ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 11, November 2017

Design, Development And Testing Of A Transformer Overload Protection Using M S P 430 Microcontroller

[1] BhavaniSingh.J, [2] Subrata chowdhury, [3] Kumar, [4] Vikram, [5] Venkateshmurthy.B.S.
[1][2] UG scholar in EEE, SSCE, Bangalore, & Assistant Professor-1, [3] Dept of EEE, SSCE,Bangalore.

***Abstract*: -- In any electrical distribution system distribution transformer considered as a heart of the system. For this reason, a working transformer should be reliable. The main problem associated with the distribution transformer is overloading, which causes the failure of the transformer and thus the whole system gets affected and makes the system unreliable. Overloading of the transformer means taking more current than it's designed value of the transformer secondary. To take the control over this overloading issue, we have a solution called 'protective relay'. Generally, protective relay works on the electromagnetic principle. It protects the transformer in an overload condition. A Protective relay is generally coupled with the circuit breaker, which isolates the system in overload conditions. In this paper, we have used the microcontroller for designing this protecting relay. Microcontroller based relays are more popular because of no mechanical operation.**

***Keywords* — Circuit breaker, distribution transformer, overload, microcontroller, relay.**

I. INTRODUCTION

Overload relay is a type of protective relay which operates when current exceeds a preset value. In this application we have used over current relay for overload protection of secondary side of a transformer. Overload means over current because voltage is constant in our system. This paper will attempt to design and develop overload relay which is nothing but over current relay with the help of MSP 430microcontroller. MSP 430microcontroller is playing the role of 'Brain' in this overload relay. This microcontroller will cause the circuit breaker to trip when the load current exceeds the preset value. Before designing the relay unit we need to measure the load current. Operation of the relay is the function of load current. When fault condition occurs, relay unit need to isolate the desired electrical system within shortest time. Operation of tripping coil of circuit breaker is controlled by MSP 430microcontroller.

II. OBJECTIVE

To design and develop an over current protection relay using microcontroller which can operate on the permissible conditions by setting the over current value To test unwanted condition and when such conditions arise to isolate the fault condition in the shortest possible time.

III. OVER CURRENT PROTECTION

Any current in excess of the rated current of equipment or capacity of conductor is known as over current. Flow of current in conductor generates heat. Higher the current, higher will be the heating of the conductor. Generally fuses, circuit breakers are used to overcome the risk of over current. But for reusability we go for the relays. The selection of over current relay depends upon the time/current characteristics .

Following are the commonly used protective relays :

1. For instantaneous over current protection- attracted armature type, moving iron type, PMMC type is used.
2. For inverse time characteristics- Electromagnetic induction type, permanent magnet moving coil type is used.
3. Directional overcurrent protection double actuating quantity induction relay with bidirectional feature.
4. Static over current relays.
5. HRC fuses, drop out fuses etc. are used in low voltage, medium voltage and high voltage distribution systems, generally up to 11 kV.
6. Thermal relays are used widely for over current protection.

IV. IMPORTANCE OF SYSTEM PROTECTION

A small deficiency in electrical supply results into financial losses decrease in productivity, loss of revenue [Fault is hazardous to user and system itself . Over current means, machine is taking more current than its rated current. Over current results into heating of a conductor. Normally thermal relays are used for overcorrect protection, it also include Short Circuit current which is several times of full load current. Power system protection is a very important element in electrical field and it is required to protect equipments as well as human. This is likely to approach the review about

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 11, November 2017

important part in the electrical protection system which is over current protection relay. Over current protection relay which utilize with microprocessor and is based on the most advanced digital technology, is now widely used to protect lines, generators, transmission and motors. Currently MCCBs are used for distribution transformer protection but MCCB takes more time to trip. So the microcontroller based relays are more popular now a days.

V. DESIGN METHODOLOGY

Protection system is mainly controlled by the protection relay which is the brain of the protection system.

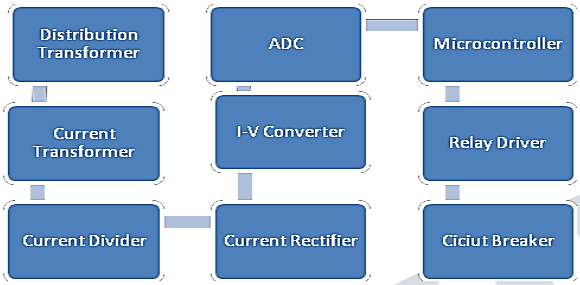


Fig.1. Block diagram of protection system flow.

Current transformer/voltage transformer will drop voltage/ current in secondary windings. If there are over current/over load, the protection relay will open the circuit (cut-off) and cause the switching devices to trip. Protection relay play an important role in this system to cause the circuit breaker to trip and it can be implemented at various stages and various types of protection devices. Most of all protection relay only act as the brain of the protection and actual switching work are done by the circuit breakers and isolators.

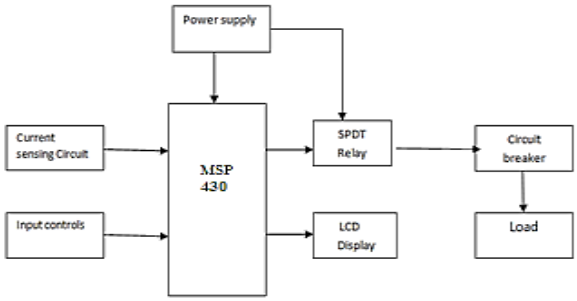
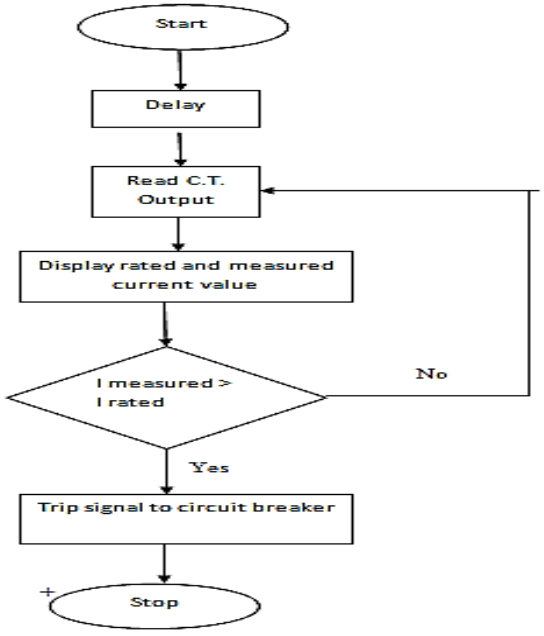


Fig.2. Schematic block diagram of over current relay.

The whole idea of this project is to isolate the faulty conditions from the load current by controlling the circuit breaker tripping coil using micro-controller When there are over current at the bus bar (load current), current transformer will supply the reduced current to current sensor unit i.e. C.T. and I-V converter with ADC. Current sensor will be used to measure the load current and will convert this current to certain voltage level as an input to micro-controller. Micro-controller will process and compare this voltage with desired voltage setting and will operate the tripping coil in circuit breaker if input voltage reaches the setting value To develop this project, the knowledge about the controller which is the brain for this system is very important. This project will use MSP 430 micro controller as the processor. Though, the result of this project should have the basic operation and principles of over current rela Flow chart for the program is as follows.



We have written a program in Assembly Level Language for Microcontroller operation, interfacing of LCD and ADC. Then we test it as explained in case study.

$$Full\ load\ current = \frac{kVA}{\sqrt{3} \cdot V \cdot PF}$$

$$Full\ load\ current = \frac{25}{\sqrt{3} \cdot 415 \cdot 95}$$

VI. CASE STUDY

We have tested this overload relay with the permission of State Electricity Board, at farm located in Solapur district. The transformer rating is 25kVA, 11kV/440V, 50Hz.

Transformer

For testing purpose we have taken a transformer of rating 25kVA. The full load of transformer is taken as follows

Full load current say Ilmax = 36.61Amps

ISSN (Online) 2395-2717

International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE)
Vol 3, Issue 11, November 2017

Current Transformer (C.T.)
Here we need current less than 1 ampere so we have selected a C.T. ratio as 200/5 Amp
Output of CT

$$I = \frac{36.61 * 5}{200}$$

I=0 .915 Amp
I= 0.92 Amp

Current rectifier

Current rectifies AC into DC. We have selected a rectifier IC DB107 which is having rectification efficiency of 98%. Input is 0.92 Amp , Efficiency is 98%, so the output (DC) is 0.90 Amp.

I-V converter

It converts current into voltage equivalent by adjusting resistor values.
So maximum current input to I-V converter is 0.90 Amp
Before this we need to decide maximum input to ADC i.e. 4 Volts (that we have decided)

ADC (Analog to Digital Converter)

We have selected ADC 0809 and decided that the maximum input voltage is 4 Volts.

SPDT Relay (Single Pole Double Throw Relay)

We used this relay as switch to close/ open the path of supply to Circuit Breaker coil. Input to this relay is 12 Volt DC.

Circuit Breaker

We used a circuit breaker to isolate the system when load current exceeds the limit i.e. 36.61 Amp. Here, like this we have successfully designed and developed the overload protection relay using microcontroller.

VII. VARIOUS APPLICATIONS

As this relay is not concerned about how much is the value of current. It can be used for protection of wide range of electrical load. Over-current protection has a wide range of applications. It can be applied where there is an abrupt difference between fault current within the protected section and those outside the protected section and these magnitudes are almost constant. The over- current protection is provided for the following purposes:

1. Motor protection

Overcurrent protection is the basic type of protection used against overloads and short-circuits in stator winding of motors. This project protects motor above 1000 kW.

2. Line protection

The lines (feeders) can be protected with the use of this project. The fault which is most common in power system is single line to ground fault. It is most common among all type of faults with 70 % of occurrence.

VIII. CONCLUSION

Overload relay using microcontroller is designed to fulfill the basic drawback of Drop-out fuses or kit-kat fuses which is about its reusability. This project has overcome that drawback with its compact design and simplicity in operation. As it is made from all the basic components its reliability is one of its advantages. The cost of project is one of its salient features. Apart from drop-out and fuses there is no other protection which is as affordable as this overload relay using microcontroller. As the core part of this project is microcontroller which is an electronic device it consumes very less amount of power for its operation, which makes it more reliable than any other relay. From test results it is clear that, as it can measure the difference between secondary current of distribution transformer and current being drawn by the load it can also be used in investigation of theft.

IX. FUTURE SCOPE

The physical parameters which may affect working of transformer can be controlled easily using this project. By making use of temperature sensor IC and capacitive transducer physical parameters like temperature and pressure respectively are controlled.

REFERENCES

1. Cristian Rotariu, Vasile Manta"WIRELESS SYSTEM FOR REMOTE MONITORING OF OXYGEN SATURATION AND HEART RATE",Preprints Of The Federated Conference On Computer Science and Information Systems, Vol No.1,Issue no.2,pp 215– 218,December 2012.

2. Dilpreet Kaur, Sukhwinder Kumar, Shashi Sharma,"ONLINE GRAPHICAL DISPLAY OF BLOOD OXYGEN SATURATION AND PULSE RATE",International Journal of Scientific & Engineering Research, Volume No.2, Issue No. 6,pp 13-19, June-2011.

3. Sangeeta Bagha ,Laxmi Shaw ,"A REAL TIME ANALYSIS OF PPG SIGNAL FOR MEASUREMENT OF SPO2 AND PULSE RATE"

International Journal of Computer Applications,Vol No. 36,Issue No.11,pp 45-50, December 2011 .

4. N. Watthanawisuth, T. Lomas, A. Wisitsoraat, A.Tuantranont "WIRELESS WEARABLE PULSE OXIMETER FOR HEALTH MONITORING USING ZIGBEE WIRELESS SENSOR NETWORK",IEEE transactions,2010.

5. Bhargavi nisarga,"PULSE OXIMETER DESIGN USING MSP430",texas instrument, application report SLAA458-june 2010.