B5W-LB series

Light Convergent Reflective Sensor

Light Convergent Reflective Type for Reduced Color and Material Susceptibility
Reliable Detection of Shiny, Black or Transparent objects

- **<Robustness of color>**
  -Stable detection of shiny, black or transparent objects
  -Unaffected by backgrounds, meaning only the intended object is sensed accurately.
- **<Robustness of the distance>**
  -A wide sensing range to allow object shifting
- **Robust design resistant to ambient lights**
- **In addition to analog voltage output and 24 VDC digital output, a 12 VDC digital output type has been added to the lineup**
- **55 mm and 10 mm sensing distances are available**

⚠ Be sure to read Safety Precautions on page 8.

Model Number Legend

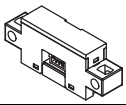
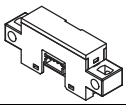
B5W-LB □□□□-□
1. 2. 3. 4. 5.

1. Size
   1: Super miniature
   2: Miniature
2. Maximum sensing distance
   Subminiature
   1: 10mm
   Miniature
   1: 55mm
3. Power supply voltage/ output
   0: Analog voltage
   1: Vcc24V, NPN / Light-ON
   2: Vcc24V, NPN / Dark-ON
   5: Vcc12V, NPN / Light-ON
4. Protective structure/indicator lamp
   1: Protective structure not available, indicator lamp not available
   2: Protective structure available, indicator lamp not available
   4: Protective structure available, indicator lamp available
5. Minimum number of deliverable units
   1: 1 piece

Ordering Information

Sensors (Dimensions→P.7)

□ infrared

Sensing method	Appearance	Size	Connecting method	Output type	Sensing distance	Power supply voltage	Operating mode *2	Operation indicator lamp	Model	Minimum number of deliverable units (Unit: pieces)
Light Convergent Reflective		Super miniature	Connector	NPN open collector	□ 2 to 10 mm *1	24 VDC ±10%	Light-ON	Not available	**B5W-LB1112-1**	1
						12 VDC ±10%			**B5W-LB1152-1**	
						24 VDC ±10%		Available	**B5W-LB1114-1**	
							Dark-ON	Not available	**B5W-LB1122-1**	
		Miniature			□ 10 to 55 mm *1	24 VDC ±10%	Light-ON	Not available	**B5W-LB2112-1**	
						12 VDC ±10%			**B5W-LB2152-1**	
						24 VDC ±10%		Available	**B5W-LB2114-1**	
							Dark-ON	Not available	**B5W-LB2122-1**	
				Analog voltage output		5 VDC ±10%	---	Not available	**B5W-LB2101-1**	

*1. White paper
*2. In case of light-ON, control output is turned ON when a sensing object is detected.
In case of dark-ON, control output is turned ON when a sensing object is not detected.

B5W-LB

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Accessories (order separately)

Connector with cable

As it is not supplied with the sensor, order as needed.

Appearance	Cord length	Model	Applicable model
	1m	EE-5002 1M	**B5W-LB1112-1** **B5W-LB1114-1** **B5W-LB1122-1** **B5W-LB2112-1** **B5W-LB2114-1** **B5W-LB2122-1** **B5W-LB1152-1** **B5W-LB2152-1**

Note: The B5W-LB2101-1 (analog output type) must be prepared by the customer according to the connector information (external dimension drawing) on Page 7.

Ratings and Specifications

Digital output models

Sensing method		Light Convergent Reflective							
Item Model	NPN output	B5W-LB1112-1	B5W-LB1152-1	B5W-LB1114-1	B5W-LB1122-1	B5W-LB2112-1	B5W-LB2152-1	B5W-LB2114-1	B5W-LB2122-1
Sensing distance	White paper	2 to 10 mm				10 to 55 mm			
	Black paper	3 to 8 mm				10 to 40 mm			
Non-sensing distance (White paper)		20 mm min.				85mm min.			
Minimum detectable object (refernce value)		0.05 mm dia.				0.15 mm dia.			
Differential travel		20% max.							
Light source (wavelength)		Infrared LED (850 nm)							
Power supply voltage *1		24 VDC ±10%	12 VDC ±10%	24 VDC ±10%		24 VDC ±10%	12 VDC ±10%	24 VDC ±10%	
Current consumption		15 mA max. (V_{CC}=at maximum rated voltage)				20mA max. (V_{CC}=at maximum rated voltage)			
Operating mode		Light-ON			Dark-ON	Light-ON			Dark-ON
Control output		Load power supply voltage: maximum rated voltage, load current: 50 mA max. Residual voltage; 0.8 V max. at 50 mA load current and 0.32 V at 10 mA load current, Open collector output (NPN)							
Operation indicator lamp		Not available		Available	Not available	Not available		Available	Not available
Response time		Operate/reset: 1 ms max.							
Ambient illumination		Incandescent lamp: 3,000 lx max., Sunlight: 10,000 lx max.							
Ambient temperature range		Operating: -10 to +60°C, Storage: -25 to +80°C (with no icing or condensation)							
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 h each in X, Y, and Z directions							
Shock resistance		500 m/s² for 3 times each in X, Y, and Z directions							
Degree of protection		IP50 (IEC60529 standard, category 2) (not including terminals)							
Connecting method		Connector models							
Weight (unit only)		Approx 1.6 g				Approx 3.4 g			
Material	Case	Polycarbonate (PC)							
	Lens	Acrylic (PMMA)							
	Cover	Polycarbonate (PC)							

*1. Including 10% ripple (p-p)

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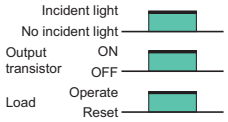
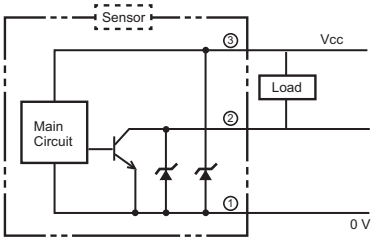
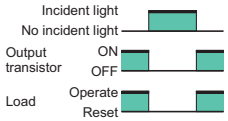
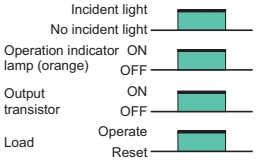
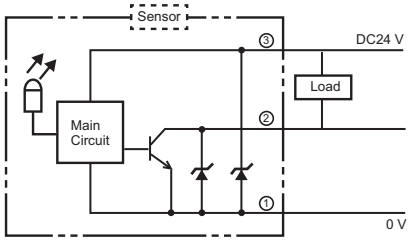
I/O Circuit Diagrams

NPN output (without indicator lamp)

Model	Operating mode	Timing charts	Output circuit
B5W-LB1112-1 **B5W-LB2112-1** **B5W-LB1152-1** **B5W-LB2152-1**	Light-ON ON		
B5W-LB1122-1 **B5W-LB2122-1**	Dark-ON ON		

Terminal No.	Name
1	GND
2	Vout
3	Vcc

NPN output (with operation indicator lamp)

Model	Operating mode	Timing charts	Output circuit
B5W-LB1114-1 **B5W-LB2114-1**	Light-ON ON		

Terminal No.	Name
1	GND
2	Vout
3	Vcc

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Analog voltage output model

● Absolute Maximum Ratings Exterior Specifications

Item	Symbol	Rated value	Unit	Remarks
Power supply voltage	Vcc	5.5	V	4. Vcc - 2. GND
Input pulse voltage *1	Vp	5.5 *2	V	1. Pulse - 2. GND
Operating temperature	Topr	-10 to 60	°C	With no icing or condensation
Storage temperature	Tstg	-25 to 80	°C	

*1. DC voltage is not covered by warranty.
*2. Pulse width: 800 µs, frequency: 500 Hz

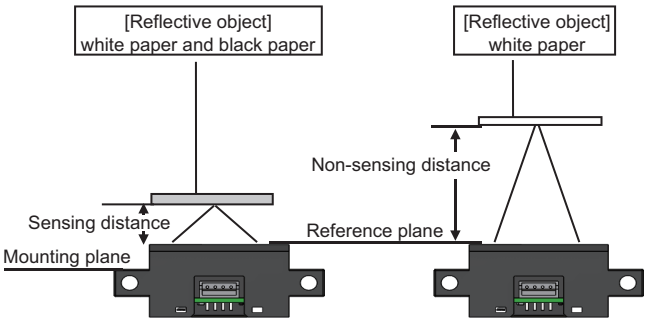
● Exterior Specifications

Connecting method	Weight (g)	Material	
		Case	Lens
Connector	Approx 3.2 g	Polycarbonate (PC)	Acrylic (PMMA)

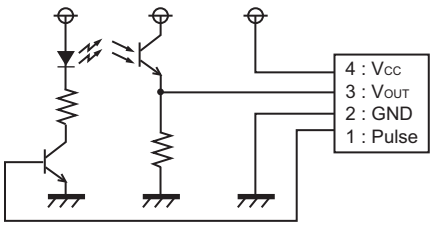
● Electrical and Optical Characteristics (Ta= 25°C, Vcc= 5.0 V)

Item	Symbol	Value			Unit	Condition
		MIN.	TYP.	MAX.		
Operating voltage	Vcc	4.5	5.0	5.5	V	---
Operating input pulse voltage	Vp	3.0	---	5.5	V	---
Maximum output voltage Forward voltage	Vomax	---	3.3	---	V	---
Sensing distance (Black paper)	Lrange	10	---	40	mm	Black paper, Vo≥70 mV
Sensing distance (White paper)	Lrange	10	---	55	mm	White paper, Vo≥70 mV
Non-sensing distance (White paper)	L	85	---	---	mm	White paper, Vo<30 mV

* Frequency = 500 Hz (duty = 40%), input voltage = 5.0 V
Output voltage without reflector = 0 mV
Specified reference plane and mounting surface are as shown Below



Analog voltage output

Model	Output circuit
B5W-LB2101-1	

Terminal No.	Name
1.	Pulse
2.	GND
3.	Vout
4.	Vcc

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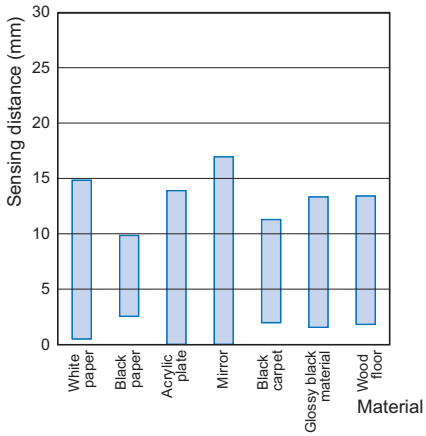
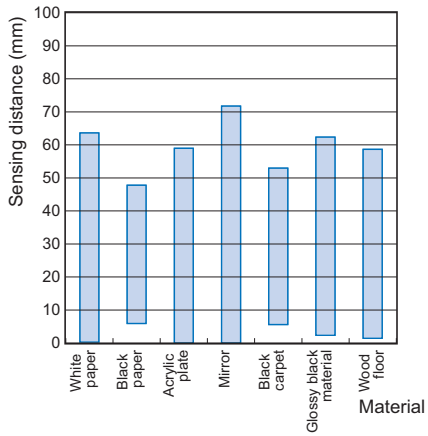
Engineering Data (Reference Value)

Distance Characteristics for Various Reflective Objects

B5W-LB1□

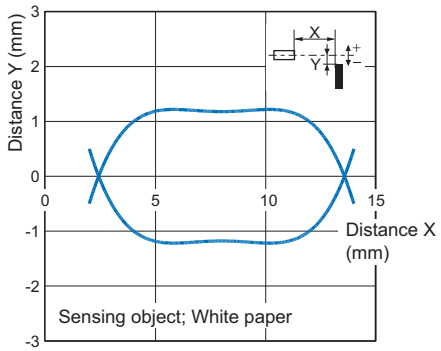


B5W-LB2□

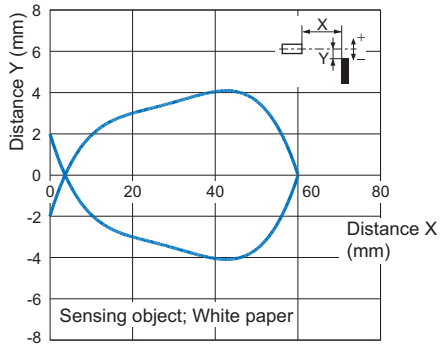


Operating Range (Left and Right)

B5W-LB1□

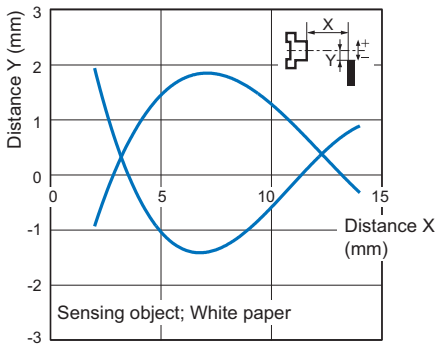


B5W-LB2□

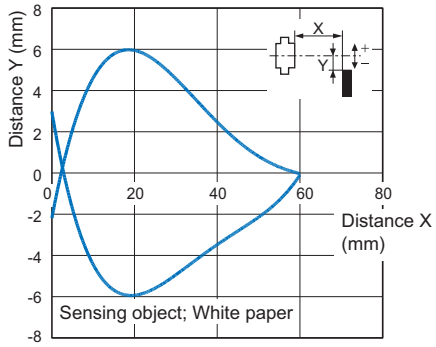


Operating Range (Up and Down)

B5W-LB1□

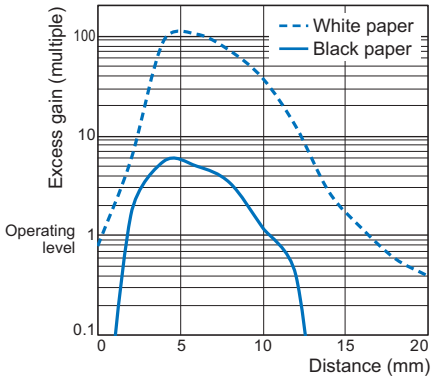


B5W-LB2□

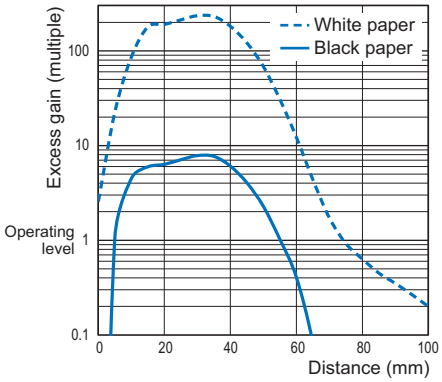


Receiver Output-Sensing Distance Characteristics

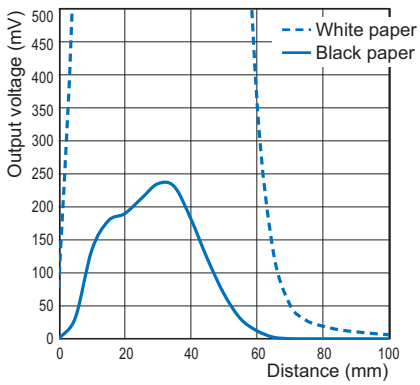
B5W-LB1□



B5W-LB2□ (except B5W-LB2101)



B5W-LB2101



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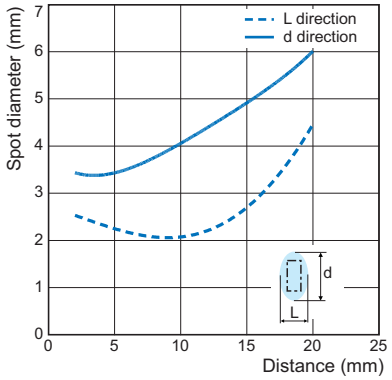
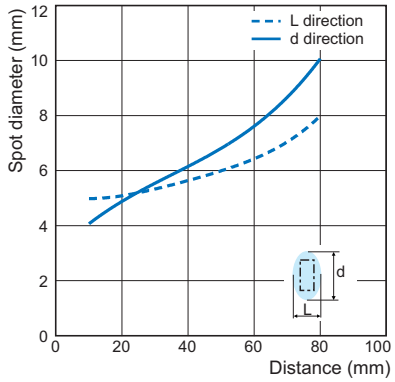
Spot diameter - distance characteristics

B5W-LB1□

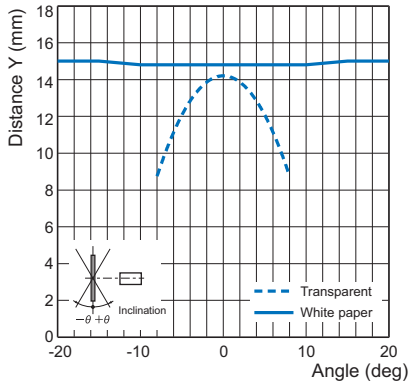


B5W-LB2□

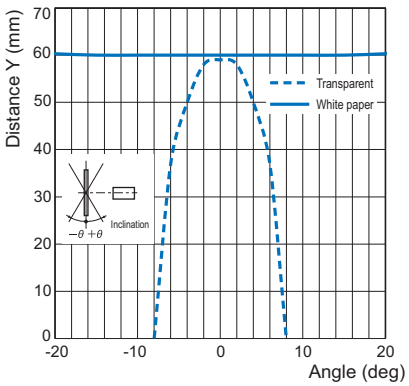


Angle characteristics (Left and right)

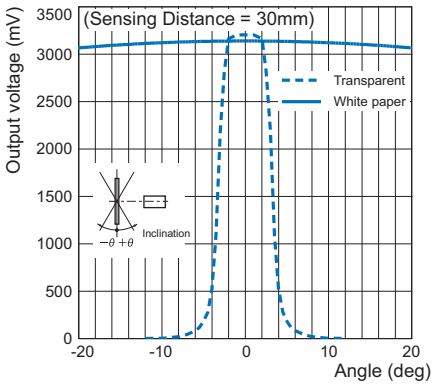
B5W-LB1□



B5W-LB2□ (except B5W-LB2101)

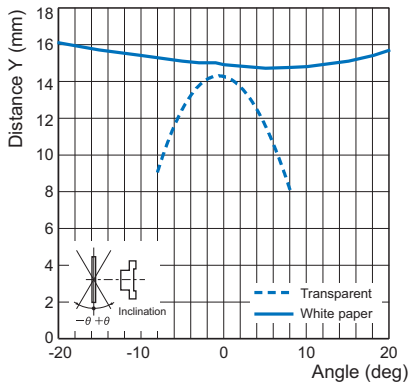


B5W-LB2101

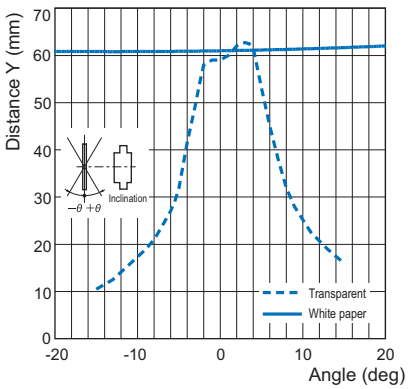


Angle characteristics (Up and down)

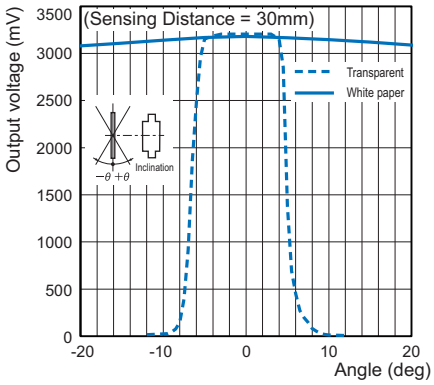
B5W-LB1□



B5W-LB2□ (except B5W-LB2101)



B5W-LB2101



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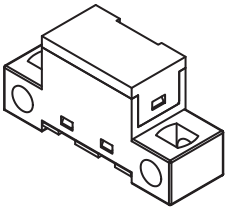
Dimensions

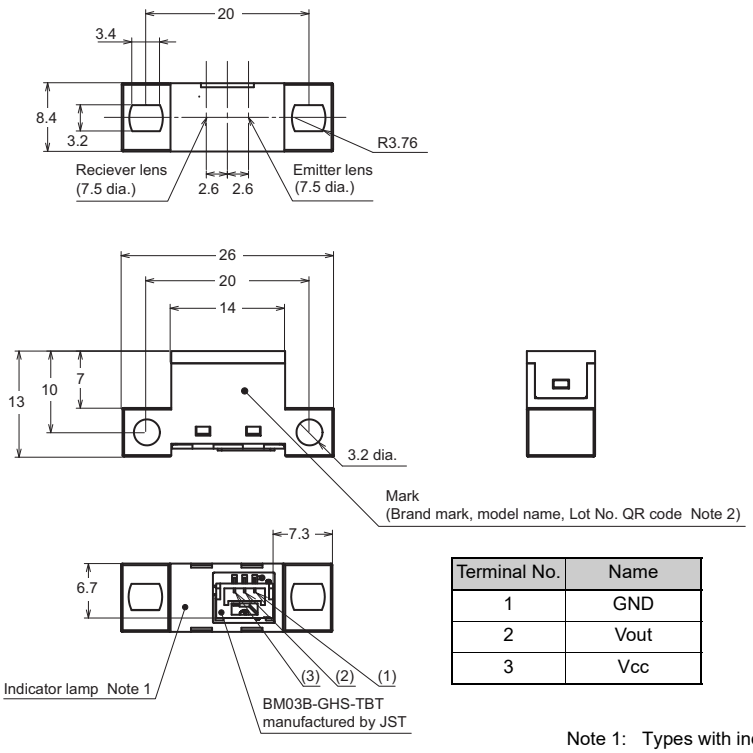
CAD Data marked products, 2D drawings and 3D CAD models are available.
For CAD information, please visit our website, which is noted on the last page.

(Unit: mm) Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

B5W-LB1112-1
B5W-LB1114-1
B5W-LB1122-1
B5W-LB1152-1

CAD Data



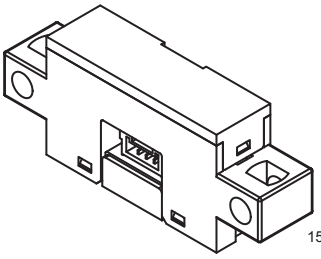


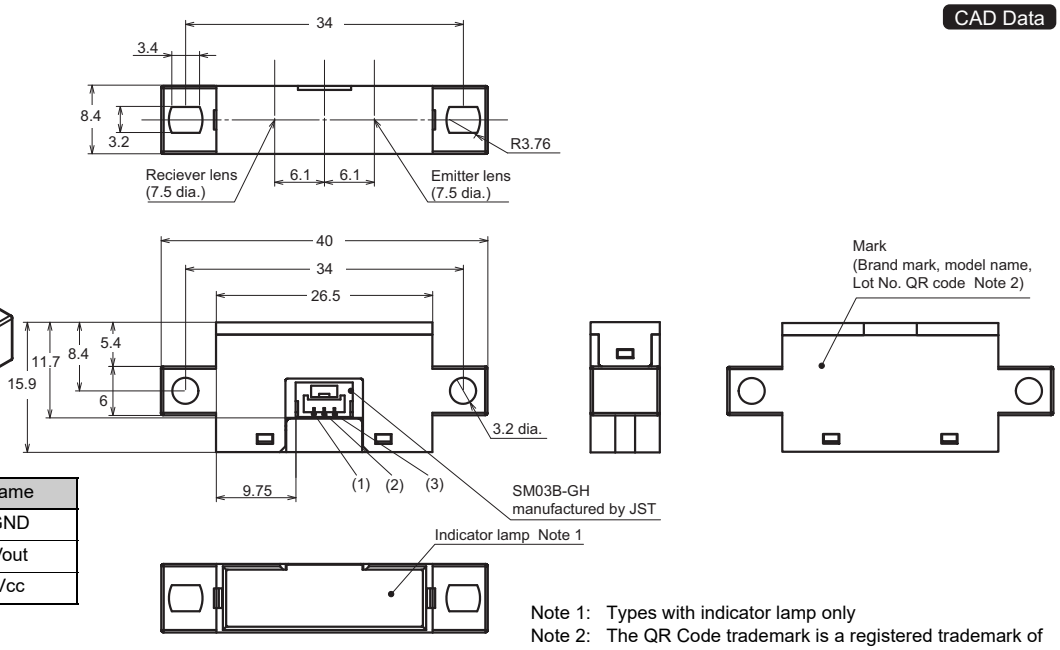
Terminal No.	Name
1	GND
2	Vout
3	Vcc

Note 1: Types with indicator lamp only
Note 2: The QR Code trademark is a registered trademark of DENSO WAVE INCORPORATED.

B5W-LB2112-1
B5W-LB2114-1
B5W-LB2122-1
B5W-LB2152-1

CAD Data





Terminal No.	Name
1	GND
2	Vout
3	Vcc

Note 1: Types with indicator lamp only
Note 2: The QR Code trademark is a registered trademark of DENSO WAVE INCORPORATED.

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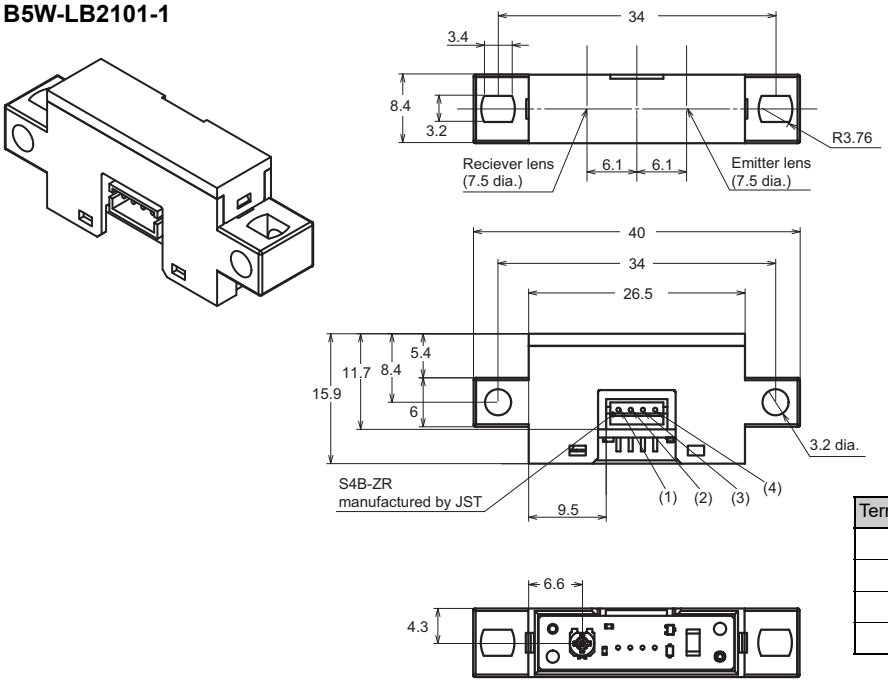
B5W-LB2101-1

CAD Data



Terminal No.	Name
1.	Pulse
2.	GND
3.	Vout
4.	Vcc

Safety Precautions

To ensure safe operation, be sure to read and follow the Terms and Conditions Agreement.

⚠ WARNING

These products cannot be used in safety devices for presses or other safety devices used to protect human life. This product is designed for use in applications for sensing workpieces and workers that will not affect levels of safety.

⚠ CAUTION

This product is not designed or rated for ensuring safety of persons either directly or indirectly.
Do not use it for such purposes.

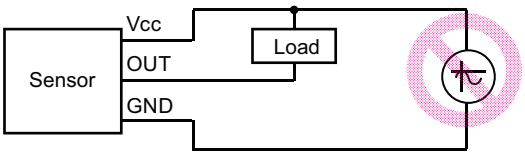
Precautions for Safe Use

To ensure safety, observe the following precautions.

●Wiring

Power supply voltage

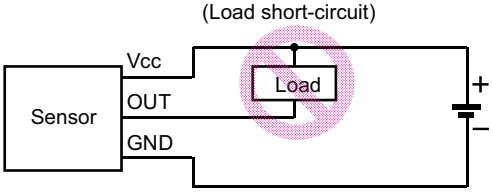
Do not use the product with a voltage or current that exceeds the rated range. Applying a voltage exceeding the specifications or using an AC power supply may result in rupture or burning.



Load Short-circuit (Digital only)

Do not short-circuit the load. Otherwise the product may be damaged or it may burn.

(Load short-circuit)

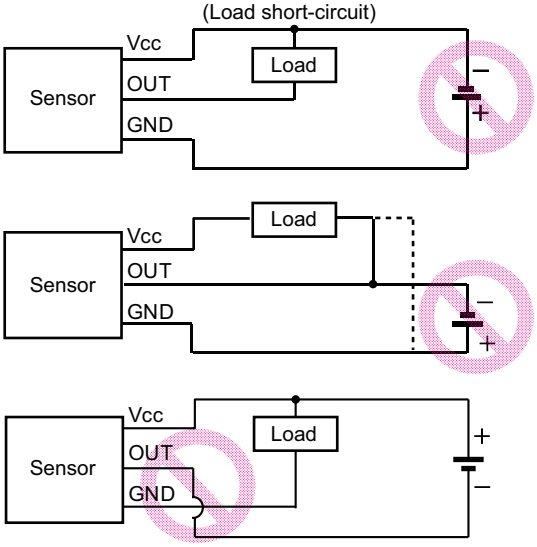


Faulty Wiring

Do not miswire such as the polarity of the power supply voltage. Otherwise the product may be damaged or it may burn.

Example 1. Wrong polarity

(Load short-circuit)



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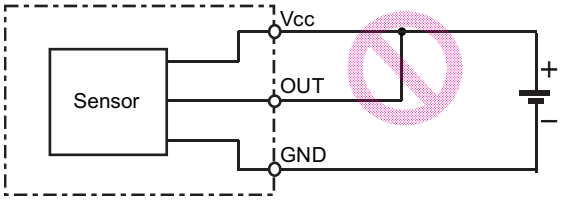
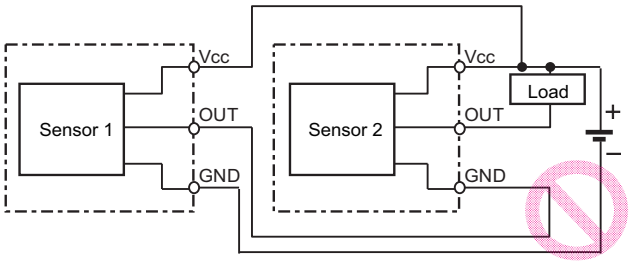
Connection without Load (Digital only)

Do not connect the power supply to the Sensor with no load connected, otherwise the internal elements may explode or burn. Always connect a load when wiring.



AND connection

With an AND connection as shown in the figure below, a voltage is applied to Vcc while GND of sensor 2 is not securely grounded. A failure may occur. Do not make this kind of connection. Also an inrush current may occur in sensor 2 when sensor 1 is turned on, causing failure or malfunction.



Storage and Operating Environment

(1) Places where the product is not exposed to corrosive gases, such as hydrogen sulfide gas, or salty wind.
(2) Places where it is not exposed to direct sunlight.
(3) Make sure that flux, oil, or other chemicals do not adhere to the surface of the emitter and receiver.
(4) Do not apply a load that may deform or deteriorate the product in any circumstances.
(5) Store the product in a normal temperature, humidity, and pressure environment.
(6) The product should be used without freezing or condensation.
(7) Do not use the product in atmospheres or environments that exceed product ratings.
(8) This product does not have a water-proof structure. Therefore, do not use it in an application or environment where it will be subjected to plashes from water, oil, or any other liquid.

Precautions for Correct Use

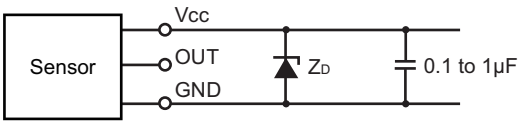
● Mounting

(1) Ambient light may cause the sensor to malfunction.
In such case, mount the sensor at an angle that ambient light does not enter the receiver lens.
Make sure that the sensor does not affected by ambient light.
(2) Mount the sensor securely on a flat surface.
(3) Use M3 screws to secure the sensor (use together with spring washers and 6-mm-diameter flat washers to prevent screws from loosening). Use a tightening torque of 0.54 N·m max.
(4) Take care that nothing comes into contact with the detected part of the sensor. Damage to the sensing element will result in poor performance.
(5) Before using the sensor, check to make sure that it has not become loose due to vibration or shock.
(6) Analog output models have a potentiometer mounted on the PCB. This potentiometer is used for in-house processes by OMRON and should not be touched.

● Wiring

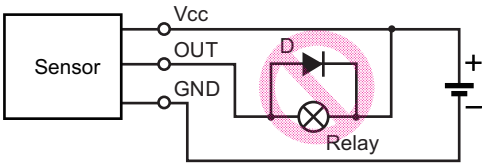
Surge Prevention

(1) If there is a surge in the power supply, try connecting a Zener diode or a capacitor (with a capacitance of 0.1 to 1 µF), depending on the operating environment. Use the sensor only after confirming that the surge has been removed.
We recommend use of 30 to 35 V Zener diodes for a 24 VDC power supply, 20 to 25 V Zener diodes for a 12 VDC power supply, and 10 to 15 V Zener diodes for a 5 VDC power supply.



ZD: Zener diode

(2) Do not use a small inductive load, such as a relay.



(3) Separate the wiring for Light convergent reflective sensors from high-voltage lines or power lines. If the wiring is routed in the same conduit or duct as such lines, the Light convergent reflective sensors may malfunction or may be damaged by inductive interference.
(4) For the digital type, make sure that the connectors are securely locked.

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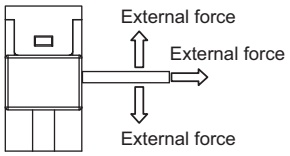
● Handling during Wiring

(1) If a force is applied to the connection area between the terminal and connector by bending or pulling the cable after the wiring is completed, the connector contact part or connection area with the cable may be damaged, resulting in contact failure. Make sure that a stress (external force) as shown in the figure below is not applied to the connection area between the terminal and connector when routing and connecting cables or harnesses.

(2) Do not perform cord wiring when power supply voltage is applied. Doing so may result in breakage.



● Design

Light Convergent Reflective Sensor

A modulated-light type of light convergent reflective sensor is used. When designing, give proper consideration to the power supply and cable lengths used.

Light convergent reflective sensors are more easily affected than the sensors with Nonmodulated Light.

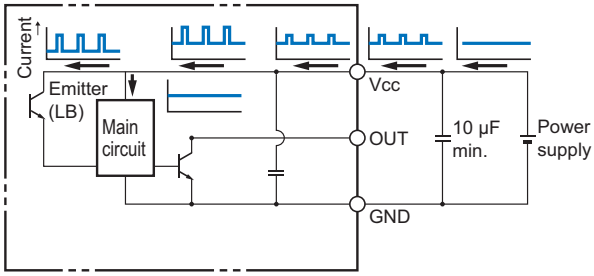
Reasons for Interference from Power and Cable Length on the sensors with Modulated Light

An LED emitter is pulse-lighted to produce modulated light. A large current momentarily flows to the sensors in sync with this pulse timing. This causes a pulsating consumption current. A photoelectric sensor incorporates a capacitor with sufficient capacity, and is virtually unaffected by the pulse of the consumption current. With a small sensor, however, it is difficult to have a capacitor with a sufficient capacity. Accordingly, when the cable length is long or depending on the type of power source, it may become impossible to keep up with the pulse of the consumption current and operation may become unstable.

Countermeasures

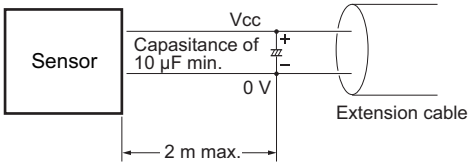
Adding a Capacitor

- Attach a capacitor of 10 µF min. to the wires as close as possible to the Sensor. (Use a capacitor with a dielectric strength that is at least twice the Sensor's power supply voltage. Do not use tantalum capacitors. A short-circuit may cause the capacitor to ignite due to the large current flow.)



<Cable Length>

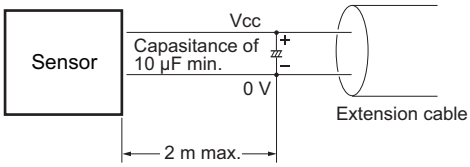
- Design the configuration so that the maximum total cable length for the Photomicrosensor with Modulated Light is 2 m.
- When using a cable longer than 2 m, attach a capacitor (e.g., an aluminum electrolytic capacitor) with a capacity of 10 µF min. to the wires. The distance between the terminal and the capacitor must be within 2 m.
  Make sure that the total cable length is no longer than 5 m. To use a cable length longer than 5 m, use a PLC or other means to read the sensor output and then transmit the signals using a PLC's communications.
- Although cables are capable of being extended longer than 5 m, performance is likely to be affected by noise interference from adjacent cables and other devices.
  Voltage drops due to the resistance of the cable material itself will also influence performance. Therefore, factors, such as the difference in voltage between the end of the cable and the sensor and noise levels, must be given full consideration.



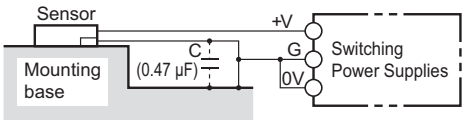
Countermeasures for Switching Power Supplies

- Take either of the following countermeasures as required if connecting a sensor to a switching power supply.

1. Attach a capacitor of 10 µF min. to the wires as close as possible to the sensor. (Use a capacitor with a dielectric strength that is at least twice the sensor's power supply voltage. Do not use tantalum capacitors. A short-circuit may cause the capacitor to ignite due to the large current flow. Do not use tantalum capacitors. A short-circuit may cause the capacitor to ignite due to the large current flow.)



2. Connect to the 0-V line of the power source or connect to the power source via a capacitor of approximately 0.47 µF to reduce the impedance of the mounting base to prevent inductive noise from entering the mounting base. Or, connect by way of a capacitor (approx. 0.47 µF).



3. Connect the noise filter terminal (neutral terminal to ACG) of the switching power supply to the case (FG) and 0-V terminal of the power supply.
   The line connected as mentioned above should be grounded or connected to the mounting base to ensure stable operation.
   (Recommended by power supply manufacturers.)

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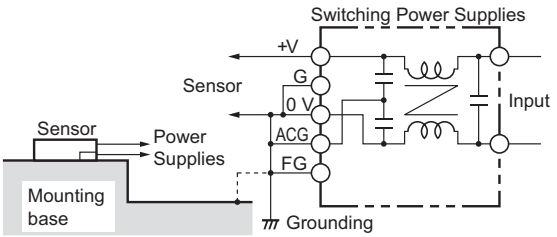
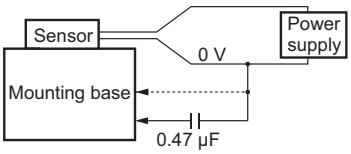
Countermeasures to Handle Inductive Noise



4. Insert a plastic insulator of approximately 10 mm between the Sensor and the mounting base.

Effects of Inductive Noise

- When there is inductive noise in the Sensor mounting frame (metal), the output of the sensor may be affected. In this case, ensure that there is no electrical potential difference between the sensor 0-V terminal and the sensor mounting frame, or put a 0.47-µF capacitor between the 0-V terminal and the frame.



<Effects when the power supply is turned ON> (Digital only)

An output pulse may occur when the power supply is turned ON depending on the power supply and other conditions. Use the sensor in the stable ready-for-detection state reached in 100 ms after turning on the power supply.

● Other

(1) Do not connect or disconnect the connector while power is applied. This may result in breakage.

(2) Do not use the product in the following locations or under the following conditions as it may cause false operations or failures.

1. Places with a lot of dust, powder dust, or oil mist as well as conditions constantly exposed to these materials or where they are attached
2. Places with a high content of corrosive gases
3. Places where water, oil, or chemicals are scattered directly or indirectly as well as conditions constantly exposed to these materials or where they are attached
4. Outdoors or places exposed to strong light such as sunlight

(3) The sensor may be dissolved by exposure to organic solvents, acid, alkali, aromatic hydrocarbon, or chlorinated aliphatic hydrocarbon solvents. Do not expose the sensor to such chemicals as it may cause deterioration in the characteristics.

(4) Output pulses may occur when the power is turned on due to the influence of the power supply environment. Use the sensor in the stable ready-for-detection state that is reached in 100 ms after turning on the power supply.

(5) The protection performance such as dustproof performance of the sensor may deteriorate depending on the usage environment.
The degree of protection confirms that this product has undergone and passed tests conducted in OMRON under controlled conditions in a laboratory, in accordance with the test methods specified by IEC60529 and JIS C0920.

(6) In order to ensure the safe use of the sensor for your desired application, please perform validation of the sensor's protection structure such as dustproof structure in your usage environment.

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