International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

Control of Induction Motor Using PLC and VFD

Adarsh Verma[1], Arbaj Sayyad[2], Shrey Kanherkar [3], Harishchandra Gore[4], Harshad Mahajan[5], Prof. Dr. D.S.Bankar[6], Prof. S.A.Namekar[7]

[1, 2, 3, 4, 5] *Students at Department of Electrical Engineering, Bharati Vidyapeeth Deemed University College of Engineering, Pune*
[6,7] *Professor, Department of Electrical Engineering, Bharati Vidyapeeth Deemed University College of Engineering, Pune*

Abstract - *In electrical machine technology there are different types of motor available and one has to choose the proper motor type depending on his/her own requirements and applications. However, the most widely used and more efficient motor available of all is the Induction Motors. Hence, it initiates a need to control various parameters of induction motor in order to run it properly and efficiently. This paper shows the "Direct On-line Starter" and speed management of 3-phase induction motor through "VFD". There are many different methods and starter available to start the motor out of which DOL (Direct Online Starter) is very simple and cheap. To control the speed of induction motor many techniques and drives are available out of which VFD (Variable Frequency Drive) is used here. The employment of VFD will increase potency, reliability, energy savings and supply speed variation. PLC is employed for beginning the DOL starter and also the main side of victimization PLC is to try and do operation remotely.*

Key Words: **PLC, VFD, CONTACTOR, INDCUTION MOTOR, DOL**

1. INTRODUCTION

In today's industrial sector industrialist demands for higher efficiency at the same time lower cost. The motor used at any instance of industrial application must run with lower maintenance cost and can be controlled easily. As induction motors are widely used, we will present the cheaper technique to control these motors. Induction motors mainly consists of two types rotors which are - wound rotor and squirrel cage rotor with similar stator construction. A three phase induction motor has 3 phase stator winding where supply is given. When supply is applied at 3 phase stator winding a rotating magnetic field is created which rotates at synchronous speed. Direction of rotation of this field depends on phase sequence of primary current. Rotor conductors cut this magnetic field which produces electromotive force (emf) in these rotor conductors. The rotor windings are either shorted or closed through external resistance therefore a current starts flowing in rotor conductor which rotates the rotor. Thus there is a high in flow of current at the time of starting. Therefore 3-phase induction motors use various techniques to control the high in flow of current for protection of motors. There are several ways in use to start the operation of 3-phase induction motors. The DOL starter that is used here is cheaper and simpler than the others.

2. PROGRAMMABLE LOGIC CONTROLLER

A PLC is a computer application used to carry out control of various operations in industries. The well-known and common applications of PLC are control of process flow, control of movements of machinery, remote operation of process and easy installation at drastic sites etc. A typical PLC consists of input-output module, Central Processing Unit, inbuilt SMPS and a Monitor display. The input module allows PLC to take input in any form and then forward it to CPU. CPU then performed necessary action according to ladder logic and output is taken from output module. PLC also has memory to use which is available in CPU. In this project Messung's Nexgeni 100 PLC is used.

3. DIRECT ON LINE STARTER

The DOL starter connects the 3-phase supply to the mechanical device winding of induction motor. The motor current at the time of beginning becomes five to seven times the total load current for the terribly little length. The current drawn by the motor depends upon its style and size. However such high quantity of current doesn't hurt the motor owing to the rugged construction of the induction motor. Such a high worth of current causes sharp unwanted voltage drops in offer voltage. After we begin DOL Starter, the present flow through negative feedback circuit energizes the contactor coil and results in shutting the contacts. If we have a tendency to stop the provision to starter, the present flow of current through the contact becomes discontinued. Since the provision of motor breaks, the machine can come back to rest.

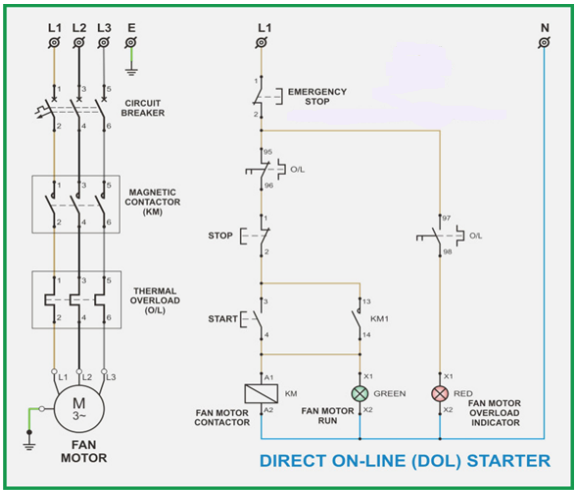

Fig.1-Connection Diagram for DOL Starter

The connection diagram of DOL starter is as shown in fig.1.As we can see from diagram there is a coil operated contactor KM1 which is controlled by START and STOP push buttons. When we press the switch START, the contactor coil KM1 is energized from line L1. The 3 mains contacts (1-2), (3-4), and (13-14) in Fig.1 are closed. The motor is so connected to the supply. If later we press stop switch STOP is ironed, the provision through the contactor KM1 is disconnected. Since the KM1 is de-energized, the mains contacts (1- 2), (3-4), and (13-14) are opened. The provision of supply to motor is disconnected and the motor stops. Within the fault condition or overload causes O/L to open, KM1 coil de-energizes & KM1 retentive contact drops out.

4. VARIABLE FREQUENCY DRIVE

A VFD (Variable Frequency Drive) is a controller used to control and monitor parameters of induction motor such as speed. The name itself suggests that VFD uses voltage and frequency to control the speed of induction motor. We already know that if we change the frequency of supply then we can easily change the speed of induction motor by the formula N= (120*f)/P where, f= frequency of supply. However, if we change the frequency alone then magnetizing flux between air gap of induction motor also changes. But the induction motors are designed to work at a knee point of magnetizing characteristics to make full use of magnetic materials. So far in accordance with change in frequency we also need to change the voltage. Thus by keeping the V/F ratio constant, the speed of induction motor is controlled by VFD. Here, in this project L&T VFD is used. The internal circuit diagram of a typical VFD is as shown in fig.2. It consists of a 3 phase AC to DC converter, filter circuit and DC to AC Inverter.

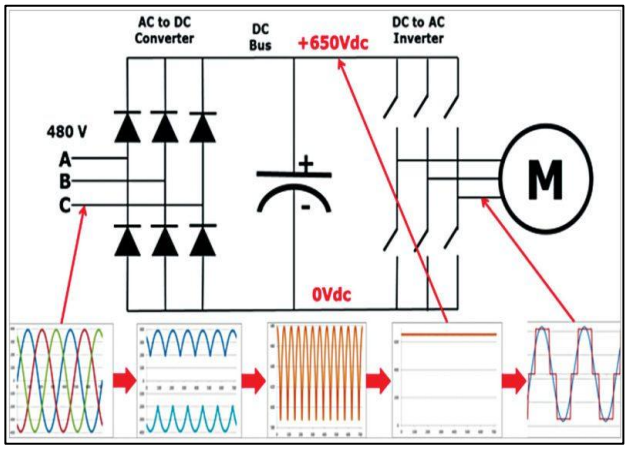

Fig.2 – Working Of VFD

5. WORKING OF MODEL

The model require 3-phase 440 v ac supply to run the induction motor which has been brought through 4 pole MCB (miniature circuit breaker) for protection purpose. Another 1-phase 230 v ac supply has brought through 1 and 2 poles MCB's and given to the SMPS. The Switched Mode Power Supply (SMPS) is used here to convert the 1-phase ac into 24v dc to operate the PLC and VFD.

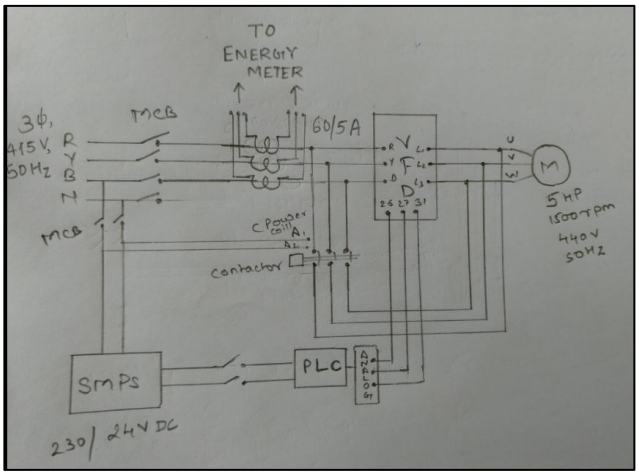

Fig.3-Connection diagram of Model

The 3-phase supply is then applied at 3-pole contactor to carry out the DOL starting. The contactor voltage limits are set according to rating. Now, the regulated dc supply from SMPS is given to PLC and from PLC to VFD. Here, VFD carry outs the speed control by using V/F method explained in earlier sections. We can also perform the forward and reverse rotation of induction motor. VFD can change the direction of rotation. The circuit diagram for the model is shown in fig.3

6. CONCLUSION

In this paper a cheaper and simpler scheme to start and control the induction motors using PLC and VFD is successfully explained. We can remotely access the motor using PLC. Thus, by implementing automation scheme the productivity can be improved at lower cost.

7. REFERENCE

[1] "Theory And Performance of Electrical Machine" – A book by J.B.Gupta

[2] "Programmable Logic Controller" – Book by Hugh Jack

[3] Mahesh Kumar K M and B Ramachandra , "Speed Control of Three Phase Induction Motor Using PLC under Open and Closed Loop Condition", (IJERA) Int. Journal of Engineering Research and Application ISSN : 2248-9622, Vol. 7, Issue 1, (Part -4) January 2017, pp.34-39

[4] S.Sneha, S.Radhika, "Controlling and Protection of Three Phase Induction Motor Using PLC",(IJRASET) International Journal for Research in Applied Science & Engineering Technology Volume 4 Issue XI, November 2016 IC Value: 13.98 ISSN: 2321-9653