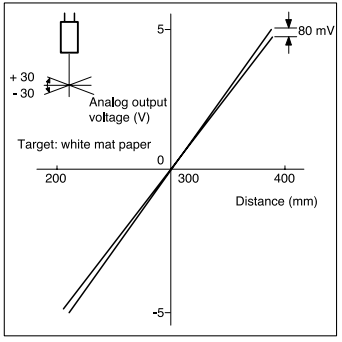


Span adjustment range



Changes in detection span when target is tilted



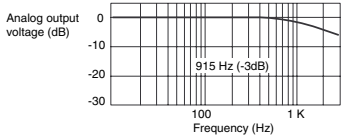


The shift-point adjustment range shows the range where the output voltage reading can be shifted to zero using the SHIFT adjustment trimmer (operates when DIP switch 4 is set to LOCK). The AUTO ZERO function (operates when DIP switch 4 is set to FREE), allows 0.V resetting at any position within the measuring range.

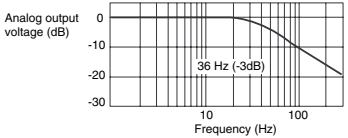
■ Frequency characteristic

Common to LB-1001(W), LB-1101(W), and LB-1201(W)

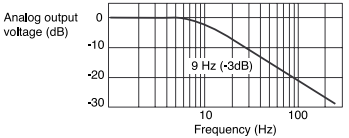
RESPONSE speed selector switch set to HIGH



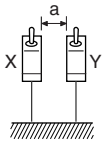
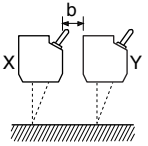
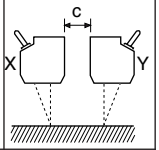
RESPONSE speed selector switch set to MID



RESPONSE speed selector switch set to LO



■ Interference range*

			
LB-041	40 mm	20 mm	40 mm
LB-081	50 mm	30 mm	80 mm
LB-301	200 mm	180 mm	290 mm

* Use of the interference suppression function enables close mounting of 2 sensors. Since sensors “X” and “Y” alternately emit a laser beam at 30 Hz, interference does not occur. (Target: white paper)

SPECIFICATIONS

Type			High resolution	Standard	Long range
Model		Sensor head	LB-041	LB-081	LB-301
		Controller	LB-1001	LB-1101	LB-1201
Reference distance			40 mm	80 mm	300 mm
Measuring range			±5 mm	±15 mm	±100 mm
Light source			Visible red semiconductor laser		Invisible infrared semiconductor laser
	Output		3.0 mW (FDA), 2.0 mW (IEC)	3.0 mW (FDA), 2.5 mW (IEC)	20 mW (FDA), 15 mW (IEC)
	Pulse duration		35 μs		
	Wavelength		670 nm		785 nm
	Laser Class	FDA (CDRH) 21CFR Part 1040.10	Class IIIa		Class IIIb
		IEC/EN 60825-1	Class 2M	Class 3R	Class 3B
Spot diameter (with white paper)			1 x 2 mm (at reference distance)		1.2 x 2.5 mm (at reference distance)
Linearity			0.25% of F.S.		0.4% of F.S.
Resolution (at LO mode)			2 μm	8 μm	50 μm
Output		Analog voltage	±5 V (1 mm/V)	±5 V (3 mm/V)	±5 V (20 mm/V)
		Impedance	100 Ω		
		Analog current	4 to 20 mA (350 Ω max.)		
		Alarm	NPN open-collector: 100 mA (40 V) max. (N.C.) Residual voltage: 1 V max.		
Adjustment range		Zero-point	±0.35 V max.[1.]		
		Span	±4% max.		
Response frequency (-3 dB)			915 Hz (HIGH), 36 Hz (MID), 9 Hz (LO)		
Sensitivity			WHITE, BLACK and AUTO (switch selectable)		
Other functions			AUTO ZERO, Response speed selectable, Fuzzy logic control, Interference suppression		
Temperature fluctuation		Sensor head	0.02% of F.S./°C		
		Controller	0.02% of F.S./°C		
Ambient light [2.]			2,500 lux max.		4,000 lux max.
Ambient temperature		Sensor head	0 to +45°C (32 to 113°F)		
		Controller	0 to +50°C (32 to 122°F), No condensation		
Relative humidity			35 to 85%, No condensation		
Power supply			100 to 240 VAC ±10% 50/60 Hz		
Power consumption			Approx. 15 VA		
Vibration resistance			10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 2 hours respectively		
Material		Sensor head	Aluminum die-cast		
		Controller	Polycarbonate		
Weight		Sensor head	Approx. 170 g		Approx. 250 g
		Controller	Approx. 530 g		

1. Every measuring point within measuring range can be shifted to zero with the AUTO ZERO function.
2. Incandescent/fluorescent lamps
   The LB-1000 series controller and sensor head are calibrated as a pair. Therefore, to satisfy specifications, combine units having the same serial number.

Option

Extension cable

The sensor head cable can be extended up to 40 m.

Model	Cable length
LB-C2	2 m
LB-C3	3 m
LB-C8	8 m

SPECIFICATIONS

Type			High resolution	Standard	Long range
Model		Sensor head	LB-041	LB-081	LB-301
		Controller	LB-1001W	LB-1101W	LB-1201W
Reference distance			40 mm	80 mm	300 mm
Measuring range			±5 mm	±15 mm	±100 mm
Light source			Visible red semiconductor laser		Invisible infrared semiconductor laser
	Output		3.0 mW (FDA), 2.0 mW (IEC)	3.0 mW (FDA), 2.5 mW (IEC)	20 mW (FDA), 15 mW (IEC)
	Pulse duration		35 μs		
	Wavelength		670 nm		785 nm
	Laser Class	FDA (CDRH) 21CFR Part 1040.10	Class IIIa		Class IIIb
		IEC/EN 60825-1	Class 2M	Class 3R	Class 3B
Spot diameter (with white paper)			1 x 2 mm (at reference distance)		1.2 x 2.5 mm (at reference distance)
Linearity			0.25% of F.S.		0.4% of F.S.
Resolution (at LO mode)			2 μm	8 μm	50 μm
Output		Analog voltage	±5 V (1 mm/V)	±5 V (3 mm/V)	±5 V (20 mm/V)
		Impedance	100 Ω		
		Analog current	4 to 20 mA (350 Ω max.)		
		Alarm	NPN open-collector: 100 mA (40 V) max. (N.C.) Residual voltage: 1 V max.		
Adjustment range		Zero-point	±0.35 V max.[1.]		
		Span	±4% max.		
Response frequency (-3 dB)			915 Hz (HIGH), 36 Hz (MID), 9 Hz (LO)		
Sensitivity			WHITE, BLACK and AUTO (switch selectable)		
Other functions			AUTO ZERO, Response speed selectable, Fuzzy logic control, Interference suppression		
Temperature fluctuation		Sensor head	0.02% of F.S./°C		
		Controller	0.02% of F.S./°C		
Ambient light [2.]			2,500 lux max.		4,000 lux max.
Ambient temperature		Sensor head	0 to +45°C (32 to 113°F)		
		Controller	0 to +50°C (32 to 122°F), No condensation		
Relative humidity			35 to 85%, No condensation		
Power supply			24 VDC ±10%, Ripple (P-P): 10% max.		
Current consumption (Max.)			Approx. 320 mA		Approx. 350 mA
Vibration resistance			10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 2 hours respectively		
Material		Sensor head	Aluminum die-cast		
		Controller	Polycarbonate		
Weight		Sensor head	Approx. 170 g		Approx. 250 g
		Controller	Approx. 500 g		

1. Every measuring point within measuring range can be shifted to zero with the AUTO ZERO function.
2. Incandescent/fluorescent lamps
   The LB-1000 series controller and sensor head are calibrated as a pair. Therefore, to satisfy specifications, combine units having the same serial number.

Option

Extension cable

The sensor head cable can be extended up to 40 m.

Model	Cable length
LB-C2	2 m
LB-C3	3 m
LB-C8	8 m

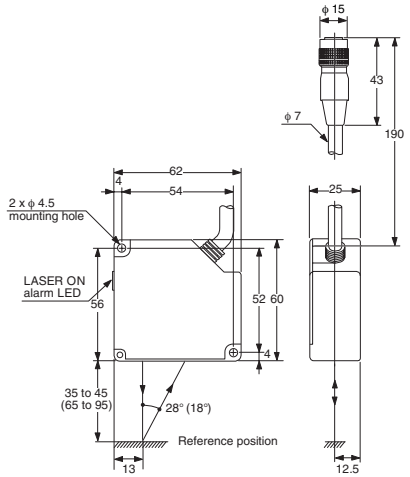
DIMENSIONS

Unit: mm

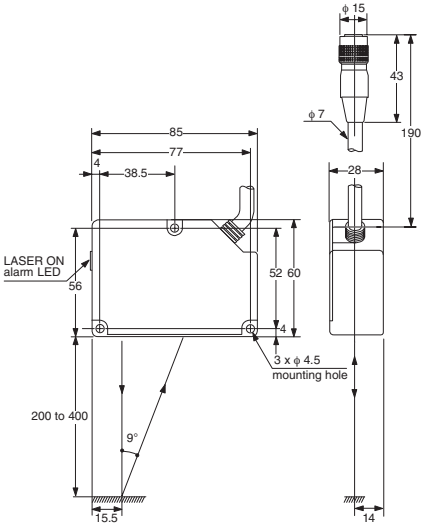
Sensor head

LB-041/LB-081

Data in ( ) applies to LB-081.
All other dimension are the same for both models.

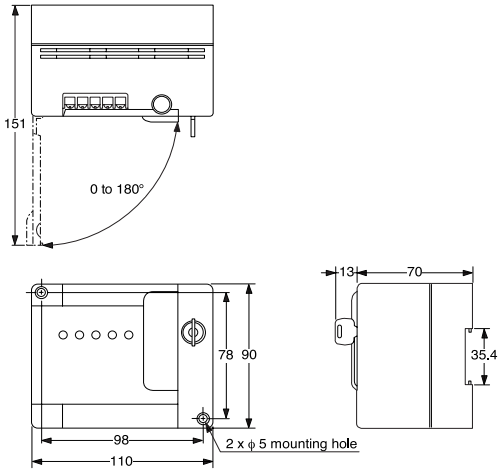


LB-301



Controller

LB-1001(W)/LB-1101(W)/
LB-1201(W)



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