International Journal of Electrical and Electronics Engineers
Vol. No. 9, Issue No. 01, January-June 2017
ISSN (O) 2321-2055
ISSN (P) 2321-2045

DEVELOPMENT OF PAPF MODULE

Shweta Khandeparkar, Dr. (Mrs.) Ameeta G. Sinai Amonkar,

Mr. Nitant Kholkar

Department of Electronics and Telecommunication, Goa College of Engineering

Components in elevator system are susceptible to abnormal input voltage scenarios like over voltage, surges in the input supply and the difference between power earth and neutral. Hence, to protect the elevator components from these scenarios, a protection module called as PAPF (Protection Against Power Fluctuations) module is introduced. The module has an over-voltage relay, a ground lift preventer and surge protection device properties. This research aims at developing the PAPF Module. An Arduino based PCB is designed which will monitor power fluctuations and give protection against over-voltage, under-voltage, ground lift, surges and phase losses. A contactor coil will be controlled by this microcontroller depending on the input supply.

Keywords: Arduino Uno, Ground-lift prevention, Over-voltage, Surge, Varistor

I. INTRODUCTION

Components like Drives, SMPS and PCBA in elevator system are susceptible to abnormal input voltage scenarios like over voltage, under voltage, surges in the input supply and the difference between power earth and neutral. Hence, to protect the elevator components from these scenarios, a protection module called as PAPF (protection against power fluctuations) module is introduced. An ATmega328 microcontroller based PCB is designed which will monitor the power fluctuations. A contactor coil is controlled by this microcontroller. The contacts will open when voltage is above 460V 3Phase or 265V any one phase.

II. OBJECTIVE

Aim of this paper is to shield valuable electrical devices from surges/spikes in electrical power. It protects system from getting damaged during neutral-earth lift scenario. Fig1 shows block diagram of PAPF Module. The module will protect electrical devices from voltage spikes by arresting excess voltage surge. It will also sense leakage between neutral and ground and amplify the error signal to provide a switching facility to prevent damages to valuable system. It will switch off once ground fault has been detected in the supply voltage.

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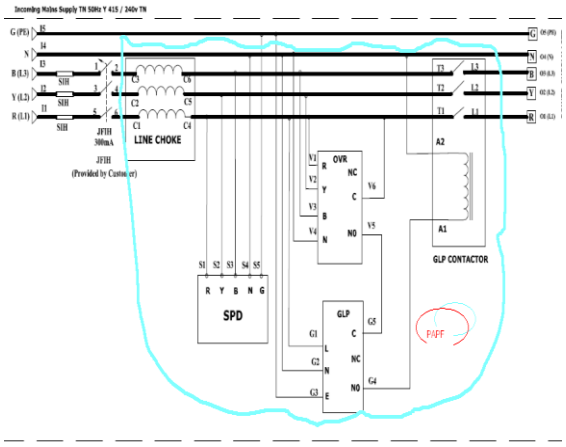

Figure 1: Block Diagram

III. BASIC THEORY

Based on literary studies that have been done, experiments are carried out using Atmega8 Microcontroller as processing circuit with input circuit (voltage sensor, current sensor) [1]. Input circuit consist of voltage sensor.

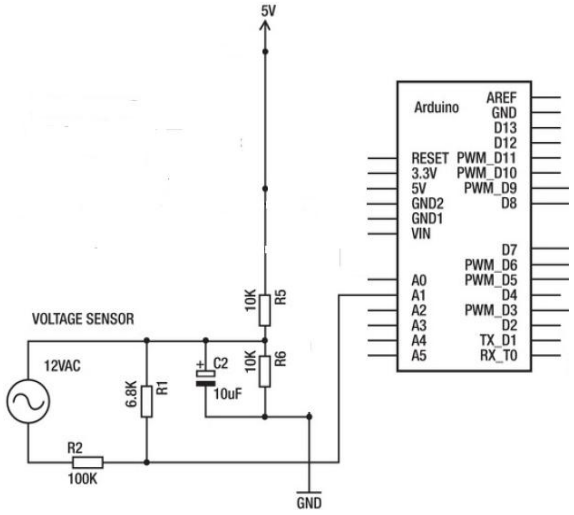

Figure 2: Voltage Sensor

Trying to sense 240 volts AC directly can be a little scary, so a transformer is used to step down the mains voltage to a safer level of 12V that we can work with. We will further reduce the incoming voltage to about 1V AC using an AC voltage divider discussed shortly in resistors R1 and R2. A second DC voltage divider in R5 and R6 is used to provide a DC bias, ensuring positive voltages that can be safely measured. Finally, we add the capacitor C2 also to soak up some of the stray noise introduced in our signals.

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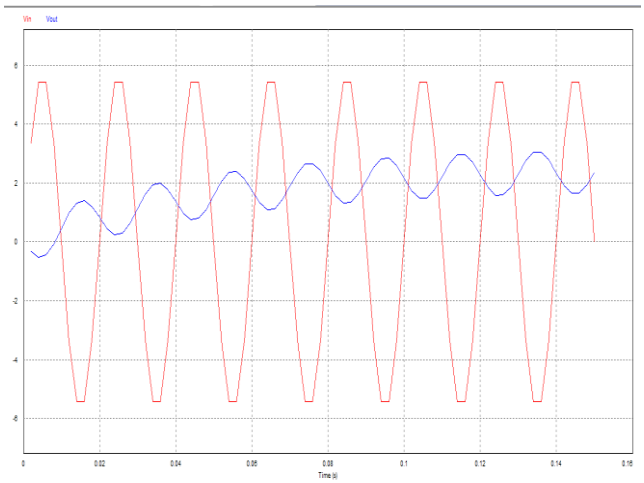

Figure 3: Output of voltage sensor given as input to Arduino

Figure 3 shows the input which is given to the analog pin of Arduino. 2.5V Dc bias is introduced by a pair of DC voltage dividers to create a positive DC signal.

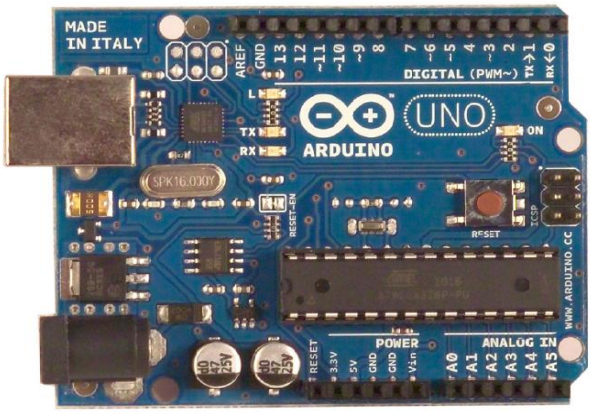

Figure 4: Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328.

Surge protection is applied at the mains input to combat disturbances on the mains supply external to the operating equipment. The varistor attenuates transient by filtering or diverting the transient to prevent damage to the load. The main function of the varistor as shown in Fig 4 is to absorb the overvoltage surge by lowering its impedance to such a level that the voltage drop on an always-present series impedance is significant enough to limit the overvoltage on “critical parts” to an acceptable level.

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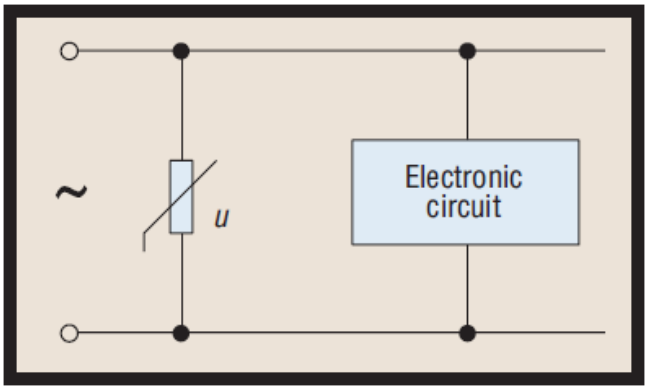

Figure 5: Varistor

IV. CIRCUIT DESCRIPTION

The module in this project is designed for 3 Phase 11A load operating at normal voltage of 460V 3 Phase. Building DC voltage from power grid's AC voltage is ubiquitous part of the non-portable electronic equipments from which they provide DC supplies for different parts of the circuits. This AC to DC conversion can be done with designs ranging from a simple AC to DC rectifier to high efficient switched-mode power supplies [2]. In most of these cases a step-down transformer is a common part of the design.

The voltage from secondary of transformer is given as input to Arduino through a voltage sensor circuit described above.

Input voltage above 260V 1 Phase is considered as over voltage. The Arduino will sense this increase in input voltage and won't give command to energize the contactor coil. So the circuit will not be complete and valuable components won't get damaged. This over voltage condition will be indicated by use of LEDs on the module.

Input voltage below 175V 1 Phase is considered as under voltage. This condition is sensed similarly by the Arduino and contactor coil is not energized. This condition of under voltage is indicated by use of LEDs on the module.

Voltage difference between earth and neutral is monitored. This voltage above 7V is not desirable. If this voltage is sensed above 7V, the microcontroller will not give command to energize the contactor coil. Rise in neutral-earth voltage is not desired as it can cause flow of current through body of components connected. This condition is also indicated by use of LEDs.

This module will also indicate loss of any one the phases.

Each phase loss will be indicated by LEDs on the module.

V. CONCLUSION

This PAPF Module is capable of protecting any equipment from power fluctuations. The developed module is compact and cost effective. It can give protection against over-voltage, under-voltage, surges, phase losses.

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