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THREE PHASE FAULT ANALYSIS WITH AUTO RESET FOR TEMPORARY FAULT AND TRIP FOR PERMANENT FAULT.

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ABSTRACT
In any electrical power system , due to some problems such as over voltage , over current, insulator failure i.e. line to line , line to ground , double line to ground faults occur. This fault collapses the transmission system. These faults may be temporary fault or permanent fault. This fault causes some defects on equipments. To get clearance of fault & disconnect the line the circuit breaker is used. For reclosing, mechanism resets the supply line after small interruption in the event of temporary fault or it remains in tripped condition in case of permanent fault.
KEYWORDS: 555 Timer, Voltage regulator (LM7805), Relays, Comparator, Transformer (230 V– 12V AC)

I. INTRODUCTION

In electrical system, the fault analysis is divided into two categories i.e. transient fault and permanent fault. The transient fault is for short duration. In that, faults like damage of insulation, swinging wires, little time contact with other & insulator flashover etc. occur. This fault is up to the range 70% - 90%. This is cleared by immediate tripping of circuit breakers to isolate the fault.

The most common causes of transient fault are lighting. The other possible cause is temporary contact & swinging wires. Thus transient fault will vanish within few seconds.

The fault which is of longer period of time is considered as a permanent fault. The range of this fault is occurring in electrical system is 10% - 30%. Disturbance on line can cause semi permanent fault i.e. if there is small or negligible disturbance it will turn the system in semi permanent fault. Semi permanent fault occurs in forested area. The fault which does not clear on tripping & reclosing is the permanent fault.

Though auto reclosing success rates differ from one company to another, it is evident that the majority of faults can be successfully cleared by the proper use of tripping and auto reclosing of system.

The temporary fault can be resolved by fault arc to de-energize, and then it automatically recloses the line to restore service. Accordingly, auto reclosing can significantly reduce the outage time due to faults and provide a higher level of service durability to the customer. Additionally, successful high-speed reclosing on transmission circuits can be a major factor when endeavoring to maintain system stability. For those faults, that are permanent, auto reclosing will reclose the circuit into a fault that has not been cleared, which may have unfavorable effects on system stability.

II. LITERATURE REVIEW

Protection is the most important requirement in electrical power system. And it is important for industrial or domestic electrical to prevent equipment from damage due to fault. Different type of fault occurs on electrical system suddenly and at random location. Fault can be classified into two parts transient fault and permanent fault.

The nature of transient fault is such that they do not cause permanent damage to the permanent damage to the system as they are transitory in nature. This fault vanishes if the line is separated from system suddenly. In order to allowed the arc to extinguish. The arc path is completely de-ionized. The line can be reclosed to

restore normal service. It is observe from experiments that about 80% of fault is cleared after the 1st trip. 10% stay in for the second reclosed made after a time delay. The 3% required for 3rd reclosed and approximately 7% fault is permanent in nature and results in lock out of the reclosing relay.

For the solution of this problem a system is built which can easily detect the faults and automatically disconnects the supply to avoid large damages to the control grid substations. In this system by using three 1phase transformers which are connected in star inputs and star outputs and three 1phase transformers are connected in delta in which input is of 230V and output is of 12V in this 555 timer are used to face short duration and longer duration fault condition. The switches are used to create line to line and line to ground fault. In the low voltage side for activating the tripping mechanism short duration fault return the supply immediately to the load i.e. called as temporary trip while long duration will result in permanent trip.

III. WORKING PRINCIPLE

In this project 6 transformers are used for the conversion 230V-12V. The low voltage i.e. 12V is used to energize entire circuit for analysis of 3phase fault.

Out of this 6 transformers, all 6 transformers having primary in star configuration and secondary of 3 transformers are in star connected and secondary of other 3 transformers are in delta for getting line to ground fault and line to line fault respectively.

The output of these transformers is rectified and filtered individually to get DC voltage. This DC voltage is given to 6 relays. To create fault i.e. line to line or line to ground fault. We connect 6 push buttons across the relay coil. All of common points of relay are grounded. The NC contacts of all 6 relay are connected in parallel, this parallel connected points are given to the 2nd pin of IC 555 timer. This is connected in monostable (timer-1) mode through a resistor of 10Kohm. The output of this IC 555 is given to another IC 555 timer which is configuring in astable (timer-2) mode. To indicate status of each IC 555 LED's are connected. The output of second IC is given to the non inverting input pin of op-amp LM358.

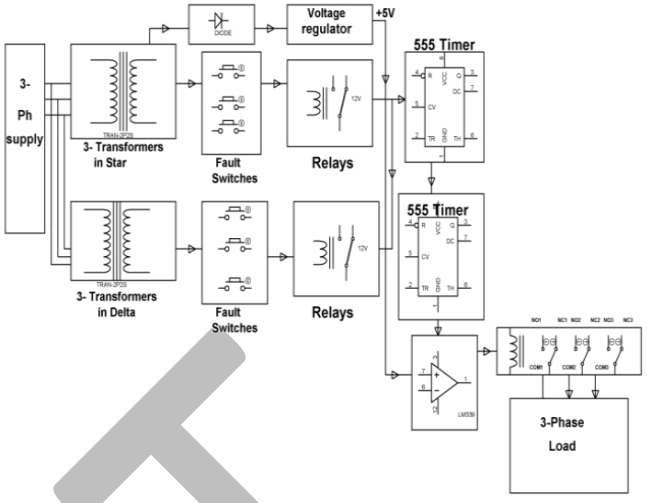


Figure 3.1: Block Diagram

While the inverting pin i.e. pin-2 of op-amp is connected to preset to potential divider for fix the voltage. At pin-2 the voltage coming from potential divider is so fixed that it is higher than the non inverting i.e. pin-3 of op-amp used as comparator so that pin-1 develop zero logic that fails to operate the relay through the driver transistor. This relay is '3CO' used for disconnecting load.

IV. OPERATION

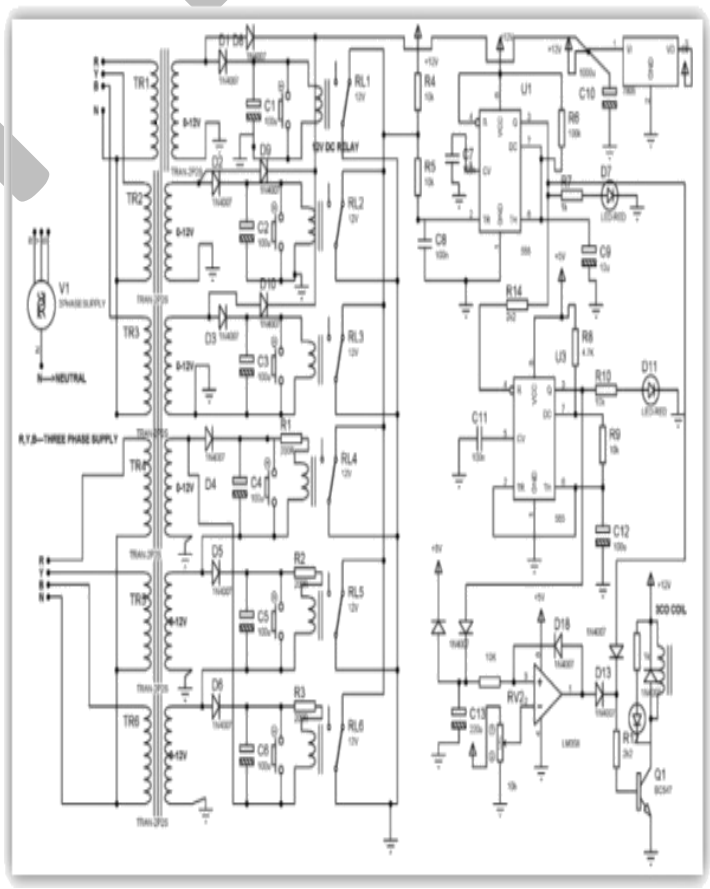


Figure 4.1: Circuit Diagram

When the 3phase supply is given to the board all the 6 relay coils get DC voltage and there common point disconnect from NC and moves to the NO points. So logic high is provided to pin-2 of timer-1. When we press any push button the common contacts moves to the NC as we provide logic low at trigger pin IC 555 i.e. timer-1. It develops an output at pin no 3. This output given to timer-2 which is used in astable mode .When we provide output of timer-1 to timer-2. The reset pin of timer-2 goes to high which is indicated by flashing LED. If the fault is temporary i.e. when we press push button and realize immediately the timer-1 (monostable state) is disables timer-2 outputs which goes to zero.

If any push button pressed for longer duration the timer-1 (monostable state) output provide active situation for longer duration to the timer-2. Due to loner active input the output of timer-2 (astable state) from pin-3 charges capacitor C through resistor R so that the output of comparator goes high. These output drives the relay 3CO permanently switch ON and disconnect the load connected to its NC contacts.

To energize above circuit voltage regulator IC 7805 used which give 12V and 5V DC.

V. COMPONENTS

The components that are used in this project are follows:-

TRANSFORMER

The AC supply is converted from 230V to 12V for low voltage supply to the circuit.

RELAY

In this six 5pin relays are used to give logic 0 or logic 1 to the timer circuit. There is another one relay called as 3CO relay. which used to disconnect the load to indicate fault conditions and it as 11 pins out of which two pins are used to energize relay coil. 3 phase supply is directly given to 3 pins. Out of remaining 6 pins 3 are NO and 3are NC.

IC 555 TIMER

In this project two 555 timer 8 pin IC's are used one in mono stable mode and another in as table mode. The supply required for these IC's ranges from 5V-15V. Figure

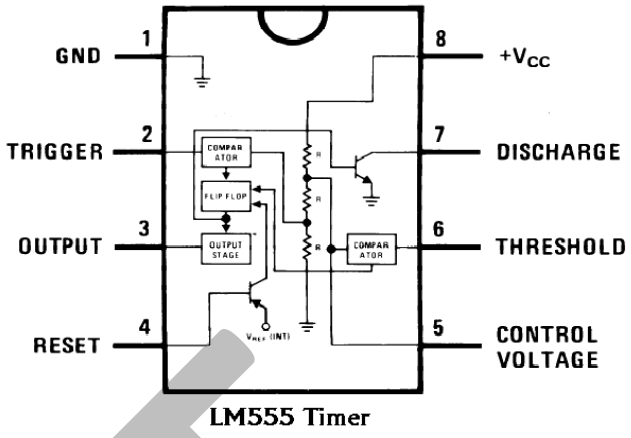


Figure 5.1: Pin diagram of LM555 timer

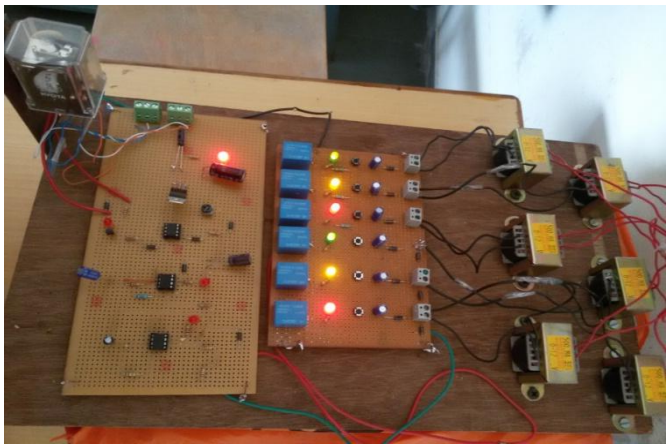
VOLTAGE REGULATOR

In this project we used voltage regulator IC 7805 to provide fix voltage to IC circuit it has 3 pin. Including one pin connected to ground and remaining input and output pins. It gives fix supply of +5V to IC circuit.

COMPARATOR

Potential dividers are connected to the inverting and non-inverting inputs of the op-amp to give some voltage at these terminals. Supply voltage is given to +Vss and –Vss and it are connected to the ground. The output of this comparator will be logic high (i.e., supply voltage) if the non-inverting terminal input is greater than the inverting terminal input of the comparator. If the inverting terminal input is greater than the non-inverting terminal input then the output of the comparator will be logic low. In this project, an op-amp is a comparator.

VI. HARDWARE



Photograph 6.1: Practical Circuit.

VII. CONCLUSION & ANALYSIS

This project is designed in the form of mechanism for three single phase transformers 230V to 12V of output for to develop an automatic tripping mechanism for the three phase supply system while transient fault and permanent fault occurs. Here we used 555 timers with relay for the fault is temporary or permanent. Short duration fault returns the supply to the load immediately called as temporary trip while long duration shall result in permanent trip.

VIII. FUTURE SCOPE

This project can be extended to develop a mechanism to send message to the authorities via SMS by interfacing GSM module.

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