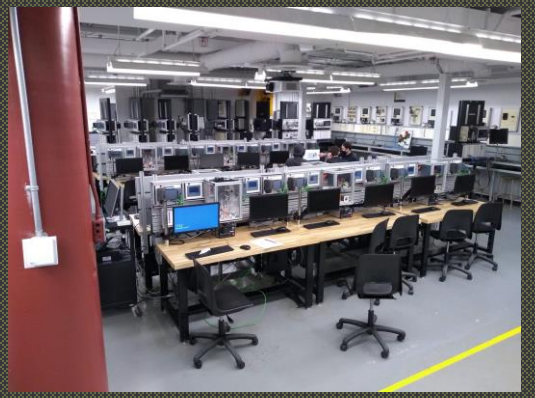


PROGRAMMABLE LOGIC CONTROLLERS
MENG 3500

HUMBER

PROGRAMMABLE LOGIC CONTROLLERS

1. Wiring of Digital I/O
2. Wiring of Analog I/O
3. Data format / Types
4. Addressing
5. Scaling analog inputs and analog outputs – show calculations
6. Function Charts /
7. Ladder Logic
8. Function Block
9. Structured Text
11. Use of specific instructions such as TOF, CTD, TOD, FRD to specify the program requirement.
12. Short answer questions from FTME, FTSE, and PLC maintenance, safety, and troubleshooting.

Please note: Test questions will differ from those in this review.

PROGRAMMABLE LOGIC CONTROLLERS

1. Wiring of Digital I/O

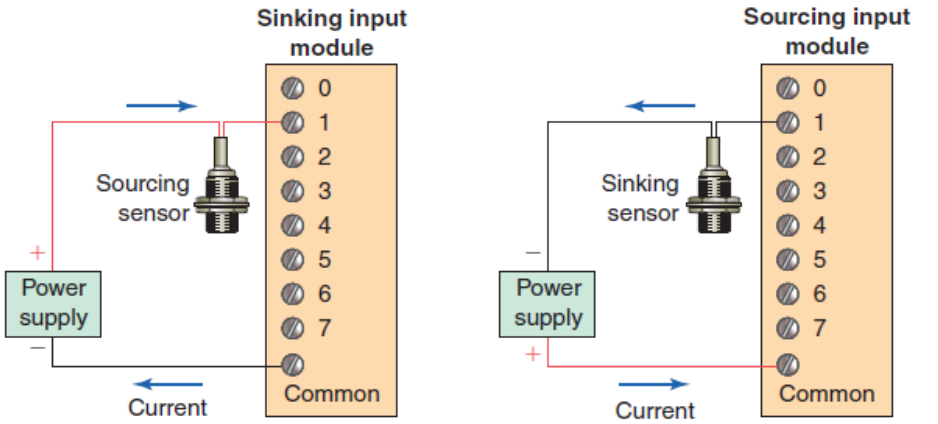


Figure 2-20 Sinking and sourcing inputs.

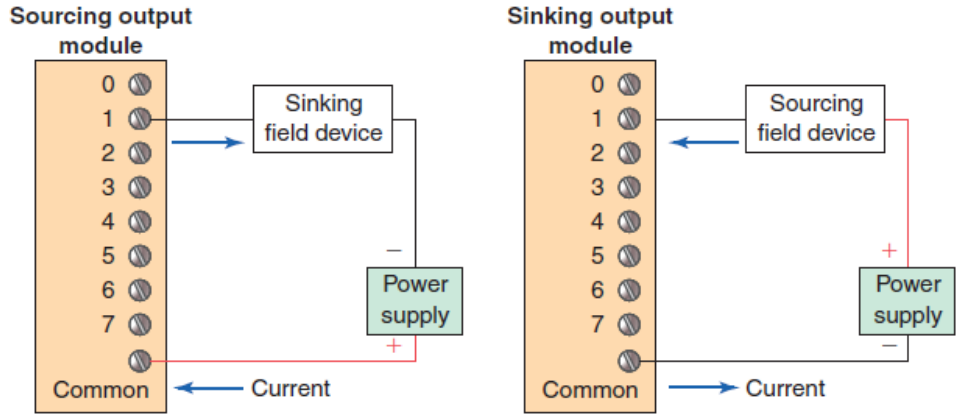
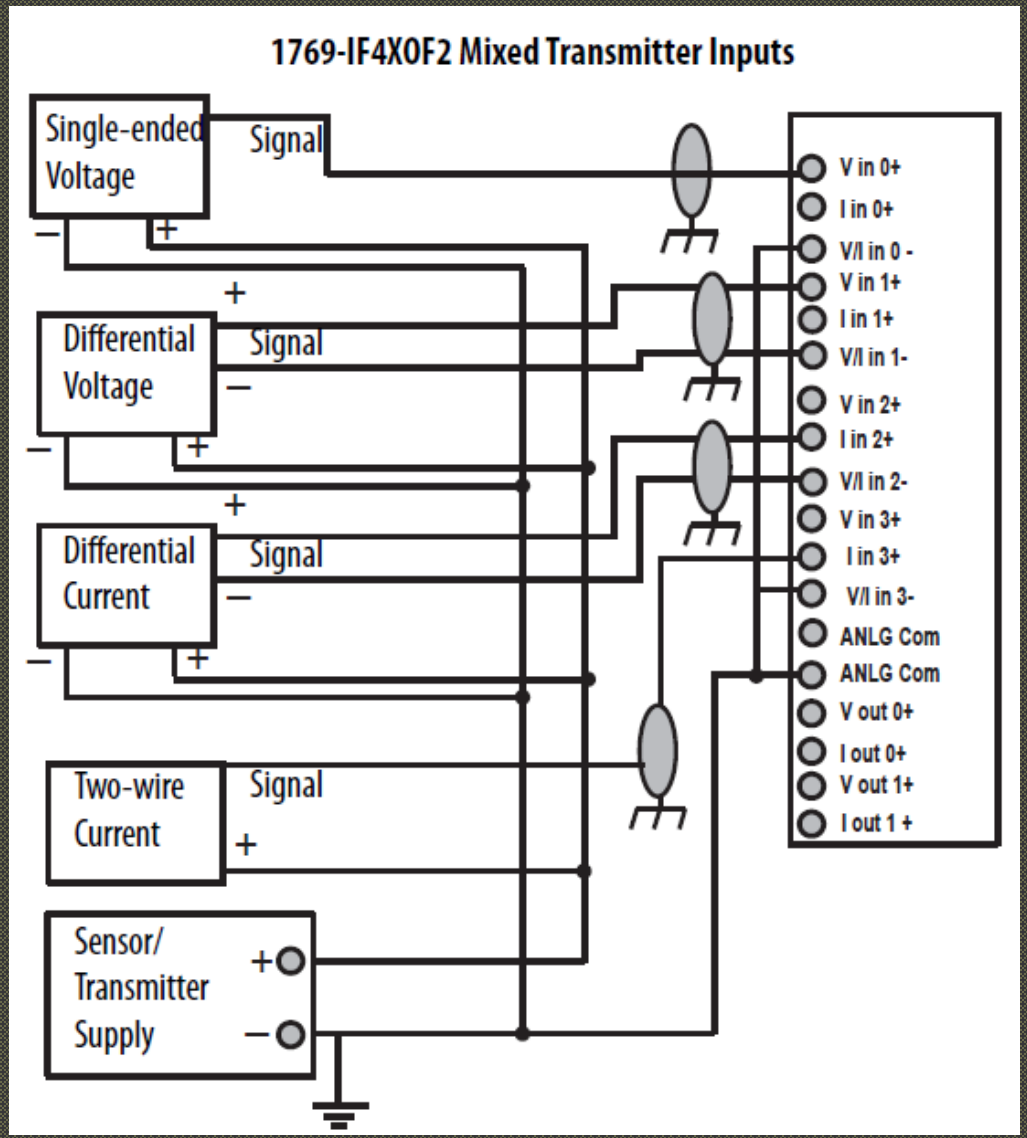


Figure 2-21 Sinking and sourcing outputs.

2. Wiring of Analog I/O



3. Data format / Types

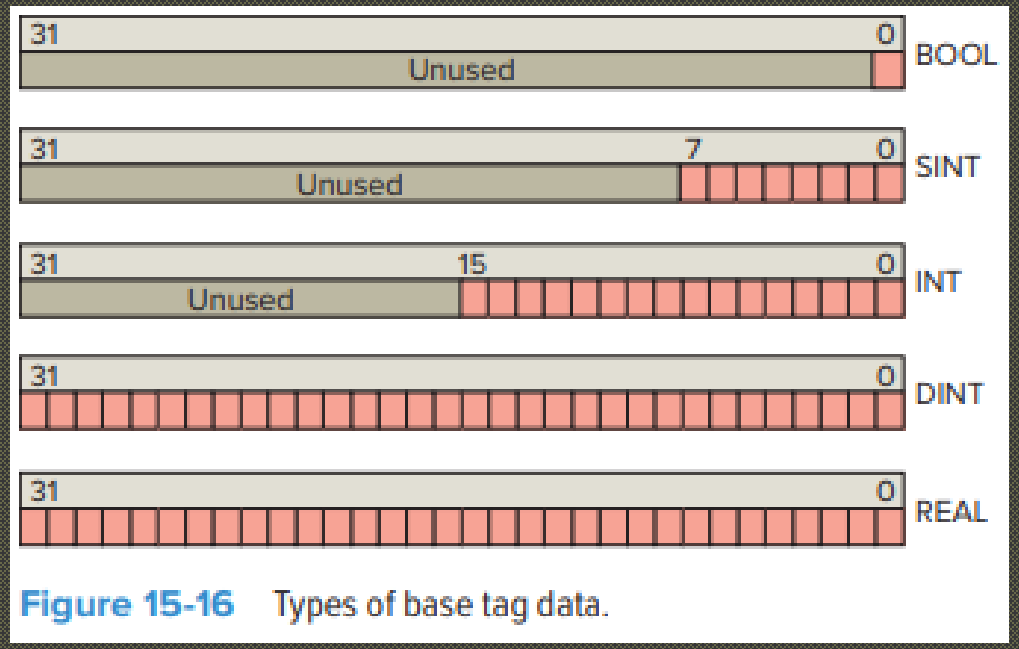


Figure 15-16 Types of base tag data.

4. Addressing

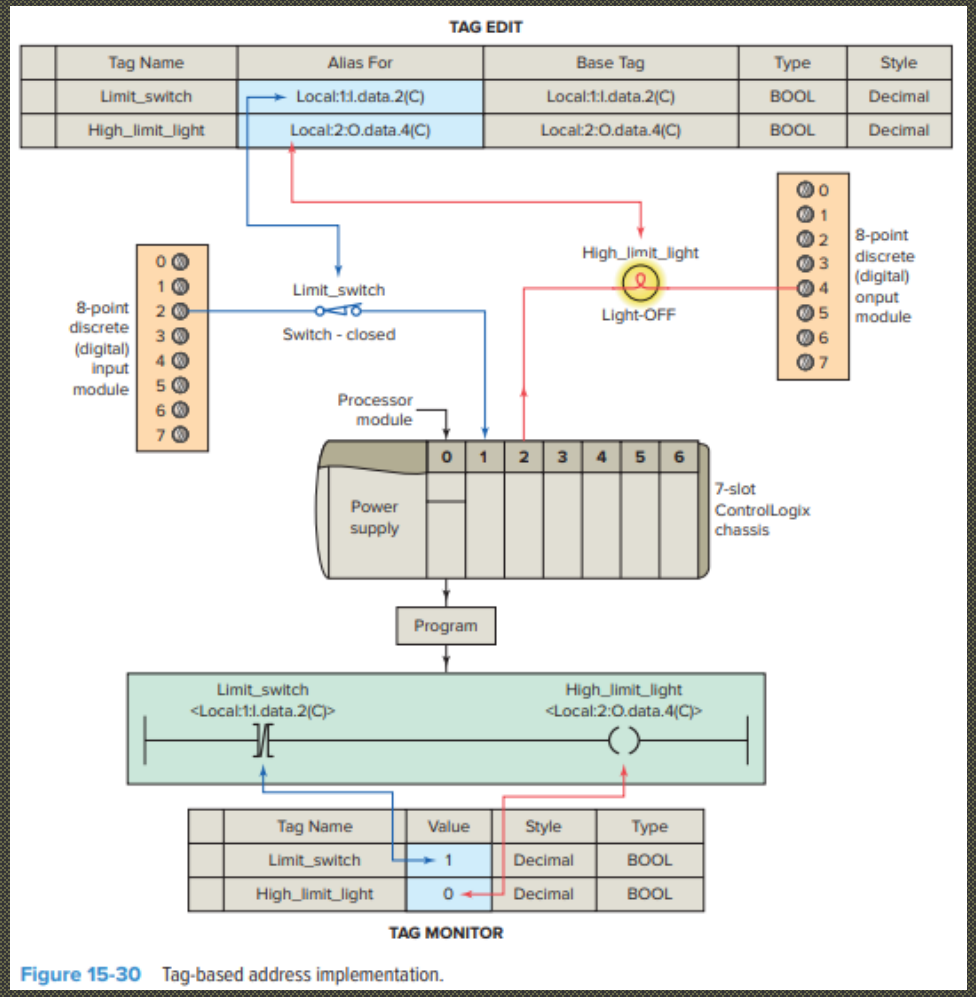


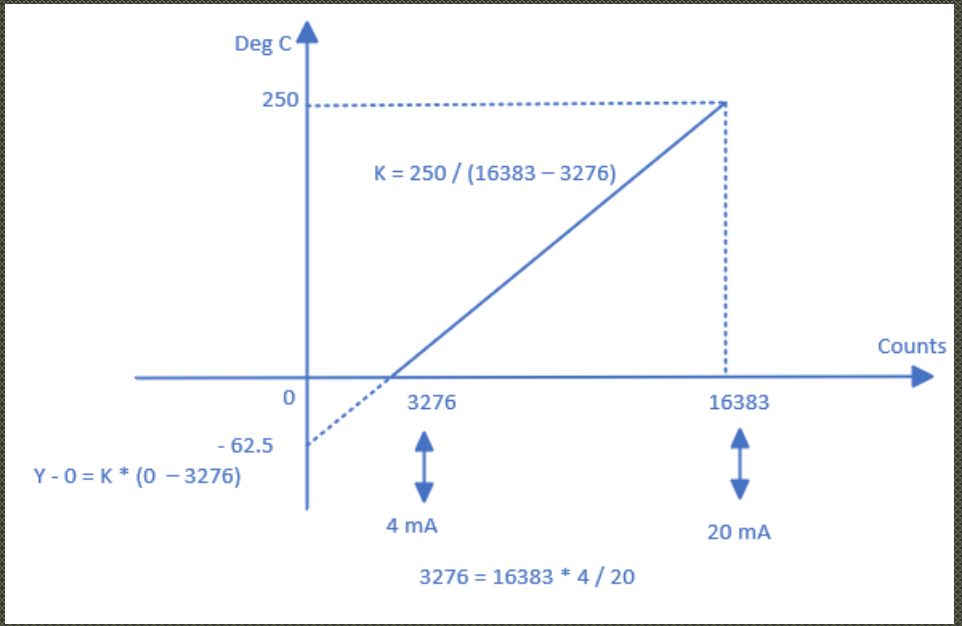
Figure 15-30 Tag-based address implementation.

Address of an analog input: Local:3:I.Ch0Data (assuming analog input module is located in Slot 3)

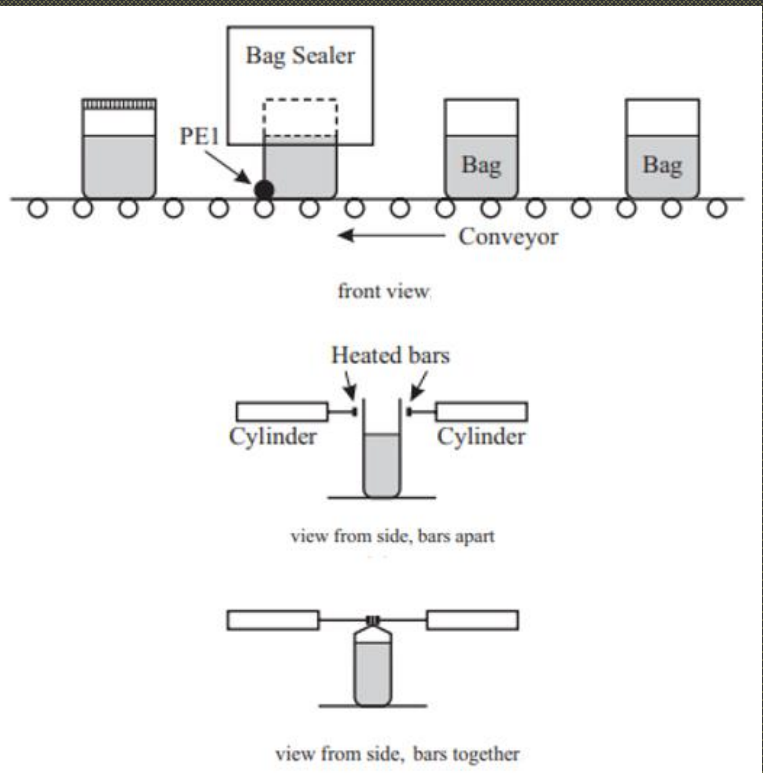
Adress of an analog output: Local:4:O.Ch1Data (assuming analog input module is located in Slot 4)

5. Scaling analog inputs and analog outputs – show calculations

- A temperature transmitter provides 4 – 20 mA for temperature in the range of 0 – 250 ^{0}C
- The transmitter is connected to an analog module with 14 – bit resolution
- Scale the temperature in the engineering units

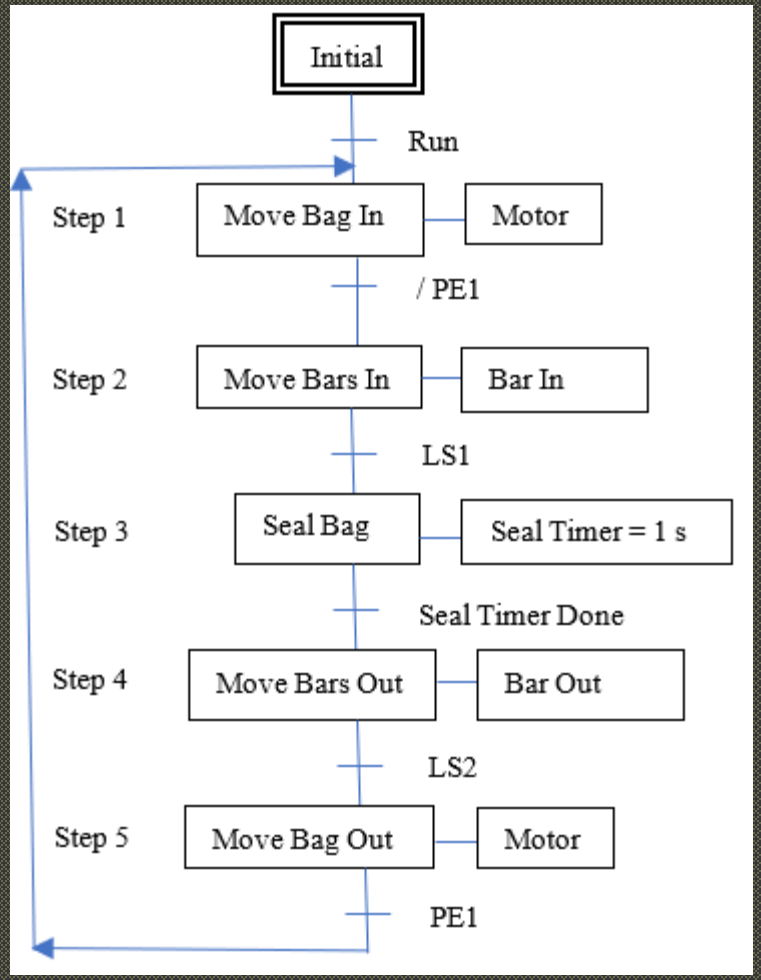


6. Function Charts – Bag Sealing Station Control
The question may include the Sequential Technique Ladder Program



- Upon startup, the conveyor motor is ON until the photoelectric "eye" PE1 senses a bag in the station.
- When a bag is in the station, the conveyor is stopped, and the bag is sealed by the following steps:
  - 1. A mechanism using air cylinders is used to push two heated bars together (one bar on each side of the bag),
  - 2. The bars are held together for 1 second, and
  - 3. The bars are moved apart.

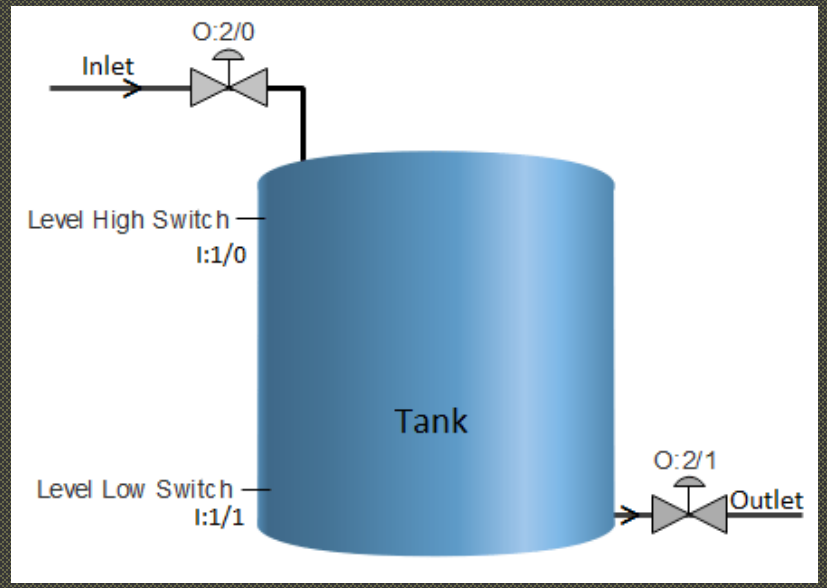
  The mechanism used to move the heated bars is driven by a double-action linear pneumatic cylinder controlled by two outputs. Once a direction output is energized, the mechanism moves and keeps moving as long as power is applied (turned on). The mechanism stops at its current position when power is removed (turned off). The mechanism will not move if both opposing directions are energized simultaneously (e.g., out and in).
    - Limit switch LS1 is on when the two heated bars are together.
    - Limit switch LS2 is on when the bars have been moved sufficiently far apart.
- When the bag-sealing operation is complete (bars have been moved apart), the conveyor motor is turned on. The sealed bag is moved out of the station, and the conveyor continues to run until a new bag moves into the station. Thus, the operation repeats. Assume there is a gap between the bags, so that the photoelectric "eye" will also sense that there is no bag in the station after the sealed bag is moved out.

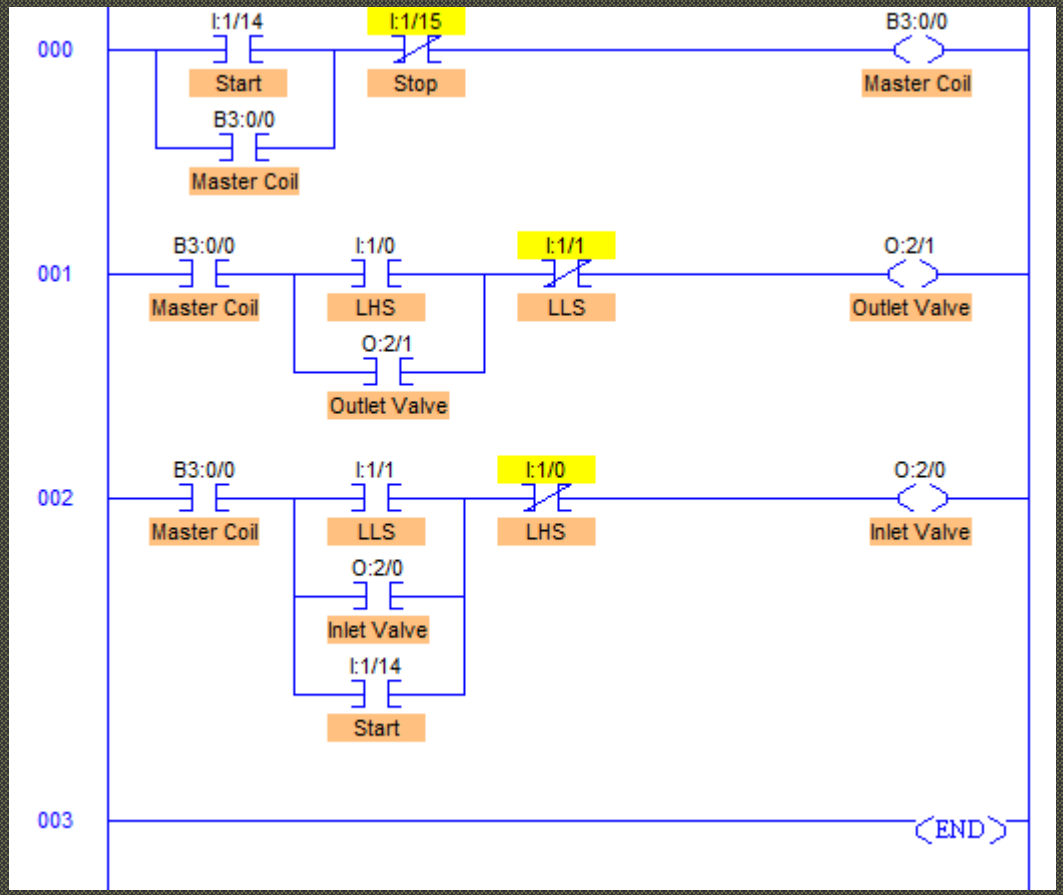


HUMBER

PROGRAMMABLE LOGIC CONTROLLERS

7. Ladder Logic
8. Function Block – same nature question as in the lab / lecture
9. Structured Text – same nature question as in the lab / lecture

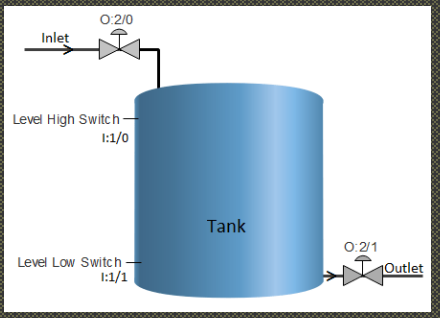




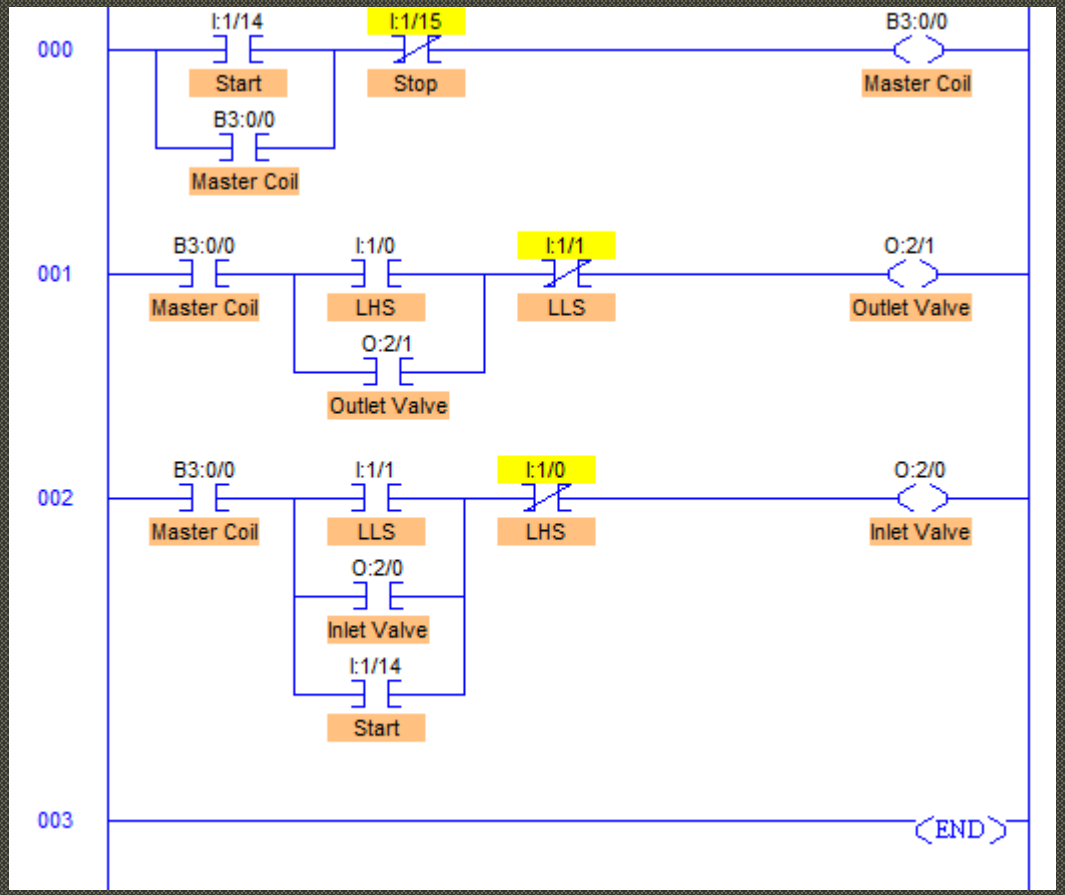
One open tank is installed in the plant of which liquid level is to be controlled. When level reaches the Level Low, Outlet flow is blocked and inlet flow is allowed until high level is achieved. And when Level High is detected, outlet flow is allowed and inlet flow is blocked.

HUMBER

PROGRAMMABLE LOGIC CONTROLLERS



7. Ladder Logic
8. Function Block – same nature question as in the lab / lecture
9. Structured Text – same nature question as in the lab / lecture



- RUNG000 is simply for latching a coil and master start-stop buttons.
- RUNG001 is to control the outlet valve through O:2/1. This is done when Level High is detected.
- Latching of Output O:2/1 is done because when High Level is detected, input to RUNG001 is temporary, like Push Button. So in order to keep outlet valve open until the Level Low I:1/1 is detected, latching is done. XIO of Level Low Switch is connected in series so that when Level Low is detected, it goes true closing the outlet valve.
- Similarly in RUNG002, it works exactly same. The only difference in RUNG002 is that extra I:1/14 contact in parallel with LLS.
- Suppose when the system is started and the tank is partially filled, neither LHS nor LLS is detected, in this case, outlet and inlet valves remain closed while inlet valve should open to start filling the tank because it's partially filled.
- To eliminate this error, I:1/14 (Start) is connected in parallel to LLS I:1/1 contact. This checks if LHS (I:1/0) is detected or not. If LHS is not detected, then it opens the inlet valve until LHS is detected.

Discuss the status of I:1/0 and I:1/1

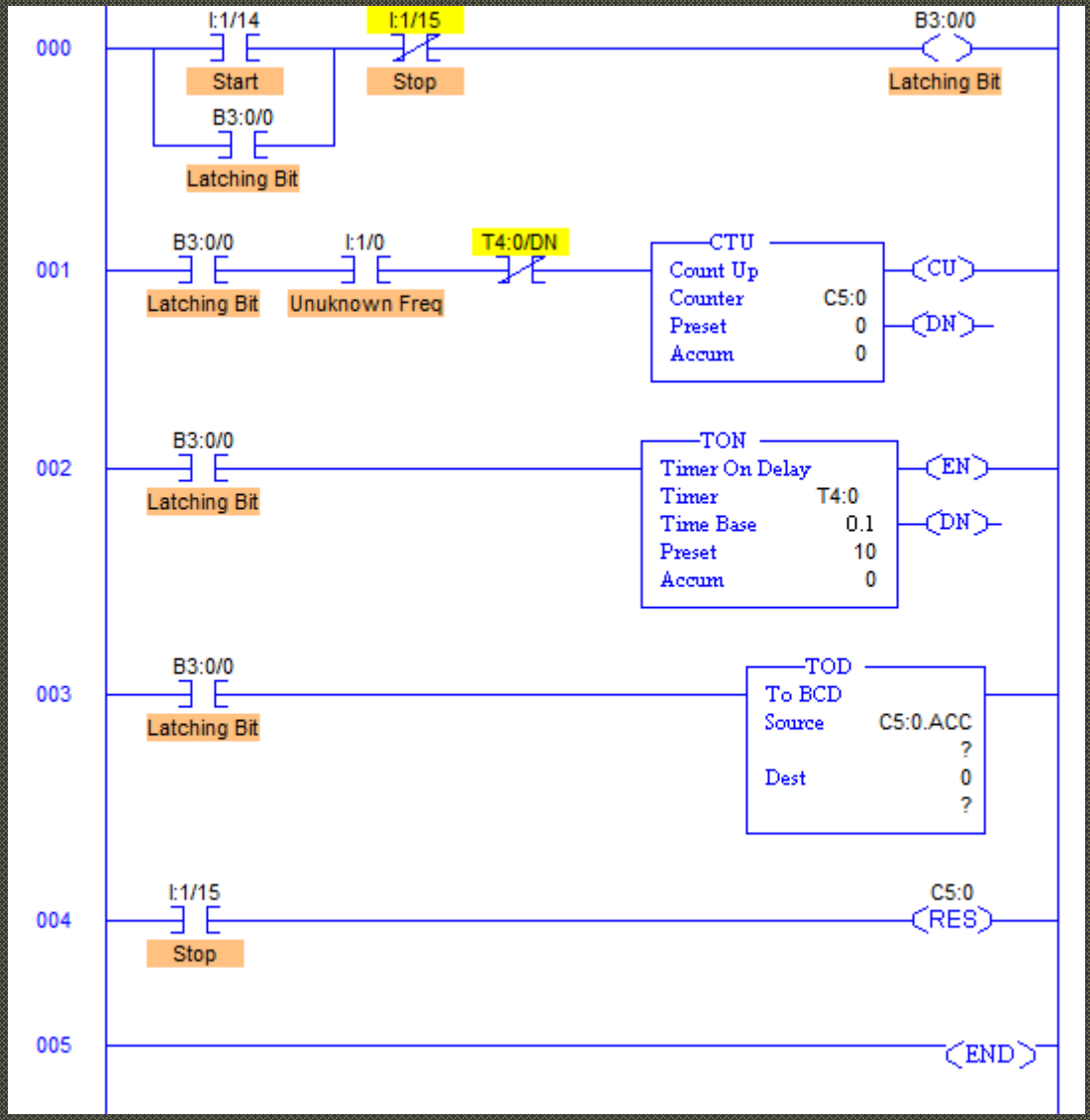
HUMBER

PROGRAMMABLE LOGIC CONTROLLERS

7. Ladder Logic
8. Function Block – same nature question as in the lab / lecture
9. Structured Text – same nature question as in the lab / lecture

Measure and display unknown frequency.

- Latching bit is connected in series with all the rungs except -(RES)- to stop the measuring process.
- Whenever it is required to measure the unknown frequency, I:1/14 Start PB is pressed which activates the latching rung hence timer is started, and counter also allows the pulses to increment accumulator value.
- This is stopped by T4:0/DN bit when 1sec is over.
- Stop PB I:1/15 input resets counter and timer both.
- Accumulator value is converted into corresponding BCD number and fed to Display with address O:6.

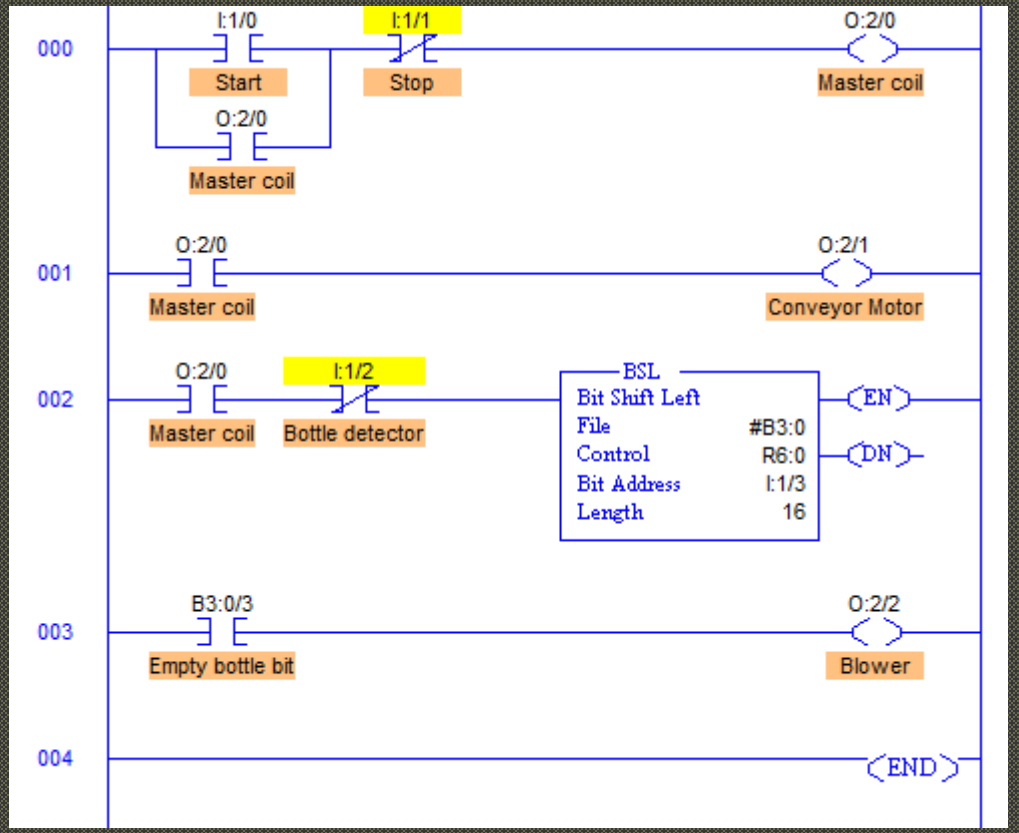


HUMBER

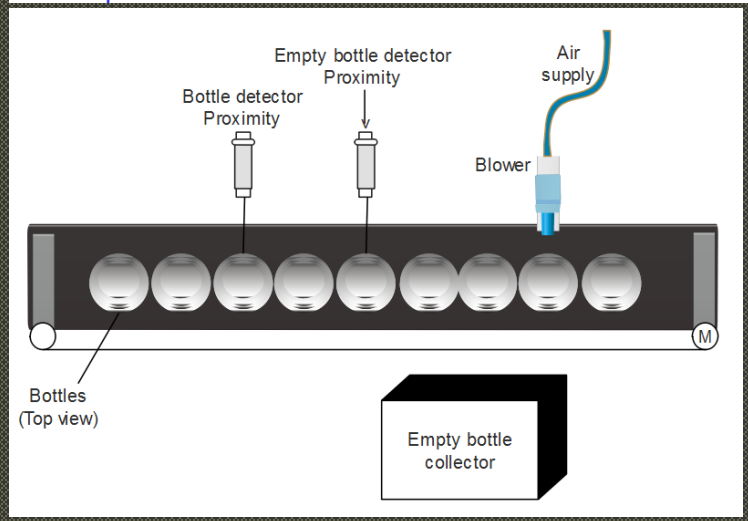
PROGRAMMABLE LOGIC CONTROLLERS

7. Ladder Logic
8. Function Block – same nature question as in the lab / lecture
9. Structured Text – same nature question as in the lab / lecture

After filling process, bottles are moved on the conveyor belt for packing process. Detect if any empty bottle is left on the conveyor and remove it from the conveyor.



- When the system is started, conveyor motor coil with address O:2/1 is energized.
- RUNG002 and RUNG003 are used to operate bit shift register and Blower with address O:2/2.
- Whenever conveyor motor is in RUN mode, empty bottles detected by the proximity sensor with input I:1/3, it sets B3:0/0 bit and is shifted left every time a bottle is detected by bottle proximity with address I:1/2.
- From proximity to blower, distance is 4 steps. Hence bit B3:0/3 of B3:0 register is used to operate blower.
- When B3:3/0 bit is set that is when empty bottle is detected by input I:1/3, after 4 steps, blower is activated and the empty bottle is removed.



HUMBER

PROGRAMMABLE LOGIC CONTROLLERS

7. Ladder Logic
8. Function Block – same nature question as in the lab / lecture
9. Structured Text – same nature question as in the lab / lecture

Problem Description

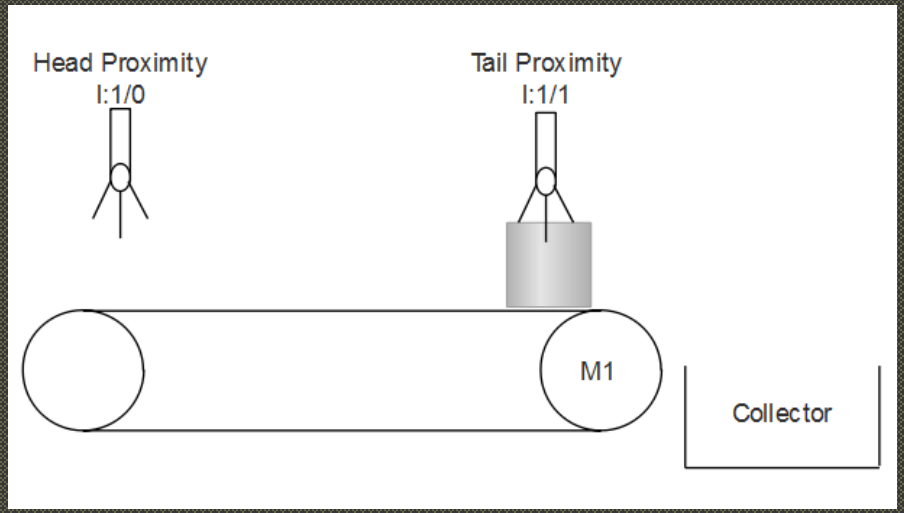
There are certain objects moving on conveyor belt. Time of an object to reach from one end to another end of the conveyor is to be measured. Implement this in PLC using Ladder Diagram programming language.

PROGRAMMABLE LOGIC CONTROLLERS

7. Ladder Logic
8. Function Block – same nature question as in the lab / lecture
9. Structured Text – same nature question as in the lab / lecture

Problem Solution

- Install two proximity switches, one at the head end and another at the tail end.
- When first proximity detects an object, it latches and output starting timer.
- When another proximity placed at the tail end detects the same object, timer is stopped.
- Move preset value to any register or output displays.
- This shows time taken by an event.



HUMBER

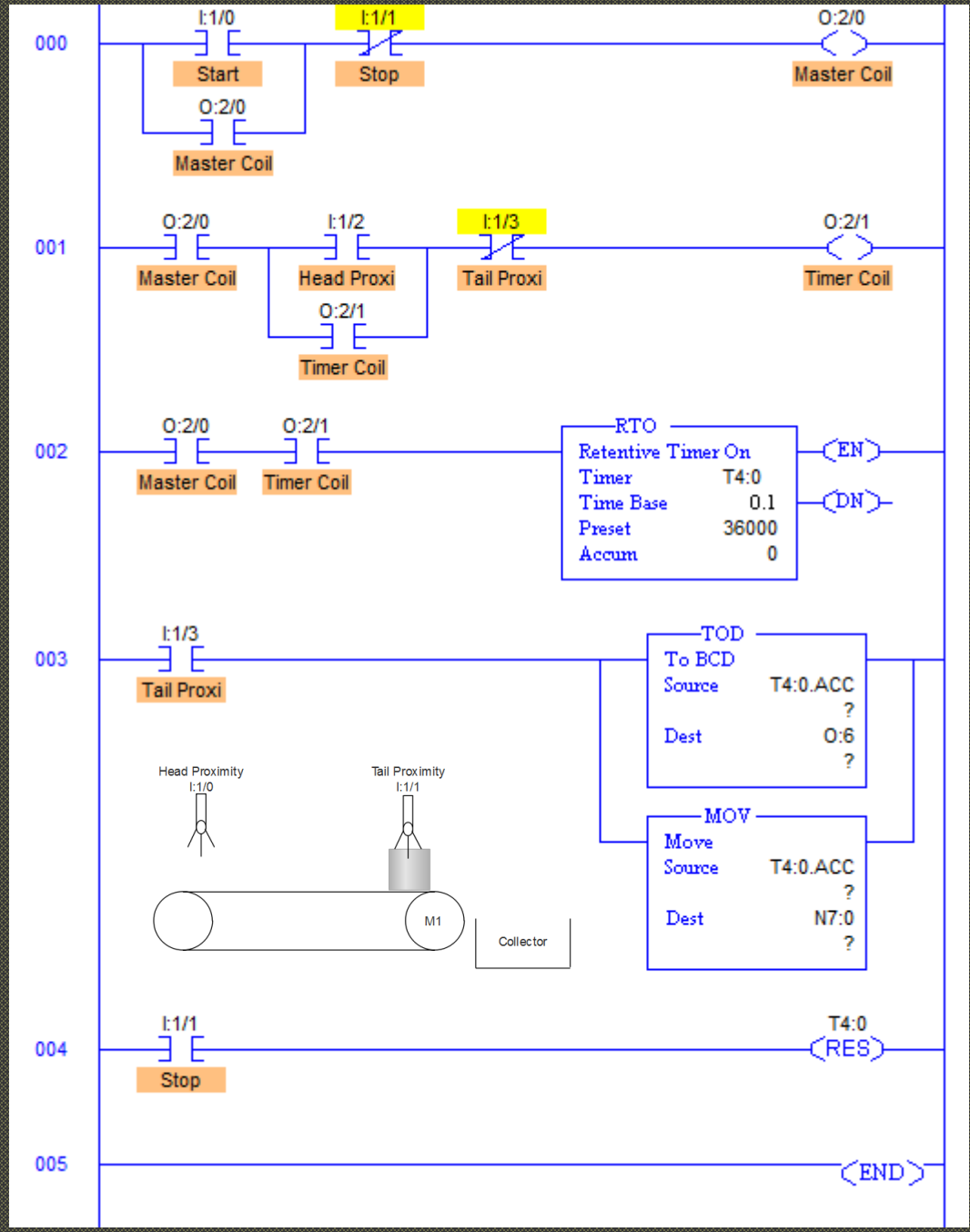
PROGRAMMABLE LOGIC CONTROLLERS

7. Ladder Logic
8. Function Block – same nature question as in the lab / lecture
9. Structured Text – same nature question as in the lab / lecture

Problem Solution

- RUNG001 & RUNG002 operate Timer T4:0 through Timer Coil O:2/1. When Head Proximity Switch detects an object, it latches timer coil activating Timer T4:0.
- RUNG003 operates moving and converting of timer accumulator value. When Tail Proximity detects an object, this de-energizes Timer Coil stopping timer T4:0. And as soon as timer stops when I:1/3, it activates RUNG003 and TOD and MOV instruction are executed.
- MOV instruction moves T4:0.ACC value intro register N7:0 and TOD instruction converts Decimal data into equivalent BCD code to operate Display with address O:6. Digits displayed on the display is time taken by an event.

Retentive timer is used here so that when Tail Proximity detects the object and Master Coil is de-energized, value in the accumulator do not change.



PROGRAMMABLE LOGIC CONTROLLERS

11. Use of specific instructions such as TOF, CTD, TOD, FRD to specify the program requirement.
12. Short answer questions from FTME, FTSE, and PLC maintenance, safety, and troubleshooting.

Thank you!

Discussions?