KEYENCE

96M00603

* 9 6 M 0 0 6 0 3 - 1 *

Digital Fiber Sensor

FS-N10 Series

Instruction Manual

⚠Danger	**Failure to follow these instructions may lead to death or serious injury.**
⚠Warning	**Failure to follow these instructions may lead to injury.**
⚠Caution	**Failure to follow these instructions may lead to product damage (product malfunction, etc.)**

Note Provides additional information on proper operations that can be easily mistaken.

Tip This provides tips about situations in which the feature being described is useful.

See "FS-N10 Series User's Manual" for details on the features of the FS-N10 series and detailed instructions for configuration.

Hints on Correct Use

⚠Warning	• **This product is used to detect targets. Do not apply the product to safety circuits for human protection.** • **This product is not of explosion-proof construction. Do not use the products in places with flammable gas, liquid, or dust.** • **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.**

- 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.

■ About UL Certification

The FS-N series is UL and C-UL certified, and is compliant with the UL and CSA standards.

- Applicable standards UL508 Industrial Control Equipment
  CAN/CSA C22.2 No.14-M05 Industrial Control Equipment
- UL File No. E301717
- UL categories: NRKH, NRKH7
- Enclosure Type 1 (based on UL50 standard)

■ Notes on UL Certification

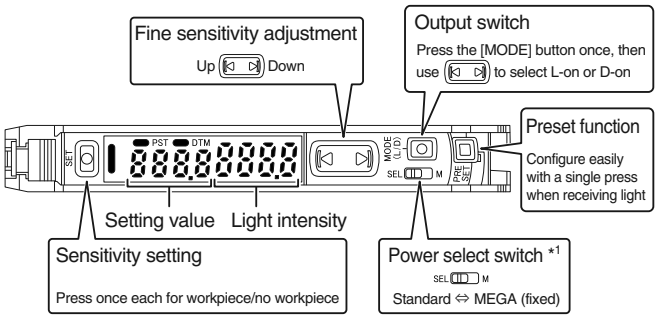
- The power source used with the FS-N series must be UL Listing certified for Class 2 output as stipulated by US National Electric Code (NEC) NFPA70.
- Connect the FS-N12 and N14 to the FS-N11 and N13 main units for use.

Included accessories

- Instruction Manual 1pc.
- Fiber cutter 1pc.

FS-N10 Series Quick Start and Cabling

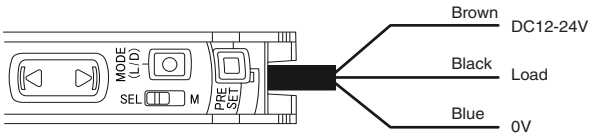
■ Quick Start



*1 This is a channel switch on 2-output types.
*2 Press and hold the [MODE] button to make advanced settings.

■ Cabling

Note See page 4 for information about connecting to external devices other than the FS-N11N.



Mounting Unit

■ Mounting on a DIN Rail

1 **Align the claw at the bottom of the main body with the DIN rail, as shown in figure1.**
While pushing the main body in the direction of the arrow 1, slant it in the direction of the arrow 2.

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.**

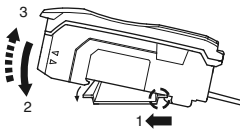


figure1

■ Installation on a Wall (Main Unit Only)

1 **Attach the unit to the optional mounting bracket (OP-73880), mount them together, and secure them with two M3 screws as shown in figure2.**

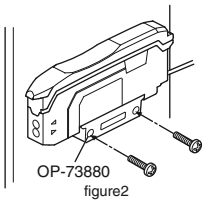


figure2

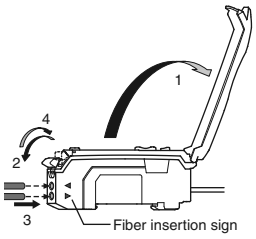
Connecting Fiber Unit

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.**

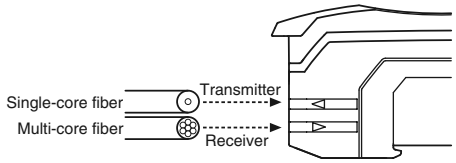


Note

- **If a thin fiber unit is used, an adapter provided with the thin fiber unit will be required.**
  Unless the correct 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.**



Connecting Multiple Amplifiers

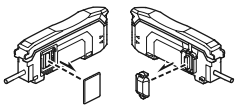
Up to 16 sub units can be connected to one main unit.

⚠Warning	**Mount on DIN rail and install on metal sheeting when connecting to multiple amplifiers or mounting main units together.**

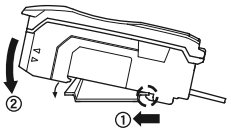
Note

- **Multiple connections cannot be made to equipment other than the FS-N10 series.**
- **Turn the power off before connecting multiple sub units.**
- **Do not touch the expansion connector with your bare hands.**

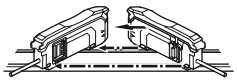
1 **Remove the protection covers of the main unit and sub unit(s).**



2 **Install the amplifiers one by one on the DIN rail.**

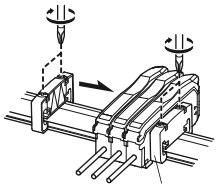


3 **Engage the two claws of the sub unit with the recesses on the main unit side until you hear a click.**



4 **Attach the end units (option: OP-26751) to the both ends of the connected amplifiers in the same way as in step (2).**

5 **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.**



OP-26751 (a set of two)

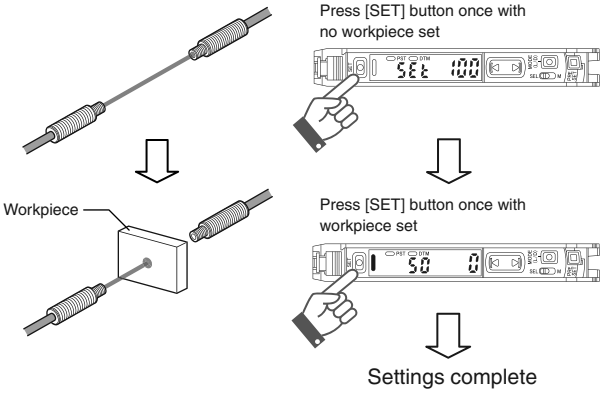
Calibration Method

■ Detecting Even Small Differences

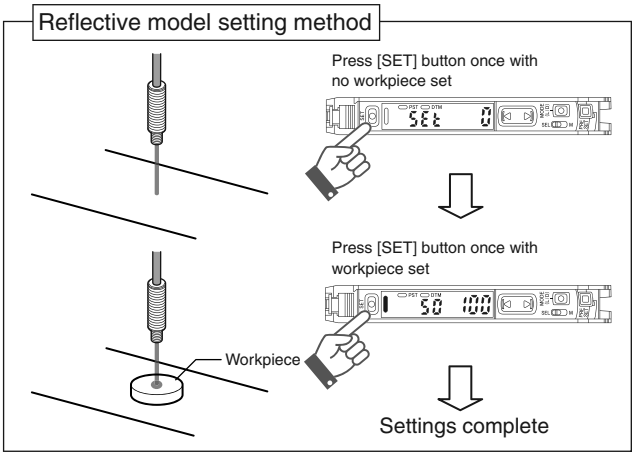
● Two-point Calibration

Two-point calibration is the basic method for making calibration.
You can set the sensitivity level automatically, simply by pressing the [SET] button twice. Just press once with the workpiece set up, and once without.

Through-beam model setting method



Reflective model setting method



Two-point calibration performs detection at a location where there is a workpiece, and another location where there is not, uses the intermediate value as the setting.
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.

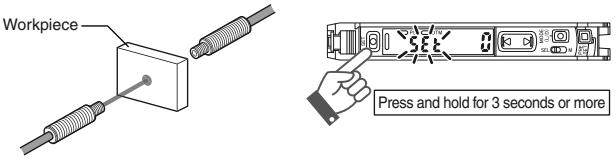
Other Calibration Methods

■ Increase Resistance to Dust and Dirt

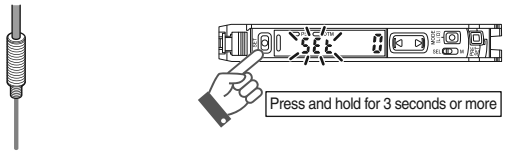
● Maximum Sensitivity Setting

In the state shown below, press and hold the [SET] button for three seconds and stop pushing when "SEt" flashes.
The sensitivity is set slightly higher than the light intensity.

Through-beam model : with workpiece set



Reflective model : without workpiece set

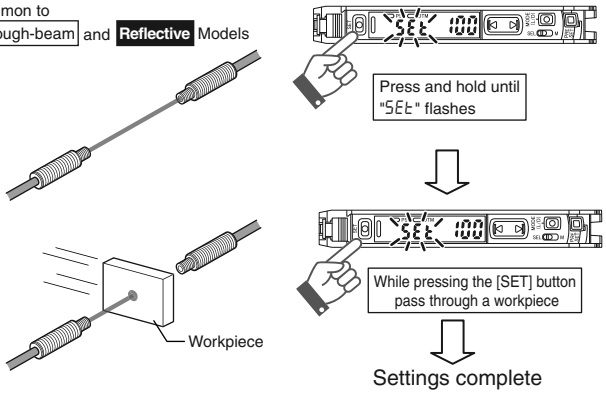


■ Calibrate with Moving Workpiece

● Full Auto Calibration

Press and hold the [SET] button with no workpiece in place, while "SEt" is flashing, pass through a workpiece. (Continue pressing the [SET] button while the workpiece passes through.)

Common to Through-beam and **Reflective** Models

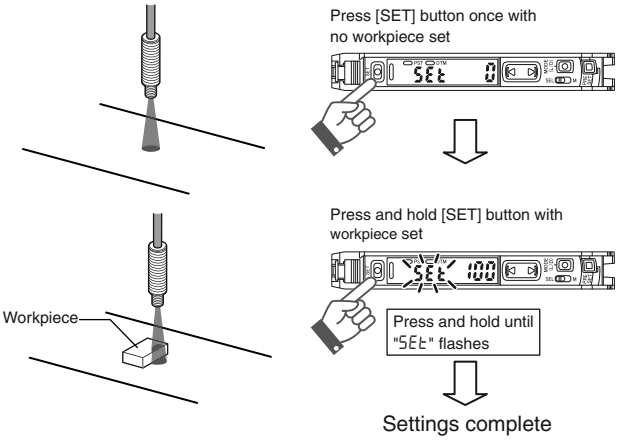


■ Position Workpiece

● Positioning Calibration

Press the [SET] button with no workpiece set.
Place the workpiece in the location you wish to position it, and press and hold the [SET] button for at least 3 seconds. Release the button when "SEt" flashes.

Common to Through-beam and **Reflective** Models

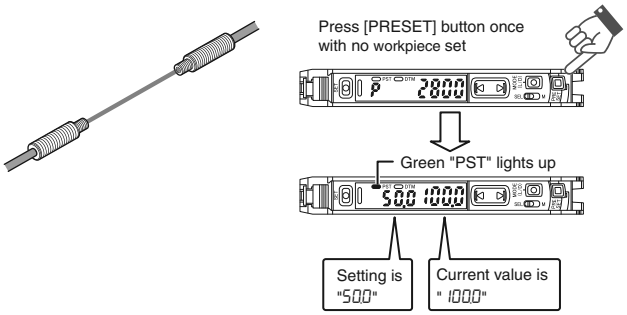


Simple, User Friendly Functions

■ Easily Set up Display

● Preset Function

With light ON, press the [PRESET] button. The current value is set to "1000".



Pressing the [PRESET] button changes the setting and current value as shown below.

- **Presetting with preset disabled:**
  The setting is changed to "500". The setting can be changed via the normal calibration method.
- **Presetting with preset enabled:**
  Only the current value is changed to "1000", and the setting is not changed.

Note

- **The preset function cannot be used together with the zero shift function. To use the zero shift function, you must first disable the preset function.**
- **This is not suited to transparent workpieces and other cases of detection with low light shielding.**

● Disable the Preset Function

Press and hold the [PRESET] button to disable the preset function.
When the preset function is disabled, the ratio of the setting and current values is maintained as-is.

Tip

Handy Uses for the Preset Function

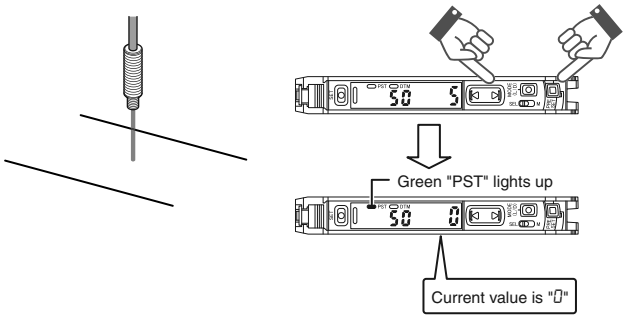
This function is mainly useful when performing simple detection using a through-beam model fiber unit (e.g. complete dark detection, such as when all light axes of the fiber unit are shielded with opaque workpieces).

When you are using multiple FS-N10 series units simultaneously, this function is an easy way to make all the displays uniform.

■ Set Current Value to "0"

● The Zero Shift Function

This function is mainly used with reflective models.
Press the [PRESET] button and [▶] button at the same time.
The current value is set to "0".



Note

The zero shift and preset function cannot be used together. To use the preset function, you must first disable the zero shift function.

● Disable the Zero Shift Function

Press and hold the [PRESET] button to disable the zero shift function.

Tip

Handy Uses for the Zero Shift Function

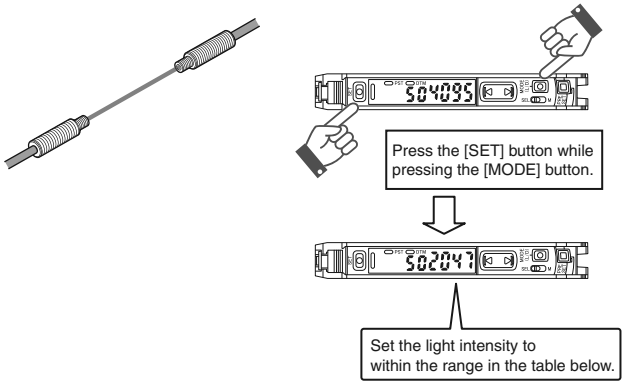
This function is mainly used to set the current value to "0" on a reflective model fiber unit.

When a reflective model is first installed, the light intensity is sometimes not set to "0".
If this happens, using the zero shift function to set the value to "0" when there is no workpiece allows for easier understanding of the difference in light intensity.

■ Set the current value to an adequate value when it is too large (when saturated).

● Use the Saturation Recovery Function

Press the [SET] button while pressing the [MODE] button to enable the saturation recovery function.
The light transmission level and light intensity gain are calibrated automatically.



Power mode	Light intensity setting range
HSP, FINE, TURBO	2047 ± 350
SUPER	4095 ± 500
ULTRA, MEGA	5000 ± 600

● Disable Saturation Recovery

When the saturation recovery function is enabled, press the [SET] button while pressing the [MODE] button to cancel it.

Tip

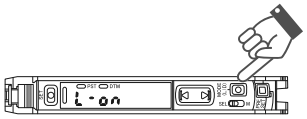
Handy Uses for the Saturation Recovery Function

This function is handy when the fiber unit becomes saturated after installation. This eliminates the saturation via a simple operation, by automatically calibrating the light transmission level and light intensity gain.

Output Switch

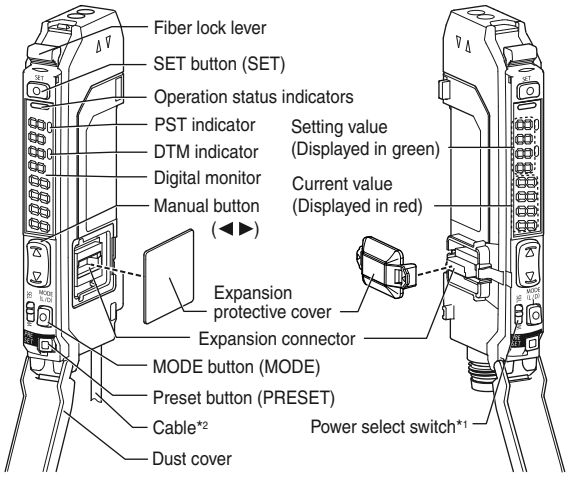
Either light-ON (L-on) mode or dark-ON (D-on) mode can be selected.

1 **While the current value is displayed, press the [MODE] button once.**



2 **Use [◀▶] to switch the output (L-on/d-on), then press the [MODE] button again. The output switch completes, and the display returns to the current value.**

Names of Each Part of the Main Unit

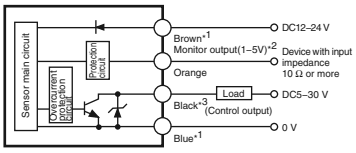


*1 Setting to "M" locks the power mode to MEGA mode. The two output type is a channel switch.
*2 On the FS-N10Cx, this is an M8 connector rather than a cable. On the FS-N10Ex, this is an e-CON connector.

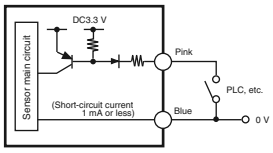
Connecting to External Devices

■ FS-N11N/N12N/N11MN/N13N/N14N

Output Circuit Diagram



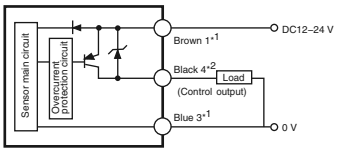
Input Circuit Diagram (FS-N13N/N14N only)



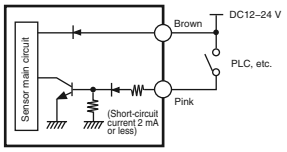
*1 FS-N11N/N11MN/N13N only
*2 FS-N11MN only
*3 The FS-N13N/N14N has a white cable as separate output 2.

■ FS-N11P/N12P/N13P/N14P/N13CP/N14CP

Output Circuit Diagram



Input Circuit Diagram (FS-N13P/N14P only)

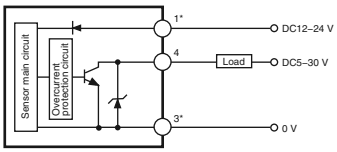


M8 connector Pin layout 

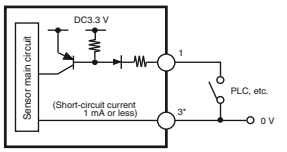
*1 FS-N11P/N13P/N13CP only
*2 The FS-N13P/N14P has a white cable as separate output 2.
The FS-N13CP/N14CP has the pin2 as separate output2.

■ FS-N11CN/N12CN/N11EN/N12EN

Output Circuit Diagram



Input Circuit Diagram

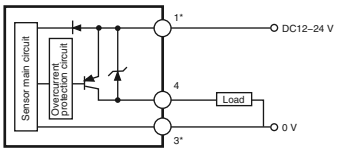


M8 connector Pin layout 
e-CON connector Pin layout 

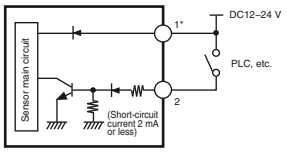
*FS-N11CN/N11EN only

■ FS-N11CP/N12CP

Output Circuit Diagram



Input Circuit Diagram



M8 connector Pin layout 
e-CON connector Pin layout 

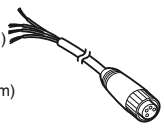
*FS-N11CP only

■ Socket Cable (Sold Separately)

For FS-N11CN/N11CP/N12CN/N12CP/N13CP/N14CP

OP-73864
(Cable length: 2 m)

OP-73865
(Cable length: 10 m)



Pin - Pin and wire color table

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

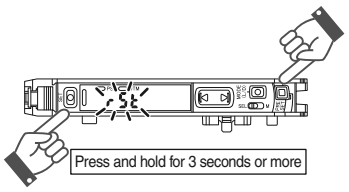
Error Displays and Corrective Actions

Error display	Cause	Solution
ErC	Overcurrent in the control output.	Check the load and return the current within the rated value.
ErE	Failed to write/load the internal data.	Perform initialization (p.4).
End APC	Large load on the light source.	Replace the sensor if highly precise detection is required.

Initializing the Settings

■ Initializing Method

1 **Press and hold the [SET] and [PRESET] buttons simultaneously for three seconds.**



2 **Use the ◁▷ to select "rSt", then press the [MODE] button.**

3 **Use the ◁▷ to select "in it", then press the [MODE] button.**
After initialization is complete, the display returns to the current value.

● Initial Settings

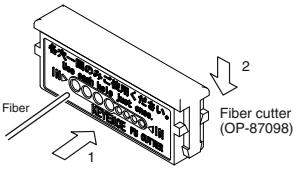
Setting	Initial Value
Power mode	FINE
Detection mode	Normal
Setting value	50
Output switch	L-on

Using a Fiber Cutter and Cautions for Use

■ Using a Fiber Cutter

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

2 **Bring down the blade in a single, swift motion to cut the fiber.**



Always insert fiber from the end with writing

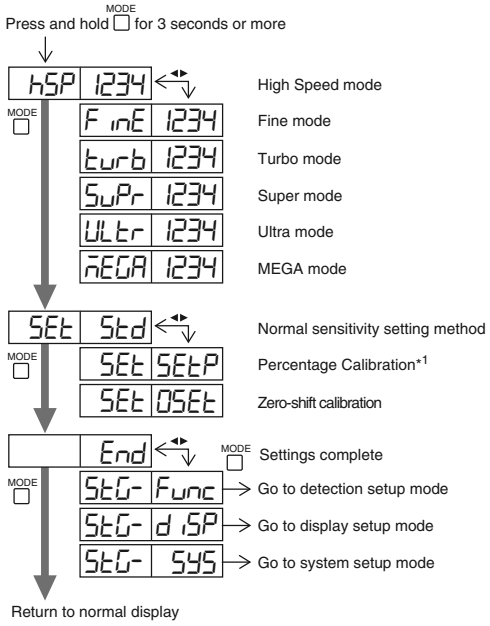
■ Cautions for Using a Fiber Cutter

Failure to heed the cautions below could reduce the detection range.

- When cutting a fiber unit to be attached to the FS-N10 series, be sure to use a gray fiber cutter (OP-87098)
- Stopping the blade midway could cause a bad cut plane, reducing the detection range.
- Do not use the same hole twice.

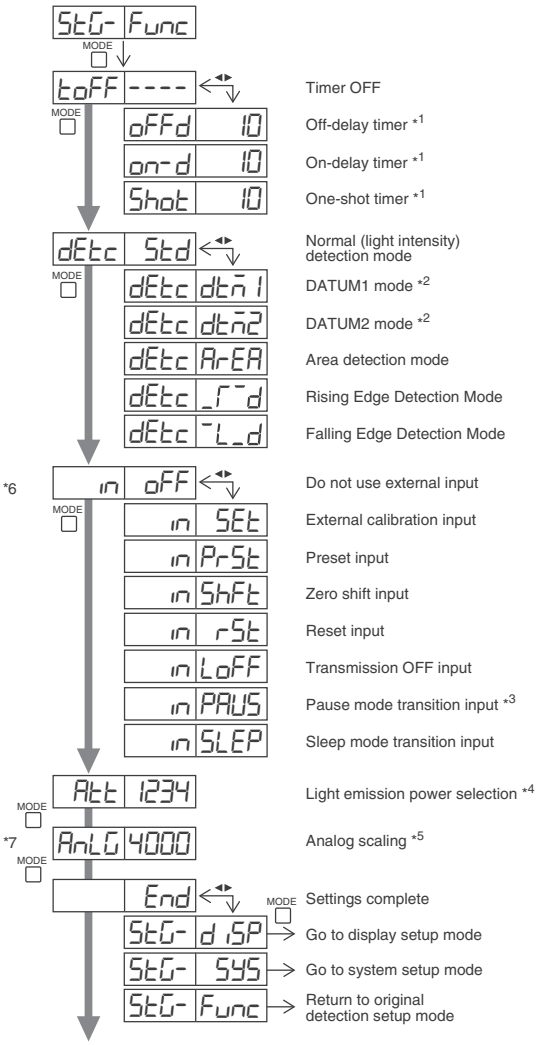
Function Configuration

■ Basic Setting



*1 You can press the MODE button to set between the range of -99P to 99P.

■ Detection Settings



*1 Press the MODE button to set between the range of 1 and 9999 (ms).

*2 Press the MODE button to set the retouch sensitivity to a range of between LEv 1 and LEv3 and set the warning output level to a range of between 0P and 100P.

*3 Press the MODE button to toggle between oFF/on/KEEP.

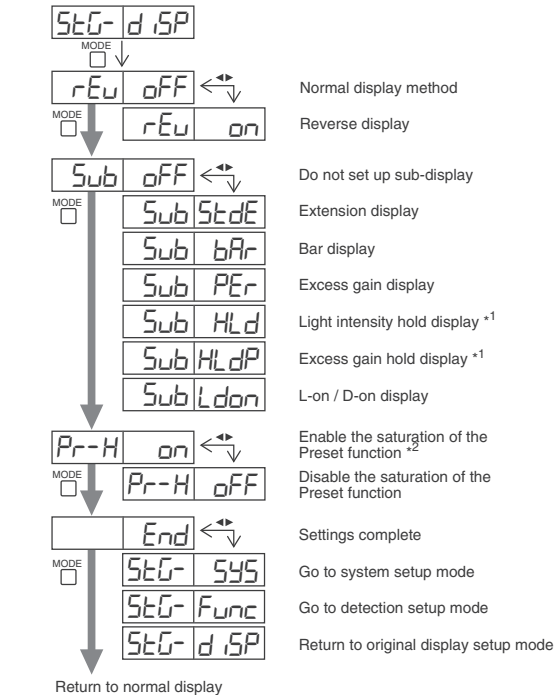
*4 Can be set between the range of 1 and 100.

*5 Can be set between the range of 100 and 9999.

*6 Only external input types (FS-N11CN/N11CP/N11EN/N12EN/N13N/N13P/N14N/N14P).

*7 Only monitor output types (FS-N11MN).

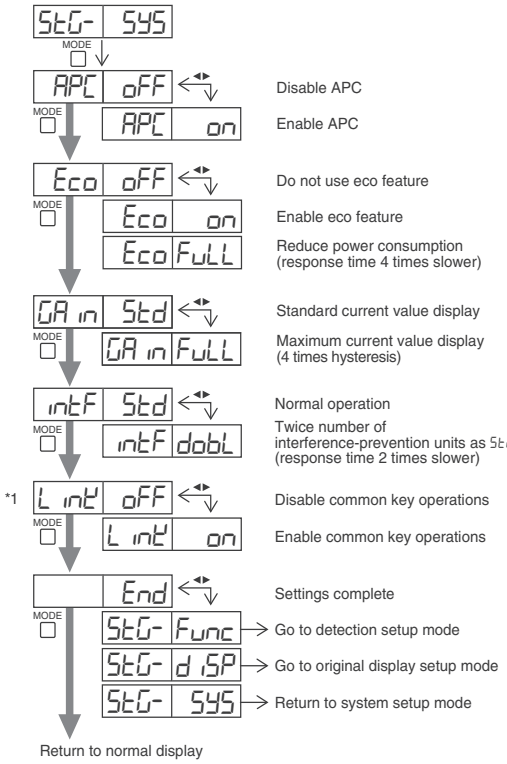
■ Display Settings



*1 Press the MODE button to toggle between Std/P-P_/b-b_/P_b-/P-b_

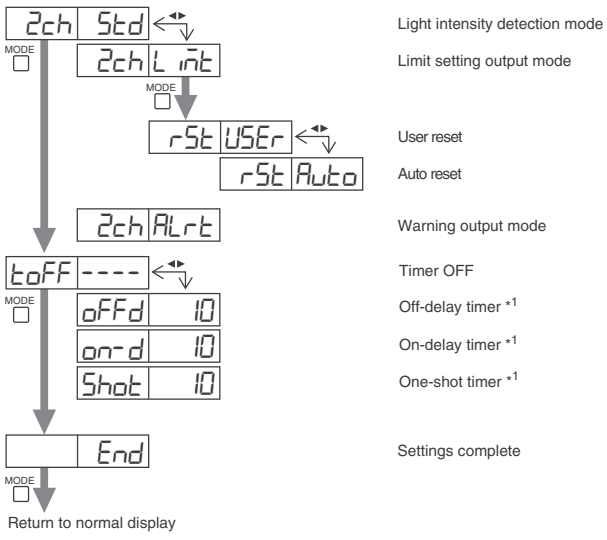
*2 Press the MODE button to set between the range of 100P and 200P.

■ System Settings



*1 Main unit only.

■ Two Output *2



*1 Press the MODE button to set between the range of 1 and 9999 (ms).

*2 Only 2 output types (FS-N13N/N13P/N14N/N14P/N13CP/N14CP).

Specifications

Type		Standard 1 output						Monitor output	High functionality 2 output			
Cable/M8 connector		Cable		M8 connector*1		e-CON connector*1		Cable	Cable		M8 connector*1	
Main unit/sub unit		Main unit	Sub unit (with output cable)	Main unit	Sub unit (with output cable)	Main unit	Sub unit (with output cable)	Main unit	Main unit	Sub unit (with output cable)	Main unit	Sub unit (with output cable)
Model	NPN	FS-N11N	FS-N12N	FS-N11CN	FS-N12CN	FS-N11EN	FS-N12EN	FS-N11MN	FS-N13N	FS-N14N	-	-
	PNP	FS-N11P	FS-N12P	FS-N11CP	FS-N12CP	-	-	-	FS-N13P	FS-N14P	FS-N13CP	FS-N14CP
Control output		1 output	1 output	1 output	1 output	1 output	1 output	1 output	2 output	2 output	2 output	2 output
Monitor output (1-5 V)		-	-	-	-	-	-	1 output	-	-	-	-
External input		-	-	1 input	1 input	1 input	1 input	-	1 input	1 input	-	-
Response time		50 μs (HIGH SPEED)/250 μs (FINE)/500 μs (TURBO)/1 ms (SUPER)/4 ms (ULTRA)/16 ms (MEGA)										
Control output	NPN output	NPN open collector 30 V; 1 output max: 100 mA or less; 2 output total: 100 mA or less (used stand-alone)/20 mA or less (multiple connections); residual voltage 1 V or less										
	PNP output	PNP open collector 30 V; 1 output max: 100 mA or less; 2 output total: 100 mA or less (used stand-alone)/20 mA or less (multiple connections); residual voltage 1 V or less										
Monitor output		1 to 5 V voltage output; load resistance 10 kΩ or more; repeat precision ± 0.5% of F.S.; responsiveness 1 ms (FS-N11MN only)										
External input		input time 2 ms (ON)/20 ms (OFF) or more										
Multiple connections to sub units		Up to 16 units can be connected total, but two-output type is treated as two units										
Number of interference prevention units		0 for HSP; 4 for FINE; 8 for TURBO/SUPER/ULTRA/MEGA (When set to double, the number of interference-prevention units will be doubled.)										
Rating	Power voltage	12 - 24 V DC ± 10% ripple (P-P) 10% or less										
	NPN	Normal:900 mW or less (36 mA max. at 24 V, 48 mA max. at 12 V)*2 Eco on mode:800 mW or less (32 mA max. at 24 V, 39 mA max. at 12 V)*2 Eco Full mode:470 mW or less (19 mA max. at 24 V, 23 mA max. at 12 V)										
	PNP	Normal : 950 mW or less (39 mA max. at 24 V, 52 mA max. at 12 V)*2 Eco on mode : 850 mW or less (35 mA max. at 24 V, 44 mA max. at 12 V)*2 Eco Full mode : 520 mW or less (21 mA max. at 24 V, 26 mA max. at 12 V)						-	Normal : 1050 mW or less(42 mA max. at 24 V, 56 mA max. at 12 V)*2 Eco on mode : 950 mW or less(38 mA max. at 24 V, 47 mA max. at 12 V)*2 Eco Full mode : 600 mW or less(24 mA max. at 24 V, 29 mA max. at 12 V)			
Environmental resistance	Operating ambient luminance	Incandescent lamp: 20,000 lx or less; Sunlight: 30,000 lx or less										
	Operating ambient temperature	-10 to +55 °C (no freezing)*3										
	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 X,Y,Z axis										
	Shock resistance	500 m/s^2 3 times for each of X,Y,Z axis										
Case material		Both main unit and housing material: Polycarbonate										
Weight		Approx 75g	Approx 45g	Approx 22g	Approx 22g	Approx 22g	Approx 22g	Approx 75g	Approx 80g	Approx 70g	Approx 22g	Approx 22g

*1 Use a cable length of 30m or less for M8 connector and e-CON connector types.
*2 Increases 100 mW (4.0 mA) for High Speed mode
*3 One or two more units connected: -10 to +55°C; 3 to 10 more units connected: -10 to +50°C; 11 to 16 more units connected: -10 to +45°C. When using 2-outputs, one unit is counted as two units. All temperature regulations are for when the unit is mounted on a DIN rail and installed on metal sheeting.

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