International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 4 Issue 10, October 2017

ISSN: 2394-4404

Three Phase Fault Analysis With Auto Reset On Temporary Fault And Permanent Trip Otherwise

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Abstract: ***This project to develop an automatic tripping mechanism for the three phase supply system. The project output reset automatically after a brief interruption in the event temporary fault while it remains in tripped condition in case of permanent fault. The major advantage of the project is, it is not only save the appliance but it will also show the type of fault that has been occurred in the system so it will be easy for the operator to solve the problem easily. It will also check whether the fault is permanent or temporary fault. If the fault is temporary fault then the supply will be restored after a predefined time of 15sec otherwise permanent trip signal is given to the relay. The concept in the failure can be extended to developing a mechanism to send message t the authorities via SMS by interfacing a GSM model.***

Keywords: 555 Timer, Voltage regulator (LM7805), Relays, Comparator, Transformer (230 V– 12V AC)

I. INTRODUCTION

A fault in a power system is any failures which interface with the normal flow of current. The cause of electric power system faults is insulation breakdown. This breakdown can be due to a variety of different factors such as Lightning stroke, Spray on insulators, Trees coming in contact with wires, Equipment failure, Human Errors as per the studies 70%-90%.Various studies have shown that anywhere from 70%, to as high as 90%, of faults on most overhead lines are transient [1]. A transient fault, such as an insulator flashover, is a fault which is cleared by the immediate tripping of one or more circuit breakers to isolate the fault, and which does not recur when the line is re-energized. Faults tend to be less transient (near the 80% range) at lower, distribution voltages and more transient (near the 90% range) at higher, sub-transmission and transmission voltages. Lightning is the most common cause of transient faults, partially resulting from insulator flashover from the high transient voltages induced by the lightning [2].other possible causes are swinging wires and temporary contact with foreign objects.

Thus, transient faults can be cleared by momentarily de-energizing the line, in order to allow the fault to clear. Auto-reclosing can then restore service to the line [3].

The remaining 10-30% of faults are semi-permanent or permanent in nature. A small branch falling onto the line can cause a semi-permanent fault. In this case, however, an immediate de-energizing of the line and subsequent auto reclosing does not clear the fault. Instead, a co-ordinate time-delayed trip would allow the branch to be burned away without damage to the system [4]. Semi-permanent faults of this type are likely to be most prevalent in highly wooded areas and can be substantially controlled by aggressive line clearance programs. Permanent faults are those that will not clear upon tripping and reclosing. An example of a permanent fault on an overhead line is a broken wire causing a phase to open, or a broken pole causing the phases to short together. Faults on underground cables and overhead lines [5]. Although auto reclosing success rates vary from one company to another, it is clear that the majority of faults can be successfully cleared by the proper use of tripping and auto-reclosing [8]. This de-energizes the line long enough for the fault source to pass and the fault arc to de-energize, then automatically recloses the line to restore service. Thus, auto-reclosing can significantly reduce the outage time due to faults and provide a higher level of service continuity to the customer [9]. Furthermore, successful high-speed reclosing auto reclosing. On transmission circuits can be a major factor

when attempting to maintain system stability [10]. For those faults that are permanent, auto reclosing will reclose the circuit into a fault that has not been cleared.

II. HARDWARE COMPONENTS

The major components that are used in the project are

- ✓ Power transformer
- ✓ Voltage regulator
- ✓ Relays and 555 timer
- ✓ LM 358

POWER TRANSFORMER

This is a device which is used to convert electricity from alternating current (AC) voltage to another alternating current (AC) voltage with less loss of power. Here step down transformers are used for step down the voltage at 12volt from 220volt AC. The ratio of number of turns in the primary and secondary windings determines that a transformer is step-up or step-down [6]. In this project three single phase transformers which are wired in star input and star output and three transformers are connected in delta connection [7].

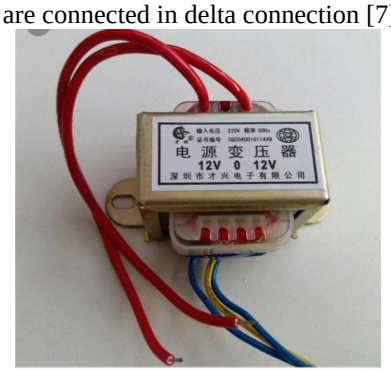

Figure 1: power transformer

VOLTAGE REGULATOR 7805

Although designed primarily as fixed voltage controllers, these gadgets can be utilized with outer parts to get flexible voltages and streams. The LM78XX/LM78XXA arrangements of three-terminal positive controllers are accessible in the TO-220/D-PAK bundle and with a few settled yield voltages, making them valuable in a wide scope of utilizations. Each sort utilizes inside current constraining, warm shutdown it basically indestructible. On the off chance that satisfactory warmth sinking is given, they can convey more than 1A yield current.

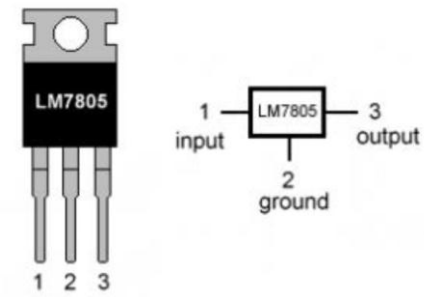

Figure 2: voltage regulator

555 TIMER

Contingent upon the producer, the standard 555 bundle incorporates more than 20 transistors, 2 diodes and 15 resistors on a silicon chip introduced in a 8-stick smaller than usual double in-line bundle (DIP-8). Variants accessible incorporate the 556 (a 14-stick DIP joining two 555s on one chip), and the 558 (a 16-stick DIP consolidating four somewhat altered 555s with DIS and THR associated inside, and TR falling edge delicate rather than level touchy). Ultra-low power variants of the 555 are additionally accessible, for example, the 7555 and TLC555. The 7555 is intended to bring about less supply glitching than the exemplary 555 and the producer asserts that it ordinarily does not require a "control" capacitor and much of the time does not require a power supply sidestep capacitor.

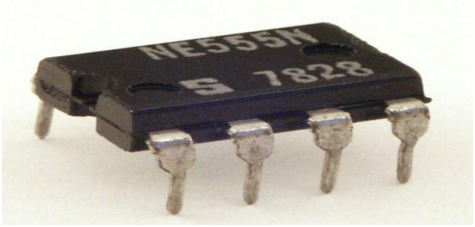

Figure 3: 555 timer

LM358

The LM358 series consists of two independent, high gains; inside frequency compensated operational amplifiers which were planned particularly to work from single power supply over a different range of voltages. Split power supplies can be possible and the low power supply current drain is independent of the value of the power supply voltage. Application of it include transducer amplifiers, dc gain blocks and all the conventional operational amplifiers circuits which now can be all the more efficiently actualized in single power supply system.

RELAYS

Relay is an electrically operated switch which helps in protecting system from severe damage by detecting and isolating fault on transmission and distribution lines by opening and closing of circuit breaker [11].

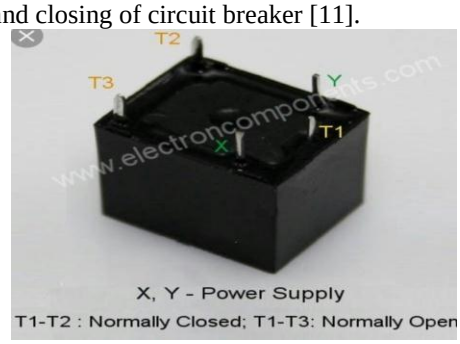

Figure 4: relay

ISSN: 2394-4404

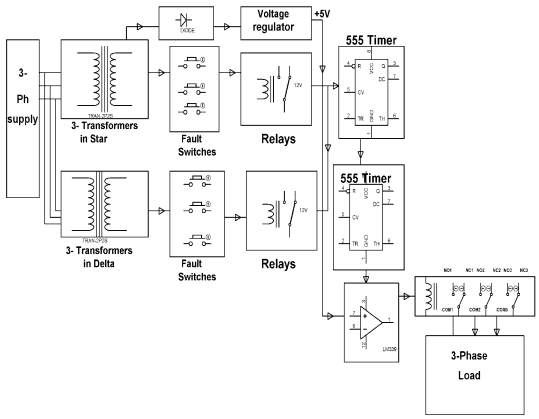

Figure 5: block diagram

III. WORKING PRINCIPLE

There are six steps down transformers which are connected to the board producing 12 volt to the circuit. These six transformers are divided into two groups; first one group is connected in star-star connection and later is connected in star-delta connection. The outputs of all the six transformers are rectified and filtered individually and are given to 6 relay coils. 6 push buttons one each connected across the relay coil is meant to create a fault condition.

The NC contacts of all the relay are made parallel while all the common points are grounded. The parallel connected point of NC is then connected to pin 2 of 555 timer through a resistor R5 i.e. wired in monostable mode the output (pin 3) of the same timer is connected to reset (pin 4) of the other 555 timer wired in astable mode. LED's are connected at their output to indicate their status.

The output (pin 1) of 555 timer (U3) is given to op-amp LM358 through wire 11 and d12 (IN4007) to the non-inverting input (pin 3) which acts as a comparator. It compares the value of pin 2 (inverting input) and pin 3 (non-inverting input) of LM358.

The voltage of pin 2 is kept at fixed/constant voltage with the help of potential divider. It is generally kept higher than the pin 3 of operational amplifier so that pin 1 i.e. output of LM358 develops low (zero logic) which fails to operate 3CO relay through the transistor Q, and the same is used for disconnecting the load used in fault condition.

OPERATIONAL PROCEDURE

Transformers and lamp bulbs are connected along with three phase power supply (230V). After the board is powered by 3 phase supply, all relay coils get DC voltage and due to this the common points disconnects from NC contacts and moves to the NO contacts. When push buttons are pressed, it disconnects the relay and due to this the common points moves to the NC position to provide a logic low at a trigger pin (pin 2) and the output (pin 3) which is linked to reset pin (pin 4) develops high logic indicated by D11 flashing LED of 555 timer (U3) which is in astable mode- If fault is temporary.

If any push button is released after a short time, 555 timer (U1) in monostable mode disables U3 due to which the output of U3 goes to zero – If fault is permanent. If any push button is pressed for longer duration, then the output of 555 timer (U3) present in monostable mode provides a longer duration of active situation for 555 timer (U3), output of the same charges the capacitor C13 through R11. The output (pin 1) of operational amplifier (LM 358), though acting like a comparator gets high which in turn drives the 3 CO relay through transistor Q1 to switch off 3 phase load.

IV. RESULTS AND DISCUSSIONS

In this final stage, components assembled and connected all the circuit related connections of the respective transformers, PCB circuit and the load to notify the faults to be occurred by tripping through the push buttons. Testing was performed on the circuits and were successfully executed for the respective continuity test and the power-on test. Implementing connections the transformers are connected to the PCB circuit whose input is 12v, the push buttons, LED's glows and is executed by pressing push button. After successfully implementing the connections of transformers and the load with PCB circuit, we gave three phase supply to transformer. We created fault by pressing push button and fault created successfully. The fault was cleared immediately within seconds notifying the occurrence of temporary fault. Following is successful execution of fault creating fault and correcting it. In electronics, a continuity test is the checking of an electric circuit to see if current flows (that it is in fact a complete circuit). A continuity test is performed by placing a small voltage (wired in series with an LED or noise-producing component such as a piezoelectric speaker) across the chosen path. If electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit is open.

V. CONCLUSION

This project design in the form of hardware for six single phase transformers to 230v to 12v of output for to develop an automatic tripping mechanism for the three phase supply system while temporary fault and permanent fault occurs in system. During temporary fault it returns the supply to the load immediately, otherwise it results in permanent trip.

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