

An Automatic Phase Selector from any Available Three Phase Supply System

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Abstract - Power failure is a common problem. It affect the production of industry, construction work of new plants and buildings. It can be beat by using a backup power supply. But it is cost reliance and also time consuming as certain time is required to switch on the generator manually. It is often noticed that power interruption in distribution system is about 65% for single phase faults while other two phases are in normal condition. Thus, in any commercial or residential power supply system where all phases is available, an automatic phase selector system is required for regulated power to critical loads in the event of power failure in any phase. There is no demand of backup power supply in that case. Also there is no time required as the phase is changed automatically within a few seconds. The main aim of this paper is to present the real idea of an automatic phase switch for 230V to 240V AC. Although, there are most of the designs that can perform almost similar functions like, single phase change-over switches, two phase automatic transfer switch and three phase automatic change-over switch, but this model is about an automatic phase switchover which is designed for only three phase alternating current input power to single phase output applications.

Key Words: Automatic Phase selector, Power failure, Single phase load.

1. INTRODUCTION

Most companies, industrial, commercial and even domestic are dependent on public power supply which has erratic supply such as phase failure, phase imbalances or total power failure due to one or more technical problem in power generation, transmission or distribution. If all the three phases are available, there is need for automation of phase change during phase failure or total power failure in any of three phases in order to safe guard consumer appliances from epileptic power supply. In most cases, many manufacturing companies, whether they are domestic or industrial, which employ single phase equipment for its operation sometimes experience challenges during failures in power supply. Much time would be required in the process of manual change over. This means that time and the process required for the phase change may cause serious damages to machines and even the products. Hence, there is need for automatic phase switching system. A single phase public utility prepaid meter is operated with a single phase power supply unit. If there is a phase failure from the public utility power supply, the prepaid meter will stop working

until the phase is manually changed to an active phase. So a person needs to be present always to make the changes at any point in time.

To overcome this problem automatic system is require. The basic idea for the project is to provide uninterrupted supply to the single phase load. More than 70% of the fault are single phase faults. For complexes like hospitals, schools, where there is incoming 3phase supply if any of the phases, out of the 3 phases faces fault, then the supply will be automatically shifted to the next available phase from the 3phase supply. Most firms Industrial, commercial and domestic necessities are depending on public power supply which have erratic supply such as phase failure, phase imbalances or total power lapse due to frequent technical problems in power generation, transmission or distribution.

Hence, it is highly necessary to make automation in phase change during phase failure or total power failure so as to protect consumer appliances from epileptic supply of power. In most cases, many manufacturing firms, be it domestic or industrial, which employs single phase equipment for its operation might come across challenges during unbalance voltages, overloads and under-voltages in supply of power, where much time would be required in the process of manual change over. This means that time and the process needed for the phase change may cause serious damages to machines and even the products. Hence, there is need for automatic phase switching system and this system will provide a single phase correct voltage in the same power supply lines through relays from other phase where correct voltage is available. The system operates by stepping down 220 Volts AC to 12 Volts DC, rectified and fed into the microcontroller through the voltage divider circuit. The microcontroller compares the three phases and switches the relays through the transistor drives.

2. RELATED WORK

A changeover switch is designed to transfer a house (or business) electricity from the commercial power grid to a local generator when outage occurs. Also known as "transfer switches," they connect directly to the generator, commercial power supply or line, and the house. When the homeowner or business owner experiences a power outage, he or she can switch over to the generator via a changeover switch.

It is mostly used in domestic and industrial level, to auto switch power supply from Generator to Mains and vice-versa

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- Changeover Switches, also called Double Throw Switches, are available with OFF and without OFF. These are used to operate two different circuits, with different number of inputs and outputs. Changeover Switches without jumpers (potential free contacts) are used to connect two different circuits from two different sources, with two different operating voltages or any other incompatible lines. All contacts by default are “Break Before Make” (BBM) type to avoid overlapping of different circuits while overlapping changeover contacts. “Make Before Break” (MBB) type are offered against specific requirements.

The automatic change over switch has the following advantages:

1. It reduces its change over timing to the minimum due to its fast response to power outage.
2. It maintains high quality of service through its fast and prompt response. The automatic change-over switch can be used in any place where alternative power is needed to complement the main power supply. In this project, a generating set is used to represent the alternative power supply. The generator to be used with the device should have the following features.
3. The generator must have electrical ‘start and stop’ facility.
4. The generator’s battery has to be in good condition always.
5. Minimizes damages to lives/equipment since it has its own monitoring system and its switching requires no human contact with the switch, thus eliminating human error.

3. METHODOLOGY

According to the block diagram the three phase supply is given to the changeover mechanism. The Changeover mechanism consists of a conductor and a gear motor (12 V). The conductor is in touch with any of the three phases. The conductor is connected with the gear motor in such a way that if the motor moves the conductor can also move from one phase to another phase. The single phase output is first stepped down and rectified. After that it is fed to the selector

circuit. This circuit selects one active phase and sends the signal to the changeover mechanism which gives the single phase output connected to the load.

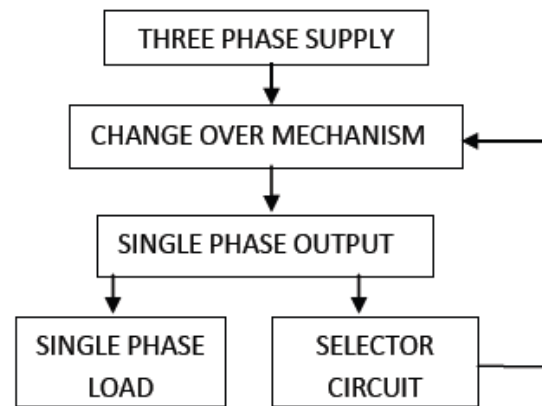


Fig. 1: Block Diagram of Automatic Phase Selector System

The automatic phase selection to drive single phase load from the available three phase supply is already done by making use of microcontroller and opto-coupler ICs where microcontroller senses the incoming voltage levels from the three phases if voltage in any one of the phase namely R, Y and B, a signal is transferred to the relay mechanism through opto-coupler to perform the switching to Y phase if R phase goes down and finally to the B phase if both of the phases (R and Y) falls below the standard voltage of 200 Volts generally. The function of opto-coupler is just to provide the electrical isolation of low voltage circuit from that of the high voltage. The same concept of phase selection can be implemented by making use of the comparator ICs and transistors to connect the load with source whose cost of energy production is least. The equipment used for building the circuit is also less than the circuit employing microcontrollers and opto-couplers.

1. Phase Input: It is the input source of the device. Contains three identical phase lines represented by (R, Y, B) respectively.
2. Power Supply: Provides necessary power supply to the circuit components. Uses rectifiers, filters and voltage regulators to ensure the input voltage between safe operative rang.
3. Current Sensing Circuit: Senses the output voltage of the loads. Feedback provided by the current transformer eliminates load unbalanced condition.
4. Relay Box: Depending upon the output of controllers the relay circuit get energized or de energized.
5. Controller Unit: The output of the controller unit drives the relay which distributes the load in a most economical way during phase and load unbalance.

An automatic power changeover switch has been designed and constructed. The prototype of the automatic power

changeover switch worked according to the specification and quite satisfactorily. The device is quite cheap, reliable and easy to operate. Whenever there is power outage, it reduces stress for manpower changeover.

3.1 Advantages

1. The time required of switching between the phases have been drastically reduced.
2. More automatic operation with the elimination of selector switch.
3. Reduced circuit size and easier implementation
4. The problem of unwanted rotation of gear motor does not arise.
5. The problem of sparking between the selector switch and the phase connection does not arise.
6. Highly sensitive
7. Works according to the phase availability
8. Low cost and reliable circuit
9. Complete elimination of manpower
10. Can handle heavy loads

3.2 Limitation

The rating of the distribution transformer have to be made higher so that it can support the load of other phases when single phase fault occurs in them. It can make the distribution process costly but with the advantage of providing uninterrupted power supply.

3.3 Application

Power failure or low voltage. Automatic Phase Changer automatically cuts supply during low voltage, thus it protects the equipment from the harmful effects of unhealthy low voltage. It can be used in

1. Residential building.
2. Commercial offices.
3. Factories operating with 1 phase machineries.
4. Hospitals/Banks/Institutions

Automatic phase changer finds huge application in the modern world .This device is more cost effective, reliable and of maintenance free.

4. CONCLUSION

It is concluded that we get the desired output from the auto phase selector. Automatically it is selecting the active phase when the connected phase is absent. The only problem is when all the three phases are not active, the motor continues to rotate and will not stop until we switch off the 12V supply of the motor manually. This problem can be overcome by implementing a timer circuit which will automatically switch off the power supply of the motor after a certain time. But our main objective is to select an active

phase automatically to save the time and without hampering the work. This objective is satisfied successfully.

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