

SPEED CONTROL OF INDUCTION MOTOR USING PLC

¹ MD Nadeem, ²Akash, ³Anil Kumar, ⁴Sagar S, ⁵Siddanna, ⁶Anjali G

¹Student, ²Student, ³Student, ⁴Student, ⁵Student, ⁶Assistant Professor,

¹Department of Electrical and Electronics Engineering,
Veerappa Nisty Engineering College, Shorapur.

Abstract: The paper is about speed control of three phase induction motor using PLC (programmable logic controller). Basically, Programmable logic controller is used as a process controlling device which is mainly used by automation industries. The purpose of this paper is about controlling the output (Speed of three phase Induction motor) by changing the V/F ratio using PLC and therefore as the outcome ratio of V/F will be changed and thus the speed of induction motor also changes accordingly. where V stands for voltage & f stands for frequency while the flux remains constant.

I. INTRODUCTION

The variable speed drives invented previously were having various limitations, such as lower speed, large space, less efficiency etc. However the invention of power electronic devices such as power MOSFETs, IGBTs and also introduction of advanced PLC have changed the scene completely. Today we have variable speed drive systems which are not only in smaller size but also very efficient. In some industries motors have certain restrictions with respect to range and smoothness of control, so induction motor plays very important role due to its low cost and simplicity.

Most equipments use programmable logic controllers (PLC) to connect with computers to monitor each load and electricity consuming devices. A PLC interacts with the external world through its inputs and outputs.

Induction motor: An induction motor is an AC electric motor in which the electric current in the rotor need to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding.

An induction motor may be of two types:

1. squirrel-cage rotor
2. slip ring or phase wound rotor

Electric drive: An Electric Motor together with its control equipment and energy transmitting device forms an electric drive. An electric drive together with its working machine constitutes an electric drive system.

Programmable logic control(PLC): PLC is a special form of microprocessor-based controller that uses programmable memory to store instructions and to implement functions such as logic, sequencing, timing, counting, and arithmetic in order to control machines and processes.

II. LITERATURE SURVEY

[1].Microcontroller based speed control of three phase induction motor using v/f method by international Journal of Scientific and Research Publication:

Use of microcontroller have made the speed control of induction motor easier. Thee various factor which makes the microcontroller based system attractive are

1. Improve reliability and increased flexibility.
2. Simplicity of implementation in variable speed drive.
3. Low cost and high accuracy.
4. possible to change the torque speed characteristics of drive by software modification.

[2].V/F Speed Control of 3 phases Induction Motor using Space Vector Modulation by Ms.Priya Subhash Raichurkar, International Journal of Engineering Research & Technology:

A number of pulse width modulation (pwm) scheme is used to obtain variable voltage and frequency supply from an inverter, such as sine wave pulse width modulation (spwm), third harmonic pulse width modulation (thpwm) and space vector modulation (svpwm).

svpwm digital realization is very easy. Output voltage is more closed to sinusoidal wave.

[3].Speed Control of a Three Phase Induction Motor Using PWM Inverter by Jatin J.Patil, A.M. Kubavat, M.Bala Jh:

In this method the v/f ratio is kept constant which in turn maintain the magnetizing Flux constant so that the maximum torque remain unchanged. The simulation work proves the idea of v/f control performance using PWM inverter and software used for simulation is PSIM(powersim) wee get the different operating zones for various speeds and torque and we can get synchronous speed with almost same maximum torque.

[4].Design and Implementation of PLC-Based Monitoring Control System for Three-Phase Induction Motors Fed by PWM Inverter by YASAR BIRBIR, H.SELCUK NOGAY:

This paper presents a design and implementation of a monitoring and control system for the three phase induction motor based on PLC technology Thee PLC correlates the operational parameters to the speed requested by the user and monitors the system during the normal operation and under trip. Test of the induction motor system driven by inverter and controlled by PLC prove a higher accuracy in speed regulations as compared to a conventional v/f control system.

[5].Speed Control of an Induction Motor using Raspberry PI by P. M. Palpankar, Shraddha Waghmare, B. Shikkewal.

The induction motor speed variations can be easily achieved for a short range by stator voltage control. Raspberry pi plays an important role in our project. Raspberry pi has a quad-core Broadcom BCM2836900 Mhz processor and 1gb ram. It can perform the work like that of computer thus it can be referred as minicomputer.

III. OBJECTIVES

To control the speed of the induction machine in forward direction with load and no load. To control the speed of the induction machine in reverse direction with load and no load. To protect induction machine against overspeed and protect drives from the fault

IV. METHODOLOGY

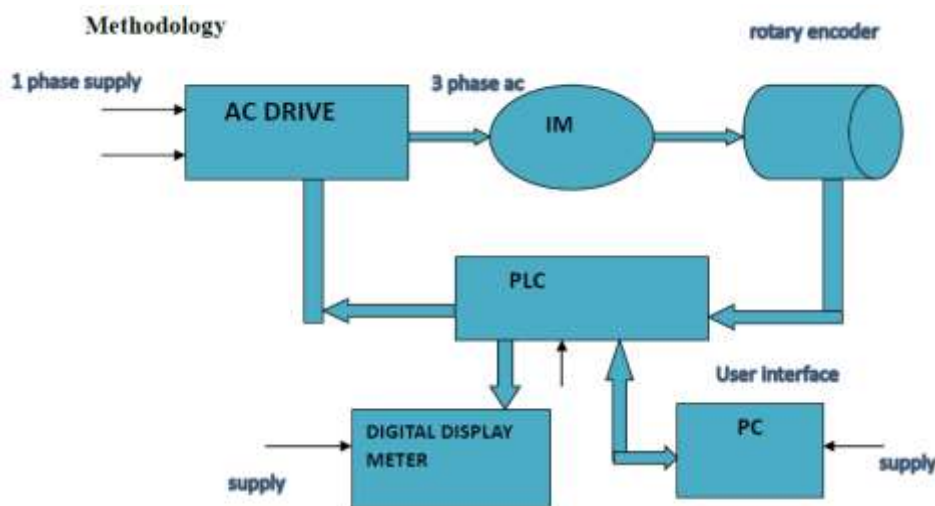


Figure1: Block & connection diagram

Many projects have been done in order to improve the performance of three phase induction motors by controlling the speed of induction motor by various methods like sensor -based control of three phase induction motor. Speed control of induction motor using PWM inverter technique, speed control of induction motor using space vector model. PLC method of control had replaced traditional control method which improves greatly dynamic control efficiency of motor. The Programmable logic controller can simultaneously evaluate data at a faster rate thus increasing the efficiency of the motor and resulting in its better performance. The objective of our work is to monitor the speed of a three phase induction motor under various operating conditions such as no load and on load.

ELECTRIC DRIVES

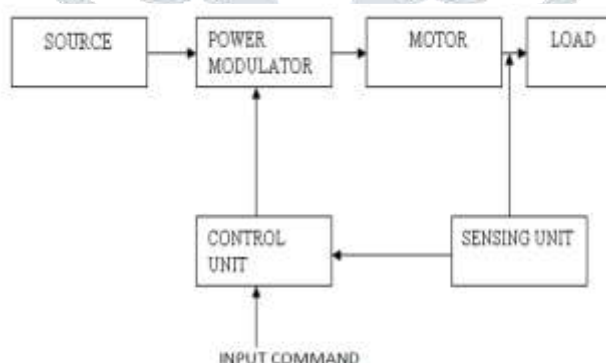


FIG 2: Basic Block diagram of an Electric Drive

Definition: The system which is used for controlling the motion of an electrical machine, such type of system is called an electrical drive. In other words, the drive which uses the electric motor is called electrical drive. **Power Modulator** – The power modulator regulates the output power of the source. It controls the power from the source to the motor in such a manner that motor transmits the speed-torque characteristic required by the load.

Control Unit – The control unit controls the power modulator which operates at small voltage and power levels. The control unit also operates the power modulator as desired.

Sensing Unit – It senses the certain drive parameter like motor current and speed. It mainly required either for protection or for closed loop operation.

Electric drives are mainly of two types:

- 1.DC drives
- 2.AC drives

For induction motor control AC Drive is used in our work AC drives receive AC power and convert it to an adjustable frequency, adjustable voltage output for controlling motor operation. All AC drives convert AC to DC, and then through various switching techniques invert the DC into a variable voltage, variable frequency output.

PROGRAMMABLE LOGIC CONTROLLER(PLC):

CPU: The internal structure of the CPU depends on the microprocessor concerned. In general, CPUs have the following: An arithmetic and logic unit (ALU) that is responsible for data manipulation and carrying out arithmetic operations of addition and subtraction and logic operations of AND, OR, NOT, and EXCLUSIVE-OR.

Buses: The buses are the paths used for communication within the PLC.

The information is transmitted in binary form, that is, as a group of bits, with a bit being a binary digit of 1 or 0, indicating on/off states.

The data bus carries the data used in the processing done by the CPU.

The address bus is used to carry the addresses of memory locations. So that each word can be located in memory, every memory location is given a unique address.

The control bus carries the signals used by the CPU for control, such as to inform memory devices whether they are to receive data from an input or output data and to carry timing signals used to synchronize actions.

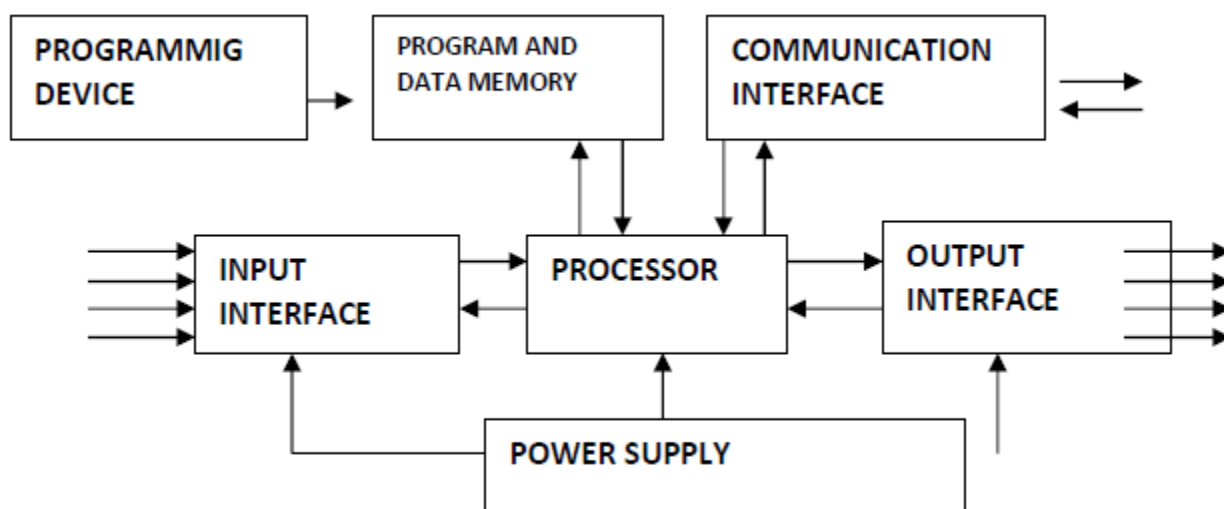


Fig 3: Programmable Logic Controller Block diagram

Memory: Read-only-memory (ROM) gives permanent storage for the operating system and fixed data used by the CPU. Random-access memory (RAM) is used for the user's program. Random-access memory (RAM) is used for data.

Output Units: The input/output unit provides the interface between the system and the outside world, allowing for connections to be made through input/output channels to input devices such as sensors and output devices such as motors and solenoids.

V. PROGRAMMING PLCS

A programming device can be a handheld device, or a computer. Only when the program has been designed on the programming device and is ready is it transferred to the memory unit of the PLC. A handheld programming device normally contains enough memory to allow the unit to retain programs while being carried from one place to another. A major advantage of using a computer is that the program can be stored on the hard disk or a CD and copies can be easily made. A very commonly used method of programming PLCs is based on the use of ladder diagrams. Writing a program is then equivalent to drawing a switching circuit. The ladder diagram consists of two vertical lines representing the power rails.

Circuits are connected as horizontal lines, that is, the rungs of the ladder, between these two verticals. Personal computers are widely configured as program development workstations. Some PLCs only require the computer to have appropriate software; others require special communication cards to interface with the PLC.

