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Automatic Tap-Changer with TRIAC Switch for Constant Voltage and Current Measurements

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Abstract: ***This research article demonstrates how to protect the power transformer from over load time. It is to controlling our desired voltage on various load times but the research gives some solution to avoid over voltage problem by automatic tapping technique. In this research tapping of transformer is selected automatically with the help of Peripheral Interface Controller (PIC) microcontroller. Effective use of potential transformer is to find out the precision in the system. The load voltage is measured by potential transformer which is given to precision rectifier. It will produce the accurate voltage levels. Here the things are using PIC microcontroller which is a flash type reprogrammable device in which system was already programmed. The Model was fabricated with Triode for Alternating Current (TRIAC) switches just as a switching devices and Peripheral Interface Controller microcontroller just as a control unit. In this research automatic control sections by using tap changer. In conventional methods industrialist used mechanical on load tap changer which is highly risk, because it does not produces constant output voltage and can create voltage dips. In this research it will be overcome above problem by using automatic electronic tap changer. It will produce constant voltage regulation and to measure variation of current.***

Keywords: ***Triode for Alternating Current (TRIAC) switch, current measurement, Peripheral Interface Controller (PIC) microcontroller, load tap changing transformer***

I. INTRODUCTION

Nowadays, Tap changing transformers which play an important role in power system. The planning for power system and power system stability in exigency conditions like huge load without using Tap changing transformers is impractical [1]. By using the tap changers in power system to regulate the output voltage of a transformer and also control the coil ratios of the transformer's load whereby rectifying the voltage. The main objective of the tap changing transformers is to maintain the change in voltage evenly and adequately in manner without any disturbance to the current flow. Even though more advantages of tap changers, but there is few disadvantages such as fault in tap changing transformer due to tap loosing or in inappropriate position and require more maintenance and cost wise is also high.[2] While operation there is looping between switch contacts which leads to minimize contact life, and also causes the oil to become dirty. This causes the more maintenance cost. [3][4][5]

Hence, in order to overcome the drawbacks of the tap changing transformers and make tap be speed and maintenance free. By replacing the vacuum interrupts switches in the conventional tap changer to TRAIC switch. Transformers may experience some significant changes in power factor.

II. ELECTRONIC TAP CHANGER

Electronic tap changer doesn't have mechanical element, solid state power devices are used as switches. The exceedingly swift switching process of TRIAC power switches leads to the high-speed tap-changing in full-electronic tap-changers, as such that it is possible to change the tap. Triode of Alternating Current was an electronic component that extensively used in AC power control application. TRIAC switches were high voltages and far above the ground levels of current, and over both parts of an AC waveform. Electronic works do not fire symmetrically. This consequences in harmonics being generated the less symmetrical the switches fires, the greater the level of harmonics was formed. As an alternative for these systems two thyristors perhaps used for easier to have power over their firing. To assist in overcome the crisis of the TRIAC non-symmetrical firing, and the bring about harmonics, an additional semiconductor device known as a DIAC (diode AC switch) was habitually positioned in series of the TRIAC. The gadget turn off as expected when the current falls to zero and for firing to cross zero current. The result to evade arc generation and to guard entire equipment.

III. TAP CHANGER OPERATION

Line voltage is given to potential transformer (voltage transformer). To avoid the losses we are using precision rectifier and also to provide accurate measurements. Analog voltage is converted into digital by A/D converter. It is inbuilt in PIC Microcontroller. Five ranges of voltages are programmed in PIC Microcontroller. The voltage ranges are i) 195 V, ii) 195-215 V, iii) 215-230 V, iv) 230-250 V, v) 250-270V. Output voltage is controlled by control circuit. It drives the output voltage constant. Here, five TRIAC switches are used. By using TRIAC switches we attain any desired voltage range. It provides isolation between AC and DC voltages. That isolation is provided by optocouplers to avoid negative voltage. Snuffers are used here for heat sink and it also provides high power withstand capability.[6]

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In power supply unit, we are giving three types of voltages. In primary side 9V is giving as input and in secondary side +15V & -15V as output. To show the variations in the voltage range, here we use auto transformer. Initially the voltage is set and displayed in the LCD. When the voltage is high or low, here the five tap transformer gives the output voltage constant.

In order to avoid voltage fluctuations, voltage dip we introduce TRIAC switches. And the same time current is also measured and displayed in the LCD. Shunt resistor are used to convert current to voltage. [7] Fig.1. Shows the block diagram of the Electronic tap changer with TRIAC switch.

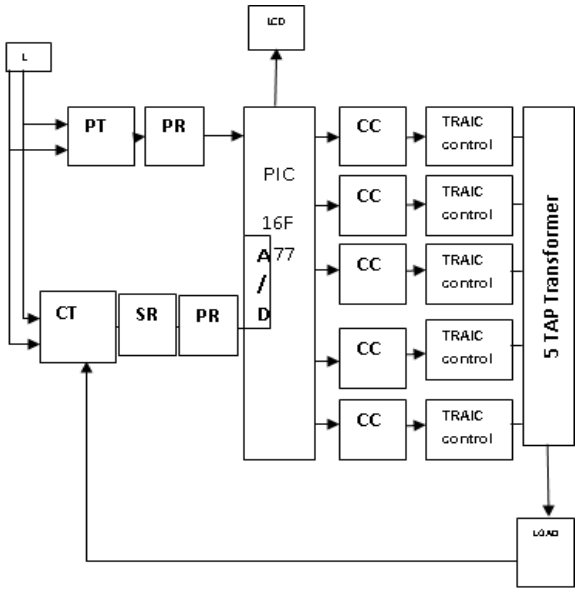

Fig.1 working principle of Electronic Tap charger

Note:
PT – Potential Transformer
PR- Potential Rectifier
SR-Shunt Resistor
CC- Control Circuit
L- Load

IV. TAP CHANGER & FORTIFICATION APPROACH

An electronic tap changer as a hasty parameter contrivance has been projected for shelter of critical loads beside deviation in voltage. The intention of a tap changer to standardize the output voltage of a transformer. Tap changer to altering the number of turns in one winding and in that way altering the turns ratio of the transformer.[9]. An OLTC varies the transformer part despite the fact that the transformer is wound up and moving load. The switching principle used to connect automatically with no break up the voltage deviation. An adjacent tap was bridged before contravention contact with the load hauling tap for the intention of transferring load from one tap to the other without interrupting or substantially shifting the load current. By detecting over voltage problem the control unit automatically to protect and stabilize the voltage to avoid the insufficiency.

V. CONCLUSION

In this research, an entirely electronic tap changer was used with five tapping switches by the use of TRIAC that was located at the output side of the transformer by the usage

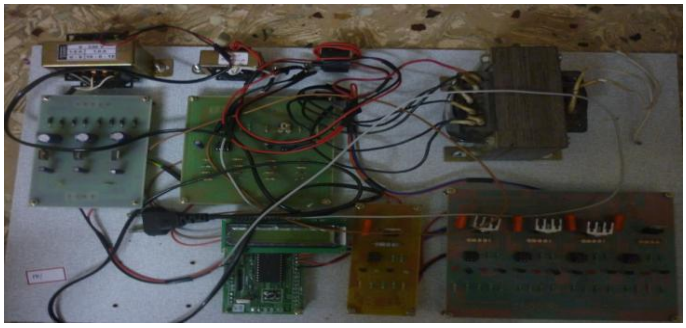

Fig.2. Working model of Electronic Tap changer.

of electronic tap changer to control voltage deviation and measurement of current to reduce over voltage problem, and steady the entire system without affecting in excess of voltage problem. As a final point the foremost reward of the research automatic tapping system to rectify an accident from the man power usage and continuously monitor the variation of voltage and current reading along with the automatic system to useful for maintain the constant voltage.

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