IQRA NATIONAL UNIVERSITY PESHAWAR

DEPTT. B.E. (ELECTRICAL)

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FINAL TERM EXAMINATION

INDUSTRIAL ELECTRONICS

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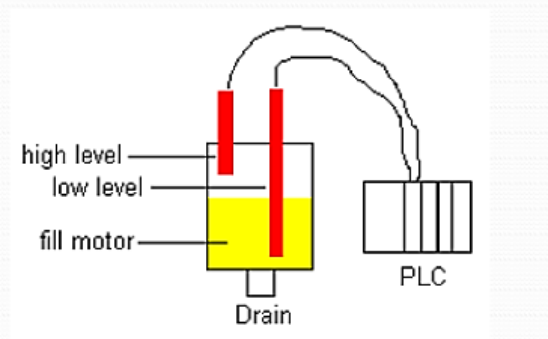
Question No 1. **10**

A. Consider a lubricating oil tank in Industrial Plant having 2 sensors, one is put near to the bottom and one near to top, to fill the tank, motor A will pump oil to tank until the high level sensor turns on, at that point the motor A turns OFF. Motor A is turned ON when the level fall below the low level sensor. Explain the states of PLC operating cycle with help of neat ladder diagrams. **CLO-3**

Answer:

- We are controlling lubricating oil being dispensed from a tank. This is possible by using two sensors.
- We put one near the bottom and one near the top. As shown in the picture below



Dispensing oil from a tank

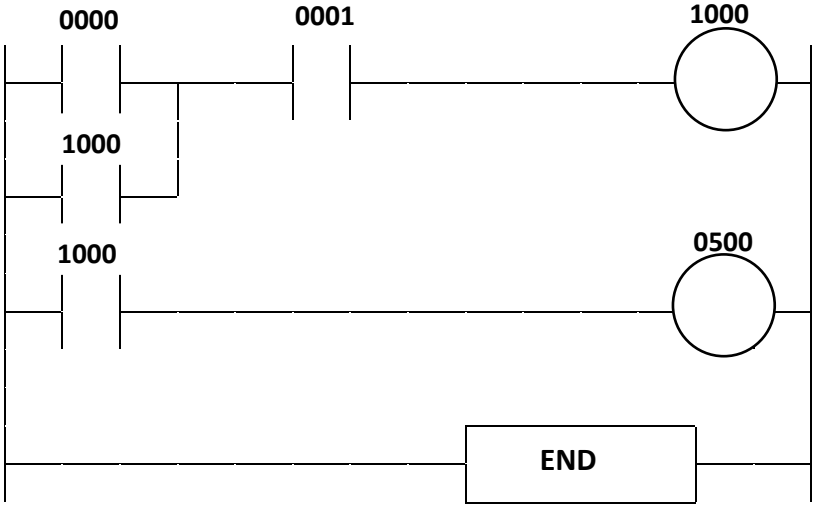
- Here, we want the fill motor to pump lubricating oil into the tank until the high level sensor turns on. At that point we want to turn off the motor until the level falls below the low level sensor. Then we should turn on the fill motor and repeat the process.

Inputs	Address
Low level sensor	0000
High level sensor	0001

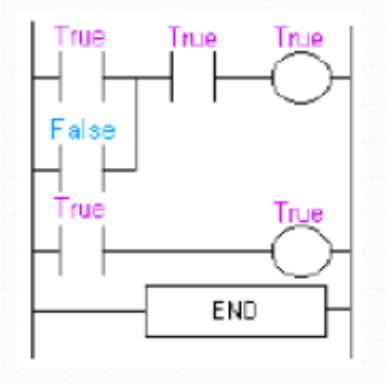
Output	Address
Motor	0500

Internal Utility Relay
1000

LADDER DIAGRAM:

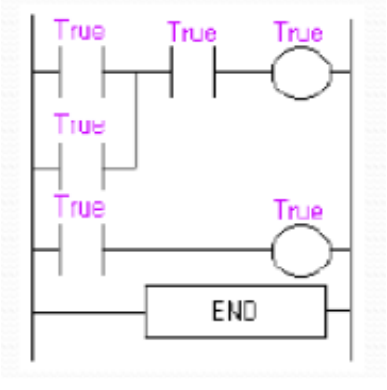


SCAN 1:



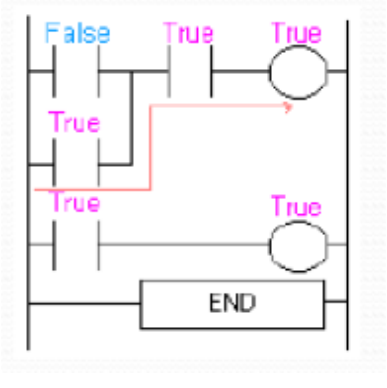
Initially the tank is empty. Therefore, input 0000 is TRUE and input 0001 is also True.

Scan 2:



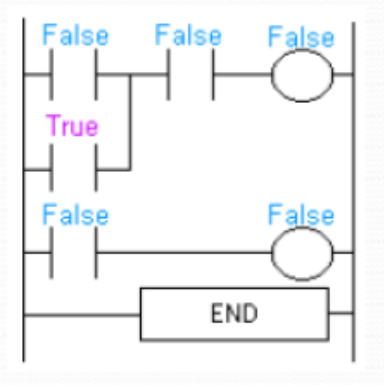
The internal relay is turned on as the water level rises.

Scan 3:



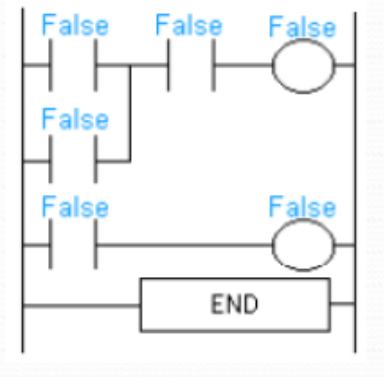
After scan 2 the oil level rises above the low level sensor and it becomes open. (i.e. FALSE)

Scan 4:



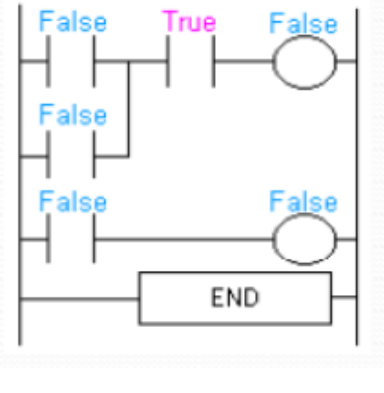
After scan 4 the oil level rises above the high level sensor at it also becomes open (i.e. FALSE)

Scan 5:



Since there is no more true logic path, output 0500 is no longer energized (TRUE) and therefore the motor turns off.

Scan 6:



After scan 6 the oil level falls below the high level sensor and it will become TRUE again.

Question No 2 **20**

A. **Write some benefits of Industrial Automation CLO-2**

BENEFITS OF INDUSTRIAL AUTOMATION:

Manufacturing would be nothing without automation, factory robots, and industrial motion control. Here are 5 key benefits of industrial automation.

Automation Reduces Costs:

Employing robots is cheaper than employing human workers. After the initial cost of a factory robot, the only costs are energy, maintenance, and repairs. This results in big savings when compared to annual salaries for human workers, and a higher return on investment.

Industrial automation provides more production with fewer workers. All you need is a handful of employees to monitor and operate machinery rather than a floor full of laborers.

High production costs mean lower profit. Lower production costs and higher production translates to more affordable goods for consumers.

Automation Improves Quality

Humans are great, but we're prone to error. Industrial motion control systems are more precise than human workers, and cut out the factor of human error. Not only does this result in a higher quality product, but it also delivers a more consistent final product.

Automation Improves Efficiency

Even your employee of the month with his impeccable work ethic needs to take a break every now and then. Robots work faster than humans, harder than humans, and they can operate 24/7.

When Ford introduced the first moving assembly line to their plant, they whittled the time it took to make a vehicle from 12 hours to 90 minutes. Today, thanks to industrial automation – as well as over 70 production facilities – Ford makes roughly 16 vehicles every 60 seconds around the world.

Automation Increases Human Safety

Increased production and lower costs are obviously important to manufacturing, but added safety is one of the most valuable benefits of industrial automation. Robots remove humans from dangerous work environments.

People are rather fragile, especially when compared to machines. Automation removes workers from exposure to hazardous chemicals, heavy objects, back-breaking labor, poor air quality, extreme temperatures, and other hazardous working conditions.

Automation Makes Manufacturing Better

Industrial automation not only makes manufacturing more profitable and more efficient, it also optimizes the entire process. Machinery frees humans to fine tune processes, improve technologies, and focus on the work that can't be automated. This leads to new, innovative products, increased customization customization, and a better consumer experience.

B. **Briefly explain the components and functions of SCADA system** **CLO-2**

Major components of SCADA

1) A collection of equipment's that is provide the operator at remote location with enough information to determine the status of particular piece of equipment or entire substation or a plant or a dynamic network and cause actions to take place regarding that equipment or network without being physically present.

2) An arrangement for operator control and separation of remotely located apparatus using multiplexing techniques once a relatively small number of interconnecting channels.

3) Collecting Data from remote electrical equipment and controlling then through suitable communication medium.

Functions of SCADA:

A SCADA system performs four functions:

1. Data acquisition
2. Networked data communication
3. Data presentation
4. Control

These functions are performed by four kinds of SCADA components :

1. Sensors (either digital or analog) and control relays that directly interface with the managed system.

2. Remote telemetry units (RTUs). These are small computerized units deployed in the field at specific sites and locations. RTUs serve as local collection points for gathering reports from sensors and delivering commands to control relays.

3. SCADA master units. These are larger computer consoles that serve as the central processor for the SCADA system. Master units provide a human interface to the system and automatically regulate the managed system in response to sensor inputs.

4. The communications network that connects the SCADA master unit to the RTUs in the field.

Question No 3 **20**

A. **Differentiate between Hardwired control systems and PLC system** **CLO-3**

Hardwired control systems

- The functions are determined by the physical wiring.
- Changing the function means changing the wiring.
- Can be contact-making type (relays, contactors) or electronic type (logic circuits)

PLC Systems

- The functions are determined by a program stored in the memory.
- The control functions can be changed simply by changing the program.
- Consist of a control device, to which all the sensors and actuators are connected.

B. **What are the function of SCADA systems** **CLO-2**

Functions of SCADA:

- Centrally monitors and controls thousands of industrial equipment, such as
  - Motors, Valves, Pumps, Relays, Sensors, etc.
- Displays current state of remote process (visualization)
- Displays alarms / Events log

SCADA (supervisory control and data acquisition) is used by manufacturers across numerous industries and applications to remotely monitor and automate the control of industrial processes and machines. SCADA systems accomplish these functions by integrating with networks, PLCs, RTUs, sensors, and machines to collect, analyze, translate, and display real-time data.

Data Acquisition:

SCADA systems acquire machine data through networked devices and sensors connected to a PLC or RTU. These devices and sensors measure parameters such as temperature, speed, pressure, or weight as raw data. The data is then sent to a PLC or RTU, where it is translated into comprehensible and actionable information. Finally, the information is sent to an HMI and displayed to operators to analyze or act on.

Control:

Automated process control based on defined set-points is another SCADA function. SCADA systems can be programmed to perform certain control decisions based on the parameters received from connected sensors. For example, if SCADA detects an abnormal condition in the process, such as power loss to a machine, and also detects an alarm that the machine's back-up battery power doesn't have a charge, the SCADA system could perform a control function to automatically turn on a generator to restore power. Additional SCADA control functions may include turning power on or off, increasing or decreasing speed and flow, raising or lowering temperature, and more.

Alarms:

When abnormal conditions occur within a process, SCADA systems can trigger alarms to notify operators that something is wrong. Alarm notifications may be presented to operators in the form of audible sounds, lights, graphical displays, email/SMS, or phone calls. Additionally, alarms can be programmed with different levels of priority to help differentiate major system errors from minor issues. It's a good practice to assign appropriate priority levels to alarms to ensure severe problems aren't ignored and the proper response is performed. For example, assigning the highest priority level to most or every alarm may prevent operators from being able to identify a major issue from minor events.

Data Communications:

SCADA systems may use wired or wireless communication technologies, as well as different communication protocols to transmit data between machines and operators. Common non-proprietary communication protocols include distributed network protocol (DNP3), Modbus, and IEC 60870-5. There are also numerous proprietary protocols specific to certain SCADA vendors. Additionally, SCADA systems typically utilize either closed local area networks (LANs) for local geographical areas, or wide area networks (WANs) for systems that need to connect multiple local area networks that are spread across different regions.