TIU – MED - 2022

PLC - LEC 6

Counters in PLC

Basics of Counting in a PLC

Counter Limits

Counter Function Blocks

Up Counter (CTU)

Down Counter (CTD)

Up Down Counter (CTUD)

Programing address

Counter application

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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.

1. Counter Limits

Counters use variables of certain data types to store numbers in the PLC. All counters need to store at least two numbers:

1.Counter Limit

2.Current Counter Value

Since these two numbers are saved in a certain data type they also have their limits.

Many PLC's save these two numbers as **WORD** or **Integer** data types and if you remember the basics of PLC data types, you will know that a WORD takes up 16 bits.

With a little bit of calculation we'll quickly find out that the maximum value of a WORD is **65.535**. The maximum value of the signed integer is **32.767**.

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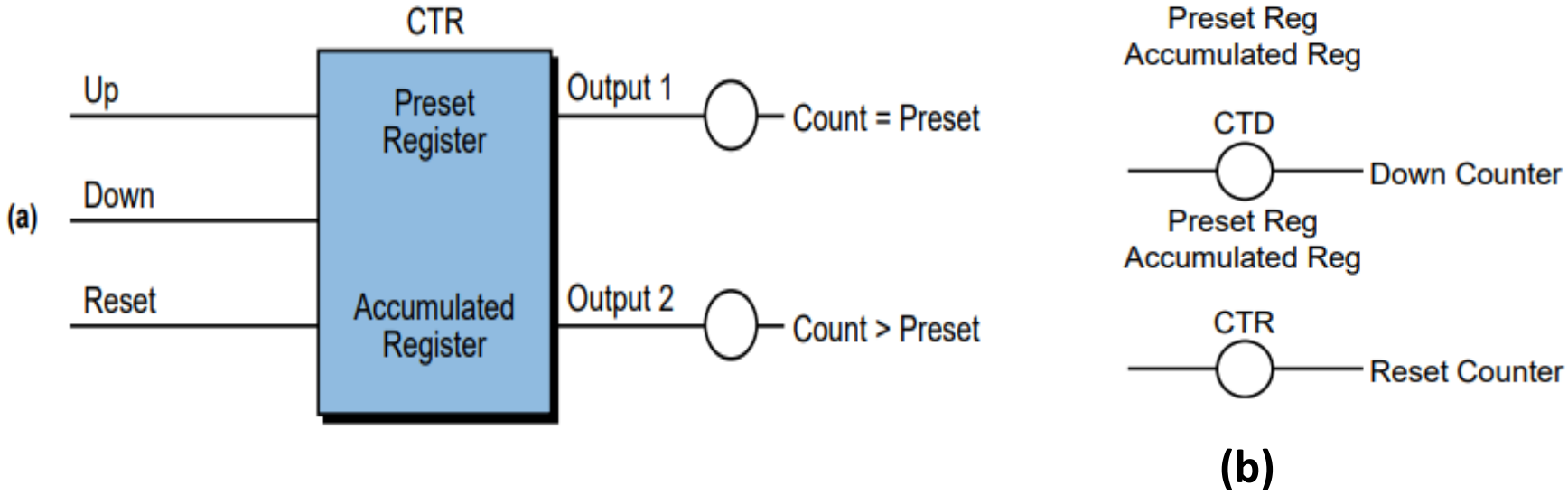
2. Counter Function Blocks

There are two basic types of counters: those that can **count up** and those that can **count down**. Depending on the controller, the format of these counters may vary. Some PLCs use the ladder format (**output coil**), while others use functional block format



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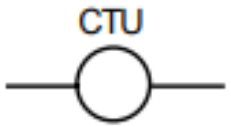
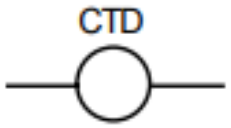
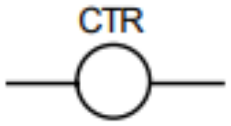
Counter instructions

Counter Instructions *(Purpose: To provide hardware counter capabilities in a PLC)*		
Instruction	**Symbol**	**Function**
Up Counter		Increases the accumulated register value every time a referenced event occurs
Down Counter		Decreases the accumulated register value every time a referenced event occurs
Counter Reset		Resets the accumulated value of an up or down counter

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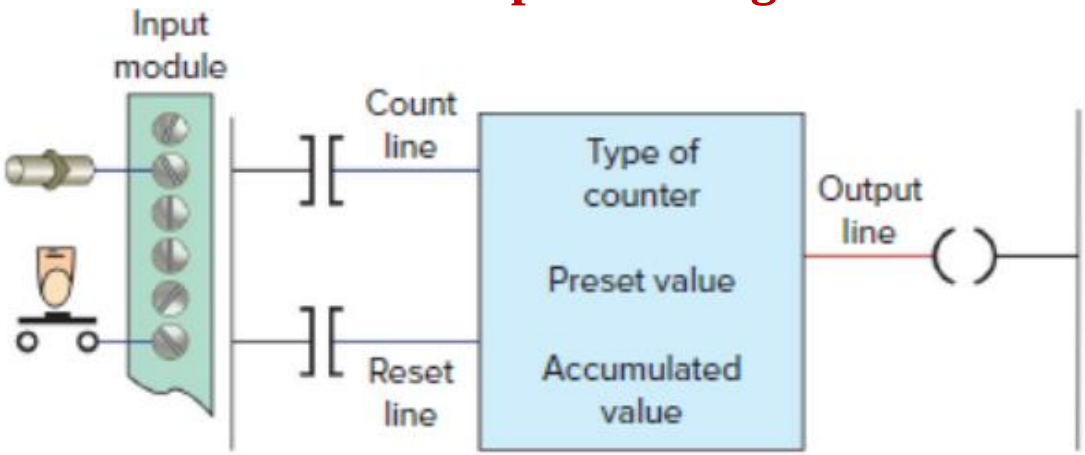
3. UP COUNTER

The two methods used to represent a counter within a PLC's ladder logic program are the coil format and the block format. The **up-counter increments** its accumulated value **by 1** 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**. Shown as part of the instruction



Counter type

- **Counter address**
- **Counter preset value**
- **Accumulated count**

- S – Set the value of a counter.
- Q – Output of the counter.
- R- Reset value of the counter.
- PV- Preset counter value.
- CV – Count Variable.
- BCD – Current count in binary decimal code.

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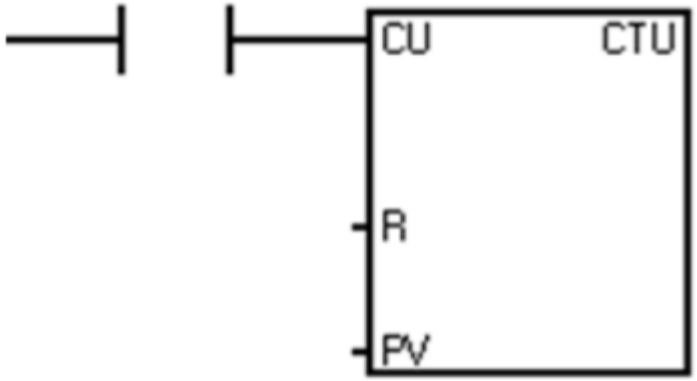
3. UP COUNTER

block-formatted counter. The instruction block indicates the type of counter (up or down), along with the counter's preset value and accumulated or current value. The counter has two input conditions associated with it, namely, the count and reset. All PLC counters operate, or count, on 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

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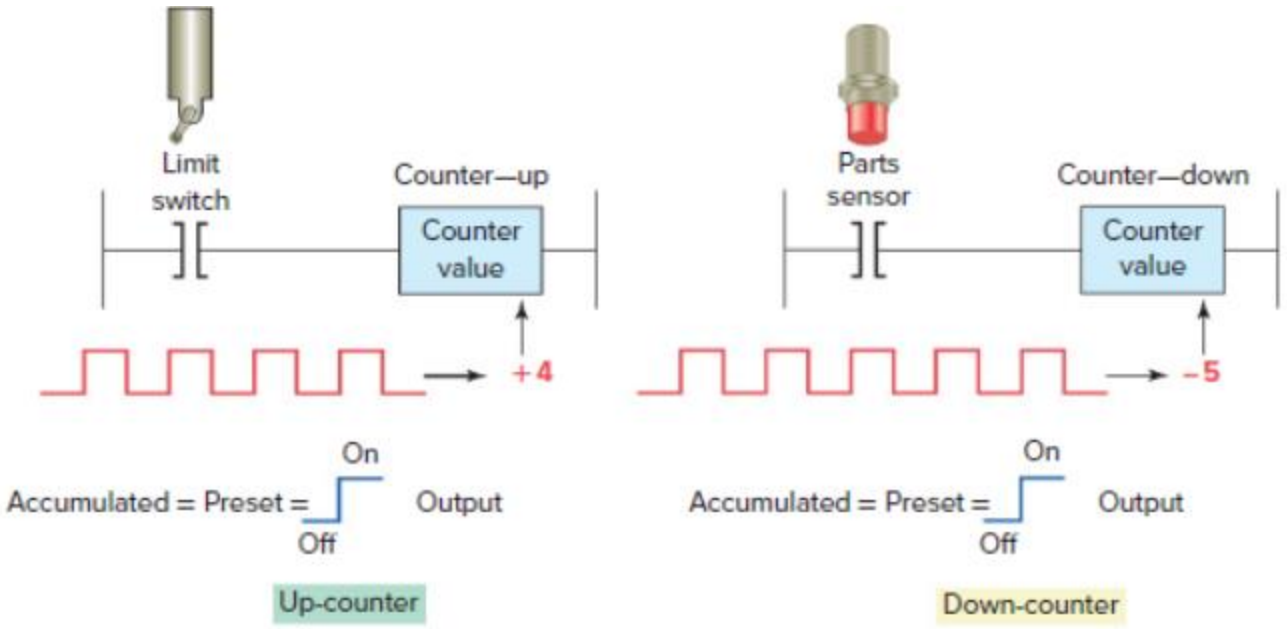
4. DOWN COUNTER

A down counter (CTD) output instruction decreases the count value in its accumulated register by one every time a certain event occurs.

In practical use, a down counter is used in conjunction with an up counter to form an up/ down counter, given that both counters have the same reference registers



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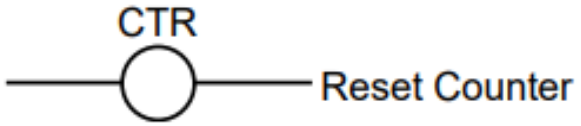
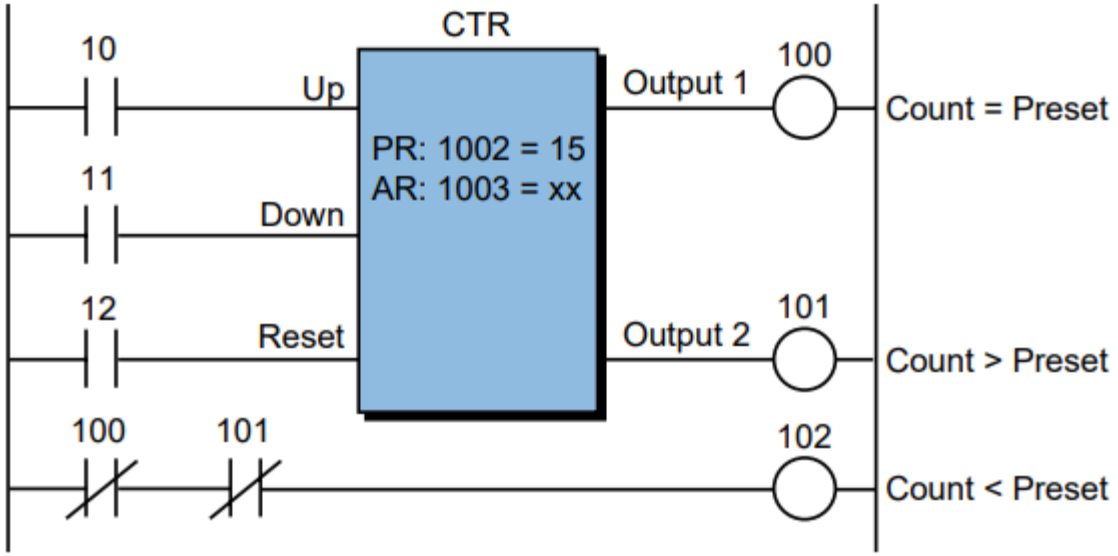
4. COUNTER RESET

A counter reset (CTR) output instruction resets up counter and down counter accumulated values to zero.



If the counter reset rung condition is TRUE,

the reset instruction will clear the referenced address. The reset line in a block format counter instruction sets the accumulated count to zero (accumulated register = 0).



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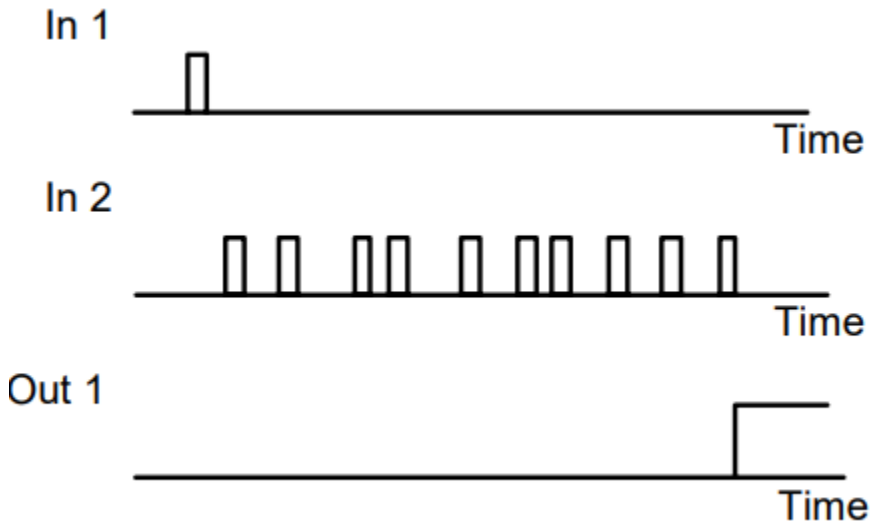
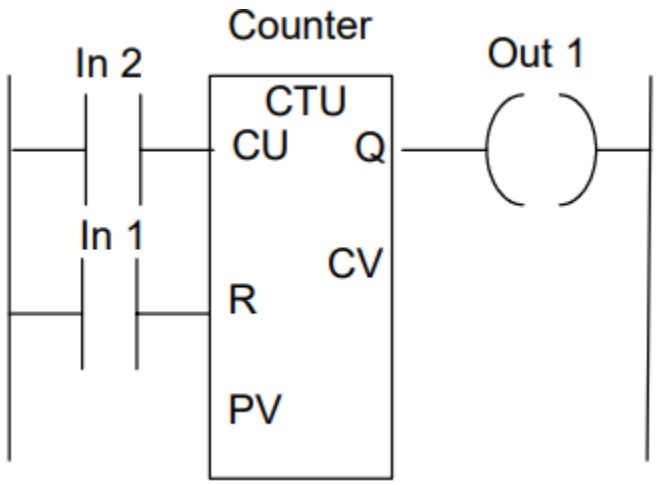
Programming

When there is a pulse input to In 1, the counter is reset. When there is an input to In 2, the counter starts counting. If the counter is set for, say, 10 pulses, then when 10 pulse inputs have been received at In 2, the counter's contacts will close and there will be an output from Out 1





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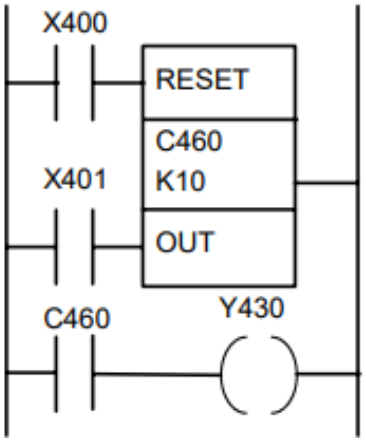
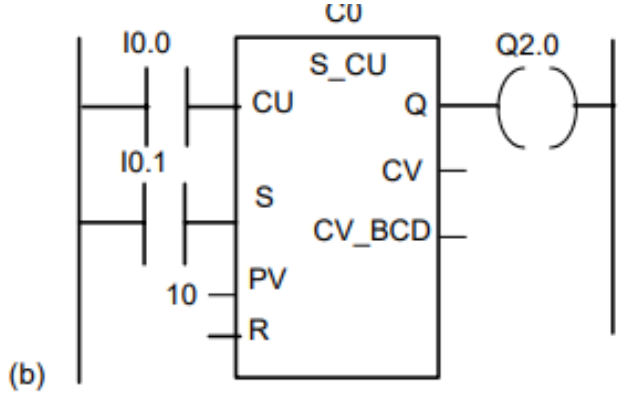
Counter Instructions Address for Multiple PLC Brands

Mitsubishi



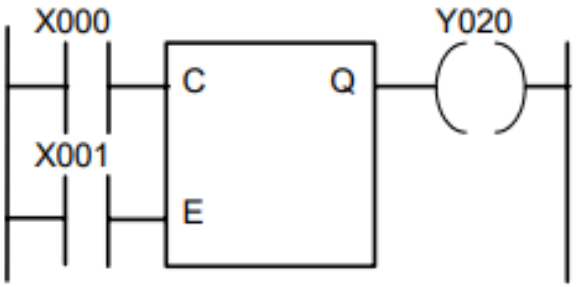

```
LD    X400
RST   C460
LD    X401
OUT   C460
K     10
LD    C460
OUT   Y430
```

Siemens



CV_BCD is count value in BCD.
CV is count value in Boolean.
S is SET and is used to activate the counter and is set to its starting value; with count up, this is zero.

Toshiba



C = count input
E = enable or reset input
Q = output

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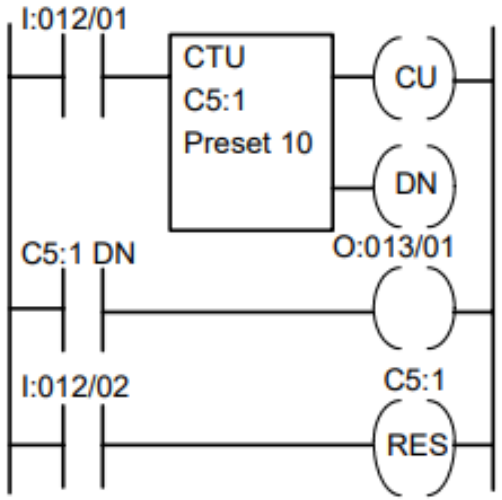
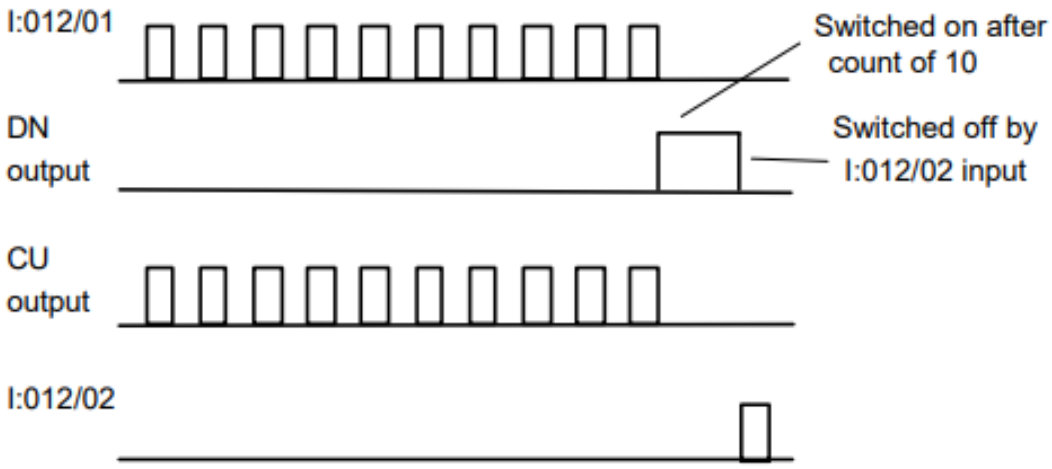
Counter Instructions Address for Multiple PLC Brands

Allen Bradly





CTU = count up
Note: CTD = count down
C5:1 is counter address
Preset is the preset count number

CU = output for use with count up counters and is termed the count up enable. It gives an output until the count has reached the preset value.

DN = output which gives an output when the count has reached the set value

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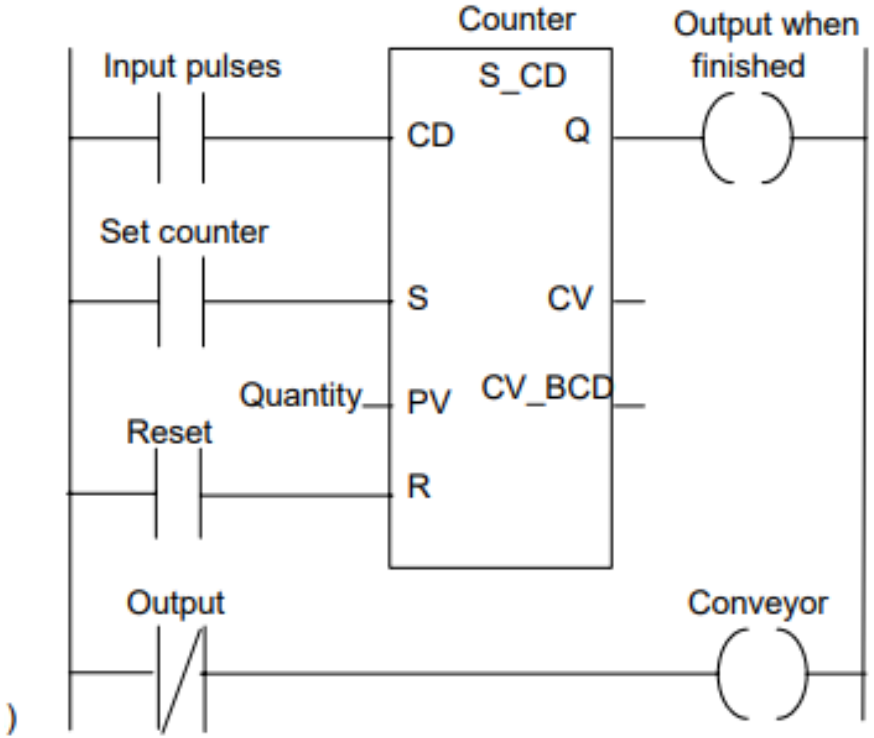
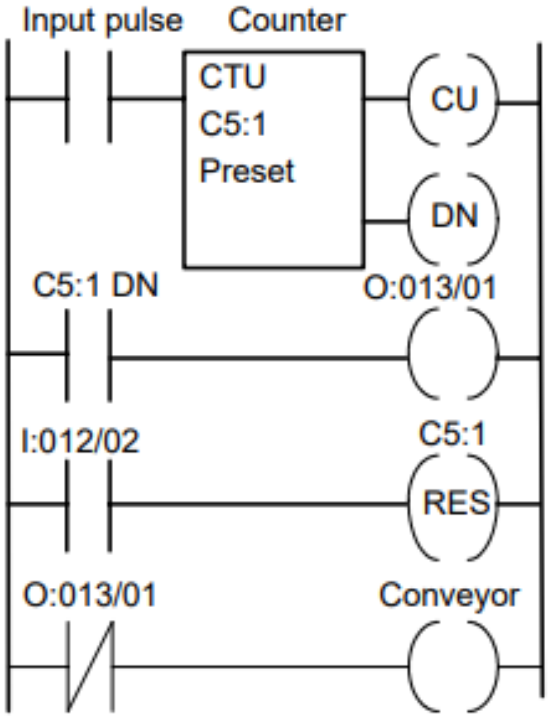
Counter application

Consider the problem of items passing along a conveyor belt, the passage of an item past a particular point being registered by a light beam to a photoelectric cell being interrupted, and after a set number there is to be a signal sent informing that the set count has been reached and the conveyor stopped.



Siemens



Allen Bradly

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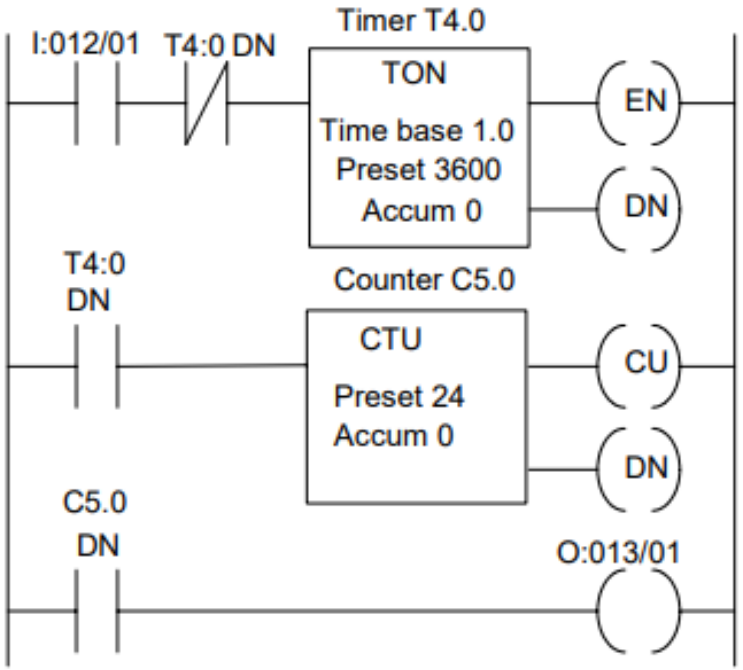
Timers with counters

A typical timer can count up to 16 binary bits of data, this corresponding to 32 767 base time units. Thus, if we have a time base of 1 s then the maximum time that can be dealt with by a timer is just over 546 minutes or 9.1 hours. If the time base is to be 0.1 s then the maximum time is 54.6 minutes or just short of an hour. By combining a timer with a counter, longer times can be counted.

If the timer has a time base of 1 s and a preset value of 3600, then it can count for up to 1 hour.



input I:012/01 is activated

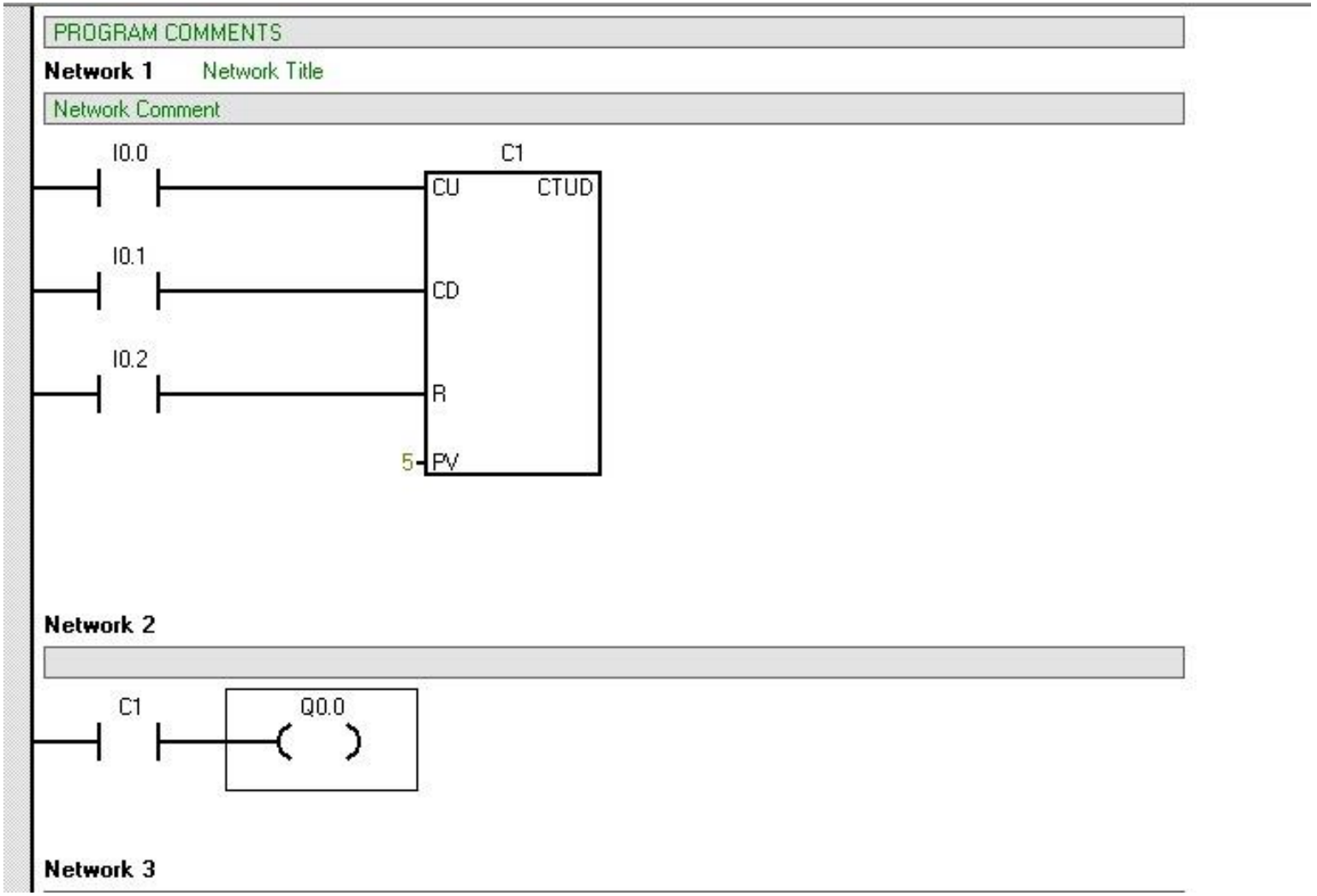
Timer starts to time in one second increments.

When the time reaches the preset value of 1 hour, the DN bit is set to 1 and the counter increments by 1 and reset the time .

when the count reaches 24 and the output O:013/01 is turned on

We thus have a timer which is able to count the seconds for the duration of a day and would l able to switch on some device after 24 hours

Lab


PROGRAM COMMENTS
Network 1
Network Title
Network Comment
I0.0
C1
CU
CTUD
I0.1
CD
I0.2
R
5
PV
Network 2
C1
Q0.0
Network 3