**Department of Electrical Engineering**

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| **Faculty Member:\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Dated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **Semester:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Section: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

**EE-383**-**Instrumentation and Measurements**

**Experiment # 6**

**Background Suppression Photoelectric Switches**

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|  |  | **PLO4/**  **CLO3** | | **PLO4/ CLO4** | **PLO8/ CLO5** | **PLO9/ CLO6** |
| **Name** | **Reg. No** | **Viva / Quiz / Lab Performance** | **Analysis of data in Lab Report** | **Modern Tool Usage** | **Ethics and Safety** | **Individual and Teamwork** |
|  |  | **5 Marks** | **5 Marks** | **5 Marks** | **5 Marks** | **5 Marks** |
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**Lab no. 6**

**Background Suppression Photoelectric Switch**

# OBJECTIVE

In this lab, you will be introduced to background suppression photoelectric switches;

• You will learn how and when they are used;

• You will also learn their advantages and disadvantages;

• You will experiment with their operation using the Reflective Block.

# Introduction

# Background suppression sensors are designed for short range applications [less than 100 mm (4 in)] 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 use sophisticated electronics actively 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 3-1 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.

# Diagram Description automatically generated

# 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% 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 3-2. Target traveling vertically may not be accurately detected.

# Diagram Description automatically generated

# The Background Suppression Photoelectric Switch of your training system is shown in Figure 3-3.

# As Figure 3-3 shows, 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 3-1

# Diagram, engineering drawing Description automatically generated

# Table Description automatically generated

## Procedure Summary

## In the first part of the exercise, Setup, you will set up the circuit and position the

## Background Suppression Photoelectric Switch.

## In the second part of the exercise, Characteristics, you will observe the ability of the

## Background Suppression Photoelectric Switch to detect the presence of various

## objects moving over the surfaces of the Reflective Block

# EQUIPMENT REQUIRED

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

# PROCEDURE

## Setup

1. Connect the circuit shown in Figure 3-4 and turn on the DC Power Supply.

Diagram

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Diagram

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***Fig.3-4 Circuit using background suppression Photoelectric Switch***

1. 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 slowly the sensor until the stability and output indicators turn off. Both indicators should be turned off without a target.

*Note: 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 distance of 12 mm (0.5 in). To do so, pass a finger over each surface and note in Table 3-2 if the sensor detects the presence of your finger.3.

|  |  |  |
| --- | --- | --- |
| **Surface** | **Detected** | **Not Detected** |
| Black Plastic Surface |  |  |
| White Plastic Surface |  |  |
| Matte Black Metallic Surface |  |  |
| Shiny Metallic Surface |  |  |
| Retroreflective Surface |  |  |

\* *Depending on the angle 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*

***Table 3-2***

4. Repeat your observations with other objects whose reflectivity differs (matte, shiny, bright, dark). What can you conclude from your observations? Which surfaces are detected by the proximity switch?

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

# CONCLUSION

In this exercise, you were introduced to Background Suppression Photoelectric switches. You learned how and when they are used, their advantages and disadvantages. You observed the ability of the Inductive Proximity Switch to detect the presence of various objects. In the last part of the exercise, you observed that the maximum sensing distance of this type of sensor is quite short.

# 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 what distance should the target be distanced from the background for reliable operation?