# 3 LAB SESSION 3

Use a refractive infrared sensor and condition its output for the application of counting and speed measurement.

## 3.1 Learning Objective:

At the end of this study, the student will be able to:

- To use different parts of Tachometer Test Module including refractive infrared sensor, counter and amplifier.

## 3.2 Apparatus

In order to complete the demonstration, we need a number of pieces of equipment.

- Refractive infrared sensor
- Amplifier
- Voltmeter
- Counter
- DC Motor
- Oscilloscope

## 3.3 Main Parts of Tachometer Test Module

1. DC Tachometer
2. DC Motor
3. Inductive Sensor
4. Refractive Infrared Sensor
5. Slot Sensor
6. Hall Effect Sensor
7. Encoder

## 3.4 Related theory

A sensor is essential to sense shaft speed. Typically, devices used for this purpose are shaft (rotary type) encoders, photoelectric (optical type) sensors and magnetic rotational speed (proximity type) sensors. All of these sensors send speed data in the form of electrical pulses. Shaft encoders offer a high resolution of typically 1-5000 pulses per revolution (PPR) and clearly defined, symmetrical pulses. Proximity sensors provide medium (or low) resolution sensing, depending on the number of pulses measured per revolution. Photoelectric sensors usually sense a reflective target on the rotating shaft. Magnetic

rotational speed sensors use various magnetic proximity measuring principles to monitor the speeds of machine components in a range between 0 and 30,000 rpm.

In principle, RPM sensors convert mechanical motion into electric pulses with or without direct contact when positioned near a turning rotor, gear, shaft or other regularly moving device. The resultant output signals are then fed to a digital counter, totaliser, tachometer, or other monitoring and control device.

An IR Emitter is a light emitting diode (LED). Different types of IR LEDs are specified based on their packaging.IR Receivers are also called sensors since they detect the wavelength and spectral radiation of the light from the IR emitter. IR receivers are specified by optic features, packaging, special circuitry such as an ambient light filter, wide viewing angle and more.

A photointerrupter is a photosensor that integrates an optical receiver and emitter in a single U-shaped package. In a transmission type photointerrupter, the light emitting and detecting elements are placed facing each other (Figure 2). Shape and size are two of the main differentiating features of a photointerrupter.

## 3.5 Experimental procedure:

1) Set up the equipment and identify its components.
2) Connect the circuit as shown in figure and adjust the potentiometer of 10KΩ at maximum path to obtain a 10K pull up resistance at the reflection sensor output.
3) Refractive infrared sensor is assembled on the apparatus. On its front it is placed a revolving disc with one part of its surface white and other black.
4) In the white part, a difference that is used to get the central axle speed value.
5) At the sensor output there will be obtained a group of pulses with a frequency that coincides with the axle revolving speed and with amplitude up to 400mV.
6) There are two reflective sensors placed one on the top of the other in front of the revolving wheel.
7) On the front board there is a switch to change the sensor as shown in the above described circuit.

## 3.6 Observations & Calculations

**Table3.1: Calculation of Input Supply of Motor and Speed**

| Obs. $n$ | Input of Motor (V) | Speed (Speed rev/sec) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |

## 3.7 Graph

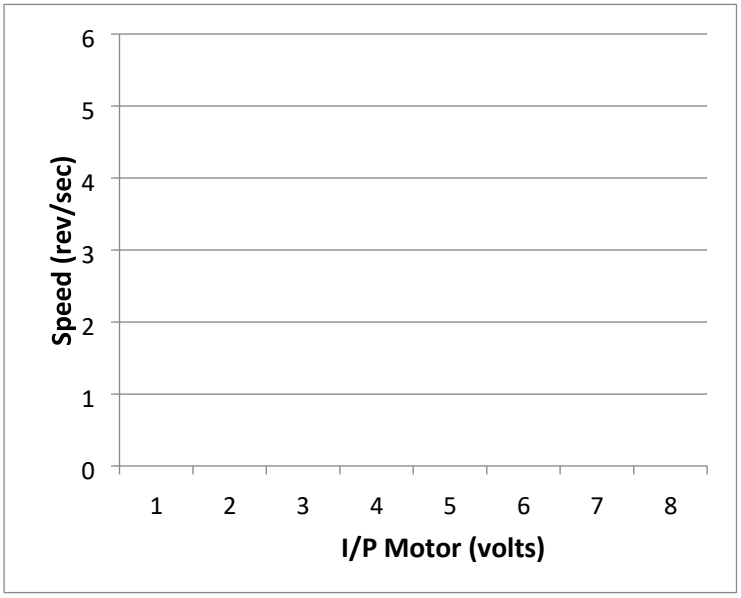


*Figure 3-2 Characteristics of refractive infrared sensor*

## 3.8 Conclusion: