# Three Phase Fault Analysis with Auto Reclosing Mechanism

Satish Parwate<sup>1</sup>, Karan Hajare<sup>2</sup>, Twinkle Harbade<sup>3</sup>, Prachi Chitriv<sup>4</sup>, Akanksha Satfale<sup>5</sup>, Diksha Waghmare<sup>6</sup>, Prof. Nandkishor Dhapodkar<sup>7</sup>

<sup>1</sup> Satish Parwate, Electrical Department, K.D.K. College of Engineering, Nagpur, Maharashtra, India
<sup>2</sup> karan Hajare, Electrical Department, K.D.K. College of Engineering, Nagpur, Maharashtra, India
<sup>3</sup> Twinkle Harbade, Electrical Department, K.D.K. College of Engineering, Nagpur, Maharashtra, India
<sup>4</sup> Prachi Chitriv, Electrical Department, K.D.K. College of Engineering, Nagpur, Maharashtra, India
<sup>5</sup> Akanksha Satfale, Electrical Department, K.D.K. College of Engineering, Nagpur, Maharashtra, India
<sup>6</sup> Diksha Waghmare, Electrical Department, K.D.K. College of Engineering, Nagpur, Maharashtra, India
<sup>7</sup> Prof. Nandkishor Dhapodkar, Electrical Department, K.D.K. College of Engineering, Nagpur, Maharashtra, India

## ABSTRACT

In supply system the faults are LL(Line-to-Line), LG(Line-to-Ground), LLG(Line-Line-Ground), etc. These faults in three phase supply system can affect the power system. To protect the system from the faults a system is designed which can sense the fault and automatically disconnects the supply to avoid large damage. This project is to develop an automatic tripping mechanism for three phase system. We are designing the system using rectifying network such that it will give the output voltage of 12 volt DC having input of 230 volt AC. The design is simple and compact and efficient as well as the cost of the design is also very low. The design is modified and thus cheap. The tripping mechanism is developed in three phase supply system. The power returns to supply in short duration fault called as temporary trip while the permanent trip will happen during long duration fault.

Keyword: - Auto Reclosing, LM339, IC555, and Fault Analysis

# 1. INTRODUCTION

A fault or fault current is any abnormal electric current. In three phase, a fault may involve one or more phases and ground or may occur only between phases. The faults that occurred are LL(line-line), LG(line-ground), LLG(line-line-ground), LLL(Three phase fault), LLLG( Three phase to earth). These faults in three phase supply system can damage the power system. According to the studies the 70% to 90% faults that occurred in overhead transmission lines are transient. A transient fault is a fault that is no longer present if power is disconnected for a short time and then restored. The transients faults are as damages of insulation, swinging wires, short time contact with other objects, an insulator flashover. These faults are cleared by immediate tripping of one or more circuit breakers to isolate the fault, and it does not occur again when the line is connected or re-energized. The remaining 20% to 30% of faults are permanent in nature which cannot be cleared by tripping and reclosing. In this case, the auto- re closure scheme is blocked. These fault is cleared by finding them in line and repairing them with results in permanent trip of line. Permanent faults as name indicates are permanent fault, which damage the insulations permanently and the line is permanently de-energized and repaired. Auto reclosing success rates vary from one company to another, it is cleared that the majority of faults can be successfully cleared by the proper use of tripping and auto reclosing.

### 2. FAULT ANALYSIS

Faults are classified into two parts, Active and Passive Fault.

 Active Fault: When current passing from one phase to another phase or phase to ground is known as Active fault. This fault must be cleared as quickly as possible otherwise its damages to the conductor or line or the equipment.
Passive Fault: Passive faults are stressing the system beyond its design and long duration fault which ultimately results in active fault. Examples are:

Overloading – When load increased its results in voltage increased and insulation is overheating.

Overvoltage – Voltage is increased to its rated voltage and stressed to the insulation.

Under frequency – Frequency goes below to its rated frequency it results in plant to behave incorrectly. Power swings – generators outage and loss of synchronism.

Symmetrical Fault: In such types of faults all the phases are short-circuited to each other and often to earth. Such fault is balanced so that the systems remain symmetrical, or the lines are displaced by an equal angle i.e.120 in three phase line. It is most severe type of fault involving largest current, but it rarely occurs. Balanced short circuit calculations are performed to determine the large currents.



#### Fig -1 Symmetrical Fault

Asymmetrical Fault: Asymmetrical faults involve only one or two phases. In asymmetrical faults the three phase lines become unbalanced. Such types of faults occur between line to ground or between phase to ground, whereas asymmetrical shunt fault is an unbalanced in the line impedances. An asymmetrical fault has a dc offset, transient in nature and unbalanced fault.

### **3. BLOCK DIAGRAM**



Fig -2 Block Diagram

#### 4. WORKING OF BLOCK DIAGRAM

A 440 V, 3 supply given through MCB (Miniature Circuit Breaker) after that will converted into pulsating DC using rectifying circuit consists of capacitor, resistor and diode which will reduce the voltage according to input per phase voltage. When we generate fault on HV side there is change in per phase voltage value and that voltages will be compare in LM358 comparator. LM358 comparator consists of 4 amplifier, three amplifier compare the per phase value of voltage with reference voltage and output of these three amplifiers given to the fourth amplifier that will also compare the voltage with reference voltage with respect to input. The 555 timer IC is an integrated circuit(chip) used in a variety of timer, pulse generator and oscillation applications. The 555 can be used to provide time delays, as an oscillator and as a flip-flop element. Derivatives provide up to four timing circuits in one package. The IC 555 drives the SPDT relay and make the circuit closed due t which contactor auxiliary coil get energized and trip the contactor and disconnect lamp load. As fault switch OFF, there is no trigger for IC 555 but IC 555 circuit gives output for some time according to biasing component i.e. R and C this will allow to clear remaining fault. After some time contactor gets closed and lamp load is turned ON. This mechanism helps to make system stable and protect from damage.

## 5. COMPONENTS OF BLOCK DIAGRAM

#### 1.1 LM339(Voltage Comparator)



This device consists of two independent, high-gain frequency compensated operational amplifiers designed to operate from a single supply or split supply over a wide range of voltages.

FEATURES: Wide Supply Ranges: Single Supply: 3 V to 32 V (26V for LM 2904) Dual Supplies: +1.5 V to + 16 V Low Supply: Current Drain, independent of supply voltage 0.7 mA typical Wide Unity Gain Bandwidth: 0.7 MHz Common-Mode input voltage range includes ground, allowing direct sensing near ground Low input bias and offset parameters:-Input offset voltage: 3 mV typical A version: 2 mV typical Input offset current: 2 nA typical

Input bias current: 20 nA typical A versions: 15 nA typical

The LM358 is a low power dual operational amplifier integrated circuit originally introduced by National Semiconductor. It is used in detector circuits. The abbreviation LM358 indicates an 8-pin integrated circuit, comprising two operational amplifiers at low power. The LM358 is designed for general use as amplifiers, high-pass filters and low, band pass filters and analog adders.

#### 1.1 Relay



A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used such as solid state relays. In this project SPDT(Single Pole Double Throw) relay is used. Single pole double throw relay is quite useful in certain applications because of its internal configuration. It has one common terminal and two contacts in two different configurations: one can be Normally Closed and the other one is opened or it can be Normally Open and the other one closed. The diagram above left shows an SPDT relay at rest, with the coil not energized. The diagram above right shows the relay with the coil energized. As you can see, the coil is an electromagnet that causes the arm that is always connected to the common to pivot when energizing the coil of a relay, polarity of the coil does not matter unless there is a diode across the coil. If a diode is not present, you may attach positive voltage to either terminal of the coil and negative voltage to the other, otherwise you must connect positive to the side Of the coil that the cathode side of the diode is connected and negative to side of the coil that the anode side of the diode is connected.



Fig -5 Circuit Diagram

#### **6. REFERENCES**

[1]. Sathish Bakanagari, A. Mahesh Kumar, M. Cheenya, "Three Phase Fault Analysis with Auto Reset for Temporary Fault and Trip for Permanent Fault" IJRET ISSN : 2248-9622, Vol. 3, Issue 6, Nov-Dec 2013, pp.1082-1086)

[2]. Vinesh Gamit, Vivek Karode, Karan Mistry, Pankaj Parmar, Ashish Chaudhari, "Fault Analysis on Three Phase System by Auto Reclosing Mechanism" IJRET Volume: 04 Issue: 05 | May-2015

[3]. Ge Yaozhong, Sui Fonghai, Xiao Yuan, "Prediction Methods for Preventing Single-Phase Reclosing on Permanent fault." IEEE No. 1, January 1989

[4]. N. G. Chothani, B. R. Bhalja , "A New Algorithm for Coordination of Relay and Auto-Reclosure in 220 kV Transmission System." IEEE 2013

