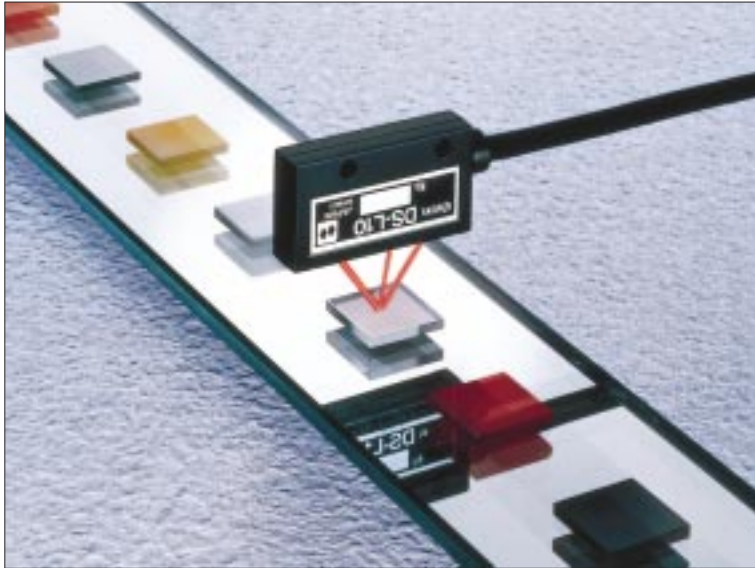


# DS SERIES

## Wafer Detection Sensor



Sensing Various Objects at Constant Distance Using 'Differential Distance Discrimination Method'

### Optimum for Wafer Detection

The sensor can reliably detect wafers irrespective of their glossiness or color.



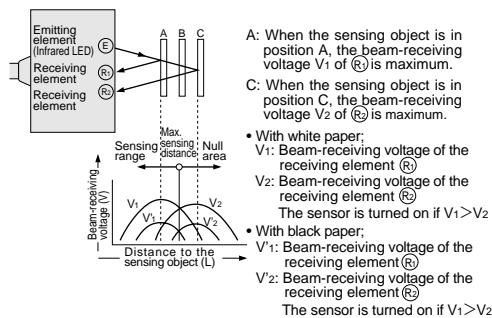
### High Performance

The repeatability is  $10\mu\text{m}$  or less. Moreover, it can detect a hair-like fine copper wire ( $\phi 50\mu\text{m}$ ).

### Reliable Fixed-focus Sensing

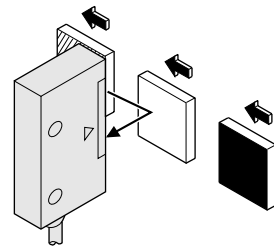
The differential distance discrimination method using two independent beam-receiving elements enables accurate fixed-focus sensing which can discriminate up to a difference of one sheet of paper.

#### Differential distance discrimination method:



### A Variety of Objects

Objects ranging from black to glossy, irrespective of their reflectivity, can be reliably detected at almost a constant distance due to the differential distance discrimination method.

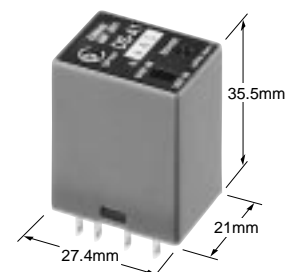


### Extremely Stable Sensing

Regardless of temperature drift or voltage fluctuation, the differential distance discrimination method ensures stable detection.

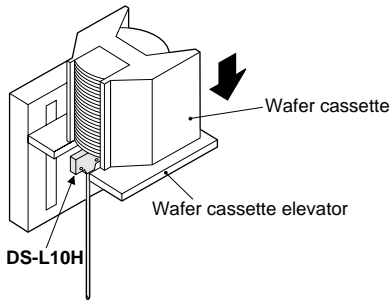
### Miniature Amplifier

The amplifier has dimensions similar to a miniature relay, which makes its handling simple. Further, it incorporates an easily visible operation indicator and a fine span adjuster.

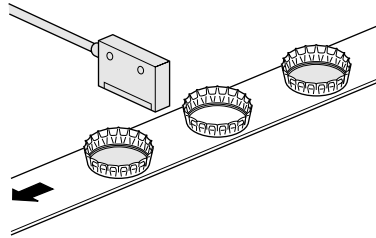


## APPLICATIONS

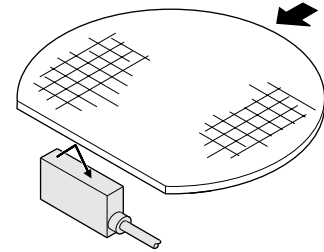
### Detecting wafers in cassette



### Detecting only inner pads on crowns



### Detecting passage of wafer



## ORDER GUIDE

### Sensor heads

Type	Appearance	Sensing range (Note)	Model No.
Side sensing		<p>Maximum sensing distance 10mm</p> <p>Optimum sensing range 2 to 8mm</p>	DS-L10
Top sensing		<p>Maximum sensing distance 30mm</p> <p>Optimum sensing range 5 to 24mm</p>	DS-L10H
		<p>Maximum sensing distance 30mm</p> <p>Optimum sensing range 5 to 24mm</p>	DS-L24H

Note: The sensing range gives the setting distance for presence detection. For sensing minute difference, use by setting at the maximum sensing distance.

### Amplifier

Type	Appearance	Model No.
Dedicated amplifier		DS-A1

## SPECIFICATIONS

## Sensor heads

Item	Model No.	Fixed-focus (for wafer sensing)		
		Side sensing	Top sensing	
		DS-L10	DS-L10H	DS-L24H
Applicable amplifier		DS-A1		
Sensing range (Note 1)		2 to 8mm (Note 2)		5 to 24mm (Note 2)
Max. sensing distance		10.0 ± 1.5mm (Note 2)		30 ± 4mm (Note 2)
Min. sensing object		φ0.05mm copper wire (Setting distance: 5mm with no background)		φ0.16mm copper wire (Setting distance: 14mm with no background)
Hysteresis		100 μm or less		1.36mm or less
Repeatability		Along sensing axis: 10 μm or less Perpendicular to sensing axis: 50 μm or less (setting distance: 5mm)		Along sensing axis: 10 μm or less Perpendicular to sensing axis: 50 μm or less (setting distance: 14mm)
Environmental resistance	Ambient temperature	0 to + 50°C (No dew condensation), Storage: - 20 to + 70°C		
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH		
	Ambient illuminance	Sunlight: 11,000 lx at the light-receiving face Incandescent light: 3,500 lx at the light-receiving face		Incandescent light: 70,000 lx at the light-receiving face
	Voltage withstandability	1,500V AC for one min. between all supply terminals connected together and enclosure		
	Insulation resistance	20MΩ, or more, with 500V DC megger between all supply terminals connected together and enclosure		
	Vibration resistance	10 to 55Hz frequency, 1.5mm amplitude in X, Y and Z directions for two hours each		
	Shock resistance	500m/s <sup>2</sup> acceleration (50G approx.) in X, Y and Z directions for three times each		
Emitting element		Infrared LED (modulated)		
Temperature characteristics		Over ambient temperature range 0 to + 50°C: within ± 1% of sensing range at 20°C		
Material		Enclosure: ABS		
Cable		0.08mm <sup>2</sup> composite 3-core shielded cable, 3m long		
Cable extension		Extension up to total 5m is possible with an equivalent cable.		
Weight		80g approx.		
Accessory		MS-DS-1 (Sensor head mounting bracket): 1 set		

Notes: 1) The sensing range gives the setting distance for presence detection. For sensing minute difference, use by setting at the maximum sensing distance.  
2) The sensing range and the maximum sensing distance are specified for white non-glossy paper (DS-L10 and DS-L10H: 20 × 20mm, DS-L24H: 50 × 50mm) as the object.

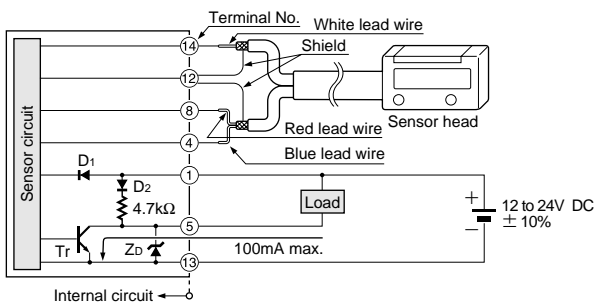
## SPECIFICATIONS

### Amplifier

Type	Dedicated amplifier	
Item	Model No.	DS-A1
Applicable sensor heads	DS-L10, DS-L10H, DS-L24H	
Supply voltage	12 to 24V DC $\pm 10\%$ Ripple P-P 10% or less	
Current consumption	40mA or less	
Output	NPN transistor universal	
	<ul style="list-style-type: none"> <li>• Maximum sink current: 100mA</li> <li>• Residual voltage: 1V or less (at 100mA sink current)</li> <li>0.4V or less (at 16mA sink current)</li> </ul>	
	Output operation	Switchable either Light-ON or Dark-ON with the operation mode switch
Short-circuit protection	Incorporated	
Response time	3ms or less	
Operation indicator	Red LED (lights up when the output is ON)	
Span adjuster	Continuously variable adjuster (enables fine adjustment of the maximum sensing distance)	
Environmental resistance	Ambient temperature	0 to +50°C (No dew condensation), Storage: -20 to +70°C
	Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH
	Noise immunity	Power line: 200Vp, 1 $\mu$ s pulse width; Radiation: 1,300Vp, 1 $\mu$ s pulse width (with noise simulator)
	Voltage withstandability	1,500V AC for one min. between all supply terminals connected together and enclosure
	Insulation resistance	20M $\Omega$ , or more, with 500V DC megger between all supply terminals connected together and enclosure
	Vibration resistance	10 to 55Hz frequency, 1.5mm amplitude in X, Y and Z directions for two hours each
	Shock resistance	100m/s <sup>2</sup> acceleration (10G approx.) in X, Y and Z directions for three times each
Material	Enclosure: Polycarbonate, Terminal base: PBT	
Weight	15g approx.	
Accessory	Adjusting screwdriver: 1 No.	

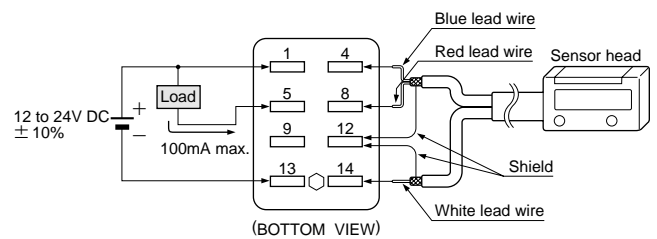
## I/O CIRCUIT AND WIRING DIAGRAMS

### I/O circuit diagram



Symbols ... D1: Reverse supply polarity protection diode  
 D2: Reverse current prevention diode  
 Zd: Surge absorption zener diode  
 Tr: NPN output transistor

### Wiring diagram



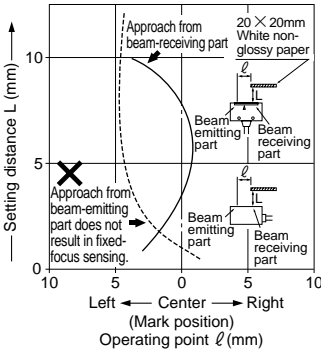
# DS

## SENSING CHARACTERISTICS (TYPICAL)

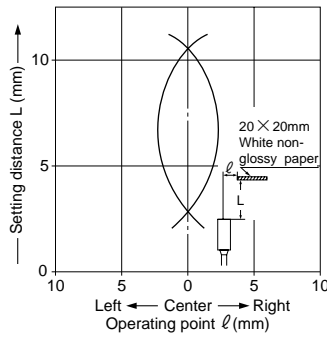
### DS-L10 DS-L10H

#### Sensing fields

##### • Vertical direction



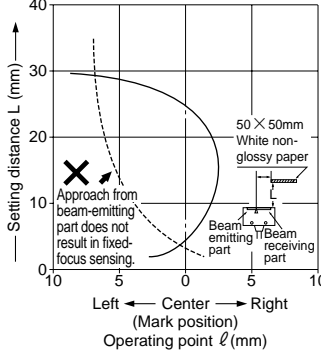
##### • Horizontal direction



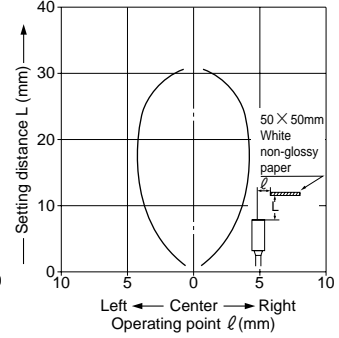
### DS-L24H

#### Sensing fields

##### • Vertical direction



##### • Horizontal direction



## PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.



This product is not a safety sensor. Its use is not intended or designed to protect life and prevent body injury or property damage from dangerous parts of machinery. It is a normal object detection sensor.

### Wiring

• Use a commercially available miniature relay terminal socket to connect **DS-A1**.

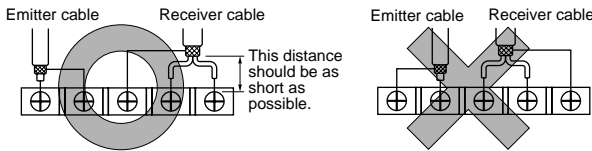
※Applicable terminal socket:

AP3822K (manufactured by Matsushita Electric Works), etc.

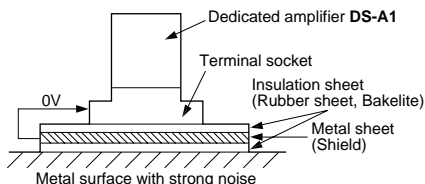
• If the attached sensor head cable needs to be extended, use appropriate shielded cables and limit the extension to 5m overall.

( Emitter cable: shielded cable with one conductor  
Receiver cable: shielded cable with two conductors )

Extension with one shielded cable containing both the emitter cable and the receiver cable is prohibited. If a joint terminal is used for extension, separate the conductors of the emitter cable and the receiver cable as far as possible as shown below.

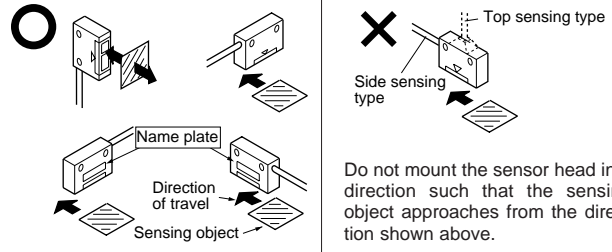


• In case the sensor is used in a noisy place, take care of the surrounding noise. Do not run the sensor head cable along any high voltage or power cable or put them in the same raceway. In fact, separate them as far as possible. Further, if the **DS-A1** amplifier is to be mounted on a metal surface, devise a shield as shown in the figure below and connect it to 0V.



### Setting of sensor head

• Take care of the mounting direction of the sensor head with respect to the direction of travel of the sensing object.



Note: Take care of the positions of the  $\triangle$  and the name plate on the sensor head to recognize the orientation.

• The tightening torque of the sensor head should be 0.29N·m or less.

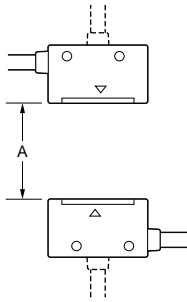


## PRECAUTIONS FOR PROPER USE

Refer to P.820~ for general precautions.

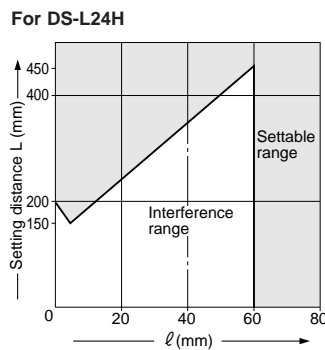
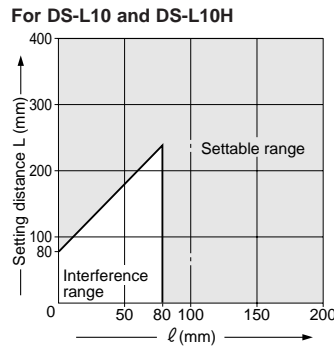
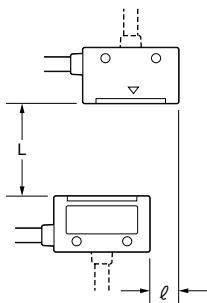
- When mounting two sensor heads face to face, the minimum separation distance should be as shown below to avoid mutual interference.

### Non-twisted facing



	DS-L10 DS-L10H	DS-L24H
A	30mm or more	120mm or more

### Twisted facing

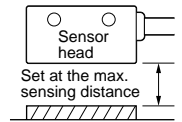


### Setting of sensing distance

- Allow an adjustable range of 5 to 12mm (**DS-L24H**: 10 to 35mm) from the sensor head to the sensing object when mounting the sensor head.  
 ※The attached mounting bracket has an adjustment range of 7mm.
- If the distance between the sensing object and the background is 7mm or more (**DS-L24H**: 25mm or more), set the sensing distance between the sensor head and the sensing object to 7mm approx. (**DS-L24H**: 25mm approx.) (span adjuster at maximum).
- To detect a small or a dark object, the optimum distance between the sensor head and the sensing object is 5mm approx. (**DS-L24H**: 14mm approx.).  
 (Optimum sensitivity setting distance: 5mm for **DS-L10H**  
 14mm for **DS-L24H**)
- If the distance between the sensing object and the background is 7mm or less (**DS-L24H**: 25mm or less), set at the maximum sensing distance for the object.

### Procedure for setting maximum sensing distance

- Set the span adjuster at the maximum position.
- Place the sensing object at the sensing position.  
 Bring the sensor head near the sensing object gradually, and while seeing the amplifier's operation indicator, find out the position where the sensor enters the Light state. Fix the sensor head at this place. (Move the sensor head carefully.)
- Check the sensor operation, ON with a sensing object and OFF without it. (If the operation is not stable, perform the step ② again.)
- If the above steps do not provide stable operation, follow the procedure given below using the span adjuster.



### Reference chart

Approx. relation between the sensing object and the maximum sensing distance

Sensing object	DS-L10 DS-L10H	DS-L24H
White non-glossy paper	10.0 ± 1.5mm	30 ± 4mm
Black non-glossy paper (Lightness: 2)	9.5 ± 1.5mm	29 ± 3mm
Aluminum-coated mirror	10.5 ± 1.5mm	30 ± 4mm
Silicon wafer	7 to 11mm	26 to 36mm

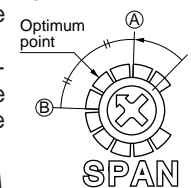
Note: The values in the above table are for reference only and may differ according to the condition of the sensing object.

### Adjustment with span adjuster

The span adjuster enables fine adjustment of the maximum sensing distance.  
 (However, it may be ineffective if the sensing object surface is specular.)

### Adjustment

- Without the sensing object, gradually turn the span adjuster counterclockwise from the maximum point to the point (A) at which the sensor enters into the Dark state.  
 (If the sensor does not enter into the Dark state, move the background away from the sensing area, or make it non-glossy black.)
- Place the sensing object at the sensing position, and check that the sensor enters into the Light state.
- Turn the adjuster gradually counterclockwise to the point (B) at which the sensor enters into the Dark state again.  
 (If the sensor does not enter into the Dark state even if fully turned, the minimum point is the point (B).)



- Set the adjuster at the center position between the points (A) and (B), which is the optimum position.

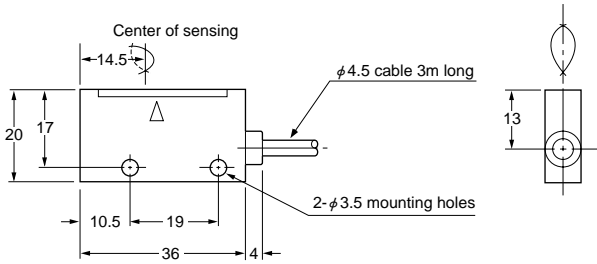
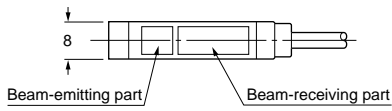
### Others

- Do not use during the initial transient time (50ms) after the power supply is switched on.

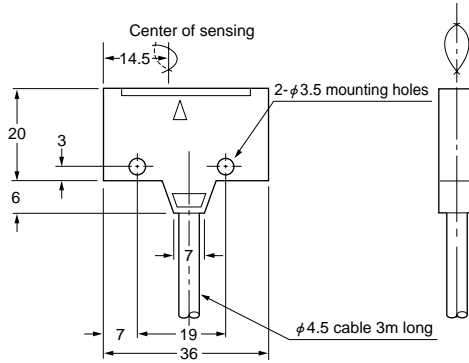
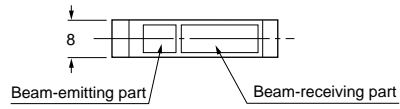
# DS

## DIMENSIONS (Unit: mm)

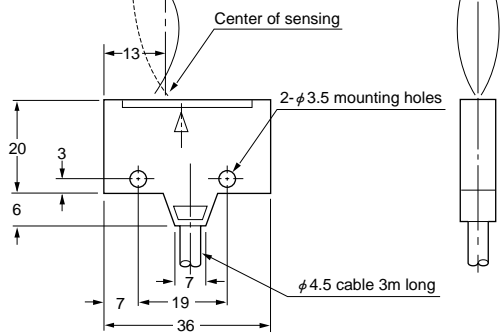
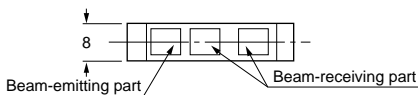
**DS-L10** Sensor head



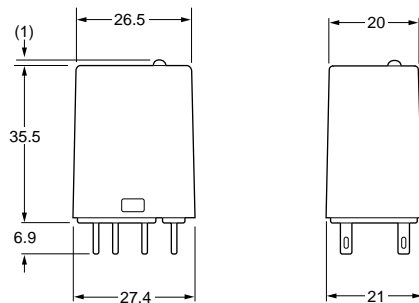
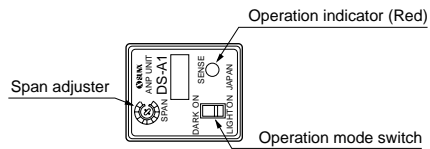
**DS-L10H** Sensor head



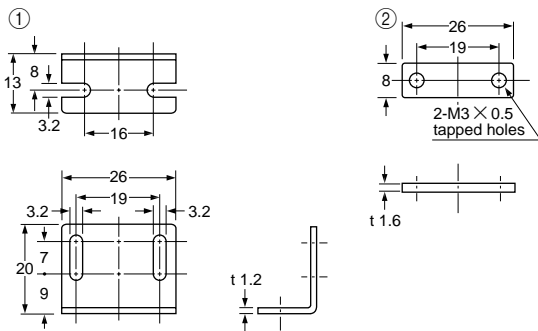
**DS-L24H** Sensor head



**DS-A1** Amplifier



**MS-DS-1** Sensor head mounting bracket (Accessory)



Material: Cold rolled carbon steel (SPCC)  
Two M3 (length 14mm) screws with washers are attached.

**Assembly dimensions**  
Mounting drawing with **DS-L24H**

