Lab 5: Count and Downcount Instructions on the S7-1200

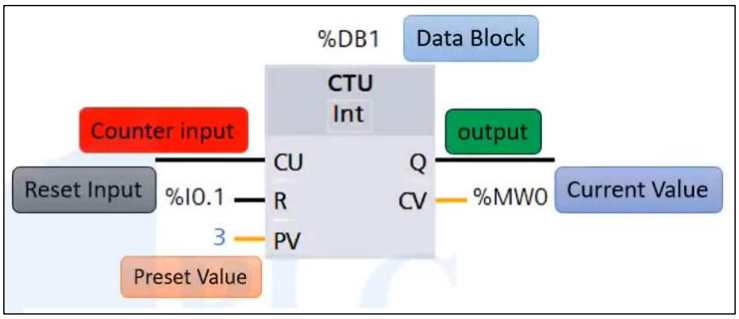
Lab Objective

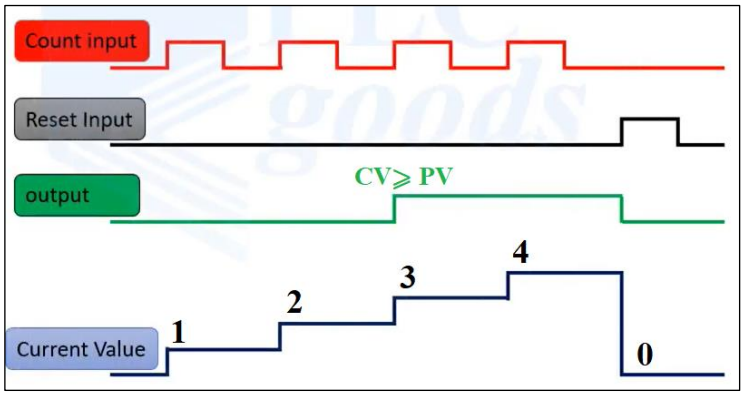
The purpose of this lab is to demonstrate how to use the software components: counter, down-counter, and up/down counter on the SIMATIC S7-1200 PLC.
You will learn:
How to use the Counters library in TIA Portal
How to simulate a program using the PLCSIM simulator

1 CTU Instruction (Up Counter)

Description

The **CTU** instruction increments the current count value (**CV**) by one whenever a **rising edge** is detected at the **CU** (Count Up) input.
The logical state of the **Q** output is determined by the **PV** (Preset Value) parameter. When the current count value **CV** is greater than or equal to **PV**, the **Q** output is set to logical "1". In all other cases, the **Q** output remains at logical "0".
The **CV** output is reset to zero when the **R** (Reset) input changes to logical "1". While the **R** input remains at "1", any rising edge on **CU** has no effect on the instruction.





Example:

The table below shows the parameters of the "Count" instruction:

Parameter	Declaration	Data Type	Memory Area	Description
CU	Input	BOOL	I, Q, M, D, L or constant	Count input
R	Input	BOOL	I, Q, M, D, L, P or constant	Reset input
PV	Input	Integer numbers	I, Q, M, D, L, P or constant	Preset value at which output Q is set to 1
Q	Output	BOOL	I, Q, M, D, L	Counter output state
CV	Output	Integer numbers, CHAR, WCHAR, DATE	I, Q, M, D, L, P	Current count value

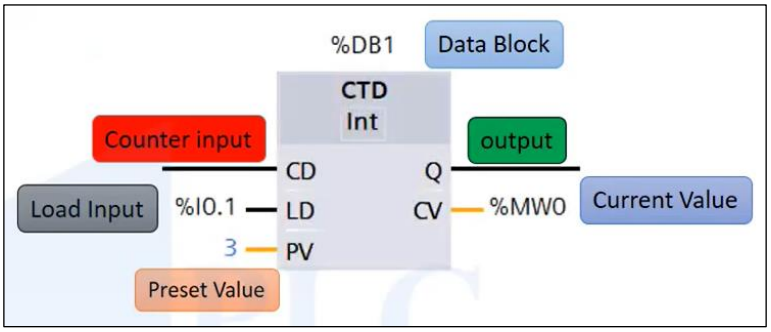
2 CTD Instruction (Down Counter)

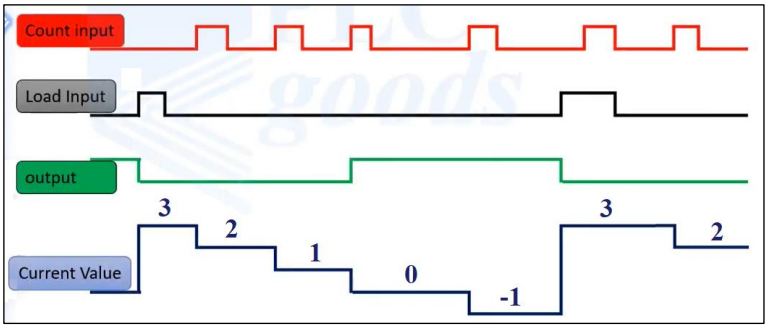
Description :

The **CTD** instruction decrements the current count value (**CV**) by one whenever a **rising edge** is detected at the **CD** (Count Down) input.

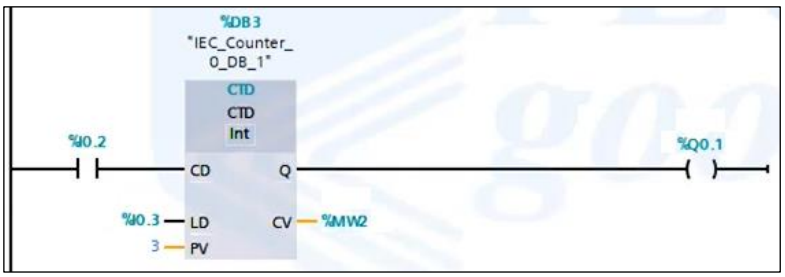
The logical state of the **Q** output is determined by the **PV** (Preset Value) parameter. When the current count value **CV** is **less than or equal to 0**, the **Q** output is set to logical "1". In all other cases, the **Q** output remains at logical "0".

The **CV** output is loaded with the **PV** value when the logical state of the **LD** (Load) input changes to **1**. As long as the **LD** input remains at "1", any rising edge on the **CD** input has no effect on the instruction.





Example:



The table below shows the parameters of the "Count Down" instruction:

Parameter	Declaration	Data Type	Memory Area	Description
CD	Input	BOOL	I, Q, M, D, L or constant	Count down input
LD	Input	BOOL	I, Q, M, D, L, P or constant	Load input
PV	Input	Integer numbers	I, Q, M, D, L, P or constant	Value loaded into CV when LD = 1
Q	Output	BOOL	I, Q, M, D, L	Counter output state
CV	Output	Integer numbers, CHAR, WCHAR, DATE	I, Q, M, D, L, P	Current count value

3 Up/Down Counter (CTUD)

Description:

The **CTUD** instruction increments or decrements the current count value **CV**.

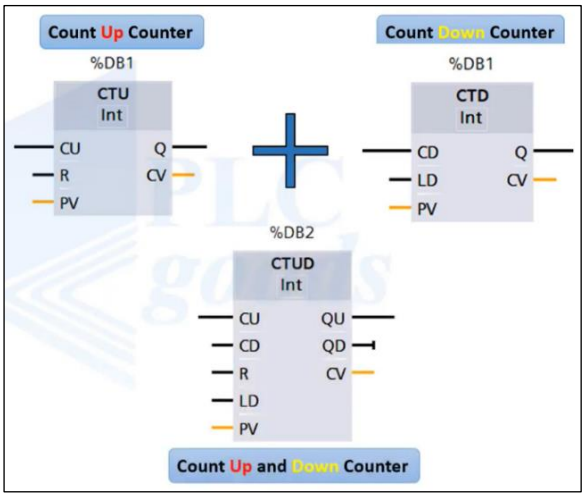
- When a **rising edge** is detected at the **CU** (Count Up) input, **CV** is increased by one (CV ← CV + 1).
- When a rising edge is detected at the **CD** (Count Down) input, **CV** is decreased by one (CV ← CV – *1*).

If rising edges are detected simultaneously on both **CU** and **CD** during the same program cycle, **CV** remains unchanged.

When the **LD** (Load) input goes to logical "1", **CV** is loaded with the value of the **PV** (Preset Value) parameter, and both **CU** and **CD** are ignored as long as **LD** remains active.

Similarly, if the **R** (Reset) input is set to "1", **CV** is reset to zero, and any changes on **CU**, **CD**, or **LD** are ignored while **R** remains active.

- When **CV ≥ PV**, the **QU** (Count Up Output) is set to logical "1"; otherwise, **QU** is "0".
- When **CV ≤ 0**, the **QD** (Count Down Output) is set to logical "1"; otherwise, **QD** is "0".



Parameter	Declaration	Data Type	Memory Area	Description
CU	Input	BOOL	I, Q, M, D, L or constant	Count up input
CD	Input	BOOL	I, Q, M, D, L or constant	Count down input
R	Input	BOOL	I, Q, M, D, L, P or constant	Reset input
LD	Input	BOOL	I, Q, M, D, L, P or constant	Load input
PV	Input	Integer numbers	I, Q, M, D, L, P or constant	Preset value for **QU** / Value loaded into **CV** when **LD = 1**
QU	Output	BOOL	I, Q, M, D, L	Counter output state (**CV ≥ PV**)
QD	Output	BOOL	I, Q, M, D, L	Down counter output state (**CV ≤ 0**)
CV	Output	Integer numbers, CHAR, WCHAR, DATE	I, Q, M, D, L, P	Current count value