MATTRESS CENTER BAND SEALING MACHINE AUTOMATIC TIME LOOP CONTROL SYSTEM USING PLC

Mrs. K. Bhavani [*1], Mr. PRALAPELLI VENKATESH[*2], Mr. BALGURI JAGADISH[*3],
Ms. BACHU NAMRATHA*[4]

[*1] Assistant Professor, Dept. of EIE, Vignan Institute Of Technology And Science
[*2, 3, 4] UG Student Dept. of EIE, Vignan Institute Of Technology And Science

Abstract: Mattresses industry is running on different technology in previous days which is based on relay logic controlling system and the mattress sealing controlling system is running on very essentially running on time loop controlling system and for this method they use the physical timers and while running these technology they are facing so many troubleshooting problems on different ways like wire damage, time taking for controlling system , troubleshooting is also not easy , production is very less , no short circuit protection , more man power need etc.. and to avoid all these terms industry need to convert into industrial automation technology which is based on PLC controlling system.Main Objective of these project is to convert the mattress center band sealing machine in to PLC control system for reduce the hardware time controlling system based on PLC controlling system while using the physical machine elements and reduce above mentioned point , every inputs (2 sensors) is and inputs to the PLC and 4solenoid valve , 2 conveyors running on different loop controlling system and each and every wiring of inputs and outputs need to connect with PLC and these controller can make the device running in automatic loop controlling system

Keywords: Delta PLC, Digital inputs and outputs, PLC Communication cable,1-pole mcb

1. INTRODUCTION

1.1 INDUSTRIAL AUTOMATION

Automation is the use of control systems such as computers to control industrial machinery and processes, replacing human operators. In the scope of industrialization, it is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist them with the physical requirements of work, automation greatly reduces the need for human sensory and mental requirements as well.

1.2 ADVANTAGES OF AUTOMATION

The purpose of automation has shifted from increasing productivity and reducing costs, to broader issues, such as increasing quality and flexibility in the manufacturing process.

Automation is now often applied primarily to increase quality in the manufacturing process, where automation can increase quality substantially.

For example, automobile and truck pistons used to be installed into engines manually. This is rapidly being transitioned to automated machine installation, because the error rate for manual instalment was around 1-1.5%, but has been reduced to 0.00001% with automation. Hazardous operations, such as oil refining, the manufacturing of industrial chemicals, and all forms of metal working, were always early contenders for automation.

2. INTRODUCTION TO PLC

2.1 Programmable logic controller

A programmable logic controller (PLC) is a specialized computer used to control machines and process. It uses a programmable memory to store instructions and specific functions that include ON/OFF control, timing, counting, sequencing, arithmetic, and data handling.

The First Programmable Logic Controllers (PLCs)

- PLC was introduced in late 1960's
- The First Commercial and successfully PLC was Design and developed by launched in 1969 by Modicon as relay replacer for general motor
- Earlier it was called acronym PC
- Late 1970's it is greatly controlling device with Microprocessor based equipment to control industrial equipments.
- Developed to offer the same functionality as the existing relay logic systems
- Programmable, reusable and reliable
  - Could withstand a harsh industrial environment
  - They had no hard drive, they had battery backup
  - Could start in seconds
  - Used Ladder Logic for programming.
- Programmable logic controllers are used throughout industry to control and monitor a wide range of machines and other movable components and systems. PLC is used to monitor input signals from a variety of inputs (input sensors) which report events and conditions occurring in a controlled process. Programmable logic controllers are typically found in factory type settings. PLCs are used to control robots, assembly lines and various other applications that require a large amount of data monitoring and control.

3.DELTA PLC INTRODUCTION

3.1 DELTA PLC

DELTA

- Delta is an **THIVAN** Based Company
- The head quarter is in Cambodia
- Delta has established in 1973 as the delta microfinance PLC and all finance of delta PLC is coming from bank of Cambodia
- Delta is now multi branches in Australia and all Asian countries

SERIES OF PLC'S IN DELTA

- S -Series for low end Type of PLC'S(0-100 I/O'S)
- ES2,EA2,EX2 Series PLC's are middle end type of PLC'S(0-1000 I/O'S)
- EH EC PM Series PLC's are high End type of PLC'S(>1000 I/O'S)

Figure: 3.1.1 Series Of PLC's In Delta

ADDRESSING IN DELTA

INPUT ADDRESSING :---

(X0 X1---X7)

(X10 X11--X17) UP T0 (X370,X371,X372—X377)

OUTPUT ADDRESSING :---

(Y0 Y1 ---Y7)

(Y10 Y11 ---Y17) UP TO (Y370,Y371---Y377)

MEMORY ADDRESSING :---

M0 M1 M2 M3------M4087

INTEGER ADDRESSING :- D0 D1 D2---D900
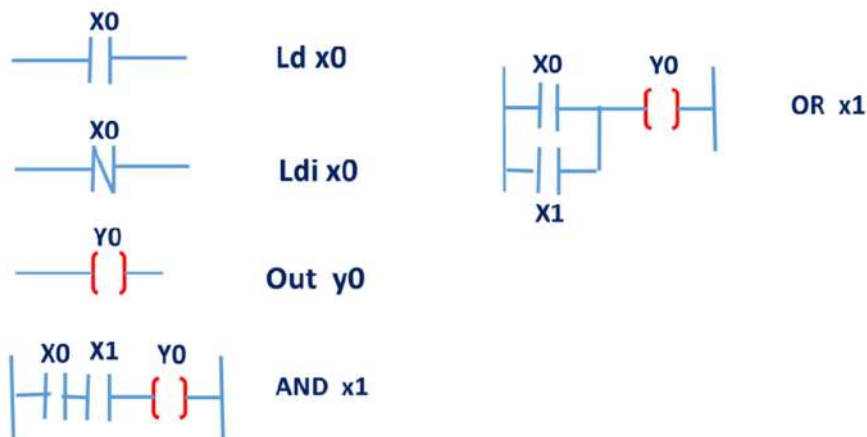
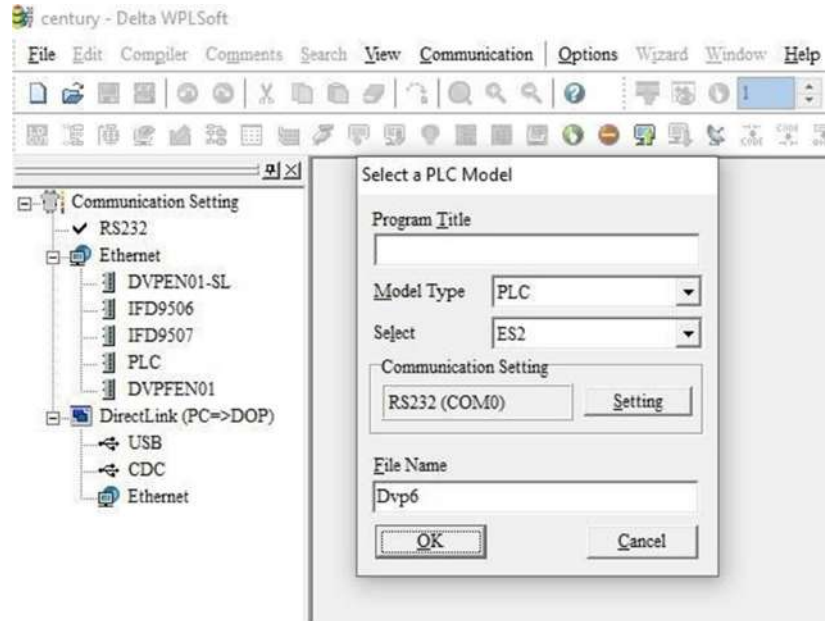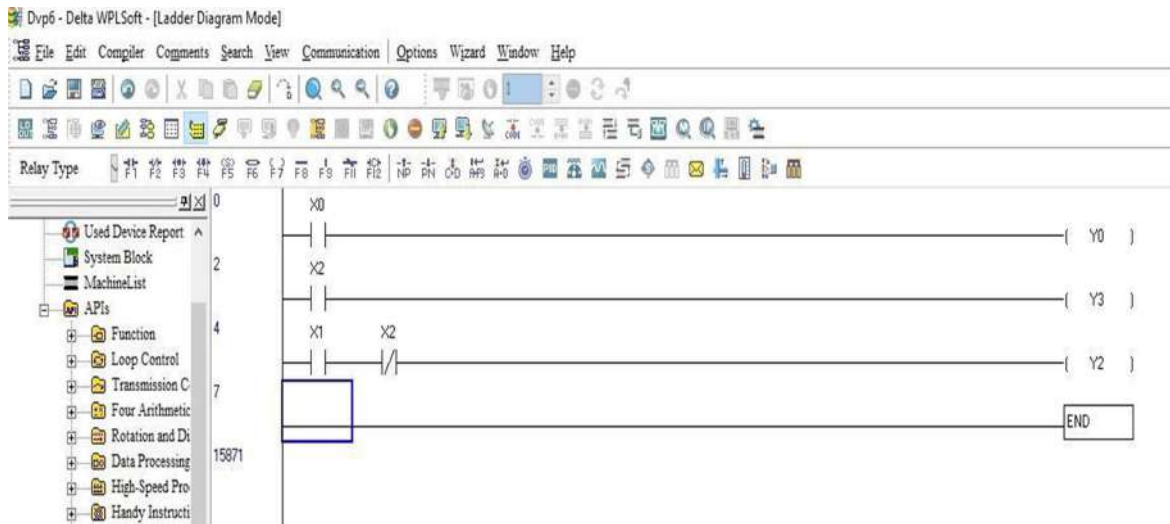**CONSTANT VALUE:** k0,k1,k2-- -

SHORTCUT KEYS

Figure: 3.1.2 Shortcut Keys
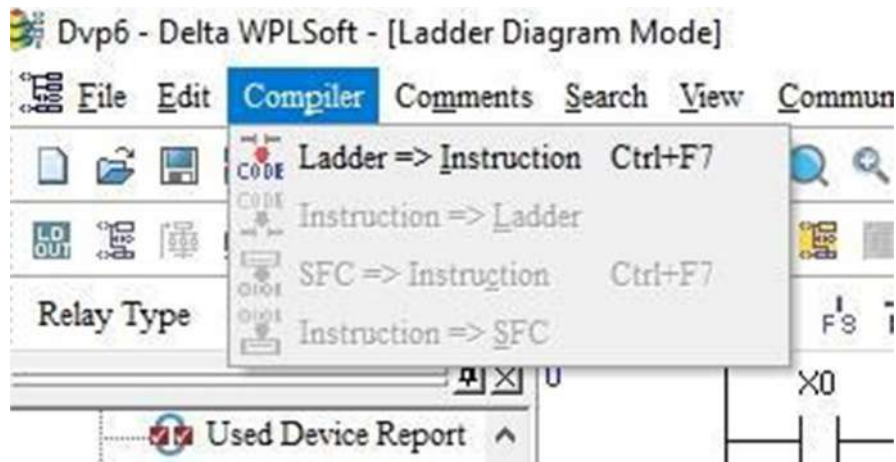
3.2 SOFTWARE EXECUTION

- Open WPL software and go to file option on tool bar and create a new program with ES2 series PLC and assign name for Project
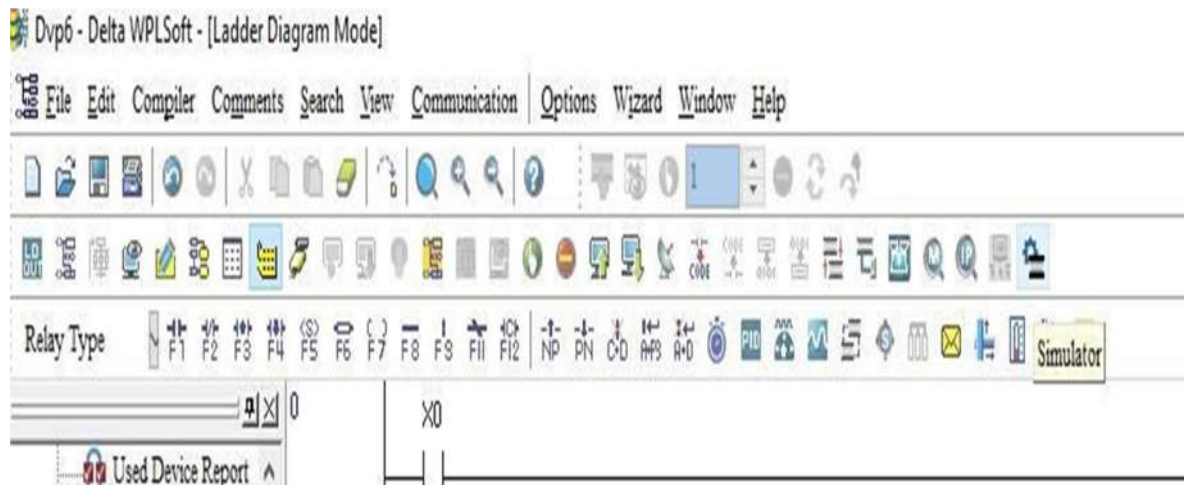

- Write a Program according to instructions

- Go to compiler Option and click on ladder instruction option

- Click on simulator Option

- Click on Online mode and next click on run mode for offline execution not on the kit
- Set on/off inputs and check ur Program

4.PROXIMITY SENSOR

- A proximity sensor is a device that can detect or sense the approach or presence of nearby objects and for this it does not need physical contact. There are different kinds of proximity sensors. Some of them are listed [8]:
- Inductive: This type of sensor is used to detect nearby metallic objects. The sensor creates an electromagnetic field around itself or on a sensing surface.
- Capacitive: This type of sensor is used for detection of metallic objects and nonmetallic objects.

- • Photoelectric: This type of sensor is used to detect objects. A light source and receiver are the main components of such sensors.
- • Magnetic: This type of sensor uses an electrical switch that is operated based on the presence of permanent magnets in a sensing area.

5 INTRODUCTION TO PLC COMPNENTS IN THE PROJECT

5.1 SMPS

Switched Mode Power Supply (SMPS) Like a linear power supply, the switched mode power supply too converts the available unregulated ac or dc input voltage to a regulated dc output voltage. However,in case of SMPS with input supply drawn from the ac mains, the input voltage is first rectified and filtered using a capacitor at the rectifier output. The unregulated dc voltage across the capacitor is then fed to a high frequency dc-to-dc converter.

Most of the dc-to-dc converters used in SMPS circuits have an intermediate high frequency ac conversion stage to facilitate the use of a high frequency transformer for voltage scaling and isolation. In contrast, in linear power supplies with input voltage drawn from ac mains, the mains voltage is first stepped down (and isolated) to the desired magnitude using a mains frequency transformer, followed by rectification and filtering. The high frequency transformer used in a SMPS circuit is much smaller in size and weight compared to the low frequency transformer of the linear power supply circuit. The 'Switched Mode Power Supply' owes its name to the dc-to-dc switching converter for conversion from unregulated dc input voltage to regulated dc output voltage.

The switch employed is turned 'ON' and 'OFF' (referred as switching) at a high frequency. During 'ON' mode the switch is in saturation mode with negligible voltage drop across the collector and emitter terminals of the switch where as in 'OFF' mode the switch is in cut-off mode with negligible current through the collector and emitter terminals. On the contrary the voltage regulating switch, in a linear regulator circuit, always remains in the active region. Details of some popular SMPS circuits, with provisions for incorporating high frequency transformer for voltage scaling and isolation, have been discussed in next few lessons.

In this lesson a simplified schematic switching arrangement is described that omits the transformer action. In fact, there are several other switched mode dc-to-dc converter circuits that do not use a high frequency transformer. In such SMPS circuits the unregulated input dc voltage is fed to a high frequency voltage chopping circuit such that when the chopping circuit (often called dc to dc chopper) is in ON state, the unregulated voltage is applied to the output circuit that includes the load and some filtering circuit.

When the chopper is in OFF state, zero magnitude of voltage is applied to the output side. The ON and OFF durations are suitably controlled such that the average dc voltage applied to the output circuit equals the desired magnitude of output voltage. The ratio of ON time to cycle time (ON + OFF time) is known as duty ratio of the chopper circuit. A high switching frequency (of the order of 100 KHZ) and a fast control over the duty ratio results in application of the desired mean voltage along with ripple voltage of a very high frequency to the output side, consisting of a low pass filter circuit followed by the load.

The high Version 2 EE IIT, Kharagpur 6 frequency ripple in voltage is effectively filtered using small values of filter capacitors and inductors. A schematic chopper circuit along with the output filter is shown in Fig.21.3. Some other switched mode power supply circuits work in a slightly different manner than the dc-to-dc chopper circuit discussed above. Details of some of these circuits have been discussed in following lessons.

6 PLC WIRING

- Before going to discuss about plc wiring we need to know about the types of inputs
- Types of inputs coming from field/site/ application
    1. Sink (24-)
    2. source (24+)
        a) If 24- signal coming from one device the it consider has a sink signal
        b) If 24 + signal coming from one field device then the signal called source signal
- Usually PLC input voltage either 230V AC or 24 DC
- For 24V DC we use SMPS
- PLC having the option as S/ S means sink /sours
- Suppose if your giving 24+ in S/S the we need to give 24- in the input terminals common
- Suppose if your giving 24- in S/S the we need to give 24+ in the input terminals common
- Types of Outputs coming from PLC also two Types
    1. Transistor (24-)
    2. Relay (24+)
        a) If 24 – signal coming from PLC then it consider has a transistor output
        b) If 24 + output signal coming from PLC then it consider has a Relay output
- In our delta PLC we are using transistor outputs
- Suppose if we are getting 24 – signal coming from PLC the we need to connect 24+ in the common terminals of output devices
- Suppose if we are getting 24 – signal coming from PLC the we need to connect 24+ in the common terminals of output devices
- Out PLC is transistor output that's why we need to use 24+ has common in the output of PLC
- In inputs (buzzer siren ,relay, limit switches ,emergency etc…) of PLC we have given 24- and we need to give 24+ in the S/S terminal of PLC
- Base these signals coming from PLC then it will turn off and protect the devices from the critical situations coming from the site

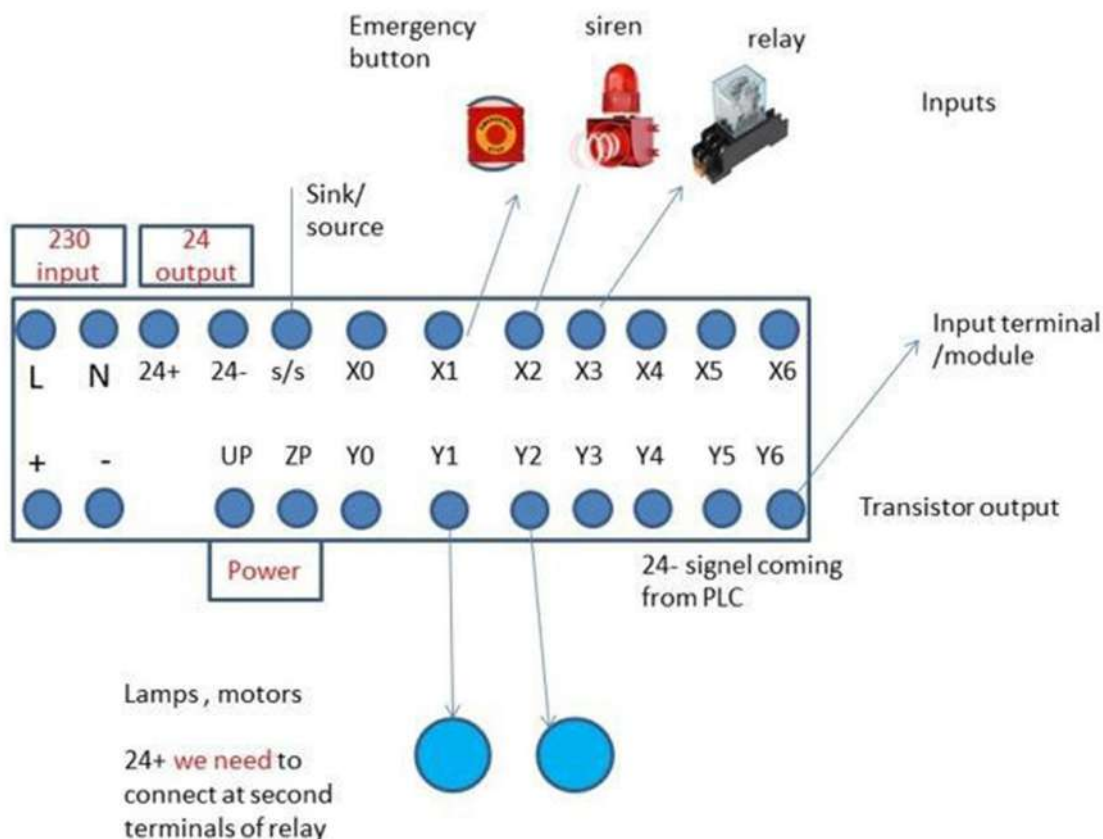### 6.1 PLC WIRING DIAGRAM FOR THE PROJECT

Figure: 6.1.1PLC Project circuit diagram

6.2 PLC software operations

- In this project we are using delta plc and we use software has WPL software
- Emergency is having behind NC contact that we need to connect with PLC as input
- Limit switch is having NC and NO contact that we have to connect either the PLC and it has inputs to PLC
- Siren is having supply and one coil feed back and it has inputs to the PLC
- 2 change over relay is also having relay feedback to the PLC
- Area sensor or any sensing object has inputs to the PLC
- When tank reach to high level it will give signal to the plc and it has input to the plc
- All feed back from all above has input tot the plc and we can do the program in the plc and we can turn off the output procedure based on the condition from field

PROJECT PROGRAM :
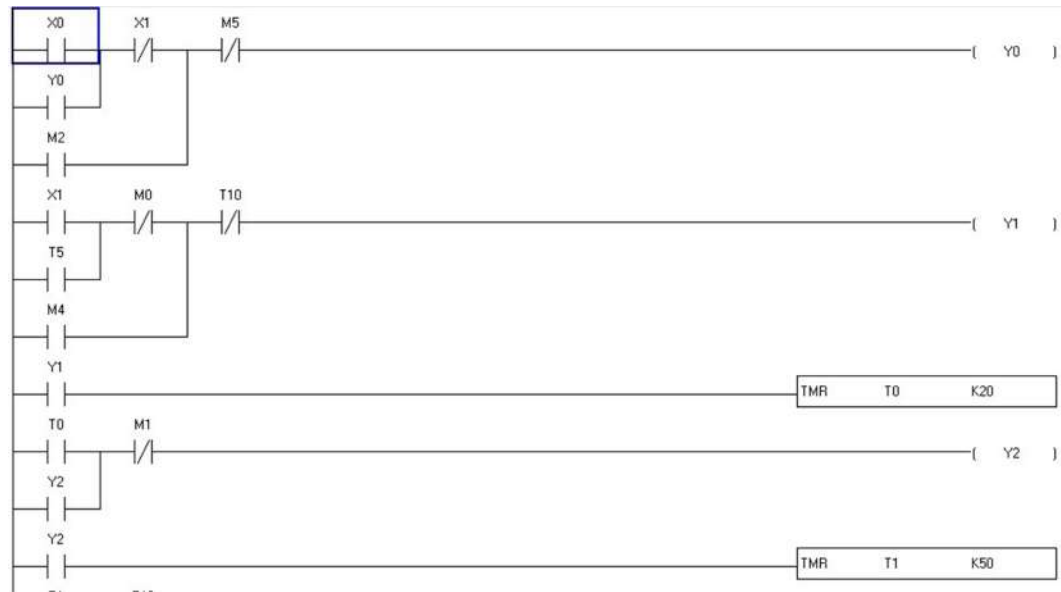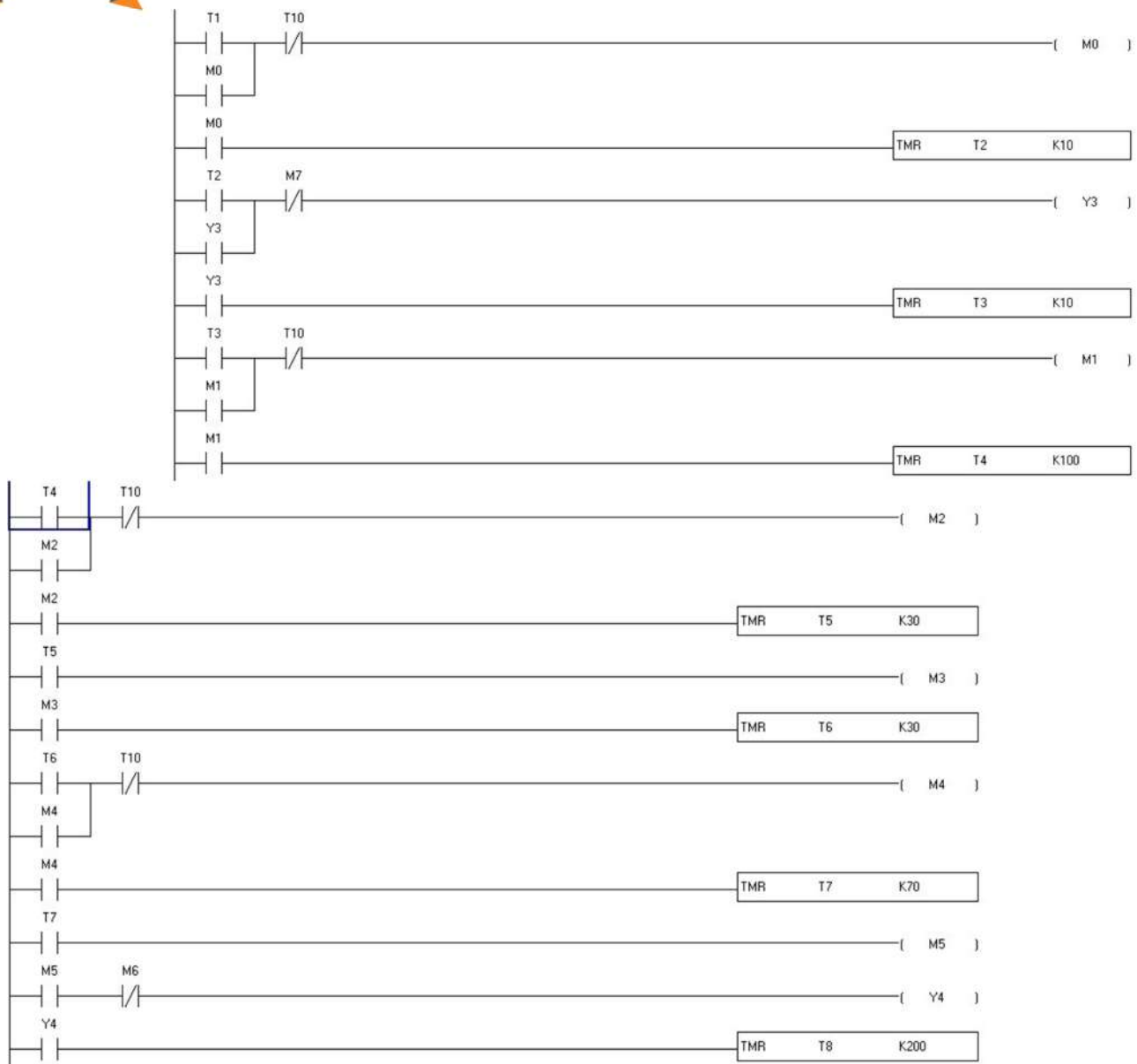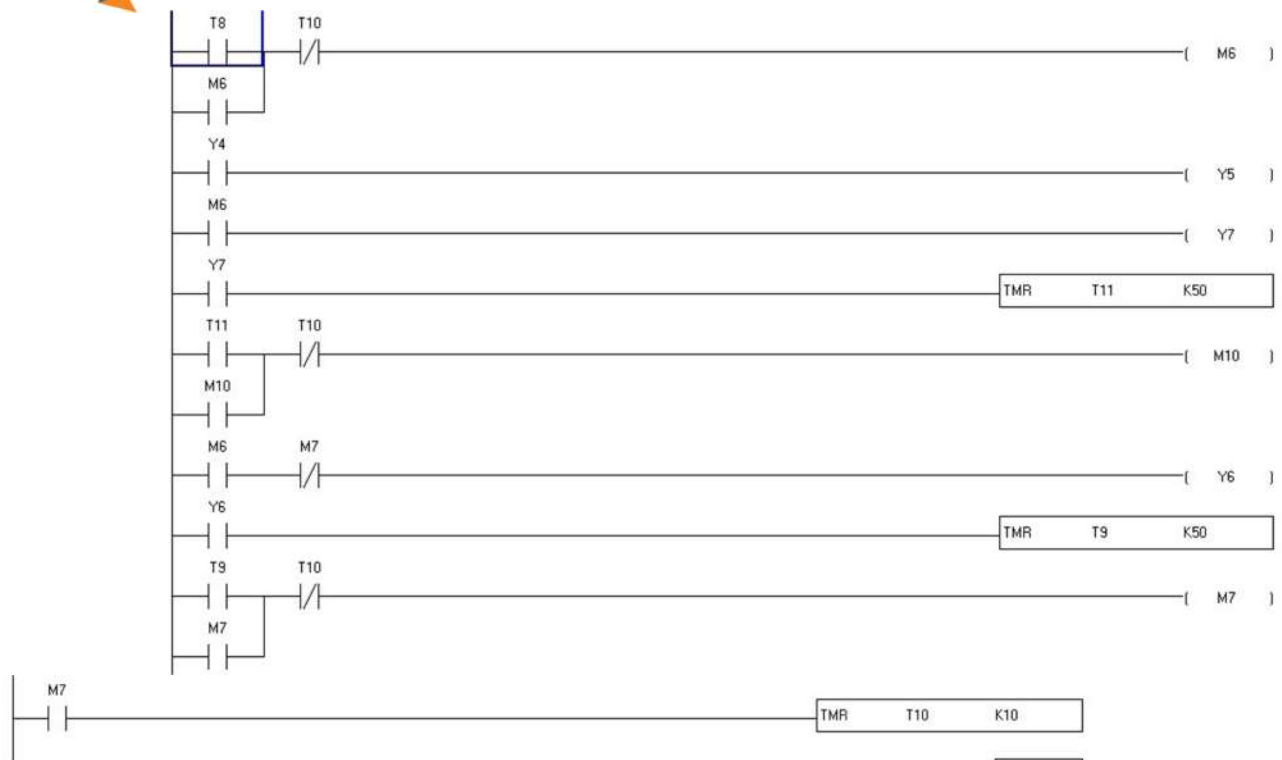
- X0 Sensor ON After 5 Seconds, Y0 ON
- After 5 Secs Y1 ON and Y0 OFF
- Repeat this process
- When M0 ON and OFF Count will Increase
- Count Reach to 3 Y2 ON
- Count Reach to 5 Y3 ON and Y2 OFF
- When X2, X3, X4, X5 ON all Process is Going to Trip

All inputs signals of emergency, limit switch , proximity sensor , buzzer , siren a we need to assign in ladder logic diagram as off conditions to thee outputs of field

CONNECTION PROCEDURE :

- Open device manger and check the port number [Comp 8]
- Open WPL Software
  1. Open options on tools pad
  2. Next, communication setting
  3. Assign same comport number [Comp 8]
  4. Open communication option on tools bar
  5. Communication transfer setup
     - [PC => PLC]
     - [PC <= PLC]
  6. Click on ONLINE mode

7. CONCLUSION

The conclusion of this project is to avoid the external timers wiring, troubleshooting, short circuit losses avoidance and increase the productions in mattresses sealing production sealing allocations while collecting inputs and outputs and standard operating procedure and give the inputs and outputs of wiring and execute a program accordingly to the conditions of a machine and increase the production in smooth way and reliable conditions of a machine.

8. REFERANCES

1. Books:

- "Programmable Logic Controllers: Industrial Control" by Khaled Kamel and Eman Kamel

- "PLC Programming Using RSLogix 500: Basic Concepts of Ladder Logic Programming!" by Gary D. Anderson

- "Programmable Logic Controllers: Hardware and Programming" by Max Rabiee

2. Journals and Research Papers:

- "Design and Implementation of Automatic Control System for Industrial Production Process Based on PLC" by Fang Yang and Haipeng Gao (International Conference on Information Computing and Applications)

- "Application of PLC Technology in Control System of Packaging Machine" by Wenjun Shi et al. (International Conference on Intelligent Robotics and Manufacturing)

3. Online Resources:

- Websites of PLC manufacturers like Siemens, Allen-Bradley (Rockwell Automation), Omron, Mitsubishi Electric, etc., often provide case studies, application notes, and white papers on various industrial automation topics.

- Technical forums and communities such as PLCtalk.net, PLCforum.uz.ua, or control.com can be valuable sources of practical insights and discussions on PLC applications.

4. Industry Reports and Magazines:

- Industry-specific reports and magazines focusing on manufacturing automation, machinery, or mattress production may feature articles, case studies, or interviews discussing automation technologies, including PLC-based control systems.