Mapping Sensor

▣ Features

- Double-scan method increases glass substrate detection stability
- Sensing distance: Glass generation+30%
- Models according to the orders
  : sensing channels (8 to 62CH), optical axes pitch (25 to 200mm)
- Communication output models: CC-LINK(ver. 1.1, 2.0), EtherCAT
- Easy installation with installation guide mode
- Built-in mutual interference prevention, self-diagnosis function
- Built-in optical axis misalignment alarm, sensing 9-level setting, emitter damage alarm
- Easy to check status at long distance with the high-brightness indicators at Slave

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

CE

▣ Applications

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

▣ Ordering Information

BWM 82 – 24 CL D – ☐☐ / ☐

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[1]	**Number**	8 to 62CH
Optical axis pitch[1]	**Number**	25 to 200mm
Item	**BWM**	Mapping sensor

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

▣ Number of CH, Optical Axis Pitch, Sensing CH

Slave — Number of CH — Master — Optical axis pitch — Sensing CH
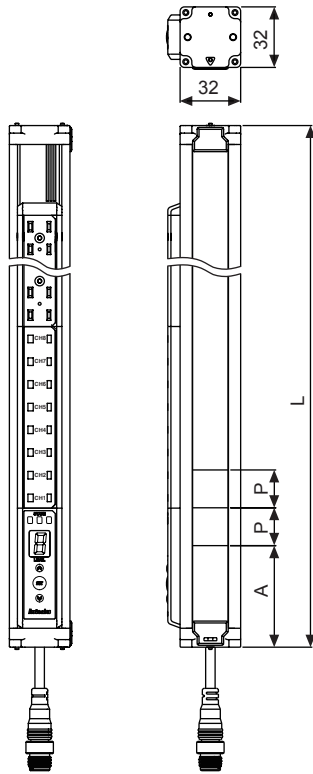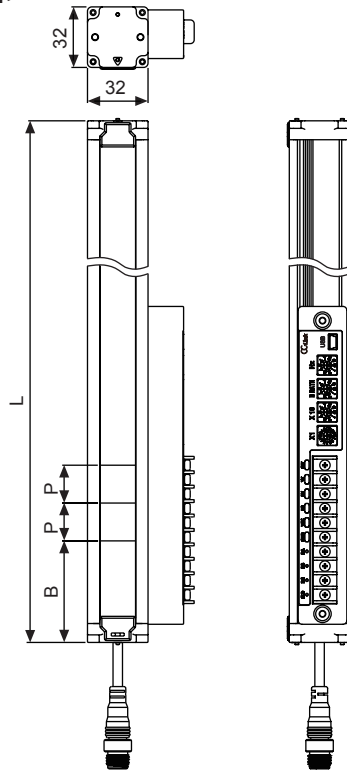
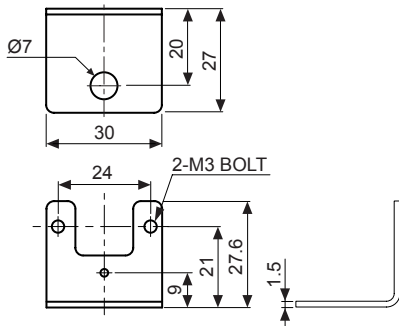# BWM Series

◼ Dimensions

<Slave>

<Master>

※Length of the product can be different by its ordered specification. Refer to the followings.
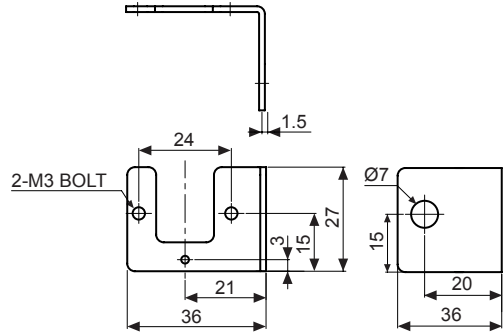 length of the product (L) = 105+{optical axis pitch (P)×(sensing CH-1)}
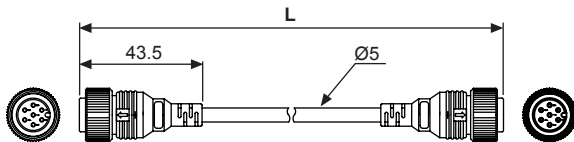 A: 45 to 65mm, B: 65 to 85mm

● **Bracket A**

Ø7
20
27
30
24
2-M3 BOLT
21
27.6
1.5
9

● **Bracket B**

1.5
24
2-M3 BOLT
3
15
27
21
36
Ø7
15
20
36

◼ Connection Cable (sold separately)

L
43.5
Ø5

Model	L
C5D617-7P	7m
C5D617-10P	10m
C5D617-15P	15m

◾ Specification

● General specifications

Model	BWM□-□CL□-□□/□	BWM□-□EC□-□□/□
Control output	CC-LINK communication output	EtherCAT communication output
Sensing type	Through-beam type	
Sensing distance	Glass ±30%	
Sensing target	Transparent or opaque glass plate	
Optical axes pitch[※1]	25 to 200mm	
Sensing CH[※1]	8 to 62CH	
CH ordering orientation[※1]	Forward (bottom=1CH) / Backward (top=1CH)	
Beam pattern	Double scan type	
Power supply	24VDC⎓ (ripple P-P: max. 10%)	
Synchronization type	Synchronized by synchronous cable	
Protection circuit	Reverse polarity protection circuit	
Current consumption	Master: max. 200mA, slave: max. 150mA	
Operation mode[※1]	Light ON/Dark ON	
Response time	120ms (60CH)	
Light source	Infrared LED (850nm modulated)	
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 illum.	Max. 5,000lx of light bulb or semiconductor	
Environment — Allowable temp.	15 to 35℃, storage: 15 to 35℃	
Environment — Allowable humi.	35 to 85%RH, storage: 35 to 85%RH	
Material	Case: aluminum, sensing part and Indicator part: polymethyl methacrylate	
Connector — Connector type	4-pin, 6-pin connector (5.08mm pitch)	4-pin connector (5.08mm pitch)
Connector — Terminal type	10-pin terminal	4-pin terminal
Cable	Ø5mm, 6-wire, 250mm, M17 connector	
Accessory	Bracket A: 4, bracket B: 4, bolt: 8	
Approval	C€, CC-LINK	C€
Weight[※2]	Approx. 5.3kg (approx. 3.2kg) (based on BWM82-24CCD-T)	Approx 5.52kg (approx 3.42kg) (based on BWM28-50ECD-T)

※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 output

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

### ● EtherCAT communication output

| Model	BWM□-□EC□-□□/□
Comm. protocol	EtherCAT protocol
Physical layer	100BASE-TX (IEEE 802.3u)
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

BWM Series

◼ Unit Description
◎ Slave
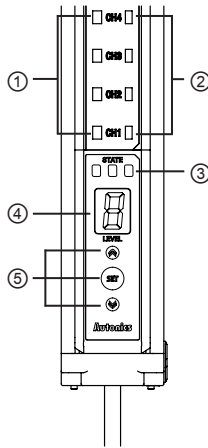
①Output indicator (red LED)
②Stability indicator (green LED)
③Status indicator (green/yellow/red LED)
④Status display
⑤Mode setting key
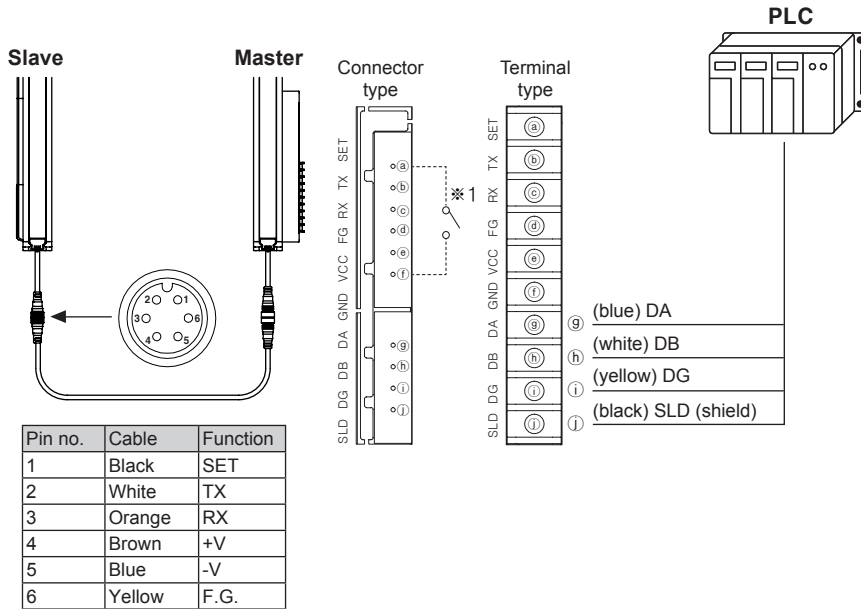
◎ CC-LINK Master
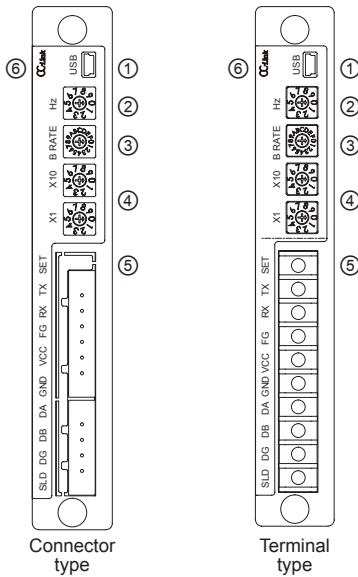
Connector type   Terminal type

①USB 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.
②Frequency setting switch (Hz)
   : This switch is for setting mutual interference prevention function.
③Comm. speed setting switch (B RATE)
   : You can set CC-LINK communication speed.
④Comm. address setting switch
   : You can set CC-LINK address. (×10: 10^1, ×1: 10^0)
⑤Output part
  - connector type: 4-pin/6-pin connector, terminal type: 10-pin terminal
⑥Comm. status indicator
   : It displays the communication status through LED.

◎ EtherCAT Master
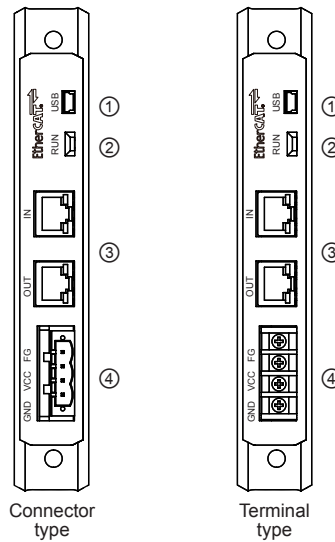
Connector type   Terminal type

①USB 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.
②Comm. status indicator
   : It displays the communication status through LED.
③EtherCAT comm. input/output connector
   : It is with the communication status indicator which turns on or
     flashes according to the communication status.
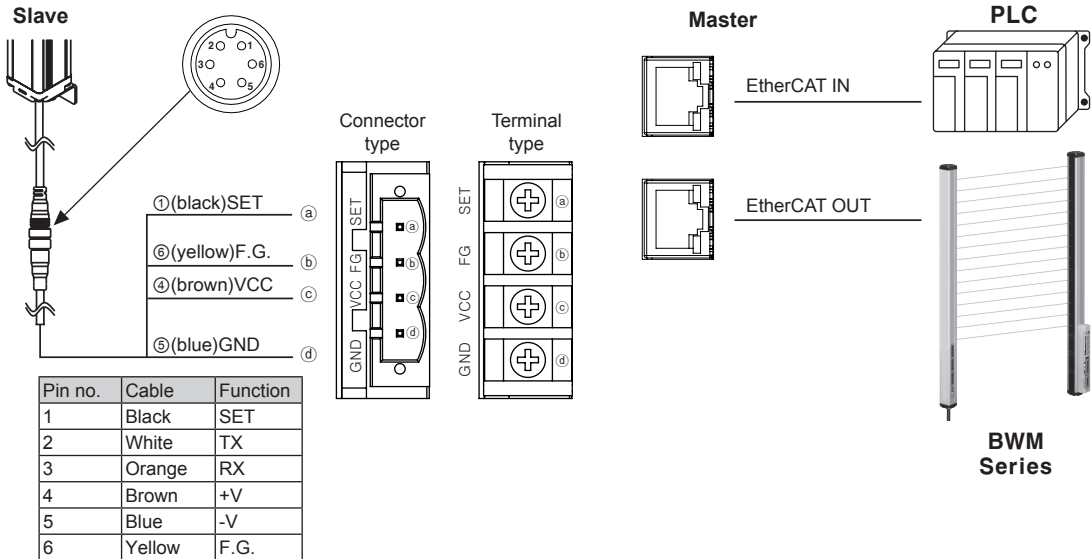④Power and synchronous cable terminal

■ Connections

◎ CC-LINK communication output

Slave **Master** Connector type Terminal type **PLC**

Pin no.	Cable	Function
1	Black	SET
2	White	TX
3	Orange	RX
4	Brown	+V
5	Blue	-V
6	Yellow	F.G.

(blue) DA
(white) DB
(yellow) DG
(black) SLD (shield)

※1: Instead of ⓢⓔⓣ key, you can use SET, GND terminal for teaching from external signal.

◎ EtherCAT communication output

Slave Connector type Terminal type **Master** **PLC**

①(black)SET ⓐ
⑥(yellow)F.G. ⓑ
④(brown)VCC ⓒ
⑤(blue)GND ⓓ

EtherCAT IN

EtherCAT OUT

BWM Series

Pin no.	Cable	Function
1	Black	SET
2	White	TX
3	Orange	RX
4	Brown	+V
5	Blue	-V
6	Yellow	F.G.

※1: Instead of ⓢⓔⓣ key, you can use SET, GND terminal for teaching from external signal.

BWM Series

◨ Mode Switching Method
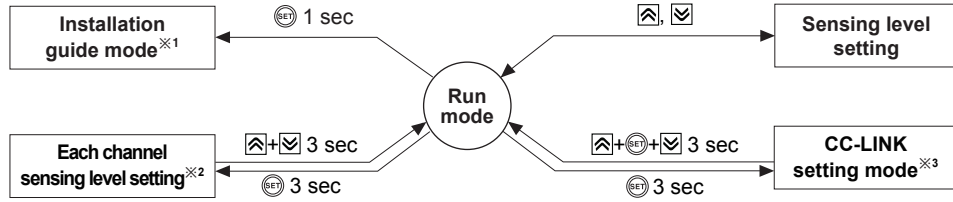
※1: Entering to the installation guide mode and pressing ⊛ key for 3 seconds starts teaching, and the product returns to the run mode after teaching completed.
※2: When the status display is d, select channel to change using ⊼, ⊻ key and press ⊛ key.
   When number of channel is flashing, set sensing level using ⊼, ⊻ key.
※3: Only for CC-LINK communication output model.

◨ CC-LINK Baud Rate and Address Setting

· For CC-LINK setting, communication speed of PLC Master and BWM 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 it.
· Press ⊼+⊛+⊻ key in the run mode and enter to the CC-LINK setting mode to set the version and the number of occupied station.
 The number of occupied station: status display 5, 1(station 1), 2(station 2)
 Version: status display C, 1(version 1.1), 2(version 2.0)

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, 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.

◨ 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.

◨ Function

● 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 ⊚ key starts teaching.

When teaching, this function detects channels with unstable received light level and adjust received light level of all channels to the same level.

● Sensing level setting

This function sets sensitivity by dividing received light into 9 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.

※You can change sensing level of each channel separately in the each channel sensing level setting mode. When using the sensing level setting function after setting each channel sensing level using the each channel sensing level setting mode, sensing level settings of each channel are reset.
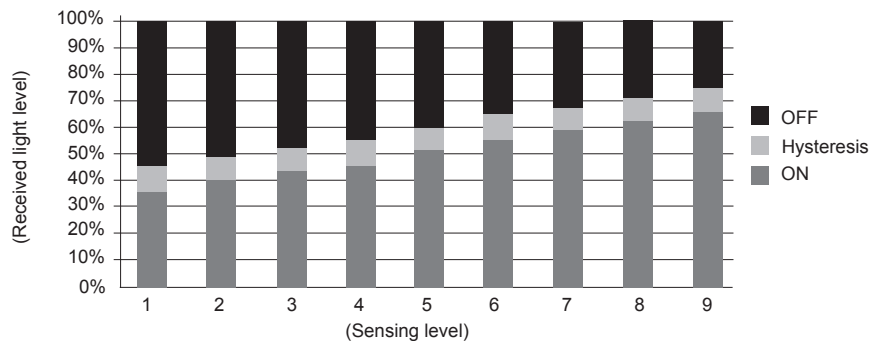
● Mutual interference prevention

When installing over 2 sensors closely, set the each frequency by the switch for frequency setting to prevent malfunction from mutual interference.

Mark	Freq.	Mark	Freq.
0	A	3	D
1	B	4 to 9	Not used
2	C		

● Optical axis misalignment alarm (low light intensity alarm)

Emitted light level can be reduced due to warped product or long-term usage.

When nothing is detected during operation, this function checks received light level and outputs alarm at 'OFF level+approx. 3%' of received light level. Emitted light level is returned to the normal level with teaching.

● Emitter damage alarm

Outputs alarm when emitter is damaged due to the long-term usage of emitter elements or strong impact to the product.

● Self-diagnosis function

Mapping sensor is able to self-diagnose periodically in normal operation. If error occurs, status indicator displays in which part error occurs.

· Malfunction of synchronous line: If there is malfunction of synchronous line, it displays error and outputs signal.

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

BWM Series

■ Operation Indicator

◎ [Slave] CH indicator

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

Item	Output (red LED)	Stability (green LED)	Item	Output (red LED)	Stability (green LED)
Stable light ON	●	☼	Stable light OFF	☼	☼
Unstable light ON	●	●	Unstable light OFF	☼	●
Teaching error	◑	◑			

◎ [Slave] Status indicator

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

Item		CH indicator[1]	Status display	Status green	Status yellow	Status red	CC-LINK, EtherCAT output
Normal operation		—	Sensing level	☼	●	●	
Teaching error		Flashing (error channel)	—	●	◑	●	Outputting H at relevant CH, N+1
Malfunction of synchronous cable (communication error)		Flashing (all LED)	0 to 9 or C	◑	◑	◑	Outputting H at N+1, Outputting H or L at N+2
Emitter damage		Flashing at 0.25 sec interval (LED of the CH)	n	◑	●	◑	Outputting H at 1 to N+1
Installation guide mode	Coinciding all CHs optical axis	Flashing (all CHs)	n	☼	●	●	Outputting H at all CHs
	Optical axis coinciding CH	Flashing (LED of the CH)		●	◑	●	
	Optical axis not coinciding CH	OFF (LED of the CH)		●	◑	●	
Teaching	Coinciding all CHs optical axis	ON (all CHs)	t	☼	●	◑	
	Optical axis coinciding CH	ON (LED of the CH)		●	◑	◑	
	Optical axis not coinciding CH	OFF (LED of the CH)		●	◑	◑	
Optical axis misalignment alarm		—	—	◑	☼	◑	Outputting H at N+2
Individual optical axis controlling mode		Flashing (relevant CH)	0 to 9	●	☼	☼	—
CC-LINK setting change[2]	No. of occupied station	Flashing (CH 1)	5	●	☼	☼	all CHs, Outputting N+1
	Version	Flashing (CH 2)	C	●	☼	☼	

[1]: Except normal operation, stability indicator (green) stands for the master and output indicator (red) stands for the slave.
[2]: Only for CC-LINK communication output model.
※N stands for all channel.

◎ [Master] Communication status indicator (CC-LINK)

Item	Communication status
Connected status	Simultaneous ON (green, red LED)
Pre connection status	ON (green LED)
Error	ON (red LED)

◎ [Master] Communication status indicator (EtherCAT)

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

Mapping Sensor

◼ Installation and Adjustment

① Mount Master and Slave to face each other.
② Place a glass plate at the guide line and adjust sensor height.
③ Touch ⑤ key of Slave once without a glass plate and it enters installation guide mode.
   (Shorting SET (gray) and GND (blue) has same function.)
④ Adjust Master and Slave up/down/right/left, and check the place where output/stability indicators flash (displaying coincidence of optical axes of all CHs) and status indicator lights ON.
   Fix them at this place by tightening screws (tightening torque: 0.39 to 0.49 N·m).
⑤ Pressing ⑤ key for over 3 sec completes teaching and operates the device in RUN mode.
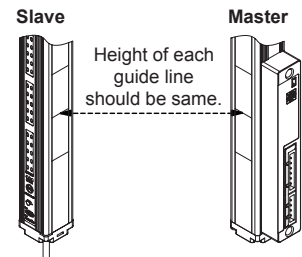
※If optical axis are not coincident, yellow LED of the status indicator flashes at 0.5 sec interval, and output indicator (red, slave) and stable indicator (green, master) flash at 0.5 sec interval.
Please re-adjust the position of Master and Slave and execute teaching again.
※Avoid using the unit in the place where the sensor is exposed directly to the fluorescent light with high speed start or high frequency.

Slave   Master
Height of each guide line should be same.

◼ Operation Timing Diagram
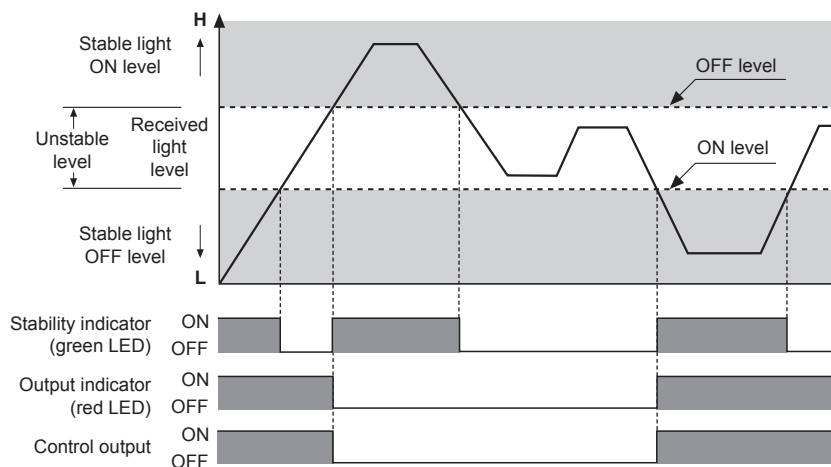
※The waveforms of 'Operation indicator' and 'Control output' are for Dark ON. The waveforms are reversed for Light ON.

◼ 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