

# Three phase fault analysis with auto reset on temporary fault and permanent trip otherwise

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**Abstract--** This project to develop an automatic tripping mechanism for the three phase supply system. The project output reset automatically after a brief interruption in the event temporary fault while it remains in tripped condition in case of permanent fault. The major advantage of the project is, it is not only save the appliance but it will also show the type of fault that has been occurred in the system so it will be easy for the operator to solve the problem easily. It will also check whether the fault is permanent or temporary fault. If the fault is temporary fault then the supply will be restored after a predefined time of 15sec otherwise permanent trip signal is given to the relay.

## 1. 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 breakdown 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 occurred in overhead transmission line which are transient. There are many transient fault, such as damages of insulation, swinging wires and little time contact with other objects. These faults are cleared by operating the circuit breakers or can be cleared by de-energizing the line at short period for clearing the fault.

The other 30% to 10% faults are occurred in overhead line which are permanent or long duration fault. Permanent or long duration fault occurred by broken wire which results one phase to ground fault or joining the two phase together which is occurred in overhead line as well as in the underground cable. These fault cleared 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

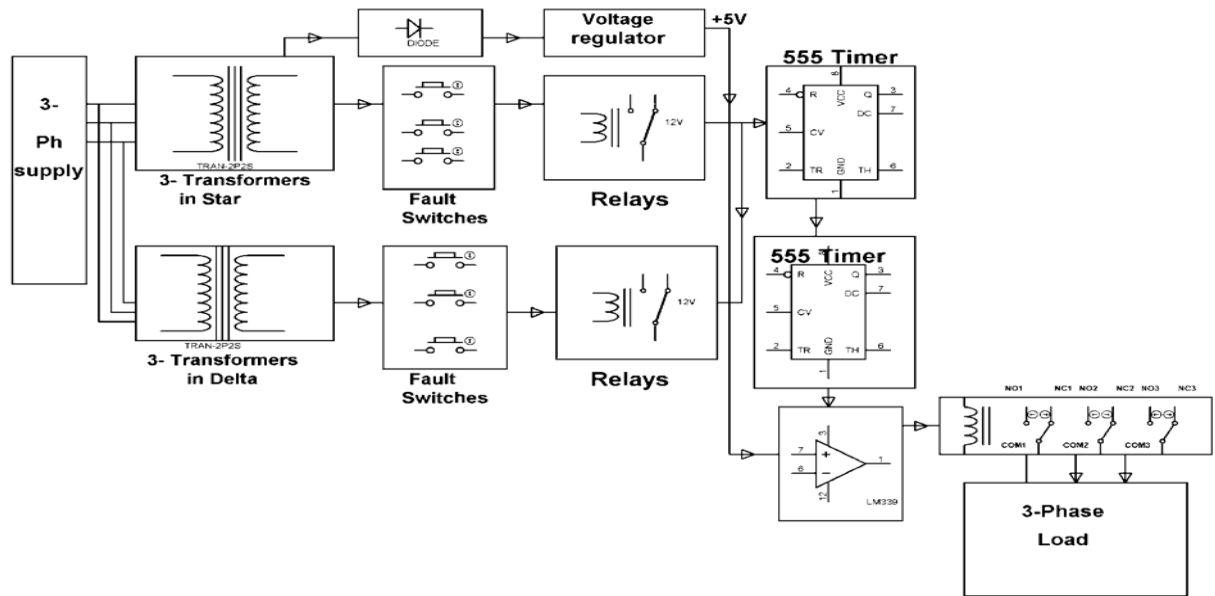
The Shunt faults are characterized by increase in current and fall in voltage and frequency. The Shunt faults can be classified as:

- 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 affect each of the three phase equally. Common type of unbalanced fault and there causes:

- Line-to-Line (LL) fault: A short circuit between 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 damages.
- Double line-to-line ground (LLG) fault: Two lines come into contact with the ground also commonly due to storm damage.

**Block Diagram**



**COMPONENTS USED:**

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

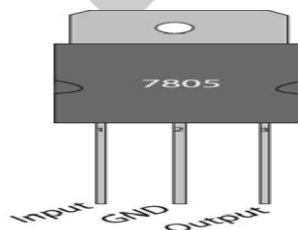
- Power transformer
- Voltage regulator
- Relays and 555 timer
- LM 358

**POWER TRANSFORMER:**



This is a device which is used to convert electricity from alternating current (AC) voltage to another alternating current (AC) voltage with less loss of power. Here step down 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 determines 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 connected in delta connection.

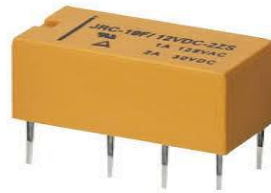
**VOLTAGE REGULATOR:**



The LM78XX/LM78XXA series of three terminal positive regulators are available. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible.

If adequate heat sinking is provided they can deliver over 1A output current. These devices can be used with external component to obtain adjustable voltage and current.

**RELAY:**



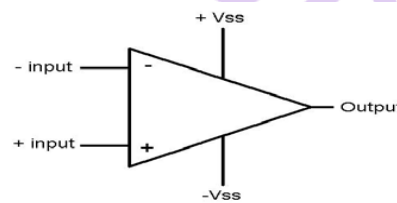
Relay is an electrically operated switch which helps in protecting system from severe damage by detecting and isolating fault on transmission and distribution lines by opening and closing of circuit breaker.

**555 TIMER:**



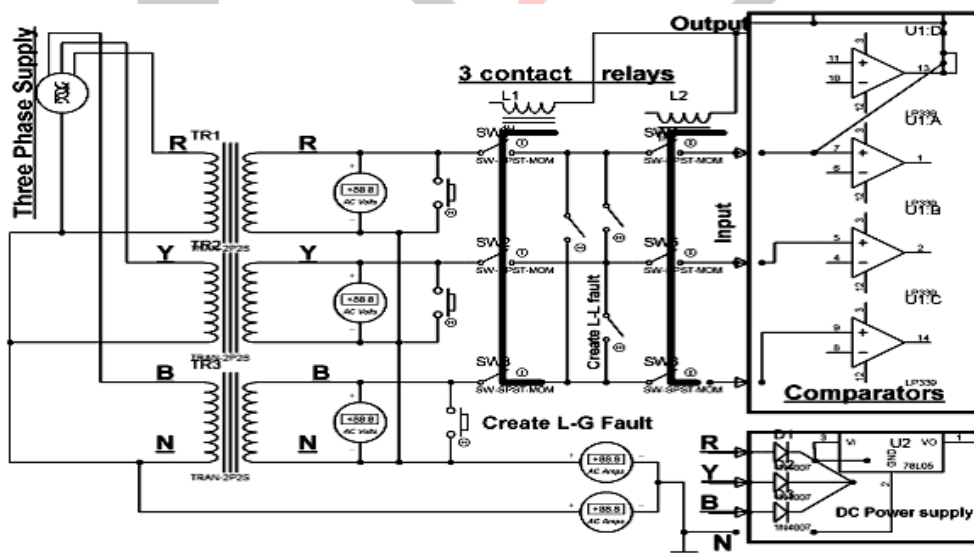
The 555 Timer is an integrated circuit implementing a variety of timer & multivibrator applications. Depending on the manufacturer, the standard 555 package includes over 20 transistors, 2 diodes & 15 resistors on a silicon chip installed in an 8-pin mini dual-in-line package.

**LM358:**



Op amp and comparator look very similar but a comparator gives a logic output indicating the relative potentials on its two outputs. An op amp amplifies the differential voltage between its two inputs and is designed always to be used in closed loop applications.

**SCHEMATIC DIAGRAM**



**Working Principle:**

There are six step down transformers which are connected to the board producing 12 volt to the circuit. These six transformers are divided into two groups, first one group is connected in star-star connection and later s connected in star-delta

connection. The output of all the six transformers are rectified and filtered individually and are given to 6 relay coils. 6 push buttons one each connected across the relay coil is meant to create a fault condition.

The NC contacts of all the relay are made parallel 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 same 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-inverting 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/constant voltage with the help of potential divider. It is generally kept higher than the pin 3 of operational amplifier so that pin 1 i.e. output of LM358 develops low (zero logic) which fails to operate 3CO relay through the transistor Q, and the same is used for disconnecting the load used in fault condition.

### OPERATIONAL PROCEDURE:

Transformers and Lamp Bulbs are connected 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 Disconnects from NC contacts and moves to the NO contacts. When push buttons are pressed, it disconnects 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) develops 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 temporary fault in industries and commercial sectors.
- Apartments.

### CONCLUSION

Various faults have been created to develop an automatic tripping mechanism for the three phase supply system while temporary 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 immediately called a temporary 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 occur in power system hence this system is more economical, automatic and hazards free compared to other type of protecting system against three phase fault.

### REFERENCES:

- [1].IEEE Power System Relaying Committee; Automatic Reclosing of Transmission Lines; IEEE Transactions, Vol. PAS-103, Feb1984, no. 2, pages 234-345.
- [2]. Protection Relay Application Guide; GEC Measurement, 1975
- [3]. Three Phase Auto Recloser Scheme; Nagar D Singh Bhalla D Paliwal D; IJSDR –International Journal for Scientific Research & Development; 2016 vol: 4 (01online) pp: 2321-613
- [4]. Three Phase Fault Analysis with Auto Reset for Temporary Fault and Trip for Permanent Fault; Bakanagari S Kumar A CheenyaM;Journal of Engineering Research and Applications.