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Hybrid Fiberoptic Sensors

FS-V11(P)/12(P)/10

Instruction Manual

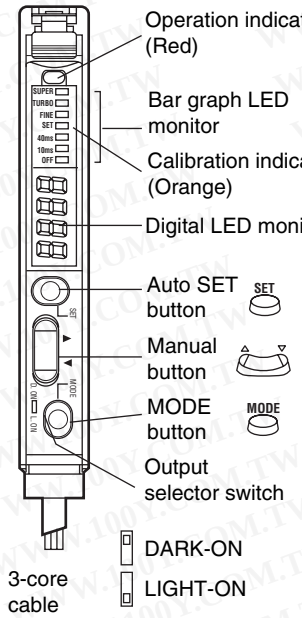
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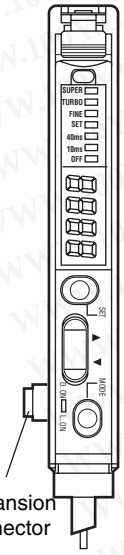
Read this manual before using the product in order to achieve maximum performance.
Keep this manual in a safe place after reading it so that it can be used at any time.

PART NAMES AND FUNCTIONS

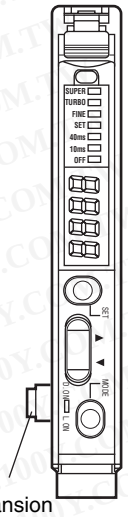
FS-V11(P)
(Main unit)



FS-V12(P)
(Expansion unit)



FS-V10
(Expansion unit)



SAFETY PRECAUTIONS

⚠ WARNING

- ***This product is just intended to detect the object(s). Do not use this product for the purpose to protect a human body or a part of human body.***
- ***This product is not intended for use as explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.***

PRECAUTIONS ON REGULATIONS AND STANDARDS

■ UL Certificate

This product is an UL/C-UL Listed product.
- UL File No. E301717
- Category NRKH,NRKH7
- Enclosure Type 1 (Based on UL50)

Be sure to consider the following specifications when using this product as an UL/C-UL Listed Product.
- Use the power supply with Class 2 output defined in NFPA70 (NEC: National Electrical Code).
- Power supply/ Control input/ Control output circuits shall be connected to a single Class 2 source only.
- Use with the over current protection device which is rated 24V or more and not more than 2A.

Accessories
- Instruction manual (x 1)
- Mounting bracket [FS-V11(P) only]
- End unit (x 2) [FS-V12(P) only]
- Directions (x 1) [FS-V12(P) only]

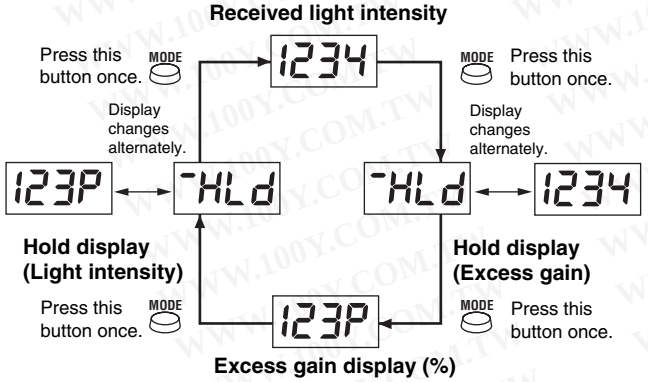
SPECIFICATIONS

Model	NPN output	FS-V11	FS-V12	FS-V10
	PNP output	FS-V11P	FS-V12P	—
Light source		Red LED		
Response time		250 μs (FINE)/500 μs (TURBO)/ 1 ms (SUPER)		410 μs to 1.7 ms [1]
Operation mode		LIGHT-ON/DARK-ON (switch selectable)		
Indicators		Output indicator: Red LED Digital LED monitor: Red LED Bar graph LED monitor: Green/Orange LED [2] Calibration indicator: Orange LED [2]		
Timer function		OFF-delay: 40 ms, 10 ms Timer OFF		
Control output		NPN or PNP open-collector 24V 100mA max. Residual voltage: 1V max.		
Protection circuit		Reverse polarity protection, Over-current protection, Surge absorber		
Power supply voltage		12 to 24 VDC ±10%, Ripple (P-P) 10% max, Class 2		
Current consumption		50 mA max.		
Ambient illumination		Candescent lamp: 10,000 lx max., Sunlight: 20,000 lx max		
Ambient temperature [3]		-10 to +55°C (14 to 131°F), No freezing.		
Relative humidity		35 to 85%, No condensation		
Vibration		10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions for two hours		
Shock immunity		500 m/s² in X, Y and Z directions, three times each		
Housing material		Body/Cover: Polycarbonate		
Weight (including 2-m cable)		Approx. 80 g	Approx. 45 g	Approx. 20 g

1. The response time varies depending on the number of expansion units connected.
2. The orange LED is normally part of the bar graph LED monitor. It is used as a calibration indicator during the setting of the sensitivity.
3. When several units are connected, the allowable ambient temperature changes depending on the following conditions. To connect several units, be sure to mount them to a DIN rail (metal DIN rail). Make sure that the output current is 20 mA. max.
   • When 3 to 10 units are connected: -10 to +50 °C (14 to 122°F)
   • When 11 to 16 units are connected: -10 to +45 °C (14 to 113°F)

SELECTING DISPLAYED DATA

The display changes every time the MODE button is pressed.



Displaying the setting value

Press ▽ or △ once while the received light intensity is displayed. The setting value flashes for 2 seconds, and then the received light intensity appears once more.

Note: To change the setting value, press ▽ or △ while the setting value is flashing.

■ Displaying received light intensity

Received light intensity is displayed approximately 4000 is the maximum setting.

Note: The MAX and MIN values vary depending on the fiber unit connected.

■ Displaying excess gain

Received light intensity is converted by defining the setting value as 100 P (%).

■ Displaying the hold value

The peak value or the minimum value of the received light intensity or excess gain is displayed.
The setting of the output selector switch determines whether the peak value or the minimum value is displayed.

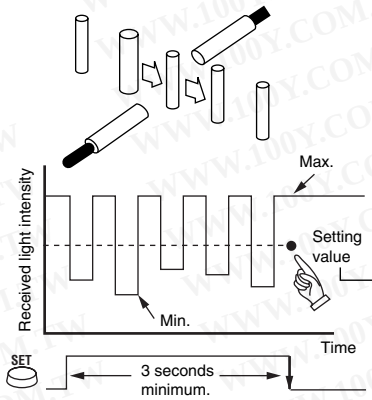
Output selector switch	Display	Hold value
LIGHT-ON	⁻HLd	Peak-hold value
DARK-ON	₋HLd	Bottom-hold value

SETTING THE SENSITIVITY (AUTOMATIC CALIBRATION)

Select the sensitivity setting procedure according to the target condition.
When the setting is completed, the setting value flashes twice.

For sensitivity adjustment using a moving target

Fully-automatic Calibration



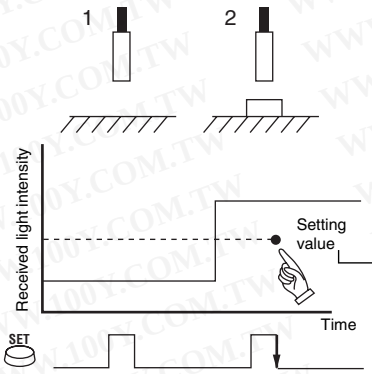
1. Pass a target through the optical axis while pressing the SET button.
2. Confirm that the calibration indicator (orange LED) flashes.
3. Release the SET button.

The setting value is adjusted to the midpoint of the difference between the maximum and minimum values of the received light intensity.

If the fully-automatic calibration does not work properly, try the two-point calibration.

For sensitivity adjustment using a stationary target

Two-point Calibration

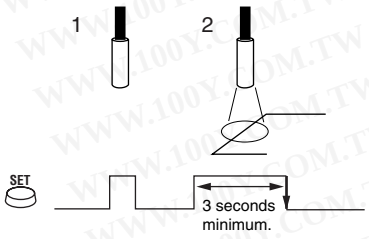


1. With no target in place, press the SET button and release it. (The orange LED lights.)
2. Position a target in place. Press the SET button again and release it.

The setting value is adjusted to the midpoint of the difference in the received light intensity when the target is absent and present.

For target positioning

Positioning Calibration

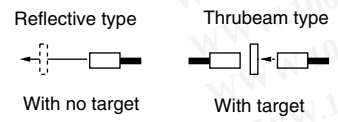


1. With no target, press the SET button and release it. (The orange LED lights.)
2. Place a target in the position where it is to be stopped.
3. Press the SET button for 3 seconds or more until the calibration indicator (orange LED) flashes. Release the SET button.

The setting value is adjusted to turn on the sensor when the target comes to the place where it should be stopped.

For maximum sensitivity

Maximum sensitivity setting



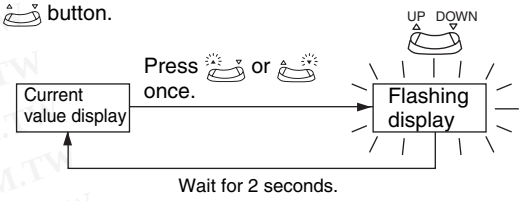
1. Under the conditions on the left, press the SET button for 3 seconds or more.
2. Confirm that the calibration indicator (orange LED) flashes.
3. Release the SET button.

When the reflective type is used to detect a target with some objects in the background, the sensitivity is set to the maximum value at which the background objects are not detected.

If the detecting distance is insufficient, try the two-point calibration.

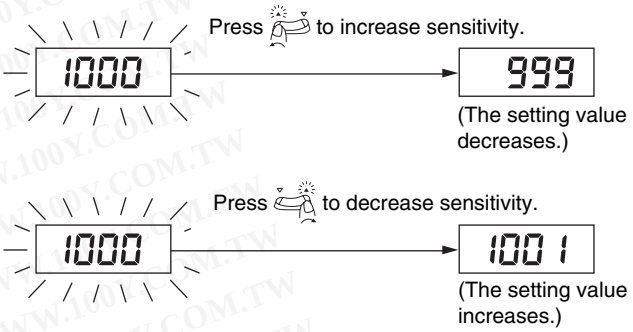
CHANGING THE SETTING VALUE (MANUAL CALIBRATION)

Use the button.



■ Received light intensity display

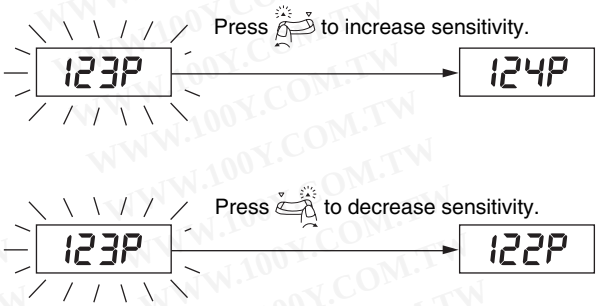
Press or once. The setting value flashes.
Change the setting value by pressing or while the value is flashing.



The current value appears after 2 seconds.*

■ Excess gain display

Press or once. The setting value flashes.
Change the setting value by pressing or while the value is flashing.



The current value appears after 2 seconds.*

Note: If the SET button is pressed by accident while the sensitivity is being manually changed, the automatic sensitivity setting will start (The calibration indicator lights.). The sensitivity cannot be changed until the automatic sensitivity setting is completed (The calibration indicator goes off.).

* Do not press any buttons other than the manual button while the setting value is flashing. Otherwise, the value cannot be changed properly.

- **When the sensitivity difference is insufficient**

If the sensitivity has no allowance, "- - - -" flashes immediately after the completion of the automatic calibration.

Note: Sensitivity is set and entered even when the sensitivity difference is insufficient. Be sure to confirm that the detection is properly performed.

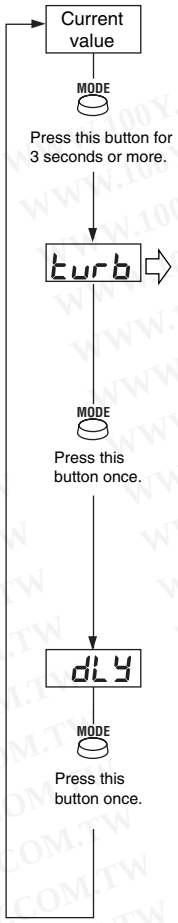
- **Locking the operation button**

Hold down and [MODE] or and [MODE] simultaneously for 3 seconds or more to lock the operation buttons. When "LOC" is displayed in flashing letters, the buttons are locked.

To unlock the operation buttons, repeat the procedure above. When "UNL" is displayed in flashing letters, the buttons are unlocked.
Even when the operation buttons are locked, you can change the display data or output method, or display the setting value.

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SELECTING MODE (POWER/TIMER)



Power selection

One lamp in the bar graph LED monitor flashes to show the currently selected power mode. Press ▲ or ▼ to choose the desired power mode.

FINE — When detecting a minute difference in a short detecting distance

TURBO — When the detecting distance of FINE mode is insufficient

SUPER — When the environment is hostile, such as dusty

Timer selection

One lamp in the bar graph LED monitor flashes to show the currently selected output timer mode. Press ▲ or ▼ to choose the desired timer mode.

OFF — Output timer OFF

10ms — OFF-delay for 10 ms

40ms — OFF-delay for 40 ms

Note: Be sure to readjust the sensitivity after the power mode is changed.

Bar graph LED monitor in normal operation

The light is steadily received.
↓
The light is irregularly received.

The light is irregularly interrupted.
↑
The light is steadily interrupted.

+15% or more
+10% or more
+5% or more
Setting value
-5% or less
-10% or less
-15% or less

The LEDs show the received light intensity with respect to the setting value.
The monitor shows the stability level of the current detection.

When the detection becomes unstable due to the change in surrounding environment or targets, readjust sensitivity.

MUTUAL INTERFERENCE SUPPRESSION FUNCTION

When several expansion units are connected, each fiber unit is free from light interference from the adjacent fiber units.

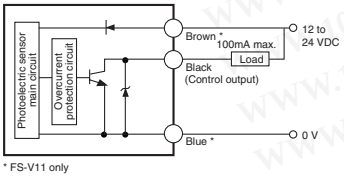
The number of fiber units that are free from light interference depends on the selected power mode.

Power mode	FINE	TURBO	SUPER
No. of units free from interference	4	8	

Note: When units are not connected using the expansion connectors, the mutual interference suppression function does not work.
The mutual interference suppression function is limited to 4 units even if only one unit is set to FINE mode.

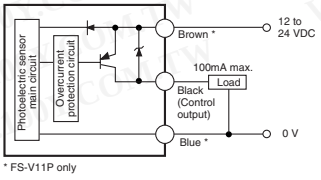
I/O CIRCUIT

NPN
FS-V11/V12



* FS-V11 only

PNP
FS-V11P/V12P



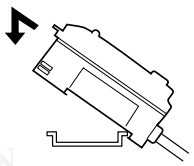
* FS-V11P only

MOUNTING MAIN UNIT

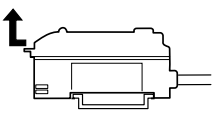
■ Mounting/Detaching the unit to/from a DIN rail or the mounting bracket.

Hook the claw located at the unit cable side onto the DIN rail, and then hook the front side claw to the rail while pressing the amplifier forward. To detach the unit, unhook the front claw by lifting the unit front side while pressing it forward.

Mounting

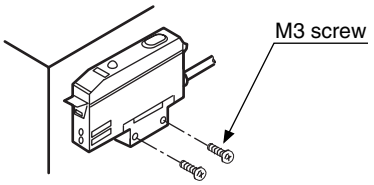


Detaching



■ Mounting a unit laterally

Secure the unit with screws through the side holes of the supplied mounting bracket [FS-V11(P) only].



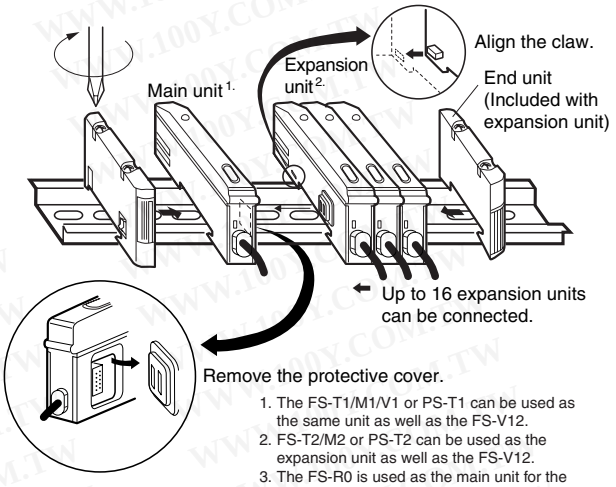
MOUNTING EXPANSION UNITS

■ Mounting expansion units

1. Detach the protective cover from the unit's side panel.
2. Mount units to a DIN rail one by one.
3. Slide one expansion unit toward another. Align the front claws of the units and push the unit together until they click.
4. Fix the units together by pushing an end unit onto each end. [The end units are included in the FS-V12(P)]

■ Detaching units from DIN rail

1. Remove the end units.
2. Slide the expansion units apart, and detach them individually. (Do not detach multiple units connected together with end units.)



1. The FS-T1/M1/V1 or PS-T1 can be used as the same unit as well as the FS-V12.
2. FS-T2/M2 or PS-T2 can be used as the expansion unit as well as the FS-V12.
3. The FS-R0 is used as the main unit for the FS-V10, FS-T0 and FS-M0.

The sticker shown on the right is included in the expansion unit. Apply this sticker near the sensor.

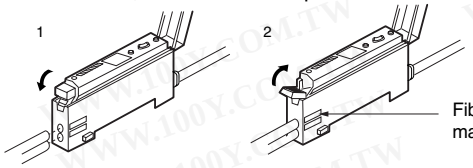


Note 1: When several units are connected, confirm the ambient temperature. (See "Specifications" on P. 1.)
Note 2: To connect several units, be sure to use a DIN rail and end units.
Note 3: To mount or detach several units, be sure to turn the power off.
Note 4: Do not remove the protective cover of the expansion connector on the outmost unit.

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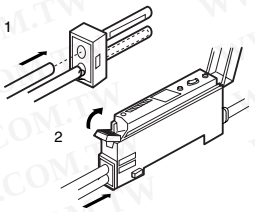
CONNECTING FIBER UNIT

Lower the quick-release lever, insert the fiber unit about 14 mm until it reaches the end, and then lift the quick-release lever.



- To connect a fiber unit with a small diameter, use the adaptor included with the FU series.

1. Attach the adaptor to the fiber unit.
2. Fully insert the adaptor into the mounting holes of the amplifier, and then lift the quick-release lever.

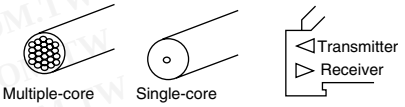


Note: If the fiber unit is improperly connected, the sensor cannot meet the specifications.

- The required adaptor is included in each model of the FU series. If an inadequate adaptor is used, the fiber unit cannot be properly installed.

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

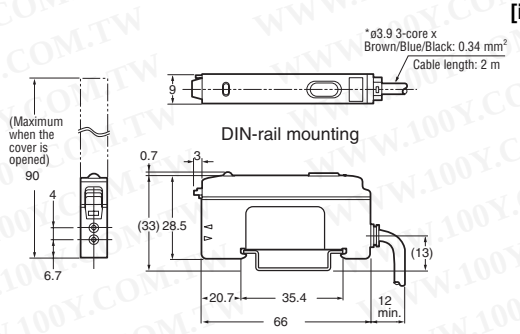
- To connect the coaxial reflective type fiber unit to the amplifier, connect the single-core fiber to the transmitter side, and connect the multiple-core fiber to the receiver side.
(Connect the fibers according to the marking on the amplifier lateral side.)



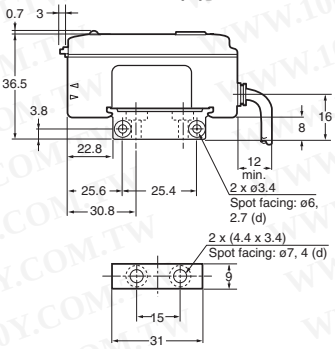
DIMENSIONS

Unit: mm

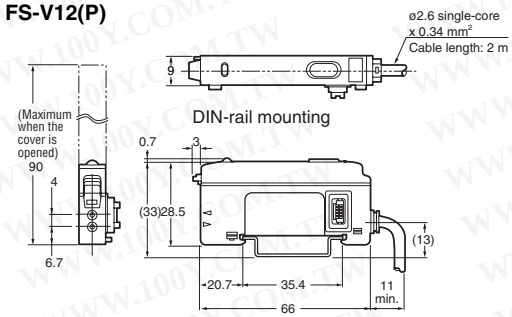
FS-V11(P)



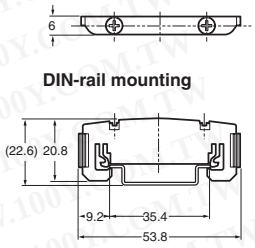
When the mounting bracket [included in FS-V11(P)] is attached:



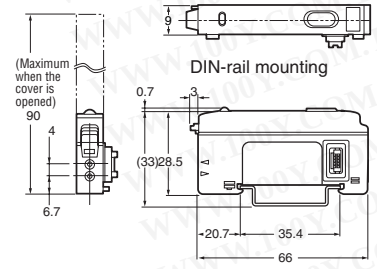
FS-V12(P)



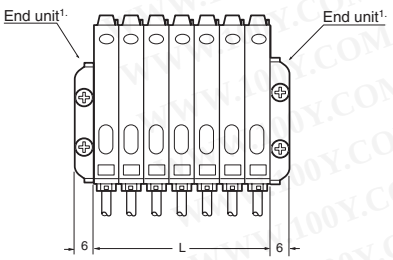
End unit [included in FS-V12(P)]



FS-V10



When several units are connected:



No. of units	L
1	9
2	18
3	27
4	36
5	45
6	54
7	63
8	72
9	81
10	90
11	99
12	108
13	117
14	126
15	135
16	144
17	153

Note: Be sure to use the end units to connect to the expansion units.

HINTS ON CORRECT USE

- To extend the cable length, use a cable with at least a 0.3 mm² cross-section area. Limit the length of cable extension to no more than 100 m. (To connect several units, contact Keyence for further information.)
- If the amplifier cable is placed together with power lines or high voltage lines in the same conduit, detection error may occur due to noise interference, or the sensor may be damaged. Isolate the amplifier cable from these lines.
- When using a commercially available switching regulator, ground the frame ground terminal and ground terminal.
- Do not use the FS series outdoors, or in a place where extraneous light can enter the light receiving surface directly.
- Due to the individual dispersion of characteristics and the difference in fiber unit model, the maximum sensing distance or displayed value of all the units are not the same.
- Improper wiring may cause the amplifier to become hot or may change the sensitivity.
- The displayed value may vary depending on the surrounding environment (change in temperature, dust, etc.).

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