



# 3 Phase Induction Motor Protection against Single Phasing and Temperature Rise

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**Abstract:** The venture has been intended to shield of against single phasing and temperature rise of an induction motor. Given an insurance framework is vital in enterprises, utilizing part of motors with the end goal that generation is not hampered inferably from disappointment of any motor. The essential thought for the advancement of this venture was to give security to the mechanical motor/pump/lift Motor and so on. On the off chance, out of the 3 phases if any of the phases out of the three phases is missing or if the temperature of the motor body amid operation surpasses the upper limit set up by the manufacturer, motor immobilizes immediately. The framework utilizes a 3-Phase mechanism supply where three single phase transformers are associated with it. In the event that any of the phase isn't accessible, the energy is being stopped by the corresponding transformer. This prompted one out of the four transformers being exchanged OFF. The principle hand-off which was being controlled through an arrangement of four transformers gets separated in view of one hand-off not being fuelled. Consequently the fundamental. Hand off that conveyed 3 phase supply to the motor gets separated. For sensing the temperature of the motor body a thermistor has been attached to the protection circuit. Under some particular circumstances when the temperature of the motor rises above certain limit the fourth transformer gets disconnected. Further the venture could have been upgraded by utilizing sensors of current for protection against terminated load and phase grouping sensor for shielding the motor from applying incorrect phase sequence.

**Keywords:** Comparator, LCD, Relay Driver, Relay.

## I. INTRODUCTION

Three-phase induction motors are responsible for 85 percent of the modern driving frameworks. In this way, the security of these motors is vital for dependable operation of loads. Motor faults are chiefly separated into three classes: electrical, mechanical and natural. Mechanical faults cause extreme heating and thus bringing about the stress and strain of rotor's orientation, while the over mechanical load makes

Substantial streams draw, and in this manner bring about expanding temperatures. Electrical faults are brought about by different kinds of faults such as line to ground faults(LG), line to line faults(LL), double line to ground faults(LLG) and phase to-ground issues, single phasing, over and under voltage, voltage and current distortion, negative sequence operation and under recurrence, and so on. An Inductance machine undertakes a significant part in industry and there is significant interest and motive for their steady and safe operation. Issues of induction machines can prompt unreasonable down circumstances and produce substantial misfortunes regarding upkeep and lost incomes, and this shoots the examination of condition checking. On condition observing includes taking estimations on a machine while it is working to recognize flaws with the point of lessening both surprising faults and upkeep costs. The paper has attempted some decent, safe and economical ways to deal with single phasing, negative sequence prevention and temperature rise. Hence proper observation and protection can help in providing less call for back up support system and less costing for secondary and tertiary protection.

## II. OBJECTIVE

- 1) The first and foremost objective of this project is the protection of induction motor against single phasing and temperature rise.
- 2) If any of the phases, out of the 3 phases is left behind or missing and, also if the temperature of the motor in the span of operation exceeds the predefined limit, the supply to the induction motor is reduced off at once, to apprehend kind of faults that are probably encountered.
- 3) To enhance our level of discovery for different types of faults this can occur in the induction motor while its working on full loading operation and techniques to defy those problems.



III. PROBLEM IDENTIFICATION

The protection circuit has been assembled to guard an induction motor from single phasing and over temperature offering a safety device which may be very helpful in industries, the usage of lot of automobiles such that production isn't always hampered resulting from failure of any of the motors. The easy idea for the improvement of this protection scheme has been to provide safety to the commercial motor/ centrifugal and reciprocal pump/induction Motor and many others. If any of the phases, out of the three was missing or if the temperature of the motor inside the route of operation shoots the limit, motor stops immediately. The device uses a 3-phase supply in which three single phase transformers are used. When any one or two phases are not available the transformer corresponding to the following phase goes out and stops transforming energy from primary to secondary side hence stopping the circuit to operate immediately. This leads to one of the four relays getting switched OFF, the primary relay which had been powered from side to side, consisted of four relays getting disconnected due to one relay now not being powered. For this reason the number one relay that offered three divisions delivered to the motor gets disconnected. A thermistor is attached to the motor body to sense the overshoot in temperature. A fourth relay has been employed to the motor's body to sense the temperature. Similarly the project could be uplifted with the aid of using modern-day sensors for over load safety and phase failure detection sensor for protecting the motor.

IV.A) BLOCK DIAGRAM AND ACTUAL EXPERIMENTAL IMAGES

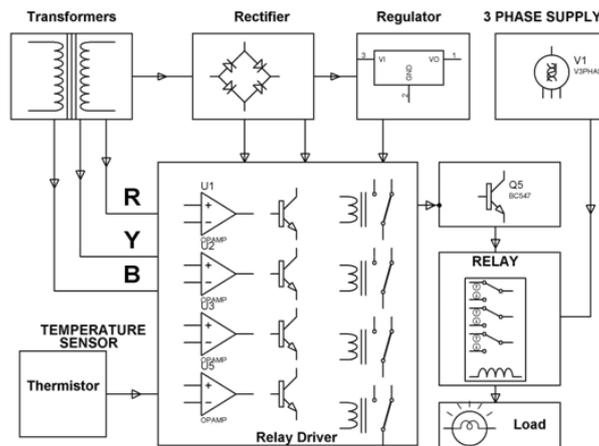
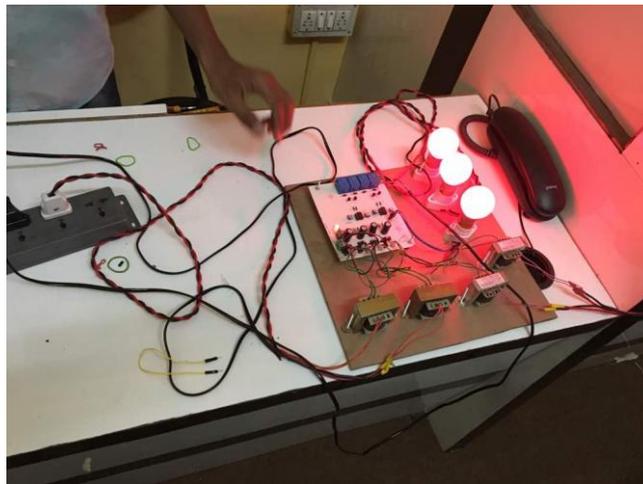


FIG.1.BLOCK DIAGRAM

IV.B) WORKING

The proposed protection scheme uses 3-phase power supply, where three single-phase transformers are connected to it. The project consists of an operational amplifier that is used as comparator for pertaining to input voltages. A thermistor was used to sense and measure the temperature rise of the induction motor by using connection with the frame of the



induction motor. This motor has functioned in a way of switching the main relay, which works by every other set of relays via detecting single phasing & over temperature situations.

A relay driver circuit is a circuit which can drive, or work, a transfer with the goal that it can work properly in a circuit. The determined relay can then work as a switch in the circuit which can open or close, as indicated by the requirements of the circuit and its operation. In this venture, we will assemble a transfer driver for AC transfers.

Since AC voltages work in an unexpected way, to assemble relay driver circuit for them requires marginally extraordinary setup. We will likewise go over a relay driver which can work from either AC or DC voltage and work both AC and DC transfers. The components used are:

#### A. 7805 Voltage Regulator:

In LM78XX, direction of motion of 3-terminal controllers is available with settled yield voltages of 5V, 8V, 12V, and 15V. This requires only a solitary outdoor fragment repayment capacitor at the yield. Those controllers use interior cutting-edge confining secure domain safety and heat shutdown for security against in every way that genuinely matters throughout-weight situations. Low ground stick contemporary of the LM78XX route of action offers yield voltage to be without difficulty helped over the present a motivating pressure with a resistor divider. The low quiet contemporary drain of those gadgets with a predefined maximum noteworthy change with line and load ensures great heading in the voltage upheld mode, for packages requiring one-of-a-kind voltages.

#### B. OPAMPS (LM324)

The LM324 series are low-cost, quad op-amps with real differential inputs. They've numerous awesome benefits over well-known operational amplifier sorts in single supply packages. The quad amplifier can function at deliver voltages as little as three zero V or as excessive. As 32 V with quiescent currents approximately one-fifth of those related to the MC1741 (on a per amplifier basis). LM324 is a 14pin integrated circuit which has a single package compensated with four unbiased operational amplifier. Op-amps are excessive digital gain voltage amplifier with differential entry and, commonly, a single-ended output. The output voltage is normally higher than the voltage distinction between entering terminals of an op-amp. These op-amps are operated through a lone electricity deliver LM324 and necessity for a dual deliver is eliminated. They may be used as oscillators, rectifiers, comparators, amplifier etc. The conventional op-amp programs can be greater effortlessly applied with LM324.

#### C. Relay

Due to inner configuration of SPDT (single pole double throw) it has been beneficial under many circumstances. It has one unusual terminal and a pair of contacts in two unique configurations: one can be generally closed and the other one is opened or it may be generally open and the other one closed. So SPDT is basically seen as a way of switching among 2 circuits: while there is no voltage carried out to the coil one circuit "gets" modern-day, the opposite one doesn't and whilst the coil gets energised the alternative is happening.

#### D. Generic Relay Driver Circuit

This is a transfer driver circuit which can be driven by either AC or DC input voltage. Furthermore, not at all like alternate circuits, a particular voltage, for example, the evaluated voltage values we used to drive the others, doesn't should be utilized. Since this circuit contains a transistor, a great deal less power needs to utilize on the info side to drive it.

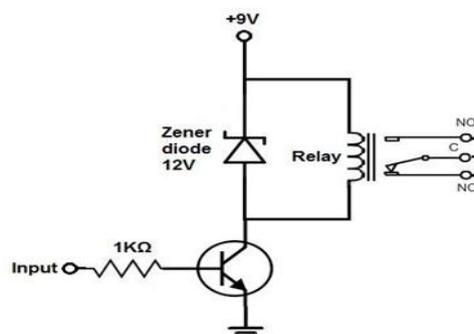


Fig.2 Relay Driver Circuit

Now that we have utilized a transistor to drive the hand-off, we can utilize extensively less energy to get the transfer driven. Since a transistor is an intensifier, we simply need to ensure that the base lead gets enough present to make a bigger current spill out of the producer of the transistor to the authority.



Once the base gets adequate power, the transistor will direct from producer to authority and power the relay. With no voltage or info current connected to the transistor's base lead, the transistor's producer to-gatherer channel is open, thus blocking current move through the hand-off's curl. Be that as it may, if adequate voltage and information current are connected to the base lead, the transistor's producer to-gatherer channel will close, permitting current to move through the transfer's coil. The advantage of this circuit is a littler and subjective (DC or AC) current can be utilized to control the circuit and the hand-off.

**ADVANTAGES:**

- Increased safety and reliability.
- Motor Protection
- Easy to use.

**APPLICATIONS:**

Three phase induction motors are generally used in :-

- Electrical traction system
- Centrifugal pumps
- Pulveriser
- Electrical Braking

**V. CONCLUSION**

The term single-phasing, means one of the stages is broken or isn't working. A solitary phasing condition subjects an electric motor to the most exceedingly terrible conceivable instance of voltage unbalance. In the event that a three-phase motor is running when the "single phase" condition happens, it will endeavour to convey its full strength... enough to drive the load. The motor will keep on trying to drive the load... until the motor wears out... or until the appropriately estimated over-burden components and additionally legitimately measured double component, time-defer wires take the motor off the line. For softly stacked three-stage motors, say 70% of typical full-stack amperes, the stage current will increment by the square foundation of three ( $\sqrt{3}$ ) under auxiliary single-stage conditions. This will bring about a present draw of around 20% more than the nameplate full load current .If the over-burdens are measured at 125% of the motor nameplate, coursing streams can even now harm the motor. That is the reason it is prescribed that motor over-burden protection be founded on the genuine running current of the motor under its given stacking, as opposed to the nameplate current rating.

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