Automatic Phase Changer: A Review

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***Abstract*— Power stability in developing countries creates a need for automation of electrical power generation. This automation is required as the rate of power outage becomes predominantly high. Most industrial and commercial processes being dependent on power supply, if the processes of change-over are manual, serious time is not wasted but also creates devices or machine damage from human error during the change-over connections, which could bring massive losses. This change over switch box separate the source between the generator and public supply when there is power supply outage from public supply, someone must go and change the line to generator. Thus, when power supply is restored someone must put OFF the generator and then change the source line from generator to public supply.**

Keywords—power stability; public supply; power generation.

I. INTRODUCTION

If the system has to work without being interrupted then here is the solution. This system is designed to monitor the presence of supply to the three phases and to display condition of each phase on an LCD. Man power is involved in starting the generator and switching from the public supply to generator when the supply is restored. The importance attached to cases of operation and emergency treatment in hospitals in order to save life and air-ports by employing generator as fast as possible makes it important for the design and construction of an automatic change-over switch which would solve the problem a of the man power and danger likely to be encountered change-over. The electronic control handles the incoming public supply voltage and detects when the voltage drops below a level that electrical gadgets can function depending. The introduction of this concept is to change from national power supply to the generator as it was done manually which is time consuming. It had many limitations which are as follows:

• The changeover manually is affected by turning the metal gear.
• The sequence of the three-phase supply cannot be selected.
• Inability to select between the phases as in the single-phase consumer.

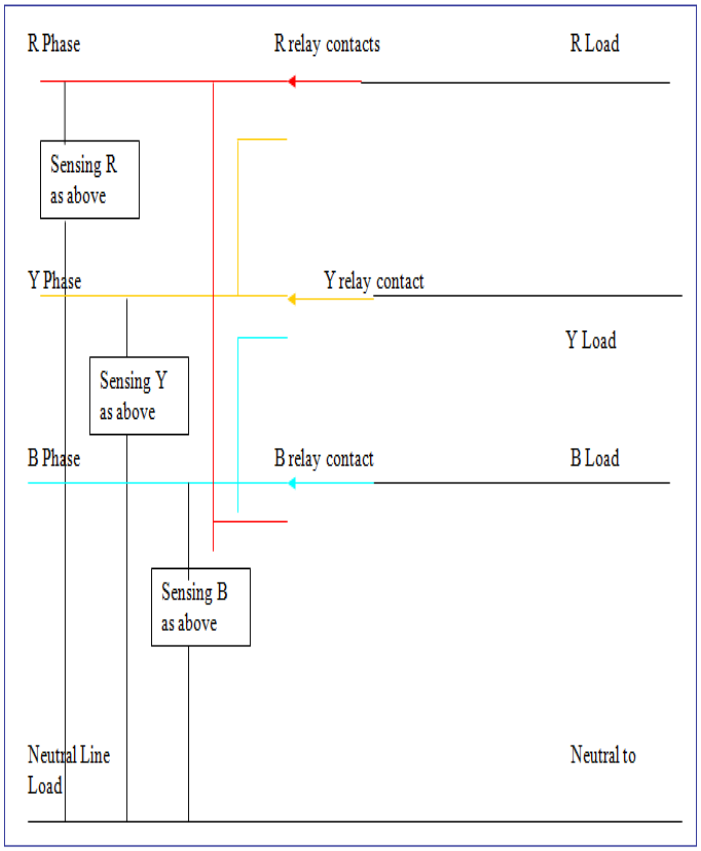

Fig. 1. Connection of R, Y, B phase

II. REQUIREMENTS OF PHASE CHANGER

The human relief stand-by which is designed only to monitor, operate, to maintain power. This operation is based on relays and optocouplers.
As of whole the duration of starting and closing the loads should be less than 5sec. Their complexity has increased to a great extent due to addition of new features to make the entire system automatic. Therefore, this automatic process has increased widely in many sectors such as industries, commercial, hospitals, banks and even in the modern residences.

III. METHODOLOGY

A. *Design Development and Considerations*

During the design of the phase selector, many conditions, cases, assumptions are considered which at end of the day give rise to the design of this phase selector.
Keeping this condition in the mind and knowing the fact that the coming on and off of the power supply from the power providers i.e. Nigeria, does not notify anyone before making their decision in this part of the world.

The conditions and questions considered are as follows:

- The power supply of 240V single-phase for the three-phase at a frequency of 50Hz was assumed.
- The load of 10kiloWatts (kW) was assumed.
- If the whole three-phase system comes out at once then how to select one phase out of them?

These above conditions should be considered during the design of phase selector control.

B. *Operation Description of the Circuit*

In three phase applications, if low voltage is available in any one or two phases and if the equipment should work on normal voltage, this circuit is useful to solve the problem. However, a proper rating fuse needs to be used in the input lines(R, Y, B) of each phase. The circuit provides correct lines voltage through relays from the other phase where correct voltage is available. Using this all the equipment can be operated even when correct voltage is available on any single phase in the building. The circuit is built using a transformer, comparator, transistor and relay. Three identical sets of this circuit, one each for three phases, are used. Let us now consider the working of the circuit connecting red coloured cable (call it R phase).

The voltage of R phase is stepped down by transformer X1 to deliver 12V, 300mA, which is rectified by the help of diode D1 and filtered using capacitor C1 to produce the operating voltage for the operational amplifier(IC1). The voltage at inverting pin 2 of operational amplifier IC1 is taken from the voltage divider circuit of resistor R1 and present resistor VR1.VR1 is used to set the reference voltage according to the requirement. The reference voltage at non-inverting pin 4 is fixed to 5.1V through zener diode ZD1. Till the supply voltage available in phase R is in the range of200V-230V, the voltage at inverting pin 2 of IC1 remains high i.e. more than reference voltage of 5.1V, and its output pin 6 also remains high. Thus, transistor T1 does not conduct, relay RL1 remains de-energized and R phase supplies power to load L1 via normally closed (N/C) contact of relay RL1. As soon as R phase voltage goes below 200V, the voltage at inverting pin 2 of IC1 goes below reference voltage of 5.1V, and its output goes low. Thus, transistors T1 conducts and relay RL1 energizes and load L1 is disconnected from phase R and connected to phase Y through relay RL2.

Similarly, the auto phase-change of the remaining two phases, via phase Y and phase B, can be explained. Switch S1 is mains power on/off switch.

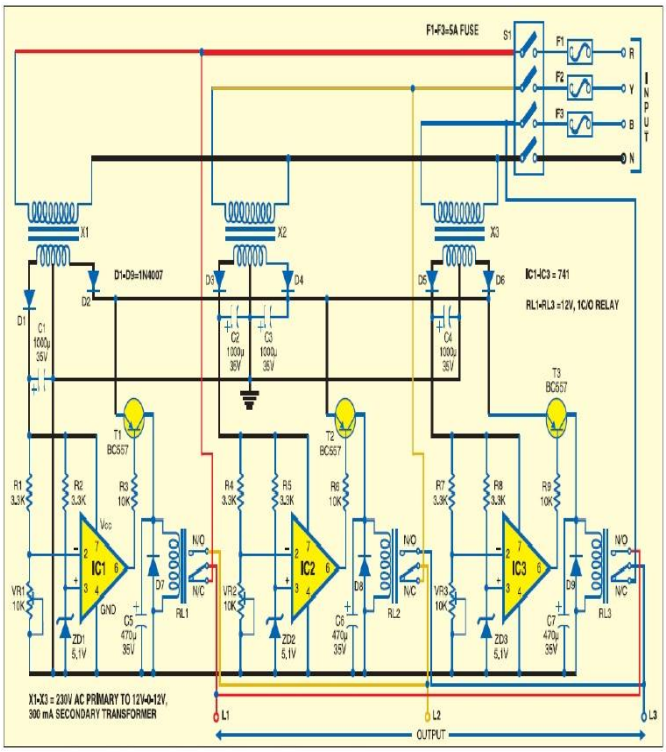

Fig.2 : Circuit Diagram of Automatic Phase Changer

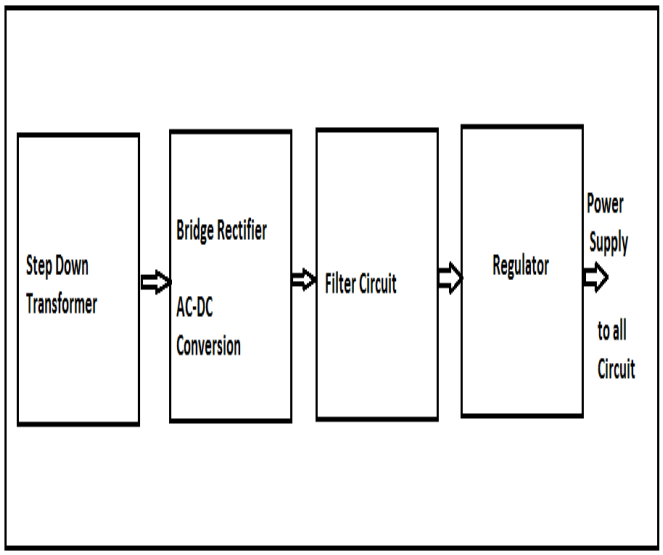

Fig.3: Block Diagram of Power Supply

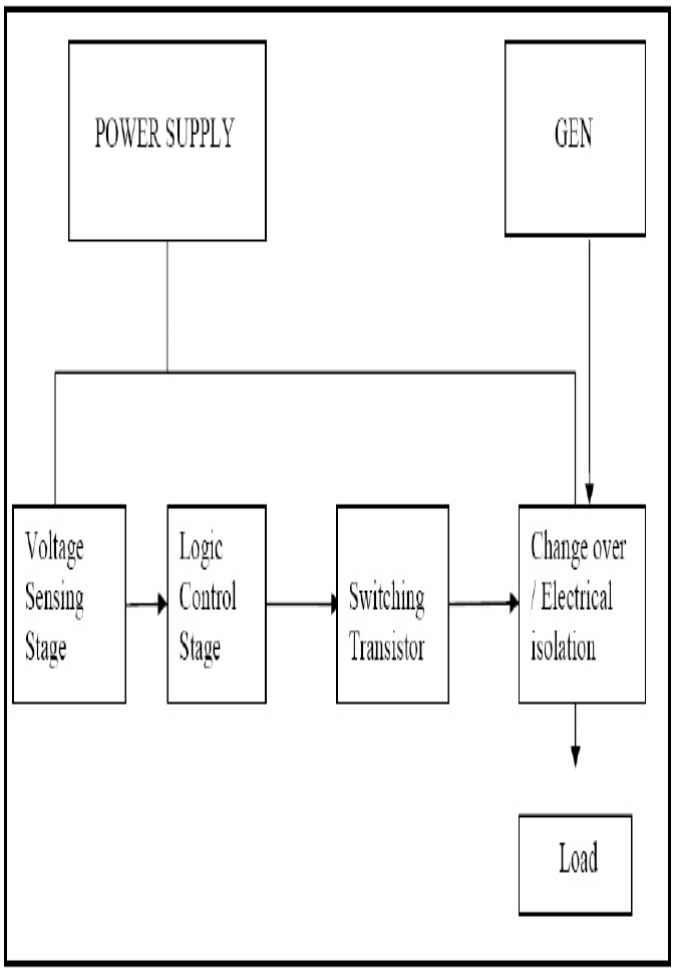

Fig 4.Block Diagram of Automatic Change over Switch.

C. Material selection

The components used for this design is based on the following:

- They are readily available.
- They are cheap.
- Fault detection leads to replacement
- Same voltage rating is required

However, with the selected components, they should be arranged in such a manner that at least one phase should be innovative and unique.

D. Advantages and Disadvantages

Following are the advantages:

- Better customer service
- Transparency in distribution
- Revenue collection efficiency
- Zero man made errors

For circuitry 230ac supply is needed.

E. Applications

- Residential Load,
- Commercial offices,
- Factories operating with 3 phase machineries,
- Hospitals and Banks.
- It automatically supplies voltage in case of fault or low voltage in up to 2 of the 3 incoming phases.

IV. FUTURE SCOPE

Automatic phase changer finds wide application in modern world. During earlier times, if there is a power failure in any of the three phase, we must manually switch to phase which is available. By implementing automatic phase changer, the phase is automatically shifted where the current voltage is available.

V. CONCLUSIONS

When the energy is restored, the manual change-over switched has to be done manually be it a change from generator to public supply or vice versa. The importance attached to cases of operation in hospitals and air-ports in order to save life from generator as fast as possible makes it important for the design and construction of an automatic change-over switch which would solve the problem a of the man power and danger likely to be encountered change-over. The electronic control monitors the incoming public supply voltage and detects when the voltage drops below a level that electrical gadgets can function depending upon utility. In three phase application if low voltage is available in any one phase and if we want our equipment to work on normal voltage, it will solve our problem. Therefore, it was designed to automatically select any one phase without affecting the load.

ACKNOWLEDGEMENT

The authors would like to acknowledge the Atharva College of Engineering, Mumbai for the support and the guidance of Ms. Karuna Nikum for this innovative project.

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