

Automatic Control of Conveyor using PLC and VFD

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ABSTRACT: The present industrial world needs advancement in the field of technology to build better automation process. The Motion control of the systems is one common scenario needed in all the industries. Earlier Gear Boxes were used for control of machines and DC drives were mostly used for variation of speed in industries for small scale applications only. With the coming of AC Drives there is a major breakthrough in which motion control of large devices became comfortable. Conveyor is being greatly used in the Industrial processes. Hence control of conveyor is of paramount need along with the PLC and VFD leading to work automatically. This paper largely focuses on the exploitation of the control technique which can yield best performance.

KEYWORDS: VFD,PLC,SMPS,PC.

I. INTRODUCTION

In this paper PLC which is an open system confers us a cost effective solution for real time control in varied applications. To incur an accurate controlling of a Conveyor, PLC ought to be interfaced with VFD Drive, Personal computer and other equipment. Relay that is a switching device decides the operation of VFD and Induction Motor. Variable frequency Drive (VFD) is being utilized in the industry that can provide a control on various motor parameters. It finds its application in the manufacturing process, machines, pumps, rolling mills etc.

Thus, VFD when compared with other starting and control methods is proved to be a better alternative. VFD raises the productivity in terms of quality and product system efficiency thereby reducing the cost of operation of the system. In this paper, the VFD enabled conveyor control via induction motor would be a VFD operation which controlled through PLC. Conventional methods in existence has got some loopholes such as high motor starting current, lower power factor, energy losses etc.

II. EXISTING SYSTEM

[1]Hybrid method for customized and thereby control of Induction Motor using ladder logic diagram and PWM based VFD was done.VFD capable of controlling Induction motors. This system have adaptive control for flexible operation.[2]For water supply system to buildings the throttling and its consequences are the main concerns considered while designing VFD for the system. This can be minimized and the power consumption can be saved by the application of the VFD was also done. The use of the VFD drive provides the best savings in both cost and GHG emissions.

[3]The harmonics was generated in the VFDs. Different source of current and voltage harmonics and their effects. The presence and analysis of harmonics was explained. The order and magnitudes of the harmonics generated are relying upon drive configuration and system impedance.

III. PROPOSED SYSTEM

PLC sequentially scans the input devices then it will update its memory and finally indicate the status of its action in a PLC ladder logic. It exploits the output coil of it in order to change condition of device at the output side. Then interfacing of VFD to the conveyor through induction motor is exercised. By means of logic functions like Start, Reverse, Reset and Jog the automatic control conveyor motor is accomplished.

When Start is on the first relay gets activated then the conveyor runs in forward direction. If Reverse action takes second relay runs, then the conveyor is in reverse direction. Reset operation is performed when there occurs error in execution then the conveyor doesn't run and simultaneously the third relay gets activated. The conveyor performs Jog operation when the Jog logic is being executed and fourth relay is in action.

Four inputs to PLC is given by push buttons. By then the Outputs from PLC is fed to relays input. This will process inputs availing the logic given via ladder program. It will then initiate output to VFD which upon performing its operation send signals to the induction motor. Then, accordingly VFD control of speed and direction of the conveyor is caused.

For the speed control of the Conveyor if the frequency of the induction motor which is connected to the conveyor then the speed of the conveyor can be easily regulated. The following formula clearly depicts this control action.

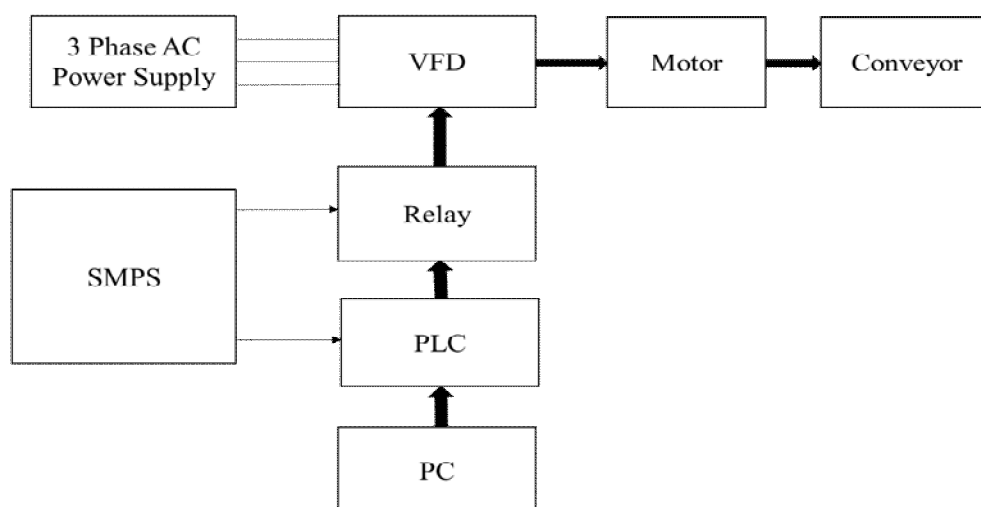
$$\text{Speed (rpm)} = f \text{ (hertz)} \times 120 / \text{number of poles}$$

In order to execute this action an AC VFD Drive is utilized. This has the potential to control the speed of the conveyor by varying the frequency of the input supply which being an ac source eases the control action.

ADVANTAGES

- Saving of energy and easy installation can be made using VFD.
- PLC used can fulfil complex industrial applications.
- Induction motor connected to the Conveyor has good speed regulation and efficiency.

IV. BLOCK DIAGRAM



An AC input is given to the VFD drive which is connected to the conveyor. Then through SMPS a DC voltage is provided to the relay and Programmable Logic Unit (PLC unit). This way through the ladder logic programming is fed to PLC and the execution starts.

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V. HARDWARE DESCRIPTION

A. **VFD:** It is a kind of an adjustable speed drive. The electro-mechanical drive systems is used to control speed and torque by varying motor input frequency and voltage which can be programmed over the menu of the VFD drive.

VFDs are used in applications all over the industries.

Over the last few years, power electronics technology has made VFD cost and size more economical and has improved its performance with the advancement in semiconductor switching devices, simulation and control techniques, control hardware and software. VFDs can be used in a number of different low and medium-voltage AC-AC and DC-AC topologies.



Figure 5.1 VFD

B. **PLC (Mitsubishi):** Programmable Logic Control also called programmable controllers. They use integrated circuits in place of electromechanical devices to execute the control functions given through the ladder logic signals.

They are able to hold many functions and the instructions like the storing instructions such as sequencing, timing, counting, arithmetic, data manipulation and communication that exhibit control action in industrial machines and processes.

Programmable controllers have many definitions. However, PLCs when explained in simple terms would be given as an industrial computers having specifically designed architecture in terms of their central units and also the interfacing circuit to field devices that is their input/output connections to the real world.



Figure 5.2 PLC (Mitsubishi-Melsec Q series)

C. **SMPS:** A switched-mode power supply (SMPS) which is an electronic circuit is capable of converting power consisting of switching devices that could be turned on and off at high frequencies also storage components like the inductors or capacitors are used to supply power when the switching device operates in its non-conduction state.

D. **INDUCTION MOTOR:** A Three phase which is an ac motor is used here for making the conveyor run. This consists of a stator and the rotor which is the rotating part which exhibits the magnetic field inside the motor due to the flux induced inside the motor.

- E. **CONVEYOR:** A flat belt type of a conveyor has been made into use in this project. It has got one or even more pulleys and also a carrying medium call the loop has been mounted. This way it helps in material handling in most of the industries.



Figure 5.3 Conveyor

VI. SOFTWARE DESCRIPTION

- A. **MELSOFT SERIES GX:** GX Works2, as part of IQ Works, is the configuration software for FX, L and Q Series controllers. GX Works2 allows developers to combine five different programming languages, each containing a separate programming style.
- B. **LADDER LOGIC:** The ladder logic continues to be the conventional way of representing the sequences of operations. These diagrams portray the inter-connection of field devices so that the activation or turning ON can be exercised. It will follow the instructions in a manner like one device will turn ON another device according to a predetermined sequence of events being programmed.

VII. EXPERIMENTAL RESULTS



(a)

(b)

(c)

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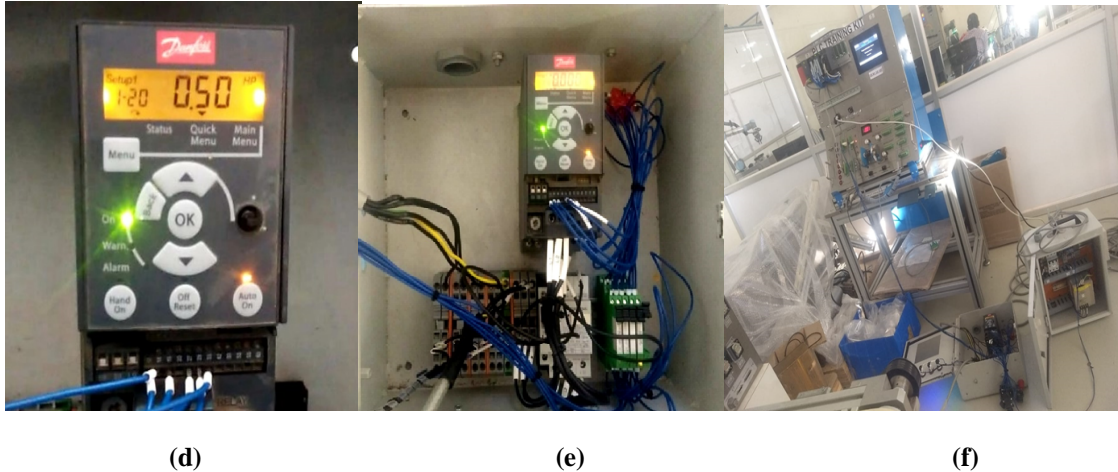


Figure 7.1- (a) Settings of Speed, (b) Settings of Voltage, (c) Settings of frequency, (d) Settings of Power, (e) VFD kit, (f) Overall circuit connection

VIII.CONCLUSION

In this paper the Conveyor's parameters can be controlled by using PLC and VFD. The motor which is connected to conveyor is controlled with automated systems and it makes the work easier and the output is represented using display on VFD drive and conveyor runs according to the input parameters. The man power is reduced and also the type of work that changes manually can be greatly decreased. In future, the speed control appears to be simpler and it is useful for various applications.

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