

To study an automatic power phase selector

Design of an automatic power phase selector

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Abstract—Phase selector is a mechanism used in alternating or switching between power phases with respect to the availability of power on any of the phases. Over the periods, there has been frequent phase failure in the power phases resulting to manual switching of the fuse from one phase to the other. However, this study focuses on the design of a phase selector using automatic switching mechanism. In the course of this design, several tests were carried out such as the continuity test of contactor and relay coils to establish low resistance, continuity test on the contacts of the materials used to ensure free flow of current, conductivity of the wires and the whole system was also imitation.

1. INTRODUCTION:-

Electricity acts as strength of any economy in the world and for the developing nation power instability and high pressure over the natural properties available due to the overpopulation poses a greater threat to their development. So there is necessity for automation of electric power generated along with availability of alternative sources of energy for the purpose of backup to the utility supply. The automatic phase selection to drive single phase load from the available three phase supply is already done by creation use of relay. The same concept of phase selection can be implemented by creation use of the comparator ICs and transistors to connect the load with source whose cost of energy production is least. Power failure or outage has been a major challenge to national development as economic activities are at most times brought to standstill. As such, a changeover switch or automatic changeover is required to change from one source to another (Generator), which is needed to be automatic. The human relief stand-by switch is designed simply to monitor, operate and maintain power, as its principle of operation is based on combine operations of the relays, contactors and overload coil. In the whole, the duration of starting and closing of the loads to the contactor should not be more than 5 sec. Their complexity has increased as lots of features are added to its intelligence expected at creation it automated process, be it in industries, commercial complexes, hospitals, hotels or even modern residences.

2. PHASE SHIFTERS & SELECTOR:-

Microwave Phase Shifters have many applications in various equipment such as phase discriminators beam forming networks, power dividers, linearization of power amplifiers and phase array antennas. Relation between transmission constant, phase Shift, delay and Wavelength. In a transmission line the Transmission Constant is a complex number having two parts the real portion is the attenuation constant, the imaginary portion is called the phase constant. The attenuation constant determines the way a signal is reduced in amplitude as it propagates down the line, while the phase constant shows the difference in phase between the voltage at the sending end of the line and at a distance. The phase constant the phase shift of the voltage at a point located at a distance along a transmission line with respect to the sending voltage (or current). Mark the distance between successive points on the waveform (such as zero crossings). The wavelength λ is the distance x required to make the phase angle βx increase by 2π radians. $\lambda = 2\pi / \beta$ The relation between the phase shift and the time delay Group delay is the average delay time that a specified narrow range of frequencies capability when passing through a circuit. Group delay is proportional to the rate of phase shift at each frequency of attention.

3. CIRCUIT DESCRIPTION:-

During the design of the phase selector, a lot of considerations, conditions and cases were considered which at the end give rise to the design of phase selector control. Having these conditions in mind and also knowing the fact that the coming up and going off of power supply from power providers, does not notify anyone before making their decision in this part of the down, low or no output from the phase selector. The power supply of 240 volts single phase for the three phases at a frequency of 50 HZ was assumed. The load of 10kilowatts (kW) was assumed. The above conditions and questions were considered during the design of the phase selector control. Having cited the truth table, the "X" is the output of all the conditions in a particular fig. with "1" meaning on, up or high while "0" means off, down, low or no output from the phase selector.

Operational Description of the Circuit As stated, the operation of the system is literally guided as in fig. with eight possible conditions, based on these possible conditions, the operations of the system are summarized into four major stages.

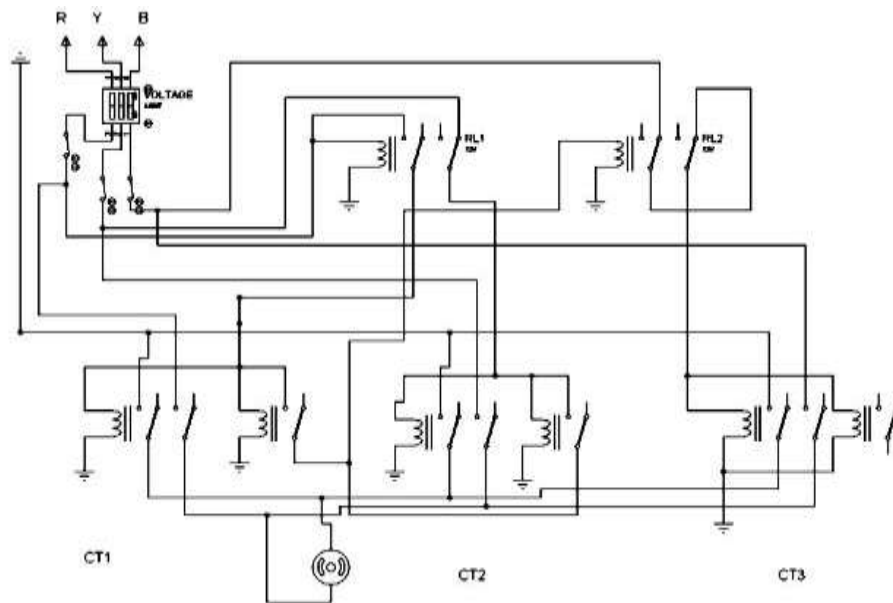


Figure: Designed Circuit diagram

Stage 1: From the fig. when there is voltage and power in the three phases, the power will standby at the line side of the contactors, through the connections of the design system, the Red phase will energize the relay one (R1), thereby powering the contactor CT1 and at the same time the Yellow phase will be disconnected by virtue of energizing the relay one (R1), thereby stopping the yellow phase from energizing contactor CT2. Also at the same time having energized contactor CT1, Y2 from CT1 will then energize relay two (R2), thereby disconnecting the Blue phase and stopping it from energizing contactor CT3. At the end CT1 will be energized and send as an output phase to the changeover system not minding the fact that other phases are available.

Stage 2: When there is no live in the RED phase, the case changes. Now the yellow phase through the normally closed (NC) contacts of the Relay one (R1) energizes the CT2 and at the same time Y2 through the normally open (NO) contact of contactor CT2 energizes the relay two (R2) and that result to separating the Blue phase and as such allowing only the yellow phase to be supplied as an output to the changeover system. The same stage is applicable to condition 6, provided the Red phase is out and the yellow phase is present.

Stage 3: At this situation when other phases are off with only the Blue phase present, the case changes. The Blue phase through the normally close (NC) contacts of Relay two (R2) then supplies the CT3, but it will only went off if the Red phase or the Yellow phase comes up, if such case happened then the previous stage will be repeated.

Stage 4: At this condition no output will be seen at the contactors outputs terminal, hence no supply from the output terminal. In this case the automatic changeover then triggers the Generator set to start.

4. Concept of Circuit Diagram:-

4.1 Phase Shifters

Phase Shifters are devices, in which the phase of an electromagnetic wave of a given frequency can be shifted when propagating through a transmission line. In many fields of electronics, it is often necessary to change the phase of signals. Radio Frequency and microwave Phase Shifters have many applications in various equipment such as phase discriminators, beam forming networks, power dividers, linearization of power amplifiers and phase array antennas. Relation between Propagation Constant, Phase Shift, Delay, and Wavelength. In a transmission line the Propagation Constant is a complex number having two parts the real portion is the attenuation constant, the imaginary portion is called the phase constant.

4.2 Contactors

Contactors are useful in commercial and industrial applications, particularly for controlling large lighting loads and motors. One of their hallmarks is reliability. However, like any other device, they are not infallible. In most cases, the contactor does not simply wear out from normal use. Usually, the reason for contactor failure is misapplication. That's why you need to understand the basics of contactors. When someone uses a lighting contactor in a motor application that's misapplication. The same is true when someone uses a "normal operation" motor contactor for motor jogging duty. Contactors have specific designs for specific purposes.

4.3 Relay

Relays are the primary protection as well as switching devices in most of the control processes or equipment regardless of whether they are electronic or electromechanical. All the relays respond to one or more electrical quantities like voltage or current such that they open or close the contacts or circuits. A relay is a switching device as it works to isolate or change the state of an electric circuit from one state to another.

4.4 Electromagnetic Relays

Classification or the types of relays depend on the function for which they are used. Some of the categories include protective, reclosing, regulating, auxiliary and monitoring relays. Protective relays continuously monitor these parameters: voltage, current, and power; and, if these parameters violate from the set limits, the protective relays generate an alarm or isolate that particular circuit. These types of relays are used to protect equipment like motors, generators, and transformers, and so on. Some of these are induction type over current relays, distance relays, differential relays, etc.

5. CONCLUSION:-

The advantage of selecting between phases for their power consumption without really doing the changing manually, as have been the normal practice. It saves the stress and time it also provides better protection as compared to the manual practice because of the use of overload is the changeover system. But our main objective is to select a phase automatically to save the time and without hampering the work. These chapters include the specific details of data generated and results obtained. Based on the analysis and interpretation data and results major findings should be pointed out unambiguously. Relay Relays are the primary protection as well as switching devices in most of the control processes or equipment regardless of whether they are electronic or electromechanical. All the relays respond to one or more electrical quantities like voltage or current such that they open or close the contacts or circuits. A relay is a switching device as it works to isolate or change the state of an electric circuit from one state to another.

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