Enter all the logic to complete the lab below this rung. Remember to add rung comments to separate each part of the lab!

0 ───[NOP]──

Implements the button functionality for the HMI

1
```
      start                                                    runTimer
  ────┤ ├──────────────────────────────────────────────────────(L)──
```

2
```
      runTimer                                         ┌── TON ──────────────────────┐
  ────┤ ├────────────────────────────────────────────│ Timer    Stopwatch_Timer    │(EN)
                                                       │ Preset              1000    │(DN)──
                                                       │ Accum                  0    │
                                                       └─────────────────────────────┘
```

3
```
      pause                                                     runTimer
  ────┤ ├──────────────────────────────────────────────────────(U)──
```

4
```
      reset          Stopwatch_Timer   runTimer  ┌── MOV ──────────┐  ┌── MOV ──────────┐
  ────┤ ├──────────────(RES)─────────────(U)─────│ Source       0  │──│ Source       0  │──
                                                  │ Dest   seconds  │  │ Dest   minutes  │
                                                  │              0  │  │              0  │
                                                  └─────────────────┘  └─────────────────┘
```

Compares the timer value to the current value and adds to seconds and minutes as they become necessasary

5
```
   Stopwatch_Timer.DN                        Stopwatch_Timer  ┌── ADD ──────────────┐
  ────────┤ ├──────────────────────────────────(RES)─────────│ Source A   seconds  │──
                                                              │                  0  │
                                                              │ Source B         1  │
                                                              │                     │
                                                              │ Dest       seconds  │
                                                              │                  0  │
                                                              └─────────────────────┘
```

6
```
  ┌── EQU ──────────────┐              ┌── MOV ──────────┐  ┌── ADD ──────────────┐
  │ Source A   seconds  │──────────────│ Source       0  │──│ Source A   minutes  │──
  │                  0  │              │                 │  │                  0  │
  │ Source B        60  │              │ Dest   seconds  │  │ Source B         1  │
  └─────────────────────┘              │              0  │  │                     │
                                       └─────────────────┘  │ Dest       minutes  │
                                                            │                  0  │
                                                            └─────────────────────┘
```

Problem 2
Compues new duty cycle and time on and off

7
```
                                                        ┌── DIV ──────────────────┐
  ──────────────────────────────────────────────────────│ Source A    dutyCycle   │──
                                                         │                  50.0   │
                                                         │ Source B          100   │
                                                         │                         │
                                                         │ Dest     newDutyCycle   │
                                                         │                   0.5   │
                                                         └─────────────────────────┘
```

8
```
  ┌── MUL ──────────────────────┐  ┌── SUB ──────────────────────┐  ┌── MUL ──────────────────────┐
  │ Source A          period    │──│ Source A            1        │──│ Source A          period    │──
  │                     400     │  │                              │  │                     400     │
  │ Source B    newDutyCycle    │  │ Source B    newDutyCycle     │  │ Source B    newDutyCycle    │
  │                     0.5     │  │                     0.5      │  │                     0.5     │
  │ Dest    lightOnTimer.PRE    │  │ Dest       newDutyCycle      │  │ Dest    lightOfTimer.PRE    │
  │                     200     │  │                     0.5      │  │                     200     │
  └─────────────────────────────┘  └──────────────────────────────┘  └─────────────────────────────┘
```

MainRoutine - Ladder Diagram
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Total number of rungs in routine: 28
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Uses the timers to calculate the time on and off for the indicator

9

waveIn

TON		
Timer	lightOnTimer	(EN)
Preset	200	(DN)
Accum	71	

10

lightOnTimer.DN

waveIn
(U)

11

waveIn
/

TON		
Timer	lightOfTimer	(EN)
Preset	200	(DN)
Accum	0	

12

lightOfTimer.DN

waveIn
(L)

13

ADD	
Source A	operandA
	0.0
Source B	operandB
	0.0
Dest	addResult
	0.0

SUB	
Source A	operandA
	0.0
Source B	operandB
	0.0
Dest	subResult
	0.0

MUL	
Source A	operandA
	0.0
Source B	operandB
	0.0
Dest	mulResult
	0.0

DIV	
Source A	operandA
	0.0
Source B	operandB
	0.0
Dest	divResult
	1.$

14

addOperands

MOV	
Source	addResult
	0.0
Dest	result
	0.0

15

mulOperands

MOV	
Source	mulResult
	0.0
Dest	result
	0.0

16

divOperands

MOV	
Source	divResult
	1.$
Dest	result
	0.0

17

MOV	
Source	118
Dest	correctPIN
	118

Computes if the pin is correct and button is pushed to begin display

18

checkPIN

startDisplay
(L)

EQU	
Source A	userPIN
	0
Source B	correctPIN
	118

Shows digit for 3 seconds with the value stored in the move instruction

Rung	Input	MOV	MOV	TON
19	startDisplay	Source 0 / Dest userPIN 0	Source 3 / Dest currentDig 0	Timer dig1T / Preset 3000 / Accum 0 (EN)(DN)
20	dig1T.DN		Source 5 / Dest currentDig 0	Timer dig2T / Preset 3000 / Accum 0 (EN)(DN)
21	dig2T.DN		Source 8 / Dest currentDig 0	Timer dig3T / Preset 3000 / Accum 0 (EN)(DN)
22	dig3T.DN		Source 13 / Dest currentDig 0	Timer dig4T / Preset 3000 / Accum 0 (EN)(DN)
23	dig4T.DN		Source 21 / Dest currentDig 0	Timer dig5T / Preset 3000 / Accum 0 (EN)(DN)
24	dig5T.DN		Source 34 / Dest currentDig 0	Timer dig6T / Preset 3000 / Accum 0 (EN)(DN)
25	dig6T.DN		Source 55 / Dest currentDig 0	Timer dig7T / Preset 3000 / Accum 0 (EN)(DN)
26	dig7T.DN		Source 89 / Dest currentDig 0	Timer dig8T / Preset 3000 / Accum 0 (EN)(DN)

MainRoutine - Ladder Diagram
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Resets all timers and current digit when the display is finished

27

dig8T.DN

MOV		MOV		MOV	
Source	0	Source	0	Source	0
Dest	dig1T.ACC	Dest	dig2T.ACC	Dest	dig3T.ACC
	0		0		0

MOV		MOV		MOV	
Source	0	Source	0	Source	0
Dest	dig4T.ACC	Dest	dig5T.ACC	Dest	dig6T.ACC
	0		0		0

MOV		MOV		startDisplay (U)	MOV	
Source	0	Source	0		Source	0
Dest	dig7T.ACC	Dest	dig8T.ACC		Dest	currentDig
	0		0			0

(End)