

Automatic CT Injection Kit

Tikone Abhishek¹, Shantanu Joshi², Rushikesh Shelke³, Vinay Joshi⁴ & Mr. Suresh G Galave (Assistant Professor), TCOER Pune

Department of Electrical Engineering, Trinity College of Engineering & Research, Pune 411048

ABSTRACT

A circuit breaker in a substation must operate flawlessly to keep the system healthy. It should trip within the minimum time when the relay detects any fault in the transmission system. This is possible when the C.T. ratio of the relay system, trip timing, and over-current setting of the respective circuit breaker is correct. If the relay overcurrent setting and C.T ratio don't match the need for circuit Breaker rating the circuit breaker might not operate on time and the system might get damaged due to overcurrent or any undetected fault. A circuit breaker operates correctly when C.T and relay settings are rightly set according to the level of the transmission system. To check this reliability of the C.T a test called C.T injection is carried out, where C.T is disconnected from the system and fed varying high current through dimmer stat, and the secondary of C.T is measured and calculated with the primary current. (eg: primary to secondary current ratio 500/1, 200/1). Other settings in the relay are peak current setting overcurrent setting trip time setting. (eg: Peak current setting: 100 A, over current setting:-150%, trip time setting :-10 ms). This setting may vary for different circuit Breakers in the different substations and different power level

INTRODUCTION

Automatic CT injection kit works in place of human workers, requires only an operator to signal the Arduino Uno kit wirelessly while changing the relay settings according to requirement and supervising the working of assembly, and finally deciding whether the circuit breaker trips on time according to outcome data and passing a judgment whether it is suitable for bringing in operation in bus bar system or to be repaired or replaced. This testing is called CT injection and our project "Automatic CT Injection Kit" focuses on safety from electrical accidents, reduction in time consumption, and reduction in per testing cost by automation of this testing process by introducing servomotors and microcontrollers to operate in place of human workers, each component is assigned a special work which is done by human labor

LITERATURE SURVEY

"Automatic CT injection kit" literature on this topic was not available on any informational platform, our assumption is that this concept is the original idea of our group members. The idea for this project came up when our group members went for circuit breaker testing at a substation while interning in an electrical services firm. The testing process is such that 3 members are needed 1 has to operate at the relay in the cabin, 1 has to operate at the dimmer stat, one has to keep changing the terminal combination, and one of them has to be in contact with the operator at the relay to ask for command whether to start next combination test or repeat the test for the same combination. The next thing is when the combination is to be changed or shorting is to be applied at the incoming side one has to climb the CT and do the task which is dangerous because if there is human error and dimmer is even lightly rotated in increasing manner it could give out high current certainly harming the other personnel doing the task. So, the idea was to reduce or say nullifying these risks at the work site. We started to gather the information about automation system and successfully gathered ideas to make it happen. To easily present the working of our project our group decided to create a prototype by replacing some equipment actual testing with some feasible alternatives. (note:- further the project procedure is explained in steps for well understanding of readers)

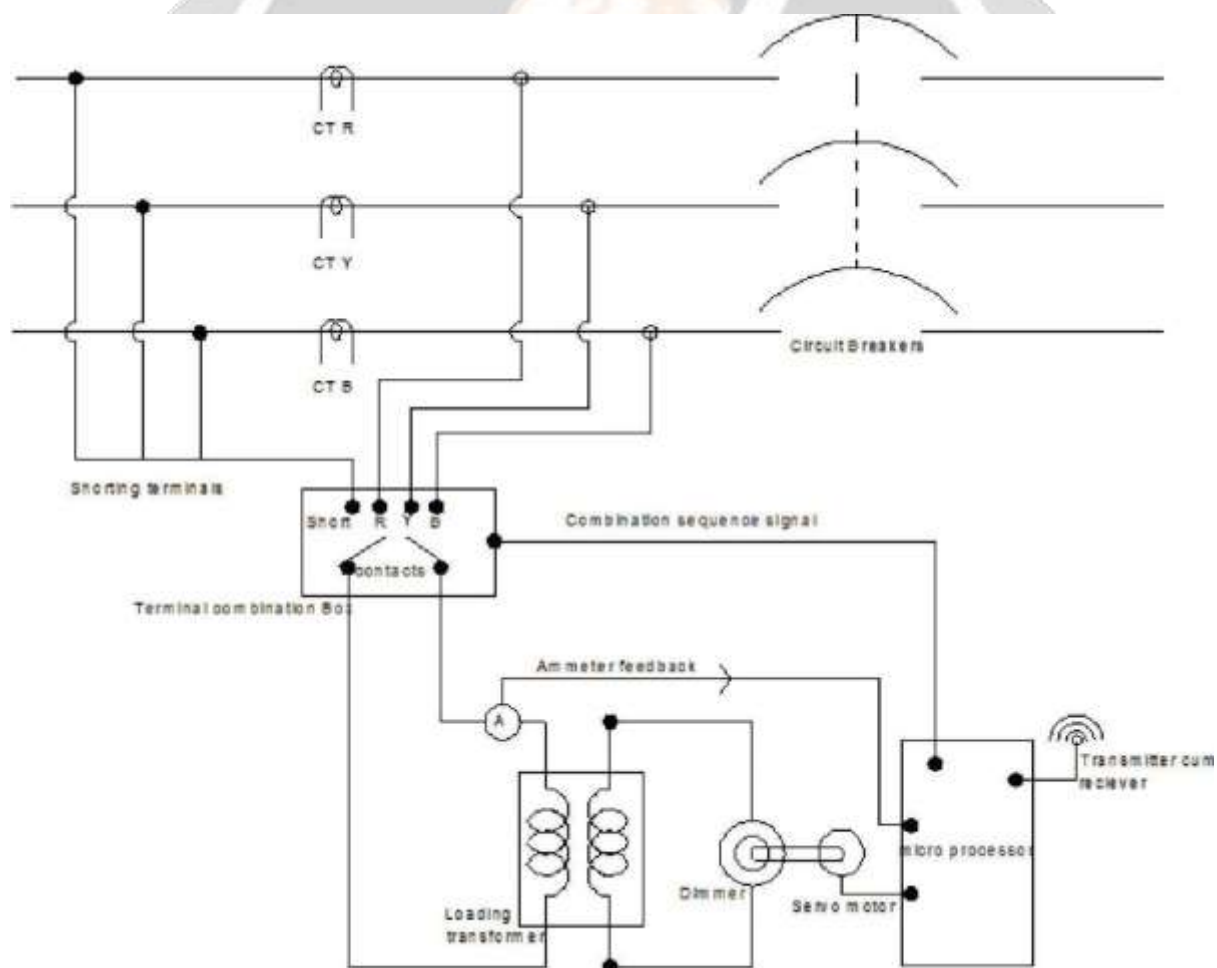


PROPOSED WORK

1. Operator is ready with the interface to start the testing at his will, firstly there is a reset button to bring the complete assembly to the initial position i.e. dimmer to zero position and contacts on S-R combination.

2. Next step is to copy forward the parameters of relay settings value in the interface to limit the current value through the testing kit (eg:- In interface image parameters like peak current and tripping time are to be written same as in relay setting — 100 ampere and 15 ms)
3. Split-core Ammeter reads the Ampere magnitude in terminals and gives feedback to Arduino kit, Arduino decides whether servo motor should stop or keep rotating so current would stop or keep increasing till peak current value.
4. Once the peak current value is reached servo motor stops for a few seconds to check if the circuit breaker can sustain peak current, and after a delay, it starts rotating again to reach the overcurrent value, when it reaches the overcurrent value the trip signal is activated and the circuit breaker is supposed to trip within minimum time respecting a tolerance band. If the circuit breaker is not tripped then there may be a fault in the relay of the circuit breaker, and needs resetting or repairing
5. This completes one cycle but if results are not satisfying then a repeat button is provided in the interface so the test can be repeated as many times. The next step is the Arduino commands terminal combination box to change contacts to the next combination and repeat the cycle.

PROPOSED ASSEMBLY LAYOUT



CONCLUSION

By building and operating on the prototype model successfully we concluded that with some additional budget it is possible to build a working model of the automatic CT Injection kit. To perform testing on a circuit breaker using the actual working model permission is needed from a substation incharge or a CB manufacturing company under the guidance of a registered electrical contractor firm.

REFERENCE

- 1) Fundamental of Switchgear and Protection
- J.S. Gupta.
- 2) CT Testing Method
<https://electrical-engineering-portal.com/testing-commissioning-current-transformer>.
- 3) Testing and Commisfioning of Electrical Equipment
Dr. Ramesh L. Chakrasali.
- 4) <https://electrical-engineering-portal.com/testing-commissioning-current-transformer#:~:text=This%20test%20is%20to%20ensure,and%20recorded%20for%20all%20cores>
- 5) <http://www.myprotectionguide.com/current-transformer-test.html>