University of Jordan
School of Engineering
Department of Mechatronics Engineering
Automation and Process Control Lab (0908462)
Batch Mixing Control

Objective

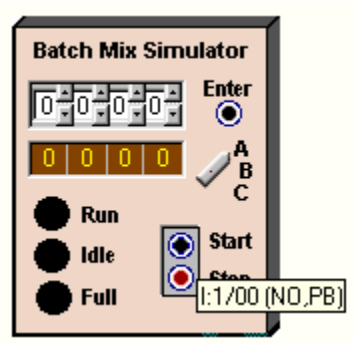
To be familiar with basic counter logic.

Pre-lab Preparation:

Read Chapter 4

Procedure:

From the Simulations Menu at the top of the screen, Select the Batch Mixing Simulation.



Exercise #1 -- Filling the Batch Mixing Tank

Using your knowledge of PLC counters, design a program to meet the following requirements:

- When the Start switch (I:1/0) is pressed, pump P1 will be energized and the tank will start to fill. The pulses generated by Flowmeter 1 should be used to increment a counter.
- When the count reaches a value where the tank is approximately 90% full, the pump is to be shut-off and and the control panels FULL light is to be energized.
- The filling operation is to halt immediately if the stop switch is pressed.
- While testing, utilize the "Reset Simulation" and the "Reset Timers and Counters" entries in the Simulations menu to re-start your program.

Exercise #2 -- Emptying the Batch Mix Tank

Modify your program so that it meets the following additional requirements:

- The mixer will run for 8 seconds once the tank is full.
- When the mixing is complete, drain pump P3 is to be started and the tank is to be drained. Flowmeter 3 will be employed to decrement the existing counter, and draining will be allowed to continue till the counters accumulator reaches zero.
- Once the tank is empty again, pressing the Start switch will cause the sequence to repeat.

Exercise #3 -- Continuous Operation

Modify your program so that the filling and emptying sequence will repeat continuously once it has been started by the initial pressing of the Start switch.

- Ensure that the RUN light is energized when the mixer or either pump is running.
- The STANDBY light should light and the process should halt when the Stop button is pressed.
- The process should restart where it left off if the the Start button is pressed following a Stop.

Exercise #4 -- Single Batch Mode of Operation

Using your knowledge of PLCs, design a program to meet the following criteria:

- **When the 3 position Selector Switch is in position "A".** The batch mixing process will run in a single batch mode. The operator may start the batch mix sequence by momentarily pressing the Start Switch.
- Once a batch sequence has begun, the sequence may be stopped and resumed at any time using the Stop and Start switches.
- The tank is to be filled with a mixture obtained from the separate fill lines utilizing fill pumps P1 and P2. A counter will track the quantity of product obtained from Line 1 (P1) while the remainder will come from Line 2 (P2). The mixture ratio of the product will be controllable by adjusting the counter's preset. The tank is to be filled to the point where the Hi-Level sensor goes true.
- When filling is complete, the Full light will turn On. Heater O:2/04 and Mixer O:2/00 will be started allowing the mixture to begin heating. Thermostat I:1/02 will be employed to control the temperature.
- The mixer will continue to run for 4 seconds after the mixture reaches the desired temperature. When the mixer stops, pump P3 will be used to drain the product from the tank. The tank will be drained to the point where the Lo-Level sensor trips.
- Once emptied, a new single batch sequence may again be started by pressing the Start Switch while the Selector switch is in position "A".

Exercise #5 -- Multiple Batch Mode of Operation

Enhance your program to include the following features:

- **When the 3 position Selector Switch is in position "B".** The process will produce multiple batches, the number of batches produced will be operator selectable, and the current batch count will be displayed on the Control panel's LED display.
- The operator will be able to enter the desired batch count using the control panel thumbwheel switches.
- The operator will be able to set the product ratio by entering the desired product one percentage via the control panel thumbwheel switches.