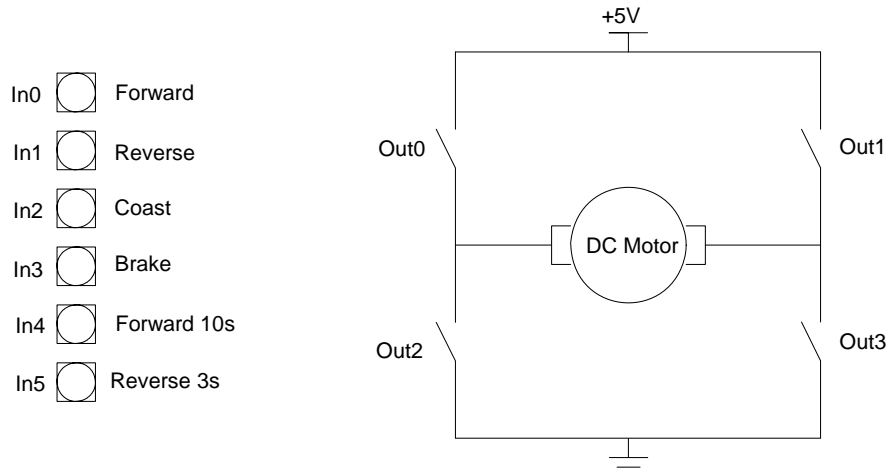# Homework #2: ECE 461 / 661

State Transitional Logic - Counters - Timers:. Due Wednesday, September 6th

A DC servo motor is connected to the PLC as follows:

Write a ladder logic program to control the stepper motor so that it has 6 funcitons

	Button	Out0	Out1	Out2	Out3
0	Forward	Closed	Open	Open	Closed
1	Reverse	Open	Closed	Closed	Open
2	Coast	Open	Open	Open	Open
3	Brake	Open	Open	Closed	Closed
4	Fwd 10s	Closed for 10s then open	Open	Open	Closed for 10s then open
5	Rev 3s	Open	Closed for 3s then open	Closed for 3s then open	Open

Turn in:

- Screen dumps for your ladder logic program
- An explanation of how it works, and
- Verification that all six modes of operation work
  - Relays are open and closed appropriately
  - Timing is correct for mode 4 and 5 (hint: use an oscilloscope)
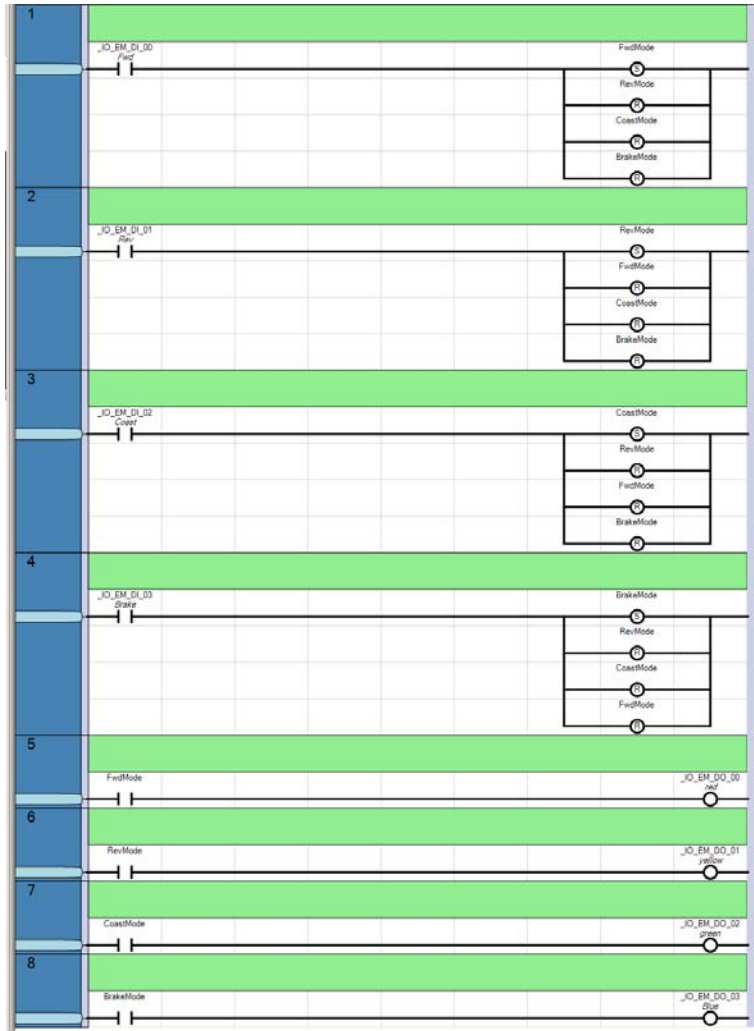
Note: There are multiple solutions.

Solution 1:

Step 1: Get the controller to switch between 4 modes as you press buttons 0..3

- Forward
- Reverse
- Brake
- Coast

Tie these 4 modes to the relays so you can watch what's happening.

1

_IO_EM_DI_00
Fwd
FwdMode

RevMode

CoastMode

BrakeMode

2

_IO_EM_DI_01
Rev
RevMode

FwdMode

CoastMode

BrakeMode

3

_IO_EM_DI_02
Coast
CoastMode

RevMode

FwdMode

BrakeMode

4

_IO_EM_DI_03
Brake
BrakeMode

RevMode

CoastMode

FwdMode

5

FwdMode   _IO_EM_DO_00
red

6

RevMode   _IO_EM_DO_01
yellow

7

CoastMode   _IO_EM_DO_02
green

8

BrakeMode   _IO_EM_DO_03
Blue

Next, get the timers to work:

1: When you press Input04, Time10s goes high for 10s

2: When you press Input05, Time3s goes high for 3s.

note: These had to go up front so the following code sees the rising and falling edge.

3: Go into forward mode if you see
- Forward button pressed, or
- A rising edge on Timer10s

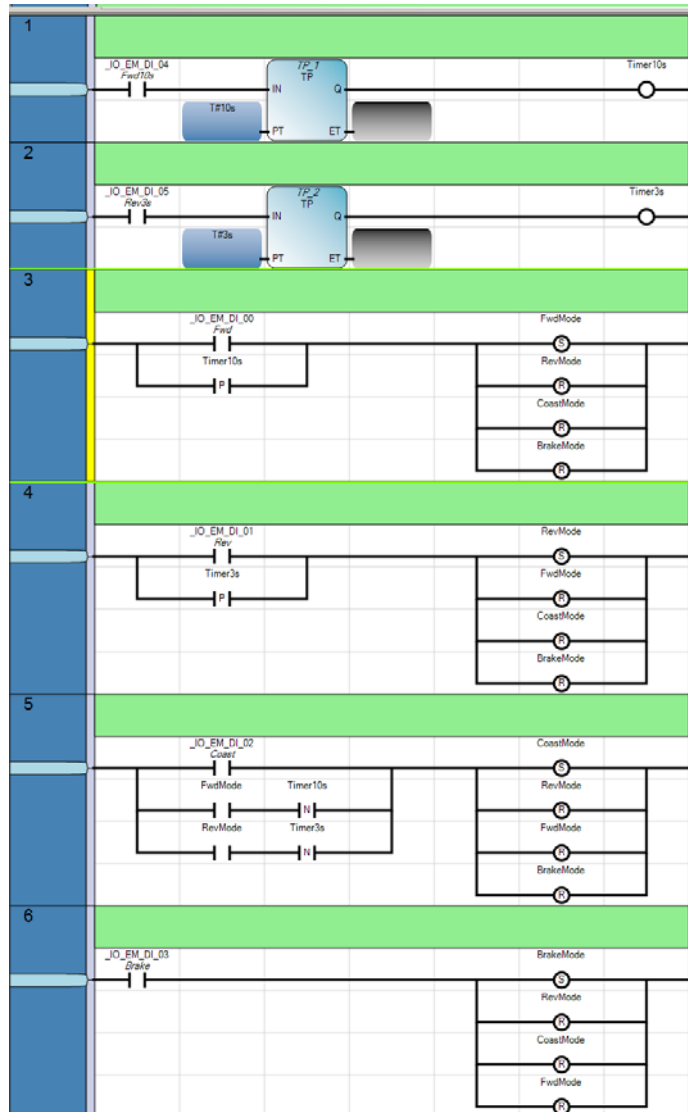4: Go into reverse mode if you see
- The reverse button being pressed, or
- You see a rising edge on Timer3s

5: Go into Coast mode it you see
- The coast button, or
- You're in forward mode and you see a falling edge on the 10s timer, or
- You're in reverse mode and you see a falling edge on the 3s timer.

6: Go into brake mode if you see the brake button.

The display routine is the same as before.

This mostly works. Once started, the timers won't restart until they time out. If you hit
- Forward10s, then
- Reverse, then
- Forward10s

right away, it won't go into Forward10s until the fist line times out.

If you hit
- Fwd10s, then
- Forward

if goes into coast mode after 10s when the timer expires. You could probably fix this by adding two more states: Fwd10s and Rev3s modes

Once you verify that you're going between the modes as desired, drive the relay I/O.

Note: Each output should appear only once: the last instance wins and overwrites the previous lines.

7

FwdMode ⊣ ⊢ — — — — — — — — — — _IO_EM_DO_00 red —( )—

8

RevMode ⊣ ⊢ — — — — — — — — — — _IO_EM_DO_01 yellow —( )—

9

RevMode ⊣ ⊢ — — — — — — — — — — _IO_EM_DO_02 green —( )—
BrakeMode ⊣ ⊢

10

FwdMode ⊣ ⊢ — — — — — — — — — — _IO_EM_DO_03 Blue —( )—
BrakeMode ⊣ ⊢