

# SINGLE PHASING, PHASE REVERSAL, OVERVOLTAGE, UNDER VOLTAGE AND OVERHEATING PROTECTION OF THREE PHASE INDUCTION MOTOR

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## ABSTRACT

*This paper tends to develop for protection of three phase induction motor from single phasing, phase reversal, over voltage and under voltage. Due to this electrical fault the winding of motor get heated which lead to insulation failure and thus reduce the life time of motor. This fault is generated in induction motor due to variation in induction motor parameters. When three phase induction motor runs continuously, it is necessary to protect the motor from these anticipated faults. Three phase induction motor generally directly connected through the supply, if the supply voltage has sag and swell due to fault the performance of motor is affected and in some cases winding is burned out. When phase sequence (RYB) is reversed due to wrong connection then motor start rotating in another direction, if supply system has only one phase and other phase is disconnected then it is single phasing problem.*

**KEYWORD:** Three phase induction motor, PIC microcontroller, over voltage, under voltage, overheating, single phasing and phase reversal kit.

## I. INTRODUCTION

Three phase induction motor generally suffers from under voltage, overvoltage, overheating, single phasing and phase reversal problems. When the three phase induction motor supply with higher voltage than is rated then induction motor starts overheated. In our project a variable resistance is used when supply voltage is lower than rated then voltage drop across the resistance is higher than it protects the motor from this fault. When supply voltage is lower than voltage drop across the resistance is lower than specified value and motor fails to start. When supply is only one phase, this is single phasing problem and supply voltage fall the rated and once again motor fails to start. In the case of motor overheating a LM sensor is used which sense the temperature of winding if it is exceed the specified limit then once again motor fails to start. It is highly desired that 3 phase induction motor works freely from these all types' of faults. Details description of all types of faults is given below.

## II. OVERVOLTAGE PROTECTION

In overvoltage protection system of 3 phase induction motor, protects the motor from overvoltage, the voltage which is higher than the rated voltage. In circuit diagram of overvoltage protection it consists the comparator which compare two voltages one is supply and another one is drop across the variable resistance. When the voltage drop across the variable resistance is higher than specified value then comparator generates signals. This signal is fed to microcontroller and microcontroller takes the appropriate action as shown in fig.1.

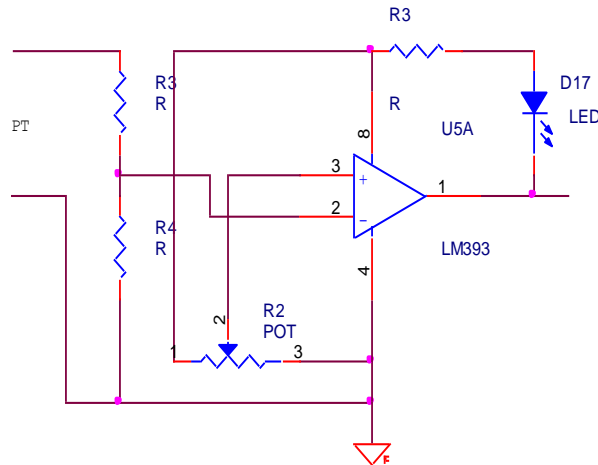


Fig.1 Circuit diagram of overvoltage protection

### III. BLOCK DIAGRAM

The block diagram of system is shown in fig.2. Microcontroller is AT89S52 is used with programming code which drives the whole system according to their characteristics. One relay drive is used which drive the relay function. All the five unit of controlling warring as input for microcontroller and a power supply is also used which provide the power supply to microcontroller. As the input provided by the different section of protection according to that microcontroller works.

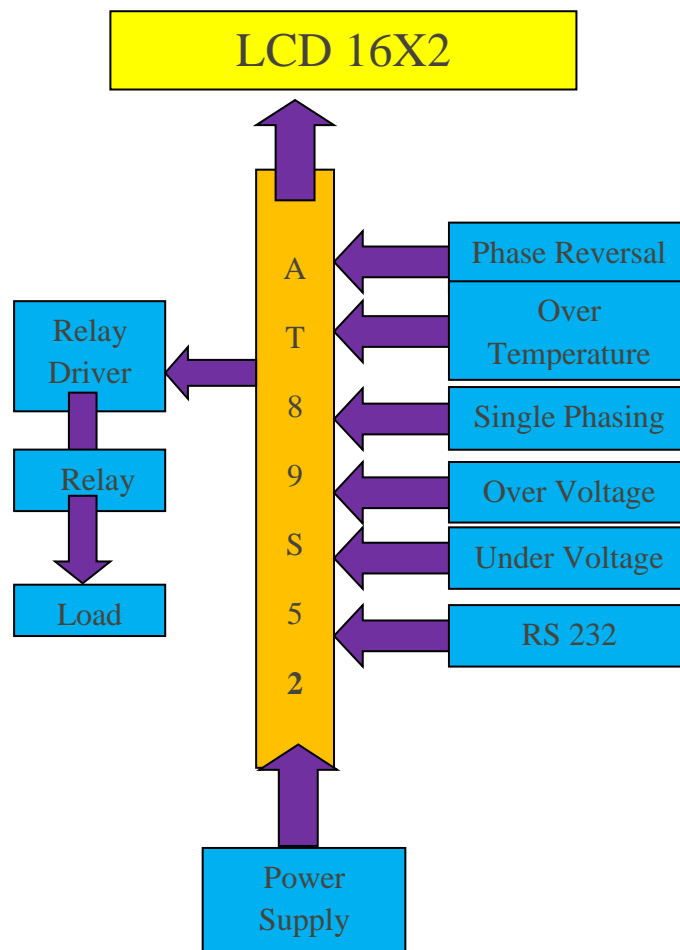


Fig.2 Block diagram of system

#### IV. UNDER VOLTAGE PROTECTION

In under voltage protection of 3 phase induction motor provides the protection from the under voltage. When supply system has low voltage than the rated of induction motor then under voltage protection section of protection supply is provided to motor. Single phasing works. It has same concept as overvoltage it also has comparator which compare two voltage one form supply and another from the voltage drop across the variable resistance. When voltage drop across the variable resistance is lower than specified value, this signal sends to microcontroller and microcontroller stop the operation of motor in the case of running and fails to operate in case of starting. Preset is used to set the specified value as shown in fig.3.



Fig.3 Preset to set value

This circuit works in same manner as overvoltage protection works only the different is that value set by preset. In this Case set value is minimum but in overvoltage case set values by preset resistor. When appropriate voltage drop across the Resister exceeds from the set values of preset the signal sends to microcontrollers.

#### V. SINGLE PHASING

In single phasing protection to 3 phase induction motor, if other two phases is faulted and only one protection of motor section starts functioning. Generally in single phase supply voltage is lower value than specified value. On this value of voltage motor is unable to start. Comparator which compares single phasing supply voltage and rated specified voltage, and single sends to microcontroller and microcontroller generates single which stop the motor if motor is running and does not allow to motor start in case of standstill. Sometimes single phasing protection looking much motor important when the motor is tight which important function like furnishing, pump driving and crane driving etc. This fig.4 show the typical single phasing condition in three phase induction motor where one phase break down and motor is only supplied by remaining phases which is equivalent to single phasing condition. Single phasing occurs as a result of several possibilities. A loose wire, a bad connection, bad starter contacts, overload relay problems, a bad breaker, a blown fuse, and other things can cause this destructive condition. Obvious signs are a louder than normal humming from the motor and/or a shaft that vibrates rather than rotating.

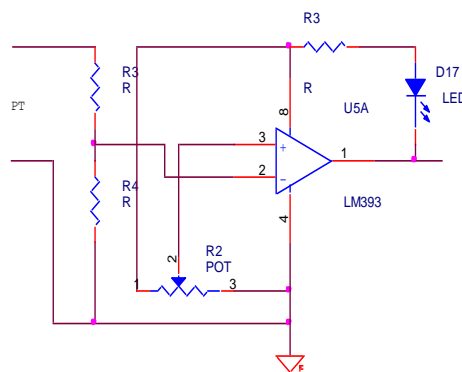


Fig.4 Diagram of single phasing

## VI. PHASE REVERSAL

Phase reversal problem occurs in motor when the supply phase is reversed due to wrong connection (except than RYB) due to phase reversal motor starts running in anticlockwise (opposite direction from normal) would cause operation and safety problem. Most of three phases motor run opposite phases. This type of protection is used in application like elevators where it would be damaging or dangerous for the motor to run in reverse. Generally when motor is connected with the important application then type of protection being much more important .When the load is connected with motor then reversal of phase means Direction of rotation is changed. It could cause serious problem therefore much more care is required to protect the motor form such type of fault. The overheating protection system is placed to turn the motor off when the exceeds heat is generated within the motor. This protection system rested the motor cools to safe operating temperature. Direction by switching the connection of any two of three although the motor having shut down because it tripped the thermal limit in inconvenient.

## VII. OVERHEATING PROTECTION

Overheating protection of motor means protect the motor from overheating of its winding. This overheating in motor is generally caused by overloading of motor, bearing seizes up something locked the motor shaft from turning. Motor simply fails to starts properly, a failure to start of motor may cause by faulty start in winding in motor. For sensing the heat LM 35 sensor is used for this purpose. This sensor is connected to comparator inputs. With the help of sensor which sense the temperature of winding & its temperature exceeds to some particular level then comparator sends this signal to microcontroller as shown in fig.5.

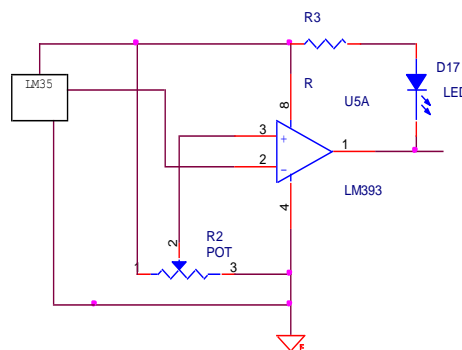


Fig.5 Diagram of overheating protection

## VIII. CONCLUSION

Protection of three phase induction motor from over voltage, under voltage, single phasing, and overheating and phase reversal provide the smooth running of motor improves its lifetime and efficiency. Generally these faults generated when supply system is violating its rating. In three phase induction motor when running at rated voltage, current and load these faults are not generated. For smooth running of motor generally concentration on supply voltage under the prescribe limit and load which is driven by the motor should also be under the specified limit.

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