

# Line-Beam Mapping Sensors



## BWML Series (CC-Link)

### 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

- Stable glass substrate detection using line beam detection with minimal non-detection area (patent)
- Sensing distance: 95 ±10 mm
- Customized models available
  - sensing channels (4 to 62 CH), sensing target pitch (≥ 20 mm), sensing area (280 to 1,775 mm)
- Communication output: CC-Link (ver 1.1, 2.0)
- Easy installation with installation instruction mode and background sensing mode
- Channel interference alarm, 5-stage sensing level setting, emitter/receiver error alarm
- Bright status indicators

#### 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 connect, repair, or inspect the unit while connected to a power source.**

Failure to follow this instruction may result in fire.

**04. Check 'Connections' before wiring.**

Failure to follow this instruction may result in fire.

**05. Do not disassemble or modify the unit.**

Failure to follow this instruction may result in fire.

**06. This product is not safety sensor and does not observe any domestic nor international safety standard.**

Do not use this product with the purpose of injury prevention or life protection, as well as in the place where economic loss maybe present.

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

**01. Use the unit within the rated specifications.**

Failure to follow this instruction may result in fire or product damage.

**02. Use a dry cloth to clean the unit, and do not use water or organic solvent.**

Failure to follow this instruction may result in fire.

**03. Do not use a load over the range of rated relay specification.**

Failure to follow this instruction may result in fire, relay broken, contact melt, insulation failure or contact failure.

#### Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
- 24 VDC≒ power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Use the product, 1 sec after supplying power. When using separate power supply for the sensor and load, supply power to sensor first.
- When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0 V and F.G. terminal to remove noise.
- When connecting a DC relay or other inductive load, remove surge by using diodes or varistors.
- Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
- 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

## Cautions during Installation

- Be sure to install this product by following the usage environment, location, and specified ratings. Consider the listed conditions below.
  - Installation environment and background (reflected light)
  - Sensing distance and sensing target
  - Direction of target's movement
  - Feature data
- When installing multiple sensors closely, it may result in malfunction due to mutual interference. Install it by referring to the interference protection and the installation method in the manual.
- Do not use in places where the light-receiving sensor is exposed to direct sunlight or where the ambient illumination is higher than the specification.
- Do not impact with a hard object or bend the cable excessively. That could decrease the product's water resistance.
- Use this product after the test. Check whether the indicator works appropriately for the positions of the detectable object.

## Ordering Information

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

**BWML** ① - ② ③ ④ - ⑤

### ① Sensing target pitch

Number: Optical axis pitch (≥ 20 mm)

### ② Sensing CH

Number: 4 to 62 CH

### ③ Control output

CL: CC-Link

### ④ Operation mode

L: Light ON  
D: Dark ON

### ⑤ CH ordering orientation

No-mark: Forward (bottom = 1 CH)  
R: Backward (top = 1 CH)

## Product Components

- Product × 1
- Instruction manual × 1
- Bracket A × 4
- Bracket B × 4
- Fixing bolt × 8

## Output Connector

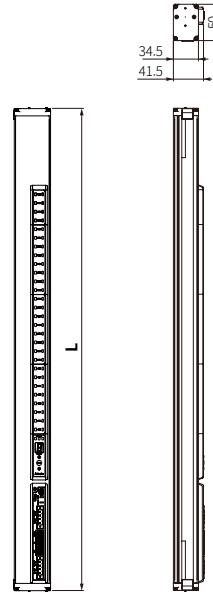
- 4-pin connector: TS04515B0000G (green), TS04510B0000G (black) (5.08 mm pitch)
- Connector socket specification: Contact the manufacture for the socket and cable.

	Specifications	Manufacture
Connector socket (4-pin, green)	OQ0455510000G	ANYTEK
Connector socket (4-pin, black)	OQ0455010000G	ANYTEK

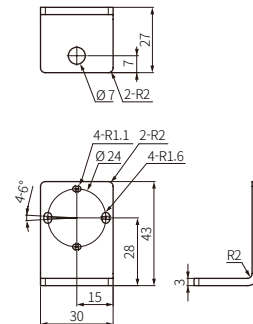
## Dimensions

- Unit: mm, For the detailed drawings, follow the Autonics website.
- Length of the product can be different by its ordered specification. Refer to the followings  
Max. sensing area = 20{[sensing target pitch × (the total number of sensing target-1)]}

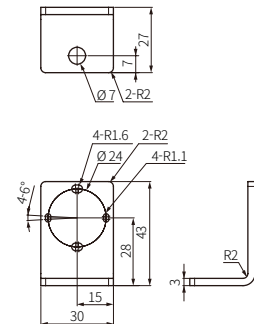
Length of the product (L)	Max. sensing area (mm)
384	280
434	310
484	335
564	460
614	490
664	515
744	640
794	670
844	695
924	820
974	850
1024	875
1104	1000
1154	1030
1204	1055
1284	1180
1334	1210
1384	1235
1464	1360
1514	1390
1564	1415
1644	1540
1694	1570
1744	1595
1824	1720
1874	1750
1924	1775



### ■ Bracket A



### ■ Bracket B



## Connections

### ■ Power cable connector

Connector	Pin no.	Cable color	Func.
	Ⓐ	Black	SET
	Ⓑ	Brown	VCC
	Ⓒ	Blue	GND
	Ⓓ	Yellow	F.G.

### ■ Comm. connector

Connector	Pin no.	Cable color	Func.
	Ⓔ	Blue	DA
	Ⓕ	White	DB
	Ⓖ	Yellow	DG
	Ⓗ	Black	SLD (Shield)
	Ⓘ		

## Specifications

<b>Model</b>	<b>BWML</b>
<b>Sensing method</b>	Diffuse reflective type
<b>Beam pattern</b>	Line-beam type
<b>Light source</b>	Infrared LED (850 nm modulated light)
<b>Sensing distance</b>	95 mm ± 10 mm
<b>Sensing target</b>	Transparent or opaque glass plate
<b>CH ordering orientation<sup>01)</sup></b>	Forward (bottom = 1 CH) / Backward (top = 1 CH) (parameter setting)
<b>Sensing CH<sup>01)</sup></b>	4 to 62 CH
<b>Sensing target pitch<sup>01)</sup></b>	20 mm to ordered specification
<b>Response time</b>	≤ 120 ms
<b>Operation mode<sup>01)</sup></b>	Light ON / Dark ON (parameter setting)
<b>Function</b>	Background sensing mode, installation guide mode, sensing level setting, output option, self-diagnosis
<b>Indicator</b>	Output indicator (red), stability indicator (green), status indicator (green, yellow, red)
<b>Approval</b>	CE, UKCA, CC-Link
<b>Weight (packaged)</b>	≈ 3.64 kg (≈ 4.8 kg) (based on BWML82-20CLL)

01) This product is order made.

02) Please refer to the website for KC certification model.

<b>Power supply</b>	24 VDC≐ (ripple P-P: ≤ 10 %)
<b>Current consumption</b>	≤ 1.0 A
<b>Protection circuit</b>	Reverse power protection circuit, output short overcurrent protection circuit
<b>Insulation resistance</b>	≥ 20 MΩ (500 VDC≐ megger)
<b>Noise immunity</b>	The square wave noise by the noise simulator (voltage: 500 V, period: 10 ms, pulse width: 1 us)
<b>Dielectric strength</b>	Between the charging part and the case : 500 VAC~ 50 / 60 Hz for 1 min
<b>Vibration</b>	1.5 mm double amplitude at frequency of 10 to 55 Hz in each X, Y, Z direction for 2 hours
<b>Shock</b>	210 m/s <sup>2</sup> (≈ 21 G) in each X, Y, Z direction for 3 times
<b>Ambient temperature</b>	15 to 35 °C, storage: -10 to 50 °C (no freezing or condensation)
<b>Ambient humidity</b>	35 to 55 %, storage: 35 to 85 % (no freezing or condensation)
<b>Protection rating</b>	IP40 (IEC standard)
<b>Material</b>	Case: AL, sensing part and Indicator part: PMMA

## Communication Interface

### ■ CC-Link

<b>Control output</b>	CC-Link
<b>Version</b>	CC-Link Ver 1.1 / CC-Link Ver 2.0
<b>Association approval</b>	CC-Link
<b>Type of station</b>	Remote Device Station
<b>Extended cyclic</b>	CC-Link Ver 1.1: - / CC-Link Ver 2.0: 1 time (single)
<b>Number of occupied stations</b>	1 station 32-point module, 2 station 64-point module
<b>Transmission speed</b>	156 kbps / 625 kbps / 2.5 Mbps / 5 Mbps / 10 Mbps
<b>Max. number of connection<sup>01)</sup></b>	42-unit
<b>Number of I/O points</b>	1 station: 32-point (I/O allocation), 2 station: 64-point (I/O allocation)

01) The number of connectable units =  $16 \times A + 54 \times B + 88 \times C \leq 2304$

- A: remote I/O station, max. 64 units

- B: remote device station, max. 42 units

- C: local, intelligent station, max. 26 units

## CC-Link Baud Rate and Address Setting

- For CC-Link setting, communication speed of PLC Master and BWML should be the same.
- Address is available from 1 to 64 and it should not be duplicated.
- When changing CC-Link setting, turn OFF the power of this unit and re-supply the power.

Setting	Setting range	
<b>B RATE</b>	Baud rate	0: 156 kbps, 1: 625 kbps, 2: 2.5 Mbps 3: 5 Mbps, 4: 10 Mbps, 5 to F: not used
<b>×10, ×1</b>	Address of unit	0: master, 1 to 64: settable address, 65 to 99: not used E.g.) To set 12 as address, set ×10 to 1 and ×1 to 2.

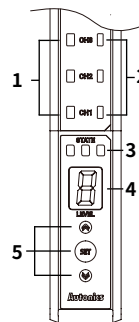
## CC-Link I/O DATA Structure

- HIGH: ON, LOW: OFF for bit status.
- Since the above is based on the product of 24 CH, the number of I/O is changeable by product.
- CC-Link I/O data structure consists of the number of CH+ERROR output BIT+ALARM output BIT.

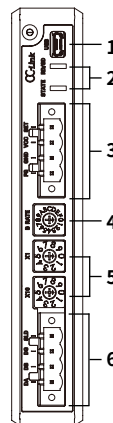
Address	Description	Address	Description
I/O0 [RX00]	CH1 status	I/O16 [RX00]	CH17 status
I/O1 [RX01]	CH2 status	I/O17 [RX01]	CH18 status
I/O2 [RX02]	CH3 status	I/O18 [RX02]	CH19 status
I/O3 [RX03]	CH4 status	I/O19 [RX03]	CH20 status
I/O4 [RX04]	CH5 status	I/O20 [RX04]	CH21 status
I/O5 [RX05]	CH6 status	I/O21 [RX05]	CH22 status
I/O6 [RX06]	CH7 status	I/O22 [RX06]	CH23 status
I/O7 [RX07]	CH8 status	I/O23 [RX07]	CH24 status
I/O8 [RX08]	CH9 status	I/O24 [RX08] <sup>01)</sup>	ERROR output BIT
I/O9 [RX09]	CH10 status	I/O25 [RX09] <sup>01)</sup>	ALARM output BIT
I/O10 [RX10]	CH11 status		
I/O11 [RX11]	CH12 status		
I/O12 [RX12]	CH13 status		
I/O13 [RX13]	CH14 status		
I/O14 [RX14]	CH15 status		
I/O15 [RX15]	CH16 status		

01) It operates as a contact. (0: normal state, 1: error state)

## Unit Descriptions



1	Output indicator (red)
2	Stability indicator (green)
3	Status indicator (green, yellow, red)
4	Status display
5	Mode setting key

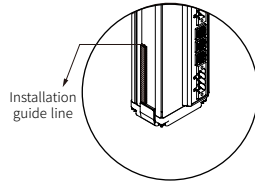


1	USB port: This port is only for firmware upgrade, run mode change, and A/S. Do not use this port for the another purpose, or the product can malfunction.
2	Comm. status indicator: It displays the communication status through LED.
3	Power cable connector
4	Comm. speed setting switch (B RATE): You can set CC-Link communication speed.
5	Comm. address setting switch: You can set CC-Link address. (×10: 10 <sup>1</sup> , ×1: 10 <sup>0</sup> )
6	CC-Link comm. connector

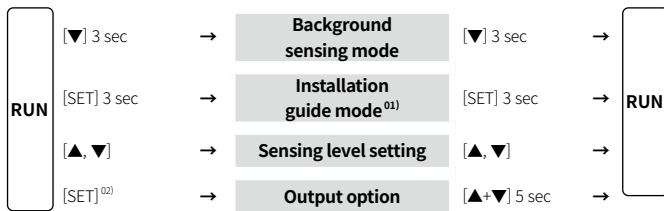
## Installation and Adjustment

- If there is disturbing light (fluorescent light) near the product, install the product vertically away from the disturbing light (fluorescent light).
- Use the product only for sensing the glass over the 6.5 generation.  
If the product is used for sensing the glass under the 6.5 generation, the product can malfunction.

- 01) Install the product on the right side of the sensing target with the bracket.
- 02) Adjust the height of the product to the place where the first glass of the full cassette is aligned with the installation guide line.
- 03) Supply the power.
- 04) Enter to the background sensing mode to detect background. If any background object is detected, reinstall the product, changing the installation angle.
- 05) Finish installation, when all channels are turned on after placing full cassette.
- 06) If all channels are not turned on, enter to the installation guide mode and adjust the product up and down. Return to the run mode and finish installation, when all channels are turned on.



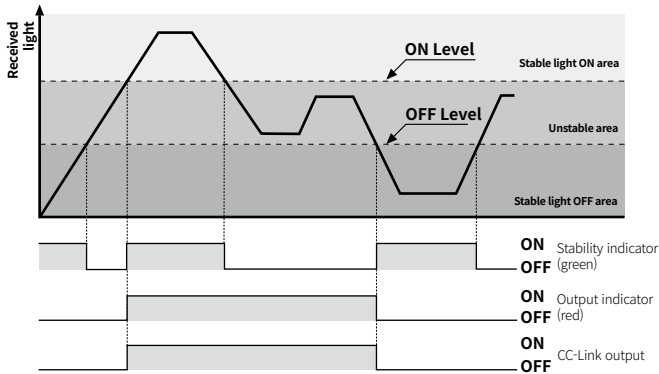
## Mode Switching Method



- 01) Entering to the installation guide mode and pressing [SET] key starts teaching, and the product returns to the run mode after teaching completed.
- 02) When the status display is  $\text{D}$ , press [SET] key to return to the run mode.

## Operation Timing Chart

### Light ON mode



- In Dark ON mode, the waveforms are reversed.

## Operation Indicator

	ON		OFF		Flashing at 0.5 sec interval
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### CH indicator

Item	Output (red)	Stability (green)	Item	Output (red)	Stability (green)
Stable light ON			Unstable light OFF		
Unstable light ON			Stable light OFF		

### Status indicator

Item	Output indicator (red)	Stability indicator (green LED)	Operation indicator			Operation display	CC-Link output <sup>01)</sup>
			Green	Yellow	Red		
<b>Normal operation</b>	-	-				Sensing level	-
<b>Background sensing mode</b>	Sensed	ON (all CHs)				b	Outputting ON at All CHs, outputting 'H' at N+1
	Not sensed	OFF (all CHs)					Outputting ON at All CHs
<b>Installation guide mode</b>	Optical axis coinciding CH	ON (LED of the CH)				n	Outputting ON at All CHs
	Optical axis not coinciding CH	OFF (LED of the CH)					
	While teaching	OFF (all CHs)				Flashing E twice	Outputting ON at All CHs
	Teaching passed	Displaying result and flashing all CHs twice				Flashing E twice	-
Teaching failed	Flashing alternately passed / failed CH twice				Flashing E twice	Outputting ON at All CHs, outputting 'H' at N+1	
<b>Channel interference error</b>	Flashing alternately relevant CH at 0.5 sec interval	ON (all CHs)				-	Outputting ON at All CHs, outputting 'H' at N+1
<b>Disturbing light sensing alarm</b>	Flashing alternately even and odd CH at 0.5 sec interval	ON (all CHs)				-	Outputting alternately even and odd CH, outputting 'H' at N+2
<b>Emitter/receiver damage alarm<sup>02)</sup></b>	Emitter damage	ON (damaged CH)	ON (emitter)			b	Outputting 'H' at emitter/receiver damaged CH, outputting 'H' at N+1
	Receiver damage	ON (CH 7, 8)	ON (receiver)				
<b>Comm. error</b>	Product ↔ CH indicator	Flashing at 0.25 sec interval				E	Outputting ON at All CHs, outputting 'H' at N+1
	Product ↔ emitter/receiver	Flashing (malfunctioning CH)	ON (CH 1)			E	

- 01) N stands for all channel.
- 02) If emitter and receiver are damaged at the same time, output of receiver is prior to that of emitter, and lower number of channel indicator is turned on. The indicator of damaged channel is flashed at 0.25 second interval.

### Communication status indicator

CC-Link	Comm. status indicator
STATE	RUN
RD/SD	ON (green LED)
	OFF
STATE	Error
RD/SD	ON (red LED)
	Red / green / yellow ON

## Functions

### ■ Background sensing mode

This function instructs adjusting angle to install the product by displaying presence of the background object in the status display when installing the product.

Use this function when sensing is unstable due to the reflection from the background object or any obstacle.

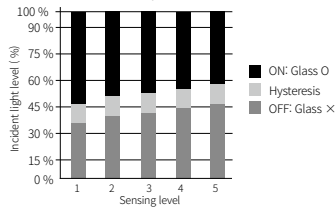
### ■ Installation guide mode

This function displays whether the sensing target is in the stable position of the guide line when installing the product through the output indicator.

Entering installation guide mode and pressing [SET] key starts teaching.

### ■ Sensing level setting

This function sets sensitivity by dividing receiving light into 5 levels for stable sensing. Use this function when some of the channels shows low sensing level due to the bent glass plate or diffused reflection. Factory default is level 5.



### ■ Output option

After setting output option, press [SET] key to set additional option.

Output option (status display)	Description	Additional option	Output option (status display)	Description	Additional option
0	Returning to operation mode	—	4	Changing error output	A: A point B: B point
1	Status display orientation	F: Forward B: Backward	5	CC-Link version	1: Ver 1.1 2: Ver 2.0
2	Channel ordering		6	CC-Link station and points	1: 1 station 32 points 2: 2 station 64 points
3	Operation mode	L: Light ON d: Dark ON			

### ■ Self-diagnosis

This function runs self-diagnose periodically in normal operation and displays the part in error at the status display when error occurs.

- Channel interference alarm  
: Outputs alarm when interference from another sensing target and external object in a channel area.
- Disturbing light sensing alarm  
: Outputs alarm when the receiver received external light besides light from the emitter. When the amount of disturbing light is under the affective level, the product operates normally in disturbing light operation mode.
- Emitter / receiver damage alarm  
: Outputs alarm when emitter/receiver is damaged due to the long-term usage of emitter/receiver elements or strong impact to the product.

## Troubleshooting

Malfunction	Cause	Troubleshooting
Non-operation	Power supply	Supply the rated power.
	Cable cut, disconnection	Check the wiring.
Non-operation in sometimes	Sensor cover pollution by dirt	Remove dirt by soft brush or cloth and set sensitivity again.
	Connector connection failure	Check the connection area of connector.
Output is ON without a target	Initial sensitivity setting goes wrong	Remove the cause and set sensitivity again.
	There is a strong electric wave or noise generator.	Put away motor, electric generator, or high voltage line.