

Laser Displacement Sensors

: Sensor head

(Regular reflective type)



BD Series

PRODUCT MANUAL

For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

Features

- Reference distance :30/65/100 mm
 - Easy maintenance with detachable sensor head/amplifier unit
 - Maximum resolution: 1 μ m (vary by model)
 - Accurate measurement of mirror and transparent materials
 - Interconnection of up to 8 sensor amplifier units
 - : Mutual interference prevention function and auto channel sorting
 - Various calculation functions supported (addition, subtraction, average)
 - Various filter functions for stable measurement (movement average, differential, median)
 - Auto sensitivity adjustment (1-point, 2-point teaching)
 - Dedicated software provided (atDisplacement)
 - DIN Rail and wall mount support (bracket accessory required for wall mount)
 - Sensor head: IP67 protection structure
- ※ Regular reflective type sensor head model supports only over 5.0 firmware version of the amplifier unit (BD-A1) and communication converter (BD-C).

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ⚠ symbol indicates caution due to special circumstances in which hazards may occur.

⚠ Warning Failure to follow instructions may result in serious injury or death.

- 01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss.** (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)
Failure to follow this instruction may result in personal injury, economic loss or fire.
- 02. Do not use the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.**
Failure to follow this instruction may result in explosion or fire.
- 03. Do not disassemble or modify the unit.**
Failure to follow this instruction may result in fire.
- 04. Do not connect, repair, or inspect the unit while connected to a power source.**
Failure to follow this instruction may result in fire.

⚠ Caution Failure to follow instructions may result in injury or product damage.

- 01. Use the unit within the rated specifications.**
Failure to follow this instruction may result in fire or product damage.
- 02. Use a dry cloth to clean the unit, and do not use water or organic solvent.**
Failure to follow this instruction may result in fire.
- 03. Mount the ferrite core to specified position before using.**
Failure to follow this instruction may result in output with noise.

Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
- The power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Do not install where strong magnetic or electric field exist. Otherwise, the resolution may be adversely affected.
- Mutual optical interference between laser sensors and photoelectric sensors may result in malfunction.
- Mutual optical interference between laser sensors may result in malfunction.
- When connecting DC relay or other inductive load to the output, remove surge by using diode or varistor.
- Since external disturbance light (sunlight, fluorescent lighting, etc.) can cause product malfunction, use the product with a light shield or slit.
- For the optimized performance, it is recommended to measure after 30 minutes from supplying power.
- Keep the emitter/receiver part clean to prevent water, oil, dust, etc. Use a soft cloth that does not produce dust during cleaning.
- When detecting with the maximum sensitivity, an error may occur depending on each characteristic deviation.
- Since it is a precision sensor, use it with caution against large shocks and thermal shocks.
- Remove the front protective sticker before operate the unit. If not it may affect the product performance.
- This unit may be used in the following environments.
 - Indoors (in the environment condition rated in 'Specifications')
 - Altitude max. 2,000 m
 - Pollution degree 3
 - Installation category II

Safety precautions during Use Laser Equipment

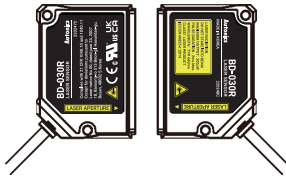
Failure to follow this instruction may result in physical disability(e.g., eyes or skin)

- If the product is handled arbitrarily without following the instructions, it may cause laser injury.
- Do not stare at the laser emitter.
- Do not stare directly or indirectly at the laser beam or direct it to the human eye.
- Do not deliberately project laser light onto a person.
- Install the laser light path so that it does not pass at eye level.
- Consider the optical path of the laser beam.
- If there is a risk of contact with the reflected light due to mirror reflection/diffusion reflection, install a barrier to block the reflected light.

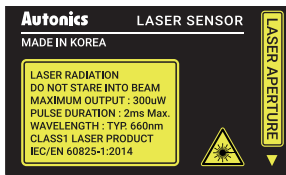
Warning Labels

- The label description - label attachment locations for the warning labels on this device are shown below.

Label attachment locations



Class 1 (IEC/EN), Class I (FDA (CDRH) CFR Part 1002)



Ordering Information

This is only for reference, the actual product does not support all combinations. For selecting the specified model, follow the Autonics website .

BD - ① ②

① Reference distance

Number: Reference distance (unit: mm)

② Measuring principle

R: Regular reflection

Specifications

Model	BD-030R	BD-065R	BD-100R
Beam shape	Standard		
Spot diameter (near)	≈ 100×100 μm	≈ 150×150 μm	≈ 200×200 μm
Spot diameter (reference)	≈ 100×100 μm	≈ 150×150 μm	≈ 220×220 μm
Spot diameter (far)	≈ 100×100 μm	≈ 150×150 μm	≈ 240×240 μm
Resolution ⁰¹⁾	1 μm	2 μm	4 μm
Reference distance	27.3 mm	62.9 mm	98.3 mm
Max. measurement range	24.9 to 29.7 mm	56.9 to 68.9 mm	86.3 to 110.3 mm
Rated measurement range ⁰²⁾	25.3 to 29.3 mm	57.9 to 67.9 mm	88.3 to 108.3 mm
Linearity ⁰³⁾	± 0.1% of F.S.		± 0.15% of F.S.
Temperature characteristic ⁰⁴⁾	± 0.05% of F.S./°C		± 0.06% of F.S./°C
Light source	Red semiconductor laser (wavelength: 660 nm, IEC 60825-1:2014)		
Optical method	Regular reflection		
Laser class	Class 1 (IEC/EN), Class I (FDA (CDRH) CFR Part 1002)		
Output	≤ 300 μW		
Laser Pulse duration	Max. 2 ms		
Material	Case: PC, Cable: PVC, Sensing part: Glass		
Certification	CE UK e FM US		
Unit weight (packaged)	≈ 55 g (≈ 205 g)	≈ 66 g (≈ 228 g)	≈ 66 g (≈ 228 g)

01) When measuring mirror in stop state at the reference distance with belows.
[Conditions] reference temperature 25°C, reference distance response time 1 ms, average 128 times

02) The rated measurement range guarantees linearity.

03) Measurement error for linear displacement of white matte paper in the rated measurement range.

04) Value measured by using an aluminum jig fix the sensor head and non-glossy white paper.

Supported amplifier	Amplifier unit (BD-A1) ⁰¹⁾
Power supply	From the amplifier unit (BD-A1)
Operation indicator	Power indicator (red), Laser emission indicator (green), NEAR/FAR indicator (green)
Insulation resistance	≥ 20 MΩ (500 VDC≒ megger)
Noise immunity	Square shaped noise by noise simulator (pulse width: 1μs) ±500V
Dielectric strength	Between the charging part and the case: 1,000 VAC~ 50/60 Hz for 1 minute
Vibration	1.5 mm amplitude at frequency of 10 to 55Hz in each X, Y, Z direction for 2 hours
Shock	300 m/s ² (≈ 30 G) in each X, Y, Z direction for 3 times
Ambient illumination	≤ 10,000 lx incandescent lamp
Ambient temperature	-10 to 50 °C, Storage: -15 to 60 °C (no freezing or condensation)
Ambient humidity	35 to 85%RH, Storage: 35 to 85%RH (no freezing or condensation)
Protection structure	IP67 (IEC Standards, except connector of extension cable)

01) Sensor head model BD-300/600 supports only over 5.0 firmware version of the amplifier unit (BD-A1) and communication converter (BD-C).

Product Components

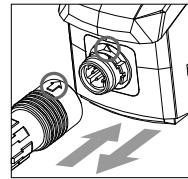
- Sensor head
- Instruction manual
- Bolt×2, Nut×2
- Ferrite core ×1
(Manufacture: TDK, ZCAT2132-1130)
- Fixing bracket (BK-BD-□) ×1

Sold Separately

- Laser displacement sensor communication converter: BD-C Series
- Extension cable: [General type] CID6P-□-SI-BD, [Robot type] CIDR6P-□-SI-BD
- Fixing bracket: BK-BD-□

Installation Step 1. Connecting Sensor Head - Amplifier Unit

- Do not supply the power when connecting / removing sensor and amplifier unit.



Connecting

Insert connector of the sensor head into amplifier unit with aligning ↑ mark and ▲ mark until it sounds click.

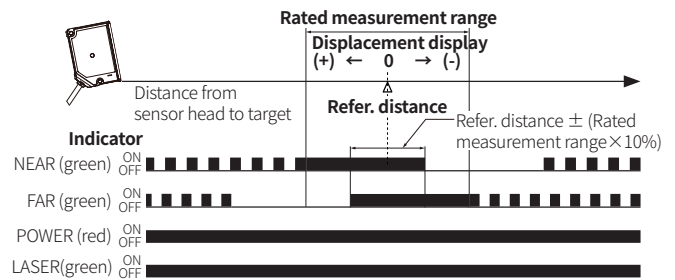
Removing

Pull out the connector cap of sensor head to the opposite direction.

Installation Step 2. Selecting Sensor Head Mounting Location

The closer the distance between the sensor head and the measurement target is to the reference distance, the more accurate the measurement can be.

Select the installation location of the sensor head considering the reference distance and measuring range of the sensor head by checking the operation of the indicator ON and the display of displacement.



Sensor head indicator operation

- Indicator ON operation distance (unit: mm)

Model	Reference distance	Rated measurement range	NEAR indicator	NEAR + FAR indicator	FAR indicator
BD-030R	27.3	25.3 to 29.3	25.3 to 27.7	26.9 to 27.7	26.9 to 29.3
BD-065R	62.9	57.9 to 67.9	57.9 to 63.9	61.9 to 63.9	61.9 to 67.9
BD-100R	98.3	88.3 to 108.3	88.3 to 100.3	96.3 to 100.3	96.3 to 108.3

Displacement indication

- The value is displaced more positive (+) as the object is closer to sensor head, more negative value (-) as the object is far from sensor head relative to the origin (0).

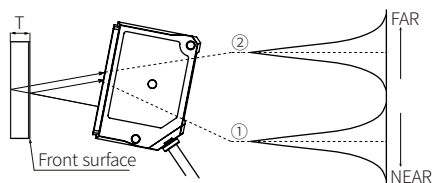
Installation Step 3. Precautions for Mounting Sensor Head

- Install the sensor head to minimize measurement error for stable measurement. Consider the listed conditions below.
 - Installation environment background (reflected light)
 - Sensing distance and sensing target

■ Narrow area or concave object

Correct	Wrong	Description
		Install the sensor head where the reflected laser beam does not blocked toward the receiver part.

■ Measurement of transparent object



- The refractive index of the transparent object is based on 1.55.
- Check the detectable thickness of transparent object for a stable measurement of the transparent object surface.

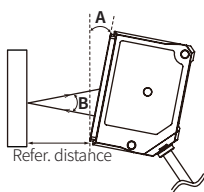
Model	BD-030R	BD-065R	BD-100R
Thickness of transparent object(T)	≥ 0.7 mm	≥ 2.0 mm	≥ 4.0 mm

- This is the standard thickness to separate the light reflected from the front surface of the transparent object (①) and the light reflected from the bottom surface after transmission (②).

Installation Step 4. Mounting

■ Sensor head

• Installation angle

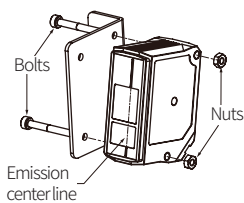


- Install it by tilting it according to the installation angle.

Model	BD-030R	BD-065R	BD-100R
A	11°	7.3°	5.2°
B	22°	14.6°	10.4°

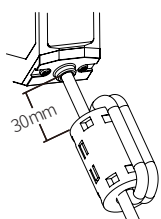
- This is the angle at which the light beam reflected from the specular body is condensed by the light receiving lens and incident on the light receiving element. Install the reflected light projection treatment at the reference distance to allow transport of the light receiving lens.
- It is recommended to use Autonics exclusive fixing bracket.

• Installation components



- Mount to the panel directly or through the bracket by using M3 bolt and nut (tightening torque: $\leq 0.5 \text{ N} \cdot \text{m}$).
- Install the measurement object and the center line are in a straight line. Check the mounting position considering emission center line, vibration and shock.

■ Accessory: Ferrite core



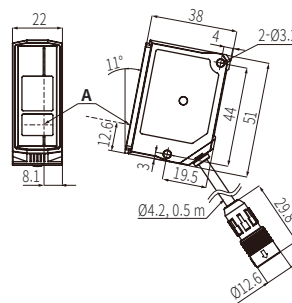
- Within 30 mm from the sensor head, wind the cable through the inside of the ferrite core three times and mount the ferrite core.

Dimensions

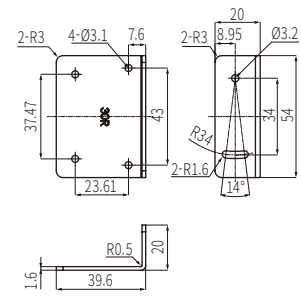
- Unit: mm, For the detailed dimensions of the product, follow the Autonics web site.

A	Optical axis of emitter
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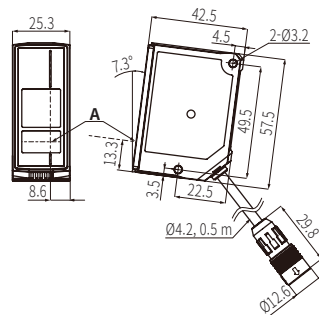
■ BD-030R



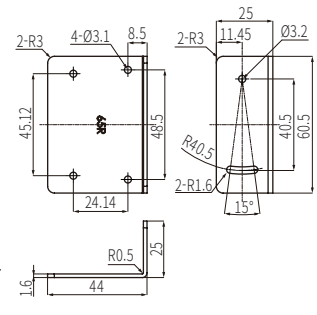
Fixing bracket (BK-BD-E)



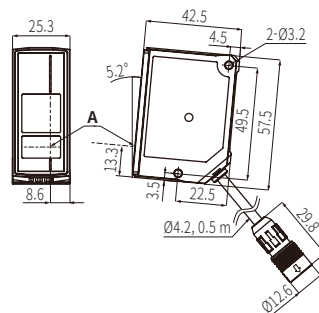
■ BD-065R



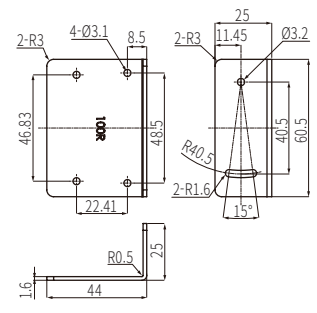
Fixing bracket (BK-BD-F)



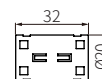
■ BD-100R



Fixing bracket (BK-BD-G)

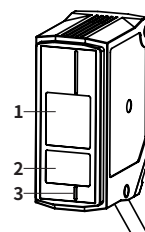


■ Ferrite core



Unit Descriptions

- It describes based on BD-030R.



1. Laser receiver

Receives the laser reflected from the measurement target.

2. Laser emitter

The point at which a laser is projected on a target to measure displacement.

3. Emission center line

The line and the object should be aligned because the laser is emitted along the line.

Install the measurement object and the center line are in a straight line.

4. Power indicator (POWER, red)

Indicates whether the sensor head is powered or not.

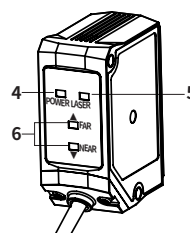
5. Laser emission indicator (LASER, green)

Turns ON while the laser is emitted from the sensor head.

6. NEAR/FAR indicator (NEAR/FAR, green)

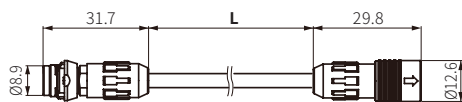
Flashes outside the rated measurement range and turns ON near the reference distance.

- For more information about indicators, refer to the Installation Step 2. Selecting Sensor Head Mounting Location



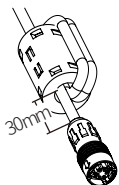
Sold Separately: Extension Cable

• Unit: mm, For the detailed drawings, follow the Autonics website.



General type	Robot type	L (length)
CID6P-1-SI-BD	CIDR6P-1-SI-BD	1 m
CID6P-2-SI-BD	CIDR6P-2-SI-BD	2 m
CID6P-5-SI-BD	CIDR6P-5-SI-BD	5 m
CID6P-10-SI-BD	CIDR6P-10-SI-BD	10 m

■ Accessory: Ferrite core



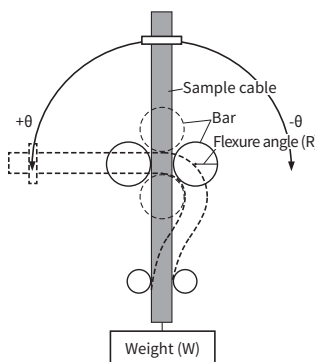
Within 30 mm from the connector of amplifier unit, wind the cable through the inside of the ferrite core three times and mount the ferrite core.

Test for Robot Type Extension Cable

In the following each test environment, repeat the test until the sample is electrically disconnected, and then check the number of times.

■ Flexure test

Test environment



Conditions

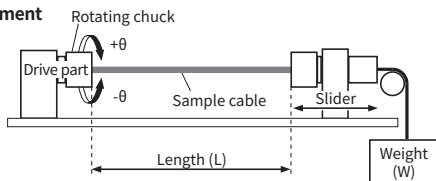
Flexure angle (θ)	90°
Weight (W)	1 kg
Flexure radius (R)	30 mm
Flexure speed	60 times / minute • 1 round trip is done once.

Result

≈ 32,000,000 times

■ Torsion test

Test environment



Conditions

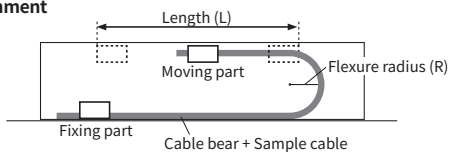
Flexure angle (θ)	180°
Weight (W)	1 kg
Length (L)	50 mm
Flexure speed	60 times / minute • 1 round trip is done once.

Result

≈ 30,000,000 times

■ U bending test

Test environment



Conditions

Length (L)	400 mm
Flexure radius (R)	18 mm
Flexure speed	60 times / minute • 1 round trip is done once.

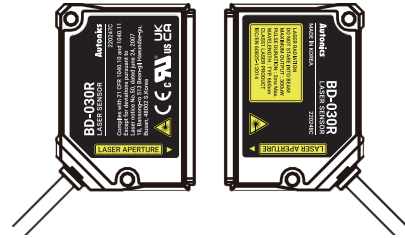
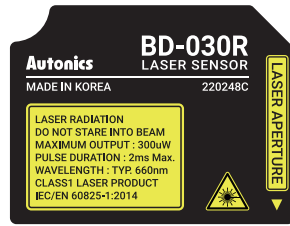
Result

≈ 42,000,000 times

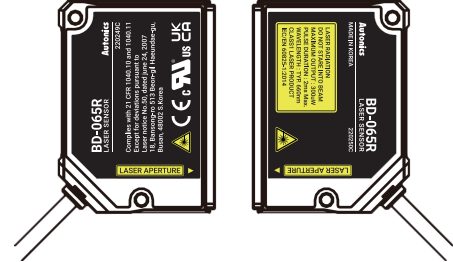
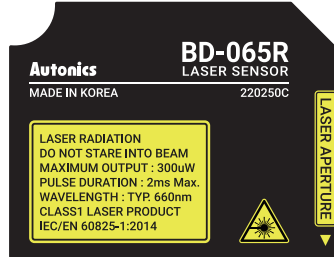
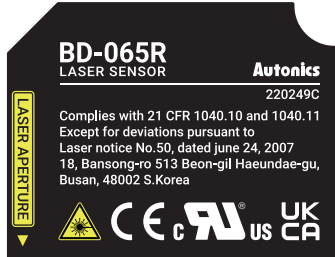
Warning Labels

• The label description (left) - label attachment locations (right) for the warning labels on this device are shown below.

■ BD-030R



■ BD-065R



■ BD-100R

