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RESEARCH PAPER ON UNDERVOLTAGE AND OVERVOLTAGE PROTECTION SYSTEM

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ABSTRACT

This paper identifies the development of an under voltage and over voltage protection in order to avoid damage in load side. Most of the industries and as well as home appliances are very expensive also more sensitive. This may get damaged due to the instabilities in ac mains supply. It can also lead to losses in the electrical circuit. These losses lead to low power factors and wastage of so much power. The fluctuations can cause great impact to the power quality and many precious and expensive equipment may be damaged. It is therefore advisable to have a tripping mechanism to protect the load.

The voltage below the rated value are usually caused under unexpected raise in load due to faults in the system, during short circuit conditions and also rapid increase in source impedance due to lose connection in the circuit.

The voltage above the rated values are caused by a sudden decrease in load in a circuit having a poor or damaged voltage regulator. The over voltage may also be caused by a damage in the circuit or loose connections in neutral wire.

Anything below that will be considered as under voltage and anything above that will be considered as over voltage. Thus, we can protect the equipment from damage. By doing this, the proposed circuit is able to protect the electrical appliance.

1. INTRODUCTION

When RMS voltage or current drops between 0.1 and 0.9 pu at the power frequency for durations of 0.5 cycles to 1 minute then it is said to be sag condition. The swell condition will occur when RMS voltage or current rise between 1.1 and 1.8 pu at the power frequency for durations of 0.5 to 1 minute. And above the 1.8pu and below 0.9pu is called over voltage and under voltage respectively. Voltage sags and under voltage conditions are caused by abrupt increases in loads such as short circuits and faults or it is caused by abrupt increase in source impendence, Actually sudden fluctuation in voltage is very big and serious problem in industries and home appliances and it causes losses in electrical circuits. These losses causes low power factor in the supply and by much amount of power is going to be wasted. These fluctuations may significantly impact the power quality as well as the reliability of other voltage controlling devices. Therefore due to this fluctuation various costly and precious equipments may get damaged, abruptly caused by loose connection. Voltage swells and over voltage conditions are almost always caused by an abrupt decrease in load on a circuit with a poor or damaged voltage regulator, although they can also be caused by a damaged or loose neutral connection.

2. METHODOLOGY

We have thoroughly research about various kinds of device or protection system which can trip the circuit whether there is over voltage or under voltage but none of them are work like stabilizer, so in this project we try to implement the dynamic voltage restorer (DVR) which is complicated static device which work by adding the missing voltage during a voltage sag. Basically this means that the device injects voltage into the system in order to bring the voltage backup to the level required by the load. Also this system is later improved byintegrating it with GSM modem that alerts user by sending an SMS about the tripping occurred, that facility is currently not available.

Our main motivation is our subject "Power Quality and Facts" in which we learn about voltage sag, voltage swell, over voltage, under voltage, power quality and many more terms. Hence we know about the why we required high power quality and how to minimize the wastage of power.

a. Areas Of Work

The proposed protecting system is to protect the load from over voltage and under voltage consists of various electrical and electronic components and device such as step down transformer, rectifier, filter, voltage regulator, resistor, capacitor, led, diodes, etc. Though we have created a protection circuit for only single phase motor, 3 phases motor protection circuit could also be created. In that circuit some scheme should also be considered i.e. single phasing. We could use a micro-controller like PIC16F877A in conjunction with a liquid crystal display

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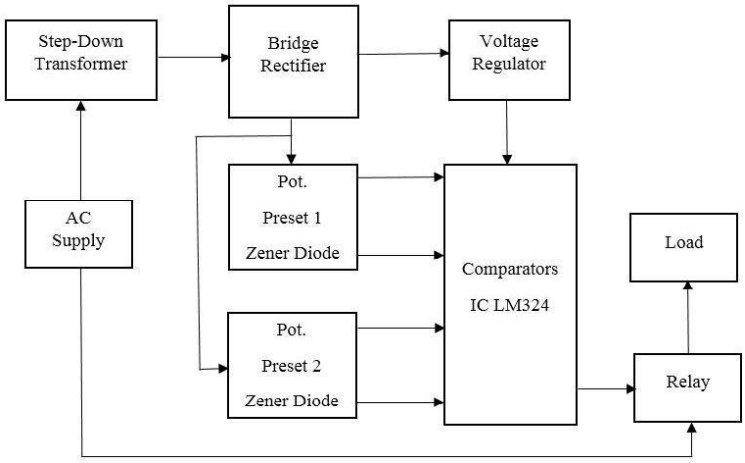
which can control the circuit tripping more accurately and also can give out information about it. Moreover, it would increase the overall sophistication of the protecting circuit.

3. WORKING

AC supply is stepped down to 12 V by using a step down transformer.The AC supply is converted to DC supply through bridge rectifier. The supply is then filtered by capacitors connected across rectifier to reduce harmonics. Then the unregulated supply is then fed to voltage regulator whose output is given to the comparators IC LM324 and relay as supply. The unregulated supply from bridge rectifier is fed to preset 1 and preset 2 as input. The preset 1 and preset 2 are potentiometer ckt.1 and potentiometer ckt.2 respectively connected to comparators IC LM324 as command or input. The Preset conditions can be adjusted.

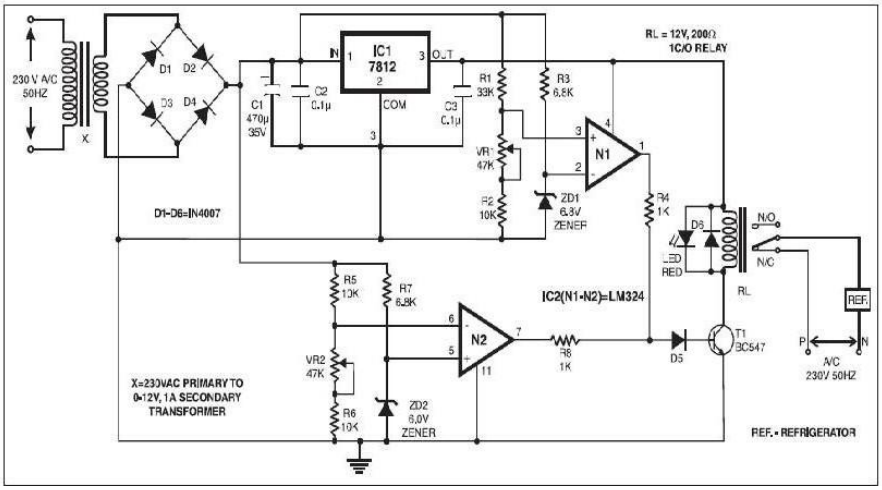
Further, the comparators are connected to the relay and load is connected to relay. Whenever there is overvoltage or under voltage the comparators analyze the preset conditions and gives the signal to the relay and relay trips and the load get switched off.



The aim of our circuit is to protect the load during under-voltage and over current conditions by controlling the relay tripping coil using a LM324 comparator. The comparator will compare the supply voltage with desired preset voltage and will trip the relay coil if the voltage drops below the desired preset value. The relay coil will also trip if the. The under voltage and over current protecting device is shown in the block diagram below

If 220VAC input is applied circuit step-down transformer will reduce voltage to 12volt.Using Bridge rectifier IC 12volt DC output is obtained.

Using IC LM7812 we get regulator DC supply Regulator Input at pin 1 and 2 and from pin 3 and 4 output is taken. IC LM324 serve as heart of protection circuit. It has 4 comparator in it.4th pin is connected to Vcc and 11th pin is grounded. Two zener diode of 6volt and 6.8volt are used.6.8 volt zener diode is connected to 2nd pin of ICLM324 (comparator no.1).6 volt zener diode is connected to 5th pin of ICLM324.



IC2/1 of comparator IC used for overvoltage Protection.IC2/2 of comparator IC used for under voltage protection. When supply voltage raise beyond or fall rated voltage Proportional DC voltage will change and relay driver IC will command to relay driver to relay and relay will get tripped.

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4. RESULTS AND DISCUSSION

Normal voltage supply

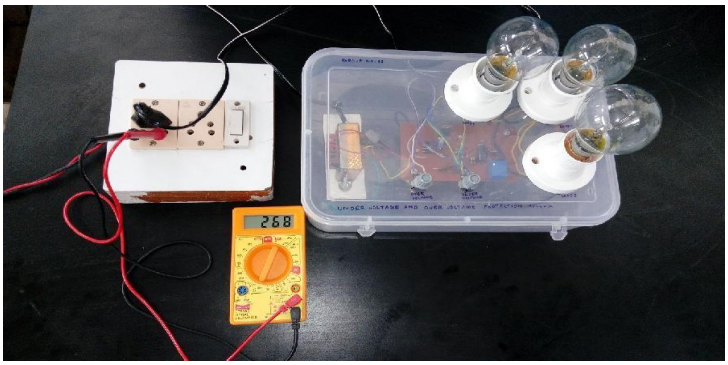
By using two potentiometer normal supply range is selected between 180 V to 250V. The supply voltage as shown by multimeter in above picture is 229 Volt, hence the protectioncircuit is closed at that time and the load is switched ON.Here protection circuit closed means the normally open contact of relay get closed when normal supply is sensed by the protection circuit. The three lamps connected as load are of different watt that is 40 watt, 60 watt and 100 watt.So for any prescribed range of voltage selected by two potentiometer, the protectioncircuit remain closed and load is ON. Normally all household appliances have 230 V voltage rating.

Under voltage supply

When the supply voltage is below 180 V, the comparator IC LM324 checks the voltage at the inverting terminal (pin 6) of operational amplifier N2 is less than the voltage at non-inverting terminal (6V). Thus the output of operational amplifier goes high and it energizes the relay.When relay is get energized the protection circuit act as open circuit and it disconnect the AC supply and load get off. The Above picture depicts the working of protection circuit in under voltage supply and under voltage reading recorded by multimeter is 176 V.Thus, when there is under voltage, the protection circuit automatically switched off the load and protects the load.

Overvoltage supply

The over voltage limit is selected by the variable resistor 2 i.e. potentiometer 2. So, the beyond 250 voltage level the protection circuit will remain open and load is off.When the line voltage increases above 250 V, the comparator IC check the voltage at the non-inverting terminal (pin 3) of operational amplifier increases and the voltage at inverting terminal remain same 6.8V due to zener diode. Thus output of operational amplifier goes high and relay get energized through transistor. As the relay get energized the AC supplyget disconnected and load is turned off. Thus, load is protected from over voltage and reading recorded by multimeter is 268 V.



5. CONCLUSION

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 modeled using comparator and relay to disconnect supply when any overvoltage and under voltage problem occurs.

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