

3) signal processing.

- the light interruption are converted into an electrical signal, each pulse corresponds to a specific amount of movement.
- the encoder's electronics can then count the number of pulses generated to determine position, speed, direction.

4) types of optical encoder-

• Incremental encoder

Output pulses that indicates motion, but the exact posn must be tracked by counting pulses from reference point.

• Absolute encoder

each position of the encoder is uniquely identified by a binary code, so even after a power cycle, the encoder knows the exact position.

Answer

An optical encoder is a device used to ~~measure~~ measure motion or position and convert it into an electrical signal. It works by detecting the pass of a rotating or linear object, typically by using light.

• main components

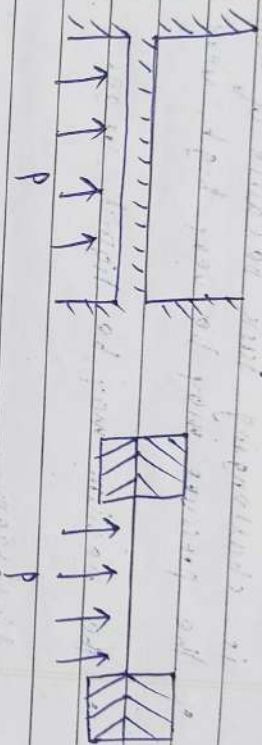
- a) LED: provides a constant beam of light.
- b) code disk or scale.
- c) Photodetector.

• Working principle

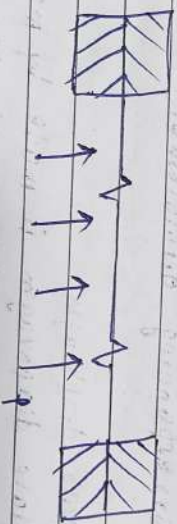
- a) the LED emits light toward the code disk, which rotates as the shaft of the device turns.
- b) As the code disk rotates, the transparent and opaque sections alternately pass in front of the light source.
- c) the photodetector on the side senses the changes in light intensity.

Corrugated diaphragm -

The sensitivity of membrane type diaphragm can be further enhanced in a corrugated diaphragm and a large deflection can be obtained for a small change in pressure however at cost of linearity.



a) thin plate b) membrane



c) corrugated diaphragm

to form a pressure transducer, the core displacement of the LVDT is produced by the movement of a metallic pressure responsive diaphragm. Hence a pressure responsive element is directly coupled to the core of linear LVDT.

Answers

Measurement of pressure

- Measurement of pressure inside a pipeline or a container in an industrial environment is challenging task because of two reasons
- The pressure may be very high, very low
- The medium may be liquid, or gas

diaphragm-

diaphragm may be of three types: Thin plate, Membrane and corrugated diaphragm. This classification is based on applied pressure and the corresponding displacement.

Thin plate diaphragm-

Thin plate diaphragm is made by machining a solid block and making a circular cross-sectioned area with smaller thickness in the middle.

Membrane diaphragm - In membrane the sensing is glued in b/w two solid blocks as shown. The thickness is smaller, as a result, the when pressure is applied on one side, the displacement is larger.

addition

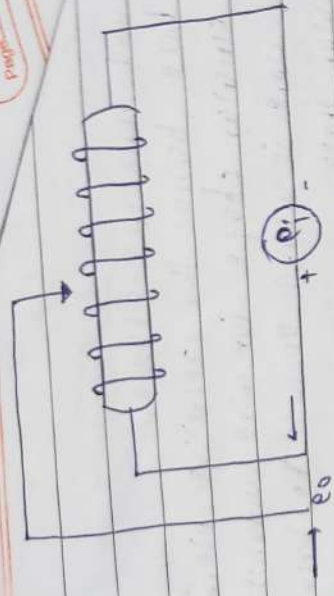
1) base and resistive element
The base houses the resistive element in a circular shape for wire-wound types, a thin wire is wound around the base forming a circular track.

2) Wiper mechanism
The wiper mechanism is connected to the rotating shaft. As the shafts turn the wiper slides across the surface of the resistive element.

3) Rotary shaft and bearing
The rotary shaft passes through the center of the potentiometer, mounted on small bearings or bushings that allow smooth turning.

4) Terminal and wiring
Terminals are usually soldered or mechanically attached to the ends of the resistive track and the wiper.

Def. A sensor is a device which responds to some type of input from physical environment.



→ the construction of the potentiometer is categorised into two parts.

- sliding and
- non-sliding parts.

The sliding part contact is called wiper. The motion of the sliding contacts is either transitory or rotational. Some potentiometer uses both the transitory and rotational motion. Such are called bix, called potipoints.

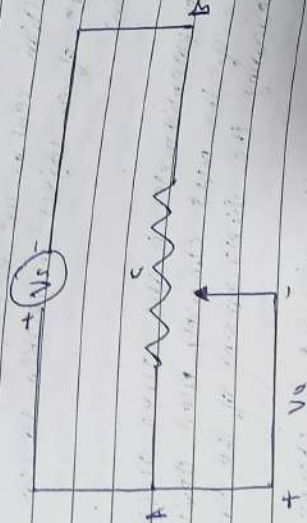
The potentiometer has three terminals. The two terminals are connected to the resistor and the third terminal is connected to the wiper which is movable with wire.

1) Circular potentiometer.

components are -

- resistive track
- housing
- wiper
- terminal
- shaft

The below circuit consists of potentiometer and a voltage source V_s . We can say that these two are connected in parallel with respect to the points A and B. Potentiometer has a sliding contact, which can be varied. So, the point C is a variable one. In this, the output voltage V_o is measured across the points A and C.



$$\frac{V_o}{V_s} = \frac{AC}{AB}$$

Answer 2

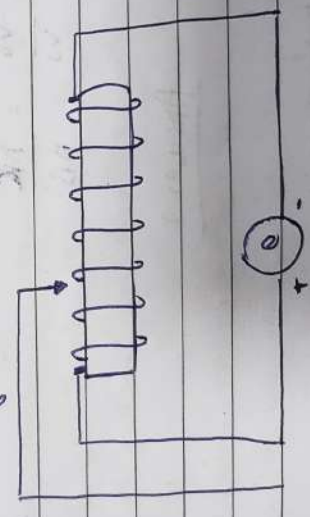
1) Linear potentiometer.

Assignment-2

Answer

Measurement of displacement using potentiometer

- displacement sensors are basically used for the measurement of movement of object.
- Position sensors are employed to determine the position of an object in relation to some reference point.
- the potentiometer is also called as pots and it is one of the most commonly used device for measuring the displacement of the body.
- It works on the principle of change of resistance of the wire with its length.



Q1. A sensor is a device which converts physical quantity into electrical signal.



Pneumatic sensor -

The sensor measure air pressure in a pneumatic system and activate a switch when the pressure reaches a certain level.

eg - pressure switch, flow sensor etc.

form of signal to another. This
that all sensors are transducer is
analyze or manipulate physical quantities.

Answer 4

1) electric sensors - Measure temperature by generating voltage due to the temperature difference between two different metals.

eg - Thermocouple, current sensors etc.

2) Optical sensors - Converts light into electrical current, the intensity of light affects the current.

Use: Common in cameras, light detection system etc.

eg Photodiode, LIDAR

3) Mechanical sensors -

A strain gauge is example of mechanical sensor.

It measures the deformation (strain) in an object when the object deforms the strain gauge changes its electrical resistance.

eg - Pressure sensors

analyze, or monitor the performance and behaviour of communication components. these instrument help in testing and diagnosing communication system to ensure they function correctly.

- measurement instrument - these are used to measure various signal parameter like voltage, current etc.

Answer 3

sensor - A sensor is a component or device that detect or measure a specific physical parameter and convert it into a signal, often electrical. It acts as the front-end in a measurement system, providing raw data.

eg - A thermocouple that detects temperature changes and produces a voltage corresponding to temp.

Instrument - An instrument, or the other hand is a device that uses sensor or transducer to measure, analyze or manipulate physical quantities. Instruments often include additional components like displays, control systems.

Transducer - A transducer is a broader term that includes any device that convert one

2) mechanical transducer: electrical energy

3) electro-optical: electrical signal \rightarrow light signal

4) Active transducer: generate electrical signal without external power

5) passive transducer: require external power source

Answer 2 Use of transducer-

A transducer is a device that converts one form of signal into another. In communication system transducer are essential for converting physical signal into electrical signal.

- Input transducer: these devices convert non-electrical signals into electrical signals for eg- in telecommunication, a microphone is an input-transducer that converts sound into electrical signal.
- Output transducer: these convert electrical signal back into form of other signal.

Use of Instrument

An instrument in communication system refer to any device used to measure

Assignment - 1

Ans 1

A sensor is a device that detect or measure a physical property and converts it into an electrical signal or other form of o/p that can be easily interpreted.
eg - a temperature sensor.

Classification of sensors -

- 1) temperature sensor: thermocouple, RTDs.
- 2) pressure sensor: piezoelectric sensor.
- 3) light sensor: photodiode, LDRs
- 4) position sensor: potentiometer, encoders etc.
- 5) proximity sensor: capacitive, inductive sensor.
- 6) Active sensor: require external power
- 7) Passive sensor: don't require power
- 8) Analog sensor: provide continuous output
- 9) digital sensor: provide a discrete o/p.

Transducer - A transducer is a device that converts one form of energy into another. It generally require refer to component that changes physical quantities.

- 1) electrical transducer: convert physical quantity into electrical signal