OMRON

Model E3AS-HF6000□M□

TOF Laser Sensor

INSTRUCTION SHEET

Thank you for selecting OMRON product. This sheet primarily describes precautions required in installing and operating the product.
Before operating the product, read the sheet thoroughly to acquire sufficient knowledge of the product. For your convenience, keep the sheet at your disposal.

The following notice applies only to products that carry the CE mark.
Notice:
In a residential environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

3669664-2B

PRECAUTIONS ON SAFETY

●Meaning of Signal Words

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

⚠ WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purpose.	🚫
Never use this product with AC power supply. Also, do not use the product with voltage in excess of the rated voltage. These may result in burst or fire.	⚠

⚠ CAUTION

Its component may be damaged and/or peeled off. Also, its protection may be degraded. Please do not apply high pressure water intensively at one place during cleaning.	⚠
When the sensor is connected to a device, changing the output by configuring the sensor settings may cause the device to malfunction. Stop the device during sensor setup.	⚠
Do not use the product in a location where the light receiving surface will be exposed to direct sunlight or strong ambient light.	⚠

To safely use laser products

⚠ WARNING

Looking into the Outgoing light continuously may cause visual impairment. Do not look directly into the Outgoing light. Caution-Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure Attention-L'utilisation des commandes ou réglages ou l'exécution des procédures autres que celles spécifiées dans les présentes exigences peuvent être la cause d'une exposition à un rayonnement dangereux	☀
Do not disassemble this product.Doing so may cause exposure to the built-in light source which can damage eyes and skin. Never disassemble it.	🚫

Laser safety measures for laser equipment are stipulated by the country of use. Follow the instructions described below categorized in four cases.
• Usage in Japan
The JIS C6802:2018 standard stipulates the safety precautions that users must take according to the class of the laser product. This product is classified into CLASS 1 LASER PRODUCT defined by this standard.
• Usage in U.S.
This product is subjected to the U.S. FDA (Food and Drug Administration) laser regulations. This product is classified into CLASS 1 LASER PRODUCT by the IEC 60825-1:2014 standard according to the regulations of Laser Notice No.56 of the FDA standard. This product is already reported to CDRH (Center for Devices and Radiological Health).
Accession Number: 2420801-000
When using a device equipped with the product in the U.S., attach an FDA certification label near the sensor mounted on customer equipment.

FDA certification label

This laser product complies with
21 CFR 1040. 10 and 1040. 11 except for
conformance with IEC 60825-1 Ed. 3, as described
in Laser Notice No. 56, dated May 8, 2019.
OMRON Corporation
Shiokoji Horikawa,Shimogyo-ku,
Kyoto 600-8530 JAPAN
Place of manufacture:
Shanghai Factory,OMRON Corp.
Manufactured in

• Usage in China
This product is classified into CLASS 1 LASER PRODUCT by the GB/T 7247.1-2024 (IEC 60825-1:2014) standard.

• Usage in countries other than U.S. and China
This product is classified into CLASS 1 LASER PRODUCT by the IEC60825-1:2014/EN60825-1:2014+A11:2021 standard.

Precautions for Safe Use

Please observe the following precautions for safe use of the products.
• Do not reverse connection of DC power supply polarity.
• Do not short-circuit the load.
• Insulate unused input/output wires individually.
• Use in an explosion-proof area is not possible. Do not use the product in environments where flammable or explosive gases are present.
• Do not dismantle, modify, or repair the product.
• Do not touch the metal surface with your bare hands when the temperature is low. Touching the surface may result in a cold burn.
• Burn injury may occur. The product surface temperature rises depending on application conditions, such as the ambient temperature and the power supply voltage. Attention must be paid during operation or cleaning.
• To prevent an accident due to the product falling, wear appropriate protective gear when performing installation work in a high location.
• Do not use the product while the case is damaged.
• Do not use the product while the cord is pinched.
• In the event that you notice an abnormality, immediately stop use, turn off the power, and contact your Omron representative.
• There is a risk of damage to the current input device or burnout of the load resistor. When using Pin2 (white wire) as current output, switch the Pin2 setting to "Current" in advance and then connect the current input device or load resistor.

Precautions for Correct Use

• Do not hit the product using a hammer for installation.
• The product must be installed with the specified torque or less. For the M12 connector, the proper tightening torque is from 0.39 to 0.49 N·m. In the case of the Pre-wired M12 Smartclick Connector, firmly tighten the connector to the mating complete mark position by hand.
• The base of the connector does not rotate. Do not try to forcibly turn it.
• Do not use the product in ambient atmosphere or environment exceeding the rating.
• Please assess the safety beforehand when using the product in chemicals and/or oil environments.
• The extension of the cord under the standard I/O mode should be 50 m or less with a conductor of 0.3mm² or more. Voltage drop may occur due to cord extension, use of a 24 V power supply is recommended. Under the IO-Link mode, the length should be 20 m or less.
• Output pulses may be generated when the power is turned off. It is recommended to turn off the power of the load or load line first.
• Do not use the product in a location with an intense electric field or ferromagnetic field.
• When the product is used at an ambient temperature of -10°C or less, a warm-up time of 10 minutes maximum is required. The output remains OFF and does not change during warming up.
• Do not pull the cord too strongly.
• Do not press the button with excessive force.
• Be sure to turn off the power supply when connecting or disconnecting the cable.
• Wait for at least 1.5 s after turning on the product's power.
• The product is rated as IP67 but please avoid using the product underwater, under rain, and outdoors.
• If the Sensor wiring is placed in the same conduits or ducts as high-voltage or high-power lines, inductive noise may cause malfunction or damage. Wire the cables separately or use a shielded cable
• Do not use the product in direct sunlight.
• Do not use the product where humidity is high and dew condensation may occur.
• Do not use the product where corrosive gases may exist.
• Use a key lock to prevent malfunction if high-pressure wash water or other substances come into contact with the button.
• Do not apply high-pressure washing water directly to the sensor's light emitting / receiving surface from a short distance. As the antifouling feature may be impaired, keep a sufficient distance from the light emitting / receiving surface.
• Do not use organic solvents (e.g. paint thinner and alcohol) for cleaning. Otherwise optical properties and protective structure may deteriorate.
• Do not use the product at a location subject to shock or vibration.
• To use a commercially available switching regulator, FG (frame ground) must be grounded.
• Be sure to check the influence caused by surrounding environments such as background objects and/or LED lighting before using the product.
• Do not exceed 100,000 writing operations of the EEPROM (non-volatile memory). Setting information is written to the EEPROM when a threshold value change, teaching, or zero reset is executed.
• Perform the beam size adjustment operation by using a screwdriver of the appropriate size to rotate the screw with a force of 0.06 N·m or less. Do not use the product at other than a selectable position.

🗑 Dispose in accordance with applicable regulations.

• When installing the product, install it so that the laser beam of another sensor does not directly enter the light receiving lens. This product is equipped with a mutual interference prevention function for up to 4 sensors, but a malfunction may occur if intense light is received.
• For an object with a mirror or glossy surface, tilt the sensor so that specular reflection light from the object does not directly enter the receiver.
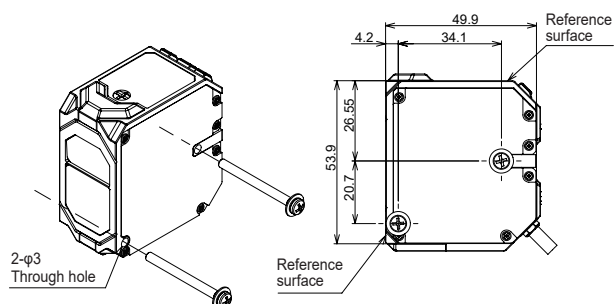
Package contents

Instruction sheet（this sheet）, Compliance sheet, Index list (attached for IO-Link type only), FDA certification label

1 Installation

1-1 Mounting of the Sensor

<Size of installation holes (Unit: mm)>

2-φ3
Through hole

Reference surface

Reference surface

Mounting brackets are sold separately.

Do not touch the emitter and/or receiver block of the sensor. Fingerprint deposits may result in improper detection. If accidentally touched, please wipe gently with a dry cloth. Do not use organic solvent (e.g. paint thinner and alcohol).
For an object with a mirror or glossy surface, tilt the sensor so that specular reflection light from the object does not directly enter the receiver. This will enable more stable detection.

2 Connection

2-1 Input/Output Circuit Diagram

■ Using Pin2 (white wire) as output

Model	Output method	Input/Output circuit diagram
E3AS-HF □□N□	NPN	
E3AS-HF □□T□	PNP Standard I/O Mode	
	PNP IO-Link Mode	

Note 1. The standard I/O mode is used as PNP ON/OFF output.
Note 2. The IO-Link mode is used for communications with the IO-Link master. The C/Q is used for IO-Link communications. The sensor output DO is used for ON/OFF output.
Note 3. For detailed information on models, ratings, and performance, refer to "8 Ratings and Specifications" ().

■ Using Pin2 (white wire) as external input "3-4 External Input" ().

| Model	Method	Input/Output circuit diagram
E3AS-HF □□N□	NPN	
E3AS-HF □□T□	PNP Standard I/O Mode	

External input	NPN	PNP
ON time	0V short-circuit or 1.5V or less (Outflow current: 1 mA or less)	Power supply voltage short-circuit or within power supply voltage - 1.5V (Sink current: 1 mA or less)
OFF time	Power supply voltage short-circuit or open	0V short-circuit or open

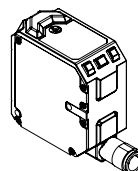■ Using Pin2 (white wire) as current "3-5 Current Output" ().

Model	Method	Input/Output circuit diagram
E3AS-HF □□N□	NPN	
E3AS-HF □□T□	PNP Standard I/O Mode	
	PNP IO-Link Mode *1	

*1. Switch Pin2 setting to "Current" before wiring. There is a risk of a load short-circuit error.

2-2 Connection Method

Pre-wired Models
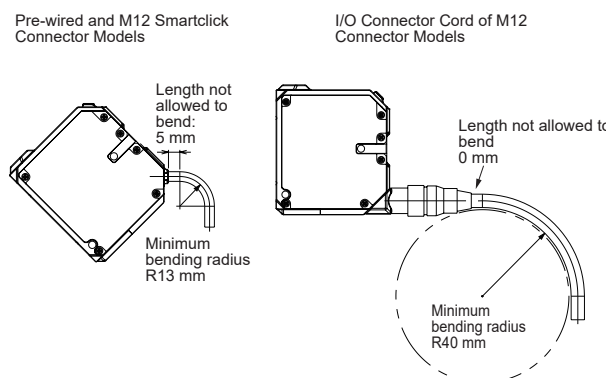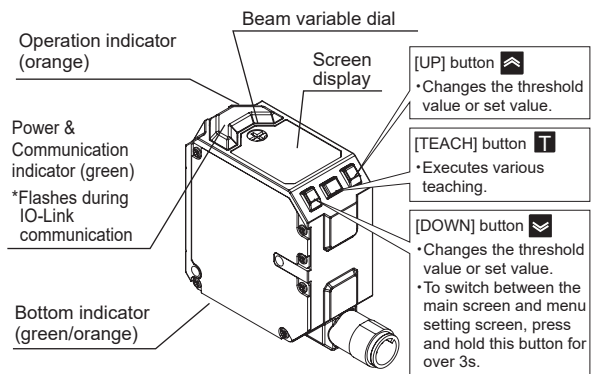

(AWG24, insulator 1.05 dia.)
E3AS-HF□□ □M

M12 Smartclick Connector Model
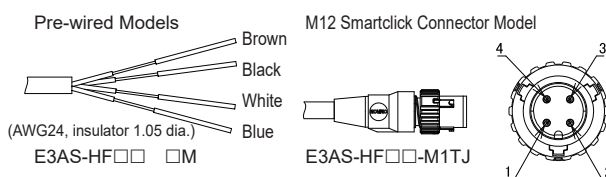
E3AS-HF□□-M1TJ

M12 Connector Models

E3AS-HF□□ M1

2-3 Cable Allowable Bending Radius

Pre-wired and M12 Smartclick Connector Models

Length not allowed to bend: 5 mm

Minimum bending radius R13 mm

I/O Connector Cord of M12 Connector Models

Length not allowed to bend 0 mm

Minimum bending radius R40 mm

Bending Specifications for Pre-wired and M12 Smartclick Connector Models			
Cable spec.	External diameter	Minimum bending radius: mm	Length not allowed to bend: mm
PVC cable	4 dia.	13	5

Bending Specifications for I/O Connector Cord of M12 Connector Models				
Model	Cable Material spec.	External diameter	Minimum bending radius: mm	Length not allowed to bend: mm
XS2F/W-D4-F	Highly oil-resistant PVC	6 dia.	40	0
XS5F/W-D5-F	Incombustible robot	6 dia.	40	0
XS5F/W-D6-X	Incombustible robot	6 dia.	40	0
XS5F/W-D6-XR	Highly oil-resistant robot PVC	6 dia.	40	0

3	Settings

3-1	Operation/Display Lookup Table

■Name and function of each part

Beam variable dial

Operation indicator (orange)

Screen display

Power & Communication indicator (green)
*Flashes during IO-Link communication

Bottom indicator (green/orange)

[UP] button ⏫
・Changes the threshold value or set value.

[TEACH] button 🅣
・Executes various teaching.

[DOWN] button ⏬
・Changes the threshold value or set value.
・To switch between the main screen and menu setting screen, press and hold this button for over 3s.

■Bottom indicator

The bottom indicator is linked with the operation indicator, and lights in either green or orange.

Operation indicator	Bottom indicator
Lights in orange	Lights in orange
Off	Lights in green

■Main screen

Zero reset indicator
Turned ON when the zero reset function is enabled.

Threshold value indicator
Displays the set value of the threshold value in [mm]*1.

Detected value
Displays the current detected value in [mm]*1.

*1. Reference value

OUT indicator
Displays output state of output 1 (Pin4, black wire).

OUT indicator
Displays input/output state of output 2 (Pin2, white wire).

	OFF time	ON time
Output1	🔳1	1

	OFF time	ON time
Output2	🔳2	2
	Normal	Inputting
External Input	IH	IH
Error Output	E (Setting)	
Current	C	

■Other button operations

Item	Operation	Reference
Teaching execution	🅣 TEACH	"4 Teaching" (page 5)
Zero reset execution	⏬ DOWN + 🅣 TEACH Simultaneously for over 3s.	"5-3 Zero Reset" (page 7)
Zero reset cancel	⏫ UP + 🅣 TEACH Simultaneously for over 3s.	
Key lock execution/cancel	⏫ UP + ⏬ DOWN Simultaneously for over 3s.	"5-1 Key Lock" (page 7)

■How to switch to each screen

Main screen

⏬ DOWN Press and hold for over 3s

Menu setting screen
"6 Detailed Settings" (pages 8 to 9)

⏫ UP or ⏬ DOWN Press for less than 1s

Threshold value setting screen
"4-3 Threshold Value Manual Operations" (page 7)
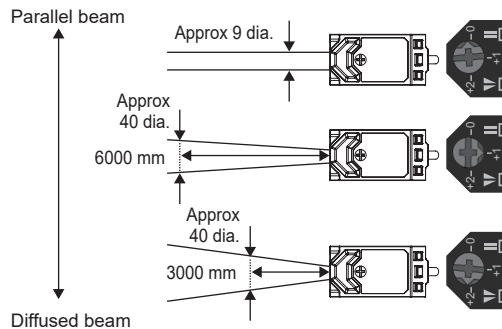
Time elapses without operation
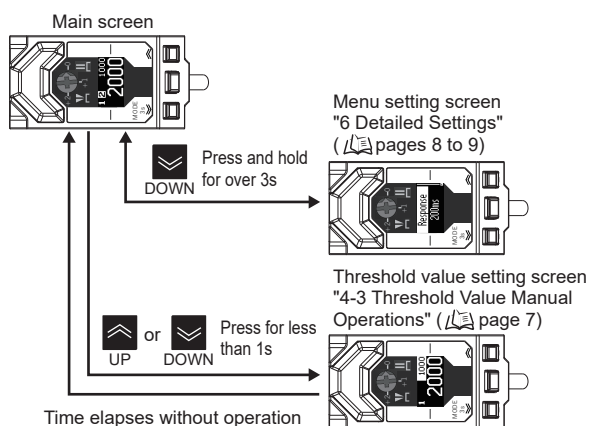
■Beam variable dial operation

The beam can be adjusted in 3 levels for each type by the dial.

**Diffused beam type　E3AS-HF6000DM□**
This type can prevent chattering when there is space between objects by widening the beam.
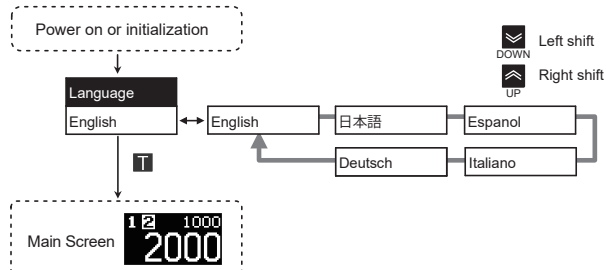

Parallel beam

Approx 9 dia.

Approx 40 dia.
6000 mm

Approx 40 dia.
3000 mm

Diffused beam

Spot beam type　E3AS-HF6000SM□
This type detects objects deep in a narrow hole by condensing the beam.

Parallel beam

Approx 9 dia.

Approx 2 dia.
3000mm

Approx 2 dia.
1500mm

Spot beam
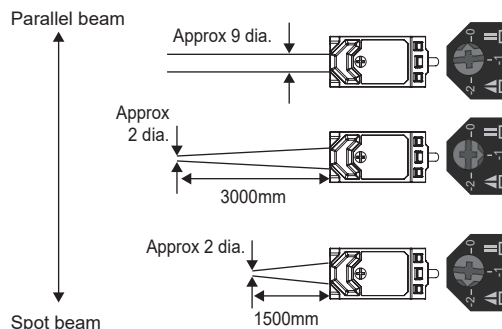
3-2	Initial Setup

The initial screen is displayed and the language can be selected when the power is turned on for the first time or after initialization. "6-15 Language" (page 11)
If IO-Link communication is performed in the initial screen, English is selected and saved automatically and the screen transitions to the main screen.

Power on or initialization

⏬ DOWN Left shift

⏫ UP Right shift

Language
English ⟷ English — 日本語 — Espanol
Deutsch — Italiano

🅣

Main Screen

3-3	Output Function

■Output1 Function

The function assigned to output 1 can be selected.
Single, window FGS, and window BGS vary depending on the teaching.

Menu display	Output1 Function
Single	The judgment method of output can be selected. "3-6 Output Mode" (page 5)
Window FGS	
Window BGS	
Deactivated	Output is turned off regardless of the position of the object.

■Output2 Function

The function assigned to output 2 can be selected.
Single, window FGS, and window BGS vary depending on the teaching.

Menu display	Output2 Function
Invert	Output 1 is inverted.
Single	The function assigned to output 2 can be selected. "3-6 Output Mode" (page 5)
Window FGS	
Window BGS	
Input	External input is accepted.
Error	Turns ON when there is a system error, output 1 has a load short-circuit error, or in the low temperature state.
Current	Current is output according to the detected value.
Deactivated	Output is turned off regardless of the position of the object.

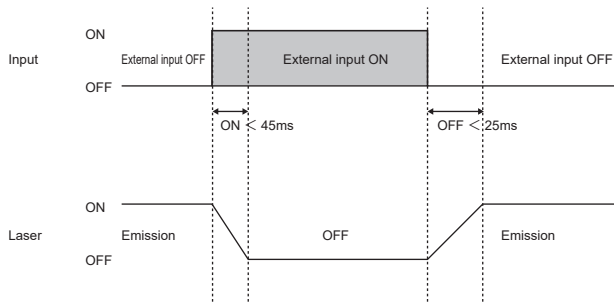| 3-4	External Input

External input can be selected from the menu setting screen.
External Input in "6 Detailed Settings   External Input" (📖 page 8)
The external input of "Output 2 Function" cannot be used in IO-Link mode.

■Laser OFF

Laser emission is turned OFF. When the laser emission is stopped, the intensity is insufficient.

Input
ON — External input OFF | External input ON | External input OFF — OFF
ON < 45ms   OFF < 25ms

Laser
ON — Emission | OFF | Emission — OFF

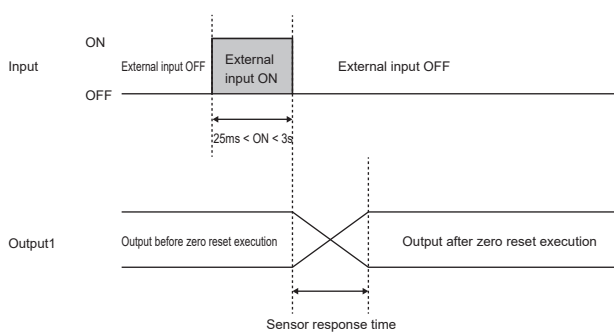* About 800 ms is required until output changes after a laser is emitted.

■Teaching

Various teaching can be executed within as much time as spent for button operations. "4 Teaching" (📖 page 5 to 6).
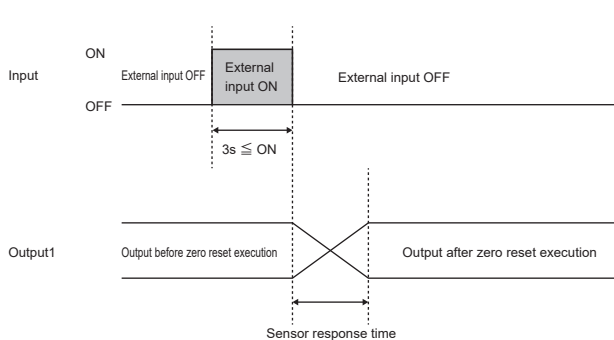
■Zero Reset

The detected value when zero reset is executed is set to "0."

●Zero reset execution

Input
ON — External input OFF | External input ON | External input OFF — OFF
25ms < ON < 3s

Output1
Output before zero reset execution | Output after zero reset execution
Sensor response time

●Zero reset cancel

Input
ON — External input OFF | External input ON | External input OFF — OFF
3s ≦ ON

Output1
Output before zero reset execution | Output after zero reset execution
Sensor response time

Note: When the power is turned off after zero reset is executed, zero reset is canceled. To retain the result of a zero reset, use the zero reset memory function.
"5-3 Zero reset memory" (📖 page 7)
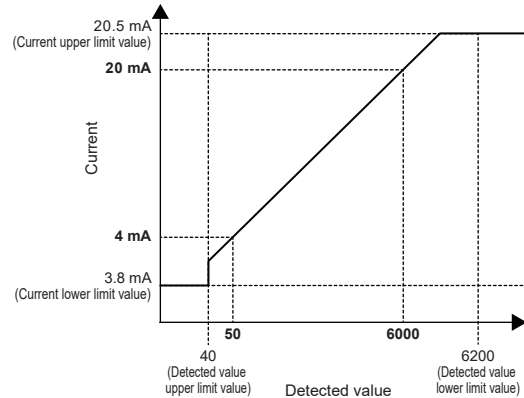
3-5	Current Output

Current is output according to the detected value.
The relationship between the detected value and current can be freely set by changing Scaling High/Low. In addition, Scaling High/Low can be taught using actually detected values.
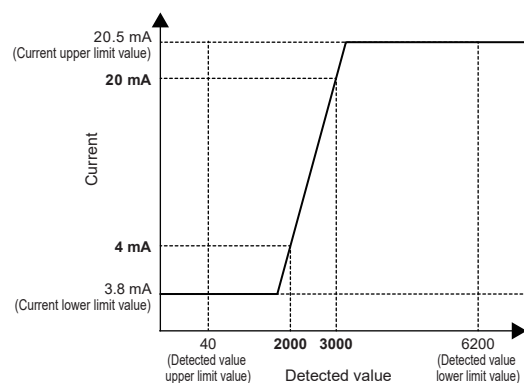"6-6 Current Scaling Value Teaching Function" (📖 page 10)

■Scaling function initial operation

Setting item	Setting value
Current scaling Low (4 mA)	50
Current scaling High (20 mA)	6000

Current axis: 20.5 mA (Current upper limit value), 20 mA, 4 mA, 3.8 mA (Current lower limit value)
Detected value axis: 40 (Detected value upper limit value), 50, 6000, 6200 (Detected value lower limit value)

■Operation when scaling is set (example)

Setting item	Setting value
Current scaling Low (4 mA)	2000
Current scaling High (20 mA)	3000

Current axis: 20.5 mA (Current upper limit value), 20 mA, 4 mA, 3.8 mA (Current lower limit value)
Detected value axis: 40 (Detected value upper limit value), 2000, 3000, 6200 (Detected value lower limit value)

Setting item	Setting value
Current scaling Low (4 mA)	6000
Current scaling High (20 mA)	1000

Current axis: 20.5 mA (Current upper limit value), 20 mA, 4 mA, 3.8 mA (Current lower limit value)
Detected value axis: 40 (Detected value upper limit value), 1000, 6000, 6200 (Detected value lower limit value)
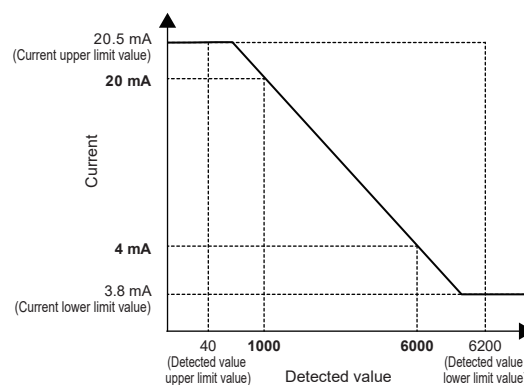
CHECK! If Scaling High and Scaling Low are the same, the scaling setting is ignored and the operation is the same as with the initial values (Low: 50, High: 6000).

3-6	Output Mode

■Single

The output is inverted when the detected value falls below the threshold value (SP1). This mode is selected automatically when 2-point teaching and object teaching are executed.
"4-1 Teaching Types" (page 5)
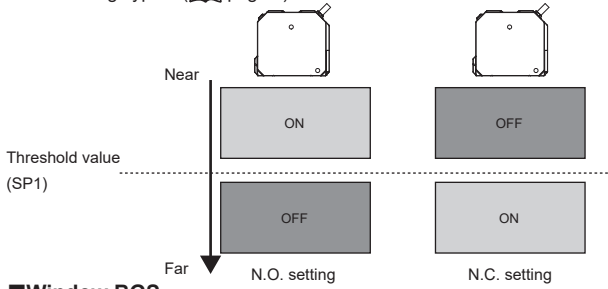
■Window BGS

The output is inverted when the detected value is between the far side (SP1) and near side (SP2) threshold values. This mode is selected automatically when window object teaching is executed.
"4-1 Teaching Types" (page 5)
The mode can perform detection without depending on the shape or reflectance of the background since a background that is farther away than the set distance is not detected.
When the light intensity is insufficient and when out of the detection distance range, output is OFF when N.O. is set, and ON when N.C. is set.
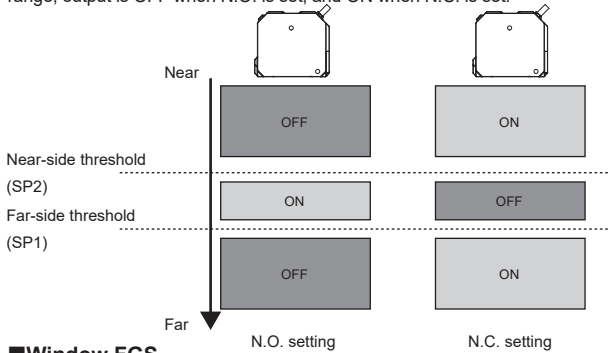
■Window FGS

The output is inverted when the detected value is between the far side (SP1) and near side (SP2) threshold values. This mode is selected automatically when background reference teaching is executed.
"4-1 Teaching Types" (page 5)
The mode is suitable for when the object has a mirror-surface, level difference, or low reflectance since an object nearer than the set distance and an object with a reflected light intensity lower than the specified value are not detected.
When the light intensity is insufficient and when out of the detection distance range, output is ON when N.O. is set, and OFF when N.C. is set.
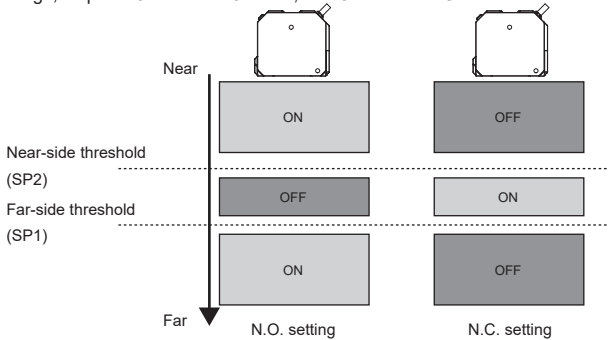
Note: Single point mode and window BGS mode perform the BGS operation, so they can be used regardless of whether there is a background, but window FGS mode cannot be used if there is no background.

3-7	Display Specification

■Single Point Mode

Factory default (initial setting) operation

Rated sensing distance range — Threshold

Standard I/O Mode	Power/Communication indicator (green)	ON / OFF	
	Operation Indicator (orange)	ON / OFF	
	Bottom indicator	Lights in orange / Lights in green	
	Output1	ON / OFF	
	Output2	ON / OFF	
IO-Link Mode	Power/Communication indicator (green)	Flashing (1s cycle)	
	Operation Indicator (orange)	ON / OFF	
	Bottom indicator	Lights in orange / Lights in green	
	Communication Output1 (PD3 bit0)	1 / 0	
	Communication Output2 (PD3 bit1)	1 / 0	
	Output2 *1	ON / OFF	

*1 In IO-Link mode, output 2 can also be used in addition to communication output.

■Window BGS mode

Factory default (initial setting) operation

Rated sensing distance range — Near-side threshold / Far-side threshold

Standard I/O Mode	Power/Communication indicator (green)	ON / OFF		
	Operation Indicator (orange)	ON / OFF		
	Bottom indicator	Lights in orange / Lights in green		
	Output1	ON / OFF		
	Output2	ON / OFF		
IO-Link Mode	Power/Communication indicator (green)	Flashing (1s cycle)		
	Operation Indicator (orange)	ON / OFF		
	Bottom indicator	Lights in orange / Lights in green		
	Communication Output1 (PD3 bit0)	1 / 0		
	Communication Output2 (PD3 bit1)	1 / 0		
	Output2 *1	ON / OFF		

*1 In IO-Link mode, output 2 can also be used in addition to communication output.

■Window FGS mode

Factory default (initial setting) operation

Rated sensing distance range — Near-side threshold / Far-side threshold

Standard I/O Mode	Power/Communication indicator (green)	ON / OFF		
	Operation Indicator (orange)	ON / OFF		
	Bottom indicator	Lights in orange / Lights in green		
	Output1	ON / OFF		
	Output2	ON / OFF		
IO-Link Mode	Power/Communication indicator (green)	Flashing (1s cycle)		
	Operation Indicator (orange)	ON / OFF		
	Bottom indicator	Lights in orange / Lights in green		
	Communication Output1 (PD3 bit0)	1 / 0		
	Communication Output2 (PD3 bit1)	1 / 0		
	Output2 *1	ON / OFF		

*1 In IO-Link mode, output 2 can also be used in addition to communication output.
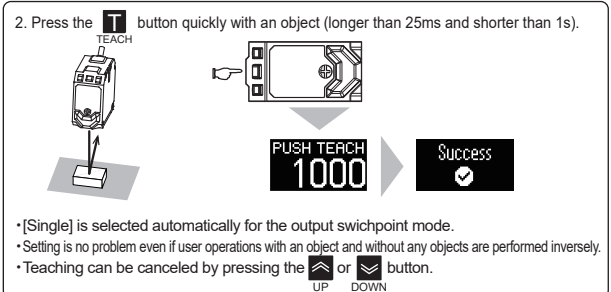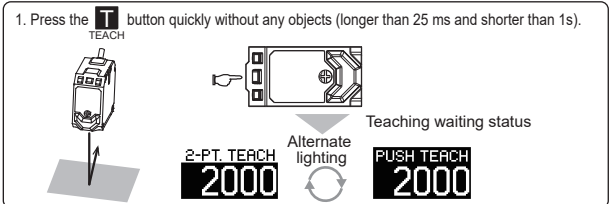
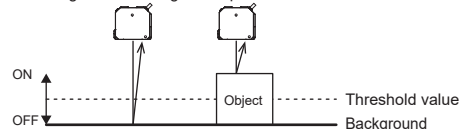| 4	Teaching

4-1	Teaching Types

■2-point Teaching

Single

Use this mode when you want to perform teaching using the two points of the object and background.

1. Press the [T] TEACH button quickly without any objects (longer than 25 ms and shorter than 1s).

Teaching waiting status

2-PT. TEACH 2000 — Alternate lighting — PUSH TEACH 2000

2. Press the [T] TEACH button quickly with an object (longer than 25ms and shorter than 1s).

PUSH TEACH 1000 ▶ Success

- [Single] is selected automatically for the output swichpoint mode.
- Setting is no problem even if user operations with an object and without any objects are performed inversely.
- Teaching can be canceled by pressing the [∧] UP or [∨] DOWN button.

●Threshold setting after teaching is completed

ON — Object — Threshold value
OFF — Background

- The threshold value is set at a distance between background and object.
- Maximum detection distance is set (threshold value is set with 6,000 mm as a teaching point) when teaching is performed with either the first or second point without detected object or background.
- Shown above is applicable to the case of N.O. output logic. In the case of N.C., this is inverted.
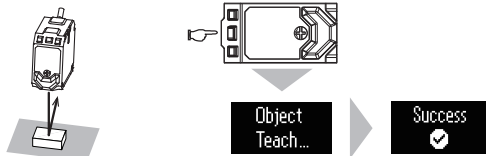
■Object teaching

Use this mode when you want to detect a short distance including an object with a single press of a button.

It can be executed if object teaching selection is set to [Object].
"6-3 Object teaching selection" (📖 page 10)

`Single`

1. Press the 🅣 button quickly with an object (longer than 1s and shorter than 5s).
   TEACH
   Release the button when [Object Teach] is displayed on the display

Object Teach... ▶ Success ✓

・[Single] is selected automatically for the output swichpoint mode.

● Threshold setting after teaching is completed
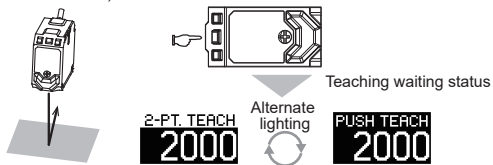
ON ⸺ Margin
Object ⸺ Threshold value
OFF ⸺ Background
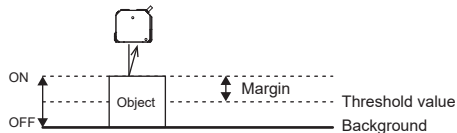
・The threshold value is set on the near side to the object.
・If teaching is performed without a detected object or background, the maximum detection value (6,000 mm) is set as the threshold.
・Margin is set automatically to the optimal value depending on the received light intensity.
・Shown above is applicable to the case of N.O. output logic. In the case of N.C., this is inverted.

■Background Reference Teaching

This is suitable for when you want to detect an object that is not stable (mirror-surface, level difference, or low reflectance) in object teaching.

`Window FGS`

1. Press the 🅣 button quickly with a reference background (longer than 25ms and shorter than 1s).
   TEACH

   Teaching waiting status

   2-PT. TEACH 2000 Alternate lighting PUSH TEACH 2000

2. Press and hold the 🅣 button with a reference background (longer than 1s and shorter than 5s).
   TEACH
   Release the button when [Reference Teach] is displayed on the display

Reference Teach... ▶ Success ✓
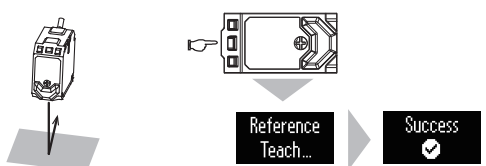
・[Window FGS] is selected automatically for the output swichpoint mode.

● Threshold setting after teaching is completed

ON
OFF ⸺ Margin ⸺ Near-side threshold value
⸺ Background (reference surface)
ON ⸺ Margin ⸺ Far-side threshold value
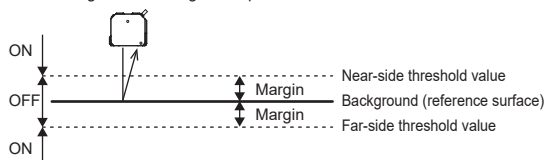
・The threshold value is set with ± margin to the background.
・Margin is set automatically to the optimal value according to the detecting distance.
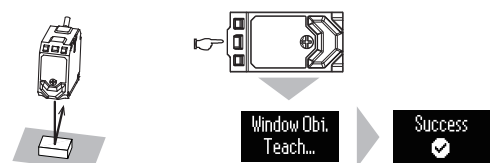・Shown above is applicable to the case of N.O. output logic. In the case of N.C., this is inverted.

■Window object teaching

Use this mode when you want to detect an object within the range of two threshold values.

It can be executed if object teaching selection is set to [Window Obj.].
"6-3 Object teaching selection" (📖 page 10)

`Window BGS`

1. Press and hold the 🅣 button with an object (longer than 1s and shorter than 5s).
   TEACH
   Release the button when [Window Obj. Teach] is displayed on the display

Window Obj. Teach... ▶ Success ✓

・[Window BGS] is selected automatically for the output swichpoint mode.

● Threshold setting after teaching is completed

OFF
ON ⸺ Margin ⸺ Near-side threshold value
Object ⸺ Margin
OFF ⸺ Far-side threshold value
⸺ Background
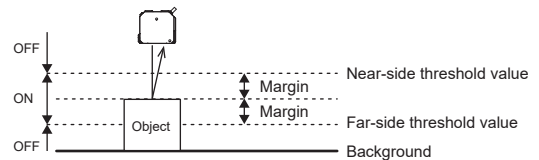
・The threshold value is set with ± margin to the background.
・Margin is fixed to 50.
・Shown above is applicable to the case of N.O. output logic. In the case of N.C., this is inverted.

🔍 The output target for teaching can be switched to output 1 or output 2 in the setting menu.
CHECK! "6-2 Teaching Target Selection" (📖 page 10)

| 4-2 | Teaching Display |

■Teaching cancel display

Display	Indicator			Description
	Power/communication indicator (green) *1	Operation indicator (orange)	Bottom indicator (green/orange)	
Teaching Cancelled Teach Cancel	Lighting	Normal operation	Normal operation	If the Teach button is pressed and held for 5s or more during teaching, [Teach Cancel] is displayed and teaching can be canceled.

■Teaching success display*2

Display	Indicator		
	Power/communication *1	Operation	Bottom
Teaching succeeded Success ✓	Lighting	Flashing (at 0.6s intervals)	Alternate lighting (at 0.6s intervals)

■Teaching error display*2

Display	Indicator			Possible causes	Countermeasure
	Power/communication *1	Operation	Bottom		
Teaching execution error Teach Error ⊗	Lighting	Flashing (at 0.3s intervals)	Alternate lighting (at 0.3s intervals)	Teaching failed.	Confirm that the sensor-object distance is within the detecting range and execute teaching again.
Teaching near error Near Error ⊗				The difference of the detected values of the 1st and 2nd points is too small when 2-point teaching is executed.	Expand the distance between 1st and 2nd points and execute teaching again.

*1. This is the operation in the standard I/O mode. The indicator blinks in the IO-Link mode (at 1s intervals).
*2. The display time is 2 seconds after teaching is executed.

6

The threshold value can be adjusted using the [UP] button and the [DOWN] button.
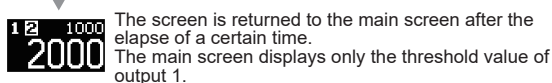
⊼ (UP) The threshold value increases.

⊻ (DOWN) The threshold value decreases.

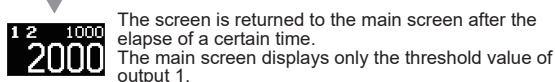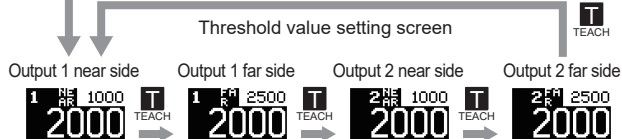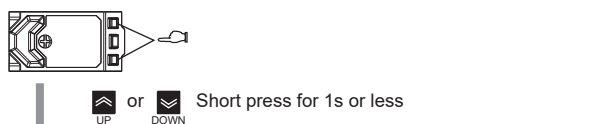💡 CHECK! Quick adjustment is usable by pressing and holding the button.

■When output swichpoint modes of output 1 and output 2 are both [Single]

The threshold values of output 1 and output 2 can be adjusted.

⊼ (UP) or ⊻ (DOWN) Short press for 1s or less

Output 1 — [T] TEACH ⟷ — Output 2

The screen is returned to the main screen after the elapse of a certain time.
The main screen displays only the threshold value of output 1.

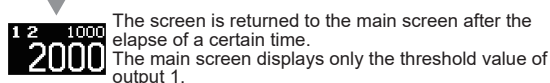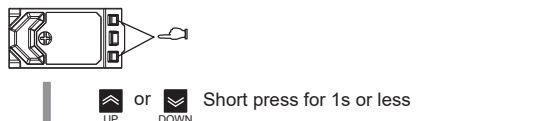### ■When output swichpoint modes of output 1 and output 2 are both [Window FGS] or [Window BGS]

The threshold values of output 1 near side, output 1 far side, output 2 near side, and output 2 far side can be adjusted.

⊼ (UP) or ⊻ (DOWN) Short press for 1s or less

Threshold value setting screen [T] TEACH

Output 1 near side → Output 1 far side → Output 2 near side → Output 2 far side

The screen is returned to the main screen after the elapse of a certain time.
The main screen displays only the threshold value of output 1.

■When output swichpoint modes of output 1 and output 2 differ

This is a combination of the above two patterns.

Example: When output swichpoint mode of output 1 is [Single] and output mode of output 2 is [Window BGS] or [Window FGS]

⊼ (UP) or ⊻ (DOWN) Short press for 1s or less

Output 1 → Output 2 near side → Output 2 far side

The screen is returned to the main screen after the elapse of a certain time.
The main screen displays only the threshold value of output 1.

💡 CHECK! When "Deactivated" is selected, the operation is the same as for single. The threshold value of output 2 is not displayed when "Invert," "Input," "Error," or "Current" is selected for the output swichpoint mode of output 2.
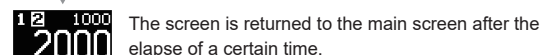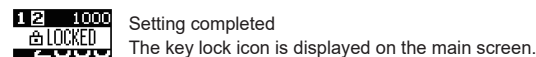
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5 Useful Functions

5-1 Key Lock

Acceptance of button operations can be disabled to prevent incorrect operations.

●Key lock execution

⊼ (UP) + ⊻ (DOWN) Press simultaneously for 3s or more

🔒LOCKED Setting completed
The key lock icon is displayed on the main screen.

The screen is returned to the main screen after the elapse of a certain time.

💡 CHECK! If buttons are operated in the key lock state, the key lock icon is displayed on the main screen.

●Key lock cancel

⊼ (UP) + ⊻ (DOWN) Press simultaneously for 3s or more

🔓UNLOCKED Setting completed
The key unlock icon is displayed on the main screen.

The screen is returned to the main screen after the elapse of a certain time.
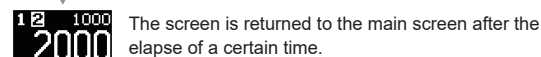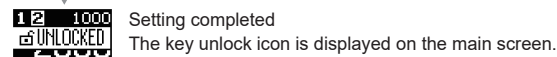
5-2 Initialization

Settings are initialized and returned to the factory settings by selecting "Yes" in Initialization in the menu setting screen.
After initialization, language setting is required as the initial setting.
📖 "3-2 Initial Setup" (page 3)

5-3 Zero Reset

The detection value when zero reset is executed is set to [0].

●Zero reset execution

⊻ (DOWN) + [T] TEACH Press simultaneously for 3s or more

Setting completed
The zero reset icon is displayed on the main screen.
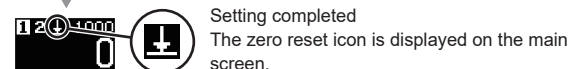
・The detection value is overwritten if zero reset has already been executed.

●Zero reset cancel

⊼ (UP) + [T] TEACH Press simultaneously for 3s or more

Releasing completed
The zero reset icon on the main screen is turned OFF.
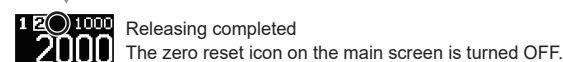
●Zero reset memory

The result of zero resetting can be saved even turning OFF the power after executing zero resetting by the external input or the communication commands of the IO-Link mode, only when the zero reset memory is set as [Off] described in 📖 "6 Detailed Settings Zero Reset Memory"(page 9).

💡 CHECK! When the sensor is operated using the buttons, the result is saved regardless of the setting of zero reset memory.

■Transition of the setting screen when English is selected in the initial screen

Numerical value settings can be adjusted quickly by pressing and holding a button.

Main screen
1 2 1000
2000

⋀ [UP] Right shift / Numerical value +

⋁ [DOWN] Left shift / Numerical value -

⋁ 3s

Response Time
📖 6-1 (page 10)
Response — 200 ms
T ↔ 200 ms → 50 ms → 10 ms → 2 ms

Teach Select
📖 6-2 (page 10)
Teach Select — Out1
T ↔ Out1 → Out2
* Displayed only when the Output 2 Mode ≠ Input, Current

Object teaching selection
📖 6-3 (page 10)
Teach 3sec. — Object
T ↔ Object → Window Obj.

Output 1 Mode
📖 3-3 (page 3)
Out1 Mode — Single
T ↔ Single → Window BGS → Window FGS → Deactivated

Output 1 Logic
📖 6-4 (page 10)
Out1 Logic — N.O.
T ↔ N.O. → N.C.

Output 1 Timer Mode
📖 6-5 (page 10)
Timer Mode1 — Off
T ↔ Off → On Delay → Off Delay → One Shot
* Not displayed when the Output 1 Mode = Deactivated

Output 1 Timer Time
Timer Time1 — 5 ms
T ↔ 1~9999 ms
* Displayed only when the Output 1 Timer Mode ≠ Off

Output 2 Mode
📖 3-3 (page 3)
Out2 Mode — Invert
T ↔ Invert → Single → Window BGS → Window FGS → Input
Deactivated → Current → Error
* Displayed only when the Teach Select = Out1
* Displayed only when the Teach Select = Out1

Output 2 Logic
📖 6-4 (page 10)
Out2 Logic — N.O.
T ↔ N.O. → N.C.

Output 2 Timer Mode
📖 6-5 (page 10)
Timer Mode2 — Off
T ↔ Off → On Delay → Off Delay → One Shot
* Not displayed when the Output 2 Mode = Deactivated

Output 2 Timer Time
Timer Time2 — 5 ms
T ↔ 1~9999 ms
* Displayed only when the Output 2 Timer Mode ≠ Off
Displayed only when the Output 2 Mode = Single, Window BGS, WindowFGS or Deactivated

External Input
📖 3-4 (page 4)
Input Func. — Laser Off
T ↔ Laser Off → Teach → Zero Reset
* Displayed only when the Output 2 Mode = Input

Current Scaling Value Teaching Function
📖 6-6 (page 10)
mA Scaling — Manual
T ↔ Manual → Teach
* Current scaling value teaching function is executed if set mA scaling = Teach and transitioned to item setting.

Current Scaling Lower Limit
📖 3-5 (page 4)
4mA Dist. — 50 mm
T ↔ -6200~6200 mm

Current Scaling Upper Limit
📖 3-5 (page 4)
20mA Dist. — 6000 mm
T ↔ -6200~6200 mm
Displayed only when the Output 2 Mode = Current

Display Selection
📖 6-7 (page 10)
Display — Standard
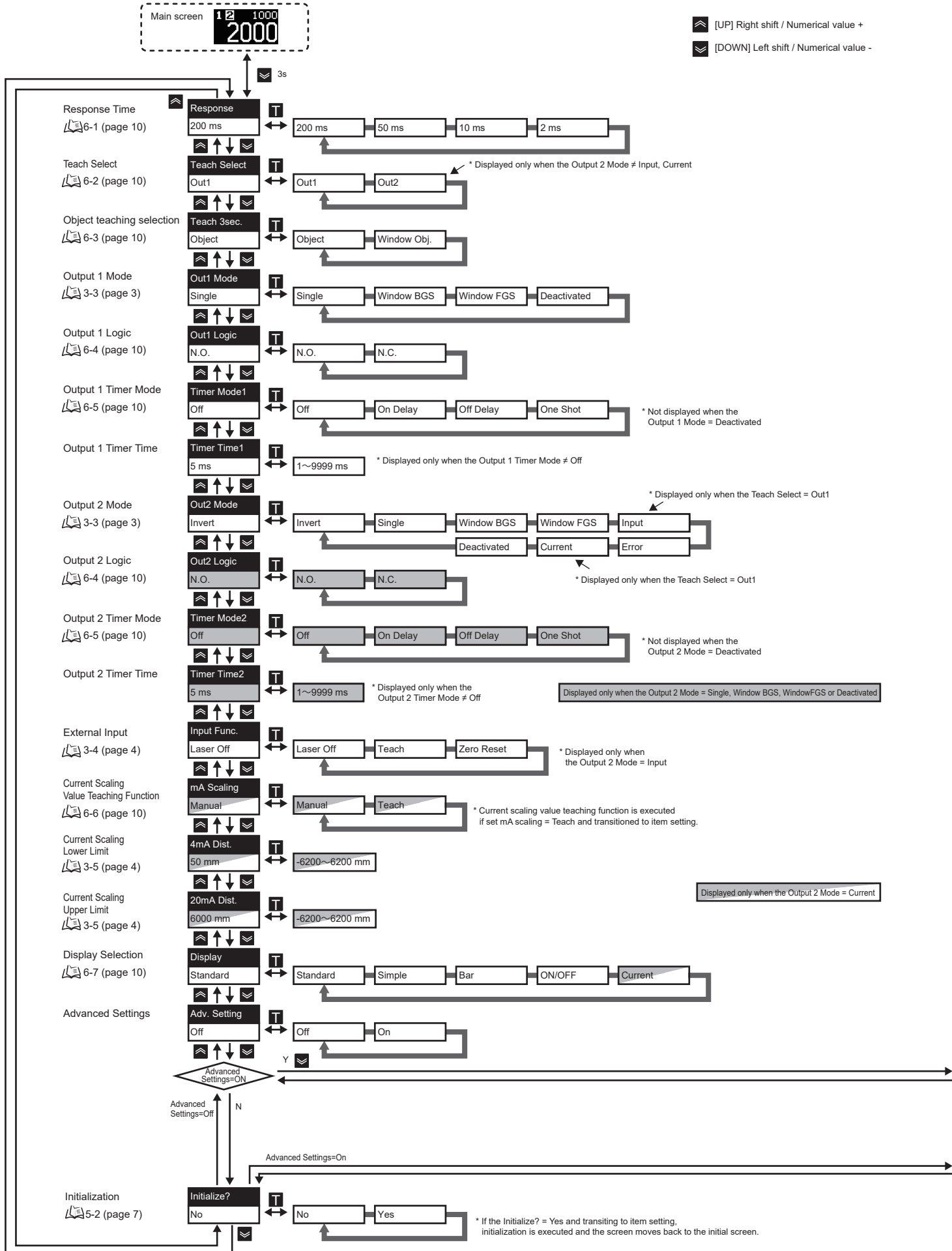T ↔ Standard → Simple → Bar → ON/OFF → Current

Advanced Settings
Adv. Setting — Off
T ↔ Off → On

◇ Advanced Settings=ON
Y ⋁

Advanced Settings=Off
N

Advanced Settings=On

Initialization
📖 5-2 (page 7)
Initialize? — No
T ↔ No → Yes
* If the Initialize? = Yes and transiting to item setting, initialization is executed and the screen moves back to the initial screen.

* Displayed only when the Response = 10 ms, 50ms or 200 ms

Sensitivity | T
Very High ↔ | Very High — High — Middle — Low — Very Low

Display Reverse
6-8 (page 10)

Disp.Reverse | T
Off ↔ | Off — On

Display Brightness
6-9 (page 10)

Brightness | T
Normal ↔ | Normal — Dark

Zero Reset Memory
5-3 (page 7)

Zero Memory | T
Off ↔ | Off — On

Keep Function
6-11 (page 10)

Keep Func. | T
Off ↔ | Off — On

Mutual Interference Prevention
6-12 (page 10)

Interference | T
Auto ↔ | Auto — Manual

Mutual Interference Channel Selection
6-12 (page 10)

Manual ch. | T
Channel1 ↔ | Channel1 — Channel2 — Channel3 — Channel4

* Displayed only when the Interference = Manual

Hysteresis Mode
6-13 (page 11)

Hys Mode | T
Auto ↔ | Auto — Manual

* Displayed only when either the Out1 mode or Out2 mode = Single, Window BGS or Window FGS

Output 1 Hysteresis width
6-13 (page 11)

Out1 Hys | T
10 mm ↔ | 0～1000 mm

* Displayed only when Out1 mode = Single, Window BGS, or Window FGS and Hys mode = Manual

Output 2 Hysteresis width
6-13 (page 11)

Out2 Hys | T
10 mm ↔ | 0～1000 mm

* Displayed only when Out2 mode = Single, Window BGS, or Window FGS and Hys mode = Manual

Process Data Settings
6-14 (page 11)

PD Setting | T
Scale ↔ | Scale — Intensity

* Displays only PNP type with IO-Link function.

Language
6-15 (page 11)

Language | T
English ↔ | English — 日本語 — Espanol — Italiano — Deutsch

Item	Initial value
Response Time	200 ms
Teach Select	Out1
Object teaching selection	Object
Output 1 Mode	Single
Output 1 Logic	N.O.
Output 1 Timer Mode	Off
Output 1 Timer Time	5 ms
Output 2 Mode	Invert
Output 2 Logic	N.O.
Output 2 Timer Mode	Off
Output 2 Timer Time	5 ms
External Input	Laser Off
Current Scaling Value Teaching Function	Manual
Current Scaling Lower Limit	50 mm
Current Scaling Upper Limit	6000 mm
Display Selection	Standard
Advanced Settings	Off
Sensitivity	Very High
Display Reverse	Off
Display Brightness	Normal
Zero Reset Memory	Off
Keep Function	Off
Mutual Interference Prevention	Auto
Mutual Interference Channel Selection	Channel 1
Hysteresis Mode	Auto
Output 1 Hysteresis width	10 mm
Output 2 Hysteresis width	10 mm
Process Data Settings	Scale
Language	English

6-1 Response Time

Response time can be changed.
Detection becomes more stable as increasing response time.
Execute teaching again or set the threshold again after changing the response time.

6-2 Teaching Target Selection

The teaching target can be switched between output 1 and output 2.
The threshold value of each output before switching is saved.
The settings for teaching can be configured by button, input function, and IO-Link command.
The target is set automatically to output 1 after the power supply is restarted.
"4-1 Teaching Types" (📖 page 5 to 6)

6-3 Object Teaching Selection

Teaching executed when pressing and holding the teaching button (longer than 1s and shorter than 5s) can be switched.
"4-1 Teaching Types" (📖 page 5 to 6)
"6 Detailed Settings Object teaching selection" (📖 page 8)

6-4 Output Logic

The output logic (N.O. or N.C.) of output 1 or output 2 can be switched.
The logic of output 2 can be changed only when the output 2 function is set to [Single], [Window BGS], [Window FGS] or [Deactivated].

6-5 Timer Mode

The timer operation of the output can be set.

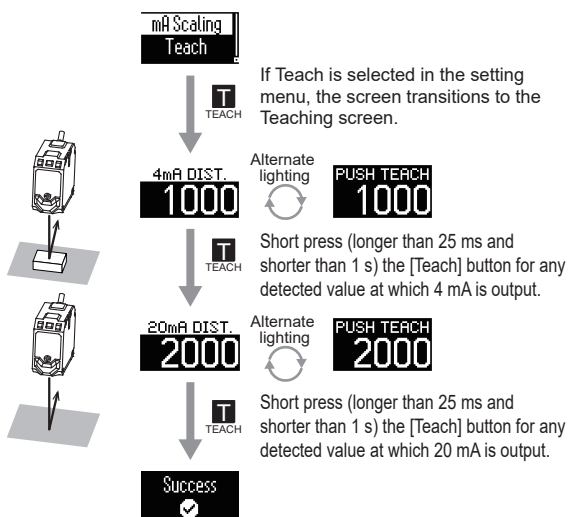| Timer mode	Description on function
Off	The timer function is not used.
On Delay	Output ON is retarded after the object is detected.
Off delay	Output ON is held if the detection time is too short for PLC to detect the object.
One shot	Output is held for a certain period of time even if the object size varies.
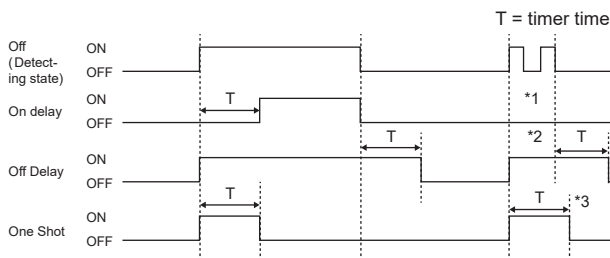
T = timer time

*1. If the ON time < the timer time, output is not turned ON.
*2. If the OFF time < the timer time, output is not turned OFF.
*3. Even if the condition of switching OFF to ON is satisfied while output is effective, it is ignored.
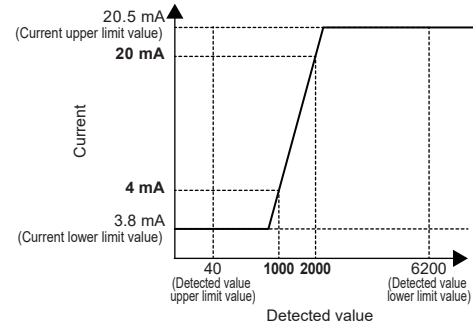
6-6 Current Scaling Value Teaching Function

Scaling High/Low of the output current can be taught according to the detected values.

Example: When scaling with Low (detected value when 4 mA output) at 1,000 mm, and High (detected value when 20 mA output) at 2,000 mm

If Teach is selected in the setting menu, the screen transitions to the Teaching screen.

Short press (longer than 25 ms and shorter than 1 s) the [Teach] button for any detected value at which 4 mA is output.

Short press (longer than 25 ms and shorter than 1 s) the [Teach] button for any detected value at which 20 mA is output.

The screen transitions automatically to the main screen, and output is as follows.

6-7 Display Selection

The screen configuration of the main screen can be selected from 5 types.

Item	Display	Description
Standard	2000	Displays the detected value, threshold value, I/O state, and setting state. This is the screen configuration of factory settings.
Simple	2000	Displays the detected value only.
Bar		Displays the detected value as a bar and the output as an icon. The downward pointing triangle is the threshold value. The bar indicates the range between the upper and lower limits of the detection distance.
ON/OFF	1 2	Displays the I/O state only.
Current	20.05	Displays the current value and output state of the current without displaying the detected values.

6-8 Display Reverse

By enabling display reverse, display is rotated by 180° and the [UP] button and [DOWN] button are switched.
However, the main screen and the menu setting screen are switched by the button beside the print, "MODE 3s", regardless of valid or invalid of display reverse.

Display reverse: Off

Display reverse: On
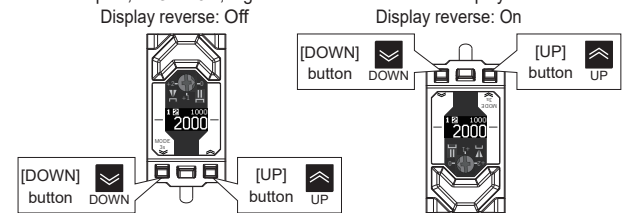
6-9 Display Brightness

Display brightness	Description
Normal	The brightness of the OLED display decreases after not operated for a certain time (60s).
Dark	The OLED display is turned OFF perfectly after not operated for a certain time (15s).

Note 1. Display's luminance decreases as the sensor is used for a long period.

6-10 Sensitivity

The sensor sensitivity can be adjusted in five levels.
A higher sensitivity makes detection of objects with low reflectance easier.
A lower sensitivity makes detection less susceptible to interference from objects around the emitted beam.
If the response time is 2 ms, the setting is fixed to "Very High".

6-11 Keep Function

This function retains and outputs the measurement value immediately before entering a non-measuring state (such as a state when the receiving light intensity is insufficient).

Keep Function	Output		
	Judgment output		Current output
	N.O. setting	N.C. setting	
Off (factory default setting)	OFF	ON	3.8 mA to 20.5 mA
On	Saves the judgment output and current output immediately before the sensor judges that in a non-measuring state.		

Note 1. If background reference teaching is executed (when Out1 mode = Window FGS), keeping is disabled on output 1 only.
Note 2. The keep function works in the same way also for detected values of IO-Link communication.

6-12 Mutual Interference Prevention Function

This product is equipped with a function to automatically prevent the influence of mutual interference.
The mutual interference function is set to "Auto" in the factory default settings.
Set this function to "Manual" and set different channel numbers if influence by mutual interference occurs even with "Auto" set.

Mutual interference prevention function	Description
Auto	The sensor automatically prevents mutual interference.
Manual	Assignable to channels 1 to 4 by the user.

■Hysteresis Mode

Minute level difference can be judged by controlling the hysteresis width minutely according to the object.

Hysteresis mode	Description
Auto	The optimum hysteresis width is automatically set according to the insufficient light.
Manual	User can set any hysteresis width.

However, note that when the detected value is fluctuating due to the movement of the object or the small intensity of the reflected light, the output may become unstable.

■Hysteresis Width

The point at which the output turns from OFF to ON is called the operating point and the point at which it turns from ON to OFF is called the return point. The distance between the operating and return points is called hysteresis width. For this sensor, threshold value is equal to operating point, so the distance to the return point can be set by the hysteresis width. The definition of hysteresis width for each output mode is shown on the figure below.
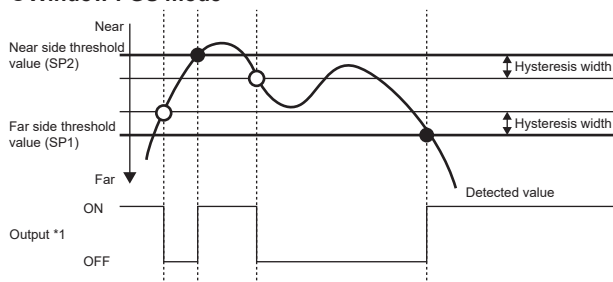
●Single Point Mode
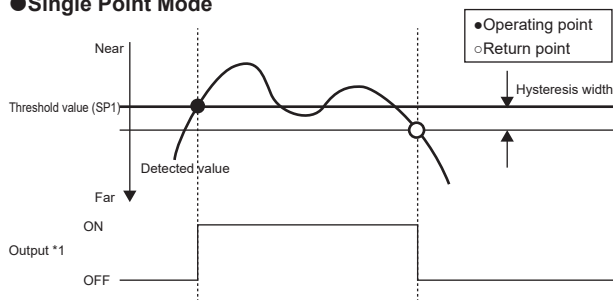
*1. This is a graph when the output logic is N.O. It is inverted in the case of N.C.

●Window BGS mode
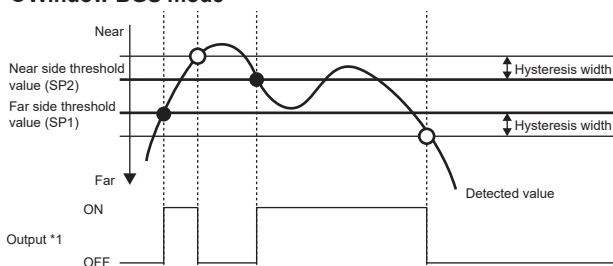
*1. This is a graph when the output logic is N.O. It is inverted in the case of N.C.

●Window FGS mode

*1. This is a graph when the output logic is N.O. It is inverted in the case of N.C.

6-14	Process data Settings

This switches the content output from the process data PD2 during IO-Link communication.

Process data Settings	Description
Scale	This is fixed to -3 (0xFD), which indicates mm as the scale for distance. (Conforms to IO-Link Smart Sensor Profile)
Intensity	The strength of the light receiving signal of the sensor is output as a value from 0 to 255. If a certain strength is exceeded, the received light intensity does not change from 255.

Note 1. For the process data format, refer to INDEXLIST.

6-15	Language

The display language can be switched in the initial screen and the Advanced Settings.
English, Japanese, Spanish, Italian, and German are supported.

English	Japanese	Spanish	Italian	German
Response 200ms	応答時間 200ms	Respuesta 200ms	Risposta 200ms	Antwort 200ms

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7	Troubleshooting

■Error Display

Error name / display	Indicator		Error details	Possible causes
	Orange	Green		
Laser failure error ⚠ Laser Error	| Orange and green indicators show quick flashing alternately (at 0.3s intervals)		The laser diode might have been deteriorated.	Restart the sensor (turn the power off and on again). If the error remains, replace the sensor.
System error ⚠ Sys-** Error			An error occurred in the system.	
Data (EEPROM) error ⚠ Data Error	◯ OFF	Quick flashing (at 0.3s intervals)	An error occurred on the memory inside the sensor.	Initialize the settings by pressing and holding the [UP] button for 3s and restarting the power. The sensor is out of order if the error is still not fixed. Replace the sensor.
Load short-circuit error ⚠ Short Error	Quick flashing (at 0.3s intervals)	◯ OFF	The output line is short-circuited.	Check the wiring and connecting.

■State Display

State name / display	Possible causes	Action and correction
Insufficient intensity Far state 1 2 1000 - - - -	• The intensity of light received from the object is insufficient or the object is farther than the detection distance range. • The laser diode may have deteriorated.	• Delay the response time or decrease the distance between the sensor unit and object to enable detection by the sensor. • If an error occurs even after restarting the sensor, replace the sensor.
Near state 1 2 1000 NEAR	The object is nearer than the detection distance range of the sensor.	Increase the distance between the sensor unit and object to enable detection by the sensor.
Warming up Warming Up...	The sensor is not ready for operation. The sensor internal temperature is low.	Allow the sensor to warm up for 10 min maximum while the power is turned on. Operation will start once the sensor is warmed up to the specified temperature by its internal heater.
[Back-to-box] command input state Waiting for Power Cycle	This is displayed when the back-to-box command is transmitted via IO-Link communication. IO-Link communication is not possible in this state.	To use again, reconnect the power supply to enable IO-Link communication.
Key lock 1 2 1000 🔒LOCKED	The key lock function enabled.	If a button operation is required, release the key lock. "5-1 Key Lock" (📖 page 7)
Laser emission OFF 1 2 1000 Laser OFF	Pin2 terminal (white) might have been short-circuited	Check the wiring and external input setting.

■Output for each state/error

State/error name	Output1*1		Output2		
	N.O.	N.C.	Invert	Current	Error
Laser failure error / System error	OFF	OFF	OFF	2.0mA	ON
Data (EEPROM) error	OFF	OFF	OFF	0mA	OFF
Load short-circuit error	OFF	OFF	OFF	2.0mA *2	ON
Insufficient light intensity / Far state*3*6	OFF	ON	Invert	20.5mA *4	OFF
Near state*3*6	ON	OFF	Invert	3.8mA*5	OFF
Warming up	OFF	OFF	OFF	2.0mA	ON

*1. When Single, Window BGS, or Window FGS mode
*2. When output 1 is short-circuited
*3. When the keep function is "On," the last value is retained.
*4. This is 20.5 mA when current scaling is Low < High, and 3.8 mA when it is Low > High.
*5. This is 3.8 mA when current scaling is Low < High, and 20.5 mA when it is Low > High.
*6. In Window BGS and Window FGS, outputs are different. "3-6 Output Mode" (📖 page 5)

8	Ratings and Specifications

Sensing method		Time-of-Flight (TOF) system	
Model	NPN output	E3AS-HF6000DMN☐ series	E3AS-HF6000SMN☐ series
	PNP output	E3AS-HF6000DMT☐ series	E3AS-HF6000SMT☐ series
Sensing distance		50 to 6,000 mm	
Beam size		Variable (Parallel / Diffusion, used with 40 dia. or less) *1	Variable (Parallel / Spot) *1
Light source (wavelength)		Red laser (660 nm)	
Power supply voltage		10 to 30 VDC, (including ripple (p-p) 10%), Class2	
Consumption current		65 mA max. (when power voltage is 24 V) *2, 155mA max. (when power voltage is 10 V) *2	
		Note. 125 max. at environment below the freezing point (when power voltage is 24 V) *2	
Control output		Load power supply voltage 10 to 30 VDC (Class2), Load current 100mA max. each output (total of 2 outputs is 200mA max.)	
		Residual voltage (Load current 10 mA max.: 1 VDC max., Load current 10 to 100 mA: 2 VDC max.)	
		Open collector output type (Depends on the NPN/PNP output type) N.O./ N.C. selectable	
Current output		4 to 20 mA, maximum load resistance 500 Ω	
External input		Laser OFF / Teaching / Zero reset selectable	
		For the applied voltage, refer to "2-1 Input/Output Circuit Diagram" (📖 page 2). For the input time, refer to "3-4 External Input" (📖 page 4).	
Protection circuits		Reversed power polarity protection, Output short-circuit protection	
		and Output reverse polarity protection	
Indicator		OLED Display(White), Power/Communication indicator (Green), Operation indicator (Orange),	
		and Bottom indicator (Green, Orange)	
Response time		2 ms / 10 ms / 50 ms / 200 ms selectable	
Mutual interference prevention		Auto setting (Manual setting is also possible: up to 4 units)	
Ambient illumination		Incandescent lamp / Sunlight: 100,000 lx max.	
Ambient temperature		Operating: -30 to 55°C (with no icing or condensation) *3,	
		Storage: -30 to 70°C (with no icing or condensation)	
Ambient humidity		Operating: 35 to 85%, Storage: 35 to 95% (with no condensation)	
Insulation resistance		20 MΩ min. at 500 VDC	
Dielectric strength		1,000 VAC at 50 / 60 Hz for 1 min	
Vibration resistance		10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions	
Shock resistance		500 m/s^2 for 3 times each in X, Y, and Z directions	
Enclosure ratings		IP67 (IEC60529), IP69K (ISO20653), IP67G (JIS C 0920 Annex 1 *4)	
Dimensions		58.6×51.2×26.5 mm (W×H×D)	
Material	Case	Aluminum die cast (Chrome plating)	
	Cover	SUS304	
	Indicator	Polyethersulfone (PES)	
	Lens cover and Display	Methacrylic resin (PMMA), Antifouling coating (Lens cover)	
Communication specifications	IO-Link specification	Ver.1.1	
	Baud rate	COM3: 230.4 kbps	
	Data length	PD size: 4 byte, OD size: 2 byte (M-sequence type : TYPE_2_V)	
	Minimum cycle time	COM3: 1.2 ms	
	Device Profile	Smart Sensor Profile (SSP4.1.1), Identification and Diagnosis (I&D)	
Conformity standards		UL/CSA Certification, CE Marking, RCM, UKCA, Various laser standards (details are provided on the cover), Ecolab, RoHs2, WEEE2	

Note: 1.Altitude: Up to 2000m, Pollution degree: 3, Enclosure type: Type1.
*1. For the beam size, refer to "Beam variable dial operation" on page 3.   *2. Excluding load current
*3. When the product is used in an environment with a temperature of -10°C or less, a warm-up time (10 min maximum) is required.
*4. JIS C 0920 Annex 1 describes the IP67G rating oil and the oil resistance of the product has been assessed by the document.
    Please visit the website of the Japanese Industrial Standards for more informarion.
    (https://www.jisc.go.jp/index.html)

■Model standard

E3AS-HF6000☐ ☐ M☐☐☐ ☐ ☐
①　②　③④⑤⑥⑦　⑧　⑨

Mark		Specification	
①	F	Sensing method	TOF distance measurement
②	6000	Sensing distance	6,000 mm
③	D	Emission beam shape	Diffusion
	S		Spot
④	Blank	Light source	Red
⑤	M	Case material	Metal
⑥	N	Output method	NPN open collector
	T		PNP open collector/COM3
⑦	Blank	Connection method	Pre-wired
	- M1TJ		Pre-wired M12 Smartclick Connector
	M1H		M12 horizontal connector
	M1V		M12 vertical connector
⑧	alphanumerical character	Optional suffix	Special specification
⑨	Blank	Code length	M12 Connector
	2M		2 m+150/-0 mm(Pre-wired)
	5M		5 m+150/-0 mm(Pre-wired)
	0.3M		0.3 m+60/-0 mm(Pre-wired Connector)