



Good Thinking, Good Future

*FASTUS is a product brand of OPTEX FA.

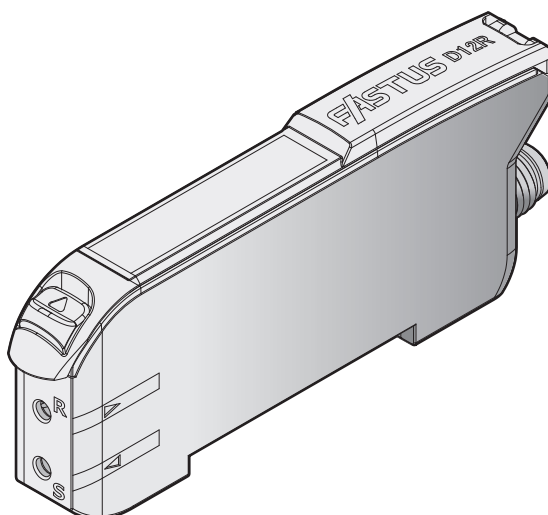
Fiber Optic Sensor D12R Series

User's Manual

Before using this product, read this manual carefully.

Keep this manual at hand so that it can be used whenever necessary.

Store the manual in a secure location.



OPTEX FA CO., LTD.

Introduction



Thank you for purchasing this Fiber Optic Sensor D12R Series.

This manual contains the information necessary for operating and configuring the D12R Series.

Read this manual thoroughly before using the product to ensure correct use with full understanding of its functions and performance. After you have finished reading this manual, store it safely for future reference.



Safety Precautions

Safety precautions for ensuring safe operation of this product are displayed as follows with the following symbols.











Precautions listed here describe important information about safety. Make sure to follow them accordingly.

■ Safety Symbols



The safety precaution symbols used and their meanings are listed below.

 Warning	Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage.
 Caution	Indicates that any improper operation or handling may result in minor injury or property damage.











■ Precautions

 Warning	
	This product cannot be used in applications that directly or indirectly detect human bodies for the purpose of ensuring safety. Do not use this product as a detection device for protecting the human body.
	This product does not have a function that stops the emission of light from the laser during disassembly. Do not disassemble the product.
 	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in an explosion or fire.
 	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in a fire.
	Do not install this product in any of the following locations. Doing so may cause a fire, damage, or a malfunction. <ol style="list-style-type: none"> 1. Locations where dust, salt, iron powders, or vapor (steam) is present. 2. Locations subjected to corrosive gases or flammable gases. 3. Locations where water, oil, or chemical splashes may occur. 4. Locations where heavy vibrations or impacts may occur. 5. Locations where the ambient temperature exceeds the rated range. 6. Locations subject to rapid temperature changes (or where condensation occurs). 7. Locations with strong electric or magnetic fields. 8. Outdoor locations or locations subject to direct sun light.
	Do not use this product in a non-industrial environment. Doing so may cause induction or radiation interference.
	This product is not intended for use with nuclear power, railways, aviation, vehicles, medical equipment, food-handling equipment, or any application where particular safety measures are required. Absolutely do not use this product for any of these fields.

⚠ Warning

	<p>In the event of a malfunction such as smoke comes out from the product.</p> <p>If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the housing becoming very hot, immediately stop operating the product and turn off the power to the controller.</p> <p>Doing so may cause a fire. Repairing the product is dangerous and should in no way be performed by the customer. Contact the OPTEX FA sales office.</p>
	<p>In case water enters the product</p> <p>If water or any other liquid enters the product or the cable, immediately stop operating the product and turn off the power to the controller. Using the product in this condition may cause a fire.</p>

⚠ Caution

	<p>Follow the instructions in this manual or the specified instruction manual when wiring the product or the dedicated controller for the correct wiring method. Incorrect wiring can damage the product or the controller or cause a malfunction.</p>
	<p>Do not bend the cable when below the freezing point.</p> <p>Doing so may cause the cable to break.</p>
	<p>Do not excessively twist or apply stress to the cable.</p> <p>Doing so may damage the cable or the connector.</p>
	<p>When connecting the cable, make sure to hold it by the connector portion, and do not apply excessive force to the cable.</p>
	<p>When disconnecting the connector, be careful not to touch the terminals inside the connector, and do not allow foreign objects to enter the connector.</p>
	<p>Route wiring separately from high-voltage circuits and power circuits.</p> <p>If the wires are routed together, induction may occur, which can cause a malfunction or damage the product.</p> <p>If this is unavoidable, use a conductive object such as a properly grounded conduit as a shield.</p>
	<p>Install this product as far away from high-voltage equipment, power equipment, equipment that generates large switching surges, welders, inverter motors, or any equipment that can be a source of noise.</p>
	<p>Use this product within the rated ranges.</p>
	<p>Install this product and the dedicated controller securely.</p> <p>Failure to ensure secure installation can result in the products falling and becoming damaged.</p>
	<p>Make sure to turn the power off before wiring the cable or connecting/disconnecting the connector. Performing work while the product is energized may damage it or cause electric shock.</p>

■ NOTICE

- After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
- All specifications may be changed without notice.
- When using this product, it is the responsibility of the customer to ensure necessary safety designs in hardware, software, and systems in order to prevent any threat to life, physical health, and property due to product malfunction or failure.
- Do not use this product for the development of weapons of mass destruction, for military use, or for any other military application. Moreover, if this product is to be exported, comply with all applicable export laws and regulations, including the “Foreign Exchange and Foreign Trade Act” and the “Export Administration Regulations,” and carry out the necessary procedures pursuant to the provisions therein.
- If installing this product in your own equipment, ensure that the product is properly handled according to the laws and regulations of the relevant country or region.
- Before using this product, fully examine the applicable environmental laws and regulations, and operate the product in conformity to such laws and regulations.
OPTEX FA does not assume any responsibility for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
- Detection characteristics values and digits value may vary depending on the state of the target object and variations among individual products.

Expressions Used in This Manual

.....

This section explains the expressions used in this manual.

CAUTION

Indicates an item that requires special attention during use.

●●● MEMO ●●●

Indicates information that is useful to know during use.

Manual Composition

This manual is composed of the following contents.

1. Read This First	This section explains the package contents of the D12R (hereinafter referred to as this product) and the names of its parts.
2. Installation and Connection	This section explains how to install and wire this product.
3. Basic Usage	This section explains the necessary functions when using this product. <ul style="list-style-type: none">• Display screens and operating procedures• Parameters that must be set first• Useful and frequently used functions
4. Settings Menu	This section explains the setting parameters of this product in menu order.
5. Troubleshooting	This section explains how to respond to error displays and trouble.
6. Appendix	This section explains the specifications of this product and other information.

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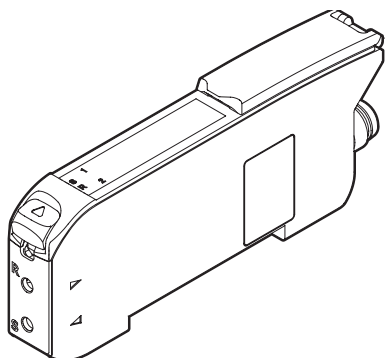
Read This First

This section explains the accessories and the names of this product's parts.

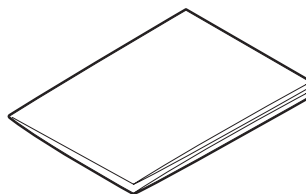
1-1 Package Contents

Before using this product, confirm that all of the following are contained in the package.

If you find a defective or damaged item, contact OPTEX FA (with the information at the back of this user's manual).

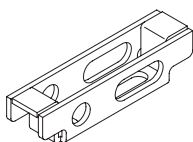


Fiber Optic sensor



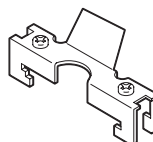
Instruction manual

1-1-1 Options



Mounting bracket

- BEF-001



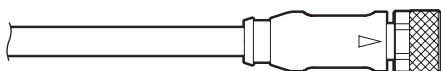
End plate

- BEF-002 (2-piece set)

Control panel cover

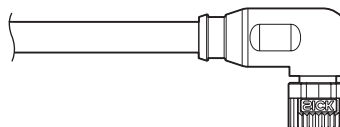
- BF-D12R (Please order when the control panel cover is lost or damaged.)

Connector cable (required for connector models)



- M84CN-2S: 2 m
- M84CN-5S: 5 m
- M84CN-10S: 10 m

Minimum bending radius (when fixed in place): 24 mm

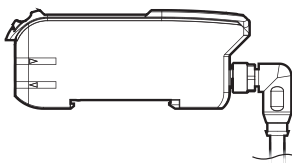


- M84CN-2L: 2 m
- M84CN-5L: 5 m
- M84CN-10L: 10 m

Minimum bending radius (when fixed in place): 24 mm

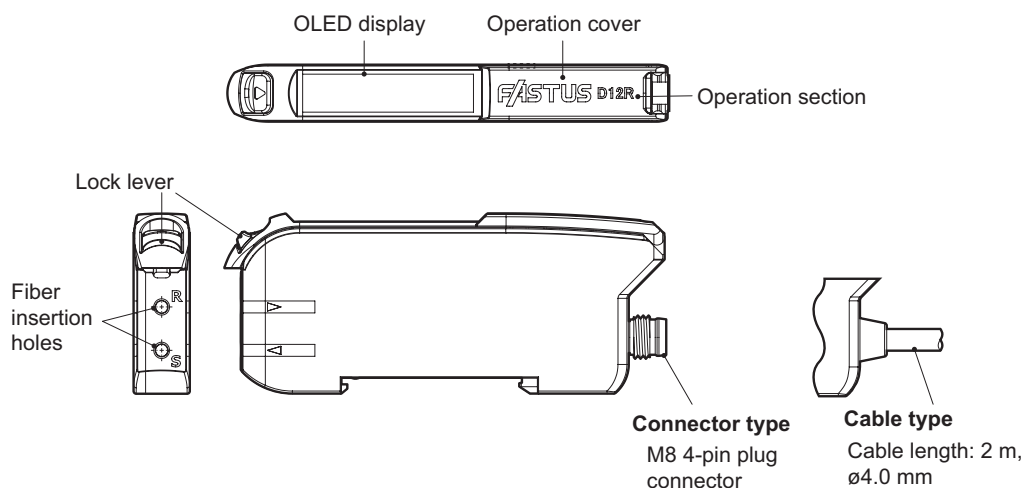
MEMO

The connector direction is set as in the diagram below when using the L-shaped connector cable.
Be aware that rotation is not possible.

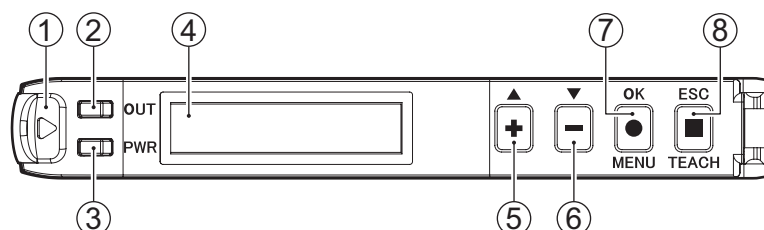


1-2 Part Names

1-2-1 Fiber Amplifier



1-2-2 Display and Operation Section



No.	Name	Description
①	Lock lever	Locks and releases the fiber cable.
②	Output indicator (orange)	Illuminates in orange when output is ON.
③	Power indicator (green)	Illuminates in green when the power is turned on.
④	OLED display	Display the present receiving light level and threshold, and the parameters during set menu.
⑤ ⑥	Selection keys (+/- keys)	Manually adjusts the threshold. In the settings menu select the item, and during item input, increase/decrease the value.
⑦	OK/MENU key	Selects a setting menu and sets the parameters.
⑧	ESC/TEACH key	Performs teach and exits menus during setting.



2

Installation and Connection

This section explains how to install and wire this product.

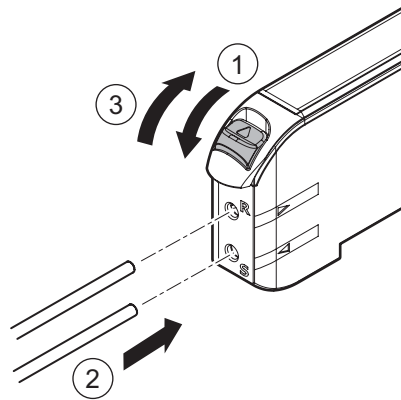
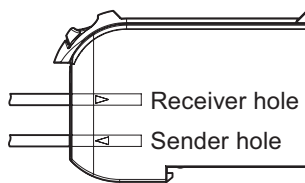
2-1 Installation

2-1-1 Mounting the Fiber Unit

- ① Slide the lock lever down.
- ② Insert the fiber wires in the holes to the end.

CAUTION

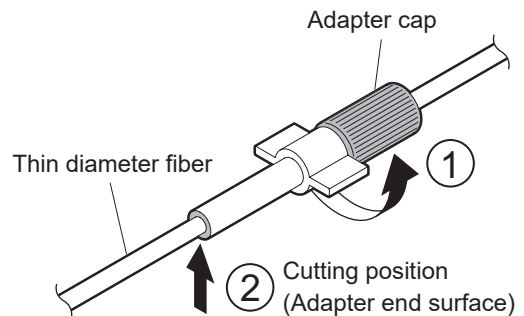
When using a coaxial reflective fiber unit, insert a single-core fiber or fiber sheath with a white line on the emitter hole, and multicore fiber on the receiver hole.



- ③ Raise the lock lever to the stop position.

■ How to Use the Fiber Adapter (Included with the Thin Fiber Units)

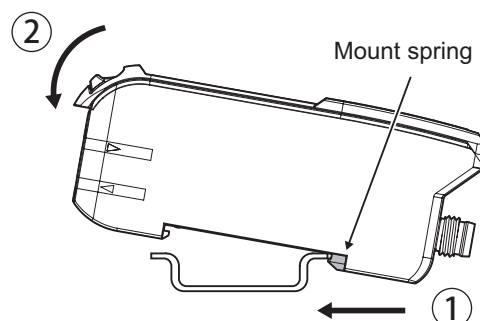
- ① Turn the adapter cap fully counterclockwise to unlock, and then align the ends of the adapter pipe and fiber. Turn the cap fully clockwise to lock the adapter.
- ② Cut the fiber to the desired length, using the fiber cutter included with the free-cut fiber unit.



2-1-2 Attaching to/Removing from a DIN-rail

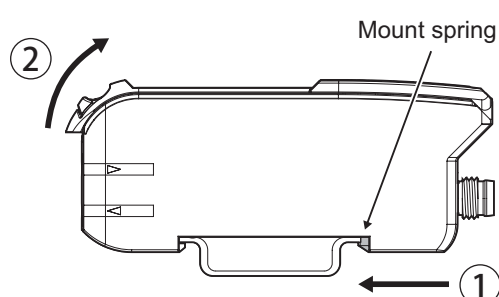
■ Installing the Amplifier

- ① Place the groove on the side of the fiber unit holes on the DIN-rail.
- ② Press down until the hook locks.



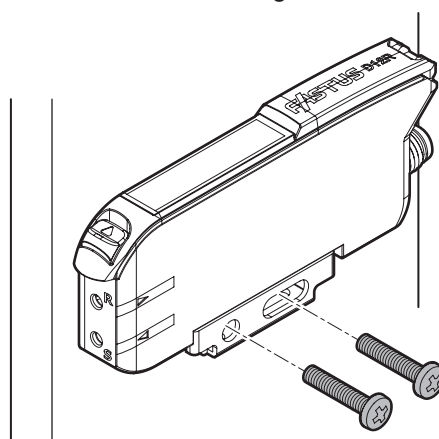
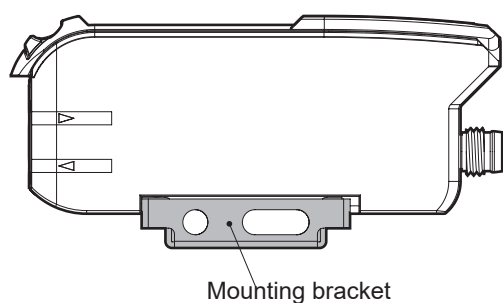
■ Removing the Amplifier

- ① Push the amplifier toward the side of the fiber unit holes.
- ② Lift up the side of the fiber unit holes and remove it.



2-1-3 Mounting on a Wall

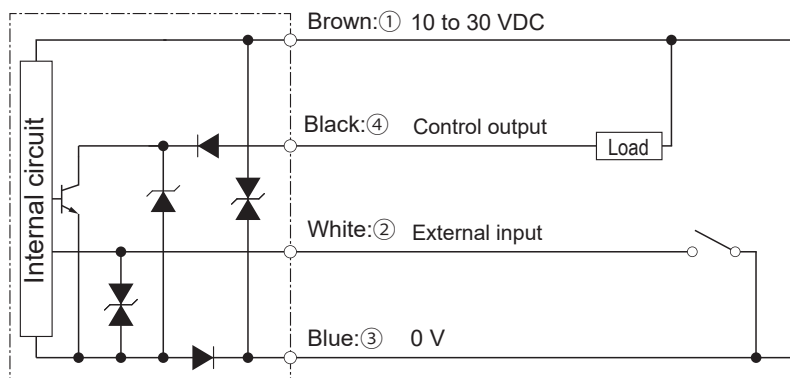
Attach the mounting bracket to the amplifier, using the same method as for mounting on a DIN rail, and then fix the mounting bracket on the wall using two M4 screws, as shown on the drawings below.



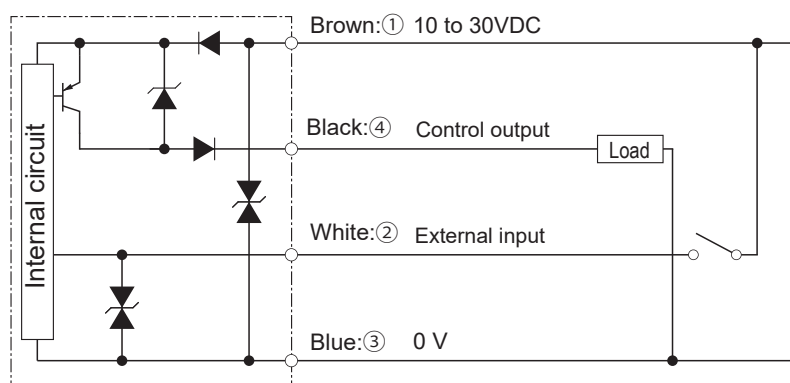
2-1-4 I/O Circuit Diagrams

The circuit diagram for each I/O type is shown below.

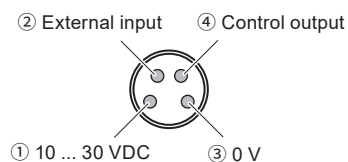
● NPN setting (D12R-TN, D12R-TNC4)



● PNP or Push-pull setting (D12R-TP, D12R-TPC4)



● M8 connector pin





3

Basic Usage

This section explains the types of display screens and transitions.

3-1 Display Screens

This section explains the types of display screens and transitions.

3-1-1 Screen Types

There are three types of screens: RUN, Teach, and Settings.

- RUN screen



- Teach screen



- Setting screen





RUN Screen

Displays the threshold and the present received light amount.




Teach Screen


Press  to display this screen.

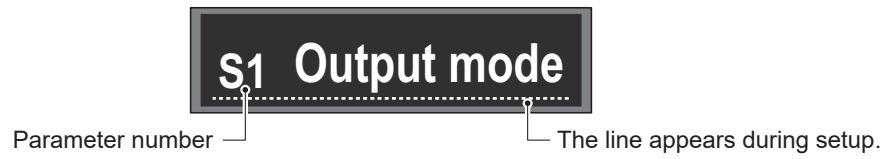
For details on the teach function settings, refer to  “3-4 Setting the Threshold (Teach Function)” (page 3-8).



■ Setting Screen

Press  to display this screen.

For details on setting operations, refer to  “3-1-2 Operations on the Setting Screen” (page 3-4).

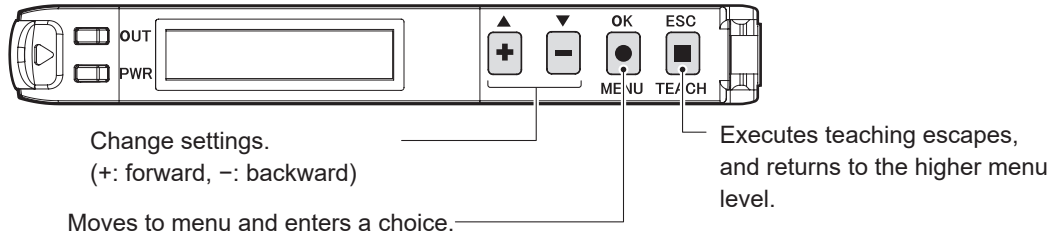


3-1-2 Operations on the Setting Screen

This section explains operations on the setting screen.

■ Operation Keys

The following keys are used when configuring settings.

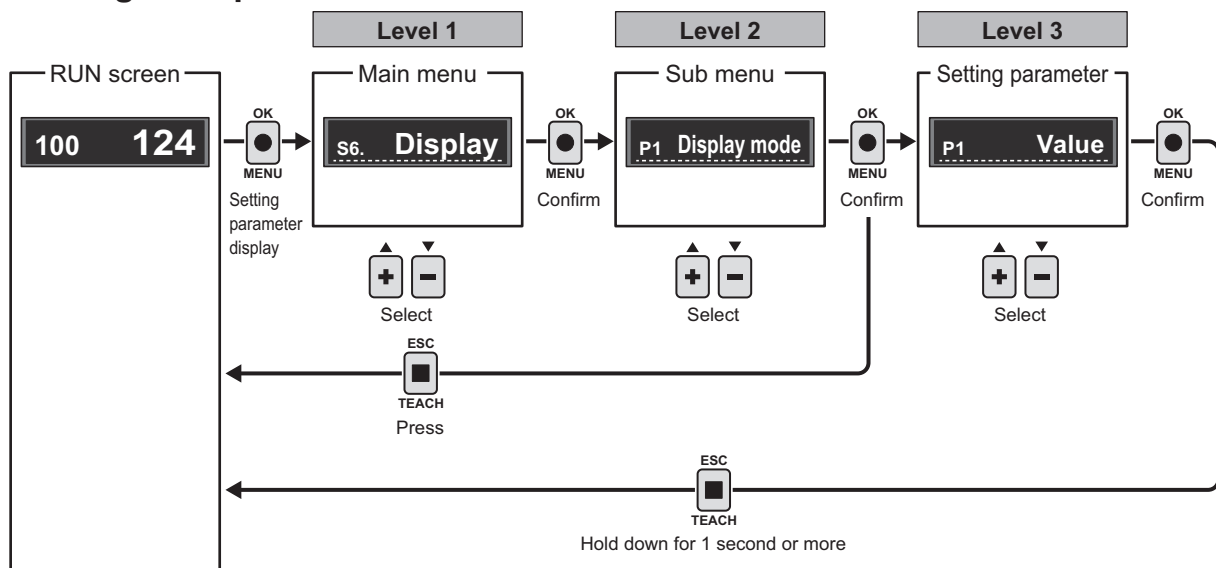


■ Setting Operations

The settings menu is separated into two levels of the main menu and sub menu and is configured on the third level.

A unique number is assigned to each setting.

● Setting examples



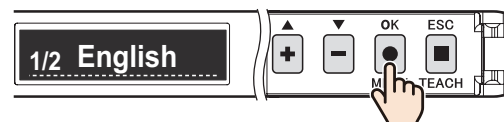
3-2 Setup on First Startup

The first time you turn the product on or reset it, the following initial settings menu appears. Configure the settings in the order they appear.



1 Select the language.

Press to select the language, and then press .



<Options>

English, 日本語, 简体中文

2 Select the display mode of the received light amount.

Press to select the display mode, and then press .

(To return to the previous menu, press .)



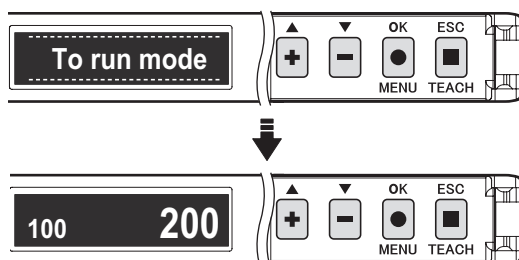
<Options>

Std. display, Hold display

The hold display is a function that maintains and displays the peak and bottom values of the detected received light amount. → Refer to "4-5-2 [S4] - [P2] Hold display" (page 4-9).

3 This completes the initial settings.

The RUN screen will automatically appear.

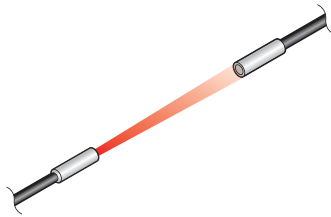


3-3 Detection Method

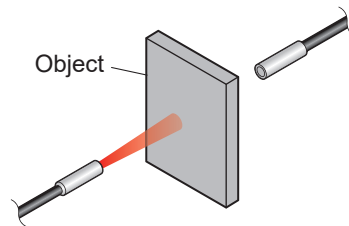
The main detection methods available are through-beam and diffuse reflective, which detect the object as shown below.

■ Through-beam

Two fiber units are installed so that one emits and one receives light, and the object passes between the units. Light is received when no object is present and is not received when an object blocks the light axis. Detection is performed according to the received light amount.



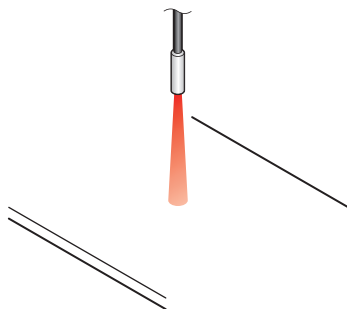
Light is received when no object is present.



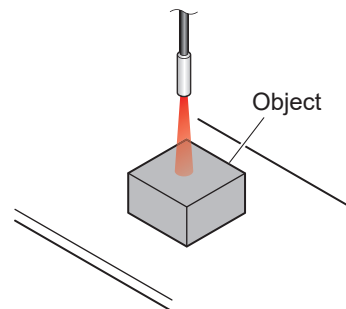
The light axis is blocked and light is not received when an object is present.

■ Diffuse Reflective

Diffuse reflective fiber units contain both a light emitter and receiver. They perform detection by receiving reflected light from an object.



Light is not received (or the received light amount is low) when no object is present.



The received light amount is high and light is determined to be received when an object is present.

*If the object is a dark color and the background is a bright color, light being received/not received may occur in the opposite manner as described here.

Detection Method Features

The features of the different detection methods are shown below.

◎: Excellent ○: Normal △: Poor

Type	General description	Features		
		Detection stability	Long range detection	Installation workload
Through-beam	<p>With this type, detection is performed by installing two fiber units so that one emits and one receives light.</p> <p>◎Not affected by the color, tilt, or uneven surfaces of the object</p> <p>◎Capable of long-distance detection</p> <p>△Necessary to install fiber units in two locations to emit and receive light</p>	◎	◎	△
Diffuse reflective	<p>With this type, there is no need to install items such as a fiber unit or a reflector behind the object.</p> <p>◎Only requires installation in one location, reducing the workload</p> <p>○Small object detection possible with fiber unit types on which optional lenses can be installed on the tips</p> <p>△Easily affected by the color, tilt, or uneven surfaces of the object</p>	△	△	◎
Limited diffuse reflective	<p>This type is the same as the diffuse reflective type, in that there is no need to install items such as a fiber unit or a reflector behind the object.</p> <p>◎Effect of the background is minimal because detection can be performed with a limit on the distance</p> <p>○More resistant to the effects of object color and tilt than the diffuse reflective type</p> <p>△Shortest sensing distance</p>	○	△	◎
Retro-reflective	<p>With this type, detection is performed by installing a fiber unit and a reflector so that the light reflects off of the reflector.</p> <p>◎Not affected by the color, tilt, or uneven surfaces of the object</p> <p>○Suited to detection of transparent objects</p> <p>△Large installation space required for reflector</p>	◎	○	△

3-4 Setting the Threshold (Teach Function)

Use control output to set criteria used to judge whether an object is present.

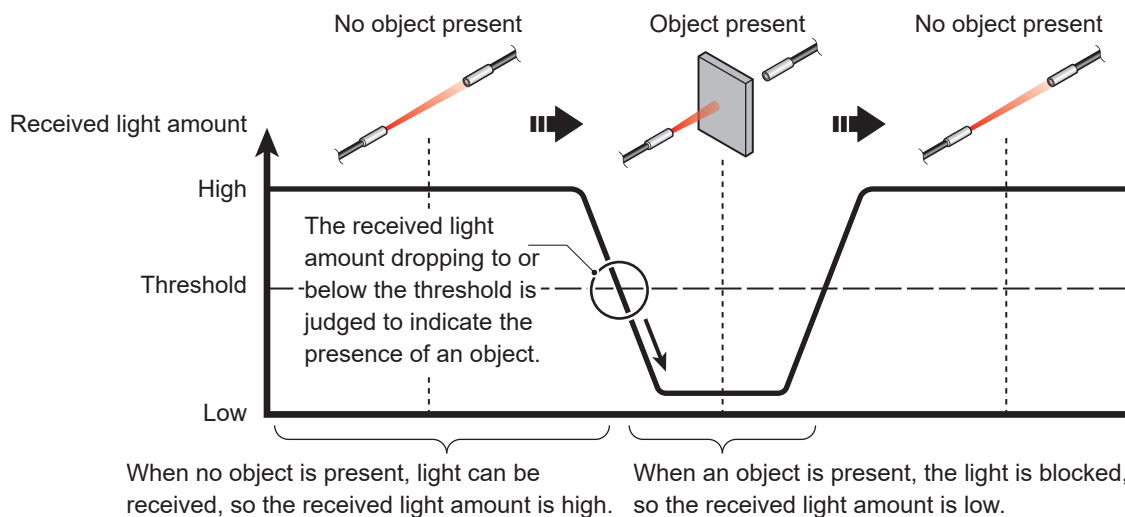
3-4-1 Threshold

Set according to the received light amount, the threshold is the standard value used to judge whether an object is present.

The method for easy setting of this threshold with key operations and an external input on the fiber amplifier is referred to as the teach function.

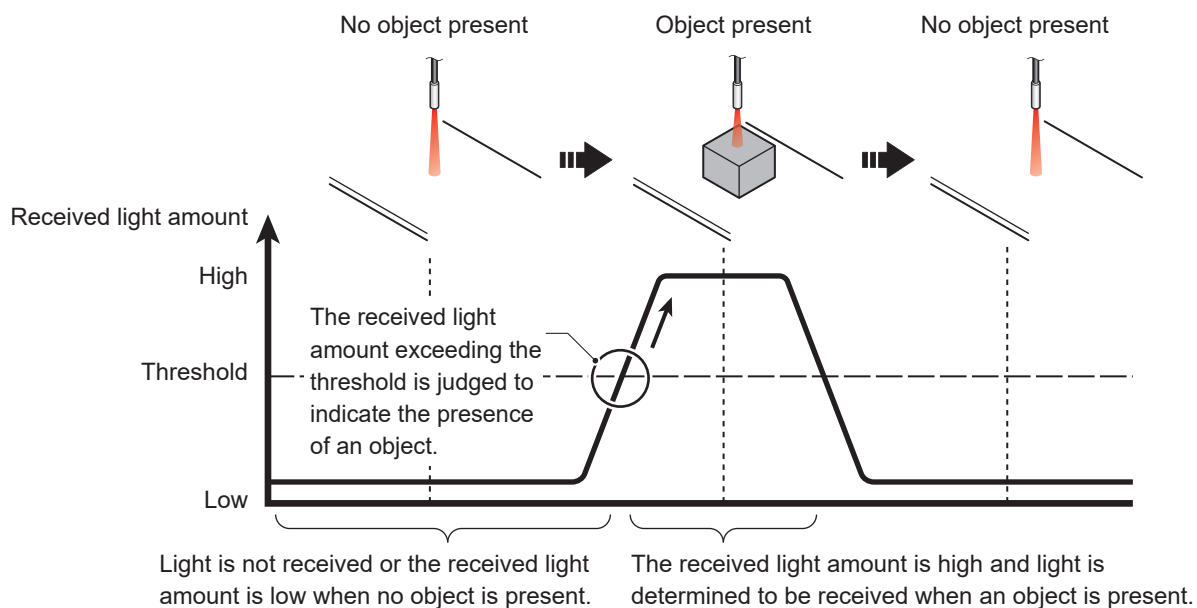
Example) Received light amount and threshold with a through-beam fiber unit

When the object blocks the light beam, the received light amount decreases. This level dropping below the threshold is judged to indicate the presence of an object.



Example) Received light amount and threshold of a diffuse reflective fiber unit

When the light hits an object, light is reflected, increasing the received light amount. This level exceeding the threshold is judged to indicate the presence of an object.



*If the background is a bright color and the object is a dark color, the increasing and decreasing of the received light amount may occur in the opposite manner as described here.

3-4-2 Teach Mode

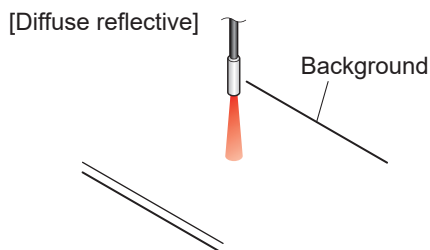
The teach function, which requires the control output threshold to be set, has the following modes (types). Select the optimal mode for the fiber unit and the type of object to detect.

○: Effective ×: Not effective

Teach mode		Selection criteria	Detection method		Sample object to teach	Description
			Through-beam/retro-reflective	Diffuse reflective		
Standard	1 point	<ul style="list-style-type: none"> When a sample object is not available. When it is difficult to execute the teach function with the actual object present and not present. 	×	○	Not required	Page 3-11
	2 points	<ul style="list-style-type: none"> When it is possible to execute the teach function with the actual object present and not present. 	○	○	Required	Page 3-14
	Auto	<ul style="list-style-type: none"> When the threshold must be set according to moving objects on a line that cannot be stopped. When it is difficult to execute the teach function with the actual object present and not present. (Such as with small objects and objects that move at high speeds) When the threshold must be set considering the effect of the worksite environment. 	○	○	Required	Page 3-17
	Through	<ul style="list-style-type: none"> When a sample object is not available. When detecting a plastic sheet, film, and other transparent/semi-transparent objects. When detecting small objects. 	○	×	Not required	Page 3-20
Expansion	1-point Zone	<ul style="list-style-type: none"> When the threshold must be set to a specific range. When detecting objects of certain sizes with a screen/array fiber unit. The threshold can be set as a percentage of the received light amount set by teaching. 	○	○	Required	Page 3-23
	2-point Zone	<ul style="list-style-type: none"> When the threshold must be set to a specific range, the same as for the 1-point Zone mode. When detecting objects of certain sizes with a screen/array fiber unit. The upper and lower limits of the threshold can be set by the teach function with objects at upper and lower limits. 	○	○	Required	Page 3-25

3-4-3 1 point


The teach function is executed with no object present. The threshold is set to a value that does not detect the background. The threshold can be set easily with a single teach operation.






Setup for 1-point teach

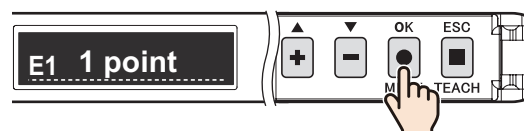
Through-beam/ retro-reflective	Diffuse reflective	Object
×	✓	Not required



Operation Procedure

*To cancel the setting of the teach function, press the  key.

- 1 Press  for less than 1 second.
The teach mode selection screen appears.

- 2 Use   to display "1 point", and then press .

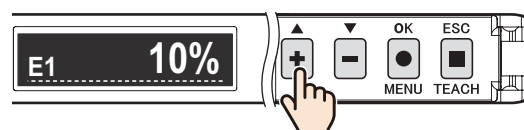



- 3 Use   to adjust the detection margin to set the thresholds.

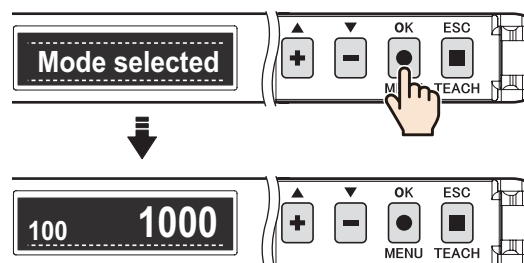
As a percentage (0 to 99%), set how high the received light amount must increase from the background level (when no object is present) to judge the presence of the object.

A small value will lead to detection when the received light amount increases even slightly. A larger value reduces the influence of vibrations, fluctuations, etc.

*With the default value (10%) the threshold is set to a value of +10% compared to the background received light amount (when no object is present).

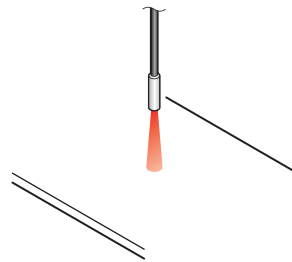


- 4 Press  to set the teach mode and the detection margin.
The OLED display returns to the RUN screen and the received light amount appears.



Continued on next page


- 5** With no object present, hold down  for 1 second or more.

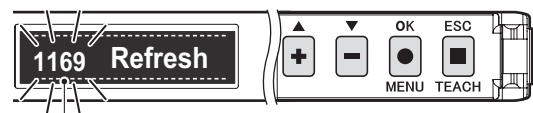


Execute the teach function with the background.

6 The threshold is set and its display blinks.

This completes the execution of the teach function. The OLED display automatically returns to the RUN screen.

*If the received light amount does not meet the conditions required for the teach function, "Teach error" will be displayed. If this error is displayed, refer to  "5-1 Error Displays" (page 5-2) for troubleshooting.




Threshold



RUN screen

MEMO

Operations when executing the teach function again

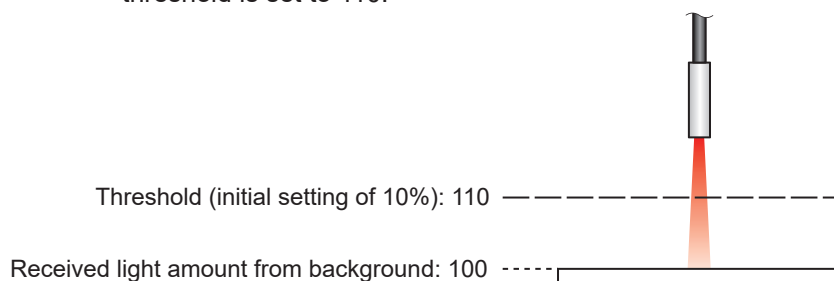
After executing the teach function, to reset the teaching with the same mode again, simply hold down the  key for 1 second or more. (The operations in steps 1 to 4 of the operation procedure are not necessary.) In this situation, the teach function is executed with the previously set mode and detection margin.

■ Mechanism of the Threshold Setting

The threshold is set to the value obtained by adding the specified percentage to the received light amount during execution of the teach function (with no object present).

Example) When the received light amount during execution of the teach function is 100 and the detection margin is 10%

If the received light amount when no object is present (the level for the background) is 100, the threshold is set to 110.



*Due to the addition of a hysteresis value with detection margin, actual threshold differs slightly from this example.

CAUTION

If the background is a bright color and the object is a dark color, detection may not be possible with the 1-point teach function. This occurs when the received light amount from the object is lower than (or equal to) the received light amount from the background.

If objects cannot be detected well with the 1-point teach function, try other modes such as the 2-point teach function.

3-4-4 2 points

In this mode, the teach function is executed at two points: with an object present and without an object present. The threshold is set to the median of the received light amounts for the first and second points, enabling the most stable detection.

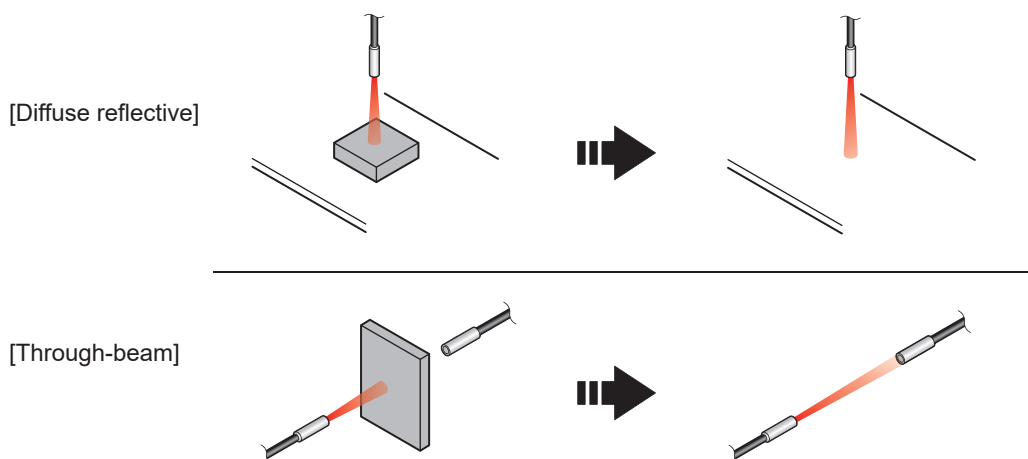
This is the standard teach function that can be used with all detection methods.

Setup for 2-point teach

Through-beam/ retro-reflective	Diffuse reflective	Object
✓	✓	Required


With an object present, execute the teach function for the first point.


Without an object present, execute the teach function for the second point.



*The teach function can also be executed with the object not present for the first point and present for the second point.

■ Operation Procedure

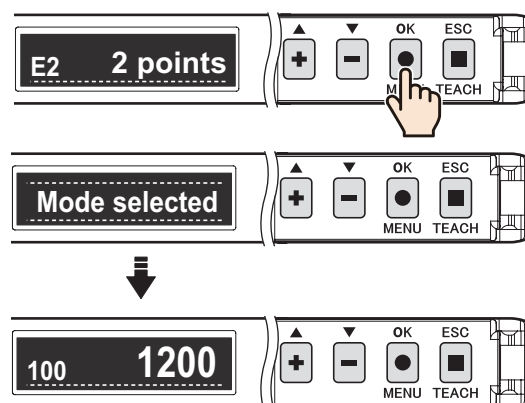
*To cancel the setting of the teach function, press the  key.

- 1 Press  for less than 1 second.
The teach mode selection screen appears.

- 2 Use   to display "2 points", and then press .

The teach mode is set.

The OLED display returns to the RUN screen and the received light amount appears.

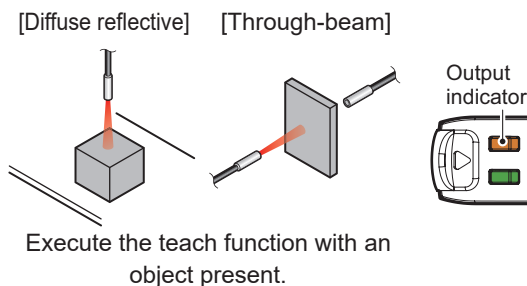


Continued on next page

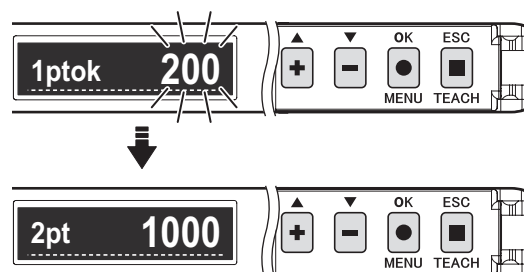
3 With an object present, hold down for 1 second or more.

The output indicator of the channel for which the teach function is being executed blinks in orange.

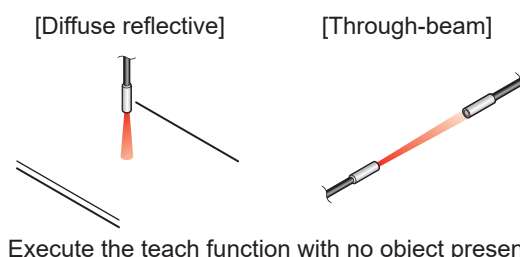
*Steps 3 and 5 can be performed in any order.



4 When the product is taught the received light amount of the first point, the numeric value blinks, then the product is set for the execution of the teach function at the second point.




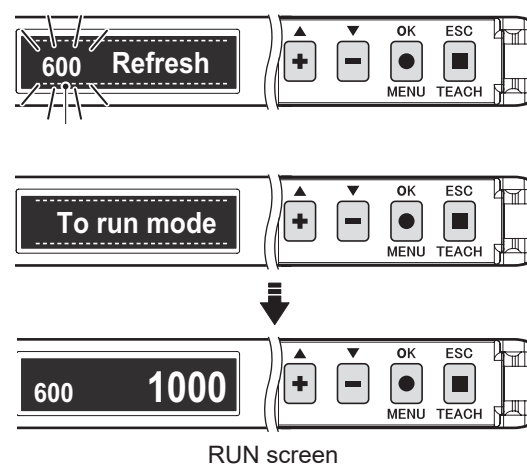
5 With no object present, hold down for 1 second or more.



6 The product is taught the received light amount of the second point, and the threshold blinks.


This completes the execution of the teach function. The OLED display automatically returns to the RUN screen.

*If the received light amount does not meet the conditions required for the teach function, "Teach error" will be displayed. If this error is displayed, refer to  "5-1 Error Displays" (page 5-2) for troubleshooting.



MEMO

Operations when executing the teach function again

After executing the teach function, to reset the teaching with the same mode again, simply hold down the  key for 1 second or more. (The operations in steps 1 and 2 of the operation procedure are not necessary.) In this situation, the teach function is executed with the previously set mode.

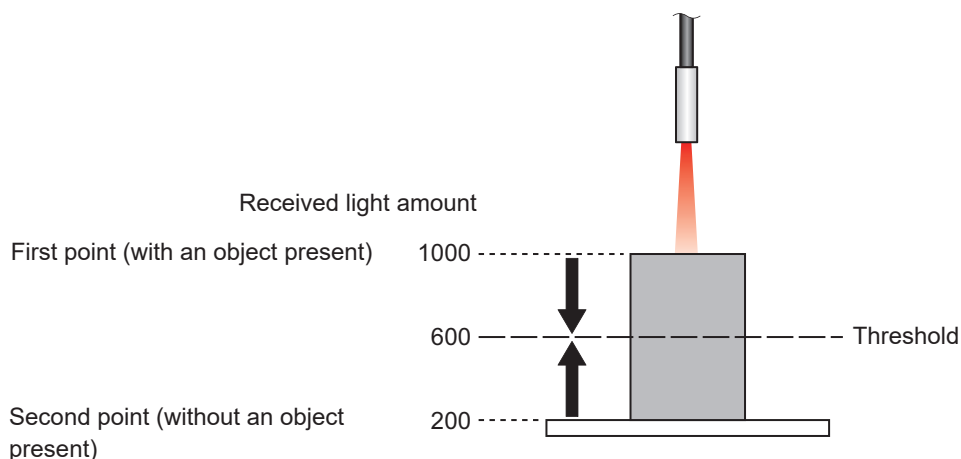
■ Mechanism of the Threshold Setting

The threshold is set to the value in the middle of the received light amounts of the first and second points.

Example) Diffuse reflective fiber unit

Executing the teach function with an object present and without an object present results in the following results, the threshold is set to the median value, 600.

- Received light amount when the teach function is executed for the first point (with an object present): 1000
- Received light amount when the teach function is executed for the second point (with no object present): 200

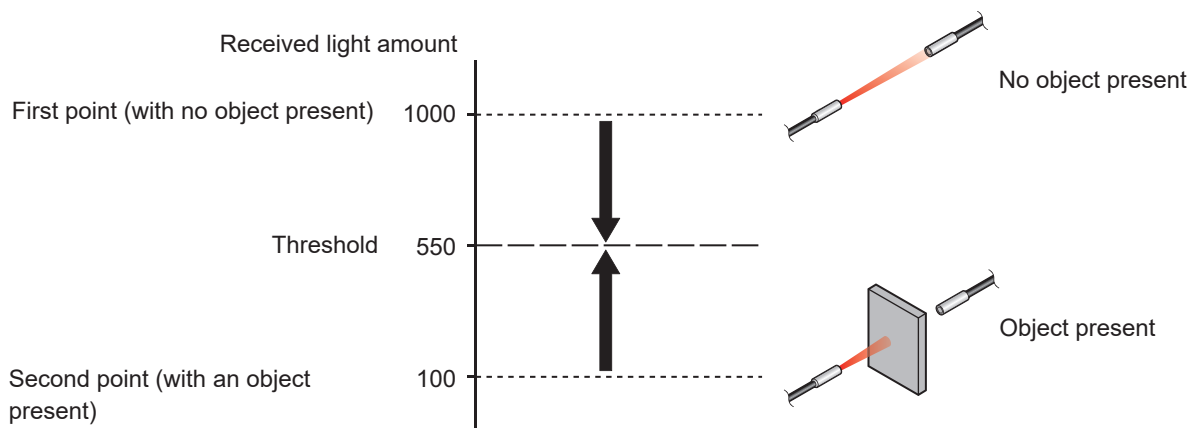


*If the object is a dark color and the background is a bright color, the high/low received light amounts may occur in the opposite manner as described here.

Example) Through-beam fiber unit

Executing the teach function with an object present and without an object present results in the following results, so the threshold is set to the median value, 550.

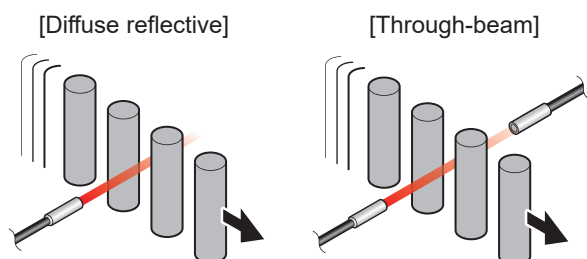
- Received light amount when the teach function is executed for the first point (with no object present): 1000
- Received light amount when the teach function is executed for the second point (with an object present): 100



3-4-5 Auto

The threshold is set by executing the teach function with moving objects.


This threshold can be set with the optimal sensitivity when the objects are small, making it difficult for them to block the light or when it is not possible to stop the production operations.



Setup for Auto teach




Through-beam/ retro-reflective	Diffuse reflective	Object
✓	✓	Required

Operation Procedure

*To cancel the setting of the teach function, press the  key.

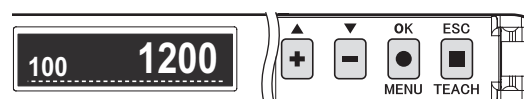
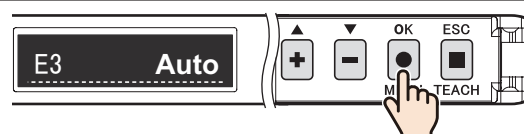
- 1 Press  for less than 1 second.


The teach mode selection screen appears.

- 2 Use   to display "Auto", and then press .

The teach mode is set.

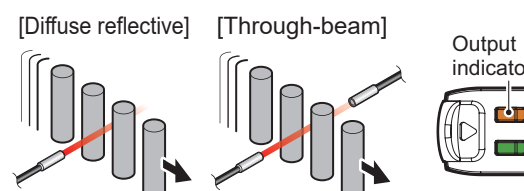
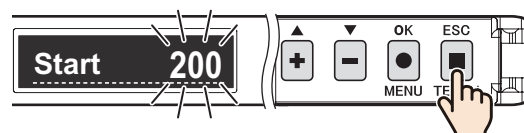
The OLED display returns to the RUN screen and the received light amount appears.




- 3 With objects moving, hold down  for 1 second or more.

The numeric value blinks, and the monitoring of the received light amount starts.

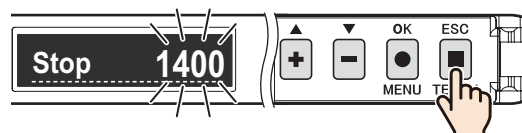
The output indicator of the channel for which the teach function is being executed blinks in orange.



Continued on next page


- 4** After a certain amount of time has passed (less than 30 seconds), hold down  for 1 second or more.

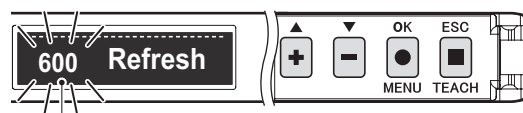
This completes the measurement of the received light amount.



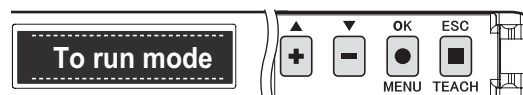
- 5** The confirmed threshold blinks.

This completes the execution of the teach function. The OLED display automatically returns to the RUN screen.

*If the received light amount does not meet the conditions required for the teach function, "Teach error" will be displayed. If this error is displayed, refer to  "5-1 Error Displays" (page 5-2) for troubleshooting.




Threshold



RUN screen

MEMO

Operations when executing the teach function again

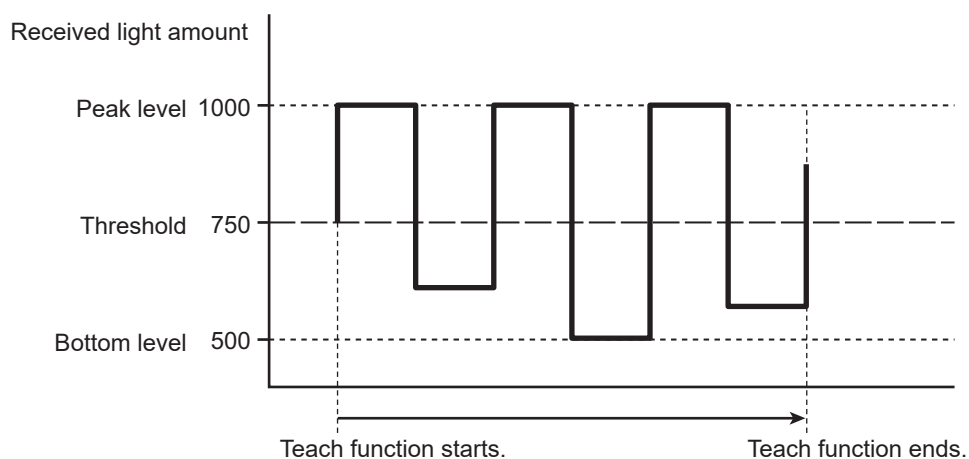
After executing the teach function, to reset the teaching with the same mode again, simply hold down the  key for 1 second or more. (The operations in steps 1 and 2 of the operation procedure are not necessary.) In this situation, the teach function is executed with the previously set mode.

■ Mechanism of the Threshold Setting

The peak and bottom amounts of received light monitored during auto teach are extracted, and the threshold is set to the median value.

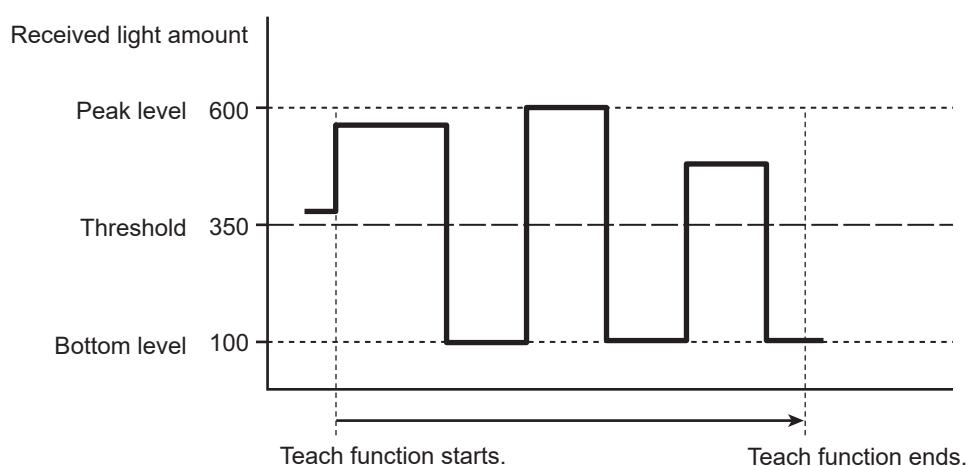
Example) Through-beam fiber unit

If the highest amount of received light is 1000 and the lowest is 500, the threshold is set to the median value, 750.



Example) Diffuse reflective

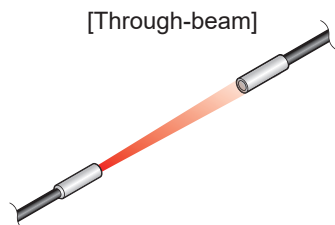
If the highest amount of received light is 600 and the lowest is 100, the threshold is set to the median value, 350.



3-4-6 Through

The threshold is set to the lowest value required for detection on the basis of the received light amount when no object is present.

This teach function is suitable for detection of targets such as small or transparent objects such as glass and film when using a through-beam/retro-reflective fiber unit.





Execute the teach function once with no object present.


Setup for Through teach

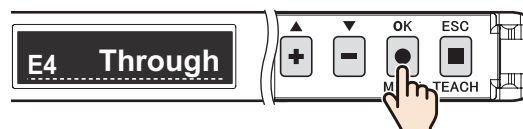
Through-beam/ retro-reflective	Diffuse reflective	Object
✓	×	Not required


■ Operation Procedure

*To cancel the setting of the teach function, press the  key.

- 1 Press  for less than 1 second.
The teach mode selection screen appears.

- 2 Use   to display “Through”, and then press .

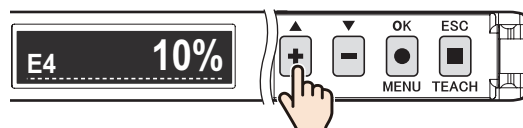


- 3 Use   to adjust the detection margin to set the thresholds.

As a percentage (0 to 99%), the threshold is set at a lower amount than the received light amount without an object present.

A smaller value will lead to detection when the received light amount decreases even slightly. A larger value reduces the influence of vibrations, fluctuations, etc.

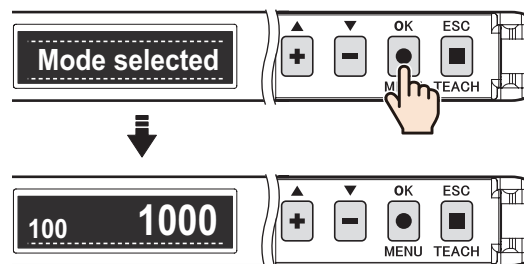
*With the default value (10%) the threshold is set to an amount lower by 10% than the received light amount when no object is present.



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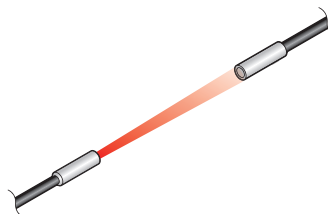
4 Press to set the teach mode and the detection margin.

The OLED display returns to the RUN screen and the received light amount appears.




5 With no object present, hold down for 1 second or more.

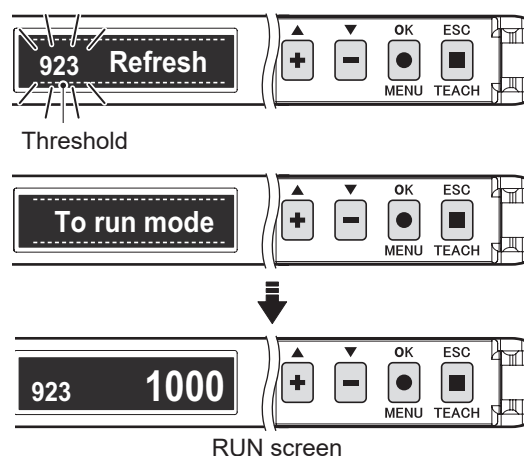
The output indicator of the channel for which the teach function is being executed blinks once in orange.



6 The threshold is set and its display blinks.


This completes the execution of the teach function. The OLED display automatically returns to the RUN screen.

*If the received light amount does not meet the conditions required for the teach function, "Teach error" will be displayed. If this error is displayed, refer to  "5-1 Error Displays" (page 5-2) for troubleshooting.



MEMO

Operations when executing the teach function again

After executing the teach function, to reset the teaching with the same mode again, simply hold down the  key for 1 second or more. (The operations in steps 1 to 4 of the operation procedure are not necessary.) In this situation, the teach function is executed with the previously set mode and detection margin.

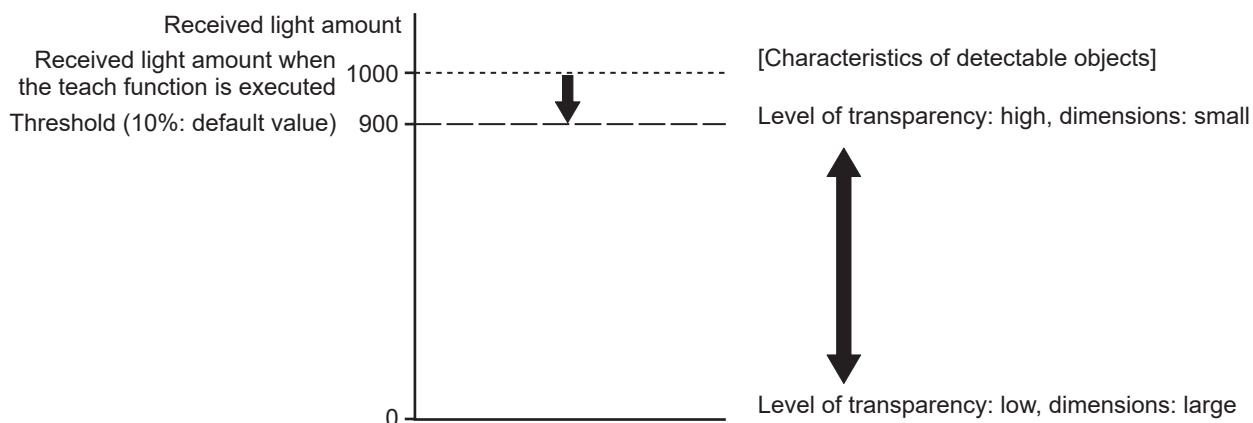
■ Mechanism of the Threshold Setting

The threshold is set to the value obtained by subtracting the specified percentage from the received light amount during execution of the teach function (with no object present).

Setting the percentage used as a margin to the threshold to a smaller value allows for detection of highly transparent objects and small objects. Setting the percentage to a larger value reduces the effect of vibrations, etc.

Example) When the received light amount during execution of the teach function is 1000 and the detection margin is 10%

The threshold is set to 900, obtained by subtracting the detection margin of 10% from the received light amount of 1000.



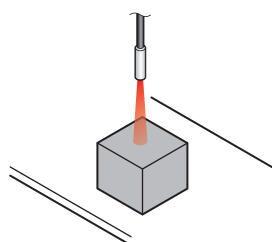
*Due to the addition of a hysteresis value with detection margin, actual threshold differs slightly from this example.

3-4-7 1-point Zone

The upper and lower limits of the threshold are set with the percentage (default value: 10%) in relation to the received light amount obtained with a single teach action.

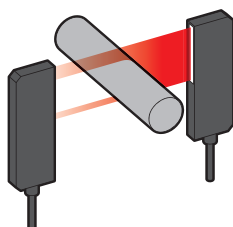
The thresholds can be set to a fixed range of received light amounts, so this method can be used in judging whether the object distance, position, and dimensions are within the set range.

[Diffuse reflective]



[Through-beam]


Example with a screen fiber unit







Setup for 1-point Zone teach

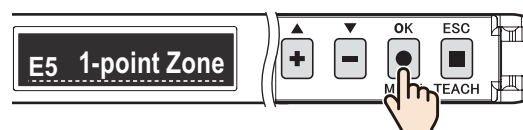
Through-beam/ retro-reflective	Diffuse reflective	Object
✓ (some limitations)	✓	Required



Operation Procedure

*To cancel the setting of the teach function, press the  key.

- 1 Press  for less than 1 second.
The teach mode selection screen appears.

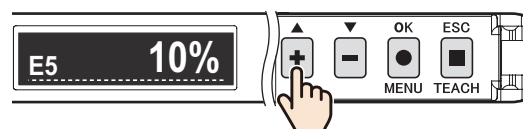
- 2 Use   to display "1-point Zone", and then press .




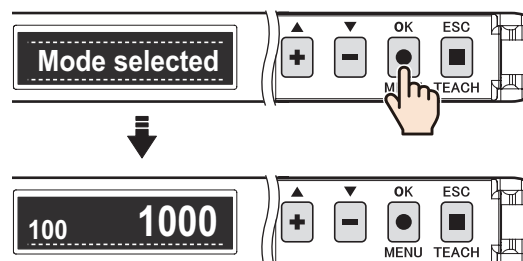
- 3 Use   to adjust the detection margin to set the thresholds.

Use the percentage related to the received light amount during execution of the teach function to set the upper and lower limits that specify the threshold range.

*With the default value (10%), the received light amount during execution of the teach function is used as a reference point, the upper threshold is set at +10% and the lower threshold is set at -10%.



- 4 Press  to set the teach mode and the detection margin.
The OLED display returns to the RUN screen and the received light amount appears.

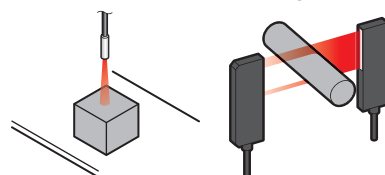


Continued on next page

5 With an object present, hold down for 1 second or more.


The output indicator of the channel for which the teach function is being executed blinks once in orange.

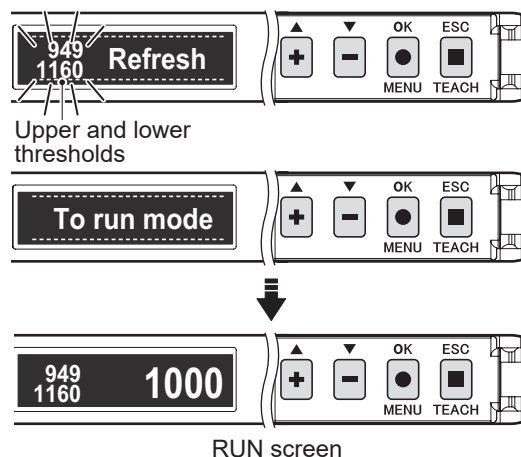
[Diffuse reflective] [Through-beam]



6 The threshold is set and its display blinks.


This completes the execution of the teach function. The OLED display automatically returns to the RUN screen.

*If the received light amount does not meet the conditions required for the teach function, "Teach error" will be displayed. If this error is displayed, refer to  "5-1 Error Displays" (page 5-2) for troubleshooting.



MEMO

Operations when executing the teach function again

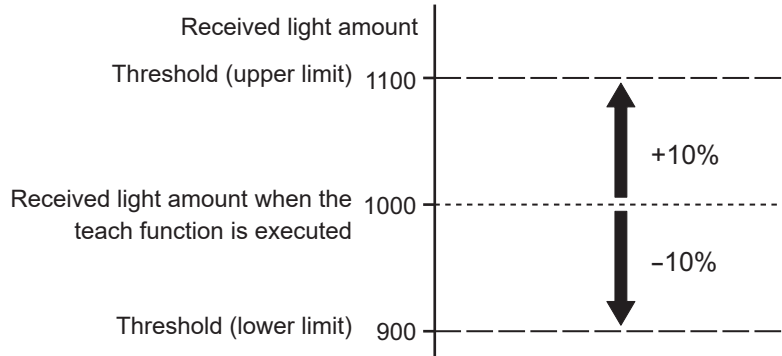
After executing the teach function, to reset the teaching with the same mode again, simply hold down the  key for 1 second or more. (The operations in steps 1 to 4 of the operation procedure are not necessary.) In this situation, the teach function is executed with the previously set mode and detection margin.

Mechanism of the Threshold Setting

The values obtained by adding the set percentage to and subtracting the set percentage from the received light amount during the execution of the teach function are set, respectively, as upper and lower thresholds.

Example) When the received light amount during execution of the teach function is 1000 and the detection margin is 10%

The upper and lower thresholds are set to the values obtained by, respectively, adding 10% to and subtracting 10% from the received light amount, so detection occurs when the received light amount is in the range of 900 to 1100.



*Due to the addition of a hysteresis value with detection margin, actual threshold differs slightly from this example.

3-4-8 2-point Zone

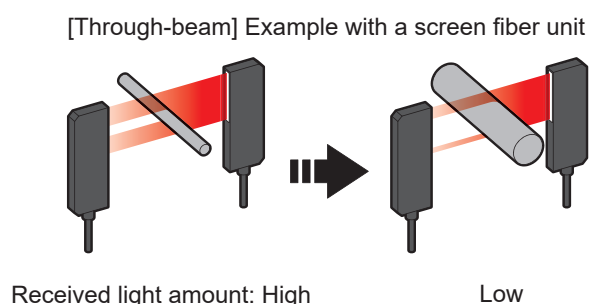
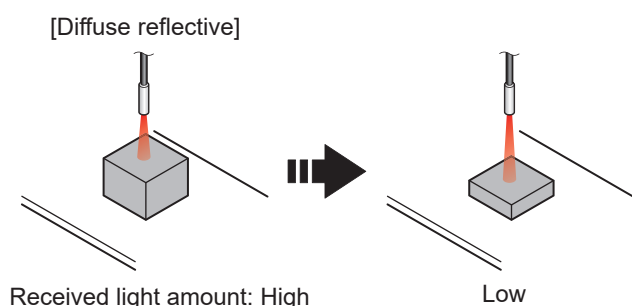
The teach function is executed twice to set the upper and lower limits of the threshold.

As with the “1-point Zone” teach mode, the threshold can be set to a fixed range of received light amount, so this method can be used to judge whether the object distance, position, and dimensions are within the set range.


The thresholds are not set by percentage but are set with an actual object, so the upper and lower thresholds can be set separately during the execution of the teach function, which differs from the “1-point Zone” mode.


Setup for 2-point Zone teach




Through-beam/ retro-reflective	Diffuse reflective	Object
✓ (some limitations)	✓	Required

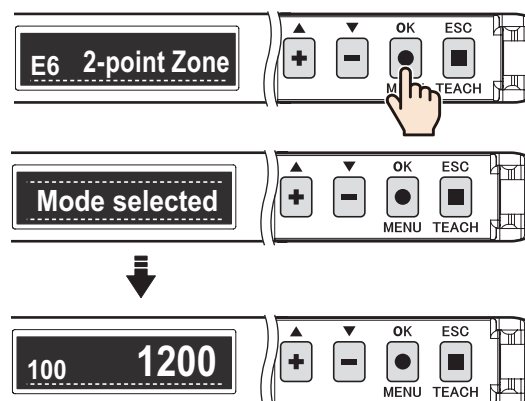


■ Operation Procedure

*To cancel the setting of the teach function, press the  key.

- 1 Press  for less than 1 second.
The teach mode selection screen appears.

- 2 Use   to display “2-point Zone”, and then press .
- The teach mode is set.
The OLED display returns to the RUN screen and the received light amount appears.

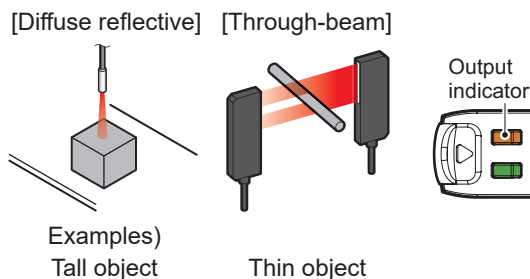


Continued on next page

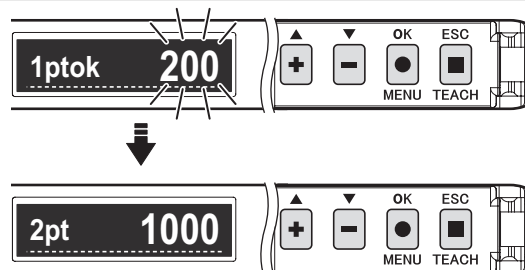
3 With an object present, hold down for 1 second or more.

The output indicator of the channel for which the teach function is being executed blinks once in orange.

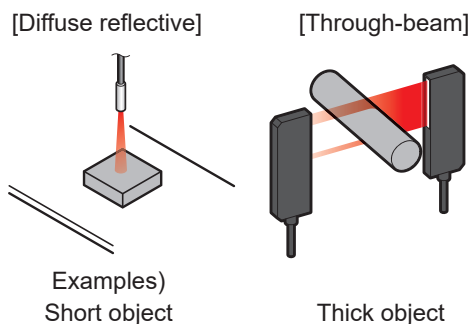
*Steps 3 and 5 can be performed in any order.



4 When the product is taught the received light amount of the first point, the numeric value blinks, then the product is set for the execution of the teach function at the second point.




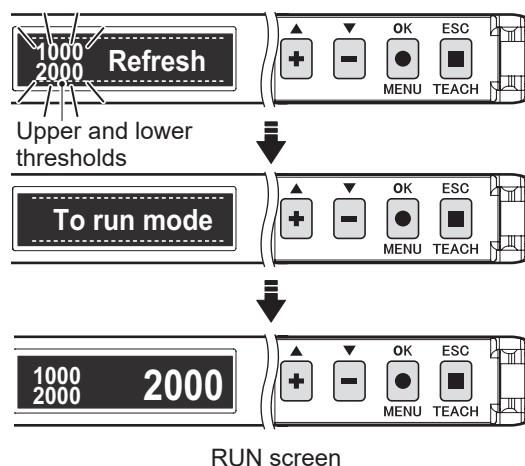
5 Place the other object, and then hold down for 1 second or more.



6 The product is taught the received light amount of the second point, and the threshold blinks.


This completes the execution of the teach function. The OLED display automatically returns to the RUN screen.

*If the received light amount does not meet the conditions required for the teach function, "Teach error" will be displayed. If this error is displayed, refer to  "5-1 Error Displays" (page 5-2) for troubleshooting.



MEMO

Operations when executing the teach function again

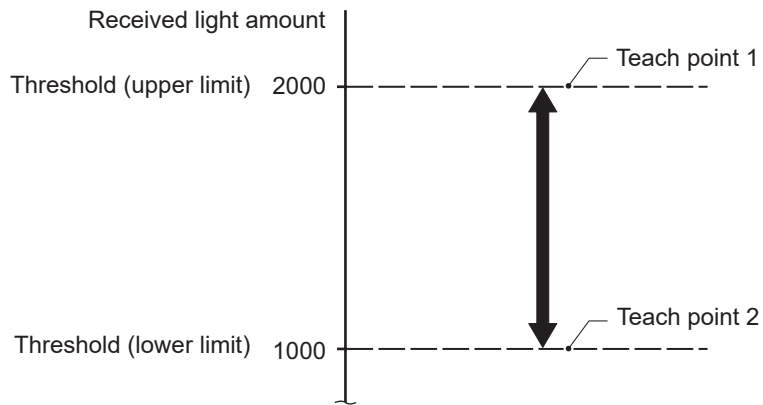
After executing the teach function, to reset the teaching with the same mode again, simply hold down the  key for 1 second or more. (The operations in steps 1 and 2 of the operation procedure are not necessary.)
In this situation, the teach function is executed with the previously set mode.

■ Mechanism of the Threshold Setting

The received light amounts obtained during the two actions of the teaching are set as the upper and lower thresholds.

Example) When the received light amounts during the two actions of the teaching are 2000 and 1000

The threshold is set with an upper limit of 2000 and a lower limit of 1000, so detection occurs when the received light amount is in the range of 1000 to 2000.



3-5 Manual Adjustment of the Threshold



The threshold set with the teach function can be changed manually.

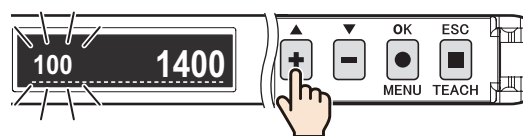
Use this operation to make adjustments to the threshold when actual detection is unstable, when the detection conditions change, and other similar situations.



This operation can also be used to set the threshold directly without executing the teach function.


■ Operation Procedure

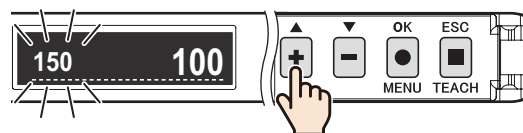
(1 point, 2 points, Auto, and Through modes)


- 1 On the RUN screen, press  .**
A line appears at the bottom of the OLED display, and the upper section threshold blinks.




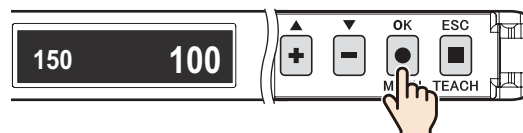
- 2 Press   to change the threshold.**
Pressing [+] increases the threshold and pressing [-] decreases it.

*If no adjustment is necessary, press  to cancel.



- 3 Press .**
The line at the bottom of the OLED display disappears. This completes the threshold adjustment.

*Even if  is not held down, the threshold will be set to the changed value if approximately 30 seconds elapse, and the OLED display will return to the RUN screen.

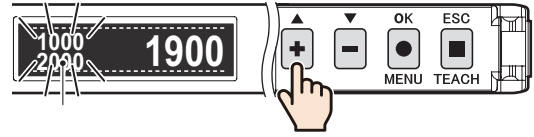


■ Operation Procedure

(1-point Zone and 2-point Zone modes)


1 On the RUN screen, press .

A line appears at the bottom of the OLED display, and the threshold blinks.

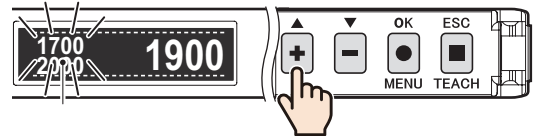


2 Press to change the upper row threshold.

Pressing [+] increases the threshold and pressing [-] decreases it.

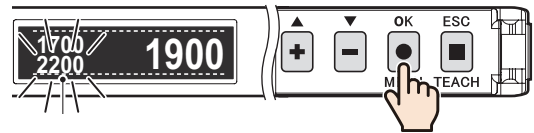
*If no adjustment is necessary, press  to cancel.

*The threshold will be set to the changed value if approximately 30 seconds elapse, and the OLED display will return to the RUN screen.




3 Press .

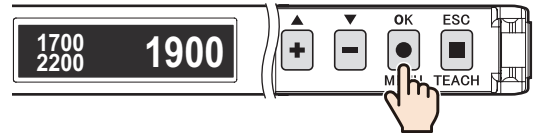
The lower row threshold blinks, so change it in the same way as the one in the upper row.



4 Press .

This completes the settings.

*Even if  is not held down, the threshold will be set to the changed value if approximately 30 seconds elapse.



3-6 Shortcut Function

The shortcut function makes it possible to immediately call the useful functions explained in the following three display modes with one or two key operations.

- Received Light Amount Display Modes
- Switching to the Hold Display
- Lock Function

3-6-1 Received Light Amount Display Modes

The display of the control output threshold and received light amount can be changed from “Value” (received light amount display) to “Percentage”.

(Percentage display: A function that displays the present received light amount as a percentage, where the received light amount during the execution of the teach function is 100%.)

The threshold and received light amount are both displayed as percentages, so the threshold margin in relation to the present received light amount is easy to understand.

For a detailed description of the display, refer to  “4-5-1 [S4] - [P1] Display mode” (page 4-8).

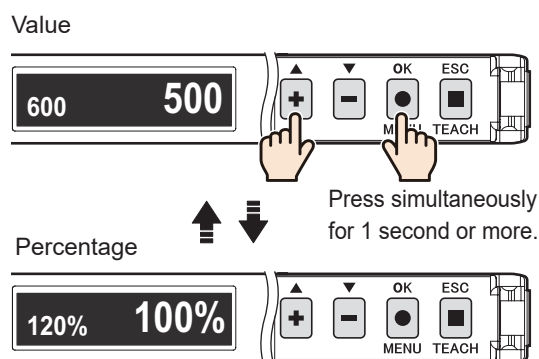
MEMO

Setting the display mode to “Percentage” makes it easy to understand the relationship between the threshold and received light amount, which makes it easy to understand information such as differences in received light amounts between multiple amplifiers and daily changes in the received light amounts.

Operation Procedure

Simultaneously hold down  and  for 1 second or more.

The values displayed on the screen change between the “Value” and “Percentage” settings each time these keys are pressed.



3-6-2 Switching to the Hold Display

You can switch the display of the control output received light amount from the present value display to the hold display (where the peak and bottom received light amounts are displayed).

Multiple hold display modes are available.

For details on the hold display, refer to "3-7-3 [P2] Hold Display" (page 3-40).

MEMO

- This makes it easier to check the received light amounts when the object is present and not present, so switching to the hold display is useful when making adjustments to the threshold.
- The hold display cannot be used when executing a "1-point zone" or "2-point zone" teach.

Operation Procedure

Simultaneously hold down and for 1 second or more.

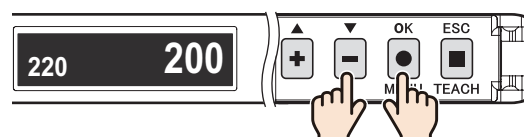
The values displayed on the screen change between the "Present value display" and "Hold display" modes each time these keys are pressed.

*The display settings are applied to the display details that are switched with this function.

→Refer to "4-5-1 [S4] - [P1] Display mode" (page 4-8).

→Refer to "3-7-3 [P2] Hold Display" (page 3-40).

Present value display (Value display mode)



Press simultaneously for 1 second or more.

Hold display (Peak/bottom)



3-6-3 Lock Function

This function locks the operations of this product to prevent incorrect operations.
You can select to lock only key operations or key and external input operations.

■ Operation Procedure

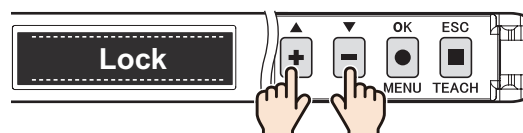
Simultaneously hold down  and  for 1

second or more.

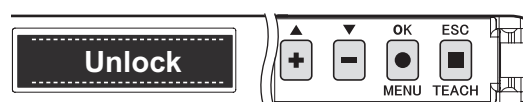
Operations are locked.

Operations switch between locked and unlocked each time these keys are pressed.

Locking



Unlocking



Key operation with keys locked






The message "Key Locked" blinks three times.

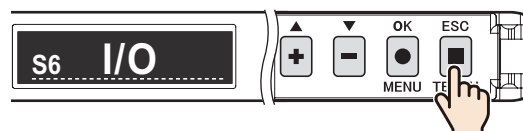
■ Lock Mode Setting




You can change the lock modes.

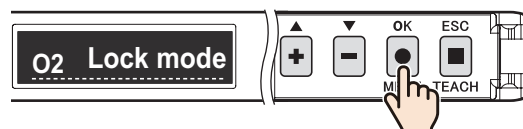
● [S6] - [O2] Lock modes

Selectable option	Function description
Lock all (default value)	Locks operations performed via the product's keys and external input.
Lock keys	Locks product key operations. Operations can still be performed via the external input.




- 1 Press  , and then use   to select the menu.
Display "I/O" on the main menu.

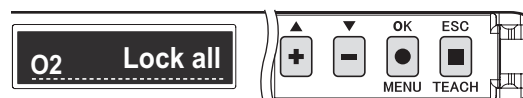



- 2 Press  , and then use   to select the menu.
Display "Lock mode" on the sub menu.

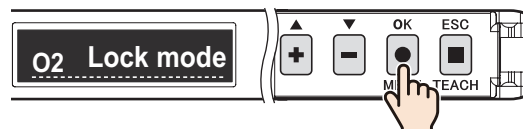



Continued on next page

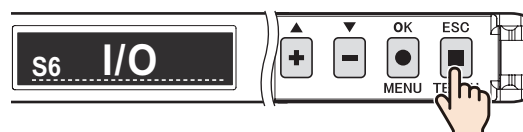
- 3** Press , and then use   to select the required mode.




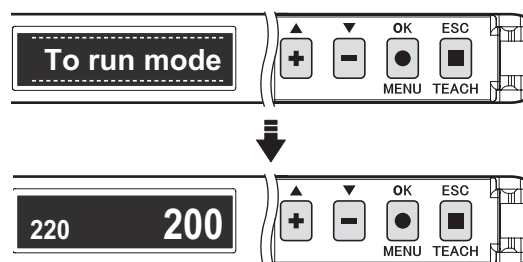
- 4** Press .
- The setting is saved, and the OLED display returns to the sub menu.



- 5** Press .
- The OLED display returns to the main menu.



- 6** Press .
- This completes the settings.
The OLED display returns to the RUN screen.



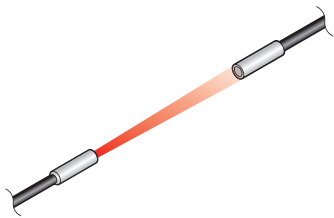
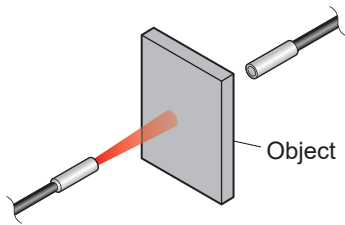
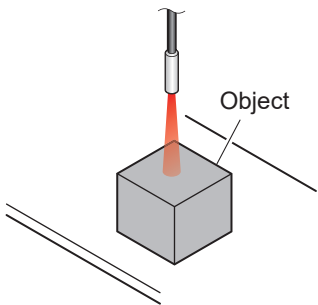
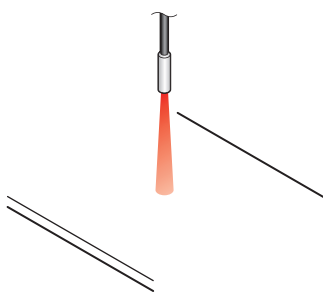
3-7 Frequently Used Functions

This section explains functions that are frequently used with this product.

General description	Function name	Details	Description
Changing the output mode	[S1] Output mode	Select the output mode from light on (on when light is received) and dark on (on when light is not received). Change this setting if an output is generated when an object is present or not present to match application requirements.	Page 3-35
Changing the response time and sensing distance	[S2] Response time	Changing the response time may affect detection results. Adjust the response time, referring to the following conditions. <ul style="list-style-type: none">• Detecting small objects or objects that are transferred at high speed. → Set a shorter response time.• Extending the sensing distance → Set a longer response time.	Page 3-38
Monitoring only peak and bottom amounts of received light	[P2] Hold display	The peak (highest) value and bottom (lowest) value of the received light amounts that have been measured are saved and displayed. With reference to the peak and bottom values, manual adjustment of the threshold can be made at the correct values.	Page 3-40
Initialization	[S8] Reset	Reset the product to the factory settings.	Page 3-45

3-7-1 [S1] Output Mode (N.O./N.C.)

Set the output mode to light on (on when light is received) or dark on (on when light is not received). Switching the output mode inverts the output.

Output mode Detection method	Light on: Output generated when light is received.	Dark on: Output generated when light is not received.
Through-beam		
Diffuse reflective		

Selectable Options with 1-point, 2-point, Auto, and Through Teach Modes

Selectable option	Function description
Light on (default value)	Sets the output mode to light on (on when light is received). Output is generated when the received light amount exceeds the threshold.
Dark on	Sets the output mode to dark on (on when light is not received). Output is generated when the received light amount drops below the threshold.

Operations of dark on and light on

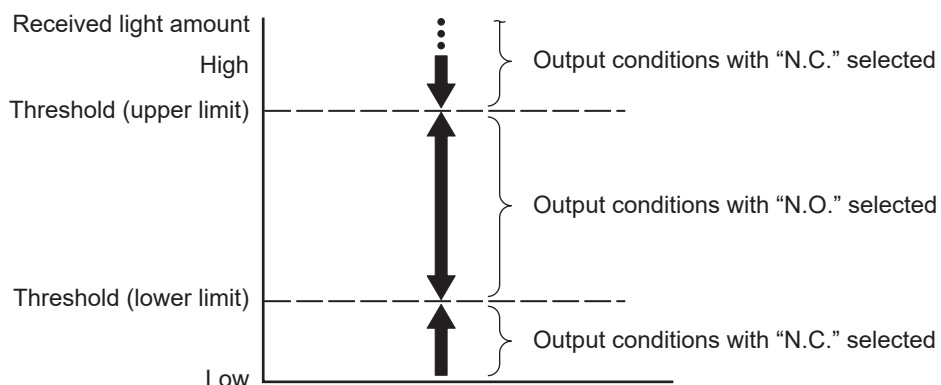
Select the mode according to whether objects are present, the detection method of the fiber unit, etc. as shown below.

Object presence	Detection method		
	Through-beam	Retro-reflective	Diffuse reflective
Output when object present	Dark on		Light on
Output when no object present	Light on		Dark on


■ Selectable Options with 1-point Zone and 2-point Zone Teach Modes

With these setting options, the display becomes “N.O.” (normally open) or “N.C.” (normally closed), which causes output to be generated according to the following conditions pertaining to the threshold.

Selectable option	Function description
N.O. (default value)	Output is generated when the received light amount is within the set range of the thresholds.
N.C.	Output is generated when the received light amount is outside the set range of the thresholds.



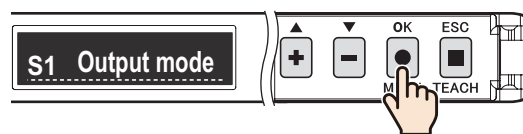
■ Operation Procedure

*To cancel the setting, press the  key.




- 1 Press , and then use   to select the menu.

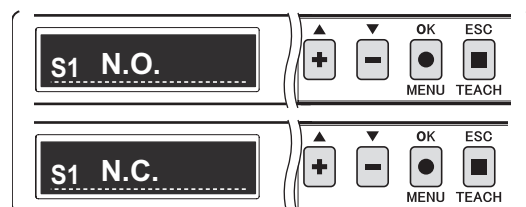
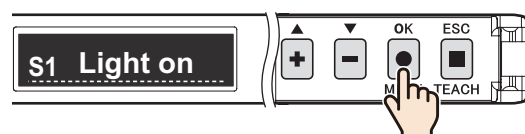
Display “Output mode”.

*When the “1-point Zone” or “2-point Zone” teach mode is selected, “N.O./N.C.” is displayed.




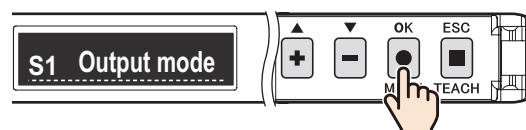
Continued on next page


- 2** Press , and then use   to select the required mode.

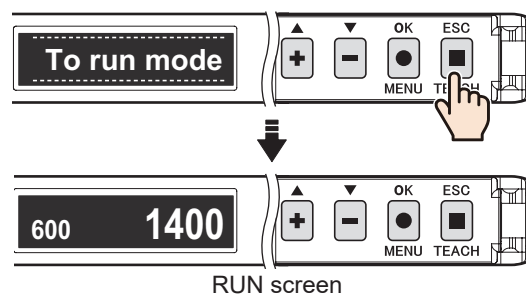


*When the teach function is set to “1-point Zone” or “2-point Zone”, “N.O.” or “N.C.” is displayed.

- 3** Press .
- The setting is saved, and the OLED display returns to the main menu.



- 4** Press .
- This completes the settings.
The OLED display returns to the RUN screen.



3-7-2 [S2] Response Time

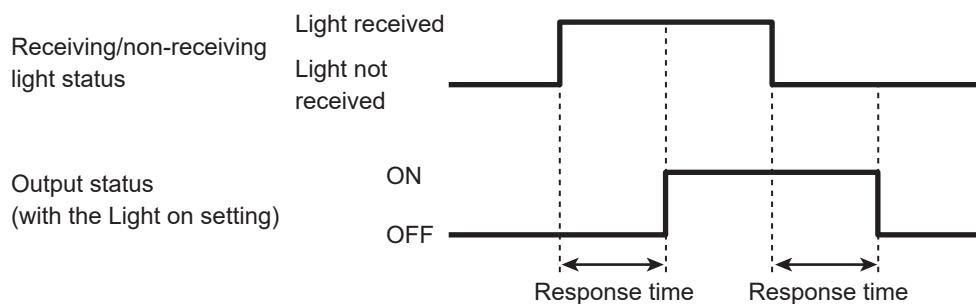
This subsection describes how to change the response time of this product.

The response time is the time from when the received light amount changes due to the presence or absence of an object until the sensor output is inverted.

MEMO

Depending on the response time setting, it is possible to detect fast-moving objects or objects that are at long range. Select a suitable response time, according to the detection conditions.


Example) Relationship between receiving/non-receiving light status and output timing






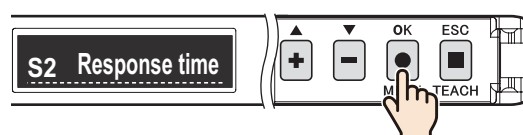
Selectable Options


Selectable option	Function description
50 μ s	The response time can be selected from four parameters.
250 μ s (default value)	
1 ms	
4 ms	

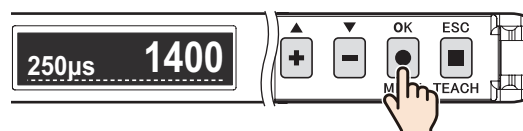
Operation Procedure

*To cancel the setting, press the  key.

- 1 Press , and then use   to select the menu.
Display "Response time".



- 2 Press .
The currently set response time and received light amount are displayed.



Continued on next page

3 Press to select the response time from the seven options.

*The shorter the response time is, the less the received light amount becomes. The longer the response time is, the greater the received light amount becomes. The received light amount increases and decreases, so execute the teach function again or make manual adjustment of the threshold (page 3-28).

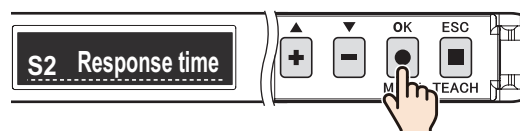


<Options>

50 μ s, 250 μ s, 1 ms, 4 ms

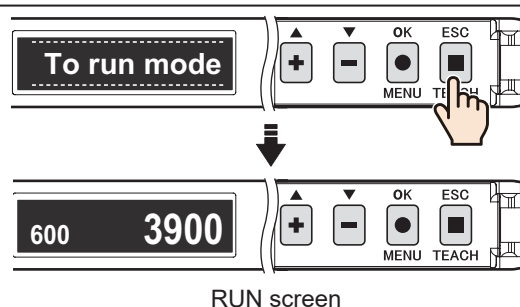
4 Press .

The setting is saved, and the OLED display returns to the main menu.



5 Press .

This completes the settings.
The OLED display returns to the RUN screen.



■ Response Time Setting Examples

Setting the response time provides the following advantages.

● Setting a longer response time

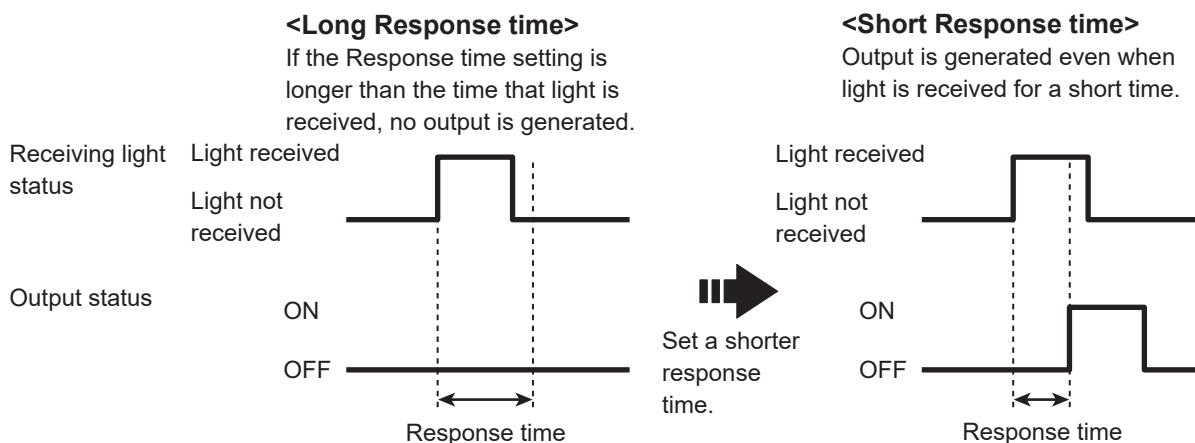
A larger amount of received light increases the sensitivity, which allows for detection at longer distances.

● Setting a shorter response time

With a short response time, the product can respond to generate output even when objects block the light axis for a short period of time.

This is effective in detecting, for example, small objects travelling at high speeds.

Example) Setting a shorter response time to allow for detection of, for example, small objects.



3-7-3 [P2] Hold Display

Maintains and displays the peak level (highest value) and bottom level (lowest value) of received light amounts after exceeding or falling below the thresholds.

MEMO

The hold display cannot be used when executing a "1-point zone" or "2-point zone" teach, and this menu will not be displayed.

The peak level/bottom value is displayed, instead of the present received light amount.



MEMO

Hold function characteristics


- Even when the received light amount fluctuates greatly, the peak and bottom levels are displayed, making it possible to determine the difference between the received light amount and the threshold at all times.
- The received light amount with an object present and with no object present can be checked, making it easier to determine if the set threshold is appropriate.
- Even when the hold display is in use, detection results are output with the same timing as for the standard display.

Selectable Options

You can select from the following hold display modes.

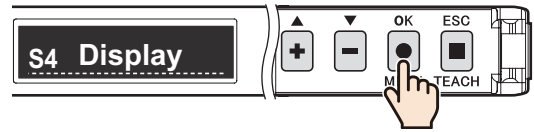
Selectable option	Function description
Off (default value)	The hold display is not used.
Peak/bottom	Continuously displays the peak level from times when the received light amount exceeded the threshold and the bottom level from times when the received light amount dropped below the threshold. (Refer to page 3-42.)
Peak	Continuously displays only the peak level from times when the received light amount exceeded the threshold. (Refer to page 3-43.)
Bottom	Continuously displays only the bottom level from times when the received light amount dropped below the threshold. (Refer to page 3-43.)
Time	Displays the peak level from times when the received light amount exceeded the threshold and the bottom level from times when the received light amount dropped below the threshold. The display switches between these values once per second. (Refer to page 3-44.)

■ Operation Procedure

*To cancel the setting, press the  key.

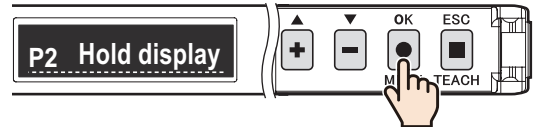
- 1 Press , and then use   to select the menu.

Display "Display" on the main menu.

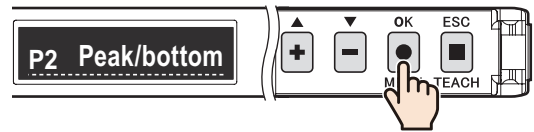


- 2 Press , and then use   to select the menu.

Display "Hold display" on the sub menu.




- 3 Press , and then use   to select the option to set.

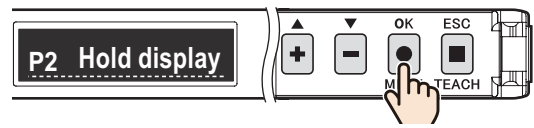


<Options>

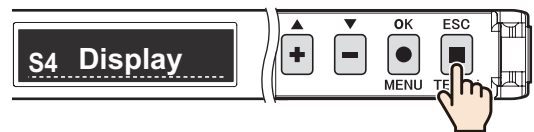
Peak/bottom, Peak, Bottom, Time, Off

- 4 Press .

The setting is saved, and the OLED display returns to the main menu.

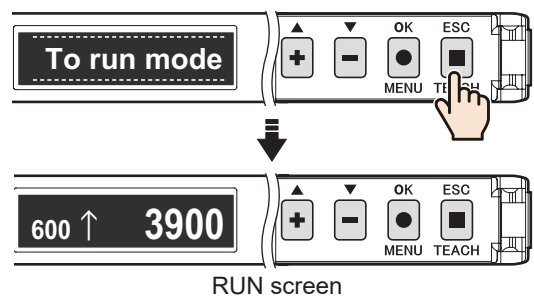


- 5 Press .



- 6 Press .

This completes the settings.
The OLED display returns to the RUN screen.



■ Mechanisms of Hold Display

This section explains the display mechanism for each type of hold display.

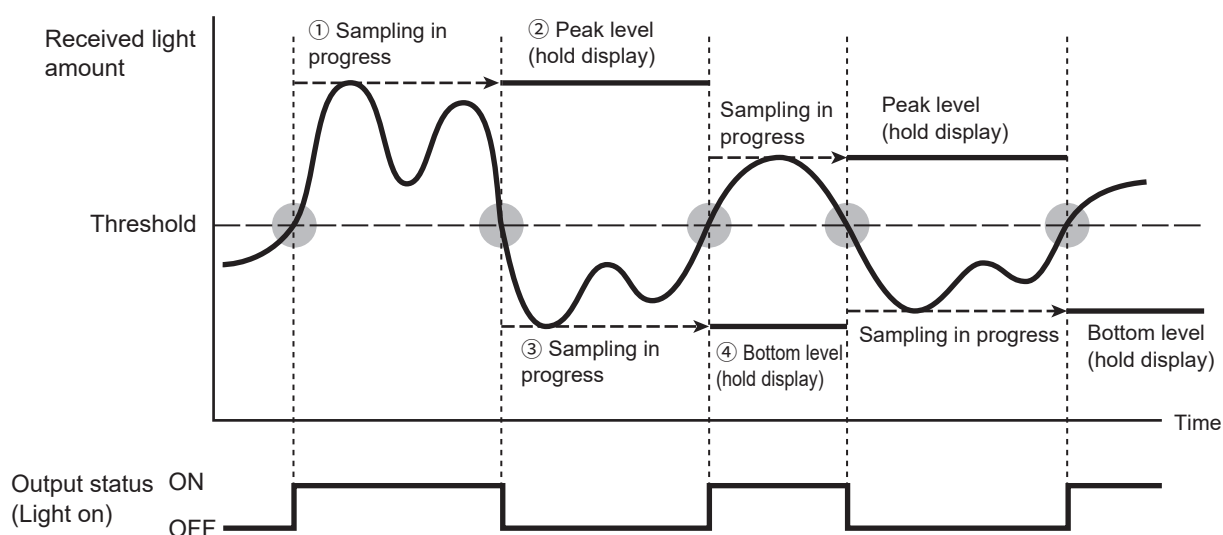
●●● MEMO ●●●

- The peak and bottom levels displayed with the hold display are numeric values resulting from sampling over a period of time. Therefore, there is a minor time lag compared to the present received light amount and output status.
- Even when the hold display is in use, detection results are output in real time, the same as with the standard display.

● Peak/bottom

This mode displays the peak value from times when the received light amount exceeds the threshold and the bottom value from times when the received light amount falls below the threshold.

The peak and bottom values are updated each time the received light amount exceeds or falls below the threshold, respectively.



- ① When the received light amount exceeds the threshold, peak level sampling starts.
- ② When the received light amount returns to the threshold, the peak level is displayed.
- ③ When the received light amount drops below the threshold, bottom level sampling starts.
- ④ When the received light amount returns to the threshold, the bottom level is displayed.

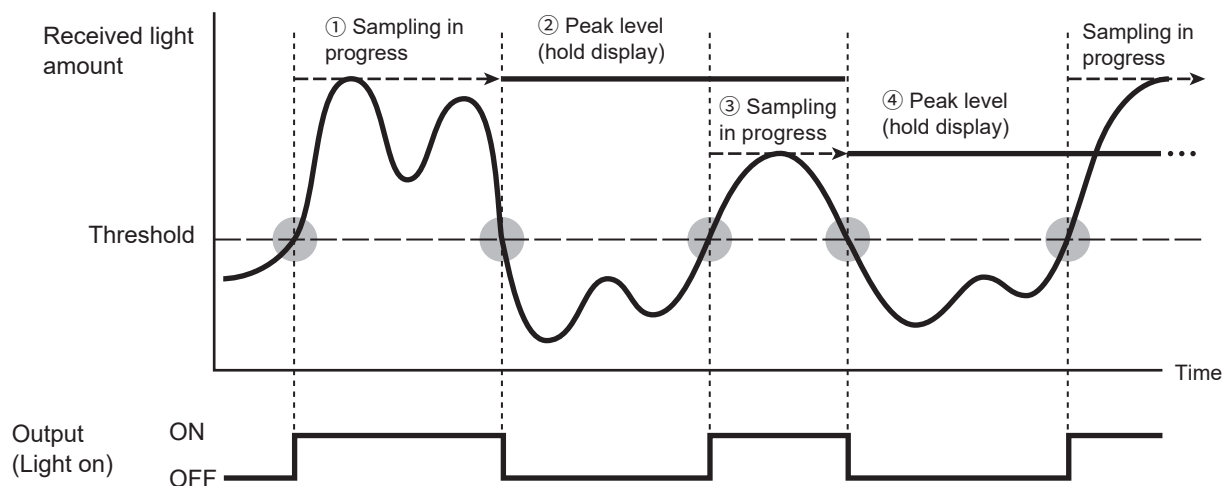
The peak and bottom values are updated each time the received light amount exceeds or drops below the threshold, respectively.

● Peak or Bottom

These modes display either the peak value from times when the received light amount exceeds the threshold or the bottom value from times when the received light amount drops below the threshold.

The peak or bottom level is updated each time the received light amount exceeds or drops below the threshold, respectively.

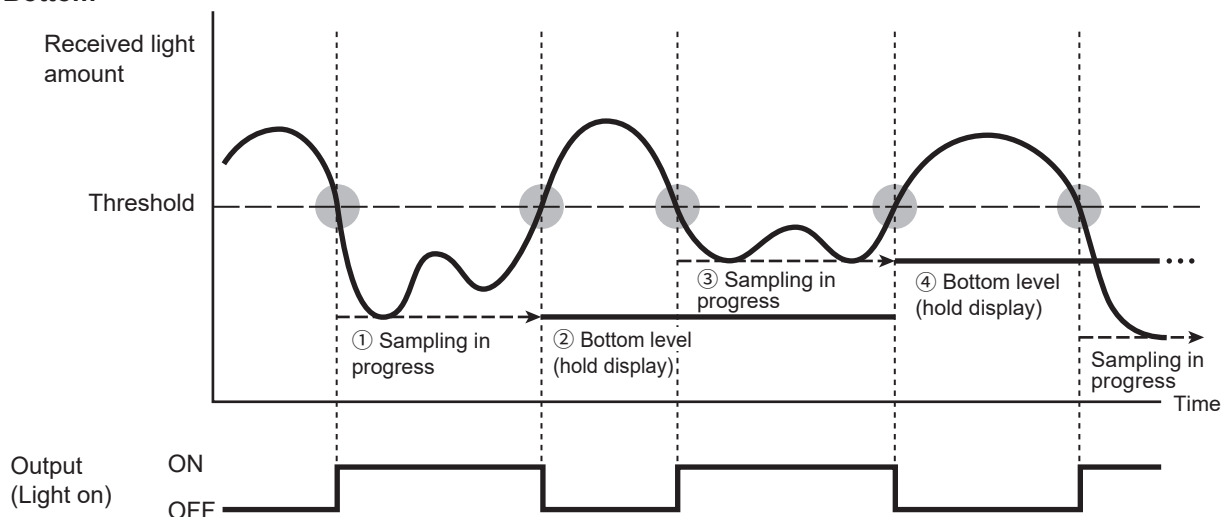
<Peak>



- ① When the received light amount exceeds the threshold, peak level sampling starts.
- ② When the received light amount returns to the threshold, the peak level is displayed.
- ③ When the received light amount exceeds the threshold again, peak level sampling starts.
- ④ When the received light amount returns to the threshold, the peak level is updated.

The peak level is updated each time the received light amount exceeds the threshold.

<Bottom>



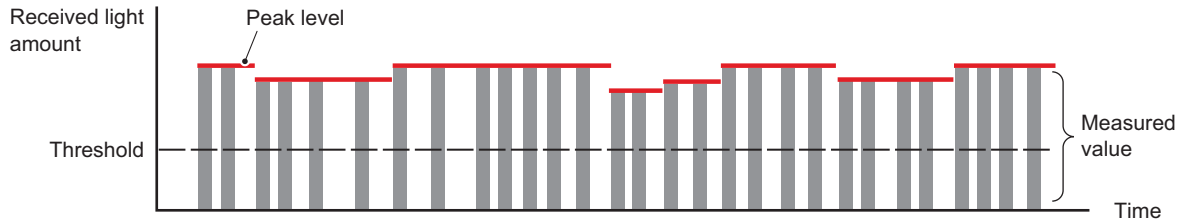
- ① When the received light amount drops below the threshold, bottom level sampling starts.
- ② When the received light amount returns to the threshold, the bottom level is displayed.
- ③ When the received light amount drops below the threshold again, bottom level sampling starts.
- ④ When the received light amount returns to the threshold, the bottom level is updated.

The bottom level is updated each time the received light amount drops below the threshold.

MEMO

The “Peak” or “Bottom” hold display is useful for detection of small objects, for which the detection time is short, and thus it is difficult to monitor detection values.

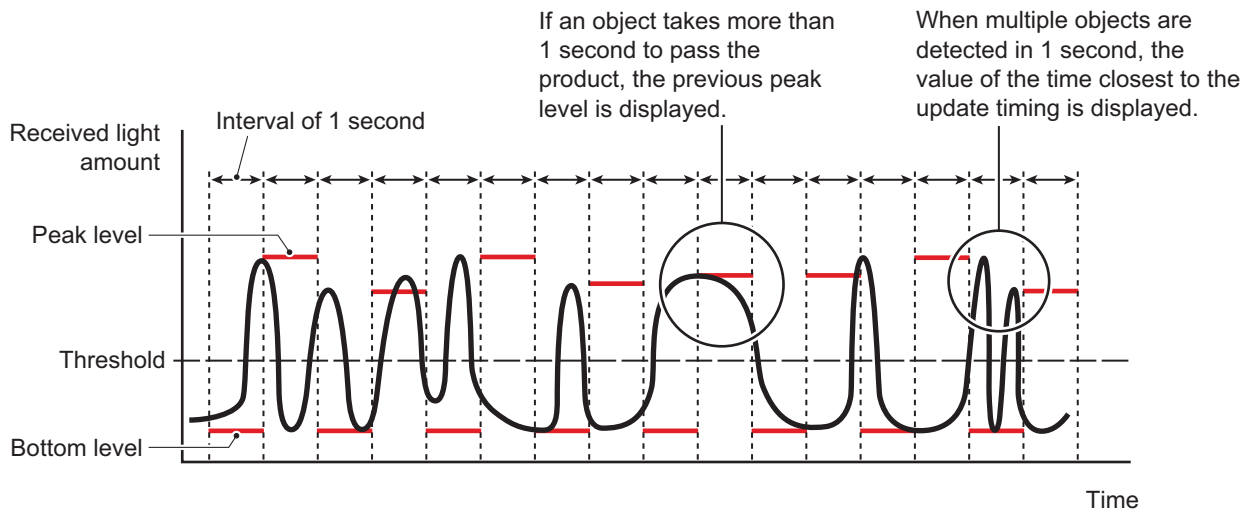
As only the “Peak” or “Bottom” is displayed, it is easy to read only the required values.



Time

This mode displays the peak value from times when the received light amount exceeded the threshold and the bottom level from times when the received light amount dropped below the threshold. Each level is displayed for one second.

The peak and bottom values can each be monitored for one second at a time, allowing the received light amounts to be checked even in cases where objects pass the product irregularly and at high speed.



3-7-4 [S8] Reset


Resets the settings of this product.




Selectable Options

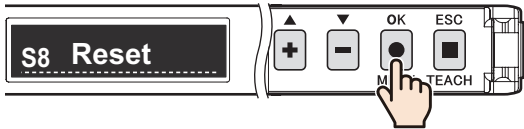
You can select from the following reset modes.




Selectable option	Function description
Factory reset	Returns all of the settings of this product to the factory defaults.

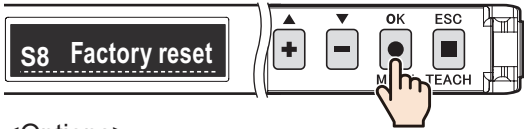
Operation Procedure

*To cancel the setting, press the  key.



- 1** Press , and then use   to select the menu.
Display “Reset” on the main menu.

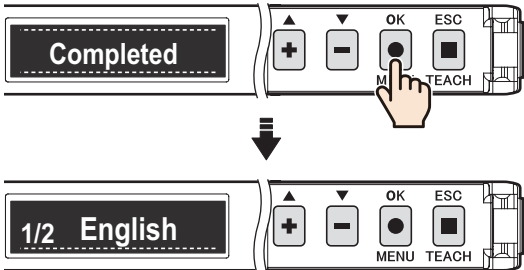


- 2** Press , and then use   to select the option to set.
Display the reset mode.



<Options>
No, Setting reset, Factory reset

- 3** Press .
This completes the reset.
The initial settings screen is displayed, so carry out the procedure in  “3-2 Setup on First Startup” (page 3-5) again.



Initial settings screen



4

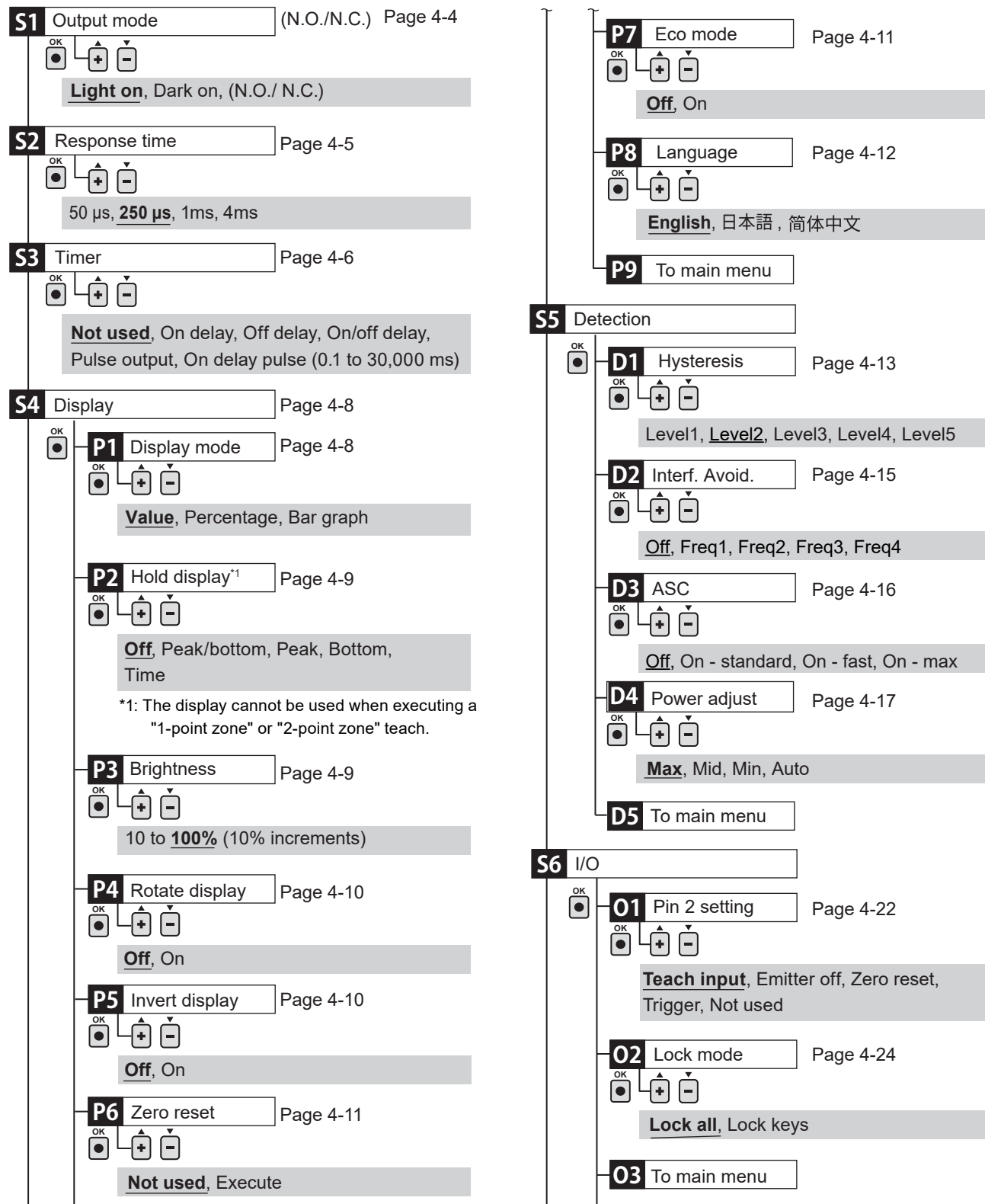
Settings Menu

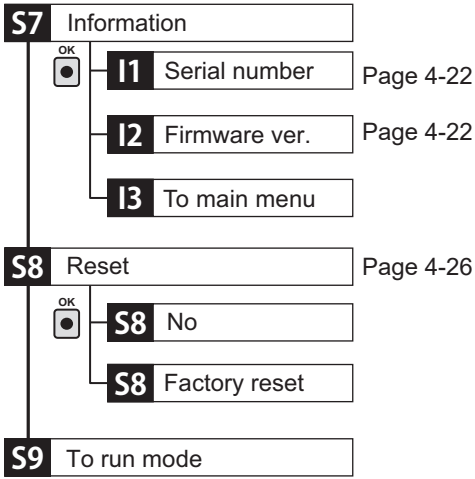
This section explains how to set the parameters of this product.

4-1 List of Setting Options

A list of the options that can be set on this product is shown below.

The initial settings are indicated with underlining.





4-2 [S1] Output mode (N.O./N.C.)




Selects the control output mode from light on (on when light is received) and dark on (on when light is not received).

For details on this function and how to set it, refer to  “3-7-1 [S1] Output Mode (N.O./N.C.)” (page 3-35).

4-3 [S2] Response time

Selects the response time of this product.

For details on this function and how to set it, refer to  “3-7-2 [S2] Response Time” (page 3-38).

4-4 [S3] Timer

This function delays the control output of this product.

■ Selectable Options

You can select the timer setting from the following six timer modes.

Selectable option	Function description	Setting value
Not used	Do not use the timer function. (Default value)	—
On delay	The output is delayed by the set time after the on judgment.	0.1 to 30,000 ms (default value: 1 ms)
Off delay	The output is delayed by the set time after the off judgment.	
On/off delay	The On delay and Off delay timers are activated.	
Pulse output	Output turns on for the set period of time after the on judgment.	
On delay pulse	The On delay and Pulse output timers are activated.	

■ On delay

After the on judgment, output is not generated until the set timer duration elapses.

Even if there are detections shorter than the timer duration, no output is generated, preventing the output of fluctuating detection results due to, for example, noise.

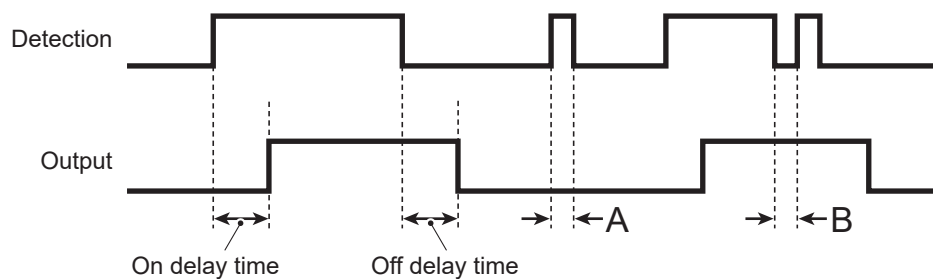
■ Off delay

This function prevents the output from turning off immediately after detection changes to off, as the output is held for the set timer duration.

This makes it possible to extend the output duration by the set time, even when the detection time is short.

This allows for input to input equipment that cannot receive short input signals.

Example) On delay and Off delay timing chart



The detection and output turning on/off differs in the above diagram.

<On delay operation>

When detection is made for a duration that exceeds the On delay time, the output turns on. Therefore, even if detection is judged momentarily, as indicated by A, output is not generated.

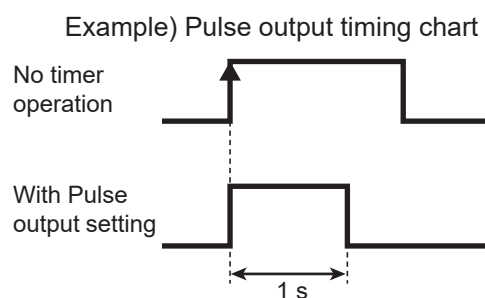
This prevents chattering caused by short noise.

<Off delay operation>

The output is turned off at the set timer time after the detection becomes off. Therefore, even if the detection becomes OFF momentarily, as indicated by B, the output does not turn off. This prevents chattering. Furthermore, setting an Off delay can lengthen the output time in cases where the objects are small and the sensor only turns on for brief periods of time. The result is that even slow-speed controllers can capture momentary changes.

■ Pulse output

The pulse output is held for the set timer time from the time the detection becomes on. The chart on the right shows the pulse output for 1 second.



■ On/off delay

The On delay and Off delay timers both are activated.

The times for the output switching from off to on and from on to off can both be delayed.

The On delay and Off delay times can be set separately.

■ On delay pulse

The On delay and Pulse output timers both operate.

The time for the output switching from off to on can be delayed, and the on status can be maintained until the set time elapses.

The On delay and Pulse output times can be set separately.

4-5 [S4] Display

This section explains how to set the display modes and received light amounts on the OLED display.

4-5-1 [S4] - [P1] Display mode

Sets how to show the received light amount on the OLED display.

Selectable Options

You can select from the following display modes.

Selectable option	Function description
Value (default value)	Displays the received light amount as a numeric value.
Percentage	Displays the received light amount as a percentage (%) of the threshold. This setting makes it easy to understand information such as differences in received light amount between multiple amplifiers and daily changes.
Bar graph	Displays the received light amount and one or more thresholds on a bar graph. This setting makes it easy to check the threshold margin in relation to the received light amount.

Value

Displays the received light amount as a relative numeric value between 0 and 9999.

Percentage

Displays the received light amount as a percentage (%) of the threshold.

The received light amount during the execution of the teach function is set as 100%.

Example) After executing the teach function with the 2-point setting

The higher received light amount from the two times the teach function was executed is set as 100%.



Example) After executing the teach function with the 1-point Zone or 2-point Zone setting

The thresholds for the upper and lower limits are displayed.

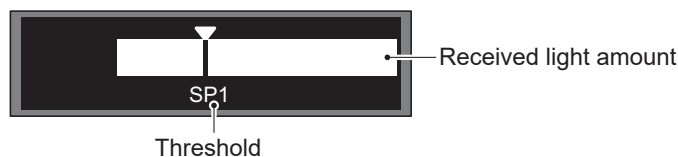


■ Bar graph

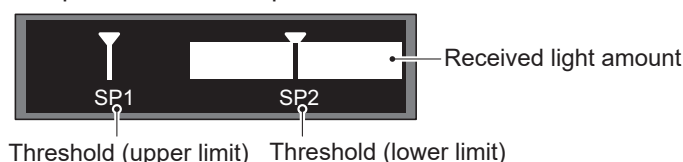
Displays the received light amount on a bar graph.

One or more thresholds are also displayed on the bar graph.

Teach mode: 1 point, 2 points, Auto, and Through



Teach mode: 1-point Zone and 2-point Zone



4-5-2 [S4] - [P2] Hold display

Continuously displays the highest value (peak level) and lowest value (bottom level) among all the times the received light amount exceeds the threshold and drops below the threshold.

For details on the Hold display function and how to set it, refer to “3-7-3 [P2] Hold Display” (page 3-40).

4-5-3 [S4] - [P3] Brightness

You can set the screen brightness to one of nine levels.

You can extend the service life of the OLED display by setting Brightness to the lowest acceptable value.

■ Selectable Options

Selectable option	Function description
Brightness (default value: 100%)	10 to 100% (in increments of 10%)

●●● MEMO ●●●

When Brightness is set to 30 to 100%, it is lowered to 20% to extend the service lifetime of OLED display, if no key of this product is operated for 2 minutes.

4-5-4 [S4] - [P4] Rotate display

You can flip the vertical orientation of the OLED display.

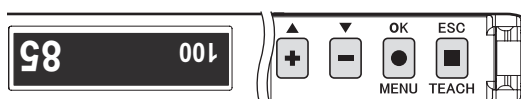
Set this mode to match the installation direction of the fiber amplifier.

Selectable option	Function description
Off (default value)	This is the standard display orientation.
On	Flips the vertical orientation of the OLED display. Select this option when installing the fiber amplifier with its top and bottom reversed.

Off



On



4-5-5 [S4] - [P5] Invert display

You can invert the colors of the text and background on the OLED display.

Selectable option	Function description
Off (default value)	This is the standard display with white characters on a black background.
On	Inverts the colors of the text and background. The text becomes black and the background white.

Off



On



4-5-6 [S4] - [P6] Zero reset

Executing the Zero reset function sets the current received light amount as zero.

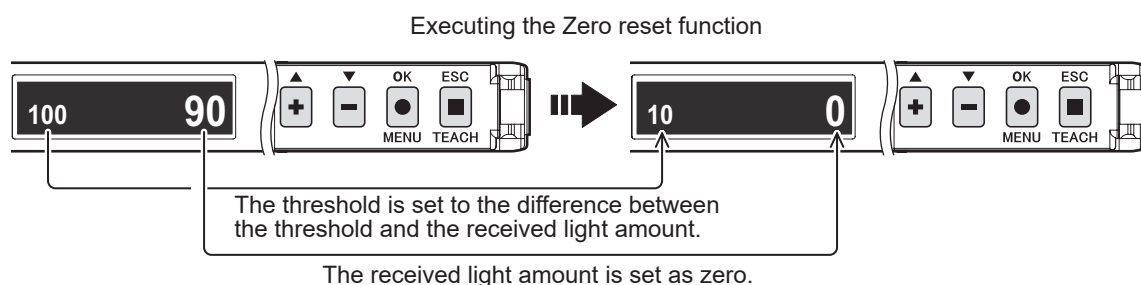
Use this function when, for example, you want to set the reference received light amount as zero or you want to set no object present as zero but the actual received light amount is not zero.

MEMO

Zero reset can also be performed via an external input.

For details, refer to  "4-7-1 [S6] - [O1] Pin 2 setting" (page 4-22)

Selectable option	Function description
Not used (default value)	The Zero reset function will not be used.
Execute	Executes the Zero reset function (displays the received light amount at the time of execution as zero).



4-5-7 [S4] - [P7] Eco mode

You can set to turn off the OLED display to reduce power consumption.

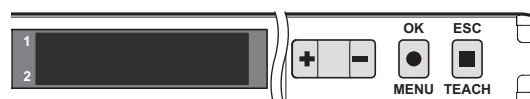
When there are no key operations for 2 minutes, this product switches to Eco mode and turns off the OLED display. The display turns on again when any key is operated.

Selectable option	Function description
Off (default value)	Eco mode will not be used.
On	Switches to Eco mode.

Eco mode Off



On



4-5-8 [S4] - [P8] Language

Sets the language of the menu text on the OLED display.

■ Selectable Options

You can select from the following three languages.

Selectable option	Function description
English (default value)	The text is displayed in English.
日本語	The text is displayed in Japanese.
简体中文	The text is displayed in Simplified Chinese.

4-6 [S5] Detection

This function is used to configure advanced settings related to detection, such as making adjustments to the reference for detection judgment, the output timing, the emitter power, and the sensitivity.

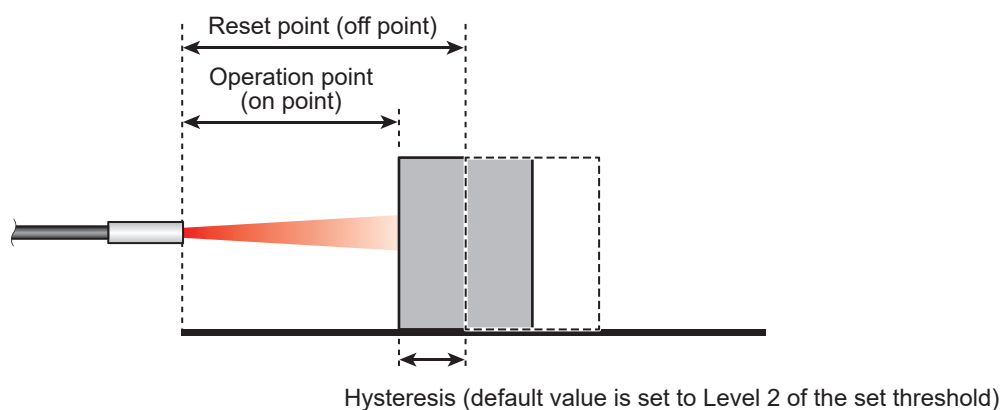
4-6-1 [S5] - [D1] Hysteresis

This function adjusts the received light amounts to turn the output on and off (it configures the margin between these levels).

These received light amounts are referred to as shown below, and this margin in (gap between) the received light amounts is referred to as hysteresis.

- Operation point: Received light amount that makes the output turn on, Threshold
- Reset point: Received light amount that makes the output turn off

Example with Light On Operation



Adjust the level of Hysteresis to set the margin in the received light amounts of the operation and reset points.

For example, set a upper level to reduce detection instability caused by fluctuation of reflection from an object and a lower level to detect small height differences.

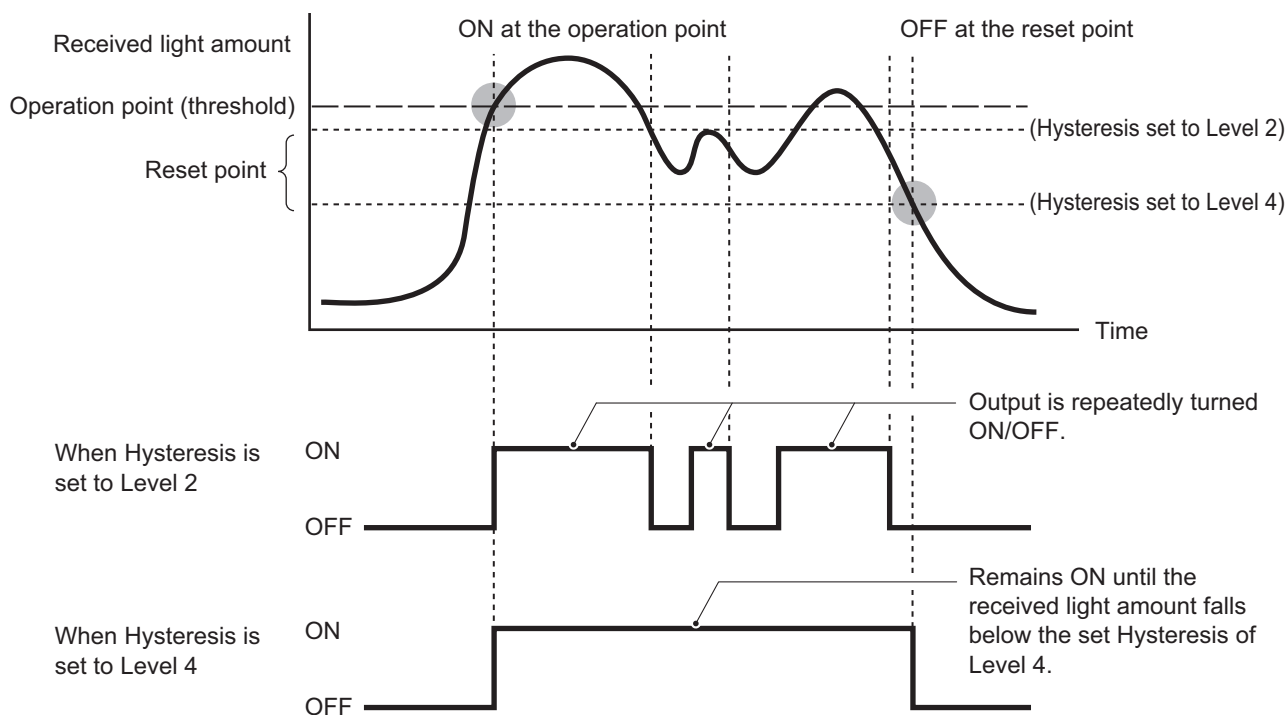
Configure settings according to the application.

■ Stabilizing Object Detection Near the Threshold

The received light amounts frequently crossing the threshold causes unstable output. In this situation, increasing the Hysteresis level lowers the light amount of the reset point to stabilize the output.

Example) Adjusting the Hysteresis setting from Level 2 to Level 4 (diffuse reflective)

Lowering the received light amount of the reset point makes the output more stable when there are small changes of the received light amount.



■ Selectable Options

Selectable option	Function description
Hysteresis (default value: Level 2)	Level1 to Level 5 Select from five levels (Level 1 to 5) to determine how much the reset point set by hysteresis should be subtracted from the operation point (threshold).

4-6-2 [S5] - [D2] Interf. Avoid. (Cross Talk Prevention)

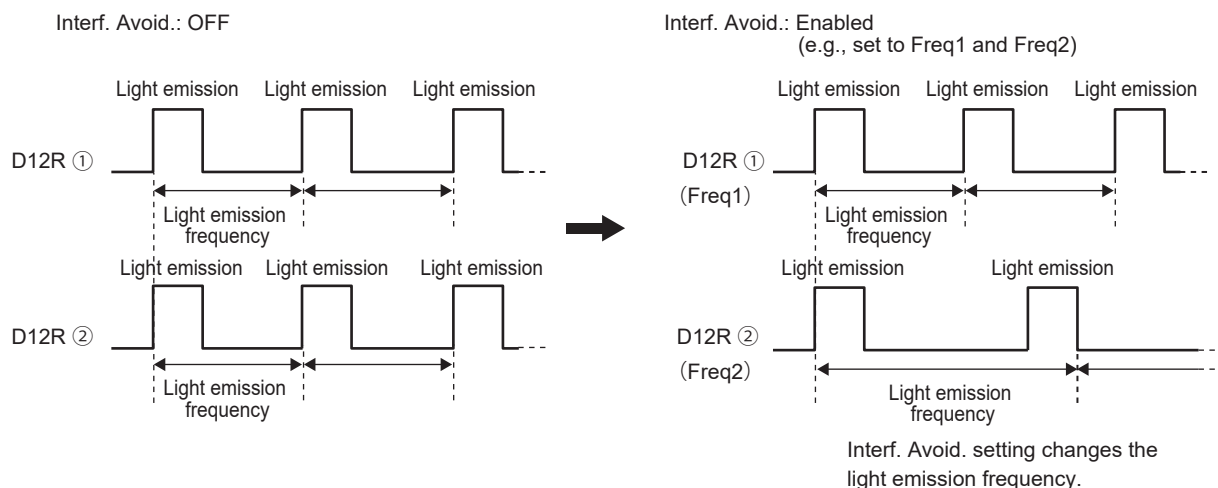
When installing fiber units connected to the D12R side by side, setting each amplifier's light emission frequency to a different value prevents malfunctions caused by cross talk.

This function supports up to four units.

MEMO

Enabling Interf. Avoid. will change the response time.

The response time set in "[S2] Response Time" will no longer apply.



Selectable Options

Selectable option	Function description
Off (Default value)	Interf. Avoid. is not used.
Freq1, Freq2, Freq3, Freq4	Light emission frequency can be selected from four options. Assign different values to adjacent units.

4-6-3 [S5] - [D3] ASC (Automatic Sensitivity Control)

This function monitors the received light amount when no object is present, and correspondingly adjusts the threshold.

Through the use of product, the received light amount may decrease due to factors such as contamination of the optical system, eventually resulting in errors by falling below the threshold. Enabling the ASC function lowers the threshold to match decreases in the received light amount, allowing for long-term stable detection. This function is especially effective when detecting transparent objects.

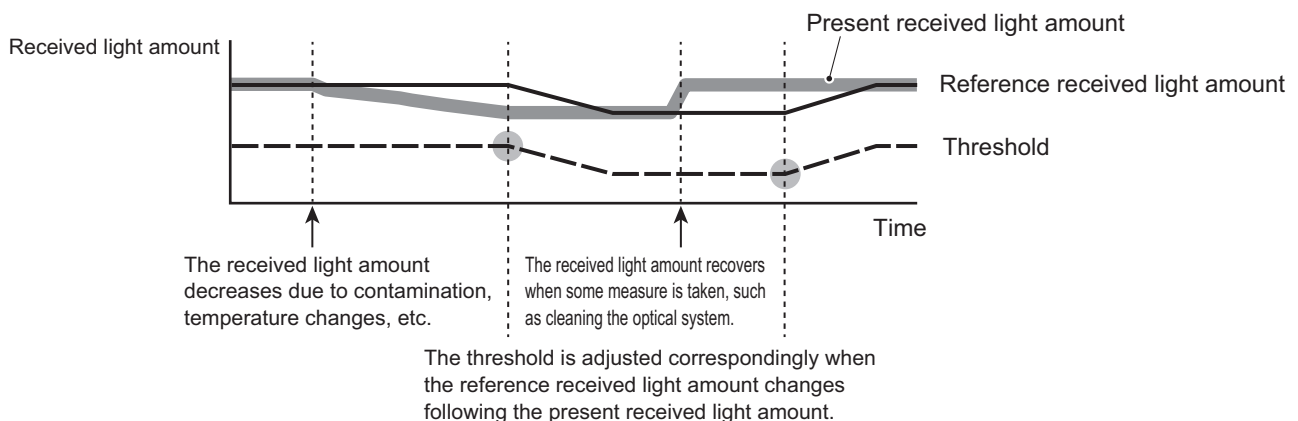
■ Before Using This Function

- Before using this function, execute the teach function.
- This function cannot be used in the following modes.
 - Teach mode: “1-point Zone” or “2-point Zone”

If the product is changed to one of the above modes while this function is in use, this function will be disabled.

■ Adjustment Example

The threshold is automatically adjusted when the received light amount decreases due to optical contamination, temperature changes, etc.



■ Selectable Options

Selectable option	Function description
Off (default value)	The ASC function is not used.
On - standard	When the received light amount changes, the threshold is adjusted by 1 every 3 seconds.
On - fast	When the received light amount changes, the threshold is adjusted by 1 every 1 second.
On - max	When the received light amount changes, the threshold is adjusted by 1 every 0.25 seconds.

4-6-4 [S5] - [D4] Power adjust

This function adjusts the light emittance power of the LED.

This enables detection of objects by adjusting the emitter power when the received light amount is too high to judge (saturation state) or when the received light amount is too low, regardless of the presence of objects.


MEMO

- Saturation refers to the situation where the object cannot be detected because there is no difference in the light amounts with and without an object due to the received light amounts being too large.
- Saturation is likely to occur with through-beam fiber units when they are installed at an extremely close range between the emitter and receiver. For diffused reflection fiber units, saturation is likely to occur when the distances to both the object and the background are extremely close.

Selectable Options

Emitter power can be selected from 3 levels (Max/Mid/Min).

When set to "Auto", the emitter power can be adjusted automatically.

Selectable option	Function description
Max (default value)	Set emitter power to Max.
Mid	Lower emitter power than Max.
Min	Set emitter power to Min.
Auto	Adjust the emitter power so that the received light amount is around "5000". The emitter power is automatically adjusted in the following two steps. 1st step: When the setting is changed to "Auto". 2nd step: When "Teach function" is executed. For the mechanism of automatic adjustment of emitter power, see  "Automatic adjustment operation when set to "Auto"" (page 4-18)

CAUTION

If the emitter power is changed, the received light amount will be also changed, so re-set (teach) the threshold.

■ Automatic adjustment operation when set to "Auto"

When "Emitter power" is set to "Auto", the emitter power is adjusted in the following two steps.

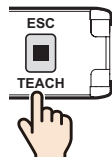
1

When set to "Auto".



2

When "Teach function" is executed.



1 Adjustment of received light amount when set to "Auto"

When set to "Auto", the emitter power is adjusted so that the received light amount is around "5000".

CAUTION

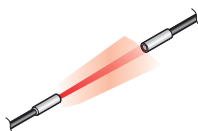
To execute the teach function with "Auto", follow the procedure below.

1. Install the fiber unit and fiber amplifier.
2. Set "Emitter power" to "Auto".
3. Execute the teach function with "Auto".

(The emitter power is not adjusted when "Teach function" is executed for these teach modes.)

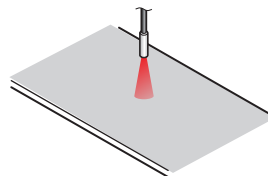
● Example 1: High or saturated received light amount

Through-beam



Saturation occurs because the distance between the emitter and the receiver fiber units is close and the emitter power is high.

Diffuse reflective



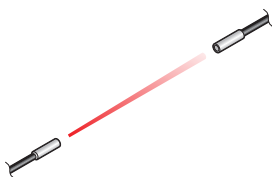
Saturation occurs because both the distance to the object and the background are close and the emitter power is high.

If the emitter power is changed from "Max" to "Auto", the received light amount will be around "5000" in all cases of A, B, and C below.

Received light amount	Case A	Case B	Case C	
Before setting with "Auto"	9999	9000	8000	← Received light amount is saturated or high
	↓	↓	↓	
After setting with "Auto"	5000	5000	5000	← The emitter power is adjusted so that the received light amount is displayed around "5000".

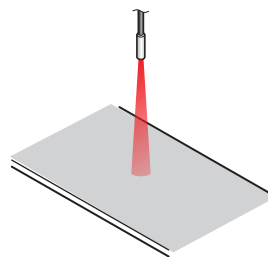
● Example 2: Low received light amount

Through-beam



The received light amount is low because the distance of the emitter and the receiver fiber units is long, and the emitter power is weak.

Diffuse reflective



The received light amount is low because the distance between the fiber unit and the background is far and the emitter power is weak.

If the emitter power is changed from "Mid" or "Min" to "Auto", the received light amount will be around "5000" in all cases of A, B, and C below.

Received light amount	Case A	Case B	Case C	
Before setting with "Auto"	50	100	500	← Received light amount is low
	↓	↓	↓	
After setting with "Auto"	5000	5000	5000	← The emitter power is adjusted so that the received light amount is displayed around "5000".

CAUTION

If the emitter power setting is set to "Max" but the received light amount is low, the power cannot be adjusted even if it is set to "Auto".

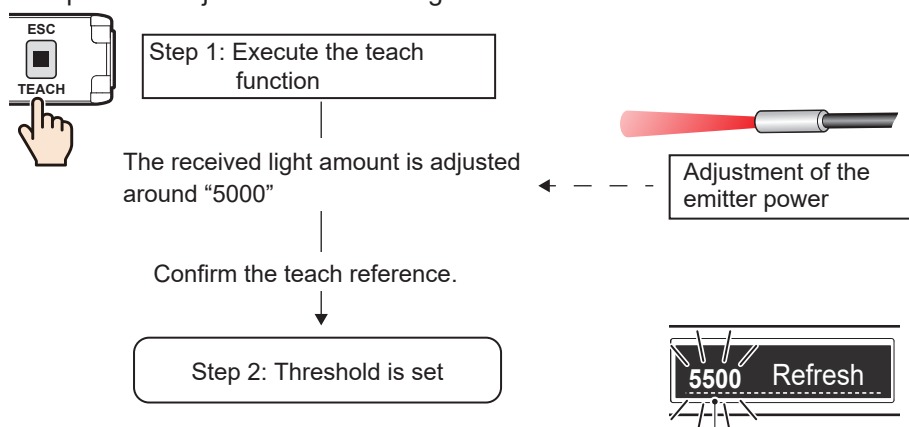
2 Automatic adjustment of the received light amount when “Teach function” is executed

The automatic adjustment of the emitter power during teaching differs depending on the teach mode as follows.

Teach mode	Automatic adjustment of emitter power
1 point Through 1-point Zone	The emitter power is adjusted after teaching.
2 points 2-point Zone	The emitter power is adjusted after teaching of the first point.
Auto	The emitter power is not adjusted after teaching.

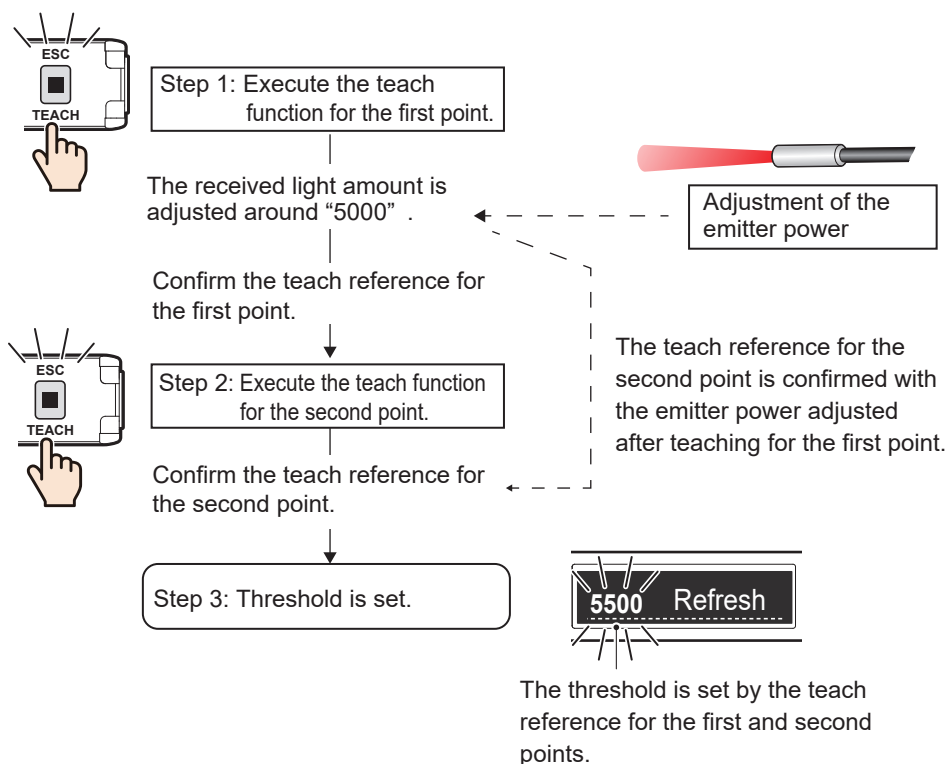
● For 1 point, Through and 1-point Zone

The emitter power is adjusted after teaching.



● For 2 points and 2-point Zone

The emitter power is adjusted after teaching of the first point.



● For Auto

The emitter power is not adjusted at teaching.

The threshold is set by the adjusted emitter power when the emitter power is set to "Auto".

CAUTION

To execute the teach function with "Auto", follow the procedure below.

1. Install the fiber unit and fiber amplifier.
2. Set "Emitter power" to "Auto."
3. Execute the teach function with "Auto"

(The emitter power is not adjusted when "Teach function" is executed for these teach modes.)


4-7 [S6] I/O

This function configures the settings of external input/output.

4-7-1 [S6] - [O1] Pin 2 setting

This assigns the (I/O) function of the white wire.

Selectable Options

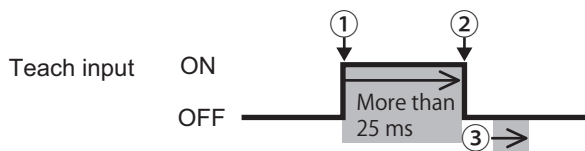
Selectable option	Function description
Teach input	Sets as an external input for teach.
Emitter off	Sets as an external input to turn off the emitter.
Zero reset	The current received light amount is displayed as zero. For details on zero reset, refer to “  “4-5-6 [S4] - [P6] Zero reset” (page 4-11).
Trigger	Output is enabled only while the external input is ON. The delay time set in Timer becomes effective.
Not used	Prevents the white wire (connector pin [2]) from being used as control output or external input.

Input timing of teach input

To execute the teach function via external input, follow the instructions below.

- “1 point” and “Through” teach modes

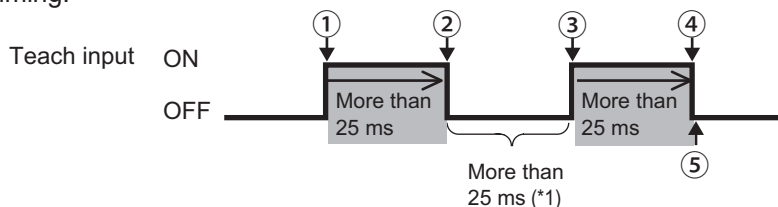
In the teach menu, select a teach mode to execute, and then enter an input at the following timing.



- ① Enter the teach input for 25 ms or more.
- ② Turn off the input.
- ③ At the point of input off, teach is executed to set a threshold. (this completes the execution of the teach function).

- “2 points”, “Auto”, “2-point Zone”, and “Analog 2-point” teach modes

On the teach menu, select the teach mode to execute, and then enter the teach input at the following timing.



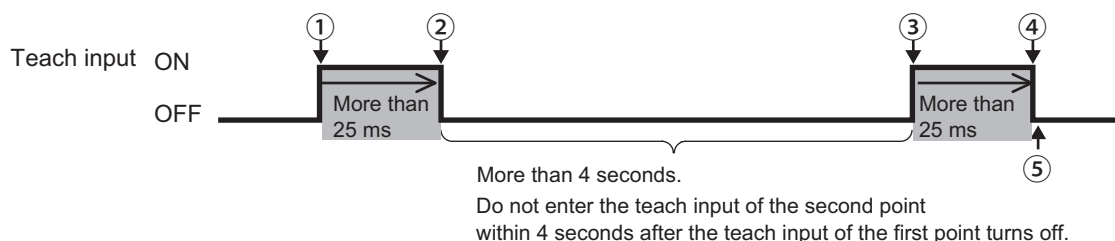
- ① Enter the teach input of the first teach point for more than a 25 ms .
- ② Turn off the teach input.
At the point of input off, the teach is executed to set a threshold of the first teach point.
- ③ After turning off the teach input of the first point, enter the second point after 25 ms or more(*1).

④ Turn off the teach input.

⑤ At the point of input off, the teach function is executed to set a threshold of the second point (this completes the execution of the teach function).

*1: When "Emitter power" is set to "Auto," time is required to adjust the emitter power.

Therefore, the teach input of the second point should be entered at least 4 seconds after the first point is turned off.



① Enter the teach input of the first point for more than 25 ms.

② Turn off the teach input.

At the point of input off, the teach function is executed to set a threshold of the first point.

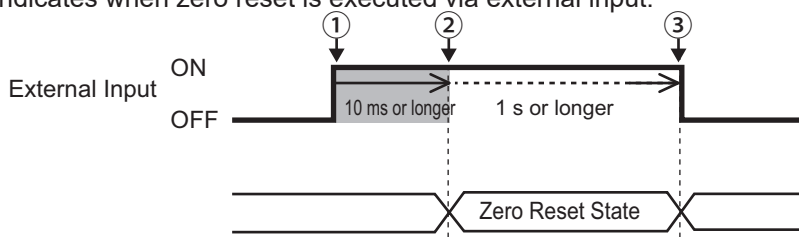
③ After turning off the teach input of the first point, enter the second point after 4 s or more.

④ Turn off the teach input.

⑤ At the teach input off, the teach function is executed to set a threshold of the second point (this completes the execution of the teach function).

■ Timing of Zero Reset

Indicates when zero reset is executed via external input.



① Turn the external input ON.

② Zero reset is executed when the external input remains ON for 10 ms or longer.

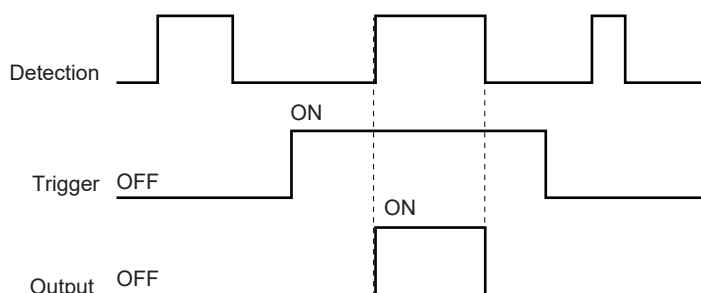
③ After the external input remains ON for 1 s or longer, switching it from ON to OFF cancels the zero reset.

■ Output Timing via Trigger

Output remains ON only while the external input is ON.

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When a timer is set, output timing follows the timer settings.



4-7-2 [S6] - [O2] Lock mode

This sets the target settings of this product to be locked.

For details on the Lock function, refer to  “3-6-3 Lock Function” (page 3-32).

4-8 [S7] Information


This displays the information of this product.

Selectable option	Function description
[S7] - [I1] Serial number	Displays manufactured time.
[S7] - [I2] Firmware ver.	Displays firmware version.

4-9 [S8] Reset



This initializes the settings of this product to the factory defaults.

For details on this function and how to set it, refer to  “3-7-4 [S8] Reset” (page 3-45).



5

Troubleshooting

This section describes error displays and countermeasures for errors that occur during product use.

5-1 Error Displays

This section provides countermeasures for errors displayed during the execution of the teach function.



Error display	Cause	Countermeasure
Teach error 1 (Output indicator blinks in orange.)	While executing the teach function, the received light amount is too small to set the threshold.	<p>To increase the received light amount, carry out the following countermeasures.</p> <ul style="list-style-type: none"> • Check whether the fiber unit has been inserted correctly. • Select "Response time" to be a longer mode. (page 3-38) • If using the product with "Power adjust" lowered, increase the power. (page 4-17) • Reduce the distance between the object and the fiber unit. (When using a diffuse reflective fiber unit.) • Accurately adjust the light axis of the emitter and receiver of the fiber unit. (When using a through-beam fiber unit.)
Teach error 2 (Output indicator blinks in orange.)	<p>While executing the teach function, the received light amount is too large to set the threshold (the saturated status). Possible causes are as follows.</p> <p><When using a diffuse reflective fiber unit></p> <ul style="list-style-type: none"> • The background is too close to the fiber unit. • Too much light is reflected from the background. • "Power adjust" is too high. <p><When using a through-beam fiber unit></p> <ul style="list-style-type: none"> • The emitter and receiver of the fiber unit are too close. • "Power adjust" is too high. 	<p>To avoid the saturated status, lower the received light amount by carrying out the following countermeasures.</p> <ul style="list-style-type: none"> • Set "Power adjust" to "Auto" or lower, and then retry the teach. (page 4-17) • Increase the distance between the object and the fiber unit. (When using a diffuse reflective fiber unit.) • Increase the distance between the emitter and receiver of the fiber unit. (When using a through-beam fiber unit.)
Teach error 3 (Output indicator blinks in orange.)	<p>While executing the teach function of 2-point mode, the difference between the received light amounts of the first and second points was too small to set the threshold. Possible causes are as follows.</p> <p><When using a diffuse reflective fiber unit></p> <ul style="list-style-type: none"> • The difference in received light amounts with the object not present (the background) and present was too small. <p><When using a through-beam fiber unit></p> <ul style="list-style-type: none"> • With an object present, the received light amount does not decrease because the object does not block the light sufficiently. 	<ul style="list-style-type: none"> • Check whether light is received for the first point and is not received for the second point during execution of the teach function. (It is also possible to execute the teach function with light not received for the first point and received for the second point.) • To increase the difference in received light amounts for the first and second points, adjust the settings during the execution of the teach function. <p><When using a diffuse reflective fiber unit></p> <ul style="list-style-type: none"> • Reduce the distance between the object and the fiber unit. • Increase the distance between the background and the fiber unit. • Avoid backgrounds that reflect a large amount of light. <p><When using a through-beam fiber unit></p> <ul style="list-style-type: none"> • Adjust the product and the object to block the light sufficiently.

Error display	Cause	Countermeasure
Teach error 4 (Output indicator blinks in orange.)	While executing the teach function of the 2-point Zone the difference between the received light amount from the first and second teach functions was too small to set the thresholds.	Increase or decrease the distance to the object when setting one of the thresholds. (When using a diffuse reflective fiber unit.)
	While executing the teach function with the 1-point Zone teach mode, the set margin was too small or the received light amount was too small to set the thresholds.	Increase the received light amount by decreasing the distance to the object (when using a diffuse reflective fiber unit). Alternatively, set the margin to a larger value.

5-2 Errors and Countermeasures

This section provides countermeasures for errors that occur during product use.

Error		Cause	Countermeasure
LED indicator	Power indicator (green) does not illuminate.	The supply voltage is insufficient or unstable.	Check whether the provided supply voltage is stable.
OLED display	Nothing appears on the OLED display. All information that appears on the OLED display disappears.	Power is not being supplied correctly.	Correctly apply the supply voltage to the product. Brown wire: 10 to 30 VDC Blue wire: 0 V
		“Eco mode” is set to “On”. (When the power indicator illuminates in green while the OLED display turns off)	Set “Eco mode” to “Off”. (page 4-11)
Operation	“Key Locked” appears on the OLED display and operation via keys and external input is not possible.	Key operations are locked by the “Lock” function, preventing the product from accepting operations.	Hold down both the [+] and [-] keys for 1 second or longer. When the “Lock” function is released, “Unlock” is displayed. (page 3-32)
	The output indicator blinks in orange, and key operation is not possible.	Execution of the teach function via external teach input is in progress, preventing the product from accepting operations.	Check for short-circuits or causes of short-circuits on the white wire.
Detection	Detection is made (the output indicator illuminates in orange) even though no object is present.	<ul style="list-style-type: none"> The threshold setting is too low or the sensing distance is too far. (When using a diffuse reflective fiber unit.) The threshold setting is too high or the sensing distance is too near. (When using a through-beam fiber unit.) 	<ul style="list-style-type: none"> Increase the threshold. (When using a diffuse reflective fiber unit.) Decrease the threshold. (With a through-beam fiber unit.)
		The background reflects a large amount of light. (With a diffuse reflective fiber unit.)	Prevent excessive light reflected from the background. (For example, change the installation positions, or paint the background black.)
		The manual adjustment of threshold with the [+] and [-] keys is not correct.	Readjust the threshold with the [+] and [-] keys or execute the teach function again to set the threshold to the correct value.

Error		Cause	Countermeasure
Detection	Detection is made (the output indicator illuminates in orange) even though no object is present.	Light from an adjacent fiber unit is received.	<ul style="list-style-type: none"> If all fiber amplifiers connected to adjacent fiber units are D12Rs, setting "Interf. Avoid." differently for each fiber amplifier enables detection without cross talk. (See Section  "4-6-2 [S5] - [D2] Interf. Avoid. (Cross Talk Prevention)" (page 4-15). Install adjacent fiber units with sufficient space between them. Also, install the fiber units so that the emitters and receivers alternate. (With a through-beam fiber unit.)
	Detection is not made (the output indicator [orange] turns off) even though an object is present.	<ul style="list-style-type: none"> The threshold setting is too high or the sensing distance is too short. (With a diffuse reflective fiber unit.) The threshold setting is too low or, in the case with a transparent object, the transparency is too high. (With a through-beam fiber unit.) 	<ul style="list-style-type: none"> Decrease the threshold. (With a diffuse reflective fiber unit.) Increase the threshold. In the case of highly transparent objects, replace the fiber unit with a retro-reflective fiber unit. (With a through-beam fiber unit.)
		The manual adjustment of threshold with the [+] and [-] keys is not correct.	Readjust the threshold with the [+] and [-] keys or execute the teach again to set the threshold to the correct value.
		Reflected light from an object with high reflectivity is oblique to the optical axis, thus it does not reach a receiver. (With a diffuse reflective fiber unit.)	Change the installation position and angle so that the light axis is perpendicular to the object.
		The fiber wires are inserted to the product incorrectly or the fiber cores are broken.	If the fiber wires are broken, replace the fiber unit.
		Light from an adjacent fiber unit is received.	<ul style="list-style-type: none"> If all fiber amplifiers connected to adjacent fiber units are D12Rs, setting "Interf. Avoid." differently for each fiber amplifier enables detection without cross talk. ( "4-6-2 [S5] - [D2] Interf. Avoid. (Cross Talk Prevention)" (page 4-15) Install adjacent fiber units with sufficient space between them. Also, install the emitters and receivers of fiber units alternately. (With a through-beam fiber unit.)

Error		Cause	Countermeasure
Detection	Detection is not made (the output indicator [orange] turns off) even though an object is present.	The hysteresis value is too small to maintain on output.	The hysteresis value is too small to maintain on output. (page 4-13)
	When the timer function is not in use, output turns off while an object is present.	The change in the light reflected from the object is larger than the hysteresis value. (With a diffuse reflective fiber unit.)	Increase the "Hysteresis" value. (page 4-13)
	There is a large gap in the received light amounts to turn the output on and off.	The set "Hysteresis" value is too large.	Decrease the "Hysteresis" value. (page 4-13)
Output	Output cannot be sent to a PLC or relay.	The output wiring is not correct.	Refer to the I/O circuit diagrams in this manual and connect the output wire correctly.
		The output pulse width is too short to be recognized by the device to be input. (For example, the "Response time" setting is too short.)	<ul style="list-style-type: none"> • Set "Response time" to a longer mode. (page 3-38) • Use the "Off delay" or "Pulse output" of the "Timer" setting and set the pulse width of the output signal to be recognized by the input device. (page 4-6)
	Noise, such as short-time changes of received light amount is output.	The product reacts too sensitively to changes in the amount of light received in a very short period of time.	<ul style="list-style-type: none"> • Set "Response time" to a longer mode. This prevents the product from responding to changes in received light amount in a short time. (page 3-38) • Use the "On delay" "Timer" setting so that output is only generated when detection is made for the set time or longer. (page 4-6)
Received light amount	The received light amount fluctuates.	<ul style="list-style-type: none"> • The received light amount is greatly affected by environmental changes and vibrations. • The ambient temperature changes greatly. • The received light amount is affected by the surface conditions of the object (such as unevenness). (With a diffuse reflective fiber unit.) 	<ul style="list-style-type: none"> • Adjust the installation environment. • Set Response time to a longer mode. (page 3-38)

Error		Cause	Countermeasure
Received light amount	The received light amount is insufficient.	<ul style="list-style-type: none"> • The emitter or receiver surfaces of fiber unit gets dirty. • The sensing distance (through-beam: distance between the emitter and receiver of fiber unit, diffuse reflective: distance to the object) is set too far. • The light axis is misaligned. (With a through-beam fiber unit.) 	<ul style="list-style-type: none"> • Clean the dirt without damaging the tip. • Review the distance and environment of installation and adjust the light axis. • If the Power adjust is set to "Min", set it to "Mid". If it is set to "Mid", set it to "Max". (page 4-17) • Set "Response time" to a longer mode. (page 3-38)
	Even when an object blocks the light, the displayed received light amount does not change from the maximum value (such as "9999").	The received light amount is saturated.	<ul style="list-style-type: none"> • Install the emitter and receiver of the fiber unit at a longer distance. (With a through-beam fiber unit.) • Install the fiber unit at a longer distance from the object. Also, set a longer distance between the object and background. (With a diffuse reflective fiber unit.) • Set "Power adjust" to "Auto" and execute the teach function again. (page 4-17) • Set "Response time" as short as possible. (page 3-38)
	The received light amount does not change regardless of object presence.	"Hold display" is On and the amount of received light is not displayed in real time, but the peak value or bottom value is displayed.	Hold down the [-] key and [OK/MENU] key for 1 second or longer to turn off the "Hold display". (page 3-40)
	The amount of received light is displayed as a negative (-) number.	The "Zero reset" function is enabled.	Set "Zero reset" to "Not used". (page 4-11)
Other	As details of the settings are not known, they need to be reset.	—	Execute the "Factory reset" of the Reset to initialize the settings. (page 3-45)



6

Appendix

This section contains information such as the specifications and factory default settings.

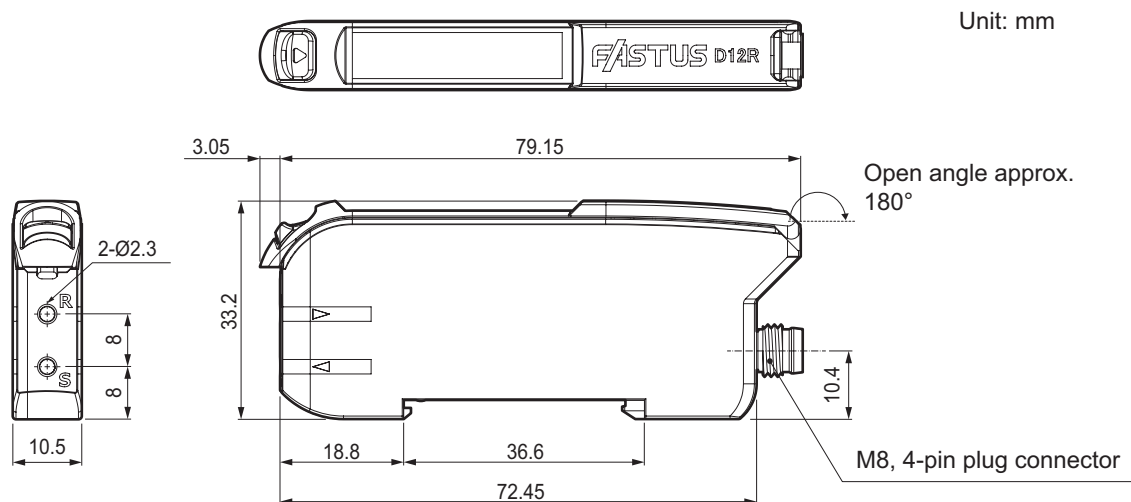
6-1 Specifications

6-1-1 Fiber-Optic Sensor Specifications

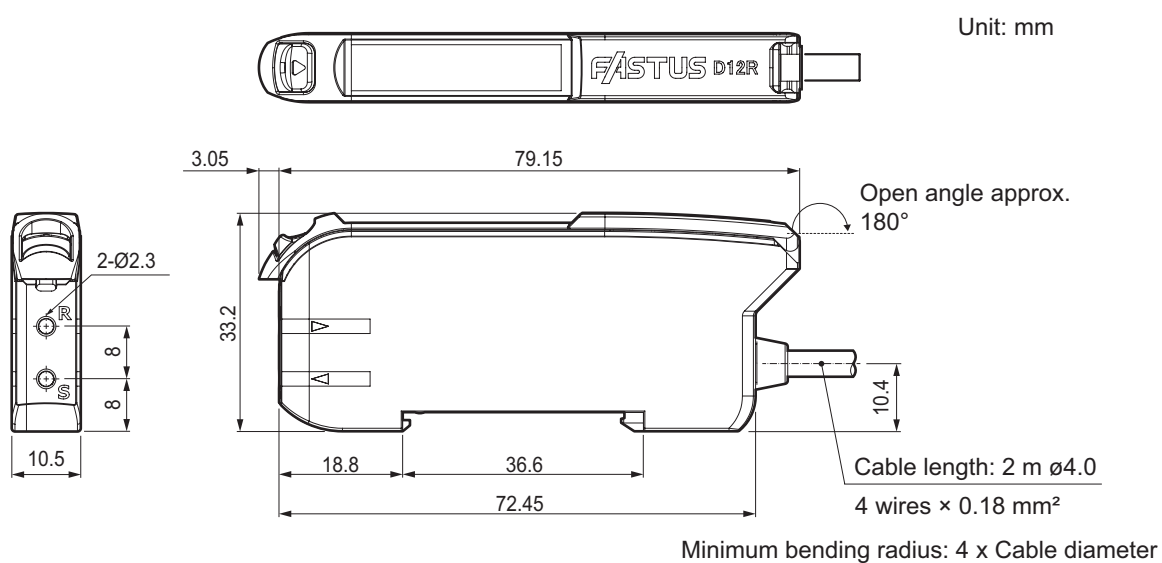
Type		Cable type	Connector type
Model	NPN	D12R-TN	D12R-TNC4
	PNP	D12R-TP	D12R-TPC4
Light source		4-element Red LED (Wavelength: 660 nm)	
Response time		50 μ s, 250 μ s, 1 ms, 4 ms	
Teach mode		1 point, 2 points, Auto, Through, 1-point Zone, 2-point Zone, Manual	
Display	Digital display	OLED display 128 x 22 pixel	
	Indicators	Menu languages: English, Japanese, Traditional Chinese Output indicator (orange), Power indicator (green)	
Timer function	Function	On delay, Off delay, On/off delay, Pulse output, On delay pulse	
	Time	Adjustable 0.1 ... 30,000 ms	
Control output		NPN/PNP, open collector Max. 100 mA/30 VDC residual voltage 1.8 V or less	
Output mode		Light ON/Dark ON, selectable by setting	
External input		Teach input, Emitter off, Zero reset, Trigger	
Protection circuit		Reverse polarity protection, Output overcurrent protection, Output short circuit protection	
Connection		2m Cable, 4 wires Minimum bending radius: 4 x Cable diameter	M8 4-pin plug connector
Interference prevention quantity		Up to 4 units (frequency-selective)	
Supply voltage		10 ... 30 VDC \pm 10 % including 10 % ripple (p-p)	
Current consumption	Eco mode: Off	42 mA or less at 10 VDC, 19 mA or less at 30 VDC	
	Eco mode: On	30 mA or less at 10 VDC, 15 mA or less at 30 VDC	
Warm-up time		300 ms	
Applicable regulations	EMC	EU EMC directive (2014/30/EU) UK directive EMC (The Electromagnetic Compatibility Regulations 2016) FCC Part 15 subpart B	
	Environment	EU RoHS directive (2011/65/EU) UK RoHS (The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012) China RoHS (MIIT Order No. 32)	
Applicable standards		EN/IEC 60947-5-2	
NRTL certification		UL Recognized Component certification for the US and Canada	UL Listed certification for the US and Canada
Environmental resistance	Ambient illuminance	Sunlight: 67,000 lx or less, Incandescent light: 99,000 lx or less LED lighting (DC light): 16,000 lx or less	
	Ambient temperature/humidity	-25 ... 55 °C/35 ... 85 % RH (no freezing or condensation)	
	Storage temperature/ humidity	-40 ... 70 °C/35 ... 85 % RH (no freezing or condensation)	
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm 2 hours in each X, Y, Z directions	
	Shock resistance	500 m/s ² 3 times in each X, Y, Z directions	
	Degree of protection	IP50 (IEC 60529)	
Material		Housing, cover: PC	
Weight		Approx. 72 g	Approx. 25 g

6-1-2 Dimensions

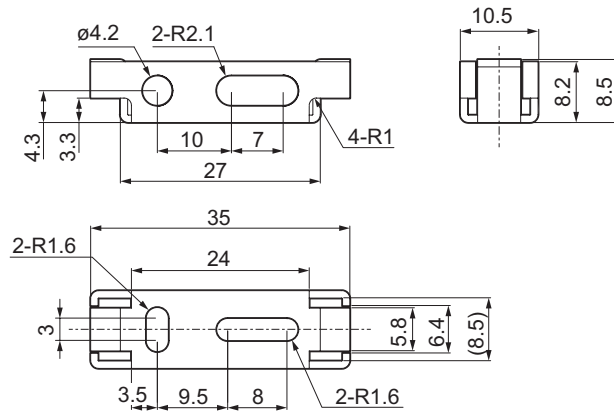
■ Connector type (D12R-TNC4, D12R-TPC4)



■ Cable type (D12R-TN, D12R-TP)

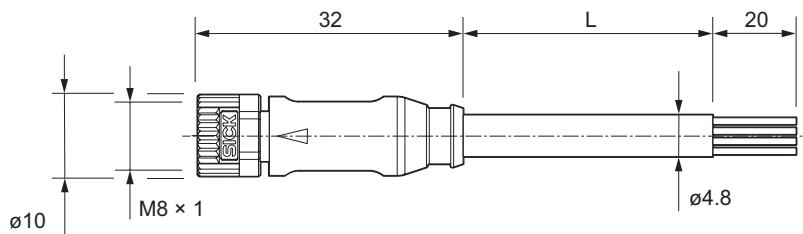


■ Mounting Bracket (BEF-001; Optional)



■ Straight Connector Cable (Optional)

● M84CN-2S, M84CN-5S, M84CN-10S



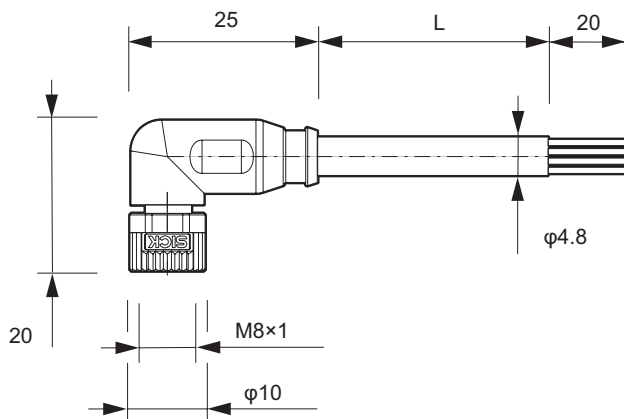
Unit: mm

L = 2000 (M84CN-2S)
= 5000 (M84CN-5S)
= 10000 (M84CN-10S)

Cable material: PVC, conductor cross-section: 4-wire × 0.25 mm²

Minimum bending radius: 24 mm (when fixed in place)

● M84CN-2L, M84CN-5L, M84CN-10L



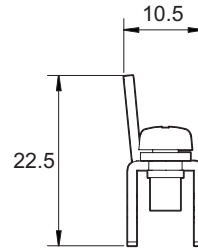
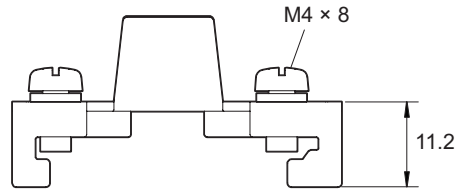
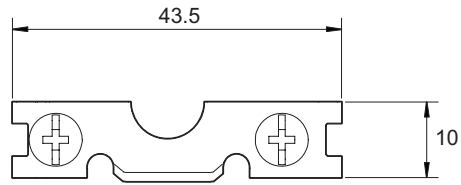
Unit: mm

L = 2000 (M84CN-2S)
= 5000 (M84CN-5S)
= 10000 (M84CN-10S)

Cable material: PVC, conductor cross-section: 4-wire × 0.25 mm²

Minimum bending radius: 24 mm (when fixed in place)

■ End Plate (BEF-002; Optional)



6-2 Initial Settings List

This section describes the factory default settings of this product.

When this product is reset ([S8] Reset - [S8] Factory reset/Setting reset), the settings return to the parameters listed below.

Main menu		Sub menu		Default value	Description
S1	Output mode (N.O./ N.C.)	—		Light on	Page 4-4
S2	Response time			250 μs	Page 4-5
S3	Timer			Not used	Page 4-6
S4	Display	P1	Display mode	Value	Page 4-8
		P2	Hold display	Off	Page 4-9
		P3	Brightness	100%	Page 4-9
		P4	Rotate display	Off	Page 4-10
		P5	Invert display	Off	Page 4-10
		P6	Zero reset	Not used	Page 4-11
		P7	Eco mode	Off	Page 4-11
		P8	Language	English	Page 4-12
S5	Detection	D1	Hysteresis	Level2	Page 4-13
		D2	Interf. Avoid.	Off	Page 4-15
		D3	ASC	Off	Page 4-16
		D4	Power adjust	Max	Page 4-17
S6	I/O	O1	Pin 2 setting	Teach input	Page 4-22
		O2	Lock mode	Lock all	Page 4-24



Attention: Not to be Used for Personnel Protection.

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.

These sensors do not include the self-checking redundant circuitry necessary to allow their use in personnel safety applications.

A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Please consult our distributors about safety products which meet OSHA, ANSI and IEC standards for personnel protection.

- Specifications are subject to change without prior notice.
- Specifications and technical information not mentioned here are written in Instruction Manual. Or visit our website for details.
- All the warnings and cautions to know prior to use are given in Instruction Manual.

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The information in this user's manual is correct as of November 2025

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