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# ON-LOAD MONITORING TEST RIG AND PROTECTION FOR CIRCUIT BREAKER

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***Abstract*—** Circuit Breaker is a protective device used in power system. Its main function is to intervene the current flow when fault is detected. Reliable operation of circuit breaker is analytical to the ability to reshape a power system and can be assured by regular examination and maintenance. An automated circuit breaker monitoring system is discovered to keep a track of circuit breaker control circuit.it makes possible to study the circuit breaker's switching phenomenon and to make conclusion of it.

**Keywords—**circuit breaker, microcontroller, power system monitoring, power system maintenance

## I. INTRODUCTION

An electric power system consist of various electrical components and devices placed to supply, transfer and use the electric power. The components and devices in the power system may get damaged due to electrical surges and various faults occurring in the system.so power system protection is of crucial importance. In the system, if the scheme such as power system protection is not employed, the components of the power system may get damaged due to the faults and surges entering the network. The damaged components then have to be replaced or repaired. This act is highly uneconomical and it also results in interruption or non-uniform power flow.

The power system protection incorporated various protection devices such as fuse, circuit breaker, relay, etc. Talking about circuit breaker, It is a apparatus whose functioning is critical to the maintenance of constant supply of power that is to make or break the flow of power .Circuit breaker has a lifetime of 20-40 years. A circuit breaker can not sense the fault by itself so relay is introduced in the circuit to sense the fault and send the signal to the circuit breaker.

A circuit breaker is composed of stationary and mobile contacts. During normal working the contacts of circuit breaker are in closed condition and hence allows to flow current through it. for circuit breaker to open, a little pressure applying to a trigger is required. Whenever a fault is detected in the system, the trip coil gets energized moving the contacts apart. Thus opening the circuit as the circuit breaker has a responsibility and function of protecting the components of power system, it itself need to be monitored ,maintained and protected time to time, currently some circuit breaker monitoring system are available but they have some limitations. The monitoring Systems available for measuring signal from the control circuit are not capable enough to monitor real time breaker performance.

In a scenario consisting of multiple circuit breakers, the measurements of signals in a switching pattern is not possible for existing monitoring system. As a result they are not capable of gathering enough information to make accurate diagnosis in the switching pattern of multiple circuit breakers. The time synchronization ability is mostly not present currently monitoring system .As a result the artificial intelligence tools are capable make decisions.

The circuit breaker monitoring system collects the performance data from various circuit breakers across the power system and combine this data to make appropriate and timely changes and modification in circuit breaker with will affect its reliability. For increasing the reliability and accuracy of the circuit breaker the synchronization of data in time is crucial. But most of the existing circuit breaker monitoring systems are not capable of timely synchronizing the data collected. The limitation of circuit breaker monitoring system limits the multiple circuit breaker operation. This restricts the usability of the recorded data for single breaker's maintenance purpose. In a situation where hundreds of circuit breakers are monitored, this limitations sets out as a obstacle to the use of on-load monitoring system. Circuit breaker monitoring system has a system wide application and increases the reliability and accuracy of system by collecting and providing information about he operation, status of individual circuit breaker , sequence of events and topology of the system.

The proposed modal of On-load monitoring test rig for the protection of circuit breaker deals with the On-load testing of the circuit breaker and monitoring which is not possible with existing circuit breaker monitoring systems. The major components of the test rig are PIC microcontroller, temperature sensor, step down transformer, potential transformer, LCD, Relay driver ULN 2003, voltage regulator IC7805.Supply will be taken from any 1 phase. The supply to the microcontroller will be fed through step down transformer which will be rectified by

rectifier. The voltage regulator will provide constant 5v DC voltage. The controller will monitor parameter such as input output voltage, current through circuit breaker, making and breaking time, temperature between contacts. The real Time status will be displayed on the display unit. By using PIC microcontroller command will be given to the circuit breaker to make or break the circuit during abnormal condition. It can provide information about the operation and status of individual breaker. This modal overcomes the drawbacks of the existing monitoring system such as real time, on-load monitoring, time synchronization, etc. and provides various other parameters of circuit breaker connected.

## II.BLOCK DIAGRAM

The Automated circuit breaker monitoring system as a function of data analysis and producing output. The monitoring system generates a precise sequence of a operation of circuit breaker whenever a fault is sensed. It is also useful on producing a precise topology of the system and tracks its current status. It keeps a track of making and breaking time of the circuit breaker. Fig. 1 shows the block diagram of on load monitoring test rig of circuit breaker. The main components of automated monitoring system are microcontroller, step down transformer ,temperature sensor, CTs', PTs', relay driver , voltage regulator ,etc.

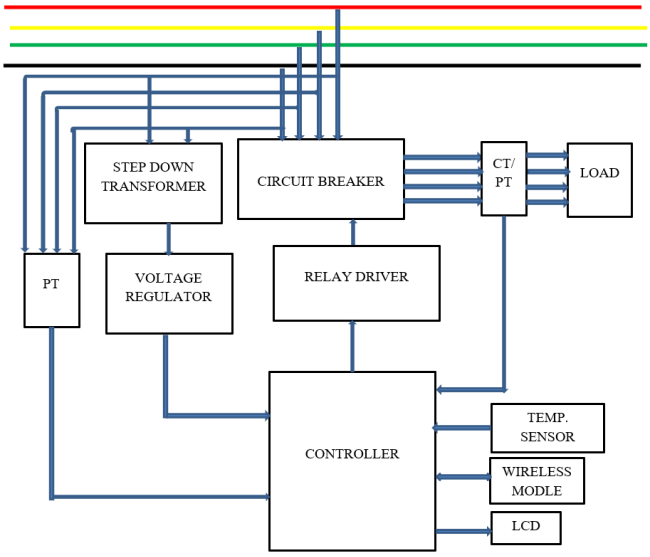


Fig.1:- Block Diagram

The monitoring system is connected to three phase supply. Microcontroller is the main component in the monitoring system which measures all the parameters. It needs a constant 5v DC supply for its working. For this purpose a single phase supply through any one phase out of the three phase supply is given to a step down transformer. Step down transformer reduces the voltage level of the supply and the reduced supply is given to the voltage regulator circuit. Voltage regulator circuit supplies constant 5v DC supply to the micro-controller. The microcontroller will monitor parameters like input output voltage, current flowing through the circuit breaker , making and breaking time and temperature of the circuit breaker.

One PT at the input end is used to lower the input voltage range up to the value which microcontroller is able to measure and another PT at the load side lowers the voltage range of output voltage up to measurable value to the microcontroller. For current measurement, a CT is connected towards the load sides which lowers the range of output current through the circuit breaker the value which is measurable to the microcontroller. A temperature sensor is placed on the circuit breaker to measure the temperature of the circuit breaker. For making and breaking time measurement the controller itself has a timer circuit which measures the time required for opening and closing the circuit breaker contacts.

Relay driver is connected between the microcontroller and circuit breaker and is used to trip the circuit breaker whenever a fault condition is occurred. Controller passes the tripping signal to the relay during fault and relay trips he circuit breaker. The real time status of the circuit breaker will be displayed on the LCD. Input and output voltage , Temperature, Current flowing through the circuit breaker and opening and closing time are the parameters are to be monitored.

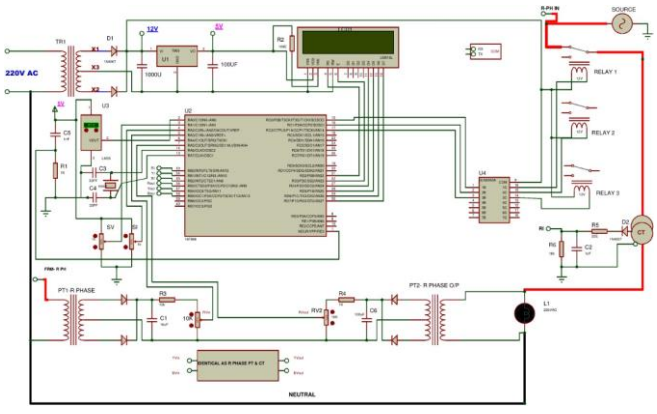


Fig.2:- Circuit Diagram

## III.PARAMETERS AND DATA ANALYSIS

From the data collected by the microcontroller and data displayed on the LCD , depending upon it the decision varies whether to trip the circuit breaker or not. The various parameters to be measured are Input and output voltage, Current flowing through circuit breaker, Temperature and Opening and Closing time.

- Input and output voltage:- If input output voltage measured by microcontroller through PTs are same then circuit breaker is considered healthy and if not then controller gives alarm indicating fault in circuit breaker.
- Current flowing through circuit breaker: The current measured by the microcontroller through CT is compared with a rated pre-set value. If both are same then the circuit breaker is healthy to use otherwise circuit breaker is considered faulty.
- Temperature: If the temperature exceeds certain rated value , the circuit breaker will trip.
- Opening and Closing time: The opening closing time measured by timer circuit of the microcontroller should be less than 300ms. If making and breaking time is more than 300ms then circuit breaker is considered faulty.

## IV. CONCLUSION

The proposed monitoring system comes up with accurate reliable results. As it is on-load monitoring system, it provides sequence of events, status of circuit breaker parameters in its working condition.

The modified time synchronization technique provides collection of data from multiple circuit breakers placed in switching sequence. This gives rise to a detailed review of the breakers to take appropriate decision.

A better understanding of condition and operating performance of each circuit breaker would be provided by the data collected by monitoring and analysis.

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