

Autonics LASER DISPLACEMENT SENSOR [AMPLIFIER UNIT] BD SERIES

INSTRUCTION MANUAL

Thank you for choosing our Autonics product.

Please read the following safety considerations before use.

■ Safety Considerations

※Please observe all safety considerations for safe and proper product operation to avoid hazards.
※⚠ symbol represents caution due to special circumstances in which hazards may occur.

- Warning** Failure to follow these instructions may result in serious injury or death.
- Caution** Failure to follow these instructions may result in personal injury or product damage.

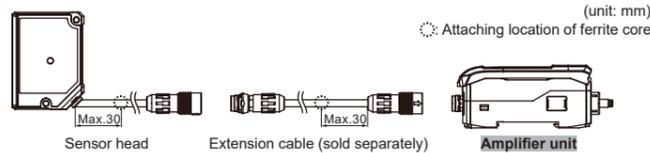
⚠ Warning

- 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.
- Do not use the unit in the place where flammable/explosive/corrosive gas, humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present. Failure to follow this instruction may result in explosion or fire.
- Do not disassemble or modify the unit. Failure to follow this instruction may result in fire.
- Do not connect, repair, or inspect the unit while connected to a power source. Failure to follow this instruction may result in fire.
- Check 'Connections' before wiring. [Amplifier unit] Failure to follow this instruction may result in fire.

⚠ Caution

- Do not stare at the laser emitter. [Sensor head] Failure to follow this instruction may result in eye damage.
- Use the unit within the rated specifications. Failure to follow this instruction may result in fire or product damage.
- Use dry cloth to clean the unit, and do not use water or organic solvent. Failure to follow this instruction may result in fire.
- Mount the ferrite core to specified position before using. [Sensor head, Extension cable] Failure to follow this instruction may result in output with noise.

■ Model



○ Sensor head

Model	Beam shape	Reference distance (Maximum measurement range)	Spot diameter		Reference	Far
			Near	Far		
BD-030	Standard	30mm (20-40mm)	Approx. 290×790μm (at 25mm)	Approx. 240×660μm (at 30mm)	Approx. 190×450μm (at 35mm)	
BD-065	Standard	65mm (50-80mm)	Approx. 360×1590μm (at 55mm)	Approx. 290×1180μm (at 65mm)	Approx. 210×830μm (at 75mm)	
BD-100	Standard	100mm (70-130mm)	Approx. 480×1870μm (at 80mm)	Approx. 410×1330μm (at 100mm)	Approx. 330×950μm (at 120mm)	

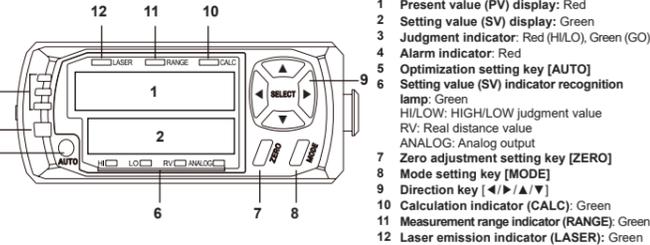
○ Amplifier unit

Model	Compatible sensor head
BD-A1	BD series sensor head: 1

○ Extension cable (sold separately)

Model	Length
CID6P-1-SI-BD	1m
CID6P-2-SI-BD	2m
CID6P-5-SI-BD	5m
CID6P-10-SI-BD	10m

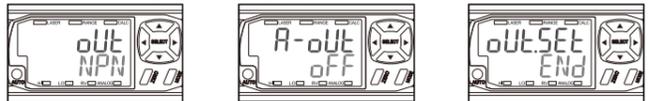
■ Unit Description



- Present value (PV) display: Red
- Setting value (SV) display: Green
- Judgment indicator: Red (HI/LO), Green (GO)
- Alarm indicator: Red
- Optimization setting key [AUTO]
- Setting value (SV) indicator recognition lamp: Green
HI/LOW: HIGH/LOW judgment value
RV: Real distance value
ANALOG: Analog output
- Zero adjustment setting key [ZERO]
- Mode setting key [MODE]
- Direction key [◀/▶/▲/▼]
- Calculation indicator (CALC): Green
- Measurement range indicator (RANGE): Green
- Laser emission indicator (LASER): Green

■ Display When Power is ON

Displays control output setting screen when connecting a sensor head and supplying power at the first time, or replacing a sensor head. Set the output type as below sequence.
Refer to 'Parameter setting' to check the setting range and the reset method.



- When 'OUT NPN' is displayed on the present value (PV) display, select control output type through the [▲/▼] keys and push the [MODE] key.
- When 'R-out OFF' is displayed on the present value (PV) display, select analog output type through the [▲/▼] keys and push the [MODE] key.
- After 'OUT.SET END' is flashed three times and it returns to the run mode.

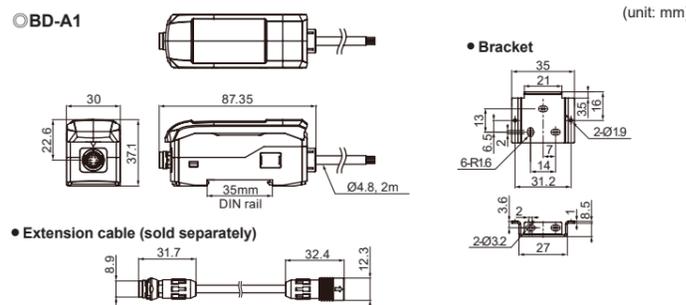
※The above specifications are subject to change and some models may be discontinued without notice.
※Be sure to follow cautions written in the instruction manual, user manual and the technical descriptions (catalog, website).

■ Specifications

Amplifier unit		
Model	BD-A1	
Power supply	10-30VDC±10% (When connecting BD-C Series communication converter, 12-30VDC±10%)	
Power consumption ^{※1}	Max. 2800mW (30VDC±10%)	
Control input ^{※2}	Timing	
	Output reset	
	Laser OFF	
	Zero adjustment	
	Bank change	
Judgment output (HIGH/GO/LOW)	NPN or PNP open collector output (Load current: Max. 100mA)	
Alarm output	NPN or PNP open collector output (Load current: Max. 100mA)	
Alarm output ^{※3}	Voltage: -5.5V, 0-5V, 1-5V (Resistance: 100Ω, ±0.05% F.S., at 10V) Current: 4-20mA (Max load resistance: 350Ω, ±0.2% F.S., at 16mA)	
Residual voltage	NPN: Max. 1.5V, PNP: Max. 2.5V	
Protection circuit	Reverse polarity protection circuit, output overcurrent (short-circuit) protection circuit	
Response time	0.33, 0.5, 1, 2, 5 ms (5-step adjustment)	
Min. display unit	1μm	
Display method	Dual display by 6-digit, 11-segment LED	
Display range ^{※4}	±99.999mm to ±99mm (4-step adjustment)	
Display period	Approx. 100ms	
Insulation resistance	Over 20MΩ (at 500VDC±10% megger)	
Noise immunity	Square shaped noise by noise simulator (pulse width: 1μs) ±500V	
Dielectric strength	1,000VAC 50/60Hz for 1 minute	
Vibration	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock	300m/s ² (Approx. 30G) in each X, Y, Z direction for 3 times	
Environment	Ambient temperature	-10 to 50°C, storage: -15 to 60°C
	Ambient humidity	Under 85%RH, Storage: under 85%RH
Protection structure	IP40 (IEC Standards)	
Material	Case: Polycarbonate, Cover: Polycarbonate, Cable: Polyvinyl chloride	
Connection	Connector type	
Sensor head compatibility	BD Series sensor head: 1	
Accessory	Mounting bracket, Side connector	
Approval	CE, RoHS	
Weight ^{※5}	Approx. 228g (approx. 126g)	

※1: Power to the load is not included.
※2: Use after assigning to external input line. For the details, refer to the item in 'Connections' Parameter group.
※3: It is possible to use among -5.5V, 0-5V, 1-5V, 4-20mA by parameter setting.
※4: Setting range is assigned automatically when connecting sensor head.
※5: The weight is with packaging and the weight in parenthesis is only unit weight.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

■ Dimensions



■ Installations

○ Mounting with bolt
Mounting without DIN rail is possible by using bracket. The method of mounting and detaching with bracket is as same as DIN rail.

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

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

○ Connecting to sensor head
① Connecting: Insert a connector of the sensor head into amplifier unit with aligning '1' mark and '▲' mark until it sounds click.
② Disconnecting: Pull out the connector cap of sensor head to the opposite direction.

○ 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/distance is down, the amplifier at the left end is the master unit, and the channel number increases sequentially to the right.

• Precautions when connecting amplifier unit
• Mount on DIN rail.
• 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, and only 1 calculation function can be performed per 1 group of mutually connected amplifiers.
• When the calculation function is activated, the setting values (SV) of the slave units are disable and the mutual interference prevention function for sensor heads is executed automatically.

○ Ferrite core (accessory for sensor head, extension cable)
• Extension cable (sold separately)
• Within 30mm from the connector of amplifier unit, wind the cable through the inside of the ferrite core three times and mount the ferrite core.

■ Manuals

For the detail information and instructions, please refer to user manual, and be sure to follow cautions written in the technical descriptions (catalog, website).
Visit our website (www.autonics.com) to download manuals.

■ Connections

Item	Code color	Description
Power	Brown	Power: 10-30VDC
	Blue	Common GND (input, output, power)
	Black	HIGH Judgment
Output	Orange	LOW Judgment
	Gray	GO Judgment
	Green	Alarm
	White	Analog: Following parameter value (-5.5V, 0-5V, 1-5V, 4-20mA)
	Shield	GND (Analog output) ※It is needed to distinguish from common GND.
External input	Pink	External input 1
	Yellow	External input 2
	Red	External input 3
	Purple	External input 4

Select parameters as below and input a signal to execution.
(Timing, Output reset, Laser OFF, Zero adjustment, BankA, BankB, OFF)

■ Control Output Diagram

○ Judgment (High, Go, Low) and alarm output

○ Analog output (-5.5V, 0-5V, 1-5V, 4-20mA)

■ Parameter Setting

Mode	Key	Description
Run mode	[MODE]+[▲]	Present value (PV) display • Solo: Displays present value (PV). • When using calculation: Displays the result of calculation, and calculation indicator (CALC) of master amplifier unit turns on.
	[MODE]+[▼]	Setting value (SV) display Can change the type of value by the [◀/▶] keys, and each recognition lamp turns on. Setting range: HIGH setting value, LOW setting value, real distance value (RV), analog output, bank (Displays [bANK - 1]) and all the recognition lamps turn off.)
Sensing optimization	[AUTO] key over 2 sec	Optimizes the level of laser emission and receiving sensitivity regarding the object color and environment. Execution: Execute automatically when entering the mode.
Zero adjustment	[ZERO] key over 2 sec	Sets the present value (PV) to the reference distance forcibly. Execution: After entering the mode, push the [ZERO] key within 1 sec, or apply the signal to external input wire for zero adjustment over 3 sec. Dismiss: Push the [ZERO]+[MODE] keys over 2 sec, or apply the signal to external input wire of zero adjustment over 3 sec. ※If the present value is changed by zero adjustment, the setting values (HIGH SV, LOW SV etc.) are not changed.
HIGH sensitivity adjustment	[MODE]+[▲] key over 2 sec	Sets the judgment output (HIGH/GO/LOW) range by manual input. Can change the number of digit by the [◀/▶] keys, and setting value by the [▲/▼] keys.
LOW sensitivity adjustment	[MODE]+[▼] key over 2 sec	The recognition lamps display the type of sensitivity adjustment.
Auto sensitivity adjustment (Teaching)	[MODE] key within 2 sec	Set the judgment output (HIGH/GO/LOW) range automatically. Enter the auto sensitivity adjustment setting mode after set the type of teaching mode in parameter 1 group. • 1-point teaching Sets the judgment output range by using present value (PV) of reference object height. HIGH setting value=height present value×1.5 LOW setting value=height present value×2 Setting: 1. 'IP' is displayed on setting value (SV) display, push the [AUTO] key within 2 sec. 2. After teaching the object for 2 sec, set the judgment output range automatically by applying the result. • 2-point teaching Sets the judgment output range by using present value (PV) of reference object step. HIGH setting value=(step×1.5)+bottom height LOW setting value=(step×2)+bottom height Setting: 1. 'IP' is displayed on setting value (SV) display, push the [AUTO] key within 2 sec. 2. After teaching the object for 2 sec, '2P' is displayed on setting value (SV) display, push the [AUTO] key within 2 sec. 3. After teaching the object for 2 sec, set the judgment output range automatically by applying the result.
	[MODE]+[▲] key over 2 sec	Sets the type of control/analog output. Setting: Select the setting value by [▲/▼] key, and apply by [MODE] key. • Setting range Control output 'OUT': NPN output 'IPN', PNP output 'IPNP' analog output 'A-OUT': Disable 'OFF', 4-20mA current output '4-20MR', 0 to 5V voltage output '0-5V', 1 to 5V voltage output '1-5V', -5 to 5V voltage output '-5-5' After setting is finished, flashes 'OUT.SET' on present value (PV) display and 'END' on setting value (SV) display 3 times, and returns to run mode.
HIGH PEAK value	[▲] key	Displays HIGH/LOW PEAK value. If there is direction key input or no key input for 5 sec, returns to run mode. If push the [▲/▼] key over 3 sec during HIGH/LOW PEAK value display mode, initializes the value.
LOW PEAK value	[▼] key	If there is no value, displays 'HHHH'/'LLLL'.
Parameter group	[MODE] key over 2 sec	Enters to the parameter group 1 to 4.

■ Parameter Group

- Push the [MODE] key over 2 sec to enter the parameter setting mode.
- In the setting mode, change the parameter group by the [◀/▶] keys and enter the group by pushing the [MODE] key.
- In the group, change the parameter by the [▲/▼] keys, select by pushing the [MODE] key, and change the setting value by [▲/▼] keys.
- In the each step, push the [MODE] key over 3 sec to save and return to the upper step.
- ※Some parameters are enable by related parameter setting.

PARAM	Parameter group 1	Setting range	Default	PARAM	Parameter group 2	Setting range	Default
PARA1	Settings related to output type, displacement, display and error output.			PARA2	Settings related to present value.		
RESP	Response time	330μs, 500μs, 1ms, 2ms, 5ms	1ms	CALC	Calculation	OFF	OFF
SEHS	Teaching mode	IPN/2PN/1-point/2-point	IPN	GAIN	Gain	1, 2, 3	1
NOHC	Output type	NC Normally open/NC Normally closed	NO	FILTER	Filter	RVF Average filter/RVFD Differential filter	RVF
DISP	PV display	SCALE Standard	SCALE	MEAN	Samples for averaging	1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096	16
DOLE	Display digit	0.000, 0.00, 0.0, 0	0.000	Hold	Hold	OFF Off/PEAK Peak/bottom Bottom/P-P Difference/SAMPLE Sample/RVG Average	OFF
H-SC	Display scale	-99.999 to 99.999	Different by models	Hold	Hold timing input	t-IN External input/REUP Over auto trigger level/RELD Under auto trigger level	t-IN
HYS	Hysteresis	0.001 to 99.999	0.001	RELV	Auto trigger level	-99.999 to 99.999	0
H-AN	Analog output scale	-99.999 to 99.999	Different by models	REHYS	Auto trigger hysteresis	0.001 to 99.999	0.001
L-RA	Error output	KEEP Keep PV/F1 Fixed value	KEEP	t-Mod	Timer	OFF Off/ON Output delay/OD Output hold	OFF
FIXOUT	Fixed output	Set analog output range	Max. value	t-MER	Timer value	0 to 9999	0
PARAM	Parameter group 3	Settings related to external input.		PARAM	Parameter group 4	Settings related to user convenience functions.	
d-IN	External input 1	OFF Off/t-IN Timing input/OUTCLR Output reset/L-OPF Stop emission	t-IN	d-IP	Display direction	▲/▼ (select direction) → [MODE] (apply)	Normal display
d-IN2	External input 2	OFF Off/t-IN Timing input/OUTCLR Output reset/L-OPF Stop emission	OUTCLR	bANK	Bank	bANK-0, bANK-1, bANK-2, bANK-3	bANK-0
d-IN3	External input 3	OFF Off/bANK-A Bank input-A/bANK-b Bank input-B	L-OFF	SAVE	Saving mode	OFF Off/SAVE Digital display/SAVE2 All display	OFF
d-IN4	External input 4	OFF Off/bANK-A Bank input-A/bANK-b Bank input-B	ZERO	LOCK	Lock mode	LOCK [AUTO], [ZERO] Lock setting parameter group (except unlock key)	OFF
				INIT	Initialize	OFF, CLR-b0, CLR-b1, CLR-b2, CLR-b3, CLR-A	OFF

※Parameter group 4 is common, not saved per bank separately.

■ Error Display

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

Setting value (SV) display	Output	Reason	Solution
HERD	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.
LASEP	O	Malfunction of emission	
dRRK	—	Not existing the object or background in maximum measurement range	Adjust the distance between sensor head and object in the maximum measurement range.
RANGE	—	Over receive the light	
bRI GHT	—	In status of display unavailable	Return to status of present value display available.
-----	—	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 'INIT' function. 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.
R-NEH	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.
H-NEH	O	Poor connection between amplifier units.	Check the connection between amplifier units, and supply the power again.
AMP-C	O	Mismatch the version of firmware between sensor head and amplifier unit.	Please contact the Autonics technical advisory center.
VER	O	Disconnection of the judgement output	After turn off the power, check connection of HIGH (black) / GO (gray) / LOW (orange) wire, and supply the power again.
OUTO	—	Teaching failure	After check the object is in the maximum measurement range, execute 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.
OUTP	O	Over current of output terminal	Check the load of output is specification range. Check the output is contacted other wire or frame.

■ 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. [Amplifier unit]
- For the optimized performance, it is recommended to measure after 30 minute from supplying power. [Amplifier unit]
- Since external disturbance light (sunlight, fluorescent lighting, etc.) can cause product malfunction, use the product with a light shield or slit. [Sensor head]
- When detecting with the maximum sensitivity, an error may occur depending on each characteristic deviation.
- This unit may be used in the following environments.
 - ①Indoors/Outdoors (in the environment condition rated in 'Specifications')
 - ②Altitude max. 2,000m
 - ③Pollution degree 2
 - ④Installation category II