Agricultural Water Discharge Control and Dry Run Protection Auto Starter for Open Well and Submersible Pump

[1]Hemant Mutha, [2]Shrenik Khabiya, [3]Kalpesh Bamb
Department of Electronics and Telecommunication Engineering,
[1,2]SNJB KBJ'S College of Engineering, Chandwad, Nashik
mutha.hhcoe@snjb.org[1]

Abstract
It is definitely understood that induction motors draw large currents during their starting phase than is the case under full load running conditions. Initially induction motor availability, starting methods other than Direct-on-Line have been used, and in some cases mandated by Utilities, to condense the effect of these high starting currents on the electrical distribution network. What is generally not recognized is the existence of short duration inrush currents, which greatly exceed these starting currents. Also, the introduction of composite starting methods to diminish starting currents is often compromised by other unsuspected inrush currents introduced by the starting system itself, unless special defenses are taken. This paper implements a device that protects three phase induction motor from inrush currents on the distribution system, as well as on the motor protection components using PIC16F84A Microcontroller.

Index Terms- Induction Motor, Microcontroller, motor protection, currents, DOL, distribution system.

I. INTRODUCTION

Induction motors are widespread due to their low-cost, sturdy construction, fast pick-up, short maintenance spending and good efficiency. The DOL starters and star/delta starters used for starting and running of induction motors offer coarse type of protections against voltage fluctuations and single phasing. Induction motors are very delicate to low voltage and single phasing during which they draw a heavy current and can burn out unless switched of within few seconds of occurrence of such conditions. This makes the requirement of a sensitive protective device essential to avoid burning of induction motors under such conditions.

The circuit of an automatic starter, incorporating the important features given below, is described here. It is meant to be used in conjunction with a DOL starter. Automatic start on resumption of proper Setting Single phasing avoidance 24-hour programmable off timer (on completion of actual runtime of the motor). An induction or nonsynchronous motor is a type of AC motor where power is provided to the rotor by means of electromagnetic induction, instead of a commutator or Slip rings as in alternative types of motor . These motor s are widely used in industrialized drives, specially poly-phase induction motors, for the sake of they are brutal and have no brushes. Single-phase versions are utilized in small appliances. Their speed is dependent uponthe frequency of your supply current, so they are most widely used in constant-speed applications, although fluctuating speed versions, using variable frequency drives are getting more common. The most commonplace type is the squirrel cage motor.

The block diagram of the system is depicted in Fig. 1.0. The embedment of a microcontroller into the system makes it a standalone system that is capable of taking decisions to keep the system functioning properly. The microcontroller receives inputs signals from the triple phase mains which is been step down by step-down generators, depending on the input the microcontroller receives, it this one takes decision to switch on the relays or switch off the relays. When the system is first switched on, it waits for 30 seconds to make sure the power source is stable and starts monitoring.

II. BLOCK DIAGRAM

The block diagram of the system is depicted in Fig. 1.0. The embedment of a microcontroller into the system makes it a standalone system that is capable of taking decisions to keep the system functioning properly. The microcontroller receives inputs signals from the three phase mains which is been step down by step-down transformers, depending on the input the microcontroller receives, it either takes decision to switch on the relays or switch off the relays. When the system is first switched on, it waits for 30 seconds to make sure the power source is stable and starts monitoring.

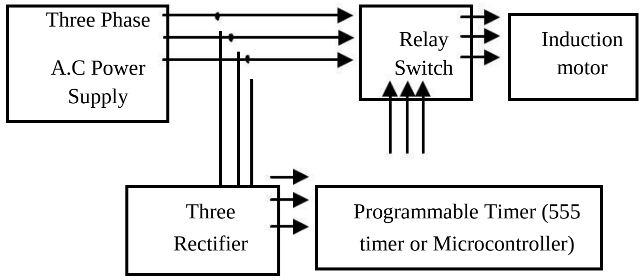

Fig.1 The automatic induction motor starter with programmable timer

By switching ON or OFF of the relays, the microcontroller also turn on LEDs and the color of LED, being lit ON, indicates which the triple phases is ON or OFF. The schematic diagram of the automatic three phase direct starter controller system is given in Fig. 2.0.The microcontroller passed down for the purpose may be the PIC16F84A.The microcontroller takes inputs from the triple mains continuously via step-down generator. Under the control of the program written, the microcontroller turns this one Red or Green LEDs and turns the triple relays ON or OFF.

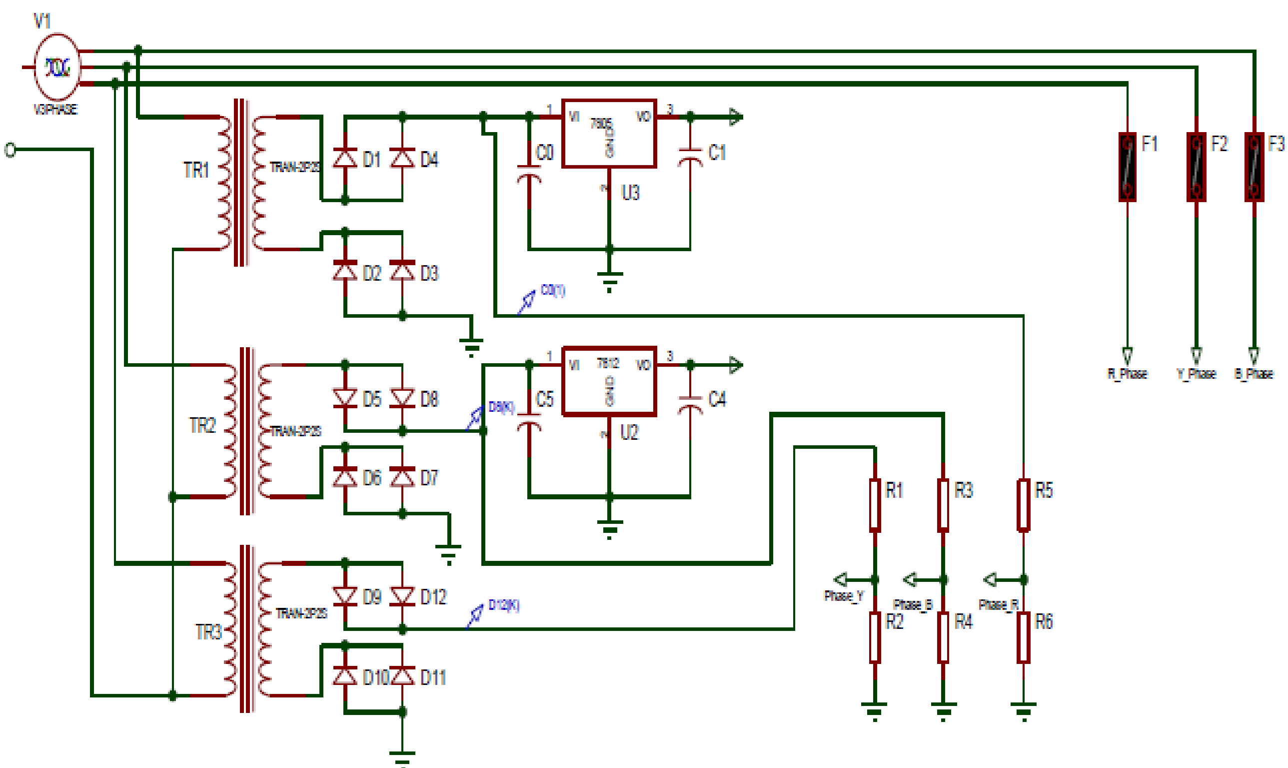

Fig.2 a Complete circuit diagram of three phase induction motor

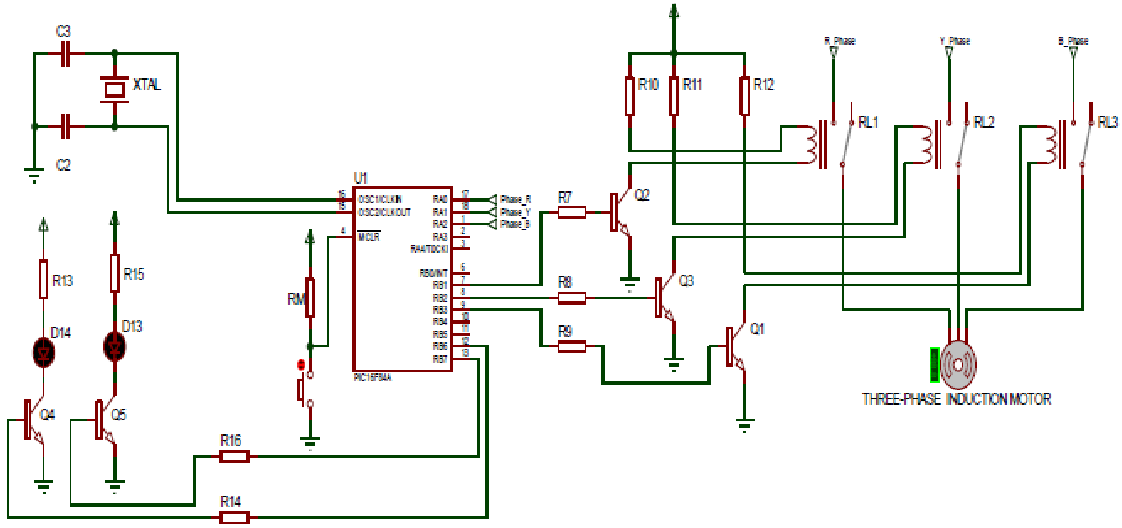

Fig.3 Complete circuit diagram of three phase induction motor

The transistors are turned on depending on the state of each AC supply phase. The voltage at each phase determines which of the transistor will trigger on. Using the requirements for the saturation of the BJT expressed as;

$$\beta_F I_B > I_C \text{.............(1)}$$

Under the condition in equation 1, the transistors (Q1, Q2, Q3, Q4, Q5, Q6, Q7) will turn on.
The transistor (Q) will turn on when,

$$R_{gb} + R < \frac{\beta_F R_1 (V_{CC} - V_{BEsat})}{V_{CC} - V_{CEsat}} \text{...........(2)}$$

Since we are using transformer of 240/12 volts and need a voltage of 5volts (nominal input voltage of microcontroller)
Figure 3.0 gives the flow chart of the program executed by the microcontroller. As indicated in the flow chart the microcontroller polls the input.

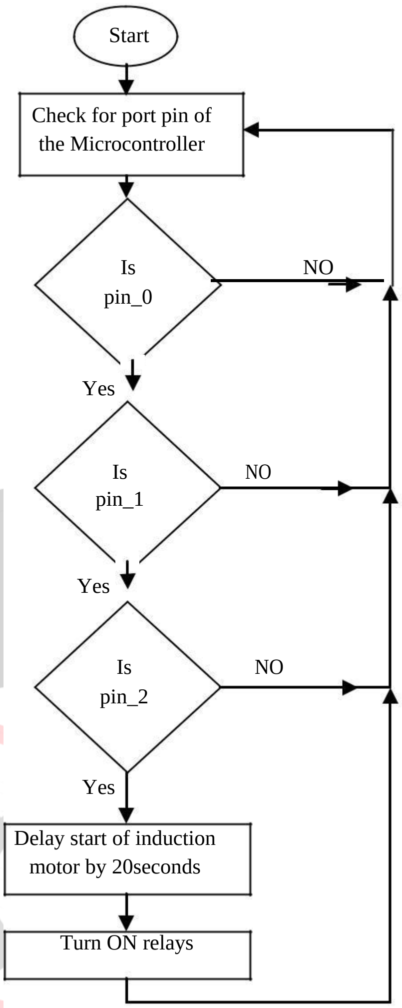

Fig.4 Flow chart of the three induction motor starter with automatic programmable time

III. RESULTS AND DISCUSSIONS

The program for the microcontroller was written in Assembly Language which is attached as Appendix 1 and was then built into an executable Hex file using the MPLAB IDE Version 8.50 and the embedded MPASM assembler. A software simulation was carried out with the simulator built into the MPLAD IDE to ensure that the program variables and registers changed as desired. The program required few registers but the output ports (PORTA and PORTB) were observed to have the correct values. The circuit shown in Fig. 2.0 was then built in Vero board, which was tested using three phase ac mains and the output was connected to 220 V, 100 Watts bulb. The microcontroller program was observed and it gave the required outputs.

Table 1: Sensor Conditions and Microcontroller Decisions

Phase Conditions			Indication	Output
P1	P2	P3		
H	L	L	Only one phase is on	Red LED ON and the relays are turned off
H	H	L	Two phases are on	Red LED ON and the relays are turned off
H	H	H	All the three phases are on	Green LED ON and the relays are turned off

Note that in Table 1, L = Low Logic Level Signal and H = High Logic Level Signal, P1 = Phase 1, P2 = Phase 2, P3 = Phase 3

IV. CONCLUSION

An programmed over and under voltage guard system has been implemented using induction motor starter which is monitor the voltage supply to equipment's and applications and accordingly guard them from the danger of being damaged due to voltage fluctuation. Based on the theoretical analysis, design and testing of this work, the following conclusions are made:

Meanwhile switching is automatic, the device is no doubt being used as an automatic voltage protector. The display of the monitored voltage is indicated simply by LEDs, which can be easily seen and implicit by all. The assembly unit is very compact and portable and can be easily incorporated into equipment's. The cost of constructing this project is relatively low as compared to the important function it performs. It can therefore be easily commercialized.

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