Course Code: RME 2202
Course Name: Microcontroller and Programmable Logic Controller Lab

Experiment No: 06
Experiment Name: Implementing the mixing mechanism in an industrial mixer using PLC.

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Date of submission: 04 March 2021

Objective:

- To learn the basic principle of the PLC
- To learn the applications of the PLC
- To get introduced with the PLC programming using LOGO! Soft

Comfort V8.2

Theory:

A programmable logic controller (PLC) or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis. They were first developed in the automobile manufacturing industry to provide flexible, ruggedized and easily programmable controllers to replace hard-wired relays, timers and sequencers. The most basic function of a programmable controller is to emulate the functions of electro-mechanical relays. Discrete inputs are given a unique address, and a PLC instruction can test if the input state is on or off. Just as a series of relay contacts perform a logical AND function and a parallel set of instructions will perform a logical OR, not allowing current to pass unless all the contacts are closed.

IEC 61131-3 standard currently defines five programming languages for programmable control systems: function block diagram (FBD), ladder diagram (LD), structured text (ST; similar to the Pascal programming language), instruction list (IL; similar to assembly language), and sequential function chart (SFC). These techniques emphasize logical organization of operations. The most commonly used programming language is Ladder diagram (LD) also known as Ladder). It uses Contact-Coil logic to make programs like an electrical control diagram.

The main difference from most other computing devices is that PLCs are intended-for and therefore tolerant-of more severe conditions (such as dust, moisture, heat, cold), while offering extensive input/output (I/O) to connect the PLC to sensors and actuators. PLC input can include simple digital elements such as limit switches, analog variables from process sensors (such as temperature and pressure), and more complex data such as that from positioning or machine vision systems.

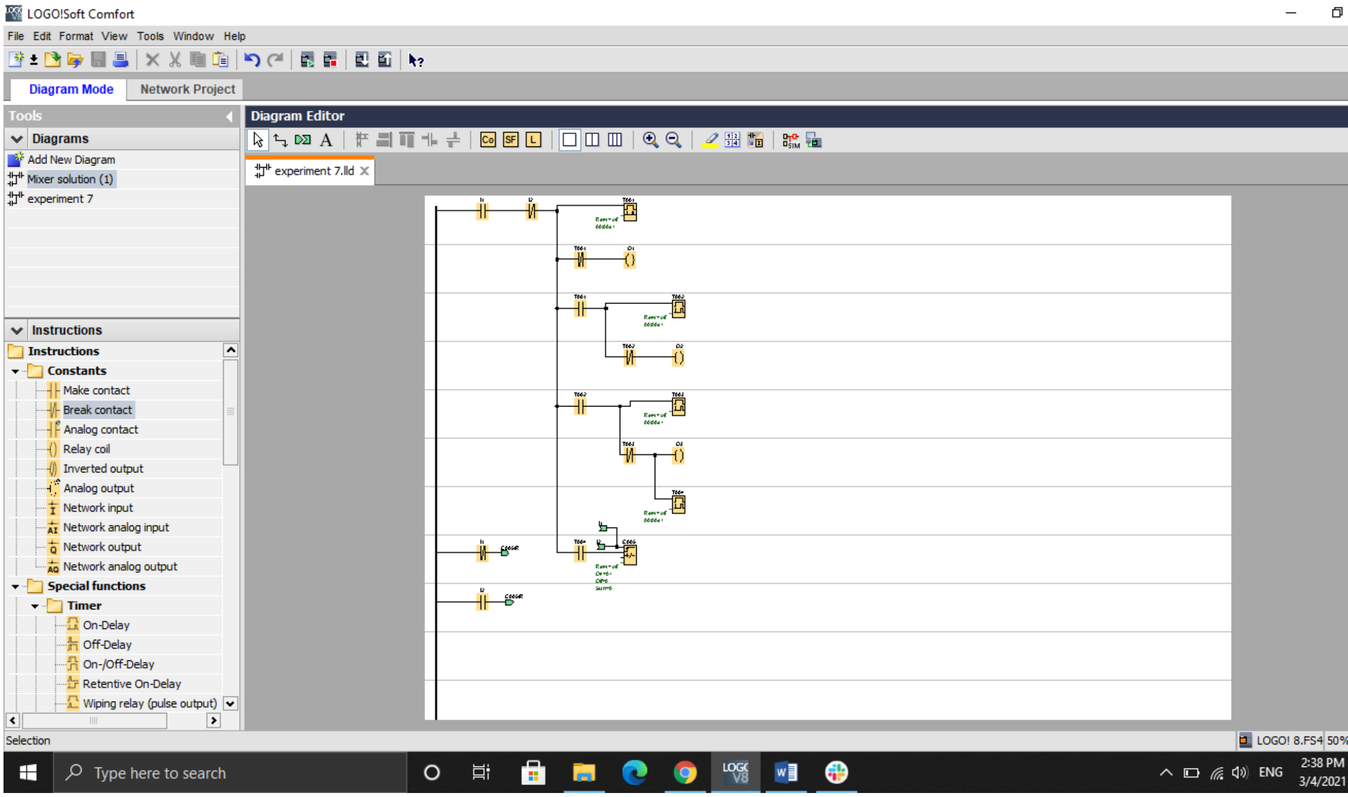
In PLC discrete (digital) signals behave as binary switches, yielding simply an On or Off signal (1 or 0, True or False, respectively). Push buttons, limit switches, and photoelectric sensors are examples of devices providing a discrete signal. Discrete signals are sent using either voltage or current, where a specific range is designated as On and another as Off. For example, the PLC used in the experiment use 24 V DC I/O, with values above 22 V DC representing On, values below 22V DC representing Off, and intermediate values undefined. Initially, PLCs had only digital I/O.

Equipment:

- Computer
- LOGO! Soft Comfort V8.2

Procedure:

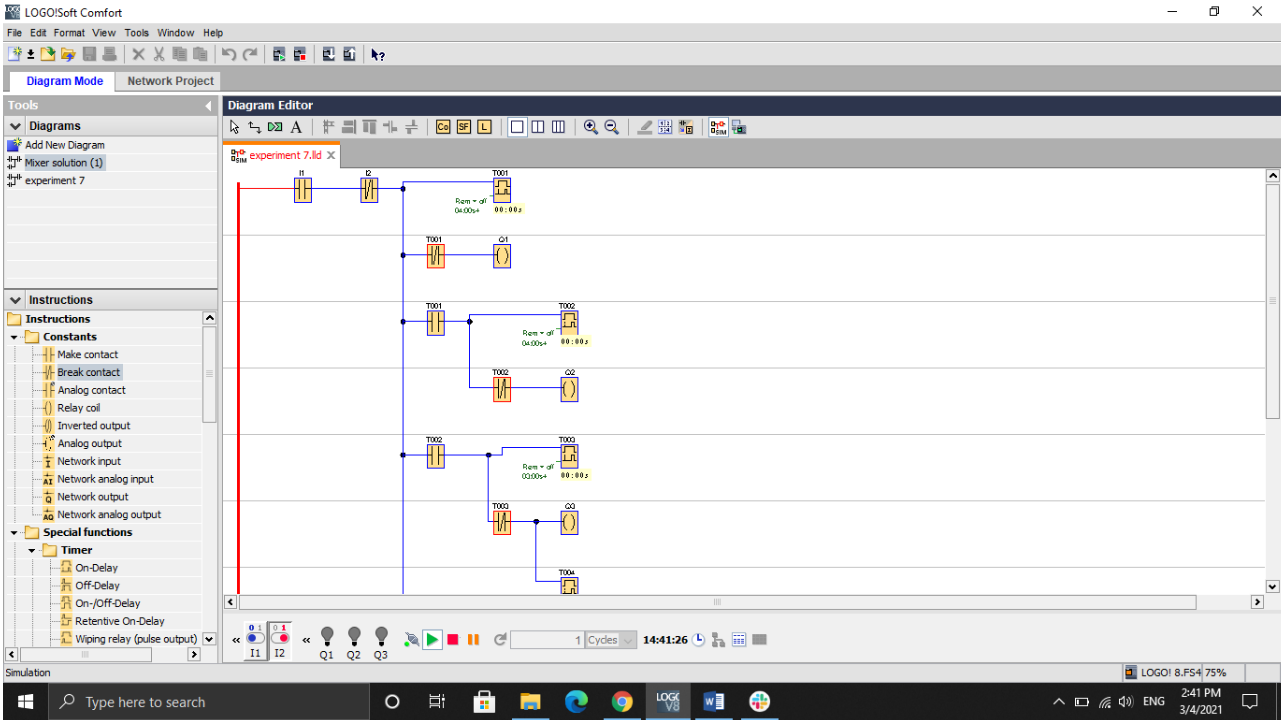
- At first I opened the LOGO! Soft Comfort V8.2 software.
- Then I opened new file in ladder diagram format naming it ‘assignment 7.lld’
- Then I took all the input contacts and outputs (relay coil) and connected them as the given circuit and completed the ladder diagram.



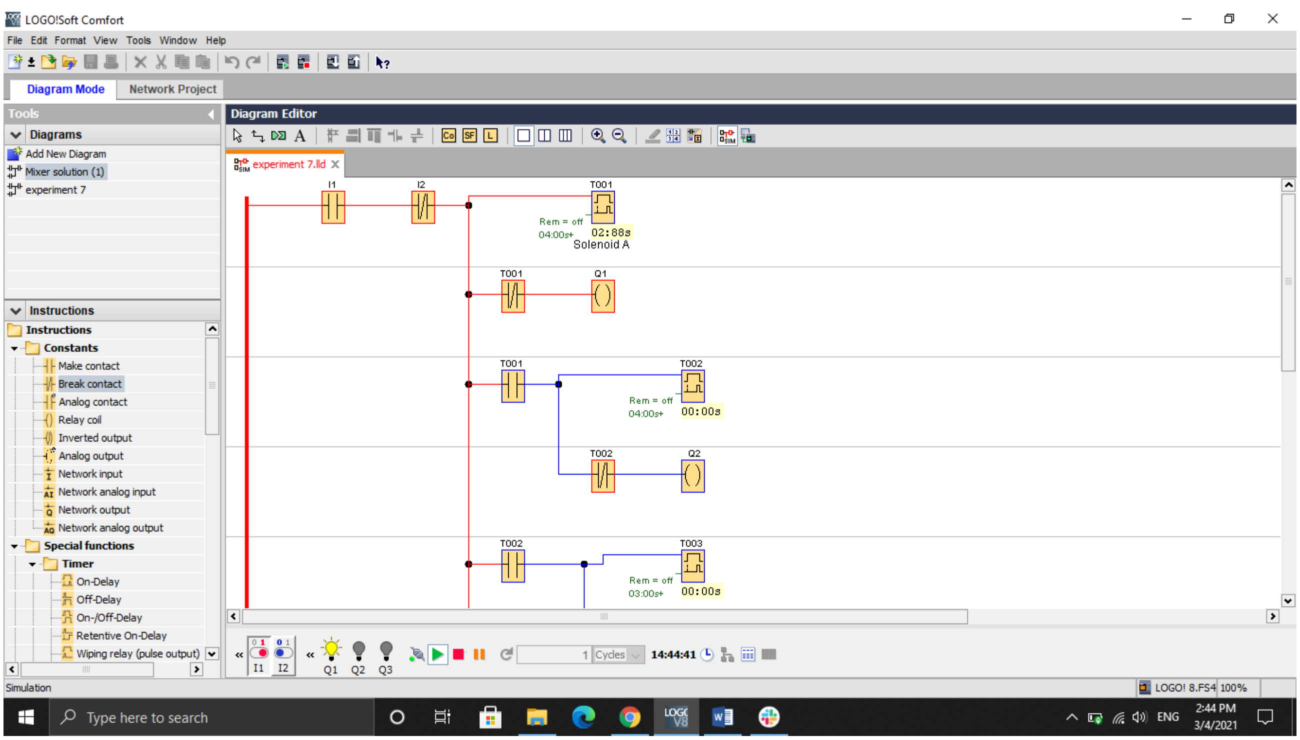
- Finally I simulated the ladder.

Result:

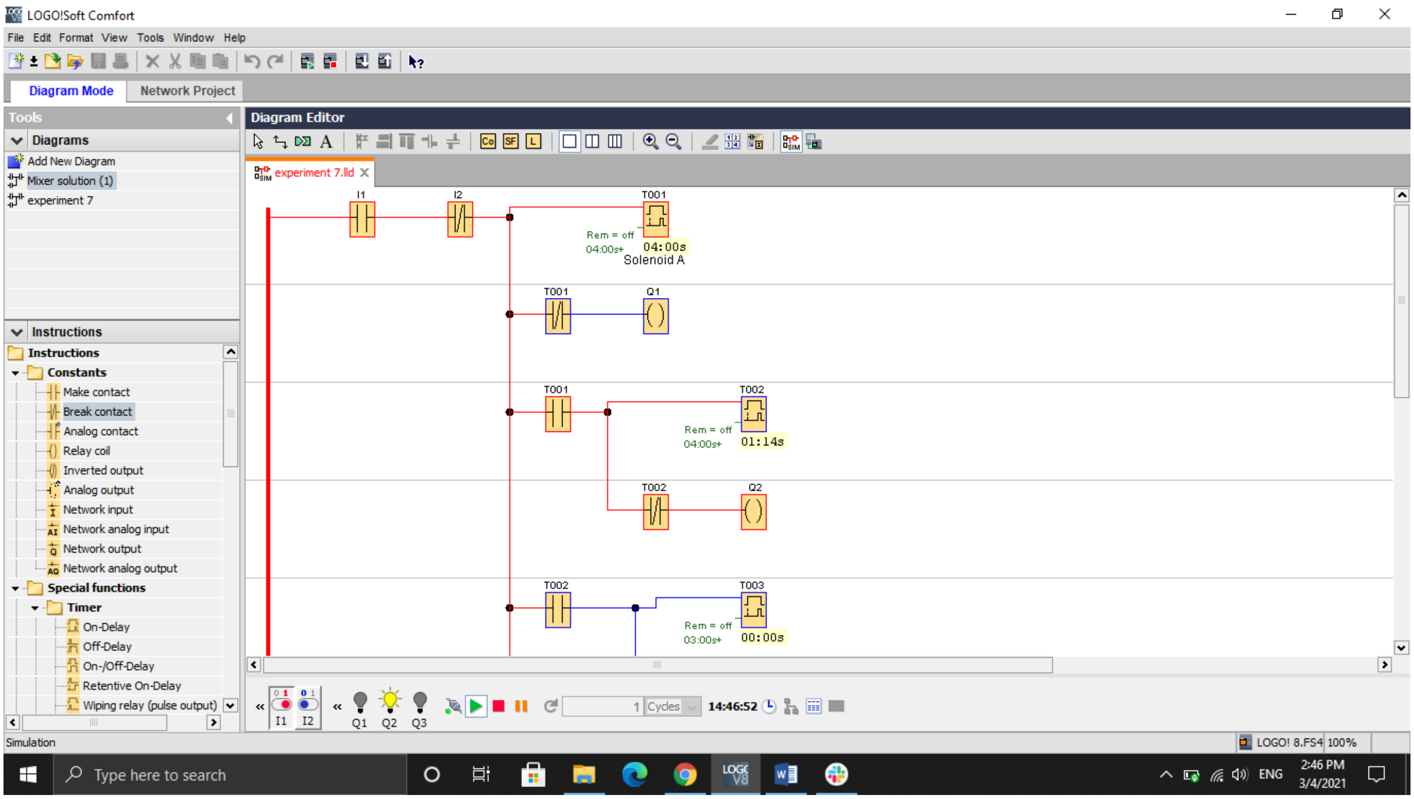
At first I1 (START Switch) was open so the system did not get power.



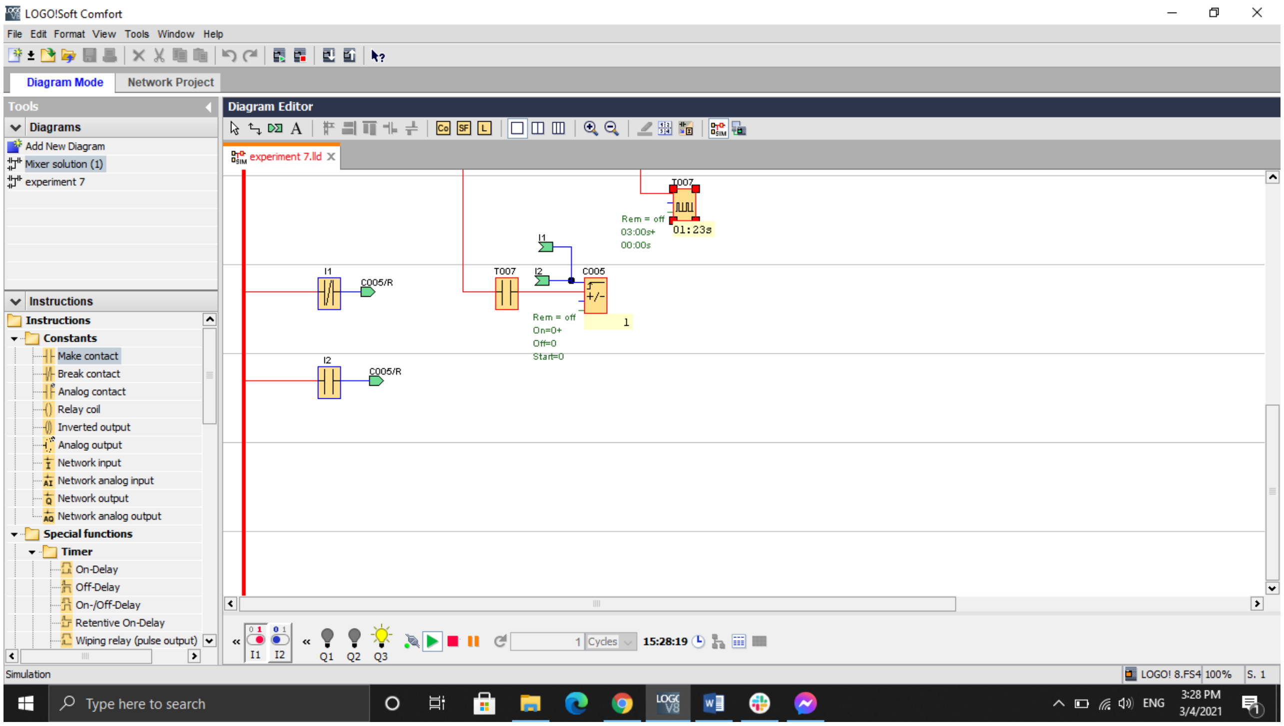
Then we pushed I1 (START) switch which powered the system. And it also energized Q1 which have to turn off after 200 gallons pass through it. We are supposing, it takes 4 seconds to fill 200 gallons. So after 4 seconds Q1 got de-energized.



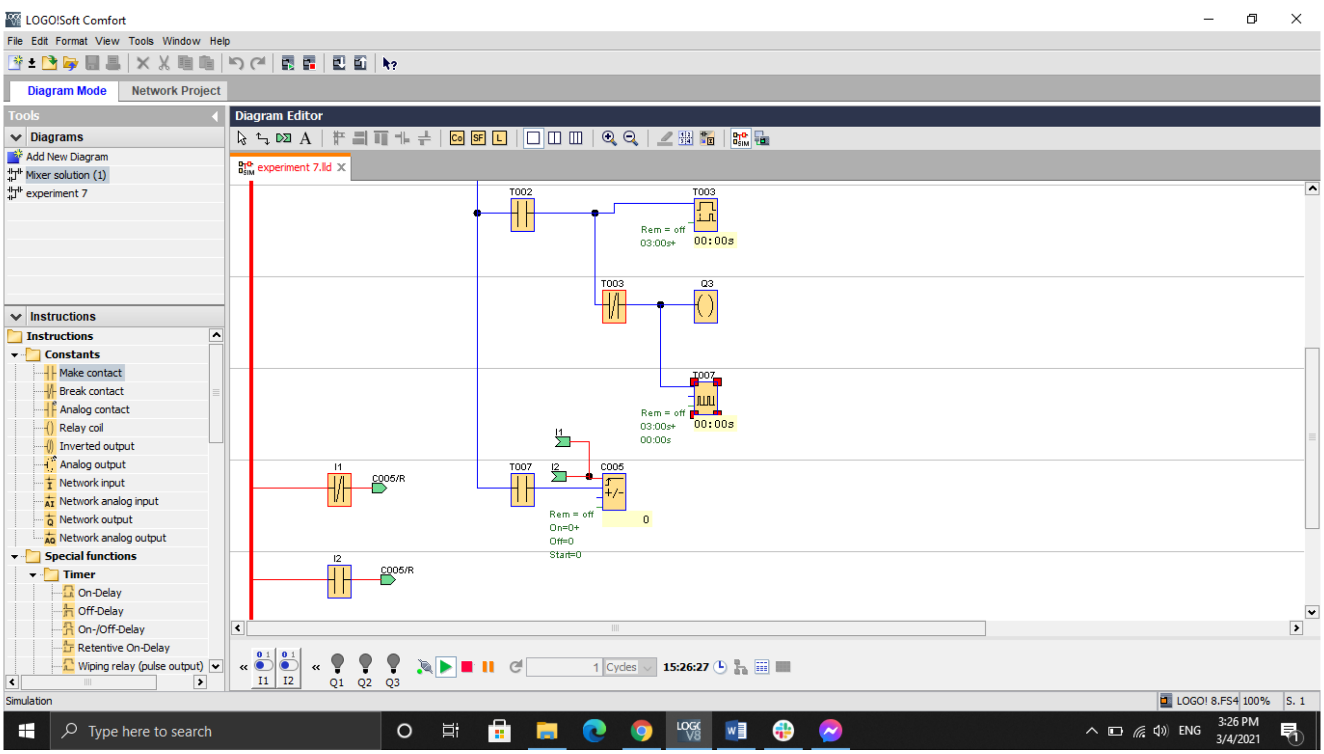
After Q1 got de-energized, Q2 got energized and it was energized for 4 seconds for the same reason.



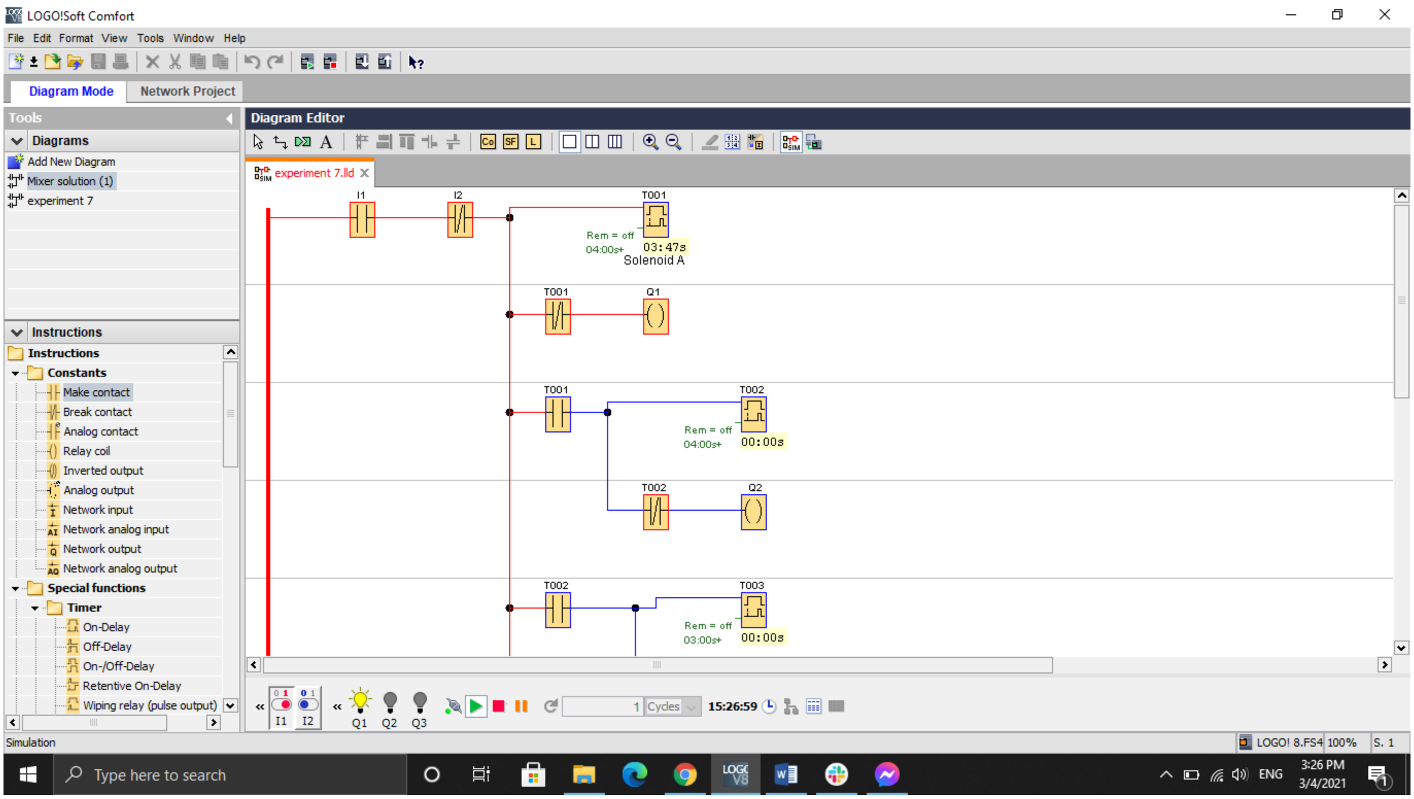
After both solenoids got de-energized it means the system is now ready to mix the items. So the motor started. It run for 3 seconds. And from an optical sensor, we got a pulse signal for the motors rotation which was fed to the counter for counting the number of rotation the motor did while it was running.



If the START switch is pressed again meaning START switch gets open, it cuts out the power from the system. So everything resets, including the counter.



Then if we press the START switch again, the system starts all over again.



However, I got the expected result.

Discussion & conclusion:

PLC can be used to control different peripheral devices. We simulated the ladder circuit and we saw the output matches with the implemented logic. So we can consider the experiment successful.