ELECTRICAL AND ELECTRONICS MEASUREMENTS USING SENSORS TRAINER KIT

LAB MANUAL

BAJAJ BEST BAJAJ ENGINEERING SKILLS TRAINING

SYMBIOSIS INTERNATIONAL (DEEMED UNIVERSITY)

S. NO	List of Experiments	Date	Sign
1	Operation of magnetic field sensor		
2	Operation of inductive sensor – flush head		
3	Operation of inductive sensor – non flush head		
4	Operation of inductive analog sensor – flush head		
5	Operation of capacitive sensor – flush head		
6	Operation of optical sensor -diffuse beam		
7	Operation of optical sensor diffuse beam with background suppression		
8	Operation of optical sensor – thru beam		
9	Operation of optical sensor – retro reflective using reflector		
10	Operation of diffuse beam fibre optic sensor		
11	Operation of thru beam optic sensor		
12	Operation of color sensor		
13	Operation of ultrasonic sensor		

Experiment-1

Title: Know your Industrial sensor

Aim: Operation of magnetic field sensor.

Objectives:

- To understand how magnetic field sensor work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Industrial magnetic field sensors operate by detecting the presence, strength, and direction of magnetic fields in their environment. These sensors typically use a magneto-resistive, Hall effect, or fluxgate principle to sense magnetic fields. When a magnetic field interacts with the sensor, it causes a change in the sensor's electrical properties (e.g., resistance or voltage), which is then measured and processed.

Application:

Magnetic industrial sensors are widely used in various applications to detect and monitor magnetic fields, positioning, and motion.

1. Position Sensing in Automation Systems: Magnetic sensors are used to detect the position of components in automation systems, such as robotic arms or conveyors.

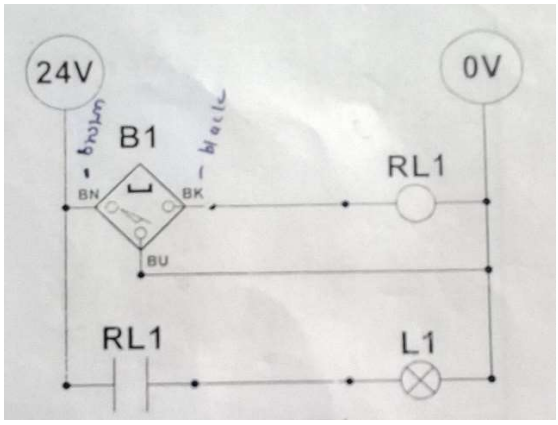
2. Speed and RPM Monitoring: In rotating machinery, magnetic sensors are employed to measure the speed or RPM (revolutions per minute) of motors, pumps, and other equipment.

3. Proximity Detection in Doors and Safety Systems: Magnetic sensors are used for proximity detection in safety systems, such as in industrial doors, gates, or emergency exit mechanisms.

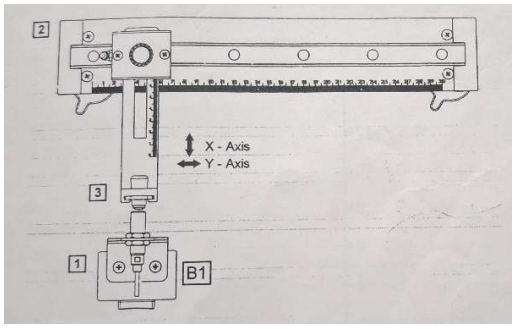
Part List

Part List			
S. No	Product Name	Product No.	QTY
1	Magnetic field sensor -Flush head	MP0223	1
2	LM guide unit	MP0239	1
3	Workpiece for magnetic sensor	MP0259-01	1
4	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relay	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



Procedure:

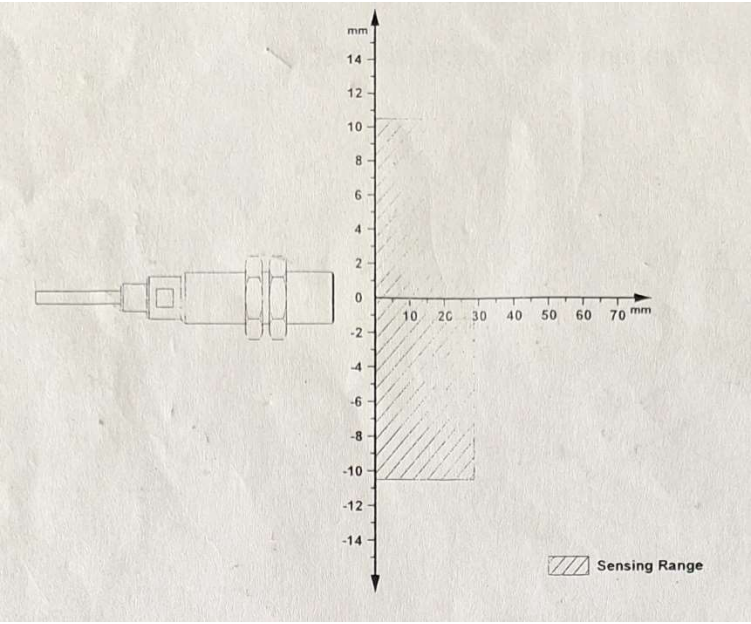
1. Arrange the components and make the electrical connection as per the c) exercise setup and b) relay ladder diagram.

2. Locate the workspace and sensor head in the same axis and set the observed value in the horizontal scale as 0.

3. With the vertical scale value as 0, move the workpiece left until the output of the sensor cutoff. Mark the value and plot it in e) Observation. Repeat the step in the opposite direction and plot the value in the e) observation

4. Similarly make the observation by increasing the value in vertical scale and also by switching between metal object as well.

Observations: Actual sensing range



Observations: Done by students

Conclusion: The sensor range is successfully plotted on graph for magnetic sensor.

Experiment-2

Title: Know your Industrial sensor

Aim: Operation of inductive sensor - flush head.

Objectives:

- To understand how inductive sensor -flush head work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Inductive sensors with a flush head operate by detecting the presence of metallic objects within their sensing range using an electromagnetic field. These sensors have a design where the sensing element is mounted flush with the surrounding surface, making them ideal for environments where the sensor needs to be installed flat or recessed to avoid damage. When a metal object enters the sensor's electromagnetic field, it induces changes in the field, which the sensor detects and converts into an electrical signal.

Application:

Inductive industrial sensors with flush heads are designed to be mounted directly into machinery or equipment where the sensor's head is flush with the surface, making them ideal for environments requiring high durability and easy cleaning.

1. Position and Presence Detection in Automated Machinery: Flush head inductive sensors are used to detect the position or presence of moving parts, such as in automated assembly lines.

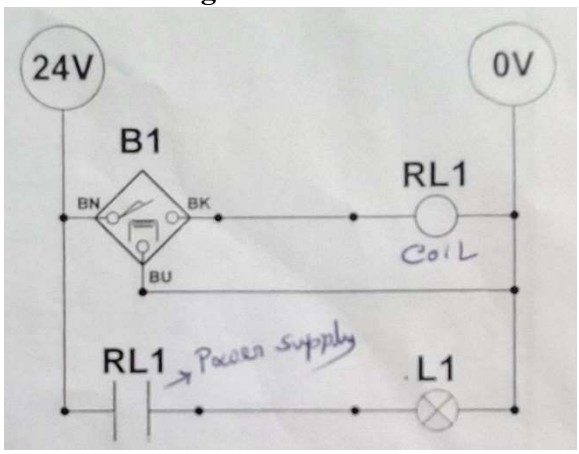
2. Object Detection in Harsh Environments: These sensors are widely used in manufacturing plants, especially in environments with dirt, dust, or liquids, like food processing or packaging industries.

3. Proximity Detection in Robotic Systems: In robotic arms or automated guided vehicles (AGVs), flush head inductive sensors are used for proximity detection of metal parts or tools.

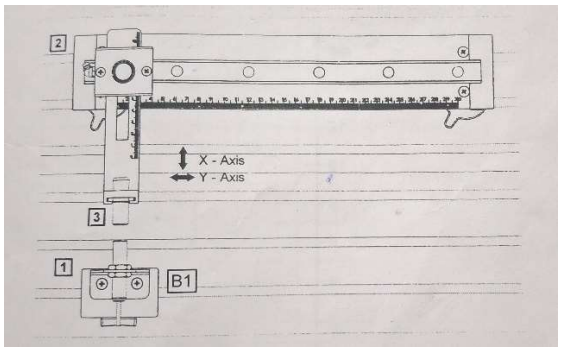
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Inductive sensor -Flush head	MP0224	1
2	LM guide unit	MP0239	1
3	Workpiece for inductive and capacitive sensor	MP0259-02	1
4	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relay	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



Procedure:

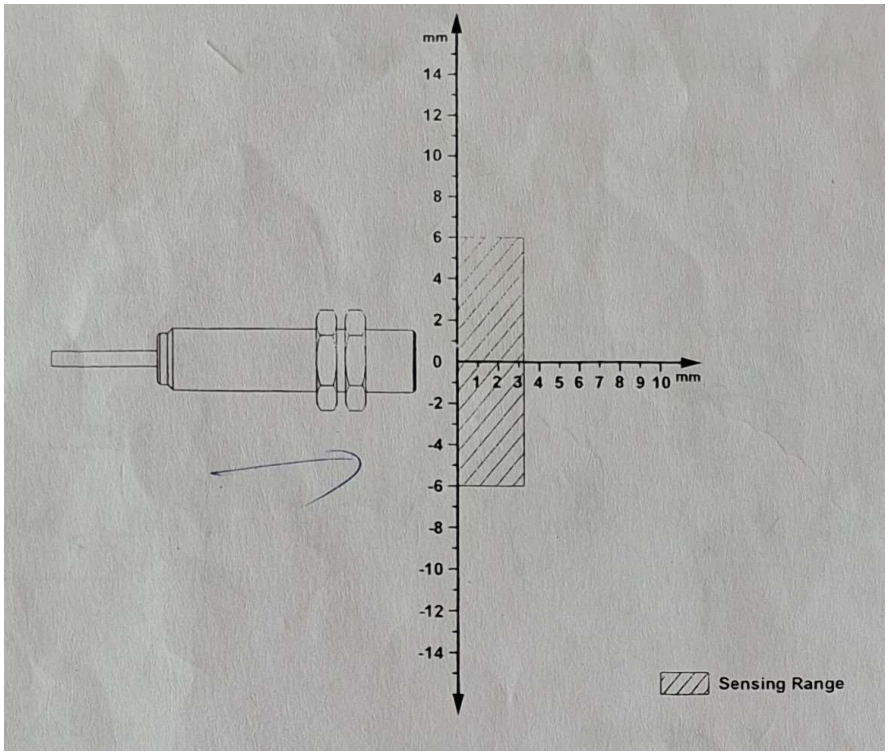
1. Arrange the components and make the electrical connection as per the c) exercise setup and b) relay ladder diagram.

2. Locate the workspace and sensor head in the same axis and set the observed value in the horizontal scale as 0.

3. With the vertical scale value as 0, move the workpiece left until the output of the sensor cutoff. Mark the value and plot it in e) Observation. Repeat the step in the opposite direction and plot the value in the e) observation

4. Similarly make the observation by increasing the value in vertical scale and also by switching between metal object as well.

Observations: Actual sensing range



Observations: Done by students

Conclusion: The sensor range is successfully plotted on graph for inductive sensor - flush head.

Experiment-3

Title: Know your Industrial sensor

Aim: Operation of inductive sensor - non flush head.

Objectives:

- To understand how inductive sensor -non flush head work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Inductive sensors with a non-flush head detect the presence of metallic objects using an electromagnetic field, where the sensor's coil generates a magnetic field that interacts with metal objects. Unlike flush head sensors, the non-flush design protrudes slightly from the mounting surface, allowing for a greater sensing range. When a metal object enters this field, it causes a disruption, which is detected by the sensor and converted into an electrical signal.

Application:

Inductive sensors with non-flush heads are commonly used in industrial applications where the sensor head protrudes beyond the surface, allowing for higher sensing ranges and greater detection capabilities.

1. Metal Object Detection in Conveyor Systems: Non-flush inductive sensors are often used in conveyor systems to detect the presence or absence of metal objects.

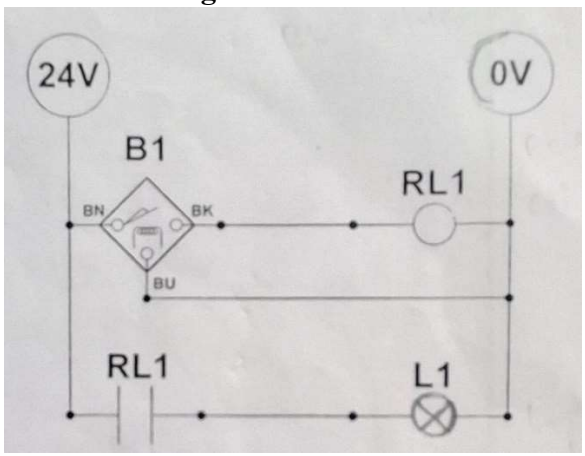
2. Speed and RPM Monitoring in Motors and Rotating Equipment: Non-flush head inductive sensors are used to monitor the speed and RPM of motors or rotating machinery.

3. Position Sensing in Automated Guided Vehicles (AGVs): Non-flush inductive sensors are ideal for detecting the position of AGVs or other mobile robotic systems that travel along predetermined paths.

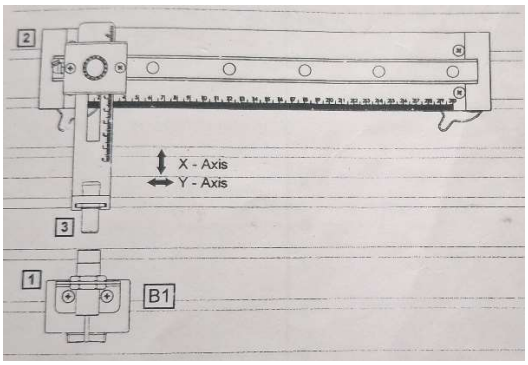
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Inductive sensor -Non flush head	MP0225	1
2	LM guide unit	MP0239	1
3	Workpiece for inductive and capacitive sensor	MP0259-02	1
4	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relay	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



Procedure:

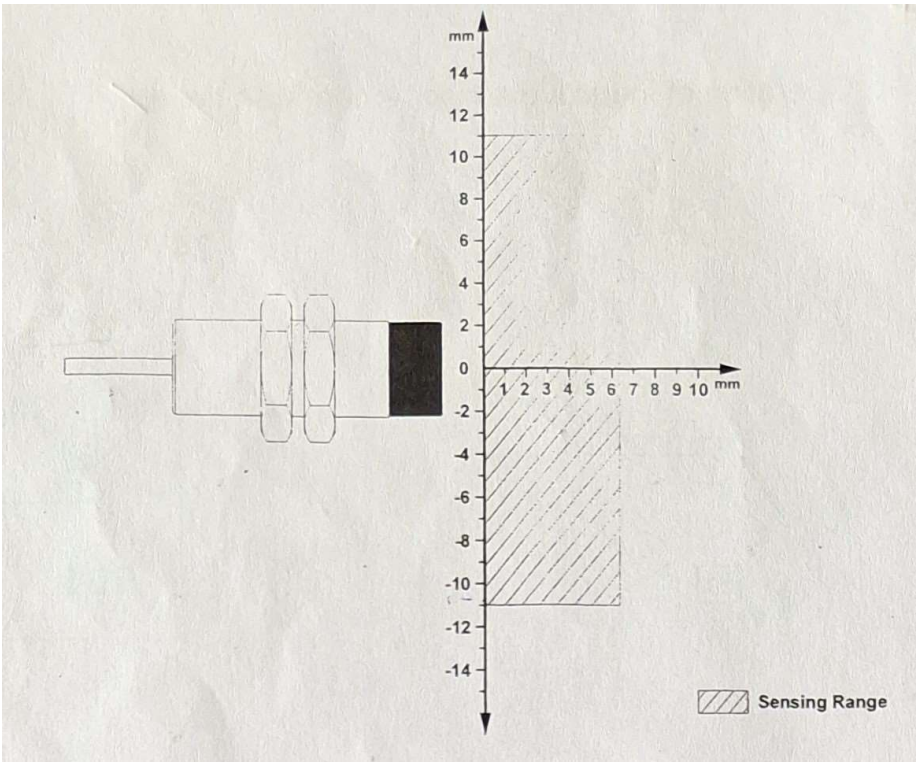
1. Arrange the components and make the electrical connection as per the c) exercise setup and b) relay ladder diagram.

2. Locate the workspace and sensor head in the same axis and set the observed value in the horizontal scale as 0.

3. With the vertical scale value as 0, move the workpiece left until the output of the sensor cutoff. Mark the value and plot it in e) Observation. Repeat the step in the opposite direction and plot the value in the e) observation

4. Similarly make the observation by increasing the value in vertical scale and also by switching between metal object as well.

Observations: Actual sensing range



Observations: Done by students

Conclusion: The sensor range is successfully plotted on graph for inductive sensor - non flush head.

Experiment-4(conclusion)

Title: Know your Industrial sensor

Aim: Operation of inductive analog sensor - flush head.

Objectives:

- To understand how inductive analog sensor -flush head work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Inductive analog sensors with a flush head detect the presence and position of metallic objects by generating an electromagnetic field that changes in response to the proximity of metal. These sensors provide a continuous output signal, typically in the form of a voltage or current, which corresponds to the distance between the sensor and the target. The flush head design allows the sensor to be mounted directly on a surface, making it ideal for applications where space constraints or environmental conditions require a flat, compact installation.

Application:

Inductive analog sensors provide continuous, real-time data rather than just a simple on/off signal, making them valuable in a range of applications that require precise, real-time monitoring of metallic targets or changes in position.

1. Position Sensing in Linear Actuators and Cylinders: Inductive analog sensors are commonly used to measure the precise position of metal components within linear actuators or cylinders.

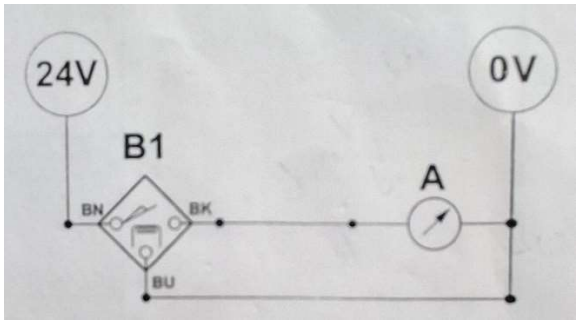
2. Speed and RPM Monitoring in Motors: Inductive analog sensors can measure the rotational speed (RPM) of motors or other rotating equipment by detecting changes in the position of metal targets (e.g., gears or shafts).

3. Torque Measurement in Rotating Machinery: Inductive analog sensors are used in applications where torque needs to be monitored in rotating machinery, such as in gearboxes, drives, or robotic arms.

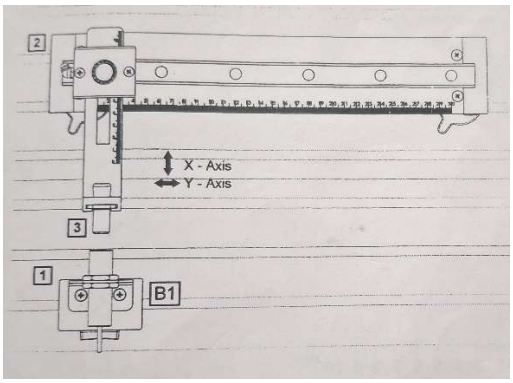
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Inductive Analog sensor -Flush head	MP0226	1
2	LM guide unit	MP0239	1
3	Workpiece for inductive and capacitive sensor	MP0259-02	1
4	Electrical connection set	MP0027	1
5	Multimeter	MP0260	1
6	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



Procedure:

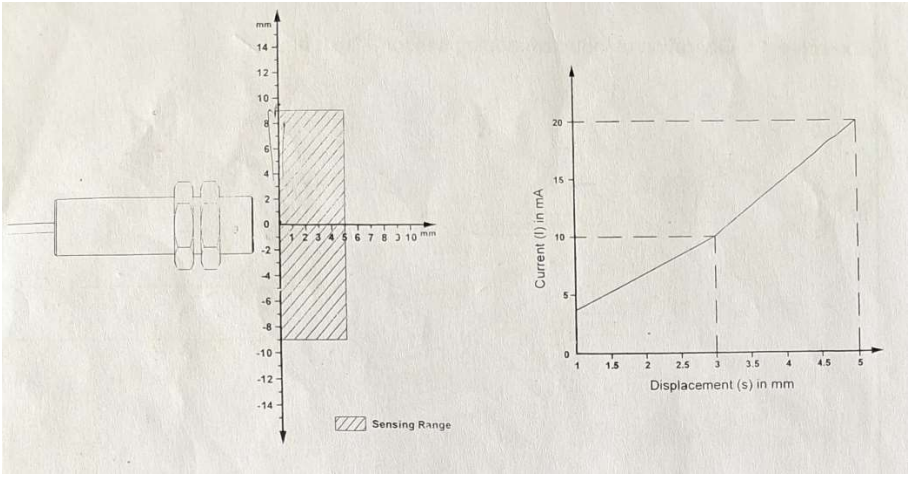
1. Arrange the components and make the electrical connection as per the c) excercise setup and b) relay ladder diagram.

2. Locate the workspace and sensor head in the same axis and set the observed value in the horizontal scale as 0.

3. With the vertical scale value as 0, move the workpiece left until the mA value in the multimeter becomes 20. Mark the value and plot it in f) Observation. Repeat the step in the opposite direction and also in vertical scale.

4. Similarly make the observation by increasing the value in vertical scale and plot the mA value in the g) characteristics response curve.

Observations: Actual sensing range



Observations: Done by students

Conclusion: The sensor range is successfully plotted on graph for inductive sensor - flush head.

Experiment-5

Title: Know your Industrial sensor

Aim: Operation of capacitive sensor - flush head.

Objectives:

- To understand how capacitive sensor -flush head work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Capacitive sensors with a flush head detect the presence of objects by measuring changes in the electrical field around the sensor. When a target object, typically non-metallic or conductive, enters the sensor's detection range, it alters the capacitance between the sensor and the object. The flush head design allows the sensor to be mounted directly against the surface, providing a compact, space-saving solution.

Application:

Capacitive sensors with flush heads are widely used in industrial applications where detection needs to be reliable, and the sensor is mounted flush with the surface to prevent damage, contamination, or wear. These sensors can detect a wide range of materials, including metals, plastics, liquids, and granular materials.

1. Object Detection in Packaging Lines: These sensors are often used for detecting the presence or absence of objects in automated packaging lines.

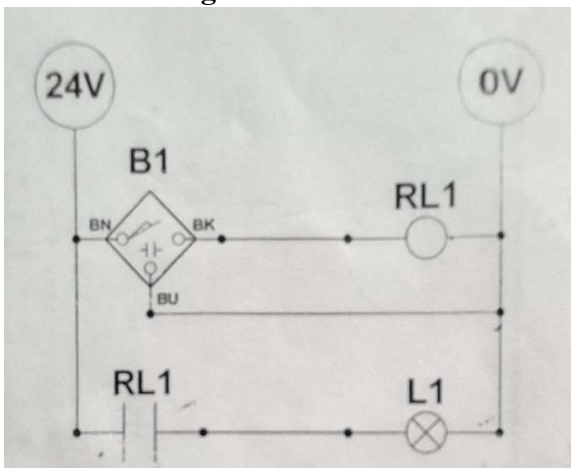
2. Liquid Level Sensing in Food and Beverage Industries: In food and beverage production, flush head capacitive sensors are employed to monitor the levels of liquids, such as water, juices, or syrups, in storage tanks, pipes, and containers.

3. Monitoring Powder or Granular Materials: In industries dealing with powders or granular materials, flush head capacitive sensors are used to monitor material levels in silos, hoppers, or conveyors.

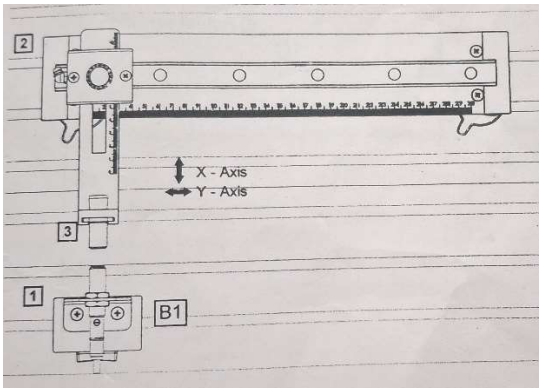
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Capacitive sensor -Flush head	MP0227	1
2	LM guide unit	MP0239	1
3	Workpiece for inductive and capacitive sensor	MP0259-02	1
4	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relays	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



Procedure:

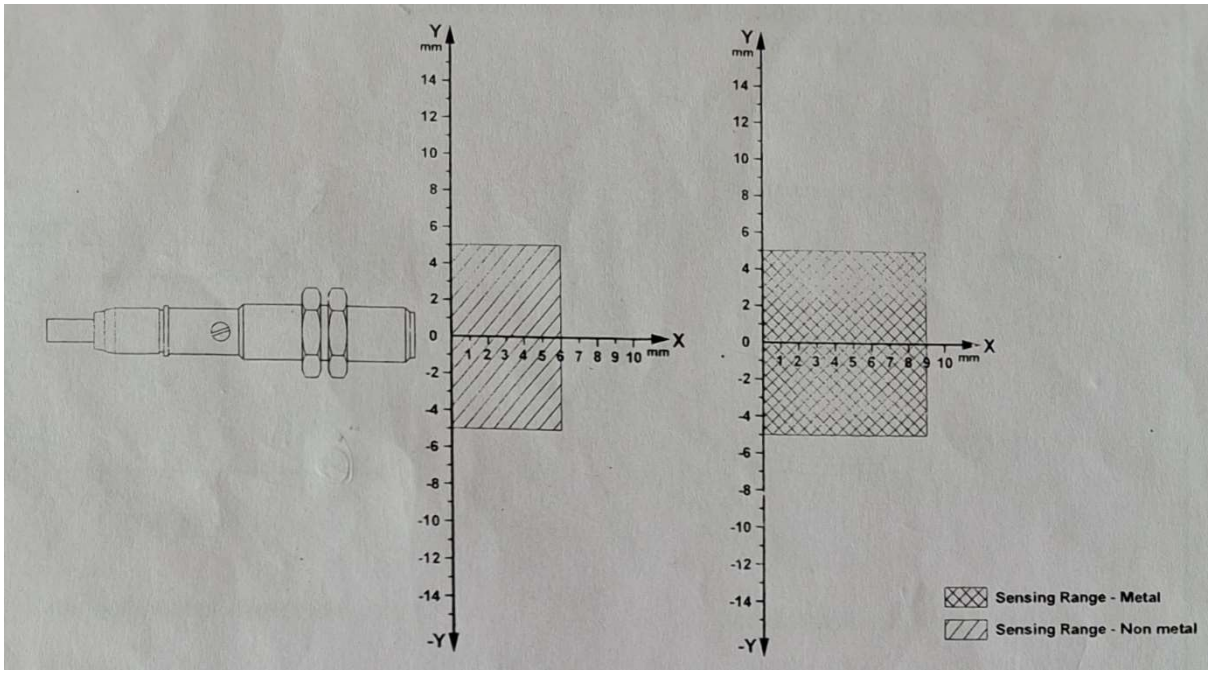
1. Arrange the components and make the electrical connection as per the c) exercise setup and b) relay ladder diagram.

2. Locate the workspace and sensor head in the same axis and set the observed value in the horizontal scale as 0.

3. With the vertical scale value as 0, move the workpiece left until the output of the sensor cutoff. Mark the value and plot it in e) Observation. Repeat the step in the opposite direction and plot the value in the e) observation.

4. Similarly make the observation by increasing the value in vertical scale and also by switching between both metal and non-metal objects and plot the value f) observation as well

Observations: Actual sensing range



Observations: Done by students

Conclusion: The sensor range is successfully plotted on graph for capacitive sensor - flush head.

Experiment-6

Title: Know your Industrial sensor

Aim: Operation of optical sensor - diffuse beam.

Objectives:

- To understand how optical sensor - diffuse beam work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Optical sensors with a diffuse beam operate by emitting light from the sensor toward the target object, which then reflects the light back to the sensor. The sensor detects the intensity of the reflected light to determine the presence or absence of the object. When the object is in the detection range, it causes a measurable change in the light reflection, triggering a response from the sensor. Diffuse beam sensors are particularly effective for short-range detection, where objects are in close proximity to the sensor.

Application:

Industrial optical sensors with diffuse beam technology are designed to detect objects or changes in the environment by measuring the interruption or reflection of light. These sensors emit light and detect the reflected signal from the target, making them ideal for a variety of non-contact applications.

1. Object Detection on Conveyor Belts: Diffuse beam optical sensors are widely used on conveyor systems to detect the presence of items moving along the belt.

2. Packaging Line Monitoring: In packaging lines, diffuse beam optical sensors are used to detect the presence or absence of products, boxes, or containers.

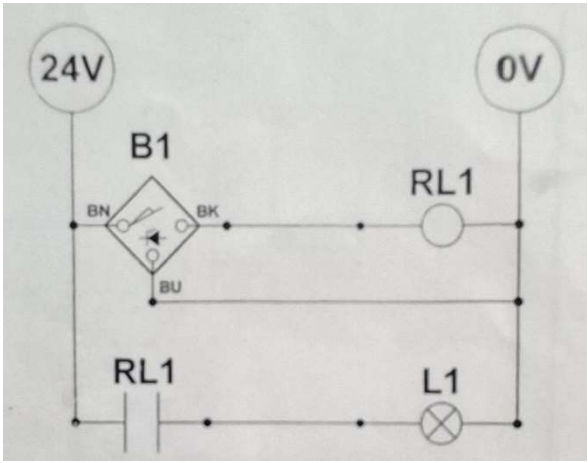
3. Position and Presence Sensing in Assembly Lines: These sensors are used to detect the position of parts or components in assembly lines. By emitting light and analysing the

reflection, the sensor ensures proper alignment or verifies that components are in the correct position, improving accuracy and reducing defects in automated manufacturing processes.

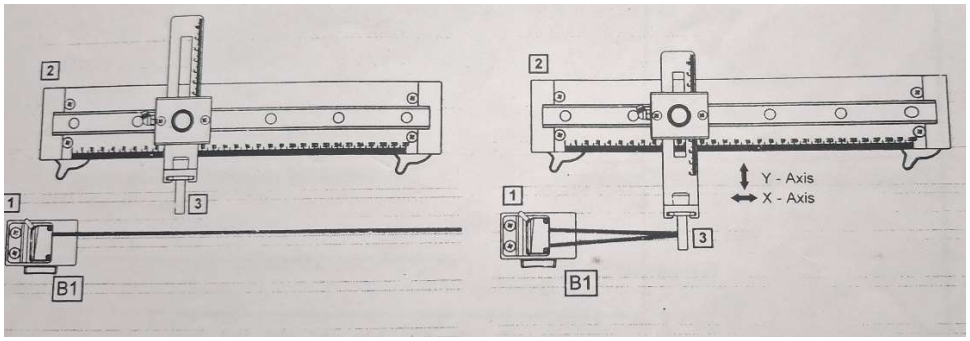
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Optical sensor -Diffuse beam	MP0233	1
2	LM guide unit	MP0239	1
3	Workpiece for optical and ultrasonic sensor	MP0259-03	1
4	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relays	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



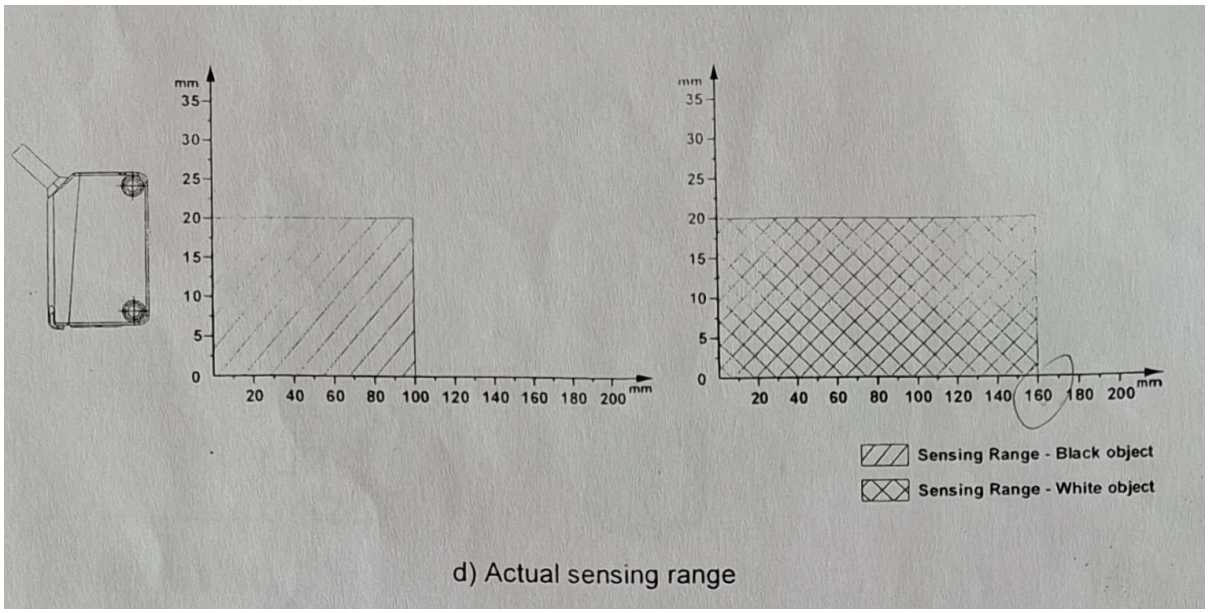
Procedure:

1. Arrange the components and make the electrical connection as per the c) excercise setup and b) relay ladder diagram.

2. Set the black object in the workspace and adjust vertically until the light beam from the sensor touches the workpiece. Obseve the value and move the workpiece in horizontal direction until the output is cutoff and plot the values in e) observation.

3. Similarly make the observation by switching white object and plot the value f) observation as well.

Observations: Actual sensing range



d) Actual sensing range

Observations: Done by students

Conclusion: The sensor range is successfully plotted on graph for optical sensor - diffuse beam.

Experiment-7

Title: Know your Industrial sensor

Aim: Operation of optical sensor - diffuse beam with background suppression.

Objectives:

- To understand how optical sensor - diffuse beam with background suppression work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Optical sensors with diffuse beam and background suppression operate by emitting light toward a target, with the sensor designed to focus on light reflected specifically from the object, while ignoring reflections from the background. The sensor uses advanced filtering techniques to differentiate between reflections from the target and those from the surrounding environment. When an object interrupts the beam, it causes a change in the reflected light intensity, which the sensor detects and processes.

Application:

Industrial optical sensors with diffuse beam and background suppression are designed to detect objects while ignoring background noise or interference, making them ideal for environments with varying backgrounds or surfaces. These sensors work by detecting changes in the light reflected from objects while suppressing the reflection from background surfaces.

1. Object Detection on Conveyor Belts: Diffuse beam optical sensors with background suppression are widely used on conveyor belts in automated production lines.

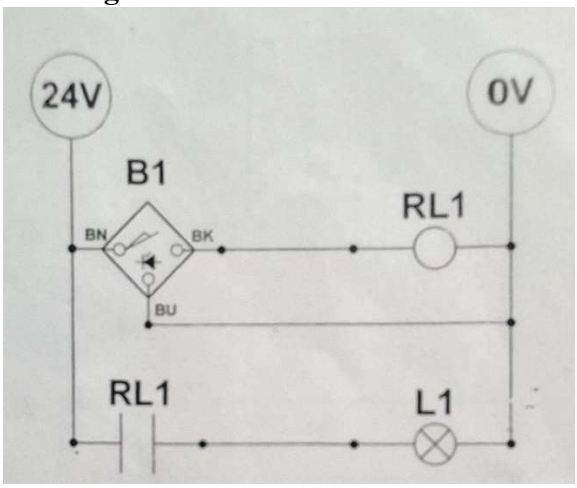
2. Package or Box Detection in Packaging Lines: In packaging industries, these sensors are used to detect boxes, packages, or containers moving along packaging lines.

3. Quality Control in Manufacturing: These sensors are used for quality control purposes in manufacturing, such as inspecting the presence of parts or checking for defects.

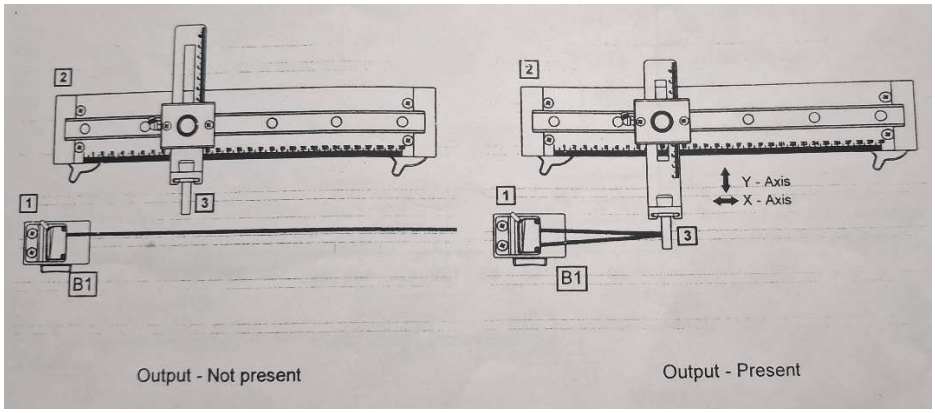
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Optical sensor -Diffuse beam with background suppression	MP0232	1
2	LM guide unit	MP0239	1
3	Workpiece for optical and ultrasonic sensor	MP0259-03	1
4	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relays	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



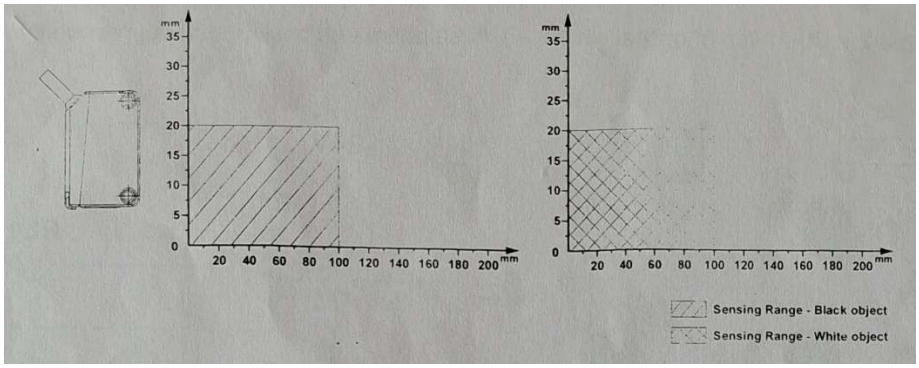
Procedure:

1. Arrange the components and make the electrical connection as per the c) excercise setup and b) relay ladder diagram.

2. Set the black object in the workspace and adjust vertically until the light beam from the sensor touches the workpiece. Obseve the value and move the workpiece in horizontal direction until the output is cutoff and plot the values in e) observation.

3. Similarly make the observation by switching white object and plot the value f) observation as well.

Observations: Actual sensing range



Observations: Done by students

Conclusion: The sensor range is successfully plotted on graph, optical sensor - diffuse beam with background suppression.

Experiment-8

Title: Know your Industrial sensor

Aim: Operation of optical sensor - thru beam.

Objectives:

- To understand how optical sensor - thru beam work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Optical sensors with thru-beam operation consist of a separate emitter and receiver positioned on opposite sides of a detection area. The emitter continuously sends a light beam (usually infrared) across the space, and the receiver is designed to detect the beam. When an object passes through the beam, it interrupts the light and triggers a response from the sensor. The sensor then detects the interruption and generates an output signal, indicating the presence of the object.

Application:

Industrial optical sensors with thru-beam technology work by emitting a beam of light from a transmitter to a receiver. The sensor detects when the beam is interrupted by an object, providing precise and reliable detection. These sensors are commonly used for their high accuracy and ability to detect small or transparent objects.

1. Object Detection in Conveyor Systems: Thru-beam optical sensors are widely used in conveyor systems to detect the presence of objects, such as products, packages, or containers. The emitter and receiver are placed on opposite sides of the conveyor, and any interruption in the light beam indicates the presence of an object, ensuring efficient sorting, counting, and tracking.

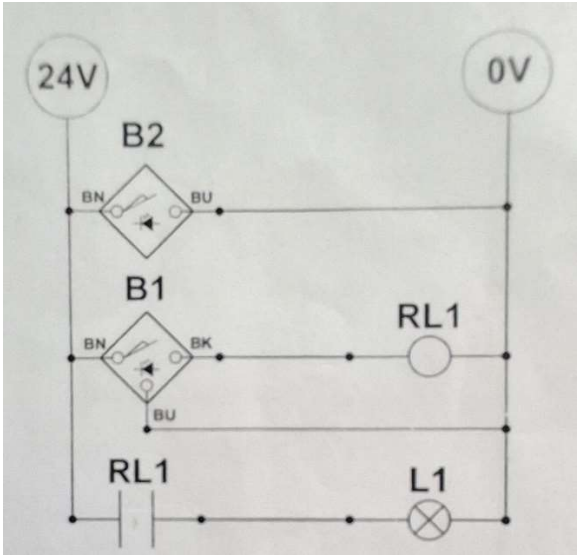
2. Safety Applications (Safety Light Curtains): Thru-beam sensors are used in safety light curtains for guarding industrial machinery.

3. Counting and Sorting Applications: In automated sorting and packaging systems, thru-beam optical sensors are used to count items as they pass through the sensor's light beam.

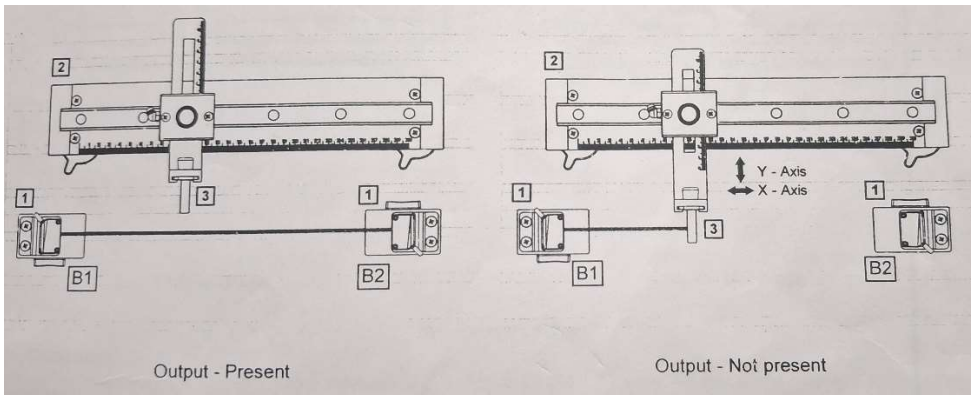
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Optical sensor -Thru beam	MP0235	1
2	LM guide unit	MP0239	1
3	Workpiece for optical and ultrasonic sensor	MP0259-03	1
4	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relays	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



Procedure:

1. Arrange the components and make the electrical connection as per the c) excercise setup and b) relay ladder diagram.

2. Move the workpiece in-between the emitter(B1) and receiver(B2) and observe that output will cutoff.

Conclusion: The optical sensor power was cutoff after its beam of light get interrupt by a workpiece.

Experiment-9

Title: Know your Industrial sensor

Aim: Operation of optical sensor - retro reflective using reflector.

Objectives:

- To understand how optical sensor – retro reflective using reflector work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Optical sensors with retro-reflective operation use a setup where the emitter and receiver are positioned together, with a reflector placed on the opposite side of the detection area. The emitter sends out a light beam that travels toward the reflector, which bounces the light back to the sensor. When an object passes through the light beam, it causes a change in the reflected light intensity, which the sensor detects. The sensor processes the reflection to determine the presence or absence of the object.

Application:

Industrial optical sensors with retroreflector technology use a light beam that is reflected back to the sensor by a retroreflector, allowing for precise detection of objects or changes in the environment. These sensors are highly effective in applications requiring long detection ranges and immunity to ambient light interference.

1. Object Detection in Long Conveyor Systems: Retroreflector optical sensors are commonly used on long conveyor systems to detect the presence or absence of objects, such as packages or products. The sensor's extended detection range, combined with the retroreflector's ability to return light to the sensor.

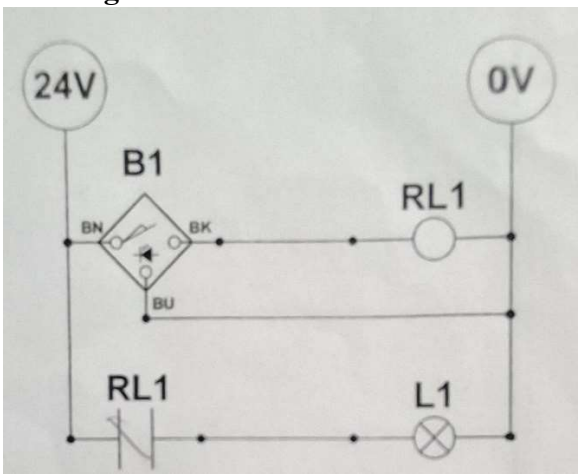
2. Position and Alignment Detection in Automated Systems: These sensors are widely used for position and alignment detection in automated systems, such as robotic arms or pick-and-place machines.

3. Safety Light Curtains in Hazardous Areas: Retroreflector-based optical sensors are used in safety light curtains to protect workers in hazardous zones. The light curtain creates an invisible barrier, and when the beam is interrupted, it triggers a safety response.

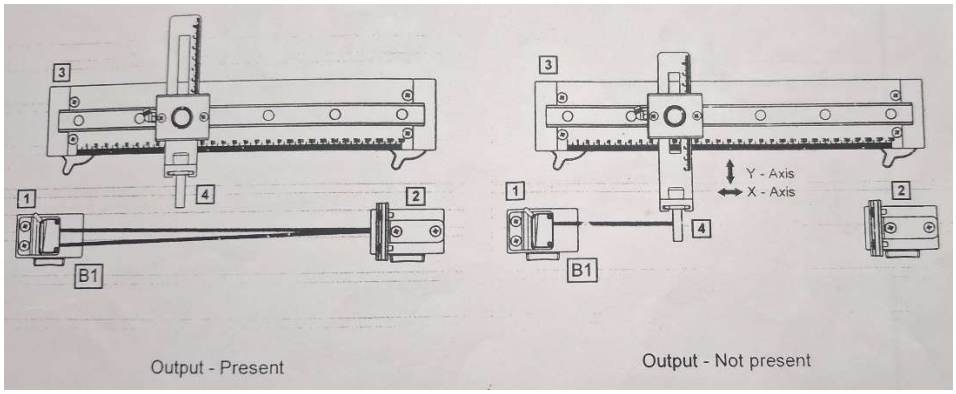
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Optical sensor -Retro reflective	MP0229	1
2	Reflector -Rectangle	MP0230	1
3	LM guide unit	MP0239	1
4	Workpiece for optical and ultrasonic sensor	MP0259-03	1
5	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relays	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



Procedure:

1. Arrange the components and make the electrical connection as per the c) excercise setup and b) relay ladder diagram.

2. Move the workpiece in-between the emitter(B1) and reflector and observe that output will cutoff.

Conclusion: The optical sensor power was cutoff after its beam of light get interrupt by a workpiece.

Experiment-10

Title: Know your Industrial sensor

Aim: Operation of diffuse beam fibre optic sensor.

Objectives:

- To understand how diffuse beam fibre optic sensor work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Diffuse beam fibre optic sensors operate by emitting light through a fibre optic cable toward an object, which reflects the light back to the sensor. The sensor detects the amount of light that returns after being reflected from the object's surface. When an object enters the sensor's detection range, it alters the intensity of the reflected light, triggering a response. These sensors are sensitive to changes in the reflection caused by the object's presence or movement.

Application:

Industrial diffuse beam fibre optic sensors are widely used in applications where precise, non-contact detection of objects is required. These sensors use fibre optics to transmit light and detect changes in light intensity caused by the interruption of a beam. The diffuse beam technology allows the sensor to detect objects at various distances, even in environments with varying backgrounds.

1. Object Detection in Conveyor Systems: Diffuse beam fibre optic sensors are commonly used in conveyor systems to detect objects such as packages, products, or containers.

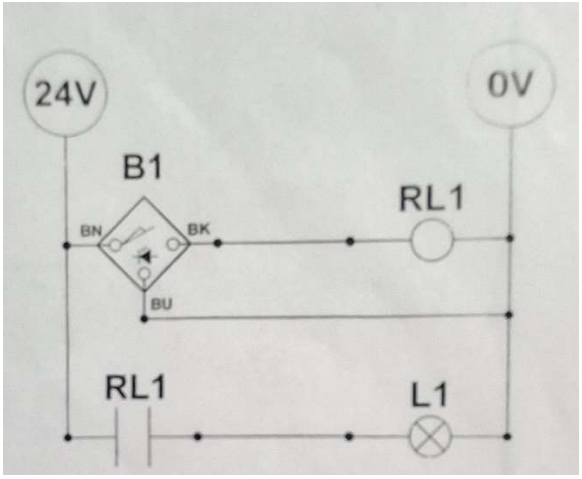
2. Presence and Position Detection in Automated Assembly Lines: In automated assembly lines, diffuse beam fibre optic sensors are used to detect the presence or position of parts and components.

3. Safety and Protective Applications: Diffuse beam fibre optic sensors are used in safety systems, such as safety light curtains or barriers, to detect the presence of objects or people in hazardous areas.

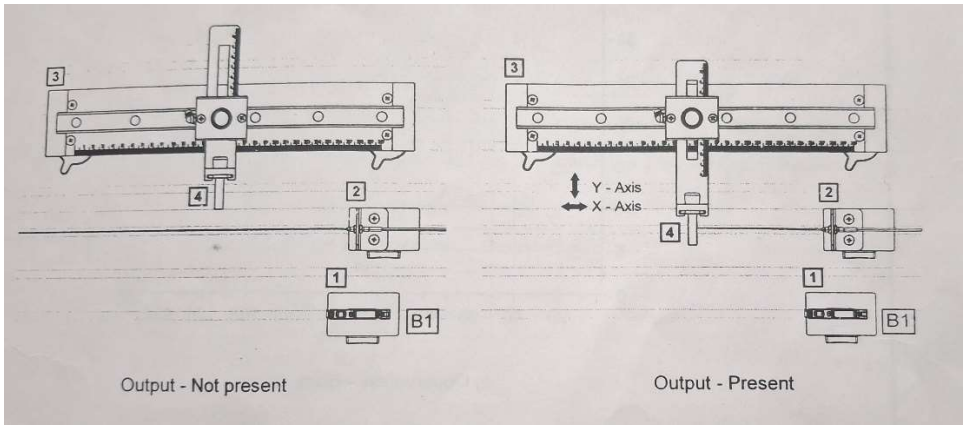
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Fiber optic sensor amplifier unit	MP0234	1
2	Fiber optic sensor -Diffuse beam	MP0235	1
3	LM guide unit	MP0239	1
4	Workpiece for optical and ultrasonic sensor	MP0259-03	1
5	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relays	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



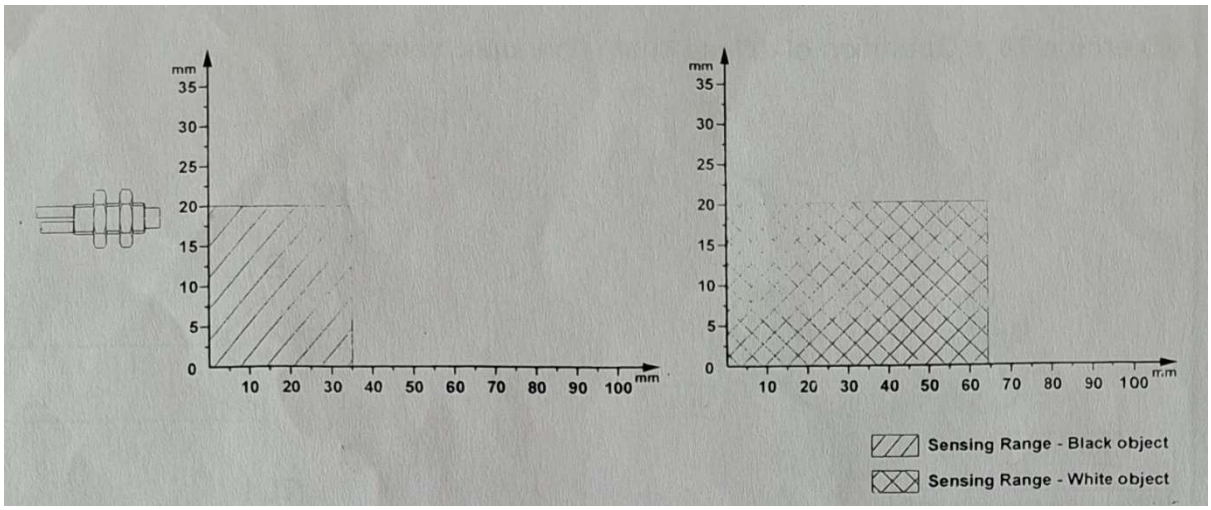
Procedure:

1. Arrange the components and make the electrical connection as per the c) excercise setup and b) relay ladder diagram.

2. Set the black object in the workspace at 0 in horizontal scale. Move the sensor close to the object until the reading in amplifier unit becomes 0.6. Increase the value in horizontal scale until the output is present plot the horizontal scale value in e) observation.

3. Repeat the above step for white object in the workpiece and plot the horizontal scale value in f) observation as well.

Observations: Actual sensing range



Observations: Done by students

Conclusion: The sensor range is successfully plotted on graph, diffuse beam fibre optic sensor.

Experiment-11

Title: Know your Industrial sensor

Aim: Operation of thru beam fibre optic sensor.

Objectives:

- To understand how thru beam fibre optic sensor work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Thru-beam fiber optic sensors consist of two separate components: an emitter and a receiver, placed on opposite sides of a detection area. The emitter sends a continuous light beam through the air or space, which is received by the sensor's receiver. When an object passes through the beam, it interrupts the light path, and the receiver detects this change. The sensor then triggers an output signal to indicate the presence of the object. Thru-beam fiber optic sensors are highly effective for long-range detection.

Application:

Industrial diffuse thru-beam fiber optic sensors use fiber optic cables to transmit light between a transmitter and receiver, and detect when the light beam is interrupted by an object. These sensors offer reliable and precise detection, especially in environments where non-contact detection is required.

1. Object Detection in Conveyor Systems: Thru-beam fiber optic sensors are commonly used in conveyor systems to detect the presence or absence of products, packages, or containers.

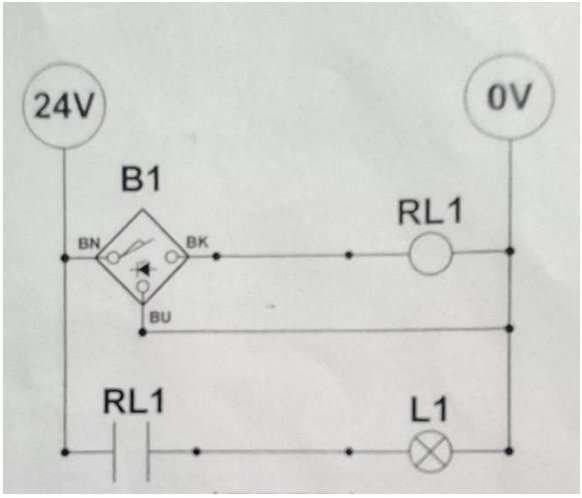
2. Position and Alignment Detection in Automated Assembly Lines: These sensors are widely used in automated assembly lines to verify the position or alignment of parts or components.

3. Counting and Sorting Applications: Thru-beam fiber optic sensors are used to count and sort objects in high-speed production lines. As items pass through the sensor's light beam, the interruption is counted and tracked.

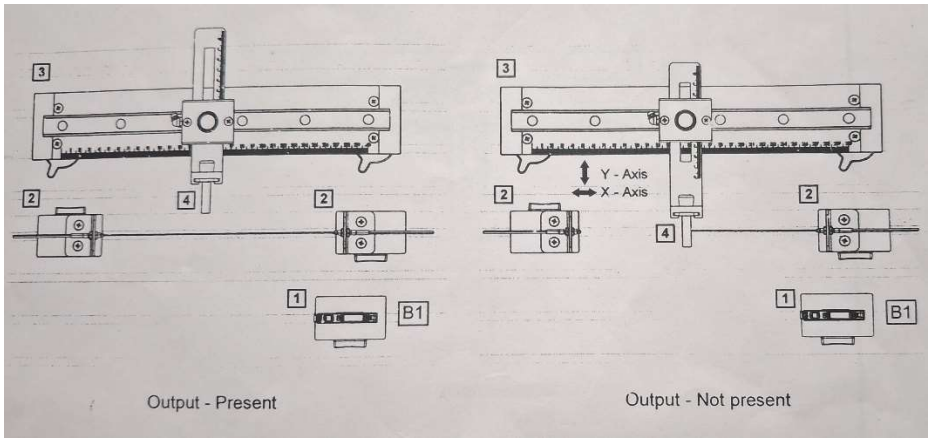
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Fiber optic sensor amplifier unit	MP0234	1
2	Fiber optic sensor -Thru beam	MP0236	1
3	LM guide unit	MP0239	1
4	Workpiece for optical and ultrasonic sensor	MP0259-03	1
5	Electrical push button module	MP0059	1
6	Electrical connection set	MP0027	1
7	Relay logic unit 4C/O -3 Relays	MP0074	1
8	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



Procedure:

1. Arrange the components and make the electrical connection as per the c) exercise setup and b) relay ladder diagram.

2. Move the workpiece in-between the emitter and receiver and observe that output will cutoff.

Conclusion:

Experiment-12

Title: Know your Industrial sensor

Aim: Operation of color sensor.

Objectives:

- To understand how color sensor work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Color sensors operate by emitting light onto an object and analyzing the reflected light to determine the object's color. The sensor typically uses a combination of red, green, and blue light sources to capture the color spectrum. By comparing the intensity of the reflected light in these color channels, the sensor calculates the precise color of the object. The sensor then processes this information and generates an output signal corresponding to the detected color.

Application:

Industrial color sensors are used to detect and differentiate colors in manufacturing and automation processes. These sensors are highly effective in applications that require precise color detection for quality control, sorting, and alignment.

1. Quality Control in Packaging Lines: Color sensors are widely used in packaging lines to ensure products are correctly labeled or packaged. They can detect color variations in labels, caps, or packaging materials, ensuring that products are correctly identified.

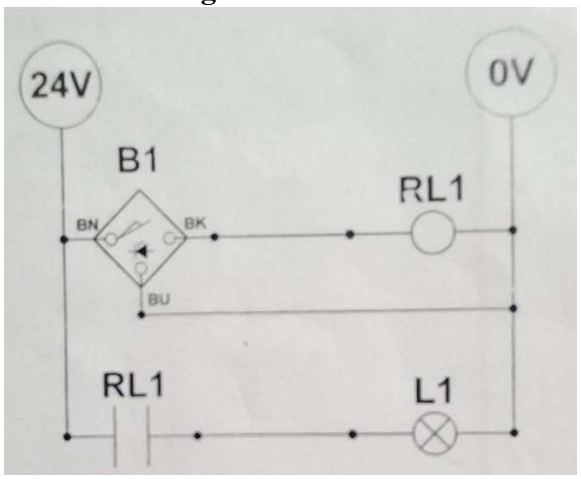
2. Sorting and Inspection of Food Products: In the food processing industry, color sensors are used to inspect and sort food products based on their color.

3. Plastic and Polymer Sorting: Color sensors are employed in the recycling industry to sort different types of plastic materials based on their color.

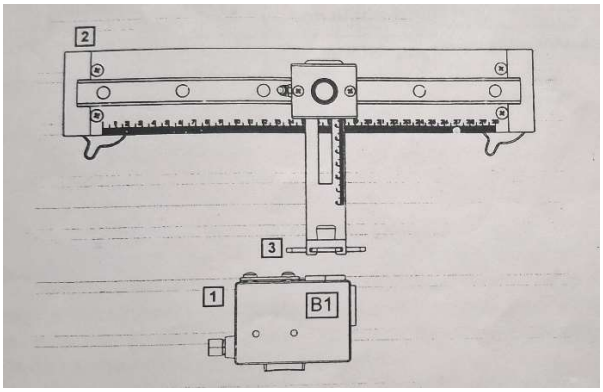
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Colour sensor	MP0237	1
2	LM guide unit	MP0239	1
3	Workpiece for colour sensor	MP0259-04	1
4	Electrical push button module	MP0059	1
5	Electrical connection set	MP0027	1
6	Relay logic unit 4C/O -3 Relays	MP0074	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c

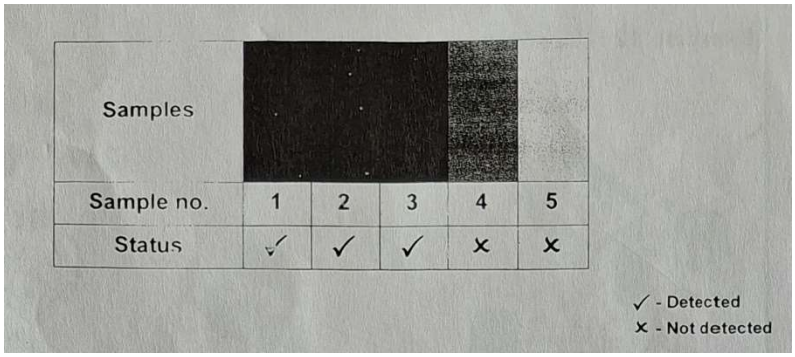


Procedure:

1. Arrange the components and make the electrical connection as per the c) excercise setup and b) relay ladder diagram.

2. Set the black color (sample no. 1) in the workpiece and mark the output status in the e)observation on respective column. Similarly repeat the steps for other sample color as well.

Observations: Actual sensing range



Observations: Done by students

Conclusion: The sensor cutoff after it sense white color, but before that the sensor detects the black color.

Experiment-13

Title: Know your Industrial sensor

Aim: Operation of ultrasonic sensor.

Objectives:

- To understand how ultrasonic sensor work.
- To understand how sensor provide Real-Time Data
- To explore how sensors are used in various fields, such as: Industrial Monitoring, Scientific Research

Introduction:

Industrial ultrasonic sensors operate by emitting high-frequency sound waves (ultrasound) from a transmitter. These sound waves travel through the air and reflect back to the sensor when they encounter an object. The sensor measures the time it takes for the sound waves to return, calculating the distance to the object based on the time of flight. By continuously emitting sound pulses and detecting the reflected waves, the sensor can monitor the position, level, or presence of objects.

Application:

Industrial ultrasonic sensors use high-frequency sound waves to detect objects, measure distances, or monitor levels in various industrial applications. These sensors are highly effective in environments where non-contact sensing is required, and they can operate in challenging conditions such as dust, dirt, or liquids.

1. Distance and Position Measurement: Ultrasonic sensors are used in applications requiring precise distance measurement, such as measuring the position of objects in automated systems or determining the spacing between parts on assembly lines.

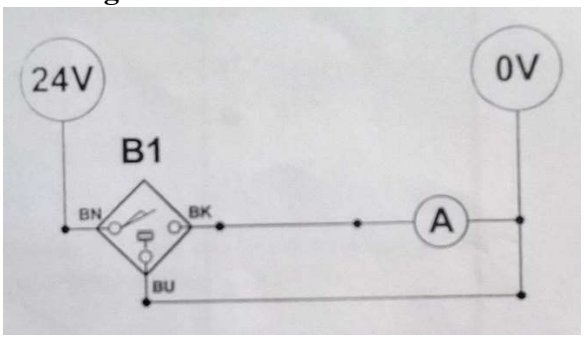
2. Level Detection in Tanks and Silos: Ultrasonic sensors are frequently used for non-contact level measurement in tanks, silos, and hoppers. By emitting ultrasonic waves and measuring the time it takes for the waves to reflect back from the material's surface.

3. Object Detection and Collision Prevention in Robotic Systems: In automated guided vehicles (AGVs), robotic arms, and other robotic systems, ultrasonic sensors are used to detect objects and prevent collisions.

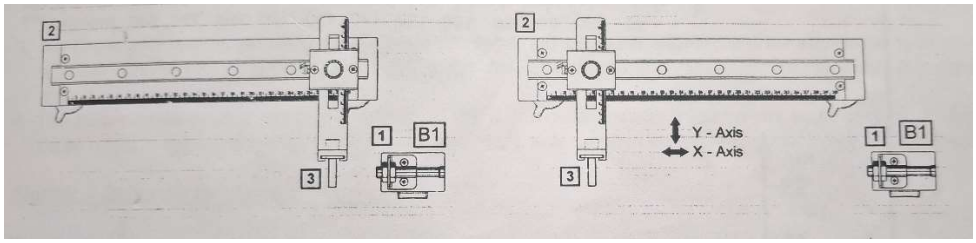
Part List:

Part List			
S. No	Product Name	Product No.	QTY
1	Ultrasonic sensor	MP0238	1
2	LM guide unit	MP0239	1
3	Workpiece for optical and ultrasonic sensor	MP0259-03	1
4	Electrical connection set	MP0027	1
5	Multimeter	MP0260	1
7	Switch mode power supply	JTK-SMPS	1

Schematic Diagram: b



Exercise: c



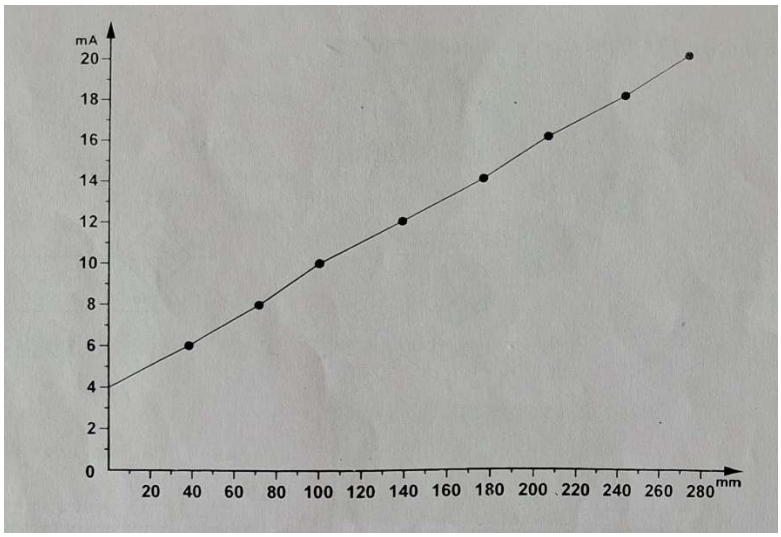
Procedure:

1. Arrange the components and make the electrical connection as per the c) excercise setup and b) relay ladder diagram.(for sensor teach settings refer h.Ultrasonic tech in procedure for exercise setup).

2. Align the workpiece and sensor for the lower evaluation limit and set the observed reading in the horizontal scale as 0. Mark the mA value in the multimeter and plot it in e)observation.

3. Similarly make the observations by increasing the value in horizontal scale and observe sale and observe the mA value in the multimeter.

Observations: Actual sensing range



Observations: Done by students

Conclusion: The sensor application of ultrasonic sensor has successfully done.