

# ANALOG DISTANCE SENSOR

# SA1D

## Operating Instructions

ES003C



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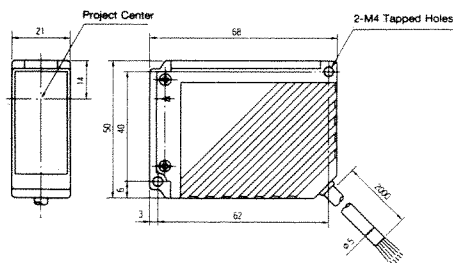
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Type No.	Output
SA1D-LK4	NPN Open Collector
SA1D-LL4	PNP Open Collector

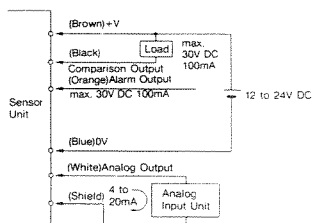
## DIMENSIONS



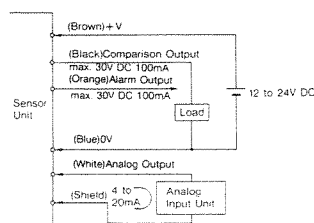
All dimensions in mm.

## WIRING DIAGRAM

SA1D-LK4  
(NPN Output)



SA1D-LL4  
(PNP Output)



### • Analog Output

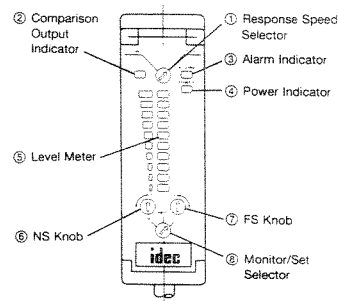
#### (1) Distance Characteristics

The analog output provides a current output ranging from 4 to 20mA in response to the object distance and can be monitored on the 10-dot LED level meter. Since the relationship between the analog output and distance is not exactly linear, confirm the analog output characteristics before actual application.

#### (2) Conversion to Voltage Output

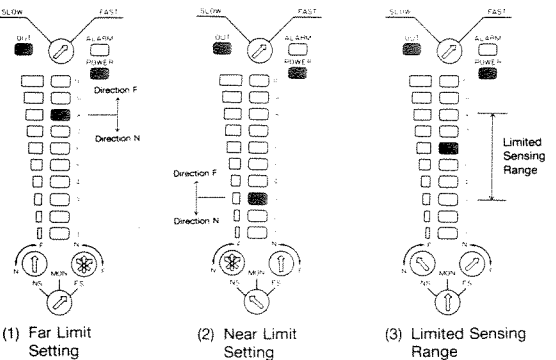
The current output can be converted to a voltage output ranging from 1 to 5V by connecting the attached resistor (249Ω) as shown below. When using a resistor other than the attached resistor, the resistance should be 250Ω or less.

## INDICATION PANEL



- ① FAST: 5msec  
SLOW: 50msec
- ② Goes on when the comparison output is on.
- ③ Goes on when incident light is excessive or insufficient.
- ④ Goes on when power is on.
- ⑤ The object distance is indicated on the level meter.
- ⑥ NS (Near Set) Knob: 14 Rotations
- ⑦ FS (Far Set) Knob: 14 Rotations
- ⑧ Monitor/Set Selector  
MON: Indicate the analog input.  
NS: Indicate the near limit.  
FS: Indicate the far limit.

## SETTING



### • Comparison Output Setting

Far and near limits for the comparison output can be set independently in the following procedure. The comparison output and the OUT indicator go on when the detected object is within the far and near limits.

#### (1) Setting the Far Limit of the Sensing Range

- ① With the monitor mode selector set to MON (monitor mode), place the object at the required sensing position for the far limit. The level meter indicates the sensing position on one of the 10-dot LED indicator. Remember the position of the lighting LED.
- ② Turn the monitor mode selector set to FS (far setting). The level meter indicates the current preset position.
- ③ Turn the FS (far setting) knob to move the level meter indication where you remembered in procedure ①. If the OUT indicator is off, turn the FS knob in direction F until the OUT indicator goes on.

#### (2) Setting the Near Limit of the Sensing Range

- ① With the monitor mode selector set to MON, place the object at the required sensing position for the near limit. Remember the position of the lighting LED on the level meter.
- ② Turn the monitor mode selector set to NS (near setting).
- ③ Turn the NS (near setting) knob to move the level meter indication where you remembered in procedure ①. If the OUT indicator is off, turn the NS knob in direction F until the OUT indicator goes on.

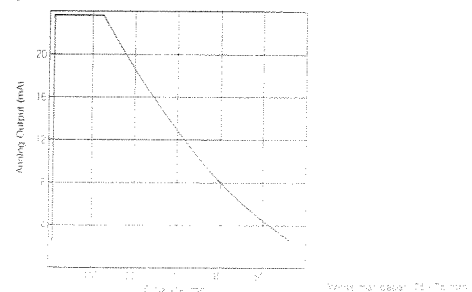
### • Response Speed Setting

Response speed can be selected from "FAST" or "SLOW" by the response speed selector. When the response in the FAST (5 msec) mode is not required, use of the SLOW (50 msec) mode is recommended because of more reliable repetition accuracy and analog output.

### • Alarm Output

When unstable sensing is caused by insufficient or excessive reflected light depending on the reflectiveness and distance of the object, the alarm output and the ALARM indicator go on. At the same time, the comparison output and the OUT indicator go off. The analog output holds an output of 4 mA or less only when the incident light is insufficient.

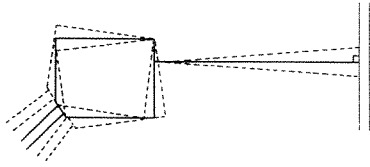
### • Analog Output vs Object Distance



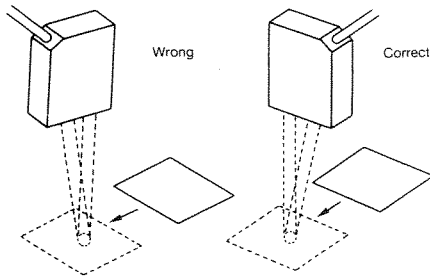
# INSTALLATION

## • Installation

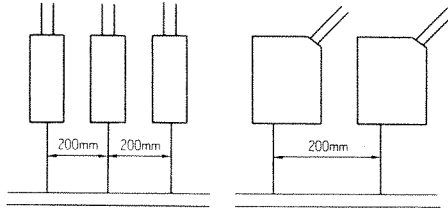
- (1) Install the analog distance sensor in such a way that the optical sensing area on the front of the sensor is as parallel as possible to the object as shown below.



- (2) Although some errors may occur depending on the moving direction of the object, errors can be reduced by installing the sensor as shown below. To minimize sensing errors, the sensor output should be taken when the projector spot falls exactly on the object using a synchronizing sensor.



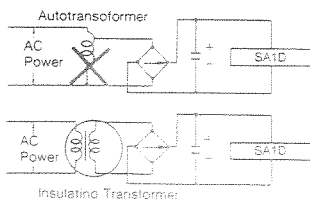
- (3) When installing the analog distance sensors collectively, keep them apart from each other to prevent interference.



- (4) Use the analog distance sensor at the operating temperature ranging from 0 to +55°C (no freezing).
- (5) Since the analog distance sensor may be adversely affected by the type and position of the incandescent lamp, the sensor receiver should not be exposed directly to the light from the incandescent lamp.
- (6) Do not use the analog distance sensor in excessive extraneous light and strong magnetic field.
- (7) Do not use the analog distance sensor in environments where steam, large amounts of dust, corrosive gases or organic solvents exist.
- (8) The optical sensing area on the front of sensor should not be subjected to water or oil drips to prevent sensing errors.
- (9) Although the analog distance sensor is of drip-proof type, do not use the sensor in water or outdoors when it rains.

## • Other Precautions

- (1) When detected objects are specular, non-reflective, transparent or liquid, accurate sensing may be impossible.
- (2) When detecting small differences in a limited sensing range, select the near setting because of its higher accuracy than the far setting. In addition, care should be taken that the sensor is scarcely influenced by external factors such as temperature and extraneous light.
- (3) Since the dielectric strength and insulation resistance tests may damage the sensor due to the capacitor grounding of the housing, do not make these two tests. The DC power supply should use an insulating transformer in stead of an autotransformer.



# SPECIFICATIONS

## • General Specifications

Power Voltage	12 to 24V DC (ripple 10% maximum)
Current Draw	100mA maximum
Dielectric Strength	Not specified due to capacitor grounding
Insulation Resistance	Not specified due to capacitor grounding
Operating Temperature	0 to +55°C (no freezing)
Operating Humidity	35 to 85% RH (no condensation)
Storage Temperature	-20 to +70°C
Vibration Resistance	Damage limits: 10 to 55Hz, Amplitude 1.5mm p-p 2 hours each in 3 axes (power off)
Shock Resistance	Damage limits: 500 m/sec <sup>2</sup> 5 shocks each in 3 axes
Extraneous Light Immunity	Sunlight: 10,000 lux, Incandescent lamp: 3,000 lux (at the receiver surface)
Material	Housing: Diecast zinc Filter and lens: Acrylic
Degree of Protection	IP65 (IEC Pub 529)
Cable	0.2mm <sup>2</sup> 5-core including shield, 2m-long cabtury cable
Weight	Approx. 350g
Dimensions	21W×50D×68H×mm

## • Function Specifications

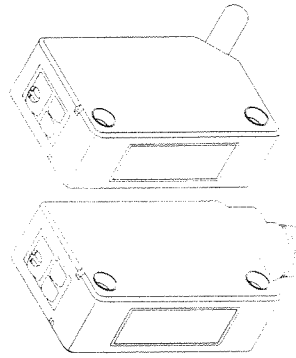
Control Output	Analog current output	4 to 20mA, 5V maximum (Distance 500 to 200mm)	
	Comparison output	NPN open collector 30V DC, 100mA max.	PNP open collector 30V DC, 100mA max.
	Alarm output	Residual Voltage: 1V max.	
Operation Indicator	Level Meter (10-dot LED)	MON Mode	Indicates the analog current output level according to the object distance.
		NS or FS Mode	Indicates the preset position for near or far limit.
	OUT	Goes on when the comparison output is on.	
	POWER	Goes on when power is on.	
ALARM	Goes on when incident light is excessive or insufficient.		
Response Time	FAST (fast response mode): 5 msec maximum SLOW (slow response mode): 50 msec maximum		
Detectable Object	Opaque objects		
Sensing Range	200 to 500mm (using 75mm sq. white mat paper)		
Comparison Output Setting	14-turn control for FAR/NEAR setting (Far and near limits can be set separately.)		
Hysteresis	10% maximum		
Repeat Error	FAST: 4% maximum, SLOW: 2% maximum		
Light Source Element	Infrared LED (modulation mode)		
Receiver Element	PSD (position sensitive device)		

# INSTRUCTIONS

- (1) Connect correctly with reference to the wiring diagram because miswiring may damage the internal circuits.
- (2) Use the analog distance sensor with power voltage ranging from 12 to 24V DC.
- (3) For extension of the cable, the analog output line can be extended up to 10m using a similar or better cable. The other lines can be extended up to 50m using a cable with core wires of 0.3mm<sup>2</sup> or more.
- (4) Parallel wiring with high-voltage or power lines in the same conduit or duct should be averted because induction noise may cause malfunction or damage.
- (5) When wiring is long, or the influence of power line and electro-magnetic equipment may occur, use a separate conduit for wiring.
- (6) For preventing the transient state when turning power ON, a circuit to turn output OFF (100 msec) is contained. Take care of the operation when turning power ON.
- (7) When using a switching power supply, be sure to ground the FG (frame ground) terminal.
- (8) Do not turn the knob or the selector excessively because overturn of the knob or selector as well as use of an unfit screwdriver causes damage to the sensor. (FS or NS knob has 14 rotations. Although more than 14 rotations can be obtained, the set range remains unchanged.)
- (9) If the settings of far and near limits are reversed, the OUT indicator does not go on. Make sure of correct settings.
- (10) When the optical sensing area on the front of the sensor has dust built-up, remove the dust with a soft cloth dipped in alcohol. Do not use organic solvents such as thinner.
- (11) Make sure that vibration and shock do not exceed the rated range.
- (12) When detected objects are specular, non-reflective, transparent or liquid, accurate sensing may be impossible.

EB-703

SA1E Series  
Photoelectric Switches  
(Amplifier Built-in Type)  
Operating Instructions



IDECIZUMI CORPORATION

www.idec.com

**SAFETY PRECAUTIONS**

End-users should read this sheet of operating instructions carefully to install, wire, operate, maintain and inspect the device correctly.

**NOTES FOR INSTALLATION**

- Do not install the sensor outdoors, nearby induction device, or heat source. Choose locations free from frequent vibrations, shocks, dust, toxic gases, water, oil, and chemicals, so as to prevent malfunctions and damage.
- Do not apply excessive impact on the sensor during the installation process, so as to prevent damage or deterioration in the device of protection.
- To install the sensor, tighten the mounting screws to a torque of 0.5N·m or less.
- Do not expose the sensor to sunlight or other direct light projections.

**NOTES FOR WIRING**

- Turn off the power supply before wiring.

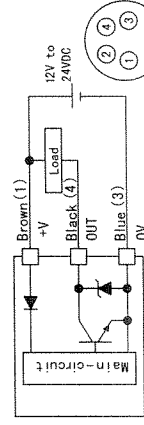
**SPECIFICATIONS**

Detection System	Through-beam		Polarized retro-reflective	Diffuse-reflective	Small beam-reflective
	Light ON	Dark ON			
NPN Output	SA1E-TN1	SA1E-TN2	SA1E-PN1	SA1E-DN1	SA1E-NN1
	SA1E-TN2	SA1E-TN1	SA1E-PN2	SA1E-DN2	SA1E-NN2
PNP Output	SA1E-TP1	SA1E-TP2	SA1E-PP1	SA1E-DP1	SA1E-NP1
	SA1E-TP2	SA1E-TP1	SA1E-PP2	SA1E-DP2	SA1E-NP2
Power Voltage	12 to 24VDC Ripple p-p 10% maximum (Operating Limit 10 to 30VDC)				
Current Consumption	Emitter : 15mA maximum Receiver : 20mA maximum 30mA maximum				
Detection Distance	10m	700mm (White paper 200×200mm)	50 to 150mm (White paper 100×100mm) Spot diameter approx. 10mm (Detection distance 100mm)		
Control Output	Open collector output (NPN / PNP output selectable) Load voltage : 30VDC maximum Load current : 100mA maximum Voltage drop : 1.2V maximum				
Protection Circuit	Reverse polarity protection Load short circuit protection Interference prevention				
Response Time	1 ms maximum				
Ambient Temperature	Operating : -25 to +55°C. Storage : -40 to 70°C (no freezing and condensation)				
Ambient Humidity	Operating : 35 to 85%RH. Storage : 35 to 85%RH (no freezing and condensation)				
Protection Degree	IP67 (IEC60529)				
Material	Housing : PC/PBT Lens : PC (PMMA ; Polarized retro-reflective type) Display : PC				
Accessories	Screwdriver				

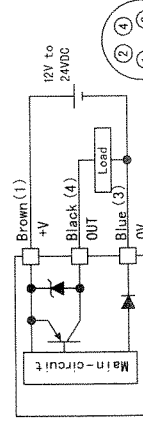
※ The connector Type sensor is suffixed with C after the Type No.

**CONNECTION EXAMPLE**

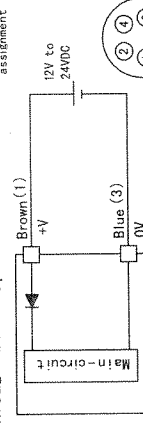
NPN Output Type



PNP Output Type



Through-beam Type (Emitter)

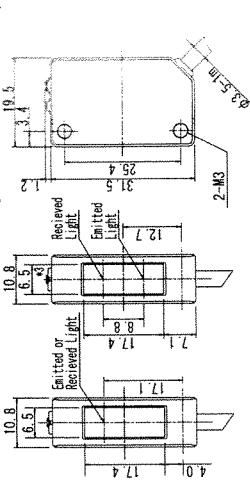
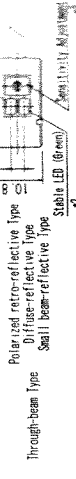


**OPERATION AT POWER ON**

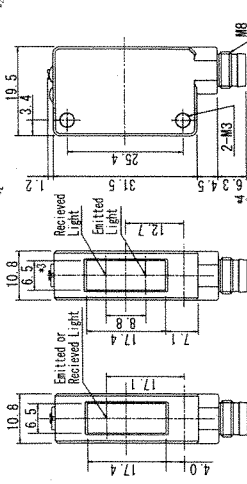
- Do not use the sensor during the transient time duration of 100 ms after turning on the power supply.
- If the sensor and the load are connected to different power supplies, the sensor must always be turned on first.

**DIMENSIONS (All dimensions in mm)**

**CABLE TYPE**



**CONNECTOR TYPE**



- #1 Power LED for the through-beam type emitter.
- #2 Not incorporated on the through-beam type emitter.
- #3 5.2 mm on the polarized retro-reflective type.
- #4 18 mm with the connector cable (SA92-OM8K-4L) connected.