



## DIGITAL FIBER SENSOR 2-OUTPUT TYPE FS-V33(P)/V34(P)/V33C(P)/V34C(P)

### Instruction 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.

<b>Warning</b>	<ul style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>This product is a sensor of DC power supply type. Do not apply AC power. The product may explode or burn if an AC voltage is applied.</li> </ul>
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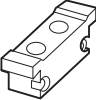
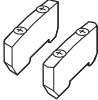
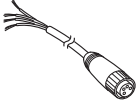
#### Precautions on Regulations and Standards

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

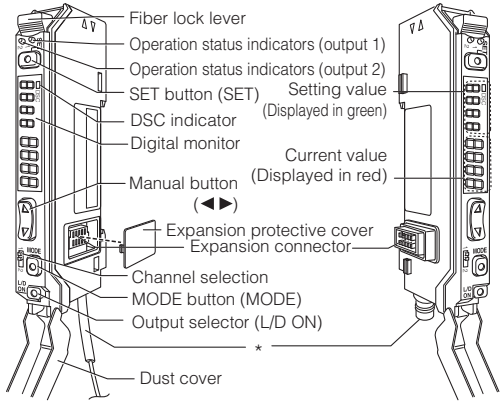
Be sure to consider the following specifications when using this product as an UL/C-UL Listed Product.

- 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.

#### Option (Sold Separately)

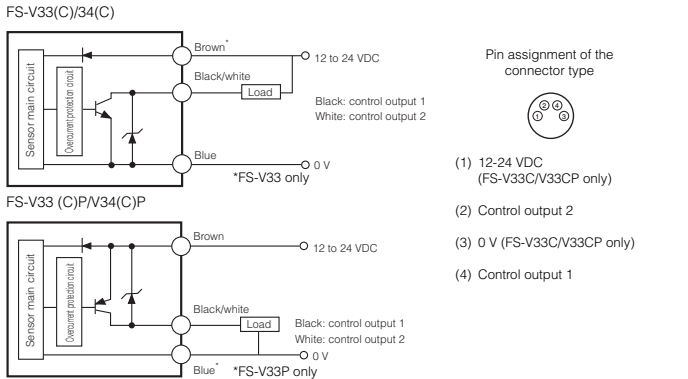
<p>Mounting bracket (main unit)</p>  <p>OP-73880</p>	<p>End unit</p>  <p>OP-26751 (a set of two)</p>	<p>Socket cable Dedicated for FS-V33C(P)/34C(P)</p>  <p>OP-73864 (cable length: 2 m) OP-73865 (cable length: 10 m)</p>
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#### Part Names

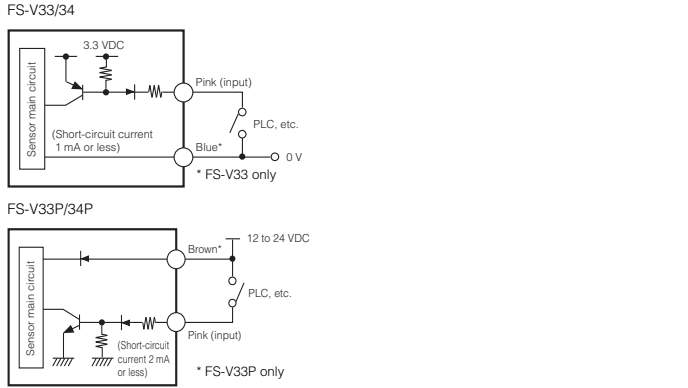


\* FS-V33 (P)/34(P) is a cable, and FS-V33C(P)/34C(P) is a M8 connector.

#### Output Circuit Diagram



#### Input Circuit Diagram



#### Socket Cable (Sold Separately for FS-V33C (P)/V34C (P))

**Connecting the Socket Cable** Pin and wire color table

- Connect the socket to the pin on the amplifier.

Connected pin No.	Core wire color
(1)	Brown
(2)	White
(3)	Blue
(4)	Black

- Turn the fixing ring on the socket clockwise to fix the socket.

#### Mounting Unit

**Mounting on a DIN Rail**

- Align the claw at the bottom of the main body with the DIN rail. While pushing the main body in the direction of the arrow 1, slant it in the direction of the arrow 2.
- To dismount the sensor, raise the main body in the direction of the arrow 3 while pushing the main body in the direction of the arrow 1.

**Installation on a Wall (Main Unit Only)**  
Attach the unit to the optional mounting bracket (OP-73880), mount them together, and secure them with two M3 screws as shown in the illustration.

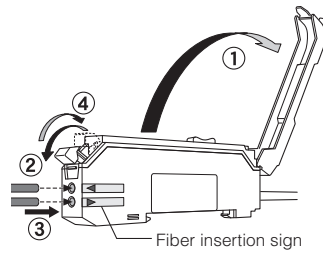
#### Connecting Multiple Amplifiers

Up to 16 sub units can be connected to one main unit.

- Remove the protection cover on the side of the main unit.
- Install the amplifier one by one on the DIN rail.
- Engage the two claws of the child unit with the recesses on the main unit side until you hear a click sound.
- Attach the end units (option: OP-26751) to the both ends of the connected amplifiers in the same way as in step (2).
- Sandwich the amplifiers between the end units. Tighten the screws at the top (two screws x two units) with a Phillips screwdriver to fix the end units.

## Connecting Fiber Unit

- 1 Open the dust cover in the direction shown by arrow 1.
- 2 Move down the fiber lock lever in the direction shown by arrow 2.
- 3 Insert a fiber unit into the fiber insertion holes to a length of the fiber insertion sign (i.e., approximately 14 mm).
- 4 Move down the fiber lock lever in the direction shown by arrow 4.

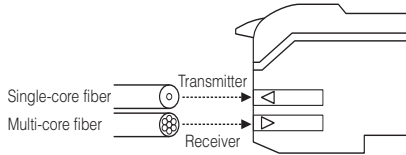


### Note

If a thin fiber unit is used, an adapter provided with the thin fiber unit will be required. Unless the right adapter is connected, the thin fiber unit will not detect targets correctly. (The adapter is supplied with the fiber unit.)

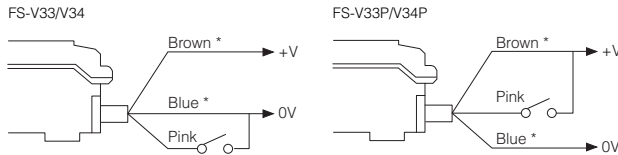
Cable outer dia.	Adapter	Appearance
φ1.3	Adapter A (OP-26500)	
φ1.0	Adapter B (OP-26501)	

- 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.



## External Input

- 1 Signals can be input externally by selecting an external input function (page 5, No. 5).
- 2 The signal can be accepted by short-circuiting the pink wire for 2 ms or more as shown below for each model (20 ms for OFF).



\* FS-V33/V34P only.

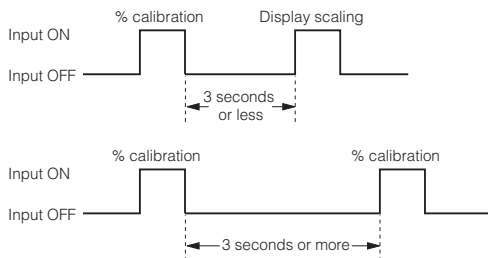
\* Setting using an external input is up to 1 million times.

\* No inputs are accepted while setting each mode.

When external calibration is selected, the operation is the same as with the SET button.

### Special Function

By performing the following operation, both sensitivity setting and scaling can be performed using external input. Select external calibration (page 5, No. 5) and display scaling (page 6, No. 7). The following is the example when using the % calibration.

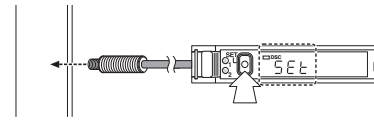


## Making Sensitivity Settings

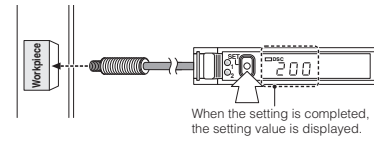
### Two-point Calibration

In this mode, the setting value used will be the mean value of two sensing values obtained with and without a workpiece.

- 1 Press the SET button without any workpiece placed in front of the fiber unit.



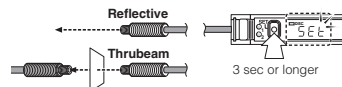
- 2 Place a workpiece placed in front of the fiber unit, and press the SET button.



If the sensitivity difference does not have enough room, "----" flashes for about two seconds after the calibration is complete. The set value is stored in memory even in that case.

### Maximum Sensitivity Setting

Set the sensitivity without a workpiece in the case of the reflective model, and with a workpiece in the case of the through-beam or retro-reflective model.

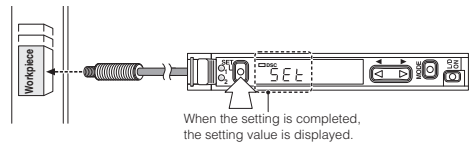


Press the SET button for three seconds in the state as shown in the above figure. (Release the button when SET flashes.) The setting value is set slightly higher than the received light intensity at the time of setting the sensitivity.

### Full Auto Calibration

In this mode, the setting value will be set to the mean value of the maximum and minimum incident values obtained within a certain period. Use this mode to detect moving workpieces.

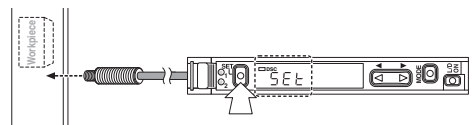
- 1 Press the set button for a minimum of three seconds while the target workpiece is passing the sensing area of the fiber unit.
  - While the set button is pressed, the sensitivity of the sensor will be set according to the incident values.



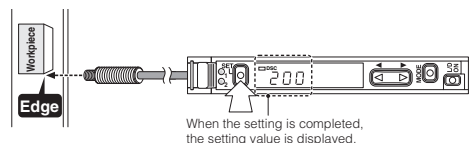
- After the setting is completed, the setting value is displayed on the digital monitor.

### Positioning Calibration

- 1 Press the SET button without any workpiece placed in front of the fiber unit.



- 2 Place a workpiece on the position where you want to perform positioning.



Press the SET button for 3 seconds or longer until the display flashes.

## Fine-adjusting Sensitivity

The setting value can be directly changed by pressing the manual button.



**When extended display (page 6, No. 9) is set for the number of digits to be displayed for the received light intensity**

- 1 Press the manual button quickly once, and check that the setting value flashes.
- 2 While the setting value is flashing, change the setting value with the Manual button.

## Percentage Calibration

This is a calibration method that can set the setting value by percentage with reference to the received light intensity at the time of sensitivity setting.

For example, if the target value is set to -10P, the setting value is determined 10% lower than the received light intensity when the SET button is pressed.

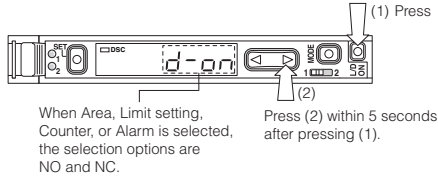
- 1 When selecting the sensitivity setting method (page 5, No. 2), select the % calibration, and set the target value of calibration.
- 2 Taking the desired light intensity as a reference (normally without a workpiece), press the SET button.



\* While the % calibration is in use, other calibrations (sensitivity setting) cannot be used.

## Output Selection

Either light-ON mode or dark-ON mode is selectable.



## Dynamic Sensitivity Correction (DSC) Function

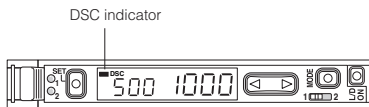
DSC automatically corrects the setting value according to the changes in the received light intensity when there is no workpiece (output OFF).

This function is effective when the light intensity difference is small when judging whether or not there is a workpiece.

At Detection mode selection (page 5, No.4), select "Dynamic sensitivity correction mode" beforehand.\*

How to set the sensitivity is the same as in the normal mode.

The DSC indicator illuminates when the DSC function is set.



- \* When Light ON is selected, the upper limit of the correctable range is twice as much as the initial setting value.
- \* The value is stored in memory even after the power is turned off.
- \* The DSC indicator flashes when the light intensity during output OFF greatly fluctuates or the L/D ON selection is inappropriate. In such a case, check the setting again.

## Edge Detection Mode

This mode detects the change in the received light intensity during a given period of time. (Set at page 5, No. 4)

	Rising edge detection	Detects the increase (rising edge) of the received light intensity
	Falling edge detection	Detects the decrease (falling edge) of the received light intensity

### Filter Setting

Basically, leave this setting as its initial value. If the passage interval of workpieces is too short for the unit to respond, strengthen the level and try again.

The selectable filter level differs depending on the power modes.

Filter level	HSP*	FINE	TURBO	SUPER	ULTRA	MEGA
Default state	5	8	9	9	9	9
Setting range	1 to 5	4 to 8	5 to 9	6 to 9	8 to 9	9 only

\*HSP: HIGH SPEED

As the number becomes smaller, the filter becomes stronger, which makes the unit difficult to respond to gradual changes in light intensity.

### Making Sensitivity Settings

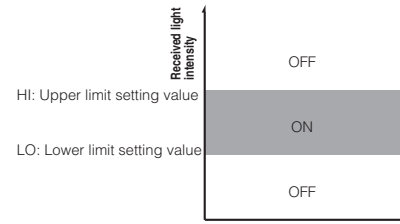
The sensitivity is set to maximum when the SET button is pressed quickly once. When the setting value is too low and the unit detects objects other than the workpiece, fine-adjust the setting value to a higher number.

### Operation When Switching Outputs

Setting	Operation
L-ON	Normally OFF. Turns ON only when the light intensity changes.
D-ON	Normally ON. Turns OFF only when the light intensity changes.

## Area Detection Mode

This mode is suited to detecting the received light intensity only of a certain range. To set this mode, select the area detection mode at Detection mode selection (page 5, No.4).



Set the value so that the upper limit setting value is larger than the lower limit setting value. The unit does not respond when the upper limit setting value is less than or equal to the lower limit setting value.

Even when the above condition is satisfied, the unit may not respond when the HI and LO values are close to each other because of hysteresis. Be sure to operate the unit to check whether the values are valid.

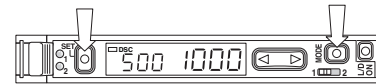
### How to Switch the Upper Limit Setting Value (HI) and the Lower Limit Setting Value (LO)

When the ◀▶ button is pressed, HI or LO and the setting value alternately flash. When the MODE button is pressed while the display alternately flashes, the HI or LO display changes. How to configure the sensitivity setting is the same as when in the normal detection mode.

## Setting the Display Scaling

This is the function to adjust the current received light intensity to the iscaling target value.

- 1 When selecting a display value correction function (page 6, No. 7), select the display scaling function, and set the target value. (The explanation here deals with the case where the target value is set to 2000.)
  - 2 During the normal display, press the SET button while pressing the MODE button.
- (Scaling is performed for the current light intensity at this time.)



The display changes as follows, and the target value (which is 2000) to be set as a scale is displayed.



The scaled value is displayed.



The reference light intensity can be set in the following range in reference with the currently received light intensity:

Power mode	Minimum value	Maximum value
HIGH SPEED	Approx. 1/20 times	Approx. 16 times
FINE	Approx. 1/20 times	Approx. 16 times
TURBO	Approx. 1/20 times	Approx. 16 times
SUPER	Approx. 1/40 times	Approx. 8 times
ULTRA	Approx. 1/160 times	Approx. 2 times
MEGA	Approx. 1/320 times	Approx. 1 time

If the value exceeds the range, Err is displayed and scaling is performed up to the possible range.

- No value can be set when the Edge detection mode is selected.
- The value is stored in memory even after the power is turned off.
- External input can be used when using FS-V33(P)/34(P) (page 5, No.5).

## Zero-shift Function

The Zero-shift function is used to forcibly set the current light intensity to zero.

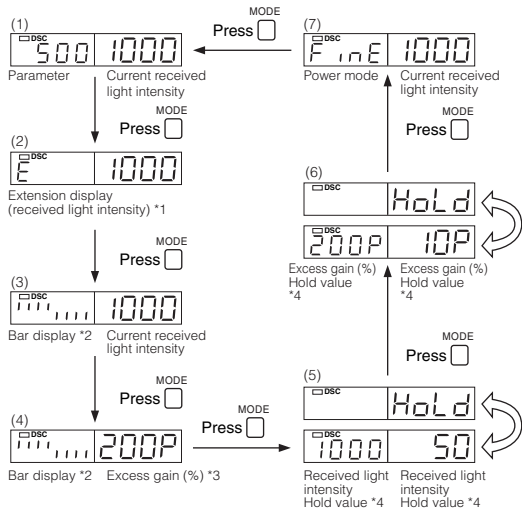
- 1 At Display value correction function selection (page 6, No.7), select "Zero-shift function".
- 2 When the SET button is pressed while the MODE button is pressed, the current light intensity is forcibly set to zero.



- This function cannot be used when the Dynamic sensitivity correction (DSC) or Edge detection mode is selected.
- The value is stored in memory even after the power is turned off.
- External input can be used when using FS-V33(P)/34(P) (page 5, No.5).

## Display Selection

The factory default value is "1" only. Other items can be displayed only after being selected at Display customization selection (page 6, No. 8).



\*1 When ULTRA/MEGA mode is selected, the current received light intensity can be displayed up to 5 digits. The setting value flashes when the ◀ ▶ button is pressed once.

The setting can be changed by pressing the ◀ ▶ button while flashing.

\*2 The excess gain is displayed in a 5% increment from 85 to 115%.

\*3 The current light intensity for the setting value is displayed in percentage.

\*4 Holds and displays the peak value and the bottom value.

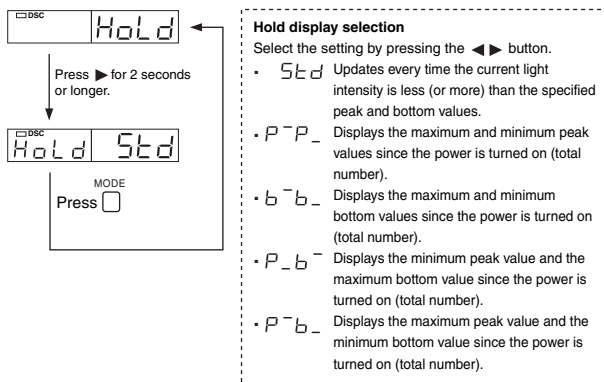
### How to reset peak or bottom value (with the (5)/(6) display)

The value can be reset by pressing the SET button for 3 seconds or more while pressing the MODE button.

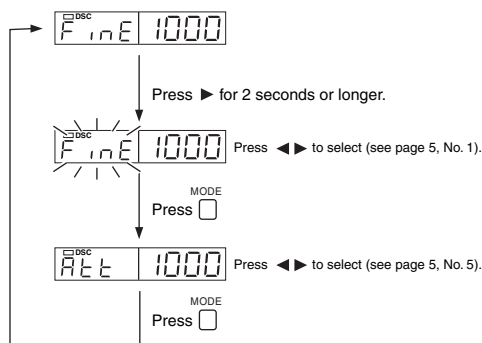
With FS-V33(P)/34(P), the value can be reset externally by selecting Reset at External input function selection (page 5, No.5). The peak/bottom value is also reset after the power is turned off.

### User-friendly Functions (Direct Access Menu)

The hold display (5/6) can be set in detail by pressing the ▶ button for 2 seconds or longer.



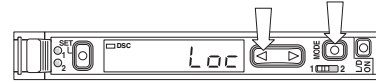
The power mode and emission power for the power mode display (7) can be switched by pressing the ▶ button for 2 seconds or longer.



## Key Lock Function

The key lock function disables the operation of all keys.

1 While pressing the MODE button, press the ◀ (▶) button for at least three seconds.



The same steps can be taken to deactivate key lock.

By selecting the key lock (page 6, No.12) level (1-3), key operations to be disabled can be changed.

(The default value is level 1.)

Basic Operations	Button	Level		
		1	2	3
Sensitivity Setting (p.3)	SET	×	○	○
Sensitivity fine-adjustment (p.3)	◀ ▶	△	○	○
Channel selection (p.1)	Channel selection switch	○	○	○
Output selection (p.2)	L/D ON	×	×	×
Menu selection (p.5)	Press and hold MODE	×	×	△

Advanced Operations	Button	Level		
		1	2	3
Initialization (p.2)	L/D ON + press and hold SET	×	×	×
Display scaling (p.4)	MODE + quickly press SET	×	○	○
Zero shift (p.4)	MODE + quickly press SET	×	○	○
Direct access menu (p.7)	Press and hold ▶	×	×	△
Display OFF/ON (p.6)	L/D.ON + press and hold MODE	○	○	○

○: Normal operation is possible.

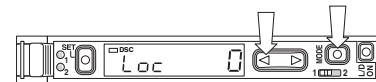
×: Operation is not possible.

△: The settings can be checked but cannot be changed.

## PIN Number Key Lock Function

The unit can be locked using a PIN number to ensure securer locking effect.

1 While pressing the MODE button, press the ◀ (▶) button 10 times.



2 Select a PIN number between 0 and 9999 using the button.

3 Press the MODE button to activate key lock.

Follow the same step to disable the key lock. Use the same PIN number used for locking.

### Note

Write down the PIN number in case it is forgotten. The key lock cannot be disabled unless the correct PIN number is used.

## Operation Configuration

Normally, this unit can be used in the basic settings.  
Set other functions as necessary.

Pressing **MODE** for 3 seconds or longer displays the basic menu.

Select a function with the **◀▶** button, and press **MODE** to confirm.

The setting for each item is confirmed when selecting END and pressing **MODE**.

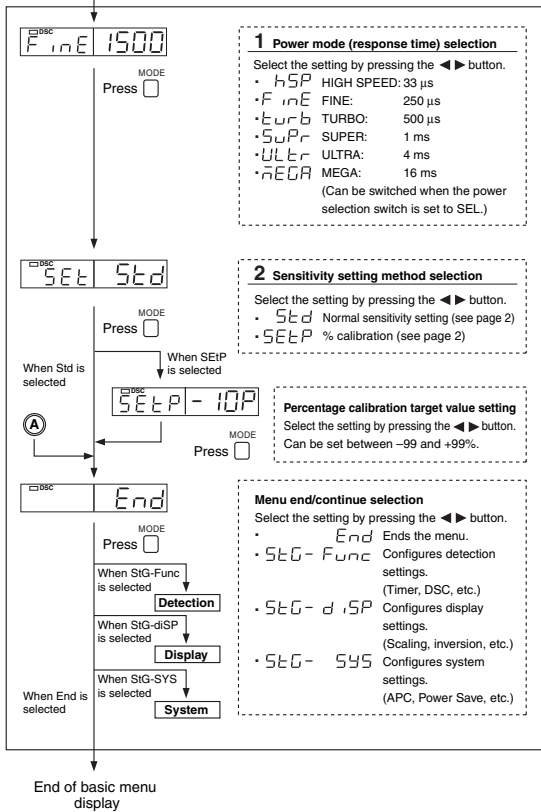
- |                        |  |
|------------------------|--|
| Basic setting menu     | 1. Power mode selection<br>2. Sensitivity setting method selection   |
| Detection setting menu | 3. Timer mode selection<br>4. Detection mode selection<br>5. Light emission power selection  |
| Display setting menu   | 6. Display value correction function selection<br>7. Display reverse selection<br>8. Display customization selection                 |
| System setting menu    | 9. APC function setting<br>10. Power save mode setting<br>11. Key lock level setting<br>12. Interference prevention function setting |

## Basic Setting Menu

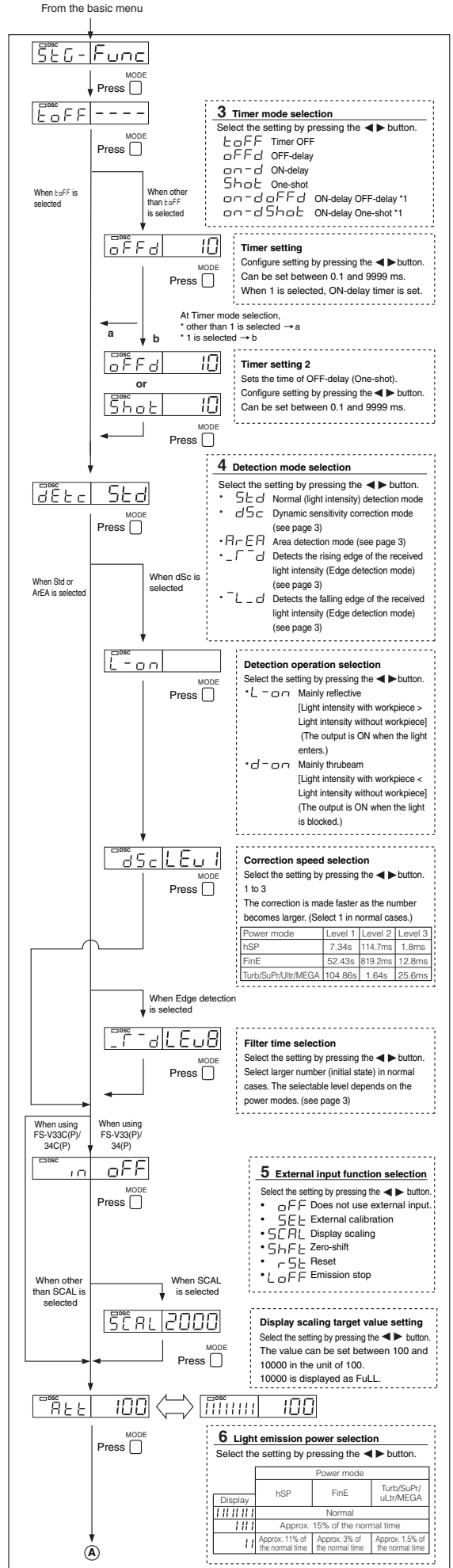
Set the channel selection switch to "1".



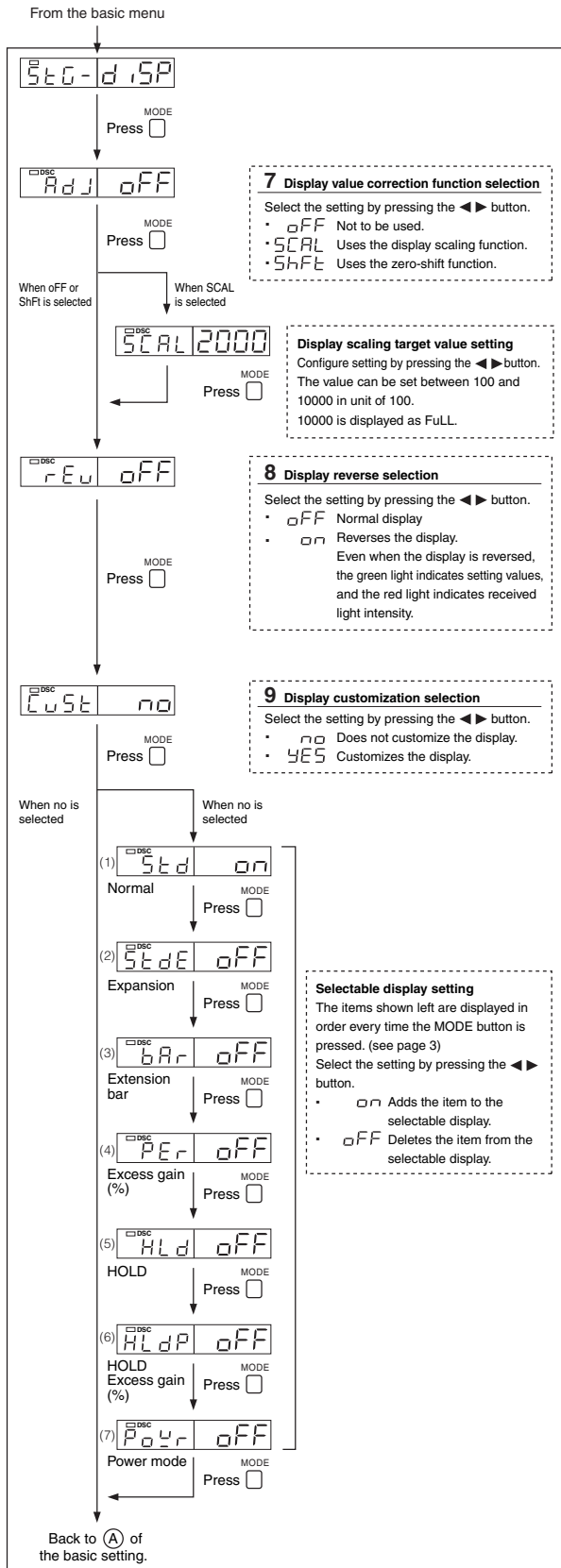
Press **MODE** for 3 seconds or longer



## Detection Setting Menu



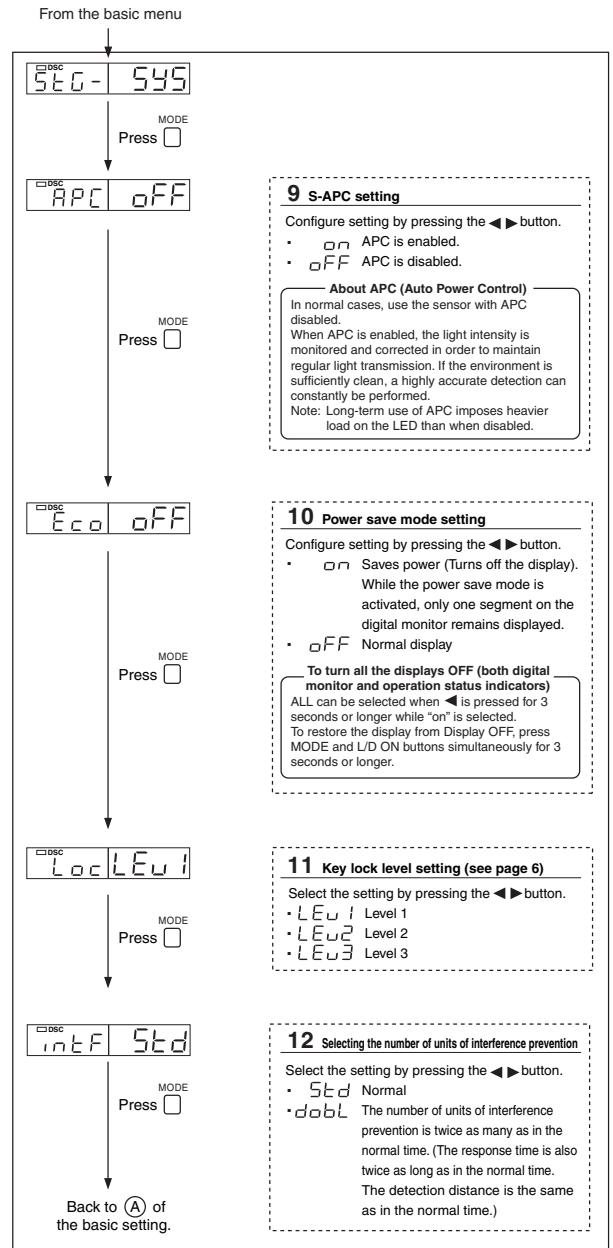
## Display Setting Menu



### Reference

When setting each mode, the display returns normal by pressing the MODE button for 3 seconds or longer.

## System Setting Menu



## Initializing, Saving and Loading the Settings

### ■ Initializing the settings

- While pressing  $\frac{L/D}{ON}$ , press  $\frac{SET}{}$  for 5 seconds or longer.
- Select "r5t" with the ◀▶ button, and press  $\frac{MODE}{}$ .
- Select "InIt" with the ◀▶ button, and press  $\frac{MODE}{}$  to initialize.

#### Default setting

Power mode: FAIN  
Detection mode: Normal  
Setting value: 50  
Output selection: L ON

### ■ Saving the Settings

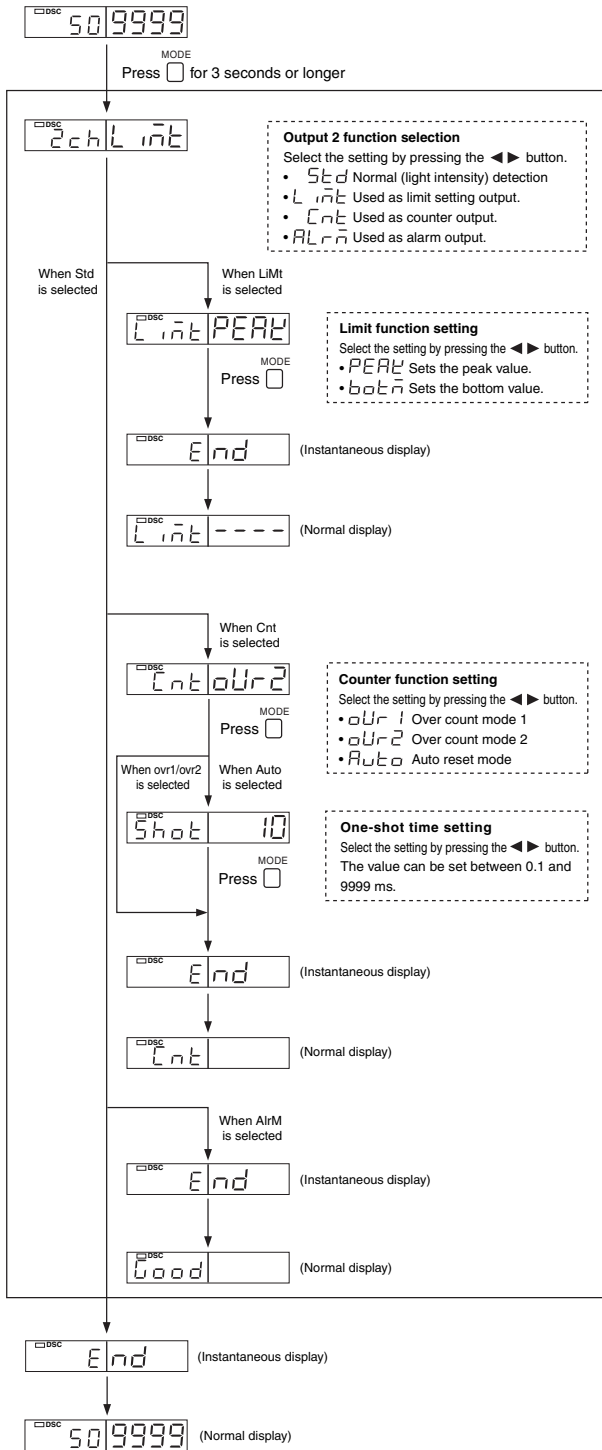
- While pressing  $\frac{L/D}{ON}$ , press  $\frac{SET}{}$  for 5 seconds or longer.
- Select "SRuE" with the ◀▶ button, and press  $\frac{MODE}{}$ .
- Select "YES" with the ◀▶ button, and press  $\frac{MODE}{}$  to save.

### ■ Loading the setting

- While pressing  $\frac{L/D}{ON}$ , press  $\frac{SET}{}$  for 5 seconds or longer.
- Select "r5t" with the ◀▶ button, and press  $\frac{MODE}{}$ .
- Select "Cust" with the ◀▶ button, and press  $\frac{MODE}{}$  to load.



To set channel 2, set the channel selection switch to "2".



■ Limit Setting

This function issues a prediction alarm when the light intensity difference is small when judging whether or not there is a workpiece.

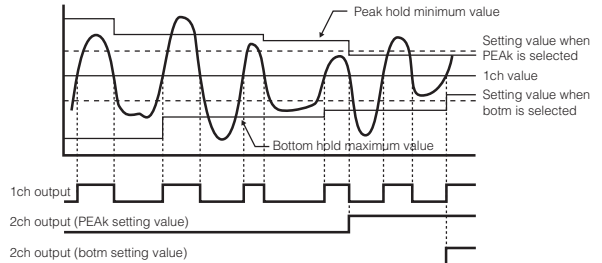
Two types of limit setting function are available:

■ Peak limit setting

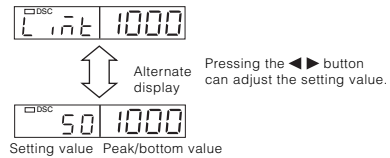
Samples the peak values of setting value while the received light intensity is higher than the output 1 setting value, and issues an alarm when the minimum peak value is lower than the output 2 setting value.

■ Bottom limit setting

Samples the bottom values of setting value while the received light intensity is lower than the output 1 setting value, and issues an alarm when the maximum bottom value is higher than the output 2 setting value.



Channel 2 normal display when using the limit setting function



How to reset the peak/bottom value

The value can be reset by pressing the SET button for 3 seconds or more while pressing the MODE button. With FS-V33(P)/34(P), the value can be reset externally by selecting Reset at External input function selection (page 5, No.5). The peak/bottom value is also reset after the power is turned off.

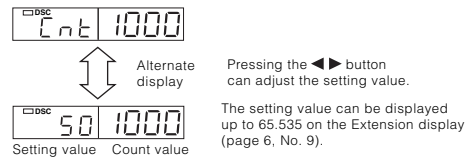
■ Counter Function

This mode counts the output (edge of OFF to ON) of output 1, and compares it with the setting value.

The following three count modes are available:

<i>ovr1</i> Over counter 1	The output turns ON with the value higher than the setting value. The counter value increases until it is reset.
<i>ovr2</i> Over counter 2	The output turns ON only when the value is the same as the setting value. The count value increases until it is reset.
<i>Auto</i> Auto reset	One-shot output is performed when the value is the same as the setting value, and the count value is automatically reset.

Channel 2 normal display when using the counter function



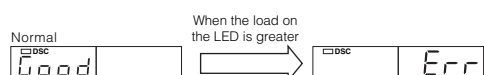
How to reset the count value

The value can be reset by pressing the SET button for 3 seconds or more while pressing the MODE button. With FS-V33(P)/34(P), the value can be reset externally by selecting Reset at External input function selection (page 5, No.5). The count value is also reset after the power is turned off.

■ Alarm Output Function

When using the APC function, the alarm output is issued when the load on the LED is too large. The alarm output is also issued when the DSC indicator is flashing (refer to Dynamic Sensitivity Correction (DSC) Function on page 4).

Channel 2 normal display when using the alarm output function



## Specifications

Type		Cable type		Connector type	
		Main unit	Sub unit	Main unit	Sub unit
Model	NPN output	FS-V33	FS-V34	FS-V33C	FS-V34C
	PNP output	FS-V33P	FS-V34P	FS-V33CP	FS-V34CP
Light source		Red 4-element LED (peak wave length: 640 nm typ.)			
Control output (2 outputs) *1	NPN output	NPN open collector 24 V 100 mA (2CH total) max			
	PNP output	PNP open collector 24 V 100 mA (2CH total) max			
Response time	ON/OFF output	33 μs (HIGH SPEED)/250 μs (FINE)/500 μs (TURBO)/1 ms (SUPER)/4 ms (ULTRA)/16 ms (MEGA)			
Control input		Calibration/Scaling/ Zero-shift/Reset/Emission stop(input time ON: 2 ms, OFF: 20 ms)		-	
Number of interference prevention units	Normal time	Power mode	HIGH SPEED	FINE	TURBO/SUPER/ULTRA/MEGA
		Number of units required to pre- vent interference	0 units	4 units	8 units
	When double is set *2	Power mode	HIGH SPEED	FINE	TURBO/SUPER/ULTRA/MEGA
		Number of units required to pre- vent interference	0 units	8 units	16 units
Timer function		Timer OFF/Off-delay/On-delay/One-shot/ On-delay Off-delay/On-delay One-shot (Timer time: 0.1 ms to 9999 ms)			
Power voltage		12-24 VDC, Ripple (P-P): 10% max, Class2			
Power consumption *3	NPN output	Normal: 710 mW max. (Using 24 V, 29 mA max., using 12 V, 40 mA max.) Power saving: 540 mW max. (Using 24 V, 22 mA max., using 12 V, 28 mA max.)			
	PNP output	830 mW max. (Using 24 V, 35 mA max., using 12 V, 45 mA max.)/ Power saving 660 mW max. (Using 24 V, 27 mA max., using 12 V, 32 mA max.)			
Operating ambient luminance	Incandescent lamp	20,000 lx max.			
	Sun light	30,000 lx max.			
Operating ambient tempera- ture		-10 to +55 °C (No freezing)			
Operating ambient humidity		35 to 85% RH (No condensation)			
Vibration resistance		10 to 55 Hz Compound amplitude 1.5 mm, 2 hours for each of XYZ axes			
Shock resistance		500 m/s <sup>2</sup> 3 times for each of XYZ axes			
Material		Main unit, housing material: Polycarbonate			
Weight (including cable)		Approx. 80g	Approx. 70g	Approx. 22g	

\*1 When several units are connected, the operating ambient temperature varies depending on the number of units to be connected. When connecting several units, be sure to mount the units on the DIN rail (mounted on a metal plate), and keep the output current within 20 mA.

When 1 to 2 units are connected: -10 to +55 °C,

When 3 to 10 units are connected: -10 to +50 °C,

When 11 to 16 units are connected: -10 to +45 °C

When using the 2-output type, count one unit as two units.

\*2 When double is set, the response time is twice longer. When using the 2-output type, be careful with the number of units to be connected.

\*3 When using the HIGH SPEED mode, the power consumption increases by 160 mW (7 mA).

## Error Displays and Corrective Actions

Error display	Cause	Corrective action
$E_r C$	Overcurrent is flowing in the control output.	Check the load and return the current within the rated value.
$E_r E$	Failed to write/read the internal data.	Perform initialization (p.2).
$E_{nd} APC$	The load on the light source is large.	If highly precise detection is required, replace the sensor.

## Hints On Correct Use

- Do not wire the amplifier line along with power lines or high-tension lines, otherwise the sensor may malfunction or receive damage due to noise.
- 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.
- If the sensor is used in S-APC mode for a long time, the LED indicators will be imposed with a heavy load. In that case, the sensor will be automatically set to ACC mode where the current consumption of the sensor for light emission will be constant, and "END APC" will be displayed. The sensor can be continuously used in this case. Replace the sensor, however, if highly precise detection is required.

## WARRANTY

KEYENCE products are strictly factory-inspected. However, in the event of a failure, contact your nearest KEYENCE office with details of the failure.

### 1. WARRANTY PERIOD

The warranty period shall be for one year from the date that the product has been delivered to the location specified by the purchaser.

### 2. WARRANTY SCOPE

(1) If a failure attributable to KEYENCE occurs within the abovementioned warranty period, we will repair the product, free of charge. However, the following cases shall be excluded from the warranty scope.

- Any failure resulting from improper conditions, improper environments, improper handling, or improper usage other than described in the instruction manual, the user's manual, or the specifications specifically arranged between the purchaser and KEYENCE.
- Any failure resulting from factors other than a defect of our product, such as the purchaser's equipment or the design of the purchaser's software.
- Any failure resulting from modifications or repairs carried out by any person other than KEYENCE staff.
- Any failure that can certainly be prevented when the expendable part(s) is maintained or replaced correctly as described in the instruction manual, the user's manual, etc.
- Any failure caused by a factor that cannot be foreseen at a scientific/technical level at the time when the product has been shipped from KEYENCE.
- Any disaster such as fire, earthquake, and flood, or any other external factor, such as abnormal voltage, for which we are not liable.

(2) The warranty scope is limited to the extent set forth in item (1), and KEYENCE assumes no liability for any purchaser's secondary damage (damage of equipment, loss of opportunities, loss of profits, etc.) or any other damage resulting from a failure of our product.

### 3. PRODUCT APPLICABILITY

KEYENCE products are designed and manufactured as general-purpose products for general industries.

Therefore, our products are not intended for the applications below and are not applicable to them. If, however, the purchaser consults with us in advance regarding the employment of our product, understands the specifications, ratings, and performance of the product on their own responsibility, and takes necessary safety measures, the product may be applied. In this case, the warranty scope shall be the same as above.

- Facilities where the product may greatly affect human life or property, such as nuclear power plants, aviation, railroads, ships, motor vehicles, or medical equipment
- Public utilities such as electricity, gas, or water services
- Usage outdoors, under similar conditions or in similar environments

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