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Three Phase Fault Analysis with Auto reset on Temporary Fault and Trip for Permanent Fault

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Abstract: This project to develop an automatic elegant mechanism for the three phase supply system. The project output rearranged automatically after a brief interruption in the event provisional fault while it remains in tripped condition in case of permanent fault. The main advantage of the project is, it is not only save the appliance but it will also show the category of fault that has been happened in the system so it will be easy for the operator to solve the problem effortlessly. It will also patterned whether the fault is permanent or provisional fault. If the fault is provisional fault then the supply will be returned after a premitive time of 15sec otherwise eternal trip signal is given to the relay.

INTRODUCTION

A fault in a power system is any failures which interface with the normal flow of current. The cause of electric power system faults is insulation breakdown. This collapse can be due to a variety of different factors such as

- Lightning stroke
- Spray on Insulators
- Trees coming in contact with wires
- Equipment Failure
- Human Errors

As from the studies 70% to 90% of faults are happened in overhead transmission line which are transient. There are several transient fault, such as damages of insulation, swinging wires and little time contact with other objects. These faults are resolved by operational the circuit breakers or can be resolved by de-energizing the line at short period for clearing the fault.

The other 30% to 10% faults are happened in overhead line which are permanent or long duration fault. Permanent or long duration fault happened by broken wire which results one phase to ground fault or joining the two phase together which is happened in overhead line as well as in the underground cable. These fault resolved by finding them in line and repair which results permanent trip of line.

Types of Faults:

The faults can be classified into:

- Symmetrical faults
- Unsymmetrical faults

The Shunt faults are categorized by rise in current and drop in voltage and frequency. The Shunt faults can be classified as:

- Single Line to Ground (LG) fault
- Line to Line (LL) fault
- Double line to ground (LLG) fault
- Three Phase fault

An unbalanced fault does not disturb each of the three phase similarly. Common type of unbalanced fault and there causes:

- Line-to-Line (LL) fault: A short circuit among lines, caused by ionization of air, or when lines come into physical contact, for example due to a broken insulator.
- Single line-to-ground (LG) fault: A short circuit between one line & ground, very often caused by physical contact, for example due to lightning or other indemnities.

Double line-to-line ground (LLG) fault: Two lines come into contact with the ground also commonly due to storm damage

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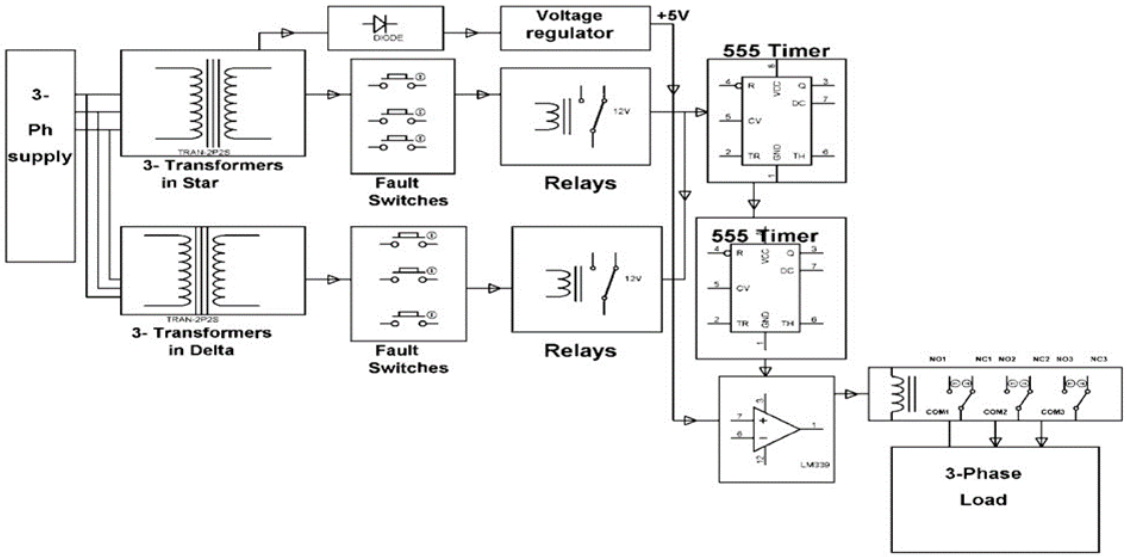
BLOCK DIAGRAM



COMPONENTS USED:

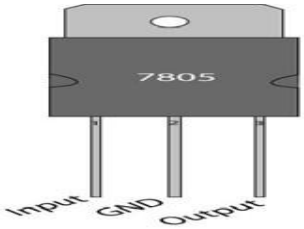
The component required to establish the project, Major of them are

- Power transformer
- Voltage regulator
- Relays and 555 timer
- LM 358

POWER TRANSFORMER:

This is a device which is used to concealed electricity from alternating current (AC) voltage to another alternating current (AC) voltage with a lesser amount of loss of power. Here stepdown transformers are used for step down the voltage at 12volt from 220volt AC The ratio of number of turns in the primary and secondary windings regulates that a transformer is step-up or step-down. In this project three single phase transformers which are wired in star input and star output and three transformers are linked in delta connection.

VOLTAGE REGULATOR:



The LM78XX/LM78XXA series of three terminal positive regulators are offered. Each type employs internal current restrictive, thermal shut down and safe operating area safety, making it essentially imperishable. If tolerable heat dropping is provided they can deliver over 1A output current. These devices can be used with external component to obtain adaptable voltage and current.

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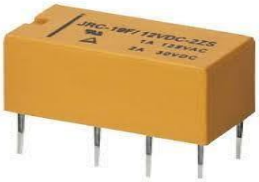
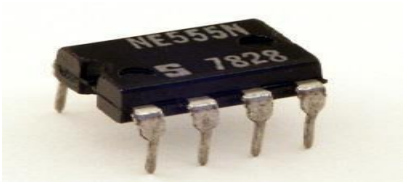
RELAY:



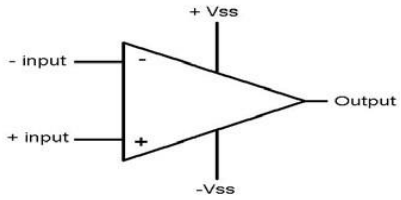
Relay is an electrically functioned switch which helps in protecting system from plain mutilation by detecting and isolating fault on transmission and distribution lines by opening and closing of circuit breaker.

555 TIMER:



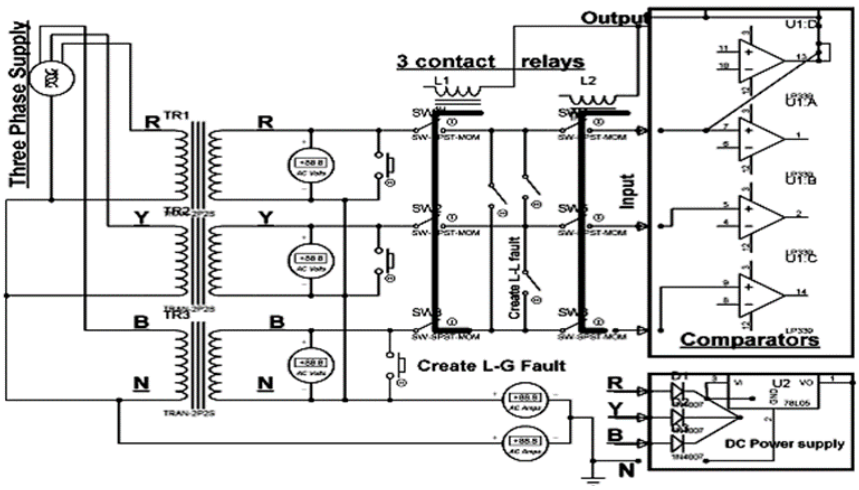
The 555 Timer is an integrated circuit instigating a variety of timer & multivibrator applications. Depending on the creator, the standards 555 package contains over 20 transistors, 2 diodes & 15 resistors on a silicon chip fixed in an 8-pin mini dual-in-line bundle.

LM358:



Op amp and comparator look very comparable but a comparator gives a logic output representing the comparative potentials on its two outputs. An op amp amplifies the discrepancy voltage between its two inputs and is planned always to be used in closed loop applications.

SCHEMATIC DIAGRAM



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WORKING PROCEDURE

There are six step down transformers which are allied to the board producing 12 volt to the circuit. These six transformers are separated into two groups, first one group is connected in star-star connection and later s connected in star- connection. The output of all the six transformers are remedied and filtered individually and are given to 6 relay coils. 6 push buttons one each connected across the relay coil is meant to form a fault condition.

The NC contacts of all the relay are made analogous while all the common points are grounded. The parallel connected point of NC is then connected to pin2 of 555 timer through a resistor R5 i.e. wired in monostable mode the output (pin3) of the equal timer is connected to reset (pin4) of the other 555 timer wired in astable mode. LED's are connected at their output to indicate their status.

The output (pin1) of 555 timer (U3) is given to op-amp LM358 through wire 11 and d12 (1N4007) to the non-reversing input (pin3) which acts as a comparator. It compares the value of pin 2 (inverting input) and pin 3 (non-inverting input) of LM358.

The voltage of pin 2 is kept at fixed voltage with the help of potential barrier. It is generally kept higher than the pin 3 of operative amplifier so that pin 1 i.e. output of LM358 matures low (zero logic) which fails to operate 3CO relay through the transistor Q, and the same is used for detaching the load used in fault condition.

OPERATIONAL PROCEDURE

Transformers and Lamp Bulbs are associated along with Three Phase Power Supply (230V). After the board is powered by 3 phase supply, all relay coils get DC voltage and due to this the common points Detaches from NC contacts and moves to the NO contacts. When push buttons are pressed, it removes the relay and due to this the common points moves to the NC position to provide a logic low at a trigger pin (Pin 2) and the output (Pin 3) which is linked to reset pin (Pin 4) changes high logic indicated by D11 flashing LED of 555 Timer (u3) which is in astable Mode.

-If fault is temporary

If any push button is released after a short time, 555 Timer (U1) in Monostable Mode disables U3 due to which the output of U3 goes to zero.

-If fault is permanent

If any push button is pressed for a longer Duration, then the output of 555 Timer (U3) present in Monostable Mode provides a longer duration of active situation for 555 Timer (U3), output of the same charges the capacitor C13 through R11. The output (Pin 1) of Operational Amplifier (LM 358), though acting like a comparator gets high which in turn drives the 3 CO relay through transistor Q1 to switch off 3 phase load.

APPLICATIONS

- Applied in transmission and distribution system.
- Used in substation.
- For clearing provisional fault in industries and commercial sectors.

CONCLUSION

Various faults have been created to change an automatic tripping mechanism for the three phase supply system while provisional and permanent fault occur. Here timer 555 has been used with relay for the fault analysis short duration fault returns the supply to the load closely called a provisional trip while long duration shall result in permanent trip as this project is advantageous compare to other protection system it can be used for protection of transmission line faults which happen in power system hencethis system is more reasonable, automatic and perils free compared to other type of protective system against three phase fault.

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