IQRA National University, Peshawar
Department of Electrical Engineering
Spring 2020
Elective 5 (Power).
Elective 4 (Electronics).
Industrial Electronics
Terminal Examination

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Total Marks : 50
Attempt All Questions.

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**

Question No 2 20

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

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

Question No 3 20

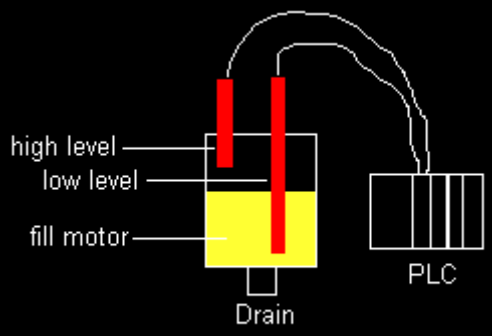
A. Differentiate between Hardwired control systems and PLC system **CLO-3**

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

.Good Luck.

Question#01

Let's consider the following application:
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.



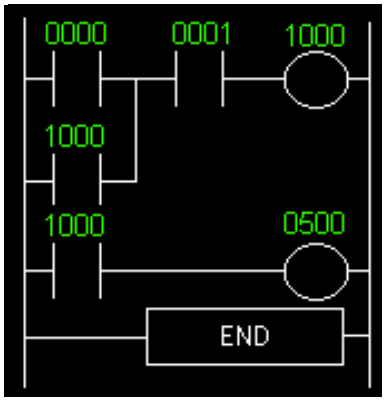
Dispensing oil from a tank

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.
Here we have a need for 3 I/O(i.e. Inputs/Outputs). 2 are inputs(the sensors) and 1 is an output(the fill motor). Both of our inputs will be NC(normally closed) fiber-optic level sensors. When they are NOT immersed in liquid they will be ON. When they are immersed in liquid they will be OFF.

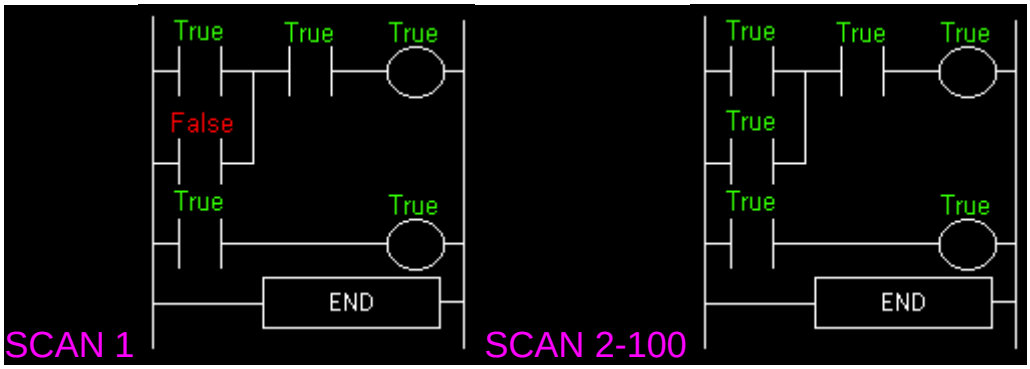
We will give each input and output device an address. This lets the plc know where they are physically connected. The addresses are shown in the following tables:

INPUTS	ADDRESS		OUTPUT	ADDRESS		INTERNAL UTILITY RELAY
Low	0000		Motor	0500		1000
High	0001					

Here is what the ladder diagram will actually look like. Notice that we are using an internal utility relay in this example. You can use the contacts of these relays as many times as required. Here they are used twice to simulate a relay with 2 sets of contacts. Remember, these relays DO NOT physically exist in the plc but rather they are bits in a register that you can use to SIMULATE a relay.

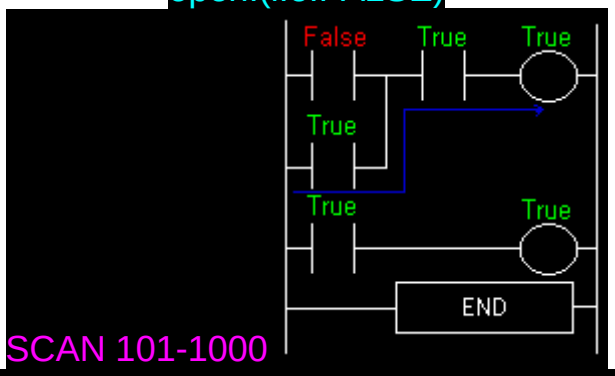


Let's watch what happens in this program scan by scan.
Initially the tank is empty.Therefore, input 0000 is TRUE and input 0001 is also TRUE.



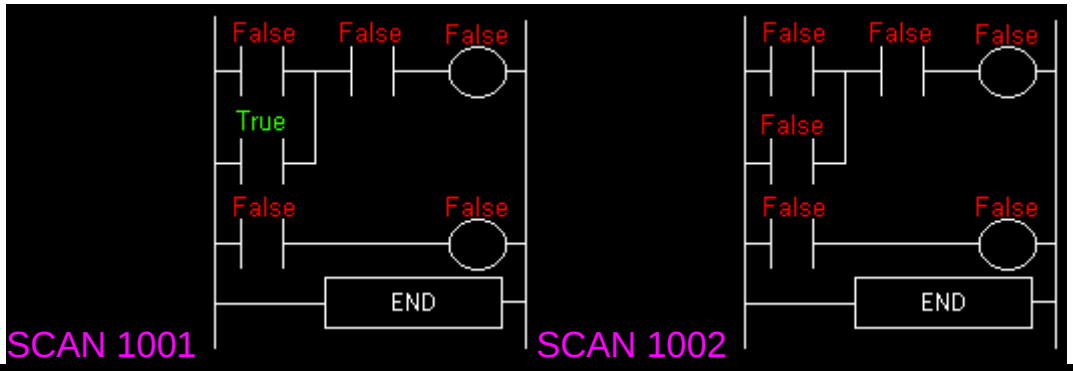
Gradually the tank fills because 500(fill motor) is on.

After 100 scans the oil level rises above the low level sensor and it becomes open.(i.e.FALSE)



Notice that even when the low level sensor is false there is still a path of true logic from left to right. This is why we used an internal relay. Relay 1000 is latching the output(500) on. It will stay this way until there is no true logic path from left to right.(i.e. when 0001 becomes false)

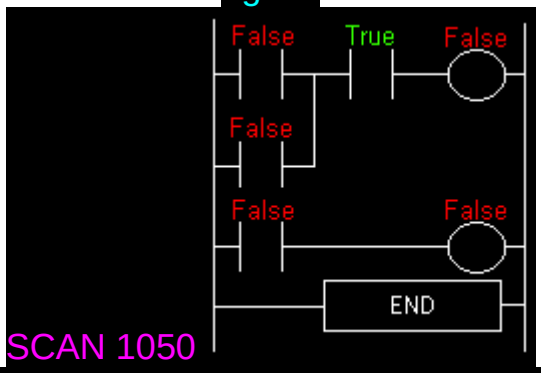
After 1000 scans the oil level rises above the high level sensor at it also becomes open(i.e.false)



SCAN 1001 SCAN 1002

Since there is no more true logic path, output 500 is no longer energized(true) and therefore the motor turns off.

After 1050 scans the oil level falls below the high level sensor and it will become true again.

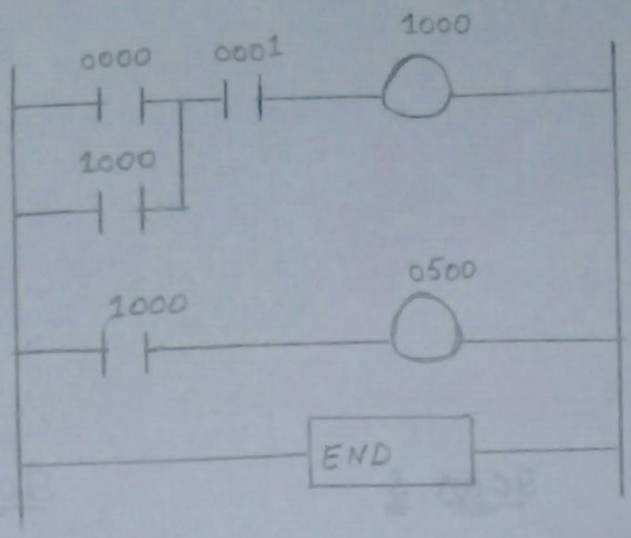


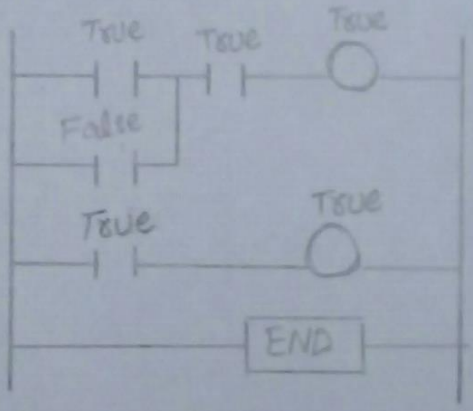
SCAN 1050

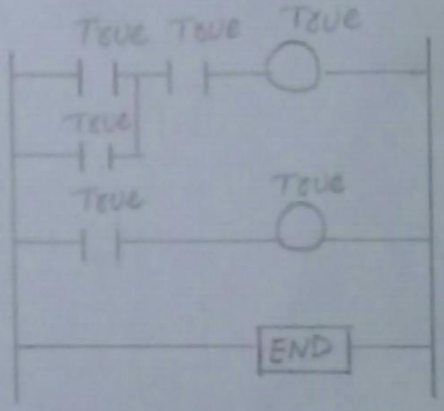
Notice that even though the high level sensor became true there still is NO continuous true logic path and therefore coil 1000 remains false!!!

After 2000 scans the oil level falls below the low level sensor and it will also become true again. At this point the logic will appear the same as SCAN 1 above and the logic will repeat as illustrated above.

Ladder Diagram:





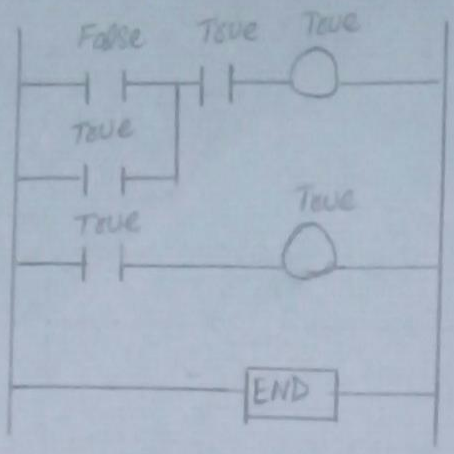


Scan 1

⇒ Initially the tank is empty therefore the Input 0000 is True & Input 0001 is also True

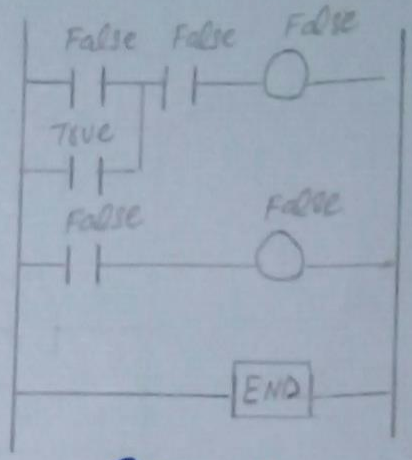
Scan 2

⇒ The Internal Relay is turned ON as the water level rises.



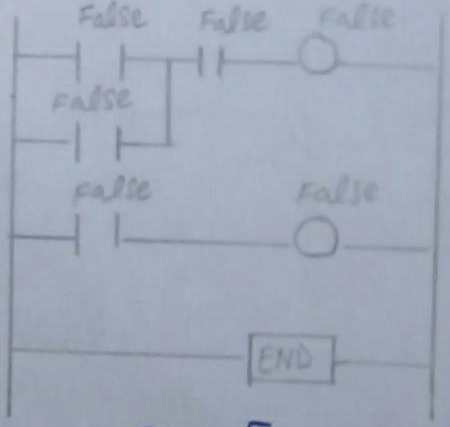
Scan 3

⇒ After Scan 2 the oil level rises above the low level sensor & it becomes open (i-e FALSE)



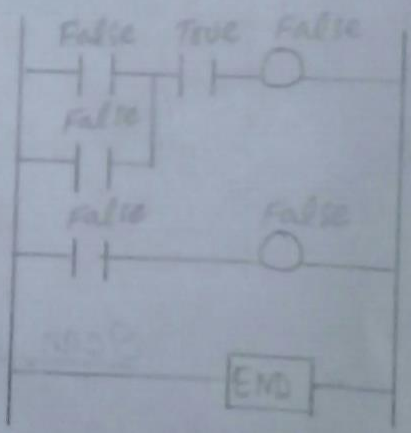
Scan 4

⇒ After all 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 500 is no longer energised (true) & therefore the motor turns OFF



Scan 6

⇒ After Scan 6 the oil level falls below the high level sensor & it will become true again

Question#02

Part(A)

Benefits of Industrial Automation:

1. Increasing Productivity:

–Increased productivity = more units/day = more money

2. Products produced more consistently:

–increased consistency = higher quality = increased consumer satisfaction

–Example -A bottled soft drink such as a Coke or a Pepsi always tastes the same no matter where or when you purchase it. Consumers count on this.

3. Products produced more reliably:

–robots can run 24 hours/day without getting tired or bored.

4. Decreased labor expenses:

–Automated systems reduce the amount of people needed to produce the goods.

5. Increasing Safety in working conditions

Part (B)

- ## Components of SCADA System:

1. **Sensors** (either digital or analog) with 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. **Communications network** that connects the SCADA master unit to the RTUs in the field.

- ## Functions of SCADA system:

1. Data Acquisition
2. Network data communication
3. Data presentation
4. Control

Data Acquisition:

First, the systems you need to monitor are much more complex than just one machine with one output. So a real-life SCADA system needs to monitor hundreds or thousands of sensors. Some sensors measure inputs into the system (for example, water flowing into a reservoir), and some sensors measure outputs (like valve pressure as water is released from the reservoir). Some of those sensors measure simple events that can be detected by a straightforward on/off switch, called a discrete input (or digital input).

Network data communication:

In real life, you want to be able to monitor multiple systems from a central location, so you need a communications network to transport all the data collected from your sensors.

Data presentation:

A real SCADA system reports to human operators over a specialized computer that is variously called a master station, an HMI (Human-Machine Interface) or an HCI (Human-Computer Interface). The SCADA master station has several different functions. The master continuously monitors all sensors and alerts the operator when there is an “alarm” — that is, when a control factor is operating outside what is defined as its normal operation.

Control:

human operator also has a button on his control panel. When he presses the button, it activates a switch on the widget fabricator that brings more widget parts into the fabricator.

Question#03

Part (A)

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.

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)

Part (B)

Functions of SCADA system:

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The End