DESIGN AND IMPLEMENTATION OF OVER VOLTAGE AND UNDER VOLTAGE AN PROTECTION CIRCUIT ON GRID

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Abstract

The purpose of this project is trip the relay according to the variations in supply voltage for protecting electrical household as well as industrial equipment in case of overvoltage and under voltage. The electronic devices are very sensitive towards voltage variation, as voltage variation comes in supply the electronic equipment get easily damaged. In that condition it requires an additional protecting mechanism to protect the equipment as a load. According voltage comparator integrated circuits the decision of tripping of relay.

Key Words :-*Op amp comparator IC, relay , LED, potentio meter , voltage regulator.*

Introduction

Protection against sudden overvoltage in substations is a vital part of the overall reliability of power systems. The degree of surge protection afforded to a station is governed by the reliability required and the economics to obtain such reliability. Since major stations generally include strategic and highly valuable power equipment, surge protection is essential to avoid or minimize major system disturbances as well as major equipment failures. Transient overvoltage occurring in our power system can cause operational breakdown and also cause failure in industrial and household equipment as well.

Transient overvoltage in power systems may be caused due to several reasons of which those occurring due to lightning strikes or switching operations of inductive or capacitive loads. The substations are protected in such a way that lightning never falls directly 2 over it, rather the travelling waves arising due to lightning at a distant point far from the substation, travels into the substation through the towers and incoming transmission lines.

Given the course of the thesis, a study of the transient overvoltage and under voltage and its corresponding effects on the substation and household equipment is carried out and model in hardware, including the protection of the device

Overvoltage are less common than under voltage but they also arise due to system faults. Overvoltage can occur due to single line to ground fault, which in turn will raise the voltage of the other phases. It can also cause due to disconnection of heavy industrial loads or switching on the capacitor banks. This is generally due to ungrounded or floating ground delta systems, where a change in ground reference would give voltage

Power quality issues: Overvoltage:

An overvoltage is an increase in the RMS value of ac voltage greater than 110 percent or 0.11pu at the power frequency for a duration longer than 1 min. over voltages are usually the result of load switching (e.g., switching off a large load or energizing a capacitor bank). The over voltages result because either the system is too weak for the desired voltage regulation or voltage controls are inadequate. Incorrect tap settings on transformers can also result in system over voltages.

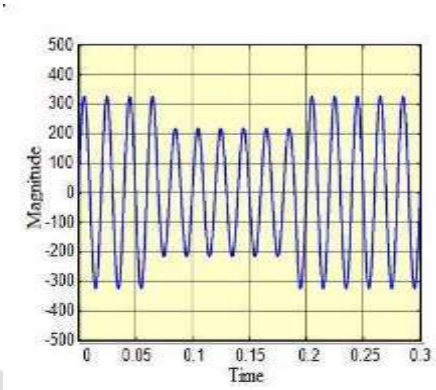

Fig-1: waveform for overvoltage 2.1.1 Causes of over voltages:

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Some more causes of Overvoltage are given below

- Loss of a Secondary Neutral (When the neutral wire is broken by falling branches).
- Ferro resonance (is a special form of series resonance between the magnetizing reactance of a transformer and the system capacitance (charging capacitors).

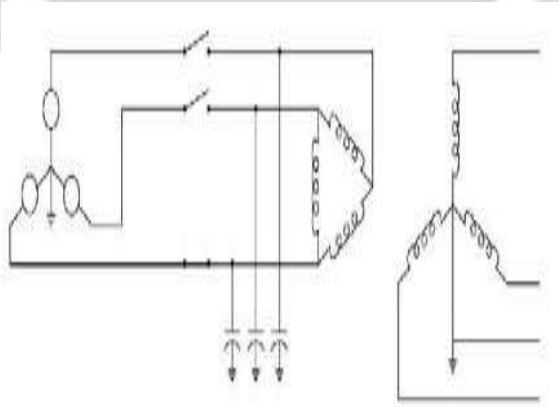


Fig-2: Cause of overvoltage

- Accidental Contact to High-Voltage Circuits
- Over voltages Due to Poor Voltage Regulation

UNDER VOLTAGE

An under voltage is a decrease in the RMS value ac voltage to less than 90 percent or 0.90pu at the power frequency for a time period longer than 1 min. Under voltages are the result of switching events that are the opposite of the events that cause over voltage

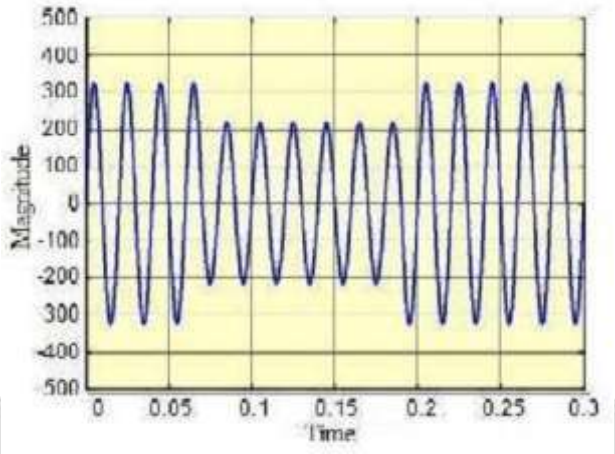


Fig-3 : Waveform for under voltage

Under voltages are the most common power disturbance whose effect is quite severe especially in industrial and large commercial customers such as the damage of the sensitivity equipment's and loss of daily productions and finances. The examples of the sensitive equipment's are Programmable Logic Controller (PLC), Adjustable Speed Drive (ASD) and Chiller control. Under voltage at the equipment terminal can be due to a short circuit fault hundreds of kilometres away in the transmission system

Causes of under voltages:

- Closing and Opening of Circuit Breakers
- Due to Fault
- Due to Motor Starting
- Due to Transformer Energizing
- Equipment Failure
- Bad Weather and Pollution (Lightning strikes, Flash over, etc.)
- Construction Activity

Hardware Components

- Voltage Regulator
- OP-AMP Comparator IC LM358
- Resistors
- Potentiometer
- Capacitors
- Transformer
- Relay
- LED
- Diode

OP-AMP Comparator IC LM358

- The comparator is an electronic decision making circuit.
- It is use as an operational amplifiers at very high gain in its open-loop state.
- There is no feedback resistor.

Voltage Regulator

- A voltage regulator is automatically maintain a constant voltage level.
- A voltage regulator may use as negative feedback.
- It may use an electromechanical mechanism.
- It used to regulate one or more AC or DC voltages.

Resistors

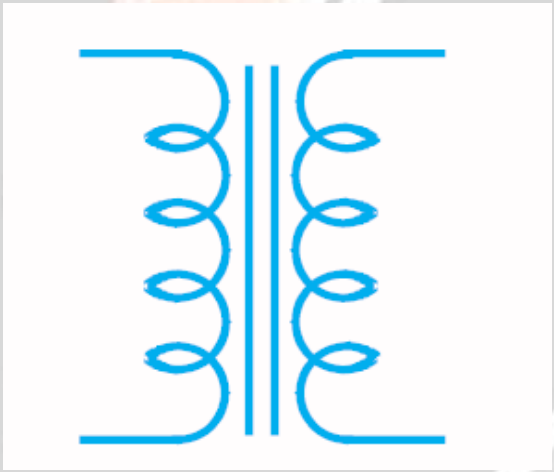
- A resistor is a passive two-terminal electrical component.
- Resistors are used to reduce current flow, adjust signal levels and terminate transmission lines.

Potentiometer

- A potentiometer is a three-terminal resistor with a sliding or rotating contact.
- It forms an adjustable voltage divider.
- If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

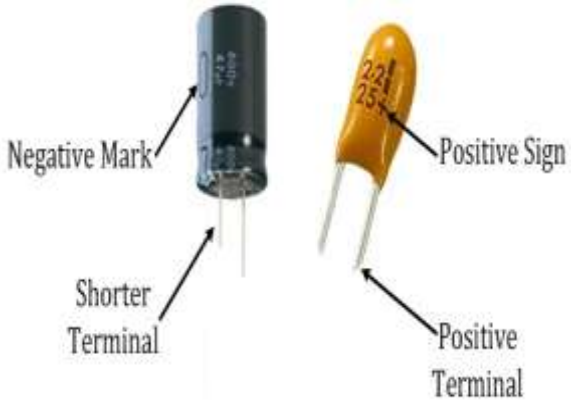
Transformer

- A varying current in one coil of the transformer produces a varying magnetic field, which in turn induces a voltage in a second coil.



Capacitor

- Capacitors store and release electrical charge.
- They are used for filtering power supply lines, tuning resonant circuits



Relay

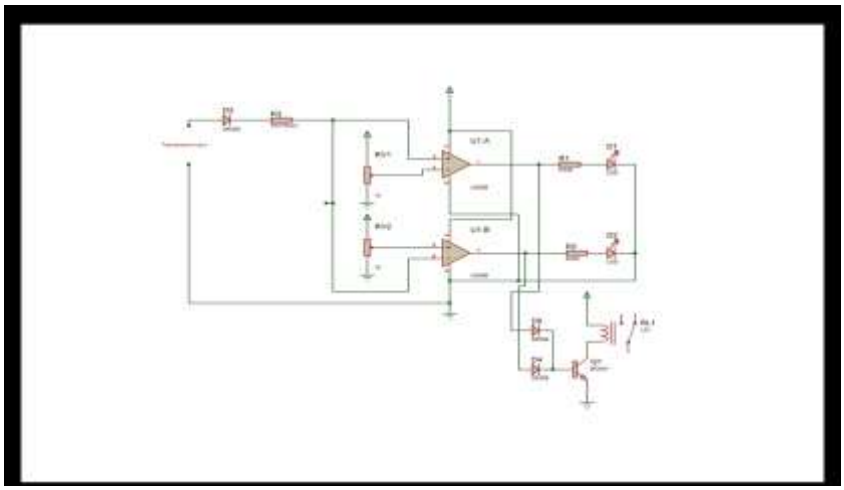
- These have two terminals which can be connected or disconnected.
- Including two for the coil, such a relay has four terminals in total.
- Whether the pole is normally open or normally closed

LED

- A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it.

Diode

- The most common function of a diode is to allow an electric current to pass in one direction, while blocking it in the opposite direction.



CIRCUIT DIAGRAM

Working

- A 230 volts ac is given as a input to the transformer.
- A step down transformer is used, as it serves to reduce the pressure remaining 12 volts, through a D3 connected to half wave rectifier circuit.
- This rectifier converts ac to dc but the obtained dc is not pure dc it is a pulsating dc, to obtain pure dc we are using regulator so that we can obtain pure dc.
- And the resistance are used for reducing the voltage.
- In the regulator the voltage across the pins will be the input and output.
- Here we are using another IC LM358 which has 8 pins.
- The 8th pin in this IC act as V cc and the 4th pin will be grounded.
- The 7.1 volts diode is connected to the 2nd pin of IC2/1 and 2.1 volts diode is connected to the 5th pin of IC2/2.
- The voltage coming from the diode D3 goes to 3rd pin of IC2/1 and 6th pin of IC2/2.
- Here IC2/1 act as high voltage detector and IC2/2 act as low voltage detectort
- When the voltage obtained across the 3rd pin is greater than the voltage at the 3rd pin then IC2/1(high voltage detector) will function and the switch will be closed and load will be and LED glow.

ADVANTAGE

- High reliability
- High performance

APPLICATION

- It is used in the home appliances, industries to control the voltage fluctuations
- Protection of sensitive electronic devices
- Agriculture motors
- Water pump

CONCLUTION

From above discussion it has cleared that of under voltage and overvoltage problem are very common and can create problem for consumer good and industrial application. So system should be protected by certain protection scheme. So here system model using comparator and relay to disconnect supply when any overvoltage and under voltage problem occurs

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