

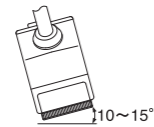
FGS-31 Series

DIGITAL MARK SENSOR



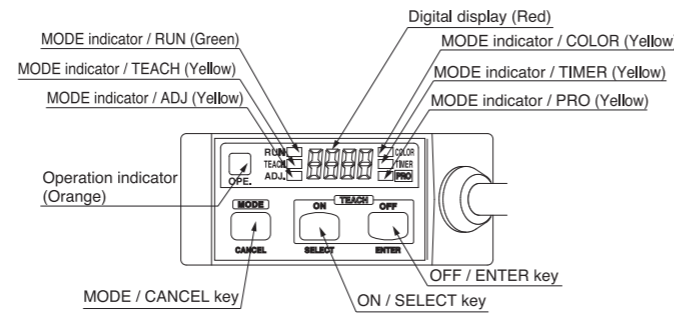
CAUTIONS

- This product has been developed / produced for industrial use only.
- Make sure to carry out wiring in the power supply off condition.
- Take care that wrong wiring will damage the sensor.
- Verify that the supply voltage variation is within the rating.
- Take care that if a voltage exceeding the rated range is applied, or if an AC power supply is directly connected, the sensor may get burnt or damaged.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- Take care that short-circuit of the load or wrong wiring may burn or damage the sensor.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- Take care that the sensor is not directly exposed to fluorescent light from a rapid-starter lamp or a high frequency light device or sunlight etc., as it may affect the sensing performance.
- If the surface of the sensing object has a shine, mount the sensor inclining approx. 10 to 15 degrees against the sensing object.
- Do not touch the lens of the sensor by hand directly. If the lens becomes dirty, wipe it off with a soft cloth gently.
- When the inside lens is steamed up, unscrew the lens to get rid of the condensation.
- Extension up to total 100m is possible with 0.3mm², or more, cable. However, in order to reduce noise, make the wiring as short as possible.
- This sensor is suitable for indoor use only.
- Do not use this sensor in places having excessive vapor, dust, etc., or where it may come in direct contact with water, or corrosive gas.
- Take care that the product does not come in contact with water, oil, grease, or organic solvents, such as, thinner, etc.
- Make sure that stress by forcible bend or pulling with 76N, or more, force is not applied to the sensor cable joint.
- This sensor cannot be used in an environment containing inflammable or explosive gases.
- Never disassemble or modify the sensor.

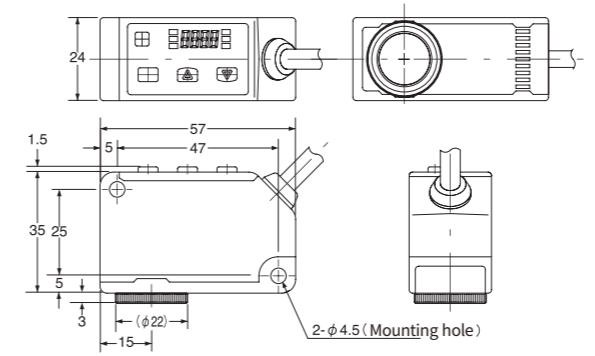


Specification		
Item	Type	Cable type
	Model No.	FGS-31N
	PNP output	FGS-31P
Sensing distance	10 ± 3mm	
Supply voltage	12 to 24V DC ± 10% Ripple P-P10% or less	
Current consumption	Normal mode: 750mW or less (Current consumption 30mA or less at 24V supply voltage) EOC mode: 600mW or less (Current consumption 25mA or less at 24V supply voltage)	
Teaching input	<NPN output type>	<PNP output type>
	Low (ON): 0 to 2V DC Source current 0.5mA or less Input impedance 10kΩ approx. High (OFF): 5V to +V DC, or open	High (ON): 5V to +V DC Sink current 3mA or less Input impedance 10kΩ approx. Low (OFF): 0 to 0.6V DC, or open
Output 1 (OUT)	<NPN output type>	<PNP output type>
	NPN open-collector transistor • Max. sink current: 50mA (Note 1) • Applied voltage: 30V DC or less (between output 1 and 0V) • Residual voltage: 1.5V or less [at 50mA (Note 1) sink current]	PNP open-collector transistor • Max. source current: 50mA (Note 1) • Applied voltage: 30V DC or less (between output 1 and +V) • Residual voltage: 1.5V or less [at 50mA (Note 1) source current]
Output operation	Mark mode: Light-ON / Dark-ON Auto-setting method on teaching, Color mode: Coincidence-ON / Non-coincidence-ON	
Short-circuit protection	Incorporated	
Output 2 (Inversion output) (OUT)	<NPN output type>	<PNP output type>
	NPN open-collector transistor • Max. sink current: 50mA • Applied voltage: 30V DC or less (between output 2 and 0V) • Residual voltage: 1.5V or less (at 50mA sink current)	PNP open-collector transistor • Max. source current: 50mA • Applied voltage: 30V DC or less (between output 2 and +V) • Residual voltage: 1.5V or less (at 50mA source current)
Output operation	Inverted operation of the output 1	
Short-circuit protection	Incorporated	
Response time	Mark mode: 45 μs or less, Color mode: 150 μs or less	
Operation indicator	Orange LED (lights up when output 1 is ON)	
MODE indicator	'RUN': Green LED, 'TEACH', 'ADJ', 'COLOR', 'TIMER', 'PRO': Yellow LED	
Digital display	4 digits red LED display	
Sensitivity setting	Mark mode: 2-level teaching / Full-auto teaching, Color mode: 1-level teaching	
Fine sensitivity adjustment function	Incorporated	
Timer function	Incorporated OFF-delay timer / ON-delay timer, switchable either effective or ineffective	
Protection	IP67 (IEC)	
Ambient temperature	-10 to +55°C (No dew condensation or icing allowed), Storage: -20 to +70°C	
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH	
Emitting element	Red / green / blue LED	
Material	Enclosure: PBT, Display: Polycarbonate, Operation buttons: Silicone rubber, Lens: Glass	
Cable	0.2mm ² 5-core cabtyre cable, 2m long	
Weight	120g approx.	

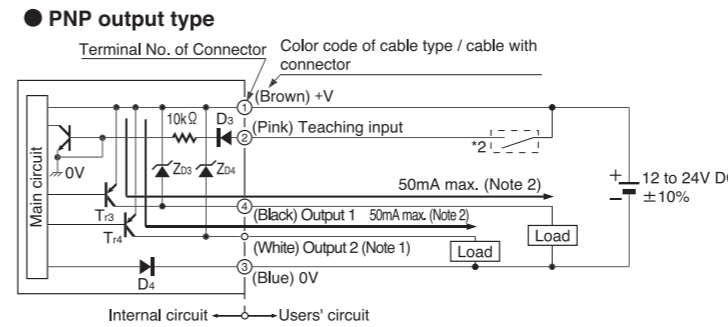
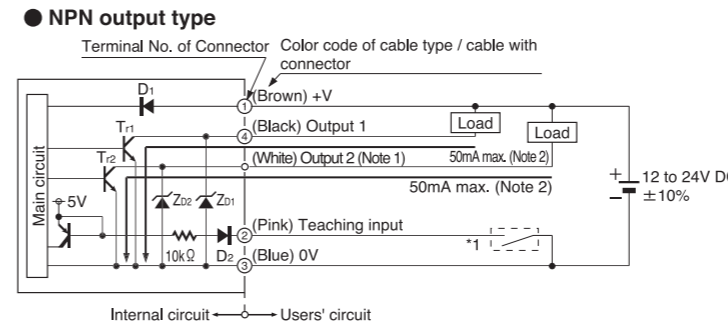
Panel Introduction



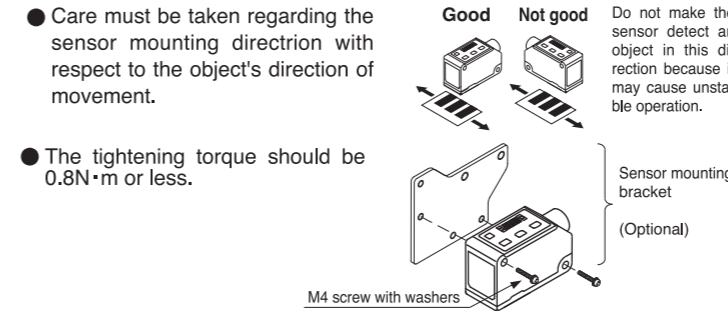
Dimensions



Wiring Diagram

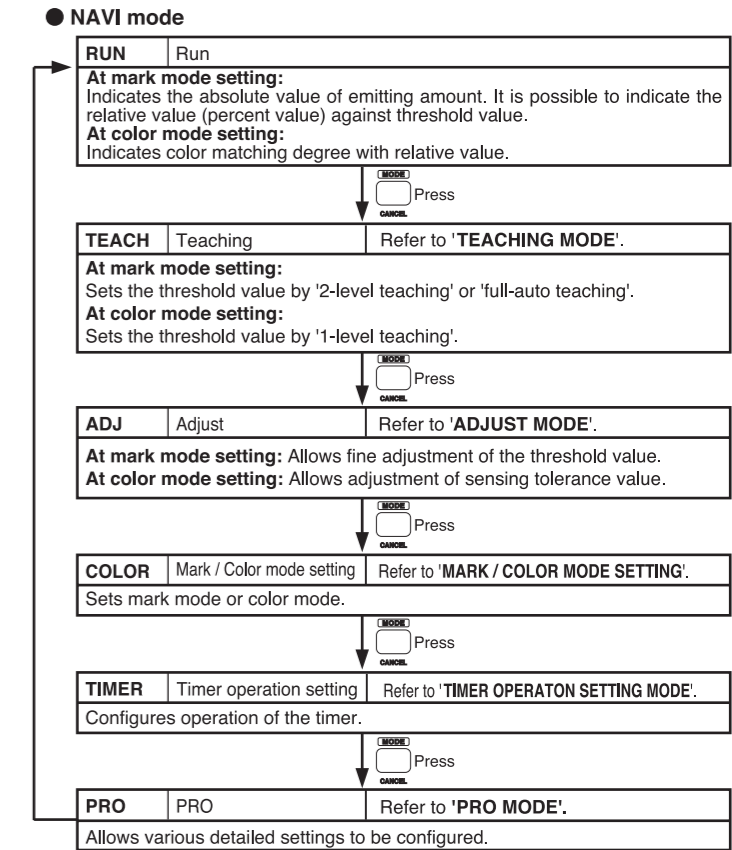


Mounting



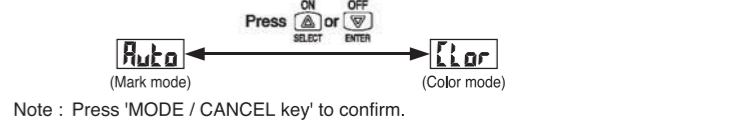
Operation Procedure

Before performing teaching or each detail setting, perform the setting of either mark mode or color mode with mark / color mode setting of NAVI mode.



Mark /Color Mode Setting

- This product enables to select the applicable mark / color mode depending on the using purpose. Before carrying out teaching or each setting, set the mark / color mode in COLOR of NAVI mode. Since the available functions differ depending on the selected mode, take care when setting mode. (The factory setting of this product is mark mode.)
 - Mark mode: Detects incident light intensity at receiving part.
 - Color mode: Detects color ratio of the sensing object. This mode can be used when desired to detect a specific color only.
- The mode is selected using either 'ON / SELECT key' or 'OFF / ENTER key'.



Key Lock Function

- The key operation is locked by pressing both 'MODE / CANCEL key' and 'OFF / ENTER key' for more than 2 seconds simultaneously when MODE indicator / RUN (green) lights up.
- In order to release the key lock, press both 'MODE / CANCEL key' and 'OFF / ENTER key' for more than 2 seconds again.

Direct Code Display

- When MODE indicator / RUN (green) lights up, the direct code is displayed on the digital display by pressing 'MODE / CANCEL key' for more than 2 seconds. (The direct code is turned off when stop pressing the 'MODE / CANCEL key'.) The current setting status can be confirmed at a glance with the direct code.

Direct code

Direct code	Mark / color mode	Operation mode	Sensing mode	Display mode	Eco mode	Display inverting mode	Key lock mode	Timer mode	Timer period
0			FINE		OFF	OFF		Without timer	1ms
1	Mark mode (GREEN)	Light-ON	COARSE	STANDARD	OFF	OFF	FULL lock	OFF-Delay	2ms
2		Dark-ON	FINE					ON-Delay	5ms
3			COARSE		ON	ON		Without timer	10ms
4	Mark mode (BLUE)	Light-ON	FINE	---P (Displayed in percentage)	OFF	OFF	RUN TEACHING	OFF-Delay	20ms
5		Dark-ON	COARSE					ON-Delay	50ms
6			FINE		ON	OFF		Without timer	100ms
7			COARSE		ON	ON		OFF-Delay	200ms
8	Mark mode (RED)	Light-ON	FINE					ON-Delay	500ms
9		Dark-ON	COARSE						
a	Color mode	Coincidence ON	FINE						
b		Incoincidence ON	COARSE						
c			FINE						
d			COARSE						
e			FINE						
f			COARSE						

Note : For details, refer to 'PRO MODE'.

Teaching Mode

- The teaching setting can be done when MODE indicator / TEACH (yellow) lights up.
- The applicable teaching for mark mode and color mode is differed in the teaching mode as shown below:
 - Mark mode : Sets either 2-level teaching or full-auto teaching.
 - Color mode: Sets 1-level teaching

Note : If stable sensing becomes impossible by environmental effect etc., carry out the teaching again.

In case of mark mode

<In case of 2-level teaching>

- Press 'MODE / CANCEL key' to light up 'MODE indicator / TEACH (yellow)'. When setting the output to ON with mark, press 'ON / SELECT key' while aligning the beam spot, and when setting the output to OFF, press 'OFF / ENTER key'. '1.5t' blinks.
- Align the beam spot to the base (non-mark area) of the mark to be detected. When 'ON / SELECT key' is pressed at the step 1, press 'OFF / ENTER key', and when 'OFF / ENTER key' is pressed at the step 1, press 'ON / SELECT key'. '2.nd' blinks.
- The threshold value is set at the mid-value between the step 1 and 2. In case stable sensing is possible : 'Good' is displayed on the digital display. In case stable sensing is impossible: 'Err' is displayed on the digital display.

<In case of full-auto teaching>

- Press 'MODE / CANCEL key' to light up MODE indicator / TEACH (yellow). In the state where the sensing objects are moving on the assembly line, align the beam spot to the position where the mark on the object passes through.
- When setting the output to on for the side with less incident light intensity, press 'ON / SELECT key', and when setting the output to on for the side with more incident light intensity, press 'OFF / ENTER key' for more than 2 seconds. 'Auto' is displayed, and sampling begins.
- In case stable sensing is possible : 'Good' is displayed on the digital display. In case stable sensing is impossible: 'Err' is displayed on the digital display. Slow down the speed of the assembly line, and carry out the teaching again.

Note: If the output is gained on the opposite side against the side desired to the step 2, carry out the teaching again. In this case, note that, when carrying out the teaching for this measurement, press the different key from the one previously pressed.

In case of color mode

<In case of 1-level teaching>

- Press 'MODE / CANCEL key' to light up MODE indicator / TEACH (yellow). Align the beam spot to the mark to be detected.
- When setting the output to ON with mark, press 'ON / SELECT key', and when setting the output to OFF, press 'OFF / ENTER key'. '1.5t' blinks.
- In case stable sensing is possible : 'Good' is displayed on the digital display. In case stable sensing is impossible: 'Err' is displayed on the digital display, and the setting value is reset to the pre-teaching value.

Adjust Mode

- The following settings can be done when MODE indicator / ADJ (yellow) lights up.

In case of mark mode: Fine adjustment of threshold value

- The threshold value is fine adjustable using 'ON / SELECT key' or 'OFF / ENTER key'.

In case of color mode: Set judging tolerance

- The judging tolerance setting is the function that can change the judging tolerance with respect to the taught reference color.
- Even if the tolerance is changed, the information of the reference color taught earlier does not change.
- The judging tolerance value increases with 'ON / SELECT key', and decreases with 'OFF / ENTER key'.

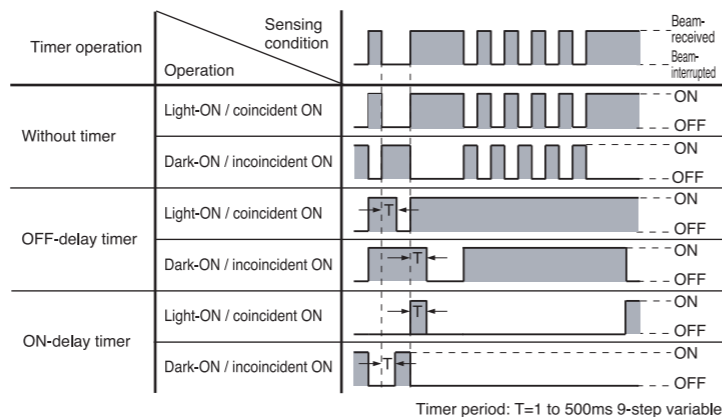
Notes: 1) Press 'MODE / CANCEL key' to confirm.
2) The numerical value indicated in the digital display should be used as a reference.

Timer Operation Setting Mode

- The setting for whether the timer is used or not can be done when MODE indicator / TIMER (yellow) lights up.
- The initial value of each timer function is 20ms.
- Refer to 'PRO MODE' for the setting delay timer, OFF-delay timer and ON-delay timer

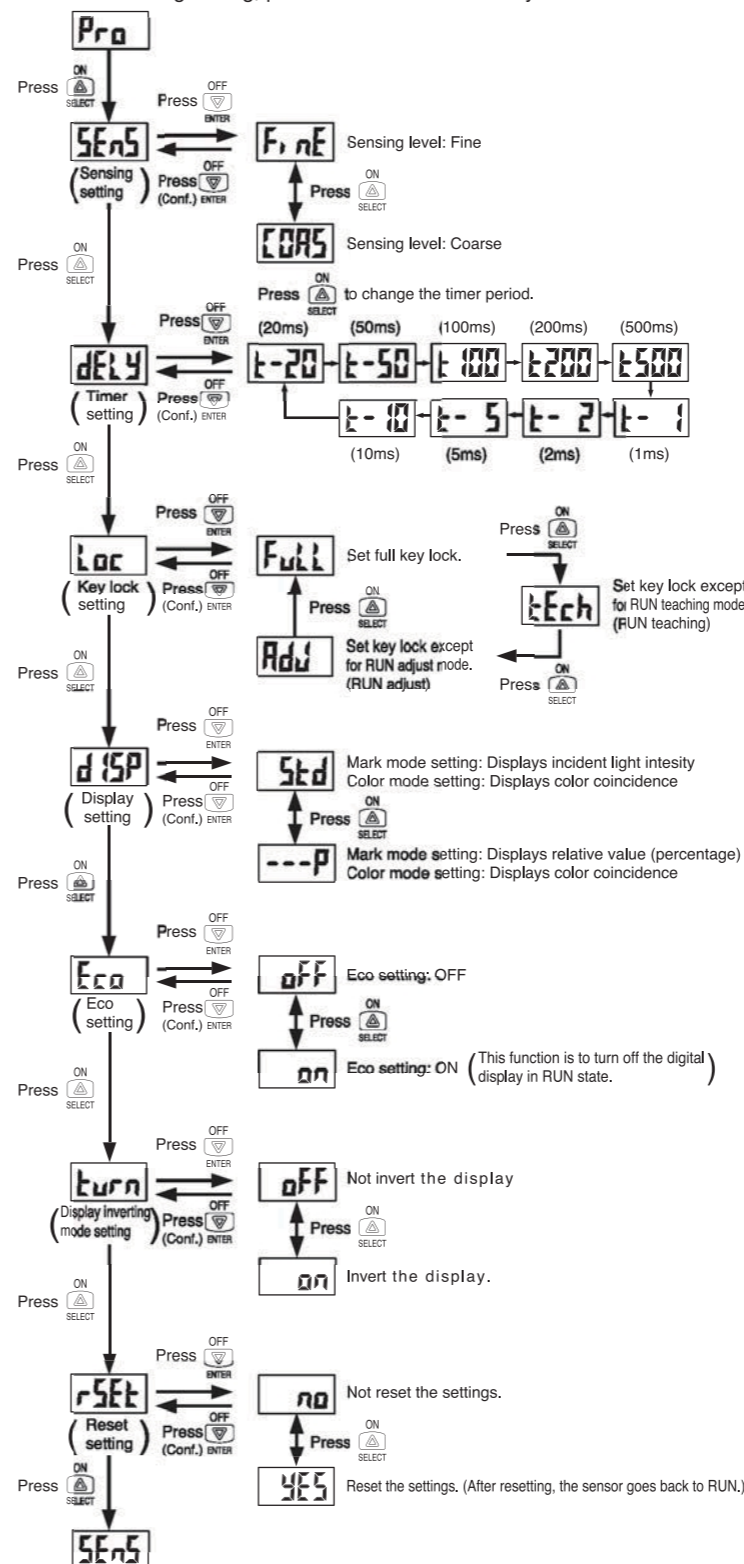
Note: Press 'MODE / CANCEL key' to confirm.

<Time chart>



Pro Mode

- The setting for whether PRO is used or not can be done when MODE indicator / PRO (yellow) lights up. For confirming each selected setting item, press 'OFF / ENTER key'. After confirming setting, the digital display flashes. For canceling setting, press 'MODE / CANCEL key'.



Function	Factory setting	Description
Sensing setting	FINE	Sets the sensing level (hysteresis.)
Timer setting	t-20	Sets timer setting period by 9-steps.
Key lock setting	Full	Selects key lock function.
Display setting	Std	Selects display method of digital display.
Eco setting	off	Sets ON / OFF of eco mode.
Display inverting mode setting	off	Changes display direction of digital display.
Reset setting	no	Resets to factory setting.

External Teaching Function

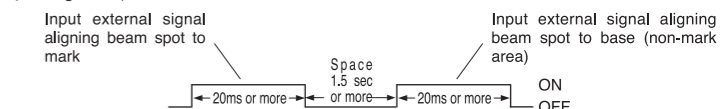
- This product incorporates the external teaching function. Take care that the teaching methods for mark mode and color mode differ in the external teaching function.

In case of mark mode

<2-level teaching>

- Align the beam spot to the mark to be detected in 'RUN mode'.
- Input the external signal for 20ms or more in step 1 state. (Do not input the external signal more than 2 sec. continuously.)
- Align the beam spot to the base (non-mark area), and input the external signal for 20ms or more.

(Timing chart)



<Full-auto teaching>

- Put the object on the assembly line at 'RUN mode' state.
- When the external signal is input for 2 sec. or more, sampling begins. When sampling finishes, the digital display flashes. If 'Err' is displayed, slow down the line speed, and carry out the teaching again.

(Timing chart)



Note: When the full-auto teaching is used, the output operation is set to 'DARK-ON'.

In case of color mode

<1-level teaching>

- Align the beam spot to the mark to be detected in 'RUN mode'.
- Input the external signal for 20ms or more in step 1 state.

(Timing chart)



Output2 (Inversion Output) (OUT)

- The FGS-31 cable type incorporates the output 2 (inversion output) (OUT). For teaching, this function is convenient for inverting logic of LIGHT-ON / DARK-ON (mark-mode), and coincidence-ON / incoincidence-ON (color mode). When the output 2 is used, connect the output wire (output 2) to +V side (0V side for PNP output type). When the output 2 is not used, be sure to insulate it.

Error Display

- Take measurement for the error as shown below:

Display	Error content	Remedy
Err-1	Shorten the load and flows overcurrent.	Turn off the power supply and check the load.

Product specifications are subject to change without notice.
For more information or if you have any questions or suggestions about this product, please feel free to contact us.