

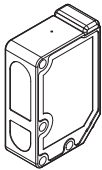
CMOS Laser Sensor

ZA-B Series

Download the index list, the IO Device Description (IODD) file, and the users manual from the OPTEX FA website.
https://www.optex-fa.com



OPTEX FA CO., LTD.



Thank you for purchasing this CMOS Laser Sensor ZA-B Series.
Before using this product, please read this manual carefully to ensure proper use.
Read this manual thoroughly, and then keep this manual at hand so that it can be used whenever necessary.

Refer to the ZA-B Series User's Manual for detailed information on how to set up the ZA-B Series and the details of each function.

Safety Precautions

Safety precautions for ensuring safe operation of this product are displayed as follows with the following symbols.
Precautions listed here describe important information about safety. Make sure to follow them accordingly.

Safety Symbols

	WARNING	Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage.
	CAUTION	Indicates that any improper operation or handling may result in minor injury or property damage.

WARNING	
	This product cannot be used in applications that directly or indirectly detect human bodies for the purpose of ensuring safety. Do not use this product as a detection device for protecting the human body.
	Do not disassemble, repair, modify, deform under pressure, or attempt to incinerate this product. Doing so may cause injury or fire.
	This product does not have a function that stops the emission of light from the laser during disassembly. Do not disassemble the product.
	Do not use this product underwater, as it may cause malfunction.
	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in an explosion or fire.
	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in an explosion or fire.
	Do not install this product in any of the following locations. Doing so may cause a fire, damage, or a malfunction. 1. Locations where dust, salt, iron powders, or vapor (steam) is present. 2. Locations subjected to corrosive gases or flammable gases. 3. Locations where oil or chemical splashes may occur. 4. Locations where heavy vibrations or impacts may occur. 5. Locations where the ambient temperature exceeds the rated range. 6. Locations subject to rapid temperature changes (or where condensation occurs). 7. Locations with strong electric or magnetic fields. 8. Locations subject to direct light.
	This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures
	This product is not intended for use with nuclear power, railways, aviation, vehicles, medical equipment, food-handling equipment, or any application where particular safety measures are required. Absolutely do not use this product for any of these fields.
	Do not look directly at the laser beam or intentionally shine the laser beam in another person's eyes. Doing so may have adverse effects on the eyes, including temporary blindness.
	What to do in the event of a malfunction such as smoke being emitted from the product If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the body becoming very hot, immediately stop operating the product and turn off the sensor power. Failure to do so may cause a fire. Repairing the product is dangerous and should in no way be performed by the customer. Contact an OPTEX FA sales representative for repairs.
	What to do if water enters the product If water or any other liquid enters the product or the cable, immediately stop operating the product and turn off the power. Using the product in this condition may cause a fire.

CAUTION

	Wire separately from high-voltage lines and power lines. Wiring them together may result in induction, which may cause malfunction or failure. If it is unavoidable, shield the wiring with a conductor such as conduit with grounding work done.
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CAUTION	
	Do not excessively twist or apply stress to the cable. Doing so may damage the cable or the connector.
	Do not drop the product or subject the product to strong impacts. Doing so may damage the product.
	Do not use this product in locations exposed to water or allowing it to get wet may affect detection performance.
	Follow the instructions in this manual or the specified instruction manual when wiring the product or the dedicated controller for the correct wiring method. In-correct wiring can damage the product or the controller, or cause a malfunction.
	Do not bend the cable when below the freezing point. Doing so may cause the cable to break.
	Install this product as far away as possible from high-voltage equipment, power equipment, equipment that generates large switching surges, inverter motors, welders, or any equipment that can be a source of noise.
	When connecting or disconnecting the connector, make sure to hold it by the connector portion, Do not pull on the cable.
	When disconnecting the connector, do not touch the pins inside the connector and do not allow foreign objects to get inside.
	Use the product and dedicated controller within the rated ranges.
	Install this product and dedicated controller securely. Failure to ensure secure installation may result in the products falling and becoming damaged.
	Use M3 screws and tightening torque of 0.5 N·m or less for mounting the product.
	The Ø0.6mm hole on the top surface on the sensor (see "1. Dimensions") is a vent. Do not block the hole or insert foreign objects, as this may compromise the degree of protection.
	Make sure to turn the power off before wiring the cable or connecting/disconnecting the connector. Performing work while the product is energized may damage it or cause electric shock.

NOTICE

- After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
- Specifications regarding the hardware, software, and systems mentioned in this manual may be subject to change without notice due to technological advancements.
- When using this product, it is the responsibility of the customer to ensure necessary safety designs in hardware, software, and systems in order to prevent any threat to life, physical health, and property due to product malfunction or failure.
- Do not use this product for the development of weapons of mass destruction, for military use, or for any other military application. Moreover, if this product is to be exported, comply with all applicable export laws and regulations, including the "Foreign Exchange and Foreign Trade Act" and the "Export Administration Regulations," and carry out the necessary procedures pursuant to the provisions therein.
- Before using this product, fully examine the applicable environmental laws and regulations, and operate the product in conformity to such laws and regulations. OPTEX FA does not assume any responsibility for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
- If installing this product in your own equipment, ensure that the product is properly handled according to the laws and regulations of the relevant country or region.
- Individual differences in products and the condition of the object may cause differences in detection characteristics.

Precautions for Laser Use

- This product emits a class 1 or class 2 visible laser beam that is compliant with IEC 60825-1 laser product safety standards. Labels for applicable standards are affixed to the product.
- If this product will be exported to the United States, approval must first be obtained from the FDA (Food and Drug Administration), the laser regulating body of the United States.
- A report for this product has been submitted to the CDRH (Center for Devices and Radiological Health).
- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Laser Class 1



Symbol	Meaning
	Laser emission
LASER 1	Class 1 laser product
	Laser aperture

Laser Class 2



Symbol	Meaning
	Laser emission warning
LASER 2	Class 2 laser product
	Laser radiation Do not stare into beam
	Laser aperture

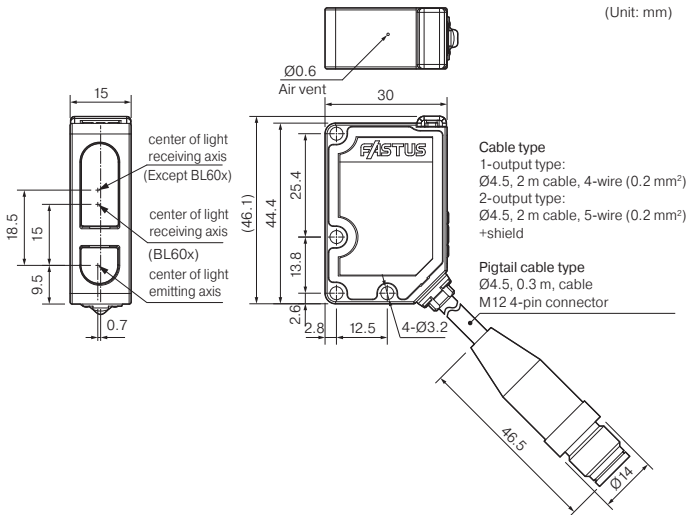
Laser warning label position



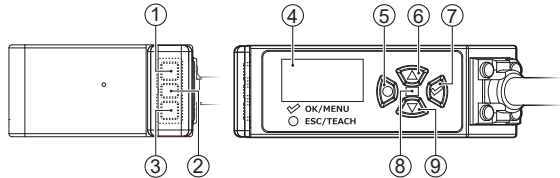
Type of laser used in this product

Type	Red semiconductor laser
Wavelength	663 nm
Maximum output	0.39 mW/1 mW
Pulse duration	180 µs max.
Repetition frequency	1 kHz

1. Dimensions



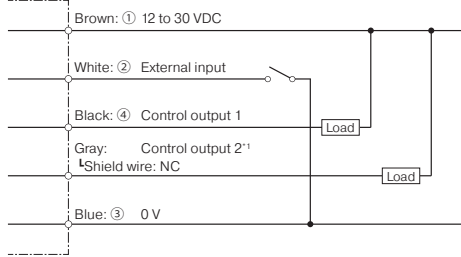
2. Part Name



No.	Part Name	Description
①	Output 1 indicator	Lights up orange when Output 1 is ON.
②	Laser emission indicator	Lights up green during laser emission.
③	Output 2 indicator	Lights up orange when Output 2 is ON. (For the 1-output type, it is linked with the output 1 indicator.)
④	Display	Displays measurement values and settings menus.
⑤	Cancel key (○)	Short press: Cancel settings Long press: Go to Teach screen
⑥	Selection key (△)	Move menu items and increase setting values.
⑦	Enter key (✓)	Short press: Confirm setting Long press: Go to Menu screen
⑧	Status indicator	Lights up green: normal state Blinks green: communicating via IO-Link Blinks red: an error occurred
⑨	Selection key (▽)	Move menu items and decrease setting values.

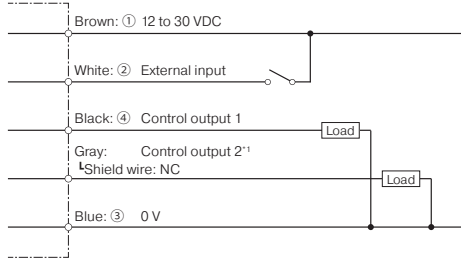
3. Connection Diagram

①NPN setting



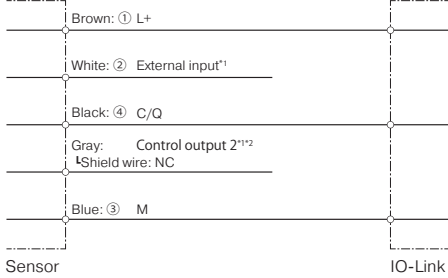
*1 Only for the 2-output type (ZA-BLxD)

②PNP setting



*1 Only for the 2-output type (ZA-BLxD)

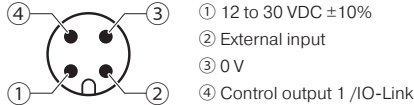
③IO-Link setting



*1 For [C9] NPN/PNP settings, refer to ① NPN setting for NPN, and ② PNP setting for PNP.

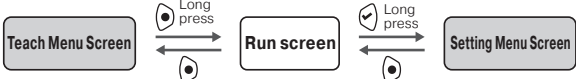
*2 Only for the 2-output type (ZA-BLxD)

M12 connector pin assignments

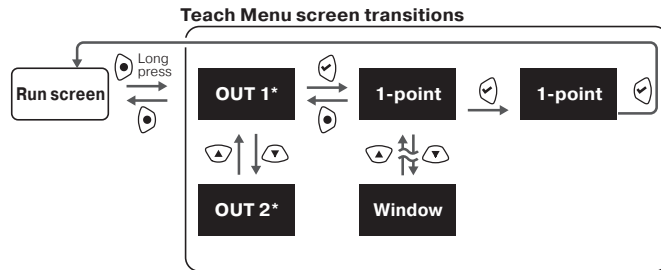


4. Menu List

This product has two menus: the Teach Menu and the Settings Menu.
This is an example display when English is selected in the [CA] language.



How to operate Teach Menu

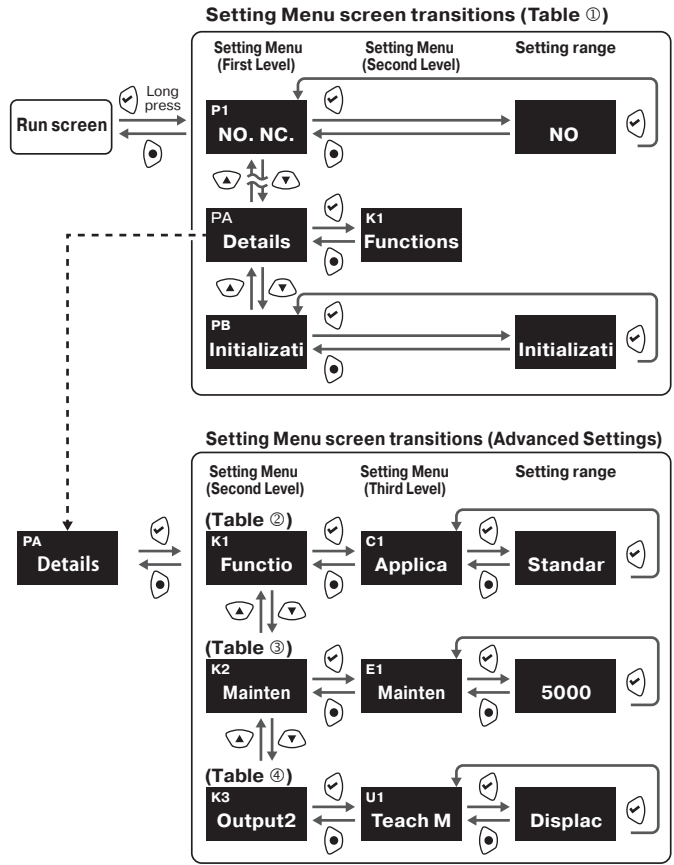


* Output selection is for the 2-output type (ZA-BLxD) only.

Teach mode list

Teach mode	Description	Output
Displacement	The measurement distance is displayed. All outputs are disabled.	Disabled
1-point	The sensing range can be set by performing TEACH once. This is a simple and versatile TEACH.	Output 1, Output 2
Window	Perform TEACH twice-once for the near distance and once for the far distance-to detect objects within those ranges. Since the sensing range can be set arbitrarily, this is ideal for detecting whether objects exist within a specific range.	Output 1, Output 2
2-point	Perform TEACH twice-once with an object present and once without-to set the sensing range. The threshold is set at the midpoint between the presence and absence points of the object, enabling detection that is resistant to the effects of distance.	Output 1, Output 2
Dynamic	Perform TEACH while the object is moving to set the sensing range. Use this when the object cannot be stopped or for small objects where positioning is difficult.	Output 1, Output 2
1-window	Perform TEACH once with the object to set the sensing range. The sensing range is set equidistantly on both the near and far distance from TEACH point.	Output 1, Output 2
BGS 3-point	Perform TEACH three times at each distance: near, medium, and far to set the sensing range. The sensing range extends from the midpoint between the near and medium distances to the midpoint between the medium and far distances.	Output 1, Output 2
FGS 1-point	Perform TEACH once in the background (no objects) to set the sensing range. This is ideal for detecting metal or shiny objects. This TEACH requires a stable background.	Only Output 1
Transparent 1-point	Perform TEACH once in the background (no objects) to set the sensing range and sensitivity. This is ideal for detecting transparent objects such as glass or film. This TEACH requires a stable background.	Only Output 1

How to operate Setting Menu



Setting Menu List (Table ①)

Setting Menu (First Level)	Setting Menu (Second Level)	Setting range, description	Default value
P1	NO. NC.	NO/NC	NO
P2	Response Time	1 ms/10 ms/20 ms/50 ms	50 ms
P3	Delay Mode	OFF/ON Delay/OFF Delay/One-shot	OFF
P4	Delay Time	0 ... 9999 ms	5 ms
P5	Tolerance	BL60: 0 ... 99.99 BL150: 0 ... 999.9 BL300: 0 ... 999.9 BL500: 0 ... 999.9 BL1000: 0 ... 9999	BL60: 0.5 mm BL150: 5 mm BL300: 5 mm BL500: 5 mm BL1000: 50 mm
P6	Sensitivity	Auto/Fix/ Auto+High Sensitivity/ Fix+High Sensitivity	Auto
P7	Input	Laser OFF/Laser ON/Teach/ Zero Set/Count Reset/ Synchronous	Laser OFF
P8	Eco	ON/Eco/OFF	Eco
PA	Details	K1 Functions K2 Maintenance K3 Output2	See [PA]-[K1] Function below. See [PA]-[K2] Maintenance on right. See [PA]-[K3] Output2 on right.
PB	Initialization ^{*1}	Initialization/Factory settings/ count only	Initialization

*1 Action settings menu. When selected, the corresponding settings will be automatically executed.

[PA]Details

[PA]-[K1] Function (table ②)

Setting Menu (Third Level)	Setting Menu (Fourth Level)	Setting range, description	Default value
C1	Applications	Invert/Standard	Standard
C2	Peak/Bottom	J1 Peak Distance Displays the peak distance during output is ON. Resets when switching from OFF to ON. J2 Bottom Distance Displays the bottom distance during output is ON. Resets when switching from OFF to ON.	- -
C3	Zero-set Teach	Enable/Disable	Enable
C4	Zero-set ^{*1}	ON/OFF	ON
C5	Hysteresis	BL60: 0 ... 99.99 BL150: 0 ... 999.9 BL300: 0 ... 999.9 BL500: 0 ... 999.9 BL1000: 0 ... 9999	BL60: 0.1 mm BL150: 1 mm BL300: 1 mm BL500: 1 mm BL1000: 10 mm

Setting Menu (Third Level)	Setting Menu (Fourth Level)	Setting range, description	Default value
C6	Edge	G1 Cycle Offset G2 Lower Limit G3 Upper Limit G4 Hysteresis G5 Direction G6 Edge Hold	0 ... 10000 0 ... 32000 0 ... 32000 0 Rise/Fall/Both -
C7	Counter	N1 Count N2 Count Threshold	- 0 ... 2,000,000,000
C8	Display	Normal/Invert	Normal
C9	NPN/PNP	NPN/PNP	NPN
CA	Language	English/日本語/简体中文	English
CB	OUT1 Function	Normal/Count/Edge	Normal
CC	Threshold1	BL60 : -70.00 ... 70.00 BL150 : -170.0 ... 170.0 BL300 : -330.0 ... 330.0 BL500 : -550.0 ... 550.0 BL1000 : -1100 ... 1100	0
CD	Threshold2	BL60 : -70.00 ... 70.00 BL150 : -170.0 ... 170.0 BL300 : -330.0 ... 330.0 BL500 : -550.0 ... 550.0 BL1000 : -1100 ... 1100	0
CE	Threshold: Transparent	0 ... 99.9	20.0

*1 Action settings menu. When selected, the corresponding settings will be automatically executed.

[PA]-[K2] Maintenance (Table ③)

Setting Menu (Third Level)	Setting range, description	Default value
E1	Maintenance Days Displays the number of days until a maintenance notification event occurs. Display range: 0 ... 5000 Values exceeding 5000 are displayed as 5000.	5000
E2	Maintenance Event An event occurs when the maintenance days falls below the set value. Setting range: 0 ... 5000	0
E3	Laser Lifetime Displays the estimated number of days remaining until the laser reaches the end of its lifetime due to degradation. Setting range: 0 ... 5000 If measurement is not possible, 65535 will be displayed.	5000
E4	Laser Lifetime Event An event occurs when the laser lifetime falls below the set value. Setting range: 0 ... 5000	0
E5	Total Operating Time Displays the total operating time from the time of initial use to the present. The unit is seconds, recorded in 10-second increments.	-
E6	Operating Time Displays the operating time after power-on. The unit is seconds, and it resets when the power is turned off.	-
E7	Laser Operating Time Displays the laser operating time of the sensor. The unit is seconds, recorded in 10-second increments.	-
E8	Temperature Displays the internal temperature of the housing in increments of 0.01°C.	-
E9	Input Voltage Displays the input voltage in increments of 0.01 V.	-
EA	Lower Limit Displays the lower limit of the distance display range for each model.	-
EB	Upper Limit Displays the upper limit of the distance display range for each model.	-
EC	Product Name Displays the product name.	-
ED	Serial number Displays the serial number.	-
EE	Hardware Revision Displays the hardware revision.	-
EF	Firmware Revision Displays the firmware revision.	-
F0	Error Displays the error occurring in the product. Press the  key to clear the error while it is displayed.	-
F1	Transmission Rate	COM3/COM2

[PA]-[K3] Output2(Table ④)

Setting Menu (Third Level)	Setting Menu (Fourth Level)	Setting range, description	Default value
U1	Teach Mode*1	Displacement/1-point/Window/ 2-point/Dynamic/1-window/3-point	Displacement
U2	Threshold1	Same as [CC]Threshold1	0
U3	Threshold2	Same as [CD]Threshold2	0
U4	NO. NC.	Same as [P1]NO.NC.	NO
U5	Delay Mode	Same as [P3]Delay Mode	OFF
U6	Delay Time	Same as [P4]Delay Time	5 ms
U7	Hysteresis	Same as [C5]Hysteresis	BL60: 0.1 mm BL150: 1 mm BL300: 1 mm BL500: 1 mm BL1000: 10 mm
U8	OUT2 Function	[CB]OUT1 Function+Error/Event	Normal
U9	Counter	R1 OUT2 Count R2 Count Threshold	0 Same as [N2]Count Threshold

*1 Action settings menu. When selected, the corresponding settings will be automatically executed.

5. Specifications

Model Specifications

Model	1-output	Cable	ZA-BL60	ZA-BL150	ZA-BL300	ZA-BL500	ZA-BL1000
	Pigtail cable		ZA-BL60M	ZA-BL150M	ZA-BL300M	ZA-BL500M	ZA-BL1000M
	2-output	Cable	ZA-BL60D	ZA-BL150D	ZA-BL300D	ZA-BL500D	ZA-BL1000D
Sensing distance ^{*1}			30 ... 60 mm	35 ... 150 mm	35 ... 300 mm	35 ... 500 mm	50 ... 1000 mm
Distance display range			27 ... 70 mm	32 ... 170 mm	32 ... 330 mm	32 ... 550 mm	40 ... 1100 mm
Display resolution			0.01 mm	0.1 mm	0.1 mm	0.1 mm	1 mm
Light source	Medium		Red semiconductor laser				
	Wavelength		663 nm				
	Maximum output		0.39 mW	0.39 mW	0.39 mW	0.39 mW	1 mW
	Pulse duration		180 μs max.				
Laser class			CLASS 1				
Spot size (Typical value)*3			Approx. 1.7 x 0.7 mm at 60 mm	Approx. 2.1 x 0.8 mm at 150 mm	Approx. 5.1 x 1.8 mm at 300 mm	Approx. 5.8 x 2.1 mm at 500 mm	Approx. 7.6 x 2.7 mm at 1000 mm
Repeat accuracy*4 (Response time: 50 ms)			0.01 mm	0.05 mm	0.2 mm	0.5 mm	2 mm
Linearity			±0.1% of F.S.	±0.2% of F.S.	±0.3% of F.S.	±0.7% of F.S.	±1.6% of F.S.
Converted value of linearity			±0.03 mm	±0.23 mm	±0.8 mm	±3.3 mm	±15.2 mm
Minimum detectable step			0.08 mm	0.6 mm	2 mm	7.6 mm	36 mm

Common Specifications

Supply voltage		12 ... 30 VDC (±10%, including ripple), IO-Link mode: 18 ... 30 VDC (±10%, including ripple)
Current consumption		40 mA or less at 24 VDC
IO-Link	Revision	1.1.4
	Baud rate	COM 3 (230.4 kbps)
	Process data length	Input: 4 bytes, Output: 1 byte
	Minimum cycle time	0.6 ms
Control output		1 output or 2 outputs (model dependent); Output 1 can be switched to IO-Link NPN/PNP open collector (selectable by setting) Max. 50 mA /30 VDC, Residual voltage 1.8 V or less
Output mode		NO/NC (selectable by setting)
Timer function		ON Delay/OFF Delay/One-shot (selectable by setting) adjustable 0 ... 9999 ms
Sensitivity adjustment		Various teaching and manual adjustments
	Teach mode	1-point/Window/2-point/Dynamic/1-window/3-point/FGS 1-point ^{*5} /Transparent 1-point ^{*6}
Response time		1 ms/10 ms/20 ms/50 ms
External input		Laser OFF/Laser ON/Teach/Zero Set/Count Reset/Synchronous
Display	Digital display	OLED display 60x32 pixel, Menu languages: English, Japanese, Simplified Chinese
	Indicators	Laser emission indicator (lit green), Output indicator (lit orange/blinking orange), Status indicator (lit green/blinking green/lit orange/blinking red)
Connection	1-output	Cable: Ø4.5 mm 2 m cable, Pigtail cable: Ø4.5 mm 300 mm cable with M12 4-pin connector
	2-output	Minimum bending radius; cable diameter x 8 (when fixed in place and movable) Cable: Ø4.5 mm 2 m cable, Minimum bending radius; cable diameter x 8 (when fixed in place and movable)
Protection circuit		Reverse connection protection, overcurrent protection
Environmental resistance	Degree of protection	IP67 (IEC 60529)
	Ambient temperature/humidity	-10 ... +55°C/35 ... 85%RH (no freezing or condensation)
	Storage temperature/humidity	-20 ... +60°C/35 ... 85%RH (no freezing or condensation)
	Ambient illuminance	Color temperature: 2750K, 30,000 lx
	Vibration resistance	10 ... 55 Hz, Double amplitude 1.5 mm; 2 hours in each of the X,Y and Z directions
	Shock resistance	500 m/s ² 3 times in each of the X, Y and Z directions
Applicable regulations	EMC	EMC Directive (2014/30/EU), UK EMC (Electromagnetic Compatibility Regulations 2016), FCC Part 15 subpart B
	Environment	RoHS Directive (2011/65/EU), China RoHS (MIIT Order No. 32)
	Safety	UK RoHS (The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012) FDA Regulations (21 CFR 1040.10 and 1040.11)Excluding differences per Laser Notice No. 56
Protection against electric shock		Class III (IEC 61140)
Applicable standards		EN 60947-5-2, IEC 60825-1
NRTL certification		UL Recognized Component certification for the US and Canada
Warm-up time		Approx. 30 minutes
Material		Housing: PC, Front cover: PC
Weight		1-output cable: Approx. 75 g, Pigtail cable: Approx. 35 g, 2-output cable: Approx. 80 g

*1: Using our standard measured object (white ceramic).

*2: In accordance with the FDA provisions of Laser Notice No. 56, the laser is classified per the IEC 60825-1:2014 standard.

*3: Defined with center strength 1/e² (13.5%) at the center of the measurement range.
There may be leak light other than the specified spot size.
The sensor may be affected when there is a highly reflective object close to the detection area.

*4: Peak to peak value of measurement in stationary state
*5: Minimum detectable step equivalent to twice the hysteresis.
Hysteresis equivalent to (linearity/2) + repeat accuracy.
For the ZA-BL60, the hysteresis is 0.04 mm, calculated as: ±0.1% of F.S. (±0.03 mm) /2 + 0.01

*6: Only Output 1 can be set.

- Support for the China RoHS directive
-  For details on the support for the China RoHS (the Administrative Measure on the Control of Pollution Caused by Electronic Information Products), see the following website.
http://www.optex-fa.com/rohs_cn/

- Specifications are subject to change without notice.
- For more information, questions and comments regarding product, please contact us at the information right.

This device complies with part 15 of the FCC Rules.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

* This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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