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# Design of Solid-State on-Load Tap-Changer for Transformer Using Microcontroller

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**Abstract:** ***The on-load tap changing (OLTC) regulators have been widely used in various industry .The main function of OLTC is to change the turns of transformer winding, so that the voltage variations are limited without interrupting the secondary current. In other word the voltage can be regulated with the changer without any supply interruption. Today mechanical OLTC can be regulating the voltage dips within few seconds that maintain the equipment in good operation. But they had considerable limitations and drawbacks likes Arc in the contacts of the diverter switches during the tap changing process, High maintains and service cost, Low tap changing speed, High losses of tap tap-changer during tap changing, Create noise disturbance during tap changing process. In order to overcome these limitations and drawbacks electronic (solid-state) tap changer were developed. The continuous new growth of power semiconductor devices, Such as the insulated gate bipolar transistor (IGBT), TRIAC, THYRISTOR has allowed the development of fast OLTC regulators which has helped to fix other problems in the ac mains, like flicker and sag. Solid-state tap-changer has considerable advantages compare with mechanical tap changers. These include higher performance, lower volume, weight and maintenance cost. In this project design a microcontroller based controller, this is able to properly control a "solid state on load tap changer of 0.5 KVA transformer". So in this project selected the project design and fabrication of electronic tap-changer, which will overcome all these drawbacks.***

**Keywords:** Solid State on Load Tap-Changer, Optocoupler, microcontroller applications

## 1. Introduction

The main of a tap-changer is to regulate the output voltage. The major object of the controller in the tap-changer system is to minimize the fluctuation of voltage amplitude with respect to reference voltage of the regulation bus. The secondary of the transformer far from this bus. The controller must regulate the voltage within a given range. Power quality is the most important things about these days. Both the power utilities and consumers are quite concern with the quality of the power supply. They needs these supplies to be at its optimum value so that the cost is efficient otherwise problems such as over voltage, under voltage, voltage swell, voltage sag noise and harmonics caused by the disturbances in power supply could be disastrous. So Solid-state tap-changer has considerable advantages compare with mechanical tap changers. These include higher performance, lower volume, weight and maintenance cost.

### 1.1 Scope of project

High controllability advantages for power electronics switches lead to their application in the tap-changer of distribution transformers. Using such switches like as IGBT, THYRISTOR, leads to quick operation of the tap-changer and so improved performance. Moreover their applications reduce maintenance and repair costs of tap-changer .so by using this topology it's possible to increase the power quality and reliability.

In this paper prototype scheme is designed for 0.5 KVA transformers with five tapping at HV side. Scheme is also applied for the 3 phase distribution transformer with some required changes.

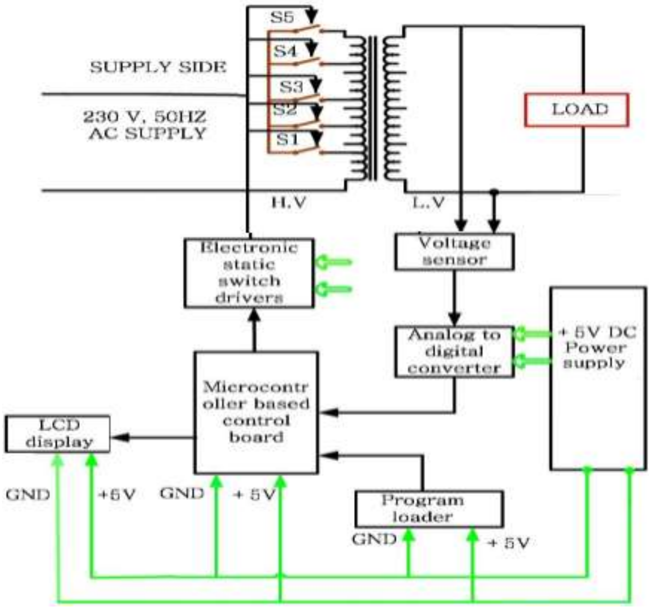


**Figure 1:** Main Block Diagram

This prototype semiconductor tap changer consists of a thyristor as the switching device to turn on the selected tap of the power transformer. As displayed in Figure 1 the low voltage circuit is separated from the high voltage circuit in order to protect the Micro controller from damage.

**Flow Chart -1** Flowchart for close loop control

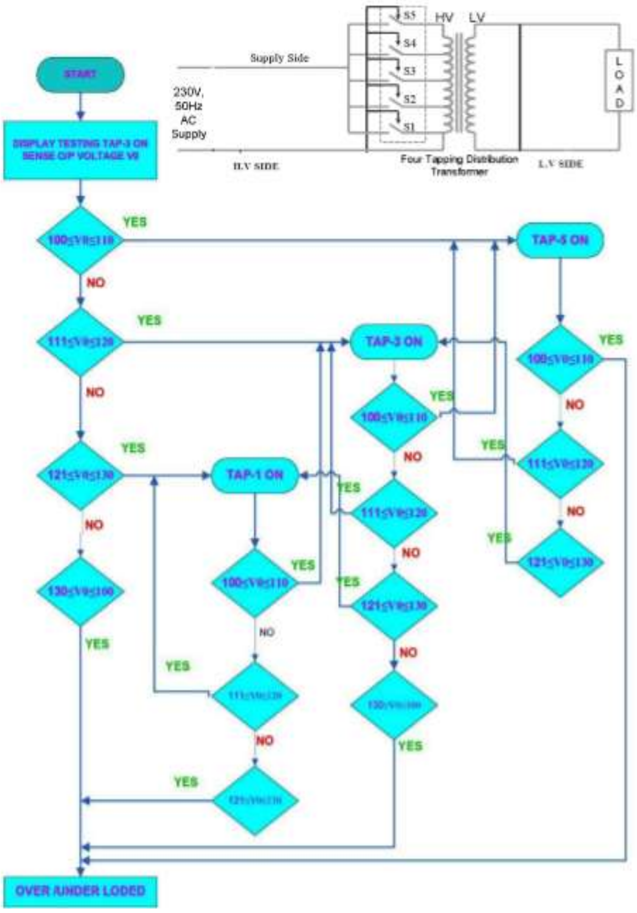


**Figure 2:** Flowchart for close loop control

**Table-1:** Selected transformer rating

| | |
|---|---|
| Number of phase | 1(single) |
| Transformer rating in (KVA) | 0.5 KVA |
| Rated input voltage(volt) | 230V |
| Tapping provide at | HV side |


**Figure 3:** Overall lab setup

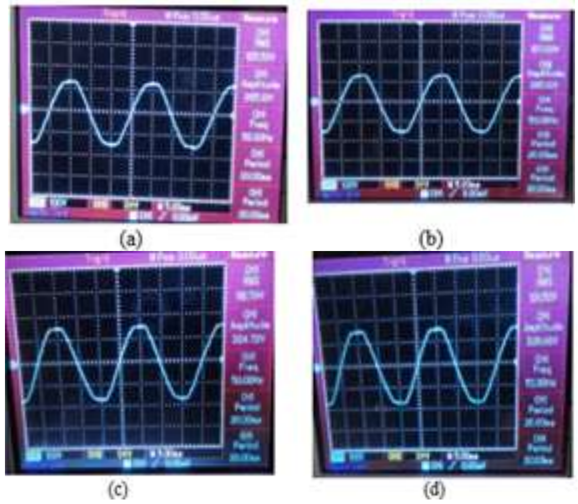


**Figure 4:** Output waveform

## 2. Conclusion

- Any variation at the output voltage of distribution transformer will be sensed by the microcontroller and compared with the reference value as per the program.
- This will produce appropriate command to trigger the appropriate pair of antiparallel thyristor for change suitable tapping of transformer.
- The system stability is improved because of quick response.
- Because of static device maintenance cost is reduced because of elimination of frequent sparking.
- Output voltage can regulate in the range of ±5V of nominal voltage.

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