

1 Objective

The objective of this experiment is to demonstrate the concept of counters in Programmable Logic Controllers (PLCs), specifically focusing on the functionality of Up Counters (CTU) and Down Counters (CTD). The experiment involves implementing ladder logic diagrams to illustrate counter operations and applying these concepts to control an automatic stamp system.

2 Equipment

The following equipment is required for this experiment:

1. Siemens S7-1200 PLC Module or LOGO PLC.
2. PC with TIA PORTAL or LOGO SOFT Comfort installed.

3 Lab Work

In this section, develop ladder logic diagrams for Up Counter (CTU) and Down Counter (CTD) instructions using the appropriate software (TIA PORTAL for Siemens S7-1200 or LOGO SOFT Comfort for LOGO PLC). After creating the ladder logic, upload it to the PLC module and execute the program to observe the counter behavior.

3.1 Up Counter

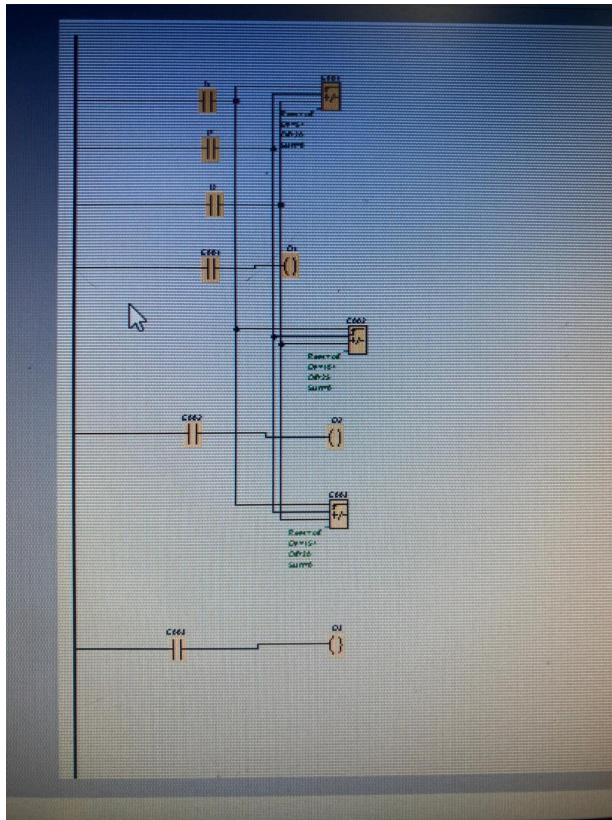
A Count Up instruction (CTU) is a PLC programming instruction used to count the number of operations or products produced by a system. Key characteristics include:

- Counts every false-to-true transition from the logic preceding the instruction in a rung.
- The cumulative value increases by one for each false-to-true transition.
- The counter continues counting beyond the preset value unless reset by an identified RES instruction.

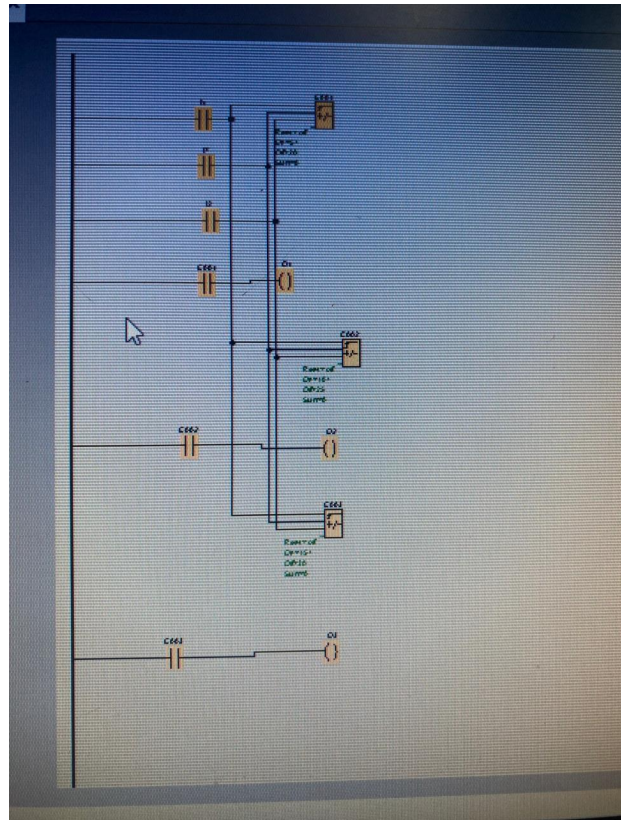
3.2 Down Counter

A Count Down instruction (CTD) is a PLC programming instruction also used to count the number of operations or products produced by a system. Key characteristics include:

- Counts down every false-to-true transition from the logic preceding the instruction in a rung.



(a) In TIA Portal



(b) In LOGO SOFT

Figure 1: Down Counter Operation

4 Experimental Work

The experiment involves controlling an automatic stamp system using a PLC with ladder logic that incorporates counter instructions. The system operates as follows:

- When the start switch is turned on, the system is ready to run.
- When a box is placed at the beginning of the conveyor (detected by limit switch LS1), the conveyor motor starts, and the conveyor moves.
- Upon reaching the midpoint of the conveyor (detected by limit switch LS2), the conveyor motor stops, and the stamp descends to place a stamp on the box.
- After stamping, the stamp ascends, and the conveyor resumes moving toward the end.
- When the box reaches the end of the conveyor (detected by limit switch LS3), the motor stops.
- The system waits for the box to be removed and a new box to be placed at the beginning of the conveyor.

- If the start switch is turned off, the system halts, even if a box is present on the conveyor.

Additional details: Counters (CTU or CTD) can be used to track the number of boxes processed or stamping operations. Test the system by simulating the start switch, limit switch activations (LS1, LS2, LS3), and monitor the PLC's input/output status to confirm proper counter functionality.

5 Discussion

The experiment, titled “Demonstrating the Concept of Counters,” successfully utilized a Siemens S7-1200 PLC Module or LOGO PLC, programmed via TIA Portal or LOGO Soft Comfort, to design ladder logic circuits for Up Counter (CTU) and Down Counter (CTD) instructions. The automatic stamp system demonstrated the practical application of counters in tracking operations, such as counting the number of boxes processed or stamping cycles. The system's behavior, controlled by limit switches (LS1, LS2, LS3) and a start switch, mirrors real-world industrial automation processes, such as conveyor-based manufacturing or packaging systems. The use of counters ensures accurate tracking of operations, with the system halting appropriately when the start switch is turned off.