Impact Factor (SJIF): 3.632

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

(Special Issue for ITECE 2016)

A Review of Radial FeederProtection Concept

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Abstract—*This paper represents the work done in the field of distribution system. Power distribution systems are the portion of electrical systems that connects consumers to the source of bulk power. Distribution System consists of several substationswhich includes one or more feeders. Radial feeder system consists of having only one path for power to flow from the source to each consumer. The protective systems of radial feeder are essential for the same. In this paper we understand various protective schemes to avoid malfunctioning of electromechanical relay). Through this paperwe are preparing operation of radial feeder protection as real substation environment. Through this protection concept, the students, in addition to getting familiar with the fundamentals of protection, learned how different protection schemes are wired and how they operate in a real power system.*

Keywords—Power Distribution (PD); Distribution System (DS); Substation (SS); Radialfeeder (RF);Electromechanical relay (EMR); Power system (PS);Radial RFP.

I. INTRODUCTION

In power Radial distribution, a set of electric conductors that originate at a primary distribution center and supply power to one or more secondary distribution centers, branch-circuit distribution centers, or a combination of these The demand of the electric power is increasing day by day. This necessitates the installation of transmission line reaching to all the areas of the state. Also the efficiency of transmission, when large bulk of power is to be transmitted at very long distance should be accurate. It needs high voltage and high voltage transmission line to be erected. The voltage of transmission has to be touched around 350 KV and still higher voltages of transmission are planned. The idea of national grid needs long ultrahigh voltage transmission line to be installed between different states of the nation. These Transmission line are required to be protected by comprehensive and quite complicated protective relays so that the power interruption is reduced to minimum with regard to the time of interruption and area affected by power interruption. The protective scheme must operate fast and selectively before the power system become unstable. This project is dedicated to protection scheme for radial feeder using directional over-current relay. [1]

Radial system the sub transmission substation supplies the primary distribution system feeders radiating from the substation bus.They feed the distribution transformer of the substations which step down the voltage to distribution voltage and supply various loads through distributors. This is also shown as radial distribution and is on the secondary distribution side.

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Application of radial feeder system are; Economy in large subs transmission circuits, several substations from each transmission circuit permits use of small, Simple multiple substations and short distribution feeders, the system takes maximum advantages of diversity factor between loads. The system permits transfer of load and thus allows maximum use of existing facilities. Addition of load in small increments is possible and so the system offers considerable freedom in the location of additional capacity. [2]

II. OPERATION AND CONTROL

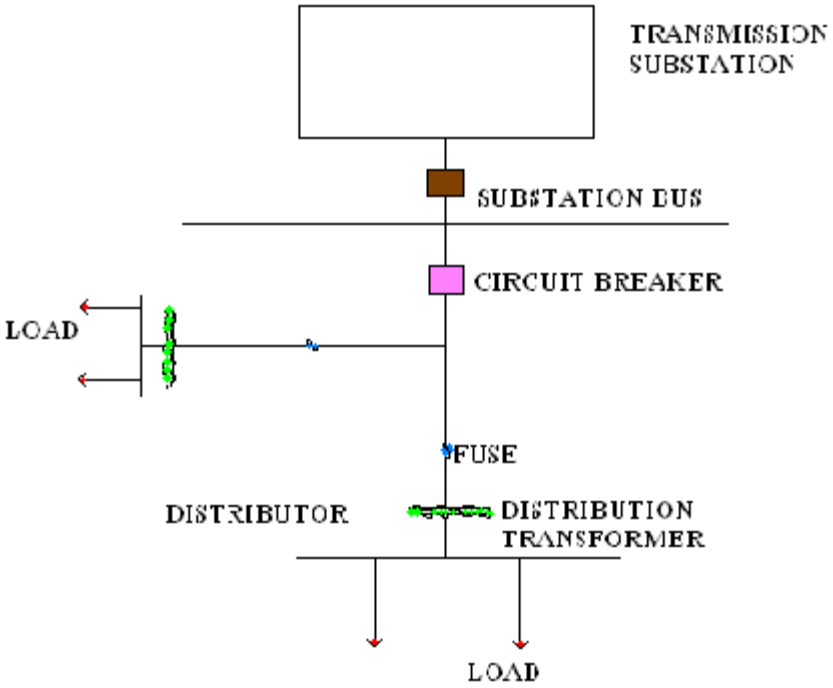

Figure 1: Radial Feeder Distribution System

A. Feeder Arrangements

A normally closed loop can be formed by tying the ends oftwo radial feeders together. Fig. 1 illustrates a schematic diagramof three possible normally closed-loop feeder arrangements. [3] This figure shows that all the closed-loop circuitshave two sources. The major difference between these three arrangementsis just the two sources. The closed-loop arrangementsare classified as follows.

Type I: The two feeders for forming a closed loop werefed by the same power transformer.

Type II: The two feeders for forming a closed loop werefed by two different transformers located in thesame substation. [4]

B. Configuration of Radial Feeder Protection

Transmission line protection presents many fundamental relaying considerations that apply to the protection of other types of system protection. Each electrical element will have problems unique to itself, but the concepts of reliability, selectivity, local and remote backup, zones of protection, coordination and speed which may be present in the protection of one or more other electrical apparatus are all present in the considerations surrounding transmission line protection. Transmission lines are also the links to adjacent lines or connected equipment; transmission line protection must be compatible with the protection of all of these other elements. This requires coordination of settings, operating times and characteristics.

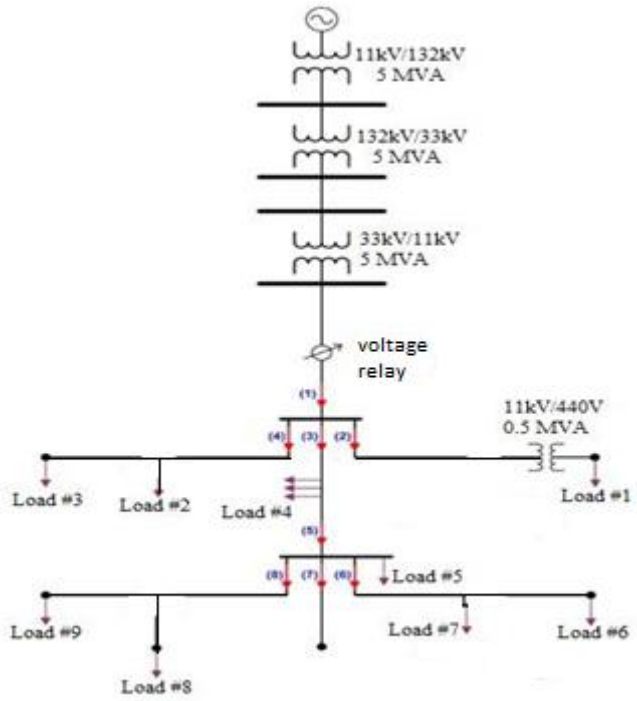

Fig. 2. Radial Feeder System-13 bus system

The purpose of power system protection is to detect faults or abnormal operating conditions and to initiate corrective action. Relays must be able to evaluate a wide variety of parameters to establish that corrective action is required. Obviously, a relay cannot prevent the fault. Its primary purpose is to detect the fault and take the necessary action to minimize the damage to the equipment or to the system. The most common parameters which reflect the presence of a fault are the voltages and currents at the terminals of the protected apparatus or at the appropriate zone boundaries. The fundamental problem in power system protection is to define the quantities that can differentiate between normal and abnormal conditions. This problem is compounded by the fact that ‘‘normal’’ in the present sense means outside the zone of protection. Electric power distribution is the portion of the power delivery infra structure that takes the electricity from the highly meshed, high-voltage transmission circuits and delivers it to customers. Primary distribution lines are “medium-voltage” circuits, normally thought of as 600 V to 33 kV. At a distribution substation, a substation transformer takes the incoming transmission level voltage (132 to 33 kV) and steps it down to several distribution primary circuits, which fan out from the substation. Close to each end user, a distribution transformer takes the primary-distribution voltage and steps it down to a low voltage secondary circuit (commonly 33 kV/11 V other utilization voltages are used as well). From the distribution transformer, the secondary distribution circuits connect to the end user where the connection is made at the service entrance. [5]

III. FUTURE SCOPE

When Distributed Generation is added to your circuit, a saving in initial cost of protective relaying, engineering design, installation time plus conservation of physical space for mounting equipment and periodic maintenance will be realized if a multifunction protection package with both current and voltage inputs is already in place for feeder protection. The additional protective elements available in these packages will solve the protection issues addressed, regardless of the size or number of DGs added to your circuit.

With the increasing loads, voltages and short-circuit duty of distribution substation feeders, distribution over current protection has become more important today Power systems that have evolved in the 20th century consist of generation plants, transmission facilities, distribution lines, and customer loads, all connected through complex electrical networks.

In the United States, electrical energy is generated and distributed by a combination of private and public utilities that operate in interconnected grids, commonly called power pools, for reliability and marketing. Elsewhere in the world, generation is tied to load through national or privatized grids. Either way, power flows according to electrical network theory.

Interconnection improves the reliability of each pool member utility because loss of generation is usually quickly made up from other utilities. However, interconnection also increases the complexity of power networks. Power pool reliability is a function of the reliability of the transmission in the individual members.

Protection security and dependability is significant in determining the reliability of electrical service for both individual utilities and the interconnected power system pool.

I. CONCLUSION

This Paper shows protection by reconfiguration of a radial distribution network. A 13-bus system was used for the purpose.

From this paper, we can protect in distribution system by three mostly affecting faults like over current, under current and earth fault with the use of the electromechanical relay. Also with the use of PSM (Plug Setting Multiplier) and TSM (Time Setting Multiplier), we can trip the relay by different types of timing situation and current.

By this paper, we can study and to understand the basics of terminology. In addition of this paper, the electromechanical relay has limited used purpose. But implement or used Numerical, Digital or Static relay, we occupied the fault very accurately and make healthy the distribution system.

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"A Review of Radial Feeder Protection Concept", International Journal of Advance Research in Engineering, Science & Technology (IJAREST) (Special Issue for ITECE 2016), e-ISSN: 2393-9877, print-ISSN: 2394-2444,2016