

Industrial Automation (EPM422s) Assignment 1

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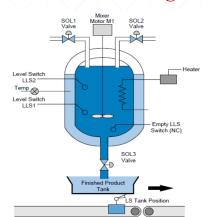
Objectives:

Application 3 – Batching Control

- 1. Two ingredients, A and B, will be mixed in the reactor tank. The reactor tank must be empty (indicated by the normally closed liquid level switch LLS) before ingredient A can be added.
- The mixer motor must be off to avoid liquid precipitation, and the finished product tank should be in a set position, which the limit switch detects.
- 3. The controller will add ingredient A by opening solenoid valve 1 (SOL1) until LLS1, which is normally open, detects the quantity of ingredient A in the tank. At this point, the controller will add ingredient B by opening SOL2. LLS2 detects the quantity of ingredient B.
- 4. When the reactor tank contains both ingredients, the controller will turn ON the mixer for two minutes and raise the temperature to 100°C.
- 5. SOL3 will activate the drain valve when the mixing is completed and the temperature sensor detect that the temperature of mixture equal to 100°C.
- 6. This operation will reset the process until another finished product tank is placed in position, and the cycle starts again.

Input	Device	Output	Device
I0.0	Start PB (NO)	Q0.0	Solenoid valve 1 (A)
I0.1	Stop PB (NC)	Q0.1	Solenoid valve 2 (B)
I0.2	Tank position LS	Q0.2	Mixer Motor (M1)
I0.3	Empty LLS (NC)	Q0.3	Solenoid valve 3 (drain)
I0.4	Low Level LLS1	Q0.4	Heater coil
I0.5	High Level LLS2	Q0.5	Start System PL
I0.6	Temperature Sensor	Q0.6	PL Heater ON

Application 3 – Batching Control



Answer Using Code Sys:

1- Defining Variables:

```
PROGRAM PLC PRG
      //Inputs I
      Start PB AT %IX0.0: BOOL := FALSE;
      Stop PB AT %IX0.1: BOOL := TRUE;
      Tank LS AT %IX0.2: BOOL := FALSE; //True when the tank is in place under the mixer
      Empty LLS AT %IX0.3: BOOL := TRUE; //True when tank is not empty, False when tank is empty
      LLS1 AT %IX0.4: BOOL := FALSE; // True when the water is above this leve
      LLS2 AT %IX0.5: BOOL := FALSE; //True when the water is above this leve
10
      Temp Sensor AT %IX0.6: BOOL := FALSE; // True when Heat is 100 C degrees or more
 13
           //Outputs Q
 14
           Valve1 AT %OX0.0: BOOL := FALSE;
 15
           Valve2 AT %QX0.1: BOOL := FALSE;
 16
           Motor AT %QX0.2: BOOL := FALSE;
 17
           Valve3 AT %QX0.3: BOOL := FALSE;
 18
           Heater AT %QX0.4: BOOL := FALSE;
 19
           Pilot Lamp For System AT %QX0.5: BOOL := FALSE;
 20
           Pilot Lamp For Heater AT %QX0.6: BOOL := FALSE;
              //Markers M
              Marker1 AT %MX0.0: BOOL := FALSE;
              Marker2 AT %MX0.1: BOOL := FALSE;
              Marker3 AT %MX0.2: BOOL := FALSE;
              //Timers T
  30
              Timer: TOF;
  31
              Elapsed Time: TIME;
  32
              R TRIG 0: R TRIG;
  33
              Timer Output: BOOL;
  34
  35
         END VAR
```

2-Ladder Diagram:

```
Stop_PB
                                                                                                                                                                                                  Marker1
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                                    Tank_LS
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                                   Tank_LS
    -
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                                     -\parallel\parallel
                                                                                                                                                                                                           -( )
                  R_TRIG_0
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  Marker3
                   R_TRIG
                                  Timer_Output
                                                    IN Q ET - Elapsed_Time
                                       T#120S --- PT
```

3-Simulation:

Step1: At Start.



Step2: Start Button Pushed and Tank is put in place under the mixer.



Step3: LLS1 is triggered.



Step4: LLS2 is triggered.



Step5: Timer counted 2 minutes.



Step5: Temperature Reached 100 c triggering the temperature sensor.



Step6: Mixer is empty.



Step7: Stop Button Pushed.



Hand Writing Answer:

Note: I did minor edits in the simulation version on Code Sys.

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