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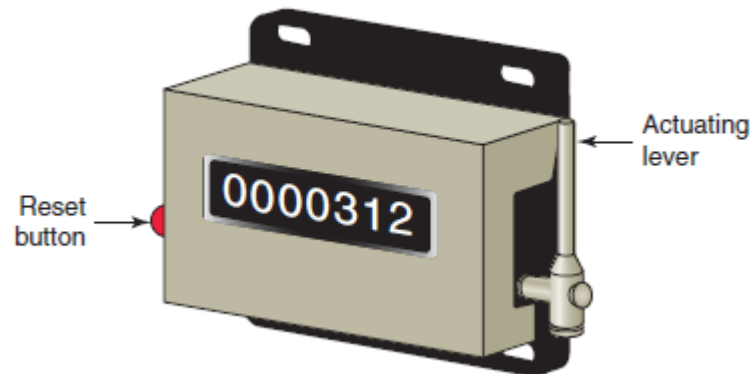
Industrial Automation (ICE 3252)

PLC Programming- Counters

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What is a Counter?

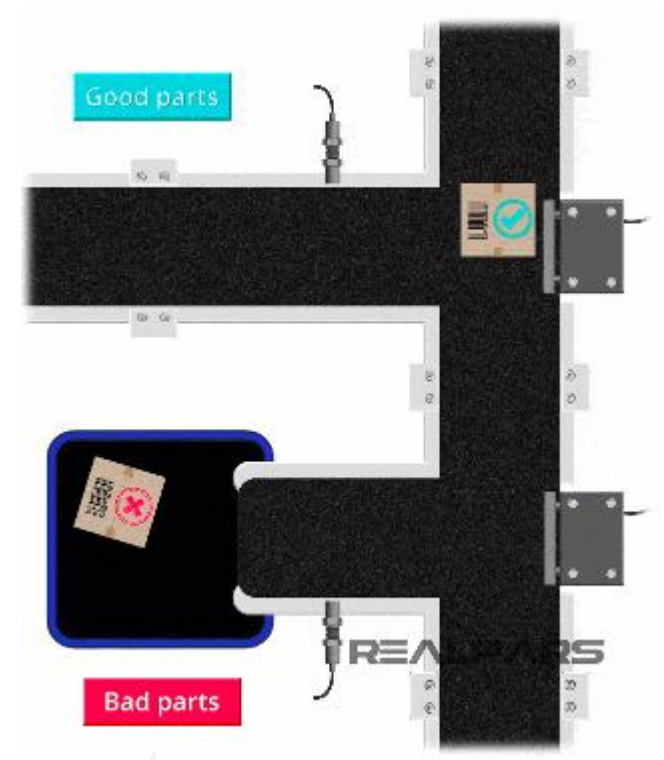
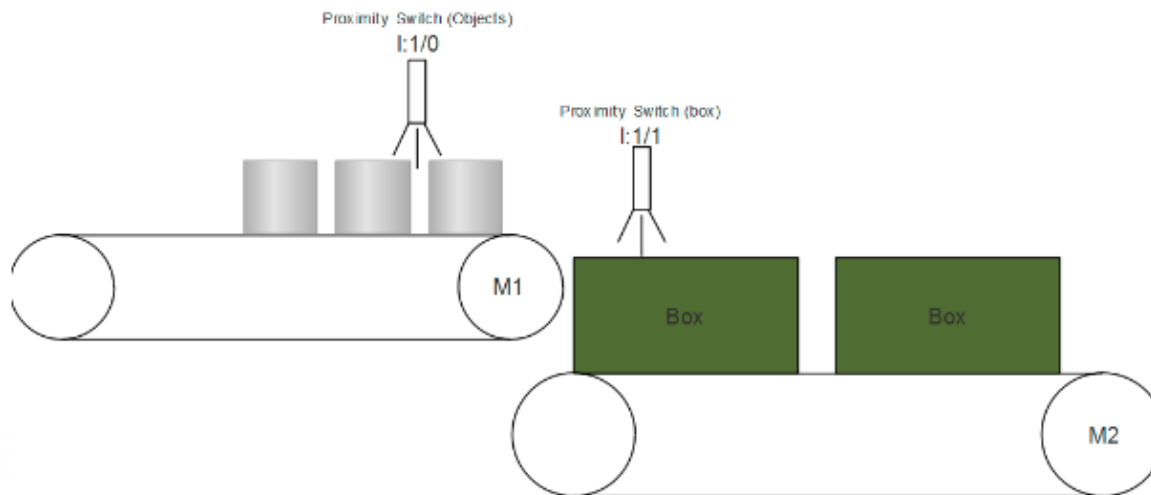
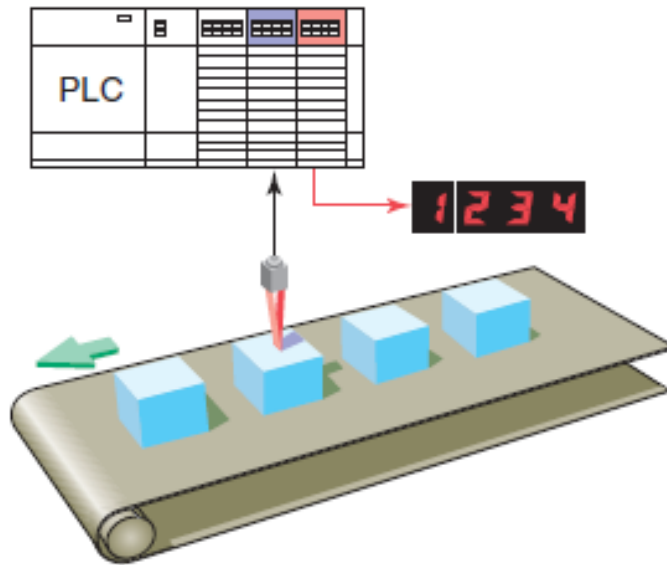
- ‘Counters are similar to timers, except that they do not operate on an internal clock, but are dependent on external or program sources for counting.’



Counter Operation

- All counters operate, or count, in the leading edge of the input signal.
- The counter will either increment or decrement whenever the count input transfers from an OFF state to an ON state.
- The counter will not operate on the trailing edge, or ON to OFF transition of the input condition.
- Some manufacturers require the reset condition to be TRUE to reset the counter and some otherwise.
- Most counters are retentive. The counter may be reset if the reset condition is activated at the time of power restoration.

Counter applications



And many more....

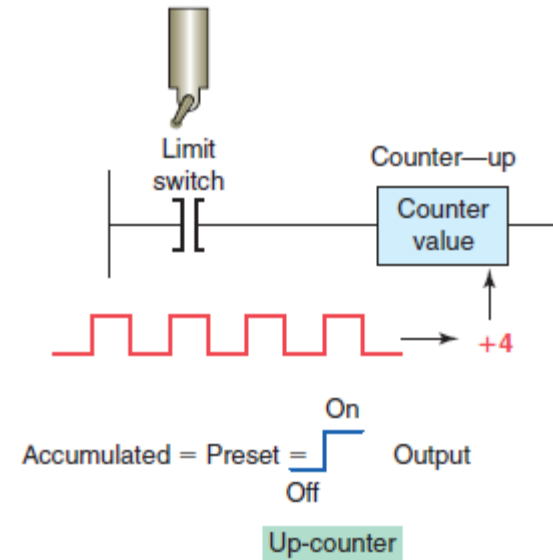
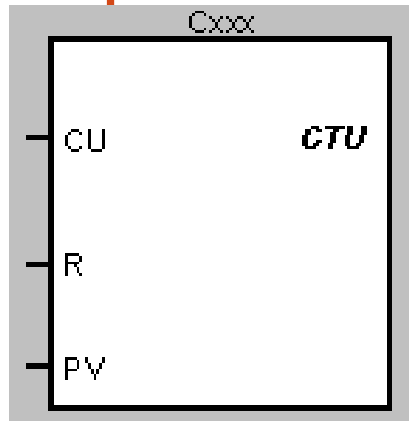
Counter Parameters

- In general, a PLC Counter has two parameters:
 - (a) The accumulator value (ACC) and
 - (b) The pre- set value (PRE)
- The accumulator value (ACC) is the number of false-to-true transitions that have occurred since the counter was last reset.
- The preset value (PRE) specifies the value that the counter must reach, before the controller sets the done bit. When the accumulator value becomes equal to or greater than the preset value, the done status bit is set. This can be used to control an output device.
- Preset and accumulated values for counters range from -32,767 and are stored as signed integers. Negative values are stored as 2's complement form.

Types of Counters

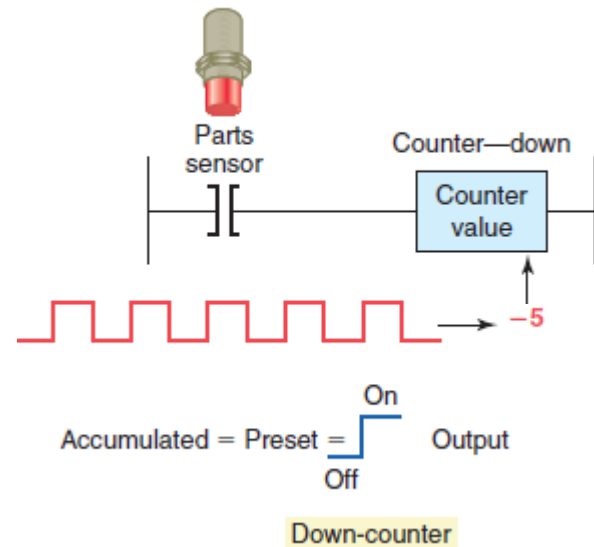
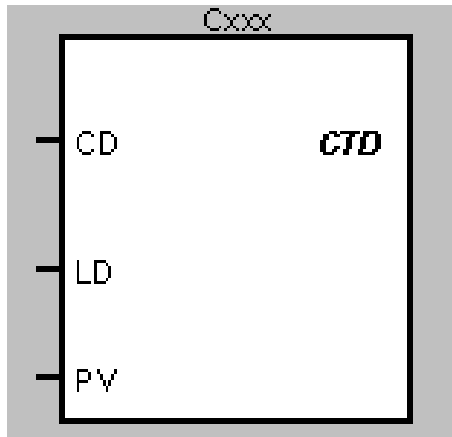
Instruction	Use this Instruction to	Functional Description
Count Up	Count from zero up to a desired value	Counting the number of parts produced during a specific work. shift or batch. Also counting the number of rejects from a batch.
Count Down	Count from zero up to a desired value	An operator interface display shows the operator the number of parts remaining to be made for a lot of 100 parts ordered.
High- Speed Counter	Count input pulses that are too fast separately from normal input points and modules	Most fixed PLCs will have a high - speed set of input points that allow interface to high-speed inputs. Signals from an incremental encoder would be a typical high – speed input. Check your specific PLC for the maximum pulse rate.
Counter Reset	Reset a timer or counter	Used to reset a counter to zero so another counting sequence can begin.

Up counter (CTU)



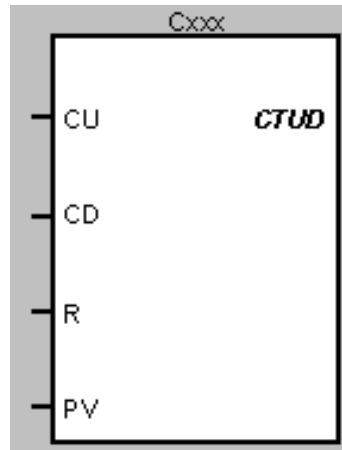
- The CTU is an instruction that counts false-to-true rung transitions. Rung transition can be caused by events occurring in the program (from internal logic or by external field devices.)
- The Count Up (CTU) instruction counts up to the maximum value on the rising edges of the Count Up (CU) input. When the current value (Cxxx) is greater than or equal to the Preset Value (PV), the counter bit (Cxxx) turns on. The counter is reset when the Reset (R) input turns on. It stops counting when it reaches PV.
- Counter range: Cxxx=C0 through C255

Down Counter (CTD)



- The Count Down (CTD) instruction counts down from the preset value on the rising edges of the Count Down input (CD).
- When the current value is equal to zero, the counter bit (Cxxx) turns on. The counter resets the counter bit (Cxxx) and loads the current value with the preset value (PV) when the load input (LD) turns on. The Down Counter stops counting when it reaches zero.

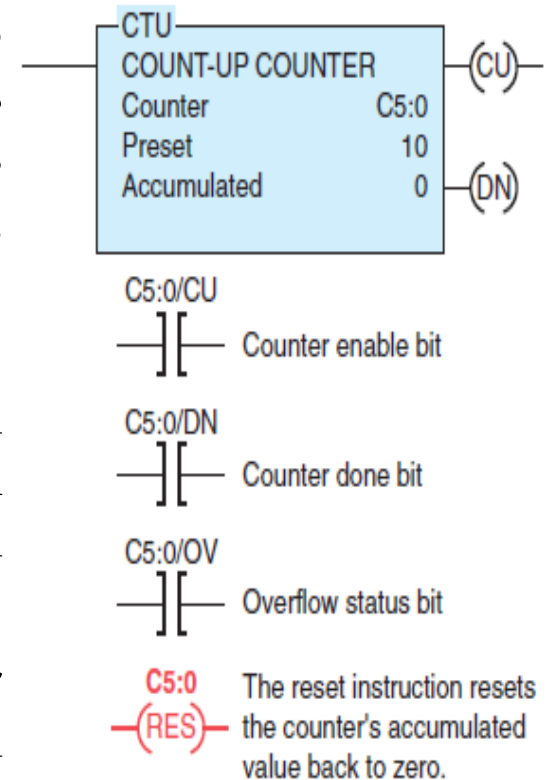
Up/Down Counter(CTUD)



- The Count Up/Down (CTUD) instruction counts up on rising edges of the Count Up (CU) input. It counts down on the rising edges of the Count Down (CD) input.
- When the current value (Cxxx) is greater than or equal to the Preset Value (PV), the counter bit (Cxxx) turns on. The counter is reset when the Reset (R) input turns on.
- Counter ranges: Cxxx=C0 through C255

UP Counter in Allen Bradley

- **Count-Up (CU) Enable Bit** —The count-up enable bit is used with the count-up counter and is true whenever the count-up counter instruction is true. If the count-up counter instruction is false, the CU bit is false.
- **Count-Down (CD) Enable Bit** —The count-down enable bit is used with the count-down counter and is true whenever the count-down counter instruction is true. If the count-down counter instruction is false, the CD bit is false.
- **Done (DN) Bit** —The done bit is true whenever the accumulated value is equal to or greater than the preset value of the counter, for either the count-up or the count-down counter.



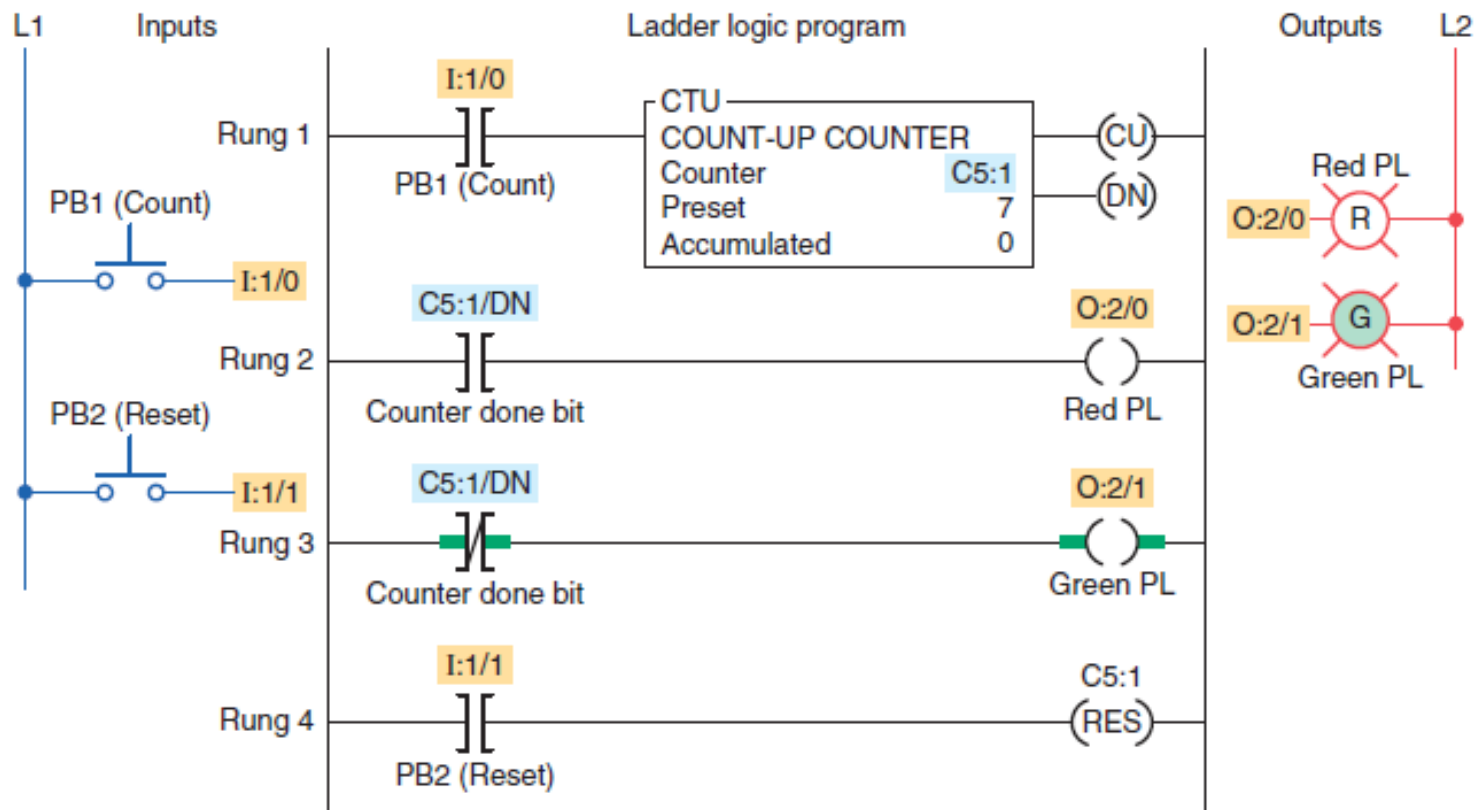
Counter in Allen Bradley

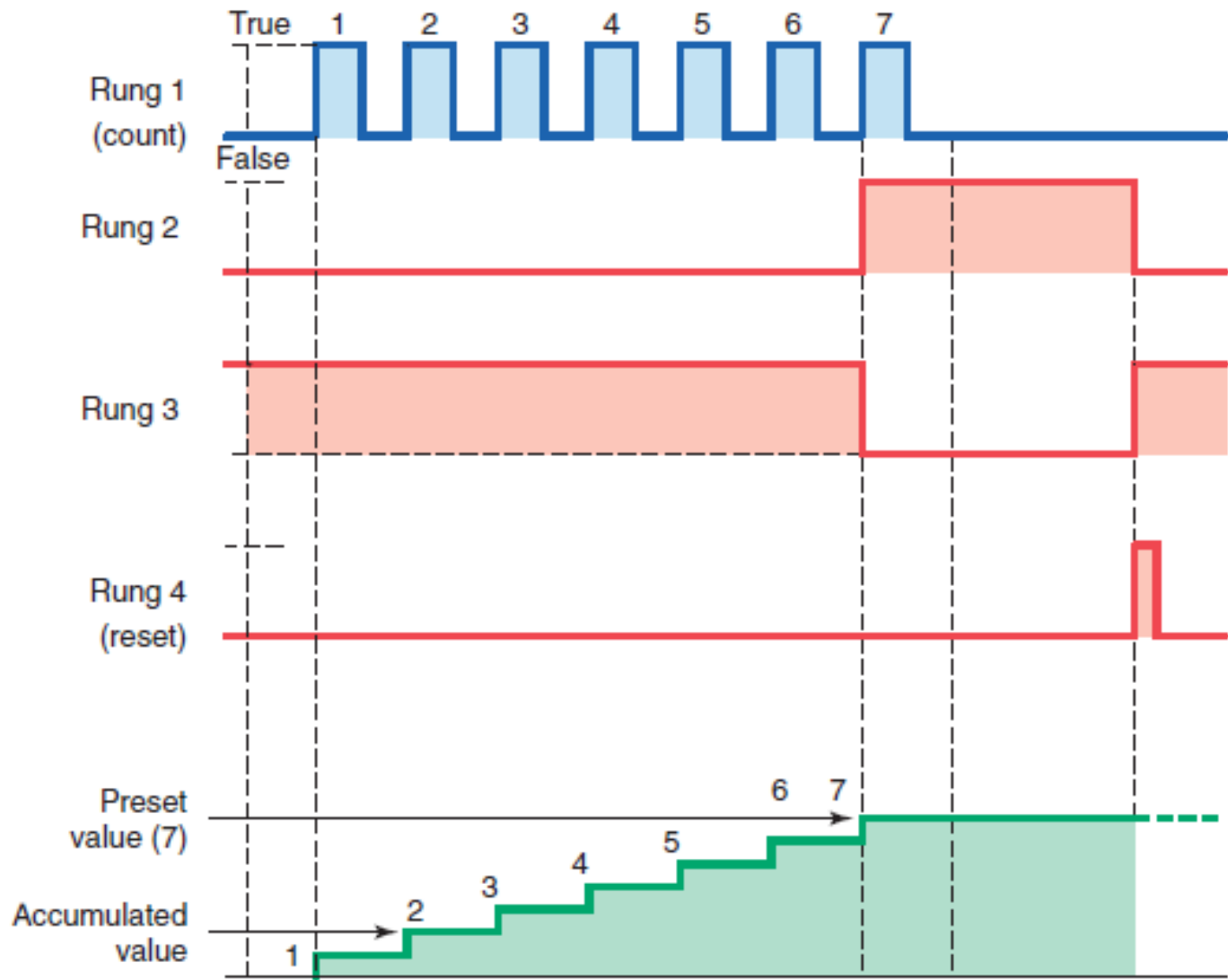
- **Overflow (OV) Bit** —The overflow bit is true whenever the counter counts past its maximum value, which is 32,767. On the next count, the counter will wrap around to 32,768 and will continue counting from there toward 0 on successive false-to-true transitions of the count-up counter.
- **Underflow (UN) Bit** —The underflow bit will go true when the counter counts below 32,768. The counter will wrap around to 132,767 and continue counting down toward 0 on successive false-to-true rung transitions of the count-down counter.
- **Update Accumulator (UA) Bit** —The update accumulator bit is used only in conjunction with an external HSC (high-speed counter).

- **Preset Value** —The preset value can range from -32,768 to +32,767.
- **Accumulated Value** —The accumulated value can also range from -32,768 through +32,767.
- Regardless of what value is entered, the reset instruction will reset the accumulated value to 0.

Example 1

- Develop a ladder logic to turn the red pilot light on and the green pilot light off after an accumulated count of 7. Also draw the timing diagram for the operation.

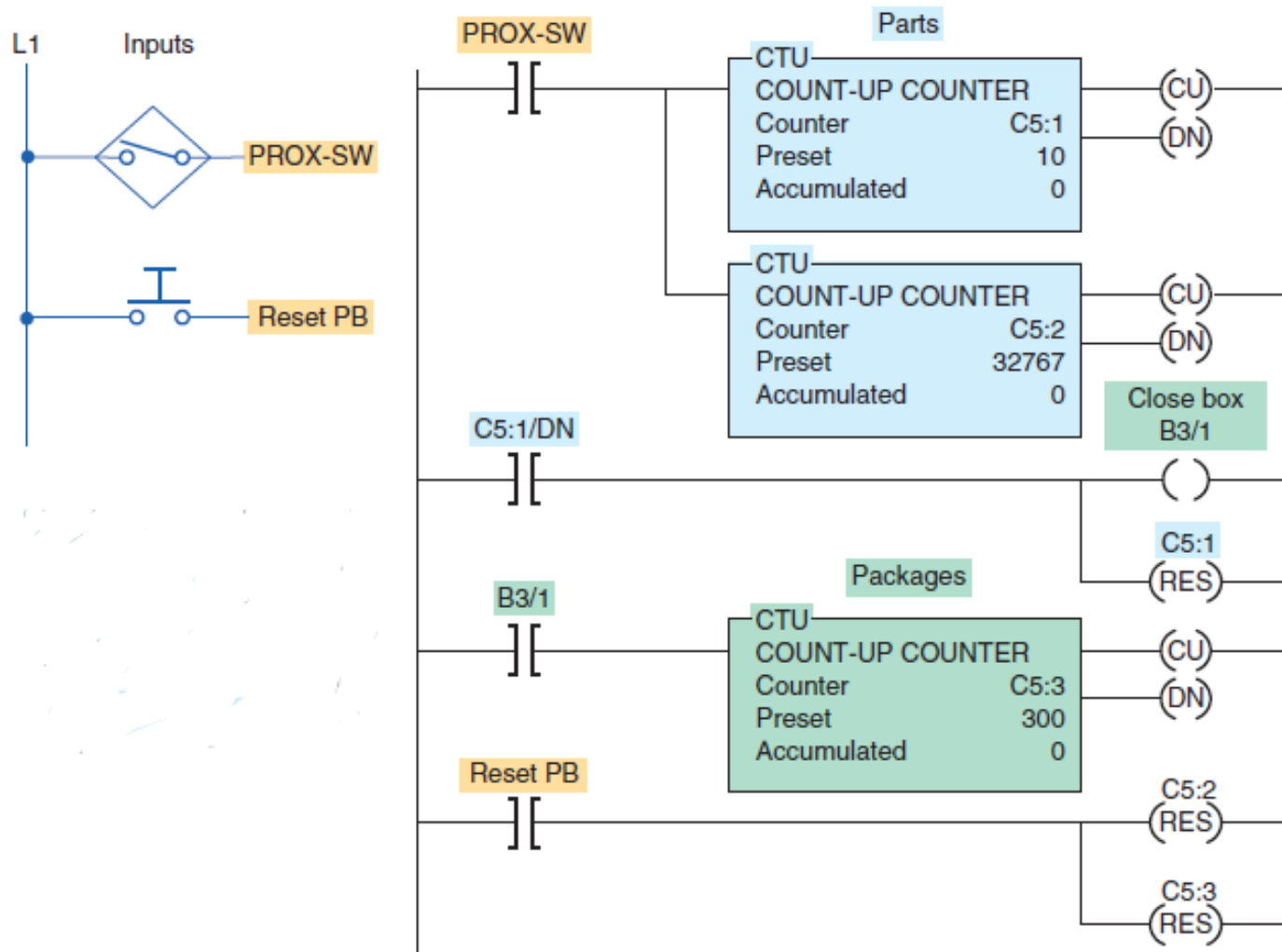




Example 2

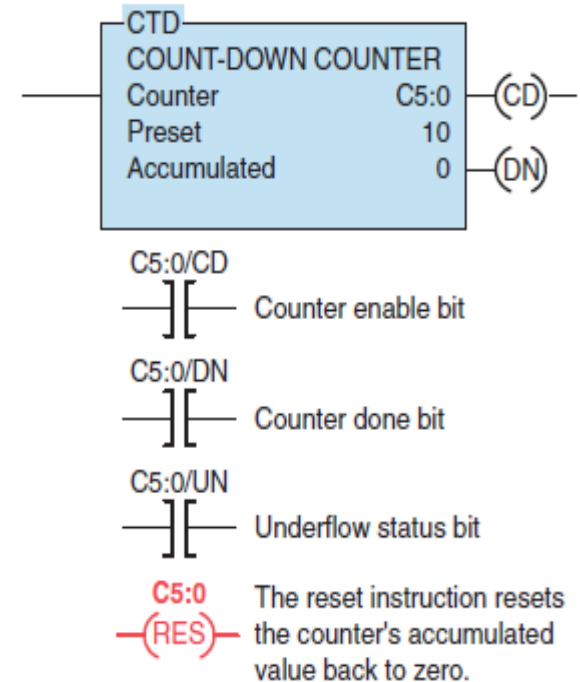
- Develop a ladder logic for the following problem.
- Everyday a plant has to finish 300 packages of cans. Each package should contain 10 cans. Count the total number of cans coming through the conveyor and the total packages made from the plant on a day. When 10 cans are entered into a package initiate the box closing sequence. A pushbutton is used to restart the total parts and packages count from zero daily.





Down Counter (Allen Bradley)

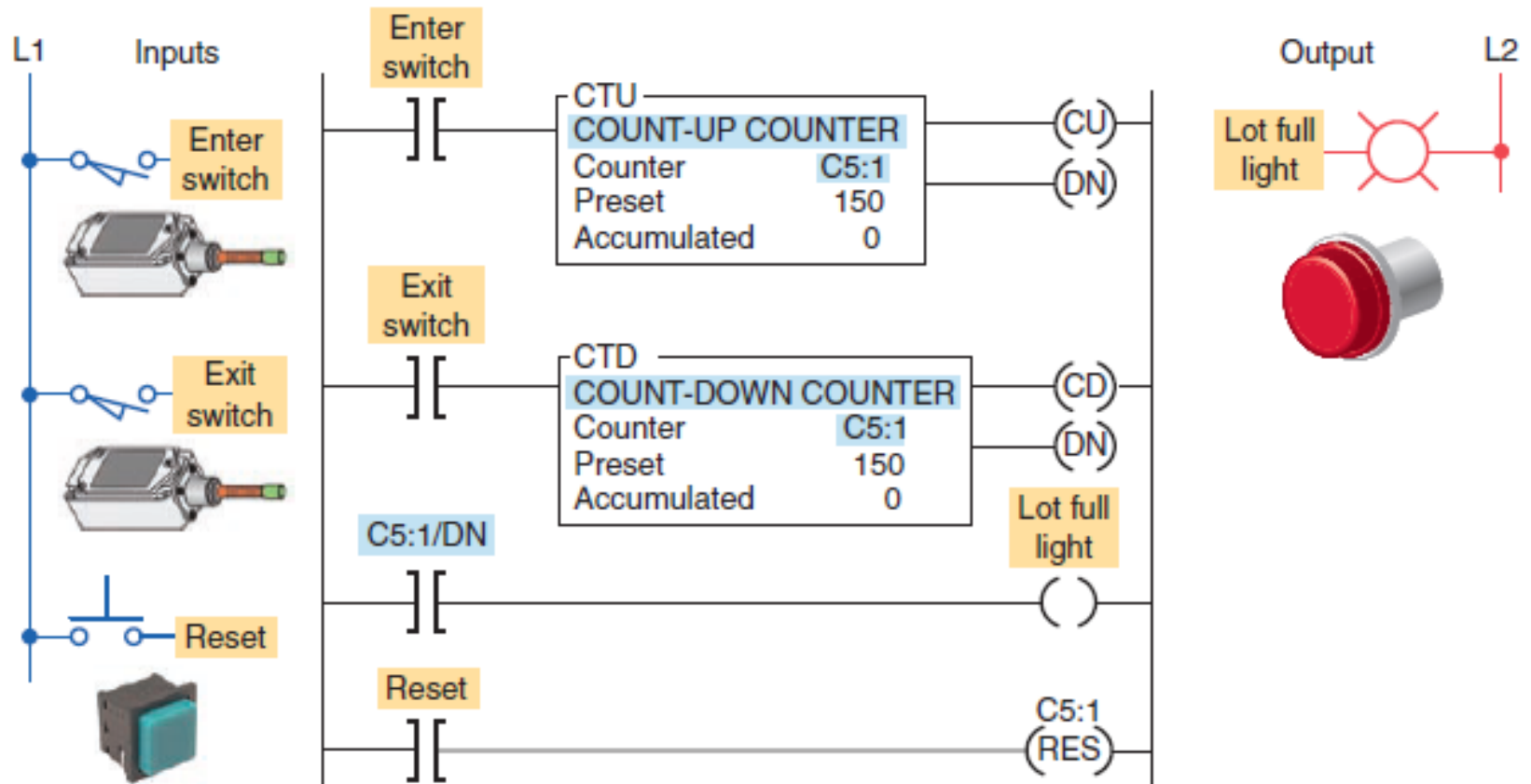
- The CTD instruction decrements its accumulated value by 1 every time it is transitioned.
- It sets its done bit when the accumulated value is equal to or greater than the preset value.
- The CTD instruction requires the RES instruction to reset its accumulated value and status bits.



Example 3

- Develop a ladder logic for counting the number of cars that enter and leave a parking garage. Garage has one entry and one exit with a capacity to accommodate 150 cars. Switch ON the Lot full light when the garage is full. A reset button has been provided to reset the accumulated count.





Example 4

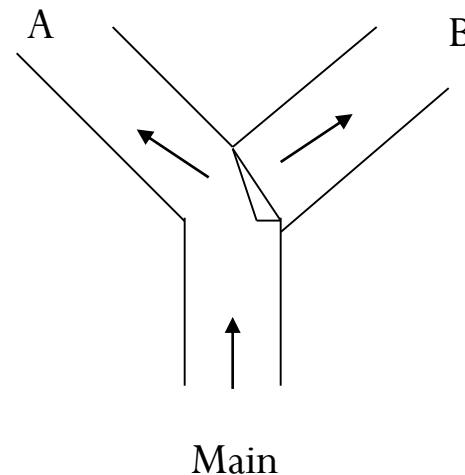
- Develop a program that will latch on an output 'B' 20 seconds after input A has been turned on. After 'A' is pushed, there will be a 10 second delay until 'A' can have any effect again. After 'A' has been pushed 3 times, 'B' will be turned off.

Example 5

Draw a ladder diagram for the following problems.

A conveyor arrangement is made as shown in the figure.

The shutter is operated with a pneumatic valve that takes 10 seconds to move from one position to other. Side A will be opened for the first 15 bags, B for the next 15 bags and that repeats until a main reset switch is enable. Moreover, all conveyors should remain off when the shutter actuator is enabled.



Reerence

- Frank D. Petruzella, *Programmable Logic Controllers*, MGH, (2e), 1997.