Name: _____

Name: _____

ME430 Mechatronic Systems:

Lab 9: Programmable Logic Controllers.

The lab team has successfully demonstrated the:

Part (A) Conveyor Belt Can Sorter Controller

_____ Computer Simulation

_____ Actual Hardware

Part (B) Tank Fill/Mix Controller

_____ Computer Simulation

_____ Actual Hardware

Part (A) Conveyer Belt Can Sorter Controller

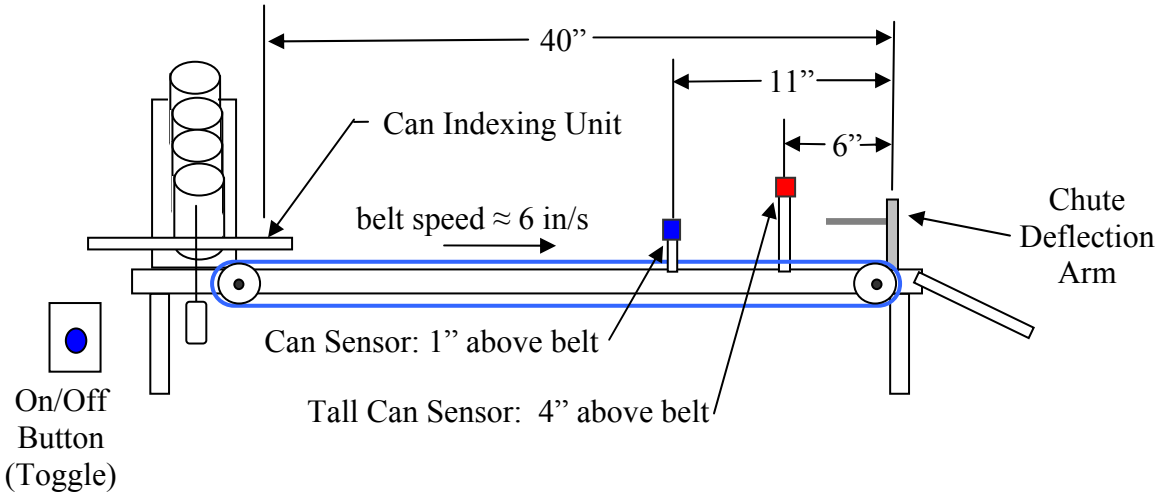
We want to create a ladder logic program to sort tall cans and short cans arriving on a conveyer belt—the short cans go in one box and the tall cans go in another box. We will stop after we have sorted four tall cans into the tall can box.

Unlike the system in Part B, this system does not gain much from analysis using finite state machine concepts—you are better off simply implementing each of the desired processes as a line or two of ladder logic. You will create the program using the Picosoft program, get it running in the simulator, get it checked off by your instructor, bring your computer to the actual hardware setup, download your program, and verify that it really works.

The actual PLC hardware uses 120 VAC power. This can hurt you.

Desired Processes: (We assume that there is a can on the belt when we begin.)

1. When we press the On/Off Button, the power to the system should toggle: it should turn on if it was off and turn off if it was on. (Hint: try using an Impulse Relay in PicoSoft to implement this function.)
2. When a can passes the Can Sensor the Can Indexing Unit should turn on for about 0.5 seconds in order to load another can on the belt.
3. If a can activates the Tall Can Sensor, the Chute Deflection Arm should turn on to divert the can into the box of tall cans. The Chute Deflection Arm should stay activated long enough for the can to go into the box. (Hint: The belt speed and some useful dimensions are given on the diagram below.)
4. After the fourth tall can has gone into the tall can box, the system should shut off. It should be possible to restart the entire process by manually pressing the On/Off Button.

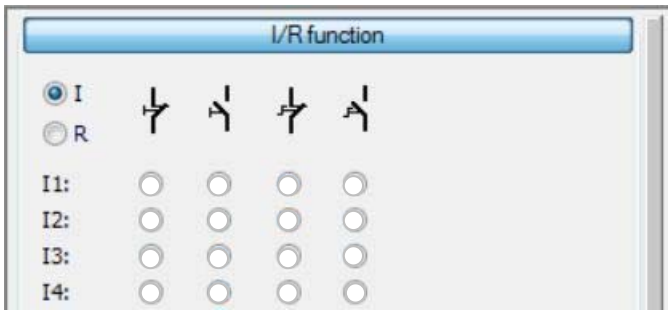


Hardware Connections:

There are three sensor inputs:

I1	Tall Can Sensor	Momentary	Normally Open	Made=Found Tall Can
I2	Can Sensor	Momentary	Normally Open	Made=Found Can
I3	On/Off Button	Momentary	Normally Open	Made=Toggle On/Off

How must you set the switches in the PicoSoft program? (Mark on the figure below.)



We can control three outputs:

Q1	Chute Deflection Arm
Q2	Can Indexing Unit
Q3	System Power

Create a PicoSoft ladder logic program to control this sequence of operations. (Try simply implementing each of the Desired Processes 1-4 as a line or two of ladder logic, without developing a finite state machine.) Run your program in the simulator and confirm that it works. When you are satisfied that it is working correctly, call your instructor over to check your simulation and sign off on the front page.

Once you are checked off on the simulator, you may bring your computer to the actual conveyor belt and (with an instructor's assistance) download and test your controller. Remind the instructor to check you off on the front page when this works.

Part (B) Tank Fill/Mix Controller

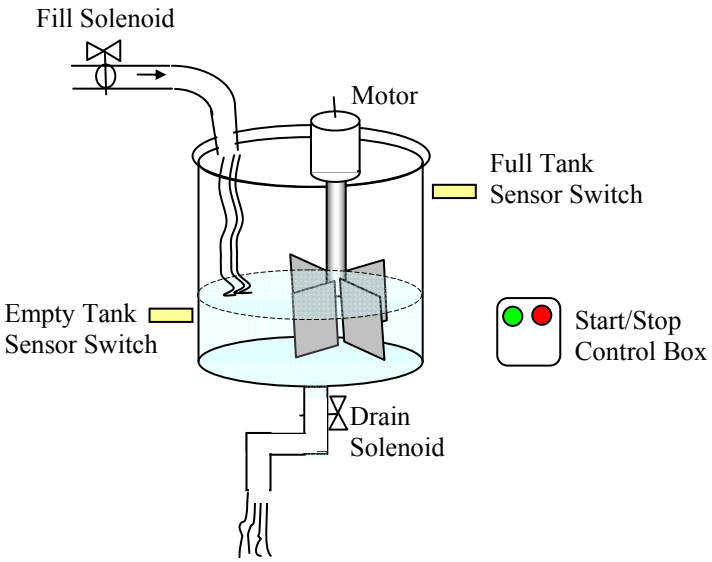
In this part of the lab, we want to create a ladder logic program to control a sequence of tank filling and mixing operations. This particular controller is particularly well-suited to planning using finite state machines. You will create the program using the Picosoft program and run it in the simulator. After that works, you will bring your computer to the actual hardware setup, download your program, and verify that it really works.

The actual PLC hardware still uses 120 VAC power. This can still hurt you.

Desired Process:

1. When we press the start button, the tank begins to fill.
2. When the tank is full, the filling stops and the mixer runs for 10 seconds.
3. After the mixing is complete, the tank begins to drain.
4. When the tank is empty, the draining stops.

Process Constraints:
If the user presses the stop button at any time, the process should pause. It should restart from where it left off when the start button is subsequently pressed. (However, we will let the timer run during any pauses in step 2, just to make our lives easier.)



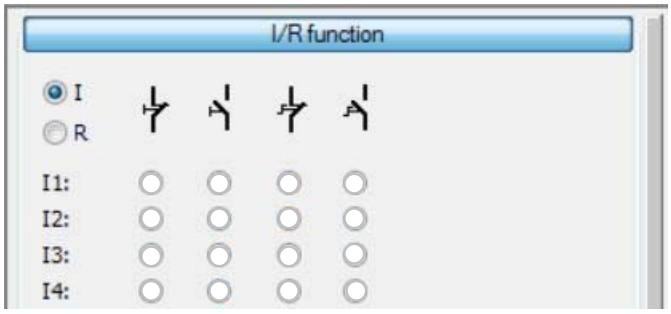
Hardware Connections:

You can't change how the hardware is built, or how it is connected to the controller itself, so you will need to set up your ladder logic program and your simulation to match our world.

There are four sensor inputs:

I1	Start Button	Momentary Switch	Normally Open	Made=start
I2	Stop Button	Momentary Switch	Normally Open	Made=stop
I3	Empty Tank	Position Switch	Normally Open	Made=NOT empty
I4	Full Tank	Position Switch	Normally Closed	Made=NOT full

How must you set the switches in the PicoSoft program? (Mark on the figure below.)



We can control three outputs:

Q1	Pump Motor On
Q2	Mixer Motor On
Q3	Drain Open

Create a PicoSoft ladder logic program to control this sequence of operations. (You will find that a finite state machine is very useful is designing this program.) Run your program in the simulator and confirm that it works. When you are satisfied that it is working correctly, call your instructor over to check your simulation and sign off on the front page.

Once you are checked off on the simulator, you may bring your computer to the actual tank and (with an instructor's assistance) download and test your controller on the real hardware. Remind the instructor to check you off on the front page when this works.

You're done with the last lab. So sad!