PC Based Transformer Fault Finding

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***Abstract*--To increase availability and to achieve optimized operating management on line condition monitoring For power transformer is useful and necessary. Based on the experience with a considerable amount of system in operation a generally applicable set up of sensors is proposed. Furthermore the way of data acquisition, analysis and distribution by using a modern monitoring system connected to internet is described. By means of mathematical models the acquired measured data are converted to useful information for a reliable condition diagnosis. The evaluation of data are acquired onsite shows the capability to detect problems within active part, bushings, on-load tap changer and cooling unit before they develop into major failures. Especially algorithm for the calculation of overload capacity is of increasing importance. Power transformer is complex and critical component of power transmission and distribution system abnormalities, loading, switching and ambient condition normally contribute towards accelerate aging and sudden failure in the absence of critical component monitoring; the failure risk is always high. For early fault detection and real time condition assessment , online monitoring system accordance with age and condition for the asset world to be important tool after being indicative of abnormality it is important to carry out offline test / diagnostic to ascertain the overall integrity and assessment to avoid unscheduled outages, financial/revenue losses and environmental /collateral damages. This paper discusses condition assessment criteria based asset abnormalities with respect to age and case study.**

I. INTRODUCTION

Transformers are a vital part of the transmission and distribution system. Monitoring transformer condition online can prevent faults that are costly to repair and result in a loss of service. You can use this system for online monitoring of transformers. You can then use information to avoid dangerous and costly failures, while optimizing maintenance schedules and extending the life of your transformers In our system a microcontroller will continuously keep on monitoring the various parameters (Output current, Output voltage and Temperature) of the transformer and this information will be continuously be updated on your PC using a VB based software. A keypad is used to change the set points for the parameters. A 16x2 LCD is used to continuously displays the parameters. We have even provided a protection relay so if there is any problem with the transformer the power to it can be remotely disconnected. Transformer outages have a considerable economic impact on the operation of an electrical network. Therefore it is the aim to ensure an accurate assessment of the transformer condition. Techniques that allow diagnosing the integrity through non-intrusive tests can be used to optimise the maintenance effort and to ensure maximum availability and reliability. With the increasing average age of the transformer population there is an increasing need to know the internal condition. For this purpose on- and off-line methods and systems have been developed in recent years. On-line monitoring can be used continuously during the operation of transformers and offers in that way a possibility to record different relevant stresses which can affect the lifetime. The automatic evaluation of these data allows the early detection of an oncoming fault. In order to enable a consistent utilisation of the technically possible load capacity of the transformer, statements regarding the current overload capacity.

II. NECESSITY FOR PROTECTION

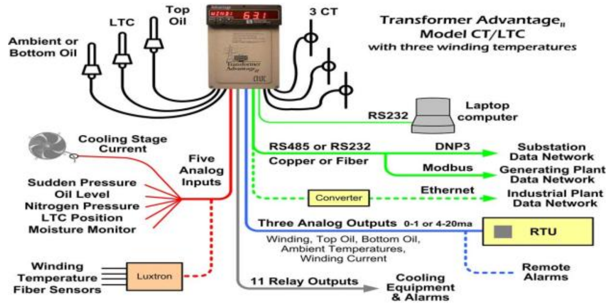
Transformers are static devices, totally enclosed and generally oil immersed. Therefore, chances of faults occurring on them are very rare. However, the consequences of even a rare fault may be very serious unless the transformer is quickly disconnected from the system. This necessitates provide automatic protection for transformers against fault. The protection system of transformer is inevitable due to the voltage fluctuation, frequent insulation failure, earth fault, over current etc. Thus the following automatic protection systems are incorporated.

Buchholz devices: A Buchholz relay, also called a gas relay or a sudden pressure relay, is a safety device mounted on some oil-filled power transformers and reactors, equipped with an external overhead oil reservoir called a conservator. The Buchholz Relay is used as a protective device sensitive to the effects of dielectric failure inside the equipment. It also provides protection against all kind of slowly developed faults such as insulation failure of winding, core heating and fall of oil level.

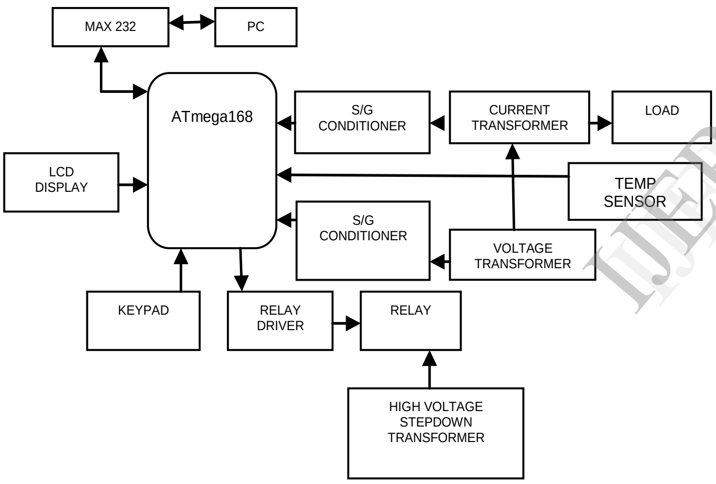
Earth fault relays: An earth fault usually involves a partial breakdown of winding insulation to earth. The resulting leakage current is considerably less than the short circuit current. The earth fault may continue for a long time and creates damage before it ultimately develops into a short circuit and removed from the system. Usually provides protection against earth fault only.

Over current relays: An over current relay, also called as overload relay have high current setting and are arranged to operate against faults between phases. Usually provides protection against phase -to-phase faults and overloading faults.

Differential system: Differential system, also called as circulating-current system provides protection against short-circuits between turns of a winding and between windings that correspond to phase-to-phase or three phase type short-circuits ie, it provides protection against earth and phase faults.



III. BLOCK DIAGRAM



The Various blocks are as follows:-

- LCD Display
- Keypad
- Microcontroller (ATmega 168)
- Voltage Transformers
- Relay Driver
- Relay
- Current Transformers
- Signal Conditioning
- High Voltage Step Down Transformer
- Load
- Max 232
- Pc
- Temperature Sensor

IV. WORKING OF VARIOUS CIRCUITS USED:

- VOLTAGE MEASUREMENT CIRCUIT

VOLTAGE MEASUREMENT

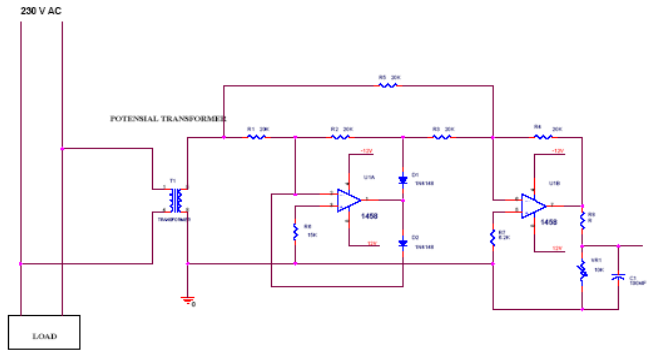


Figure : 4.1 Voltage Measurement Circuit

This circuit is designed to monitor the supply voltage. The supply voltage that has to monitor is step down by the potential transformer. Usually we are using the 0-6v potential transformer. The step down voltage is rectified by the precision rectifier. The precision rectifier is a configuration obtained with an Operational amplifier in order to have a circuit behaving like an ideal diode or rectifier. The full wave rectifier is the combination of half wave precision rectifier and summing amplifier. When the input voltage is negative, so it works like an open circuit, there is no current in the load and the output voltage is zero. When the input is positive, it turns the diode on. There is current in the load and, because of the feedback, the output voltage is equal to the input. In this case, when the input is greater than zero, D2 is ON and D1 is OFF, so the output is zero. When the input is less than zero, D2 is OFF and D1 is ON, and the output is like the input with an amplification of $-R2 / R1$.. The result is a reversal of the selected polarity of the input signal. Then the output of the rectified voltage is adjusted to 0-5v with the help of variable resistor VR1. Then given to ripples are filtered by the C1 capacitor. After the filtration the corresponding DC voltage is given to ADC.

- **CURRENT MEASUREMENT CIRCUIT**

CURRENT MEASUREMENT CKT

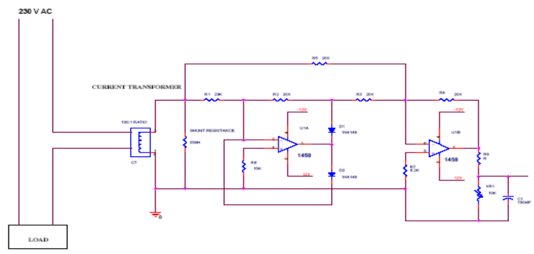


Figure: 4.2 Current Measurement Circuit.

This circuit is designed to monitor the supply current. The supply current that has to monitor is step down by the current transformer. The step down current is converted by the voltage with the help of shunt resistor. Then the converted voltage is rectified by the precision rectifier. The precision rectifier is a configuration obtained with an operational amplifier in order to have a circuit behaving like an ideal diode or rectifier. When the input is positive, it is amplified by the operational amplifier and it turns the diode on. There is current in the load and, because of the feedback, the output voltage is equal to the input. The full-wave rectifier depends on the fact that both the half-wave rectifier and the summing amplifier are precision circuits. It operates by producing an inverted half-wave-rectified signal and then adding that signal at double amplitude to the original signal in the summing amplifier. The result is a reversal of the selected polarity of the input signal. Then the output of the rectified voltage is adjusted to 0-5v with the help of variable resistor VR1. Then given to filtration the corresponding DC voltage is given to ADC or other related circuit. ripples are filtered by the C1 capacitor. After filtration the corresponding DC voltage is given to ADC or other related circuit.

- **SIGNAL CONDITIONING CIRCUIT**

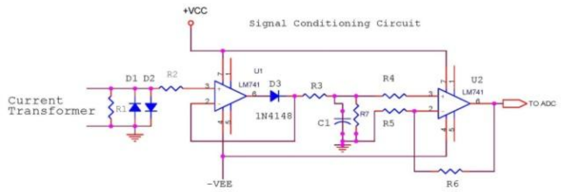


Figure: 4.3 Signal Conditioning Circuit

The output of the current transformer is Current. Which is then given to a Current to voltage convertor i.e. basically it is given across a resistor(R1) so the voltage generated is V= I x R1.The two diodes D1 & D2 are used to make sure the voltage does not get above +0.7 & -0.7v. This is done for circuit protection i.e. to make sure the output of the circuit dosent go above 5v. This AC signal is then given to an active rectifier circuit. A rectifier converts ac signal to dc. Normally diodes are used to create a rectifier. But the voltage drop across a diode is 0.7v so we cannot rectifie signals ledd than 0.7v. For this purpose active rectifier is used. The active rectifier circuit consists of R2, U1 & D3. The output of the rectifier circuit is a pulsating DC signal. So this signal is then applied to a filter circuit conisting of R3, C1 & R7. Basically this circuit converts the pulsating DC signal into fixed DC signal.

Then the signal is then given to an amplifer circuit (R4, R5, R6, U2). We are using opamp in non inverting mode. The o/p of this signal is then given to ADC.

V. CONCLUSION:

The justification for on-line monitoring of power transformers is driven by the need of the electrical utilities to reduce operating costs and enhance the availability and reliability of their equipment. The evaluation of data acquired by an on-line monitoring system shows the capability to detect oncoming failures within active part, bushings, on-load tap changer and cooling unit. Using the benefits of modern IT-technology the distribution of information about the condition of the equipment can easily be done by means of standardized web browser technology.

REFERENCES

[1] S. Tenbohlen, F. Figel: “On-line Condition Monitoring for Power Transformers”, IEEE Power Engineering Society Winter Meeting, Singapore, Jan. 2000

[2] S. Tenbohlen et al.: “Enhanced Diagnosis of Power Transformers using On- and Off-line Methods: Results, Examples and Future Trends”, CIGRE Session 2000, paper 12-204, Paris, 2000.

[3] J.P. Dupraz et al.: “ Electronic Control of Circuit Breakers”, CIGRE Session 2000, paper 13-206, Paris, 2000

[4] T. Stirl, et al.: “Assessment of Overload Capacity of Power Transformers by on-line Monitoring Systems”, IEEE Power Engineering Society Winter Meeting, Columbus, Ohio, 2001

[5] IEC 60354: “Loading guide for oil immersed power Transformers” (IEC, 1991)