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Three Phase Fault Analysis Autoreset on Temporary Fault or Permanent Trip.

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Abstract: *The project is intended to improve an automatic tripping mechanism for the three phase supply system. The project output resets automatically after a brief stoppage in the event short-term fault while it remains in tripped condition in case of long-lasting fault. The electrical substation which supply the power to the consumers i.e. industries or domestic can have failures due to some faults which can be short-term or long-lasting.*

These faults lead to considerable damage to the power system equipment. In India it is common to witness the let-downs in supply system due to the faults that occur during the transmission or distribution. The errors might be LG (Line to Ground), LL (Line to Line), 3L (Three lines) in the supply systems and these errors in three phase supply system can affect the power system. To stunned this problem a system is built, which can sense these errors and automatically separates the supply to avoid large scale impairment to the control gears in the grid sub-stations.

*This scheme is built using three single phase transformers which are wired in star input and star output, and 3 transformers are connected in delta networks, having input 220 volt and output at 12 volt. This idea low voltage testing of fault conditions is followed as it is not suitable to create on mains line. 555 timers are used for handling short period and long period error conditions. A set of switches are used to make the LL, LG and 3L fault in low voltage side, for activating the falling mechanism. Short period fault returns the supply to the load instantaneously called as temporary trip while long period shall result in permanent trip. The idea in the future can be extended to developing a device to send message to the authorities via SMS by interfacing a GSM modem.**[1]***

I. Introduction

A fault in power system in 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
- Tree coming in contact with wires
- Equipment Failure
- Human Errors

As from the studies 70% to 90% of fault are occurred in overhead transmission line which are transient. There are many transient fault, such as damages of insulation, swinging wires and little time constant with other objects. These fault are cleared by operating circuit breaker or can be cleared by de-energizing the line at short period for clearing the fault.

The other 30% to 10% fault are occurred in overhead line which are permanent or long duration fault. Permanent or long duration fault occurred by broken wire which result one phase to ground fault or joining the two phase together which is occurred in overhead line as well as in the underground cable. These fault cleared by finding them in line and repair which results permanent trip of line.

Types of fault:
The fault can be classified into:
- Symmetrical fault
- Un-symmetrical faults

The Shunt faults are characterized by increase in current and fall in voltage and frequency. The shunt faults can be classified as
- Single Line To Ground (LG) fault
- Line to line (LL) fault
- Double line to ground (LLG) fault
- Three Phase fault

II. Proposed System And Block Diagram

The block diagram presenting plan arrangement of three phase fault analysis autoreset on temporary fault or permanent trip otherwise

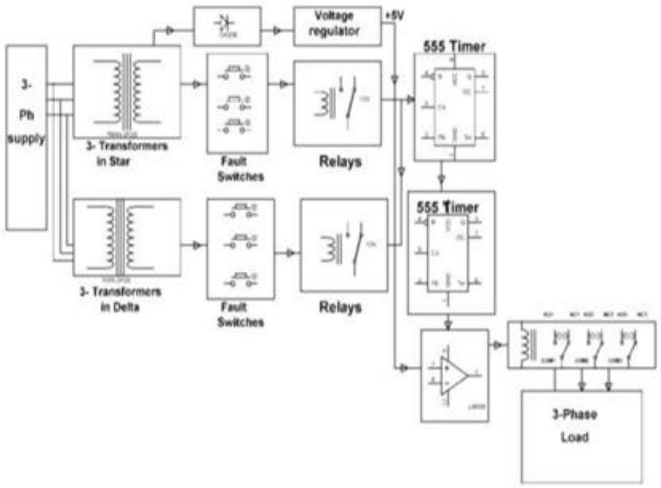


Fig. 1: block diagram of implemented scheme

The single phase supply is step down and it is transformed into 12v dc. The fault occur on the line when the capacitor are charge there rated value that time the temporary fault are occur on the line after that the fault clearance the relay are in normally open position. But in permanent fault condition the capacitor will be charge then over current will flow through comparator the comparator compares the value capacitor charge and line voltage or rated voltage. That time the relay goes into permanent trip position the load current will be trip. [3]

III. Component Used

The component require to establish the project, Major of them are
- Transformer
- Voltage Regulator
- LM555 Timer
- Relay

3.2.1. Transformer

Transformers are a static scheme which carries power from one path to another path according to the principle of mutual induction. Transformer converts AC current from one voltage to another with a tiny loss of power. Step-up transformers rise voltage, step-down transformers decrease voltage. Most power supplies use a step-down transformer to decrease the hazardously high voltage to a harmless low voltage. [3]

Fig 2: Typical Transformer

3.2.2 Voltage regulator

A voltage regulator is intended to automatically maintain a constant voltage level. A voltage regulator may be a simple feed forward scheme or may include negative response control loops. It may practice an electromechanical device, or electronic modules.

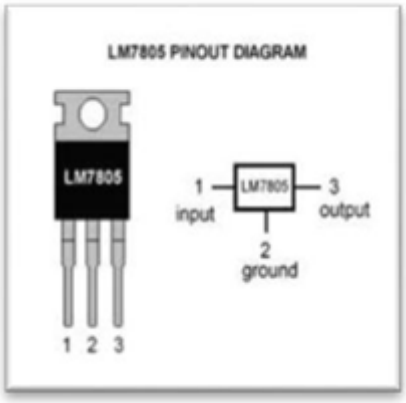


Fig 2: Voltage Regulator

Electronic voltage regulator is originate in scheme such as computer power supplies where they stabilize the DC voltages used by the processor and additional elements. In automobile alternators and essential power station generator plants, voltage regulator control the productivity of the plant. In an electrical power distribution system, voltage regulator may be connected at a substation or along distribution lines so that all customers obtain steady voltage self-governing of how much power is drawn from the line. [3]

3.2.3. LM358/555 Timer

The LM358/555 Timer series involves of two self-governing, high achievements internally frequency compensated Operational amplifiers which were intended specifically to operate from a single power supply over a Wide variety of voltages. Operation from divided power supplies is also possible and the low power supply Current drain is self-governing of the magnitude of the power supply voltage.

Application areas contain transducer amplifiers, dc achievement blocks and the whole conventional op-amp Circuits which now can be more easily applied in single power supply systems. For example, theLM358 series can be directly functioned off of the standard +5V power supply voltage which is used in digital systems and will easily provide the essential interface electronics without requiring the additional±15V power supplies. [3]

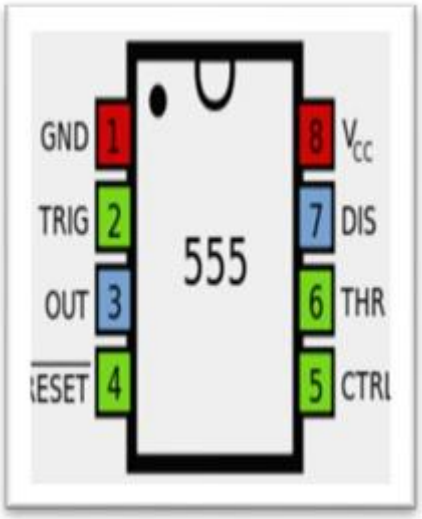


Fig 3: 555 Timer

3.2.4. Relay

A relay is an electrically functioned switch. Many relays use an electromagnet to function as switching device mechanically, but other functioning principles are also used. Relays are used where it is necessary to switch a circuit by a low-power signal (with complete electrical separation between control and controlled circuits), or where some circuits must be controlled by one signal. [4]

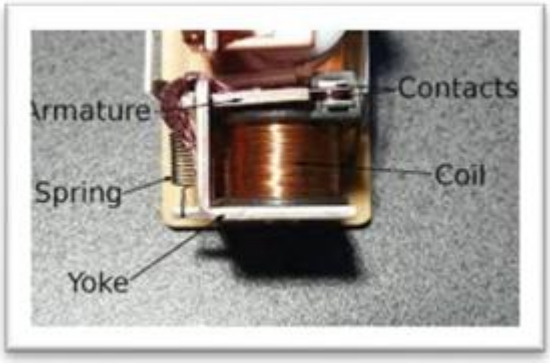


Fig 4: Relay

3.2.5. Comparator

Op amps and comparators look very comparable but a comparator gives a logic output representing the relative potentials on its two inputs. An op amp amplifies the variance voltage between its two inputs – and is intended always to be used in closed-loop applications. Potential dividers are linked to the inverting and non inverting inputs of the op-amp to give particular voltage at these terminals. Supply voltage is given to +v and –v is linked to ground. The output of this comparator will be logic high (i.e. Supply voltage) if the non-inverting terminal input is superior than the inverting terminal input of the comparator. If the inverting terminal input is superior than the non-inverting terminal input then the output of the comparator will be logic low (i.e. Gnd).[6]

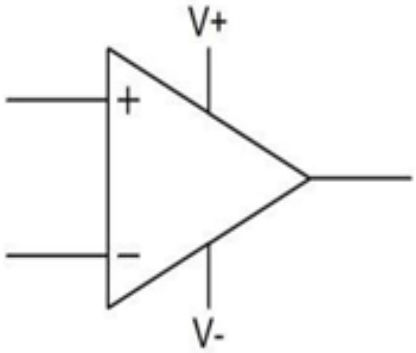


Fig 5: Comparator

3.2.6. Resistor

A resistor is a two-terminal electronic module intended to oppose an electric current by creating a voltage drop between its terminals in quantity to the current, that is in accordance with Ohm's law: V = IR. Resistors are used as part of electrical systems and electronic circuits. They are extremely common place in most electronic apparatus. Practical resistors can be made of numerous compounds and films, as well as resistance wire (wire prepared of a high-resistivity alloy, such as nickel/chrome).[7]

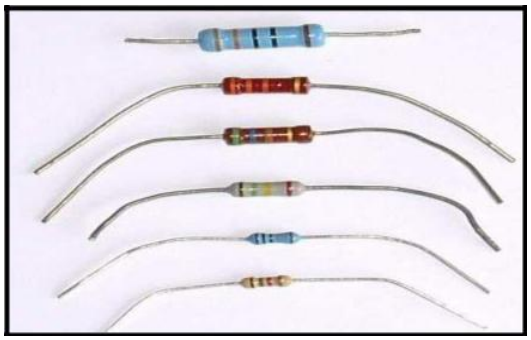


Fig 6: Resistor

3.2.7. Capacitor

A capacitor or condenser is a inert electronic constituent consisting of a couple of conductors separated by a dielectric. When a voltage potential variance exists between the conductors, an electric field is present in the dielectric. This field stocks energy and produces a mechanical power between the plates. The effect is extreme between wide, flat, parallel, narrowly parted conductors. [3]

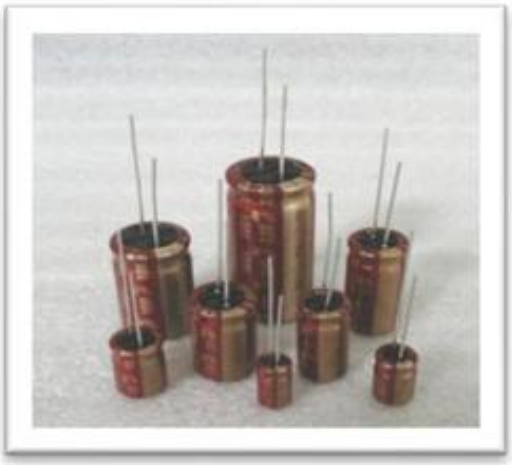
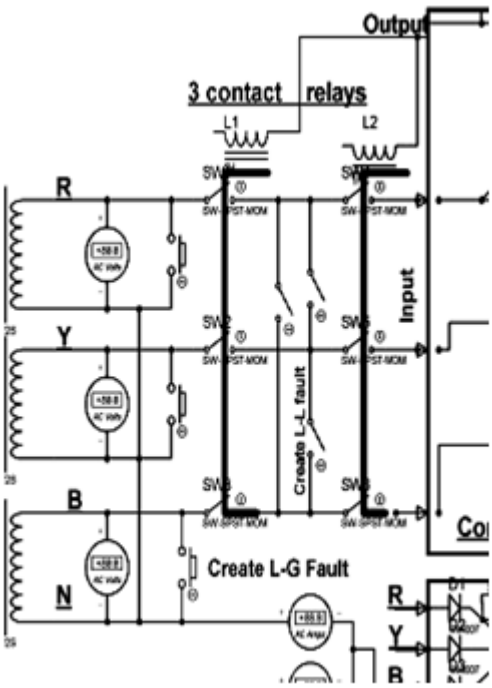


Fig 7: Capacitor



SCHEMATIC DIAGRAM

IV. Working Prnciple

There are six step down transformer which are connected to the board producing 12 volt to the circuit. 6 push buttons one each connected across the relay coil is meant to create a fault condition.

The NC contact of all realy are made parallel while all other points are grounded. The parallel connected point of NC is then connected to pin2 of 555 timer through a resistor R5 i.e. wired in monostable mode the output (pin3)of the same timer is connected to reset (pin4) of the other 555 timer wired in astable mode. LESs are connected at their output to indicate their status.

The output (pin1) of 555 timer (u3) is given to op-amp LM358 through wire 11 and d12 (1N4007) to the non-inverting input (pin3) which acts as a comparator. It compare the value of pin2 (inverting input) and pin3 (non-inverting) of LM358.

The voltage of pin2 is kept at fixed voltage with the help of potential divider. It is generally kept higher than the pin 3 of operational amplifier so that pin1i.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.

APPLICATION

- Applied in transmission and distribution system.
- Used in substation.
- For clearing temporary fault in industries and commercial sectors.
- Apartments.

V. Conclusion

Various fault have been created to developed an automatic tripping mechanism for the three phase supply system while temporary and permanent fault occur. Here timer 555 has been used with relay for the fault analysis short duration fault returns the supply to the load immediately called a temporary trip while long duration shall result in permanent trip as this project is advantageous compare to other protection system it can be used for protection of transmission line fault which occur in power system hence this system is more economical, automatic and hazards free compared to other type of protecting system against three phase fault.

Acknowledgments

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