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PROTECTION OF INDUCTION MOTOR USING CLASSICAL METHOD

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Abstract - *This paper presents the Protection of an Induction Motor (IM) against possible problems such as single phasing, over voltage, over current, overload, dry run as well as under voltage occurring in the Induction Motor.The Electric Motor is a most crucial drive in a modern era of automation. Induction Motors can be protected using some components such as contactors, voltage measurement, current measurement and relays circuit. So, This method is named as the classical method. Classical method involves electrical as well as mechanical dynamic parts. The circuit was fully controlled by microcontroller and it will continuous monitored the voltage, current, speed of the three phases. If any problem come due to fault that normally created in the motor like a protection system which is implemented will monitored working of the induction motor during normal condition and abnormal condition. The motor will get protected from these faults by the operation of the implemented protection system and all the condition are display by it over the LCD display.*

Key Words: Over Current, Over Voltage, Single Phasing, Three Phase Induction Motor, Trip Conditions, Under Voltage.

1. INTRODUCTION

The motor protection is required as day to day life. Three phase induction motor generally suffers from under voltage, overvoltage, overheating, single phasing and phase reversal problems..In our project a variable resistance is usedwhen supply voltage is lower than rated then voltage drop across the resistance is higher than itprotects the motor from this fault. Classical protection techniques for three phase IMs are very fast emerging technology for the detection of various faults. The equipments which is used in this project have mechanical parts and their responses are very fast compared with that of other equipment. The mechanical parts of the equipment can increases the reliability of the system and efficiency of the system. In terms of economy the cost of classical relays has been decreased recently.For understanding motor thermal overload protection in induction motor we can discuss the operating principle of three phase induction motor. There is one cylindrical stator and a three phase winding is symmetrically distributed in the inner periphery of the stator. Due to such symmetrical distribution, the three phase supply is given to the three phase Induction motor.The potential transformer is connected in parallel with three phase supply and the current transformer is connected in series with the three phase supply. The function of the potential transformer and current transformer in this protective system is to continuously monitoring the voltage and current respectively.The voltage sensing unit is used to sensing the voltage.It is connected in series with the potential transformer and also the current sensing unit is used to sensing the voltage. It is connected in series with the potential transformer and also the current sensing unit is used to sensing the current. It is connected in series with the current transformer. When the three phase supply is given the working of CT and PT is followed by continuously. If the any type of fault occurs such as over voltage, under voltage, over load, phase reversing, unbalanced voltage, single phasing then the sensing unit operated. PIC 16F877 microcontroller some preset values are set with help of this value the microcontroller compared the reference value and set values. The main function of the relay and contactor unit is to sense the signal which is comes from the microcontroller and relay operated and relay will trip i.e. the three phase supply is disconnected from the three phase Induction motor. This signal goes to the drive unit which is connected to the three phase Induction motor and motor stop with sefty operation.

1.1 IMPORTANCE OF MOTOR PROTECTION

Protection of three phase induction motor from single phasing, phase reversal, over voltage and under voltage. According to this electrical fault the winding of motor get heated which lead to fails the insulation of the winding 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 any wrong connection then motor start rotating in another direction, if supply system has only one phase and other phase is disconnected from the motor then it is called as single phasing problem. Induction motors have been used extensively for many industrial applications since several decades ago. These applications range from intensive care unit pumps, electric vehicle propulsion systems and computer-cooling fans, to electric pumps used in nuclear power plants. Safety, reliability,

efficiency, and performance are some of the major concerns of motor applications.

2. EXPERIMENTAL SETUP

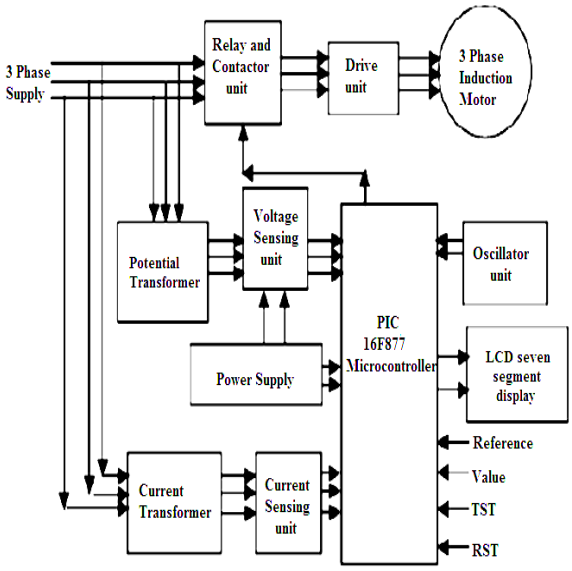

Fig -1: Block Diagram of the Protection System of Three Phase Induction Motor

2.1 Overvoltage Protection

In overvoltage protection system of three 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 résistance 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. 2

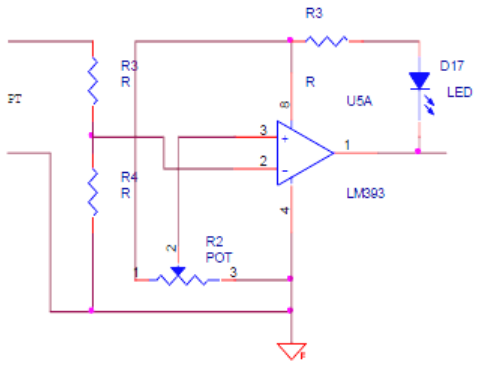

Fig -2: Circuit Diagram of Overvoltage Protection

2.2 Single Phasing

In single phasing protection to three 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. 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 as shown in Fig. 3

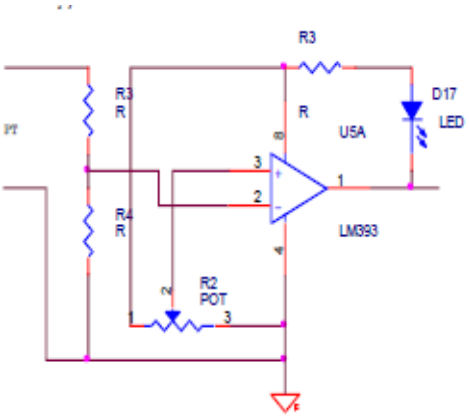

Fig -3: Circuit Diagram of Single Phasing

2.3 Under Voltage Protection

In under voltage protection of three 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 a overvoltage it also has comparator which compare two voltage one form supply and another from the voltage drop across the variable résistance. 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. 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 resister. When appropriate voltage drop across the Resister exceeds from the set values of preset the signals sends to microcontrollers.

2.4 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 withmotor 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.

2.5 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 and its temperature exceeds to some particular level then comparator sends this signal to microcontroller as shown in Fig. 4

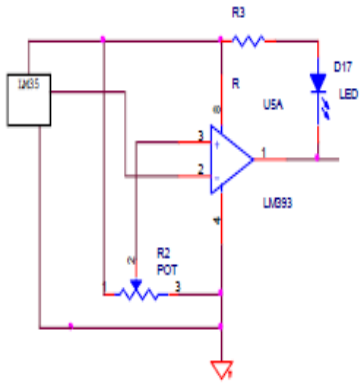

Fig -4: Circuit Diagram of Overheating Protection

3. RESULT

This paper shows that one statistical feature alone can be used to classify faulty and normal condition 99 percent accuracy. Also, the new seperability metric proposed, which is computationaly less expensive and faster.

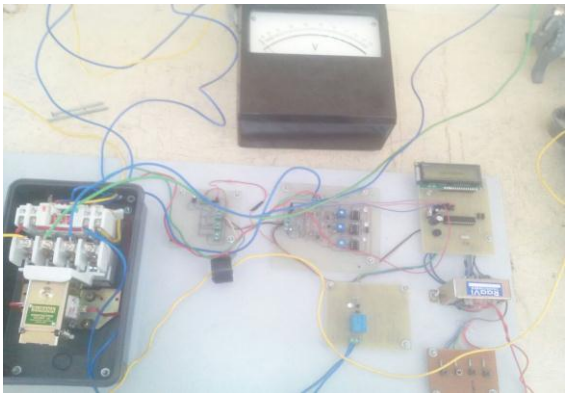

Fig -5 Circuit Design Protection Of Induction Motor

It protect the induction motor from the various faults such as under voltage, overvoltage, overheating, single phasing' dry run and phase reversal problems. The importance of statistical features based on how well these statistical features can distinguish between healthy and faulty condition.

4. CONCLUSIONS

In this project we concluded that the 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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