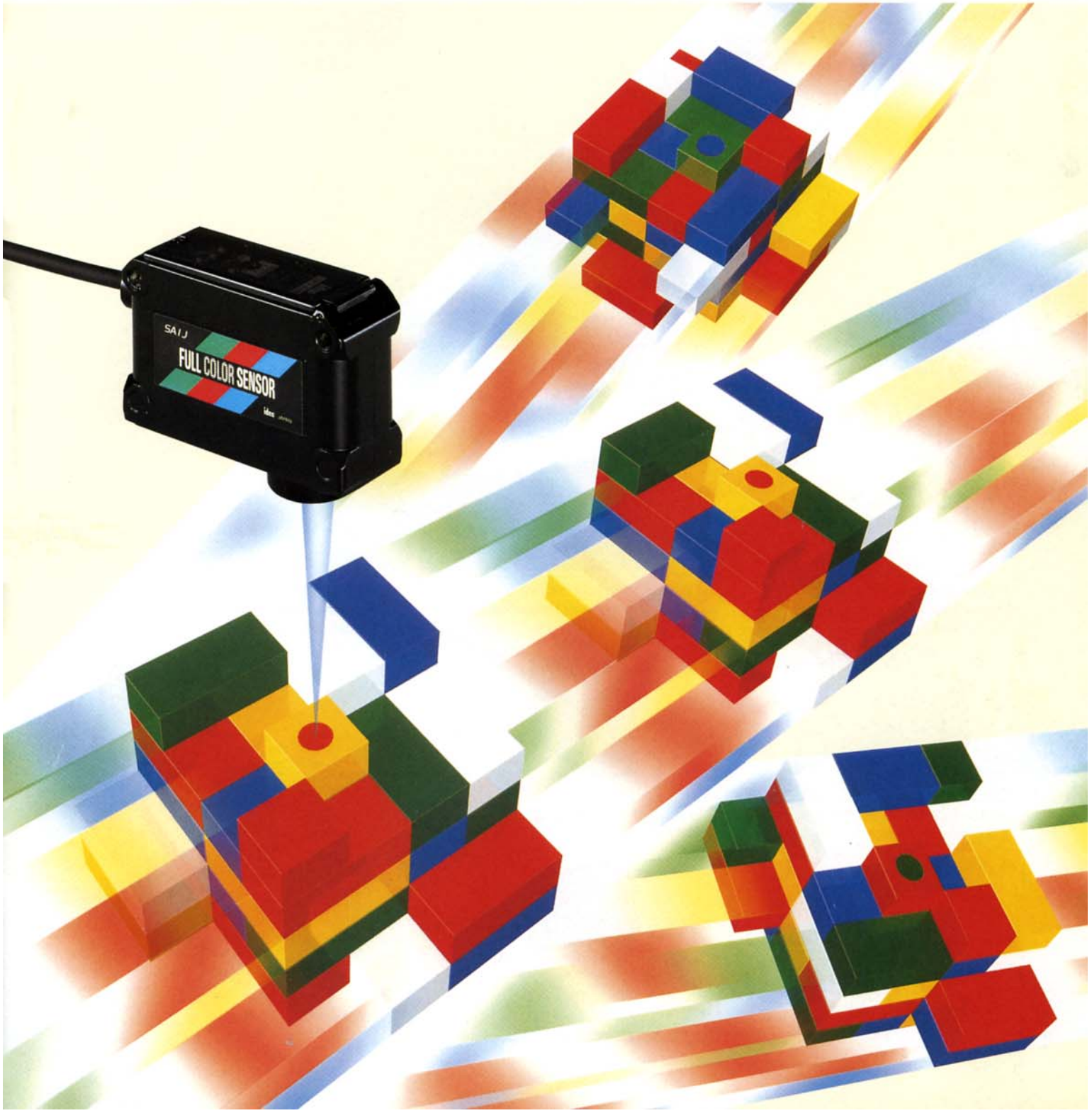
LED

FULL COLOR SENSORS

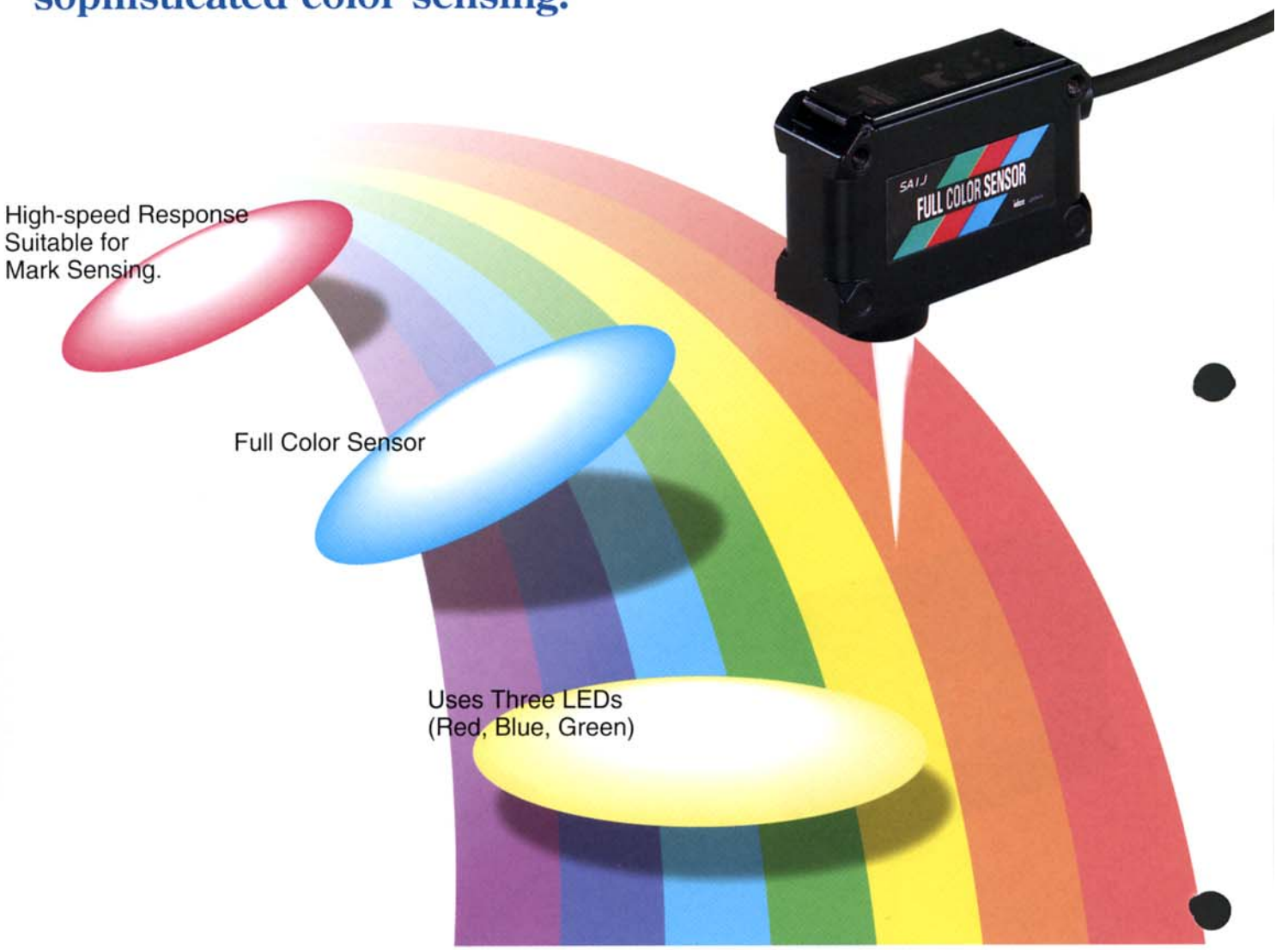
SA1J

IDEC IZUMI CORPORATION



SA1J FULL COLOR SENSORS

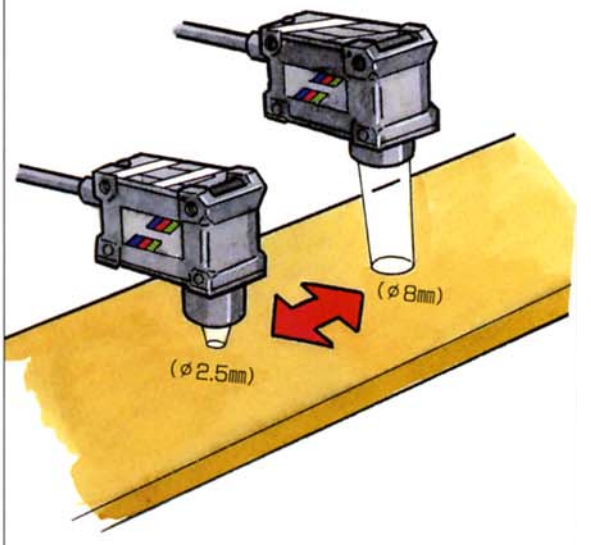
SA1J is as easy to use as a photoelectric switch, but unlike photoelectric switches, SA1J ensures sophisticated color sensing.



Degree of Protection: IP67
(Dust/water tight)

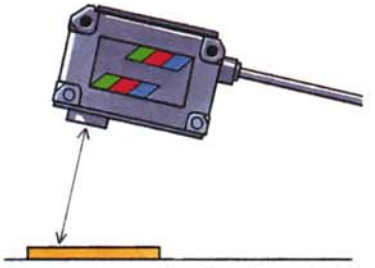
Teaching system allows for easy registration of any reference color.

Small Spot or Standard Spot are selectable depending on the sensing applications.

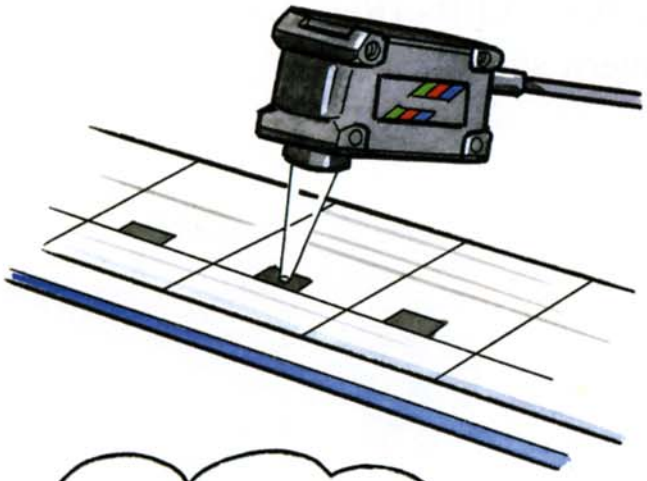


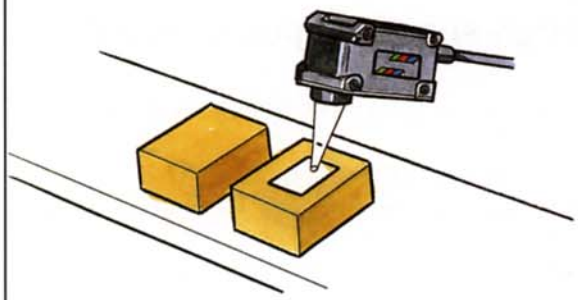
Lightweight because housing is made of aluminum.

Long-distance sensing
(60mm maximum)

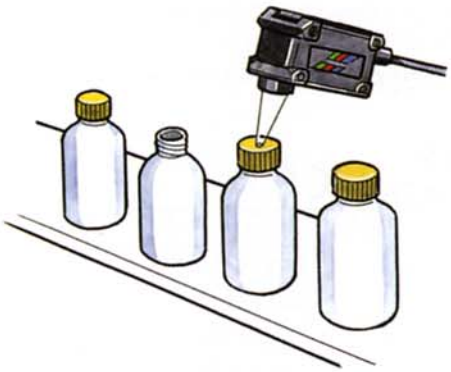


1-color Type



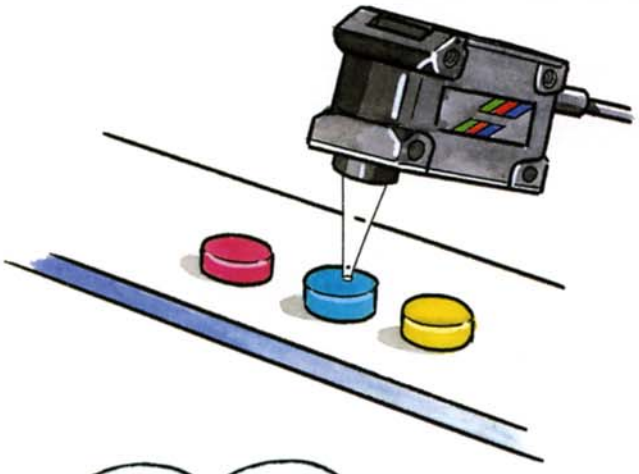


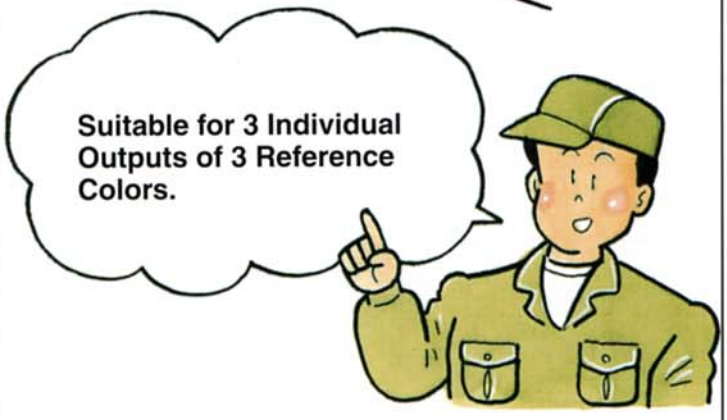
• Sensing the Presence of a Label.

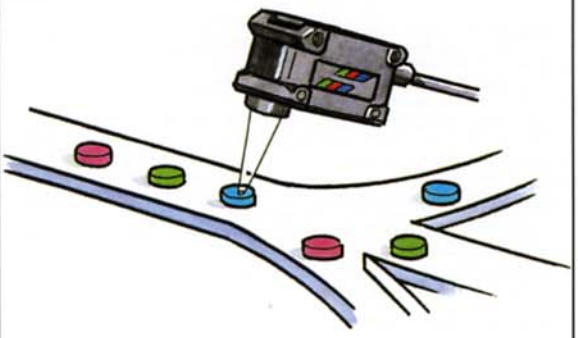


• Sensing the Presence of a Cap.

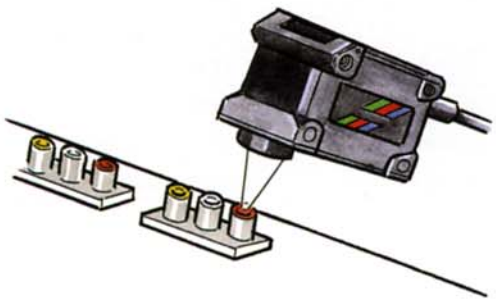
3-color Type







• Classifying Objects by Discriminating Their Colors.



• Checking a Color Combination or a Order by Color Inspection.

SA1J FULL COLOR SENSORS

General-purpose color sensors use three LEDs (Red, Green, Blue). High-speed response suitable for mark sensing.

- Uses three LEDs (Red, Blue, Green). Ensures long sensing life.
- 3-color type and 1-color type.
- High-speed response (0.3msec) ideal for mark sensing. (1-color type)
- Degree of Protection: IP67 (Dust/water tight)
- Teaching system allows for easy registration of any reference color.
- Lightweight because housing is made of aluminum.
- Small Spot (ϕ2.5 to ϕ4.5mm) or Standard Spot (ϕ4 to ϕ8mm) are selectable depending on the sensing applications.
- Long-distance sensing (60mm maximum).

TYPES

• 1-color Type CE

Inspection Spot	Type No.	Output Type
Standard	**SA1J-C1N1**	NPN open collector 30V DC, 100mA max.
Small	**SA1J-C2N1**	
Standard	**SA1J-C1P1**	PNP open collector 30V DC, 100mA max.
Small	**SA1J-C2P1**	

• 3-color Type

Inspection Spot	Type No.	Output Type
Standard	**SA1J-C1N3**	NPN open collector 30V DC, 100mA max.
Small	**SA1J-C2N3**	
Standard	**SA1J-C1P3**	PNP open collector 30V DC, 100mA max.
Small	**SA1J-C2P3**	

SPECIFICATIONS

• General Specifications

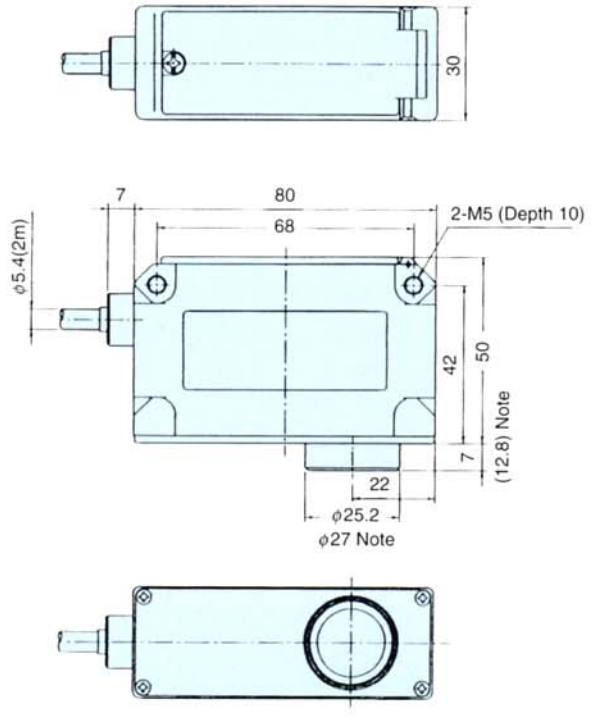
	1-color Type	3-color Type
Power Voltage	12 to 24V DC (ripple 10% maximum) Operating voltage: 10 to 30V DC	
Current Draw	150mA maximum	
Dielectric Strength	1,000V AC, 1 minute (between live and dead parts)	
Insulation Resistance	20MΩ minimum (500V DC megger)	
Operating Temperature	–10 to +50°C (without freezing)	
Operating Humidity	35 to 85% RH (without condensation)	
Storage Temperature	–30 to +70°C	
Vibration Resistance	10 to 55Hz, Single amplitude: 0.75mm 2 hours each in 3 axes	
Shock Resistance	500 m/sec^2 (Approx. 50G) 5 shocks each in 3 axes	
Extraneous Light Immunity	Sunlight: 10,000Lx max., Halogen Lamp: 3,000Lx max.	
Material	Housing: Aluminum, Lens: Glass, Cover: PAR	
Degree of Protection	IP67 (IEC Pub 529)	
Connection	0.2mm^2 ϕ 5.4 mm 5-core oiltight vinyl cabtyre cable, 2m long	0.2mm^2 ϕ 5.4 mm 7-core oiltight vinyl cabtyre cable, 2m long
Weight	Approx. 250g	
Dimensions	50H × 30W × 80D mm	
Attachments	Adjusting screwdriver	

• Function Specifications

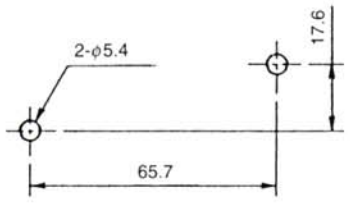
		1-color Type												3-color Type											
Type No.		SA1J-C1N1			SA1J-C2N1			SA1J-C1P1			SA1J-C2P1			SA1J-C1N3			SA1J-C2N3			SA1J-C1P3			SA1J-C2P3		
Sensing Distance (mm)		40	50	60	15	20	25	40	50	60	15	20	25	40	50	60	15	20	25	40	50	60	15	20	25
Spot Diameter (mm)		ϕ4	ϕ6	ϕ8	ϕ2.5	ϕ3	ϕ4.5	ϕ4	ϕ6	ϕ8	ϕ2.5	ϕ3	ϕ4.5	ϕ4	ϕ6	ϕ8	ϕ2.5	ϕ3	ϕ4.5	ϕ4	ϕ6	ϕ8	ϕ2.5	ϕ3	ϕ4.5
Function Setting	Reference Color Set	Teaching system, 1 color												Teaching system, 3 colors											
	Inspection Tolerance	5-step digital setting												5-step digital setting (Normal Run Mode Only)											
	Inspection Mode	Color (C)/Color + Intensity (C+I)												Color (C)/Color + Intensity (C+I) selectable											
	Operation Mode	——												Normal Run Mode (1 to 5)/Select Run Mode											
	Synchronous Mode	Internal Synchronous Mode (INT)/External Synchronous Mode (EXT)																							
	Response Mode	Fast (F), Normal (N), Slow (S)																							
	Off-delay Timer	Timer ON (T-ON), Timer OFF (T-OFF)																							
	Timer	OFF delay timer 40 msec																							
Control Output		NPN open collector 30V DC, 100mA max. Voltage drop 1.5V maximum protected against short circuit.						PNP open collector 30V DC, 100mA max. Voltage drop 1.5V maximum protected against short circuit.						NPN open collector (Note) 30V DC, 100mA max. Voltage drop 1.5V maximum protected against short circuit.						PNP open collector (Note) 30V DC, 100mA max. Voltage drop 1.5V maximum protected against short circuit.					
SET Input External Synchronous Input		30V DC max. /3.6mA (when connected to 0V.) Typical Operating voltage: (0V) +4V maximum						30V DC max. /3mA (when connected to 24V.) Typical Operating voltage: (–V) –4V maximum						30V DC max. /3.6mA (when connected to 0V.) Typical Operating voltage: (0V) +4V maximum						30V DC max. /3mA (when connected to 24V.) Typical Operating voltage: (–V) –4V maximum					
Operation Indicator		Yellow LED												Yellow LED (3-color Individual Display)											
Output Operation Mode		Equivalent to reference color taught																							
Response Time		FAST: 0.3 msec, NORMAL: 1 msec, SLOW: 5 msec												FAST: 0.8 msec, NORMAL: 1.5 msec, SLOW: 6 msec											
Light Source		3 LEDs (Red, Green, Blue)																							

Note: Each of the three control circuits are individually protected against short circuits.

DIMENSIONS (All dimensions in mm.)



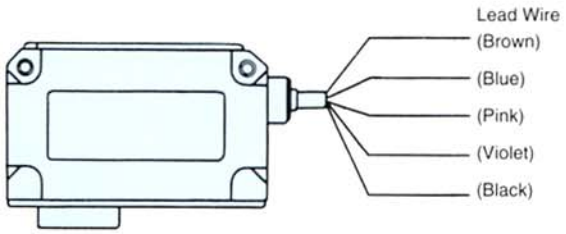
(Panel Cut-Out)



Note: Dimensions in ( ) represent small spot diameter type (SA1J-C2□□).

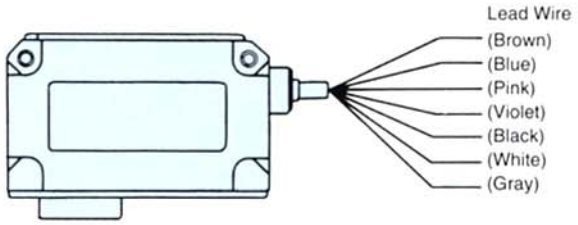
CONNECTION DIAGRAM

(1-color Type)



Lead Wire Color	Name	Function
Brown	+V	Power Voltage 12 to 24V
Blue	0V	Power Ground
Pink	SET	Set Input
Violet	EXT	External Synchronous Input
Black	OUT	Control Output

(3-color Type)



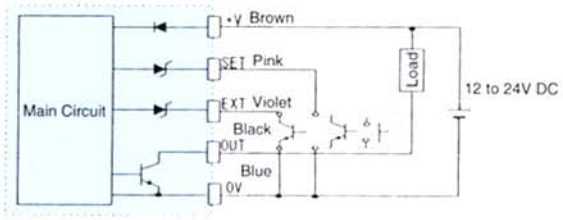
Lead Wire Color	Name	Function
Brown	+V	Power Voltage 12 to 24V
Blue	0V	Power Ground
Pink	SET	Set Input
Violet	EXT	External Synchronous Input
Black	OUT A	Control Output A
White	OUT B	Control Output B
Gray	OUT C	Control Output C

CONNECTION EXAMPLE

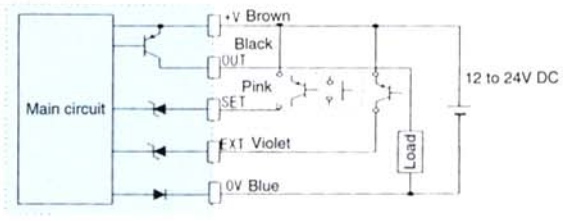
• I/O Circuit Example

[1-color Type]

(SA1J-C1N1/-C2N1)



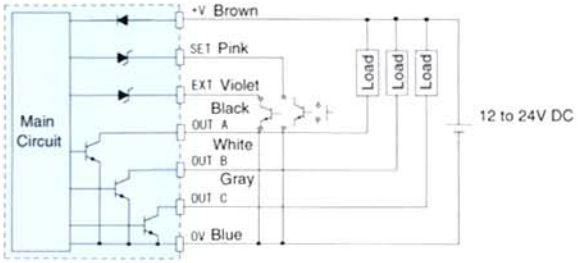
(SA1J-C1P1/-C2P1)



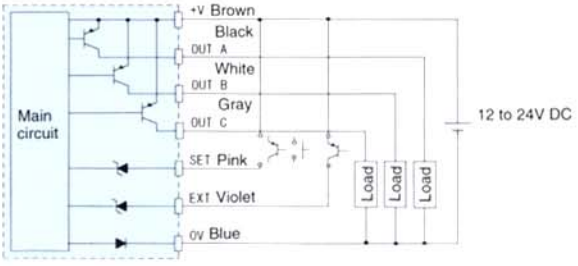
Use a non-contact output sensor for external synchronous input to prevent chattering.

[3-color Type]

(SA1J-C1N3/-C2N3)



(SA1J-C1P3/-C2P3)

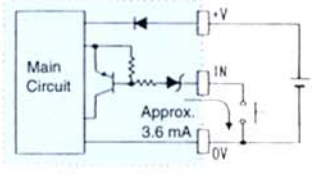


Use a non-contact output sensor for external synchronous input to prevent chattering.

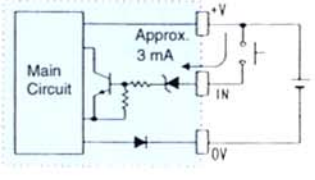
• Input Circuit

(1-color Type/3-color Type)

NPN

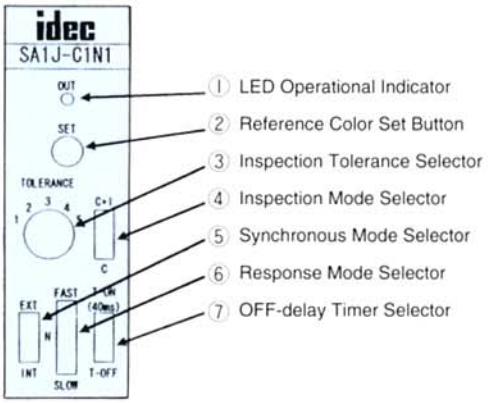


PNP



OPERATION PANEL

[1-color Type]



① LED Operational Indicator
LED operation indicator goes on when the output is on.

② Reference Color Set Button
This button is used to register a reference color. A reference color can also be registered by an external signal. When this button is pressed or the external signal is inputted, the existing reference color is replaced by the new reference color.

③ Inspection Tolerance Selector
The selector is used to select the degree of the inspection tolerance which allows for a difference from the reference color. The inspection tolerance can be selected in 5 steps. The inspection tolerance is smaller at a small number.

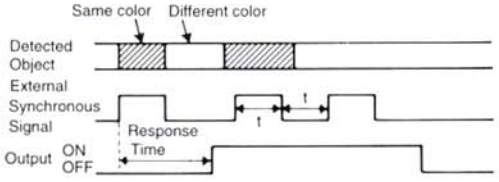
④ Inspection Mode Selector
This selector is used to select "C" inspection mode or "C+I" inspection mode.

• "C" Inspection Mode
Since this mode inspects color components (R·G·B color difference) only, the sensor is scarcely influenced by surrounding lights and deflections. This mode is ideal for detecting different kind of objects.

• "C+I" Inspection Mode
Since this mode inspects not only color components but also color brightness, this mode is ideal for inspecting the difference of similar colors. In this mode, the sensor is somewhat influenced by surrounding lights and deflections.

⑤ Synchronous Mode Selector
This selector is used to select the external synchronous mode or the internal synchronous mode.

• External Synchronous Mode (EXT)



This mode performs a color inspection synchronized with an external signal.
Note 1: The inspection can be performed only when an external synchronous signal rises.
Note 2: External synchronous signal should lasts for "t" in response to Response Mode.
F (Fast response): 0.2 msec or more
N (Normal response): 0.5 msec or more
S (Slow response): 3 msec or more
Note 3: Use non-contact signals for an external synchronous signal to prevent chattering.

• Internal Synchronous Mode (INT)
This mode performs a color inspection continuously according to the repeat response time.

⑥ Response Mode Selector

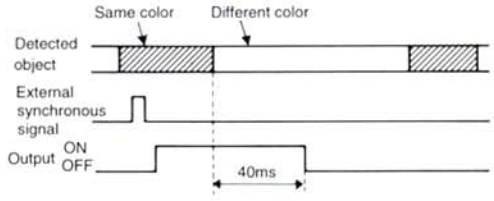
• Fast Response Mode (F)
This mode is used for high-speed inspection. Response time is 0.3 msec.

• Normal Response Mode (N)
This mode is used for normal inspection. Response time is 1 msec.

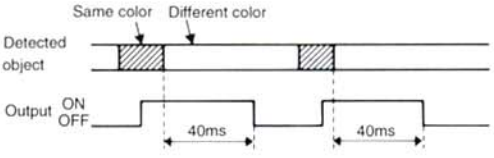
• Slow Response Mode (S)
This mode is used for stable inspection. Response time is 5 msec.

⑦ OFF-delay Timer (T-ON/T-OFF) Selector
This mode is used to select the use of OFF-delay Timer (40 msec).
This mode holds the output for 40 msec.

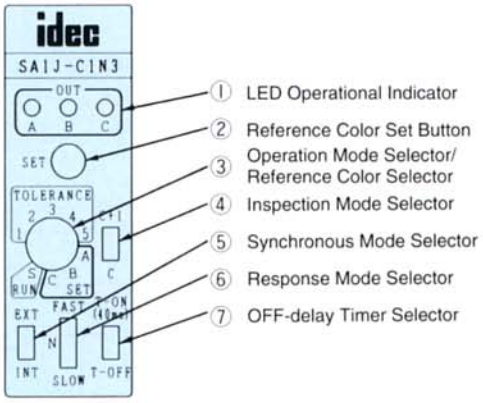
• When external synchronization is used.



• When internal synchronization is used.



[3-color Type]



① LED Operational Indicator
LED operation indicator goes on when the output is on.

② Reference Color Set Button
This button is used to register a reference color. A reference color can also be registered by an external signal. When this button is pressed or an external signal is applied, the existing reference color is replaced by the new reference color.
Note: Up to 3 colors can be registered as a reference color.

③ Operation Mode Selector/Reference Color Selector

[Operation Mode Selection]
[Normal Run Mode: 1 to 5]
This selector is used to select the degree of the inspection tolerance which allows for a difference from the reference color. The inspection tolerance can be selected in 5 steps. The inspection tolerance is smaller at a smaller number.

[Select Run Mode: S RUN]
When this mode is selected, output corresponds to the most similar reference color matching object detected from 3 reference colors. Since the inspection tolerance is automatically determined, this mode is ideal for classifying objects. This mode is also suitable when a difference in color between object and background is small or when objects vary widely.

(Notes for Select Run Mode)
- Select Run Mode is not applicable for 1-color registration.
- When Select Run Mode is used for 2-color registration, register a completely different color as a remaining reference color.

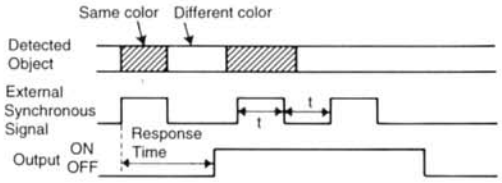
[Reference Color Selection]
This selector is used to select the reference color A, B, or C for reference color registration.

④ Inspection Mode Selector
This selector is used to select "C" inspection mode or "C+I" inspection mode.

• "C" Inspection Mode
Since this mode inspects color components (R·G·B color difference) only, the sensor is scarcely influenced by surrounding lights and deflections. This mode is ideal for detecting different kind of objects.

• "C+I" Inspection Mode
Since this mode inspects not only color components but also color intensity, this mode is ideal for inspecting the difference of similar colors. In this mode, the sensor is somewhat influenced by surrounding lights and deflections.

⑤ Synchronous Mode Selector
This selector is used to select either the external synchronous mode or the internal synchronous mode.



• External Synchronous Mode (EXT)
This mode performs a color inspection synchronized with an external signal.
Note 1: The inspection can be performed only when an external synchronous signal rises.
Note 2: External synchronous signal should lasts for "t" in response to Response Mode.
F (Fast response): 0.5 msec or more
N (Normal response): 0.8 msec or more
S (Slow response): 3 msec or more
Note 3: Use non-contact signals for an external synchronous signal to prevent chattering.

• Internal Synchronous Mode (INT)
This mode performs a color inspection continuously according to the repeat response time.

⑥ Response Mode Selector

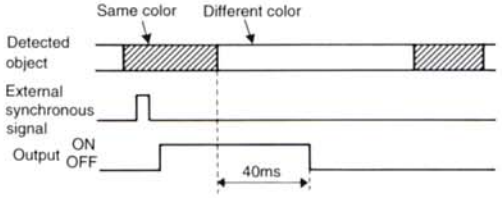
• Fast Response Mode (F)
This mode is used for high-speed inspection. Response time is 0.8 msec.

• Normal Response Mode (N)
This mode is used for normal inspection. Response time is 1.5 msec.

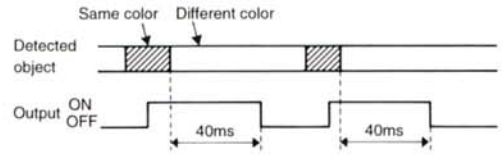
• Slow Response Mode (S)
This mode is used for stable inspection. Response time is 6 msec.

⑦ OFF-delay Timer (T-ON/T-OFF) Selector
This mode is used to select the use of OFF-delay Timer (40 msec).
This mode holds the output for 40 msec.

• When external synchronization is used.



• When internal synchronization is used.



REFERENCE COLOR REGISTRATION

[1-color Type]

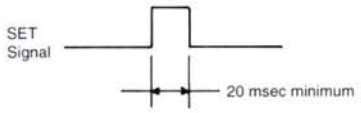
• Basic Operation by Manual Registration

When inspection mode, inspection tolerance, and a reference color are set on the operation panel.

(1) Set the synchronous mode to "INT".
(2) Fix the registration color and press the Reference Color Set Button (SET).
(3) Set the inspection tolerance, inspection mode, response mode, and off-delay timer.

When inspection mode and inspection tolerance are set on the operation panel and a reference color is registered by an external signal.

(1) Set the synchronous mode to "EXT".
(2) Fix the registration color and send the input signals to SET input as shown below.



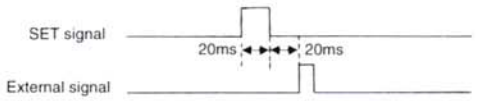
- A pulse of 20 msec or more should be provided to SET input.
- The interval between SET signal and external synchronous signal should be 20 msec or more.

(3) Set the inspection tolerance, inspection mode, response mode, and off-delay timer.

• Remote Registration of Reference Color

This method is used for on-line color registration.

(1) Set the synchronous mode to "EXT".
(2) Set the inspection tolerance, inspection mode, response mode, and off-delay timer.
(3) Input signals are transmitted as follows.



- A pulse of 20 msec or more should be provided to SET input.
- The interval between SET signal and external synchronous signal should be 20 msec or more.
- Registration timing can be determined by an external synchronous signal.

Note: Remote registration cannot be performed when FAST mode is selected.

[3-color Type]

• Basic Operation by Manual Registration

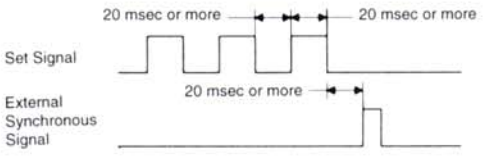
When inspection mode and inspection tolerance are set on the operation panel.

(1) Set the synchronous mode to "INT".
(2) Set the inspection tolerance to A and press the SET button, reference color is memorized and operation indicator goes on. (When memorizing reference colors B and C, repeat the same procedures as reference color A.)
(3) Set the inspection tolerance, inspection mode, response mode, and off-delay timer.

• Remote Registration of Reference Color

This method is used for on-line registration.

(1) Set the inspection tolerance, inspection mode, response mode, and off-delay timer.
(2) Input signals are transmitted as follows.



SET Signal	1 pulse	2 pulses	3 pulses
Registration	A	B	C

* The example above illustrates the registration C.

Reference colors A, B, and C are registered when an external synchronous signal is on immediately after the set signal is on. The number of pulses determines the reference color.

Note 1: Set signal should be the pulse of 20 msec or more.
Note 2: The interval between SET signal and external synchronous signal should be 20 msec or more.
Note 3: For external synchronous signal, refer to the OPERATION PANEL.
Note 4: Registration can be timed by an external synchronous signal only.
Note 5: When remote registration is used, color inspection is timed by the external synchronous signal only. Whether synchronous mode is in INT or EXT has no affect on the timing of the color inspection.

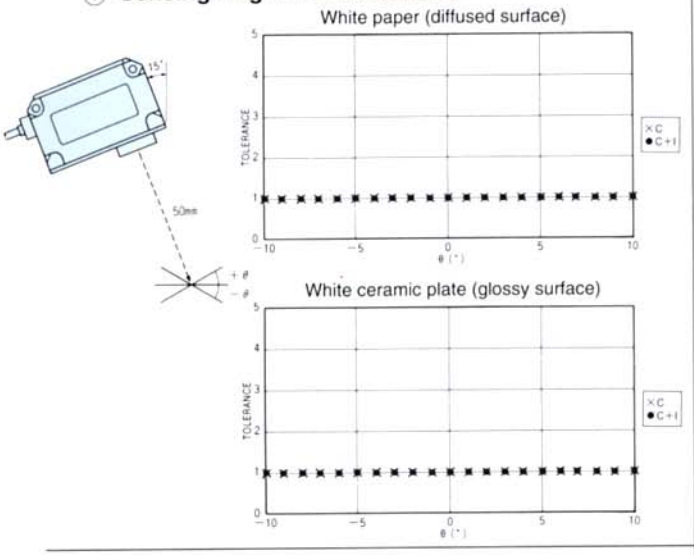
Note: Remote registration cannot be performed when FAST mode is selected.

CHARACTERISTICS (Typical)

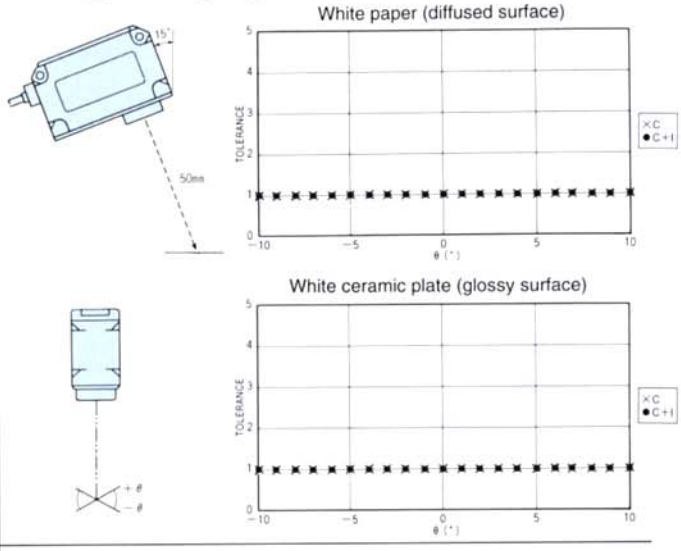
To register a reference color, glossy white ceramic plate and mat white paper are used in the standard installation. The most limited inspection tolerance (the smallest digital number) is plotted on each diagram. Response mode is normal.

(1) SA1J-C1 □□ (Standard Spot)

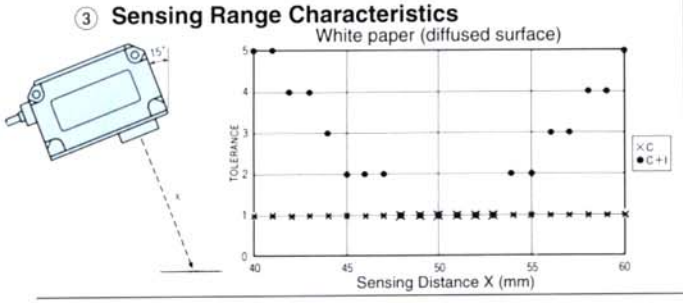
① Sensing Angle Characteristics



② Sensing Angle Characteristics

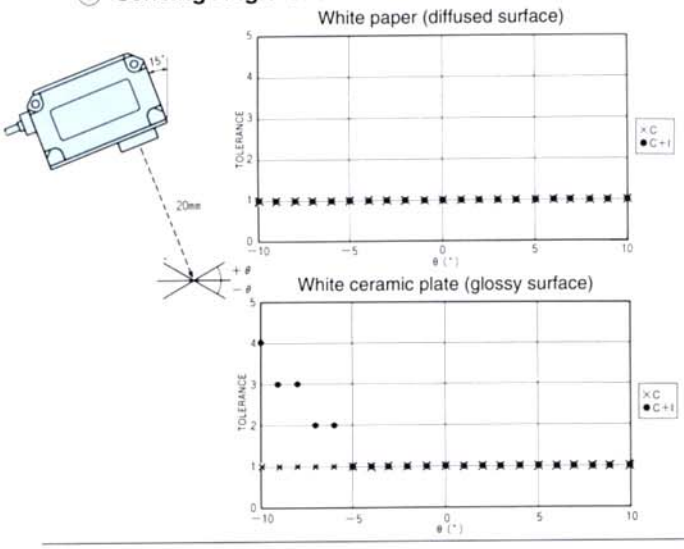


③ Sensing Range Characteristics

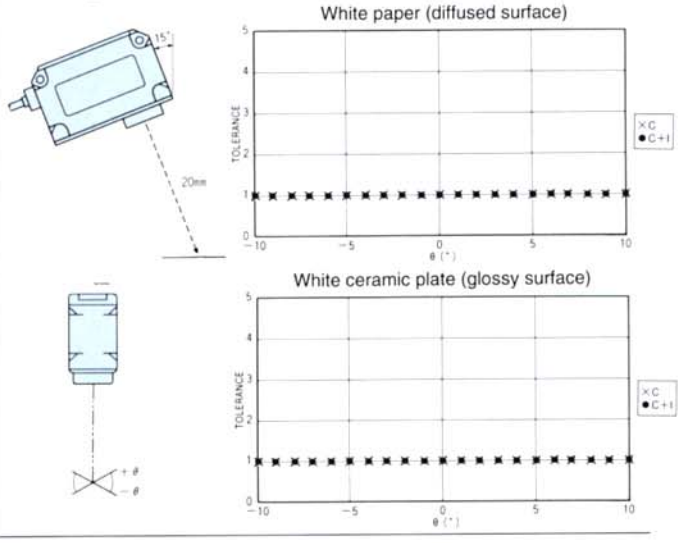


(2) SA1J-C2 □□ (Small Spot)

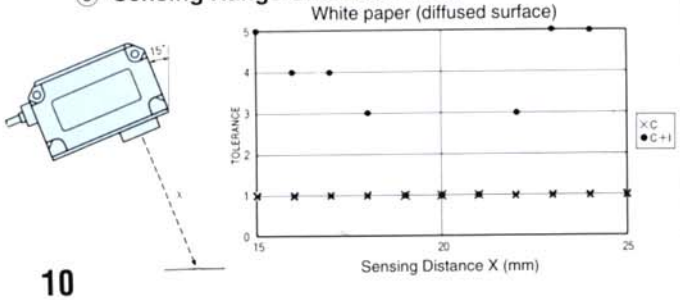
① Sensing Angle Characteristics



② Sensing Angle Characteristics



③ Sensing Range Characteristics



INSTRUCTIONS

OPERATION AT POWER ON

- Note that the sensor contains a circuit to keep the output off for approx. 2 seconds immediately after power is turned on.
- To ensure stable sensing, run a test operation for about 15 minutes.

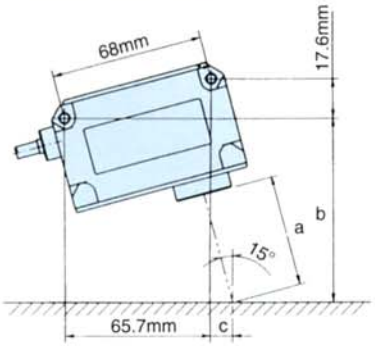
REFERENCE COLOR MEMORY

Since an EEPROM is used for reference color memory, no battery back-up is required.

NOTES FOR INSTALLATION

- Do not use the sensor near an induction machine or heat source, or where they are subjected to strong shocks and vibrations. Avoid large amounts of dust, corrosive gases, water for a long period of time, oil and chemicals.
- The receiver should not be exposed to excessive extraneous light.
- When the sensing area on the front of sensor has dust build-up, clean it with a soft cloth dipped in alcohol. Do not use organic solvents such as thinner.
- Do not tighten the mounting screws excessively for mounting the sensors, otherwise, the protection characteristics may be damaged. The tightening torque for mounting screws should be within 2.0N·m.
- Do not apply voltage exceeding the rated voltage between the power supply and housing.
- When installing SA1J sensors in parallel, keep the sensors at least 30mm apart.
- When screwing down the cover, tightening torque should range from 0.49 N·m to 0.69 N·m. Note to prevent dust accumulation inside the operation cover, or the degree of protection (IP67) may be impaired.

STANDARD INSTALLATION



Type No.	a	b	c
SA1J-C1 □□	50mm	82.5mm	10.2mm
SA1J-C2 □□	20mm	53.5mm	2.5mm

- Install the sensor in such a way that the distance a between lens and object conforms to the lengths shown in the table above.
- The optical axis is tilted by approx. 15° to the vertical direction of the object surface.
- The spot center is positioned away from the mounting hole by the horizontal distance c.
- Since the best installation position is variable depending on the object, determine the best installation to ensure stable sensing, by referring to the above table.
- Since the sensing direction in Figure 1 is less affected by the changes in the sensing angle than in Figure 2, install the sensor as shown in Figure 1.
  The object should more in the direction as shown in Figure 3.

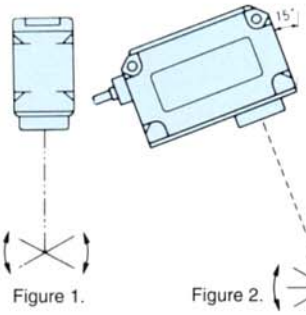


Figure 1.

Figure 2.

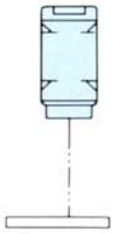


Figure 3.

⚠ NOTES FOR SAFETY

The sensors are designed to detect an object, and are not designed to ensure safety like accident prevention. Read the operating instructions carefully before installation, wiring, operation, maintenance, and check. The operating instructions should be distributed to the actual sensor users.

SWITCH OPERATION

- Turning torque for setting the inspection tolerance should not exceed 0.02N·m.
- Press the button to set the registration color, but operating load for Reference Color Set Switch should not exceed 30N.

WIRING

- Connect correctly because miswiring will cause damage.
- The power voltage should not exceed the rated range.
- Do not install high-voltage power lines in the same conduit with the input and output lines. Use separate conduit.
- When wiring is long, or the influence of power lines or electromagnetic equipment may occur, use a separate conduit for wiring.
- When using a switching power supply, be sure to ground the FG (frame ground) terminal.
- Cable extension is allowed up to 100m using a cabtyre cable with core wires of 0.3mm^2 or more.

IDEC IZUMI CORPORATION

7-31, Nishimiyahara 1-Chome, Yodogawa-ku, Osaka 532, Japan
Phone: (06) 398-2571, Telex: 523-3710, Facsimile: (06) 392-9731

IDEC CORPORATION (USA)
1213 Elko Drive, Sunnyvale, CA 94089-2240, USA
Phone: (408) 747-0550, Facsimile: (408) 744-9055

IDEC CANADA LIMITED
Unit 22-151, Brunel Road Mississauga, Ontario L4Z, 1X3 Canada
Phone: (905) 890-8561, Facsimile: (905) 890-8562

IDEC AUSTRALIA PTY. LTD.
2/3 Macro Court, Rowville, Victoria 3178, Australia
Phone: (61) 3-9763-3244, Facsimile: (61) 3-9763-3255

IDEC ELEKTROTECHNIK GMBH
Wendenstraße 331, D-20537 Hamburg, Germany
Phone: 0 40-25 11 91-93, Facsimile: 0 40-254 33 61

IDEC ELECTRONICS LIMITED
Unit 12, Canbury Business Park Elm Crescent, Kingston-Upon-Thames,
Surrey KT2 6HJ, UK
Phone: 0181 549 0737, Facsimile: 0181 546 0963

IDEC IZUMI (H.K.) CO., LTD.
Room 1409, Tower 1, Silvercord, 30 Canton Road, Tsimshatsui,
Kowloon, Hong Kong
Phone: (852) 2376-2823, Facsimile: (852) 2376-0790

IDEC TAIWAN CORPORATION
3F, No.75, Hsin Tai Wu Road, Sec. 1, Hsi-Chih, Taipei County, Taiwan, R.O.C.
Phone: (886)-2-698-2601, Facsimile: (886)-2-698-2709

Cat. No. EP833-0 APRIL '97 5T PRINTED IN JAPAN