ICS002 PLC Exercise 2 Timers-Counters

Lab Objectives

In this lab you will learn about

- Programming timers and counters within the Do-more Designer environment.
- The difference between retentive and non-retentive instructions.
- Using bits associated with timers and counters.

Lab Duration

30 – 45 minutes

Lab Scenario

Develop a PLC program to turn three different lights using different timers. Counters will be used to keep track of how many times some of the lights turned on.

Lab Procedure

Definition: A non-retentive instruction is the one for which the accumulated value goes to zero when the power is lost or removed. The accumulated value of a retentive instruction does not go to zero when the power is lost or removed.

Timers

1. Build the diagram below. The timer's bits are: T0.Timing and T0.Done.

2. Turn the switch **X0** on, observe the accumulated value. What will happen to the accumulated value when **X0** is off? Is the timer instruction retentive or not?
3. Turn the switch **X0** on again and answer the following:
   a) Which output(s) is on during the first 10 seconds?
   b) Which output(s) is on after 10 seconds?
   c) Does the accumulated value go beyond 10 seconds?
   d) Which bit does not provide any information about time?

4. Add the following rung to the diagram.

5. Save and write the program to the PLC.
6. Turn the switch **X1** on, observe the accumulated value. What will happen to the accumulated value when **X1** is off? Is the timer instruction retentive or not?
7. The instruction (switch) **X2** is tied to the reset input (RST) so that when true will reset the timer (i.e. make the acc. value = 0). Turn the switch **X2** on, what will happen to the accumulated value? Retentive instructions require additional means to reset them.

Up Counters

8. To learn how to use a counter to count up, add the following rung to the diagram.

9. Turn the switch **X4** on, observe the accumulated value. Keep the **X4** on, does the accumulated value change? It will change when there is a false-to-true (off-to-on) transition of the input.
10. What will happen to the accumulated value when **X4** is off? Is the counter instruction retentive or not?
11. Turn the switch **X4** on again, observe the accumulated value. This is the only way (off-to-on) to change the acc. value. Is the acc. value increasing (up counter) or decreasing (down counter). Is the counter up or down?
12. Turn the switch **X3** on, observe the accumulated value. The switch (instruction) **X3** is tied to the reset (RST) input allowing for reset of counters.
13. Sometime we do not need to connect a switch as input to the counter, we can use timers and other input instruction to count (activate the counter. This is illustrated below.

14. When the timer T0 is done timing, the counter starts counting.

15. Two methods are used to reset the counter, manual (using **X3**) or automatic (when the counter is done counting-**CT0.Done**)

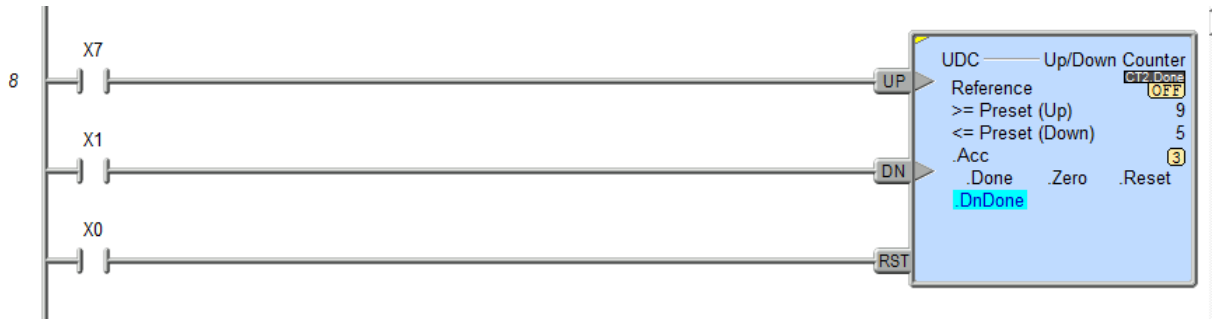
Down Counters

16. To learn how to use the counter to count down, add the following rung to the diagram.

17. Turn the switch **X5** on, observe the accumulated value. Keep the **X4** on, does the accumulated value change? It will change when there is a false-to-true (off-to-on) transition of the input.
18. What will happen to the accumulated value when **X5** is off? Is the counter instruction retentive or not?
19. Turn the switch **X5** on again, observe the accumulated value. This is the only way (off-to-on) to change the acc. value. Is the acc. value increasing (up counter) or decreasing (down counter). Is the counter up or down?
20. Turn the switch **X6** on, observe the accumulated value. The switch (instruction) **X6** is tied to the reset (RST) input allowing for reset of counters. What is the acc. value (**zero or not**)?

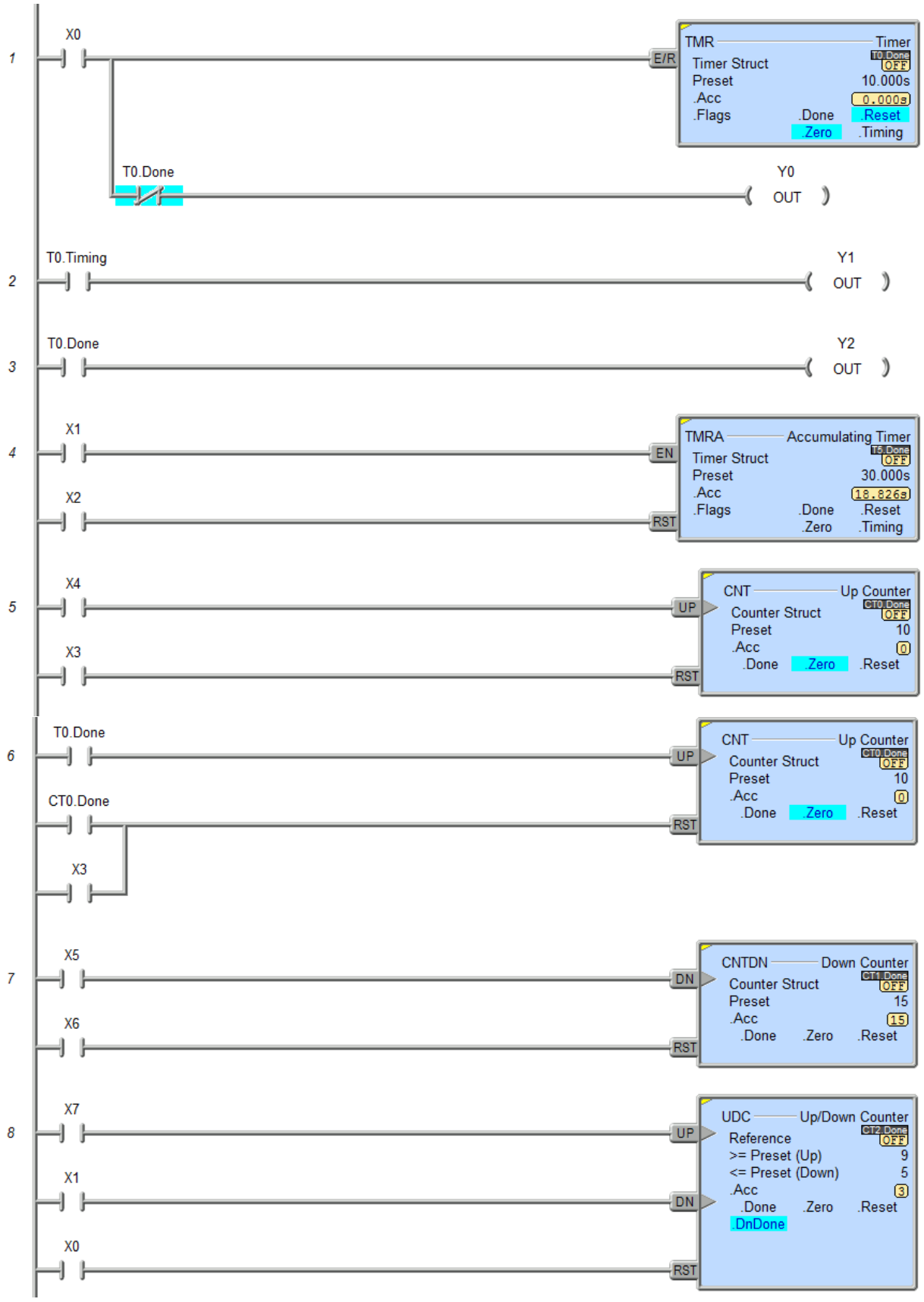
Up/Down Counters

21. To learn how to use the counter to count up and down, add the following rung to the diagram. The Up preset value is always greater than the down one.



22. Turn the switch **X7** on, the accumulated value will go up (up counter).
23. Turn the switch **X1** on, the accumulated value will go down (down counter).
24. Turn the switch **X0** on, observe the accumulated value. The switch (instruction) **X6** is tied to the reset (RST) input allowing for reset of counters. What is the acc. value (**zero or not**)?

The overall program is listed below.


1
X0
E/R
TMR
Timer
Timer Struct
Preset
10.000s
.Acc
0.000s
.Flags
.Done
.Reset
.Zero
.Timing
T0.Done
Y0
OUT
2
T0.Timing
Y1
OUT
3
T0.Done
Y2
OUT
4
X1
EN
TMRA
Accumulating Timer
Timer Struct
Preset
30.000s
.Acc
18.826s
.Flags
.Done
.Reset
.Zero
.Timing
X2
RST
5
X4
UP
CNT
Up Counter
Counter Struct
Preset
10
.Acc
0
.Done
.Zero
.Reset
X3
RST
6
T0.Done
UP
CNT
Up Counter
Counter Struct
Preset
10
.Acc
0
.Done
.Zero
.Reset
CT0.Done
RST
X3
7
X5
DN
CNTDN
Down Counter
Counter Struct
Preset
15
.Acc
15
.Done
.Zero
.Reset
X6
RST
8
X7
UP
UDC
Up/Down Counter
Reference
>= Preset (Up)
9
<= Preset (Down)
5
.Acc
3
.Done
.Zero
.Reset
.DnDone
X1
DN
X0
RST