Trigger Circuit (Microcontroller Based Fault Detector)

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Abstract

The aim of this research is to develop a device used to detect faults in the line and isolate the connected system or instrument connected to it. This device involves the use of microcontroller for detection and isolation of the system of instrument with proper use of programming. The instrument devised is economical and effective compared to other protective devices available in market. The design methodology involves the use of microcontroller in conjugation with the relay circuitry with display on a LCD screen. It is a totally new design in the market and it will be a substitute to ELCB's, MCB's and Relays in near future .

INTRODUCTION

A fault in electrical equipment is defined as a defect in its electrical circuit due to which the current is diverted from the intended path.

- Faults are generally caused by mechanical failure, accidents, excessive internal and external stresses etc.
- The fault impedance being low, the fault currents are relatively high. During the faults, the power flow is diverted towards the fault and the supply to the neighboring zone is affected. Voltages become unbalanced.
- It is necessary to detect the fault as early as possible that is why a kit is being made using microcontroller to make its process faster. It will detect following four major faults and will give trip signal to relay.

The four faults detected by the model are: **Short Circuit, Earth leakage, Sparking and UV detection, Phase Failure faults.**

WORKING:

The idea of the device designed is that it is used to detect the kind of fault that has occurred in a faulty line.

- By using 8051 microcontroller the fault is detected by the designed circuit and it also displays on the LCD screen.
- Apart from that relay circuit is also attached to it in order to save the system from being damaged by disconnecting the faulty circuit from the healthy one.
- First of all the analog signals are converted to digital signals
- Those signals are given in the microcontroller, the program fed into the microcontroller will compare the input digital signal of the ADC and will compare with the given set range of value, if the input is above or below the range

of set value, the microcontroller will send a signal to the relay to trip the circuit and also send a parallel signal to the LCD to display the type of fault that has occurred.

- Thus we finally obtain the tripping as well as display of the fault at same time.

Circuits in Detail:

Various electrical and electronic auxiliaries used in the project model include:

MICRO-CONTROLLER-89C52:

Features:

8 bit CPU with registers A and B
16 bit program counter and data pointer
8 bit program status word
Internal ROM or EPROM of 0 to 4k
Internal ROM of 128 bytes
Control registers: TCON, TMOD, SCON, PCON, IP and IE
Two external and three internal interrupt sources
Oscillator and clock circuit

LCD MODULES:

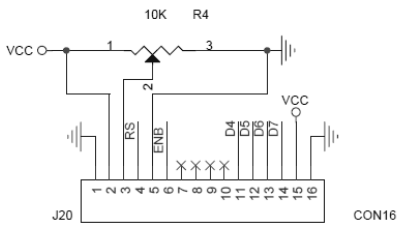
The LCD we used has 14 pins. The descriptions of each pin are given below.

Vcc, Vss, Vee

While Vcc and Vss provide +5v and ground respectively, Vee is used for controlling LCD contrast.

There are two very important registers inside the LCD. The RS pin is used for third selection as follows. If RS=0, the instruction command code register is selected, etc. if RS=1 the data register is selected, allowing the user to send data to be displayed on the LCD.

LCD INTERFACING:



Microcontroller/LCD interfacing is being done to get the desired output on the display screen. Two serial resistors are also connected to the microcontroller ports which enhances the operation of LCD. Also a brightness adjuster is provided with LCD circuitry to adjust the brightness of display.

OPERATION:

The main operation of the circuit is as explained as below:

- A 230 V AC supply is required for the operation of the device.
- A 6-0-6 transformer or a 12-0-12 is connected to step down the voltage to 12 volts.
- Two terminals viz(6-6) are connected and a 12 V AC supply is fed to the electromagnetic sugarcane type of relay connected for sensing and isolating the circuit.
- The relay is then connected to the load. In our device we have used a lamp load to show the operation of relay.
- Now, the AC supply is used to get a 3 phase looped supply by a switch named R Y B in the project. It is used to get a three phase supply done by looping the three terminals of the switch and getting three different phase voltages.
- The three phases are then fed to the CT- PT (combined CT PT) whose rating is 220 / 4 volts. The applications of combined CT PT includes Clip-on meter. It is used to measure both the current and the voltage values.
- A half wave and full wave rectifier circuits consisting of diodes and current limiting resistors are also connected in the circuit to get a regulated DC output voltage.
- Full wave Rectifier Bridge is across the main supply fed to the LCD and in turn fed to the voltage

regulator IC 7805 which gives a regulated +5 V output.

- Before that a optocoupler circuitry is also connected which is used to trigger the circuit. A resistor is attached to the optocoupler circuit as it would not resist the high current passing through it.
- So, it becomes a kind of "protective device" in a protective device circuit.
- Various LED's are also connected at the end of the optocoupler circuit to ensure the normal operation of the circuit and display the working of that line.
- Microcontroller circuit is fed by a +5 V supply and the ports are assigned their respective operations as shown in the pin diagram.
- The unused ports such as TX RX are not used in the project.
- The relay senses the type of fault and through the program loaded in the microcontroller the result is displayed on the LCD screen.
- The ports as assigned their respective functions works accordingly and gives a output on the LCD screen which is a 16 port device whose working is dependent upon the interfacing done between the microcontroller and LCD.
- LCD Microcontroller interfacing is being done and hence depending upon the program loaded in the microcontroller the output is seen on the LCD screen.
- Different phase sensing ports as assigned in the port diagram senses the failure and gives the fault of phase failure. Same is the case with the Earth and UV detection faults.

References

1. Otto H. Schmitt, A Thermionic Trigger, Journal of Scientific Instruments 15 (January 1938): 24–26.
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