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# Three Phase Fault Analysis for Temporary and Permanent Fault Based on Microcontroller

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## ABSTRACT

The electrical substation which supply the power to the consumer, have failures due to some fault which can be temporary or permanent. These faults lead to substantial damage to the power system. The faults might be LL, LG, over voltage in the supply system and these faults can affect the power system. To overcome this problem a system is built, which can sense these faults automatically using microcontroller. For power to be useful in a home or business; it comes off the power station and is stepped-down to the suitable level of voltage. It is the transformers that step up the voltages or step down the voltages according to consumer's requirement. We can say that Transformer plays important role in our Power System.To maintain reliability in power system it is important to protect the 3 phase devices like inductive, resistive, etc. against various faults occurring in it. This fault should be identified and analyzed quickly for their remedies. The aim of our project is to study and implement various fault detection technique and monitoring system.

**Keywords:** Three phase fault, tripping mechanism, microcontroller,

## I. INTRODUCTION

The devices like induction motors, transformer, etc. have a long service life if they are operated at its full load condition . However, their life is significantly reduce if they are overloaded, unbalance power condition resulting in unexpected failures and loss of supply to a large number of customers thus effecting system reliability.

The project is design for the automatic tripping mechanism when temporary fault and permanent fault occure. The faults occure in the transmission line are undervoltage, overvoltage, overcurrent, temporary and permanent fault. a small branch falling on to the line can cause a temporary fault. Permanent faults are those that will not clear upon tripping. An example of permanent fault on an overhead line is a broken wire causing a phase to open, or a broken pole causing a phases to short together. On transmission circuits can be a major factor when attempting stability. For those faults that are permanent, autoreclosing will reclose the circuit into a fault that has not been cleared which may have adverse effect on system stability (particularly at transmission system). The features are as follows:-

1. Isolate the load when there is increase in the load.
2. Type of fault that it can sense; low voltage, high voltage ,high current.
3. If the load is isolated because of low voltage it will be switched on automatically when the voltage gets stabilized.
4. Indication of type of fault that has been occurred on a 16/2 LCD.

Different sections of the project are designed on the separate PCB so that the project can be demonstrated easily. The demonstration of the project is very simple

as by opening any one phase wire, which is nothing but a low voltage can be viewed on the display. By working on the project one can understand how to measure the value of voltage by using ADC. The voltage and the current magnitude are stepped down by using PT and CT. From there the output is given to an ADC which is interfaced to the microcontroller. The controller will operate if it finds any unexpected change in output of the detector section, so that the load is separated from the supply. All the required DC voltage s are designed in the circuit itself by using the voltage regulator IC.

For monitoring and control purpose we are using PIC microcontroller, Potential transformer, Regulator IC, Relay, LCD.

## II. BLOCKDIAGRAM

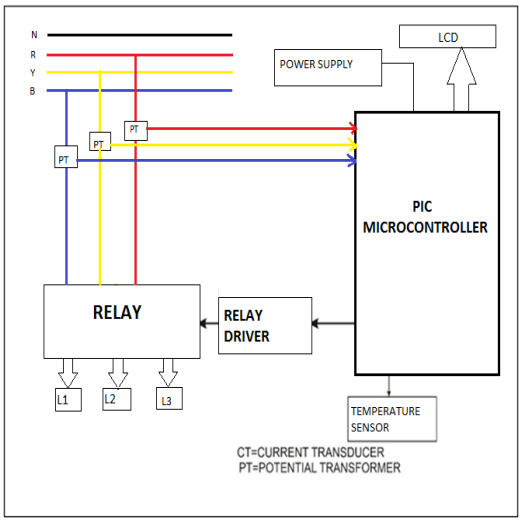


**Figure 1**

### BLOCK DIAGRAM DESCRIPTION

The setup or field devices consist of three major components, instrument transformer (Potential transformer), microcontroller ,Temperature sensor. The primaries of PT which are connected to the line sense the corresponding voltage value of the system and fed the output to the ADC of microcontroller which converts the signal to a digital form in order to be proceed by the CPU of microcontroller. The secondaries of PT is connected to Temperature sensor and the output of the Temperature sensor is fed to the microcontroller. LCD is connected to the microcontroller. Its function to display the values which the microcontroller has sensed.

Regulator IC is design to automatically maintain a constant voltage level and is connected to the secondary of potential transformer. In our project it is design to maintain 5V (dc) constant voltage and supplies to the microcontroller.

The microcontroller serves as the central point of the set up. It contains a set of programming codes which has been stored in EEPROM which enables it to classify the fault type based on the voltage values & Temperature values. Based on the program, the microcontroller compare these values to see whether they are within the range required. If the voltage values & Temperature value are out of range as compare to the reference it gives an indication of a fault and create a signal to trip the relay and send it towards the Relay Driver.Function of Relay driver is to amplify the signal coming out from microcontroller.

## III. WORKING

The project uses one step-down transformer for handling the entire circuit under low voltage conditions of 12V only to test the 3 phase fault analysis. The primaries of one transformer are connected to a 3 phase supply in star configuration, while the secondary of the same is also connected in star configuration. The output of the transformer are rectified and filtered and are given to 3 relay coils. 12 fault switches, each one is connected across the relay coil, meant to create a fault condition either at star i.e. LL Fault and 3L fault. LED'S are connected at their output to indicate their status. The Microcontroller is used which converts the analog value of the voltage to digital one which is displayed on 16x2 LCD screen. If the fault is created by means of any fault switches the digital value shown on the LCD screen will fluctuate abnormally giving the fault location. If the fault is cleared within the specific time period then it

will be temporary fault if it is not then there will be a permanent trip. This relay is meant for disconnecting the load to indicate fault conditions.

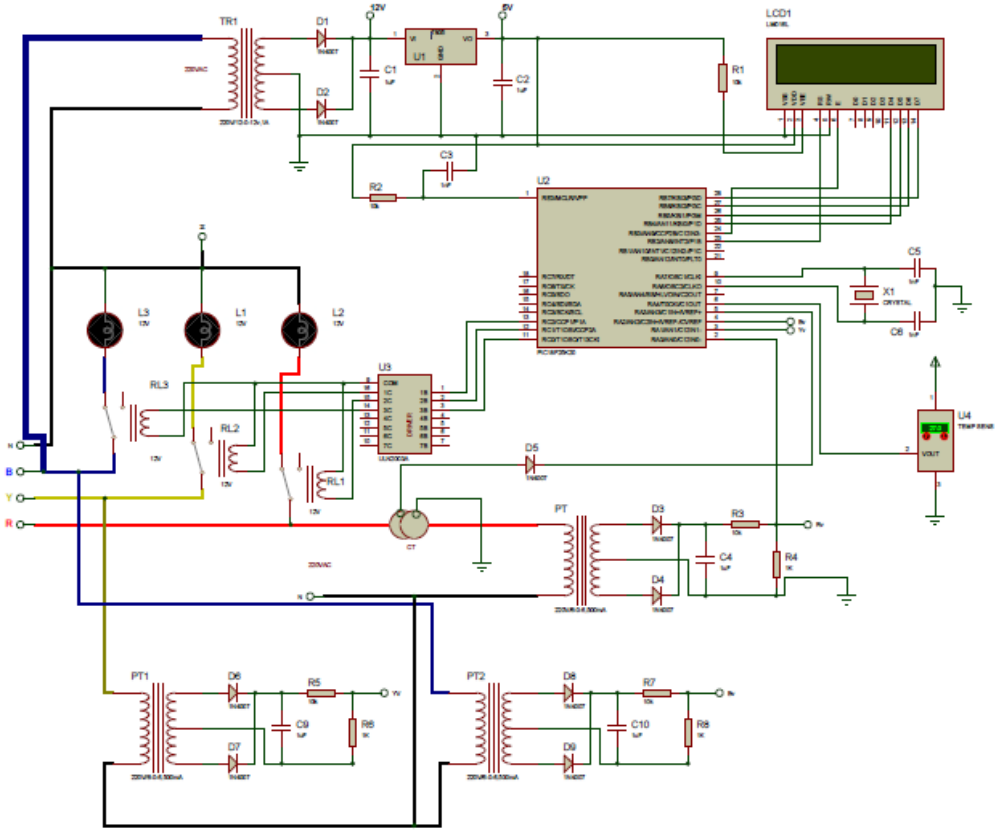

**Figure 2.** Circuit Diagram

## IV. COMPONENTS

- ✓ Power supply
- ✓ Variable resistor
- ✓ Microcontroller PIC
- ✓ LCD

The detailed description of these components is as follows-

**Power Supply:**

The rated voltage 230V is taken from the mains and is supplied to transformer. This transformer is of the rating 230V-14V/10V 0.5A each. Two bridge rectifiers are used of 1.5A each. The secondary of the transformer has two tapping viz., 5V and 12 V of which 5V for the Microcontroller and other circuit components and 12 V exclusively used for relays and ULN driver 2803. On supply PCB, capacitor for the sake of filtering only and a heat sink is used to dissipate the heat generated in case of over currents and thus protecting the system getting damaged. The filter capacitors are of electrolytic type. Two voltage regulators one for 5V (7805) & one for 12V (7812) are used for regulating voltages.

**Variable resistors :**

**Figure 3.** Variable Resistors

We need to use 3 variable resisters –

All 3 variables for checking the voltage in the transformer phases. The output of the three variable

resistors is connected to the E port of the microcontroller.

**Microcontroller PIC:**

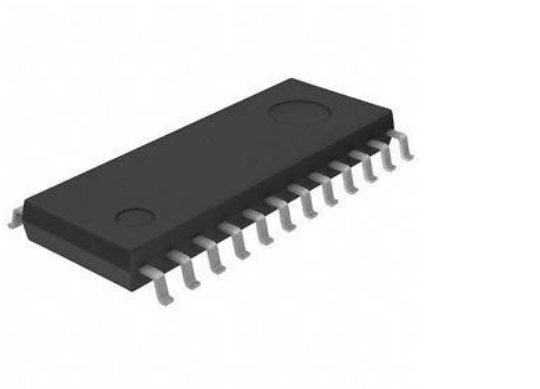

**Figure 4.** PIC Microcontroller

We are using PIC 16F877A microcontroller which has 10-bit in-built Analog to Digital Converter (ADC) so that no extra special IC is required to convert the analog data into the digital form. It is a 40 pin IC with 5 ports-A, B, C, D and E. This IC is manufactured by microchip. In the model name PIC16F877A, '16' is the series which we are using. F stands for "flash programming". Flash Programming means memory is written or erased simply by a flash. The detailed information regarding this IC is given in the datasheets attached. 2 ADC inputs are connected to the A port of the microcontroller.

**LCD:**

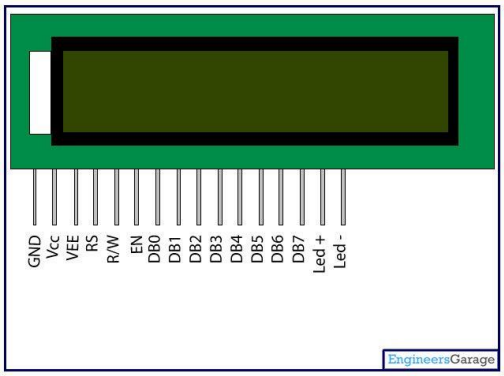


**Figure 5**

We are using 2 lines 16 segments each for the display purpose. The values of 3 set points and the actual data which is to be compared for the operation of the relays are displayed on the LCD. It is connected to the D port of the microcontroller. The LCDs are available in 4 bit and 8 bit mode. The LCD is normally in default 4-bit mode. We are using in our project, the LCD in 4-bit mode.

## V. APPLICATION AND ADVANTAGES

**Advantages**

- ✓ Safety Equipment
- ✓ Work Complete Time to Time
- ✓ More Efficiency
- ✓ Reduce Losses
- ✓ More Reliable

**Application**

- ✓ Substation
- ✓ Transformer
- ✓ Drives & Relay
- ✓ Transmission Line

## VI. CONDUCTIVITY TEST

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". Devices that can be used to perform continuity tests include multi meters which measure current and specialized continuity testers which are cheaper, more basic devices, generally with a simple light bulb that lights up when current flows. An important application is the continuity test of a bundle of wires so as to find the two ends belonging to a particular one of these wires; there will be a negligible resistance between the "right" ends, and only between the "right" ends. This test is the performed just after the hardware soldering and configuration has been completed. This test aims at finding any electrical open paths in the circuit after the soldering. Many a times, the electrical continuity

in the circuit is lost due to improper soldering, wrong and rough handling of the PCB, improper usage of the soldering iron, component failures and presence of bugs in the circuit diagram. We use a multi meter to perform this test. We keep the multi meter in buzzer mode and connect the ground terminal of the multi meter to the ground. We connect both the terminals across the path that needs to be checked. If there is continuation then you will hear the beep sound.

## VII. CONCLUSIONS

This paper is designed successfully with on single phase transformer 230V to 12V of output for develop and automatic tripping mechanism using microcontroller for the three phase supply system while temporary fault and permanent fault occurs

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