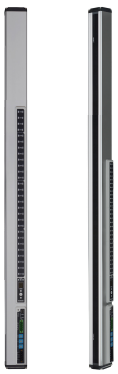
Line Beam Mapping Sensor

▣ Features



- Line-beam method minimizes bad condition of glass substrate detecting and non-detecting area
- Sensing distance: 95±10mm
- Models according to the orders
  : sensing channels (8 to 62CH), sensing target pitch (min. 20mm), sensing area (280 to 1595mm)
- Communication output models: CC-LINK(ver. 1.1, 2.0), EtherCAT
- Easy installation with installation guide mode, background sensing mode
- Built-in channel interference error, 5-level sensing level setting, emitter/receiver damage alarm, etc.
- Easy to check status at front, side and long distance with the high-brightness indicators
- IP67 protection structure (IEC standard)

Please read "Safety Considerations" in the instruction manual before using.

CE

▣ Applications

Applications: Display panel detecting sensor on the cassette, etc.

▣ Ordering Information

BWML **20** - **24** **CL** **L** - □ □ / □

Custom order option	**No mark**	No option
	A	Mixed sensing pitch
	Number	Option
CH ordering orientation	**No mark**	Forward (bottom=1CH)
	R	Backward (top=1CH)
External device connection mode	**No mark**	Connector type
	T	Terminal type
Operation mode	**L**	Light ON
	D	Dark ON
Control output	**CL**	CC-LINK communication output
	EC	EtherCAT communication output
Sensing CH	**Number**	8 to 62CH
Sensing target pitch	**Number**	Min. 20mm
Item	**BWML**	Line Beam Mapping sensor

※□ This information is intended for product management of custom order option.
(no need to refer when selecting model)

▣ Specifications

● General specifications

Model		BWML□-□CL□-□□/□	BWML□-□EC□-□□/□
Control output		CC-LINK communication	EtherCAT communication
Sensing type		Reflective type	
Sensing distance		95mm ±10mm	
Sensing target		Transparent or opaque glass plate	
Sensing area		280 to 1595mm	
Sensing target pitch※1		20mm to ordered specification	
Sensing CH※1		8 to 62CH	
CH ordering orientation		Forward (bottom=1CH) / Backward (top=1CH) (parameter setting)	
Beam pattern		Line beam type	
Power supply		24VDC⎓ (ripple P-P: max. 10%)	
Protection circuit		Reverse polarity protection	
Current consumption		Max. 1.0A	
Operation mode		Light ON/Dark ON (parameter setting)	
Response time		Max. 120ms	
Noise immunity		The square wave noise by the noise simulator (voltage: 500V, period: 10ms, pulse width: 1us)	
Dielectric strength		· Between all power input terminals and F.G. terminal: 500VAC 50/60Hz for 1 min · Between communication input terminals and F.G. terminal: 1000VAC 50/60Hz for 1 min · Between power input terminals and communication input terminals: 1000VAC 50/60Hz for 1 min	
Insulation resistance		Over 20MΩ (at 500VDC megger)	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock		210m/s^2 (approx. 21G) in each X, Y, Z direction for 3 times	
Environment	Allowable temp.	15 to 35℃, storage: -10 to 50℃	
	Allowable humi.	35 to 55%RH, storage: 35 to 85%RH	
Material		Case: aluminum, sensing part and indicator part: polymethyl methacrylate	
Accessory		Bracket A: 4, bracket B: 4, bolt: 8	
Protection structure		IP40 (IEC standard)	
Approval		CE, CC-LINK	CE
Weight※2		Approx. 4.8kg (approx. 3.64kg) (based on BWML82-20ECL)	

※1: This product is order made.
※2: The weight includes packaging. The weight in parenthesis in for unit only.
※Environment resistance is rated at no freezing or condensation.

● CC-LINK communication control output

Model	BWML□-□CL□−□□/□	
Version	CC-LINK Ver 1.1	CC-LINK Ver 2.0
Type of Station	Remote Device station	
Extended cyclic	—	1 time (single)
Number of occupied stations	1 station 32 points module, 2 station 64 points module	
Transmission speed	156kbps/625kbps/2.5Mbps/5Mbps/10Mbps	
Max. number of connection※1	42 units	
Number of I/O points	1 station: 32 points (I/O allocation) 2 station: 64 points (I/O allocation)	

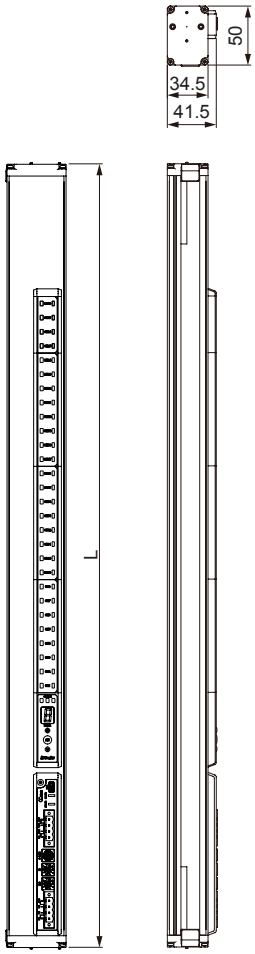
※1: The number of connectable units = 16×A+54×B+88×C≤2304
- A: remote I/O station, max. 64 units
- B: remote device station, max. 42 units
- C: local, intelligent station, max. 26 units

● EtertCAT communication control output

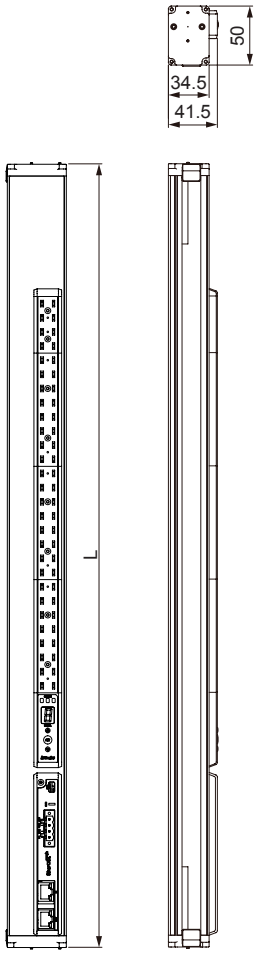
Model	BWML□-□EC□-□□/□
Comm. protocol	EtherCAT protocol
Physical layer	100BASE-TX (IEEE802.3u)
Comm. medium	Over CATEGORY 5/E (must be shield cable)
Connection method	Daisy chain
Transmission speed	100Mbps
Address range	0 to 65535 (16-bit)
Address setting	Software (EtherCAT Master)
Comm. range	Distance between nods: max. 100m

▣ Dimensions

◎ **CC-LINK**



◎ **EtherCAT**

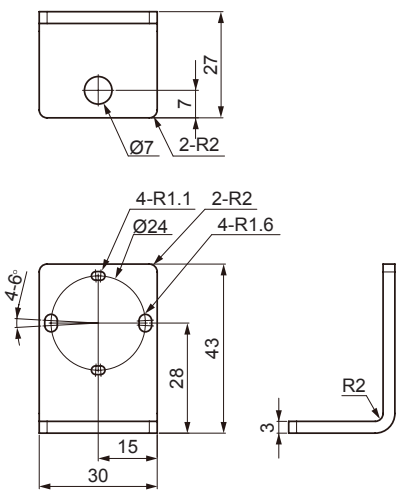


(unit: mm)

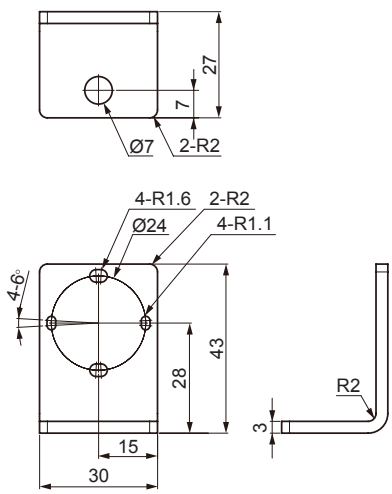
Length of the product (L)	Max. sensing area (mm)
384	280
434	310
484	335
564	460
614	490
664	515
744	640
794	670
844	695
924	820
974	850
1024	875
1104	1000
1154	1030
1204	1055
1284	1180
1334	1210
1384	1235
1464	1360
1514	1390
1564	1415
1644	1540
1694	1570
1744	1595

※Max. sensing area = 20+{sensing target pitch×(the total number of sensing target-1)}

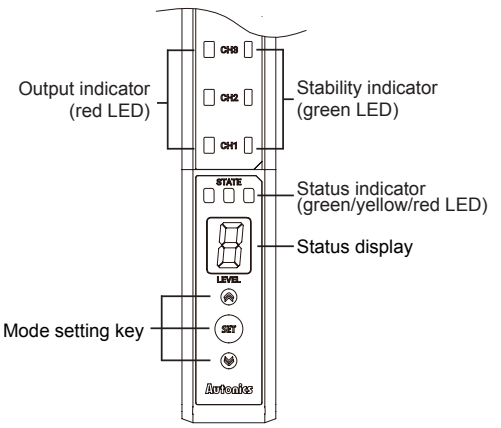
● **Bracket A**

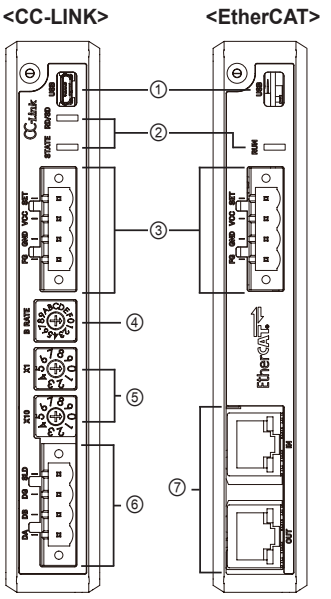


●**Bracket B**



▣ Unit Descriptions

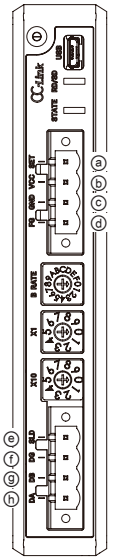




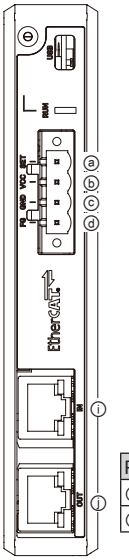
①USB port
: This port is only for firmware upgrade, channel setting, and A/S.
Do not use this port for the another purpose, or the product can malfunction.
②Comm. status indicator: It displays the communication status through LED.
③Power cable connector
④Comm. speed setting switch (B RATE): You can set CC-LINK communication speed.
⑤Comm. address setting switch: You can set CC-LINK address. (×10: 10^1, ×1: 10^0)
⑥CC-LINK comm. connector
⑦EtherCAT comm. input/output connector
: It is with the communication status indicator which turns on or flashes according to the communication status.

▣ Connections

〈CC-LINK〉 〈EtherCAT〉



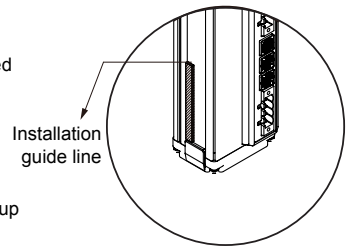
Pin no.	Func.
ⓐ	SET
ⓑ	VCC
ⓒ	GND
ⓓ	F.G.



Pin no.	Func.
ⓘ	IN
ⓙ	OUT

Pin no.	Cable color	Func.
ⓔ	Yellow	DA
ⓕ	White	DB
ⓖ	Blue	DG
ⓗ	Yellow	SLD (shield)

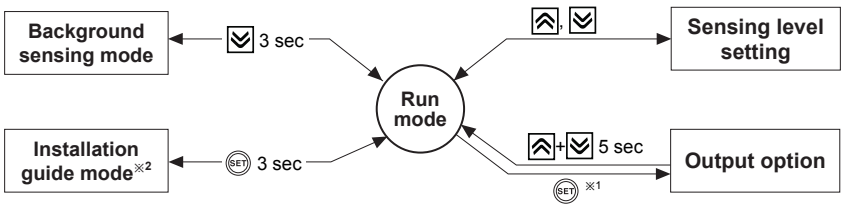
■ Installation and Adjustment



①Install the product on the right side of the sensing target with the bracket.
②Adjust the height of the product to the place where the first glass of the full cassette is aligned with the installation guide line.
③Supply the power.
④Enter to the background sensing mode to detect background.
If any background object is detected, reinstall the product, changing the installation angle.
⑤Finish installation, when all channels are turned on after placing full cassette.
⑥If 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.

※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.

■ Mode Switching Method



※1: When the status display is ▯, press (SET) key to return to the run mode.
※2: Entering to the installation guide mode and pressing (SET) key starts teaching, and the product returns to the run mode after teaching completed.

■ 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 RATE	Baud rate	0: 156kbps, 1: 625kbps, 2: 2.5Mbps 3: 5Mbps, 4: 10Mbps, 5 to F: not used
×10, ×1	Address of unit	0: Master, 01 to 64: settable address, 65 to 99: not used E.g.) To set 12 as address, set ×10 to 1 and ×1 to 2.

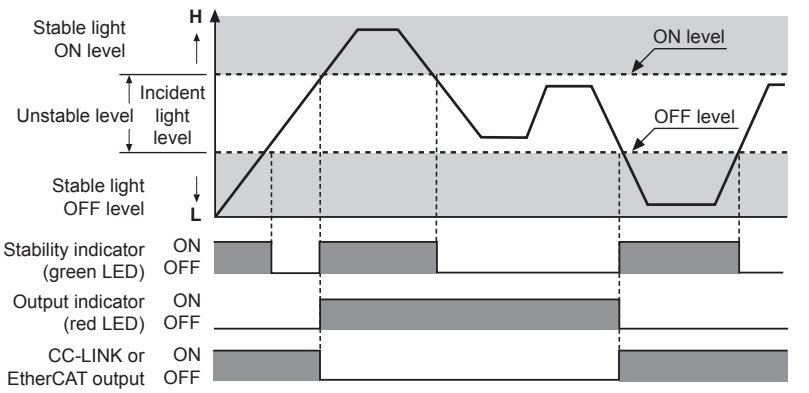
■ EtherCAT I/O DATA Structure

※HIGH: ON, LOW: OFF for bit status.

1st Word	Description	2nd Word	Description
I/O0 [BIT0]	CH1 status	I/O0 [BIT0]	CH17 status
I/O1 [BIT1]	CH2 status	I/O1 [BIT1]	CH18 status
I/O2 [BIT2]	CH3 status	I/O2 [BIT2]	CH19 status
I/O3 [BIT3]	CH4 status	I/O3 [BIT3]	CH20 status
I/O4 [BIT4]	CH5 status	I/O4 [BIT4]	CH21 status
I/O5 [BIT5]	CH6 status	I/O5 [BIT5]	CH22 status
I/O6 [BIT6]	CH7 status	I/O6 [BIT6]	CH23 status
I/O7 [BIT7]	CH8 status	I/O7 [BIT7]	CH24 status
I/O8 [BIT8]	CH9 status	I/O8 [BIT8]	ERROR output BIT
I/O9 [BIT9]	CH10 status	I/O9 [BIT9]	ALARM output BIT
I/O10 [BIT10]	CH11 status	—	—
I/O11 [BIT11]	CH12 status		
I/O12 [BIT12]	CH13 status		
I/O13 [BIT13]	CH14 status		
I/O14 [BIT14]	CH15 status		
I/O15 [BIT15]	CH16 status		

※Since the above is based on the product of 24 CH, the number of I/O is changeable by product. EtherCAT I/O data structure consists of the number of CH+ERROR output BIT+ALARM output BIt.

▣ Operation Timing Diagram



※The waveforms of 'Operation indicator' and 'CC-LINK or EtherCAT output' are for Light ON.
The waveforms are reversed for Dark ON.

▣ Functions

◎ Background sensing mode

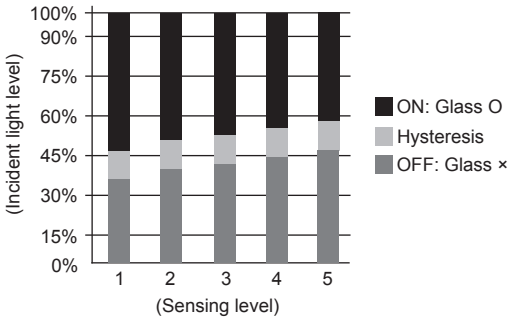
This function instructs adjusting angle to install the product by displaying presence of the background object in the status display when installing the product. Use this function when sensing is unstable due to the reflection from the background object or any obstacle.

◎ 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.

※For more information about operation indication display, refer to **"▣ Operation Indicator"**

▣ Operation Indicator

◎ CH indicator

(☼: light ON, ●: light OFF, ◑: flashing at 0.5 sec interval)

Item	Output indicator (red LED)	Stability indicator (green LED)
Stable light ON	☼	☼
Unstable light ON	☼	●
Unstable light OFF	●	●
Stable light OFF	●	☼

◎ Status indicator

(☼: light ON, ●: light OFF, ◑: flashing at 0.5 sec interval)

Item		Output indicator (red LED)	Stability indicator (green LED)	Status			Status display	Communication output
				Green	Yellow	Red		
Normal operation		—		☼	●	●	Sensing level	—
Background sensing mode	Sensed	ON (all CHs)	OFF (all CHs)	●	●	☼	b	Outputting ON at All CHs, outputting 'H' at N+1
	Not sensed	OFF (all CHs)	ON (all CHs)	☼	●	●		Outputting ON at All CHs
Installation guide mode	Optical axis coinciding CH	ON (LED of the CH)	ON (all CHs)	☼	●	●	n	Outputting ON at All CHs
	Optical axis not coinciding CH	OFF (LED of the CH)		●	◑	●		
	While teaching	OFF (all CHs)		☼	●	●	Flashing t twice	Outputting ON at All CHs
	Teaching passed	Displaying result and flashing all CHs twice		☼	●	●	Flashing t twice	—
	Teaching failed	Flashing alternately passed/failed CH twice		●	◑	●	Flashing E twice	Outputting ON at All CHs, outputting 'H' at N+1
Channel interference error		Flashing alternately relevant CH at 0.5 sec interval	ON (all CHs)	☼	◑	●	—	Outputting ON at All CHs, outputting 'H' at N+1
Disturbing light sensing alarm		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
Emitter/ receiver damage alarm※1	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)					
Comm. error	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)	●	☼	☼	C	

※1: 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.
※N stands for all channel.

◎ Communication suatus indicator

● CC-LINK

Item		Communication status
STATE	RUN	ON (green LED)
RD/SD		OFF
STATE	Error	ON (red LED)
RD/SD		ON (red/green/yellow LED)

● EtherCAT

(☼: light ON, ●: light OFF, ◑: flashing at 0.5 sec interval)

Item		Communication status (green LED)
RUN	Initial status	●
	Pre operation status	Flashing at 200ms interval
	Safe operation status	Repeating 200ms ON and 1000ms OFF
	Operation status	☼
L/A IN, L/A OUT	No connection	●
	Operation status	Flashing at 50ms interval
	Disconnection in operation	☼

▣ Troubleshooting

Malfunction	Cause	Troubleshooting
Not operate	Power	Supply the rated power.
	Cable cut, disconnection	Check the wiring.
Not operate 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.

▣ Proper Usage

1. Follow instructions in 'Proper Usage'.
   Otherwise, it may cause unexpected accidents.
2. 24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Use the product, 1 sec after supplying power.
   When using separate power supply for the sensor and load, supply power to sensor first.
4. When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
5. When connecting a DC relay or other inductive load, remove surge by using diodes or varistors.
6. Wire as short as possible and keep away from high voltage lines or power lines, to prevent surge and inductive noise.
7. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 2
   ④Installation category II