Laser Displacement Sensors : Amplifier unit

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 :30/65/100/300/600 mm
- Easy maintenance with detachable sensor head/amplifier unit
- Maximum resolution: 1 ㎛ (vary by model)
- Accurate measurement with minimal influence from target color or material
- 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

※ Sensor head model BD-300/600 supports only over 5.0 firmware version of the amplifier unit (BD-A1).

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.

05. Check 'Connections' before wiring. [Amplifier unit]
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.

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.
- Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
- For the optimized performance, it is recommended to measure after 30 minute from supplying power.
- When detecting with the maximum sensitivity, an error may occur depending on each characteristic deviation.
- This unit may be used in the following environments.
  - Indoors (in the environment condition rated in 'Specifications')
  - Altitude max. 2,000 m
  - Pollution degree 2
  - Installation category II

Product Components

- Amplifier unit
- Instruction manual
- Fixing bracket (BK-BD-C)
- Side connector

Sold Separately

- Laser displacement sensor communication converter: BD-C Series
- Fixing bracket (BK-BD-C)

Manual

For proper use of the product, refer to the manuals and be sure to follow the safety considerations in the manuals.
Download the manuals from the Autonics website.

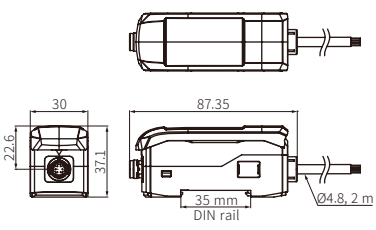
Specifications

Model	BD-A1
Power supply	10 - 30 VDC⎓ ±10% (when connecting BD-C, communication converter, 12-30 VDC⎓)
Power consumption [01]	≤ 2,800 mW (30 VDC⎓)
Control Input	Hold trigger, Output reset, Laser OFF, Zero-point adjustment, BANK-A/B combinations : No-voltage input
Judgment output (HIGH/GO/LOW)	NPN or PNP open collector (load current: ≤ 100 mA)
Alarm output	NPN or PNP open collector (load current: ≤ 100 mA)
Analog output	Voltage: -5 - 5 V, 0 - 5 V, 1 - 5 V (resistance: 100 Ω, ± 0.05% F.S., at 10 V) Current: 4 - 20 mA 4 - 20 mA (load resistance: ≤ 350 Ω, ± 0.2% F.S., at 16 mA)
Residual voltage	NPN: ≤ 1.5 V, PNP: ≤ 2.5 V
Protection circuit	Reverse polarity protection circuit, output over current (short-circuit) protection circuit
Response Time	0.33 / 0.5 / 1 / 2 / 5 ms
Min. display unit	[BD-030 / 065 / 100] 1 μm [BD-300 / 600] 10 μm [02]
Display type	11 segment (red, green), 6-digit, LED
Display range [03]	[BD-030 / 065 / 100] ± 99.999 to ± 99 mm (4-step paramete set) [BD-300 / 600] ± 999.99 to ± 999 mm (3-step parameter set)
Display period	≈ 100 ms
Insulation resistance	≥ 20 MΩ (500 VDC⎓ megger)
Noise immunity	Square shaped noise by noise simulator (pulse width: 1 μs) ± 500 V
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 55 Hz in each X, Y, Z direction for 2 hours
Shock	300 m/s² (approx. 30 G) in each X, Y, Z direction for 3 times
Ambient temperature	-10 to 50 °C, Storage: -15 to 60 °C (no freezing or condensation)
Ambient humidity	≤ 85%RH, Storage: ≤ 85%RH (no freezing or condensation)
Material	Case: PC, Cover: PC, cable: PVC
Supported sensor head	Sensor head (BD-□) [04]
Supported comunication converter	Communication converter (BD-C) [05]
Protection structure	IP40 (IEC standard)
Approval	CE UK CA c UL us EAC
Unit weight (packaged)	≈ 126 g (≈ 228 g)

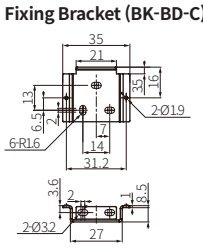
01) Power to the load is not included.
02) Sensor head model BD-600 displays values per min. display unit (10 μm) but actual value is increased/decreased per 20 μm.
03) Setting range is assigned automatically when connecting sensor head.
04) Sensor head model BD-300/600 supports only over 5.0 firmware version of the amplifier unit (BD-A1).
05) The communication converter (BD-C) over 5.0 firmware version of supports only over 5.0 firmware version of the amplifier unit (BD-A1).

Dimensions

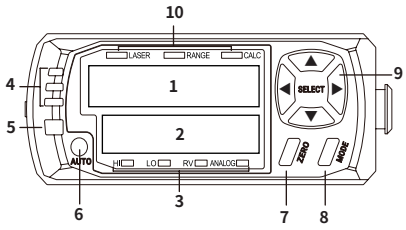
- Unit: mm, For the detailed drawings, follow the Autonics website.



Fixing Bracket (BK-BD-C)



Unit Descriptions



1. PV display (red)
Displays PV (present value), calculating result (when using calculation), parameter name (when setting parameter).

2. SV display (green)
Displays SV (setting value), parameter setting value (when setting parameter).

3. SV display recognition indicator (green)
HI: HIGH judgment value
LO: LOW judgment value
RV: Real distance value
ANALOG: Analog output

4. Judgment indicator
HI (red) / GO (green) / LO (red)

5. Alarm indicator (red)

6. Emission optimization setting key [AUTO]

7. Zero-point adjustment setting key [ZERO]

8. Mode setting key [MODE]

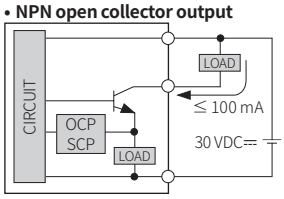
9. Direction key [◀], [▶], [▲], [▼]

10. Status indicator (green)
CALC: Calculation indicator
RANGE: Turns on within measurement range, Turns off when out of range or laser emission stops
LASER: Laser emission indicator

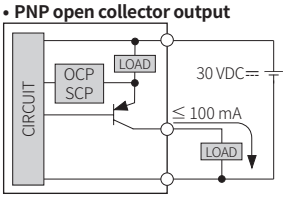
Control Output Diagram

■ Judgment (HIGH, GO, LOW) and alarm output

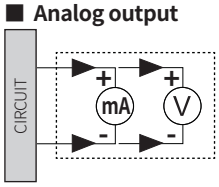
• NPN open collector output



• PNP open collector output



■ Analog output



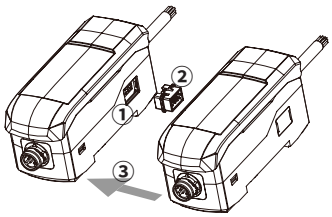
- OCP (Over Current Protection), SCP (Short Circuit Protection)
- The control output is abnormal when the control output circuit is shorted or over current is supplied.

Installation Step 1. Installation Precautions

- Do not supply the power when adding amplifier unit.
- Supply power to each connected amplifier unit at the same time.
- Up to 8 amplifier units can be connected
- The function can be set using the master amplifier unit, and measurements are made according to the corresponding setting value.
- Only 1 calculation function can be performed per 1 group of mutually connected amplifiers.
  When the calculation function is activated, the SV of the slave units are disable and the mutual interference prevention function for sensor heads is executed automatically.
- Check the compatible firmware version when connecting the sensor head or communication converter to the amplifier unit.

Installation Step 2. Connect amplifier unit

■ Connecting amplifier units mutually

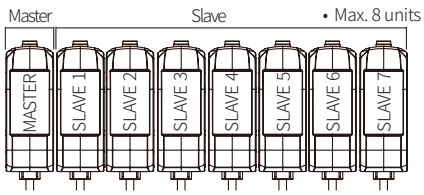


1. Remove the side cover at the connecting side.
2. Connect the side connector to the units.
3. After mounting amplifier unit on DIN rail, push it to arrow direction tightly.

- In case of disconnecting, follow the upper sequence reversely.

■ Distinguishing master/slave amplifier units

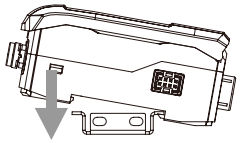
When the power cable direction is down, the amplifier at the left end is the master unit, and the channel number of slaves increases sequentially to the right.



Installation Step 3. Installation

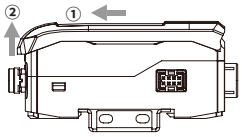
■ DIN rail installation

• Installation



1. Insert the bottom holder of amplifier unit to 35 mm width DIN rail.
2. Push the front part of the unit to arrow direction to mount.

• Remove



1. Side amplifier unit to ① direction.
2. Pull the assembly part to ② direction to detach.

■ Mounting with bolt

• Mounting is possible by using bracket. The method of mounting and detaching is as same as DIN rail.

Installation Step 4. Connection

• Supply power after installation.

Color	Description		Item
Brown	Power: 10 - 30 VDC⎓		Power
Blue	Common GND (Input/Output/Power)		
Black	HIGH judgment output		Output
Orange	LOW judgment Output		
Gray	GO judgment Output		
Green	Alarm output		
White	Analog output		
Shield	Analog output GND 01)		
Pink	External input1	Ecternal input □: OFF, Hold trigger, Output reset, Laser OFF, Zero-point adjustment, BANK-A/B combinations	External input
Yellow	External input2		
Red	External input3		
Purple	External input4		

01) It is needed to distinguish from common GND.

Display & Mode Setting when Power is ON

• Setting control output type when connecting a sensor head and supplying power at the first time, or replacing a sensor head.
• [▲], [▼] key: Changes setting value, [MODE] key: Saves the setting value and move to the next
• For details of Mode setting and parameter, refer to the user manual.
• The version information displays right after supplying the power.

Parameter	Display	Default	Description
Version information	VER	Version	Displays firmware version
Control output type	oUt	NPN	NPN, PNP
Analog control output type	A-oUt	oFF	OFF, 4 - 20 mA, 0 - 5 V, 1 - 5 V, -5 - 5 V • After 'OUT.SET' flashed 3 times and it returns to the run mode

Mode Setting

RUN

- [◀ / ▶] → **Change SV display value**
- [◀ / ▶] over 3 sec → **Key lock**
- [AUTO] over 5 sec → **Emission optimization** → Completed: OK Marked and return / Failed: Return after displaying FAIL, please try again. →
- [ZERO] over 2 sec → **Zero-point adjustment** → ZERO → Return after displaying 0000 →
- [MODE]+ [▲] over 2 sec → **HIGH sensitivity adjustment**
- [MODE]+ [▼] over 2 sec → **LOW sensitivity adjustment**

  → [MODE] key within 2 sec →
- [MODE] within 2 sec → **Auto sensitivity (Teaching)** → Auto →
- [MODE]+[AUTO] over 2 sec → **Control / Analog output type** → PV display: OUT.SET / SV display: After 'END' is flashed 3 times and it returns automatically →
- [▲] → **HIGH PEAK value**
- [▼] → **LOW PEAK value**

  → [◀ / ▶ / ▼/ ▲] or auto after no key input for 5 sec →
- [MODE] over 2 sec → **Parameter group** → [MODE] key over 3 sec →

RUN

Parameter Setting

• Some parameter are activated / deactivated depending on other parameters.
• [MODE] key: Enters parameter group, save and return to the upper step (over 3 sec)
  [◀], [▶] key: Changes parameter group, parameter
  [▲], [▼] key: Changes setting value of parameter
• Some parameters/functions only support only over 5.0 firmware version.
• Some default value is varied by connected sensor head model.

■ Parameter group 1

Parameter	Display	Default
Response time	RSPd	Varied model
Teaching mode	SENS	IPNt
Output type	No.NC	No
PV display	di SP	StNd
Display digit	dot	Varied model
Display scale low limit	H-SC	Varied model
Display scale high limit	L-SC	
Hysteresis	HYS	Varied model
Analog output scale low limit	H-AN	Varied model
Analog output scale high limit	L-AN	
Error output displacement	ERR.oUt	KEEP
Fixed error output _Analog	FI x.oUt	Max. value
Fixed error output _Judgment	FI x.oU2	Go
Offset	oFFSEt	Varied model

■ Parameter group 2

Parameter	Display	Default
Calculation	CALC	oFF
Gain	GAIN	1
Filter	FILtER	AVF
Samples for averaging	AVF	16
Samples for median	MEdIAN	oFF
Hold	HoLd	oFF
Hold timing input	HoLdt	t-IN
Auto trigger level	At.LV	0
Auto trigger hysteresis	At.HYS	Varied model
Timer	t-Mod	oFF
Timer value	tIME	0

■ Parameter group 3

Parameter	Display	Default
External input 1	d-IN1	oFF
External input 2	d-IN2	oFF
External input 3	d-IN3	oFF
External input 4	d-IN4	oFF

■ Parameter group 4

Parameter	Display	Default
Display direction	diR	Normal
Bank	bANK	bANK-0
Saving mode	SAVE	oFF
Lock mode	LoCK	oFF
Initialize	INIt	oFF

Error

In error status, 'ERROR' is displayed on PV display.
Deal with an error by referring to the below solution of each setting value SV display.

SV display	Output	Causes	Troubleshooting
HEAd	O	Disconnection of sensor head/amplifier unit/cable Sensor head malfunction	Check the connection between sensor head and amplifier unit. Check the disconnection of sensor head cable. Perform the above items and supply the power again. If the problem is not resolved after the above items are performed, it is judged that the sensor head is defective and needs to be replaced.
LASER	O	Malfunction of emission	
dARK	-	Not existing the object or background in maximum measurement range	Adjust the distance between sensor head and object in the maximum measurement range.
RANGE			
bRIGHt	-	Over receive the light	
------	-	In status of display unavailable	Return to status of present value display available.
A-MEM	O	Amplifier unit memory malfunction (EEPROM cannot be refreshed due to exceeding the number of recording over 1 million times)	Turn off the power, check the connection of sensor head, and supply the power again. Executes the initialize function in parameter group 4. If the problem is not resolved after the above items are performed, it is judged that the amplifier unit is defective and needs to be replaced.
H-MEM	O	Sensor head memory malfunction	Turn off the power, check the connection of sensor head, and supply the power again. If the problem is not resolved after the above item is performed, it is judged that the amplifier unit is defective and needs to be replaced.
AMP-C	O	Poor connection between amplifier units	After turn off the power, check the connection between amplifier units, and supply the power again.
VER	O	Firmware version incompatible	Check the firmware version and needs to update to compatible version.
oUt	O	Disconnection of the judgment output	After turn off the power, check connection of HIGH (black) / GO (gray) / LOW (orange) wire, and supply the power again.
AMP	O	Amplifier unit error	After turn off the power, check the connection of sensor head, and supply the power again. If the problem is not resolved after the above items are performed, it is judged that the amplifier unit is defective and needs to be replaced.
oCUR	O	Over current of output terminal	Check the load of output is specification range. Check the output is contacted other wire or frame.
AIF	O	Poor connection between amplifier units or communication module	After turn off the power, check the connection between amplifier units or communication module, and supply the power again.

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