Background Suppression Photoelectric Switch

EXERCISE OBJECTIVE

- Introduce the Background Suppression Photoelectric Switch;
- Become familiar with its operation using the Reflective Block.

DISCUSSION

Background suppression sensors are designed for short range applications where the background behind the target is very close and very reflective. Background suppression sensing is one of the many types of the diffuse sensing mode.

Instead of attempting to ignore the background behind the target, background suppression sensors actively use sophisticated electronics to detect the presence of both the target and the background.

Background suppression sensors contain two active photoelectric sensing elements calibrated to detect objects in front and behind the nominal sensing distance. As Figure 8 shows, sensing element 1 detects reflections from behind the nominal sensing distance, and sensing element 2 detects reflections in front of the nominal sensing distance.

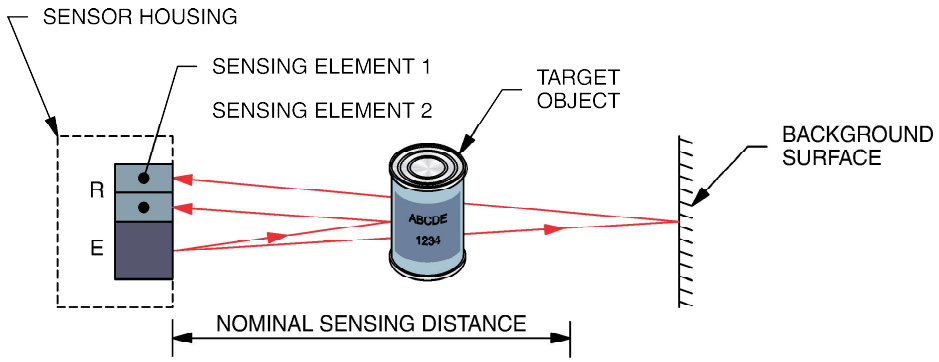

Figure 8. Background suppression sensing.

By comparing the two signals, the sensor can ignore the presence of a very reflective background almost directly behind a dark, less-reflective target. The sensor output will change state on active detection of the target, or on active detection of the background.

For reliable background suppression, a minimum separation distance of 10% of the maximum sensing distance is recommended between the target object and the background.

Due to the detection method, only targets traveling horizontally to the sensor are detected, that is from left to right or front to back, as shown in Figure 9. Targets traveling vertically may not be accurately detected.

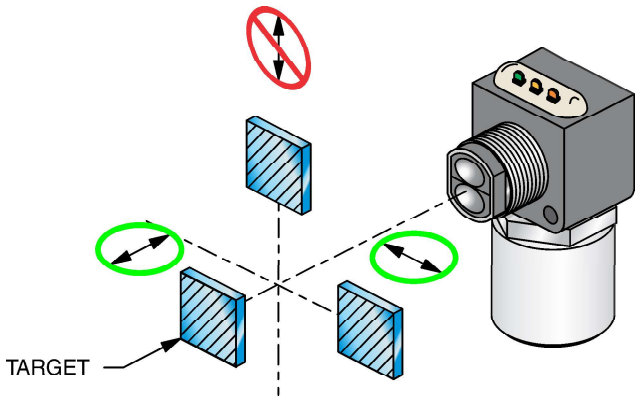

Figure 9. Detection method.

The Background Suppression Photoelectric Switch of your training system is shown in Figure 10. The sensor has a power indicator (green LED), an output indicator (yellow LED) that lights when the output is activated, and a stability indicator (orange LED) that lights when the excess gain exceeds 2.5. There is no sensitivity adjustment on this sensor. Other characteristics of the Background Suppression Photoelectric Switch are shown in Table 2.

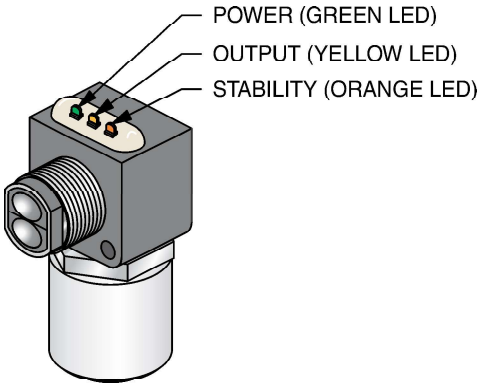

Figure 10. Background Suppression Photoelectric Switch.

Table 2. Characteristics of the Background Suppression Photoelectric Switch.

Background suppression photoelectric switch	
Type	Background suppression
Transistor output type	Sourcing (PNP)
Sensing distance	100 mm (3.9 in)
Light source Type Wavelength	Infrared 880 nm (34.6 micro-inch)
Response time (sensor only)	1.0 ms
Light beam detection modes	Light operate/Dark operate (1)

(1) The sensor has light operate and dark operate outputs. The output relay coil is connected to the light operate output. The dark operate output is not used.

PROCEDURE OUTLINE

The Procedure is divided into the following sections:

- Set up and connections
- Equipment required
- Setup
- Characteristics

PROCEDURE

Set up and connections

In the first part of the exercise, you will set up the circuit and position the Background Suppression Photoelectric Switch.

In the second part, you will observe the ability of the Background Suppression Photoelectric Switch to detect the presence of various objects over the surfaces of the Reflective Block.

Equipment required

Refer to the Equipment Utilization Chart in Appendix A to obtain the list of equipment required to perform this exercise.

Setup

1. Set up the circuit shown in Figure 11.

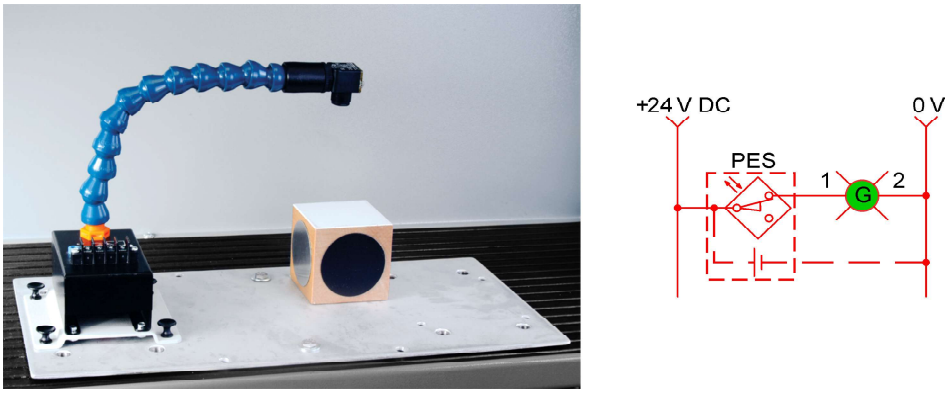

Figure 11. Circuit using the Background Suppression Photoelectric Switch.

2. Perform the Energizing procedure.

   Position the Reflective Block so the white plastic surface is parallel to the sensor sensing face at a distance of 100 mm (4 in). Raise the sensor slowly until the stability and output indicators turn off. Both indicators should be turned off without a target.

   In this part of the exercise, the Reflective Block surfaces are used as background surfaces.

Characteristics

3. Test the ability of the Background Suppression Photoelectric Switch to detect some objects moving over each surface of the Reflective Block at a distance of 12 mm (0.5 in). To do so, pass a finger over each surface and note in Table 3 if the sensor detects the presence of your finger.

Table 3. Surface detected by the Background Supression Photoelectric Switch.

Surface	Detected	Not detected
Black plastic surface		
White plastic surface		
Matte black metallic surface		
Shiny metallic surface (1)		
Depolarizing retroreflective surface		

(1) Depending on the angle that the light beam hits the shiny metallic surface, the sensor may detect its presence although the maximum sensing distance of the sensor is exceeded. If this is the case, modify the angle of the sensor slowly until it becomes deactivated.

4. Repeat your observations with other objects whose reflectivity differs (matte, shiny, bright, dark). What can you conclude from your observations?

5. Compare the operation of the power indicator (green LED) to that of the output indicator (yellow LED). Note your observations.

6. Turn the individual power switch of the AC Power Supply off, disconnect the circuit, and return the equipment to the storage location.

CONCLUSION

In this exercise, you were introduced to the Background Suppression Photoelectric Switch.

You experimented on how it detects the presence of various objects moving over the surfaces of the Reflective Block.

REVIEW QUESTIONS

1. What are background suppression photoelectric switches designed for?

2. How do the background suppression photoelectric switches ignore the background behind the target?

3. Name two advantages of background suppression photoelectric switches.

4. Explain how background suppression photoelectric switches can detect objects in front and behind the nominal sensing distance of the switch.

5. At which distance should the target be distanced from the background to obtain a reliable operation?