# PLC Counting Instructions

The PLC counting instructions are advanced software version or replacement of electronic or mechanical counters. The counting instructions are subdivided into up counting , down counting , and combined up down counting instructions. These key instructions are widely used in industrial application . For example they may be used to keep track of the number of water bottles coming out of the filling station, to control a gate for redirecting the movement of items ( books, bottles, etc.) , to count the number of time an event take place, measuring the linear distance an object moves, measuring the rotation speed of motors, keeping track of the undesired items on a conveyor, etc.

## UP Counting Counters

Up counters increase their current count output variable " CV" each time their trigger inputs experience a transition from logic zero to logic one. The instruction output Boolean variable Q toggles from zero to one when CV reaches the preset count value " PV" and stay so unless reset by the reset input R. The upper counting level depends upon the counting instruction type. Table 1 lists the upper limits for the various up counting instructions . Figure 1 shows the instruction function block and timing chart.

Table 1: Maximum counting value of counting up instructions.

| Instruction | PV data type | Maximum counting value |
|---|---|---|
| CTU_INT | Integer | 32767 |
| CTU_DINT | Double integer | 2147483647 |
| CTU_LINT | Long integer | 9223372036854775807 |
| CTU_UINT | Unsigned integer | 65535 |
| CTU_UDINT | Unsigned double integer | 4294967295 |
| CTU_ULINT | Unsigned long integer | 18446744073709551615 |

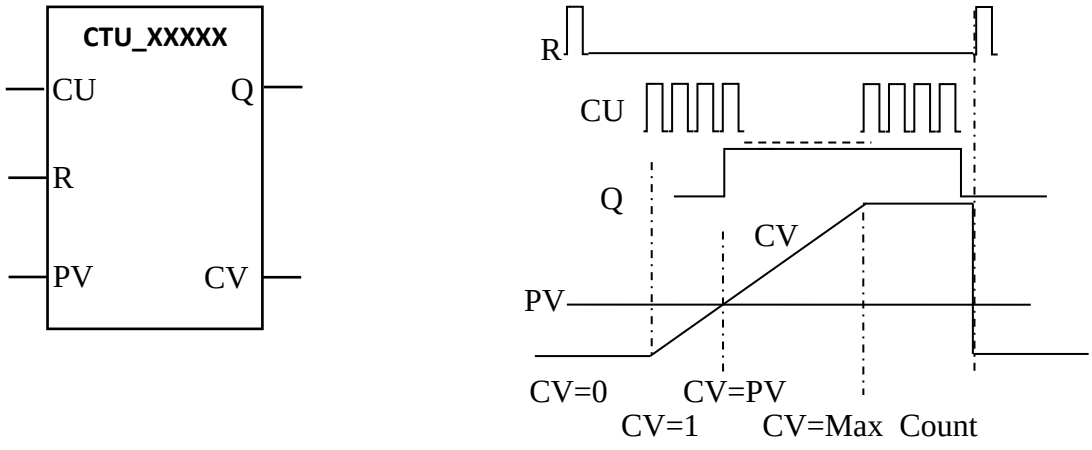


Figure 1: Up counting instruction timing chart

Example 1: In book packaging process it is required to change the traveling path of the books each time preset number of books have been passed ( say 12 books). assuming two paths, write PLC program to do that.

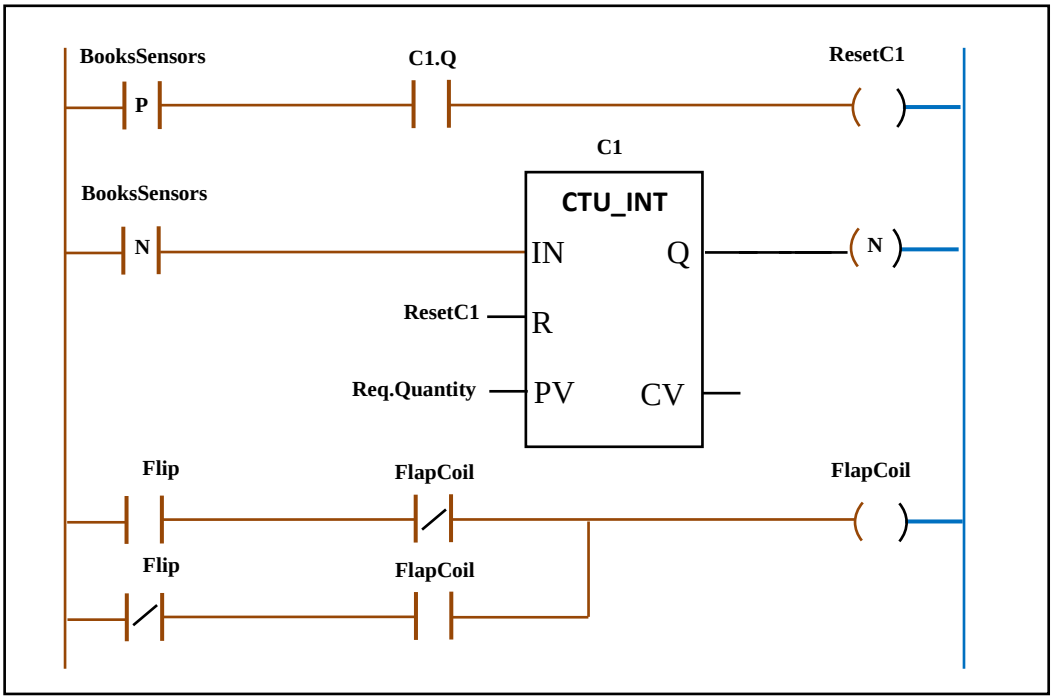


Figure 2: Traveling Path Controller.

**Down Counting Counter**

Down counters decrease their current count output variable labeled CV , starting from the preset value "PV" loaded by the load input "LD", each time their trigger inputs experience transition from logic zero to logic one. The instruction output Boolean variable Q toggles from zero to one the time CV reaches zero and stay one unless reset by the load input LD . The minimum counting level depends upon the counting instruction type. Table 2 lists the lower limits for the various down counting instructions . Figure 2 shows the instruction function block and details its timing chart.

Table 2: Minimum counting value of counting down instructions

| Instruction | PV data type | Minimum counting value |
|---|---|---|
| CTD_INT | Integer | -32768 |
| CTD_DINT | Double integer | -2147483648 |
| CTD_LINT | Long integer | -9223372036854775808 |
| CTD_UINT | Unsigned integer | 0 |
| CTD_UDINT | Unsigned double integer | 0 |
| CTD_ULINT | Unsigned long integer | 0 |

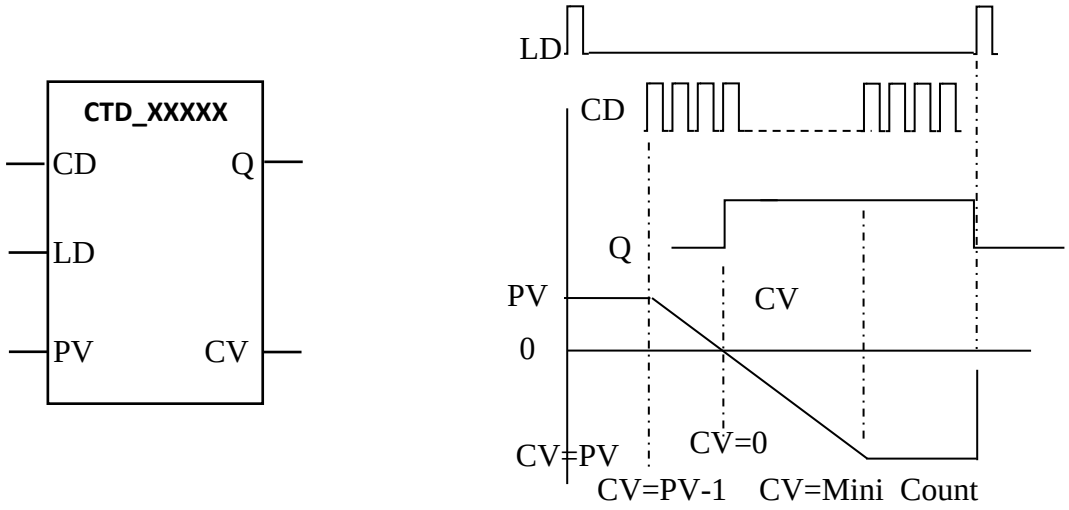


Figure 3: Down counting instruction timing chart

Example 2: Write ladder diagram to track the number of remaining items in a store previously loaded with 100 items.

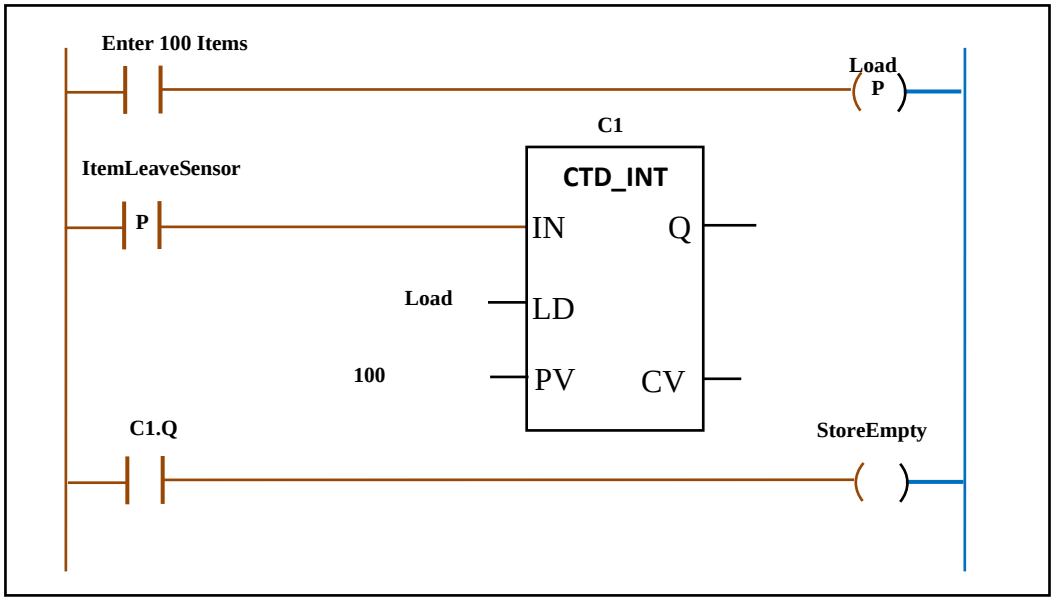


Figure 4: Tracking the remaining items in a store

## UP/ Down Counting Counters

UP / Down counters can be considered as two counters (up counter and down counter) sharing the same preset value input variable PV and current value output variable CV. The up counting part has its own unshared terminals or variables represented by the triggering input CU, reset input R, and the output QU. The down counter unshared variables are the triggering input CD, the load input LD, and the output variable QD. The upper and lower counting levels for these counters depend upon the instruction used type. Table 3 list down these limits.

Table 3: MAXIMUM /Minimum counting values of up/down counting instructions

| Instruction | PV data type | Max/Min counting value |
|---|---|---|
| CTUD_INT | Integer | -32768 to 32767 |
| CTUD_DINT | Double integer | -2147483648 to 2147483647 |
| CTUD_LINT | Long integer | -9223372036854775808 to 9223372036854775807 |
| CTUD_UINT | Unsigned integer | 0 to 65535 |
| CTUD_UDINT | Unsigned double integer | 0 to 2**32 -1 |
| CTUD_ULINT | Unsigned long integer | 0 to 2**64-1 |

Example 3: Draw ladder diagram for Parking Garage Controller with N car capacity

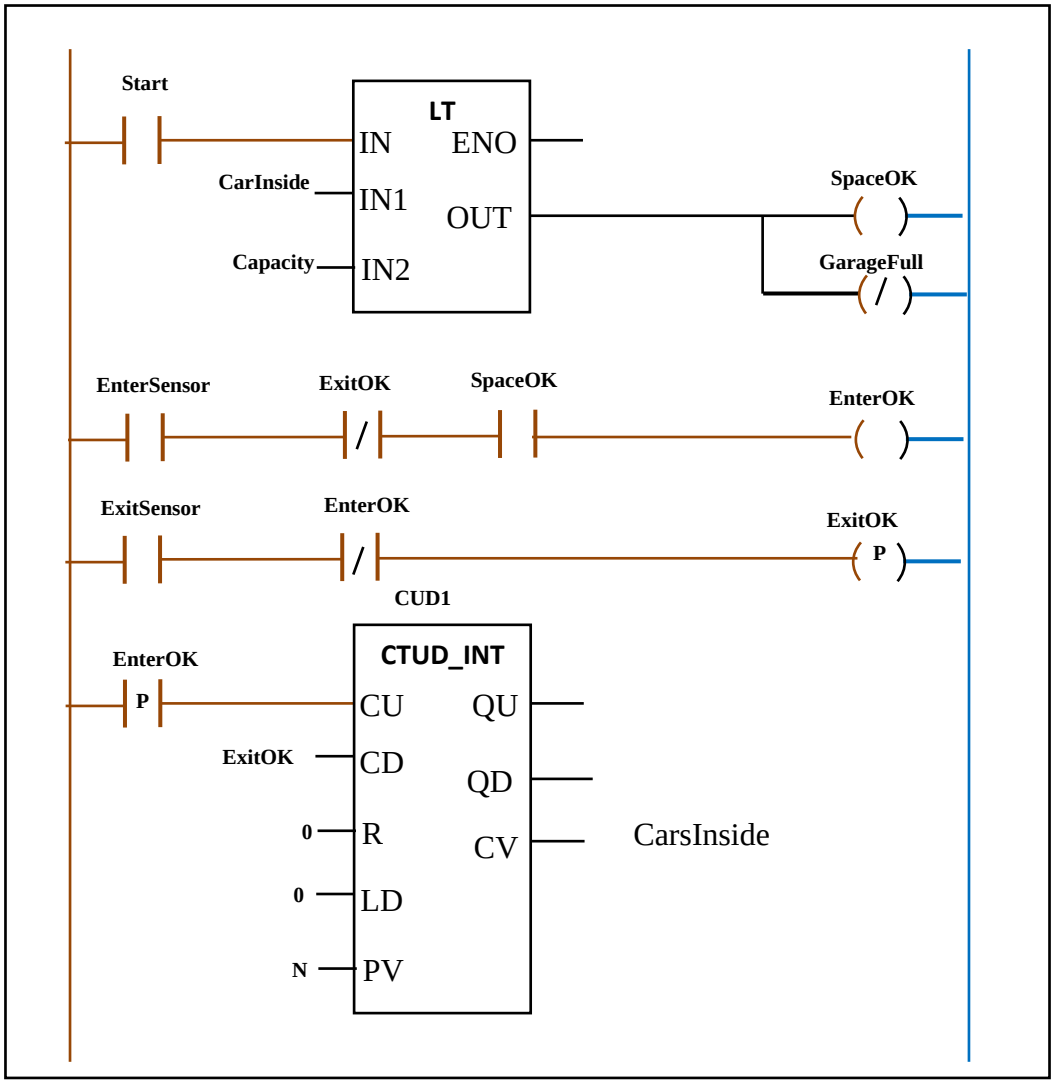


Figure 5: Parking Garage Controller

## Ring Counter

Ring counter CTR is an up counting instruction with inherent reset strobe facility. Here the current value CV increases as the rung connected to CD experiences a transition from zero to one and CV is less than PV. When CV equals PV the Q output becomes "1". The next positive transition on CD ( after CV=PV) resets the Q output and forces CV to take a value of one and new cycle starts. The ring counter supports only integer data types for its CV and PV variables. Figure 6 displays the ladder symbol and the timing chart of the ring counter.

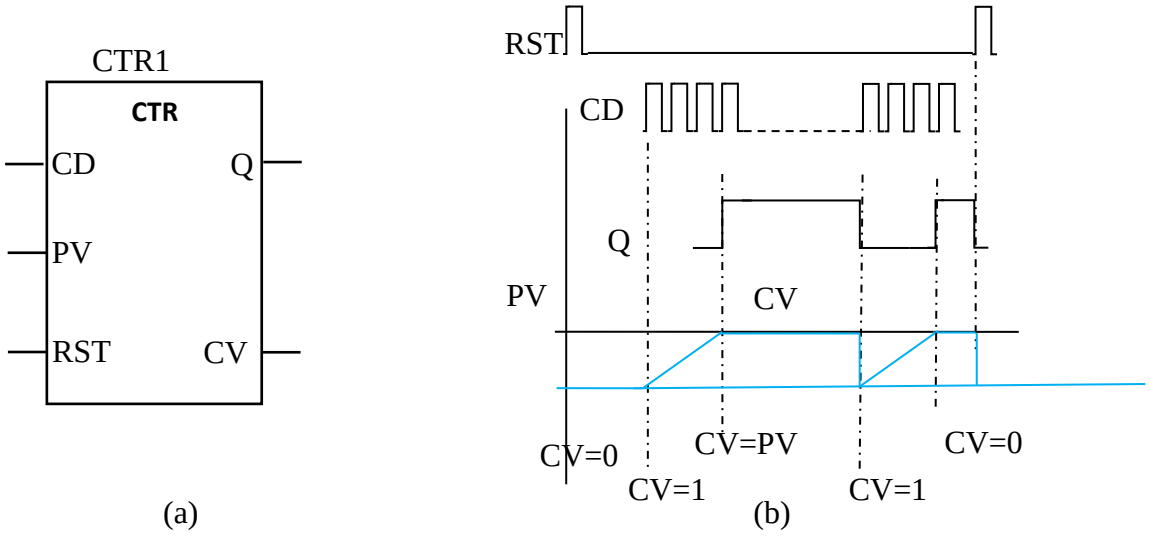


Figure 6: Ring counter instruction (a): Symbol . (b): timing chart

Example 4: Y is one dimensional array. It consists of 10 word type elements. Write PLC Program segment to continuously copy the contents of this array one after the other to the PLC output terminals. Let the copy process time span equals to 30sec.

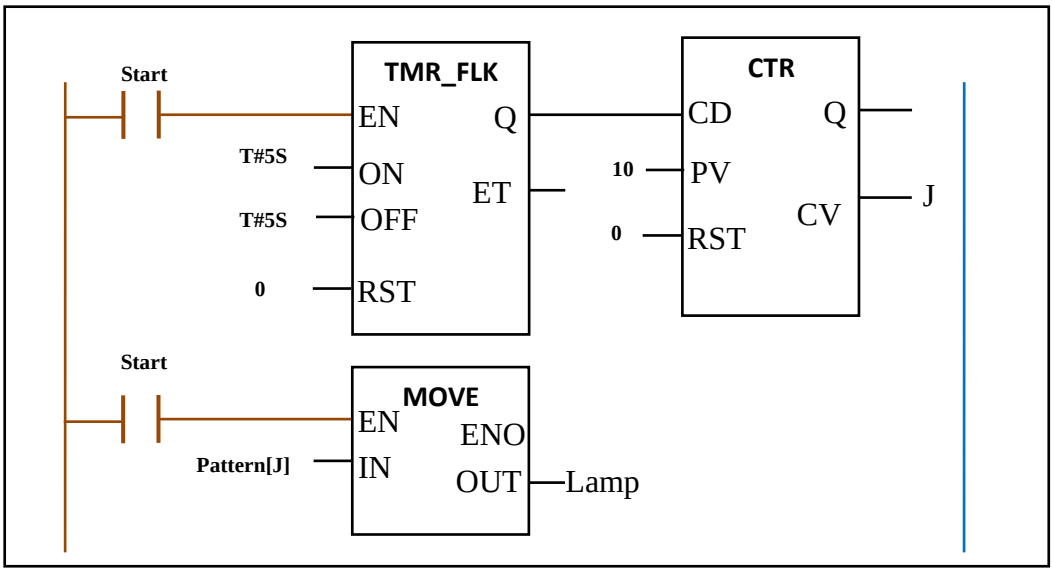


Figure 6: Light Flashing System