

Under Voltage and Over Voltage Protection of Electrical Appliances

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Abstract - Sudden fluctuation in supply is a very big problem in industries and domestic applications. It causes a major loss for industries, offices and homes. This project gives a low cost and powerful solution for this problem. This Circuit protects refrigerators ACs, Microwave ovens as well as other appliances from over and under voltage fluctuations. Operational amplifier IC LM324 is used here as a comparator. IC LM324 consists of four operational amplifiers, of which only two operational amplifiers are used in the circuit. The unregulated power supply is connected to the series combination of resistors and preset. The same supply is also connected to 6.8v zener diode through a resistor. The preset is adjusted such that for the normal supply of 180V to 240V, the voltage at non-inverting terminal of op-amp is less than 6.8V. The same unregulated supply is given to the second comparator through a 5.6V zener.

Keywords - IC LM324, zener diode, resistor, Protection, over voltage, under voltage.

I. INTRODUCTION

12V SPDT relay is used to control the Load. An NPN transistor is used to drive the relay. An LED is connected across the relay for visual indication of relay position. This project uses regulated 12V, 500mA power supply. 7812 three terminal voltage regulator is used for supply voltages and reference voltages for LM324 comparator circuit. Bridge type full wave rectifier is used to rectify the ac out put of secondary of 230/12V step down transformer For the satisfactory working of all electrical and electronic devices, it is recommended to allow voltage at prescribed limits. Voltage fluctuations in electric power supply certainly have adverse effects on connected loads. These fluctuations can be of over voltage and under voltages which are caused by several reasons like voltage surges, lightning, overload, etc. Over voltages are the voltages that exceed the normal or rated values which cause insulation damage to electrical appliances leading to short circuits. Similarly, under-voltage causes overloading of the equipment leading to lamp flickers and inefficient performance of the equipment. Thus, this article is intended to give under and overvoltage protection circuit schemes with different control structures between one phase conductor and earth or between phase conductors having a peak value exceeding the corresponding peak of the highest voltage for any voltage equipment. Alternatively known as under volting, under voltage is a reduction of power to one or more devices in a computer to help conserve power and reduce heat. For example, a laptop user could under volt their computer processor and notice a reduction of heat and an increase of battery life.

II. BLOCK DIAGRAM

Over voltages are the voltages that exceed the normal or rated values which cause insulation damage to electrical appliances leading to short circuits. Similarly, under-voltage causes overloading of the equipment leading to lamp flickers and inefficient performance of the equipment. Thus, this article is intended to give under and overvoltage protection circuit schemes with different control structures between one phase conductor and earth or between phase conductors having a peak value exceeding the corresponding peak of the highest voltage for any voltage equipment. Alternatively known as under volting, under voltage is a reduction of power to one or more devices in a computer to help conserve power and reduce heat. For example, a laptop user could under volt their computer processor and notice a reduction of heat.

III. WORKING

This circuit when the voltage is 220 volts AC through a transformer T1. It serves to reduce the pressure remaining 12 volts, through a D1-D4 connected to Direct rectifier bridge circuit. To convert the voltage, alternating current to direct current. Then, through the C1 and C2 to the power filter smoothing. And entering a pin. Or input pin of IC1, a loan IC Rex bit computing to 12-volt power supply is fixed to the IC2. That it is IC Op Amp. Pressure acts edge IC2/1 High Voltage Detector, High Voltage ICs, if this current work to the Q1 and relay function, it works with, thus cutting off power from the load instantly. The IC2/2 serves to detect the lower voltage. The two components can be specified by VR1, VR2. LED1 display when power or low power over a specified.

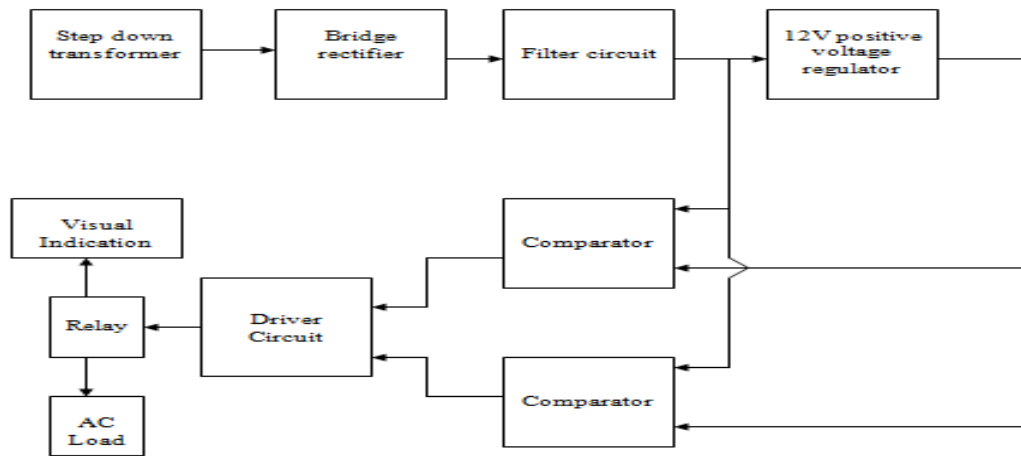


Fig. 1. Block Diagram

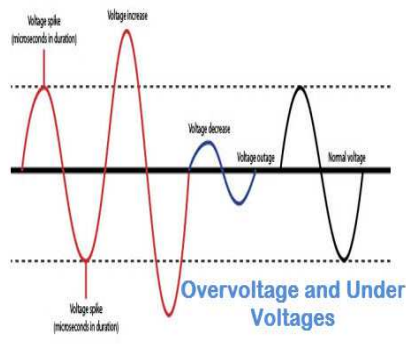


Fig. 2. Waveforms under and over voltage conditions

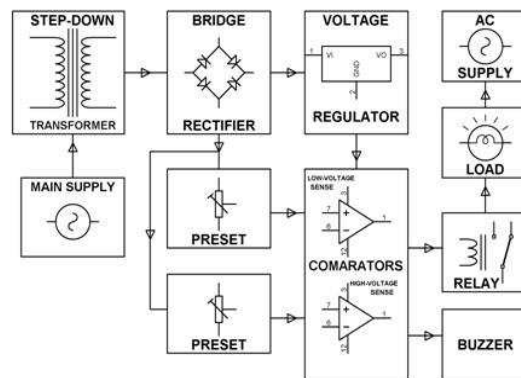


Fig. 3. Overvoltage and Under Voltage Protection Block Diagram

The voltage input is entered to transformer that designed with primary of 230 volts and secondary of 12 volts. From transformer feature as above will cause can get voltage at secondary of 12 volts. When input voltage is 220 volts as normally. As shown in the above block diagram, the mains AC power supplies the power to the whole circuit and for operating loads by using relays, and also for tripping the load (lamps) in the presence of the input voltage which falls above or below a set value. Two comparators used as a window comparator formed out of one quad comparator IC. This operation delivers an error in the output if the input voltage to the comparator crosses the limit beyond the voltage window. In this circuit, an unregulated power supply is connected to both op-amps terminals, wherein each non-inverting terminal is connected through the two series resistors and a potentiometer arrangement. Similarly, the inverting terminal is also powered through Zener diode and resistance arrangements, as shown in the given under or overvoltage protection circuit. The Potentiometer's preset VR1 is adjusted such that the voltage at non-inverting is less than 6.8V for stable maintenance of load for the normal supply range of 180V-240V and the voltage of inverting terminal is 6.8V constant due to Zener diode. Hence the op-amp output is zero under this range and thus the relay coil is de-energized and the load is not interrupted during this stable operation. When the voltage is beyond the 240 V the voltage at the non-inverting terminal is more than 6.8, so the operational amplifier output goes high. This output drives the transistor and thus the relay coil gets energized and finally loads are turned off due to overvoltage. Similarly, for under voltage protection, lower comparator energizes the relay when the supply voltage falls below 180 V by maintaining 6V at the inverting terminal. These under and overvoltage settings can be changed by varying the respective potentiometers

A. Advantages

- Highly sensitive
- Fit and Forget system
- Low cost and reliable circuit
- Complete elimination of manpower
- Can handle heavy loads up to 7A
- Auto switch OFF in abnormal conditions

B. Applications

- Industrial machinery
- House hold items like TV, refrigerator, AC
- Agriculture Motors
- Water pumps

IV. CONCLUSION

This project indicates high voltage and low voltage. Due to this we can safe guard our home appliance without any damaging the equipments. It has been discussed that under voltage and overvoltage problem are very common and can create problem for consumer good and industrial application. So a system has been modeled using relay and comparator and it is found to be good in disconnecting the supply when it sees any of the above problems.

V. FUTURE SCOPE

Apart from the simulation of the software of this project in PSIM we can further extend or upgrade the operation of this protection device in the following ways: Although we are applying 1 phase power supply in the Prepared hardware, the implementation of the hardware can also be done applying 3 phase power supply. The concept in future can be extended by integrating an alarm which sounds when voltage fluctuations occur. It can also be interfaced with a GSM modem to convey alert message to the user via sms to take appropriate actions.

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