

# LOAD BALANCING SYSTEM USING PLC SCADA

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**Abstract**—Here we found a fault, faced by industries which led big production loss and also damage to critical equipments. The fault was due to lightning on line-1. Also DG Set was failed to restore power. To prevent this production loss or harm to critical equipments if supply could be restored with another line-2 which is established to feed another plant. This idea led us to design a bus coupler using PLC which supplies critical equipments of plant and also protect feeder side equipments to be damaged due to under voltage, single phasing, unbalanced currents by tripping faulty supply side and restoring supply from healthy line.

**Keywords**—PLC, DG Set, single phasing, unbalanced currents

## I. INTRODUCTION

Electrical power system consists of generator, transformers, transmission line, switch gears etc. In “Power system” there are mainly two type of fault is occur, first one is „Symmetrical fault” and second one is „Unsymmetrical fault”. “A three phase fault is called a Symmetrical fault”. In symmetrical fault all the three phases are short circuited. This can be with ground or without involving ground. A Symmetrical fault occurs rarely, but it is the most severe type of fault involving largest fault current. “The fault which makes the three phase system unbalanced is known as an Unsymmetrical fault” The most of the fault occur in the power system is Unsymmetrical fault type. An Unsymmetrical fault consists of Single line to ground (L - G) fault, Line to line (L - L) fault, Double line to ground (L - L - G) fault, and Open conductor fault. If the fault is occur in electrical power system it can damaged other feeder, commercial consumers home appliances and also it can damaged industries equipment. Now a days in industries they faced one of the large problem occur due to fault which make large production loss. Due to lightning stroke on 66 KV line of 66/11 KV switchyard the one plant was tripped. Remedy to this employed in plant is DG set which can restore power, but no remedy was provided if DG set is also fails to restore the same. In our project we have simulate tripping of main line, how power restore through DG set and also design and basic working principle of bus coupler system which is the remedy if DG set is failed. In our project we have employed PLC(programmable Logic Control) to control DG set and bus coupler with applying different logics to PLC monitors main feeder and operates DG set it also monitor healthy condition of DG set and in case of DG set failure operates bus coupler..

A. **INTRODUCTION OF BUS-COUPLER SYSTEM** Bus Coupler is nothing but a one type of switch. Which is connects two feeders to establish supply in case of failure of one of the feeder and run critical equipments connected to that feeder. These critical equipments may be motors, pumps, compressors etc. Now our aim is to maintain power supply of this plant and prevent the cut off or shutdown of plant with PLC logic. Bus coupler is a breaker between two feeders operated when PLC sense any abnormality in any of the feeder. If disconnects the feeder and by operating circuit breaker it restores power through another healthy feeder, maintaining the Integrity of the specifications.

## II. DISTRIBUTION WITH B.C.S

The solution we carried out that if logic is developed to continue monitoring main feeder condition and controlling DG set and also controlling bus coupler in case of failure of DG set. Plants critical equipments can be keep in working condition. } In industries if there is two or more plant then that another plant is feed from another feeder of 66/11KV if is in healthy condition then this feeder is used to feed critical equipments then our aim of preventing tripping of plant can be achieved.

### A. Bus Coupler System

Bus coupler is a one type of a switch which is connected between two feeders. Two PT (potential transformer) is connected with both feeders which sense the voltage of both feeder and give signal to PLC. PLC is connected with Circuit breaker of both the feeder and it gives signal to circuit breaker in faulty condition. Both the feeder is connected with a HV bus bar at load side, which is normally open in healthy condition. Bus bar is connected with PLC, when PLC send signal to bus bar it will close.

### B. Units

PT on faulty feeder will transmits the signal to PLC .Which if match to set value of minimum voltage for operation of bus coupler PLC will check for healthy condition of both the buses also check supply on other feeder. If this supply is healthy than it will generate a command to CB thus CB which is NO will be closed. But before it will open the breaker on faulty feeder side as shown in Fig 1.1:

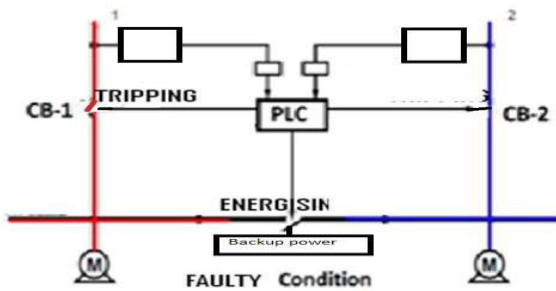


Fig 1.1.

### C. Basic Flow

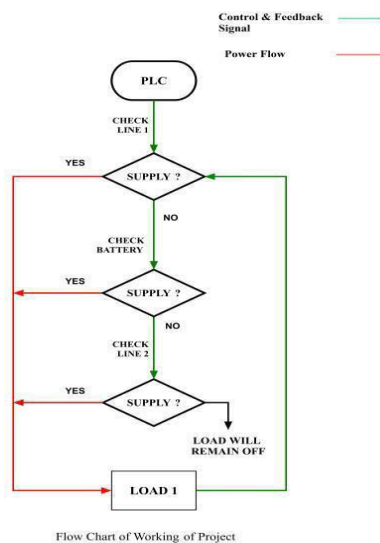


Fig 1.2.

- When a switch on the main supply. PLC checks two conditions. First check it, is there Incomer-1 healthy or not?
- If yes, Incomer-1 supplies power to loads and down comers of the plant.
- If any case, 1-fails to supply power to loads then by commanding and signalling process plc gives command to D.G set and by D.G., it supplies to load a temporary time period until the restore the power or healthy 1. Even if after some time lag, 1 is healthy then D.G set will be off.
- In rare cases, it happens in same time power of an interrupts as well as D.G set fails to stare in crucial condition. Due to these, power cut off is possible

in plant.

Thus large loss i.e. production, damages of equipments. To overcome these, by providing a bus System it can be possible to restore power supply to A-down comers from feeder-2.

Contacts of B.C.S will be closed after a contact of 1 is open and supply power from 2. and plc indicates signal also indicates the tripping signal of feeder1.

### D. INTRODUCTION TO PLC

A Programmable Logic Controller, or PLC, is more or less a small computer with a built-in operating system (OS). This OS is highly specialized to handle incoming events in real time, i.e. at the time of their occurrence. The PLC has input lines where sensors are connected to notify upon events (e.g. temperature above/below a certain level, liquid level reached, etc.), and it has output lines to signal any reaction to the incoming events (e.g. start an engine, open/close a valve).

The system is user programmable. It uses a language called "Relay Ladder" or RLL (Relay Ladder Logic).

The name of this language implies the fact that the control logic of the earlier days, which was built from relays, is being simulated..

A PLC overcomes these limitations; it is a machine controlled operation. It requires input voltage of 100-120 V AC or 200-240V AC or 24V DC. It can extend up to 96 I/O in up to 6 digital and/or analog I/O modules.

Control engineering has evolved over time.

The development of low cost computer has brought the most recent revolution, the Programmable Logic Controller (PLC). The advent of the PLC began in the 1970s, and has become the most common choice for manufacturing controls. PLCs have been gaining popularity on the factory floor and will probably remain predominant for some time to come.

### III. INTRODUCTION TO SCADA

SCADA is Supervisory Control and Data Acquisition. It is a software interface used to monitoring and controlling of industrial process. It is also called graphical representation of control system. It enables to view and interact with working of entire operation through graphically representation of process. SCADA enables the operator to remotely control the devices. It prevents the device from unauthorized operation. It informs the operator about the unnecessary events and undesired conditions. It logs all the operating entry all alarms and other information. In other words it keeps the record of all the events. The measurement and control system of SCADA has one master terminal unit (MTU) which could be called the brain of the system and one or more remote terminal units (RTU). The RTUs gather the data locally and send them to the MTU.

• SCADA enables engineers, supervisors, managers & operators to view & interact with the working of entire operations through the graphical representation of process.

• Software for graphical representation in SCADA. Wonder ware is known for its market leading HMI/SCADA software solutions - the most popular

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HMI/SCADA offerings in the world.

· Solutions built on technology benefit from a single, open and scalable software architecture that can connect to virtually any automation system, remote terminal unit (RTU), intelligent electronic device (IED), programmable logic controller (PLC), database, historian or business system in use

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#### A. IMPLEMENTATION OF LADDER DIAGRAM

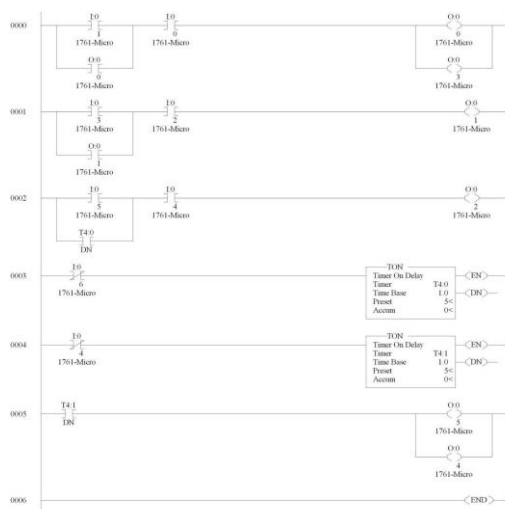


Fig 1.3

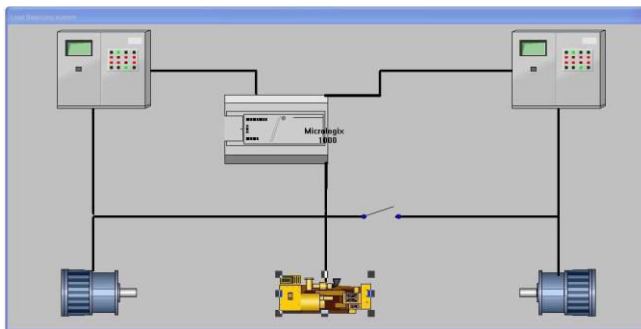


Fig 1.4 Scada Block Representation

#### B. Conclusion

We have completed the all work regarding our project and the outcome of the project is to maintain continues power supply, and prevent production loss. By implementation of this system in industries at a time of fault, production loss and damaged of equipment is avoided with help of fast response of PLC.

#### ACKNOWLEDGMENT

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