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GP2D02/05 Application Note

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GP2D02/ 05 Application Note

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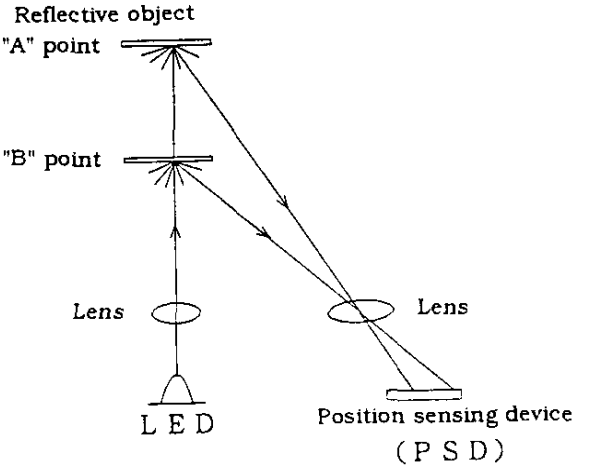
1. General Description

This GP2D02/05 application note has been completed by preparing several characteristic data for customers' convenient reference when the GP2D02/05 are used.
Please utilize this application note for customers' design. This application note should be for reference, however please make sure them in actual mounted condition before using.

2. Measuring principal and features of this sensor

2-1. Principal of triangulation

Optical spot position on PSD shall be changed when reflective object is at "A" point and at "B" point. By processing this optical spot position electrically, the position (distance) of the reflective object on straight line can be detected.



2-2. Features of the GP2D02/05

① Compact high performance distance measuring sensor with built-in PDS, Infrared LED and signal processing circuit

② Little influence by color and reflective ratio of the reflective object

③ High accuracy measuring by sequential position detection and mean processing data output

④ GP2D02 : 8 bit serial measured output which is possible to connect directly with micro computer

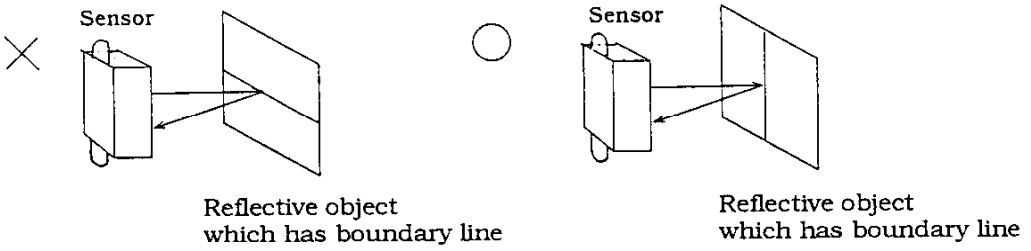
⑤ GP2D05 : 1 bit (High/Low) measured output
The measuring range can be adjustable as threshold level at any distance by adjusting the built-in volume

⑥ Low current consumption at stand-by mode (Current consumption at stand-by mode : TYP 3 μA)

3. Attended issues in use

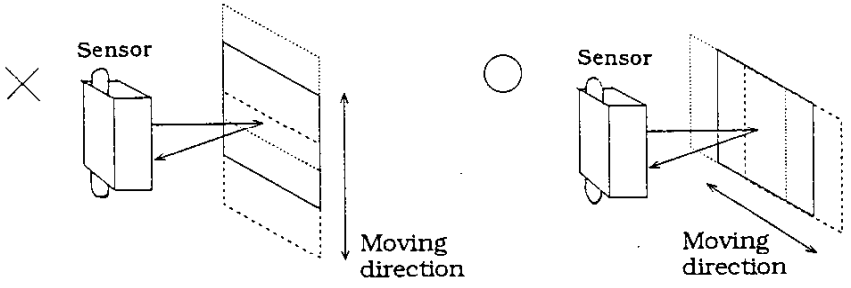
3-1. Direction of the reflective object

In case that reflective object has boundary line which material or color etc. are excessively different, in order to decrease deviation of measuring distance, it shall be recommended to set the sensor that the direction of boundary line and the line between emitter center and detector center are in parallel.

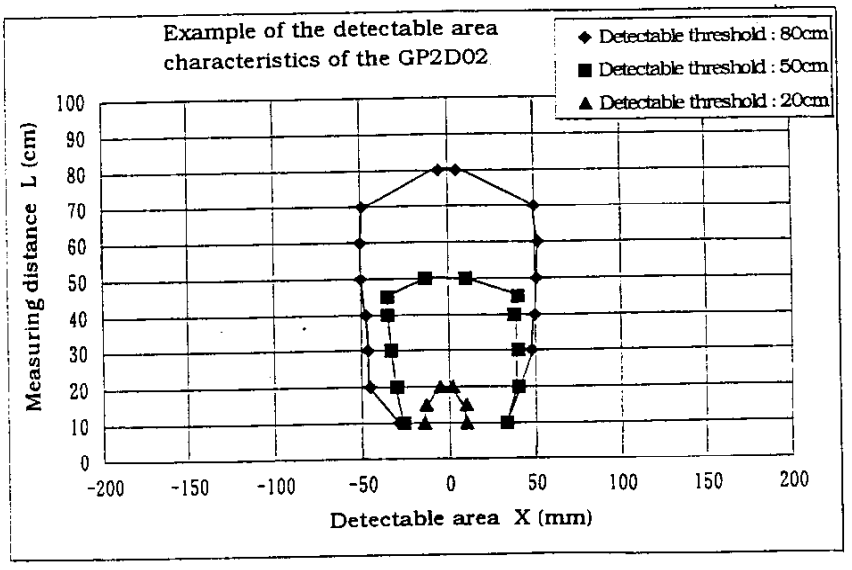


3-2. Moving direction of moving reflective object

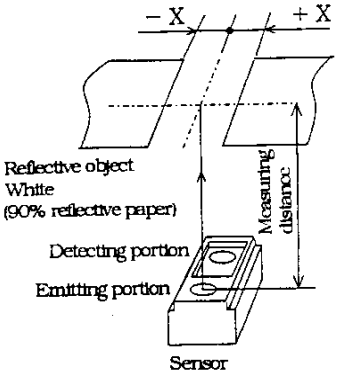
In order to decrease deviation of measuring distance by moving direction of the reflective object, it shall be recommended to set the sensor that the moving direction of the object and the line between emitter center and detector center are vertical.



Detectable area vs. moving object example of characteristics are the following;



Measuring method

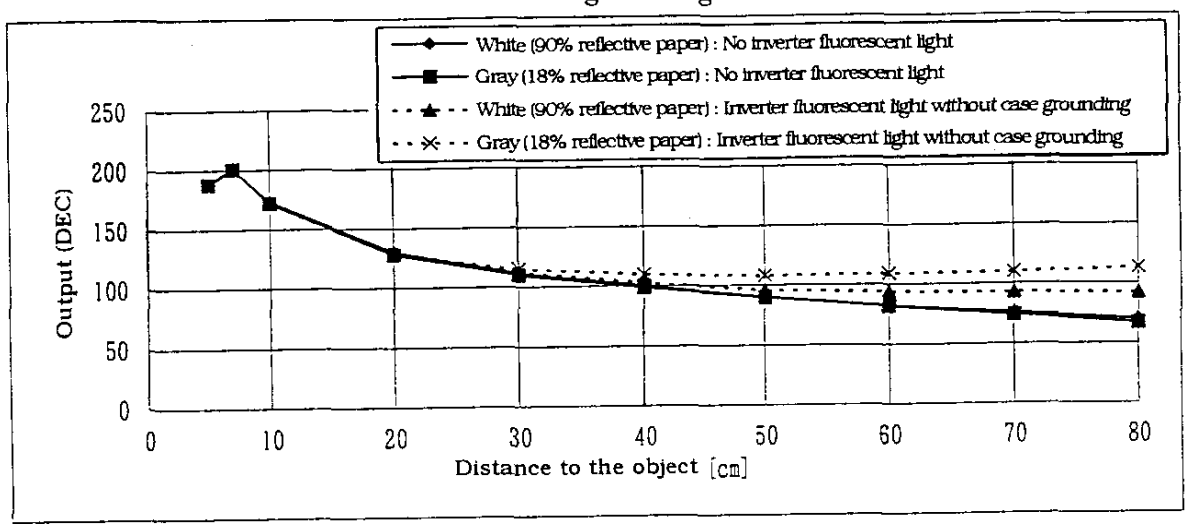


3-3. Noise resistance characteristics

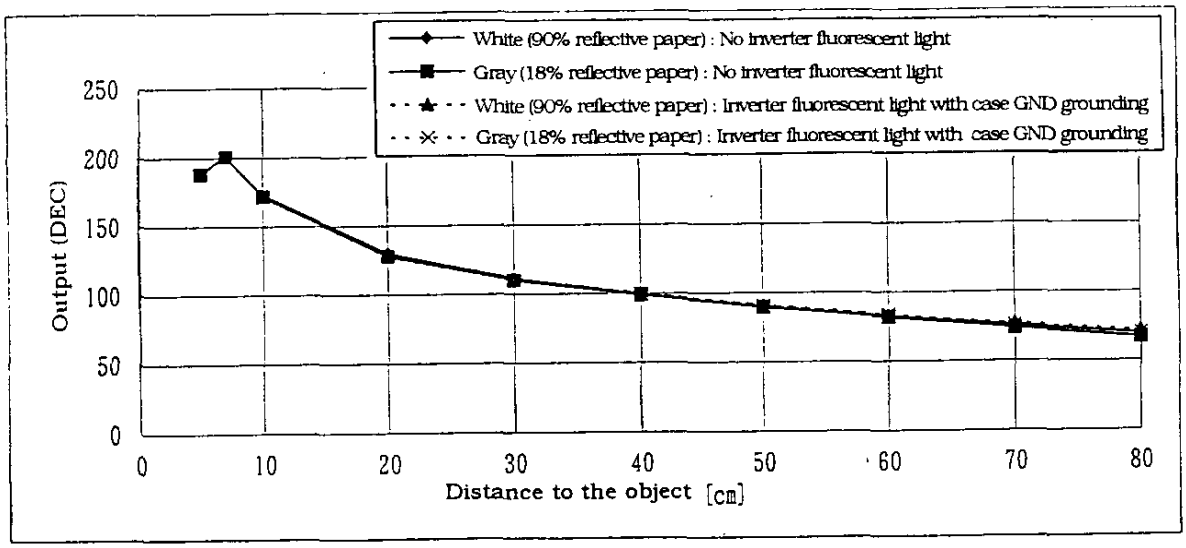
Conductive resin is used as the case material. In order to avoid an influence of output signal by external disturbing noise, it shall be recommended that this case is grounded for use.

Noise resistance characteristics of the GP2D02 without/with grounding are the following;

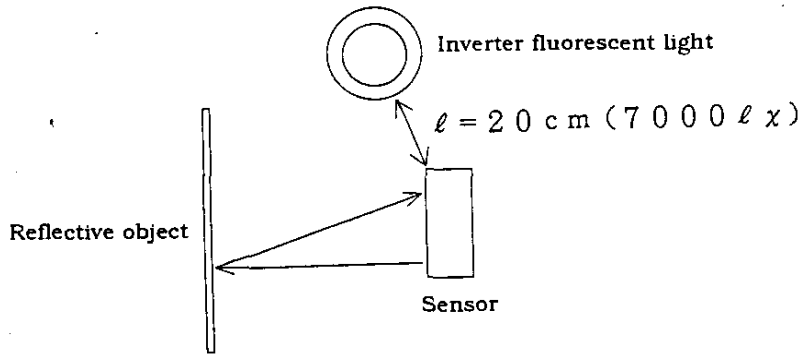
Without case grounding



With case grounding



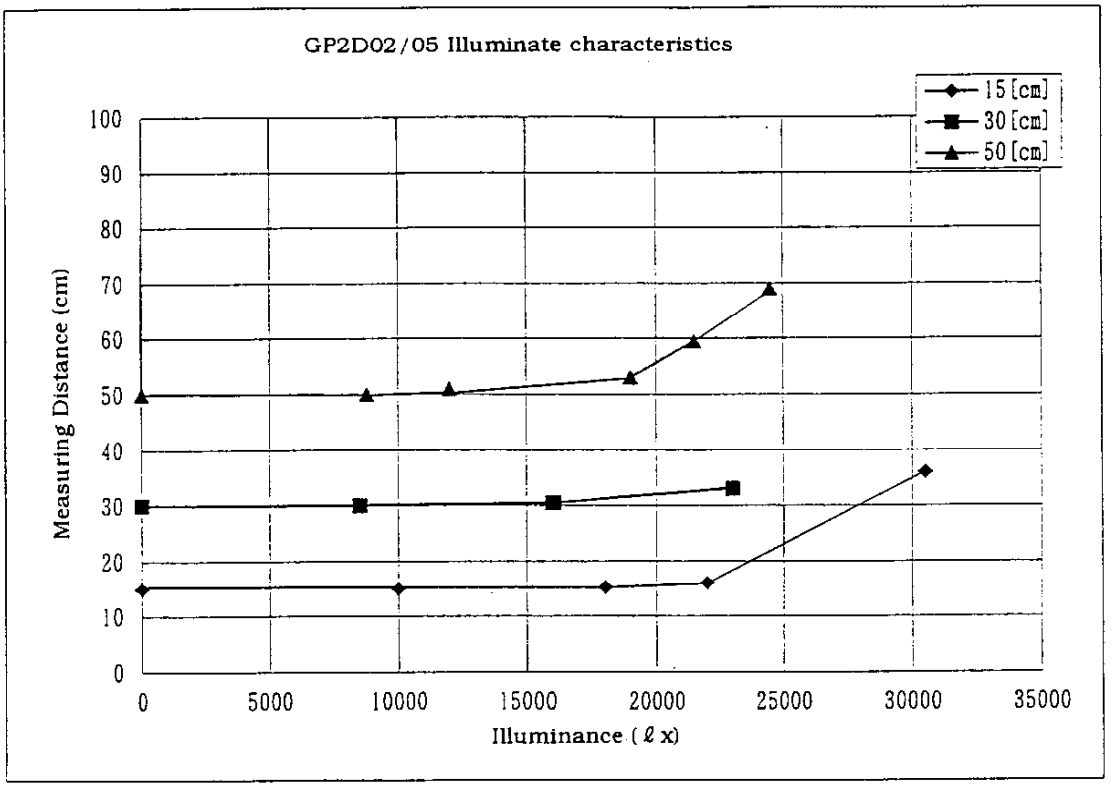
(Measuring method for noise resistance characteristics)



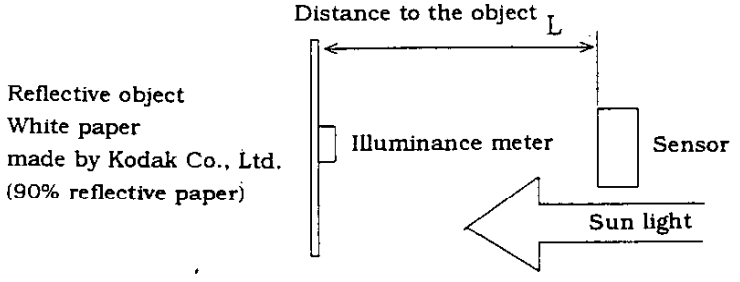
3-4. External disturbing light resistance characteristics

If the direct light from light source such as the sun, tungsten lamp etc. comes into the detector surface, there are cases that it can not measure exactly. Please consider the design that the direct light from such light source does not come into the detector surface.

External disturbing light resistance characteristics of the GP2D02/05 are the following;



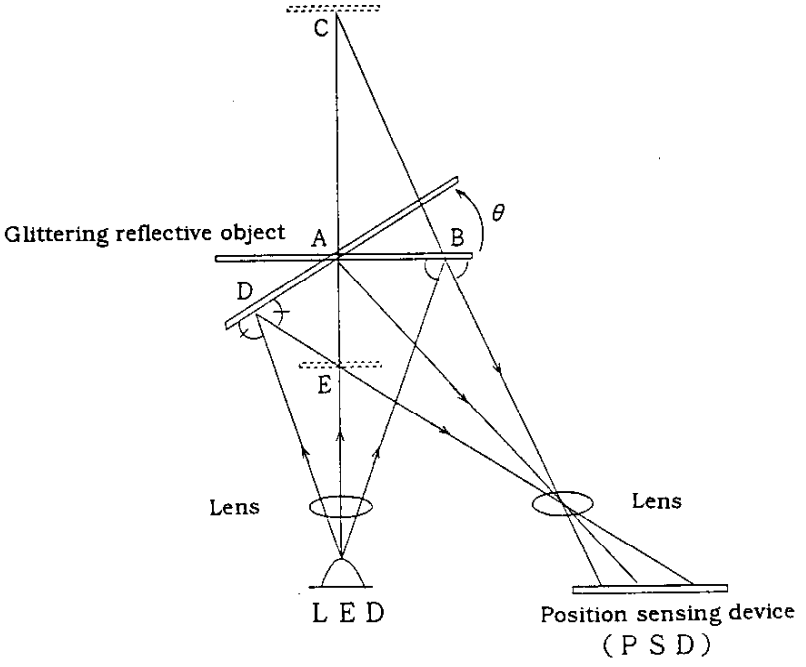
(Example of external disturbing light resistance characteristics measuring method)



3-5. Output at glittering reflective object

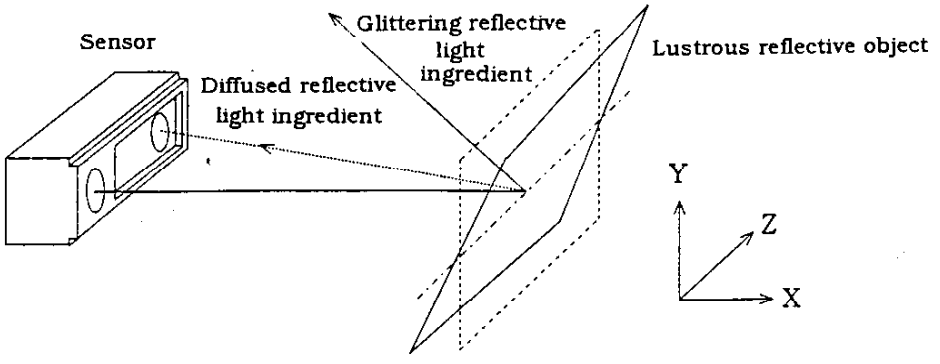
3-5-1. In case of glittering reflective object with no diffused reflective light ingredient (Mirror, Glass etc.)

LED light beam has an expanse. (Half intensity angle for LED in GP2D02/05 : $\Delta\theta = 1.5^{\circ}$). Therefore, in case that there is glittering reflective object at "A" point in the following drawing, the glittering reflected light comes into the detecting device from "B" point and it shall be the same output when there is the diffused lustrous reflective object at "C" point, so that accurate measuring is not possible.



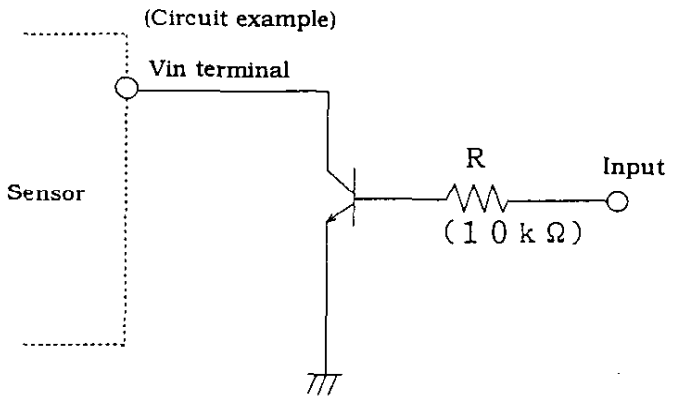
3-5-2. In case of lustrous reflective object with diffused reflective light ingredient (painted metal, Colored vinyl etc.)

In case that lustrous reflective object with diffused reflective light ingredient shall be measured, accurate measuring for the distance between the sensor and the object is possible by tilting the lustrous reflective object like the following drawing since the glittering reflective light ingredient runs away to "Y" direction and the diffused reflective light ingredient comes into the detecting device (PSD).



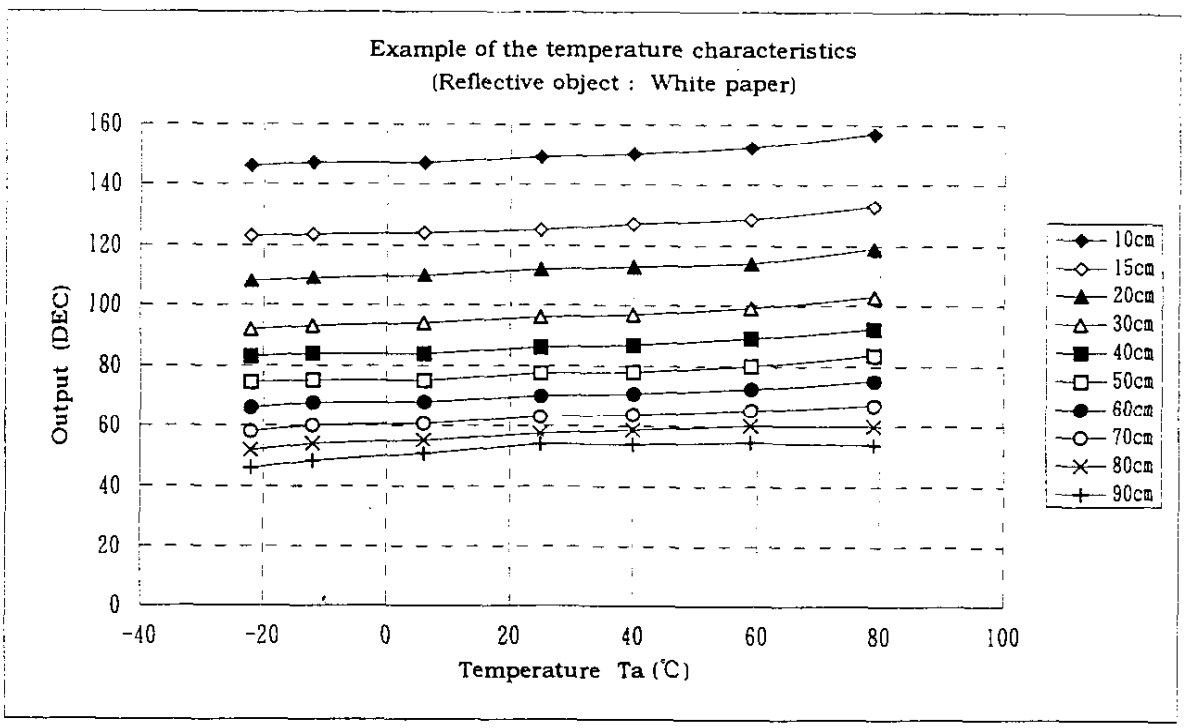
3-6. Input signal

Input should be current driving input in order to improve the measuring accuracy.



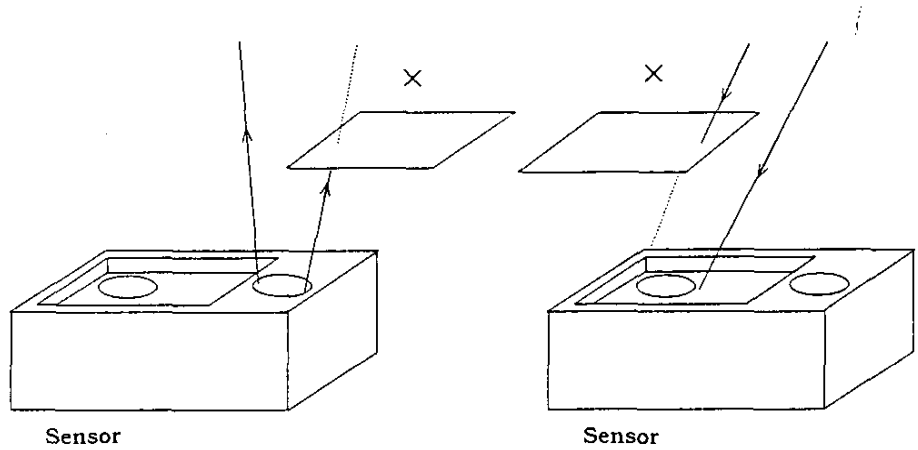
3-7. Ambient temperature

Example of ambient temperature characteristics of the GP2D02/05 are the following;

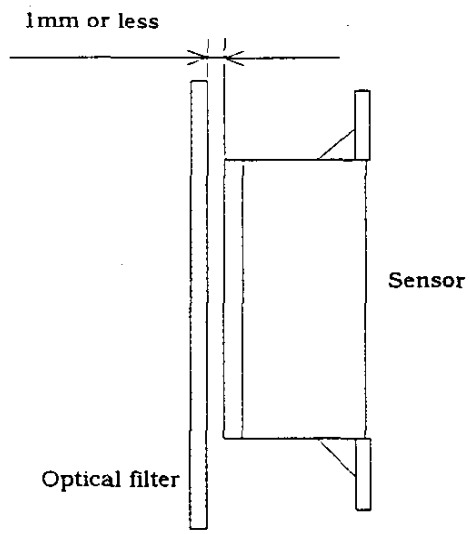


3-8. Optical conditions in front of the sensor

① Please consider that there is no object which interrupt the LED beam from sensor or no object which interrupt the reflective light from the reflective object to the detector portion.



② In case that an optical filter is set in front of the sensor, the filter must have high transmittance with emitted spectrum wavelength of LED (λ =850nm±70nm) which is used in the sensor, should be used. Also, the clearance between the sensor and the optical filter should be set at 1mm or less.



When an optical filter is used, please use it after confirming the operation in actual application.

4. Concrete application example of the GP2D02/05

4.1 Concrete application example of the GP2D02

- Output conversion

The relation between the output of the GP2D02 : "D" and the distance to the reflective object : "L" can be shown in the following;

$$D=b/(L1+a)+C \qquad (*1)$$

However, actual deviation shall deviate mainly shifting the following output curve (Distance characteristics) toward up and down direction.
This is caused by the positioning tolerance between the detecting device (PSD) and the front lens in assembly.

This deviation will be appeared as "C" in (*1). Since "a" and "b" can be assumed as almost constant value, actual relation between "D" and "L" shall be shown in the following;

$$D=1560/(L1+0.5)+C \qquad (*2)$$

- Output conversion method

① As shown in (*2), the output of the GP2D02 : "D" is in proportion to 1/(L1+0.5) (at L1=10 to 80cm). The relation graph between output "D" of the sample which has output characteristics shown in Fig.1 and 1/(L1+0.5) is shown in Fig.2.

② By getting "C" for each sample using (*2), the distance to the reflective object : "L1" can be calculated by output value "D".

(Example) Sample shown in Fig.1 : at L1=60cm D=80 (DEC)
Using (*2) 80=1560/(60+0.5)+C Therefore, C=54.2

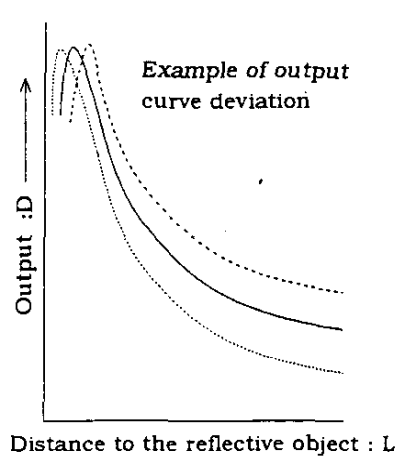
So the relation between "D" and "L" of that sample shall be shown in the following;

$$D=1560/(L1+0.5)+54.2$$

Then, the sample output at D=202 (DEC) is

$$202=1560/(L1+0.5)+54.2 \quad \text{Therefore, } L1=10.1\text{cm}$$

As mentioned above, for example, by measuring the output at L1=60cm before, "C" for each sample can be got, then the distance to the reflective object : "L1" can be detected by sensor output "D".



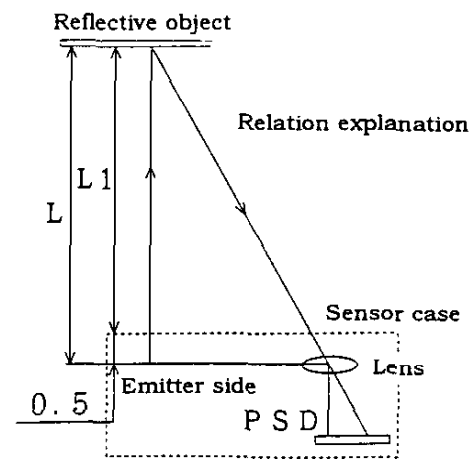


Fig.1

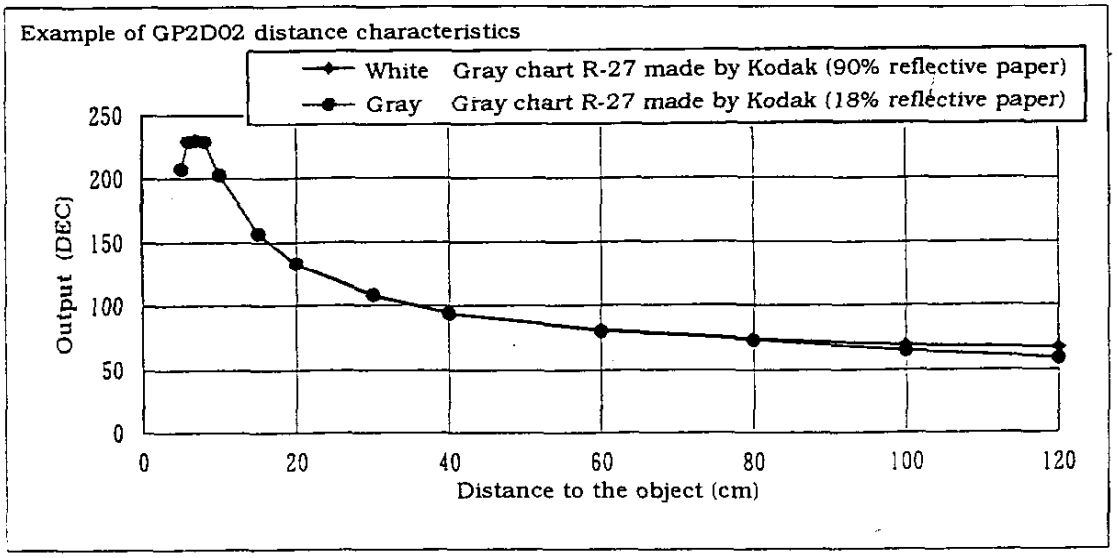
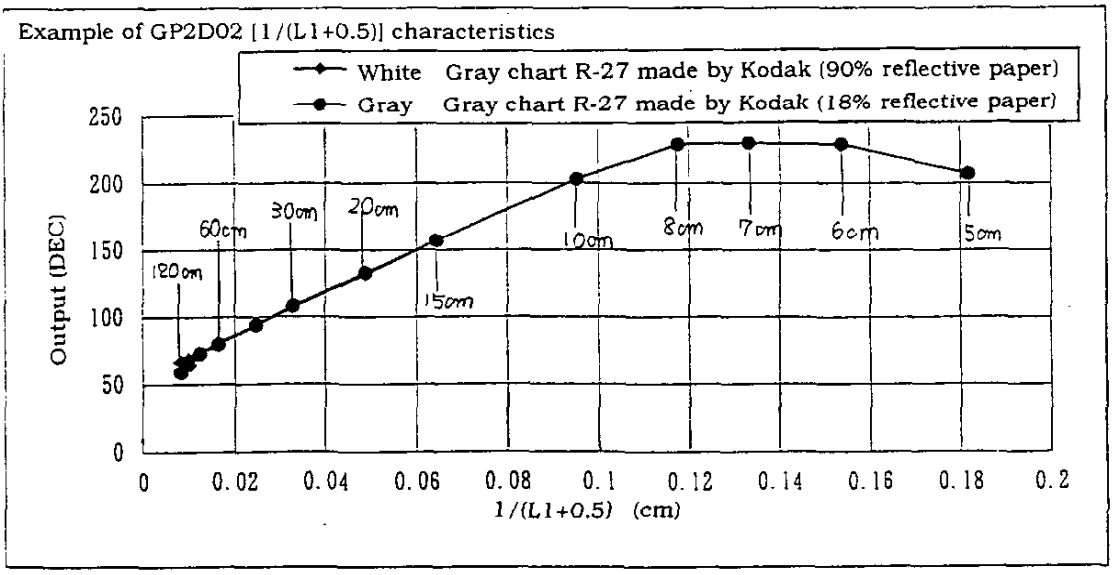
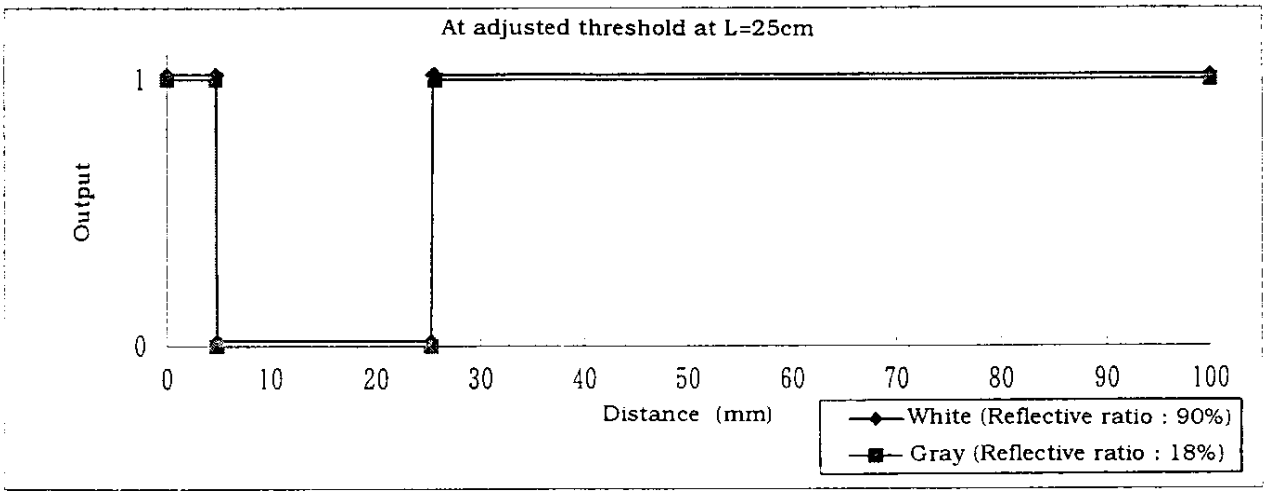

Example of GP2D02 distance characteristics
White Gray chart R-27 made by Kodak (90% reflective paper)
Gray Gray chart R-27 made by Kodak (18% reflective paper)
Output (DEC)
250
200
150
100
50
0
0
20
40
60
80
100
120
Distance to the object (cm)

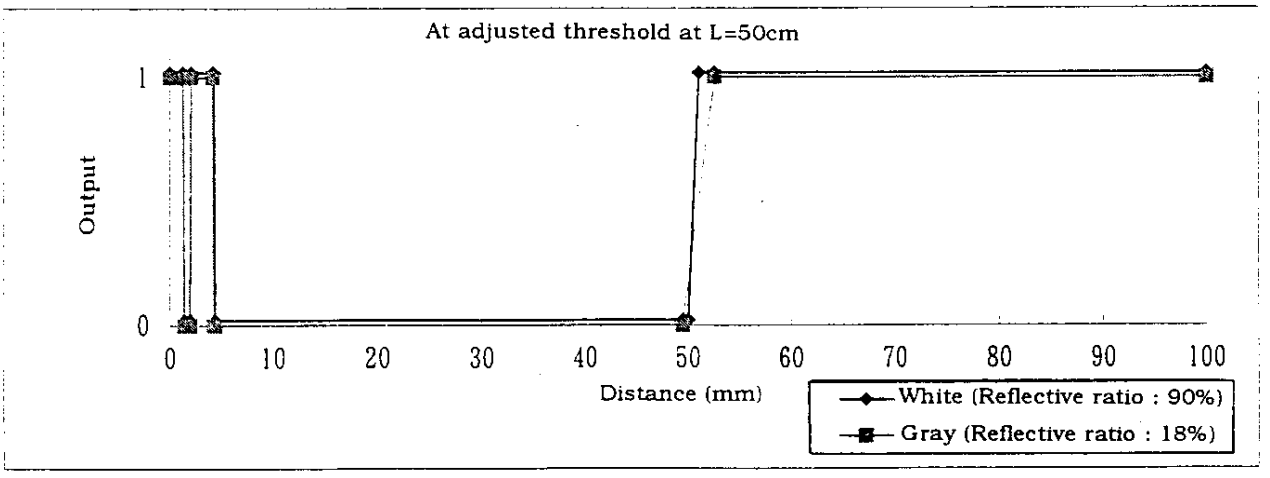
Fig.2

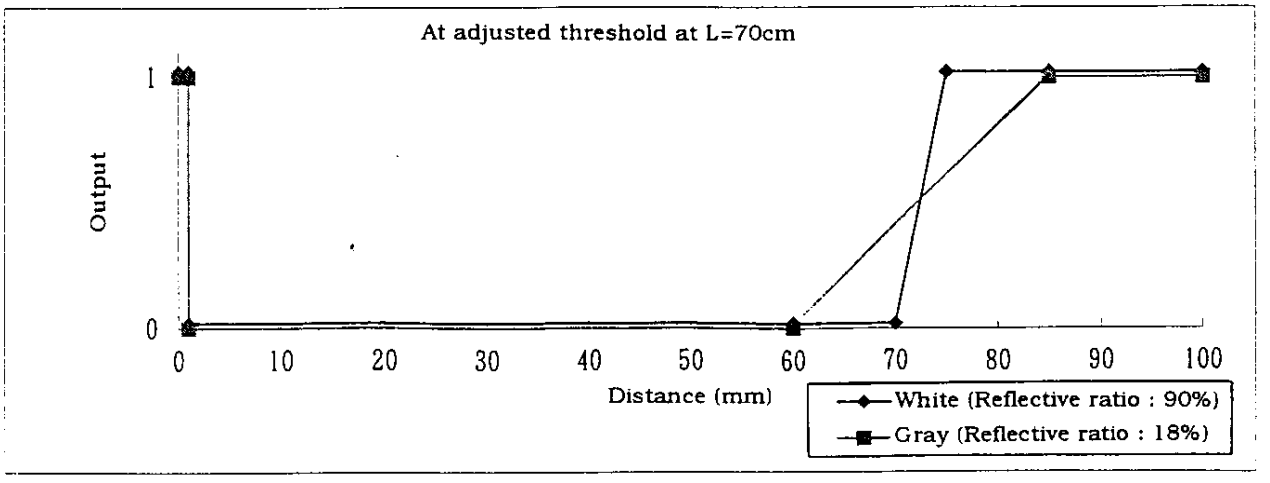

Example of GP2D02 [1/(L1+0.5)] characteristics
White Gray chart R-27 made by Kodak (90% reflective paper)
Gray Gray chart R-27 made by Kodak (18% reflective paper)
Output (DEC)
250
200
150
100
50
0
120cm
60cm
30cm
20cm
15cm
10cm
8cm
7cm
6cm
5cm
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
1/(L1+0.5) (cm)

4-2. Concrete application example of the GP2D05

- Since the GP2D05 is not adjusted the detecting threshold distance at shipping from Sharp, please adjust the built-in volume to get the detecting threshold distance by customer.
- If the detecting threshold distance shall be adjusted at around L=80cm, there are cases that the detecting accuracy is deteriorated remarkably. Then consult Sharp.







5. Supplement

Modification of the measuring range
The following expression shall be realized by geometrical relation among the distance to the reflective object : "L", Base line length : "A", Focal distance of the lens : "f" and Optical spot position on PSD : "X".

$X=(A\times f)/L$

For example, when possible measuring range would like to be changed without any change of PSD detector size, it can be realized by changing the base line length : "A" or the focal distance of the lens : "f". Current distance measuring sensors GP2SD02/05 have the measuring range : 10 to 80cnm. Modified measuring range type which is confirmed the operation by test samples by Sharp shall be the following;

- 4 to 30cm
- 50 to 400cm