Impact Factor (SJIF): 3.632

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

(Special Issue for ITECE 2016)

Advanced Single Phasing Preventer without Microcontroller

[1]Hardik Parmar, [2]Marmik Rachh, [3]Tarun Patel

[1]*Shri Labhubhai Trivedi Institute of Engineering and Technology, Rajkot.*
[2]*Shri Labhubhai Trivedi Institute of Engineering and Technology, Rajkot.*
[3]*Shri Labhubhai Trivedi Institute of Engineering and Technology, Rajkot.*
Electrical Engineering,

Abstract: ***For three phase induction motor, it is necessary that all the three phases of supply should present. While it is on load when any one of the fuse goes out, or missing, the motor will continue to run with two phases only, but it will start drawing huge current for the same load. This high current may run the motor unless switched of immediately. A single phasing preventer avoids such a mishap with this circuit; the motor will not run unless all the three phases are present. In this context we need to design a preventer which prevents these mishaps and protects the costly motor under such conditions. The single phase preventer designed by myself is very less expensive and protects reliably the motor which is very costly. In addition to this Single Phase Preventer we had added a Blown Fuse Indicator circuit. Generally, when equipment indicates no power, the cause may be just a blown fuse. Itis a circuit that shows the condition of fuse through LEDs. This circuit will give indicationwhen the fuse is blown due to over current. This compact circuit is very useful and reliable. Ituses very few components, which makes it inexpensive too.***

Keywords: Three Phase Supply, Single Phasing Preventer, Blown Fuse Indicator Circuit, Switches, Relays, Transformers, Bridge Rectifiers, Contactors, Pilot-Lamps.

I. INTRODUCTION

Before discussing OUR PROJECT, let’s take a look at our analysis for the ways that electric motors fail. Historically, the causes of motor failure can be attributed to:

- Overloads -30%
- Contaminants -19%
- Single-phasing -14%
- Bearing Failure -13%
- Old Age -10%
- Rotor Failure -5%
- Miscellaneous -9%

From the above data, it can be seen that **44%** of motor failure problems are related to HEAT.

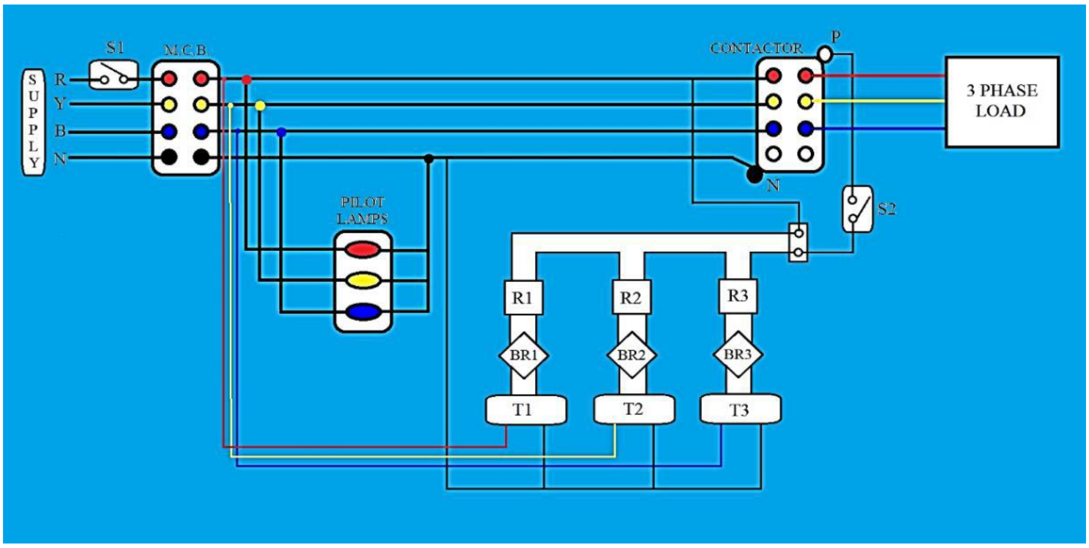
Single-Phasing:

- The term **single-phasing**, means one of the three phases is open circuited. If a three-phase motor is running when the “single phase” condition occurs, it will attempt to deliver its full horsepower enough to drive the load. The motor will continue to try to drive the load until the motor burns out.
- For proper working of any 3 phase I.M. it must be connected to a 3 phase A.C. power supply. Once these three phase motors are started they will continue to run even if one of the three phase supply lines gets disconnected. The loss of current through one of these phase supply is described as single phasing.
- Due to single phasing the current in the remaining two phase’s increases and it approximate 57% times the normal current value.
- Now in our project components we have used: M.C.B., Transformer, Diode for the bridge rectifier, Relay and contactor.
- No any kind of microcontroller is used.

II. COMPONENTS TO BE USEDLIST OF COMPONENT

1. M.C.B.
2. PILOT LAMP
3. PREVENTER CIRCUIT
   - TRANSFORMER
   - BRIDGE RECTIFIER
   - RELAY
4. CONTACTOR
5. SWITCHES
6. BLOWN FUSE INDICATOR CIRCUIT
   - FUSE
   - IC MCT2E
   - DIODES
   - LEDS
   - RESISTOR
   - PIEZO BUZZER

III. BLOCK DIAGRAM

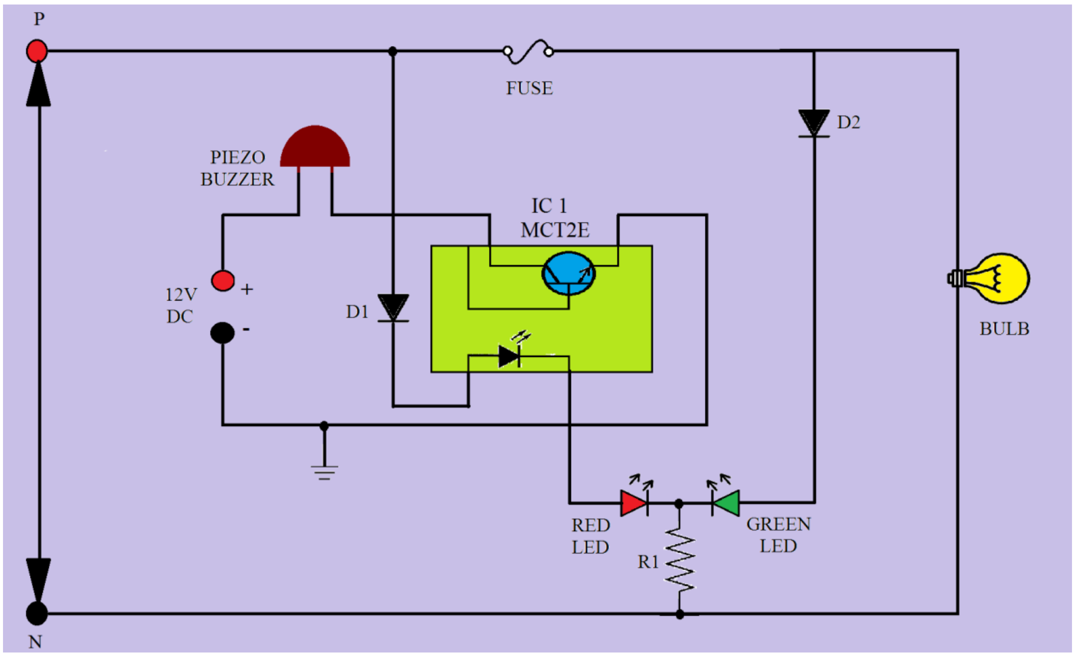


IV. WORKING

In our project the Single Phasing fault takes place by switching OFF the Toggle switch which is connected in series with R phase before the M.C.B. .We can turn the switch manually OFF, to form Single Phasing fault. As mentioned above we got three tapings from M.C.B. One taping is given to Pilot Lamps. Pilot Lamps are used for indication that the phase is live or not. If the phase is not live means if it is breakdown then the respective Pilot Lamp will not glow. The pilot lamps consists of LED. It requires single phase supply means one phase and one neutral. Second taping is given to Contactor. Contactor is placed between load and M.C.B. Contactor is used as Tripping Device in our project. Contactor also requires Single Phase Supply 230V. This supply is required by the contactor coil to form magnetic field. This field is required to pull the metallic plunger downside. Due to this contacts are connected of load and supply. When the Single Phase Supply is disconnected then the electromagnetic coil of contactor fails to generate the magnetic field. Due to this the spring which is connected to plunger to apply reverse force will increase and the plunger will move upward and the contacts will open so the load can't get the supply. The third and last but not least taping is given to preventer circuit. We have used three set of three components consisting Transformer, Bridge Rectifier and Relay.

The taping of each phase is directly connected to the respective phase transformer. All the three transformers are step down type with rating 230V to 12V. The output of transformer 12V AC is applied to the Bridge Rectifier. Bridge Rectifier is used to convert AC power into DC power. The output of transformer 12V AC is taken as input to Bridge Rectifier and it is converted to 12V DC. We used bridge rectifier because the relays we have used are operated on 12V DC. The three relays in our preventer circuit are connected in series with each other. The DC supply is applied to the relay coil. The coil forms magnetic field which holds the COM in direction of NO terminal. As the relays are connected in series so due to above action the next relay gets the supply. When the coil lost supply, the COM terminal moves to the NC terminal so the circuit is open circuited. Now when the single phasing fault takes place the faulty phase transformer lost the input. So the output of transformer is zero as there is no input due to respective phase breakdown. As the transformer output is zero so the rectifier input is zero. Due to above reason the output of rectifier is zero so the relay coil lost the supply an as discussed above the relay circuit will be opened. And the contactor coil lost supply as its supply is dependent on relay circuit. So the contactor coil stops to generate magnetic field and the plunger will move downside so the contacts of contactor will open and the load will be disconnected from the supply.

V. FUSE BLOWN INDICATION CIRCUIT



The circuit shown on figure is the circuit for blown fuse indicator with alarm circuit. It gives indication if the fuse is blown due to overheating or due to any reason.A buzzer, piezo buzzer is also there to give indication by ringing.So this circuit gives two types of indication, one is using LEDs & the second one isalarm indication using piezo buzzer.The circuit contains following components :

- 2 Diods
- 2 LEDs
- IC MCT2E
- Piezo Buzzer

Diodes used are 1N4007. The IC we have used is MCT2E. It is an Octocoupler. One LED is RED & other is GREEN. 230 V AC supply is given to terminal 'P' and 'N'. A bulb is used as a load. A 12v DC supply is given to the Piezoelectric Buzzer. This 12V DC supply is taken from the main Preventer Circuit.In Preventer Circuit we have used rectifiers to convert 230v AC into 12v DC for Relays. This 12v DC for buzzer is taken from there. The circuit works in two Modes.

- Fuse is in Healthy condition
- Fuse is Blown

4.1.1 MODE 1 (Healthy Condition):

The fuse is alright, working properly. The terminals 'P' and 'N' are given 230 V single phase supply. The fuse is in working condition so the load will receive the current from the supply. So the Lamp used as load in our circuit will glow. The diode D2 is in Forward Bias, that's why it will also conduct. And as shown in figure because of the conduction of diode D2 the Green LED will glow. At the same time the diode D1 is also in forward bias but it will not conduct. Because the resistance of the path of D1 is more than the path of diode D2.So very less current will flow through the diode D1.The current is so less that the IC MCT2E will not conduct. So due to this the RED LED will remain OFF, i.e. it will not glow. The IC MCT2E will not conduct due to less value of current, due to this the buzzer circuit will remain open, and i.e. buzzer will not rang during this mode. During this mode the Green LED remain ON continuously, and the RED LED will remain OFF during this Mode.

4.1.2 MODE 2 (Faulty Condition):

The fuse is blown. Now the path of current will change. As the fuse is blown the load circuit is opened, i.e. the load will not receive the current from the supply. The current will not flow through load because the fuse is blown so the current will flow through the diode D1.All the current will flow through D1, so the IC MCT2E will get sufficient current to conduct itself. So now the IC MCT2E will conduct. The conduction of IC is made by using conduction of a photo transistor. The photo transistor will conduct by using a simple LED. Due to the current the LED in the IC MCT2E will glow. So the light of LED will be absorbed by the photo transistor and it will conduct. Due to the conduction of photo transistor of the IC MCT2E the buzzer circuit is completed. Due to this the buzzer will rang during this mode. So this is how during mode 2 i.e. faulty condition indication is given by the buzzer. The RED LED will give visual indication by glowing continuously during this mode and the buzzer will give the alarm indication when the fuse is blown.

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