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A Review on AC Drive Controller using PLC

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Abstract: An AC drive or variable frequency drive (VFD) is a device that is used to control the speed of an electrical motor. The speed of is controlled by changing the frequency of electrical supply of the motor. It converts the frequency of the network to anything between 0 to 300Hz or even higher and thus controls the speed of motor proportional to the frequency. The benefit of an AC drive is that it controls are normally operating at constant speed. It enables the user to control the speed of motor proportionally that gives him various benefits in terms of process control, system stress and energy savings. PLC or programmable logic controller is a digital computer used for the automation of various electromechanical processes in industries. It consists of microprocessor which is programmed using the computer language. This proposed paper discusses various applications of AC drives and controlling mechanism of PLC.

Keywords: PLC, variable frequency drives, v/f method, AC drives, speed controller, frequency based controller.

I. INTRODUCTION

To fulfil high control performance requirements and advanced control, the control engineering method used in industries was the proportional, integral and derivative (PID) controller that is widely used since the last four decades. To simplify the controlling in manufacturing system, process control system etc, PLC is widely used as industrial control [5]. A computer control system consisting of PLC is designed to improve the level of automation. By using the PC, desired temperature or set point (SP) is set by the user and the process temperature based on the SP temperature is maintained by the controller within the PLC [5]. A Variable Frequency Drive is used for applications wherein speed control is of an essential importance due to load changes wherein the speed needs to be increased or decreased accordingly [6]. VFD provides a flexible approach as compared to traditional methods of speed control especially for certain applications which do not require a constant speed at all times [6]. Variable frequency drives are generally required because in many applications it is not desired to run the motor at same speed all the time due to its surrounding circumstances. The revolution per minute of the driven shaft need to be increased or decreased depending on load changes, application requirement or other circumstances [2].The input signal to the VFD is an electrical signal which is come from sensor output. The speed control is performed by continuous feedback provided by output of VFD to PLC as illustrated in figure 1. The output obtained is in the form of signal or waveform displayed on pulse width modulator (PWM).

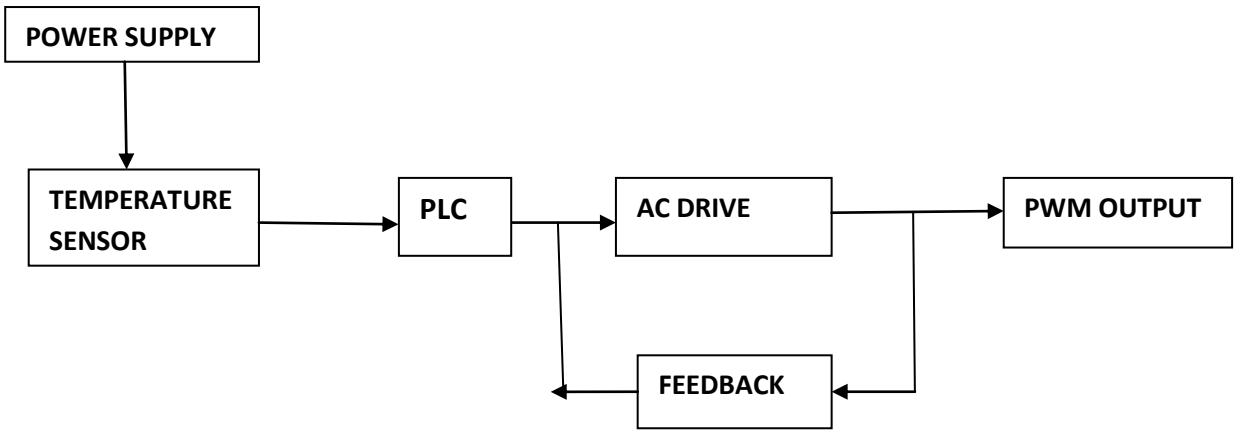

Fig. 1 Basic block diagram of AC drive controller.

II. LITERATURE SURVEY

The literature survey describes various applications of AC drives and PLCs. The description of the various processes is given by different authors is given below:

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Anshul Tiwari et al. (2016) proposed the PLC application for speed control of induction motors through VFD. . Programmable logic controller is an industrial controlling device and is used to automate machines and factory assembly lines. A three phase induction motor can also be controlled manually through variable frequency drives. So, the main purpose of this paper is to automate the three phase induction motor by controlling the inputs to variable frequency drive through PLC and therefore as a result the inputs to the induction motor will be changed and thus the speed of induction motor will change accordingly. VFD employed in this experiment work on V/f method of speed control in which flux remains constant. VFD comprises of converter, filter and PWM inverter. The output obtained from these three steps is fed to the induction motor. Obtain speed control up to the range of 0 to 1510 RPM. This paper is about controlling the speed of induction motor, which is most economical motor, using variable frequency drive (VFD) through programmable logic controller (PLC).

Hong Li Zhu et al. (2009) proposed temperature monitoring system based on AT89C51 microcontroller this paper designs an inspecting and alarming system based on AT89C51 microcontroller. The hardware circuit of this system is composed of collector, host control machine and PC. Through the key courses of collection, storage, conversion and transmission, the temperature data of electric cable interface is sent to real-time show and alarm, achieves inspecting and alarming for the interface of electric cable and avoids the happenings of fire effectively To avoid occurrences of the electric hazards effectively, a method of monitoring the real-time temperature of electric cable interface, aiming for understanding the working condition of each interface accurately and comprehensively and determining the service plan, may ensure safety of the power transmission.

Mahesh Kumar K M et al. (2017) stated that The variable speed drives which can control the speed of AC/DC motors are indispensable controlling elements in automation systems. Depending on the application some of them are fixed speed and some of them are variable speed drives. The objective of the work is to monitor and control the speed of an Induction motor under various operating conditions such as no load and on load driven by AC Drive using programmable logic controller. The variable speed drives, till a couple of decades back, had various limitations, such as poor efficiencies, large space, lower speed etc., However, the advent of power electronic devices such as power MOSFETs, IGBTs etc., and also with the introduction of advanced PLC has transformed the scene completely. Today we have variable speed drive systems which are not only in smaller size but also very efficient, highly reliable and meeting all the stringent demands of various industries of modern era.

Ramavtar Singh Rathore et al. (2015) proposed PLC based PID implementation in process control of temperature flow and level. In the present Industrial scenario the Temperature, Flow, Level, Pressure and density of a process is controlled using the Proportional-Integral-Derivative (PID) controller which is based on microcontroller. Out of the above mentioned variables controlling, Temperature control is very difficult by using ordinary control techniques; hence the motive of our research is to implement PID controller design along with programmable logic controller (PLC) in order to control the time to heat up a particular solution to a desired temperature efficiently without sacrificing the stability of the system. The temperature control, flow and level unit NE40UX are used where the temperature control unit is a special I/O unit that receives inputs directly from RTDs and special I/O unit that receives inputs directly from flow sensors and level sensor of plant. Whatever the temperature, flow, level is desired by the user in accordance with that the set point (SP) is set by the user using the PC. In this work in addition to PLC controlling, Cascade, Ratio and Feedback loops are also used for controlling the above mentioned process parameters.

Rinchin Geonmit Dorjee et al. (2014) proposed monitoring and control of a variable frequency drive using PLC and SCADA. Programmable Logic Controller (PLC) and Supervisory Control And Data Acquisition (SCADA) are two new approaches to control a Variable Frequency Drive (VFD) whose output is fed to a three-phase induction motor and driving a conveyor belt. The conveyor belt has three sensors are inputs which senses a passing object and carries out the necessary instructions programmed in ladder logic programming of the PLC through the medium of a personal computer (PC). The SCADA software installed in the PC in turn enables the human operator to control the entire operation away from the plant and just by using the virtual inputs designated on his computer screen. The results have been verified with a validating experiment.

Vikas Vats et al. (2015) proposed speed control of fan based on room temperature by using programmable logic controller. This paper gives the design and image of fans speed control system based on room temperature using programmable logic circuit (PLC). The design projected here is according to the smart lifestyle. The image of the system has done on a software v 8.0 and graphs showing relation between temperature and different parameter that plotted in graphs to show the accuracy of the system. Microcontroller has a very important role in the growth of the smart system like brain is given to the system. It is a single chip microprocessor adjustable for the automation of the machines and processor. There is block diagram to understand the micro controller system. It has a timer and counter,

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C.P.U, interrupts, memory input and output port on a single chip. A temperature sensor is being introduced to measure the room temperature and hence fans moving accordingly.

Yasar Birbir et al. (2008) proposed design and implementation of PLC-based monitoring control system for three-phase induction motors fed by PWM inverter. This paper presents a design and implementation of a monitoring and control system for the three-phase induction motor based on programmable logic controller (PLC) technology. Also, the implementation of the hardware and software for speed control and protection with the results obtained from tests on induction motor performance is provided. The PLC correlates the operational parameters to the speed requested by the user and monitors the system during normal operation and under trip conditions. Tests of the induction motor system driven by inverter and controlled by PLC prove a higher accuracy in speed regulation as compared to a conventional V/f control system. The efficiency of PLC control is increased at high speeds up to 95% of the synchronous speed. Thus, PLC proves themselves as a very versatile and effective tool in industrial control of electric drives. A power factor controller for a three- phase induction motor utilizes PLC to improve the power factor and to keep its voltage to frequency ratio constant under the whole control conditions.

III. CONCLUSION

The speed of variable frequency drive or AC drive is controlled using PLC. This PLC getting the signal from feedback path connected with output of the AC drive, hence continuous speed control is obtained. The benefit of using AC drive is that the types of motors, which control by it are normally at constant speed. It enables the user to control the speed of the motor proportionally that gives him various benefits in terms of process control, system stress and energy savings.

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