

DEVELOPMENT OF PLC BASED INDUSTRIAL AUTOMATION WITH SYSTEM MONITORING

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ABSTRACT

In recent years most of the manufacturing industries have been switching from the traditional manual based to automation system based on PLC (Programmable Logic Controller), since the later offers many advantages such as repeatability at higher speed, tighter control, and monitoring with greater accuracy. The aim of this project is to develop a PLC for a Hot Foil printing machine used to emboss the caps used in the beverages and monitoring and control of the machine is provided through the touch screen HMI (Human Machine Interface) with speed control of the motors.

Keywords: HMI, Hot Foil Printing Machine, PLC, System Monitoring, TIA portal

I. INTRODUCTION

Automation plays a very important role in manufacturing industry especially where repeatability is of great concern. The automated machines works in hazardous environment that is, in extreme temperature which is beyond the human conveniences. Depending on the demand rate the production speed can also be increased in such machines. It has reduced the need for man power, reduced the wastage, and increased the accuracy. In automation industries most of the work is carried out by using machines. These machines are controlled by PLC (Programmable Logic Controller) which are programmed using ladder logic. And the HMI (Human Machine Interface) provides control of the machine using HMI.

In large industrial units PLCs are used to start up and shutdown of critical equipments. A PLC ensures that a machine operates when all the permissive conditions for the safe start are has established. It monitors for the necessary conditions for safety when the machine is in running mode and trips whenever any abnormality occurs in the system. Through HMI devices PLC's also provide easy monitoring of the inputs and outputs. The centralized control unit for manufacturing line is the HMI. System control is provided through the HMI in the form of alarms, reliable messages to the operator automatically. System monitoring is also done through the simulations provided by the HMI.

II. OVERVIEW

PLC plays vital role not only in process control plants but also in manufacturing industries where it is necessary to have proper control of the automated machine to yield accurate result and easy fault identification and fault location. This is achieved by using PLC and HMI for the control and monitoring of the machine. The speed of

the service, the downtime of the machine, the different alarms generated due to the abnormalities that occur during the runtime are all monitored by using HMI.

III. SOFTWARE USED

The software used in developing the PLC ladder logic for the Hot Foil Printing Machine is TIA portal for Siemens controllers. The Totally Integrated Automation (TIA) also enables to develop the interactive user interface for the monitoring and control using the HMI. The communication mode between the PLC and the HMI is supported by the ProfiNet protocol.

IV. SYSTEM DESIGN

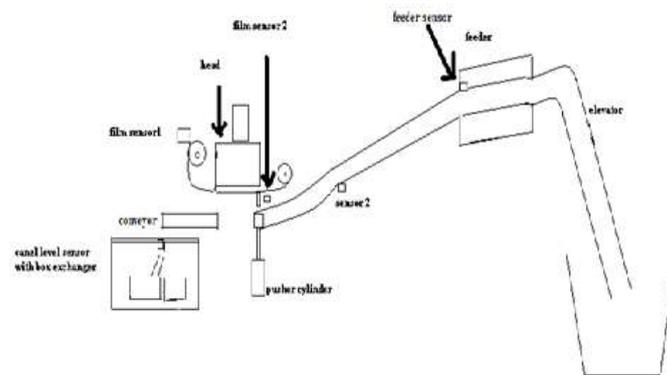
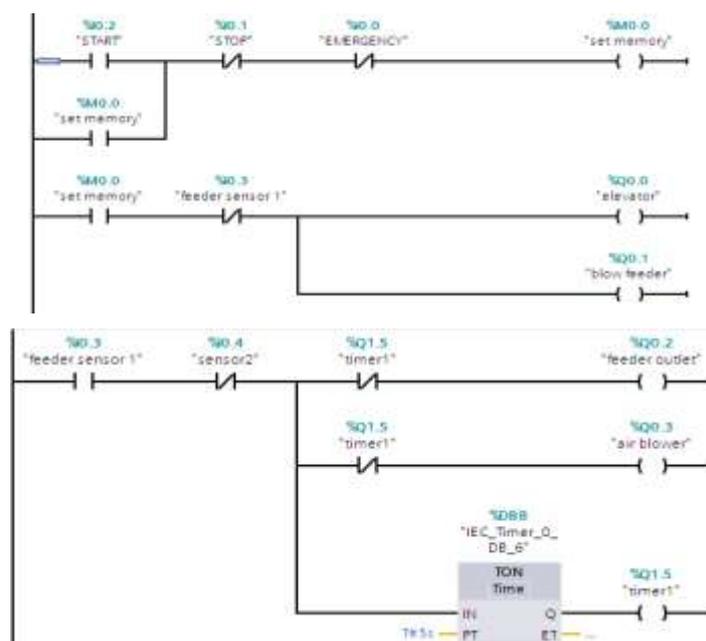


Figure 1 Basic Block Diagram

The ladder logic for the above system with its working is as given below:



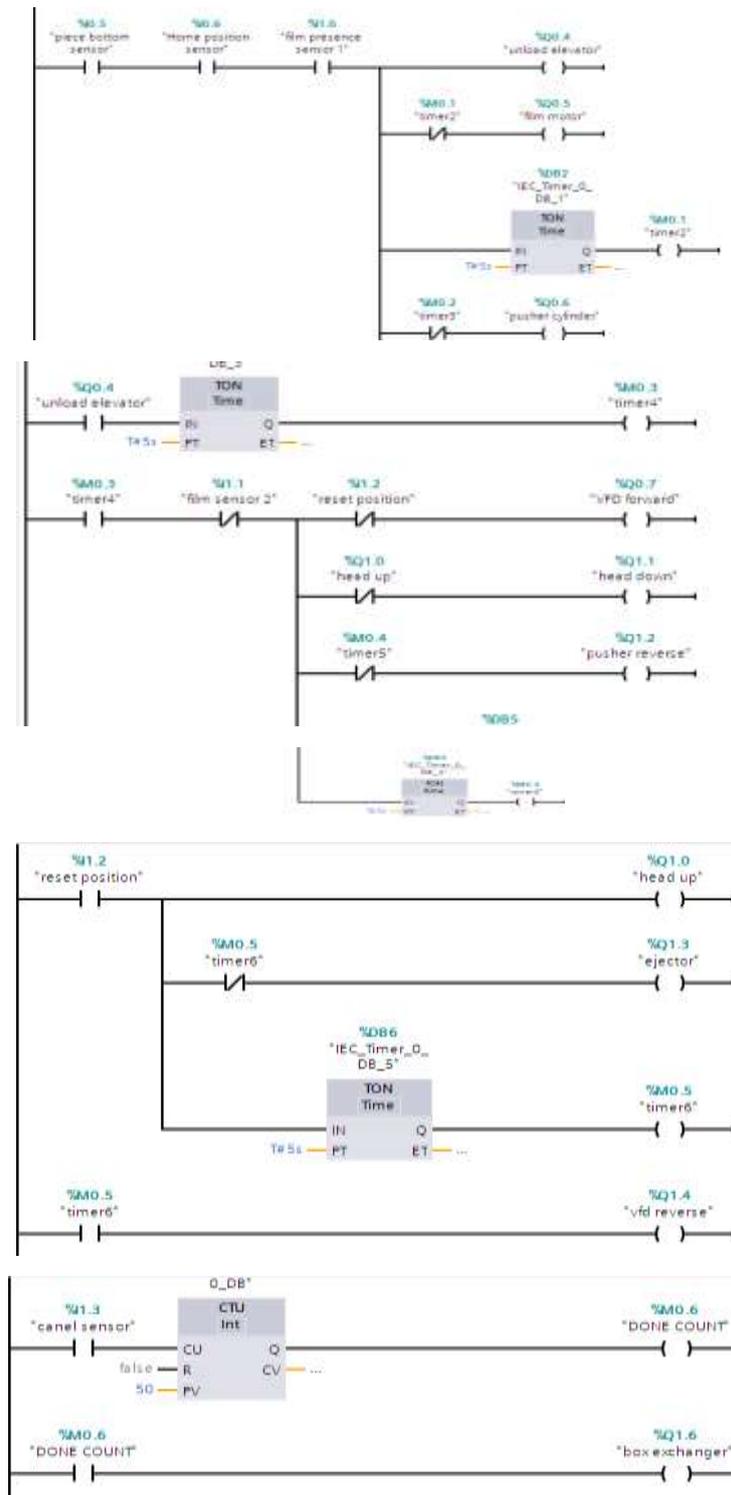


Figure 2 Ladder logic using TIA portal

The above ladder is developed such that the elevator is ON only when the feeder is OFF which carries the caps to be printed. Once they reach the outlet of the feeder the elevator goes OFF and sends the caps out of it. Initially the Home Position sensor has to be ON for the pusher cylinder to place the object on the carriage after a

delay of few seconds the header is moved down for printing to take place at reset position it moves the header up.

V. SYSTEM MONITORING

Automation implemented without the use of monitoring pose problems to the operator since he is not able to identify the actual state of the machine. And he is not able to control whenever any abnormalities occur. Hence nowadays companies are moving to monitoring and control along with automation for the advantages it offers such as increased accuracy, accurate result, decreased wastage, etc. One of the ways of providing monitoring, control, and optimization is through HMI. In the below Fig. 3 HMI is developed for changing the motor speed through the VFD.



Figure 3 HMI to change the motor speed

HMI offers high resolution screen which provides a realistic representation of the machinery. Alarms, trends, simulation, messaging, animation are the different functions which a HMI offers and one can develop the needful for the particular machine.

VI. CONCLUSION

The ladder logic was developed for Hot Foil Stamping with HMI using TIA portal for Siemens PLC. Energy monitoring can be done to know the voltage, frequency, current, power, power factor, used by the Hot Foil Printing Machine. It automatically collects the Consumption, Diagnostic and Status from energy metering devices and sends it to a central database for billing. We can use wireless technology such as ZIGBEE or GSM or even RFID with the machine to send the data to the central station where the monitoring and control can be done using animation with the help of SCADA.

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4th International Conference on Science, Technology and Management

India International Centre, New Delhi

(ICSTM-16)

15th May 2016, www.conferenceworld.in

ISBN: 978-81-932074-8-2

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