



AUTOMATIC PHASE SELECTOR

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ABSTRACT

In many cases we have three phase supply where only single phase is used to run the equipment such as load of Operation Theater in hospitals, commercial Internet servers. In some cases if phase supply voltage is low in any of the load driving phase and if you wish to run all the equipment in proper way as required then you must be sure about the continues and normal single phase electrical supply. By the use of proper TPDT relay logic we can instantly select proper available phase and avoid the short circuit condition between the different phases. However fuse of proper rating should be used in three phase's i.e. inputs lines. At that time correct voltage must be available for driving the load. in the building, to run all the equipment on the single phase we have to shift low voltage phase to the correct available phase voltage by using electrical component such as transformer, under voltage, overvoltage protection and TPDT relay.

Keywords— under Voltage, overvoltage, relay.

I. INTRODUCTION

Generally distribution of electricity use in 3 phases 4-wire system. For domestic, commercial purpose single phases mandatory to provide uninterrupted power supply, in these single phase supply is used out of three phase supply. In developing countries power instability phase failure has posed serious problem to their economic development. I.e. to say, where there is an erratic power supply, there is no development. This is because one of the factors that boost economic of country is the availability of steady and power supply. However industrial, commercial and even domestic are dependent on public power supply such as phase failure, total power failure due to one or more technical problem in power generation, transmission, distribution. Hence there is need for automatic phase change during phase failure in order to safe consumer appliances from unbalanced power supply. In the above topic we are going to propose the automatic phase selector by TPDT relay. In this topic load is shifted on different phases according to availability of phase. For that TPDT relay is used to develop phase shifter or phase selector which select the phase according to availability of phase and avoid the short circuiting of three phase available here that provide under voltage protection. The system operates by step down 220/12Volts, rectify and feed to the operational amplifiers through voltage divider circuits. The operational amplifiers works for the under voltage and over voltage protection and switch the relay through transistor driver. The automatic phase changer is made from some electronics components in which op-amp, diodes TPDT relays and fuses are include. Result obtained during test shows that whenever there is failure of phase, under voltage condition then the load gates shifted on another phase instantly.

II. LITERATURE SURVEY

2.1 Automation Requirement:

This topic is covered from journal of research and development and ameliorating power supply problem in Nigeria authored by A.A and Yusuf from that book automation is required in Nigeria because there is an electric supply and these also provide journal R&D department hence there is necessity for automation. These also covered from international journal of engineering and technology. The next system was proposed by Mariuz Malinowski named as “Simple Direct Power Control Of Three Phase PWM Rectifier Using Space Vector Modulation(DPC-SVM) in April 2004 but due to variable switching frequency and violation in polarity there was a need to design such a system which would overcome all of above system drawback.

2.2 Electronic Components:

This topic is covered from power electronics authored by M.D.Singh and K. B. Kahnchandani from that text book covered the function and use of CAPACITORS, RESISTORS, TRANSISTERS, VOLTAGE REGULATOR IC-7812, LED etc. these also covered from principle of Electronics.Newdelhi.India:S.Chand and Company-Ltdmoh.Ajmal P.

2.3 Electrical Components:

The information for electrical component used in this topic is taken from V. K. Mehta, B.L.Thereja and Use of Transformer, Relay, Fuse Etc These Also Covered Fromshepherdj. Mortan

III. METHODOLOGY

3.1 BASIC IDEA:

In this topic the load is shifted on different phase according to phase selector which select the phase according to availability of phase and avoid the short circuiting of three phase available by using transformer , rectifier , voltage regulator IC-7812 ,Operational Amplifier LM-324, Zener Diode , Resistors And Relay. Hence for convenience indicating lights are provided which indicate which phase is running in load

3.2 STAGE OF IMPLIMENTATION:

The automatic phase changer design was implemented in three units are as given below

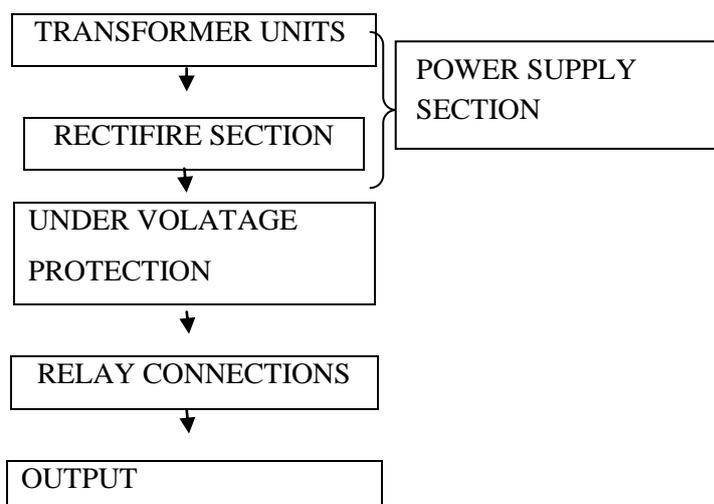


Figure 1



3.3 Design Development and Considerations

During the design of the phase selector, we have provided a lot of over voltage and under voltage protection for those considerations, conditions and cases where considered which gives the accurate and healthy phase for the load. It is shown by following Truth table.

S/N	1	2	3	4	5	6	7	8
R phase	1	0	0	1	1	0	1	0
Y phase	1	1	0	0	0	1	1	0
B phase	1	1	1	1	0	0	0	0
O/p	1	1	1	1	1	1	1	0

Table 1

In 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 world. As such the conditions and questions considered are as follows; The power supply of 240 volts single phase for the Three phases at a frequency of 50 HZ was assumed.

1. If load of 5 kW was assumed.
2. When the whole three phase supply is present then from above table the output is 1 i.e. Healthy phase.
3. When two out of the three phase are present then from above table the output is 1 i.e. Healthy phase.
4. The relay logic is made such that more than one phase comes in contact with each other

The above conditions and output of that condition were considered during the design of the phase selector control. Having from the given truth table, the “X” is the output of all the conditions which is occur in system which is given in a particular row of table, i.e. “1” meaning on, while “0” means off, or no output from the phase selector.

IV. PROBLEM STATEMENT

4.1 SELECTION

In our day to day life we have to modify the system so that it reduces the problem in person life. Now in modern science and technology there was one thing in mind that to develop a system which can be applied for several applications in our daily life. So our concept of automatic phase changer was selected, which is used in 3 phase application. If there is low voltage in any two phase and if we want to work all equipment in such condition i.e. in normal voltage.

4.2 BLOCK DIAGRAM

In this topic the load is shifted on different phase according to phase selector which select three phase according to availability of phase and avoid the short circuiting of 3 phase available. By using transformer, rectifier, voltage regulator IC-7812, operational amplifier LM-324, zener diode, resistor and relay.

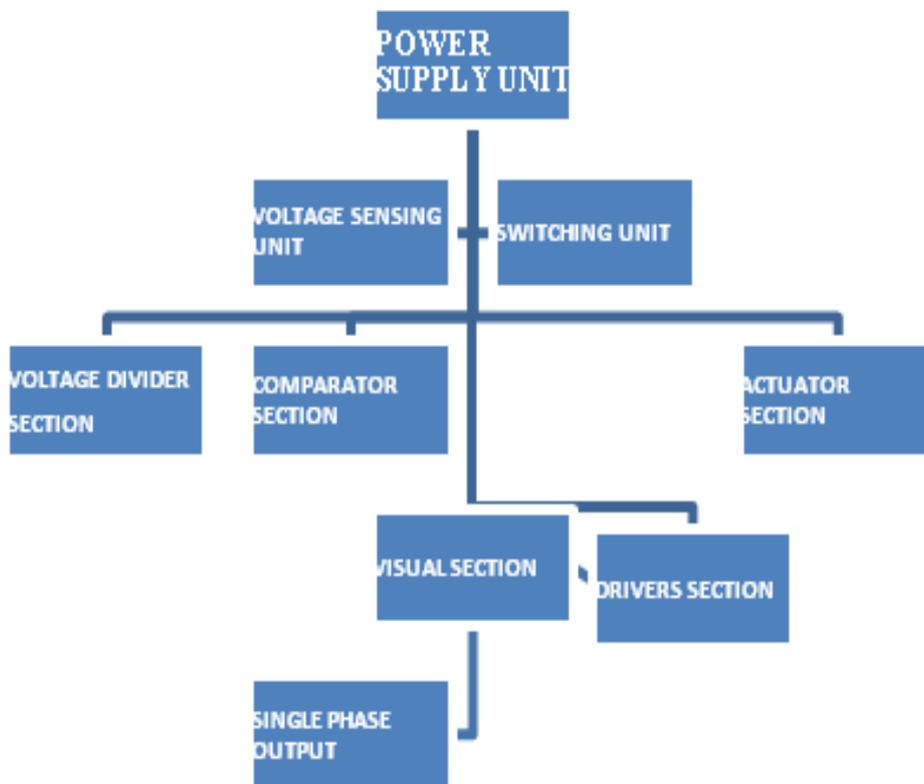


Figure 2

V. WORKING

This circuit protects appliances from over and under voltage operational amplifier IC-LM324 IS used as a comparator. IC LM-324 consists of 4 operational amplifiers from which only two amplifier are use in the circuit. The un regulated power supply is connected to the series combination of resistor R1 and R2 and pot meter VR1. The same supply is connected to 6.82v zener diode through resistor R3.

When the ac voltage increase beyond 240V, the voltage at non- inverting terminal of operational amplifier N1 increase. The voltage at inverting terminal is still 6.8 V because of zener diode. Thus now if the voltage at Pin 3 of the operational amplifier is higher than 6.8 V the output of operational amplifier goes high to drive transistor T1 and hence energies relay RL consequently the AC supply is disconnected and electrical appliances turn off thus the appliances protected against over voltage. Now let consider under voltage condition when the line voltage is below 180V, the voltage at the inverting terminal of operational amplifier into is less than the voltage at non-inverting terminal. Thus the operational amplifier into goes higher and it energies the relay through transistor T1. The AC supply is disconnected and electrical appliances turn off. Thus the appliances are protected against the under voltage. All this activity is happens in under voltage and over voltage protection kit which one of the important part of this project.

5.1 OVERALL CIRCUIT

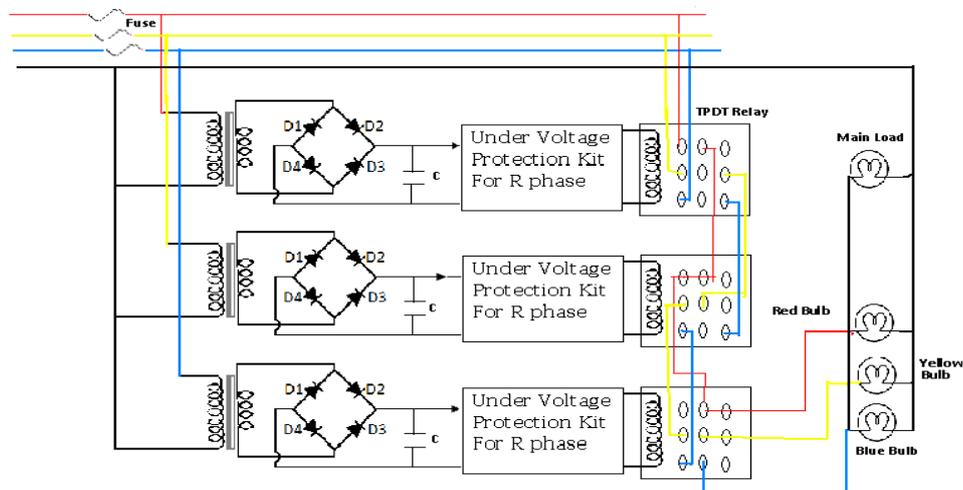


Figure 3

In automatic phase selector load is shifted on different phase according to availability of phase

Now consider the normal condition all the three phase running normally. At that situation the voltage sensing unit that is operational amplifier sense the voltage and trigger to the relay and the relay will drive to main relay. When all the phase are available the load will be driven by R-phase.

The arrangement of main relay is made in such a way that in case of availability of all the phase under normal conditions only r-phase will drive the load. But when the R-phase goes below under voltage level then the load is shifted on Y-phase.

When both the phase R & Y are unavailable at that time the load will be shifted on b-phase but as soon as any one phase from R & Y is come in normal condition then the load will is shifted on that respective phase.

In that system we have the relay logic in which the priority given to R-phases and then Y-phase and lastly to B-phase. Like that we get continuous power supply to the load from available phase.

The list of components and there specifications are given below.

Sr. No.	Name of component	Specification
1	Transformer	230/12 V, 1A
2	Light emitting diode	2.2V/35mA
3	Fix resister	280Ω,250Ω, 3.3KΩ,6.8KΩ
4	Variable resister	47KΩ
5	Capacitors	470μF
6	Capacitors	0.1μF
7	Diode	1N4007
8	Comparator	LM324IC
9	Transistor	BC547
10	Zener diode	6.8V,6.0V
11	Relay	12V/200Ω
12	3-way switch	12V/5A
13	Connecting chords	
14	Incandescent lamp	20W

Table 2



5.2 OUTPUT:

We arrange the transformer in such a way that it gives rectified output to obtained signals the signal gives input to phase shifter and controller these signal is given to three relay. According to signal relay operates and gives output which is given to selected relay.

Condition 1

When phase R & B present or only R-phase present then the under voltage protection relay for R-phase trip.

Condition 2

When R-phase is unavailable and phase Y & B phase is available then load is shifted on phase Y in that condition when r comes in normal situation then load will be shifted on R-phase then the under voltage protection relay for Y-phase trip.

Condition 3

When both R & Y is unavailable then load is shifted on B-phase-in that case if B-phase drive the load and R & Y phase comes in normal condition then load is shifted according to priority. Then the under voltage protection relay for B-phase trip The input output voltage across each transformer is found as below.

Vin(volt)	V out (volt)		
	R-phase	Y- phase	B- phase
230	12.36	12.40	12.12
220	11.83	11.58	11.77
210	11.32	11.33	11.20
200	10.73	10.60	10.46
190	10.20	10.20	10.30
180	9.70	9.31	9.62

Table 3

VI. CONCLUSION

Hence it concludes that by such a arrangement of electrical and electronics component we got continuous single phase supply from any available phase out of three phase. Also studied the operation of operational amplifier and whole under voltage protection kit and also studied the operation of three way relay.

In this work the automatic phase changer using LM324 comparator has been design, built and tested. The system operates smoothly as expected. It is reliable, durable and portable. The cost involved in developing it , make it much more affordable than comparator product. We the use of automatic phase changer we protect home appliances from voltage unbalancing. It is used in following locations such as Hospitals, Laboratories, Administrative buildings, Home appliances, Libraries

VII. FUTURE SCOPE

From this topic in future reduce the cost so that it can be marketable if this project is installed in many places in same area then it may suffer from unbalancing of supply system, so in future system is develop like that which maintain unbalancing giving priority to important places.



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