KEYENCE

731GB

* 7 3 1 G B – 3 *

Digital Fiberoptic Sensor
FS-N40 Series
User's Manual

Read this manual before using the product in order to achieve maximum performance.
Keep this manual in a safe place after reading it so that it can be used at any time.

■ Symbols

The following symbols are used in this manual to enable the recognition of important information at a glance. Be sure to read these messages carefully.

DANGER	**It indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
WARNING	**It indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
CAUTION	**It indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**It indicates a situation which, if not avoided, could result in product damage as well as property damage.**

Point **It indicates additional information on proper operation.**

Reference It indicates tips for better understanding or useful information.

Safety Precautions

DANGER	• **This product is only intended to detect objects. Do not use this product for the purpose of protecting a human body or a part of a human body.** • **This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.**
WARNING	• **This is a direct current (DC) power supply type sensor. Application of an alternating current (AC) may result in explosion or fire.**
NOTICE	• **Use separate conduits for power lines and high-voltage lines. Use of a common conduit may result in device malfunction due to noise or damage to the sensor.** • **Always ground the frame ground terminal when using an off-the-shelf switching regulator.** • **Do not use this product outdoors.**

Precautions on Regulations and Standards

■ CE Marking

KEYENCE Corporation has confirmed, on the basis of the following specifications, that this product complies with the essential requirements of the applicable EU Directive(s). Be sure to consider the following specifications when using this product in the member states of the European Union.

● EMC Directive, applicable standard: EN60947-5-2, Class A

Ensure that the cable length is 30 meters or less.
These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of the EMC Directive. The manufacturer of the end-product is solely responsible for confirming the compliance of the end-product itself according to the EMC Directive.

■ UL Certificate

This product is a UL/c-UL certified product.
- UL File No.: E301717
- Category: NRKH/NRKH7 (NRKH2/NRKH8: FS-N42N(P))
- Enclosure Type 1 (based on UL50)

Be sure to consider the following specifications when using this product as a UL certified product.
- Use a power supply with Class 2 output defined in NFPA70 (NEC: National Electrical Code).
- Connect the power supply, external input, and control output to a single power supply with Class 2 output.
- Use the OP-73864, OP-73865, or OP-85498 cable with FS-N41C when field wiring is required.

Table of Contents

1. Before Operation

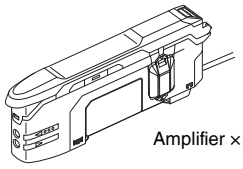
This section outlines the package contents and identifies part names and functions.

1-1 Package Contents

Before using the device, make sure that the following equipment and accessories are included in the package.
We thoroughly inspect the package contents before shipment; however, in the event of defective or broken items, contact the nearest KEYENCE office.

Reference The FS-N40 Series is an amplifier. Each amplifier unit must be used with a separately sold fiber unit. This allows for the selection of a fiber unit that best suits the intended application.

FS-N40 Series

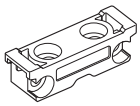


Amplifier × 1

Instruction manual × 1

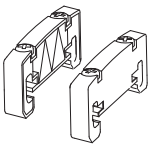
■ List of optional parts (sold separately)

OP-88245



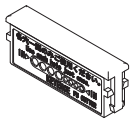
Amplifier mounting bracket (for main unit) × 1
"2-1 Installing Amplifiers" (page 3)

OP-26751



End unit × 2
"2-1 Installing Amplifiers" (page 3)

OP-87098



Fiber cutter × 1
"2-2 Fiber Unit Installation" (page 3)

OP-73864

M8 connector cable (2 m) × 1
Input/output cable for the FS-N41C

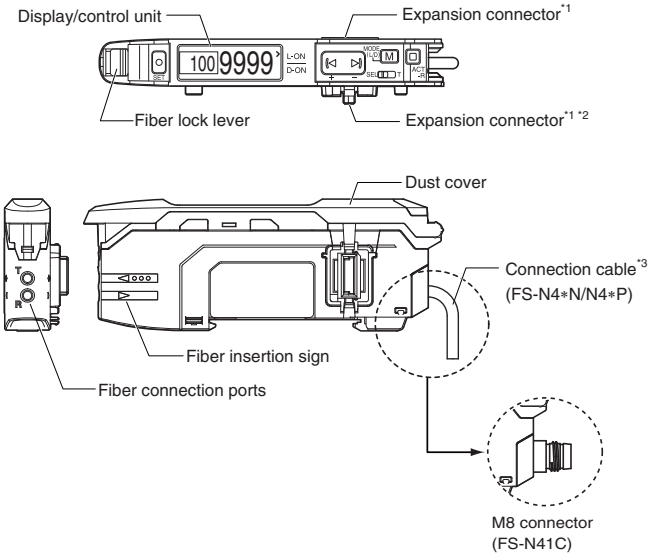
OP-73865

M8 connector cable (10 m) × 1
Input/output cable for the FS-N41C

OP-85498

M8 extension connector cable (2 m) × 1

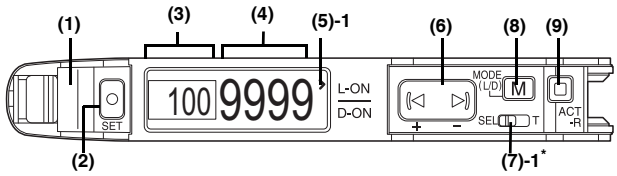
1-2 Part Names



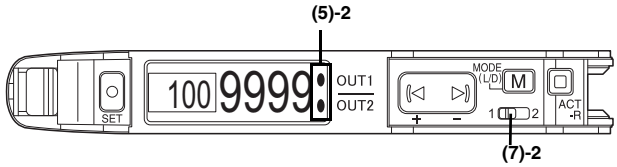
*1 A protective cover is installed over the expansion connector prior to shipment.
*2 Not available on the main unit type.
*3 There is no connection cable on the zero line type (FS-N40).

■ Display/control unit

Single output/zero line: FS-N41N/N42N/N41P/N42P/N40



Dual output: FS-N41C/N43N/N44N/N43P/N44P



Item		Description
(1)	Output indicator	Indicates the current output (detection) status. On dual output types (including the FS-N41C), the indicator operates according to the output channel selected with the output channel selection switch.
(2)	SET button	Used to perform calibration. "3-5 Setting the Sensitivity" (page 5)
(3)	Setting value display	Displays the setting value (detection threshold).
(4)	Current value display	Displays the current value (received light intensity).
(5)-1	L/D ON setting status indicator	Indicates whether light ON (L-ON) or dark ON (D-ON) is selected.
(5)-2	Output indicators	Indicates the output (detection) status of channel 1 (output 1) and channel 2 (output 2).
(6)	Manual adjustment button	Used to adjust the setting value or select an option.
(7)-1	Output channel selection switch*	Changes the power mode. SEL: Eight power modes are selectable. "Power Modes" (page 10) T: Fixes the power mode to "TERA mode". "3-9 Locking in TERA Mode" (page 6)
(7)-2	Channel selection switch	Toggles between channels 1 and 2 (outputs 1 and 2) for configuring the received light intensity display or sensitivity setting.
(8)	MODE button	Used for toggling light ON/dark ON, switching the language, proceeding to advanced settings, or confirming selections.
(9)	ACT-R button	Used to set the active receiver (ACT-R) function.

* Not present on zero line types (FS-N40).

1-3 Model Number Description

The numbers and letters used in product names are explained below.

FS-N4□ □
(1) (2)

(1) Amplifier type
0: Expansion unit (zero line)
1: Main unit (single output) (An additional output can be enabled on the FS-N41C)
2: Expansion unit (single output)
3: Main unit (dual output)
4: Expansion unit (dual output)
(2) Output type (cable type)
None: Zero line
N: NPN (2-meter cable)
P: PNP (2-meter cable)
C: PNP/NPN switchable (M8 connector)

Model	(1) Amplifier type	(2) Output type (cable type)
FS-N40	Expansion unit (zero line)	-
FS-N41C	Main unit (dual output/single output switchable)*	PNP/NPN switchable (M8 connector)
FS-N41N	Main unit (single output)	NPN output (2-meter cable)
FS-N41P	Main unit (single output)	PNP output (2-meter cable)
FS-N42N	Expansion unit (single output)	NPN output (2-meter cable)
FS-N42P	Expansion unit (single output)	PNP output (2-meter cable)
FS-N43N	Main unit (dual output)	NPN output (2-meter cable)
FS-N43P	Main unit (dual output)	PNP output (2-meter cable)
FS-N44N	Expansion unit (dual output)	NPN output (2-meter cable)
FS-N44P	Expansion unit (dual output)	PNP output (2-meter cable)

* When single output is selected, the operation becomes single output + single input.

2. Installation and Connection 2-1 and 2-2

This section provides procedures for installing sensor amplifiers and cables as well as operating precautions.

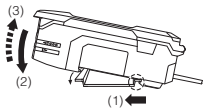
2-1 Installing Amplifiers

Mounting the Amplifier

■ Mounting the main unit on a DIN rail

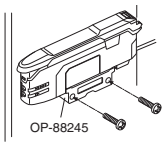
1 **Align the claw at the bottom of the main unit with the DIN rail, as shown in the figure. While pushing the main unit in the direction of arrow 1, push down in the direction of arrow 2.**

2 **To remove the sensor, raise the main unit in the direction of arrow 3 while pushing the main unit in the direction of arrow 1.**



■ Installation on a wall (main unit only)

1 **Attach the main unit to the optional mounting adapter (OP-88245), and then insert M3 screws into the two locations shown in the figure to secure the main unit in place.**



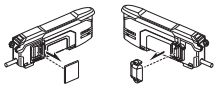
■ Connecting multiple expansion units

Up to 16 expansion units can be connected to 1 main unit. Note, each dual output type will be treated as 2 expansion units.

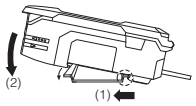
CAUTION	**When connecting to multiple amplifiers or when mounting main units together, mount the units on a DIN rail installed on a metal surface.**

NOTICE	**• Be sure to turn the power off before connecting multiple expansion units.** **• Do not touch the expansion connector.**

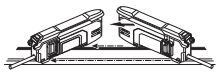
1 **Remove the expansion protective covers from the main unit and expansion unit(s).**



2 **Install the amplifiers on the DIN rail one at a time.**

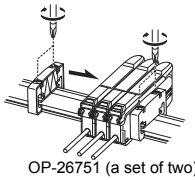


3 **Slide the main unit and expansion unit(s) together. Mate the two claws of the expansion unit with the recesses on the main unit side until a click is heard/felt.**



4 **Attach the end units (optional, sold separately: OP-26751) to the DIN rail on both sides of the amplifiers in the same way as step (2).**

5 **Secure the amplifiers between the end units. Tighten the screws from the top (two screws × two units) with a Phillips screwdriver to fix the end units in place.**



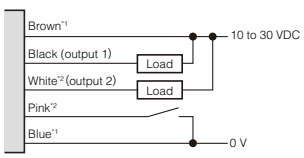
OP-26751 (a set of two)

Amplifier Wiring

NOTICE	**• Be sure to turn OFF power before wiring.** **• Insulate each input or output wire that will not be used.**

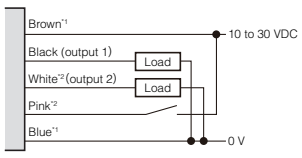
■ Wiring (cable type)

● **FS-N41N/N42N/N43N/N44N**



*1 FS-N41N/N43N only
*2 FS-N43N/N44N only

● **FS-N41P/N42P/N43P/N44P**



*1 FS-N41P/N43P only
*2 FS-N43P/N44P only

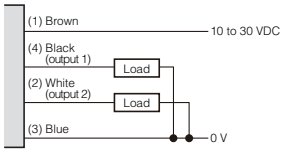
■ Wiring (M8 connector type: FS-N41C)

Select PNP or NPN and the function of I/O pin (2) during the initial settings.

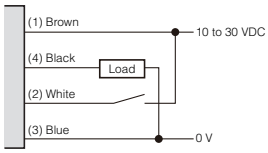
Sensor pin layout

● **When using the sensor in PNP mode**

OUT1 + OUT2

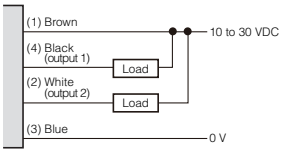


OUT1 + INPUT

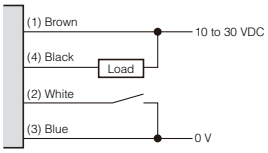


● **When using the sensor in NPN mode**

OUT1 + OUT2



OUT1 + INPUT



The wire colors indicate the colors when using an OP-73864/73865 M8 connector cable (sold separately).

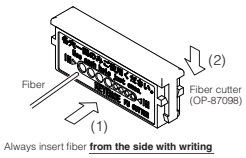
2-2 Fiber Unit Installation

This section provides procedures for connecting the fiber unit and operating precautions.

■ Using a fiber cutter

1 **Insert the fiber into the cutter hole.**

2 **Bring down the blade in a single, swift motion to cut the fiber. (Do not use a hole that has already been used.)**

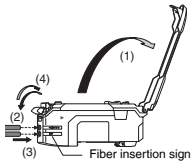


■ Connecting to the amplifier unit

1 **Open the cover (1), and then lower the lever in the direction indicated by (2).**

2 **Insert the fiber unit into the installation holes (approximately 14 mm). (3)**

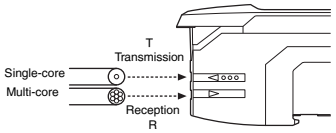
3 **Move the lever back in the direction indicated by (4).**



NOTICE	**• If a thin fiber unit is used, an adapter provided with the fiber unit will be required.** **Make sure to use the adapter that matches the fiber unit.**

Cable outer diameter	Adapter	Appearance
ø1.3	Adapter A (OP-26500)	
ø1.0	Adapter B (OP-26501)	

• When installing a coaxial reflective fiber in the main unit, install the single-core fiber in the transmission (T) installation hole and the multi-core fiber in the reception (R) installation hole.

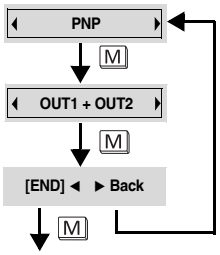


3. Basic Operation 1/4 — 3-1 to 3-4

This section explains basic instructions for operating and setting the sensor amplifier.

3-1 Initial Settings (FS-N41C Only)

When turning ON the FS-N41C for the first time or when the sensor has been initialized, select the initial settings shown below.



Use [◄ ►] to select PNP or NPN.

Use [◄ ►] to select the I/O combination.
"OUT1 + OUT2"/"OUT1 + INPUT"

Use [◄ ►] to select this item.

After completion, if these settings need to be changed again, perform an initialization. (page 6)

3-2 Switching the Output Style (Light ON/Dark ON)

Select whether to turn the output ON when the receiver is lit (light ON) or is dark (dark ON).

1 Press [M] once.*1 — Switch L-On/D-On

2 Use [◄ ►] to switch the output style.*2

3 Press [M] three times.*1

*1 When using the bar or sub display, the number of times that [M] must be pressed varies.
"3-4 Top Display Transitions" (page 4)

*2 Perform no operations for 6 seconds or more or press [M] 3 times to return to the top display.

Point

- **This is used to switch between N.O. and N.C. when "Area detection", "Area % Mode", "Rising edge", or "Falling edge" is selected under "Detection Mode" (page 11).**
  "Area detection" (page 14)
  "Rising edge/Falling edge" (page 15)
- **When using a dual output type, the output style can be set individually for each output. Select the output using the channel selection switch.**

3-3 Switching the Display Language

Select the language to display from English (default setting), Japanese, Chinese, and German.

1 Press [M] twice.*1 — Language/ 语言

2 Use [◄ ►] to select the language.*2

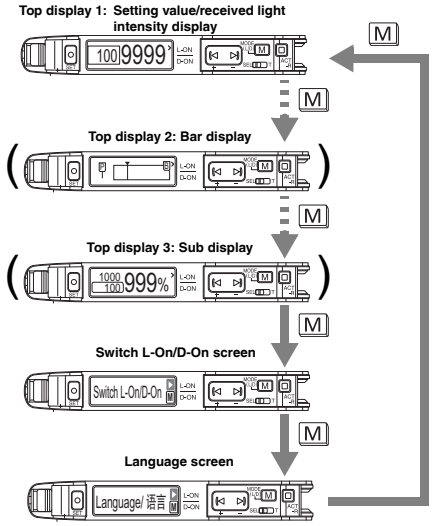
3 Press [M] twice.*1

*1 When using the bar or sub display, the number of times that [M] must be pressed varies.
"3-4 Top Display Transitions" (page 4)

*2 Perform no operations for 6 seconds or more or press [M] twice to return to the top display.

3-4 Top Display Transitions

Each time that [M] is pressed, the top display switches as shown below.
In the default state, the "bar display" screen (page 10) and "sub display" screen (page 18) are hidden.



Point

- **If no operations are performed for 6 seconds or more on the "Switch L-On/D-On" screen or "Language/语言" screen, the sensor returns to the top display that was last displayed.**
- **For dual output types, when the channel selection switch is set to channel 2, the bar display and sub display are hidden.**

3-5 Setting the Sensitivity

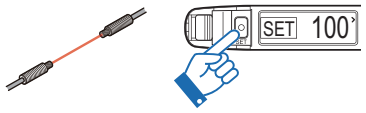
In this manual, the value at which the amplifier output switches (ON/OFF) is expressed as the "setting value". Also, adjusting the setting value is referenced as "setting the sensitivity". This section will explain how to set the sensitivity.

Usage Scenario		Sensitivity setting (calibration)	Description	Reference page
Basic	Using thrubeam/ retro-reflective/ reflective models	2-point calibration	This setting can be established just by pressing SET once when an object to detect is present and again when it is absent.	5
Other	Using the unit in an environment where the unit tends to get dirty easily	Maximum sensitivity calibration	This setting greatly reduces malfunctions even in environments where the unit tends to get dirty easily.	5
	The object to detect moves quickly	Full auto calibration	Calibration can be performed on fast-moving objects.	5
	Using the unit for positioning	Positioning calibration	A setting suitable when more precise detection is required.	5

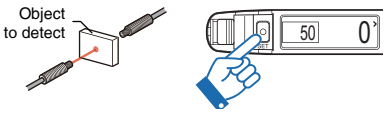
2-point Calibration

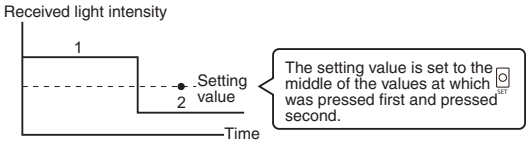
2-point calibration is the most basic method of setting the sensitivity. The setting value can be established by simply pressing SET once when the object to detect is present and once when the object to detect is absent.

1 Press SET once with no object to detect present.



2 Press SET once with the object to detect present.
Calibration is complete after the setting value flashes momentarily, and then stops (lights up).
Press ◀ ▶ to fine-tune the setting value.





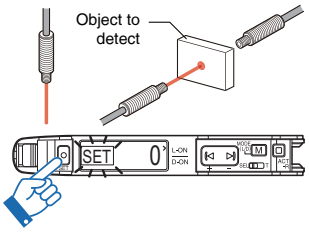
* If the difference between the two received light intensities is too small, "- - -" flashes after calibration is complete. However, a setting value will still be established.

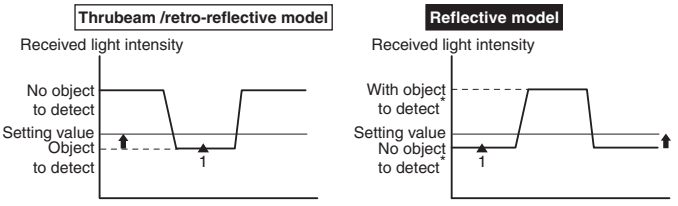
Reference Step 1 or step 2 may be performed first.
When performing 2-point calibration on channel 2 of a dual output type, set the channel selection switch to 1 2 .

Maximum Sensitivity Calibration

This sensitivity setting method is useful if the received light intensity is expected to be reduced by dust or dirt.
The setting value is set slightly higher than the received light intensity when the setting was executed.

1 For reflective models, ensure that no object to detect is present. For thrubeam/retro-reflective models, ensure that an object to detect is present. Then, hold down SET for 3 seconds or more.
Release the button when "SET" flashes.
Calibration is complete after the setting value flashes momentarily, and then stops (lights up).
Press ◀ ▶ to adjust the setting value.





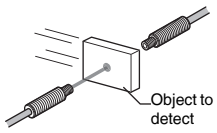
* When detecting a target that has a background, the maximum sensitivity setting can be used to ignore the background. Maximum sensitivity calibration cannot be used if the background is more reflective than the object to detect.

Reference When performing maximum sensitivity calibration on channel 2 of a dual output type, set the channel selection switch to 1 2 .

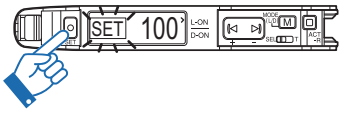
Full Auto Calibration

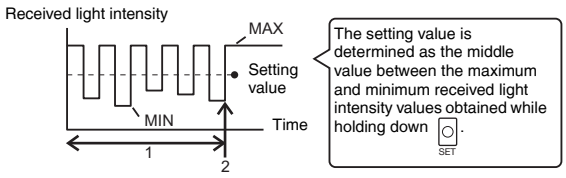
This method automatically sets the sensitivity using a moving object. The sensitivity can be set without shutting down the equipment, as it can be set by referencing a moving target.

1 While the object to detect passes the sensor, hold down SET until "SET" flashes.



2 After the object to detect has completely passed the sensor, release SET.
Calibration is complete after the setting value flashes momentarily, and then stops (lights up).



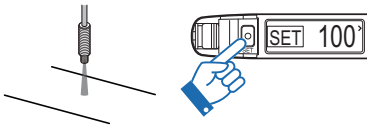


Reference
- If detection is not stable after the setting operation, due to vibration for example, press ◀ ▶ to adjust the setting value.
- When performing full auto calibration on channel 2 of a dual output type, set the channel selection switch to 1 2 .

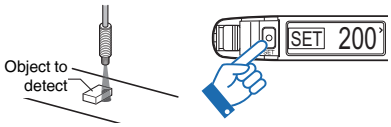
Positioning Calibration

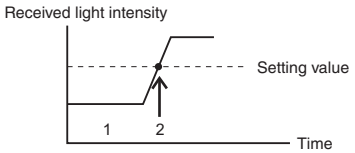
Use this method when precise position detection is necessary.

1 Press SET once with no object to detect present.



2 Position an object to detect such that its edge aligns with the center of the projecting beam. Then, hold down SET for 3 seconds or more.
Release the button when "SET" flashes.
Press ◀ ▶ to adjust the setting value.

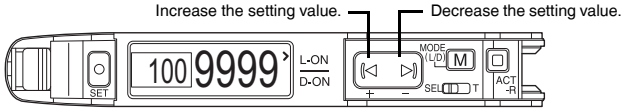




Reference When performing positioning calibration on channel 2 of a dual output type, set the channel selection switch to 1 2 .

Fine-tuning the Setting Value (Threshold)

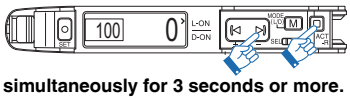
Use ◀ ▶ to adjust the setting value. Hold down either button to make adjustments more quickly.



3-6 Setting the Current Received Light Intensity Display to 0 (Zero Shift)

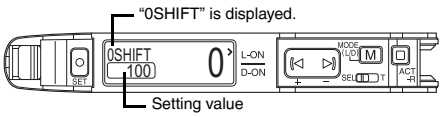
This function adjusts the current received light intensity display to "0". It is primarily used with reflective models.
If the received light intensity does not display "0" due to the background when no object to detect is present, this function can be used to shift the received light intensity to "0". This makes the difference in received light intensity easier to distinguish.

1 Press [ACT -R] and [◁ ▷] simultaneously.



Cancel: Hold down [ACT -R] and [◁ ▷] simultaneously for 3 seconds or more.

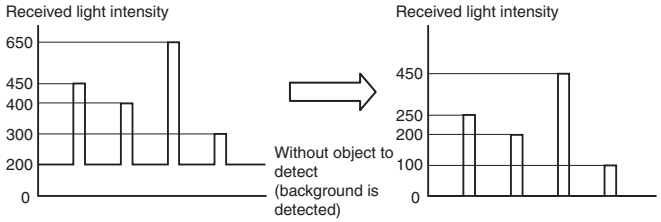
Screen display while using the zero shift function



The setting value is not shifted.

Operating Principle of the Zero Shift Function

<For reflective models>



In applications for distinguishing colors or for detecting objects on a background, the received light intensity will not be "0" even when no object to detect is present.

Applying zero shift input to the lower level of the received light intensity (with no object to detect present) enhances the detection display visibility.

Point **The zero shift function cannot be used in combination with the preset function. To use the zero shift function, first disable the preset function.**

3-7 Light Emission/Received Light Intensity Adjustment (Saturation Canceling)

When a fiber unit with high power (longer detecting distance) is used at a close range, the received light intensity may remain unchanged from the maximum value of the display-enabled range (saturated) regardless of whether an object to detect is present or not. (Example: The numerical value does not change from 9999.)
In such a case, the light emission and the received light intensity can be automatically corrected appropriately by using the saturation canceling function.

1 Press [M] and [SET] simultaneously.

Cancel: Use the same procedure.

* If the received light intensity value is very large, saturation canceling may not be possible.

3-8 Initialization

Initialize all the settings and return the sensor to its factory default state.

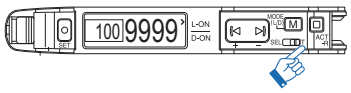
1 Hold down [SET] and [ACT -R] simultaneously for 3 seconds or more. Initialize
2 Press [M] once. Back
3 Press [◁ ▷] once. Execute
4 Press [M] once.

Reference See "8. Factory Default Settings List" (page 23).

3-9 Locking in TERA Mode

This function is available on the FS-N41N/N41P/N42N/N42P.
The sensor amplifier can be locked in TERA mode such that it always operates in the TERA power mode regardless of the "[A] Power Modes" (page 10) setting.
"Power Modes" (page 10)

1 Slide the power select switch to the "T" side.
Sliding the power select switch back to the "SEL" side restores the power mode that was set before sliding the power select switch to TERA mode.



Reference
- When the amplifier is locked in TERA mode, if "[A] Power Modes" is changed, "Keys Locked" will flash on the display, and the setting will not be changed.
  "Power Modes" (page 10)
- Likewise, when the amplifier is in the key locked state, the power mode cannot be changed, as indicated by the flashing of "Keys Locked".
  "3-10 Disabling the Key Operations" (page 6)

3-10 Disabling the Key Operations

Disable button operations.

● **When "Normal" (default setting) is selected for "Key Lock Method" (page 19)**

1 Hold down [M] and [◁ ▷] or [◁ ▷] simultaneously for 3 seconds or more.

Cancel: Use the same procedure.

● **When "PIN Key Lock" is selected for "Key Lock Method"**

1 Hold down [M] and [◁ ▷] simultaneously for 3 seconds or more.

Cancel: 1 Hold down [M] and [◁ ▷] or [◁ ▷] simultaneously for 3 seconds or more.
2 Press [◁ ▷] to specify the PIN code, and then press [M].

For details, see "Key Lock Method" (page 19).

3-11 Saving/Recalling Settings

Saving Settings

The current setting value and the advanced function settings can be saved in the amplifier.

Point **Saving the settings will overwrite the previously saved settings with the current settings.**

1 Hold down [SET] and [ACT -R] simultaneously for 3 seconds or more. Initialize
2 Press [◁ ▷] to display "Custom Save", and then press [M]. Custom Save
3 Press [◁ ▷] to display "Execute", and then press [M]. Execute

Recalling Settings

Saved settings can be recalled.

Point **Recalling settings will overwrite all of the previous settings with the saved settings.**

1 Hold down [SET] and [ACT -R] simultaneously for 3 seconds or more. Initialize
2 Press [◁ ▷] to display "Reset User", and then press [M]. Reset User
3 Press [◁ ▷] to display "Execute", and then press [M]. Execute

3-12 Changing the Fiber Unit Indicator Settings (ACT-R)

The ACT-R (active receiver) function makes the fiber unit's receiver light in green.

Operation When the Sensor Is Shipped from the Factory

When the sensor output is ON, the fiber unit's receiver lights in green. (This is linked to the output.)

To Force the Receiver to Blink in Green (Pairing Mode)

This function is useful when using multiple units. It can be used to easily check the amplifier and fiber unit combination.

1 **Press ACT-R once.** ACT-R Blinking

2 **Press ◀ ▶.**

3 **The light-receiving side blinks in green.**

4 **Press ACT-R four times to return to the normal status.**

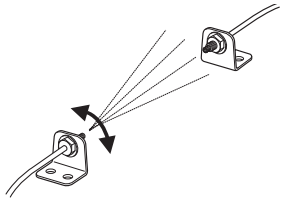
To Make it Easy to Perform Optical-axis Alignment (Optical-axis Alignment Assist Mode)

In this mode, the fiber unit indicator provides assistance during optical-axis alignment.

1 **Press ACT-R twice.** Opt Axis Assist

2 **Press ◀ ▶ to make the light-receiving side blink in green.**

3 **Move the tip of the fiber unit within the movable range.**
The light-receiving side lights in green near the peak light intensity within the range in which the tip moved.
Align the optical axis with the center of the range in which the light-receiving side lights in green.



4 **When the alignment is finished, press ACT-R three times.**
The sensor returns to the normal status.

To Change the Normal Lighting Status of the Receiver (Change the Settings)

1 **Press ACT-R three times.** Active Rec. Set

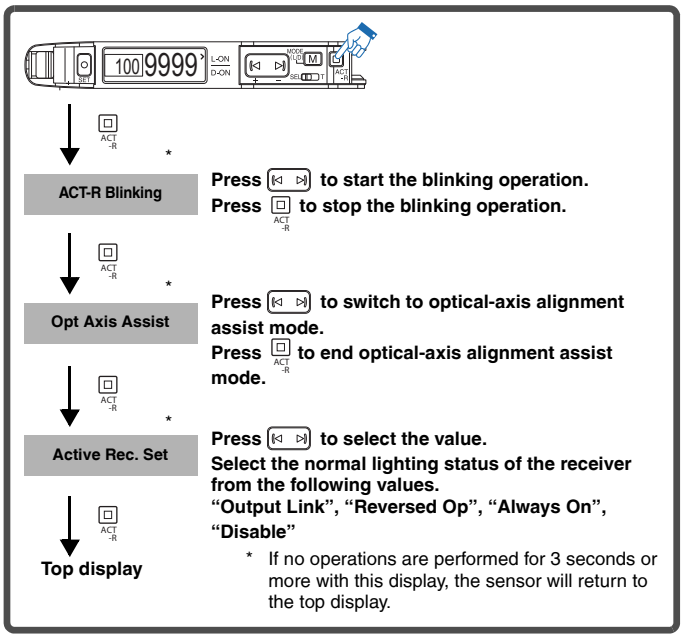
2 **Use ◀ ▶ to select the status from those shown below.**

Output Link:	The receiver will light when the output is ON.
Reversed Op:	The receiver will light when the output is OFF.
Always On:	The receiver will be lit always.
Disable:	The receiver will be OFF always.

3 **Press ACT-R twice to return to the normal status.**

Reference During pairing mode and optical-axis alignment assist mode, the amplifier operates regardless of the above setting.

Setting flow of the active receiver function



4. List of Settings 1/2

This section describes advanced settings.

Switch the language to English before use. (📖 "Switching the Display Language" (page 4))

Hold down [M] for 3 seconds or more to enter the settings menu. Then, press [M] to change the item or press [◀ ▶] to switch the setting value.

- Press [M] + [◀ ▶] when an item is being set to return to the previous item.
- While in the settings menu, hold down [M] for 3 seconds or more to complete the settings.
- Underlined items are the default setting values.

Operation flow

1 Hold down [M] for 3 seconds or more.
2 Press [M] to switch between the items ([A], [B], [C]...).
3 Press [◀ ▶] to select/change the value.
4 Press [M] to confirm the setting.

5 Hold down [M] for 3 seconds or more to complete the settings.

Top display

Hold down [M] for 3 seconds or more.

A Power Modes — Press [◀ ▶] to select the value. (📖 page 10)

[M]

- S-HSPD[*1] • HSPD • FINE • TURBO
- SUPER • ULTRA • MEGA • TERA

B Switch L-On/D-On — Press [◀ ▶] to select the value. (📖 page 10)

[M]

- Light ON • Dark ON

C Display Bar — Press [◀ ▶] to select the value. (📖 page 10)

[M]

- OFF • ON

[END] ◀ ▶ ADVANCE — Press [◀ ▶] to select the value.

END [M] ADVANCE

Settings complete

D Detection Mode [*2] — Press [◀ ▶] to select the value. (📖 page 11)

[M]

- Standard • Preset • Percent • Zeroshift
- Area detection • Area % Mode • DATUM • Rising edge
- Falling edge

- After selecting and confirming "Preset", press [M] to display "D1 Preset Sat". Press [◀ ▶] to set the value within the range of 100% to 200% (initial value: 110%).
- After selecting and confirming "Percent", press [M] to display "D2 Percent Target". Press [◀ ▶] to set the value within the range of -99% to 99% (initial value: -10%).
- After selecting and confirming "Area % Mode", press [M] to display "D3 Area % Setting". Press [◀ ▶] to set the value within the range of ±1% to ±99% (initial value: ±10%).
- After selecting and confirming "DATUM", press [M] to display "D4 DATUM Level". Press [◀ ▶] to set the value within the range of level 1 to level 3 (initial value: level 1). After selecting and confirming the setting, press [M] to display "D5 Warning level". Press [◀ ▶] to set the value within the range of 0% to 100% (initial value: 50%).

E Output timer [*3] — Press [◀ ▶] to select the value. (📖 page 16)

[M]

- OFF • Off-delay • On-delay • One-shot
- On/Off-Delay • On-Del/1Shot

After selecting and confirming a value other than "OFF", press [M] to display "E1 Duration 1".
Press [◀ ▶] to set the value within the range of 1 to 9999 ms (initial value: 10 ms).
When "On/Off-Delay" or "On-Del/1Shot" is selected, press [M] with "E1 Duration 1" displayed to display "E2 Duration 2".
Press [◀ ▶] to set the value within the range of 1 to 9999 ms (initial value: 10 ms).

(1)

(1)

F Ext. Input [*4] — Press [◀ ▶] to select the value. (📖 page 16)

[M]

- OFF • External Set • Zero shift • Reset
- LED OFF • Pause • Sleep

After selecting and confirming "Pause", press [M] to display "F1 Pause Mode".
Press [◀ ▶] to select "OFF", "ON", or "Keep".

G Saturate Cancel — Press [◀ ▶] to select the value. (📖 page 17)

[M]

- Back • Execute • Cancel

H Attenuation — Press [◀ ▶] to select the value. (📖 page 17)

[M]

Set the value within the range of 1 to 100 (initial value: 100).

I Zero Shift — Press [◀ ▶] to select the value. (📖 page 17)

[M]

- Back • Execute • Cancel

J Limit Detection [*3] — Press [◀ ▶] to select the value. (📖 page 17)

[M]

- OFF • ON

After selecting and confirming "ON", press [M] to display "J1 Limit Det Point".
Press [◀ ▶] to set the value within the range of 1% to 99% (initial value: 5%).
After confirming the setting, press [M] twice to display "J2 Limit Reset".
Press [◀ ▶] to select "User reset" or "Auto reset".

K Auto Power — Press [◀ ▶] to select the value. (📖 page 17)

[M]

- OFF • ON

L Hysteresis — Press [◀ ▶] to select the value. (📖 page 17)

[M]

- Level 1 • Level 2 • Level 3 • Level 4 • Level 5

M Language — Press [◀ ▶] to select the value. (📖 page 17)

[M]

- ENGLISH • 日本語 • 中文 • Deutch

N Flip Display — Press [◀ ▶] to select the value. (📖 page 17)

[M]

- Standard • Flip Disp.

O Sub Display — Press [◀ ▶] to select the value. (📖 page 18)

[M]

- OFF • Gain(%) • Display Hold • Gain(%) Hold

After selecting and confirming "Display Hold" or "Gain(%) Hold", press [M] to display "O1 Hold".
Press [◀ ▶] to select "Standard", "Peak Max/min", "Btm. Max/min", "P min/B Max", or "P Max/B min".

P ACT-R — Press [◀ ▶] to select the value. (📖 page 18)

[M]

- Output Link • Reversed Op • Always On • Disable

Q Brightness — Press [◀ ▶] to select the value. (📖 page 19)

[M]

- Brightness 1 • Brightness 2 • Brightness 3

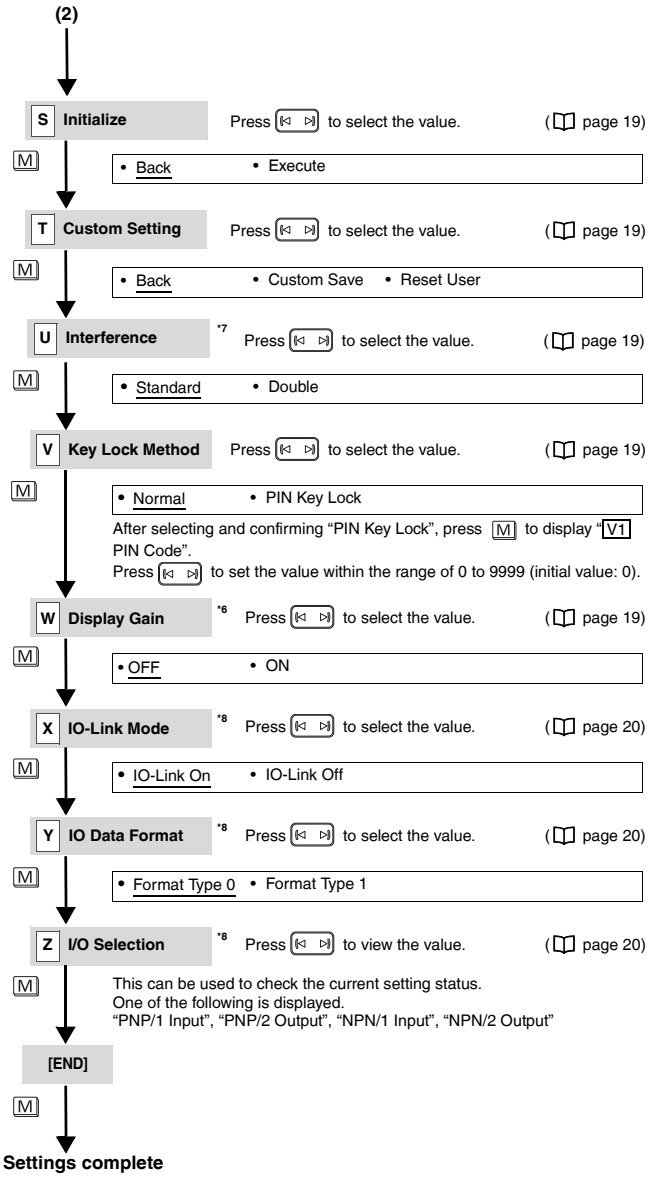
R ECO [*5] — Press [◀ ▶] to select the value. (📖 page 19)

[M]

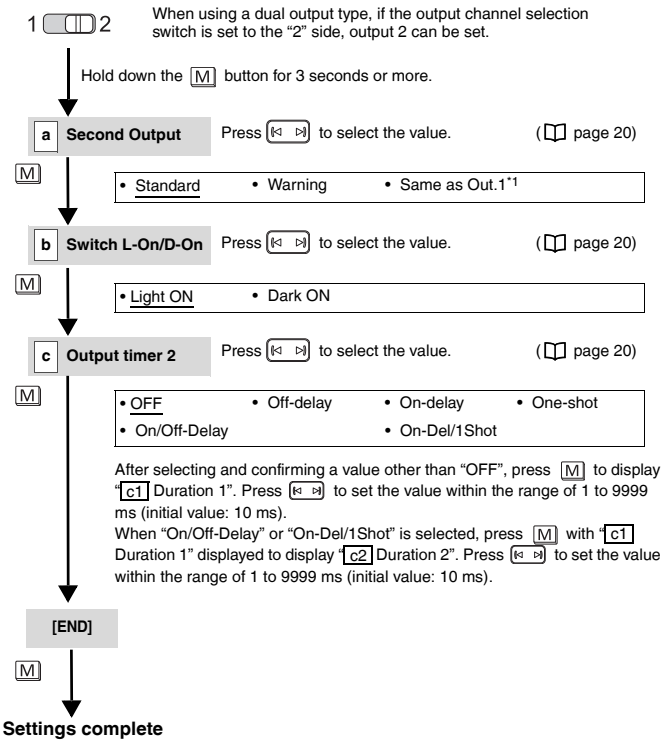
- OFF • ON • FULL

(2)

4. List of Settings 2/2



■ Channel 2 (output 2) settings



*1 This can only be selected on the FS-N41C.

*1 When "S-HSPD" is selected for "Power Modes"
Output 2 of dual output type is fixed to OFF.
IO-Link communication cannot be used (FS-N41C).

*2 When "S-HSPD" is selected for "Power Modes"
"Area detection", "Area % Mode", "DATUM", "Rising edge", or "Falling edge" cannot be selected.

*3 This cannot be used when "S-HSPD" is selected for "Power Modes".

*4 This can only be used on types that support an external input.
When connected to the multi-output unit FS-MC8N/P or the communication unit NU Series, this setting can be configured on types that do not normally support an external input.

*5 When "S-HSPD" is selected for "Power Modes",
"FULL" cannot be selected for the ECO function.
The IO-Link communication cannot be used when "FULL" is selected for the ECO function (FS-N41C).

*6 This cannot be used when "S-HSPD" or "HSPD" is selected for "Power Modes".

*7 This item is not displayed on the FS-N41C.

*8 This item is only displayed on the FS-N41C.

A Power Modes

For setting methods, see page 8.

Delaying the response time increases the received light intensity, which increases the detection stability.
Select from the following eight power modes.

Display	Response time	Maximum received light intensity
S-HSPD	23 µs	9999
HSPD	50 µs	
FINE (default setting)	250 µs	
TURBO	500 µs	
SUPER	1 ms	
ULTRA	4 ms	
MEGA	16 ms	99999*1
TERA	64 ms	

*1 This is 65535 when connected to an NU Series unit.

Depending on the power mode, the following function restrictions exist.

✓: Usable, —: Not usable

Item	S-HSPD	HSPD	FINE	TURBO/SUPER/ ULTRA/MEGA/ TERA
Dual output type channel 2 (output 2)	-	✓	✓	✓
IO-Link (FS-N41C)				
Sub Display “Display Hold” and “Gain(%) Hold”				
Detection Mode “Area detection”, “Area % Mode”, “DATUM”, “Rising edge”, and “Falling edge”				
Output timer				
ECO function “FULL”				
Limit Detection				
Display Gain	-	-	✓	✓
Number of units for mutual interference prevention with an expanded system when Interference is set to “Standard”	0	0	4	8
Number of units for mutual interference prevention with an expanded system when Interference is set to “Double”			8	16
Number of units for mutual interference reduction between main units			2	2

Reference

The response time from ON to OFF can be affected by the cable length and the load and may become long. If a faster response time is required, we recommend making detection trigger the output from OFF to ON.

B Switch L-On/D-On

For setting methods, see page 8.

Select whether to turn the output ON when the receiver is lit (light ON) or is dark (dark ON).

Point

- **This is used to switch between N.O. and N.C. when “Area detection”, “Area % Mode”, “Rising edge”, or “Falling edge” is selected under “Detection Mode” (page 11).**
  “Area detection” (page 14)
  “Rising edge/Falling edge” (page 15)
- **When using a dual output type, the output style can be set individually for each output. Select the output using the channel selection switch. This function is also used to switch between N.O. and N.C. when “Warning” is selected under “Second Output” (page 20).**

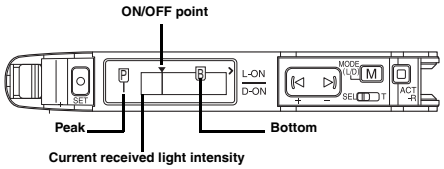
C Display Bar

For setting methods, see page 8.

The bar display shows the current value on a bar graph.
On the setting screen, select “ON” to enable the bar display, which will be shown the next time the top display appears. “3-4 Top Display Transitions” (page 4)

Bar graph

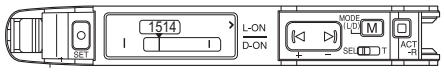
Normal screen



If “S-HSPD” is selected for “Power Modes” (page 10) or “DATUM” is selected for “Detection Mode” (page 11), the peak and bottom are not displayed.

The peak or bottom received light intensity is updated each time the received light intensity falls below or rises above the setting value, respectively.

Press [◁ ▷] to display the setting value as shown below.



The upper and lower limits of the bar graph are set as shown below when the sensitivity is set (when calibration is performed).

Calibration, etc.	Upper limit (maximum value)	Lower limit (minimum value)
Not set	1000	0
2-point calibration	The point at which the received light intensity was largest during calibration	The point at which the received light intensity was smallest during calibration
Maximum sensitivity calibration	Received light intensity during calibration + (setting value - received light intensity during calibration) × 2	Received light intensity during calibration
Full auto calibration	Maximum received light intensity during calibration	Minimum received light intensity during calibration
Positioning calibration	The point at which the received light intensity was largest during calibration	The point at which the received light intensity was smallest during calibration
Percentage calibration	Twice the light intensity during calibration	0
Edge detection calibration	Not supported	Not supported
Preset Work-preset Maximum sensitivity preset Full auto preset DATUM mode	Value that makes the preset value 100.0	Value that makes the preset value 0

When using zero shift calibration, the lower limit is shifted to 0.

Point

For dual output types, when the channel selection switch is set to channel 2, the bar display is hidden.

D Detection Mode

For setting methods, see page 8.

The table below lists the detection modes that can be selected.

Display	Detection mode	Function	Reference page
Standard	Received light intensity distinction mode	Normal detection mode (default setting)	—
Preset	Preset	During calibration, the displayed value can be corrected to “100.0” or “0.0” at the same time as the sensitivity is set.	11
Percent	Percentage calibration	During calibration, the setting value is established as a percentage of the current received light intensity.	13
Zeroshift	Zero shift calibration	This sensitivity setting method executes the zero shift function and performs basic calibration at the same time during calibration.*1	13
Area detection	Area detection mode	Detection occurs only when the received light intensity goes out of a given range.	14
Area % Mode	Area percentage calibration	In this mode, detection is performed with the operations of area detection mode and percentage calibration.	14
DATUM	DATUM mode	The display value when there is no object to detect is always corrected to “100.0”, and the setting value is also corrected so that the setting value and received light intensity ratio is constant.	14
Rising edge	Rising edge detection mode	Detection is performed only when the received light intensity increases sharply.	15
Falling edge	Falling edge detection mode	Detection is performed only when the received light intensity decreases sharply.	15

*1 2-point calibration, maximum sensitivity calibration, full auto calibration

● Restrictions for sensitivity settings in each detection mode

Sensitivity setting methods are restricted based on the selected detection mode. Refer to the chart below for details. 🕮 “Setting the Sensitivity” (page 5)

✓: Usable, —: Not usable

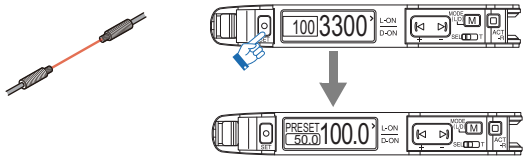
Sensitivity setting method (calibration)	Detection mode								
	Standard	Preset	Percent	Zero shift	Area detection	Area % Mode	DATUM	Rising edge	Falling edge
2-point	✓	—	—	✓*1	✓	—	✓	—	—
Maximum sensitivity	✓	—	—	✓*1	✓	—	✓	—	—
Full auto	✓	—	—	✓*1	✓	—	✓	—	—
Positioning	✓	—	—	—	✓	—	—*2	—	—

*1 The zero shift is performed at the same time as calibration.

*2 Positioning calibration is not possible in DATUM mode. 2-point calibration operations will be performed.

Preset

The displayed value of the received light intensity is corrected to “100.0” at the same time as the sensitivity is set.

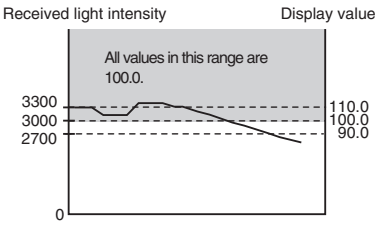


■ Preset operating principles

(The current received light intensity is 3300 in this example.)

Preset calibration is used to register the display value of the current received light intensity as “100.0”.

The display value of the actual received light intensity (3300) is set to “110%” and all received light intensities exceeding “100%” are displayed as “100.0”.



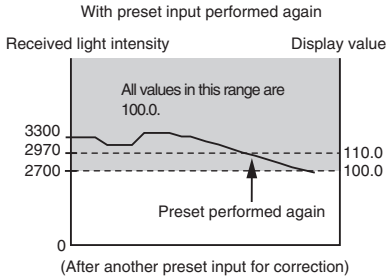
When the received light intensity falls below “100%”, a value lower than “100.0” is displayed.

The percentage value “110%” (i.e., the saturation level) at the time of light intensity registration can be any value between 100% and 200%.

🕮 “Preset Sat.” (page 13)

If the display value falls below “100.0”, the preset input can be performed again to restore stable detection.

If the light intensity is not displayed as “100.0” after preset input, the received light intensity (the current value) is low and the sensor amplifier cannot perform stable detection.



(After another preset input for correction)

Reference Even when the work-preset calibration, maximum sensitivity preset calibration, or full auto preset calibration is used, the preset saturation level function operates on the basis of the “100.0” point.

Basic way to select the appropriate calibration when using the preset function

Usage Scenario		Calibration method	Description	Reference page
Basic	Using thrubeam/ retro-reflective models	Preset	When no object to detect is present, simply press SET to complete the sensitivity setting.	12
	Using reflective model	Maximum sensitivity preset	When no object to detect is present, simply hold down SET to complete the sensitivity setting.	12
Other	Unable to successfully display “100.0” and “0.0” when light is received and when light is blocked	Work-preset	The user can select the statuses in which “100.0” and “0.0” are displayed.	12
	Object to detect moves quickly	Full auto preset	Preset can be performed on fast-moving objects.	13

Point

- **The preset calibration functions cannot be used when the following functions are set.**
  Disable the function or change the settings before executing the preset function again.
  - **Zero shift function → 🕮 “Zero Shift” (page 17)**
  - **Zero shift input → 🕮 “Ext. Input” (page 16)**
- **Presets are not suited for detection of transparent objects with thrubeam/retro-reflective models and other such detection in which the received light intensity difference is low.**
- **After changing any of the following settings, disable each preset, and then execute them again.**
  - **🕮 “Power Modes” (page 10)**
  - **🕮 “Preset Sat.” (page 13)**
  - **🕮 “Display Gain” (page 19)**
- **If the received light intensity (the current value) is 50 or less (200 or less when ON is selected under 🕮 Display Gain (page 19)), the display will be “100.0” or less when preset calibration is executed.**

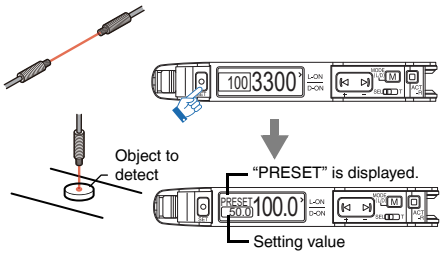
Reference

- If SET is pressed when presets are enabled (when “PRESET” is displayed), the display value of the current received light intensity changes to “100.0” and the setting value does not change.
- Periodic preset calibration is possible with input signals from an external source.
  “ Ext. Input” (page 16)
- With the preset function, a process is carried out to ignore minute received light intensity changes that do not affect the detection. The change amount to be ignored can be adjusted.
  “Preset Sat.” (page 13)

● Preset calibration

1 **Press SET.**

The display value of the current received light intensity is changed to “100.0”. The setting value becomes “50.0”.



Disabling presets

With “PRESET” displayed, hold down SET for 3 seconds or more.

The “PRESET” display turns OFF and the preset is disabled.

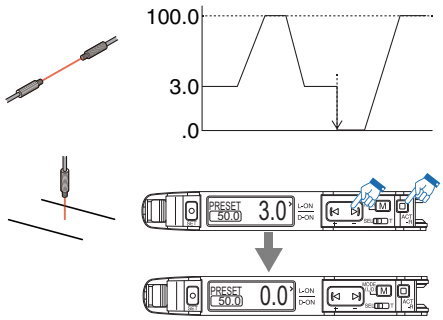
● Work-preset calibration

This function corrects the display value to “0.0”. After the preset function has been executed in the state in which “100.0” should be displayed, executing this function in the state in which “0.0” should be displayed adjusts the two points to “100.0” and “0.0”.

Work-preset calibration can be used when a preset calibration has already been performed (when “PRESET” is displayed).

1 **In the state in which “0.0” should be displayed, press ACT-R and simultaneously.**

The display value at that point is set to “0.0”.
The value set to “100.0” using the preset function is not changed.



Reference

Even if the received light intensity is low during preset and is high during work-preset, the value is set to “100.0” during preset and to “0.0” during work-preset. When the received light intensity (the current value) increases, the display will approach “0.0”. (The preset saturation is decreased with respect to “100.0”.)

Disabling presets

With “PRESET” displayed, hold down SET for 3 seconds or more.

The “PRESET” display turns OFF and the preset is disabled.

● Maximum sensitivity preset calibration

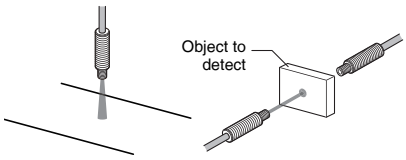
This function adjusts the reference state to “0.0” and the state in which the received light intensity is slightly higher to “100.0”. This function is useful when using a reflective model to perform detection, using a background as the reference.

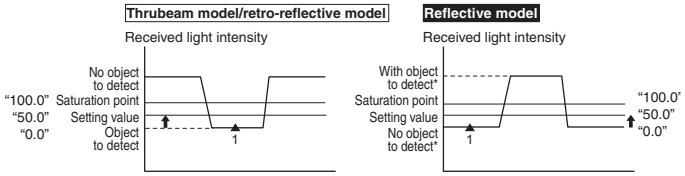
Configure the settings with “PRESET” not displayed.

1 **For the reflective models, ensure that no object to detect is present. For the thrubeam/retro-reflective models, ensure that an object to detect is present. Then, hold down SET for 3 seconds or more.**

Release the button when “AUTO” flashes.

“PRESET” lights and the setting value is set to “50.0”.





* When detecting a target that has a background, the maximum sensitivity setting can be used to ignore the background.
Maximum sensitivity preset calibration cannot be used if the background is more reflective than the object to detect.

Reference

If the received light intensity is saturated, the maximum sensitivity preset function cannot be executed. (“--- ---” will appear during step 1.)
“3-7 Light Emission/Received Light Intensity Adjustment (Saturation Canceling)” (page 6)

Disabling presets

With “PRESET” displayed, hold down SET for 3 seconds or more.

The “PRESET” display turns OFF and the preset is disabled.

● **Full auto preset calibration**

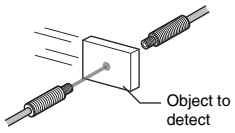
This function automatically judges two states (such as the object to detect being present/absent) and adjusts the display values to “100.0” and “0.0”, respectively. This is useful when the object to detect is moving at high speed or in similar situations where the object to detect cannot be stopped.

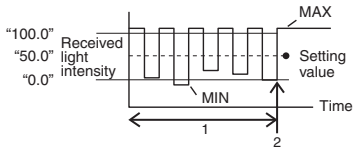
Configure the settings with “PRESET” not displayed.

1 **While the object to detect passes the sensor, hold down SET until “AUTO” flashes.**

2 **After the object to detect has completely passed the sensor, release SET. Calibration is complete after the setting value flashes momentarily, and then stops (lights up).**

“PRESET” is displayed and the setting value is set to “50.0”.





The area near the maximum value of the received light intensity while SET is pressed is set as “100.0”, and the area near the minimum value is set as “0.0”.

Reference If the received light intensity is saturated, the full auto preset function cannot be executed. (“--- ---” will appear during step 2.)
“3-7 Light Emission/Received Light Intensity Adjustment (Saturation Canceling)” (page 6)

Disabling presets

With “PRESET” displayed, hold down SET for 3 seconds or more.

The “PRESET” display turns OFF and the preset is disabled.

D1 Preset Sat.

For setting methods, see page 8.

The saturation level can be set in the range of 100% to 200%.
For example, if the saturation level is set to 150%, the display value of the received light intensity will be corrected to “150.0” when the preset function is executed, and “100.0” will be displayed on the screen.

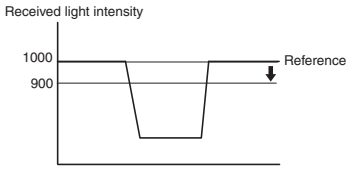
*1 When “Detection Mode” is set to “DATUM”, the saturation level is fixed to 101%, and the setting screen will not appear.

Reference For the operating principles, see “ “Preset operating principles” (page 11)”.

Percent (Percentage Calibration)

The setting value can be established as a percentage (%) of the current received light intensity. For example, if “Percent Target”, the target value of the setting value,
is set to -10%, the setting value is set to a value that is 10% lower than the received light intensity when the SET button is pressed.
“Percent Target” can be set in the range of -99% to 99%.
Initial value: -10%

Setting example When “Percent Target” is set to “-10%”



To set the target value, see “D2 Percent Target” (page 8).

Sensitivity setting method

1 **When the received light intensity is at the level to be set as the reference, press SET.**

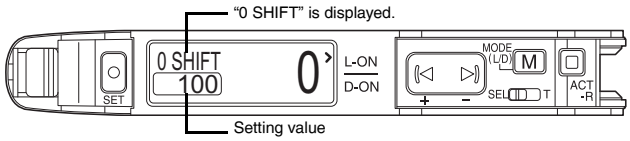
Calibration is complete after the setting value flashes momentarily, and then stops (lights up).

Reference When “External Set” is selected for “Ext. Input”, periodic percentage calibration is possible from external devices, enabling stable detection even on objects to detect that have small sensitivity differences.
“Ext. Input” (page 16)

Zeroshift (Zero Shift Calibration)

This sensitivity setting (zero shift calibration) performs the zero shift function and basic calibration (2-point calibration/maximum sensitivity calibration/full auto calibration) simultaneously.
The lower of the received light intensity values at the time of sensitivity setting will automatically be set to “0”.

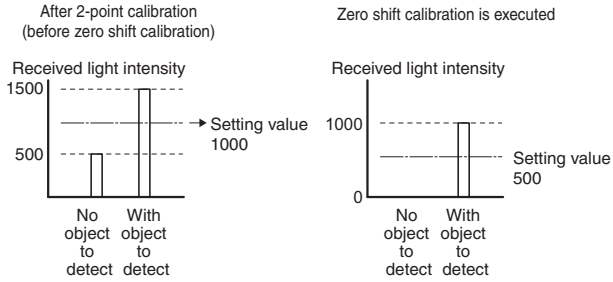
Screen display while using the zero shift function



Reference The light intensity received when an object to detect is present will be affected by the same decrease in intensity caused by the zero shift.

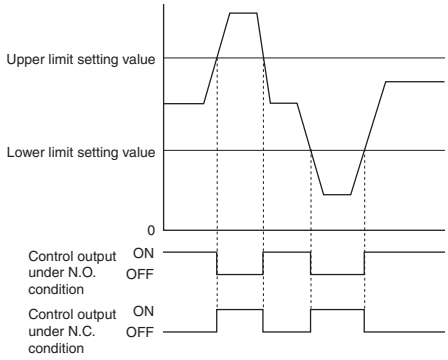
The following sensitivity settings are possible during zero shift calibration.
- 2-point calibration
- Maximum sensitivity calibration
- Full auto calibration

Setting example If a 2-point calibration is performed with a reflective model, where the received light intensity with an object to detect is “1500” and without an object to detect is “500”:



Area Detection (Area Detection Mode)

In this mode, the output signal is sent if the received light intensity is in the area defined by the upper limit setting value and lower limit setting value (N.O. condition).

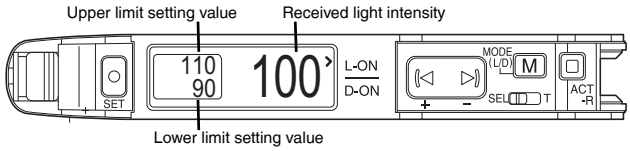


Reference
- The function can be set so that output 1 turns ON (N.O.) or OFF (N.C.) when the received light intensity is within the set range (greater than or equal to the lower limit setting value and less than or equal to the upper limit setting value).
  "Switch L-On/D-On" (page 10)
- Only output 1 can be set to "Area detection". Output 2 operates according to the "Second Output" (page 20) settings.

Point

Always ensure that "upper limit setting value > lower limit setting value". If "upper limit setting value ≤ lower limit setting value", the output will be performed in accordance with the received light intensity always being outside the range specified by the upper limit setting value and lower limit setting value.

Methods for Setting Upper and Lower Limits



1 Press [◀ ▶] to select the upper limit setting value or the lower limit setting value. The selection switches between the upper limit and the lower limit each time [M] is pressed.

With the upper limit setting value selected

[M]

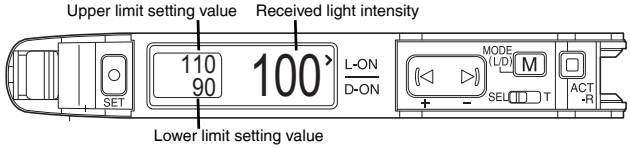
With the lower limit setting value selected

Press [◀ ▶] to display a yellow frame around the upper limit setting value or lower limit setting value. With one item selected, press [M] to switch the selected setting value.
If no operations are performed for 3 seconds or more, the display will return to the state in which both setting values are enclosed in a yellow frame (neither selected).

2 Press [SET] to set the sensitivity (such as by using 2-point calibration or the maximum sensitivity setting).
Press [◀ ▶] to fine-tune the setting value.

Area % Mode (Area Percentage Calibration) For setting methods, see page 8.

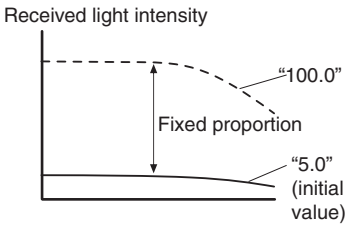
This detection mode combines the area detection mode (page 14) and the percentage calibration (page 13).
When the sensitivity is set, the upper limit setting value and the lower limit setting value are set at the same time in relation to the received light intensity.



(Example) If "D3 Area % Setting" is set to "±10%" when the reference received light intensity is 100, the upper limit and lower limit setting values are as shown below.
Upper limit setting value: 110
Lower limit setting value: 90

DATUM (DATUM Mode)

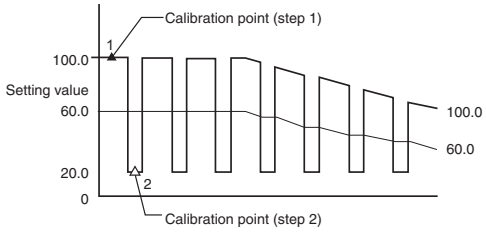
In DATUM mode, the received light intensity with no object to detect present is always corrected to "100.0" (for thrubeam models).
The setting value is also corrected according to the correction amount so that the ratio of the setting value and the received light intensity is kept constant, which results in stable detection. The display of the setting value does not change.



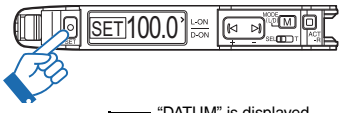
DATUM mode is an effective detection mode in environments where received light intensity decreases gradually, for example, locations where the sensor head becomes dirty easily and locations subject to large temperature changes.

Sensitivity setting method

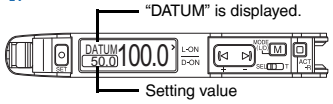
The sensitivity setting procedure below is an example of 2-point calibration (where the display value is "100.0" when no object to detect is present and "20.0" when an object to detect is present) using a thrubeam/retro-reflective model.



1 Press [SET] with no object to detect present.



2 Press [SET] with an object to detect present.
The received light intensity in the full-light receiving state is displayed as "100.0".



Point
- **When the received light intensity stays lower than a given level (Warning level), the received light intensity correction stops and the "DATUM Offset" display flashes.**
  "Warning level" (page 15)
- **The correction stops if the received light intensity (the current value) drops below 50 (200 when "Display Gain" is set to "ON".) The received light intensity (the current value) can be checked on the "Power Modes" (page 8) selection screen displayed by holding down [M] for 3 seconds or more on the basic screen, and then pressing [◀ ▶].**
  "Display Gain" (page 19)
- **This cannot be used when "S-HSPD" is selected for "Power Modes."**

D4 DATUM Level (Adjusting the Correction Interval)

For setting methods, see page 8.

The correction interval can be selected from three levels.

Power mode	DATUM level		
	Level 1	Level 2	Level 3
HSPD	4.4 s	0.55 s	34.2 ms
FINE	13.1 s	1.64 s	102.4 ms
TURBO/SUPER/ULTRA/MEGA/TERA	26.2 s	3.27 s	204.8 ms

Reference Level 1 is recommended.

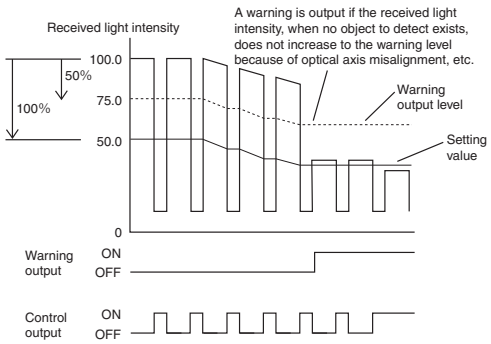
D5 Warning level

For setting methods, see page 8.

If the received light intensity continuously remains between the warning level and the setting value, the received light intensity correction stops, "DATUM Offset" is displayed, and the unit goes into alarm mode.

The level for outputting the warning can be set in the range of 0% to 100%.
(default setting: 50%)

Setting example When "Warning level" is set to "50%" and "DATUM" and "Dark ON" are set:



- 100%: The unit does not go into alarm mode even if the received light intensity varies.
- 50%: The unit goes into alarm mode when the received light intensity lowers to the intermediate value between the received light intensity when no object to detect is present and the setting value.
- 0%: The unit goes into alarm mode when the received light intensity lowers even slightly.

Reference A dual output type can output to an external devices that it is in alarm state with the Output 2 settings (1 2). For details, see "Output 2 settings" (page 20).

Rising edge/Falling edge (Edge Detection Mode)

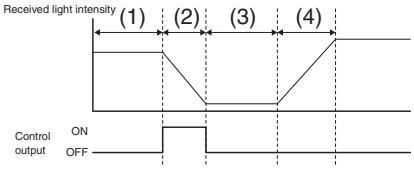
In the edge detection mode, the sensor amplifier detects changes in received light intensity over a fixed period.
This mode is used to turn ON the output only when an object to detect moves into or out of the detection range of the fiber unit.

- Turning the output ON when the received light intensity decreases:
  → Select "Falling edge"
- Turning the output ON when the received light intensity increases:
  → Select "Rising edge"

■ Timing chart

Setting example When "Falling edge" is selected with a thrubeam model:

(1), (3): The output is OFF because the received light intensity is not changing.
(2): The output is ON because the received light intensity is decreasing.
(4): The output remains OFF because the received light intensity is changing but is increasing.



Point

Combining the edge detection mode and any of the functions below makes it more difficult to detect gradual changes in received light intensity.

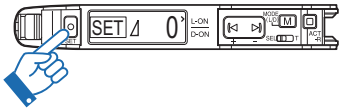
- **If the mutual interference prevention is "Double"**
  "Interference" (page 19)
- **If the ECO function is "FULL"**
  "ECO" (page 19)

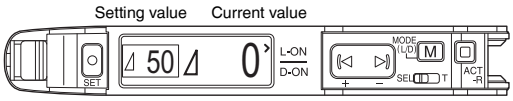
Sensitivity setting method

1 Press SET with no object to detect present.

The amplifier is now configured to ignore changes in received light intensity that occurred during the duration that SET is pressed.

Calibration is complete after the setting value flashes momentarily, and then stops (lights up).





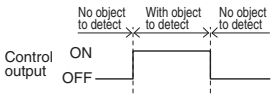
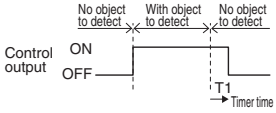
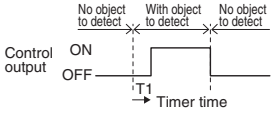
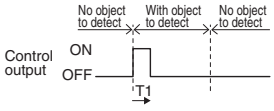
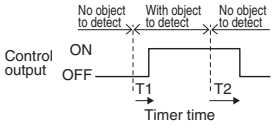
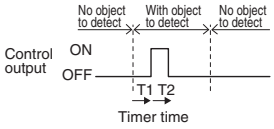
Reference

- When detecting objects running on a conveyor, holding down SET makes the sensor ignore the fluctuations in received light intensity due to conveyor vibrations.
- If the setting value is so low that changes other than those attributable to the object to detect are also detected, use ◁ ▷ to make fine adjustments.

E Output timer

For setting methods, see page 8.

There are five types of output timers available.

Display	Function	Timing chart*
OFF	Uses no output timer. (Default setting)	
Off-delay	Off-delay timer Turns OFF the output at a specified time after the detection signal turns OFF. Setting range: 1 to 9999 ms Initial value: 10 ms	
On-delay	On-delay timer Turns ON the output at a specified time after the detection signal turns ON. Setting range: 1 to 9999 ms Initial value: 10 ms	
One-shot	One-shot timer Turns ON the output and keeps it ON for a specified period after the detection signal turns ON. Setting range: 1 to 9999 ms Initial value: 10 ms	
On/Off-Delay	On-delay/off-delay timer This is a composite timer that includes both an on-delay timer (Duration 1: T1) and an off-delay timer (Duration 2: T2). Each timer's specified time can be set separately. Setting range: 1 to 9999 ms Initial value: 10 ms	
On-Del/ 1Shot	On-delay/one-shot timer This is a composite timer that includes both an on-delay timer (Duration 1: T1) and a one-shot timer (Duration 2: T2). Each timer's specified time can be set separately. Setting range: 1 to 9999 ms Initial value: 10 ms	

* Example of the light ON (L-ON) mode for a reflective model and the dark ON (D-ON) mode for a thrubeam/retro-reflective model

Reference
- When using the dual output type, different timer functions and timer times can be set separately for channels 1 and 2.
  "Output 2 settings" (page 20)
- Timers cannot be used for the warning output on the dual output type.

F Ext. Input

For setting methods, see page 8.

On amplifiers with an external input option (FS-N43∗/N44∗/N41C), the external input wire can be controlled to utilize the following functions:

Display	Function
OFF	Disables use of the external input function (default setting).
External Set	External calibration input Uses the external input to perform calibration. * This is the preset calibration input when Preset is selected for Detection Mode. "Detection Mode" (page 11)
Zero shift*1	Zero shift input Executes a zero shift at the rising edge of the external input. "Setting the Current Received Light Intensity Display to 0 (Zero Shift)" (page 6)
Reset*2	Reset input Resets the display at the rising edge of the external input when using Display Hold or Limit Detection. "Display Hold" (page 18), "Gain(%) Hold" (page 18) "Limit Detection" (page 17)
LED OFF	LED stop input Keeps the light emission OFF during external input.
Pause	Pause function Locks the output status during external input.
Sleep	Sleep function Uses the power save mode during external input. "Sleep (sleep function)" (page 16)

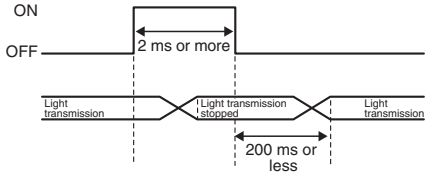
*1 When the zero shift input is selected, each preset function (page 11) is disabled and cannot be set.
This cannot be used when "Preset" is selected under "Detection Mode" (page 11).

*2 This is not displayed when "S-HSPD" is selected under "Power Modes" (page 10).

Reference
- For external input wiring, see Amplifier Wiring (page 3).
- Provide a short-circuit time of 2 ms or more, 25 ms or more when external calibration input is selected.

■ LED OFF

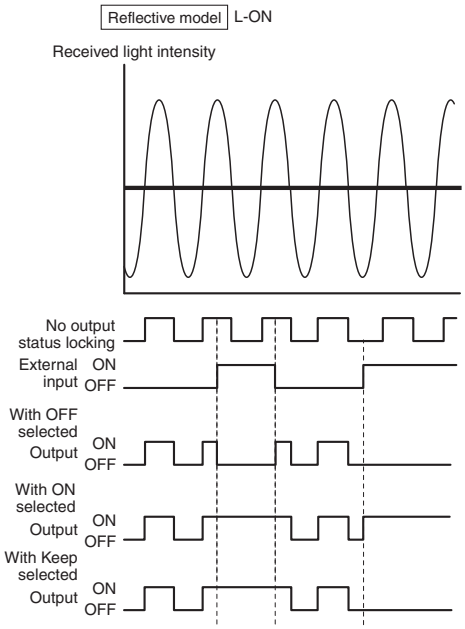
Stops the light emission during external input.



■ Pause (pause function)

During external input, the output can be locked in a state regardless of the received light intensity.
The following three output statuses that can be locked with the pause function.

Display	Function overview
OFF	The output is locked in the OFF state during external input (default setting).
ON	The output is locked in the ON state during external input.
Keep	The output is locked in its existing state when the external input is received.



■ Sleep (sleep function)

This function holds the sensor amplifier in the power save state (sleep mode) during external signal input.
Once the sensor amplifier enters sleep mode:
- Light transmission stops.
- The output is turned OFF (for both "Light ON"/"Dark ON").
- A single small square pulses across the display.

The normal display is restored after any button is pressed.
If no operations are performed for 4 seconds, the sensor amplifier enters sleep mode again.

Writing of External Input to EEPROM

Setting "Saving by Input" to "OFF" when "External Set" or "Zero shift" is selected for "Ext. Input" will prevent the settings modified by external input from being written to the EEPROM.
This prevents writing to the EEPROM even when frequent external inputs are performed and thus prevents the EEPROM from reaching the end of its service life (1 million write operations too quickly).

1 When the received light intensity is displayed, hold down M, SET, and ◁ ▷ simultaneously for 3 seconds or more.
To restrict the writing of settings, use ◁ ▷ to select "OFF".

2 Press M.
The current received light intensity is displayed.

Reference
- When "OFF" is set, if the settings are changed using the external input and the power is then turned OFF and ON, the values changed using the external input will not be recorded.
- When "ON" (the initial value) is set, the settings are written to the EEPROM approximately 3 seconds after the settings are changed using the external input.

G Saturate Cancel

For setting methods, see page 8.

This is the same function as “3-7 Light Emission/Received Light Intensity Adjustment (Saturation Canceling)” (page 6) (page 6)

H Attenuation

For setting methods, see page 8.

When a fiber unit with high power (longer detecting distance) is used at a close range, the received light intensity may remain unchanged from the maximum value of the display-enabled range (saturated) regardless of whether an object to detect is present or not. (Example: The numerical value does not change from 9999.)
In such a case, the light emission and the received light intensity can be manually adjusted by using the attenuation function.

Setting range: 1 to 100 (initial value: 100)

When the value is decreased with [◁ ▷], the received light intensity is decreased to match.

Reference The light emission and received light intensity can also be automatically adjusted.
“3-7 Light Emission/Received Light Intensity Adjustment (Saturation Canceling)” (page 6)

I Zero Shift

For setting methods, see page 8.

This is the same function as “3-6 Setting the Current Received Light Intensity Display to 0 (Zero Shift)” (page 6)

J Limit Detection

For setting methods, see page 8.

If “Limit Detection” is set to “ON”, a notification of a drop in received light intensity is shown on the display when the received light intensity drops due to factors such as build-up.
With dual output types, it is also possible to generate an output to an external device using “Limit Detection”.
When connected to the multi-output unit FS-MC8N/P, it is possible to generate an output to an external device using the “common” output of the FS-MC8N/P even for single output typ amplifiers.

Model	Warning status type	
	Display (light intensity drop)	Output 2 (to an external device)
FS-N41N/N41P/N42N/N42P/N40	○	*
FS-N43N/N43P/N44N/N44P/N41C	○	○

* When connected to the multi-output unit FS-MC8N/P, it is possible to generate an output to an external device from the “common output” of the FS-MC8N/P.

J1 Limit Det Point

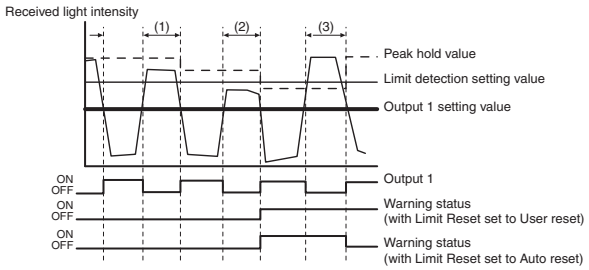
For setting methods, see page 8.

When “Limit Detection” is set to “ON”, drops in the received light intensity can be detected.
A drop in the received light intensity is identified when the cumulative minimum of the peak values (page 18) of the received light intensity falls below the limit detection setting value.
The limit detection setting value can be established with a percentage in respect to the control output setting value.
It can be set in the range of 1% to 99%.

Setting example

When the setting value is 1000, “Limit Det Point” is set to “5%”.
The limit detection setting value becomes “1050”.

■ Timing chart



During period (1), the peak value is not less than the limit detection setting value, so the warning status does not turn ON.
During period (2), the peak value is less than the limit detection setting value, so the warning status turns ON.
During period (3), the peak value once more is greater than the limit detection setting value, so the warning status turns OFF if “Auto reset” has been selected for “Limit Reset” (page 17). If “User reset” has been selected, the warning remains ON and does not turn OFF.

J2 Limit Reset

For setting methods, see page 8.

Select the reset method after a limit detection occurs.

Display	Limit Reset
User reset	- Hold down [M] and [ACT -R] simultaneously. - Perform a reset using the external input. - Turn the power OFF, and then turn it back ON.
Auto reset	- Hold down [M] and [ACT -R] simultaneously. - Perform a reset using the external input. - Turn the power OFF, and then turn it back ON. - When “peak value > limit detection setting value + hysteresis” (an automatic reset) occurs.

K Auto Power

For setting methods, see page 8.

The APC (Auto Power Control) function automatically adjusts the light emission to a constant level.
This function reduces variation in the emitted light intensity due to changes in ambient temperature.

Point **The APC function monitors and adjusts the LED light emission. Therefore, variation in the received light intensity due to contamination or characteristic changes of the fiber unit cannot be reduced. When high-precision detection is necessary, also apply the DATUM mode and percentage calibration using external input.**
DATUM mode → “DATUM” (page 14)
Percentage calibration → “Percent” (page 13)

Display	Function
OFF	The APC function is disabled (default setting).
ON	The APC function is enabled.

L Hysteresis

For setting methods, see page 8.

Hysteresis is the difference between the value at which the output turns ON and the value at which the output turns OFF.
Select from the following five types.

“Level 1”, “Level 2”, “Level 3” (default setting), “Level 4”, “Level 5”

If vibrations cause sensor chattering, select “Level 4” or “Level 5”. To detect even smaller received light intensity differences, select “Level 2” or “Level 1”. However, selecting “Level 1” or “Level2” may lead to unstable detection, ensure that the output is stable.

M Language (Language Selection)

For setting methods, see page 8.

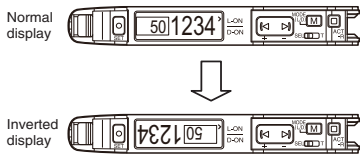
This is the same function as “3-3 Switching the Display Language” (page 4).
Select from the following four languages.
ENGLISH (default setting), 日本語(JAPANESE), 中文(CHINESE), Deutch (GERMAN)

N Flip Display

For setting methods, see page 8.

The current value and setting value displays can be inverted.

Display	Function
Standard	Normal display (default setting)
Flip Disp.	Inverted display



O Sub Display

For setting methods, see page 8.

On the setting screen, select a value other than “OFF” to enable the sub display, which will be shown the next time the top display appears.
“3-4 Top Display Transitions” (page 4)

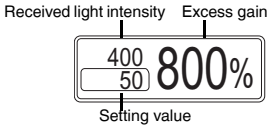
In addition to the received light intensity and setting value, the following information can be displayed on the sub display.

Display	Information	Reference page
OFF	No sub display (default setting)	-
Gain(%)*1	Received light intensity/setting value/gain	18
Display Hold*2	Received light intensity/setting value/peak hold/bottom hold	18
Gain(%) Hold*1 *2 *3	Received light intensity/setting value/gain peak hold/ gain bottom hold	18

*1 This cannot be used when “Rising edge” or “Falling edge” is selected under “Detection Mode” (page 11).
*2 This cannot be used when “Area detection” or “Area % Mode” is selected under “Detection Mode” (page 11).
When this screen is displayed, the saturation canceling function cannot be used.
*3 This cannot be used when “DATUM” is selected under “Detection Mode” (page 11).

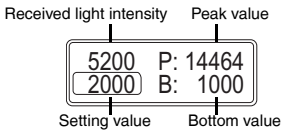
■ Gain(%)

Received light intensity is displayed as an excess gain* (percentage) relative to the setting value.
* Excess gain = (received light intensity/setting value) × 100



■ Display Hold

The maximum peak value and the minimum bottom value of the received light intensity can be displayed continuously.



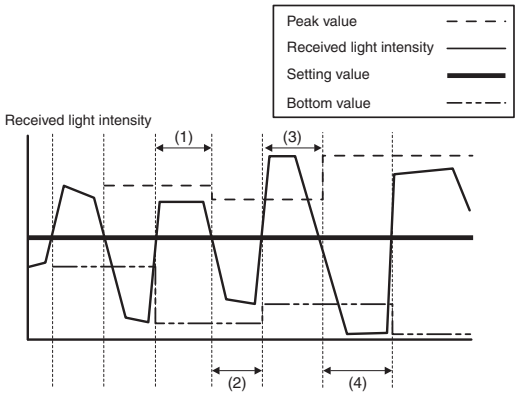
The following five display combinations are available.

Display	Displayed values
Standard	Updates the peak or bottom value each time the received light intensity falls below or rises above the setting value, respectively. (default setting)
Peak Max/min	Displays the maximum and minimum of the peak values since power was turned ON (cumulative).
Btm. Max/min	Displays the maximum and minimum of the bottom values since power was turned ON (cumulative).
P min/B Max	Displays the minimum of the peak values and the maximum of the bottom values since power was turned ON (cumulative).
P Max/B min	Displays the maximum value and the minimum value since power was turned ON (cumulative).

● How to reset the held values

To reset the peak and/or bottom values that are currently held, use one of the following methods.
- Hold down M and ACT-R simultaneously.
- Perform a reset using the external input.
“Ext. Input” (page 16)
- Turn the power OFF, and then turn it back ON.

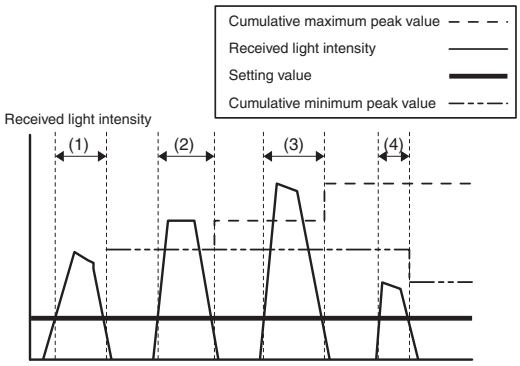
● Timing chart for the Standard setting



[Peak value]
- Samples while the received light intensity > the setting value ((1), (3), etc.).
- When the current received light intensity drops lower than the setting value, the peak value is updated.

[Bottom value]
- Samples while the received light intensity < the setting value ((2), (4), etc.).
- When the current received light intensity raises higher than the setting value, the bottom value is updated.

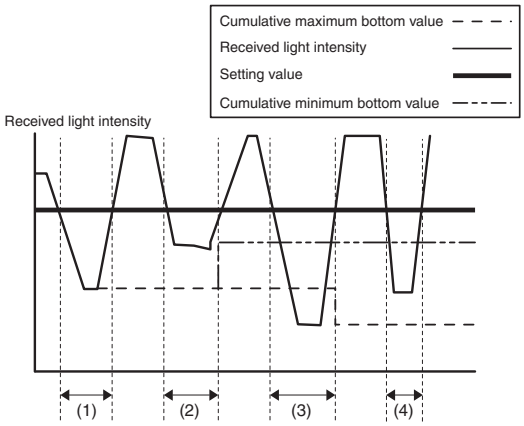
● Timing chart for the peak value



[Cumulative maximum peak value]
- Samples while the received light intensity > the setting value ((1) to(4)).
- When the received light intensity drops lower than the setting value, the previous peak value and current peak value are compared. If the current peak value is higher, the value is updated.

[Cumulative minimum peak value]
- Samples while the current received light intensity > the setting value ((1) to(4)).
- When the current received light intensity drops lower than the setting value, the previous peak value and current peak value are compared. If the current peak value is lower, the value is updated.

● Timing chart for the bottom value



[Cumulative maximum bottom value]
- Samples while the received light intensity < the setting value ((1) to(4)).
- When the received light intensity raises higher than the setting value, the previous bottom value and current bottom value are compared. If the current bottom value is higher, the value is updated.

[Cumulative minimum bottom value]
- Samples while the received light intensity < the setting value ((1) to(4)).
- When the received light intensity raises higher than the setting value, the previous bottom value and current bottom value are compared. If the current bottom value is lower, the value is updated.

■ Gain(%) Hold

This function is the same as “Display Hold”. The values being held are displayed as excess gain (percentages) instead of received light intensity.
“Display Hold” (page 18)

P ACT-R

For setting methods, see page 8.

The settings are the same as shown under “To Change the Normal Lighting Status of the Receiver (Change the Settings)” (page 7).

Q Brightness

For setting methods, see page 8.

The screen brightness can be selected from the following three levels.
"Brightness 1", "Brightness 2", "Brightness 3" (default setting)
The default setting of "Brightness 3" makes the screen the brightest.

R ECO

For setting methods, see page 8.

Power consumption can be reduced by turning OFF the screen display and the output indicators.

Display		Function
OFF		Disables the ECO function (default setting).
ON		The output indicators turn OFF, the active receiver turns OFF, and a single small square pulses across the screen.
FULL		The ECO function explained above turns ON, and the response time is two times longer.
	ALL	The output indicators turn OFF, the active receiver (ACT-R) turns OFF, and the screen turns OFF. This item becomes selectable by holding down [▷▷] while "FULL" is displayed. The response time is the same as during normal operation.

Immediately after the "ON" or "FULL" option is selected, the option is enabled, and the power save display appears. For details on the power consumption, see the specifications.
The normal display is restored when any key operation is performed (except for "ALL").
If no operation is performed for 30 seconds, the power save display appears again.

- **Deactivating "ALL"**

1 Hold down [M] and [ACT-R] simultaneously for 3 seconds or more.

The screen returns to the display of the current received light intensity.
If no operation is performed for 30 seconds, the "ALL" state is restored.

S Initialize

For setting methods, see page 8.

This is the same function as "3-8 Initialization" (page 6)
Select "Execute" and press [M] to execute the initialization.

T Custom Setting

For setting methods, see page 8.

This is the same function as "3-11 Saving/Recalling Settings" (page 6).

U Interference

For setting methods, see page 8.

Malfunction may result from "interference", a phenomenon in which light transmission occurs simultaneously with another amplifier. However, when the number of amplifiers increases, the light transmission timing automatically shifts and prevents this interference.
Setting this function to "Double" on all the connected amplifier units doubles (compared to normal operation) the number of units that do not mutually interfere.

Display	Function
Standard	Normal operation (default setting)
Double	The mutual interference prevention is twice that in the Standard state.

Point

- **Selecting "Double" also doubles the response time compared to that when "Standard" is selected.**
- **When selecting "Double", the main unit and its connected expansion units must all be set to "Double".**
- **This function cannot be set if "ECO" is set to "FULL".**

- **Maximum number of mutual interference prevention units**

The maximum number of amplifiers for which mutual interference can be prevented varies depending on the selected power mode. The maximum numbers of units for which mutual interference is prevented when a FS-N40 Series main unit and expansion units are connected are shown below.

Power mode	Standard	Double If the ECO function is "FULL"
S-HSPD HSPD	0	0
FINE	4	8
TURBO SUPER ULTRA MEGA TERA	8	16

Reference

Interference prevention is enabled even if connected to models other than the FS-N40 Series.
For the number of units for which mutual interference can be prevented, contact KEYENCE.

- **Interference prevention when using main units in a standalone manner (without connecting to expansion units)**

The interference between two main units is automatically reduced. This is not supported when "Power Modes" (page 10) is set to "S-HSPD" or "HSPD".
This is not supported during IO-link communication. (FS-N41C)

V Key Lock Method

For setting methods, see page 8.

Disable button operations to prevent unauthorized use.

Display	Function
Normal	Normal operation (default setting)
PIN Key Lock	A personal identification number can be set when activating the key lock. Only users who know the personal identification number can operate the unit.

For details on activating/deactivating the key lock, see "3-10 Disabling the Key Operations" (page 6).

W Display Gain

For setting methods, see page 8.

The received light intensity display value can be multiplied by four without sacrificing the response time.

Display	Function
OFF	Normal received light intensity display (default setting)
ON	Four times the normal received light intensity display (the hysteresis is also four times the normal value)

The maximum received light intensity that can be displayed does not change even when "ON" is selected.

X IO-Link Mode

For setting methods, see page 8.

This can only be set on the FS-N41C.

This function prevents the unit from unexpectedly switching to IO-Link communication.

Display	Function
IO-Link On	Normal (default setting)
IO-Link Off	Prevents switching to IO-Link communication

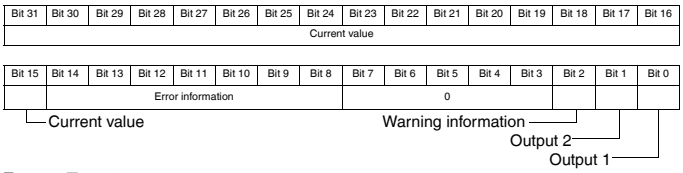
Y IO Data Format

For setting methods, see page 8.

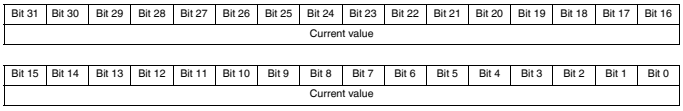
This can only be set on the FS-N41C.

Select this function when using IO-Link communication. This function communicates the predetermined data for a fixed period. The output type can be selected from the two shown below.

Format Type 0



Format Type 1



Z I/O Selection

This item is only displayed on the FS-N41C.
The details configured in the initial settings (page 4) can be checked.
To change the settings, initialize (page 6) the unit.

Display	Pin number 2 function	Pin number 4 function
PNP/1 Input	Input	Output 1 (PNP)
PNP/2 Output	Output 2 (PNP)	Output 1 (PNP)
NPN/1 Input	Input	Output 1 (NPN)
NPN/2 Output	Output 2 (NPN)	Output 1 (NPN)

Output 2 settings

a Second Output

For setting methods, see page 9.

The table below lists the detection modes that can be selected.

Selection display	Function
Standard	Normal detection mode (default setting)
Warning	Warning output mode
Same as Out.1	Performs the same ON/OFF operations as output 1 (only selectable on the FS-N41C)

When this is set to “Warning”, output 2 turns ON (OFF with the N.C. setting) when:

- A “DATUM Offset” occurs.
- An “APC Cor Error” occurs.
- A “Memory Access” error occurs.
- The peak value falls below the limit detection setting value with “Limit Detection” enabled.

b Switch L-On/D-On

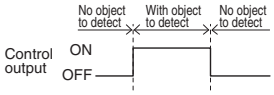
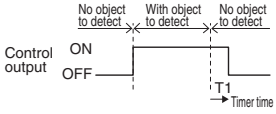
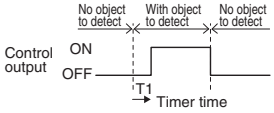
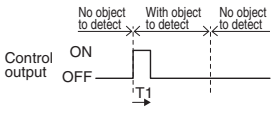
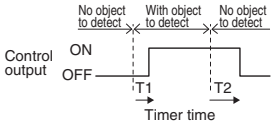
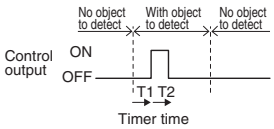
For setting methods, see page 9.

Select whether to turn the output ON when the receiver is lit (Light ON) or is dark (Dark ON).
This function is also used to switch between N.O. and N.C. when “Warning” is selected for a “Second Output”.

c Output timer 2

For setting methods, see page 9.

There are five types of output timers available.

Display	Function	Timing chart*
OFF	Uses no output timer. (Default setting)	
Off-delay	Off-delay timer Turns OFF the output at a specified time after the detection signal turns OFF. Setting range: 1 to 9999 ms Initial value: 10 ms	
On-delay	On-delay timer Turns ON the output at a specified time after the detection signal turns ON. Setting range: 1 to 9999 ms Initial value: 10 ms	
One-shot	One-shot timer Turns ON the output and keeps it ON for a specified period after the detection signal turns ON. Setting range: 1 to 9999 ms Initial value: 10 ms	
On/Off-Delay	On-delay/off-delay timer This is a composite timer that includes both an on-delay timer (Duration 1: T1) and an off-delay timer (Duration 2: T2). Each timer's specified time can be set separately. Setting range: 1 to 9999 ms Initial value: 10 ms	
On-Del/ 1Shot	On-delay/one-shot timer This is a composite timer that includes both an on-delay timer (Duration 1: T1) and a one-shot timer (Duration 2: T2). Each timer's specified time can be set separately. Setting range: 1 to 9999 ms Initial value: 10 ms	

* Example of the “Light ON” (L-ON) mode for the reflective model and the “Dark ON” (D-ON) mode for the thrubeam/retro-reflective model

Reference

- When using the dual output type, different timer functions and timer times can be set separately for channels 1 and 2.
- Timers cannot be used for the warning output on dual output types.

6-1 Specifications

Model	NPN output	FS-N41N	FS-N42N	FS-N43N	FS-N44N	FS-N41C[*1] (selectable output)	FS-N40
	PNP output	FS-N41P	FS-N42P	FS-N43P	FS-N44P		
Cable/connector		Cable				M8 connector[*2]	-
Main unit/expansion unit		Main unit	Expansion unit	Main unit	Expansion unit	Main unit	Expansion unit
Number of control outputs		1	1	2	2	2[*3]	None[*4]
Number of external inputs		-	-	1	1	1[*3]	-
Light source LED		Transmitter side: Red, four-element LED (wavelength: 660 nm)					
Response time		23 µs (S-HSPD[*5])/50 µs (HSPD[*6])/250 µs (FINE)/500 µs (TURBO)/ 1 ms (SUPER)/4 ms (ULTRA)/16 ms (MEGA)/64 ms (TERA)					
Control output		Open-collector, 30 V or less 100 mA or less per output, 100 mA or less total for 2 outputs (when used as a solitary unit)/ 20 mA or less (when used as an expansion unit)					-
	Residual voltage	NPN 1.4 V or less (output current: 10 mA or less)/ 2 V or less (output current: 10 to 100 mA) PNP 1.6 V or less (output current: 10 mA or less)/ 2.2 V or less (output current: 10 to 100 mA)					-
External input		Input time: 2 ms (ON)/20 ms (OFF) or longer[*7]					
Unit expansion (excluding the FS-N41C)		Up to 16 units (17 units connected in total including the main unit). However, each dual output type will be treated as two expansion units.					
Protection circuit		Protection against reverse power connection, output overcurrent, output surge, and reverse output connection					
Mutual interference prevention		S-HSPD/HSPD: 0 units, FINE: 4 units, TURBO/SUPER/ULTRA/MEGA/TERA: 8 units (The mutual interference prevention values are twice those shown here when Double is set.)					
Power supply	Power supply voltage	10 to 30 VDC (including 10% ripple (P-P) or less), class 2 or LPS[*8]					
	Power consumption[*9] NPN FS-N40	During normal operation: 870 mW or less (34 mA or less at 24 V/62 mA or less at 12 V) ECO ON: 800 mW or less (31 mA or less at 24 V/56 mA or less at 12 V) ECO FULL: 710 mW or less (28 mA or less at 24 V/49 mA or less at 12 V)					
	Power consumption[*9] PNP FS-N41C	Single output type (FS-N41P/N42P) and FS-N41C During normal operation: 910 mW or less (36 mA or less at 24 V/65 mA or less at 12 V) ECO ON: 840 mW or less (33 mA or less at 24 V/60 mA or less at 12 V) ECO FULL: 750 mW or less (30 mA or less at 24 V/52 mA or less at 12 V)					
		Dual output type (FS-N43P/N44P) During normal operation: 990 mW or less (39 mA or less at 24 V/72 mA or less at 12 V) ECO ON: 920 mW or less (36 mA or less at 24 V/66 mA or less at 12 V) ECO FULL: 830 mW or less (33 mA or less at 24 V/59 mA or less at 12 V					
Ambient light		Incandescent lamp: 20,000 lx or less, sunlight: 30,000 lx or less					
Ambient temperature		-20°C to +55°C (no freezing)[*10]					
Vibration resistance		10 to 55 Hz; double amplitude 1.5 mm; 2 hours each for X, Y, and Z axes					
Shock resistance		500 m/s^2; 3 times each for X, Y, and Z axes					
Case material		Main unit and cover: polycarbonate					
Weight		Approx. 78 g	Approx. 48 g	Approx. 83 g	Approx. 73 g	Approx. 25 g	Approx. 23 g

*1 IO-Link Specification V.1.1/COM2 (38.4 kbps) is supported.
*2 Ensure the cable length is 30 m or less for the M8 connector type. Ensure the cable length is 20 meters or less when connecting by way of IO-Link.
*3 Output 2 and the external input are selectable.
*4 This counts as 1 output when connecting multiple units to the FS-MC8N/P, NU Series.
*5 Restrictions when S-HSPD is selected
- Output 2 of dual output types (FS-N43N/N43P/N44N/N44P/N41C) is fixed to OFF.
- IO-Link communication (FS-N41C) cannot be used.
- Area detection, Area % Mode, DATUM, Rising edge, and Falling edge cannot be selected for Detection Mode.
- Output timer, Limit Detection, and Display Gain cannot be used.
- FULL cannot be selected for the ECO function.

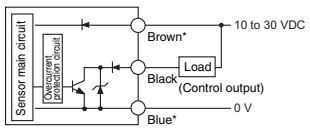
*6 Restrictions when HSPD is selected
- Display Gain cannot be used.

*7 The input time becomes 25 ms (ON)/25 ms (OFF) when external calibration input is selected.
*8 When expanding the system to 9 or more units, use a power supply voltage of 12 V or higher.
*9 The load current is excluded. The power consumption including the load when the maximum number of units are connected is 38 W max.
*10 When expanded by 1 to 2 units: -20°C to +55°C. When expanded by 3 to 10 units: -20°C to +50°C.
When expanded by 11 to 16 units: -20°C to +45°C. When using 2 outputs, 1 unit is counted as 2 units.
The prescribed values for the ambient temperature assume that the sensor amplifier has been mounted on a DIN rail installed on a metal surface.
Exercise special care when installing the product in an airtight space.

6-2 Input/Output Circuit Diagrams

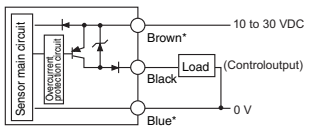
■ Cable type

FS-N41N/N42N



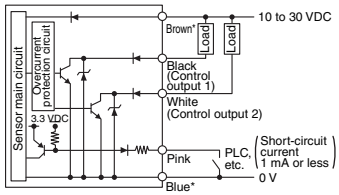
* FS-N41N only

FS-N41P/N42P



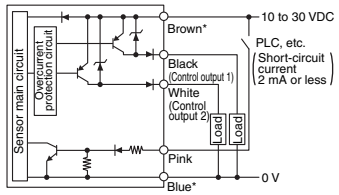
* FS-N41P only

FS-N43N/N44N



* FS-N43N only

FS-N43P/N44P



* FS-N43P only

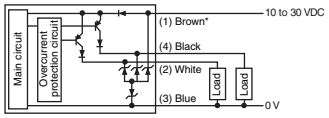
■ M8 connector type (FS-N41C)

Select PNP or NPN and the function of I/O pin (2) during the initial settings.

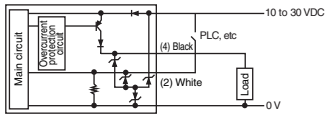
Sensor pin layout

When using the sensor in PNP mode

When OUT1 + OUT2 is selected



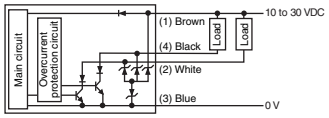
When OUT1 + INPUT is selected



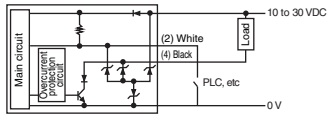
The wire colors indicate the colors when using an OP-73864/73865 M8 connector cable (sold separately).

When using the sensor in NPN mode

When OUT1 + OUT2 is selected



When OUT1 + INPUT is selected



The wire colors indicate the colors when using an OP-73864/73865 M8 connector cable (sold separately).

7-1 Troubleshooting

■ Frequently Asked Questions

Category	Problem	Cause	Action
Received light intensity display	The received light intensity is inconsistent. How can it be stabilized?	The received light intensity may be affected by factors such as vibration, temperature change, or the state of the surface of the object to detect.	• Review the installation environment. • The received light intensity can be stably displayed at "100.0" by using the preset function. "Detection Mode" (page 11) • When using DATUM mode, the setting value and the received light intensity are both corrected to maintain a set ratio. "Detection Mode" (page 11)
	The received light intensity is too low. How can it be increased?	This may be the result of a long detecting distance. When using reflective models, the intensity of the light reflected from the object to detect may be low or there may be contamination. When using thrubeam models or retro-reflective models, the optical axis may be misaligned.	• Review the installation environment and detecting distance. • Selecting a higher "Power Modes" setting increases the received light intensity value. "Power Modes" (page 10) • The apparent received light intensity can be increased 4-fold by using the Display Gain setting. "Display Gain" (page 19)
	The received light intensity remains unchanged from 9999 or 99999 even if an object to detect is placed for detection.	The received light intensity has become saturated.	• Extend the detecting distance. • Lower the light emission level and the received light sensitivity. "3-7 Light Emission/Received Light Intensity Adjustment (Saturation Canceling)" (page 6)
Screen display	Nothing is displayed.	The ECO function (ALL) is selected.	Disable the ECO function. "ECO" (page 19)
		The power is OFF or the power cable is disconnected.	Review the wiring and the power supply voltage.
	"-" scrolls from left to right on the display.	The ECO function (FULL) is selected.	Disable the ECO function. "ECO" (page 19)
		Sleep mode has been enabled by the external input.	Set "Ext. Input" to "OFF" or select a value other than "Sleep" with the external input function. "Ext. Input" (page 16)
Output operation	The received light intensity at which the output turns ON and the received light intensity at which the output turns OFF are slightly different.	The timer function has been set.	Review the timer function settings. "Output timer" (page 16/20)
		Hysteresis	A slight hysteresis is set to prevent chattering in the output. If this level of received light intensity is notable during detection, the detection tolerance may be low. Review the detection details.
Fiber unit indicators and active receiver related	The light receiving side lights in red.	The fiber units on the transmitting side and light receiving side are reversed.	Connect the fiber unit to the amplifier correctly.
	When using a reflective model, the color of the transmitted spot changes slightly when the unit turns ON/OFF.	The active receiver function causes the receiver to light in green.	The unit can be used as-is. However, if this issue is bothersome, set the normal lighting status of the active receiver function to Disable. "Changing the Fiber Unit Indicator Settings (ACT-R)" (page 7)
Preset related	A value less than 100.0 is displayed even when "Preset" is selected for "Detection Mode" and [SET] is pressed.	The current received light intensity is 50 or less.* (* 200 when Display Gain is set to ON.)	Take actions to increase the received light intensity such as adjusting the optical axis, removing contamination, and reviewing the installation environment.
		The maximum sensitivity preset has been executed when the received light intensity is almost saturated.	Lower the received light intensity, and then execute the maximum sensitivity preset again. "3-7 Light Emission/Received Light Intensity Adjustment (Saturation Canceling)" (page 6)
	"--- ---" is displayed when "Preset" is selected for "Detection Mode" and [SET] is pressed.	The zero shift function is enabled.	Disable the zero shift function. "3-6 Setting the Current Received Light Intensity Display to 0 (Zero Shift)" (page 6)
		Zero shift input is selected with the external input function.	Select a mode other than zero shift input for the external input function. "Ext. Input" (page 16)
		The difference in received light intensity during preset function execution and work-preset function execution is small.	Provide a sufficient difference in received light intensity when using preset calibration and work-preset calibration.
		The received light intensity was saturated when using the maximum sensitivity preset function and the full auto preset function. Alternatively, the received light intensity was saturated when executing either the preset function or work-preset function.	Lower the received light intensity. "3-7 Light Emission/Received Light Intensity Adjustment (Saturation Canceling)" (page 6)
Zero shift related	"--- ---" appears or nothing happens even when using the zero shift function.	"Preset", "DATUM", "Rising edge" or "Falling edge" is selected for "Detection Mode".	Select a value other than "Preset", "DATUM", "Rising edge" and "Falling edge" for "Detection Mode".
DATUM related	The received light intensity is not corrected to 100.0/0.0 in DATUM mode.	The received light intensity (the current value) is 50 or less.* (* 200 when Display Gain is set to ON.)	Take actions to increase the received light intensity such as adjusting the optical axis, removing contamination, and reviewing the installation environment.
		The received light intensity (the current value) is less than the warning output level.	• Check the installation environment and confirm that the optical axis is not misaligned and that the surface of the object to detect is not contaminated. • To continue corrections, increase the warning output level. The corrections will not stop as frequently.
Others	It is necessary to initialize all the settings.	-	Perform initialization. "3-8 Initialization" (page 6)
	The user cannot remember the key lock PIN.	-	Contact the nearest KEYENCE office.
	A setting error occurred when connecting to the communication series NU Series.	The setting is incorrect.	Perform initialization. "3-8 Initialization" (page 6)

■ Error displays

Display	Cause	Solution
Overcurrent	An overcurrent is flowing through the control output.	• Check the load and return it to a value within the rated range. • Check that the output wire is not contacting any other wire or frame.
Memory Access	The attempt to write/read internal data failed.	• Turn the power OFF and ON. If the data is not recovered, initialize the settings. "3-8 Initialization" (page 6) • The sensor is damaged. Replace the sensor.
Low Intensity	The received light intensity is low. (When using Limit Detection.)	• Check the installation environment. • Check that the fiber unit is not dirty. • Check that the fiber cable is not starting to break.
APC Cor Error	The reduction in LED light intensity exceeded the APC correction limit.	• Because the sensor is in a state where the APC function cannot be used further, replace the sensor if high-level detection is needed.
Over Saturated	The received light intensity is saturated. The sensitivity cannot be set to an appropriate value.	• Lower the light emission level and the received light sensitivity. • "3-7 Light Emission/Received Light Intensity Adjustment (Saturation Canceling)" (page 6)
DATUM Offset	A correction error occurred in DATUM mode.	• Check that the received light intensity has not dropped. • Adjust the "Warning level". "Warning level" (page 15) • Ensure that the current received light intensity value is 50 or higher (200 or higher when Display Gain is set to ON).

Reference For the initialization method, see "3-8 Initialization" (page 6).

■ Display when a multi-output unit (FS-MC8N/8P) is connected

Display	Cause
Now Saving...	The amplifier settings are being saved to the multi-output unit.
Now Loading...	The settings saved to the multi-output unit are being written to the amplifier.

8. Factory Default Settings List 8

The default settings are as follows.

Item	Default setting	Reference page
A Power Modes	FINE	10
B Switch L-On/D-On	Light ON	10
C Display Bar	OFF	10
D Detection Mode	Standard	11
E Output timer	OFF	16
F Ext. Input*1	OFF	16
G Saturate Cancel	-	17
H Attenuation	100	17
I Zero Shift	-	17
J Limit Detection	OFF	17
K Auto Power	OFF	17
L Hysteresis	Level 3	17
MLanguage	ENGLISH	17
N Flip Display	OFF	17
O Sub Display	OFF	18
P ACT-R	Output Link	18
Q Brightness	Brightness 3	19
R ECO	OFF	19
S Initialize	-	19
T Custom Setting	-	19
U Interference*2	Standard	19
V Key Lock Method	Normal	19
W Display Gain	OFF	19
X IO-Link Mode*2	IO-Link On	20
Y IO Data Format*2	Format Type 0	20
Z I/O Selection*2	-	20
a Second Output*3	Standard	20
b Switch L-On/D-On*3	Light ON	20
c Output timer 2*3	OFF	20

*1 This can only be used on types that support an external input.
When connected to the multi-output unit FS-MC8N/P or the communication unit NU Series, this setting can be configured on types that do not support an external input.

*2 This item is not displayed on the FS-N41C.

*3 This item is only displayed on the FS-N41C.

*4 This item is only displayed on dual output types.

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(1) KEYENCE warrants the Products to be free of defects in materials and workmanship for a period of one (1) year from the date of shipment. If any models or samples were shown to Buyer, such models or samples were used merely to illustrate the general type and quality of the Products and not to represent that the Products would necessarily conform to said models or samples. Any Products found to be defective must be shipped to KEYENCE with all shipping costs paid by Buyer or offered to KEYENCE for inspection and examination. Upon examination by KEYENCE, KEYENCE, at its sole option, will refund the purchase price of, or repair or replace at no charge any Products found to be defective. This warranty does not apply to any defects resulting from any action of Buyer, including but not limited to improper installation, improper interfacing, improper repair, unauthorized modification, misapplication and mishandling, such as exposure to excessive current, heat, coldness, moisture, vibration or outdoors air. Components which wear are not warranted.

(2) KEYENCE is pleased to offer suggestions on the use of its various Products. They are only suggestions, and it is Buyer's responsibility to ascertain the fitness of the Products for Buyer's intended use. KEYENCE will not be responsible for any damages that may result from the use of the Products.

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