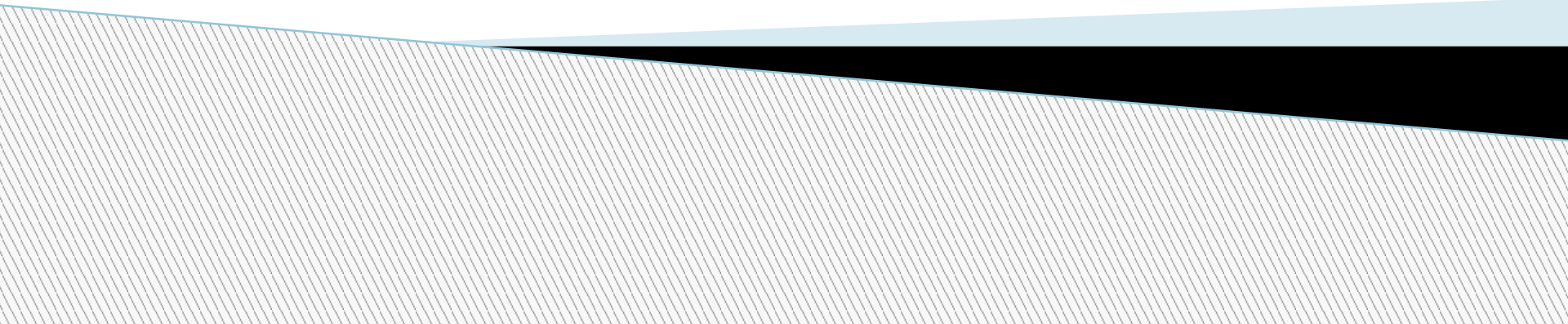


COUNTER INSTRUCTIONS



COUNTER OPERATION IN PLC

- Counts the events
- Counters are similar to timers except that they do not operate on an internal clock but are dependent on external or program sources for counting
- Types:
 1. Up counter
 2. Down counter
- The up-counter increments its accumulated value by one each time the counter rung makes a false-to-true transition.
- When the accumulated count equals the preset count the counter output is energized or set to 1.
- Part of the instruction are:
 - Counter type
 - Counter address
 - Counter preset value
 - Accumulated count

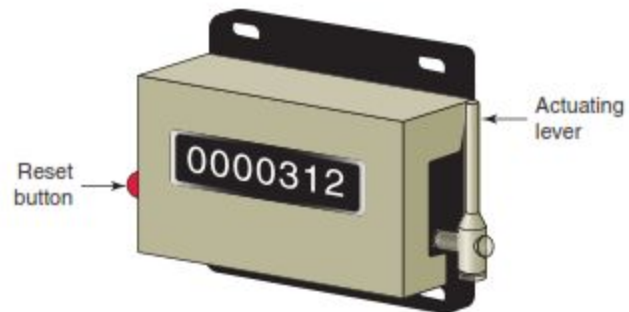


Figure 8-1 Mechanical counter.



Figure 8-2 Electronic counters.

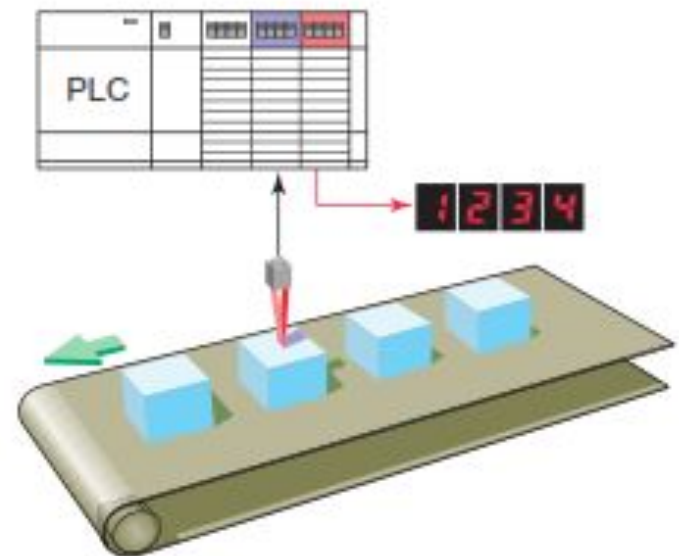


Figure 8-3 Counter application.

COIL FORMATTED COUNTER INSTRUCTION

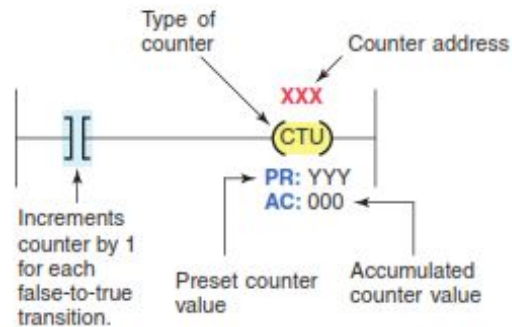


Figure 8-4 Coil-formatted up-counter instruction.

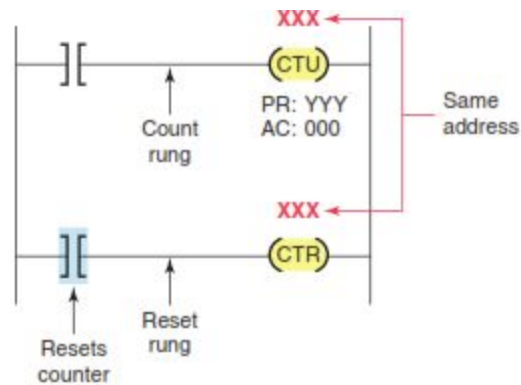


Figure 8-5 Coil-formatted counter and reset instructions.

BLOCK FORMATTED COUNTER INSTRUCTION

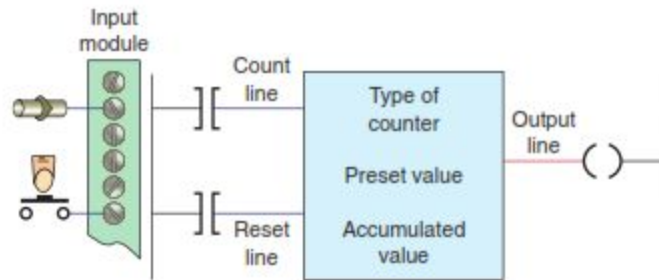


Figure 8-6 Block-formatted counter instruction.

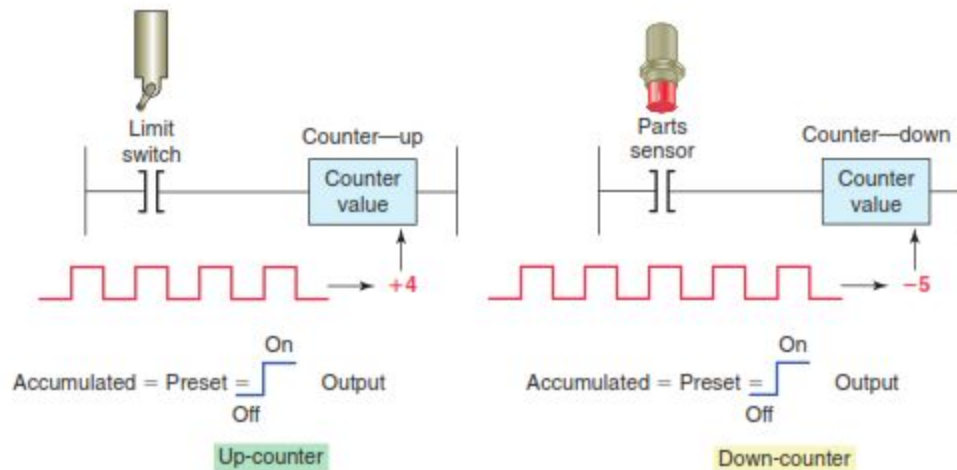


Figure 8-7 Counter counting sequence.

ALLEN-BRADLEY SLC 500 COUNTER FILE

- C5: Counter File
- 256 elements
- C5:1 □ Counter File 1 st element
- Each counter element composed of 3 data words
- Control word, preset word, Accumulated word

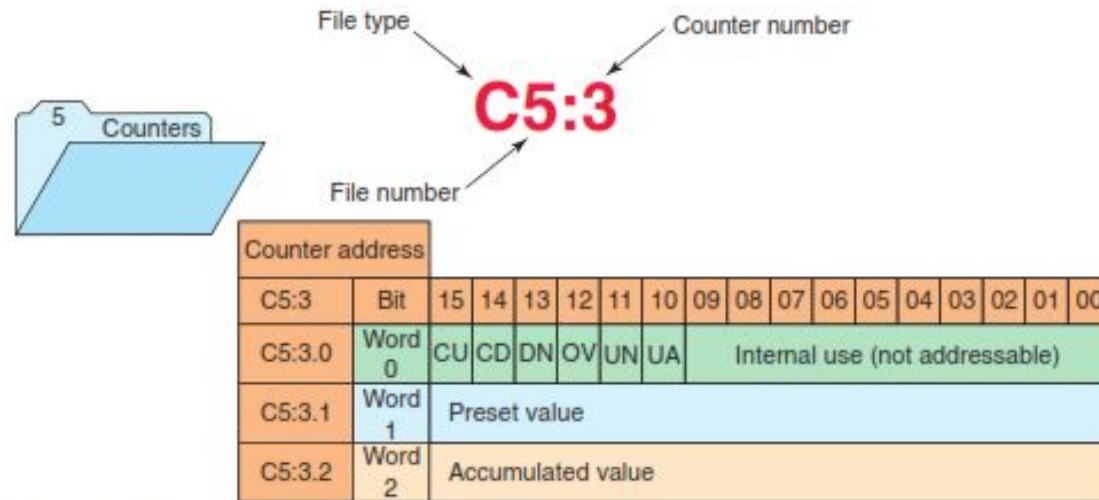


Figure 8-9 SLC 500 counter file.

ALLEN-BRADLEY SLC 500 COUNTER FILE

□ Control word status control Bits:

1. Count-Up (CU) Enable Bit

□ It is true whenever the count-up counter instruction is true

2. Count-Down (CD) Enable Bit

□ It is true whenever the count-down counter instruction is true

3. Done (DN) Bit

□ The done bit is true whenever the accumulated value is equal to or greater than the preset value of the counter

4. Overflow (OV) Bit —The overflow bit is true whenever

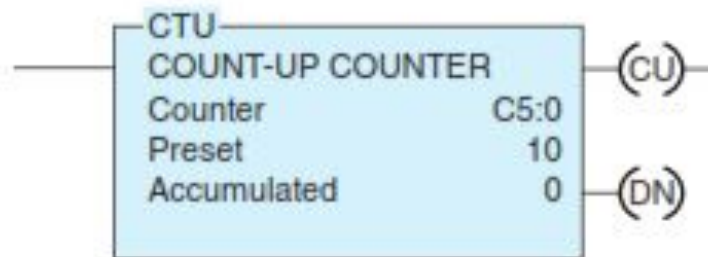
□ the counter counts past its maximum value, which is 32,767

5. Underflow (UN) Bit

□ The underflow bit will go true when the counter counts below 32,768

6. Update Accumulator (UA) Bit

□ used only in conjunction with an external HSC (high-speed counter)



C5:0/CU

—] [— Counter enable bit

C5:0/DN

—] [— Counter done bit

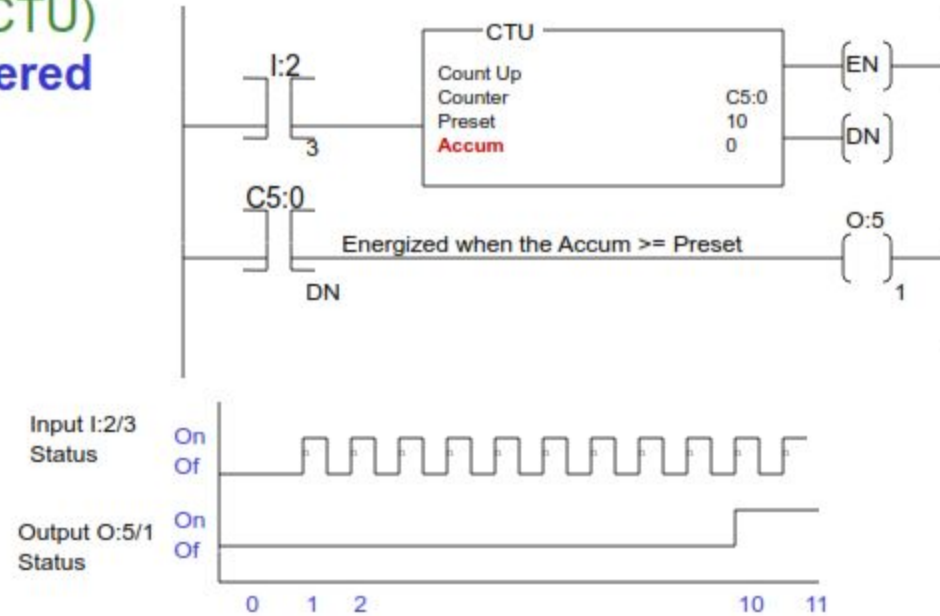
C5:0/OV

—] [— Overflow status bit

C5:0
— (RES) — The reset instruction resets
the counter's accumulated
value back to zero.

COUNTER OPERATION

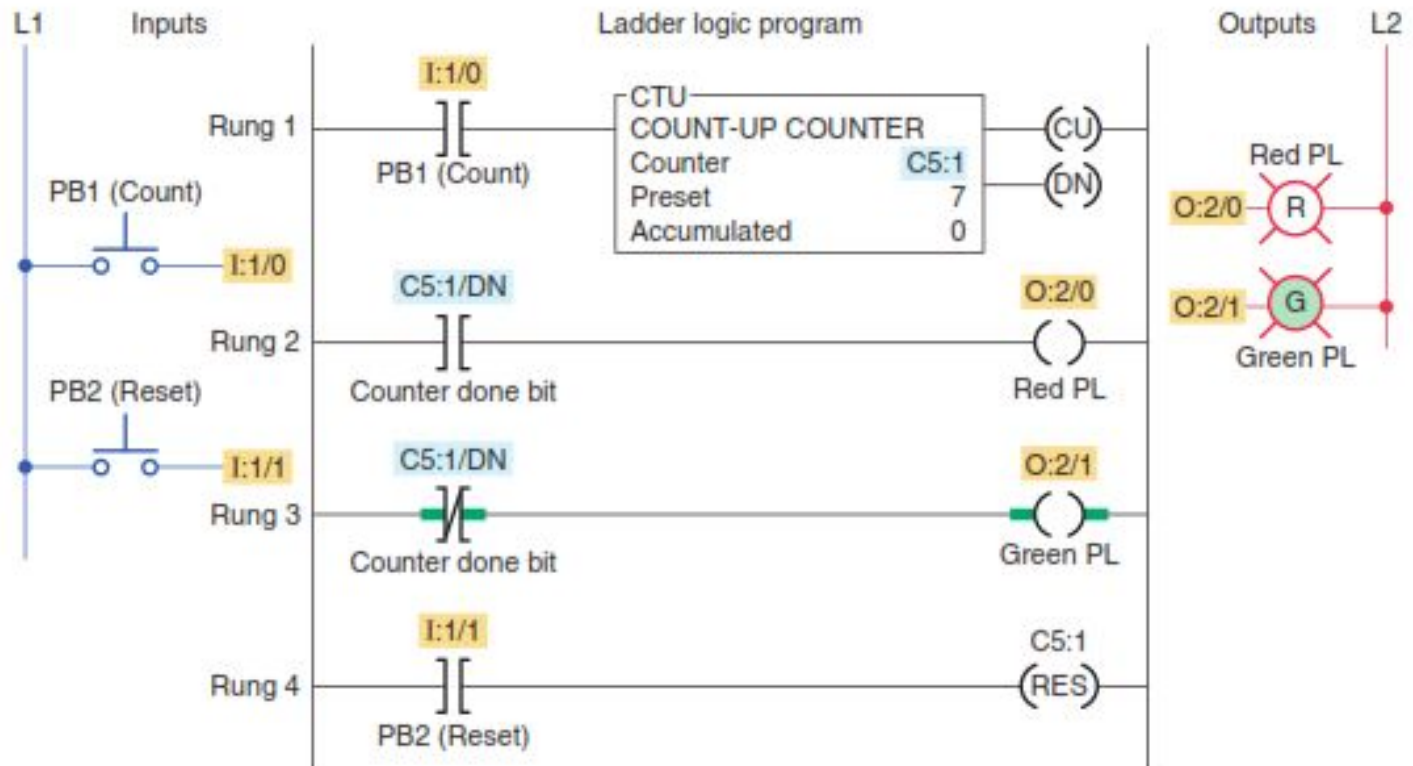
Counters (CTU) Edge-Triggered



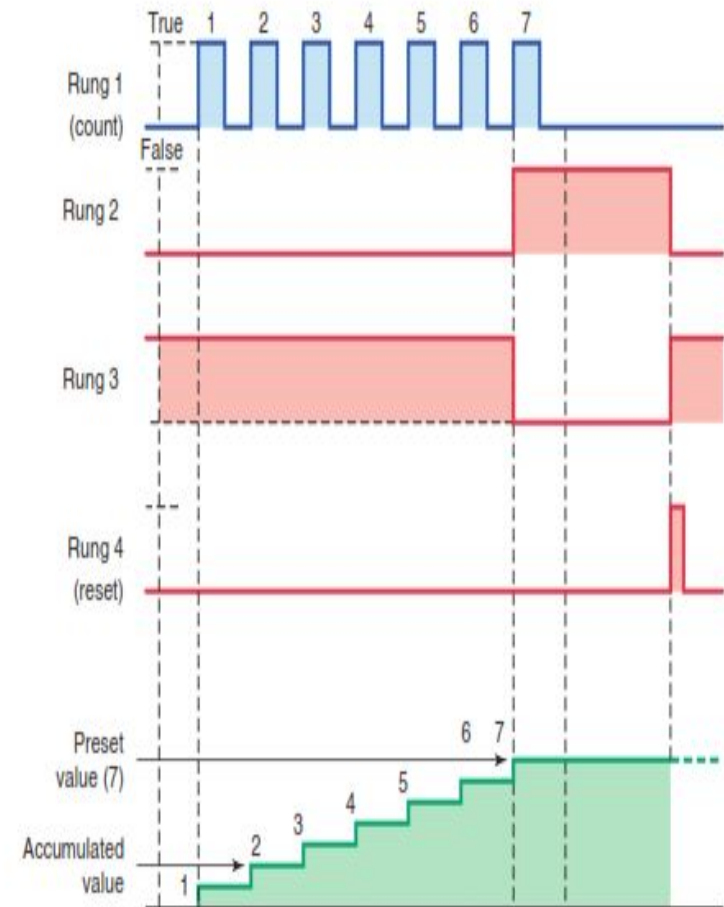
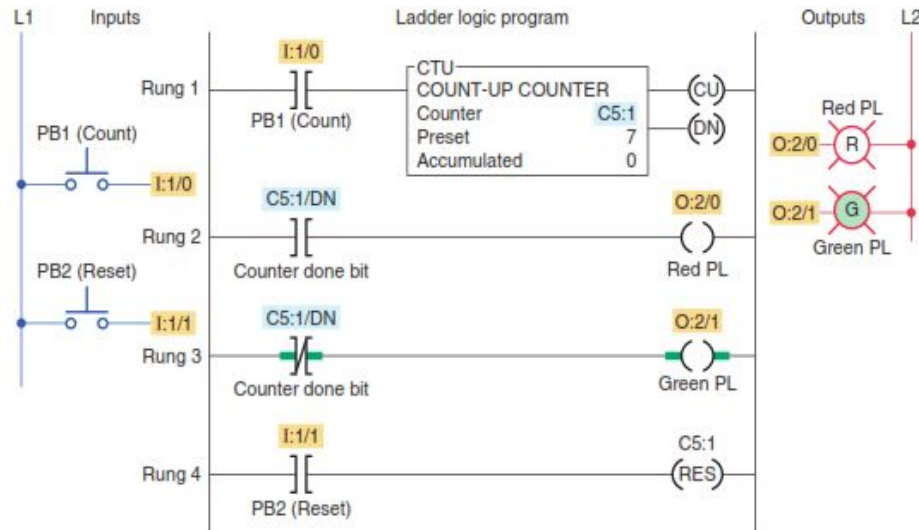
The rising edge triggers the counter

- I:2/3 counts the pulses:
 - Each time there is an Of to On transition, the Counter increments its count by 1 (CTU)
 - When the **Accum**ulate count equals the preset value, the counter turns on
 - Turns on Output O:5/1

UP COUNTER OPERATION

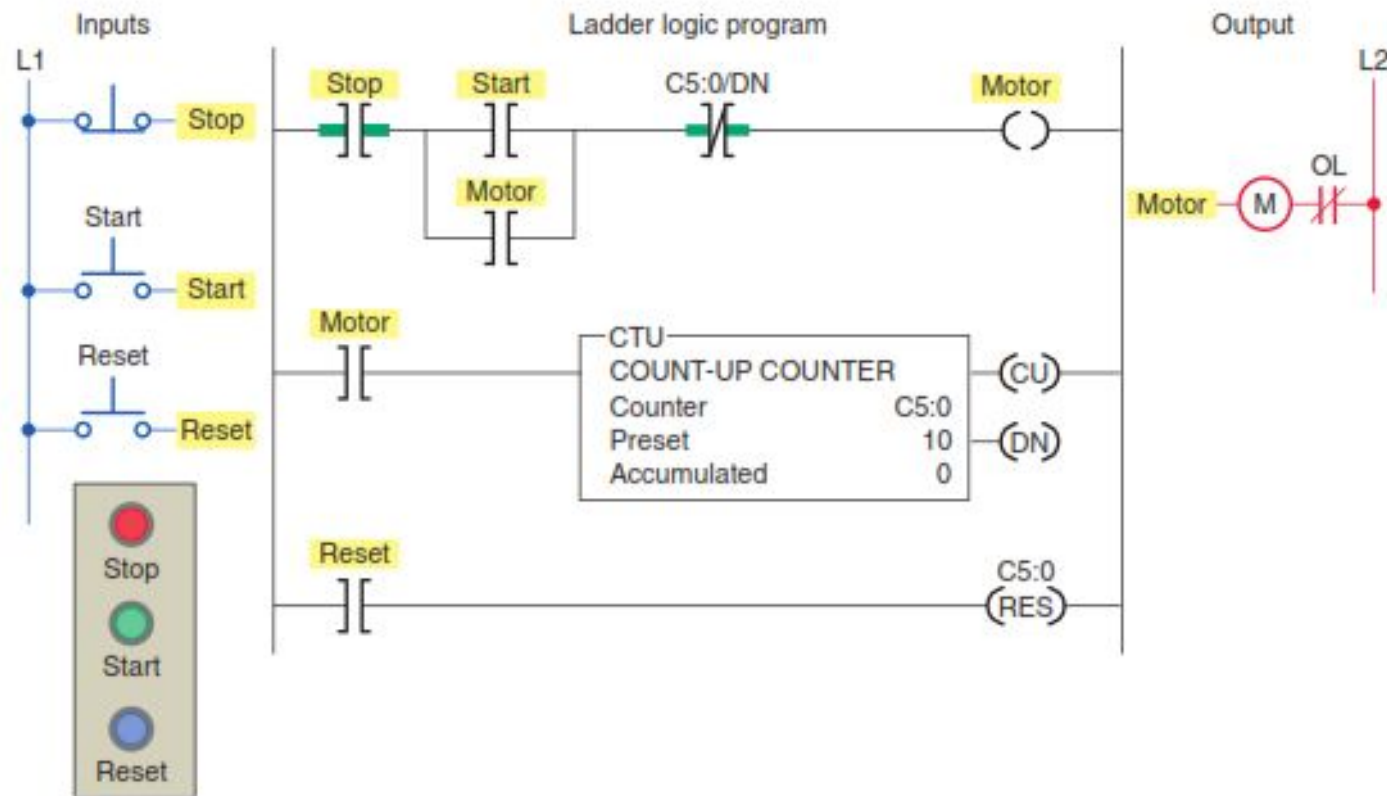


UP COUNTER OPERATION WITH TIMING DIAGRAM



COUNTER PROGRAMMING

- PLC counter program used to stop a motor from running after 10 operations(Using Speed Sensor O/P)

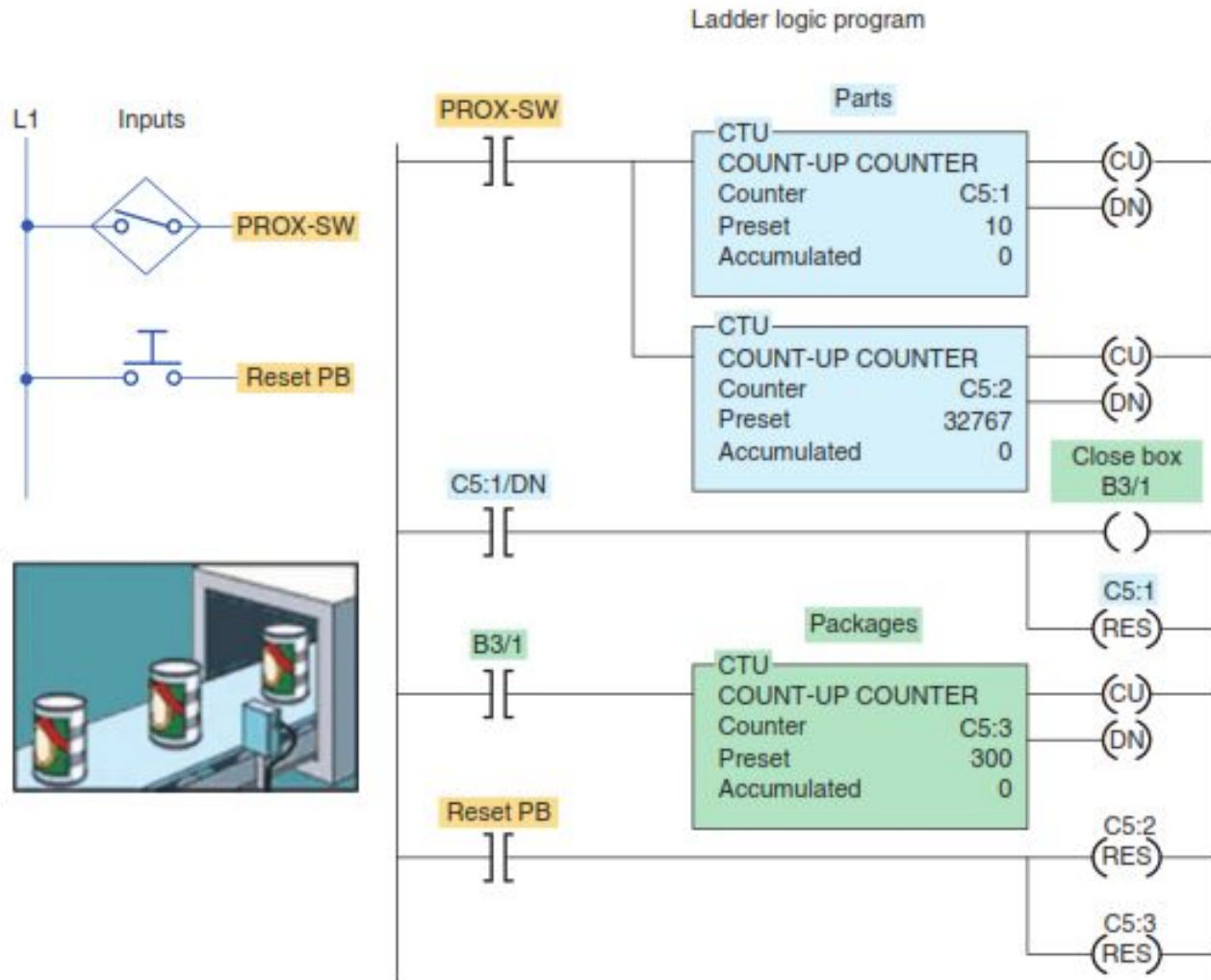


COUNTER PROGRAMMING

- can-counting program that uses three up-counters
- The operation of the program can be summarized as follows:
 - Counter C5:2 counts the total number of cans coming off an assembly line for final packaging
 - Each package must contain 10 parts
 - When 10 cans are detected, counter C5:1 sets bit B3/1 to initiate the box closing sequence
 - Counter C5:3 counts the total number of packages filled in a day. (The maximum number of packages per day is 300.)
 - A pushbutton is used to restart the total part and package count from zero daily

COUNTER PROGRAMMING

- can-counting program that uses three up-counters



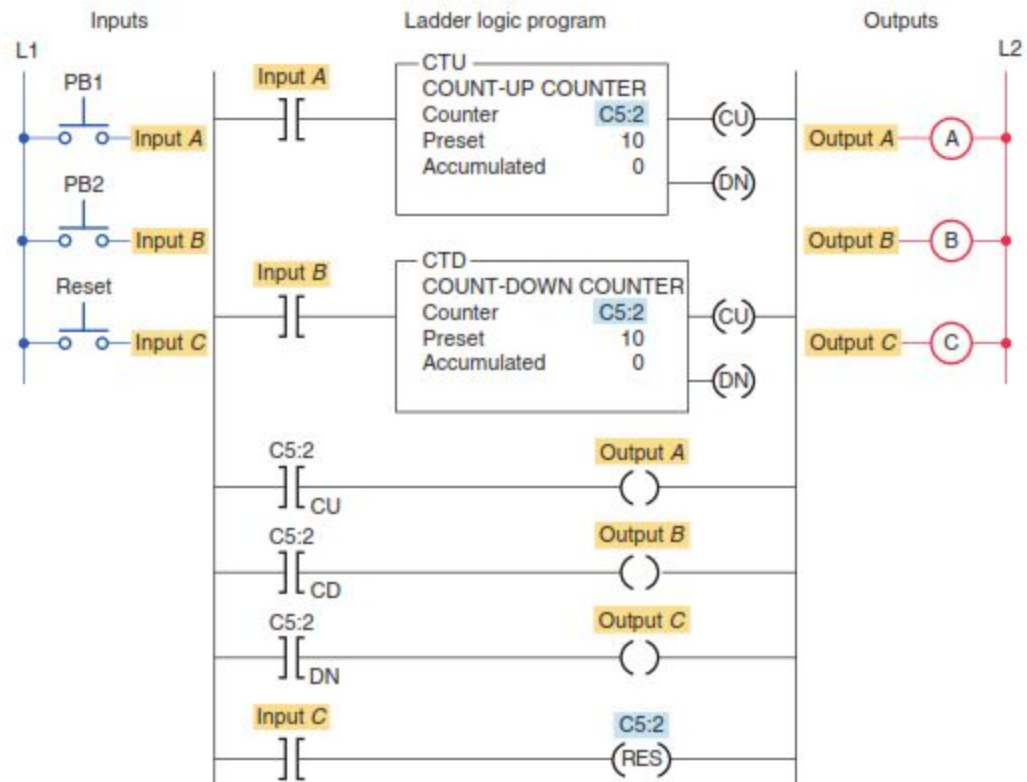
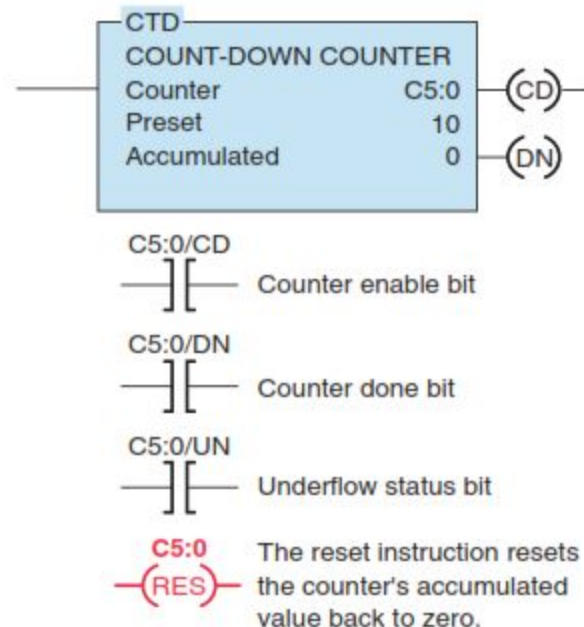


Figure 8-24 Up/down-counter program.

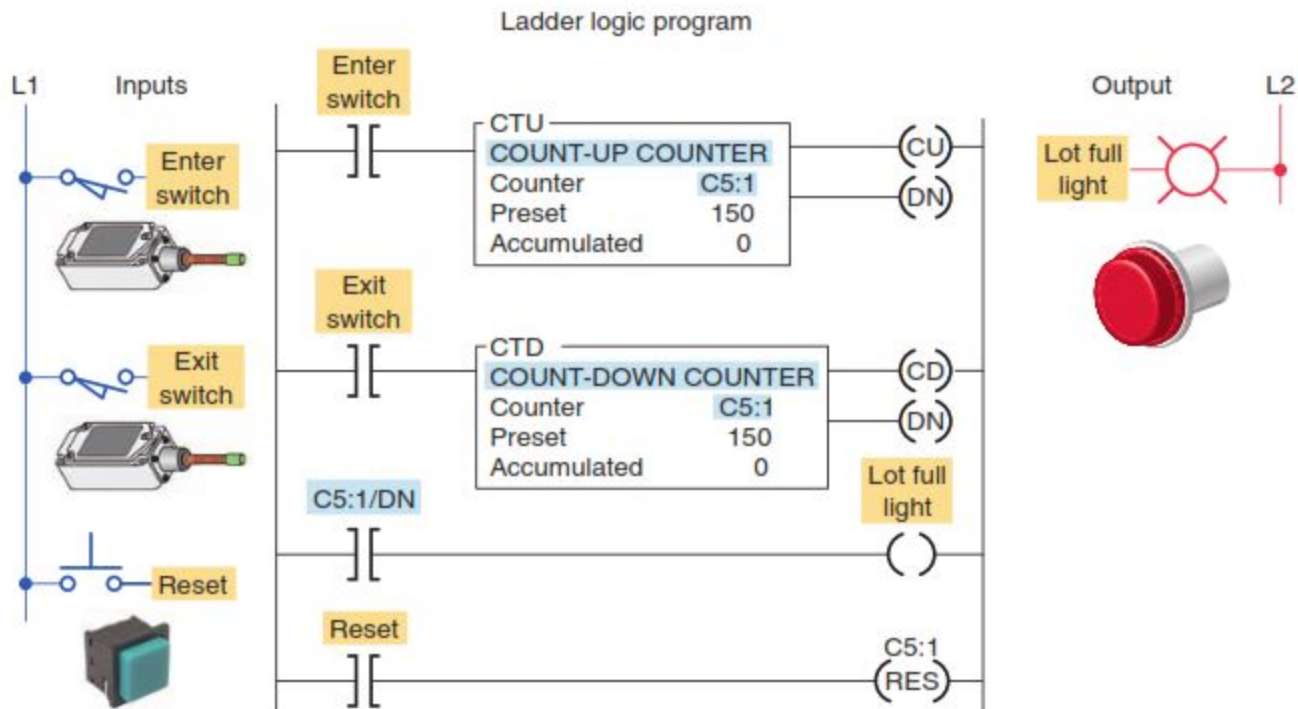
DOWN COUNTER

- The down-counter instruction will count down or decrement by 1 each time the counted event occur
- Each time the down-count event occurs, the accumulated value is decremented
- maximum counter preset limit of 999



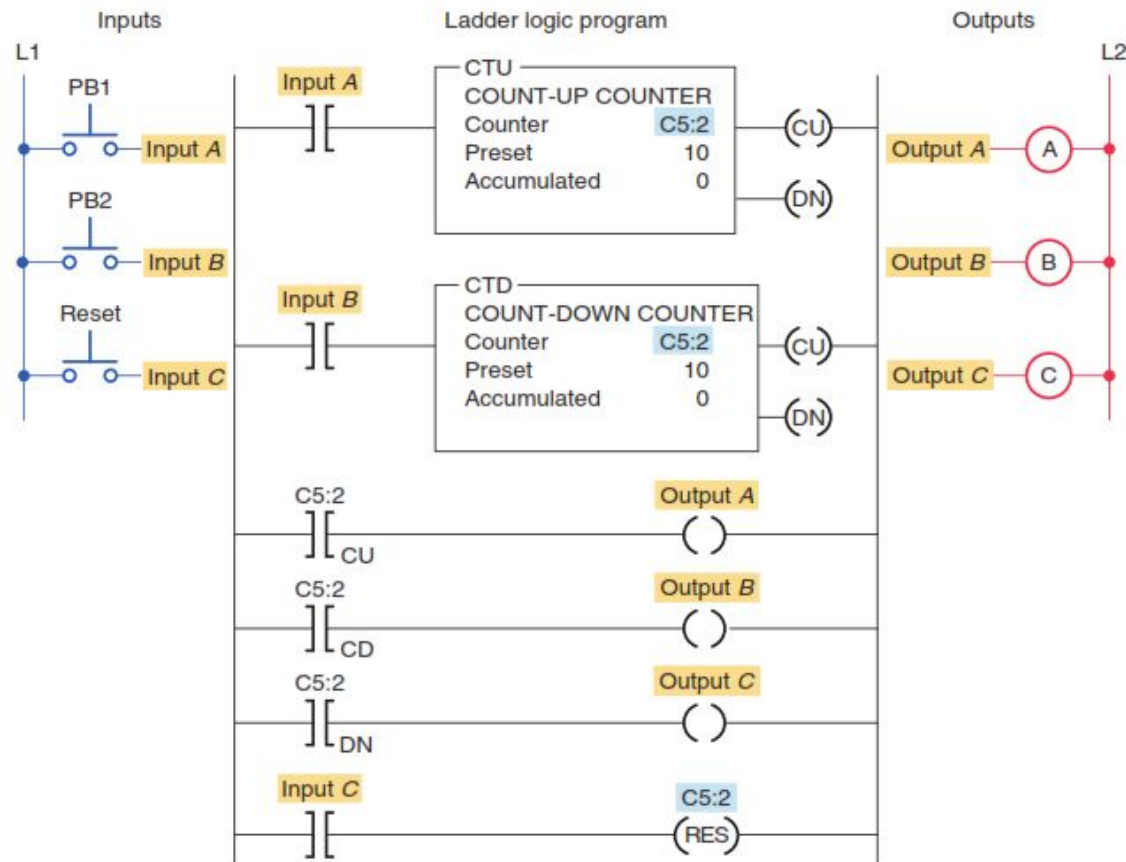
APPLICATIONS

- Up/down-counter is to keep count of the cars that enter and leave a parking garage



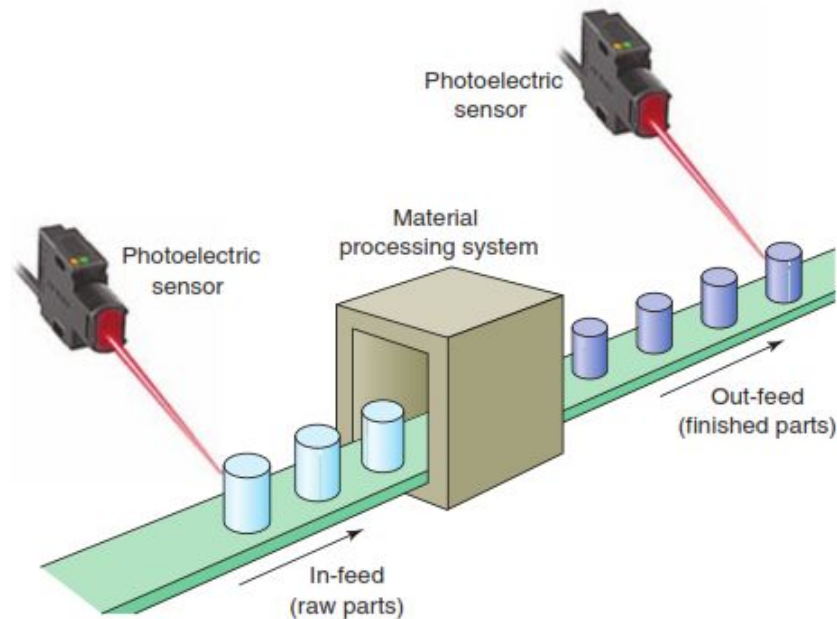
APPLICATIONS

- up/down-counter program that will increase the counter's accumulated value when pushbutton PB1 is pressed and will decrease the counter's accumulated value when pushbutton PB2 is pressed



APPLICATIONS

- Continuous monitoring of items in process
- An in-feed photoelectric sensor counts raw parts going into the system, and an out-feed photoelectric sensor counts finished parts leaving the machine
- The number of parts between the in-feed and out-feed is indicated by the accumulated count of the counter
- Counts applied to the up-input are added, and counts applied to the down-input are subtracted



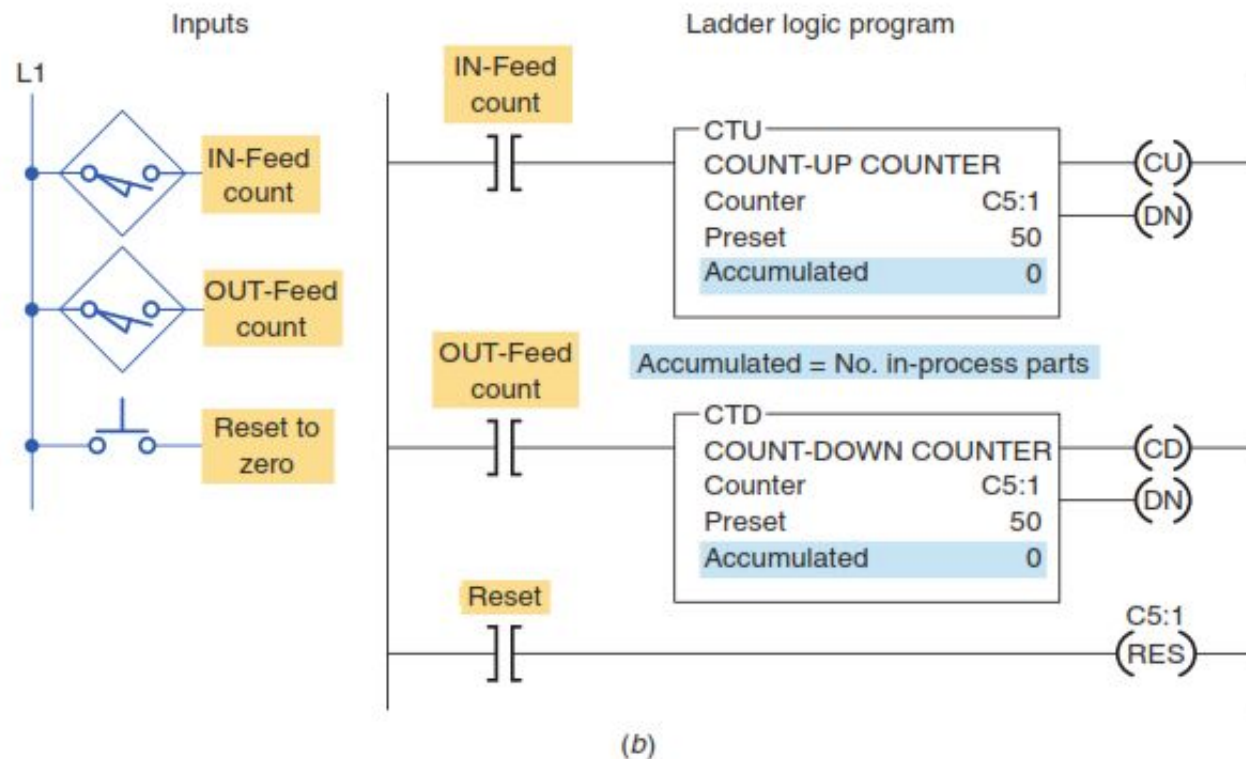
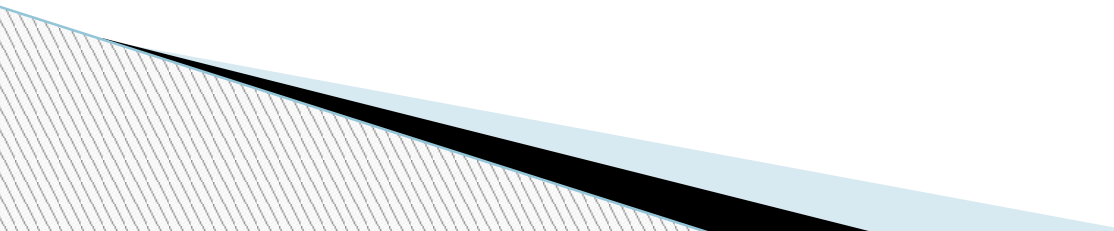


Figure 8-25 In-process monitoring program. (a) Process. (b) Program.

CASCADING COUNTERS

- ❑ count events that exceed the maximum number allowable per counter instruction
- ❑ One way of accomplishing this count is by interconnecting, or cascading, two counters

OPERATION

- ❑ The output of the first counter is programmed into the input of the second counter
 - ❑ The status bits of both counters are programmed in series to produce an output
 - ❑ These two counters allow twice as many counts to be measured
- 

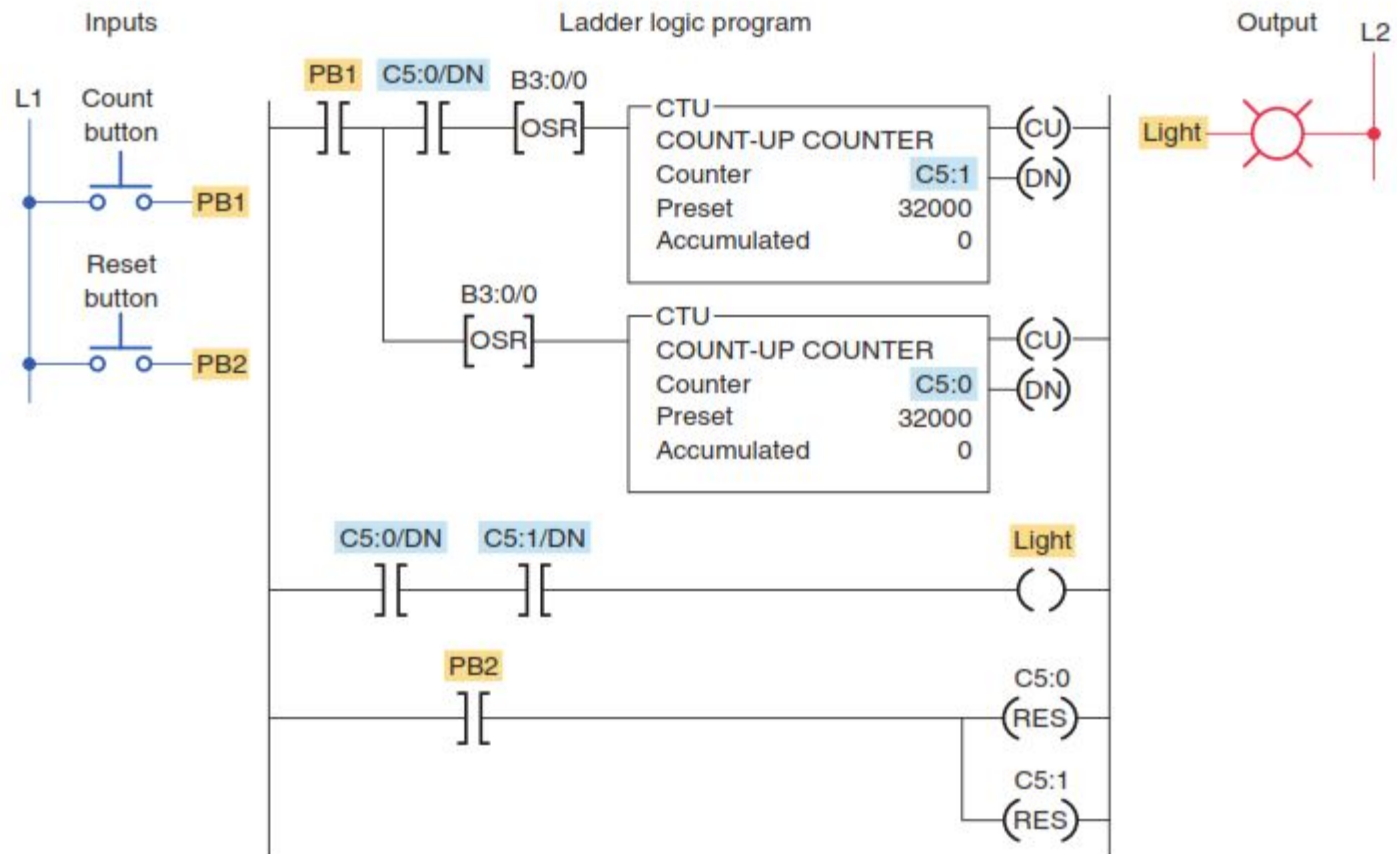


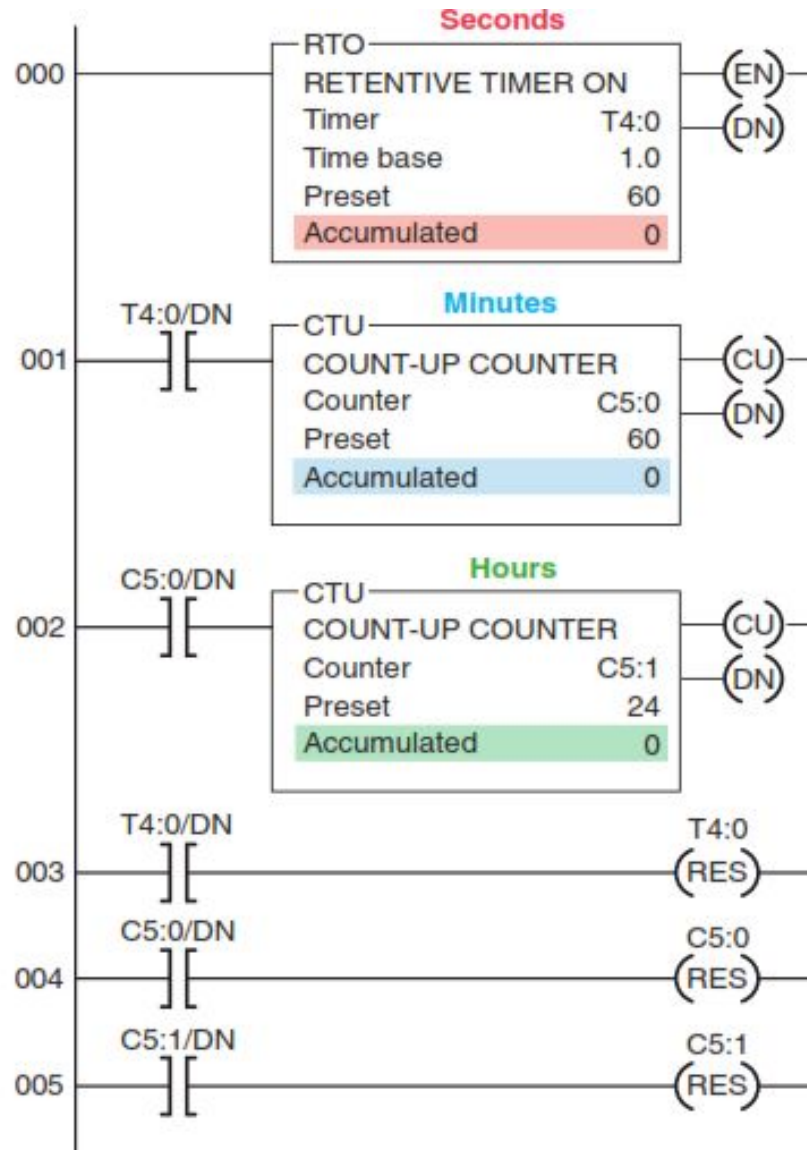
Figure 8-26 Counting beyond the maximum count.

Timer-Counter Combination

timer-counter program that produces a time-of-day clock measuring time in hours and minutes. The operation of the program can be summarized as follows:

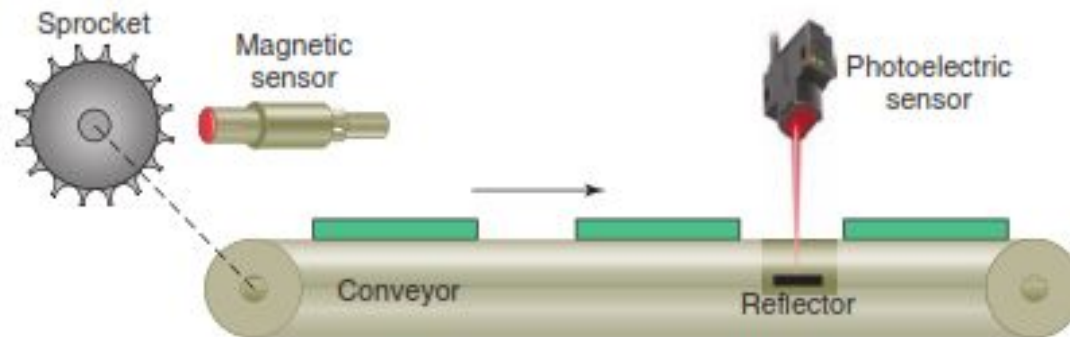
- An RTO timer instruction (T4:0) is programmed first with a preset value of 60 seconds.
- The T4:0 timer times for a 60-s period, after which its done bit is set.
- This, in turn, causes the up-counter (C5:0) of rung 001 to increment 1 count.
- On the next processor scan, the timer is reset and begins timing again.
- The C5:0 counter is preset to 60 counts, and each time the timer completes its time-delay period, its count is incremented.
- When the C5:0 counter reaches its preset value of 60, its done bit is set.
- This, in turn, causes the up-counter (C5:1) of rung 002, which is preset for 24 counts, to increment 1 count.
- Whenever the C5:1 counter reaches its preset value of 24, its done bit is set to reset itself.

Timer-Counter Combination



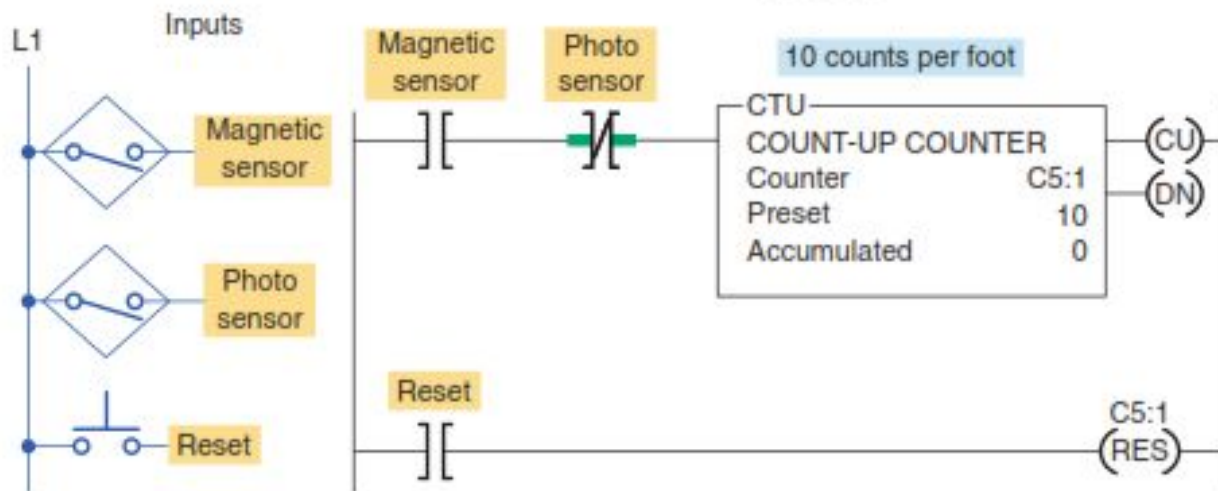
Timer-Counter Combination

Length Measurement



(a)

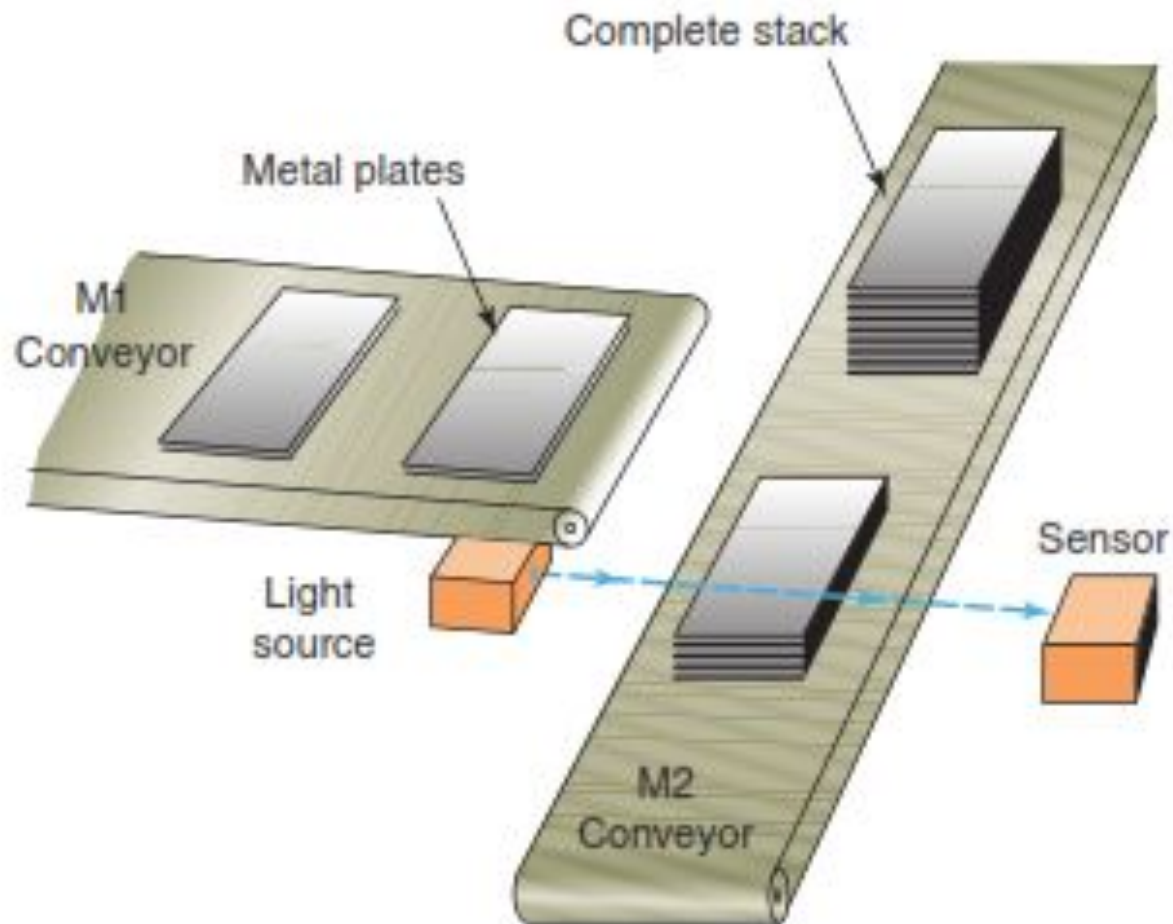
Ladder logic program



(b)

Timer-Counter Combination

- Automatic stacking program that requires both a timer and counter



Timer-Counter Combination

