

# Automatic Changeover Switch for Three Phase AC Motor

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**Abstract:** Power uninterrupted is a common problem. It hampers the production of industry, construction work of new plants and buildings. It can be overcome by using an alternative power supply such as a generator. But it is costly and also time consuming as certain time is required to switch on the auxiliary supply manually. It is often noticed that power interruption in distribution system is about 70% for three phase supply while other power supply are in normal condition. Thus, in any commercial or domestic power supply system where main supply is available, an automatic changeover switch for three phase system is required for uninterrupted power to critical loads in the event of power failure in main power supply. Also there is no time consumption as the auxiliary supply is changed automatically within a few seconds. The main aim of this paper is to present the real idea of an automatic changeover switch for 220V to 240V alternating current. Although, there are many designs that can perform almost similar functions like, three phase change-over switches, two phase automatic transfer switch and three phase automatic change-over switch, but this model is about an automatic changeover switch which is designed for only three phase ac input power to three phase output applications.

**Keywords:** Automatic Changeover system, Carrying three phase supply, High efficiency, Relays, Resistance, Diode, LED.

## I. INTRODUCTION

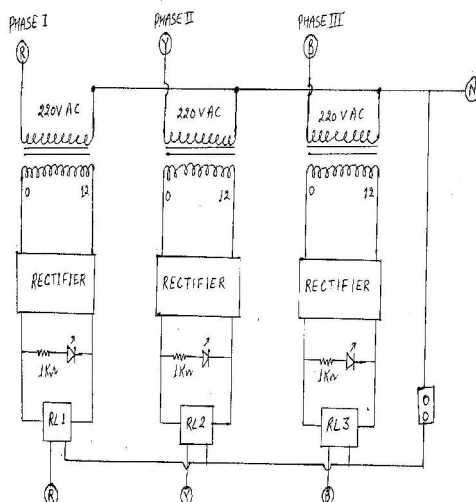
In three-phase applications, if main supply is not available in the system & you want your equipment to work on normal voltage, this circuit will solve your problem. However, a proper fuse needs to be used in the input lines (R, Y & B) of each phase. The circuit provides right voltage in the same power supply lines through relays from the other supply where correct voltage is available. Using it you can operate all your ac motor even when main power or auxiliary power supply is available on a three phase supply. Most companies, industrial, commercial and even domestic are dependent on public power supply which has unstable supply such as phase imbalances or total power failure due to more technical problem in power generation, transmission or distributions. If main power supply are available, there is need for automation of changeover during phase failure or total power failures in any of three phases in order to safe guard consumer appliances from epileptic power supply.

In most of the cases, many manufacturing companies, whether they are industrial, which employ three phase equipment for its operation sometimes experience challenges during failures in power supply. Much time consume would be required in the process of manual change over. It means that time and the process required for the main supply to auxiliary supply change may cause serious damages to machines and even the products. Hence, there is need for automatic changeover switching system. A Three phase public utility prepaid meter is operated with a three phase power supply unit. A person needs to be present always to make the changes at any time. To overcome this problem automatic system is required.

Automatic changeover switch is an indiscernible part of the process of power generation, allowing smooth and instant transfer of electric current between multiple sources and load. The function of the automatic change over switch is to the incoming public supply voltage and detect when the voltage or main supply is absent that electrical/electronic appliances can function depending on the utility supply. The automatic change over switch the auxiliary supply of the using a changeover circuit and if the main power supply are not available, the system changes over from public supply to generator. When the auxiliary power supply is in operation, the automatic changeover switch prevents any feedback current to the load. It ensures that the different power supply are synchronized before the load is transferred to them. The automatic changeover switch senses when there is interruption of mains supply remains absent. The basic principle of the automatic change-over switch is such that it links the load and mains supply or the alternative supply together. This enables the use of

either the mains supply or an alternative source when there is outage on the mains source which can either be a three phase or a single phase.

## II. CIRCUIT DIAGRAM



## III. OPERATION

Automatic changeover switch is applicable for a three phase load. When a three phase supply is absent to this system, it compares the voltages of three phase appears across the output. As a result an auxiliary supply is automatically selected among the three phases (R,Y,B) when one of those phases is absent. That active supply is connected to the load. Automatic changeover consists of a selector circuit & a change over mechanism. Automatic changeover circuit compares the voltage of main supply. The change over mechanism consists of a transformer and one relay. When any of the supply is absent, it gives the signal to the change over mechanism through electromagnetic relay. The three phase ac motor starts to rotate until the conductor reaches to the next supply. As per the circuit diagram three phase supply is given to the change over mechanism and the single phase output is taken out for supplying a three phase load. One part of this output is step down by a 220V/12V step down transformer. After that it is bridge rectifier and filtered by capacitor. After filtration the signal is given to pin no 3, pin no 3 is already connected to a 12V DC supply. If the connected supply is active, the output of op-amp is zero. But whenever that main supply is absent the output of op-amp become 1. The output significant is upto here to an electromagnetic relay. The relay coil become energised and the connection changes from N/C to N/O. If the next auxiliary supply is active, the output of the op-amp becomes 0 again and the load can get supply from that the carbon brush is in contact with that available supply. But in case if that main supply is absent, the rotor shaft with the carbon brush again reaches to the next auxiliary supply. In this way we can get three phase supply continuously in spite of absence of any supply.

## IV. DESIGN METHODOLOGY

1. Paper design of the circuit
2. Obtaining all the components required to make the circuit of the automatic transfer switch
3. The three 220/24v, 1A transformers, 1000μF capacitors, bridge rectifiers, variable resistors are used.
4. LEDS are used as indicators for the three phases as well as for the generator.

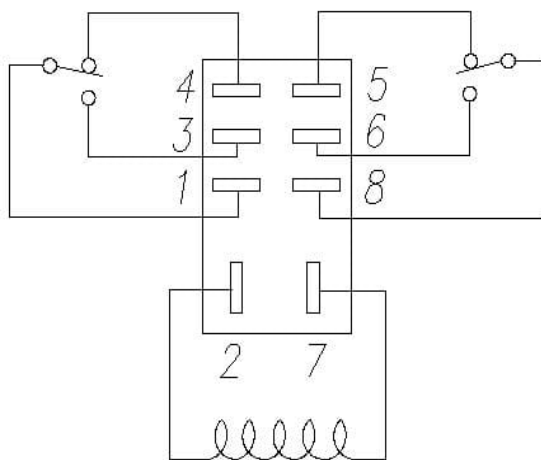
## V. WORKING OF RELAY

It works on the principle of an electromagnetic attraction. When the relay senses the fault current, it energizes the electromagnetic field which produces the temporary magnetic field.

The magnetic field movement to the relay armature for opening or closing the connections. The small power relay has only one contacts, and the high power relay has two contacts for opening the switch.



### 5.1. Circuit of Relay



### VI. LIST OF EQUIPMENT'S

COMPONENTES	RATING	UNIT
MCB	20AMP,220V	6
RELAY(koyon 0122)	50AMP,24V	3
INDICATING LIGHT	220V	3
DIODES	1N4007	12
CONNECTING WIRES	2MM	2MTR
CAPACITOR	25V 1000UF	3
RELAY BASE	--	3
TRANSFORMER	12-0-12V 1AMP	3
AC MOTOR	440V 5HP	1

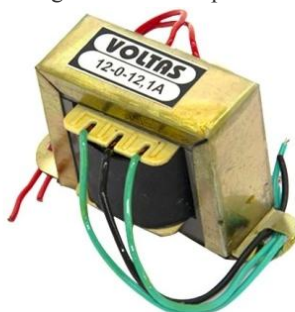
### 6.1 Mechanical Equipment's

Equipment's	Specification
Wooden Board	35*70 cm

### VII. TRANSFORMER

A transformer is a device's that transfers electric energy from one alternating-current circuit to one, either increasing or reducing the voltage. We are using 12-0-12 centre tap step up transformer for current lamp.

The transformer is a basically a voltage control device that is used far in the distribution and transmission of alternating current power. The idea of a transformer was first discussed by Michael Faraday in the year 1831 and was carried forward by many other prominent scientific scholars. The general purpose of using transformers was to maintain balance between the electricity that was generated at very high voltages and consumption which was done at very low voltages.



### 7.1 Calculations

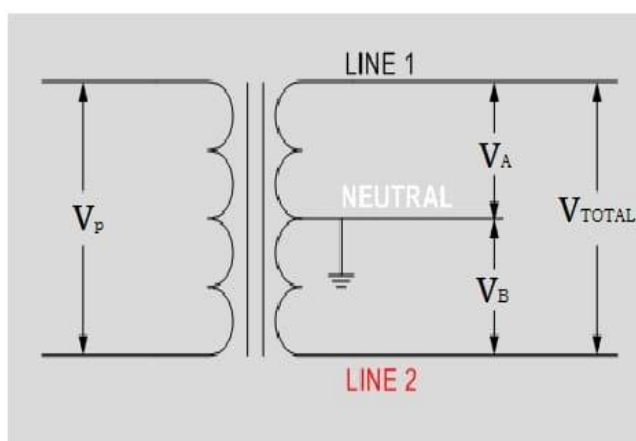
Primary turns = 1748

Thickness = 34 SWG (0.23mm)

Secondary turns =  $1748/220 = 7.94$  turn/volt = 8 approx

For 12 volts ,  $8 \times 12 = 96$  turns

For 24 volts ,  $8 \times 24 = 192$  turns



### VIII. RESULT

When the main supply is shut down, it automatically transfer main supply to auxiliary supply successfully. The performance evaluation of the automatic changeover switch has shown that the switch is more reliable than manual change over switches.



**Figure:** Automatic Changeover Switch

### IX. CONCLUSION

Basis on the test results, the whole system performed according to the designed aim and objectives. The automatic changeover switch circuit was able to switch between the two power supply sources according to the set fundamentality and also automatically switches on the auxiliary supply and switches on. The switch was able to power up a standby generator and perform the load switching between the mains public supply and the standby generator in a split second action to eliminate noticeable outage in power. Therefore it could be employed when two different sources of power are supply to an installation in which one of them should be connected to the installation at a given time. Its ability to change over in the twinkling of an eye is also commendable, thus eliminating the delay and human error associated with manual change over switches.

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