Three Phase Auto Recloser Scheme

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Abstract— in this project an involuntary tripping system is to be built for 3-ø supply system. The output of the project resets automatically after a transient interruption in the case of temporary fault occur otherwise it remains tripped in event of permanent fault. There may be any type of failures due to some faults which can be temporary or permanent in natue Ingrid substation or network through which the supply is delivered to the consumers i.e. domestic, industrial and commercial. These faults are the cause of significant detriment to the power system equipments. It is commonly observed In India that the failures in power system are due to the faults that occur during the transmission or distribution of electrical power. The faults can be LG (Line to Ground), LL (Line to Line), LLL (three phase) in the supply systems and these faults in3-øsupply system can affect the power system drastically. To deal with this problem an involuntry operating system is built, which can determine these faults and instinctively disconnects the supply to avoid severe damage to the switch gears and equipments in the electrical grid network. Six 1-ø transformers are used in which 3 transformers are wired in star input and star output, and 3 transformers are wired in delta connections, having input 220V and output at 12V to develop the system. As it is hazardous to simulate faults on mains line so it is advised to follow the concept of low voltage testing of fault conditions? To determine the short duration and long duration fault conditions 555 timers are used. For the LL, LG and 3L fault creation in low voltage side, a number of fault simulator switches are used which activates the tripping mechanism. When the Short duration fault are subjected to system the tripping mechanism returns the supply to the load immediately and it is called as temporary trip while when the long duration faults occur in the system the tripping mechanism completely disconnects the faulty system from healthy system and it is called as permanent trip system.

Key words: Comparator, Relays, Transformer (230 V– 12V AC), Voltage regulator, 555-timer

I. INTRODUCTION

Protection of power system is the most important necessity in the domestic or industrialelectrical to preclude equipment from detriment occure by leakage current. The circuit breaker consisting the automatic tripping system must be installed at every place where the power supply is needed.For example at each of house, hospital, factory, or at any other electrical load.

According to different studies from 70%, to as high as 90%, faults on most overhead lines are transient. A transient fault is a type of fault which is cleared by the instantaneous tripping of one or more circuit breakers to clear the faults in the electrical system. The example of transient fault is like insulator flashover. When the line is again re-energized the transient faults does not reoccur [2]. At lower distribution voltages faults tend to be less transient (near the 80% range of sub transmission and transmission voltages.) andat higher distribution voltages faults tend to be more transient (near the90% range of sub transmission and transmission voltage). The most common cause of transient faults is lightning; partway consequences like insulator flashover because of high transient voltages generated by the lightning stroke. Swinging wires and temporary contact with foreign objects might be the cause of transient faults. Thus, by de- energizing the line for a short timetransient faults can be cleared. Service to the line can be recreated by instant auto reclosing. The abide 10% - 30% of faults in electrical system are semi- permanent or permanent in nature. A semi-permanent fault can be effectuated when a small branch of tree falls on line. In such case of permanent fault, the fault can't be cleared by an instantaneous de-energizing of the line and subsequent auto reclosing. If there is a compeered time-delayed trip then system would let the branch to be burned away without any harm to the existing system. In highly wooded areas Semi-permanent faults of such type are likely to be customary and by aggressive line clearance programs faults can be significantly controlled [4]. By tripping and reclosing of circuit breaker type of permanent faults can't be cleared. On an overhead line, a broken wire or conductor making a phase open, or a broken pole making the phases to short are the example of common and most often occurring permanent fault. Faults on underground cables are also the example of permanent fault. Without using the auto reclosing system the cable faults can be cleared easily and the repair of affected cable must be done before the cable is used for power supply. Some exceptions may exist to this, as in the circuit designing of both underground cables as well as overhead lines. Though, success ratesof auto reclosing may differ from one company to another company, but the results reveals that the most of the faults can be successfully cleared by using the appropriate tripping and auto reclosing mechanism[3]. Proper tripping can de- energize the line for enough time period to pass the fault source and to de-energize the fault arc, then the system automatically recloses the line to maintain the power supply. Thus, auto reclosing mechanism can substantially decrease the outage time because of faults and gives a significant level of service consistency to the consumer and reliability of power system. On transmission circuits, desired high-speed auto reclosing plays a vital role to achieving and maintaining power system stability. When the permanent faults occur in system, auto reclosing system recloses the circuit still a fault that has not been cleared is present in system, which can arise the threatening condition for system stability (mainly at transmission levels)[5].

In the present scenario of power systems, automatic reclosing system has a very wide area where it can be applied. To affect fault clearance and posterior re-closure, it is often comulsory to make them sequentially several equipments of switchgear. Recently, Control of auto re-closer switching sequences is done by logical design

principles inthe large substations. The main advantages of auto re-closer system are consistent supply except for short time duration when tripping and re-closure actions are done by circuit breaker, so there is no need to attend the substation by any human operator. The speed of operation of the protection equipments is the most important factor which affects the success of rapid re-closer system. The reason behind the dependency is high speed operation of protection system decreases the amount of damage occurred and thus maximizes the possibility of successful operation.
With the help of automatic reclosing system a very simple but high speed protection of the lines can be achieved with the reliable operation of power system. With instant protection being applied assorted tripping of several circuit breakers may occur but the application of auto-reclosesystem makes it a selective operation is indispensible that the system dead time is to be set for a few cycles so that the generators do not drift apart. The application of High speed protection is used to obtain operating times of one ortwo cyclessuch as pilot wire carrier. So to attain that the re-closuremust be of the single shot type. To enhance thestability to a better extent on single-circuit ties high speed re-closure scheme must be used in high voltage circuits.

II. CIRCUIT DESCRIPTION

A. Voltage Regulator

With different fixed output voltages, making them useful for various typeof applications, the LM78XX/LM78XXA series of 3- terminal positive regulators can be foundin the TO-220/D-PAK package. Each type of voltage regulator retainsthermal shutdown, internal current limiting, and safe operating area protection, so it makes it certainly inextinguishable. They can deliver over 1A output Current, if adequate heat sinking is provided. These devices can be used with external components to obtain variable voltages and currents,although they are designed as fixed voltage regulators.

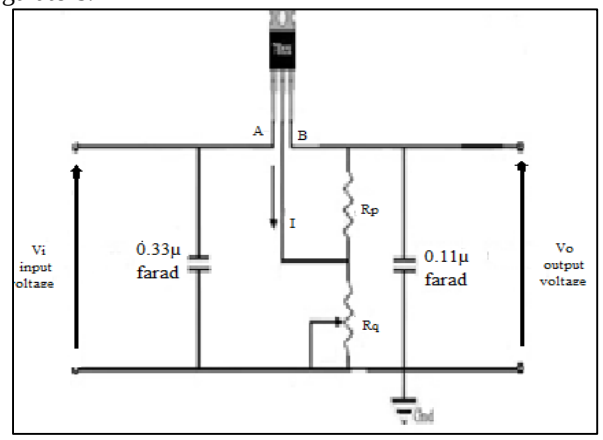

Fig. 1: Voltage Regulator Circuit

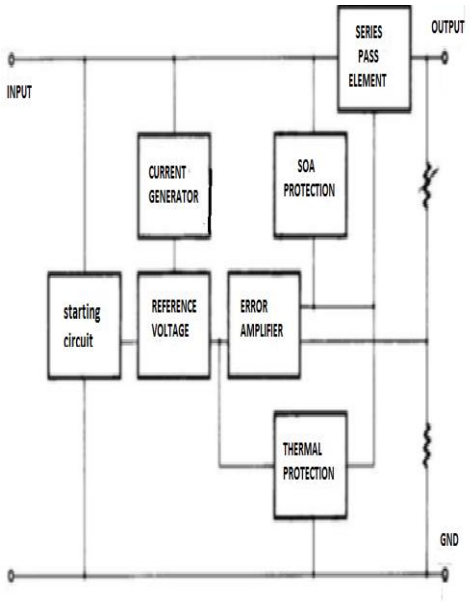

Fig. 2: Block Diagram of Voltage Regulator

B. Working Principle

In this project six step-down transformers have been used for maintain the voltage level of complete circuit under low voltage conditions of 12V just to test the analysis of three-phase fault . The primary windings of three transformers are connected to a three phase supply in star connection, whereas the secondarywinding of the three transformers is also connected in star connection. The remaining three transformers'sset with its primary winding connected in starconfiguration to three phases with their secondary windings connected in delta configuration. The voltage at the secondary windings of all the six transformers are rectified and filtered by using the R-C filter individually and then the obtained DC voltages are given to six relay coils. To simulate a fault condition either at star i.e. Line to line Fault or 3-ø Fault, six fault simulator switches (NO push buttons) are used each connected across the relay coil. While all the common points are made connected to ground, the NC contacts of all the relays are connected in parallel connection. At pin-2 of a 555 timer (i.e. wired in monostable mode)the parallel connected point of NC of relay coil is connected. The reset pin-4 of 555 timer (i.e. wired in astable mode)is connected tothe output of the same 555-timer. For the signal purpose andto indicate their operatingstatusLED'S (light emitting diodes) are connected at their output terminal. The output of the U3 555- timer from pin-3 is connectedto an Op-amp (LM358) through wire-11 and d12 to the non-inverting input pin-3, whileby usingpotential divider RV2, the inverting input is kept at a certain voltage level or fixed voltage. The voltage level at pin-2 (connected to the potential divider) is kept at certain voltage level that it is higher than the pin-3 of the Op-amp (function of a comparator) so that pin-1 develops 0(zero) logic that cannot make the relay operate with the help of driver transistor (Q1). For disconnecting the load when a fault conditions occur relay Q1 i.e. a '3CO' relay is used as a switch.

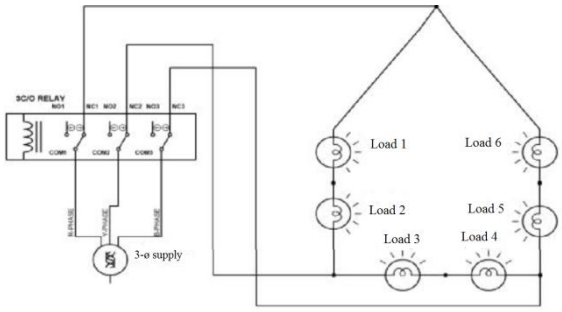

Fig. 3 : Proposed Schematic Diagram

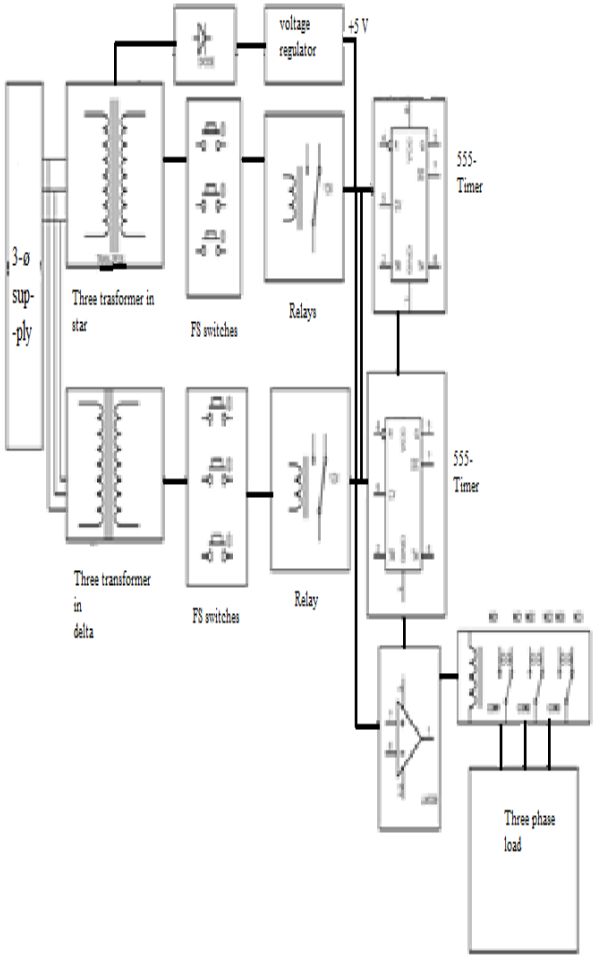

Fig. 4: Schematic Diagram

III. OPERATING PROCEDURE

When the circuit is powerd by a three phase supply, DC voltage is received at all the six relay coils in the circuit and their common point of the relays deatchs d from the NC and gets attached on the NO points which than generates the logic high (1) at pin-2 of 555- timer .The 555-timer is set on monostable mode. When any of six fault simulator switch across the relay is operated it the relay is disconnected and according to the procedure common contacts shifts to the NC position to generate a logic low i.e. zero at trigger pin of 555-timer to generate an output that fetches the 555-timer which is set in astable mode for its reset pin to logic high in such way that the astable operation occur at its output which is also showed by blowing LED. If there is temporary fault by nature i.e. if the fault simulator switch is operatedand than it is released instantly the U1 disables U3 then output of U3 goes to 0 (zero).If any of the fault simulator switches is kept operated for a extended time duration the monostable output gives a extended duration active operation for U3. The output of astable timer which charges capacitor through R11 in such way that the output of the comparator attains logic high (i.e. 1) that actuates the relay to operate as switching off 3-øload. The output of Op-amp abides high (i.e. 1) for infinite time duration with the help of positive feedback feeded for its pin-1 to pin-3 through a forward biased diode and a resistor connected in series. As the result of operation the relay permanently switchs on and disconnects the load connected at its NC contact terminal. As per the operational requirements the supply of DC voltage and the star configured secondary set DC'S are connected in parallel for uninterrupted power supply to the circuit.The voltage levels of 12V DC and 5V DC are generated with the help of IC-7805 (i.e. voltage regulator)

IV. CONCLUSION

This project is designed in the form of Hardware for three single phase transformers 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. Here we are using 555 -timer with relay for the determination wheather 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.

The concept in the future can be extended to developing a mechanism to send message to the authorities via SMS by interfacing a GSM modem.

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