



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118



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Automatic Liquid Mixing Device Based on PLC

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ABSTRACT: According to the technological requirements of the control system, the Micrologix PLC can operate the valve by liquid level sensor data, and complete automatically the liquid mixing in this liquid control system. It can undertake the single cycle or more cycle work, has the power memory function, and continue to work after the reset. Conditions monitor through the configuration interface has an application in industrial liquid mixture stirring device, and the realization of mixing process has realized automatic control, which can provide the strong guarantee for high mixer, mixing device of the smooth and orderly and accurate work.

KEYWORDS: PLC, Industrial Automation, Liquid Mixing.

I. INTRODUCTION

Different type of sector, where liquid are used as a product. That's offers opportunities that can be transformed into success only by those companies that have technology to take it beyond competition. High degree of flexibility is its prior need. Also industries face many other challenges. The pressure to continually increase production volumes has stressed older systems and has increased maintenance requirements. For manufacturers, this creates two problems: higher costs and increased downtime. Production managers are being challenged to reduce cost, wastage and downtime. New technologies are required that will reduce water usage, increase energy efficiency and minimize downtime in high-speed beverage production environments. Increasing competitive pressures, ever more stringent legal regulations, rising costs of commodities and energy and consumers whose preferences are subject to rapid change – beverage companies today are forced to increase their flexibility and operate with maximum efficiency at the same time. The key to this problem is an integrated process approach. After all, if all processes are perfectly coordinated with each other and reliable communications have been established between all parts of the manufacturing plant, it is much easier to address the big challenges. In small industries, the refilling system usually operates in manual mode and even this is true for some other industries also. Literature suggests that microcontrollers are being used in these industries as it brings a cost effective solution for controlling the process. Although PLCs are costly, still those are also used in industries.

THE DESIGN OF THE SYSTEM:

The main components used are as followed:

- i. Micrologix PLC
- ii. Solenoid Valve
- iv. DC Motor

Micrologix PLC: Many PLC configurations are available but, in each of these there are common components and concepts. The most essential components are: Power Supply - This can be built into the PLC or be an external unit. Common voltage levels required by the PLC (with and without the power supply) are 24Vdc. CPU (Central Processing Unit) - This is a computer where ladder logic is stored and processed. I/O (Input/output) - A number of input/output terminals must be provided so that the PLC can monitor the process and initiate actions. Indicator lights - These indicate the status of the PLC including power on, program running, and a fault. These are essential when diagnosing problems. The configuration of the PLC refers to the packaging of the components. Lower cost and compactness make these ideal for small applications.

Objectives:

- Be able to understand and design basic input and output wiring.

- PLC hardware configurations
- Input and outputs types
- Electrical wiring for inputs and outputs
- Relays



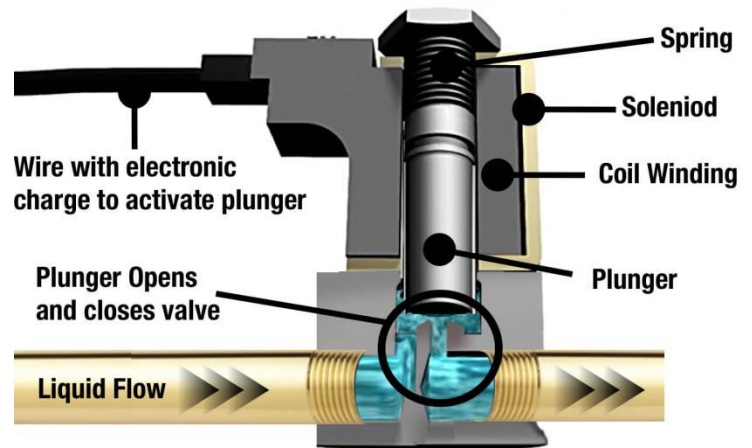
I/O and limited abilities, but costs will be the lowest.

Software - software based PLC requires a computer with an interface card, but allows the PLC to be connected to sensors and other PLCs across a network.

Digital Input and Output

- Number of inputs : 14
- Rated Voltage: 24 VDC at 4 mA, Nominal
- Surge Voltage: 35 VDC for 0.5 sec
- Logic 1 Signal(min.): 15 VDC at 2.5 mA
- Logic 0 signal(max.): 5 VDC at 1 mA
- Number of outputs: 10
- Current(max): 2A
- Surge current: 7A with contacts closed
- Maximum relay switching frequency: 1 Hz

Solenoid valve: Flow control (solenoid) valves are connected to liquid tank. After inspection done by the inspection unit the container comes below the solenoid valve there one capacitive sensor placed below the valve and when it sense the container the conveyor stops, then the solenoid valve get ON and fills the liquid to the component based on the instruction given by inspection unit(i.e. which size container has to be filled). Liquid will be as soon as the conveyor stops. Solenoid control valves are electromagnetic plunger valves which control flow rates of liquids or gases. The input to solenoid valve is given by PLC. Three different timings are given to three different containers. The timing of solenoid valve and conveyor stopping is set by the timers used in program. We can change the timing based on the requirement. Conveyor stopping time also varies for three containers. The overhead liquid tank will supply liquid to the solenoid valve. After filling liquid to container the solenoid valve gets OFF and conveyor starts to run. And automatically cycle repeats.

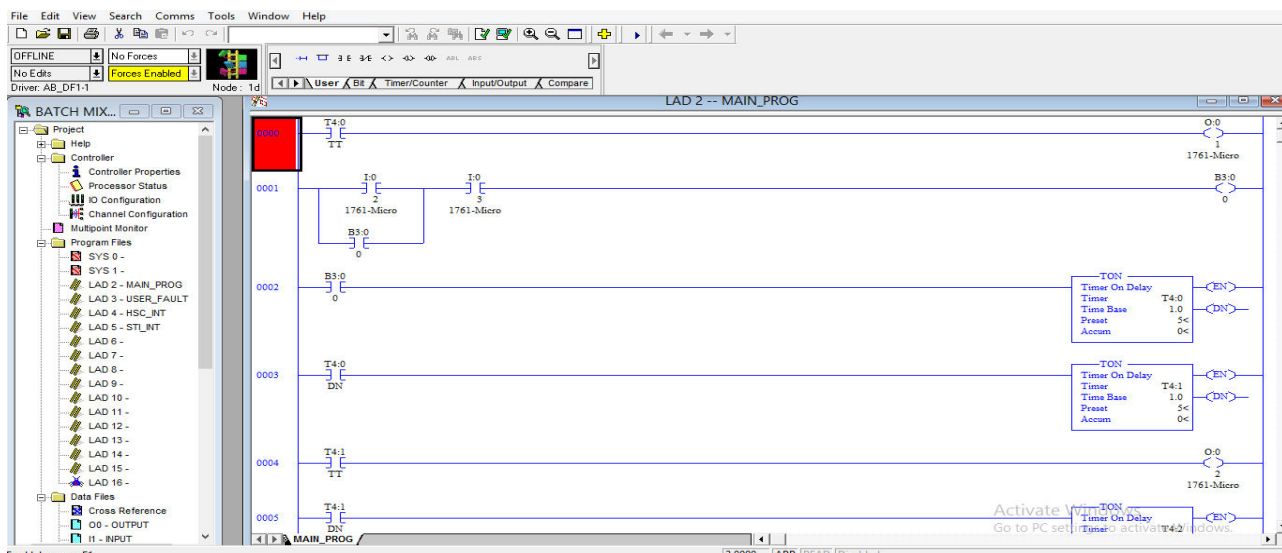


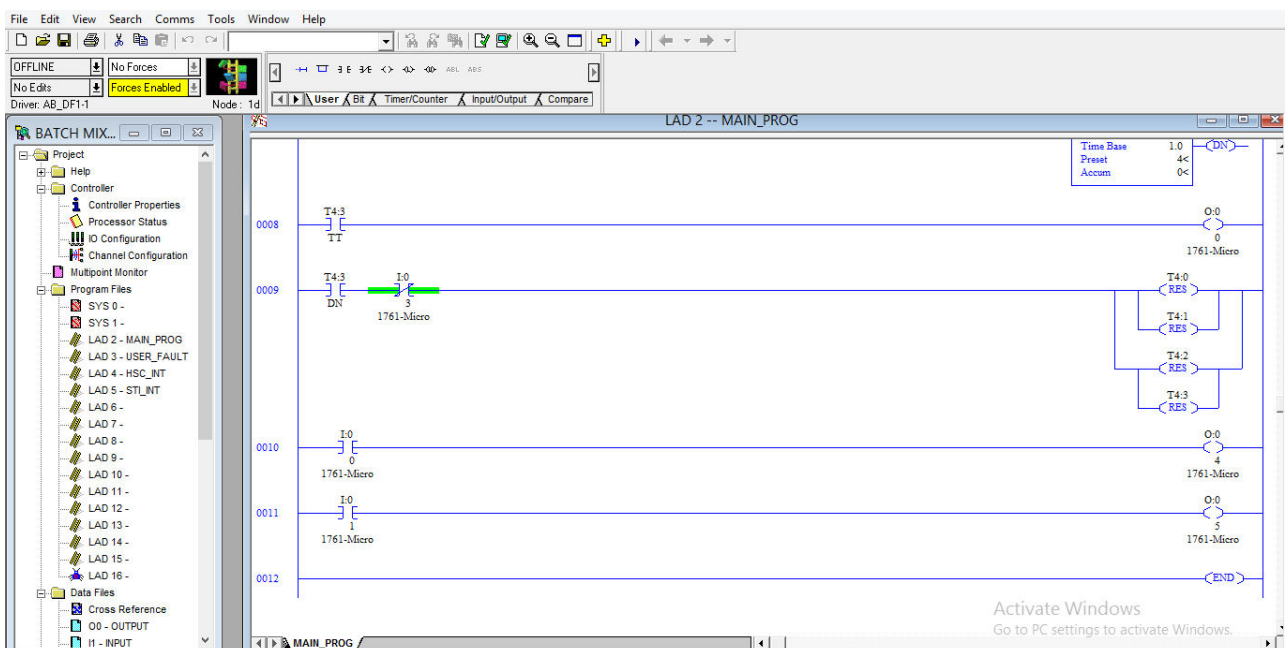
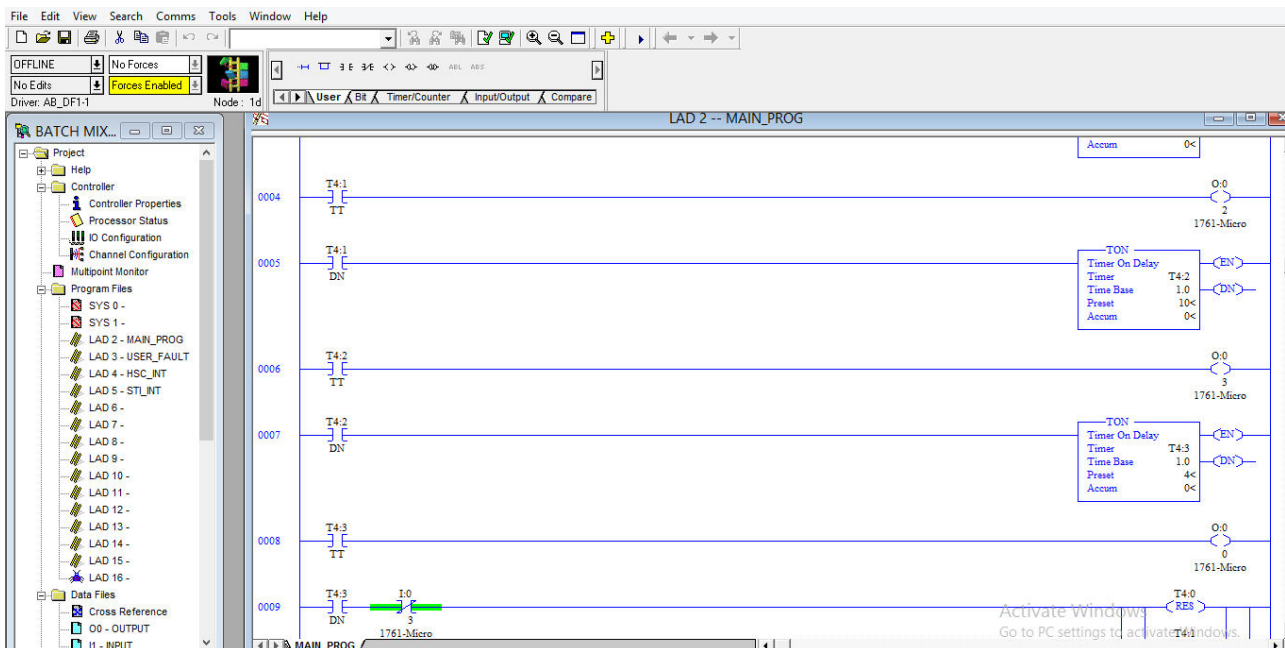
1. Solenoid valve to control the flow of liquid
2. Liquid filled tank
3. Pipe connected to solenoid valve

DC motor: DC motor was used to move the conveyor which is transferring the product between stations. This motor will operate at the voltage of 12 VDC. The conveyor part, it will use dc motor to move the conveyor forward and It will stop according to the sensor or the limit switch position.



Ladder Logic Diagram





II. ADVANTAGES

1. Accurate & Proportional mixing of liquid.
2. Reduction in operating costs as compare to manual process.
3. Increasing production.
4. Fully automatic system so that quality production achieved in less time.
5. Efficiency & Maintenance easy.
6. Same system used for different purpose.



III. APPLICATIONS

1. Food processing technology.
2. Beverage processing industry.
3. Concrete industry.
4. Paint industry.

IV. CONCLUSION

Using Micrologix programmable controller for a variety of liquid mixing state can realize automatic control, realize accurate control requirements in the mixing process, improve the stability of liquid mixture ratio, stable operation and high degree of automation, and shows that liquid water mixed state through the configuration interface, it is suitable for industrial production needs.

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Impact Factor: 8.118



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