

A REVIEW OF POWER TRANSFORMER TAP SWITCHING USING SEMICONDUCTOR DEVICES

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ABSTRACT:

For the power transformer tap switching earlier mechanical type of on line tap changer was used. This method has some drawback like arcing, high maintains, slow reaction time and service cost. in order to overcome this limitation power semiconductor device used .In power semiconductor devices mainly used insulated gate bipolar transistor (IGBT) ,Triac ,thyristor .With the help of that devices we can improve the performance of the system using that devices we can improve quick operation of system because of that other problem in the ac main like flicker and sag .Also it have more controllability The experimental results demonstrate that the fast switching is able to correct several disturbances of the ac mains besides, the long duration in variation in time is much lower than the one corresponding to the traditional regulators.

KEYWORDS: Tap Changer, Power Electronics Devices, Power Transformer.

INTRODUCTION:

The device used to provide constant load voltage from power transformer is known as tap changer[1]. The input of power transformer is fluctuated, then to provide constant secondary power transformer output tap changing is necessary as per required to load[2]. Conventionally mechanical tap changer is used for tap changing. The mechanical tap changer has Complicated gear mechanisms of selectors, diverters and switches [3.] If mechanical tap changer is used then arching problem and delay occurs, also it required maintenance. To avoid the problems occur in mechanical tap changer, design tap changer using Semiconductor devices. TRIAC and DIAC are switching devices used in semiconductor tap switching. Operation of switching devices is controlled by microcontroller [4].

LITERATURE REVIEW:

The problem of conventional tap changer is due to its mechanical structure of complicated gear mechanisms of selectors, diverters and switches. These arrangements are slow in response and susceptible to contact wear condition and deterioration of insulating

oil, thus requires regular maintenance [5]. Due to its property mechanically on-load tap changer power transformer arched during tap changing processes. This is further developed to a single diverter resistance and then to inverse parallel thyristor pairs which are connected across a set of mechanical switch contacts [6]. In power semiconductor devices mainly used insulated gate bipolar transistor (IGBT) ,Triac ,thyristor .With the help of that devices we can improve the performance of the system using that devices we can improve quick operation of system because of that other problem in the ac main like flicker and sag. Also it have more controllability The experimental results demonstrate that the fast switching is able to correct several disturbances of the ac mains besides, the long duration in variation in time is much lower than the one corresponding to the traditional regulators [7-8].

RESEARCH METHODOLOGY:

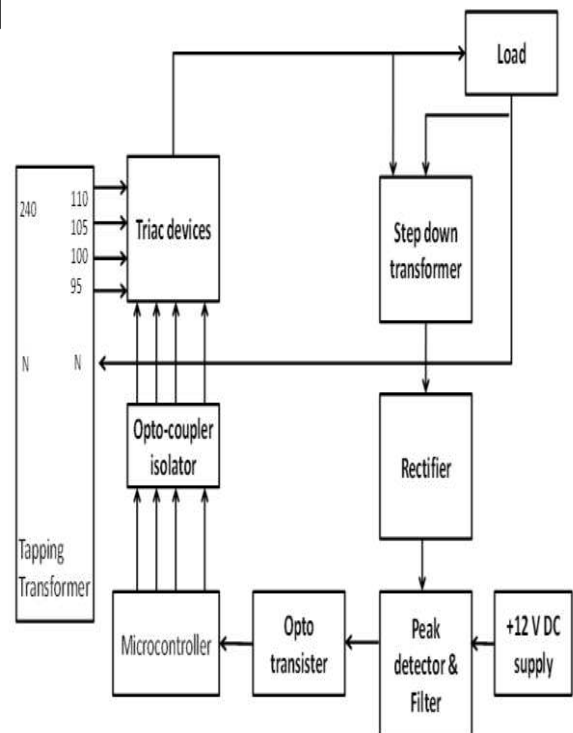


Fig.1 Block diagram of detailed on-load electronic semiconductor tap changer [1]

Above fig shows the detailed blocks diagram for the semiconductor tap changer used in this work. Whatever the extra devices are inserted in the prototype to provide a better accuracy and Safety for the system. It consists of a feedback loop circuit of 120V/6V step-down transformer, rectifier, peak detector, filter and opt-transistor, is incorporated into the prototype. This are the component which include in above paragraph .The function of this parameter convert the 110V AC line voltage to an acceptable DC level voltage for the microcontroller operation and provide a protection from damaging the microcontroller. Below Fig shows the connection of the microcontroller, resistors, opto-couplers, triac circuits, and load and power transformer. Opto-coupler protects the output of the microcontroller from the high voltage value of the power transformer. It has also important functions to maintain the ON-OFF switching operation of the triac. When the microcontroller has samples the DC voltage from the rectifier, and determines the appropriate tap setting to maintain the voltage, it will generate pulse signal to the designated opto-coupler. This opto-coupler will then activate the triac connected to it.

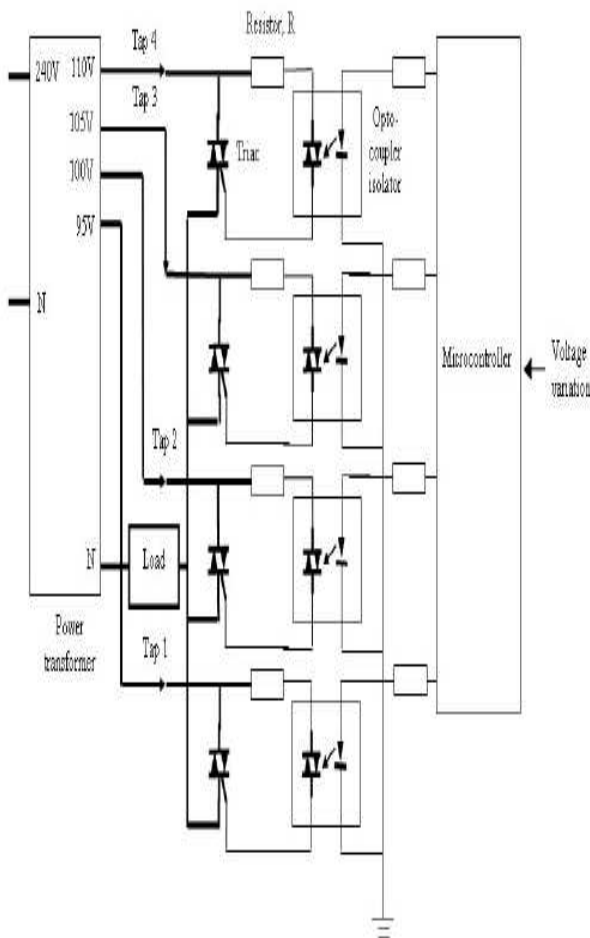


Fig. No. 2. Opto Coupler mechanism [2]

Whatever the software loaded into the microcontroller is written using program. It Samples the input given to the microcontroller and compares the value with the determined Value written in the program. The software has been given a set value of 110V.what ever the signal is given that signal is converted in to digital value with the help of the analog-to-digital converter before microprocessor starting the process on the information .If the value is 10% more or10% less than the nominal value, the microcontroller will quickly change the tapping to allow lower or a higher taps setting respectively. Microcontroller will continue changing the setting to maintain the voltage within the set value. If the tap setting is at its maximum or minimum, alarm signal will be generated and indicated by the flashing LEDs. Otherwise, the taps setting will remain unchanged.

This are few design step which are used for this system

- 1) Tap switching circuit.
- 2) Feedback circuit: We have to take feedback from output of switching circuit and to provide a microcontroller. Use step down transformer as a sensor to provide operational microcontroller voltage.
- 3) Controlling circuit: Also we have to take a feedback from output voltage and tap adjust as programmed in microcontroller.

OBJECTIVES:

- 1) Avoid arching problem
- 2) Faster Operation
- 3) Less maintenance

Gate terminal voltage of the TRIAC plays a vital role in its working. Microcontroller controls the on and off state of TRIAC.

Whatever software loaded in the microcontroller is written using program .It compare the input value given to the microcontroller with the determine value which is written in the program. Whatever the signal given to the microcontroller is first converted into the digital form by using analog to digital converter before processing it. suppose set value is 100V then, the compared value if 10% less or 10% more than the nominal value then microcontroller will tapping switch lower or higher respectively likewise microcontroller will continuously change the set value to maintain the value of voltage within the set value .switching of tapping indicate with the help of LED's

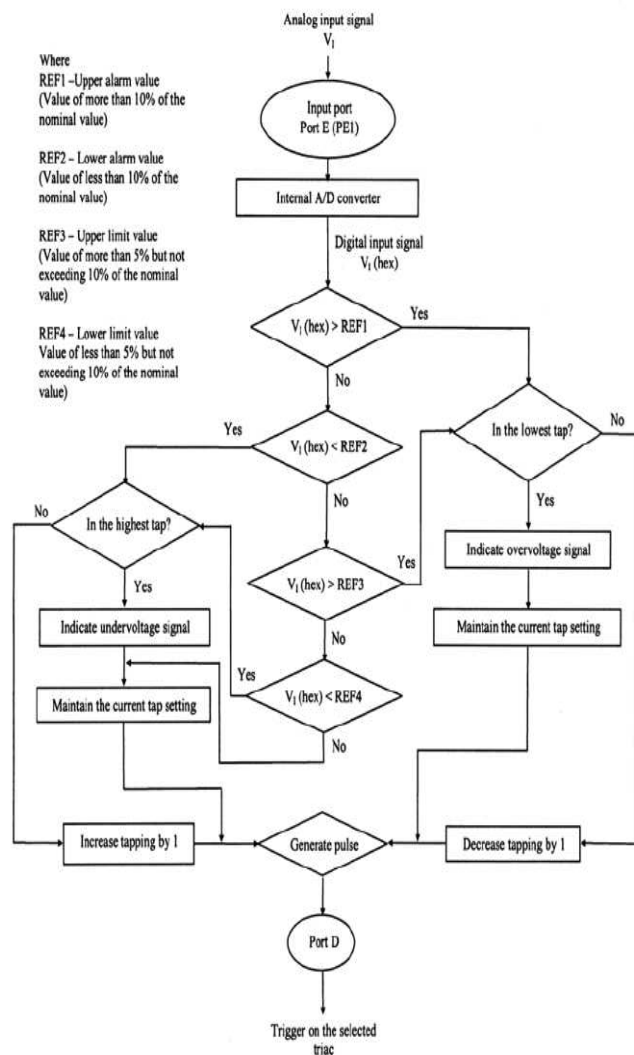


Fig. No.3. Flow chart for triac triggering program [3]

CONCLUSION

Whatever the variation at the output voltage of the power transformer will be sensed by the microcontroller and compare with the reference value as per the program. From that produce appropriate command for triggering the appropriate pair of anti parallel thyristors for change in the suitable tapping of transformer. The different advantage also given, the system stability is improved, because of quick response. In that system because of static devices, maintenance cost is reduced due to elimination of frequent sparking. Whatever the output voltage we getting can be regulated

in the range of ± 5 V of nominal voltage. In this system prototype of fully electronic on-load tap changer has been built and tested. One of the important devices is Triac devices as the switching device that had eliminated all disadvantages of arching, contact wear and maintenance that associated with conventional mechanical tap changer. With these semiconductor devices and microcontroller as the processing element, the response time of the tap changer had been improved to approximately.

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